LOMAS DATA PRODUCTS INC.

THUNDER 186 OWNER'S MANUAL

REV.0

PROPRIETARY NOTICE

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1.0 THUNDER 186

1.1 Introduction

The THUNDER 186 is based upon the newest in a family of 16 bit microprocessors from Intel. The 80186 is an advanced, high performance microprocessor with specially optimized capabilities for use in highly integrated systems. THUNDER 186 is a complete single board computer on a single height S100 bus board. It contains all components to form a high performance 16 bit computer without need of additional boards. The 80186 is upward compatible with 8086 and 8088 software. This insures a wide variety of software will be available as most of the popular personal computers use the the 8088 microprocessor.

1.2 Features

THUNDER 186 offers many features which are summarized below:

* 80186 advanced microprocessor (8086/8088 compatible)
* Addresses up to 1 Megabyte of memory
* Full object code compatibility with 8086/8088 code
* Integrated Interrupt controller with 11 vectored interrupts
* 2 EPROM sockets for up to 64K bytes of EPROM
* Strict conformance to IEEE 696
* Floppy disk controller controls both 8" and 5 1/4" disk drives simultaneously
* Two serial ports with software programmable baud rates up to 9600 baud
* Centronics compatible parallel printer port
* Software programmable real time interrupt
* Two DMA channels, both accessible by bus peripherals

1.3 Limited Warranty Information

LOMAS DATA PRODUCTS will repair or replace, at our option, any parts found to be defective in either materials or workmanship for a period of one year from date of invoice. Defective parts must be returned to LOMAS DATA PRODUCTS for replacement.

If a defective part causes a LOMAS DATA PRODUCTS product to operate improperly during the one year warranty period, we will service it free (original owner only) if delivered and shipped at owner's expense to and from LOMAS DATA PRODUCTS. If improper operation is due to an error or errors on part of the purchaser, there may be a repair charge. The purchaser will be notified of any anticipated charges.

We are not responsible for damages caused by use of solder intended for purposes other than electronic equipment construction, failure to follow printed instructions, misuse or abuse, unauthorized modifications, theft, fire, accidents, or use

of our products in applications in other than those intended by LOMAS DATA PRODUCTS.

Return to the purchaser of a fully functioning unit meeting all advertised specifications in effect as of the date of purchase is considered to be complete fulfillment of all warranty obligations assumed by LOMAS DATA PRODUCTS. This warranty covers only products marketed by LOMAS DATA PRODUCTS and does not cover other equipment used in conjunction with products from LOMAS DATA PRODUCTS.

Prices and specifications are subject to change without notice, owing to the volatile nature and pricing structure of the electronics industry.

2.0 THUNDER 186 SPECIFICATION

2.1 Word Size

Instruction 8, 16, 24, or 32 bits

Data 8 and 16 bits

2.2 Cycle Time

Fastest Instruction

Instruction in Queue
8 MHz 500 ns

2.3 Memory Capacity

2.3.1 ROM/EPROM

On board: 64K bytes of EPROM maximum
8K if 2732's
beginning address FE000H
16K if 2764's beginning address FC000H
32k if 27128's beginning address F8000H
64k if 27256's beginning address F0000H

2.3.2 RAM

256K bytes of Dynamic RAM. 150 ns. 4164's allow full speed operation with wait states only on refresh collisions. Beginning address 0000H.

Offboard expansion: Up to 704 Kbytes of RAM, ROM or EPROM.

2.4 Processor Bus

THUNDER 186 is fully IEEE S100 bus compatible. Strict conformance to timing has been designed into the THUNDER 186.

2.5 Environmental Requestments

Temperature 0 to 50 C (32 to 122 F)
Relative humidity from 5% to 90% non-condensing

2.6 Physical Characteristics

Width 10 inches
Height 5 inches
Component height max .5 inches

2.7 Power Requirements

+8V at 2.5 amps typical 3.0 amps max.
+16V and -16V at 100 ma.

2.8 Bus Pin Usage

TABLE 2.9

PIN #	SIGNAL		DESCRIPTION
1	8 VOLTS	I	Instantaneous minimum greater than 7 volts. Instantaneous maximum less than 25 volts. Average maximum less than 11 volts.
2	+16 VOLTS	I	Minimum 14.5 volts Maximum 21.5 volts. Instantaneous peak less than 35 volts.
3	XRDY	I	One of two ready inputs from slave devices. Both must be true to continue.
4	VI0*(O.C.)	I	Vectored interrupt 0 through 7 with interrupt 0 being the highest priority. VI0 thru VI7 may be configured thru jumpers to cause vectored interrupts on any of the four 80186 vectored interrupt pins INT0 thru INT3
5	VI1*(O.C.)		
6	VI2*(O.C.)		
7	VI3*(O.C.)		
8	VI4*(O.C.)		
9	VI5*(O.C.)		
10	VI6*(O.C.)		
11	VI7*(O.C.)		
12	NMI*(O.C.)	I	Non-maskable interrupt.
13	Not implemented		
14	Not implemented		
15	A18	O	Address bit 18.
16	A16	O	Address bit 16.
17	A17	O	Address bit 17.
18	SDSB*(O.C.)	I	This signal disables the 8 status lines sM1, SMEMR, sINP, sOUT, sWO*, sINTA, sHLTA and sXTRQ*.
19	CDSB*(O.C.)	I	This signal disables the five control out signals pSYNC, pSTVAL, pDBIN, pWR*, and pHLDA.
20	GND		Logic ground common with pins 100, 70, 53 and 50.
21	Not defined		
22	ADSB*(O.C.)	I	This signal disables the 24 address lines A0 through A23.
23	DODSB*(O.C.)	I	This signal disables the Data Out output buffers from DO0 through DO7.
24	O	O	This master system clock derives from the processor clock.
25	pSTVAL*	O	Status Valid Strobe indicating that address and status are valid during the current bus cycle.

26	pHLDA	O	Indicates to a requesting temporary master that the LIGHTNING ONE is relinquishing the bus.
27	Not used		
28	Not used		
29	A5	O	Address bit 5
30	A4	O	Address bit 4
31	A3	O	Address bit 3
32	A15	O	Address bit 15
33	A12	O	Address bit 12
34	A9	O	Address bit 9
35	DO1	O/I	Data out bit 1
36	DO0	O/I	Data out bit 0
37	A10	O	Address bit 10
38	DO4	O/I	Data out bit 4
39	DO5	O/I	Data out bit 5
40	DO6	O/I	Data out bit 6
41	DI2	O/I	Data in bit 2
42	DI3	O/I	Data in bit 3
43	DI7	O/I	Data in bit 7
44	SM1	O	This status line indicates that the current cycle is an instruction fetch cycle.
45	sOUT	O	This status line indicates that the current bus cycle is outputting data to an I/O port.
46	sINP	O	This status line indicates that the current bus cycle is an input cycle from an I/O port.
47	sMEMR	O	This status line indicates that the current bus cycle is a memory read.
48	sHLTA	O	Acknowledges that a HALT instruction has been executed.
49	clock	O	2 MHz asynchronous clock
50	GND		Logic ground common with Pins 100, 70, 53 and 20.
51	+8 volts	I	Common with Pin 1.
52	-16 volts	I	Instantaneous maximum -14.5 volts Instantaneous minimum -35 volts Average minimum greater than -21.5 volts
53	GND		Common with Pins 100, 70, 50 and 20.
54	SLAVE CLR*(O.C.)	O	A reset signal to bus slaves
55	Not implemented		
56	Not implemented		
57	Not implemented		
58	sXTRQ*	O	Requests 16 bit data transfer
59	A19	O	Address Bit 19
60	Not implemented		
61	A20	O	Address Bit 20
62	A21	O	Address Bit 21
63	A22	O	Address Bit 22

