PRELIMINARY

MAINTENANCE MANUAL

FOR THE

1C 436

PATRICK COMPUTER SYSTEMS, INC.

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HOUSING: The housing as shown in Fig.1, consists of three main parts: The outer chassis, the inner chassis and the base. All are made of steel. This protects the electronic components from static discharge, radiation from sources of noise, and allows the unit to run without a fan, because of its excellent heat dissipation. Disassembly of the housing is described at the end of this section.

A. OUTER CHASSIS: The outer chassis is the aesthetic shell of the computer and normally need not be removed for servicing. It contains ventilation holes at the back which must not be blocked. All components are accessable with the inner chassis and the printer removed. If, however, the power transformer should ever have to be changed, removal of the outer chassis is recommended. The keyboard is a subassembly which, when mounted, becomes part of the outer chassis. It must be removed before the outer chassis may be removed. The outer chassis also has a rear cover plate which is attached to the inner chassis which serves as part of the outer skin.

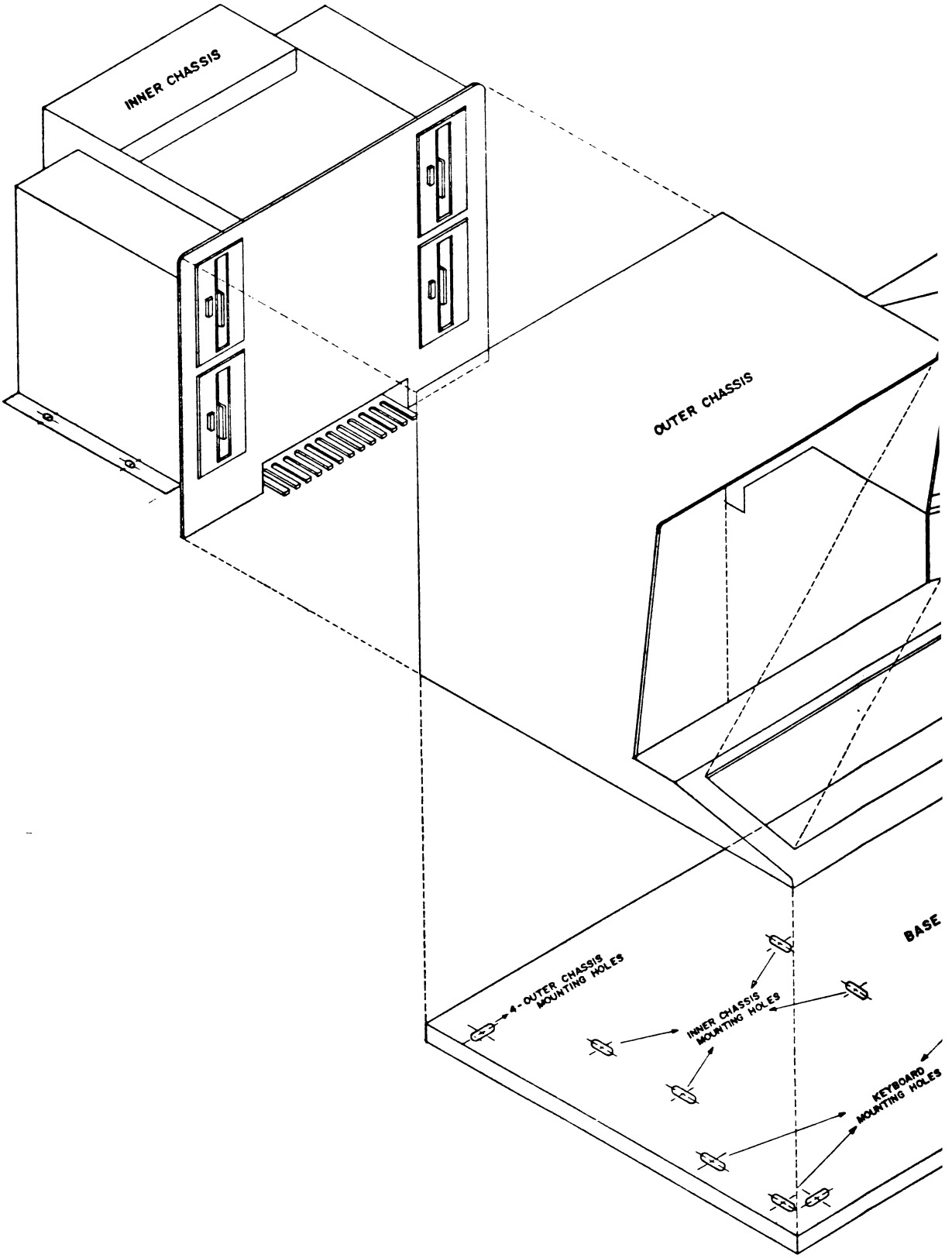
B. INNER CHASSIS: The inner chassis supports the CRT and it's associated electronics, the disk drives, and the motherboard containing the printed circuit board set. the Inner Chassis also provides shielding between the disk drives and the CRT. For servicing, the Inner Chassis may easily be removed allowing access to all of its components. A connector is provided for the power supply, the keyboard and external communications ports to facilitate Disassembly. The Inner Chassis comprises the complete electronics package for the unit and may be operated outside the outer chassis. A power supply, keyboard, printer and communications device may be connected for testing.

C. BASE: The base supports all the iC436 components with the outer and inner chassis being bolted to it. It contains ventilation holes which must not be blocked, and is designed to sit on the open frame stand provided by Patrick Computer Systems, Inc. The base has a laminate wood grain trim and gives the illusion that the unit is sitting on a desk when the stand is used. The power supply is permanently attached to the base and is not removable for external testing. Only individual components should be changed for servicing of the power supply.

D. STAND: The stand consists of four chrome-plated steel tubes with a laminate covered particle board modesty panels which form a rugged and sturdy platform for the unit. The glides are adjustable for uneven floors. It is easily assembled and allows for the proper air flow ventilation of the unit.

E. HOUSING ASSEMBLY: Assembly and disassemby of the unit is easily accomplished. All that is required is a screw driver. Figure1 shows an exploded view of the unit. the keyboard subassembly, the inner chassis, the outer chassis, the base, the stand, and the printer all may be easily removed from each other for individual testing and service. The keyboard and printer must be removed before the removal of the outer chassis.

Keyboard Removal: Remove the four screws from the base which secure the keyboard subassembly. Carefully lift the keyboard assembly from the outer chassis. The top of the keyboard tilts out first. Then unplug the 24 pin DIP ribbon cable connector from its socket on the keyboard PCB and remove the keyboard subassembly.


INNER CHASSIS
OUTER CHASSIS
BASE
4 - OUTER CHASSIS MOUNTING HOLES
INNER CHASSIS MOUNTING HOLES
KEYBOARD MOUNTING HOLES

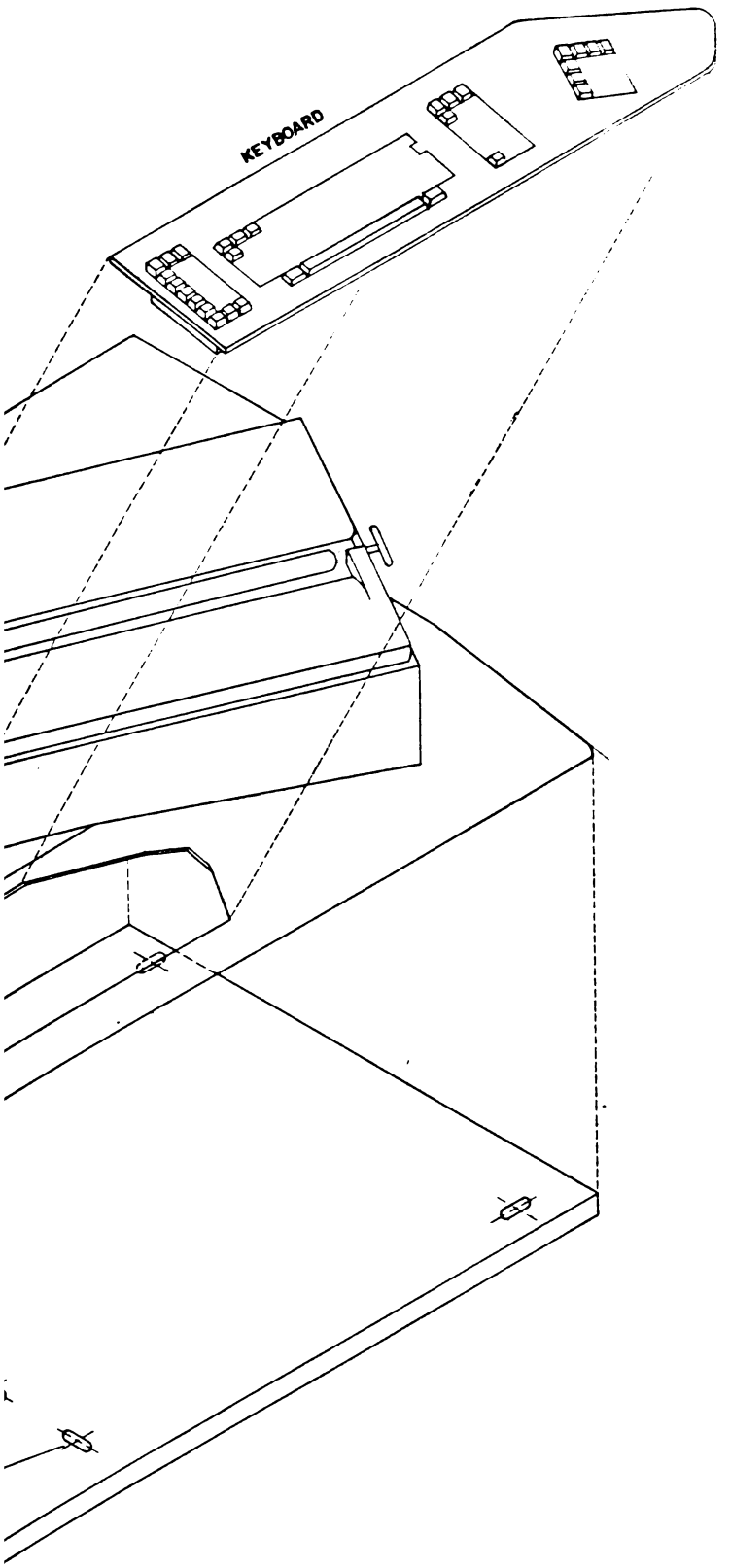


FIGURE 1

PATRICK COMPUTER SYSTEMS, INC.		
SCALE:	APPROVED BY	DRAWN BY V.M.D
DATE: 81-08-06		REVISED
HOUSING ASSEMBLY		
		DRAWING NUMBER

Mother Board: The Mother Board has two functions. It provides support for, and the interconnection of up to ten 10" X 6" Printed Circuit Boards V1A 10-100 pin edge correctors.
It contains the voltage regulators for the Disk Drives and Printer power supply. See figure 2 for physical assembly information and figure 3 for the circuit schematic.

The interconnection of the edge connectors is parallel. The bottom side of the Mother Board provides these interconnections, while the top side provides a ground plan.

The parallel connection of the 100 pin edge connectors form the System bus where all communication between the printed circuit boards take place. We have adopted an S100 Type bus structure.

There are four voltage regulators mounted on the heat sink at the front of the board, two 5 volt 5 amp and two 12 volt 5 amp. Each of the 12 volt regulators provide current for the motors for each vertical pair of Disk Drives. One 5 volt regulator provides the current for the logic on all the Disk Drives while the other 5 volt regulator provides the current for the logic in the Printer. The capacitors in the regulator circuits eliminate high frequency noise to ensure that the regulators will not oscillate. The rectifiers in the 12 volt regulator circuits prevent damage to the regulators from induced currents when the motors are turned off.

Soldered to the Mother board are five cable harnesses. Four of the harnesses are identical and are the power cables for each of the Disk Drives. The fifth comprises the power interconnections between the Mother Board as part of the Inner Chassis sub-assembly and the Power Supply sub-assembly, including 5 volt Printer logic current. The Heat Sink also acts as a guide, preventing the circuit boards from being inserted incorrectly.

Keyboard: The keyboard is a scanning type. Its I/O communications originate on the PKIB. The keyboard block diagram is shown in figure4. Figure 5 shows the schematic.

The keyswitches are solid state, utilizing the hall effect. Each has a strobe line and an active low output. The keyswitch output is active only when its strobe line is low and the keyswitch is pressed. There is no need for de-bounce circuitry.
The scanning of the keyswitch matrix is totally under the control of the software which is resident on the PKIB.

Referring to the Keyboard Block diagram, figure 4, the scanning logic on the keyboard (including the keypad), consists of the following: An Input Port, and Output Port, a Decoder, four Hardwired Keyswitches and two Indicator L.E.D.s.

Input Port: The Input Port has two functions. It accepts and presents a four bit byte (a nybble) from the PKIB Data Bus to the Decoder. It can also illuminate either of the two Indicator L.E.D.s.

DECODER: The Decoder is a four line to one-out-of sixteen line type. Each of its sixteen outputs is connected to a different group of eight keyswitch strobe lines. With eight keyswitch lines tied to each of the sixteen outputs, 128 different keyswitches are scanned. The Output Port allows the PKIB software to determine which, if any, of the keyswitches in each group of eight was pressed.

INDICATOR L.E.D.s.: There are two Indicator L.E.D.s. on the keyboard. They are situated in the CAPS LOCK and the SHIFT LOCK keytops. They indicate to the operator that these keys are active.

KEYBOARD MATRIX: The Keyboard Matrix consists of the actual keyswitches. They are arranged into sixteen groups of eight, as seen from the Decoder or eight groups of sixteen, as seen from the Output Port. The outputs of the keyswitches are arranged such that when one group of eight is activated, each of its eight outputs is connected to a different data line at the Output Port. Thus, if any keyswitch is pressed in the matrix, it can be identified by the combination of its Decoder number and bit position at the Output Port.

OUTPUT PORT: The Output Port accepts eight bits of data from the keyswitch matrix and presents it to the PKIB Data Bus.

HARDWIRED KEYSWITCHES: There are four hardwired keyswitches. They are: Reset, Ribbon Reverse, Detent Release and the last one is not yet defined.

The Reset keyswitch is hardwired to the Reset line on the System Bus. When depressed the system is reset. Data in RAM may be destroyed.

When pressed, the Ribbon Reverse key causes the ribbon on the daisy wheel printer to wind in the opposite direction. This prevents the same length of ribbon at the end of the reel from being used over and over again.

The Detent Release causes the current to the paper feed motor to be altered so that the platen is easier to turn by hand.

KEYBOARD SCANNING: The Keyboard Scanning can be seen to work as follows: The PKIB outputs a byte to the Keyboard Input Port. Two of the bits determine whether either of the two Indicator L.E.D.s should be illuminated. Four other bits are Decoded to enable a group of eight keyswitches. Each of the sixteen groups is enabled, in its turn, so that all 128 keyswitches are scanned.

The Output Port presents each of the eight outputs of each group to the PKIB Data Bus. The microprocessor on that board then determines the code for the keyswitch pressed. It should be noted that the complete keyboard is scanned every 20 milliseconds. This provides N-key roll-over and no possible conflicts in keyswitch codes.

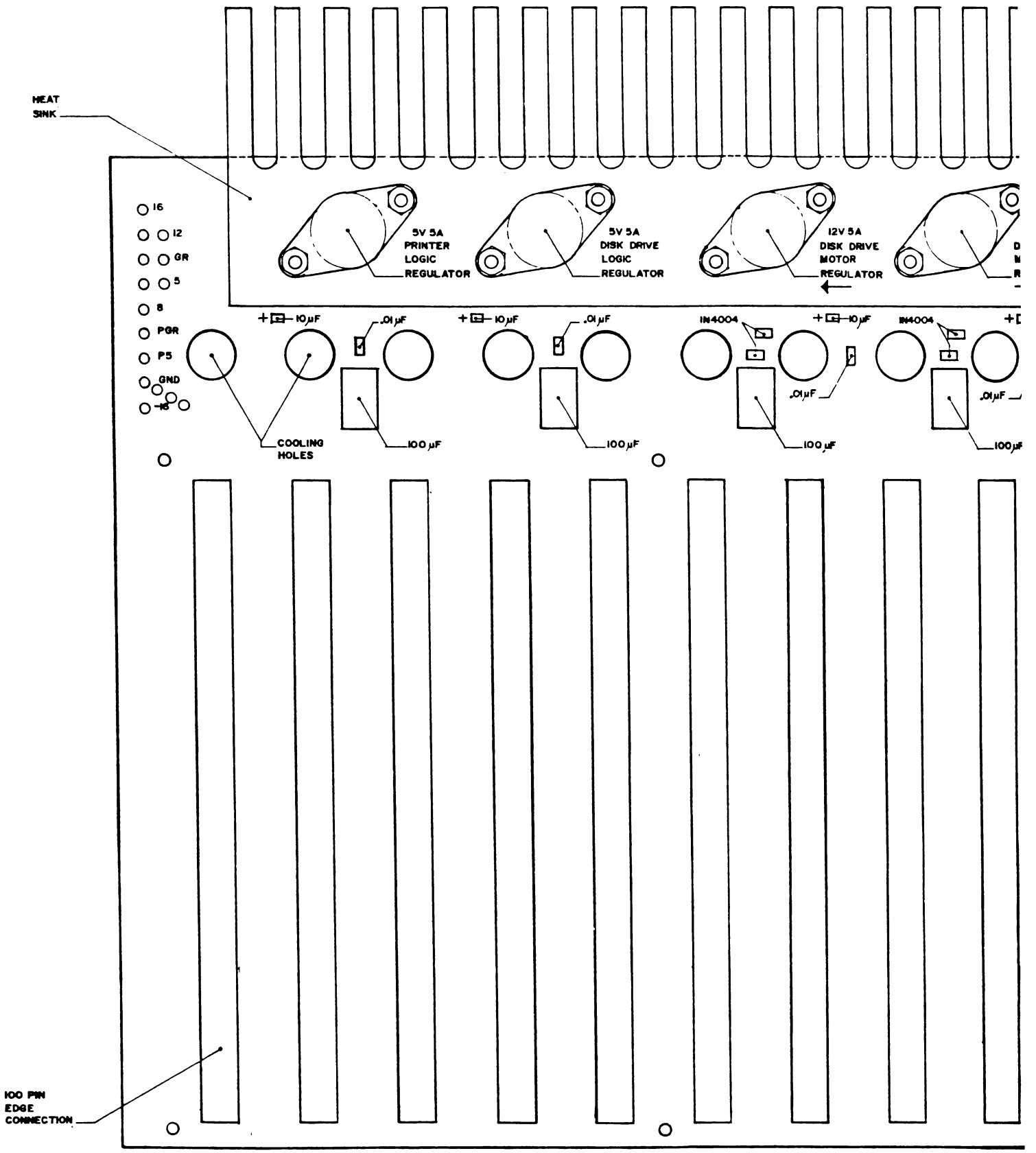
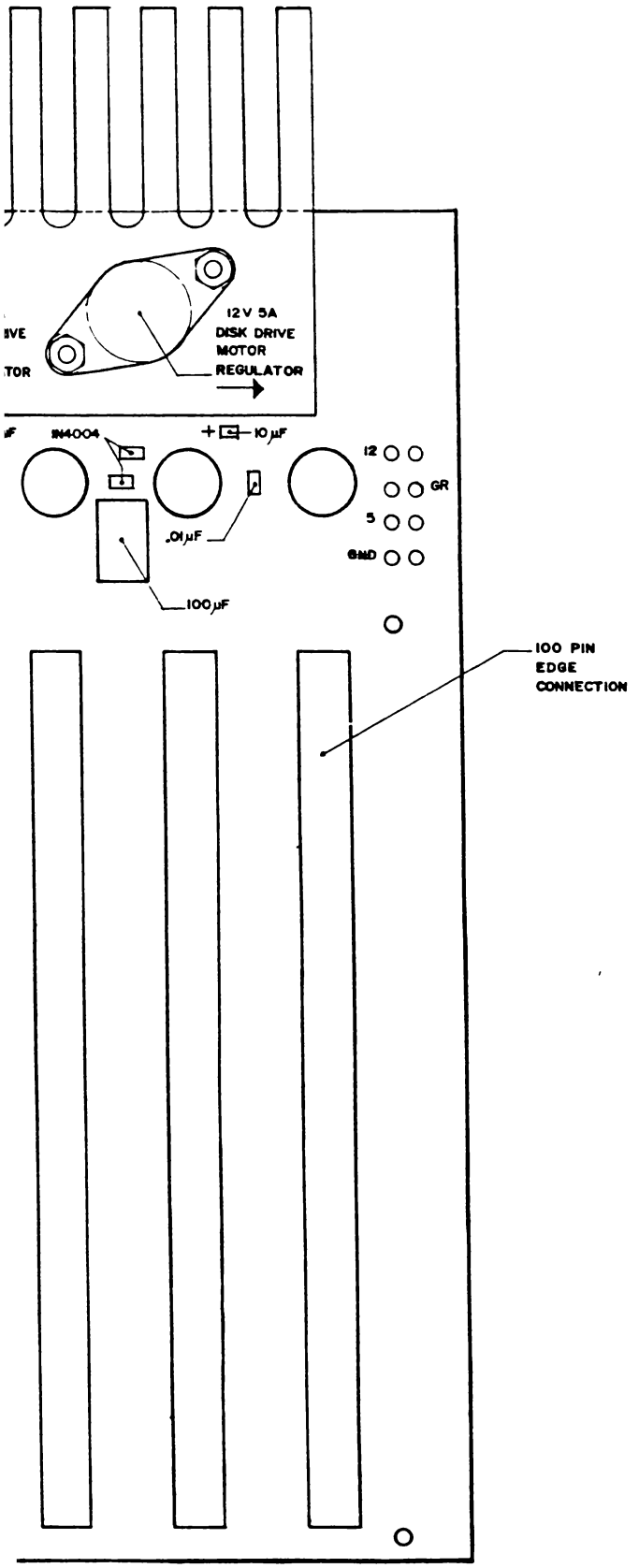
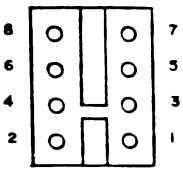


FIGURE 2 MOTHER BOARD PICTORIAL



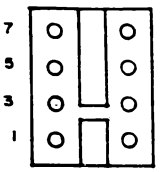
MOTHER BOARD POWER CONNECTOR



CABLE SIDE
OF CONNECTOR
TO MOTHER BOARD

	POWER SUPPLY SIDE
① -16 GEEL	① -16 V
② GND Zwart	② HQ GND
③ P5 Groen	③ +5V TO PRINTER POWER CONNECTOR PIN ⑧
④ PGR Zwart	④ HQ GND
⑤ 8 Rood	⑤ 8V
⑥ 16 Oranje	⑥ 16V
⑦ GND Zwart	⑦ HQ GND
⑧ N/C —	⑧ N/C

PRINTER POWER CONNECTOR



CABLE SIDE
OF CONNECTOR
TO PRINTER

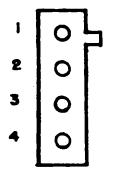
① N/C
② -24 V
③ N/C
④ +24V
} TO POWER SUPPLY

⑤ HQ GND

⑥ PIN ⑦
⑦ PIN ⑥
} ON SAME CONNECTOR

⑧ PIN ⑤ ON POWER SUPPLY SIDE OF MOTHER BOARD, +5V

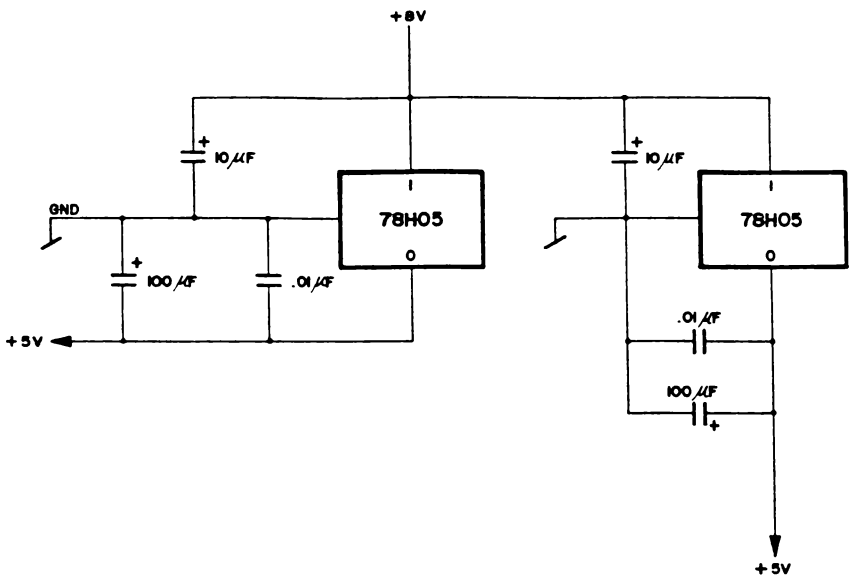
5 INCH DRIVE POWER CONNECTOR



CABLE SIDE
OF CONNECTOR
TO MOTHER BOARD

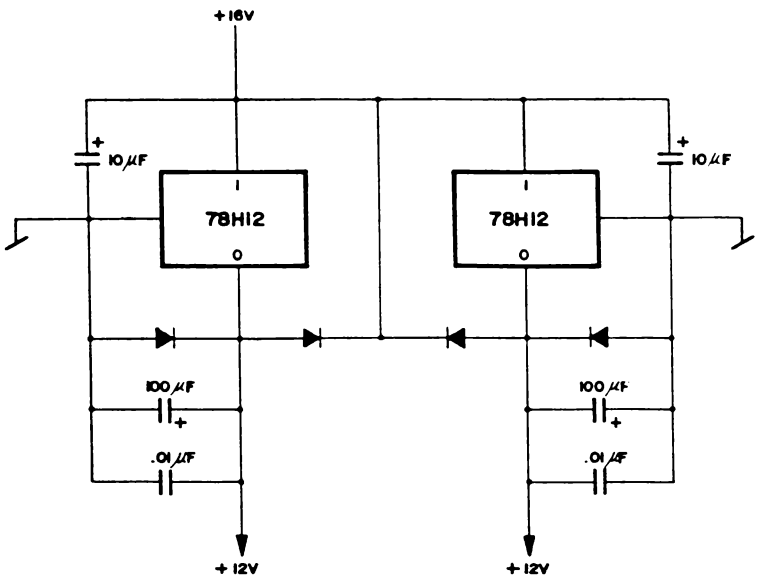
① 12
② GR
③ GND
④ 5
} TO MOTHER BOARD

Date 81-07-30
Scale NONE
Drawn R.O
Job



PIN No.	1	2	3	4	5	6	7	8	9	10	11	12	24	25	26	29	30	31	32	33	34	35	36	37
SIGNAL	+8V	+16V	XRDY	VI0	VI1	VI2	VI3	VI4	VI5	VI6	VI7	NMI	ϕ	pSTVAL	pHLDA	A5	A4	A3	AI5	AI2	A9	DOI	DOO	AI0

PIN No.	51	52	66	67	68	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
SIGNAL	+8V	+16V	RFSH	PHANTOM	MWRT	RDY	INT	HOLD	RESET	pSYNC	pWR	pDBIN	A0	A1	A2	A6	A7	A8	AI3	AI4	AII



5	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
)1	D00	A10	D04	D05	D06	D12	D13	D17	sMI	sOUT	sINP	sMEMR	sHLTA	CLOCK	GND

5	86	87	88	89	90	91	92	93	94	95	96	99	100
A13	A14	A11	D02	D03	D07	D14	D15	D16	D11	D10	sINTA	POC	GND

Figure 3

MOTHERBOARD		
SCALE: NONE	APPROVED BY:	DRAWN BY V.M.D.
DATE: 81-07-06		REVISED

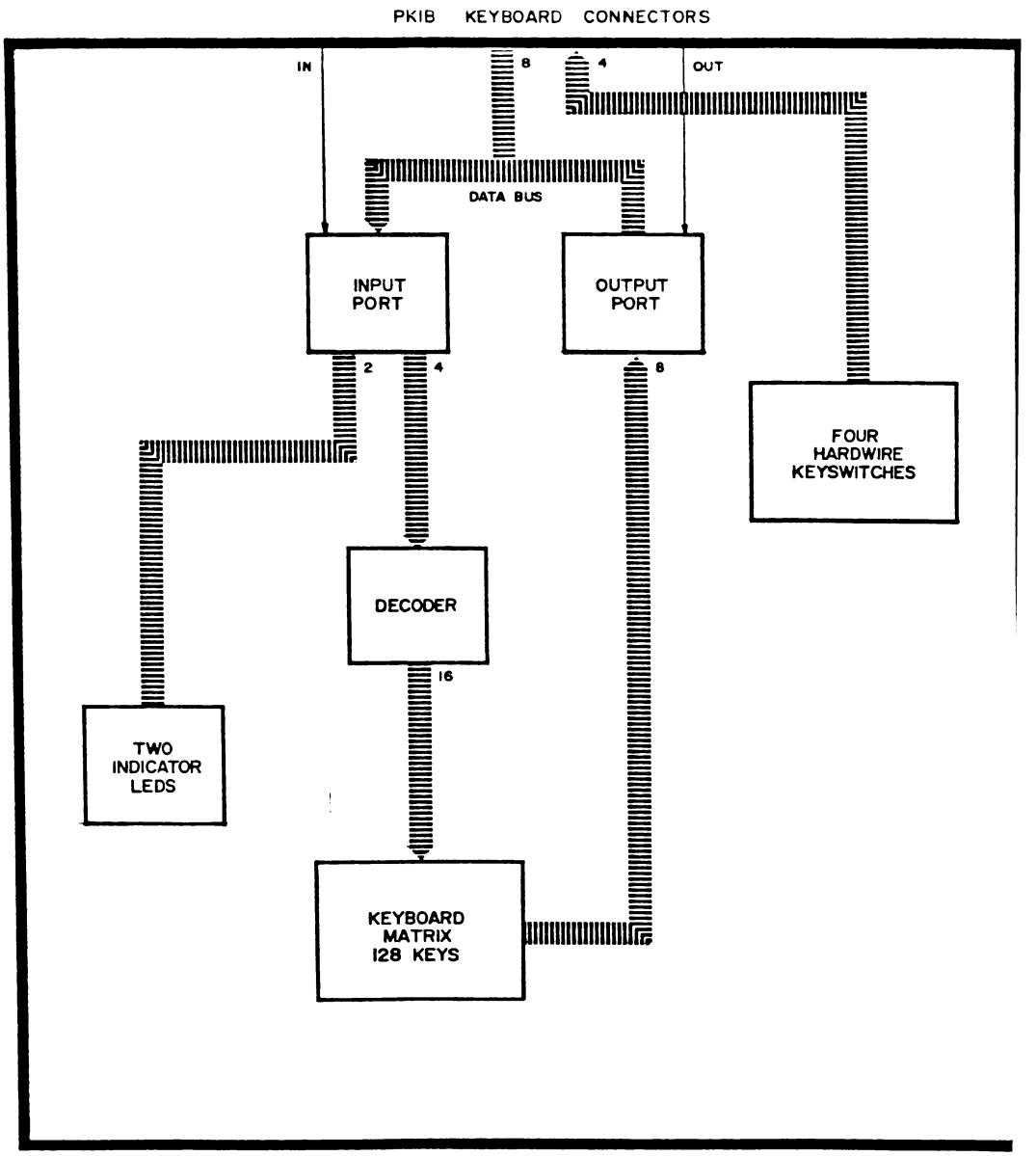
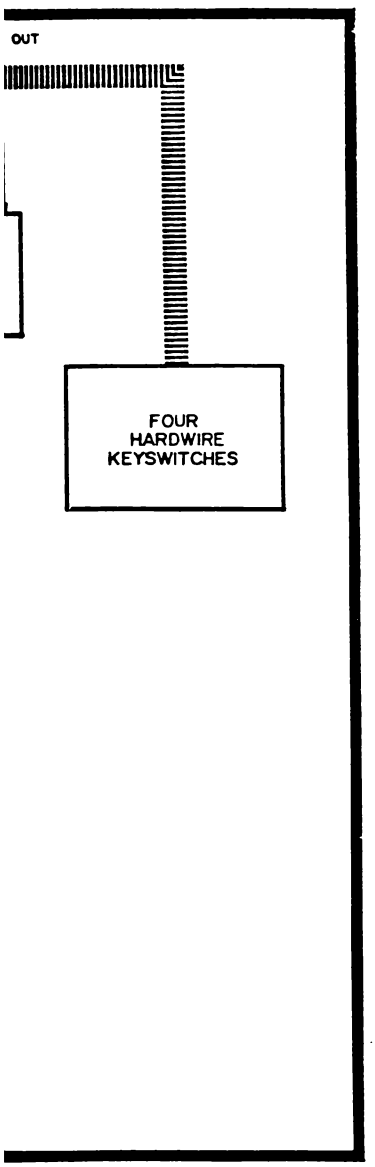


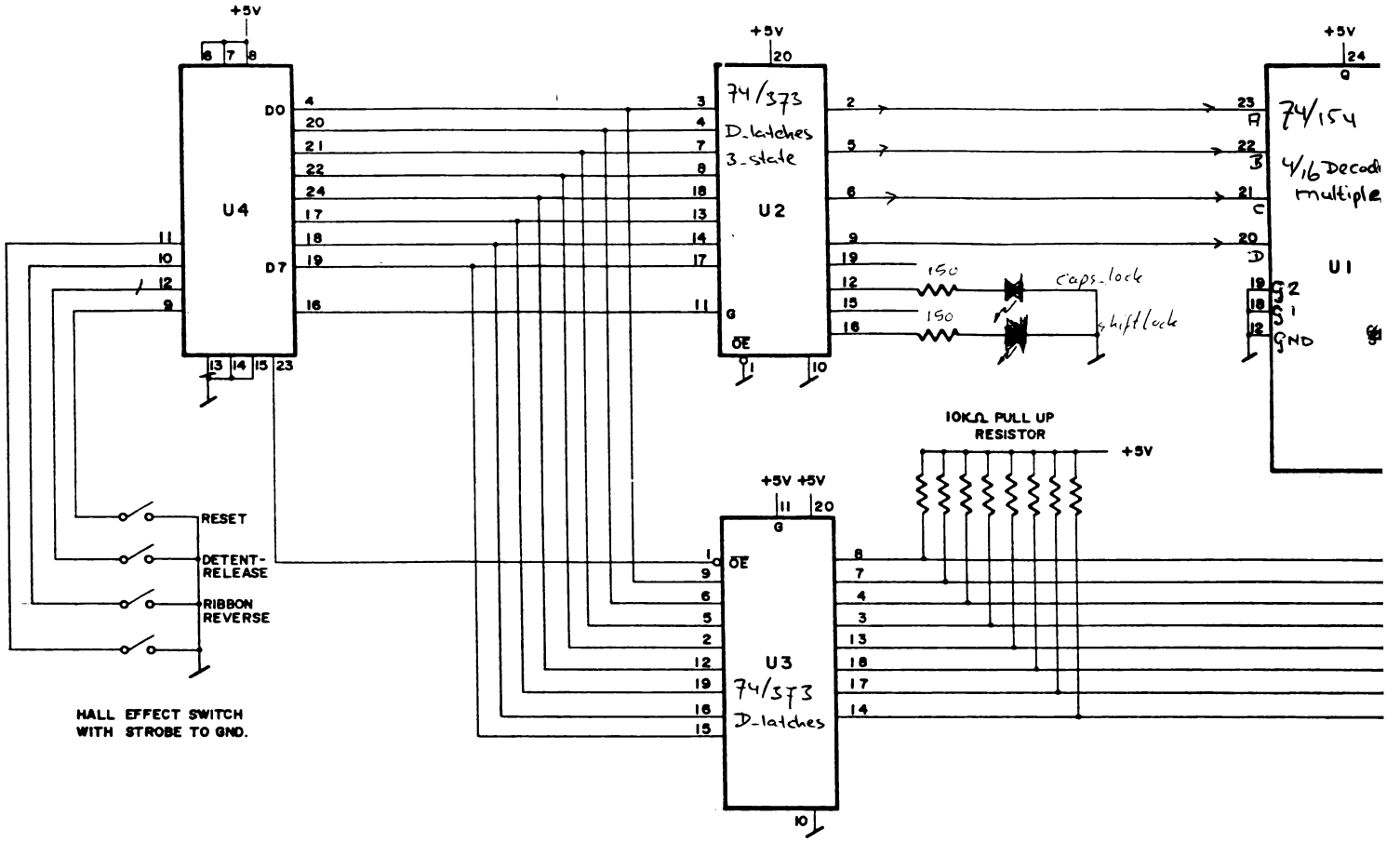
FIGURE 4 KEYBOARD AND PAD BLOCK DIAGRAM

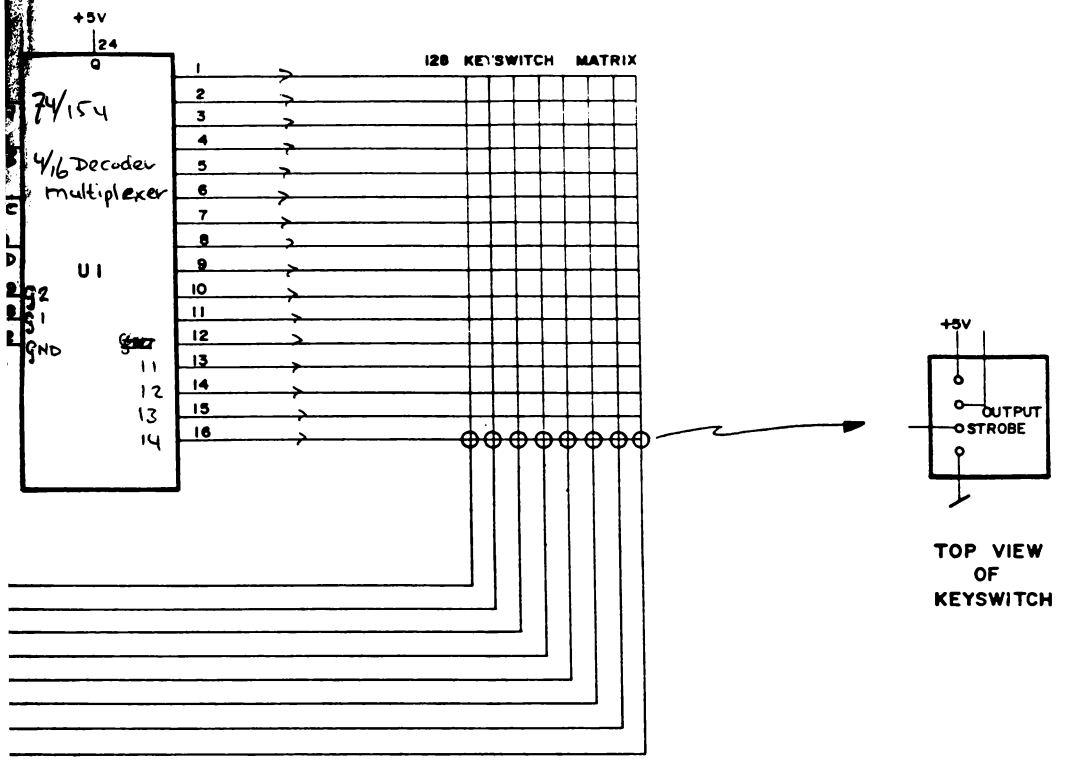
RS



PATRICK COMPUTER SYSTEMS, INC.

