

User Manual



Buffer Analyzer (Demo)

071-2358-00

Copyright © Tektronix. All rights reserved. Licensed software products are owned by Tektronix or its subsidiaries or suppliers, and are protected by national copyright laws and international treaty provisions.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supercedes that in all previously published material. Specifications and price change privileges reserved.

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.

Contacting Tektronix

Tektronix, Inc.
14200 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Table of Contents

Preface	iii
Manual Conventions	iii
Introduction to the Demo Version	1
Installing the Program	1
Starting the Program	3
Opening a File	5
Getting Started	7
Suitable Streams	7
Table Handling	8
Starting the Program	8
Settings	10
Opening an MPEG File	15
Opening a BMR File	16
Window Layout	16
Initial Processing of MPEG Files	17
Initial Processing of BMR Files	18
Menus and Controls	19
Toolbar	19
Status Bar	20
Menu Options	22
Stream List	27
Selecting Streams	29
Processing Streams	29
Event and Message Logs	33
Global Event Log	33
PID Event Log	34
Trace	34
Results Graphs	41
Common Features	41
Elementary Buffer Graph	51
Multiplex or Main Buffer Graph	52
Transport Buffer Graph	53

List of Tables

Table 1-1: File menu options for demo version	4
Table 1-2: File menu options	10
Table 1-3: View menu options	10
Table 1-4: File menu options	22
Table 1-5: Edit menu options	22
Table 1-6: View menu options	22
Table 1-7: Options menu options	23
Table 1-8: Process menu options	23
Table 1-9: Trace menu options	23
Table 1-10: Window menu options	24
Table 1-11: Help menu options	25

Preface

This manual supports the Buffer Analyzer demo.

Other documents are available on the Tektronix Web site (www.tektronix.com/manuals):

- *MTS400 Series MPEG Test System Getting Started Manual (071-1505-xx).*
- *MTS400 Series MPEG Test System Programmer Manual (071-1725-xx).*
This manual specifies the remote control and status monitoring interfaces available to a management application.

Manual Conventions

The following formatting conventions apply to this manual:

- **Bold** text refers to specific interface elements that you are instructed to select, click, or clear.
Example: Select **Settings** from the Configuration menu.
- Mono-spaced text can indicate the following:
 - Text you enter from a keyboard.
Example: Enter the network identity (`http://TSMonitor01`).
 - Characters you press on your keyboard.
Example: Press CTRL+C to copy the selected text.
 - Paths to components on your hard drive.
Example: The program files are installed at the following location:
`C:\Program Files\Tektronix\.`

Introduction to the Demo Version

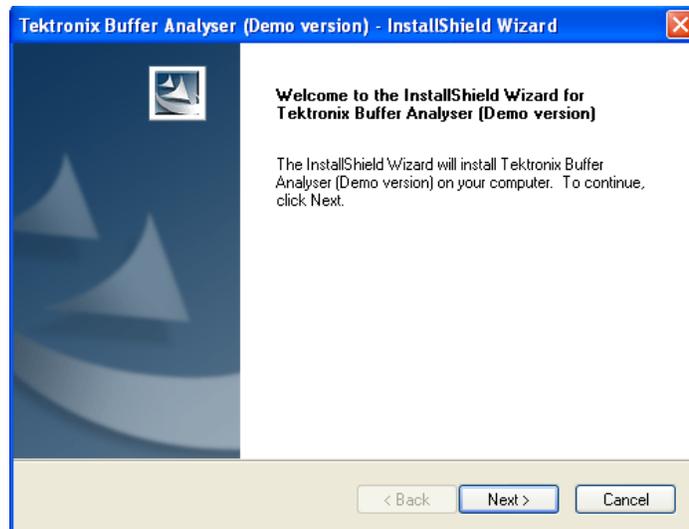
The T_STD Buffer Analyzer (Demo version) models the behavior of the buffers in the hypothetical Transport Stream System Target Decoder, as specified in ISO/IEC 13818-1. It processes the video, audio, and system control default sample stream.

The demo supports only one transport stream, which contains the elementary stream of H.264 video, MPEG2 video, AAC audio, and AC3 audio.

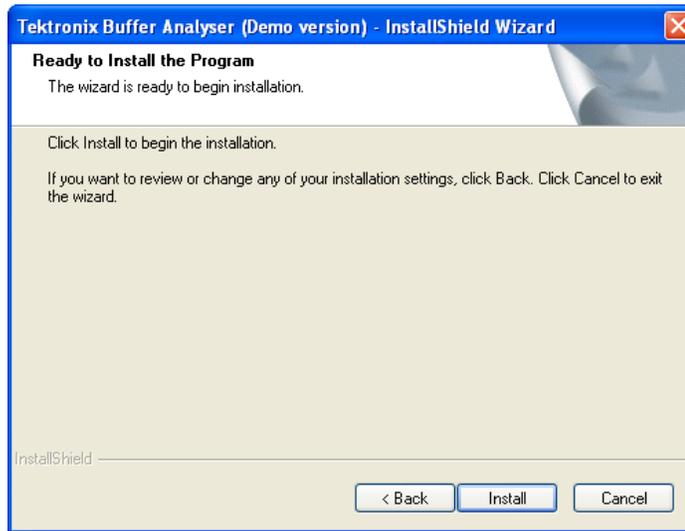
Installing the Program

You can download the BufferAnalyserSetup.exe file from www.tektronix.com/software and follow these steps to install the demo version of the Buffer Analyzer.

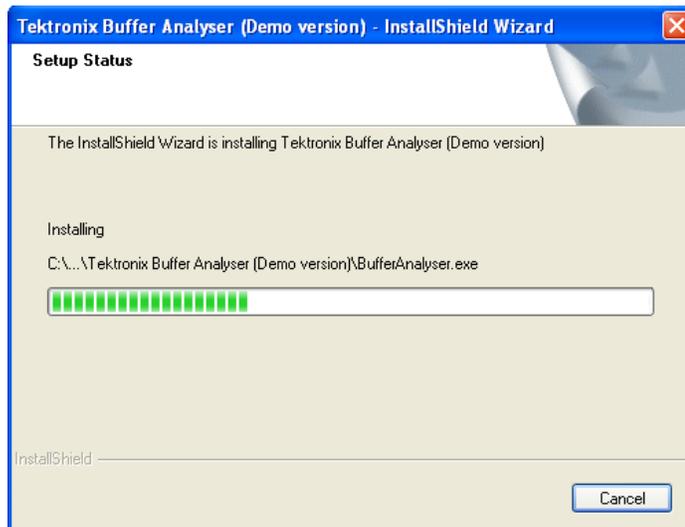
1. Double-click the BufferAnalyserSetup.exe to start the InstallShield Wizard that installs the Buffer Analyzer demo version on your computer. Click **Next** to continue.



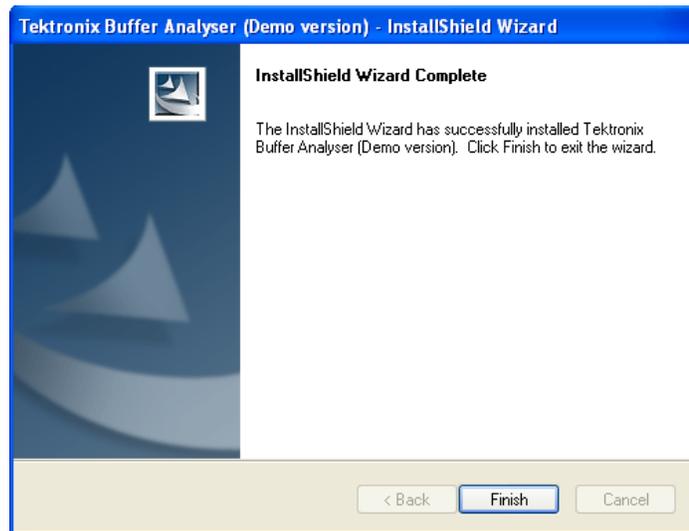
2. Click **Install** to begin the installation.



The InstallShield Wizard installs the application displaying the progress.

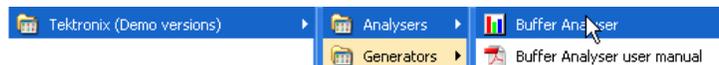


3. Click **Finish** to exit the Wizard once the demo version is successfully installed.



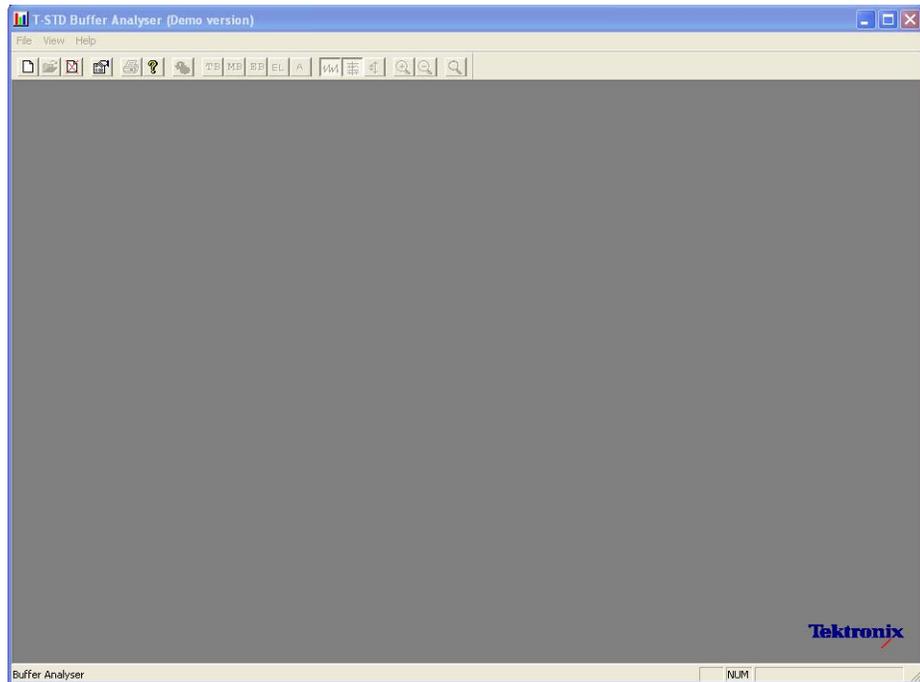
Starting the Program

Start the program by selecting the Buffer Analyser option from the Start > Programs > Tektronix (Demo version) > Analysers menu or by double-clicking the Tektronix Buffer Analyser (Demo version) shortcut on the desktop.



Initial Appearance

Once the demo program starts and is ready for use, it opens a main window as follows:



The title bar of the main window shows Buffer Analyser to be a demo version.

Initial Menu Options

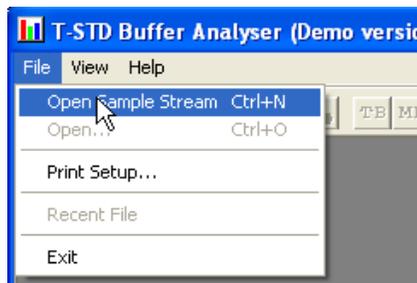
The demo version of the application supports all menus and options that are available in the full version except for the File menu options. The File menu options available when the application has just started, or after a file is closed, are listed in Table 1-1:

Table 1-1: File menu options for demo version

Command	Function
Open Sample Stream	Creates a Buffer Model Results (BMR) file using the sample TS file for analysis. The BMR file will not be saved.
Open...	Disabled for the Buffer Analyser Demo version.
Print Setup...	Opens a dialog box for selecting the printer and the associated options to use.
Recent File	Disabled for the Buffer Analyser Demo version.
Exit	Stops running the program.

Opening a File

When you select the **Open Sample Stream** option from the File menu, the sample TS file is automatically loaded and displayed in the Buffer Analyser window. In this version, the Stream File dialog box (from where a file is selected) does not open and you will not be able to save the results of the analyzed TS file.



