Assembly Instructions MP-B2 Mother Board

Introduction

The MP-B2 Mother Board is a 9 " x 14" double sided plated thru hole board onto which all of the various processor boards are plugged. Provisions have been made for one processor board, up to four memory boards plus two unused slots. This gives the user the ability to handle up to 32K words of memory.

The mother board also provides the line buffering and address decoding for up to eight interface boards. Although one of the eight must be the serial control interface, the other seven may be any combination of serial (MP-S) and parallel (MP-L) interfaces the user may choose to have. For those demanding even more interfaces the 50-line processor bus may be paralleled onto another MP-B2 Mother Board with power supply expanding the interfacing to one serial control interface, plus any combination of up to fifteen serial (MP-S) and parallel (MP-L) interfaces. Doing this requires a minor modification to the second mother 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.

PC Board Assembly

NOTE: Since all of the holes on 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.

( ) Install all of the capacitors on the board. Solder.

( ) Install each of the 59, 10-pin Molex male connectors oriented so the shorter pinned side fits into the holes provided on the mother 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 plug-on boards to be less rigid. Do not solder the pins adjacent the dotted lines shown in the component layout drawing. It is suggested that you solder only the two end pins of each of the fifty-nine connectors until all have been installed; at which time, if everything looks straight and rigid, you should solder the as yet unsoldered pins still excluding the ones adjacent the dotted lines on the component layout drawing.

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( ) Using a pair of wire cutters, cut off the "INDEX" pin on each of the seven main board and eight interface board male connector strips. Each row is pointed out by the word "INDEX" printed right on the "TOP" side of the mother board. Be very careful when doing this. Do not cut off anything other than the "INDEX" pins. You cannot afford to make a mistake here. These "INDEX" locations prevent the various plug-on boards from being plugged on incorrectly later during assembly.

( ) Install each of the integrated circuits excluding IC2. 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 place 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.

( ) Install integrated circuit IC2 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, lockwasher and nut. The three leads of the integrated circuit must be bent down into each of their respective holes and the heatsink must be orientated as shown in the component layout drawing. Solder.

( ) Remove any oxidation from the copper on the two mother board support strips using a piece of Scotchbrite. Take the shorter of the two and position it on the "BOTTOM" side of the mother board along the main board GND bus and perpendicular to the mother board as indicated in the component layout drawing. It should be oriented with its copper edges against the "BOTTOM" side of the mother board, extending from the first to the seventh main board connection rows. Solder the as yet unsoldered connector pins adjacent the strip making sure the strip is soldered in place as well. Make sure the strip remains firmly against the PC board while soldering. Now take the longer of the two strips and position it against the "BOTTOM" side of the mother board parallel to and in the center of the +8 UNR interface bus as indicated in the component layout drawing and attach like the first strip. These strips provide rigidity and support for the mother board and prevent the mother board from bottoming out when the plug-on boards are installed.

( ) 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 o n 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. Do not fill in the 16 holes on the edge of the board that are to be used for wiring connections.

( ) Now that all 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 checkout. Also, look for solder "bridges" and "cold" solder joints which are another common problem.

This completes the assembly phase for the MP-B2 board. Checkout instructions for the board are provided with the System Checkout Instructions supplied with this kit. The System Checkout Instructions are used after having assembled the processor board, M P-B 2 mother board, serial control interface and the M PM P-P power supply.

How It Works

The only circuitry on the MP-B2 mother board is that tying the various interface cards to the system's interface information bus. IC1 is a non-inverting buffer used to drive selected control lines feeding the interface cards. One of eight decoders IC3 and IC6 decode and enable one of eight interface cards when one of the interface addresses is loaded to the 50-line system information bus.

Since the eight bit data bus for the main boards as well as the interface cards is bi-directional, transceiver buffers IC7 and IC8 buffer the incoming and outgoing data to and from the interface data bus to the system's data bus. Gates within NAND gate IC4 and NOR gate IC5 control the direction of data flow within the transceiver/buffers. +5 VDC power for the interface decode/buffer circuitry is provided by voltage regulator IC2. +5 VDC power for all of the plug-on boards, including interfaces, is provided by separate regulators on each board.

