

WaveS!

Sound Editor for Windows

From

Station Software

Welcome to Release 1.6a of WaveS. WaveS is a sound file editor for casual users and professionals. WaveS is fast and easy to use with many advanced features found in professional studio equipment.

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Introducing WaveS

WaveS is an exploratory tool used to manipulate, analyze and play sound samples. Sound files are drawn graphically allowing you to see and modify the sound as you would text in a word processor.

This is a demonstration version of WaveS1.6a. It is fully functional with the exception of file save capabilities. Please feel free to distribute this demo version to anyone or upload it to your favorite BBS.

WaveS Release 1.6a is a 16-bit monaural memory based sound file editor. Buffer size is only limited by the amount of memory in your system. For larger files see Windows swap file configuration.

Program designers use this program for creating sound bites in MultiMedia programs. MultiMedia Authors use WaveS to edit the sound for presentations. Game designers use WaveS to create and edit game sounds. MultiMedia PC users create sounds for fun, for use in batch files and as informative signals or alarms. WaveS supports the Microsoft Windows 3.x .WAV format and will play sounds over any Microsoft Windows 3.x supported sound card. The sound device must have its driver installed to hear the sounds created with WaveS.

WaveS features a fully functional Sound Editor with easy to use and intuitive DDEdit. Multiple viewing options allow you to look at the waveform and decide which is the best way to translate audio information into visual information. Special effects (F/X) allows you to manipulate the sounds, creating useful and entertaining wave files.

The WaveS Window shows the waveform in customizable colors and can be sized to suit your tastes. Many other waveforms can be displayed limited only by your system's memory. Just open another WaveS application. DDEdit allows you to send waveforms between windows. WaveS was designed specifically to show as much of your waveform as possible, keeping the screen clutter to a minimum and keeping you focused on what is important. Consistent user interfaces and easy to understand options are used throughout WaveS.

A create waves option makes waveforms from scratch. These are useful for effects and for calibration and testing.

WaveS plays the selected area over any Windows 3.x compatible sound card. Features include looping and pause.

WaveS supports full featured waveform recording. You can record with a 4000 to 44100 sample rate, 8 or 16 bit as large as your system's memory.

With practice and with this help file WaveS will handle all of your waveform editing needs. If you want to edit sound like you edit words then order the fully functional release of WaveS!

WaveS Window

The WaveS window shows the sound file selected in a visual format. Depending on the current View option. The waveform is represented graphically with a X and Y axis. The markers are used to mark a section of the buffer that you wish to play, modify or zoom in on. The title bar of the window has the WaveS name followed by the current file name.

Using WaveS is very easy. Position the markers to the part of the sound you wish to modify. Then select one of the menu commands. The sound inside the markers is then transformed, played or zoomed.

Hardware Requirements

WaveS requires an IBM compatible 80286 PC or better. As all buffers are held in memory, 2 MB or more for large files is preferred. A math coprocessor makes most of the effects and specifically the Spectrum view tolerably quick. A sound card is not required to run the program. WaveS will use any Windows 3.x sound driver installed. For larger files see Windows swap file configuration.

Menu Commands

Use this help section as you would the menu items when using WaveS.

File

View

Edit

F/X

WaveS

Help

File Menu Commands

The File commands read files from the disk into memory, save files from memory to disk, rename files, clears the buffer or quits the program.

Open

Save

Save as

New

Exit

View Menu Commands

The View commands change the way the WaveS window presents the audio information in a visual format. The representation of sounds visually has different requirements based on the user's desires. All view choices present the waveform graphically with a X and Y axis. The options dialog selects whether more lines are drawn and the amount of averaging used in some of the views. You can zoom in on any portion of the waveform and then out to view the entire buffer. Move the markers to an area of interest then edit or transform the buffer. The marker position window indicates the precise time. If the window is in either CRF or CRF Plus mode, a CRF icon appears in the lower right corner. As speed can be important when drawing large buffers, the waveform view shows just the samples needed to fill the window. Finally the window colors are fully configurable to match the user's preferences.

Info...

Zoom

Entire Buffer

Tile CRF

Marker Positions

Ave. Waveform

Waveform

Log Waveform

Spectrum

Options...

Customize...

Edit Menu Commands

The edit menu choices are similar to most text editor commands. What makes WaveS unique is that instead of a hidden edit buffer, WaveS uses DDE to create another WaveS window and renames it to the "Cutting Room Floor" (CRF). This is an almost fully functional WaveS window where edited scraps go and can then be reused or manipulated as desired. Only one CRF can exist under windows. Any number (limited by resources) of WaveS windows can exist. This unique feature of windows allows multiple waveforms to be viewed simultaneously and allows waveforms to be sent between windows.

In the WaveS window all editing actions occur on the buffer section between the start and end markers. Once the markers are positioned in the buffer as desired. The edit menu choice can be selected.

- Copy To
- Cut Out
- Paste From
- Replace From
- Mute
- Delete Forever
- Insert Silence
- Mix Add
- Mix Multiply
- Zero Cross Detect
- Cutting Room Floor
- Cutting Room Floor Plus

F/X Menu Commands

F/X is Hollywood for special effects. Besides practical sound file modification as gain and equalization. WaveS offers some other interesting effects. Fade, Reverse and a very useful resampling effect which makes files with dissimilar sample rates match up. The Equalize effect is a sophisticated Inverse Fast Fourier Transform giving you in effect a 512 band graphic equalizer. Flange is a fun effect to transform a waveform. It can make white noise sound like a jumbo jet taking off. Other useful effects include Sample size conversion for using 8 bit files with 16 bit and vice-versa. Invert and DC filter help to clean up editing splices.