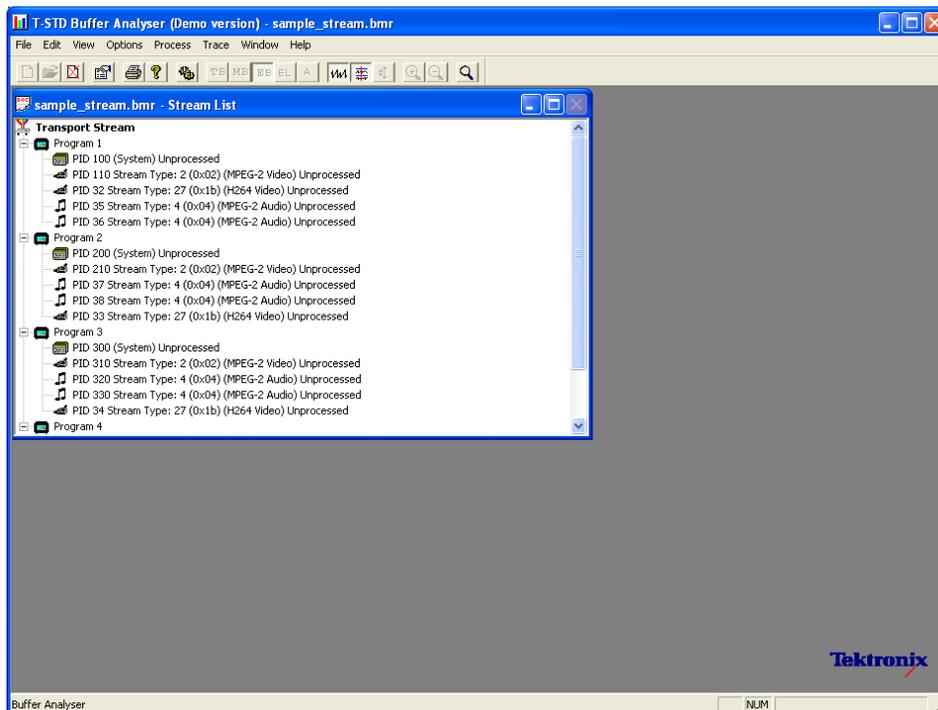
NOTE. The **Open** and **Recent File** options are disabled because you can load only the Sample TS file provided with this application.

The toolbar contains a shortcut for opening the sample stream file.



Window Layout

The Stream List window opens after the sample BMR file is loaded. The application inspects the file to find the program streams that are present according to the Packet Interpretation setting.

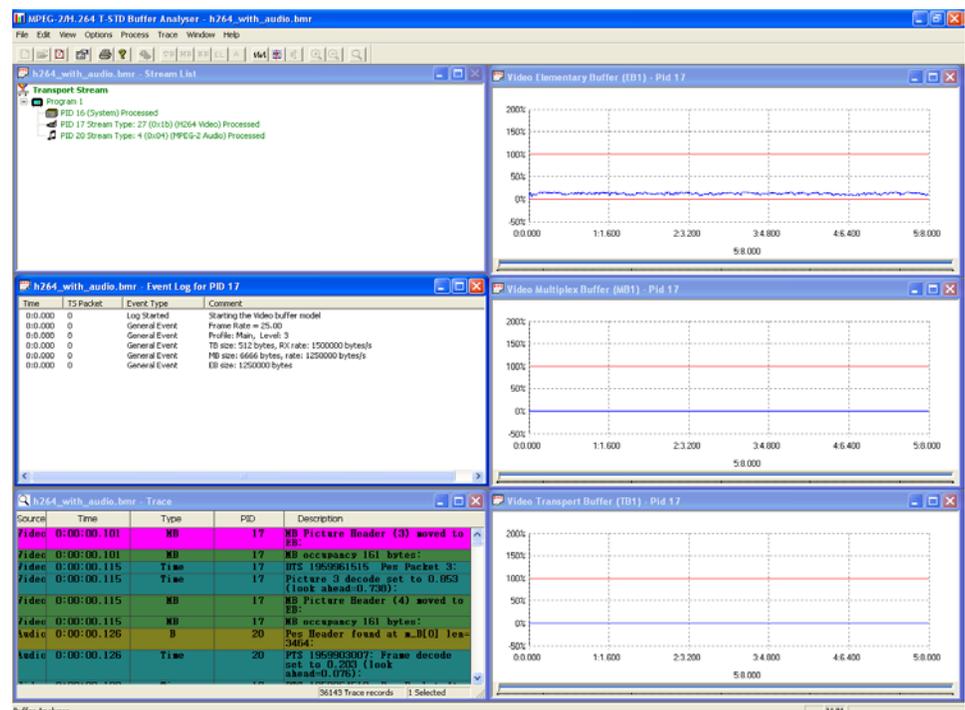


Once the file is open, the program performs initial analysis to form the Stream List and calculates the mean transport rate. All further analysis and processing of streams are the same as the full version application and are described in the following sections.

NOTE. When PID 32 and PID 33 of the stream list are processed, the elementary buffers overflow and underflow. During overflow, the elementary buffer occupancy goes above the 100% level. During underflow, the elementary buffer occupancy goes below the 0% level.

Getting Started

The T_STD Buffer Analyzer (Full version) models the behavior of the buffers in the hypothetical Transport Stream System Target Decoder, as specified in ISO/IEC 13818-1. It can process video, audio, and system control streams. The results of the analysis are displayed as graphs of the buffer capacity over time and a log of exceptions and noteworthy events.



Suitable Streams

Any valid MPEG file, recorded or synthesized, can be processed by this application. A valid file is one that starts on a transport stream (TS) packet boundary (the first byte of the file must contain the first byte of a TS packet).

The Buffer Analyzer will process video, audio, and system control streams that are compliant with the 1996 standard ISO/IEC 13818 parts 1-3.

It will handle transport streams that contain PCR and/or PTS/DTS discontinuities. The PTS/DTS and PCR in a stream must, however, use the same time base.

Buffer Analyzer is unable to work on scrambled streams. If it fails to make sense of a stream, use TS Analyzer to determine if the stream is scrambled.

Table Handling

Multiple PAT and PMT Versions

Buffer Analyzer forms a list of which elementary streams are present in the transport stream. This is called the Stream List. It creates the Stream List by reading the first occurrence of the Program Association Table (PAT) and Program Map Table (PMT).

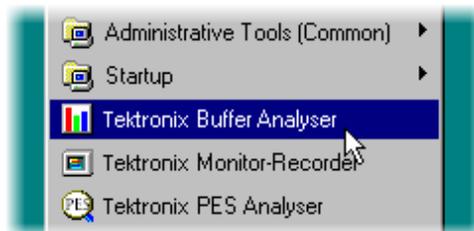
If more than one version of the PAT and/or PMT are present, TS Cutter may be used to isolate a particular section for analysis.

MPEG-2, DVB and ATSC Tables

Only PIDs carrying MPEG-2 PSI tables are included in the System model. Any DVB or ATSC tables that are present in the Transport Stream are ignored.

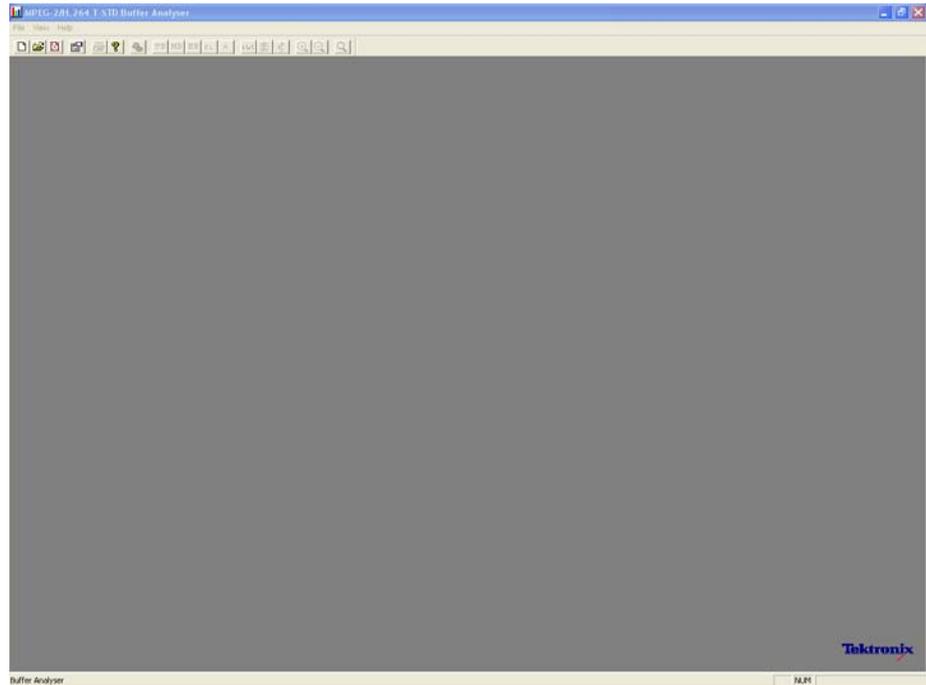
Starting the Program

The program may be started by selecting the Tektronix Buffer Analyser option from the Start > Programs menu or by double clicking the Tektronix Buffer Analyser Shortcut on the desktop.



Initial Appearance

Once the program has started and is ready for use, it will open a main window. When the program starts, the main window looks like the following illustration:



The toolbar (row of buttons above the dark gray area of the empty window) may be hidden from view, moved to a separate window, or moved to either side or the bottom of the main window.

The status line at the very bottom of the window may be hidden from view. It displays information about the application and keyboard status.

Initial Menu Options

The application presents different menus and options, depending on whether a file is open for analysis. The menu options available when the Buffer Analyzer has just been started, or after a file is closed, are shown in Tables 2-1 and 2-2:

File Menu Options. Table 2-1 lists the File menu options.

Table 2-1: File menu options

Command	Function
New	Opens a stream file for analysis and opens or creates a Buffer Model Results (BMR) file in which to store the results. The application opens a file selection dialog box allowing you to choose the stream file. It then opens another file selector dialog box to specify the BMR file.
Open...	Opens an existing BMR file to review results of a previous analysis. The application opens the file selection dialog box allowing you to choose the required file.
Print Setup...	Opens a dialog box for selecting which printer and associated options to use.
1 <filename> 2 <filename> 3 <filename> 4 <filename>	A list of the four most recently used BMR files. If the Buffer Analyzer has recently been installed, the list may hold less than four files. Selecting a file name opens that BMR file for review.
Exit	Finishes running the program.

View Menu Options. Table 2-2 lists the View menu options.

Table 2-2: View menu options

Command	Function
Toolbar	Displays or hides the toolbar.
Status Bar	Displays or hides the status bar.
Settings...	Opens the Settings dialog for specifying Video Buffer Sizes and Video Data Transfer method.

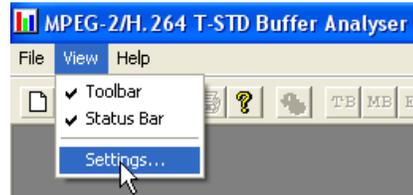
(A check mark next to an option shows that the toolbar is currently visible; no check mark means that it is hidden.)

Settings

Various configuration parameters, including Packet Interpretation, Pre-Scan Packets, PES Private Interpretation, Video Buffer Sizes, Video Data Transfer method, and Audio Buffer sizes can be modified before and after opening an MPEG file. When a file is open, one or more streams can be analyzed, the settings can be changed, and then other streams can be analyzed with the new settings. If the settings are changed, the MPEG file must be closed and opened again to reanalyze the streams analyzed with previous settings.

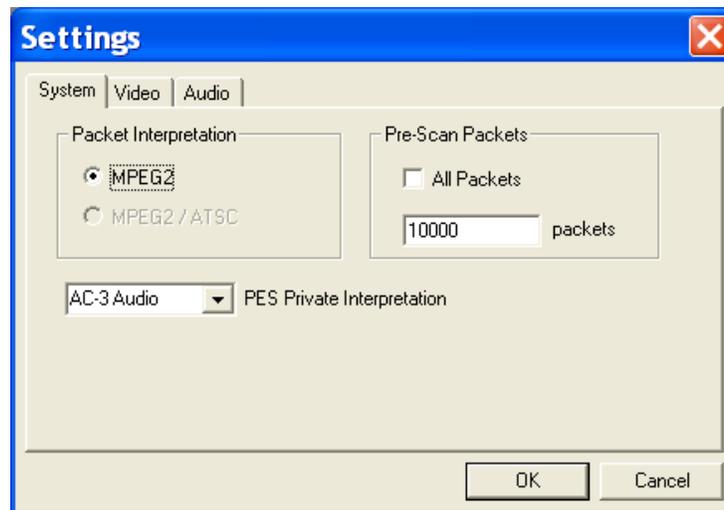
It is a good idea to check the settings before opening a file to verify the method with which video streams will be analyzed.

