

WaveTrak Menus

WaveTrak runs on top of HyperCard, and therefore the menu bar contains a combination of standard HyperCard menu items along with those specially designed for the WaveTrak environment. This manual does not discuss the standard HyperCard menus, and assumes that you are familiar with the normal HyperCard environment.

This chapter is divided into sections dealing with general menu items, accessible from anywhere in the WaveTrak stack, followed by menus specifically enabled in certain cards. Those menu items not mentioned behave exactly as described in HyperCard manuals.

Technical notes are included with most menu items to help the more experienced user add his or her own functions or modify the behavior of the existing WaveTrak menus. If you are new to WaveTrak, you can ignore the technical discussions for now.

General Menu Items

Apple  Menu.

1. About HyperCard...

This menu selection brings up a window displaying the WaveTrak logo, version number, trademark and copyright notices. Click the mouse to dismiss the window and view the standard About HyperCard windows. The amount

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of free memory (free space in the heap) is displayed in the message box.

File Menu

1. Compact Stack

Although this is a standard HyperCard item, it deserves brief mention. As HyperCard operates it tends to accumulate excess space in its stacks which must be explicitly freed using this menu item. We recommend that you compact your stacks before archiving them to avoid wasting space on disks or tapes. Large stacks may take a few minutes to compact.

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Go Menu:

The Go menu contains the standard HyperCard navigation commands, as well as some additional ones specific to WaveTrak, to help you get to frequently visited cards conveniently. Because WaveTrak has its own way of organizing roots, traces and other standard cards, we don't recommend using any of the standard HyperCard Go commands, with the following exception: selecting the 'First' menu item (Command-1) will always take you to the first card in the WaveTrak stack which is the Home Card (not to be confused with the standard HyperCard Home *stack*). Choosing other Go commands will not cause any problems but is likely to be confusing.

1. Home Card.

The 'Home Card' selection functions exactly as the Go First item, taking you directly to WaveTrak's Home Card from anywhere in the stack. This is a convenient "escape mechanism" when you are first getting familiar with the way WaveTrak is organized. If you get lost in a large stack, just go directly to the Home Card to get your bearings.

2. Button Bank

This menu item takes you to the standard WaveTrak Button Bank card; as the name implies, this card is a repository for pre-programmed buttons performing specialized functions such as data acquisition, signal generation, wave processing and analysis. Go to this card to copy (*not cut*) buttons for pasting into other parts of your stack as needed. You can also deposit your own custom buttons for later retrieval. Later chapters describe the functions of the Button Bank buttons.

3. Digital Filters.

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The Digital Filter Parameters Card was described in the WaveTrak Cards chapter. This card allows you to globally set filtering parameters such cut-off frequencies and roll-off slope. You can get to this card by selecting the 'Digital Filters' menu item.

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4. System Parameters.

The System Parameters card is crucial to the proper functioning of WaveTrak. You will visit this card frequently to set gains and various other default hardware parameters. The System Parameters menu item allows you to jump to this important card directly from anywhere in the stack. The card is described in detail in the WaveTrak Cards chapter.

5. Slot Addresses.

The Slot Address card lets you tell WaveTrak where your MacADIOS II acquisition card is installed. The first time you start up WaveTrak, unless your card is installed in slot 9 (the leftmost slot in six-slot Mac II series machines), you must choose this menu item and select the correct slot for WaveTrak to access the card. You will need to do this only once, unless you change the location of the acquisition board.

6. Notes.

Another standard WaveTrak card is the Notes card which contains a scrolling field where you can type in general notes or comments. The Notes menu item will jump to this card from anywhere in the stack.

7. Summary Stack.

The WaveTrak environment includes a separate stack called the Summary Stack; you can jump to it using the 'Summary Stack' menu selection. See the 'Compile Stack Comments' item in the Home Card 'Functions' menu below for a detailed description of the Summary Stack.

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Technical Note:

Messages sent by these Go menu items are: **goHomeCard**, **goButtonBank**, **goFilterCard**, **goSysParams**, **goSlotAddr**, **goNotes**, and **goSummary**. Handlers for these messages are in the stack script.

The 'Tools', 'Objects', 'Font', and 'Style' menus are standard HyperCard menus. Use them freely when you customize your WaveTrak stacks.

Functions menu:

1. Scrap to Tab

HyperCard uses a slightly different format for representing tabular data than the standard for other programs. Normally, items in the same row are delimited by tab characters, and the end of a row is signaled by a carriage return. In HyperCard, items are separated by commas instead. If you copy a comma delimited table of data from a HyperCard field, many programs will not recognize this as a table of data. 'Scrap to Tab' converts data on the clipboard (the clipboard is also called the *scrap*) from comma-delimited to tab-delimited format for pasting into spreadsheets or graphing programs.

