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User Manual

Tektronix

MTS300 MPEG Test System
Program Stream Analyzer

071-0662-00

This document applies to MPEG Test System
version 5.0 firmware and above.

www.tektronix.com

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Preface

This manual describes how to use the Tektronix MPEG Program Stream Analyzer application. Using the MPEG Program Stream Analyzer, you can view the fields and values of MPEG2 program streams and MPEG1 system streams at the pack and PES packet level, extract and save all or part of program and system streams, and analyze streams for coherence to the MPEG standards.

The MPEG Program Stream Analyzer is part of the MTS 300 suite of hardware and software components used to create, generate, acquire, and analyze MPEG and DVB transport and program streams and can be used by itself or as an integral part of the MPEG test system. If you have the Elementary Stream Analyzers installed on your system, you can send video or audio elementary streams directly to the appropriate analyzer for analysis at the elementary stream level.

For information about other MTS 300 test system applications, refer to the user manuals provided with test system or software option. For information about MTS 300 test system hardware installation, specifications, and first-time operation, refer to the *MTS 300 PEG Test System Hardware and Software Installation Technical Reference*, Tektronix part number 071-0667-XX.

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

Table i lists the MTS 300 MPEG Test System application version supported by this manual. To verify an application version number, select **Help** in the application menu bar; then select **About** from the Help menu.

Table i: MTS 300 MPEG Test System (V5.0) supported applications

Application	Supported version
MPEG Program Stream Analyzer	V1.04 and above

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Product Support	For questions about using Tektronix measurement products, call toll free in North America: 1-800-833-9200 6:00 a.m. – 5:00 p.m. Pacific time Or contact us by e-mail: tm_app_supp@tek.com For product support outside of North America, contact your local Tektronix distributor or sales office.
Service support	Tektronix offers a range of services, including Extended Warranty Repair and Calibration services. Contact your local Tektronix distributor or sales office for details. For a listing of worldwide service centers, visit our web site.
Toll-free Number	In North America: 1-800-833-9200 An operator can direct your call.
Postal Address	Tektronix, Inc. Department or name (if known) P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com

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Getting Started

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Getting Started

The MPEG Program Stream Analyzer is used to view and analyze MPEG1 and MPEG2 program stream structures, fields, and values. This section lists the various views and analysis functions enabled by the MPEG Program Stream Analyzer and describes how to find the information you need to install and use your analyzer the first time.

Product Description

You can display graphical representations of the MPEG structures of a program stream using interactive view windows, called interpreted views. Interpreted views are used to display the following MPEG program stream structures:

- Pack header
- PES packets
- Program stream map (PSM)
- Program stream directory (PSD)

In addition to the interpreted views, the analyzer provides other ways of viewing MPEG structures and values:

- Hierarchic view
- Hexadecimal and binary views
- System clock reference (SCR) views
- Presentation time stamp/Decoding time stamp (PTS/DTS) views

You can analyze syntactic, semantic, and temporal (time-based) characteristics of a program stream using the analysis functions provided by the analyzer. The analysis functions provided are indicated in the following list:

- Multiplex rate analysis
- Syntactic analysis
- Consistency analysis (coherence between all components of the stream)
- System clock reference (SCR) analysis
- Presentation/Decoding time stamp (PTS/DTS) analysis

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Using the MPEG Program Stream Analyzer you can also extract individual elementary streams for analysis later. Alternatively if you have the Tektronix MPEG Audio Stream Analyzer and/or MPEG Video Stream Analyzer installed on your system, you can extract an elementary stream and display a graphical representation of it using one of the elementary stream analyzers automatically.

First Time Operation

The MPEG Program Stream Analyzer is part of a suite of hardware and software components used to create, generate, acquire, and analyze MPEG and DVB transport and program streams. Before you can use the analyzer, you need to ensure that you have entered the correct password for your software configuration. To enable the software you have purchased, use the procedure for entering the general password described in the *MTS300 Series Software Only Installation Instructions*, Tektronix part number 075-0630-XX.

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Operating Basics

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Operating Basics

This chapter provides a functional overview of the MPEG Program Stream Analyzer interface elements and provides basic operating procedures that will help you become familiar with the application. This chapter is organized into the following sections:

***NOTE**. For basic Windows operating techniques such as minimizing windows or using the scroll bars, refer to your Windows documentation.*

- *Functional Overview* shows you how to start the MPEG Program Stream Analyzer and describes user interface elements and characteristics of the windows used by the analyzer.
- *MPEG Program Stream Analyzer Views* describes the Hierarchic view and the common characteristics of Interpreted views.
- *Basic Operations* describes how to open, extract, and save program or system stream files; how to print data encoded in the active file; and how to exit the application.
- *Menu Selections* provides a table that summarizes the menu selections.

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Functional Overview

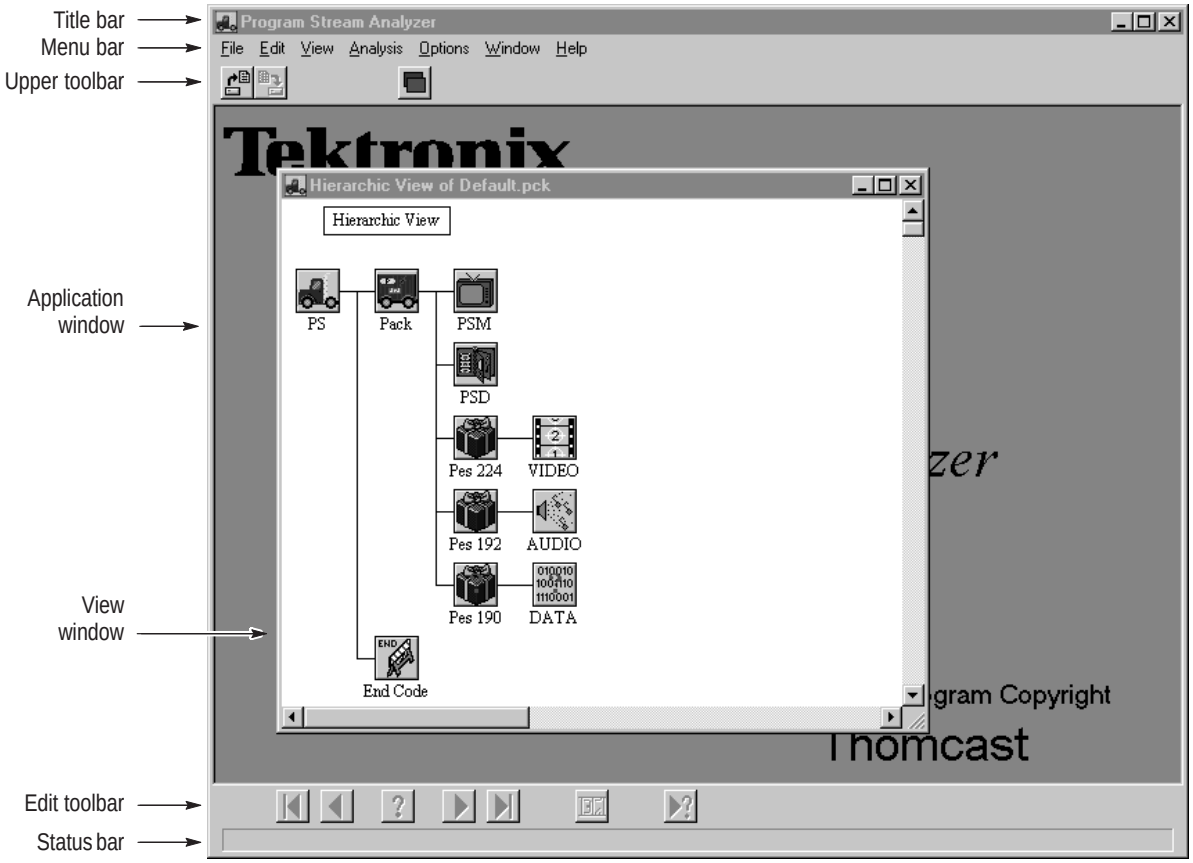


Double click the MPEG Program Stream Analyzer icon in the MPEG Test System program group window.

The MPEG Program Stream Analyzer uses two types of windows to display the elements of a program stream: the application window and view windows. This section describes these window types. (See your Windows documentation for information about common Windows display elements.)

Application Window

The basic application window looks similar to the following illustration.



Title bar. The title bar displays the application name and application icon. The window control buttons are standard window controls and allow you to minimize, maximize, and close the application window.

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Menu bar. The menu bar provides access to the commands you use to control the display, analysis, and look of the MPEG Program Stream Analyzer. A list of menu selections is provided in *Menu Selections* beginning on page 2–18. Complete descriptions of each menu selection are provided in the *Options Menu Reference* section beginning on page 3–19.

Upper toolbar. The Upper toolbar provides shortcut buttons to five commonly used menu selections. These buttons, and the menu selection they represent, are described in Table 2–1.

Table 2–1: Upper toolbar buttons

Button	Name/Menu selection	Menu	This selection...
	Open	File	Displays the Open dialog box. See *Opening Program Stream Files* beginning on page 2–11.
	Save as	File	Displays the Save As dialog box. See *Extracting and Saving Program Streams* beginning on page 2–12.
	Add View	Window	Displays a submenu from which you specify a view to be displayed. See *Adding Views* beginning on page 3–6.

Edit toolbar. Selecting an Edit toolbar command button is identical to selecting the Edit menu selection of the same name. These buttons, described in Table 2–2, allow you to move through the items of the displayed element and to view errors in the program stream file.

Table 2–2: Edit toolbar buttons

Button	Name	This selection/button...
	First Item	Displays the first item in the active view.
	Previous Item	Displays the previous item in the active view.
	Go to	Displays a dialog box that allows you to select the item number of the active view you want displayed.
	Next Item	Displays the next item in the active view.
	Last Item	Displays the last item in the active view.
	Number of Items	Counts the number of items in the element and displays the number in the top line of the view window.
	Next error	Displays the next item that has an error in the program stream file.

