User Manual

Tektronix

MPEG Test System
Video Stream Analyzer

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Preface

This document supports the MPEG Video Stream Analyzer application.

For information about other MTS 200 Series test system applications, refer to the user manuals provided with test system. For information about MTS 200 Series test system hardware installation, specifications, and first-time operation, refer to the *MTS 200 Series MPEG Test System Hardware Installation and Specifications Manual*, Tektronix part number 061-4143-0X.

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

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

Contacting Tektronix

Product Support	For application-oriented questions about a Tektronix measure-ment product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time
	Or contact us by e-mail: tm_app_supp@tek.com
	For product support outside of North America, contact your local Tektronix distributor or sales office. You can also call 1-503-627-2400 between 14:00 and 01:00 UTC (GMT).
Service Support	Contact your local Tektronix distributor or sales office. Or visit our web site for a listing of worldwide service locations.
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Getting Started

Getting Started

Product Description

You can use the MPEG Video Stream Analyzer to analyze and save MPEG-1 and MPEG-2 video elementary streams. You can display MPEG video elementary stream structures, items, and parameters at different levels using a variety of secondary windows called *view windows*.

View Windows

The following view windows provide high-level views of the video stream:

- Main Characteristics (see page 2–7)

- Main (see page 2–8)

- Decoded Picture (see page 2–11)

The following four view windows, called *interpreted views*, provide graphical displays of the video stream syntax:

- Sequence (see page 3–4)

- Group of pictures (GOP) (see page 3–5)

- Pictures (see page 3–6)

- Slice (see page 3–8)

All of the interpreted views are interactive in ways that make it easy for you to analyze the structures of the elementary stream.

Finally, you can view the bitstream of the video elementary stream in binary and hexadecimal formats using the Binary or Hexadecimal view windows.

Analysis

From the Interpreted, Binary, and Hexadecimal view windows, you can perform a syntactic analysis of the active MPEG structure. From the Main and Decoded Picture view windows you can also perform a semantic analysis on the complete video stream. See *Analyzing Video Elementary Streams* on page 2–17 and *Analyzing Video Elementary Streams* on page 3–11 for more information on performing syntactic and semantic analyses.

Limitations   The MPEG Video Stream Analyzer does not perform a syntactic analyses on the following MPEG-2 structures:

- Macroblock

- Macroblock modes

- Motion vectors

- Motion vector

- Coded block pattern

- Block

First Time Operation

The MPEG Video Stream Analyzer is part of a suite of hardware and software components used to create, generate, aquire, 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 test system configuation you have purchased, use the procedure for entering the general password described in the *MPEG Test System Software MTS2ES, MTS2AN, MTS2CR, and MTS2TS Installation Manual*.

NOTE. If you have already performed the procedure described in the installation manual, you do not need to perform it again.

Operating Basics

Operating Basics

Operating Basics is organized into the following sections:

- *Starting the MPEG Video Stream Analyzer* describes how to start the analyzer using standard Windows NT techniques.

- *Functional Overview* describes the application window types and the application interface elements.

- *MPEG Video Stream Analyzer Views* describes the views used by the application and how to access them.

- *Basic Operations* describes common procedures used to display, analyze, and decode video stream files.

- *Menu Selections* summarizes the menu selections.

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

Starting the MPEG Video Stream Analyzer

Video Stream Analyzer

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

Functional Overview

The MPEG Video Stream Analyzer uses two window types to display video elementary streams: an application window and secondary windows called view windows. *Functional Overview* describes the characteristics of these windows.

Application Window

When you first open a video elementary stream, the application window opens and looks similar to the following illustration.
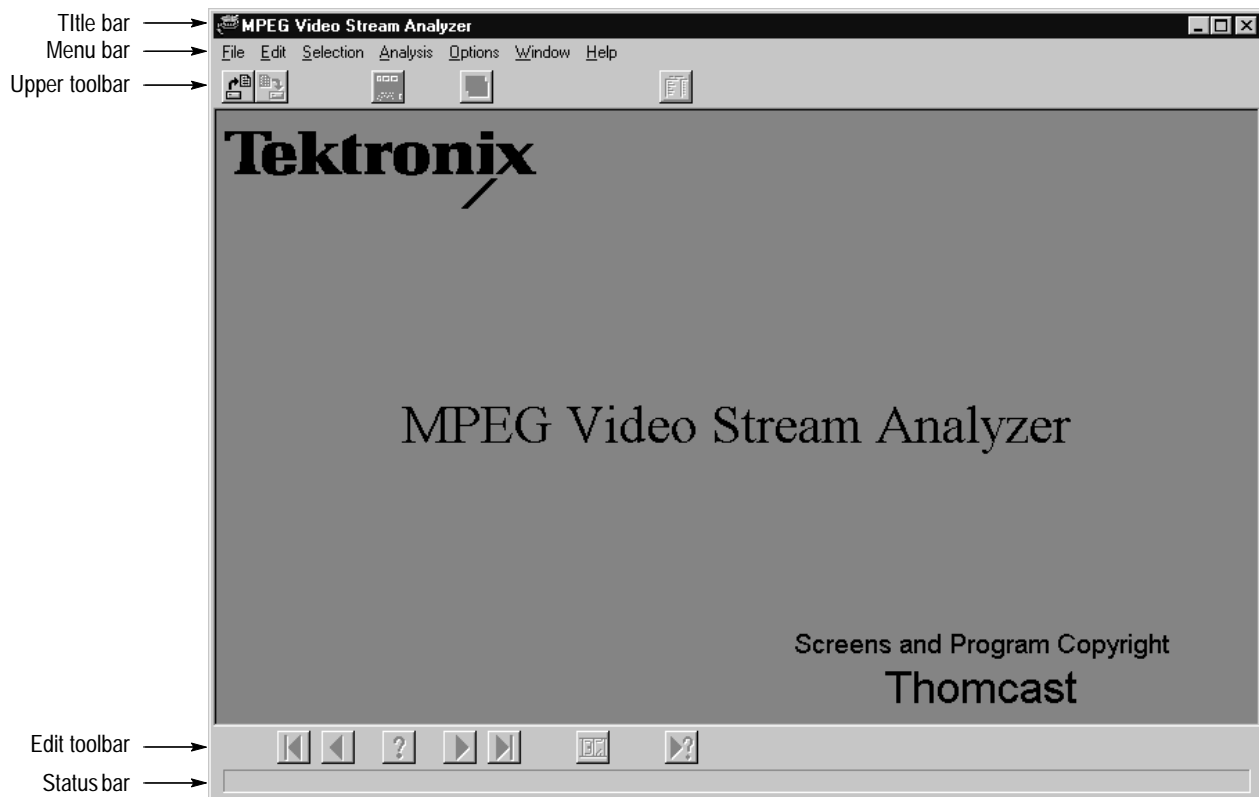
The following sections describe the elements of the application window.

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.

Menu Bar. The menu bar provides access to the commands you use to control the display, analysis, and look of the MPEG Video Stream Analyzer. A list of menu selections is provided in *Menu Selections* beginning on page 2–19.

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

Table 2–1: Upper toolbar buttons

Button	Name	Description
	Open	Displays the Open dialog box. Selecting this button is the same as selecting **Open** from the File menu (see page 2–13).
	Save as	Displays the Save As dialog box. Selecting this button is the same as selecting **Save As** from the File menu (see page 2–15)
	Main view	Displays the Main view window for the active video stream. Selecting this button is the same as selecting **Main view** from the Selection menu (see page 2–8).
	Add view	Displays a submenu from which you specify a view to be displayed. Selecting this button is the same as selecting **Add view** from the Window menu (see page 2–12).
	Main characteristics view	Displays the Main Characteristics window for the active video stream. Selecting this button is the same as selecting **Main characteristics** from the Selection menu (see page 2–7).

Edit Toolbar. The Edit toolbar provides shortcut buttons to selections found in the Edit menu. These buttons, described in Table 2–2, allow you to move through the items (decoded picture, sequence, GOP, or picture items) of the active view and to view the errors in the video stream file. More complete descriptions of these buttons are provided in the *Menu Selections* section beginning on page 2–19 where the Edit Menu selections are described. (The button descriptions are the same as the menu selection descriptions.)

Table 2–2: Edit toolbar buttons

Button	Name	Description
⏮	**First**	Displays the first item in the active view. Selecting this button is the same as selecting **First** from the Edit menu.
◀	**Previous**	Displays the previous item in the active view. Selecting this button is the same as selecting **Previous** from the Edit menu.
?	**Go to**	Displays a dialog box that allows you to select the item number of the active view you want displayed. Selecting this button is the same as selecting **Go to** from the Edit menu.
▶	**Next**	Displays the next item in the active view. Selecting this button is the same as selecting **Next** from the Edit menu.
⏭	**Last**	Displays the last item in the active view. Selecting this button is the same as selecting **Last** from the Edit menu.
▣	**Number of Items**	Counts the number of items in the element and displays the number at the top of the interpreted view. Selecting this button is the same as selecting **Number of Items** from the Edit menu.
▶?	**Next error**	Displays the next item that has an error in the video stream file. Selecting this button is the same as selecting **Next error** from the Edit menu.

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 describes the menu selection.