SCALE: NONE	APPROVED BY:	DRAWN BY R O
DATE: 81-07-30		REVISED


+5V
U4
D0
D7
U2
74/373
D-latches
3-state
OE
U3
74/373
D-latches
U1
74/154
4/16 Decod
multiple
caps-lock
shiftlock
150
150
10KΩ PULL UP
RESISTOR
RESET
DETENT-
RELEASE
RIBBON
REVERSE
HALL EFFECT SWITCH
WITH STROBE TO GND.

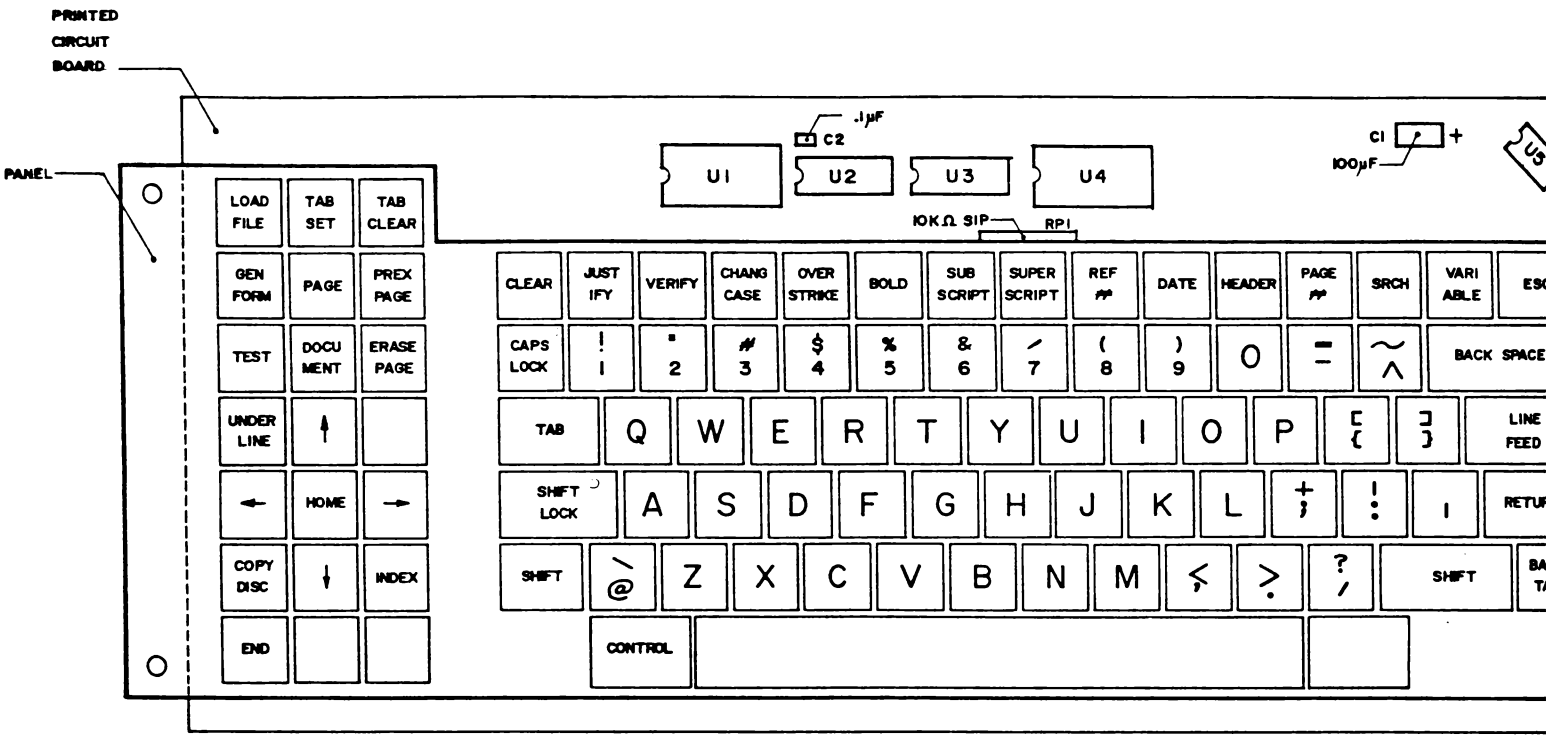


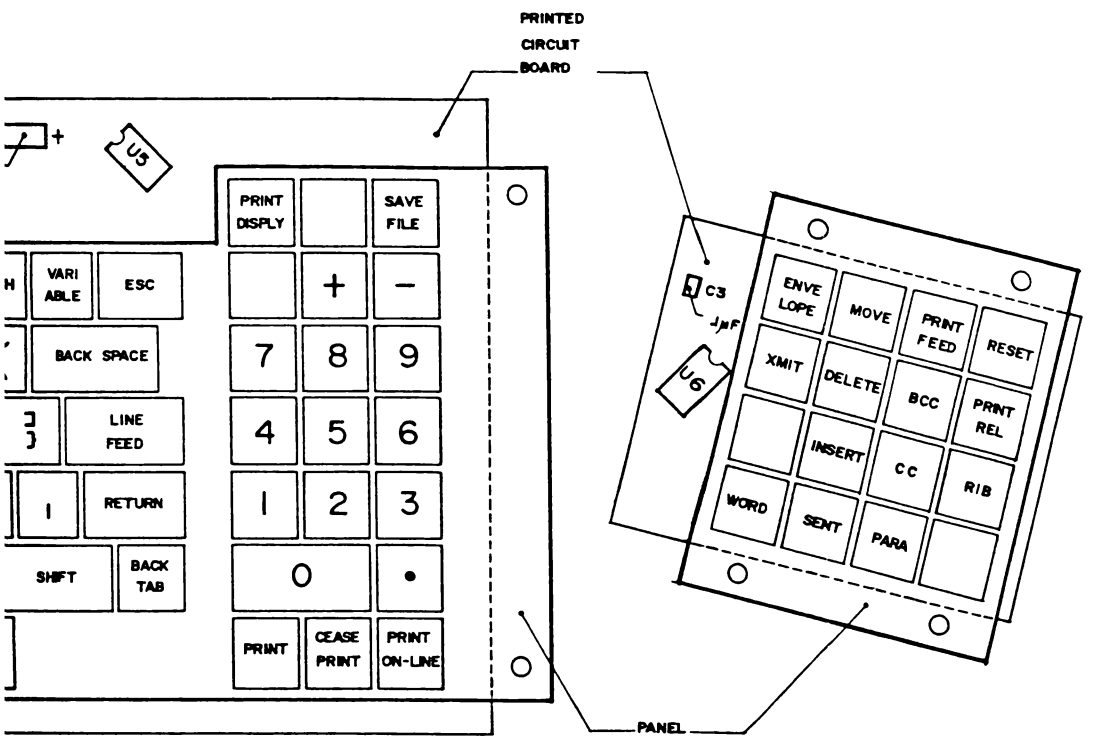
TOP VIEW
OF
KEYSWITCH

push + low strobe enable. output.
high. " disable.

Figure 5

Date 81-07-15
Scale NONE
Drawn V.M.D.
Job KEYBOARD


PRINTED
CIRCUIT
BOARD
PANEL
.1μF
C2
U1
U2
U3
U4
C1
100μF
10KΩ SIP
RP1
LOAD FILE
TAB SET
TAB CLEAR
GEN FORM
PAGE
PREX PAGE
TEST
DOCU MENT
ERASE PAGE
UNDER LINE
HOME
COPY DISC
INDEX
END
CLEAR
JUST IFY
VERIFY
CHANG CASE
OVER STRIKE
BOLD
SUB SCRIPT
SUPER SCRIPT
REF
DATE
HEADER
PAGE
SRCH
VARI ABLE
CAPS LOCK
BACK SPACE
TAB
LINE FEED
SHIFT LOCK
SHIFT
CONTROL



KEYBOARD		
SCALE: FULL SIZE	APPROVED BY:	DRAWN BY V.M.D.
DATE: 81-06-02		REVISED

The Bus structure as described in the section on the Mother Board conforms to the proposed IEEE S100 Bus Standard. (IEEE TASK 696.1/D2) with the following exceptions: The Ready signal on Pin 3 of the Bus has been deleted. The Ready signal on Pin 72 of the Bus is Active Low. Two extra signals have been added. Pin 66 has the Refresh signal which is used to force Refreshing of the Memory Board. Pin 65 has the Memory Request Signal which is also required for the Memory Board.

The iC436 Model 1 is configured as a single Bus Master System. It contains five circuit boards which slot into the Mother Board. They are the CPU, PKIB, VDB-80, MB-64 and the FDIB. Except for the MB-64 (the memory board) each board contains a Z-80A microprocessor. The CPU is the only Bus Master, the other boards being Bus Slaves. The system may also be totally Interrupt driven.

Figure 6 is a Block diagram showing the functional elements of the CPU Board. The following sections describe the operation of each of the Blocks and how they relate to one another on the Board.

MICROPROCESSOR: The Microprocessor is at the heart of the System. It executes the programs, handling all data flow. The CPU uses the Z-80A microprocessor and is configured to handle Vector Interrupts. The Z-80A issues all control signals to the System Bus. Because the CPU is the only Bus Master in the System, the Z-80A never receives a Bus Request and thus always commands the Bus.

OSCILLATOR: The Crystal Oscillator generates the 2MHz and 4MHz clock signals for the System Bus. The 4MHz signal is also used to drive the Z-80A

I/O ADDRESS DECODER: This block decodes the lower eight bits of the Address Bus and allows the Z-80A to address the CTC integrated circuits, which make up the Vector Interrupt Controller. It also enables the Data In Buffer, allowing data to reach the Z-80A from off-board I/O devices. This block is also used to deselect the 2K of EPROM from the memory map.

MEMORY ADDRESS DECODER: This logic decodes the upper five bits of the Address Bus and is used to select the 2K of EPROM on the CPU. It also contains the logic to jump start the Z-80A at Reset time. When off-board memory is read, a signal from this block enables the Data In Buffer.

2K EPROM: The EPROM contains the software which is executed after the RESET keyswitch is pressed. It initializes the System and causes the FDI Board to read data from a System Diskette. After System software is loaded into the Memory Board, the EPROM is removed from the memory map by the Memory Address Decoder. Please note that Diagnostic Software will be available in EPROM form, and will facilitate the service of the Computer.

VECTORED INTERRUPT CONTROLLER: This Block consists of two Daisy-Chained Z-80A-CTC integrated circuits. They are programmed by the microprocessor to operate with mode 2 interrupt processing. They allow eight prioritized interrupt lines to be connected to the interrupt (INT) input on the Z-80A. This produces an interrupt driven CPU which facilitates data through put for the System. When one of the interrupt lines goes low a preprogrammed jump address is placed on the Bus by the CTC chip. This directs the CPU to service the interrupt with a specific software routine.

STATUS AND CONTROL BUFFERS:This Block controls the access of all the Status and Control lines from the Z-80A to the System Bus. They are disabled only when the Z-80A receives a Bus Request. This event never occurs in the iC 436 system, therefore these signals remain on the System Bus at all times. The Status and Control Buffers act as drives, ensuring that the signals from the Z-80A are capable of driving a fully loaded System Bus.

ADDRESS BUFFER: The Address Buffer drives the System Bus with all the Address data from the Z-80A's sixteen address lines. This data is always present on the System Bus because the CPU is the only Bus Master in the System.

DATA OUT BUFFER: The Data Out Buffer drives the System Bus with the eight Data Lines from the Z-80A. This data is always present on the System Bus because the CPU is the only Bus Master in the System.

DATA IN BUFFER: The Data In Buffer provides the Z-80A with read data from the offboard I/O and Memory devices. The Buffer is enabled only during these Read Cycles.

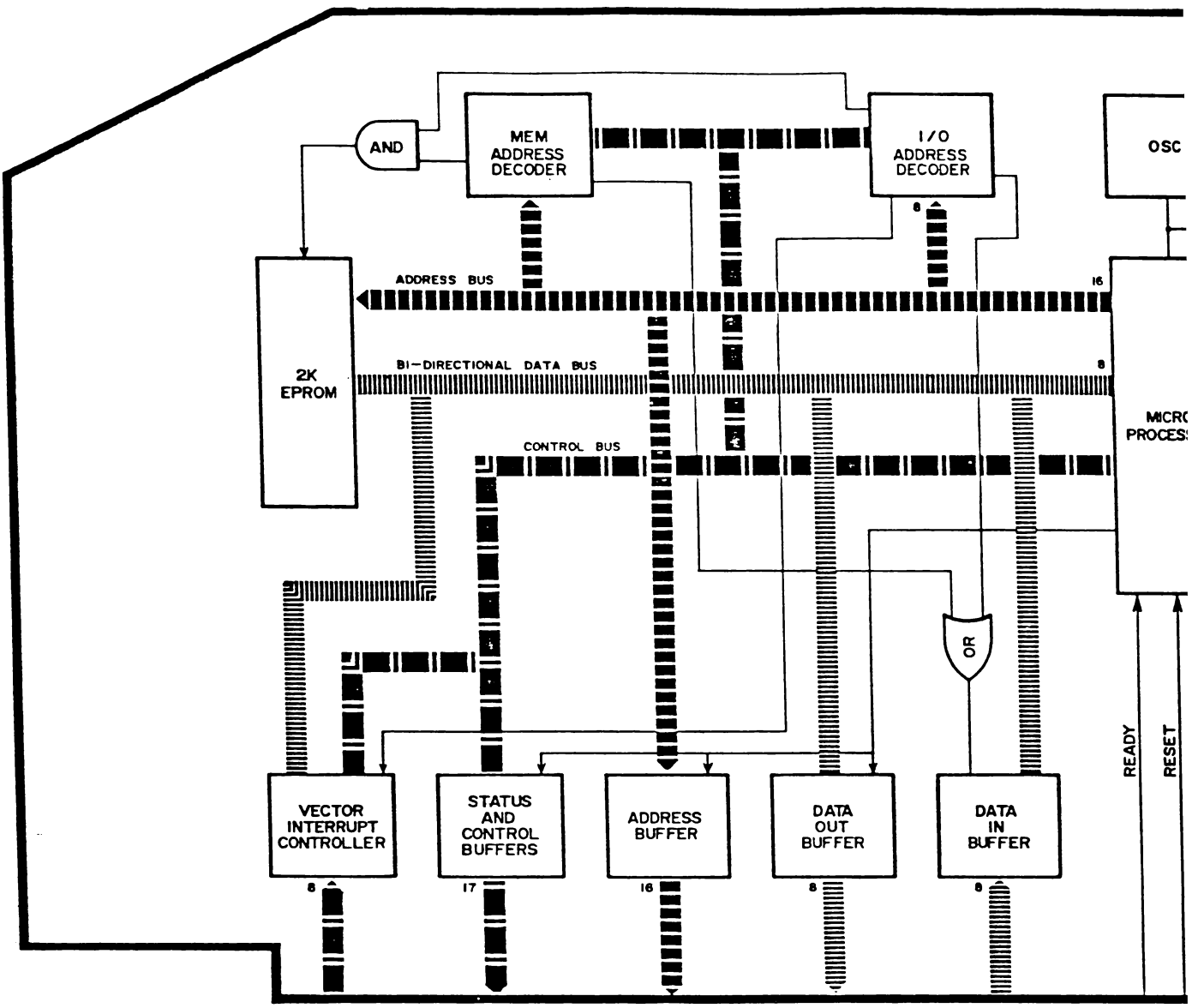
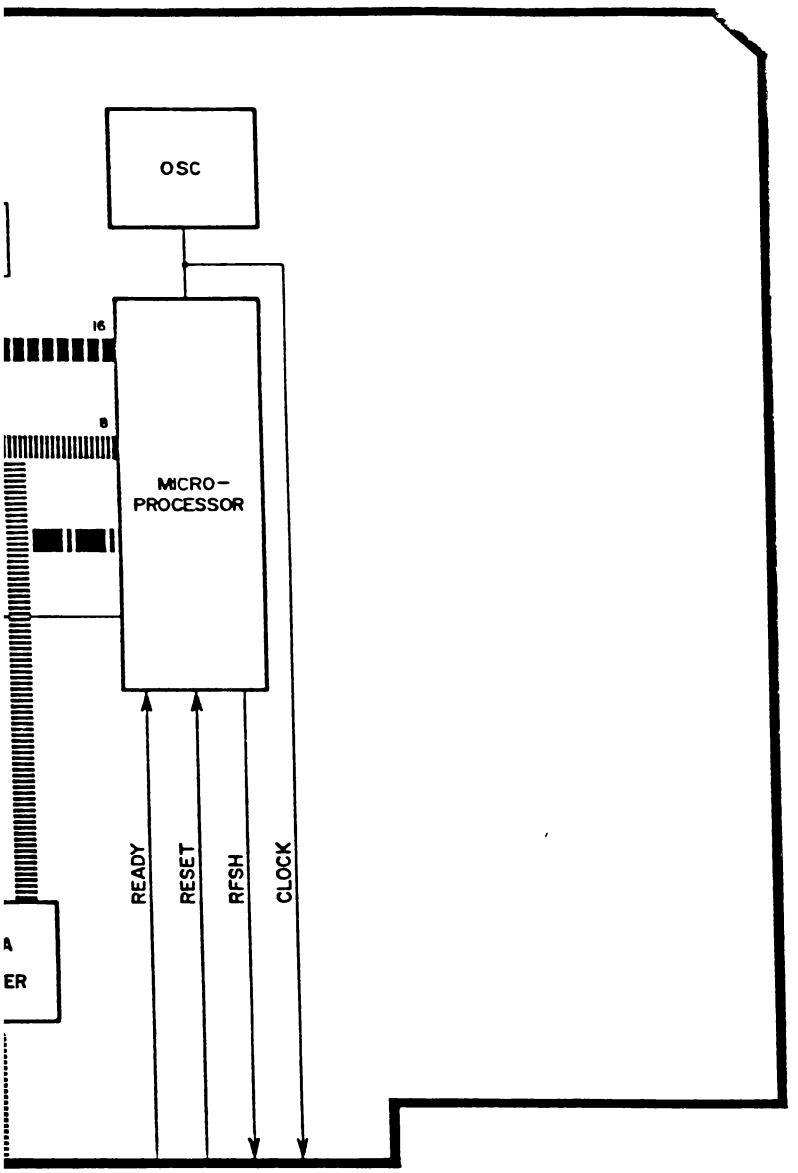


FIGURE 6 CPU BLOCK DIAGRAM



Date 81-07-30
Scale NONE
Drawn R.O.
Job

The PKIB is the interface between the System the keyboard and the Daisy Wheel Printer. As an option the PKIB also interfaces with a Matrix Printer. The Board is intelligent in that it has a Z-80A microprocessor and sufficient memory for executing elaborate programs. It was designed to aid the system throughout by allowing the CPU to undertake more important tasks than peripheral handling. Figure 7 is a Block Diagram showing the functional elements of the PKIB Board. The following sections describe the operation of each of the Blocks and how they relate to one another on the Board.

MICROPROCESSOR: The Z-80A on the PKIB controls every aspect of this board. It provides all the local Address, Data, and Control lines. This functional Block receives all of its Data from the System Bus via the Printer Input Buffer. All Output Data originating from the keyboard or the Printer Status lines are placed on the System Bus by either the Status Output Buffer or the Keyboard Output Buffer. The Microprocessor receives its Reset and 4 MHz Clock from the System Bus.

MEMORY ADDRESS DECODER AND REFRESH LOGIC: This Block is responsible for multiplexing the address lines and supplying the Row and Column address Strobes to the 16 K of Dynamic RAM on the Board, during memory read or write cycles. In addition, it decodes the upper address lines to select either the RAM or the 1K of EPROM that is on the Board. This type of circuit performs a RAS only refresh whenever the microprocessor is executing an opcode fetch. This ensures that the Dynamic memory is constantly refreshed to prevent loss of Data.

16K DYNAMIC RAM: This Block consists of the actual memory devices and its associated I/O driver. When the PKIB is Reset, the EPROM program allows the CPU to load system software to the Board. This software resides in the Dynamic RAM. The local Z-80A then executes this software allowing the PKIB to operate as it does. The 16K of Dynamic RAM also provides buffer storage for Data coming from the keyboard and going to the Printers.

1K EPROM: The EPROM contains software which is executed after the Reset keyswitch is pressed. It initializes the Board and allows the CPU to load System software to the PKIB where it resides in the Dynamic RAM. The EPROM is selected by the Memory Decoder and Refresh Logic. This EPROM may be exchanged for one containing Diagnostic software which will assist in the servicing of the system.

PRINTER I/O: This Block consists of three Output Ports and One Input Por These Ports generate the twenty output lines and five input lines for the Daisy Wheel Printer and the ten output lines and two input lines for the Matrix Printer. The Output Ports also provide sufficient current sinking capacity so that noise in the System will not pose a problem. Data is strobed into and out of these ports via four I/O control line from the local I/O Decoder. This Block allows the microprocessor complete control over the parallel communications to the Printers.

SYSTEM I/O DECODER: The System I/O Decoder receives all of it's signals from the CPU Board. This Block controls Data transfer in both directions between the Board and the System Bus. It allows the CPU to place data into the Printer Input Buffer and to read Data from the Status Output Buffer and the Keyboard Output Buffer. In addition, the System I/O Decoder is capable of generating a Vectored Interrupt to the System. This becomes important in multi-user systems where an Interrupt driven system speeds up through put.

PRINTER INPUT BUFFER: This Block receives Data from the System Bus. After the Data is entered, the System I/O Decoder interrupts the Microprocessor. The Z-80A then services the interrupt and inputs the Data.

STATUS OUTPUT BUFFER: The Z-80A on the PKIB uses this buffer to inform the System of the status of the Printer. The System is able to recognize the fact that new data is available to it by interrogating one of the Bits of the Status Output Buffer by using the System I/O Decoder.

KEYBOARD OUTPUT BUFFER: The Z-80A on the PKIB uses this Buffer to output Keyboard Data to the system. The System recognizes that there is new Data available to it by interrogating a Bit from the Status Output Buffer by using the System I/O Decoder.

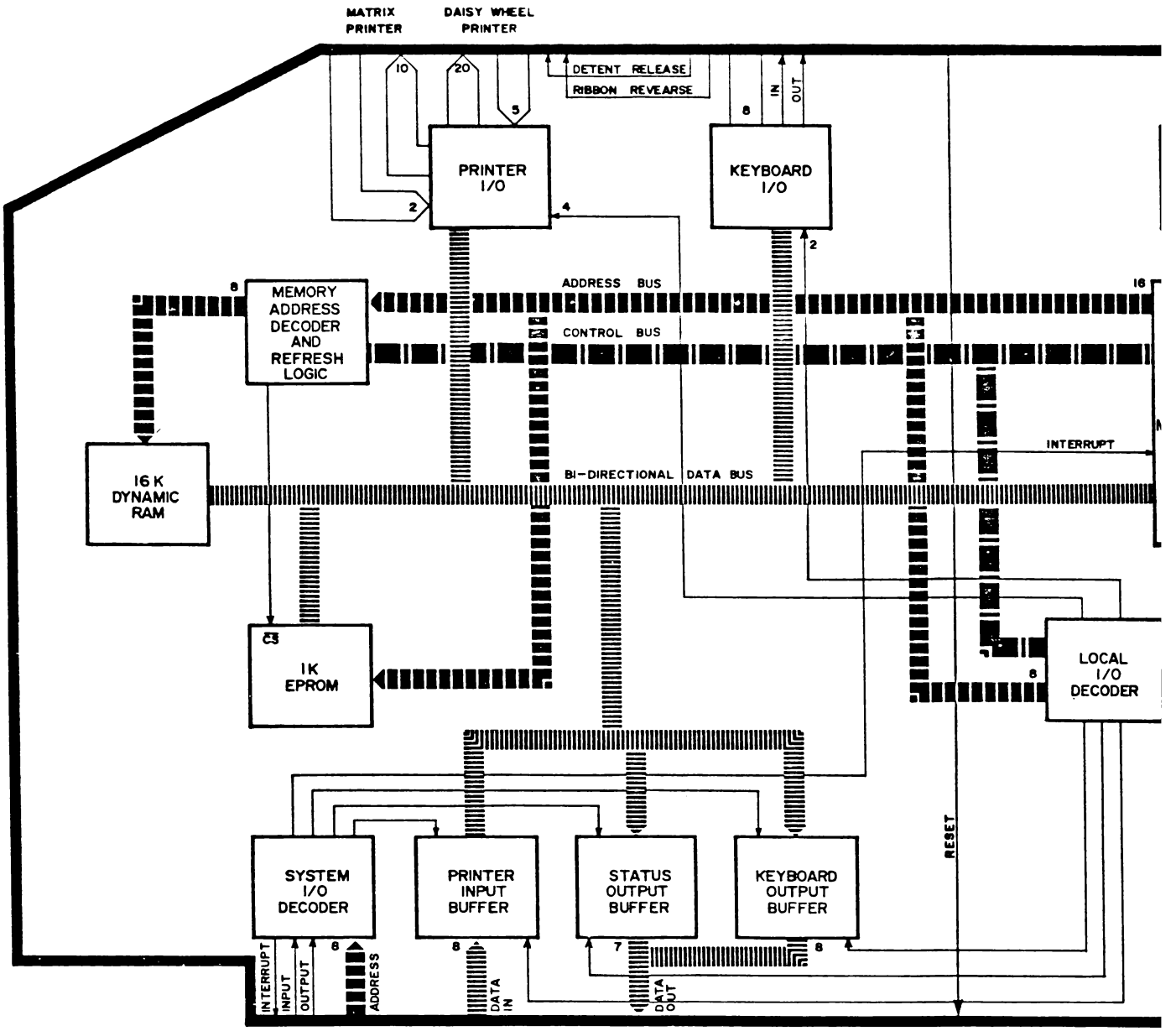
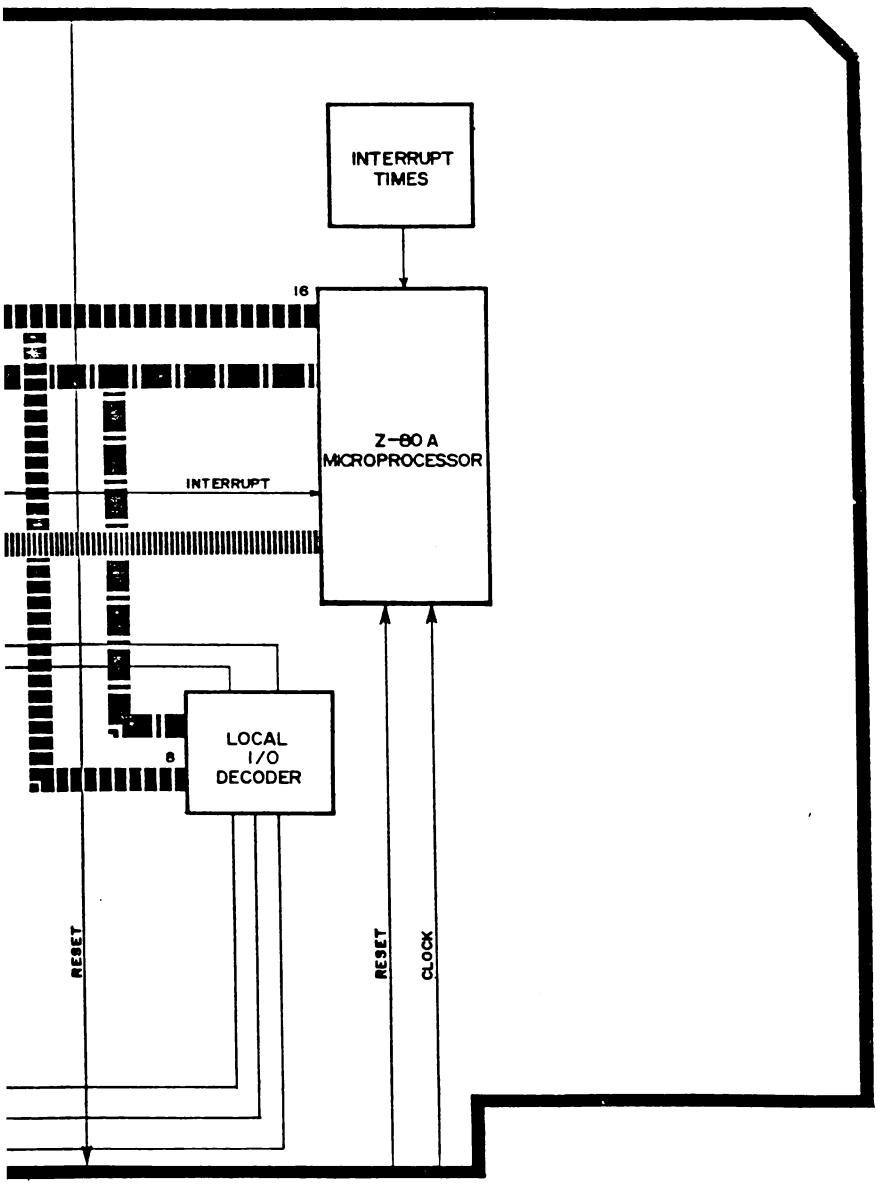


FIGURE 7 PKIB BLOCK DIAGRAM



Date	81-07-30
Scale	NONE
Drawn	R.O.
Job	

LOCAL I/O DECODER: This Block serves many functions. It allows the Z-80A to select any I/O port both on the Board and on the keyboard. It performs this function by decoding the lower eight Address lines. Data can thus be moved to and from the System Bus, the Printers and the Keyboard.

INTERRUPT TIMER: The Interrupt Timer generates an interrupt to the Z-80A at regular intervals. This provides the Z-80A with a time reference for the generation of repeated character entries when a keyswitch is held down. It also provides timing for the servicing of the Printers and the System Bus.

KEYBOARD I/O: This Block actually consists of a bi-directional Bus Transceiver with an Input and Output Strobe line. It allows the microprocessor to drive the cable to the keyboard with Data and to receive Data back without noise becoming a concern. The Input and Output strobe lines are provided by the Local I/O Decoder and are used by the Z-80A to strobe Data in and out of the two Ports on the keyboard. This line is picked up by the CPU, conditioned, used and fed back from the keyboard which is connected to the System Bus. In addition to this, the PKIB has the Hardwired Reset line out to the System Bus, where it is used by the other boards. Two other Hardwire Keyswitch lines are connected on the PKIB from the Keyboard to the Daisy Wheel Printer. They are the Detent Release line and the Ribbon Reverse line. The PKIB provides a route for these lines to be connected.

The Video Display Board is responsible for providing the interfacing between the system and the video monitor. The Board is intelligent in that it has a Z-80A microprocessor and 16K of Dynamic RAM and can execute elaborate programs. The VDB-80 accepts Character and Control Codes from the System Bus and processes them. With the use of the Direct Memory Access Controller (DMA) and the Cathod Ray Tube Controller (CRTC) these processed codes are used to address the Caracter RAM. The Character RAM contains the Dot Patterns that will be displayed as Characters on the CRT Screen. The Microprocessor is also capable of programming the Character RAM. This allows System Softwre to change the Character set and facilitates language change for use in different countries. It also allows the System to display a graphics character set. Figure 8 is a Block Diagram showing the functional elements of the VDB-80 Board. The following sections describe the operation of each of the Blocks and how they relate to one another on the Board.

MICROPROCESSOR: The Z-80A on the VDB-80 provides the basic control over the operation of the Board. It provides all the Local Address, Data, and Control lines. It handles Data input from the System Bus through the Input Buffer and programs both the DMA Controller and the CRT Controller at Reset time. The Z-80A runs at 2MHz and receives this Clock signal as well as the Reset signal from the System Bus.

MEMORY ADDRESS DECODER AND REFRESH LOGIC: This Block is responsible for multiplexing the address lines and supplying the Row and Column address Strobes to the 16 K of Dynamic RAM on the Board, during memory Read on Write cycles. In addition it decodes the upper address lines to select either the Ram or the 1K of EPROM that is on the Board. This type of circuit performs a RAS only refresh whenever the microprocessor is executing an opcode fetch. This ensures that the Dynamic memory is constantly refreshed to prevent loss of Data.

16K DYNAMIC RAM: This Block consists of the actual memory devices and its associated I/O driver. When the VDB-80 is Reset, the EPROM program allows the CPU to load System software to the Board. This software resides in the Dynamic RAM. The local Z-80A then executes this software, allowing the VDB-80 to operate as it does.

1K EPROM: The EPROM contains software which is executed after the Reset keyswitch is pressed. It initializes the Board and allows the CPU to load System software to the VDB-80 where it resides in the Dynamic RAM. The EPROM is selected by the Memory Address Decoder and Refresh Logic. This EPROM may be exchanged for one containing Diagnostic software which will assist in the servicing of the system.

LOCAL I/O DECODER This Block Decodes the lower 8 Bits of the Address Bus from the Microprocessor to allow selection of the I/O Buffers. The Microprocessor is thus able to receive Data from the Input Buffer and the System. It can also output Data to the System through the Output Buffer and is able to change the Data and therefore the character set in the Character RAM.

SYSTEM I/O DECODER: This Block receives the eight lower Address lines and two Control lines from the System Bus. This allows the System Bus to control Data transfer in both directions between the VDB-80 and the CPU Board. The Microprocessor also has the ability to interrupt the CPU Board by logic that is provided by this Block.

INPUT BUFFERThis Block receives Data from the System Bus and holds it for the Microprocessor. It is selected by the System I/O Decoder. The Microprocessor is able to determine whether new Data is available by polling a status Flag which is automatically set when the System places Data into the Input Buffer. The address for this Flag is produced by the Local I/O Decoder. This Flag is also available to the System and thus informs the CPU when the Microprocessor has removed the Byte. This allows complete unambiguous Data exchange.

OUTPUT: This Block receives Data from the Microprocessor and holds it until the System Bus is ready to accept it. The Microprocessor is able to determine whether the System has taken the old Data from the Output Buffer by polling a status Flag which is automatically set when the System has removed the Data. The address for this Flag is decoded from the lower eight Address lines from the Microprocessor by the Local I/O Decoder. Similarily this Flag is also available to the System via the System I/O Decoder. The System is able to poll the Flag and determine whether new Data is available to it. This allows unambiguous Data exchange.

DMA CONTROLLER: This Block provides the CRTC with Direct Access to the 16K Bytes of Dynamic RAM. Whenever the CRTC requires a row of Characters for Vido Display, it sends a Request to the DMA Controller. The Controller then takes over control of the Local Bus from the Microprocessor and very rapidly transfers Characters to the CRTC. When it has completed its request from the CRTC, the DMA Controller transfers Local Bus control back to the Microprocessor.

DOT AND CHARACTER CLOCK: This Block produces the Dot Clock Frequency for the Attribute and Video Combining Circuit. The Dot Clock frequency is the same as the Video output rate. The Character Clock is derived from the Dot Clock and provides the operating clock for the CRTC.

CRT CONTROLLER: This Block provides all the timing signals and Attributes producing a Raster Scan type Video Display. It is programmed by the Microprocessor at Reset time for a particular Screen format and together with the DMA Controller receives characters to be displayed from the 16K of RAM via the Local Data Bus. The CRTC then uses these character codes as Address Data for the Address Multiplexer. This Address Data is used to select the Rows of Dots for the Attribute and Video Combining Circuit. These Rows of Dots become the Video Signal for the Monitor. The CRTC also provides the signals for the Character Attributes. These include Reverse Video, Reduced Brightness, Blinking, Underline and any combination of these. These signals are combined along with the Horizontal and Vertical Retrace Signals in the Attribute and Video Combining Circuit to produce the final Video Signals.