64	A23	O	Address bit 23
65	DMAREQ0	I	Channel 0 off board DMA request
66	DMAREQ1	I	Channel 1 off board DMA request
67	PHANTOM*(O.C.)	O	Disables normal slaves and enables PHANTOM slaves
68	MWRT	O	Memory write pulse
69	Not used		
70	GND		Common with Pins 100, 53, 50, and 20
71	Not used		
72	RDY(O.C.)	I	See Pin 3
73	not used		
74	HOLD*(O.C.)	I	Used to request the permanent master to release the bus.
75	RESET*(O.C.)	O/I	Used to reset bus master devices
76	pSYNC	O	A control signal indicating BS1
77	pWR*	O	Indicates valid data on the data out bus
78	pDBIN	O	Requests that the selected slave place data on the DI bus lines
79	A0	O	Address bit 0
80	A1	O	Address bit 1
81	A2	O	Address bit 2
82	A6	O	Address bit 6
83	A7	O	Address bit 7
84	A8	O	Address bit 8
85	A13	O	Address bit 13
86	A14	O	Address bit 14
87	A11	O	Address bit 11
88	DO2	O/I	Data out bit 2
89	DO3	O/I	Data out bit 3
90	DO7	O/I	Data out bit 7
91	DI4	O/I	Data in bit 4
92	DI5	O/I	Data in bit 5
93	DI6	O/I	Data in bit 6
94	DI1	O/I	Data in bit 1
95	DI0	O/I	Data in bit 0
96	sINTA	O	Status signal indicated that the current bus cycle is an interrupt acknowledge cycle.
97	sWO*	O	Indicates the current bus cycle transfers data from a bus master to a bus slave
98	Not used		
99	POC*	O	Power on clear. Remains low for 10 msec. after power on.
100	GND		

3.0 CONFIGURING THE THUNDER 186

3.1 Introduction

THUNDER 186 provides a number of jumper options for user flexibility. The options provided by jumpering are as follows:

EPROM selection
Write precompensation (125 of 250 ns.)
Slave reset connected to Master reset

3.2 EPROM SELECTION

Various EPROM types may be used in the THUNDER 186 CPU. The type used is selected by various jumper selections on JP1. The following table provides the jumper selections for the various EPROM types:

EPROM	JUMPERS(JP1)
2732	2-3,5-6
2764	2-3,5-6
27128	1-2,5-6
27256	1-2,4-5

3.3 FLOPPY DRIVE PRECOMPENSATION

The floppy disk controller provides write precompensation. The amount of precompensation is jumper selectable with jumper JP2. Pins 1 to 2 selects 125 nanosecond precompensation and pins 2 to 3 select 250 nanosecond precompensation. Normally 125 nanosecond precompensation is sufficient.

3.4 SLAVE RESET

The IEEE 696 specification for the S100 bus defines three different reset lines on the bus, POC(power on clear), RESET, and SLAVE CLR. THUNDER 186 asserts all three reset lines for 50 milliseconds after power on. Normally the front panel reset button only asserts RESET when pushed, leaving any bus slave devices in the previous condition. By inserting jumper JP3, both RESET and SLAVE CLR are asserted when the front panel reset button is pushed. This is the preferred position.

3.5 SERIAL PORT CONNECTORS

The serial port connectors (J1 and J2) are set up to use a direct one to one cable when connecting to a terminal. The following is the connector pin as seen at the rear panel of the computer when connected with a standard ribbon cable with a header at one end and a DB25S connector at the other end:

PIN NUMBER	SIGNAL	
2	RXDATA	IN
3	TXDATA	OUT
4	DSR(DATA SET READY)	IN
5	DTR(DATA TERMINAL READY	OUT
6	RTS(REQUEST TO SEND)	OUT
7	SIGNAL GROUND	
20	CLEAR TO SEND	IN

CONNECTOR J1 IS THE CONNECTOR FOR YOUR TERMINAL. THE ONBOARD SERIAL MONITOR EXPECTS A TERMINAL CONNECTED TO THIS PORT. THUNDER IS SHIPPED WITH THIS PORT SET AT A BAUD RATE OF 9600 BAUD.

3.6 PARALLEL PRINTER PORT PIN ASSIGNMENTS

The parallel printer port (J3) has the following pin assignment when connected to the rear panel with LOMAS DATA PRODUCTS cable, part number 030-00026-01:

PIN NUMBER	SIGNAL	DIRECTION
1	STROBE	OUT
2	DATA 0	OUT
3	DATA 1	OUT
4	DATA 2	OUT
5	DATA 3	OUT
6	DATA 4	OUT
7	DATA 5	OUT
8	DATA 6	OUT
9	DATA 7	OUT
10	ACK	IN
11	PTR BUSY	IN
18	GND	
19	GND	
20	GND	
21	GND	
22	GND	
23	GND	

3.6 FLOPPY DISK DRIVE CONNECTOR PIN ASSIGNMENTS

8 INCH DRIVES(J5)		5 1/4 INCH DRIVES(J4)	
PIN	SIGNAL	PIN	SIGNAL
2	LOW CURRENT	2	TWO SIDED
4	FAULT RESET	4	NC
6	FAULT	6	DS3
8	NC	8	INDEX
10	TWO SIDED	10	DS0
12	NC	12	DS1
14	SIDE SELECT	14	DS2
16	NC	16	MOTOR ON
18	HEAD LOAD	18	DIRECTION
20	INDEX	20	STEP
22	READY	22	WRITE DATA
24	NC	24	WRITE ENABLE
26	DS0	26	TRACK 0
28	DS1	28	WRITE PROTECT
30	DS2	30	READ DATA
32	DS3	32	SIDE SELECT
34	DIRECTION	34	READY
36	NC		
38	WRITE DATA		
40	WRITE ENABLE		
42	TRACK 0		
44	WRITE PROTECT		
46	READ DATA		
48	NC		
50	NC		

ALL ODD PIN ARE GROUND ON BOTH CONNECTORS

4.0 PROGRAMMING THUNDER 186

THUNDER 186 comes with CONCURRENT CP/M-86 and the source code for the XIOS. The XIOS should be consulted as the primary source for programming the THUNDER 186. In addition to the XIOS source code the appendix includes a reprint of an application note on the 80186 microprocessor. This note contains detailed information about the internal features and programming of the 80186. The file, T186.LIB on the distribution diskette, contains equates for THUNDER 186 which provide all I/O addresses necessary to program THUNDER 186. Also the source code for the THUNDER 186 monitor is provided on the distribution diskette. This should provide useful for interfacing to the monitor and as further examples of programming the 80186 and the peripheral I.C.'s of the THUNDER 186.