Select Settings... from the View menu.



This opens the Settings dialog box, which has three tabs: System, Video and Audio.

System Settings



These options can be set only before analyzing a file. They are disabled (grayed out) while a file is open.

The MPEG2 / ATSC option is available on ATSC or ATSC/DVB dual standard MPEG Test System products. It is disabled (grayed out) on single standard DVB systems.

Packet Interpretation. Specifies which standards will be used for interpreting the packets in the Transport Stream when a file is opened for analysis. The options are:

MPEG2 Interprets the packets according to the standards for DVB streams.

MPEG2 / ATSC Interprets the packets according to the ATSC standards. This option is required to allow AC-3 audio stream content to be analyzed.

Pre-Scan Packets. During the initial processing of an MPEG file, a number of packets are prescanned for information that will result in a more accurate analysis of the initial parts of the transport stream. The greater the number of prescanned packets, the greater the chance of locating all of the information required for accurate analysis. The drawback is increased processing time. By default, 10000 packets are prescanned, which should be sufficient for most streams, excluding High Definition Video.

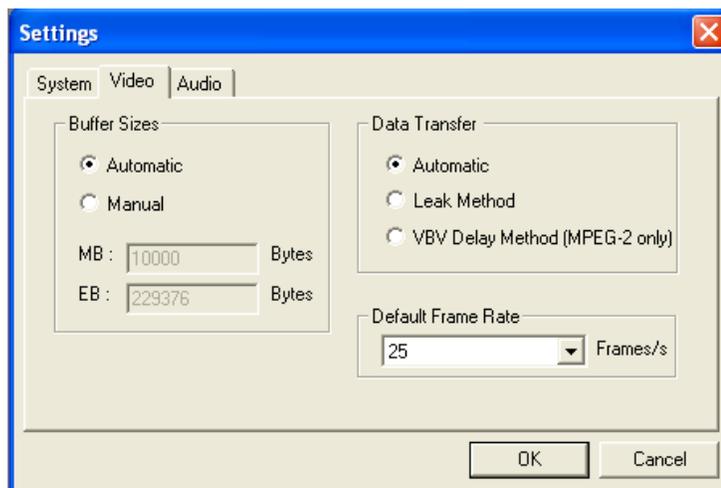
All Packets Select this check box to cause all packets to be prescanned. The packets field will be disabled (grayed out).

Packets If the All Packets check box is not selected, enter the number of packets to be prescanned in this field.

PES Private Interpretation. This setting specifies the model type to use for streams signaled as PES Private (stream_type = 6).

The selections available include the following: AC-3 Audio, AAC Audio, MPEG-2 Audio and Video and System. The default setting is AC-3 Audio.

Video Settings



Buffer Sizes. Specifies the sizes that will be used for the Main and Elementary Buffers, when interpreting the stream. The options are:

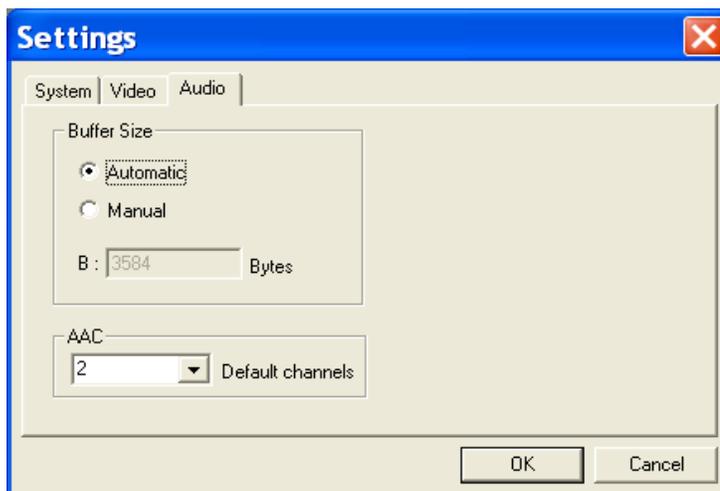
- | | |
|------------------|--|
| Automatic | Automatically detects the buffer sizes from the Sequence Headers and Extensions in the elementary stream being processed. This is the default option when the application is started. |
| Manual | Enables the size of the Main or Multiplex buffer (MB) and Elementary Buffer (EB) to be specified manually. The MB and EB fields are available for editing when this option is enabled. |

Data Transfer. By default, the Buffer Analyzer inspects the stream to determine which transfer method to use. This can be overridden if required. The options are:

- | | |
|-------------------------|---|
| Automatic | Examines the stream to determine the transfer method. This is the default option when the application is started. |
| Leak Method | Initiates modeling of the stream using the Leak Method. H.264 streams support only this method but the option can be kept as Automatic. |
| VBV Delay Method | Initiates modeling of the stream using the Video Buffer Verifier (VBV) Delay Method. This option is specific to MPEG-2. |

Default Frame Rate. The frame rate is one of the parameters that is searched for during the prescan phase of analysis. If it is not found, the default value selected from the drop-down list in the Default Frame Rate field is used.

Audio Settings



Buffer Size. Specifies the size that will be used for the audio buffer when interpreting the stream. The options are as follows:

- | | |
|------------------|---|
| Automatic | Automatically detects the buffer sizes from the Sequence Headers and Extensions in the elementary stream being processed. This is the default option when the application is started. |
| Manual | Enables the size of the buffer (B) to be specified manually. The B field is available for editing when this option is enabled. |

AAC. Select the number of AAC channels required from the drop-down list.

Within the ADTS (Audio Data Transfer Stream) fixed header, the channel configuration field is used to indicate the number of channels required by AAC. If the number in this field is zero, the value in the AAC Default channels field is used.

The associated ADIF (Audio Data Interchange Format) is unsupported.

Refer to Information technology –
Generic coding of moving pictures and associated information,
Part 7: Advanced Audio Coding (AAC) ISO/IEC 13818-7:1997

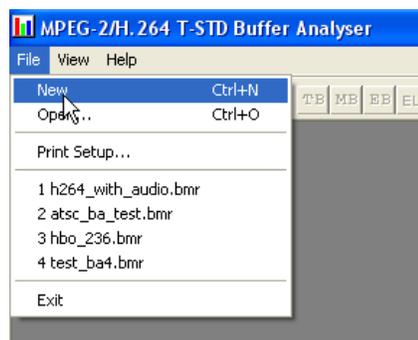
NOTE. If the settings are modified, the new settings are used for all video streams that are subsequently processed. The settings are reset to the default option when the application is started.

Opening an MPEG File

Any file holding a recorded or synthesized sample of a Transport Stream that carries video, audio, and/or system control streams can be analyzed. These files are referred to as MPEG files to distinguish them from Buffer Model Results (BMR) files. The results of analysis are written to a BMR file.

Opening a File from the Menus and Toolbar

To open a file for analysis, select the New option from the File menu. Alternatively, use the Ctrl+N keyboard shortcut.



NOTE. The list of previously used files shows BMR not MPEG files, as can be seen by their .bmr extension.

The toolbar contains a shortcut for the New command.



In response to the New command, the Buffer Analyzer opens a file selection dialog to choose an MPEG file for processing. When the MPEG file has been chosen, the MPEG file selector closes and another file selection dialog opens. This is for choosing a Buffer Model Results File (BMR), which holds the results of any analysis performed on the MPEG file.

The Buffer Analyzer suggests an output file with the same name as the MPEG file but a file extension of .bmr to hold the Buffer Model Results. Select OK if you want to accept the suggested filename. Otherwise, select a different file or type in a different name and then select OK.

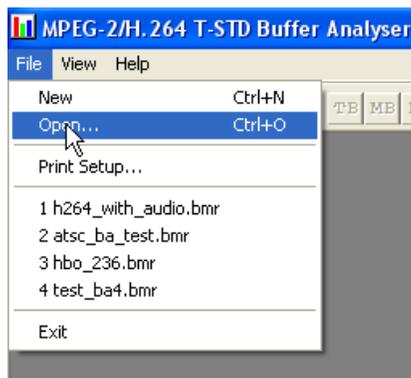
NOTE. Choosing an existing BMR file will erase all results that had previously been saved in that file.

Opening a BMR File

An existing Buffer Model Results (BMR) file can be opened to review the results saved in it from previous Buffer Model Analysis.

Opening a File from the Menus and Toolbar

To open a BMR file select the Open... option from the File menu. Alternatively, you can use the Ctrl+O keyboard shortcut.



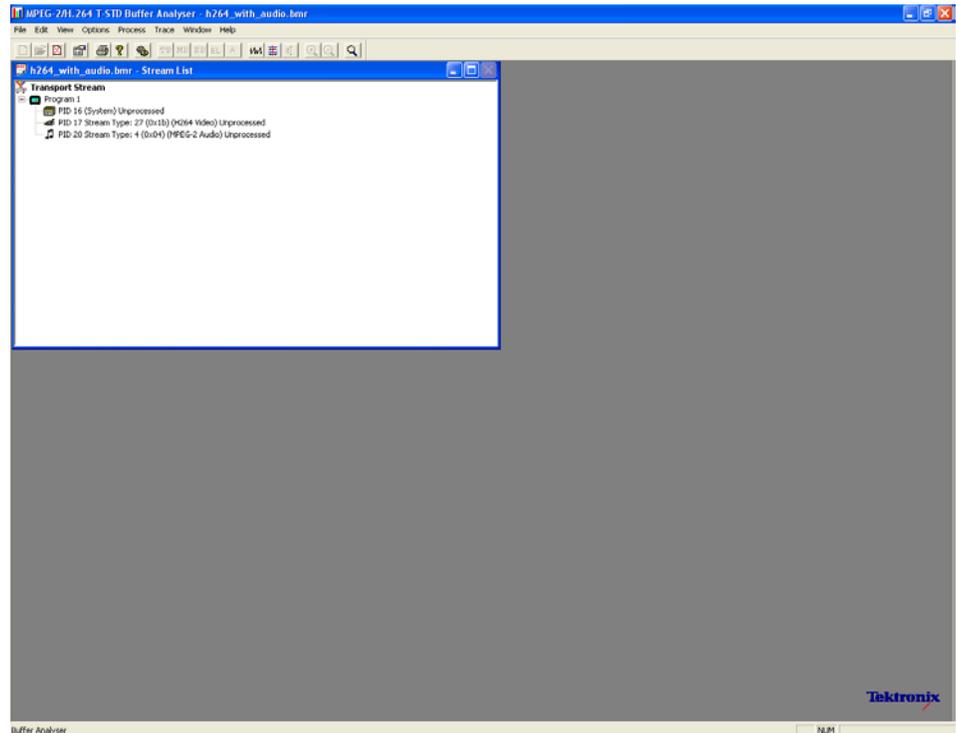
If the required file is in the list of recently analyzed BMR files, it can be opened from the list to save using the open file dialog.

The toolbar contains a shortcut for opening a file:



Window Layout

The Stream List window is opened as soon as either an MPEG or BMR file is opened. The application inspects the file to find what program streams are present according to the Packet Interpretation setting, as shown in the following illustration:



Initial Processing of MPEG Files

If an MPEG file is opened, the program performs initial analysis to form the Stream List and calculate the mean transport rate. All streams in the list are marked as Unprocessed, because no analysis has been performed on them in this session.

To build the Stream List the MPEG file is scanned for the PAT and PMT table contents. It is assumed that the contents are constant, which is usually the case. If the program changes drastically, such as streams disappearing between PMTs, the model will give meaningless results.

Only the first occurrence of complete PAT and PMT are read when forming the Stream List. Use TS Cutter to isolate a section when multiple versions of the tables occur.

A number of packets in the file are scanned for the Sequence Header and Extension start codes (containing profile and level) (see *Settings*, page 10). If they are not found, the Main Profile and Level settings are assumed together with the maximum VBV buffer size.

Initial Processing of BMR Files

If a BMR file is opened, the State column indicates which streams had been processed. The file only holds results for those streams marked as Processed. To obtain results for unprocessed streams, the original MPEG file will have to be opened again and analyzed.

Menus and Controls

When a file is open, the program presents a different set of menus and options. They change as soon as the Stream List window appears. For example, the Open file commands are replaced by Close file commands.

