

WaveTrak Organization

HyperCard

WaveTrak is best described as a hybrid application. WaveTrak uses the friendly HyperCard interface to interact with the user, but under the hood, a comprehensive set of highly optimized units written in C and assembly language perform the time-critical and computationally intensive tasks needed for data acquisition, signal generation and digital processing of acquired data.

The basic information record in HyperCard is the *card*, in effect, an organized collection of text fields, graphics and buttons. This metaphor is ideally suited for storing and databasing digitized waveforms: each wave is stored on its own card, along with any other readings taken at the time, a time stamp, comments entered by the user and buttons used to acquire or analyze the information. The following sections describe the structure of the WaveTrak environment, and the chapter entitled 'WaveTrak Cards' describes in detail what each card does, how and where your acquired data is stored.

Stack Structure

The WaveTrak application consists of the main WaveTrak stack itself (called the *Master*), and one or more support stacks containing code resources or data distilled from the Master. The following table outlines the respective roles of each stack:

Stack Name	Function
WaveTrak (Master)	Stores user data. Holds code for displaying and exporting user data.
WTRK A/D Lib (optional, required if you want to digitize data directly on your Macintosh)	Holds code resources for controlling the data acquisition card. The Master calls functions stored in this stack.
WTRK DSP Lib	Holds code resources for performing digital

WaveTrak Organization

	signal processing functions. The Master calls functions stored in this stack.
WTRK Summary	A summary stack containing a synopsis of results and comments from the Master.
Miscellaneous stacks	Additional stacks can be linked by the user to perform custom functions. See the 'Scripting with WaveTrak' chapter.

WaveTrak Organization

Tip:

Because the Master must be able to find these support stacks, you must place them all either at the root level of your hard disk or in the same folder as the Master stack. Otherwise, you will have to modify the Master stack script and provide the full path name for each of the above support stacks. You cannot substitute aliases for the support stacks.

The scripts in the Master stack are executed by HyperCard itself, whereas the library stacks (identified by an 'L' in their icons) hold executable units called code resources. Code resources specifically designed to run under HyperCard are called external commands (XCMDs) and external functions (XFCNs). It is these XCMDs/XFCNs that form

WaveTrak Organization

WaveTrak's extensions to the HyperTalk language, and which perform the data acquisition and analysis tasks. Fig. 4-1 illustrates the relationship between HyperCard and the WaveTrak environment:

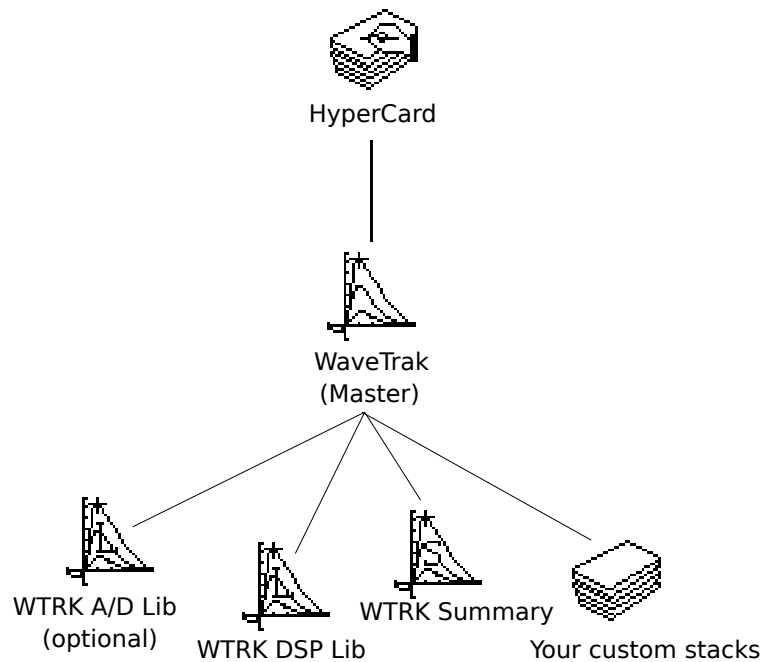


Fig 4-1: Relationship between HyperCard, the WaveTrak Master and its support stacks.

