KAYPRO®

Technical Manual

KAYPRO TECHNICAL MANUAL

SEPTEMBER 1985

Part Number 1484-F

The information contained in this publication is for general reference and is intended for hardware and program designers, programmers, engineers and those who need to understand the design and operation of Kaypro products.

Kaypro Corporation provides this manual on an "as is" basis and without warranty, either express or implied, of any kind, including, but not limited to, merchantability and/or fitness for a particular purpose. The user should be aware that Kaypro may, at any time and without notice, make improvements, modifications and/or changes in any or all products, programs and/or systems referenced in this manual.

The user should also be alert to the fact that this manual might possibly include technical inaccuracies or typographical errors. Additionally, this manual may not contain updated information reflecting improvements, modifications and/or changes in Kaypro products. Changes to the information contained in this manual may also occur from time to time. User discretion is advised.

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

1.Ø INTRODUCTION

1.1 PURPOSE OF TECHNICAL MANUAL

This publication is intended to be a technical reference guide to be used by trained repair technicians. It will attempt to cover all dealer-serviceable sections of Kaypro computers. This manual replaces previous manuals on the subject.

The procedures and information contained in this manual assume technical expertise on the part of the reader. To avoid personal injury, do not perform any servicing unless you are a qualified service technician.

It is our desire to provide dealers with the information and support needed to expedite repairs and provide the users with the service they deserve. We encourage your comments and suggestions regarding this manual.

1.2 SCOPE OF TECHNICAL MANUAL

The information and procedures covered by this manual assume some technical knowledge on the part of the reader.

The policy of Kaypro Corporation is to repair computers to the modular level only. Even Kaypro's repair technicians do not repair switching power supplies, CRT assemblies, or disk drives. Repairs to modular components not manufactured by Kaypro Corporation (power supplies, CRT assemblies, disk drives) are NOT covered by this manual.

However, we do not discourage dealers and technicians who have the knowledge and the tools to repair to the component level from doing so, on out-of-warranty Kaypro computers.

The adjustment and removal/replacement information in this manual is organized by module type, with the exception of removal/replacement information for the KAYPRO ROBIE, which is placed in a separate section due to the differences in chassis design and hardware module placement in that machine.

1.3 SERVICE WARNING

Proper precautions must be observed to assure that components are not damaged when a unit is serviced or adapters are added to or removed from the I/O channels.

The preferred method is to have a grounding strap attached to the wrist with the drain lead connected to a common earth ground, and to have the unit positioned on a conductive grounded mat. With the above precautions observed, and the power switched off, one may insert or remove components or adapters.

If one has built up a charge, this may be felt when first contacting the aforementioned surfaces.

Failure to observe these precautions may damage the unit in such a manner as to render it unserviceable or unreliable.

2.Ø FCC INFORMATION

As Kaypro keeps in step with computer technology, the models have changes which affect FCC ratings. The proper rating is affixed to the back of each computer. Contact the Kaypro Engineering Department if you need further information.

3.Ø MODEL SPECIFICATIONS

3.1 KAYPRO 2 SPECIFICATIONS

CPU	Z-8Ø, 2.5 MHz
RAM	64K bytes
MAINBOARD	81-11Ø-n or 81-24Ø-n series.
DISK STORAGE	Two 5-1/4 inch, double-density, single-sided, floppy disk drives, providing 191K bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 8Ø column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, one RS-232C serial port.

3.2 KAYPRO 2/84 and 2X SPECIFICATIONS

CPU	Z8Ø-A, 4.Ø MHz
RAM	64K bytes
MAINBOARD	81-294-n series.
DISK STORAGE (Kaypro 2/84)	Two 5-1/4 inch double-density, single-sided, floppy disk drives, providing 191K bytes of storage per diskette.
DISK STORAGE (Kaypro 2X)	Two 5-1/4 inch double-density, double-sided, floppy disk drives, providing 39ØK bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 8Ø column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports.

3.3 KAYPRO 4 SPECIFICATIONS

CPU	Z-80, 2.5 MHz
RAM	64K bytes
MAINBOARD	81-240-n series.
DISK STORAGE	Two 5-1/4 inch double-density, double-sided, floppy disk drives, providing 390K bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 80 column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, one RS-232C serial port.

3.4 KAYPRO 4/84 SPECIFICATIONS

CPU	Z-80A, 4.0 MHz
RAM	64K bytes
MAINBOARD	81-184-n series.
DISK STORAGE	Two double-density, double-sided, floppy disk drives, providing 390K bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch green phosphor screen with a 25 row x 80 column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports, one RJ11C modular telephone jack.
MODEM	Built-in, 300-baud modem, with Bell System 103 compatibility. Uses Texas Instruments TMS99531/TMS99532.
REAL-TIME CLOCK	Built-in real-time clock. Uses National MM58167.

3.5 KAYPRO 4X SPECIFICATIONS

CPU	Z-8ØA, 4.Ø MHz
RAM	64K bytes
MAINBOARD	81-296-n series.
DISK STORAGE	Two 5-1/4 inch, high-density, double-sided, floppy disk drives providing 2.6M bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 8Ø column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports, one RJ11C modular telephone jack.
MODEM	Built-in, 3ØØ-baud modem, with Bell System 1Ø3 compatibility. Uses Texas Instruments TMS99531/TMS99532.
REAL-TIME CLOCK	Built-in real-time clock. Uses National MM58167.

3.6 KAYPRO 10 SPECIFICATIONS

CPU	Z80A, 4.0 MHz
RAM	64K bytes
MAINBOARD	81-180-n series.
DISK STORAGE	One 5-1/4 inch double-density, double-sided, floppy disk drive providing 390K bytes of storage per diskette. One hard disk drive providing 10M bytes of storage.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 80 column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports.

3.61 KAYPRO 10 with CLOCK and MODEM SPECIFICATIONS

CPU	Z80A, 4.0 MHz
RAM	64K bytes
MAINBOARD	81-583-n series.
DISK STORAGE	One 5-1/4 inch double-density, double-sided, floppy disk drive providing 390K bytes of storage per diskette. One hard disk drive providing 10M bytes of storage.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 80 column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports.
MODEM	Built-in, 300 baud modem, with Bell System 103 compatibility. Uses Texas Instruments TMS99531/TMS99532.
REAL-TIME CLOCK	Built-in real-time clock. Uses National MM58167.

3.7 KAYPRO ROBIE SPECIFICATIONS

CPU	Z8ØA, 4.Ø MHz
RAM	64K bytes
MAINBOARD	81-296-n series.
DISK STORAGE	Two 5-1/4 inch, high-density, double-sided, floppy disk drives providing 2.6M bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 8Ø column display.
I/O CONNECTIONS	One "Centronics"type parallel port, two RS232C serial ports, one RJ11C modular telephone jack.
MODEM	Built-in, 3ØØ-baud modem, with Bell System 1Ø3 compatibility. Uses Texas Instruments TMS99531/TMS99532.
REAL-TIME CLOCK	Built-in real-time clock. Uses National MM58167.

3.71 KAYPRO 12X SPECIFICATIONS

CPU	Z8ØA, 4.Ø MHz
RAM	64K bytes
MAINBOARD	81-471-n series.
DISK STORAGE	One 5-1/4 inch high-density, double-sided, floppy disk drive providing 2.6M bytes of storage per diskette. One hard disk drive providing 1ØM bytes of storage.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 8Ø column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports.
MODEM	Built-in, 3ØØ baud modem, with Bell System 1Ø3 compatibility. Uses Texas Instruments TMS99531/TMS99532.
REAL-TIME CLOCK	Built-in real-time clock. Uses National MM58167.

3.8 KAYPRO NEW 2 SPECIFICATIONS

CPU	Z-8ØA, 4.Ø MHz
RAM	64K bytes
MAINBOARD	81-294-n series.
DISK STORAGE	One 5-1/4 inch double-density, double-sided, floppy disk drive, providing 39ØK bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 8Ø column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports.

3.9 KAYPRO 1 SPECIFICATIONS

CPU	Z8ØA, 4.Ø MHz
RAM	64K bytes
MAINBOARD	81-8Ø9-n series.
DISK STORAGE	Two 5-1/4 inch double-density, double-sided, floppy disk drive providing 39ØK bytes of storage per diskette.
KEYBOARD	Detachable, 72 key typewriter style keyboard with 18 programmable keys.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 8Ø column display.
I/O CONNECTIONS	One "Centronics"-type parallel port, two RS-232C serial ports.

4.Ø KAYPRO ROM REVISION—CP/M VERSION COMPATIBILITY

MODEL NAME	CP/M VERSION	MAINBOARD	ROM REVISION
2/83	2.2f	81-11Ø	81-149-C
4/83	2.2f	81-24Ø	81-232-A
4/83 + 88	2.2f	81-24Ø	81-232-A
2/84	2.2g	81-294	81-292-A
4/84	2.2g	81-184	81-292-A
4/84 + 88	2.2g	81-184	81-292-A
2X	2.2g 2.2h	81-294	81-292-A
4X	2.2g 2.2h	81-297	81-326-E
ROBIE	~~2.2g~~ 2.2ul ~~2.2h~~	81-296	81-478-A
1Ø	2.2g 2.2h	81-18Ø	81-3Ø2-C
2X W/MODEM and CLOCK	2.2ul	81-58Ø	81-478-A
1Ø W/MODEM and CLOCK	2.2ul	81-582	81-478-A
NEW 2	2.2ul	81-294	81-478-A
1	2.2ul	81-294	81-478-A

5.Ø CHASSIS

5.1 CHASSIS HOOD REMOVAL (EXCEPT KAYPRO ROBIE)

1. Turn off the machine.
2. Disconnect AC power by unplugging the power cord from wall outlet.
3. Remove the ten screws from the chassis hood; there are two on top and four on each side.
4. Remove the hood from the chassis.

CHASSIS HOOD REPLACEMENT

1. Lower the hood onto the unit.
2. Align the two holes on top of the hood with those on top of the chassis.
3. Insert the two flat-head screws into the holes on the top of the chassis and start them, but do not tighten them yet.
4. Insert the eight round-head screws, four on each side, and start them.
5. Tighten each screw securely.

5.2 TOUCH-UP INFORMATION

Kaypro Corporation has small amounts of touch-up paint for Kaypro hoods and chassis available to the dealers. Contact the Hardware Technical Support personnel to obtain this paint.

Occasionally a customer's computer will have scratches on the hood or chassis. A small amount of rubbing compound, when carefully applied, will often smooth out very small scratches on a hood or chassis. Should painting be necessary, there are two sizes of sable paintbrushes to have on hand: size ØØ and size ØØØ. These brushes are available at any art supply store.

6.Ø MAINBOARDS

The following sections contain schematics, chip layout diagrams, and IC lists (by U-number) for Kaypro mainboards. This is not intended to be a theory of operation, but rather an aid in locating possible problems on a mainboard.

Consult an appropriate databook (TTL, Zilog, etc.) if you need to find out the internal workings of a particular IC.

MAINBOARD TROUBLESHOOTING TIPS:

A blank EPROM can be used to help troubleshoot Kaypro mainboards of series 81-11Ø, 81-24Ø, and 81-18Ø. The appropriate model of EPROM (2732, 2716, etc) allows a quick check of the board. It will usually force the data and address lines to toggle at approximately the same amplitude, allowing the technician to use a scope to spot affected lines.

If the video display does not show a screen filled with alternating "9"'s and apostrophes, you have a problem in the video RAM or associated circuitry.

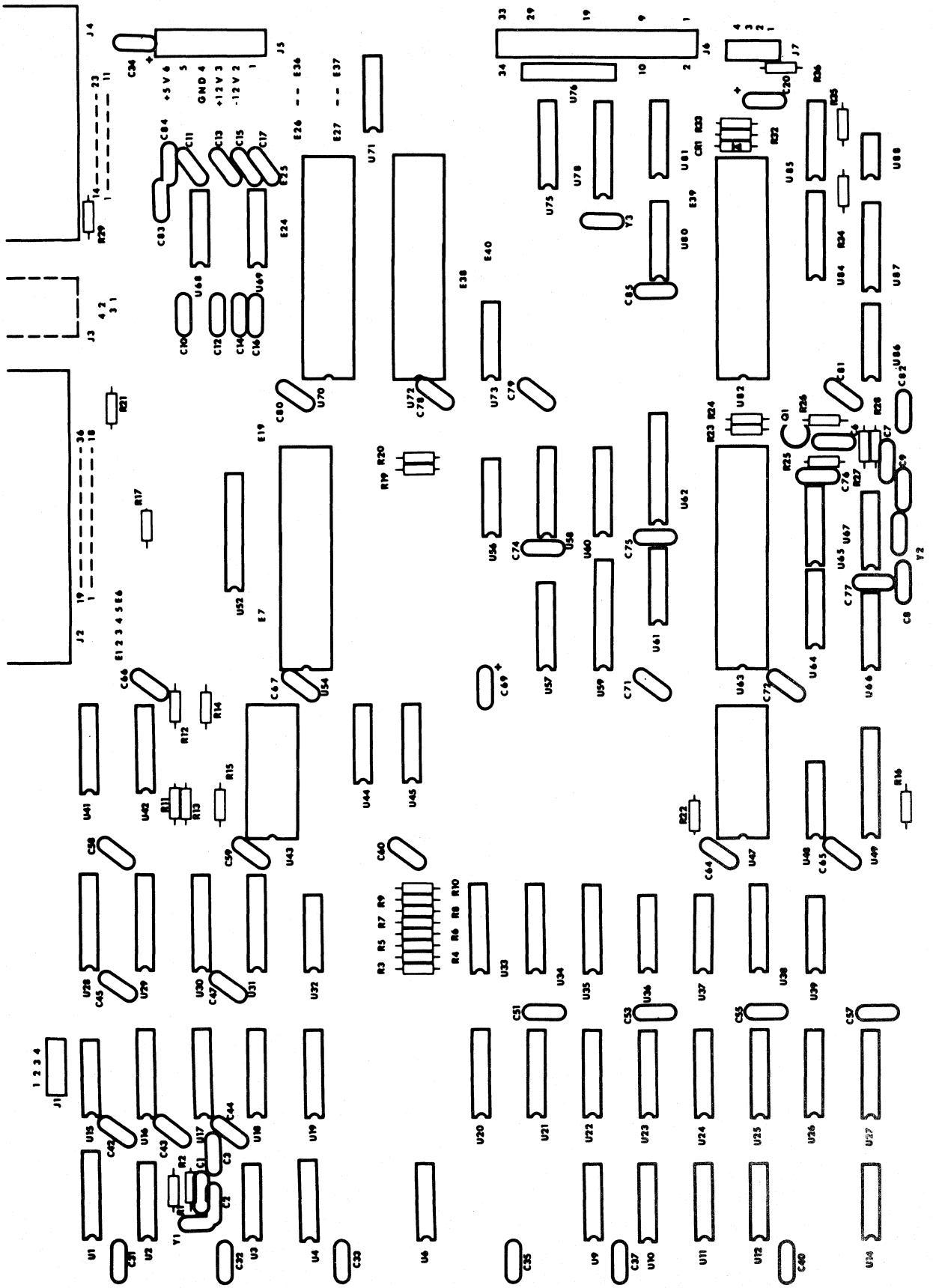
You can check the main RAM and associated circuitry quickly with a scope by looking at pin 14 on each of the RAM chips. The following pattern should be observed:

For the 81-24Ø board:

U2Ø (D7)	low
U21 (D6)	low
U22 (D5)	toggle
U23 (D4)	toggle
U24 (D3)	toggle
U25 (D2)	low
U26 (D1)	low
U27 (DØ)	toggle

The U-numbers of the main RAM chips will vary depending on which mainboard you have, but the pattern will be the same.

6.1 KAYPRO 2 (81-110-n)



IC LIST, KAYPRO 2 (81-110-n)

Reference Designation		Description
U1	74LS161	4-bit counter
U2,U67*	74HCU04	Hex inverter, CMOS
U3	74LS290	decade counter
U4	74LS10	Tri NAND gates
U6, U11	74LS393	Dual binary counter
U9, U80	74LS08	Quad AND gates
U10, U61	73LS32	Quad OR Gates
U12, U14, U32	74LS74	Dual "D" flip-flop
U15, U39	74LS00	Quad NAND Gates
U16 through U19	74LS157	Quad 2/1 MUX
U20 through U27	MCM6665	(or equivalent) 64K x 1 RAM
U28 through U31	2114	1K x 4 RAM
U33, U34	74157	Quad 2/1 MUX
U35, U38	8216	Quad Bi-directional MUX
U36	74LS20	Dual NAND gates
U37, U56, U85	74LS02	Quad NOR gates
U41	74S151	8/1 MUX
U42	74LS174	Hex "D" flip-flop
U43	81-146	Character generator EPROM
U44, U45, U64, U65	74LS243	Quad bus trans
U47	81-149	Boot EPROM
U48, U73	74LS04	Hex inverter
U49, U52, U62	74LS241	Octal buffer
U54, U72	Z80 PIO	
U57, U58, U60	74LS138	3/8 MUX
U59	74LS373	Octal "D" latch
U63	Z80 CPU	
U66	74164	8-bit shift register
U68	1488	Quad line driver (OUT)
U69	1489	Quad SCHMITT line receiver (IN)
U70	Z80 SIO	
U71	74S04	Hex inverter
U78	8116	Dual programmable baud rate generator
U81	7406	Hex inverter, open collector
U82	FD1793	Floppy disk controller
U84	74LS195	4-bit shift register
U86	74LS293	4-bit binary counter
U87	74LS390	Dual decade counter
U88	FDC9216	Data separator

*NOTE: THERE ARE SOME VERSIONS OF THE 81-110 BOARD ON WHICH U2 AND U67 ARE NOT CMOS IC.S BUT ARE NORMAL TTL ICS. READ THE NUMBER ON THE IC TO BE SURE.

SCOPE SIGNALS TO AID IN TROUBLESHOOTING (81-110-n)

The examples of correct signals shown below do not represent all of the signals on a Kaypro mainboard, since most signals will be simple high-low toggles. A group of video signals (CC0 through CC3) are included as illustrations of the timing relationships between the various video signals. Note that only one of the I/O signals on U57 will be low at any given time.

State of the machine: The door of drive A is open; the machine is waiting to boot.

The signal measurements were made using a Tektronix oscilloscope, model 2213. It has a bandwidth of DC-60 MHz, sensitivity of 2mV/cm, a sweep delay of 0.1 microseconds to 1 second, and a graticule display measuring 8 x 10 cm.

Signal M1 from pin 27 of the CPU (U63) was triggered on. This signal is shown in the top half of each display and was channel 1. Ground for the signals shown on channel 2 was established at first graticule line above the bottom of the display.

Each square of the representation is the equivalent of one square cm on the graticule. The scope was set for 2V/div. for all figures, and was set for .5 micro-secs/div. for all figures EXCEPT figure 6, which was taken using 1 micro-secs/div.

Figure 1: Pin 6 of U63, 2.5MHz clock signal.

Figure 2: Pin 24 of U82, 1MHz clock signal.

Figure 3: Pin 3 of U6, CC0.

Figure 4: Pin 4 of U6, CC1.

Figure 5: Pin 5 of U6, CC2.

Figure 6: Pin 6 of U6, CC3.

FIGURE 1

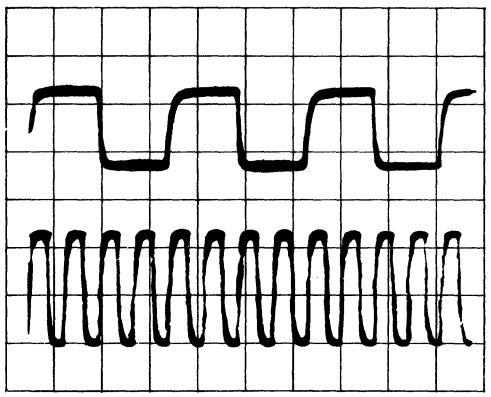


FIGURE 2

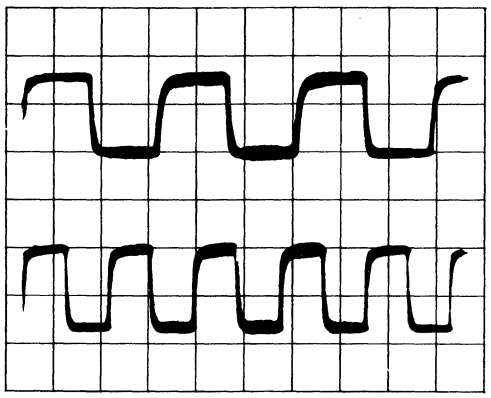


FIGURE 3

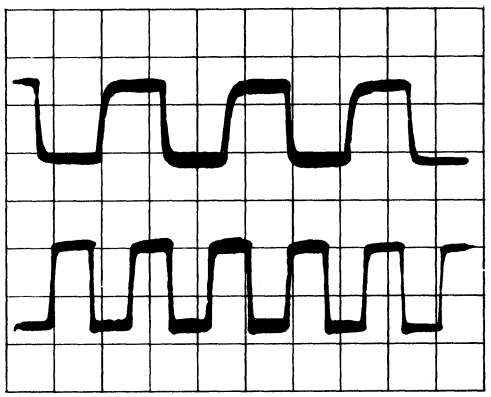


FIGURE 4

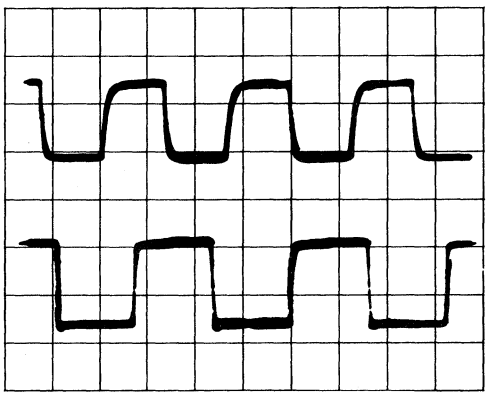


FIGURE 5

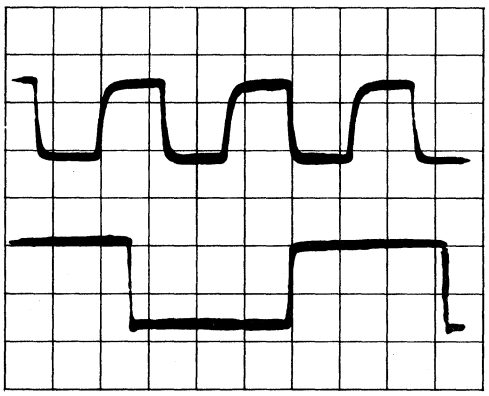
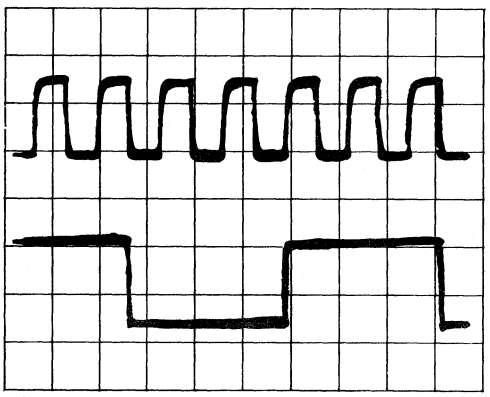
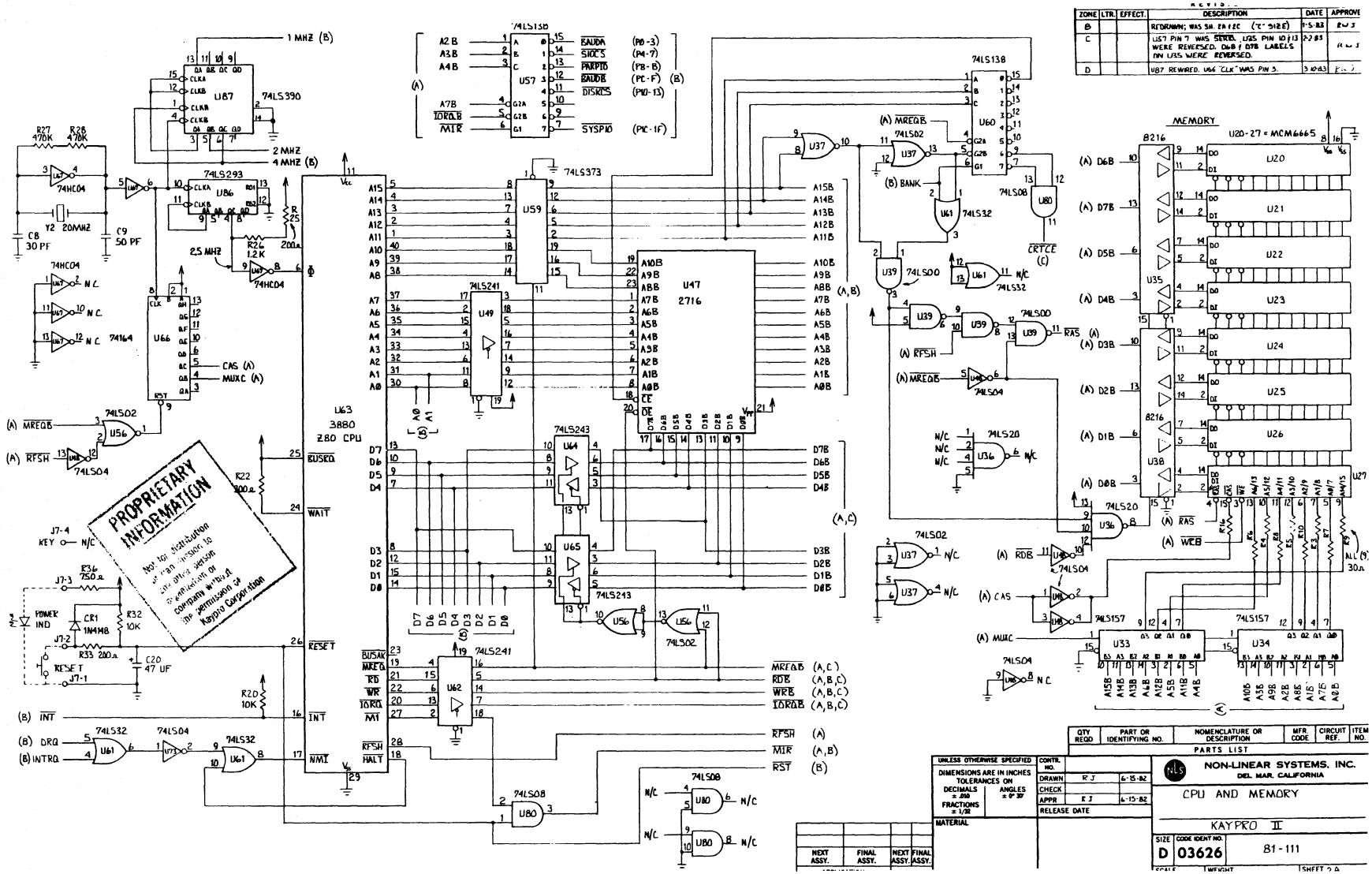


FIGURE 6



SIGNAL LOCATIONS ON MAINBOARD 81-110-n

SIGNAL	IC LOCATION	PIN NO.
CPU SIGNALS		
2.5 MHz	U 63	6
MREQB	U 62	16
RDB	U 62	5
WRB	U 62	14
MEMORY SIGNALS		
RAS	U 39	11
CAS	U 66	5
MUXC	U 66	4
VIDEO CLOCK SIGNALS		
CLOCK, Y1	U 2	8
CC0	U 6	3
CC1	U 6	4
CC2	U 6	5
CC3	U 6	6



ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVE
B			REDRAWN; WAS SH. 8 REV C ("E" SIZE)	1-5-83	RWJ
C			U57 PIN 7 WAS SERIES. U35 PIN 10 & 13 WERE REVERSED. D6B & D7B LABELS ON U35 WERE REVERSED.	2-2-83	RWJ
D			U87 REWIRED. U66 "CLK" WAS PIN 3.	3-10-83	RWJ

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

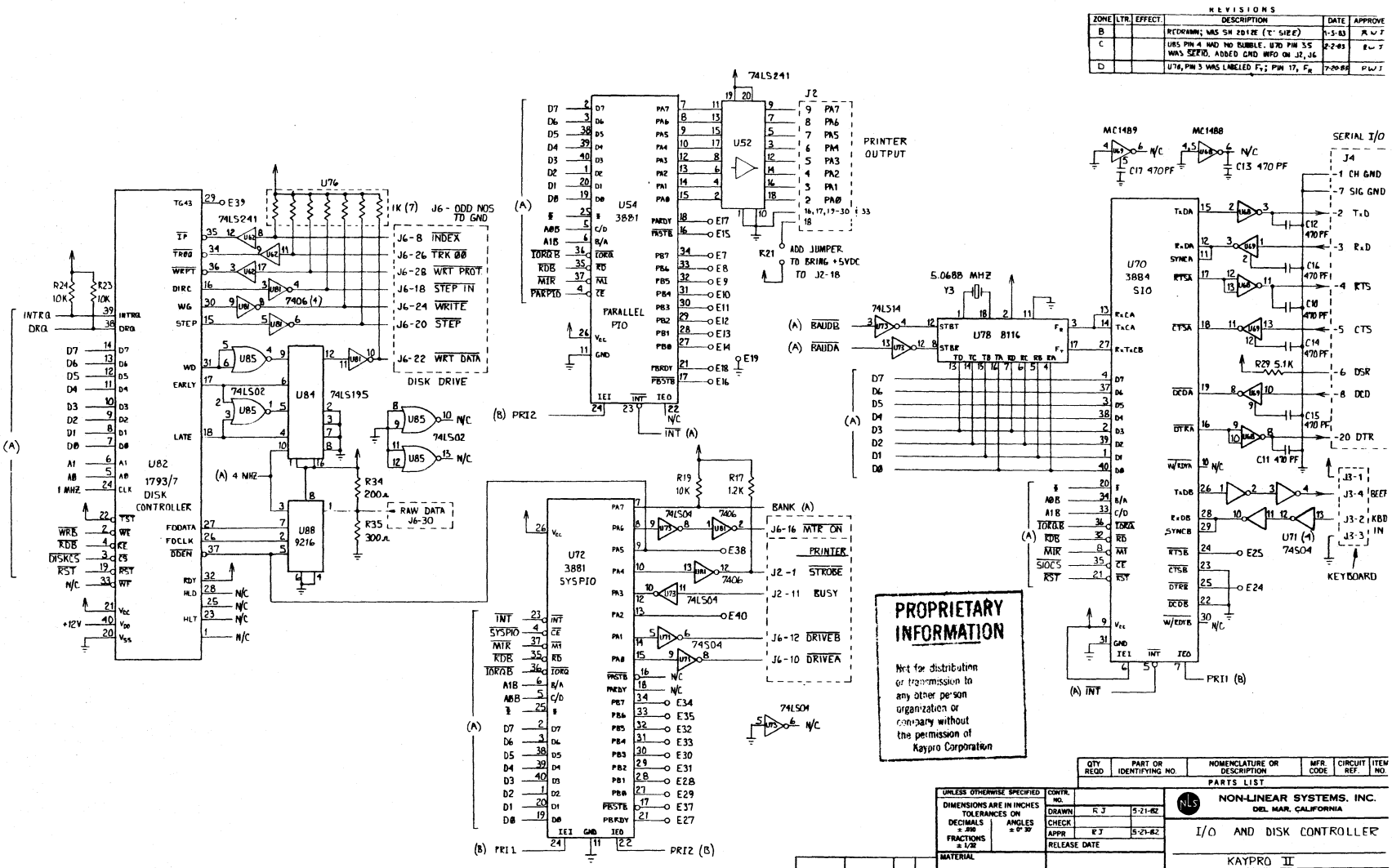
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'

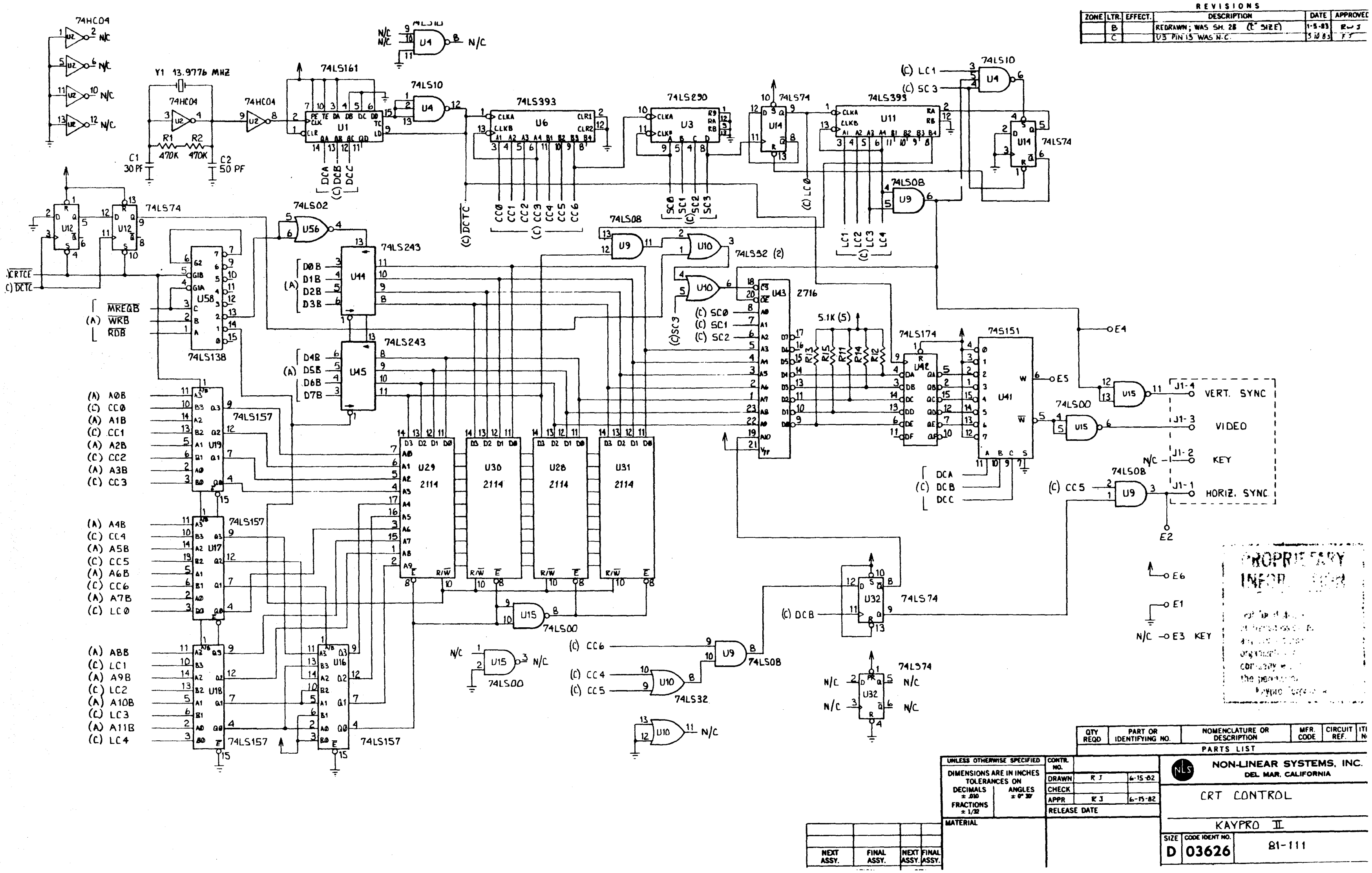
CONTR. NO.		
DRAWN	R J	6-15-82
CHECK		
APPR	R J	6-15-82
RELEASE DATE		