Toolbar



The Toolbar provides the following shortcuts for frequently used menu options:

	Opens dialog boxes to select an MPEG file for analysis and a BMR file for saving the results. This button is disabled (grayed out) when a file is open.
	Opens a dialog box to select a BMR file to review the results of a previous analysis session. This button is disabled (grayed out) when a file is open.
	Closes the current file. This button becomes available the moment a file is opened. If the wrong file is being opened, or the wrong options are selected, clicking on the button will abandon the analysis and close the file.
	Opens the Settings dialog box.
	Prints the contents of the current window.
	Opens a dialog box which displays the program version number.
	Analyzes the stream(s) from the PID(s), which are currently selected in the Stream List. This button is only enabled when one or more PIDs that are marked as unprocessed are selected.

The next group of five buttons open Results Views for the selected streams.

	Opens a graph of the Transport Buffer for the selected stream. This button is only enabled when the PID of a Processed stream is selected in the Stream List window.
	Opens a graph of the Multiplexing Buffer of a video stream; Main Buffer of an audio stream or of a system information stream. The button is only enabled when the PID of a Processed stream is selected in the Stream List.
	Opens a graph of the Elementary Stream Buffer for the selected video stream. This option is available only when a PID carrying a Processed Video stream is selected in the Stream List.

	Opens the Event Log for the selected stream. The button is enabled only when the PID of a Processed stream is selected in the Stream List window.
	Opens all of the relevant graphs and the event log for the selected stream. This option is available only when a PID carrying a Processed Video stream is selected in the Stream List.

The remaining buttons control display options for Graphs of buffer analysis results.

	Draw all points toggles the graph displays between having all points drawn and sampling the points for drawing.
	Synchronize Graphs toggles the graphs between using the same position and zoom settings or operating independently.
	Auto Scale toggles the selected graph between fixed and auto scaling of the y axis.
	Zoom In increases the magnification along the x-axis (time scale) of the currently selected graph. All graphs are affected if Synchronize Graphs is enabled.
	Zoom Out reduces the magnification along the x-axis (time scale) of the currently selected graph. All graphs are affected if Synchronize Graphs is enabled.
	Trace analyzes the message logs. You can view the message log that is produced by the Buffer Analyzer.

The Toolbar can be dragged off the edge of the main window into a floating pallet. To do this, place the mouse pointer on the background inside the toolbar, (not on one of the buttons), hold the left button down, and drag into the main window area. The result is a self-contained window that looks like this:



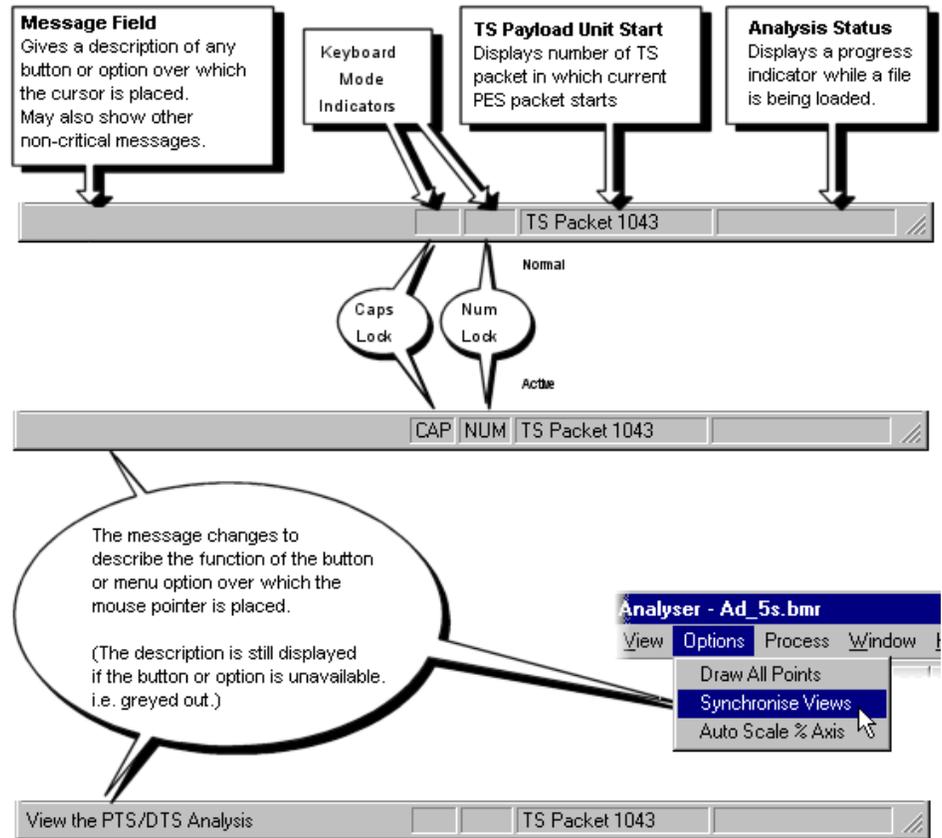
To replace the toolbar on the window border, drag it over the border, until the outline changes shape, and release it. It can be placed on the top, bottom, left or right hand edges.

Status Bar



The status bar might be hidden from view, but if is visible, it is always at the bottom of the main window. The status bar can be displayed by selecting Status

Bar option from the View menu. It displays the following information about the program and keyboard states:



Menu Options

Table 2-3 to Table 2-10 list the available menu options.

Table 2-3: File menu options

Command	Function	
Close	Closes the current file. This option is available as soon as analysis starts. If the wrong file is being opened, or the wrong options are selected, selecting this option will abandon the analysis and close the file.	
Print	Prints contents of the current window.	
Print Preview	Prints contents of the current window.	
Print Setup	Selects printer and configuration.	
Trace Print Options	Font	Selects the font to be used for printing text.
	Colors	Not available with Buffer Analyzer.
Exit	Closes any file that is open and terminates the program.	

Table 2-4: Edit menu options

Command	Function
Cut	Moves the currently selected records from the main window to the clipboard.
Copy	Copies the contents of the currently selected records to the clipboard. They are not removed from the main window.
Delete	Deletes the selected records from the main window.
Delete Except	Deletes all records except those selected from the main window.
Delete All	Deletes all records.
Select All	Selects all records.

Table 2-5: View menu options

Command	Function
Toolbar	Shows or hides the Toolbar.
Status Bar	Shows or hides the Status Bar.
Settings...	Opens the Settings dialog box.
Global Event Log	Shows or hides the Global Event Log window.
Transport Buffer	Opens a graph of the Transport Buffer for the selected PID.

Table 2-5: View menu options (Cont.)

Command	Function
Main Buffer	Opens a graph for the selected PID in the Stream List. The graph shows results for the Main Buffer of audio and system streams or the Multiplex Buffer for video streams.
Elementary Buffer	Opens a graph of the Elementary Buffer for the selected PID.
PID Event Log	Displays the Event Log for the selected PID.
All Buffers	Opens all graphs and the log for the selected PID.
Trace	Generates a detailed trace log.

Table 2-6: Options menu options

Command	Function
Draw All Points	Toggles between drawing all points on the graphs, and drawing every nth point. 'n' is calculated from the total number of data points and the screen space for the graph.
Synchronize Views	Toggles the graphs between using the same position and zoom settings and operating independently.
Auto Scale % Axis	Toggles the selected graph between fixed and auto scaling of the y axis.

Table 2-7: Process menu options

Command	Function
Process Streams	Applies the stream(s) from the PID(s) selected in the Stream List to the System Target Decoder Buffer Model. This option is enabled only when one or more unprocessed PIDs are selected in the Stream List.

Table 2-8: Trace menu options

Command	Function
View	
Column	Opens the column definition dialog box for selecting the columns of information to be displayed.
Font	Selects the font that is used for displaying the text of detail message log records.

Table 2-8: Trace menu options (Cont.)

Command	Function
Colors...	Selects background and text colors that are used to display each type of message.
Newest End	Displays the newest record.
Show	
Markers	Shows markers permanently while using Trace with the Buffer Analyzer.
General Text	Shows or hides general messages, such as messages indicating start of processing for a particular PID.
Fixed	Shows or hides information such as transport rates and buffer sizes.
PCR Timestamp	Shows or hides messages about PCRs and associated instantaneous transport rates.
System...	Selects which types of system messages to show.
Audio...	Selects which types of audio messages to show.
Video...	Selects which types of video messages to show.

Table 2-9: Window menu options

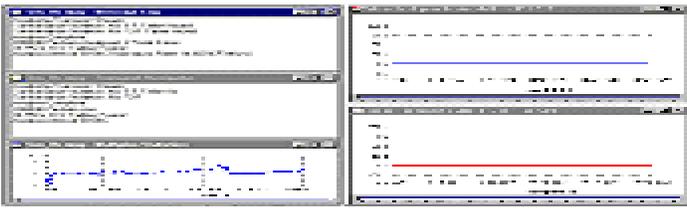
Command	Function
Cascade	Cascades the windows. 
Tile	Tiles the windows. 
Arrange Icons	Arranges any minimized windows along the bottom of the main window. Aligns icons of any minimized windows at the bottom of the program's main window.
1 <window file>	Lists all of the available windows. A check mark indicates the active window. Select an option to bring that window to the top.

Table 2-10: Help menu options

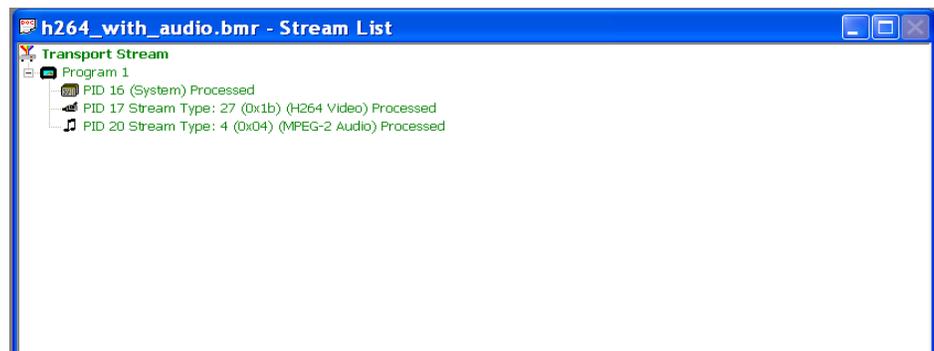
Command	Function
About Buffer Analyser...	Opens a dialog box that displays the program version number.

Stream List

The Stream List is displayed in the form of a tree view. The tree view is grouped and sorted by the program numbers with the label for the PIDs, stream types, and the states that are displayed. The Stream List displays all the elementary streams in the file. An unprocessed state is indicated by the black label and the processed state is indicated by the green label.

The '+' symbol displayed to the left of some icons indicates that the item includes lower-level stream components that are not displayed. The symbol changes to '-' when the lower level components are displayed. To expand the hierarchy, click on the '+' symbol. To collapse the hierarchy, click on the '-' of the selected upper-level icon.

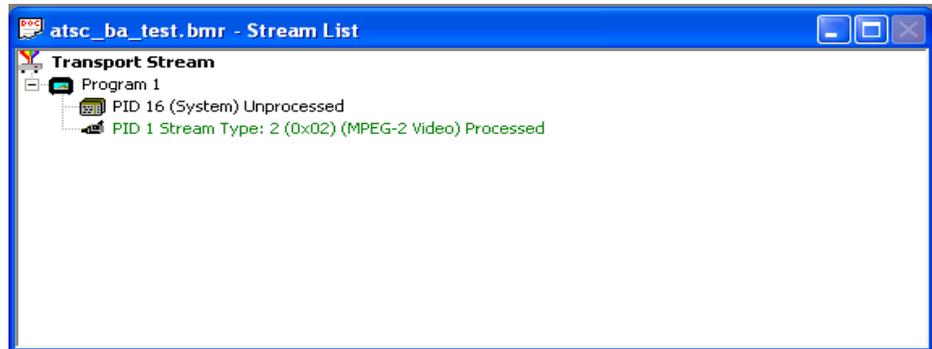
The System, Audio, and Video PIDs of a specific program number are displayed as leaf nodes of the same level.



Stream Type includes Video, Audio, AC-3 Audio, AAC Audio, System, or Private. Private streams cannot be processed, but may show more information about the type, such as ISO/IEC 13818 Auxiliary. The Packet Interpretation from the System tab of the Settings dialog box sets the standard that is used for identifying these types.

The preceding example is from a DVB compliant transport stream.

