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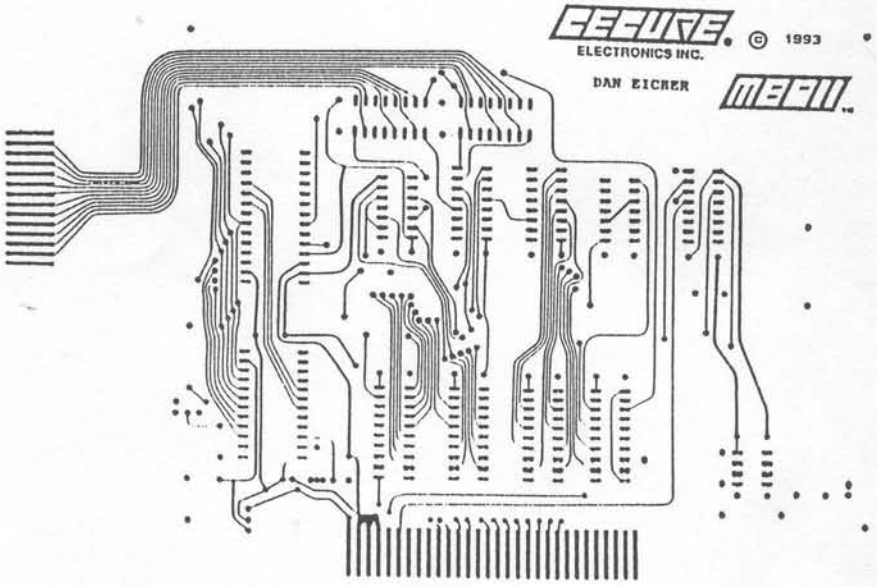

USERS MANUAL

AND

CONSTRUCTION GUIDE

ACKNOWLEDGEMENTS

The MBPII Clock and Analog to Digital Printed Circuit Board is an extension and refinement of a system design created by Mr. Gary Emmich of the Northern New Jersey 99er User's Group which was distributed to the Public Domain by Mr. Tony Albanese of the same group. This design was then enhanced by Jerry McCluskey and William Byrne of **MBP PRODUCTS** in Wichita Kansas, and was marketed as the MBP card.

CECURE ELECTRONICS INC. is indebted to them for providing us with the background to create this Latest version.

Compatibility with **S & T BBS**, an electronic bulletin board created and sold by Tim Tesch has been assured by initial efforts on our part to implement this kit on **CECURE / MAUG S & T BBS** and further collaboration with Tim Tesch. We are indebted to Tim for the creation of **S & T BBS** and his continuing effort which insures that this board will remain compatible with future **S & T BBS** updates.

We have made every effort to be certain this board is easy for you to complete. If you are having problems with any part of this board, please check **CECURE / MAUG S & T BBS**, 414 422-9669, to see if there are any messages concerning your problem. Also check the MBPII SECTION Info SECTION. Someone else might have already brought it to our attention. If so we will leave a message on the BBS as to the correction necessary. If you find no such message, then you are the first to find the problem. Leave us a message and we will advise you promptly of the corrections necessary and leave a message for others. We are anxious for you to be pleased with you clock, so please let us know if you are having any problems.

NOTE: This MBPII CARD is also compatible with the TIBBS (tm) BBS, an electronic bulletin board created by Ralph Fowler of Kennesaw Georgia.

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Real Time Clock and Analog to Digital Converter
for
TI 99/4A

Original Circuit Design and Development
by
Gary Emmich
Tony Albanese

Original Software
by
William Byrne

Original MPB PCB Design
by
Jerry McCluskey

With special thanks to
Dan H. Eicher
for rescuing this board from obscurity

Printed Circuit Board Enhancements
by
Donald M. Walden

Sound Digitizing Software
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N O T I C E

CECURE ELECTRONICS INC. reserves the right to make improvements in the product described in the manual at any time and without notice.

Introduction This documentation contains all of the information needed to construct and use the MBPII Clock/ADC PCB. It contains kit assembly instructions, system check out procedures, and general usage instructions. You should be able to assemble this board and have it functioning in your PEB in approximately 2 hours.

The system contains a battery backed real time clock and an 8 input channel multiplexed, 8 bit, analog to digital converter. Once initialized, the clock will keep time with the PEB power turned off. You can even remove the card from the PEB and reinstall it without affecting the clock. The analog to digital converter can be used to monitor any electrical signal in the 0 to 5 volt range. The clock ADC are memory mapped so that they can be accessed via software PEEK instructions. The board is designed and the memory mapped so that you need not be concerned with interaction with any other software or hardware (except of course for the use of one PEB card slot). Use of this board does not restrict the utility of your computer in any way. It does not require that you give up the use of one of your RS232 ports.

We are convinced that the TI 99/4A Home Computer is a well designed and fabricated product that will provide its owners with many years of reliable service. **CECURE ELECTRONICS INC.** is dedicated to making your computer as useful as possible.

The design of this product is in the Public Domain and not copyrighted. However, the implementation of this design is the property of **CECURE ELECTRONICS INC.** and **is copyrighted.** Specifically, the printed circuit board layout and this documentation package are copyrighted property of **CECURE ELECTRONICS INC.** and must not be copied in any form without the expressed written consent of **CECURE ELECTRONICS INC. Violators** of these copyrights can and will be prosecuted.

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BASIC CIRCUIT OPERATION:

The clock and A/D converter circuit card works by decoding the 16 bit address bus of the TMS 9900/9995 address space and placing output data on the 8 bit data bus.

There are three basic ways to design and interface unit between the outside world and a CPU:

1. Memory Mapped I/O.

2. CRU Mapped - This is a special feature of TMS 9900 processors.

3. DMA - Direct Memory Access.

The MBPII A/D card uses the first approach. This approach trades off ease of design/use with power/features. Memory Mapped I/O works by dedicating certain address in a CPU's address space for Input and/or Output with the outside world, the disadvantage to this approach is that those memory address can not be used for general purpose memory. This approach was used extensively by TI, included with this package is a TI memory so you can see exactly how much memory TI dedicated to memory mapped I/O.