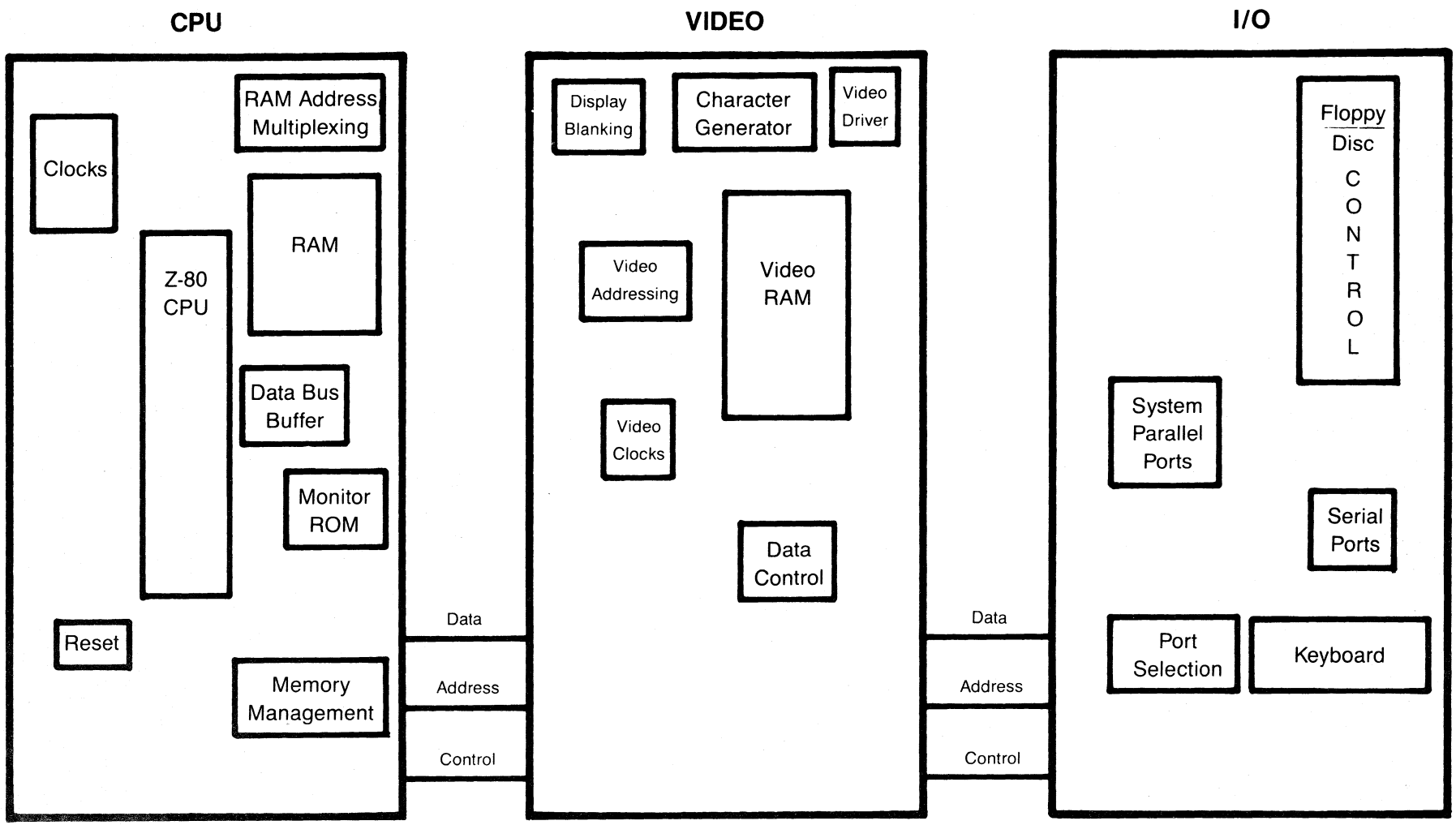
MATERIAL

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.

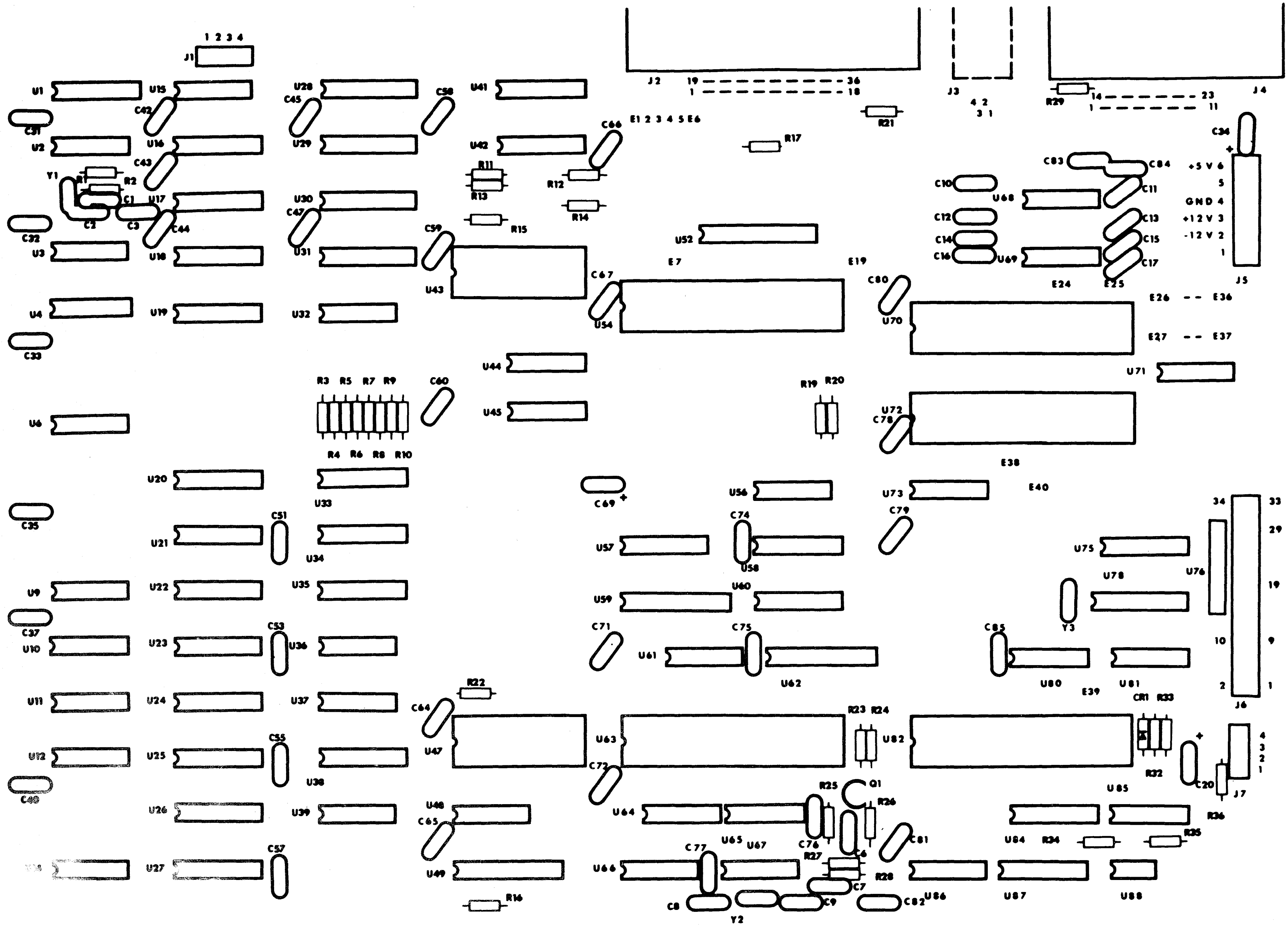
SIZE D | CODE IDENT NO. 03626 | WEIGHT | SHEET 2 A


REVISIONS
ZONE LTR EFFECT DESCRIPTION DATE APPROVE
B REDRAWN; WAS SM 2012E (T: SIZE) 11-5-83 R W J
C U85 PIN 4 WAS NO BUBBLE. U70 PIN 35 WAS SERIO. ADDED GND INFO ON J2, J6 2-2-83 R W J
D U76, PIN 3 WAS LABELED F1; PIN 17, FR 7-20-83 R W J
U82 1793/7 DISK CONTROLLER
U76
74LS241
1K (7)
J6 - ODD NOS TO GND
J6-8 INDEX
J6-26 TRK 00
J6-28 WRT PROT
J6-18 STEP IN
J6-24 WRITE
J6-20 STEP
J6-22 WRT DATA
DISK DRIVE
7406 (4)
U84
74LS195
74LS02
U88 9216
4 MHZ
R34 200Ω
R35 300Ω
RAW DATA J6-30
R24 10K
R23 10K
INTRQ
DRQ
1 MHZ
+12V
U54 3881 PARALLEL PIO
U52
J2
PRINTER OUTPUT
ADD JUMPER TO BRING +5VDC TO J2-18
R21
INT (A)
PRI2 (B)
U72 3881 SYSPIO
R19 10K
R17 1.2K
BANK (A)
J6-16 MTR ON
PRINTER STROBE
J2-1
J2-11 BUSY
J6-12 DRIVEB
J6-10 DRIVEA
74S04
74S06
PRI1 (B)
PRI2 (B)
U78 8116
74LS14
BAUDB
BAUDA
5.0688 MHZ
Y3
U70 3884 SIO
MC1489
MC1488
C17 470PF
C13 470 PF
C12 470 PF
C16 470 PF
C10 470 PF
C14 470 PF
C15 470 PF
C11 470 PF
R29 5.1K
SERIAL I/O
J4
1 CH GND
7 SIG GND
2 TxD
3 RxD
4 RTS
5 CTS
6 DSR
8 DCD
20 DTR
U71 (A) 74S04
J3-1
J3-4 BEEP
J3-2 KBD IN
J3-3
KEYBOARD
PRI1 (B)
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL
CONTR. NO.
DRAWN R J 5-21-82
CHECK
APPR R J 5-21-82
RELEASE DATE
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
I/O AND DISK CONTROLLER
KAYPRO II
SIZE D
CODE IDENT NO. 03626
81-111


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
B | REDRAWN; WAS SH. 28 ("C" SIZE) | 1-5-83
C | U3 PIN 15 WAS N.C. | 5-10-83
74HC04
Y1 13.9776 MHZ
74LS161
74LS10
74LS393
74LS290
74LS74
74LS02
74LS243
74LS138
74LS157
74LS08
74LS32
2716
74LS174
74S151
74LS00
2114
VERT. SYNC
VIDEO
KEY
HORIZ. SYNC
PROPRIETARY INFORMATION
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
CRT CONTROL
KAYPRO II
D 03626
81-111
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ±.010
ANGLES ±0° 30'
FRACTIONS ±1/32
MATERIAL
DRAWN R J 6-15-82
CHECK
APPR R J 6-15-82
RELEASE DATE
NEXT ASSY.
FINAL ASSY.



KAYPRO 2 and 4 BLOCK DIAGRAM



1 2 3 4
J1
U1
U15
U28
U41
J2
19
1
36
18
J3
4 2
3 1
R29
14
1
23
11
J4
C42
C45
C58
E1 2 3 4 5 E6
R21
C31
U2
U16
U29
U42
C66
R17
C34
C43
C83
C84
Y1
R1
R2
R11
R12
+5 V 6
5
C10
C1
U17
U30
R13
C11
GND 4
C2
C3
C44
C47
R14
U68
C32
U3
U18
U31
C59
R15
U52
C12
C13
+12 V 3
C14
C15
-12 V 2
C16
U69
C17
1
U43
E7
E19
E24
E25
J5
U4
U19
U32
C67
C80
E26 - - E36
U54
U70
C33
E27 - - E37
U44
U71
R3 R5 R7 R9
C60
R19 R20
U72
U6
U45
C78
R4 R6 R8 R10
E38
U20
U33
C69
U56
U73
E40
34
33
C35
C51
C74
C79
29
U21
U34
U57
U58
U75
U76
U9
U22
U35
U59
U60
U78
19
C37
C53
C71
C75
C85
Y3
U10
U23
U36
U61
U62
U80
U81
10
9
U11
U24
U37
R22
E39
2
1
C64
R23 R24
CR1 R33
J6
C55
U47
U63
U82
U12
U25
U38
C72
R25
Q1
R32
C20
4
3
2
1
C40
R26
J7
U85
U26
U39
U48
U64
U84
R36
C65
U65
U67
C76
C81
R34
R35
C77
R27
U27
U49
U66
R28
C7
U86
U87
U88
R16
C8
C9
C82
Y2

IC LIST, KAYPRO 2/4 (81-240-n)

Reference Designation		Description
U1	74LS161	4-bit counter
U2,U67	74HCU04	Hex inverter, CMOS
U3	74LS290	Decade counter
U4	74LS10	Tri NAND gates
U6,U11	74LS393	Dual binary counter
U9, U80	74LS08	Quad AND gates
U10, U61	73LS32	Quad OR Gates
U12, U14, U32	74LS74	Dual "D" flip-flop
U15, U39	74LS00	Quad NAND Gates
U16 through U19	74LS157	Quad 2/1 MUX
U20 through U27	MCM6665	(or equivalent) 64K x 1 RAM
U28 through U31	2114	1K x 4 RAM
U33, U34	74157	Quad 2/1 MUX
U35, U38	8216	Quad Bi-directional MUX
U36	74LS20	Dual NAND gates
U37, U56, U85	74LS02	Quad NOR gates
U41	74S151	8/1 MUX
U42	74LS174	Hex "D" flip-flop
U43	81-146-n	Character generator EPROM
U44, U45, U64, U65	74LS243	Quad bus trans
U47	81-232-n	Boot EPROM
U48, U73	74LS04	Hex inverter
U49, U52, U62	74LS241	Octal buffer
U54, U72	Z80 PIO	
U57, U58, U60	74LS138	3/8 MUX
U59	74LS373	Octal "D" latch
U63	Z80 CPU	
U66	74164	8-bit shift register
U68	MC1488	Quad line driver (OUT)
U69	MC1489	Quad SCHMITT line receiver (IN)
U70	Z80 SIO	
U71	74S04	Hex inverter
U78	8116	Dual programmable baud rate generator
U81	7406	Hex inverter, open collector
U82	1793	Floppy disk controller
U84	74LS195	4-bit shift register
U86	74LS293	4-bit binary counter
U87	74LS390	Dual decade counter
U88	FDC9216	Data separator

SCOPE SIGNALS FOR TROUBLESHOOTING 81-240-n

The examples of correct signals shown below do not represent all of the signals on a Kaypro mainboard, since most signals will be simple high-low toggles. A group of video signals (CC0 through CC3) are included as illustrations of the timing relationships between the various video signals. Note that only one of the I/O signals on U57 will be low at any given time.

State of the machine: with a blank, 2732, EPROM inserted in place of normal EPROM at location U 47. The door of drive A is open; the machine is waiting to boot.

The signal measurements were made using a Tektronix oscilloscope, model 2213. It has a bandwidth of DC-60 MHz, sensitivity of 2mV/cm, a sweep delay of 0.1 microseconds to 1 second, and a graticule display measuring 8 x 10 cm.

Signal M1 from pin 27 of the CPU (U63) was triggered on. This signal is shown in the top half of each display and was channel 1. Ground for the signals shown on channel 2 was established at first graticule line above the bottom of the display.

Each square of the representation is the equivalent of one square cm on the graticule. The scope was set for 2V/div. for all figures, and was set for .5 micro-secs/div. for all figures EXCEPT figure 6, which was taken using 1 micro-secs/div.

Figure 1: Pin 6 of U63, 2.5MHz clock signal.

Figure 2: Pin 24 of U82, 1MHz clock signal.

Figure 3: Pin 3 of U6, CC0.

Figure 4: Pin 4 of U6, CC1.

Figure 5: Pin 5 of U6, CC2.

Figure 6: Pin 6 of U6, CC3.

FIGURE 1

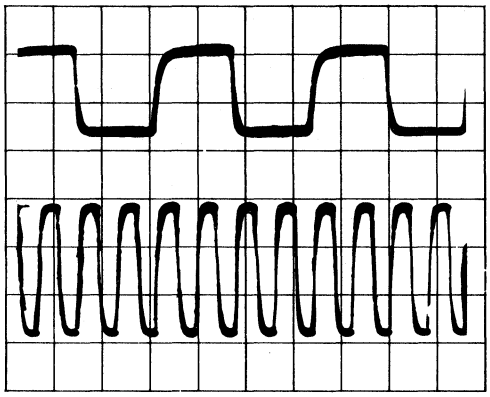


FIGURE 2

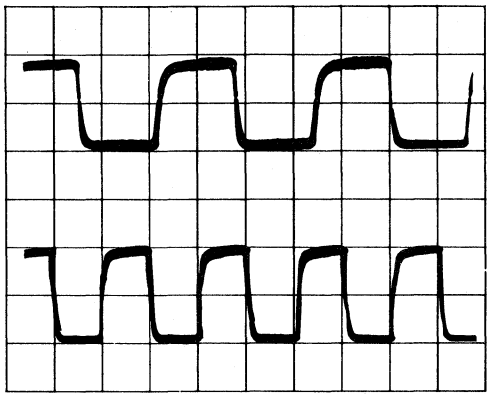


FIGURE 3

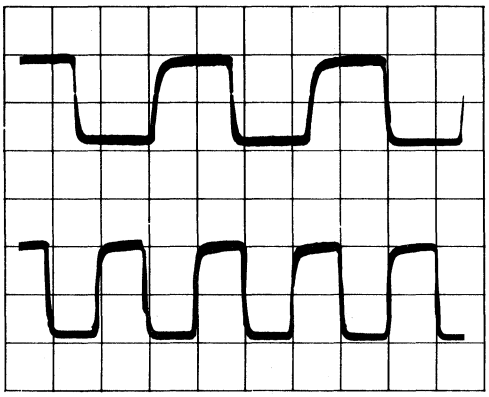


FIGURE 4

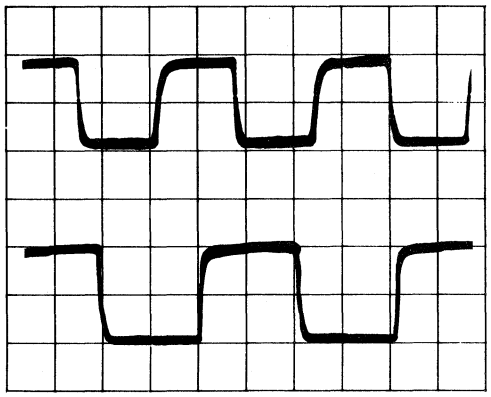


FIGURE 5

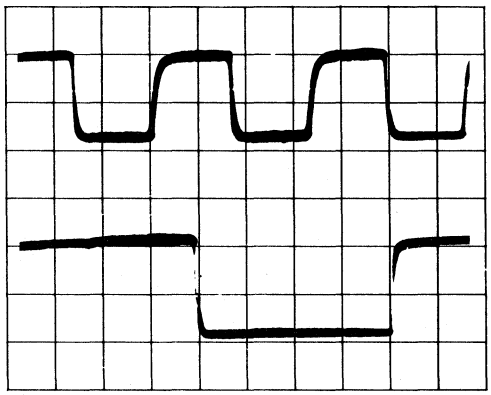
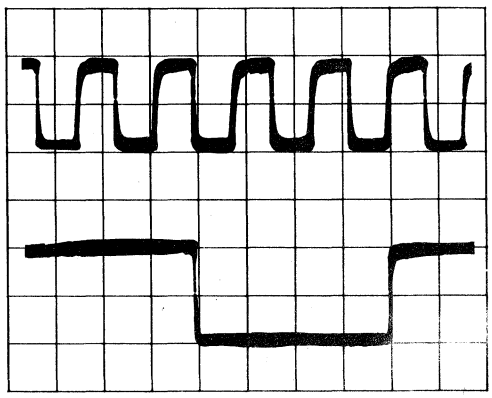


FIGURE 6

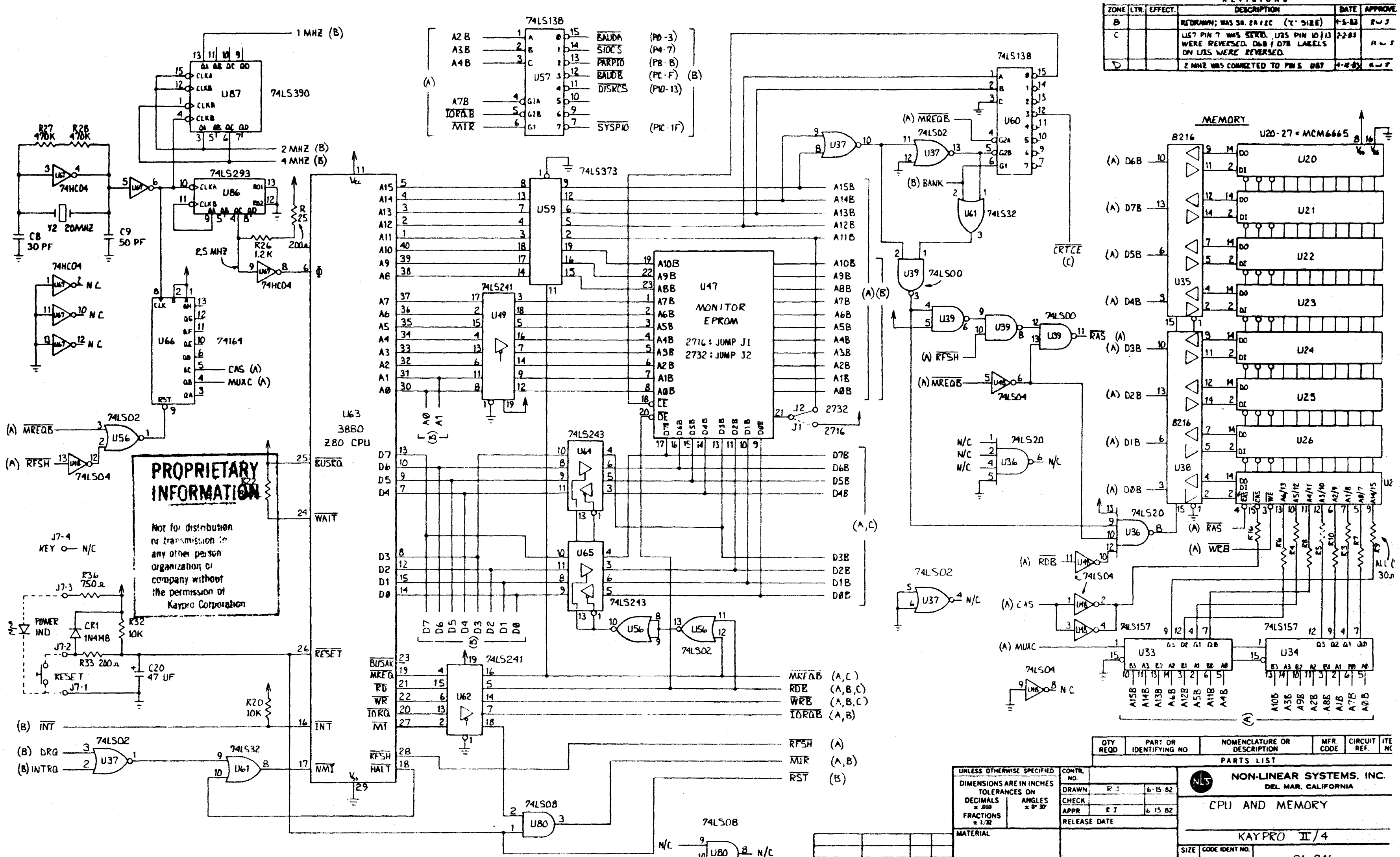


SIGNAL LOCATIONS, 81-240-n

SIGNAL	IC LOCATION	PIN NO.
CPU SIGNALS		
CPU clock	U 67	6
1 MHz	U 87	13
2 MHz	U 87	3
MREQB	U 62	16
RDB	U 62	5
M1R (reference)		
MEMORY SIGNALS		
RAS	U 39	11
CAS	U 66	5
MUXC	U 66	4
VIDEO CLOCK SIGNALS		
CLOCK, Y1	U 2	8
CCØ	U 6	3
CC1	U 6	4
CC2	U 6	5
CC3	U 6	6

REVISIONS

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVE
B			REDRAWN; WAS SH. 2A & 2C ("C" SIZE)	1-5-83	RWJ
C			U57 PIN 7 WAS SERD. U35 PIN 10 & 13 WERE REVERSED. D6B & D7B LABELS ON U35 WERE REVERSED.	2-2-83	RWJ
D			2 MHZ WAS CONNECTED TO PINS U87	4-12-83	RWJ



UNLESS OTHERWISE SPECIFIED	CONTR. NO.	
DIMENSIONS ARE IN INCHES	DRAWN R J	6-15-82
TOLERANCES ON DECIMALS ±.010, ANGLES ± 0° 30', FRACTIONS ± 1/32	CHECK	
	APPR R J	6-15-82
MATERIAL	RELEASE DATE	

QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

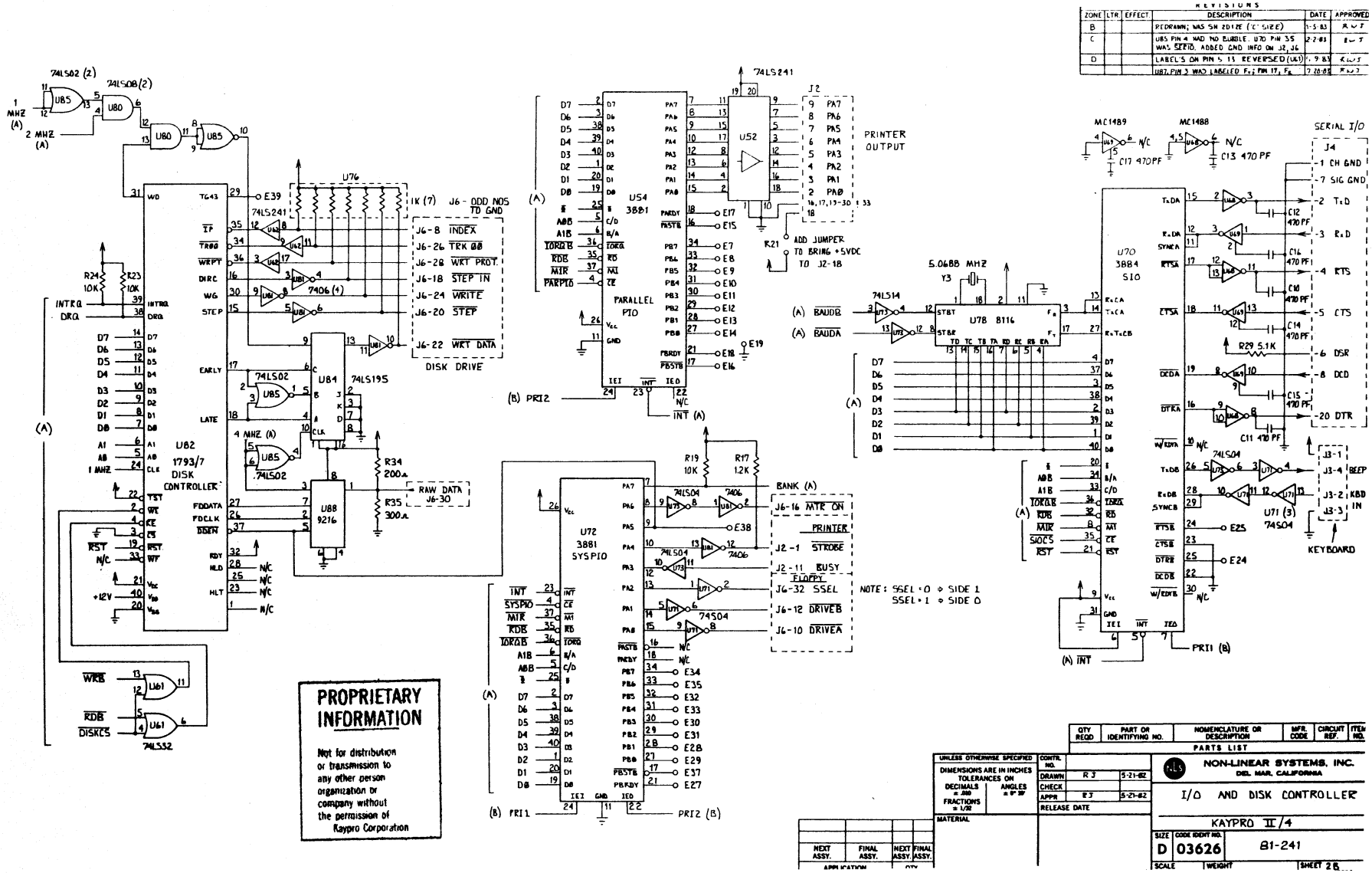
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

