alpha-1

ASSEMBLY and
USERS MANUAL

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ATTENTION

THOSE WHO HAVE PURCHASED ASSEMBLED ALPHA-1 SYSTEMS SHOULD PROCEED TO SYSTEM FINAL CHECK IN SECTION IV, PAGE 16.

IMPORTANT BEFORE ATTEMPTING TO BRING UP YOUR SYSTEM, YOU SHOULD READ SECTION IV THOROUGHLY. THIS WILL SAVE YOU TIME AND FRUSTRATION IN THE LONG RUN.

***PLEASE COMPLETE WARRANTY CARD ON PAGE VIII-2a

NOTICE TO KIT BUILDERS PLEASE VERIFY THAT YOU HAVE RECEIVED ALL THE NECESSARY COMPONENTS. A LIST OF ALL PARTS AND THEIR CORRESPONDING BAG NUMBERS WILL BE FOUND ON THE FOLLOWING PAGES: I-2, II-2, II-3, III-2, III-3, IV-2.

IF YOU ADVISE MECA WITHIN 30 DAYS OF RECEIPT OF KIT, WE WILL SEND YOU ANY COMPONENTS WHICH HAVE BEEN SHORTED FROM YOUR KIT AT NO CHARGE.

ALPHA-1 SYSTEM MANUAL

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SECTION I

alpha-1
power supply

ASSEMBLY INSTRUCTIONS

NOTE The Power Supply included with the ALPHA-1 System is a booster Supply and is only used to supply the high current requirements of the MECADRIVE Motors and LED's. It is capable of supplying these requirements for two MECADRIVES.

Only a portion of the possible component locations will be used for the ALPHA-1 Users. The unused components are:

A. Diodes CR2, CR5 and CR8
B. Resistor R1
C. Capacitors C1 and C4
D. The Three Terminal Regulator (next to Resistors R2-R5)

POWER SUPPLY

PARTS LIST

		BAG NUMBER
1.	TRANSFORMER	29
2.	FUSE HOLDER + 1 AMP FUSE	3Ø
3.	FOUR MOUNTING NUTS, BOLTS & RUBBER BUMPERS (NOTE: Rubber Bumpers needed only if Enclosure is not purchased)	31
4.	THREE WIRE NUTS (2 LARGE, 1 SMALL)	31
5.	SPADE LUG	31
6.	CAPACITORS	
	A. 33ØØ MFD 16V ELECTOLYTIC (C2)	32
	B. 21ØØ MFD 35V ELECTOLYTIC (C3)	32
7.	FIVE DIODES, 1N4ØØ2 (CR1, 3, 4, 6, 7)	32
8.	FOUR 11Ø OHM 1/2 WATT RESISTORS (R2,3,4,5)	32
9.	POWER CORD	33
1Ø.	PRINTED CIRCUIT BOARD FOR POWER SUPPLY	34

NOTE: USE SPECTRASTRIP FURNISHED IN YOUR MECADRIVE KIT(S)

ALPHA-1 POWER SUPPLY ASSEMBLY INSTRUCTIONS

CAUTIONThe components in this section are polarity sensitive. Please follow instructions carefully.

( ) 1. Install Diode CR1, it is a 1N4002, insuring that the banded end is toward the direction which the small arrow points.

( ) 2. Install Diodes CR3, and CR4. They should have the same orientation as CR1. They also are 1N4002 Diodes.

( ) 3. Install CR6 and CR7, 1N4002 Diodes, making sure they have the correct orientation.

( ) 4. Install C2, a 3300 mfd 16V Electrolytic Capacitor. It is imperative that the + terminal be oriented the same direction as the + is shown on the printed circuit card.

( ) 5. Install C3, a 2100 mfd 35V Electrolytic Capacitor. Observe the polarity.

( ) 6. Install a bare wire jumper in the two holes shown connected by a dashed line closest to the "J1-1" nomenclature. Use some of the wire trimmed from the other components.

( ) 7. Install a bare wire jumper from the hole marked "in" to the hole marked "out".

( ) 8. Install Resistors R2 through R5 (110 ohm ½ W Resistors).

( ) 9. Cut a 12" length of spectrastrip cable (MECADRIVE Kit).

( ) 10. Strip off the white and black wires by carefully cutting between the white and gray wires and then pealing the two extra conductors off (The white & Black wires will not be used).

( ) 11. Separate all eight remaining wires for approximately one inch. See Figure A. NOTE: SEPARATE THE WIRES BY SLITTING WITH EXACTO KINIFE APPROX. 1/8", THEN PEALING THE REST OF THE WAY.

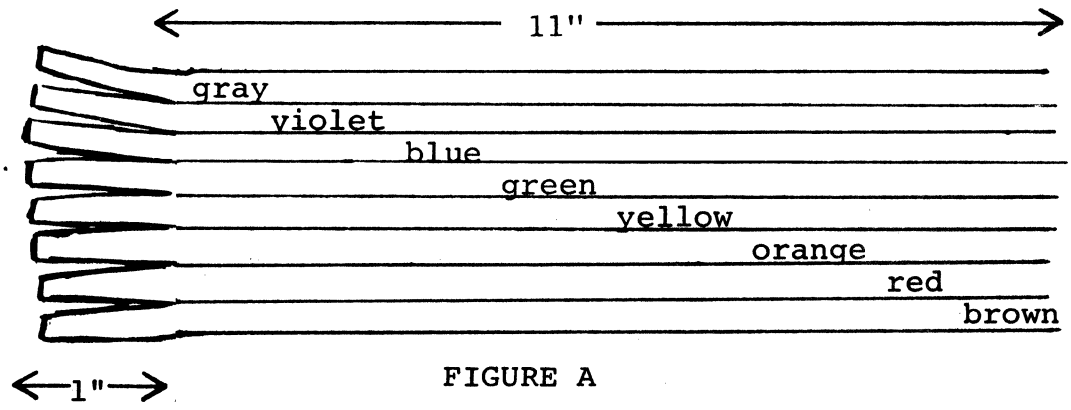


FIGURE A

( ) 12. Strip approximately ¼" of insulation from each wire. Tin wires by putting a small amount of solder on each one.

( ) 13. Insert the brown wire into the hole labeled "J1-1" from the top. Solder it in place.

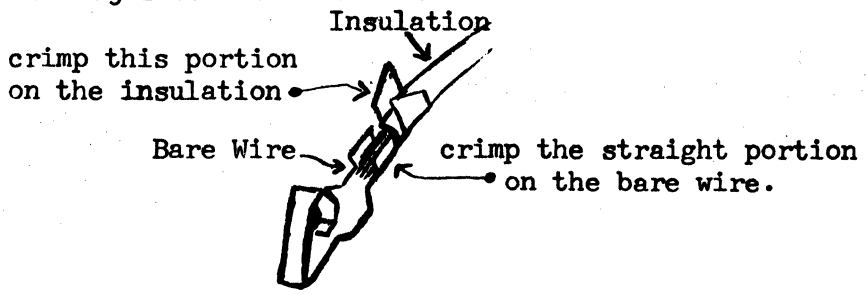
( ) 14. Similarly, insert the remaining 7 conductors into the remaining 7 holes directly beneath the brown wire. The order is IMPORTANT & is as follows:

RED
ORANGE
YELLOW
GREEN
BLUE
VIOLET
GRAY

Solder all wires into position & trim off any excess wire.

( ) 15. Fan out the other end of this cable in a similar manner. This time only strip 1/8" off the insulation. Do not tin.

( ) 16. Insert each conductor into the Molex Connector Insert & crimp it down TIGHT as shown in Figure B below. Inserts will be found in Bag 1 of MECADRIVE Kit.



NOTE CRIMP INSERTS HARD, SO WIRES ARE FIRMLY HELD.

FIGURE B

( ) 17. Now insert these into the Pin Nest with the small flange on the back of the insert on the same side as the slotted holes in the Nest. When you hear a slight click, the inserts are in place. THE ORDER IS IMPORTANT and is brown first, followed by other colors as listed in Step 14 above. Place brown wire into the first position (as indicated by a one (1) on the Pin Nest.

( ) 18. This connector will later be installed on the MECADRIVE as P1. The above wiring is extremely important. DOUBLE CHECK the previous steps.

If the Power Supply is to be used with a second MECADRIVE, do Steps 19, 20, 21 and 22. Otherwise skip to Step 22.

( ) 19. Repeat Steps 9 through 12 as above.

( ) 20. Insert these into the holes for Connector "J2" beginning with the Brown wire in J2-1 (indicated on the P.C. Card).

( ) 21. Perform Steps 15 through 18 as above.

( ) 22. The transformer has 2 Red Leads and 1 Yellow Lead on one side and 2 Black Leads on the other. Strip ¼" of insulation from the Red and Yellow Leads, Tin these Leads & make sure the solder flows freely. Then insert them in the holes marked "+", "CT", and "-" (located in the upper left corner of the P.C. card, next to the Copyright nomenclature. NOTE: The Yellow Center Lead goes into the hole marked "CT".) Solder and trim.

( ) 23. For check out, assemble according to the following Figure.

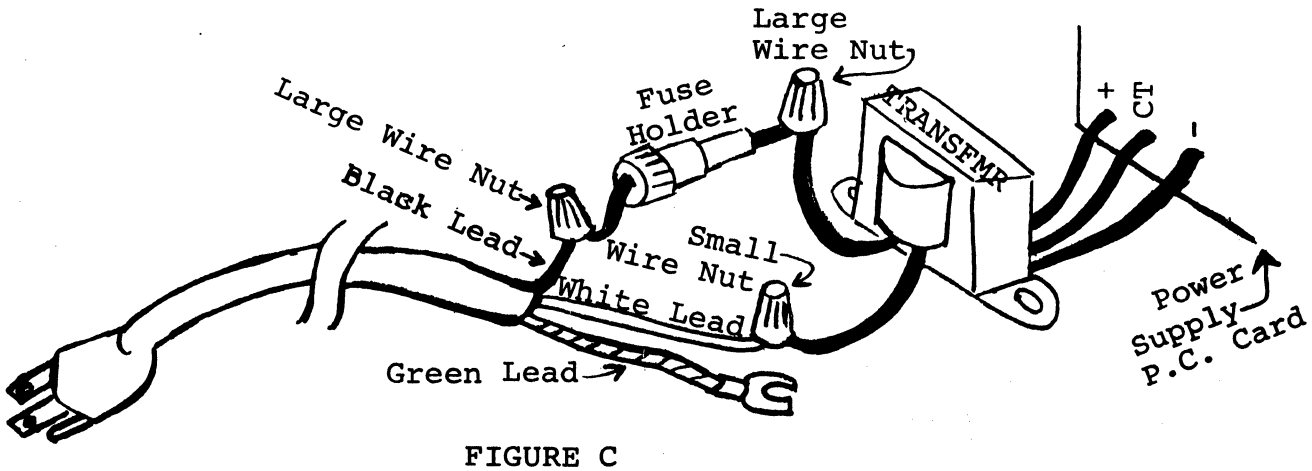


FIGURE C

( ) 24. To install the wire nuts, strip wires 3/8". Pretwisting is not necessary (if you twist the ends of the wires together, it could cause you difficulty in getting wire nuts to hold firmly). Hold stripped wires together with ends even. Screw on wire nut connector, push wires firmly into connector when starting. Twist until the whole assembly is very tight. Inspect: Part of the insulation should be pulled into wire nut with no bare wire showing.

( ) 25. Solder or crimp a terminal lug on the green wire. This should be connected to chassis ground. (A suitable place for this is on one of the transformer mounting screws.)

NOTE For safety reasons, the power supply assembly should be mounted inside an enclosure, and the power cord fed through the stress relief clamp provided. If you do not purchase the ALPHA-1 Enclosure, it is strongly recommended that you construct your own Power Supply Enclosure.

ALPHA-1 POWER SUPPLY FINAL CHECK OUT

( ) 1. Plug in the line cord.

( ) 2. Attach your ground lead to the negative Lead of Capacitor C2.

( ) 3. Measure the Voltage on the red lead of the connector. It should measure between 17 and 19 Volts.

( ) 4. Measure the Voltage on the Orange Lead. It should measure between 7 and 10 Volts.

If these voltages are correct, unplug the Power Supply and set it aside. Proceed with the ALPHA-1 control card Assembly (Section II).

SECTION II

alpha-1
control card

ASSEMBLY INSTRUCTIONS

ALPHA-1 CONTROL CARD

PARTS LIST

		BAG NUMBER
1.	INTEGRATED CIRCUITS	
	A. TWO 4ØØ1	19
	B. TWO 4Ø11	19
	C. SEVEN 4Ø13	19
	D. ONE 4Ø15	19
	E. ONE 4Ø16	19
	F. FOUR 4Ø19	19
	G. ONE 4Ø24	19
	H. ONE 4Ø3Ø	19
	I. ONE 4Ø42	19
	J. ONE 4Ø46	20
	K. TWO 4Ø5Ø	19
	L. TWO 4Ø69	19
	M. ONE 4Ø71	19
	N. TWO 4Ø81	19
	O. ONE LM71Ø	19
	P. ONE LM1458	19
	Q. TWO 8Ø93	19
	R. SEVEN 8836	19
	S. ONE 74ØØ	19
	T. ONE 74Ø2	19
	U. ONE 74Ø4	19
	V. ONE 74Ø8	19
	W. FOUR 7416	19
	X. ONE 7427	19
	Y. ONE 749Ø	19
2.	ONE 14 PIN DIP (GOLD) COMPONENT WITH 4 RESISTORS, R41 THROUGH R44, AND 1 CAPACITOR, C24 (SOLDERED AT FACTORY)	2Ø
3.	DIODES	
	A. THREE 1N914	21
	B. ONE 1N4742 ZENER (12V)	21
	C. ONE 1N4735 ZENER (6.2V)	21
4.	RESISTORS	
	A. ONE 75 OHM 1/2 W (FOR MITS A CHASSIS)	22
	B. ONE 22Ø OHM 1/2 W	22
	C. ONE 1ØØ OHM 1/4 W	22
	D. ONE 47Ø OHM 1/2 W FOR ALL OTHER COMPUTERS	22
	E. SIX 47Ø OHM 1/4 W	22
	F. TWENTY-ONE 3 K OHM 1/4 W	22
	G. ONE 4.7 K OHM 1/4 W	22
	H. ONE 12 K OHM 1/4 W	22
	I. ONE 15 K OHM 1/4 W	22
	J. ONE 18 K OHM 1/4 W	22
	K. TWO 22 K OHM 1/4 W	22
	L. ONE 33 K OHM 1/4 W	22
	M. ONE 43 K OHM 1/4 W	22
	N. ONE 15Ø K OHM 1/4 W	22
	O. ONE 1 K OHM 1/4 W	22

ALPHA-1 CONTROL CARD PARTS LIST - CONTINUED

		BAG NUMBER
5.	REGULATORS	
	A. ONE 78Ø5	23
	B. ONE 7812	23
6.	HEATSINK, 2 NUTS AND 2 BOLTS	23
7.	CAPACITORS	
	A. ONE .ØØ1 MFD DISK CERAMIC	24
	B. THREE .Ø1 MFD DISK CERAMIC	24
	C. ONE .Ø47 MFD DISK CERAMIC	24
	D. TWELVE .1 MFD DISK CERAMIC	24
	E. ONE .22 MFD TANTALUM	24
	F. ONE .47 MFD TANTALUM	24
	G. ONE 22Ø PF DISK CERAMIC	24
	H. TWO 47Ø PF DISK CERAMIC	24
	I. ONE 1Ø MFD TANTALUM	24
8.	INTEGRATED CIRCUIT SOCKETS	
	A. FORTY 14 PIN SOCKETS	25
	B. Nine 16 PIN SOCKETS	25
9.	PRINTED CIRCUIT BOARD (CONTROL CARD)	26
1Ø.	JUMPERS (PRE-CUT)	26

ALPHA-1 CONTROL CARD

All references to top, bottom, left or right assume the Board is component side up with the 100 pin connector nearest the observer.

IMPORTANT

INSTRUCTIONS FOR HANDLING CMOS COMPONENTS

READ BEFORE BEGINNING ASSEMBLY

Many of the Integrated Circuits supplied with the MECADRIVE Card and Control Card are CMOS (all of the CD4000 series). The CMOS components are packed in conductive foam because they are susceptable to damage by static electricity. The following procedures should be observed to minimize the chance of damaging these components:

1) Handle the components only when absolutely necessary (AVOID TOUCHING THE LEADS AT ALL TIMES).

2) When handling components, wear rubber soled shoes. Do not wear nylon, rayon, etc. clothing.

3) If you normally draw sparks in a room, do not work in that room.

If you follow these common sense procedures, you are unlikely to damage your CMOS components.

ALPHA-1 CONTROL CARD ASSEMBLY INSTRUCTIONS

A. Install the Integrated Circuit Sockets (refer to Module Map on Page II-12).

IMPORTANT Before beginning to solder a socket, INSPECT TO MAKE SURE ALL PINS ARE THROUGH THE HOLES. It is very difficult to remove a partially soldered socket to straighten a bent pin.

( )A.1 - Install the 16 Pin Sockets for U39, U42, U45 & U46. These are oriented with the notch toward the 100 Pin Connector. The remaining sockets are oriented with the notch away from the 100 Pin Connector (see Step A.2).

( )A.2 - Install the remaining 16 Pin Sockets, U5, U29, U34, U38 and U48.

( )A.3 - Solder, making sure no Pins have been overlooked. (This procedure should be repeated after installing a small group of I.C. Sockets).

( ) A.4 - IMPORTANT** Do not install sockets in the 3 locations marked with small rectangles (between U6 & U15; between U19 & U26; and between U28 & U35). Resistors are to be installed in these locations later.

NOTE: Do not install 14 Pin Socket in U1. It is unused.

( ) A.5 - Before beginning installation of the 14 Pin sockets, mark the four upper right corner locations with a small piece of masking tape. They are the drive connectors, and are covered in Step A.9.

( ) A.6 - Install a 14 Pin I.C. Socket in the lower left hand corner of the Board where the phase lock loop plug will be inserted later.

( ) A.7 - Install the remaining thirty-eight 14 Pin Sockets (all of these sockets are oriented with the notch away from the 100 Pin connector (Reference Module Map).

( ) A.8 - The location of I.C.'s U47 & U50 (both are 8 pin modules) do not include I.C. sockets. These 8 pin I.C.'s are to be soldered directly into P.C. board.

( ) A.9 - Install the 16 Pin Socket(s)(one per MECADRIVE) which are included in the MECADRIVE Kit(s), located in the upper right corner of the card. Note: Drive Zero must be installed.

1. Drive Ø is the corner socket.
2. Drive 1 is directly below Drive Ø.
3. Drive 2 is directly left of Drive Ø.
4. Drive 3 is the remaining location.

B. Install the Jumpers. **NOTE**Jumper Terminations are marked with Black Silk Screened Circles. Wire lengths referenced below are lengths of insulation. All Jumpers, except B9, are to be wired on the Component Side of the Board.

( ) B.1 - Install a Jumper from E21, bottom right of board, to E5, bottom left of board (8" Blue wire provided in Kit)

( ) B.2 - Install a Jumper from E22, bottom right of board, to E1, bottom left of board (9 3/16" White Wire provided).

( ) B.3 - Install a short wire from E24 to E23, bottom right (extremely short wire provided in Kit) NOTE: do not cover the ground hole for C19.

( ) B.4 - Install a Jumper from E25, bottom right, to E7, left center (NOTE: E26 is directly above E25 and CAUTION is needed in order not to confuse the two) (7 7/8" yellow wire provided in kit).

( ) B.5 - Install a Jumper from E26, bottom right, to E11, located above U19 (6" blue wire provided in kit).

( ) B.6 - Install a Jumper from E12 to E16, located above U45 (4 3/4" White Wire provided in kit).

( ) B.7 - Install a Jumper from E17 to E6, located next to U7 (6 11/16" Yellow wire provided in kit).

( ) B.8 - Install a Jumper from E3 to E4, located next to U2 (extremely short wire provided in kit).

( ) B.9 - Install a Jumper on the BACK OF THE CARD from the hole marked E2 to the hole marked E29 (7¼" Blue Wire) Solder it on the component side, being careful to avoid solder bridges.

( ) B.10- Install a Jumper from E10, located between U10 & U14, to E28, located in upper right corner. (7" White Wire)

( ) B.11- Install a Jumper from E9, located directly above U10, to E27, located next to E28 (7 9/16" yellow wire).

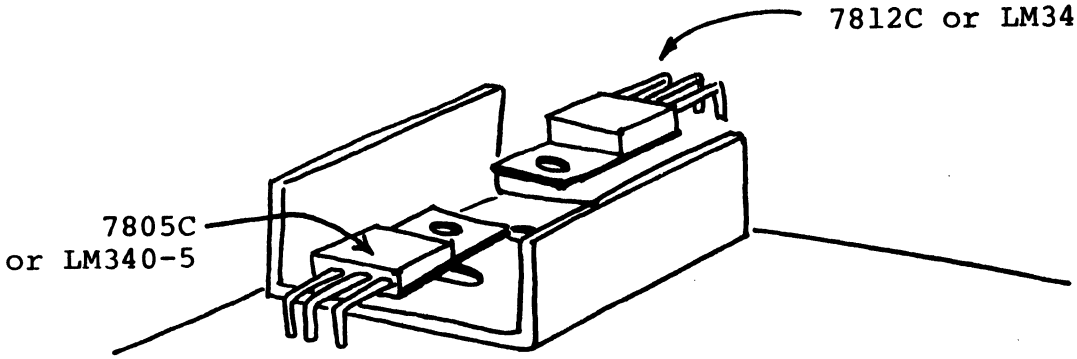
( ) B.12- Install a Jumper from E13, located next to U38, to E14 located next to U40 (1 15/16" blue wire provided).

( ) B.13- Install a Jumper from E18, located above U43, to E20, located between U46 & U49. NOTE, route the Jumper to the left of U46 (3 6/16" white wire provided in kit).

( ) B.14- Install a Jumper from E15, located between U41 & U45, to E19, located at the top of the board (4 5/16" Yellow wire provided in kit).

****NOTE**** The E8 location for a Jumper Termination is not to be used.

C. Install the Regulators according to Figure D, with nuts & bolts provided. Install the bolts with the heads on the solder side of the card.



REGULATOR INSTALLATION

FIGURE D

IMPORTANTREAD AND UNDERSTAND THE FOLLOWING. ALL DISCRETE COMPONENT LOCATIONS (RESISTORS, CAPACITORS, & DIODES) ARE MARKED ON THE P.C. BOARD WITH A SMALL BLACK SILK SCREENED RECTANGLE AND THE HOLES HAVE SQUARE METAL PADS AROUND THEM (except as noted).

D. Install the Capacitors (plus one Resistor, Step D.4).

( ) D.1 - Install C1, it is a .01 mfd Disk Ceramic.

( ) D.2 - Install C2, it is a .22 mfd Tantalum (observe Polarity) The positive Side is indicated by a small red dot or a "+" sign. This side goes in the hole marked "+" on the P.C. Card.

( ) D.3 - Install C3, it is a 470 pf Disk Ceramic.

( ) D.4 - Install R1, it is a 3K ¼ W Resistor (Orange-Blk-Red).

( ) D.5 - Install C4, it is a .1 mfd Disk Ceramic.

( ) D.6 - Install C5, it is a 10 mfd Tantalum (observe Polarity).

( ) D.7 - Install C6, it is a .1 mfd Disk Ceramic.

( ) D.8 - Install C7, it is a .47 Tantalum (observe Polarity). **NOTE**C7 is commonly installed incorrectly. The correct hole for the plus side is located above the "+" nomenclature, NOT BELOW. The correct holes have SQUARE TERMINALS.

( ) D.9 - Install C8 and C9, they are .1 mfd Disk Ceramic. (C9 is located directly below U9).

( ) D.10- Install C10, it is a .047 mfd Disk Ceramic.

( ) D.11 - Install C11, it is a .1 mfd Disk Ceramic.

( ) D.12 - Install C12, it is a 220 pf Disk Ceramic.

( ) D.13 - Install C13, C14 (USE EXTRA CAUTION ON C14. The top lead is very close to Pin 7 of U23), C15, C16 (located between U33 & U37), C17, C18 (located below U45), and C19 (make sure you do not short C19 to the Jumper from E23 to E24). These are all .1 mfd Disk Ceramic Capacitors.

( ) D.14 - Install C20, it is a .01 mfd Disk Ceramic.

( ) D.15 - Install C21, it is a .01 mfd Disk Ceramic.

( ) D.16 - Install C22, it is a 470 pf Disk Ceramic.

( ) D.17 - Install C23, it is a .001 mfd Disk Ceramic.

E. Install Resistors (R1 previously installed, See D.4).

( ) E.1 - Install R2, it is a 4.7 K ohm Resistor (Yellow-Violet-Red) ¼ Watt.

( ) E.2 - Install R3, it is a 33 K ohm ¼ W (Orange-Orange-Orange)

( ) E.3 - Install R4, it is a 150 K ¼ W (Brown-Green-Yellow).

( ) E.4 - Install R5, R6, R7, R8, R9, R10 & R11, they are 3 K ¼W (Orange-Blk-Red) NOTE: These are to be inserted into smaller holes with smaller spacings than the previous Resistors. In order to do this, the leads must be bent very close to the Resistor body. The resistors will not mount flush with the card, but will stand off ¼".

( ) E.5 - Install R12, it is a 3 K ¼ W (Orange-Black-Red).

( ) E.6 - Install R13, R14, R15, R16, R17 & R18, they are 470 ohm ¼ W Resistors (Yellow-Violet-Brown). See note in Step E4.

( ) E.7 - Install R19, it is a 75 ohm ½ W (FOR MITS) (Violet-Green Blk) or a 220 ohm ½ W (FOR IMSAI) (Red-Red-Brown).

( ) E.8 - Install R20, R21, R22, R23, R24, R25, R26, R27, R28 & R29. They are 3 K ¼ W (Orange-Blk-Red).

( ) E.9 - Install R30, it is a 22 K ¼ W (Red-Red-Orange)

( ) E.10- Install R31, it is a 12 K ¼ W (Brown-Red-Orange)

( ) E.11- Install R32, it is a 3 K ¼ W (Orange-Blk-Red).

( ) E.12- Install R33, it is a 43 K ¼ W (Yellow-Orange-Orange)

( ) E.13- Install R34, it is a 1 K ¼ W (Brown-Blk- Red)

( ) E.14- Install R35, it is an 18 K ¼ W (Brown-Gray-Orange)

( ) E.15 - Install R36, it is a 100 ohm ¼ W (Brn-Blk-Brn)

( ) E.16 - Install R37, it is a 22 K ¼ W (Red-Red-Orange)

( ) E.17 - Install R38, it is a 15 K ¼ W (Brn-Green-Orange)

( ) E.18 - Install R39, it is a 3 K ¼ W (Orange-Black-Red)

( ) E.19 - Install R40, it is a 220 ohm ½ W (FOR MITS) (Red-Red-Brn) or 470 ohm ½ W (FOR IMSAI) (Yell-Violet-Brn)

F. Install Diodes (ORIENT WITH BANDED END TOWARD DIRECTION SHOWN BY THE ARROW).

( ) F.1 - Install D1, D2, and D4, they are 1N914 Diodes.

( ) F.2 - Install D3, it is a 1N4742 Zener Diode (12V).

( ) F.3 - Install D5, it is a 1N4735 Zener Diode (6.2V)

G. Install Integrated Circuits (8 Pin) as listed below:

( ) G.1 - U50 is a LM710 (I.C. in metal can). Orient so that the lead directly under the tab on the can goes into the hole for U50 which is nearest the R38 & C21 nomenclature. The other leads must be formed to fit into the other holes. No socket is proved for this I.C.

( ) G.2 - U47 (no socket provided) is a 1458 module.

H. Check Power (the following steps should be done before inserting the remaining I.C.'s).

( ) H.1 - Insert card into computer and turn on computer power.

( ) H.2 - Measure voltage on the left most lead of the top regulator (the bolt which secures the I.C. may be used as a ground reference). This voltage should be 12V ±5%.

( ) H.3 - Measure the voltage on the right lead of the bottom regulator. Voltage should be 5V ± 5%.

( ) H.4 - Measure the voltage at the junction of R19 & D3. This voltage should be approximately -12V.

( ) H.5 - Measure the voltage at the junction of R40 & D5. This voltage should be approximately -6.2V.

ANY SIGNIFICANT DISCREPANCIES FROM THE ABOVE READINGS PROBABLY INDICATES A CONSTRUCTION ERROR ON YOUR CARD.

I. After Step "H" has been successfully completed, install the I.C.'s according to the module map (page II- All modules, except U39, U42, U45 & U46 are oriented with Pin 1 toward the top of the card (CD4019 I.C.'s). Reference notches on Module Map, page 12 of this Section.

J. DOUBLE CHECK MODULE LOCATION AND ORIENTATION.

K. Install the special 14 Pin DIP Component Carrier. Insert it with the Capacitor toward the top (Pin 1 end). The location on the P.C. Card is in the lower left-hand corner.

L. Install the card in the machine & apply power. Recheck the voltages as in Step "H" above. AT THIS POINT, SET THE CARD ASIDE UNTIL FINAL CHECK OUT.

SPECIAL CONSIDERATIONS FOR IMSAI OWNERS

A. BOOTSTRAP

In order to use the bootstrapping function with an IMSAI machine, the following changes must be made:

On the ALPHA-1 Control Card, the trace which connects to Pin 75 ($\overline{\text{Preset}}$) on the 100 Pin Bus Connector must be cut. This trace may be located by turning over the card with the connector nearest you (two large heat sink holes at the upper right). Now, count from your right to left starting with 51. The correct trace is 75 (it is the one which is by itself, just to the right of the paired traces 77 & 78). Carefully cut this trace with a sharp tool as follows:

1. Cut it in two places, apprx. 1/16 of an inch apart.
2. Lift out the center section by cutting under it.
3. Inspect for shorts between the two ends.

The IMSAI Machine has a diode which connects from the reset switch to the external clear switch. The function of this diode is to provide an external clear any time a reset is done. Since the ALPHA-1 enters bootstrap mode on an external clear signal, the processor cannot be independently reset without then doing a bootstrap. <u>If this is unacceptable,</u> there are 2 alternatives:

1. Cut the diode from reset to external clear.
2. Disable the ALPHA-1 auto-bootstrap function & use a software bootstrap function (11 bytes).

If you choose to cut the diode, it will be necessary to remove the IMSAI's lower metal bracket & plastic front panel. The diode is mounted vertically, just to the right of the reset switch (viewed from the top front looking down).

It is possible to cut the top lead of the diode loose with a small pair of diagonal cutters without removing the switches. The loose end of the diode should be lifted well clear of the board. It will be satisfactory to leave the diode like this if you are not operating in a high vibration environment. If you do not wish to cut the diode, the ALPHA-1 automatic bootstrap function must be disabled. This is covered in Application Note #111, available upon request.

XRDY - PRDY COMPATIBILITY PROBLEM

Due to the fact that the IMSAI Front Panel actively drives the XRDY Line (Pin 3 on S100 Bus) the ALPHA-1 Bootstrap may not work properly. This will be observed as a failure of the Data Bus Lights to remain static after the EXT CLR/RUN sequence. If the Data Lights do not remain off (except for DØ) for approximately 1Ø seconds (until Data is reached), then the 7416 U6 does not have sufficient "pull-down" to defeat the Front Panel active "pull-up". In this case, it will be necessary to cut the trace going to Pin 3 (XRDY) and wire this trace instead to PRDY (Pin 72). See Figure E.

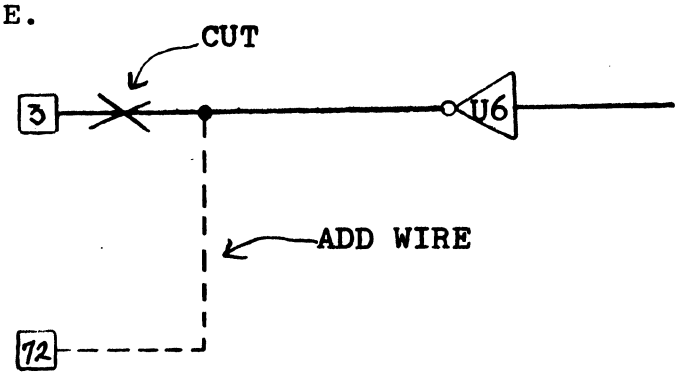
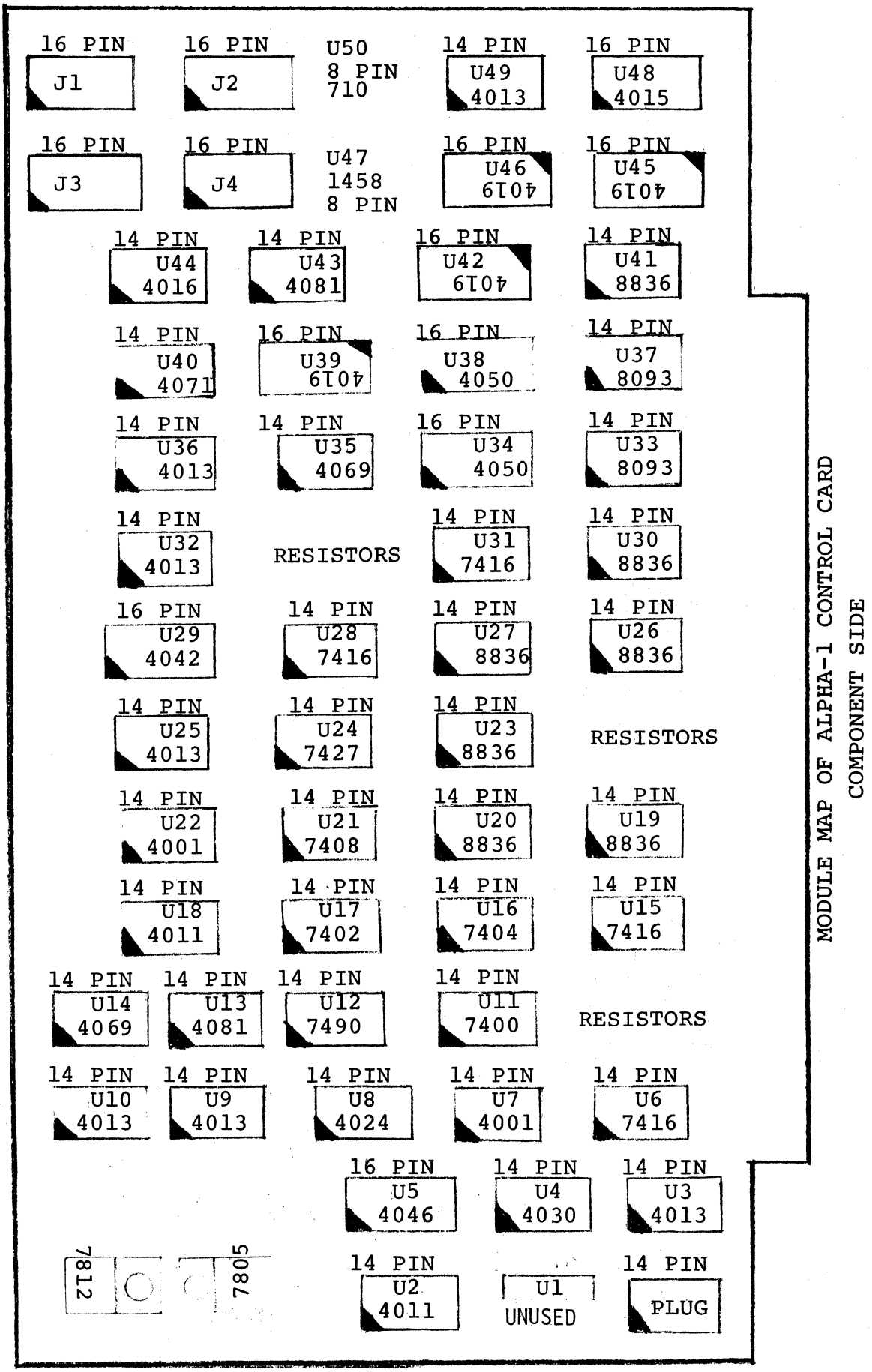


FIGURE E

This modification is recommended for all IMSAI's but may not be required for your particular computer. If you decide to make this modification, be careful not to get an excessive amount of solder on the gold connector finger.


16 PIN J1
16 PIN J2
U50 8 PIN 710
14 PIN U49 4013
16 PIN U48 4015
16 PIN J3
16 PIN J4
U47 1458 8 PIN
16 PIN U46 4019
16 PIN U45 4019
14 PIN U44 4016
14 PIN U43 4081
16 PIN U42 4019
14 PIN U41 8836
14 PIN U40 4071
16 PIN U39 4019
16 PIN U38 4050
14 PIN U37 8093
14 PIN U36 4013
14 PIN U35 4069
16 PIN U34 4050
14 PIN U33 8093
14 PIN U32 4013
RESISTORS
14 PIN U31 7416
14 PIN U30 8836
16 PIN U29 4042
14 PIN U28 7416
14 PIN U27 8836
14 PIN U26 8836
14 PIN U25 4013
14 PIN U24 7427
14 PIN U23 8836
RESISTORS
14 PIN U22 4001
14 PIN U21 7408
14 PIN U20 8836
14 PIN U19 8836
14 PIN U18 4011
14 PIN U17 7402
14 PIN U16 7404
14 PIN U15 7416
14 PIN U14 4069
14 PIN U13 4081
14 PIN U12 7490
14 PIN U11 7400
RESISTORS
14 PIN U10 4013
14 PIN U9 4013
14 PIN U8 4024
14 PIN U7 4001
14 PIN U6 7416
16 PIN U5 4046
14 PIN U4 4030
14 PIN U3 4013
7812
7805
14 PIN U2 4011
U1 UNUSED
14 PIN PLUG
MODULE MAP OF ALPHA-1 CONTROL CARD
COMPONENT SIDE

SECTION III

mecadrive

ASSEMBLY INSTRUCTIONS

All references to top, bottom, left or right apply with the Board oriented so that "Copyright 1976 by MECA" is located closest to the observer, right reading. The component side of the Board may be easily identified by the component designations etched on the Card.

Kit assembly will be facilited if the resistors are sorted by value before beginning.

NOTE*** The Resistor and capacitor holes are much larger than required. This allows you to determine the component holes from feed-through holes where it might otherwise be confusing.

MECADRIVE

PARTS LIST

		BAG NUMBER
1.	MOLEX CONNECTORS	
	A. EIGHTEEN INSERTS	1
	B. TWO 9 PIN MALE	1
	C. ONE 8 PIN MALE	1
	D. TWO 4 PIN MALE	1
	E. ONE 5 PIN MALE	1
	F. ONE 5 PIN FEMALE PIN NEST	1
	G. ONE 8 PIN FEMALE PIN NEST	1
2.	FOUR STANDOFFS (SPACERS) MEASURING 1/4" DEPTH	2
3.	FOUR SCREWS, FOUR SMALL NUTS, FOUR LARGE NUTS & FOUR RUBBER BUMPERS (NOTE: BUMPERS FOR USE ONLY WHEN ENCLOSURE IS NOT PURCHASED)	2
4.	I.C. SOCKETS	
	A. THREE 8 PIN SOCKETS	3
	B. EIGHT 14 PIN SOCKETS	3
	C. FOUR 16 PIN SOCKETS	3
5.	PRINTED CIRCUIT BOARD	4
6.	INTEGRATED CIRCUITS	
	A. ONE CD4ØØ1	5
	B. TWO CD4Ø11	5
	C. ONE CD4Ø16	5
	D. TWO CD4Ø23	5
	E. ONE CD4Ø28	5
	F. ONE CD4Ø44	5
	G. ONE CD4Ø49	5
	H. ONE CD4Ø5Ø	5
	I. ONE CD4Ø69	5
	J. ONE LM39ØØ	5
	K. THREE LM1458	5
7.	PHI-DECK	6
8.	CAPACITORS	
	A. ONE .1 MFD MYLAR	7
	B. TEN .1 MFD 25 VOLT DISK CERAMIC	8
	C. FIVE 1 MFD TANTALUM	9
	D. TWO 47Ø PF DISK CERAMIC	9
	E. TWO 82Ø PF DISK CERAMIC	7
	F. TWO 22 MFD 16 VOLT ALUMINUM AXIAL	7
	G. TWO .Ø47 MYLAR	7
	H. FOUR .ØØ1 MFD DISK CERAMIC	9
	I. ONE .Ø1 MFD MYLAR	7

MECADRIVE PARTS LIST - CONTINUED

		BAG NUMBER
9.	TWO SPECIAL 16 PIN SOCKETS (FOR CABLE)	1Ø
1Ø.	DIP CABLE	1Ø
11.	TWO DIP HOLD DOWNS (BLACK PLASTIC)	1Ø
12.	SPECTRASTRIP	1Ø
13.	SOLDER	1Ø
14.	TRANSISTORS	
	A. TWELVE 2N44ØØ	11
	B. SEVEN 2N29Ø7	11
15.	DIODES	
	A. ELEVEN 1N914 (OR 1N43Ø5)	12
	B. SIX 1N4ØØ2	12
	C. ONE 1N4735 ZENER (6.2V)	12
16.	RESISTORS	
	A. TWO 1.5 OHM 1/2 W	13
	B. ONE 2.7 OHM 1/4 W	14
	C. THREE 4.7 OHM 1/4 W	14
	D. TWO 12 OHM 1 W	13
	E. THREE 1ØØ OHM 1/4 W	14
	F. TWO 1ØØ OHM 1/2 W	13
	G. ONE 2ØØ OHM 1/4 W	14
	H. ONE 22Ø OHM 1/2 W	13
	I. THREE 47Ø OHM 1/4 W	14
	J. ONE 68Ø OHM 1/4 W	14
	K. NINE 1 K OHM 1/4 W	15
	L. FIVE 2 K OHM 1/4 W	15
	M. TWO 3 K OHM 1/4 W	15
	N. TWO 4.7 K OHM 1/4 W	15
	O. THREE 5.6 K OHM 1/4 W	15
	P. TWO 6.8 K OHM 1/4 W	15
	Q. SEVEN 1Ø K OHM 1/4 W	16
	R. TEN 12 K OHM 1/4 W	16
	S. TWO 18 K OHM 1/4 W	16
	T. FIVE 2Ø K OHM 1/4 W	16
	U. FOUR 24 K OHM 1/4 W	16
	V. ONE 27 K OHM 1/4 W	16
	W. THREE 43 K OHM 1/4 W	16
	X. ONE 82 K OHM 1/4 W	16
	Y. FOUR 1ØØ K OHM 1/4 W	17
	Z. SEVEN 18Ø K OHM 1/4 W	17
	AA. ONE 22Ø K OHM 1/4 W	17
	BB. TWO 68Ø K OHM 1/4 W	17
	CC. FOUR 1.5 M 1/4 W	17
	DD. ONE 3 M 1/4 W	17
17.	PHI-DECK PLASTIC COVER	18
18.	(FOR E.C. #1)	
	A. ONE 110 OHM 1/2 WATT RESISTOR	A
	B. ONE 1N4002 DIODE	A
	C. ONE 2 1/2" JUMPER WIRE	A
	D. 1" SECTION OF 1/8" HEAT SHRINK TUBING	A
	E. 1" SECTION OF 1/16" HEAT SHRINK TUBING	A

ASSEMBLE MOLEX CONNECTORS

( ) A. Insert the 8 pin male from the component side into the holes in the lower right corner (labeled J1). See Fig. F

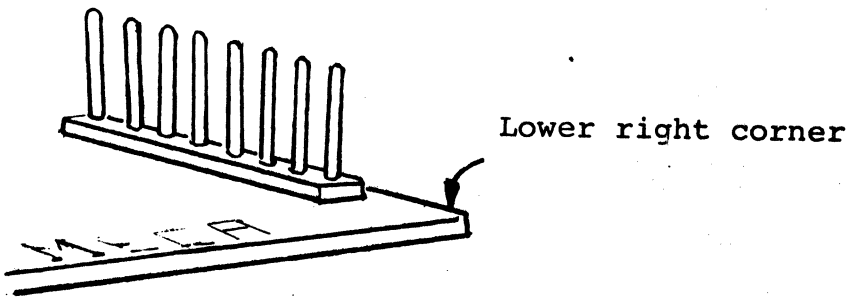


FIGURE F

( ) B. Using masking tape, tape the connector to the Board.