Library stacks are transparent to the user; they each consist of only one card with no buttons, and you never have to open them. All of your interaction with WaveTrak occurs from within the Master stack itself. The WaveTrak Summary stack (identified by an 'S' in its icon) contains a synopsis of results and comments from the Master.

Note:

The custom WaveTrak icons will only be displayed under System 7; standard HyperCard document icons will be shown with earlier versions of system software. The appearance of the icons has no bearing on the function of the WaveTrak application.

WaveTrak Organization

Cards

The fundamental information record in HyperCard is the *card*. Cards can contain graphics, fields for storing information which is automatically saved to disk, and buttons which contain scripts for performing certain tasks. Consult a HyperCard reference for more details. WaveTrak consists of a number of standard cards for performing a variety of housekeeping tasks; the chapter entitled "WaveTrak Cards" describes each of these cards in detail. When you start WaveTrak, you are taken to the first card, the *Home Card*. The data you acquire during an experiment is also stored on cards. Each new experiment is introduced by a *root card*; the root card contains the date and title of the experiment, as well as user comments pertaining to the entire experiment. Each acquired or imported waveform is in turn stored on a trace card. Traces from the same experiment are collected 'under' one root. The spatial organization of these cards is shown in Fig. 4-2. The traces "grow" down in sequence below each root card, hence the name "root card".

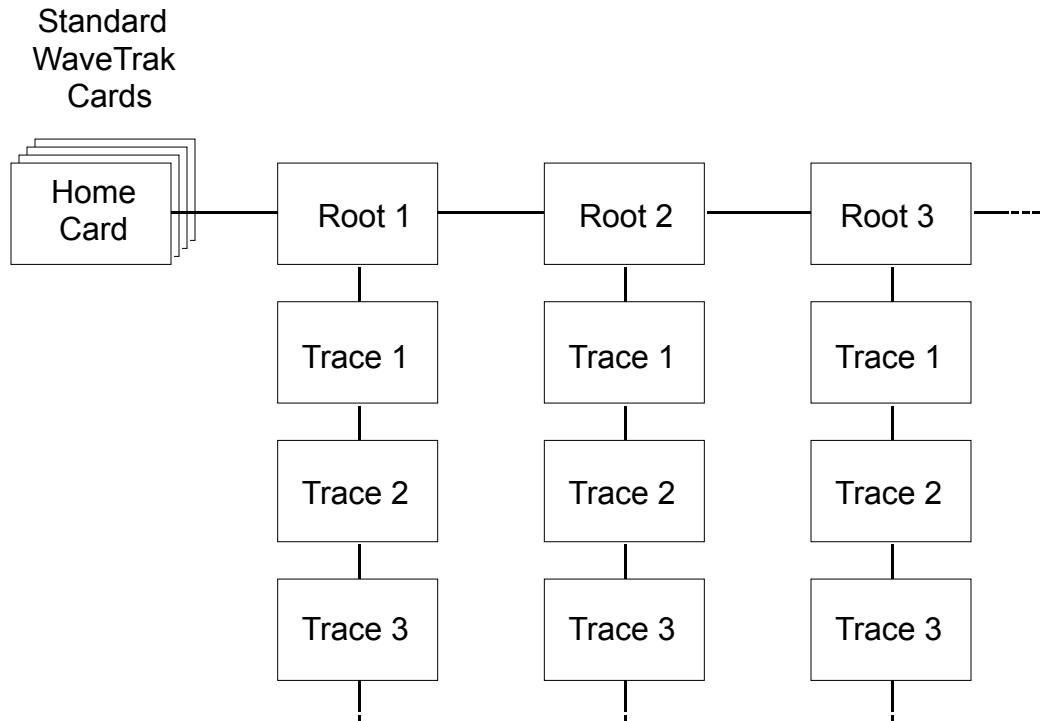


Fig. 4-2: WaveTrak consists of several standard cards, the first being the Home Card. Root cards are arranged in a row to the right of the Home Card. Traces belonging to a root (i.e. to a single experiment) are arranged sequentially below their respective root card; trace cards store digitized signals and other data pertaining to a single acquisition.

WaveTrak Organization

WaveTrak Organization

Organizing the cards in this way, with roots along a single row to the right of the Home Card, and traces arranged in columns below their respective roots, helps to maintain cards in logically related groups, and facilitates navigation around a large stack to quickly find the data you need. The following section explains how to find your way around the WaveTrak stack.