ADDRESS MULTIPLEXER: This Block allows the Microprocessor access to the Character RAM using the Local I/O Decoder. When the Address Multiplexer is selected, the Microprocessor Address Bus is connected to the Address lines of the Character RAM. The Microprocessor then is able to select any address in the Character RAM permitting the Character Fonts to be changed. When this block is de-selected the Address Lines from the CRTC are automatically connected to the Character RAM.

DATA BUFFER: The Data Buffer, when selected with the Address Multiplexer by the Local I/O Decoder, permits the Microprocessor to write Data to the Character RAM. This means that the Character Fonts may be changed.

CHARACTER RAM: This Block consists of 2K Bytes of RAM and contains the Character Fonts after they have been loaded by the Microprocessor. Because this storage medium is volatile, any type of Font can be easily programmed, allowing the System to be configured for different languages.

ATTRIBUTE AND VIDEO COMBINING CIRCUIT: This Block combines the Attribute Signals from the CRTC and Character Row Data from the Character RAM. It converts this Data to a Serial Bit stream using the Dot Clock, which becomes the Video Signal for the Video Monitor. It also provides the Horizontal and Vertical Sync. pulses.

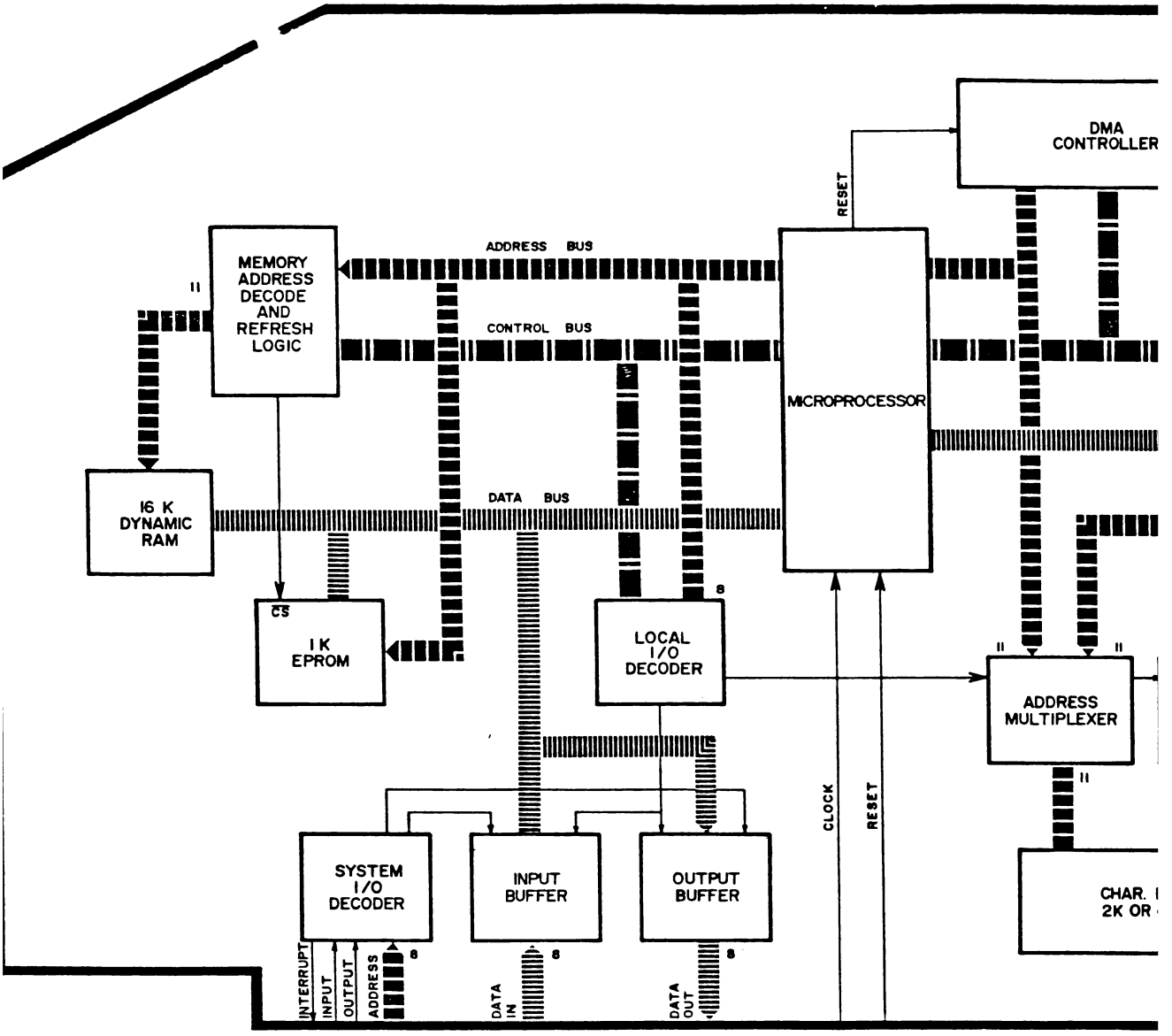
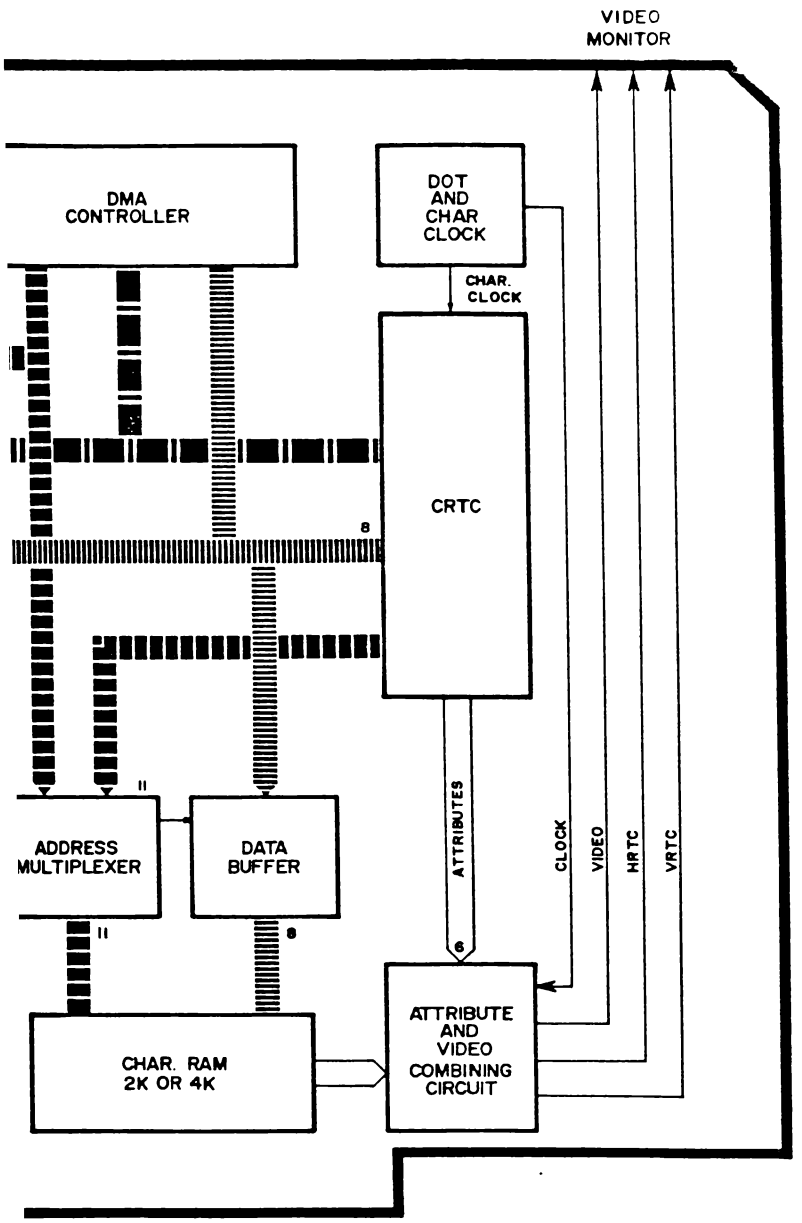


FIGURE 8 VDB-80 BLOCK DIAGRAM



Date	81-07-30
Scale	NONE
Drawn	R.O.
Job	

MB - 64:

The MB-64 is a Port selectable 64K Byte Dynamic Memory Board. It is a Bus Slave and does not contain a Microprocessor. It does, however, contain a Refresh Controller which provides Row Address Refresh for the Dynamic Memory Integrated Circuits. All Control, Address and Data Bus signals are supplied by the System Bus. The Board is Port Selectable so that up to four MB-64 Boards may reside on one System Bus. The Memory on the Board is divided into one 16K Byte Bank and one 48K Byte Bank. A System with only one MB-64 is configured so that it completely fills the System Memory Map. A System with four MB-64 Boards is configured such that one 16K Byte Bank resides in the Memory Map always, with the Operating System Software Port selecting the other five 48K Banks as required. Note that the fifth 48K Bank is comprised of three 16K Banks, one from each of the three extra MB-64 Boards in the System Figure
9 is a Block Diagram showing the functional elements of the MB-64 Board. The following sections describe the operation of each of the Blocks and how they relate to one another on the Board.

REFRESH CONTROLLER: This Block provides all the Address Lines, Strobe lines and Control lines to maintain Data Integrity in the four 16K Bytes Banks of Dynamic RAM. It also provides the Interface Signals to the System Bus. The RFSH Signal from the Bus to the Refresh Controller originates on the CPU Board. This line is active during an operative phase of the Z-80A, on the CPU Board, when the Z-80A does not require the use of the System Bus. At this time a Refresh Cycle may occur without introducing a Wait State into the System. High System through put is thus maintained. The Refresh Controller does, however, issue Wait States by activating its Wait Line during some of its Read and Write Cycles.

CLOCK: The Clock is a 21MHz Crystal Oscillator and is used by the Refresh Controller to generate proper timing for all of its Control Signals.

RAS SELECT: This Block allows the 16K Byte Bank of memory to be selected on any of the four 16K Byte memory Address Boundaries. This is used to select the fifth 48K Byte Port Selected Bank.

DATA INPUT BUFFER: This Block provides Buffering of the Data In Bus so as not to Load the System Bus. It is always enabled.

DATA OUTPUT BUFFERS: There are two Data Output Buffer Blocks; one for the 16K Byte Bank and one for the 48K Byte Bank. They are both connected to the Data Out Bus and present Read Data to the System Bus during System Memory Read Cycles. They have two enable lines each an input enable and an output enable. The XACK Line from the Refresh Controller is connected to the Input enable on each buffer. Whenever a System Memory Read occurs, Read Data from the Memory is latched into each Buffer. The Address Select Logic determines which Output enable is activated for the correct addressed Data to reach the System Bus. The Data Output Buffers are not enabled during a System Memory Write Cycle.

64K BYTE MEMORY BLOCK: This Block consists of the actual Memory Devices. They are arranged in four Banks of 16K Bytes each. They are Dynamic components and require the Cell Refresh as provided by the Refresh Controller to maintain Data Integrity.

ADDRESS SELECT LOGIC: This Block determines the Port Address for the Board and enables the appropriate Data Output Buffer according to the RAS Select Logic. It also provides the Write logic to ensure that Data is written to the proper 16K Byte Bank.

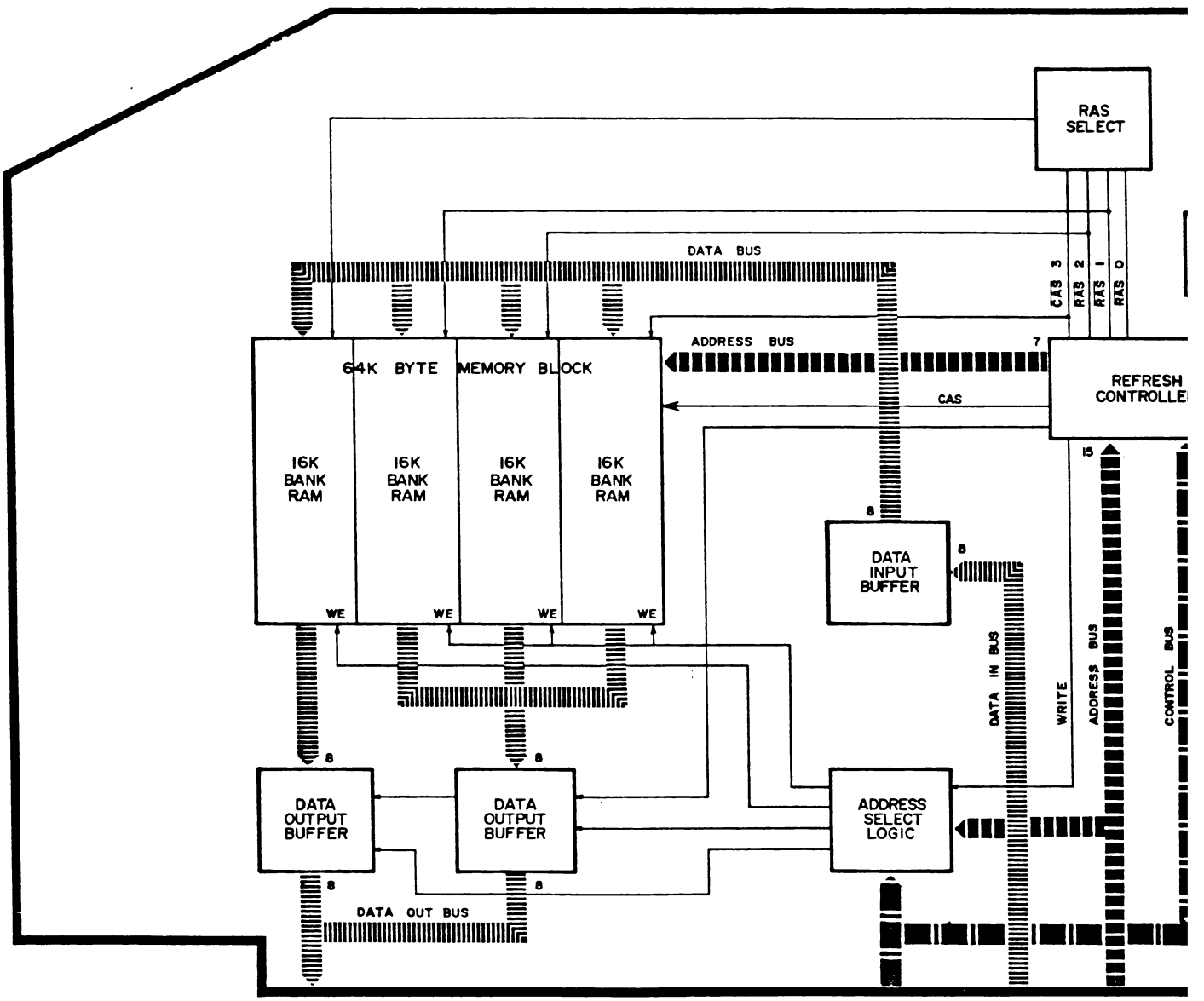
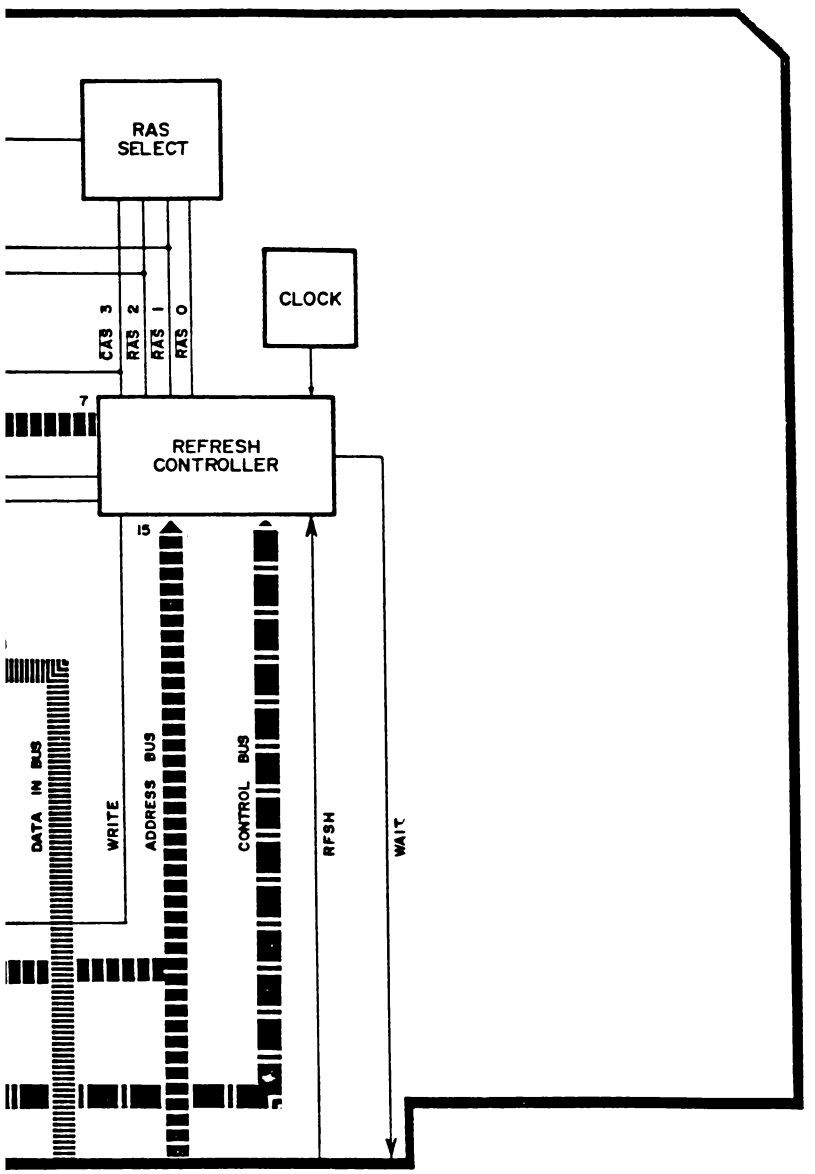


FIGURE 9 MB-64 BLOCK DIAGRAM



Date	81-07-30
Scale	NONE
Drawn	R.D.
Job	

The Floppy Disk Interface Board provides the interface between the System and up to four 5 1/4" or 8" Floppy Disk Drives. It can handle single or double density and single or double sided Disk Drives. The Board is intelligent in that it has a Z-80A microprocessor and sufficient memory for executing elaborate programs. It was designed to aid the System throughput by allowing the CPU to undertake more important tasks than peripheral handling. The FDIB receives Commands from the System Bus and handles all File manipulation, storage and retrieval. This is accomplished with the use of a powerful Floppy Disk Drive Controller Integrated Circuit. With the aid of a DMA Controller, rapid data transfers are made between the 16K Dynamic R M and the selected Disk Drive. Figure 10 is a Block Diagram showing the functional elements of the FDIB Board. The followig sections describe the operation of each of the Blocks and how they relate to one another on the Board.

MICROPROCESSOR: The Z-80A on the FDIB provides the basic control over the operation of the Board. It provides all the local address, Data, and Control lines. It handles Data input from the System Bus through the Input Buffer and programs both the DMA Controller and the Floppy Disk Drive Controller at Reset time. The Z-80A runs at 2MHz and receives this Clock signal as well as the Reset signal from the System Bus.

MEMORY ADDRESS DECODER AND REFRESH LOGIC: This Block is responsible for multiplexing the address lines and supplying the Row and Column address Strobes to the 16K of Dynamic RAM on the Board, during memory read or write cycles. In addition it decodes the upper address lines to select either the RAM or the 2K of EPROM that is on the Board. This type of circuit performs a RAS only refresh whenever the microprocessor is executing an opcode fetch. This ensures that the Dynamic memory is constantly refreshed to prevent loss of Data.

16K DYNAMIC RAM: This Block consists of the actual memory devices and its associated I/O driver. When the FDIB is Reset, the EPROM program allows the CPU to load System software to the Board. This software resides in the Dynamic RAM. The local Z-80A then executes this software allowing the FDIB to operate as it does efficiently.

2K EPROM: The EPROM contains software which is executed after the Reset keyswitch is pressed. It initializes the Board and allows the CPU to load system software to the FDIB where it resides in the Dynamic RAM. The EPROM is selected by the Memory Address Decoder and Refresh Logic. This EPROM may be exchanged for one containing Diagnostic software which will assist in the servicing of the system.

LOCAL I/O DECODER:

This Block Decodes the lower 8 Bits of the Address Bus from the Microprocessor to allow selection of the I/O Buffers. The Microprocessor is thus able to receive Data from the Input Buffer and the System and output Data to the System through the Output Buffer. In addition, this Block allows the Microprocessor to select the Clock frequency for the Floppy Disk Drive Controller and to select the Floppy Disk Drive Controller itself for programming and status Data.

SYSTEM I/O DECODER:

This Block receives the eight lower Address lines and two Control lines from the System Bus. This allows the System Bus to control Data transfer in both directions between the FDIB and the CPU Board. The Microprocessor also has the ability to interrupt the CPU Board by logic that is provided by this Block.

INPUT BUFFER:

This Block receives Data from the System Bus and holds it for the Microprocessor. It is selected by the System I/O Decoder. The Microprocessor is able to determine whether new Data is available by polling a status Flag which is automatically set when the System places Data into the Input Buffer. The address for this Flag is produced by the Local I/O Decoder. This Flag is also available to the System and thus informs the CPU when the Microprocessor has removed the Byte. This allows complete unambiguous Data exchange.

OUTPUT BUFFER:

This Block receives Data from the Microprocessor and holds it until the System Bus is ready to accept it. The Microprocessor is able to determine whether the System has taken the old Data from the Output Buffer by polling a status Flag which is automatically set when the System has removed the Data. The address for this Flag is decoded from the lower eight Address lines from the Microprocessor by the Local I/O Decoder. Similarily this Flag is also available to the System via the System I/O Decoder. The System is able to poll the Flag and determine whether new Data is available to it. This allows unambiguous Data exchange.

DMA CONTROLLER:

This Block provides the Floppy Disk Drive Controller with Direct Access to the 16K Bytes of Dynamic RAM. The DMA Controller is programmed by the Microprocessor to respond to commands given by the Floppy Disk Drive Controller. During a Disk Read operation the DMA Controller takes over control of the Local Bus from the Microprossor and transfers Read Data from the Floppy Disk Drive Controller directly to the 16K Byte Dynamic RAM. During a Disk Write operation the DMA Controller transfers Data in the opposite direction. Once a Data transfer is competed the Microprocessor regains control of the Local Bus.

FLOPPY DISK DRIVE CONTROLLER:

This Block provides all the Control signals and the Write and Read lines for four Floppy Disk Drives. It receives Commands from the Microprocessor and performs the operations required to access a particular track and sector on one of four Floppy Disk Drives. It handles the conversion of Parallel Data to Serial Data for the Write Precompensation Logic during a Disk Write operation and the opposite conversion when receiving Read Data from the Recovery Logic. At Reset, the Microprocessor programs this Block for proper operation.

CLOCK AND 5 1/4" OR 8" SELECT LOGIC:

This Block provides the Floppy Disk Drive Controller with either an 8 MHz or a 4 MHz Clock Signal, depending on the type of Drive being used. The Operating Software on the Board makes the selection of frequency through the Local I/O Decoder. This Block also provides the Read Data Recovery Logic with the correct operation frequency.

READ DATA RECOVERY LOGIC:

This Block takes the Raw Read Data Signal from the Disk Drive and provides the Floppy Disk Drive Controller with Raw Read Data Pulses and a Data Window. With these signals the Controller is able to reconstruct the Data that was stored on the Drive.

WRITE PRE-COMPENSATION LOGIC:

This Block provides the logic for bit shifting the Raw Write Signal from the Floppy Disk Drive Controller. This bit shift is necessary for certain combinations of ones and zeros in the Data Write Bit Stream. It enables easier recovery of the Data by the Recovery Logic.

DRIVE SELECT AND CONTROL LOGIC:

This Block provides the buffering for the Control lines to and from the Disk Drives. It also decodes the Drive Select lines from the Floppy Disk Drive Controller for the selection of the proper Drive. The Low Current Line is used for 8" Drives for adjusting the Write Pre-compensation timing.

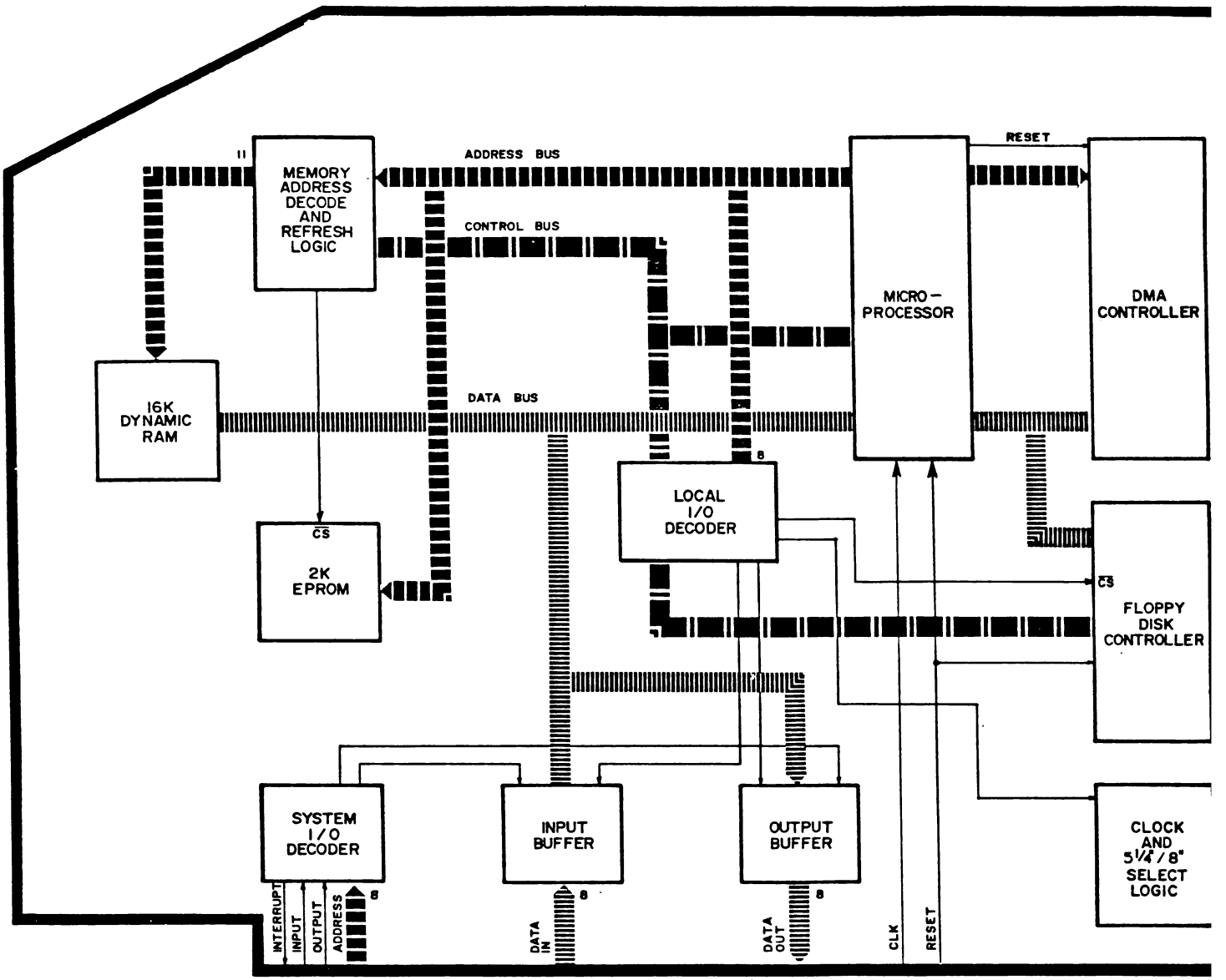
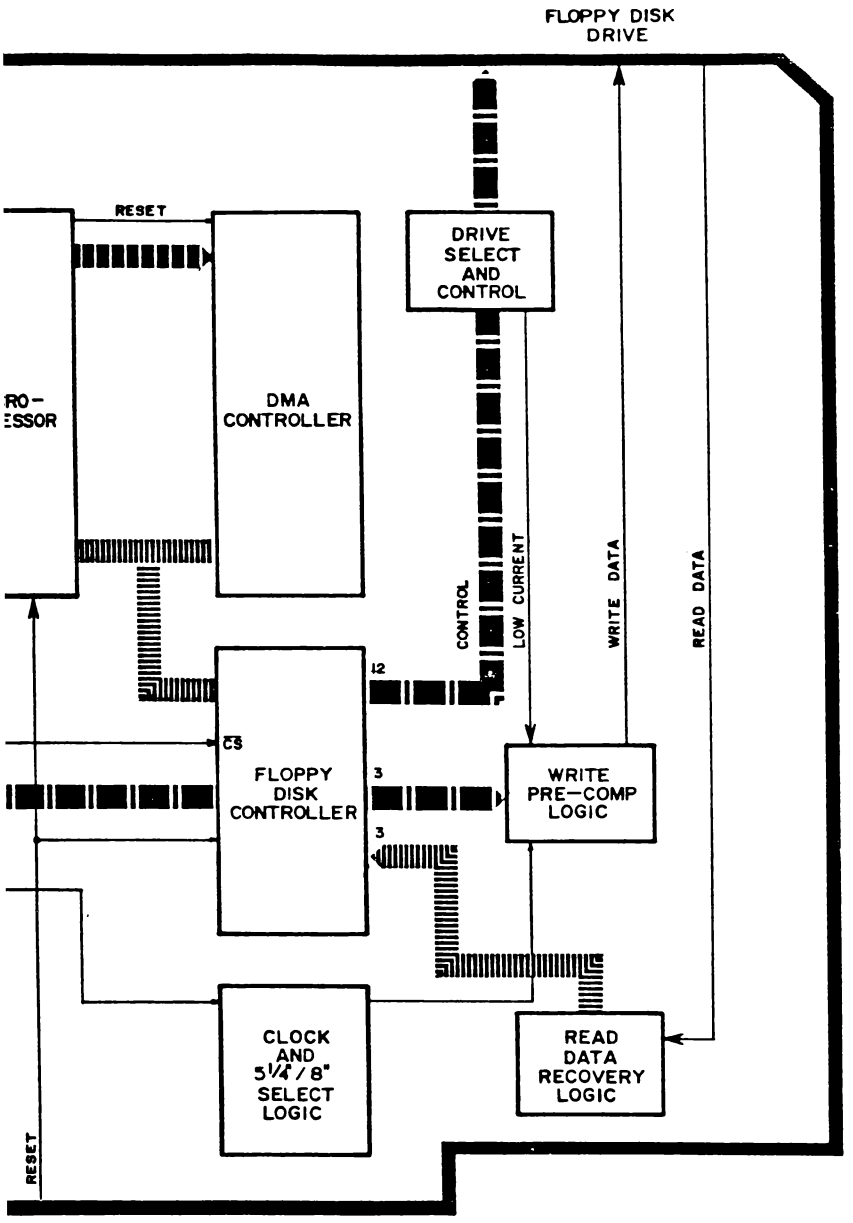


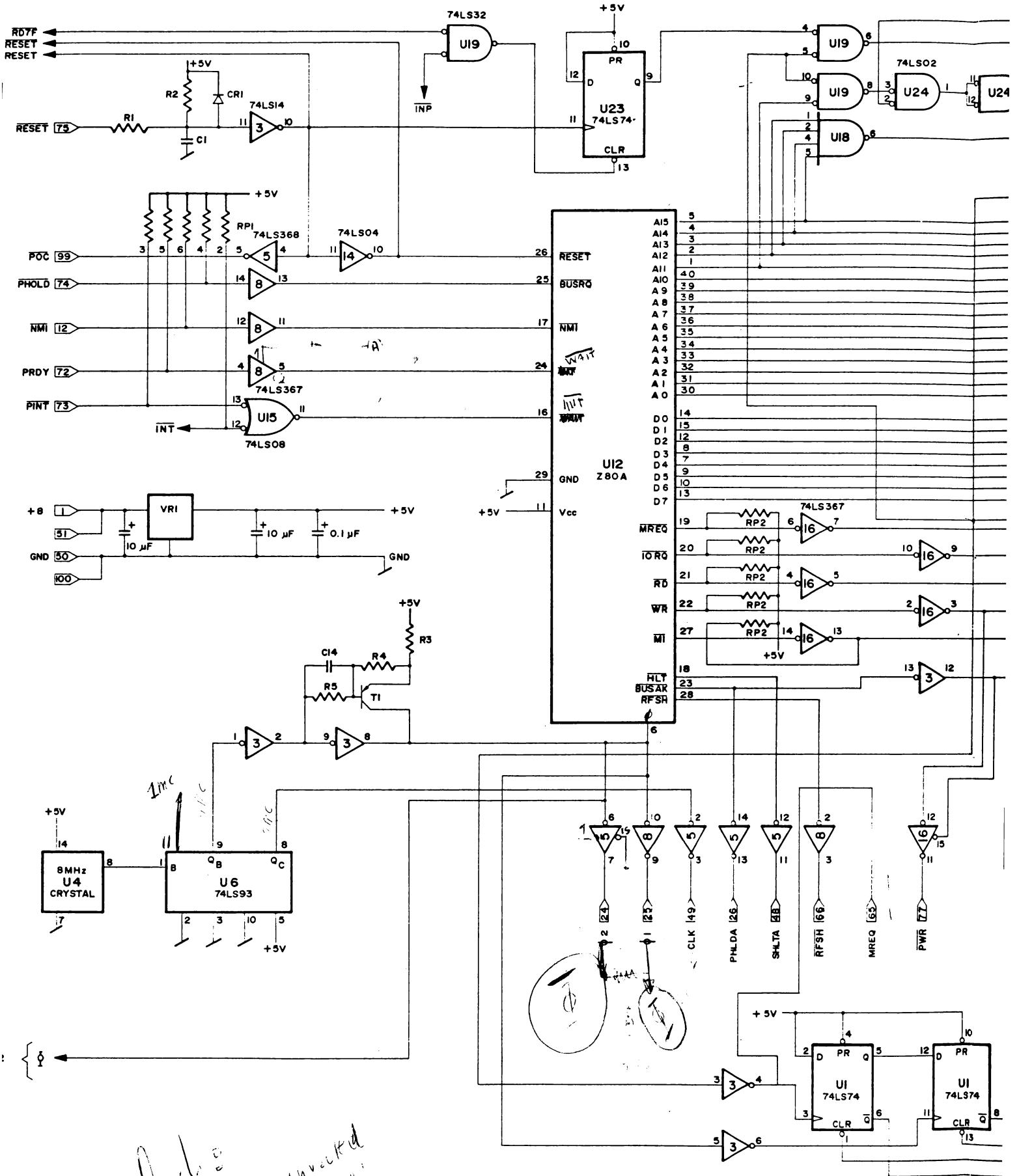
FIGURE 10 FDIB BLOCK DIAGRAM



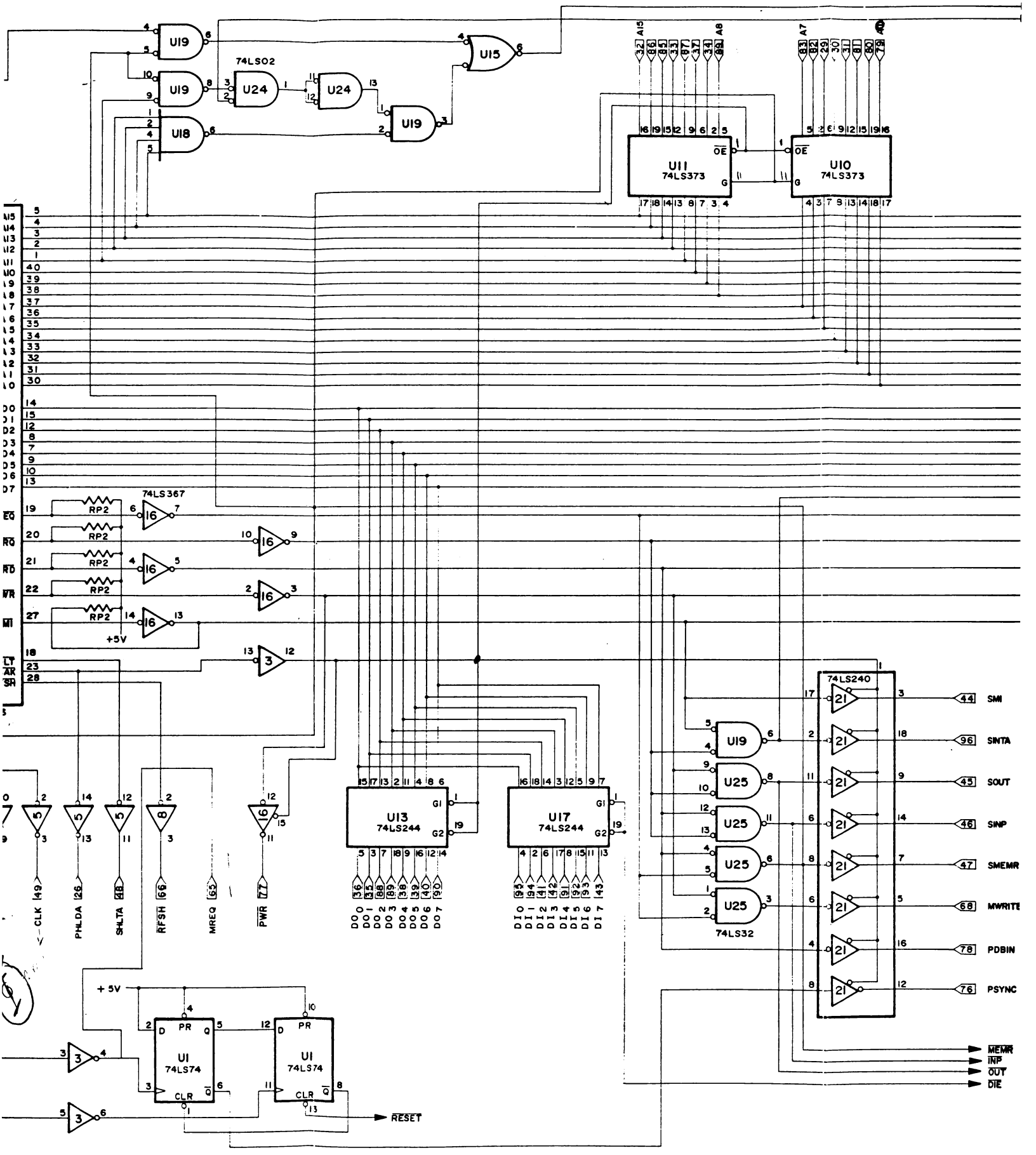
Date	81-07-30
Scale	NONE
Drawn	R.O.
Job	

There is one Power Supply for the System. It consists of one transformer, three Bridge Recifiers, five filter Capacitors, three Connectors, a Mains Connector with Tap selector, and a Power Switch. All of these components are mounted to the Base. See figure 11 for a pictorial representation and figure 12 for a schematic of the Power Supply. The Power Supply provides Current to the System at 6 different Voltages. Bridge Rectifiers with Capacitive filtering provide the unregulated voltage levels.The +15 Volt Supply goes directly to the Printer, unregulated and provides the Current to drive the Carriage and Print Wheel Motors. Connection is made through the 8 Pin Printer Connector. The +8 Volt Supply provides Current to the Mother Board through its 8 PIN Connector where it is regulated by several different devices to +5 Volts. There are two +5 Volt Regulators on the Mother Board itself. See figure 12. One provides current for the Logic on the Printer. The other provides current for the Logic on the four Disk Drives. In addition, each of the Printed Circuit Boards, that is plugged into the Mother Board, contains its own +5 V Regular. The +16 Volt supply also provides current to the Mother Board. The +16 Volt supply is Regulated to +12 V for the Disk Drive Motors. There are two Regulators on the Mother Board that provide this. In addition there are Regulators or Zener Diodes on each of the Printed Circuit Boards that is plugged into the Mother Board. These Regulate both the +16 Volt and -16 Volt Supplies to the +12 Volt and -12 Volt or -5 Volt levels respectively. The Power Supply provides the Ribbon Motor current for the Printer as well at 24 Volts a.c. Also there is a 24 Volt winding on the transformer that presently is not used.