Working with the MBP card is as easy as writing to a memory address and reading a result back from another address, no complicated OPEN/CLOSE statements to deal with. This card can be used with all of the common TI programming languages.

LANGUAGES:

BASIC with Editor Assembler
Extended BASIC
Extended BASIC with Editor Assembler
9900/9995 Assembly
GPL
Pascal
C
Fortran

MINIMUM EQUIPMENT REQUIREMENTS:

TI 99/4A Computer
TI Expansion System
TI Disk Controller
TI 32k Memory
One 5.25 Double Side Single Density Disk Drive
Extended Basic

ASSEMBLY INSTRUCTIONS

1. **Kit Inspection.** Review the list of materials shown in Appendix A to insure that you received a complete kit. Inspect the printed circuit board for damage. We have inspected the PCB prior to shipment. Please inspect it again before beginning assembly. If the board is cracked or any leads are loose, please call us at 414 679-4343 or send us a FAX at 414 679-3736 or leave us a private message on CECURE/MAUG S & T BBS, 414 422-9669 (modem) or write us a letter at the address shown on the front of this package. **DO NOT** solder on the PCB if it is damaged! We will have difficulty dealing with PCB defects after you begin the assembly process.

2. **Parts and Tools Review.** Review the parts and tool list of Appendix A to insure that you have everything needed to complete the project. You may, of course, start assembly before you have all of the parts but we recommend that you at least make arrangements to receive all of the parts before you start since you should be able to assemble this board in one evening and your frustration level will be very high if you have to stop construction to wait for parts.

3. **To Box or Not to Box.** We have operated our implementation of this board without an enclosure on the card and have observed no evidence of electromagnetic interference of any kind. It has been operated in PEB's with both the CorComp disk controller card and the Foundation 128K card for extended periods of time. One is in daily operation on CECURE / MAUG S & T BBS and we have observed no ill effects. If you decide to enclose your card, now is the best time to make provisions for this. The card has been laid out so that TI or CorComp card enclosures can be applied without difficulty. However, because we have been able to operate the card without an enclosure, we have designed it so that the card edges fit in the alignment slots of the PEB. If you intend to mount the card in an enclosure, it will be necessary to trim the card edge along the dotted line as shown on the Parts Layout. The card can be trimmed later but it must be done with the utmost of care after the components are installed. While trimming the card we recommend that you apply a pressure sensitive coating such as foam tape to prevent damage to the printed circuit area during the trimming operation.

4. Discrete Component Installation. The discrete components MUST be installed with reference to the Parts Layout. Reference directions are defined with the component side of the board up and the PEB connector at the bottom.

R1	100 Ohm 1/4W 5% Carbon Film Resistor
R2-4	1K Ohm 1/4W 5% Carbon Film Resistor
R5	220K Ohm 1/4W 5% Carbon Film Resistor
C1-3	22 uF 35 VDC Electrolytic Axial Lead Capacitor
C4-5	18-22 pF 50 VDC Ceramic Radial Lead Capacitor
C6-21	.1 uF 50 VDC Monolithic Axial Lead Capacitor
D1-3	1N914 or 1N4148 switching Diode
BH1	Coin Cell Battery Holder BH-906

NOTE: For easier assembly install, solder and clip the resistors, diodes and .1 uF capacitors first. Then install all the IC DIP sockets. Hold them down with tape, turn over the PCB and solder the two diagonal corner pins on each socket. Then remove the tape and make sure all sockets are flush to the PCB. If not, heat one corner, while applying pressure, then the other corner. When you have made sure that all sockets are flush with the PCB, turn the board over and finish soldering the rest of the pins. Next install the 22 uF capacitors, and the 20 pF capacitors, solder and clip. Now install the battery holder with clip down and solder. **IMPORTANT:** Please check to see that the polarity of the electrolytic capacitors and the diodes are correct!

5. 5 Volt Regulator / Heat Sink Installation. Bend the 3 legs on the 7805 regulators as shown on the Parts Layout. The legs are bent so when the regulator is installed, the metal tab will be against the PCB and the hole through the tab and the hole in the PCB will be in line. Coat HS1 on both sides with Thermal Compound and place it between VR1 and the PCB. Coat VR2 with Thermal Compound on back and install it on PCB. Install screws/nuts and tighten. Solder leads and clip.

VR1,VR2	LM340T5/7805 TO-220 5 Volt 1.5 AMP REGULATOR
HS1	TO-220 HEAT SINK THM-6079
TC	THERMAL COMPOUND
SC1,SC2	#6-24 X 1/2" MACHINE SCREW ROUND HEAD SLOTTED
NU1,NU2	#6-24 HEX NUT

6. **LED and Clock Crystal.** Install the LED with the cathode (short) leg in the bottom hole and the bottom edge of the LED standing up 3/8 inch above the PCB. Now bend the LED over toward the left as shown on the Parts Layout. Install Clock Crystal in its location and solder and clip LED and Clock Crystal leads.

7. **FLUX REMOVAL.** You must remove all solder flux from the PCB before you proceed. It is recommended that you use either a water wash flux, that can be washed off in hot water or a no wash flux, that does not require any removal. If you use rosin core flux solder you will need to use **HARSH** chemicals to remove the flux. Contact **CECURE ELECTRONICS INC.** for obtaining either the water wash or no wash solder.

8. **VOLTAGE CHECK.** Apply +12 volts DC to pin 1 of the 60 pad edge card connector using the large metal area of the PCB as ground. Measure the outputs of both regulators. Compare your results with these values below.

VR1 4.9 to 5.3 VDC
VR2 5.1 to 5.5 VDC

BE CAREFUL NOT TO SHORT OUTPUT TO GROUND!

If your measurements check out ok, remove voltage and proceed to the next step. If they do not, remove voltage and re-check your work. After you find and correct the problem, retest the board.

***** CAUTION *****

DO NOT use an ohmmeter to check anything on the board after installing the IC's, as this could damage the IC's!!

9. Integrated Circuit Installation. We recommend sockets on all the IC's, so they do not get damaged by excessive heat when soldering. Use good quality sockets to ensure long term reliable operation of the board.

NOTE: IC6 and IC7 are expensive chips and you'll want to take care installing them.