Navigation

The Home Card serves as a "home base", a familiar reference point, and is the first card that comes up when you start WaveTrak. Among other things, it contains a field displaying the titles of all the root cards in the stack, if any. You can always jump directly to the Home Card from anywhere in the stack by selecting it from the 'Go' menu.

Tip:

Pressing Command-1 (⌘-1) will do the same. This is the standard HyperCard keyboard shortcut for jumping to the first card in a stack. This is the only keyboard shortcut we recommend. *Do not use the 'Go Prev' or 'Go Next' commands* since the sequence of cards as far as HyperCard is concerned is different from the logical organization of roots and traces in WaveTrak.

If you have one or more roots already in the stack, two arrow buttons (Fig. 4-3) at the bottom right corner of the Home Card are used to jump to either the first or last root in the stack.

WaveTrak Organization

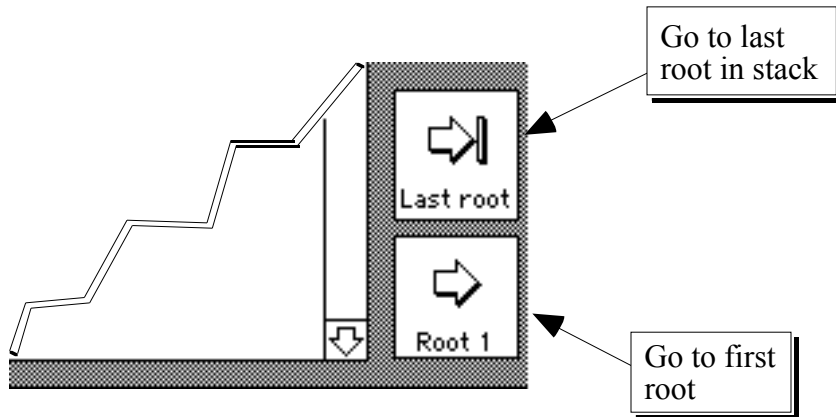


Fig. 4-3: Arrow buttons at the bottom right corner of the Home Card are used to jump to either the first or last root of the stack. These buttons will not appear if you have an empty stack with no roots. You must create the first root by choosing 'New Root' under the 'Edit' menu.

These buttons will not be visible if there are no roots in the stack, such as when you run WaveTrak for the very first time. In this case, you must create the first root by choosing 'New Root' under the 'Edit' menu. Each root card has similar buttons near the bottom right for navigating from root to root (Fig. 4-4). The left and right arrow keys do the same thing as the 'Prev Root' and 'Next Root' buttons, respectively. The up arrow key sends you to the Home Card, and the down arrow goes to the first trace card belonging to this root (see below).

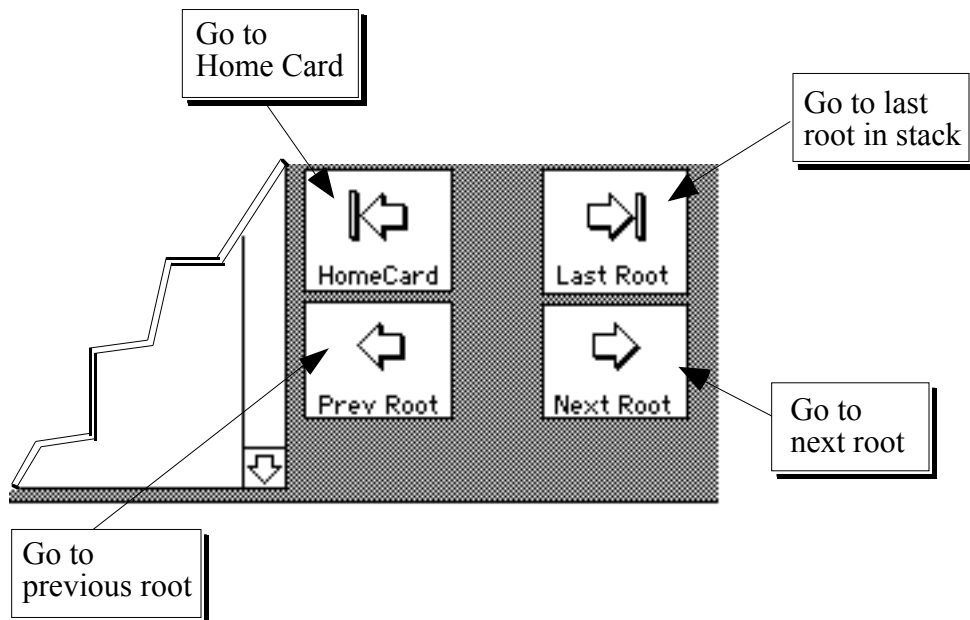


Fig. 4-4: Arrow buttons on each root card allow you to navigate along the top row of root cards (see Fig. 4-2), from root to root.