SCHEMATICS



WIRING DIAGRAM


U19
U19
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U24
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U19
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U10
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U13
74LS244
U17
74LS244
74LS240
U19
U25
U25
U25
U25
74LS32
+5V
U1
74LS74
U1
74LS74
RESET
CLK
PHLDA
SHLTA
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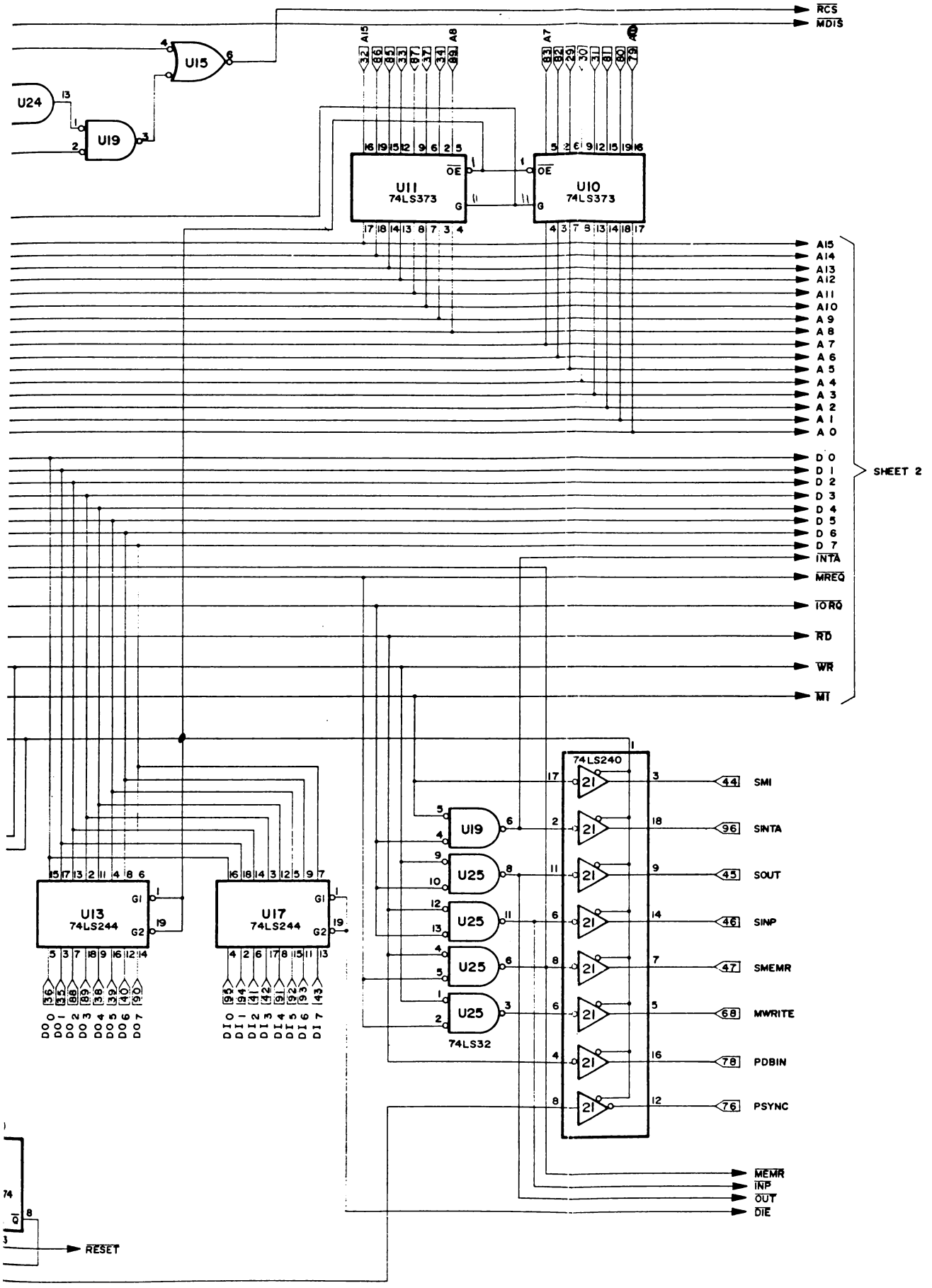
MWRITE
PDBIN
PSYNC
MEMR
INP
OUT
DIE



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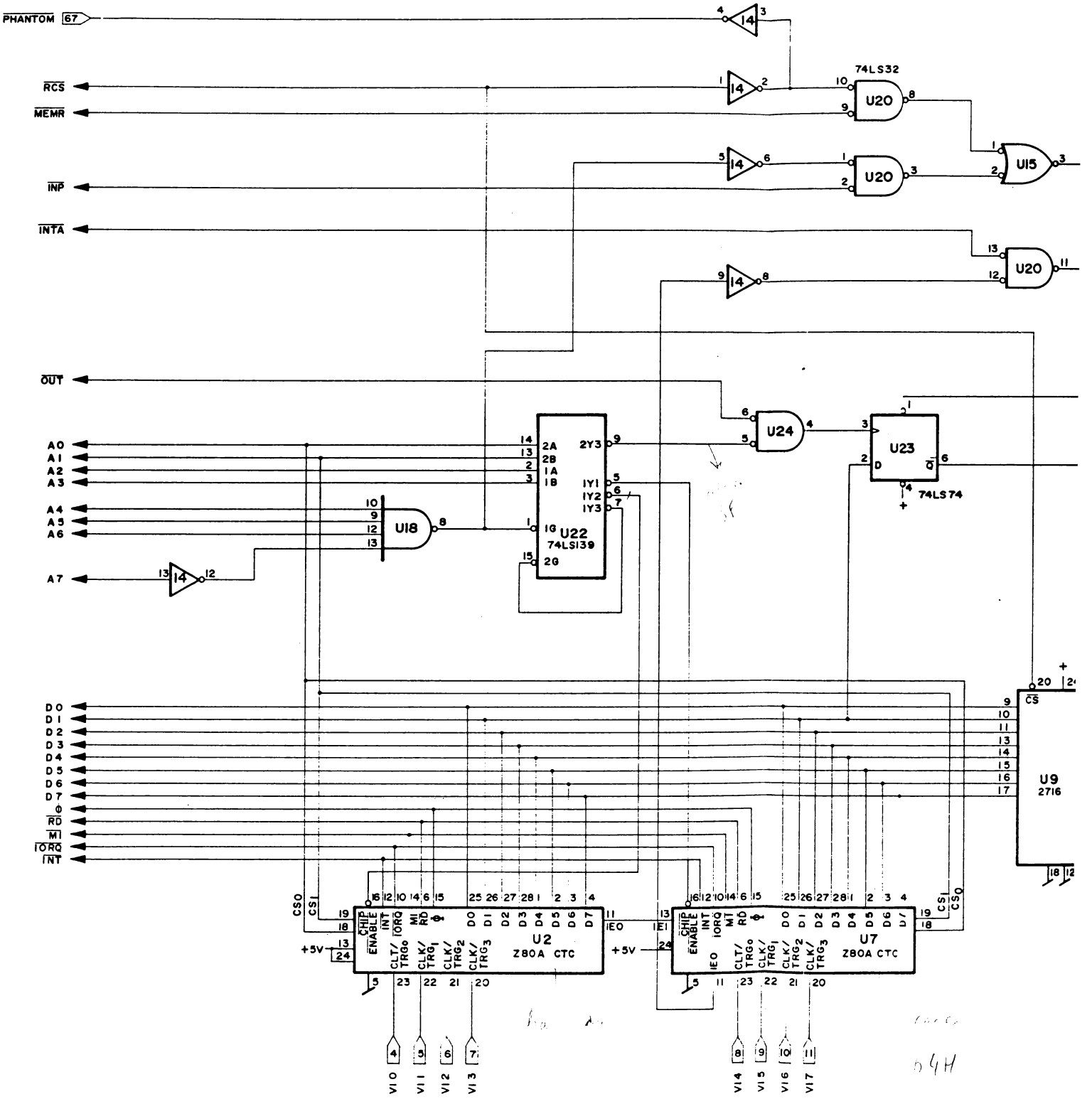
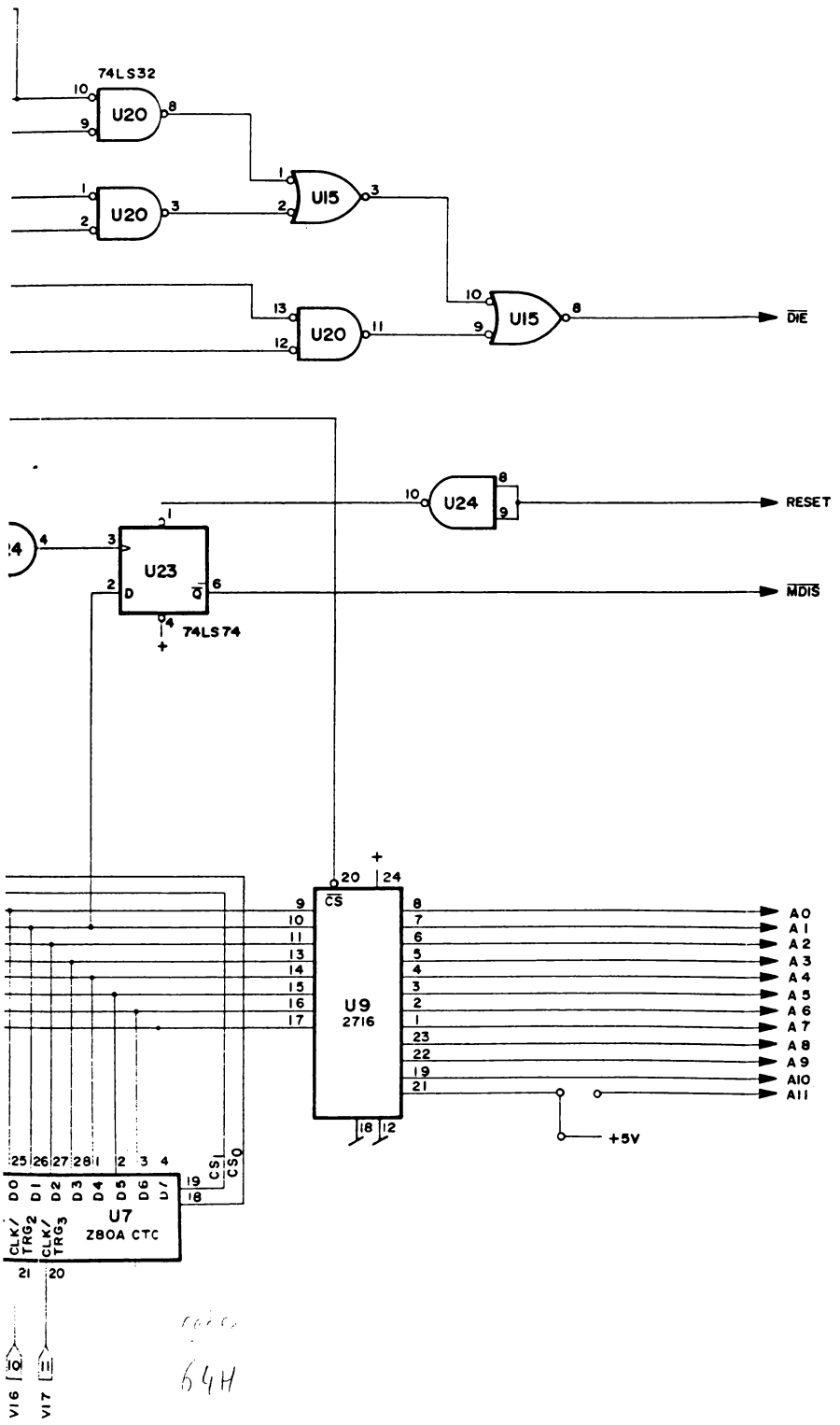
Scale	NONE
Drawn	V.M.D.

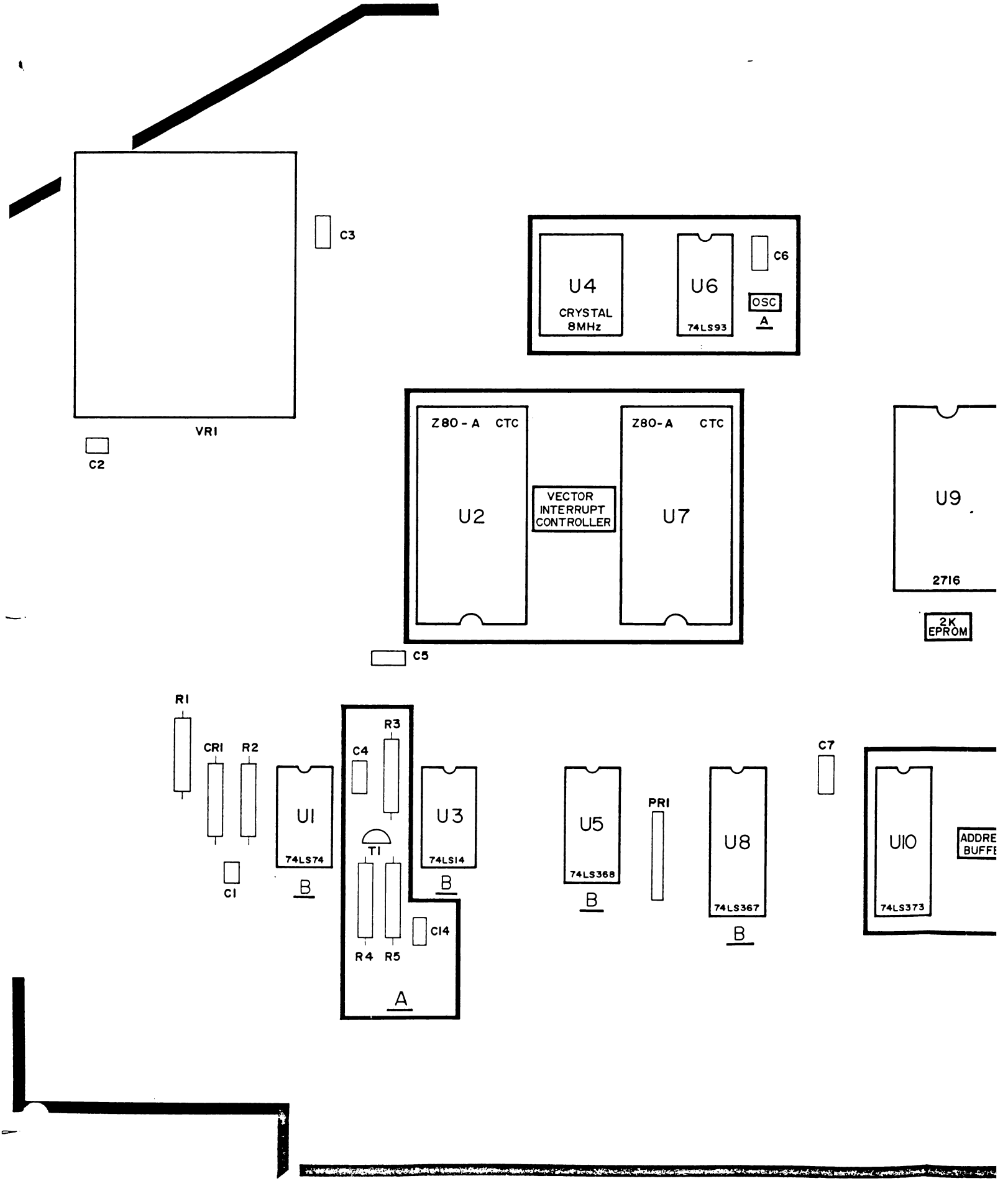


WIRING DIAGRAM

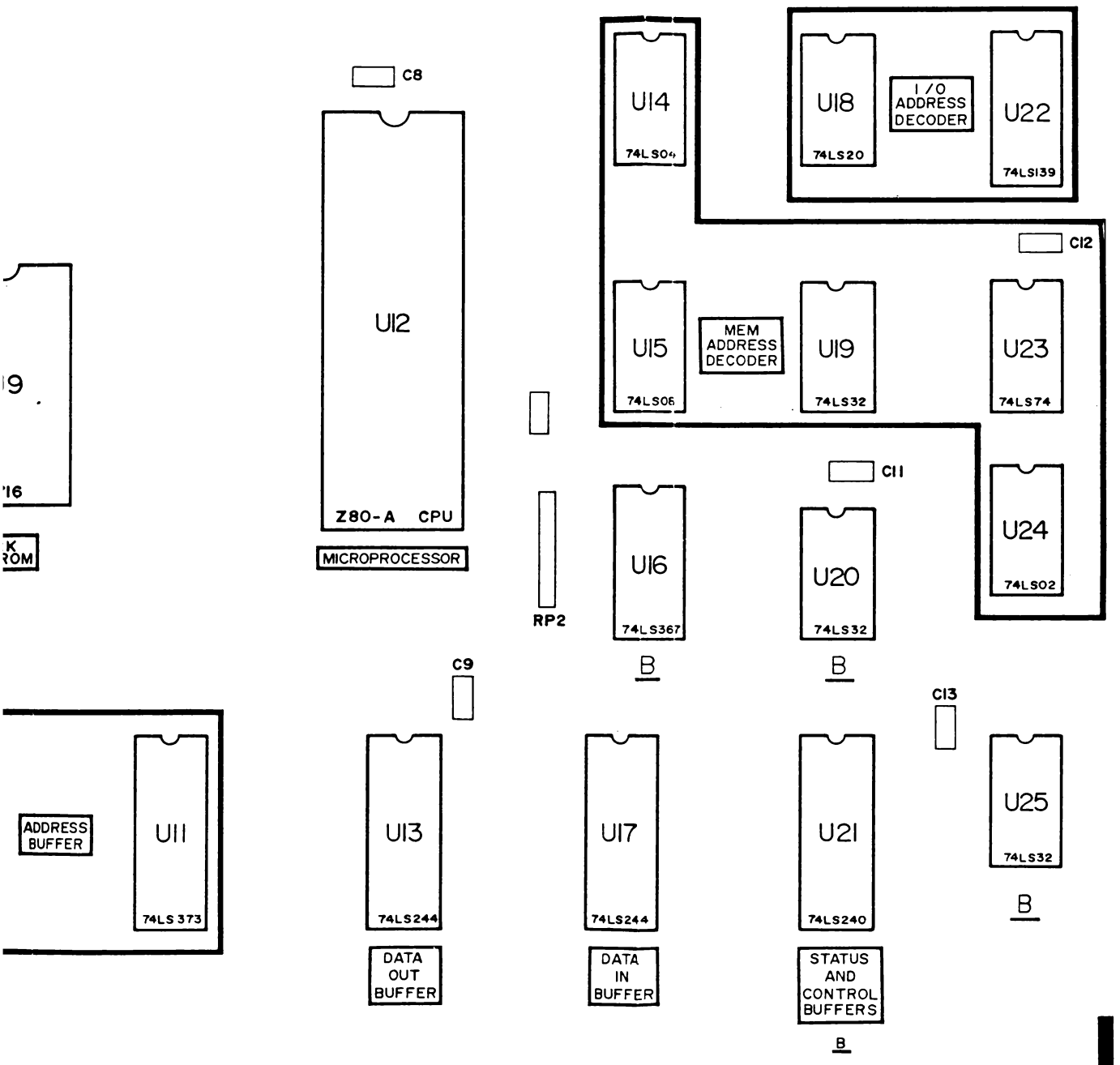


64H

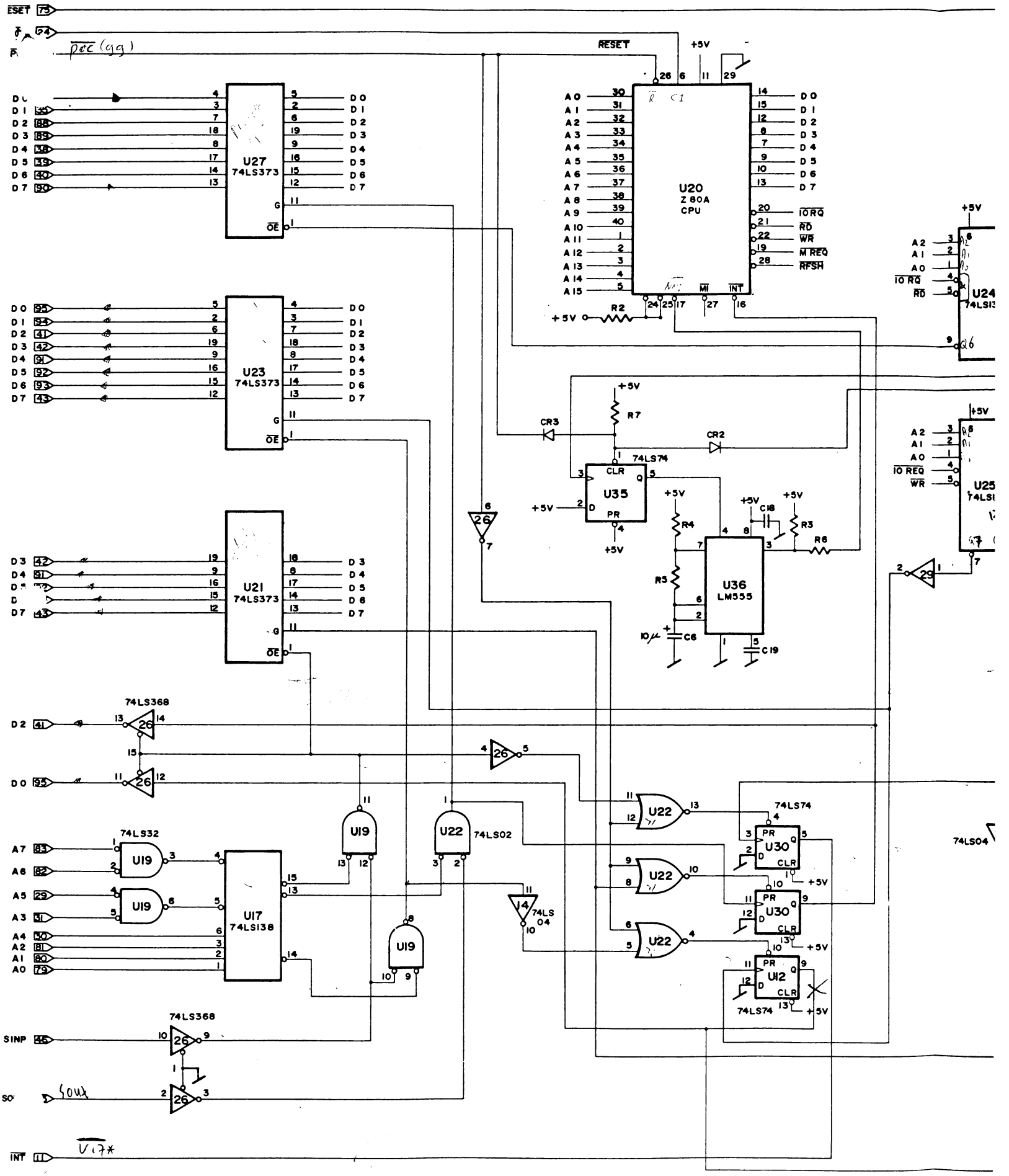
SCALE: NONE	APPROVED BY:	DRAWN BY V.M.D



CPU BOARD DIAGRAM



SCALE: NONE | APPROVED BY: | DRAWN BY V. M. D.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U20
Z 80A
CPU
U27
74LS373
U23
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U21
74LS373
U35
74LS74
U36
LM555
R2
R3
R4
R5
R6
R7
CR2
CR3
C6
C18
C19
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U19
U17
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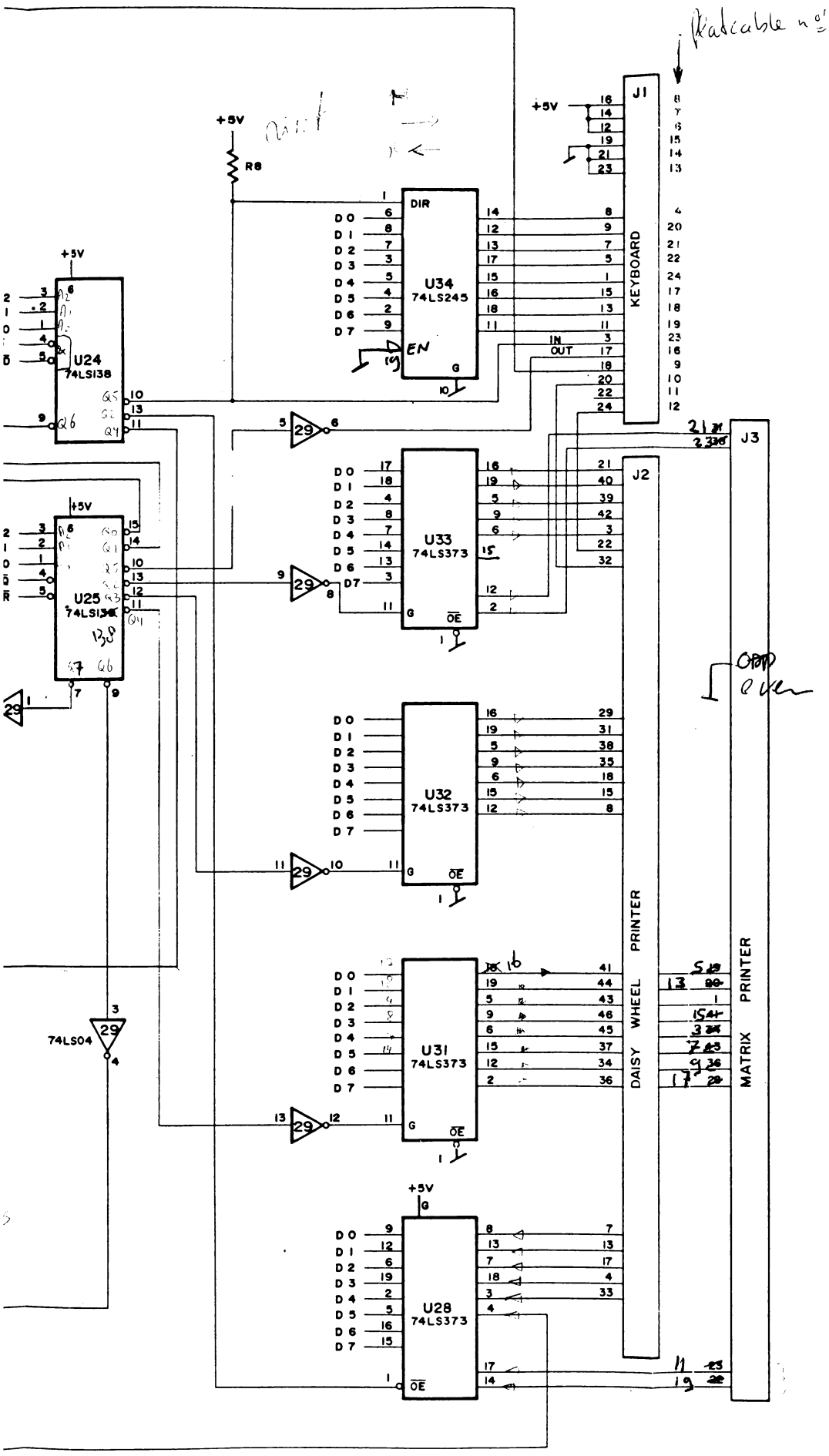
U22
74LS02
74LS04
U30
U12
SINP
INT



Date 81-05-20
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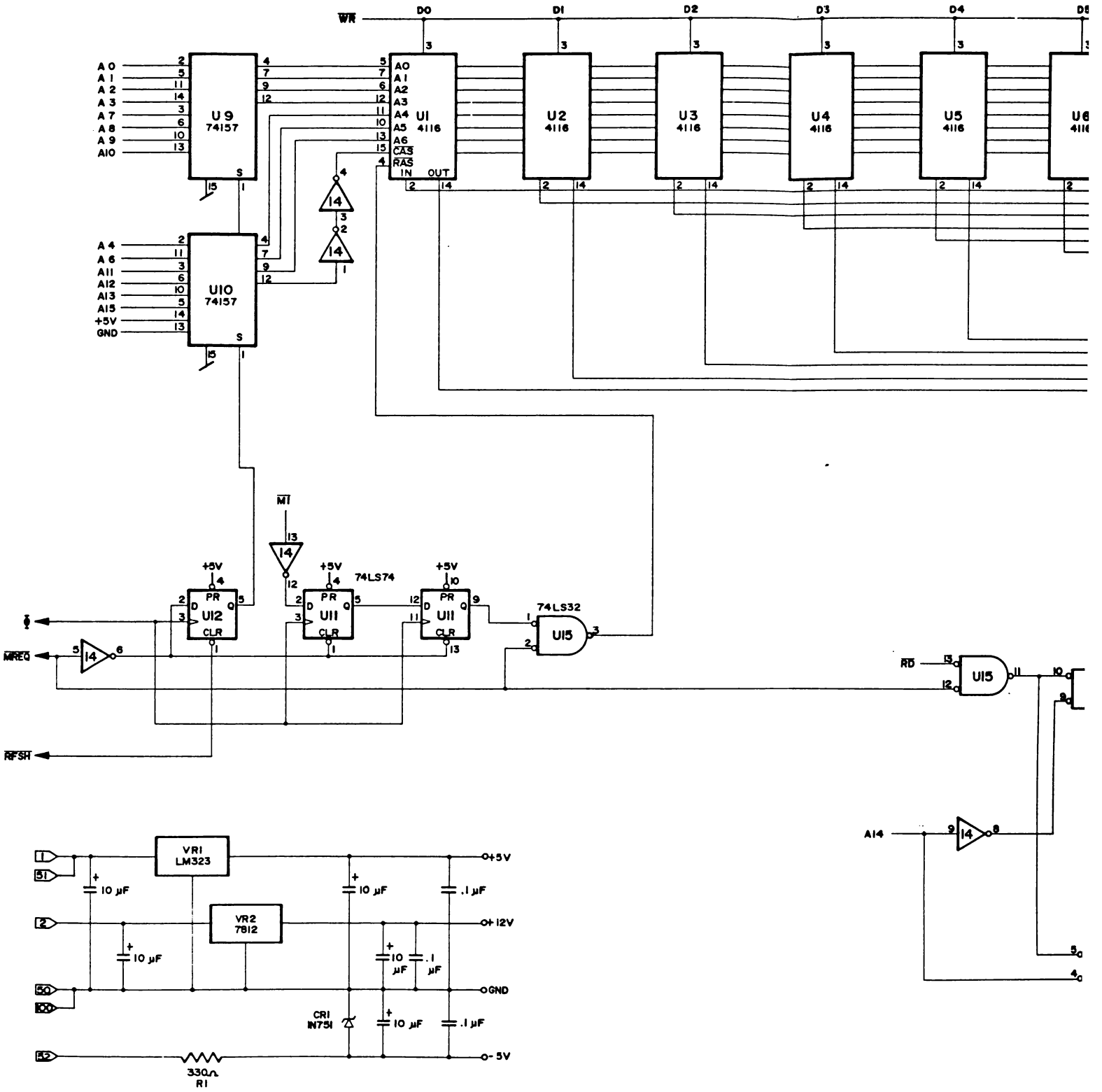
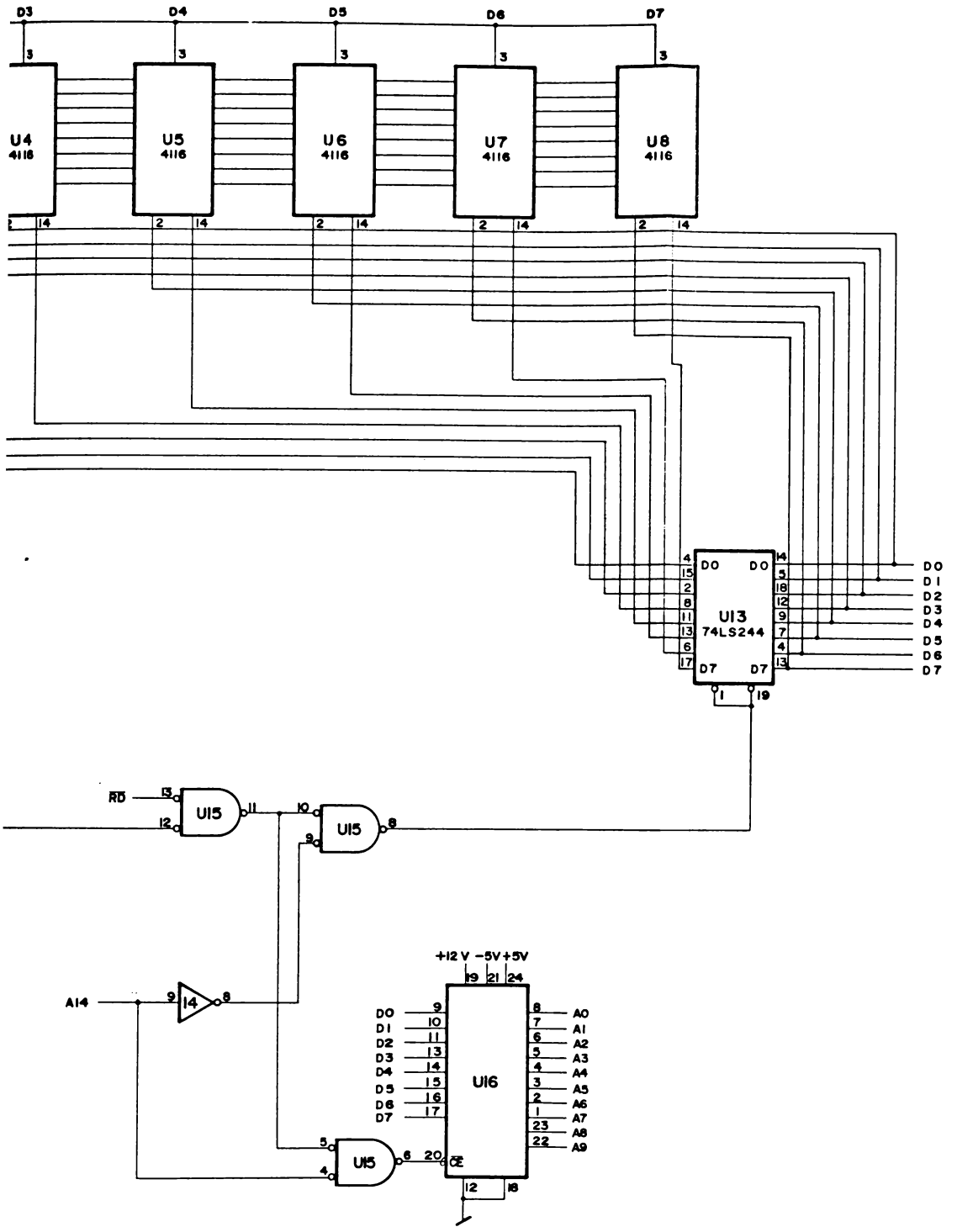
Drawn V.M.D.

