D & N MICRO PRODUCTS, INC.

The D & N Micro Products' MEM-CM9 card will support 24K of Static Ram as well as an OSI type floppy disk controller.

The card uses industrial standard 2114 type memory chips. Memories, assembled and tested by D & N, are supplied with 300ns. access time chips for card operation with 6502 clocks up to 2 Mhz. and Z-80 CPU clocks up to 4 Mhz.

CIRCUIT DESCRIPTION

The 24K of memory is divided into two independent blocks each with DIP SWITCH address selection. One block is 8K in size with U13, a magnitude comparator, performing the decoding function. The second block is 16K in size with U12 performing the decoding. The memory card may also be addressed into 1 of 16 memory partitions by the use of U7. Two cards may be placed in each partition, thereby allowing 48K of memory in each partition, for use in multiterminal time shared systems.

All address lines are buffered to minimize loading on the backplane bus. Since the 2114 type memory is a static chip, the logic inversion of address lines AØ through A9 does not affect their operation. Likewise address lines AØ through A9 are arranged on the P.C. board for minimum run length and may and may not necessarily go to pin AØ through A9 in the memory chip. Since the same chip address is present during a read or write function, the output data will be correct. Each address line is terminated with a 1K and 470 ohm resistor. The use of these line terminators reduces noise on the memory card.

Each 1K of memory is enabled by the use of U3, U6, and U8 decoders. Each of these decoders is enabled by the magnitude comparators U12 or U13.

U1 and U4 interface the data line to the system backplane. U1 and U4 normally pass data from the system bus to the data input/outputs of the 2114's. When the board is enabled, i.e. U13P6 or U12P6 go high, Ø2 is high and Read/Write line is high, U1 and U4 change direction and pass data from the memories to the system bus. When the board is enabled and a Write function is requested (R/W line low), data is written into the memory chips when Ø2 goes high.

The MEM-CM9 card contains a floppy disk controller which

is compatible with OSI software using 5¼" or 8" drives. The controller is designed to operate with disk drives having separated clock and data outputs. The MEM-CM9 also includes an OSI-type real time clock. The real time clock is derived from the crystal controlled write circuit but is not required for disk operation.

Address decoding for the floppy controller is done with U75 and U76. When U75P6 goes high, the controller function is enabled. The transmitted signal to the floppy disk is generated by U62 and U65. The transmitter clock one shot fires on the negative edge of the signal at U65P1 producing a negative pulse which is always sent to the disk. The transmitter data one shot fires on the positive edge of the signal at U65P10 producing a positive pulse. This pulse is gated with the transmit data coming from ACIA U62, and combined with the transmitter clock, to provide the write data signal to the floppy disk.

The received separated clock pulse output from the floppy disk is stretched via a one shot and applied to the receive clock input of the ACIA. The separated data pulses from the floppy disk are stretched so the data is valid during the beginning of the next clock pulse.

The PIA U63 provides all handshaking control signals to the floppy disk. The real time clock counts down the crystal oscillator and applies pulses to the CA1 and CB1 inputs of the PIA. The PIA is programmed to cause IRQ interrupts upon the receipt of these pulses. The real time clock function is not required for proper disk operation.

CONSTRUCTION NOTES

Although not required, it is highly recommended that sockets be used in all IC locations. This will aide in troubleshooting and may prevent damage to the IC's. Memory chips and bi-directional bus drivers (8T26) are sensitive to static electricity and should only be handled on a conductive surface. It is suggested to place aluminum foil on the table top and then placing memory devices in their anti-static tubes on the foil. Place the memory card on the foil and remove the memory from the tubes and insert into the card.

All soldering on the P.C. card should be done with a pencil tip iron of only 15 to 25 watts.

ASSEMBLY INSTRUCTIONS

Memory Section

( ) Install IC sockets in all locations U1 through U61.
( ) Using an Ohm Meter, check for solder bridges between lines running through the memory matrix.
Install the following resistors:
( ) R6 through R11, 4.7K ohm
( ) R12 & R13, 1K ohm
( ) R14 & R15, 470 ohm
( ) R16 through R24, 1K ohm
( ) R25 through 33, 470 ohm
( ) Check for solder bridges in the area of R12 through R33.
( ) Install Dip Switch at S1.
( ) Install Data Direction diode D2.
( ) Wait diode D1 required only if low speed memory chips are used with a 2 MHz. CPU clock.
( ) Install 24 .1mfd disc capacitors.
( ) Install 6 47mfd 10V capacitors.
Install:
( ) Jumper wire JW2, 3 & 4 if +5 Volts is to come from the normal 48 pin backplane. Use J2 if external power input is desired. See Fig. 1.
( ) Install Jumper wire JW1 if board is built for memory only (no floppy controller). See Fig. 1.
( ) Install Jumper wire JW5 between pin 4 and 5 of U8. See Fig. 1.
( ) If memory partitioning is desired, install the following:
    ( ) Dip Switch S2
    ( ) R1 through R5, 4.7K ohm.
    ( ) IC U7
( ) Check for solder bridges with the card placed in front of a high intensity lamp.
( ) Install IC's U1 through U6 into their sockets.
( ) Install IC's U8 through U13 into their sockets.
( ) Install memory chips in desired block. See Fig. 2.
( ) Set S1 to desired address. See Table 1.
    NOTE: Be sure the 8K and 16K blocks are set to an address that do not conflict with each other, or do not conflict with memory (ROM or RAM) already in the system. Example; C4 system with 8K of memory, set new 8K block to 2ØØØ-3FFF and the 16K block to 4ØØØ-7FFF, even if there are no memory chips in the 16K block.
( ) If memory partitioning is used, refer to Table 2 for correct user address.

Disk Controller Section

( ) Install IC sockets in all locations U62 through U77.
Install the following resistors:
( ) R34 through R39, 220 ohm.
( ) R40, 470 ohm.
( ) R41, 220 ohm.
( ) R42 through R48, 390 ohm.
( ) R49, 4.7K
( ) R50 through R58, 470 ohm.
( ) Check for solder bridges in the area of R34 through R58.
( ) Install Pots R60, 70, 72, 74.
( ) Install IRQ jumper wire.

( ) Jumper U71, U72, and U73 Pin 9 to U71 Pin 8
( ) Install C13 a 390pf cap. from J3 Pin 5 to J3 Pin 12
( ) Install R59, 65, 73,75 4.7K ohm
( ) Install R66 & R68, 220 ohm.
( ) Install R67 & R69, 390 ohm.
( ) Install R61 - R64, 1K ohm.
( ) Install R71, 4.7K for 8" drives - 12K for 5¼" drives.
( ) Install 3 .1mfd disc capacitors.
( ) Install Capacitors C7 through C12.
( ) Install 4 MHz. crystal.
( ) Install jumper wires per Fig. 3 for 5¼" or 8" floppy disk drive.
( ) Install male MOLEX connectors at J3.