Gain...

Fade...

Sample Rate...

ReSample...

Reverse

Echo...

Flange...

Noise Gate...

Equalize...

Convert 8<>16

Invert

D.C. Filter

Normalize

WaveS Menu Commands

The WaveS commands play, record or create waveforms. Each command calls up a dialog box that allows you to control the playing or creation of new waveforms.

Play...

Record...

Create...

WaveS Play Dialog Box

The WaveS Play menu choice brings up the Play Wave dialog box. Play is only available if a sound card driver is installed. The Play Section group plays the selected area of the buffer. The **Buffer** button plays the entire buffer. The **Window** button plays just the waveform displayed in the current window. The **Marker** button plays the area between the markers. The Status window indicates if the buffer is playing and whether it is looped or paused. The Playing Time window initially shows the entire buffer playing time. If Window or Marker is chosen then this playing time is shown. The **Loop** button can be pressed at any time to loop the selected play area. This causes the sound to play over and over until you turn off loop by pressing Loop again or by pressing the **Stop!** button. The **Pause** button can only be pressed while the waveform is playing. Press Pause again to continue or Stop! The Stop! button can be pressed at any time to exit the dialog box and return to the WaveS window. While a buffer is playing you may work in other windows applications. For example start a waveform playing (with loop) and then call up a sound card mixer application to set the play level.

A waveform can also be played by dragging the filename (.WAV) from the file manager to any minimized WaveS icon and dropping it. This allows easy auditioning of files.

By double clicking with the right mouse button anywhere on a displayed waveform (except in Spectrum View) the buffer is played from that point on. This is useful for finding edit points.

WaveS Record Dialog

The record menu choice calls up the record dialog box. This menu choice is only available if your sound driver is installed and the sound card supports recording. The dialog choices allow you to select the sample rate, 8 or 16 bit sample widths and the record time. Use the _Modify (M) button to change the record time or sample rate. Based on the choices made, the maximum amount of time available to record is displayed. If you change the sample rate the maximum record time is displayed. This can be decreased, but not increased. When the time selected to record has expired the waveform is displayed. When you press Start the status window displays "Recording". If paused is pressed while recording the status window displays "Recording Paused". Press pause again to continue recording. Press Stop! to stop recording and display your new waveform.

Recording a good waveform is a subtle art. It is best to say that practice makes perfect. Pay attention to the record level of your sound card to avoid clipping while also attempting to get the highest level waveform. This minimizes background noise. 16 bit recording is best as it's high dynamic range can handle low volume recordings. The Sample rate is very significant in trading off sound quality with recording time. Keep in mind though, that for voice and non-music recordings 11025 is good quality and affords 4 times more recording space. See WaveS Tips for more information on recording techniques and editing practices.

WaveS Create Dialog

The create waves menu choice allows creation of customized waveforms from scratch. The create waves dialog allows you specify the waveform parameters. The selections include sine, square, triangle sweep and noise waveforms. The buffer size, sample rate, volume and frequency can be set by clicking on the Modify (M) buttons. the default numbers in these fields are there as an example. The sample size can be set to 8 or 16 bit.

Help Menu Commands

These menu choices select help topics to guide you through WaveS or through using Windows help.

on WaveS

on Help

About WaveS

View Spectrum Menu Command

The Spectrum View computes the Fast Fourier Transform (FFT) of the sound sample currently displayed in the WaveS window. The status window indicates the number of samples selected then indicates the per cent progress. Once the spectrum is finished the window displays a 512 sample frequency analysis. The markers then indicate the frequency if Marker Positions is selected. The spectrum's Y axis is linear and the level indicators are used as a reference only. The display represents the sum of the frequency components of all the 512 sample windows in the buffer selected. The spectrum's view can be adjusted with the Spectrum Scale button in the View Options dialog box. The spectrum calculation can be stopped at any time by pressing the space bar. The spectrum view is also entered if the F/X Equalize effect is chosen. The spectrum view is exited by choosing another view. The spectrum must be calculated again to get back to the spectrum view.

.WAV File Format

The .WAV file format is the standard Microsoft MultiMedia format for sound files. These files are Resource Interchange File Format (RIFF). A waveform file can contain 8 or 16 bit mono or stereo PCM (Pulse Code Modulation) samples. Release 1.6a of WaveS only edits monaural 8 or 16 bit files. Stereo files can be mixed to monaural if desired when loaded.

Windows 3.x Sound Driver

In order to play or record sounds with WaveS a sound driver must be installed under windows. This is explained in the Windows User Manual. At its simplest, the PC speaker sound driver is available from many BBSs or from Microsoft's Download BBS. Most sound cards (MediaVision, Creative Labs...) have drivers for Windows 3.x. With a good sound card your listening pleasure is greatly enhanced. If a driver is installed the View Info... dialog shows the driver information.