View Windows   View windows display the syntax of the elementary stream at different levels. The following illustration show the Main view window and the application window.
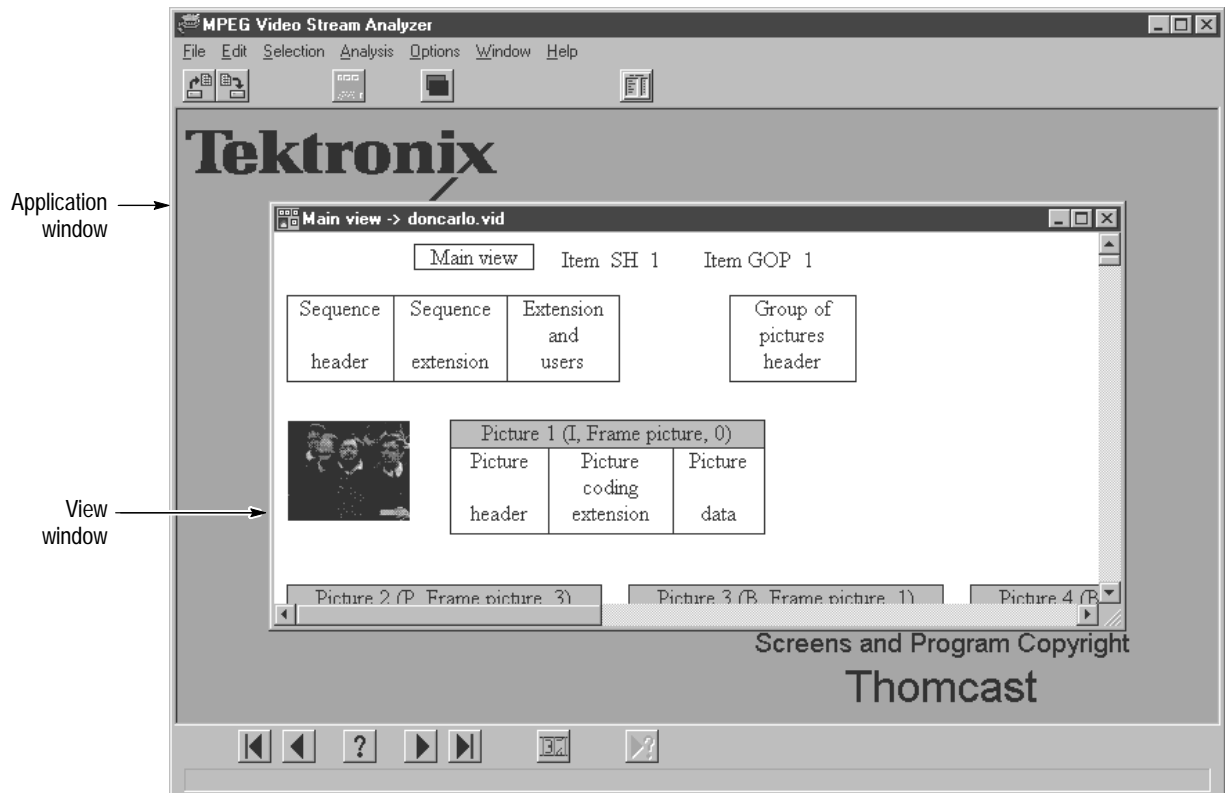
Common View Window Elements. In addition to standard window controls, the title bar of the view windows provides the following information:

- View type. The view type indicates the type of view displayed in the view window.

- File name. The file name indicates the name of the video stream file or the transport stream from which the video stream was extracted.

NOTE. If you maximize the view window, the view type and file name are displayed in the title bar of the application window.

The top line of the Main and interpreted view windows provides the following information (refer to the illustration below):

■ View type. The view type indicates the type of view displayed (Main, Sequence, GOP, or Picture).

■ Item. The item indicates which item of the viewed syntax is displayed. From the Main view window, you can display the total number of items in each structure by performing one of the following operations:

■ Click the Number of Items command button from the Edit toolbar (see page 2–4).

■ Select **Number of Items** from the Edit menu.

The Number of Items message window is then displayed, indicating the total number of Sequences and GOPs in that structure for the active video stream.
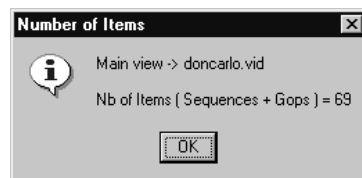
The total number of items in each structure is displayed in the top line of the view window as shown in the following illustration.
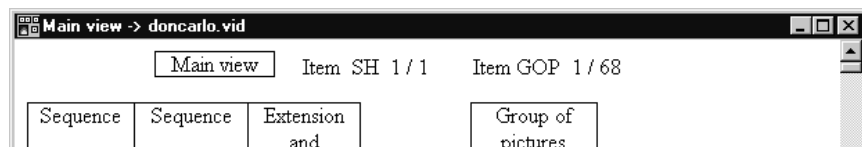
In the interpreted views, the item number provided is the number of items in the displayed structure. For instance, if you were to double-click the GOP rectangle, the top line of the GOP interpreted view window would look similar to the following illustration.
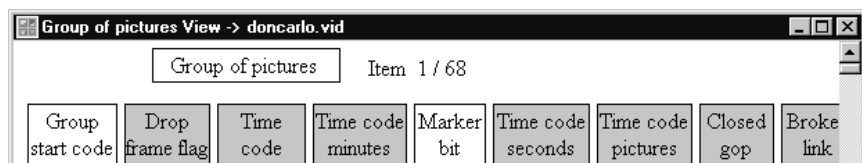
The areas of the view windows below the top line are described briefly in *MPEG Video Stream Analyzer Views*, the next section, and more thoroughly in the *Reference* section of this manual.

MPEG Video Stream Analyzer Views

You can use the MPEG Video Stream Analyzer to view elementary video streams at different levels. This section briefly describes these views and how to access them. See *Interpreted Views* beginning on page 2–9, and see *Additional Views* beginning on page 3–9 for more detailed information about the various view types used by the analyzer.

Main Characteristics View

When you open a new video elementary stream, the Main Characteristics view window is automatically displayed if the elementary stream includes a sequence header.

NOTE. Because the main characteristics of the stream are read in the first sequence header of the stream, if the stream does not contain a sequence header, the Main Characteristics view window is not displayed and is not available from any other view window. The requirement for a sequence header also means that if a video stream is opened as a Sequence, GOP, or Picture document file type (see Opening Video Streams, *on page 2–13), the Main Characteristics view window will not be available.*

The Main Characteristics view window allows you to quickly access basic information about the video stream.

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MAIN CHARACTERISTICS

MPEG-2 stream

Horizontal size	704 samples
Vertical size	576 lines
Aspect ratio information	reserved
Frame rate	25.000 pictures/s
Bit rate	5 400 000 Bit(s)/s
VBV Buffer size	0 Bit(s)
Profile	Main
Level	Main
Progressive sequence	all types of pictures
Chroma format	4:2:0
Video format	unspecified
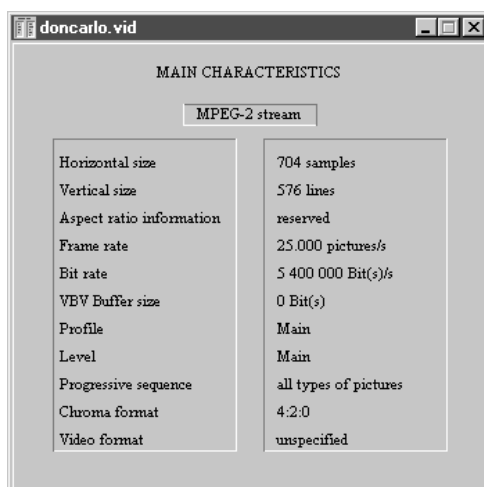
Display the Main Characteristics view window from any of the other view windows by clicking the Main Characteristics button on the Upper toolbar (see page 2–3), or by selecting **Main Characteristics** from the Selection menu.

Main View
When you open a video elementary stream as a Video Stream file type (see *Opening Video Streams* on page 2–13), the Main view window is displayed. The Main view is interactive and allows you to display specific video stream syntax for further analysis.

NOTE. *To display the Main view window, the video stream must include a sequence header. You can open a video stream that does not have a sequence header by opening the file as a Sequence, GOP, or Picture document. See* Opening Video Streams *on page 2–13.*

Display the Main view window from any of the other interpreted view windows by clicking the Main View button on the Upper toolbar (see page 2–3), or by selecting **Main View** from the Selection menu.
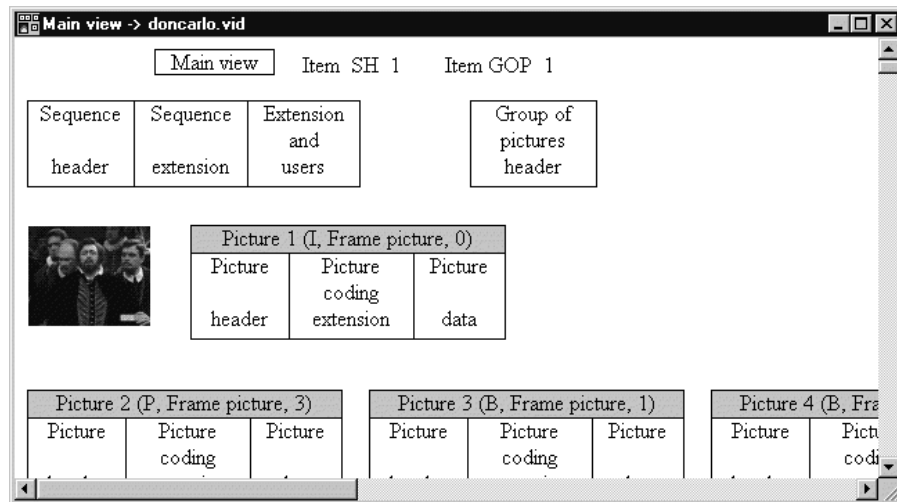
The different elements of the displayed video stream are represented by rectangles. Each rectangle displays some minimal information about the structures of a sequence, GOP or picture. For example, in the illustration above, the sequence structure consists of a sequence header, sequence extension, and user data.

Table 2–3 lists the video stream elements displayed in the Main view window. Double-click the rectangles to access more detailed interpreted views for the structures indicated. (The page numbers in parentheses indicate where the interpreted view for each structure is discussed in this manual.)