An ATSC stream might look like this:



This tree view lists processed (analyzed in the buffer model) and unprocessed streams. A stream can be processed only once when the file is open. To process a stream again, the file must be closed and then opened again.

When an MPEG file is first opened, the program streams are all marked as Unprocessed, which indicates that no buffer analysis has been performed in this session.

If a BMR file is opened, the streams state will be displayed as processed or unprocessed. The file only holds results for those streams marked as Processed. To obtain results for unprocessed streams, the original MPEG file will have to be reopened and analyzed.

Selecting Streams

To analyze or open the results views for a stream or streams, the streams must first be selected in the Stream List. To select a stream, click on the PID number.

For example, click PID 1 Stream Type text to select the Video stream carried in PID 1.



By using the Shift and Control keys, you can make multiple selections for all the tree nodes.

You can select the highest level node to process all the descendent nodes. For example, selecting the highest level transport stream node will process all the PIDs or selecting a specific program level node will process all the PIDs of that program.

To select a contiguous range of streams: click on the first stream's PID, and then hold the Shift or **▲** key down and click on the last stream's PID number. If the required streams are not adjacent, hold the Ctrl key down and click the PID number for each stream.

All streams can be deselected by clicking the mouse pointer outside the tree view data. To deselect a particular stream while leaving the others selected, hold the Ctrl key down and click the stream's PID number.

Processing Streams

When one or more streams are selected from Stream List, they can be analyzed in the buffer model.

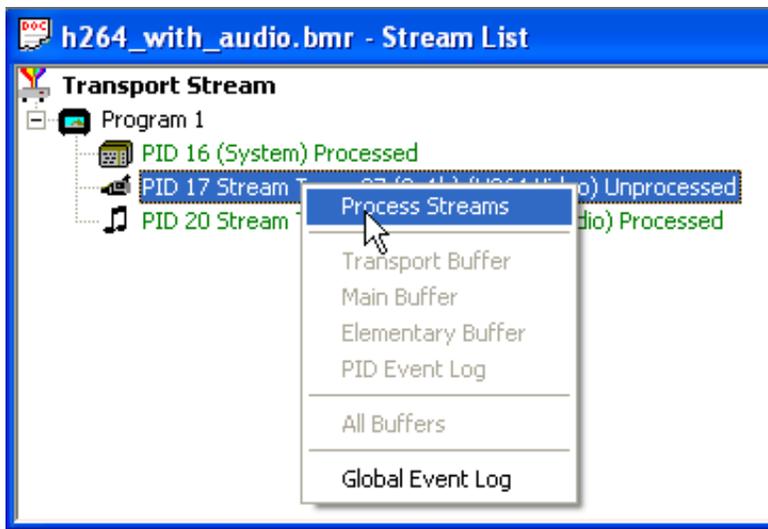
To start analysis, select the Process Streams option from the Process menu.



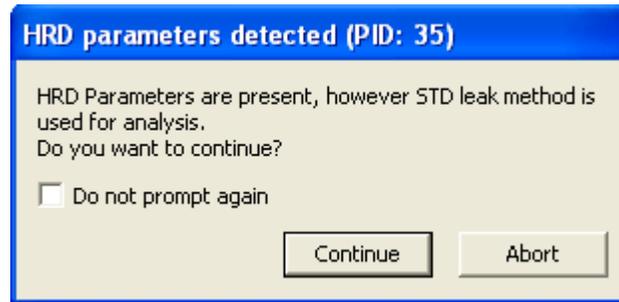
Alternatively, click on the Process button in the toolbar.



You can also process the highlighted streams by selecting Process Streams from the shortcut menu.



When H.264 streams with SEI (HRD) parameters are processed, a dialog box is displayed prompting you to either continue or abort the processing of streams. If you continue, the STD leak method will be used for analysis. If you abort the process, the state of that stream will be displayed as aborted.



NOTE. For HRD model analysis, use a Tektronix ES Stream Analyzer (MTS4EA).

Supported Profiles & Levels

Buffer Analyzer supports six Profiles for MPEG-2 video: Simple, Main, SNR, Spatial, High, and High4.2.2.

Buffer Analyzer supports seven Profiles for H.264: Baseline, Main, Extended, High, High10, High4.2.2, and High4.4.4.

It supports four Levels: High, High - 1440, Main, and Low.

Details of valid combinations of profile and level are given in standards document ISO/IEC 13818 part 2 section 8.5.

Start-Up

The hypothetical T-STD specified in ISO/IEC 13818 part 1 section 2.4.2 assumes a processing steady state. To handle the start-up processing before reaching the steady state, the Buffer Analyzer performs as follows:

- The fraction of the first video frame leading up to the first picture start code is not passed through the Buffer Analyzer. This is because it is not possible to determine whether the Leak or VBV Delay method is being used. During this period, the PES header, Sequence Header, and Extension information are extracted. This information is used to determine the initial DTS, size of the MB and EB buffers.
- The Decoding Time Stamp (DTS) for the first frame is assumed to be correct. It is used as a base for the timing of all subsequent frames. MB underflow errors are suppressed during the first frame.

If the DTS of the first frame is not correct, use TS Cutter to remove the suspect frame(s) from the file.

Approximations

The application uses the following approximations to model the behavior of the hypothetical T-STD:

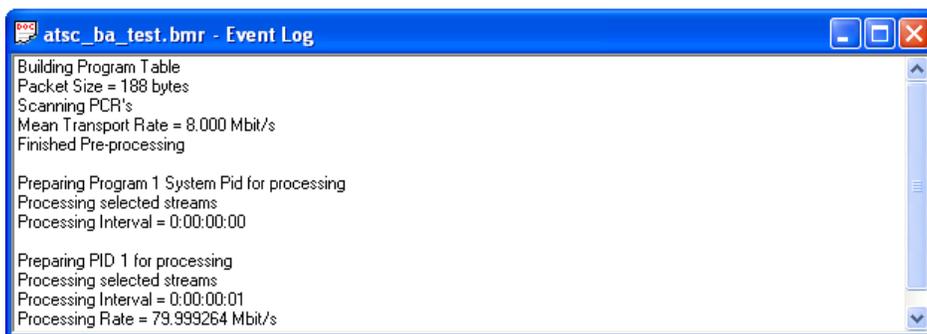
- Data is processed one packet (188 bytes) at a time. An underflow/overflow condition that occurs and clears within the period of one packet will be missed.
- Processing one packet at a time causes the buffers to be emptied in block fashion, thus giving a stepped graphical output.
- Slight quantization effects occur because the model is processed at discrete time intervals, corresponding to a single packet length. This may affect the VBV Delay calculations. The timing intervals for transferring frames from MB to EB are dynamically adjusted to compensate.

Event and Message Logs

The T-STD Buffer Analyzer allows you to access the Global Event log and the PID Event log. You can use the Trace to create a log containing a more detailed analysis of the entire process.

The views can be synchronized by selecting the Synchronize Views option from the Options menu. While Synchronize Views is enabled, a change to any view is immediately applied to all the other views.

Global Event Log



The Global Event Log displays: reports from the initial analysis, PID independent information (Transport Stream errors) and high level details for each stream processed.

For details of events detected during the processing of a stream, open the PID Event Log for that stream.

PID Event Log

Time	TS Packet	Event Type	Comment
0:0.000	0	Log Started	Starting the Systems buffer model
0:0.000	0	General Event	TB size: 512 bytes, RX rate: 125000 bytes/s
0:0.000	0	General Event	B size: 1536 bytes, R rate 16000.000 bytes/s (127999.999 b
0:0.001	3	TB Overflow Start	Start of TB overflow
0:0.007	39	Fatal Error	TB is full, Data being discarded
0:0.007	39	TB Overflow End	End of TB overflow

An Event Log window can be opened for each PID that has been or is currently being processed. Results are written to the log as they are produced. All time and packet numbers are given relative to the start of the file.

Event Selection

Selecting an event row from the Event Log will place a cursor at that time in each of the Buffer Results graphs. To select an event, click the row of the desired event.

Time	TS Packet	Event Type	Comment
0:12.080	64254	B/MB Overflow Start	Start of MB overflow
0:12.110	64413	General Event	VBV_DELAY period exceeds available time before dec
0:12.117	64450	B/MB Overflow End	End of MB overflow
0:12.118	64457	General Event	VBV_DELAY period exceeds available time before dec
0:15.273	81238	B/MB Overflow Start	Start of MB overflow
0:15.352	81661	General Event	VBV_DELAY period exceeds available time before dec
0:15.403	81931	B/MB Overflow End	End of MB overflow
0:15.697	83496	B/MB Overflow Start	Start of MB overflow
0:15.797	84028	General Event	VBV_DELAY period exceeds available time before dec
0:15.802	84052	General Event	VBV_DELAY period exceeds available time before dec
0:15.872	84423	B/MB Overflow End	End of MB overflow
0:16.095	85614	B/MB Overflow Start	Start of MB overflow

To deselect an event, click the mouse pointer outside the data column.

Trace

The Trace is used for analyzing the message logs produced by the Buffer Analyzer. The message logs may be useful for in-depth analysis of the internal processing, particularly for the video stream type. Trace has filtering capabilities that allow you to focus on message types of particular interest.

Trace record is displayed only for processed streams.

Source	Time	Type	PID	Description
Audio	0:03:57.467	B	20	B occupancy 2072 bytes. Removing frame of size 576 bytes:
Audio	0:03:57.467	Time	20	Frame rate= 41.67 intDTS= 21374226:
Audio	0:03:57.491	B	20	Pes Header found at m_B[39898] len= 3464:
Audio	0:03:57.491	Time	20	PTS 1981261087: Frame decode set to 237.515 (look ahead=0.024):
Audio	0:03:57.491	B	20	B occupancy 2048 bytes. Removing frame of size 576 bytes:
Audio	0:03:57.491	Time	20	Frame rate= 41.67 intDTS= 21376386:
Audio	0:03:57.515	B	20	B occupancy 2010 bytes. Removing frame of size 576 bytes:
Audio	0:03:57.515	Time	20	Frame rate= 41.67 intDTS= 21378546:
Audio	0:03:57.539	B	20	B occupancy 2132 bytes. Removing frame of size 576 bytes:
Audio	0:03:57.539	Time	20	Frame rate= 41.67 intDTS= 21380706:
Audio	0:03:57.563	B	20	B occupancy 2146 bytes. Removing frame of size 576 bytes:
Audio	0:03:57.563	Time	20	Frame rate= 41.67 intDTS= 21382866:
Audio	0:03:57.587	B	20	B occupancy 2058 bytes. Removing frame of size 576 bytes:
Audio	0:03:57.587	Time	20	Frame rate= 41.67 intDTS= 21385026:

User Interface To start Trace, select the Trace option from the View menu.
Alternatively, click the Trace button in the toolbar.



Trace displays the detailed message log in the main window. It has a status bar at the bottom of the window and a scroll bar on the right side.

The status bar may be hidden from view, but when it is visible it is always at the bottom of the main window. The status bar is displayed by selecting the Status Bar option from the View menu bar.

Detailed Message Records

The trace window displays the detailed message records in a table format. Each record is represented by a single row of the table. The window displays buffer sizes, transfer rates, profiles, levels, and frame rates that are used for the analysis. It also displays the data movements between buffers and their occupancies with respect to time and packet numbers.

The example shows a log in which a PID (PID 17) carrying video was analyzed and then another PID (PID 20) carrying audio was analyzed.

The types of messages that are displayed in the trace window are selected from the Show menu.

To move forward and backward through the log, use the scroll bar on the right of the window, the Page Up, Page Down, Cursor Up Arrow, and Cursor Down Arrow Keys.