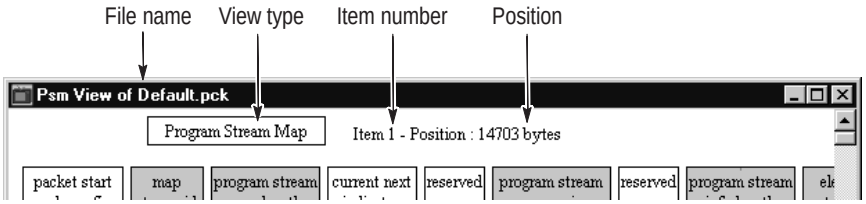
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NOTE. Items *are instances of specific data types, or elements. The first instance of the program_stream_map() element in the bitstream is the first item displayed in the PSM interpreted view.*

Status bar. The Status bar, located just below the Edit toolbar, provides you with first level help on using the menus. As you highlight a menu item, the status bar briefly describes the selection.

View Windows

View windows are used to display program stream files at different levels. Most of the important information displayed in view windows is discussed in the discussions of the individual view windows elsewhere in this manual. However, in addition to standard window controls, the title bar and top line of most view windows have the following information types in common:



- File name. Indicates the file name of the view displayed.
- View type. The view type indicates the program stream element displayed. For instance, pack_header() and PES_packet() data represent Pack header and PES packet elements respectively
- Item number. Indicates the item number of the element displayed. If you have previously selected the last item, or have selected the Number of Items command button, the item number is followed by the total number of items for the displayed element in the bitstream.
- Position. Indicates the position (in bytes) of the first bit of information displayed in the interpreted view relative to the first bit of the program stream. The first bit of the program stream is zero.

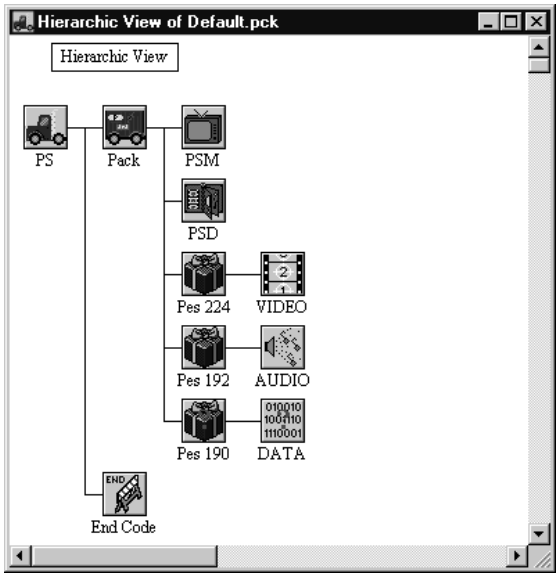
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MPEG Program Stream Analyzer Views

You can use the MPEG Program Stream Analyzer to view the program stream and program stream elements at different levels. This section briefly describes the three basic views (hierarchic, interpreted, and binary and hexadecimal views) and how to access them. See *Interpreted Views* beginning on page 3–1, and see *Additional Views* beginning on page 3–6 for more detailed information about the various view types used by the analyzer.

Hierarchic View

The Hierarchic view window displays a graphical view of the overall structure of the program stream indicated in the title bar of the active view window. The Hierarchic view is displayed when you first open an program stream file as a stream file type. See *Opening Program Stream Files* on page 2–11 for more information on opening different file types.



The icons displayed show the logical structure of the active program stream, provide access to various interpreted view and analysis functions, and allow you to save the elementary stream data to a file. These icons, and the interpreted views they access, are shown in Table 2–3 on page 2–6.

Icons with a red “X” on top of them indicate stream elements that are referenced in the PS map or PS directory, yet are not present in the bitstream. Icons with a red “?” on top of them indicate stream elements that are found in the bitstream, yet are not referenced in the program stream map (ghost elements).

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Table 2–3: Hierarchic view icons

Icon	Name	Double click the icon to display	The interpreted view displays	Right-clicking the icon will also allow you to
	PS	Pack header interpreted view (page 3–2)	Fields associated with the pack_header () and system_header() elements of program streams.	Perform Rate or SCR analyses, or display a packet map of all the packets in the program stream.
	Pack	Pack header interpreted view (page 3–2)	Fields found in the pack_header () and system_header() elements of program streams.	Perform Rate or SCR analyses, or display a packet map of the packets in the program stream.
	PSM	Program stream map interpreted view (page 3–4)	Fields associated with the program_stream_map() element of program streams.	
	PSD	Program stream directory interpreted view (page 3–5)	Fields associated with the directory_PES_packet() element of program streams.	
	PES	PES packet interpreted view (page 3–3)	Fields associated with the PES_packet() element of program streams.	Perform PTS/DTS analyses on the selected program stream item.
	VIDEO	Save Video Stream dialog box (page 2–16)		Analyze the video stream using the MTS Video Stream Analyzer, provided you have the Elementary Stream Analyzer installed on your system.
	AUDIO	Save Audio Stream dialog box (page 2–16)		Analyze the audio stream using the MTS Audio Stream Analyzer, provided you have the Elementary Stream Analyzer installed on your system.
	DATA	Save Data Stream dialog box (page 2–16)		
	End Code	End Code message window		

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Interpreted View Windows

You can display the values encoded in program stream structures using interactive view windows, called interpreted views. The interpreted views enabled by the MPEG Program Stream Analyzer and some of the fields and values displayed in each view are indicated in the following list:

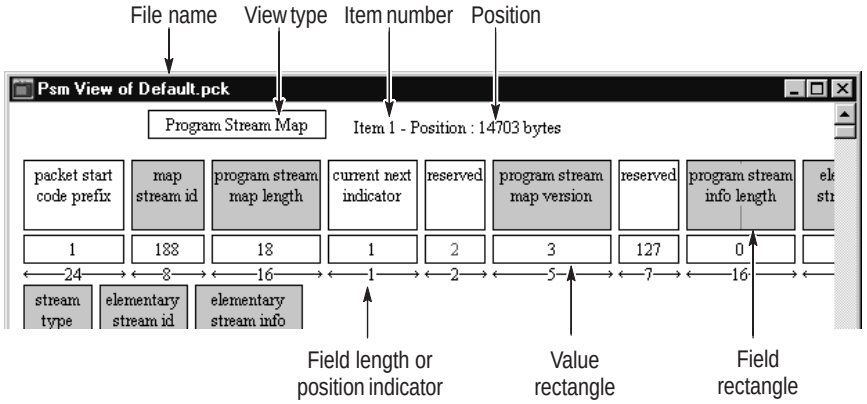
- Pack header. The Pack header interpreted view displays SCR, multiplex rate, audio and video bounds, and target decoder fields and values.
- Program stream map. The PSM interpreted view displays PSM header, elementary stream ID, and CRC fields and values.
- Program stream directory. The PSD interpreted view displays PSD header, PES position offset, and access unit PTS fields and values.
- PES packets. The PES packet interpreted view displays PES packet header, scrambling, and PTS/DTS fields and values.

Access interpreted views by double-clicking the icons displayed in the Hierarchic view. See Table 2–3 on page 2–6. Page references in the table indicate where you can find more information about the specific interpreted view.

The following sections describe the interface elements and interactive characteristics common to all interpreted views and how to navigate through the items of program stream elements.

Interface elements. Each interpreted view window displays the following types of information:

- File name. The file name indicates the name of the program stream file displayed.
- View type. The view type indicates the program stream element displayed (for instance, pack_header() and PES_packet() data represent Pack header and PES packet elements respectively).



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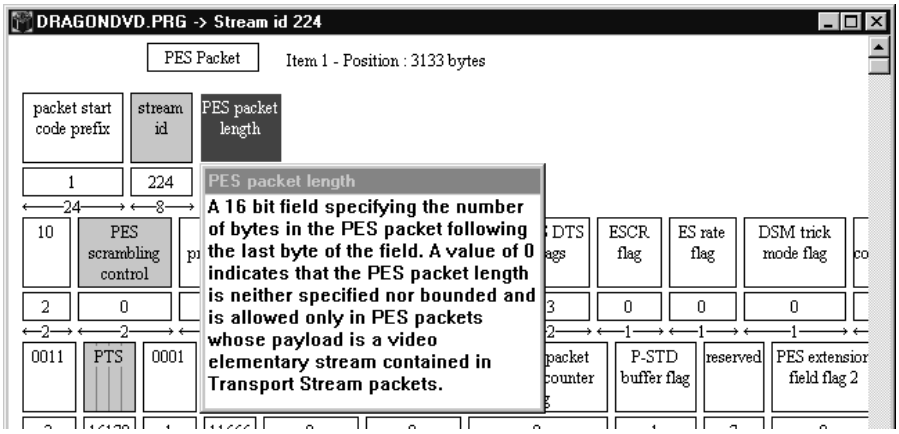
- Item number. Indicates the item number of the element being displayed. (See page 2–4 for the definition of an *item.)* If you have previously selected the last item, or have selected the Number of Items command button, the item number is followed by the total number of items for the displayed element in the bitstream.
- Position. Indicates the position (in bytes) of the first bit of information displayed in the interpreted view relative to the first bit of the program stream. The first bit of the program stream is zero.
- Field rectangle. Indicates the name of the field displayed. See the description for Field rectangles in the following section, *Interactive characteristics*.
- Value rectangle. Indicates the value for the field named in the Field rectangle immediately above it. See the description for Value rectangles in the following section, *Interactive characteristics*.
- Field length or position indicator. Indicates the position in the bitstream of the field immediately above it relative to the first bit in the current item. The first bit of the current item is zero. You determine which type of information, if any, is displayed using the Interpretation selection from the Options menu.

Interactive characteristics. Interpreted views display selected fields and values of MPEG1 and MPEG2 encoded program streams. The fields and values displayed for any given item in the program stream are represented by the field and value rectangles displayed in the interpreted view window.

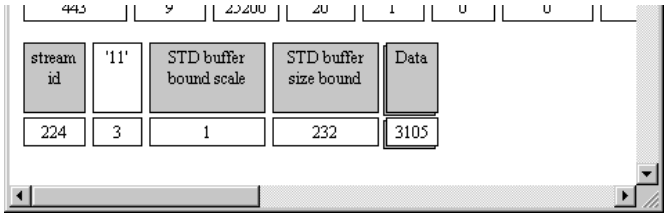
- Field rectangles. Field rectangles (the large rectangles), name the fields analyzed by the MPEG Program Stream Analyzer and display marker bit indicators, when marker bits are part of the field. If marker bit values are incorrect, marker bit indicators (the vertical lines) are displayed in red. Shaded or gray rectangles represent fields that are important indicators of the quality of the program stream.