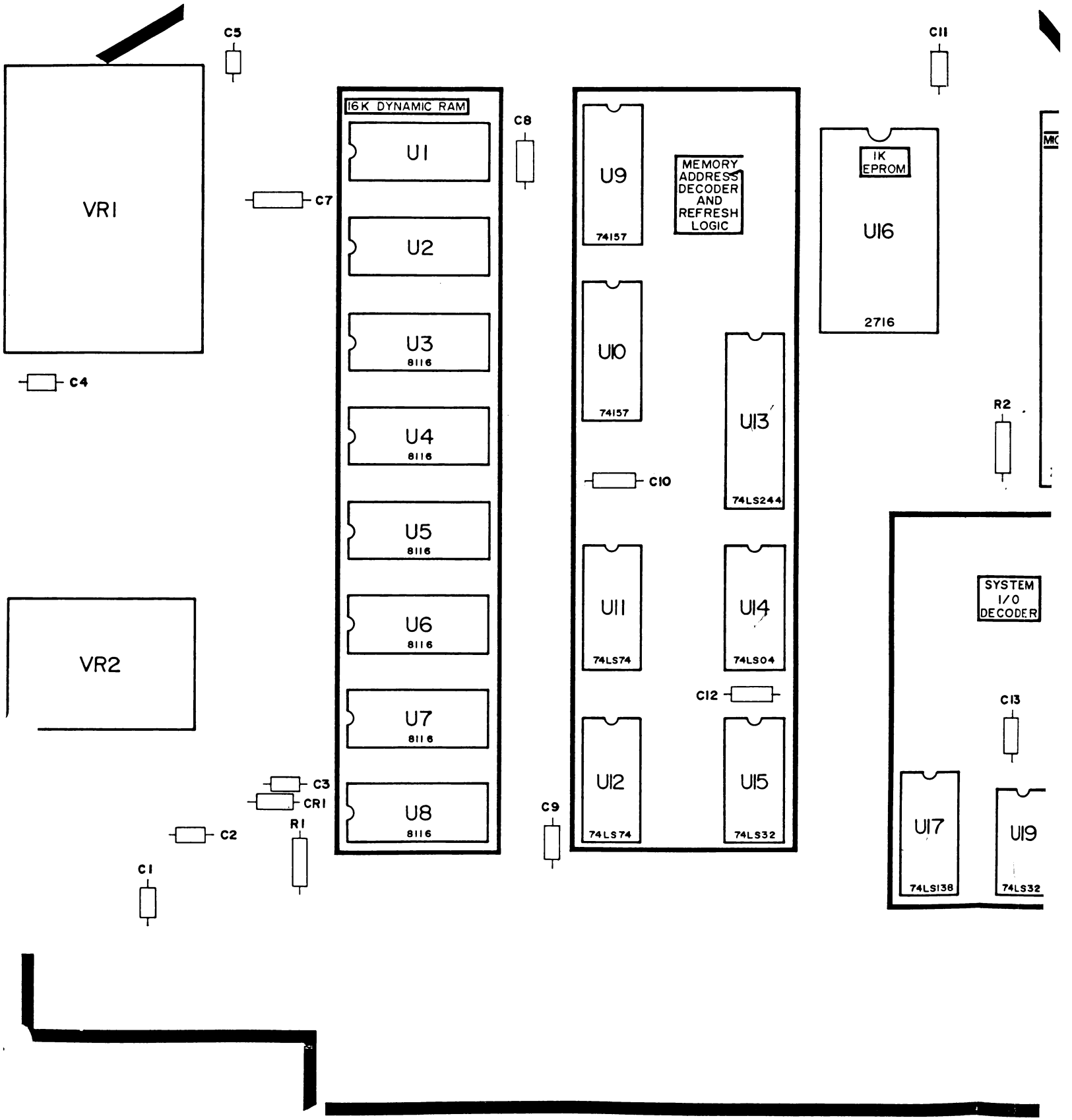


PKIB WIRING DIAGRAM

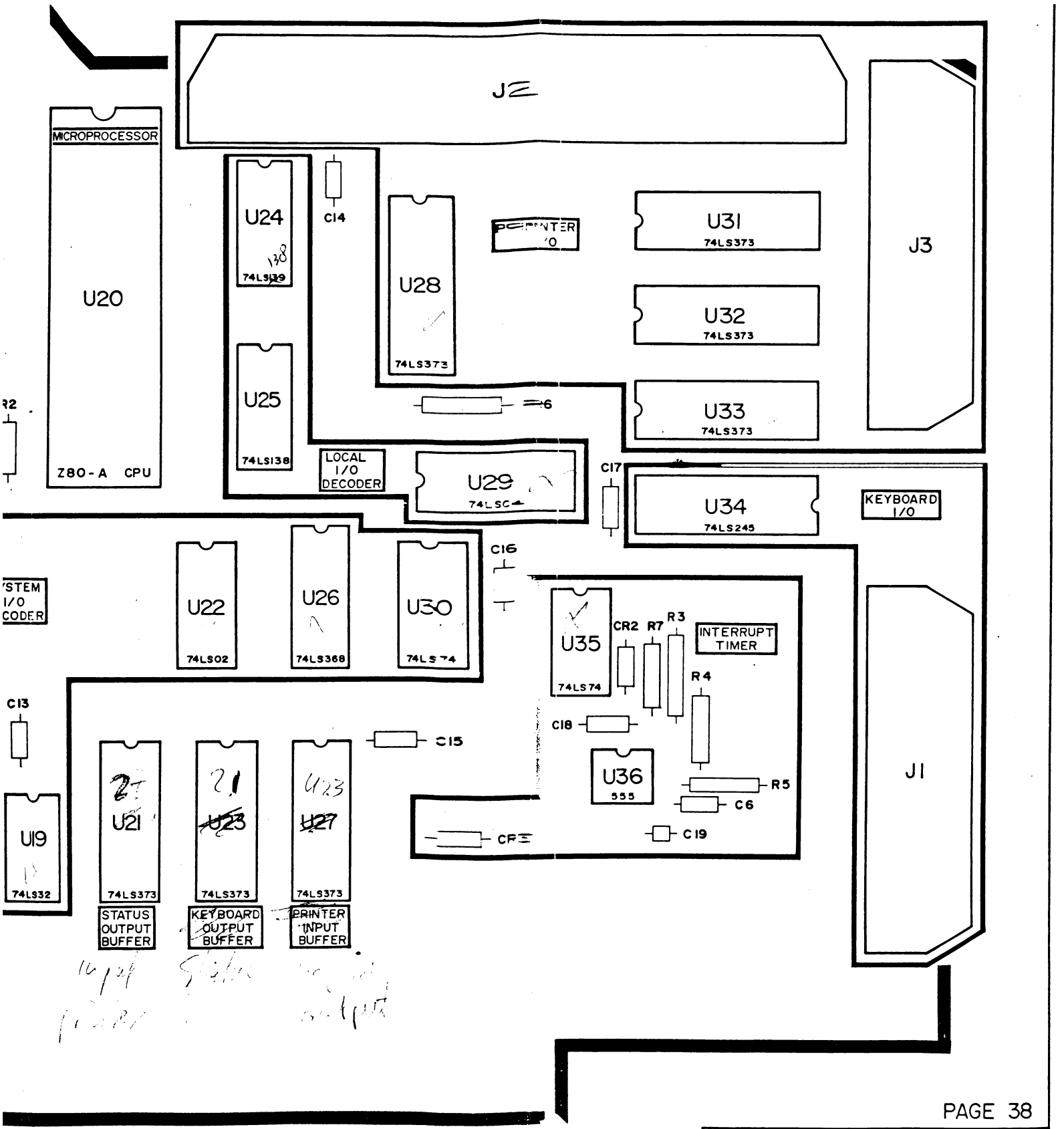


PAGE 37

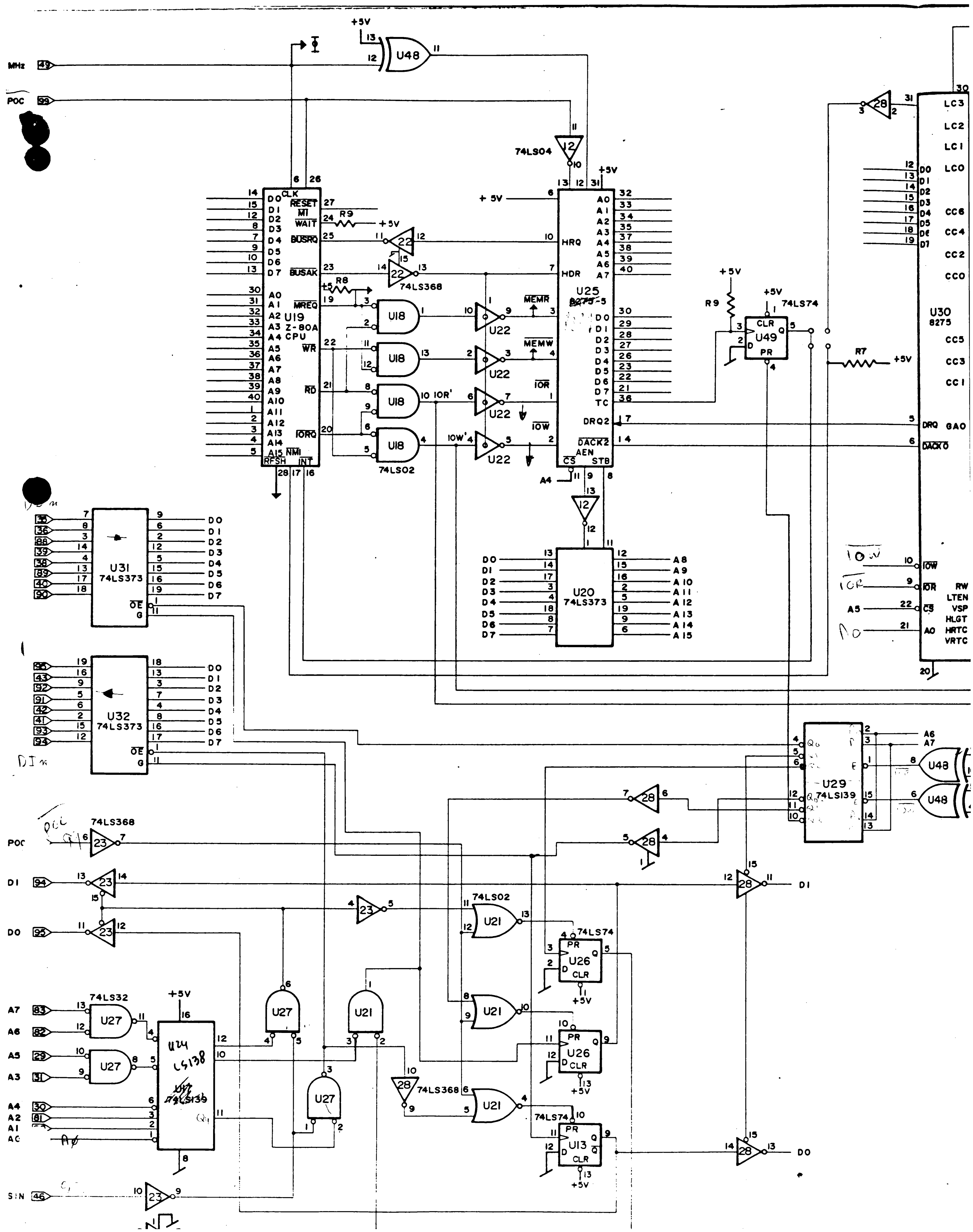
Date	81-05-20
Scale	NONE
Drawn	V.M.D.
Job	PKIB

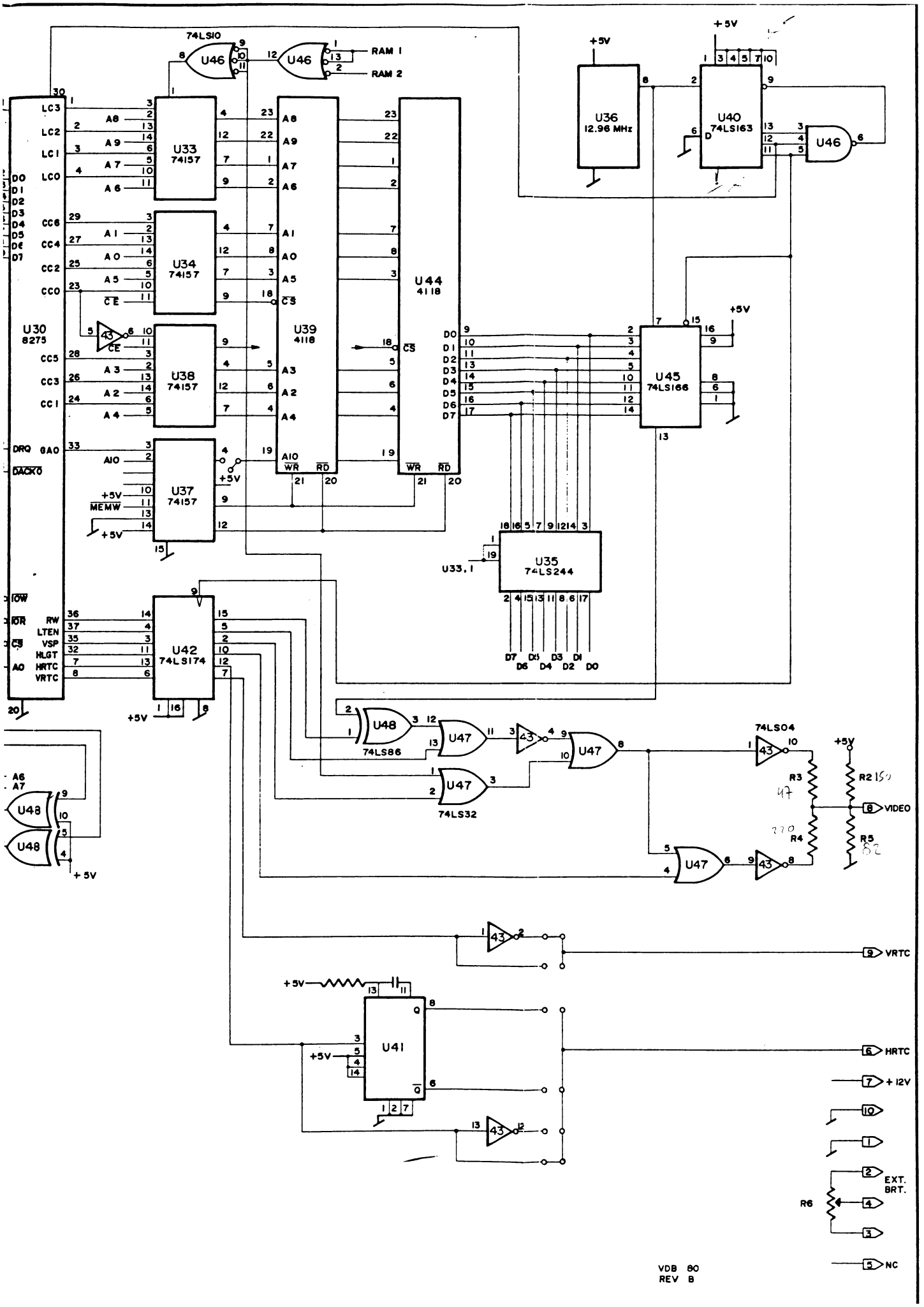


PKIR BOARD DIAGRAM



SCALE: NONE | APPROVED BY: | DRAWN BY V.M.D.


MHz
POC
+5V
U48
74LS04
U19
Z-80A
CPU
CLK
RESET
MI
WAIT
BUSRQ
BUSAK
MREQ
WR
RD
IORQ
NMI
RFSH
INT
R9
R8
74LS368
U18
74LS02
U22
MEMR
MEMW
IOR
IOW
IOR'
IOW'
U25
8275-5
HRQ
HDR
TC
DRQ2
DACK2
AEN
CS
STB
U20
74LS373
U31
74LS373
U32
74LS373
OE
U49
74LS74
CLR
PR
R7
U30
8275
LC3
LC2
LC1
LC0
CC6
CC4
CC2
CC0
CC5
CC3
CC1
DRQ
GA0
DACK0
IOW
IOR
CS
A0
RW
LTEN
VSP
HLGT
HRTC
VRTC
U29
74LS139
U28
U23
U21
U26
U27
74LS32
U24
LS138
U13
SIN

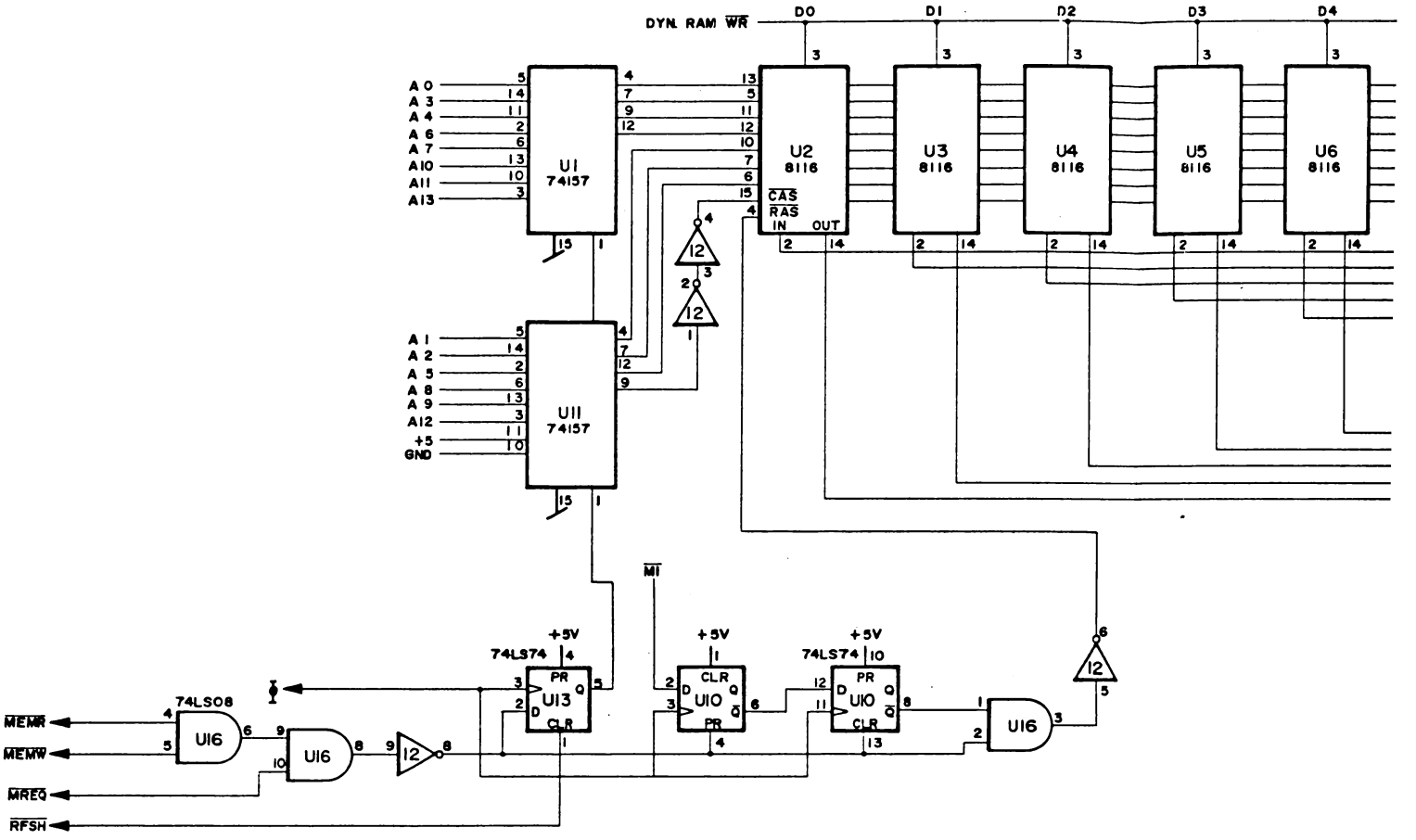


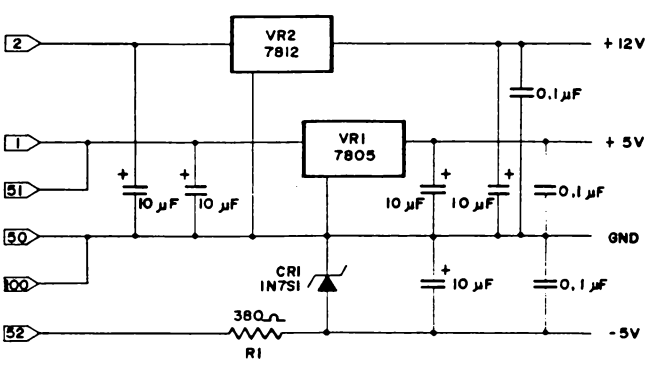
REVISIONS	BY

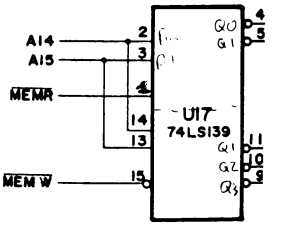
Date 81-05-14

Scale NONE

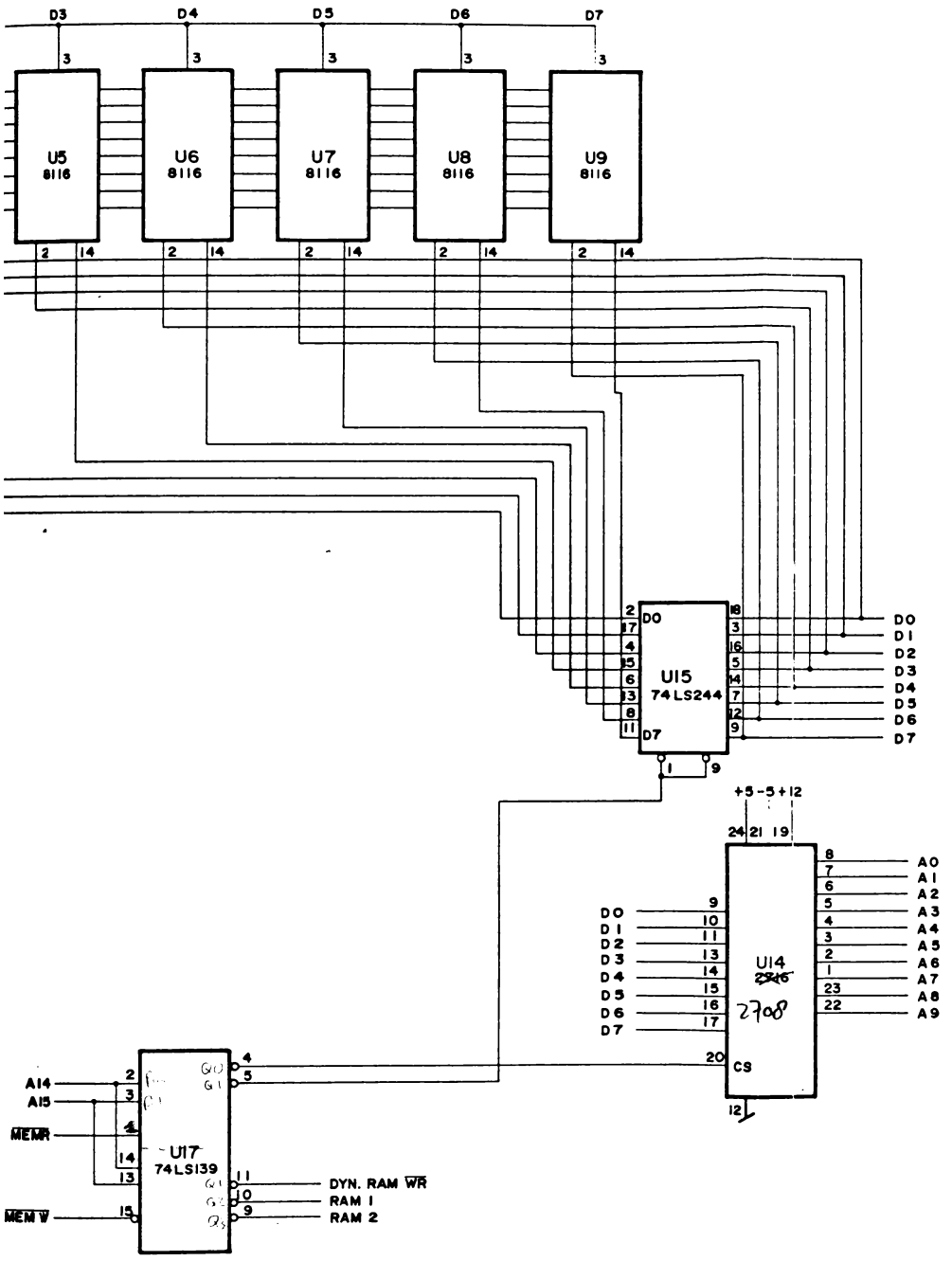
Drawn V.M.D.







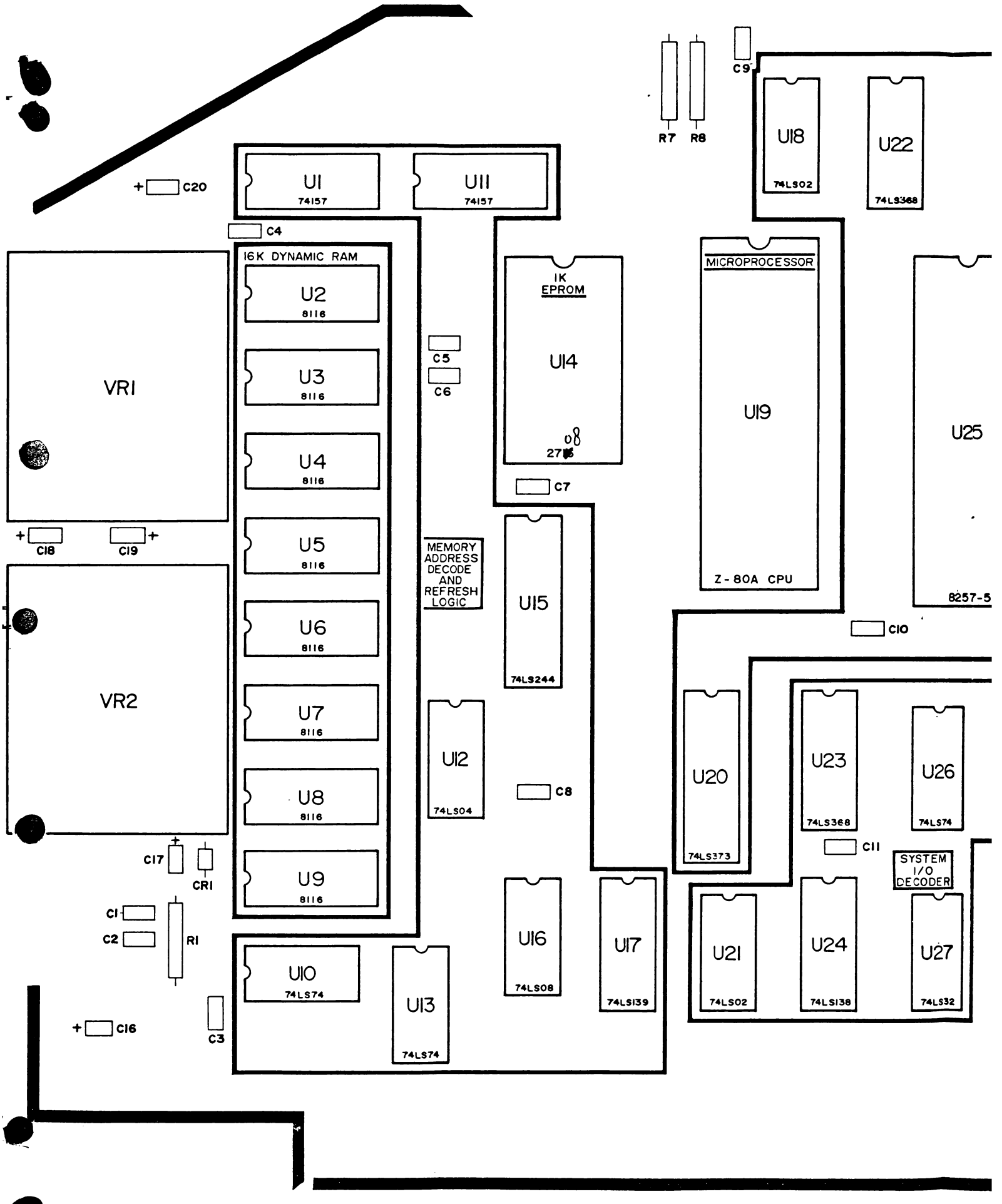
VDB 80 WIRING DIAGRAM



RING DIAGRAM

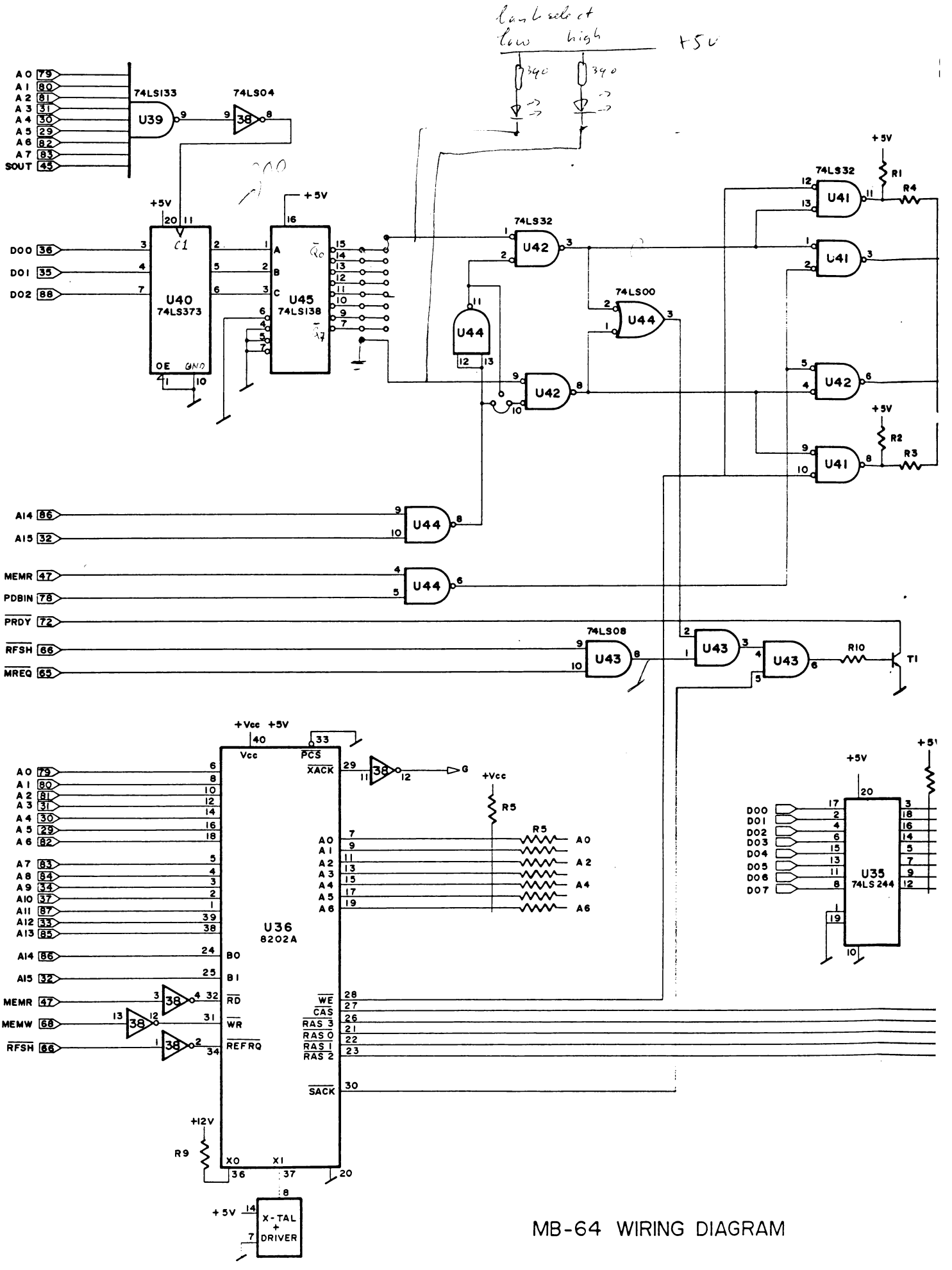
PAGE 40

Date	81-05-14
Scale	NONE
Drawn	V.M.D.
Job	VDB-80

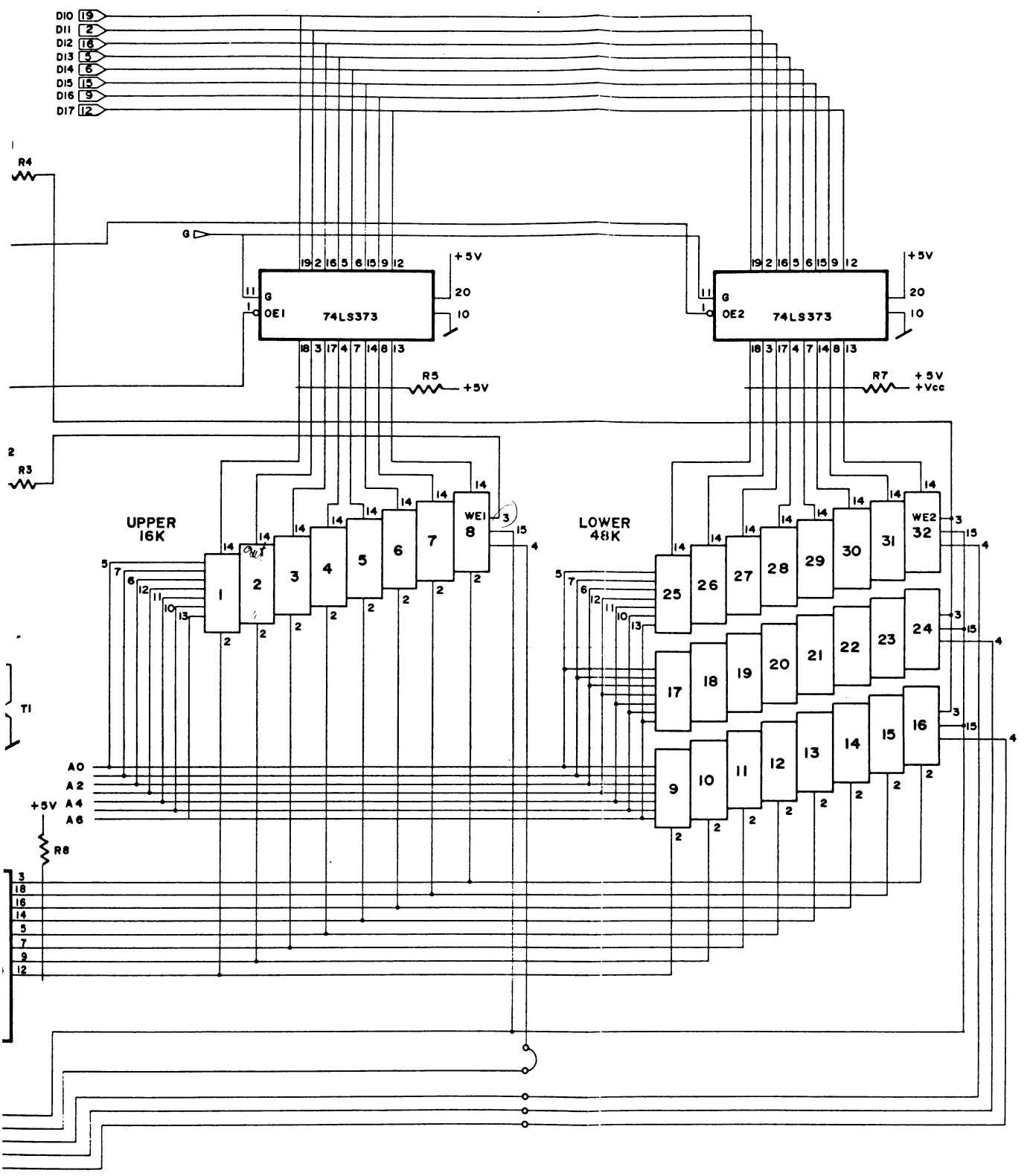


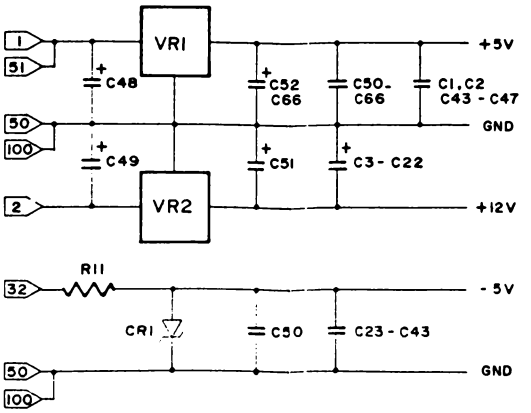
VDB-80 BOARD DIAGRAM

SCALE: NONE | APPROVED BY: | DRAWN BY V.M.D.