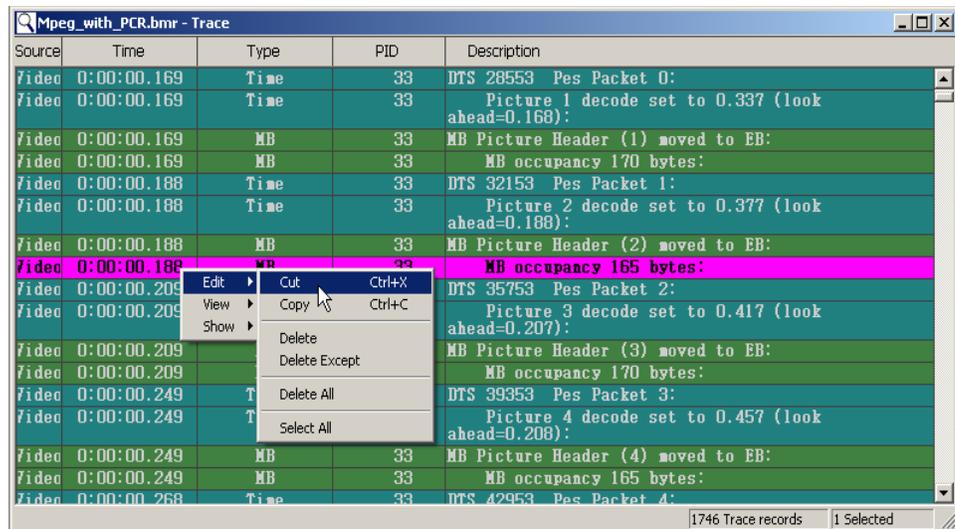
NOTE. If more than one PID is processed concurrently by the Buffer Analyzer, the records will be interleaved in the Trace display. Unless this interleaving is required, processing one PID at a time will make it easier to follow the messages for each stream.

Selecting Records

Records can be selected for printing, copying, deleting, and other Edit menu operations. To do this, they must first be selected.

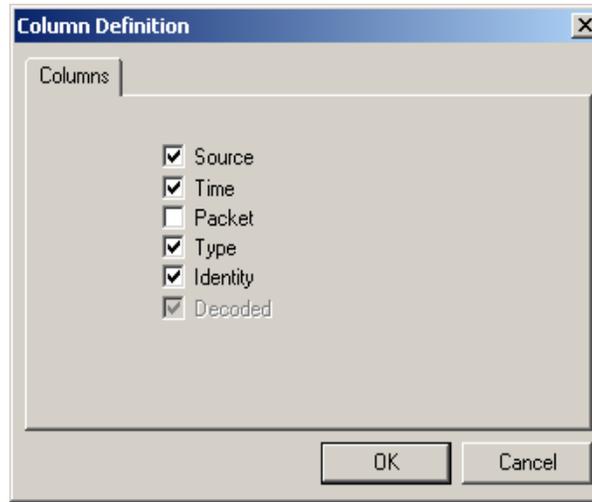
A single record can be selected by clicking on it. To select a contiguous range of streams, click the first record to be selected and then hold the Shift down and click the last required record. Alternatively, click the first record, hold the left mouse button down and drag the pointer to the last record.

Selected records are repainted in the highlight color scheme. By default, this is black text on a magenta background. For example:



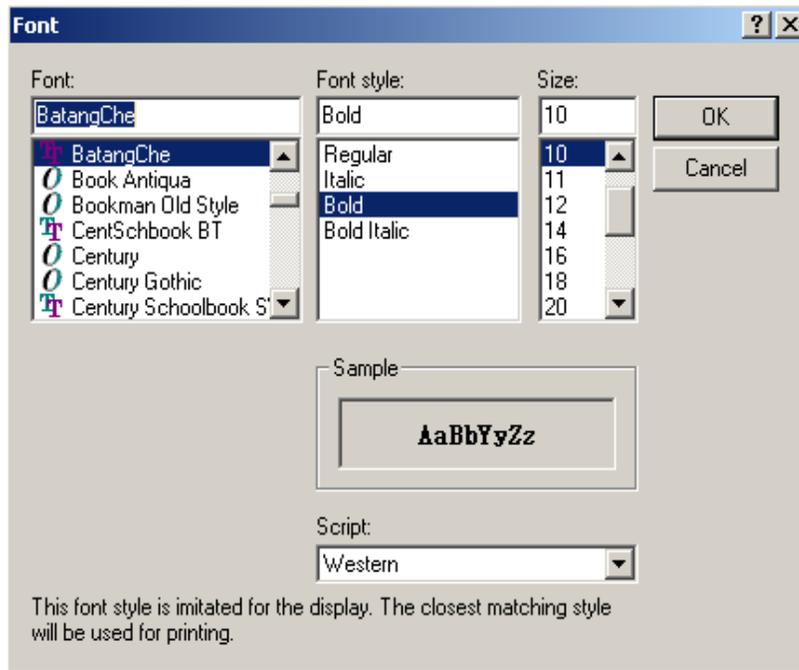
The selected records can be edited and viewed by using the shortcut menu option. You can edit (cut, copy, delete) records, define the Trace (column, font, colors), and select messages (System, Audio, Video) to be displayed in the Trace. You can also show or hide general text, fixed, and time stamp features.

Column Options To set the columns of information that are displayed in the Trace table, select the Column option from the View menu.



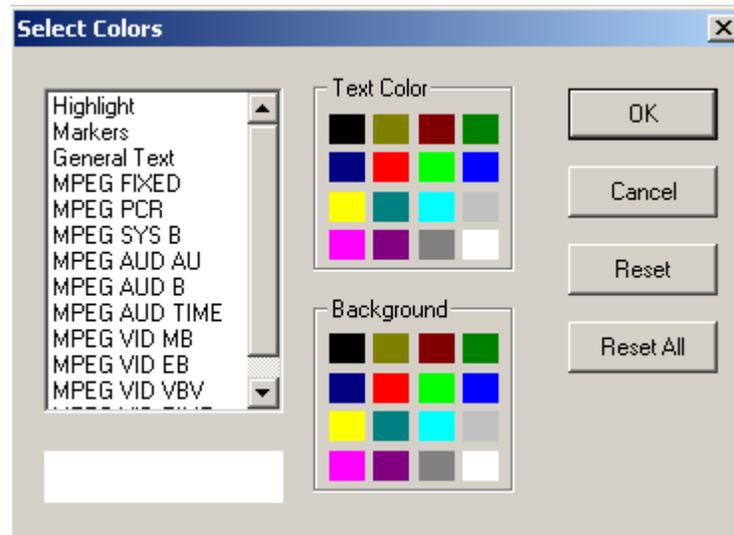
Enabled (checked) column options will show in the Trace table. Click an option to change its state.

Fonts The font of the messages displayed in the Trace table can be changed using the Font dialog box.



You can select the font, font style, size, and script from this dialog box. A sample of the selected font is displayed in the Sample display box. Click OK to see the selected font in the Trace table.

Color Schemes The color scheme for each message type and for highlighting selections can be changed using the Select Colors dialog box.



To modify the color schemes, select the Colors option from the View Menu. This opens the Select Colors dialog box.

Select the message type to be changed from the list box on the left. The current color scheme will be displayed in the Sample underneath the list box. Click the swatch (colored square) in the Text Color and Background panels for the required text and background colors.

Repeat the procedure for each message type that is to be changed and click OK.

The Reset button restores the selected message type to the default color scheme. The Reset All button restores all of the color schemes to their defaults.

Results Graphs

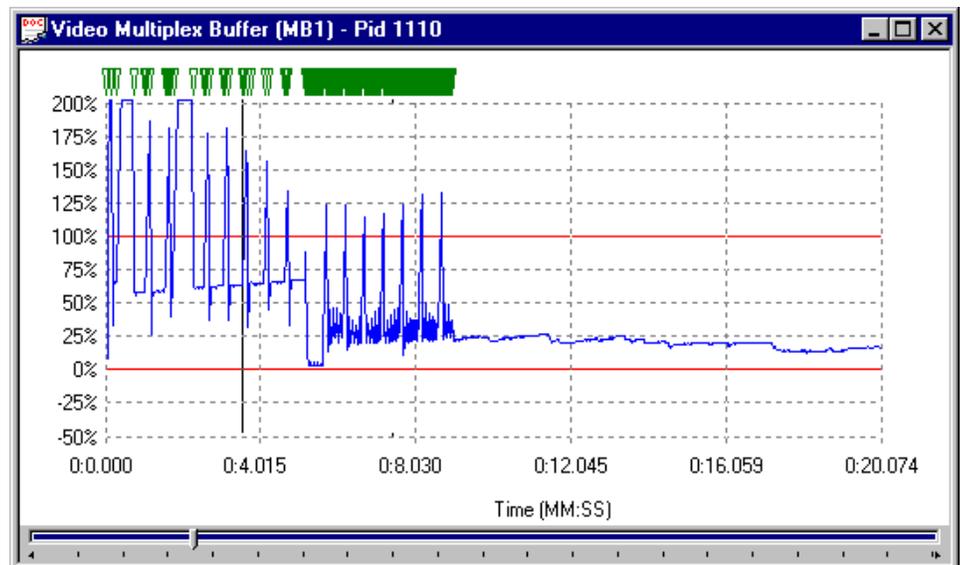
The results of the analysis are plotted on a separate graph for each buffer. When a graph is opened for a stream that is still being processed, each result is plotted as soon as it is produced from the model.

All of the graphs have a similar format and controls.

Common Features

The Axes All of the graphs plot time from the start of file on the x-axis and current space used in the buffer on the y-axis.

Zoom When the results graph is first opened, the entire graph is shown. Even a small file can display data points packed too closely to see the features clearly. For example, here is just under 20 seconds of a video stream that generated a lot of events:

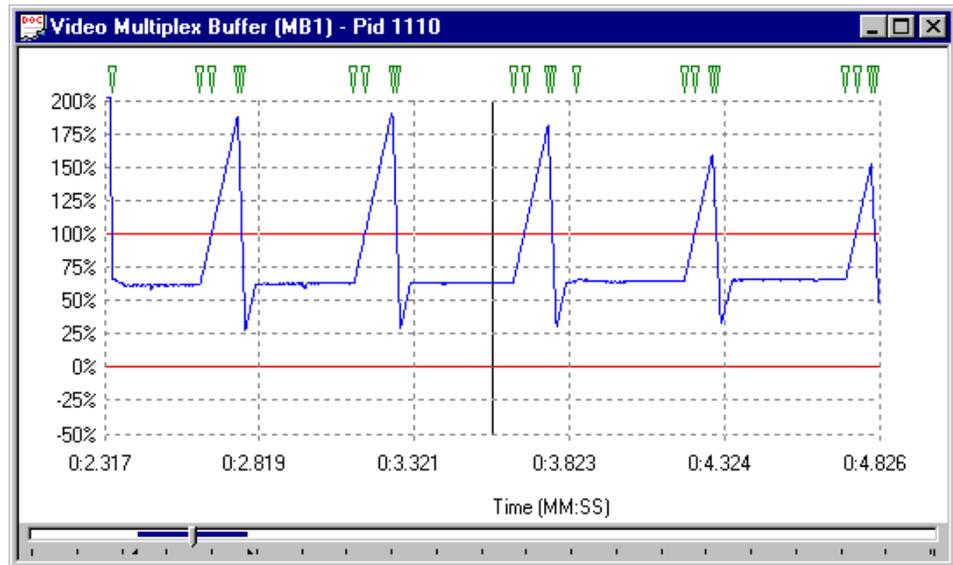


Even this small sample holds some solid bands of blue lines and green event markers, from which only general trends can be determined. To change the time scale (x-axis) to resolve finer detail, click on the Zoom In button on the toolbar:



Zoom in as many times as required to achieve the desired magnification. The magnification is doubled each time the button is clicked.

In this example, clicking the Zoom In button three times gave a much clearer view:



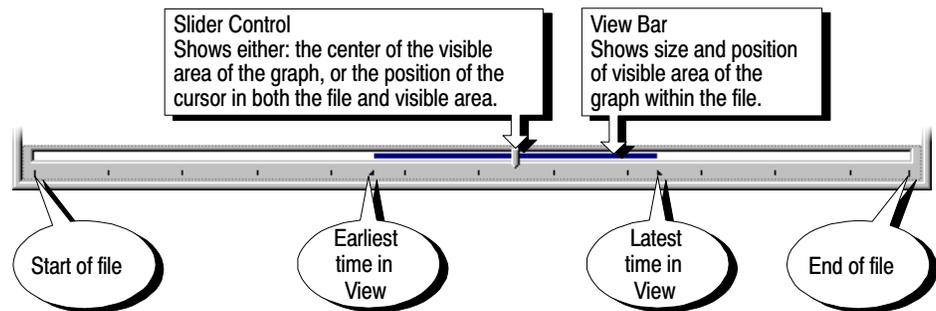
To Zoom back out, click the Zoom Out button as many times as required:



Each time the Zoom Out button is clicked, the magnification is halved, until the full graph is again displayed.

Scrolling the View

The slider at the bottom of the window indicates where the displayed area is in relation to the rest of the file. It can be used to scroll the display through the graph in a similar way to a window scroll bar.



