THE HEX EDITOR

INTRODUCTION

This chapter explains the operation of Resorcerer's Hex Editor, which lets you directly edit the byte data in resources of any type.

If you are not already familiar with general resource editing, see the "Editing Resources" chapter earlier in the manual.

TOPICS COVERED

- Opening any resource
- Hex Editor window layout
- Using the Hex Editor
- Editing hex data
- Finding and replacing
- Viewing options
- Printing hex data
- Decompiling hex data

OPENING ANY RESOURCE

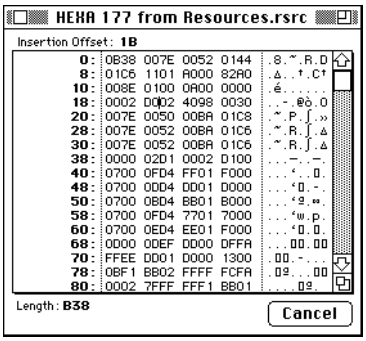
The Hex Editor is a general purpose hexadecimal editor that displays and edits the data from any resource, regardless of type. Internally, all offsets are computed in full 32-bits so that the Editor handles even the largest resources. Your Mac's installed memory will, of course, limit the size of any large resources you can open. Resorcerer's partition size will be a limiting factor also.

Resorcerer calls upon the Hex Editor to edit a resource whenever no other Editor is more appropriate. Since any resource can always be edited in hex, every File Window contains a special **Hex** button that directly opens the resource with the Hex Editor, bypassing any other type-specific editors that Resorcerer would otherwise use when you click in the **Open** button. If there are no appropriate editors for a type, the **Open** button will call upon the Hex Editor as the editor of last resort.

Note: To be consistent with the way Resorcerer identifies Editors, the Hex Editor has a major resource type of 'HEXA'. When you ask Resorcerer to create a new resource, for instance, the 'HEXA' type appears in the New Resource dialog's list of known resources.

HEX EDITOR LAYOUT

Every resource is nothing but a sequence of 0 or more bytes of data. The Hex Editor lets you view this data in its own editing window, showing each 8-bit byte as a pair of hexadecimal digits. The main part of the window is the data display area, which is a scrollable list of lines of hex resource data. In addition, a **Cancel** button lets you throw away any changes you've made and closes the editing window.



There are three parts to each line. On the left, in **boldface**, you can see the offset of the first byte of data in the rest of the line. Initially this offset is shown in hex with respect to the beginning of the resource data; you can set offsets to be in decimal and/or with respect to any other position in the data (see "Viewing Options" later in this chapter).

The central part of each line consists of pairs of hex digits, where each pair represents each byte in the resource data. Every line always has at least one pair of hex digits in it. The Editor separates the hex data into pairs of bytes to indicate where even word boundaries fall.

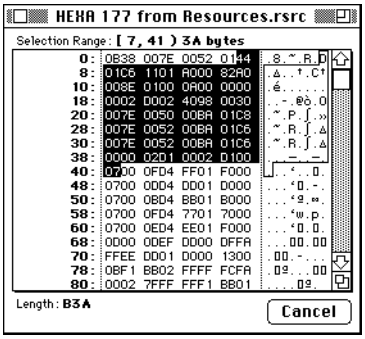
On the right side of each line, the Editor displays the same data in character form. Characters with ASCII values less than $20 (the hex code for the space character) are considered non-printable, and are shown as periods.

To the right of the data is a scroll bar that lets you position your view to any byte offset in the data (see "Scrolling the Hex Data" in the next section).

Above the upper left corner of the scrollable area, the Editor displays information about the current selection. If the selection is empty, then it shows you the position, as an offset from the beginning of the resource, of the blinking insertion caret (in the above illustration, it is at **1B**, in the fourth line from the top). If the selection range is non-empty, you can see the

range's endpoints (again, as offsets from the start of the resource data) followed by the range length. For certain small range lengths, the Editor also decodes and displays the selected data in other formats. The most common of these, for selections of 1, 2, or 4 bytes, is as a decimal number. You may also want to use Resorcerer's **Value Converter** (in the **Edit** menu) to view any 32-bit hex value in a variety of other common formats (for more information on this, see the "Value Converter" chapter later in the manual).

