FW-Z80

User's Guide

This document describes the functions and operations of the Trionyx H8 Panel Monitor Program, FW-Z80, which resides permanently in EPROM on the Z-H8 CPU circuit board. FW-Z80 provides a sophisticated front panel display and keypad executive. It also provides for master clear and interrupt operations. Some of the major features of FW-Z80 are:

1) display and alteration of memory or register contents in Binary, Hexadecimal or Split Octal.

2) display and alteration of all eight Z-80 registers as well as the additional prime registers.

3) unique display of the FLAGS register.

4) extended display of memory contents via register pairs.

5) program execution control, (both breakpoint and single instruction operation).

6) self-contained bootstraps for H17 and H47/Z47 disk systems.

7) port input and output routines.

8) continuous monitoring of data at a port address.

9) support of ORG0 circuitry for standard Heath CPM systems.

In addition to the functions listed above, the FW-Z80 supports all functions and features found in the Heath Front Panel Monitor, PAM-8.

H8 DISPLAYS

The H8 front panel must be understood in order to use FW-Z80. The display is made up of nine digits in three groups of three digits. Each group will display various data depending upon which display mode you are operating in. FW-Z80 automatically initializes the Hexadecimal mode. The information displayed may represent the contents of a designated register or register pair, data contained at an address pointed to by a register pair, the address and data of a memory location itself, or it may be the data and address of an I/O port. The register names are also displayed.

All data are converted to the proper format for display on the H8 front panel. The three formats used are:

      1) split octal

      2) hexadecimal.

      3) binary.

The split octal format is the same as that described in the PAM-8 Panel Monitor manual.

Hexadecimal format splits the nine LED digits on the front panel into three groups of two digits each. The first group uses displays two and three, the second group uses displays four and five. The last group uses displays seven and eight. Each byte is displayed as two standard hexadecimal digits. Group one is used to display the high byte, group two is used to display the low byte, and group three is used to display either data or the register pair indicator. In the port monitor mode, group one displays the data found at the port, while group two displays the port address, (group three will be blank).

Binary format allows only the display of eight bits of data. Display digits two through nine are used to display a one or a zero, (depending on whether the displayed bit is set or reset). Display digit one is used to indicate the register being displayed. (Digit one is blank when displaying data in the memory display mode.) When displaying Z-80 prime registers, the decimal point on display digit one will be set, (on).

H8 DISPLAYS (continued)

The Flags format will result in an F being displayed in the left most
display digit, (digit one). In addition, if the Z80 alternate flag
register is selected, the decimal point in digit one will also be lit.
The individual bits of the flag registers are displayed as letters on
the front panel display. Digits four and six will always be blank.   If
a particular bit in the flags register is not set, the display which
corresponds to that bit will be blank.

If all bits were set, you would expect the following data to be
contained on the front panel display:

DIGIT NUMBER	DATA	DESCRIPTION
ONE	F	FLAG REGISTER INDICATOR
TWO	S	SIGN
THREE	O	ZERO
FOUR	BLANK	
FIVE	H	HALF CARRY
SIX	BLANK	
SEVEN	P	PARITY/OVERFLOW
EIGHT	n	ADD/SUBTRACT
NINE	C	CARRY

H8 KEYPAD

Included with FW-Z8Ø is a replacement keycap label set for the H8 front panel keypad. All functions originally contained in PAM-8, PAMGO, and XCON-8 are retained. The additional functions contained in FW-Z8Ø are outlined on the new label set.

Many of the keys on the keypad have multiple functions. Those unique to FW-Z8Ø will be discussed. Explanation of the other functions can be found by studying the PAM-8 Front Panel Monitor manual.

The "C" key on the keypad serves as the cancel key, function key and the C data key when operating in the Hexadecimal mode. To access the unique functions of FW-Z8Ø, first press the Function key, (C key), then press the desired function, (unique functions are bracketed in the lower left of the key cap labels). For example, to boot from the primary device, simply press "FNCTN" followed by "[BOOT 1]", (FW-Z8Ø also supports the single key boot by pressing the "GO" key). To enter the Split-Octal display mode, press "FNCTN" followed by "[OCTAL]". Likewise, to enter the binary mode, press "FNCTN" followed by "[BINARY]".

To access the IX register of a Z8Ø CPU, simply press "REG", (the F key on the keypad), followed by "IX", (the 7 key on the keypad). NOTE: The "X" portion of the display will be indicated as an "H" on the front panel display. To access the IY register, press "REG" followed by "IY", (the 8 key on the keypad).

Accessing the prime registers of a Z8Ø is a very simple process. Press the "REG" key followed by the "REG'" key, (the A key on the keypad). To return to the standard registers, (i.e. non-prime), press the "REG" key again followed the the "REG'" key. NOTE: Though indicated on the front panel display when in the Prime Register display mode, there are NOT prime sets of IX, IY, SP or PC registers.

To display the flags register in the special flags display mode, press the "REG" key followed by the "FLAGS" key, (the 9 key on the keypad). Alternately, if it is desired to display the alternate flags register, press the "REG" followed by the "REG'" key.

There are two additional features of FW-Z8Ø. The first is the register pair extended display mode. This feature allows the operator to monitor the data at a memory location whose address is contained in the register pair being displayed. For example, to monitor the next instruction to be executed during single step mode perform the following key strokes: Press "REG", "PC" followed by "REG", "XDSP". The first two groups on the front panel display will indicate the contents of the Program Counter while the third group, (digits seven, eight and nine), will display the instuction contained at the memory location pointed to by the Program Counter. Pressing of the "SI" key will now result in the Program counter incrementing to the next executable instruction and displaying that instruction.