Now install the integrated circuits with their #1 pin to the upper left, except for the 2 top chips, IC13 and IC14, these chips are horizontal and pin #1 is towards the top of the board.

IC1	555	8 Pin
IC2	74LS244	20 Pin
IC3	74LS244	20 Pin
IC4	74LS244	20 Pin
IC5	74LS245	20 Pin
IC6	MM58167	24 Pin
IC7	ADC0809	28 Pin
IC8	74LS08	14 Pin
IC9	74LS138	16 Pin
IC10	74LS138	16 Pin
IC11	74LS93	14 Pin
IC12	74LS368	16 Pin
IC13	74LS174	16 Pin
IC14	74LS174	16 Pin

10. Battery Installation. Slide the battery back into the Coin Cell Holder being careful not to bend the battery retainer clip upward. The "+" side of the battery **MUST** be up. You're done!!

BT1 3 Volt Lithium Coin Cell Battery BR-2320 or equivalent

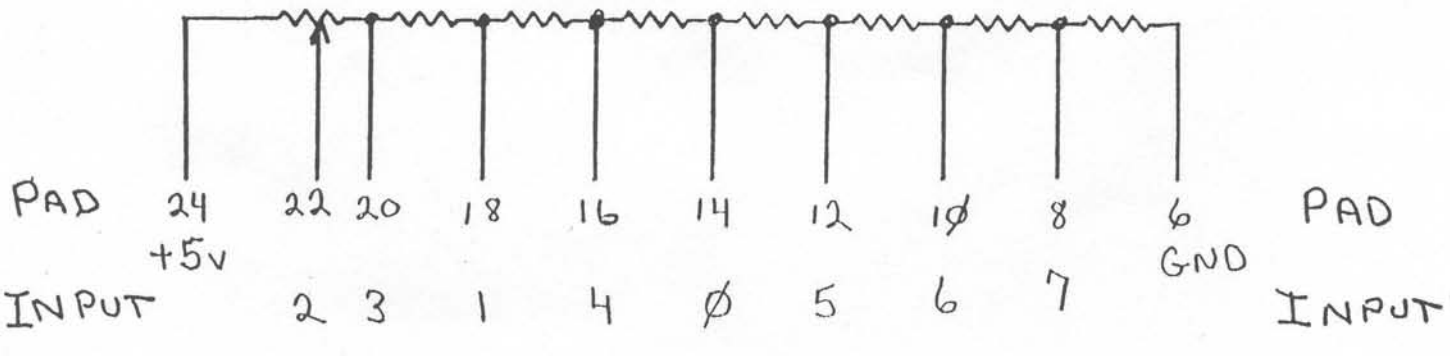
SYSTEM CHECKOUT

Clock. Turn off your PEB for at least 3 minutes. Remove the top and slide the card into any slot, being careful to get the card edges in the guides. Gently press on the top of the card to engage the card in the edge connector. Inspect the card to see that it is not in contact with any other cards in the box. Replace the PEB lid. Turn on the PEB. The LED on the clock card should be off. Install you XBASIC module and turn on the console and the monitor. You should not get the TI menu screen. Place the MBPII disk in drive one. Now the moment of truth!! Select XBASIC. Type RUN "DSK1.CLOCK". Follow the prompts.

ADC. Build a resistor ladder like the one shown below. Measure the resistance between pins 6 and 24 of the external circuit to insure that it is greater than 5K Ohms. After you have purchased a 34 pin edge socket, plug it onto the ADC Port at the rear of the card. Number 1 pad is at the very bottom of the card, solder side. Turn on the PEB. Install your XBASIC module and turn on the console and the monitor. Place the MBPII disk in drive one. Type RUN "DSK1.ADC_TEST". Change the variable resistor and watch the numbers on the screen change. Remove the 5VDC lead from the test circuit; all display values will become "0". Reinsert the 5VDC lead and remove the ground lead; all display values will become "255".

This resistor ladder can be built on a project board and connected with a cable to the socket. We used 1K Ohm for the 7 resistors and a 1K variable.

BE CAREFUL not to short out the + directly to the -. There you have it. The whole system works. Now the fun begins, develop your own applications and enjoy!



INTEGRATED CIRCUIT FUNCTIONS:

U1 - LM555 Timer. Used in monostable mode, it increases the duration of the pulse from U11 pin 3, this keeps the LED (Light Emitting Diode) lit long enough for you to see it!

U2 - U4 - 74LS244 Octal TRI-STATE Bus Drivers. Used to help increase the amount of devices the flex cable can drive. These buffer chips protect your card from damage. Any many cases when a card stops working these chips can be replaced to fix the problem. What has happened is these inexpensive buffer chips have taken some type of surge or spike and burnt out internally, but they have protected the other less common/more expensive chips on the board.

U5 - 74LS245 Octal TRI-STATE Bus Transceiver. Receives from or transmits to the CPU depending on the level of DBIN (Data Bus IN). When this signal goes HIGH data is being read by the CPU, when LOW data is being written by the CPU.

U6 - MM58167 The Real Time Clock. BT1 will continue to supply this clock with power when the P.E. Box is turned off.

U7 - ADC0809 The Analog to Digital Converter with 8 input channels. This unit accepts analog voltages in the range of 0 to +5 volts DC and converts them into a number in the range of 0 to 255. The ADC requires 100 microseconds to make this conversion.

U8 - 74LS08 Quad 2-Input AND Gate. Performs Various logic functions to support the other circuits.

U9 - U10 - 74LS138 3 to 8 Line Decoder/Demultiplexer. Addressing is as follows on U9:

PIN#	DEVICE	CHIP #	HEX ADDRESS	DECIMAL ADDRESS
15	Digital Output	U13	>8600 to >863E	-31232 to -31170
14	Clock	U6	>8640 to >867E	-31168 to -31106
13	A/D CONVERTER	U7	>8680 to >86BE	-31104 to -31042
12	Digital Output	U14	>86C0 to >86FE	-31040 to -30978
11	NA	---	>8700 to >873E	-30976 to -30914
10	NA	---	>8740 to >877E	-30912 to -30850
9	NA	---	>8780 to >87BE	-30848 to -30786
7	NA	---	>87C0 to >87FE	-30784 to -30722

NOTE: When the above address locations are accessed, the LOGIC State goes LOW on the U9 Pin # corresponding to the address range and selects that device.