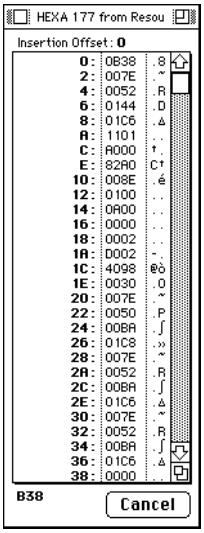
Note: The selection range values are printed enclosed by a square bracket **[** on the left and an open right parenthesis **)** on the right, to indicate that the offset value of the byte at the end of the range is not part of the range, but the first byte *after* the selection.



For example, a range of **[7, 41)** has a length of $41 - $07= $3A bytes, from offset $07 up to but not including the byte at offset $41.

Below the lower left corner of the scrollable area, the Editor shows you the current length of the data, measured in bytes. Initially the value is displayed in hex, but will be in decimal if you have chosen **Decimal Offsets** in the **Hex** menu.

At the bottom of the scroll bar is a grow box that you use to change the size of the editing area and its window to suit your taste. The ZoomBox on the right side of the window's drag bar grows the window to the size of the screen it's on, and back again.



Whatever width you set the window to, the Editor fills each line with as much hex data as will fit. However, lines may end early if you have inserted a line break to start a new paragraph of hex data (for more on this, see the "Marking Paragraphs" section later on in this chapter). The minimum width of the hex data is 2 bytes worth, or four hex digits.

The GoAway box in the window's drag bar closes the resource and saves any changes you may have made to an in-memory copy of the resource, which will be saved to disk when you next save the entire file.

USING THE HEX EDITOR

SCROLLING THE HEX DATA

The value that the scroll bar represents is the offset of the first visible byte of data in the window. This offset is always the one displayed on the left side of the first visible line of data, and it can be either even or odd.

To scroll a windowful at a time, click in the gray area above or below the scroll bar's thumb.

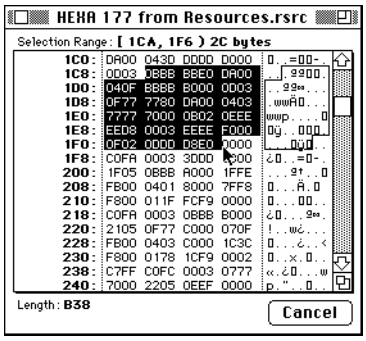
To scroll a line at a time, click on either the up or down arrow in the scroll bar, or tap the up or down arrow cursor key.

To change the view to a given offset, use **Goto/Find/Replace** in the **Hex** menu (described later on in this chapter).

To scroll one byte at a time, hold the Shift key down and click on the scroll bar arrow in the direction you wish to scroll.

Note: When scrolling upward a line at a time, the Editor may need to re-register lines as you scroll across any paragraph boundaries. This causes a complete redraw of the displayed lines.

MAKING SELECTIONS



You can click and drag the mouse to make a selection of any contiguous set of bytes in the resource data. The selection begins at the byte boundary closest to where you clicked the mouse button, and extends to the byte boundary closest to where you let go of the mouse button. Any previous selection will be collapsed.

As you drag the mouse, the current selection is highlighted in both the hex data and to the right in the character

data. The values of the start and end of the range are constantly updated in the upper left corner of the window, so that you can make accurate selections in the middle of lines.

You can start your selection in either the hex data or the character data. When you finish, the selection remains highlighted in the area you started it in, but is left only outlined in the opposite area.

Note: The current selection remains outlined in both areas when the window becomes inactive.

To change the active selection highlight from the hex data to the character data or vice-versa, use **Swap Selection** in the **Hex** menu.

To extend a selection without collapsing it when you click, hold the Shift key down and click the mouse at the new endpoint in the data. If the offset you click on is after the start of the selection, the Editor adjusts the end of the selection to where you click. Otherwise, it adjusts the start of the selection.

To select all the data in the resource, choose **Select All** from Resorcerer's **Edit** menu. To select all the data in a given paragraph, double-click anywhere within the paragraph. If there are no line breaks, then double-clicking is the same as **Select All**.

To move the selection forward or backward by the same amount as the length of the selection, tap either right or left arrow cursor key.

If the start of the selection has been completely scrolled out of the window display, you can tap the Enter key to scroll the display so the start of the selection becomes visible. If the start is already visible but the end of the selection is not, tapping the Enter key will scroll the view so that the end of the selection becomes visible.

THE CURRENT INSERTION POINT

As in other Macintosh text editors, when the selection range is empty, it represents the boundary between two bytes, and is indicated on the screen by a blinking vertical line, called the *insertion caret*. In the upper left corner of the window the Editor constantly shows you the offset of the insertion caret, so that you know exactly where any byte's position is, and exactly where any data may be inserted.