5.0 THE MONITOR

5.1 Introduction

The monitor has the following commands:

B	Boot
C	Convert decimal to Hex
D	Dump memory
E	Enter data
F	Fill memory
G	Go
H	Hex Arithmetic +,-,/,*
I	Input from I/O port
L	Load Disk sectors to memory
M	Move memory
O	Output data to I/O port
R	Display Registers
S	Search memory for data string
T	Trace Instruction cycles
V	Verify memory
W	Write memory to disk

In addition to the above commands, the monitor includes power up diagnostics to insure the correct functioning of the required hardware. At power up time and each time the CPU is reset memory diagnostics that test the first 1K bytes of memory are executed. 1K bytes of memory starting at memory location 0 are the minimum amount of memory necessary to execute the monitor. If a memory error is encountered or if no memory is found the following message is printed at the console:

Memory failure or no memory present

Disk problems may be isolated with the disk utilities in the monitor. These basic tests will insure that the minimum requirements of the monitor are present. If an error is found, an attempt to report it is made using the console device. Execution continues even if an error is found.

5.2 Monitor Parameters

The monitor commands described in the following sections use combinations of the following parameters:

BYTE	2 Digit HEX number
WORD	4 digit HEX number
ADDRESS	5 digit HEX number
RANGE	Is either (ADDRESS) (ADDRESS) or (ADDRESS) L (WORD)
LIST	Is a series of byte values which may

	be expressed as a sequence of BYTES separated by either a ',' or a SPACE, or as a STRING.
STRING	Is a number of characters enclosed either in (') or ("). The opening and closing quotes must be the same.

5.3 BOOT

B

B ADDRESS . . . Address

Boot may take either of the above two forms. The first form loads the first two tracks from a single density diskette into memory starting at location 400H and then jumps to the first location. The Stack Pointer is set to 7000H. The second form loads the first two tracks as in the previous example and then sets breakpoints at the specified addresses. The tracks are loaded before the breakpoints are set so any errors in the breakpoints will not be found until after the load.

5.4 Convert

C word

Converts a four digit decimal number to its hex value and outputs the result to the console.

5.5 Dump

D ADDRESS

D RANGE

Dump displays the memory area specified as a parameter in the command as hex bytes followed by their ASCII representation. Nonprinting characters are shown as a '.' in the dump. The first form displays 128 bytes beginning at the specified address. The second form displays the whole range, which must be less than 64K bytes.

5.6 Enter

E ADDRESS,LIST

E ADDRESS

The first form enters the parameters in LIST into memory beginning at the specified address and then returns to command mode. The second form puts the monitor into enter mode, starting at the specified. After a carriage return, the address and its contents should be changed, type the new value to be entered. If no change is required, type a space and the next location may be examined and changed if required. A '-' will back up to the previous location. A carriage return will terminate the command and return to command mode.

5.7 Fill

F RANGE,LIST

The specified address range is filled with the data specified in LIST. If the range is longer than the LIST, the LIST is repeated. The LIST may be just one byte which will cause the entire range to be filled with the same value.

5.8 Go

G

G ADDRESS . . . ADDRESS

Go sets all the registers from the register save area, including the CS and IP registers. Therefore, you must set the CS and IP registers to point to the program you wish to execute before you execute this command. The first form will not set any breakpoints. The second form will set breakpoints at each of the specified address up to a maximum of 10 breakpoints. The stack pointer in the register save area must point to a valid memory area in order for this command to work. If the program under test leaves interrupts enabled, execution may be interrupted by typing a C at the console. All registers are saved when interrupted and the program may be continued with a GO command.

5.9 Input

I WORD

Inputs a byte of data from the specified port and displays it. A 16 bit port address is allowed.

5.10 Hex Arithmetic

H WORD WORD +,-,\,*

This function performs the specified function on the two supplied parameters. The displayed result is always a 16 bit quantity.

5.11 Load Disk Sections

L ADDRESS, Drive, Beginning Record #, # of Sectors

The specified number of sectors are loaded beginning at address. The first sector is specified by Beginning Record # . The records on a disk are numbered from 0, with track 0 sector 1 being record 0.

DRIVE DESIGNATORS SWITCH 4 ON

DRIVE #	DRIVE SELECT	FORMAT EXPECTED
0	0	SS-DD 8 SPT
1	1	SS-DD 8 SPT
2	2	SS-DD 8 SPT
3	0	DS-DD 8 SPT
4	1	DS-DD 8 SPT

5	2	DS-DD 8 SPT
6	0	SS-DD 9 SPT
7	1	SS-DD 9 SPT
8	2	SS-DD 9 SPT
9	0	DS-DD 9 SPT
A	1	DS-DD 9 SPT
B	2	DS-DD 9 SPT

DRIVE DESIGNATORS SWITCH 4 OFF

0	0	SS-SD 8"
1	1	SS-SD 8"
2	0	SS-DD 8"
3	1	SS-DD 8"
4	0	DS-DD 8"
5	1	DS-DD 8"
6	2	5 1/4" SINGLE SIDED
7	2	5 1/4" DOUBLE SIDED

5.12 Move

M RANGE ADDRESS

MOVE moves a block of memory from the area specified by RANGE to the new area beginning at ADDRESS. Overlapping moves are allowed.

5.13 OUTPUT TO PORT

O WORD BYTE

Outputs the BYTE value to port specified in WORD.

5.14 REGISTER DISPLAY

R

R REGISTER NAME

Register - with no parameters, this command dumps the register save area.

Giving a register name as a parameter allows that register to be displayed and modified. The register name may be AX, BX, CX, DX, SP, BP, SI, DI, DS, ES, SS, CS, IP, PC or F (upper case only): anything else will result in "BR Error". IP and PC both refer to the Instruction Pointer and F refers to the Flag register. For all except the Flag register, the current 16-bit value will be printed in hex, then a colon will appear as a prompt for the replacement value. Typing carriage return leaves the register unchanged; otherwise, type a WORD to replace.

The Flag register uses a system of two-letter mnemonics for each flag, as shown below:

FLAG	CLEAR	SET
Overflow	NV No Overflow	OV Overflow

Direction	UP Up (Incrementing)	DN Down (Decrementing)
Interrupt	DI Disabled Interrupts	EI Enabled Interrupts
Sign	PL Plus	NG Negative
Zero	NX Not Zero	ZR Zero
Auxiliary Carry	NA No Auxiliary Carry	AC Auxiliary Carry
Parity	PO Parity Odd	PE Parity Even
Carry	NC No Carry	CY Carry

Whenever the Flag register is displayed, all flags are displayed in this order. When the F register is specified with the R command, the flags are displayed and then the Monitor waits for any replacements to be made. Any number of two letter flag codes may be typed, and only those flags entered will be modified. If a flag has more than one code in the list, a "DF Error" (Double Flag) will result. If any code is not recognized, and "BF/Error" (Bad Flag) will occur. In either case, those flags up to the error have been changed, and those after the error have not.

