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Adherent Stream Source

Multiplexer

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AD991 Stream Source Product - Multiplexer

Adherent Document: SI255v1.1 Issue 1.1a

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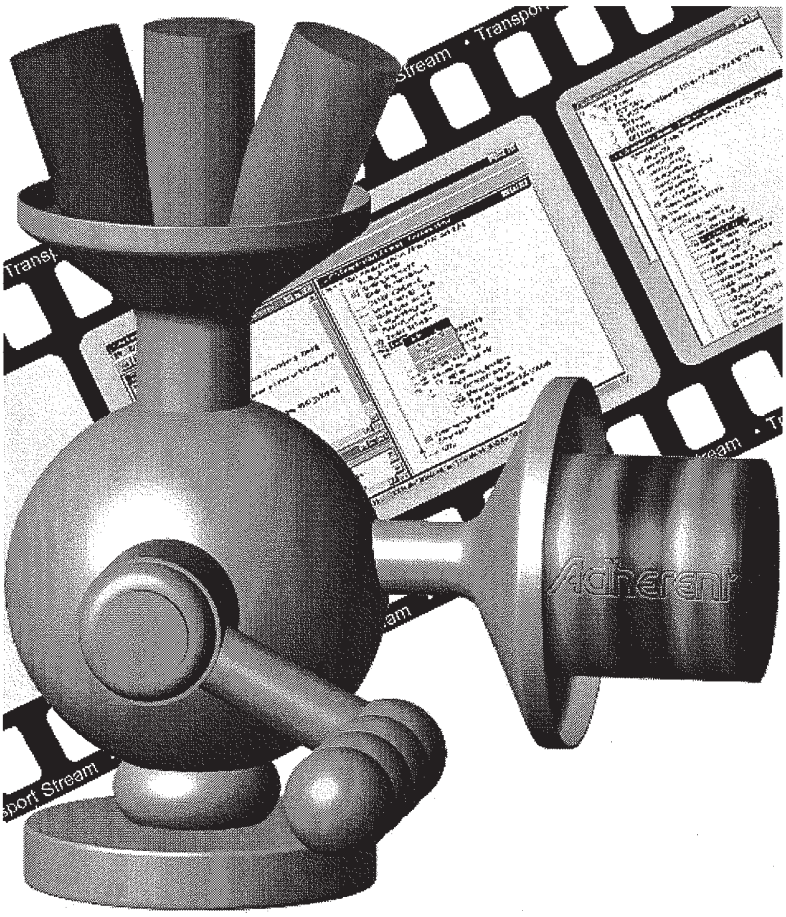
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Adherent Systems Ltd
Endeavour House
Vision Park, Histon
Cambridge
CB4 4ZR
United Kingdom

Telephone: +44 (0)1223 200700
Fax: +44 (0)1223 200701

World Wide Web: http://www.adherent.com
E-mail - Sales & Enquiries: info@adherent.com
E-mail - Technical Support: support@adherent.com

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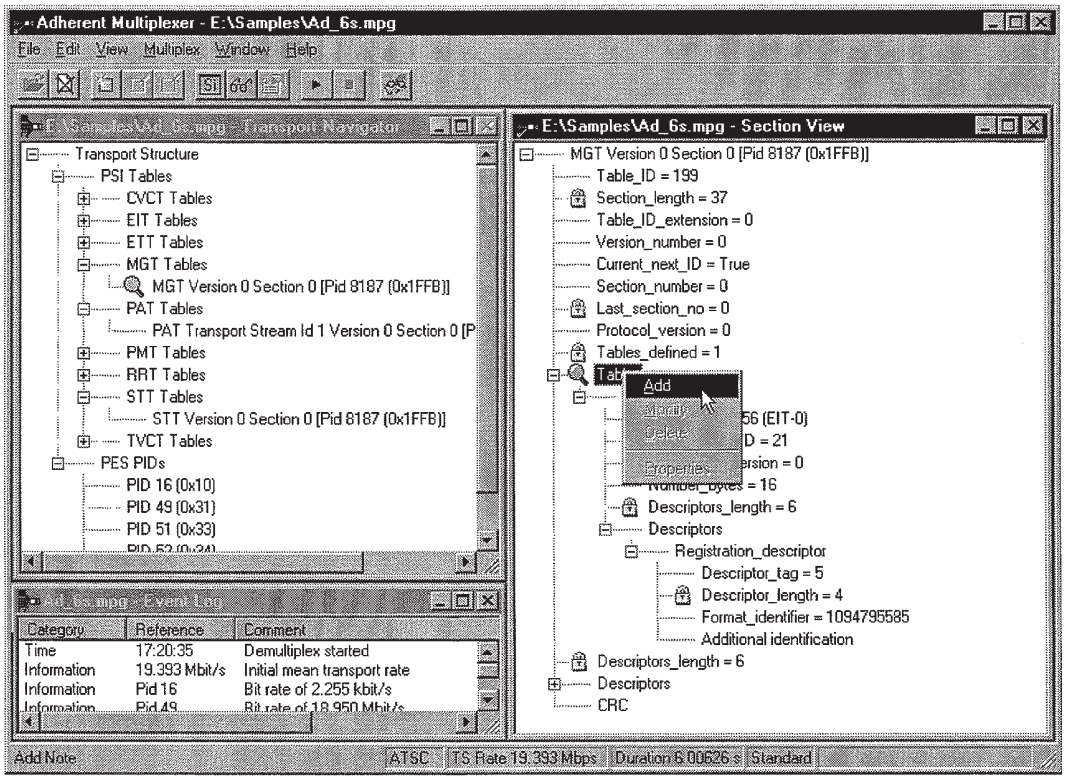
Multiplexer

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Introduction

The Adherent Multiplexer provides off-line multiplexing of ATSC, MPEG-2 and DVB Transport Streams.



Transport streams, elementary streams, packetised elementary streams, PIDs – all can be selected, manipulated and recombined to form customised, synthesised transport streams.

The functionality provided includes:

- Two or more instances of Multiplexer may be running concurrently. This allows table information to be copied from one file to another.
- Table contents are displayed in and edited from structure diagrams (tree diagrams).
- Transport Streams can be generated which:
    - conform strictly to the standards selected for interpretation or
    - have precisely engineered, known, non-conformances
- The source data for non-conformant streams can be saved in a raw format, which can be quickly re-loaded 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 non-conformances to be introduced into the new transport stream.

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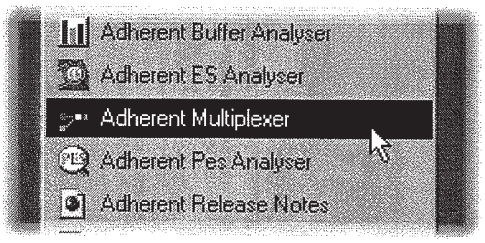
On opening, streams are analysed and displayed according to the standard selected: MPEG, DVB or ATSC. Scripts may also be added to the analysis process which allow private SI tables and descriptors to be defined. Script generation is described in the *Custom SI Scripting appendix*, which forms part of this handbook.

To assist the Multiplexer user, the following procedures are described in Multiplexer Procedures, page 61:

- Add a program to a synthesised multiplex
- Add a Video Stream
- Add an Audio Stream
- Starting a Multiplex

Starting the Program

The program may be started by selecting the **Adherent Multiplexer** option from the **Start** -> **Programs** menu.



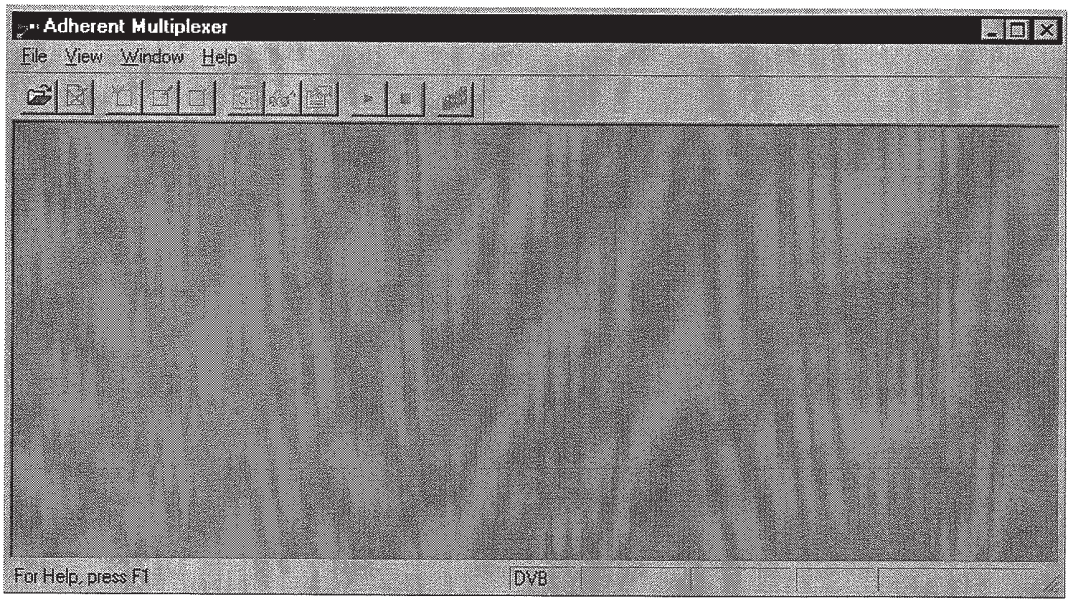
or

by double clicking on the **Adherent Multiplexer** Shortcut on the desktop.



Initial Appearance

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



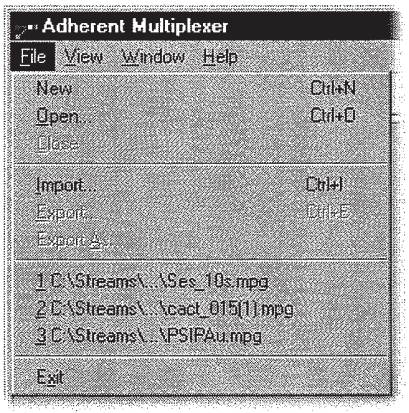
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Use the View menu to select which standard will be used to interpret transport streams. Then open a transport stream file or import a multiplex configuration file.

Initial Menu Options

Users are presented with different menus and options, depending on whether or not a file is open for manipulation. The important menu options available when the program has just been started, or after a file is closed, are:

File Menu Options



New — Opens new multiplex configuration file.

Open ... — Opens an MPEG file for use. The program opens the file selection dialogue allowing the user to choose the required file.

Close — Closes the currently open file. This options is disabled (greyed out) when no file is open.

Import... — Opens a previously saved multiplex configuration file.

Export... — Exports the current multiplex specification in a form that can be Imported even if it no longer generates a conformant transport stream. This options 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.

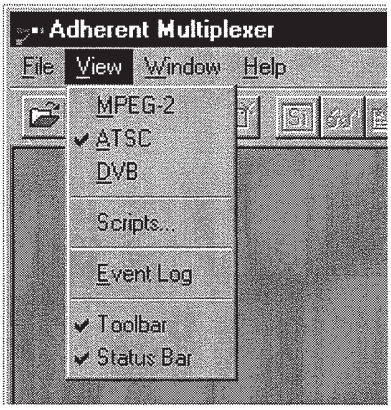
1 ***<filename>***
2 ***<filename>***
3 ***<filename>***
4 ***<filename>*** — A list of the four most recently used files. If the program has recently been installed the list may be empty or hold less than 4 files.

Selecting a filename opens that file for use.

Exit — Finishes running the program.

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View Menu Options



(a check mark ✓ next to one of the top three options indicates which standards are being used to interpretation the stream.

a check mark ✓ next to other options indicates that the object is currently visible.)

MPEG-2 The tables are interpreted according to the MPEG-2 standard. This option is not available in release 6.0.

ATSC The tables are interpreted according to the ATSC standard *A65*.

DVB The tables are interpreted according to the DVB standard and associated parts of the MPEG-2 standard. This option is not available in release 6.0.

Scripts... Opens the Script dialog that allows scripts to be selected for use during stream analysis.

Event Log Opens the Event Log window.

Toolbar Displays or hides the Toolbar.

Status Bar Shows or hides the Status Bar.

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Custom SI Scripting

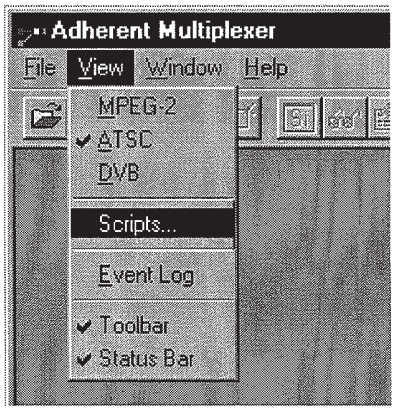
Customised SI scripts are available to the Multiplexer to enable custom SI table and descriptor data to be analysed successfully.

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

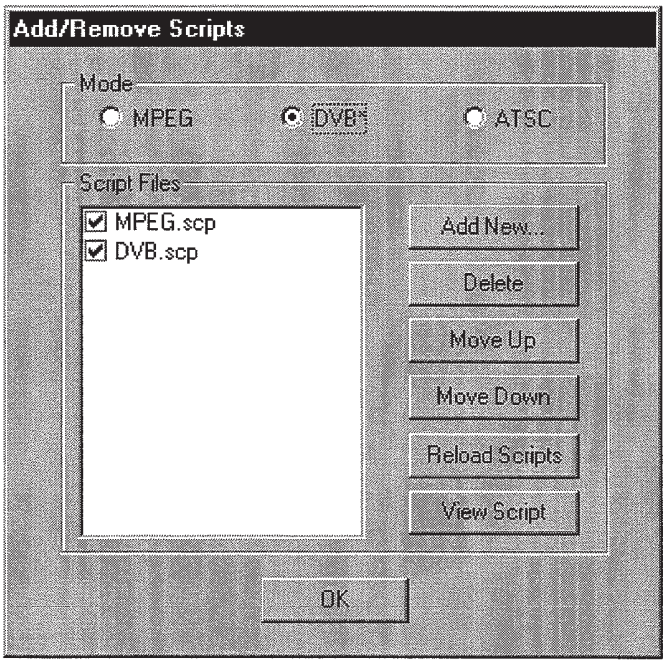
Scripts can only be selected and enabled when no files are open. The option is not available when a file is open.

Handling Script files

To open the script file dialog, with all files closed select the **Script...** option from the **View** menu.



The Script Add/Remove dialog is displayed as shown below:



The Script dialog displays the scripts currently associated with each standard and allows them to be added, removed and manipulated.

The currently selected analysis standard is indicated with an asterisk (*) adjacent to the standard name in the **Mode** panel (DVB in the example opposite).

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.

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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; that is it displays a check mark '✓' in the Script File list.
- The scripts have been reloaded by selecting the **Reload Scripts** button. If the Script dialog is closed before the Reload Scripts button is pressed, a message box is displayed offering the opportunity of reloading the scripts.

Adding a Script file

1. In the Script dialog, select the **Mode** to which the script is to be added; e.g. DVB.
2. Select the **Add New...** button. A standard Windows file selection dialog 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 but is *not* enable; that is it will not be used for any analysis.

Enabling a Script file

A check mark ✓ adjacent to the required script file indicates that it is enabled; that is, it is available for analysis. The check mark has a toggle action; simply place the mouse pointer over the check mark box and click the left-hand button.

The enabled file will not take effect until the script has been reloaded by selecting the **Reload Scripts** button. Closing and re-opening Multiplexer will also reload the scripts. A further opportunity to reload the scripts is also offered if the Script dialog is also closed before the Reload Scripts button is selected.



Scripts will not be used for stream analysis until they are loaded by pressing the **Reload Scripts** button or the Multiplexer is closed and re-opened.

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

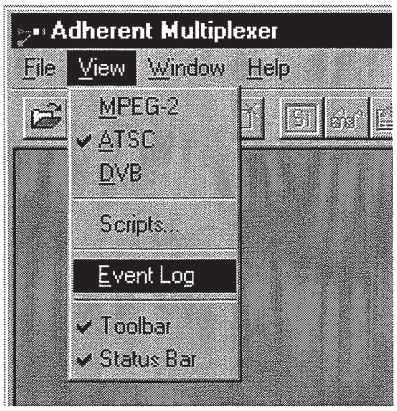
Script files can be viewed and edited in a text editor (provided that the scp extension has been associated correctly in Windows Explorer). To edit a script, highlight the script name and select **View**. This will open the script in Notepad or its equivalent. The required edits can then be made and the script saved.

Remember that the script will not be used for stream analysis until it is loaded by pressing the **Reload Scripts** button or the Multiplexer is closed and re-opened.

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Event Log

The Event Log, which is described in more detail on pages 20 et seq., can be used to identify errors when a script is loaded.



To open the Event Log, select the **Event Log...** option from the **View** menu.

Alternatively use **AltF+E** keyboard shortcut.

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Opening files

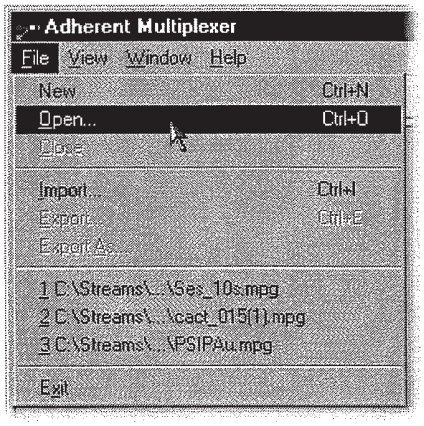
Opening an MPEG file

Any file holding a recorded or synthesised sample of a stream, which is conformant to the relevant standards, can be opened.

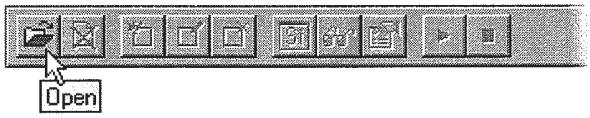
Some non-conformant streams can be opened, although, only the conformant parts can be edited usefully. Any tables that are carried in a conformant PID and have the correct syntax will appear in the output transport stream. As will any elementary streams (whether referenced by a table or not) which are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

To open a file holding a transport stream, select the **Open...** option from the **File** menu. If the required file is in the list of recent files then it can be opened from the list to save using the open file dialogue.

Alternatively use the **Ctrl+O** keyboard shortcut.



There is also a shortcut button available on the Toolbar for opening a file:



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

The multiplex configuration file can be re-opened using the **Import** option.

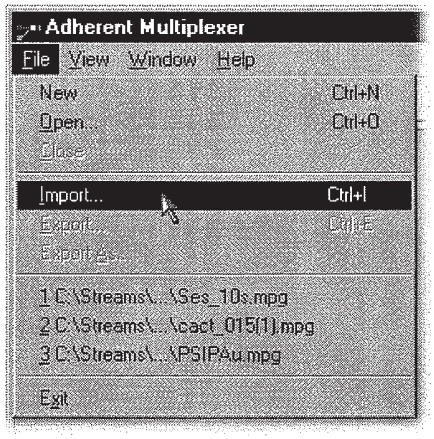
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Importing a file

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

To open a previously exported multiplex configuration file select the **Import...** option from the **File** menu. If the required file is in the list of recent files then it can be opened from the list to save using the Import file dialogue.

Alternatively use the **Ctrl+I** keyboard shortcut.





Multiplexer reads the name and location of the MPEG file from the multiplex configuration file and then opens it automatically.

Initial Stream Analysis

The Transport Navigator window is opened as soon as a file is opened or imported. The program now starts to analyse the file to determine what tables are present; any enabled scripts are also taken into account during the analysis.

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



The progress indicator returns to the blank state when the analysis is completed.

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

What To Do Next

The file can now be manipulated to act as the specification to synthesise a new transport stream. The tables and elementary streams are viewed and selected via the Transport Navigator window. The components of any table selected in the Transport Navigator are viewed and selected via the Section View window.

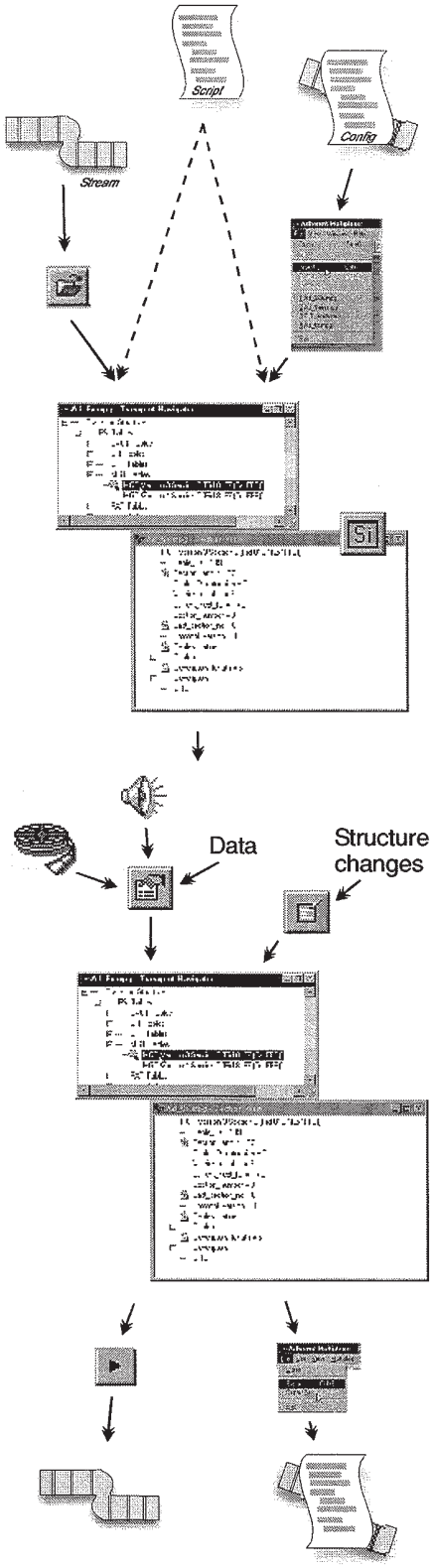
Once selected a table, component of a table or a PID can be manipulated using the **Edit**, **View** and Pop-Up menu options. There are also toolbar buttons for these menu options.

The **Multiplex** menu has options for inhibiting and re-enabling enforcement of conformance to the selected standards.

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

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The illustration below gives an overview of the Multiplex process.



Open/Import

'Any file holding a recorded or synthesised sample of a stream, which is conformant to the relevant standards, can be opened.'

See **Opening an MPEG file**

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

See **Importing a file**

Transport Structure Demultiplex

'As the file is analysed the Top Levels of the Transport Structure diagram are drawn in the Transport Navigator.'

See **Initial Stream Analysis**

Transport Structure Modifications

'The file can now be manipulated to act as the specification to synthesise a new transport stream. The tables and elementary streams are viewed and selected via the Transport Navigator window. The components of any table selected in the Transport Navigator are viewed and selected via the Section View window.'

See **What To Do Next**

Output/Export

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

See **Multiplexing Transport Streams**

'To ensure that the specification for any synthesised stream can be re-used, it can be saved to a multiplex configuration file.'

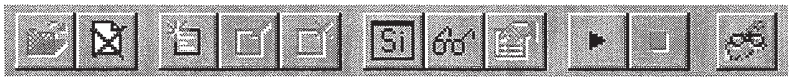
See **Multiplex Configuration Files**

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Menus And Controls

When a file is open, the program presents a different set of menus and options. They change as soon as the file is selected. For example, the options to open files are removed from the **File** menu and the **Open File** toolbar button disabled.

Toolbar



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


Open a file. This button is disabled when a file is open.


Closes the current file. This button becomes enabled the moment a file is opened and initial analysis starts. If the wrong file is being opened, or the wrong options are selected, clicking on the button will abandon processing and close the file.


Adds a section or loop to the item currently selected in the Transport Navigator or Section View.


Modifies the information in the field or item currently selected in the Transport Navigator or Section View.


Deletes the item currently selected in the Transport Navigator or Section View.


Opens the Section View window. This shows details of the version and section of the table that is currently selected in the Transport Navigator.


Displays the Event Log window. This shows the list of events that are recorded in the Event Log.

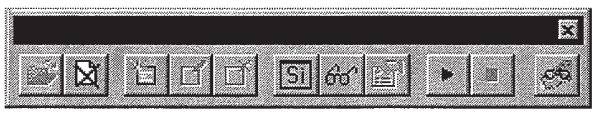

Opens the properties dialog for editing the item currently selected in the Transport Navigator window.


Starts the Multiplex Engine to synthesise a new transport stream file.


Only available while the Multiplex Engine is running, this button abandons multiplexing. The output file is closed and contains all of the data synthesised up to the point where the multiplex engine stopped.


Enables the Make seamless function (see page 58).

The Toolbar can be dragged off the edge of the main window into a floating pallet. To do this place the mouse pointer on the background inside the Toolbar, i.e. not on one of the buttons, hold the left button down 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 hand edges.

