

## APPENDIX B SUPER MONITOR

### 1. PARTS LIST

TYPE	NUMBER	QTY	DESCRIPTION
INTEGRATED CIRCUITS			
U6*	*	1	EPROM SUPER MONITOR 2708
CAPACITORS			
C5, C7	10.0 MFD 15V	2	Tantalum
C6, C8	0.1 MFD 50V	2	Ceramic
MISCELLANEOUS			
---	24 Pin Socket	1	Low Profile
---	Apndx B	1	Appendix B

\* May be one of following depending upon order  
1K x 8 EPROM 2708, 2758  
2K x 8 EPROM 2716, TMS 2716, TMS 2516

### 2. ASSEMBLY INSTRUCTIONS

Review the assembly instructions in Appendix A and install the components using the method described. Refer to Figure B1 for the jumper configuration required for the EPROM supplies. Also verify the correct jumpers are installed in areas J1 and J4. Refer to Figure A6.

If you have either the 2708 EPROM or the TMS 2716 EPROM you must supply +12 VDC and -5 VDC  $\pm$  5% (measured AT the SUPER EXPANSION board).

Before installing the EPROM, apply power and verify proper voltages. Then remove power, install the EPROM, apply power and recheck the voltages.

### 3. INITIAL CHECKOUT

Cutting J2 on the SUPER ELF (Refer to Page 7 SUPER ELF connections) disabled the 32 byte monitor (which will not work with an expanded system) and allows the 'M' button to become a 'RUN' with monitor button. By pushing the

'M' button (ALWAYS from a reset state) the SUPER MONITOR starts running and will display 'AA' in the output displays to indicate that it is ready for mode selection. Now you are ready to learn how to use the SUPER MONITOR.

#### 4. Learning To Use the SUPER MONITOR

##### SUPER MONITOR Step-by-Step Instructions

To aid in the learning and understanding of the capabilities of the SUPER MONITOR, a complete set of step-by-step instructions is provided here. Please make every effort to follow these steps closely and observe the results very carefully.

Here are some notes on some symbols and abbreviations used in the instructions:

1. In the hex display boxes, every effort was made to provide the data value that you should see after you perform the step. Sometimes the value is either unpredictable or meaningless. In this case an X or Y was inserted in the appropriate box.
2. The term "enter" means push and release the indicated key(s). For example: Enter "A" means push and release the A key. Enter "AB" means push and release the A key, then push and release the "B" key, in that order.
3. N/C means "No Change From Before".

A. Computer Turn On

1. Turn on Power to Computer  
(or assure that power is already applied).
2. Depress and release the "R" key.      ADD OUT Q LRGW 0123  
xxxx xx • 0000 0000
3. Depress and release the "M" key.      ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

The "AA" indication on the data display is the signal that the monitor is initialized and is ready for executing one of the ten options. Any option can be chosen when the computer has been set up and is ready as in 1, 2, and 3 above.

B. Error Indication and Invalid Option Selection

1. With the computer set up as in "Computer Turn On", push the "I" key but don't release yet.
2. Release "I" key.      ADD OUT Q LRGW 0123  
8088 AA • 0000 0000
3. Enter "O". Note that the rightmost digit (Y) now appears shifted to the next display digit on the left.      ADD OUT Q LRGW 0123  
8888 XY • 0000 0000
4. Enter "B".      ADD OUT Q LRGW 0123  
8888 Ob • 0000 0000
5. Push the "I" key but don't release yet.      ADD OUT Q LRGW 0123  
8088 Ob • 0000 0000

6. Release the "I" key. Note the "Q" LED has come on. The "EE" appears as an indication that an error has occurred since "OB" is an invalid option code.

ADD OUT Q LRGW 0123  
8088 EE 0 0000 0000

7. Suggestion: Repeat steps 1 through 6 for a total of 5 more times but enter "OA" the first time (steps 3 and 4), "OC", the second time, "OD", "OE" and "OF", the third, fourth, and fifth times respectively.

The correct monitor response for all five times is the response of step 6.

8. With the computer set up as in step 6 above, verify that the lights and display is as shown here.

ADD OUT Q LRGW 0123  
8088 EE 0 0000 0000

9. Depress and release the "I" key. Note the Q LED has turned off.

ADD OUT Q LRGW 0123  
8888 XY 0 0000 0000

10. Enter "OB".

ADD OUT Q LRGW 0123  
8888 OB 0 0000 0000

11. Depress and release the "I" key. The response is the same as step 6.

12. Suggestion: Repeat steps 8 through 10 for a total of 5 more times but enter "OA", "OC", "OD", "OE", and "OF" successively, instead of "OB" in step 10. The response each time is the same as in step 6.

The "AA" or "EE" indications are signals that the monitor

is ready for option select. One must depress and release "I" first, which "clears" the "AA" or "EE" from the display and allows the option code entry to be displayed (as it is entered).

All options have a means of aborting as desired or upon performance of the task (except for Option 00) and the signal that an abort or end has occurred is the "AA" indication. Some options can detect errors, and the signal that an error has occurred is the "EE". You sometimes have to use the option 01 to look into the Register Save Area to find out the cause of the error (See Section F).

C. Aborting after Option Selection  
But Before Using the Option

1. Set-up the computer as in Section A Steps 1, 2, and 3.
2. Depress and release the "I" key.
3. Enter "00".
4. Depress and release the "I" key.
5. Depress the "I" key and while holding it in, enter any digit other than "0" (since "0" was last entered in Step 2). For the sake of being definite, use "F". Hold the "F" key down.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

ADD OUT Q LRGW 0123  
8888 XY • 0000 0000

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

6. Release the "I" key.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

7. Release the "F" key.

You are now back to option selection again.

8. Since this might take a bit of practice to get the hang of it, repeat steps 1 through 6, nine more times entering 01 through 09 in step 2 successively. Each time the response will be the same as in Step 7.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

#### D. Option 01 - Memory Inspect

1. Set up the computer as in Section A, Steps 1, 2, and 3.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

2. Depress and release the "I" key.

ADD OUT Q LRGW 0123  
8888 XY 0 0000 0000

3. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

4. Depress the "I" key.

ADD OUT Q LRGW 0123  
8088 01 0 0000 0000

5. Release the "I" key.

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

6. Enter "80".

ADD OUT Q LRGW 0123  
8888 80 0 0000 0000

7. Depress the "I" key. Note the appearance of the "01"; this is the option code selected.

ADD OUT Q LRGW 0123  
8088 01 0 0000 0000

8. Release the "I" key.

ADD OUT Q LRGW 0123  
8888 80 0 0000 0000

You have just entered the high address of memory to

be read out.

9. Depress the "I" key.

ADD	OUT	Q	LRGW	0123
8088	80	•	0000	0000

10. Enter "1".

11. Release the "I" key.

ADD	OUT	Q	LRGW	0123
8088	AA	•	0000	0000

The indication "AA" now is the signal that you are not reading out memory any more, that you have aborted the Option 01 and that the monitor is ready for another selection of an option.

Caution: the "1" entered in step 10 is not the only code that could have been entered to get the results of Step 11. In fact, any of the hexadecimal codes could have been entered except "0". Entering "0" would have no effect and you would have continued to read out memory as you were doing. The rule is that any code can be entered to abort the option as long as it is not the same as the last entry (digit) entered via the keypad. In this case, the last entry made via the keypad was in Step 6, it was an "0", therefore to abort this sequence a different code other than an "0" must be used.

The Steps 9, 10, and 11 can be used anytime in Option 01 to terminate the option.

12. Repeat Steps 1 through 8.

13. Enter "00". (the low address).

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

14. Depress the "I" key. Note the appearance of "80"; this is the high address you previously selected, in step 6.

ADD OUT Q LRGW 0123  
8088 80 • 0000 0000

15. Release the "I" key. The "71" appearing is the first data byte stored in location 8000. This is the first instruction of the monitor itself. Refer to the hexadecimal listing of the monitor code, Figure B-4.

ADD OUT Q LRGW 0123  
8088 71 • 0000 0000

16. Depress the I key. Note the "01"; this is the low address of the next data byte to be displayed when the I key is released.

ADD OUT Q LRGW 0123  
8088 01 • 0000 0000

17. Release the I key.

ADD OUT Q LRGW 0123  
8088 20 • 0000 0000

18. If you wish to verify that the contents of your monitor is the same as on the listing, continue to repeat Steps 13 and 14 until address 83FF is reached.