2. Scrap to Comma

Scrap to Comma does the reverse of Scrap to Tab; when you copy a table from a spreadsheet for instance, and want to paste it into a HyperCard field, tabs will not be preserved and will be replaced by spaces. Therefore copying this data back to a spreadsheet won't work. This menu item converts all tab characters on the clipboard to commas. In addition, all existing commas are replaced by slashes (/); otherwise these commas would confuse HyperCard into thinking there are more items in a row. Using this and the previous item, you can use HyperCard fields to store tabular results (such as analyses performed from within WaveTrak or another application) in the same place as the raw data itself. This is more convenient than having the raw data in WaveTrak and analyses in another spreadsheet file. These menus allow you

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to easily export your results to a spreadsheet or wave processor for further calculations. Fig. 7-1 shows an example of a tab-delimited table copied from another application, converted with Scrap to Comma, then converted again with Scrap to Tab. All converted data is placed back on the clipboard with each step.

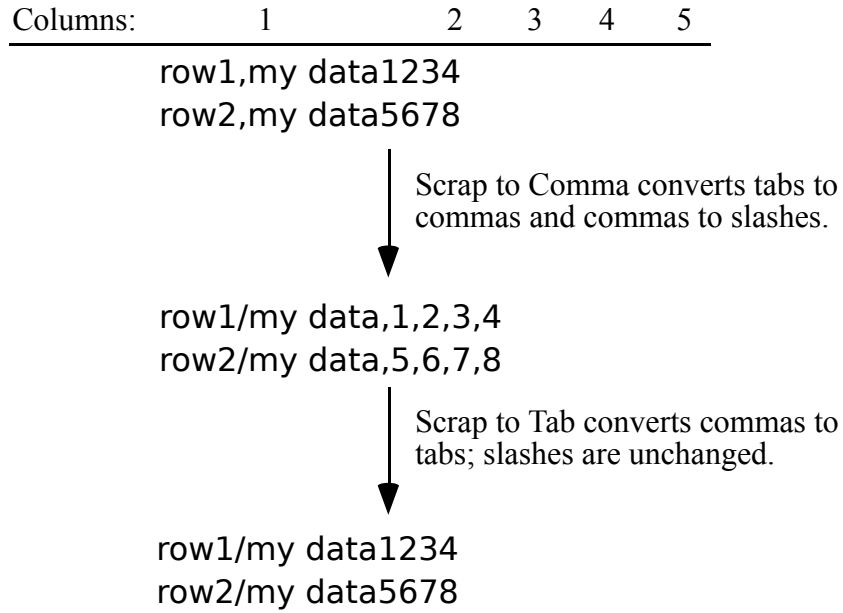


Fig. 7-1: Tab-delimited data on the clipboard is converted to comma-delimited text by Scrap to Comma for pasting into HyperCard fields. Scrap to Tab will return the original tab-delimited format for export to other application, with the exception that any commas in the original data will be replaced by slashes.

Technical Note:

These menu selections send **doScrapToTab** and **doScrapToComma** messages. The handlers for these messages are both in the stack script and in turn call the **ScrapToTab** and **ScrapToComma** XFCNs, respectively. See the chapter on WaveTrak XCMDs/XFCNs for more details.

Acq menu:

1. Scope.

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You will use the Scope card frequently to monitor signals at your A/D converter inputs. Use this menu item to jump to the scope card directly, or use the command-S keyboard equivalent for convenience.

Technical Note:

The message sent by the Scope menu item is **goScope**; the handler is in the stack script.

Although the menu bar remains the same in all WaveTrak cards, items underneath will change and be enabled according to the context of the card you go to. The following sections describe menu items by cards. The 'Functions', 'Analysis' and 'A/D' menus contain few entries to leave space for you to append your own custom menu items. Consult your HyperCard reference on how to insert new menus. An easy way to invoke buttons (in the Button Bank for example) is to have your custom menu handler simply send a 'mouseUp' to the required button. We have found that it is more convenient to have functions implemented as button scripts, which can be more easily edited and modified than menu message handlers buried in a large background or stack script.

Home Card

File menu.