After reset, all registers are set to zero except the segment registers are set to 40H, and the Stack Pointer, which is set to 0C00H. Flags are cleared except for interrupts. Execution on a Trace or Go command would thus begin at 400H, which is the first location after the interrupt table.

5.15 Search

S RANGE LIST

The specified range is searched for a byte or string of bytes specified in LIST. The address of each occurance is listed at the console.

5.16 TRACE

T
T WORD

The number of instructions specified are traced. The register contents are printed after each step.

5.17 VERIFY

V TEST START COUNT ITERATIONS

TEST is a single digit number in the range 0 to 4 which specifies a particular memory test. START is a 4 digit hex number which specifies the starting paragraph number for testing. A paragraph number is the absolute memory address divided by four. For instance to begin testing memory at address 400H, specify 40 for

start. COUNT is the number of paragraphs to test. Each paragraph is 16 bytes. The minimum starting paragraph for testing should be 40H, as the memory below 40H is used by the monitor for working RAM. ITERATIONS is the number of times to test the specified range. An example command line to test all testable memory in a 128K byte system is as follows

*V 2 40 1FC0 8

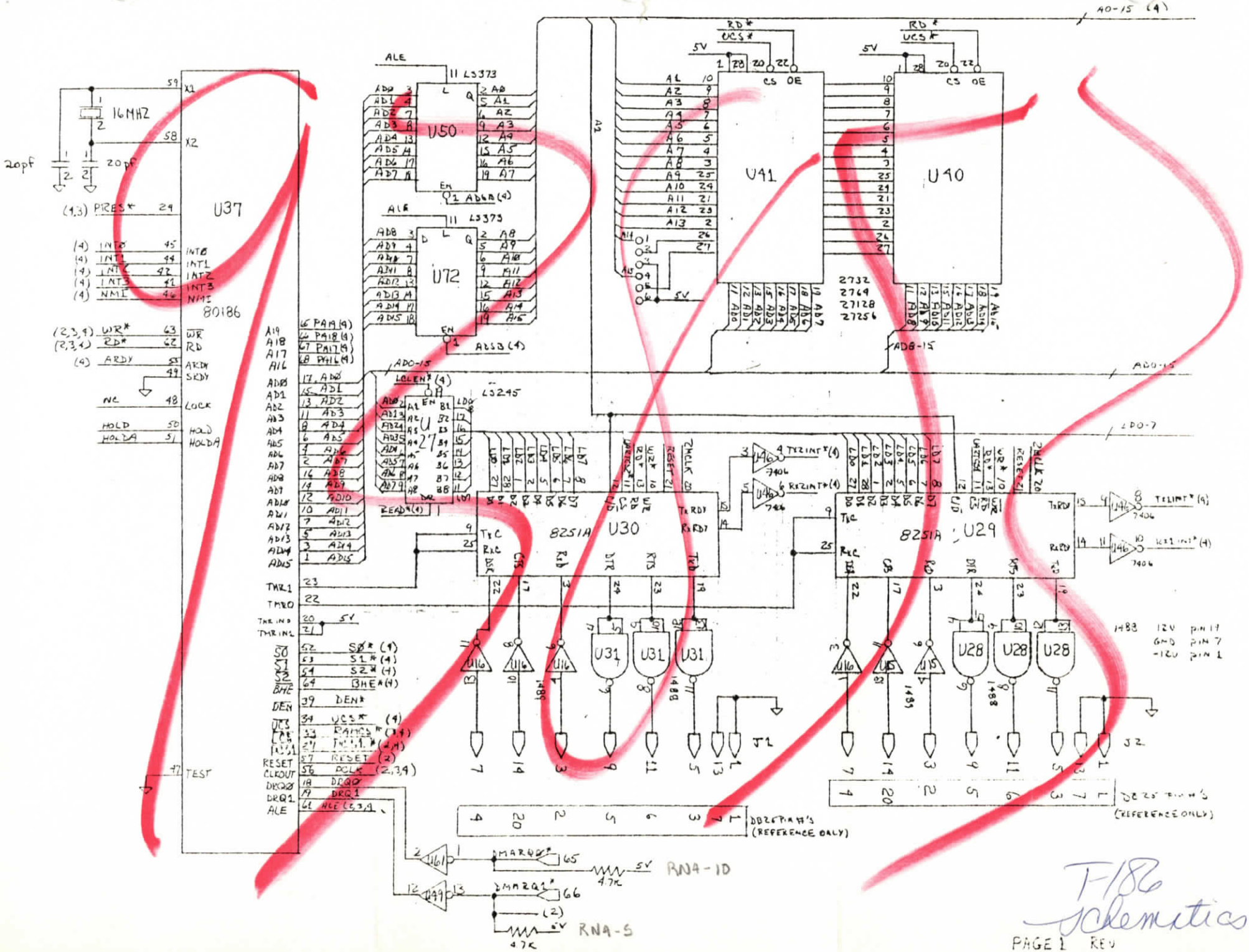
This command will test all but the first 1K of memory in a 128K system, which is used by the monitor and is tested at reset time, eight times. The tests available are as follows:

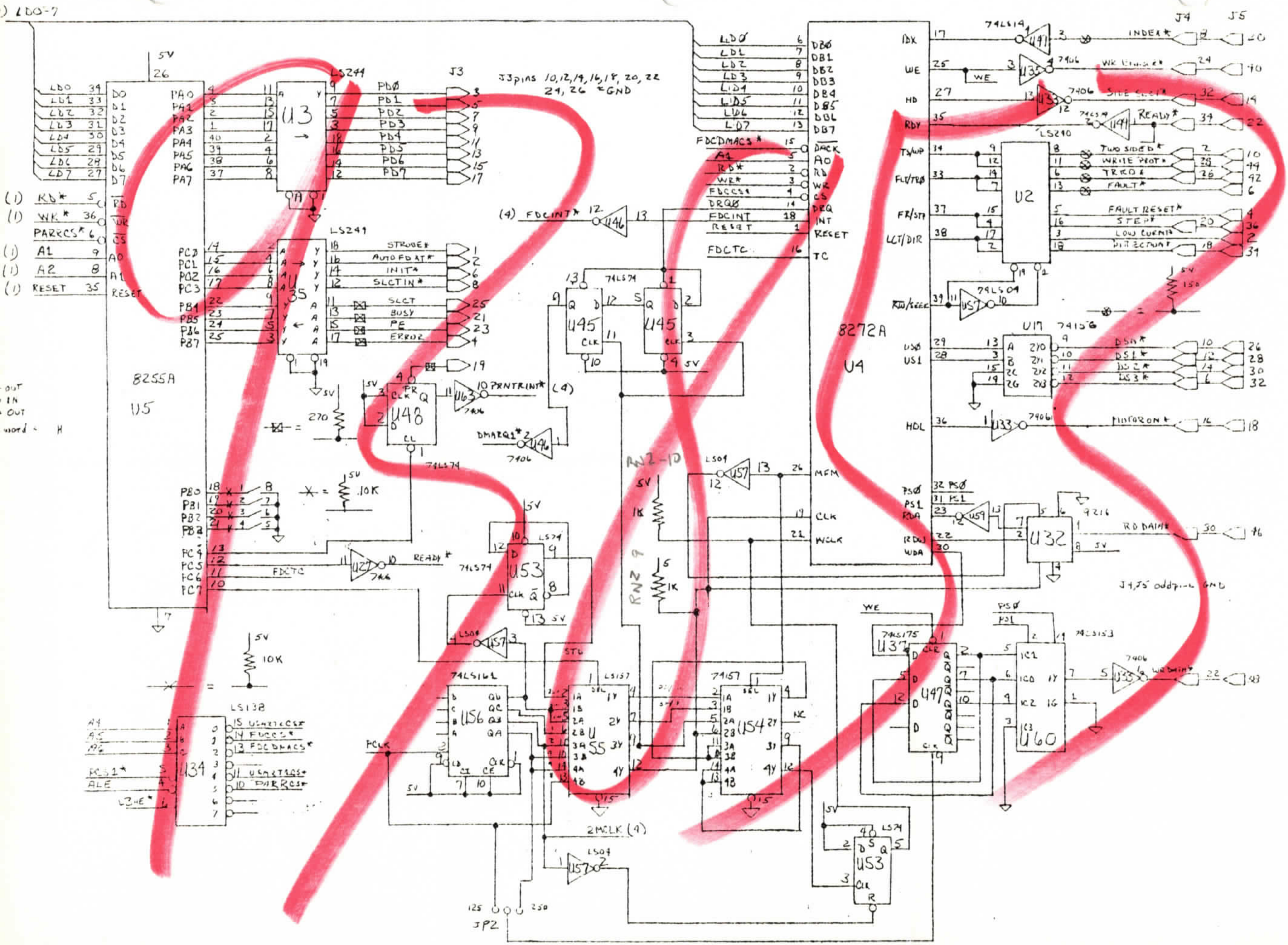
TEST 0 - tests the specified range with all 0's
TEST 1 - tests the specified range with all 1's
TEST 2 - tests the specified range with an alternating 0,1's pattern and then its complement. In other words the the test first fills memory with 55H and verifies it and then fill memory with AAH and verifies it.
TEST 3 - tests memory with a shifting 1 pattern. The first iteration uses 1 in bit 0 and each succeeding iteration shifts it left one position. In order to test memory for all single bit combinations an iteration count of 8 should be specified.
TEST 4 - tests the specified range with a shifting 0 pattern.
Bit 0 has a 0 and the remaining bits are set to 1's. Each iteration shifts the 0 one bit left. As in test 3 an iteration count of 8 should should be specified in order to test all locations for each possible combination.