( ) C. Turn the card over and solder all 8 pins (remove tape).

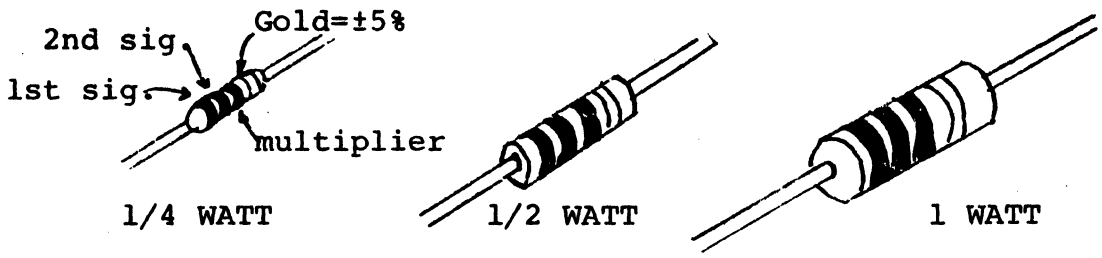
( ) D. In a similar manner, assemble the 9 pin connectors J2 and J3.

( ) E. Select one of the special 16 pin DIP sockets from the bag which contains the ribbon cable (bag 10).

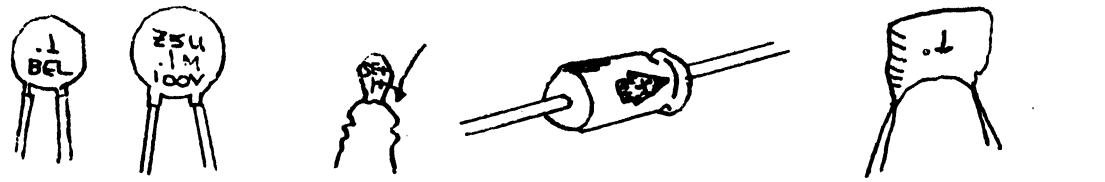
- ( ) E.1 - Insert it into the connector location near the upper left corner labeled "J4" taking care to orient it so that the pin 1 key is in the position labeled 1 on the card.
- ( ) E.2 - Bend the pins slightly on opposite corners of the socket to hold it in place.
- ( ) E.3 - Turn the card over and solder all 16 pins.
- ( ) E.4 - Inspect for solder bridges or cold solder joints.

( ) F. Select the 5 pin male molex connector and assemble it into the upper left corner labeled "J7".

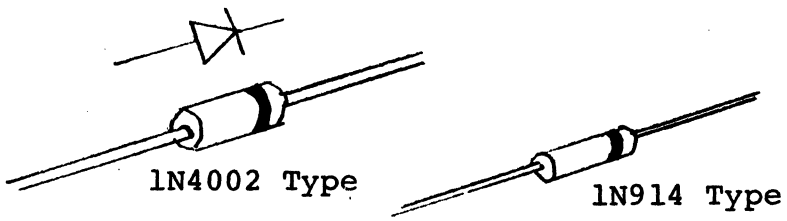
( ) G. Select the two 4 pin male molex connector and assemble them into the "J5" and "J6" locations.



RESISTORS
(Slightly Larger than Actual)



CAPACITORS



DIODES

FIGURE G

ASSEMBLE SOCKETS & RESISTORS

( ) 1 - Assemble all 15 sockets onto the card as follows:

Select a socket with the correct number of pins and insert it in the module position as indicated. Reach under the board and bend out the solder tabs slightly on opposite corners of the socket if required to hold the socket secure. After doing approx. 4 sockets, turn the board over & solder all pins. Continue until all module locations are filled (designated U1 - U15). Note: Orient them so the notched end is toward the right (Pin 1 end). See Module Map, Page III- 14.

( ) 2 - Assemble Resistors as follows:

( ) 2.a - Select the appropriate value.

( ) 2.b - Gently bend the leads so that they insert easily into the holes indicated.

( ) 2.c - Bend the leads out slightly on the underside of the board so the resistor will remain in position until it is soldered. CAUTION** If the leads are bent too much, it will be much more difficult to remove them later if it becomes necessary.

( ) 2.d - Work each area as follows:

( ) #1 - Insert

*R92	180	K	¼ W	(Brown -Gray	-Yellow)**
R1	24	K	¼ W	(Red	-Yellow-Orange)
R2	24	K	¼ W	(Red	-Yellow-Orange)
R3	12	K	¼ W	(Brown -Red	-Orange)
R4	43	K	¼ W	(Yellow-Orange-Orange)	
R5	43	K	¼ W	(Yellow-Orange-Orange)	
*R93	10	K	¼ W	(Brown -Black -Orange)	

( ) #2 - First - solder using care not to cause solder bridges.
Second- Trim leads close to board.
Third - Inspect for good solder connections.

( ) #3 - Insert

R6	180	K	¼ W	(Brown -Gray	-Yellow)
R7	180	K	¼ W	(Brown -Gray	-Yellow)
R8	180	K	¼ W	(Brown -Gray	-Yellow)
R9	180	K	¼ W	(Brown -Gray	-Yellow)
R10	180	K	¼ W	(Brown -Gray	-Yellow)
R11	180	K	¼ W	(Brown -Gray	-Yellow)
R12	24	K	¼ W	(Red	-Yellow-Orange)
R13	24	K	¼ W	(Red	-Yellow-Orange)

( ) #4 - Solder, trim & Inspect.

*Resistor Number is out of sequence.

**There is a fourth color band of gold on each Resistor which is not referenced in the color description (the gold band indicated ± 5 percent)

( ) #5 - Insert	R14	680	K	¼	W	(Blue -Gray -Yellow)
	R15	680	K	¼	W	(Blue -Gray -Yellow)
	R16	3	Meg	¼	W	(Orange-Black -Green)
	R17	12	K	¼	W	(Brown -Red -Orange)
	R18	12	K	¼	W	(Brown -Red -Orange)
	R19	100	K	¼	W	(Brown -Black -Yellow)
	R20	1.5	Meg	¼	W	(Brown -Green -Green)
	R21	43	K	¼	W	(Yellow-Orange-Orange)
	R22	12	K	¼	W	(Brown -Red -Orange)
( ) #6 - Solder, Trim & Inspect						
( ) #7 - Insert	R23	12	K	¼	W	(Brown -Red -Orange)
	R24	100	K	¼	W	(Brown -Black -Yellow)
	R25	1.5	Meg	¼	W	(Brown -Green -Green)
	R26	1.5	Meg	¼	W	(Brown -Green -Green)
	R27	1,5	Meg	¼	W	(Brown -Green -Green)
	*R94	100	ohm	¼	W	(Brown -Black -Brown)
	*R88	200	ohm	¼	W	(Red -Black -Brown)
( ) #8 - Solder, Trim & Inspect						
( ) #9 - Insert	*R96	10	K	¼	W	(Brown -Black -Orange)
	R28	5.6	K	¼	W	(Green -Blue -Red)
	R29	3	K	¼	W	(Orange-Black -Red)
	R30	1	K	¼	W	(Brown -Black -Red)
	R31	20	K	¼	W	(Red -Black -Orange)
	R32	1	K	¼	W	(Brown -Black -Red)
	R33	20	K	¼	W	(Red -Black -Orange)
	R34	6.8	K	¼	W	(Blue -Gray -Red)
( ) #10- Solder, Trim & Inspect.						
( ) #11- Insert	R35	18	K	¼	W	(Brown -Gray -Orange)
	R36	4.7	Ohm	¼	W	(Yellow-Violet-Gold)
	R37	4.7	K	¼	W	(Yellow-Violet-Red)
	R38	1	K	¼	W	(Brown -Black -Red)
	R39	2	K	¼	W	(Red -Black -Red)
	+R40	100	ohm	½	W	(Brown -Black -Brown)
	+R41	1.5	ohm	½	W	(Brown -Green -Gold)
	R42	470	ohm	¼	W	(Yellow-Violet-Brown)
( ) #12- Solder, Trim & Inspect						
( ) #13- Insert	+R43	12	ohm	1	W	(Brown -Red -Black)
	R44	2	K	¼	W	(Red -Black -Red)
	R45	1	K	¼	W	(Brown -Black -Red)
	R46	100	K	¼	W	(Brown -Black -Yellow)
	R47	12	K	¼	W	(Brown -Red -Orange)
	R48	2	K	¼	W	(Red --Black -Red)
	R49	12	K	¼	W	(Brown -Red -Orange)
	R50	20	K	¼	W	(Red -Black -Orange)
	R51	1	K	¼	W	(Brown -Black -Red)
	R52	470	ohm	¼	W	(Yellow-Violet-Brown)

*Out of Sequence
+Note Resistor Wattage

( ) #14 - Solder, Trim & Inspect.

( ) #15 - Insert (NOTE CAUTION BELOW ON R53)

R53	100	ohm	¼	W	(Brown -Black -Brown)
R54	10	K	¼	W	(Brown -Black -Orange)
R55	10	K	¼	W	(Brown -Black -Orange)
*R90	10	K	¼	W	(Brown -Black -Orange)
*R91	10	K	¼	W	(Brown -Black -Orange)
R56	100	ohm	¼	W	(Brown -Black -Brown)
R57	680	ohm	¼	W	(Blue -Gray -Brown)

( ) #16 - Solder, Trim & Inspect

( ) #17 - Insert

R58	2.7	ohm	¼	W	(Red -Violet-Gold)
***R59	DO NOT ASSEMBLE UNTIL INSTRUCTED LATER				
R60	100	K	¼	W	(Brown -Black -Yellow)
R61	2	K	¼	W	(Red -Black -Red)

( ) #18 - Solder, Trim & Inspect.

( ) #19 - Insert

R63	5.6	K	¼	W	(Green -Blue -Red)
R64	3	K	¼	W	(Orange-Black -Red)
R65	1	K	¼	W	(Brown -Black -Red)
R66	20	K	¼	W	(Red -Black -Orange)
R67	1	K	¼	W	(Brown -Black -Red)
R68	20	K	¼	W	(Red -Black -Orange)
R69	6.8	K	¼	W	(Blue -Gray -Red)

( ) #20 - Solder, Trim & Inspect.

( ) #21 - Insert

R70	18	K	¼	W	(Brown -Gray -Orange)
R71	4.7	Ohm	¼	W	(Yellow-Violet-Gold)
R72	4.7	K	¼	W	(Yellow-Violet-Red)
R73	1	K	¼	W	(Brown -Black -Red)
R74	2	K	¼	W	(Red -Black -Red)
+R75	100	ohm	½	W	(Brown -Black -Brown)
+R76	1.5	ohm	½	W	(Brown -Green -Gold)

( ) #22 - Solder, Trim & Inspect

( ) #23 - Insert

+R77	12	ohm	1	W	(Brown -Red -Black)
R78	12	K	¼	W	(Brown -Red -Orange)
R79	470	ohm	¼	W	(Yellow-Violet-Brown)
R80	5.6	K	¼	W	(Green -Blue -Red)
R81	27	K	¼	W	(Red -Violet-Orange)
R82	220	K	¼	W	(Red -Red -Yellow)
R83	12	K	¼	W	(Brown -Red -Orange)
R84	12	K	¼	W	(Brown -Red -Orange)
R85	1	K	¼	W	(Brown -Black -Red)
R86	82	K	¼	W	(Gray -Red -Orange)
+R87	220	ohm	½	W	(Red -Red -Brown)

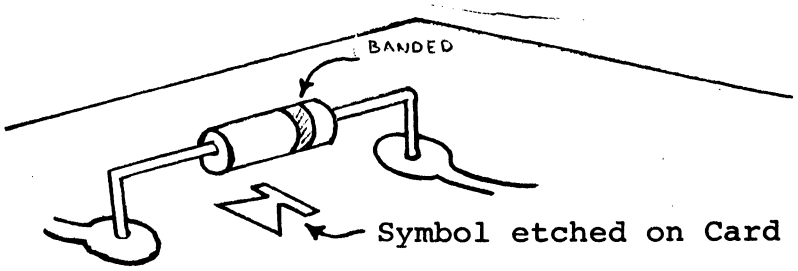
NOTESPACING ON R87 IS FOR A TWO WATT RESISTOR**********

( ) #24 - Solder, Trim & Inspect..

+Note Resistor Wattage.
*Out of sequence.
***If R59 is assembled at this point, Q5 & Q14 will be destroyed during check out.
CAUTION: DO NOT INSTALL R53 IF YOU PLAN TO USE CHANNEL 2 AS AN ANALOG CHANNEL.

ASSEMBLE THE DIODES

( ) Step 1. Assemble the 1N4002 type Diodes onto the card. (These are the larger diodes) *CAUTION* The diode must be assembled with the correct orientation. Putting it in backwards may cause catastrophic failure of some components. (See Figure H) The leads should be bent similar to resistor assembly procedure. NOTE: There is one Zener Diode (1N4735) in Bag #12. Locate this Zener and set it aside to be used later.



CORRECT DIODE ASSEMBLY
FIGURE H

( ) 1.A - Insert CR6 (located below U10), CR10 (below & to the right of CR6). Solder and trim.

( ) 1.B - Insert CR12 and CR13. (Note: they have opposite orientations). Solder and trim.

( ) 1.C - Insert CR14 and CR15. (Note: they have the same orientation) Solder and trim.

( ) Step 2. Assemble the 1N914 type Diodes.*CAUTION* The orientation is important. See directions in Step 1 above. Start assembly in upper left corner.

( ) 2.A - CAREFULLY OBSERVE the location on the P.C. card for CR20 & assure there are no shorts due to letters being joined by small letter bridges. If necessary, cut letters with a sharp knife. (NOTE: CR20 is UNUSED)

( ) 2.B - Insert CR16 (NOTE: there is an error on the card, therefore, assemble CR16 from the top hole of CR16 to the top lead of Resistor R1.) See Figure I.

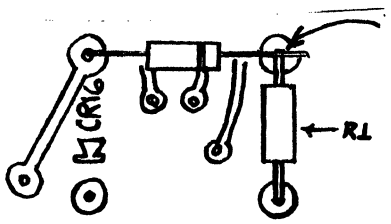


FIGURE I

( ) 2.C - Insert CR1, CR2, CR3 & CR4. Solder & trim.

MECADRIVE DIODES ASSEMBLY - CONTINUED

( ) 2.D - Insert CR5 & CR17 (CR17 is located above & to the right of CR5). Solder & trim.

( ) 2.E - Insert CR8 & CR9, (located under module U12). Solder and trim.

( ) 2.F - Insert CR11 (located off right edge of U11 & down 2") and CR19 (located just to the left of U9). Solder & trim.

ASSEMBLE THE CAPACITORS

Step 1. Assemble the capacitors USING CAUTION on the capacitors which require orientation. These are indicated on the card with a "+" on one lead. It is helpful to pre-trim capacitor leads to apprx. ½" before inserting. Begin assembly in the upper left corner.

( ) 1.A - Insert C24, it is a 1 mfd Tantalum capacitor (observe polarity).

( ) 1.B - Insert C1, C2 and C3 (C3 is located between U6 & U7). They are .1 mfd Disk Ceramic capacitors.

( ) 1.C - Insert C4, it is a 1 mfd Tantalum (located below left edge of U6). Observe polarity. Solder & trim. (Be sure not to overlook C24 & C4).

( ) 1.D - Insert C5, C9 (located below C5) and C6. They are .1 mfd Disk Ceramic capacitors.

( ) 1.E - Insert C7, it is a 1mfd Tantalum (observe polarity).

( ) 1.F - C8 IS NOT to be installed.

( ) 1.G - Solder & trim (be sure not to overlook C7)

( ) 1.H - Insert C10, it is a .1 mfd Disk Ceramic (below U9).

( ) 1.I - Insert C12, it is an 820 pf Disk Ceramic (between J5 & J6 on left side of card).

( ) 1.J - Insert C13, it is a .1 mfd Disk Ceramic.

( ) 1.K - Insert C15, it is an 820 pf Disk Ceramic.

( ) 1.L - Insert C16, it is a .1 mfd Disk Ceramic.

( ) 1.M - Solder and trim.

( ) 1.N - Insert C18, it is a .1 mfd Mylar. Note: the Mylars are in Bag 7.

( ) 1.O - Insert C14 & C17, they are .047 Mylars.

( ) 1.P - Install a .01 mfd Mylar across the erase head J5-3 and J5-4 (no holes are provided). Please Note, located on page 11 of Section VI is a MECADRIVE CARD LAYOUT DIAGRAM, since parts of your card are going to be covered with components, this should be helpful in locating proper "markings".

MECADRIVE CAPACITOR ASSEMBLY - CONTINUED

( ) 1.Q - Insert C11 & C22, they are 22 mfd 16 V Axial Electrolytic (observe polarity, the arrows indicate + & -).

( ) 1.R - Solder and trim.

( ) 1.S - Insert C19, it is a 1 mfd Tantalum (observe polarity).

( ) 1.T - Insert C23, it is a .1 mfd Disk Ceramic.

( ) 1.U - Insert C20, it is a 1 mfd Tantalum (observe polarity). NOTE: Insert from "+" hole as indicated to the small hole in the wide trace to the left of the C20 nomenclature (NOT the large hole to the right of the C20 nomenclature). Straighten negative lead as required.

( ) 1.V - Solder and trim (be sure not to overlook C19 & C20).

NOTEC21 is an optional capacitor & will be covered later.

ASSEMBLE THE TRANSISTORS

( ) Step 1. Assemble NPN Transistors (2N4400 type). These transistors may be one of several types as shown in Figure J below.

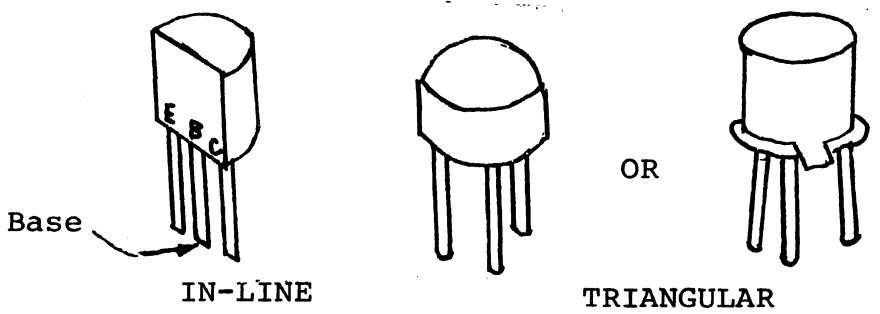


FIGURE J

NOTE: These should be inserted into the card as shown in FIGURE K below.

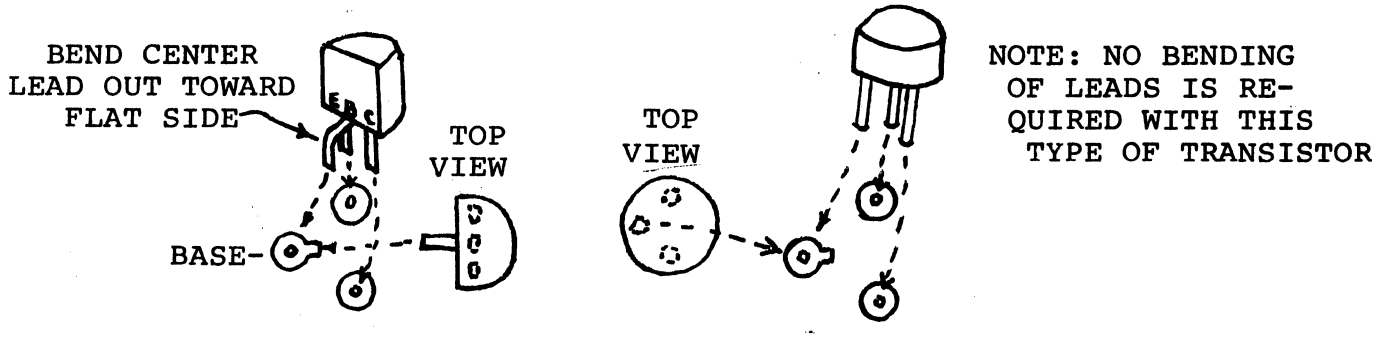


FIGURE K

Insert each Transistor to within ¼" of the Board, then bend the leads outward slightly to prevent them from falling out when the board is turned over for soldering.

NOTE**All Transistors, except Q19, are located on the lower half of the Board.

MECADRIVE TRANSISTORS ASSEMBLY - CONTINUED

( ) 1.A - Insert Q19 (located to the right of U12)

( ) 1.B - Solder and trim.

( ) 1.C - Insert Q1 and Q2.

( ) 1.D - Insert Q3 (NOTE: Q3 has opposite orientation from Q1 and Q2).

( ) 1.E - Insert Q4 (same orientation as Q3).

( ) 1.F - Insert Q11 and Q12 (same orientation as Q1).

( ) 1.G - Solder and trim leads.

( ) 1.H - Insert Q5 (same orientation as Q1)

( ) 1.I - Insert Q15 (same orientation as Q3)

( ) 1.J - Insert Q16 & Q17 (same orientation as Q1)

( ) 1.K - Insert Q8 (same orientation as Q3)

( ) 1.L - Solder and trim leads.

Step 2. Assemble PNP Transistors (2N2907 type). All of these Transistors are triangle type (NOTE: Do not be confused by the tab on the transistor. It does not correspond to the tab etched on the base lead hole on the card. See Figure K. (Page III-11)

( ) 2.A - Insert Q6, Q7 and Q9.

( ) 2.B - Solder and trim.

( ) 2.C - Insert Q10 and Q13.

( ) 2.D - Insert Q14 and Q18.

( ) 2.E - Solder and trim.

MISCELLANEOUS ASSEMBLY

( ) Step 1. Assemble a wire jumper between the extra large holes on the left & right of the R89 nomenclature (1½" directly above the work "Copyright").

( ) Step 2. Install CR18, it is a 1N4735 6.3 volt Zener.

( ) Step 3. Install four .001 mfd disk ceramic capacitors from the manual inputs (J7-1, J7-2, J7-3 & J7-4) to ground. A convenient place to install these is on the bottom of the card near the connector J7. The nearest ground trace is available on the top or R92 (it is the widest trace in the upper left corner viewed from the component side). It will be necessary to "solder tac" these capacitors, since no holes are provided. It is suggested that you use a piece of electricians tape to eliminate the possibility of electrical contact between the ground side of the capacitors & any other traces. Be as neat as possible and inspect your work carefully.

( ) Step 4. Install a 470 pf capacitor across resistors R31 and R66. These capacitors should be carefully soldered across the resistor terminals specified.

( ) Step 5. Install R62 (it is a 10K ¼ W Resistor) from the hole provided (just below Q7) to the ground trace connected to the negative lead of C20. There is no hole provided for the other end of R62 here so it will be necessary to solder tac one end to the ground trace.

Before proceding, reference Engineering Change on Page III-19.

MECADRIVE FINAL ASSEMBLY

Before inserting the Integrated Circuits, do the following:

( ) Step 1. Plug in the power supply connector J1 and the 16 Pin DIP connector which connects to the control card. Plug in power supply and turn on the computer.

( ) Step 2. Measure the voltage on Pin 14 of the U1 socket. This should read approx. 12 Volts. If it does not, turn off power and turn to Trouble Shooting Section.VI.

( ) Step 3. Measure the Voltage on J1 Pin 3. This Voltage should be between 6 and 10 Volts. If not, turn to Trouble Shooting Section

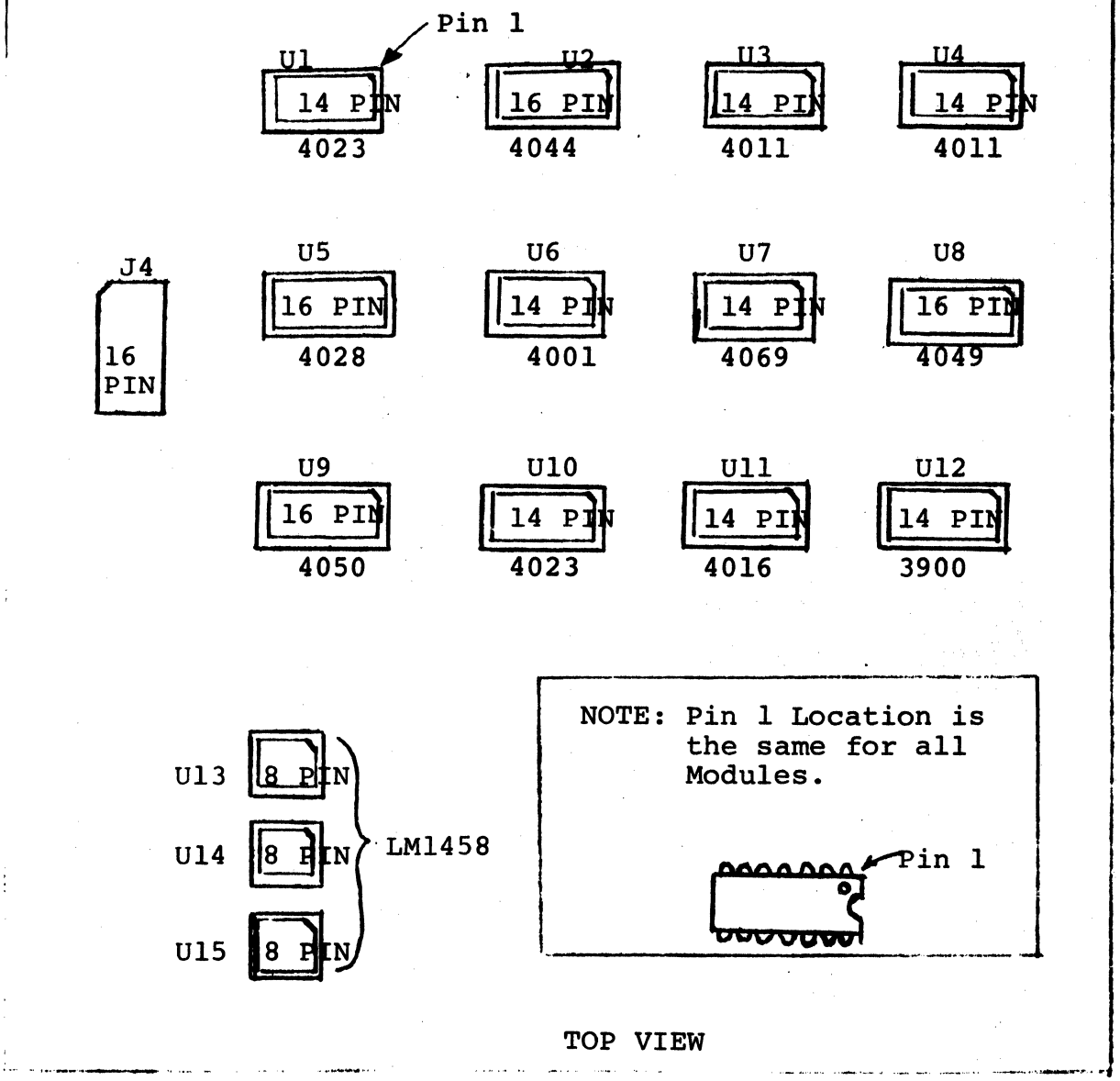
( ) Step 4. Measure the Voltage on J4 Pin 5. It should be negative and between 8 & 18 Volts. If not, turn to Trouble Shooting Section.

( ) Step 5. Measure the Voltage on the top lead of R78 (first Resistor to the right of the name "MECA"). This should read approx. 11.5 Volts. If significantly different, turn to Trouble Shooting Section.

( ) Step 6. If the preceding steps check out, remove all power and insert the Integrated Circuits.(See Page III-14)

( ) Step 7. Insert R59, it is a 4.7 ohm ¼ W Resistor (yellow-violet-gold). Solder and trim.

ALPHA-1 Kit Builders should now proceed to the Enclosure Assembly (Section IV) if they have purchased the Enclosure. Otherwise, continue with the following steps on page III-14. Non-ALPHA-1 MECADRIVE Owners should proceed to Section VII.



MECADRIVE

MODULE MAP

INSTALLING THE PHI-DECK

( ) Step 1. Install the Phi-Deck as follows:

( ) 1.A - Locate the package with the Spacers & their associated nuts and bolts (Bag 2).

( ) 1.B - Place the 4 rubber bumpers, included in Bag 2, on each bolt and insert the 4 bolts from the bottom of the Drive card.

( ) 1.C - Assemble the ¼" spacers and the large nuts on the 4 bolts. Tighten Bolts.

( ) 1.D - Carefully set the Phi-Deck on the four bolts so that the Head-Bar is toward the front.

( ) 1.E - The small nuts should be assembled on the four screws and tightened down.

( ) 1.F - CAUTION: Do not perform the next few steps until you have the time and patience to use great care. There are two 9 Pin Molex Cable Assemblies coming out of the right side of the Phi-Deck. The one that has the most wires in it is P3. Install it on J3 so that the black wire is toward the back of the Drive (Pin 1). Be careful! This can be plugged in wrong. See Fig. M.

Reference Page IV-15 for full description of the Phi-Deck wiring.

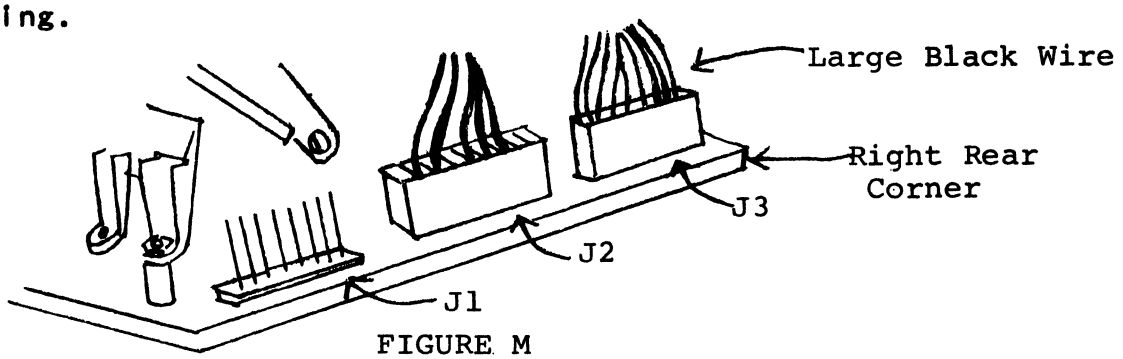


FIGURE M

( ) 1.G - The remaining 9 Pin Molex is P2. Install it so that the group of three wires is toward the rear of the Drive.

( ) 1.H - There are two 4 Pin Molex connectors coming from the left side of the Phi-Deck. The one with 4 wires (read/write head connector) is P6. Plug it in so that the Cable which is wired to the upper most terminals on the Read-Write Head is toward the front of the phi-deck. (Reference the pictorial on page 15 in Section IV - Enclosure Final Assembly - for full details)

( ) 1.I - The remaining 4 Pin Molex with 2 wires is P5. Install it on J5 so that the 2 wires are toward the front of Drive.

NOTE**Inspect for clearance between J5 & the Head Bar Starwheel.

MECADRIVE ASSEMBLY - CONTINUED

( ) 1.J - Assemble the 5 Pin Molex Female Connector which interfaces to the manual switches if manual operation is desired (switches not included). Any type of normally open momentary switch is acceptable.

( ) 1.K - See the Section entitled Interfacing to Manual Control Switches for a description of Connector J7.

( ) 1.L - Reference the Engineering Change #1 on Page III-19 (TO IMPROVE REWIND CHARACTERISTICS NEAR BEGINNING OF TAPE).

The MECADRIVE is now ready for Final Check Out (Page IV-16 for ALPHA-1 Systems and Section VII Page 9 for non-ALPHA-1 MECADRIVE Owners.

ENGINEERING CHANGE #1

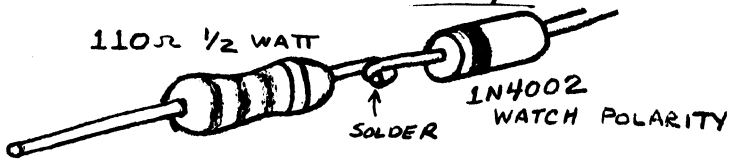
CARD AFFECTED: MECADRIVE CARD

PURPOSE: TO IMPROVE REWIND CHARACTERISTICS NEAR BEGINNING OF TAPE.

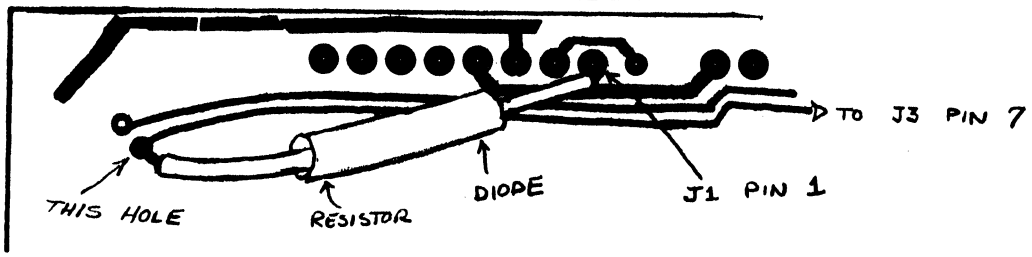
CHANGE DESCRIPTION:

The following change implements a "Rewind Boost" Function which will significantly improve MECADRIVE Rewind Characteristics on some high friction cassettes. These changes may be made entirely on the bottom of the card.

1. Build a Diode Resistor sub-assembly as shown below.



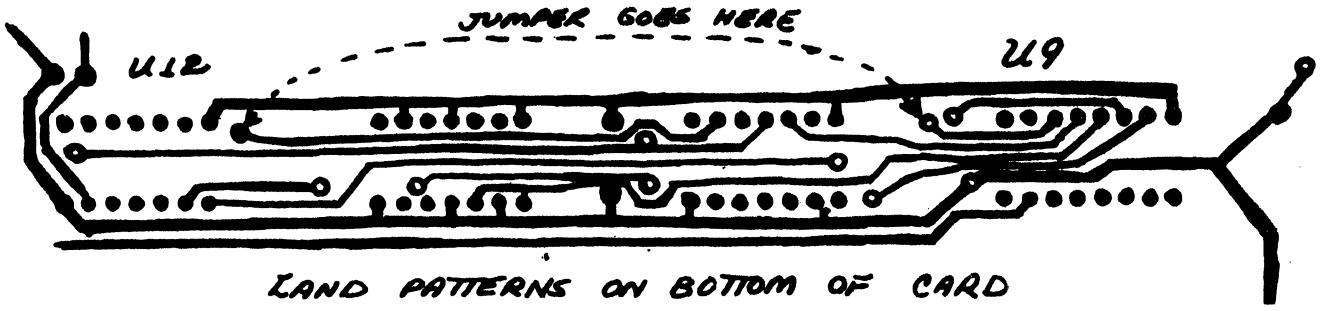
2. Using heat shrink tubing, install this assembly from J1 Pin 1 to the feed through hole near the closest corner (as shown below).



(The target land should go to J3 Pin 7)

3. Using a short Jumper Wire, trim the bare section to approx. 1/8".

4. Install the Jumper from the feed-through hole next to Pin 7 of Module U12 to the feed-through hole on the land coming from U9 Pin 3 (See Figure).



NOTE Components needed to make this Engineering Change are located in Bag A in MECADRIVE Kit.

SECTION IV

alpha 1

enclosure

ASSEMBLY INSTRUCTIONS

ENCLOSURE

PARTS LIST

		BAG NUMBER
1.	LED COVERS	
	A. TWO RED	35
	B. TWO YELLOW	35
	C. FOUR GREEN	35
2.	LED'S	
	A. TWO RED	35
	B. TWO YELLOW	35
	C. FOUR GREEN	35
3.	TOGGLE COVERS (FOR SWITCHES)	
	A. THREE RED	35
	B. TWO BLUE	35
4.	SPACERS	
	A. FOUR 1/4" SPACERS	35
	B. EIGHT 1/8" SPACERS	35
5.	STRESS RELIEF	35
6.	TWO 470 OHM 1/2 WATT RESISTORS	35
7.	HEAT SHRINK TUBING	
	A. TWO SECTIONS OF THE SMALLER DIAM.	36
	B. ONE SECTION OF THE LARGER DIAMETER	36
8.	WIRE	
	A. 2Ø" BLACK WIRE	36
	B. 4Ø" YELLOW WIRE	36
9.	SWITCHES	
	A. THREE SPDT SWITCHES (ON/OFF)	36
	B. TWO MOMENTARY SWITCHES	36
1Ø.	DRESS NUTS (FIVE)	36
11.	ONE WIRE NUT	37
12.	BOLTS & NUTS	
	A. TWO 1/2" BOLTS	37
	B. TWO LARGE NUTS	37
		37
13.	SPECTRASTRIP	37
14.	BLANK PLASTIC COVER (NOTE; THIS IS FOR SINGLE DRIVE USERS ONLY)	38
15.	ENCLOSURE TOP & BOTTOM	

ENCLOSURE ASSEMBLY INSTRUCTIONS

Step 1. In order to construct a wiring harness for top LED indicators, the enclosure will be used as a jig in the following steps.

( ) 1.A - Set the ALPHA-1 enclosure in front of you and install the plastic LED covers from the inside with the colors as shown in the Figure below. BE CAREFUL not to drop solder on the enclosure or scratch the finish.

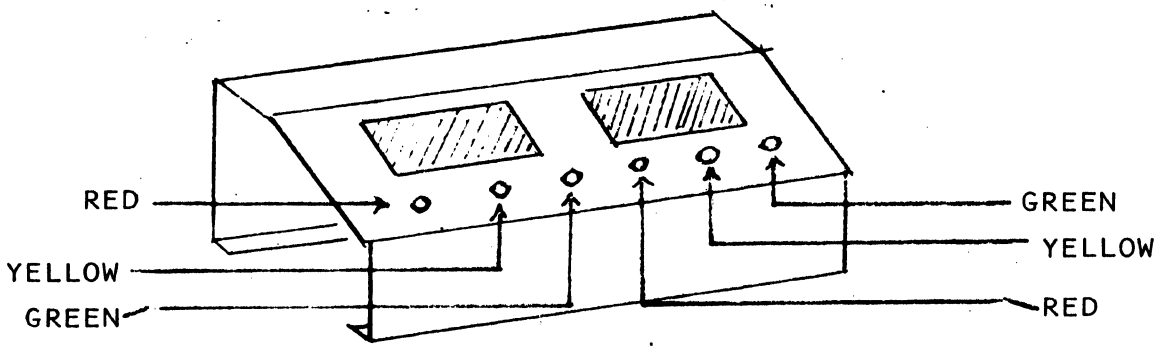


FIGURE N

( ) 1.B - Select one of the LEDS and NOTE that there is a flat spot on the colored plastic near one lead. This indicates the negative (cathode) lead of the diode. In the following steps, orient the LED with the flat spot nearest to you. THIS IS IMPORTANT, if you wire the LED backwards, it will not light up. See Fig. O.