Caution: The monitor never displays the high portion of the address. To know you have arrived at 83FF you must keep track of the high address by observing the data values displayed when the I key is released, or by making suitable notes on a separate piece of paper. The transition from a given high address to the next (e.g. from 80 to 81) is always accompanied by the "rolling over" of the

address displayed when the I key is depressed, from one depression to the next, from "FF" to "00".

19. To illustrate the caution above, repeat Steps 1 through 14 and get this display.

ADD OUT Q LRGW 0123  
8088 20 0 0000 0000

20. Repeat Steps 13 and 14 a total of 253 more times (checking the display when the I key is depressed will help keep track of the count).

21. Depress the I key.

ADD OUT Q LRGW 0123  
8088 FF 0 0000 0000

22. Release the I key ("AA" is data).

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

23. Now the depression of the I key gives the indication as shown. This is address 8100. You must be aware of this and make a note of it to keep track of the whole address of the data.

ADD OUT Q LRGW 0123  
8088 00 0 0000 0000

24. Release the I key.

ADD OUT Q LRGW 0123  
8088 D 0 0000 0000

25. Abort the option 01 by following Steps 9, 10, and 11 taking care to use a digit in Step 10 that is not the same as the last digit previously entered via the keypad.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

Note: The last digit entered was in Step 13.

#### E. Alternate Option Code Entry

- With the computer set-up as in Section C steps 1 or 2 or step 24, depress and release the I key.

ADD	OUT	Q	LRGW	0123
8888	XY	•	0000	0000

- Enter "11".

ADD	OUT	Q	LRGW	0123
8888	11	•	0000	0000

- Depress the I key.

ADD	OUT	Q	LRGW	0123
8088	11	•	0000	0000

- Release the I key.

ADD	OUT	Q	LRGW	0123
8888	11	•	0000	0000

- Enter "80".

ADD	OUT	Q	LRGW	0123
8888	80	•	0000	0000

- Depress the I key. Note the appearance of the 01 and not 11 as entered in Step 2. The monitor only needs the lower digit entered for option selection.

ADD	OUT	Q	LRGW	0123
8088	01	•	0000	0000

- Enter "00".

ADD	OUT	Q	LRGW	0123
8888	00	•	0000	0000

- Depress the I key. The option 01 has been entered and the read out of the monitor code, can proceed.

ADD	OUT	Q	LRGW	0123
8088	80	•	0000	0000

ADD	OUT	Q	LRGW	0123
8088	71	•	0000	0000

#### F. Using the Register Save

- Set-up the computer as in Section A, Steps 1, 2 and 3. Depress the I key.

ADD	OUT	Q	LRGW	0123
8888	XY	•	0000	0000

- Enter "01", Depress and release the I key.

ADD	OUT	Q	LRGW	0123
8888	01	•	0000	0000

- Enter "98", depress and release the I key.

ADD	OUT	Q	LRGW	0123
8088	98	•	0000	0000

4. Enter "DO", depress and release the I key.

ADD OUT Q LRGW 0123  
3088 XY • •••• 00••

5. Record the data in a Table which can be arranged something like this: (The codes in parentheses are the low addresses of the save area)

RO (EO)	—	—	(DO)
R1 (E1)	—	—	(D1)
R2 (E2)	—	—	(D2)
R3 (E3)	—	—	(D3)
R4 (E4)	—	—	(D4)
R5 (E5)	—	—	(D5)
R6 (E6)	—	—	(D6)
R7 (E7)	—	—	(D7)
R8 (E8)	—	—	(D8)
R9 (E9)	—	—	(D9)
RA (EA)	—	—	(DA)
RB (EB)	—	—	(DB)
RC (EC)	—	—	(DC)
RD (ED)	—	—	(DD)
RE (EE)	—	—	(DE)
RF (EF)	—	—	(DF)

Record the data in the top right hand side of the table.

6. Depress and release the I key fifteen more times and enter the data into the table on each of the next fifteen places on the right hand side of the table. These 16 readouts of data are from address 98DO through 98DF and come from the low half of the 16 scratch registers of the computer. The data was copied from the registers by the monitor and stored

into the Save Area just prior to the appearance of the "AA" on the display and represents the state of the registers from just before the call for the "AA" occurred, however it happened. (For example, from an abort of an option) the data from Register 0 and 2 are not saved.

7. Repeat Step 4 sixteen more times and enter each data value in the left hand side of the table starting from top to bottom. These values now have been read out of addresses 98E0 through 98EF and come from the high half of the 16 scratch registers.

8. Read across the table from left to right to get a four hex digit number representing the previous contents of each scratch register. Register 2 is the only number which will always be the same, namely 98D1.

9. To illustrate the use of the Register Save, repeat Section B Steps 1 through 6.

ADD	OUT	Q	LRGW	0123
8088	EE	O	0000	0000

10. Depress and release the I key.

ADD	OUT	Q	LRGW	0123
8888	0b	O	0000	0000

11. Enter "01". Depress and release the I key.

ADD	OUT	Q	LRGW	0123
8888	01	O	0000	0000

12. Enter "98". Depress and release the I key.

ADD	OUT	Q	LRGW	0123
8888	98	O	0000	0000

13. Enter "D0". Depress and release the I key.

ADD	OUT	Q	LRGW	0123
8888	82	O	0000	0000

14. Record the "82" in a table as suggested in Step 5.
15. Repeat steps 6 and 7 until the table is filled in.
16. Verify the following values are in the table for the given registers:

Reg	0	8082
"	2	98D1
"	3	830E
"	4	0B0B

"	A	805F
"	B	80D0
"	C	8068
"	D	80A1
"	E	8060

The fact that Reg 3 reads 830E indicates that the prior state of the monitor was in an error condition due to invalid option code selected. The invalid option code selected can be read from the high (and low) data from register 4. In this case, "OB".

Register 0 has a typical value for an error condition. It may also be 8084 (but not here). Register A also reads 805F which is a typical value for an error condition.

Register B contains the address into the option table within the monitor and is pointing to the position for option OB which since it is invalid, gives an error exit. Registers C,

D and F contain the addresses of three subroutines used in the monitor (see the section of this Appendix titled "Monitor Subroutines and Usage").

#### G. Option 02 Memory Loading

1. Repeat the computer set up as in Section A Steps 1, 2 and 3.

ADD	OUT	Q LRGW 0123
<u>8088</u>	AA	• 0000 0000

2. Depress and release the I key.

ADD	OUT	Q LRGW 0123
<u>8888</u>	XY	• 0000 0000

3. Enter "02".

ADD	OUT	Q LRGW 0123
<u>8888</u>	02	• 0000 0000

4. Depress the I key.

ADD	OUT	Q LRGW 0123
<u>8088</u>	02	• 0000 0000

5. Release the I key.

ADD	OUT	Q LRGW 0123
<u>8888</u>	02	• 0000 0000

6. Enter "01", the high address of where we will be loading into memory.

ADD	OUT	Q LRGW 0123
<u>8888</u>	01	• 0000 0000

7. Depress the I key. The "02" is the Option Code selected indication.

ADD	OUT	Q LRGW 0123
<u>8088</u>	02	• 0000 0000

8. Release the I key.

ADD	OUT	Q LRGW 0123
<u>8888</u>	01	• 0000 0000

9. Enter "00", the low address of loading.

ADD	OUT	Q LRGW 0123
<u>8888</u>	00	• 0000 0000

10. Depress the I key. The "01" is the previous high address.

ADD	OUT	Q LRGW 0123
<u>8088</u>	01	• 0000 0000

11. Release the I key. Note the Q LED has come on.

ADD	OUT	Q LRGW 0123
<u>8888</u>	00	0 0000 0000

This indicates that we are ready to load into memory.

12. Enter "EF".

ADD OUT Q LRGW 0123  
8888 EF O 0000 0000

13. Depress the I key. The "00" is the low address into which the "EF" will be loaded.

ADD OUT Q LRGW 0123  
8088 00 O 0000 0000

14. Enter "D".

15. Release the I key.

ADD OUT Q LRGW 0123  
8088 AA O 0000 0000

As in Section D Steps 9, 10 and 11 you are back to the monitor for option selection. By depressing I and holding it in, then entering a digit different than the last digit entered, you may abort the option 02 anytime. The data just previously entered (as in step 12) will not be loaded into memory.