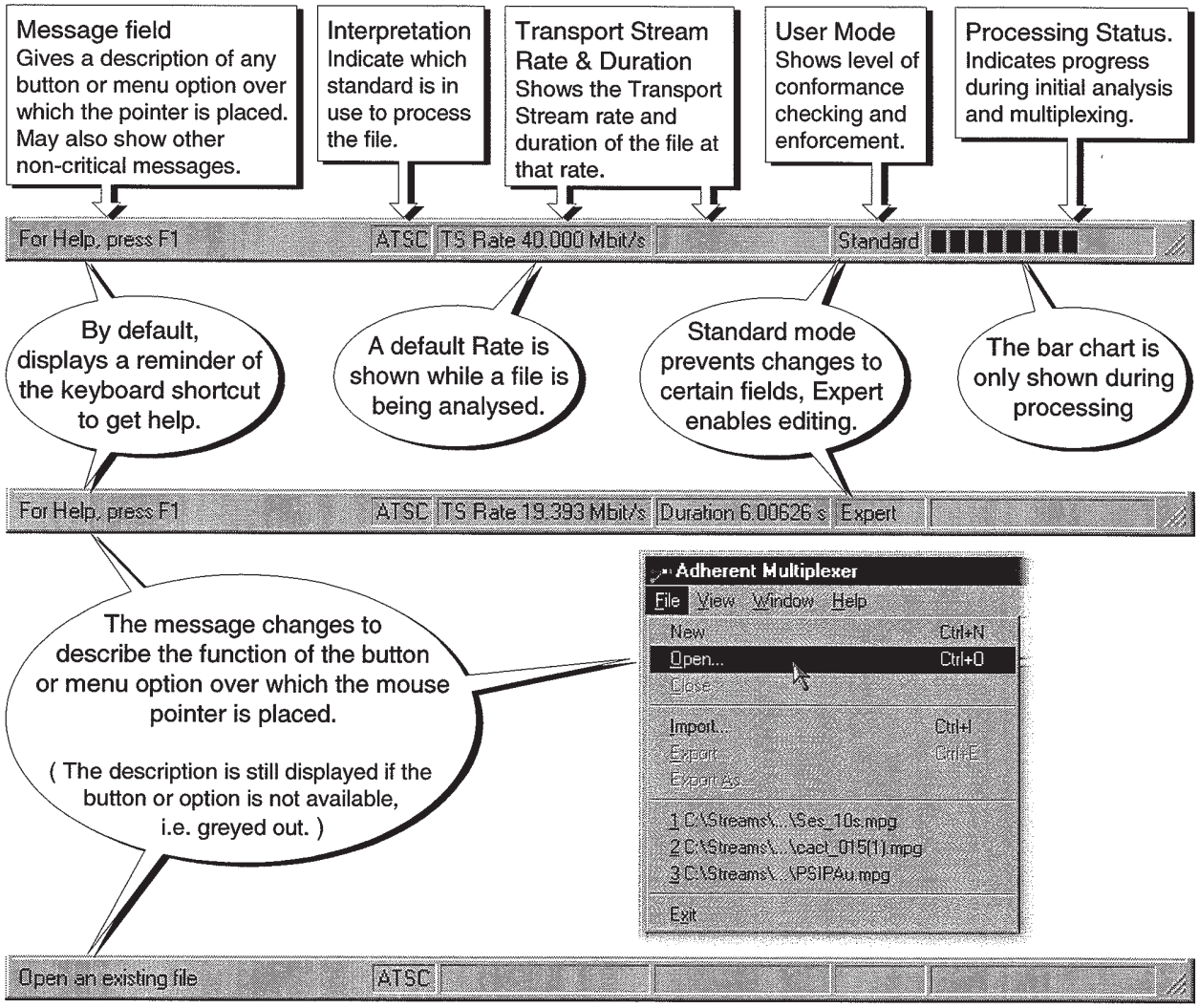
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Status Bar

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



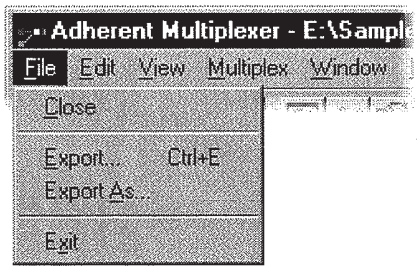
It displays the following information about Multiplexer and the open stream:



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Menus and Options

File Menu Options



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.

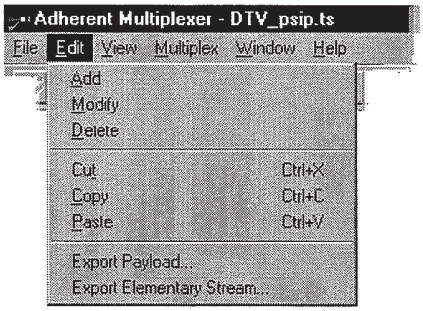
Export... Exports the current file in a form that can be Imported even if it no longer contains a conformant transport stream. This option is disabled when no file is open.

Export As... Exports the current file, as above, and allows a different file name to be specified. This option is disabled when no file is open.

Exit Closes any file that is open and terminates execution the program.

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Edit Menu Options



Add Adds a section or loop to the item currently selected in the Transport Navigator or Section View.

Modify Edits the information in the field or item currently selected in the Section View.

Delete Deletes the item currently selected in the Transport Navigator or Section View.

Cut Cuts the current selection from the window to the clipboard

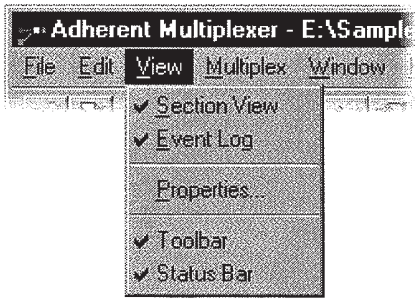
Copy Copies the contents of the current selection to the Clipboard.

Paste Pastes data from the clipboard to the part of the transport structure which holds that type of data.

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 packetised elementary stream headers and exports the remaining information in the form of a simple data file.

View Menu Options



(a check mark ✓ next to an option indicates that the window or toolbar is currently visible, no ✓ means that it is hidden.)

Section View Opens the window that shows the section of the table that is currently selected in the Transport Navigator.

Event Log Displays the list of events that are recorded in the Event Log.

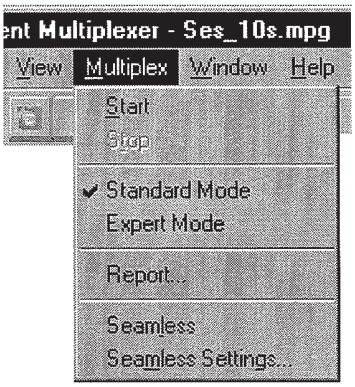
Properties Opens a properties dialog for editing the item currently selected in the Transport Navigator window.

Toolbar Displays or hides the Toolbar.

Status Bar Shows or hides the Status Bar.

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Multiplex Menu Options



(Either **Standard Mode** or **Expert Mode** will be in operation. A check mark ✓ indicates which mode is currently selected.
A check mark ✓ will also indicate that **Seamless** is enabled.)

Start — Starts the Multiplex Engine, to synthesise a new transport stream file.

Stop — Aborts multiplexing. The output file is closed and contains all of the data synthesised 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 which can be generated automatically

Expert Mode — Inhibits the above conformance checking so that non-conformant files may be created.

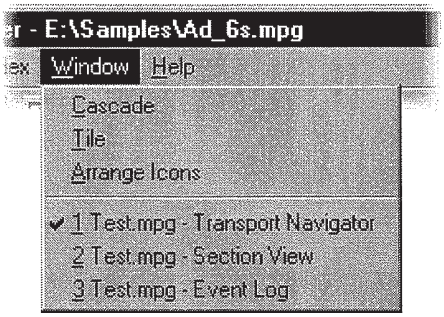
Report... — Provides the option of printing all or part of the transport structure to either a file or a printer.

Seamless — When enabled, the program specified in Seamless Settings… is processed and made seamless.

Seamless Settings... — Opens a dialog in which the Make seamless parameters are specified.

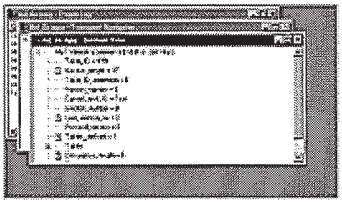
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Window Menu Options

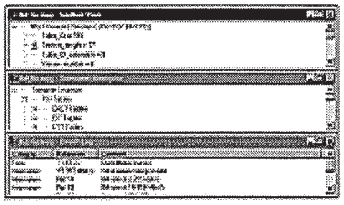


(The check mark ✓ next to an option indicates the currently active window.)

Cascade Re-arranges the windows like this:



Tile Tiles the windows horizontally. For example, three windows would be tiled like this:



Arrange Icons Aligns icons of any minimised windows at the bottom of the program's main window.

1 *<window title>*
2 *<window title>*
3 ... etc.

Makes the named window active, putting it on top of any windows that had been hiding all or part of it.

Help Menu Options



About ... Opens a dialogue that displays the program version number and license number.

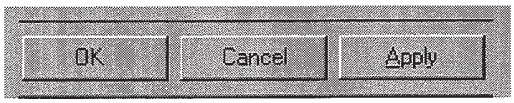
Dialogs

Where dialogs are displayed, their operation follows standard Windows' practice. The following buttons may be used:

OK accept all changes and close the dialog.

Cancel abandon all changes made since the dialog was opened and since the Apply button was used. Close the dialog.

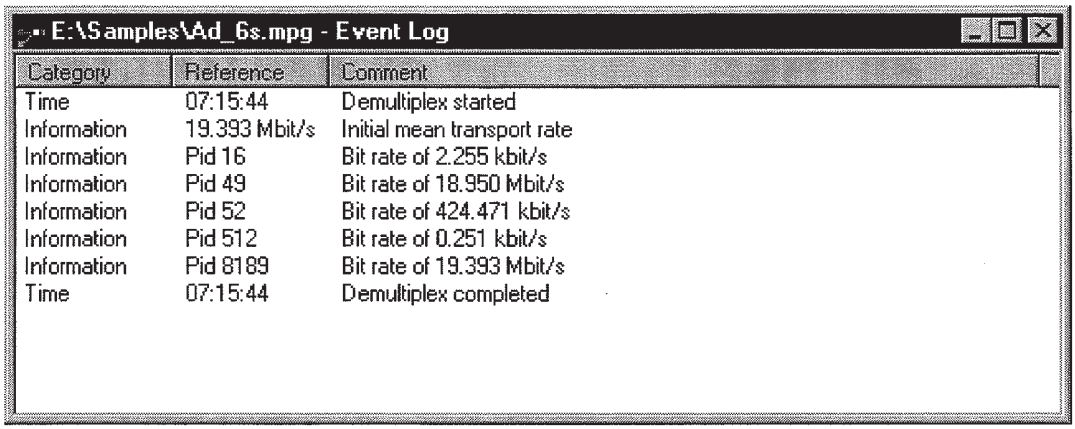
Apply accept all changes made since the dialog was opened. Keep the dialog open. This allows intermediate changes to be applied.



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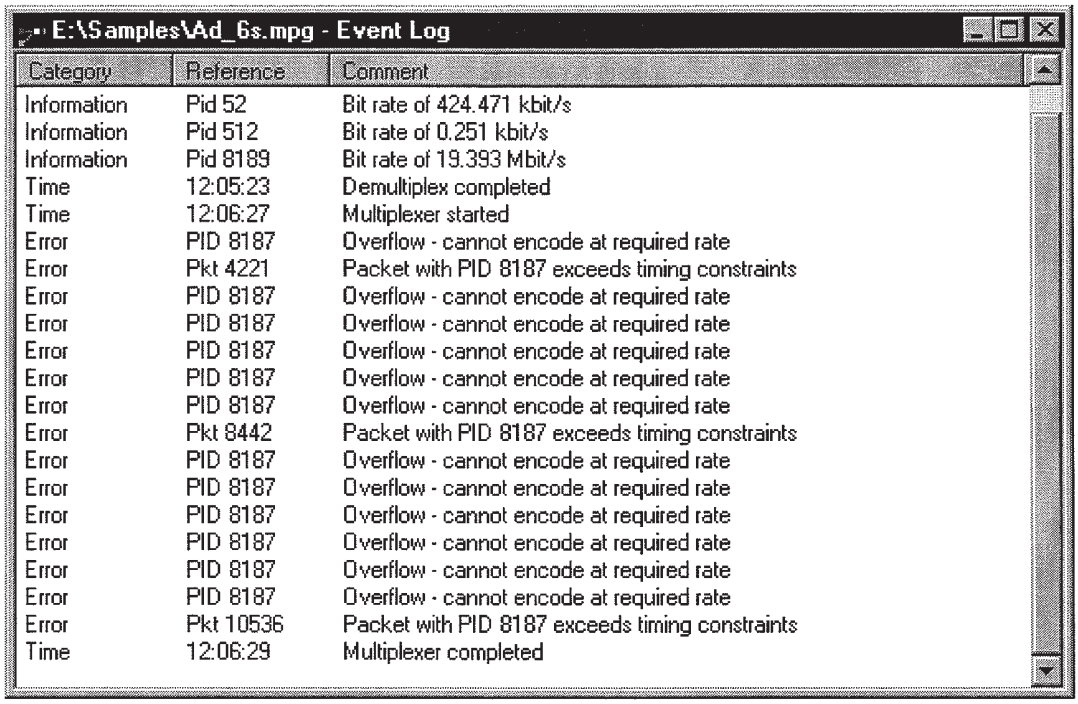
Event Log

Messages about significant events are written to the Event Log from the time a file is first opened. The Event Log may be opened 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 PES PID and a **Demultiplex completed** message are written in the Event Log.


E:\Samples\Ad_6s.mpg - Event Log

Category	Reference	Comment
Time	07:15:44	Demultiplex started
Information	19.393 Mbit/s	Initial mean transport rate
Information	Pid 16	Bit rate of 2.255 kbit/s
Information	Pid 49	Bit rate of 18.950 Mbit/s
Information	Pid 52	Bit rate of 424.471 kbit/s
Information	Pid 512	Bit rate of 0.251 kbit/s
Information	Pid 8189	Bit rate of 19.393 Mbit/s
Time	07:15:44	Demultiplex completed

The start and end times for generating a new transport stream are shown by the **Multiplexer started** and **Multiplexer completed** messages. When synthesising a new transport stream any errors or warnings about the new stream are written to the Event Log between the start and completed messages:


E:\Samples\Ad_6s.mpg - Event Log

Category	Reference	Comment
Information	Pid 52	Bit rate of 424.471 kbit/s
Information	Pid 512	Bit rate of 0.251 kbit/s
Information	Pid 8189	Bit rate of 19.393 Mbit/s
Time	12:05:23	Demultiplex completed
Time	12:06:27	Multiplexer started
Error	PID 8187	Overflow - cannot encode at required rate
Error	Pkt 4221	Packet with PID 8187 exceeds timing constraints
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	Pkt 8442	Packet with PID 8187 exceeds timing constraints
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	Pkt 10536	Packet with PID 8187 exceeds timing constraints
Time	12:06:29	Multiplexer completed

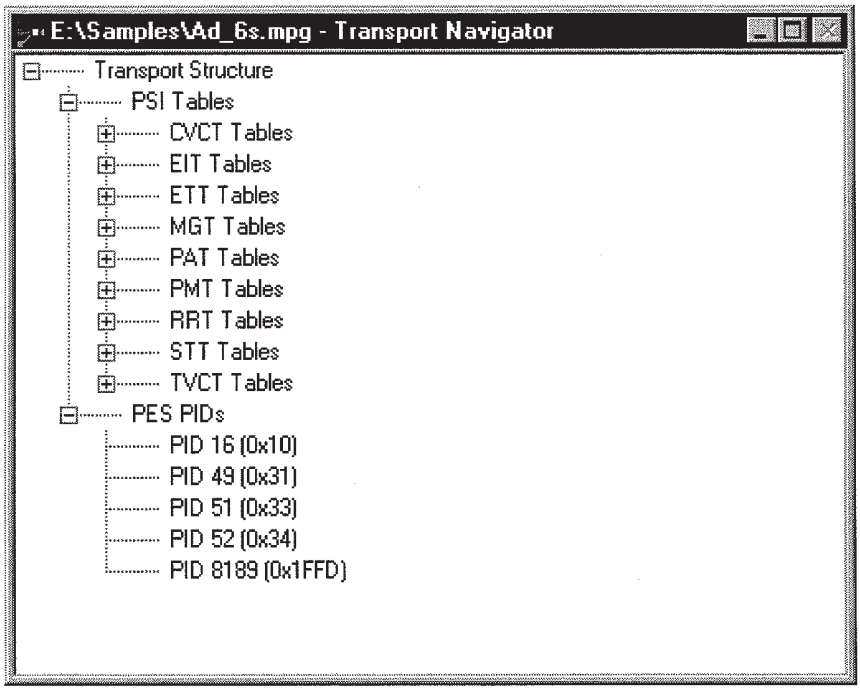
The **Category** column indicates the type of event. The subject or time of the event is shown in the **Reference** column and the details are given in the **Comment** column.

The complete text may be copied onto the windows clipboard, using the **Copy** option from the **Edit** menu. The text can also be cleared with the **Clear** command. Both commands are also available from the Event Log window right-click popup menu.

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Transport Navigator

The Transport Navigator is displayed by the program as soon as a file is opened. As the file is analysed, the top levels of a structure diagram are drawn in the window:



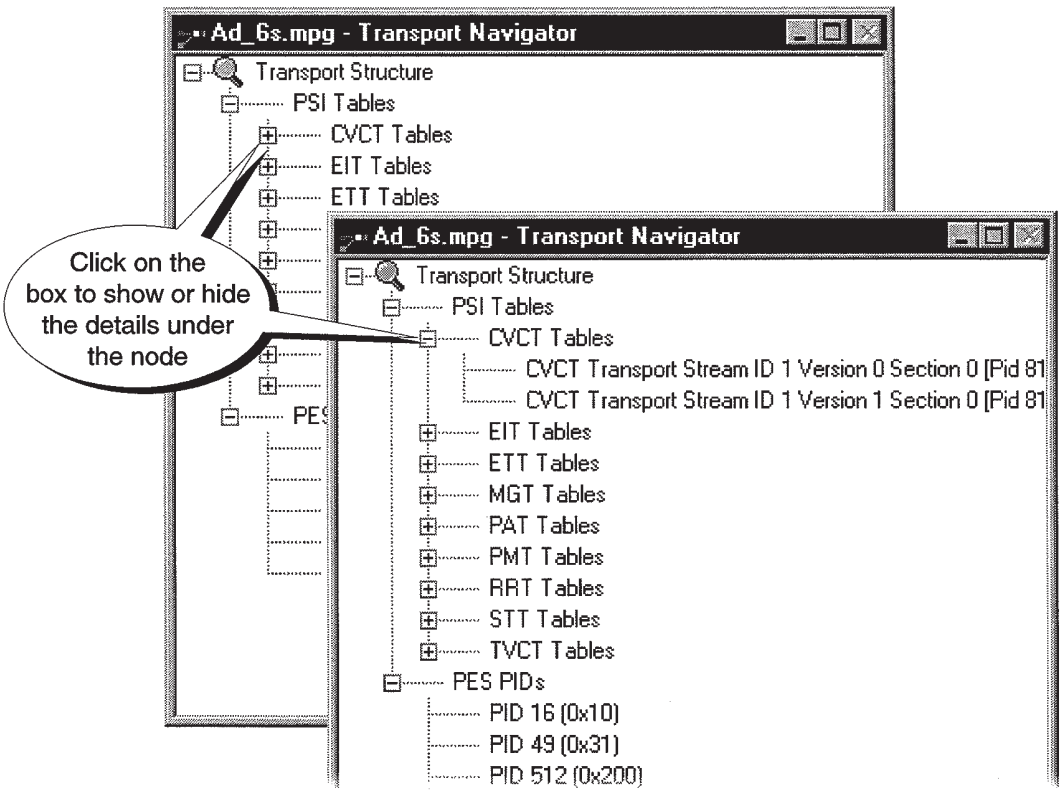
The Transport Navigator displays high level structure of the Program and System Information Protocol (PSIP), Service Information (SI) and Program Specific Information (PSI) Tables. More detailed payload information can be examined and edited, for a selected section of a table, using the Section View.

Any SI information that the program cannot confidently analyse, will be shown in the PES PIDs section. For example, if the user opens a DVB stream, because DVB analysis is not currently implemented, all of the DVB SI tables will be shown under the PES PIDs section.

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Structure Diagram

The Transport Structure is represented by a tree diagram, with the "root node" or highest level component at the top. Components that contain more information beneath them in the structure are indicated by a square box.



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 contained by the node which 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. They display the lowest and finest level of detail available in this diagram. These are either a Section of a Table or a PID.

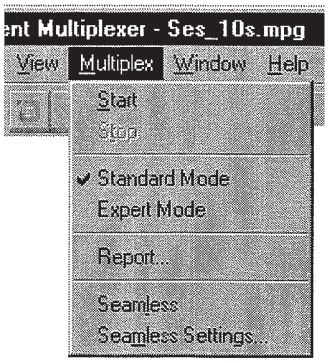
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Expert and Standard Modes

The Transport Navigator and Section View have two modes of operation for conformance checking when editing table contents. These are selected from the Multiplex menu. The checks that affect the Transport Navigator are:

Standard Mode Prevents changing the PID of a table whose PID number is specified in the standard, e.g. 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.



The check mark, ✓, next to a menu option indicates which mode is currently selected. This is also reflected in the second pane from the right of the Status Bar:

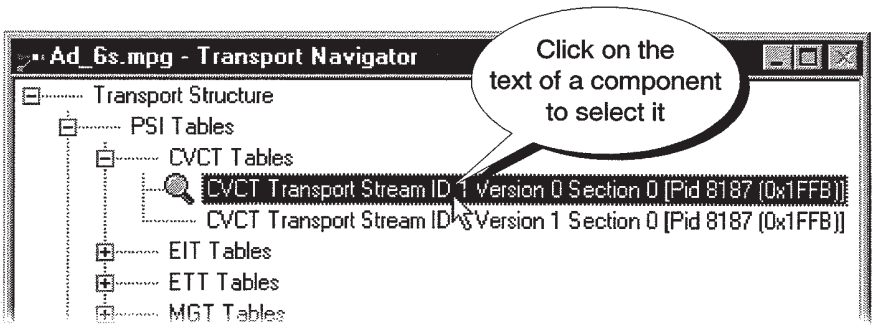


Editing the Transport Structure

To add, change or delete a component of the transport structure select the appropriate line in the Transport Navigator window. Then select the required option from the Edit, View or Pop-Up menus. Alternatively click on the equivalent button from the Toolbar.

Selecting a Component

To select a Table, Version or PID place the mouse pointer over it and click the left button. Select the **Transport Structure** to edit the Bit rate for the transport stream. To add a new table, first select the **PSI Tables** component. Similarly to add an Elementary Stream select the **PES PIDs** component.



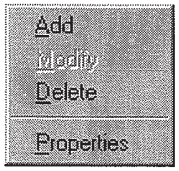
The magnifying glass symbol, 🔍, indicates the selected component. There is no default selection. When a file has just been opened the magnifying glass is not shown since nothing is selected.

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Menu Options

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

There is also a pop up menu that provides the Add, Delete and Properties options. Place the mouse pointer over the component to change and click the right mouse button to "pop up" the menu.



Add Adds a component to the item currently selected in the Transport Navigator.

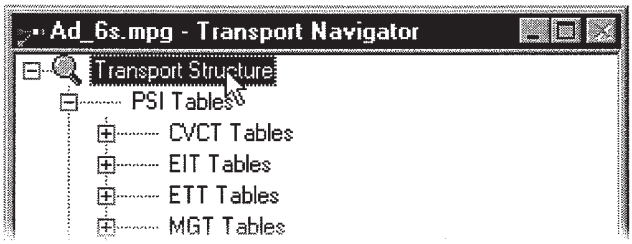
Modify This option is disabled (greyed out) for selections in Transport Navigator.

Delete Deletes the currently selected Section or PID in the Transport Navigator.

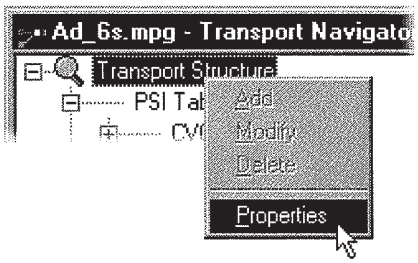
Properties Opens a properties dialog for editing the item currently selected in the Transport Navigator.

Change Transport Stream Bitrate and Duration

To specify a new bitrate or duration for the synthesised transport stream click on **Transport Structure**. Then select **Properties** from the **Edit** menu, or click on the Properties button on the toolbar.

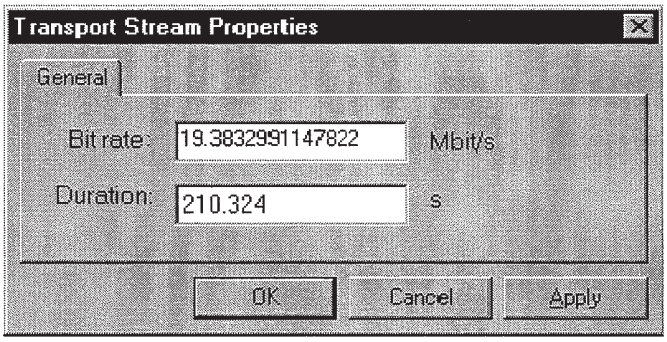


Alternatively right click on **Transport Structure** and select **Properties** from the Pop-Up menu.



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All of these open the Transport Stream Properties dialog, which looks like this:



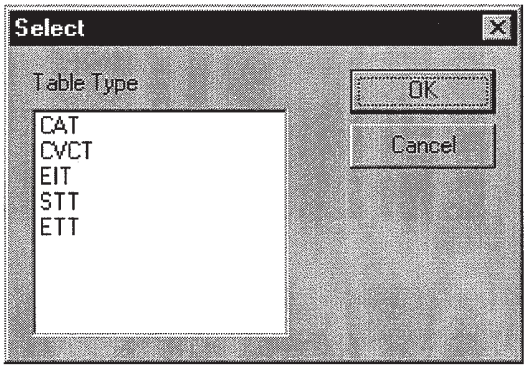
Edit the **Bit rate** and the **Duration** as required, then click on the **OK** button.