1. New WaveTrak Stack...

When you accumulate a large number of traces, the WaveTrak stack can grow to many megabytes in size. In order to keep file sizes manageable, you will want to start with a fresh stack. Although you can go back to your original version of WaveTrak on your original floppy, chances are you will have created your own buttons, scripts or menus to suit your application. This menu selection allows you to create a blank WaveTrak stack with no roots or traces, while preserving all of your changes. *This function will duplicate only those cards listed in the 'Standard WaveTrak Cards' field in the System Parameters card.* If you add completely new

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cards to your stack and you want them to be included in future generations then make sure to name these cards and add their names to this field.

Technical Note:

The message sent by the New WaveTrak Stack... menu item is **CreateBlankWTRK**; the handler is in the card script of the Home Card.

Functions menu:

1. Compile Stack Comments.

Digitized signals require large amounts of storage space; only the smallest stacks could fit on a single floppy disk. Frequently however, you will have analyzed your data and crunched it down into a smaller table. If you make a habit of pasting these tables along with your comments into the 'Comments' field of root cards, you can use the 'Compile Stack Comments' function to scan your master stack and compile a synopsis into a much smaller stack, the Summary Stack.

Summary Stack

Fig. 7-2 shows an example of a Summary stack containing entries from three roots. The first card contains a scrolling list of entries with their creation dates; click on a title to jump to its summary *card*. Each card contains information from its corresponding root card in the master stack. *Only the contents of the root Title field, the Comments field and the creation date are copied.* Traces or trace comments are not included (unless you choose 'Compile Trace Comments' first, see below). Using this feature, you can distill the results from hundreds of experiments into a stack that will fit on a floppy. By noting in the root Comments field the numbers of specific traces in a root you may want to retrieve in the future, the Summary stack can lead you to a particular trace in the corresponding master stack using the trace number and the date the root was created. For this reason, if you expect to accumulate a large number of master stacks, it's a good idea to archive them using names containing the starting and ending dates of experiments contained therein. For instance, if a Master stack contains experiments from Jan. 1,

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1990 to March 1, 1990, you could rename it as 'WTRK (1Jan90-1Mar90)' when you archive it.

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If you inadvertently select 'Compile Stack Comments' twice for the same stack, you would end up with duplicate entries in the Summary. WaveTrak first checks whether the present master has already been compiled and will warn you if this is the case. Entries cannot be individually deleted from the Summary stack.

