Assembly Instructions MP-A2 Microprocessor/System Board

Introduction

The MP-A2 board is the primary logic board for the SWTPC 6800 Computer system. It is a 5½" x 9" double sided plated thru hole circuit board containing the 6800 microprocessor chip, the 6830 ROM which stores the Mini-Operating system and the 6810 128 byte scratch pad memory for the ROM. There is a crystal controlled baud rate generator providing serial interface baud rates of 110, 150, 300, 600 and 1200 baud. The board also contains a power up/manual reset circuit, which loads the ROM stored operating sys-tem when activated. Full I/O buffering is provided for the 16 address lines and 8 bi-directional data lines with these and other inter-connections made to the rest of the system thru a fifty-pin connector to the mother board (MP-B). +5 Volt power for the board is supplied by two on board +5 Volt regulators with heatsinks at a total current consumption of 1A typical.

The new MP-A2 board supercedes the former MP-A board originally provided with the SWTPC 6800 Computer System and comes equipped with the following features:

Socket provisions for up to 8K of Intel 2716 pinout EPROM, PROM or ROM

- Relocatable EPROM/PROM addressing for custom monitor or dedicated controller applications.
- SWTBUG® or MIKBUG® compatible-switch configurable
- Dual voltage regulators for better heat dissipation
- Resistor adjustable CPU clock for programmable CPU clock speeds
- On board address select switches for selecting external memory above 40K, The entire 64K range may be switched external to the MP-A2 board

When the SWTPC 6800 Computer System is being assembled work on only one board at a time. Each of the system's boards and their associated parts must not be intermixed to avoid confusion during assembly. The MOS integrated circuits supplied with this kit are susceptible to static electricity damage and for this reason have been packed with their leads impressed onto a special conductive foam or possibly wrapped in a conductive foil. In either case, do not remove the protective material until specifically told to do so later in the instructions.

PC Board Assembly

NOTE-Since all of the holes of the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until **all** of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board **only.** The plated-thru holes provide the electrical connection to the top foil.

( ) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks". It is unlikely that you will find any; but, should there be one especially on the "TOP" side of the board, it will be very hard to locate and correct after all of the components have been installed on the board.

( ) Attach all of the resistors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8" of wire remains. Solder. You should have one 1 M ohm resistor left over.

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( ) Install all of the capacitors on the board. Be sure to orient the electrolytic capacitors correctly. The polarity is indicated on the component layout drawing. Solder.

( ) Attach crystal XTAL1 to the circuit board. It should be oriented so its length lies flat across the circuit board as shown in the outline on the component layout drawing. If the crystal has long thin wire leads, they may be bent down 90 degrees at the base of the crystal so they fit into the two holes provided for the crystal on the circuit board. If the crystal has short heavy wire leads, solder onto and at a 90 degree angle, the crystal's leads some heavy bus wire. The bus wire with the crystal attached may then be inserted into the board. In either case the crystal must be attached so its metal case could never inadvertently come into contact with either the foil on the circuit board or either one of its own two leads. Solder. If desired, the crystal may be firmly secured by strapping the body of the crystal to the circuit board using a piece of light gauge wire. The wire need not be insulated. Pads are provided for attaching the wire adjacent the sides and just beneath the body of the crystal.

( ) Starting from one end of the circuit board install each of the five, 10 pin Molex female edge connectors along the lower edge of the board. These connectors must be inserted from the "TOP" side of the board and **must** be pressed down firmly against the board. Make sure the body of the connector seats firmly against the circuit board and that each pin extends completely into the holes on the circuit board. Not being careful here will cause the board to either wobble and/or be crooked when plugged onto the mother board. It is suggested that you solder only the two end pins of each of the five connectors until all have been installed; at which time, if everything looks straight and rigid, you should solder the, as yet, unsoldered pins.

( ) Insert the small nylon indexing plug into the edge connector pin indicated by the small triangular arrow on the "BOTTOM" side of the circuit board. This prevents the board from being accidentally plugged onto the mother board incorrectly.

( ) Install integrated circuits IC3 thru IC20. As each one is installed, make sure it is down firmly against the board and solder only two of the leads to hold the pack in plate while the other IC's are being inserted. Be very careful to install each in its correct position. **Do not** bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The semicircle notch or dot on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

( ) Cut off the center pin on integrated circuits IC21 and IC22.

( ) Install integrated circuits IC21 and IC22 on the circuit board. This component must be oriented so its metal face is facing the circuit board with the small metal heatsink sandwiched between the two. The heatsink and IC are secured to the circuit board with a 4-40 x 3/8" screw, lock-washer and nut. The leads of the integrated circuit must be bent down into each of their respective holes and trimmed, and the heatsink must be oriented as shown in the component layout drawing. Solder.

( ) Attach the six integrated circuit sockets to the board in the IC1, IC2 and IC23 thru IC26 positions only. There is no socket for IC3, The 40 pin socket goes in the IC1 position while the 24 pin sockets go in the remaining positions. Turn each socket so the corner having the indexing tab is adjacent the pin indicated by the "dot" within the integrated circuit outline on the component layout drawing. Solder.

( ) Attach DIP switch S1 to the circuit board. The switch must be mounted so the switches are ON when flipped toward the right side of the circuit board. Solder.