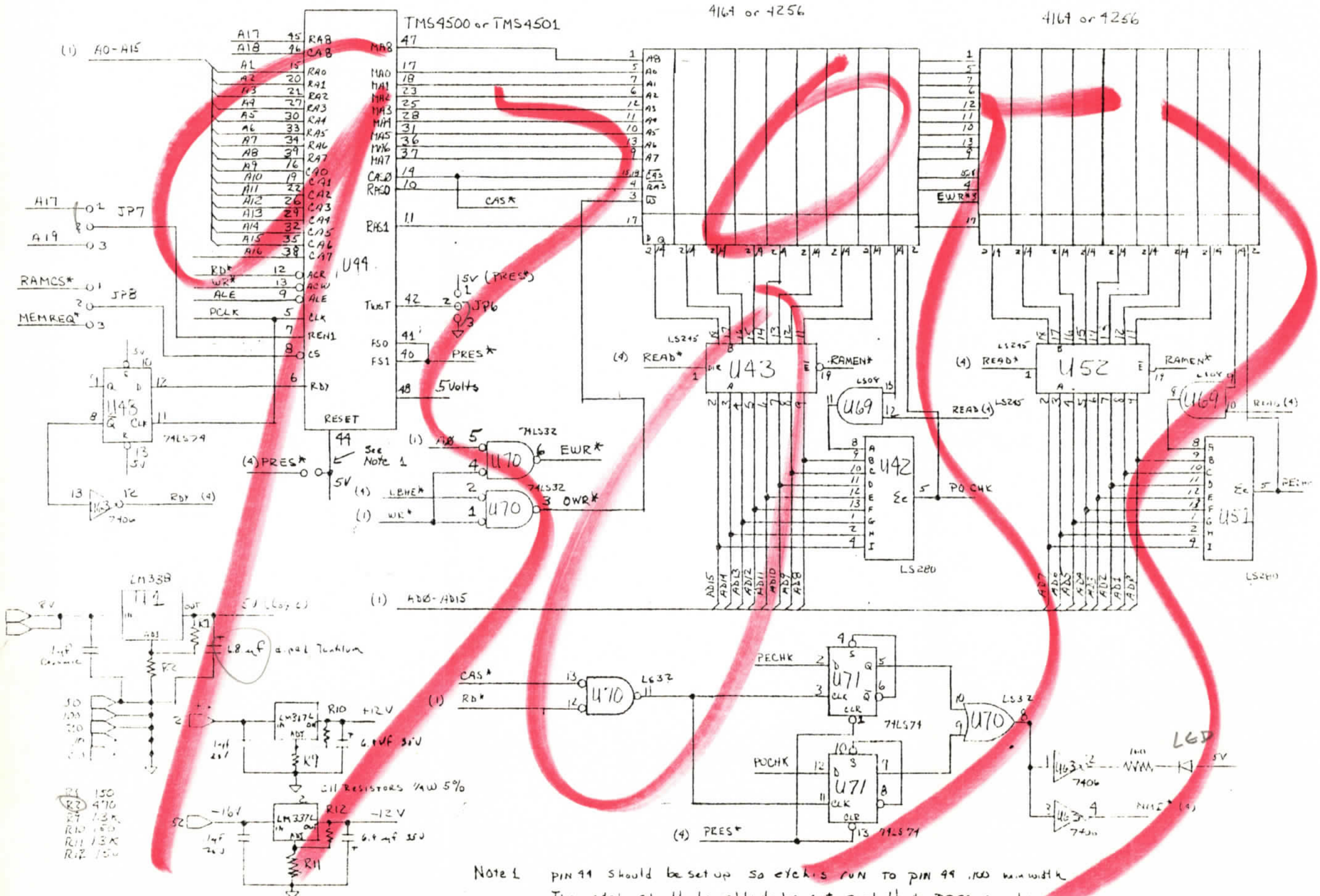
5.18 WRITE

W ADDRESS, Drive, Beginning Record #, # of Records

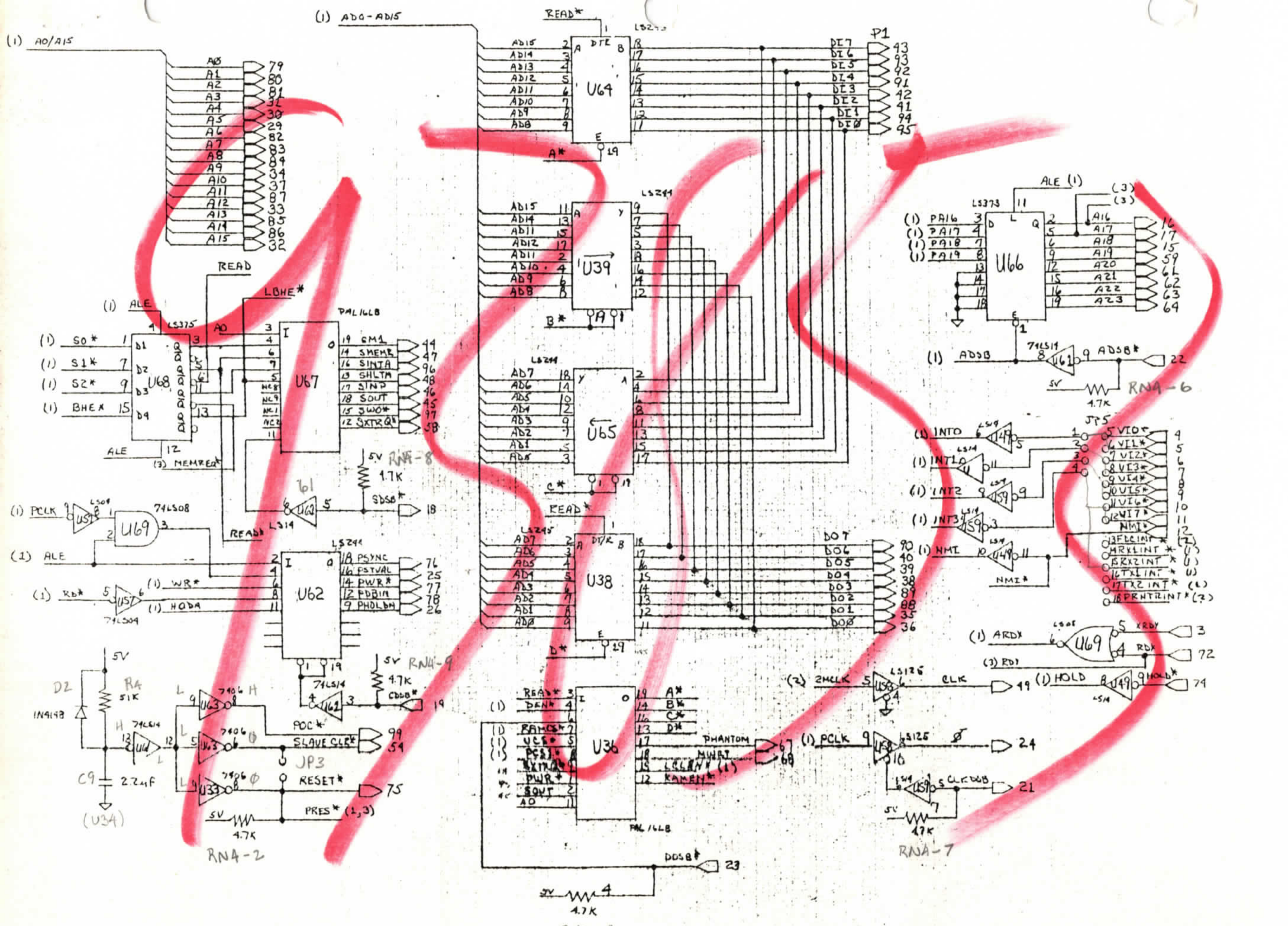
The specified number of sectors are written to the specified disk. First byte transferred is at address. See the drive designators under the LOAD command.

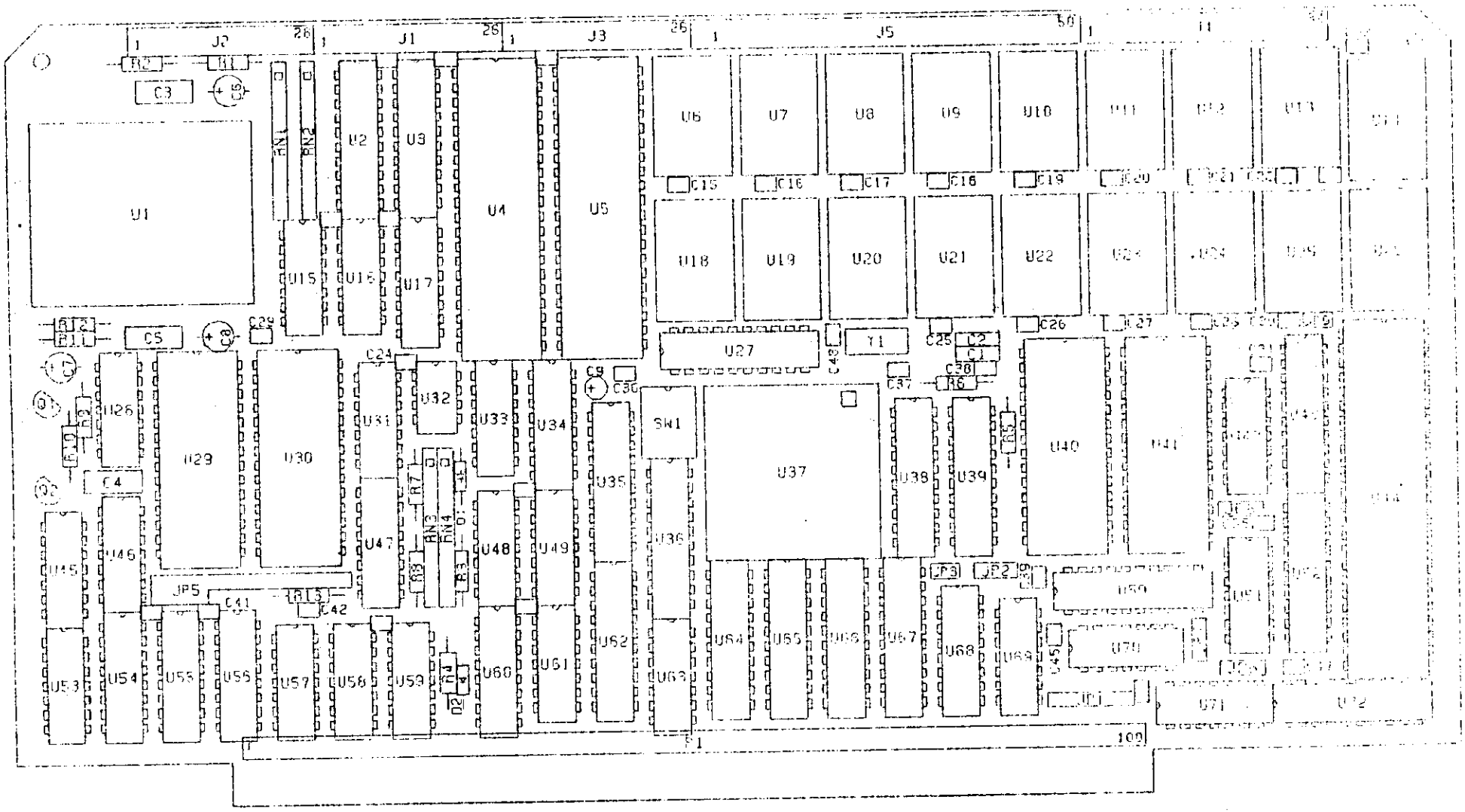

U37
80186
16MHZ
20pF
20pF
U50
U72
U27
U41
U40
U30
8251A
U29
8251A
U31
U28
U46
7406
U61
U99
LS373
LS373
LS245
2732
2764
27128
27256
ALE
ADO-15
A0-15 (4)
LD0-7
RD*
UCS*
5V
MARQ0*
MARQ1*
4.7K
RN4-10
RN4-5
DB25 PINS
(REFERENCE ONLY)
1488 12V PIN 14
GND PIN 7
-12V PIN 1
T-18 Schematics
PAGE 1 REV


8255A
U5
8272A
U4
J3
J4
J5
J3 pins 10,12,14,16,18,20,22 24,26 = GND
J4,J5 odd pins GND
JP2



Note 1 PIN 44 should be set up so etch is run to pin 44 .100 min width
The etch should be able to be cut such that PRES can be connected to pin 44 when a jumper is installed and the 5V etch is cut.


