SWTPC MODIFICATION - APPLICATION NOTICE AN #124

Product: S/09 Computer
Date: Oct. 21, 1980 J.D.

Operating the SWTPC S/09 Computer at 2 MHz

The following information is supplied to assist competent technical personnel in the set-up, operation and checkout of a 2 MHz computer system. This notice is intended to show differences which may exist between the computers shipped for 2 MHz operation and the originally supplied documentation. It is not intended to be a step-by-step conversion procedure. Included is a description of what revisions and parts are necessary on each circuit board within the S/09 for proper 2 MHz operation. Application notice AN #114 and AN #122A show how the boards are being shipped for 2 MHz operation on the date of this notice. Parts values not specifically noted in the board descriptions are as described in the original parts list. Some of the changes noted have already been made on some pre-2 MHz units.

As stated, this application notice is designed for those persons well versed with the operation of the SWTPC S/09 computer. No attempt should be made to field modify a 1 MHz computer to 2 MHz. SWTPC does not supply a step-by-step conversion procedure and can provide no assistance with such modification.

The changes described below include and do not conflict with those changes outlined in SWTPC AN #122A "Hardware Modifications for the UniFLEX and FLEX Operating Systems".

MP-09A Processor Board

1.) The circuit board must be a MP-09A, not an MP-09.

2.) Several parts value changes have been made. Correct values are as follows:

___	IC8	74S189 RAM (not 74LS189)
___	IC11	74S189 RAM (not 74LS189)
___	IC14	68B09 Processor date code 8021 or higher (not 6809 or 68A09)
___	IC21	74LS132 Quad Schmitt NAND gate
___	Y1	8 MHz crystal
___	R9	470 ohm 1/4 watt resistor
___	R10	" " " " "
___	R13	" " " " "
___	R14	" " " " "
___	R21	" " " " "
___	R22	" " " " "
___	R23	" " " " "
___	R24	" " " " "

3.) Several board cuts and patches are necessary as shown in AN #122A.

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MP-MB Motherboard

1.) The three terminating resistor packs should be removed as shown in AN #122A.

MP-S2 Serial Interface

No modifications are necessary on the MP-S2. If 6850 integrated circuits are used in place of 68B50 IC's, the SLOW PER jumper must be installed on the MP-ID board. (See MP-ID description.)

MP-L2 Parallel Interface

No modifications are necessary on the MP-L2. If a 6820 or 6821 is used in place of a 68B20 or 68B21, the SLOW PER jumper must be installed on the MP-ID board.

MP-ID Interface Driver Board

1.) If the MP-ID contains a 6820/6821 or a 6840 instead of a 68B20/68B21 or 68B40, or if any interfaces are installed that use non "B" series parts (6850, 6821, etc), or if a minifloppy disk controller board is installed, then the SLOW PER/NORM jumper should be placed in the SLOW PER position.

2.) Several parts value changes have been made. The correct values should be as follows:

___R1	removed	___R12	removed
___R2	removed	___R13	removed
___R3	removed	___R14	6.8K ohm 1/4 watt
___R4	removed	___R15	6.8K ohm 1/4 watt
___R5	470 ohm 1/4 watt	___R16	removed
___R6	470 ohm 1/4 watt	___R17	330 ohm 1/4 watt
___R7	removed	___R21	150K ohm 1/4 watt
___R8	removed	___R24	10K ohm 1% resistor
___R9	470 ohm 1/4 watt	___R27	1.5K ohm 1/4 watt
___R10	470 ohm 1/4 watt		
___R11	330 ohm 1/4 watt	* Adjust as necessary	

___C7*	220 pF poly capacitor
___C12	0.1 mfd film capacitor

___IC13	9602 integrated circuit (not 96S02)
___Q3	2N2222 transistor

3.) In addition to the parts listed above, a 560 ohm 1/4 watt resistor should be installed between the base of Q3 and ground.

4.) Adjust R24 and/or C7 if necessary to obtain a 1250 nS cycle on stretched I/0 accesses. (See description later on "Measuring Stretched Cycles".)

DMF2 Disk Controller

1.) Several parts value changes have been made. Parts values are as follows:

___R47*	10K 1% resistor
___R48*	10K 1% resistor
___C16	240 pF Polystyrene capacitor
___C19	100 pF Polystyrene capacitor
___IC18	9602 (not 96S02) one shot
___IC28	68B44 or 68A44 DMA controller
___IC36	74LS132 quad NAND gate
	*Adjust as necessary

2.) All board cuts and patches should be made as shown in AN #114.

3.) Set the 1 MHz/2 MHz jumper to the 2 MHz position.

4.) Adjust R47 to obtain a 1125 nS cycle on stretched I/0 accesses. (See description later on "Measuring Stretched Cycles".)