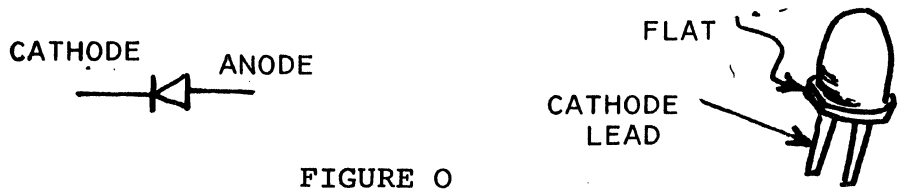


FIGURE O

( ) 1.C - Insert the LED's (so the colors match the LED covers installed in Step 1.A) into the LED covers. (Watch the flat sides, they must be toward you.) The two additional green LED's will be installed later.

( ) 1.D - Cut 24 inches of the 10 conductor spectrastrip provided as follows: Strip the brown conductor from this section. Then separate the rest of the wires between the Blue & Violet wires.

WIRING OF THE LEFT LED's (DRIVE ZERO)

Step 2. Cut a piece of the red through blue spectrastrip 11" long.

( ) 2.A - Separate all the wires on the Red through Blue apprx. 5".

( ) Step 3. The following "in line" solder connection technique is to be used in making connections to the LED leads unless otherwise instructed:

( ) 3.A - Strip apprx. 1/8" insulation from the wire to be joined and twist the strands together.

( ) 3.B - "Tin" the lead by heating & flowing a small amount of solder on the lead. If done properly, leads will be shiney & of approx. the same diameter as before tinning (no globs).

( ) 3.C - Cut approx. ¼" off the LED leads.

( ) 3.D - "Tin" the LED lead to be connected by melting a small amount of solder on the lead (As in Step 3.B)

( ) 3.E - Insert approx. ½" of spagetti over the wire and push it well back from the bare end.

( ) 3.F - Bring the two leads together, holding them parallel. See Figure P.

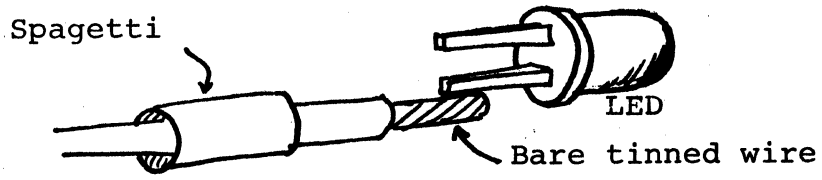
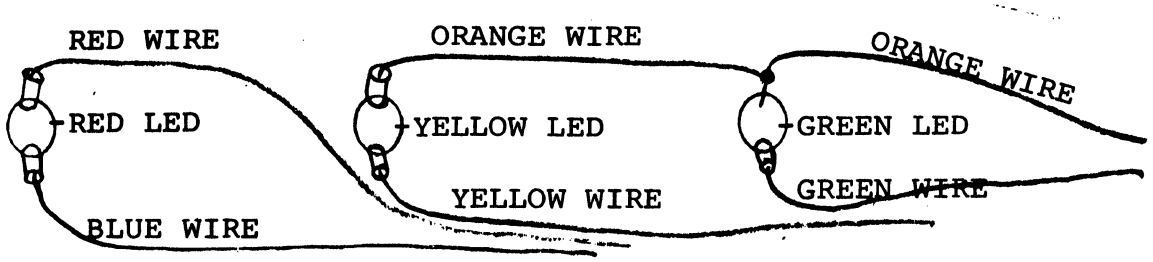


FIGURE P

( ) 3.G - While gently holding the wires next to each other, heat them with the soldering iron from below until the solder melts & the two are joined. Remove the iron while holding the two wires together. It is important to hold the wires steady until the solder cools below the eutectic. This will usually be a couple of seconds. If the solder connection is shiney and the wires appear to be against each other, the joint will provide a good mechanical & electrical bond. If it is dull & granular, however, Step 3.G should be repeated.

( ) 3.H - After the solder has cooled to the touch, push the spagetti down over the solder joint. The spagetti is heat shrink tubing, therefore, heat it slightly with a cigarette lighter (be careful, a little heat is plenty)



WIRING THE LEFT LED'S
FIGURE Q

( ) Step 4. In the following Steps, refer to the Figure above. Using the technique covered on Page 4 (Sec. IV), connect the Red Wire to the top lead of the Red LED.

( ) Step 5. Similarly, connect the Blue Wire to the bottom lead of the Red LED.

( ) Step 6. Trim off approx. 2" of the yellow wire & connect it to the bottom lead of the yellow LED.

( ) Step 7. Trim off approx. 4" of the Green Wire and connect it to the bottom lead of the Green LED.

( ) Step 8. Trim off approx. 4" of the Orange Wire. Using the 4 inch section removed, connect one lead to the top of the Yellow LED.

( ) Step 9. Cut the 4" Orange wire down so that it will reach just beyond the top lead of the Green LED. Strip and tin the free end.

( ) Step 10. Strip and tin the original portion of the Orange wire.

( ) Step 11. Make a small bend in each of these wires and crimp them around the top lead of the Green LED. See Fig.R

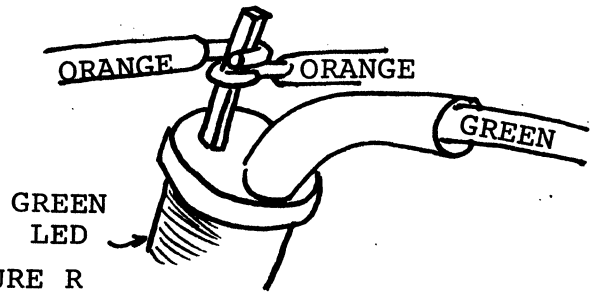


FIGURE R

( ) Step 12. Solder these three leads together by adding a small amount of solder. No insulation is required on this joint.

WIRING OF THE RIGHT LED'S (DRIVE 1)

( ) Step 1. Using a procedure similar to that on page 5, cut an 11" section of Red through Blue spectrastrip.

( ) Step 2. Using the Diagram in Figure S, wire the LED's.

( ) Step 3. Note: the LED Orientation should be such that the Negative side will be located at the bottom.

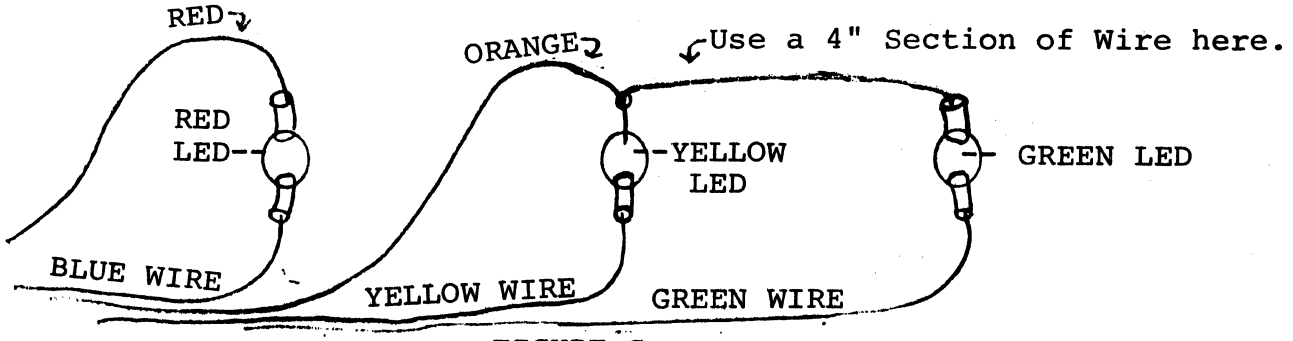


FIGURE S

( ) Step 4. Remove the LED's from the plastic covers by grasping both leads near the body & pulling firmly (The LED will snap out).

( ) Step 5. Position your power supply card and the LED sub-assemblys as shown in the Figure below (T).

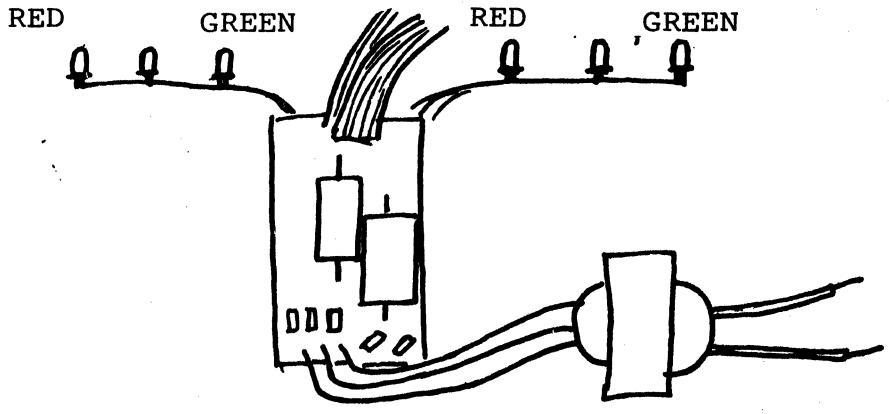


FIGURE T

( ) Step 6. Separate the Spectrastrip as necessary to wire the left group of LED's as follows:

( ) 6.A - In each case below, strip approx. 3/16" of insulation, twist the wires & tin them before inserting into holes.

( ) 6.B - Wire the Yellow Wire to the hole labeled "8" on the Power Supply Card.

( ) 6.C - Wire the Green Wire to the hole labeled "7" on the Power Supply Card.

( ) 6.D - Wire the Red Wire to the hole labeled "2" (top edge).

( ) 6.E - Wire the Blue Wire to the hole directly above the C4 nomenclature on the power supply card (located between the C4 and the hole labeled "1").

( ) 6.F - The Orange Wire will be wired later.

( ) Step 7. Separate the spectrastrip as necessary to wire the right "Bank" of LED's as follows:

( ) 7.A - Wire the Yellow Wire to the hole labeled "10" on the Power Supply Card.

( ) 7.B - Wire the Green Wire to the hole labeled "6".

( ) 7.C - Wire the Red Wire to the hole labeled "5"

( ) 7.D - Wire the Blue wire to the hole labeled "1" (top edge).

( ) Step 8. The 2 Orange wires will have to share the hole labeled "9" on the Power Supply Card. To do this, strip approx. 3/8" insulation from each end & twist the two wires together. Tin them. Insert in "9" & solder.

( ) Step 9. The LED's may now be tested if the transformer and Power Cord are wired.

( ) 9.A - Stretch out the unit so there is plenty of room between each component (to avoid possibility of shorts).

( ) 9.B - Plug in the Power Cord.

( ) 9.C - NOTE: In the following, the connections are made on the Molex Connectors coming from the Power Supply. Using the Molex coming from J1 on the Power Supply Card, connect the 220 ohm ½ Watt Resistor provided from the Yellow to the Violet Wire (Pin 4 to Pin 7). The left Bank Green LED should light.

( ) 9.D - Connect the 220 ohm Resistor from the Yellow to the Blue Wire (Pin 4 to Pin 6). The left yellow LED should light.

( ) 9.E - Connect the 220 ohm Resistor from the Orange to the Green Wire (Pin 3 to Pin 5). The left Red LED should light.

( ) 9.F - Repeat steps 9.C through 9.E using the other Molex connector. The LED's in the other Bank should light.

( ) 9.G - Unplug the Power Cord.

( ) 9.H - Discharge the 12 Volt Capacitor by connecting the 220 ohm Resistor from the Red wire to the Yellow wire for a few seconds.

( ) 9.I - Similarly, discharge the 7 Volt Capacitor by connecting the 220 ohm Resistor from the Orange wire to the Yellow Wire for a few seconds.

WIRING THE LOWER CONTROL SWITCHES & LED's

( ) Step 1. Remove the colored LED Covers from the holes by pressing down firmly.

( ) Step 2. Select a SPDT Switch (it is the type which does not return to the center position) On/Off Switch.

( ) Step 3. Cut two pieces of Yellow Wire 10 inches long.

( ) Step 4. It will be helpful to use one of the holes on the back of the enclosure to temporarily mount the switch in the next steps.

( ) Step 5. Strip, tin & solder the wires to the center and either outside lead of the switch.

( ) Step 6. For a Dual Drive, repeat Steps 2 through 5, using one of the other SPDT Switches.

( ) Step 7. Mount the Switch Assembly(s) just constructed into the holes labeled Protect/Normal. See Figure U.

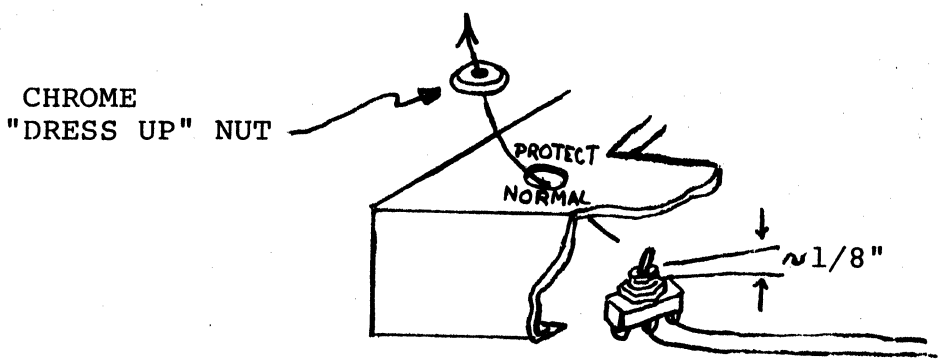


FIGURE U

NOTE**The position of the unwired terminal is toward the front of the enclosure. Tighten down the Dress Nut finger tight by hand. Then, using an open end wrench of the correct size, very carefully tighten it. You can protect your enclosure by wrapping masking tape around the open end wrench. Use great care not to scratch the paint or lettering in this operation. **CAUTION**Using long-nose pliers will almost certainly result in a scratched enclosure. It is better to purchase the correct sized open end wrench if you do not have one, in order to protect your enclosure.

( ) Step 8. Set the enclosure on its edge with the back facing you. Insert a momentary switch and a green LED Cover and LED as shown in Figure V on next page.

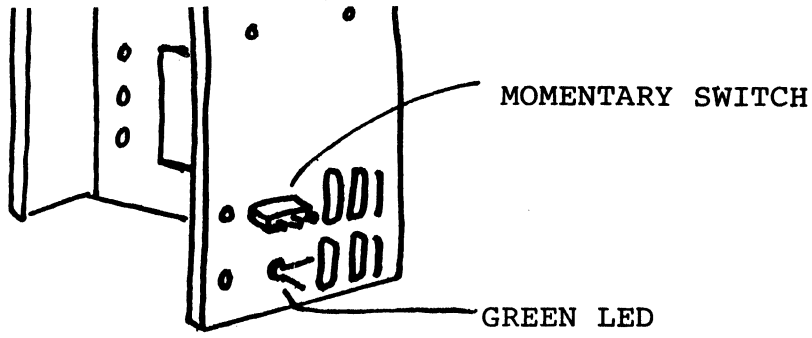


FIGURE V

NOTE: Mount the LED with the "flat spot" to your left. Cut approx. ¼" off each lead.

( ) Step 9. Cut a 14" section of the Violet through Black spectrastrip which you should have remaining from the LED wiring.

( ) 9.A - Separate the Black wire about 3½ inches.

( ) 9.B - Separate the other wires about ½ inch. Strip them approx. 3/16" and tin.

( ) 9.C - Install the White wire and a 470 ohm ½ Watt Resistor on the Center Terminal of the Switch. See Figure W.

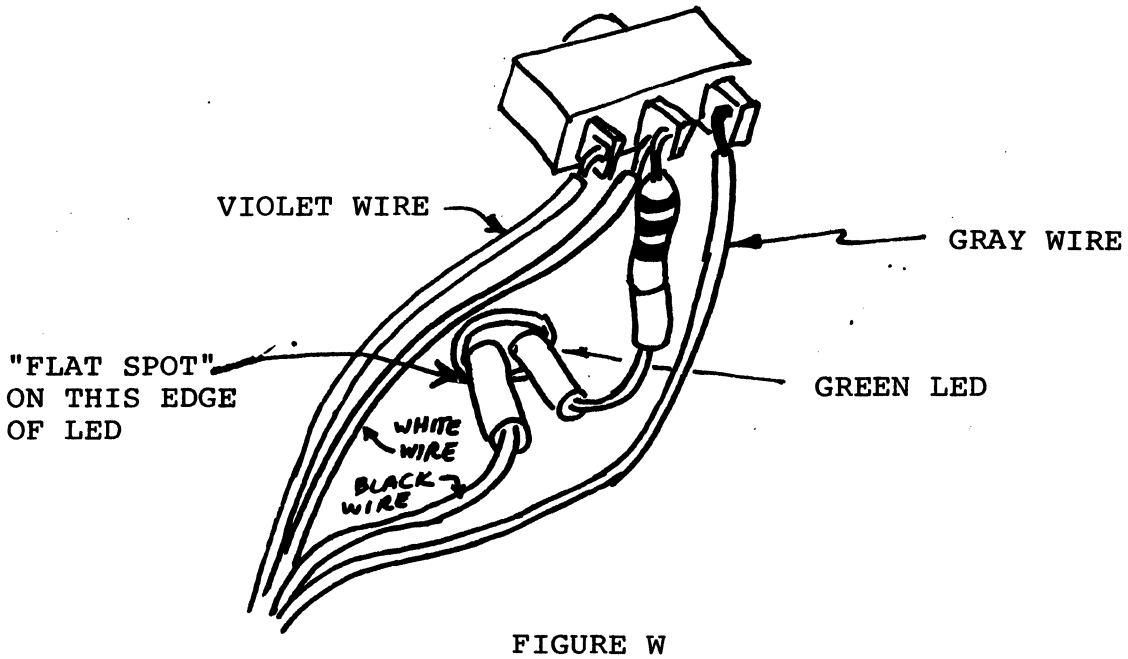


FIGURE W

( ) 9.D - Install the Violet & Gray wires as shown in Fig. W.

( ) 9.E - Trim approx. 2½" from the Black wire and install it on the negative lead of the LED according to the previous technique, as shown in Figure W.

ENCLOSURE ASSEMBLY - CONTINUED

( ) 9.F - Install a wire (using the remaining Black wire) from the free end of the 470 ohm Resistor to the Positive Lead of the LED as shown in Figure W.

( ) 9.G - Remove the assembly from the back of the enclosure & install it in the two holes in the bottom. The LED & cover go into the hole labeled Power. Orient the switch so the violet wire is closest to the Front of the Enclosure.

( ) 9.H - For a Dual Drive, repeat from Step 8 Page 8 for the other Stop/Rewind Switch and Green LED.

( ) 9.I - Remove the LED/Switch Assembly from the back and install in the correct holes on the front of the enclosure.

POWER SWITCH WIRING

( ) Step 1. Install the remaining SPDT Switch loosely in the back of the Enclosure.

( ) 1.A - Cut two 10" Sections of the Black Wire.

( ) 1.B - Strip & solder to the center & one outside terminal of the switch using spagetti & assure that no bare wires are exposed. This will have 117 Volts on it when the Unit is plugged in.

( ) 1.C - Using wire cutters, cut off the remaining outside terminal on the switch as close to the switch body as possible.

( ) 1.D - Remove the switch and mount it in the center hole which is labeled "ON", "OFF". Mount the switch so that the 2 wired terminals are toward the rear of the Enclosure.

WIRING THE 5 PIN MOLEX FEMALE CONNECTORS

( ) Step 1. The following refers to the Switch & LED just wired. Peel back the black wire & cut off approx. 4½" and discard it.

( ) 1.A - Strip approx. 3/16" from the remainder & tin. It will be soldered directly to the MECADRIVE Card later.

( ) 1.B - Split the remaining three wires back approx. 3/4". Strip 3/16" of insulation. Do Not Tin.

( ) 1.C - Mount a Molex Pin Insert on each of these 3 wires with a crimp connection. See Page 4, Section I, Power Supply Assembly. Also see Figure X next page.

( ) 1.D - Insert these into the White Nylon Pin Nest as shown in Figure X on the next page.

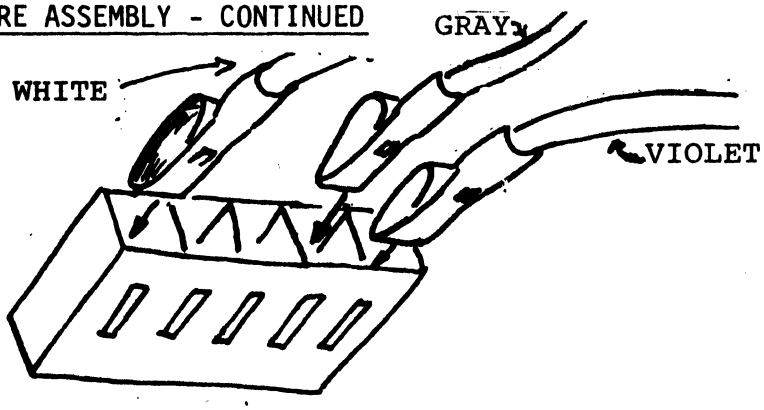


FIGURE X

( ) 1.E - For a Dual Drive, repeat from Step 1, Wiring the 5 Pin Molex, previous page, for the other Stop/ Rewind Switch and Green LED.

NOTE: At this point, insure that there is a 220 ohm ½ W Resistor in the location for R87 on the MECADRIVE Card(s) (Write mode series limiting Resistor).

INSTALL THE MECADRIVES

( ) Step 1. Separate the MECADRIVE Card & Phi-Deck & remove any hardware in the four card mounting holes. Save the Four Rubber Bumpers, they will be used on the bottom of the Enclosure.

( ) Step 2. Remove the plastic cassette cover from the Phi-Deck if it is on it at this time.

( ) Step 3. Position the Phi-Deck on edge with the head bar toward the front of the enclosure. Slip the Phi-Deck into position by inserting the rear first. This allows the Capstan Motor mounting assembly to clear the brackets. Then rotate the front into position taking care to guide the Head Cables by the Mounting Brackets.

( ) Step 4. Temporarily secure the Phi-Deck by installing one bolt in the upper right corner (only insert this bolt a few turns, it will be removed shortly).

( ) Step 5. Position the MECADRIVE Card with the "MECA" logo toward the front and loosely install 3/4" bolts in the two lower corners first, using one ¼" Spacer & one 1/8" Spacer between the card and the phi-deck. Do not tighten yet. See Figure Y.

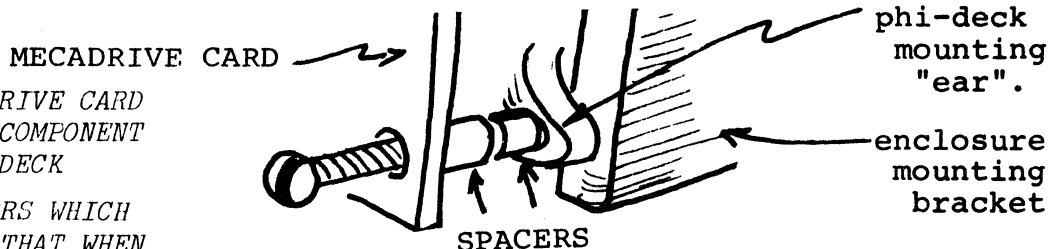


FIGURE Y

PLEASE NOTE: MECADRIVE CARD IS MOUNTED SO THAT COMPONENT SIDE IS FACING PHI-DECK

ALSO, BEND CAPACITORS WHICH ARE STICKING UP SO THAT WHEN THE P.C. BOARDS ARE MOUNTED, THE COMPONENTS WON'T BE IN THE WAY.

ENCLOSURE ASSEMBLY - CONTINUED

( ) Step 6. Remove the bolt previously installed in the upper right corner & reinstall it in the same manner as the two lower bolts.

( ) Step 7. Install the bolt in the other corner similarly.

( ) Step 8. Tighten all bolts while insuring that no cabeling is being pinched.

( ) Step 9. For a Dual Drive, install the top Unit in a similar manner.

INSTALL THE POWER SUPPLY & LED INDICATORS

( ) Step 1. If the transformer 117V leads (black) have been connected for check out, remove the wire nuts & separate the wires.

( ) Step 2. Flip the Enclosure & set it on its other end so that the ALPHA-1 nomenclature is on the bottom.

( ) Step 3. Loosely mount the transformer, using the hardware provided so that the head of the bolts are on the outside of the Unit and the black leads are toward the bottom of the Unit.

( ) Step 4. Position the Power Supply Card over the 4 mounting holes such that the transformer leads are closest to you. Install it loosely using 4 bolts & ¼" Spacers between the card & Enclosure. It is best to work on the most difficult (most inaccessible) corner first & work toward the easiest (most accessible).

( ) Step 5. Install the colored LED Covers in the holes from the outside as follows:

"Ready" - Green
"Write Prot" - Yellow
"Write Mode" - Red

( ) Step 6. Fan out the LED wiring harness & snap the LED's into their correct covers.

( ) Step 7. Tighten down the Power Supply Board while assuring that no wires are being pinched.

( ) Step 8. Insert the Power Cable through the large hole directly next to the transformer approx. 2 inches.

( ) Step 9. Put the stress relief (plastic cable) provided around the Power Cable such that the large end of it is away from the enclosure. It is suggested you wrap a few layers of electricians tape around the Power Cord to provide a tighter fit for the stress relief.

( ) Step 10. Fit the two pieces together & snap it into the hole.

ENCLOSURE ASSEMBLY - CONTINUED

( ) Step 11. If installed correctly, it should now be very difficult to pull the Cord from the enclosure.

( ) Step 12. Install the Terminal Lug under the closest nut which is holding the transformer. Tighten down the bolts on both sides of the transformer.

( ) Step 13. Strip 3/8" of insulation from the Black wires going to the Power Switch.

( ) Step 14. Using the wire nuts provided, connect the wires as shown in the Figure below (AA). NOTE: If Wire Nuts will not grip FIRMLY on the Transformer Wires, use a Lineman's Splice (See Figure Z below) Strip approx. 5/8" for this splice.

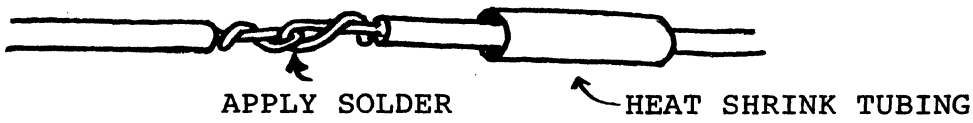


FIGURE Z

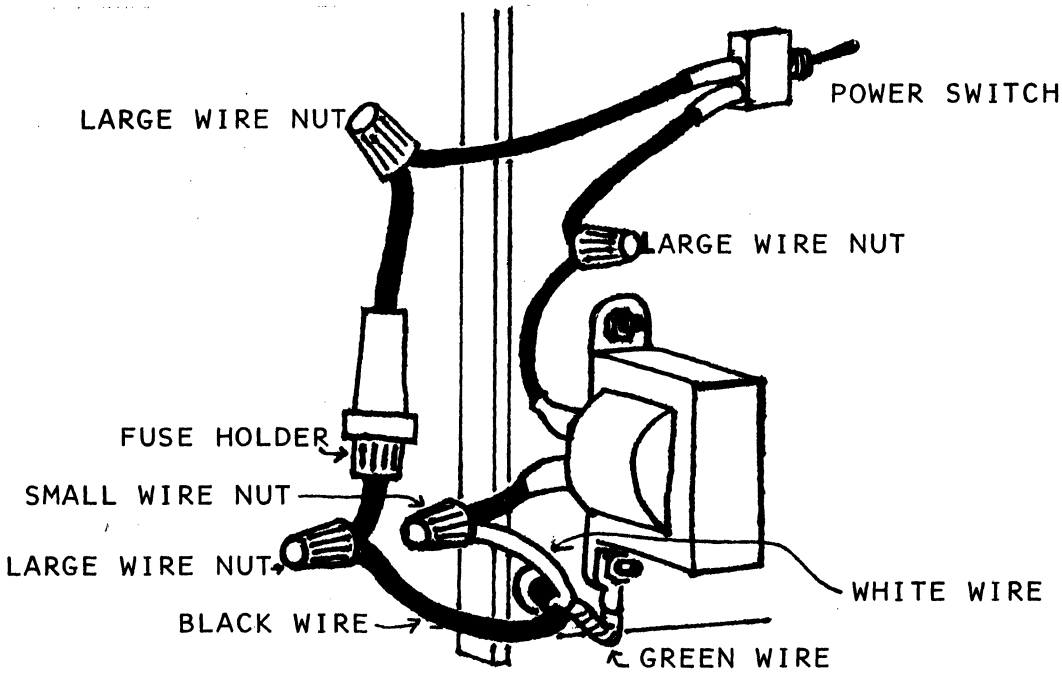


FIGURE AA

NOTE: If properly installed, no bare wire will be visible in the wire nuts & it will be IMPOSSIBLE to pull the wires apart except by breaking the wire. This wiring is very important. If you do it incorrectly or sloppily, it may result in an unsafe Unit. If there is anything that is unclear, please call your dealer or MECA.

WIRING THE WRITE PROTECT SWITCH.

( ) Step 1. Flip the enclosure to the other end.

( ) Step 2. Locate the 9 Pin Female Molex coming from the Phi-Deck which has 5 wires extending out of it.

( ) Step 3. Mark the location of the end-most wire of the two-wire group on the plastic pin nest, then remove the wire by pressing down on the locking tab (accessible through a small slot) while pulling on the wire. (See pictorial on next page)

( ) Step 4. Clip off the insert. Strip & tin the wire. Insert a piece of spagetti on the wire.

( ) Step 5. Splice this wire to one of the wires coming from the Write Protect Switch (labeled "Protect Normal") & cover the splice with the spagetti.

( ) Step 6. Install a Molex Insert on the other wire coming from the Write Protect Switch & insert it in the hole where the wire was removed in Step 3 above.

( ) Step 7. For a Dual Drive, repeat above sequence for 2nd Drive.

FINAL ASSEMBLY

( ) Step 1. Solder the Black Wire coming from the Green Power LED to the large hole in the extreme corner of the MECA-DRIVE Card. It may be identified by noting that it visibly connects to a very wide land which runs along the edge of the card (ground).

( ) Step 2. Repeat for the 2nd Drive for Dual Drive Unit.

( ) Step 3. Plug in the 4 Pin Connector with the 2 wires. It goes toward the front of the enclosure with the 2 wires forwardmost.

( ) Step 4. Plug the other 4 Pin Connector with the Cable which is wired to the uppermost terminals on the Read-Write Head toward the Enclosure front. (See Pictorial on Page IV-15)

( ) Step 5. Plug the 5 Pin Connector in such a manner that the white wire is toward the enclosure front.

( ) Step 6. Select the 16 Pin DIP Cable included in MECADRIVE Kit & install it in the DIP Socket on the MECADRIVE. There is only one end which will install easily (white arrow points toward cable). Insert the cable through the back of the enclosure through one of the large holes provided.

( ) Step 7. Snap a plastic hold down into place on the 16 Pin Plug just installed.

( ) Step 8. Repeat above steps for 2nd Drive for Dual Drive Unit.

( ) Step 9. Flip the enclosure onto the other edge.

ENCLOSURE FINAL ASSEMBLY - CONTINUED

( ) Step 10. Install the 9 Pin Connector coming from the Phi-Deck with 9 wires coming from it, onto the rear-most Molex Male Connector. The Black Wire goes toward the rear of the enclosure.

( ) Step 11. Install the other Connector coming from the Phi-Deck (5 Wires) onto the middle Molex Connector. The 3 Wire Group goes toward the back of enclosure.

( ) Step 12. The other Male Molex is to be connected to the Power Supply Connector. The cable coming from the Power Supply nearest the top of the enclosure (J1) is for Drive Zero (left Drive when facing Unit). Plug it in so the brown wire is nearest the back of the enclosure (Gray nearest the front).

( ) Step 13. Repeat Step 10 & 11 above for 2nd Drive, using the other Power Supply Cable at Step 12.

( ) Step 14. DOUBLE CHECK all the steps in FINAL ASSEMBLY, taking care that the Connectors are not plugged one position forward or backward from the correct position. This is easily done SO USE EXTREME CAUTION!

Your Unit is now ready for test. The bottom need not be installed until check out has been completed.

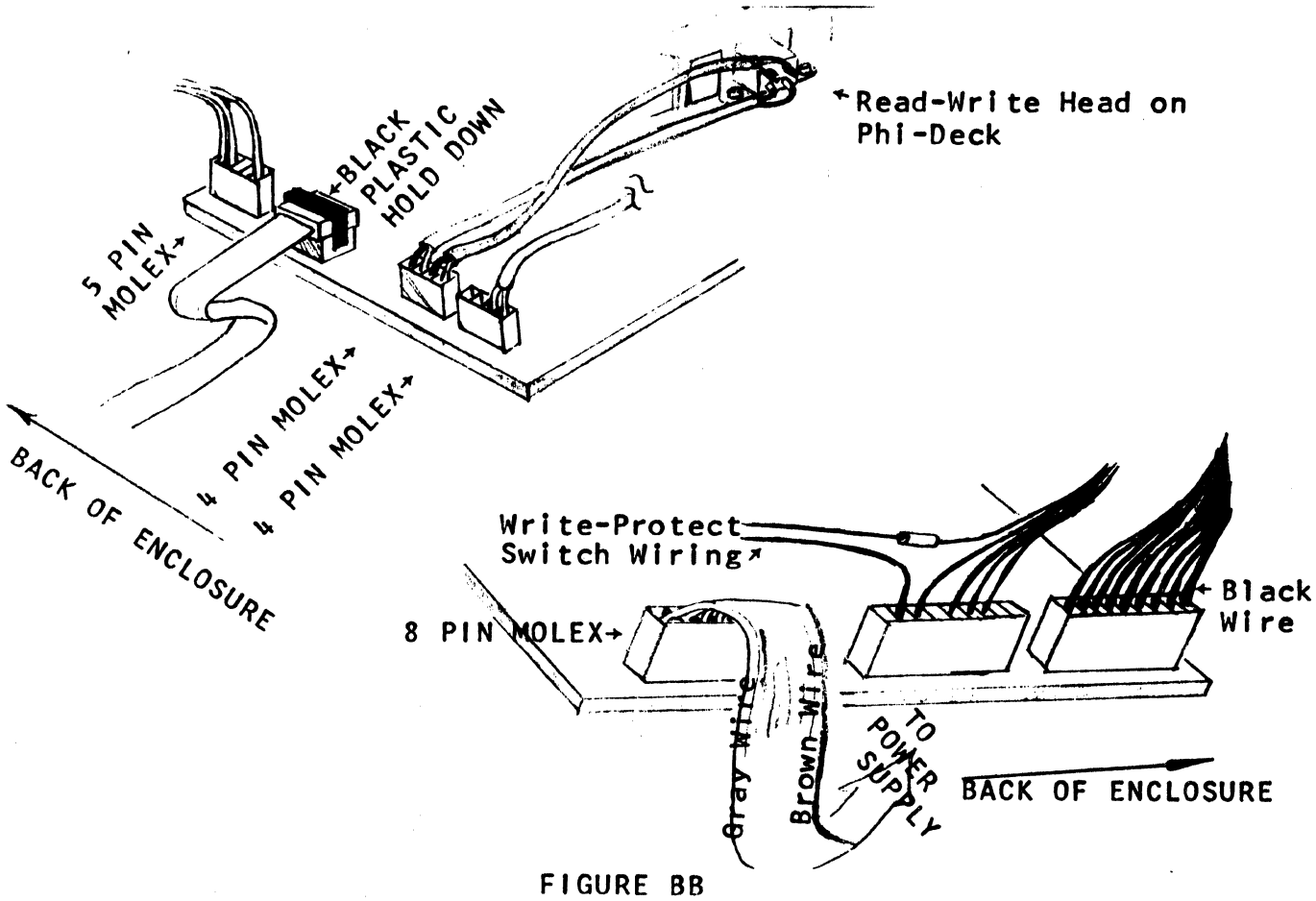


FIGURE BB

SYSTEM FINAL CHECK

( ) A. This final Check Procedure should be repeated for each MECADRIVE in your System.

( ) A.1 - Turn off the Computer power & remove the Control Card.

( ) A.2 - Plug in the 16 Pin MECADRIVE Connector into Drive Ø (Upper right corner on Control Card), making sure the small arrow points to Pin 1. IT IS POSSIBLE TO PLUG THIS IN ONE ROW TOO HIGH OR TOO LOW. MAKE SURE THIS HAS NOT BEEN DONE. IT MAY CAUSE COMPONENT DAMAGE.

( ) A.3 - Reinstall the Control Card.

( ) A.4 - Install the 8 Pin Molex Connector which comes from the booster Power Supply onto the MECADRIVE Card in Position J1 (The brown lead is Pin 1 & is physically closest to Connector & the gray wire is closest to the front of the Drive. MAKE SURE THIS IS CORRECT.

( ) A.5 - Double check all Connectors.

( ) A.6 - Plug in the MECADRIVE Power Supply. Nothing should be happening at this time.

( ) A.7 - Turn on the Computer while watching the MECADRIVE. Both Cassette Drive Reels should spin briefly (< 1 Second) & stop. If they do not do this, or if anything else happens, remove power immediately & turn to "In Case of Trouble Section".

( ) A.8 - Before installing the Bootstrap tape, try the tape functions manually, using the following short program (put it in manually).*

ADDRESS	INSTRUCTION	CODE OCTAL	CODE HEX
Ø	IN 255_{10}	333	DB
1		377	FF
2	OUT 252_{10}	323	D3
3		374	FC
4	JMP Ø	303	C3
5		000	00
6		000	00

Put all sense switches down. Examine Zero & Run. You should now have control of Drive Functions through the sense switches. Install an old tape & check all drive functions in the following manner:

1. Set the Function Code in the lowest 3 Bits.
2. Raise then lower the appropriate Execute Bit. Bit 3 (All) for Drive Zero.
3. The Drive should enter the mode requested.

*For a SOL, a similar routine may be entered through the monitor.

The following modes should be checked:

FUNCTION	SWITCH A10	A9	A8
Fast Forward	↓	↓	↑
Stop	↓	↓	↓
Rewind	↓	↑	↓
Play	↓	↑	↑

NOTE: A Stop Function must be performed in order to change from any of the other Modes.

Repeat from Step A.1 for each Drive in your System.

SOL USERS should note that the following bytes output to address F4 will produce the desired results.

FAST FORWARD - Ø9
STOP - Ø8
REWIND - ØA
PLAY - ØB

Be sure to issue a stop command after every mode.

SECTION V

mcos

operating system

IMPORTANT; IT IS POSSIBLE TO INSTALL CASSETTES IN SUCH A MANNER THAT THE DRIVE HUBS ARE NOT PROPERLY ENGAGED (SINCE THE PHI-DECK DRIVE SPROCKETS ARE SPRING LOADED). SEE FIGURE BELOW. THIS CAUSES THE FORWARD REEL TO SLIP & LOSE TRACK OF TAPE POSITION. IT USUALLY MAKES A LOUD NOISE (NO PHYSICAL DAMAGE IS DONE).

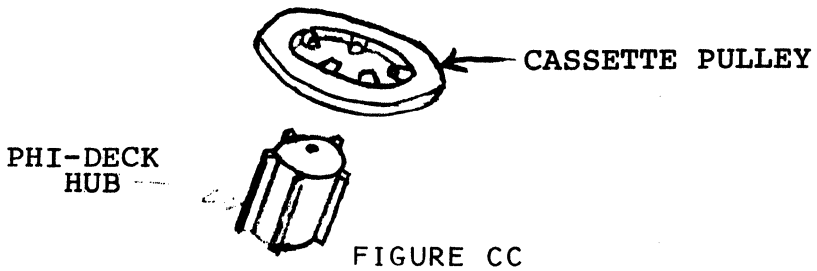


FIGURE CC

IDEALLY, THE HUB FINGERS SHOULD ENGAGE BETWEEN THE CASSETTE PULLEY STUDS. THE HUB, HOWEVER, IS SPRING LOADED & CAN BE COMPRESSED IF THE STUDS COME TO REST ON TOP OF THE FINGERS. TO SEAT THESE HUBS, YOU SHOULD ALWAYS ISSUE A REWIND INSTRUCTION AFTER INSTALLING A CASSETTE.

MECA OPERATING SYSTEM MANUAL
VERSION 3.0
TABLE OF CONTENTS

BRINGING UP YOUR OPERATING SYSTEM

The Version 3.0 MECA Operating System is configured to allow it to be brought up with a minimum amount of effort on the most popular computer systems.

1) MITS with a 2SIO Card
2) IMSAI with a SIO2 Card
3) Other S100 Bus Systems with 3P+S type I/O interfacing.

Using the Tape supplied, try the following Coldstart/Bootstrap procedure. (Read the entire procedure before beginning) Take careful note of the Recovery From A Bootstrap Failure procedure.

The Bootstrap/Initialization Routine requires setting the senses switches to specify the I/O configuration which your machine has.

If you have:	Set Switches On: ↑
IMSAI with a SIO2	Programmed Input Ø (A8) ↑
MITS with a 2SIO	Sense Switch A9 ↑

Any other switch setting will cause the computer to trap in the initialization routine and allow you to "customize" the I/O for your machine.
(See Item 10, Step 2 on next page).

ALPHA-1 COLD START (BOOTSTRAP) PROCEDURE

IMPORTANT: In the following Cold Start (Bootstrap) procedure, it is important that you be able to switch the power to the computer and the drive on and off together. This is most easily accomplished if you have a switch controlled extension cord, such as is available from most hardware stores. This also provides the convenience of one switch power on for your system.