Edit Mix Multiply Menu Command

When Mix Multiply is chosen from the Edit menu the marked section of the buffer is multiplied with the section of the CRF buffer starting at the CRF start marker. The result is put back into the CRF. The CRF buffer lengthens to accommodate the WaveS window marked area. A gain scrollbar pops up allowing you to set the gain of the WaveS window buffer before it is multiplied with the CRF area. Selecting OK multiplies the buffer area with a gain of 0 dB. If the buffer's sample rates or width's do not match then a dialog box pops up asking if you wish to continue. If the CRF is empty then no action is taken.

Mix Multiply is used to create strange sound effects. Try creating a 90 Hz sine wave at about -15 dB in the CRF and then mix multiplying a voice file into the sine waveform. Be careful to keep the mixed waveforms at low levels before multiplying as clipping is likely.

Edit Mix Add Menu Command

When Mix Add is chosen from the Edit menu the marked section of the buffer is added with the section of the CRF buffer starting at the CRF start marker. The result is put back into the CRF. The CRF buffer lengthens to accommodate the WaveS window marked area. A gain scrollbar pops up allowing you to set the gain of the WaveS window buffer before it is added with the CRF area. Selecting OK mixes the buffer area unchanged. If the buffer's sample rates or width's do not match then a dialog box pops up asking if you wish to continue. If the CRF is empty then the WaveS buffer is copied to the CRF unchanged.

Mix Add is used to mix two tracks of sound into one track. See [WaveS Tips](#) for more ways to use mixing. Be careful to keep the mixed waveforms at low levels before mixing as [clipping](#) is possible. Reducing the gain of both buffers by 6 dB assures clipping cannot occur.

File Open Menu Command

The File Open menu choice brings up the file open dialog box with all files in the current directory with the .WAV extension. A file is selected by either double clicking on the filename or typing it in the file window. Click on OK and the file is read and displayed in the WaveS window. If the current directory is changed the Open File dialog remains in that directory. When opening a file the directory is saved in WaveS.ini. When you start up WaveS again it automatically goes to this directory when select File Open or File Save. This saves having to traverse to your working directory every time you start WaveS.

File Save Menu Command

The File Save menu choice saves the entire buffer to the current directory. The file is saved to the directory and name as it appears in the WaveS window title bar. If saving the CRF buffer, a created waveform or a recorded wave then the Save File dialog box appears and the file can then be named and saved. Saving a file changes the working directory in WaveS.ini. If you exit WaveS and restart it or start a new WaveS window the File Open or File Save As dialog starts in this directory.

File Save As Menu Command

The File Save As menu choice pops up the file save dialog and requests a filename to save the buffer to. The drive and path can be specified in the filename box or click to get to the path and enter just the file name. Saving a file changes the working directory in WaveS.ini. If you exit WaveS and restart it or start a new WaveS window the File Open or File Save dialog starts in this directory.

File New Menu Command

The File New command erases the buffer and clears the WaveS window. If you have made any modifications WaveS asks if you want to save the buffer first. You must reopen a waveform file, create a new wave or record a waveform to continue editing.

File Exit Menu Command

The File Exit command quits WaveS and closes the WaveS window. If a CRF has been created it must be closed separately. If you have made any modifications WaveS asks if you want to save the buffer first.

View Info Menu Command

The View Info menu choice pops up a dialog box with information about the current buffer, the Sound Card and about your PC. The buffer title is always RIFF as WaveS only uses .WAV files. The file's revision, length (in samples), the sample rate and the sample size is also displayed. WaveS16a always display Monaural in the Channel box.

The next section is the sound driver name (if installed). Followed by that is the best sound file playing and recording capability of your sound card. If you have more than one sound card WaveS will only use the first one it finds.

The next section is information about your PC. Hard disk drive space left for the current drive, followed by the largest buffer memory space left. This is less than the total memory as a buffer needs a continuous block of memory. Buffer memory is shown in bytes. Each waveform sample requires 2 bytes, so divide this by two to see how large a waveform your system can handle.

View Zoom Menu Command

The View Zoom command zooms the area between the Start and End Markers to fill the entire window. You can zoom indefinitely until the maximum resolution of your display is reached. Zoom is then grayed and you cannot zoom anymore. The maximum Zoom shows a single sample per pixel in the WaveS window. Use Entire Buffer to view the entire buffer again. The bottom scroll bar is only activated when the buffer is zoomed. Clicking on the arrows advances the buffer by 1/10th of the window. Clicking on the page scroll area advances the buffer to the next window of the buffer. The scroll bar thumb represents where you are in the entire buffer. Use Zoom, the Marker Positions and the timelines to precisely position the WaveS window to the area of interest.

View TileCRF Menu Command

The View TileCRF command moves the WaveS window to the top half of the screen and the CRF window to the bottom half. This is useful to compare two waveforms in the same size window. If there is more than one WaveS window active then the one where the command is executed will be moved. If a CRF is not present then just the WaveS window is moved to the top of the screen. Do this for another WaveS window and move it into the lower half of the screen to compare two WaveS windows.

View Marker Positions Menu Command

The View Marker Positions command activates the marker position window. This indicates the position of the Start and End markers and appears in the upper right corner of the WaveS window. If any view other than Spectrum is selected the window indicates the time position of the markers.

As an example, if the window displays "Start: 01:45:123 End: 02:22:001". The Start Marker is at 1 minute, 45 seconds and 123 milliseconds (thousands of a second). The End Marker is at 2 minutes, 22 seconds and 1 millisecond.