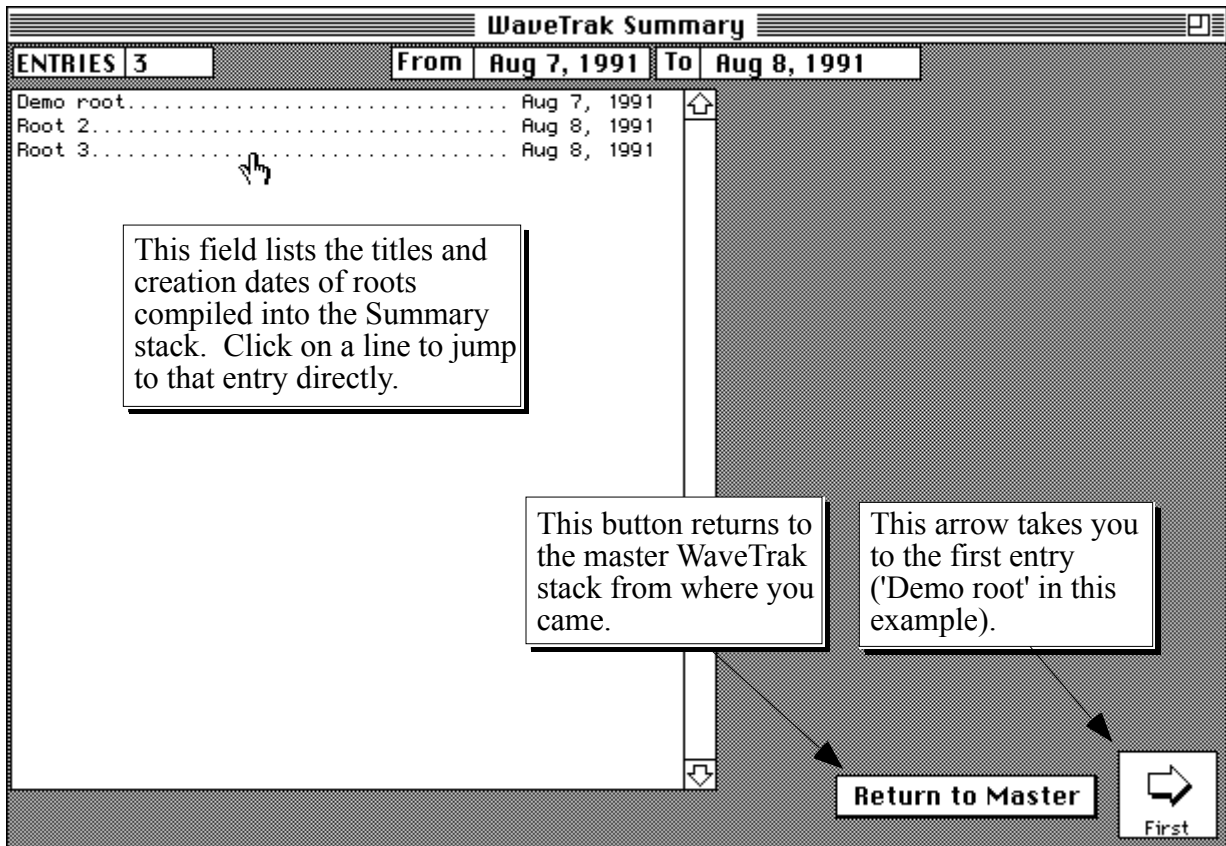


Fig. 7-2: First card of the Summary Stack listing the entries contained in the stack in the scrolling field. The Summary Stack contains only the information in each root card from the WaveTrak master stack, allowing you to store the summarized results of hundreds of experiments in a relatively small file.

There are three custom menu items in the summary Stack. 'New Summary Stack...' under the File menu works exactly like New WaveTrak Stack; it creates a new, blank Summary stack if the existing one gets too large, or if you want to start adding entries into a new stack at the beginning of a new year for example. Note that you must rename your new Summary stack as 'WaveTrak Summary' after creating it (and rename the existing one with a different name, of course) and place it in the same folder or directory level as WaveTrak if the master stack is to find the Summary stack with its Go menu item.

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The 'Functions' menu contains two additional items. 'Sort by Date' will sort the entries in the scrolling field by date. For example, if you compile a recent master, then realize you forgot to compile an older master stack, adding the older one will result in entries that are chronologically mixed up. 'Sort by Date' will order them for you. *Use the 'Clear Entries' selection with caution as it is not undoable.* This item will clear all entries and corresponding summary cards. We suggest you use 'New Summary Stack...' instead, for creating new blank stacks.

Technical Note:

The message sent by the 'Compile Stack Comments' menu item is **CompileStackComments**; the handler is in the card script of the Home Card.

Root Card

Edit Menu.

1. Delete Card.

Normally Delete Card commands are intercepted and WaveTrak will not allow you to delete standard cards. You can, however, delete root and trace cards. If you select Delete Card from a root card, a dialog will ask you to confirm your request, because *all traces under that root will be deleted as well.* This is done because it makes no sense to delete a root card while preserving the traces belonging to it. *This action is not undoable* so make sure you're deleting the correct root. The Home Card titles and root numbers will be adjusted accordingly. Deleting a root containing many traces may take over a minute, so you might want to do this at the end of your work. *Do not interrupt WaveTrak in the middle of a delete operation (with command-period, or worse, the programmer's reset switch) as this could leave the index fields of your stack incomplete and could corrupt your stack.*

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Technical Note:

The **on doMenu** handler in the stack script intercepts several menu selections, including Delete Card. The appropriate instructions are then issued depending on whether you choose Delete Card from a root or trace card.

Analysis Menu.

1. Show Plot.

The 'Show Plot' item in the Analysis menu simply takes you to the Plot Card to review a graph drawn by a previous operation. You can add more items under this menu as required. Consult your HyperCard reference on how to insert new menus. An easy way to invoke functions contained in analysis buttons (in the Button Bank for example) is to have your custom menu handler simply send a 'mouseUp' message to the required button.

Functions menu:

1. Compile Trace Comments.

If you acquire many traces under a root and annotate any interesting waves, it is convenient to have a list of all your comments and the traces they belong to. The Compile Trace Comments function scans all traces under the current root and copies a list of trace numbers and their comments, if any, into the root Comments field. Trace numbers and comments are grouped by mark. This allows you to quickly jump to an interesting trace without scrolling through dozens of cards looking for the appropriate annotation. This is also very useful for storing all trace comments in the root Comment field for inclusion in the Summary stack (see the 'Compile Stack Comments' section above).

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Technical Note:

The message sent by the 'Compile Trace Comments' menu item is **CompileComments**; the handler is in the background script of the root cards.