WaveTrak Organization

If you accumulate many roots in a stack, it becomes awkward to sequentially move from root to root using the arrow buttons. The 'Root Titles' field in the Home Card lists all the titles from each root in the stack, similar to a table of contents in a book. Clicking on a title will send you directly to that root.

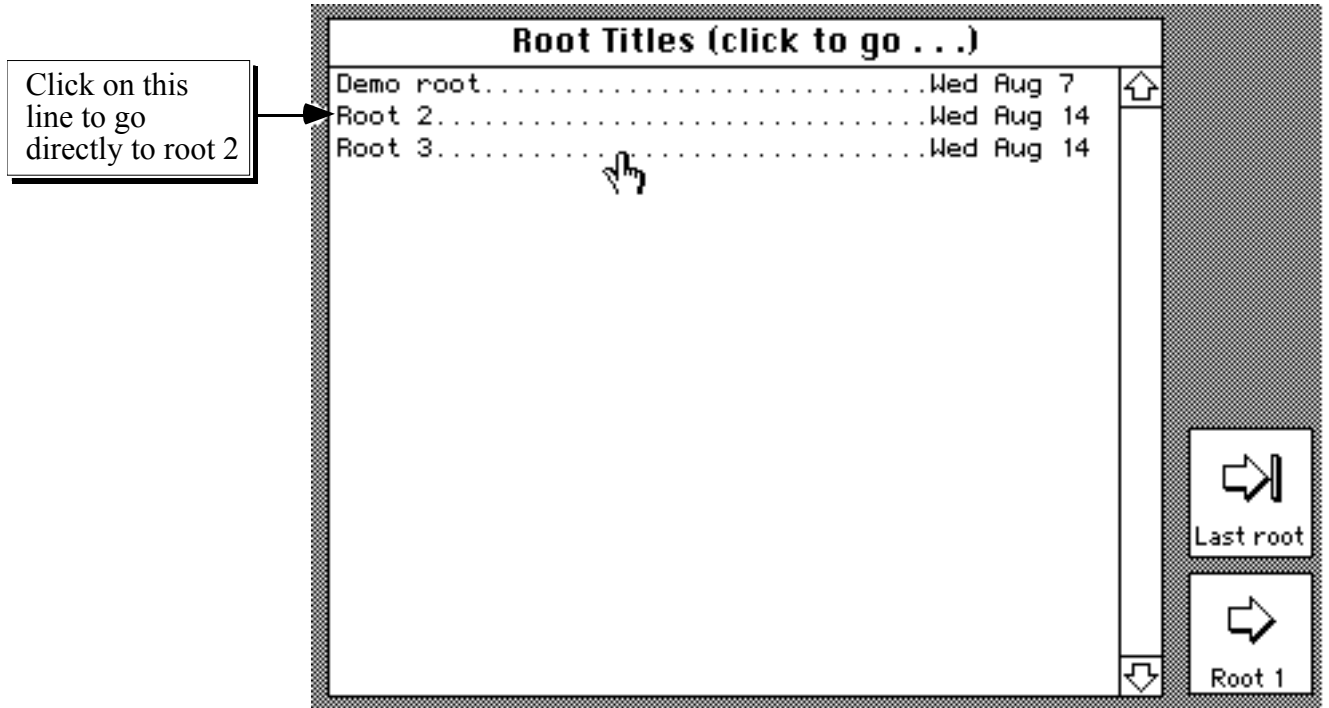


Fig. 4-5: The 'Root Titles' field in the Home Card (see Fig. 6-1) contains titles compiled from each root in the stack, along with its date of creation. In this example, clicking the 'Last root' arrow button will go to the third root, whereas the 'Root 1' button will take you to the first root. To go to the second root directly, click on its title in the field.