Adding an SI Table

Any Table which is defined in the selected standards, and not already present, may be added the transport stream. To add a table to the transport stream, click on **PSI Tables** in the Transport Navigator:



Then select the **Add** option from the **Edit** or Pop-Up menus or click on the add button on the toolbar. This will open a dialog to select an appropriate table type. The dialog displays a list of table types which are not already present.



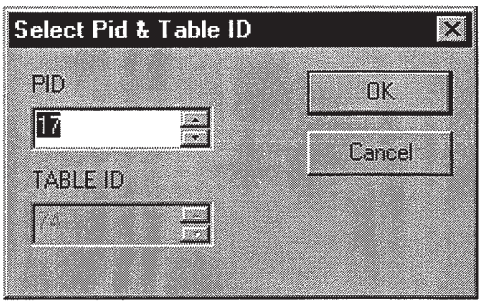
Pressing **Cancel** will abandon the Add operation without adding a new table.

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

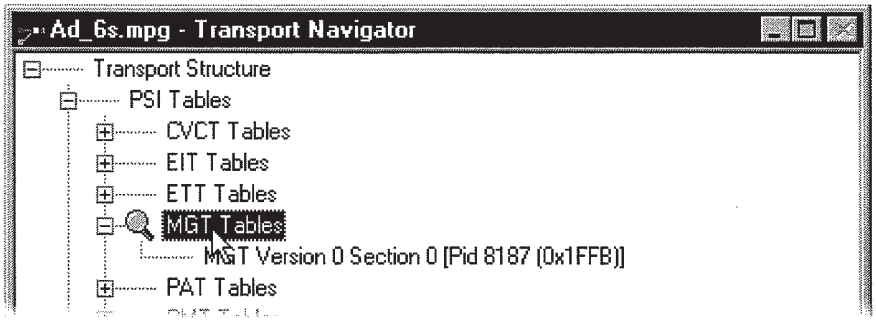
Select the required table type, then click on **OK**.

The **Select PID & Table ID** dialog is displayed only if a PID and/or Table ID need to be identified. Otherwise the selected Table type is automatically created.

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

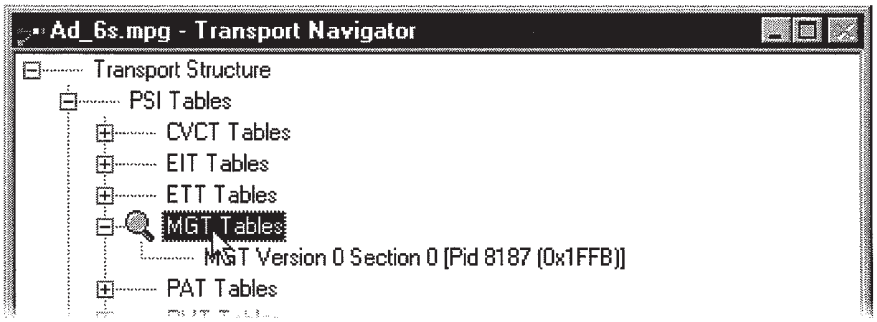


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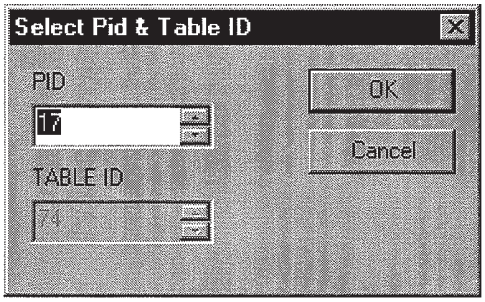
Adding a Section to an SI Table

To add a section to a table select the parent table in the Transport Navigator. For example to add a section to the MGT select **MGT Tables**:



Then select the **Add** option from the **Edit** or Pop-Up menus. Alternatively click on the add button on the toolbar.

The **Select PID & Table ID** dialog is displayed only if a PID and/or Table ID need to be identified. Otherwise the selected section is automatically created.



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

Pressing **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:

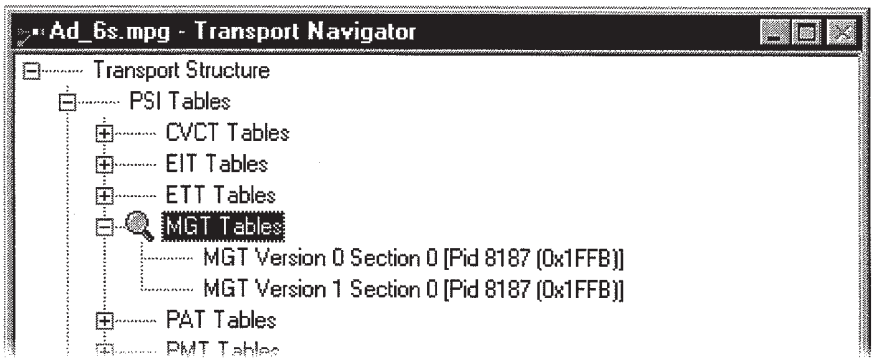
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- For tables that the selected standard dictates should always have a section number of 0, the version number is increased by one. The new version number is based on the version currently in the table with the most recent number. The **version_number**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

  $$\textbf{version_number}_{NEW} = (\textbf{version_number}_{RECENT} + 1) \text{ modulo } 32$$

- When the standards permit more than one section:
  - the section and version numbers are based on the version/section with the most recent version number.
  - the section number is increased by one.
  - the most recent version number is applied to the new section

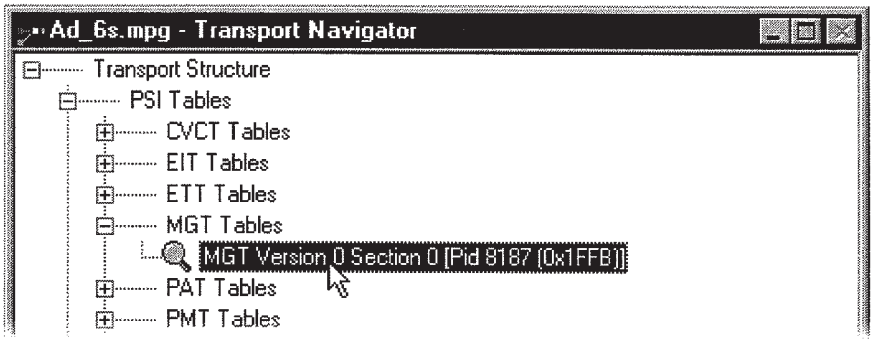
For example the ATSC standard A65 specifies that an MGT may only have one section. The new version/section added to the above example will be **Version 1 Section 0** and Transport Navigator will look like this:



The version, section and any table specific fields shown in Transport Navigator can now be changed from the Section View window.

Editing SI Table Properties

Table and Section Properties are edited by selecting one of the versions/section within the table. Then selecting the Properties option form either the View or Pop-Up menus, or by clicking on the properties button from the toolbar.



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

The properties that may be edited from the Transport Navigator are:

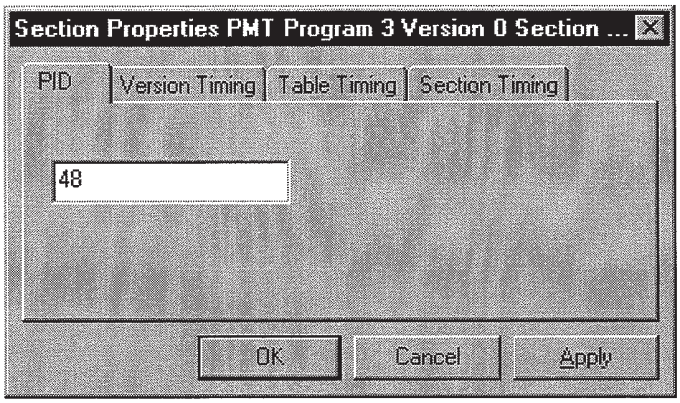
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PID Number

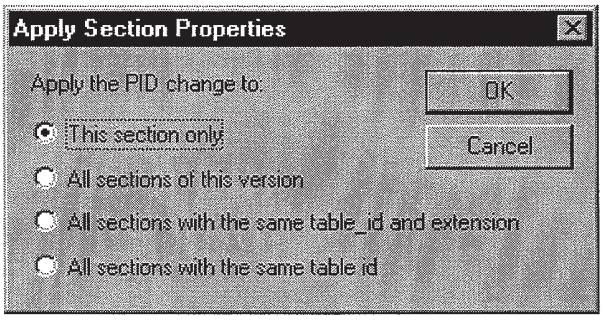
The PID tab is displayed by default when the Section Properties dialog is opened.

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.



Multiplexer checks the new PID number for conflicts and non-conformance issues. If none are found it opens another dialog to define the scope of the changes:

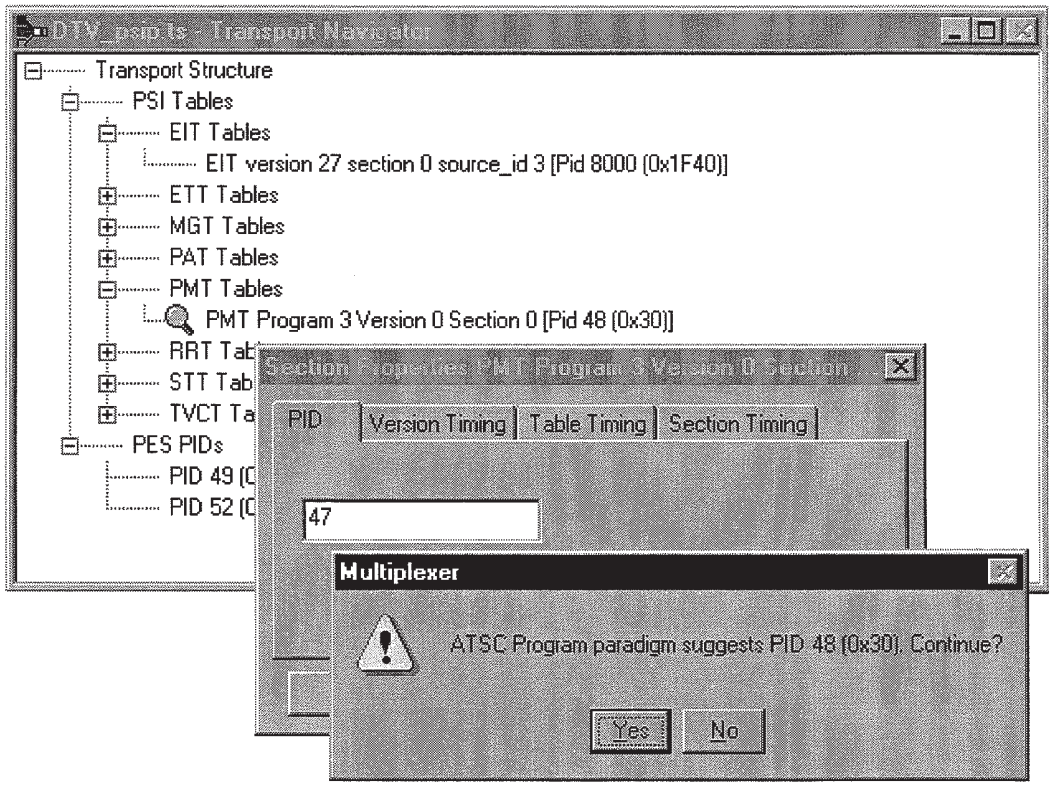


Select the required scope and click on **OK**. Selecting **Cancel** will abandon the change.

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Non-Conformance Issues

Multiplexer checks the new PID number against the selected standards and warns of any non-conformance issues. For example: the warning when about to change a PMT from PID 48 is:



To continue with the change select **Yes**. Multiplexer then continues to process the change as normal by opening the dialog to define the scope of the changes.

PID Number Conflicts

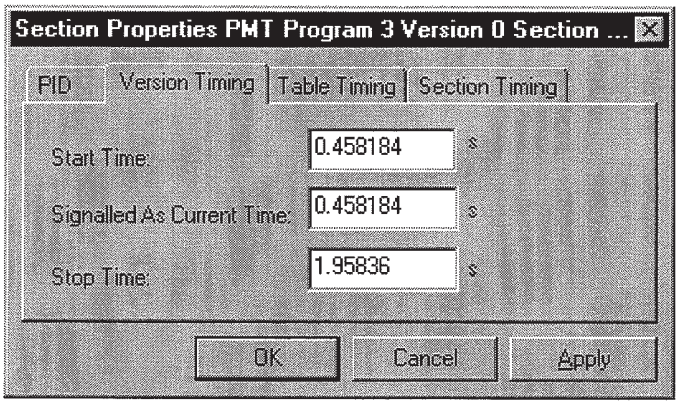
Multiplexer checks for conflicts with other PIDs. If the new PID number conflicts with an existing PID Multiplexer displays an error dialog and rejects the change.

Either choose a different PID number for the table or edit the number of the PID that is currently the owner.

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Version Timing

The Version timing tab shows the time when the version will become current, 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 **current_next_field** set to 1.

By default when these sections start to appear in the transport stream, the **current_next_field** of the section set to 0. To specify a version which is always current set the **Start Time** and **Signalled As Current Time** fields to the same value.

Stop Time specifies the time after which no sections of this version will appear in the transport stream.

All of the times are in seconds, taken from the start of the transport stream file.

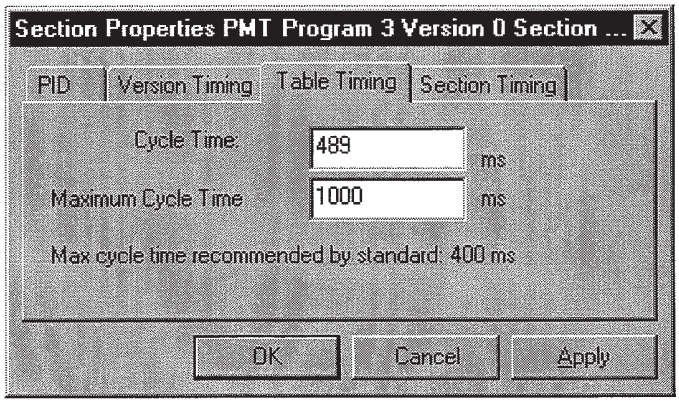
Edit the values and select **OK** to change the timings. Edit the values and select **Apply** to make the changes and update the other properties (tabs) without having to close this dialog.

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Table 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 table (where a table is defined by the table_id, table_id_extension and version_number on the same PID).

Use the Table Timing tab to specify the desired and the maximum acceptable period between instances of the table. When an MPEG file has been opened this shows the mean time between instances of the table in the transport stream.



Cycle Time — Displays the mean time between instances of the table specified for synthesising a new MPEG file. The value may be edited to specify a different cycle time.

Maximum Cycle Time — Displays the maximum time between instances of the table specified for synthesising a new MPEG file. The value may be edited to specify a different maximum cycle time.

Beneath the **Maximum Cycle Time** the dialog displays table specific information from the currently selected standard.

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

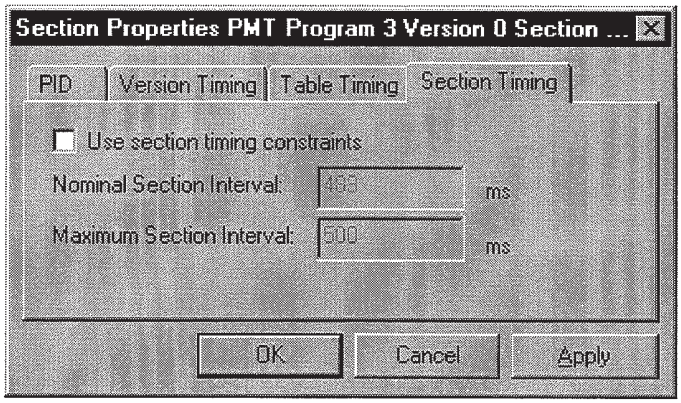
When synthesising a new transport stream the multiplex engine tries to insert the table at the frequency specified by the **Cycle Time**. An error message is written to the event log whenever a table cannot be multiplexed into the stream within the period specified by the **Maximum Cycle Time**.

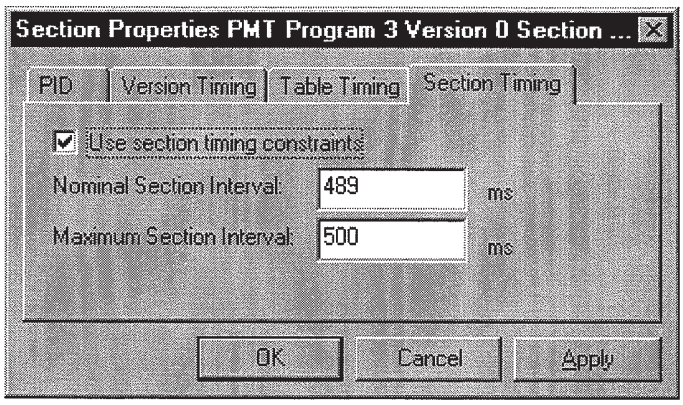
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Section Timing

Service information is usually constrained to appear at regular intervals in the transport stream. This constraint may be implemented as a maximum time between any two sections having the same table_id and using the same PID. Multiplexer always applies the strongest constraint of the Table Timing or Section Timing when synthesising a new transport stream.

Section timing can be enabled and the interval between sections specified from the **Section timing** tab.





When the **Use section timing constraints** option is deselected the other fields are disabled (greyed out). To specify nominal and maximum intervals between sections select the **Use section timing constraints** option:

Nominal Section Interval Displays the mean time between sections of the table for synthesising a new MPEG file. The value may be edited to specify a different interval.

Maximum Section Interval Displays the maximum time between any two sections for synthesising a new MPEG file. The value may be edited to specify a different maximum.

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

When synthesising a new transport stream the multiplex engine checks both the **Nominal Section Interval** and the **Table Timings: Average Cycle Time**. It tries to insert sections at whichever gives the shortest interval.

An error message is written to the event log whenever a table cannot be multiplexed into the stream within the period specified by the **Maximum Section Interval**.

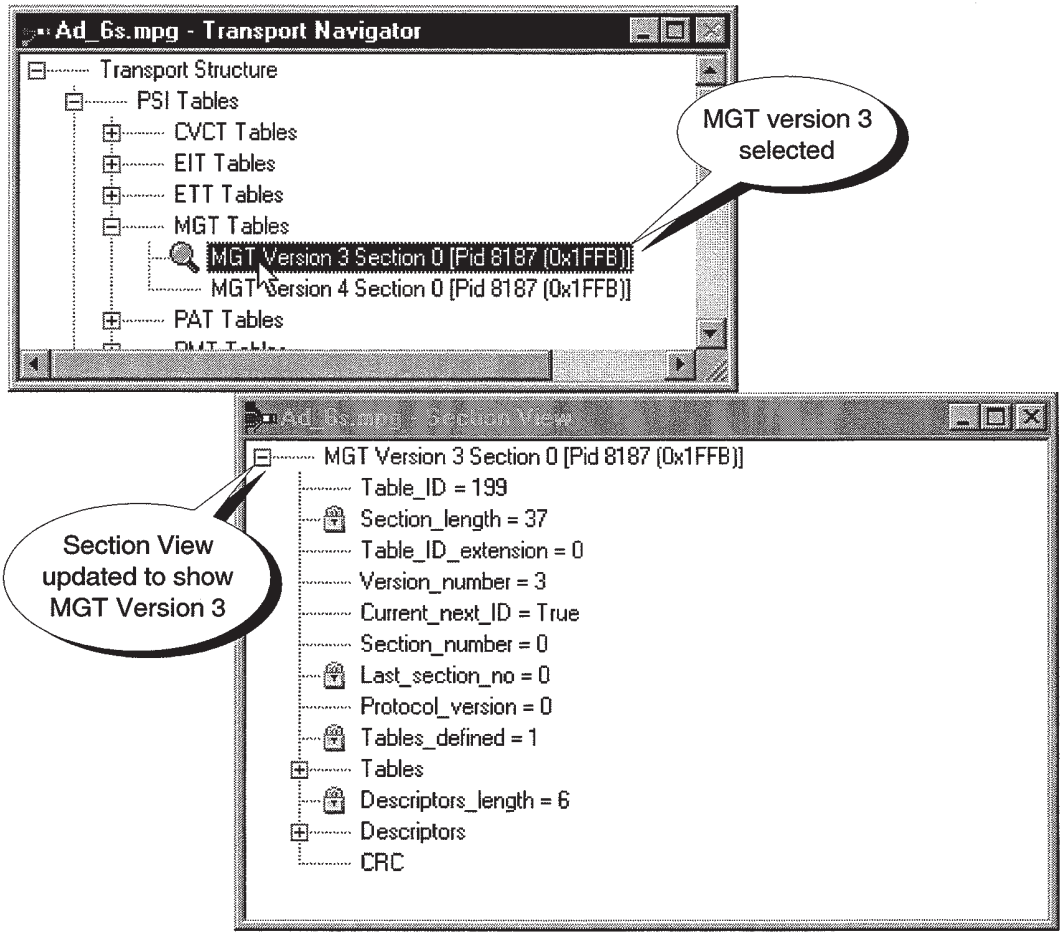
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Editing a Section Contents

Use the Section View window to modify the contents of a version/section. This includes **version**, **section** and table specific data which Transport Navigator displays. If the Section View window it is not already open, select the **Section View** option from the **View** menu. Alternatively click on the Section View button on the toolbar.

If a section/version is selected in the Transport Navigator, the contents are automatically displayed in the Section View; otherwise the Section View window is blank.

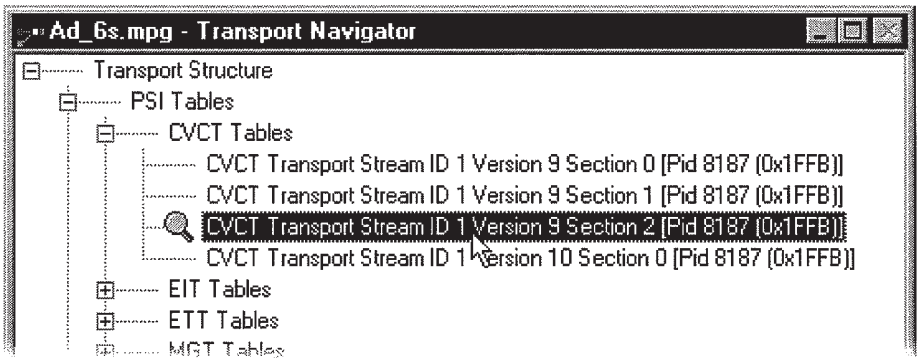
To open a table version/section in Section View select the component in Transport Navigator. The Section View is updated immediately to show the selected section/version.



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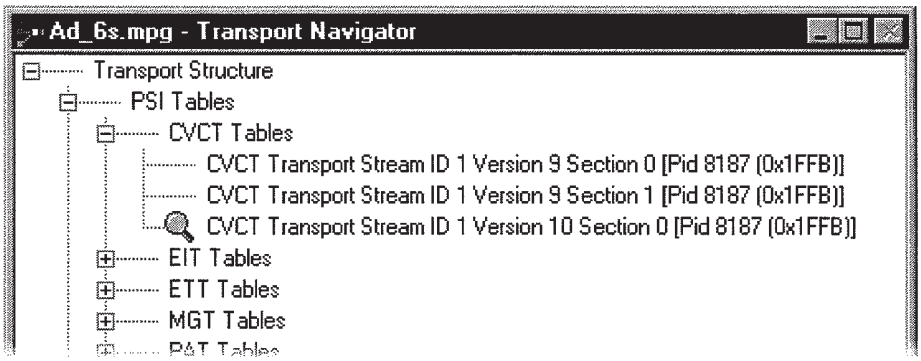
Deleting a Section

A section may be deleted from a table by selecting it in the Transport Navigator. For example to delete the last section from CVCT version 9 select the line **CVCT Transport Stream ID 1 Version 9 Section 2** …etc.:



Then select the **Delete** option from the **Edit** or Pop-Up menus, or click on the delete button on the toolbar.

After deleting the section the **CVCT Tables** looked like this:



To delete more than one section, select and delete each one in turn.

Cutting, Copying and Pasting Sections

A section of a table may be cut, copied and pasted using the windows clipboard. Only one section can be held on the clipboard at a time.

Cutting a Section to the Clipboard

A section may be deleted from a table, and placed on the windows clipboard. It can be pasted to a different file or back into the current file. Select the section in Transport Navigator as though to delete it, then select the **Cut** option from the **Edit** menus, or use the **Ctrl+X** keyboard shortcut.

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Copying a Section to the Clipboard

A section may be copied on to the windows clipboard. From the clipboard it can be pasted to a different file or back into the current file.

Click on the required section in the Transport Navigator. Then select the **Copy** option from the **Edit** menu, or use the **Ctrl+C** keyboard shortcut.

Pasting a Section from the Clipboard

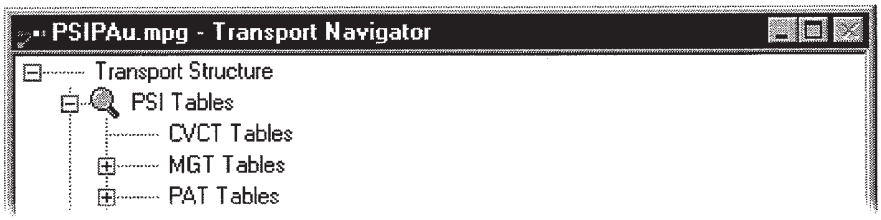
More than one instance of Multiplexer can run concurrently on a machine. A section may be pasted from the clipboard into any open transport stream file. The contents of the clipboard are not affected by the paste operation, so the section can be pasted to many files and more than once to the same file.

Make the Transport Navigator window of the required transport stream file (i.e. instance of Multiplexer) active. Then select the **Paste** option from the **Edit** menu, or use the **Ctrl+V** keyboard shortcut.

