# Quickstart

This chapter will give you a brief demonstration of WaveTrak basics: creating a new root, importing/acquiring waveforms and exporting the data as graphics or in numerical format.  If you haven't already, you should read the chapters on how to install the WaveTrak application and how to navigate around the stack. It is best to have WaveTrak running while you read this chapter so you can try everything out as we go along.

*WaveTrak AD version only:* you should also have a MacADIOS II card installed in one of the slots in your Mac, with a signal source connected to A/D channel 0 (consult the MacADIOS II hardware manual for details on how to install the card and connect external signal sources).

*Selecting a slot (WaveTrak AD version only)*

Double-click on the WaveTrak icon to launch the application.  Dismiss the opening screen by clicking the mouse.  Chances are that your MacADIOS II card is installed in the wrong slot and WaveTrak will report an error.  Dismiss the error dialog and go to the 'Slot Address' card under the 'Go' menu.  Click on the slot where your card is installed, then press the 'Go Back' button to return to the Home Card.  WaveTrak will perform a hardware check to see if the card in the slot you chose is a MacADIOS II card.  A dialog will tell you if all is well.

If you start WaveTrak and do not get an error, this means that the default slot chosen in the Slot Address card is the one containing the MacADIOS II card.  You don't have to do anything else, and a message will appear in the HyperCard message box at the bottom of the screen telling you that the hardware check was successful.

Technical note:

The MacADIOS II card has no declaration ROM, therefore the Mac has no way of finding out which slot the card is in.  You have to manually inform WaveTrak of the correct slot.  You do not have to repeat this step unless you move the card into another slot.

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**Important note:**

**As hardware and system software change, it is possible, though unlikely, that certain low-level hardware operations performed by WaveTrak at startup could fail and force HyperCard to quit before getting to the Home Card. You can prevent WaveTrak from accessing any hardware devices by holding down the option key while you double-click its icon to launch it from the Finder. Keep the option key down until you get to the Home Card. This will permit you to access your stack and check the 'Hardware Lockout' box in the System Parameters card (see the WaveTrak Cards chapter for details).**

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*Creating a root*

You should now be at the Home Card. A new WaveTrak stack has no roots, and you must create the first root by selecting 'New Root' under the 'Edit' menu. Type in a descriptive title for this new root in the title field. Go back to the Home Card; your new title appears in the 'Root Titles' field. Additional roots are created in exactly the same way, either from the Home Card or from any root card. New roots are always appended to the end of the last existing root.

Go back to your new root card. A new root has no traces under it. The usual way of adding a trace is by digitizing a signal.

*Scope card: simulating an oscilloscope or previewing data*

Select 'Scope' under the 'Acq' menu. This takes you to a card called 'Scope', short for oscilloscope. As the name implies, this card functions much like a real oscilloscope, allowing you to either preview data stored in a file or on the clipboard, or monitor what is going on at a particular A/D channel. Select 'F' from the 'Import Type' pop-up menu near the bottom right corner of the card. This tells WaveTrak that you will be importing a floating point waveform. Press the 'Import XY' button and select the file named 'TestWave' from the dialog. The waveform will be read from the file and displayed. The

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range of the data and true sampling rate is determined separately, and will be covered in more detail in later chapters.

*WaveTrak AD version only*: Select A/D channel 0 from the pop-up menu, then choose the 'Free Run' trigger option.  When you press the 'Continuous' button, WaveTrak will continuously and asynchronously sample A/D channel 0, in accordance with the sample rate and number of points/wave shown in the 'SAMPLING RATE' box, until you press and hold the mouse button.  No traces are created, and only the most recent wave is stored on the Scope card.  This allows you to set up all your gains, offsets, and acquisition parameters before actually acquiring and saving any traces.

Pressing 'Continuous' will acquire data until the mouse is pressed, simulating a real oscilloscope.