Note: The byte whose offset is the same as the caret's is the byte that occurs just *after* the caret.

The insertion caret appears in either the hex data area or the character data area, but not both. Which area it is in depends on which area you last clicked within. Any typing of text you do is directed at the current editing area, either hex or character, and the characters you type are interpreted differently depending on their destination (for more on this, see the next section, "Editing Resource Data").

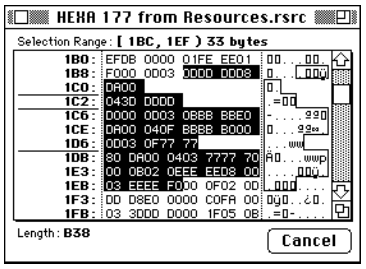
To change the caret from one area to the other while leaving its offset the same, use the **Hex** menu's **Swap Selection** command.

To move the insertion point either forward or backward by one byte position, tap either the right or left arrow cursor key.

MARKING HEX PARAGRAPHS

The Editor supports line breaks at any given offset into the hex data. These let you create paragraphs of data while you're editing which can help you mark and decode groups of bytes that logically belong together, such as an embedded Pascal string, a table, etc. You can also ask the Editor to display line break relative offsets when you choose **Line break relative offsets** from the **Hex** menu (for more on this, see the "Viewing Options" section later in the chapter).

The Editor marks every line break in the offset area to the left of the hex data. This mark is a horizontal line just above the offset of the first byte of the new paragraph. You cannot have more than one line break at any given offset.



To enter a line break, place the insertion caret just in front of the byte you want to begin on a new line, and then tap the Return key.

To surround the current selection with line breaks, tap the Return key once to place a line break at the start of the selection, and then again to insert one at the end of the selection.

The carriage returns you type are not entered as part of your resource data and cannot replace any selected data. The editor maintains a line break table separately from the data. You can temporarily suppress all line breaks when you use **Hide Line Breaks** in the **Hex** menu.

Sorcery: To enter a carriage return as data, place the insertion caret at the proper offset in the character area of the display. Then tap Return while holding the Option key. Or you can place the caret at the proper position in the hex data and type its hex value (0D) directly.

Sorcery: To determine the length of a paragraph, double-click within its bounds to select it. The Editor will then display the length of the selection above the data editing area.

To delete a line break, and thereby merge two paragraphs into one, place the insertion caret to the left of the first byte of the paragraph. This will always be on the leftmost edge of the editing area, either hex or character. Then tap the Delete key *once* to delete the line break.

EDITING HEX DATA

ENTERING NEW DATA

To enter a single byte of data at a particular offset in your resource, place the insertion caret at that offset in the hex data, making sure it's correct by checking the displayed offset value in the upper left of the window. Then type the two hex digits for that byte.

When you type the first hex digit, the Editor inserts a new byte whose low-order 4 bits have the value you've typed, and whose high-order 4 bits are zero. The insertion caret is advanced by two hex digits. However, when you type the second hex digit, the Editor shifts the new byte value over 4 bits, places the second hex digit in the low order 4 bits of the byte, and leaves the caret in place. This lets you enter only the lower order hex digit for hex values whose high-order 4 bits are 0.

If you select any data prior to typing a new value, the selected data is deleted first, so that what you type replaces it.

Sorcery: To enter raw keyboard characters that would otherwise have meaning to the Editor, such as carriage returns, cursor arrow keys, or the Delete key, hold the Option key down and tap the key you want to enter. The insertion caret or selection highlight should be in the character editing area on the right for this to work.

DELETING DATA

To delete a byte of data (which equals 2 hex digits), place the insertion caret just after it on its line, and tap the Delete key once. Or choose **Clear** from the **Edit** menu. You can do this in either the hex data area of the window, or the character data area.

To delete a selection from your data, make the selection in either the hex or character data area, then tap the Delete key. Or choose **Clear** from the **Edit** menu.

CUTTING OR COPYING DATA

To cut or copy a selection from your data, make the selection in either the hex or character data areas, and then choose **Cut** or **Copy** from the **Edit** menu.

If your highlited selection is in the hex data area, the hex digits as a string of text are placed in the Macintosh scrap. You can then paste the hex digits into any other text editing field or application. If, however, the highlighted selection is in the character editing area, the command places the actual character data in the scrap.

PASTING DATA

To paste data into your resource, place the insertion caret at the position in the data where you want to insert the text in the scrap. Then choose **Paste** from the **Edit** menu.