2. Create Posted Card.

Like the familiar sticky 'posted notes' carrying important messages we all have in our work place, WaveTrak offers a similar option in the form of *posted cards*. When you select this menu item, you will be prompted for a short descriptive name for your new card. WaveTrak creates a blank card and places a button with the same name at the bottom of the 'Analysis' box in the root card. This button takes you to your new "posted card" i.e. an extra add-on where you can paste graphics, create a new field for holding more text, and so on. For example, say you performed an analysis on your traces and plotted the graph in another application. Rather than saving the graph in yet another file, it is much more convenient to create a posted card and paste the graph there, where you can easily get to it from the root to which the graph is logically related. Therefore, WaveTrak is not only a database for raw digitized data, but also for numerical or graphical analyses performed on this data, organized in a logical and easily accessible manner.

This menu item is also available in trace cards.

Tip:

You can create more than one posted card. The button to each new card will be placed right over the previous button; manually move the new button so it doesn't obscure the previous one.

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Technical Note:

The message sent by the 'Create Posted Card' menu item is **CreatePostedCard**; the handler is in the stack script.

Acq menu:

1. Paste XY, Import XY.

In addition to the 'Scope' item, the Acq menu contains the important 'Paste XY' and 'Import XY' menu commands, which are almost identical and will be described together. These commands import the first trace of a root, either from the clipboard or a disk file. These commands simply execute the scripts in the 'Paste XY' or 'Import XY' buttons in the trace cards, so it will reflect any modifications you might later make. Subsequent acquisitions from within the trace cards can be performed with the same menu selection or by pressing the 'Paste XY' or 'Import XY' buttons in the trace cards. The chapter describing WaveTrak cards contains a detailed description of these two buttons under the 'Trace Card' heading, with examples of how to import traces into your stack.

Technical Note:

The messages sent by the 'Paste XY' and 'Import XY' menu items in root cards are **PasteXY** and **ImportXY**, respectively. The handlers for these messages are in the background script of the root cards; these handlers in turn send a mouseUp message to the 'Paste XY' and 'Import XY' buttons in the trace cards.

2. Single A/D.

A/D version only: The Acq menu also contains the important 'Single A/D' command, which acquires the first trace of a root from the A/D converter. This command simply executes the script in the 'Single A/D' button in the trace cards, so it will reflect any modifications you might later make. Subsequent acquisitions from within the trace cards can be performed with the same menu selection or by pressing the Single A/D

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button itself. Note that the A/D channel sampled by 'Single' is the channel currently selected by the pop-up menu under the Single button in the trace card (see Fig. 6-3), and *not* the channel selected in the scope card. If this isn't the channel you want to sample, simply delete the first trace card after acquiring additional traces from the required channel.

Technical Note:

The message sent by the 'Single A/D' menu item in the root cards is **Single**. The handler for this message is in the background script of the root cards; this handler in turn sends a mouseUp message to the 'Single A/D' button in the trace cards.

Trace and Scope Cards

Custom menus in the trace and Scope cards are virtually identical and are discussed together in this section.

Edit Menu.

1. Delete Card

Choosing 'Delete Card' from a trace card will remove that trace from the list under the root and delete the card from the stack. All traces following the deletion will be renumbered. *This action is not undoable and no warning dialogs are presented*, so be certain that you really want to delete the trace for good. In roots containing many traces, the renumber operation (signaled in the message box) may take a long time. If you don't want to wait, yet wish to remove this trace from any subsequent analysis, change its mark to an 'X'; you can delete it later if you wish. In the current release of WaveTrak, there is no provision for deleting several traces at once, or a range of traces. The fastest way to exclude such cards is to change their marks to 'X'.

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Tip:

If you change the mark of the last trace to 'X' to exclude it, remember that the following and all subsequent acquisitions will also be marked 'X'. Therefore, make sure to manually reset the mark of your next acquisition.

As with all standard WaveTrak cards, Delete Card is ignored when selected from the Scope card.

Technical Note:

The **on doMenu** handler in the stack script intercepts several menu selections, including Delete Card. The appropriate instructions are then issued depending on whether you choose Delete Card from a root or trace card.

The following menu items make up WaveTrak's powerful export options. They are set up in such a way that the currently displayed wave is exported, which may not necessarily be the wave stored in the current trace card. For instance, when you go to a new trace (when you *open* a new trace, in technical terms), the previously stored wave is automatically plotted. You then choose 'Freq Spectrum' (see later) from the Analysis menu to compute the wave's frequency spectrum. If you now choose any of the export functions, the *spectrum* and not the original wave, will be converted and copied to the clipboard (or written to a disk file). If you follow the scripting guidelines described in later chapters, you can very easily create your own analysis functions that will be automatically recognized by WaveTrak's export functions.