  Double-click a field rectangle to display a pop-up message window for the field, as shown in the following illustration. The title bar of the message window names the field; the text below describes the field as defined by ISO/IEC 11172-1 and ISO/IEC 13818-1. You can move this window by clicking and dragging the title bar. Dismiss the window by clicking anywhere outside of it in the application window.

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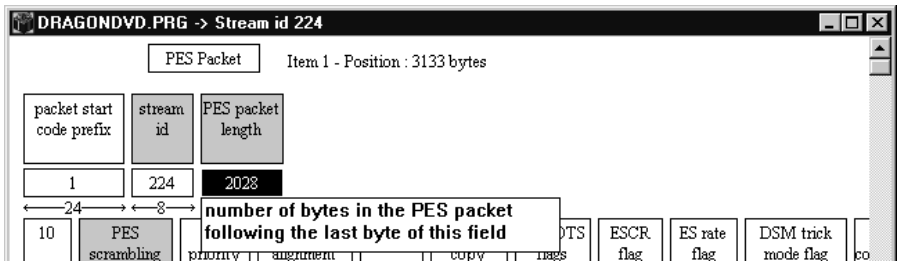


Double-clicking on field rectangles that look three dimensional opens a hexadecimal view of the bitstream for the item displayed (see *Binary and Hexadecimal Views* on page 2–10 for a description of the hexadecimal view window).



- Value rectangles. Value rectangles (the small rectangles) display the value for the field named in the large rectangle directly above it. Values can be displayed in either decimal or hexadecimal base. To toggle between decimal and hexadecimal base, press the **F2** function key. Values displayed in red indicate values that are in error.

  Double-click a value rectangle to display a pop-up message window for the value, as shown in the following illustration.



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The message window interprets the value for that field, and reports any errors encoded in the bitstream. If marker bits are part of the field, the message window also reports whether the marker bit values are correct. Dismiss the message rectangle by clicking anywhere outside of it within the application window.

Three dimensional value rectangles to display the number of data bytes encoded in the bitstream for that item.

Navigating through interpreted view items. Use the Edit toolbar command buttons (located at the bottom of the application window) to navigate through the items of the element displayed. See Table 2–2, on page 2–3 for more information about how to use the Edit toolbar command buttons.

NOTE. Items *are instances of specific data types, or elements. The first instance of the program_stream_map() element in the bitstream is the first item displayed in the PSM interpreted view.*

Binary and Hexadecimal Views

The Binary and Hexadecimal views show the bit representation, in either binary or hexadecimal format, of the interpreted view from which it was accessed. Access Binary and Hexadecimal views from interpreted view windows by clicking the Add View icon on the upper toolbar and selecting Binary or Hexadecimal from the submenu.

The blue text in the binary and hexadecimal views represent the data that appears in the first line of the item displayed in the interpreted view.

Navigate through the items represented in the binary or hexadecimal view using the Edit toolbar or the Edit menu selections. As you move through the items in binary and hexadecimal views, the interpreted view from which you accessed the binary or hexadecimal view also increments. In order to display two separate items of the same element, you need to display two interpreted view windows and access a binary or hexadecimal view from each.

You can also display binary and hexadecimal views of many program stream elements by double-clicking the three dimensional data packet fields in some of the interpreted views.

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Basic Operations

This section describes how to open, extract, and save MPEG program and system stream files; how to print information displayed in interpreted and hierarchic views; and how to exit the application.

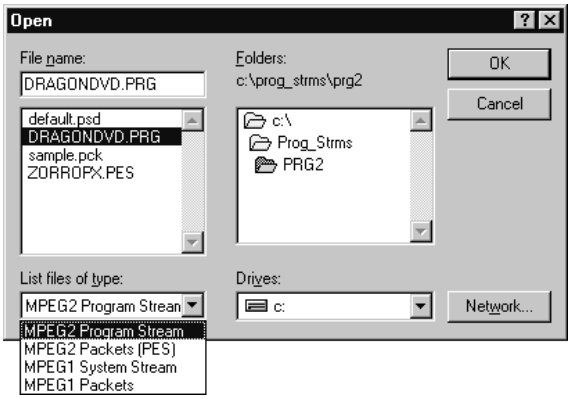
Opening Program Stream Files

The MPEG Program Stream Analyzer can display the following types of files:

- MPEG2 program streams
- MPEG1 system streams
- MPEG1 and MPEG2 PES packet streams

Opening a program stream file. To open a program stream file, use the following procedure:

1. Select the Open command button on the Upper toolbar (or select **Open** from the file menu).



2. Use standard Windows techniques to select the drive and directory that contains the file you want to open.

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3. From the **List files of type:** drop-down selection box, make one of the following selections (the list describes the elements that the analyzer displays when you select the option):

   - MPEG2 Program Stream. This will display all of the elements in program or system stream files (opening a file as an MPEG2 Program Stream is the default option).
   - MPEG1 System Stream. This will display all of the elements of system stream files. If the file opened using this option is an MPEG2 encoded file, the PSD and PSM elements will not be displayed.
   - MPEG2 Packets. This will display all of the PES packet elements encoded in the program or system stream. Program and system stream level information is not displayed when you use this option.
   - MPEG1 Packets. This will display all of the MPEG1 PES packet elements encoded in the program or system stream. If the file is an MPEG2 encoded bitstream, the MPEG2 elements will not be displayed.

4. Select the file that you want to display from the **File name:** selection box (or type the name of the file in the text box), and then select **OK**.

   The initial display depends on the option you selected in step 3. If you open a file as a program or system stream, the Hierarchic view is the first view displayed. If you open a file as packets, an interpreted view is the first view displayed.

Extracting and Saving Program Streams

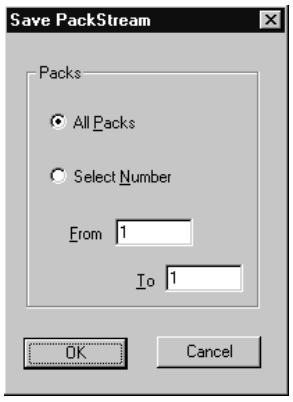
You can extract and save complete program stream files or specific parts of the program stream using the procedures described in this section. The following list indicates how program stream data is saved when different views are active:

- Pack header interpreted view. When this view is active, the analyzer extracts the packs you indicate and saves files using the pack file name extension (*.pck*).
- PSM interpreted view. When this view is active, the analyzer extracts the indicated program stream map PES packets and saves files using the PSM packets file name extension (*.psm*).
- PSD interpreted view. When this view is active, the analyzer extracts the indicated program stream directory PES packets and saves files using the PSD packets file name extension (*.psd*).
- PES interpreted view. When this view is active, the analyzer extracts the PES packets you indicate and saves files using the PES stream file name extension (*.pes*).

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Extracting packs. To extract and save packs from a program or system stream, use the following procedure:

1. From a Pack header interpreted view, select the Save As command button from the Upper toolbar (or select **Save as** from the File menu).
2. Choose **All Packs** or **Select Number** from the dialog box.
   - Select **All Packs** to extract the entire stream (packs, packets, and end code).
   - Select **Select Number** to extract the packs you indicate in the **From** and **To** text boxes.



3. If you chose **Select Number**, enter the pack item numbers for the packs you want to save in the **From** and **To** text boxes. The numbers you enter in the text boxes are inclusive.
4. After you press OK, a standard Save As dialog box is displayed. Using standard Windows techniques, indicate the file in which to save the extracted data.

   Pack header data saved using this procedure are saved using the pack stream file name extension (*.pck*).

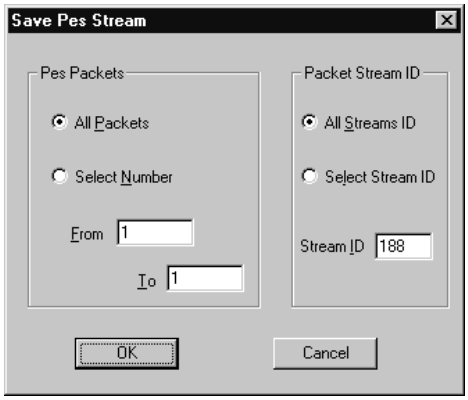
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Extracting packets. To extract and save packets from a program or system stream, use the following procedure:

1. Navigate to the interpreted view for the stream element you want to save, and then select the Save As command button from the Upper toolbar (or select **Save as** from the File menu).

   The **Save PES Stream** dialog box is displayed with the following parameters:

   - The **All Stream ID** and **All Packets** options are selected.
   - The stream ID of the active interpreted view is displayed in the **Stream ID** text box.
   - The item number displayed in the active interpreted view is displayed in the **From** and **To** text boxes.



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Use Table 2–4 to determine the choices you need to make from the Save PES Stream dialog box options.

Table 2–4: Save PES Stream option matrix

PES Packets group	Packet Stream ID group	
	All Streams ID	**Select Streams ID**
All Packets	Extracts all of the PES packets in the stream.	Extracts all of the packets for the indicated element from the stream. Indicate which element to extract by entering its stream ID in the **Stream ID** text box.
Select Number	Extracts all of the packets in the range of PES packets you indicate in the **From** and **To** text boxes. The range entered in the text boxes is inclusive.	Extracts *n* number of *x* elements from the stream. *n* represents the number of items found in the range of packets indicated in the **From** and **To** text boxes. The range is inclusive and begins with the item listed in the **From** text box. For example, entering 12 and 18 in the **From** and **To** text boxes will extract seven items of element *x*, starting with the 12th such item in the stream. *x* represents the element you want to extract. You determine which element to extract by entering the appropriate stream ID in the **Stream ID** text box.

2. After you have chosen the options you want from the **Pes Packets** and **Packet Stream ID** groups and have entered the appropriate values in the text boxes, select OK and a standard Save As dialog box is displayed.

3. Select the drive, directory, and file name of the new file you will create using the options in the **Save as** dialog box.

   You can make managing your files easier if you use the following suggested file name extensions:

   - Use *.psd* for program stream directory files.
   - Use *.psm* for program stream map files.
   - Use *.pes* for packetized elementary stream files.

4. Select **OK**.

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If you entered a number into either the **From** or **To** text box that is greater than the total number of items in the stream for the element you are extracting, you will see an *End of File* error message and the resulting file may be unusable.