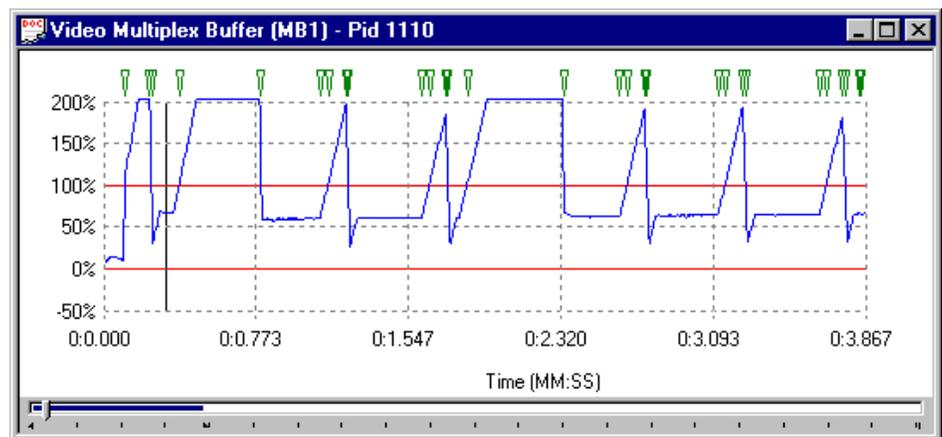
To scroll the stream through the view:

- Drag the Slider Control left or right with the mouse.
- Click the mouse pointer in the slider bar (either the clear sections or the view bar) to the side of the Slider Control.

When a time or event is selected on the graph, the Slider Control is automatically repositioned within the View Bar. The placement of the Slider Control reflects the position of the selected packet in the field of view.

Event Markers

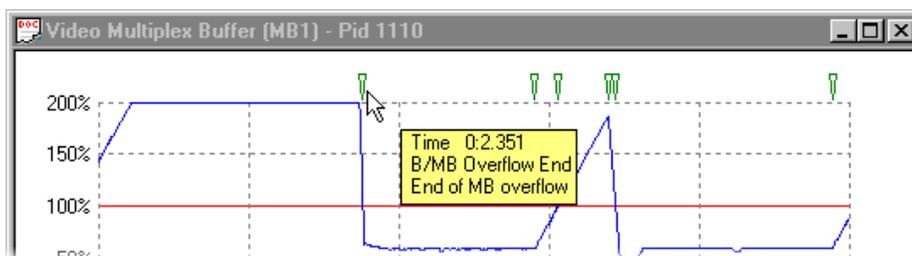
A graph can show one or more green triangular markers along the top. Each marker indicates the time a particular event, listed in the PID Event Log, occurred.



Only events that relate to the points plotted on the graph are displayed in that graph. For example, an event relating to a Video Multiplex Buffer will only be

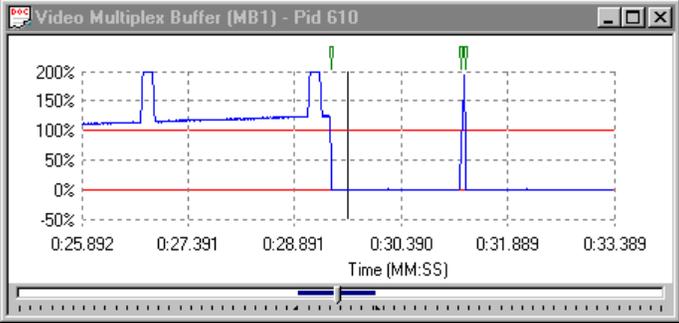
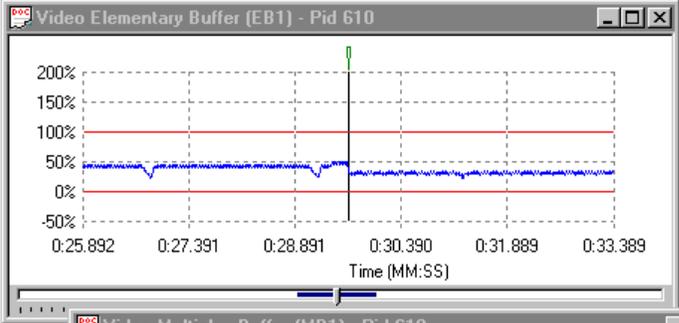
marked on the Video Multiplex graph and not on the Elementary or Transport Buffer graphs.

Double-clicking a marker will display a pop-up window. This shows the time and a brief description of the event that is marked.



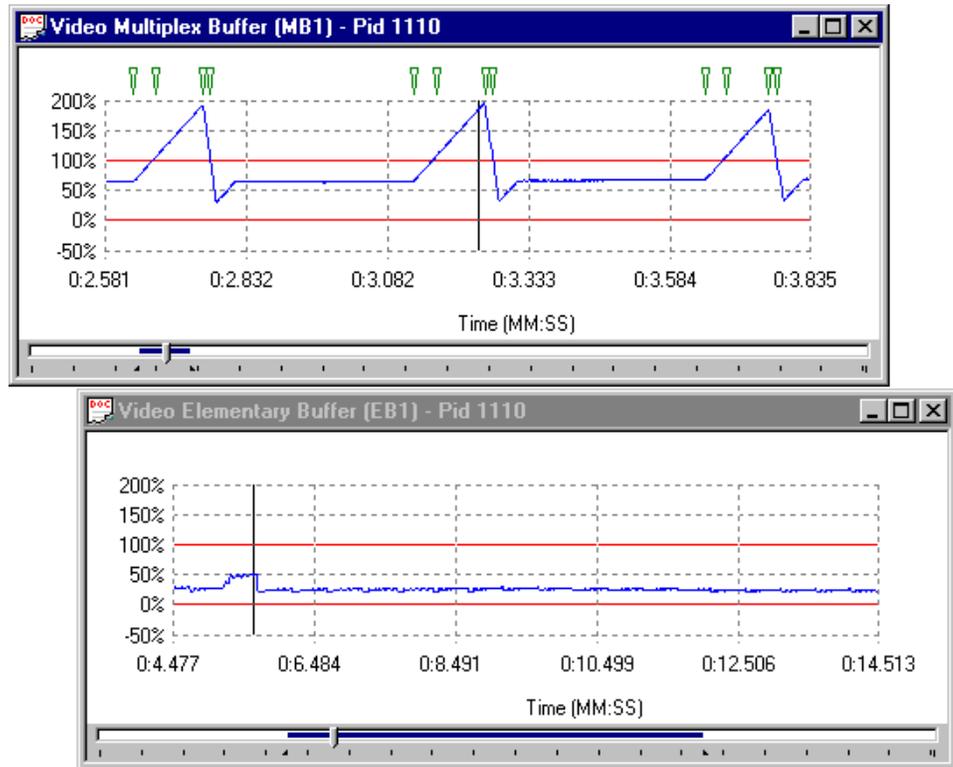
For example, selecting an event relating to the Elementary Buffer from the Event Log of a video stream will place a cursor at the time of the event in the buffer results graphs. Looking at the graphs, a marker of the event has been placed on the Elementary Buffer graph, but not the Multiplex Buffer graph.

Time	TS Packet	Event Type	Comment
0:29.569	157284	General Event	VBV_DELAY period exceeds availat
0:29.609	157497	General Event	VBV_DELAY period exceeds availat
0:29.640	157662	EB Underflow Start	Start of EB underflow
0:29.649	157709	General Event	VBV_DELAY period exceeds availat
0:29.655	157739	EB Underflow End	End of EB underflow
0:29.689	157920	General Event	VBV_DELAY period exceeds availat



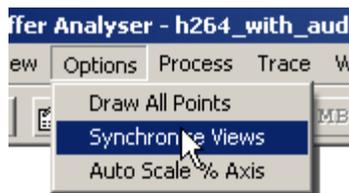
Synchronize Views

Graphs of results can be open for one or more streams. For each stream, one or more graphs can be displayed. The graphs can have their zoom, cursor position and visible section manipulated separately, or all the graphs can be synchronized. For example, in unsynchronized operation, the open graphs might look like this:



This pair of graphs shows different periods in the file at different magnifications.

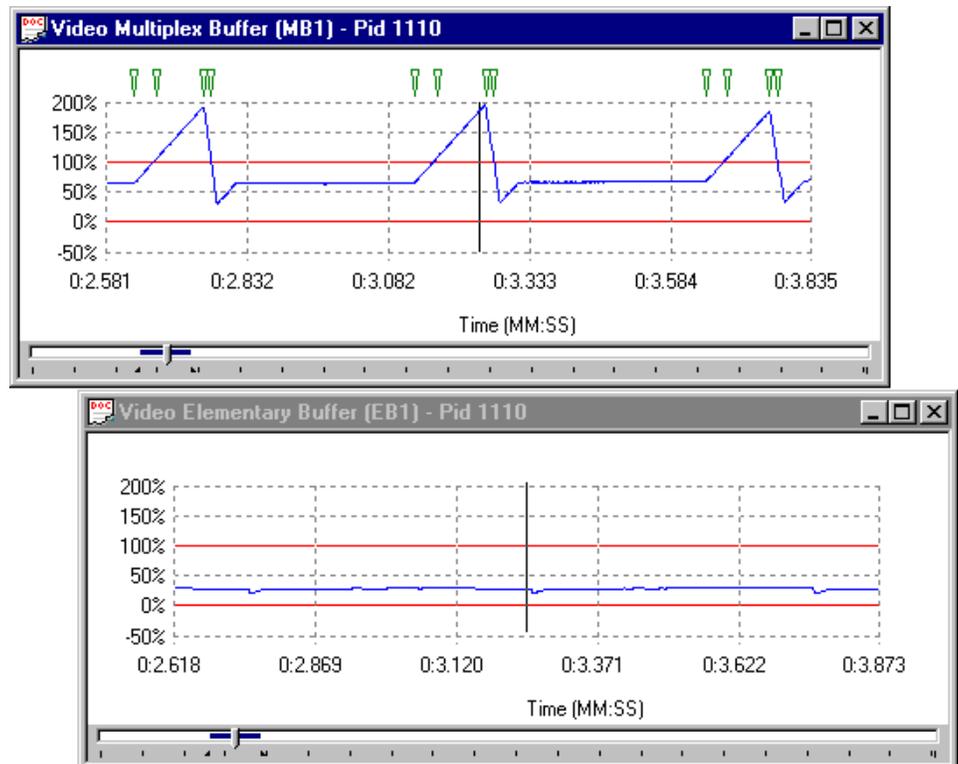
To synchronize the views, select the Synchronize Views option from the Options menu.



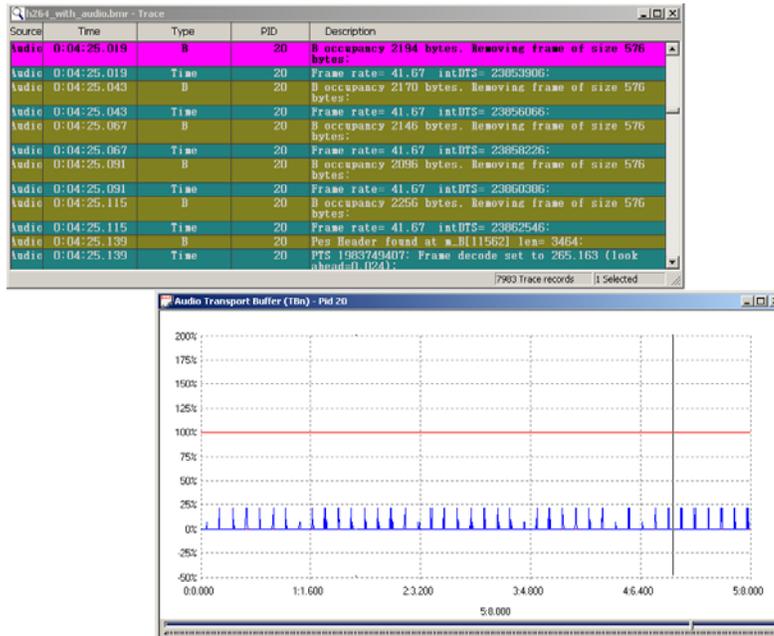
Alternatively, click on the equivalent shortcut button.



This will apply the zoom, cursor, and visible section of the active window to all of the other graphs. While Synchronize Views is enabled, a change to any graph is immediately applied to all the other graphs.