Measuring Stretched Cycles

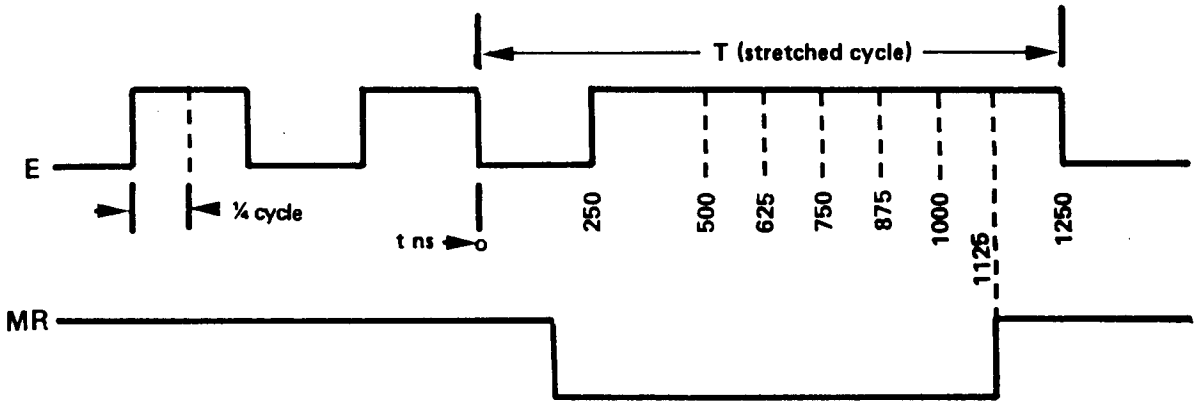
The 6809 processor has the ability to "stretch" certain clock cycles to allow slower peripherals to operate correctly on faster systems. There are currently three peripherals which require cycle stretching at 2 MHz:

1.) Memory accesses to the SMS3509 memory boards. (Hardware set requires no adjustments or measurements.)

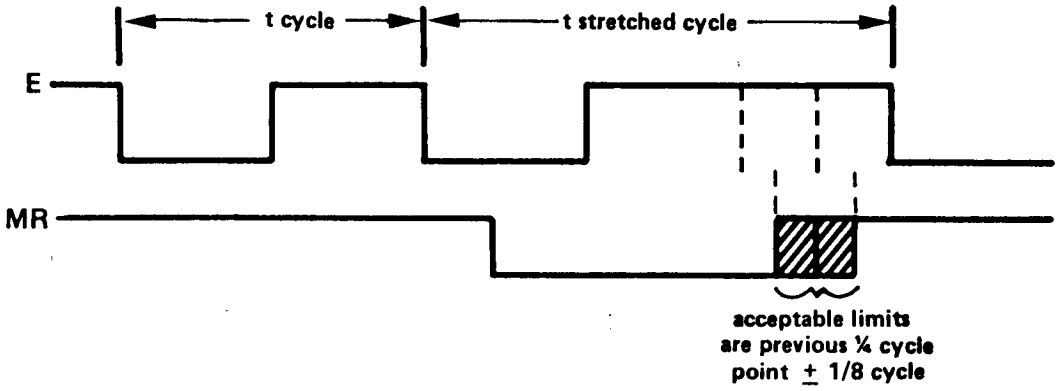
2.) Accesses to the DMF2 disk controller.

3.) Accesses to any I/0 peripheral not using 68B series integrated circuits (including SWTPC "DC" series minifloppy controller boards).

When a peripheral requests a stretched cycle it will pull the MEMORY READY line (MR) on the bus low. The 6809 will stretch the high phase of the E clock in one quarter cycle increments to the next quarter cycle past where MR returns high. (One quarter cycle at 2 MHz = 125 nanoseconds.)



The cycle shown above has a T (stretched cycle)=1250 nS. Notice that MR goes high exactly one quarter cycle sooner, at 1125 nS. Timing diagrams for proper setup are shown below:



The following procedure can be used to measure the cycle stretches of the various SWTPC peripherals. Measurements require a good dual channel, triggered sweep, calibrated oscilloscope.

Oscilloscope Connections

1.) Connect scope probe A to pin 36 (MRDY) on the 68B09. Set the scope to trigger on this signal.

2.) Connect scope probe B to pin 34 (E) on the 68B09.

3.) Configure the scope to view both of the signals in the "chop" mode.

Measuring the Stretched Cycle Timer of the MP-ID

1.) Make oscilloscope connections as described earlier.

2.) Be sure the MP-ID SLOW PER/NORM jumper is in the SLOW PER position.

3.) Power up the computer. With the computer running idle it should automatically be executing a routine in its ROM which polls an I/0 port. This should give the desired display on the oscilloscope.

4.) Adjust components on the MP-ID board if necessary to yield a 1250 nS stretched cycle time. (See MP-ID board description earlier in this text.)

Measuring the Stretched Cycle Timer of the DMF2

1.) Make oscilloscope connections as described earlier.

2.) Be sure the DMF2 1 MHz/2 MHz jumper is in the 2 MHz position.

3.) Power up the computer and enter and execute the following program: (Start execution at F000.)

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F000 B6
F001 F0
F002 23
F003 7E
F004 F0
F005 00
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The correct waveform should be displayed on the scope.

4.) Adjust components on the DMF2 board if necessary to yield a 1125 nS stretched cycle time.