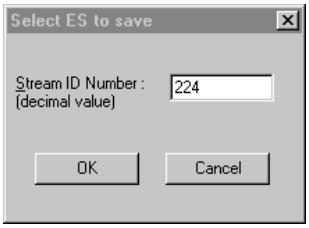
Extracting elementary streams. You can extract elementary streams using one of the following procedures:

1. Double-click a Video, Audio, or Data icon.
2. Use standard Windows techniques to select the drive, directory, and file name you will create using the options provided in the **Save as** dialog box. The default file name extensions for saving elementary streams are indicated in the following list (these extensions are automatically appended to the file name displayed in the **File Name:** text box):

- Video streams use *.vid* file name extensions.
- Audio streams use *.aud* file name extensions.
- Data streams use *.dat* file name extensions.

You can also use the Elementary Stream selection from the View menu to extract and save elementary streams.

1. Navigate to the Hierarchic or PES packet interpreted view for the elementary stream you want to extract, and then select **Elementary Stream** from the View menu.
2. Enter the stream ID for the elementary stream you want to extract in the dialog box.



3. Use standard Windows techniques to select the drive, directory, and file name you will create using the options provided in the **Save as** dialog box.

   The default extension for all elementary streams saved using this procedure is *.es*.

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Finally, you can automatically display an elementary stream and analyze it using the MPEG Audio Stream Analyzer or the MPEG Video Stream Analyzer, if the Elementary Stream Analyzer is installed on your system:

1. Right-click an Audio or Video icon.
2. Select either **Analyze with Video Stream Analyzer** or **Analyze with Audio Stream Analyzer** from the submenu.

   The appropriate application will be opened with the extracted elementary stream displayed.

Printing Program Stream Data

You can print the information displayed in the hierarchic, interpreted, hexadecimal, and binary view windows. To print a view window, use the following procedure:

1. Select **Print Setup** from the File menu, and then use the options provided in the dialog box to configure the printer and document characteristics for your document. (This step is optional.)
2. Select **Print** from the File menu and use standard Windows techniques to send the file to the printer.

Quitting the MPEG Program Stream Analyzer

To quit the MPEG Program Stream Analyzer, select **Exit** from the File menu.

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Menu Selections

Table 2–5 is a quick reference to the menu selections of the MPEG Program Stream Analyzer and briefly describes what happens when you make the menu selection. Page references indicate the page on which you can find more information about specific menu selections.

Table 2–5: Menu selections

Menu	Selection	Result
File	Open	Displays the Open dialog box from which you identify the existing file you want to view. See page 2–11.
	Save as	Displays the Stream Save dialog box from which you indicate which portion of the stream you want to save. See page 2–12.
	Print	Displays a standard Print dialog box from which you can print the active view window.
	Printer setup	Displays the Page Setup dialog box. The dialog box also provides access to printer options.
	Exit	Quits the MPEG Program Stream Analyzer.
Edit	Next Item	Displays the next item in the active view.
	Previous Item	Displays the previous item in the active view.
	First Item	Displays the first item in the active view.
	Last Item	Displays the last item in the active view.
	Go to	Displays the specified item in the active view.
	Number of Items	Calculates the number of items in the active view, and then displays the number in the upper portion of the active view window.
	Next error	Displays the next item in the active view with either a CRC or syntactic error.
View	Packs View	Displays the Pack header interpreted view for the active program stream. See page 3–2.
	(PES) Packets	Displays a dialog box in which you enter the stream ID of the elementary stream you want to view. See page 3–3.
	Elementary Stream	Displays a dialog box in which you enter the stream ID of the elementary stream you want to extract. See page 2–16.
	PS Map	Displays the program stream map interpreted view for the active program stream. See page 3–4.
	PS Directory	Displays the program stream directory interpreted view for the active program stream. See page 3–5.

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Table 2–5: Menu selections (cont.)

Menu	Selection	Result
Analysis	Characteristics	
	Multiplex Rate	Displays the multiplex rate for the program stream.
	Packs/Packets Map	Displays the Pack Headers/Packets Map view showing the distribution of stream_IDs and packets for the program stream. See page 3–7.
	Syntactic/Semantic	Initiates a syntactic analysis on the active stream or element. See page 3–14.
	Consistency	Initiates an analysis on the consistency of active stream. See page 3–15.
	Temporal	
	SCR	Initiates an analysis of the system clock reference clocks for the active program stream. See page 3–8.
	PTS/DTS	Displays a dialog box in which you enter the stream number of the elementary stream upon which you want to perform a presentation/decoding time stamp analysis. See page 3–10.
	Automatic	Initiates the analyses selected using the Automatic Analysis selection from the Options menu. See page 3–17.
Options	DVD	Inactive. This menu selection will be used in future enhancements.
	Automatic Analyses	Displays a dialog box from which you select the types of analyses you want performed when you select Automatic from the Analysis window. See page 3–19.
	Interpretation	Displays the Interpreted view option dialog box from which you can choose to display either the length or the position of the structures in the interpreted views. See page 3–22.
	Base	Displays the Base dialog box from which you set the numeric base (decimal or hexadecimal) used for various views.
	Messages Output	Displays a dialog box from which you can select the drive and directory into which the output from analyses are written. For each program or system stream file analyzed, one *.log* file is generated. To prevent this file from being appended to, copy it into another location or rename it. See page 3–20.
	Font	Displays the Font dialog box from which you set the font used for most of the views windows. (The Binary and Hexadecimal view windows are not affected by the font selection.)

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Table 2–5: Menu selections (cont.)

Menu	Selection	Result
Options	Configuration	
	Save	Saves the current analyzer configuration. See page 3–22.
	Load	Loads a saved configuration file into the current MPEG Program Stream Analyzer session. See page 3–22.
	Default	Loads the default configuration into the current MPEG Program Stream Analyzer session. See page 3–22.
Window	Cascade	Overlaps the open windows on top of one another.
	Tile	Fits the open view windows to the application window.
	Arrange icons	Arranges all minimized window icons to the bottom of the application window.
	Close view	Closes the selected view window.
	Close all	Closes all of the view windows.
	Add view	Displays a submenu from which you can choose to add a view window identical to the selected view or a different view of the displayed information. See page 3–6.
	Open view windows	Lists all of the open view windows, including any minimized windows. Select a view window from the list to make it the active view window. A checkmark indicates the active view window.
Help	Contents	Displays the MPEG Program Stream Analyzer Help contents from which you can choose or search for a specific help topic.
	Using help	Displays the Windows Help contents.
	About MPEG Audio Stream Analyzer	Displays the software version number and copyright information about the MPEG Program Stream Analyzer.

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Reference

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Reference

Reference provides detailed information about the MPEG Program Stream Analyzer. This chapter is organized into the following sections:

- *Interpreted Views* describes each of the interpreted views enabled by the MPEG Program Stream Analyzer.
- *Additional Views* describes other views used by the analyzer to display and interpret program stream data.
- *Analyzing Program Streams* describes the types of analyses available using the MPEG Program Stream Analyzer.
- *Options Menu Reference* provides a reference for the Options menu selections that allow you to configure the MPEG Program Stream Analyzer.

***NOTE**. For information about common Windows interface elements such as scroll bars and window controls, see your Windows documentation.*

Interpreted Views

Interpreted views provide a graphical user interface for examining MPEG program stream elements. This section describes individual interpreted views and is organized alphabetically.

See *Interpreted View Windows* beginning on page 2–7 for a description of, and how to use, common interactive characteristics of interpreted view windows such as, navigating through the items of an interpreted view and descriptions of the interface elements.

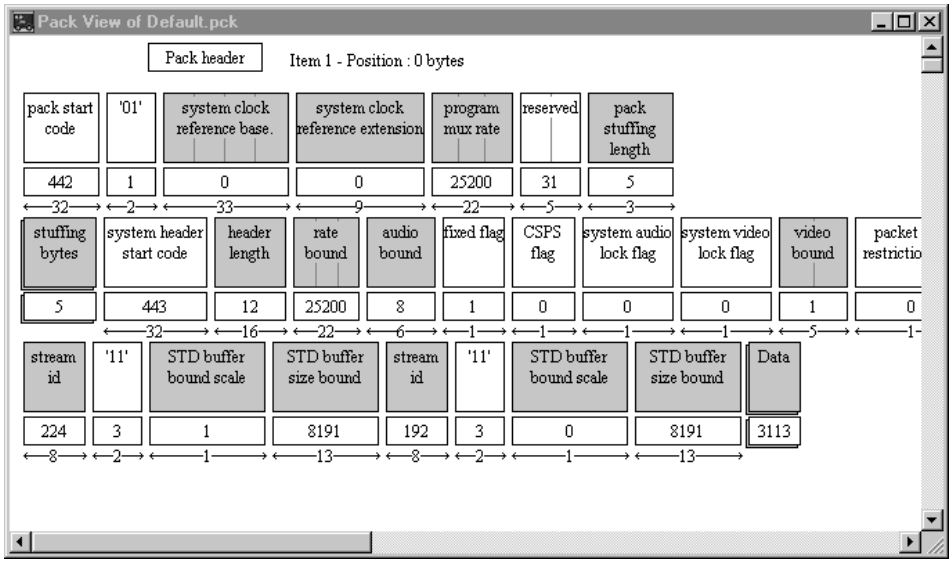
***NOTE**. The MPEG Program Stream Analyzer analyzes both program and system streams. The illustrations in this section show the interpreted view windows for an MPEG2 program stream. The interpreted views of MPEG1 system streams are similar, but will typically look simpler. Furthermore, system streams do not have program stream map and program stream directory PES packet elements.*

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Pack Header View

The Pack header interpreted view displays the values found in pack_header() and, if present, system_header() elements. Display the Pack header interpreted view window by double-clicking the PS or Pack icon from within the Hierarchic view window (both icons display the Pack Header interpreted view). Alternatively, select **Packs View** from the View menu.

Pack header data is given on the first line of the display, system header information is given in the second line, and elementary stream specific information is given on subsequent lines.