NOTE: MOS integrated circuits are susceptible to damage by static electricity. Although some degree of protection is provided internally within the integrated circuits, their cost demands the utmost in care. Before opening and/or installing any MOS integrated circuits you should ground your body and all metallic tools coming into contact with the leads, thru a 1 MΩ ¼ watt resistor (supplied with the kit). The ground must be an "earth" ground such as a water pipe, and not the circuit board ground. As for the connection to your body, attach a clip lead to your watch or metal ID bracelet. Make absolutely sure you have the 1 Meg

Ώ resistor connected between you and the “earth” ground, otherwise you will be creating a dangerous shock hazard. Avoid touching the leads of the integrated circuits any more than necessary when installing them, even if you are grounded. On those MOS IC's being soldered in place; the tip of the soldering iron should be grounded as well (separately from your body ground) either with or without a 1 Meg Ώ resistor. Most soldering irons having a three prong line cord plug already have a grounded tip. Static electricity should be an important consideration in cold, dry environments. It is less of a problem when it is warm and humid.

( ) Install MQS integrated circuits IC3 and IC4 following the precautions given in the preceding section. As each is installed, make sure it is down firmly against the board before soldering all of its leads. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The “dot” on the end of the package is used for orientation purposes and must match with that shown on the component layout drawing for each of the IC's

( ) Working from the “TOP” side of the circuit board, fill in all of the feed-thru’s with molten solder. The feed-thru’s are those unused holes on the board whose internal plating connects the “TOP” and “BOTTOM” circuit connections. Filling these feed-thru’s with molten solder guarantees the integrity of the connections and increases the current handling capability.

( ) Now that most of the components have been installed on the board, double check to make sure all have been installed correctly in their proper location.

( ) Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during check out. Also, look for solder “bridges” and "cold" solder joints, which are another common problem.

This completes the assembly phase for the MP-A board. Integrated circuits IC1 and IC2 should not be installed until the board goes thru a preliminary checkout detailed in the System Checkout Instructions supplied with the MP-B Mother Board kit. The System Checkout Instructions are used after having assembled the MP-A Microprocessor/System Board, MP-B Mother Board, MP-S Serial interface, and the MP-P Power Supply.

Since the MP-A Circuit Board now contains MOS devices it is susceptible to damage from severe static electrical sources. One should avoid handling the board any more than necessary and when you must, avoid touching or allowing anything to come into contact with any of the conductors on the board.

How It Works

The entire 6800 Computer System is built around IC1, the 6800 Microprocessor Unit (MPU). Most of components within the system are used to provide the clocks, buffering and decoding necessary to interface to this integrated circuit. Complete details of the operation and specifications of IC1 are contained in the 6800 Hardware section of the System Documentation Notebook and will not be repeated here.

Integrated circuit IC2 is a 1024 x 8 bit read only memory (ROM) which permanently stores the computer’s mini-operating system described in the Operating System section of the System Documentation Notebook. Whenever the computer system is first powered up or when the front panel RESET switch is depressed the computer jumps to this operating system firmware (programming stored in ROM) which gives the user terminal control.

The ROM stored mini-operating requires a small amount of random access memory (RAM) for operation. It uses IC3, a 128 x 8 bit static memory. What is nice here is that a large portion of the RAM memory addresses are unassigned which means many short programs such as the diagnostics can be loaded right into the operating system RAM without using any of the large MP-M static memory cards. Complete information regarding the unassigned RAM locations is contained in the Operating System section of the System Documentation Notebook.

IC4 is the crystal controlled clock/baud rate generator. It produces the five baud rate clock frequencies required by the control and serial interfaces. IC14 provides the buffering for each of the used outputs on baud rate generator IC4.

Integrated circuit IC6 is responsible for generating the power-up/manual pushbutton RESET which loads the mini-operating system stored in the ROM, IC2. It also generates the two phase clock required by IC1

Half of D flip flop, IC12 is used for timed halting of the processor in direct memory access (DMA) applications. Integrated circuits IC5, IC7 and IC8 are used as non-inverting address line buffers for each of the six-teen address lines.

Integrated circuits IC19 and IC20 are inverting bi-directional transceiver buffers for the systems eight eight bi-directional data lines. The gates feeding the enable lines of the transceiver IC's guarantee the appropriate receive or transmit data bus buffers are enabled at the proper time.

+ 5VDC power for the board is supplied by voltage regulators IC21 and IC22.

Parts List -MP-A2 Microprocessor/System Board

Resistors

___	R1	680 Ω ¼ watt resistor	___	R8	1K Ω ¼ watt resistor
___	R2	10K Ω ¼ watt resistor	___	R9	10K Ω ¼ watt resistor
___	R3	6.8K Ω ¼ watt resistor	___	R10	10K Ω ¼ watt resistor
___	R4	6.8K Ω ¼ watt resistor	___	R11	10K Ω ¼ watt resistor
___	R5	1 K Ω ¼ watt resistor	___	R12	10K Ω ¼ watt resistor
___	R6	1 K Ω ¼ watt resistor	___	R13	470 Ω ¼ watt resistor
___	R7	10K Ω¼ watt resistor	___	R14	1M Ω ¼ watt resistor

Capacitors

			___		
___	C1	60 pF Film capacitor	___	C6	0.1 uF capacitor
___	C2	1000 pF Film capacitor	___	C7	0.1 uF
___	C3*	100 uF Film capacitor	___	C8	0.1 uF
___	C4	0.1 uF capacitor	___	C9*	47 uF tantalum Electrolytic
___	C5	0.1 uF capacitor			