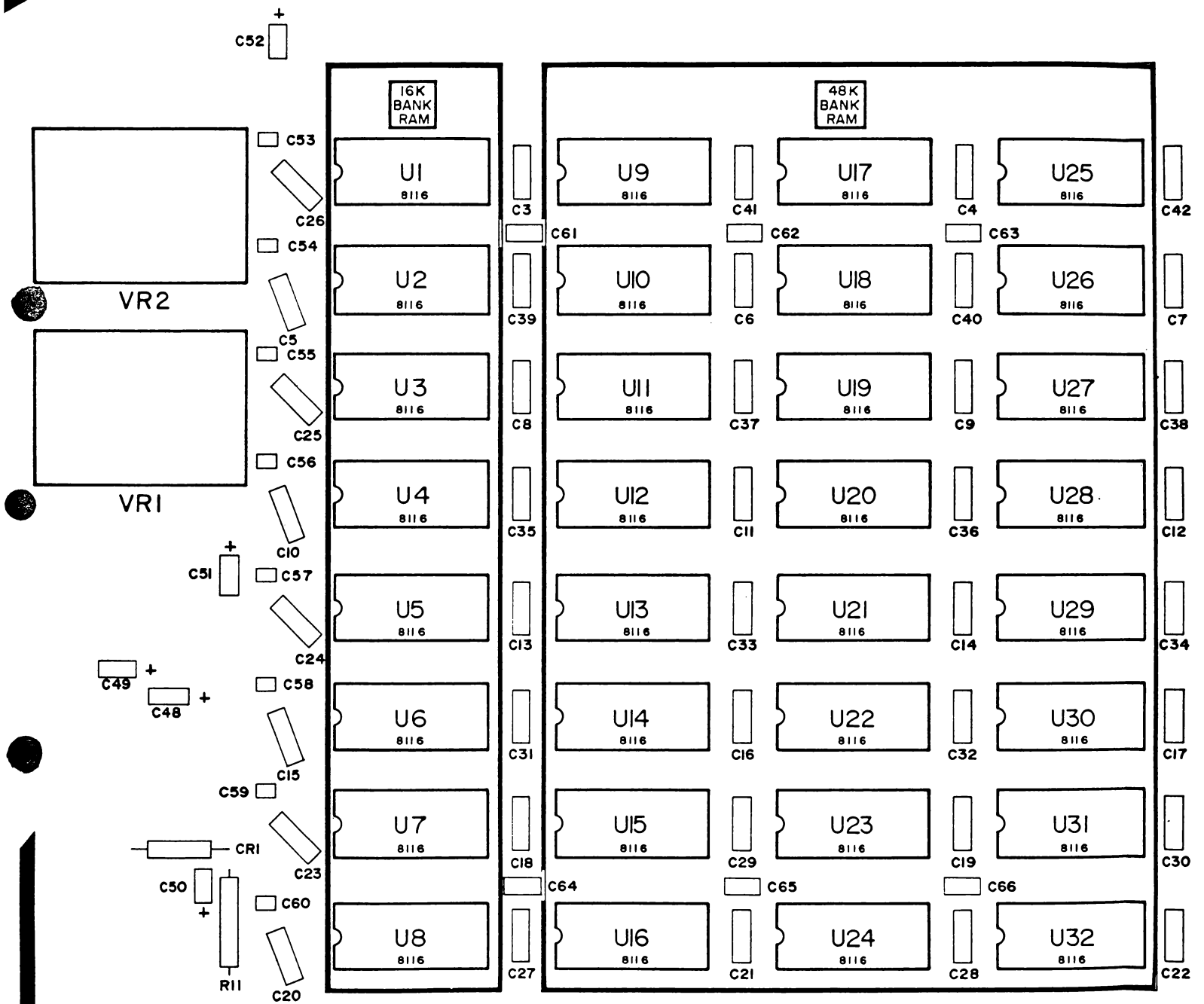
MB-64 WIRING DIAGRAM

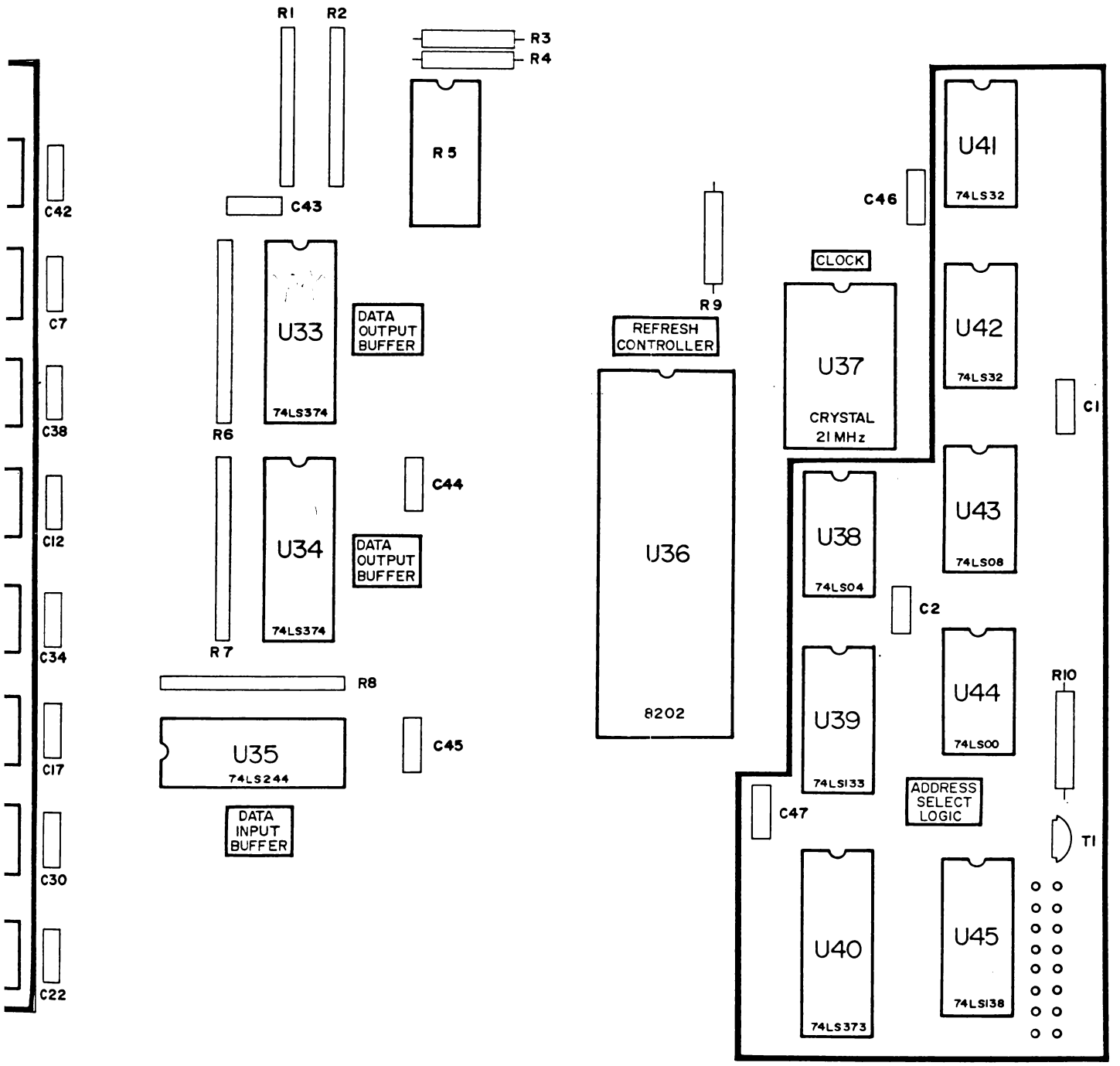




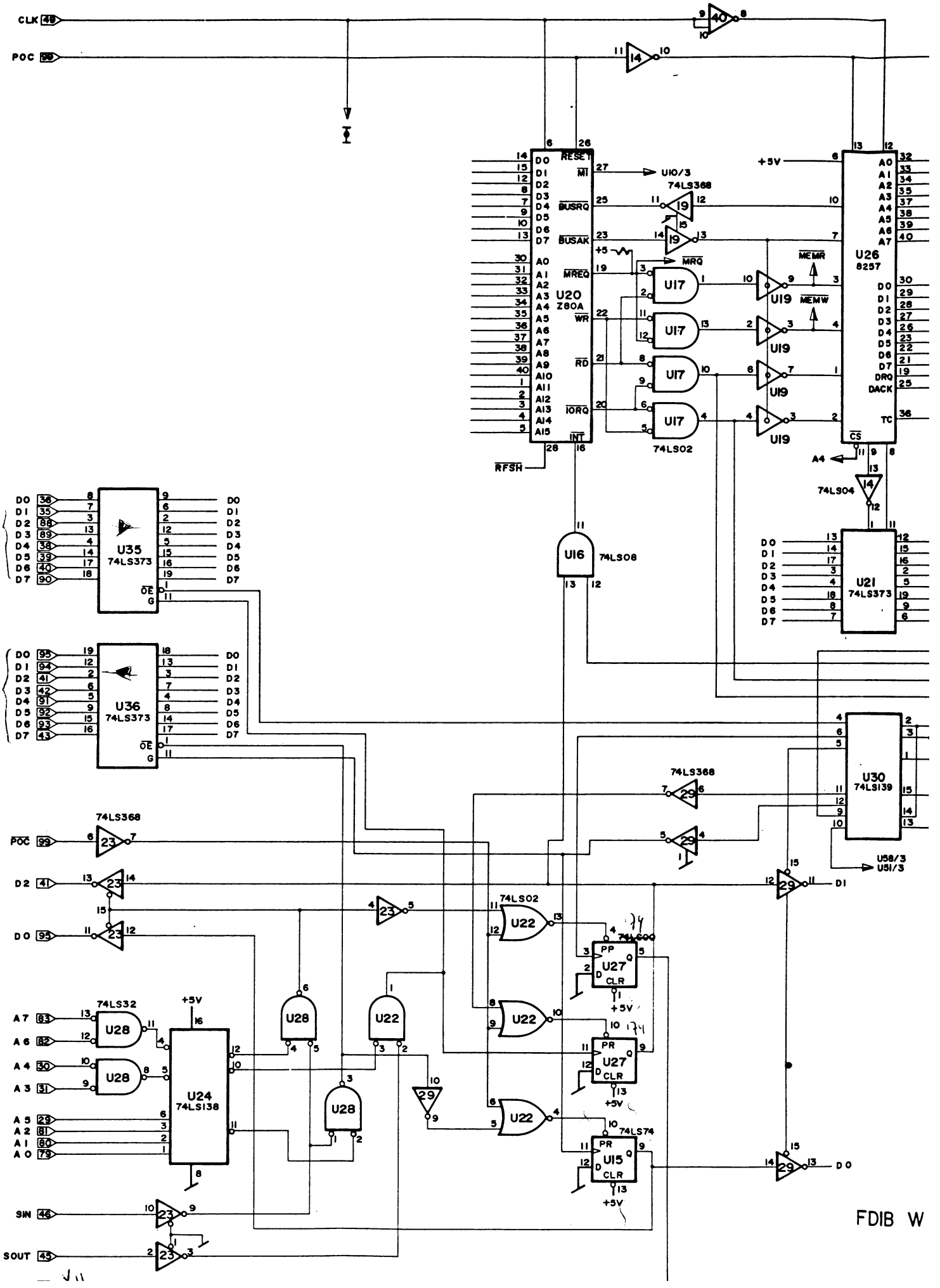
PATRICK COMPUTER SYSTEMS, INC.

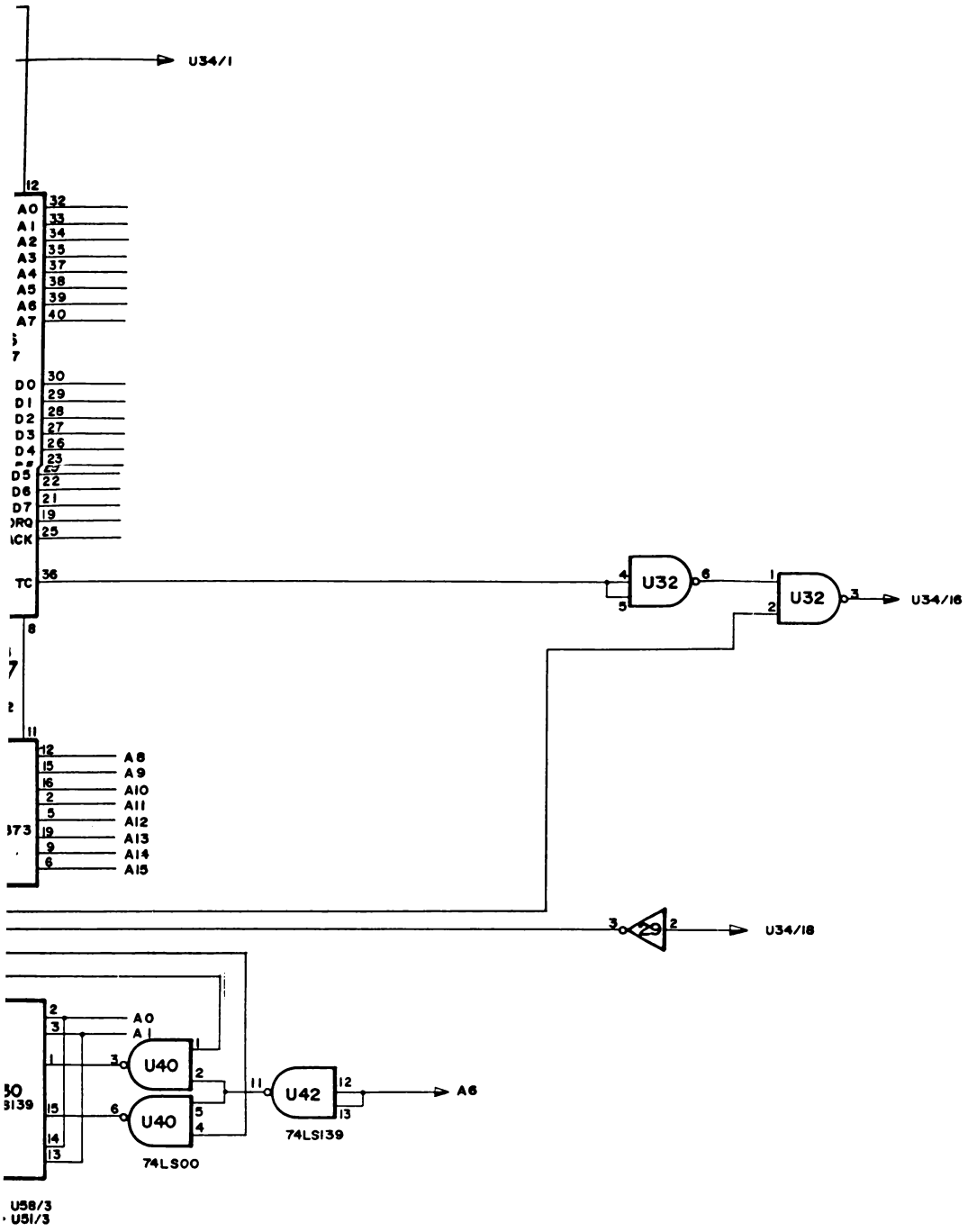
SCALE: NONE | APPROVED BY: | DRAWN BY V.M.D.


16K BANK RAM
48K BANK RAM
U1 8116
U2 8116
U3 8116
U4 8116
U5 8116
U6 8116
U7 8116
U8 8116
U9 8116
U10 8116
U11 8116
U12 8116
U13 8116
U14 8116
U15 8116
U16 8116
U17 8116
U18 8116
U19 8116
U20 8116
U21 8116
U22 8116
U23 8116
U24 8116
U25 8116
U26 8116
U27 8116
U28 8116
U29 8116
U30 8116
U31 8116
U32 8116
VR1
VR2
C52
C53
C54
C55
C56
C57
C58
C59
C60
C61
C62
C63
C64
C65
C66
C51
C49
C48
C50
CR1
R11
C3
C39
C8
C35
C13
C31
C18
C27
C41
C6
C37
C11
C33
C16
C29
C21
C4
C40
C9
C36
C14
C32
C19
C28
C42
C7
C38
C12
C34
C17
C30
C22
C26
C5
C25
C10
C24
C15
C23
C20



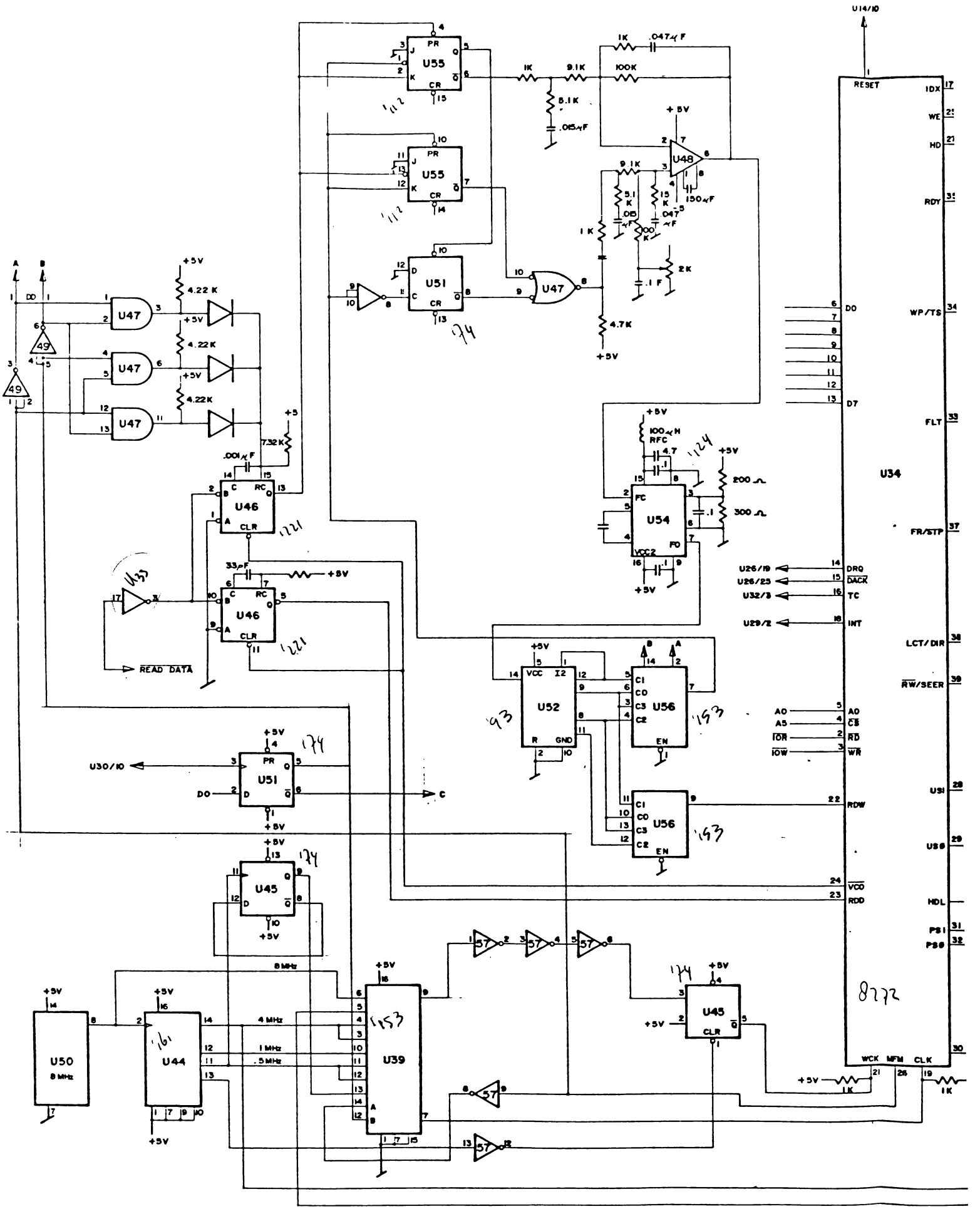
SCALE: NONE	APPROVED BY:	DRAWN BY V.M.
DATE: 81-06-15		REVISED

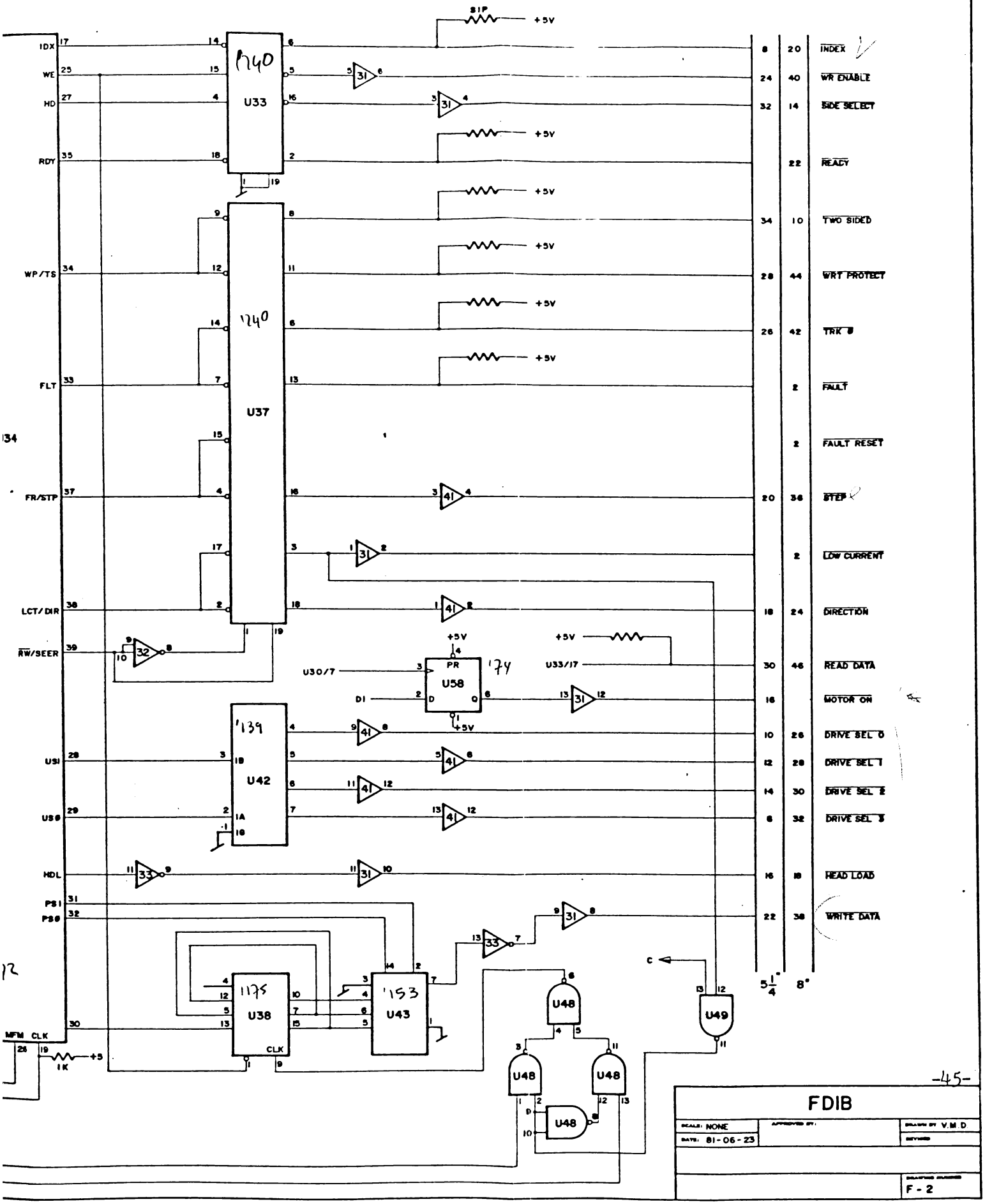

CLK 49
POC 99
U20 Z80A
U26 8257
U35 74LS373
U36 74LS373
U21 74LS373
U30 74LS139
U16 74LS08
74LS02
74LS04
74LS368
74LS32
U24 74LS138
U22
U27
U28
U15
74LS74
U17
U19
MREQ
WR
RD
IORQ
BUSRQ
BUSAK
RESET
INT
RFSH
MRQ
MEMR
MEMW
SIN 46
SOUT 45
FDIB W



DIB WIRING DIAGRAM

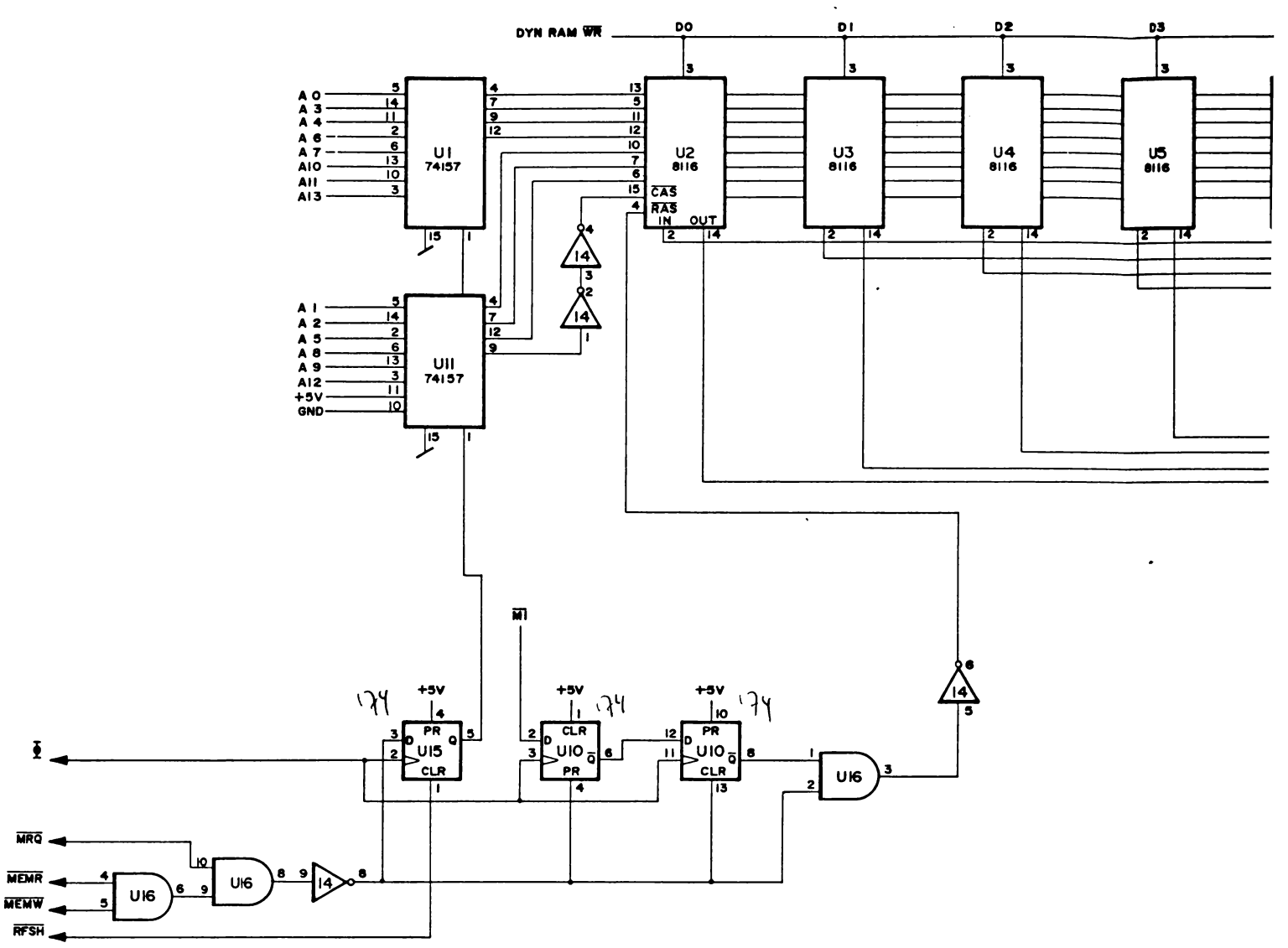
SCALE: NONE	APPROVED BY:	DRAWN BY V.M.D.


U14/10
RESET
U55
U48
U51
U47
U46
U54
U34
U52
U56
U45
U50
8 MHz
U44
4 MHz
1 MHz
.5 MHz
U39
READ DATA
U30/10
DO
C
RDW
RDD
WCK MFM CLK
8272

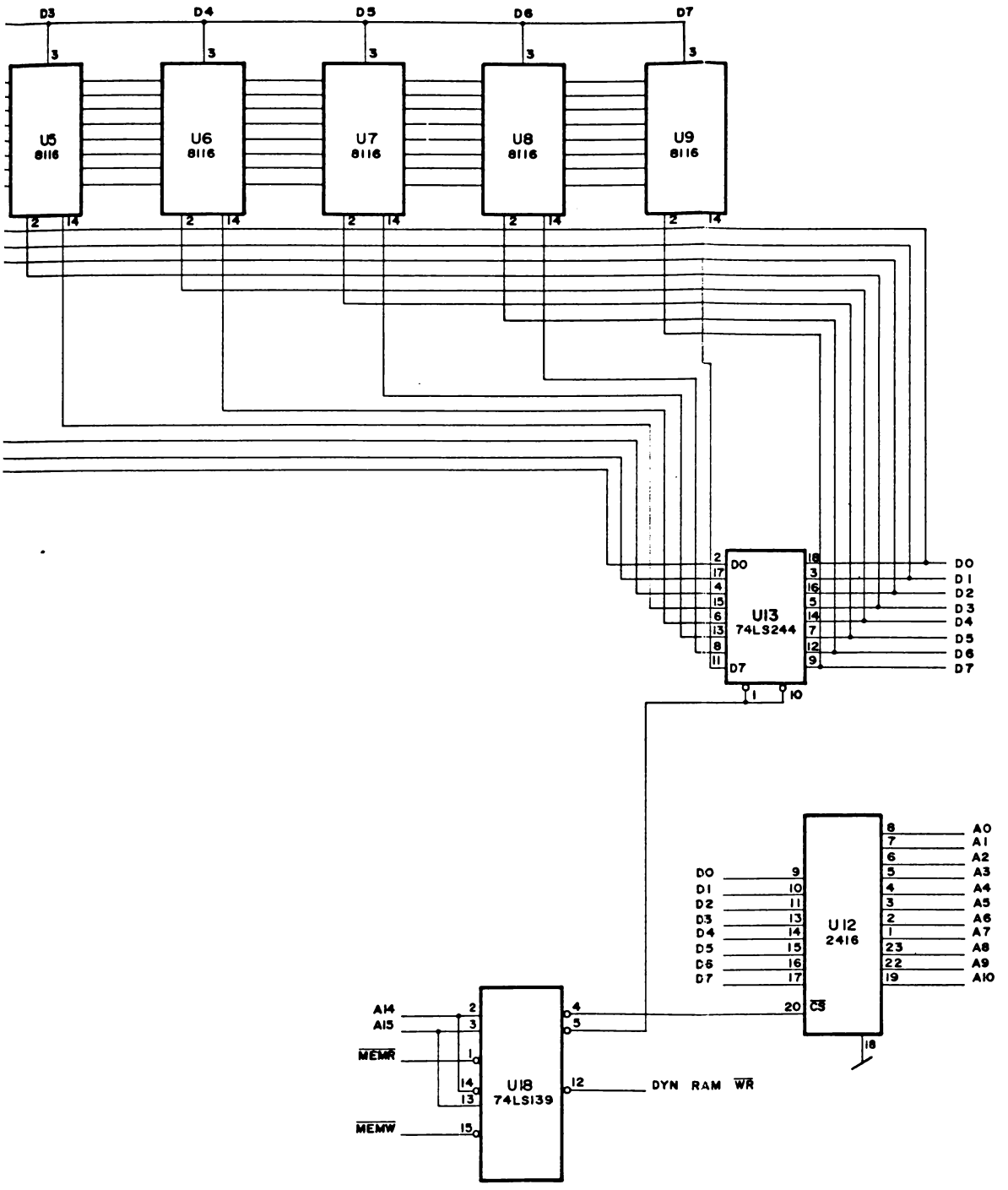


-45-

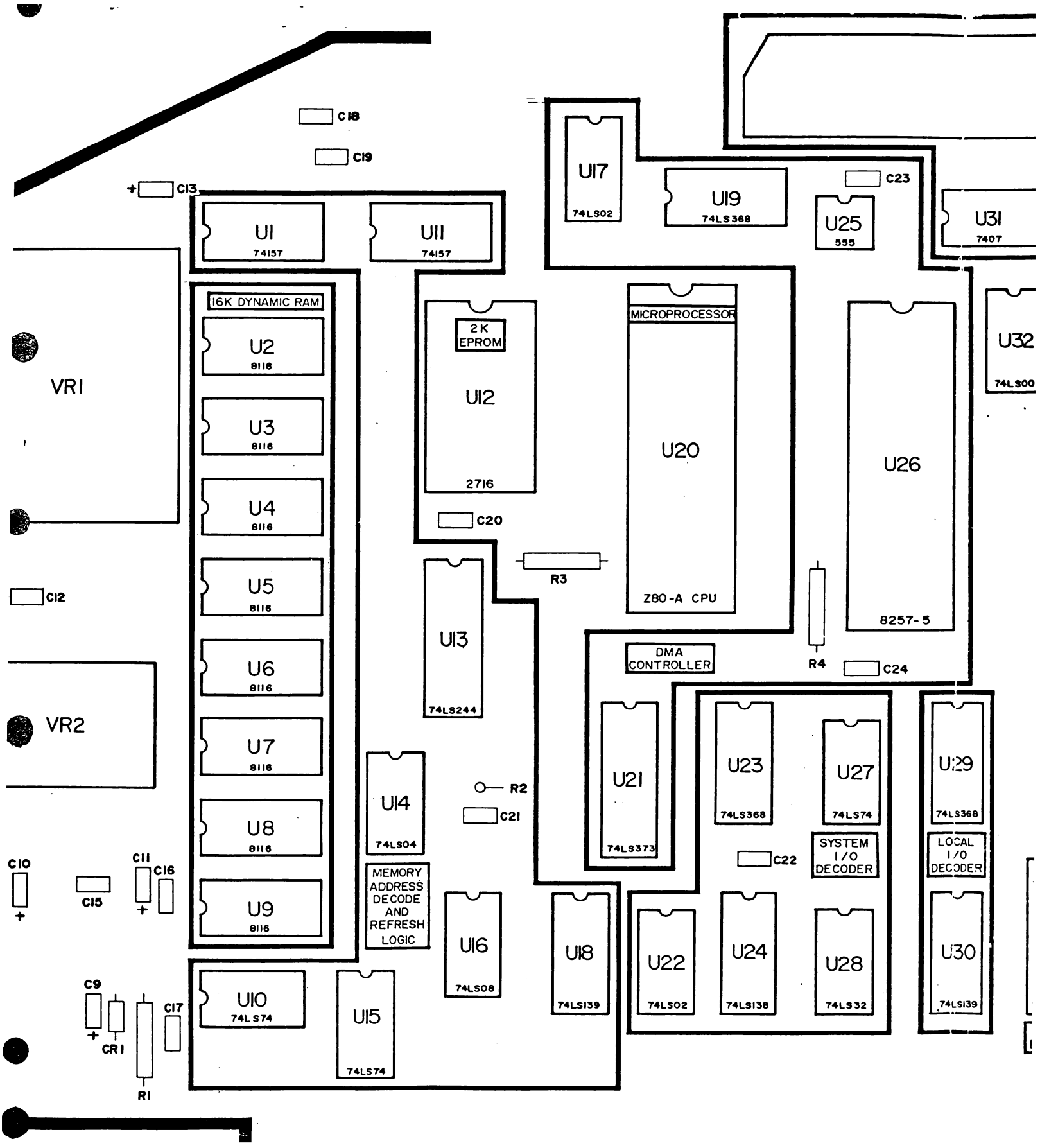
FDIB		
SCALE: NONE	APPROVED BY:	DRAWN BY: V.M.D
DATE: 81-06-23		REVISED
		DRAWING NUMBER F-2