The following list indicates some of the important Pack header fields displayed by this interpreted view:

- System clock reference
- Program multiplex rate
- Target decoder data

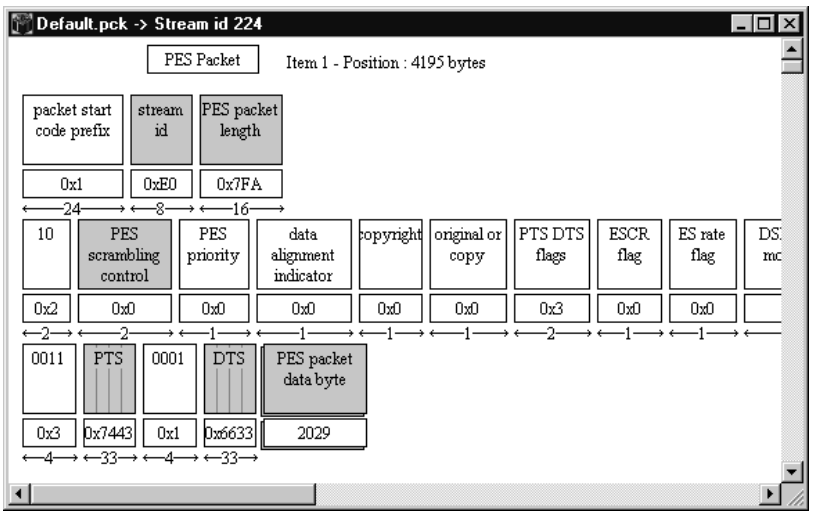
To view the bytes displayed in the interpreted view in hexadecimal format, double-click the **stuffing bytes** or **Data** field rectangles.

Use the command buttons on the Edit toolbar (or the selections from the Edit menu) to navigate through the pack header items.

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PES Packet View

The PES Packet interpreted view displays the values found in PES_packet() elements. Display the PES packet interpreted view by double-clicking a PES icon from within the Hierarchic view. Alternatively, select **(PES) Packets** from the View menu, and then enter the stream ID of the audio, video, or data stream you want to view.



The following list indicates some of the important PES Packet fields displayed by this interpreted view:

- Stream ID
- Scrambling control
- Copyright information
- PTS/DTS and ESCR time stamps
- Target decoder data
- Previous PES CRC data
- Trick mode controls and flags
- Field ID data

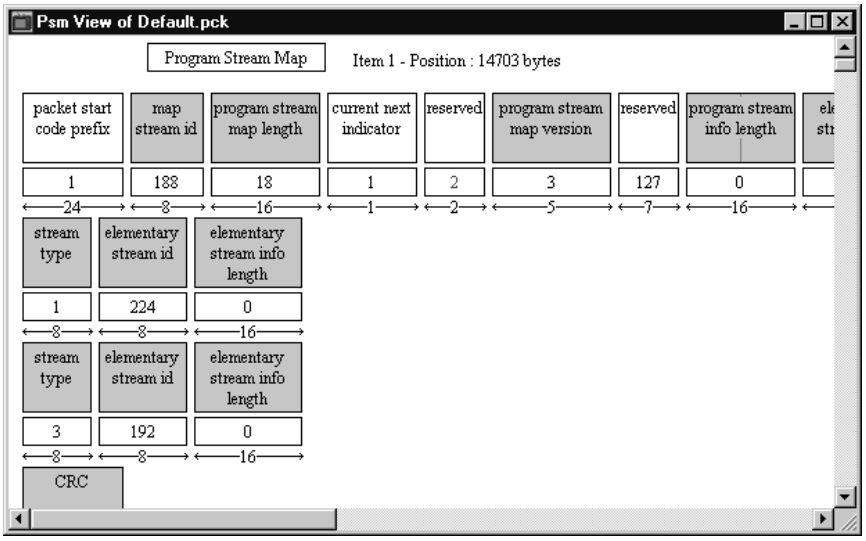
To view the bytes displayed in the interpreted view in hexadecimal format, double-click the **PES packet data byte** field rectangle.

Use the command buttons on the Edit toolbar (or the selections from the Edit menu) to navigate through the PES Packet items.

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Program Stream Map View

The Program Stream Map (PSM) interpreted view displays the values found in program_stream_map() elements. Display the Program stream map interpreted view by double-clicking the PMT icon from within the Hierarchic view window. Alternatively, select **PS Map** from the View menu.



The following list indicates some of the important PSM fields displayed by this interpreted view:

- PSM map ID, length, and version
- Descriptors
- Elementary stream IDs and types
- CRC values

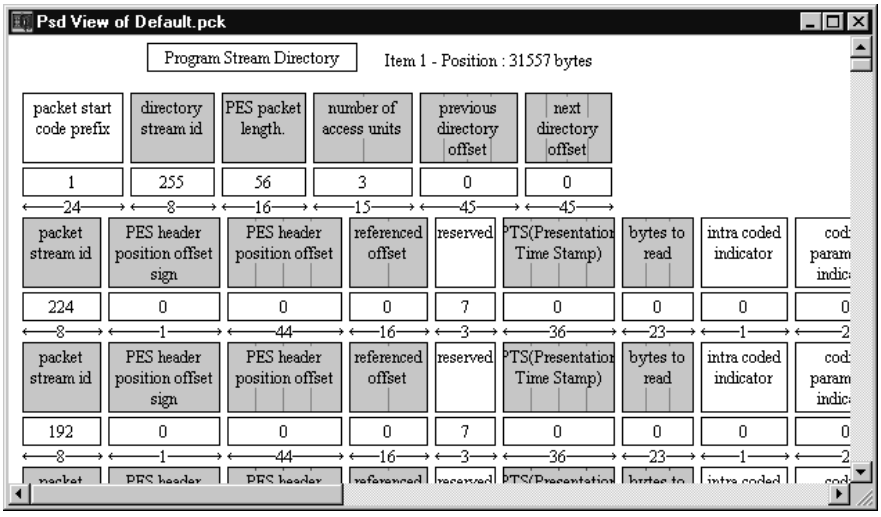
To view the bytes contained in the displayed item select the **Add View** command button, and then select **Binary** or **Hexadecimal** from the submenu.

Use the command buttons on the Edit toolbar (or the selections from the Edit menu) to navigate through the program stream map items. You can check all of the CRC values in a program stream using the **Next error** command button from the Edit toolbar. The analyzer will check the program stream map syntax for the active stream, including CRC values, and display the next item with an error.

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Program Stream Directory View

The Program Stream Directory (PSD) interpreted view displays the values found in program_stream_directory() elements. Display the PSD interpreted view by double-clicking the PSD icon from within the Hierarchic view. Alternatively, select **PS Directory** from the View menu.



The following list indicates some of the important PSD fields displayed by this interpreted view:

- PES packet length
- Number of access units
- Previous and next directory offsets
- PES header offset of the referenced access unit
- PTS of the referenced access unit

To view the bytes contained in the displayed item, select the **Add View** command button, and then select **Binary** or **Hexadecimal** from the submenu.

Use the command buttons on the Edit toolbar (or the selections from the Edit menu) to navigate through the program stream directory items.

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Additional Views

This section describes additional views used by the MPEG Program Stream Analyzer to display program and system stream data.

Adding Views

You can add multiple view windows to the application window using one of the following techniques:

- Select the **Add View** command button from the Upper toolbar, and then select the view you want displayed from the submenu.
- Select **Add View** from the Window menu, and then select the view you want displayed from the submenu.

Table 3–1 lists the views you can add from within the view windows indicated.

Table 3–1: Add view options

View window	Add view options
Hierarchic view	An identical Hierarchic view
Interpreted view	An identical interpreted view A Binary or Hexadecimal view
Binary or Hexadecimal view	An interpreted view of the bitstream A Binary or Hexadecimal view
SCR view	An SCR Graphic view An SCR Values view
PTS/DTS view	A PTS/DTS Graphic view A PTS/DTS Values view

The Add View command button and menu selection are not available from the Multiplex Rate and Pack Headers/Packets Map view windows.

If you add views using the Add View command button (or menu selection), and then navigate to another item using the resulting window, the first window (the parent window) also displays the new item. In order to view multiple, unique items of program stream elements, add another interpreted view window by selecting the appropriate icon from the Hierarchic view.

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Binary and Hexadecimal Views

Binary and Hexadecimal views show the bitstream of the interpreted view from which it was accessed in either binary or hexadecimal format. Access these views from interpreted view windows by clicking the **Add View** icon on the upper toolbar and selecting **Binary** or **Hexadecimal** from the submenu.

The blue text in the binary and hexadecimal views represents the data that appears in the header of the interpreted view.

You can also display binary and hexadecimal views of many program stream elements by double-clicking the three dimensional data packet fields in some of the interpreted views.

Multiplex Rate View

The Multiplex Rate view window displays the multiplex rate for the active program stream. Display the multiplex rate using one of the following methods:

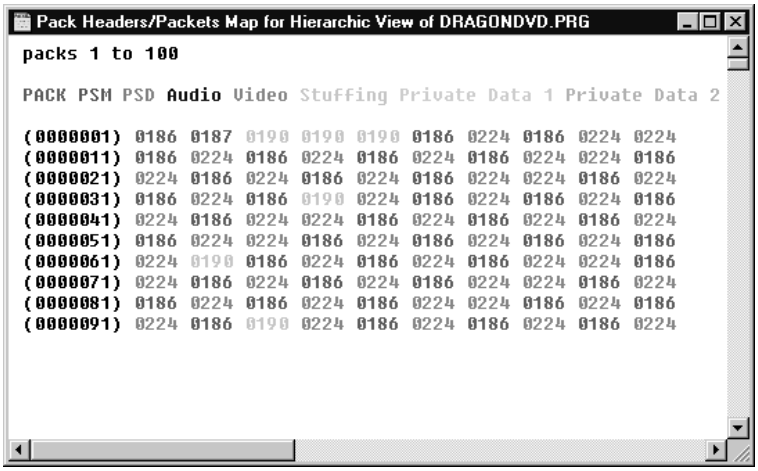
- Right-click a PS or Pack icon, and then select **Rate** from the submenu.
- From the Hierarchic view, select **Characteristics** from the Analysis menu, and then select **Multiplex Rate** from the submenu.

The Multiplex Rate view window is a static display.

Pack Headers/Packets Map View

The Pack Headers/Packets Map view window displays the distribution of the program stream items in the packets of the program stream. To display the Pack Headers/Packets Map view window, use one of the following techniques:

- Right-click the PS or Pack icon, and then select **Packets Map** from the submenu.
- From the Hierarchic view, select **Characteristics** from the Analysis menu, and then select **Packs/Packets Map** from the submenu.



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This view of the program stream shows the distribution of packets and indicates the type and stream ID of the data encoded in each packet. Each Pack Headers/ Packets map window displays up to 100 packets.