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

Deleting a Table

To remove a table simply delete all of the versions to leave an empty container. The empty container cannot be deleted, but will not cause any packets to be created for that Table. An empty container, for example the **CVCT Tables**, will look like this:



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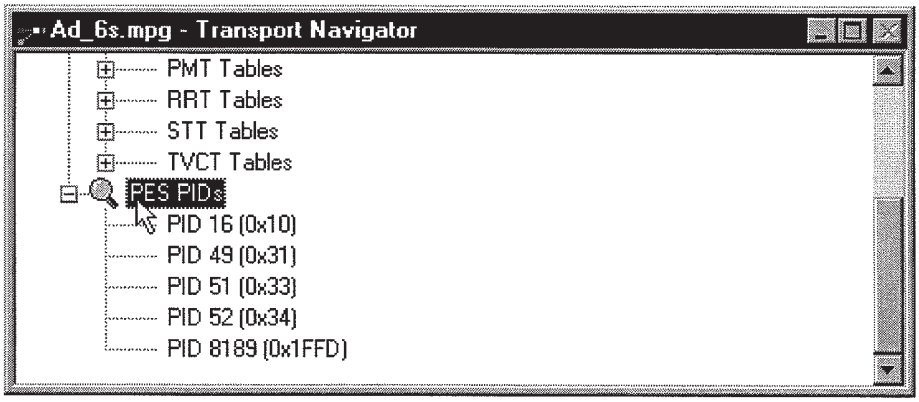
Editing PES PIDs

PES PIDs which carry additional Elementary Streams can be multiplexed into the synthesised transport stream. The following actions are required when defining an elementary stream to be added:

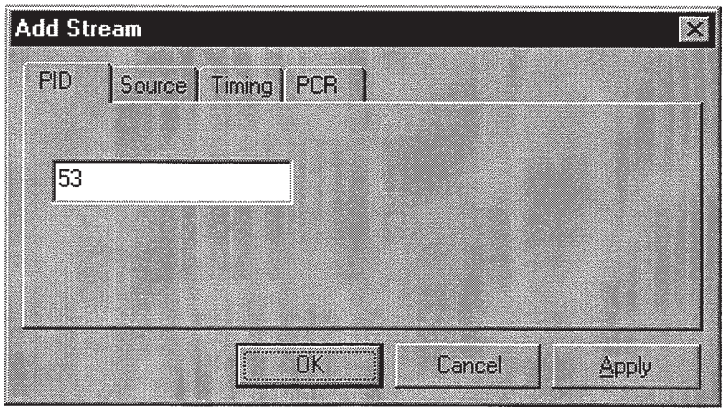
- Allocate a PID number
- Define the source of the elementary stream to be added
- Define the timing to be applied to the new stream
- Define the PCR placement

Adding a PES PID

To add a new stream select **PES PIDs** in the Transport Navigator:



Then select the **Add** option from the **Edit** menu or the right-click pop-up menu, or click on the Add button on the toolbar. This will open the Add Stream dialog; the **PID** tab will be displayed by default.



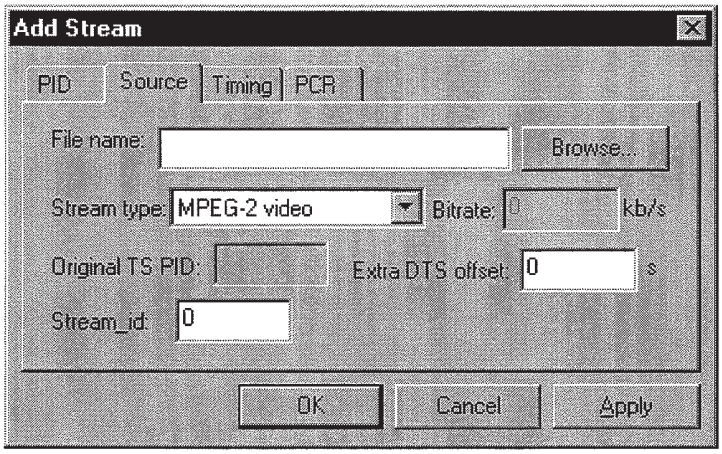
Enter the PID number. A new value may be entered using either decimal or hexadecimal notation. Values are assumed to be decimal unless prefixed with **0x**. The dialog is not case sensitive and values may include zeros after the prefix and before any significant digits.

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

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Defining the PID Source

On the **Add Stream** dialog select the **Source** tab; this will allow the PID source to be selected and defined.



File name: Enter the file name of the stream to be multiplexed. If the filename is unknown, select **Browse** to open a standard file browser dialog and locate the file required.

Stream type: Select the type of stream to be multiplexed from the drop-down list box.

The following **Stream Types** are available:

MPEG-2 video ES or PES

MPEG-2 audio ES or PES

AC-3 audio ES or PES

(ES – Elementary Stream; PES – Packetised Elementary Stream)

Transport stream conformant to *ISO/IEC 13818 Information technology – Generic coding of moving pictures and associated audio information*. The **Original TS PID** will require setting.

Transport Packet Stream A single PID stream. The **Bitrate** value will require setting.

Other Any binary or ASCII file which is to be packetised into the transport stream at the specified bitrate. The **Bitrate** value will require setting.

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

Bitrate: When first defining a source, the bitrate is unknown and **0kbit/s** is displayed. If the Transport Packet Stream or an '**Other**' **Stream Type** is selected, the field is enabled and a value (in kbit/s) can be entered.

Original TS PID For streams other than transport streams, this field will be blank and disabled.

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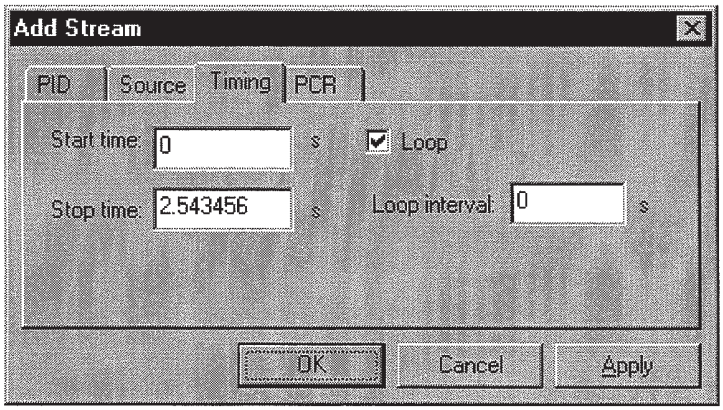
Extra DTS offset: When multiplexing ES or PES streams, the Multiplexer will derive an offset between the PCR and the decoded timestamp (DTS) of the first access unit (video picture / audio frame). The user can override this offset and make it larger (positive + number) or smaller (negative – number). Changing this value may cause the resultant stream to be non-conformant with respect to the T-STD of the MPEG-2 standard. Enter the **DTS offset** in seconds required.

Stream_id — Only enabled for elementary stream types. This number specifies the value of the stream_id field in the PES packet header.

Only needs to be set for DVB stream. Stream identity in the PES header.

Defining the Stream Timing

On the **Add Stream** dialog select the **Timing** tab; this will allow timing parameters for the selected source stream to be defined.



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 via the Transport Stream Properties dialog.

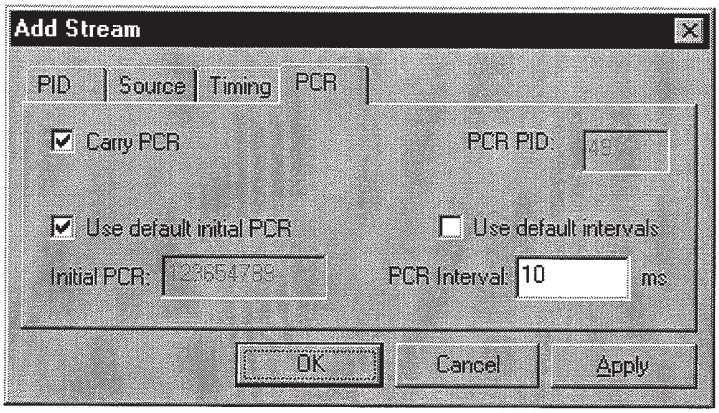
Loop: Select this checkbox to loop the selected source stream for the duration of the synthesis. A **Loop Interval** may be set which introduces a delay between each repeat of the source stream; if zero is entered, the source stream will loop continuously. The Loop checkbox will always be disabled for transport stream types. The multiplexer cannot loop transport streams.

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

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Defining the PCR Placement

On the **Add Stream** dialog select the **PCR** tab; this will allow PCR placement to be defined.



Initially **Carry PCR** is normally disabled. If it is enabled, either the default initial PCR timing can be used (by selecting the **Use default initial PCR** checkbox) or user-defined timing, by disabling the **Use default initial PCR** checkbox, and entering a value in the Initial PCR field.

Similarly, either the default PCR timing intervals can be used (by selecting the **Use default intervals** checkbox) or user-defined intervals, by disabling the **Use default intervals** checkbox and entering a value in the PCR Interval field.

Even if the **Carry PCR** checkbox is enabled by default, it may still be disabled.

Carry PCR disabled:

A disabled **Carry PCR** checkbox means either that any PCR information contained in the source stream is to be discarded or that the source stream carried no PCR information.

In this case, for video or audio streams, a **PCR PID** number must be defined.

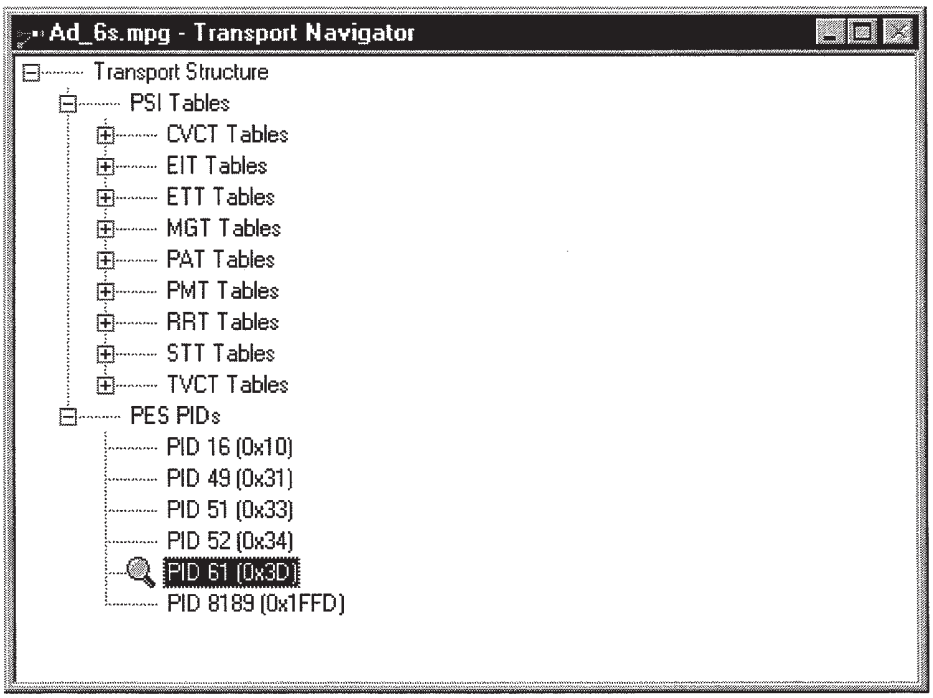
Modifying PES PID Details

To modify any of the **PES** PID parameters, open the **Modify Stream** dialog by selecting the **Properties** option from the **Edit** menu or the right-click pop-up menu, or clicking on the Properties button on the toolbar. (The Stream properties dialog and it's tabs are identical to the **Add Stream** dialog – refer to the previous section.) Locate the parameter to be amended and when changed, select the **OK** button.

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Deleting a PES PID

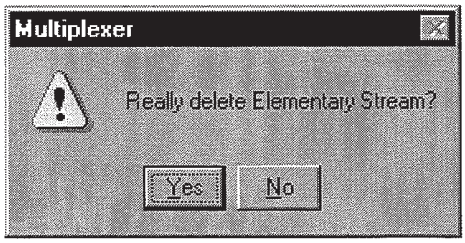
An elementary stream can be removed from the multiplex by deleting the PID. To delete a PID select it in the Transport Navigator. For example to delete PID 61 select the line **PID 61 (0x3D)**:



Then select the **Delete** option from the **Edit** or Pop-Up menus. Alternatively click on the delete button from the toolbar.

Multiplexer asks for confirmation before removing the PID from the multiplex.

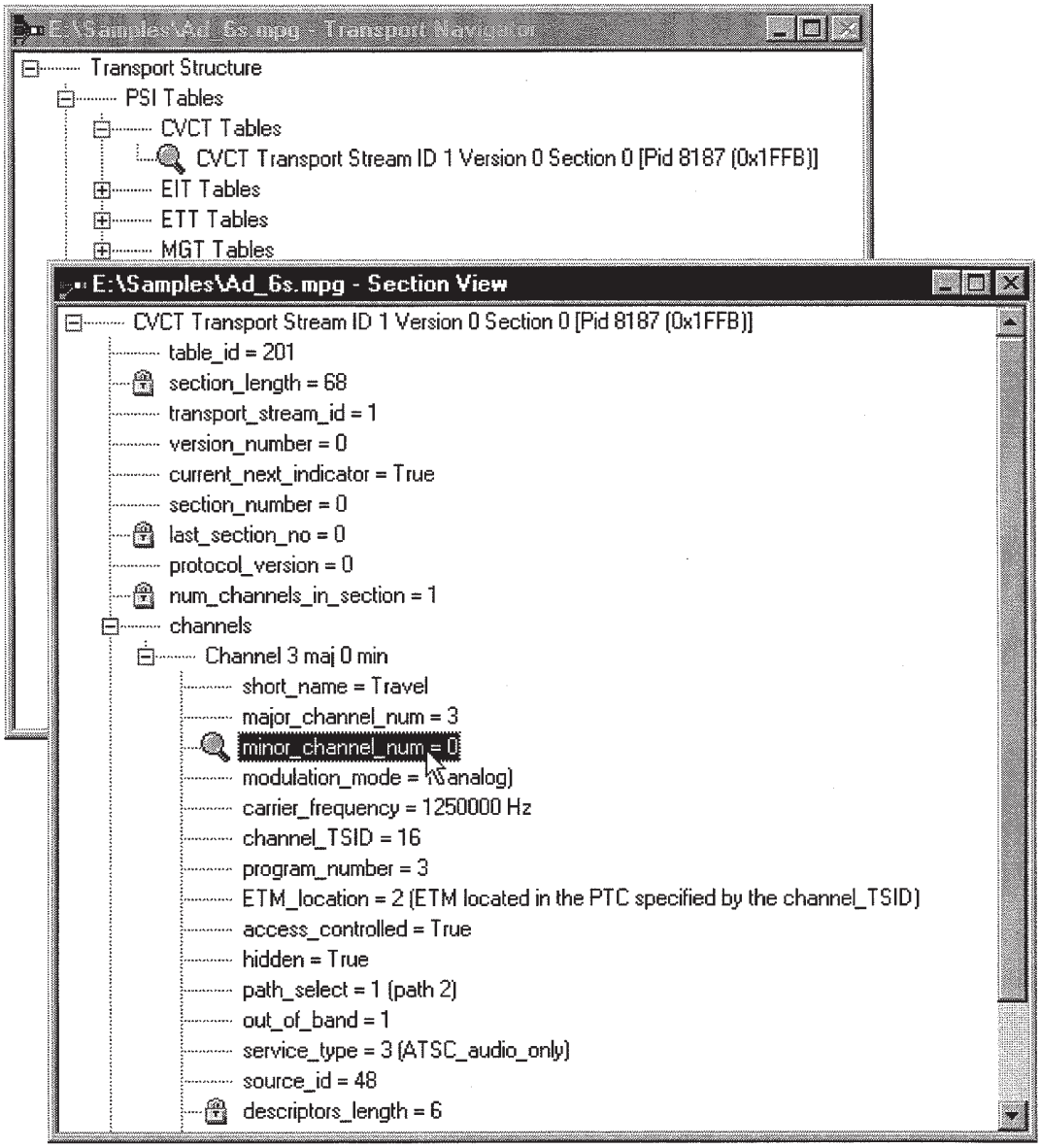
Select **Yes** to delete the stream or **No** to abandon the operation and leave the stream unchanged.



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Section View

The Section View displays the contents of the section currently selected in the Transport Navigator window. It is similar in appearance and operation to the Transport Navigator.

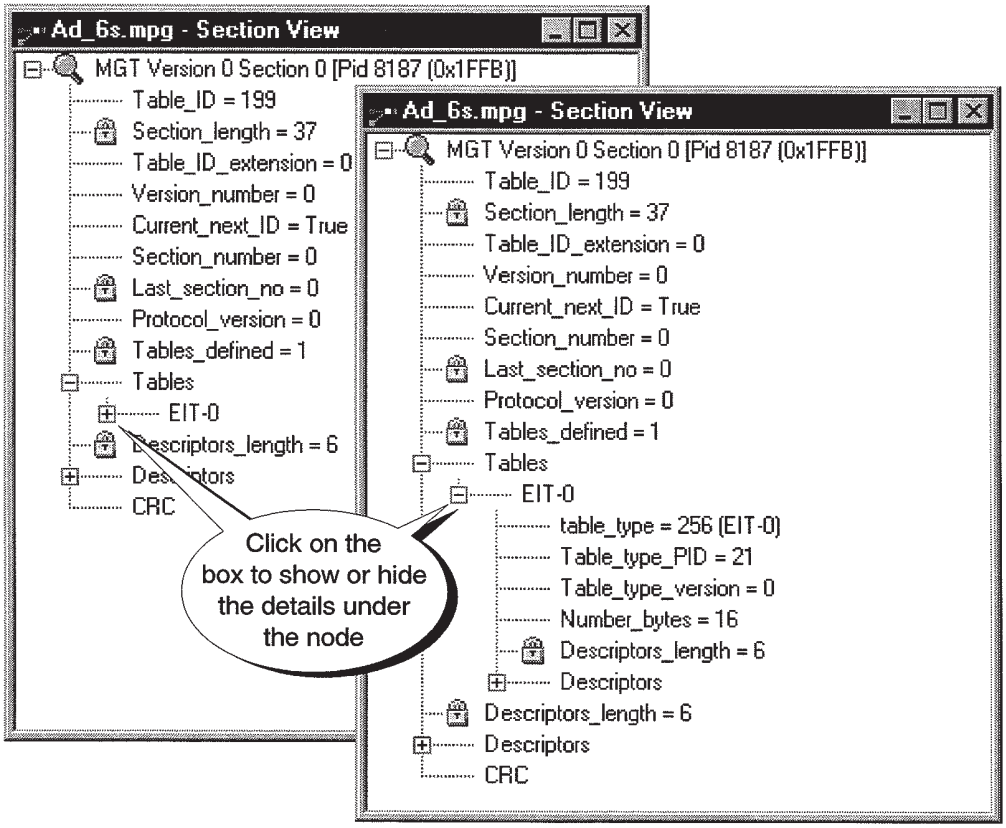


The Section View will display a blank window if the component currently selected in Transport Navigator is not a section.

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Structure Diagram

The structure of a section is represented by a tree diagram. The section of the table selected in Transport Navigator is shown as the "root node" or highest level component of this diagram. Components which contain more information beneath them in the structure are indicated by a square box.



If the node has a minus sign ⊟ in the box the level of detail below it is 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 contained by the node which is currently hidden. Click the mouse pointer on the box to display the next level of information under the node.

Components which are connected to a branch of the tree without a square box are leaf nodes. They represent the individual fields of the table.

Fields which may not be edited directly are indicated by a padlock symbol, 🔒. These, locked fields, are updated automatically when the fields they are derived from is changed. This protection may be switched off by selecting **Expert Mode** from the **Multiplex** menu. It can be re-enabled by selecting **Standard Mode**.

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Syntax of a Section

The diagram on the previous page shows screenshots of 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
    descriptors_length
    for (I = 0;I< N;I++)
        descriptor()
    CRC_32
}
```


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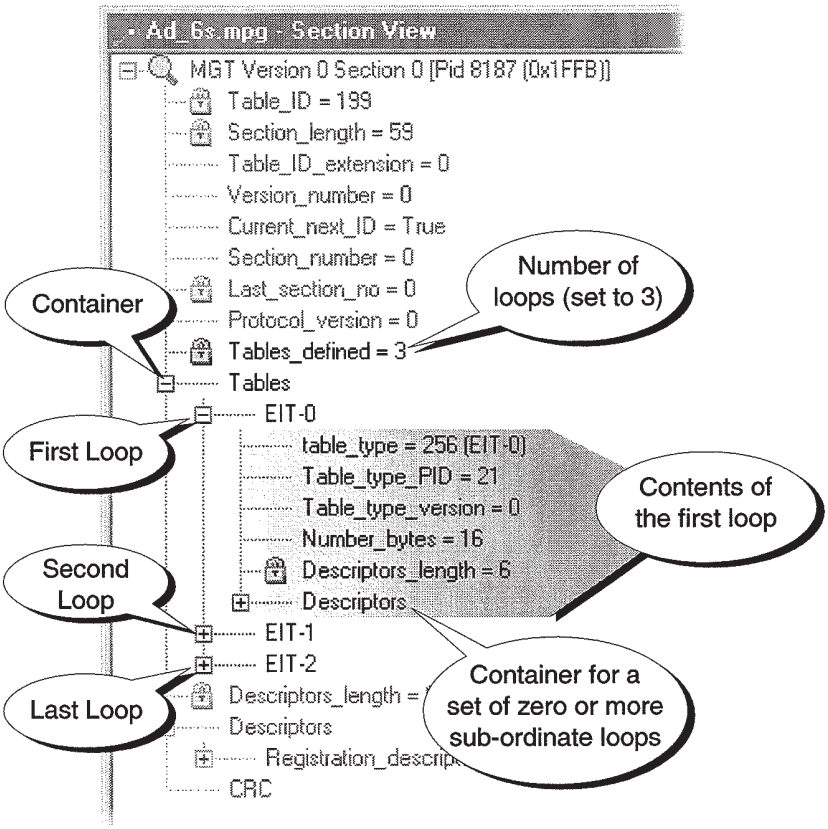
The terms used in this manual to describe the components, represented by nodes, in the structure diagram are:

Container — is a term used by Adherent 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 pre-ceded by a field which specifies the number of loops it contains.

Loop — describes a data structure composed of a specified set of fields and sub-ordinate loops. The structure diagram shows each loop as a node with the fields and sub-ordinate 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 which 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 sub-ordinate loops which it contains.

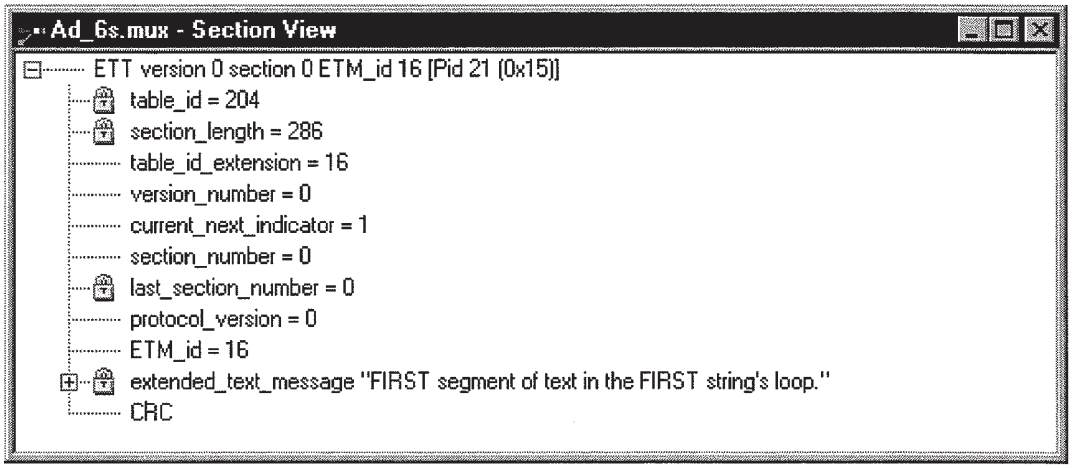
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Syntax of a Multiple String Structure

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]
        }
    }
}
```

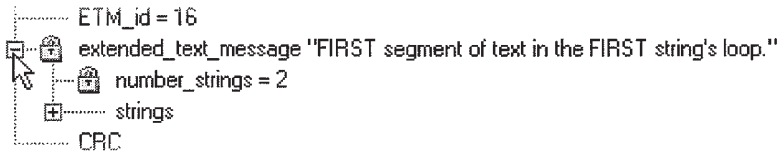
Using the notation of container, loop and field nodes, Section View represents the Multiple String Structure in the same way as any other data structure. For example: an Extended Text Table (ETT) carries its **extended_text_message** in a Multiple String Structure. The default view of a section of an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



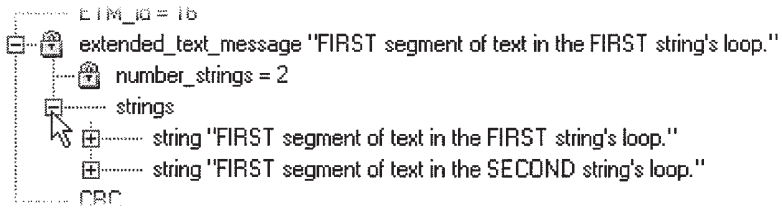
Section view displays a node for the **extended_text_message** with as much as possible of the first segment from the first string.