In the View Options... dialog box the Samples check box, if selected, causes the Marker Window to display samples instead of time. The window displays "Start: 102345 End: 204567". This indicates the Start Marker is at sample 102345 and the End Marker is at 204567.

If the Spectrum view is selected the window indicates the frequency position of the markers. The frequency is in kHz (thousands of cycles per second).

To turn on the window click on the menu choice, a check mark appears indicating the window is active. To turn it off do the same.

View Ave. Waveform Menu Command

View Ave. Waveform displays the buffer as an average of the samples giving a pleasing and easy to use display of the average level of the waveform. This method highlights the changes in gain allowing one to find locations between words or different sounds. Used with the display averaging option this view shows a smooth transition between sounds. This is the default view when starting WaveS. The averaging does not show the actual size of the samples and should not be used to gauge the level when increasing the gain or any other operation that may clip the waveform. Use the Log Waveform view or the Waveform view to accurately see the waveform level.

View Waveform Menu Command

View Waveform displays the buffer samples unaltered. This method is the fastest way to view a large waveform. It also shows the actual volume allowing one to observe potential areas of clipping. This view does not use display averaging. Use this view if you are working with a small buffer or are zoomed all the way in on a marked area. This view shows the actual waveform and can show areas where there are clicks or pops in the sound.

View Log Waveform Menu Command

This view shows the waveform as an average of the samples in a Decibel scale. This view displays the changes of level best in order to detect the start and end of words or different sounds. Also it is used to observe the effect of level changes as these are in dB also. This view uses display averaging. See WaveS Tips for explanations of sample size vs. dynamic range and noise floors.

View Options Menu Command

The View Options dialog has multiple choices that decide how you want to change the waveform display.

The display smoothing box has 5 choices ranging from 1 to 16. The larger the number the smoother the waveform is drawn. This effects only the average, log power and spectrum views. Use this if the waveform is too rough to see the desired area. See [display averaging](#) for more information.

The next three buttons draw labels and axis lines allowing you to display the waveform as if it were drawn on graph paper. Click on **Show Text** to display the axis level numbers and the view type. **Show Time Lines** will draw time lines in the Y axis along with the time under the Y axis. **Show Level Lines** draws level lines in the X axis. All of these choices modify the [WaveS.ini](#) file in your windows directory and are in effect the next time you start up WaveS. The **Show Samples** check box causes the [Marker Positions](#) Window to display samples instead of time.

The **Waveform Scale** and **Spectrum Scale** buttons zoom the waveform display in the vertical direction. Each time a button is pressed the Zoom is multiplied by 10. Waveform scale only effects Ave. Waveform and Waveform views. Click once to zoom in by a factor of 10. The waveform displayed is then shown from 0 to 3200 (if 16 bit) instead of 0 to 32000. Use this if you desire to see fine detail in low level waveforms. The Spectrum Scale button is used similarly for the spectrum view. To get back to 1:1 zoom, the waveform scale is at 1 and the spectrum is at 100.

View Customize Menu Command

The customize dialog allows you to change the colors of the WaveS window. The three scrollbars are colored Red, Green and Blue. Select the screen attribute you wish to change and then mix the appropriate amount of primary colors to get the effect desired. The background, waveform, axis, text and marker colors can be changed. The changes are saved in the WaveS.ini file. Be careful to not choose the same color for two items as one may not be visible when the window is displayed.

Edit Copy To Menu Command

The Edit Copy To command copies the marked area of the buffer and sends it to the CRF. The buffer is unchanged. If the CRF is in CRF Plus mode the CRF appends the area to the CRF buffer.

Edit Cut Out Menu Command

The Edit Cut Out command deletes the portion of the buffer between the markers and sends it to the CRF. The WaveS buffer is now shorter.

Edit Paste From Menu Command

The Edit Paste From command inserts the marked area of the CRF buffer at the location of the WaveS window start marker. The WaveS buffer is now larger and is redrawn. If zoomed the entire buffer is displayed. Use the markers in the CRF window to find areas of interest and then use the start marker in the WaveS window to insert the CRF area.

Edit Replace From Menu Command

The Edit Replace From command replaces the WaveS window area starting with the Start Marker with the area between the Start and End markers in the CRF buffer. The WaveS buffer size stays the same. Use the markers in the CRF window to find the area of interest and then use the Start Marker in the WaveS window to replace with the CRF area.

Edit Delete Forever Menu Command

The Edit Delete Forever command deletes the area between the markers forever. You will be prompted if you wish to continue. The window is redrawn and the buffer is now smaller.

Edit Insert Silence Menu Command

The Edit insert Silence command inserts silence beginning at the Start Marker. A Number Entry dialog requests how much silence you wish to insert. If you wish to insert 0.5 seconds of silence then position the start marker at the location for insertion. Enter 00:05.000 in the number entry box and press OK. The buffer is now larger.

Edit Cutting Room Floor (Plus) Menu Command

Choosing this command causes the WaveS window to convert to the Cutting Room Floor (CRF). This is a special instance of the WaveS window that is used as an edit buffer for holding edited scraps of sound from other WaveS windows. The CRF is identified by the CRF icon in the lower right corner and by its title. Only one CRF can exist at a time. If a CRF is created by a WaveS window it can be turned into a WaveS window by deselecting this menu choice. CRF and CRF Plus are mutually exclusive. The CRF will erase its buffer if a WaveS window sends it another scrap. The CRF Plus will append to its current buffer any scraps sent to it. This is the only difference between the two. The CRF Plus Icon has a blue "+" sign on it.