Integrated Circuits

			___		
___	IC1*	6800 MPU (MOS)	___	IC11*	8098 or 74368 Buffer
___	IC2*	6830L7, L8 or P8 (MOS) are Mikbug's	___	IC12*	7474 flip flop
___		SWTBUG versions noted -	___	IC13*	74S139 dual decoder
___		accordingly	___	IC14*	7404 hex inverter
___	IC3*	6810 RAM (MOS)	___	IC15*	7420 dual 4 input NAND gate
___	IC4*	14411 Baud Rate Generator (MOS)	___	IC16*	7400 quad NAND gate
___	IC5*	8097or 74367 buffer	___	IC17*	74LS55 AND-OR-INVERT gate
___	IC6*	6875 clock driver	___	IC18*	74LS55 AND-OR-INVERT gate
___	IC7*	8097 or 74367 buffer	___	IC19*	8835 bi directional transceiver
___	IC8*	8097 or 74367 buffer	___	IC20*	8835 bi directional transceiver
___	IC9*	7404 hex inverter	___	IC21*	7805 5 volt voltage regulator
___	IC10*	74L04 low power hex inverter	___	IC22*	7805 5 volt voltage regulator

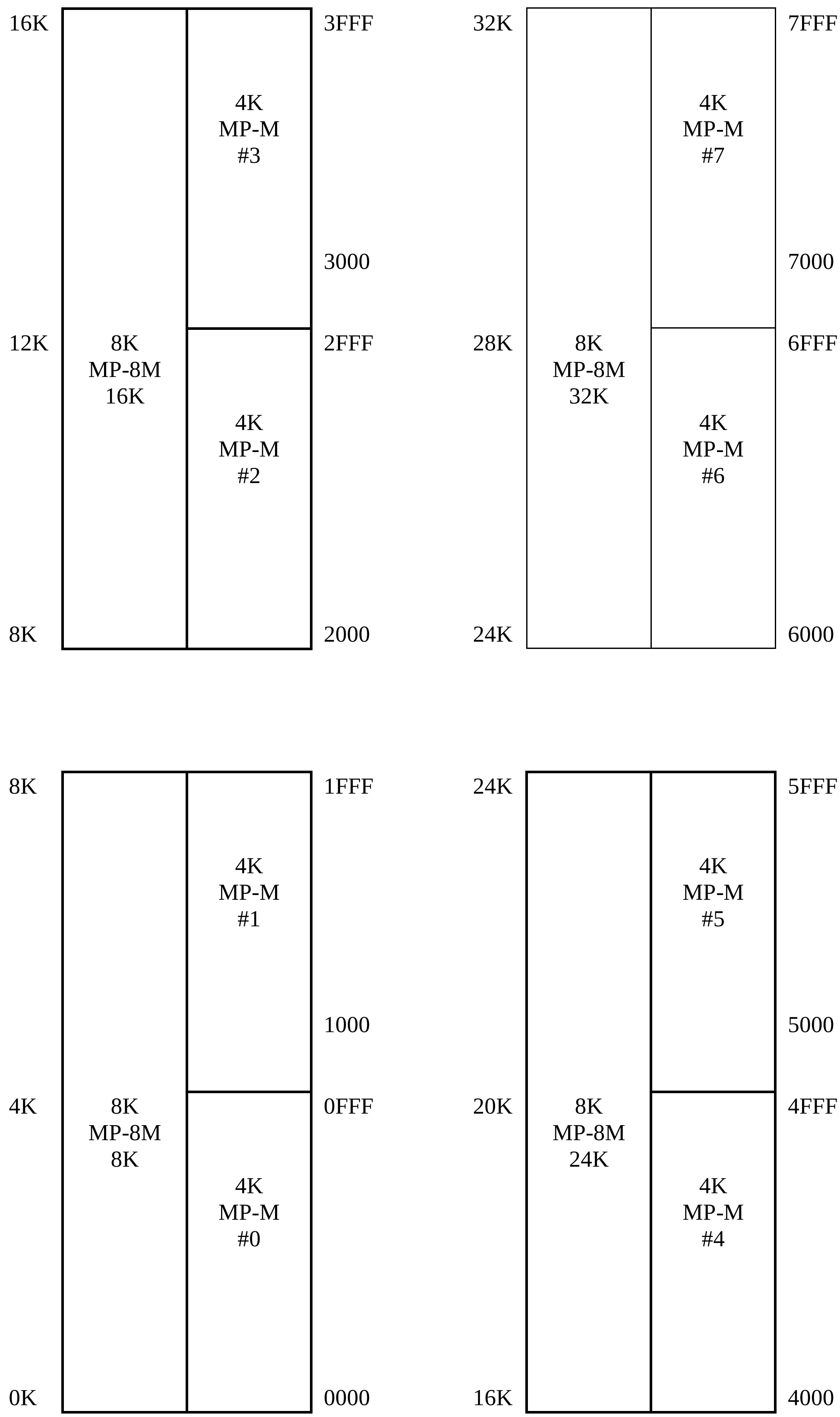
Note: Integrated circuits IC23 thru IC26 are not included with the MP-A2 kit. The positions may be filled with PROM's pin compatible with the Intel 2716 2K byte PROM.