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

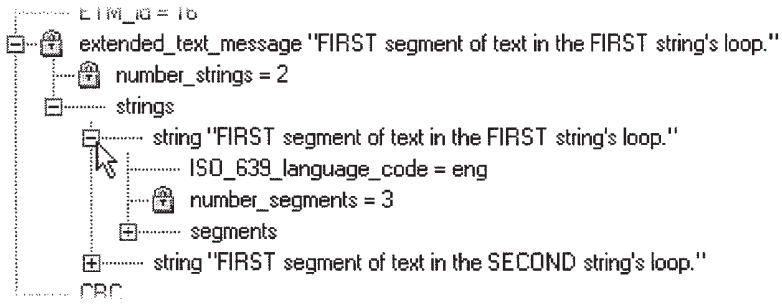
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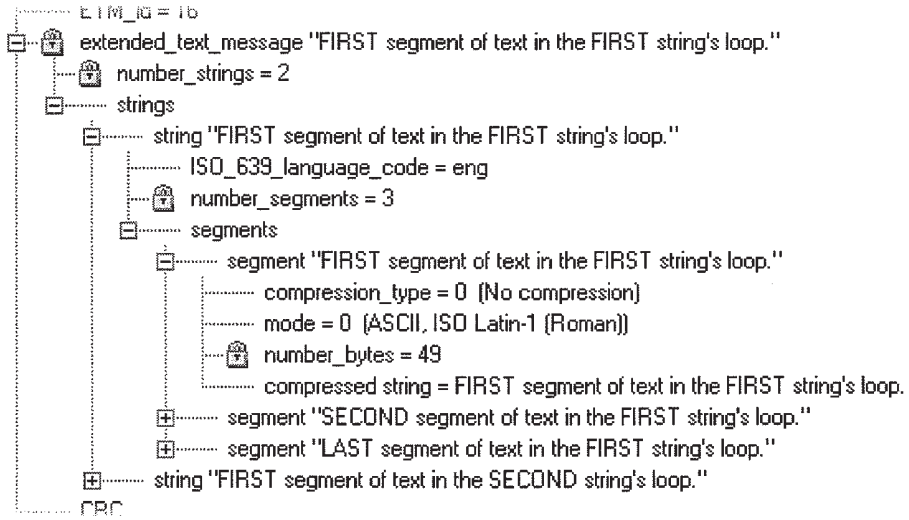
The **number_strings** field shows that there are 2 strings in this example. Expanding the **strings** container shows the loop for each string. Each loop node shows that it defines a string and displays as much as possible of the text from the first segment:



Expanding the node for the first string displays the contents of the loop:



From this it can be seen that the string is in English and is made up of 3 segments. Expanding the segments container will show the 3 loops, one for each segment. Then expanding the loop for the first segment displays the full detail of the structure:



The contents of the segment loop define what compression and character set are used followed by the actual text. The text is held in the **compressed string** field.

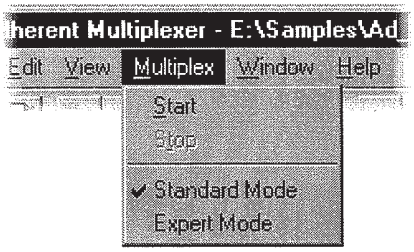
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Expert and Standard Modes

The Transport Navigator and Section View have two modes of operation for conformance checking when editing table contents. These are selected from the Multiplex menu:

Standard Mode Prevents direct editing of many fields whose value or contents can be generated automatically.

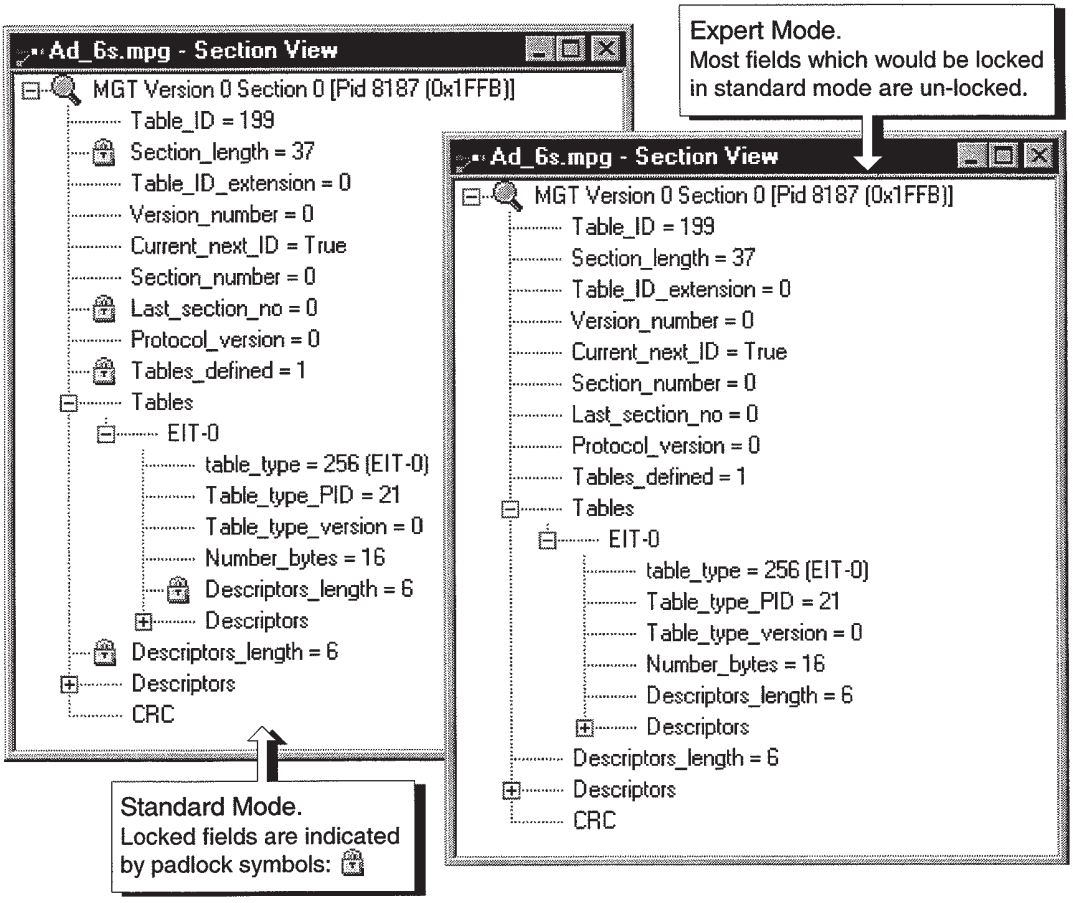
Expert Mode Enables manual editing of fields to allow non-conformances to be specified in transport streams created by the Multiplex Engine.



The check mark, ✓, next to a menu option indicates which mode is currently selected. This is also reflected in the second pane from the right of the Status Bar:



Section View displays a padlock symbol, 🔒, on all of the fields which can not be edited in the current mode. For example, here are two screenshots of the same MGT Version:



A locked field is updated whenever any data changes from which its contents is derived. An edit made in Expert Mode is preserved in Standard Mode unless, or until, a piece of data it is derived from is changed.

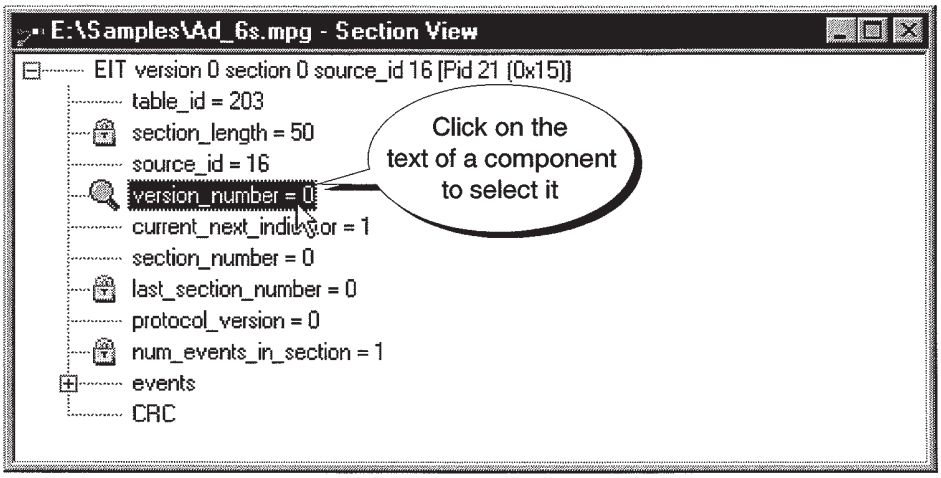
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Editing Fields

To add, change or delete a field, loop or container in a section/version the parent table must be selected in the Transport Navigator window. Then select the appropriate line in the Section View window. Now select the required option from the Edit, View or Pop-Up menus. Alternatively click on the equivalent button from the Toolbar.

Selecting a Field

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



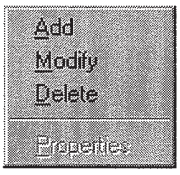
The magnifying glass symbol, 🔍, indicates the selected component. There is no default selection, in the Section View window, when a table section/version is selected in the Transport Navigator window.

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

Menu Options

The specifications for the contents of table versions can be manipulated by options from the **Edit** menu, **View** Menu and Toolbar.

There is a pop up menu which also provides the **Add**, **Modify** and **Delete** options. Position the mouse pointer over the field or container to change and click the right mouse button to "pop up" the menu.



Add Adds a loop to the selected container.

Modify Opens the appropriate dialog to edit the information in the selected field.

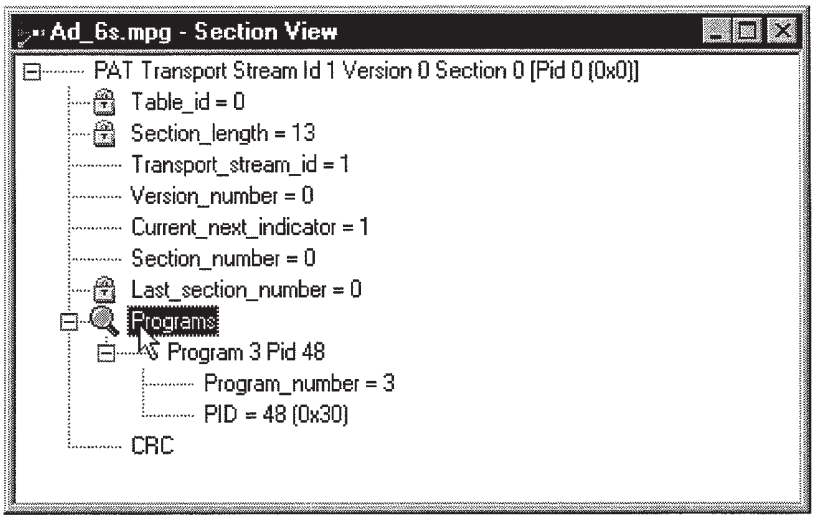
Delete Deletes the selected loop.

Properties This option is disabled (greyed out) for selections in Section View. It opens a properties dialog for editing an item selected in the Transport Navigator.

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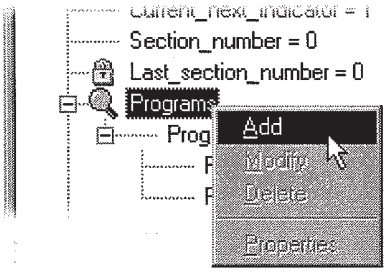
Adding a 'loop'

To add a loop to a section, select the parent which will contain it. For example to add a program to a PAT select the **Programs** container:

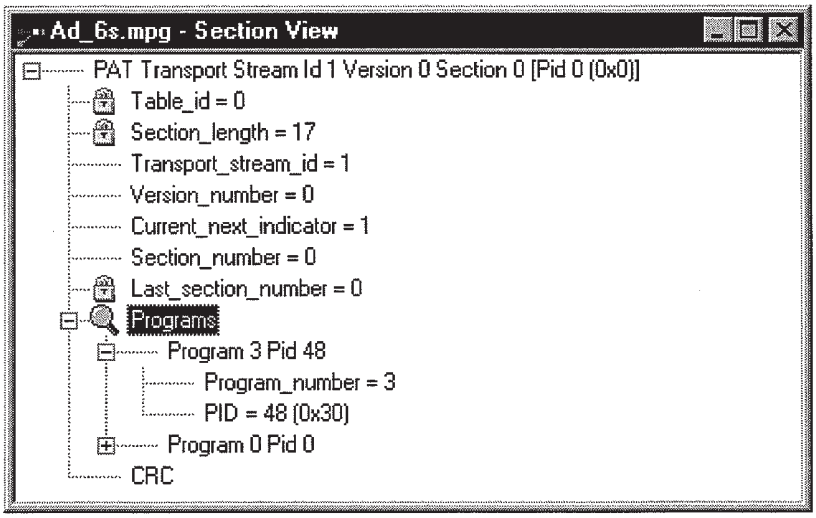


Then select the **Add** option from the **Edit** menu or click on the add button on the toolbar.

Alternatively right click with the mouse on the **Programs** container and select the **Add** option from the Pop-Up menu:



The new loop is created with a set of default contents. An entry is displayed for the new loop, with its details hidden, at the end of the list of loops in the container. For the example of adding a loop to the **Programs** container in a PAT the new entry is **Program 0 PID 0**:

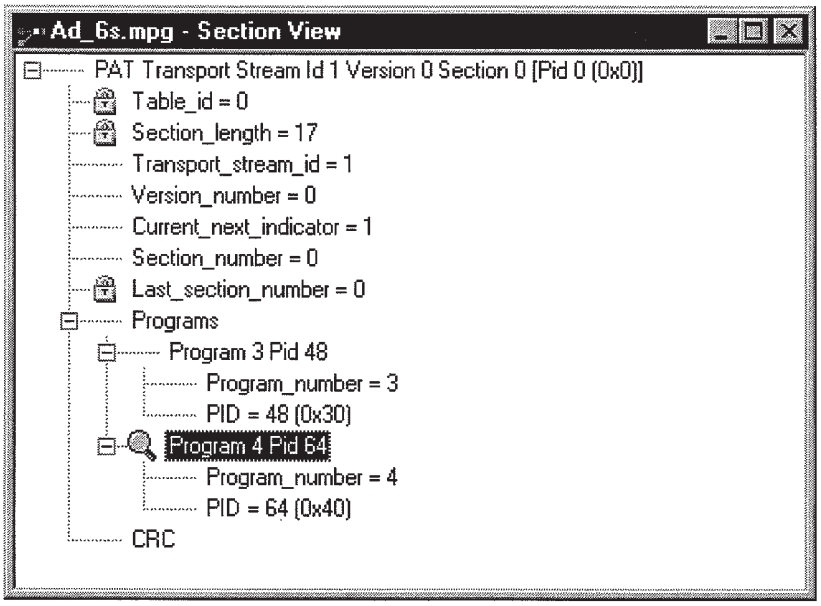


The contents of the loop may now be edited as required.

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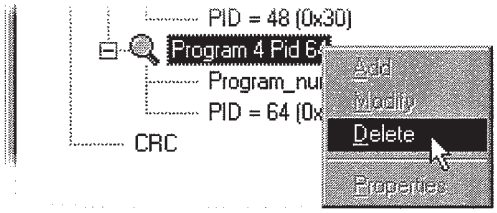
Deleting a 'loop'

To delete a loop select the loop container by clicking on it with the mouse. For example to delete Program 4 from the following PAT select the loop **Program 4 PID 64**:

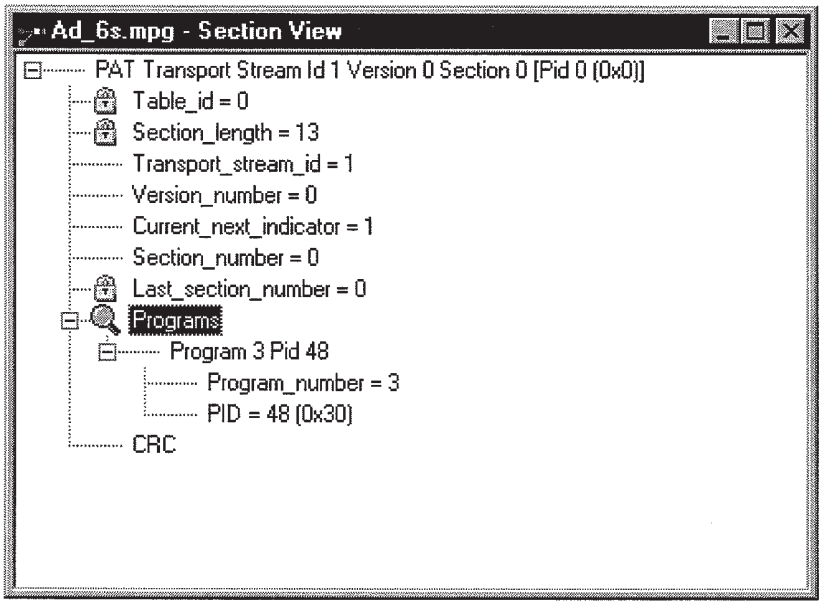


Then select the **Delete** option from the **Edit** menu or click on the delete toolbar button.

Alternatively right click with the mouse on the loop and select the **Delete** option from the Pop-Up menu:



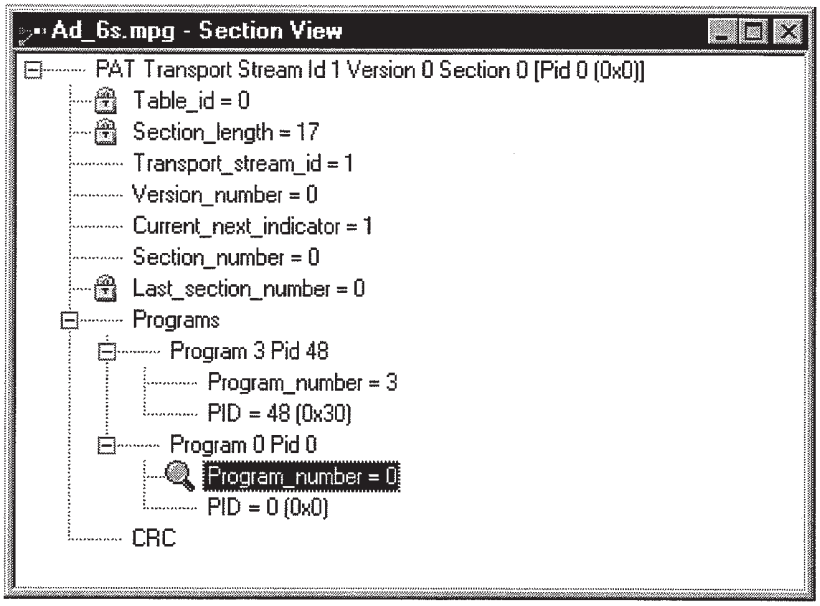
The loop is deleted and the Section View window updated to reflect the changes:



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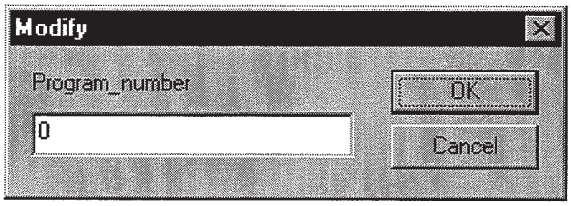
Modifying the Contents of a Field

To edit the contents of a field select it with the mouse. For example to change the program number of Program 0 in a PAT select the line **Program_number=0**:



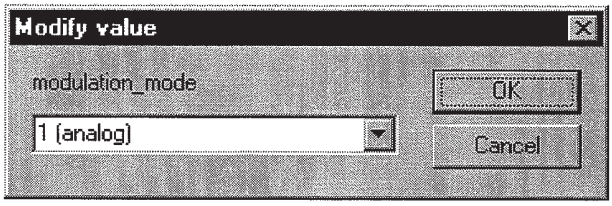
Then select the **Modify** option from the **Edit** or Pop-Up menus. Alternatively click on the modify button on the toolbar. This will open the appropriate dialog for modifying the type of data held by the field.

The above example shows a numeric data type, for which Multiplexer will open this dialog:



Enumerated Value

The **Modify value** dialog 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.



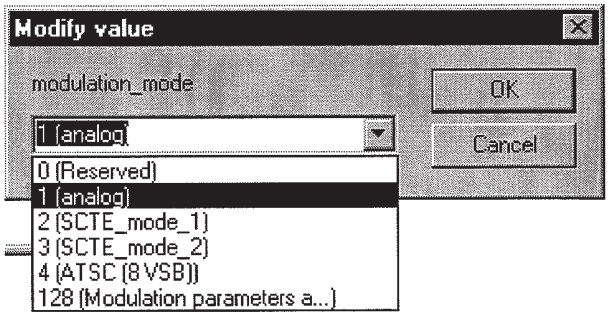
In this screenshot the field being edited is a **modulation_mode** and the current text is **1 (analog)**.

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

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

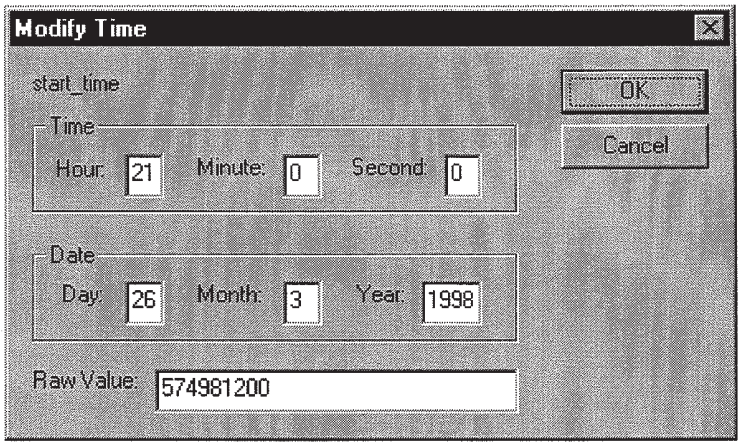
This displays a list of the defined values and their interpretation:



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

Date & Time

The **Modify Time** dialog displays the name of the field. It displays and allows the time to be edited in both interpreted and raw formats.

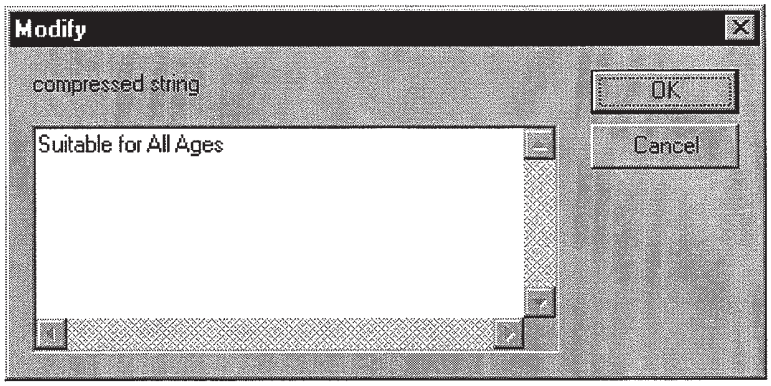


Edit the numbers in any of the fields as required. All fields are updated as each digit is added, changed or deleted. Select **OK** to commit the changes or **Cancel** to abandon editing and keep the original time.

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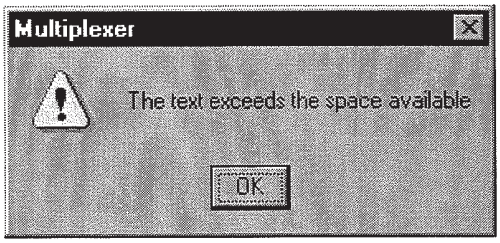
Compressed String

The **Modify** dialog displays the name of the field, which is always **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 will check that the new string length will not make the total section length exceed the maximum specified by the standards.

If it does an error message will be displayed:

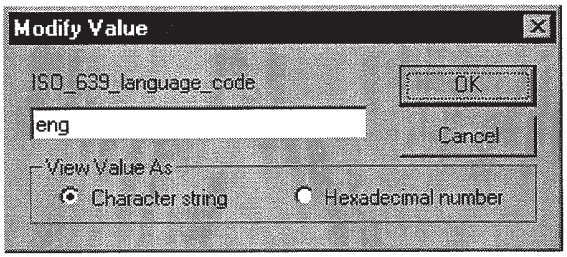


Select **OK** to return to the **Modify** dialog and shorten the string.

Text

The **Modify Text** dialog 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 this screenshot, the field being edited is an **ISO_639_language_code** and the current text is **eng**.



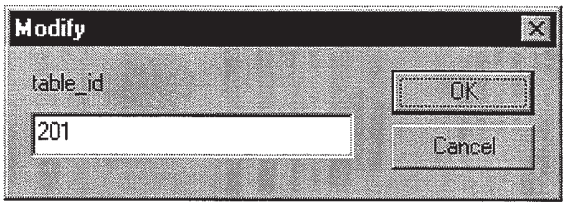
View Value As allows the user to choose between viewing the text as an ASCII character string or a hexadecimal sequence.

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

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Numeric

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



In this screenshot, the field being edited is a **table_id** and the current value is **201**.

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

decimal	hexadecimal
12	**0x0C or 0x0c** (hexadecimal is not case sensitive)
21	**0x15**
201	**0xC9**
2001	**0x7D1 or 0x07D1**

Edit or replace the existing value 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 offering advice and/or asking for more information or confirmation. For example: when changing a **version_number** a dialog is opened to determine the scope of the change.

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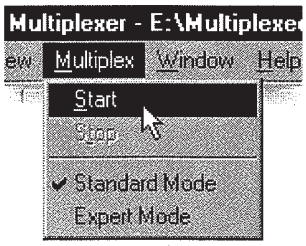
Multiplexing Transport Streams

The Multiplex Engine in Adherent Multiplexer synthesises 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 Transport Navigator and Section View windows.