* When building only the floppy disk controller section, install the following:

( ) Jumper wire J2, 3, &4. See Fig. 1.
( ) Install Data Direction diode D2.
( ) Install a Jumper wire from U13 Pin 6 location to U13 Pin 8.
( ) Install a Jumper wire from U12 Pin 6 location to U12 P8.
( ) Install sockets at locations U1, 2, 4, 5, 9, 10 & 11.
( ) Install IC's at U1, 2, 4, 5, 9, 10 & 11.

( ) Install IC's at U62 through U77.

ADJUSTMENT

( ) Temporarily install a jumper wire between J3 P9, 10 & 11.
( ) Adjust R60, 70, 72 and 74 to obtain the waveforms and timing length as shown in Fig. 4, when observed with a triggered oscilloscope.
( ) Remove Jumper wire between J3 P9, 10 & 11.
( ) Connect floppy disk to controller.
( ) Install board into system.

ADDING DISK TO C4 OR C8

A floppy disk controller can be added to a C4 or C8 computer with only one modification to the 502 CPU card. This involves enabling the floppy disk boot software already present in the Monitor ROM. This may be done permanently or with a switch if the use of ROM Basic is desired. Refer to Figure 5 for Monitor addressing change. After making the change, powering up the computer and pressing BREAK key will result in the video display of "H/D/M?". To initialize the floppy disk, type the letter "D". Typing a "M" will enter you into the OSI machine code monitor.

PARTS LIST MEM-CM9

MEMORY

Qty.	Part No.	Description	Qty.	Part No.	Description
3	7485	U7,12,13	3	74LS138	U3,6,8
1	74367	U11	3	7404	U2,9,10
1	7427	U5	2	8T26	U1,4
48	2114	U14-61	11	4.7K	R1-11
11	470 ohm	R14,15,25-33	11	1K	R12,13,16-24
1	1N914	D2	6	47mfd 10V	C1-6
24	.1mfd	Capacitor	4	14 Pin Sockets	
9	16 Pin Sockets		48	18 Pin Sockets	
4	Female Molex	Connectors	2	Dip Switch	

DISK CONTROLLER & REAL TIME CLOCK

1	6520 or 6821	U63	1	6850	U62
2	74123	U64,65	2	74367	U66,69
2	7400	U70,77	1	7404	U68
1	7493	U74	1	7410	U67
3	CD4518	U71-73	2	7485	U75,76
4	10K Pot	R60,70,72,74	2	150pf	C8,9
1	360pf	C10	1	1000pf	C11
1	47mfd 10V	C7	1	30pf	C12
3	.1mfd	Capacitor	9	220 ohm	R34-39,41,66,68
5	4.7K	R49,59,73,75,65	9	390 ohm	R42-48,67,69
10	470 ohm	R40,50-58	4	1K ohm	R61-64
1	4.00 MHz.	Xtal	1	40 Pin Socket	
1	24 Pin Socket		9	16 Pin Sockets	
5	14 Pin Sockets		2	Male Molex	Connectors
			1	390pf	C13

R71 4.7K for 8" disk drives
R71 12K for 5¼" disk drives

When building only disk controller section, add U1,2,4,5,9,10 & 11 from memory section.

ADDRESS DECODING

16K Block

Address	S1-4	S1-5
0000-3FFF	on	on
4000-7FFF	off	on
8000-BFFF	on	off
C000-FFFF	off	off

If your system already contains 32K of memory and you are adding 16K of memory, Set the 16K block to address 8ØØØ-BFFF and the unpopulated 8K section to 8ØØØ-9FFF.

8K Block

Address	S1-6	S1-7	S1-8
0000-1FFF	on	on	on
2000-3FFF	off	on	on
4000-5FFF	on	off	on
6000-7FFF	off	off	on
8000-9FFF	on	on	off
A000-BFFF	off	on	off
C000-DFFF	on	off	off
E000-FFFF	off	off	off

TABLE 1

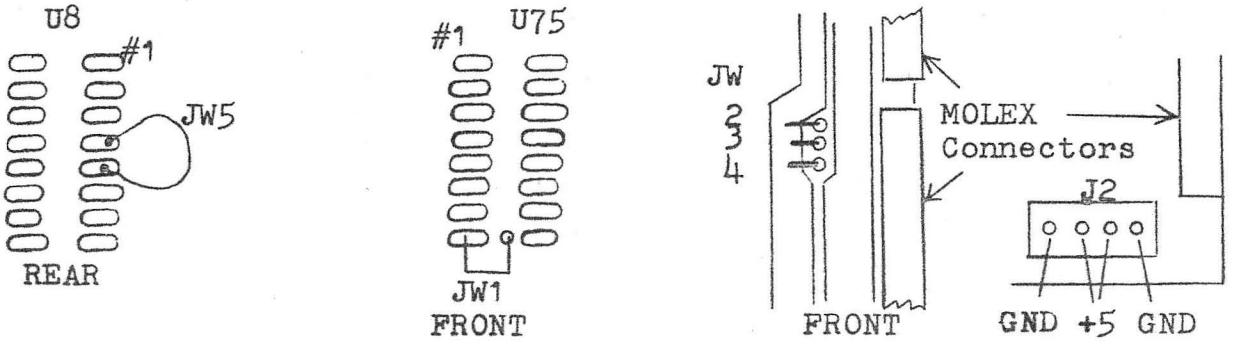
MEMORY PARTITIONING

Enable = S1-3 on Disable = S1-3 off

User Selection for Memory Partitioning

User	S2-1	S2-2	S2-3	S2-4	User	S2-1	S2-2	S2-3	S2-4
#0	off	off	off	off	#8	on	off	off	off
#1	off	off	off	on	#9	on	off	off	on
#2	off	off	on	off	#10	on	off	on	off
#3	off	off	on	on	#11	on	off	on	on
#4	off	on	off	off	#12	on	on	off	off
#5	off	on	off	on	#13	on	on	off	on
#6	off	on	on	off	#14	on	on	on	off
#7	off	on	on	on	#15	on	on	on	on