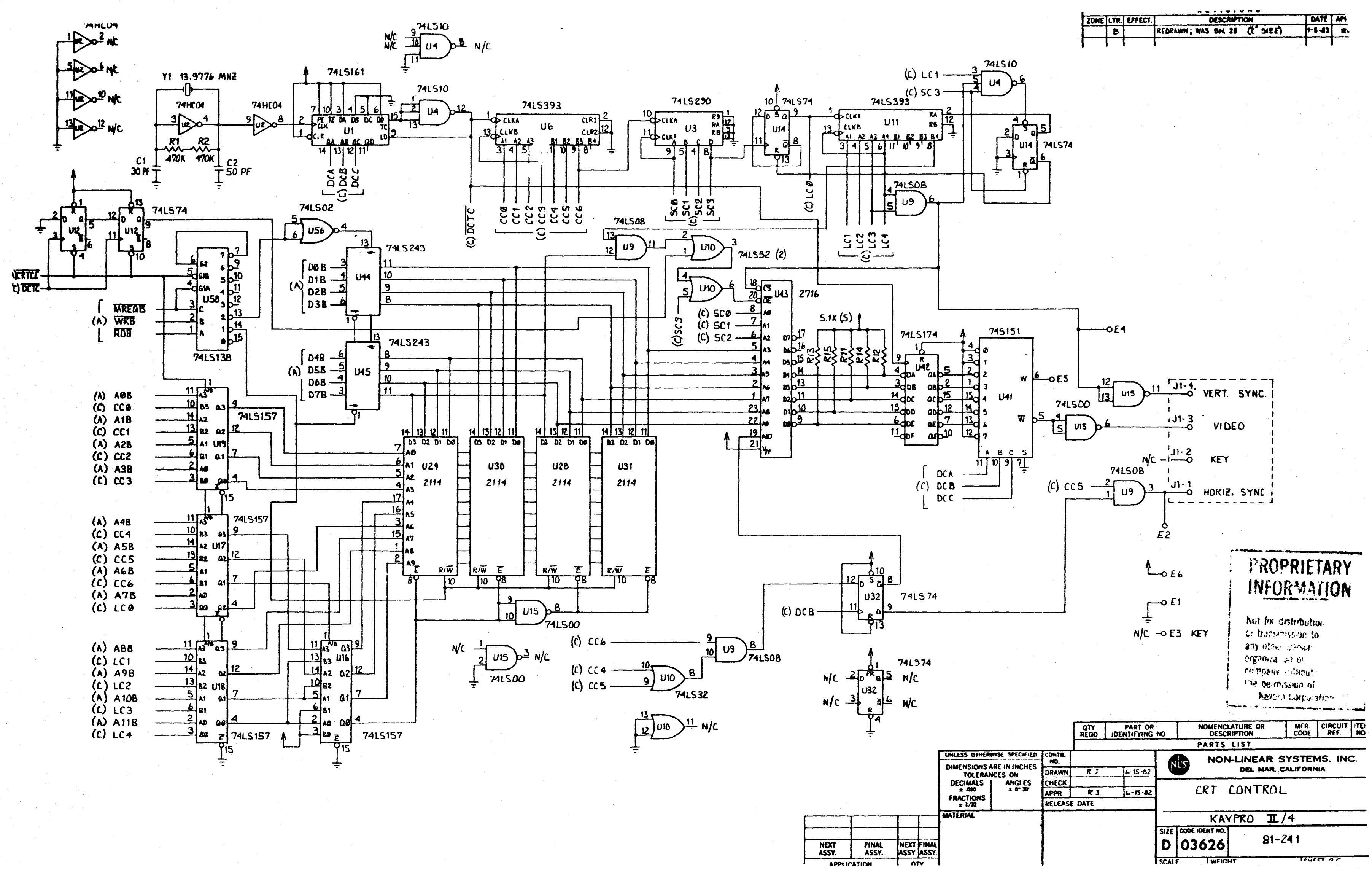
CPU AND MEMORY

KAYPRO II/4

SIZE D | CODE IDENT NO. 03626 | 81-241

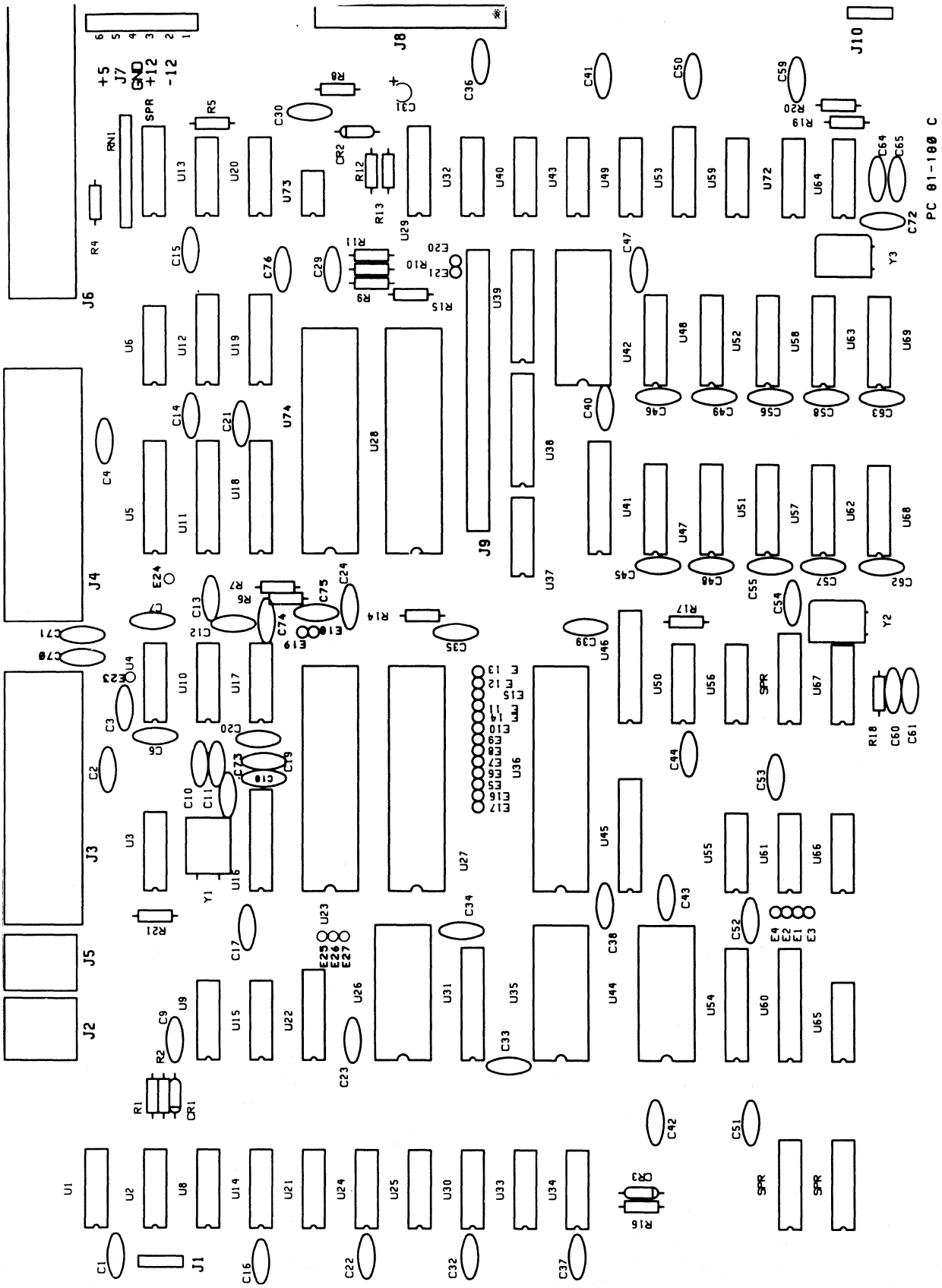
SCALE | WEIGHT | SHEET 2A


REVISIONS
ZONE LTR EFFECT DESCRIPTION DATE APPROVED
B REDRAWN; WAS SH 2 OF 2E (C SIZE) 1-5-83 R.W.T
C U85 PIN 4 WAS NO BUBBLE. U70 PIN 35 WAS SERIO. ADDED GND INFO ON J2, J6 2-2-83 R.W.T
D LABELS ON PIN 5, 13 REVERSED (U61) 7-9-83 R.W.T
U87, PIN 3 WAS LABELED F2; PIN 17, F8 7-26-83 R.W.T
74LS02 (2)
74LS08 (2)
1 MHZ (A)
2 MHZ (A)
U85
U80
U76
1K (7)
J6 - ODD NOS TO GND
J6-8 INDEX
J6-26 TRK 00
J6-28 WRT PROT
J6-18 STEP IN
J6-24 WRITE
J6-20 STEP
J6-22 WRT DATA
DISK DRIVE
74LS241
7406 (4)
U82
1793/7
DISK CONTROLLER
U84
74LS195
4 MHZ (A)
U88
9216
R34 200Ω
R35 300Ω
RAW DATA J6-30
INTRQ
DRQ
R24 10K
R23 10K
WRB
RDB
DISKCS
74LS32
U61
U54
3881
PARALLEL PIO
PRINTER OUTPUT
ADD JUMPER TO BRING +5VDC TO J2-18
R21
INT (A)
PRI2
U52
J2
U72
3881
SYSPIO
R19 10K
R17 1.2K
BANK (A)
J6-16 MTR ON
PRINTER
J2-1 STROBE
J2-11 BUSY
FLOPPY
J6-32 SSEL
J6-12 DRIVEB
J6-10 DRIVEA
NOTE: SSEL=0 ⇒ SIDE 1
SSEL=1 ⇒ SIDE 0
PRI1
PRI2 (B)
5.0688 MHZ
Y3
U78 8116
74LS14
BAUDB
BAUDA
U70
3884
SIO
MC1489
MC1488
C17 470PF
C13 470 PF
C12 470 PF
C16 470 PF
C10 470 PF
C14 470 PF
C15 470 PF
C11 470 PF
R29 5.1K
SERIAL I/O
J4
1 CH GND
7 SIG GND
2 TxD
3 RxD
4 RTS
5 CTS
6 DSR
8 DCD
20 DTR
J3-1
J3-4 BEEP
J3-2 KBD IN
J3-3
KEYBOARD
U71 (3) 74S04
PRI1 (B)
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
CONTR. NO.
DRAWN RJ 5-21-82
CHECK
APPR RJ 5-21-82
RELEASE DATE
MATERIAL
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
I/O AND DISK CONTROLLER
KAYPRO II/4
SIZE D
CODE IDENT NO. 03626
81-241
SCALE
WEIGHT
SHEET 2B



REDRAWN; WAS SH. 28 ("C" SIZE)
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person, organization or company without the permission of Kaypro Corporation
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
CRT CONTROL
KAYPRO II/4
D 03626
81-241
PARTS LIST
VERT. SYNC.
VIDEO
KEY
HORIZ. SYNC.

6.3 KAYPRO 10 MAINBOARD (81-180-n)



IC LIST, 81-180-n

Reference Designation		Description
U1	74S74	Dual "D" flip-flop
U2	74S08	Hex Schmitt Quad AND gate
U3	74S04	Hex inverter
U4, U10	1489	Quad SCHMITT line receiver
U5, U38, U41	74LS244	Octal buffer
U6, U21, U24, U33, U49	74LS74	Dual "D" flip-flop
U20, U30	74LS08	Quad AND gate
U8, U37, U50	74LS00	Quad NAND gate
U9, U59	74LS393	Dual binary counter
U11, U18, U31, U45, U46, U60	74LS373	Octal "D' latch
U12, U19	74LS138	3/8 MUX
U13	7406	Hex inverter, open collector
U14	74S86	Hex Schmitt Quad XOR gate
U15, U61	74S20	Dual NAND gate
U16	8116	Dual programmable baud rate generator
U17	1488	Quad transmitter
U22	74LS165	8-bit shift register
U23, U27	Z80A SIO	
U25, U72	74LS10	Tri NAND gate
U26	81-187	Character generator EPROM (2732)
U28	Z80A CPU	
U29	74LS195	4-bit shift register
U32, U43	74LS02	Quad NOR gate
U34	74LS14	Hex Schmitt inverter
U35, U44	6116	RAM, 2K x 8-bit (200ns)
U36	6545A-1	Video controller
U39, U54	74LS245	Bi-directional 8-bit buffer
U42	81-302-C	Boot EPROM (2732)
U40	74LS32	Quad OR gate
U47, U48	74LS157	Quad 2/1 MUX
U51, U52, U57, U58, U62, U63, U68, U69	4565N-15	Dynamic RAM 64K x 1 (150ns) (Mostek number)
U53	74LS163	Synchronous 4-bit binary counter
U55	14-2-392	14-Pin pull-up resistor
U56, U65	74LS04	Hex inverter
U64, U67	74HCU04	Hex inverter, CMOS
U66	74LS93	Asynchronous 4-bit binary counter
U73	WD9216	Data separator
U74	1793	Floppy disk controller

SCOPE SIGNALS FOR TROUBLESHOOTING 81-180-n

The examples of correct signals shown here do not represent all of the signals on the 81-180-n mainboard, since most of the signals will be high-low toggles. A group of signals taken from a video clock divider (U66) are shown to illustrate the timing relationships between the various video signals.

The signal measurements were made using a Tektronix ocilloscope, model 2213. It has a bandwidth of DC-60 MHz, sensitivity of 2mV/cm, a sweep delay of 0.1 microseconds to 1 second, and a graticule display measuring 8 x 10 cm.

Each square of the representation is the equivalent of one square cm. on the graticule. The scope was set for 2V/div. and .2micro-secs/div. for all figures except figure 2, which was set at .5micro-secs/div.

Signal M1 from pin 27 of the CPU (U28) was triggered on. This signal is shown in the top half of each display and was channel 1. Ground for signals shown on channel 2 was established at the first graticule line above the bottom of the display.

State of the machine: The machine has just booted-up on the hard drive.

Figure 1: Pin 6 of U28, 4MHz clock signal.

Figure 2: Pin 24 of U74, 1MHz clock signal.

Figure 3: Pin 12 of U66, video, clock divider.

Figure 4: Pin 9 of U66, video, clock divider.

Figure 5: Pin 8 of U66, video, clock divider.

Figure 6: Pin 11 of U66, video, clock divider.

FIGURE 1

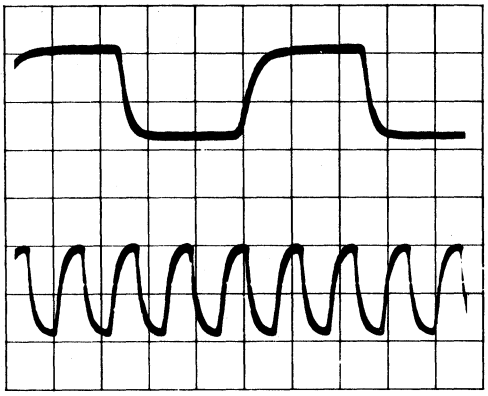


FIGURE 2

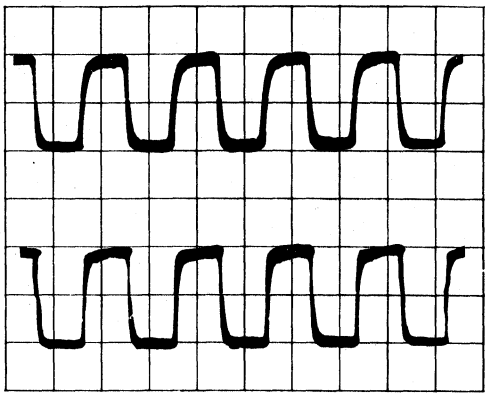


FIGURE 3

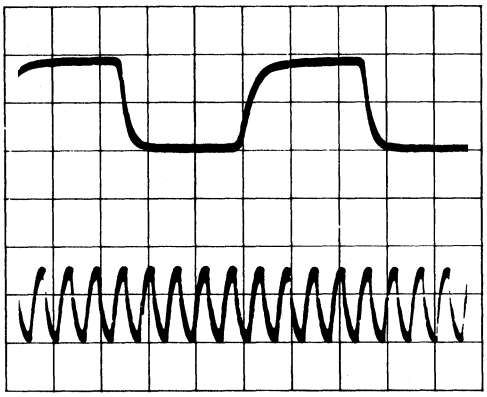


FIGURE 4

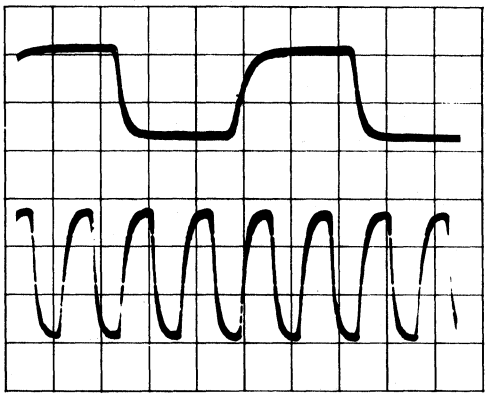


FIGURE 5

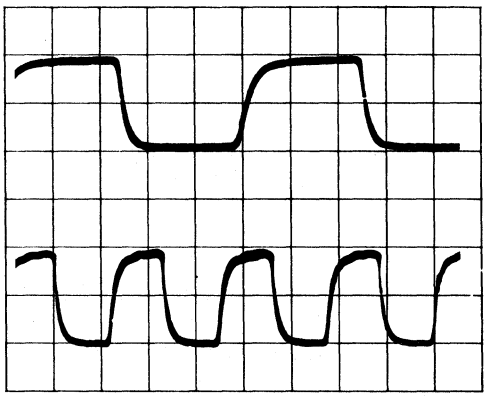
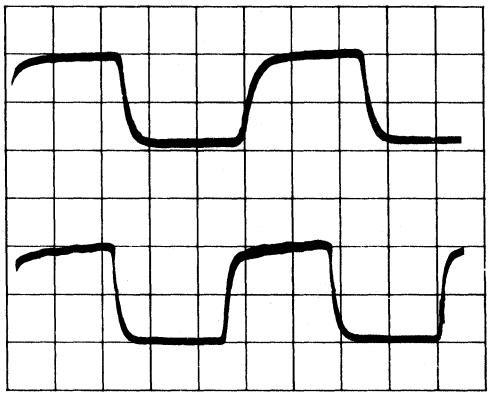
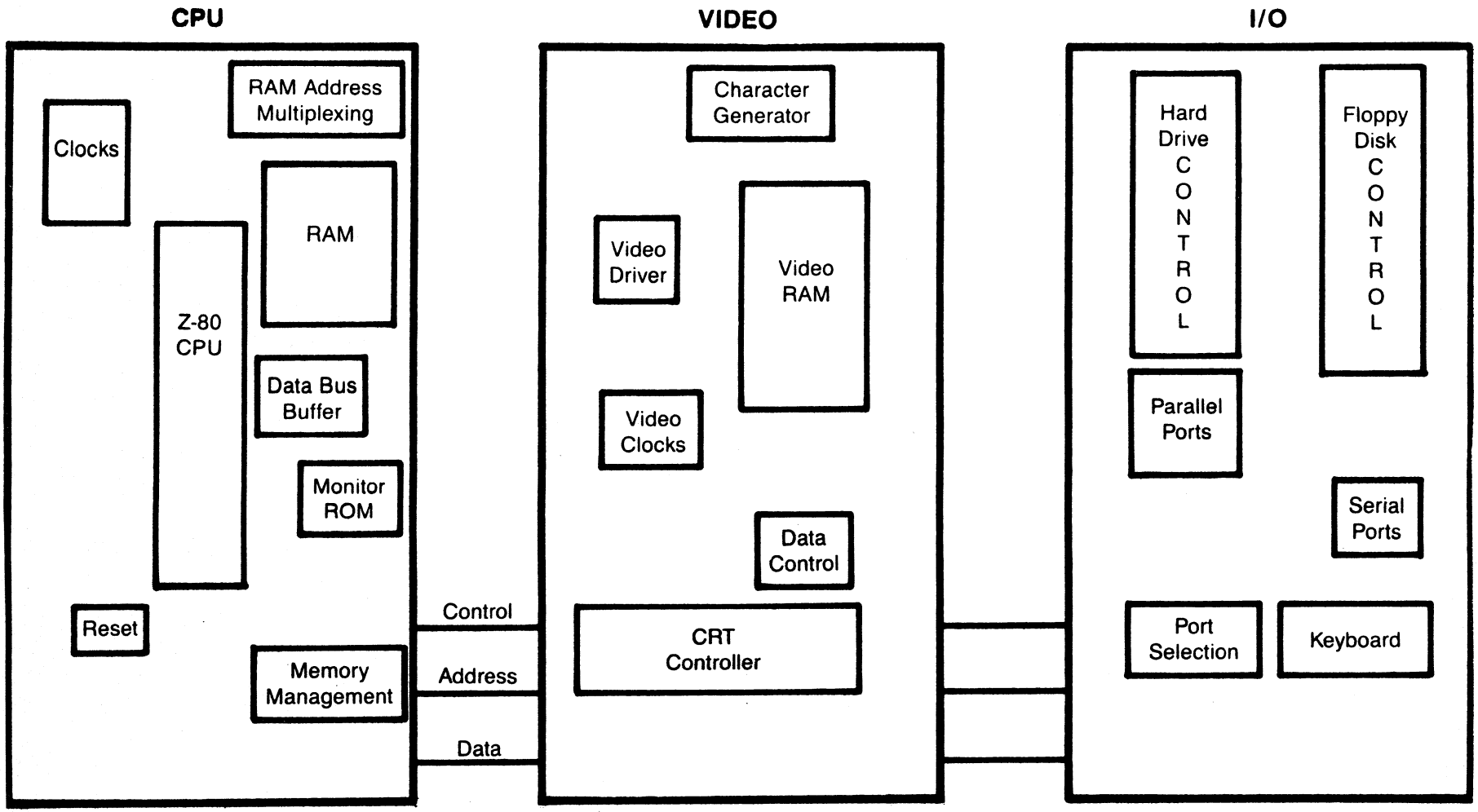


FIGURE 6

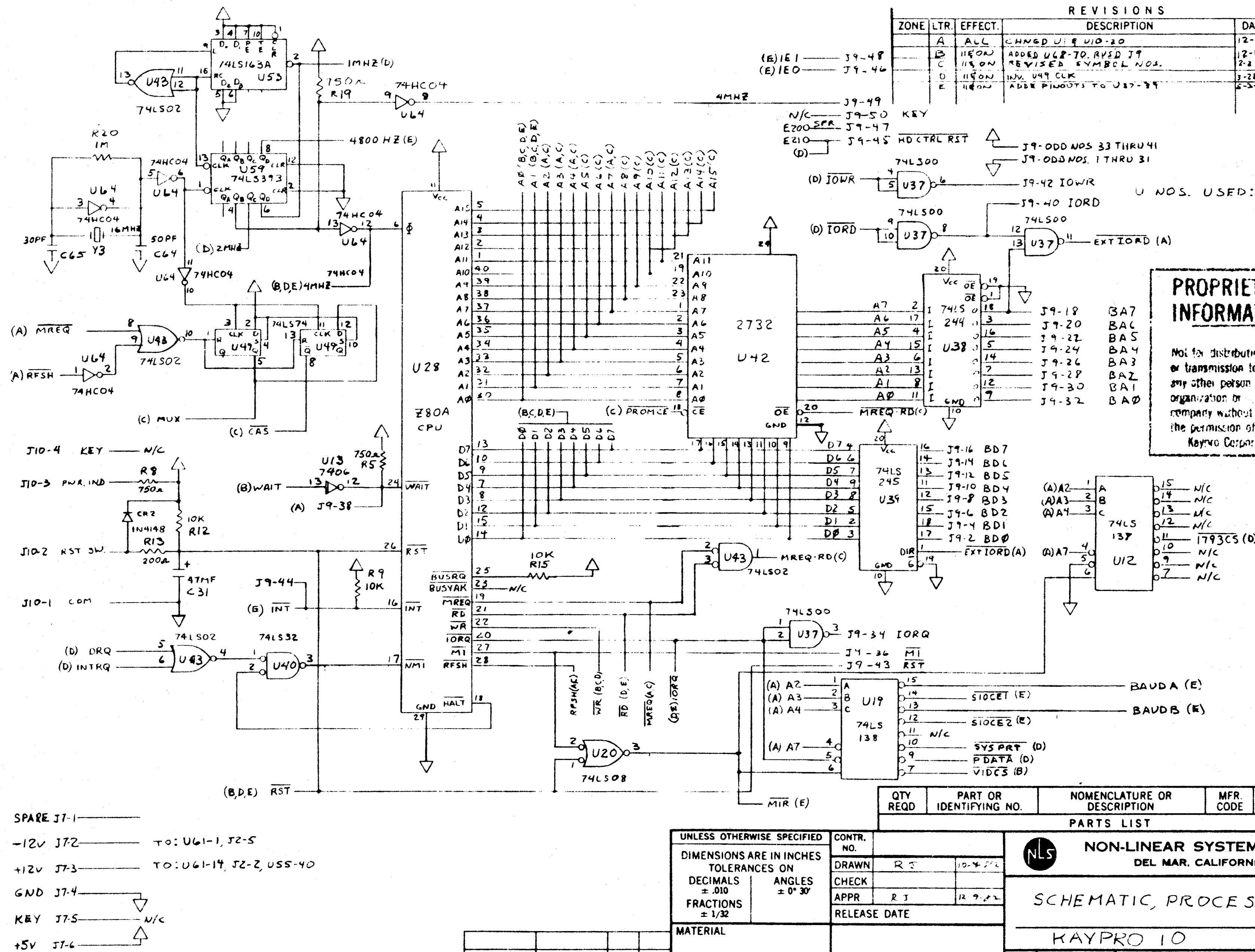




KAYPRO 10 BLOCK DIAGRAM

REVISIONS

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	ALL	CHNGD U19 U10-20	12-9-82	RJ
	B	11EON	ADDED U68-70, RVSD J9	12-11-82	RJ
	C	11EON	REVISED SYMBOL NOS.	2-24-83	RJ
	D	11EON	INV. U49 CLK	3-29-83	RJ
	E	11EON	ADDE PINOUTS TO U37-39	5-3-83	RJ



PROPRIETARY INFORMATION

Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 | ANGLES ± 0° 30'
FRACTIONS ± 1/32

MATERIAL

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

CONTR. NO.		
DRAWN	RJ	10-4-82
CHECK		
APPR	RJ	12-9-82
RELEASE DATE		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, PROCESSOR

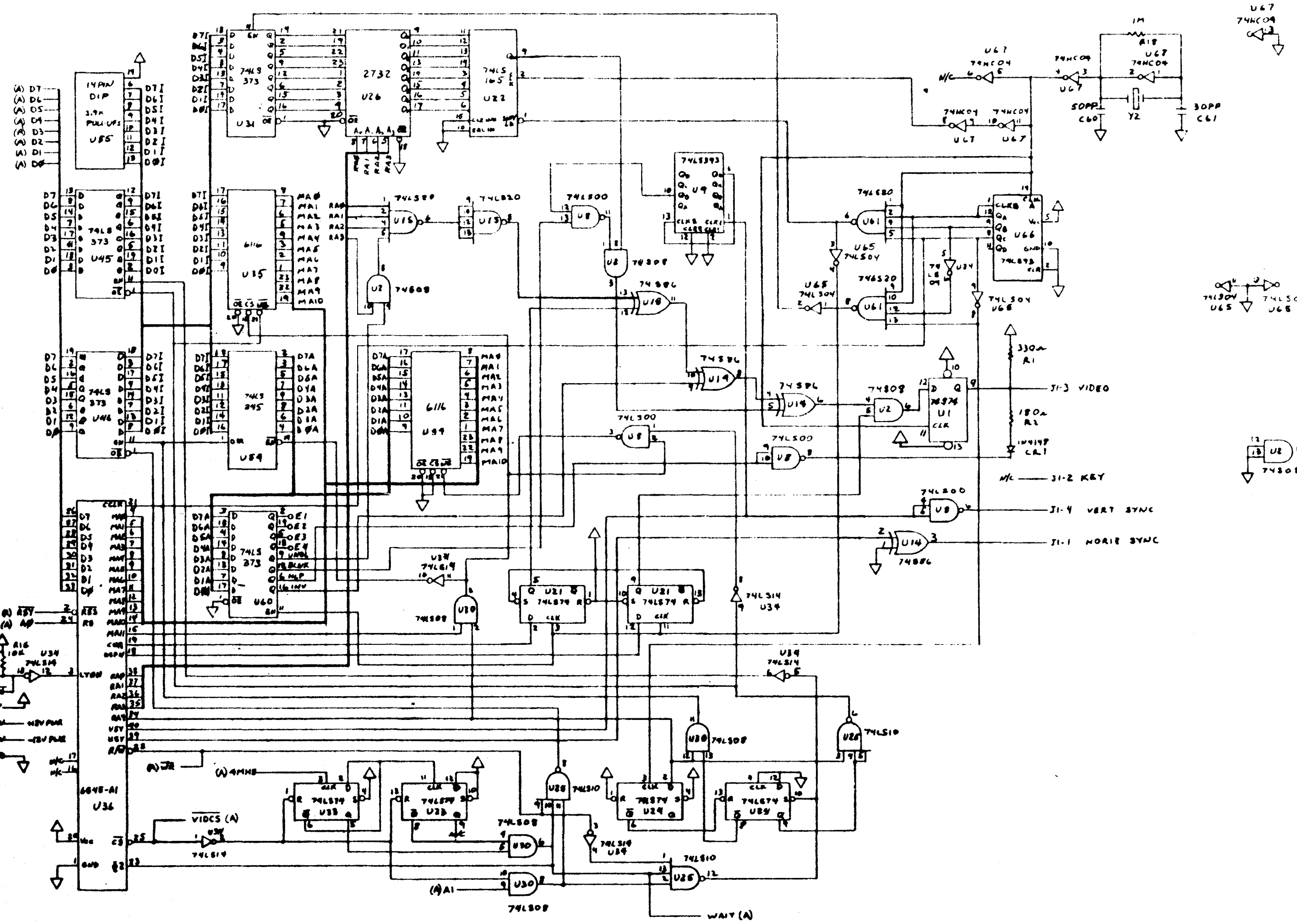
KAYPRO 10

SIZE	CODE IDENT NO.	
C	03626	81-181

SCALE | WEIGHT | SHEET 2A

REVISIONS

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	ALL	CHGD CONNECTIONS TO U38, 28, 27 & 32	12-8-82	AJ
	B	2-1-83	ADDED U71	2-1-83	RJ
	C	[illegible]	REVISED SYMBOL NOS	[illegible]	RJ



P.C. BD: 81-180

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 — ANGLES ± 0° 30'
FRACTIONS ± 1/32

MATERIAL

CONTR. NO.	
DRAWN	RWT 10-15-82
CHECK	
APPR	RJ 11-9-82
RELEASE DATE	

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

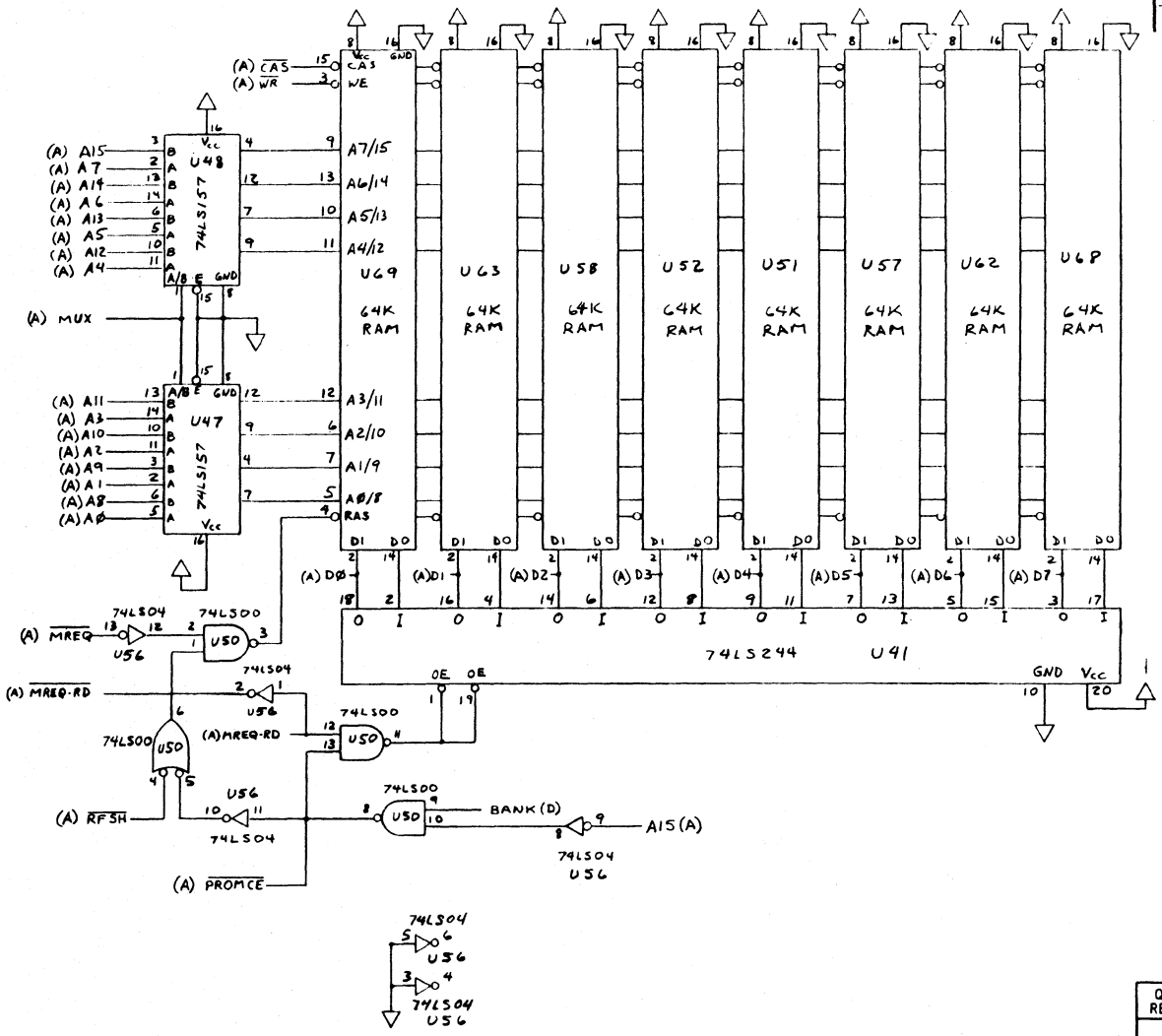
SCHEMATIC, VIDEO

KAYPRO 10

SIZE D — CODE IDENT NO. 03626 — 81-181

SCALE — WEIGHT — SHEET 2B

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	ALL	ADD CONN TO U49	12-7-82	RJ
	B	115ON	REVISED SYMBOL NOS	2-24-83	RJ



UNOS USED:

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32	DRAWN	RJ	10-4-82
	CHECK		
	APPR	RJ	12-9-82
	RELEASE DATE		
MATERIAL			

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, RAM

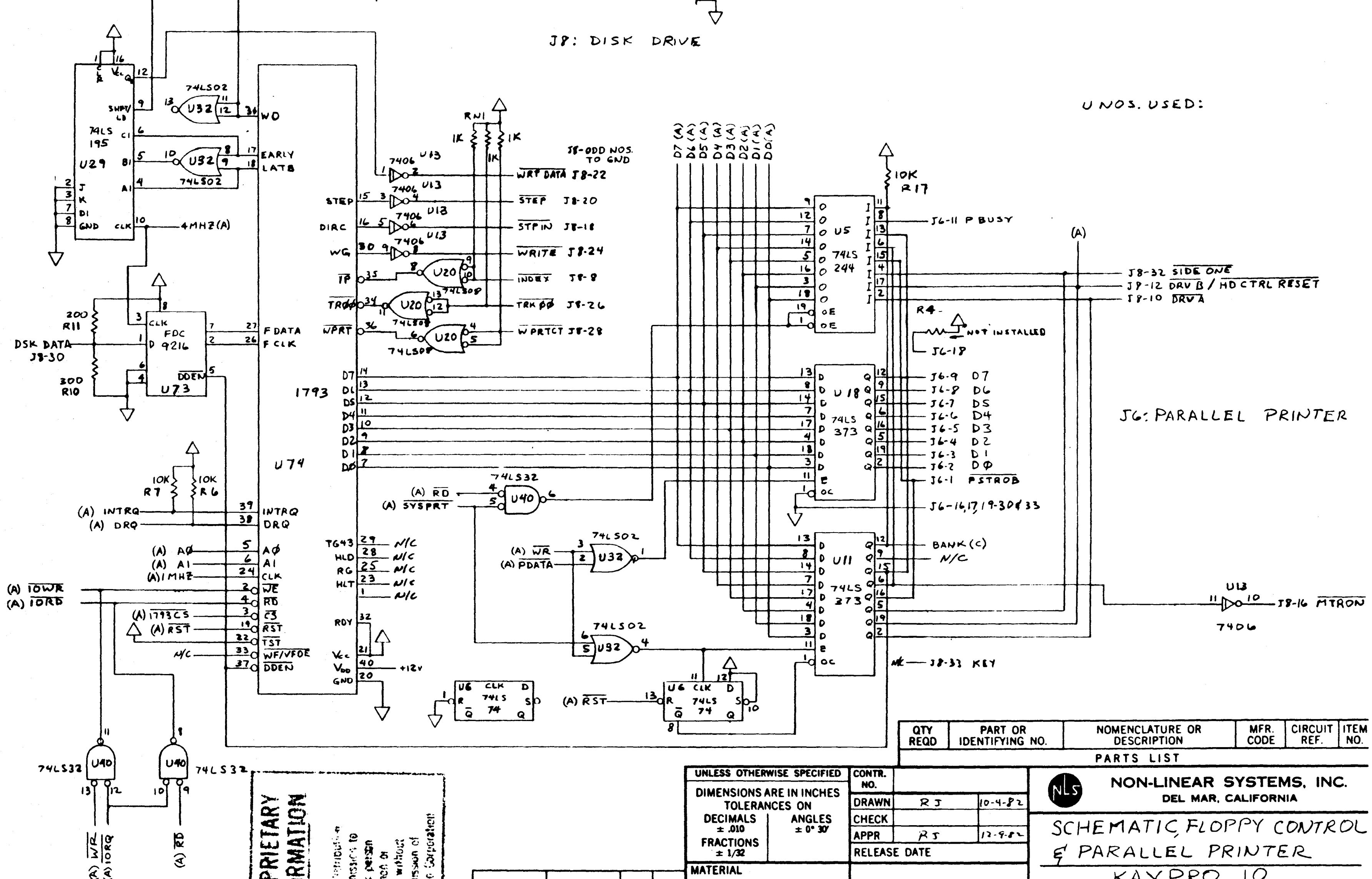
KAYPRO 10

SIZE	CODE IDENT NO.	
C	03626	81-181

SCALE | WEIGHT | SHEET 2C

REVISIONS

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	ALL	ADD CIRC TO U59-6 & 15. INTRCHG'D U59-30,31 & J8-22,24	12-7-82	RJ
	B	11 & ON	REVISED SYMBOL NOS & WRITE PRECOMP	2-24-83	RJ
	C	11 & ON	REMOVED R3, C8 & U7. CHNGD J6 & J8	3-15-83	RJ