Table 2–3: Main view elements

Element rectangle	Video stream element
Sequence header / Sequence extension / Extension and users	Sequence (page 3–4)
Group of pictures header	GOP (page 3–5)
Picture 1 (I, Frame picture, 0) — Picture header / Picture coding extension / Picture data	Picture (page 3–6)

The gray title bar in the Picture rectangles indicates the picture number, coding type (I, P or B), structure (field or frame for MPEG-2 streams), and the temporal reference of the picture.

You can display the Main view window without the detail in the rectangles by selecting **Cut Down/Blow up Main View** from the Window menu, or by pressing the **F3** function key.

Interpreted Views

To access a graphical view of an MPEG structure, double-click one of the rectangles associated with the structure you want to display from the Main view window. The resulting display is called an interpreted view. Using interpreted view windows, you can display a representation of the following MPEG-1 and MPEG-2 video stream structures and perform syntactic analyses on these structures:

- Sequence structures

- Group of Pictures structures

- Pictures structures

- Slice structures

Like the Main view window, interpreted view windows are interactive. Each interpreted view displays the values found in different MPEG structures for the active video stream. Each field is named and represented by a large rectangle; each value is displayed in a small rectangle just below the large named rectangle. (See the following illustration of the Sequence view window.)
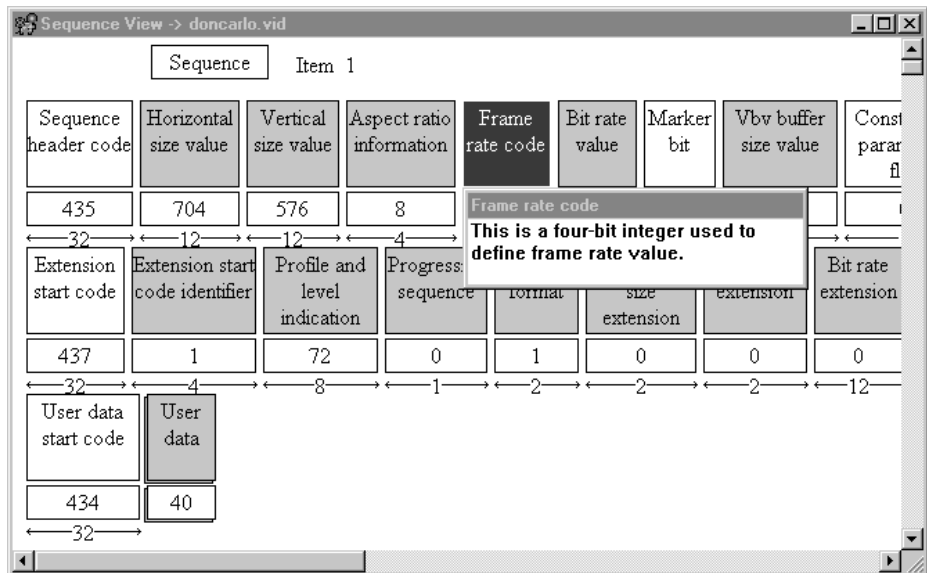
Double-click a large rectangle to display a description of the field. You can move the displayed message box anywhere within the view window. To move the message box, click and drag the title bar. Dismiss the message box by clicking anywhere outside of it.

Double-click a small rectangle to display an interpretation of the value for that field. Dismiss the message box by clicking anywhere outside of it.
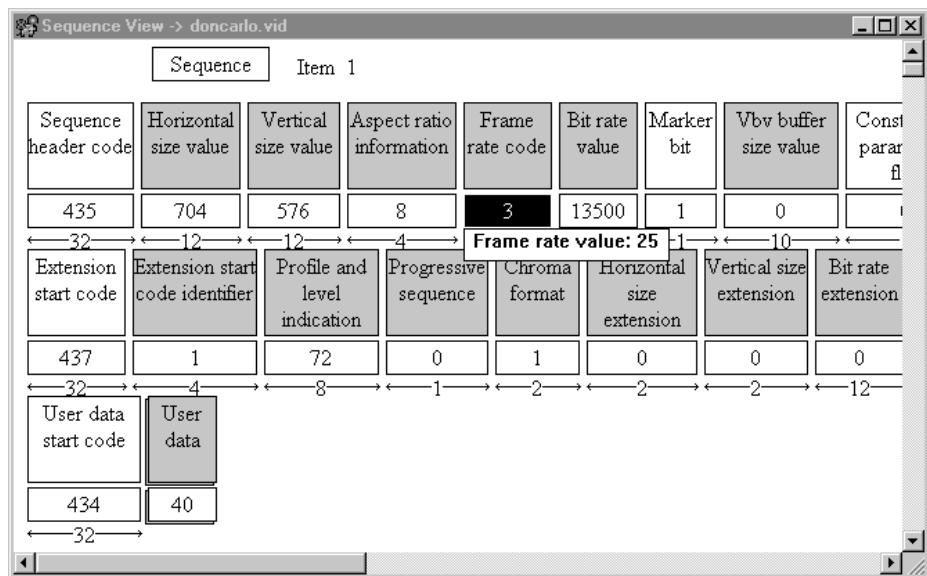
Interpreted view windows can also display the position or the length of the field in the bitstream. When enabled, this information is displayed below the small rectangles. Select which type of information, if any, you want to display using the following procedure:

1. Select **Interpretation** from the Options menu, and then select one of the following options:

    ■ **Position** indicates the position in the bitstream of the first bit of the parameter. Position is relative to the to the first bit in the displayed syntax.

    ■ **Length** is the length in bits of the parameter.

2. To disable the display of this information, deselect both options (this is the default configuration).

When you start a new MPEG Video Stream Analyzer session, the analyzer uses the configuration used the last time the analyzer was exited.

Binary and Hexadecimal Views

You can use the Binary and Hexadecimal view windows to view the bitstream of the video elementary stream for the active MPEG structure. Access the Binary and Hexadecimal views using the following procedure:

1. Navigate to the interpreted view window for the structure you want to analyze.

2. Select the Add View button on the Upper toolbar (see page 2–3), and then select **Binary** or **Hexadecimal** from the submenu. Alternatively, you can select **Add View** from the Window menu, and then select **Binary** or **Hexadecimal** from the submenu.

The characteristics of the Binary and Hexadecimal view are described in *Binary and Hexadecimal View* on page 3–9.

Decoded Picture View

The picture displayed under the Sequence rectangle in the Main view window (if decoded) corresponds to the first I-picture of the group of pictures. This picture is decoded using only the DC coefficients of the macroblocks. Double-click the picture to display the Decoded Picture view window. The resulting picture is decoded using all of the coefficients.

NOTE. The Decoded Picture view window is a visualization tool, not an analysis tool.

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

- Select the Add View button from the Upper toolbar (see page 2–3), and then select the type of view window you want displayed from the submenu.

- Select **Add View** from the Window menu, and then select the type of view window you want displayed from the submenu.

The views available from the submenus in both cases depend on the active view window as described in Table 2–4.

Table 2–4: Add view options

From this view window	Select Add View to display
Main view	■ An additional Main view or ■ A Decoded Picture view
Interpreted view	■ An additional interpreted view or ■ A Binary or Hexadecimal view
Binary or Hexadecimal view	■ An interpreted view of the syntax or ■ A Binary or Hexadecimal view
Decoded Picture view	■ A Main view or ■ An additional Decoded Picture view

Basic Operations

This section describes how to open, save, print, and analyze MPEG video stream files and how to exit the application.

Opening Video Streams   The MPEG Video Stream Analyzer displays the following video elementary stream types:

- MPEG-1 and MPEG-2 elementary video stream files

- Video elementary streams extracted from an MPEG transport stream

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NOTE. The MPEG Video Stream Analyzer cannot analyze a file containing both MPEG-1 and MPEG-2 video streams.

Opening elementary video stream files. To open a video stream file, use the following procedure:

1. Click the Open button on the Upper toolbar (see page 2–3), or select **Open** from the File menu.

2. Select the appropriate file from the Open dialog box.

3. From the **List files of type** drop down selection box, select the type of document you want to open the file as, and then select OK.
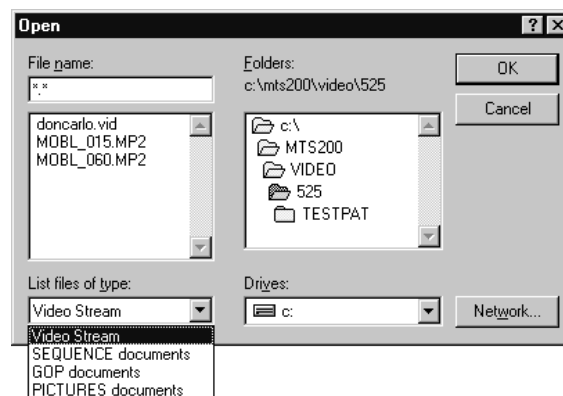
The following list describes how each of the **List files of type** options affects how the elementary stream file is opened:

NOTE. Files opened using the Video Stream option display only those items that come after the first sequence header in the bitstream. Files opened using either the GOP and Picture document options display all of the GOPs and Pictures in the file regardless of whether the file has a sequence header. Consequently, files opened using one of the latter options may allow you to view GOPs and Pictures you otherwise could not.

- **Video Stream.** When a video stream file is opened using this option, the Main Characteristics and Main view windows are displayed. Only files that have a sequence header can be opened using this option.

- **SEQUENCE documents.** When a video stream file is opened using this option, the Sequence interpreted view window is displayed.

- **GOP documents.** When a video stream file is opened using this option, the Group of pictures interpreted view window is displayed.

- **PICTURES documents.** When a video stream file is opened using this option, the Pictures interpreted view window is displayed.