The following is a brief description of each of the fifty lines on the system information bus:

D0 - D7#	The D0 - D7# lines carry inverted data bits 0 thru 7 respectively forming 8-bit data words which are exchanged between the various boards within the system.
A0 - A15	The A0 - A15 lines carry address bits 0 thru 15 respectively forming a 16-bit address which is used to define either a memory location or interface address.
GND	The GND line is the system's common or power supply ground point.
7- 8 VDC UNREG or +8 UNR	The 7 - 8 VDC UNREG point is the line to which a +7 to 8 volt DC @10A unregulated power supply should be attached. This voltage is then regulated down to +5 VDC by in dependent regulators on the various boards within the system.
-12, +12	The -12 and +12 points are lines to which an isolated ground -12@200 Ma and +12 @200 Ma power supply should be connected. The voltages are necessary for generating the currents required by 20 Ma current loop and RS-232 equipment on the serial interfaces.
INDEX	The INDEX is an unused bus and is provided so the pin on each of the male connectors may be cut with the corresponding female connector pins plugged, preventing the circuit boards from being plugged on incorrectly
M. RESET#	The MANUAL RESET# line when momentarily grounded indirectly resets the registers internal to the processor and interfaces, and loads the ROM stored mini-operating system. This line is normally grounded by depressing the RESET button on the system's front panel.
NMI#	The NMI# is the non-maskable, single level interrupt line feeding the processor board. When momentarily grounded it forces the processor into a push-down stack, store routine, followed by a program jump to a user selected address stored in the operating system RAM. The NMI# is non-maskable thus, can not be inhibited by the programmer thru software.
IRQ#	The IRQ# is the maskable, single level interrupt request line feeding the processor board. If not inhibited by software it will, when momentarily grounded, force the processor into a push-down stack, store routine followed by a program jump to a user selected address stored in the operating system RAM.
UD1, UD2	The UD1 and UD2 are user defined lines and have not been assigned a function.
ø2	ø2 is one of the two complementary system clock outputs and is used to signal that valid data is on the data lines D0 - D7# when low.
VMA#	VMA# is the valid memory address line which goes low to confirm that valid memory data is being presented on the sixteen address lines, A0 - A15.

R /W	The READ/WRITE line establishes the direction of data flow on the eight data lines, D0 -D7. It is high for a read from memory or interface and low for a write to memory or interface.
RESET#	The RESET line when low resets the registers internal to the processor and interfaces, and loads the ROM stored mini-operating system. This line is activated by a one-shot on the processor board when the system is first powered up or when M. RESET line is momentarily grounded
BA	The BUS AVAILABLE line goes high acknowledging a processor halt meaning the processor has stopped and that the system information bus is available for external control.
HALT#	The normally high HALT# line when brought low, halts the processor and frees the system information bus for external control
ø1	ø1 is the non-overlapping clock complement of ø2. This signal is provided by the MP-A but not by the MP-A2 processor board.
110b, 150b 300b, 600b, 1200b	These five lines carry the clocks required by the serial interfaces for 110, 150, 300, 600, 1200 baud communication.

Attached to the 50-line system information bus are the interface decode and driver circuits. A considerable cost savings is made by providing the address decoding and information bus buffering for all of the interfaces right on the mother board instead of providing it on each of the interface boards individually. Since each of the parallel interfaces require four address locations and the serial two, four addresses are provided for each of the interface positions. They are assigned as shown in the memory map, figure 1. Interface position 1 (8004 - 8007) is reserved for the terminal, control interface. The signals carried on the interface information bus are almost identical to those on the system bus. UD3 and UD4 are here again User Defined data lines and RS0 and RS1 are Register select lines which are identical to address line A0 and A1 respectively.

The original MP-B Mother Board decoded the entire 8 K block of memory from 32K thru 40K as being resident on the mother board. Although simpler from a circuitry viewpoint, this technique was wasteful and has been changed on this version, the MP-B2, so that only the 32K thru 36K block has been allocated to the mother board interface addresses. This allows boards outside the interface address range to use the 36K thru 40K memory addresses.

The new decoding arrangement also makes it easy to reassign the interface address block to any 4K region from 32K to 64K in 4K increments. Although this isn't allowable when using the MIKBUG® or SWTBUG® monitors, it does have potential when using custom monitors.

