M-16A INSTALLATION INSTRUCTIONS

UNPACKING

1) Open the box. If you have read this far you have already completed step 1. Go to step 2.

2) Remove the packing material from around the M-16A circuit board and inspect for obvious signs of damage due to shipping. If there is damage, save all packing material and notify the carrier.

HOW TO INSTALL

1) BE SURE YOUR SWTPC 6800 HAS BEEN COMPLETELY TESTED PRIOR TO INSTALLING THE M-16A. At a minimum, be sure the CPU board works with the on board 6810 RAM as outlined in the SWTPC instruction manual. IF THE SWTPC 6800 HAS NOT BEEN ASSEMBLED CORRECTLY, IT IS POSSIBLE TO SEVERLY DAMAGE THE M-16A.

2) The M-16A may be switch selected to begin at any 4K memory location. (0000hex, 1000hex, 2000hex etc). See the beginning location selection chart to determine the proper switch setting for your particular desired location. Note that although the M-16A can select any 4K starting location, not all locations are compatible with the SWTPC 6800. The M-16A occupies 4000hex or 16K of memory from the starting location. Thus, if you selected the board to begin at 1000hex, it would occupy 1000hex through 4FFFhex.

3) After selecting the desired starting location, check to be sure you have no other memory located in an area that overlaps the area selected for the M-16A.

4) WRITE PROTECT Turn the write protect switch S-1 to the up position. In the up position, write is enabled and you can read and write from the M-16A. In the down position, write is disabled and the M-16A functions as read only memory.

5) TURN OFF THE POWER TO THE SWTPC 6800. Installing the M-16A (or removing the M-16A) with the power applied may damage the components on the M-16A board.

6) Plug the M-16A into any of the 7 positions on the SWTPC 6800 mother board. Turn the power on and the system is ready to use. If you have more than 3 boards installed in the system, please read the following section on POWER SUPPLY CONSIDERATIONS.

POWER SUPPLY CONSIDERATIONS

While the power supply in the SWTPC 6800 will supply about 10
amps without overheating, it has been our experience that when
drawing more than 4 amps, the voltage may drop below 7.5 volts.
This is particularly true on the earlier units and with line
voltages below 118 volts. While the M-16 will probably function
satisfactorily with an input voltage below 7.5 volts, this
is below the guaranteed operating voltage of the manufacturer
of the voltage regulator. Therefore, we suggest the following
test:

1) With all boards you normally use in your SWTPC 6800 installed
    and connected to their normal load in the case of I/O boards,
    measure the plus 8 volt unregulated supply at the Molex
    connector on the mother board. If the measured voltage is
    above 8 volts, no power supply modifications should be made.

2) If the measured voltage is below 7.5 volts, we strongly
    recommend that the supply be modified to increase the voltage.

3) If the voltage is between 7.5 and 8.0 volts, no modification
    is necessary unless the AC line voltage regularly falls
    7 or 8 volts below the value of the line voltage at the
    time the measurement is made.

Again, everything should work properly even with a heavily loaded
unmodified supply. Our philosophy, however, is to do everything
possible (consistant with reasonable cost) to be sure your system
operates reliably even under worst case conditions. Thus, we
believe you should be aware of this potential problem in a
heavily loaded system.

This is the end of the required reading in the instruction manual.
The rest of the manual may or may not be of interest to you -
read it if you wish.

WHAT MAKES IT TICK?

To the real hardware freak, it is probably intuitively obvious
from the schematic diagram how the M-16A works. If you're not
a digital logic crazy, however, you may wish to read further.

U-39 and U-40 are address buffers. They drive all 12 address
lines to the 32 4K memory chips and connect to address lines
A-0 through A-11 on the mother board. In addition to providing
sufficient drive to the 32 memory chips without significantly
loading the address lines on the motherboard, they provide
important protection to the very expensive memory chips - both
from transients on the motherboard and from static discharges
during shipping and handling outside the motherboard.

U-33 and U-34 are bi-directional bus drivers. They perform
a very similar function to the address buffers except that
they buffer the data bus and swing either way depending on
whether the CPU is performing a read or write to the memory
board. When the CPU is neither reading from or writing to
the memory board, these chips go tri-state - that is, they
go into a high impedance mode and appear as an open circuit
to the lines on either side of the chip.