    If you open a video stream as a Pictures document and the file contains no sequence header, the MPEG Video Stream Analyzer uses default interpretation parameters to display the file. In this case, you will see a message indicating that some of displayed parameters could be false.

Opening video streams extracted from a transport stream. To open and analyze an elementary stream that is extracted from a transport stream file, use the following procedure:

1. Confirm that you know the PID of the packets that contain the video stream of interest. If necessary, examine the transport stream first with the Tektronix Deferred-Time Analyzer application.

2. Select **Open** from the File menu.

3. Select the appropriate file from the Open dialog box.

4. Enter the PID of the packets that contain the video stream.

*NOTE. You can open the MPEG Video Stream Analyzer with an elementary video stream directly from the Tektronix Deferred-Time Analyzer. From the Hierarchic View, right-click the video elementary stream icon and select **Video Stream Analyzer** from the submenu.*

Saving Video Streams

Use the following procedure to save all or part of a video stream to a file. (See *Appendix A: Save Video Stream Option Examples* for examples of how the different Save as dialog box options work in different scenarios.)

NOTE. Because you can save video streams only from the Main view window, only those sequence headers, GOPs, and pictures after the first sequence header can be saved to a new video stream file.

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1. Navigate to the Main view window, and then click the Save as button on the Upper toolbar (see page 2–3), or select **Save As** from the File menu.

   The displayed dialog box allows you to select which part of the active video stream you want to save. The default settings are shown in the following illustration.

2. Choose the portion of the elementary stream you want to save by selecting one of the following options:

   - **All the video stream.** Use this option to save the entire displayed video stream; that is, all sequence headers, GOPs, and pictures.

NOTE. For the following options, if a sequence header immediately precedes the GOP, the sequence header is automatically saved.

   - **I-Picture.** Use this option to save the indicated I-Picture and the GOP associated with it.

■ **From picture.** Use this option to save the indicated range of pictures. The saved portion of the stream begins with the GOP *following* the picture indicated in the **From picture** text box and includes the GOP of the picture indicated in the **to picture** text box, with the following two exceptions:

■ If the picture indicated in the **From picture** text box is the first picture in any GOP, then the stream is saved beginning with the GOP of the picture, not the following GOP.

■ If the indicated pictures are in the same GOP, then that GOP is saved.

■ **From GOP.** This option allows you to save the indicated range of groups of pictures.

■ **From.** This option allows you to save the indicated time segment of the video stream. Time is indicated in milliseconds. This option uses the same criteria as the **From picture** option.

NOTE. All of the text boxes in the Save as dialog box must include a value greater than 0. Blank text boxes, or text boxes with out of range values are flagged as errors. If a blank text box, or out of range value is detected, an error message is displayed indicating the correct range of values. To continue saving the video stream, you must first enter a valid value in the text box.

3. If you have selected an I-picture, a range of pictures or GOPs, or a time segment, enter the I-picture number or the appropriate values in the **From** and **to** text boxes.

4. Enter the **Repetition Count** to specify the number of times the stream segment is repeated in the new file. All repetitions greater than one are appended to one another in the new file.

NOTE. Ensure that the first saved GOP is preceded by a sequence header. If you do not, you will be unable to open a Main view window of the saved stream later.

5. Choose a **Sequence Header** and/or a **Sequence End** if appropriate. Choose **Sequence Header** if the selected picture(s) or GOP(s) are not immediately preceded by a sequence header. The new file will use the first sequence header found in the source stream.

6. When all of the necessary information has been entered, click **OK**, and a standard Save as dialog box is displayed.

7. Select an appropriate drive, directory, and file name from the Save as dialog box, and then click **OK**.

NOTE. You cannot save video streams to the Tektronix MPEG Test System Data Store directory, C:\Carb0.

8. A progress bar is displayed to indicate the status of the operation. Click cancel to stop the process, or you can press the Esc key on your keyboard.
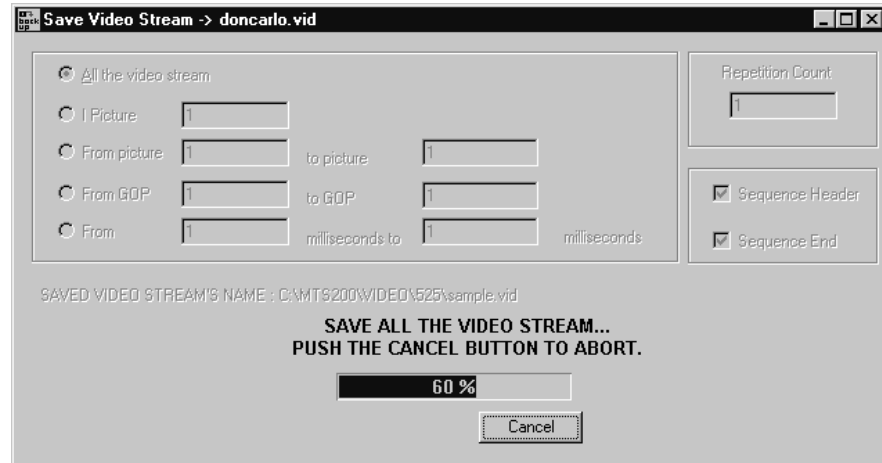
When the Save as process is finished, a message box is displayed indicating that the new file has been saved successfully.

Analyzing Video Streams

You can use the MPEG Video Stream Analyzer to check MPEG encoded video streams for syntactic and semantic errors.

Syntactic Analysis. Syntactic errors indicate errors in the values of the MPEG structures.

To perform a syntactic analysis, use the following procedure:

1. Navigate to the interpreted view of the element in the elementary stream that you want to check.

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

3. The analyzer performs a syntactic analysis of the element you have selected and reports errors in an error message window.

4. Each line in the error message window represents a syntax error. Double-click an error message and the interpreted view window containing the error is displayed with the value in error displayed in red.

You can perform a syntactic analysis on all of the structures in the video stream by navigating to the Main view window, and then performing the analysis. See *Syntactic Analysis* on page 3–11 for more information about how the MPEG Video Stream Analyzer performs syntactic analyses.

Semantic Analysis. Semantic errors indicate errors in the MPEG structure when compared to the standard.

To perform a semantic analysis, use the following procedure:

1. Navigate to the Main view window.

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

3. The analyzer performs a semantic analysis of the video stream and reports errors in an error message window.

4. Each line in the error message window represents a semantic error. Double-click an error message and the interpreted view window showing the syntax in error is displayed. Semantic errors are not displayed in red.

Semantic analyses can be performed only from the Main view window. See *Semantic Analysis* on page 3–14 for more information about how the MPEG Video Stream Analyzer performs semantic analyses.

Printing Interpreted Views

With the MPEG Video Stream Analyzer, you can print any of the view windows except the Main Characteristics and Decoded Picture view windows. To print the information displayed in a view window, use the following procedure:

1. Set up the page layout by selecting **Printer setup** from the File menu, and then make the appropriate selections for paper size and source, orientation, and margins from the Page Setup dialog box.

2. Set up the printer connections by selecting the **Printer** command button, and then making the appropriate printer and printer properties selections (see your Windows documentation).

3. Return to the view window you want to print and select **Print** from the File menu.

4. The Print dialog box is displayed. Make standard Windows Print selections and print the contents of the active view window.

Quitting the Application   To quit the MPEG Video Stream Analyzer, select **Exit** from the File menu.

To close a window without exiting the analyzer application, use one of the following techniques:

■ To close an active view window, select the close button on the active view window. Alternatively, select **Close view** from the Window menu.

■ To close all windows, select **Close all** from the Window menu.

Menu Selections

Table 2–5 summarizes each of the menu selections for the MPEG Video Stream Analyzer.

Table 2–5: Menu selections

Menu	Selection	Description
File	Open	Displays the Open dialog box from which you identify the existing video stream file you want to view.
	Save as	Displays the Video Stream Save dialog box from which you indicate how much of the file you want to save. After you select OK, a standard Save As dialog box is displayed.
	Print	Displays a standard Print dialog box from which you can print the active view window.
	Printer setup	Displays the Page Setup dialog box from which you specify the paper size, orientation, and page margins. The dialog box also provides access to printer options.
	Exit	Quits the MPEG Video Stream Analyzer.
Edit	Next	Displays the next item in the active view.
	Previous	Displays the previous item in the active view.
	First	Displays the first item in the active view.
	Last	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 displays the number in the upper portion of the active view window.
	Next error	Displays the next item in the active view with a syntactic error.

Table 2–5: Menu selections (cont.)

Menu	Selection	Description
Selection	**Main Characteristics**	Displays the Main view window for the video stream file indicated in the title bar of the view window.
	Main View	Displays the Main Characteristics view for the video stream file indicated in the title bar of the view window.
Analysis	**Syntactic**	Performs a Syntactic analysis on the video stream file indicated in the title bar of the secondary window. See page 3–11.
	Semantic	Performs a Semantic analysis on the video stream file indicated in the title bar of the secondary window. See page 3–14.
	Automatic	Performs the analyses you select using the Options for automatic analysis dialog box See page 3–17.
Options	**Cut Down/Blow up Main View**	Toggles the Main view window between a detailed view and one that is less detailed. The **F3** function key also toggles between these types of views.
	Base	Displays the Base dialog box from which you set the numeric base (decimal or hexadecimal) you want to use for various interpreted views.
	Font	Displays the Font dialog box from which you set the font you want to use for various views.
	Directories	Displays the Default Directories dialog box. You select the directories to which the MPEG Video Stream Analyzer messages and configuration files are saved.
	Automatic Analysis	Displays the Options for automatic analysis dialog box from which you indicate the types of analyses performed when you select **Automatic** from the Analysis menu. You can choose any combination of the two options. The default is to perform both syntactic and semantic analyses.
	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.
	Read configuration	Displays the Read Configuration dialog box from which you can load an existing configuration file into the MPEG Video Stream Analyzer.
	Save configuration	Displays the Save Configuration dialog box from which you can save the current configuration into a specified configuration file.
	Set default configuration	Loads the default configuration file into the MPEG Video Stream Analyzer.