U11 - 74LS93 4-Bit Binary Counter. Used to slow the clock rate from (PH3) down and provides this slower rate to the ADC.

U12 - 74LS368 Hex Invertor TRI-STATE. Performs Various logic functions to support the other circuits.

U13 - U14 - 74LS174 Hex D Flip Flop with Clear. Each provide 6 digital outputs that are user programmable. U13 is written to at >8600 or -31232 and U14 is written to at >86C0 or -31040.

PARTS LIST:

U Number	Chip Number	Number of Pins
U1	LM555CN	8 Pins
U2 - U4	74LS244	20 Pins
U5	74LS245	20 Pins
U6	MM58167AN	24 Pins
U7	ADC0809	28 Pins
U8	74LS08	14 Pins
U9 - U10	74LS138	16 Pins
U11	74LS93	14 Pins
U12	74LS368	16 Pins
U13, U14	74LS174	16 Pins

Capacitors:

C1 - C3	22 uF 35 VDC Electrolytic Axial Lead
C4 - C5	18 - 22 pF 50 VDC Ceramic Radial Lead
C6 - C21	.1 uF 50 VDC Monolithic Axial Lead

Resistors:

R1	100 Ohm 1/4W 5% Carbon Film
R2 - R4	1k Ohm 1/4W 5% Carbon Film
R5	220k Ohm 1/4W 5% Carbon Film

Dip Sockets:

1 - 8 Pin
2 - 14 Pin
5 - 16 Pin
4 - 20 Pin
1 - 24 Pin
1 - 28 Pin

Misc:

D1 - D3	1N914 or 1N4148 switching diode
LED1	Red LED T1-3/4 Note: Green or yellow may be used.
VR1, VR2	LM340T5/7805 TO-220 5 Volt 1.5 AMP regulator
HS1	TO-220 Heat Sink THM-6079
BH1	Coin Cell Battery Holder BH-906
BT1	3 Volt Lithium Coin Cell Battery BR-2320
XTAL1	32.768kHz Clock Oscillator Radial
SC1, SC2	#6-24 X 1/2" Machine Screw Round Head
NU1, NU2	#6-24 HEX Nut
PCB1	Bare Printed Circuit Board
TC	Thermal Compound as required between VR & HS & PCB

SUPPLIERS:

CECURE ELECTRONICS INC.
Digi-Key Corp
Newark Electronics
Radio Shack

IC Data Books are available from the following manufacturers:

National Semiconductor
Texas Instruments
Motorola
Hitachi
RCA/General Electric

WHO TO CALL:

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Analog to Digital Converter Usage. The eight multiplexed, 8 bit, analog to digital converter input channels allow you to monitor anything you can convert to a relatively slowly varying electrical signal in the 0-5 volt range. The BASIC or XBASIC interpreter functions so slowly that you needn't concern yourself with the speed of the converter. If you decide to use the converter with an assembly level language program, you'll need to add a delay loop or perform some other function such as converting the previous measurement to some other scaling to allow the converter time to complete its job.

We have brought out the system ground and +5VDC on pins of the external connector. If the sensors you're using have a combined current requirement of 0.1 amps or less, you may power them from this source. The safest approach is to power the sensors form an external power source using the edge connector ground and the +5VDC as a reference.

***** **CAUTION** *****

Attempts to draw more than 0.1 amp of current from the ADC port may overheat and destroy the VR1 regulator. The ADC inputs are designed to operate over the range of -0.1 to +5.1 volts. Voltage inputs outside this range may damage the ADC!!!

****

With the exception of these two limitations, you are free to use the ADC inputs any way you like. The functions which can be provided by the computer, clock and ADC inputs are limited only by your imagination! Some of the ideas we've had and intend to pursue in the near future are:

1) A data logging weather monitor station. We'll be able to log wind direction and velocity, air temperature, barometric pressure, relative humidity and outside light level. If we could then add the ability to monitor our home energy consumption, we'd be able to draw some correlations about the severity of the winter or summer and its effect on home energy consumption.

2) Security systems also provide some interesting possibilities. Motion sensors and smoke detectors usually provide outputs which can be monitored with the addition of minimum circuitry. Simple reed switch closures can be used to determine when various doors and windows are opened and closed. The addition of the clock and your printer or disk will allow you to keep track of the time of various events. Based on the time of the occurrence your computer can be programmed to ignore the event (other than logging it) or sound an alarm via the sound generators built into your computer.

Analog to Digital Converter Usage continued

3) A simple sound switch can be employed to log the times when your telephone rang but you were not at home. It could also be used to alert you to tell the kids to turn off the TV when they're supposed to be doing homework or sleeping and you're busy working (?) with your computer.

4) You can also monitor for high water in the basement or high temperature in the freezer.

5) How about a water temperature measurement in the swimming pool and an outside air temperature measurement to tell you when to cover the pool or turn the water heater on?

I'm sure you'll be able to think of many more potential applications. If you implement one and find it to be useful, please leave us a message on CECURE / MAUG S & T BBS. Other folks might also like to implement your ideas. We're planning to send out infrequent newsletters to board purchasers and would be pleased to serve as a clearinghouse for applications.

Clock Usage. The real time clock in you board contains a calendar which when combined with the power of you computer, provides some interesting potential applications. You could program an appointment calendar that determines the day, the week, or the month and searches a file to display appointments for you. Birthdays, anniversaries (think how much your wife or husband would like that), time to write various checks, recording of events, etc. could be reviewed by simply running the program since your computer now knows the day of the week, the date, and the month. It would also be nice to add dates to various favorite programs you have written to document the output schedule. Financial analysis programs, disk lists, etc. could all benefit from and automatic feature of this type. We haven't figured out how to modify TI-WRITER or MULTIPLAN to be able to use this function but wouldn't that be nice! It would also be helpful to be able to automatically date files which we downloaded from various telecommunications sources.

**** PLEASE NOTE ****
THIS MBPII CARD WILL NOT WORK WITH THE 9640 GENEVE WITHOUT THE AMA, AMB, and AMC MEMORY DECODE AND SYSTEM CLOCK SPEED REDUCTION MODIFICATION!