TABLE 2



Install JW1 only when
not using floppy controller

FIGURE 1

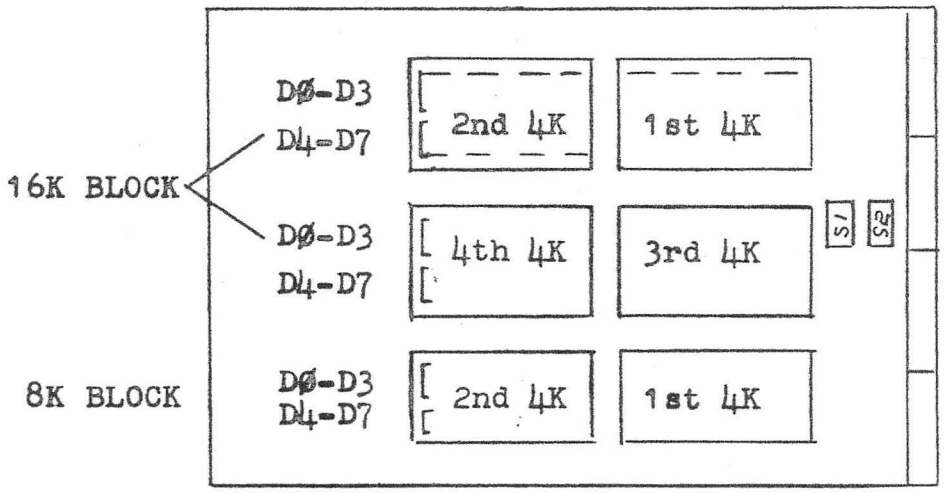
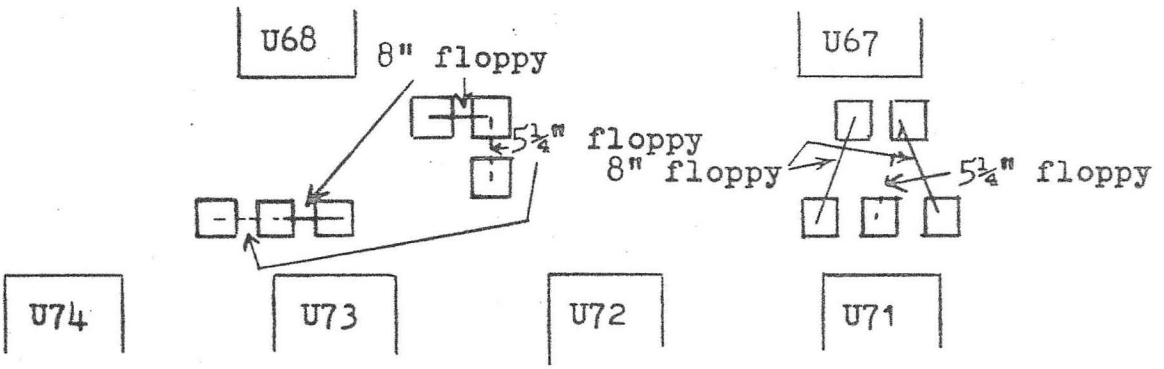


FIGURE 2



5¼" or 8" Floppy controller jumper set up
FIGURE 3

	5¼" Drives	8" Drives
U65 Pin 4	400ns	260ns
U65 Pin 5	400ns	260ns
U64 Pin 4	6µs	2.75µs
U64 Pin 5	1µs	1µs

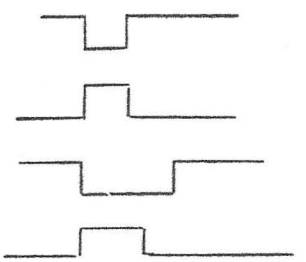
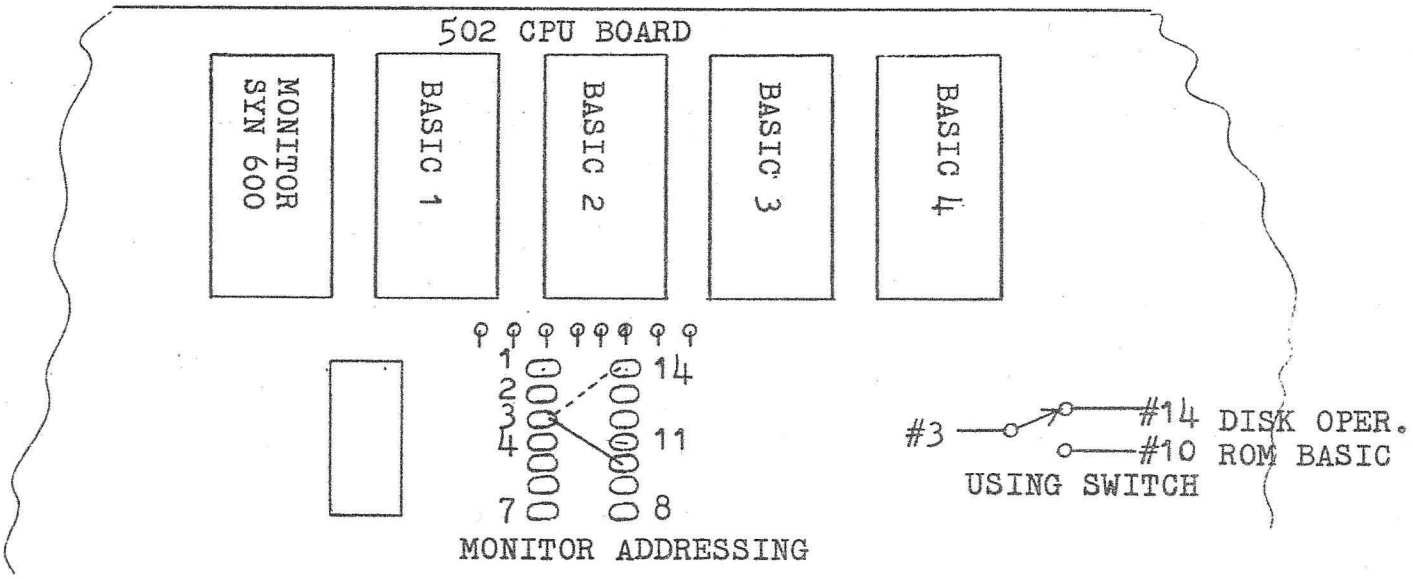