When a new root is first created, it has no trace cards. Trace cards are created when you import data from a file or the clipboard, or by acquiring data with the A/D converter. Selecting 'Paste XY' or 'Import XY' from the 'Acq' menu (selecting 'Single' will acquire a single waveform from the A/D converter) will import a single wave and create a new trace card to store it (see the later chapters on how to perform and program data acquisition protocols). The new trace will be placed under the current root. When a root possesses one or more traces, three additional buttons become visible at the bottom right. Two arrow buttons are used to jump to the first or last trace under the current root. Clicking on the

WaveTrak Organization

button named 'Go trace...' brings up a dialog box asking for the trace number you wish to jump to directly.

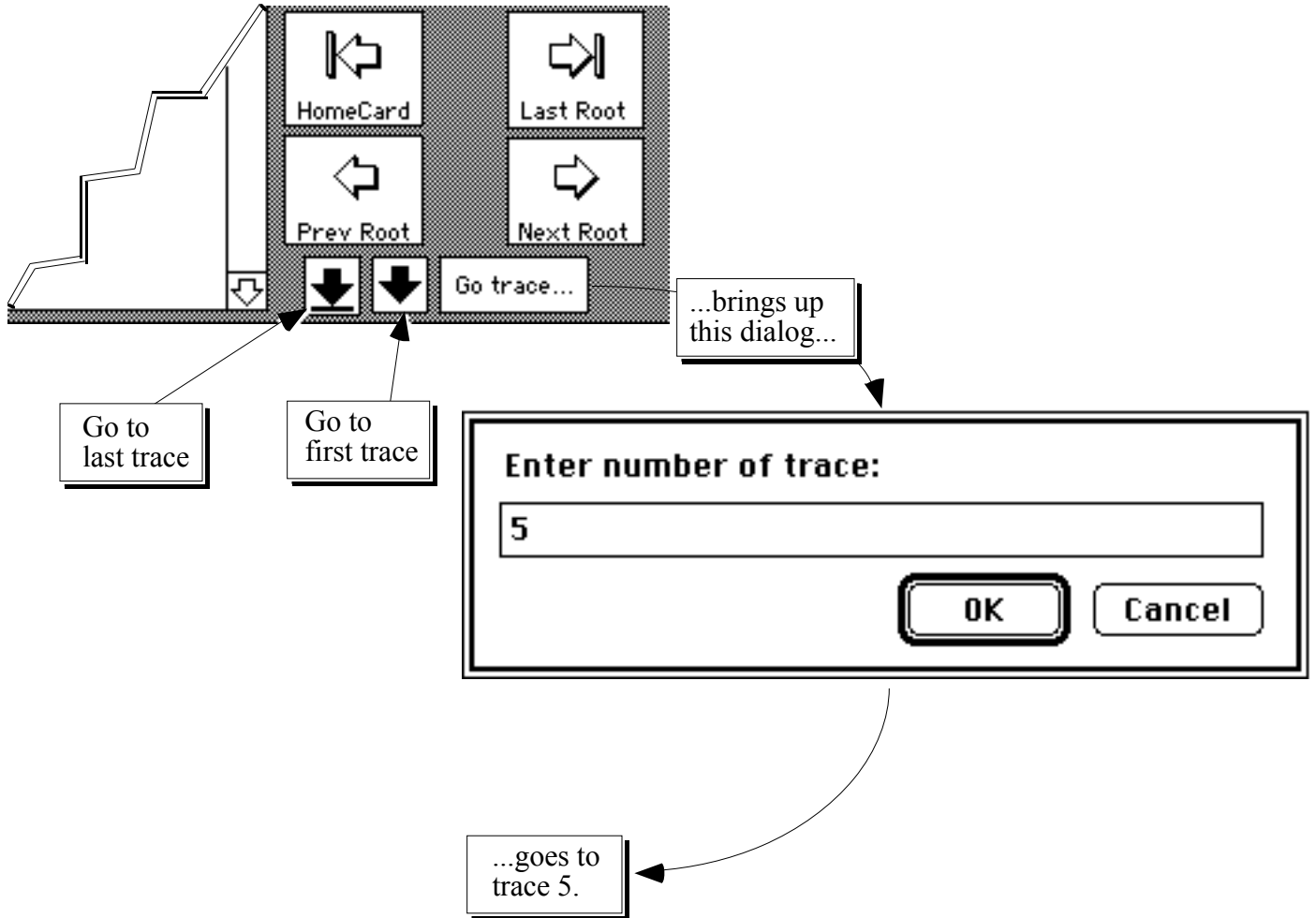


Fig. 4-6: Roots that possess one or more traces have additional buttons. Arrow buttons allow you to jump to the first or last traces under the current root. The 'Go trace...' button asks you which trace number you wish to jump to directly.