___	IC23*	0 thru 2K addressed 2716 compatible PROM
___	IC24*	2 thru 4K addressed 2716 compatible PROM
___	IC25*	4 thru 6K addressed 2716 compatible PROM
___	IC26*	6 thru 8K addressed 2716 compatible PROM

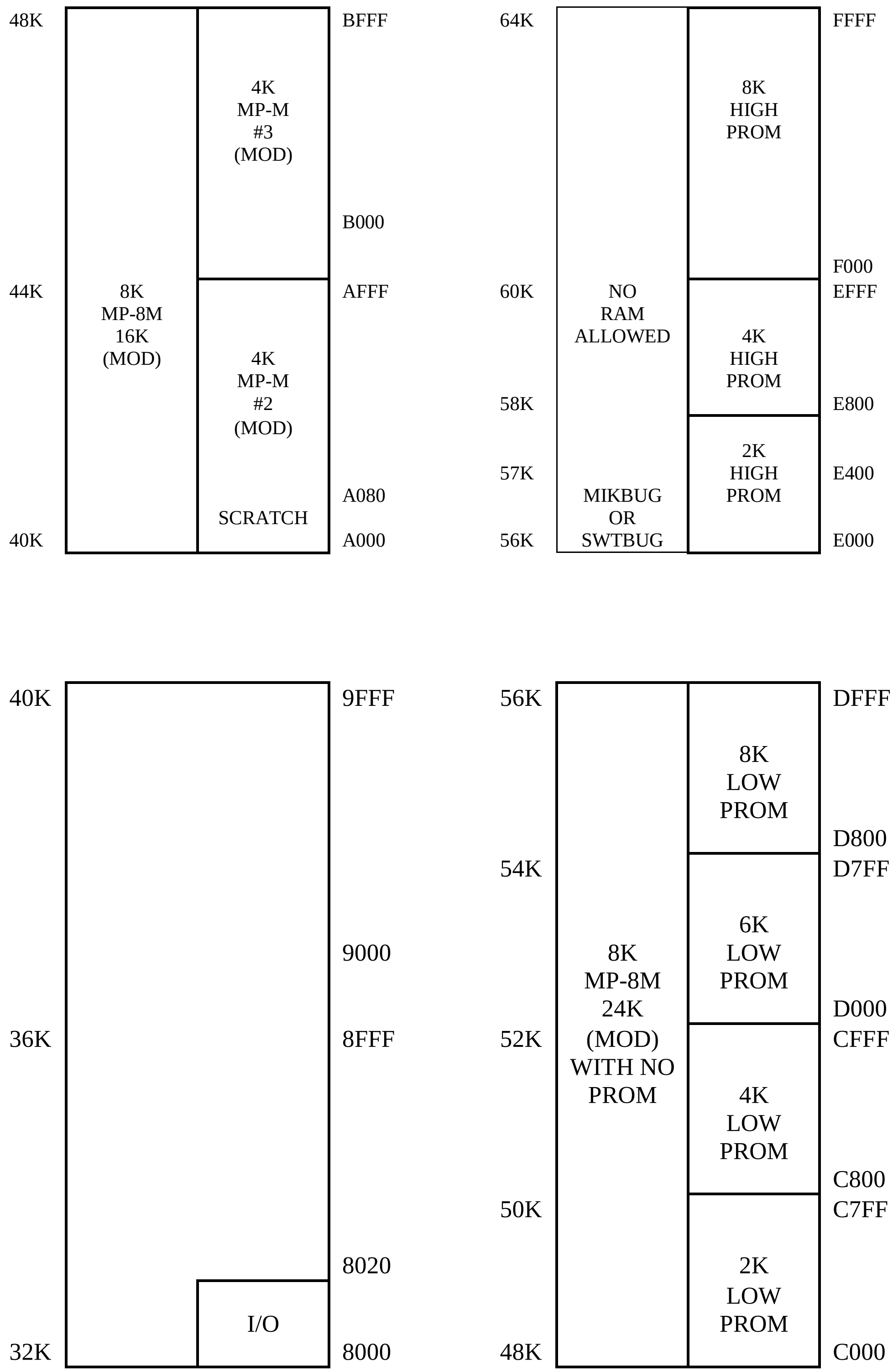
Miscellaneous

___	XTAL1	1.7971 MHz for Mikbug
___		1.8432 MHz for SWTBUG
___	S1	8 section SPST dip switch

All components flagged with a * must be oriented as shown in the component layout drawing.



SWTPC 6800 COMPUTER SYSTEM MP-A2 MEMORY MAP



SWTPC 6800 COMPUTER SYSTEM MP-A2 MEMORY MAP

Memory Map Details

Before you can configure the address select DIP switch, you must know how the memory addresses of the computer system will be organized. The Motorola 6800 CPU chip is capable of addressing 64K bytes of memory. This must be split between RAM, ROM, PROM and I/O. The memory map for the SWTPC 6800 Computer System shows the options that are available. The map has been divided into eight 8K memory blocks for convenience. The 0 to 8K (0000 to 1FFF hex) block shows that it may be filled by two MP-M 4K memory boards programmed as shown or by one MP-8M memory board programmed as shown. The 8K to 16K (2000 to 3FFF hex), 16K to 24K (4000 to 5FFF hex) and 24K to 32K (6000 to 7FFF hex) memory blocks are similar to the first and require no explanation. The lower 32K of memory addresses are generally assigned to RAM addresses. Address assignments from 32K thru 40K are fixed on the mother board and cannot be moved. The address decoding on the mother board allocates the entire 8K memory segment from 32K to 40K (8000 to 9FFF) for I/O.

Neither the 4K MP-M or the MP-8M memory boards were designed to operate at addresses above 32K so minor modifications must be made for use above 32K. Details on this are given later in this instruction set.

The first 128 bytes of the 40K to 48K (A000 to BFFF hex) memory block must be assigned as scratchpad RAM for the Mikbug or SWTBUG monitor. IC3 on the MP-A2 board contains the required memory, but it may be switch disabled to allow substitution of a MP-M 4K or MP-8M 8K memory board. If you do choose to use the additional memory board(s) be sure not to try and use the lower 128 bytes (A000 thru A07F hex) for program use since these locations are reserved for the monitor’s scratchpad.