1. Be sure that you double check that the cables are plugged into your Drives correctly.
2. Turn on Power.
3. Install the tape on Drive Zero.
4. Reset the computer (Reset and Stop Switches).
5. Press down on the External Clear Switch (same as Reset). If tape is not rewound, it will begin to rewind.
6. Release Clear
7. Press Run. Computer lights should be as follows:
   A. Wait Light on.
   B. Run Light on (IMSAI only).
   C. DØ Light on (D1 through D7 off).
   D. Address Bus A15 through A10 on (A9 and A8 off). (Others do not matter).
8. When fully rewound, the Drive will raise the head and enter Play Mode.
9. In approximately 5 seconds (depending on how far out the Bootstrap has been written), the Interrupt Enable Light will blink. This indicates that the system is performing correctly. If this does not happen, or if the Interrupt Enable Light comes on and stays on, there is a problem. See Recovery from a Bootstrap Failure.

10. If your machine is performing normally, in approximately 6 seconds, the Wait Light should go out and the Drive will stop. For the IMSAI and MITS, it will begin Execution. For other I/O Configurations, use the following procedure. For MITS or IMSAI with 2SIO, skip Steps 1 through 5.

**NOTE TO USERS WITH COMPUTERS WHICH DO NOT HAVE DATA SWITCHES WILL BE FOUND ON THE NEXT PAGE.

STEP 1. Stop the Computer.

STEP 2. Examine the following locations and modify them as instructed:

Hex Address:	Present Contents (Hex):	Change to:
3ØØ5	Ø 16	Your Status Port Address
3ØØ6	1 Ø1	Your Input Ready Bit (Mask) location
3ØØ7	1 17	Your Data I/O Port
3ØØ8	8Ø Ø2	Your Output Ready Bit (Mask) location
3ØØ9	CA (JZ)	C2 (JNZ) if your Ready Bits above have a Negative True Sense.
3ØØA	Ø	The first initialization byte for your I/O Card. It will be Output to the Status Port Address.
3ØØB	Ø	The second initialization byte.

STEP 3. After Step 2 is done and checked, set the Address 3ØØØ (Hex) in the Data Switches and press Examine.

(Address 3ØØØ Hex = Address Switches A12 and A13 Up, All others Down)

STEP 4. Now change the switches so that A8 and A9 are up, but all the rest are down.

STEP 5. Press Run.

STEP 6. Your Console Output Device should display the following message:

```
        ++  MECA OS VER. 3.0 ++
   OK--
```

All of your Drives should have rewound and the Directory for Drive Ø should have been read.

STEP 7. Before trying any other O.S. functions, you should make additional copies of your O.S. as follows:

YOU TYPE:	COMPUTER RESPONSE:
A. LOAD BDMPR	Indicates File Name and Address Range....New Prompt
B. REWIND	Rewinds Tape and New Prompt

At this point, remove the O.S. Tape on Drive Ø and install a new uncommitted Tape. Manually Rewind it. Make sure the tape is Unprotected.

C. NEWTAPE	It will go into write mode and erase approx. 2Ø seconds of tape, then rewind and write an empty directory on the front of the tape. Then New Prompt.
D. UNLOAD	Green Light blinks and New Prompt.

E. EXEC 1BØØ 3ØØØ 3FFF 3ØØØ

It will write a Bootstrap copy of the 16K Operating System on the front of the New Tape. Then you will get a New Prompt.

To generate additional system tapes, you should repeat this procedure from Step 7.B.

When using the tapes just generated, those with custom I/O configurations will get the Bootstrap and Go Function if switches A8 and A9 are set on (up) before beginning the Bootstrap procedure.

RECOVERY FROM A BOOTSTRAP FAILURE

1. There are many possible reasons for failure of the Bootstrap Routine to Execute successfully. A few are:
   - A. The wrong tape is installed.
   - B. The tape had an error (hard or soft).
   - C. There is a hardware malfunction.
2. The proper procedure for recovering from a Bootstrap failure is as follows:
   - A. If Interrupt Enable is on, simply stop the Drive manually.
   - B. If Interrupt Enable is not on, hold down on the Drive manual stop switch (This should unload the head) and turn off the computer power (or the main power if all the system components are switched together).
3. Turn the power back on and the Bootstrap may be retryed.
4. In the event that there is no manual stop switch for the Drive;
   - A. If the Drive is not moving tape, remove power from the computer and the Drive (preferably simultaneously).
   - B. If the Drive is in Play Mode and moving tape, wait until it is past the Bootstrap Program (approx. 10 to 15 seconds) and remove power from both Drive and computer.

WHEN POWER IS TURNED BACK ON, THE HEAD SHOULD UNLOAD AUTOMATICALLY AND THE BOOTSTRAP MAY BE RETRYED.

**SPECIAL NOTE TO USERS WITH COMPUTERS WHICH DO NOT HAVE DATA SWITCHES:

Make the following changes on Page V-4

STEP 3. Change Memory Location 3Ø2Ø Hex from C2 Hex to 21 Hex.

STEP 4. Begin Program Execution (Jump To) 3Ø1C Hex.

STEP 5. None

MECA OPERATING SYSTEM OPERATION

After bringing up your system, the computer should give the normal O.S. Prompt "OK--". This is your signal that it is in the command mode. If you do not see the prompt, the O.S. is not in command mode. At certain points during the O.S. execution there are built in pauses (mainly to assure that the display will not page off a T.V. Monitor). At these pauses, it will be necessary for you to input something from the keyboard to signal it to continue (normally this should be a carriage return). As a rule of thumb, when the computer stops with no prompt and you wish to continue, type a carriage return.

In addition, carriage returns with no other input (null line) are used by the support programs to return to the O.S. (EDITR, DEBUG).

The system abort command is an "escape" in the stand alone O.S. and a "control C" when operating under Extended BASIC. Hitting an abort character will cause the system to stop the present tape or listing operation. For tape operations, it will also report an "ERROR Q" message. Remember, you must type a carriage return after error messages are reported in order to return to command mode.

The backspace character for the stand alone O.S. is the "line-feed". It will print a less than (<) sign or back up the cursor, depending upon the particular I/O configuration you have. Note, under Extended BASIC, it is the normally defined BASIC backspace character.

3.Ø O.S. ORGANIZATION

The stand alone O.S. will load into a 4K block of memory starting at relative zero. The following O.S. configurations are supplied on your tape to allow optimum system configuration.

O.S. TITLE	MEMORY LOCATION
"Bootstrap"	3ØØØ - 3FFF
@24KOS	5ØØØ - 5FFF
@32KOS	7ØØØ - 7FFF
@40KOS	9ØØØ - 9FFF
* @48KOS	AØØØ - AFFF
** @56KOS	CØØØ - CFFF

The 16KOS is supplied in bootstrap form only. Systems of less than 16K are of very limited use in any applications which use an Operating System, although a special O.S. could be designed for a particular application.

In general, it is best to locate your O.S. in the highest available memory.

Each O.S. Tape is organized as follows:

TAPE LOCATION		CONTENTS
Ø - 1Ø24	Decimal	Bootstrap Region (Reserved)
1Ø24 -	Decimal	Tape Directory
138Ø - ?	Decimal	First File

The tape directory is always stored at the same tape location. The standard directory size is 456 bytes (1C8 Hex) which allows for 5Ø file names. This may be easily expanded or contracted for special applications but any tape which is exchanged with other users should have the "standard" directory size.

The standard Operating System is configured for a dual drive system and space is allotted for two directories (> 2 drive Operating Systems should be ordered special).

*This is actually a 44K O.S.
**This is actually a 52K O.S.

In the following discussion, the high order Hex digit of the O.S. addresses is variable based upon your O.S. location and is thus designated "X".

The Drive Ø Directory will be read into memory by the O.S. and stored at X1C8 (Hex). The Drive 1 Directory will be stored at XØØØ. Note, before the Drive 1 Directory is read, XØØØ - X1ØF contains the O.S. initialization routine. Therefore, after system initialization:

MANUAL O.S. RE-ENTRY POINT IS X39Ø (Hex)

You should keep in mind at all times that there are two copies of a tape directory, the memory copy and the tape copy.

The memory copy is updated during O.S. operation as required and is not always the same as the tape copy.

They are only the same if no saves, overlays, deletes or tends have been done since the last directory read or record operation.

Therefore it is very important that you do not try to fool the system until you become very familiar with it.

The best method of avoiding trouble is:

1. Manually Rewind tapes after they are installed (If the tape makes a funny noise, it is not installed properly).
2. Always issue an "UNLOAD" before removing a tape. (The exception to this is after an error on a "COPY" command. In this case, you should issue a "MOUNT" Command before doing an unload.

The remainder of the O.S. will be described in a MECA Application Note and a Source Listing is available for a nominal charge.

The message "EH?" means that the system cannot interpret your input line.

BRINGING UP OTHER MECA OPERATING SYSTEMS

The following procedure may be used to generate a bootstrap tape of any other Operating System included on your MECA Tape.

To do the 24 K Operating System:

1) Bring up the normal 16KOS
2) LOAD BDMPR :Ø
3) LOAD @24KOS :Ø 5ØØØ
4) Modify the Initialization Section at 5ØØ5 - 5ØØB as you did for the 16KOS (not required for MITS and IMSAI with standard 2SIO Cards).
5) Install a New Tape on Drive Ø
6) REWIND :Ø
7) NEWTAPE :Ø
8) EXEC 1BØØ 5ØØØ 5FFF 5ØØØ

   For the other Operating Systems, change Steps 3, 4 and 8 above according to the following Table.

O.S.	Step 3, LOAD:	Step 4, MODIFY:	Step 8, EXEC:
32K	@32KOS :Ø 7ØØØ	7ØØ5 - 7ØØB	1BØØ 7ØØØ 7FFF 7ØØØ
40K	@40KOS :Ø 9ØØØ	9ØØ5 - 9ØØB	1BØØ 9ØØØ 9FFF 9ØØØ
*48K	@48KOS :Ø AØØØ	AØØ5 - AØØB	1BØØ AØØØ AFFF AØØØ
**56K	@56KOS :Ø CØØØ	CØØ5 - CØØB	1BØØ CØØØ CFFF CØØØ

*This is actually a 44K O.S.
**This is actually a 52K O.S.

There are 4 data fields used to specify what functions the Operating System (O.S.) is to perform. These fields must occur in the order specified in the specific command description. Blanks are used to delimit the fields.

Command Field - This field specifies the Drive/Computer function to be performed. On the Version 3.Ø O.S., two characters are sufficient to define the function, although at least four are recommended. The only default allowable for this field is the exclamation point (!) which specifies that the O.S. should repeat the immediately preceding command (manual retry). Note, any keyboard entry at all will not allow use of this function. There is no maximum field length.

Name Field - The name field is a minimum of one non-blank character. The characters A - Z, Ø - 9, and all special characters' are allowed. There is no maximum field length, but the O.S. will only use the First Five Characters.

Drive I.D. Field- This is a two-character field which must have a colon (:) as the first character and a number Ø - 3 as the second. It specifies which Drive the operation is to be performed on.

Numeric Modifier Fields - These fields are always last sequential fields and are Hex numbers which normally represent memory addresses. The "TEND" command is an exception, in which this field specifies a tape location. In the "EXEC" command, three fields are used to set the machine registers.

In the O.S. Command Statement, several defaults are applied as follows:

A Carriage Return will force defaults of all fields which would normally follow.

A period (.) requests a default on the field which is expected at that point.

The defaults which apply will be discussed under the appropriate commands. In general: A Name Field will default to the last name specified to the O.S. and The Drive I.D. Field will default to the last specified Drive.

There is no command field default other than the Retry (!).

COMMAND FORM(S)	FUNCTION
LOAD fname :d addr LOAD fname :d LOAD fname LOAD . :d LOAD	This specifies that the requested file be loaded at the memory address specified. If the address is omitted, the file will load in the memory locations from which it was dumped.
LDGO fname :d LDGO . :d LDGO	This specifies that the requested file should be loaded and control transferred to the first byte.

SAVEQ fname :d aaaa bbbb
SAVE fname :d . bbbb
SAVE . :d aaaa
SAVE . :d
SAVE fname
SAVE

This specifies that the memory locations from aaaa (Hex) to bbbb (Hex) are to be saved under the name specified. The "Q" will suppress the automatic directory recording function and allow for faster operation when the user becomes familiar with the System. If the address range is omitted, then the program assigns them as follows:

1. If a file has just been loaded, the default addresses are the memory locations just loaded. NOTE: This includes Directory Saves and Loads.
2. If you have just returned from "EDITR", the default addresses are that of the EDITOR Source File.
3. If an assembly has just been completed, the default addresses are assigned the values where the machine code was stored.

OVERQ fname :d aaaa bbbb
etc.

Analogous to the SAVE command except that, if the file name "fname" exists in the directory specified, an attempt will be made to overlay the file (use the same tape space). Obviously this cannot be accomplished if the new file is considerably larger than the old file. The file may "grow" by approximately 1 K bytes with the present O.S. If the file will not fit the space available, the O.S. will automatically put it at the end of the tape. If the file name does not exist, the O.S. will do a "SAVE" command.

REWIND :d
REWIND

This is an O.S. and tape drive syncronization command. It rewinds the drive and sets the O.S. location pointer to zero. Use this command any time you have done manual operations to the drive or changed tapes without using the Unload Command.

UNLOAD :d
UNLOAD

This command should normally be used before removing a tape from the drive. It will cause the directory to be written on the tape if it has been flagged as changed.

MOUNT :d
MOUNT

This command causes the directory to be read from the drive specified and flags the drive as available. This command will be executed automatically if another command needs the directory but the drive is flagged as "not mounted".

TEND :d aaaa
TEND . aaaa

This command sets end of tape location pointer to the value aaaa. This parameter specifies where the next write operation is to begin. This command may be used to skip defective areas of tape or "reserve" large areas of tape for special functions. Beware of indiscriminate use of this command.

NEWTAPE :d
NEWTAPE

This command initializes a tape for use in the System. It erases approx. 20 seconds of tape and writes an empty directory. A Rewind Command must be issued prior to executing this command.

SHOW aaaa

This command will print the contents of the memory location aaaa (Hex) and aaaa+1 formatted as an 8080 address or 16 Bit number. Address aaaa+1 is represented by the first two Hex digits and aaaa by the last two. This is basically a two Byte "peek".

EXEC aaaa hhll ddee bbcc
etc.

This command may be used to transfer control to the Hex address aaaa with the 8080 machine registers set as follows:

H,L = hhll (Hex)
D,E = ddee (Hex)
B,C = bbcc (Hex)

This allows transfer to a machine language program from the O.S. All machine register designations are optional and will be filled with zeros or the value of the immediately preceding specified register, if unspecified:

EXAMPLE: EXEC 3FØØ 12FD Transfers control to 3FØØ Hex with HL = DE = BC = 12FD Hex

DIREC :d
DIREC

This requests a listing of the files on the drive specified. If there are more than 28 files, the system will pause after listing the first 28 and wait for an input from the operator before continuing the listing.

DELETE name1 :d
etc.

This will cause the file name specified to be dropped from the directory specified. If it is not in the directory, an "ERROR C" occurs. Nothing is done to the tape and the space occupied by the file is lost until a "data pack" operation is performed. Also the new directory is not stored on the tape unless an "UNLOAD" is issued.

COPY :d_1 :d_2

This command allows the copying of programs and data files from drive to drive. Also if $d_1 = d_2$, it performs a "data pack" operation in which all the dead files will be compressed out of the tape. The copy takes place from drive d_1 to drive d_2 and only the files listed in the "memory copy" of the directory for drive d_1 are added to the tape on drive d_2. Note both drives should have been "mounted" prior to issuing this command.

Several uses of this command are illustrated below:

A. To copy all files from Drive Ø to a new tape on Drive 1
   1) REWIND :Ø
   2) MOUNT
   3) REWIND :1
   4) NEWTAPE
   5) COPY :Ø :1

B. To copy selected files from Drive Ø to Drive 1. After Step 2 above, delete the unwanted files from the Directory on Drive Ø (Note: This does not delete them from the directory on tape), then continue with Step 3.

C. To add files to Drive 1, replace Step 4 by a MOUNT :1 command.

CONTINUED ON NEXT PAGE.....

COPY :d_1 :d_2 - CONTINUED

D. To compress out unused space on Drive Ø
1) REWIND :Ø
2) LOAD the first file
3) DELETE it
4) SAVE it again on the tape. This puts it on the end of the tape.
5) TEND :Ø 5ØØ
6) COPY :Ø :Ø

IMPORTANT If you do not set the "TEND" parameter, it will copy the files on the end of the tape. This has the useful function of backing up the data on the same tape if there is room.

CAUTION DO NOT set the "TEND" parameter to anything except 5ØØ unless you know what you are doing!

NOTE: Steps 2 through 4 above assure that Drive to Drive speed variations will not cause a data file overlap and loss of data. Of course, if you have a multiple Drive System, you should prefer to copy drive to drive which also packs out the dead file space.

ASSM aaaa bbbb cccc
ASSM aaaa bbbb
default cccc = 4Ø
ASSM aaaa
default bbbb = 1CØØ
aaaa cccc = 4Ø
ASSM
default aaaa = 1CØØ
bbbb = 1CØØ
cccc = 4Ø

This tells the O.S. to assemble the Source File found at address cccc in memory. The code developed should be put at address bbbb, but the desired execution address of the code is aaaa. That is the code can only be executed when it has been relocated from bbbb to aaaa. This is handy if something you want to keep is stored at aaaa, such as Assembler. NOTE: Before you can use this command, you must first load the file "ASMBL". The O.S. does not do this automatically. You can easily "crash" the system with this command, so save some frustration by reading the section on using the Assembler. The addresses may be defaulted as shown.

ASSML — Same as ASSM, except a listing is produced.

EDITN aaaa bbbb — This tells the O.S. to transfer control the MECA EDITOR, and set the Data Buffer Start to Memory Address aaaa (Hex) and the Data Buffer End to Memory Address bbbb (Hex). The "N" specifies it will be a "new" File. aaaa defaults to 40 (Hex) and bbbb defaults to 1EØØ (Hex)

EDITO — Specifies that the Editor should be re-entered for the "Old" file. This can only be done if no "assembly" has been performed.

EDIT aaaa — Specifies that editing is to be done on the file which has just been loaded. The buffer limit will be set to aaaa if specified, otherwise it is set to 1EØØ or 1ØØ (Hex 256 decimal) bytes greater than the current end of the file.

CAUTION All of the above EDIT commands transfer control to 2ØØØ (hex) and no check is made to assure that "EDITR" has indeed been loaded there.

ALSO - - if an Assembly has been done, both the Editor and the Source File must be re-loaded even through it is known that the source file has not been affected. This is because the Editor resides in the memory space used by the Assembler symbol table and all the source file pointers will be lost. Thus, always save an Edit File before doing an assembly.

MECA EDITOR - (EDITR) SOURCE CODE = $EDIT

The MECA Assembler File Editor provides the functions necessary to generate and correct assembler language files to be processed by the MECA assembler. It is a page oriented editor which allows it to generate more efficient source code than line oriented editors which store the line number with the source code. Each "page" consists of 25Ø lines and the line numbers given in the Editor commands refer to the "active" page sequential location of the line. Thus, inserting and deleting of lines will change the line numbers of lines which follow the modified location. To avoid confusion, get in the habit of making modifications from the bottom toward the top.

The "active page" may be specified by the PAGE Command but may also be changed by a list or find command. BEWARE: The active page is the last one shown on a listing (see the Example).

```
EDIT--L 245                    ACTIVE PAGE = 2

2;245 EOL  INR  C
2;246      MOV  A,C
2;247      CPI  PERPG+1
2;248      JNZ  EOL2
2;249      MVI  C,1
2;250      LDA  PAGNO
3;001      INR  A          <-- ACTIVE PAGE
3;002      STA  PAGNO          CHANGED AUTOMATICALLY
3;003      INX  H
3;004      SHLD ABUF
3;005      DCX  H

EDIT--LIST 245                 ACTIVE PAGE = 3

3;245 NUM  DB   Ø
3;246      INR  A
3;247      CPI  PERPG+1
3;248      JNZ  NOTFL
```

This can be confusing when editing near the bottom of a page. It is best to list changes after they have been made.

There are three methods of entering the editor:

1. EDIT aaaa — Takes file pointers from the file just loaded. aaaa, if included, sets the end of the buffer (where the source is stored) otherwise it will default to 1EØØ Hex or the file end address + 1ØØ Hex, whichever is greater.

2. EDITN aaaa bbbb — "Opens" a new file and the buffer area will begin at aaaa and will be limited by bbbb. If they are not specified, the defaults are aaaa = 4Ø and bbbb = 1EØØ.

3. EDITO — Specifies that you wish to keep the same exact file pointers as most recently existed. This can only be used before doing an Assembly.

CAUTION The editor supplied uses the same memory space as the assembler symbol table and the DEBUG program. Therefore, it is best to get in the habit of reloading the EDITR anytime you wish to use it. ALSO, the file which you are editing must be reloaded after reloading the editor. This is not automatic. See the example of Editor, Assembler and DEBUG use included. Follow and understand the example before striking out on your own.

The only error report printed by the program is "EH?" which means it cannot do what you have asked or does not understand what you have asked.

An "escape" during "insert" or "add" mode returns to command mode and will ignore the line being input when it was received.

The input line is limited to 8Ø characters.

The following commands are recognized. Only the first character is significant. The command mode prompt is: EDIT--

LIST n	Begins listing at the line number n. After 15 lines, the listing stops and the program waits for an input line. A carriage return alone continues the listing for 15 more lines. Any character plus a carriage return terminates this mode. An "escape" also returns to command mode.
REPLACE n	Shows the specified line and waits for input. Any input replaces the line shown. A carriage return alone leaves it as is.
DELETE n m	Deletes the line or lines specified (Note: n must be less than m). This deletes n through m.
ADD	After this command, the program waits for input lines. These are added to the end of the file. A null line (carriage return only) terminates this mode.
INSERT n	Inserts the added line(s) before the specified number. A null line terminates this mode.
FIND alpha string	The program begins listing at the location where it finds a line beginning with the specified string (leading blanks are ignored). Note: Lower numbered pages than the "active" page are not searched.
PAGE n	This displaces the zero reference for the Editor forward by (n-1) x 250 lines.

NOTE: Return to the Operating System is made with a null line.

The Source Program ($EDIT) is provided, so the user may reassemble it to other locations as desired. However, the user must also change the branch location in the O.S. so the O.S. will know where it is (currently at x43D, x43E).

THE MECA O.S. ASSEMBLER - (ASMBL)

SYSTEM ASSEMBLER

The Assembler supplied is a modified version of the MICRO-TEC Assembler, written for Processor Technology and supplied by them free of charge.

Entry may be made into the Assembler via the ASSM or ASSML O.S. command (The ASSML requests a listing, ASSM lists only errors). The parameters and their defaults are as follows:

ASSM(L) aaaa bbbb cccc

aaaa is the execution time memory address where the code is to be located (default = 1CØØ).

bbbb is the memory address where the code generated during assembly is to be put (it may be non-existent memory if desired).

cccc specifies the memory address where the Source Code is to be found (default = ØØ4Ø HEX)

NOTE: For most programs it is acceptable to put the generated code back into the same memory area which was occupied by the Source Code. This is because there is a size "contraction" when going from Source Code to Machine Code (typically a 1 K Program may have a 6 K or larger Source). The exception to this occurs if Define Storage (DS) or ORGIN (ORG) statements are used in your program which skip great blocks of Memory.

When an ASSML is done, the listing pauses after each 14 lines and waits for a carriage return before continuing. This will also occur on an "ASSM" if you have lots of errors.

The Assembler has one significant idiosyncrasy. Multiple character registers must be coded as "M".

EXAMPLE: 1. Push PSW must be coded as PUSH M
2. LXI SP,Ø must be coded as LXI M,Ø

No source listing is included for this program.

When the Assembler is given control by the executive it proceeds to translate the Symbolic 8Ø8Ø Assembly Language (source) Program into 8080 Machine (object) Code. The Assembler is a two pass Assembler. Features include:

*Free Format Source Input
*Symbolic Addressing, including Forward References and Relative Symbolic References.
*Complex Expressions may be used as Arguments
*Self Defining Constants
*Multiple Constant Forms
*Up to 256 Five Character Symbols
*Reserved Names for 8080 Registers
*ASCII Character Code Generation
*6 Pseudo Operations (Assembler Directives)

The Assembler will assemble a source program file composed of STATEMENTS, COMMENTS, and PSEUDO OPERATIONS.

During Pass 1, the Assembler allocates all storage necessary for the translated program and defines the values of all symbols used, by creating a symbol table. The storage allocated for the object code will begin at the first byte dictated by the first parameter in the original Executive ASSM Command.

During pass 2, all expressions, symbols and ASCII constants are evaluated to absolute values and are placed in allocated memory in the appropriate locations. The listing, also produced during Pass 2, indicates exactly what data is in each location of memory.

STATEMENTS may contain either symbolic 8080 machine instructions or pseudo-ops. The structure of such a statement is:

```
NAME      OPERATION      OPERAND      COMMENT
```

The name field, if present, must begin in assembler character position one. Symbol in the name field can contain as many characters as the user wants, however, only first 5 characters are used in the symbol table to uniquely define a symbol. All symbols in this field must begin with an alphabetic character and may contain no special characters.

The Operation field, contains either a 8080 operation mnemonic or a system pseudo-operation code.

The Operand field contains parameters pertaining to the operation in the operation field. If two arguments are present, they must be separated by a comma. Example:

```
FLOP  MOV M,B COMMENT
* COMMENT
      JMP BEG
      CALL FLOP
BEG   ADI 8+6-4
      MOV A,B
```

All fields are separated and distinguished from one another by the presence of one or more blank characters (spaces).

The Comment field is for explanatory remarks. It is reproduced on the listing w/o processing. Comment lines must start with an asterisk (*) in character position 1.

SYMBOLIC NAMES

To assign a symbolic name to a statement, one merely places the symbol in the name field. To leave off the name field, the user skips one or more spaces and begins the operation field. If a name is attached to a statement, the assembler assigns it the value of the current location counter. The location counter always holds the address of the next byte to be assembled. The only exception to this is the EQU pseudo-op. In this case a symbol in the name field is assigned a value which is contained in the operand field of the EQU pseudo-op statement. Example:

```
POTTS EQU 128
```

assigns the value 128 to the name POTTS. This date can then be used elsewhere in the program as: eg ADI POTTS

Names are defined when they appear in the name field. All defined names may be used as symbolic arguments in the argument field.

In addition to user defined names, the assembler has reserved several symbols, the value of which is predetermined. These names are not to be used by the user except in the operand field. They are (with their value in parentheses):

```
A - the accumulator   (7)
B - Register B        (Ø)
C - Register C        (1)
D - Register D        (2)
E - Register E        (3)
H - Register H        (4)
L - Register L        (5)
M - Memory (through   (6)
        H,L)
```

In addition to the preceding reserved symbols, there is the single special character symbol ($). This symbol changes in value as the assembly progresses. It is always equated with the value of the program counter after the current instruction is assembled. It may only be used in the operand field. Examples:

```
JMP $       Means jump to the next instruction after this instruction;
MOV A,B     i.e., the MOV instruction
LDA $+5
DB  Ø
DB  1       Means load the data at the 5th location after this instruction.
DB  2       In this case, the data has the value 5.
DB  3
DB  4
DB  5
```

RELATIVE SYMBOLIC ADDRESSING

If the name of a particular location is known, a nearby location may be specified using the known name and a numeric offset. Example:

```
      JMP  BEG
      JPE  BEG+4
      CC   SUB
      CALL $+48
BEG   MOV  A,B
      HALT
      MVI  C,'B'
      INR  B
```

In this example, the instruction JMP BEG refers to the MOV A,B instruction. The instruction JPE BEG+4 refers to the INR B instruction. BEG+4 means the address BEG plus 4 bytes. This form of addressing can be used to locate several bytes before or after a named location.

CONSTANTS

The assembler allows the user to write positive or negative numbers directly in a statement. They will be regarded as decimal constants and their binary equivalents will be used appropriately. All unsigned numbers are considered positive. Decimal constants can be defined using the descriptor "D" after the numeric value. (Not required, default is decimal).

Hexadecimal constants may be defined using the descriptor "H" after a numeric value (i.e., +1ØH, 1ØH, 3AH, ØF4H).

Note that a hexadecimal constant cannot start with the digits A-F. In this case a leading Ø must be included. This enables the assembler to differentiate between a numeric value and a symbol.

ASCII constants may be defined by enclosing the ASCII character within single quote marks, i.e. 'C'. For double word constants, 2 characters may be defined within one quote string.

EXPRESSIONS

An expression is a sequence of one or more symbols, constants or other expressions separated by the arithmetic operators plus or minus.

```
PAM +3
ISAB-'A'+52
LOOP+32H-5
```

Expressions are calculated using 16 bit arithmetic. All arithmetic is done modulo 65536. Single byte data cannot contain a value greater than 255 or less than -256. Any value outside this range will result in an assembler error.

PSEUDO-OPERATIONS

The pseudo-operations are written as ordinary statements, but they direct the assembler to perform certain functions which do not always develop 8080 machine code. The following describe the pseudo-ops:

ORG--Set Program Origin; label ORG expression. Where the label is optional, but if present will be equated to the given expression.

END--End of Assembly; this pseudo-op informs the assembler that the last source statement has been read. The assembler will then start on Pass 2 or terminate the assembly and pass control back to the executive. This pseudo-op is required when assembling from a memory file since the assembler will not stop unless an end has been read.

EQU--Equate Symbolic Value; the EQU is used to make two symbols equivalent in value; label EQU expression.

Where: label is the symbol, the value of which will be determined from the expression.
expression is an expression which when evaluated will be assigned to the symbol given in the name field.

DS --Define Storage; the DS causes the assembler to advance the assembly program counter, effectively skipping past a given number of memory bytes.

label DS expression

DB --Define Byte; this pseudo-op is used to reserve 1 byte of storage. The content of the byte is specified in the argument field.

label DB expression

DW --Define Word; this pseudo-op is used to define 2 bytes of storage. The evaluated argument will be placed in the 2 bytes; high order 8 bits in the low order byte and the low order 8 bits in the high order byte. This conforms to the Intel format for 2 byte addresses.

ASSEMBLER ERRORS

The following error flags are output on the assembler listing when the error occurs. Some of the errors are only output during Pass 1.

O	Opcode Error
L	Label Error
D	Duplicate Label Error
M	Missing Label Error
V	Value Error
U	Undefined Symbol
S	Syntax Error
R	Register Error
A	Argument Error

When an assembly is complete, the number of symbols defined, the starting memory address and ending address of the generated code will be printed and it will stop and wait for a carriage return from the operator.

After the return to the O.S., the code may be easily saved by typing:

```
SAVE anyname :d
    or
OVER anyname :d
```

See the example included.

MECA DEBUG UTILITY (DEBUG)

SOURCE CODE = $DBUG

The MECA debugger is a simplified break point program debug tool. It allows the setting of one break point and uses the RESTART 7 locations 38, 39 and 3A Hex in memory. See an example of it used in the example of EDITOR, ASSEMBLER and DEBUG.

The program provided uses the same memory locations as the Assembler symbol table and the Editor and therefore should be reloaded before use if there is doubt about it still being in memory.

When debugging a program with DEBUG, you should assure that there is an extra 30 Bytes of stack in the program being debugged (after it has been debugged, the stack may be "shrunk" to the proper size).

The DEBUG prompt is a "?". The initial entry into DEBUG must be made via the O.S. by a LDGO or EXEC 2000 command (after it has been loaded). This is so it can set up pointers to allow it to find its way back to the O.S.

The commands are as follows: (h is a Hexadecimal Character 0-9. A-F).

^ hhhh "DUMP" Shows a memory dump in Hexidecimal, beginning at the location specified for 16 lines or until an "escape" is hit.

> hhhh "GOTO" Transfers program control to the location specified.

S hhhh "SET BREAK POINT" Sets a break point at the location specified. (Note: this program uses the location 38 (Hex) to implement a RST7 return for this function)

M hhhh + Carriage Return "MODIFY MEMORY" Allows modifying sequential memory locations starting at hhhh. The format is Hex, (separated by blanks). It is terminated by a null line.

M hhhh BB "MODIFY MEMORY" One Byte modify. The address specified is changed to the Byte (BB) specified.

< hhhh Continues break point mode execution by transferring control to the old location and setting a new break point at address (hhhh) specified.

A hhhh Sets the accumulator (A Register) and Flag Register with the 16 Bit value specified.

B hhhh Sets the B and C Registers as specified.

D hhhh Sets the D and E Registers.

H hhhh Sets the H and L Registers.

* "Display Registers"

Return to the Operating System is accomplished by a null line.

GETTING FAMILIAR WITH YOUR O.S.

1. Power down the system.
2. Turn power back on.
3. Bootstrap your system, using one of the new tapes just generated (make sure the switches are set correctly).
4. Using one of the tape copy procedures illustrated below, copy the files named EDITR, ASMBL, DEBUG and DIREC on to the new bootstrap tape you have created. (NOTE: It is not prudent to use your master tape any more than is absolutely necessary. Please make copies.)
5. You may now try the following illustrative procedure for creating Editing, Assembling and Debuging programs. In the procedure the ⊕ indicates that you must type a carriage return to continue.

```
                ++  MECA OS VER. 3.0  ++
+
OK--LOAD EDITR
+++++
EDITR 2000 25EA
OK--EDITN

EDITR   0040  003F  1E00
EDIT--ADD
*
* THIS IS A SHORT DEMONSTRATION
* PROGRAM ILLUSTRATING THE
* USE OF THE MECA EDITOR/ASSEMBLER
* AND DEBUGGER
*
BLINK IN 255  READ SENSE SWITCHES
 ANI 128 CHECK HIGH ORDER
 RNZ  QUIT IF ON
 EI TURN ON INT. ENABLE LIGHT
 CALL DELAY WAIT A WHILE
 DI TURN IT OFF
 CALL DELAY WATI<<IT SM<OME MORE
 JMP BLINK  REPEAT
DELAY LXI B,0  GET B=C=0
 DCR C  DECR C
 JNZ $-4 WAIT 256 COUNTS
 DCR B  C<DCR B
 JNZ DELAY +1<<<+1
 RET
 END
⊕

EDIT--LIST 1

1;001 *
1;002 * THIS IS A SHORT DEMONSTRATION
1;003 * PROGRAM ILLUSTRATING THE
1;004 * USE OF THE MECA EDITOR/ASSEMBLER
1;005 * AND DEBUGGER
1;006 *
1;007 BLINK IN 255  READ SENSE SWITCHES
1;008  ANI 128 CHECK HIGH ORDER
1;009  RNZ  QUIT IF ON
```

```
1;010  EI TURN ON INT. ENABLE LIGHT
1;011  CALL DELAY WAIT A WHILE
1;012  DI TURN IT OFF
1;013  CALL DELAY WAIT SOME MORE
1;014  JMP BLINK  REPEAT
1;015 DELAY LXI B,0  GET B=C=0
```

```
1;016  DCR C  DECR C
1;017  JNZ $-4 WAIT 256 COUNTS
1;018  DCR B  DCR B
1;019  JNZ DELAY+1
1;020  RET
1;021  END
```

```
EDIT--REPLACE 18
 DCR B  DCR B
 DCR B  WAIT 256 OF MINOR LOOPS

EDIT--LIST 16

1;016  DCR C  DECR C
1;017  JNZ $-4 WAIT 256 COUNTS
1;018  DCR B  WAIT 256 OF MINOR LOOPS
1;019  JNZ DELAY+1
1;020  RET
1;021  END

EDIT--DELETE 20

EDIT--LIST 18

1;018  DCR B  WAIT 256 OF MINOR LOOPS
1;019  JNZ DELAY+1
1;020  END


EDIT--INSERT 20
 RET
THIS IS ADDITIONAL STUFF
WHICH MAY BE INSERTED AT
THIS TIME IF DESIRED.
IT WILL BE DELETED WITH THE
MULTIPLE LINE DELETE.
```

```
EDIT--LIST 18

1;018  DCR B  WAIT 256 OF MINOR LOOPS
1;019  JNZ DELAY+1
1;020  RET
1;021 THIS IS ADDITIONAL STUFF
1;022 WHICH MAY BE INSERTED AT
1;023 THIS TIME IF DESIRED.
1;024 IT WILL BE DELETED WITH THE
1;025 MULTIPLE LINE DELETE.
1;026  END
```

```
EDIT--DELETE 21 25

EDIT--L 18

1;018   DCR B  WAIT 256 OF MINOR LOOPS
1;019   JNZ DELAY+1
1;020   RET
1;021   END

EDIT--
EDITR    0040   01EA   1E00

OK--SAVE TEST1
*
+*
+
OK--LOAD ASMBL
++++++++++++++++
ASMBL 1E00 2FFF
OK--ASSML 1000 1000 40



1000                    *
1000                    *       THIS  IS A SHORT DEMONSTRA
1000                    *       PROGRAM ILLUSTRATING THE
1000                    *       USE   OF THE MECA EDITOR/A
1000                    *       AND   DEBUGGER
1000                    *
1000 DB FF              BLINK   IN    255  READ SENSE SWIT
1002 E6 80                      ANI   128 CHECK HIGH ORDER
1004 C0                         RNZ   QUIT IF ON
1005 FB                         EI    TURN ON INT. ENABLE
1006 CD 10 10                   CALL  DELAY WAIT A WHILE
1009 F3                         DI    TURN IT OFF
100A CD 10 10                   CALL  DELAY WAIT SOME MORE
100D C3 00 10                   JMP   BLINK  REPEAT



1010 01 00 00           DELAY   LXI   B,0  GET B=C=0
1013 0D                         DCR   C  DECR C
1014 C2 13 10                   JNZ   $-4 WAIT 256 COUNTS
1017 05                         DCR   B  WAIT 256 OF MINOR
1018 C2 11 10                   JNZ   DELAY+1
101B C9                         RET
SYMBOLS=02
FIRST BYTE=1000
LAST BYTE=101B

OK--LDGO DEBUG
+++
DBUG

?↑ 1000
```

```
1000  DB FF E6 80
1004  C0 FB CD 10
1008  10 F3 CD 10
100C  10 C3 00 10
1010  01 00 00 0D
1014  C2 13 10 05          HIT ESCAPE
1018  C2 ⊕

?S 1006

?> 1000


PC= 1006
A, F=006E
B, C=0080
D, E=0003
H, L=0000
SP= 3FEB
?< 100A

PC= 100A
A, F=006E
B, C=0000
D, E=0003
H, L=0000
SP= 3FEB
?< 100D

PC= 100D
A, F=006E
B, C=0000
D, E=0003
H, L=0000
SP= 3FEB
?> 100D          TURN ON SENSE SWITCH A15

DBUG

?⊕

OK--LOAD EDITR
+++++
EDITR 2000 25EA
OK--LOAD TEST1
+
TEST1 0040 01EA
OK--EDIT

TEST1    0040  01EA  1E00
EDIT--LIST 1

1;001 *
1;002 * THIS IS A SHORT DEMONSTRATION
1;003 * PROGRAM ILLUSTRATING THE          HIT ESCAPE
```

```
EDIT--FIND DELAY

1;015 DELAY LXI B,0  GET B=C=0
1;016  DCR C  DECR C
1;017  JNZ $-4 WAIT 256 COUNTS
1;018  DCR B  WAIT 256 OF MINOR LOOPS
1;019  JNZ DELAY+1
1;020  RET
1;021  END
⊕

EDIT--REPL 15
DELAY LXI B,0  GET B=C=0
DELAY LXI B,12800

EDIT--⊕
TEST1    0040  01E3  1E00 ⊕

OK--OVER

*
+*
+
OK--ASSM 1000



SYMBOLS=02
FIRST BYTE=1000
LAST BYTE=101B

OK--EXEC 1000

OK--SAVE BLINK

*
+
OK--DI

                DRIVE 0  TEND=0AD3
NAME    BYTES  TLOC        NAME    BYTES  TLOC
EDITR   05EB   0546        ASMBL   1200   0631
DEBUG   0377   081D        DIREC   0AFC   08D1
TEST1   01A4   0A20        BLINK   001C   0AAD
OK--
```

TURN SENSE SW. A15 DOWN.
CAN'T SEE BLINKING... TOO FAST
TURN SENSW A15 UP

MECA DIRECTORY RECONSTRUCTION PROGRAM (DIREC)

SOURCE CODE = $DIRE

The directory reconstruction program provides a method of recovering the directory for a tape which has been lost. It is also possible to recover files which have been deleted if no "data pack" has been performed on the tape (the overlay command writes over old files). To run the directory reconstruction program, you should issue the command: LDGO DIREC :d

You will be asked several questions:

DIRECTORY SIZE (Hex) =

You should normally answer "1C8"

AUTO OR SINGLE STEP -

In automatic mode, it will put each file encountered into the directory and keep the last named file in case of duplicates.

In single step, you will be allowed to specify the file disposition after each file is read.

An error will also require operator input. The program will print:

SPECIFY OPTION--

The available Options are: (only the first letter is significant)

1. DROP - (same as a plain carriage return) Specifies that you don't want this file in the Directory.
2. SAVE - Specifies that you want the file save. It will delete any file already in the Directory with the same name.
3. LIST - Lists what is currently in the Directory (before the last file).
4. RETRY- Will try to read the last file over again.
5. TERMINATE - Will quit looking for files and offer you the option of recording the Directory. Then control will be returned to the O.S.

You may enter specify option mode at any time by hitting the "escape" key.

When all of the files have been exhausted, the program will continue to search for more. Hit an "escape" key to get the specify option message.

See the example run included.