SEE APPENDIX C

APPENDIX A

A. Kit Contents

1. DSSD Disk filenames CLOCK, ADC_TEST and others
2. Printed Circuit Board
3. Manual

B. Parts List

1. Integrated Circuits
   a. 3 ea 74LS244
   b. 1 ea 74LS245
   c. 2 ea 74LS138
   d. 1 ea 74LS93
   e. 1 ea 74LS368
   f. 1 ea 74LS08
   g. 1 ea MM58167AN
   h. 1 ea ADC0809CCN
   i. 1 ea LM555CN
   j. 2 ea 74LS174
2. Capacitors
   a. 16 ea .1 uF 50 VDC Monolithic Axial Lead
   b. 3 ea 22 uF 35 VDC Electrolytic Axial Lead
   c. 2 ea 18 - 22 pF 50 VDC Ceramic Radial Lead
   d. 1 ea 3-25 pF TRIMMER (optional for C5 20 pF) You supply this part if wanted.
3. Resistors
   a. 1 ea 100 Ohm 1/4W 5% Carbon Film
   b. 3 ea 1K Ohm 1/4W 5% Carbon Film
   c. 1 ea 220K Ohm 1/4W 5% Carbon Film
4. Dip Sockets
   a. 1 ea 8 Pin
   b. 2 ea 14 Pin
   c. 5 ea 16 Pin
   d. 4 ea 20 Pin
   e. 1 ea 24 Pin
   f. 1 ea 28 Pin
5. Miscellaneous
   a. 3 ea 1N914 or 1N4148 switching diode
   b. 1 ea LED T1-3/4 any color
   c. 2 ea LM340T5/7805 TO-220 5 Volt 1.5 AMP regulator
   d. 1 ea TO-220 Heat sink THM-6079
   e. 1 ea Coin Cell Battery Holder BH-906
   f. 3 Volt Lithium Coin Cell Battery BR-2320
   g. 1 ea 32.768kHz Clock Oscillator Radial Lead
   h. 2 ea #6-24 X 1/2" Machine Screw Round Head
   i. 2 ea #6-24 HEX Nut
   j. Thermal compound as required between Voltage Regulator, Heat Sink and Printed Circuit Board. You supply this compound.
   k. Solder as required 60/40. You supply this solder. **DO NOT USE ACID CORE SOLDER!**
   l. 25 - 30 watt soldering pencil - small tip
   m. small side clippers
   n. #2 standard screwdriver

APPENDIX B
MEMORY ADDRESS CODES AND FUNCTION

HEX D FLIP FLOP WITH CLEAR

>8600	-31232	WRITE 6 BITS TO OUTPUT U13
>8602	-31230	TO >863E -31170 REPEAT OF ABOVE

REAL TIME CLOCK MM58167B

>8640	-31168	COUNTER - MILLISECONDS
>8642	-31166	COUNTER - HUNDREDTHS AND TENTHS OF SECONDS
>8644	-31164	COUNTER - SECONDS
>8646	-31162	COUNTER - MINUTES
>8648	-31160	COUNTER - HOURS
>864A	-31158	COUNTER - DAY OF WEEK
>864C	-31156	COUNTER - DAY OF MONTH
>864E	-31154	COUNTER - MONTH
>8650	-31152	RAM - MILLISECONDS
>8652	-31150	RAM - HUNDREDTHS AND TENTHS OF SECONDS
>8654	-31148	RAM - SECONDS
>8656	-31146	RAM - MINUTES
>8658	-31144	RAM - HOURS
>865A	-31142	RAM - DAY OF WEEK
>865C	-31140	RAM - DAY OF MONTH
>865E	-31138	RAM - MONTH
>8660	-31136	INTERRUPT STATUS REGISTER
>8662	-31134	INTERRUPT CONTROL REGISTER
>8664	-31132	COUNTERS RESET
>8666	-31130	RAM RESET
>8668	-31128	STATUS BIT
>866A	-31126	GO COMMAND
>866C	-31124	STANDBY INTERRUPT
>866E	-31122	TO >867C -31108 NOT USED
>867E	-31106	TEST MODE

8 INPUT ANALOG TO DIGITAL CONVERTER ADC0809

>8680	-31104	TO >868E -31090 NOT USED
>8690	-31088	START CONVERSION
>8692	-31086	READ INPUT 7
>8694	-31084	READ INPUT 6
>8696	-31082	READ INPUT 5
>8698	-31080	READ INPUT 4
>869A	-31078	READ INPUT 3
>869C	-31076	READ INPUT 2
>869E	-31074	READ INPUT 1
>86A0	-31072	READ INPUT 0
>86A2	-31070	TO >86BE -31042 NOT USED

HEX D FLIP FLOP WITH CLEAR

>86C0	-31040	WRITE 6 BITS TO OUTPUT U14
>86C2	-31038	TO >86FE -30978 REPEAT OF ABOVE

APPENDIX C

MODIFICATIONS REQUIRED TO USE MBPII ON 9640

DECODE of AMA, AMB, and AMC

Since the 9640 has 512k of memory decoded to the bus (64 8k pages) ranging from HEX 80 to BF. You **MUST** make sure that the **MBPII CARD** is correctly decoded to the BC page of memory. You will need to decode the AMA, AMB, and AMC addresses on the bus. This will require 1 74LS138 and some wire wrap wire, COLORED wire is helpful to keep track of what points you are connecting on the board.

1. Remove U10 74LS138 from the socket.
2. Squeeze the pins on the second 74LS138 with a pin straightener so it will fit snug on the bottom U10 74LS138.
3. Piggy-back this chip on top of U10 74LS138.

   NOTE: Both notches **MUST BE** lined up with each other.

4. Solder pins 8 and 16 on the top chip to the ones below.
5. Bend out all the legs that are not soldered. Pins 9, 10, 11, 12, 13, 14, and 15 are not connected, So clip them off.
6. Replace the piggy-backed chips back in the socket

   NOTE: All wire connections are to the top chip.

