

## Assembly Instructions MP-LA Parallel Interface

### Introduction

The MP-LA Parallel Interface is a 5 1/4" x 3 1/2" double sided, plated thru hold board implemented with the 6820 peripheral interface adapter integrated circuit which is used to interface a parallel data device to the computer. The board is provided with two separate connections along the edge of the board. Each connector contains eight data lines which may be programmed for either outputs or inputs, one "data ready" line, and one "data accepted" line for full handshake control. All data lines are fully buffered with bi-directional transceivers to allow eight inputs and eight outputs, 16 inputs and no outputs or 16 outputs and no inputs. Programming of a particular set of data lines is done via jumpers on the MP-L board. Software control of interrupt lines and the polarity of the handshake lines is provided. Power for the board is supplied by a +5 volt voltage regulator and has a current consumption of approximately 0.4 A.

When using the parallel interface the control registers internal to the PIA (6820) must be configured through software as either outputs or inputs. The software programming of outputs and inputs, however, must match the input/output jumper configuration of the board. Software programming of interrupts and handshaking is also required. Complete details on the interface's internal registers and the configuring of them is contained in the Hardware and Programming sections of the System Documentation Notebook and are not explained here.

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 circuit supplied with this kit is susceptible to static electricity damage and for this reason has been packed with its 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.

The MP-L parallel interface is an option board and need not be assembled nor should it be installed onto the mother board until the entire computer system has been checked out and is known to be working properly.

### 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 hold. 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 connections to the top foil.

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- ( ) 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.
- ( ) Starting from one end of the circuit board install each of the three, 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 circuit board so 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 plugging it into the mother board. It is suggested that you solder only the two end pins of each of the three connectors until all have been installed at which time if everything looks straight and rigid you should solder the as yet unsoldered pins.
- ( ) Following the procedure outlined above, attach the two remaining 12 pin Molex female edge connectors along the upper edge of the board. Solder.
- ( ) Insert the small nylon indexing plugs into both the upper and lower edge connector pins indicated by the small triangular arrows on the "BOTTOM" side of the circuit board. This prevents the board and I/O connectors from being accidentally plugged on incorrectly.
- ( ) Attach the capacitor 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 the resistors on the board. Solder.
- ( ) Install integrated circuit IC2 on the circuit board. This component must be oriented so its metal face is facing the circuit board and is secured to the circuit board with a #4 - 40 x 1/4" screw, lockwasher and nut. A heatsink is not used. The three leads of the integrated circuit must be bent down into each of their respective holes. Solder.
- ( ) Install integrated circuits IC3 -IC7 on the circuit board. 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 semi-circle notch, dot or bar 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.

- ( ) The parallel interface can now be programmed for the particular combination of inputs and outputs that will fit your needs. Jumpering a G pad to OA will make the A side an output while jumpering IA to G will make the A side inputs. The same holds true for the B side. Unless your particular needs dictate otherwise, we suggest you jumper OA to G and IB to G to be compatible with SWTPC software.
- ( ) Unless you plan to use the board in a special situation where you will be using interrupts leave the IRQ and NMI jumpers out. If you will be using standard interrupts, you will want to run a jumper between point A and IRQ and/or point B and IRQ on the board. This allows you to use the conventional interrupt request line (IRQ) when it is selected in your program. These jumpers are not shown in place on the component layout drawing. If non-maskable interrupts are desired jumper from either A or B to NMI.

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 M ohm 1/4 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 ohm 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 ohm 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 MOS integrated circuit ICI following the precautions given in the preceding section. As it is installed, make sure it is down firmly against the board before soldering all of its leads. Do not bend the leads on the back side-of the board. Doing so makes it very difficult to remove the integrated circuit should replacement ever be necessary. The "dot" or "notch" on the end of the package is used for orientation purposes and must match with that shown on the component layout drawing for the IC.
- ( ) 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 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.

Since the MP-L circuit board now contains a MOS device 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.