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 ANGLES ± 0° 30'
FRACTIONS ± 1/32

MATERIAL

CONTR. NO.		
DRAWN	RJ	10-4-82
CHECK		
APPR	RJ	12-9-82
RELEASE DATE		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

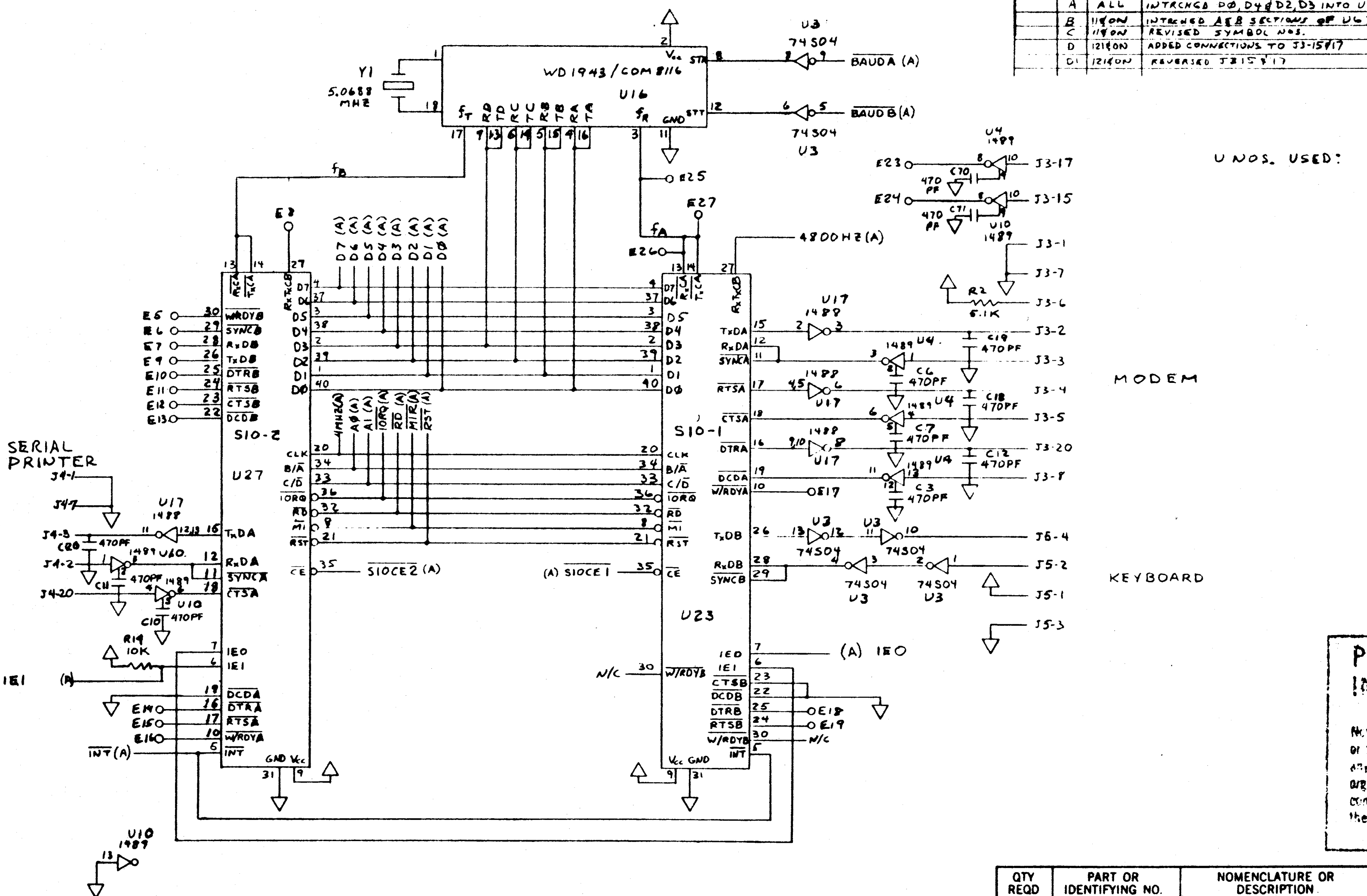
SCHEMATIC, FLOPPY CONTROL & PARALLEL PRINTER
KAYPRO 10

SIZE C | CODE IDENT NO. 03626 | 81-181

SCALE | WEIGHT | SHEET 2 D

REVISIONS

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	ALL	INTRCNGD DØ, D4 & D2, D3 INTO U64	12-7-82	RJ
	B	11 & ON	INTRCNGD A & B SECTIONS OF U63	[illegible]	RJ
	C	11 & ON	REVISED SYMBOL NOS.	2-21-83	RJ
	D	121 & ON	ADDED CONNECTIONS TO J3-15 & 17	3-28-83	RJ
	D1	121 & ON	REVERSED J3 15 & 17	6-27-83	RJ



PROPRIETARY INFORMATION

Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 — ANGLES ± 0° 30'
FRACTIONS ± 1/32

MATERIAL

CONTR. NO.		
DRAWN	RJ	10-4-82
CHECK		
APPR	RJ	11-5-82
RELEASE DATE		

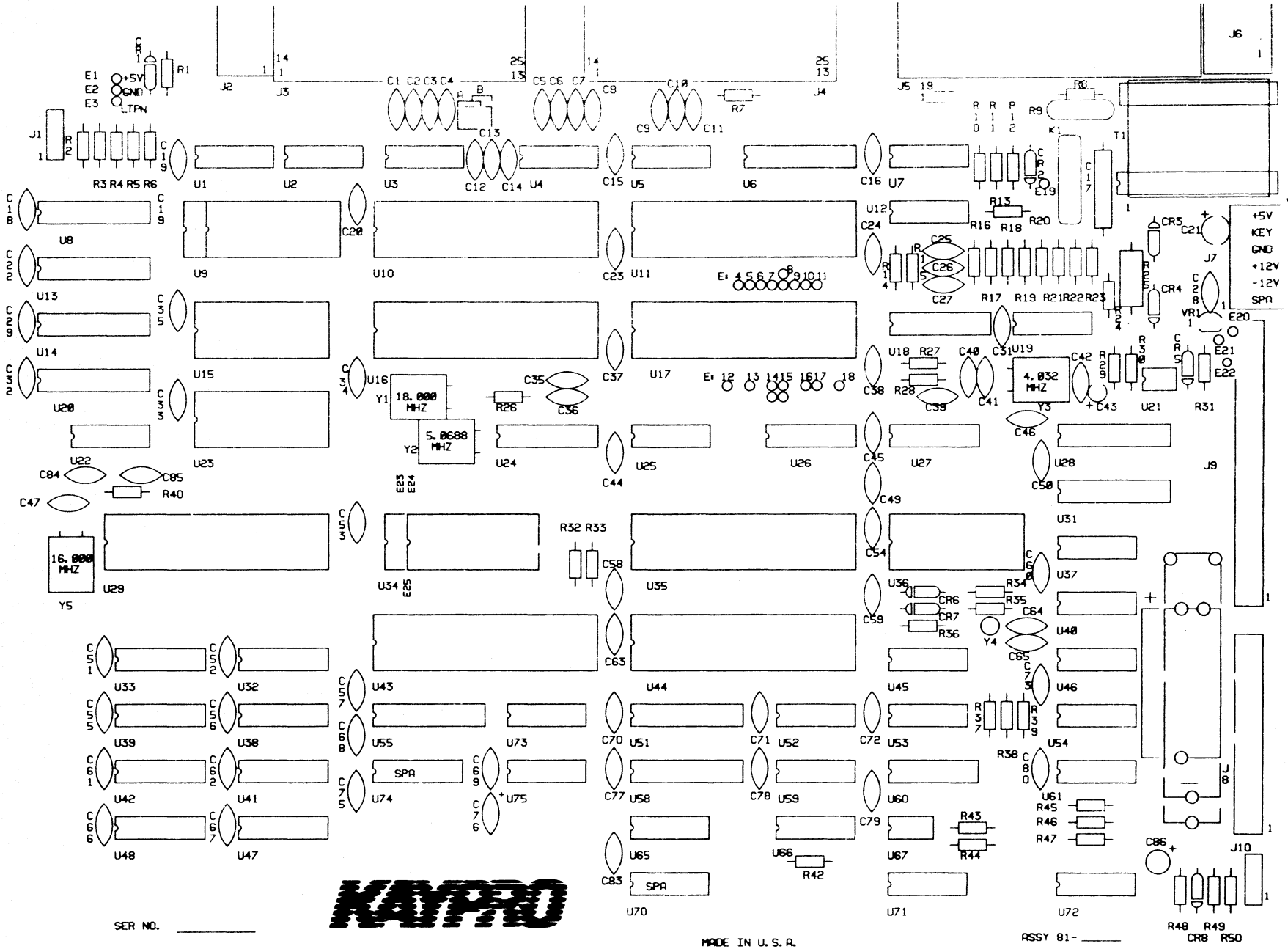
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, SERIAL PORTS

KAYPRO 10

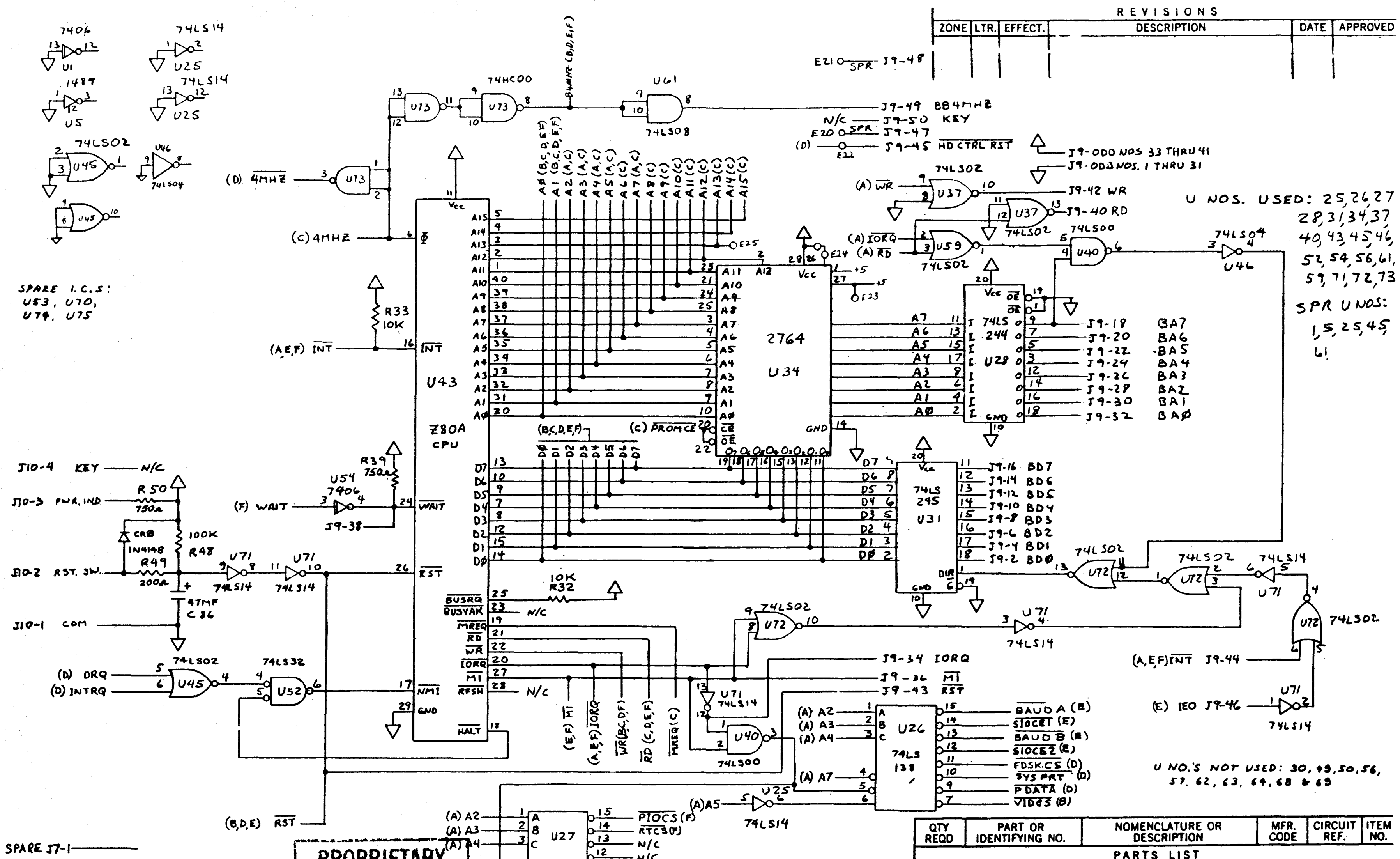
SIZE C | CODE IDENT NO. 03626 | 81-181

SCALE | WEIGHT | SHEET 2E


KAYPRO
SER NO. _____
MADE IN U.S.A.
ASSY 81-_____
+5V
KEY
GND
+12V
-12V
SPA
18.000 MHZ
5.0688 MHZ
16.000 MHZ
4.032 MHZ
LTPN

IC LIST, 81-294-n

Reference Designation		Description
U1, U54	74Ø6	Hex inverter, open collector
U2, U25, U71	74LS14	Hex Schmitt inverter
U3, U5	1489	Quad Scmitt line driver
U4	1488	Quad line driver
U6, U13, U14,U55, U58	74LS373	Octal "D" latch
U8	74LS374	Octal "D" flip-flop
U9	81-235-n	Character PROM (2732)
U1Ø	81-189	Custom gate array
U11, U17	Z8Ø SIO	
U15, U23	6116	Video RAM
U16	6545EA	CRT controller
U2Ø, U31	74LS245	Octal bus transceiver
U22	3.9K	Pull-up Resistor
U24	WD1943/ 8116	Dual programmable baud rate generator
U26, U27	74LS138	3/8 MUX
U28, U51	74LS244	Octal buffer/line driver (3-state outputs)
U29	81-194	Custom gate array
U32, U33, U38, U39, U41, U42, U47, U48	2164	64K x 1 RAM
U34	81-292	Boot PROM (2764)
U37, U45, U59, U72	74LSØ2	Quad NOR gate
U4Ø	74LSØØ	Quad NAND gate
U43	Z8ØA CPU	
U44	1793	Floppy disk controller
U46	74LSØ4	Hex inverter
U52	74LS32	Quad OR gate
U6Ø	74LS195	4-bit shift register
U61	74LSØ8	Quad AND gate
U65	74LS1Ø	Tri NAND gate
U66, U75	74LS74	Dual "D" flip-flop
U67	FDC9216	Data separator
U73	74HCØØ	Quad NAND gate



PROPRIETARY INFORMATION

Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 ANGLES ± 0° 30'
FRACTIONS ± 1/32

CONTR. NO.		
DRAWN	R J	2-29-84
CHECK		
APPR	R J	2-29-84
RELEASE DATE	3-6-84 KSI	

MATERIAL

Board Rev A

NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.

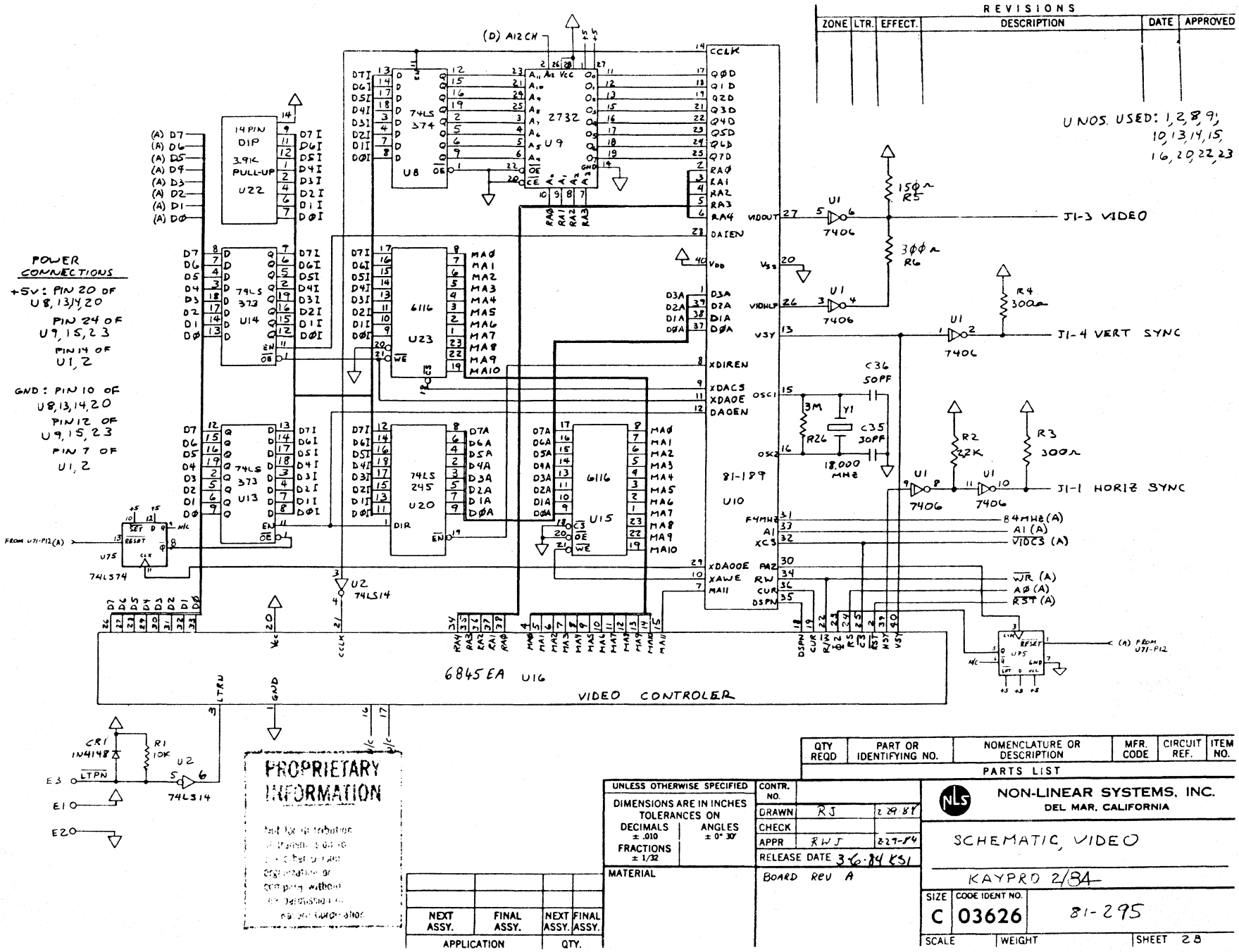
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, PROCESSOR

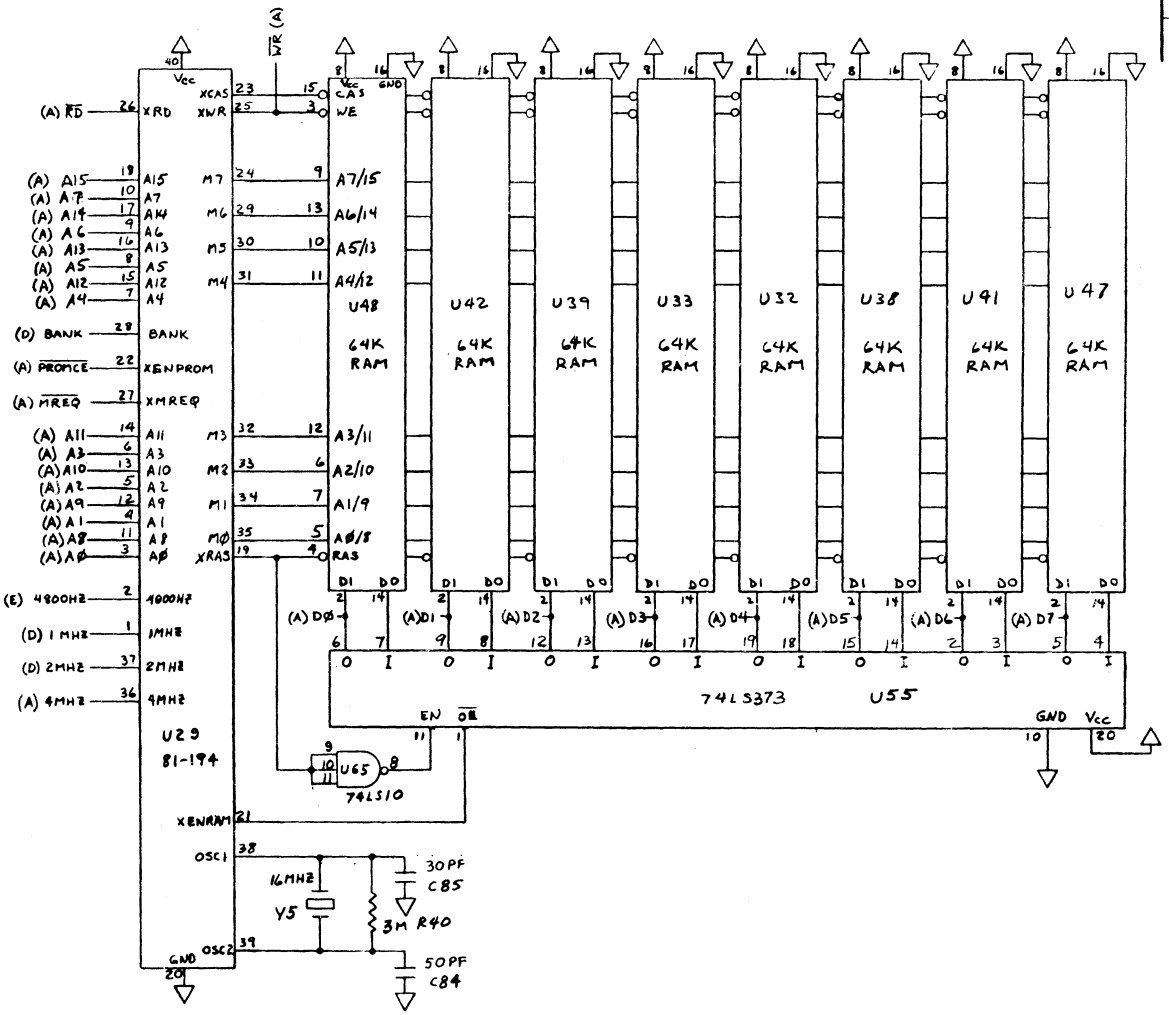
KAYPRO 2/84

SIZE C | CODE IDENT NO. 03626 | 81-295

SCALE | WEIGHT | SHEET 2A


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
U NOS. USED: 1,2,8,9; 10,13,14,15, 16,20,22,23
POWER CONNECTIONS
+5v: PIN 20 OF U8,13,14,20
PIN 24 OF U9,15,23
PIN 14 OF U1,2
GND: PIN 10 OF U8,13,14,20
PIN 12 OF U9,15,23
PIN 7 OF U1,2
14 PIN DIP 3.9K PULL-UP U22
74LS 374 U8
2732 U9
74LS 373 U14
6116 U23
74LS 373 U13
74LS 245 U20
6116 U15
81-189 U10
74LS74 U75
74LS14 U2
6845EA U16
VIDEO CONTROLER
7406
15Ω R5
30Ω R6
300Ω R4
300Ω R3
22K R2
3M R26
C36 50PF
C35 30PF
18.000 MHz
Y1
CR1 IN4148
R1 10K
J1-3 VIDEO
J1-4 VERT SYNC
J1-1 HORIZ SYNC
B4MHz (A)
A1 (A)
VIDCS (A)
WR (A)
A0 (A)
RST (A)
(A) FROM U71-P12
FROM U71-P12(A)
LTPN
E3
E10
E20
PROPRIETARY INFORMATION
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL
CONTR. NO.
DRAWN RJ 2-29-84
CHECK
APPR RWJ 3-27-84
RELEASE DATE 3-6-84 KSI
BOARD REV A
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, VIDEO
KAYPRO 2/84
SIZE C
CODE IDENT NO. 03626
81-295
SCALE | WEIGHT | SHEET 28

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED



U NOS USED: 29, 48, 42, 39, 33, 32, 38, 41, 47, 55, 65

PROPRIETARY INFORMATION

Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	DRAWN	RJ	2-29-84
	CHECK		
	APPR	RJ	2-29-84
	RELEASE DATE	3-6-84 KSI	
MATERIAL	BOARD REV A		

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

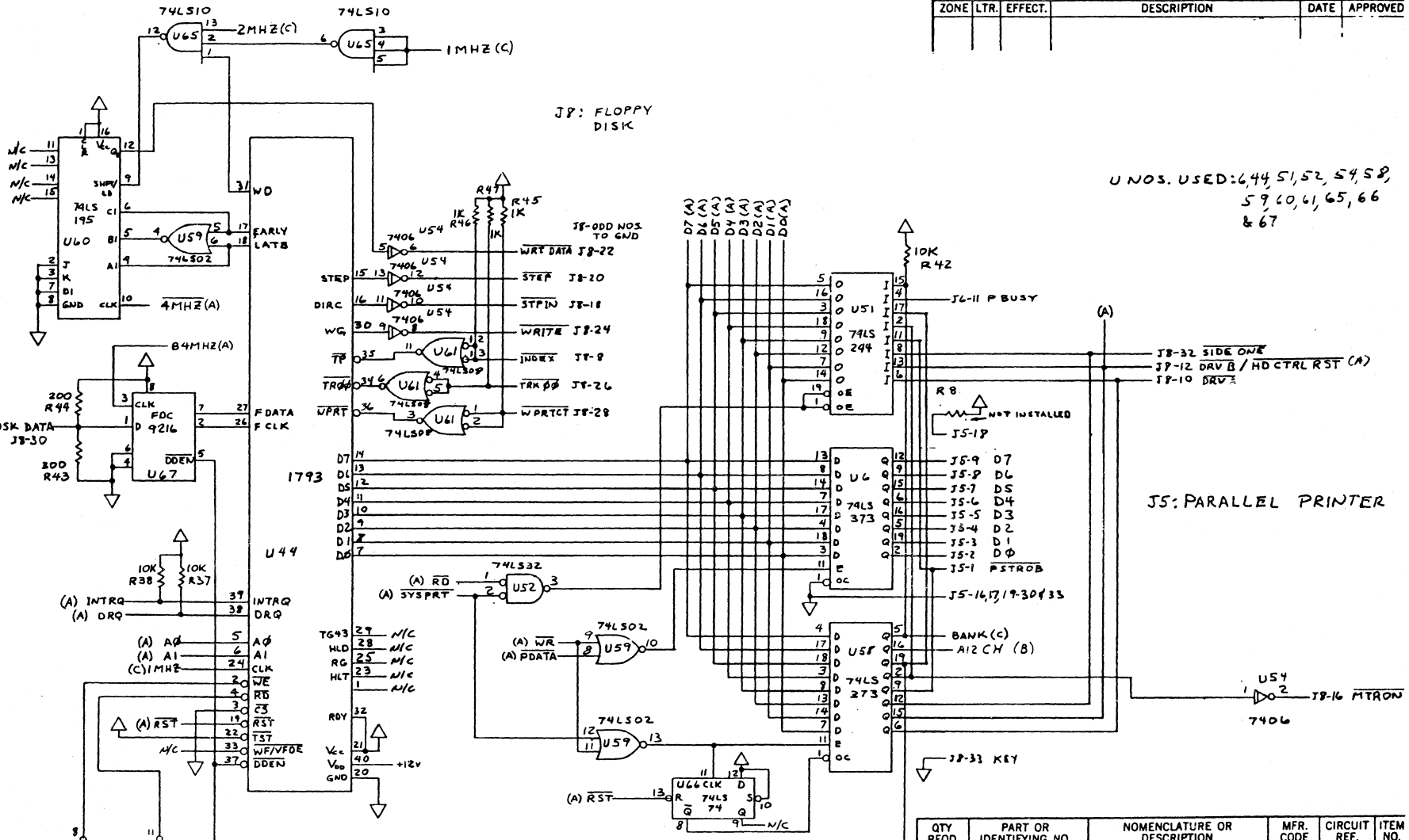
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, RAM

KAYPRO 2/84

SIZE	CODE IDENT NO.	
C	03626	81-295

SCALE | WEIGHT | SHEET 2 C



6—31

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL

CONTR. NO.		
DRAWN	RJ	2-29-84
CHECK		
APPR	RJ	2-29-84
RELEASE DATE	3-6-84 KSI	

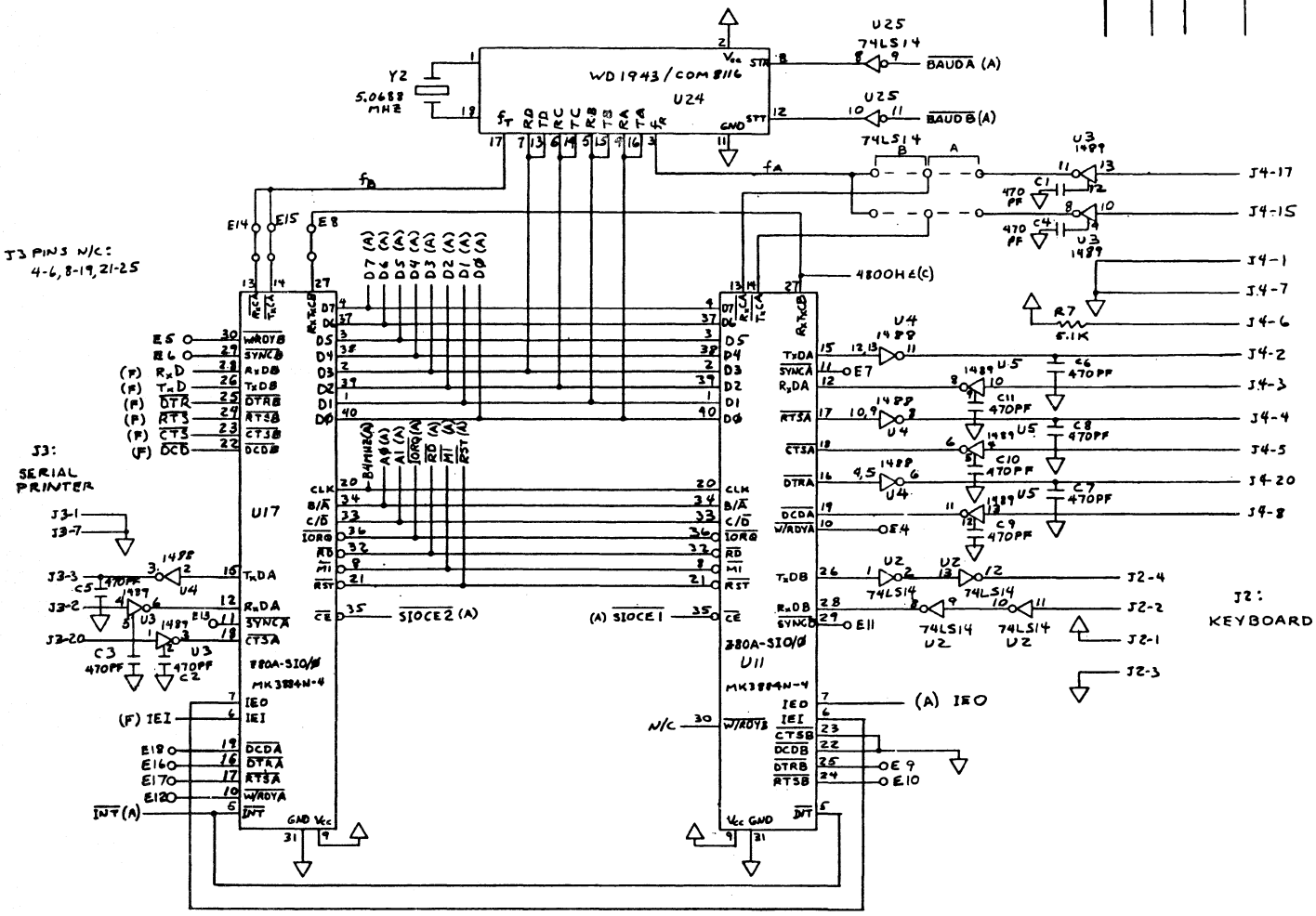
BOARD Rev A

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, FLOPPY CONTROL & PARALLEL PRINTER
KAYPRO 2/84