7. Connect pin 1 to pad 46 (AMA) on the 60 pad edge card connector.
8. Connect pin 2 to pad 45 (AMB) on the 60 pad edge card connector.
9. Connect pin 3 to pad 48 (AMC) on the 60 pad edge card connector.
10. Connect pin 6 to pin 16 (+5 volts)
11. Cut trace coming from pad 56 (MEMEN) and going to pin 4 U10.
12. Connect wire from pad 56 (MEMEN) to pins 4 and 5.
13. Connect pin 7 on top 74LS138 to pin 4 on the solder side socket of U10 74LS138.
14. This completes the DECODE of AMA, AMB, and AMC.

SYSTEM CLOCK SPEED REDUCTION

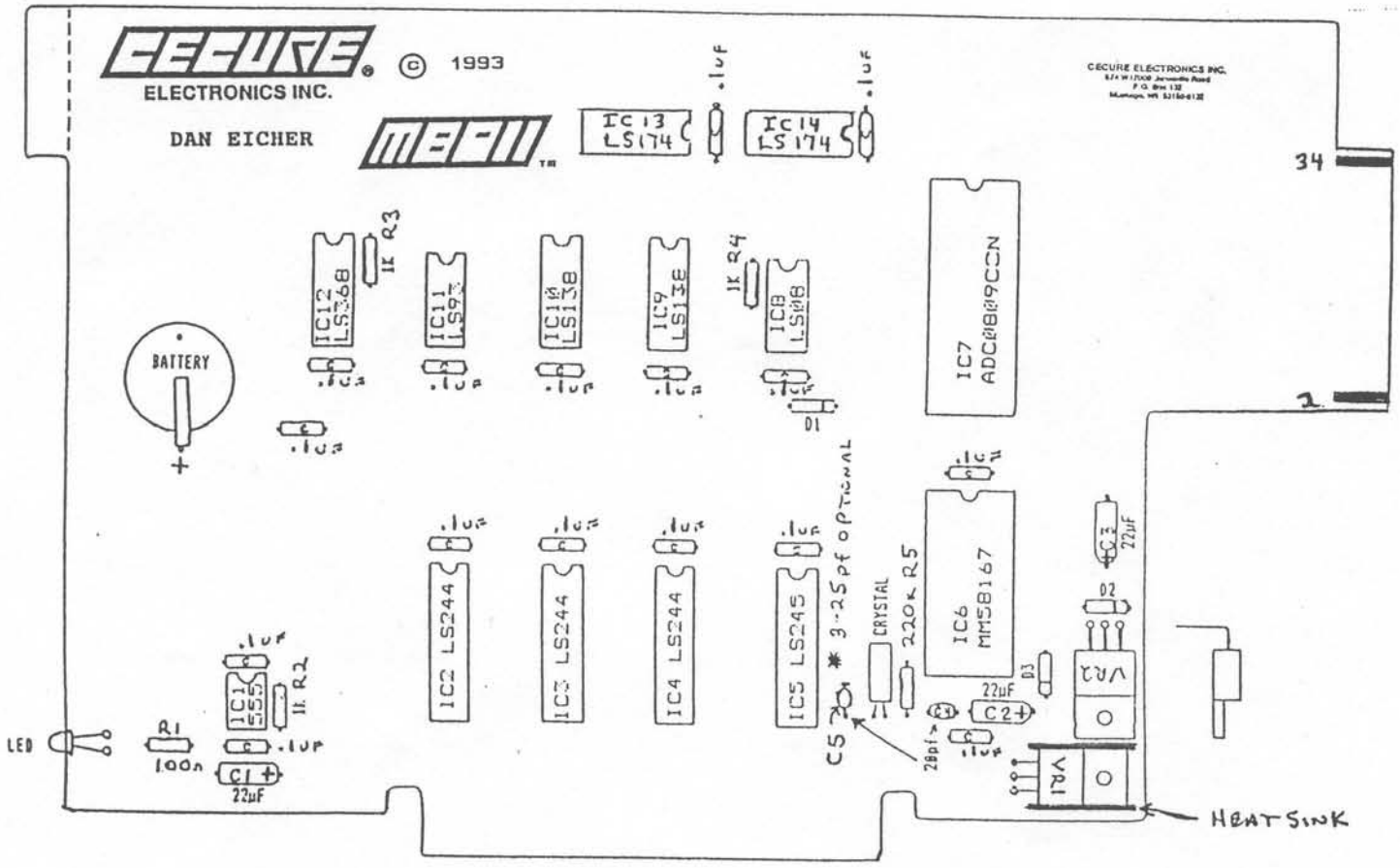
Since the 9640 has a system clock speed of 12 MHz and the 99/4A is at 3 MHz, you will have to slow down the 9640's clock rate to the Analog to Digital Converter so that it equals the 99/4A.

1. Remove U11 74LS93.
2. Bend out pin 1, pin 8, and pin 11.
3. Replace U11 74LS93 in socket.
4. Connect pin 11 of U11 74LS93 to pin 8 on the U11 socket, solder side of board.