To relocate the 4K interface address block to something other than the 32K thru 36K hardwired assignment, carefully cut the foil trace going to pin 15 of IC6 on the bottom side of the MP-B2 board. Jumper pin 12 of IC5 to the specified pin of IC6 using the table below:

Interface	Address	Assignment	IC6 pin #
32K -	36K	(8000-8FFF)	15
36K -	40K	(9000-9FFF)	14
40K -	44K	(A000-AFFF)	13
44K -	48K	(B000-BFFF)	12
48K -	52K	(C000-CFFF)	11
52K -	56K	(D0D0-DFFF)	10
56K -	60K	(E000-EFFF)	9
60K -	64K	(F000-FFFF)	7

The actual interface card addresses will be the first 32 addresses of each 4K block with four sequential addresses assigned to each card position.

If you ever wish to expand your system to two MP-B2 mother boards in order to accommodate more interface cards, you must first modify the second MP-B2 board so it responds to the second set of 32 sequential addresses within the 4 K address block. The second MP-B2 board should also be assigned the same 4 K memory address block as the first MP-B2 board. Modify the second MP-B2 mother board by cutting the foil trace going to pin 4 of IC6 right at IC6. Now run a jumper from pin 4 of IC6 to pin 4 of IC5. The MP-B2 mother boards themselves are interconnected by paralleling the 50-pin buses together using #18 gauge or heavier stranded wire. The wire length should be kept as short as possible and preferably no more than 24 inches in length.

NOTE: The MP-A2 Processor board does not generate the ø1 signal described in the mother board bus line definitions when plugged onto the M P-B mother board.

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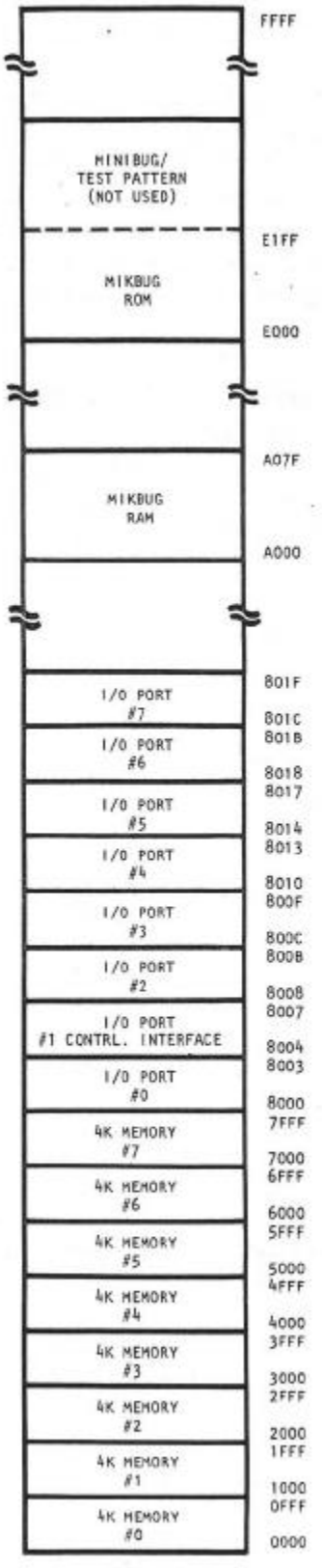

All addresses are in hexadecimal

SwTPC 6800 Memory Map

Figure 1

Resistors

___	R1	470 ohm 1/4 watt resistor	___	R7	6.8K ohm 1/4 watt resistor
___	R2	470 ohm 1/4 watt resistor	___	R8	6.8K ohm 1/4 watt resistor
___	R3	470 ohm 1/4 watt resistor	___	R9	1K ohm 1/4 watt resistor
___	R4	470 ohm 1/4 watt resistor	___	R10	470 ohm 1/4 watt resistor
___	R5	470 ohm 1/4 watt resistor	___	R11	1K ohm 1/4 watt resistor
___	R6	470 ohm 1/4 watt resistor			

Capacitors

___	C4	0.1 mfd disk capacitor

Integrated Circuits

___	IC1	DM8097 / 74367 / 74LS367	___	IC5	7402 Quad NOR Gate
___	IC2	7805 +5VDC Voltage Regulator	___	IC6	74S138 1 of 8 decoder
___	IC3	74S138 1 of 8 decoder	___	IC7	DM8835 / DS8835
___	IC4	7400 Quad NAND Gate	___	IC8	DM8835 / DS8835