16. Repeat Steps 1 through 11.

ADD OUT Q LRGW 0123  
8888 00 O 0000 0000

17. Enter "7B".

ADD OUT Q LRGW 0123  
8888 7B O 0000 0000

18. Depress the I key. As before in Step 13, the "00" is the low address into which the data (the "7B") will be loaded.

ADD OUT Q LRGW 0123  
8088 00 O 0000 0000

19. Release the I key. The "7B" is now loaded into address 0100.

ADD OUT Q LRGW 0123  
8888 7B O 0000 0000

20. Repeat steps 17, 18 and 19 a total of 12 more times

but enter the data given below instead of the "7B" in step 17 and verify the address displayed as in Step 18 is as shown below for each entry:

Step 17	Step 18
Entry	Address Display

F8	01
47	02
B1	03
21	04
91	05
3A	06
04	07
39	08
00	09
7A	0A
30	0B
01	0C

ADD	OUT	Q LRGW 0123
8888	01	• 0000 0000

ADD	OUT	Q LRGW 0123
8088	AA	• 0000 0000

21. Depress the I key and repeat steps 14 and 15, noting that any hex code can be entered except "1".

22. Using Section D step-by-step instructions as a guide, use Option 01 to read out and verify locations 0100 through 010C, that they contain the data loaded in steps 17 through 20.

The data loaded in steps 17 through 20 are the instructions of a program which when executed causes the Q LED to blink on and off at the rate of approximately one time per second indefinitely. The "47" in location 0102 is the time constant and can be varied to speed up or slow down the blinking rate. Section

H will show how to get this program working by using the Monitor Option 00.

23. Depress and release the R key.

ADD OUT Q LRGW 0123  
8080 AA 0 0000 0000

24. Depress and release the L key.

ADD OUT Q LRGW 0123  
8080 AA 0 0000 0000

25. Enter "CO". Depress and release I key.

ADD OUT Q LRGW 0123  
0000 CO 0 0000 0000

26. Enter "01". Depress and release I key.

ADD OUT Q LRGW 0123  
0001 01 0 0000 0000

27. Enter "00". Depress and release I key.

ADD OUT Q LRGW 0123  
0002 00 0 0000 0000

28. Depress and release R key.

ADD OUT Q LRGW 0123  
0000 00 0 0000 0000

29. Depress and release the G key. The Q LED will blink as stated above in step 22.

ADD OUT Q LRGW 0123  
8888 00 0 0000 0000

#### H. Option 00 Program Execute

1. Repeat the computer set-up as in Section A, Steps 1, 2 and 3.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

2. Reload memory per Section G, steps 16 through 21 or verify that memory addresses are loaded per Section G step 22.

3. Repeat Section G, Step 21.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

4. Depress and release I key.

ADD OUT Q LRGW 0123  
8888 XY 0 0000 0000

5. Enter "00".

ADD OUT Q LRGW 0123  
8888 00 0 0000 0000

6. Depress I key.

ADD OUT Q LRGW 0123  
8088 00 0 0000 0000

7. Release the I key.

ADD OUT Q LRGW 0123  
8888 00 0 0000 0000

8. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

9. Depress the I key. The "00" is the option 00 code selected indication.

ADD OUT Q LRGW 0123  
8088 00 0 0000 0000

10. Release the I key.

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

11. Depress the I key and while holding the I key down, enter "2". Then release the I key.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

This is, as with Options 01 and 02, the technique to abort the option and can be used in Option 00 until the final I key release before program execution, as in Step

12. Repeat Steps 4 through 10.

ADD OUT Q LRGW 0123  
8088 01 0 0000 0000

13. Enter "00".

ADD OUT Q LRGW 0123  
8088 00 0 0000 0000

14. Depress the I key. While holding it down you may abort option 00 and go back to the monitor; but if not, releasing the I key will start the program to execute which was loaded in locations 0100 through 010C.

15. Release the I key. Note

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

that the high digit of the address display changes at a rate twice that of the blinking of the Q LED.

16. At this point, the only way to get back to the monitor (unless the program does it, which it doesn't) is to repeat Section A steps 2 and 3.

## I. Option 03, Block Move

1. Repeat the computer set-up as in Section H, steps 1 and 2.
2. Depress and release the I key.
3. Enter "03".
4. Depress and release the I key.
5. Enter "01".
6. Depress the I key. The "03" is the option selection indication.
7. Release the I key.
8. Depress the I key and while holding it down, enter "3". Release the I key.

As with the other options above, this is the technique to abort this option. It is available until the

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

ADD OUT Q LRGW 0123  
8888 XY 0 0000 0000

ADD OUT Q LRGW 0123  
8888 03 0 0000 0000

ADD OUT Q LRGW 0123  
8888 03 0 0000 0000

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

ADD OUT Q LRGW 0123  
8088 03 0 0000 0000

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

last I key stroke.

9. Repeat steps 2-7.

ADD OUT Q LRGW 0123  
8088 01 • 0000 0000

10. Enter "00".

ADD OUT Q LRGW 0123  
8088 00 • 0000 0000

11. Depress the I key. The "01" is the high address of the start of the data to be moved.

ADD OUT Q LRGW 0123  
8088 01 • 0000 0000

12. Release the I key.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

13. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

14. Depress the I key. The "00" is the low address.

ADD OUT Q LRGW 0123  
8088 00 • 0000 0000

15. Release the I key.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

16. Enter "OC".

ADD OUT Q LRGW 0123  
8888 OC • 0000 0000

17. Depress the I key. The "01" is the high address of the end of the data to be moved.

ADD OUT Q LRGW 0123  
8088 01 • 0000 0000

18. Release the I key.

ADD OUT Q LRGW 0123  
8888 OC • 0000 0000

19. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

20. Depress the I key. The "OC" is the low address of the end of the data to be moved.

ADD OUT Q LRGW 0123  
8088 OC • 0000 0000

21. Release the I key.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

22. Enter "OD".

ADD OUT Q LRGW 0123  
8888 OD • 0000 0000

23. Depress the I key. The "01" is the high address of the start of where the data will be moved. This is the last chance to abort this option (refer to step 8 if you so wish).
- ADD OUT Q LRGW 0123  
8088 01 • 0000 0000
24. Release the I key. The data previously loaded in memory 0100 through 010C has now been copied into memory 010D through 0119.
- ADD OUT Q LRGW 0123  
8088 AA • 0000 0000
25. Depress and release the I key.
- ADD OUT Q LRGW 0123  
8888 0d • 0000 0000
26. Verify that the data was moved properly by using Option 01. The start address is 010D. The data from that location to 0119 should match the data entered in Section G, steps 19 and 20.

#### J. Option 04, Record on Cassette

1. Repeat the computer set-up as in Section H, steps 1 and 2.
- ADD OUT Q LRGW 0123  
8088 AA • 0000 0000
2. Depress and release the I key.
- ADD OUT Q LRGW 0123  
8888 XY • 0000 0000
3. Enter 04. Depress and release I key.
- ADD OUT Q LRGW 0123  
8888 04 • 0000 0000
4. Depress the I key, while holding it down, enter "D" and release the I key. This is the method to abort this option until you perform Step 18 below. The technique from there on
- ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

will be merely to depress I.