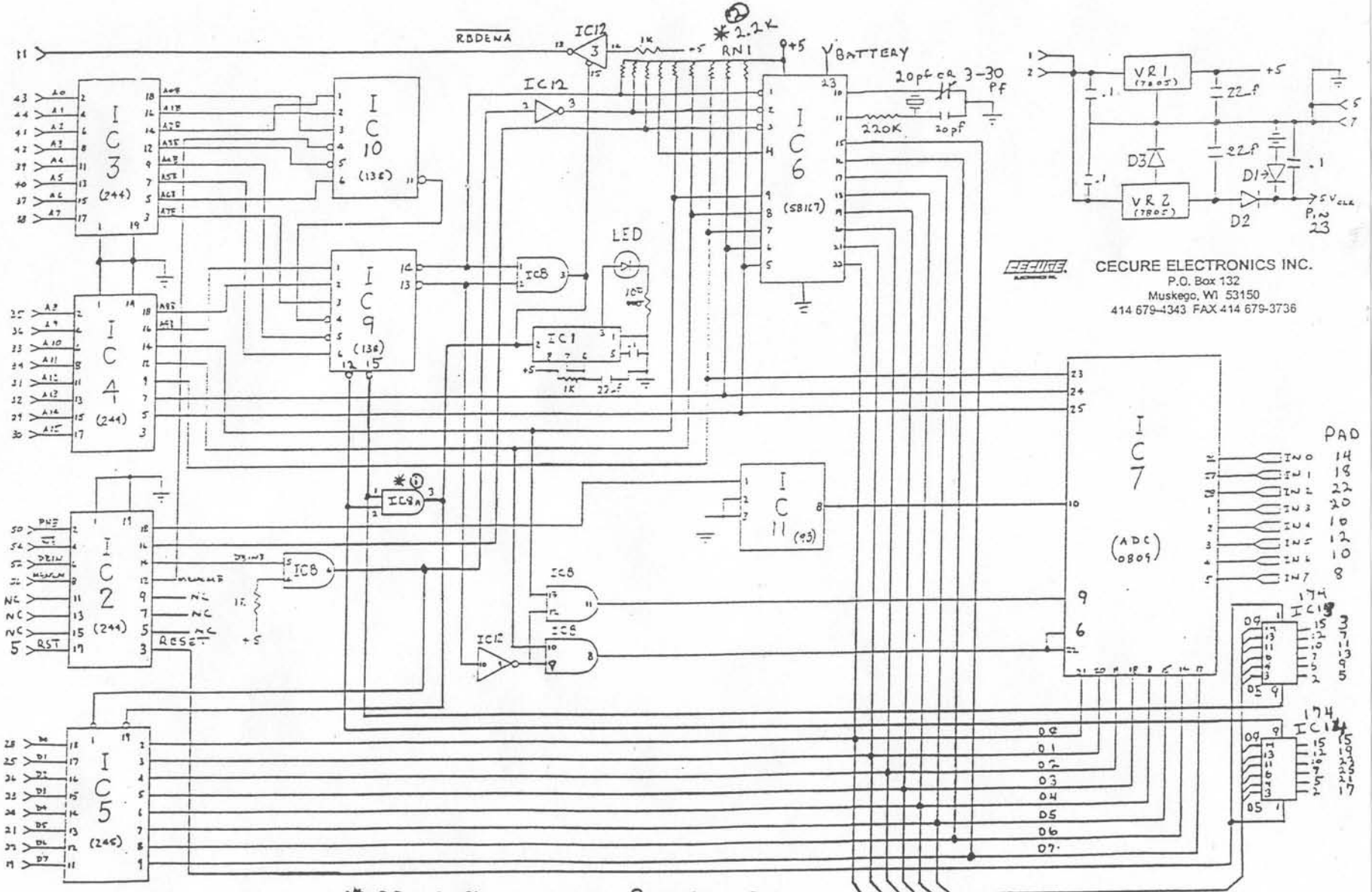
   DO NOT PUT THE WIRE BETWEEN PIN 8 AND PIN 11 ON THE 74LS93!!

5. Connect the bottom of the socket pins 14, 12, and 1 together.
6. This completes the SYSTEM CLOCK SPEED REDUCTION.

APPENDIX D


CECURE
ELECTRONICS INC.
© 1993
DAN EICHER
MEGA
CECURE ELECTRONICS INC.
IC13 LS174
IC14 LS174
.1uF
.1uF
34
1
IC12 LS368
1K R3
IC11 LS32
IC10 LS138
IC9 LS132
1K R4
IC8 LS08
IC7 ADC0809CCN
BATTERY
+
D1
IC2 LS244
IC3 LS244
IC4 LS244
IC5 LS245
* 3-25pf OPTIONAL
CRYSTAL
220K R5
IC6 MM5837
22uF
C3
D2
D3
C2+
C5
28pf
VR1
VR2
HEAT SINK
LED
R1
100Ω
IC1 555
11K R2
C1+
22uF