U64
U39
U65
U38
U36
U66
U67
U68
U62
U69
P1
JP3
JP5
RNA-2
RNA-4
RNA-6
RNA-7
RNA-8
RNA-9
PHANTOM
RESET*
SLAVE CLR*
POC*
PRES* (1,3)
D2
1N4148
R4
51K
C9
2.2uF
(U34)
PAL16L8
LS373
LS375
LS244
LS245
(1) A0/A15
(1) AD0-AD15
READ*
LBHE*
MEMREQ*
ADSB
ADSB*
SDSB*
CDSB*
DDSB*
CLKDSB


J2
J1
J3
J5
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U15
U16
U17
U18
U19
U20
U21
U22
U27
Y1
U26
U29
U30
U31
U32
U33
U34
U35
SW1
U36
U37
U38
U39
U40
U41
U45
U46
U47
U48
U49
U53
U54
U55
U56
U57
U58
U59
U60
U61
U62
U63
U64
U65
U66
U67
U68
U69
U70
U71
U72
JP5
JP3
JP2
1
100

THUNDER 186
MS-DOS CONFIGURATION INFORMATION (8/08/85)
BIOS REVISION 1.00

The I/O system on this diskette contains only 3 device drivers. They are the CONSOLE, CLOCK, and DISKETTE. The printer driver and auxilliary drivers are linked to the operating system at boot time. The file CONFIG.SYS specifies which additional drivers to link to the system. The following drivers are supplied with the system:

TPARPTR.SYS - Parallel printer driver.

TSERPTR.SYS - drives a serial printer using the second serial port of THUNDER. The information contained with your CCP/M-86 diskettes pertaining to cabling is also valid for MS-DOS.

TAUXSER.SYS - uses the second serial port of THUNDER as the AUX input/output device.

MEMDRV.SYS - implements a 256 Kbyte memory disk emulation which must be located in memory at an absolute address of 80000H. See the appropriate LDP manual for the switch settings for your board. See MEMDRV.ASM for additional comments.

Only persons experienced in assembly language programming and familiar with I/O drivers should attempt to modify any of these drivers. For the experienced person, these drivers and their sources may be used as models for incorporating any number of additional I/O devices. See the PROGRAMMER'S MANUAL for additional information on device drivers.

SYSTEM CONFIGURATION

MS-DOS comes configured for a parallel printer attached to the parallel port of THUNDER and for a serial auxilliary device attached to the second serial port of THUNDER. See the CCP/M configuration sheets for cable pinouts.

STEP RATE CHANGES (8" operating system)

The step rate used in the standard distribution operating system is 8 ms. Most disk drives will work at a faster rate than 8 ms., which will improve system performance. In order to change the step rate, first boot the standard distribution disk and make a copy of it using FRMT followed by DISKCOPY. The following modifications should be made to the copy of the distribution diskette (not the original). The following steps will change the step rate:

1. Reset the computer system and get into the monitor.
2. Put the copy of the distribution diskette in drive A:.
3. Use the following monitor command to load the first two tracks of the diskette into memory:

```
L 500 2 0 10
```

4. Use the following monitor command to change memory location 1D03H to the value for the new step rate:

```
E 1D03 XX (WHERE XX IS A NEW VALUE FROM THE
          TABLE BELOW)
```

FF	1MS STEP RATE
EF	2MS STEP RATE
DF	3MS STEP RATE
CF	4MS STEP RATE *
BF	5MS STEP RATE
AF	6MS STEP RATE
9F	7MS STEP RATE
8F	8MS STEP RATE **

* Recommended for most double-sided drives.
** Value as shipped for single-sided drives.

5. Use the following monitor command to write the changed value back to the diskette:

```
W 500 2 0 10
```

6. The diskette is now ready to boot.

USE OF A SLOW STEP RATE WITH DRIVES DESIGNED FOR FASTER RATES CAN INCREASE THE FREQUENCY OF DISK ERRORS. CHANGE YOUR BOOT DISK (NOT THE ORIGINAL) TO A STEP RATE APPROPRIATE FOR YOUR DRIVES.

DRIVES SUPPORTED

The Revision 1.00 I/O system will support up to four disk drives. They are defined as follows:

A: - 8" Single sided single density, single sided double density or double sided double density.
B: - SAME AS A:
C: - 5 1/4" disk drive supports all four IBM-PC PC-DOS formats
D: - SAME AS C:

FORMATTING 8" DISKETTES

Formatting 8" diskettes is a two step process. First, new diskettes must be formatted with the program FRMT. This process does the actual formatting of the diskette. After using FRMT to format as many diskettes as desired, the program GFORMAT (FORMAT in the MS-DOS USER'S MANUAL) must be used to initialize the directory. After the directory has been initialized, the diskette may be used. If you are going to use DISKCOPY to duplicate a diskette, you may skip using GFORMAT as DISKCOPY creates an exact copy of the original.

FORMATTING 5 1/4" DISKETTES

Formatting 5 1/4" diskettes is accomplished with FORMAT and requires only one step. FORMAT functions as described in the MS-DOS USER'S MANUAL. The following switches may be used:

/2 Format the specified diskette as double sided
/F Skip the verify after format step
/C Clear the directory only, do not format. Unless /F is specified also the verify step is still done.
/S Transfer system files to the new diskette after formatting.
/V Put a volume name on the new diskette. The user is prompted for the name at the appropriate time.

DO NOT USE FORMAT on 8" diskettes or FRMT on 5 1/4" diskettes.

To create backup copies of your distribution diskettes use DISKCOPY after formating your diskettes with FORMAT.