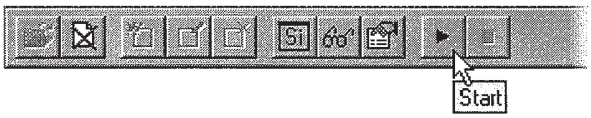
The tables displayed in the Transport Navigator are synthesised from the current specification. Elementary streams and other data are acquired from the original MPEG file and other stream files and re-multiplexed according to the specification.

Start

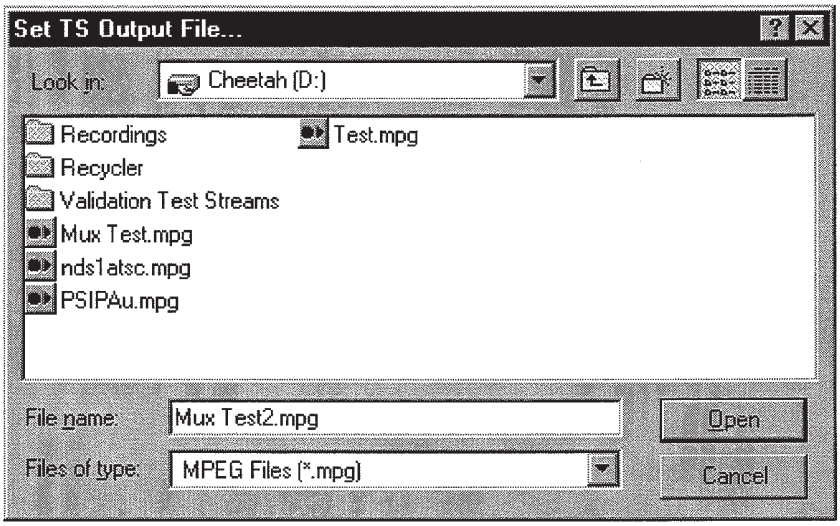
To start the Multiplex Engine select the **Start** option from the **Multiplex** menu.



Alternatively select the start button on the Toolbar:



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



A new file may be created or an existing file can be selected to be overwritten. The program will ask for confirmation before writing over an existing file.

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Errors and Reporting

The right hand pane of the status bar indicates progress as the Multiplex Engine synthesises 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 can not be multiplexed into the new stream at the specified rate:

E:\Samples\Ad_6s.mpg - Event Log

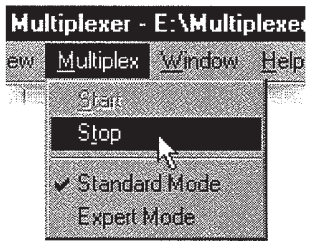
Category	Reference	Comment
Information	Pid 52	Bit rate of 424.471 kbit/s
Information	Pid 512	Bit rate of 0.251 kbit/s
Information	Pid 8189	Bit rate of 19.393 Mbit/s
Time	12:05:23	Demultiplex completed
Time	12:06:27	Multiplexer started
Error	PID 8187	Overflow - cannot encode at required rate
Error	Pkt 4221	Packet with PID 8187 exceeds timing constraints
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	Pkt 8442	Packet with PID 8187 exceeds timing constraints
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	PID 8187	Overflow - cannot encode at required rate
Error	Pkt 10536	Packet with PID 8187 exceeds timing constraints
Time	12:06:29	Multiplexer completed

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

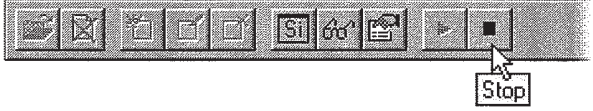
Stop

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 synthesised up to the time the engine was stopped.

To stop the Multiplex Engine select the **Stop** option from the **Multiplex** menu.



Alternatively select the stop button on the Toolbar:



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Multiplex Configuration Files

Any file holding a recorded or synthesised sample of a stream, which is conformant to the relevant standards, can be opened. Many non-conformant streams can be opened providing the PAT, PMT and MGT tables correctly specify all the other tables and their PIDs.

Multiplexer is used for generating both conformant and non-conformant streams. Having generated a non-conformant stream, it may not be possible to 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.

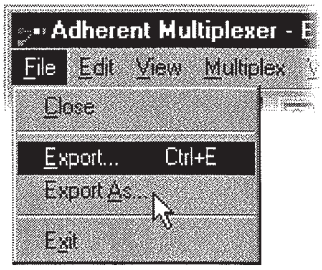


The multiplex configuration file does not contain a copy the transport stream, instead, it refers to the original MPEG file by the full path name. Deleting or moving the MPEG file will render the multiplex configuration file invalid and unusable.

Export

Select the **Export...** option from the **File** menu to save any changes to the current multiplex configuration file.

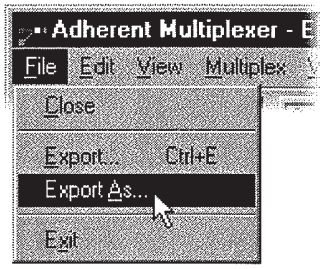
Alternatively, use the **Ctrl+E** keyboard shortcut.



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

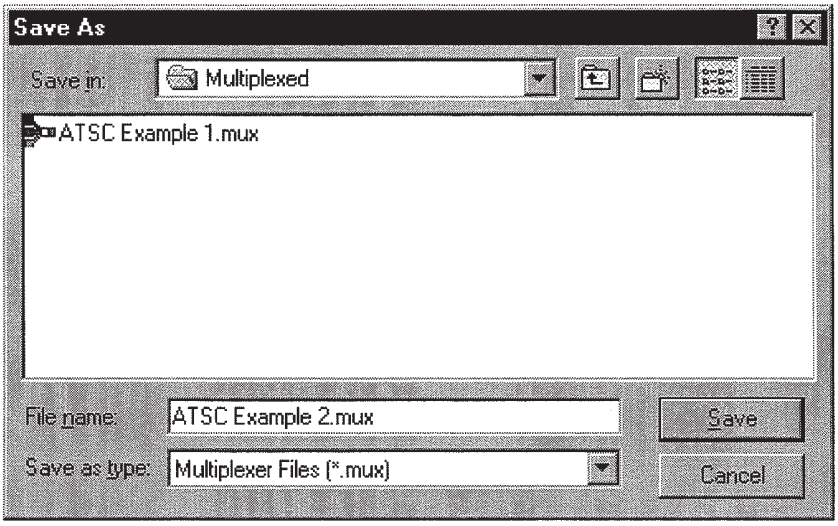
Export As

The **Export As...** option from the **File** menu exports a file with a user specified name.



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

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

Make Seamless

When looping 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.

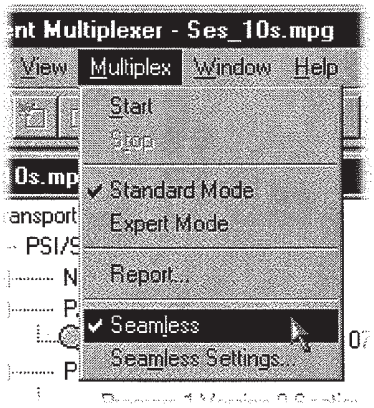
The option can be set up and enabled so that all multiplex operations result in seamless output – or none.

Enabling the Seamless option

Toggle the Seamless option by selecting **Multiplex ➔ Seamless.**

or

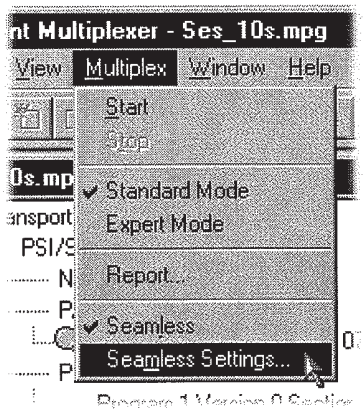
by selecting the toolbar button 



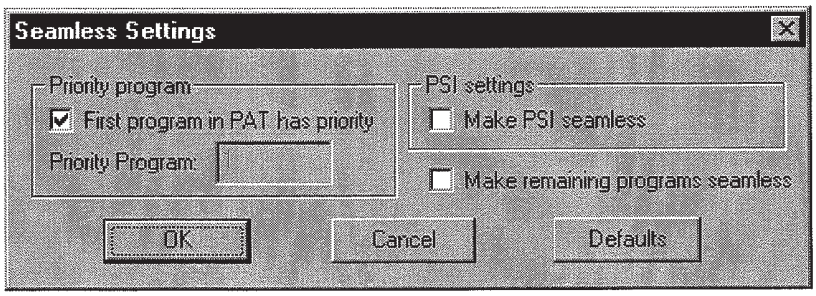
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Seamless Settings

Open the Seamless Settings dialog by selecting **Multiplex → Seamless Settings...**



The dialog shown below is displayed:



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.

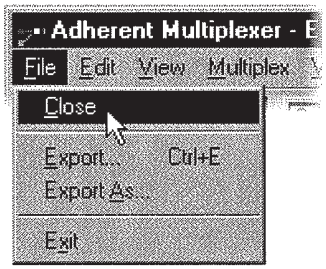
If the setting is disabled, the SI is not processed but simply copied to the output transport stream.

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.

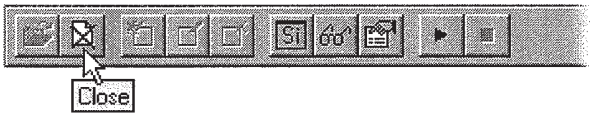
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Closing files

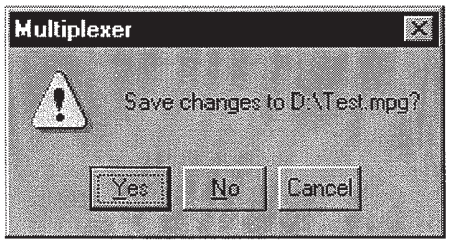
To close the files select the **Close** option from the **File** menu. This will close both the MPEG file and any multiplex configuration file that is open.



There is also a shortcut button 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.

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Multiplexer Procedures

To assist the Multiplexer user, the following procedures are documented in this section:

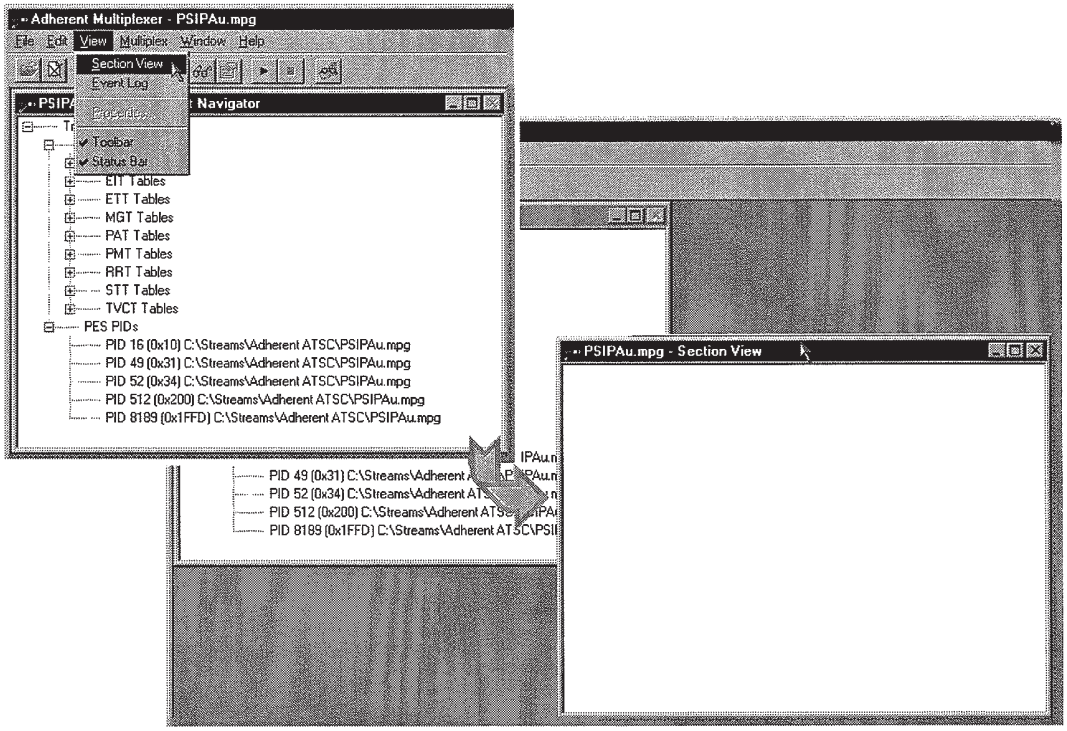
- Add a program to a synthesised multiplex
- Add a Video Stream
- Add an Audio Stream
- Starting a Multiplex

The procedures are presented in modular form to enable full tasks to be carried out; such as, creating a synthesised multiplex containing a video and it's associated audio information.

Add a program to a synthesised multiplex

Detailed below are the steps needed to add a program to a transport stream.

1. Open either a Transport Stream or a Multiplexer Configuration file which is to form the basis of the new multiplex. Wait for it to be analysed; when it is complete, the structure will be displayed in the Transport Navigator window.
2. Open the Section View window (which may be blank initially).

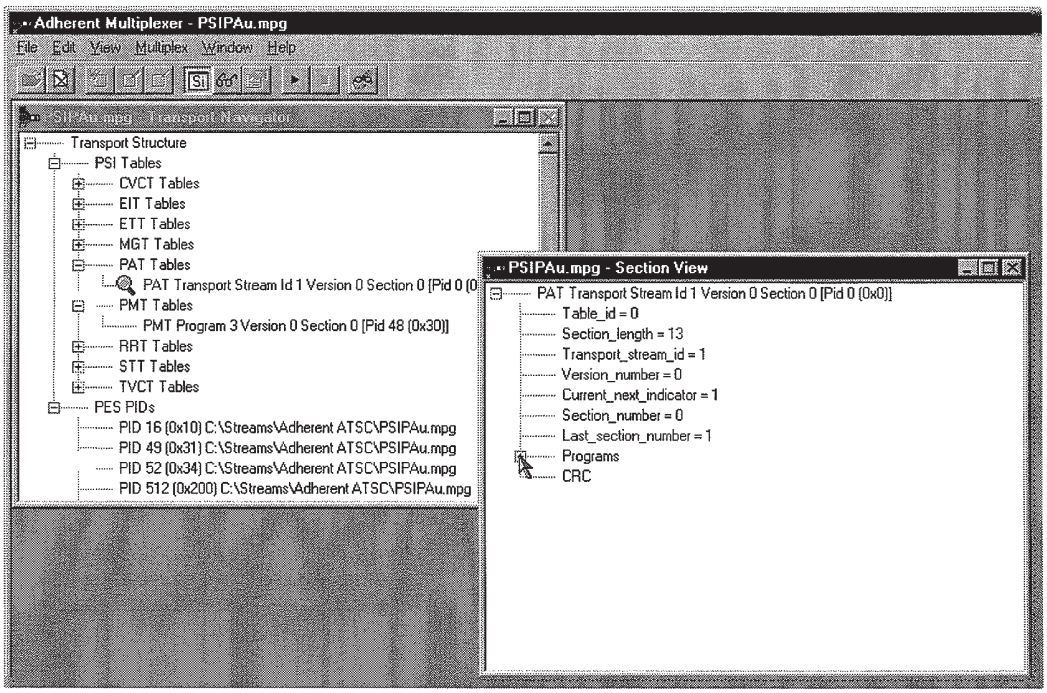


3. In the Transport Navigator window expand the PAT Tables section by clicking on the plus symbol to the left of the PAT table type.

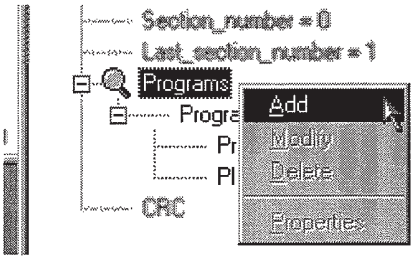
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4. Highlight the PAT section required. Normally there will be only one entry. Note that the magnifying glass symbol is now adjacent to the PAT section entry and that details of the selected section are displayed in the Section View window.

   The PAT (Program Association Table) provides the link between a program number and the PID number in a Transport stream which carries the program definition.



5. In the Section View window select the Programs entry and from the right-click popup menu, select Add.

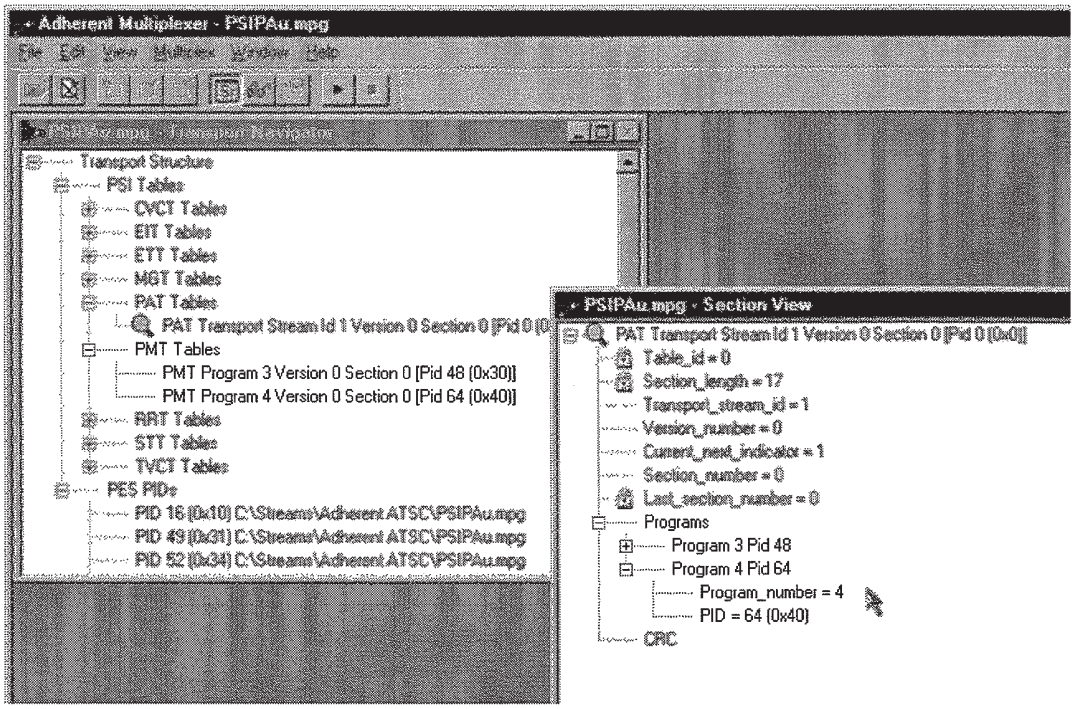


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6. Check that a new program has been added by clicking on the plus symbol on the left of the title and expanding the Programs entry. Note that a new program entry has been added automatically below the last program in the current list.

   The Program number and the PID number are allocated automatically. The PID number allocated is based on the ATSC paradigm and the next available PID.

   Note also, in the Transport Navigator window, that a new PMT (Program Map Table) section has been created



That completes the actions needed to add a new program to a transport stream multiplex. The most likely next action is to add (or associate) a video or audio stream to the newly created program.

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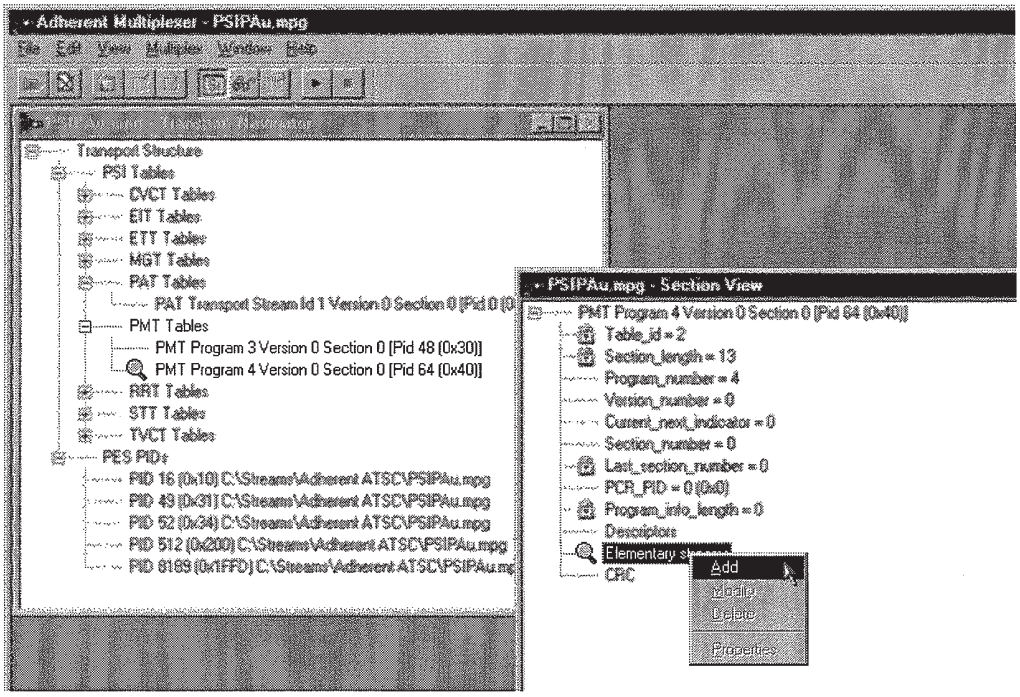
Add a Video Stream

This procedure for adding a video stream to a program assumes the following:

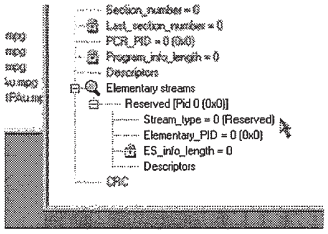
- either a Transport Stream or a Multiplexer Configuration file is open and successfully analysed.
- If no PMT section is available for this stream, the procedure *Add a program to a synthesised multiplex* (see page 67) may need to be carried out.
- the Section View window is open (although it may be blank initially).

The first actions in adding a video stream are to reserve an elementary stream in the PMT (Program Map Table).

1. In the Transport Navigator window, expand the PMT table type and select the required program. Note that the program's details are displayed in the Section View window.
2. In the Section View window, select the Elementary streams entry and from the right-click popup menu select Add.



3. Expand the Elementary streams entry and note that a new elementary stream has been added at the bottom of the existing list.

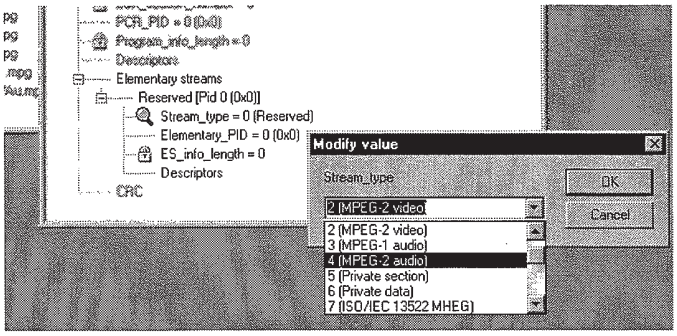


The default Stream_type is (0) Reserved; similarly, the default Elementary_PID number is 0 (0x0). These values must now be changed to concur with the stream to be added.

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4. Select **Stream_type** in the new elementary stream entry and from the right-click popup menu select **Modify**.

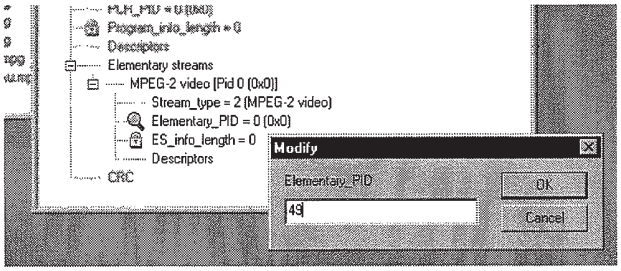
5. In the **Modify value** dialog, select a video source (e.g. MPEG-2, PID form transport stream, etc.) from the drop-down list. Select **OK**.



6. Select Elementary_PID in the new elementary stream entry and from the right-click popup menu select Modify.

7. In the **Modify** dialog, enter the PID number which is to carry the elementary stream.

   If the number entered does not conform to the ATSC Paradigm, a warning message will be displayed which will indicate the recommended PID number.



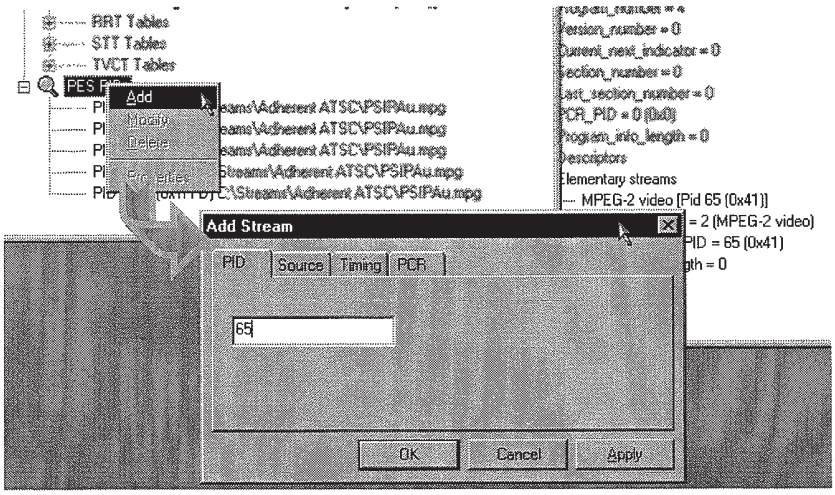
If required, select No from the warning dialog and repeat the Elementary_PID modification using the recommended PID number.