FIGURE 4



MONITOR ADDRESSING

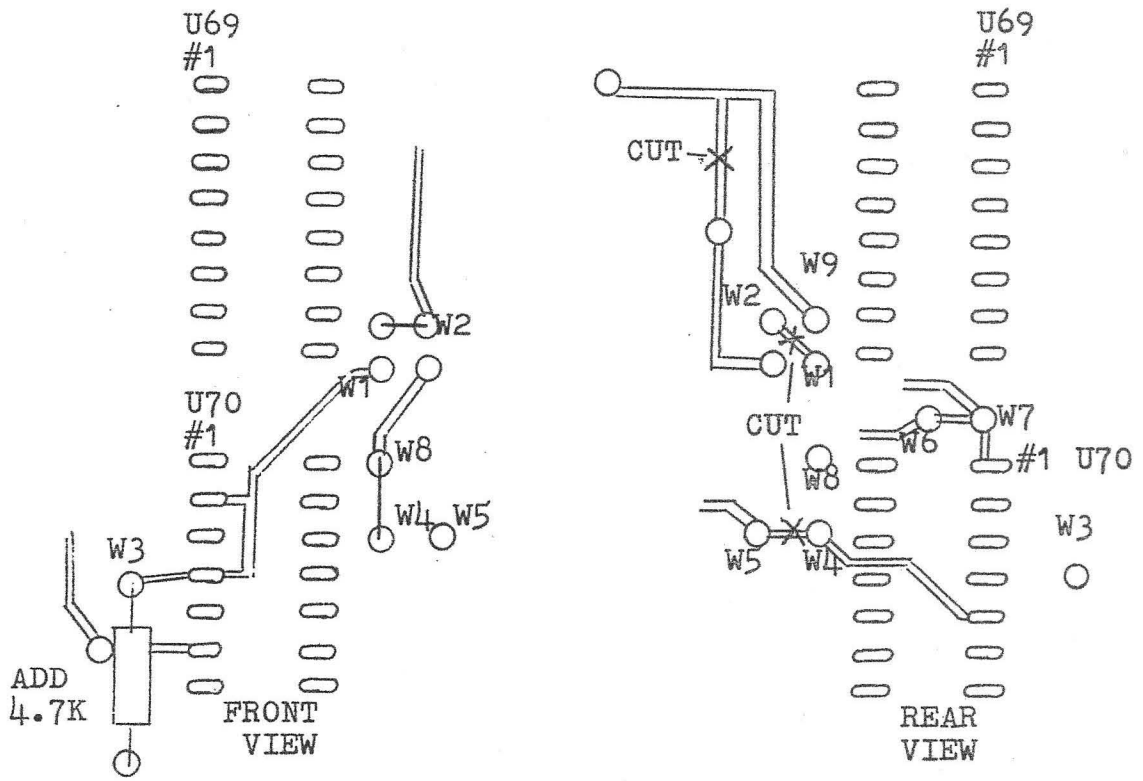
When the SYN 600 Monitor ROM is in the CPU board change the jumper wire between #3 and #10 to #3 and #14.

When the SYNMON V1.0 Monitor ROM is in the CPU board change the jumper wire between #3 and #10 to #3 and #7.

Figure 5

USING DOUBLE-SIDED FLOPPY DISK DRIVES

Double-sided drives can be used with the controller by making the cuts and jumpers shown below. When using this function, J3P3 becomes a binary drive select, i.e., low=drive 1, high=drive 2, and J3P18 becomes the side select output.



JUMPERS LOCATED ON 8" DISK DRIVES

DISK CONTROLLER Pin #		SHUGART 801R and SIEMENS FDD 100-8 Pin #
1	HEAD LOAD	18
2	LOW CURRENT	NC
3	SELECT DRIVE 1	26
4	FAULT RESET	NC
5	STEP	36
6	DIRECTION	34
7	ERASE ENABLE	NC
8	WRITE ENABLE	40
9	WRITE DATA	38
10	SEPARATED CLOCK	50
11	SEPARATED DATA	48
12	GROUND	17,25,33,35
13	GROUND	37,39,47,49
14	+5V DC	NC
15	-9V DC	4
16		NC
17	INDEX	20
18	SELECT DRIVE 2	28
19	WRITE PROTECT	44
20	READY DRIVE 2	22
21	SECTOR	24
22	FAULT	NC
23	TRACK Ø	42
24	READY DRIVE 1	22

SHUGART 801R DISK JUMPER SETUP Drive A, Move Jumper DS1 to DS2 for B

Pin	Pin	Pin	Pin	Pin	Pin	Pin	Pin
Y=J	Z=0	X=0	HL=0	DS=J	A=J	B=J	DC=0
D=0	C=J	DS1=J	DS2=0	DS3=0	DS4=0	800=J	801=0
L=*	T1=0	T2=0	T3=!	T4=!	T5=!	T6=!	

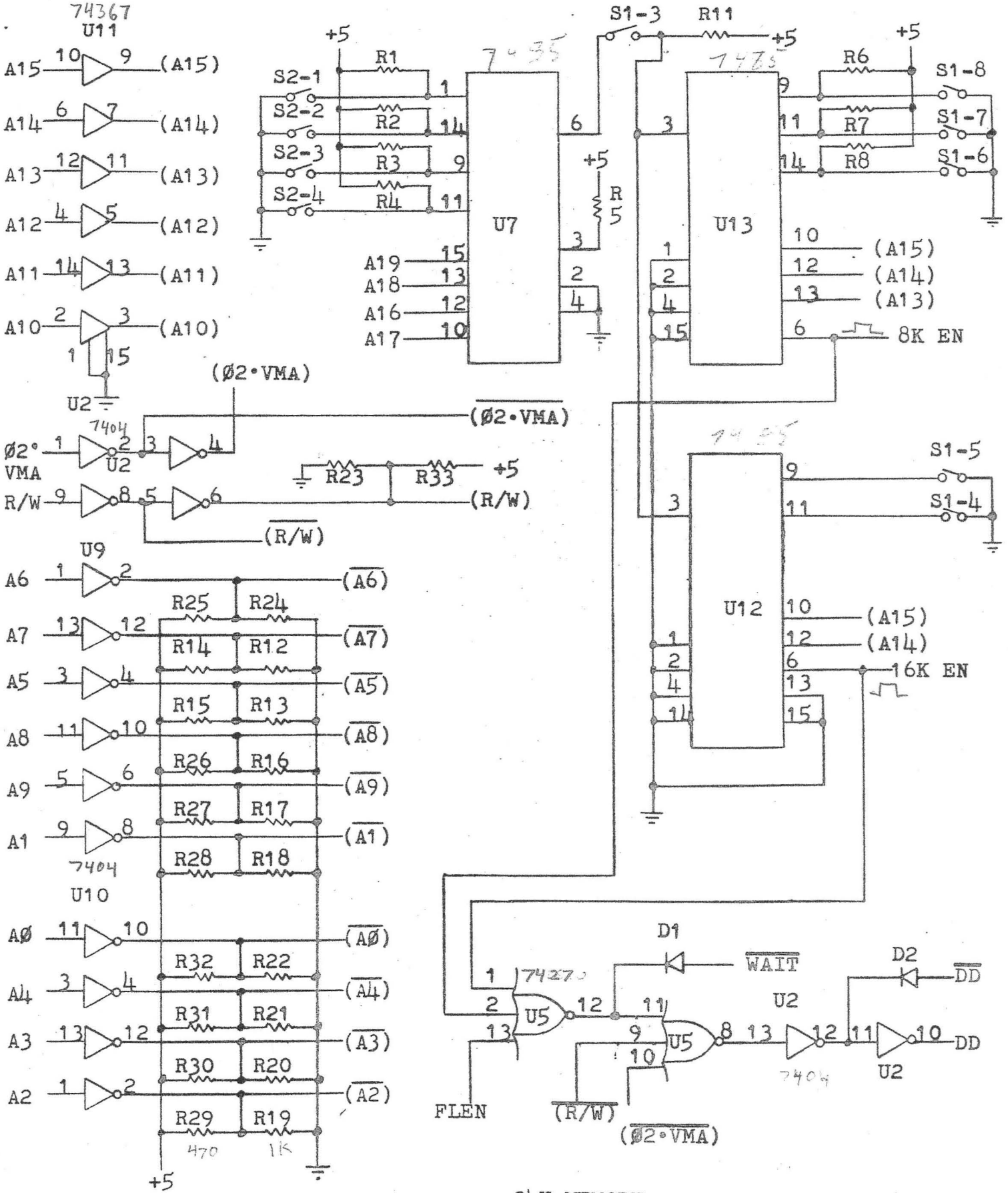
SIEMENS FDD 100-8 JUMPER SETUP Drive A, Move Rad Sel Jumper from Ø to 1 for Drive B