APPENDIX E



CECURE ELECTRONICS INC.
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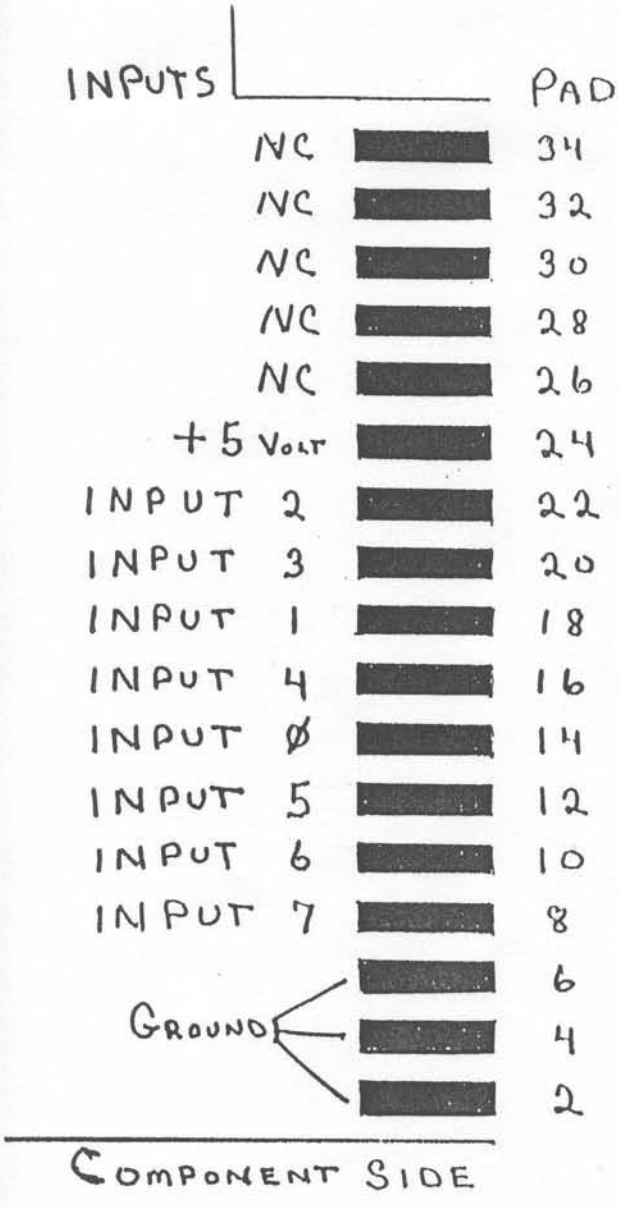
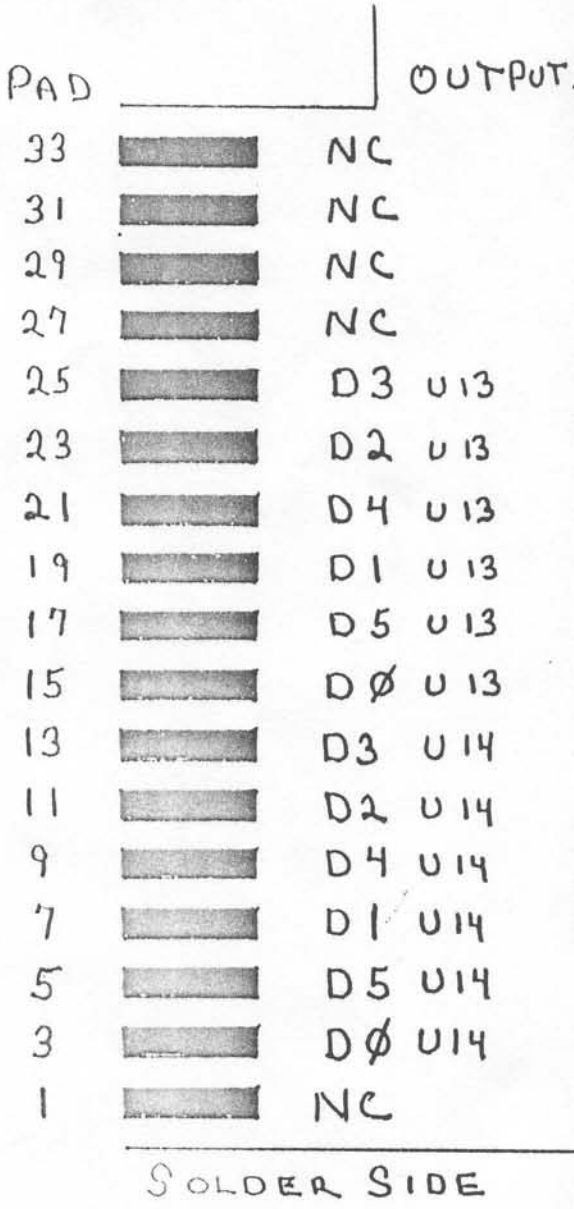
414 679-4343 FAX 414 679-3736

*① IC 8A MUST BE ADDED TO ENABLE IC 13 + 14 OUTPUTS

② RESISTER NETWORK ADDED TO KEEP CLOCK INPUTS FROM FLOATING

APPENDIX F


INPUTS
PAD
NC 34
NC 32
NC 30
NC 28
NC 26
+5 Volt 24
INPUT 2 22
INPUT 3 20
INPUT 1 18
INPUT 4 16
INPUT Ø 14
INPUT 5 12
INPUT 6 10
INPUT 7 8
GROUND 6
4
2
COMPONENT SIDE


PAD
OUTPUT
33 NC
31 NC
29 NC
27 NC
25 D3 U13
23 D2 U13
21 D4 U13
19 D1 U13
17 D5 U13
15 DØ U13
13 D3 U14
11 D2 U14
9 D4 U14
7 D1 U14
5 D5 U14
3 DØ U14
1 NC
SOLDER SIDE

IN CASE OF DIFFICULTY

If the **MBPII** card does not appear to work properly, check the following:

1. **LOCK UP**
   Make sure the computer and the **MBPII** card are not locked up. If this is the case, turn the computer and the PEB off to reset the system.

2. **COMPUTER CONSOLE**
   Make sure the computer console works properly with all accessory devices disconnected.

3. **PERIPHERAL EXPANSION BOX**
   Check the peripheral system and accessory cards as outlined in the Texas Instruments owner's manuals.

4. **MBPII CARD**
   Make sure the **MBPII** card is firmly in place.

5. **INTERFACE UNIT**
   Make sure the 34 pin edge card connector is firmly in place if used.

6. **SOFTWARE**
   If the problem is not corrected with any of the above procedures, check your program. The MBPII card may appear not to work correctly if there are logic errors in the software.

7. **9640 GENEVE USE**
   This card **WILL NOT** work with the Geneve without the **AMA, AMB,** and **AMC** memory decode and **SYSTEM** CLOCK SPEED REDUCTION **MODIFICATION!**

8. **SERVICING**
   If the difficulty is still not corrected, the MBPII card may require service. Contact **CECURE ELECTRONICS INC.** for more information.

***** NOTE *****

The card edge connector is numbered so that all of the odd number pads are on the solder side of the board while all of the even numbered pads are on the component side.

The numbering starts at the bottom of the edge connector, with pad 1 at the very bottom, on the solder side. Pad 2 is on the component side, directly opposite pad 1.

Pad 33 is at the very top of the card edge connector on the solder side and pad 34 is on the component side, directly opposite pad 33.

PLEASE REMEMBER THAT :

1. **THE NUMBERING INCREASES FROM BOTTOM TO TOP.**
2. **THE ODD NUMBERS ARE ON THE SOLDER SIDE.**
3. **THE EVEN NUMBERS ARE ON THE COMPONENT SIDE.**

Don, I now have the DIGITAL OUTPUT portion of my MBPII card WORKING !!! Basically I stacked a second 74LS08 on top of IC8, Stack-solder pins 3, 7 and 14, (flair out the rest of the pins on TOP IC). Two insulated jumper wires are needed, each about 3 inches long. Solder one jumper wire from pin 1 of the top IC8 to pin 12 of IC9 (the nearest 74LS138), Solder the second jumper wire from pin 2 of the top IC8 to pin 15 if IC9. NOTE: < From the flaired pins of the top IC8, I ran the two insulated jumper wires thru the two holes just below IC8 and soldered to the pins of IC9 on the non-component side of the card>. Doing this enabled the data to flow THRU the 74LS245 and flash the LED in the MBPII card. Happy Holidays! ..... Mac in Memphis 12/28/93

IC8A INSTRUCTIONS