U-1 through U32 are the 4K memory chips. They are organized
such that each combination of the 12 address lines access a
unique 1 bit message within the chip. The chips are arranged
in rows of 8 so that as each row is accessed a unique 8 bit
byte is selected by the 12 address lines. Thus, each row
contains 4096 8 bit bytes. The memory chip assignment table
shows which memory chip contains each bit of information
depending on what area of memory the bit of information is in.
This is useful for trouble shooting.

For instance, let's assume that you run a memory diagnostic
on the M-16A and that every time the diagnostic program tries
to write a CO into location 2300 hex in memory, it reads back
a 40. From the Hexadecimal to Binary Conversion Table, we
can see that bit 6 is being read as a one instead of a zero.
From the Memory Chip Assignment Table, we can see that bit
6 of all memory locations between 2000 and 2FFF are contained
in U-23 (Assuming an M-16A starting address of 0000. If the
starting address were 1000, then it would be U-15).) This
would usually indicate that U-23 is defective and should be
replaced. If, however, each time a 00 was written into any
memory location between 0000 and 3FFF a 40 was read back, it
is highly unlikely that U-7, U-15, U-23, and U-31 would all
be defective. Thus, it would be more likely that U-34 which
drives bit 6 to and from the data bus would be defective.

U-36 determines the direction of the data bus drivers from the data on the read/write line and the outputs of U-35 and U-38. U-35 is an adder hooked up as a subtracter to have its outputs at pins 13 and 10 both low any time the board is selected as determined by the switch positions. Pins 4 and 1 feed the row select information to U-37 which decodes this information and enables the selected row for read or write operation.

U-41 is a 5 volt 3 amp voltage regulator. Normally the M-16A draws about 1.8 amps so this regulator is well within its current rating.

LIMITED WARRANTEE

Smoke Signal Broadcasting will repair or replace any defective M-16A returned to it within 90 days of purchase provided that, in our opinion, the damage or defect was not caused by a malfunction in the computer or other device in which it was installed and that it was not mishandled. Our warrantee extends to repair or replacement only and we will not be liable for any consequential damages incurred by the user of an M-16A.

REPAIRS

Outside of the 90 day warrantee period, there is flat $25 rate for repairs to the M-16A provided that there is no physical damage to the circuit board and that no more than one memory chip needs to be replaced. To return a board for repair, enclose a check for $25 with the board and mail to:

Smoke Signal Broadcasting
31336 Via Colinas
Westlake Village, Ca. 91361

If the board does not qualify for the $25 flat rate, you will be notified and an estimate given before any work is done on the board. Otherwise, it will be repaired promptly and returned.

HEXADECIMAL TO BINARY CONVERSION TABLE
FOR NUMBERS CONTAINING ONLY ONE BIT SET TO LOGIC LEVEL ONE

HEXADECIMAL NUMBER	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 1
00	0	0	0	0	0	0	0	0
01	0	0	0	0	0	0	0	1
02	0	0	0	0	0	0	1	0
04	0	0	0	0	0	1	0	0
08	0	0	0	0	1	0	0	0
10	0	0	0	1	0	0	0	0
20	0	0	1	0	0	0	0	0
40	0	1	0	0	0	0	0	0
80	1	0	0	0	0	0	0	0

BEGINNING ADDRESS SELECTION CHART

SWITCH POSITIONS				BEGINNING	ENDING
S2	S3	S4	S5	ADDRESS	ADDRESS
--	--	--	--	--------	------
DN	DN	DN	DN	0000	3FFF
DN	DN	DN	UP	1000	4FFF
DN	DN	UP	DN	2000	5FFF
DN	DN	UP	UP	3000	6FFF
DN	UP	DN	DN	4000	7FFF
UP	DN	UP	DN	A000	DFFF **

** TO USE THE M-16A AT THIS LOCATION, IT IS NECESSARY TO MAKE THE FOLLOWING
MODIFICATIONS TO THE SWTPC 6800 CPU BOARD.
1) CUT THE FOIL BETWEEN PINS 10 AND 13 OF IC 16 ON THE SWTPC 6800 CPU BOARD.
2) ADD A JUMPER BETWEEN IC 7 PIN 3 AND IC 16 PIN 13.
IT IS NOT NECESSARY TO REMOVE THE 6810 RAM, HOWEVER, IT IS NOT USED WHEN
USING THE M-16A AT A000 THROUGH DFFF SO IT MAY BE REMOVED IF YOU LIKE.