Pin	Pin	Pin	Pin	Pin	Pin	Pin	Pin
V=0	E=J	D=J	B=0	M=J	1=0	2=J	SS=J
H=J	G=0	F=0	R1=J	32=J	SE=J	TE=0	J=0
L=J	K=0	U=J	S=0	R=0	H=J		

Place resistor termination at 7D in last drive.

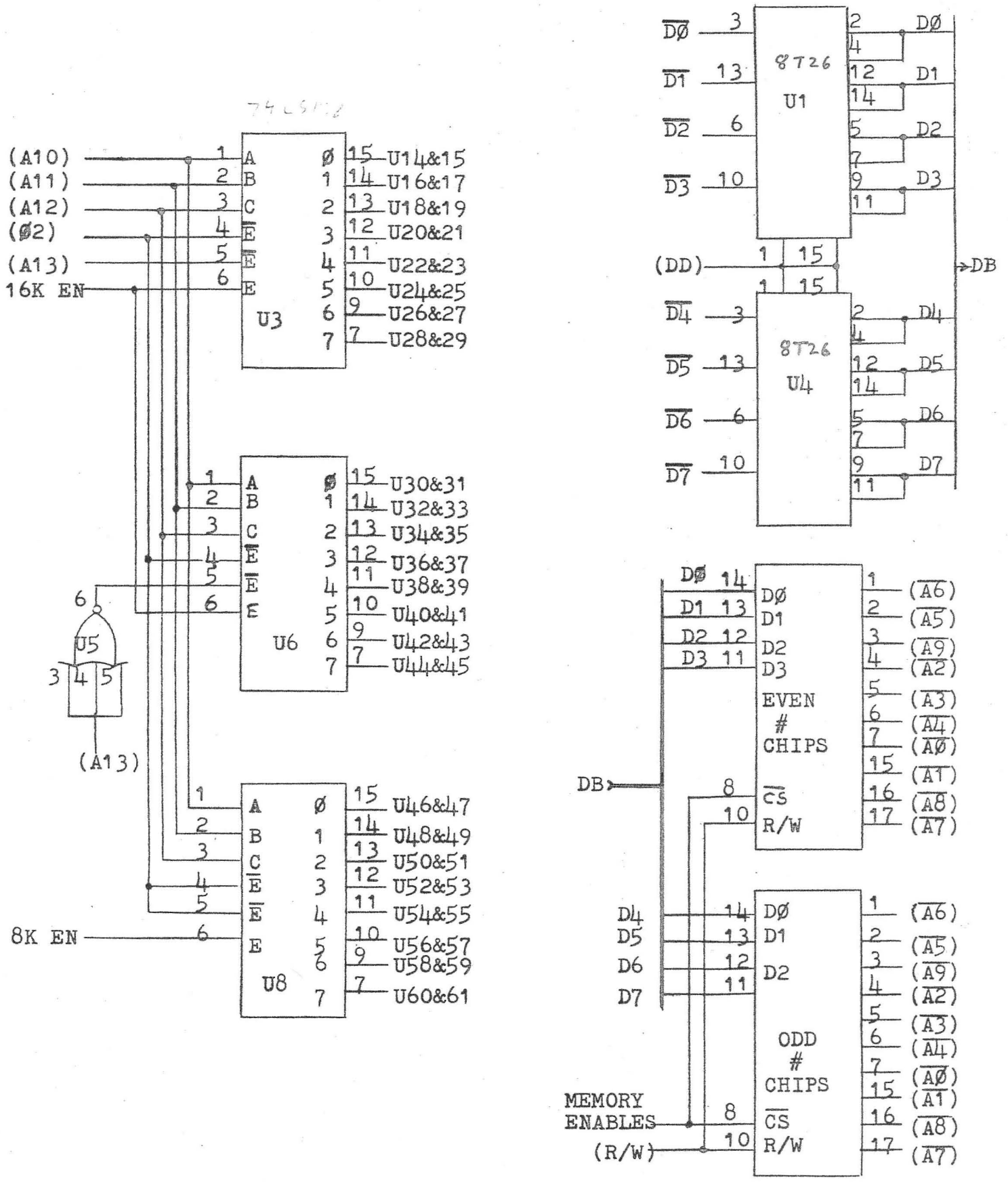
DC Power input