EXAMPLE OF USING MECA DIRECTORY RECONSTRUCTION PROGRAM

```
                ++  MECA OS VER. 3.Ø  ++
+
OK--LDGO DIREC :Ø
++++++++++

            MECA DIRECTORY RECONSTRUCTION PROGRAM

DIRECTORY SIZE (HEX)-- 1C8


AUTO OR SINGLE STEP?--AUTO

WHICH DRIVE?--Ø


+++++

FILE NAME = EDITR    FILE TYPE = Ø2
START ADDR = 2ØØØ  END ADDR = 25EA  NO. BYTES = Ø5EB
RECORDED LOC. = Ø546  TAPE LOC. = Ø544
END OF FILE = Ø5CC
++++++++++++++++

FILE NAME = ASMBL    FILE TYPE = Ø2
START ADDR = 1EØØ  END ADDR = 2FFF  NO. BYTES = 12ØØ
RECORDED LOC. = Ø631  TAPE LOC. = Ø62F
END OF FILE = Ø7B7
+++

FILE NAME = DEBUG    FILE TYPE = Ø2
START ADDR = 2ØØØ  END ADDR = 2376  NO. BYTES = Ø377
RECORDED LOC. = Ø81D  TAPE LOC. = Ø813
END OF FILE = Ø863
++++++++++

FILE NAME = DIREC    FILE TYPE = Ø2
START ADDR = Ø4ØØ  END ADDR = ØEFB  NO. BYTES = ØAFC
RECORDED LOC. = Ø8D1  TAPE LOC. = Ø8B8
END OF FILE = Ø9A4
+

FILE NAME = TEST1    FILE TYPE = Ø2
START ADDR = ØØ4C  END ADDR = Ø1E3  NO. BYTES = Ø1A4
RECORDED LOC. = ØA2Ø  TAPE LOC. = Ø9F7
END OF FILE = ØA1F


FILE NAME = BLINK    FILE TYPE = Ø2
START ADDR = 1ØØØ  END ADDR = 101B  NO. BYTES = ØØ1C
RECORDED LOC. = ØAAD  TAPE LOC. = ØA77
END OF FILE = ØA3Ø
++++++++++++++++++++    HIT ESCAPE TO TERMINATE SEARCH
ERROR Ø  DRIVE Ø
SPECIFY OPTION--T
```

EXAMPLE OF USING MECA DIRECTORY RECONSTRUCTION PROGRAM - Continued

```
RECORD THIS DIRECTORY?--YES
*
+

NOW REWIND AND MOUNT DRIVE

OK--REWIND :0

OK--MOUNT
+
OK--DIREC

                  DRIVE 0   TEND=0A9E
NAME     BYTES    TLOC        NAME     BYTES    TLOC
EDITR    05EB     0546        ASMBL    1200     0631
DEBUG    0377     081D        DIREC    0AFC     08D1
TEST1    01A4     0A20        BLINK    001C     0AAD
OK--
```

MECA BOOTSTRAP DUMPER (BDMPR)

SOURCE CODE = $BDMP

This program allows the user to generate self-loading tapes which use the MECA bootstrap loading technique.

The use of this program is very straight forward and is illustrated below: (The dump is always on Drive Ø and the Drive must not be write-protected, since no check is made).

1. LOAD BDMPR :d
2. EXEC 1BØØ aaaa bbbb cccc

   (NOTE: The 1BØØ entry point specified above is only for the program supplied which loads at this address. If you re-assemble this program elsewhere, this entry point will change accordingly)

   Where aaaa = First Byte to be Dumped
   bbbb = Last Byte to be Dumped
   cccc = Execution Entry Point of Program for "Boot and Go" operation. If cccc = FFFF Hex, then execution is suppressed and the Loader will trap when loading is complete.

When dumping is complete, control will be returned to the Operating System.

MECA SELF-LOADING TAPES

The technique used by MECA to generate self-loading tapes takes advantage of the following features of the S100 Bus microprocessors. See "$BDMP" for the source of a program which generates tapes.

1. The Address Bus Disable Line.
2. The External Clear Line.
3. The Ready Line.

The bootstrap tape will be read as a memory location (FCØØ+)* and is constructed with the following format:

BYTE	INSTRUCTION	
1	JMP	
2	ØØ	
3	FC*	
4	MVIA	
5	8Ø	Suppresses
6	OUT	Write Clock and
7	252	Frees the Address Bus
8	EI	Visual Indicator
9	LXI SP	
10	XX	Bottom of
11	XX	Bootstrap
12	LXI H	
13	bb	Last two
14	bb	Data Bytes of Boot
15	PUSH H	
16	LXI H	
17	bb	Next to the last
18	bb	two Data Bytes
19	PUSH H	

↑

THIS SEQUENCE IS REPEATED UNTIL THE CHECK SUM LOADER HAS BEEN ASSEMBLED

↓

n	JMP	
n+1	XX	First of Bootstrap
n+2	XX	↓

THE REMAINDER OF THE DATA IS IN 256 BYTE BLOCKS WITH A CHECK BYTE AFTER EACH BLOCK. ONLY AN EVEN MULTIPLE OF 256 IS ALLOWED.

↓

WHEN DATA HAS BEEN FULLY LOADED, THE BOOTSTRAP PROGRAM EXECUTES A JUMP TO THE EXECUTION ADDRESS.

The bootstrap operation is as follows:

1. Pressing down on CLEAR causes:
   A. Address Bus to be floated and Tape Drive Address to be inserted (This is latched).
   B. Drive to be set to Rewind Mode.
   C. Reset to be Forced.
2. Releasing CLEAR requests a Play (after Rewind).
3. Pressing RUN starts the Processor. Machine will now wait until Data is available from the Tape Drive. It will be interpreted as a normal machine instruction. NOTE: The processor thinks it is reading from location Zero, but the address on the Address Bus is FCØØ Hex.*
4. The first output operation to the Port FC*Hex releases the address Bus and clears the Play Request from the Tape Drive Interface (See Bootstrap Tape Description).

*NOTE: For SOL use, this has been modified to F4ØØ or F4. Rev. 1/16/78

MECA FILE ORGANIZATION

BYTE #	BYTE VALUE (HEX)	EXPLANATION
1	Ø	Sync Burst
2	Ø	" "
3	Ø	" "
4	Ø	" "
5	1	" "
6	55 (Hex)	Header Flag
7	TLOC LO	Tape Location
8	TLOC HI	Tape Location
9	LOAD ADDR LO	Redundantly Recorded Load Address
10	LOAD ADDR LO	" " " "
11	LOAD ADDR HI	" " " "
12	LOAD ADDR HI	" " " "
13	EXEQ ADDR LO	Redundantly Recorded Exec. Addr. for Load and Go
14	EXEQ ADDR LO	" " " " " " " "
15	EXEQ ADDR HI	" " " " " " " "
16	EXEQ ADDR HI	" " " " " " " "
17	FTYPE	File Type
18	FNAME 1	FILE Name
19	FNAME 2	" "
20	FNAME 3	" "
21	FNAME 4	" "
22	FNAME 5	" "
23	NO. BYTES LO	Number of Bytes Remaining in File
24	NO. BYTES HI	" " " " " "
25	1ST DATA BYTE	Actual Data First Block
26	2ND DATA BYTE	" " " "
		" " " "
	↑	" " " "
	↓	" " " "
280	256th DATA BYTE	" " " "
281	CHECK BYTE	Check Sum
291	Ø	Resync Burst
292	Ø	" "
293	Ø	" "
294	Ø	" "
295	1	" "
296	24 (Hex)	Non-Header Flag
297	TLOC LO	Tape Location
298	TLOC HI	" "
299	NO. BYTES LO	Number of Bytes Remaining
300	NO. BYTES HI	" " " "
301	257TH DATA BYTE	Actual Data Second Block
302	258TH DATA BYTE	" " " "
	↑	" " " "
	↓	" " " "
556	512TH DATA BYTE	" " " "
557	CHECK BYTE	" " " "

This form is followed until the last Data Block which may or may not be 256 Bytes.

Ø	Resync
Ø	"
Ø	"
Ø	"
1	"
TLOC LO	Tape Location
TLOC HI	" "
NO. BYTES LO	Actual Number of Data Bytes in Block
NO. BYTES HI	Actual Number of Data Bytes in Block
1st DATA BYTE IN LAST BLOCK	
2nd DATA BYTE IN LAST BLOCK	
•	
•	
•	
LAST DATA BYTE	
CHECK BYTE	
Ø	IBG Begins
Ø	" "
Ø	" "
Ø	" "
1	" "
24 (HEX)	" "
TLOC LO	Tape Location
TLOC HI	" "
COUNT	Indicates IBG Resync

↑
↓ *APPROX. 17 MS OF CLEAN TAPE*

The above sequence repeats 4 times with the count being incremented each time.

PROGRAM SAVES AND LOADS

NOTE: In the following, the underscore denotes spaces where a space is required.

"CLOAD" - The most general form of the CLOAD command is:

CLOAD "name1_:d_+,RUN

1. "name1" is the MECA file name desired.
2. "d" is the drive I.D.
3. The plus sign (+) specifies that the file should be concatenated with (tacked on to the end of) the existing BASIC file. This is very useful for adding different sets of "DATA" statements to a common main program.

The CLOAD command may be issued at either command level or during program execution.

The parameters enclosed in quotes may be represented by a string variable as follows:

```
10  A$ = "name1_" :B$ = ":d_" :C$ = "+,RUN"
20  CLOAD A$+B$+D$+E$
```

DEFAULTS: If no drive is specified, the program will read from the last active drive.

NOTES: If the concatenation form (plus sign) is used, the drive I.D. must be specified or a syntax error will occur.

"CSAVE" - The most general form of the CSAVE command is:

CSAVE "name1_:d

The parameters are as specified for the CLOAD command with the same notes.

ARRAY SAVES AND LOADS

Numeric arrays may be saved and loaded under the MECA O.S. as follows:

CSAVE_"*B_name1_:1

Note that the first quote is required as with program Loads. This command will also accept string variables as parameters as with the program CLOAD. In this command: "B" is the array name in BASIC and name1 is the name to be assigned under the MECA O.S. The array CLOAD is:

CLOAD_"*B_name1_:1

In both of the above commands, the drive I.D. is optional and will default to the last active drive if not specified.

MECA OPERATING SYSTEM COMMANDS

In addition to the regular CLOAD, CSAVE commands above, the following system commands are available to the user: (NOTE: An asterisk must precede these commands. Only the first four characters are significant.)

1. *MOUNT_:d — This requests the system to read the directory on the drive specified (d).

2. *UNLOAD_:d — Instructs the system to rewind the tape on drive "d" and write the directory if it has been changed.

3. *DIRECTORY_:d — This requests a listing of the files on the drive specified. If there are more than 28 files, the system will pause after listing the first 28 and wait for an input from the operator before continuing the listing.

4. *REWIND_:d — This forces the system to rewind the tape on the drive specified and set the drive location pointer in memory to zero. This synchronizes the drive and the O.S. This is only necessary if you do manual tape operations or install a tape that is not fully rewound.

5. *LOAD_name1_:d_aaaa — This is a NON-BASIC LOAD Function. It will load files outside the BASIC System. For example, these files may be data files which you wish to "peek" and "poke". The address aaaa is hexidecimal and is optional. If not specified, the file will load into the exact memory locations from which it was dumped.

6. *OVERLAY_name1_:d_aaaa_bbbb — This command will attempt to write over the specified files (name1) with the memory data from address aaaa (Hex) to and including bbbb (Hex). Two potential problems arise during this function:

   A. The name does not exist on the drive specified.
   B. The data will not fit in the space allotted.

   In both cases, the machine will add the data at the end of the tape under the name specified.

   If the file is the last file on the tape, there is no limit imposed upon the size of the file with the exception of the amount of tape remaining.

   If the overlay is successful and the file was not the last one on the tape, the "automatic" recording of the directory is suppressed since the only directory change is possibly the number of bytes. The directory will be recorded when the drive is "unloaded", however.

7. *SAVE_name1_:d_aaaa_bbbb — This is the NON-BASIC SAVE function. It is complementary to the LOAD function above and the same comments apply. The addresses aaaa and bbbb specify the memory addresses to be saved on tape and are optional. If not specified, the memory area which was last loaded will be dumped. However, these default addresses will be updated by any tape operation (e.g., CLOAD, CSAVE, readback check, or a read or write directory operation). Thus, care must be used when using the default.

MECA OPERATING SYSTEM COMMANDS - Continued

8. *DELETE_name1_:d

This will cause the file name specified to be dropped from the directory specified. If it is not in the directory, an "ERROR C" occurs. Nothing is done to the tape and the space occupied by the file is lost until a "data pack" operation is performed. Also the new directory is not stored on the tape unless an "UNLOAD" is issued.

9. *NEWTAPE_:d

This command is used to Initialize a tape for use in the system. The drive should be rewound before issuing this command. This command takes approximately 30 seconds to complete.

10. *EXEC_aaaa_hhll_ddee_bbcc

This command may be used to transfer control to the Hex address aaaa with the 8080 machine registers set as follows:

H,L = hhll (Hex)
D,E = ddee (Hex)
B,C = bbcc (Hex)

This allows transfer to a machine language program from BASIC. To return to BASIC, the external program should issue a jump to zero command. All machine register designations are optional and will be filled with zeros or the value of the immediately preceding specified register, if unspecified:

EXAMPLE: *EXEC_3FØØ_12FD Transfers control to 3FØØ Hex with HL = DE = BC = 12FD Hex

11. *TEND_:d_aaaa

This command allows setting the tape location at which the next write operation will begin. It is useful for skipping defective sections of tape. However, indiscriminate use of this command will almost certainly result in problems.

12. *COPY_:d_1_:d_2

This command allows the copying of programs and data files from drive to drive. Also if $d_1 = d_2$, it performs a "data pack" operation in which all the dead files will be compressed out of the tape. The copy takes place from drive d_1 to drive d_2 and only the files listed in the "memory copy" of the directory for drive d_1 are added to the tape on drive d_2. Note both drives should have been "mounted" prior to issuing this command.

Several uses of this command are illustrated below:

A. To copy all files from drive Ø to a new tape on drive 1
   1) REWIND_:Ø
   2) MOUNT
   3) REWIND_:1
   4) NEWTAPE
   5) COPY_:Ø_:1

B. To copy selected files from drive Ø to drive 1. After step 2 above, delete the unwanted files from the directory on drive Ø (NOTE: This does not delete them from the directory on tape), then continue with step 3.

CONTINUED ON NEXT PAGE.....

MECA OPERATING SYSTEM COMMANDS - Continued

12. *COPY_:d_1_:d_2 - Continued

C. To add files to drive 1, replace step 4 by a MOUNT_:1 command

D. To compress out unused space on drive Ø
   1) REWIND_:Ø
   2) LOAD the first file
   3) DELETE it
   4) SAVE it again on the tape. This puts it on the end of the tape.
   5) TEND_:Ø_5ØØ
   6) COPY_:Ø_:Ø

IMPORTANT If you do not set the "TEND" parameter, it will copy the files on the end of the tape. This has the useful function of backing up the data on the same tape if there is room.

CAUTION DO NOT set the "TEND" parameter to anything except 5ØØ unless you know what you are doing!

NOTE: Steps 2 through 4 above assure that drive to drive speed variations will not cause a data file overlap and loss of data. Of course, if you have a multiple drive system, you should prefer to copy drive to drive which also packs out the dead file space.

13. *SHOW_aaaa

This command will print the contents of the memory location aaaa (Hex) and aaaa+1 formatted as an 8080 address or 16 Bit number. That is address aaaa+1 is represented by the first two Hex digits and aaaa by the last two. This is basically a two Byte "peek".

MECA O.S. COMMANDS DURING PROGRAM EXECUTION

All of the MECA O.S. commands listed above may be invoked under program control by using a "REM*" statement.

EXAMPLE: 5Ø_REM*_REWIND_:Ø

Note that a single space is required between the * and the actual command. (No space is required during command mode).

SPECIAL FUNCTIONS: A "control C" will abort most functions of the Operating System but will result in an "ERROR Q" (QUIT) Message.

GENERAL: All MECA O.S. file names are 1 to 5 alphanumeric characters (if more than 5 are specified, only the first 5 are used).

The characters Ø-9, A-Z and all special characters are allowed. However, it is advisable to avoid the "@" sign, the "*", quotation marks and colons.

It is best to begin the names with a letter or special character to avoid possible confusion with Hexadecimal numbers.

Both arrays and programs are stored the same manner under the O.S., so it is up to the user to include identifying characteristics. A possible method is to begin all array names with a "$" (e.g., $aray, $bray, etc.).

VERSION 3.0 MECA O.S. ERRORS AND ERROR RECOVERY PROCEDURES

1. SYNTAX ERROR or "EH?" - Something is wrong with the last line processed by the BASIC interpreter or the MECA O.S. Consult your Manual.

2. All ALPHA-1 errors will be reported in the form:

   ERROR n DRIVE d. Then the system will wait for operator response.

   UNDER BASIC: On Saves and Loads, typing an "R" will cause the system to retry the operation.

   UNDER THE STAND ALONE O.S.: Type a carriage return to return to command mode. When you get the "OK--" prompt, you may type an exclamation point (!) to retry the last command

The Error Codes (n) are summarized below.

ERROR CODE	MEANING	
1	Drive refuses to take a command	Indicates a missing drive or a hardware malfunction.
2	A read request was issued to a Drive in write mode.	Usually indicates a hardware malfunction.
3	A write request was issued to a file protected drive.	
4	Indicates data was not received from the drive requested.	
5	The first data encountered after a file read request was not a header.	
6	The load address was not read correctly.	
7	The execute address was not read correctly.	
8	The file type does not match the expected value.	
9	The file name read does not compare with that requested.	
B	A command was issued to a drive already in motion.	(Busy)
C	The file name specified is not in the directory specified.	(Can't find it)
D	Duplicate file name specified.	A save command was issued with the same name as one already in the directory.
F	Formatting Error.	Construction of file does not fit the MECA Format. (Very rare error)
O	Overlay Error.	You are trying to load a file on top of the Operating System.
Q	An abort request was received.	(Quit)
R	On save: Read back check failed to compare (Possibly a bad spot on tape). On Load: Indicates Bad or Non-existent memory.	Either type an R to retry or advance the TEND parameter and reissue the command.

ERROR CODE	MEANING	
S	Check Sum Error	A read failure of some type occurred. Type an R to retry.
T	The directory is full.	(Too many)
X	Drive dropped busy	For some reason, the drive stopped when it should be in motion. Could be a similar problem as mentioned in Z below.
Y	Data has stopped coming in.	
Z	Zip. Nothing is out there. Probably means that the drive is out of sync with the Operating System.	Rewind the drive and reissue the command.
?	The file start address specified is greater than the end address.	

Abort request is a "control C" when running under MITS BASIC. It is an "ESCAPE" when running the stand-alone MECA Operating System.

INSTRUCTIONS FOR TAPE COPY

On the next two pages there are examples of copying tapes using the ALPHA-1 System.

When we duplicated the tapes in our Lab we used 40 K of Memory. There are ways to copy parts of the Operating System without having 40 K of Memory. However, in order to duplicate the entire Operating System, you will have to have 40 K. (Your System will give you an "ERROR R" if you try this will less Memory. Error R is defective or non-existent Memory)

If you have less than 40 K you will have to "DELETE name1 :d" all of the files for which you have no memory available. Please reference the following list of files which are contained on your O.S. along with their default address.

FILE NAME	MINIMUM AMOUNT OF MEMORY REQUIRED TO COPY THIS	FILE NAME	MINIMUM AMOUNT OF MEMORY REQUIRED TO COPY THIS
→ $BCOS	40 K	DEBUG	16 K
BMOS	24 K	ASMBL	16 K
$EDIT	16 K	→$MCOS	40 K
EDITR	16 K	@40KO	16 K
$BDMP	16 K	@32KO	16 K
BDMPR	16 K	@48KO	16 K
$DIRE	40 K	@24KO	16 K
DIREC	16 K	@56KO	16 K
$DBUG	16 K	DPRET	24 K

NOTE: DPRET is for MECA Internal Use and overlaps the 16 K O.S. This should be deleted by ALPHA-1 Users.

You will notice by above requirements that the 24KOS through the 56KOS only requires 16 K of Memory to duplicate, however you obviously need the amount of Memory indicated in order to use the file. (Example: you need 40 K of Memory to use the 40 K Operating System)

→Unless you have purchased the Source Code Listing, These programs are deleted from your tape.

EXAMPLE OF TAPE TO TAPE COPY WITH ONE DRIVE

```
                ++  MECA OS VER. 3.0  ++
+
OK--

    ** CHANGE TO SOURCE TAPE **

OK--REWIND

OK--MOUNT
+
OK--LOAD EDITR
+++++
EDITR 2000 25EA
OK--

    ** CHANGE TO OBJECT TAPE **

OK--REWIND

OK--MOUNT
+
OK--SAVE EDITR :0 2000 25EA
*****
++++++
+
OK--

    ** CHANGE TO SOURCE TAPE **

OK--REWIND

OK--MOUNT
+
OK--LOAD ASMBL
++++++++++++++++
ASMBL 1E00 2FFF
OK--

    ** CHANGE TO OBJECT TAPE **

OK--REWIND

OK--MOUNT
+
OK--SAVE ASMBL :0 1E00 2FFF
**********
++++++++++++++++
+
OK--

    ** REPEAT THE ABOVE PROCEDURE **
    ** AS REQUIRED....**
```

NOTE: SOL USERS AND VIDEO MAPPED I/O WILL NOT GET * and + AS SHOWN

EXAMPLE OF TAPE TO TAPE COPY WITH A MULTIPLE DRIVE SYSTEM

```
                ++  MECA OS VER. 3.0  ++
+
OK--MOUNT :1
+
OK--COPY :1 :0
++++++++++++++++++++++++++++
$EDIT 0040 1C8E
**************************
++++++++++++++++++++++++++++
+++++
EDITR 2000 25EA
*****
+++++
++++++++++
$BDMP 0040 0B28
**********
++++++++++
++
BDMPP 1B00 1D0F
**
++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
$DIRE 4000 7752
**********************************************************
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

In the above example:

The Plus Signs (+) are shown during Read after each 256 Byte Data Block Transfer.

The asterisk (*) is shown during Write after each 256 Byte Data Block.

There are two Reads and a Write required to transfer each file, as follows:

1. Read the File
2. Write the File
3. Read-back Check the File

MODIFYING THE STANDARD MECA O.S.
FOR MORE THAN TWO DRIVES

The Standard Assembler Language O.S. (Operating System), not the BASIC Version, may be easily modified for multiple Drives by changing the Byte in the O.S. which represents the number of Drives allowed in the System. The location of this Byte is shown in Table 1.

TABLE 1

O.S.	LOCATION	STANDARD VALUE
16KOS	3663	2
24KOS	5663	2
32KOS	7663	2
40KOS	9663	2
48KOS	B663	2
56KOS	D663	2

To change this for any O.S. which you desire, use the following procedure:

1. Bootstrap in your O.S.

   IMPORTANT Do Not read the Directory for Drive 1 (This will destroy the Initialization Sequence).

2. LOAD BDMPR (This should be on Drive Ø).
3. Install a clean tape on Drive Ø.
4. Rewind :Ø
5. Newtape :Ø
6. Key in the appropriate entry for your O.S. From the following Table:

TABLE 2

O.S.	KEY IN		
16	EXEC	1BØØ	3ØØØ 3FFF 3ØØØ
24	"	"	5ØØØ 5FFF 5ØØØ
32	"	"	7ØØØ 7FFF 7ØØØ
40	"	"	9ØØØ 9FFF 9ØØØ
48	"	"	BØØØ BFFF BØØØ
56	"	"	DØØØ DFFF DØØØ

Note: Your usable memory is diminished by 1C8 Hex Bytes (The Directory Size) for each additional Drive (over Two).

The first Byte of the Operating System may be found from Table 3.

TABLE 3

O.S.	3 DRIVES	4 DRIVES
16*	2E38*	2C70*
24	4E38	4C70
32	6E38	6C70
40	8E38	8C70
48	AE38	AC70
56	CE38	CC70

*Note: The Directorys for Drives 2 and 3 overlap the System Assembler when using the 16KOS. This can cause problems

WRITING SYSTEM PROGRAMS USING THE ALPHA-1

VERSION 3.Ø

APPLICATION NOTE 107

This information is provided for the "hard core" system man who desires to do his own thing with the ALPHA-1. It is assumed that he has a thorough understanding of the ALPHA-1 hardware and theory of operation. Timings are very important! The program is required to output data during write at intervals of less than 16Ø μs (at 625Ø bits/second). There is not a lot of time for inefficient use of the machine. Also, the housekeeping during a read operation should be done directly after reading a byte, since there is only 16Ø micro-seconds allowed between the time the data ready signal goes true and the data read operation. It is crucial that you understand these timing restrictions before getting too involved in programming.

In addition, you must call RST1 (or something similar) at regular intervals to avoid missing location pulses. This is necessary during read, write and search modes.

To read from a drive, you must first output the drive I.D. on port A1 as bits B1 and B2 (BØ contains serial data out and does not matter on read). Note this data is updated on <u>every</u> output to port A1.

To write on a drive, the read drive (selected by bits B1 and B2 of port A1) must be <u>different</u> from the write drive. The drive must be in write mode and moving tape.

Please read and understand the theory of operation and description of the ALPHA-1 I/O Ports before beginning any serious attempts at system programming.

....BASIC DRIVER ROUTINES FOR ALPHA-1....

1. The AØ through A2 EQU statements simply define the I/O port addresses used by the ALPHA-1. The standard is:

   AØ = 252 decimal = FC Hex

2. The remaining EQU's define neumonic equivalences for certain 8080 instructions.

CHEKC - This routine is called to check whether the console Input device (keyboard) has received an abort character (1B Hex = escape). If so, the status is Zero on return, otherwise the status is non-zero.

GBYTE - This routine reads data from tape (8 Bits from AØ). The data ready bit is B6 of A1. The B register is used to limit the "wait time".

An exit to the error routine is made if:

1. The active drive stops (goes non-busy) - ERROR X.

or 2. The B Register counts to Zero - ERROR Y.

On return, the accumulator contains the eight bits received from tape.

In the following motion control routines, the active drive I.D. is stored at "DRID".

PLAY - Routine which is called to set the drive into play mode. An error Exit with A=2 is taken if the drive is found to be in write mode.

ERASE - Routine which sets the erase current on and sets up to begin writing data. An error exit is made (A = 3) if drive is write protected.

RITE - Calls erase and then sets the drive in motion.

FFWD - Sets fast forward mode.

RWND - Sets rewind mode.

AGAIN - Entry into motion control routines used by stop routine.

ERET - Dynamically modified location which defines the condition for a successfully completed operation.

RTRYS - Dynamically modified location which determines the number of retry operations to be performed before an Error 1 exit is taken (Drive won't take commands).

GEXB - Routine to "compute" the position of the execute bit for the drive desired.

QBSY - A routine which may be called to determine if the "active drive" is busy.

BPRT and
BMASK - Are dynamically modified storage locations which hold the Busy Bit Port and Busy Bit Mask respectively.

MOTT -- Table which gives the port and mask for the location pulses of each Drive Ø through 3.

BSYT - Table which gives the port and mask for the drive busy bits.

STOP - Routine which stops the active drive.

SETSW - This is a dynamically modified storage location which determines whether or not the STOP Routine will update the Drive location using the value stored in "RLOC". RLOC is used by the active drive and each drive has a separate DLOC storage location.

STLOC - An entry point which allows modification of DLOC for the active drive (HL are stored in DLOC).

MS - A delay routine which causes a delay of approximately the number of milliseconds in the B Register.

RST1 - The routine which keeps track of the location of the active drive. "RSW" is dynamically changed from JZ to JNZ.

"RFR" is dynamically changed from INX H to DCX H (forward or backward).

DO8 - This routine outputs the bits contained in the B Register (serially) as the low order bit of port A1. The second and third bits are used to set the "read drive". Note, to write on Drive 1, the read drive may be set to anything else. That is, if the read drive is 2, a write signal will be delivered to drives Ø, 1 and 3 simultaneously. Only the drive(s) in write mode will write on tape, however. After 4 bits are transmitted, the routine calls RST1 via "CHEK" to keep track of tape position.

DRID - Location which holds the active drive I.D. (Ø through 3).

RLOC - Tape location of the active drive is maintained here.

DLOC - All stopped drives have their locations stored here.

SETUP - Routine called by the tape motion routines to set up the dynamically modified storage locations.

LKUP and TABLD are used to find the desired entries in the tables MOTT and BSYT.

```
0000                    A0      EQU     252
0000                    A1      EQU     A0+1
0000                    A2      EQU     A0+2
0000                    LXID    EQU     11H
0000                    LXIH    EQU     33
0000                    MVIA    EQU     62
0000                    INXH    EQU     35
0000                    DCXH    EQU     43
0000                    RENZ    EQU     192
0000                    REZ     EQU     200
0000                    RETX    EQU     201
0000                    *
0000                    *       ROUTINE TO CHECK FOR AN
0000                    *       ABORT CHARACTER FROM THE
0000                    *       INPUT DEVICE
0000                    *
0000 DB 00              CHEKC   IN      0
0002 2F                         CMA
0003 E6 01                      ANI     1
0005 C0                         RNZ
0006 DB 01                      IN      1
0008 E6 7F                      ANI     7FH
000A FE 1B                      CPI     1BH
000C C9                         RET
000D                    *
000D                    *       MOST  PRIMATIVE INPUT ROUT
000D                    *
000D C5                 GBYTE   PUSH    B
000E 01 00 00                   LXI     B,0
0011 DB FD                      IN      A1
0013 E6 40                      ANI     64
0015 C2 37 00                   JNZ     GETIT
0018 CD 36 01                   CALL    RST1
001B DB FD                      IN      A1
001D E6 40                      ANI     64
001F C2 37 00                   JNZ     GETIT
0022 CD D8 00                   CALL    QBSY
0025 3E 58                      MVI     A,'X'
0027 CA 56 01                   JZ      ERRX
002A 0D                         DCR     C
002B C2 11 00                   JNZ     GBYTE+4
002E 05                         DCR     B
002F C2 11 00                   JNZ     GBYTE+4
0032 3E 59                      MVI     A,'Y'
0034 C3 56 01                   JMP     ERRX
0037 DB FC              GETIT   IN      A0
0039 C1                         POP     B
003A C9                         RET
003B                    *
003B                    *       DRIVE MOTION CONTROL ROUTI
003B                    *
003B 3A 84 01           PLAY    LDA     DRID
003E 47                         MOV     B,A
003F CD CF 00                   CALL    GEXB
0042 07                         RLC
0043 47                         MOV     B,A
0044 DB FE                      IN      A2
0046 A0                         ANA     B
```

```
0047 3E 32                    MVI   A,'2'
0049 C2 56 01                 JNZ   ERRX
004C 0E 83                    MVI   C,131
004E C3 84 00                 JMP   FFWD+2
0051 3A 84 01         ERASE   LDA   DRID
0054 47                       MOV   B,A
0055 3E C9                    MVI   A,RETX
0057 32 C0 00                 STA   ERET
005A 0E 84                    MVI   C,132
005C CD A5 00                 CALL  AGAIN
005F C5                       PUSH  B
0060 CD CF 00                 CALL  GEXB
0063 07                       RLC
0064 47                       MOV   B,A
0065 DB FE                    IN    A2
0067 A0                       ANA   B
0068 C1                       POP   B
0069 C2 71 00                 JNZ   $+5
006C 3E 33                    MVI   A,'3'
006E C3 56 01                 JMP   ERRX
0071 0E 83                    MVI   C,131
0073 78                       MOV   A,B
0074 3C                       INR   A
0075 32 6F 01                 STA   DMSK
0078 07                       RLC
0079 D3 FD                    OUT   A1
007B C9                       RET
007C CD 51 00         RITE    CALL  ERASE
007F C3 84 00                 JMP   FFWD+2
0082 0E 81            FFWD    MVI   C,129
0084 3E 23                    MVI   A,INXH
0086 C3 8D 00                 JMP   RWND+4
0089 0E 82            RWND    MVI   C,130
008B 3E 2B                    MVI   A,DCXH
008D 32 41 01                 STA   RFR
0090 3E C0                    MVI   A,RENZ
0092 32 C0 00                 STA   ERET
0095 CD 8F 01                 CALL  SETUP
0098 3E 05            EXEC    MVI   A,5
009A 32 C2 00                 STA   RTRYS
009D CD D8 00                 CALL  QBSY
00A0 3E 42                    MVI   A,'B'
00A2 C2 56 01                 JNZ   ERRX
00A5 C5               AGAIN   PUSH  B
00A6 79                       MOV   A,C
00A7 D3 FC                    OUT   A0
00A9 CD CF 00                 CALL  GEXB
00AC B1                       ORA   C
00AD D3 FC                    OUT   A0
00AF 06 32                    MVI   B,50
00B1 CD 26 01                 CALL  MS
00B4 79                       MOV   A,C
00B5 D3 FC                    OUT   A0
00B7 06 32                    MVI   B,50
00B9 CD 26 01                 CALL  MS
00BC C1                       POP   B
00BD CD D8 00                 CALL  QBSY
```

```
00C0 C0          ERET   RNZ
00C1 3E                 DB     MVIA
00C2 00          RTRYS  DB     0
00C3 3D                 DCR    A
00C4 32 C2 00           STA    RTRYS
00C7 3E 31              MVI    A,'1'
00C9 CA 56 01           JZ     ERRX
00CC C3 A5 00           JMP    AGAIN
00CF 3E 04       GEXB   MVI    A,4
00D1 04                 INR    B
00D2 07                 RLC
00D3 05                 DCR    B
00D4 C2 D2 00           JNZ    $-5
00D7 C9                 RET
00D8 DB          QBSY   DB     219
00D9 00          BPRT   DB     0
00DA E6                 DB     230
00DB 00          BMASK  DB     0
00DC C9                 RET
00DD FD          MOTT   DB     A1
00DE 02                 DB     2
00DF FD                 DB     A1
00E0 04                 DB     4
00E1 FE                 DB     A2
00E2 01                 DB     1
00E3 FE                 DB     A2
00E4 04                 DB     4
00E5 FD          BSYT   DB     A1
00E6 08                 DB     8
00E7 FD                 DB     A1
00E8 10                 DB     16
00E9 FE                 DB     A2
00EA 02                 DB     2
00EB FE                 DB     A2
00EC 08                 DB     8
00ED 3A 84 01    STOP   LDA    DRID
00F0 47                 MOV    B,A
00F1 3E C8              MVI    A,REZ
00F3 32 C0 00           STA    ERET
00F6 3E 03              MVI    A,3
00F8 32 C2 00           STA    RTRYS
00FB 0E 80              MVI    C,128
00FD C5                 PUSH   B
00FE CD A5 00           CALL   AGAIN
0101 06 C8              MVI    B,200
0103 CD 26 01           CALL   MS
0106 CD 26 01           CALL   MS
0109 C1                 POP    B
010A 3E                 DB     MVIA
010B 00          SETSW  DB     0
010C B7                 ORA    A
010D C0                 RNZ
010E 2F                 CMA
010F 32 0B 01           STA    SETSW
0112 3A 84 01    STLOC  LDA    DRID
0115 47                 MOV    B,A
0116 21 87 01           LXI    H,DLOC
0119 CD BF 01           CALL   LKUP
```

```
011C EB                        XCHG
011D 2A 85 01                  LHLD   RLOC
0120 7D                        MOV    A,L
0121 12                        STAX   D
0122 13                        INX    D
0123 7C                        MOV    A,H
0124 12                        STAX   D
0125 C9                        RET
0126 3E 0C             MS      MVI    A,12
0128 F5                        PUSH   M
0129 CD 36 01                  CALL   RST1
012C F1                        POP    M
012D 3D                        DCR    A
012E C2 28 01                  JNZ    MS+2
0131 05                        DCR    B
0132 C2 26 01                  JNZ    MS
0135 C9                        RET
0136                   *
0136                   *       ROUTINE TO KEEP TRACK
0136                   *       OF     TAPE POSITION
0136                   *
0136 DB FD             RST1    IN     A1
0138 E6 04                     ANI    4
013A CA 50 01          RSW     JZ     CCKC
013D E5                        PUSH   H
013E 2A 85 01                  LHLD   RLOC
0141 23                RFR     INX    H
0142 22 85 01                  SHLD   RLOC
0145 E1                        POP    H
0146 3A 3A 01                  LDA    RSW
0149 EE 08                     XRI    8
014B 32 3A 01                  STA    RSW
014E 37                        STC
014F C9                        RET
0150 CD 00 00          CCKC    CALL   CHEKC
0153 C0                        RNZ
0154 3E 51             ABORT   MVI    A,'Q'
0156 C3 00 00        U ERRX    JMP    EROUT
0159                   *
0159                   *       MOST   PRIMATIVE OUTPUT ROU
0159                   *
0159 D5                D08     PUSH   D
015A 11 04 08                  LXI    D,0804H
015D DB FD             CLK1    IN     A1
015F E6 20                     ANI    32
0161 C2 5D 01                  JNZ    CLK1
0164 DB FD                     IN     A1
0166 E6 20                     ANI    32
0168 CA 64 01                  JZ     $-7
016B 78                        MOV    A,B
016C 07                        RLC
016D 47                        MOV    B,A
016E 3E                        DB     MVIA
016F 00                DMSK    DB     0
0170 17                        RAL
0171 D3 FD                     OUT    A1
0173 1D                        DCR    E
0174 CA 7D 01                  JZ     CHEK
0177 15                        DCR    D
```

```
0178 C2 5D 01              JNZ   CLK1
017B D1                    POP   D
017C C9                    RET
017D CD 36 01       CHEK   CALL  RST1
0180 15                    DCR   D
0181 C3 5D 01              JMP   CLK1
0184                *
0184                *      MORE  TAPE MOTION CONTROL
0184                *
0184 00             DRID   DB    0
0185 00 00          RLOC   DW    0
0187 00 00          DLOC   DW    0
0189 00 00                 DW    0
018B 00 00                 DW    0
018D 00 00                 DW    0
018F E5             SETUP  PUSH  H
0190 97                    SUB   A
0191 32 0B 01              STA   SETSW
0194 3A 84 01              LDA   DRID
0197 47                    MOV   B,A
0198 21 87 01              LXI   H,DLOC
019B CD C8 01              CALL  TABLD
019E 22 85 01              SHLD  RLOC
01A1 21 DD 00              LXI   H,MOTT
01A4 CD C8 01              CALL  TABLD
01A7 7D                    MOV   A,L
01A8 32 37 01              STA   RST1+1
01AB 7C                    MOV   A,H
01AC 32 39 01              STA   RST1+3
01AF 21 E5 00              LXI   H,BSYT
01B2 CD C8 01              CALL  TABLD
01B5 7D                    MOV   A,L
01B6 32 D9 00              STA   BPRT
01B9 7C                    MOV   A,H
01BA 32 DB 00              STA   BMASK
01BD E1                    POP   H
01BE C9                    RET
01BF 78             LKUP   MOV   A,B
01C0 87                    ADD   A
01C1 D5                    PUSH  D
01C2 5F                    MOV   E,A
01C3 16 00                 MVI   D,0
01C5 19                    DAD   D
01C6 D1                    POP   D
01C7 C9                    RET
01C8 CD BF 01       TABLD  CALL  LKUP
01CB D5                    PUSH  D
01CC 5E                    MOV   E,M
01CD 23                    INX   H
01CE 56                    MOV   D,M
01CF EB                    XCHG
01D0 D1                    POP   D
01D1 C9                    RET
SYMBOLS=31
LAST BYTE=01D1

OK--
```

USING THE MCOS AS A SUBROUTINE

To use the O.S. as a callable subroutine, it is necessary to take advantage of the special linkage table at the first of the MCOS. The table organization is illustrated in the listing included. The addresses shown will vary based upon the O.S. location in memory. The first address digit will change as follows:

O.S. TYPE	FIRST ADDRESS DIGIT
16KOS	3
24KOS	5
32KOS	7
4ØKOS	9
44KOS	A
48KOS	B
52KOS	C
56KOS	D

All version 3.Ø O.S. have the same type of linkage.

When the O.S. transfers control to an external program by way of a "LDGO" or an "EXEC" instruction, the address of "MENTR" is pushed onto the top of the stack.

A. The calling program should enter the O.S. via a call to MENTR + 32 Hex.

B. Prior to doing this, however, the following setup should be performed:

1. Put the command desired into the MCOS buffer (exactly as it would be typed into a keyboard with the high order bit low). The buffer address (not the buffer!) is at MENTR+2C Hex. Limit the command to 32 bytes.

2. Put your error return address at MENTR+2A Hex.

3. If doing a save and you wish to use the default address area, the start address should be stored at "ALOAD" (MENTR+1E Hex) and the end address at "EØFP1" (MENTR+2Ø Hex).

4. The default drive I.D. may be stored at DRID (or MENTR=2E Hex). It may also be scanned into the buffer in step 1 above.

   Note: When a force load command is used (e.g. LO(AD) ANAME :1 1EØØ), the whole command must be scanned into the buffer in ASCII.

5. The default file name may also be stored at FNAME (5 characters) MENTR+18 Hex.

Note: Do not forget to put a carriage return (ØD Hex) in the buffer after your command.

There are two error conditions which will cause the O.S. to fail to return to the calling program in the version 3.Ø O.S. They may be patched to return to the calling program error exit as follows (They do not need to be changed back for normal operation):

ADDRESS	OLD	NEW
X41F	C5	B3
X42Ø	X3	X8
X4A2	C5	1E
X4A3	X3	X4

6. STACK Considerations:

The calling program should allow 5Ø bytes of stack space for the MCOS. If this is inconvenient, then the MCOS stack should be loaded prior to entering the MCOS. (The MCOS stack ADDRESS may be found at MENTR+24 Hex) On return the program stack may be reloaded.

C. Normal Return From O.S.

Normal O.S. return (no errors) will be made to the address on the top of the stack when the O.S. was entered (normal call linkage).

If a load operation was performed (including a read directory), the load range may be found at ALOAD and EOFP1.

D. ERROR Return From the O.S.

Return to the calling program will be made to the address stored at MENTR+2A Hex in the event of an error. The error codes will be in the A Register and corresponds to those specified in the ALPHA-1 manual.

E. Exit From Applications Program to MCOS

When the applications program has completed its work, the O.S. should be reentered at "MENTR". No other setup is required when this entry point is used.

IMPORTANT PROGRAMMING NOTES:

1. Be sure you understand the difference between getting the address of a buffer area and getting the address of the address of a buffer.

2. The MCOS "OV" overlay command may be used for normal saves, but no duplicate name error is given and may result in inadvertent file destruction if the same name is used for two different files.

3. To SUPPRESS RECORDING the directory, an ASCII Q must be stored in the MCOS buffer at buffer address + 4.

F. You may use certain of the MCOS I/O routines via the MENTR linkage.

WIN = character input routine character returned in A.

OUT = character output routine character to be output in A.

CRLF = generate a carriage return line feed function.

CHEKC = check input device for an abort character (escape standard). Status of zero means abort received.

NLF2 = output a character to the output device without checking for device ready.

G. Other useful features of the MENTR linkage -

RLOC - The active drive tape location is stored here.

MLMIT - This defines the lower limit of memory space which the O.S. will not load data into. It may be changed dynamically to protect certain areas of memory.

XLMIT - This defines the upper limit as above.

DIRSZ - This defines the size of the directory in this O.S.

DIRAD - This defines the starting address of the drive Ø directory.

DRIVE 1 Location is at DIRAD - (DIRSZ)