Continuous | Single A/D | A/D Channel | 0 | Import Type:

Trig source
⊙ Free Run
○ Threshold

Import XY

Paste XY

Select 'Free Run'
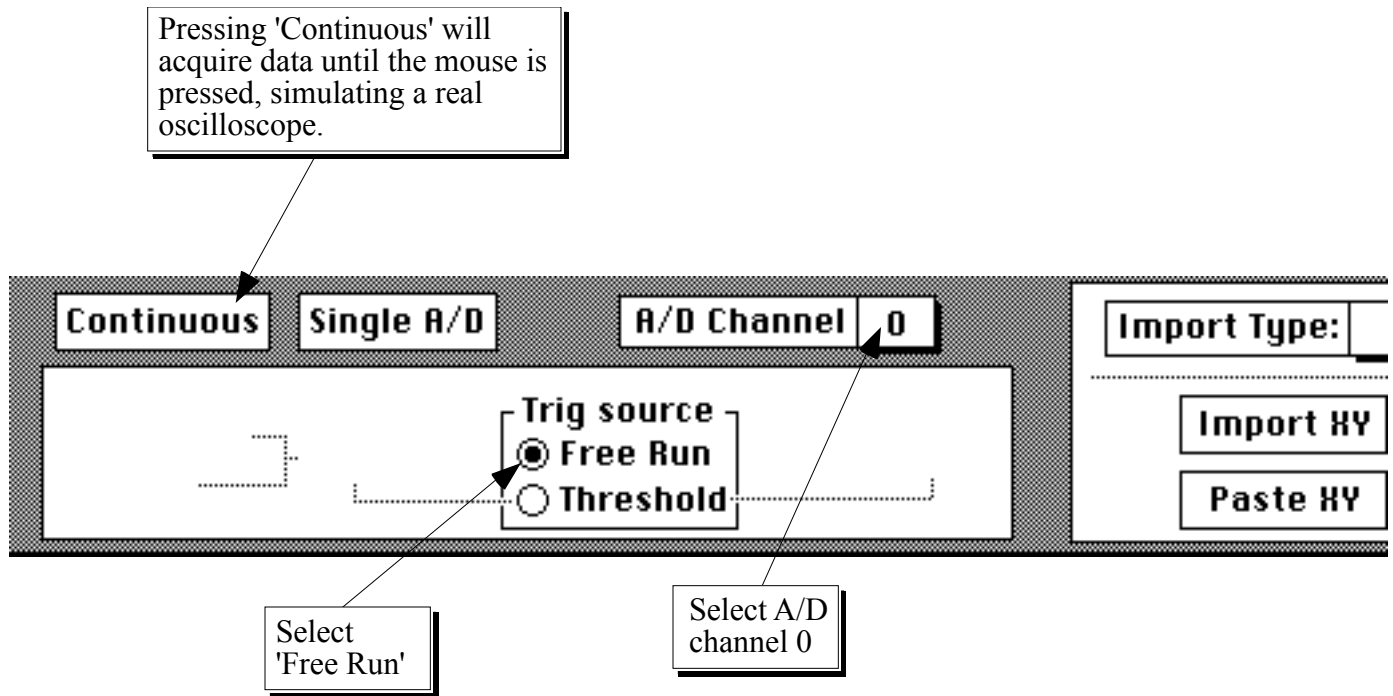
Select A/D channel 0

Fig. 5-1: Select these options in the Scope card to simulate the function of a real oscilloscope so you can monitor the signal at A/D channel 0.  Available with AD version only.

*Acquiring/importing traces*

When you are done previewing your data and would like to store it in the WaveTrak stack, press the 'OK' button to go back to your root.  Select the 'Import XY' menu item under the 'Acq' menu and choose the file you want to import from.