5. Repeat Steps 1, 2 and 3.

ADD OUT Q LRGW 0123  
8888 04 • 0000 0000

6. Enter "01".

7. Depress the I key. The "04" is the option selection indication.

ADD OUT Q LRGW 0123  
8888 04 • 0000 0000

8. Release the I key.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

9. Enter "00".

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

10. Depress the I key. The "01" is the high address as entered in step 6 for the beginning of the data for recording.

ADD OUT Q LRGW 0123  
8088 01 • 0000 0000

11. Release the I key.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

12. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

13. Depress the I key. The "00" is the low address as entered in Step 9.

ADD OUT Q LRGW 0123  
8088 00 • 0000 0000

14. Release the I key.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

15. Enter "0C".

ADD OUT Q LRGW 0123  
8888 0C • 0000 0000

16. Depress the I key. The "01" is the high address of the end of data to be recorded as entered in step 12.

ADD OUT Q LRGW 0123  
8088 01 • 0000 0000

17. Release the I key.

ADD OUT Q LRGW 0123  
8888 0C • 0000 0000

18. Depress and release the I key. Note that the Q LED is on.
- ADD OUT Q LRGW 0123  
8888 01 0 0000 0000
19. Within 10 seconds depress the I key. This is the technique to go back to the monitor any time until the recording process is through.
- ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000
20. Repeat steps 3 through 17.
- ADD OUT Q LRGW 0123  
8888 OC 0 0000 0000
21. Depress and release the I key. After 10 seconds, note that the data display flickers and steadies at "OC" then after 5 seconds the display becomes like step 19.
22. Repeat steps 5 through 17.
- ADD OUT Q LRGW 0123  
8888 OC 0 0000 0000
23. With the cassette recorder loaded with tape and the tape rewound, start the recorder in the record mode. Then depress and release the I key.
24. Observe when the lights and display are like this the recording is finished.
- ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000
25. To verify the recording, disconnect the tape recorder, rewind the tape and play back on audio (turn the volume down). Note the 10 second leader tone of about 2400 hertz, a brief "grinding" noise and 5 seconds of 800 hertz tone. The amount of data recorded was small. Try recording longer stretches of data,

say from 0000 to OFFF.  
Then listen to the playback.  
The same 10 second leader  
will precede the "grinding"  
sounds of the data. The  
data records at a rate of  
about 133 bytes per second  
so 4000 bytes should take  
around 30 seconds. Following  
the data will be  
the 5 seconds of trailer  
tone.

26. Save the recording of steps  
22 through 24.

K. Option 08: Automatic Compare -  
Tape to Memory

1. Repeat the computer set-up  
as in Section H, Steps 1  
and 2.

ADD OUT Q LRGW 0123  
8088 AA 0 0000 0000

2. Depress and release the I  
key.

ADD OUT Q LRGW 0123  
8888 XY 0 0000 0000

3. Enter "08". Depress and  
release the I key.

ADD OUT Q LRGW 0123  
8888 08 0 0000 0000

4. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

5. Depress the I key. The  
"08" is the option selec-  
tion code.

ADD OUT Q LRGW 0123  
8088 08 0 0000 0000

6. Release the I key. The  
monitor is now cycling  
looking for a leader tone.  
The tape recorder is now  
started so it will wait in-  
definitely. The "00" in-  
dication says no file has  
been found yet.

ADD OUT Q LRGW 0123  
8888 00 0 0000 0000

7. Depress and release the I key. This is the technique to abort this option and can be used until the option finishes its work.
- ADD OUT Q LRGW 0123  
8088 AA • 0000 0000
8. Load and rewind the tape made in Section J, steps 22-24.
9. Make sure the volume is up full and the tone control is at the maximum (maximum high).
10. Repeat steps 2, 3 and 4.
- ADD OUT Q LRGW 0123  
8888 01 • 0000 0000
11. Start the tape recorder, depress and release the I key.
- ADD OUT Q LRGW 0123  
8888 00 • 0000 0000
- If you get this indication before the ten second leader has played out, it is possible that random noise triggered the leader search routine prematurely. This can happen if the recorder is started with the plastic leader by the playback head. Rewind the tape, repeat steps 2, 3 and 4. Repeat this step but wait for a few seconds before starting the playback.
- ADD OUT Q LRGW 0123  
8088 EE • 0000 0000
12. At the end of ten seconds of the leader, the data will compare, giving this indication.
- ADD OUT Q LRGW 0123  
8088 AA • 0000 0000
13. Rewind the tape, depress and release the I key, enter "08", depress and release I, enter "02".
- ADD OUT Q LRGW 0123  
8888 02 • 0000 0000

14. Follow the caution in step 11 and repeat step 11. At the point when the data compared as indicated in step 12, the display will indicate as shown.

ADD OUT Q LRGW 0123  
8088 01 • 0000 0000

The "01" means that the monitor has found file 1. If you have recorded on a brand new tape, you can let the tape keep playing and no more indication will result. Depress and release I.

15. Using Option 02, load an "FF" into memory location 0100. Abort the option and get the standard indication.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

16. Repeat steps 2, 3 and 4. Rewind the tape and following the caution of Step 11, start the tape playing back.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

17. Depress the release the I key.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

18. After the 10 seconds of leader has elapsed, the monitor will detect the "error" due to step 15. Normally this indication will be due to a bad recording and you must repeat the recording.

ADD OUT Q LRGW 0123  
8088 FF 0 0000 0000

19. Using Option 02, reload "7B" into memory location 0100. (Suggestion: merely depress and release I and enter the option code, and so on).

20. Repeat steps 16 and 17. When the "AA" again appears, stop the recorder. Following the steps 22, 23 and 24 of Section J, record another file of data.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

21. Following steps 2, 3 and 4, enter "02" instead of "01". Rewind the tape and following the caution of step 11, start the tape playing back.

22. Depress and release the I key. The indications will appear as in step 17, then will change to at the end of the leader for file 1. Then when encountering file 2, the comparison of tape to memory will occur.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

#### L. Option 07 Automatic Playback

1. Perform Section K before this section and load the tape as recorded in step 20 into the cassette recorder.

2. Remove power from the computer or verify that location 0100 through 0119 do not contain the data loaded in Section H.

3. Repeat steps 1, 2 and 3 of Section A.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

4. Depress and release the I key.

ADD OUT Q LRGW 0123  
8888 XY • 0000 0000

5. Enter "07". Depress and release the I key.

ADD OUT Q LRGW 0123  
8888 07 • 0000 0000

6. Depress the I key.

ADD OUT Q LRGW 0123  
8088 07 • 0000 0000

7. Enter "F" and release the I key. This is the back-to-monitor abort for this option. This technique may be used up until after the I key stroke for file number and go entry. After that, merely depressing the I key will abort this option.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

8. Repeat steps 4 and 5.

ADD OUT Q LRGW 0123  
8888 07 • 0000 0000

9. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

10. Depress the I key. The "07" is the option code indication.

ADD OUT Q LRGW 0123  
8088 07 • 0000 0000

11. Release the I key. The indication and effect is the same as in Section K, step 6.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

12. Depress and release the I key. This is, of course, the abort as pointed out in Step 7.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

13. Repeat steps 4, 5 and 9.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

14. Make sure the tape is rewound in the tape recorder. Observing the caution in section K, step 11, start the tape recorder.

15. Depress and release the I key.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

16. Before 10 seconds are up,

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

depress and release the I key.

17. Repeat steps 4, 5, 9, 14 and 15 and allow the operation to proceed.

ADD	OUT	Q	LRGW	0123
8888	00	•	0000	0000

18. When the display reads "AA", the playback is done. If an "EE" appears, try playing back again. If that doesn't work, re-check the recording in Section J and the compare made in Section K. In any case the careful following of those sections will guarantee a playback in this section.

19. Using Option 01, verify that the data was played back into locations 0100 through 010C as previously entered in Section G, steps 19 and 20.

20. Repeat steps 2, 3, 4 and 5.

ADD	OUT	Q	LRGW	0123
8888	07	•	0000	0000

21. Enter "02".

ADD	OUT	Q	LRGW	0123
8888	02	•	0000	0000

22. Repeat steps 14 and 15. The indication will change to "01" at the end of the leader of file 1, then at the encounter of file two, the playback will proceed. Refer to step 18.

ADD	OUT	Q	LRGW	0123
8888	00	•	0000	0000

23. Repeat step 19.

M. Option 05 - Playback into Selected Memory

1. Perform Section K before

this section and load the tape as recorded in step 20 into the cassette recorder.