SIZE	CODE IDENT NO.	
C	03626	81-295

SCALE | WEIGHT | SHEET



REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.
PARTS LIST					

UNLESS OTHERWISE SPECIFIED		CONTR. NO.	
DIMENSIONS ARE IN INCHES TOLERANCES ON		DRAWN	R J 2-29-84
DECIMALS ± .010	ANGLES ± 0° 30'	CHECK	
FRACTIONS ± 1/32		APPR	R S 2-29-84
MATERIAL		RELEASE DATE	3-6-84 A31
		BOARD	Rev A

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

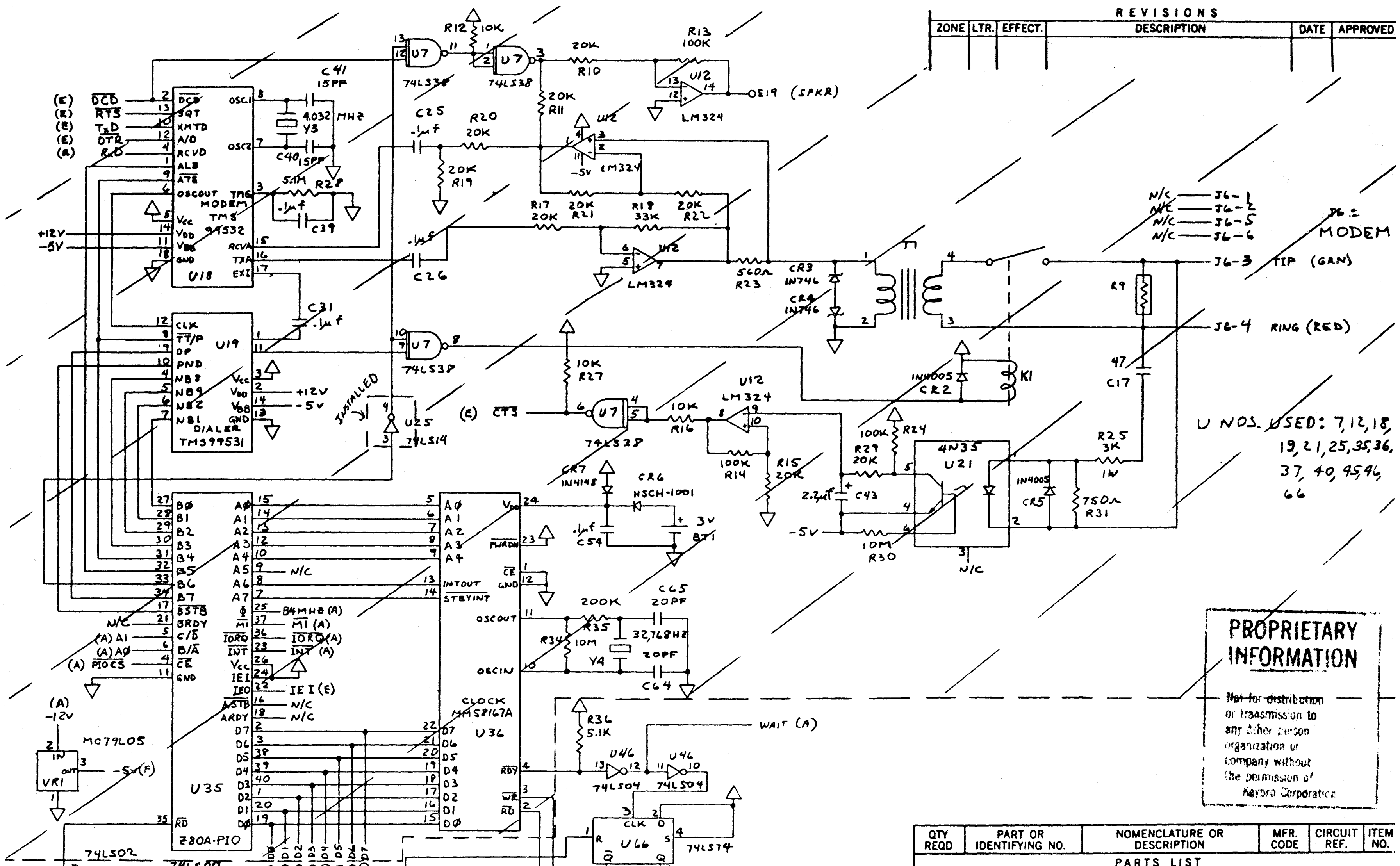
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, SERIAL PORTS

KAYPRO 2/84

SIZE	CODE IDENT NO.	
C	03626	81-295

SCALE | WEIGHT | SHEET 2E



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 | ANGLES ± 0° 30'
FRACTIONS ± 1/32

MATERIAL

CONTR. NO.		
DRAWN	RJ	2-29-84
CHECK		
APPR	RJ	2-29-84
RELEASE DATE	3-6-84 KSV	

BOARD REV A
KII

NOTE: PARTS IN CROSS HATCHED AREA ARE NOT INSTALLED

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

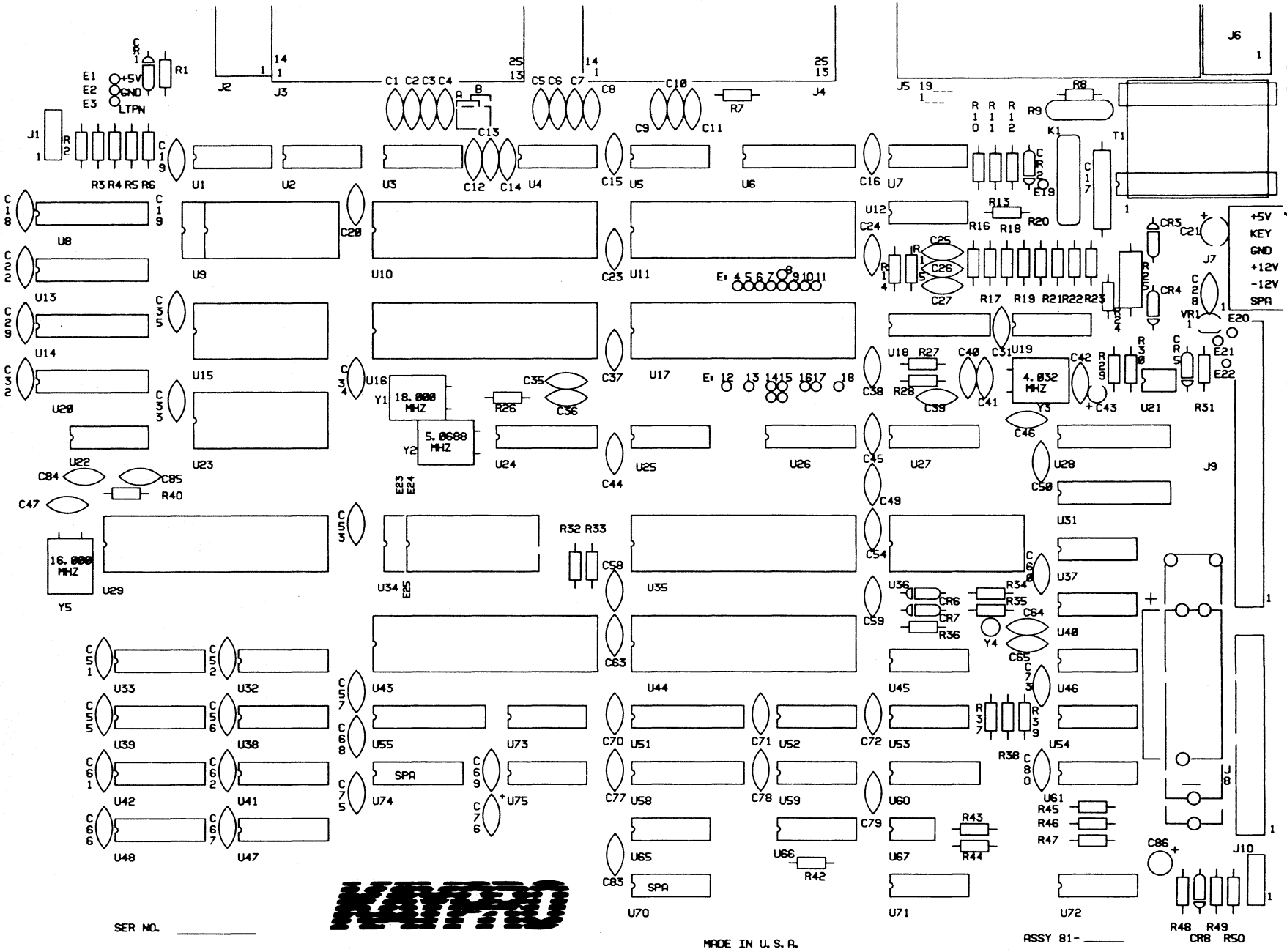
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC MODEM & RTC

KAYPRO 2/84

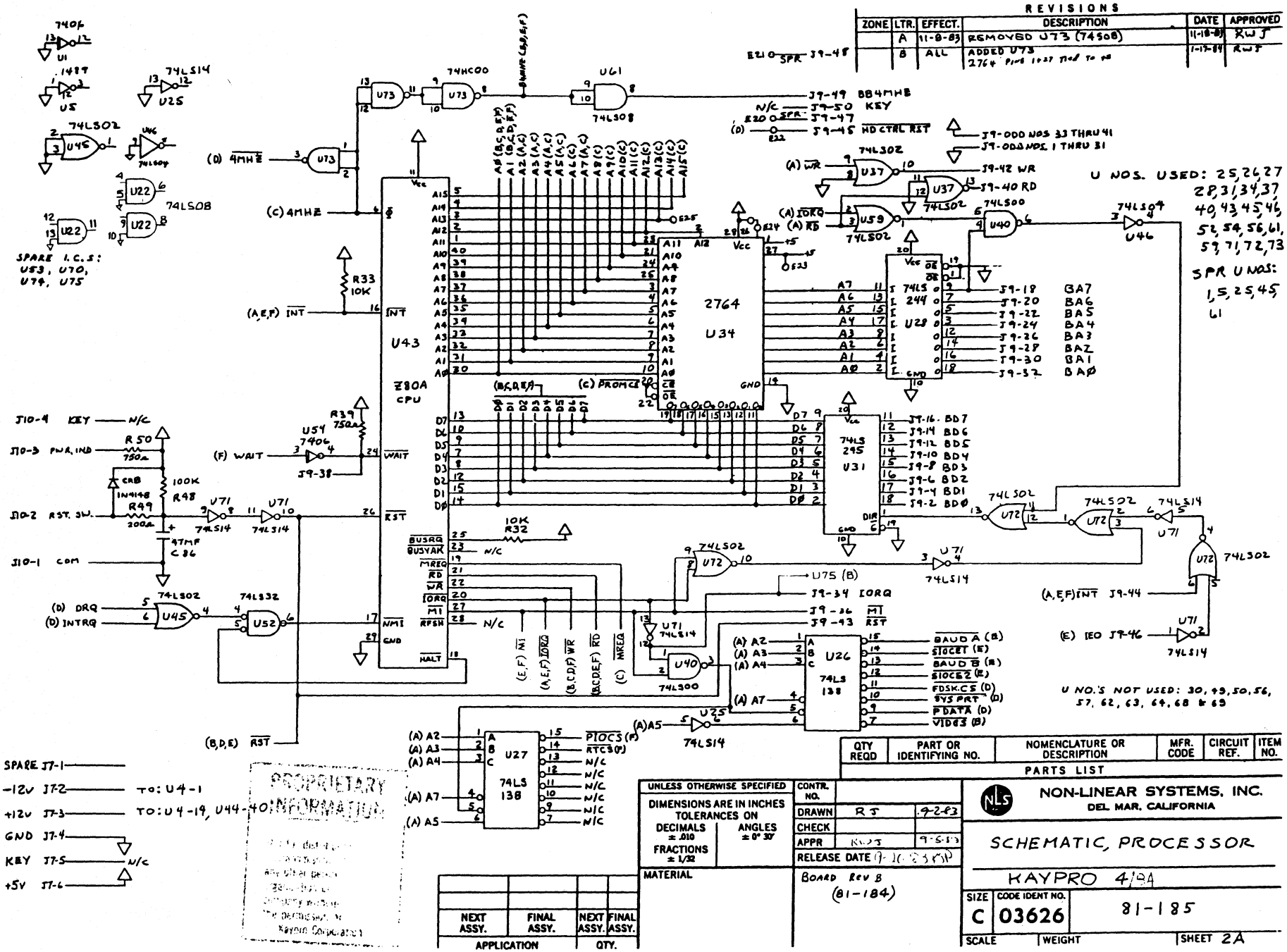
SIZE C | CODE IDENT NO. 03626 | 81-295

SCALE | WEIGHT | SHEET 2F

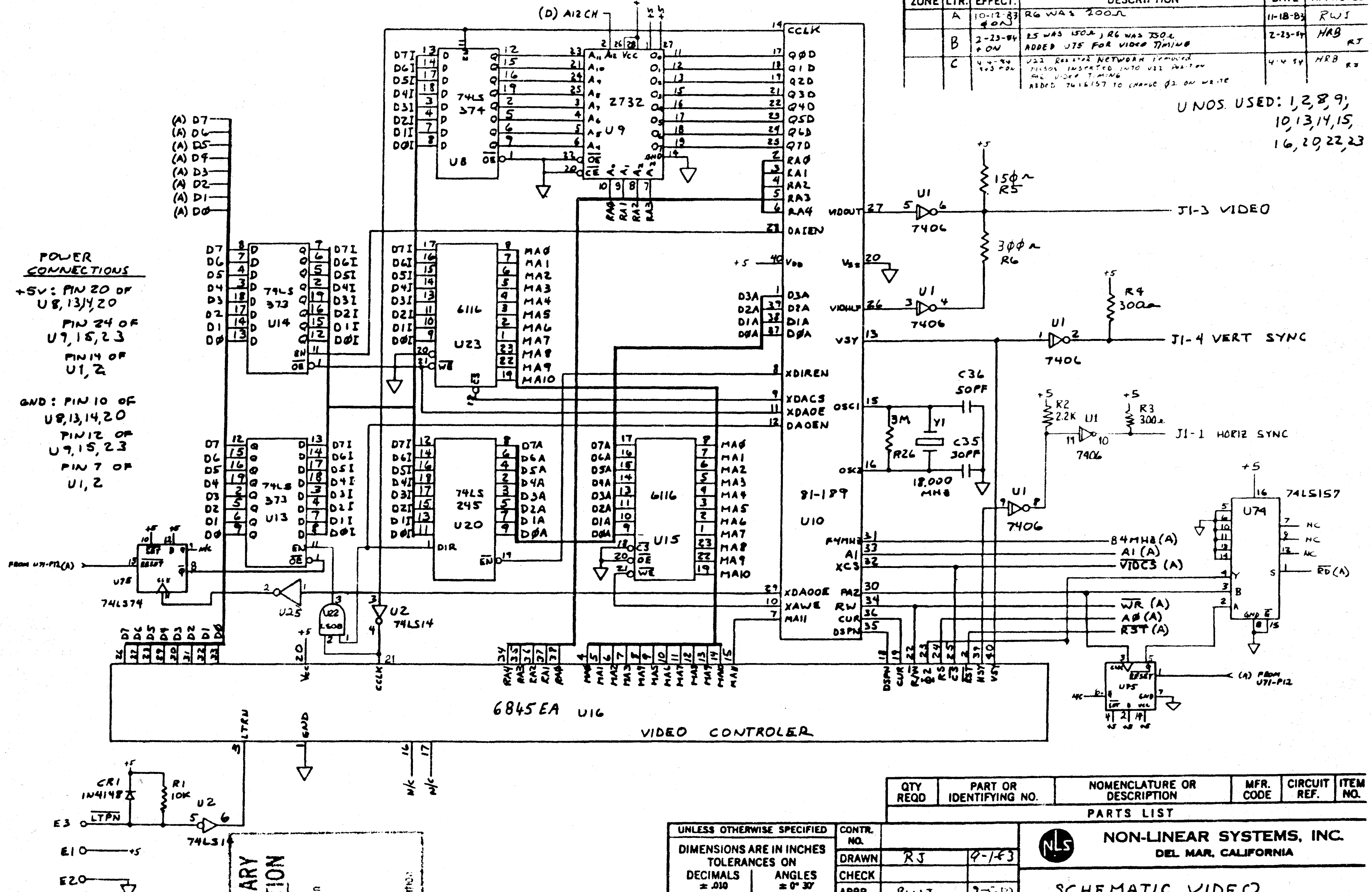

J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
E1 +5V
E2 GND
E3 LTPN
+5V
KEY
GND
+12V
-12V
SPR
16.000 MHZ
18.000 MHZ
5.0688 MHZ
4.032 MHZ
SPR
KAYPRO
SER NO. _____
MADE IN U.S.A.
ASSY 81-_____

IC LIST, 81-184-n

Reference Designation		Description
U1, U54	74Ø6	Hex inverter, open collector
U2, U25, U71	74LS14	Hex Schmitt inverter
U3, U5	1489	Quad Schmitt line driver
U4	1488	Quad line driver
U6, U13, U14, U55, U58	74LS373	Octal "D" latch
U7	74LS38	Positive-NAND buffer
U8	74LS374	Octal "D" flip-flop
U9	81-235	Character PROM (2732)
U1Ø	81-189	Custom gate array
U11, U17	Z8ØA SIO	
U12	LM324	Op-Amp
U15, U23	6116	Video RAM
U16	6545A	Video controller
U18	TMS 99532	Modem
U19	TMS 99531	Dialer
U2Ø, U31	74LS245	Octal bus transceiver (3-state outputs)
U21	4N35	Photo isolator
U22	3.9K	Pullup resistor, 14-pin DIP
U24	WD1943/ 8116	Dual programmable baud rate generator
U26, U27	74LS138	3/8 MUX
U28, U51	74LS244	Octal buffer/line driver
U29	81-194	Custom gate array
U32, U33, U38, U39, U41, U42, U47, U48	2164	64K x 1 RAM
U34	81-292	Boot PROM (2764)
U35	Z8ØA PIO	
U36	MM581678	Clock
U37, U45, U59, U72	74LSØ2	Quad NOR gate
U4Ø	74LSØØ	Quad NAND gate
U43	Z8ØA CPU	
U44	1793	Floppy disk controller
U46	74LSØ4	Hex inverter
U52	74LS32	Quad OR gate
U53, U7Ø, U74, U75		Spares
U6Ø	74LS195	4-bit shift register
U61	74LSØ8	Quad AND gate
U65	74LS1Ø	Tri NAND gate
U66, U75	74LS74	Dual "D" flip-flop
U67	FDC9216	Data separator
U73	74HCØØ	Quad NAND gate


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
A | 11-8-83 | REMOVED U73 (74S08) | 11-18-83 | RWJ
B | ALL | ADDED U73 2764 PINS 1&27 TIED TO +5 | 1-17-84 | RWJ
U NOS. USED: 25,26,27 28,31,34,37 40,43,45,46, 52,54,56,61, 69,71,72,73
SPR UNS: 1,5,25,45 61
U NO.'S NOT USED: 30, 49, 50, 56, 57, 62, 63, 64, 68 & 69
SPARE I.C.'S: U53, U70, U74, U75
SPARE J7-1
-12V J7-2 TO: U4-1
+12V J7-3 TO: U4-19, U44-40
GND J7-4
KEY J7-5 N/C
+5V J7-6
PROPRIETARY INFORMATION
Property of Kaypro Corporation
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL
CONTR. NO.
DRAWN RJ 9-2-83
CHECK
APPR 9-5-83
RELEASE DATE
BOARD REV B (81-184)
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
PARTS LIST
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, PROCESSOR
KAYPRO 4/84
SIZE C | CODE IDENT NO. 03626 | 81-185
SCALE | WEIGHT | SHEET 2A
6-36

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	10-12-83 4 ON	R6 WAS 200Ω	11-18-83	RWJ
	B	2-23-84 + ON	R5 WAS 150Ω, R6 WAS 330Ω ADDED U75 FOR VIDEO TIMING	2-23-84	HRB RJ
	C	4-4-84	U22 RESISTOR NETWORK REMOVED 74LS08 INSERTED INTO U22 POSITION ... ADDED 74LS157 TO CHANGE Ø2 ON WRITE	4-4-84	HRB RJ



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

PROPRIETARY INFORMATION
Not for distribution or transmission to any other person or organization without the permission of Kaypro Corporation

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION			

CONTR. NO.
DRAWN RJ 9-1-83
CHECK
APPR RWJ 9-5-83
RELEASE DATE 9-20-83

BOARD REV B (81-184)

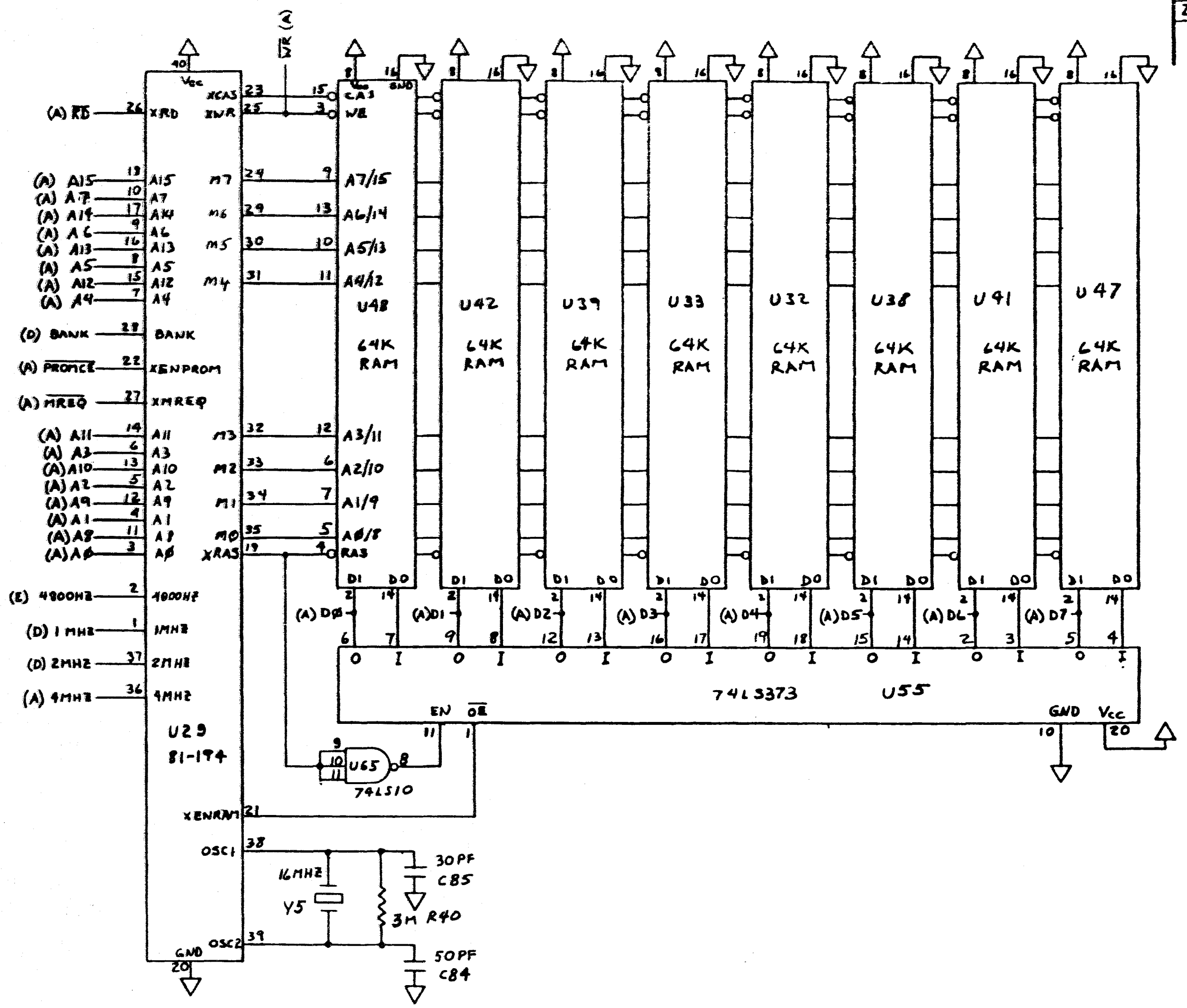
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, VIDEO
KAYPRO 4/84

SIZE C | CODE IDENT NO. 03626 | 81-185
SCALE | WEIGHT

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

REVISIONS



U NOS USED: 29, 48, 42, 39, 33, 32, 38, 41, 47, 55, 65

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 | ANGLES ± 0° 30'
FRACTIONS ± 1/32

MATERIAL

CONTR. NO.		
DRAWN	RJ	9-1-83
CHECK		
APPR	RJ	9-16-83
RELEASE DATE	1-30-83	

BOARD REV B
(81-184)

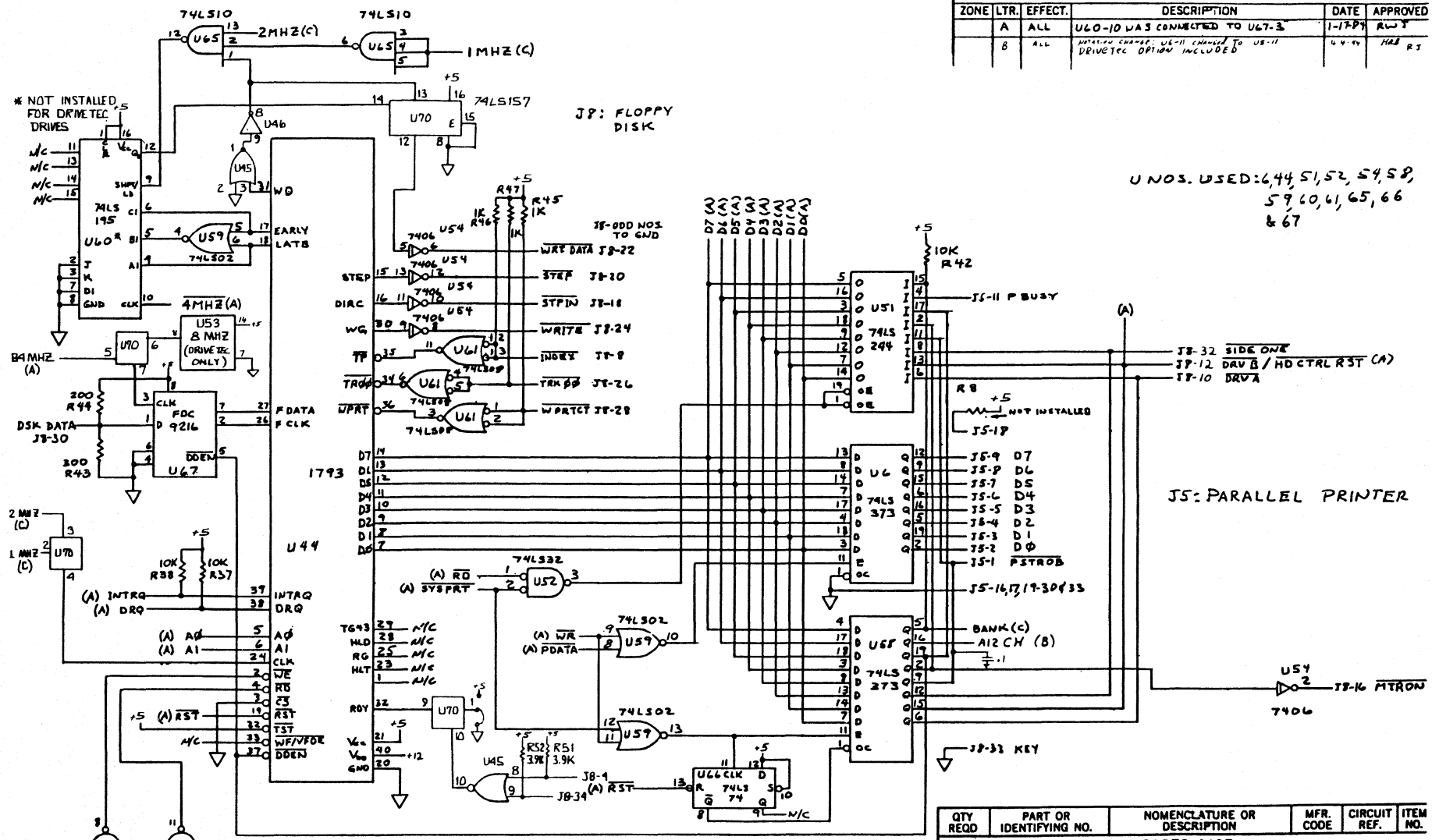
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, RAM

KAYPRO 4/84

SIZE C | CODE IDENT NO. 03626 | 81-185

SCALE | WEIGHT | SHEET 2 C



6—39

REVISIONS

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	ALL	U60-10 WAS CONNECTED TO U67-3	1-17-84	RWT
	B	ALL	NOTATION CHANGE: U6-11 CHANGED TO U8-11 DRIVETEC OPTION INCLUDED	4-4-84	HAB RJ

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL

CONTR. NO.		
DRAWN	RJ	9-4-83
CHECK		
APPR	RWT	9-5-83
RELEASE DATE	9-20 83 KS	

BOARD REV B
(81-184)

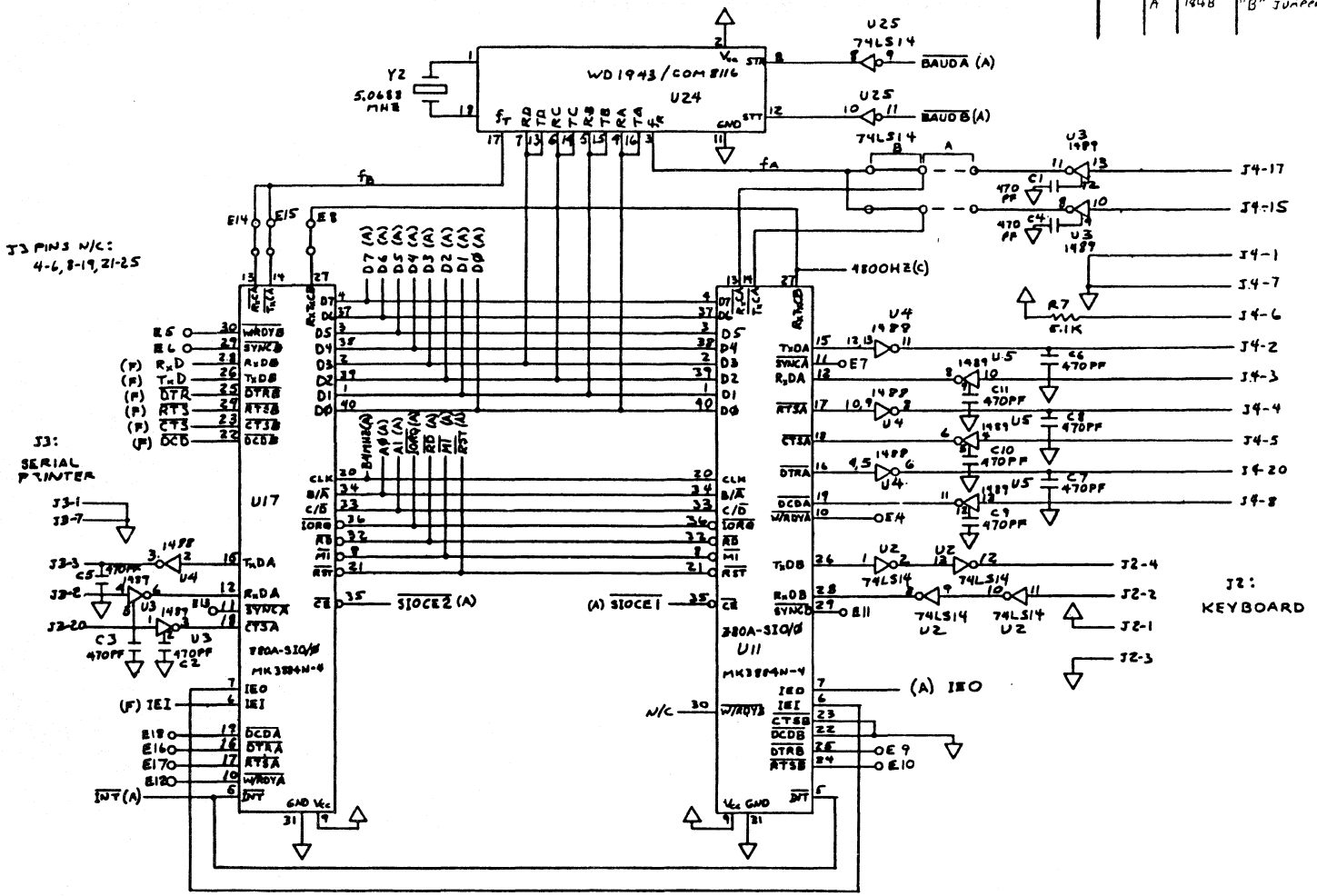
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, FLOPPY CONTROL & PARALLEL PRINTER
KAYPRO 4/84

SIZE	CODE IDENT NO.	
C	03626	81-185

SCALE | WEIGHT | SHEET 2 D

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	1848	"B" JUMPERS INSTALLED IN FOIL	3-23-84	HRB RT



U NOS. USED: 2, 3, 4, 5, 11, 17, 24, 25

J3 PINS N/C: 4-6, 8-19, 21-25

J4 PINS N/C: 9-14, 16, 18, 19, 21-25

PWR TO U4: +12V TO PIN 14
GND TO PIN 7
-12V TO PIN 1

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32	DRAWN	R J	9-3-83
	CHECK		
	APPR	RWJ	9-5-83
	RELEASE DATE	9-20-83 KSD	
MATERIAL	BOARD Rev B (81-184)		