J=Jumpered O=Open *=Open for -7 to -12 volt in. !=Jumper on last



24K MEMORY

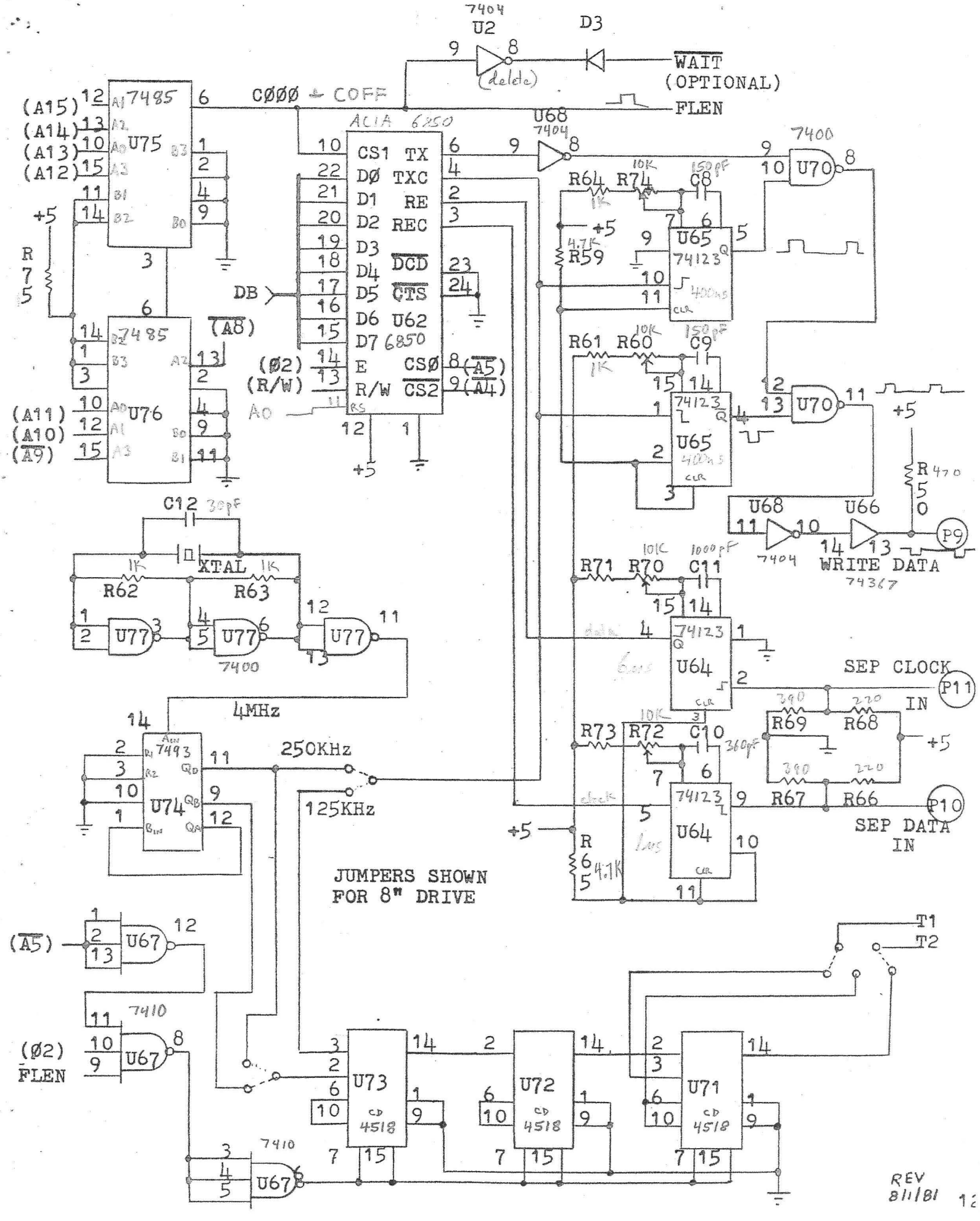
D&N MICRO PRODUCTS, INC.

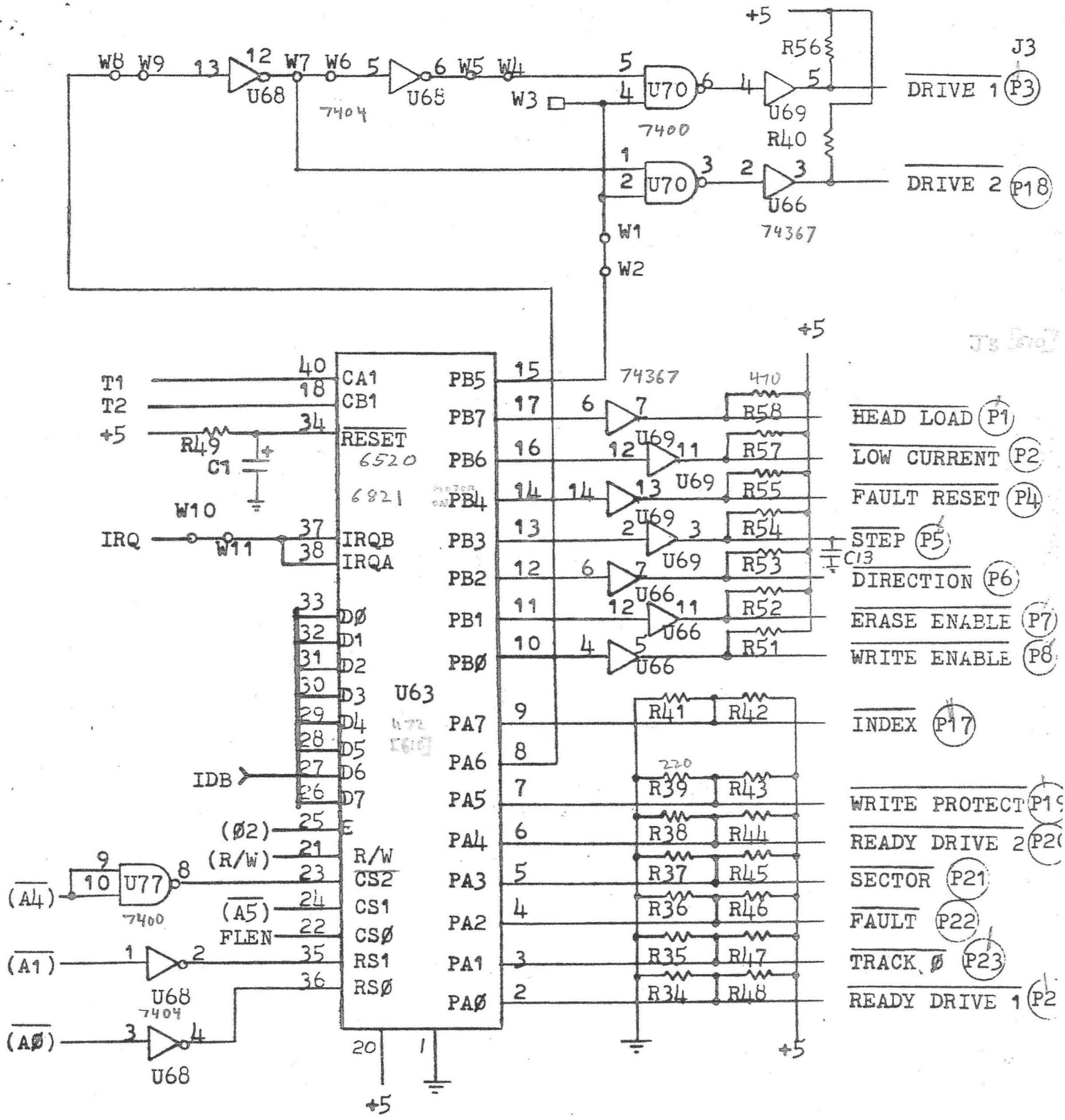


24K MEMORY

D&N MICRO PRODUTCS,INC.