To replace a selection of data with text from the scrap, make the selection and then choose **Paste**. For more on replacing, see the next section, "Finding and Replacing," in this chapter.

Note: The **Paste** command only recognizes text scraps.

If the insertion caret or selection is in the hex data area, then the text you are pasting must consist entirely of hex digits possibly interspersed with white space characters. White space characters include carriage returns, tabs, spaces and non-breaking spaces, and all ASCII control characters. The hex digits can be in either upper or lower case. The Editor will complain and not allow the paste if it encounters any other non-hex digit in the text.

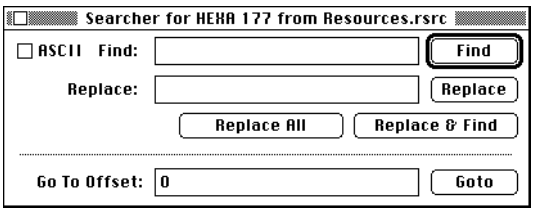
Note: The number of hex digits in any text you want to paste must be even. If it is odd, the Editor will ask if you want to append a final 0 to the text to make it even. Or you can **Cancel** the paste so that you can go back and place the proper hex text into the scrap.

When the insertion caret or selection is in the character data area, then the text you are pasting can consist of any character data, and can be any length (memory permitting).

FINDING AND REPLACING

The **Goto/Find/Replace** command in the **Hex** menu lets you place the Editor's insertion caret at any given offset in the resource data; specify a hex or text string to search for and select; specify a replacement string for any matches of the search string; or replace all such matches at once. This capability is most often used when you want to patch a resource containing compiled code in order to fix a simple bug.

When you choose **Goto/Find/Replace,** the Editor opens a modeless dialog, called the resource's *Searcher* (we thought about calling it the resource's *Finder*, but some fruit company seems to have trademarked that name). The Searcher is designed to let you perform all of the above related activities in one dialog, and to do it easily from the keyboard. Since it is important to be able to see the data in your resource editing window while you are searching, the Hex Editor may rearrange your editing window size and position to keep the two windows from overlapping.



Each separately opened resource can have its own Searcher. Every Searcher contains three text fields and a variety of buttons that let you perform the searching actions. As you interact with different text fields, the appropriate button is highlighted as a default button.

When you are done using a Searcher, click in its GoAway box to close it. The Editor also closes the Searcher when you close the resource it searches.

Sorcery: The Tab key makes the next text field active, and the default buttons track the active text box. This makes it easy to operate the Searcher entirely from your keyboard.

Note: Searchers (and the **Goto/Find/Replace** command) are entirely private to the Hex Editor. They have nothing to do with Resorcerer's **Search All...** command, which cannot search for hex digits, only for text data. However, if your resource has been opened by Resorcerer's **Search All...** command, the Searcher will be initialized to do an ASCII search with the same search string.

SEARCHING FOR DATA

To find a piece of hex in your resource data, enter the hex you are looking for into the text field labeled "Find" at the top of the Searcher. The hex string can be either upper- or lowercase, but should not have any non-hex characters in it. Make sure the ASCII box is not checked, and then click on the **Find** button to find the next instance of the string in your resource.

The Searcher scans for a matching piece of data, beginning at the end of the current selection range. If it finds a match, it selects the matching data and scrolls the display if the selection is not currently showing. If the Searcher can't find a match by the time it has scanned to the end of the resource data, it beeps.

Note: Since the hex data is in a background window, any matching selection will be outlined rather than highlighted.

The ASCII checkbox lets you tell the Searcher whether you want the search string to be interpreted as hex or as ASCII text. When the ASCII box is checked the search string can be any text, and the character data area rather than the hex data area, will be searched.

To reset the position in the data from which to start the search, enter the offset value into the "Go to Offset" field, and click in the **Goto** button (for more on this, see "Going to a Particular Offset" later in this section).

REPLACING DATA

Once you have found a selected section of your data, you can click on the **Replace** button to replace the selection with whatever you enter into the Searcher's "Replace" text field. Again, the replacement string must consist of only upper- or lowercase hex digits if the ASCII box is unchecked, or any text if the ASCII box is checked.

The **Replace** button replaces the selection in your resource data, or, if the selection is empty, it inserts the replacement text at the current position of the insertion caret.

If the replacement text is empty, then **Replace** will delete any selection in your resource data.