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

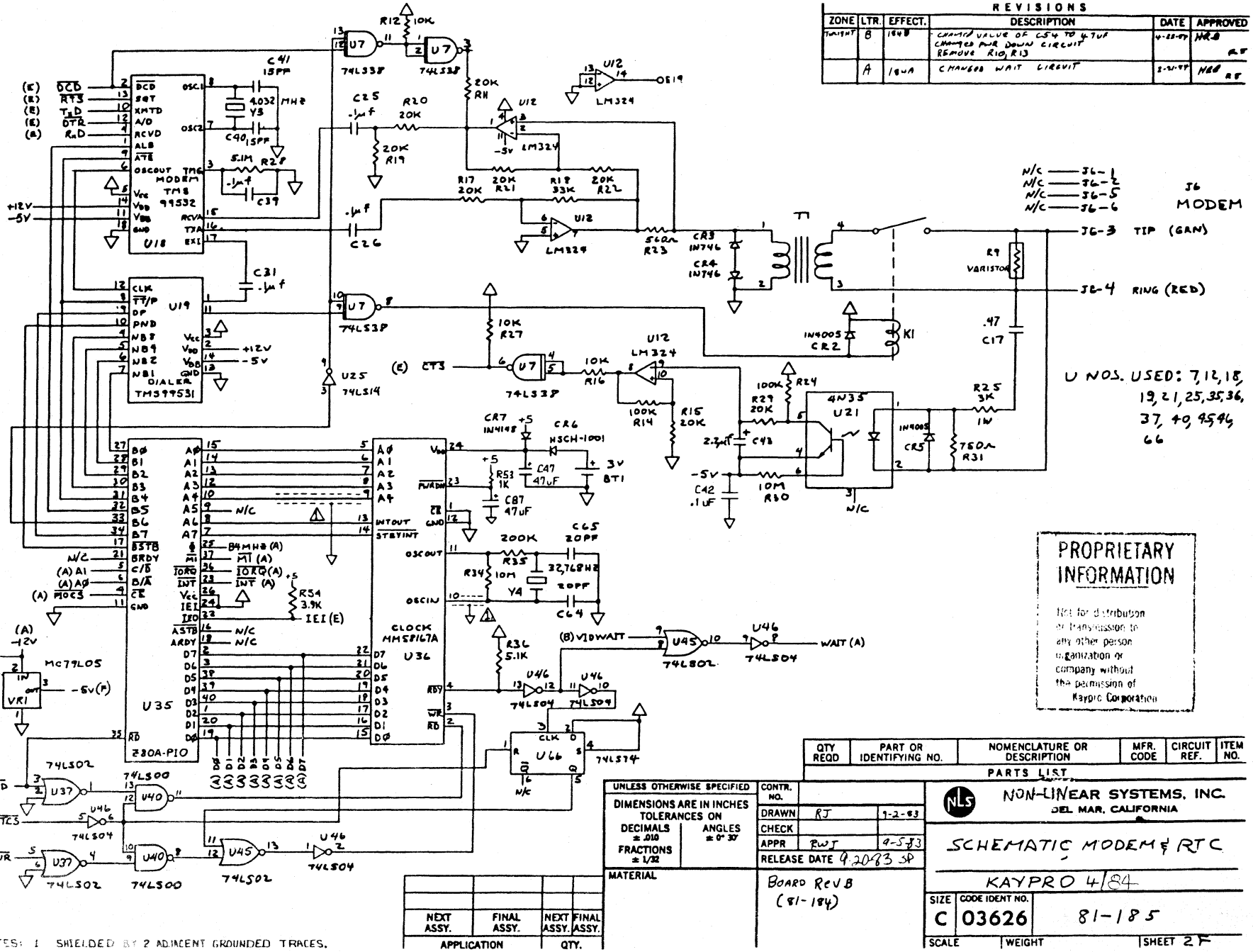
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

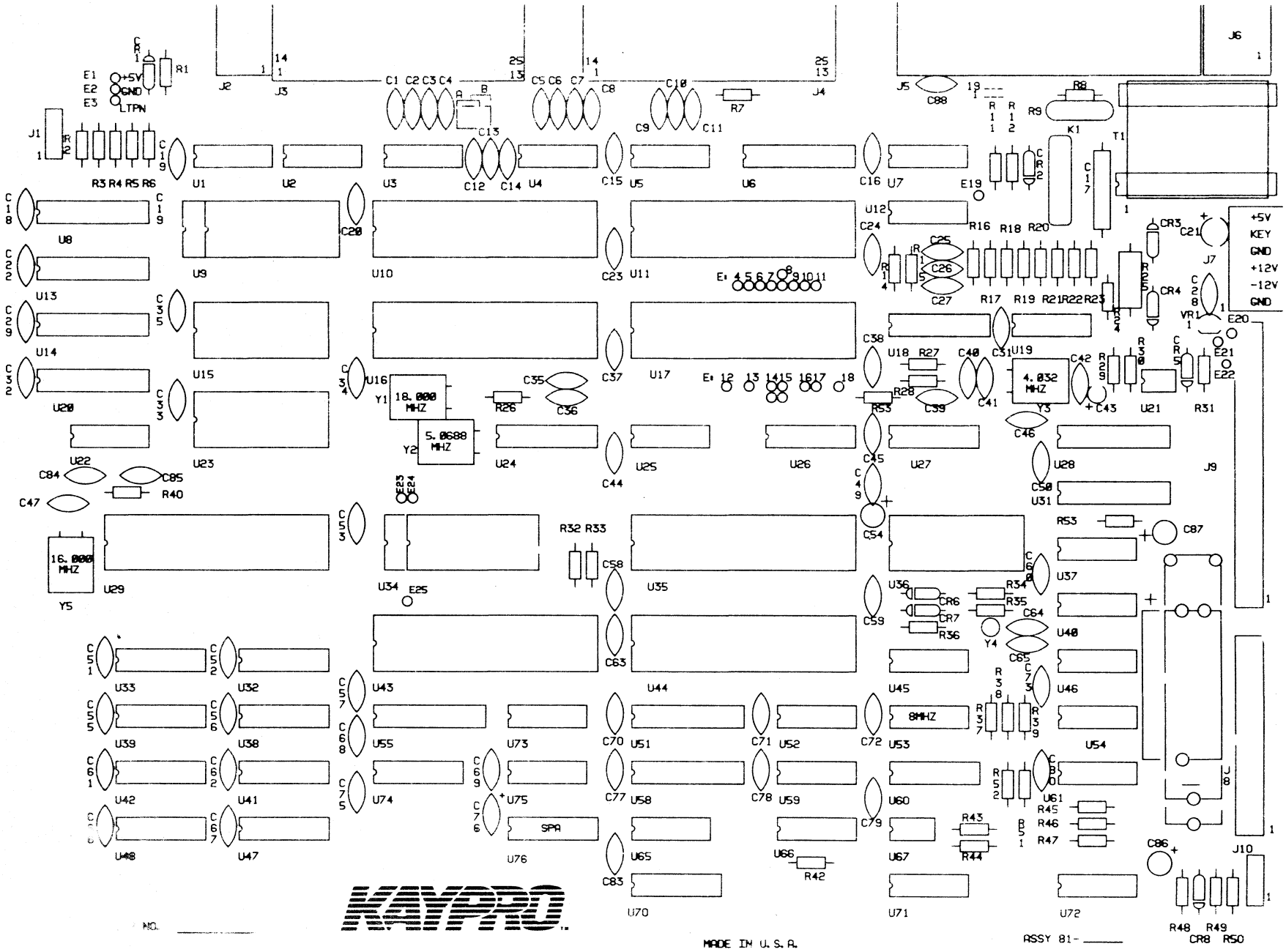
SCHEMATIC, SERIAL PORTS

KAYPRO 4/84

SIZE	CODE IDENT NO.	
C	03626	81-185

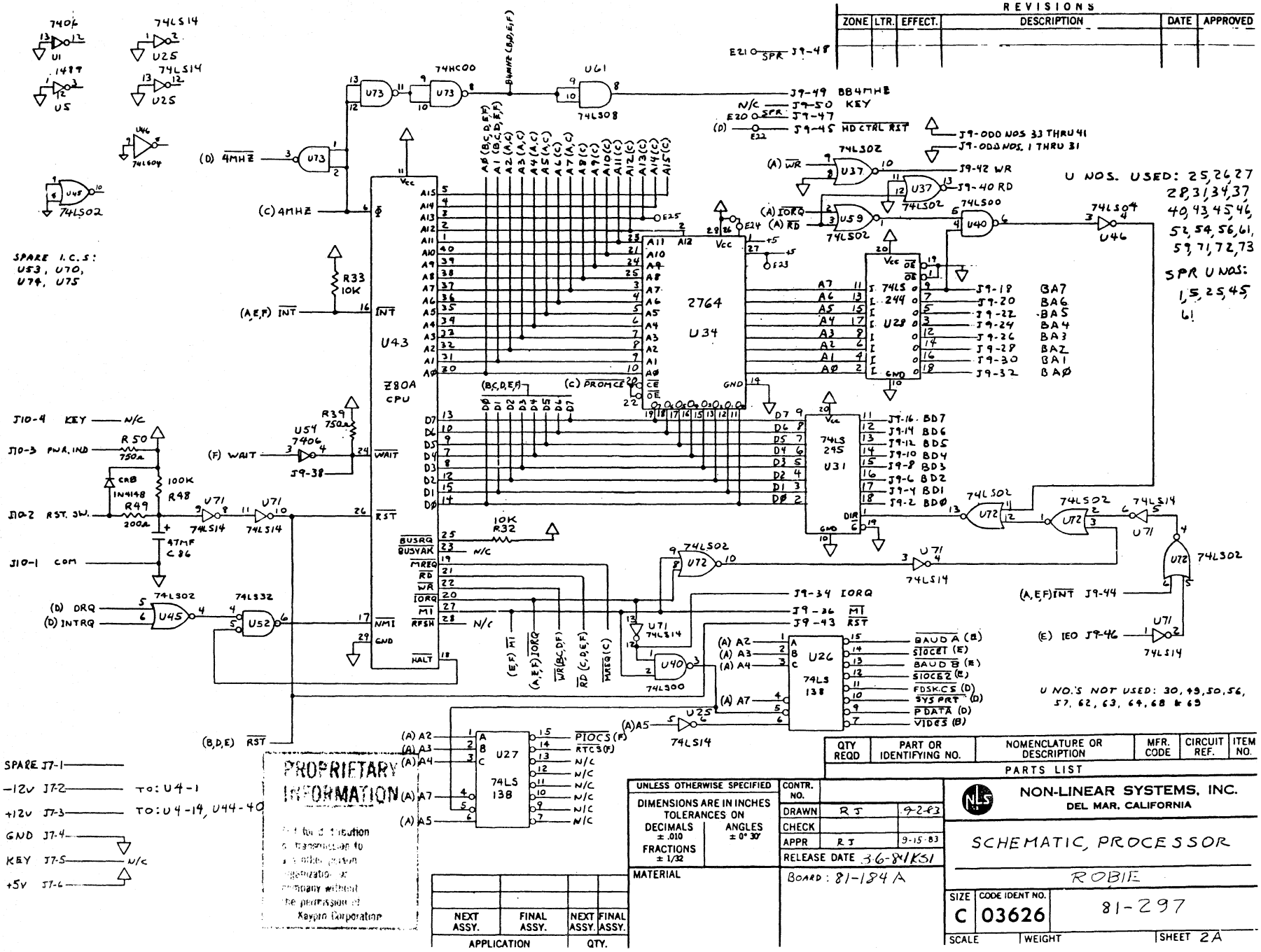
SCALE | WEIGHT | SHEET 2E


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
TWIGHT | B | 16kB | CHANGED VALUE OF C54 TO 4.7uF CHANGED PWR DOWN CIRCUIT REMOVE R10, R13 | 4-28-83 | MRB RF
A | 16kA | CHANGED WAIT CIRCUIT | 2-24-83 | MRB RF
U NOS. USED: 7, 12, 18, 19, 21, 25, 35, 36, 37, 40, 45, 46, 66
J6 MODEM
J6-3 TIP (GRN)
J6-4 RING (RED)
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL
CONTR. NO.
DRAWN RJ 9-2-83
CHECK
APPR RWJ 9-5-83
RELEASE DATE 9.20.83 SP
BOARD REV B (81-184)
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC MODEM & RTC
KAYPRO 4/84
SIZE C | CODE IDENT NO. 03626 | 81-185
SCALE | WEIGHT | SHEET 2F
NOTES: 1 SHIELDED BY 2 ADJACENT GROUNDED TRACES.


J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
E1
E2
E3
+5V
GND
LTPN
R1
R3 R4 R5 R6
C1 C2 C3 C4
C5 C6 C7 C8
C9 C11
C10
R7
C13
C12 C14
C15
C16
C88
R8
R9
K1
T1
R10 R11 R12
C17
C18
C19
C20
C22
C23
C24
C25
C26
C27
R14
R15
R16 R18 R20
R17 R19 R21 R22 R23
R24
R50
CR3
CR4
C21
C28
VR1
E20
E21
E22
+5V
KEY
GND
+12V
-12V
GND
C29
C32
C33
C34
C35
C36
C37
C38
C40
C41
C42
C43
C45
C46
C49
C50
C51
C52
C53
C54
C55
C56
C57
C58
C59
C60
C61
C62
C63
C64
C65
C66
C67
C68
C69
C70
C71
C72
C73
C76
C77
C78
C79
C80
C83
C84
C85
C86
C87
U1 U2 U3 U4 U5 U6 U7
U8 U9 U10 U11 U12
U13 U14 U15 U16 U17 U18 U19
U20 U21 U22 U23 U24 U25 U26 U27 U28
U29 U31 U32 U33 U34 U35 U36 U37
U38 U39 U40 U41 U42 U43 U44 U45 U46
U47 U48 U51 U52 U53 U54 U55 U58 U59 U60 U61
U65 U66 U67 U70 U71 U72 U73 U74 U75 U76
R26 R27 R28 R29 R30 R31
R32 R33 R34 R35 R36
R37 R38 R39
R40 R42 R43 R44 R45 R46 R47
R48 R49
R51 R52 R53
CR6 CR7 CR8 R50
Y1 18.000 MHZ
Y2 5.0688 MHZ
Y3 4.032 MHZ
Y4 8MHZ
Y5 16.000 MHZ
E4 5 6 7 8 9 10 11
E12 13 14 15 16 17 18
E23 E24 E25
SPA
KAYPRO
MADE IN U.S.A.
NO. _____
ASSY 81-_____

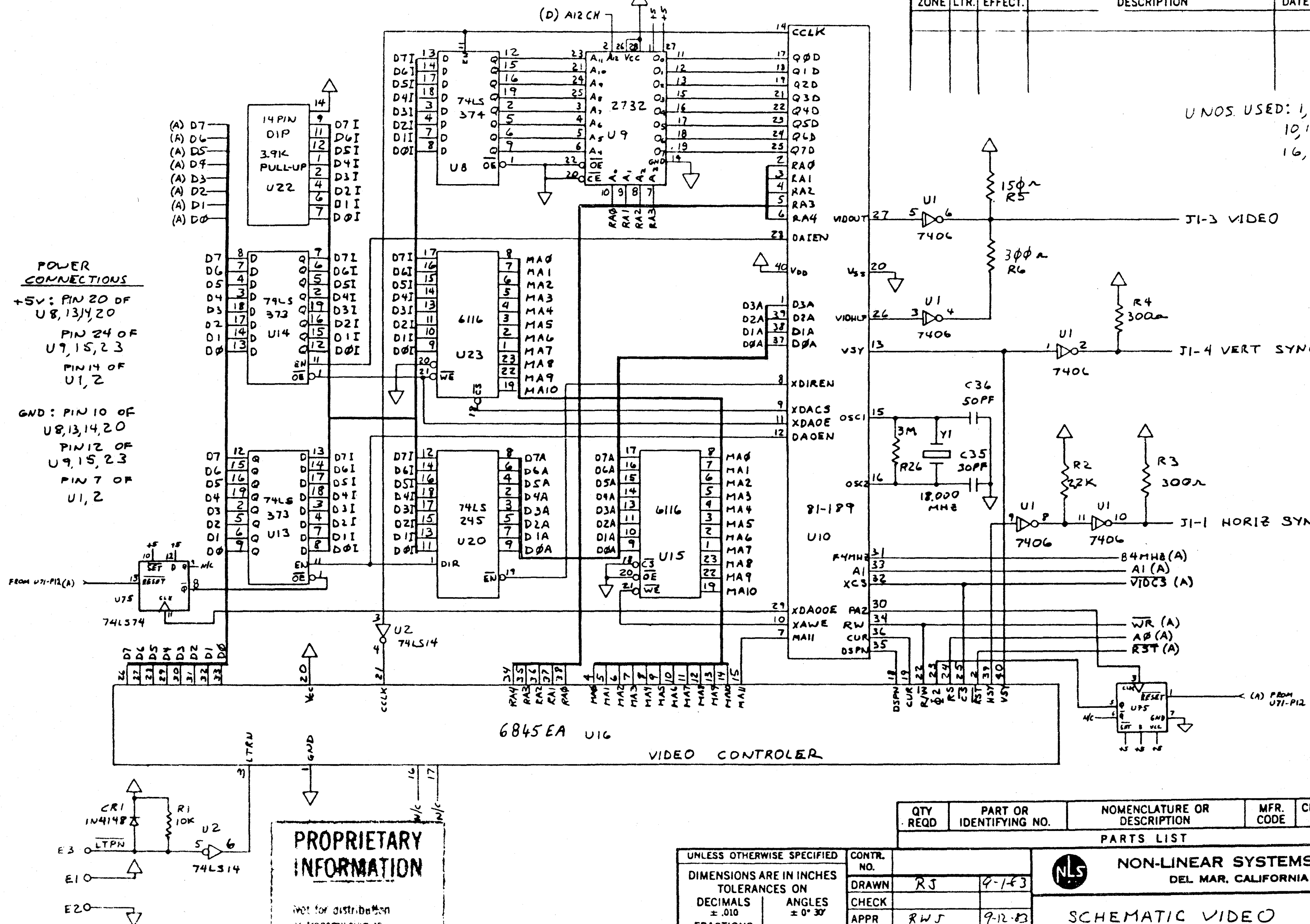
IC LIST, 81-296-n

Reference Designation		Description
U1, U54	74Ø6	Hex inverter, open collector
U2, U25, U71	74LS14	Hex Schmitt inverter
U3, U5	1489	Quad Schmitt line driver
U4	1488	Quad line driver
U6, U13, U14, U55, U58	74LS373	Octal "D" latch
U7	74LS38	Positive-NAND buffer
U8	74LS374	Octal "D" flip-flop
U9	81-235	Character PROM (2732)
U1Ø	81-189	Custom gate array
U11, U17	Z8ØA SIO	
U12	LM324	Op-Amp
U15, U23	6116	Video RAM
U16	6545EA	Video controller
U18	TMS 99532	Modem
U19	TMS 99531	Dialer
U2Ø, U31	74LS245	Octal bus transceiver
U21	4N35	Photo Isolator
U22	3.9K	Pullup resistor, 14-pin DIP
U24	WD1943/ 8116	Dual programmable baud rate generator
U26, U27	74LS138	3/8 MUX
U28, U51	74LS244	Octal buffer/line driver
U29	81-194	Custom gate array
U32, U33, U38, U39, U41, U42, U47, U48	2164	64K x 1 RAM
U34	81-326	Boot PROM (2764)
U35	Z8ØA PIO	
U36	MM581678	Clock
U37, U45, U59, U72	74LSØ2	Quad NOR gate
U4Ø	74LSØØ	Quad NAND gate
U43	Z8ØA CPU	
U44	1793	Floppy disk controller
U46	74LSØ4	Hex inverter
U52	74LS32	Quad OR gate
U7Ø, U74, U75		Spares
U6Ø	74LS195	4-bit shift register
U61	74LSØ8	Quad AND gate
U65	74LS1Ø	Tri NAND gate
U66, U75	74LS74	Dual "D" flip-flop
U67	FDC9216	Data separator
U73	74HCØØ	Quad NAND gate


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
U NOS. USED: 25,26,27, 28,31,34,37, 40,43,45,46, 52,54,56,61, 69,71,72,73
SPR U NOS: 1,5,25,45, 61
SPARE I.C.S: U53, U70, U74, U75
U NOS. NOT USED: 30, 49, 50, 56, 57, 62, 63, 64, 68 & 69
Z80A CPU
U43
2764 U34
74LS 245 U31
74LS 244 U28
74LS 138 U26
74LS 138 U27
SPARE J7-1
-12V J7-2 TO: U4-1
+12V J7-3 TO: U4-14, U44-40
GND J7-4
KEY J7-5 N/C
+5V J7-6
PROPRIETARY INFORMATION
Exidy Corporation
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL
CONTR. NO.
DRAWN RJ 9-2-83
CHECK
APPR RJ 9-15-83
RELEASE DATE 36-84/KS1
BOARD: 81-184 A
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
PARTS LIST
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, PROCESSOR
ROBIE
SIZE C | CODE IDENT NO. 03626 | 81-297
SCALE | WEIGHT | SHEET 2A

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

REVISIONS



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

PROPRIETARY INFORMATION

Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION			

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL

CONTR. NO.		
DRAWN	RJ	9-1-83
CHECK		
APPR	RWJ	9-12-83
RELEASE DATE	3-6-84 KSI	

BOARD: 81-194A

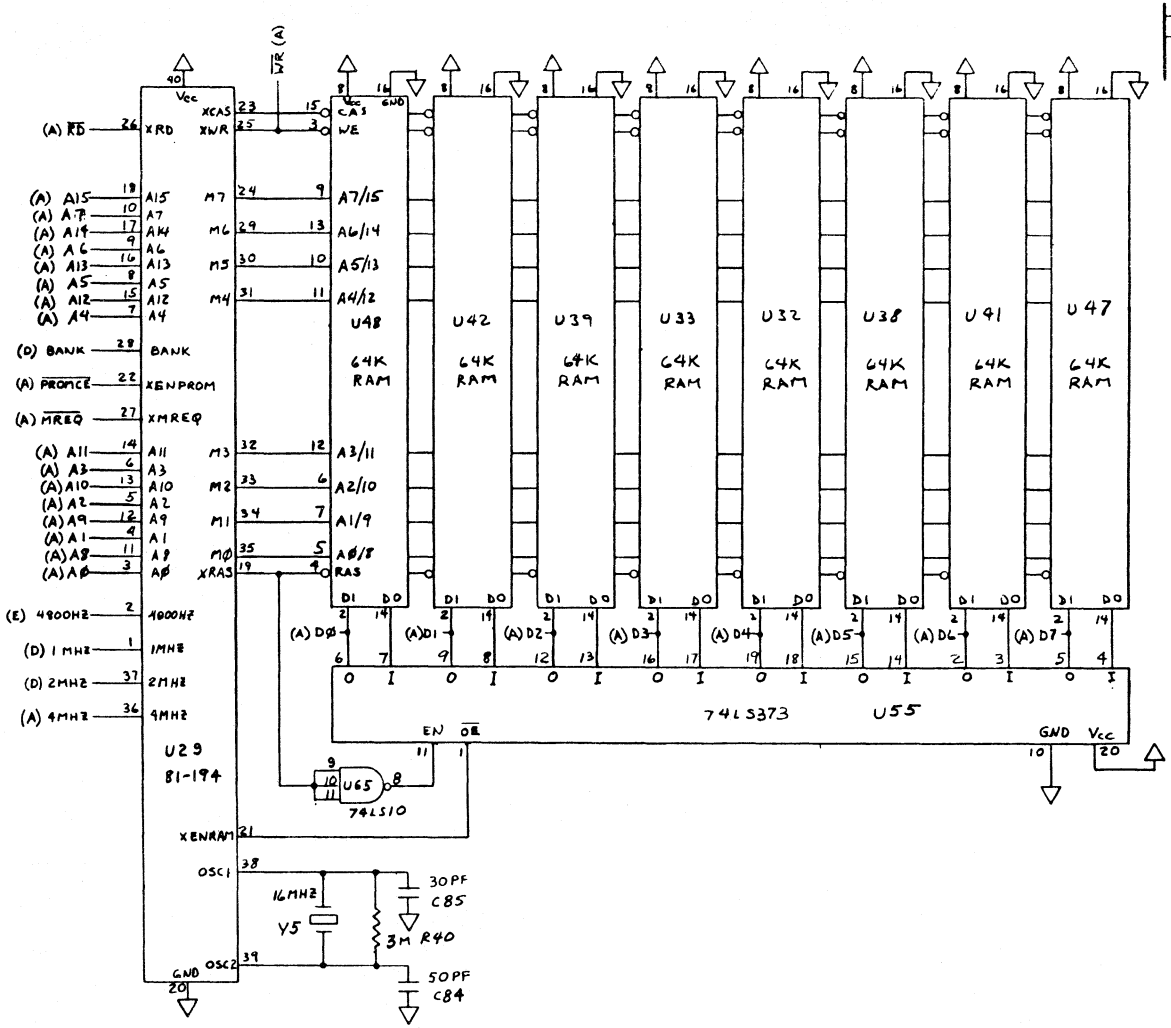
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, VIDEO

ROBIE

SIZE: C | CODE IDENT NO.: 03626 | 81-297

SCALE | WEIGHT | SHEET 28



U NOS USED: 29, 48, 42, 39, 33, 32, 38, 41, 47, 55, 65

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.
PARTS LIST					

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	DRAWN	R J	7-1-83
	CHECK		
	APPR	R J	9-16-83
	RELEASE DATE 3-6-84 KS1		
MATERIAL	BOARD: 81-184A		

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

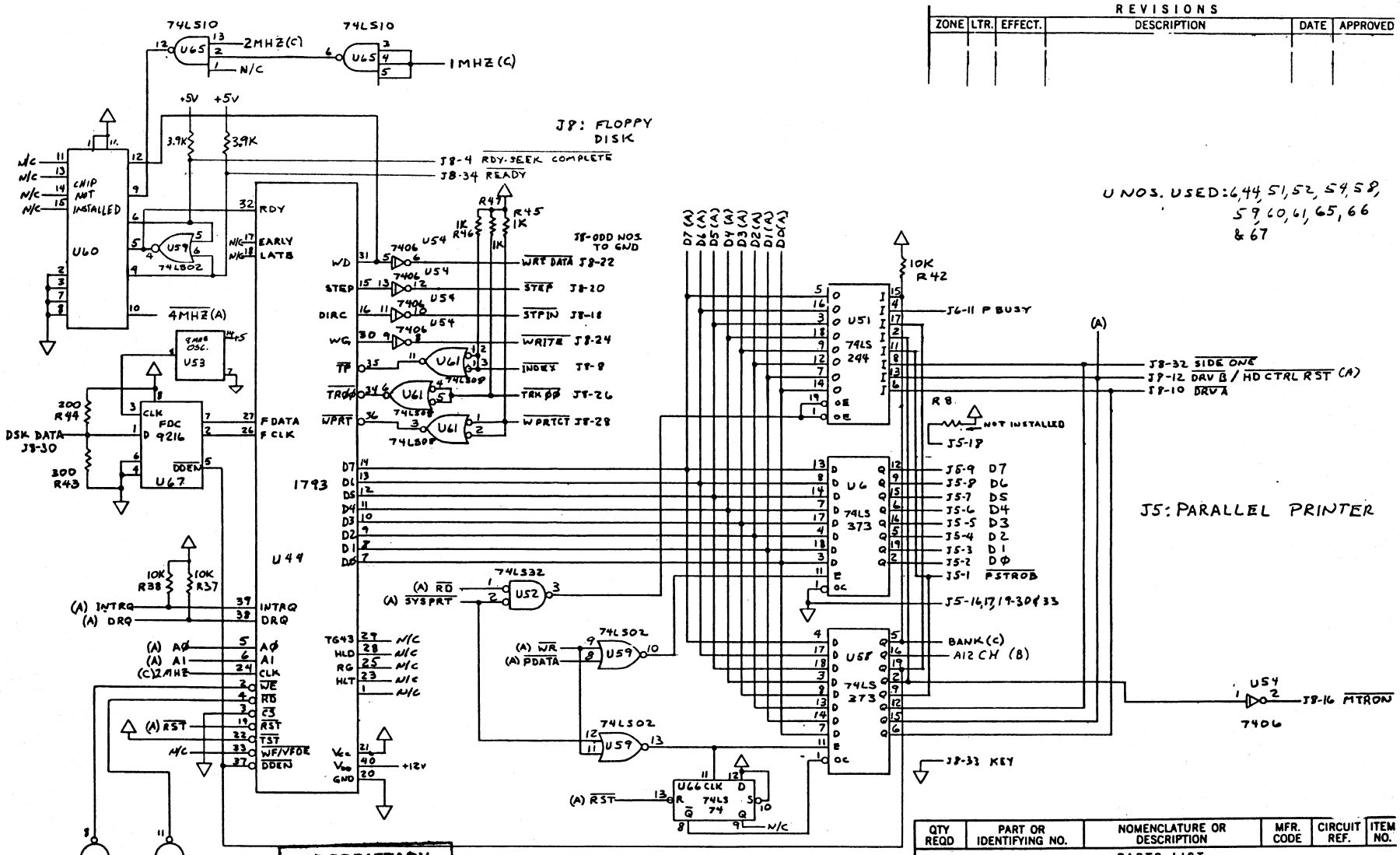
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, RAM

ROBIE

SIZE	CODE IDENT NO.	
C	03626	81-297

SCALE | WEIGHT | SHEET 2 C



REVISIONS

ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'

MATERIAL

CONTR. NO.			
DRAWN	RJ	9-4-83	
CHECK			
APPR	RJ	9-15-83	
RELEASE DATE	3-6-84 KSJ		

BOARD: 81-184A

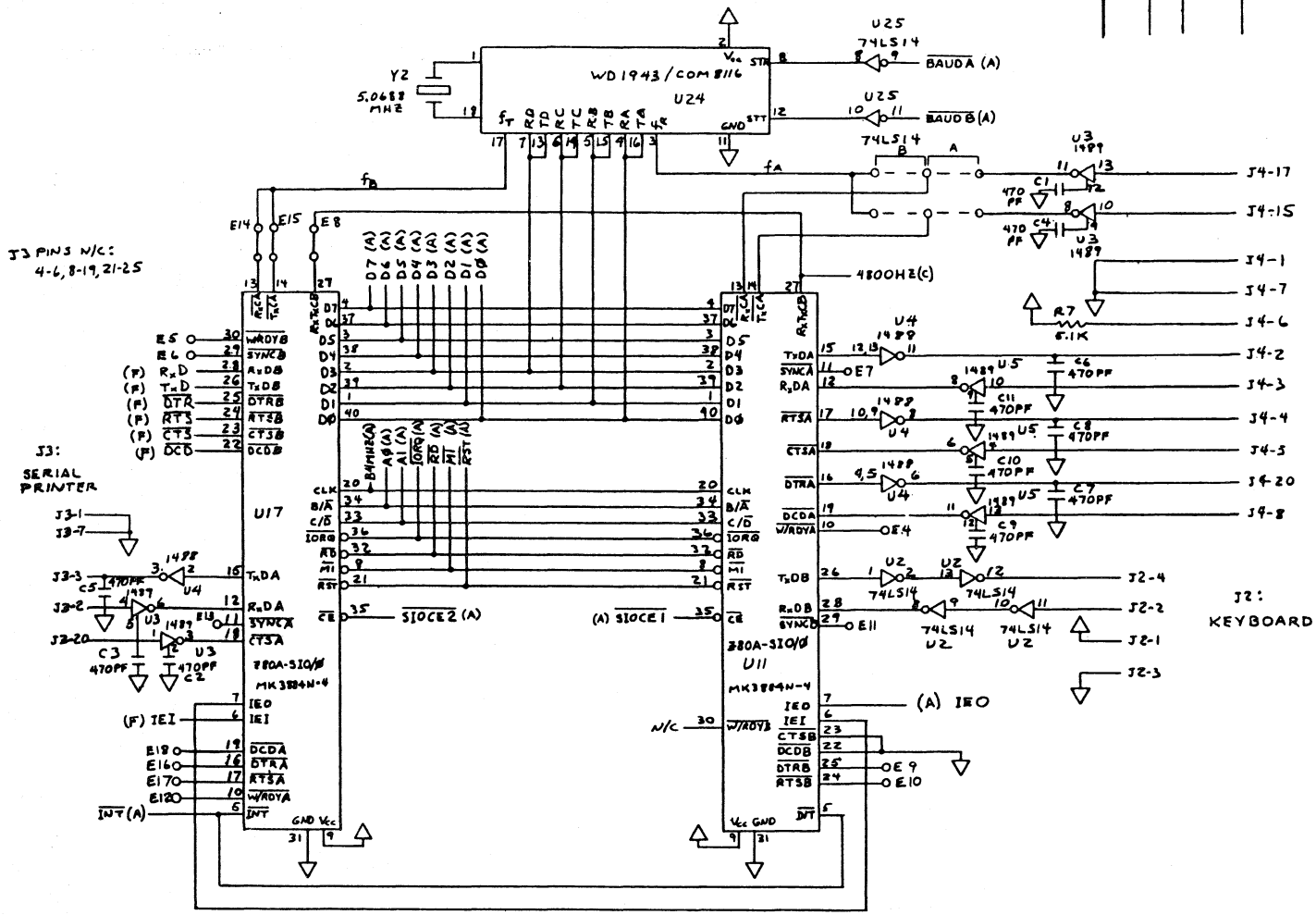
NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, FLOPPY CONTROL & PARALLEL PRINTER

ROBIE

SIZE	CODE IDENT NO.	
C	03626	81-297
SCALE	WEIGHT	SHEET 2 D



REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.
PARTS LIST					

UNLESS OTHERWISE SPECIFIED		CONTR. NO.	
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32		DRAWN	R J 9-3-83
		CHECK	
		APPR	R S 9-11-83
		RELEASE DATE	3-6-84 KM
MATERIAL		BOARD:	81-184A