2. Repeat Section A, steps 1, 2 and 3.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

3. Depress and release the I key.

ADD OUT Q LRGW 0123  
8888 XY • 0000 0000

4. Enter "05". Depress and release the I key.

ADD OUT Q LRGW 0123  
8888 05 • 0000 0000

5. Depress the I key, enter "B", release the I key. This is the technique for aborting this option until step below. After that, merely depressing I returns to the monitor.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

6. Repeat steps 3 and 4.

ADD OUT Q LRGW 0123  
8888 05 • 0000 0000

7. Enter "02".

ADD OUT Q LRGW 0123  
8888 02 • 0000 0000

8. Depress the I key. The "05" is the option code indication.

ADD OUT Q LRGW 0123  
8888 05 • 0000 0000

9. Release the I key.

ADD OUT Q LRGW 0123  
8888 02 • 0000 0000

10. Enter "00".

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

11. Depress the I key. The "02" is the high address of the start area of memory into which the data will be played back.

ADD OUT Q LRGW 0123  
8088 02 • 0000 0000

12. Release the I key.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

13. Enter "02".

ADD OUT Q LRGW 0123  
8888 02 • 0000 0000

14. Depress the I key. The "00" is the low address entered in step 10.

ADD OUT Q LRGW 0123  
8088 00 • 0000 0000

15. Release the I key.

ADD OUT Q LRGW 0123  
8888 02 • 0000 0000

16. Enter "ID".

ADD OUT Q LRGW 0123  
8888 1d • 0000 0000

17. Depress the I key. The "02" is the high address of the end of the area into which the data is to be played back.

ADD OUT Q LRGW 0123  
8088 02 • 0000 0000

18. Release the I key.

ADD OUT Q LRGW 0123  
8888 1d • 0000 0000

19. Depress and release the I key. The results are the same as in Section K, step 6.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

20. Depress and release the I key.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

21. Repeat steps 3, 4, 7 through 18.

ADD OUT Q LRGW 0123  
8888 1d • 0000 0000

22. Repeat steps 14, 15 and 16 of Section L.

ADD OUT Q LRGW 0123  
8088 AA • 0000 0000

23. Repeat steps 3, 4, 7 through 18.

ADD OUT Q LRGW 0123  
8888 1d • 0000 0000

24. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

25. Repeat steps 14, 15 and 16 of Section L but let the operation proceed. The "EE" indication is because

ADD OUT Q LRGW 0123  
8088 EE O 0000 0000

a playback area of memory was requested which is larger than what was recorded.

26. Refer to Section F and obtain a table of the register values.
27. Verify that Register 3 contained the address 81E2. This is the indication for an error as encountered in Step 25.

NOTE: There is another type of error which can occur, the parity error. Using the technique of obtaining the register data from the Save Area in Steps 26 and 27, a parity error is indicated when Register 3 contained the address 81CD.

28. Repeat steps 3, 4, 7 through 15.

ADD	OUT	Q	LRGW	0123
8888	02	*	0000	0000

29. Enter "OC".

ADD	OUT	Q	LRGW	0123
8888	OC	*	0000	0000

30. Repeat steps 17 and 18.

ADD	OUT	Q	LRGW	0123
8888	OC	*	0000	0000

31. Enter "01".

ADD	OUT	Q	LRGW	0123
8888	01	*	0000	0000

32. Repeat steps 14, 15 and 16 of Section L.

ADD	OUT	Q	LRGW	0123
8888	AA	*	0000	0000

33. Using Option 01, read out locations 0200 through 020C verifying that the data is the same as entered in Section 6, steps 19 and 20.

34. Repeat steps 28 through 33, playing file 2 of the tape into locations 0300 through 030C.

N. Option 06 Compare of Selected Memory from Tape

1. Perform Section M before this section and load the tape as recorded in Section K, step 20 in the cassette recorder.

2. Repeat the verification as in Section M, step 33 for memory locations 0200 through 020C and 0300 through 030C.

3. Repeat Section A, steps 2 and 3.

ADD	OUT	Q LRGW 0123
8088	AA	• 0000 0000

4. Depress and release the I key.

ADD	OUT	Q LRGW 0123
8888	XY	• 0000 0000

5. Enter "06". Depress and release the I key.

ADD	OUT	Q LRGW 0123
8888	06	• 0000 0000

6. Depress the I key. Enter "A" and release the I key. As before, this is the technique for returning to the monitor.

ADD	OUT	Q LRGW 0123
8088	AA	• 0000 0000

7. Repeat steps 4 and 5.

ADD	OUT	Q LRGW 0123
8888	06	• 0000 0000

8. Enter "02".

ADD	OUT	Q LRGW 0123
8888	02	• 0000 0000

9. Depress the I key. The "06" is the option code indication.

ADD	OUT	Q LRGW 0123
8088	06	• 0000 0000

10. Release the I key.	ADD 8088	OUT 02	Q LRGW 0123 • 0000 0000
11. Enter "00".	ADD 8888	OUT 00	Q LRGW 0123 • 0000 0000
12. Depress the I key. The "02" is the high address of the start of the area of memory to be compared to the contents of the tape.	ADD 8088	OUT 02	Q LRGW 0123 • 0000 0000
13. Release the I key.	ADD 8888	OUT 00	Q LRGW 0123 • 0000 0000
14. Enter "02".	ADD 8888	OUT 02	Q LRGW 0123 • 0000 0000
15. Depress the I key. The "00" is the low address as entered in step 11.	ADD 8088	OUT 01	Q LRGW 0123 • 0000 0000
16. Release the I key.	ADD 8888	OUT 02	Q LRGW 0123 • 0000 0000
17. Enter "0D".	ADD 8888	OUT 0d	Q LRGW 0123 • 0000 0000
18. Depress the I key. The "02" is the high address of the end of the area of memory to be compared.	ADD 8088	OUT 02	Q LRGW 0123 • 0000 0000
19. Release the I key.	ADD 8888	OUT 0d	Q LRGW 0123 • 0000 0000
20. Depress and release the I key. The results are the same as in Section K, step 6.	ADD 8888	OUT 00	Q LRGW 0123 • 0000 0000
21. Repeat steps 3, 4, 5, 8 through 19.	ADD 8888	OUT 0d	Q LRGW 0123 • 0000 0000
22. Enter "01".	ADD 8888	OUT 01	Q LRGW 0123 • 0000 0000
23. Repeat Section M, steps			

25, 26 and 27 realizing  
this is for compare, not  
playback. The note after  
step 27 also applies.

- |  |                               |
|--|-------------------------------|
| 24. Repeat steps 3, 4, 5, 8<br>through 16.   | ADD      OUT      Q LRGW 0123 |
|  | 8888    02      0 0000 0000   |
| 25. Enter "0C".  | ADD      OUT      Q LRGW 0123 |
|  | 8888    0C      0 0000 0000   |
| 26. Repeat steps 18 and 19.  | ADD      OUT      Q LRGW 0123 |
|  | 8888    0C      0 0000 0000   |
| 27. Enter "01".  | ADD      OUT      Q LRGW 0123 |
|  | 8088    01      0 0000 0000   |
| 28. Repeat steps 14, 15 and 16<br>of Section L.  | ADD      OUT      Q LRGW 0123 |
|  | 8088    AA      0 0000 0000   |
| 29. Repeat steps 24 through 28<br>comparing file 2 of the<br>tape to memory locations.<br>0300 through 030C. |                               |

#### O. Option 09 Video Graphics

- |   |                               |
|---|-------------------------------|
| 1. Set up the computer per<br>Section A, steps 1, 2 and<br>3. Make sure power has<br>been switched off the<br>computer. | ADD      OUT      Q LRGW 0123 |
|   | 8088    AA      0 0000 0000   |
| 2. Turn on the TV monitor.  |                               |
| 3. Depress and release the I<br>key.  | ADD      OUT      Q LRGW 0123 |
|   | 8888    XY      0 0000 0000   |
| 4. Enter "09". Depress and<br>release the I key.  | ADD      OUT      Q LRGW 0123 |
|   | 8888    09      0 0000 0000   |
| 5. Depress the I key. Enter<br>"5". Release the I key.<br>This is at page select and                                    | ADD      OUT      Q LRGW 0123 |
|   | 8088    AA      0 0000 0000   |

the only step whereby you return to the monitor in this option.

6. Repeat steps 3 and 4. Note that the Q LED is glowing. This is the indication that you are to select a page of memory for display.

ADD OUT Q LRGW 0123  
8888 09 0 0000 0000

7. Enter "01".

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

8. Depress the I key.

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

9. Release the I key. Note that the Q LED is off and the S2 LED is now glowing. The TV screen should be lit with a random pattern of light and dark squares.

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

10. Depress the I key. Enter "2". You are now at page select again. The screen stays lit.

ADD OUT Q LRGW 0123  
8888 12 0 0000 0000

11. Enter "02".

ADD OUT Q LRGW 0123  
8888 02 0 0000 0000

12. Repeat step 5.

ADD OUT Q LRGW 0123  
8888 AA 0 0000 0000

13. Repeat steps 3, 4, 7, 8 and 9.

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

14. Enter "00".

ADD OUT Q LRGW 0123  
8888 00 0 0000 0000

15. Depress the I key. The "01" is the page number indication.

ADD OUT Q LRGW 0123  
8888 01 0 0000 0000

16. Release the I key. Note the blinking of the first 8 positions of the upper

ADD OUT Q LRGW 0123  
8888 00 0 0000 0000

line on the left of the TV screen.