```
010F                          ORG     MLOC+DRVAL+DRVAL
0390 C3 C5 03       MENTR     JMP     NSTRT
0393 C3 D0 06       TVIN      JMP     WIN
0396 C3 EB 06                 JMP     OUT
0399 C3 04 07       NEWL      JMP     CRLF
039C C3 04 07       CLEAR     JMP     CRLF
039F C3 0A 07                 JMP     CHEKC
03A2 C3 01 07                 JMP     NLF2
03A5 00 00          RLOC      DW      0
03A7 06                       DB      6
03A8 00 00          FNAME     DW      0
03AA 00 00                    DW      0
03AC 20 20                    DW      '  '
03AE 00 00          ALOAD     DW      0
03B0 00 00          EOFP1     DW      0
03B2 90 03          MLMIT     DW      MENTR
```

```
03B4 EB 0F          XLMIT   DW      STACK
03B6 C8 01          DIRSZ   DW      DRVAL
03B8 C8 01          DIRAD   DW      MENTR-DRVAL
03BA 90 03                  DW      MENTR  ERROR EXIT
03BC 9B 0F                  DW      BUFR
03BE 00             DRID    DB      0
03BF C3 93 03       PWAIT   JMP     TVIN
03C2 C3 DB 03               JMP     RTRY-15
03C5 31 EB 0F       NSTRT   LXI     M,STACK
03C8 21 90 03               LXI     H,MENTR
03CB 22 BA 03               SHLD    DIRAD+2
03CE E5                     PUSH    H
03CF CD 9D 06               CALL    TVINL
03D2 05                     DB      5
03D3 0D                     DB      0DH
03D4 4F 4B                  DW      'KO'
03D6 2D 2D                  DW      '--'
03D8 CD 74 04               CALL    INTV
03DB E5                     PUSH    H
03DC 2A AE 03               LHLD    ALOAD
03DF 22 3E 0E               SHLD    MEMS
03E2 2A B0 03               LHLD    EOFP1
03E5 2B                     DCX     H
03E6 22 45 0E               SHLD    MEND
03E9 E1                     POP     H
03EA EB             RTRY    XCHG
03EB 21 B0 04               LXI     H,CTAB
03EE 7E                     MOV     A,M
03EF 23                     INX     H
03F0 46                     MOV     B,M
03F1 23                     INX     H
03F2 4E                     MOV     C,M
03F3 23                     INX     H
03F4 CD AF 09               CALL    SEAR
03F7 C2 17 04               JNZ     WHAT
03FA 1A                     LDAX    D
03FB FE 0D                  CPI     0DH
03FD CA 07 04               JZ      $+7         *
0400 FE 20                  CPI     ' '
0402 13                     INX     D
0403 C2 FA 03               JNZ     $-12            *
0406 1B                     DCX     D
0407 1B                     DCX     D
0408 D5                     PUSH    D
0409 5E                     MOV     E,M
040A 23                     INX     H
040B 56                     MOV     D,M
040C EB                     XCHG
```

SECTION VI

THEORY OF OPERATION
AND TROUBLE-SHOOTING

THEORY OF OPERATION & TROUBLE SHOOTING GUIDE

TABLE OF CONTENTS

MECADRIVE - THEORY OF OPERATION

The Printed Circuit Card mounted under the *Phi-Deck provides the following major functions:

1. Control of the four motors
2. Read Circuitry including preamplification
3. Write Circuitry (2 Channels)
4. Interface for Computer and Manual Operation

CAPSTAN MOTOR

The Capstan Motor is driven any time power is applied to the Unit. This motor is not switched, because after it is switched on it takes approximately one second to come up to speed, which would degrade the speed of the System.

Speed regulation of the Capstan Motor is integral to the Phi-Deck.

Changes in the speed are accomplished by changing the size of the pulley on the Capstan Motor.

HEAD MOTOR

The head is raised by the Star Wheel. To raise or lower the head bar requires 1/1Ø turn.

High torque is required as the head begins to raise, thus this motor is driven with 11 Volts instead of 7 Volts, like the other three motors. The momentum generated in raising the head into place would also carry the Star Wheel into the disengaged position before it stopped. To prevent this coasting, the motor is dynamically braked by shorting the positive lead to ground for a short time (Q5).

Head position sensing is provided by a microswitch on the side of the Unit. The head and play signals are input to an exclusive-OR circuit which engages and disengages the head motor as required.

FORWARD/REWIND MOTORS

The Forward/Rewind Motors are wired so that positive current drives the foward motor to advance the tape and the rewind motor to rewind the tape. The forward/rewind motors are interfaced with 2N44ØØ type transistors in a Darlington Circuit to provide enough current gain to drive Q3 or Q12 well into saturation with the worst case output from two CMOS buffer stages (U8).

Using a 7 Volt Supply, the forward/rewind motors will move tape at an average speed of 1ØØ inches per second. The exact speed is a function of the quality of the cassette, length of tape, and the individual tape transport. Average Speed will degrade if tapes of greater length than C6Ø are used.

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Excessive speed near the end of tape is prevented by dynamically braking the non-driven motor sufficiently to slow the tape before reaching the end of tape (CR1Ø and CR13 provide this function).

During play mode, Q4 (instead of Q12) is turned on so that extra resistance (R43) may be used to reduce the current supplied to the motor. This reduces the torque of the motor to provide a gentle take-up action.

When the drive is switched from Fast Forward, Rewind or Play to Stop, Q13 turns on briefly applying power to both motors. This insures that any slack is taken up.

TAPE MOTION SENSING

The Phi-Deck provides 18 pulses per revolution of the forward reel from a photosensor. This is used by the MECADRIVE to sense when tape motion has stopped. When a pulse has not been received for 1.Ø seconds in Play Mode or 9Ø milliseconds in Fast Forward/ Rewind, Stop Mode is triggered, which resets all latches on the motor drive circuits, thus removing power from all motors. Q13 is then turned on briefly to take up any slack in the tape.

The pulse train generated from the tape motion is also available on connector J4-4 for use in determining the tape position. (The relation between number of pulses and tape position is non-linear but repeatable).

READ CIRCUITRY

The MECADRIVE has preamplifiers on the drive card to minimize the effects of outside noise sources. The signal from the tape is on the order of 2 mv rms. The preamplifiers are 1458 modules configured to provide a gain of 4ØØ (U13 and U15). Thus the output signal from the MECADRIVE is approximately 8ØØ mv rms at a very low impedance (<2ØØ ohms). This means the signal can be run for long distances through unshielded cable without picking up excessive noise.

WRITE CIRCUITRY

The erase oscillator composed of transistors Q1 and Q1Ø and their associated resistors and capacitors uses the erase head as the inductor in an L.C. oscillator. The frequency of oscillation is approximately 55 KHZ and the amplitude at the erase head should be approximately 45 Volts peak to peak. This provides total AC erasure (which is far superior to DC erasure) of any data on Channel 1 and Channel 2 (they are not independently erased).

The erase oscillator is also used to provide AC bias for the write operation (it is fed through C12 and R28, or C15 and R63). The actual record signal is supplied by U14 (a 1458 dual op-amp). The signal is approximately 4 V peak to peak at the output pins (U14-1 of Channel 1 and U14-7 for Channel 2).

This current is mixed with the bias current at the Read/Write head and provides sufficient drive to fully saturate the tape. The advantages of AC biased write have been known for decades. The reason that DC erase and write are traditionally used for digital recording is that it is more economical, not that it works better. In point of fact, AC biased write is superior to DC write for any application. This is evidenced by the fact that instrumentation recorder manufacturers use AC erase and biased recording.

A side benefit of this technique is that it allows analog recording to be done on the same drive using Channel 2.

WRITE PROTECT

Write protect is implemented by supplying all power (+12V) to the erase oscillator and write drivers through the microswitch which senses the write protect tab on the cassette. In addition, in the ALPHA-1 System, a switch is inserted to allow manual protect to be implemented.

DRIVE FUNCTIONS

The Decoder U5 is used to allow three BITS to set all drive functions (8 possible). The fourth Decoder input is used to gate the output (execute) and has a negative sense. Thus many drives can be common on a three bit bus and only the ones whose execute bit is negative will accept the instruction.

The manual inputs are implimented by adding resistors to the outputs of the decoder and "forcing" the function with a switch (Note that CMOS gate inputs draw essentially no current).

The latches in the U2 module are used to establish and hold the drive modes FAST FOWARD, REWIND or PLAY.

The U1 module provides the lock-out functions to keep the drive from being set into a second mode until the first mode is reset (i.e. you cannot set FAST FORWARD mode while it is rewinding).

The circuit composed of U1Ø-6 gate, U12-9 amplifier, U7-8 and U6-1Ø provides the stop logic and timing. This is a single-shot whose timing is approximately 3ØØ ms. It is triggered by a STOP Command (manual or computer), power on Reset, Busy being Reset or motion of the forward reel stopping.

MECADRIVE INDICATORS

Q17 is driven in such a manner that it is on when the drive is "not busy", thus it may be used to drive an indicator which indicates the drive is ready to accept a command.

Q16 is driven on when the write circuitry 12 Volts is not present, indicating a write protect function.

When the drive actually enters WRITE MODE, the voltage on the collector of Q1 (≈11V) is fed through Diode CR15 and Resistor R87 to J1-5. This may be used to drive a write mode indicator.

COMPUTER INTERFACE CONNECTOR SIGNAL DESCRIPTION (J4)

The Pin assignments on J4 are shown in Figure DD.

POWER PINS: Pin 1 is for Ground
Pin 2 is for +12 Volts
Pin 5 is for -12 Volts

DRIVE OUTPUTS:

BUSY (PIN 3) - This is a positive true CMOS Logic level which indicates that the drive is moving tape.

POSITION PULSES (PIN4) - This Pin has pulses related to the motion of the forward tape reel. 18 Pulses are produced for each revolution of the forward reel. These may be used to determine the approx. location on tape of a particular data block (the accuracy is good to within approx. 2" on a C60 tape).

WRITE MODE (PIN 6) - This Pin is positive true & indicates that the drive is in Write Mode. Before the Computer issues a Play Command, it should sense this line to guard against unintentional erasure. It is also useful for determining whether or not a tape is Write Protected.

CHANNEL 2 READ (PIN 7) - This Pin is discussed in Section entitled "READ/WRITE OPTIONS".

CHANNEL 1 READ (PIN 8) - This Pin is discussed in Section entitled "READ/WRITE OPTIONS".

APPLICATIONS INFORMATION (8 BIT I/O PORT)

			SIGNAL TYPE
	POWER		
1.	J4-1	Ground	Power
2.	J4-2	+12V	Power
3.	J4-5	-12V	Power
	DRIVE OUTPUTS		
1.	J4-3	+ Busy	Logic
2.	J4-4	Position Pulses	LOGIC
3.	J4-6	+ Write Mode	Logic
4.	J4-7	Chan. 2 Read	Analog
5.	J4-8	Chan. 1 Read	Analog
	DRIVE INPUTS		
1.	J4-9	Play	Logic
2.	J4-10	C1	Logic
3.	J4-11	C2	Logic
4.	J4-12	Execute	Logic
5.	J4-13	CØ	Logic
6.	J4-14	WRT CH 1	Logic or Analog
7.	J4-15	WRT CH 2	Logic or Analog
8.	J4-16	RWND	Logic

FIGURE DD

DRIVE INPUTS: PLAY - This Pin requires a CMOS Level & may be used to set the drive directly into Play Mode. It is useful in conjunction with "REWIND" to implement a bootstrap circuit (This Pin is 9).

COMMAND BUS: CØ, C1 & C2 (Pins 13, 1Ø & 11 respectively). These Pins are the normal Computer control pins & are one of eight decoded to determine the function to be performed. (The function is inhibited, however, until the execute Pin is taken low). The following table shows the code to function translation.

C2	C1	CØ	FUNCTION
Ø	Ø	Ø	Stop
Ø	Ø	1	Fast Forward
Ø	1	Ø	Rewind
Ø	1	1	Play
1	Ø	Ø	Set Write Mode
1	Ø	1	Set Peripheral Driver On
1	1	Ø	Set Peripheral Driver Off
1	1	1	Not used.

NOTE: All operational state transistions must be made via the Stop Mode, i.e.,

Fast Fwd → Stop → Rewind
Play → Stop → Rewind
Write → Stop → Fast Forward
Play → Stop → Fast Forward
------etc.-----

This is not true, however, for the Set Write Mode to Play Sequence. Since Stop resets Write Mode, you should not issue a Stop Command after setting Write Mode until you wish to reset Write Mode.

EXECUTE: (Pin 12) This Pin is negative true & causes the command on the Command Bus to be Executed. There are 2 reasons for this Pin's existence:

1) It allows commands to many different Drives to be bussed (CØ-C3) since only the Drives whose execute line is negative will execute the command.

2) It allows the instruction to "set-up" in the decoder before it is gated out (no output "glitches").

WRT CHANNEL 1: (Pin 14) Write Data for Channel 1 is presented to this Pin as a CMOS Logic Level (This Pin should not be exercised when in Read Mode since the almost negligible (< 5 MV) Signal which feeds through to the head is sufficient to interfere with the read signal).

WRT CHANNEL 2: (Pin 15) Write Data input for Channel 2 when it is used as a digital Channel (When it is used an an Analog Channel the input is on Pin 8 of connector J1).

REWIND: (Pin 16) This Pin sets the Drive into the Rewind Mode & is most useful for implementing a bootstrap function.

MECADRIVE TROUBLE SHOOTING GUIDE

GENERAL: A high percentage of problems will be the result of solder bridges. Using a very strong light & a magnifying glass (if you have one), carefully inspect the under-side of the Board for inadvertent solder connections. These are most common around I.C.'s and in congested wiring areas.

Another common problem is failure to solder a lead (or cold solder joints). This will generally give intermittent operation & is sometimes very difficult to diagnose. Using the same technique as above, inspect all component leads for a shiney solder connection.

POWER INCORRECT:

A. Without Integrated Circuits -

( ) 1 - Unplug your power supply from the Card & try it to make sure it is functioning satisfactorily.

( ) 2 - First trace out the appropriate voltage line visually & inspect it carefully.

( ) 3 - 7 Volt Supply: Consult the schematic, Section A through F, 2 & 3. Very little is connected to the 7V supply. Try disconnecting parts of the circuit until the fault is isolated.

( ) 4 - 12 Volt Supply: The regulated 12 Volts has several capacitors connected directly across the supply. See Sec. G1 & G2 of the schematic.

( ) 5 - -12 Volt: This is used only by the op-amps U13 & U15. The problem is most likely a solder bridge or possibly C13 is defective.

B. With I.C.'s (Be sure to remove power when removing or putting in Modules).

( ) 1 - Remove the I.C.'s except U3 and U4 one at a time to isolate which I.C. is causing the trouble & consult the schematic.

OTHER PROBLEMS

SYMPTOM: HEAD RAISES & LOWERS CONTINUOUSLY.
Diagnostic Technique: Consult the schematic Sec. G through J, 2 through 4 (HEAD CONTROL). Remove one end of R59 & Pin 6 from the J3 connector. This will allow you to rotate the Head control Starwheel by hand & diagnose the problem.

SYMPTOM: DRIVE ENTERS CORRECT MODE BUT DOES NOT LATCH IN THAT MODE (Button must be held down).
Diagnostic Technique: This indicates a defective or incorrect component in the MOTION SENSE Circuit (Schematic Section C3, D3 and G6, G7).

SYMPTOM: FAILURE TO ENTER A MODE
Diagnostic Technique: This should be straight-forward to trouble shoot from the theory of operation & schematic (A - E, 4 - 8).

If you have more subtle problems, return the Drive prepaid to MECA & we will repair & return the Drive as soon as possible. Please refer to the MECA Warranty.

PROBLEM: HEAD PHASE REVERSAL - It has come to our attention that a small quantity of Phi-Decks have been shipped in kits with the read head phased incorrectly. Such a drive will read its own tapes but will not read those generated by other drives. If your Unit reads the MCOS Standard tape you do not have this problem. If, however, it will not bootstrap during Final Test (or tapes will not interchange) this is possibly the problem. To check this, use the following procedure:

( ) 1 - Remove the enclosure bottom if installed.

( ) 2 - Located the 4 Pin Molex Connector coming from the Read/ Write Heads (left front of MECADRIVE Card).

( ) 3 - Remove & reinstall it as shown in the Figure below

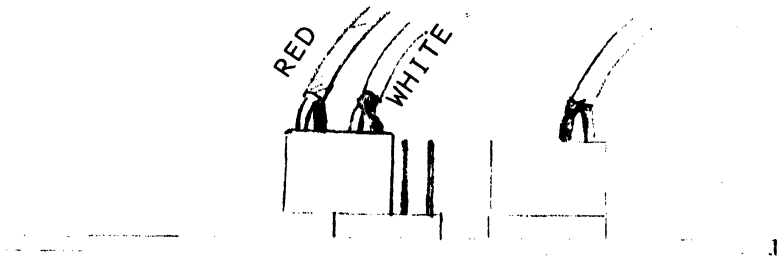


FIGURE EE

( ) 4 - Retry the Drive.

( ) 5 - If this fixes the problem, you may reverse the Molex wiring & reinstall the Connector correctly.

( ) 6 - If this does not fix your trouble, there are other problems in the Read Chain & this experiment cannot provide you any information about Head Phasing until the other problem has been fixed.

PROBLEM: LOW "Q" BIAS OSCILLATOR CAPACITORS - There have been a few instances in which out of specification Mylar Capacitors were shipped with MECADRIVE Kits. These are C14, C17 & C18.

This problem manifests itself as a failure of the bias oscillator to oscillate. This will cause intermittent write operation. By far the more common problem, however, will be incorrectly installed components or solder bridges. After you have carefully checked your work, the capacitors may be replaced with Disk Ceramics of equivalent value (> 50 Volt). If the oscillator then behaves properly, the problem is proven to be low "Q" capacitors. Return the capacitors to MECA & we will send you replacements at no charge.

MECADRIVE SPECIFICATIONS

TAPE MOTION CONTROL
High Speed Search-100 "/sec. avg.
Play/Record-5 "/sec. ± 3%

MAXIMUM DATA RATE
Single Track-6250 bits/sec.
Double Track-12500 bits/sec.
Single Track-781.25 bytes/sec.
Double Track-1562.5 bytes/sec.

STORAGE CAPACITY
>500 K bytes unformatted*

HEAD ENGAGE/DISENGAGE TIME
100 Milli-Seconds Maximum

READ PRE-AMPLIFIER
Freq-response (±3 DB)-DC-12 KHZ
** Nominal Output (1 KHZ)-3V P-P

AC BIAS
Frequency-60 KHZ
Amplitude-350 Micro-Amps

DRIVE INPUT REQUIREMENTS (12 Volt Supply)

CMOS Levels

Most negative down level	-0.4v
Most positive down level	+3v
Most negative up level	+9v
Most positive up level	+12.4v

Special Bootstrap Inputs

A. Rewind-causes drive to enter rewind mode.
B. Play-causes drive to enter play mode.

DRIVE FUNCTION - COMMAND BITS

	C2	C1	C0
Stop (write mode off)	0	0	0
Fast Forward	0	0	1
Rewind	0	1	0
Play	0	1	1
Set write mode	1	0	0
Set peripheral driver on	1	0	1
Set peripheral driver off	1	1	0
Not used	1	1	1

Normal Motion Control

A. C0-Low order command bit
B. C1-Second command bit
C. C2-High order command bit
D. Execute-causes command to be executed.

WRITE SIGNAL
Digital Write-CMOS Logic Signal
Analog Write-2v peak to peak max.

DRIVE OUTPUTS

DIGITAL

Busy-Indicates drive is performing some function

Position Pulses-Pulses which allow location of any position on tape to within 2 inches

Write Mode-Signal indicating that drive is in write mode

ANALOG

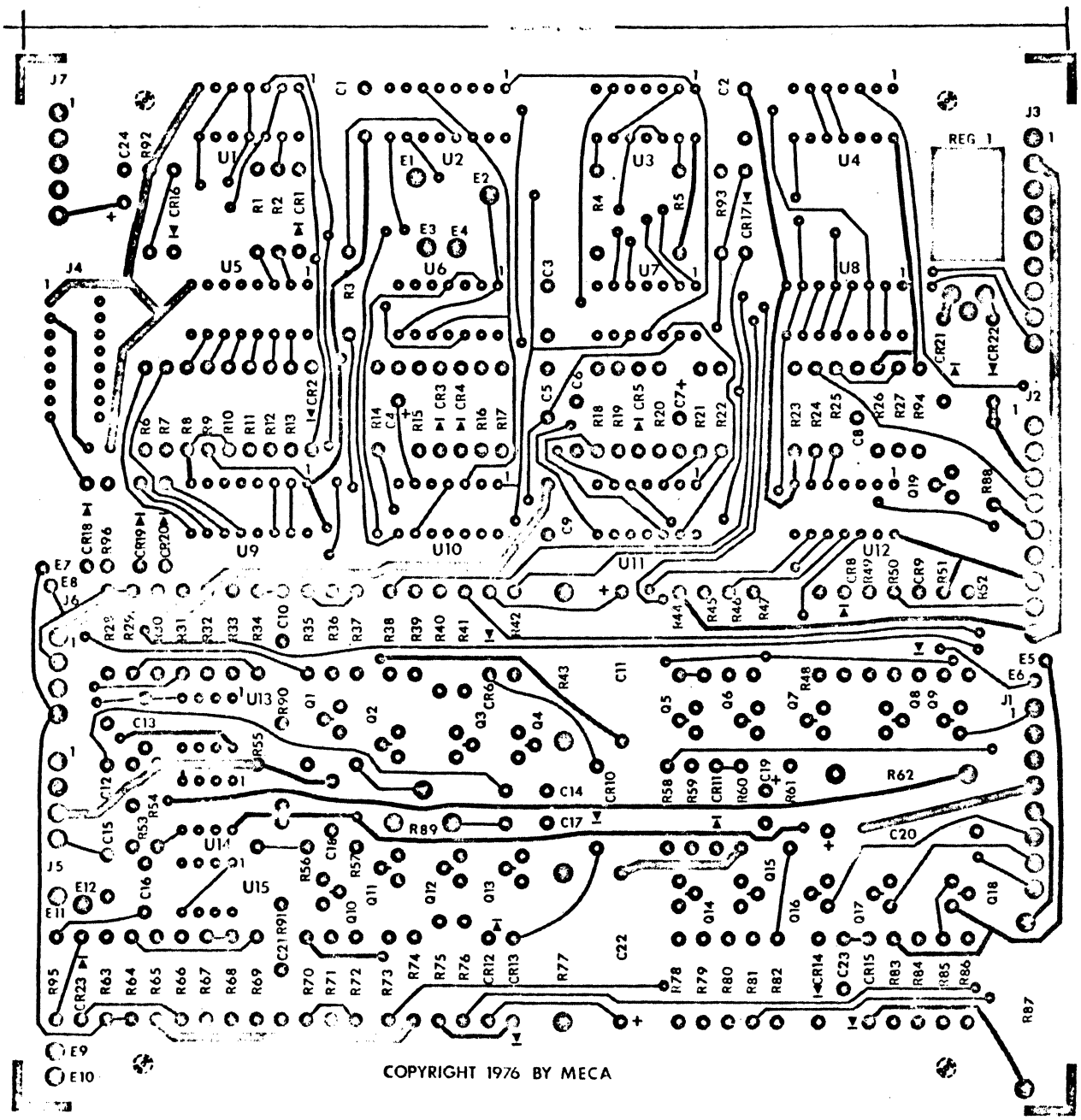
Read Channel 1-Read data from Ch. 1
Read Channel 2-Read data from Ch. 2

*C-30 Cassette
**Adjustable with resistor change

MECADRIVE CARD LAYOUT DIAGRAM

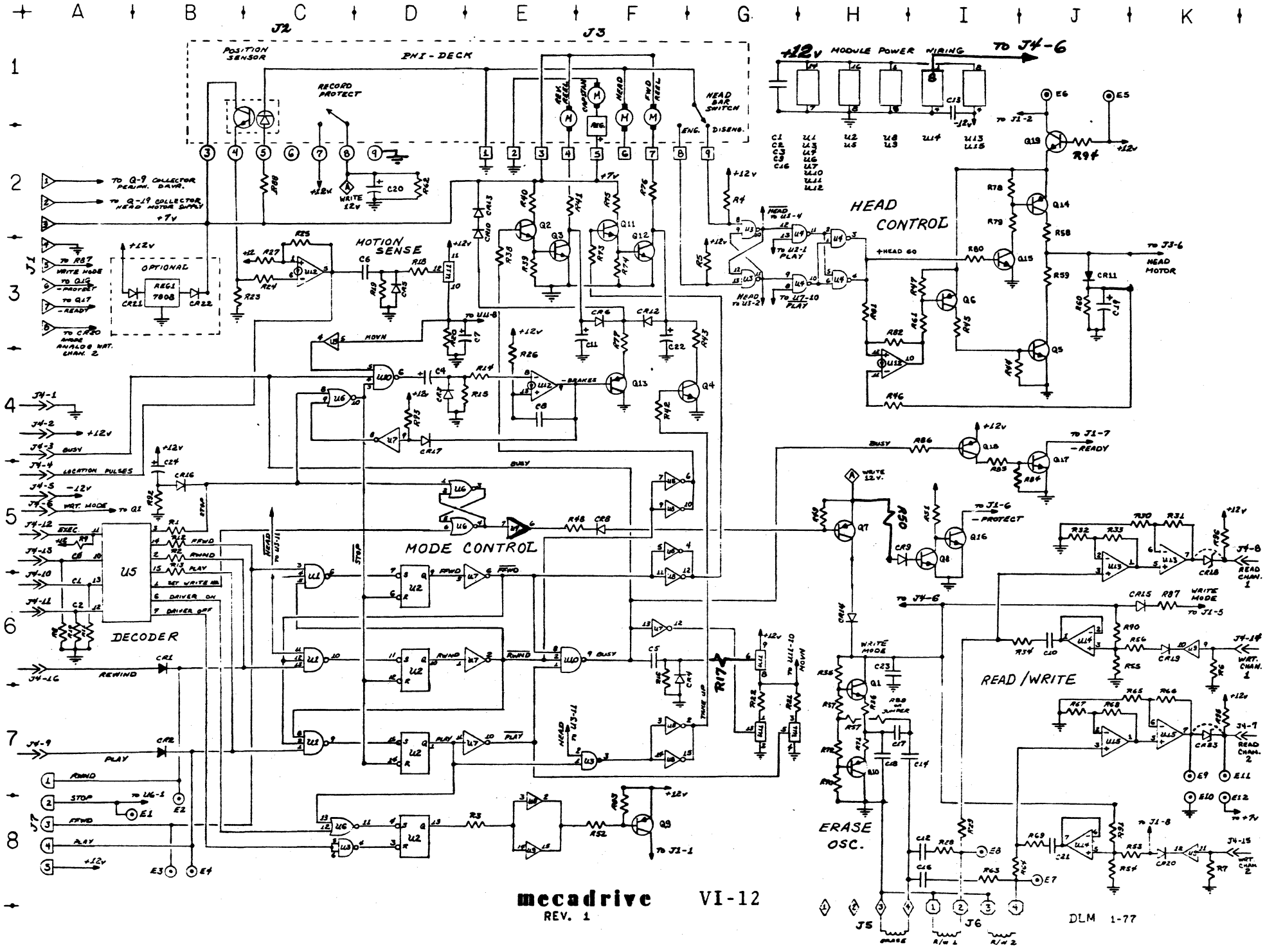
TOP

LEFT



RIGHT

BOTTOM


J2
J3
POSITION SENSOR
PHI-DECK
RECORD PROTECT
REV. REEL
CAPSTAN
HEAD
FWD REEL
HEAD BAR SWITCH
ENG.
DISENG.
+12v MODULE POWER WIRING
TO J4-6
TO Q-9 COLLECTOR PERIPH. DRVR.
TO Q-19 COLLECTOR HEAD MOTOR SUPPLY
+7v
WRITE 12v
OPTIONAL
REG1 7808
CR21
CR22
MOTION SENSE
HEAD CONTROL
+HEAD GO
TO J3-6 HEAD MOTOR
MOVN
BUSY
-BRAKES
MODE CONTROL
DECODER
U5
EXEC.
FFWD
REWIND
PLAY
STOP
WRT. MODE
LOCATION PULSES
DRIVER ON
DRIVER OFF
TO J1-7 -READY
TO J1-6 -PROTECT
WRITE MODE
TO J1-5
READ/WRITE
READ CHAN. 1
READ CHAN. 2
WRT. CHAN. 1
WRT. CHAN. 2
ERASE OSC.
TO J1-8
TO J1-1
TO J1-2
TO +7v
J5
J6
GROUND
R/W 1
R/W 2
mecadrive
REV. 1
VI-12
DLM 1-77

ALPHA-1 CONTROL CARD

THEORY OF OPERATION

S100 BUS INTERFACING

Information is gated onto the "Data In" Bus using U33 and U37 Tri-State Bus Drivers. U34 and U38 are CMOS to TTL translate devices and perform no logical function. U39, U42, U45 and U46 operate as a 24 line to 8 line digital multiplexer and are controlled by decoding bits B8 and B9 of the computer address bus. Address zero is assigned to the 8 bit parallel data input while addresses 1 and 2 are assigned to status indicator functions. Address 3 is not used and is disabled so as not to interfere with the computer data switch function.

U19, U23, U26, U27, and U3Ø are used as bus receivers to minimize the effects of noise on the computer bus. These devices have hysteresis as well as minimum bus loading. U26 and U3Ø buffer the "data out" bus. U23 and U27 buffer the high order 8 bits of the address bus (only the high order 8 bits are decoded). U24-8, U24-6 and U21-8 are set up to recognize address FCØØ (HEX). The low order bits used to resolve this into sub-addresses (U2Ø-13 is used to "knock out" address 3 since this corresponds to the System data switches FF).

U19 and the associated logic determine the appropriate time to read from (or insert data onto) the computer data bus. Note that the ALPHA-1 card will also respond to memory read requests from addresses FCØØ to FEFF.

U12 and U8 generate the write clock used in the system. U12 devides the 2 MHZ $\overline{\emptyset}$ 2 signal by 1Ø (2ØØKHZ). U8 in turn divides by either 32 or 64 to give 6.25 KHZ or 3.125 KHZ (6.25 KHZ is used in the ALPHA-1 System). The actual PE write data is on U4-11. It is the exclusive-OR of the data in the preceding U3 latch (D Flip-Flop) and the write clock. The U3 latch and the preceding U49 latch form a two-bit shift register. The write data is output bit serial into U49-1. It is shifted into U3-1 by the write clock. The software senses the write clock as a data required signal. Thus, during write, the software must service this function at intervals of 232Ø machine cycles or less (.5 microseconds machine).

The bootstrap function is controlled by the gates U11-8, U11-11 and the inverters immediately above them on the schematic. Pressing down on clear initiates the bootstrap function as follows:

1. U11-8 and U11-11 are latched and the address disable function is invoked. Address FCØØ is inserted onto the bus.

2. While clear is down:
   a. Reset is forced.
   b. A rewind request is issued to Drive Zero.
   c. The play request latch is set, but the output is disabled (U7-4).

3. When clear is released, a play request is issued. It will not be honored, however, until the rewind operation is complete.

4. Pressing on Run causes the computer to begin execution from address Zero. Since, however, the address bus is disabled and the address FCØØ has been inserted, the ALPHA-1 card recognizes the read memory request as its own and pulls down the ready line. The machine then enters the wait state until data is read from Drive Zero. This data is interpreted as a machine instruction from address Zero. On a bootstrap tape, the first three bytes are a jump to FCØØ instruction. This causes the 8Ø8Ø program counter to be set to the desired address (FCØØ). The next 4 bytes are MVIA, 128 followed by an OUT FC. When the ALPHA-1 gets the output instruction, U11-8 & U11-11 are reset, the address bus is released and "normal" operation resumes. The processor is now doing normal memory operations from the ALPHA-1 card as though it were memory space FCØØ+. The bootstrap program uses the LXI H and PUSH H instructions to load itself. See the software section for a detailed description of the bootstrap program.

   Due to the minimum number of gates used to implement this function, however, if the bootstrap operation fails to read the first 7 bytes of the tape correctly, the machine is hung-up and can only be recovered by a power-off operation (See recovery from a bootstrap failure (see Page 18, Section IV)).

READ OPERATION

Data from the read drive (addressed by the U36 latches) is analog multiplexed by U44 into the input of the differentiator amplifier stage U47-1. Basically this stage is used to turn read signal "peaks" into "zero crossings". This provides a crude form of equalization.

The equalized signal is fed to the limiter stage U5Ø. This turns the analog read signal into a digital signal. The digital read signal is then processed by the data descriminator circuit to recover the digital information. The descriminator is composed of a phase locked loop U5, and exclusive U4-3, & a shift register U48.

The synchronization of the phase locked loop is accomplished during an all zeros burst of less than 39 bits and a single one at the beginning of each record. Data after this "resynchronization burst" is decoded by exclusive oring the phase locked loop signal and a sample of the input data stream. This is shifted into the input shift register U48 and is preceded by a 1. When the leading 1 gets to the high order position (after 8 shifts), the data ready bit becomes true. The computer may then read the 8 parallel data bits. The shift register is reset after the information has been read by the network composed of U13-4 and the associated components and inverters.

Drive control commands are latched by the 4 Bit Latch U29 along with the suppress write clock bit and fed directly to the drive connectors. Drive execute commands are latched by U25 and U32 (note these are negative true signals).

ALPHA-1 INPUT PORTS

I. Address FC Hex (252 Decimal): This Port has read data from the selected Drive.

II. Address FD Hex

BIT NO.	Data Description
Ø	Read Amplitude Sense
1	Location Pulses from Drive Ø
2	Location Pulses from Drive 1
3	Busy Indication from Drive Ø
4	Busy Indication from Drive 1
5	Write Clock
6	Read Data Ready
7	Raw Limited Data from Read

III. Address FE Hex

Ø	Location Pulses for Drive 2
1	Busy Indication for Drive 2
2	Location Pulses for Drive 3
3	Busy Indication for Drive 3
4	Write Mode Drive Ø
5	Write Mode Drive 1
6	Write Mode Drive 2
7	Write Mode Drive 3

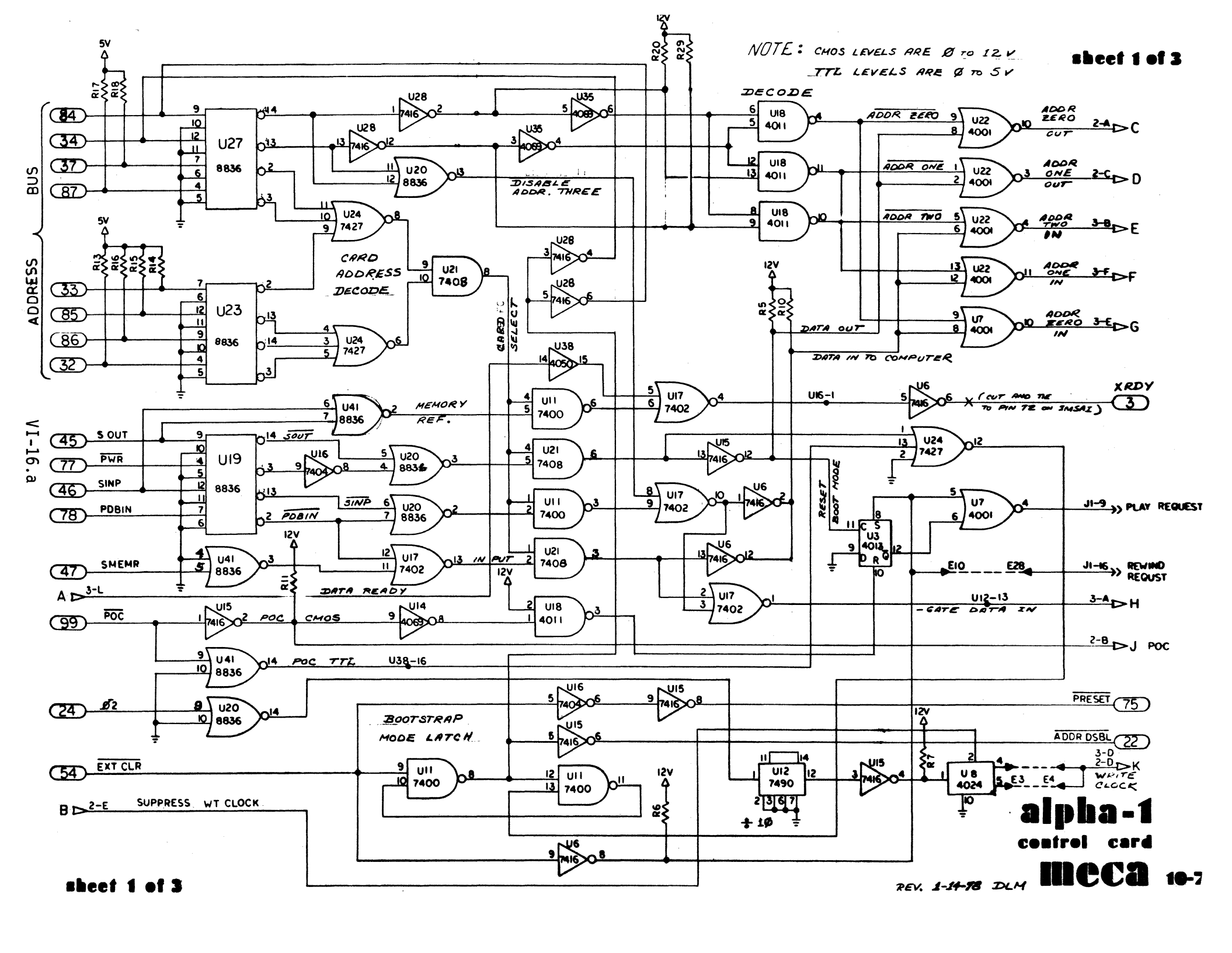
ALPHA-1 OUTPUT PORTS

I. Address FC Hex

Ø	Drive Command Bit Ø
1	Drive Command Bit 1
2	Drive Command Bit 2
3	Execution Bit Drive Ø
4	Execution Bit Drive 1
5	Execution Bit Drive 2
6	Execution Bit Drive 3
7	+ Suppresses Write Clock

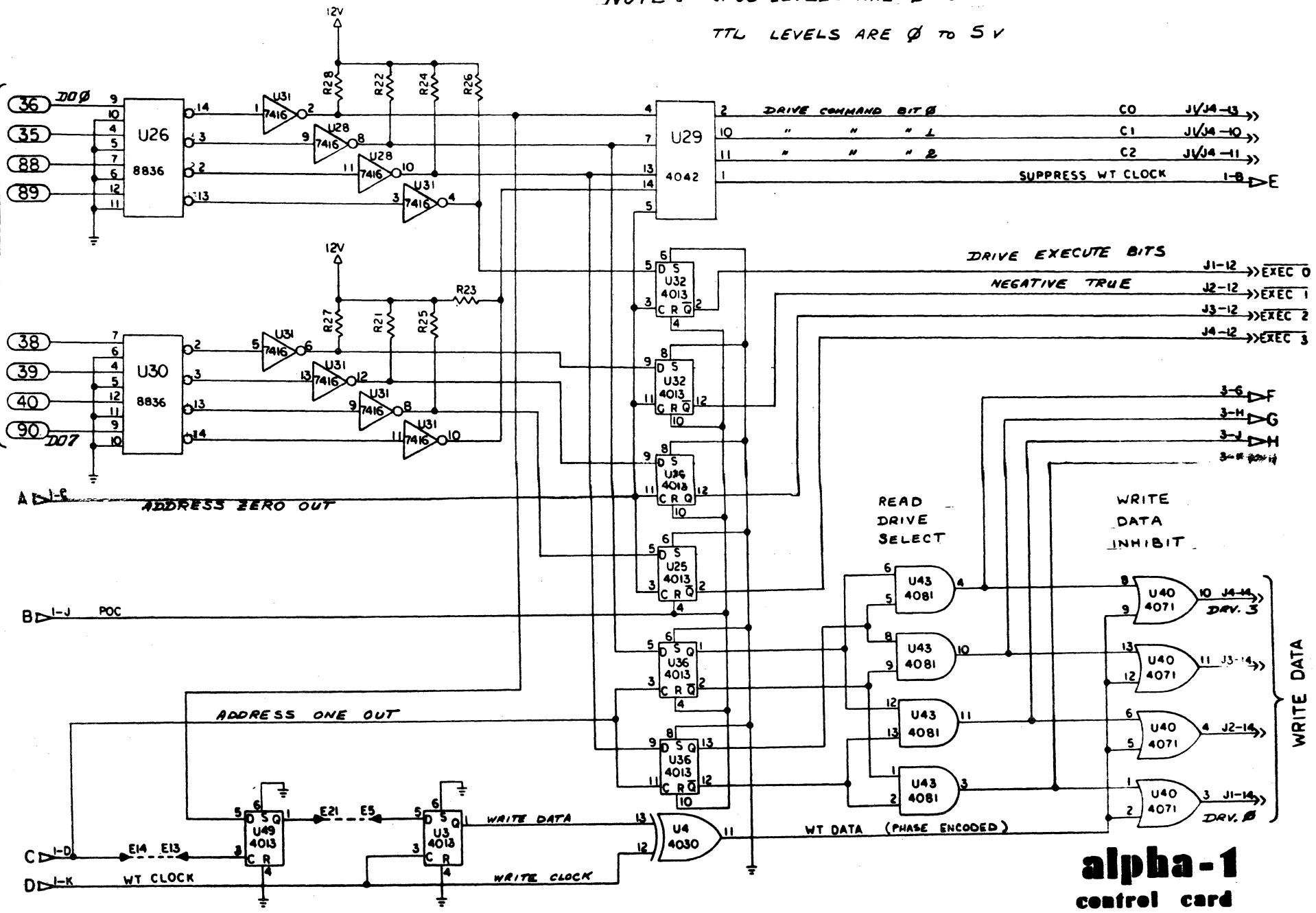
II. Address FD Hex

Ø	Write Data Out Serial (see DO8 routine for method)
1	Read Drive Select Bit Ø
2	Read Drive Select Bit 1


NOTE: CMOS LEVELS ARE Ø TO 12 V
TTL LEVELS ARE Ø TO 5 V
sheet 1 of 3
ADDRESS BUS
DECODE
CARD ADDRESS DECODE
DISABLE ADDR. THREE
CARD SELECT
DATA OUT
DATA IN TO COMPUTER
MEMORY REF.
DATA READY
BOOTSTRAP MODE LATCH
RESET BOOT MODE
- GATE DATA IN
SUPPRESS WT CLOCK
XRDY
PLAY REQUEST
REWIND REQUST
PRESET
ADDR DSBL
alpha-1
control card
meca
REV. 1-14-78 DLM
sheet 1 of 3

NOTE: CMOS LEVELS ARE Ø TO 12 V

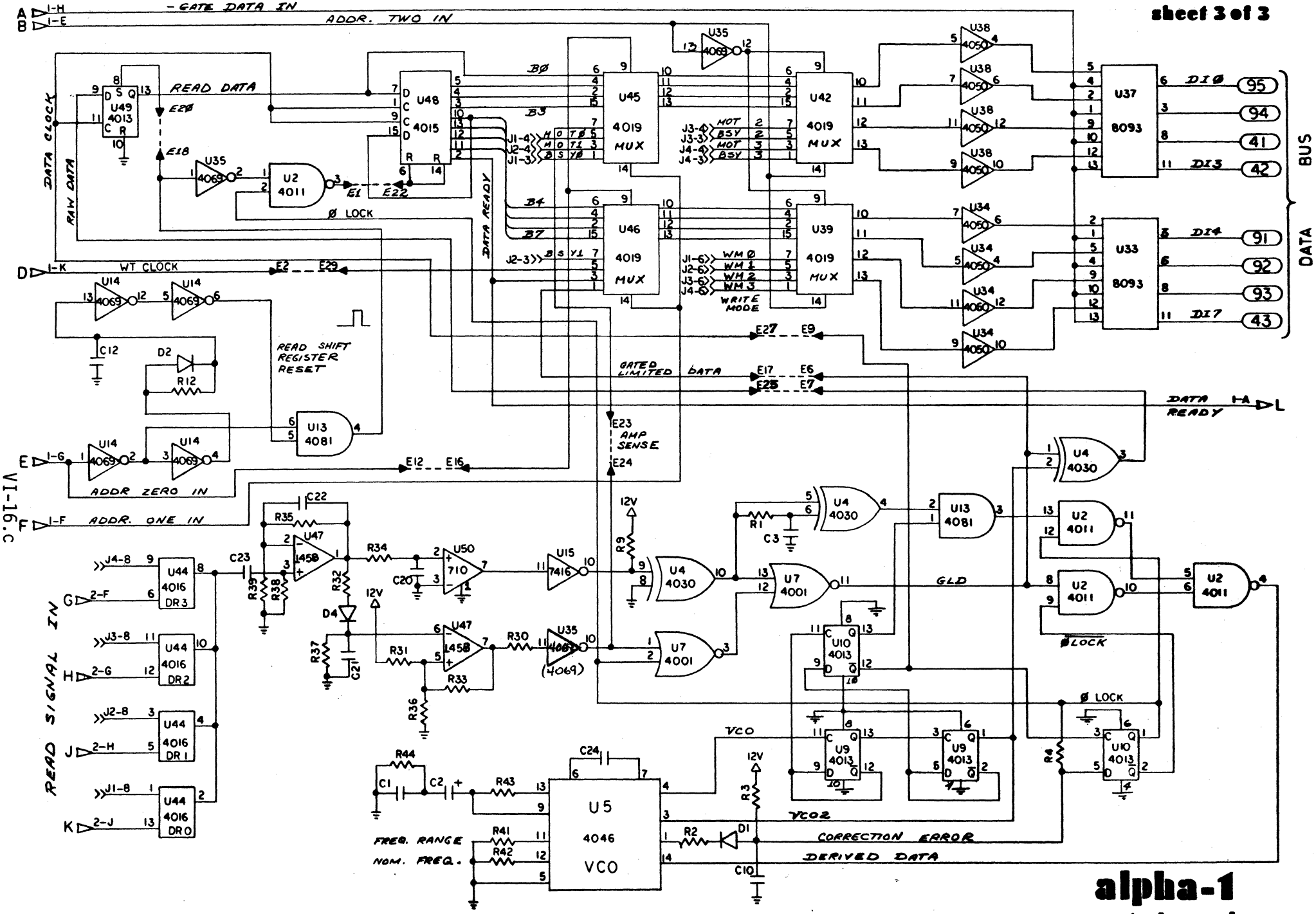
TTL LEVELS ARE Ø TO 5 V



alpha-1
control card

REV 1-14-78 DLM

meca 10-77

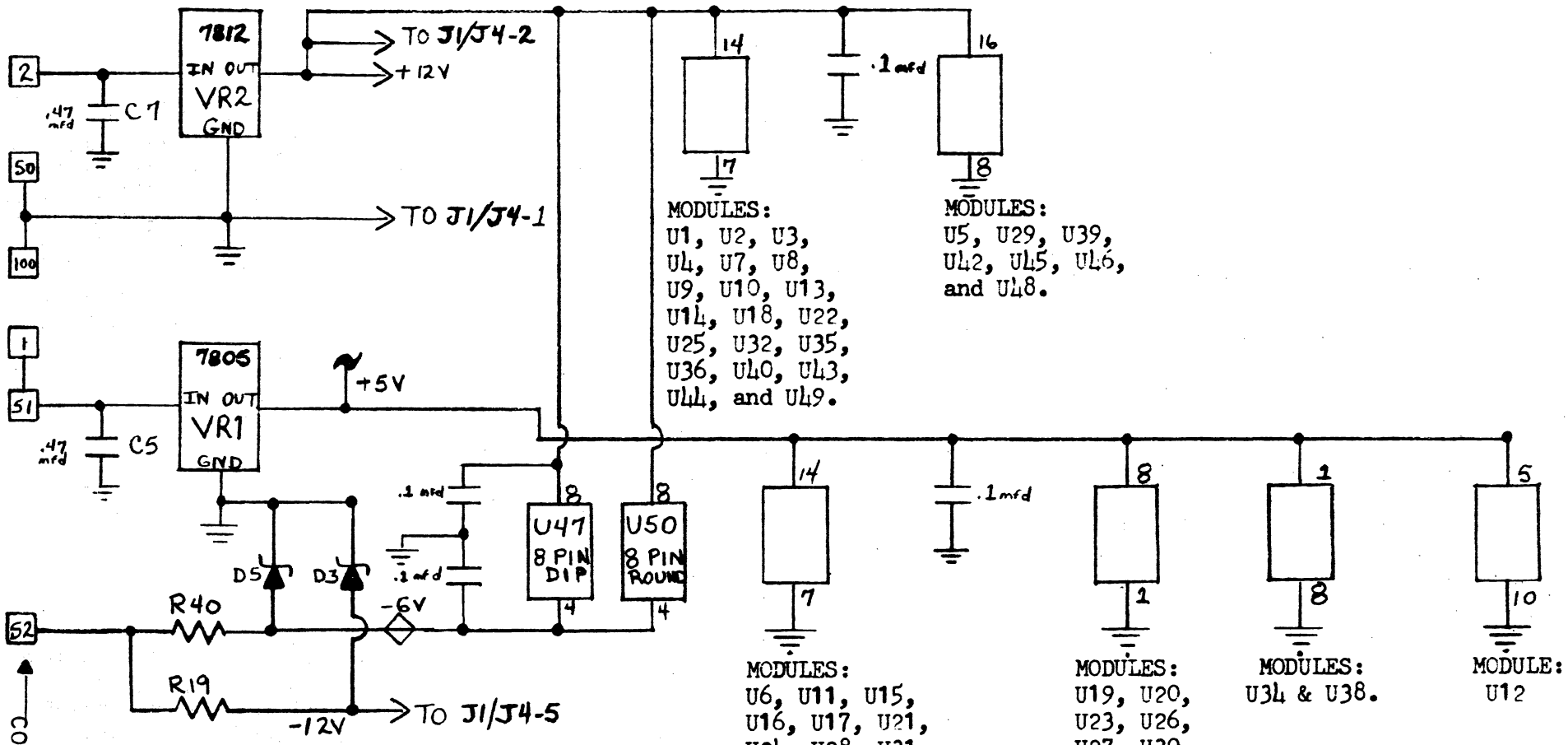


VI-16.c

NOTE : CMOS LEVELS ARE Ø TO 12V
TTL LEVELS ARE Ø TO 5V

REV. 1-14-78

alpha-1
control card
mcca 10-77



VI-17

COMPUTER BUS CONNECTIONS

POWER WIRING
CONTROL CARD
3/21/77

mcca

njm

BOOTSTRAP DIAGNOSTIC PROCEDURE

FOR MACHINES WITH FRONT PANELS ONLY

If the ALPHA-1 bootstrap procedure does not perform correctly, the following procedure may be used to help determine what the problem is.

1. Enter the following simple programs into memory as shown.