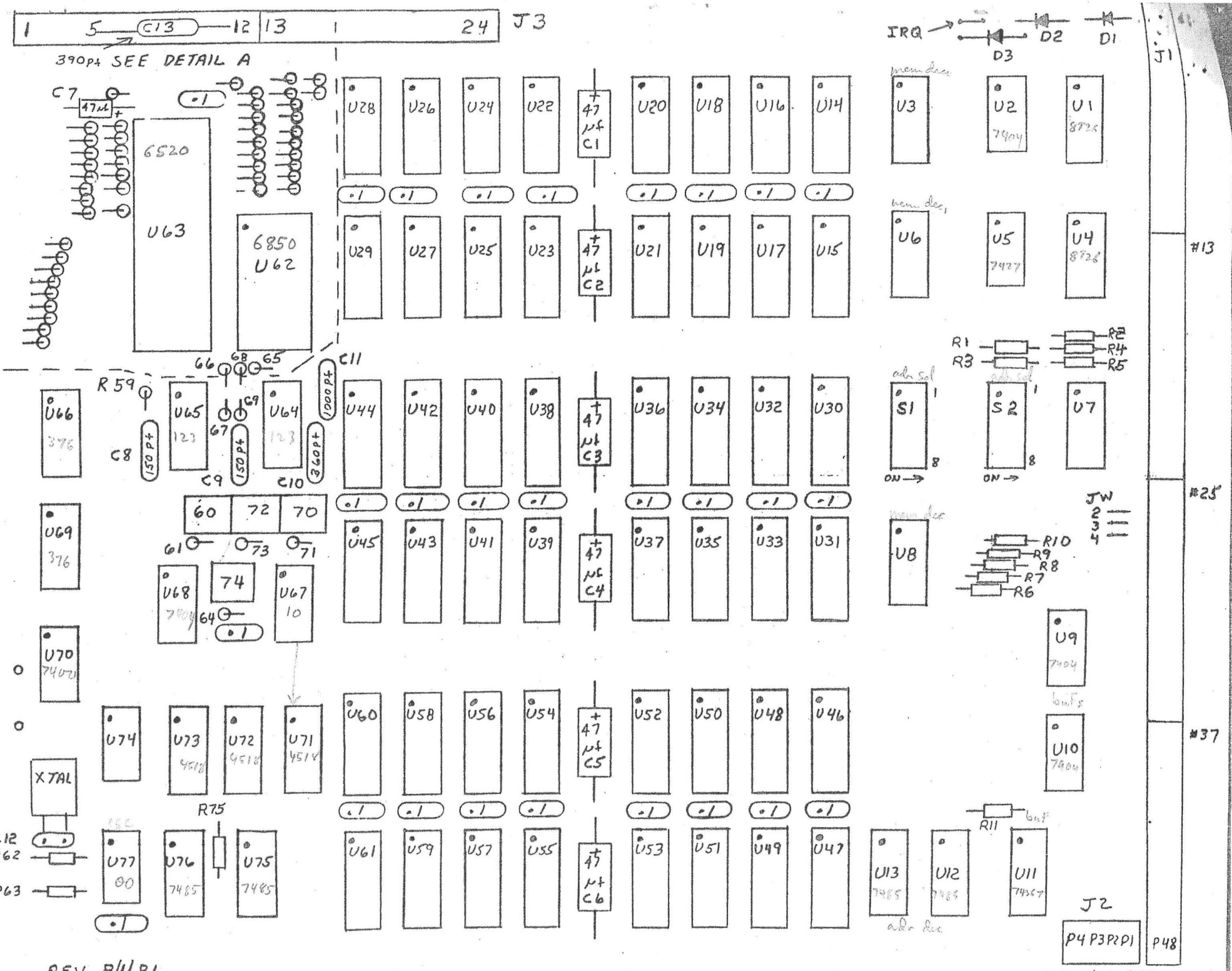
REV

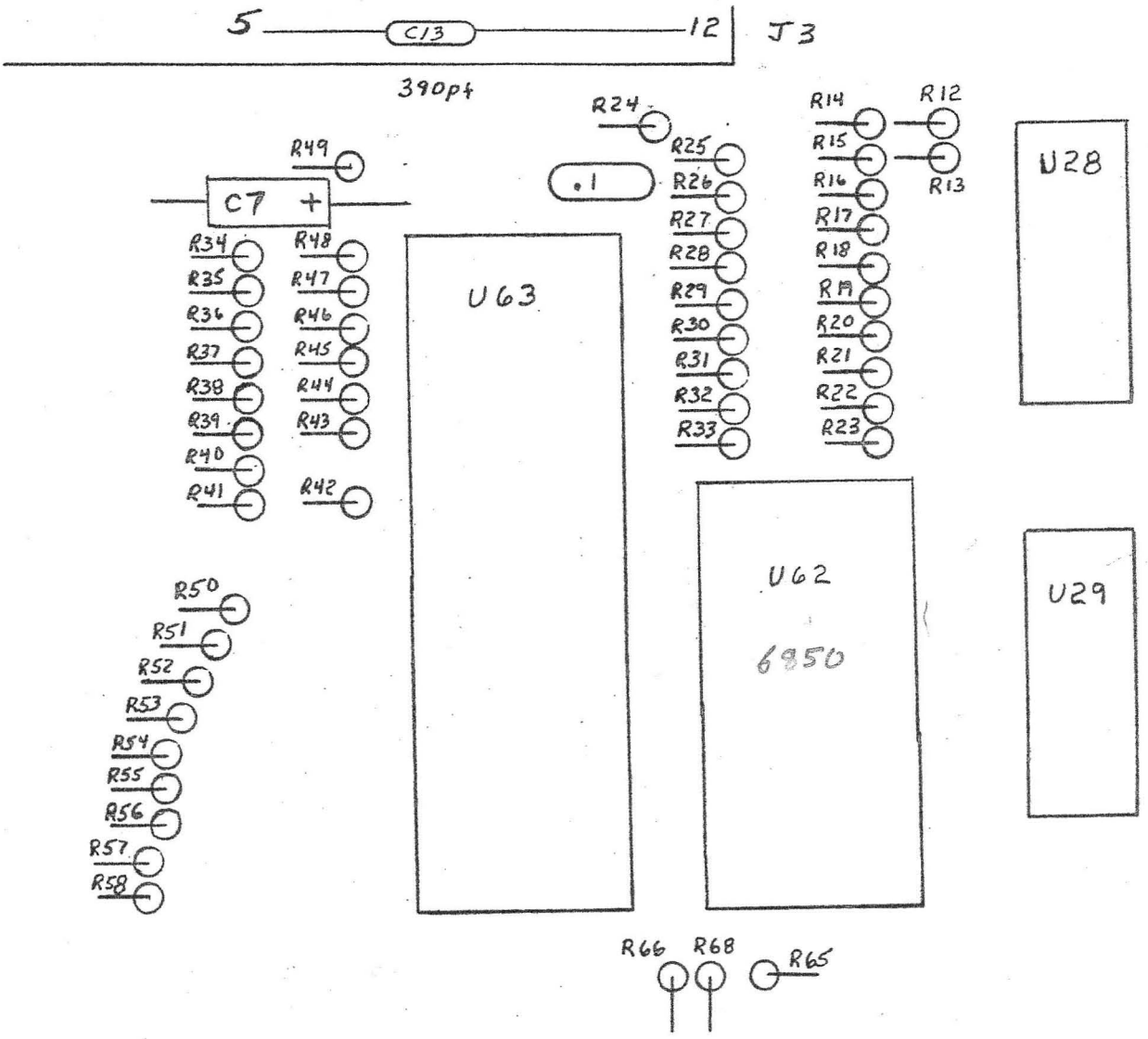

7404
U2
D3
WAIT
(OPTIONAL)
FLEN
CØØØ = COFF
ACIA 6850
U68
7404
7400
U70
U65
74123
U66
WRITE DATA
74367
P9
P10
P11
SEP CLOCK IN
SEP DATA IN
7485
U75
U76
U74
7493
U77
7400
4MHz
250KHz
125KHz
XTAL
C12 39pF
R62
R63
R64
R74
R59
R61
R60
R71
R70
R73
R72
R69
R68
R67
R66
R75
R59
R63
R470
C8
C9
C10
C11
150pF
1000pF
360pF
10K
1K
4.7K
390
220
4.1K
JUMPERS SHOWN
FOR 8" DRIVE
U67
7410
U73
U72
U71
CD 4518
T1
T2
REV 8/1/81



DISK CONTROLLER

D&N MICRO PRODUCTS, INC.

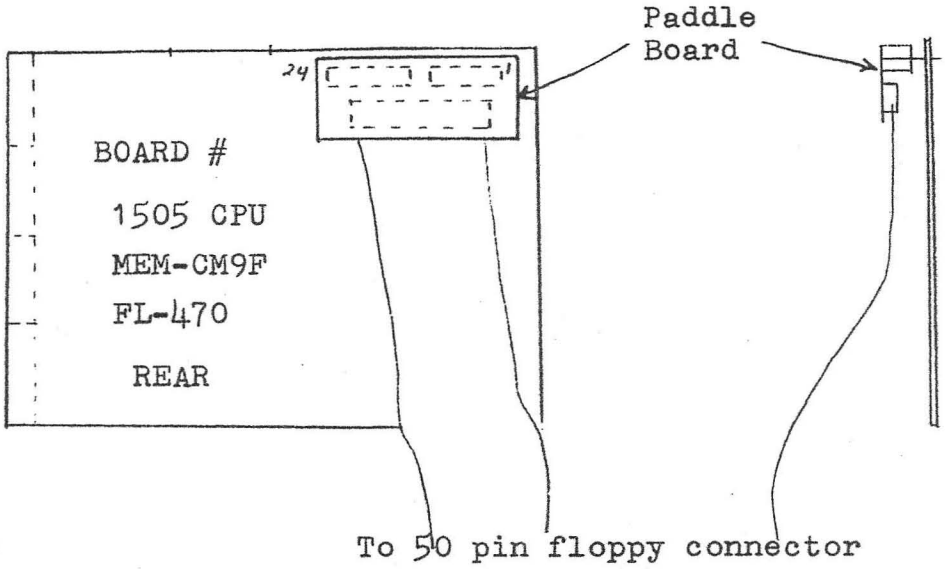

1
5
C13
12
13
24
J3
390pf SEE DETAIL A
IRQ
D3
D2
D1
J1
C7
47µ
6520
U63
6850
U62
U28
U26
U24
U22
47 µf C1
U20
U18
U16
U14
U3
U2
7404
U1
8726
U29
U27
U25
U23
47 µf C2
U21
U19
U17
U15
U6
U5
7427
U4
8726
#13
R1
R3
R2
R4
R5
R59
C11
1000 pf
C8
150 pf
C9
150 pf
C10
360 pf
U66
376
U65
123
U64
123
U44
U42
U40
U38
47 µf C3
U36
U34
U32
U30
S1
S2
U7
ON
60
72
70
61
73
71
74
64
U68
7404
U67
10
U45
U43
U41
U39
47 µf C4
U37
U35
U33
U31
U8
JW
2
3
4
R10
R9
R8
R7
R6
#25
U69
376
U70
7407
U9
7404
U74
U73
4518
U72
4518
U71
4518
U60
U58
U56
U54
47 µf C5
U52
U50
U48
U46
U10
7404
#37
XTAL
R75
R11
C12
R62
R63
U77
00
U76
7465
U75
7465
U61
U59
U57
U55
47 µf C6
U53
U51
U49
U47
U13
7465
U12
7465