The MP-A2 processor board has provisions for up to 8K bytes of 2716 pinout PROM or ROM. The 2716 is a new 2K byte EROM manufactured by Intel and second sourced by other firms. This PROM or ROM memory is switch locatable for low memory or high memory. If LOW PROM is selected, the ROM is positioned with a starting address of 48K (C000 hex). To execute the program(s) resident in ROM you suimply load the starting address of the program to be run into the program counter addresses using the Mikbug or SWTBUG monitor and type a G for the “Go to User Program function”. The LOW PROM function should be used for PROM basic or other PROM programs requiring system flexibility and monitor resident subroutines. The HIGH PROM function allows you to switch in a custom monitor or dedicated controller in place of the standard Mikbug or SWTBUG monitor. All reset and interrupt vectors must then be resident in the upper eight memory locations of the highest addressed PROM and the PROM may only be implemented in 2K, 4K and 8K increments. The system then configures and operates as per the custom program contained within the (PROM(s). The HIGH PROM configuration supports auto restart on power up, may operate operator unassisted and may even operate without a terminal system if operator interfacing is not required. The Mikbug or SWTBUG monitors may not be used along with the HIGH PROM option. If the LOW PROM function is not selected, 4K MP-M or 8K MP-8M memory boards may be located from 48K to 56K (C0 00 to DFFF hex). No RAM boards may be used above 56K (E000 hex) since either the monitor or HIGH PROM will be resident at the upper addresses and the decoding structure of the board forbids the intermixing of the PROM/ROM and RAM within the same 8K memory segment above 32K (8000 hex).

Programming the DIP switch S1

Now that you have some understanding of how the memory of the SWTPC 6800 Computer System is organized, you should be able to properly configure DIP switch S1 The switch is actually an eight section SPST slide switch with only the lower seven switches being used. Markings on the top of the switch show which way is ON and OFF for the switch paddles. Nomenclature just to the right of the switch indicates the function of each paddle. Once the switches have been programmed, it will be easy to inadvertently change a switch setting while handling the MP-A2 circuit board. So be sure to recheck the setting of the switches before plugging the MP-A2 circuit board onto the MP-B mother board. The System Checkout instructions contain a switch table showing settings for initial checkout. After which they may be set to suit the user’s system configuration.

USER D This switch is not used and has been assigned as a user defined switch. It may be set either ON or OFF.

4K-8K	This switch must be flipped OFF when the HI PROM option is selected (ON) and only 2K of PROM are plugged into the PROM sockets. The switch should otherwise be left ON.
SWT	This switch must be flipped OFF if the Mikbug ROM is being used and ON if the SWTBUG ROM is being used on the MP-A2 board. Information in the Parts List or Operating System section of the System Documentation Notebook will tell you which ROM was supplied with your system.
8K	This switch must be flipped OFF when the HI PROM option is selected (ON) and only 2K or 4K of PROM are plugged into the sockets. The switch should otherwise be left ON.
RAM	This switch when flipped OFF disables the on board scratchpad RAM required by the Mikbug and SWTBUG monitors. The user may then plug on modified 4K MP-M or 8K MP-8M memory boards to fill the space. The switch must be left ON when this con-figuration is not selected.
LO PROM	This switch when flipped ON allows the PROM memory plugged into the PROM sockets to be enabled from memory locations 48K thru 56K (C000 thru DFFF). If the HI PROM option is selected or if no PROM's are being used then the switch should be in the OFF position.
HI PROM	This switch when flipped ON allows the PROM memory plugged into the PROM sockets to be enabled from memory locations 56K thru 64K (E000 thru FFFF). If the LO PROM option is selected (ON) or if the MON option is selected (ON) or if no PROM's are being used then the switch should be in the OFF position.
MON	This switch should always be ON unless the HI PROM option is selected in which case it should be OFF. The HI PROM and Monitor use the same address space and therefore may be enabled only one at a time.

Memory Board Modification for Operation above 32K

The SWTPC 4K MP-M and 8K MP-8M memory boards are not designed to respond to memory addresses higher than 32K. Both boards however, with a few minor modifications, will operate at addresses above 32K but once modified will not permit operation below 32K without remodification.

Modifying the 4K MP-M Memory Board

To modify the MP-M memory board for operation above 32K break the conductor foil between pin 6 of integrated circuit IC22 and pin 1 of IC24 as well as the conductor foil between pin 4 of IC22 and connector pin A15. Break the conductors near IC22 using a small screwdriver or knife to scribe a small line across the trace deep enough to break the conductive path. Using a piece of light gauge hookup wire connect pin 6 of IC22 to connector pin A15. Using a separate piece of hookup wire connect pin 4 of IC22 to pin 2 of IC24. Check your modifications and wiring for accuracy. This completes the modification. Use the table below to determine the proper position for the address select programming jumper which must be in-stalled on the memory board.

Modifying the 8K MP-8M Memory Board

To modify the MP-8M memory board for operation above 32K first flip all of the address select slide switches on the memory board to their OFF position. For operation from 40K to 48K (A000 to BFFF) solder a piece of light gauge hookup wire from pin 1 of IC22 to pin 10 of IC18. For operation from 48K to 56K (C000 to DFFF) solder a piece of light gauge hookup wire from pin 1 of IC22 to pin 9 of IC18. For operation from 56K to 64K (E000 to FFFF) solder a piece of light gauge hookup wire from pin 1 of IC22 to pin 7 of IC18. Only one of the three above mentioned jumpers may be installed at a time. Check your wiring for accuracy. This completes the modification. Table II gives the new memory assignments for each of the memory integrated circuits.