```
*
* READ FROM TAPE DIRECTLY INTO MEMORY...
*
HEX ADDRESS     MACH. CODE HEX        ASSEMBLER
   0000           21 00 01            LXI H,100H
   0003           DB FD          DIN  IN 253
   0005           E6 40               ANI 64
   0007           CA 03 00            JZ DIN
   000A           DB FC               IN 252
   000B           77                  MOV M,A
   000C           23                  INX H
   000F           C3 03 00            JMP DIN
*
* TAPE MOTION CONTROL
*
   0040           DB FF          LOOP IN SWITCHES
   0042           D3 FC               OUT ALPHA1
   0044           C3 40 00            JMP LOOP
```

2. Using the tape motion control program check out your tape motion control functions
3. Read circuit check out procedure (A5, A6 refer to front panel switches and ↑ means switch up)(start with all down ↓ & tape fully rewound)
   A. A6↑, examine (DB in data lights), RUN, A6↓
   B. A8↑, A9↑, A11↑then A11↓(drive should play)
   C. Quickly raise reset and release it.
   D. Wait about 15 seconds and then stop the computer & tape drive.
   E. Manually examine the locations beginning at 100 Hex. They should contain the following data.

      If they contain errors the read circuits are not performing correctly. If this data is correct then the fault is with the bootstrap circuits.

```
      0100  C3 00 FC 3E
T     0104  80 D3 FC FB
A     0108  31 05 2E 21
P     010C  C9 CA E5 21
E     0110  D3 FC E5 21
      0114  3E 80 E5 21
"A"   0118  E3 E3 E5 21
 →    011C  D3 FC E5 21
      0120  F6 08 E5 21
      0124  D3 FC E5 21
      0128  3E 80 E5 21
      012C  F2 2D E5 21
      0130  FB C3 E5 21
      0134  F5 2D E5 21
      0138  30 CD E5 21
      013C  C3 00 E5 21
```

```
      0100  C3 00 FC 3E
T     0104  80 D3 FC FB
A     0108  31 05 2E 21
P     010C  C9 CA E5 21
E     0110  D3 FC E5 21
      0114  3E 80 E5 21
"B"   0118  E3 E3 E5 21
 →    011C  D3 FC E5 21
      0120  F6 08 E5 21
      0124  D3 FC E5 21
      0128  3E 80 E5 21
      012C  F2 2D E5 21
      0130  FB C3 E5 21
      0134  F5 2D E5 21
      0138  30 CD E5 21
      013C  C3 00 E5 21
```

TAPE "C" →

```
0100  C3 00 FC 3E
0104  80 D3 FC FB
0108  31 1A 62 21
010C  C9 27 E5 21
0110  D3 FC E5 21
0114  3E 80 E5 21
0118  E3 E3 E5 21
011C  D3 FC E5 21
0120  F6 08 E5 21
0124  D3 FC E5 21
0128  3E 80 E5 21
012C  07 62 E5 21
0130  FB C3 E5 21
0134  0A 62 E5 21
0138  70 CD E5 21
013C  C3 00 E5 21
```

TAPE "F" →

```
0100  C3 00 F4 3E
0104  80 D3 FC FB
0108  31 DC 1C 21
010C  C9 47 E5 21
0110  D3 F4 E5 21
0114  3E 80 E5 21
0118  E3 E3 E5 21
011C  D3 F4 E5 21
0120  F6 08 E5 21
0124  D3 F4 E5 21
0128  3E 80 E5 21
012C  C9 1C E5 21
0130  FB C3 E5 21
0134  CC 1C E5 21
0138  30 CD E5 21
013C  C3 00 E5 21
```

TAPE "G" →

```
0100  C3 00 F4 3E
0104  80 D3 FC FB
0108  31 DC 1C 21
010C  C9 47 E5 21
0110  D3 F4 E5 21
0114  3E 80 E5 21
0118  E3 E3 E5 21
011C  D3 F4 E5 21
0120  F6 08 E5 21
0124  D3 F4 E5 21
0128  3E 80 E5 21
012C  C9 1C E5 21
0130  FB C3 E5 21
0134  CC 1C E5 21
0138  30 CD E5 21
013C  C3 00 E5 21
```

TAPE "R" →

```
0100  C3 00 FC 3E
0104  80 D3 FC FB
0108  31 1A 2D 21
010C  C9 44 E5 21
0110  D3 FC E5 21
0114  3E 80 E5 21
0118  E3 E3 E5 21
011C  D3 FC E5 21
0120  F6 08 E5 21
0124  D3 FC E5 21
0128  3E 80 E5 21
012C  07 2D E5 21
0130  FB C3 E5 21
0134  0A 2D E5 21
0138  2E CD E5 21
013C  C3 00 E5 21
```

TAPE "S" →