- The color reference at the top of the window maps the colors used in the text below to the program stream elements that can be displayed using the MPEG Program Stream Analyzer. Not all of the data types will be found in every program stream.
- The numbers in parentheses along the left-hand side of the window are the packet numbers for the first packet shown in that row.

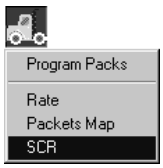
  The first colored text in a row represents the packet whose number is indicated in parentheses immediately to the left.
- The colored text indicates the stream ID of the data encoded in that packet.

SCR Clock Views

SCR clocks are used as timing references at the decoder for the program stream and are encoded in the pack layer. The MPEG Program Stream Analyzer analyzes and displays system clock reference data using two SCR Clock views: an SCR Graphical View and an SCR Values View.

SCR Graphic view. To display the graphical SCR view window, using one of the following techniques:

- From the Hierarchic view, right click the **PS** or **Pack** icon, and then select **SCR** from the submenu.
- From the Hierarchic view, select **Temporal** from the Analysis menu, and then select **SCR** from the submenu.

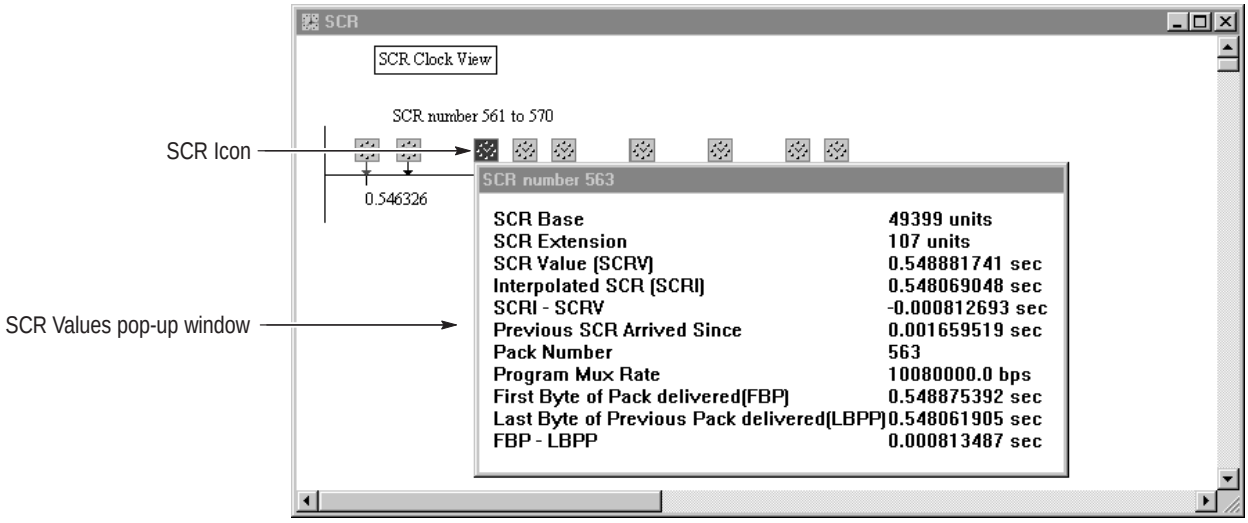


When you display the SCR Clock View, the MPEG Program Stream Analyzer analyzes the SCR data for the active program stream. If errors are found during the analysis, they are indicated on the display as red arrows leading from SCR clock icons to the black line, which represents time. SCR clocks without errors are indicated using black arrows.

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Each SCR view window displays ten SCR clocks, starting with SCR numbers one through ten. If successive clock references are very close together (in time), some of the clock reference icons may not be visible. To access the data for these clock references you need to display the SCR Values view, which is described in the next section. Click the **Next Item** command button to display successive SCR items or use the **Go to Item** button to display a specific item.

To display the values associated with each clock, double-click one of the SCR icons and an SCR number *n* pop-up window is displayed (*n* is the number of the clock reference you double-clicked). See the previous illustration. In this display, bad SCR values are displayed in red. You can drag this pop-up window to a new position by clicking and dragging the title bar. Dismiss the window by clicking anywhere outside of the pop-up in the application window.



Some of the displayed values are encoded in the program stream itself (for instance, SCR Base and SCR Extension values) and some are derived (for instance, SCRI – SCRV and FBP – LBPP values). Derived values are based on the values encoded in the program stream multiplex rate, SCR base, and SCR extension fields.

SCR Values view. In the graphical view, some of the SCR clocks may not be visible. This occurs when the time between successive clocks is too small for the display to resolve. However, the SCR Values view window displays the SCR values for all ten SCR clocks. To access this display, click the Add View button while the SCR graphical display is active, and then select SCR Values from the submenu.

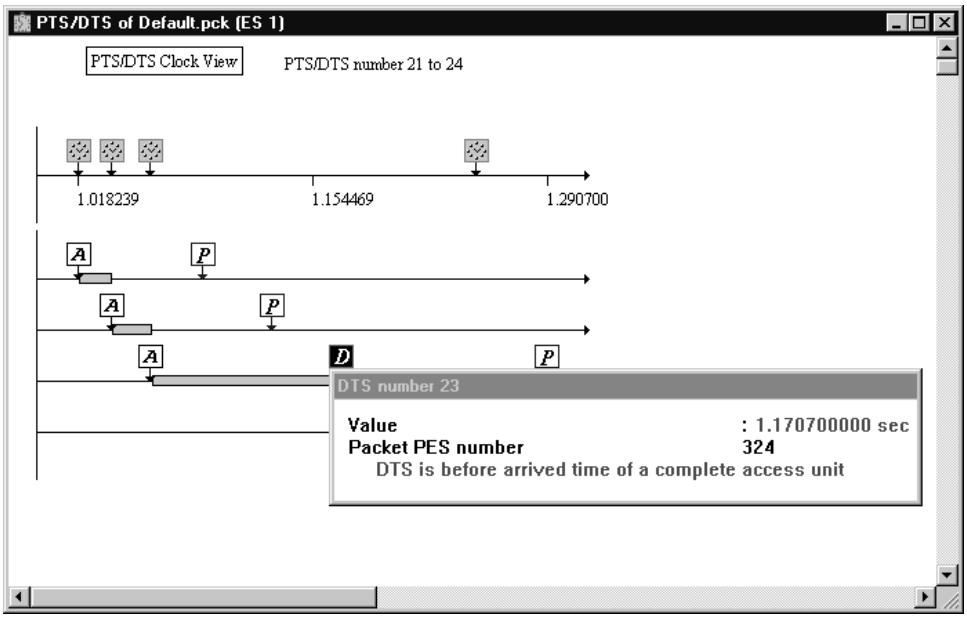
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Use the scroll bar to view the values for the ten displayed clocks. Click the **Next Item** command button to display successive clocks, or use the **Go to Item** command button to select a specific system clock reference to display. As with the graphical display, red values indicate errors.

PTS/DTS Clock Views

PTS/DTS clocks are used as timing references at the decoder for presentation and decoding the access units of the PES packets in which they are encoded. The PTS/DTS Clock views display presentation and decoding time stamps for the selected elementary stream. Like SCR clocks, you can display PTS/DTS clocks in both graphical and numerical formats.

PTS/DTS Graphic view. To display the graphical view of PTS/DTS clocks, right-click a PES packet icon, and then choose **PTS/DTS** from the submenu.



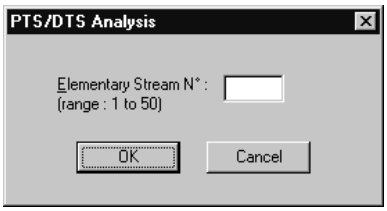
You can also display the PTS/DTS view window using the following procedure:

1. From the Hierarchic view, select **Temporal** from the Analysis menu.
2. Select **PTS/DTS** from the submenu.

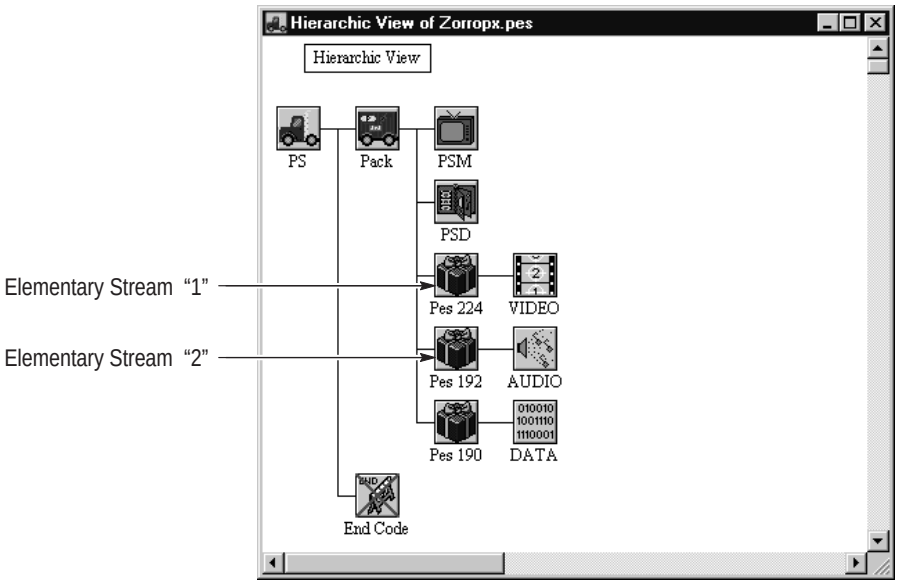
NOTE. *You cannot perform PTS/DTS analyses on data elementary streams.*

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3. In the PTS/DTS Analysis dialog box, enter the stream *number* of the audio or video elementary stream for which you want to display the PTS/DTS values, and then click **OK**.



Use the number of the stream as it appears in the hierarchy of the Hierarchic view. For instance, if the Hierarchic view for the active file looked like the following illustration, you would enter “2” in the **PTS/DTS Analysis** text box to analyze the audio elementary stream. You would enter “1” to analyze the video elementary stream (do not enter the stream ID).



When you display the PTS/DTS view, the MPEG Program Stream Analyzer analyzes the PTS/DTS values for the active program stream and displays the first four PTS/DTS items. If successive time stamp references are very close together (in time), some of the PTS or DTS icons may not be visible. To access the data for these references you need to display the PTS/DTS Values view, which is described in the next section beginning on page 3–13.