THE M-16A MAY BE SWITCH SELECTED TO LOCATIONS OTHER THAN THOSE INDICATED
ON THE CHART, HOWEVER THE LOCATIONS GIVEN ARE THE ONLY ONES EASILY COMPATIBLE
WITH THE SWTPC 6800. TO DETERMINE OTHER LOCATIONS, THE SWITCHES READ THE
BEGINNING ADDRESS IN BINARY WITH S5 BEING THE LEAST SIGNIFICANT BIT.

MEMORY CHIP ASSIGNMENT TABLE

STARTING ADDRESS PLUS	STARTING ADDRESS PLUS	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--------	--------	-----	-----	-----	-----	-----	-----	-----	-----
0000 THRU 0FFF		IC-8	IC-7	IC-6	IC-5	IC-4	IC-3	IC-2	IC-1
1000 THRU 1FFF		IC-16	IC-15	IC-14	IC-13	IC-12	IC-11	IC-10	IC-9
2000 THRU 2FFF		IC-24	IC-23	IC-22	IC-21	IC-20	IC-19	IC-18	IC-17
3000 THRU 3FFF		IC-32	IC-31	IC-30	IC-29	IC-28	IC-27	IC-26	IC-25

Indicates connection to
designated pin number U1 thru U32

A0, A1, A2, A3, A4, A5 — U39

1, 2, 3, 4, 5, 6
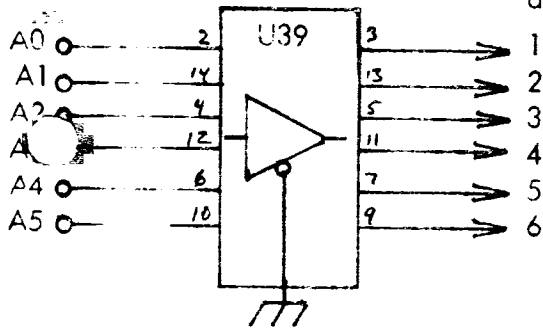
SMOKE SIGNAL BROADCASTING
HOLLYWOOD, CA.
M-16A SCHEMATIC DIAGRAM
© 1977

Parts List
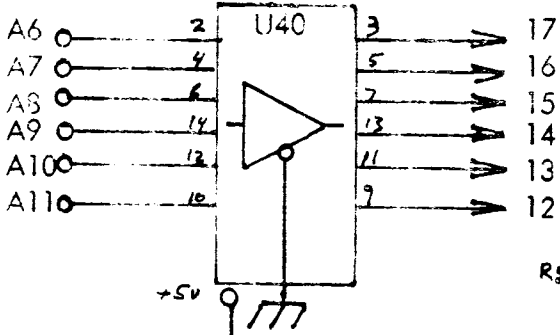
U1 thru U32	TMS4044	C1-C2	10uf 16vdc
U33 and U34	8835	C3-C12	.047uf
U35	74LS283	R1-R5	1K 1/4w
U36	7410	U41	LM323K
U37	74S138	S1-S5	76B05
U38	7402		
U39 and U40	8097		

A6, A7, A8, A9, A10, A11 — U40

17, 16, 15, 14, 13, 12

+5v

R3, R2

+5v

A12, A13, A14, A15 — U35

Co, B1, A2, B3, B4, E1, E2, E3, E4

SW5, SW4, SW3, SW2

U38 — BS

U37 — Y0 $\overline{CS0}$, Y1 $\overline{CS1}$, Y2 $\overline{CS2}$, Y3 $\overline{CS3}$

Ah, AL, AL

Ø2
VMA

U38

Ø2-VMA

D0, D1, D2, D3 — U33

U1,9,17,25
U2,10,18,26
U3,11,19,27
U4,12,20,28

Pins 7 & 11

U36 $\overline{R/W}$

U36

U36

R/W

R1

TO U1-U32
PIN 8

SW1

D4, D5, D6, D7 — U34

U5,13,21,29
U6,14,22,30
U7,15,23,31
U8,16,24,32

Pins 7 & 11

R/W — U38 — $\overline{R/W}$ — U38 — $\overline{R/W}$