WaveTrak will import the wave, create a new trace card to hold it, and fill in all the default data pertaining to the acquisition

from the System Parameters card (see later chapters).  You can review these details by pressing the 'Show Wave Info' button.Single'

*WaveTrak AD version only*: choosing the 'Single' menu item under the 'Acq' menu. will cause WaveTrak to digitize a waveform from the A/D converter, and save it on a new trace card.  Note that the A/D channel used to acquire traces is not necessarily the same as the one chosen in the Scope card; the *trace* acquisition channel is selected using the pop-up menu below the 'Single' button in the trace card.  Acquire another trace by pressing the 'Single' button below the display window.
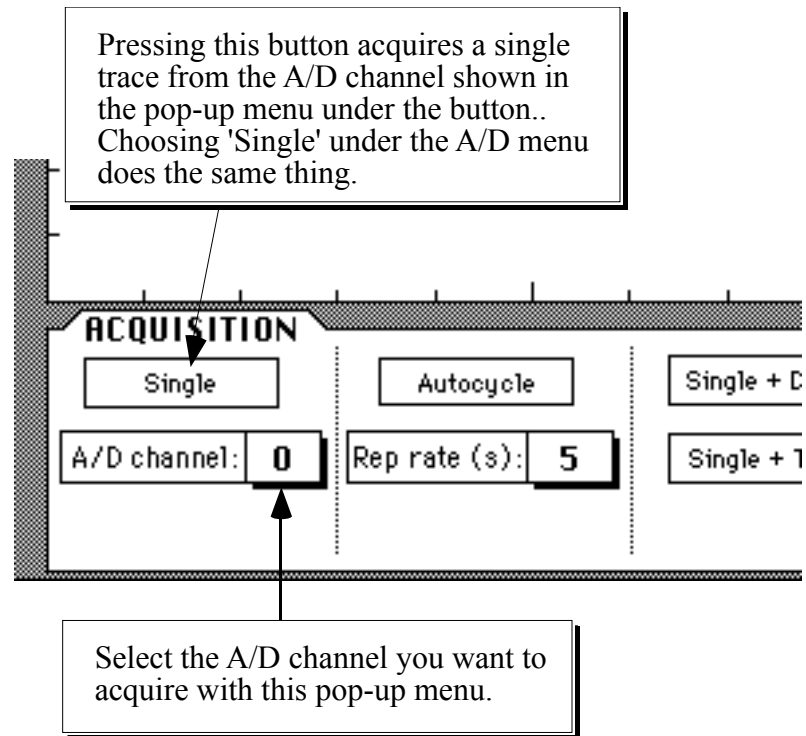


Fig. 5-2: The 'Single' button in the trace card will acquire a single trace from the A/D channel selected in the pop-up menu.  The sampling rate and number of points per wave are taken from the 'SAMPLING RATE' window in the Scope card.

You now know how to import or digitize signals and store them in WaveTrak.  You will notice that each trace is time-stamped and numbered sequentially (top left of trace cards).  If you wish, open the script of the Single button to examine the code used to perform a simple acquisition.

Tip:

A shortcut for opening a window to display the script of an object (button or field), is to press the shift, option and command keys together, then click on the object.  The resulting scrolling window allows you to examine and edit the object's script.  Press Enter to close the editing window and automatically save the script.

*Examining waves*

Move the cursor into the display window over your wave.  The cursor changes into a cross-hair, and the time/voltage values of the current cursor position are displayed near the top right corner of the display window.  Depressing the *option key* changes the cursor into an 'expand cursor'; move the new cursor over a segment of your wave and click the mouse (with the option key held down).  The view is zoomed in by a factor of 2 in both X and Y directions.

Tip:

As with almost every aspect of WaveTrak, the zooming factor is customizable for each of the X and Y directions independently - the chapter on WaveTrak globals explains how.

This allows you to zoom in to take a closer look at a piece of your signal (see Fig. 6-4).  The XY legends at the top right corner are scaled accordingly.  Pressing both the *option and command* (⌘) keys while clicking in the display window zooms out.  Note that the point on the wave where you click will be placed at the center of the new view; if you click over a blank area, you may therefore end up with a blank display.  Double clicking will restore the normal view showing the whole wave.