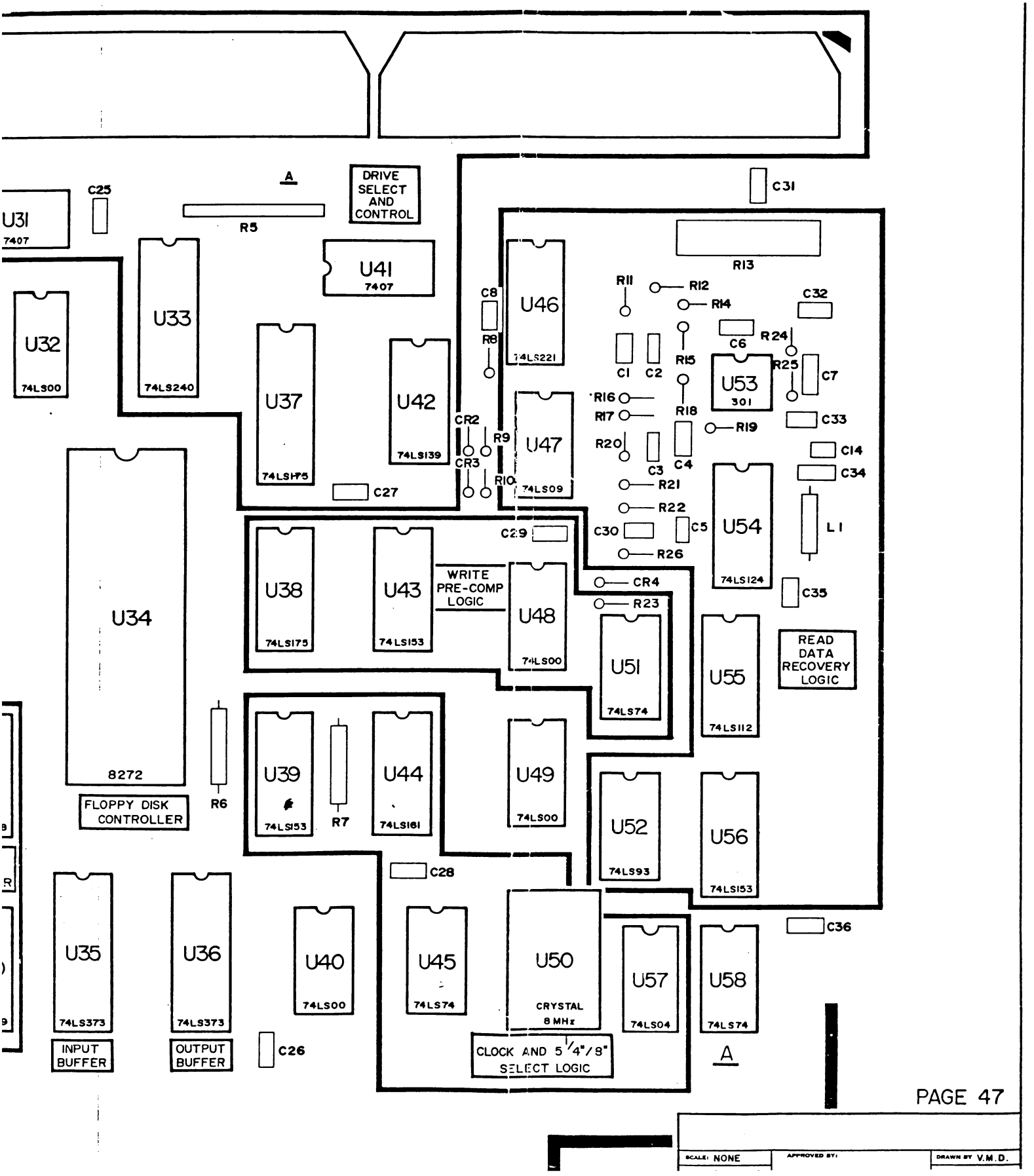


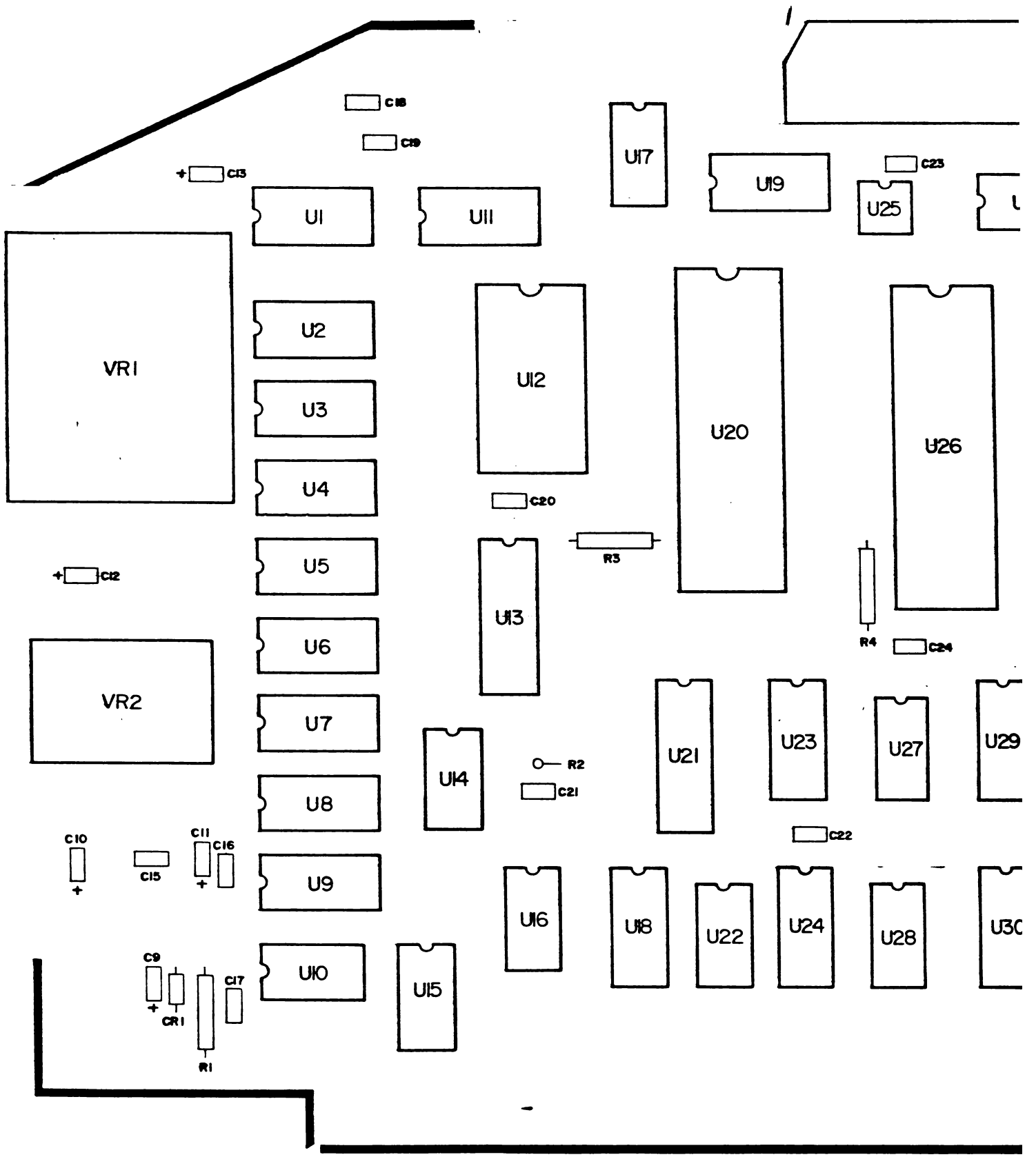
FDIB WIRING DIAGRAM

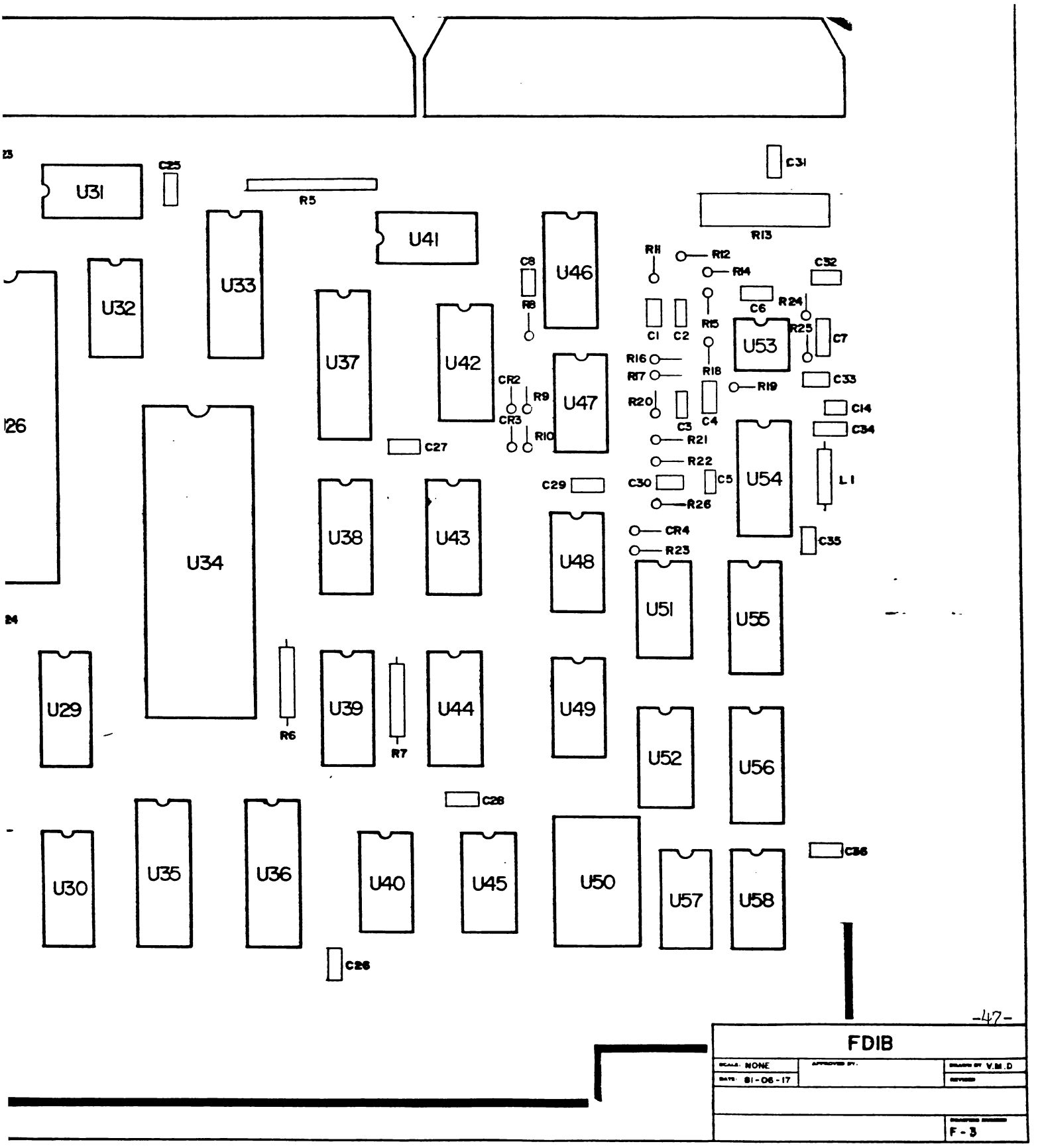


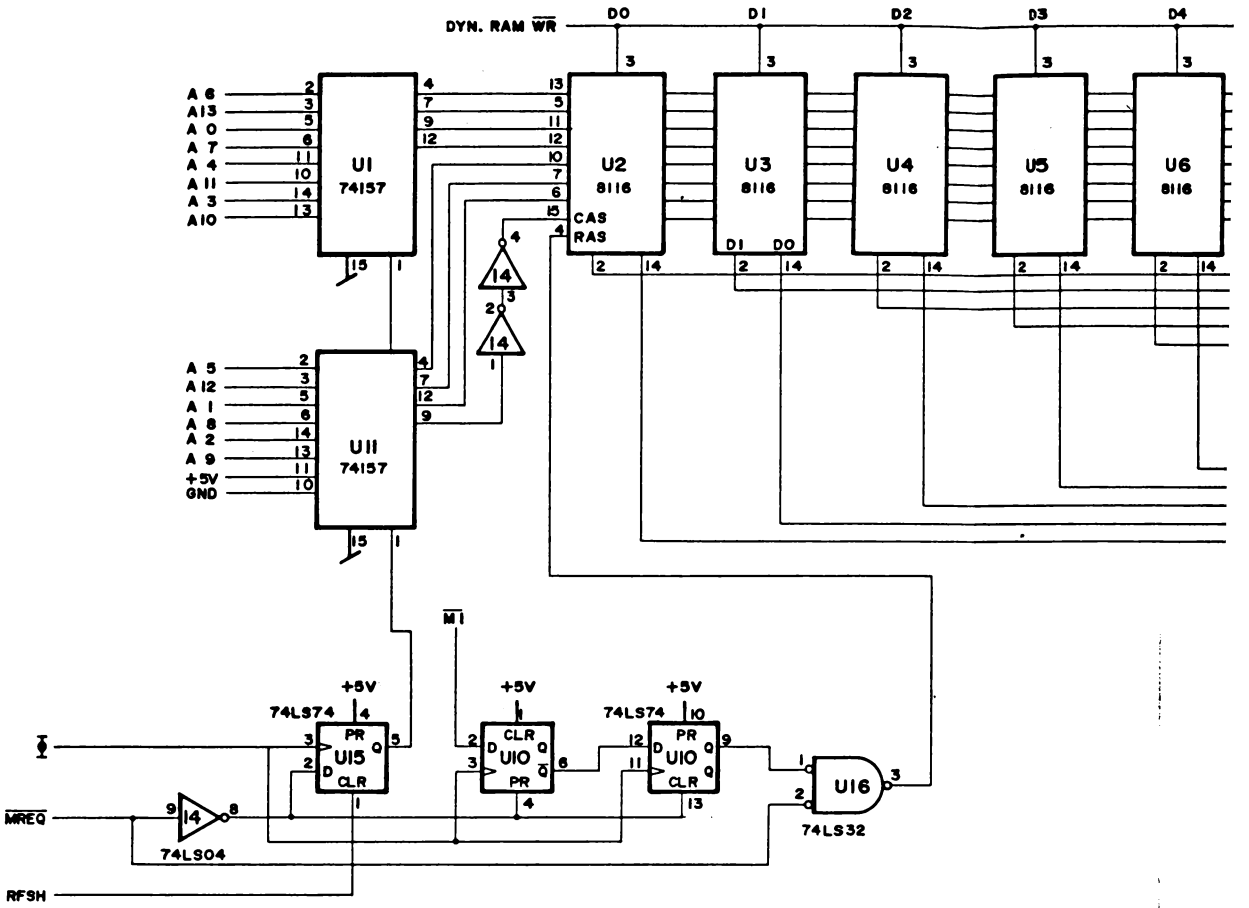
Date 81-07-29
Scale NONE
Drawn R.O./V.M.D.
Job FDIB

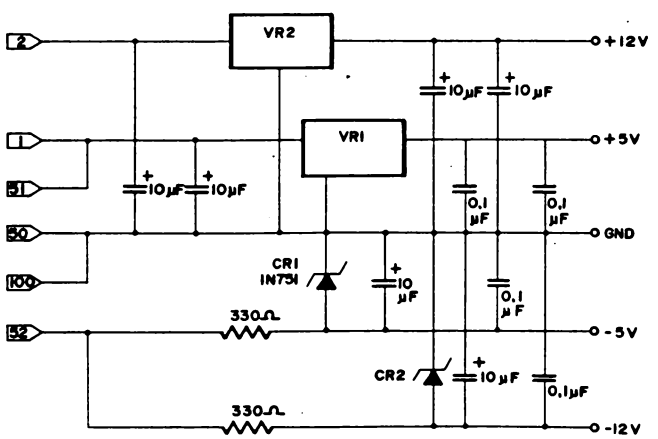

C18
C19
+ C13
U1
74157
U11
74157
16K DYNAMIC RAM
U2
8116
U3
8116
U4
8116
U5
8116
U6
8116
U7
8116
U8
8116
U9
8116
VR1
C12
VR2
C10
C15
C11
C16
C9
CR1
C17
R1
U10
74LS74
U15
74LS74
U14
74LS04
MEMORY ADDRESS DECODE AND REFRESH LOGIC
U16
74LS08
U18
74LS139
2K EPROM
U12
2716
C20
U13
74LS244
R3
U17
74LS02
U19
74LS368
C23
U25
555
U31
7407
MICROPROCESSOR
U20
Z80-A CPU
U26
8257-5
U32
74LS00
DMA CONTROLLER
R4
C24
R2
C21
U21
74LS373
U23
74LS368
U27
74LS74
SYSTEM I/O DECODER
C22
U22
74LS02
U24
74LS138
U28
74LS32
U29
74LS368
LOCAL I/O DECODER
U30
74LS139


U31
7407
C25
A
R5
DRIVE SELECT AND CONTROL
C31
U41
7407
R13
U32
74LS00
U33
74LS240
U37
74LS175
U42
74LS139
C8
R8
U46
74LS221
R11
R12
R14
C32
C6
R24
C1
C2
R15
R25
C7
U53
301
R16
R17
R18
R19
C33
CR2
CR3
R9
R10
U47
74LS09
R20
C3
C4
C14
C34
C27
R21
R22
C30
C5
U54
74LS124
L1
C29
U34
8272
FLOPPY DISK CONTROLLER
U38
74LS175
U43
74LS153
WRITE PRE-COMP LOGIC
U48
74LS00
CR4
R23
C35
U51
74LS74
U55
74LS112
READ DATA RECOVERY LOGIC
R6
U39
74LS153
R7
U44
74LS161
U49
74LS00
U52
74LS93
U56
74LS153
C28
U35
74LS373
U36
74LS373
U40
74LS00
U45
74LS74
U50
CRYSTAL
8 MHz
U57
74LS04
U58
74LS74
C36
INPUT BUFFER
OUTPUT BUFFER
C26
CLOCK AND 5 1/4"/8" SELECT LOGIC
A
PAGE 47
SCALE: NONE
APPROVED BY:
DRAWN BY V.M.D.

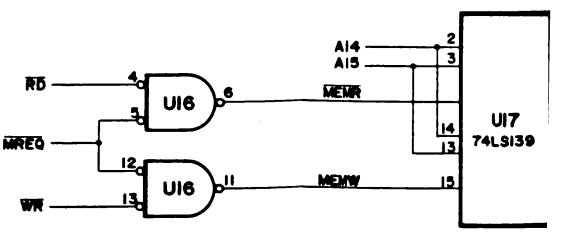

C18
C19
C13
U1
U11
U17
U19
C23
U25
VR1
U2
U3
U4
U12
U20
U26
C20
R3
C12
U5
U13
R4
C24
VR2
U6
U7
U14
R2
C21
U21
U23
U27
U29
U8
C22
C10
C15
C11
C16
U9
U16
U18
U22
U24
U28
U30
C9
C17
U10
U15
CR1
R1

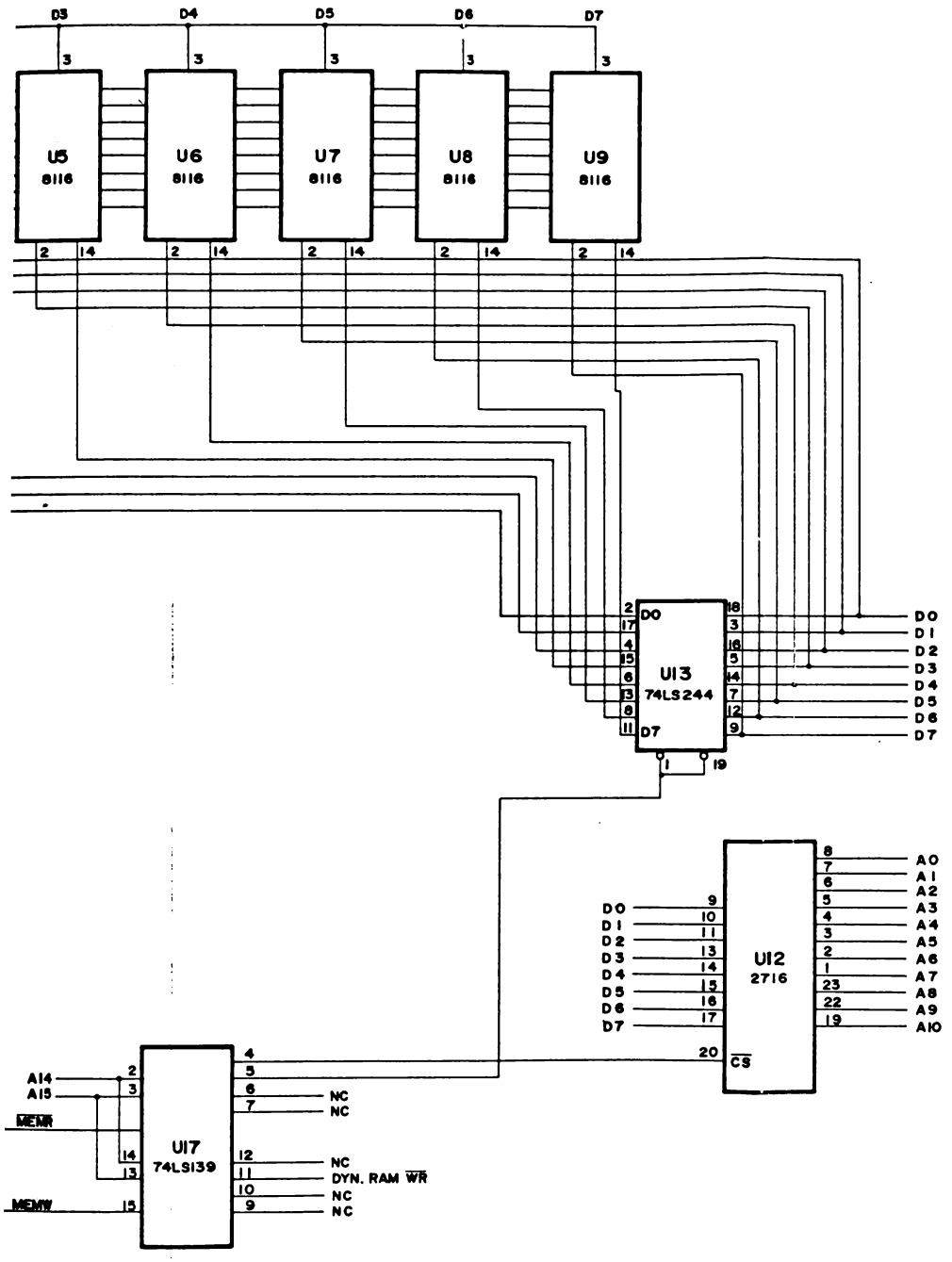

U31
C25
R5
U41
C31
R13
U33
U32
U46
C8
R8
R11
R12
R14
C32
C6
R24
C1
C2
R15
U53
R25
C7
U37
U42
R16
R17
R18
C33
R19
CR2
R9
U47
R20
C3
C4
C14
C34
CR3
R10
C27
R21
R22
C30
C5
U54
L1
C29
U38
U43
U48
R26
CR4
R23
C35
U34
U51
U55
U29
R6
U39
R7
U44
U49
U52
U56
C28
U30
U35
U36
U40
U45
U50
U57
U58
C36
C26
FDIB
SCALE: NONE
DATE: 81-06-17
APPROVED BY:
DRAWN BY V.M.D
REVISED
F-3





POWER SUPPLY





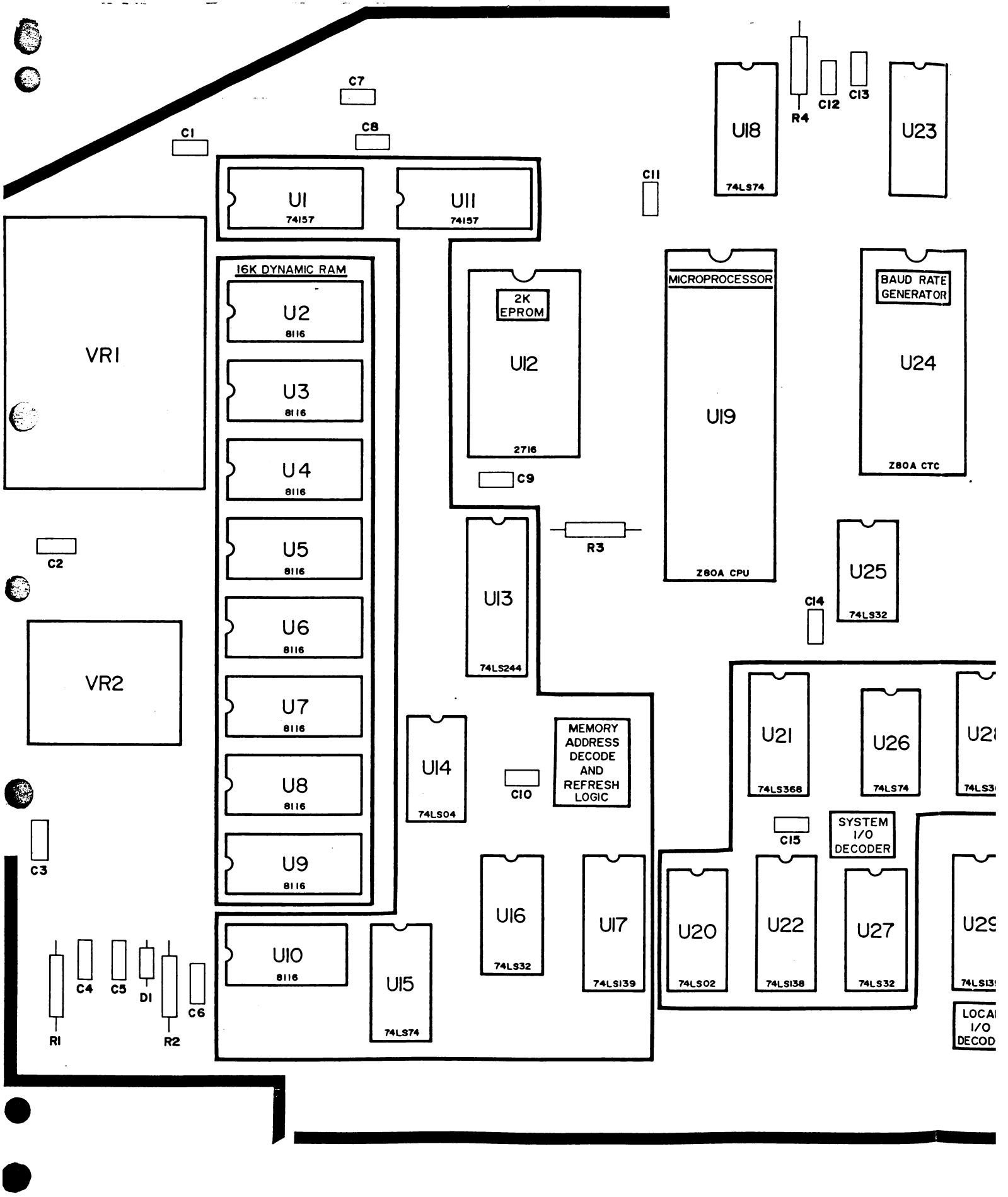
SIB

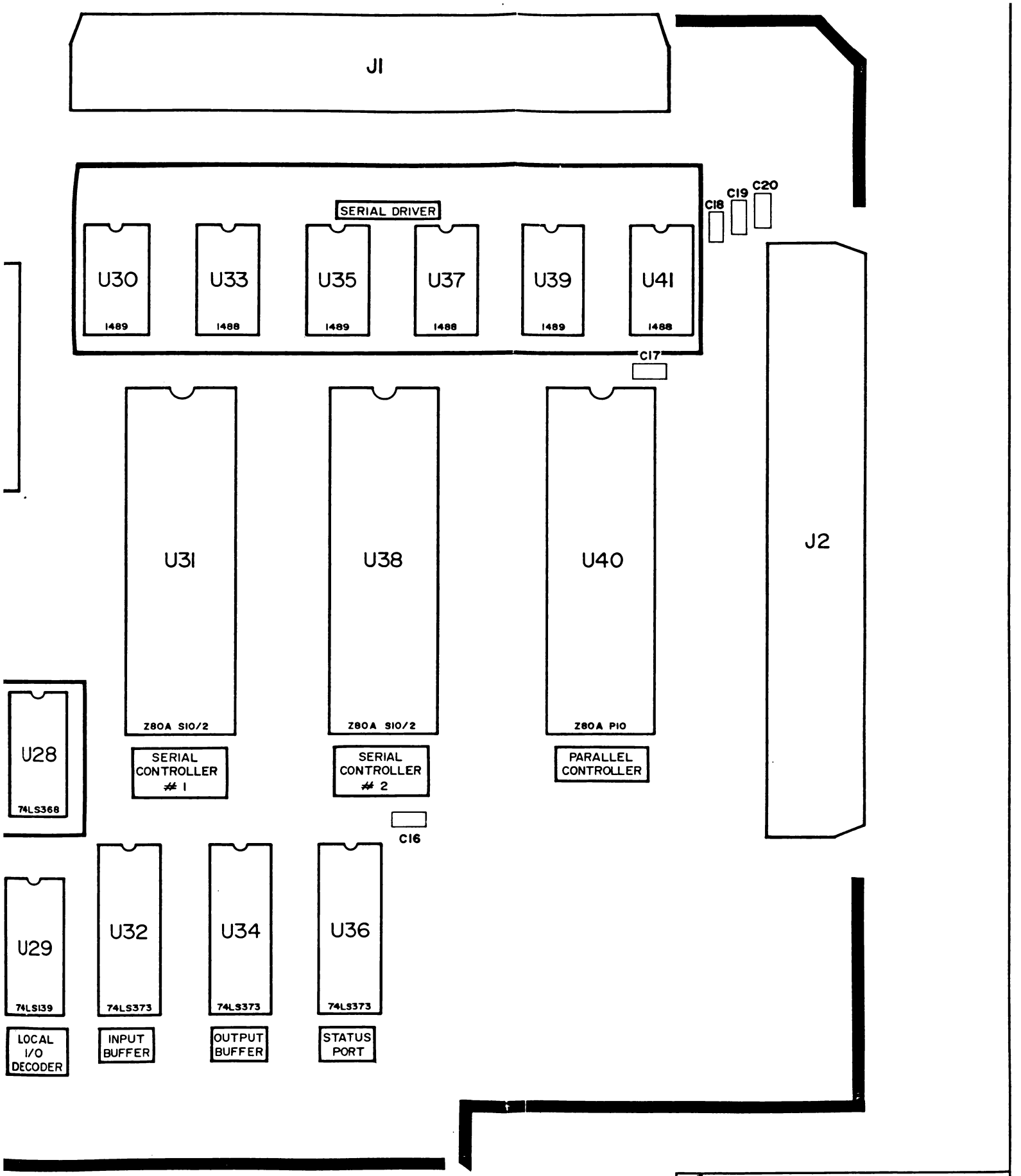
SCALE: NONE

APPROVED BY:

DRAWN BY V.M.D.

REVISED


C7
C8
C1
U1
74157
U11
74157
16K DYNAMIC RAM
U2
8116
U3
8116
U4
8116
U5
8116
U6
8116
U7
8116
U8
8116
U9
8116
U10
8116
VR1
VR2
C2
C3
C4
C5
D1
C6
R1
R2
U15
74LS74
U14
74LS04
C10
MEMORY ADDRESS DECODE AND REFRESH LOGIC
U16
74LS32
U17
74LS139
2K EPROM
U12
2716
C9
U13
74LS244
R3
C11
MICROPROCESSOR
U19
Z80A CPU
U18
74LS74
R4
C12
C13
U23
BAUD RATE GENERATOR
U24
Z80A CTC
U25
74LS32
C14
U21
74LS368
U26
74LS74
C15
SYSTEM I/O DECODER
U20
74LS02
U22
74LS138
U27
74LS32



PATRICK COMPUTER SYSTEMS, INC.

SCALE: NONE	APPROVED BY:	DRAWN BY V.M.D.
DATE: 10-27-81		REVISED

QUANTITY	DESCRIPTION	REMARKS
1	Mother Board PCB	
4	10uF 35V Tant. Capacitor	C1 - C4
4	100uF 35V Electrolytic Capacitor	C5 - C8
4	.1uF 50V Mono. Cer. Capacitor	C9 - C12
4	1N4004 Diode	CR1 - CR4
2	78H05 TO-3 Voltage Regulator	VR1, VR2
2	78H12 TO-3 Voltage Regulator	VR3, VR4
4	TO-3 Mica Insulators	
5	100 pin .125" spacing edge connector	
1	Heat Sink	
14	6-32 1/2" Robertson steel round head machine screws	
14	6-32 steel hex nuts	
8	Size 6 shoulder washers	
6	Size 6 steel ext. tooth flat lockwashers	

QUANTITY	DESCRIPTION	REMARKS
1	Keyboard PCB	
1	Keyboard Panel	
1	74154	U1
2	74LS373	U2, U3
1	24 pin DIP socket	U4
2	14 pin DIP socket	U5, U6
1	100uF 16V Electrolytic Capacitor	C1
2	.luF Mono. Cer. Capacitor	C2, C3
1	4.7 KOHM 10 pin SIP	RP1
1	Noise Suppressor Pad #SW10117	
2	Space Bar Supports #SD10438	
1	Torsion Bar #40005023-001	
115	Keyswitch #1001SD4B35	
3	Dummy Keyswitch #1001SD6B1D	
54	Dark Grey Single Space Keytop	
		5 BLANKS
		4
	1 each of the following	LOAD FILE, TAB SET, TAB CLEAR, GEN FORM, PAGE, PREV PAGE, TEST, DOCUMENT, ERASE PAGE, UNDERLINE, COPY DISC, INDEX, END, CLEAR, JUSTIFY, VERIFY, CHANGE CASE, OVER STRIKE, BOLD, SUB SCRIPT, SUPER SCRIPT, REF#, DATE, HEADER, PAGE#, SRCH, VARIABLE, PRINT DISPLAY, SAVE FILE, REF#, DATE, HEADER
		+, -, 1, 2, 3, 4, 5, 6, 7, 8, 9, ., PRINT, CEASE PRINT, PRINT ON LINE

QUANTITY	DESCRIPTION	REMARKS
49	Light Grey Single Space Keytop 1 each of the following	CAPS LOCK, !/1, "/2, #/3, $/4, %/5, &/6, '/7, (/8,)/9, 0, =/-, ~/^, A through Z, [/{,]/}, +/;, */:, \/¦, `/@, </,, >/., ?//, BACK TAB
1	Dark Grey 1 1/4 Space L. H. Mount Keytop	ESC
1	Dark Grey Double Space L. H. Mount Keytop	0
1	Light Grey 9 Space Centre Mount Keytop	space bar
1	Light Grey Double Space R. H. Mount Keytop	BACK SPACE
1	Light Grey Double Space L. H. Mount Keytop	SHIFT
1	Light Grey 1 3/4 Space R. H. Mount Keytop	SHIFT LOCK
1	Light Grey 1 3/4 Space L. H. Mount Keytop	LINE FEED
2	Light Grey 1 1/2 Space L. H. Mount Keytop	RETURN, CTRL
2	Light Grey 1 1/2 Space R. H. Mount Keytop	BLANK, TAB
1	Light Grey 1 1/4 Space R. H. Mount Keytop	SHIFT

QUANTITY	DESCRIPTION	REMARKS
1	Keypad PCB	
1	Keypad panel	
1	.luF Mono. Cer. Capacitor	
1	14 pin DIP socket	
16	Keyswitch #1001SD4B35	
16	Dark Grey Single Space Keytop	2 BLANKS
	1 each of the following	ENVELOPE, MOVE, PRINT FEED, RESET, XMIT,
		DELETE, BCC, INSERT, CC, PRINT REL, WORD, SENT, PARA, RIB
16	8-32 steel hex nuts	
8	Size 8 steel ext. tooth flat lockwashers	

Sub-Assembly

CPU PARTS LIST

QUANTITY	DESCRIPTION	REMARKS
1	CPU PCB with pins	
1	Z80A	U12
2	MK3882 Z80 CTC	U2, U7
1	2716 350 nS EPRom 2K×8	U9
1	74LS02	U24
1	74LS04 inverter	U14
1	74LS08	U15
1	74LS14	U3
1	74LS20	U18
3	74LS32	U19, U20, U25
2	74LS74 Dual D-type Edge trigg. F.F.	U1, U23
1	74LS93 4 bit binary counter.	U6
1	74LS139	U22
1	74LS240	U21
2	74LS244	U13, U17
2	74LS367	U8, U16
1	74LS368	U5
2	74LS373	U10, U11
1	8 MHz Crystal DIP	U4
3	10uF 35V Tant. Capacitor	C1, C2, C3
10	.1uF 50V. Mono. Cer. Capacitor	C5 - C14
1	33pF 50V. Mono. Cer. Capacitor	C4
2	4.7 KOHM 6 pin SIP	RP1, RP2
2	220 OHM 1/4W 5% Resistor	R1, R4
1	10 KOHM 1/4W 5% Resistor	R2
1	1.2 KOHM 1/4W 5% Resistor	R5
1	22 OHM 1/4W 5% Resistor	R3
1	2N3906 Transistor	T1
1	1N914 Diode	CR1
1	7805 TO-3 Voltage Regulator, 3 amp	VR1
1	THM 6103 Base Heat Sink	
2	5-40 1/2" Slotted steel round head machine screws	
4	5-40 steel hex nuts	
2	Size 6 steel ext. tooth flat lockwashers	

QUANTITY	DESCRIPTION	REMARKS
1	PKIB PCB with pins	
1	Z80A	U20
1	2708 350nS 8K (1K x 8) EPROM	U16
8	4116 250nS	U1 - U8
1	LM555	U35
1	74LS02	U22
2	74LS04	U14, U29
2	74LS32	U15, U19
5	74LS74	U11, U12, U18, U30, U36
3	74LS138	U17, U24, U25
2	74157	U9, U10
1	74LS244	U13
1	74LS245	U34
1	74LS368	U26
7	74LS373	U21, U23, U27, U28, U31, U32, U33
6	10uF 35V Tant. Capacitor	C1 - C6
12	.1uF 50V Mono. Cer. Capacitor	C7 - C18
1	.01uF 50V Mono. Cer. Capacitor	C19
1	1.2 KOHM 1/4W 5% Resistor	R6
3	4.7 KOHM 1/4W 5% Resistor	R2, R3, R7
1	330 OHM 1/4W 5% Resistor	R1
2	220 OHM 1/4W 5% Resistor	R4, R5
1	1N751 Zener	CR1
2	1N914 Diode	CR2, CR3
1	7805 TO-3, 3 amp, Voltage Regulator	VR1
1	7812 TO-220 Voltage Regulator	VR2
1	THM 6103 Base Heat Sink	
1	THM 6107-14 Base Heat Sink	
1	50 position Universal Header	
1	24 position Universal Header	
3	5-40 1/2" Slotted steel round head machine screws	
6	5-40 steel hex nuts	
3	Size 6 steel ext. tooth flat lockwashers	