The last feature of FW-Z8Ø is the port monitor mode.   In this mode, the operator can monitor the changing data at an I/O port address. This feature must be used with caution as some I/O ports change their status when they are read. To enter this mode, press "MEM" ØØXX, where XX is the I/O port address that is to be monitored. (This assumes you are in the Hexadecimal display mode.) Follow the previous key stroke sequence by pressing "FNCTN" followed by "[PORT]IN".   The right portion of the display panel will blank. Each time the data at the selected port address changes, the new data will be reflected on the first group of display digits. For example, after the system is booted under HDOS, do a return to monitor command by pressing "MEM" and "Ø" simultaneously. Now press "FNCTN", "[OCTAL]", (this will place the system in the split octal mode), now press, in sequence, "MEM", ØØØ35Ø, "FNCTN", "[PORT]IN", "GO". The system has been returned to the HDOS operating system though the front panel and the front panel display is operating in Port Monitor mode. Note that each time a key is pressed on the terminal, the octal equivalent is displayed on the first group of display digits.

DISPLAYING AND ALTERING MEMORY LOCATIONS

Special consideration should be given to displaying and altering memory locations when operating in the Hexadecimal and Binary modes.

The Hexadecimal input/output display mode uses all sixteen keys of the H8 front panel as data entry keys. This creates some unique conditions. When entering into the Memory Display mode, an entire address must be given, (i.e. four hex digits must be entered). Control will automatically return to FW-Z80 after four digits have been entered. This same consideration must be given when altering data at a memory location.

When altering data at a memory location, the alter mode will be indicated by the scanning decimal points on the front panel display. When a byte of data has been entered, (two hex digits), the memory location will increment on the display and the alter mode will cease. To alter the next byte, the operator must press the alter key again. This is due to the fact that all keys on the keypad are being used for data and there is not any way to exit the alter mode when in the Hexadecimal display mode.

As in the PAM-8 Front Panel monitor, the "+" and "-" keys can be used to increment or decrement through memory locations. These two keys cannot be used when in the Hex-Alter mode. In addition, when in Hex mode pressing the "FNCTN" key followed by either a "+" or a "-" will increment or decrement the displayed memory location by one page, (i.e. 256 bytes).

When operating in the binary mode an entire 16 bits for the address must be entered (most significant byte first), and 8 bits must be entered for data, (only the 1 and 0 keys are used to enter data when in the binary mode).

DISPLAYING AND ALTERING REGISTERS

Accessing each of the CPU registers is accomplished in the same manner as with PAM-8. The additional registers are accessed as indicated in the "H8 KEYPAD" portion of this document.

When operating in the binary display mode, any individual 8 bit register may be accessed and displayed. For example, to view the L register in the binary mode, it would first be necessary to enter the binary mode, ("FNCTN","[BINARY]"), then press "REG","HL". This will display the most significant byte of the register pair "HL" (i.e. H). To access the L register, press the "+" key. In a like manner, each of the additional registers may be examined by pressing the "+" or "-" keys to step through each of the registers individually. The register being displayed is indicated on display digit one, (i.e. D for register D, C for the least significant byte of the PC, etc.). The operator must be aware that the "H" register indicator will appear the same as the "X" register indicator. This also applies for the "P" indicator for "SP" and "PC". When in the alternate register mode, (i.e. prime registers), the decimal point of digit number one will be lit. When stepping through the registers, note that the IX register follows the HL register pair and is followed by the IY register and then the PC. When stepping through the registers in the binary mode, the "+" will increment to the next register while the "-" will decrement to the previous register. The table below indicates the order in which the registers will occur if the operator accesses the Stack Pointer register first and is in binary display mode:

	REGISTER	IDENTIFIER
MSB	SP	S
LSB	SP	P
	A	A
	F	F
	B	b
	C	c
	D	d
	E	E
	H	H
	L	L
MSB	IX	I
LSB	IX	H
MSB	IY	I
LSB	IY	y
MSB	PC	P
LSB	PC	c

When in the binary mode, only the register being displayed may be altered. The other byte of a register pair must be accessed before it may be altered. Special consideration must be given when in the hex mode and a register pair is being altered. A four digit entry is required since all keystrokes represent valid digit values.

Keypad Definition

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=================      =================      =================      =================
| IX            |      | IY            |      | Flags         |      | Reg '         |
|               |      |               |      |               |      |               |
|       7       |      |       8       |      |       9       |      |       A       |
|               |      |               |      |               |      |               |
|           SI  |      |         LOAD  |      |         DUMP  |      |           +   |
=================      =================      =================      =================


=================      =================      =================      =================
| DE            |      | HL            |      | PC            |      | XDSP          |
|               |      |               |      |               |      |               |
|       4       |      |       5       |      |       6       |      |       B       |
|               |      |               |      |               |      |               |
|           GO  |      | [PORT]    IN  |      |          OUT  |      |           -   |
=================      =================      =================      =================


=================      =================      =================      =================
| SP            |      | AF            |      | BC            |      | CANCEL        |
|               |      |               |      |               |      |               |
|       1       |      |       2       |      |       3       |      |       C       |
|               |      |               |      |               |      |               |
| [BINARY]      |      | [OCTAL]       |      | [HEX]         |      | FNCTN         |
=================      =================      =================      =================


=================      =================      =================      =================
|               |      | REG           |      | MEM           |      | ALTER         |
|               |      |               |      |               |      |               |
|       0       |      |       F       |      |       E       |      |       D       |
|               |      |               |      |               |      |               |
| [BOOT]        |      | [BOOT 2]      |      |         RTM/0 |      |         RST/0 |
=================      =================      =================      =================
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