The CRF can manipulate sounds just like the normal WaveS window with the exception of commands that would use another CRF. These are as follows:

Edit Copy To
Edit Cut To
Edit Paste From
Edit Mix Add
Edit Mix Multiply
Edit Replace From
Edit TileCRF

The CRF receives its buffers via DDE (Dynamic Data Exchange). It also can send its buffer to a WaveS window that requests it via the Edit Paste From and Edit Replace From command. Buffers that are appended or inserted into other buffers are checked to see if their sample rates and sample sizes match. If not, then you are asked if you wish to continue. It is recommended to use the FX ReSample or the Convert 8<>16 commands to change the buffer to match. A WaveS window can, with the View TileCRF command, cause the CRF window to be sized in the lower half of the screen along with the WaveS window in the top of the screen.

FX Gain Menu Command

The FX Gain command brings up a gain scroll bar that adjusts the gain of the marked area up or down by 45 dB . If the gain is adjusted up and clipping occurs then the per cent of the buffer clipped is shown.

FX Fade Menu Command

The FX Fade dialog has a gain scroll bar that specifies the ending gain of the fade. If the **Fade In** button is selected the marked area of the buffer is faded from silence to the level selected. If the **Fade Out** button is selected then the marked area of the buffer is faded to the level selected. If the end level selected is greater than 0 dB then clipping can occur. The per cent of the buffer clipped is displayed.

FX ReSample Menu Command

The FX ReSample command effects the entire buffer. It changes the sample rate without effecting the way the buffer sounds. Changing the sample rate up causes the buffer to grow in size. Changing down causes the buffer to become smaller. Resampling is most useful for combining buffers with different sample rates. There are tradeoffs in changing the sample rate for sound quality. The higher the sample rate the more high frequency sounds are available. Resampling a buffer down loses the higher frequencies. Resampling a buffer up does not regain these frequencies and introduces low level noise (hiss).

FX Reverse Menu Command

FX Reverse turns the buffer around backwards. If you want to hear if that heavy-metal riff really says what the school board thinks then try this. This effects only the marked section of the buffer. You can Reverse the same area again to return the buffer to normal.

FX Mute Menu Command

Mute silences the area bounded by the markers. It is useful for eliminating noise between words and for damping clicks and pops. This effect cannot be undone.

FX Equalize Menu Command

The FX Equalize command allows you to change the frequency response of the buffer. Think of it as an advanced graphic equalizer. The equalize dialog has a start and stop frequency and a start and stop gain which are changeable via the Modify (M) buttons. The start gain is the gain applied to the start frequency. The gain is ramped linearly to the end gain at the end frequency. The following are some examples on how this can work.

A lowpass filter can be applied to the buffer by changing the start frequency to where the undesired frequencies start (actually a bit before). The end frequency can only go as far as one half the sample rate. The End gain can be set to how much attenuation you wish at the highest frequency. If your buffer has a sample rate of 44100 samples per second and you wish to lower the high frequencies above 10000 Hz then set the start frequency at 9000, the end at 22050 Hz and the end gain at -20 dB.

A highpass filter can be created by changing the end frequency to where the desired frequencies start. Leave the start frequency at 0. The start gain is set to how much attenuation is desired at the lowest frequency. If your buffer has a sample rate of 8000 and you wish to attenuate the low frequencies below 1000 Hz then set the end frequency at 1000 and the start gain at -20 dB.

A band reject filter is easily made by changing the start frequency to where the undesired frequencies start and the end frequency to where the undesired frequencies end. Set both the start and end gains to the desired attenuation. If you want to get rid of some annoying whining noise in your speech file use the spectrum view to find the highest peak in the high frequency range. Set the start and end markers at the beginning and end of the peak and the attenuation at -40 dB or more.

A limited bandpass filter is possible by doing a band reject and instead of negative dBs make the gain positive. Clipping can occur and you will be informed.

This method is best learned by experimenting on small buffers. Use the spectrum view to observe your changes. When the equalization is finished the ideal frequency response is shown. To observe the actual frequency response, change to any other view then back to the spectrum view. Watch out for large changes in gain. These can introduce undesired noise. If large changes are required then do it in several steps.

The Equalize calculations can be stopped at any time by pressing the spacebar. The FFT progress is displayed in per cent in the status window.

Help on WaveS Menu Command

This command brings up the help file you are reading now.

Help on Help Menu Command

This command brings up a help file that helps you use Microsoft's help files.

Help About Menu Command

This displays a dialog with information about WaveS.

Markers

The markers are thick vertical lines with end pointers. The markers contain the buffer area that you wish to modify. The start marker is initially just at the Y axis line at the left of the WaveS window. The end marker is at the far right end of the WaveS window. The markers can only be moved by a mouse. Double clicking the mouse anywhere in the WaveS window moves the closest marker to that position. If you double click between the markers be sure to be closer to the one you want to move. For fine positioning move the cursor over a marker and see it change to the start or end cursor. The start cursor is a left and right pointing arrow with a large "S" in the middle. The end cursor has instead a large "E". By holding down the left mouse button the marker turns into a dashed line and follows the cursor. Let up on the mouse button and the marker is put down at that position. The markers are also colored depending on your current background color. Use the View Customize dialog to change the marker colors for a good contrast. If the window is vertically very small the marker pointers are no longer used and they become just vertical lines. The cursors are reset to the beginning and end of the window for many menu commands. Use the Marker Positions window to see the exact position of the markers.