Table 2–5: Menu selections (cont.)

Menu	Selection	Description
Window	**Cascade**	Displays the open view windows on top of one another.
	TIle	Fits the open view windows to the application window.
	Arrange icons	Arranges all minimized windows 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 an identical view of the selected view or a different view of the displayed information. Same as the Add View button on the upper toolbar.
	List of open view windows	Selects the active view from the listed view windows and brings the selected view to the front of the display. All open views are listed, including any minimized windows. A checkmark indicates the current active view.
Help	**Contents**	Displays the MPEG Video 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 Video Stream Analyzer	Displays version number and copyright information about the MPEG Video Stream Analyzer.

MPEG Video Stream Analyzer User Manual

Reference

Reference

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

- *Interpreted Views*

- *Additional Views*

- *Analyzing Video Elementary Streams*

- *Configuration Reference*

Commonly performed procedures, view window descriptions, and common interface elements are described in *Operating Basics.*

Interpreted Views

The MPEG Video Stream Analyzer uses four interpreted views to display the elements of MPEG-1 and MPEG-2 encoded video streams:

- **Sequence.** This view window displays elements described by the video sequence structures of MPEG-1 and MPEG-2 encoded video streams.

- **Group of pictures (GOP).** This view window displays elements described by the GOP structures of MPEG-1 and MPEG-2 encoded video streams.

- **Picture.** This view window displays elements described by the picture structures of MPEG-1 and MPEG-2 encoded video streams.

- **Slice.** This view window displays elements described by the slice structures of MPEG-1 and MPEG-2 encoded video streams.

Each of the interpreted view windows are interactive and have some common interface elements. These common elements are described in the next section, *Interpreted View Window Common Elements*. The following sections describe each of the interpreted views in more detail.

Interpreted View Window Common Elements

Each interpreted view window uses a series of rectangles to represent the fields and values associated with specific MPEG video elementary stream structures. Shaded rectangles are used to highlight more important or critical fields and values of MPEG elementary streams. The following illustration of the Sequence view window shows the elements that all interpreted view windows have in common.
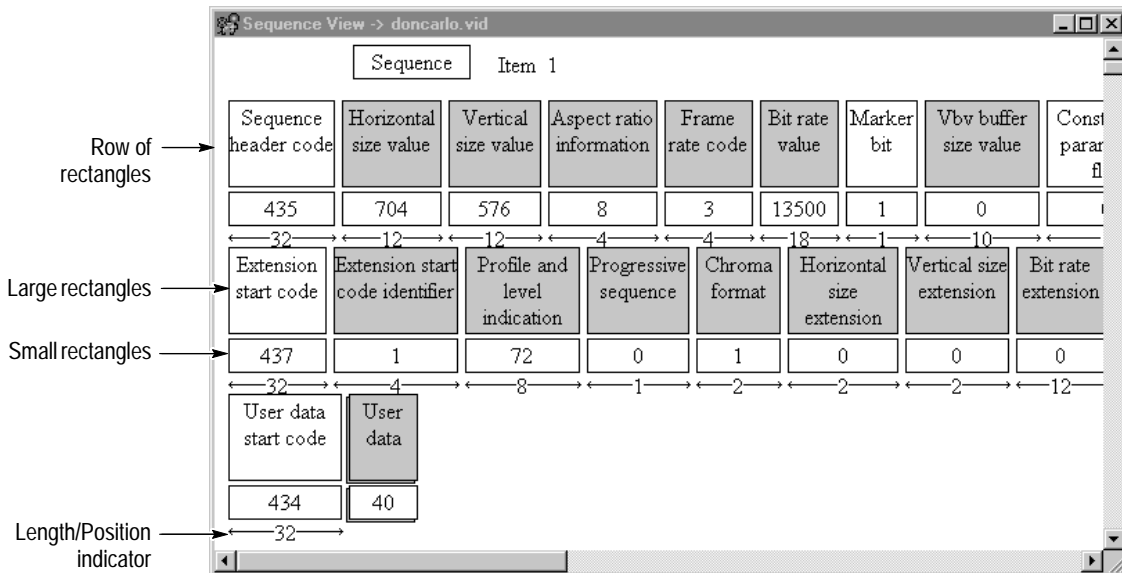
In addition to the common elements for the MPEG Video Stream Analyzer view windows (see *Common View Window Elements* on page 2–5), the preceding illustration shows the following elements common to interpreted view windows:

- **Row of rectangles.** Each row in an interpreted view window represents a structure in the displayed element. For instance, the first row of the preceding illustration represents the sequence_header() structure; the second row represents the sequence_extension() structure, and the third line represents the extension_and_user_data() structure.

- **Large rectangles.** The large rectangles represent specific fields in the structure of the displayed element. For instance, in the preceding illustration, the large rectangle, Horizontal size value, represents the horizontal_size_value field.

  Double-click a large rectangle to display a description of the field. You can move the message box to make it easier to read by clicking and dragging the title bar of the message box. Dismiss the message box by clicking anywhere outside of the box.

■ **Small rectangles.** The small rectangles represent the values encoded in the bitstream for the fields.

Displayed values can be shown in decimal or hexadecimal base. To toggle between the two, press the **F2** function key. (You can also select **Base** from the Options menu, and then make the selection from the dialog box.) Red values indicate syntax errors.

Double-click a small rectangle to display an interpretation of the value. Dismiss the message box by clicking anywhere outside of the box.

■ **Length/Position indicator.** Interpreted views can display the position or the length of the fields. When enabled, this information is displayed below the small rectangles. You determine which type of information, if any, is displayed using the following procedure:

1. Select **Interpretation** from the Options menu, and then select one of the following options:

   ■ **Position** indicates the position in the bitstream of the first bit of the parameter. Position is relative to the to the first bit in the displayed syntax.

   ■ **Length** is the length in bits of the parameter.

2. To disable the display of this information, deselect both options (this is the default configuration).

When you start a new MPEG Video Stream Analyzer session, the analyzer uses the configuration used the last time the analyzer was exited.

You can use the Edit toolbar to navigate through the displayed items from all of the interpreted view windows. See *Edit Toolbar* on page 2–4 for more information about the Edit toolbar.

You can also display a Binary or Hexadecimal view window from any interpreted view window using one of the following methods:

■ Click the Add view button, and then select either **Binary** or **Hexadecimal** from the submenu.

■ Select **Add view** from the Window menu, and then select either **Binary** or **Hexadecimal** from the submenu.

Sequence View To access the Sequence interpreted view window, double-click the large Sequence Header rectangle from the Main view window.

Sequence	Sequence	Extension
		and
header	extension	users

You can also access the Sequence interpreted view window by opening a video stream as a **Sequence documents** file type. See *Opening Video Streams* on page 2–13.

See *Interpreted Views* on page 2–9 and *Interpreted View Window Common Elements* on page 3–2 for information about interpreted view windows and how to use the interface elements.
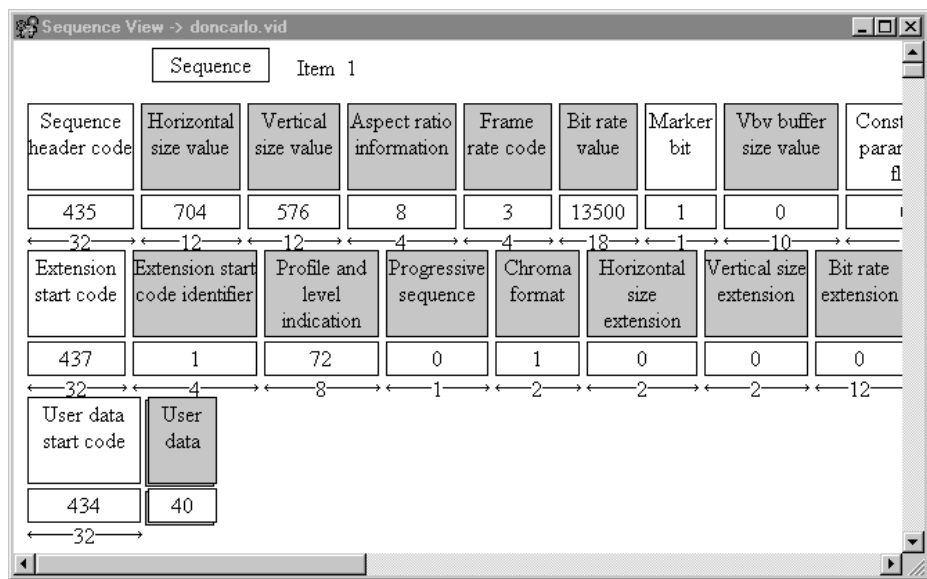

If the video stream was extracted from a transport stream, the PID of the elementary stream is displayed in the title bar of the view window.

The Sequence interpreted view may display the following structures:

■ Sequence Header

■ Sequence Extension

■ Sequence Display Extension

■ Sequence Scalable Extension

■ User Data

Double-clicking the value rectangle (small rectangle) of the quant matrixes (which can be present in either the sequence header or in the quant matrix extension) displays the quant matrix.

```
Non Intra Quantiser Matrix

10 11 11 12 12 12 13 13
13 13 14 14 14 14 14 15
15 15 15 15 15 16 16 16
16 16 16 16 17 17 17 17
17 17 17 17 18 18 18 18
18 18 18 19 19 19 19 19
19 1A 1A 1A 1A 1A 1B 1B
1B 1B 1C 1C 1C 1D 1D 1E
```

Double-click the large User data rectangle to display either a binary or hexadecimal view of the sequence structure. The value displayed in the small User data rectangle indicates the number of data bytes.