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If errors are found during the analysis, they are indicated on the display as red arrows leading from PTS/DTS icons to the black line, which represents time. PTS/DTS clocks without errors are indicated using black arrows. Use the **Next Item** command button to display successive PTS/DTS items or use the **Go to Item** to display a specific item.

Table 3–2 lists the icons used in the PTS/DTS view and indicates the type of information displayed when you double-click the icon.

Table 3–2: PTS/DTS view icons

Icon	Represents[1]	Double-click to display
	**SCR number *n***	The system clock reference value associated with the displayed access units. The item number of the pack containing the SCR value.
	**Arrived number *n***	The time that the access unit (the encoded data for a picture or block of sound) arrived at the decoder. The elapsed time since the last bit of the previous PTS/DTS field arrived at the decoder. The PES packet number containing the displayed access unit.
	**PTS number *n***	The presentation time stamp value. The PES packet item number containing the PTS value.
	**DTS number *n***	The decoding time stamp value. The PES packet item number containing the DTS value.
[2]	**Access Unit number *n***	The time that the first bit of the displayed access unit was decoded (relative to the first SCR clock). The time that the last bit of the displayed access unit was decoded (relative to the first SCR clock). The number of bytes in the displayed access unit. The type of picture for the selected access unit: B-, P-, or I-Picture[3]. The sequence in which the decoded pictures are to be displayed relative to the most recent I-picture[3] (*Reference time* for I-pictures is zero).

1 ***n* represents the position of the displayed data relative to the first like data item in the program stream. For example, *PTS number 2* means that the displayed PTS value is the second instance of the presentation time stamp in the program stream.**

2 **Access Unit icons can represent multiple access units.**

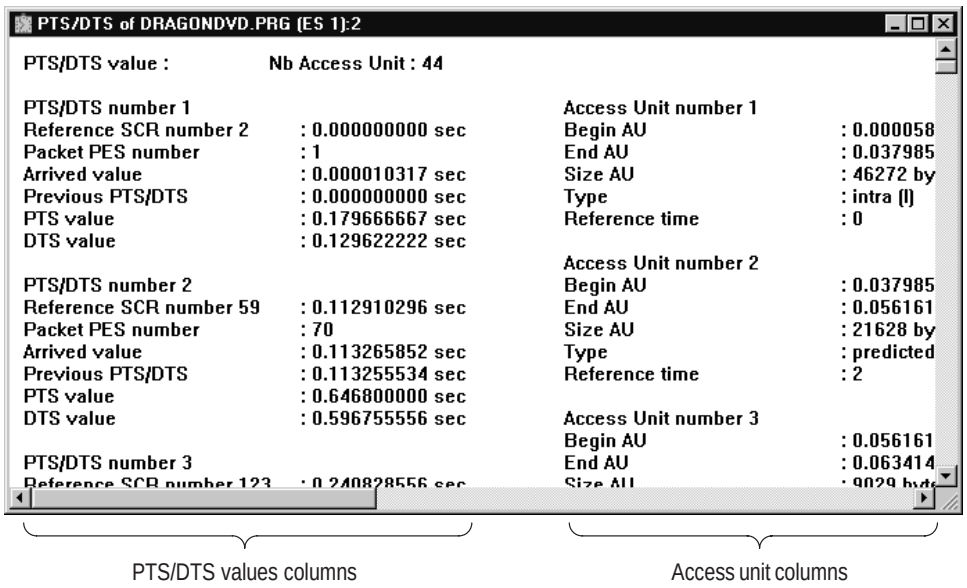
3 **Picture type and sequence information is displayed only for video elementary streams.**

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The message windows displayed when you double-click icons in the PTS/DTS view show errors in red. You can drag these windows to a new position by clicking and dragging the title bar. Dismiss the windows by clicking anywhere outside of the pop-up in the application window.

PTS/DTS Values view. In the graphical view, some of the presentation/decoding time stamps and access unit icons may not be visible, or may be difficult to select. To display all of the values represented in the active PTS/DTS view, click the **Add View** button, and then select **PTS/DTS Values** from the submenu.

In the PTS/DTS Values view, PTS/DTS values are displayed in the two left columns, and access unit data is displayed in the two right columns. The total number of access units displayed is listed at the top of each window. Red values indicate errors.



Use the **Next Item** command button to display successive PTS/DTS items, or use the **Go to** command button to select a specific item.

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Analyzing Program Streams

The MPEG Program Stream Analyzer provides multiple analysis functions for checking different aspects of MPEG program and system streams. The following analysis functions are described in this section:

- Syntactic analysis. Syntactic analyses check the conformance of the values encoded in the bitstream to MPEG standards.
- Consistency analysis. Consistency analyses check the conformance of the fields and values encoded in the bitstream relative to each other as required in the MPEG standards for program and system streams.
- SCR analyses. SCR analyses checks the temporal references for the program stream.
- PTS/DTS. PTS/DTS analyses checks the temporal references for a specific elementary stream.

One of the Analysis menu selections is **Automatic**, which initiates any combination of the above analyses. See *Automatic Analyses* on page 3–19 for more information about setting the options for automatic analyses.

Syntactic Analysis

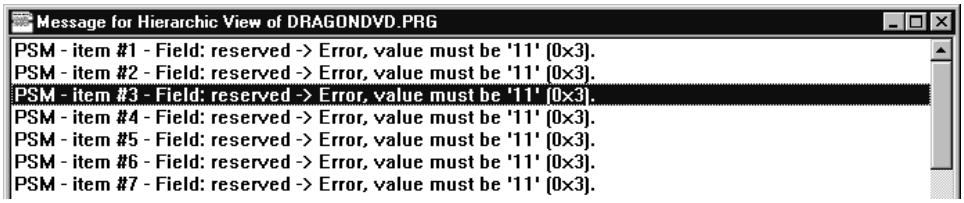
Syntactic analyses check the conformance of the values encoded in the bitstream to MPEG standards. You can perform syntactic analyses on a specific MPEG element or on the entire program stream. To perform an analysis on the entire stream, use the following procedure (to perform a syntactic analysis on a selected element, use the same procedure, but first make the interpreted view of the element you want to analyze the active view):

1. Navigate to the Hierarchic view for the program stream you want to analyze.
2. Select **Syntactic Semantic** from the Analysis menu.

   The analyzer initiates a syntactic analysis of the program stream.

   After the analysis is complete, the following message window is displayed listing the syntactic errors found in the file.

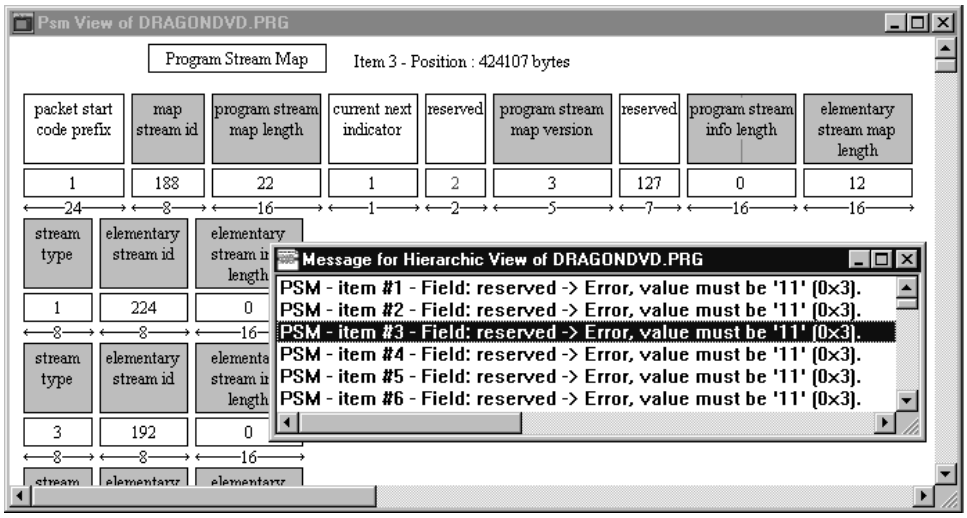
   Errors are listed by MPEG element, item number, field name, and error.



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3. To display the interpreted view for item containing an error, double-click an error message.

   The appropriate interpreted view is displayed and the value in error is displayed in red.



When you perform a syntactic analysis on a program or system stream, or any element of a stream, the analyzer creates a text file of the resulting errors (see *Messages Output* on page 3–20).

Consistency Analysis

Consistency analyses check the conformance of the fields and values encoded in the bitstream relative to each other as required in the MPEG standards for program and system streams. Consistency analyses can only be performed from the Hierarchic view. To perform a semantic analysis, use the following procedure:

1. Navigate to the Hierarchic view for the program stream you want to analyze.
2. Select **Consistency** from the Analysis menu.

   The analyzer initiates a semantic analysis among the elements and fields of the program stream.

3. After the analysis is complete, a message box similar to the syntactic analysis message window is displayed listing all consistency errors.

When you perform a consistency analysis on a program or system stream, the analyzer creates a text file of the resulting errors (see *Messages Output* on page 3–20).

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Temporal Analysis

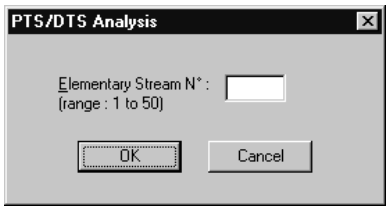
You can perform two types of temporal, or time-based, analyses on program streams: SCR and PTS/DTS analyses. SCR clocks are used as timing references at the decoder for the program stream. PTS/DTS clocks are used as references for the elementary stream in which they are encoded.

SCR analysis. To perform an SCR analysis on a program stream, use the following procedure:

1. Right-click the PS or Pack icon, and then select **SCR** from the submenu. (Alternatively, select **Temporal** from the File menu, and then select **SCR** from the submenu when the Hierarchic view or Pack header interpreted view is active.)
2. The **SCR Clock View** is displayed. See *SCR Clock views* beginning on page 3–8 for details about how to interpret the resulting display.