REPLACING AND FINDING AGAIN

To replace multiple instances of your search text with a replacement, enter your search text into the "Find" field, and **Find** the first instance of your search text. Then enter the replacement text in the "Replace" field, which will change the default button to **Replace and Find**. You can now repeatedly click in the **Replace and Find** button to make the change and then move on to the next match. If there are no more matches, the Searcher will beep.

To ensure that you have found all matches in the resource data, use the **Goto** button to place the insertion caret at the start of the resource before beginning your searching (for more on this, see "Going to a Particular Offset" later in this section).

REPLACING ALL MATCHES

If you want the Searcher to search for a given string and replace all instances of the search text with a replacement text, begin by resetting the current insertion caret to offset 0. Then enter the two strings in the appropriate "Find" and "Replace" fields, and click once in the **Replace All** button. The Searcher finds all instances and replaces them in your resource with the replace string. When it finishes, it beeps and displays the number of replacements it just made.

Replace All is undoable, unless you are low on memory or the resource is very large.

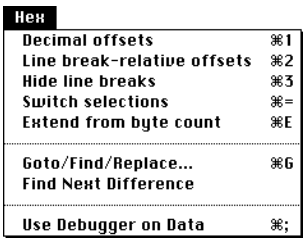
GOING TO A PARTICULAR OFFSET

To place the insertion caret at a given offset in your resource data, type the offset's value into the "Go to Offset" text field. This value should be in hex unless you currently have the **Decimal offsets** mode turned on (see "Viewing Options" later in this chapter for more on this).

When the **Go to Offset** text field is active, the **Goto** button becomes the dialog's default button so that you can tap the Return key to scroll the resource data to the given offset. The byte of data at that offset will be the first visible byte in the hex data area of your resource.

VIEWING OPTIONS

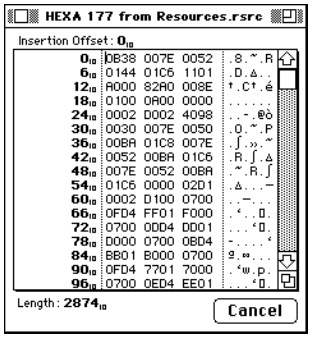
The Editor's **Hex** menu lets you set various viewing options, according to your taste or the task at hand. When a particular mode is in effect, the Editor places a checkmark next to the associated menu command.



DECIMAL OFFSETS

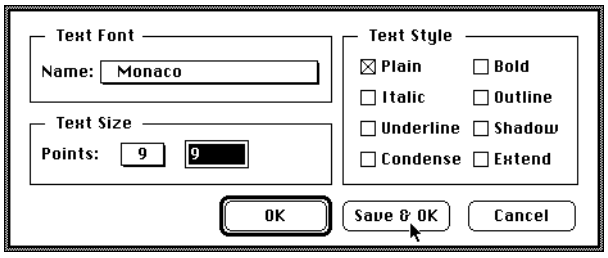
The **Decimal offsets** mode asks the Hex Editor to display offsets, ranges, and lengths in decimal rather than hexadecimal. This also affects the way the Searcher interprets the value you type into its "Go to Offset" field.

This helpful mode is provided for those programmers who have only 10 fingers on their hands.



SET TEXT STYLE

The **Set Text Style...** command in the **Resource** menu lets you view and edit your hex data using any installed font on the Mac. This is useful for larger displays, where a larger fixed width font is easier on the eyes; or for resources with international string data in them. Both the hex and the character areas of the display draw single characters at a time, so if you choose a variable width font, the spacing may be uneven.



If you click on **Save & OK**, the type style you choose is recorded in Resorcerer's preferences file, so that every time you use the Hex Editor it displays with your favorite font. If you click on **OK**, then the change is only temporary.