2. Copy as XY

Copy as XY will translate the wave presently displayed in the trace card display window into XY *tab-delimited* pairs and will copy the result as text onto the clipboard. All points are converted. You can then directly paste the result into a

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graphing program or wave processor for further analysis. The units will be those displayed by the cursor readout in the display window. This menu item behaves similarly in the Scope and trace cards.

Technical Note:

The message sent by the 'Copy as XY' menu item from both the Scope and root cards is **CopyAsXY**.

The handler for this message is in the stack script.

3. Copy as Y

Copy as Y is similar to Copy as XY except that only the Y values are translated and copied on the clipboard. You can use this function if you define your X-values separately as a certain number of μs per point, for instance, in the application receiving the data. Alternatively, once you paste an XY set using 'Copy as XY' and you wish to export additional traces with the same number of points and X scaling, use Copy as Y to avoid duplicating the X data.

Technical Note:

The message sent by the 'Copy as Y' menu item from both the Scope and root cards is **CopyAsY**. The handler for this message is in the stack script.

4. Copy as PICT

Copy as PICT translates the currently displayed wave into a Macintosh graphics object (known as a PICT) and places it on the clipboard. The size of the graphic, as well as the number of vertices drawn in the graph, will be the same as the display window.

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Tip:

Waves are exported graphically as polygons and therefore the number of *vertices* in a polygon is the same as saying the number of *points* in the exported wave.

If you have sharp transients you don't want to miss, increase the number of points displayed by choosing 'Display points...' under the 'Analysis' menu. Waves will be displayed and any PICTs will be created using the new setting. Only the "lines between points" format is supported; you cannot export a wave using the "dots only" mode.

Technical Note:

The message sent by the 'Copy as PICT' menu item from both the Scope and root cards is **CopyAsPICT**. The handler for this message is in the stack script; this handler in turn calls the CopyPICT XCMD. CopyPICT constructs a 72 dpi PICT best suited for pasting into WaveTrak cards or other applications where the data will be viewed on screen. Printing resolution will be limited to 72 dpi.

5. Copy as Big PICT

When you need to create a figure containing a wave for printing, this menu selection will allow you to generate graphics at full LaserWriter resolution. Unfortunately, QuickDraw generally limits graphics objects to 72 dpi, so you must perform a few extra steps for best results. The example is given using Deneba Software's Canvas, but the idea is the same for other object-oriented drawing programs:

1. Select the 'Copy as Big PICT' item and enter the number of vertices you want to send to the graphic in the dialog (limited to the number of points in your wave).

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2. Go to Canvas and paste the object; you will see a huge image spanning several pages. By reducing the object within Canvas, you can get much better resolution and thinner lines.
3. Under the 'Objects' menu in Canvas, select 'Group' then 'Scale...' your wave down to the required size. Checking 'Scale Pen Size' will make your lines thin too. If your picture now appears off screen, perform a 'Cut', immediately followed by a 'Paste', to place the image in the center of your view.
4. The wave and calibration marks will scale together correctly. Now you probably have to fix the size of the text in the legends. Ungroup your picture, select the text for the horizontal and vertical calibration marks and choose 'Restore Original' under the 'Effects' menu (cut and paste to bring the text into view). Now the original size of the text is restored and you can position it accordingly.

Tip:

For those using Canvas 3.0, unchecking the 'Scale Text Size' check-box in the 'Scale...' dialog will maintain the size of the text in the calibration marks at 12 points, eliminating the extra step of restoring the text size.

5. Group the baseline and the wave (the latter will consist of any number of contiguous polygons, each with 400 vertices) together so they maintain their relationship when you move them around.

Only the "lines between points" format is supported; you cannot export a wave using the "dots only" mode.

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Technical note:

For 'Copy as PICT' and 'Copy as Big PICT', WaveTrak translates your wave into a QuickDraw polygon. Unfortunately, the PostScript interpreter in your LaserWriter will generate an error if you try to print a polygon with more than about 400-500 vertices. For this reason it is necessary to split waves up into a number of contiguous polygons.

The message sent by the 'Copy as Big PICT' menu item is **CopyAsBigPICT**. The handler is in the stack script.