TABLE I

MP-M Memory Address Assignment Table (Hex) above 32K

Board #	Memory Quandrant (K of memory)	Starting Address	Ending Address
	1	8000	83FF
	2	8400	87FF
0	3	8800	8BFF
	4	8C00	8FFF
	1	9000	93FF
	2	9400	97FF
1	3	9800	9BFF
	4	9C00	9FFF
	1	A000	A3FF
	2	A400	A7FF
2	3	A800	ABFF
	4	AC00	AFFF
	1	B000	B3FF
	2	B400	B7FF
3	3	B800	BBFF
	4	BC00	BFFF
	1	C000	C3FF
	2	C400	C7FF
4	3	C800	CBFF
	4	CC00	CFFF
	1	D000	D3FF
	2	D400	D7FF
5	3	D800	DBFF
	4	DC00	DFFF
	1	E000	E3FF
	2	E400	E7FF
6	3	E800	EBFF
	4	EC00	EFFF
	1	F000	F3FF
	2	F400	F7FF
7	3	F800	FBFF
	4	FC00	FFFF

MP-M/MP-MX Memory IC Assignment Map

		Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Quadrant 1	(1K)	IC15	IC13	IC11	IC9	IC7	IC5	IC3	IC1
Quadrant 2	(2K)	IC16	IC14	IC12	IC10	IC8	IC6	IC4	IC2
Quadrant 3	(3K)	IC40	IC38	IC36	IC34	IC32	IC30	IC28	IC26
Quadrant 4	(4K)	IC25	IC39	IC37	IC35	IC33	IC31	IC29	IC27

00 hex = 0000 0000 binary
01 hex = 0000 0001 binary
02 hex = 0000 0010 binary
04 hex = 0000 0100 binary
08 hex = 0000 1000 binary
10 hex = 0001 0000 binary
20 hex = 0010 0000 binary
40 hex = 0100 0000 binary
80 hex = 1000 0000 binary

TABLE II
MP-8M Memory Address Assignment Table (Hex) above 32K

Board Select	Half of Memory	Starting Address	Ending Address
IC18 pin 11	lower	8000	8FFF
	upper	9000	9FFF
IC18 pin 10	lower	A000	AFFF
	upper	B000	BFFF
IC18 pin 9	lower	C000	CFFF
	upper	D000	DFFF
IC18 pin 8	lower	E000	EFFF
	upper	F000	FFFF

MP-8M Memory IC Assignment Table

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Lower 4K	IC 7	IC 5	IC 5	IC 4	IC 3	IC 2	IC 1	IC 0
Upper 4K	IC 15	IC 14	IC 13	IC 12	IC 11	IC 10	IC 9	IC 8

Hex to Binary Conversion

00 hex = 0000 0000 binary
01 hex = 0000 0001 binary
02 hex = 0000 0010 binary
04 hex = 0000 0100 binary
08 hex = 0000 1000 binary
10 hex = 0001 0000 binary
20 hex = 0010 0000 binary
40 hex = 0100 0000 binary
80 hex = 1000 0000 binary

Operating at Baud Rates higher than 1200 baud

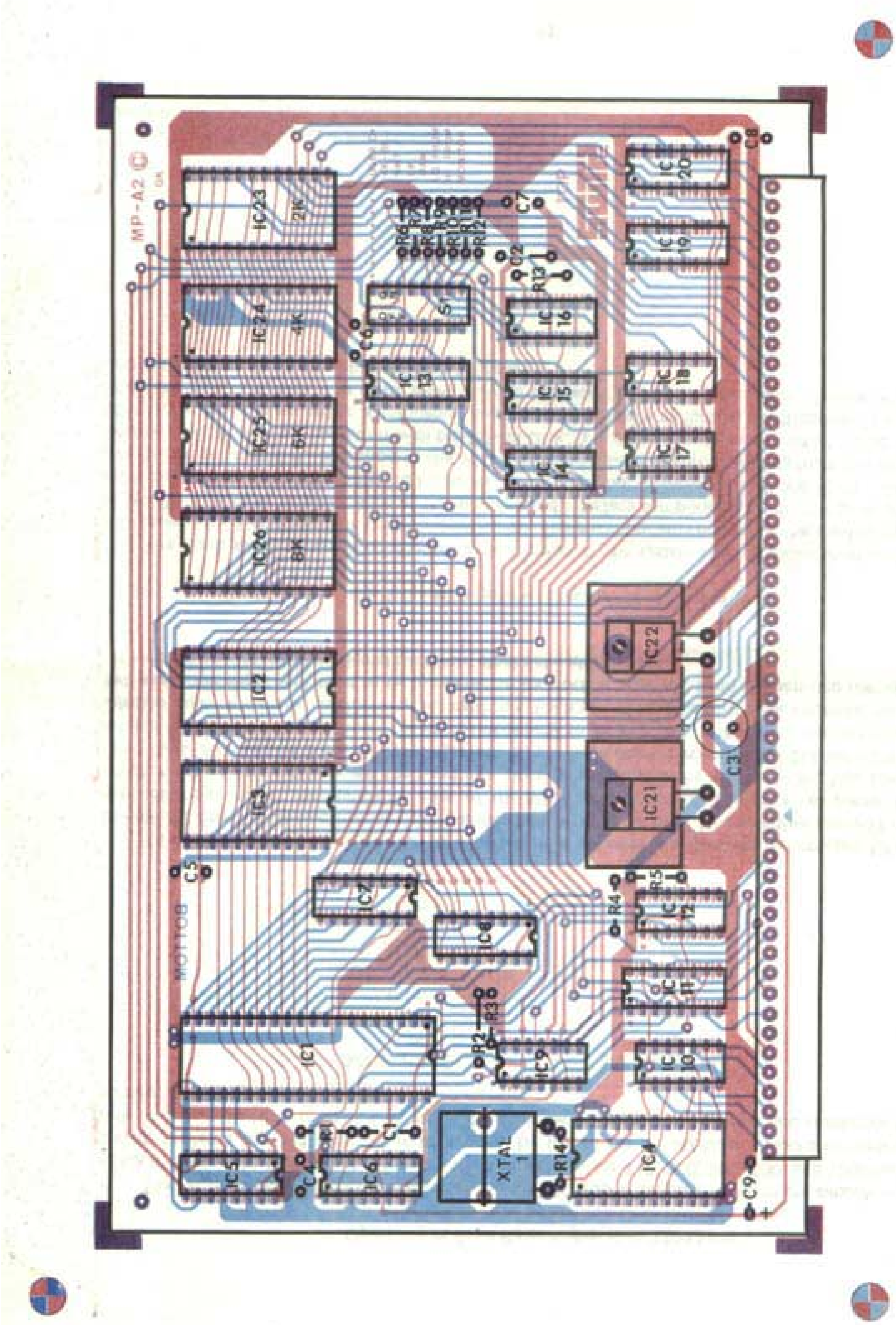
The MP-S Serial Interfaces available for the SWTPC 6800 Computer System are capable of operating at baud rates up to 9600 baud. Although baud rate clocks for 110, 150, 300, 600, and 1200 baud are generated, buffered and fed onto the mother board by IC4 of the MP-A2 board, clocks for additional baud rates are also available from IC4 as well. The table below gives the baud rate and respective output pin number of IC4.