Group of Pictures (GOP) View

The GOP interpreted view displays the GOP header structure. To access the GOP interpreted view window, double-click the large GOP rectangle in the Main view window.

```
Group of
pictures
header
```

You can also access the GOP interpreted view window by opening a video stream as a **GOP documents** file type. See *Opening Video Streams* on page 2–13.

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*NOTE. If you display the GOP interpreted view window from the Main view window, only the GOP structures that follow the first sequence header are displayed. None of the GOPs located before the first sequence header are displayed. To display all of the GOPs before the first sequence header, open the file as a **GOP documents** file type.*

See *Interpreted Views* on page 2–9 and *Interpreted View Window Common Elements* on page 3–2 for information about interpreted view windows and how to use the interface elements.

If the video stream was extracted from a transport stream, the PID of the elementary stream is displayed in the title bar of the view window.

Picture View
To access the Picture interpreted view, double-click the large Picture rectangle in the Main view window.

You can also access the Picture interpreted view by opening a video stream as a **Picture documents** file type. See *Opening Video Elementary Streams* on page 2–13.

---

*NOTE. If you display the Picture interpreted view window from the Main view window, only the Picture structures that follow the first sequence header are displayed. None of the pictures located before the first sequence header are displayed. To display all of the pictures before the first sequence header, open the file as a **Picture documents** file type.*

See *Interpreted Views* on page 2–9 and *Interpreted View Window Common Elements* on page 3–2 for information about interpreted view windows and how to use the interface elements.

If the video stream was extracted from a transport stream, the PID of the elementary stream is displayed in the title bar of the view window.

The Picture interpreted view may display the following picture structures:

- Picture header

- Picture coding extension

- Quant matrix extension

- Picture display extension

- Copyright extension

- Picture spatial scalable extension

- Picture temporal scalable extension

- Picture data

Double-click the large Picture data rectangle to display the Slice view, which is described in the next section. The small Picture data rectangle indicates the number of data bytes for the picture data.

Slice View   To display the Slice interpreted view, double-click the large Picture data rectangle in the Picture interpreted view window.
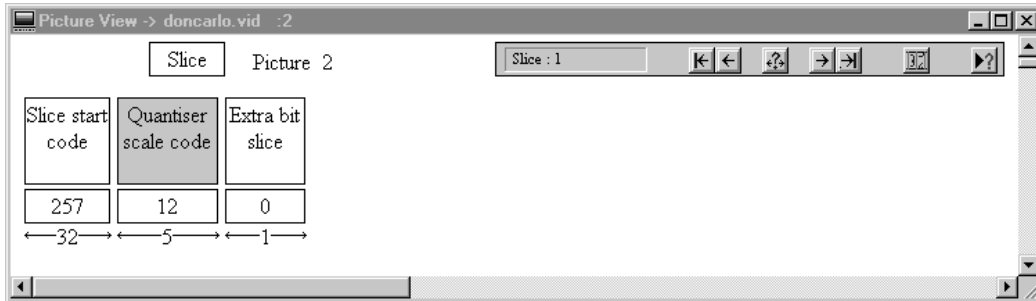
You can also display the Slice view from the Picture view using one of the following methods:

■   Click the Add View button on the Upper toolbar (see page 2–3), and then select **Slice View** from the submenu.

■   Select **Add View** from the Window menu, and then select **Slice View** from the submenu.

The look and use of the Slice view is similar to the other interpreted views. However, the Slice view window provides an additional toolbar that you use to navigate through the slices of the displayed picture. The current picture is indicated in the top line of the view window. Table 3–1 describes the Slice toolbar elements.

Table 3–1: Slice toolbar elements

Element	Name	Description
Slice : 6	**Slice number**	Indicates which slice of the current picture is displayed.
⇤	**First**	Displays the first slice of the current picture.
←	**Previous**	Displays the previous slice of the current picture.
⟲	**Go to**	Displays the slice of the current picture that you indicate.
→	**Next**	Displays the next slice of the current picture.
→⏐	**Last**	Displays the last slice of the current picture.
⬛	**Number of items**	Displays the number of slices of the current picture. The total number of slices is then displayed in the Slice number element.
▶?	**Next Error**	Displays the next slice of the current picture that contains at least one syntactic error.

Additional Views

The MPEG Video Stream Analyzer provides different ways of looking at the video bitstream using the views described in this section: Binary, Hexadecimal, and Decoded Picture views. The interactive characteristics of these view windows are limited and are described in the following sections.

Binary and Hexadecimal View

Binary and Hexadecimal views display the bitstream for the structures displayed when you accessed the Binary or Hexadecimal view.

NOTE. The Binary and Hexadecimal views accessed from the Picture and the Slice views are identical. Also, the Hexadecimal view of the sequence structure displays the same information that is displayed when you double-click the large User data rectangle in the Sequence view window.

To display the Binary and Hexadecimal views for a specific video elementary stream structure, use the following procedure:

1. Navigate to the interpreted view window for the structure you want to display.

2. Select the Add View icon on the Upper toolbar (see page 2–3), and then select **Binary** or **Hexadecimal** from the submenu. (Alternatively, select **Add View** from the Window menu, and then select **Binary** or **Hexadecimal** from the submenu.)

The information displayed is the bitstream of the item indicated in the top line of the view window. The following illustration shows the bitstream of the third item out of 750 in binary format.
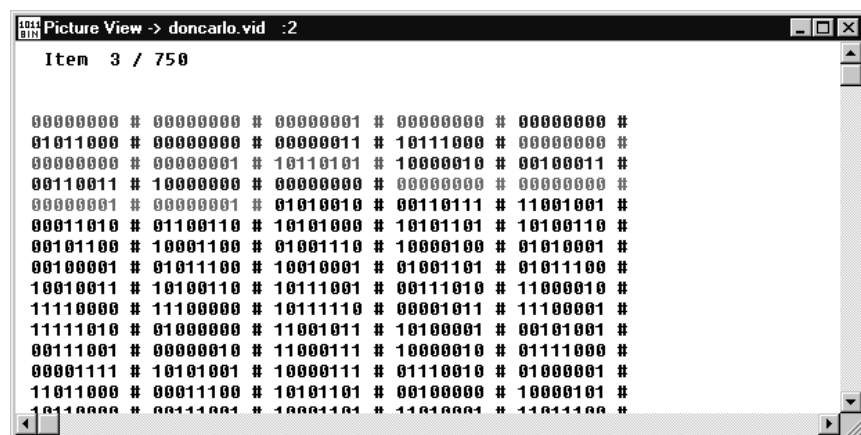
The analysis functions of the MPEG Video Stream Analyzer (see *Analyzing Video Elementary Streams* beginning on page 3–11) and the Edit toolbar are available from both the Binary and Hexadecimal views. Only syntactic analyses can be performed from the Binary or Hexadecimal views, and the Next error button (and the **Next error** menu selection) searches for and displays only syntactic errors.

Decoded Picture View

The small I-picture displayed in the Main view is decoded using only the DC coefficients. You can display the picture with all of the coefficients decoded using one of the following methods:

■ From the Main view, double-click the small I-picture.

■ From the Main view, select **Add View**, and then select **Decoded Picture View** from the submenu.

■ From the Main view, select the Add View button on the Upper toolbar (see page 2–3), and then select **Decoded Picture View** from the submenu.

NOTE. The decoded I-picture is independent from all analyses performed by the MPEG Video Stream Analyzer. It is not a way to analyze the stream, but provides you with visual feedback about the video stream. If a problem occurs during the decoding process, the I-picture is not decoded.

Analyzing Video Elementary Streams

The MPEG Video Stream Analyzer can check for both syntactic and semantic errors as described in this section.

Syntactic Analysis

Syntactic analysis checks the validity of the values for each structure indicated in Table 3–2 against the syntax described in the appropriate paragraph from the standard.

Table 3–2: Syntactic analysis tests

Interpreted View	Structure	ISO/IEC 13818-2 paragraph
Sequence	Sequence header	6.2.2.1
	Sequence extension	6.2.2.3
	Sequence display extension	6.2.2.4
	Sequence scalable extension	6.2.2.5
Group of Pictures	Group of pictures header	6.2.2.6
Picture/Slice	Picture header	6.2.3
	Picture coding extension	6.2.3.1
	Quant matrix extension	6.2.3.2
	Picture display extension	6.2.3.3
	Picture temporal scalable extension	6.2.3.4
	Picture spatial scalable extension	6.2.3.5
	Copyright extension	6.2.3.6
	Picture data	6.2.3.7
	Slice	6.2.4

The MPEG Video Stream Analyzer does not perform a syntactic analysis on the following MPEG-2 structures:

■ Macroblock (6.2.5)

■ Macroblock modes (6.2.5.1)

■ Motion vectors (6.2.5.2)

■ Motion vector (6.2.5.2.1)

■ Coded block pattern (6.2.5.3)

■ Block (6.2.6)

You can perform syntactic analyses on a specific video stream structure, or on the entire video stream, using the following procedure:

1. Display the interpreted view window of the syntax you want to check. (If you want to check all of the sequence, GOP, and picture structures, perform the syntax analyses from the Main view window.)