QUANTITY	DESCRIPTION	REMARKS
1	VDB-80 PCB with pins	
1	Z80A	U19
2	4118	U39, U44
1	2708 350nS	U14
8	4116 250nS	U2 - U9
1	8257-5	U25
1	8275	U30
2	74LS02	U18, U21
2	74LS04	U12, U43
1	74LS08	U16
1	74LS10	U46
2	74LS32	U27, U47
4	74LS74	U10, U13, U26, U49
1	74LS86	U48
1	74LS122	U41 OPTIONAL
1	74LS138	U24
2	74LS139	U17, U29
6	74157	U1, U11, U33, U34, U37, U38
1	74LS163	U40
1	74LS166	U45
1	74LS174	U42
2	74LS244	U15, U35
3	74LS368	U22, U23, U28
3	74LS373	U20, U31, U32
1	12.96 MHz Crystal DIP	U36
1	100uF 16V Electrolytic Capacitor	C21
5	10uF 35V Tant. Capacitor	C16 - C20
21	.1uF 50V Mono. Cer. Capacitor	C1 - C15, C21 - C26
1	1mH 50V Choke	L1
3	4.7 KOHM 1/4W 5% Resistor	R7, R8, R9
1	330 OHM 1/2W 5% Resistor	R1
1	220 OHM 1/4W 5% Resistor	R2
1	150 OHM 1/4W 5% Resistor	R3
1	82 OHM 1/4W 5% Resistor	R4
1	47 OHM 1/4W 5% Resistor	R5
1	100 KOHM trim pot linear	R6
1	1N751 Zener	CR1
1	78H12 TO-3 Voltage Regulator	VR2
1	7805 TO-3, 3 amp, Voltage Regulator	VR1
2	THM 6103 Base Heat Sinks	
4	5-40 1/2" Slotted steel round head machine screws	
4	5-40 steel hex nuts	
4	Size 6 steel ext. tooth flat lockwashers	

MB-64 PARTS LIST

QUANTITY	DESCRIPTION	REMARKS
1	MB-64 PCB with pins	
32	4116 250nS	U1 - U32
1	8202A	U36
1	74LS00	U44
1	74LS04	U38
1	74LS08	U43
2	74LS32	U41, U42
1	74LS133	U39
1	74LS138	U45
1	74LS244	U35
1	74LS373	U40
2	74LS374	U33, U34
1	21 MHz Crystal DIP	U37
5	10uF 35V Tant. Capacitor	C48 - C52
47	.1uF 50V Mono. Cer. Capacitor	C1 - C47
14	.01uF 50V Mono. Cer. Capacitor	C53 - C66
1	1 KOHM 1/4W 5% Resistor	R9
1	3.3 KOHM 1/4W 5% Resistor	R10
2	33 OHM 1/4W 5% Resistor	R3, R4
1	330 OHM 1/2W 5% Resistor	R11
3	3.3 KOHM 10 pin SIP	R6, R7, R8
2	3.3 KOHM 8 pin SIP	R1, R2
1	33 OHM 16 pin DIP	R5
1	2N3904 Transistor	T1
1	1N751 Zener	CR1
1	7812 TO-220 Voltage Regulator	VR2
1	7805 TO-220 Voltage Regulator	VR1
2	THM 6107-14 Base Heat Sinks	
2	5-40 1/2" Slotted steel round head machine screws	
2	5-40 steel hex nuts	
	Size 6 steel ext. tooth flat lockwashers	

QUANTITY	DESCRIPTION	REMARKS
1	FDIB PCB with pins	
1	Z80A	U20
8	4116 250nS	U2 - U9
1	2716	U12
1	8257-5	U26
1	8272	U34
1	LM301	U53
1	LM555	U25
4	74LS00	U32, U40, U48, U49
2	74LS02	U17, U22
2	74LS04	U14, U57
2	7407	U31, U41
1	74LS08	U16
1	74LS09	U47
1	74LS32	U28
5	74LS74	U10, U15, U27, U45, U51
1	74LS93	U52
1	74LS112	U55
1	74S124	U54
1	74LS138	U24
3	74LS139	U18, U30, U42
3	74LS153	U39, U43, U56
2	74157	U1, U11
1	74LS161	U44
1	74LS175	U38
1	74LS221	U46
2	74LS240	U33, U37
1	74LS244	U13
3	74LS368	U19, U23, U29
3	74LS373	U21, U35, U36
1	8 MHz Crystal DIP	U50
6	10uF 35V Tant. Capacitor	C9 - C14
22	.1uF 50V Mono. Cer. Capacitors	C15 - C36
1	220pF 50V Mono. Cer. Capacitors	C5
2	.047uF 50V Mono. Cer. Capacitors	C4, C7
2	.015uF 50V Mono. Cer. Capacitors	C2, C4
1	150pF 50V Mono. Cer. Capacitors	C6
1	.001uF 50V Mono. Cer. Capacitors	C1
1	33pF 50V Mono. Cer. Capacitors	C8
1	100uH 50V Choke	L1
1	330 OHM 1/2W 5% Resistor	R1
1	200 OHM 1/4W 1% Resistor	R22
1	300 OHM 1/4W 1% Resistor	R26
2	15 KOHM 1/4W 1% Resistor	R18, R24
2	100 KOHM 1/4W 1% Resistor	R19, R25
2	9.1 KOHM 1/4W 1% Resistor	R14, R16
2	1 KOHM 1/4W 1% Resistor	R12, R20
2	5.1 KOHM 1/4W 1% Resistor	R15, R17
2	4.22 KOHM 1/4W 1% Resistor	R9, R10

QUANTITY	DESCRIPTION	REMARKS
1	1.1 KOHM 1/4W 1% Resistor	R23
1	7.32 KOHM 1/4W 1% Resistor	R11
1	3.3 KOHM 1/4W 1% Resistor	R8
6	4.7 KOHM 1/4W 5% Resistor	R27 - R32
1	150 OHM 8 pin SIP	
1	2 KOHM 10 turn trim pot	R13
1	1N751 Zener	CR1
3	1N914 Diode	CR2 - CR4
1	7805 TO-3, 3 amp, Voltage Regulator	VR1
1	7812 TO-220 Voltage Regulator	VR2
1	THM 6103 Base Heat Sink	
1	THM 6107-14 Base Heat Sink	
1	34 pos Universal header	
3	5-40 1/2" Slotted steel round head machine screws	
6	5-40 steel hex nuts	
3	Size 6 steel ext. tooth flat lockwashers	

POWER SUPPLY PARTS LIST

QUANTITY	DESCRIPTION	REMARKS
1	Power Transformer	
2	AMP Mate-N-Lock 8 pos Housing 1-480283-0	
1	AMP Mate-N-Lock 3 pos Housing 1-480305-0	
3	Bridge Rectifiers KBPC 25-04	
1	Beldon AC cord 7A S84 BR-3489	
1	Corcom Connector 6J4	
1	DPST On/Off Switch	
1	3A slow-blow fuse	
1	10,000uF 25V Electrolytic Capacitor	
3	43,000uF Electrolytic Capacitor	
1	100,000uF 15V Electrolytic Capacitor	
1	1 3/4" Capacitor Clamp	
3	2" Capacitor Clamp	
1	3" Capacitor Clamp	
14	1/16" to 1 3/4" Panduit nylon ties	
14	up to 5/8" Panduit nylon ties	
1 ft	1/4" Heat Shrink tubing	
15	5/32" steel rivets	
4	3/16" steel rivets	
2	10-32 3/4" Robertson steel machine screw	
1	10-32 steel hex nuts	
1	Size 10 steel external tooth flat lockwasher	
7	6-32 1/2" Robertson steel round head machine screws	
3	6-32 1" Robertson steel round head machine screws	
10	6-32 steel hex nuts	
10	Size 6 steel ext. tooth flat lockwashers	
2	#6 Burr flat washers	

BASE PARTS LIST

QUANTITY	DESCRIPTION	REMARKS
1	Chassis	
1	Table	
1	Printer	
1	Platen Extension	
1	Name Plates with Fasteners	
1	Serial No. Plate	
175 cm	Wood Grain Trim	
1	Rubber Trim	
12	8-32 1/2" Robertson steel round head machine screws	
4	8-32 steel hex nuts	
2	#6 3/8" Type A Robertson pan head tapping screws	
4	1/4" X 2 1/2" plated hexagon cap screws	
4	1/4" Style BB 1 1/4" o.b. flat washers	
12	#8 Internal external tooth flat lockwashers	

QUANTITY	DESCRIPTION	REMARKS
1	CRT #V23D12P4CNC12	
4	CRT PCB Insulators	
4	Drive Insulators	
2	Mother Board Insulators	
4	MPI Disk Drives #91 or #92	
1	Plastic Front Panel	
1	CRT PCB Cover	
12	6-32 3/8" Slotted steel flat head machine screws	
16	6-32 steel hex nuts	
16	Size 6 steel ext. tooth flat lockwashers	
8	#6 3/8" Type A Robertson pan head tapping screws	
12	6-32 1/2" Robertson steel round head machine screws	
8	#6 Burr flat washers	

CABLE ASSEMBLIES

QUANTITY	LENGTH IN CM	DESCRIPTION	CONNECTORS
4	55 cm	Black 16 A.W.G.	16 M-N-L sockets
2	55 cm	Purple 16 A.W.G.	4 M-N-L 4 pos. housing
2	55 cm	Green 16 A.W.G.	
4	41 cm	Black 16 A.W.G.	
2	41 cm	Purple 16 A.W.G.	
2	41 cm	Green 16 A.W.G.	
3	15 cm	Black 14 A.W.G.	7 M-N-L pins
1	15 cm	Yellow 14 A.W.G.	1 M-N-L 8 Pos chasis mount housing
1	15 cm	Green 14 A.W.G.	
1	15 cm	Red 14 A.W.G.	
1	15 cm	Orange 14 A.W.G.	
1	34 cm	Black 14 A.W.G.	ring tongue, fast-on soc.
3	55 cm	Black 14 A.W.G.	ring tongue, M-N-L socket
2	52 cm	Black 14 A.W.G.	ring tongue, ring tongue
1	42 cm	Black 14 A.W.G.	ring tongue, ring tongue
1	50 cm	Black 14 A.W.G.	ring tongue, [illegible] socket
1	73 cm	Black 14 A.W.G.	ring tongue, [illegible] tongue
1	7 cm	Black 14 A.W.G.	ring tongue, ring tongue
1	8 cm	Black 14 A.W.G.	ring tongue, ring tongue
1	4 cm	Black 14 A.W.G.	M-N-L socket, M-N-L socket
1	79 cm	Orange 14 A.W.G.	ring tongue, M-N-L socket
1	53 cm	Orange 14 A.W.G.	ring tongue, M-N-L socket
1	39 cm	Orange 14 A.W.G.	ring tongue, fast-on socket
1	33 cm	Orange 14 A.W.G.	ring tongue, fast-on socket
1	68 cm	Yellow 14 A.W.G.	ring tongue, M-N-L socket
1	36 cm	Yellow 14 A.W.G.	ring tongue, M-N-L socket
1	31 cm	Yellow 14 A.W.G.	ring tongue, fast-on socket
1	41 cm	Yellow 14 A.W.G.	ring tongue, fast-on socket
1	45 cm	Red 14 A.W.G.	ring tongue, fast-on socket
1	45 cm	Red 14 A.W.G.	ring tongue, M-N-L socket
1	67 cm	Green 14 A.W.G.	M-N-L socket, M-N-L socket
1	62 cm	Yellow 18 A.W.G.	Corcom connector pin
1	62 cm	Orange 18 A.W.G.	Corcom connector pin
1	62 cm	Red 18 A.W.G.	Corcom connector pin
1	62 cm	Blue 18 A.W.G.	Corcom connector pin
1	62 cm	White 18 A.W.G.	Corcom connector pin
2	18 cm	Black 14 A.W.G.	2 Corcom connector pin
2	18 cm	Black 14 A.W.G.	2 Faston sockets (small)

CABLE ASSEMBLIES

QUANTITY	LENGTH IN CM	DESCRIPTION	CONNECTORS
1	39 cm	Yellow 14 A.W.G.	Fast-on socket
1	37 cm	Yellow 14 A.W.G.	Fast-on socket
1	43 cm	Orange 14 A.W.G.	Fast-on socket
1	37 cm	Orange 14 A.W.G.	Fast-on socket
1	44 cm	Red 10 A.W.G.	Fast-on socket
1	41 cm	Red 10 A.W.G.	Fast-on socket
2	47 cm	White 14 A.W.G.	2-M-N-L pin
1	37 cm	Blue 14 A.W.G.	
1	33 cm	Blue 14 A.W.G.	
2	14 cm	Black 14 A.W.G.	2-ring tongue
2	18 cm	Black 14 A.W.G.	2-quick connect sockets
2	18 cm	Black 14 A.W.G.	2-Corcom connector pins
1	122 cm	34 cond. ribbon cable	4-34 pin edge, 34 pin receptacle
1	61 cm	24 cond. ribbon cable	24-pin receptacle, 24 pin DIP plug
1	25 cm	14 cond. ribbon cable	2-14 pin DIP plugs
1	36 cm	10 cond. ribbon cable	20 pin edge
1	69 cm	50 cond. ribbon cable	50 pin edge, 50 pin receptacle

READ BEFORE APPLYING POWER

PHYSICAL INSPECTION

Ensure that the disk drives have no diskette in them, that the printer is not jammed with paper, that the print head, daisy wheel, and platen move freely.

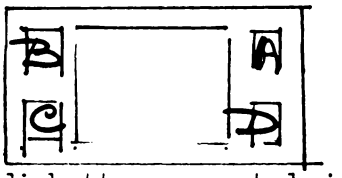
Ensure that the power cable is pushed all the way into both the wall outlet and into the computer itself.

Check that the computer has two inches overhang from the table it is sitting on in order to allow it sufficent ventilation.

POWER ON

After the physical inspection above, push the switch at the rear of the LEPRECHAUN down.

Disk drive A, the drive in the top right side of the console, will start, indicated by the red light coming on. If the light does not come on, turn the computer off, by lifting the poer on switch to it up position. Wait 10 minutes and apply power again. If the light fails to light after this second power on sequence, turn the power off and get assistance.



START-UP

When the disk drive A light is lit, insert the diskette requested in the operating manual. Do not proceed until your instructions are displayed on the screen. From this point the Operating Manual in conjunction with the screen display instructions are to be followed.

PRINTER FAILURE

In the Word Processing Operation, a feature has been provided where the printer will indicate if it is not working only when a document is requested to be printed. The message provided should be adhered, then following the display instructions, preparation of documents etc. can be continued, stored for later printing when the printer is again operational.

The applications packages will stop if a report is requested, requiring the systems RESET key to be replaced, and other non-report operations to be carried out until the printer is repaired. No data will be lost if a printer fault is encountered.

READ BEFORE TOUCHING A DISKETTE

THE SA-400 DISK DRIVE

The SA-400 was designed for ease of operator use to facilitate a wide range of operator orientated applications.

MINIDISKETTE LOADING

Figure i.1 shows the proper method of loading a minidiskette in the SA-400. To load the diskette, open the door on the front panel, insert the diskette with label towards the door handle. A mechanical interlock prevents door closure without proper media insertion, thus eliminating media damage.

MINIDISKETTE HANDLING

To protect the diskette, the same care and handling procedures specified for computer magnetic tape apply. These precautionary procedures are as follows.

1. Return the diskette to its storage envelope whenever it is removed from the drive.
2. Keep cartridges away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on the disk.
3. Replace storage envelopes when they become worn, cracked, or distorted. Envelopes are designed to protect the diskette.
4. Do not write on the plastic jacket with a lead pencil or a ball point pen. Use a felt tip pen.
5. Heat and contamination from a carelessly dropped ash can damage the diskette.
6. Do not expose diskette to heat or sunlight.
7. Do not touch or attempt to clean the diskette surface. Abrasions may cause loss of stored data.

WRITE PROTECT FEATURE

The diskettes used in the SA-400 have the capability of being write protected. A write protect notch is located on the diskette jacket. When the notch is open writing is allowed. When the notch is covered with a tab, writing is inhibited and the interface signal will be activated. This feature is used mainly to protect data while in storage, preventing the inadvertent formatting of diskettes containing crucial data, or there being written over when inadvertently inserted in the drives.

READ BEFORE USING THE PRINTER

GENERAL

The principal functions to be performed by the operator are loading paper, adjusting for multi-part forms when used, selecting and installing ribbons, and selecting and installing print wheels.

LOADING PAPER

Paper loading with a friction feed platen is very much like loading a standard typewriter. The paper pinch release lever is located on the right side towards the rear of the printer. The line detent release feature is electronic and the button which controls this function is on the bottom right of the 16 key keypad just in front of the printer.

The forms thickness adjustment lever is on the left side of the printer, opposite the paper release lever. This control has six positions, roughly corresponding to the number of sheets (one to six) accommodated. For single sheet thickness, the control should be in its rearmost position.

RIBBON REPLACEMENT

An ink free leader at the beginning of the ribbon ensures easy ribbon loading without the need to touch the inked surface. The ribbon is threaded around the guide roller, past the print wheel and onto the take-up spool in a straightforward manner. One side of the ribbon reel has guide holes which fit over nipples in the ribbon motor hubs. Ribbon reversal occurs automatically when reflective strips at the ends of the ribbon are sensed. Figure i.2 illustrates the ribbon threading path.

PRINT WHEEL REPLACEMENT

Replacing a print wheel is exceptionally fast and easy. No interference occurs with the ribbon and the print head tilts all the way back for convenient access.

For easier access and convenience, first place the carriage towards the center of its travel. The print head pivot lock is located on the right side of the carriage with a button for unlocking the print head, and one for relocking it. Depress the button marked O for "Open", and swing the print head back. The print wheel is held onto the hub by friction, and is removed by grasping its rubber hub.

Installing a print wheel is a simple matter of pushing it solidly onto the hub, ensuring that its alignment hole engages the alignment tab on the hub. Replacement is then completed by tilting and locking the print head into its closed position by pressing the button marked C "Close".

RIBBON REVERSE

The button marked RIB when depressed, will cause the ribbon to reverse itself, if currently travelling in the power-on direction. This feature is only used when the system is frequently turned off after very short printing cycles and the same section of ribbon would otherwise be used continuosly.

FIGURES

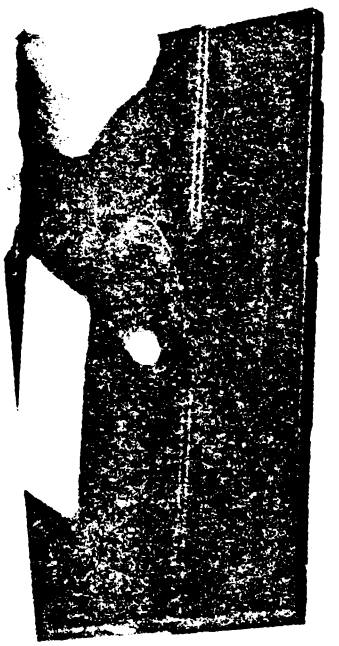
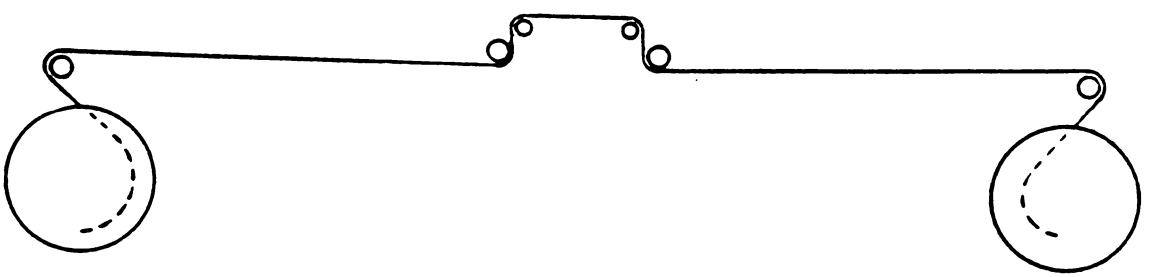


FIGURE i-1



Ribbon Replacement

FIGURE i-2

LEPRECHAUN COMPUTER OPERATING SYSTEM MANUAL

INDEX

Section 1

Operating System Arrangement

1.0 Diskette Utilization

Diskettes used with the Leprechaun are divided into two sections. The first section is the operating system area. The second section is the general file section which contains user programs. The DIR command lists the files contained in this section.

1.1 Memory Utilization

The operating system uses the first 256 locations in memory as well as the last 11K of memory leaving approximately 53K of memory for user programs.

1.2 Files

A file is a place for storing information.

1.3 File Names and File References

1.3.1 File Names - when a file is created it is given a primary file name of up to 8 characters and optionally, a secondary file name of up to 3 characters (eg - ffffffff.ext). It is the file name which enables a file to be referenced later. Any ASCII character (printable) may be used in either file name except the following:

$ * ? = / . , : "space"

Lower case letters of file names are converted by the operating system to upper case characters.

There are several secondary file names assigned by and/or expected by some system programs.

These are listed below:

.BAS	- *BASIC source
.BAK	- *Editor backup
.FOR	- *FORTRAN source
.CCL	- *COBOL source
.APL	- *APL source
.MAC	- *Macro Assembler source
.PAS	- *Pascal source
.FTH	- *Forth source
.ASM	- *Assembler source
.WST	- *Wordprocessor Text
.SLV	- *Wordprocessor Variable File
.COM	- Executable command program
.SYS	- System image
.HEX	- *Intel hex format
.PRN	- *Printout file
.CMD	- *Batch command file
.OBJ	- Relocatable file, linkable hex object

* ASCII format

When an executable command file is referred to without specifying a disk drive for the file, the current drive will be searched first. If the file is not found, and the current drive is not drive A:, then drive A: will be searched for the file.

1.3.2 File References

Unambiguous or specific file reference refers to an individual file on a particular disk.

Ambiguous file reference, which contains either a ? or an *, refers to a group of files where the ? or * can be substituted for any character in the same position in either the primary or secondary file name. However, the * also replaces and characters to the right, up to the . between the primary and secondary file names, or up to the end of the secondary file name if placed after the ".".

eg - If you have the following files:

FIL.OBJ	FILEA.OBJ	FILEB.OBJ	FILEA.BAS
FILEB.BAS	FIL.BAS		

The reference FIL??.OBJ would select all the OBJ file listed above.
The reference FIL.* would select both FIL.OBJ and FIL.BAS.

1.4 I/O Device Names

The following I/O devices are available in the operating system:

Device	Name	Data Transfer
Console	CON:	Input & Output
Line Printer	PRT:	Output
List Device	LST:	Output (usually the Line Printer)
Dummy Device	DUM:	Input & Output
Disk	A:, B:, C:, D:	Input & Output

Up to four 8" and 5" disk drives may be connected to the system at one time. All disk files may be accessed in either random or sequential order.

Section 2

Operating System Operation

2.0 Startup

Turn on the Leprechaun, place the operating system diskette in drive A:, and close the disk drive door. The screen should then display the bootup procedures as the system is set up for operation (if it does not then contact PCS for help).

The display will eventually display the startup display on your application's packages.

Should you need to return to the operating system - request the program to stop.

2.1 Changing Diskettes when in the Operating System

When another disk is inserted into a drive then the operating system **MUST** be reinitialized. To reinitialize the operating system press the CTRL (Control) key and the C key simulataneously. This proceedure will reinitialize the operating system to prevent errors from occuring due to a different disk being in the system than the one the operating system thinks is there.

2.2 Changing Diskettes when in an Applications Program

Do not change diskettes in any Applications Program unless the program requests that a diskette be changed. This will prevent any confussion in the operating system from different disks being used than should be there.

2.3 Console Editing features

When in the operating system the following keys will perform the listed functions:

Key	Function
BACK SPACE	Deletes the previous character and backs up the cursor
RETURN	Terminates the current command so that the operating system can begin working on the command
CTRL R	Retypes the current line
CTRL S	Causes the current I/O device to pause until the next CTRL S is typed
CTRL U	Deletes the current line and backspaces the cursor
CTRL X	Deletes the current line and moves to the next line
CTRL P	Turns the printer on/off to allow information that is being sent to the screen to be also sent to the printer

3.0 Command Structure and Syntax

Any combination of upper and lower case characters may be entered in a command line (as they will be automatically translated into upper case characters).

The REN, WRTSYS, XFER commands use the following structure:

Destination-File-Ref=Source-File-Ref

Options are preceeded by a space and a slash [/].

The following symbols are used in explaining the structure of the commands:

[ ] Brackets are used to indicate a parameter which is optional and may be omitted.

{ } Braces are used to indicate a choice of items, one of which must be used.

[{ }] Braces enclosed in brackets indicate an optional choice of items.

_ Character underline is used to show which characters must be entered if used.

3.1 Commands

3.1.1 ATRIB

Enables the user to set up, change or delete parameters which protect a file from being read, written to or erased.

Command Line Structure

ATRIB file.ref [+] [p...] cr

Where:

file.ref	is the reference (which may be ambiguous) to the file(s) to which attributes are to be assigned or deleted.
+	this parameter is required only when assigning additional protective parameters to a file and can only be used at that time.
[p...]	are the protective parameters to be assigned to the file
P	Protects a file from being erased
R	Protects a file from being read by a TYPE or DUMP command.
W	Protects a file from being written to.
cr	carriage RETURN

Attributes already assigned to a file will be deleted by assigning new attributes without using the + sign. All attributes assigned to a file will be deleted by entering only ATRIB and the file reference in the command line.

3.1.2 DIR

Lists the disk files giving their size (in K bytes), number of extents nd the file attributes.

COMMAND LINE STRUCTURE

DIR [{Y:}{file.ref}] cr

Where:

Y:	specifies the disk drive whose directory of files is to be displayed. If a drive is not specified, the directory of the currently selected drive will be displayed.
file.ref	specifies the file for which the size, number of extents and attributes are to be displayed. This file reference may include the replacement characters ? and/or *.

3.1.3 ERA

Deletes the file(s) from the disk directory.

COMMAND LINE STRUCTURE

ERA file.ref cr

Where:

file.ref specifies the file(s) which will be deleted form the disk directory. This file reference may include the replacement characters ? and/or *. The disk space previously used by the erased files will then be available.

NOTE: Caution is recommended when replacement characters are used, as it is possible to delete a large number of files this way.

3.1.4 GET

Enables the user to load into memory (and optionally run) any .HEX absolute object file. The file will be loaded into the address specified by the INTEL hex object format.

COMMAND LINE STRUCTURE

GET file.ref [/G] cr

Where:

file.ref specifies the HEX file(s) you wish to get (load into memory). If the secondary file name is omitted .HEX is assumed.

/G specifies, upon loading, that the program is to be run immediately starting at the first address in the .HEX file.

3.1.5 REN

Enables the user to rename a file (either primary name, secondary name or both).

COMMAND LINE STRUCTURE

REN file.ref1=file.ref2 cr

Where:

file.ref1 is the new name of the file. The file reference may include the replacement characters ? and/or *.

file.ref2 is the old name of the file. The file reference may include the replacement characters ? and/or *.

3.1.6 SAVE

Saves the specified number of 256 byte pages of the user area starting at address 100H.

COMMAND LINE STRUCTURE

SAVE file.ref N cr

Where:

file.ref — specifies the file name to be given to the contents saved from the user area. If the secondary file name is entered as ".COM" the file will be saved as a command file.

N — is the number (decimal) of pages to be saved.

3.1.8 SET

The SET command provides a means of reassigning the printer to an alternate device.

COMMAND LINE STRUCTURE

SET L=0 (for System printer)
1 (for Remote printer) cr

3.1.8 TYPE

Displays the contents of the ASCII file referenced on the console.

COMMAND LINE STRUCTURE

TYPE file.ref cr

Where:

file.ref — specifies the file whose contents are to be displayed on the console.

NOTE: pressing any key will terminate the command. The display will pause when the CTRL key and the S key are pressed simultaneously. Pressing any other key will resume the display.

3.1.9 @ (Batch)

The @ command enables the user to execute a file of commands sequentially without operator intervention. This allows job stream processing.

COMMAND LINE STRUCTURE

[X:] @ [/RY] file.ref [P1 P2 P3 .... P9] cr

Where:

X: specifies the disk drive location of the batch COM file (@.CCM). This parameter is required only if the @.CCM file is not located on the current drive or drive A.

/R is an optional nesting function switch which enables a batch command (.CMD) file to call another batch command file and return to the first batch command file when execution has terminated on the second batch command file. If the switch is not set there will not be a return to the first batch command file. The maximum level of nesting is 128. The maximum number of commands pending at one time is 128. Recursive files must have thier workspace located on different disk drives.

/Y specifies the disk drive on which the .CMD file is to be located. (optional)

file.ref is the batch command file (CMD) to be executed.

P1, P2 ..P9 are optional parameters to be passed to the CMD file upon entering the batch command line. They are typically file references or parameters for programs in the batch stream to use. They are referenced by putting a ^ followed by the number indicating which parameter position is to be used with that command. eg TYPE ^1 will display the file referenced in the first parameter. If ^0 is used, the batch file itself is the parameter.

COMMAND LINE STRUCTURE

[X:] @ [/RY]

Where:

Parameters as above as well as direct entry of commands for executing the batch process on a once only basis is allowed. The first blank line starts the execution of the batch processing.

3.1.10 DSKDIAG

Used to detect disk drive problems and bad diskettes.

COMMAND LINE STRUCTURE

[X:] DSKDIAG cr

Where:

X: specifies the disk drive where DSKDIAG is to be found and is only needed when it is not on the currently selected drive or drive A.

The following prompt is displayed indicating program is ready

TEST # DRIVE # [TTDD] :

The user may then enter the following:

1XX	Read/Write Test - each sector tested sequentially
2XX	Read Test - each sector sequentially
3XX	Read/Write Test - each sector randomly
4XX	Read/Write Test - each sector/drive randomly
5XX	Formats the diskette specified
10XX	Loads data from diskette into memory (no file reference)
11XX	Saves data from memory to diskette (no file reference)
FFOO	Exits program to address specified by user
cr	Exits to disk operating system

TT is 1-5, 10, 11, or FF
DD or XX is the drive specification as follows

Type of Drive Drive Name	8"	5" 1 sided	5" 2 sided
A	50	60	70
B	51	61	71
C	52	62	72
D	53		73

3.1.11 DUMP

Displays (on the console) the contents of the specified file in both hexadecimal and ASCII.

COMMAND LINE STRUCTURE

[X:] DUMP file.ref cr

Where:

X: specifies the drive which contains the DUMP program. This parameter is only required when the program is not located on the current drive or drive A.

file.ref is the file to be displayed.

3.1.12 ERASE

Erase files, on the condition that the user enters Y when asked if the file displayed is to be erased. Use is identical to the ERA command.

3.1.13 FORMAT

Used to initialize diskettes for operation with the Leprechaun system. All Diskettes must be initialized to be work with the Leprechaun.

COMMAND LINE STRUCTURE

[X:] FORMAT {A}[N] cr
{B}
{C}
{D}

or [X:] FORMAT cr

Where:

X: specifies which drive FORMAT is to be found on, if it is not on the current drive or drive A.

N specifies what type of drive is used

5 if 8" drive
6 if 5" single sided drive
7 if 5" double sided drive

3.1.14 MCOPY

Copies all information contained on one disk to another disk. The source disk may be any drive and the destination disk may be any drive (A,B,C,or D).

CAUTION: The Source Drive should not be designated as the destination drive (eg. - copying one disk onto itself).

COMMAND LINE STRUCTURE

[X:] MCOPY [/YZF] cr

Where:

X: Specifies the disk drive that contains MCOPY. This is only required where MCOPY is not on drive A:.

/YZF The / must be entered to tell the copy routine that there is a specification following. Y is the source disk (where the information is coming from). Z is the destination disk (where the information is going to). F is optional, specifying that the destination disk is to be formatted, but should be used to make sure that there is no left over information on the diskette from previous use.

Without the /YZF specification the program will go into the multiple copy mode automatically.

You will be prompted with the following questions:

```
COPY FROM DRIVE (A, B, C, or D) or Q to quit ?
COPY TO DRIVE (A, B, C, or D) ?
```

Following these questions you will be prompted with the following information and asked a final question before the actual copy operation is done.

```
INSERT SOURCE  DISKETTE IN DRIVE Y:
AND DESTINATION DISKETTE IN DRIVE Z:
AND TYPE
C - TO CONTINUE
F - TO FORMAT DISKETTE IN DRIVE Z:
R - TO RESET DRIVES
Q - TO QUIT AND RETURN TO DOS
```

Where

Y: is the source drive previously selected
Z: is the destination drive previously selected

C Specifies that the actual copy operation is to start
F Specifies that the destination diskette is to be formatted (after which the above menu is redisplayed)
R Resets both drives
Q Quits and returns operation back to DOS (Disk Operating System)

3.1.14 cont.

When the copying starts it will display it's progress on the screen as follows:

```
0         1         2         3         4         5         6         7
01234567890123456789012345678901234567890123456789012345678901234567890123456
^^^^^^^^^^^^^^^^^^^^^^^^EEEEEEEEEE
```

DISKETTE COPIED AND VERIFIED

You will then be prompted with the COPY FROM DRIVE (A, B, C, or D) or Q to QUIT message at the start of the program. This enables you to copy more than one set of disks at a given time.

If you hit any key while the copy operation is being done the following prompt will be displayed '*OPERATOR ABORT*' and the menu will be redisplayed allowing you to do the copy operation again or select a new task.

The ^ is representative of a successful copy operation for a given track on the diskette. The 'E' is representative of an empty track found on the source diskette which is read but not copied. After 10 empty tracks the copy operation is terminated and the program is restarted with the COPY FROM message after displaying the above displayed message DISKETTE COPIED AND VERIFIED.

Error Messages:

Wrong Disk Type Drive Z:	- Diskette must be reformatted (using the F option).
INVALID DRIVE SELECTION	- Specifying a disk drive that does not exist of the present system will cause this error
OPERATOR ABORT	- Hitting any key during the copy operation
DATA VERIFICATION ERROR DRIVE Z:	- a bad diskette, or not in drive correctly.
DISK READ ERROR DRIVE Y:	- diskette not in drive correctly, or a damaged diskette.

3.1.15 WRTSYS

Copies the operating system from the system disk onto a newly formated diskette.

COMMAND LINE STRUCTURE

[X:] WRTSYS Y:=Z: cr

Where:

X: Specifies which diskette contains the WRTSYS program, and is only needed when WRTSYS is not on drive A:.
Y: Specifies the destination drive.
Z: Specifies the source drive, and is usually drive A:.

Eg. WRTSYS B:=A:

3.1.16 XDIR

Similar in operation to DIR except that the directory is listed four columns wide and twenty one lines deep.

COMMAND LINE STRUCTURE

XDIR [Y:file.ref] cr

Where:

Y: Specifies the disk drive whose directory is to be displayed. If a drive is not specified the currently selected drive will be displayed.
file.ref Specifies the file(s) for which the size is to be displayed. This file reference may include the replacement characters ? and/or *.

Entering CTRL S while the directory is being displayed will cause the display to pause until another key is pressed.

3.1.17 XFER

Copies files from one diskette to another diskette. This command has the following two structures:

1. COMMAND LINE STRUCTURE for Repetitive Execution:

   [X:] XFER cr

2. COMMAND LINE STRUCTURE for One Time Execution:

   [X:] XFER [/p1 /p2...D:file.ref1=file.ref2 [,file.ref3...]]cr

When the repetitive execution mode is entered the command prompts the user with an exclamation mark (!). The valid responses are the entry of the destination drive (and file), and the entry of one or more source files.

Here:

X: Specifies the disk drive which contains XFER, and need only be used when XFER is not located on Drive A:

/p1/p2 are the combination of the following optional parameters.

- A designates an ASCII file transfer (characters only)
- C designates a comparison on files (without an actual transfer). Used to check for two files being the same.
- F designates that illegal ASCII characters are to be dropped
- I designates that the ASCII end of file should be ignored (CTRL Z)
- R designates that a read protected file is to be copied.
- S designates that all rubouts and nulls are to be stripped from the file This applies to ASCII files only.
- T designates that TABS are to be expanded. This applies to ASCII files.
- V designates that the file is to be verified after it is written onto the destination diskette.
- Z designates that the size statistics are not to be printed upon the completion of a transfer.

D: is the destination drive
file.ref1 is the name of the destination file
file.ref2,3... is the name(s) of the source files. If more than one file is specified, the files will be concatenated together.

eg. XFER /A /F /Z A:ZAP.MST=B:MESS.MST C:GARB.MST (CR)

ZAP.MST will be the combination of MESS.MST and GARB.MST with all illegal characters dropped out, and without the size displayed when the transfer is completed.

3.1.18 XSTAT

Gives the status of a particular disk drive.

COMMAND LINE STRUCTURE

XSTAT [Y:] cr

Where:

Y: specifies the drive to print the status of.

eg. XSTAT A: will print the status of drive A: as follows:

```
XXXK    bytes   Total disk space
 XXK    bytes   Total available memory area for user programs
XXXK    bytes   disk space available for use.
  XX    Directory Entries
```

Where:

XX is the number of bytes/entries.

Error messages:

XXH NOT ALLOCATED - You have not entered CTRL C after inserting a new diskette - so far no damage has occured.

XXH LINKED CLUSTER file.ref, file.ref - the same disk block has been used by more than one file. To be safe both files should be deleted or at least the oldest one.