Trace cards also have similar arrow buttons to move vertically from trace to trace, directly to the root card, or to the last trace card, as shown in Fig. 4-7. The up and down arrow *keys* will go to the previous and next trace cards, respectively. The 'Go trace...' button allows you to jump directly to any trace card.

WaveTrak Organization

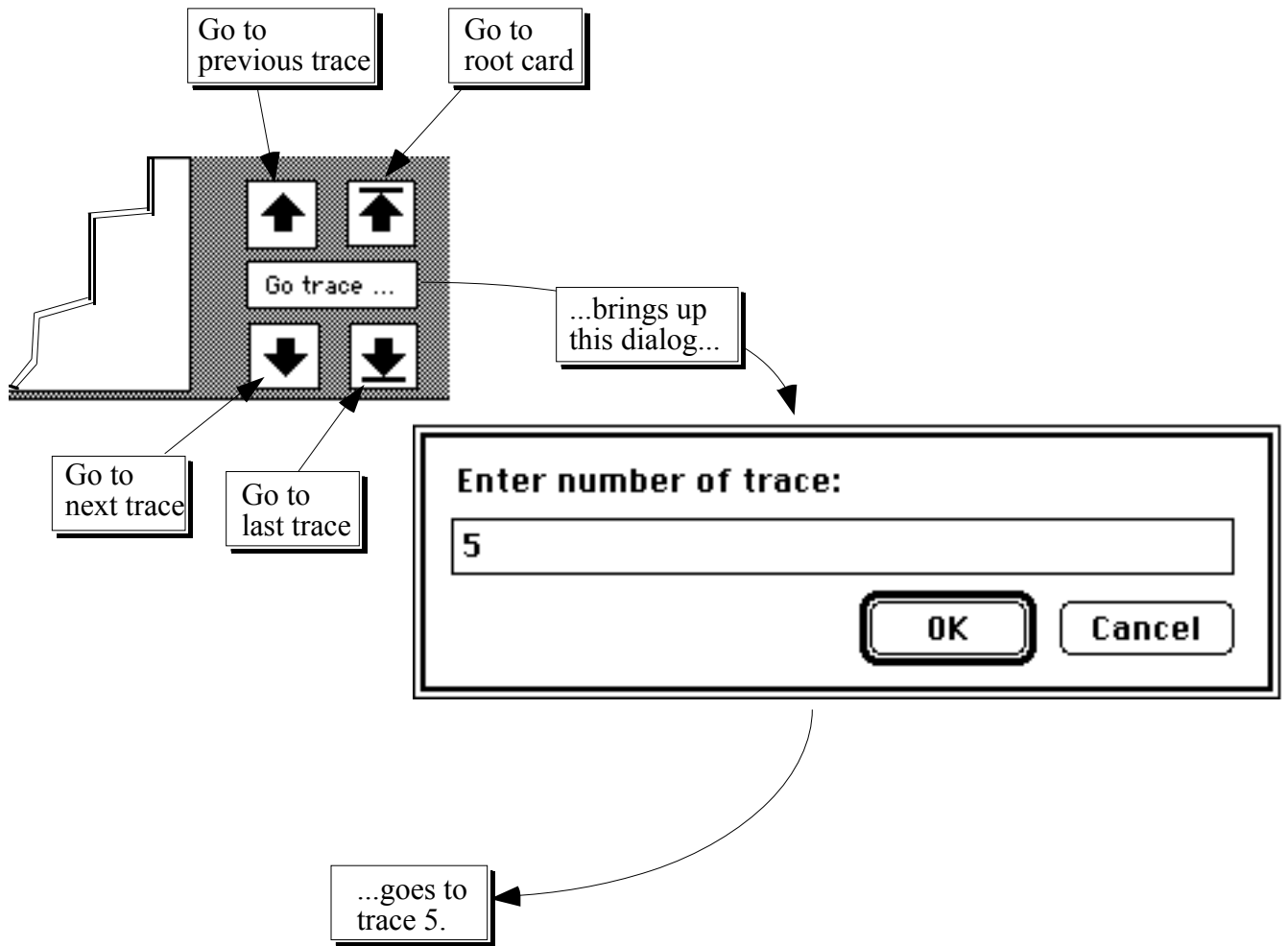


Fig. 4-7: Arrow buttons in trace cards allow you to go to the next or previous traces, to the last trace, or back up to the root card. The 'Go trace...' button will bring up a dialog asking you which trace number you wish to jump to directly.