BAUD RATE	MP-A2 IC4 pin #
75	9
200	6
1800	15
2400	3
3600	16
4800	2
7200	17
9600	1

To use the selected clock, run on insulated jumper between the specified pin and pin 13 of IC10 on the MP-A2 board. Run another insulated jumper between pin 12 of IC10 and either the UD1 or UD2 bus connections points at the connector edge of the MP-A2 circuit board, IC10 is a low power TTL buffer which must be inserted between the baud rate clock generator and the mother board bus. Since user defined lines UD1 and UD2 are carried on just the 50 pin main board bus and lines UD3 and UD4 are carried on just the 30 pin interface board, it will be necessary to jumper two of the buses together to provide the selected baud rate clock on the interface card bus. Each serial interface card to be operated with the selected baud rate clock will have to be jumpered so its clock is acquired from the selected user defined line rather than one of the five original baud rate clocks already present.

Clock Speed Adjustment on the MP-A2 Board

The clock speed on the MP-A2 board which is that of the system itself is determined by the resistor R1 -- capacitor C1 combination on the MP-A2 board. These components determine the oscillating frequency of the 6875 clock driver chip. Most of the memory and interface components on the computer system have been chosen for operation in the 100 KHz to 1.1 MHz region; however, the MF-68 Floppy Disk is more critical and requires CPU operation in the 900 KHz to 1.05 MHz region. Deviating from this will cause unreliable if not impossible operation with the MF-68 Disk. It is therefore suggested that you check for proper CPU clock speed using either a frequency counter or accurately calibrated oscilloscope. The ideal clock speed setting is 1 .0 MHz. The clock speed may be increased by lowering the value of either R1 or C1 and decreased by increasing the value of either R1 or C1.


MP-A2
IC1
IC2
IC3
IC21
IC22
IC23
IC24
IC25
IC26
2K
4K
8K
XTAL 1
C3
C5
C6
C7
C9
R4
R5
R13
R14

Software Patches for Serial Interface Operation

If you are using your disk system with a MP-S serial interface as is supplied with the 6800/2 kit, several modifications may need to be made to your FDOS software to allow proper operation. BASIC and CO-RES are the only programs affected. The following procedure should be followed carefully to make the changes. Be sure to make a back-up diskette before making any changes in case anything goes wrong.

Patches for FDOS 1.0, 1 .1 and 1.4

1) Bring up the FDOS operating system and leave the supplied system diskette in drive 0.

2) Insert a blank diskette in drive 1 and **INITIALIZE** it. **Do not** copy the data on the diskette in drive 0 onto the diskette in drive 1.

3) Type **EXIT** to return to the SWTBUG monitor.

4) Change location **278B** to a **20** using the Memory Examine and Change function of SWTBUG.

5) Type **J2600** to return to the FDOS system.

6) Type **LOAD $BASIC**

7) Type **EXIT**

8) Make the following patches using the Memory Examine and Change function of SWTBUG.

0020	BF	0036	3A	004C	7F	0062	7E
0021	00	0037	7E	004D	27	0063	01
0022	3A	0038	01	004E	20	0064	EE
0023	8E	0039	00	004F	39	0065	7E
0024	00	003A	00	0050	FE	0066	02
0025	3A	003B	00	0051	A0	0067	00
0026	CE	003C	7F	0052	10	0068	B6
0027	27	003D	00	0053	7A	0069	80
0028	20	003E	91	0054	27	006A	04
0029	32	003F	7D	0055	20	006B	7E
002A	A7	0040	E0	0056	39	006C	01
002B	00	0041	D6	0057	7D	006D	EC
002C	8C	0042	2B	0058	27		
002D	27	0043	0F	0059	20	014E	2F
002E	52	0044	BD	005A	26	014F	90
002F	27	0045	E1	005B	0C		
0030	03	0046	D3	005C	B6	01E9	7E
0031	08	0047	26	005D	80	01EA	27
0032	20	0048	07	005E	04	01EB	32
0033	F5	0049	FE	005F	47	09DC	BD
0034	BE	004A	A0	0060	24	09DD	27
0035	00	004B	10	0061	03	09DE	21

9) Type **J2600** to return to FDOS.