17. Depress the I key. Enter "3". Release the I key. Note that the blinker has stopped. At this point you can enter another position for the blinker.

ADD OUT Q LRGW 0123  
8888 03 • 0000 0000

18. Enter "FF".

ADD OUT Q LRGW 0123  
8888 FF • 0000 0000

19. Depress the I key. The "00" was the prior address of the blinker.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

20. Repeat step 17.

ADD OUT Q LRGW 0123  
8888 F3 • 0000 0000

21. Enter "00". Depress and release the I key.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

22. Enter "00" again. Depress the I key. The "00" here is the address into which the entered "00" will be stored.

ADD OUT Q LRGW 0123  
8888 00 • 0000 0000

23. Release the I key. Note that the blinker is now at the second position on the top line. The blinker tells you where you may load data at the next I depression and release.

24. Enter "AA". Depress I.

ADD OUT Q LRGW 0123  
8888 01 • 0000 0000

25. Release I. (The "AA" here is data)

ADD OUT Q LRGW 0123  
8888 AA • 0000 0000

26. Depress and release I a few times and note the striped pattern beginning

to form.

- |   |  |
|---|--|
| 27. Depress I and enter "F".<br>Release I and the blinker<br>stops.   | ADD      OUT      Q LRGW 0123<br>8888      AF      0 0000 0000 |
| 28. ENTER "FF". Depress and<br>release the I key.   | ADD      OUT      Q LRGW 0123<br>8888      FF      0 0000 0000 |
| 29. Depress and release the I<br>key. Note that you are now<br>at a different page than<br>before. The blinker is at<br>top left. | ADD      OUT      Q LRGW 0123<br>8888      FF      0 0000 0000 |
| 30. Enter "42". Depress and<br>release I a few times (20<br>or 30 times).   | ADD      OUT      Q LRGW 0123<br>8888      42      0 0000 0000 |
| 31. Depress I, enter "6" and<br>release I.  | ADD      OUT      Q LRGW 0123<br>8888      26      0 0000 0000 |
| 32. Depress I, enter "7" and<br>release I. Note that the<br>Q LED is on.  | ADD      OUT      Q LRGW 0123<br>8888      67      0 0000 0000 |
| 33. Enter "02". Depress and<br>release I. Verify that<br>the screen does not change.  | ADD      OUT      Q LRGW 0123<br>8888      02      0 0000 0000 |

## 5. SUPER MONITOR USER INSTRUCTIONS

1. The monitor has 10 options which are as follows:

00	Program Execute
01	Memory Inspect
02	Memory Load
03	Block Move
04	Record on Cassette
05	Playback into Selected Memory
06	Compare to Selected Memory from Tape
07	Automatic Playback
08	Automatic Compare to memory from Tape
09	Video Graphics

2. Every option starts from monitor initialization signalled by the display of "AA". During initialization, the registers are saved and stored in the page of memory where the stack is located. Such as page 8C or 98. The address of the save area is (MS)DO through (MS)EF, where (MS) stands for the memory page where the stack is. The save is arranged with the low register half of Reg 0 first, in (MS)DO then Reg 1 and so on through Reg F in (MS)DF. The high half of Reg 0 is stored in (MS)EO, then Reg 1 and so on through Reg F, in (MS)EF.
3. When "AA" is displayed, an Input (I) key depression and release enables Option Select and one of the 10 valid codes can be entered. Enter is by keying in the code and depressing I and releasing. If an invalid code is entered, the monitor answers with the "EE" for error. By depressing I and releasing, you can try another option code.

#### 4. Option 00 Program Execute

Enter in hi address, I key, low address, I key and the P/C jumps to the entered address. P/C is Reg 3 and stack pointer is Reg 2. Note: Changing the keypad to a different entry while the I key is depressed and released causes and abort of this option and the "AA" will display.

#### Option 01 Memory Inspect

Enter in hi address, I key, low address, I key and the contents of entered address appears on display. While I key is depressed the address of next location is displayed. Releasing I key then displays the data in the location - See note in Option 00.

#### Option 02 Memory Load

Enter in hi address, I key, low address, I key, the Q-LED comes on and the address of the memory location to be loaded is displayed. Enter in data, which is displayed. Depressing I causes the address, into which the data will be loaded, to be displayed. The note in option 00 applies and the data is loaded into memory only if the keypad data is not changed during I key depression.

#### Option 03 Block Move

Enter in start hi address, I key, start low address, I key, stop hi address, I key, stop low address, I key, New Location Hi address, I key, New location Hi address, I key, New location lo address, I key. The data is transferred from Start/Stop to New location. When completed "AA" is

displayed indicating readiness of monitor for further options.

The note in option 00 applies.

Option 04 Record On Cassette

Enter in start hi address, I key, start low address, I key, stop hi address, I key, stop low address I key. Cue up cassette recorder, start recorder then hit I key. There is ten seconds of leader of "one" pulses followed by the recording of the start hi and low address, then the hi and low portions of the true count of the required number of byte of memory to record (maximum of FFFF bytes) (65279 in decimal) is recorded. Then the data at a rate of around 133 bytes per second. The display will change as the address of each data byte as it is recorded is put on the display. After recording of data, there is a 5 second trailer of all zero pulses. The display reads the last address (low) of the data. At the end of the trailer, "AA" displays, and back to option select.

Option 05 Playback into Selected Memory

Enter in high address of selected memory into which the cassette data is to be stored, I key, then the low address, I key, then the stop hi address, I key, then the stop low address, I key. At this point, position the cassette recorder at the desired place. Enter in file number which is displayed. Start tape recorder and depress the I key (and release). The display indicates 00 until the first file is found. If file 01 is the desired file then the data

address and number of bytes is read from the tape. If the desired portion of memory is larger than the amount of data stored in the file, the option aborts with an "EE" on the display. Otherwise the data is read into memory. Anytime after the I key is depressed to start the playback, the I key can be depressed again, the option aborts and the "AA" is displayed again. If the file that is found is not the desired file, the display will show what the current file is and the search will continue for the next file.

#### Option 06 Compare to Selected Memory from Tape

Enter in Hi address of memory to be compared to tape, I key, enter low address, I key, Hi address of end of compare memory, I key, Lo address, I key. At this point, position tape as in Option 05. Hit I key when recorder is started. When the desired file is found, it is compared with the data in memory as selected. If the data compares the display indicates "AA". If the data miscompares, the "EE" indication is given. An inspection of the save area using Option 01 in addresses (MS)DE (low) and (MS)EE (high) gives the address of the failed compare.

#### Option 07 Automatic Playback

Enter in file #, position tape, depress the I key and the loading is done automatically into the same locations of memory which were previously recorded in the file. NOTE: I key aborts as in Option 05.

### Option 08 Automatic Compare to Memory from Tape

Enter in file #, position tape, depress the I key and the compare is done automatically to the same memory locations which were previously recorded in the file.

### Option 09 Video Graphics

The Q-LED light glows. Enter Page to be displayed and I key. The screen will light up displaying the desired page. Enter address of desired data to be edited. Depress I key and that position will start blinking. Note that during the I depression, the page number is displayed on the segmented display. Next enter in a data value. The value of the data is displayed on the segmented display. Hit the I key. The blinking stops, the address into which the data will be stored is now displayed on the hex display. If a key entry is made while the I key is depressed which is different than the prior entry, the data update mode is aborted and the monitor goes back for address entry. If the I key is depressed again, and the keypad entry is different than before, the monitor goes back to page entry. If the keypad entry is changed again at the I key depression then the option is aborted and the screen goes blank, the "AA" is displayed and another option may be selected.

## 6. SUPERMONITOR Subroutines

Subroutines of the Monitor Available to the User

REGISTER SAVE "REGSAV"

1. Load register 2 with the last address of your save area. Allow 32 locations totally.
2. Initialize Register 0 with the return address to your program.
3. Branch to the entry address of REGSAV (from the table) or initialize a register to the entry address and use the SEP command (cannot use Register 0).

ENABLE MONITOR "ENAMON"

You may wish to call the monitor from your program.