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

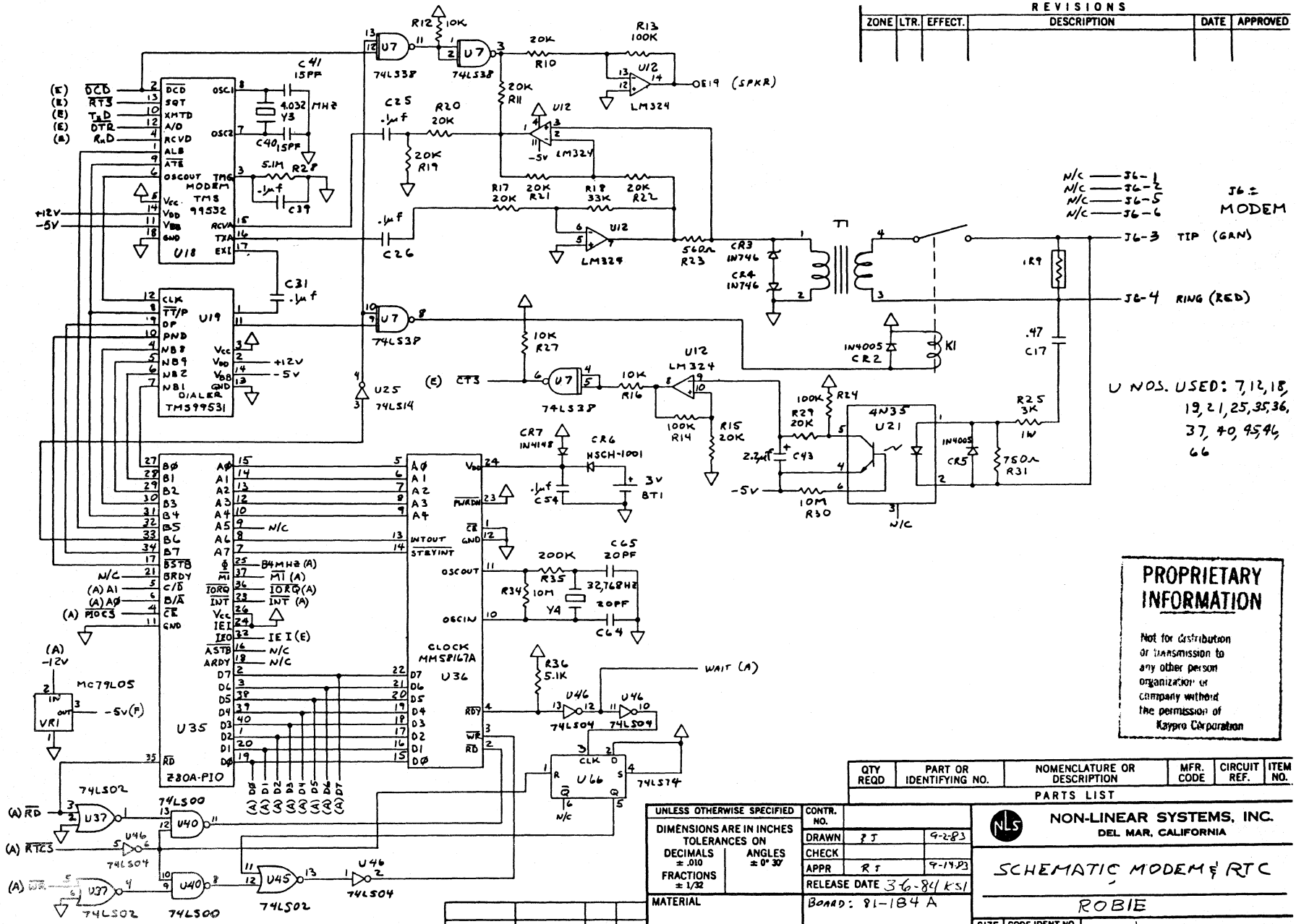
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

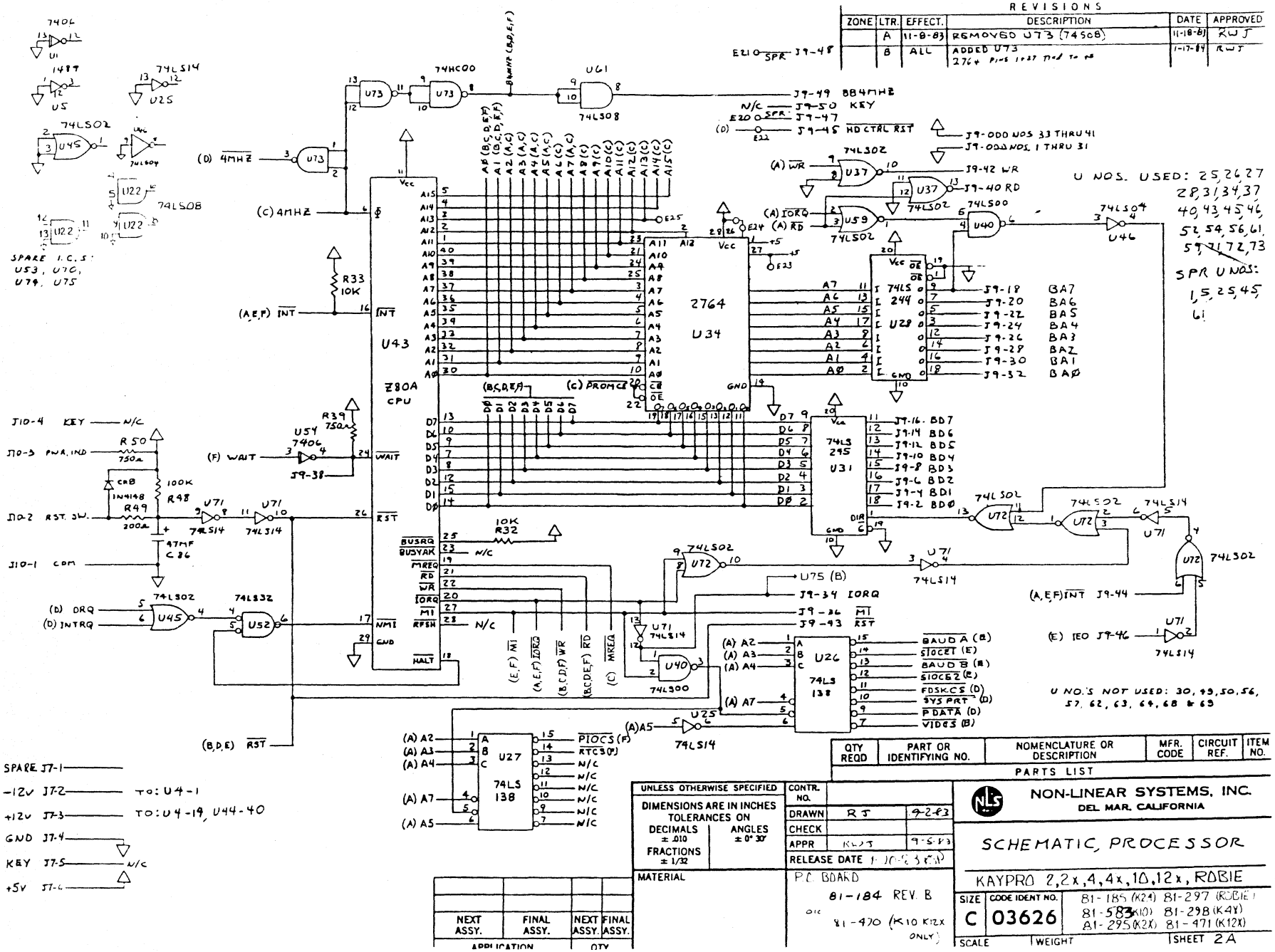
SCHEMATIC, SERIAL PORTS

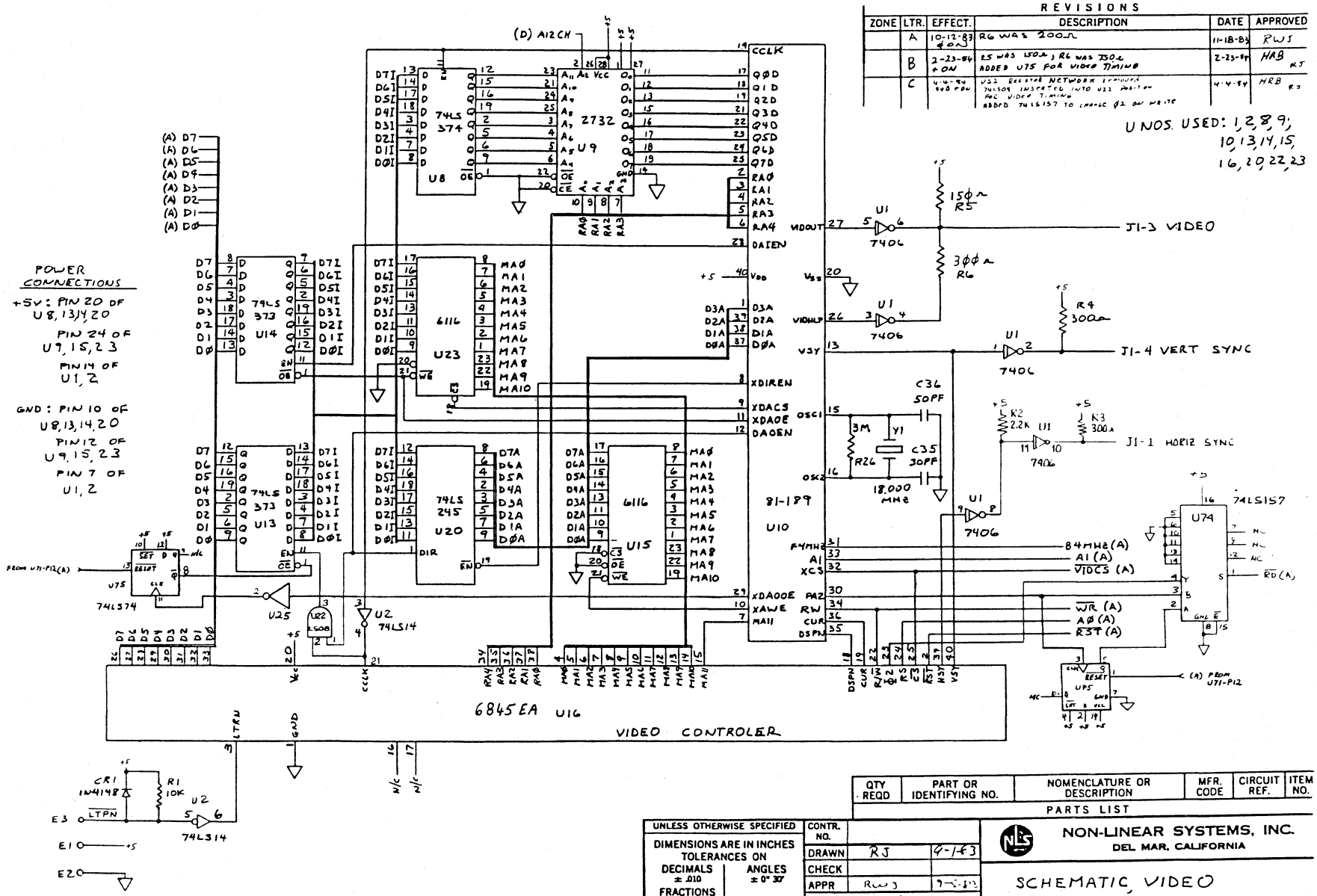
ROBIE

SIZE	CODE IDENT NO.	
C	03626	81-297

SCALE | WEIGHT | SHEET 2E


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
U NOS. USED: 7, 12, 18, 19, 21, 25, 35, 36, 37, 40, 45, 46, 66
J6 = MODEM
J6-3 TIP (GRN)
J6-4 RING (RED)
N/C — J6-1
N/C — J6-2
N/C — J6-5
N/C — J6-6
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL
CONTR. NO.
DRAWN TJ 9-2-83
CHECK
APPR RT 9-19-83
RELEASE DATE 36-84 KSI
BOARD: 81-184 A
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC MODEM & RTC
ROBIE
SIZE C | CODE IDENT NO. 03626 | 81-297
SCALE | WEIGHT | SHEET 2F


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
A | 11-8-83 | REMOVED U73 (74S08) | 11-18-83 | RWJ
B | ALL | ADDED U73 | 1-17-84 | RWJ
U NOS. USED: 25,26,27 28,31,34,37 40,43,45,46 52,54,56,61, 69,71,72,73
SPR UNS: 1,5,25,45 61
U NO.'S NOT USED: 30, 49, 50, 56, 57, 62, 63, 64, 68 & 69
SPARE I.C.'S: U53, U76, U79, U75
SPARE J7-1
-12V J7-2 TO: U4-1
+12V J7-3 TO: U4-19, U44-40
GND J7-4
KEY J7-5 N/C
+5V J7-6
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
CONTR. NO.
DRAWN RJ 9-2-83
CHECK
APPR RWJ 9-5-83
RELEASE DATE
MATERIAL
P.C. BOARD
81-184 REV. B
81-470 (K10 K12X ONLY)
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, PROCESSOR
KAYPRO 2,2x,4,4x,10,12x, ROBIE
SIZE C | CODE IDENT NO. 03626
81-185 (K24) 81-297 (ROBIE)
81-583 (K10) 81-298 (K4Y)
81-295 (K2X) 81-471 (K12X)
SCALE | WEIGHT | SHEET 2A



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'

MATERIAL

CONTR. NO.		
DRAWN	RJ	4-1-83
CHECK		
APPR	RWJ	9-5-83
RELEASE DATE	9/21/83	

P.C. BOARD
81-184 REV B
OK
81-470 (K10, K12X ONLY)

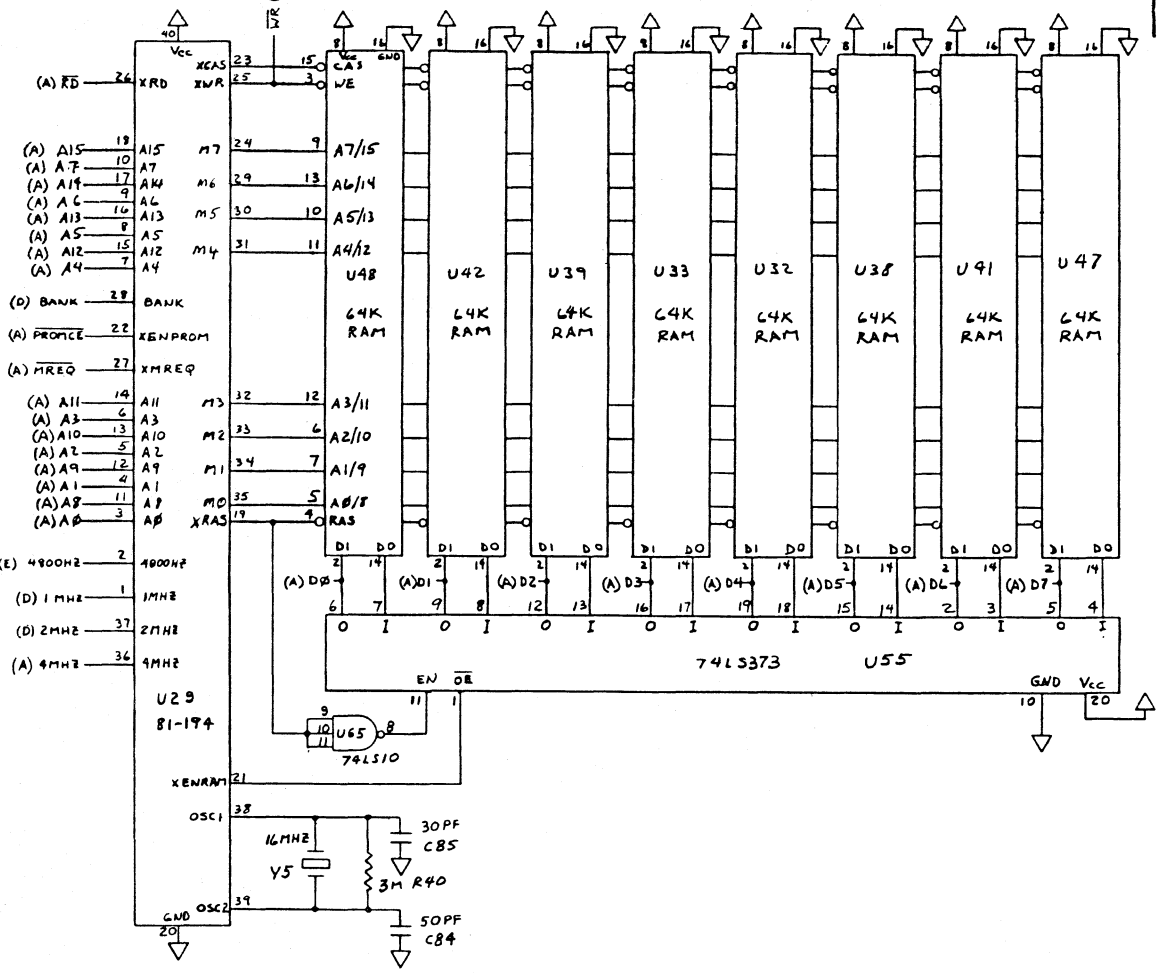
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, VIDEO

KAYPRO 2,2x,4,4x,10,12x, ROBIE

SIZE	CODE IDENT NO.	
C	03626	81-185 (K24) 81-297 (ROBIE) 81-58 (K10) 81-298 (K4X) 81-295 (K2X) 81-471 (K12X)

SCALE | WEIGHT | SHEET 28



REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

U NOS USED: 29, 48, 42, 39, 33, 32, 38, 41, 47, 55, 65

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32	DRAWN	R J	7-1-83
	CHECK		
	APPR	R J	9-16-83
	RELEASE DATE		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, RAM

KAYPRO 2,2x,4,4x,10,12x, ROBIE

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

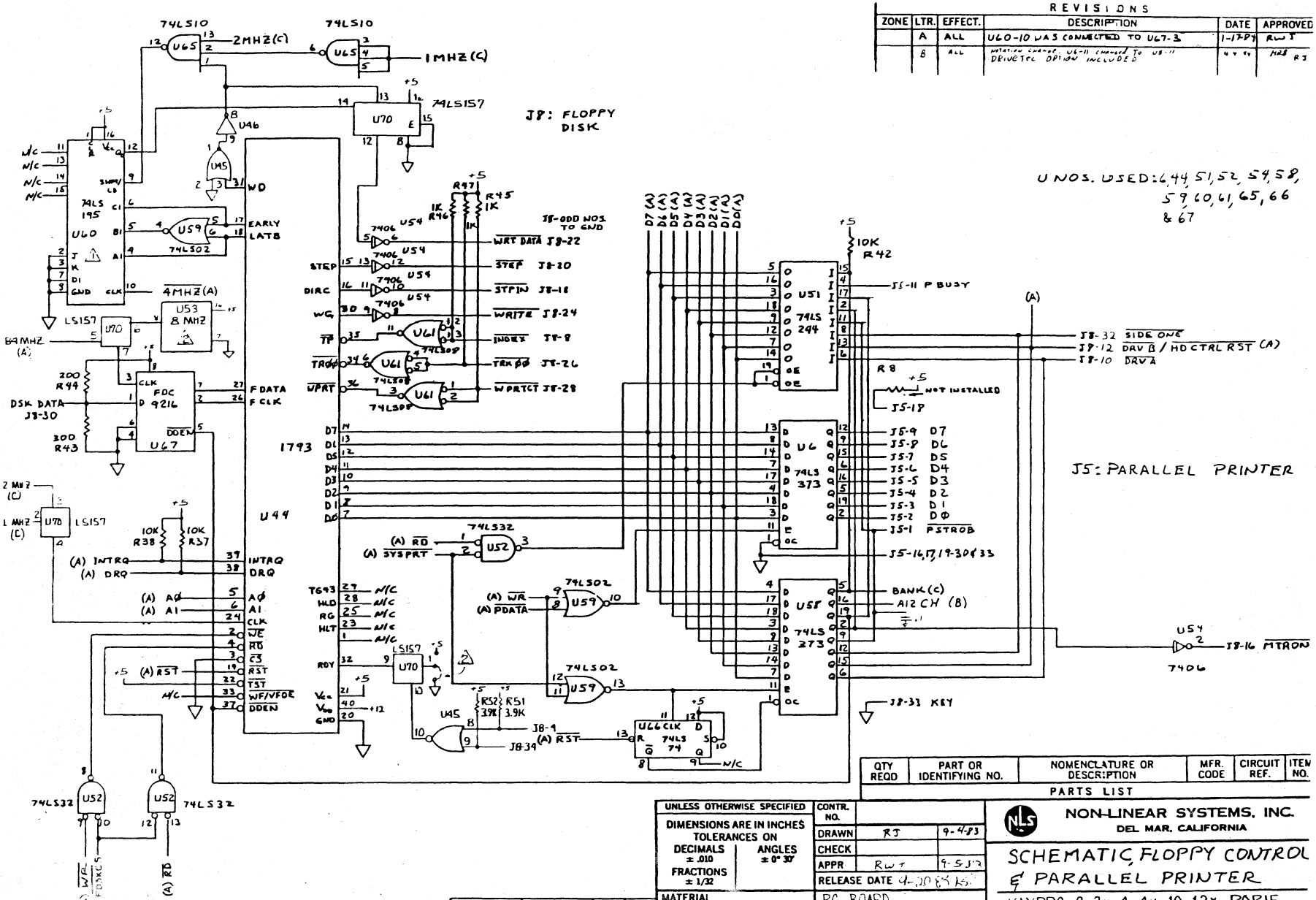
MATERIAL

P.C BOARD
81-184 REV. B
OR
81-470 (K10, K12X ONLY)

SIZE	CODE IDENT NO.	
C	03626	81-185 (K24) 81-297 (ROBIE) 81-[illegible] (K10) 81-298 (K4X) 81-295 (K2X) 81-471 (K12X)

SCALE | WEIGHT | SHEET 7 C

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	ALL	U60-10 WAS CONNECTED TO U67-3	1-17-84	RWT
	B	ALL	ROTATION CHANGE. U6-11 CHANGED TO U8-11 DRIVETEC OPTION INCLUDED	4-4-84	HRB RJ



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	DRAWN	RJ	9-4-83
	CHECK		
	APPR	RWT	9-5-83
	RELEASE DATE 4-20-84 KS		
MATERIAL	P.C. BOARD 81-184 REV. B OR 81-470 (K10, K12X ONLY)		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, FLOPPY CONTROL & PARALLEL PRINTER

KAYPRO 2,2X,4,4X,10,12X, ROBIE

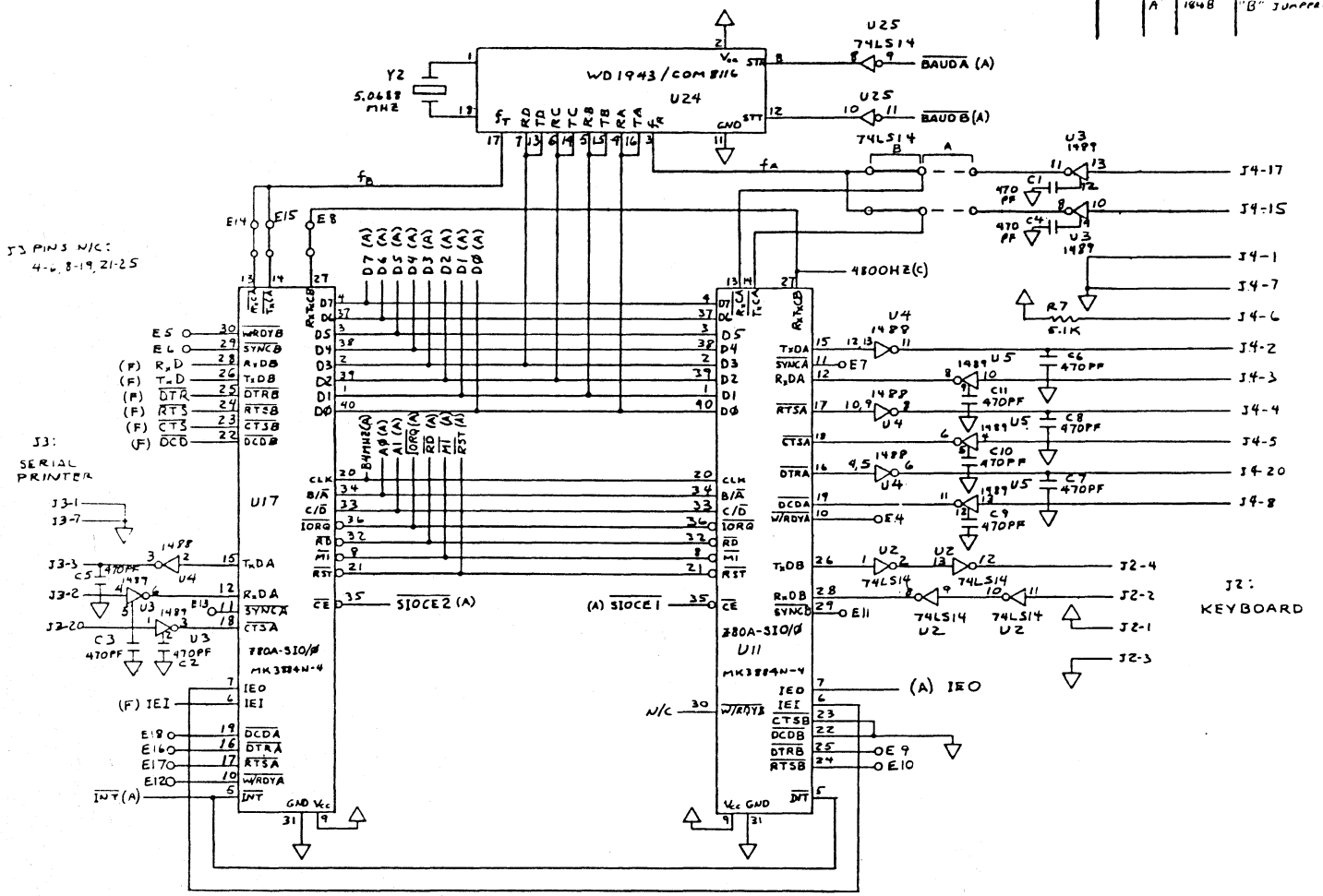
SIZE	CODE IDENT NO.	
C	03626	81-185 (K24) 81-297 (ROBIE) 81-523 (K10) 81-298 (K4X) 81-295 (K2X) 81-471 (K12X)

SCALE | WEIGHT | SHEET 2 D

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY	

NOTES:
1. U60 INSTALLED ON 2,2X,4,10.
2. ON 4X,12X,ROBIE: CUT JUMPER. ADD JUMPER TO +5V. INSTALL U53.

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
	A	1648	"B" JUMPERS INSTALLED IN FOIL	3-22-84	NRB MJ



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.
PARTS LIST					

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	DRAWN	R J	9-3-83
	CHECK		
	APPR	RWJ	9-5-83
	RELEASE DATE	9 [illegible]	
MATERIAL	P.C. BOARD 81-184 REV. B CK 81-470 (K10, K12X ONLY)		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

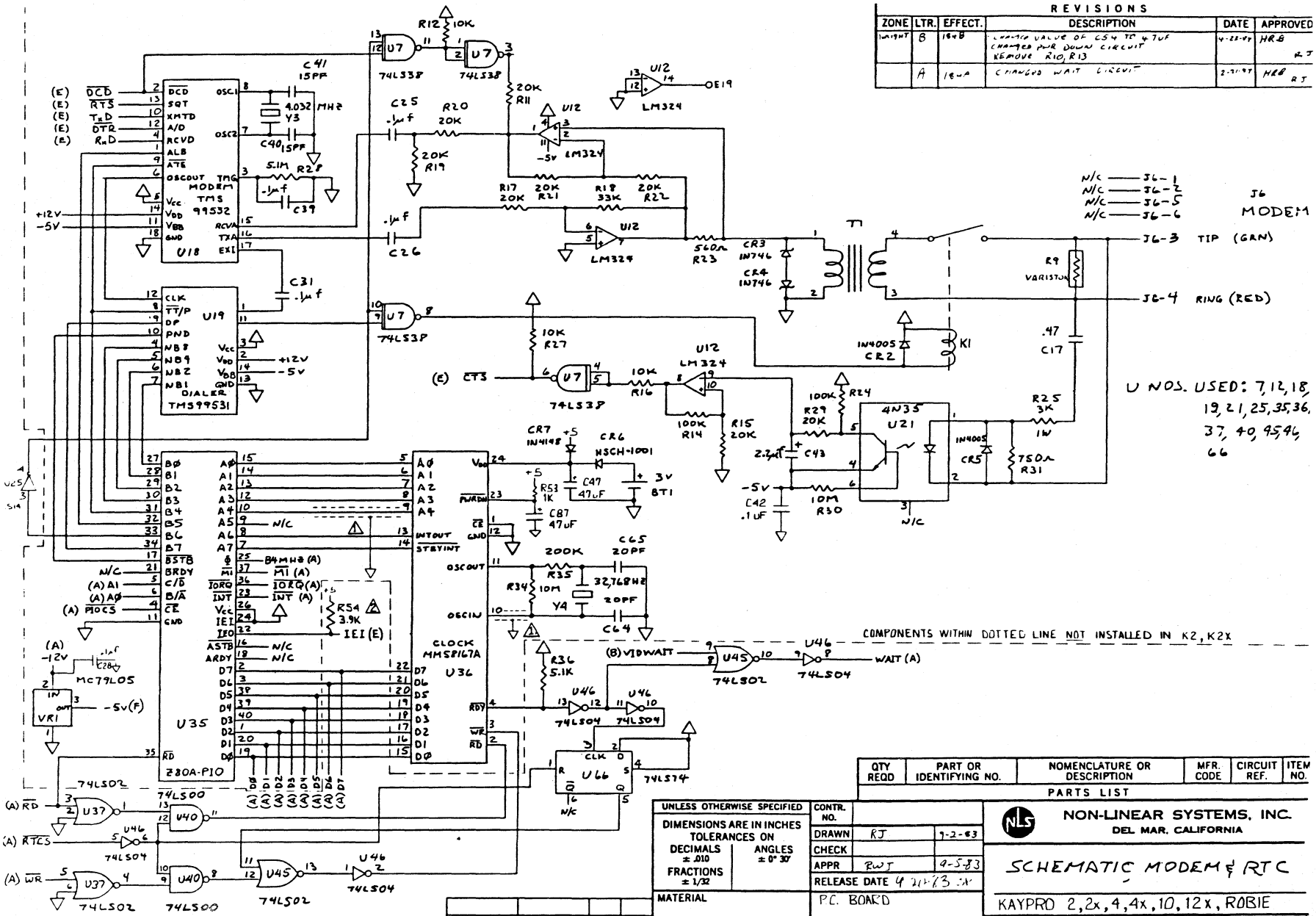
SCHEMATIC, SERIAL PORTS

KAYPRO 2,2x,4,4x,10,12x, ROBIE

SIZE	CODE IDENT NO.	
C	03626	81-185 (K24) 81-297 (ROBIE) 81-583 (K10) 81-298 (K4X) 81-295 (K2X) 81-471 (K12X)

SCALE | WEIGHT | SHEET 2E

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	



REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED
[illegible]	B	16K B	CHANGED VALUE OF C54 TO 4.7UF CHANGED PWR DOWN CIRCUIT REMOVE R10, R13	4-22-83	HRB RJ
	A	16K A	CHANGED WAIT CIRCUIT	2-21-83	HRB RJ

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	DRAWN	RJ	1-2-83
	CHECK		
	APPR	RWJ	4-5-83
	RELEASE DATE	4 21 83	
MATERIAL	P.C. BOARD 81-184 REV B (K10, K12X ONLY) 81-470		

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

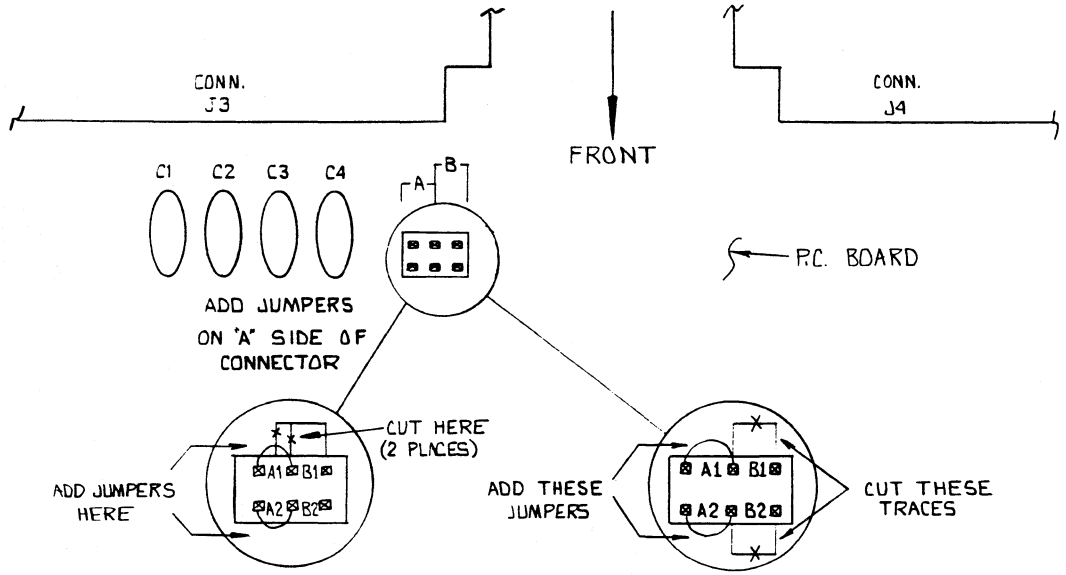
SCHEMATIC MODEM & RTC

KAYPRO 2, 2x, 4, 4x, 10, 12x, ROBIE

SIZE	CODE IDENT NO.	
C	03626	81-185 (K2, K4) 81-297 (ROBIE) 81-533 (K10) 81-298 (K4X) 81-295 (K2X) 81-471 (K12X)

SCALE | WEIGHT | SHEET 2

REVISIONS					
ZONE	LTR	EFFECT.	DESCRIPTION	DATE	APPROVED



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.
PARTS LIST					

UNLESS OTHERWISE SPECIFIED		CONTR. NO		
DIMENSIONS ARE IN INCHES		DRAWN	K. BILINSKI	5-29-84
TOLERANCES ON DECIMALS ± .010	ANGLES ± 0° 30'	CHECK	T. SOULÉ	5-29-84
FRACTIONS ± 1/32		APPR	RWJ	5-30-84
MATERIAL		RELEASE DATE	5-30-84	

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

USER OPTION: SYNCHRONOUS DATA MOD. (KAYPRO 2,2X,4,4X,10,12X, ROBIE)

SIZE	CODE IDENT NO.	ASSY: 81-185(K2,4) 81-297(ROBIE) 81-5?3K10) 81-298 (K4X) 81-295(K2X) 81-471(K12X)
B	03626	

SCALE — WEIGHT SHEET 2G

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

6.7 MAINBOARD REMOVAL

1. Turn off the machine and disconnect the AC power (5.1).

2. Remove the chassis hood (5.1).

3. Remove the two screws from the front of the mainboard that attach the mainboard and the two plastic standoffs.

4. Remove the screws from the rear, top of the chassis that secure the mainboard. The KAYPRO 2/83 and 4/83 each have four Phillips-head screws and two hex-head screws. The KAYPRO 10, 2/84 and 4/84 each have three Phillips-head screws and four hex-head screws.