You cannot move from a trace card under one root directly to another trace card under a different root. Fig. 4-8 summarizes the possible ways you can navigate around the WaveTrak stack.

WaveTrak Organization

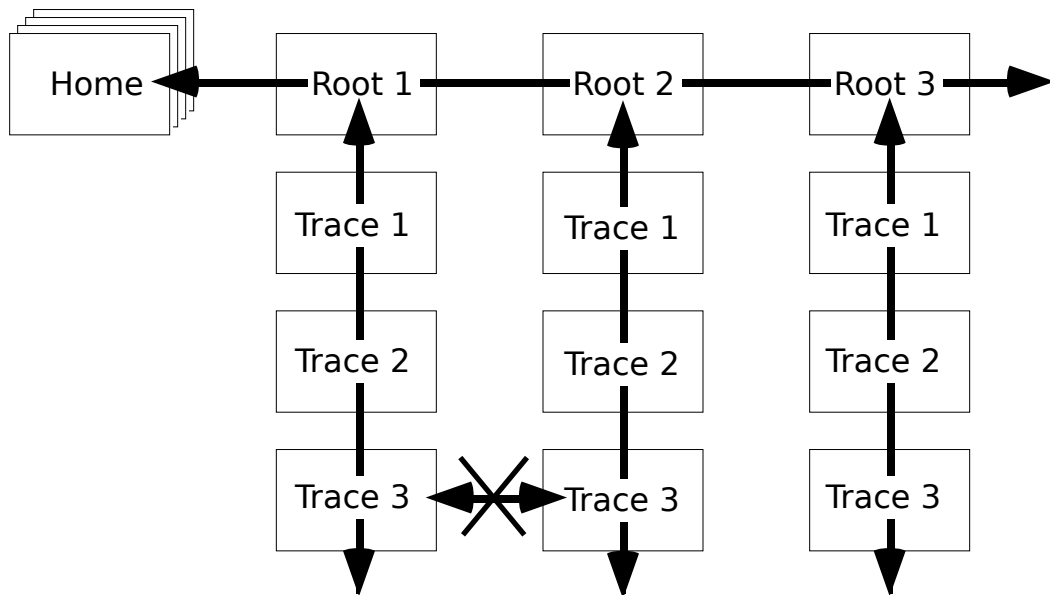


Fig. 4-8: Arrows showing the possible ways of navigating around the WaveTrak stack. You cannot go from a trace card under one root directly to a trace card under another. You must first move up to the root level.

Technical note:

WaveTrak maintains its own map of which trace belongs to which root, and the order of roots and traces. These maps are stored as hidden fields containing card IDs in the Home Card (listing all root cards) and in each root card (listing all traces belonging to that root). These fields are updated automatically for you as your stack grows, and you need not concern yourself with them. However, if these fields should become corrupted for any reason, your stack may be unreadable and you could lose most or all of your data. *Be very careful if you intend to alter the index fields yourself!*

Jumping to the standard cards is usually done with the 'Go' menu. This is discussed in detail for each card in the 'WaveTrak Cards' chapter. Now that you are familiar with the way WaveTrak is organized, the following chapter entitled 'Quickstart' will give you a quick demonstration of the basics of creating roots, acquiring signals and exporting data.

WaveTrak Organization

In Summary

- WaveTrak consists of a number of standard cards which do the housekeeping.
- Roots and traces contain your data
- A root card represents the first card of each new experiment; it contains summary data and comments pertaining to the whole experiment.
- Trace cards are arranged 'under' their root. Each trace card holds one wave along with other information and readings taken at the time, thus completely describing the acquisition.
- You navigate among roots and traces using arrow buttons.
- Standard cards are accessed through the 'Go' menu.