Notices

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Modify

The "M" push-button calls up a number entry or gain dialog box. The number entry box has a row of scroll bars and each digit is changed with its corresponding scroll bar. Click the up arrow to increase the digit and the down arrow to decrease. The **Min** button causes the number to go as low as it can. The **Max** button causes it to go as high as it can. If you are entering time the scrollbars are separated and the number appears in time format: [m:s.msec]. When you are finished entering the number click the "OK" button. If you wish no change then click Cancel. If a gain level dialog appears the scroll bar is used to change the Decibel (dB) level. Based on the dialog the scrollbar goes from +3 to -90 dB or from +45 to -45 dB.

Display Averaging

The View Options Display averaging smoothes the waveform display allowing you to see the general trend in amplitude or frequency. Use this option if the waveform is too noisy or if a more pleasing display is desired. This setting is kept in the WaveS.ini file and is in effect the next time you use WaveS.

WaveS.ini

The WaveS.ini file contains initialization numbers that control how the WaveS window appears. This file is written to your windows directory when you first invoke WaveS. It is not recommended modifying this file as its contents can be changed via the View Options dialog or the View Customize dialog. You do not need this file to use WaveS. If it is erased WaveS recreates it with defaults.

Decibels

Decibels are a logarithmic scale and are used to measure sound level. Your ears actually hear in decibels as it takes ten times the sound level to sound twice as loud. Decibels are abbreviated dB. A 6 dB volume change causes a 50% change in level. Hence if you change the gain of a waveform by -6 dB you then reduce its level by half. See [WaveS Tips](#) for a discussion of sample size vs. dB.

Decibels

Clipping occurs when the sound is louder than the sample number range. 8 bit sound files range from -128 to +128. 16 bit files range from -32767 to +32767. If you try to change the gain on a sound file by too much some of the samples exceed these levels and are then counted as clipped. Clipping produces distortion and is irreversible. The warning dialog for FX Gain and other effects tells you what per cent of the buffer has been clipped. If this number is large (greater than 1 or 2%) try reducing the volume. As clipping cannot be undone be sure to save your work often and reload the buffer before trying again. Any clipping at all can produce harsh pops in your buffer. See [WaveS Tips](#) for a discussion on how to guarantee no clipping occurs.

WaveS Tips

This section contains information on advanced techniques of waveform editing and more in depth explanations of digital sound. Some material uses math and your only excuse for not reading it is that WaveS is more fun to use than to understand.

[Recording](#)

[Mixing](#)

[Sample Size vs. Noise](#)

[How to Minimize Clipping](#)

[Use Invert to Remove a Waveform](#)

Ordering Information

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View Entire Buffer Menu Command

The View Entire Buffer command (assuming you are zoomed) zooms out to show the entire buffer in the window. This command can also be used to reset the markers to the start and the end of the entire buffer.

Edit Zero Cross Detect Menu Command

This command toggles detecting Zero Crossings when you edit or use special effects on a waveform. This actually shifts the location of the Start and End Markers to a place nearby that is more suitable for editing. A Zero Crossing is where the waveform goes from a positive number to a negative number or vice-versa. When you splice two waveforms together then the Zero Crossings create a better transition between the sounds. Otherwise the Edit can cut a waveform cycle in half creating a abrupt transition and a potential click in the edit. The Zero Cross Detect finds the point closest to the Marker and is usually never discernible as being different from the desired area unless you are editing very small portions of a waveform. Make sure that if you are using the CRF that it is enabled there also.

If enabled, Zero Cross Detect is used for all effects that involve an area of a waveform. As effects can also cause abrupt transitions in a sound. Starting and ending an effect at a Zero Crossing creates better transitions.

Using Zero Cross Detect in conjunction with [FX Invert](#) can create flawless edit transitions.

FX Invert Menu Command

The FX Invert menu command inverts the area between the Start and End Markers. This causes the samples that were positive to be negative and vice-versa. This effect does not cause the waveform to sound different. What it does (coupled with [Edit Zero Cross Detect](#)) is allow for the best transitions between splices. If Zero Cross Detect is enabled the waveform is cut between cycles. What is desired is the next cycle after the cut to go in the opposite direction. Invert does this. The best way to try this is to listen before and after applying Invert. You can also observe the splice point with Zoom. Another use for Invert is to subtract out a waveform with Edit Mix Add. See [WaveS Editing Tips](#) for applications of this technique.

Windows Swap File

You can use WaveS with larger buffers than your RAM can normally hold. If you have a 386 PC or better and can run in Enhanced Mode, Windows creates a permanent swap file on your hard disk. The swap file is contiguous hard disk space that is added to the amount of RAM in your PC. Ideally one would format your HD with a utility such as Norton's Speed Disk, this creates the maximum amount of contiguous space which Windows can then setup to use as a permanent swap file. A swap file can be as big as the hard disk space you have to spare. Refer to your [Windows User's Guide](#) for specifics on swap file setup. Swap files allow you to record and edit **MultiMegabit** files with WaveS!!