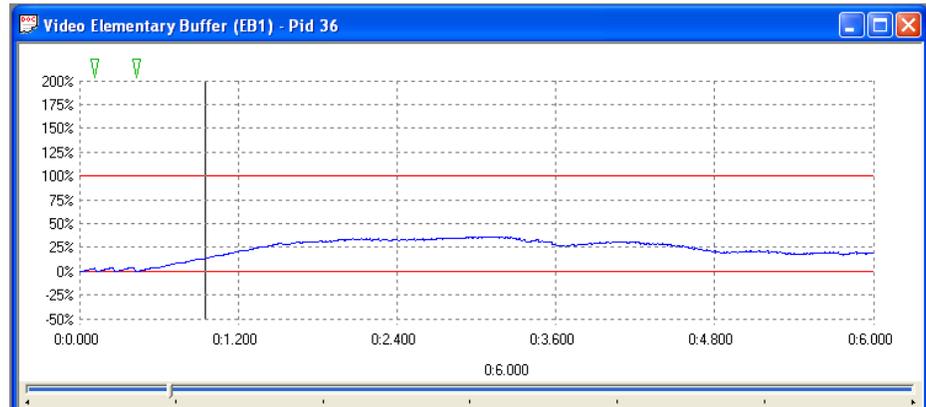
The Trace table can also be synchronized with the other graphs by enabling the Synchronize Views icon. While Synchronize views is enabled, a change in the selected event of the Trace table moves the cursor position of all other graphs accordingly. Similarly, a change in any of the graphs moves the highlighted event of the Trace table accordingly.



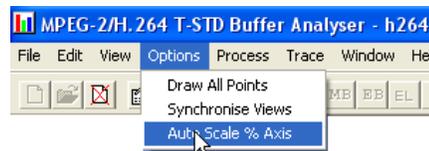
To separate the control of the graphs, disable synchronize views by selecting the menu option or by clicking the shortcut button again.

Selection The cursor may be repositioned within a graph by clicking the required point. This is useful when Synchronize Views is selected as a way of marking the same time in all the graphs for ease of comparison.

Auto Scale The scale on the y-axis of the graphs shows space used in the buffer as a percentage. By default, all of the graphs have a vertical scale that goes from -50% to 200%. The following illustration shows an example graph.



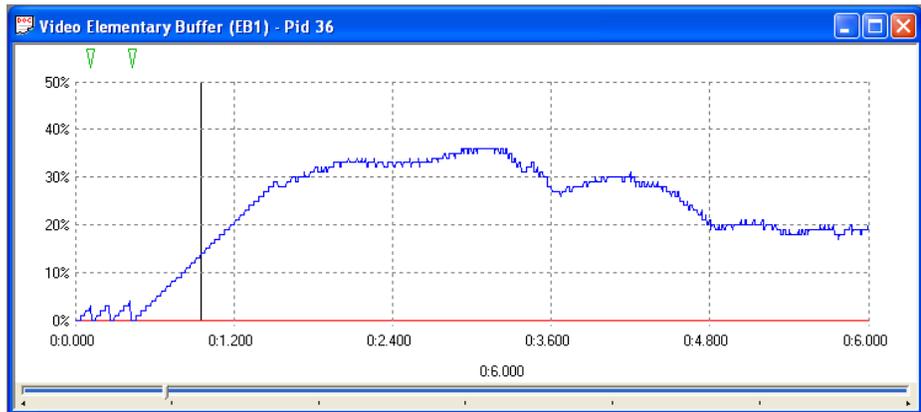
Selecting the Auto Scale % Axis option from the Options menu changes the y-axis for the currently active graph.



Alternatively, select the equivalent shortcut button.



The y-axis is now drawn so that the full scale contains the range of values in the graph, to the nearest 25%. For example, if the range of values was from 30% to 64%, the y-axis would go from 25% to 75%. The earlier example will be rescaled to look like the following illustration.



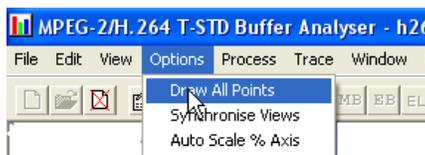
To revert to the default scale, select the menu option or click on the shortcut button again.

Draw All Points

The graphs often contain more data points than can be resolved on the screen. By default, to avoid drawing points on top of each other, the application will plot every nth point. This also speeds up drawing process. How many points to plot is determined from the available width of the graph on the screen and the total number of points to plot.

Use the Draw All Points option to look for outlying points and to resolve the fine detail when zoomed in on the data.

Selecting the Draw All Points option from the Option menu will cause the application to plot every point.

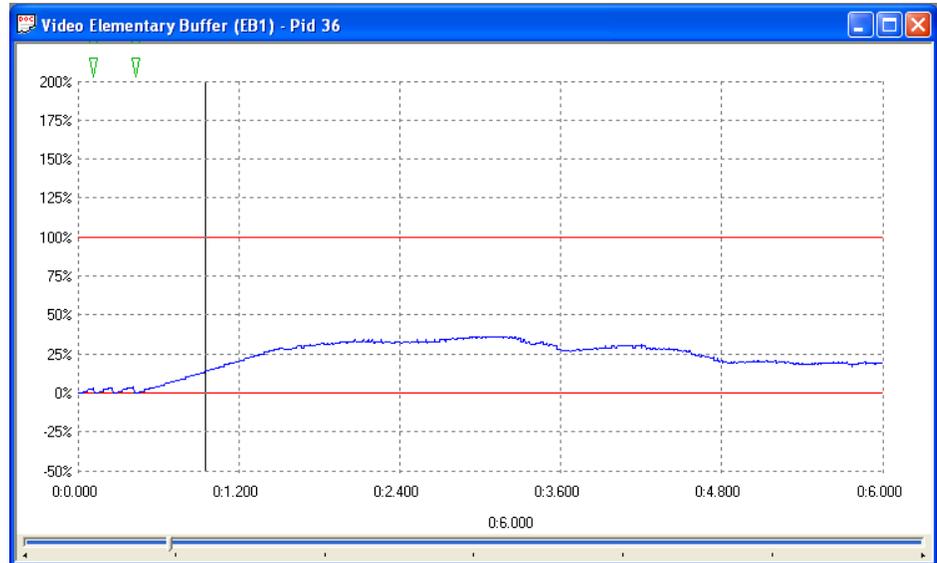


Alternatively, select the equivalent shortcut button.



Drawing all points may take much longer for larger files than the default option. The option can be disabled by clicking the shortcut button again or deselecting the option from the menu. This can be done even while redrawing the graphs.

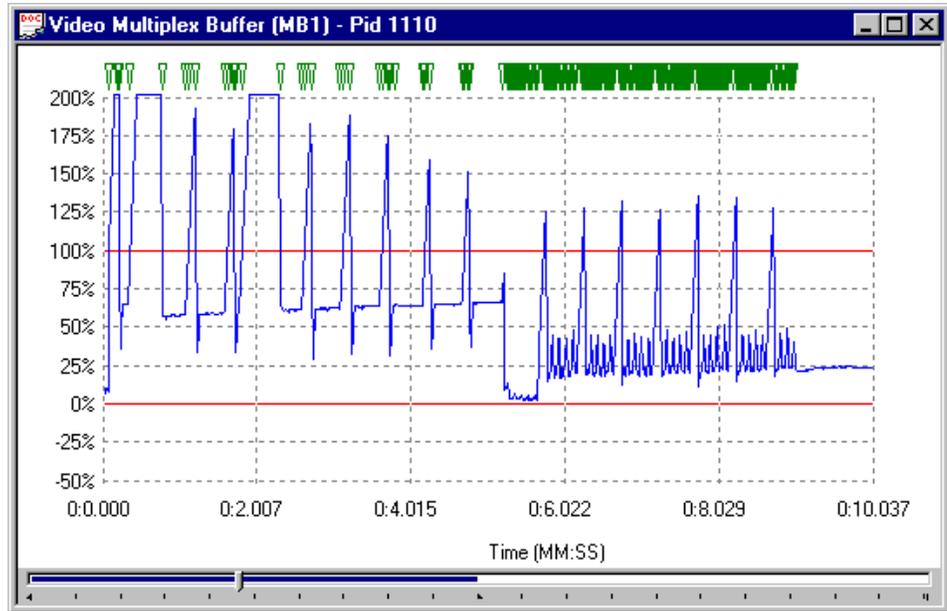
Elementary Buffer Graph



An Elementary Buffer graph can only be opened for Video Streams, since these are the only types of streams that have an elementary buffer.

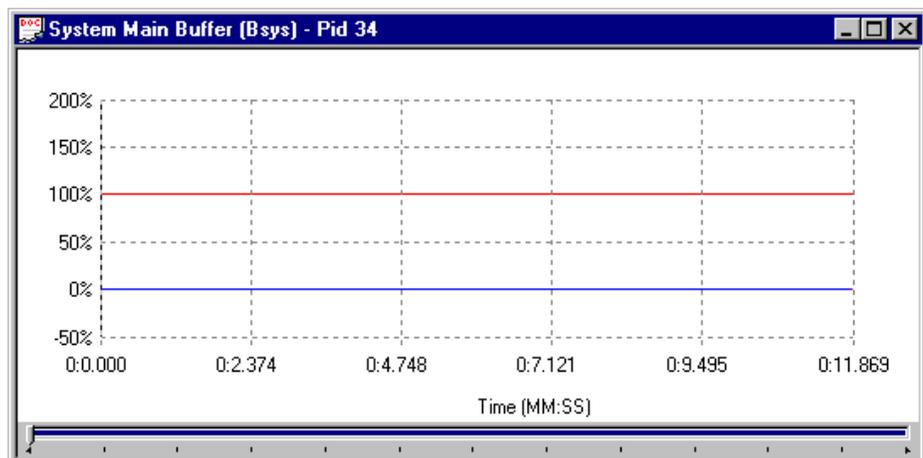
Elementary Buffers are not allowed to overflow, so the graph of the results never goes above 100%. The graph uses the scale -50% to +250% to make comparison easy.

Multiplex or Main Buffer Graph

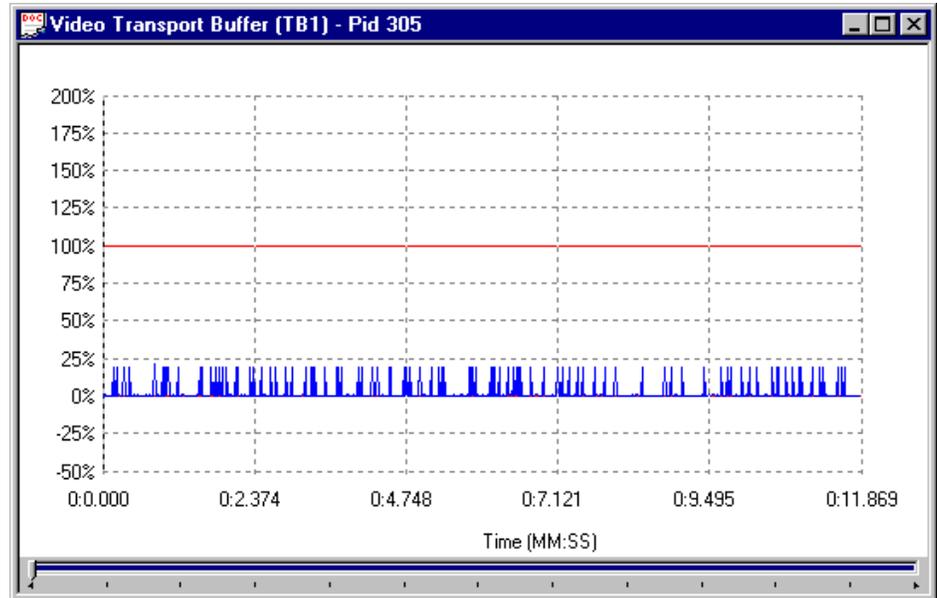


For Video streams, this graph shows the results for modeling a Multiplex buffer. For Audio and System Control streams, the graph shows the results for the Main buffer. The title bar shows the stream type.

Here is an example to show the title for a graph of a System Control stream.



Transport Buffer Graph



The Transport Buffer graph shows results of modeling the Transport buffer for Video, Audio, or System Control streams. The type of stream is shown in the title bar. In the above example, the results plotted are for a video stream carried in PID 305.

Here is an example of an audio stream.