#### Input/Output (I/O) Connector Wiring

Actual I/O connections are made thru the two 12 pin connectors along the top edge of the board. The functions of each of the I/O connector pins are as follows:

##### B Connector Pins

- C1 is the "handshake" control input. It is electrically the same as the CB1 input on ICI, the PIA integrated circuit. The line is buffered and represents one TTL load.
- C2 is the "handshake" control output. It is the line buffered output of the CB2 pin on IC1, the PIA integrated circuit. It is TTL compatible and is capable of sourcing 5.2 mA. and sinking 16mA of current.
- GND is the common line for all I/O connections and is electrically
- B0-B7 are eight non-inverting data lines. The buffered lines feed pins PBO thru PB7 respectively on ICI, the PIA integrated circuit.

##### A Connector Pins

- C1 is the "handshake" control input. It is electrically the same as the CA1 input on ICI, the PIA integrated circuit. The line is buffered and represents one TTL load.
- C2 is the "handshake" control output. It is the line buffered output of the CA2 pin on ICI, the PIA integrated circuit. It is TTL compatible and is capable of sourcing 5.2 Ma and sinking 16 Ma of current.
- GND is the common line for all I/O connectors and is electrically connected to the computer system's ground buss.
- A0-A7 are eight non-inverting data lines. Each is the buffered input or output of pins CAO thru CA7 respectively on ICI, the PIA integrated circuit.
- NOTE: Each data output line (A0-A7 and B0-B7) is capable of sourcing 10.4mA and sinking 32mA. Each data input represents one standard TTL load.

### Attaching the I/O Connector to the Interface

The male I/O connectors which attach to the interface are simply a row of twelve pins supported by a nylon base. The longer side of the male connector plugs onto the interface board edge connector while the cable wires going to the peripheral device are soldered onto the shorter side of the connector. The cable which goes back to the peripheral should, if at all possible, be a multi-conductor cable (not supplied with the kit) with a minimum of twelve separate conductors.

When preparing to attach the cables to the connectors, first strip back 2" of the cable's outer insulation. While positioning each cable in line with the male connector's nylon support strip allowing the wires to extend just beyond the last pin on the strip, attach and solder each of the appropriate wires oriented so the C1 pin is connected to the shortest wire on the B side connector and GND is connected to the shortest wire on the A side connector. It is very easy to melt the body of the nylon connectors which will loosen the pins, so be very careful and use a heatsink on each pin between the solder point and connector body where possible. After attaching all of the cable wires bend each connector around the cable a full 180 degrees and secure with two wire ties (supplied with the kit). Now cut off the indexing pin on each male connector. To minimize noise and ringing, keep the cable length between the interface and peripheral as short as possible.

### Address Assignments

Four address assignments have been allocated for each interface port; they are as follows:

PORT 0	8000 to 8003
PORT 1	8004 to 8007 (serial control interface only)
PORT 2	8008 to 800E
PORT 3	800C to 800F
PORT 4	8010 to 8013
PORT 5	8014 to 8017
PORT 6	8018 to 801E
PORT 7	801C to 801E

The actual addresses to be used in your programs for the interface(s) is determined by the interface position (port #) onto which the board is plugged.

Within each block of four addresses the lowest is used for Peripheral Register A and Data Direction Register A. The second sequential address is used for Control Register A. The third sequential address is used for Peripheral Register B and Data Direction Register B. The last sequential address is used for Control Register B. Complete details on these registers and their functions are contained in the Hardware section of the System Documentation and will not be repeated here.

### Optional MP-L Parallel Interface Checkout Procedure

Should you have problems with the MP-L board, you may wish to check it out independent of the peripheral device to which it is connected. You may do so by running the "PARINT" diagnostic listed in the Software section of the System Documentation Notebook.

#### How It Works

The entire board is configured around the operation of ICI, the peripheral interface adapter integrated circuit described in detail in the Hardware section of the System Documentation Notebook. Non-Inverting buffer integrated circuits IC3 thru IC7 simply provide the line driving and buffering for IC1. +5 VDC power for the board is provided by voltage regulator integrated circuit, IC2.

#### Parts List MP-L Parallel Interface

##### Resistors

R1-R5                    1K ohm 1/4 watt resistor

##### Capacitors

C1                        0.1 mfd disc

##### Semiconductors

ICI                        MC6820 peripheral interface adapter (MOS)  
IC2                        7805 5 VDC voltage regulator  
IC3-IC7                    DM 8833 quad TRI-STATE bi-directional transceiver

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