FX Sample Rate Menu Command

The FX Sample Rate menu command changes the sample rate of the buffer. When this command is selected a Number Entry dialog box appears. The sample rate can be varied from 4000 to 44100 samples per second. Adjusting the sample rate down causes the waveform to sound lower and play longer. Adjusting it up makes it sound higher and play faster. This is the same as playing a tape faster or slower. Many MultiMedia products can only use waveforms sampled at 8000, 11025, 22050 and 44100. It is recommended that you use one of these rate if you intend to distribute your digital work.

FX Flange Menu Command

The FX Flange menu command is a varying delay that simulates a very common effect one hears in popular music. A dialog box allows you to enter the **Flange Depth** , the **Flange Speed** and **Flange Gain** . All via an (M) button that calls up either a number entry dialog or Gain entry scroll bar. Flanging is best described by example. Start by creating a white noise waveform about 10 seconds long at about -6 dB. With the entire buffer marked, select FX Flange and enter about 5 milliseconds into the Depth, .1 Hz for the speed and 0 dB for the Gain . The resultant waveform sounds like a jumbo jet taking off!! Add Echo and Fade for added realism.

The Flange Effect was originally produced by mixing two tapes of the same sound with one of the tapes slowed by finger pressure on the "flange" of the recorder. This variable delay produced the whooshing sound you hear.

FX Echo Menu Command

The FX Echo menu command allows you to add echo to your waveform. A dialog box allows you to enter the **Echo Delay** and the **Echo Level** via a (M) button that calls up a number entry dialog and a gain entry scroll bar respectively. The Echo effect only echoes the marked area of your buffer. The echoes, though, extend as far as the length of the buffer. The Delay sets the amount of time before the echoed waveform is heard and the Gain sets the level of each echoed waveform. Each decreasing (or increasing) by the selected amount. An example is echoing a single word in a sentence. The example sentence "Where I lay my head is home." Echo the "I" by bounding it with the markers. Choose WaveS Play Markers to hear the area selected. Apply Echo at about 100 milliseconds and a gain of -6 dB. The "I" is then Echoed through the "lay my head is home." Every 100 msec. "I" is repeated, attenuated by -6 dB (50%). If you wish to echo the entire buffer then choose View Entire Buffer and apply the echo.

FX Convert 8<>16 Menu Command

The FX Convert 8<>16 menu command converts the entire buffer to either 8 bit or 16 bit sample size. If the buffer is 8 bit it is converted to 16 bit. If 16 bit you are asked if you wish to continue as conversion from 16 to 8 bit cannot be reversed to the same 16 bit quality as existed before. This effect is used if you need to convert a sound to your buffers format. Along with FX Sample Rate , you can mix and edit any types of waveforms together. As 8 bit files are half the size of 16 bit, this effect can also save disk space if you can sacrifice the waveform quality.

FX Noise Gate Menu Command

The FX Noise Gate menu command mutes all samples between the Markers that are less than the value entered. A Number Entry dialog is used to enter the desired sample level. If the sample size is 8 bit then the maximum sample size you can gate is 127. If the buffer is 16 bit then the maximum size is 32767. Noise Gate is used to mute undesired noise in-between sounds. It is used primarily for speech to allow absolute silence between words. The Gate Value must be chosen carefully and it is best to start small and work up until the desired effect is achieved. Noise Gate once performed is irreversible. Be sure to save your work often.

FX DC Filter Menu Command

The FX DC Filter menu command filters DC from the area between the Markers. DC arises from recordings or effects and causes all samples to be shifted up or down by a constant amount. Mixing many waveforms with DC eventually causes the DC to add up and can cause clipping of one side of the buffer. Also to get a true reading of the Signal to Noise level of your recordings it is important to remove the DC as it shows up in low level Log Waveform views.

FX Normalize Menu Command

The FX Normalize menu command maximizes the gain of the marked area. It finds the loudest sample and then increases the gain of the buffer to make the loudest portion as high as possible. This effect is used to finish waveforms for publication. It is best to always have the highest volume possible to minimize noise when playing. This effect also makes your sound files consistent in volume. Hence if you are creating a Hyperlinked MultiMedia presentation, one sentence or word is not be louder than the other.

Recording Tips

Recording a good waveform is a subtle art. It is best to say that practice makes perfect. WaveS allows you to record simply and reliably in the waveform format of your choice. To acquire a professional recording requires that several systems work well together.

Recording from a microphone

The input circuitry on many sound boards is designed for recording directly from a microphone. This is convenient if a microphone is the only piece of audio gear you own, but for a variety of reasons, it is much easier to get a good sample if you first record your voice on a tape deck, and then record the sound from the tape. When recording from a microphone, it is important to obtain the highest possible level without overdriving the sound hardware's analog to digital converter. Recording a short waveform then observing it via the [View Log Waveform](#) or [View Waveform](#) is best way to ensure this. The peaks of your recording should never touch the top of the view as this results in clipping. It may require a few "takes" to get it right, but with practice it gets easier.