```
0100  C3 00 FC 3E
0104  80 D3 FC FB
0108  31 1A 2D 21
010C  C9 44 E5 21
0110  D3 FC E5 21
0114  3E 80 E5 21
0118  E3 E3 E5 21
011C  D3 FC E5 21
0120  F6 08 E5 21
0124  D3 FC E5 21
0128  3E 80 E5 21
012C  07 2D E5 21
0130  FB C3 E5 21
0134  0A 2D E5 21
0138  2E CD E5 21
013C  C3 00 E5 21
```

ALPHA-1 CONTROL CARD READ OPERATION DIAGNOSTIC AIDS

THE FOLLOWING MEASUREMENTS SHOULD BE MADE WITH THE TAPE PROVIDED ON DRIVE Ø AND PLAYING IN THE BOOTSTRAP MODE:

( ) 1. During data bursts a read signal should be observed at Pin 1 and Pin 2 U44 (CD4Ø16). The amplitude should be between 1.5 and 4V peak to peak (There is about +6.3 volts DC offset).

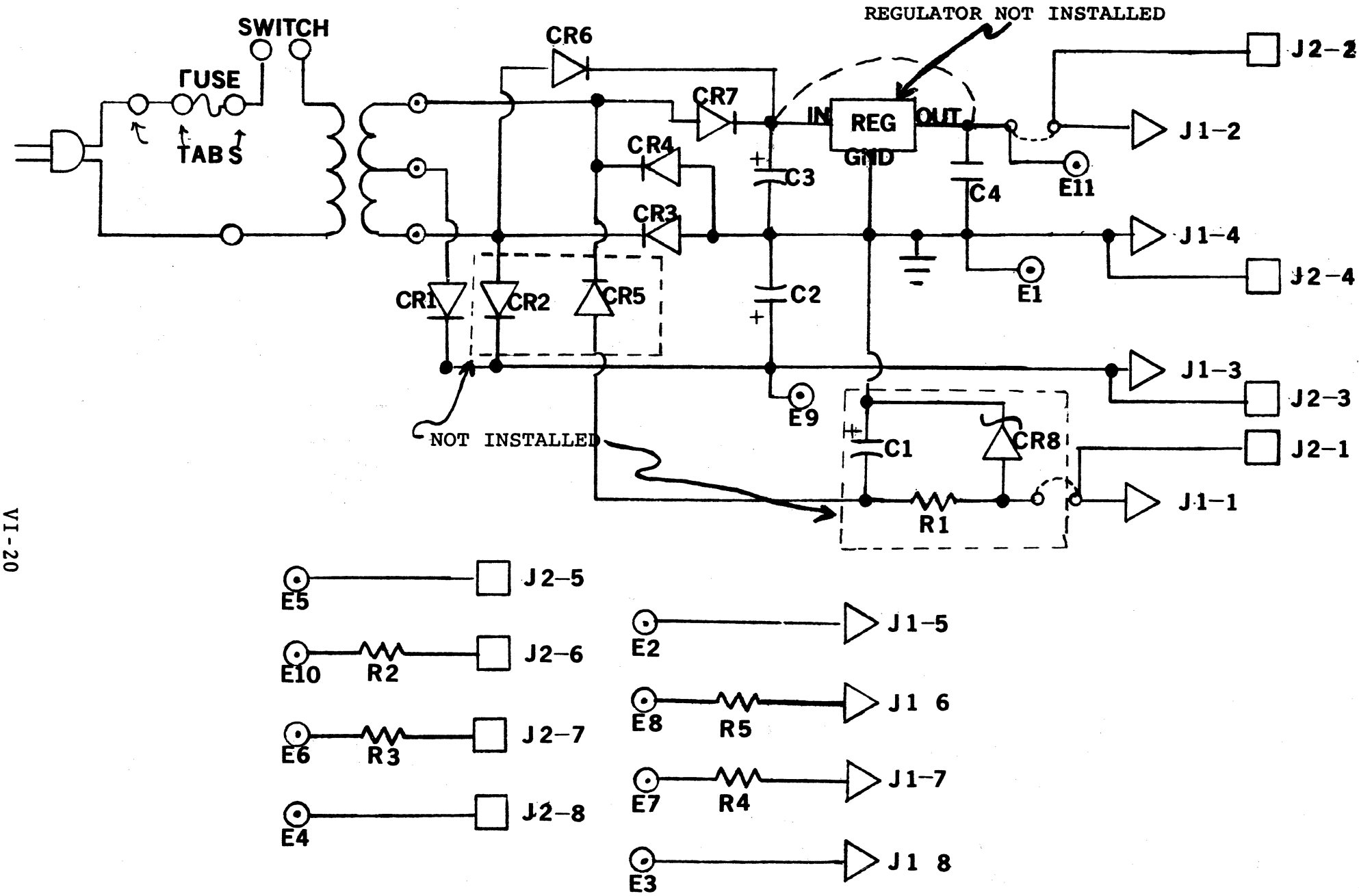
( ) 2. During data bursts the voltage at Pin 9 of module U5 (phase lock loop) should be between 3.5 and 7 volts (measured with a high impedance probe). This signal should be essentially DC with little correction spikes of approx. .5 volts in amplitude. If this voltage breaks up and returns to zero while data is present, it usually indicates the presence of excessive noise in the input data signal.

( ) 3. During data bursts Pin 3 of the S100 Bus (Pin 72 for IMSAI modification) should show a square wave signal.

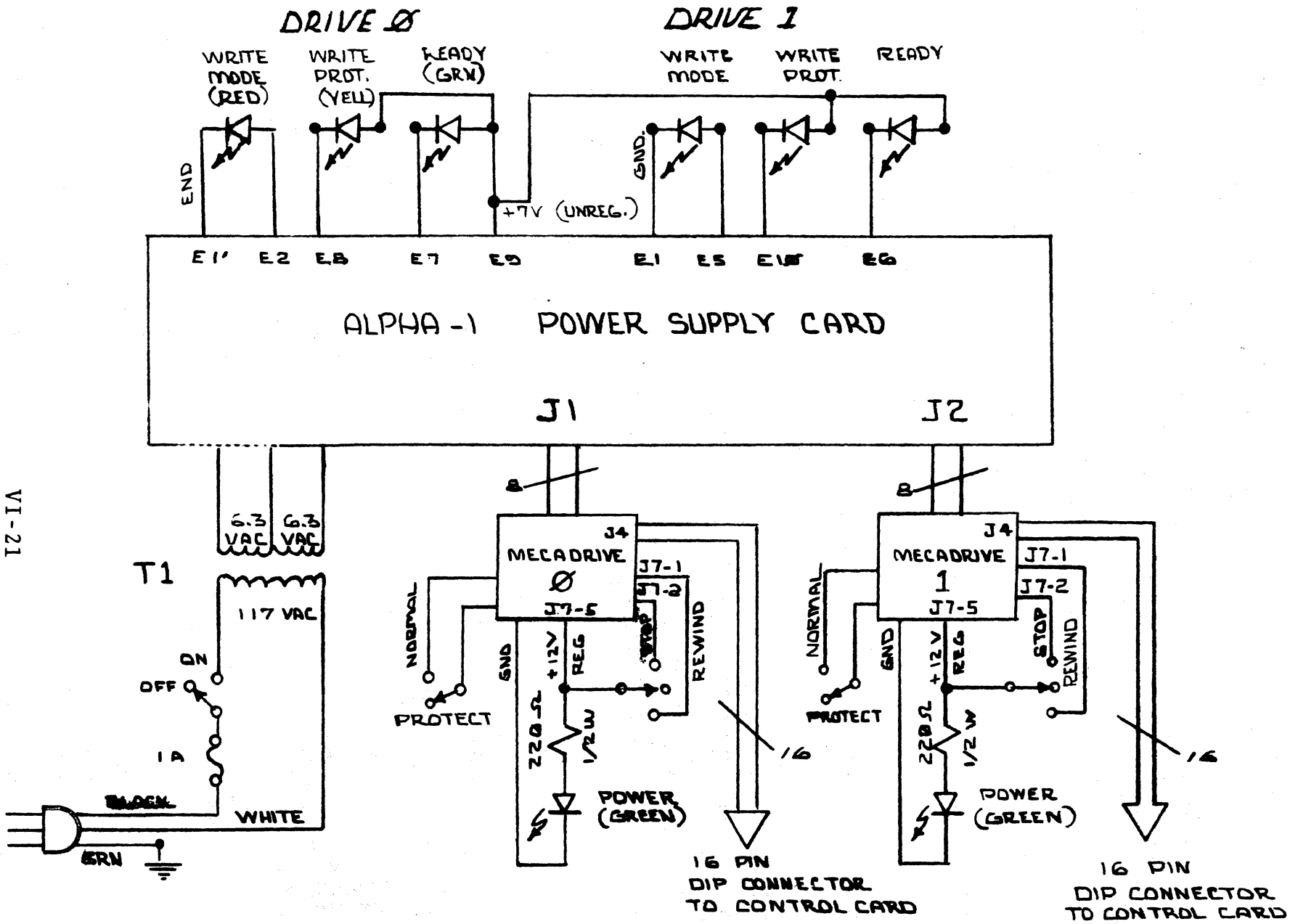
( ) 4. The output of the amplitude sense device (U47 Pin 7) should be negative during data bursts.

( ) 5. Pin 1 on U1Ø should go high during data bursts indicating phase lock has occured.

( ) 6. Square wave data should be present on U15 Pin 1Ø and U7 Pin 11 during data bursts.



POWER SUPPLY
3-77
NJM



ALPHA-1 ENCLOSURE, WIRING DIAGRAM

5-11-77
DLM/DL

SECTION VII

SPECIAL INSTRUCTIONS FOR
MECADRIVE USERS WITHOUT AN ALPHA-1

MECADRIVE USERS WITHOUT AN ALPHA-1

TABLE OF CONTENTS

WRITE CIRCUITS

OPTION A - - CHANNEL 2 DIGITAL

The MECADRIVE has two Read/Write Channels. Channel 1 is configured as only a Digital Channel. Channel 2 may be used as either a Digital or an Analog Channel. To configure as a Digital Channel, perform the following:

( ) A.1 - Insert CR20 (1N914). Solder and Trim.

( ) A.2 - Insert C21, it is a .1 mfd Disk Ceramic Capacitor. Solder and trim.

OPTION B - - CHANNEL 2 ANALOG

To use Channel 2 for Analog purposes, leave CR20 out and the Analog signal should be input at J1-8. The tape will saturate at approx. 4V peak to peak.

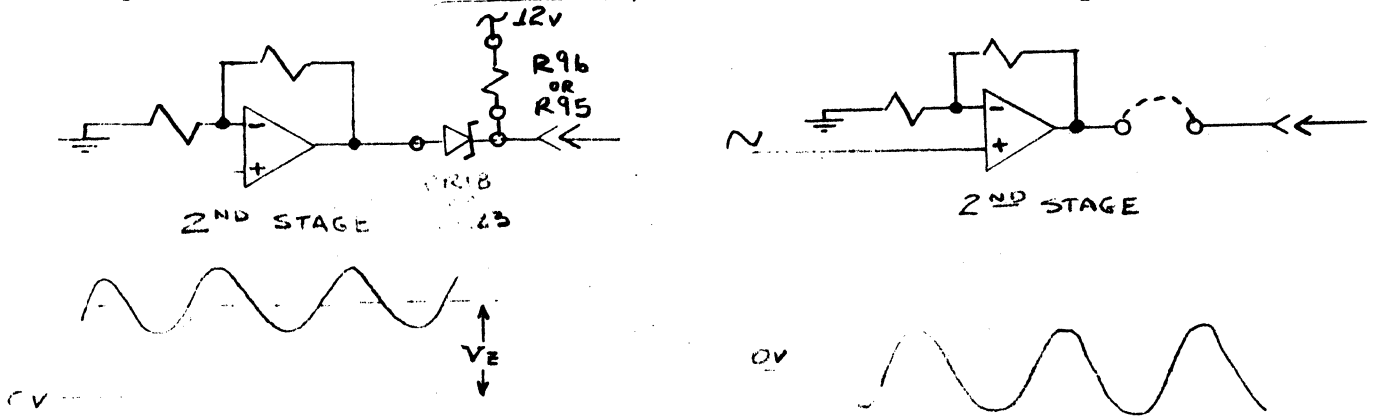
( ) B.1 - Install a 10 mfd 12 Volt non-polar capacitor (not supplied in Kit) in the location for C21. This provides better low frequency response.

( ) B.2 - Install a 1 mfd 2Ø volt non-polar capacitor in the location for R53. This provides AC coupling for the Analog Input.

READ CIRCUITS

The two read channels are identical. There are two amplifier stages in each channel. The gain may be tailored as desired by selecting the feedback components. The "standard" configuration provides a nominal 2 Volt peak to peak unequalized output signal.

The "standard" output (Option B) configuration provides a signal which swings about ground. There will be some DC offset ($\leq |1V|$) due to amplifier offset. There is also provision made for DC translation of the output signal (Option A). This is useful if CMOS Analog signal routing is to be used. Figure FF shows these 2 circuit options.



OPTION A - TRANSLATED OUTPUT

OPTION B - STANDARD CONFIGURATION

FIGURE FF

OPTION A. To select the translated output: (components included)

( ) A.1 - Install CR18, it is a 1N4735 (6V Zener).

( ) A.2 - Install R96, it is a 10K Resistor (Brn-Blk-Orange).

( ) A.3 - Install a wire jumper in CR23 (This is the Audio Channel)

READ CIRCUITS - CONTINUED

OPTION B. To select the Standard configuration:

( ) B.1 - Add wire jumpers in the locations marked CR18 & CR23. Solder and trim. CR18 is located at the extreme left corner. CR23 is located in the lower left hand corner.

POWER WIRING

Consult the Section entitled Powering the MECADRIVE. (Below). Decide upon the powering scheme which best fits your application & wire P1 and P4 accordingly.

An 8 Pin Female molex pin nest with inserts is included for use as P1. The assembly of these connectors is as follows:

( ) 1. Using 20 to 22 guage stranded wire, strip approx. 1/8" of insulation from the end. Insert it in the metal insert as shown in Figure B, Section I, Page 4.

( ) 2. Crimp the tabs around the wire using longnose pliers (Include some insulation). A touch of solder may be added if desired. This assembly may now be inserted into the Pin Nest at the appropriate location (The insert "snaps in" when properly inserted).

( ) 3. Do Steps as directed in Section III, page 15 (INSTALLING THE PHI-DECK) and page 16.

POWERING THE MECADRIVE

There are numerous options available to the MECADRIVE owner for powering. In order to clarify these, a discussion of the functional units is helpful. These functional units may be divided into five circuit groups (Refer to Figure GG)

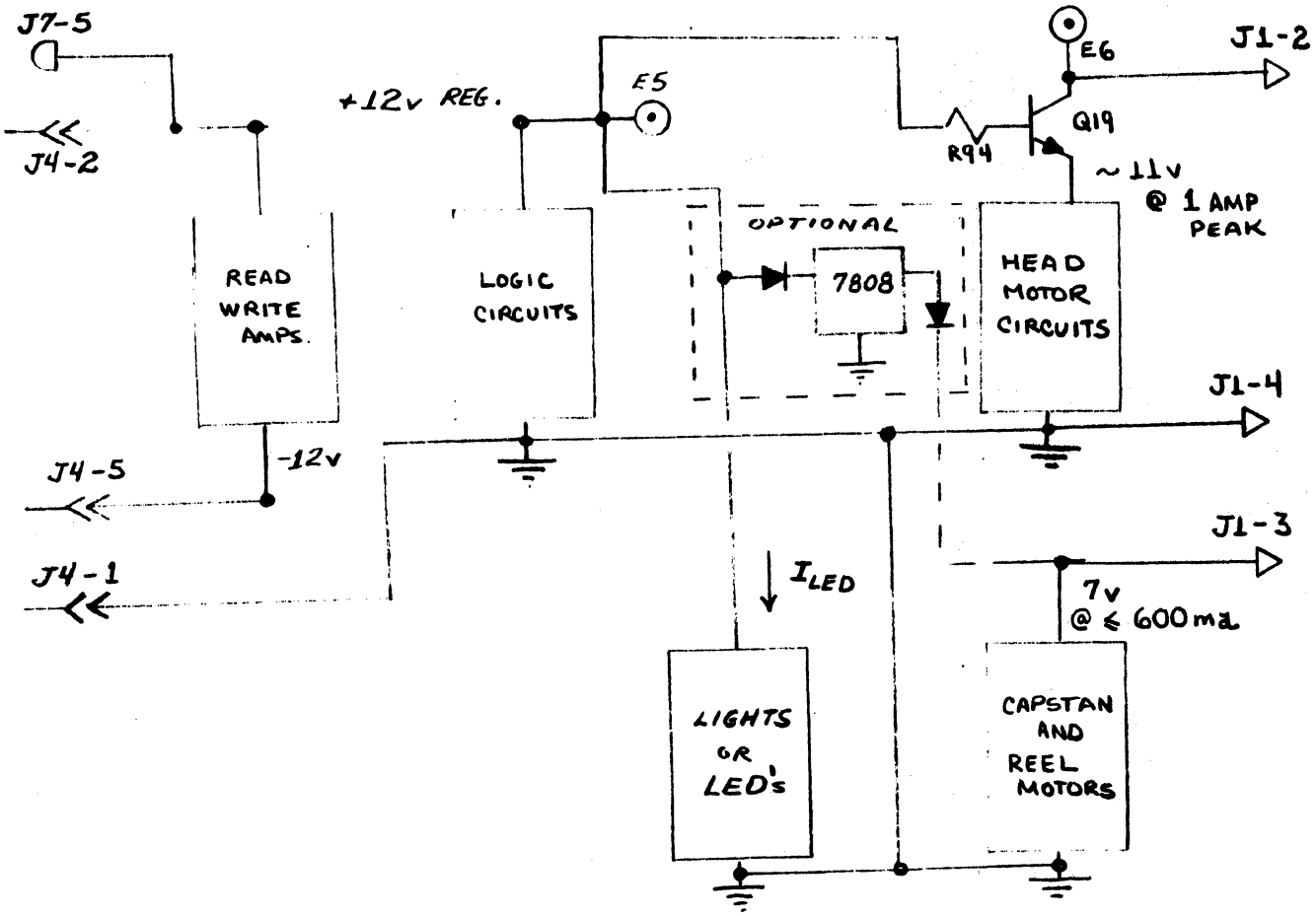
1. Forward, Reverse and Capstan Motors. Power Requirement 6 - 8 Volts at $\leq$ 600 ma.

2. Head Control Motor. Power Requirement 10 - 12 Volts at $\leq$ 1 Amp (For 100 MS)

3. Read-Write Amplifiers +10 to +15 Volts at $\leq$ 20 ma -8 to -15 Volts at $\leq$ 20 ma.

4. Control logic. +10 Volts to +15 at $\leq$ 20 ma.

5. Indicator LEDs. (See Section entitled "Interfacing LEDS or Lights".)



Note: The current I_{LED} is an extra load on 12 volts.

MECADRIVE POWER REQUIREMENTS
FIGURE GG

The following methods may be used to achieve adequate power.

The negative supply may be implemented by the following method: (Figure HH)

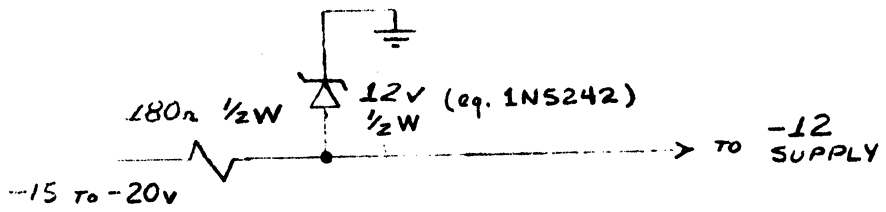


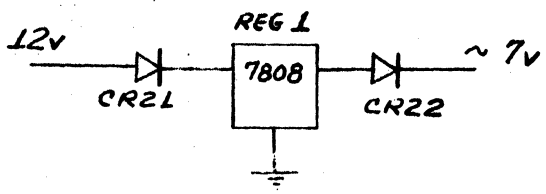
FIGURE HH

ZENER SHUNT REGULATOR. This method is applicable if a source of negative Voltage (regulated or unregulated) is available. (Figure II)

FIGURE II

BATTERY SUPPLY. This method may be used to provide power quickly and simply. It has the disadvantage that the battery must be occasionally replaced.

SINGLE 12 VOLT SUPPLY. If you have a regulated 12 V Power Source which will support a 1 amp transient and a continuous 600 ma load, this may be used to supply all the drive positive power requirements. This is done by inserting the optional 78Ø8 8 Volt regulator and two voltage dropping diodes 1N4001 or equivalent. (Figure JJ) Parts not included.



LM340T-8 is equivalent to the 7808 regulator.

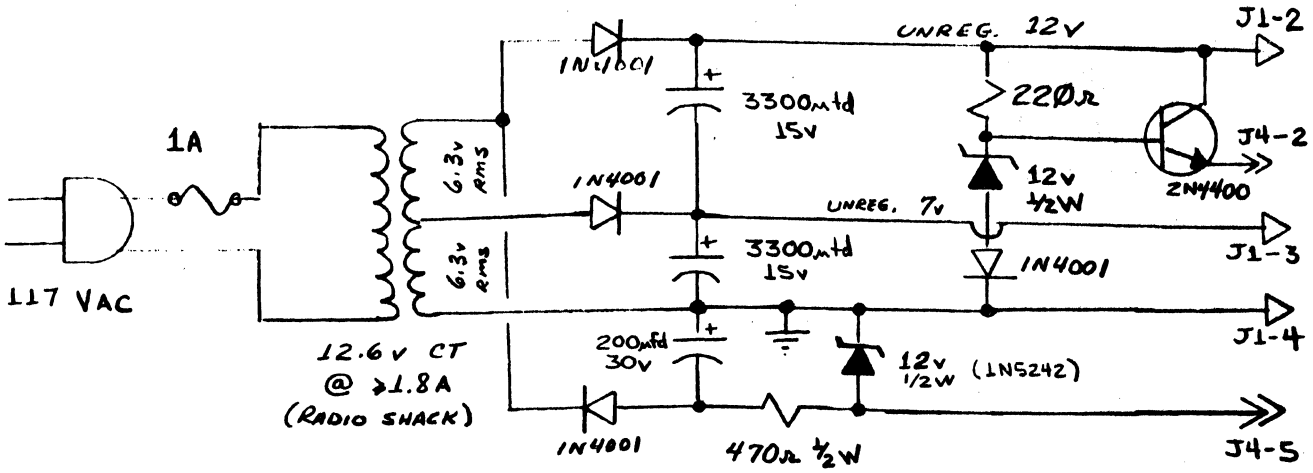
FIGURE JJ

Since the requirements for head motor activation and reel motor control are not present simultaneously, the total 12 V current will never exceed the 1 amp. transient required by the head motor.

REGULATED LOW CURRENT & UNREGULATED HIGH CURRENT SUPPLIES

DUAL 12 VOLT

The following scheme may be used to supply all power requirements for the MECADRIVE: (Figure KK) - NEXT PAGE.



* Resistor selection depends on LED drivers and perpherial driver.

FIGURE KK

The unregulated 12V is used to power the head motor only.

The regulated 12V supplies the power requirements for the Control Logic and Read/Write Amplifiers.

The unregulated 7V Supplies Power for the reel motors and Capstan Motor.

The negative 12V is used only by the read amplifiers.

OPTIONS

A. Standard Power Supply Connections:

( ) A.1 - Wire the +12V Supply to Connector J4 Pin 2.

( ) A.2 - Connect a wire jumper from the hole labeled E5 to the one labeled E6. (This places the Head Motor Load on the regulated +12V Line).

( ) A.3 - Wire the +7V Supply to Connector J1 Pin 3.

( ) A.4 - Connect the Power Supply Ground to Connector J1 Pin 4.

( ) A.5 - Connect the -12 Volt Supply to Connector J4 Pin 5.

B. Single Positive Supply (12V Supply capable of +12V @ 1 Amp for 100 MS)

( ) B.1 - Wire +12V Supply to Connector J4 Pin 2

( ) B.2 - Jumper E5 to E6.

( ) B.3 - Install CR21, CR22, & the 8 V 3 Terminal Regulator (parts not supplied).

( ) B.4 - Connect the -12 Volt Supply to Connector J4 Pin 5.

NOTE: DO NOT APPLY POWER UNTIL INSTRUCTED.

MODIFICATIONS TO MECA POWER SUPPLY

STAND ALONE MECADRIVE

INDEPENDENTLY POWERED

Jumper J1 Pin 1 to J2 Pin 1 if using two drives.

Install a Jumper between CR8 and J1 Pin 1 (Holes provided).

Jumper E11 to J1 Pin 2 (Holes provided).

CR2 NOT INSTALLED

Jumper Across CR3 with a bare wire.

CR4 NOT INSTALLED

CR5 = 1N4002 or equivalent

CR6 NOT INSTALLED

CR8 = 12 Volt Zener 1 Watt (1N4742)

C1 = 1000 mfd Capacitor ≥25 Volt

C4 = .1 mfd Capacitor

R1 = 110 ohm 1/2 Watt Resistor

Regulator = 7812

J1 Pin 3 provides +7 Volts

J1 Pin 2 provides +12 Volts

J1 Pin 1 provides -12 Volts

J1 Pin 4, Ground

MODIFY MECADRIVE CARD(S) AS FOLLOWS:

Cut land on Component Side of MECADRIVE Card from Q9 Collector to J1 Pin 1.

Wire J1 Pin 1 to land which goes to J4 Pin 5, or any feed-through hole which goes to J4 Pin 5 (This is -12 Volts).

MECADRIVE TAPE MOTION FINAL CHECKOUT

If you have any descrepancies, proceed to the "In Case of Trouble Section".

( ) Step 1) Apply power to the Drive. The Drive should remain in a stopped state.

( ) Step 2) Measure the voltage at the bottom of Resistor R78. It should be the same as in the Final Assembly Section (~11.3V).

( ) Step 3) Measure the voltage at the + side of C22 (next to R78). This is the 7 Volt supply. It should be as previously measured (~7V).

( ) Step 4) Measure the voltage at E5 (this is on the right side of the Drive, just above the first connector). This is the 12 Volt regulated supply and should be the same as above (~12V).

( ) Step 5) Perform the following with no tape installed:

- ( ) 5.a) If you have switches installed, try the switch functions. Fast forward should cause the forward (right) reel motor to spin rapidly and continue spinning until stop is hit. Stop should cause the reverse reel to start, but then both reels will spin and stop. Rewind will cause the reverse reel to start first, but then both reels will spin and stop. This is because there is no tape installed. Play should cause the head to be loaded and the forward reel will spin continuously. Stop will cause the head to be unloaded and both reels will spin and then stop.
- ( ) 5.b) If you do not have switches installed, the same functions may be performed by shorting the appropriate pins on J7 to J7-5 with a jumper wire.

( ) Step 6) Install an old C30, C45 or C60 Cassette.

( ) Step 7) Try the functions again.

- ( ) 7.a) Fast Forward
- ( ) 7.b) Stop
- ( ) 7.c) Rewind
- ( ) 7.d) Stop
- ( ) 7.e) Play
- ( ) 7.f) Stop

The tape should move rapidly on the "Fast" operations and it will be under control of the Capstan Shaft and Rubber Pinch Roller during Play Mode.

MECADRIVE TAPE MOTION FINAL CHECKOUT - CONTINUED

( ) Step 8) Set the Drive in Rewind Mode and allow the tape to fully rewind (there should be a noticeable slowing of the tape as it nears the end to limit the stress on the leader to hub bond).

( ) Step 9) As soon as the tape completes rewind, set Fast Forward (if this cannot be done immediately, there is a problem).

( ) Step 10) Record the length of time it takes for the tape to be fully pulled onto the forward reel. This should be less than 45 seconds for a C60 and less than 25 seconds for a C30. If it is significantly slower than this, it is possible a drive problem exists, although certain types of cassettes have unusually high hub friction.

( ) Step 11) Time the Rewind Operation. The results should be similar.

( ) Step 12) Set the drive in Play Mode. Measure the voltage at J4-3. It should be high (~12V).

( ) Step 13) Stop the drive. Again measure J4-3. It should be low (~ØV).

( ) Step 14) Remove the cassette and rotate the right reel very slowly by hand. Measure J4-4 Voltage. It should go alternately high and low as a function of the reel position.

( ) Step 15) Install the remaining four nuts and tighten down the Phi-Deck.

If the above has been successfully completed, the Tape Motion Circuits are performing correctly.

READ AND WRITE CHECKOUT

( ) Step 1) Install an unprotected cassette (The tab on the back left must be in place).

( ) Step 2) Set the Drive in Write Mode by issuing a static Set-Write Mode Command to the Interface (C2=HI, C1=LOW, CØ= LOW WITH EXECUTE LOW).

( ) Step 3) Check the Voltage at J4-6. It should be high (~12V). If it is not, check the signals being applied to the Interface (or the cassette may be protected).

( ) Step 4) If you have a Scope, check the waveform at the erase head J5-5 (The lead closest to the front of the Card). This waveform should be sinusoidal of about 45 V P-P amplitude. The frequency should be about 60 KHZ, but is not critical.

The following circuit may be used to monitor the erase head signal if no scope is available.

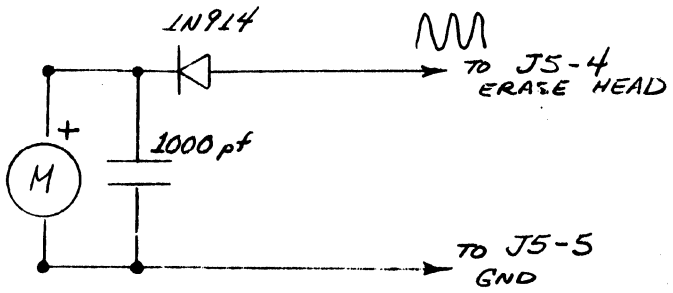


FIGURE LL
Volt-Meter resistance should be greater than 1 Meg Ohm.
Erase Head DC value should be >18V.

( ) Step 5) Record a test signal of about 4 KHZ as follows:

- ( ) 5.a) Set Write Mode
- ( ) 5.b) Set Play Mode
- ( ) 5.c) Apply 4 KHZ CMOS Signal to J4-14 and J4-15
- ( ) 5.d) After approx. one minute, stop the tape and remove the 4 KHZ Signal.

( ) Step 6) Check the Voltage at J4-6. It should be approx. ØV.

( ) Step 7) Check the Read Circuit as follows:

- ( ) 7.a) Rewind the Drive
- ( ) 7.b) Set Play Mode
- ( ) 7.c) Measure the AC Signal at J4-7 and J4-8. With a Voltmeter, it should read approx. Ø.6V RMS. (The Voltmeter should have a response >4 KHZ). With a Scope, it will be approx. 2 Volts P-P at 4 KHZ and will look somewhat triangular (see Figure MM)

( ) Step 8) Repeat the above experiment with a 2 KHZ Signal.

The Voltmeter should read ~.5V. The Scope should show a peaked wave form at 2 KHZ

4 KHZ Readback

2 KHZ Readback

UNEQUALIZED READ SIGNALS

FIGURE MM

If the above has been successfully completed, your MECADRIVE is performing properly.

INTERFACING THE MECADRIVE

LOGIC SIGNALS

All MECADRIVE Logic Signals are 12 Volt CMOS Signals. If the Drive is to be used in a DTL of TTL 5 Volt System, logic signal translation will be necessary. This is a relatively straight forward operation and the recommended techniques are shown in Figures NN and OO below. Note the +12 Volts can be obtained from the 16 Pin Dip Connector (J4) on Pin 2. Note also that the TTL to CMOS Translate Circuit logically inverts the Signal. If a non-inverting circuit is desired, add an inverter to the input of the 7416.

The CMOS to TTL converter shown is a non-inverting translate. A CD4049 may be used if inverting is desired.

RECOMMENDED INTERFACING
OF TTL.. to CMOS

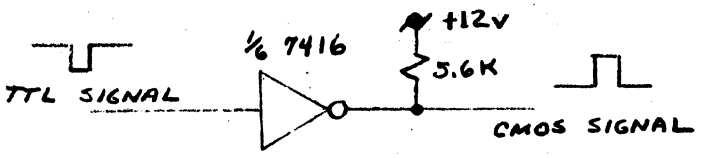


FIGURE NN

RECOMMENDED INTERFACING
OF CMOS to TTL

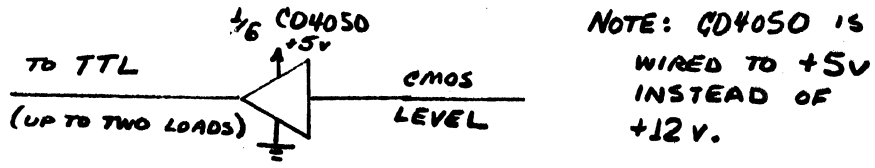


FIGURE OO

READ SIGNAL CONDITIONING

In most Systems, FSK, BYTE STANDARD or TARBELL, no signal conditioning should be necessary other than possibly attenuation to the proper level for the decoder used.

The analog channel will record and play back reasonably good quality voice tracks without any equilization. For recording music, however, equilization is a must. (Equilization is covered in MECA APPLICATION NOTE 101)

RECORD SIGNAL CONDITIONING

For digital signals, no conditioning is required.

Analog signals may require some type of automatic gain control to assure the proper record level independent of the MICRO-PHONE Position. You can actually record without this, but it will be too "touchy" for extensive use. An automatic gain control circuit is covered in MECA APPLICATION NOTE 102.

INTERFACING TO LEDs or LIGHTS

Three different conditions are sensed by the circuits provided for driving lights. The outputs of these are available on the 8 Pin Molex Connector J1.

1. WRITE MODE - J1 PIN 5.

   This is a "positive true" indication that the erase oscillator is active and the Drive is in Write Mode. This circuit is capable of driving a relatively high current load. The equivalent circuit is shown in Figure PP. (Next page)

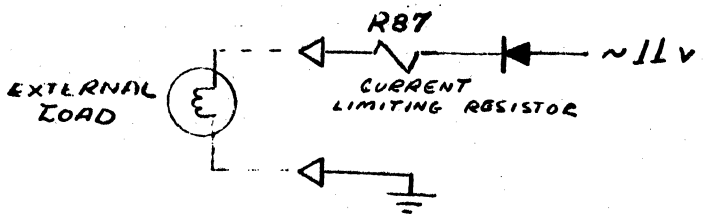


FIGURE PP

Note, however, that this current is derived from the +12 Volt Regulated Supply and thus increases the demands on this supply accordingly.

2. WRITE PROTECT INDICATION (J1-6)

This circuit provides an open collector transistor to ground indicating when the write 12 Volts is not available. It is capable of supplying in excess of 150 MA. Figure QQ shows two possible uses of this output.

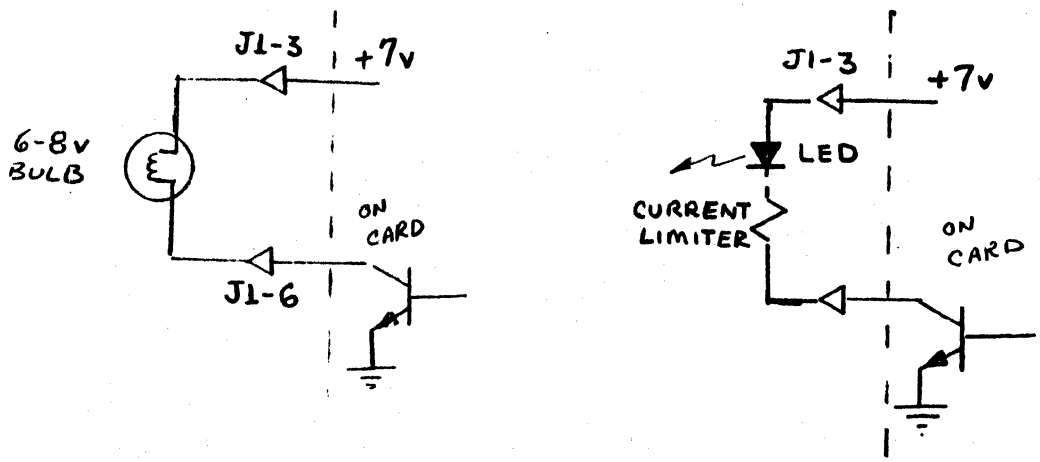


FIGURE QQ

3. DRIVE READY INDICATION (J1-7)

This circuit has the same output structure as the Write Protect above and provides a high current driver for indicating that the drive is not busy. It may be used as shown in Figure QQ.

INTERFACING TO MANUAL CONTROL SWITCHES

Connector J7 is specifically for manual switch interfacing and has the following pin assignments:

Connector J7 Pin Assignments

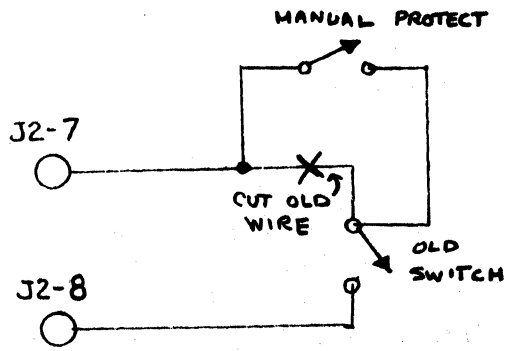
Pin	Function
1	Rewind
2	Stop
3	Fast Forward
4	Play
5	+12 Volts

Connection of any Pin to + 12 Volts causes the corresponding Mode to be entered.

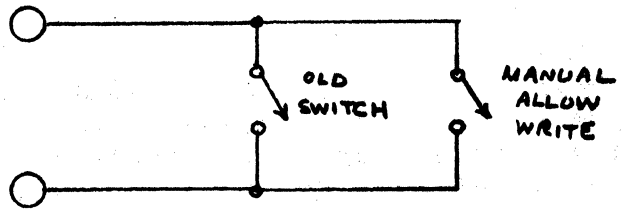
No provision has been made for manually entering Write Mode ("Stop" causes Write Mode to be reset). If it is desired to manually set Write Mode, a connection must be made to Module U6, Pin 6 directly. Carefully solder a wire to this Pin. (No. 28 insulated wire-wrap is ideal for this purpose). There is no problem with shorting the outputs of CMOS Logic directly to the power rails occasionally, since they will limit to a relatively low current out. The wire attached to U6-6 may then be wired through a switch to +12V to manually set Write Mode.

RECORD PROTECT

Record Protect is provided to allow the user to protect tapes against accidential data destruction. The "standard" method is to remove the record protect tab on the back-left of the cassette tape (there are two tabs, one for each side of the tape). A manual over-ride switch may be added if desired to either protect tapes which have the tab in place or to allow writing tapes which have the tab removed (the latter one is less fool-proof). The micro-switch located to the back-left of the cassette holder performs the normal write protect function by interrupting the +12V used in the write circuits. The above mentioned modifications are shown in Figure RR and involve modifying this circuit.



MANUAL PROTECT SWITCH



MANUAL WRITE ALLOW SWITCH

RECORD PROTECT MODIFICATIONS

FIGURE RR

ALPHA-1 SYSTEM MANUAL

APPENDICES

TABLE OF CONTENTS

WARRANTY

IF YOUR UNIT ARRIVES DAMAGED, PLEASE DO NOT RETURN IT TO US UNTIL YOU PHONE US AND WE CAN ARRANGE TO HAVE THE UPS INSPECTOR COME TO YOUR LOCATION TO VALIDATE YOUR CALIM. THIS IS IMPORTANT.

ELECTRONIC COMPONENTS WARRANTY

All electronic components sold by MECA are purchased through normal factory distribution and any part which fails because of defects in workmanship or material will be replaced at no charge for a period of 3 months for kits and 6 months for assembled units, following the date of purchase. The defective part must be returned postpaid to MECA within the warranty period.

Any malfunctioning unit or units purchased as a kit and returned to MECA requiring repair on any of the following will be billed per the list below:

Mecadrive Card.....$20.00 each
Control Card.....$30.00 each
Power Supply Card....$10.00 each
Enclosure.....$15.00 each

Note: Warranty is void and we will refuse to repair any kits assembled with acid core solder.

In no case will labor charges exceed those listed above without prior notification and approval of customer.

All units purchased assembled and tested are guaranteed to meet specifications in effect at the time of manufacture for a period of 6 months following purchase. These units, with the exception of Phi-Decks, see below, are guaranteed against defects in materials or workmanship for the same 6 month period. All warranted factory assembled units returned to MECA postpaid will be repaired and returned without charge, unless, in the judgement of MECA, the returned unit has been damaged due to mechanical or electrical abuse, improper handling or installation, or unspecified modifications. In such an event, the unit will be repaired at a cost commensurate with the work required, as specified for kits.

PHI-DECK WARRANTY

All Phi-Decks included in MECA Kits or Assembled Systems are warranted against defects in workmanship for a period of 90 days from date of purchase. Units returned during the warranty period will be repaired at no charge, if in the judgemet of MECA, they have not been subjected to mechanical or electrical abuse. Phi-Decks returned after the warranty perod or damaged due to improper handling or installation will be repaired at a cost commensurate with the work required. In no case will this charge exceed $30.00 for labor and $15.00 for parts without notification and approval of the owner.

WARRANTY - CONTINUED

IMPORTANT

WHEN RETURNING ANY HARDWARE TO MECA FOR SERVICE (complete this form even if the equipment is under warranty) COMPLETE THE FOLLOWING INFORMATION AND RETURN IT INSIDE THE BOX WITH YOUR EQUIPMENT.

Your Name:_____
Shipping address:_____
_____
Phone #:_____ Date Purchased:_____
Under Warranty: ☐ Yes ☐ NO Purchased from:_____

Your CPU Manufactured by ☐8080 ☐Z-80 ☐other_____ (specify

Video: ☐VDM ☐POLY ☐Other_____ (specify)

CRT Terminal: ☐ADM3 ☐SORAC ☐Microterm ☐Other_____ (specify)

I/O: ☐Mits 2SIO ☐IMSAI SIO ☐3P+S ☐Other_____ (specify)

Memory: _____K Bytes RAM ☐Static or ☐Dynamic

PROM/ROM:_____K Bytes Address Range:_____Hex

This warranty is made in lieu of all other warranties expressed or implied and is limited in any case to the repair or replacement of the unit involved.

TO VALIDATE YOUR WARRANTY, CUT BELOW THIS LINE, COMPLETE THE INFORMATION & RETURN TO MECA WITHIN 15 DAYS: DATE OF PURCHASE_____

NAME:_____

YOUR ADDRESS:_____

PURCHASED FROM:_____

DEALERS LOCATION:_____

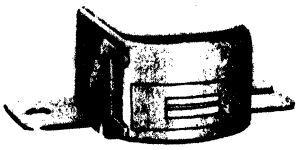
DESCRIPTION OF PURCHASE:_____

meca, P.O. BOX 696, Yucca Valley, California 92284

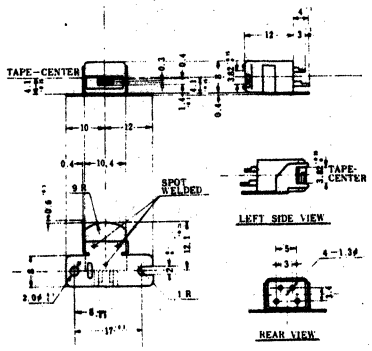
IKEJIRI HEAD

CASSETTE STEREO RECORD/PLAYBACK HEAD

R-747



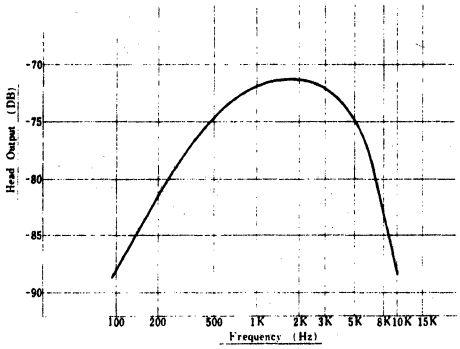
DIMENSIONS



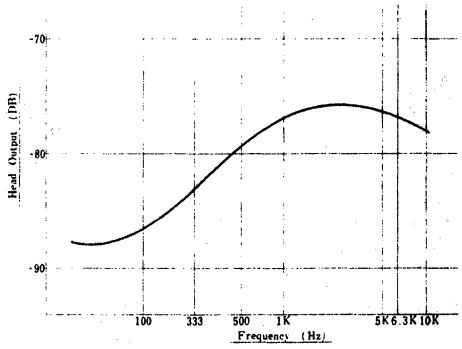
ELECTRICAL SPECIFICATIONS

1.	Impedance at 1 KHz	: 750Ω ± 30%
2.	Impedance at 50 KHz	: 20KΩ ± 30%
3.	Bias Current (50 KHz)	: 350μA ± 30%
4.	Audio Current (1 KHz)	: *35μA ± 25%
5.	Sensitivity (1 KHz)	: −72 DB ± 3 DB
6.	Frequency Response (8 KHz)	: −11 DB ± 4 DB (0 DB−1 KHz)
7.	Separation between channels	: Less than −30 DB (1 KHz)
8.	Insulate Resistance	: Better than 50MΩ (250V D.C.)
9.	Playback Sensitivity (333 Hz)	: −82 DB ± 3 DB
	*(10 DB down from saturation level.)	
10.	Playback Frequency Response (8 KHz)	: +8 ± 4 DB (333 Hz−0 DB)
11.	Output Difference	: 3 DB max at 333 Hz 4 DB max at 8 KHz

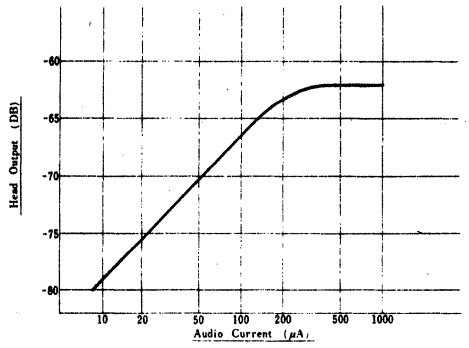
* Test Tape : BASF QP 12LH
* Tape Speed : 4.75 cm/sec
* Playback Test Tape : TEAC MTT 116L



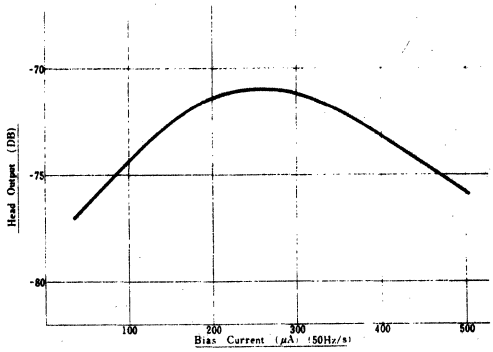
RECORD PLAYBACK FREQUENCY RESPONSE



PLAYBACK FREQUENCY RESPONSE



AUDIO CURRENT RESPONSE



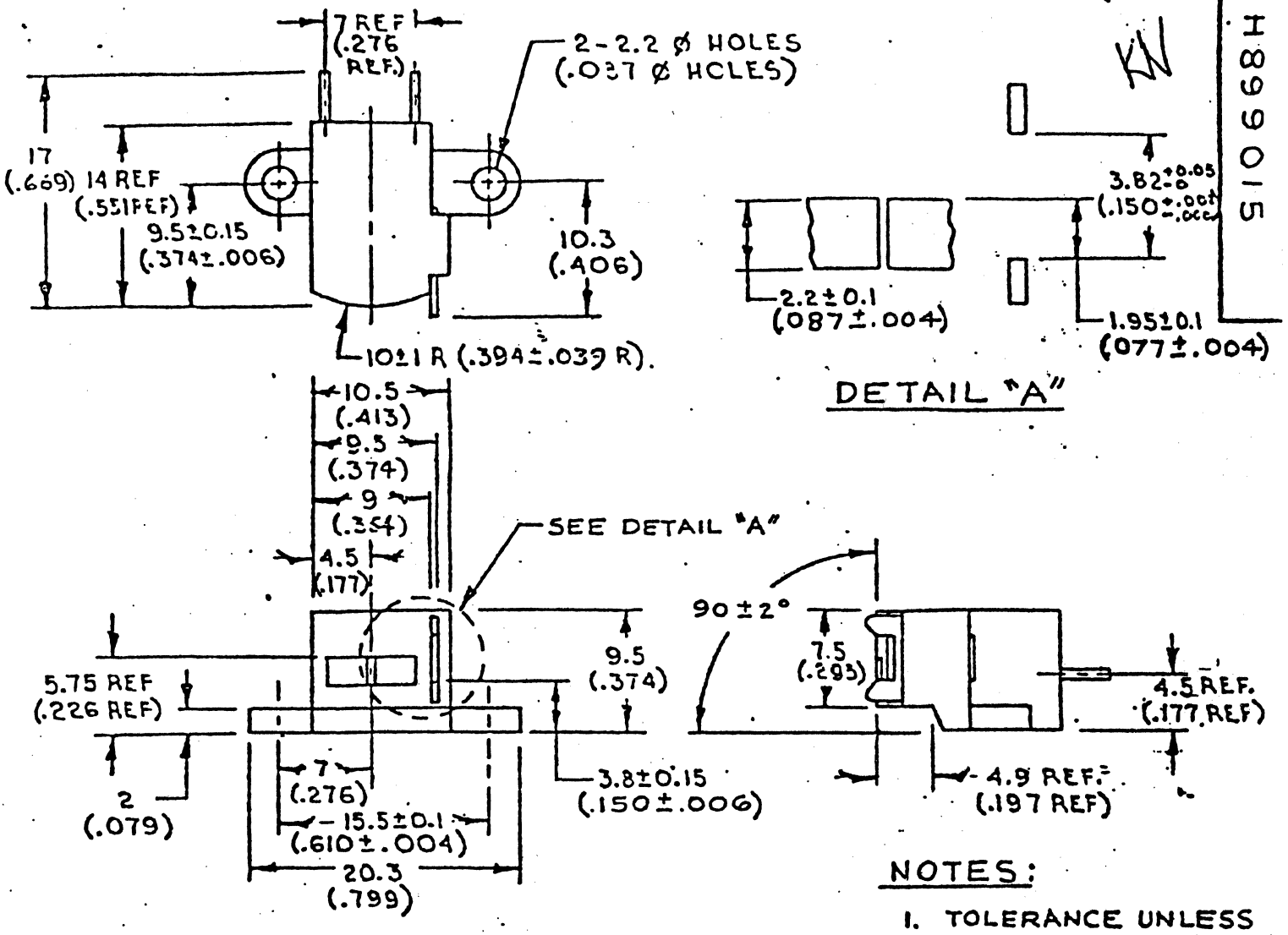
BIAS CURRENT RESPONSE

IKEJIRI ELECTRIC CO., LTD.
10-3, HONKOMAGOME 2-CHOME, BUNKYO-KU, TOKYO 113, JAPAN.
TEL: 03 (945) 1610
CABLE: IKEJIRIHEAD TOKYO TEX: 272 3244 IKEHD J

F21 74003

H899015

KW



NOTES:

1. TOLERANCE UNLESS SPECIFIED ±0.2 (±.008)
2. METRIC DIMENSIONS HAVE PRIORITY

ELECTRICAL SPECIFICATIONS

1. INDUCTANCE AT 10MV 1KHz, ~0.3 MHY REF.
2. D.C. RESISTANCE - 200 OHMS REF.
3. 100 KHZ IMPEDANCE - 200 OHMS REF
   ERASE VOLTAGE 100 KHz, RMS - 15 VOLTS REF
   ERASE CURRENT FOR 100 KHz - 75 MA REF
4. 60 KHZ IMPEDANCE 110 OHMS ± 25%
   ERASE CURRENT 60KHz 100 MA
   ERASURE 60 dB MIN

MAY 2 1975

SYM	REVISION / DCN	APP.	DAT
B	ADDED 60 KHz DATA - 100 KHz REF ADDED METRIC DIM'S	WW	4/26
A	MADE FROM WAS HF213801		5-31

ITEM	QTY	PART NUMBER	DESCRIPTION

MADE FROM HF 213846 | SCALE 2X | PROJ. | TOOL NO.

HEAT TREAT | FINISH

NORTRONICS COMPANY, INC.
8101 Tenth Avenue North, Minneapolis, Minnesota 55427

DES.			
DR.	K.A.B.	5-17-73	
CKD.	[illegible]	5-16-73	
APP.	[illegible]	5-16-73	
	SIG.	DATE	

TOLERANCE UNLESS NOTED

PLACES	IN.	MM
ONE PL (.0)	± .030	0,
TWO PL (.00)	± .015	0, 1
THREE PL (.000)	± .003	
ANGLES	± 1°	1°

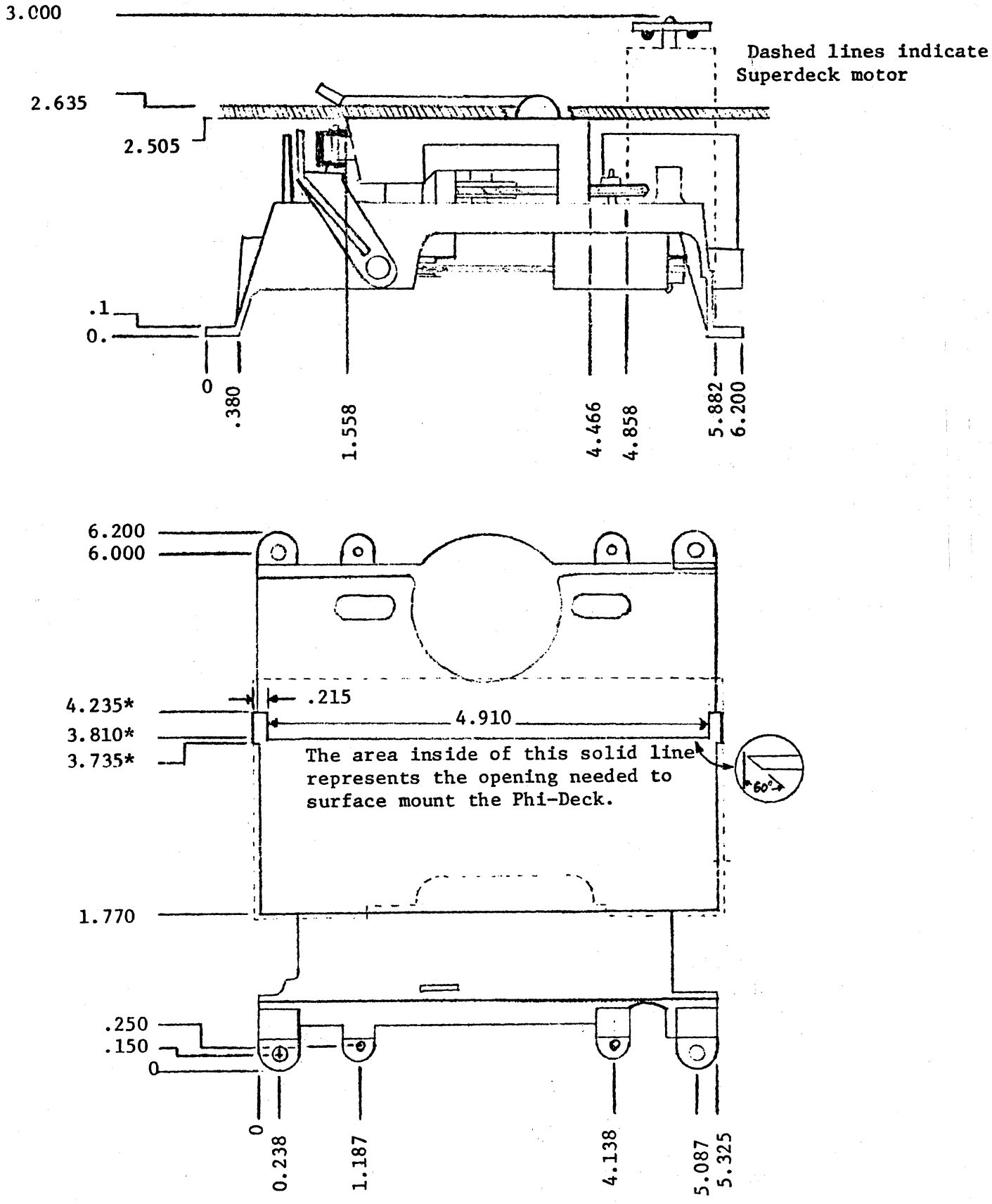
DO NOT SCALE PRINT

REV. B

TITLE 1 CHAN 2 TRACK CASSETTE ERASE HEAD

DWG. NO. H899015 F22

DECK MOUNTING LOCATIONS



*Less .125" for well designed prior to revision - (3/8/76)

F12

PHI-DECK MAINTENANCE

In order to obtain a longer more trouble-free life and to insure proper performance, a routine maintenance check should be made as outlined in the following schedule. The steps and time involved were derived from Triple I testing and from normal procedures involved in tape transport maintenance.

Every 500 hours:

1. Clean the transport thoroughly. Remove any accumulated dust, metal oxide particles and lint with an air hose or brush.

2. Using a thin needly-type applicator, oil* the starwheel shaft bearings, headbar pivot sleeve bearings, and the capstan bearing. Remove any excess oil on external surfaces.

3. Remove the two reel rest assemblies and post. Clean any oil or buildup from the insides of the assembly. This can be done by running a thin rag along the inside. Clean any oil or buildup from the reel post. Oil* the post at the bearing surfaces and under the metal cap then reassemble to the deck. Remove any excess oil on the external surfaces.

4. Clean the head with G.C. magnetic head cleaner solvent or equivalent and wipe dry.

5. Clean the pinchroller with G.C. rubber drive cleaner solvent or equivalent and wipe dry.

6. De-magnetize the head.

7. Check and adjust as required the following functions:

   a. Head depth (Set with an Information Terminals M-300 Gauge)
   b. Pinchroller spring tension (pinchroller should be pulled from the capstan with a force of 250-275 grams at the outside edge of the pinchroller bracket).
   c. Head height and azimuth.
   d. Capstan drive motor speed plus Wow & Flutter. (Wow & Flutter problems are usually caused by the drive belts.)

8. For best performance replace all belts during the 500 hour routine maintenance.

* Use a light weight oil such as 3 in 1 oil, or SAE 10W

PATCHING THE O.S. I/O ROUTINES

The Version 3.0 Input/Output Routines are listed here for your reference (These are not the same in the SOL Operating System).

If your I/O requires modification of these routines, first read and understand what is going on. If you do not understand these routines, you should obtain competent help in this endeavor.

COMMENTS:

1. The addresses shown are relative to your O.S. initilization entry point. (i.e. 3000 for 16K O.S., 5000 for 24K O.S., etc.)
2. The assembly shown is for the following I/O configuration.
   A. Status Port - 0
   B. Data Port - 1
   C. Input Ready - B0 Positive True
   D. Output Ready - B7 Positive True
   E. An escape (1BH) is the abort character.
   F. A line feed (0AH) is interpreted as a backspace and a 3CH is substituted for it by the output routine.
3. WIN - The character input routine with echo.
4. WOUT - A "wait for output ready" routine.
5. OUT - The character output routine. A carriage return will produce a following line feed.
6. NOLF - A branch point.
7. NFL2 - A routine called by the tape read and write routines which outputs a character without sensing status. It is best to insert a return here if you are patching the I/O routines. (There is not a great amount of time to do console I/O during the tape write operation.)
8. CRLF - A carriage return line feed routine.
9. CHECKC - A routine to check for the abort character. Status is returned as zero if it was sensed.
10. You may skip the normal I/O personalization of the program by changing the jump at the O.S. entry point from C3 0C x0 to C3 A5 x0.

```
06D0             0010 *
06D0             0020 *  MECA OS I/O ROUTINES
06D0             0030 *  FOR THE STAND ALONE OS
06D0             0040 *  1-19-78
06D0             0050 *
06D0             0060 *  INPUT ROUTINE...
06D0             0070 *     AS SHOWN:
06D0             0080 *        STATUS PORT = 0
06D0             0090 *        INPUT PORT = 1
06D0             0100 *        INPUT READY BIT MASK = 1
06D0             0105 *            INPUT READY BIT IS POSITIVE TRUE
06D0             0110 *
06D0 DB 00       0120 WIN        IN    STATUS
06D2 E6 01       0130            ANI   INRDY
06D4 CA D0 06    0140            JZ    WIN  MAY WANT A JNZ HERE
06D7 DB 01       0150 WW2        IN    DPORT  GET DATA
06D9 F5          0160            PUSH  PSW    SAVE IT
06DA CD EB 06    0170            CALL  OUT  PRINT IT
06DD F1          0180            POP   PSW   GET IT BACK
06DE F6 80       0190            ORI   80H   SET THE HIGH ORDER BIT
06E0 C9          0200            RET
```

```
06E1                    0210 *
06E1                    0220 *  WAIT FOR OUTPUT READY ROUTINE
06E1                    0230 *
06E1 F5                 0240 WOUT       PUSH  PSW    SAVE DATA
06E2 DB 00              0250            IN    STATUS
06E4 E6 80              0260            ANI   ORDY     CHECK OUTPUT READY
06E6 CA E2 06           0270            JZ    WOUT+1    MAY WANT A JNZ HERE
06E9 F1                 0280            POP   PSW     GET DATA BACK
06EA C9                 0290            RET
06EB                    0300 *
06EB                    0310 *  ACTUAL CONSOLE OUTPUT ROUTINE
06EB                    0320 *
06EB CD E1 06           0330 OUT        CALL  WOUT   WAIT ON IT
06EE E6 7F              0340            ANI   7FH   KNOCK OUT HIGHEST BIT
06F0 FE 0A              0350            CPI   0AH   CHECK FOR A LINE FEED
06F2 C2 F7 06           0360            JNZ   NOLF  IF NOT DO NORMAL OUTPUT
06F5 3E 3C              0370            MVI   A,3CH  IF YES CHANGE TO A '<'
06F7 D3 01              0380 NOLF       OUT   DPORT    PRINT IT
06F9 FE 0D              0390            CPI   0DH  CHECK FOR A CARRIAGE RET
06FB C0                 0400            RNZ   IF NOT QUIT
06FC CD E1 06           0410            CALL  WOUT  IF SO, THEN GIVE
06FF 3E 0A              0420            MVI   A,0AH  HIM A LINE
0701 D3 01              0430 NLF2       OUT   DPORT   FEED TOO.   *
0703 C9                 0440            RET
0704                    0450 *
0704                    0460 *  CARRIAGE RET LINE FEED FUNCTION
0704                    0470 *
0704 3E 0D              0480 CRLF       MVI   A,0DH    GET A CARR. RET
0706 CD EB 06           0490            CALL  OUT      GO DO IT
0709 C9                 0500            RET
070A                    0510 *
070A                    0520 *  ROUTINE TO CHECK FOR THE ABORT
070A                    0530 *  CHARACTER FROM THE INPUT
070A                    0540 *  DEVICE..STATUS=0 IF FOUND
070A                    0550 *
070A DB 00              0560 CHEKC      IN    STATUS
070C 2F                 0570            CMA   PUT A NO-OP HERE IF NEG. TRUE
070D E6 01              0580            ANI   INRDY   CHECK FOR INPUT
070F C0                 0590            RNZ   IF NOT DON'T LINGER
0710 DB 01              0600            IN    DPORT   IF SO,GET IT.
0712 E6 7F              0610            ANI   7FH    KNOCK OUT HIGHEST BIT
0714 FE 1B              0620            CPI   ABORT   CHECK FOR ABORT CHARACTER
0716 C9                 0630            RET
0717                    0640 STATUS     EQU   0
0717                    0650 DPORT      EQU   1  DATA PORT
0717                    0660 INRDY      EQU   1  INPUT READY MASK
0717                    0670 ORDY       EQU   80H  OUTPUT READ MASK
0717                    0680 ABORT      EQU   1BH  ABORT CHARACTER
```

*NOTE: Internal routines call NLF2 and the function should be no-op'ed by putting a return here if you make significant alterations to I/O routines.

OPTIONAL APPLICATION NOTES AND SOFTWARE

Send Check for total amount, plus $1.50 shipping and handling. California residents add 6% Sales Tax. PLEASE NOTE: MINIMUM ORDER IS $10.00

A.N.#	TITLE	COST
101	Digital Read Signal Conditioning - Analog Read Signal Conditioning	$1.00
102	Automatic Gain for Recording Level Control	.50
103	Interfacing the MECADRIVE to a Tarbell Cassette Interface	1.00
104	Rules Governing Program Control of the MECADRIVE	1.00
106	Low Cost UART Interface for the MECADRIVE	1.00
111	Disabling the ALPHA-1 Bootstrap Function	.50
112	Changing the ALPHA-1 Addresses	.50
114	Relationship Between the Lineal Tape Location and the Pulse Count	1.00
115	Z-80 Modifications	1.00
117	MECA Loader for Systems with PROM	1.00
118	Sub-Routine Description for Source Code Listings	3.00
121	Modifications for use with Processor Technology SOL (Requires Special O.S.)	1.00
122	ACR/TARBELL Load Application Note (See price of software below)	1.00
123	Use of Multiple I/O Devices with Version 3.0 O.S.	1.00
124	Bringing up the O.S. on Turnkey Systems (Vector Graphics/Cromemco Z-2, etc.)	1.00
125	Special Instructions for Bringing up MECA BASIC with Non-Standard I/O	1.00
126	Saving String Variables Under MECA BASIC	1.00
127	Instructions to Delete Asterisks & Pluses from Mits 4.0 BASIC to MECA Patch	.50
128	Special Application Note for TDL Xitan Owners	1.00
130	Mixing String and Numeric Data in Arrays using Extended MECA BASIC	1.00

OPTIONAL SOFTWARE:

ACR/TARBELL LOAD: For users with a large program base stored on ACR or Tarbell. 5.00

GAME TAPE: Hurkle is Hiding, Chomp, Matches, Star Trek (Runs under Extended BASIC) 5.00

DYNAMIC DEBUGGER: A powerful debugging facility with Program Display, Program Execution Control & Program Monitoring Functions. NOTE: Because DDS requires Addressable Cursor Control, we can support only Poly-VTI, ADM-3,Proc Tech VDM or SOL. 30.00

PDS1: A very sophisticated Editor/Assembler for use with Systems of 16K or more. Includes Unlimited Symbol Table, Multiple Files & more liberal naming requirements. 40.00

4.4 8K BASIC: MECA Microsoft 8K BASIC (requires 16K RAM) 75.00

4.4 EXTENDED BASIC: MECA Microsoft Extended BASIC (requires 32K RAM) 150.00

PATCHES TO 4.0 and 4.1 MITS EXTENDED BASIC: Note, does not include BASIC 25.00 ea

SOURCE CODE LISTING: Source Code in machine readable form (useful for those knowledgeable in 8080 Assembler Language Programing) 45.00

SPECIAL OPERATING SYSTEMS: Processor Technology SOL or Poly-VTI or Proc. Tech.VDM or Poly-88 (BE SURE TO SPECIFY ONE OF THESE since each one is different!) 30.00

WORD PROCESSING PROGRAM: Electric Pencil - requires 3P+S I/O, Polymorphic Driver and Anderson-Jacobson Selectric with Parallel ASCII Interface. 100.00

PAYROLL PROGRAM: For a company with up to 50 employees. 50.00