6. Save as Igor TEXT

This menu selection will translate your wave and write it to a disk file which can be read directly by Igor, a wave processor from WaveMetrics (Lake Oswego, OR). Only the Y values are written, but all the X scaling information and units are included in a format directly compatible with Igor. The name of the file will always be 'IgorTextFile' (subsequent selections of this menu item will overwrite previous versions of this file), but the name of the *wave*, after it is imported into Igor, will reflect the trace number and creation date for easy identification (for example, 't1_7Aug91'). Waves exported from the Scope card will have the *wave name* 'scope', but will still be written to a file named 'IgorTextFile'. After selecting this menu item, go to Igor and choose the 'Load Igor Text...' sub-menu in the 'Load Waves' item under 'File'.

Technical note:

The message sent is **SaveIgorTEXT**. There are two separate handlers which differ slightly. One is in the background script of the traces cards, and the other is in the card script of the Scope card. This export option allows the experienced user to program very powerful macros. When Igor reads in a text file containing a wave such as this one, you can append any number of valid Igor commands to the file which will be automatically executed when the file is read in. Consult the Igor manual for details and examine the `SaveIgorTEXT` handlers to see how easy it is to set up automated Igor macros from within WaveTrak.

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Analysis.

1. Wave Stats.

Wave Stats performs a number of statistical calculations on the currently displayed wave and writes the result into the 'REPORT' field of the trace card. Information returned by this selection includes:

- Data type: -12 means a 12-bit two's complement integer wave (see later chapters for more details on how data is encoded in WaveTrak).
- DC level: the mean value of the wave.
- True RMS (root-mean-square) value.
- AC RMS, which is the RMS value with the DC component removed. This is useful for checking the absolute AC noise in a system with a finite DC offset.
- Absolute minimum and maximum points in the wave, along with their positions in time (or whatever the current X unit is).
- Peak-to-peak amplitude, the difference between the maximum and minimum values.
- The encoded size of the wave, i.e. how many bytes it occupies in the 'data' field after compression and encoding.

Because the Scope card has no REPORT field, Wave Stats is not available in this card.

Technical note:

The message sent is **TrStats** and the handler is in the trace card background script. The handler in turn sends a mouseUp to the 'Wave Stats' button in Button Bank.

2. Peak Frequency

The 'Peak Frequency' function computes the frequency spectrum of the displayed wave and finds the highest peak. The result is displayed in Hz in the message window. Peak Frequency therefore functions as a frequency counter. Because the

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FFT is used for efficient computation, *the number of points in your wave must be an integral power of 2*. The advantage of this method is that it allows you to measure the peak frequency of very low amplitude or noisy waves, where a traditional threshold-detecting frequency counter would be ineffective. Because of sampling theory however, the disadvantage is that the frequency resolution is limited by your original sampling rate. Also, with certain signals (such as trains of narrow pulses where the repetition frequency falls between the resolving limits of the sampling rate), the fundamental peak may in fact be smaller (though its area will be greater) than some harmonics, and Peak Frequency may return an incorrect result. That's why it's always a good idea to examine the original signal in the time domain, and its entire spectrum with the 'Freq Spectrum' command.

Technical note:

For traces, the message sent is **TrPkFreq** and the handler is in the trace card background script. From the Scope card, the message is **ScopePkFreq**, with its handler located in the card script of the Scope card. Both handlers in turn send a mouseUp to the 'Peak Frequency' button in Button Bank.

3. Freq Spectrum

This function will compute and display the frequency spectrum of the current wave. The result is displayed on a log scale in dB, with the largest component normalized to zero. Because the FFT is used for efficient computation, *the number of points in your wave must be an integral power of 2*. All export functions will correctly export the spectrum, including the 'Save as Igor TEXT' menu item.

The Scope card will only store waves in the time domain; if you leave the Scope card with a spectrum in the window, it will be discarded and the previously saved signal will reappear when you return.

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Technical note:

From traces, the message sent is **TrFreqSpectrum** and the handler is in the trace card background script. From the Scope card, the message is **ScopeFreqSpectrum**, with its handler located in the card script of the Scope card. Both handlers in turn send a mouseUp to the 'Peak Frequency' button in Button Bank. The ScopeFreqSpectrum handler sets an additional flag instructing closeCard not to save the current data, as it is no longer in the time domain.

3. Overlay Waves...

You may need to superimpose several waves to see how they compare to each other. The 'Overlay Waves...' menu item will prompt you for trace numbers, and overlay these waves in the current display window. Enter trace numbers as a comma-delimited list (you cannot enter a range using a dash); you can overlay up to 16 waves at once. *All waves must have the same number of points or an error will occur.* In addition, if the sampling rates differ between waves, the overlay will be meaningless. All cursor readout and zooming features will function normally. Invoking any of the export functions will export the original wave, however, and not multiple waves from the overlay. The overlay function is not available in the Scope card.