Recording from a CD or Tape

Recording from a CD or tape is much easier than recording from a microphone, as the signal is consistent. It is always at the same level each time you play it, which makes it much easier to get a good recording. It is also easier to get a good vocal "take" when recording on tape than it is when sampling from a mike, because you don't have to deal with the computer and the artist simultaneously. Depending on which sound board you use, there may be some signal level matching problems when recording from such a source. CD players and tape decks output something called a line level signal, which is much "louder", electrically speaking, than the signal from a microphone. While many sound boards can accept either line level or mike signals, some (including the original Sound Blaster) are designed to accept only microphone level signals. Recording directly from a CD with such a board results in serious distortion. The solution is to use a special "attenuator plug", which reduces the output level of the CD player to match that of a microphone. This might sound like an esoteric, hard-to-find beast, but it's not: Radio Shack carries attenuator plugs (part number 274-300). Connect this between one channel of your CD player or tape deck and the sound board's microphone input. If you're sampling from a stereo sound source like a CD or taped music, there's another problem: many sound boards can only handle mono signals. In this case, you'll need to put an audio mixer between the source and the mono line input in order to mix the two stereo channels to one.

Mixing Tips

Mixing two waveforms is extremely easy with WaveS and DDEdit. let's start with an example and create a multilayered cartoon segment. The cartoon character is named Willy. The segment lasts 27 seconds and is scripted to have Willy walking through the desert. Just before he comes up to a canyon cliff a buzzard swoops down, yells "Hellooo" and proceeds to land "Rubber wheel Screech". The first thing to do is get times for the events from the Cartoon preview.

00:00.000 for start of music.

00:20.123 for Buzzard appearance

00:20.230 for Buzzard helloooo.

00:24.740 for Buzzard landing

Assuming all the separate pieces for this segment have been created and edited to proper lengths the first track to lay down is naturally the longest. Load the music track in a WaveS window then to start the Mix merely select Edit Copy To and the CRF appears with the music track layed down. Start up a new WaveS window and load the next event (Helloooo). Select View TileCRF to position the Start Marker in the CRF window at 00:20.230. Turn on the Marker Positions window to see the Marker time. In the "Helloooo" WaveS window select Edit Mix Add to layer the "Hellooo" into the CRF. If clipping occurs reduce the level in the Gain Scrollbar when you select Mix Add for the "Hellooo" or reduce the gain of the music in the CRF. Now play the CRF buffer and see if is satisfactory. If so save the CRF waveform otherwise you have to start over again if clipping occurs or you are not satisfied with the next Mix. Now follow the same steps for the Buzzard's landing screech. Choose FX Normalize to get a consistent sound level and you are finished. Ideally this one of many segments that make up the finished cartoon. The segments can now be strung together via the Edit CRF Plus option.

Sample Size vs. Noise

WaveS handles both 8 bit and 16 bit sample files. The number of bits specifies the resolution of a waveform sample and represents how many binary digits in the sample. An 8 bit sample has 8 digits, each digit can only be a zero or a one. Given all possible combinations of zeros and ones with 8 bits allows for 256 different combinations. Hence a waveform sample can be one of 256 levels. From -127 to 0 to +127. A waveform made of levels is called a discrete waveform. All the levels are predefined. An analog waveform (what you hear in real life) is not digitized hence has infinite levels. This quantization introduces noise when changing from step to step. It also controls the dynamic range of a waveform. The dynamic range is from the smallest level to the largest. For 8 bit files this is from -127 to +127. Since we hear in Decibels the loudest sound is 256, for us to perceive one-half this loudness we need to reduce the levels to one half or 128, then again to 64 on down to 2 then 1. As the levels are reduced the noise increases as there is a larger transition between levels to represent the same sound (try this with a created sine wave and use View Options Waveform Scale to magnify the waveform). To convert the levels to dB requires a simple formula. The highest level is always 0 dB. The lowest is 1/127. Hence to convert the absolute levels to dB do the following:

$$\text{dB} = 20 * \text{LOG}_{10}(\text{Sample}/127)$$

where the "*" is multiplication and "LOG10" is the log base 10. You can see that the lowest dB possible is where Sample = 1. This comes out to about -45 dB. Now do the same for 16 bit samples and you get about -90 dB, or twice the dynamic range. By the way the "dB" comes from "Decibels" which is a tenth of a "Bell". Alexander Graham Bell that is. The "B" is capitalized because it comes from His last name.

How to Minimize Clipping

Clipping prevention is taken care of simply by keeping buffer levels low. Most effects and Mix Add add samples together. If the addition is greater than the maximum level (127 for 8 bit and 32727 for 16 bit) then it is clipped and counted. If the clipping is detected you are informed as to the per cent clipped. A good technique is to adjust the gain of your buffers by -6 dB. This reduces all samples by one-half, preventing any additions from exceeding the maximum. If your buffer is already low then you have to retry until no clipping occurs. Echo can actually add more than two samples together. Be careful to save your intermediate work often so you can undo editing and effects.

Use Invert to Remove a Waveform

The perfect world of digital samples allows effects and manipulations otherwise impossible. An example of this is subtracting out a mixed waveform. By Inverting then doing a Mix Add the effect or mixed buffer is completely removed. An example follows.

Load a waveform in a WaveS window then Edit Copy To to create a CRF. Echo a portion of the WaveS buffer, select View Entire Buffer to reset the Markers and then select FX Invert. Now do a Edit Mix Add. What is now in the CRF is just the echo. The original buffer has been subtracted out. This only works if the buffers are perfectly aligned. If you zoom, change the length or otherwise modify it, this technique does not work.