Tip:

You may have noticed that when you temporarily activate another window over the trace card (for example by switching to another application under MultiFinder, or opening an editing window), your wave is not automatically redrawn when you again return to the trace card.  This is because, in order to save memory, WaveTrak does not draw your wave as a HyperCard graphic on the card.  To re-draw your wave, simply move the cursor into the display window.  Later chapters will explain why this was done and where your digitized data are actually stored.

So far, we have explored how to acquire signals and examine the digitized waveforms within the display window of the trace card.  Let's finish the Quickstart chapter by exporting your wave as a graphic, and then in numerical format.

*Exporting waves as graphics*

Go to whichever trace you would like to export.  Select 'Copy as PICT' under the Edit menu.

Technical note:

A 'PICT' in the Mac world means a QuickDraw graphics object - it is synonymous with 'graphic' or 'picture'.

A dialog box will ask you what size of calibration marks you want to include.  Calibration marks are represented by an L-shape whose size is equivalent to the time and voltage you select in the dialog.  These marks are extremely useful if you scale your wave in a drawing program.  By including the calibration marks in your expansion or reduction, they will always reflect the true magnitude of your waveform.  Type "10000,1000", representing 10 ms (=10000 μs) and 1000 mV, respectively.  WaveTrak will translate your wave into a Macintosh graphic and place it on the clipboard.  WaveTrak reports what it just did with the following message in the message box:

`Waveform copied to clipboard as a 72 dpi graphic`

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Tip:

Keep a close eye on the message box.  WaveTrak frequently tells you what is going on by writing messages here (see Fig. 6-1).

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Open your favorite drawing program (e.g. Canvas or MacDraw) and paste.  The calibration marks are positioned to the left of your wave which was created the same size as your display window on the trace card (this too, of course, is customizable).  Your wave is now on the clipboard as a standard PICT (i.e. graphic) that you can paste into any document.  Using this export option, however, limits your waveform to a resolution of 72 dots per inch (dpi), the standard resolution of the Mac screen.  This export option is best suited for material that will be viewed on the screen and not printed.

Technical note:

Standard QuickDraw was designed to render graphics at 72 dpi.  Although regular objects such as circles and rectangles will still print at full LaserWriter resolution, irregularly shaped graphics objects (such as your digitized waves) will not.  WaveTrak works around this limitation and includes a mechanism for exporting and printing waveforms at full resolution using the 'Copy as Big PICT' menu item.  See the chapter on WaveTrak menus for details.

## *Exporting waves as numbers*

Frequently it is necessary to export all the information in a wave, point by point, as a table of exact numbers.  This allows you to perform precise calculations and analyses on your data in other applications such as spreadsheets, wave processors or statistical programs.

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Select the 'Copy as XY' menu item under the Edit menu. After a second or so, WaveTrak issues a message in the message box:

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Wave copied to clipboard in numerical format as XY
pairs.
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The clipboard now contains a numerical representation of your wave, as tab-delimited XY pairs, corresponding to time and voltage (or whatever other unit you're measuring), respectively. Pasting this data into a table in a spreadsheet for instance, will result in two columns of numbers: time in the first, and voltage in the second. The number of rows will equal the number of points in your original wave.

Additional waves can be imported and pasted beside the first one; you might want to use the 'Copy as Y' menu item instead. Copy as Y does the same thing except that it generates a single column of values without the time values. This avoids duplicating unnecessary time data, provided all the waves have the same sampling rate and number of points. Later chapters will show you how to easily customize the format when converting waves into numbers.

**In Summary**

• The Scope card functions much like an ordinary oscilloscope, allowing you to either preview waveforms previously acquired on the Mac or another system, or view analog signals at one of the A/D inputs.

• Create a new root, as an introduction to a new experiment or set of data.

• Waves are imported/acquired and stored on trace cards, where they can be reviewed with the built it cursor read-out.

• Data can be exported from the Scope card and from trace cards in two standard Mac data formats: graphics and numerical tables.