Technical note:

The message sent is **TrOverlay** and the handler is in the trace card background script.

4. X mag... and Y mag...

The wave display windows in the Scope and trace cards allow you to zoom in (or out) by holding down the option key (or option and shift keys) and clicking on the wave segment you want to magnify. With each click, the X and Y dimensions are magnified by a certain factor, whose default value is set to 2.0 at startup. You may want to zoom in more gradually or more quickly with each click, or you may want to restrict the zoom to one dimension. For instance, examining frequency spectra for peaks is more convenient by zooming only in the X direction. The 'X mag...' and 'Y

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'mag...!' menu items allow you to change the default zoom factors for the X and Y dimensions separately. By entering 1, you will prevent that dimension from enlarging. The values must be greater than or equal to 1 and need not be integer.

Technical note:

The messages sent are **getXmag** and **getYmag**; the handlers are in the stack script.

5. Zoom X Only, Zoom Y Only, Zoom X & Y

It is frequently convenient to quickly change from zooming just in the X direction, just in the Y direction, or in both directions. These three menu items allow you to quickly change zooming modes, rather than bringing up a dialog and typing in a zooming factor for each direction. The 'Zoom X Only' item restricts magnification to the X direction only by setting that factor to 2 and the Y magnification factor to 1. 'Zoom Y Only' does the reverse, restricting magnification to the Y direction only. 'Zoom X & Y' restores the default condition of zooming in both directions by a factor of 2. Check marks will appear beside the corresponding menu item to remind you which mode you last selected. If you manually enter zooming factors using the 'X mag...!' or 'Y mag...!' menu items, which correspond to one of these preset combinations, a check mark will also be automatically shown beside the appropriate item. For example, if you select the 'X mag...!' menu item and type in 1, meaning that you want to zoom only in the Y direction, and assuming that the default Y factor is still 2, a check mark will be placed beside the 'Zoom Y Only' item, even though you didn't select it.

Technical note:

The messages sent by 'Zoom X Only', 'Zoom Y Only' and 'Zoom X & Y' are **ZoomXonly**, **ZoomYonly**, and **ZoomXY**, respectively. The corresponding handlers are in the stack script.

ZoomXonly sets the globals **xMag** to 2 and **Ymag** to 1.
ZoomYonly sets **xMag** to 1 and **Ymag** to 2.
ZoomXY sets both **xMag** and **Ymag** to 2.

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6. Display Points...

To maximize drawing speed, not all points in your wave are plotted on the screen when your wave is first drawn. One side-effect is that very fast transients (narrow pulses or frequency spectra of very pure sine waves, for instance) may be missed in the normal view. Zooming in will of course reveal all of the wave's details. If you expect many sharp spikes in your data and want to make sure they appear in the normal view, you can increase the number of points WaveTrak plots in the display windows. The trade-off is slower drawing speed. The default is 500 points, which is fast and represents most data well.

Technical note:

The message sent is **getMaxPlotPts**. The corresponding handler, which is in the stack script, updates the global **maxPlotPoints** with the value entered in the dialog.

7. Dots Only

By selecting the 'Dots Only' menu item you toggle its check mark on or off. If checked, waves will be plotted as dots only, unconnected by lines. If unchecked, lines will be drawn between points. The default is the lines-between-points mode. However, you might find the dot-only mode useful in certain instances where you want to very accurately identify a particular point.

The graphics exporting functions (Copy as PICT and Copy as Big PICT) ignore the state of this menu item and will always export graphics in the lines-between-points mode.

Technical note:

The message sent is **ToggleDotsOnly**. The corresponding handler, which is in the stack script, toggles the boolean value of global **dotFlag**. If you change this global in your own scripts, make sure to update the CheckMark property of the 'Dots Only' menu item so it always reflects the current state of the **dotFlag** global.

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Functions Menu.

The 'Functions' menu contains the item, 'Create Posted Card', which is discussed in detail under the Root Card menus above. The format conversion functions 'Scrap to Tab' and 'Scrap to Comma' are also described above. The Functions menu intentionally leaves space for you to append your own custom menu items. Consult your HyperCard reference on how to insert new menus.

In Summary

- WaveTrak contains three menus in addition to the standard HyperCard menus: Analysis, Functions and Acq.
- Additional WaveTrak-specific menu items appear under standard HyperCard menus, depending on the context
- WaveTrak menu items send messages which are intercepted and executed by HyperTalk scripts.
- You can add your own custom menus and associated scripts anywhere in the stack.