1. Load the accumulator with a non-zero value
2. Load Register 0 with the entry address for ENAMON (from the table).
3. Use the SEP 0 command.
4. If the accumulator is zero, i.e. you did not follow step 1, then steps 2 and 3 will result in a return back via a SEP 3 command in the monitor.

HOT READ "HTREAD"

A user program can use a subroutine in the monitor that A reads the keypad, B displays the data on the hex date display and C tests to see if the Input (I) key is depressed. If the I key is not depressed, the routine stays in a loop, each time repeating A, B and C. If the I key does get depressed however, the routine does a return via a SEP-3. The routine is re-entrant.

1. Set up a stack area, using register 2 as the X pointer register (SEX-2)
2. Branch to entry location for HTREAD in the Table. If a register (N) is loaded (not register 2 or 3) with the address, a SEP-N can be used to call this routine over and over as desired.

3. Data read from the keypad is available in the stack after return.
4. Provide a de-bounce test of the I key being released before going on after using this routine.

UTILITY # 1 "D4IRDK"

A user program can use a subroutine in the monitor which is compatible with the "HTREAD" subroutine.

D4IRDK performs the following functions in the order given:

- A) Gets the contents of low register 4 and displays on the hex data display.
- B) Waits for the release of the I key.
- C) Reads the keypad and compares the resultant input against what was in the stack prior to entry. Results of compare are zero in accumulator if equal and non-zero if not equal.
- D) Returns via a SEP-3. The routine is re-entrant.

Rules for use are:

1. Set up stack area using register 2 as the X pointer register (SEX-2). The stack must be two deep as a minimum.
2. Branch to entry location for D4IRDK given in the table or load the address in register N (not register 2 or 3) and do a SEP-N.
3. Load a value in low register 4 you would like to see displayed between depression and release of the I key.
4. Assure that the I key has been depressed (but not released yet) prior to entry.
5. After return, test the accumulator if you wish to determine if a keypad entry was made while the I key was depressed, and the keypad entry was different than the value in the stack prior to entry. If the accumulator is zero-then no difference exists between the current keypad data and the contents of the stack. Otherwise, the two are different.

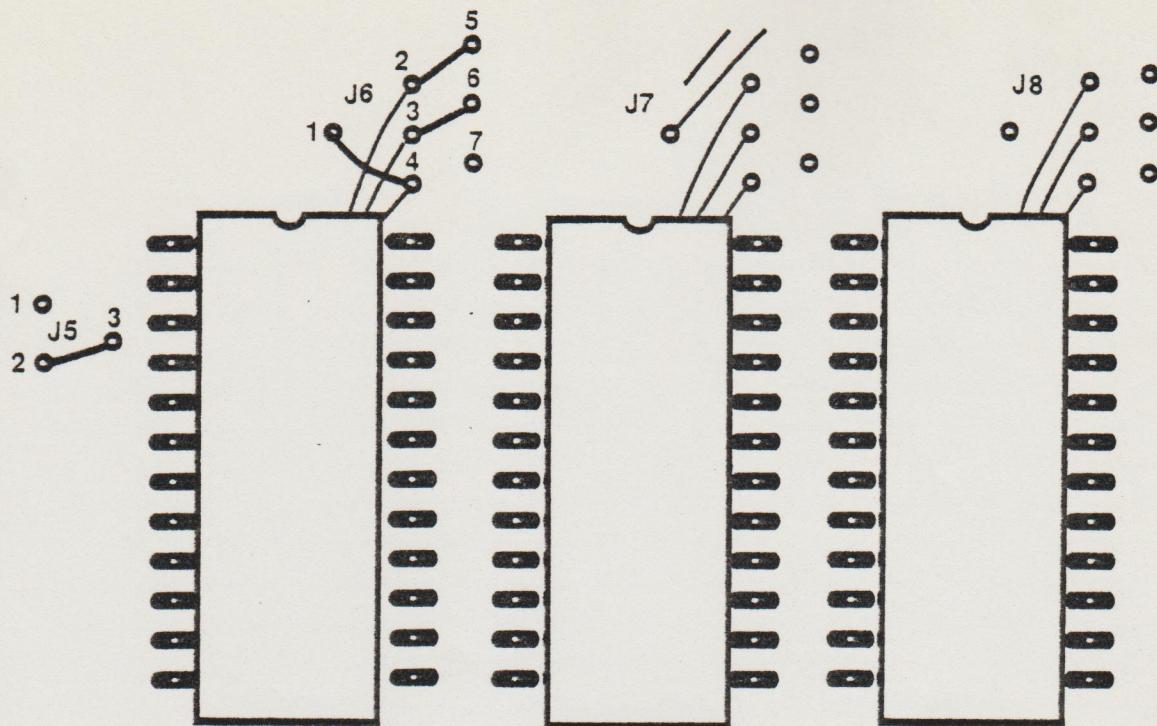
VIDEO INTERRUPT SERVICE ROUTINE "VIDINT"

1. Initialize Register 1 with the address in the Table.

2. The video interrupt will use register 0 and therefore make sure it is available.
3. Load high register 4 with the page number which is to be displayed.
4. Set up a stack area with register 2 as the X pointer register (SEX-2), the stack must be three deep at least.
5. Load high register 5 with "00" to disable blinker, otherwise set to non-zero. Low Register 4 is used as the address for the blinker.

Entry Address Table

Routine	Address	Notes
REGSAV	8017	Non-Re-entrant
ENAMON	8054	Non-Re-entrant
HTREAD	8060	Re-entrant
D4IRDK	8068	Re-entrant
VIDINT	826B	Re-entrant



J5 For 2708, TMS2716 Connect 2-3  
 For 2716, TMS2516, 2758 Connect 1-3

J6 For 2708 Connect 1-4,2-5,3-6  
 For TMS2716 Connect 1-2,3-6,4-7  
 For 2758 Connect 1-2,3-4,3-5  
 For 2716,TMS2516 Connect 1-2,4-5 6-7