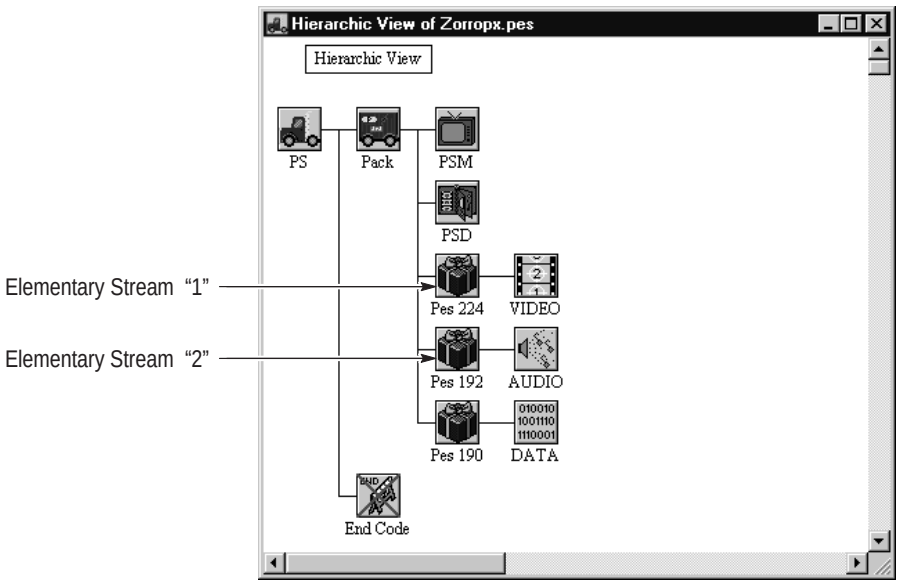
PTS/DTS analysis. To perform a PTS/DTS analysis on a program stream, use the following procedure:

1. Right-click a video or audio PES packet icon, and then select **PTS/DTS** from the submenu. (Alternatively, select **Temporal** from the File menu, and then select **PTS/DTS** from the submenu when the Hierarchic view or Pes Packet interpreted view is active.)
2. If you selected **PTS/DTS** from the File menu, the **PTS/DTS Analysis** dialog box will be displayed. Enter the number of the video or audio elementary stream you want to analyze in the text box.



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Use the number of the stream as it appears in the hierarchy of the Hierarchic view. For instance, if the Hierarchic view for the active file looked like the following illustration, you would enter “2” in the **PTS/DTS Analysis** text box to analyze the audio elementary stream. You would enter “1” to analyze the video elementary stream (do not enter the stream ID).



3. The **PTS/DTS Clock View** is displayed. See *PTS/DTS Clock views* beginning on page 3–10 for details about how to interpret the resulting display.

Automatic Analysis

The **Automatic analysis** selection from the Analysis menu allows you to perform any combination of analyses described in this section without having to select them individually. When you perform an automatic analysis on a stream, the analyzer creates a text file of the resulting errors (see *Messages Output* on page 3–20).

To perform an automatic analysis on the active program stream, use the following procedure:

1. Navigate to the Hierarchic view for the program stream on which you want to perform the analyses.

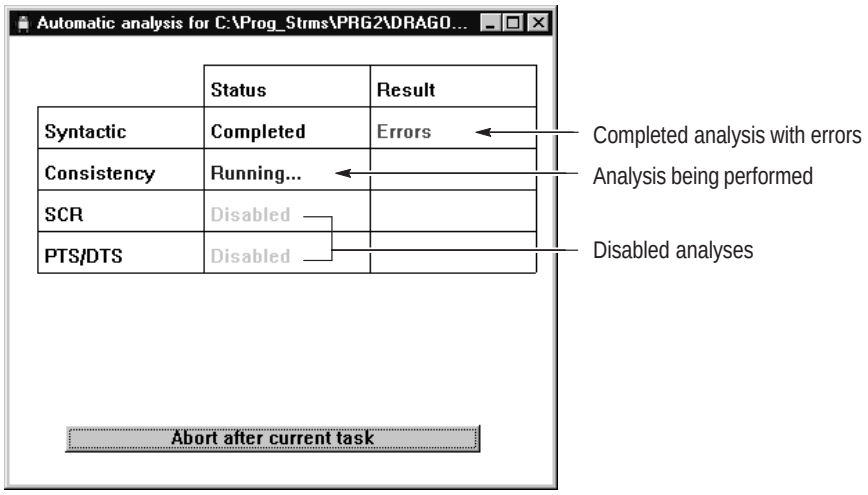
2. Select **Automatic** from the Analysis menu.

   The resulting **Automatic analysis** window indicates which analyses are being performed. (See *Automatic Analyses* on page 3–19 for information about how to specify which analyses are performed when you select Automatic from the Analysis menu.)

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3. To stop the analysis, press the button at the bottom of the message window.

   In the following illustration, the SCR and PTS/DTS analyses have been disabled, the Syntactic analysis is completed, and Consistency analysis is being performed.



   If errors are detected, the word *Errors* is displayed in red in the row for the appropriate analysis under the Result column.

4. Double-click the word ***Errors***, to display a message windows listing the errors. Double-click an error message in the Syntactic, SCR, or PTS/DTS analysis message windows and the item in error is displayed in the appropriate view window.

   You can have the analyzer automatically generate an error log file for the analyzed file using the **Analyses Result Output** dialog box (see *Messages Output* on page 3–20). This file is appended to each time an analysis is performed.

NOTE. *To generate the error log file, you need to set the* Messages Output in file *option in the Messages Output dialog box each time you start an MPEG Program Stream Analyzer session. See page 3–20.*

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Options Menu Reference

The Options menu selections allow you to configure specific MPEG Program Stream Analyzer parameters. The parameters in use when you exit the application are used to configure the analyzer when you open it again. This section describes the parameters you can set using the Options menu selections.

DVD

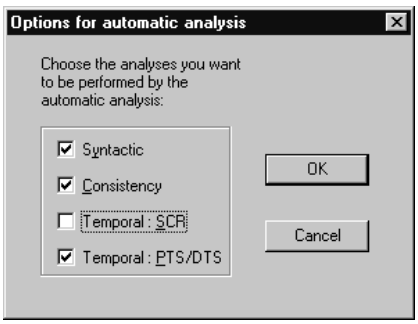
This menu selection is inactive. DVD analyses will be supported in a future enhancement to the MPEG Program Stream Analyzer.

Automatic Analyses

The options you set using the **Options for automatic analysis** dialog box allow you to perform any combination of the analyses described in *Analyzing Program Streams* (beginning on page 3–14) without having to select them individually.

To specify which analyses should be performed when Automatic is selected from the Analysis menu, use the following procedure:

1. Select **Automatic Analyses** from the Options menu and the Options for automatic analysis dialog box is displayed.

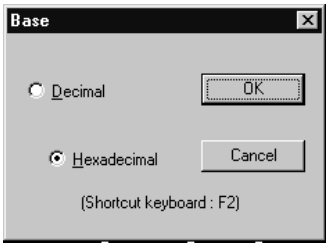


2. Select any combination of analyses from the dialog box. Until you change these settings, the selected analyses will be performed every time you select Automatic from the Analysis menu.

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Base

Use the Base menu selection to determine how the interpreted views display the program stream values: in either decimal or hexadecimal base. The default is decimal base. Toggle between the two by pressing the **F2** function key.



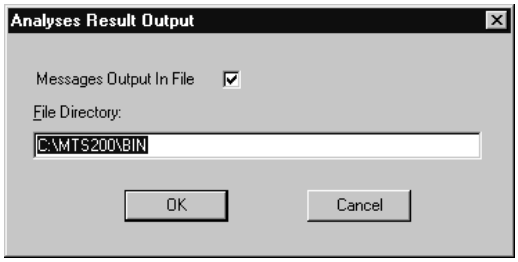
Messages Output

Use the Messages Output menu selection to specify the following parameters:

- Whether an error log file is automatically created when Syntactic/Semantic, Consistency, or Automatic is selected from the Analysis menu.

NOTE. *SCR and PTS/DTS data is logged when automatic analyses are performed, but not when SCR or PTS/DTS analyses are performed singly.*

- If created, the directory in which the error log file is written.



1. To automatically create an error log file, select the **Messages output to File** check box.

   If you clear the **Messages Output in File** check box, no error log file will be generated when analyses are performed.

NOTE. *Each time you exit the MPEG Program Stream Analyzer, the* Messages Output in File *check box is cleared. You need to select this option each time you begin an MPEG Program Stream Analyzer session in order to automatically generate error log files.*

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2. Specify the directory into which log files are written by entering a new directory path in the **File Directory** text box.

Error log files are named using the file name with a *.log* file name extension. Subsequent analyses results are appended to files without destroying previous data. Each new analysis is indicated with an error message header providing the following information:

- View from which the analysis was performed (for Syntactic/Semantic analyses)
- Program or system stream file name (for Syntactic/Semantic analyses)
- Date and time the error messages were generated

For automatic analyses, the following headers are also used in the body of the error messages:

- The type of analysis performed separates the list of error messages (error messages of a specific type follow the analysis type separator).
- An *End of report for automatic analysis* statement indicates where the error messages for that particular automatic analysis end.

Finally, the error messages in the error log files are formatted similarly to the error message windows displayed in the analyzer: Errors are listed by MPEG element, item number, field name, and error.

Font Use the Font menu selection to specify the font (typeface, style, and size) used for displaying information in the following analyzer view windows:

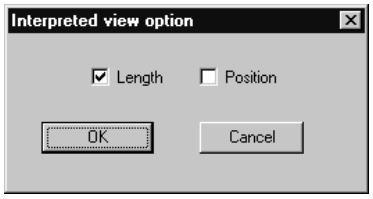
- Hierarchic view windows
- Interpreted view windows
- SCR and PTS/DTS Graphic view windows

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Interpretation

Use the Interpretation menu selection to specify whether to display length or position information in interpreted views. The Length and Position check boxes shown in the following illustration are cleared by default.

- Select **Length** to display the number of bytes in a field.
- Select **Position** to display the position (in bytes) of the field relative to the first bit displayed in the interpreted view.



Configuration Files

The following Options menu selections allow you to save and load configuration files.

Read configuration. Choose Read configuration from the Options menu to restore a configuration file (a *.acf* file) that you saved earlier. A standard Windows **Open** dialog box appears. Change the Drive and Directory if necessary and then select the file name. Click **OK** to restore the configuration saved in the file.

Save configuration. Use Save configuration to save the current option settings to a file. A standard Windows **Save as** dialog box opens. Be sure to select a Drive and Directory that will make it easy to later retrieve the file; then enter a descriptive name for the configuration file and click **OK**. The file receives the extension *.acf by default.

Set default configuration. Use this menu selection to revert the current options settings to the default settings.

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