U11
74157
J2
P4 P3 P2 P1
P48
REV 8/1/81
D-N MICRO PRODUCTS, INC
GND
+5
GND


5
C13
12
J3
390pf
R24
R49
C7 +
.1
R25
R26
R27
R28
R29
R30
R31
R32
R33
R14
R12
R15
R13
R16
R17
R18
R19
R20
R21
R22
R23
U28
U63
U62
6950
U29
R34
R35
R36
R37
R38
R39
R40
R41
R48
R47
R46
R45
R44
R43
R42
R50
R51
R52
R53
R54
R55
R56
R57
R58
R66
R68
R65

DETAIL A

48 PIN BUS PINOUT

PIN #	FUNCTION	PIN #	FUNCTION
1	$\overline{\text{WAIT}}$	25	+5 VOLTS
2	$\overline{\text{NMI}}$	26	+5 VOLTS
3	$\overline{\text{IRQ}}$	27	GROUND
4	$\overline{\text{DATA DIRECTION}}$	28	GROUND
5	$\overline{\text{DØ}}$	29	A6
6	$\overline{\text{D1}}$	30	A7
7	$\overline{\text{D2}}$	31	A5
8	$\overline{\text{D3}}$	32	A8
9	$\overline{\text{D4}}$	33	A9
10	$\overline{\text{D5}}$	34	A1
11	$\overline{\text{D6}}$	35	A2
12	$\overline{\text{D7}}$	36	A3
13	D8	37	A4
14	D9	38	AØ
15	D10	39	Ø2
16	D11	40	R/$\overline{\text{W}}$
17	Reset	41	VMA
18		42	Ø2•VMA
19	A19	43	A1Ø
20	A18	44	A11
21	A16	45	A12
22	A17	46	A13
23	+12 VOLTS	47	A14
24	-9 VOLTS	48	A15



6 Pin DC power connector

Pin #	Shugart 801	Siemens FDD-100
1	+24 VDC	+24 VDC
2	24 V Gnd	Gnd
3	-5 V Gnd	N.C.
4	-5 VDC Opt. -7 to -16	N.C.
5	+5 VDC	+5 VDC
6	5 V Gnd	N.C.

3 Pin AC power connector

Pin #	Function
1	85-127 V AC input
2	Frame gnd.
3	85 - 127 V AC input