J7 Same as J6 for EPROM No.2

J8 Same as J6 for EPROM No.3

#### Pad Identification

J5-1 +5

2 -5

3 U6P21,U7P21,U8P21

J6-1 U4P1      J7-1 U4P2

J8-1 U4P4

2 U6P18

2 U7P18

2 U8P18

3 U6P19

3 U7P19

3 U8P19

4 U6P20

4 U7P20

4 U8P20

5 Gnd

6 +12

7 50P41

5 Gnd

5 Gnd

6 +12

7 50P41

Figure 81. Jumper Areas 5,6,7,&8 EPROM's

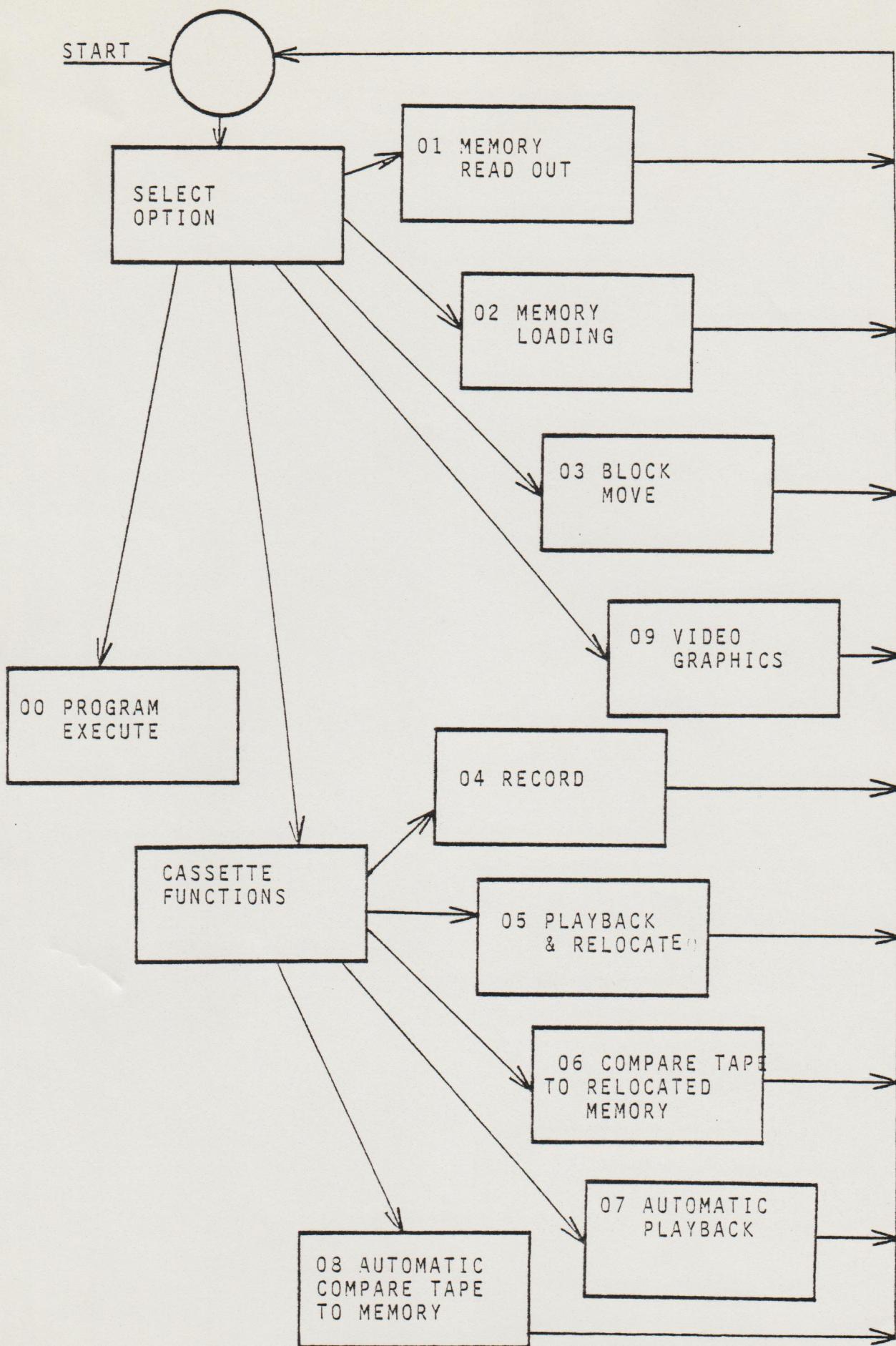
U6, U7, U8

SOP17 A9	22		
SOP42 A8	23		
SOP18 A7	1	17	D07 SOP22
SOP43 A6	2	16	D06 SOP47
SOP19 A5	3	15	D05 SOP23
SOP44 A4	4	14	D04 SOP48
SOP20 A3	5	13	D03 SOP24
SOP45 A2	6	12	D02 SOP49
SOP21 A1	7	11	D01 SOP25
SOP46 A0	8	10	D00 SOP30
		9	

EPROM TYPE PIN ASSIGNMENTS

FOR PIN	2708	TMS2716	2758	TMS2516 2716
18	GND	CS	CS	CS
19	+12	+12	GND	A10
20	CS	A10	GND	GND
21	-5	-5	+5	+5

Figure B2. EPROM's



Flow Diagram

8000	7120	F880	B0F8	98B2	F8FF	A230	1432	1492!	8200	D352	F808	A9A5	027E	527B	F809	3318	15F8!
8010	FF01	3008	F8EF	A29F	7381	BFF8	9EA1	22F8!	8210	20FF	013A	117A	F815	FF01	3A18	99FE	7A33!
8020	D073	8152	D273	2181	FBB1	3A1E	9F52	D0F8!	8220	3929	3A25	8932	00F6	322C	302E	76B9	F804!
8030	FFA2	90BF	BDBC	BBBA	F860	AFF8	59AA	F868!	8230	FF01	3A30	02F6	3F06	DB85	7676	52F3	302D!
8040	ACF8	AA39	47F8	EE52	6422	3F4A	374C	90B3!	8240	DBF8	08A7	A936	4599	FF01	3B51	3E48	2730!
8050	F874	A3D3	3253	7A30	5A7B	F800	E0A0	D0D3!	8250	5AF8	00FC	013B	58DA	3E53	8932	6302	7E52!
8060	6C64	223F	6030	5FD3	2284	5264	2237	6D6C!	8260	2930	4587	F602	3B40	DA72	7022	7822	52C4!
8070	12F3	3067	3078	B6A6	7ADF	377A	FA0F	B4A4!	8270	C4C4	94B0	F800	A080	E220	A0E2	20A0	E220!
8080	F884	A0DD	22F8	C1AB	7394	524B	F73B	8B2B!	8280	A0E2	3C77	953A	8B3B	6930	8F25	853A	6904!
8090	8B12	F752	9BF4	B3F8	C522	F4AB	0B12	12A3!	8290	FBFF	54F8	3C33	99F8	05F6	A530	69DA	DADA!
80A0	D330	A872	A302	B3D3	93BH	83AB	9DB3	F8B7!	82A0	D36C	6426	3FA1	2684	5664	26F3	B537	AD6C!
80B0	A3D3	9BB3	8B30	9FDF	DCD0	02A4	220F	DC00!	82B0	16F3	30A0	DADA	DADA	93B1	BFF8	6BA1	F8A1!
80C0	DD02	0809	0FD5	D8DB	0000	0000	5151	B80D!	82C0	AF92	B6F8	FBA6	E370	63F8	00F6	B57B	DF7A!
80D0	0000	0000	0000	101D	DD30	DDDD	7B72	A402!	82D0	32D7	629A	B01A	DA06	B4A4	69DF	3ACD	06A4!
80E0	B431	F122	4452	646C	3FE8	DCD0	39E3	0254!	82E0	93B5	DF3A	DB06	5414	30E0	E169	6969	6969!
80F0	14DF	30EA	D33F	F437	F790	D009	0000	00AA!	82F0	D84E	F332	F6DA	DB26	963A	F093	0069	AAAA!
8100	DD02	AEA4	22DD	72A4	A512	F7A6	2272	B512!	8300	D85E	1E8E	5264	2226	963A	0093	D0DA	2901!
8110	77B6	1633	16DA	02BE	94FB	033A	5130	1FDD!	8310	818B	0189	038B	A38B	030B	8909	0303	8B03!
8120	2696	FC01	B68E	F772	A79E	7702	B733	4322!	8320	A111	0BB1	2111	112B	21A1	0103	3123	2903!
8130	86F4	A712	9674	FF01	B705	5725	2627	963A!	8330	8B01	8B8B	0381	0383	0201	832B	8A81	0203!
8140	3993	D04E	5717	2696	3A43	93D0	6422	4ED8!	8340	21A3	0021	2801	1B21	9131	8183	0901	0908!
8150	27DF	DCD0	90BB	F8F5	AB94	FB04	3A9A	3061!	8350	0381	8989	AA03	8103	0B0B	OB8B	8B83	8381!
8160	F893	FC01	B8F8	01A8	F9BD	F6B9	F8FF	D886!	8360	2121	222B	A121	0920	A911	0181	3921	0900!
8170	A796	B7DB	9ED8	2797	FC01	B7DB	8ED8	DBDB!	8370	8301	8303	038B	830B	8B83	0B03	0181	8389!
8180	96D8	DBDB	86D8	DB8E	5264	224E	D827	973A!	8380	7474	7474	7554	7474	7474	7C74	7D55!	
8190	87F8	20F6	B9F8	00D8	93D0	02A4	F800	B993!	8390	FEEE	5752	F65C	D654	D6C6	D696	5E55	C65E!
81A0	FC01	B8F8	41A8	F800	5264	2284	F332	CAF8!	83A0	7474	7474	D47C	5C54	7564	7454	7474!	
81B0	FFA7	DB36	B299	FF01	3BC2	3EB6	8732	B227!	83B0	D4F6	CEF6	5ECE	6CCE	5E44	57EC	FE57	D654!
81C0	30B2	873A	AF02	FC01	30A8	3ECA	D8BC	D8AC!	83C0	F474	7474	7C70	7474	747C	74D4	757C!	
81D0	D8BD	22D8	A094	FF07	33E2	86F5	1296	7533!	83D0	5FD6	66DC	D4E6	EFDE	C4DE	C66E	D4FE	5455!
81E0	E8DA	129C	B8BC	AE9D	B68D	A626	96FC	01B6!	83E0	74F4	547C	7C70	F4F6	F474	FC54	7074	74F4!
81F0	94F6	CB82	F0C0	8300	DADA	DADA	DADA	DADA!	83F0	F6DE	747F	DE76	5BFF	DCEC	DEF4	F6FE	C6FC

Figure B4 SUPER MONITOR V. GC01-8098