2. Select **Syntactic** from the Analysis menu. The view window changes and looks similar to the following illustration. Press the **Esc** key to stop the process.
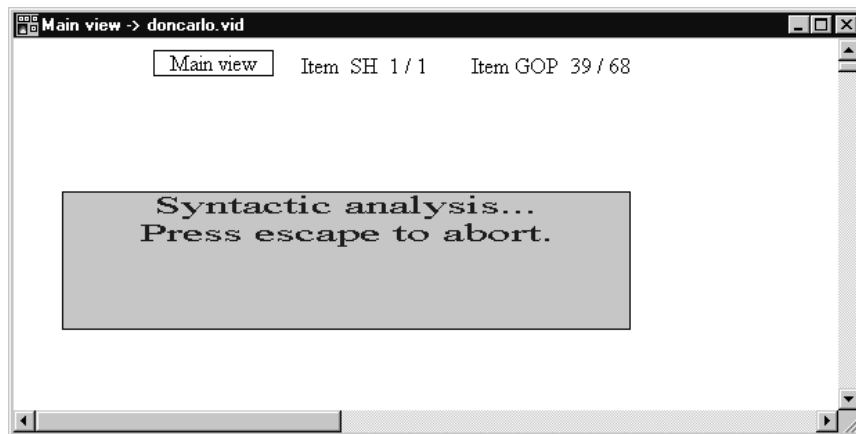
3. If the analysis finds errors in the video stream syntax, the following message box is displayed. Each line represents an error at the location indicated (structure, item, and field).
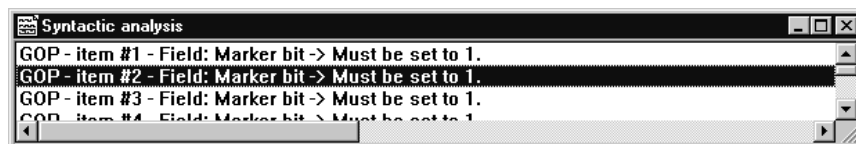
4. To view the error, double-click a message line. The interpreted view containing the field in error is displayed with the value in error shown in red.
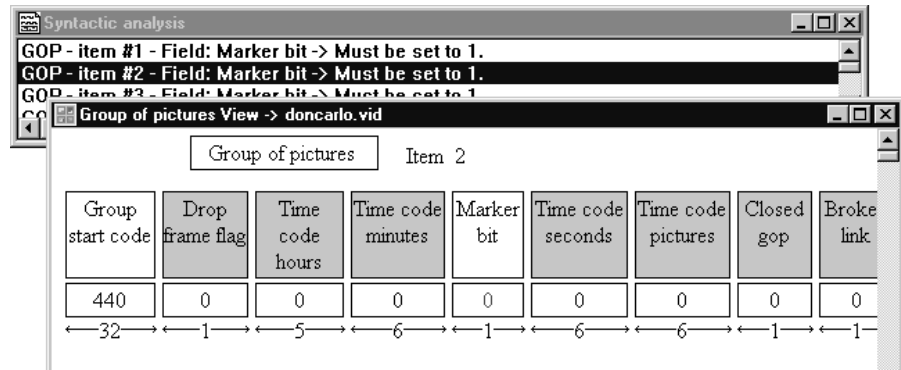
You can perform syntactic analyses on multiple structures or multiple elementary streams at the same time.

*NOTE. If you perform a syntactic analysis on a stream that you opened as a **Video Stream** file type, the syntax analysis begins on the structures located after the first sequence header. If you perform a syntactic analysis on a stream you opened as a **Sequence, GOP,** or **Pictures documents** file type, the analyses are performed on all of the items for the video stream.*

Semantic Analysis   Semantic analyses checks the structure of the MPEG video stream, rather than the values of the fields. Semantic analyses can be performed only when the Main view is the active view window.

Table 3–3 describes the analyses performed when you conduct a semantic analysis of the video stream. The paragraph numbers indicate the paragraph or paragraphs of the standard upon which the tests are based.

Table 3–3: Semantic analysis tests

Structure	ISO/IEC 13818-2 paragraph(s)	Description
Sequence header	6.1.1.6	If there are repeated sequence headers, all of the data elements shall have the same values as in the first sequence header (with the exception of those defining the quantization matrixes: load_intra_quantiser_matrix, load_non_intra_quantiser_matrix, and optionally intra_quantiser_matrix and non_intra_quantiser_matrix).

In the case that an interlaced frame is coded as two separate field pictures, a repeat sequence header shall not precede the second of these two field pictures. |
| Sequence extension | 6.3.1

6.1.1.6 | Sequence_extension() shall only occur immediately following a sequence_header().

If the first sequence_header() of a sequence is followed by a sequence_extension(), then all subsequent occurrences of sequence_header() shall also be immediately followed by a sequence_extension().

All of the data elements in the sequence_extension() that follow a repeated sequence_header() shall have the same values as in the first sequence_extension().

Sequence_extension() shall not immediately precede a sequence_end_code. |
| Sequence display extension | 6.1.1.6 | If a sequence_display_extension() occurs after the first sequence_header(), then all subsequent sequence headers shall be followed by sequence_display_extension().

All data elements of a repeated sequence_display_extension() must be the same as in the first sequence_display_extension().

Conversely, if no sequence_display_extension() occurs between the first sequence_header() and the first picture_header(), then sequence_display_extension() shall not occur in the bitstream. |

Table 3–3: Semantic analysis tests (cont.)

Structure	ISO/IEC 13818-2 paragraph(s)	Description
Sequence scalable extension	6.1.1.6	If a sequence_scalable_extension() occurs after the first sequence_header(), then all subsequent sequence headers shall be followed by sequence_scalable_extension().
		All data elements of a repeated sequence_scalable_extension must be the same as the first sequence_scalable_extension().
		Conversely, if no sequence_scalable_extension() occurs between the first sequence_header() and the first picture_header(), then sequence_scalable_extension() shall not occur in the bitstream.
Picture header	6.3.1 6.1.1.11 6.3.9	The first coded frame following a group_of_pictures_header() shall be a coded I-frame.
		The first coded frame after a sequence header shall not be a B-frame.
		When a frame is coded as two fields, then temporal_reference in the picture header of both fields is the same.
Picture coding extension	6.3.1 6.3.10 6.1.1.4.1 6.3.5	picture_coding_extension() shall only occur immediately following a picture_header().
		If sequence_extension() occurs in the bitstream, then each picture_header() shall be followed immediately by a picture_coding_extension().
		When a frame is encoded in the form of two field pictures, both fields must be of the same picture_coding_type, except when the first encoded field is an I-picture.
		When a frame is encoded in the form of two field pictures, if the first encoded field is an I-picture, the second may be either an I-picture or a P-picture.
		The first encoded field of a frame may be a top field or a bottom field, and the next field must be of opposite parity.
		If progressive_sequence is set to 1, the coded video sequence shall contain only progressive frames pictures.
Picture display extension	6.3.12	A picture_display_extension() shall not occur unless a sequence_display_extension() followed the previous sequence_header().

Use the following procedure to perform a semantic analysis of the video stream:

1. Navigate to the Main view window for the video stream you want to analyze.

2. Select **Semantic** from the Analysis menu. The view window will change and look similar to the following illustration. Press the **Esc** key to stop the process.
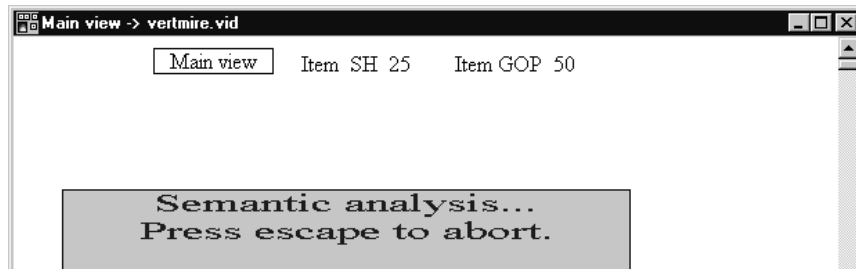
3. If the analysis finds semantic errors, a message box similar to the following illustration is displayed.
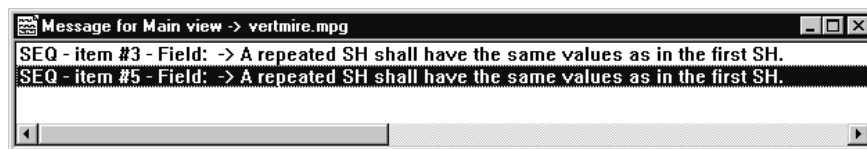
4. To view an error, double-click a message line. The interpreted view displaying the structure in error is displayed as shown in the following illustration. For semantic analyses, the errors are not indicated in red.
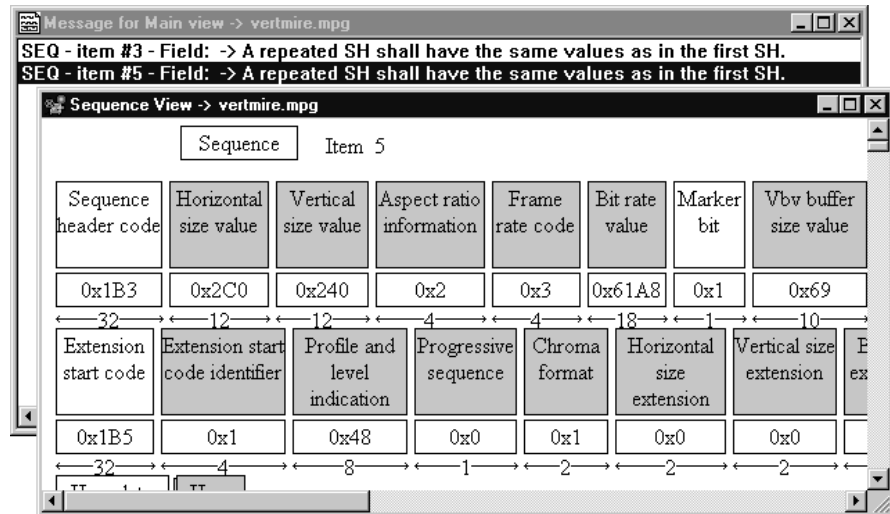
You can perform semantic analyses on multiple elementary streams at once.

Automatic Analysis

When you select **Automatic** from the Analysis menu, the MPEG Video Stream Analyzer can perform any combination of Syntactic and Semantic analyses. Indicate which analyses you want performed by selecting or deselecting them in the **Options for automatic analysis** dialog box.