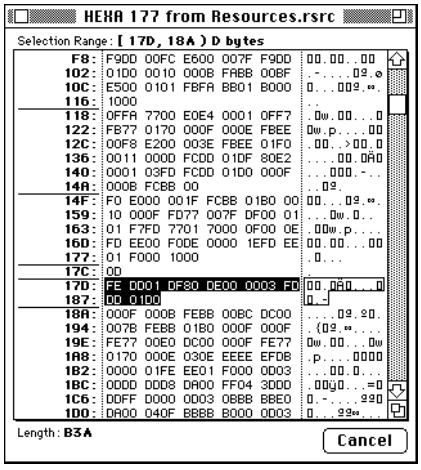
HIDING LINE BREAKS

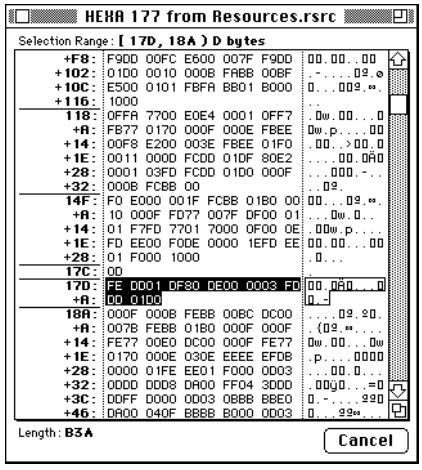
The **Hide line breaks** mode temporarily deletes all line breaks and their associated markings from the display. This is helpful when you need to count hex bytes across paragraph boundaries.

LINE BREAK RELATIVE OFFSETS

The **Line break relative offsets** mode asks the Editor to show you the offsets of data relative to the last line break, instead of relative to the beginning of the resource data.

This is most useful when you need to analyze an embedded structure, such as a table or Pascal string, in the data.





When this mode is in effect, the first byte of every paragraph continues to be displayed relative to the start of the resource, since it would otherwise always be 0 (an elegant but altogether useless piece of information). Subsequent lines in the paragraph have offsets that are preceded by a plus sign '+' to indicate that they are relative to the offset of the beginning of the paragraph.

EXTEND FROM BYTE COUNT

Many embedded structures in resource data begin with a count of the following bytes. Pascal strings, for example, begin with a length byte, followed by that many bytes. The **Extend from Byte Count** command lets you make selections whose length is specified by an initial selection in the data.

For example, to select an embedded Pascal string, first select its initial 1-byte count, and then choose **Extend from Byte Count**. To select an embedded word-length string, select the initial word with the count in it and choose the command. If the selection is empty, then the first byte after the insertion caret is used as the byte count.

FIND NEXT DIFFERENCE

The **Find Next Difference** command operates on two simultaneously opened Hex Editor windows. You can use it to help you track down differences between the two resources that should be the same.

Starting at the end of the current selection in both windows, the command searches forward in the data looking for the first different byte. It then selects that byte in both windows.

USE DEBUGGER ON DATA

If you have a debugger installed in your Mac, such as MacsBug, you can use it to view the resource data to get a better idea of what it means.

To do this, choose **Use Debugger on Data** in the **Hex** menu. This command invokes your debugger by calling `DebugStr` with an argument string that tells you the starting address of the resource data you are currently editing.

In MacsBug, for instance, you can then issue the **IP** or **IL** commands with the data's starting address as the argument.

When you are finished viewing your data from within your debugger, you can get back to the editor when you use the debugger's Go command. In MacsBug, this means simply typing a ⌘G.

Sorcery: Prior to calling the debugger, the Editor locks the handle to the data. This handle is nearly always in the middle of the heap. If you do a Heap Dump (in MacsBug, **HD**) you can usually find the handle easily, since it will be marked as locked, but by itself in the middle of the heap.

PRINTING HEX DATA

To print a copy of your Hex editing session, choose **Print to Printer** from the **File** menu. The printout looks basically the same as the scrollable area of your editing session, printed on as many pages as is necessary.

Any current viewing modes or paragraph breaks remain in effect during printing. You should make sure the editing area is not too wide before printing, otherwise bytes on the right may get clipped.

If no hex pairs are selected, the entire resource is printed. If there is a selection, then only the lines containing the selected pairs are printed.

DECOMPILING HEX DATA

To decompile the hex data you are editing, make sure nothing is selected and choose **Copy** from the **Edit** menu. The Editor decompiles the resource into a Rez declaration of hex data, and the text of this declaration is placed into the clipboard for you to paste directly into your Rez source file.

Each hex paragraph is decompiled as a separate block labeled with its starting and ending offsets within the resource. The maximum width of each hex string is the same as your hex editing window displays. Any current viewing modes or paragraph breaks remain in effect during printing.

Note: Decompiling using the **Copy** command only occurs if no selection is currently in effect. If any bytes in the resource are selected, only those bytes are placed into the clipboard, either as hex text if the selection is in the hex editing area, or as pure text if the selection is in the ASCII editing area.

Sorcery: If you want to decompile only a piece of your resource, mark the boundaries of the section of hex with returns to turn the section into a paragraph, then decompile all paragraphs as above. After you paste the Rez hex strings into your text file, you can then delete from the text all but the paragraph you are interested in.