If the entered number is to be used, select Yes from the warning dialog.

Having reserved an elementary stream, the remaining actions identify the stream to be added.

8. In the Transport navigator window, select the **PES** PIDs section and from the right-click popup menu select Add.

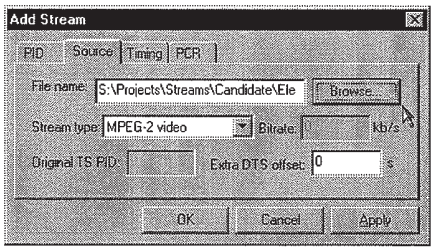
   The Add Stream properties dialog is displayed.



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a. In the **PID** tab, enter the number allocated to the elementary stream in the step 7.

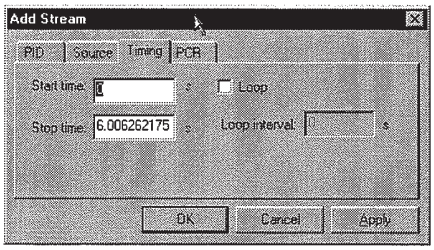
b. In the **Source** tab, enter the name of the stream to be multiplexed or use the **Browse** button to locate and add the file.



c Identify the **Stream Type** by selecting a video source (e.g. MPEG-2, PID from transport stream, etc) from the drop-down list.

d In the **Timing** tab, enter the Start and Stop times.

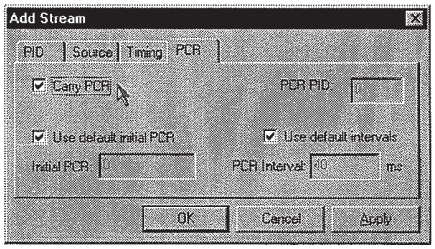
The fields will default to the source Transport Structure start and stop times. However, the times entered refer to the start and stop times of the new elementary stream within the new multiplex.



e In the **PCR** tab, enable the **Carry PCR** checkbox, if required. This will ensure that PCR information is added to the multiplex.

Set the Initial PCR and PCR Interval if necessary.

If this stream PID now carries PCR, this PID number must be recorded in the PMT PCR_PID field.



f Select OK to accept the modifications.

If required the new multiplex can now be created (see Starting a Multiplex, page 70).

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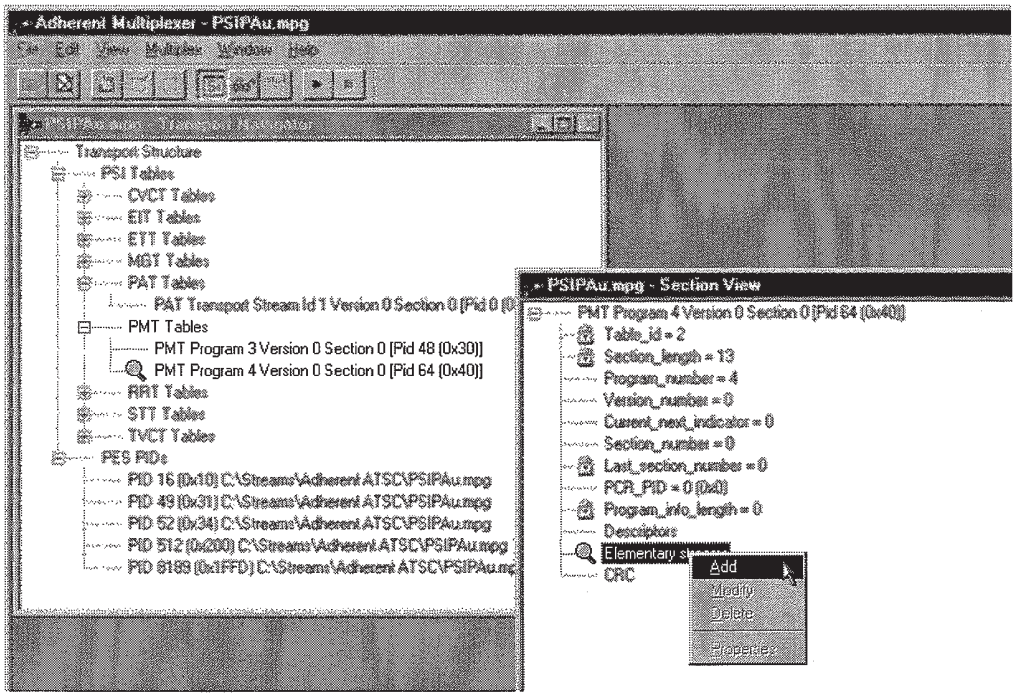
Add an Audio Stream

This procedure for adding an audio stream to a program assumes the following:

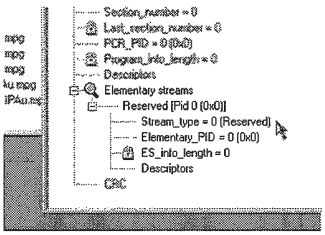
- either a Transport Stream or a Multiplexer Configuration file is open and successfully analysed.
- If no PMT section is available for this stream, the procedure *Add a program to a synthesised multiplex* (see page 67) may need to be carried out.
- the Section View window is open (although it may be blank initially).

The first actions in adding an audio stream are to reserve an elementary stream in the PMT (Program Map Table).

1. In the Transport Navigator window, expand the PMT table type and select the required program. Note that the program's details are displayed in the Section View window.
2. In the Section View window, select the Elementary streams entry and from the right-click popup menu select Add.



3. Expand the Elementary streams entry and note that a new elementary stream has been added at the bottom of the existing list.

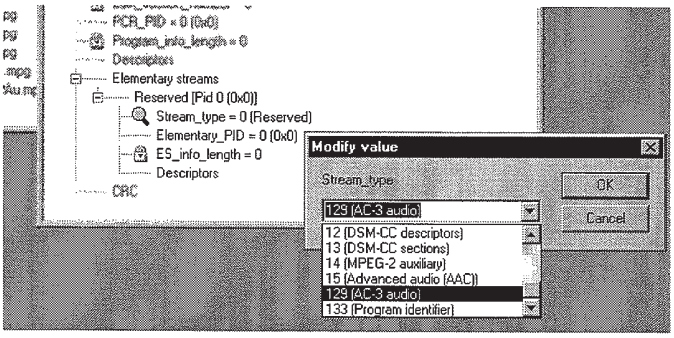


The default Stream_type is (0) Reserved; similarly, the default Elementary_PID number is 0 (0x0). These values must now be changed to concur with the stream to be added.

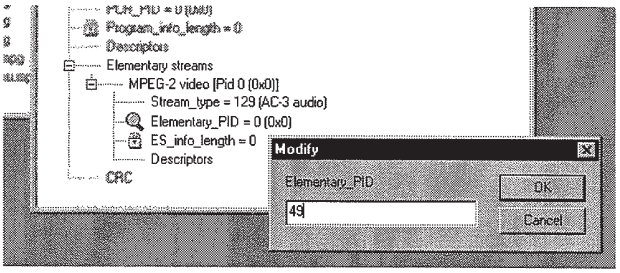
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4. Select **Stream_type** in the new elementary stream entry and from the right-click popup menu select **Modify**.

5. In the **Modify value** dialog, select an audio source (e.g. AC-3, MPEG-2, PID from transport stream) from the drop-down list. Select **OK**.



6. Select Elementary_PID in the new elementary stream entry and from the right-click popup menu select Modify.



7. In the Modify dialog, enter the PID number which is to carry the elementary stream.

   If the number entered does not conform to the ATSC Paradigm, a warning message will be displayed which will indicate the recommended PID number.

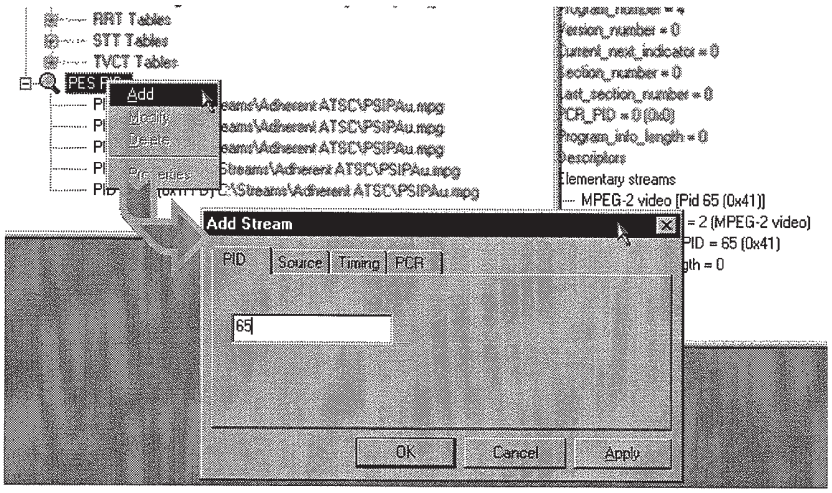
   If required, select **No** from the warning dialog and repeat the Elementary_PID modification using the recommended PID number.

   If the entered number is to be used, select **Yes** from the warning dialog.

Having reserved an elementary stream, the remaining actions identify the stream to be added.

8. In the Transport navigator window, select the **PES** PIDs section and from the right-click popup menu select Add.

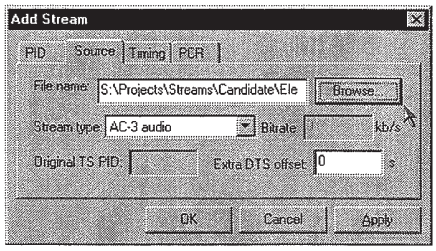
   The Add Stream properties dialog is displayed.



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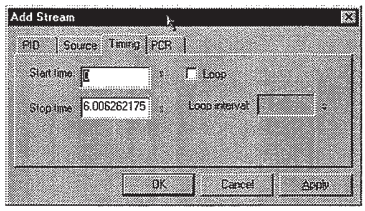
a. In the **PID** tab, enter the number allocated to the elementary stream in the step 7.

b. In the **Source** tab, enter the name of the stream to be multiplexed or use the **Browse** button to locate and add the file.



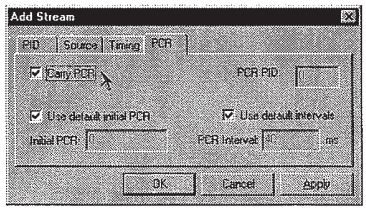
c Identify the **Stream Type** by selecting an audio source (e.g. AC-3, MPEG-2, PID from transport stream) from the drop-down list.

d In the Timing tab, enter the Start and Stop times.



The fields will default to the source Transport Structure start and stop times. However, the times entered refer to the start and stop times of the new elementary stream within the new multiplex.

e In the **PCR** tab, disable the **Carry PCR** checkbox, if required.



f Most audio streams will be associated with a video stream and can therefore use the same PCR timing information.

Set the Initial PCR and PCR Interval if necessary.

If this stream PID now carries PCR, this PID number must be recorded in the PMT PCR_PID field.

g Select OK to accept the modifications.

If required the new multiplex can now be created (see Starting a Multiplex, page 70).

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Starting a Multiplex

Starting a multiplex assumes that the configuration details have been set up.

An aspect of configuring a multiplex that is often overlooked is Bandwidth. For example, adding a program containing both video and audio to an existing transport stream *will* increase the bandwidth required.

Bandwidth can be inspected before starting the multiplex operation by highlighting the Transport Structure node in the Transport Navigator window and selecting Properties from the right-click popup menu. Both overall bandwidth and duration can be modified in the Transport Stream Properties dialog displayed.

Before starting open the Event Log window; this allows the multiplex process to be monitored if required.

When the multiplex is started, either from the toolbar or from the Multiplex menu, the new file will require naming; the default filename extension is .mpg.

Progress of the multiplex progress is indicated on the right-hand side of the Status Bar.

When processing is complete, the newly multiplexed stream can be opened and inspected using Multiplexer (or any of the Stream Station applications).

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Adherent Stream Source

Transport Stream Editor

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AD991 Stream Source Product - Transport Stream Editor

Adherent Document: SI257v1.0 Issue 1.0a

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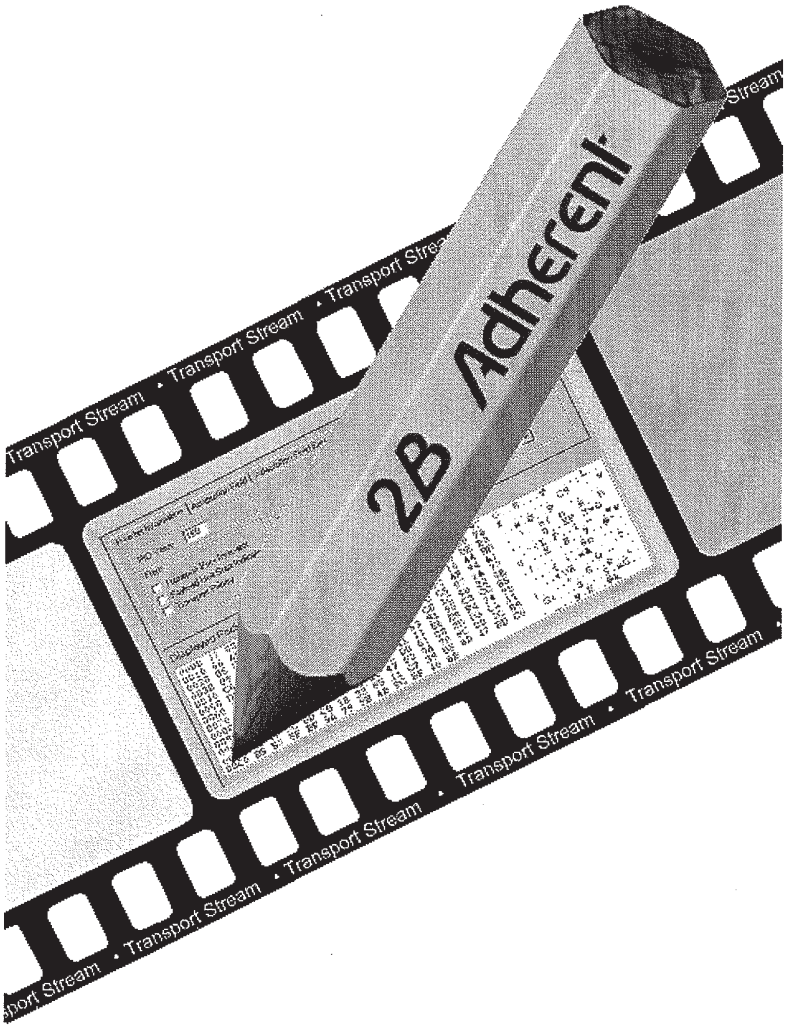
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Adherent Systems Ltd
Endeavour House
Vision Park, Histon
Cambridge
CB4 4ZR
United Kingdom

Telephone: +44 (0)1223 200700
Fax: +44 (0)1223 200701

World Wide Web: http://www.adherent.com
E-mail - Sales & Enquiries: info@adherent.com
E-mail - Technical Support: support@adherent.com

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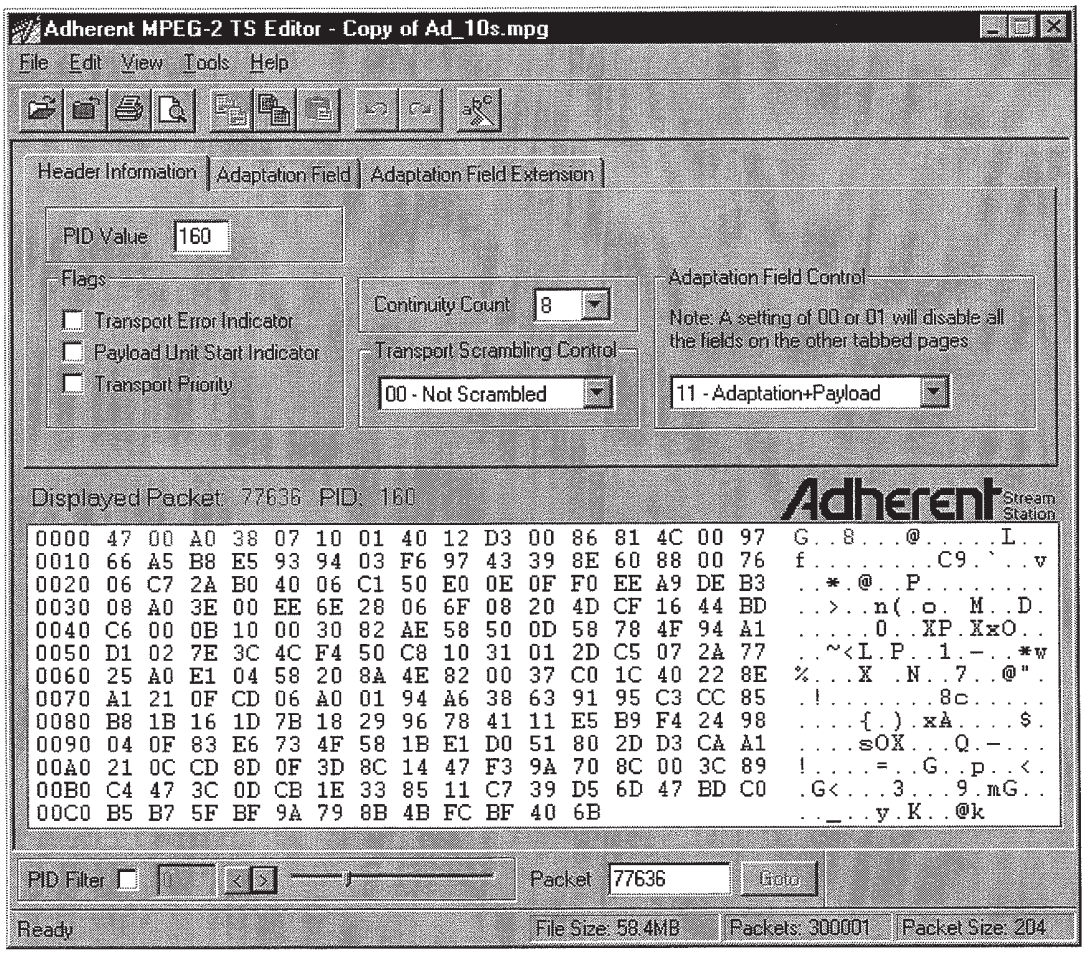


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Introduction

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

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Packet headers may 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 which "make sense" with the other fields in the header. It gives full syntax checking of all changes which are made.

Payload, and any Reed Solomon, data is edited from the Hexadecimal Editor.

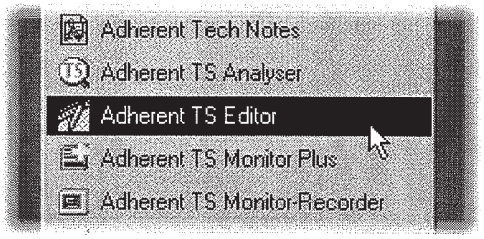
On the right of the Hex Editor pane the ASCII character is displayed. Unprintable characters are shown as a period (dot or full stop).

It is normal to edit a copy of a transport stream. Transport Stream Analyser may be used to view the original whilst editing the copy.

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Starting the Program

The program may be started by selecting the **Adherent TS Editor** option from the **Start** -> **Programs** menu.



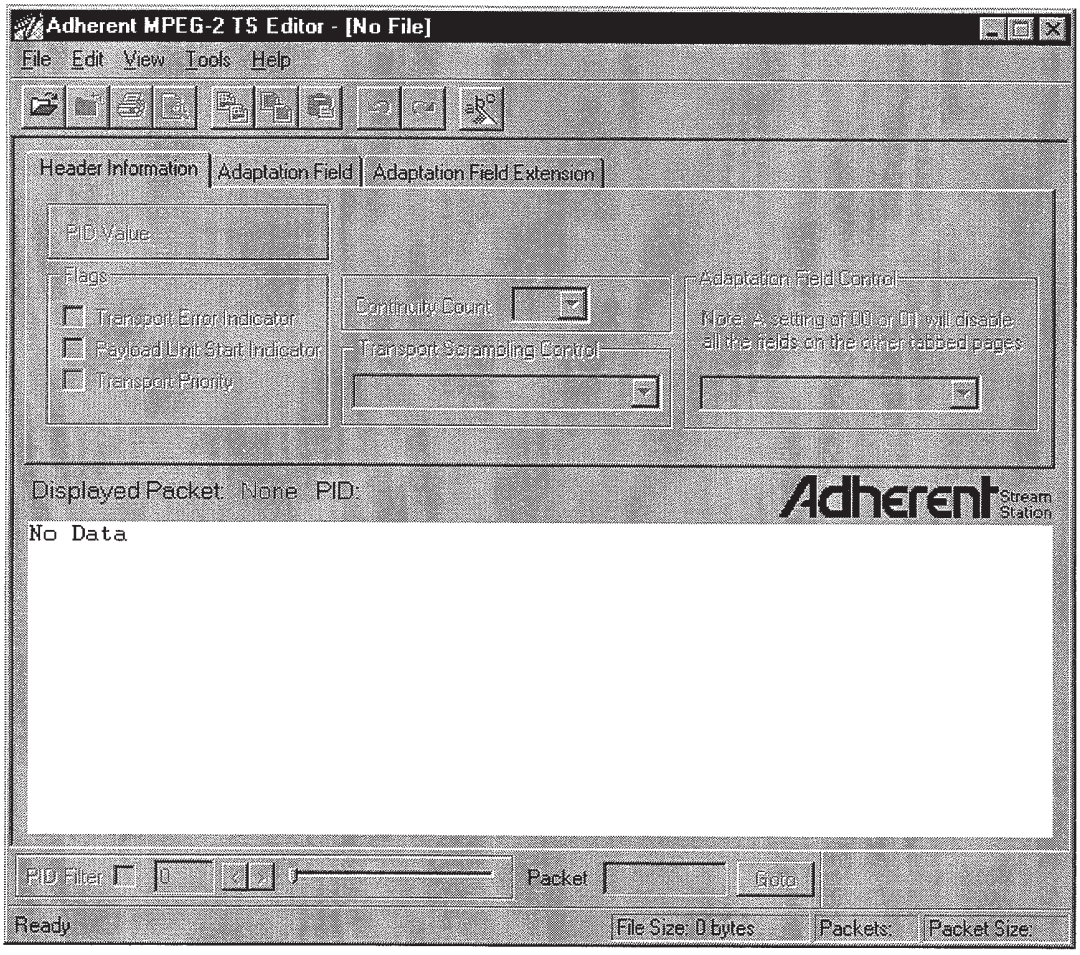
or

by double clicking on the **Adherent TS Editor** Shortcut on the desktop.



Initial Appearance

Once the program has started and is ready for use it will open a Main Window which looks like this:



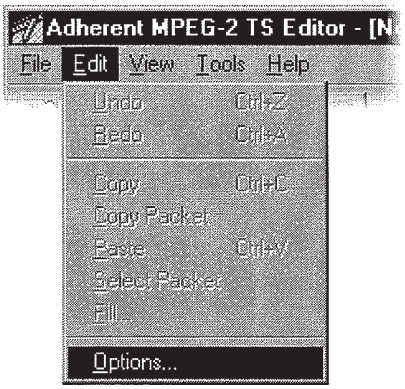
The Toolbar (row of buttons close to the top of the window) and the Status Bar at the bottom of the window may be hidden from view. They are always displayed when the program first starts.

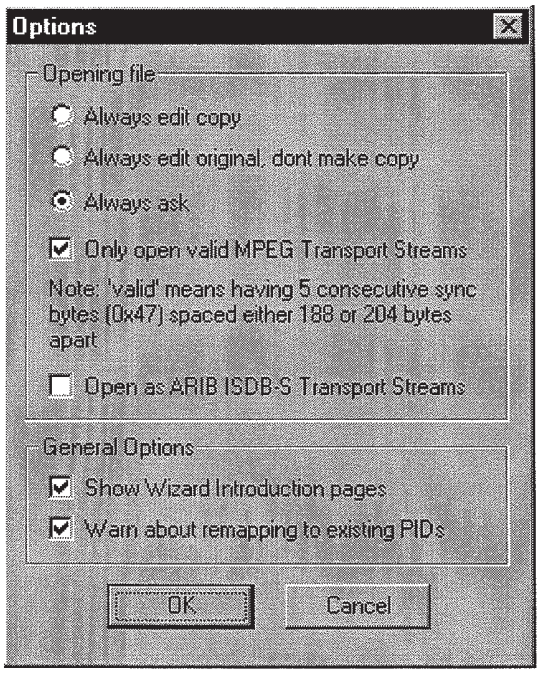
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Options

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 may be changed at any time by selecting **Options...** from the **Edit** menu, which opens the Options dialogue.





Opening file

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

Always edit copy	When opening a file Editor always makes a copy, without asking.
Always edit original, dont 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	Option to stop Editor opening files which do not have 5 or more consecutive sync bytes.
Open as ARIB ISDB-S Transport Streams	Option to open transport streams encoded as ARIB ISDB-S format (including TMCC information).

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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 which is already in use.

Opening a file

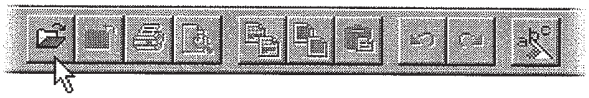
Any stream which is held in a file may be edited with the Transport Stream Editor.