To specify how the analyzer performs automatic analyses, use the following procedure:

1. Select **Automatic Analysis** from the Options menu.

2. Select any combination of the two options from the dialog box, and then click **OK**.

To perform an automatic analysis, use the following procedure:

1. Navigate to the Main view window for the stream you want to analyze.

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

3. The message box shown in the following illustration is displayed while the type(s) of analyses that you selected in the previous procedure are performed.
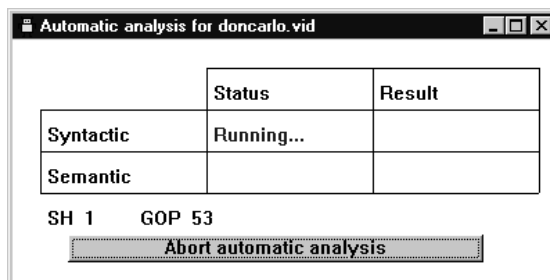
The title bar indicates the file on which the analyses are being performed. The sequence headers and GOPs being analyzed are indicated in the bottom portion of the Automatic Analysis window. Select the command button at the bottom of the window to stop the analyses.

4. When the analyses are complete, the results column indicates whether any syntactic and/or semantic errors were found.
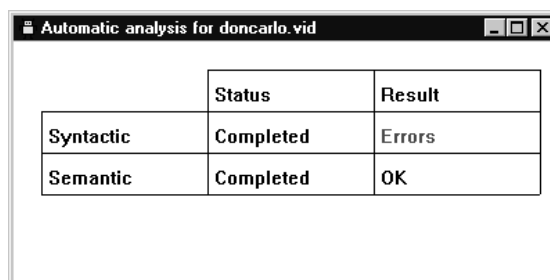
5. Double-click a red *Error* to display an error message window.

6. To view an error, double-click a message line in the error message window. The interpreted view containing the field in error is displayed. If the error is a syntax error, the value in error is shown in red. Semantic errors are not shown in red.

Configuration Reference

Using the selections from the Options menu, you can configure how the current MPEG Video Stream Analyzer session displays information, and you can save and load configuration files.

Numerical Base You can change the numerical base displayed in the small rectangles of the interpreted view using one of the following methods:

■ Select **Base** from the Options menu, and then select **Decimal** or **Hexadecimal**.

■ Press the **F2** function key to toggle the numerical base settings.

NOTE. Even though you can display information in either decimal or hexadecimal, you can enter values only in decimal base.

When you start a new MPEG Video Stream Analyzer session, the analyzer uses the base displayed the last time you exited the application.

Font You can change the font displayed in the view windows using the Font dialog box. To display the Font dialog box, select **Font** from the Options menu. Some view windows use a fixed font and are not affected by font choices.

When you start a new MPEG Audio Stream Analyzer session, the analyzer uses the font displayed the last time you exited the application.

Interpretation You can display the length or the position of a parameter in the bitstream. When enabled, this information is displayed below the small rectangles in interpreted view windows. You determine which type of information, if any, is displayed using the following procedure:

1. Select **Interpretation** from the Options menu, and then select one of the following options:

   ■ **Position** indicates the position in the bitstream of the first bit of the parameter. Position is relative to the to the first bit in the displayed syntax.

   ■ **Length** is the length in bits of the parameter.

2. To disable the display of this information, deselect both options (this is the default configuration).

When you start a new MPEG Video Stream Analyzer session, the analyzer uses the configuration used the last time the analyzer was exited.

Directories   The Default Directories dialog box accessed by this menu selection allows you to indicate what directory the MPEG Video Stream Analyzer should default to when writing and loading message and configuration files.
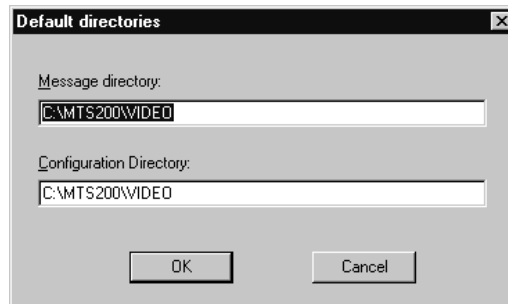
Include the full path to each directory.

Configuration Files   There are three Options menu selections you can use to save and load configuration files. The configuration files determine the following states for the current analyzer session (default settings are indicated in parentheses):

- Base (Decimal)

- Font (9pt, Times New Roman)

- Interpretation (No interpretation options selected)

- Main view type (Standard view)

- Default message and configuration directories (path to your MTS200\VIDEO directory)

- Type of automatic analysis (Syntactic and Semantic analyses performed)

The analyzer uses the configuration that was current when you last exited the application.

Read Configuration. This menu selection displays a dialog from which you can load a previously saved configuration file (an .acf file) into the current analyzer session. Use standard Windows NT Open dialog box methods to open and load a configuration file.
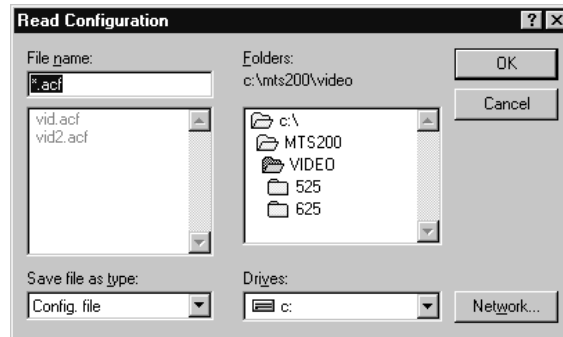
Save Configuration. This menu selection displays a dialog box from which you can save the current configuration settings to a new configuration file (an .acf file). Use standard Windows NT Save as dialog box methods to save a new configuration file.
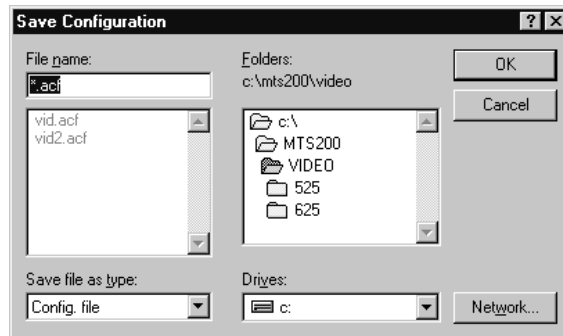
Set Default Configuration. This menu selection displays a dialog box from which you can change the current configuration selections to the default settings described on page 3–20.

Appendix

Appendix A: Save Video Stream Option Examples

The following scenarios will help explain how parts of a video stream are saved using the Save Video Stream dialog box options. For each of the examples in this section, refer to the following description of a hypothetical video stream:

Sequence headers (5)	Group of pictures (5)	Pictures (84)
SH1	GOP1	P1 through P12
SH2	GOP2	P13 through P24
SH3		P25 through P36
SH4		P37 through P48
	GOP3	P49 through P60
	GOP4	P61 through P72
SH5	GOP5	P73 through P84

Keep in mind the rules used by the MPEG Video Stream Analyzer when determining which parts of the video stream to save:

- Video stream files can be saved only from the Main view window.

- Only video streams with at least one sequence header can be saved.

- Only those sequence headers, GOPs, and pictures after the first sequence header can be saved to a new video elementary stream file.

- If a sequence header immediately precedes a GOP that is to be saved, the sequence header is automatically saved.

- The saved portion of the stream begins with the GOP *following* the picture you indicate in the **From picture** text box and includes the GOP *of* the picture you indicate in the **to picture** text box, with the following two exceptions:

  - If the picture indicated in the **From picture** text box is the first picture in any GOP, then the stream is saved beginning with the GOP of the picture, not the following GOP.

  - If the indicated pictures are in the same GOP, then that GOP is saved.

Scenario A   In the Save as dialog box, you select **From GOP** 2 **to GOP** 2. The saved portion of the stream will then include the following elements:

Sequence headers	Group of pictures	Pictures
SH2	GOP2	P13 through P24
SH3		P25 through P36
SH4		P37 through P48

Scenario B   In the Save as dialog box, you select **From GOP** 2 **to GOP** 3. The saved portion of the stream will then include the following elements:

Sequence headers	Group of pictures	Pictures
SH2	GOP2	P13 through P24
SH3		P25 through P36
SH4		P37 through P48
	GOP3	P49 through P60

Scenario C   In the Save as dialog box, you select **From GOP** 3 **to GOP** 4. The saved portion of the stream will then include the following elements:

Sequence headers	Group of pictures	Pictures
	GOP3	P49 through P60
	GOP4	P61 through P72

Scenario D   In the Save as dialog box, you select **From picture** 30 **to picture** 70. The saved portion of the stream will then include the following elements:

Sequence headers	Group of pictures	Pictures
	GOP3	P49 through P60
	GOP4	P61 through P72

P30 belongs to GOP2, but it is not the first picture of the GOP. Therefore, the analyzer begins saving with GOP3.

Because P70 is part of GOP4, the analyzer saves all of GOP4.

Scenario E   In the Save as dialog box, you select **From picture** 13 **to picture** 70. The saved portion of the stream will then include the following elements:

Sequence headers	Group of pictures	Pictures
SH2	GOP2	P13 through P24
SH3		P25 through P36
SH4		P37 through P48
	GOP3	P49 through P60
	GOP4	P61 through P72

P13 is the first picture of the GOP2, so the analyzer begins saving with GOP2. As in the previous example, the analyzer saves all of GOP4.

Scenario F   In the Save as dialog box, you select **From picture** 50 **to picture** 57. The saved portion of the stream will then include the following elements:

Sequence headers	Group of pictures	Pictures
	GOP3	P49 through P60

P50 and P57 belong to the same GOP, so the entire GOP (GOP 3) is saved.

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