10) Type **SAVE 1 $BASIC**
    FIRST ADDRESS = 0020
    LAST ADDRESS = 23FF
    PRG START = 0020
    ? $$

11) Type **LOAD $CORES**

12) Type **EXIT**

13) Make the following patches using the Memory Examine and Change Function of SWTBUG.

1682	47
1683	24
1684	02
1685	20
1686	A0

14) Type **J2600** to return to FDOS.

15) Type **SAVE 1 $CORES**
FIRST ADDRESS = 0020
LAST ADDRESS = 23FF
PGM START = 0100
? $$

16) Type **LOAD $COPY**

17) Type **SAVE 1 $COPY**
FIRST ADDRESS = 0100
LAST ADDRESS = 0427
PGM START = 0100
? $$

18) Type **LOAD $PACK**

19) Type **SAVE 1 $PACK**
FIRST ADDRESS = 0100
LAST ADDRESS = 02FF
PGM START = 0100
? $$

The diskette in **drive** #1 is now modified for ACIA operation. The diskette in drive #0 is unmodified.

Patches for FDOS 1.41

FDOS 1.41 already contains the necessary patches for correct BASIC operation. Follow the procedure given for modifying FDOS 1.0 but omit steps 6, 7, 8, 9 and 10.

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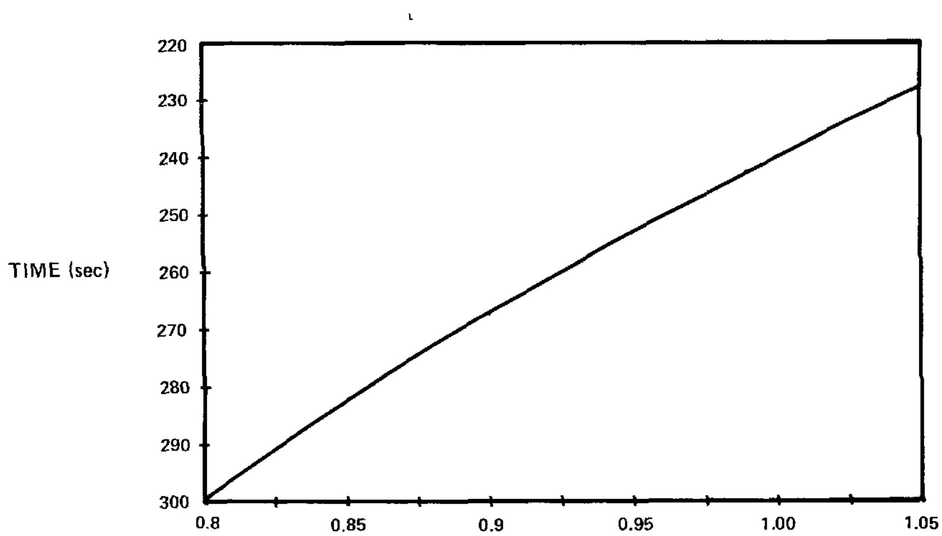
Measuring the Frequency of a SWTPC 6800
Computer System Without a Frequency Counter

The MP-A2 processor board utilizes the time constant of a RC network to set the computer's operating frequency-the crystal is used only for the baud rate generator. In order for the computer to operate properly with the supplied memory and other peripherals the processor's frequency must lie between 850 kHz and 1.0 MHz The MP-A2 instruction set describes the procedure to change the frequency.

If a frequency counter is not available, the frequency of a 6800 Computer System can be measured with a short delay loop and a wrist watch or stopwatch. To measure the computer's frequency, enter the short program below and set the program counter to 0100. Timing must begin the instant the G is typed to start the timer. The computer will output a B immediately after execution and every 60 sec. thereafter. Approximately 60 sec. after the fourth B is output an E will be output and processor control will return to the computer's operating system. The stopwatch must be stopped when the E is output. The following formula can then be used to calculate the frequency:

F (MHz) = q Where t is the measured time in seconds.

If a shorter time interval is desired replace the contents of locations 0103, 0104, 0105, 0106, 0107, 0108, 0109, 010A and 0108 with a 01. This will give an overall time measuring period of about one min. In this case use the following formula: F (MHz) = 60/t



FREQUENCY (MHz)
F(MHz) = 240 /t

```
0100 BD 01 14  START    JSR    LOOP
0103 BD 01 14           JSR    LOOP
0106 BD 01 14           JSR    LOOP
0109 BD 01 14           JSR    LOOP
010C 86 45              LDA A  #'E
010E BD E1 D1           JSR    OUTEEE
0111 7E E0 E3           JMP    CONTRL
0114 86 42     LOOP     LDA A  #'B
0116 BD E1 D1           JSR    OUTEEE
0119 C6 3B              LDA B  #$3B
011B CE F8 00  OVR1     LDX    #$F800
011E 09        OVR      DEX
011F 09                 DEX
0120 08                 INX
0121 26 FB              BNE    OVR
0123 5A                 DEC B
0124 26 F5              BNE    OVR1
0126 39                 RTS
```

```
$  G     B  B  B  B  E
$  ^                 ^
   Start             End
   Timing            Timing
```