HARD DISK SYSTEMS

There are two files on the distribution diskette which are associated with hard drive support. They are THDRV.ASM and TWFRMT.ASM. TWFRMT.ASM is the source code for the winchester drive formatter and THDRV.ASM is the source code for the device driver. These files have been used to generate several .SYS files. Each file THDRVXX.SYS has been generated for a particular drive, where XX is a suffix attached to identify the type of drive. The following is a list of the suffix for each type of supported drive:

A1 - Driver for the first 20 Mbytes of a 40 Mbyte drive (QUANTUM models Q540 or Q2040).
A2 - Driver for the second 20 Mbytes of a 40 Mbyte drive (QUANTUM models Q540 or Q2040).
B - I/O driver for a QUANTUM Q520 or Q2020
C - I/O driver for a SHUGART model SA712
D - I/O driver for a SHUGART model SA1004
E - I/O driver for a QUANTUM model Q2010

The files TWFRMTX.COM are preconfigured formatters and the suffix corresponds to the suffixes above except that it is not necessary to format the first and second halves of the 40 Mbyte drive separately and, therefore, the formatter for the 40 Mbyte drive is TWFRMTA.COM. (TWFRMT must be followed by GFORMAT)

The I/O driver is installed in the system by listing it in the CONFIG.SYS file as described previously. The following is an example which includes the driver for a SA712 attached to the system:

CONFIG.SYS

```
BUFFERS = 10
FILES = 10
BREAK = ON
DEVICE = TSERPTR.SYS
DEVICE = TAUXPAR.SYS
DEVICE = THDRVC.SYS
```

NOTE:
IO1.SYS is an I/O system configured to use the battery protected clock calendar of the HAZITALL for the system time of day function. You may create a boot diskette with this I/O system as follows:

1. Duplicate your original diskette with DISKCOPY. (original diskette in A: and blank diskette in B:)
2. After duplication erase IO.SYS on drive B:

```
DEL B:IO.SYS
```

3. Copy the new I/O system to B:

4. The diskette in B: when booted will use the HAZITALL clock calendar.

1.0 INTRODUCTION

Congratulations on the purchase of one of the most advanced 8/16 bus CPU boards available today. LOMAS DATA PRODUCTS has tested your board thoroughly and is confident that it will serve well for many years. The following sections have been prepared to help the user get their THUNDER 186 up and running quickly. Sections have been prepared for the following topics:

Cabling for THUNDER
Setting up your terminal
Setting THUNDERS baud rate
Jumpering your disk drives
Booting the operating system
Formatting new diskettes
Creating backup boot diskettes
Changing between virtual terminals
User configurable options

1.1 ADDITIONAL DOCUMENTATION

CONCURRENT CP/M-86 is provided along with the CONCURRENT USERS MANUAL. The CONCURRENT PROGRAMMERS REFERENCE MANUAL is available at a price of $40.00. This manual is necessary only if you intend to write assembly language programs under CCP/M or if you wish to make modifications to the CCP/M XIOS.

2.0 CABLING FOR THUNDER

There are five connectors along the top of THUNDER. The function of these five connectors are as follows:

J1	Console (Main terminal port)
J2	Serial printer port
J3	Parallel printer port
J4	5 1/4" Floppy disk drive connector
J5	8" Floppy disk drive connector

The connectors are not in sequence. They are in the following order from left to right: J2, J1, J3, J5, J4. LOMAS DATA PRODUCTS offers cables to connect the board connectors to the rear panel of an enclosure or to disk drives as required. The following is a list of cables and their LDP part numbers:

J1/J2 to rear panel	033-00020-01
J3 to rear panel	033-00026-01

J4 (5 1/4" floppy) to drive(1)	033-00034-01
J4 (5 1/4" floppy) to drive(2)	033-00034-02
J5 (8" floppy) to drive(1)	033-00050-01
J5 (8" floppy) to drive(2)	033-00050-02

Call for pricing information.

2.1 EXTERNAL CABLING

The cable from the rear panel to the terminal should connect the following pins in a direct one to one configuration: 1, 2, 3, 4, 6, 7, 20.

The serial printer cable (connected to J2 of THUNDER) requires TxData, pin 3, printer ready, to pin 20 and 4, and pins 1 and 7 for ground.

The parallel printer cable uses the same pinout as the IBM-PC, purchasing an IBM-PC cable for your parallel printer will make the correct connections.

3.0 SETTING THUNDERS BAUD RATE

THUNDER may be set to the following baud rates:

BAUD RATE	SW1	SW2
9600	ON	ON
1200	OFF	ON
300	ON	OFF
110	OFF	OFF

Thunder is set at 9600 baud as shipped.

4.0 DISK DRIVE JUMPERING

Disk drives have option jumpering to configure them for specific controllers and applications. The following table lists the drives and recommended jumper configurations for THUNDER.
(also see the section on user configurable options for setting step rates.)

DRIVE JUMPERING FOR THUNDER 186

QUME DATA TRACK 8:

On Qume Data Track 8 drives, the mini jumpers should be installed and removed as shown below, and the DIP shunt should be altered

as specified.

Installed (C, 2S, DL, DSx) Removed (T40, GMD, DS, D, DC, Y, HA)

Shunt: Cut HL and X, all others intact. Terminator resistors should be installed on the last drive of the cable.

SHUGART 800/801:

On a Shugart 800/801 drive, the following mini jumpers should be installed and removed on all drives:

Installed (T2, A, B, C, Z, 800) Removed (D, DC, X, Y, HL, DS)

Drive select (DSx) should be installed appropriately and the terminators T1, and T3-T6 should be installed on the last drive of the cable.

SHUGART 850/851:

On a Shugart 850/851 drive, the mini jumpers should be installed and removed as shown below and the DIP shunt should be altered as required.

Installed (C, 2S, S2, IW, RS, DL, IT, AF, M 850)

Removed (FS, TS, Y, DS, HLL, HI, D, DC, NF)

Shunt: Cut Hl and X, all others intact. Terminator resistors should be installed on the last drive of the cable.

SIEMENS MODEL FDD 100-8:

On Siemens Model D drives, the mini jumpers should be installed and removed as shown.

Installed (SS, SE, E, D, RR, O, 2, F, RI, L, U, H)

Removed (HS, 8, 16, 32, 1 TE, A, V, B, J, K, M, G)

The following modifications to the PC board are required for using two or more drives:

1. Remove the PC board and cut the trace leading to IC 6C Pin 9.
2. Connect IC 6C Pin 9 to IC 6C pin 12 and reinstall the PC

board.

MITSUBISHI

On Mitsubishi drives the following jumpering should be used:

Install (E, Z, 2S, I, R, S2, IW, C, WP)

Remove any other shunts.

Cut PJ4, PJ5.

SHUGART SA455/465

Jumpers MM and DS along with the appropriate device select, DS1, DS2, DS3, or DS4, should be installed.

TANDON TM100-2

The only shunt that should be installed is the appropriate device select shunt. Remove all terminators except the last drive.

On systems with both 8" and 5 1/4" drives, only one of the 8" drives should have the terminators installed. There should not be a terminator in the 5 1/4" drive also.

5.0 BOOTING THE OPERATING SYSTEM

THUNDER may boot either 5 1/4" diskettes or 8" diskettes. The type of diskette THUNDER expects to boot is determined by the position of switch 4. With Switch 4 in the on position THUNDER expects to boot from 8" disk drives, with switch 4 off THUNDER expects to boot from 5 1/4" disk drives. Switch 3 determines whether THUNDER will automatically boot after its initial diagnostics or whether it will enter the onboard monitor program. With switch 3 on it will automatically attempt to boot after diagnostics and with it off THUNDER will enter the monitor. Once in the monitor you may boot with the 'B' command.

6.0 FORMATTING NEW DISKETTES

6.1 8" FORMAT UTILITY

A utility to format uninitialized diskettes is included with the system, FORMAT. FORMAT will allow formatting any of the three