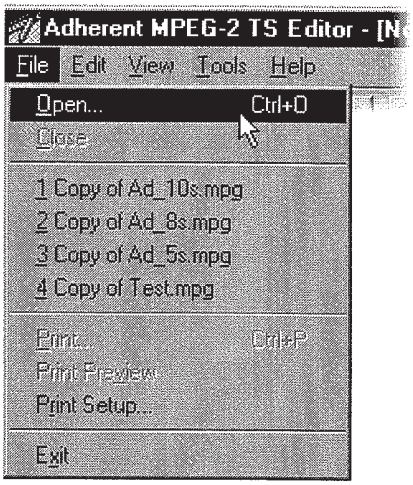
Opening a file from the Menus and Toolbar

To edit a file select the **Open ...** option 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 dialogue.

Alternatively use the **Ctrl+O** keyboard shortcut.

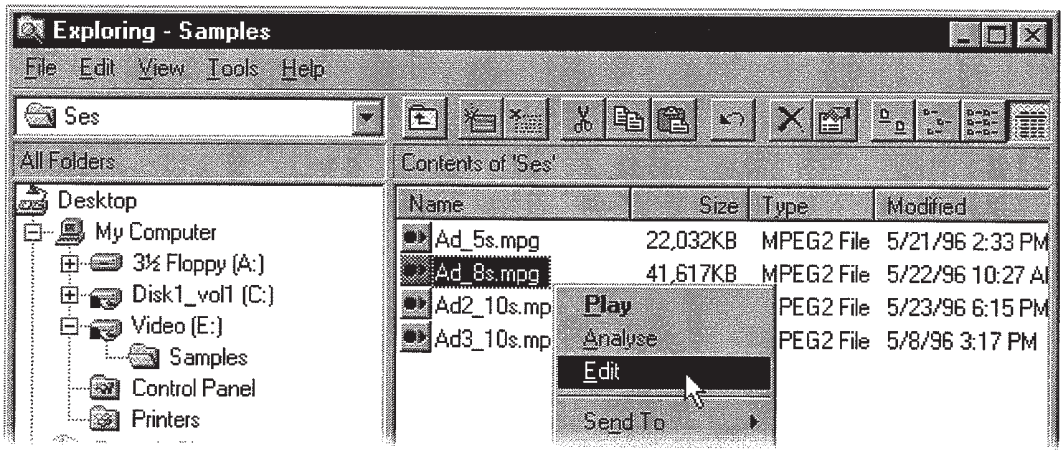
There is also a shortcut button available on the Toolbar for opening a file, which has the standard file open symbol:



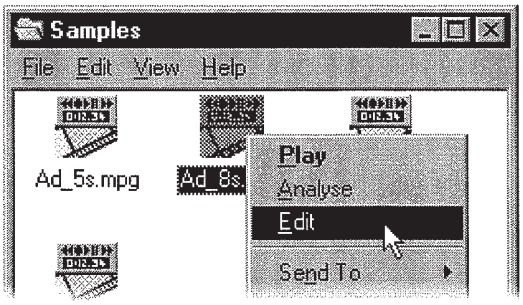


Opening a file from NT Explorer or a File Browser Window

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



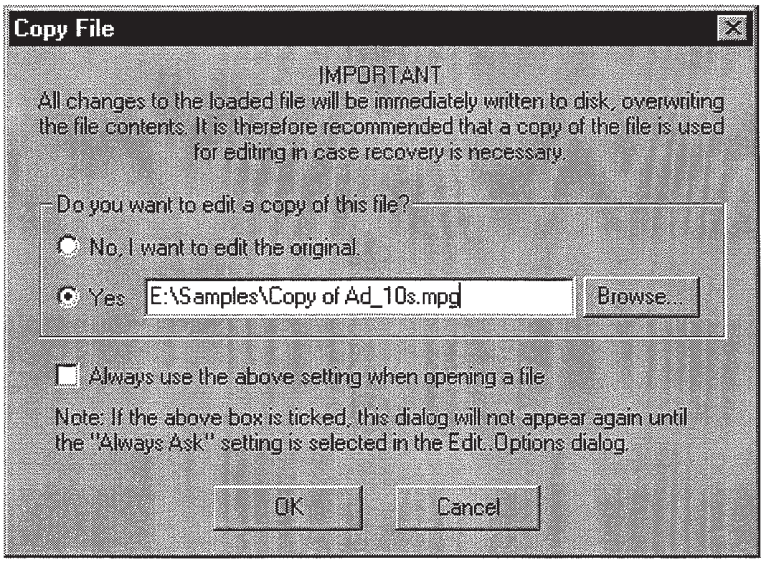
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Place the pointer over the file name or icon, press the right mouse button to pop-up a menu and then select the **Edit** option

Copying 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, a dialog is displayed asking whether to edit the original or make a copy.



For users who do not like to be presented with this dialog each time a file is opened the copy or edit original option can be set as the default.

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

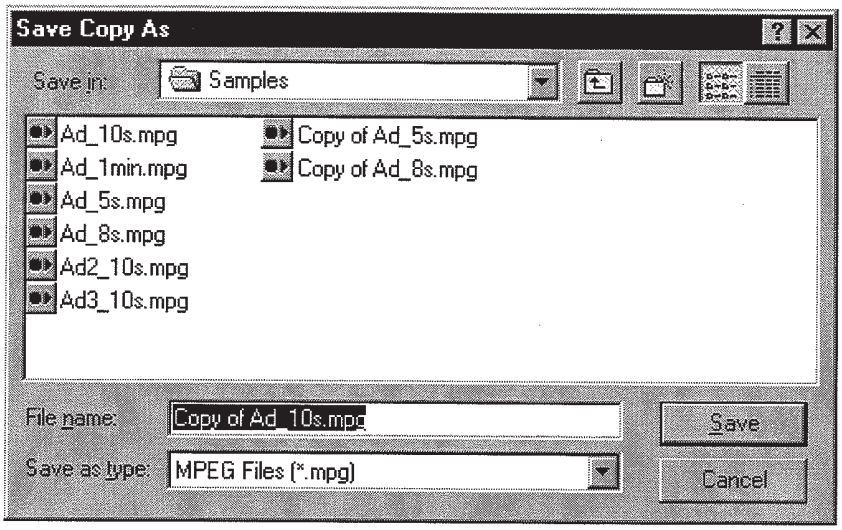
If someone else has used the Stream Station it is a good idea to look at the Options before opening a file.

To edit the original (useful when making edits to a file which is already a copy) select the **No, I want to edit the original** option, 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 mouse pointer changes to the busy pointer, usually an hour glass.

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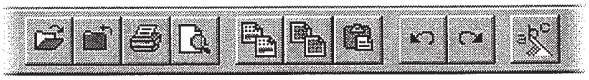
When the Edit a copy option is selected the dialog suggests a suitable filename. This may be edited by selecting the filename text box and typing from the keyboard. To look for a different directory or filename select on the **Browse...** button. This will open a standard file browser window, like this:



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Menus And Controls

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 is 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 which 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 (greyed out) when nothing is selected which may 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.


Re-instates the previously undone change.

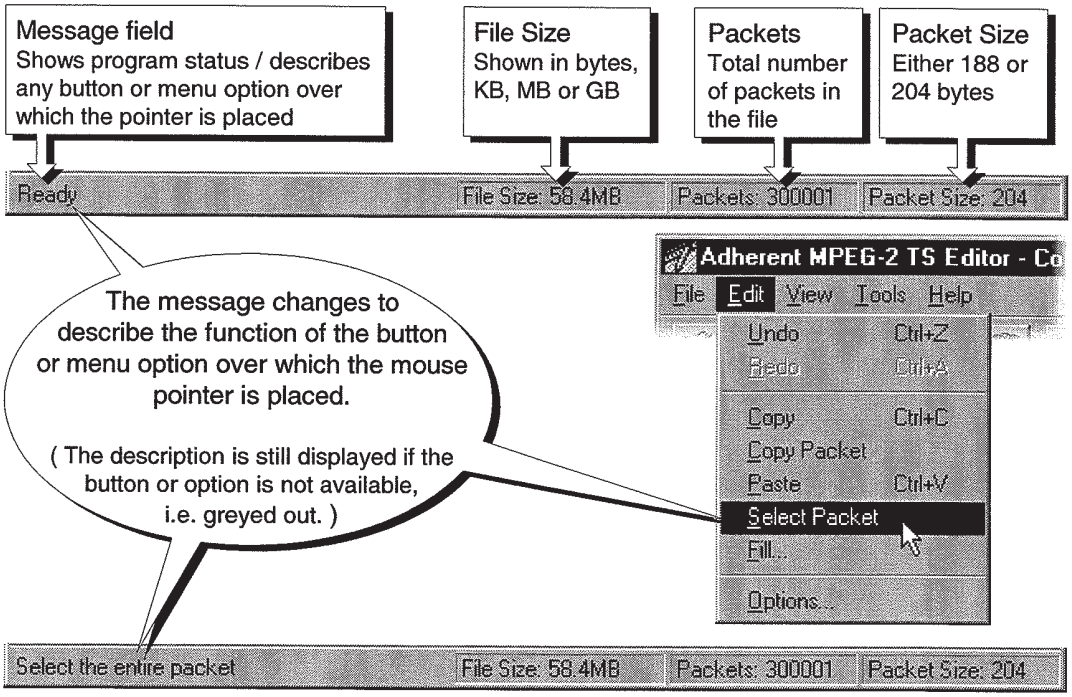

Opens the Options Dialog

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Status Bar



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



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



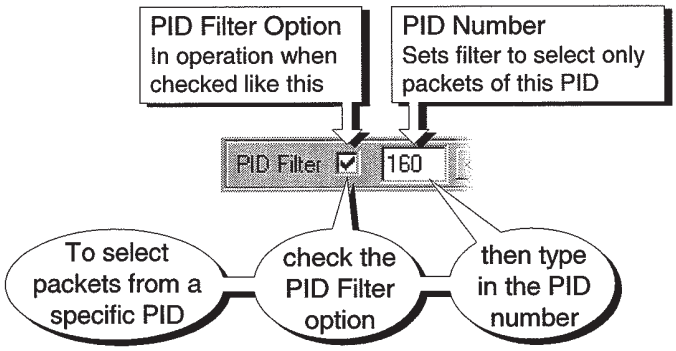
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Slider Bar

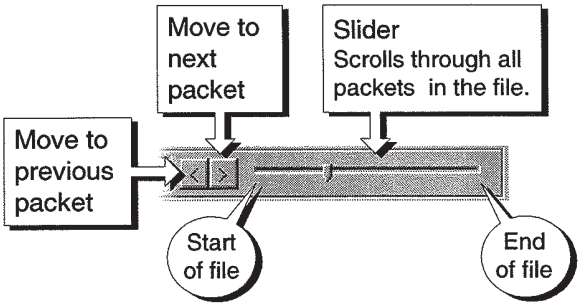


The contents of any transport stream packet in the currently open file may be selected using the Slider bar. Packets are numbered according to their position in the file, the first packet being 0 (zero). The controls in the slider bar are:

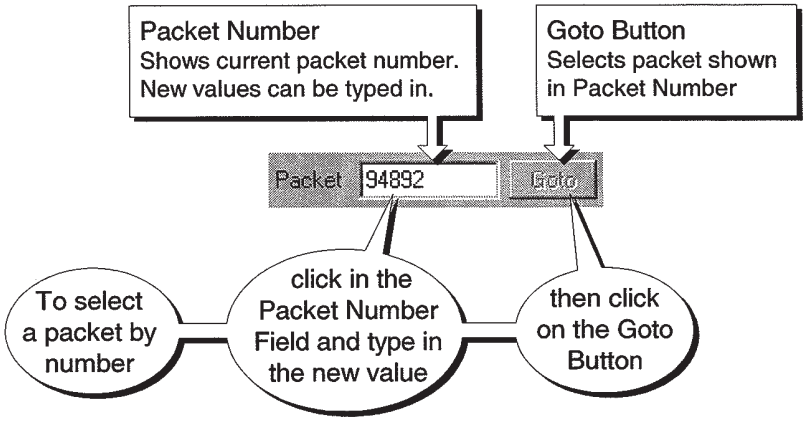
PID Filter



Slider



Packet number



It is normal to edit a copy of a transport stream. Transport Stream Analyser uses the same packet numbering as Editor. Hence the packet number can be used to find and view a packet in Analyser then edit the copy of the same packet in Editor.

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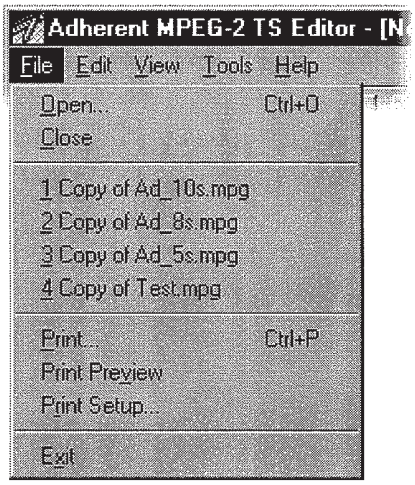
The Slider Bar can be dragged from the edge of the main window into a floating pallet. To do this place the mouse pointer on the background, inside the Slider Bar, hold down the left mouse button and drag away from the window border. The result is a self contained window which looks like this:



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

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File Menu Options



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 4 files.

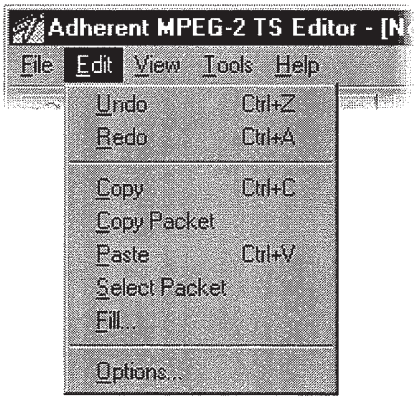
Print — Prints the current packet.

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



Undo — Undoes the last edit, restoring the previous value. Selecting undo again undoes the previous change.

Redo — Re-instates the previously undone change.

Copy — Copies the bytes which 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.

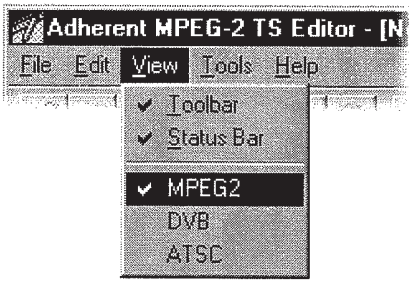
Select Packet — Selects the entire contents of the packet.

Fill — Prompts for and fills all selected bytes with a value.

Options ... — Opens the options dialog.

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View Menu Options



(a check mark ✓ next to an option indicates that it is currently selected.)

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.

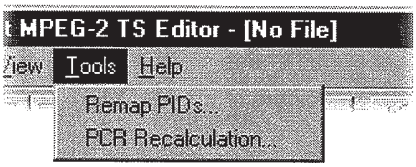
The following menu options select which standard is used to interpret the values held in the **Transport Scrambling Code** field. Only one standard can be selected at any time.

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.

Window Menu Options



Remap PIDs... Starts the tool to Remap packets from one or more PIDS to different PIDs.

PCR Recalculation ... Invokes a Wizard to Recalculate the Program Clock References (PCR) carried in one or more PIDS.

Help Menu Options

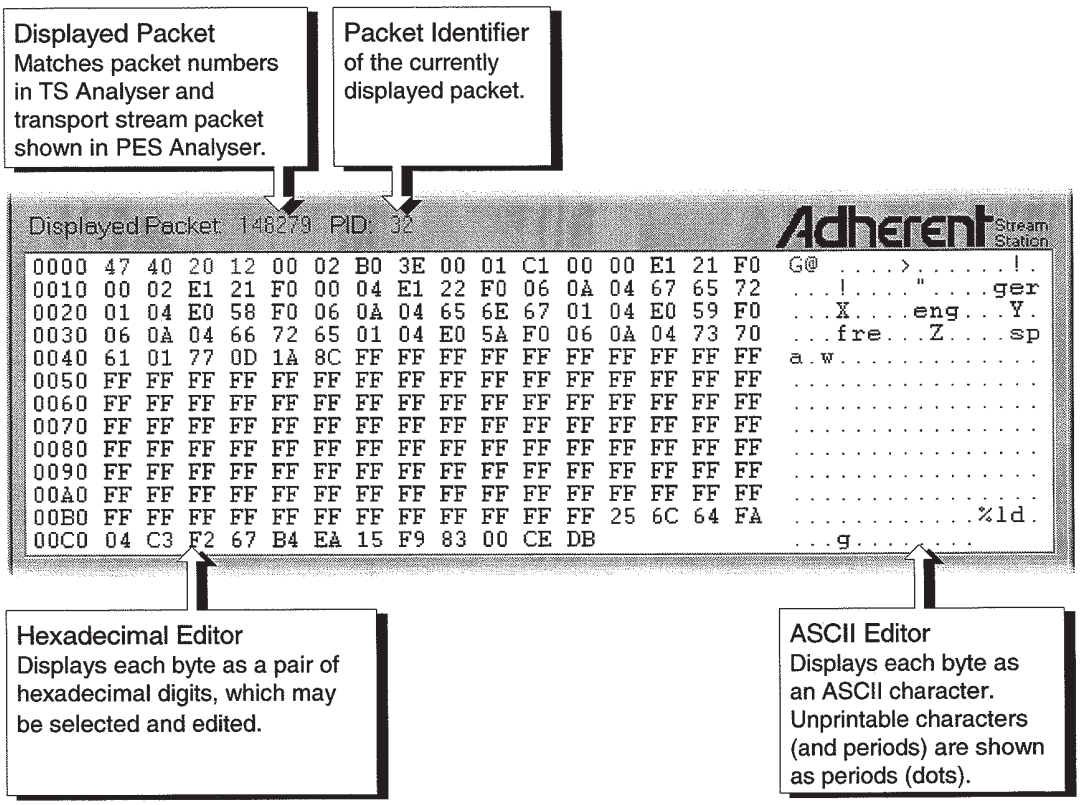


About ... Opens a dialogue which displays the program version number and license number.

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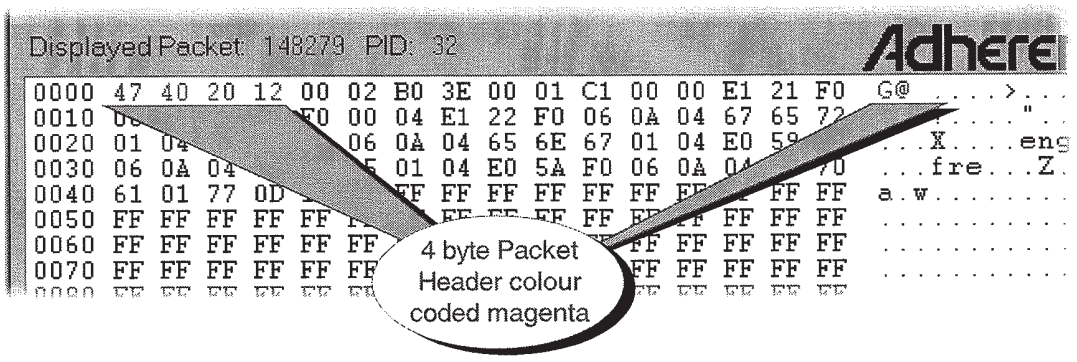
Hex Editor

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



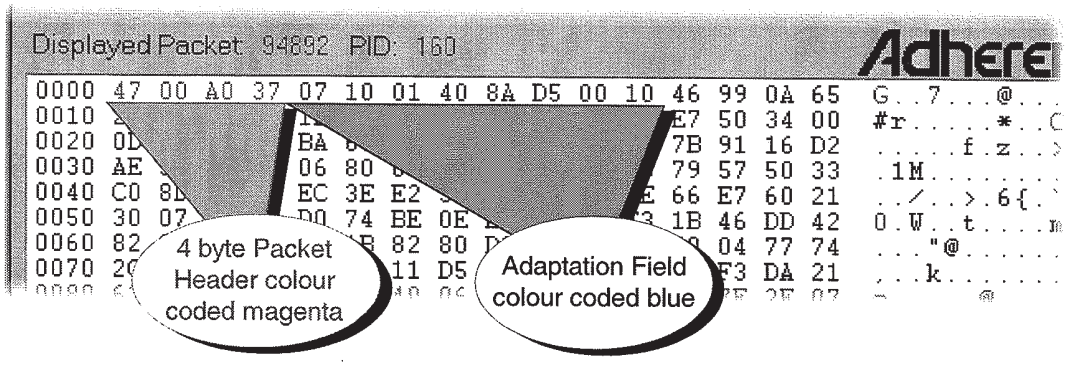
Colour Coding

Colour 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.

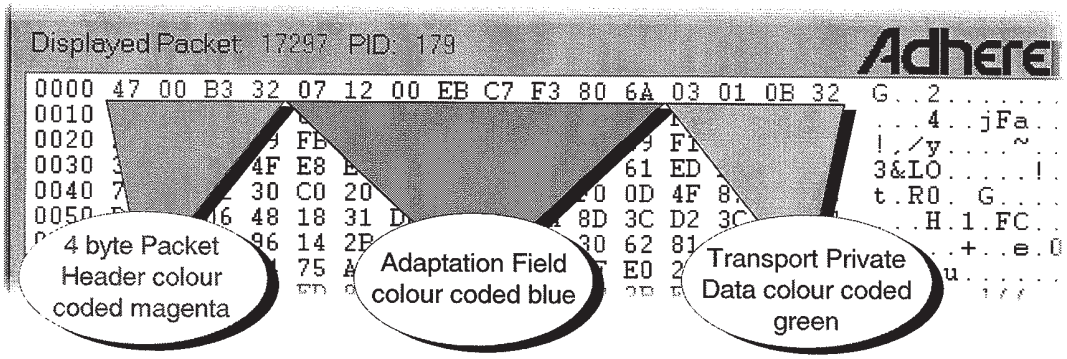


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When an adaptation field is present it is shown by blue coloured text:



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



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

Selecting & 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 it 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 on 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 and by using the up, down, left and right cursor keys.

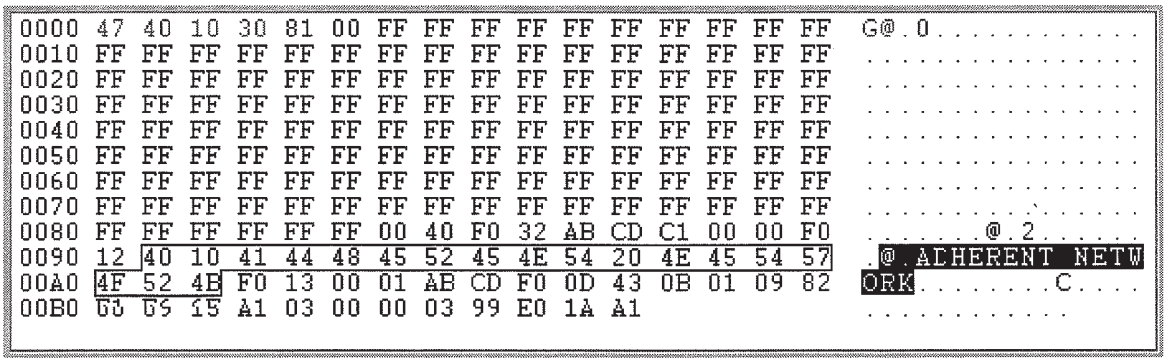
The cursor will not move beyond the end or back before the start of the packet. To select another packet use the Slider Bar.

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Blocks of Bytes

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

With the mouse click on the first byte required and hold the left mouse button down. 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:

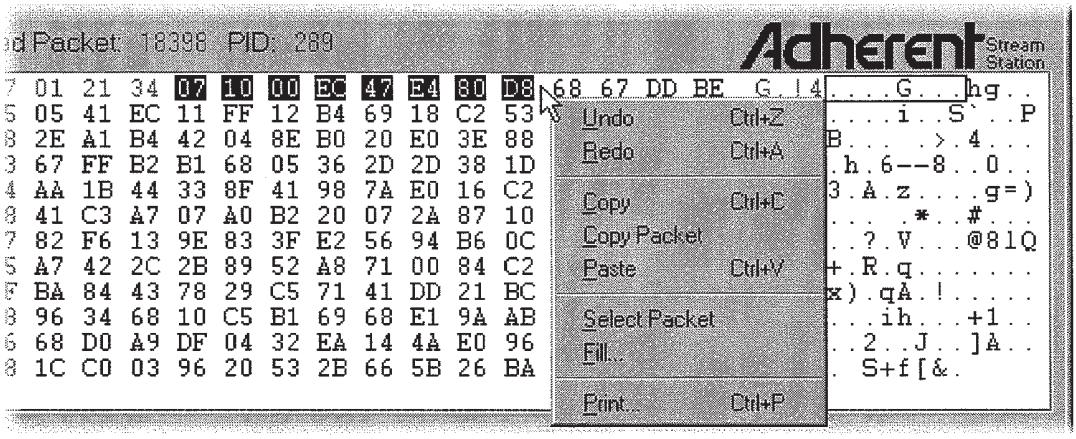


Once selected the block of bytes may be edited with the available options from the **Edit** and the Pop-Up menus. Clicking the mouse or pressing a cursor key clears the selection.

To select a block using the cursor keys: position the cursor on the first byte, 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:



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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:

Undo 

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 re-instated. As each change is undone the cursor moves to the appropriate field (in the Hex or Header Editors) and restores the previous value.

Redo 

Re-instates the most recently undone operation. When a new edit is made the Redo list is cleared.

Copy 

Copies the currently selected bytes to the clipboard. From there they may be pasted in to other packets or used by other applications.

Copy Packet 

Copies the entire contents of the current packet to the clipboard. From there it may be pasted in to other packets or used by other applications.

Paste 

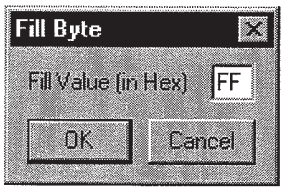
Pastes packet contents held on the clipboard into the current packet, starting at the current cursor position.

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. 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.

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