5. Remove the power, reset, and video plugs. On the KAYPRO 2/83 and 4/83 these are J1, J5, and J7. On the KAYPRO 10, 2/84 and 4/84 these are J1, J7, and J10.

6. Remove the ribbon cable(s). On the KAYPRO 2/83 and 4/83 this is J6. On the KAYPRO 10 they are J8 and J9. On the KAYPRO 2/84 and 4/84 this is J8.

7. Remove the mainboard.

MAINBOARD INSTALLATION

1. Set the mainboard on the plastic standoffs, insert the screws, but do not tighten them yet.

2. Align the ports and the keyboard jack with the openings on the rear, top of the chassis.

3. Insert the screws through rear of chassis into mounting holes. Do not tighten yet.

4. The KAYPRO 2/83 and 4/83 each have four Phillips-head and two hex-head screws. The KAYPRO 10, 2/84 and 4/84 each have three Phillips-head and four hex-head screws.

5. Tighten the screws on the rear of the chassis and the screws that go into the plastic standoffs.

6. Replace the power, reset, and video plugs.

7. Replace the ribbon cable(s).

7.Ø CRT ASSEMBLIES

7.1 HARDWARE DESCRIPTIONS AND ADJUSTMENTS

Figure 7.1
Dotronix video board

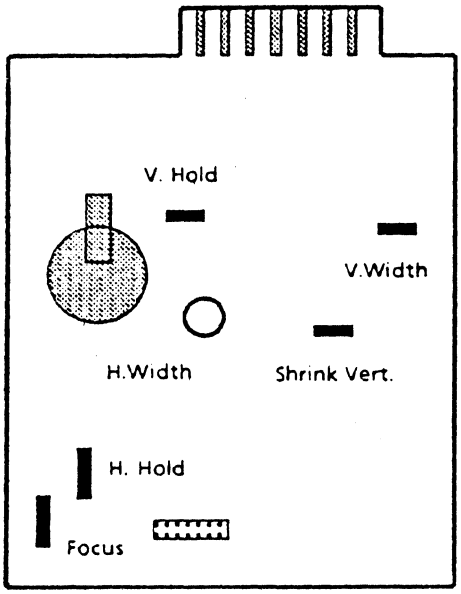
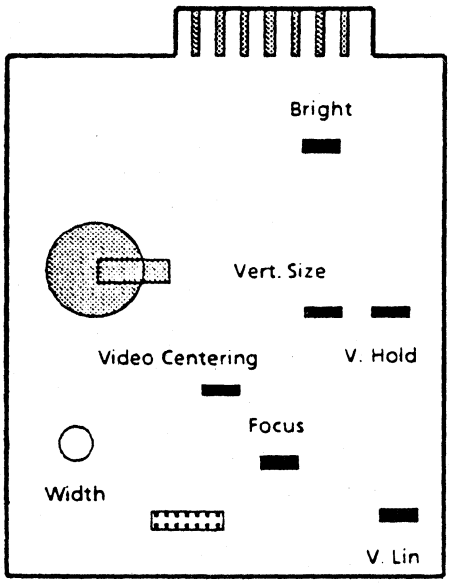


Figure 7.2
Elston video board



VIDEO ADJUSTMENTS

At the current time Kaypro is using CRT assemblies produced by Dotronix, Elston, Micrex and Toshiba. The adjustment pots are positioned in different locations on the boards and can be located by using figures 7.1 through 7.4. These pots are factory aligned and normally need no adjustment. The purpose of these adjustments is to obtain the correct size, centering, and brightness of the display.

Use only non-metallic tools when making these adjustments.

Before any adjustments are made on the video board, the ALIGN diagnostic should be invoked. This will fill the screen with H's and aid in adjustment.

HORIZONTAL CENTERING

Check to see that the pattern is centered on the screen. Adjust the horizontal hold pot until the display is correctly centered. On the Elston video board, adjust the video centering pot.

VERTICAL SIZE AND LINEARITY

The following two procedures are to be performed alternately until correct display is obtained.

Adjust the vertical size pot to obtain pattern height of approximately 4-7/8 inches.

Adjust vertical linearity pot until all characters are the same vertical size, top to bottom.

HORIZONTAL WIDTH

Adjust the horizontal width pot to obtain a display width of approximately 7 inches.

Figure 7.3
Toshiba video board

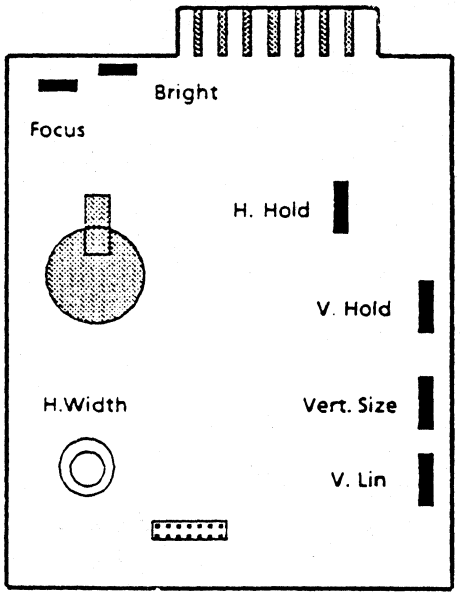
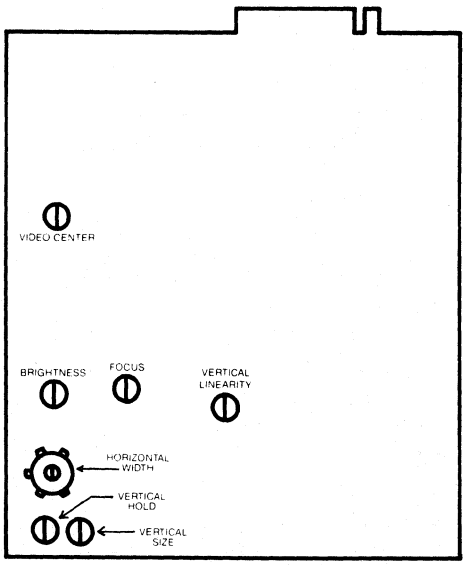


Figure 7.4
Micrex video board



HORIZONTAL HOLD (KAYPRO 2/83 and 4/83 with Dotronix only)

These procedures should be performed to adjust horizontal hold.

Attach one end of a test jumper to TP2 (test point 2). Attach the other end of the jumper to the heat sink at Q3.

Adjust R43 (horizontal hold pot) until the display either stops scrolling or almost stops. (sometimes they don't stop scrolling completely)

Disconnect the test jumper.

Adjust the horizontal deflection rings as needed.

FOCUS

Adjust the focus pot until the edges and center of the display image are in focus.

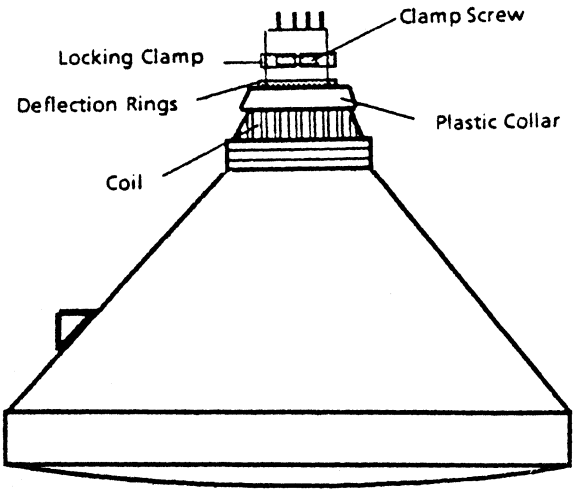
BRIGHTNESS

To prolong the life of the CRT, the maximum brightness obtainable should not be excessive. If the brightness is excessive, adjust the brightness pot. If the raster lines are visible, the brightness pot should be adjusted until they disappear.

ALIGNING CRT YOKE

*** CAUTION ***
HIGH VOLTAGE IS PRESENT AT THIS POINT

Figure 7.5
Yoke alignment



Loosen the screw on the locking clamp (figure 7.5).

Grasp the white collar on the rear of the coil.

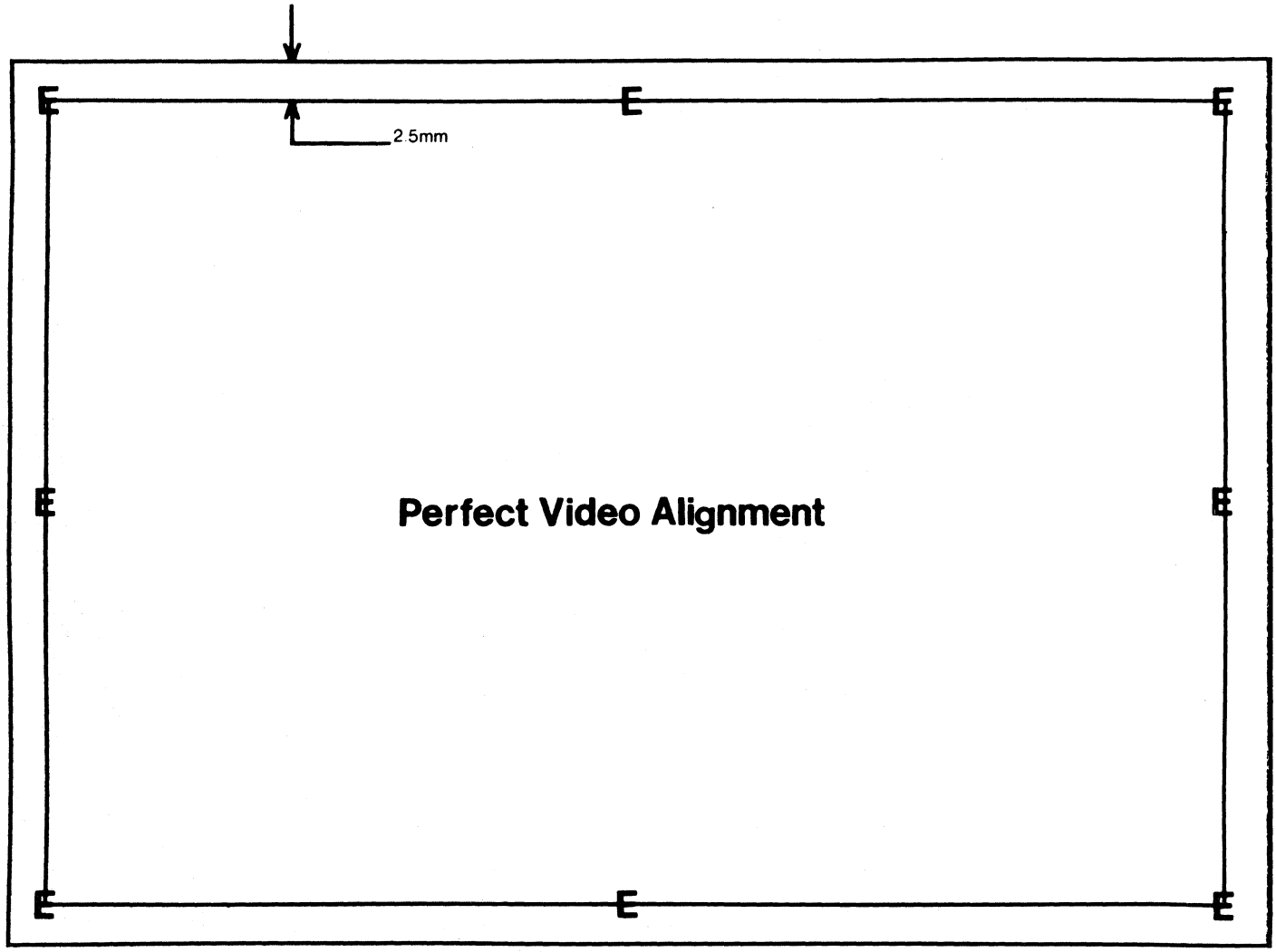
Turn the collar in the direction required to square the display.

Turn the collar slightly past the alignment point, as it will turn back slightly when released.

Tighten the locking screw.

7.2 PERFECT VIDEO ALIGNMENT EXAMPLE

Below is an example of perfect video alignment with a capital E positioned along the borders. You can copy this diagram onto a piece of clear, stiff plastic to use as a template over the screen.



7.3 VIDEO SIGNALS, ON KAYPRO MAINBOARD

Below is a list of the video signals on connector J1 of the mainboard and the voltages on the video board. Repeated removal and installation of the video board connector will loosen the connection and produce poor contact. Malfunctions due to a loose connector can be very difficult to trace.

Video comes from the main board as separate signals, not as a composite like a TV signal.

A simple check for 12V on the video board is to turn the BRIGHTNESS pot up, then turn the rear panel brightness control down. If 12V is present on the board, you should be able to see the raster lines on the screen.

Video signals on main board at J1

Pin 1 - Horizontal Sync.
Pin 2 - Key
Pin 3 - Video
Pin 4 - Vertical Sync.

Voltages on Video Board

Pin 1 —> Øv
Pin 6 —> Øv
Pin 7 —> 12v
Pin 8 —> Øv
Pin 9 —> 4v approx. (this voltage controls brightness)
Pin 1Ø —> Øv

7.4 CRT ASSEMBLY REMOVAL, (EXCEPT ROBIE)

1. Turn off the machine and disconnect the AC power (5.1).

2. Remove the chassis hood (5.1).

3. Remove the mainboard (6.7).

4. Remove the four screws that connect the video PCB and the bottom of the chassis. This should be done from the outside, bottom of the chassis, not from inside the machine.

5. Remove the video connector from the back of the video PCB.

6. Remove the four screws that connect the CRT to the front of the machine chassis.

7. Remove the CRT assembly from the chassis.

8. Remove the four plastic standoffs from the CRT PCB. These can be used on the new CRT PCB.

CRT ASSEMBLY INSTALLATION

*** Note: Before starting with CRT installation, check to see if the small plastic standoffs are attached to the bottom of the CRT PCB. If they are not attached, use the ones from the old board.

1. Lower the CRT assembly into the chassis.

2. Position the CRT so that the top mounting holes are aligned with the two metal standoffs on the chassis.

3. Insert screws through the top two mounting holes on the CRT and into the standoffs, but do not tighten.

4. Insert screws through the bottom two mounting holes on the CRT and into the standoffs. Tighten these two screws and the top two screws.

5. Hold the CRT PCB in place and tilt the machine up so that it is sitting on the cord wraps.

6. Align the plastic standoffs on the PCB with the holes in the bottom of the chassis.

7. Insert the four screws and tighten securely.

8. Replace the video connector on the back of the video PCB.

8.Ø POWER SUPPLIES

8.1 INTRODUCTION

Kaypro is using three different brands of power supplies at the present time. These are Astec, Boschert, and Cal D.C. These three power supplies are interchangeable with any of the Kaypro computers, if the power supply being changed is a new one from the factory.

***** EXCEPTION *****

If a power supply is removed from a 2/83 or a 4/83, and it's going to be used in another computer, it MUST be used in a 2/83 or 4/83. The power supplies used in 2/83 and 4/83 computers are not interchangeable with other Kaypro computers.

****

There are no authorized dealer repairs that can be made on any of the power supplies. The ONLY authorized dealer service to power supplies is 22ØV configuration. Each brand of power supply can be configured for 22ØV operation.

8.2 DESCRIPTION AND 220V CONFIGURATION INSTRUCTIONS

Two fuses are associated with each of the power supplies. One fuse (2 amp) is mounted on the rear of the chassis and accessible from outside the computer. The other fuse (2.5 amp) is mounted directly on the power supply board.

Disconnect AC power from the computer whenever replacing fuses. Be especially careful when replacing the fuse on the power supply board. Use of a fuse replacement tool is recommended due to the difficulty of reaching this component.

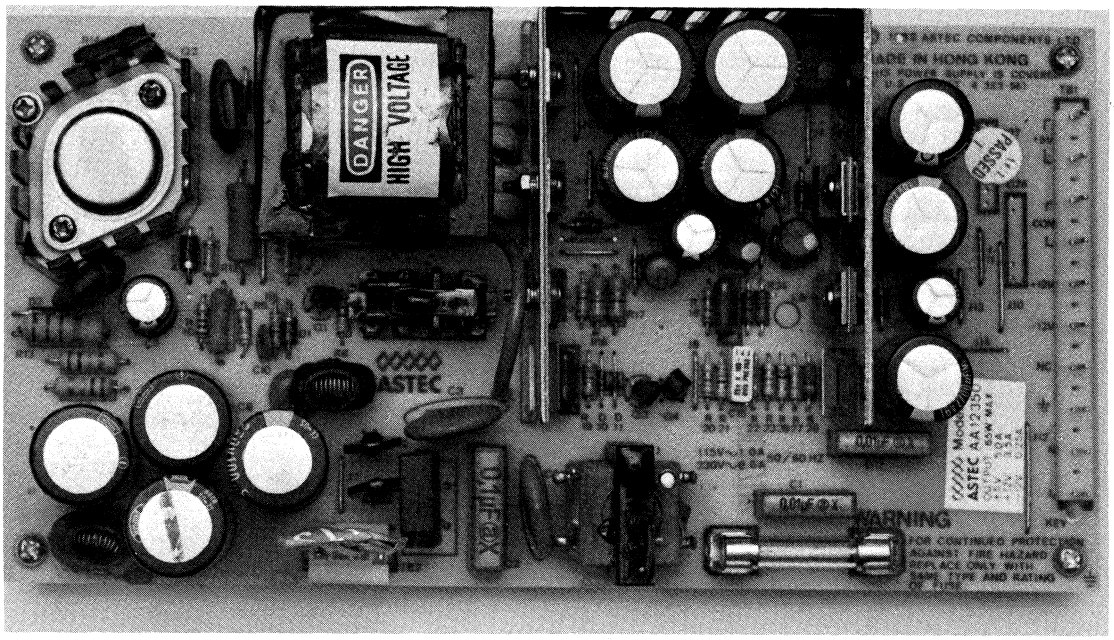
220V CONFIGURATION

Astec Power Supply

Identified by a beige board with a white label on the right of the component side. The label will have the name ASTEC, followed by a model number, and the output voltages.

Locate the white shorting block labelled TB2. If the board is configured for 110V, a pin will be visible on the right of the shorting block.

Remove the shorting block and shift it to the right so that it covers the pin. A different pin should now be exposed on the left of the shorting block. The power supply is now configured for 220V use.



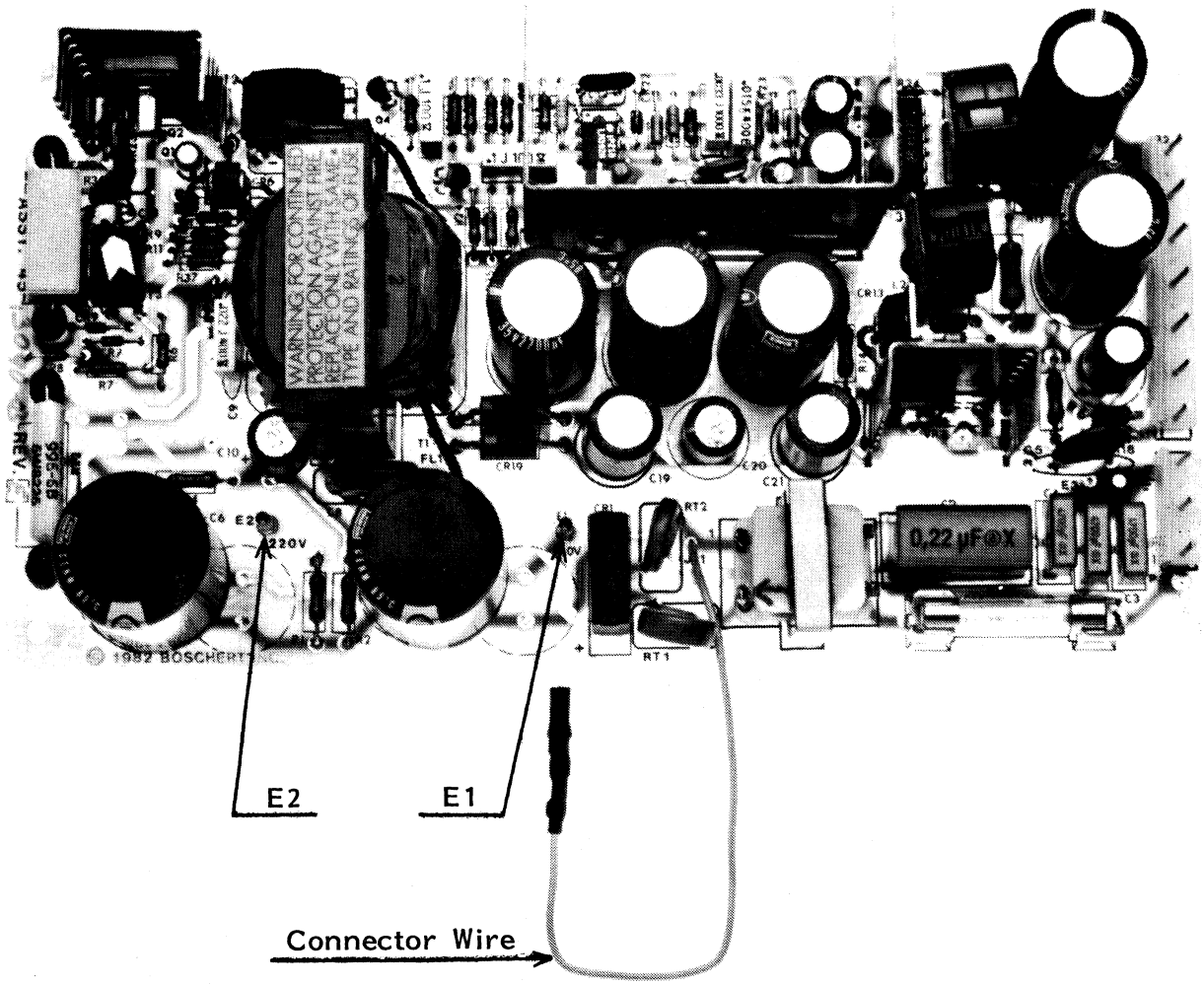
220V CONFIGURATION

Boschert Power Supply

Identified by the word "Boschert" on the component side of the board at lower right and above the fuse and capacitor C2.

Locate a six-inch wire that is soldered to point JP1. If the board is configured for 110V, the other end of the wire is attached to point E1 (labelled 110V).

Unplug the wire from point E1 and plug it into point E2 (labelled 220V). Point E2 is to the left of point E1. The power supply is now configured for 220V use.



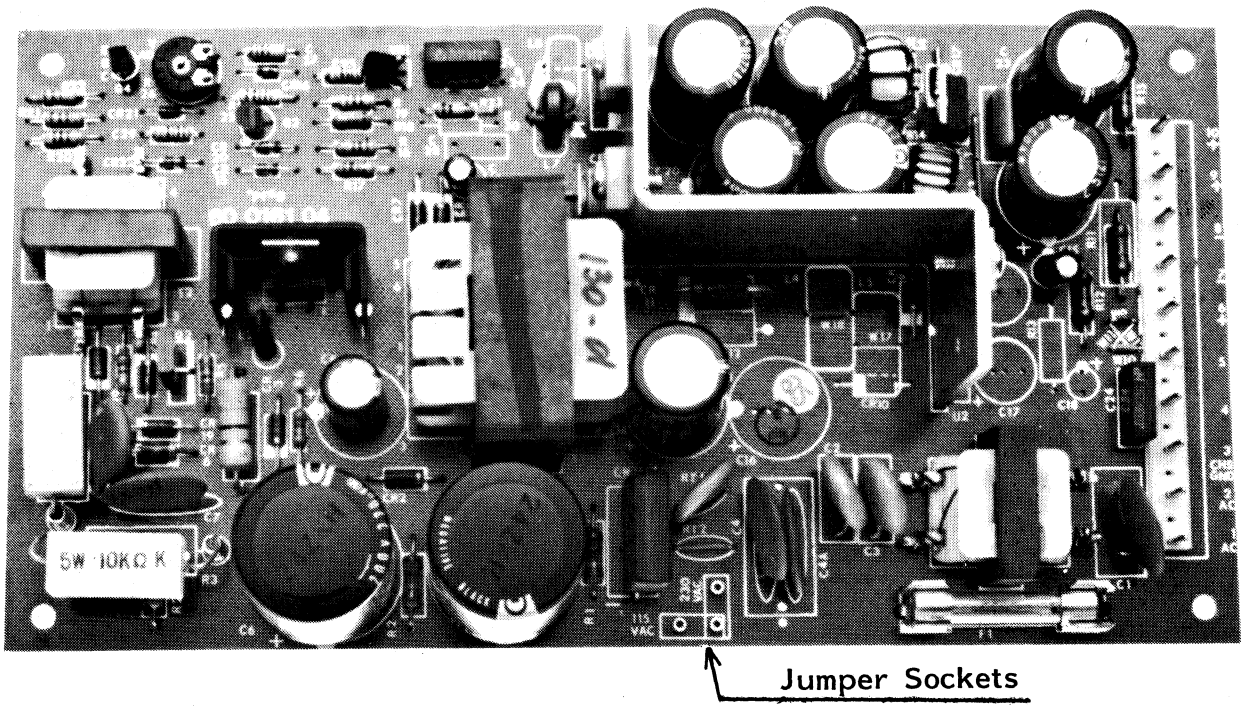
220V CONFIGURATION

Cal D.C. Power Supply

Identified by a bright blue circuit board. A white sticker with "California DC", model, and serial number is located on solder side of board.

Locate a jumper block labelled 115VAC and 230VAC. With the jumper in the 115VAC position the board is configured for 110V.

Remove the jumper from the socket labelled 115VAC and position it in the socket labelled 230VAC. The power supply is now configured for 220V use.



8.3 POWER SUPPLY REMOVAL

1. Turn off the machine and disconnect the AC power (5.1).
2. Remove the chassis hood (5.1).
3. Remove the mainboard (6.7).
4. Remove the four screws that connect the power supply and the back of the chassis. These are easier to remove from outside the back of the chassis than from inside the machine.
5. Remove the power plug from the power supply.
6. Remove the tie wraps from the plastic standoffs.
7. Remove the power supply.

POWER SUPPLY INSTALLATION

1. Position the power supply inside the chassis so that the four plastic standoffs are aligned with the four mounting holes in the chassis. Be certain that the power connector is on the side nearest the drives.
2. Place the tie wraps on the plastic standoffs.
3. Insert four screws through the rear of the chassis and into the plastic standoffs of the power supply.
4. Tighten the screws securely.
5. Replace the power connector.
6. Replace the mainboard (6.7).
7. Replace the chassis hood (5.1).

9.Ø DISKETTE DRIVES

9.1 INTRODUCTION

All diskette drive types (except the high-density drives in the ROBIE and 4X) are functionally interchangeable between manufacturers.

Because of the number of manufacturers from which Kaypro gets its diskette drives, no attempt is made in this manual to show alignment procedures for diskette drives. To perform drive alignments you will need a drive manual for the particular model, a Dysan Alignment Diskette (Dysan's part number: 224/2A), the knowledge and an oscilloscope. Drive manuals are available through the Hardware Technical Support Department for a nominal fee.

However, since the company recognizes the fact that many customers want a KAYPRO computer in which both drives have the same outward appearance, we provide a guide for determining models of diskette drives from the placement of the LED and the drive door closure.

This section also contains diagrams and instructions on jumpering the various models of diskette drives to be used as either A or B (or, in the case of the KAYPRO 1Ø, C) drive.

DISK DRIVE CLEANING

Generally speaking the majority of people clean disk drives too often. Unless the environment is especially dusty or dirty, under commercial use there is no reason to clean the drives more than twice a year.

Use care in selecting a cleaning kit. Many of the drive head cleaning kits on the market are very abrasive. Cleaning is done by the liquid solution, not by mechanical scrubbing.

NOTE The manufacturer (Drivetec) of the high-density drives in the ROBIE, and 4X recommends only four brands of head-cleaning kits for their drives. The letter from Drivetec states:

> "THE FOLLOWING CLEANING DISKS HAVE BEEN EVALUATED AND ARE RECOMMENDED FOR USAGE ON THE DRIVETEC DISK DRIVE WHEN HEAD CLEANING IS DEEMED NECESSARY:
>
> 1) SCOTCH #744Ø
> 2) HEAD COMPUTER PRODUCTS 5 1/4 CLEANING DISK
> 3) PERFECT DATA 5 1/4 CLEANING DISK
> 4) FLOPPICLENE 5 1/4 CLEANING DISK"

Refer to the symptom-fix guide for troubleshooting hints relative to the floppy drives, the Winchester hard disk, and the Drivetec (high-density) drives.

9.2 WHICH BRAND OF DRIVE IS IT?

The following figures represent the face plates of the different brands of half-height floppy drives that are used in Kaypro computers. The drive door closure and the LED position can be used to reference the drive.

Fig. 9.1, TANDON Half-Height

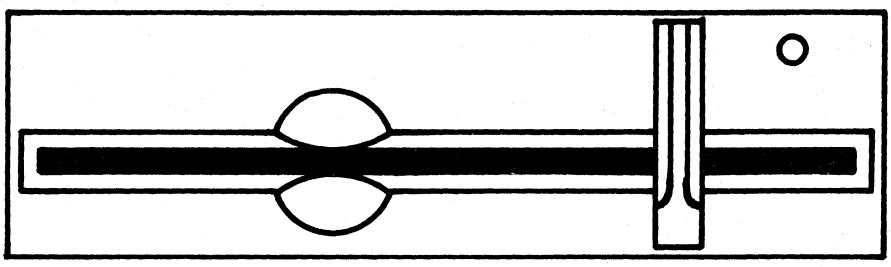


Fig. 9.2, EPSON

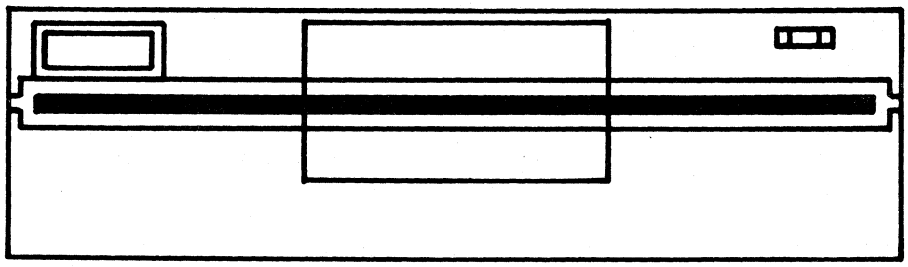


Fig. 9.3, SHUGART

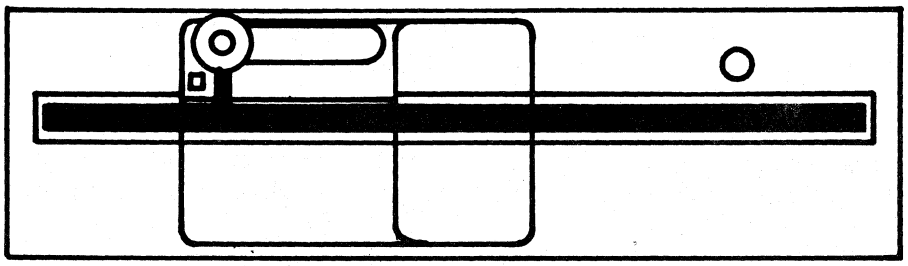


Fig. 9.4, TOKYO ELECTRIC

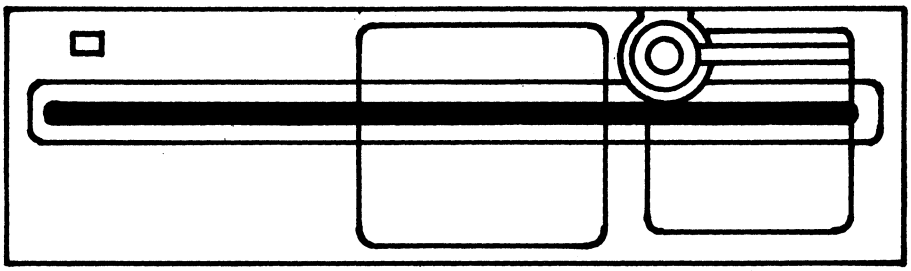


Fig. 9.5, TOSHIBA

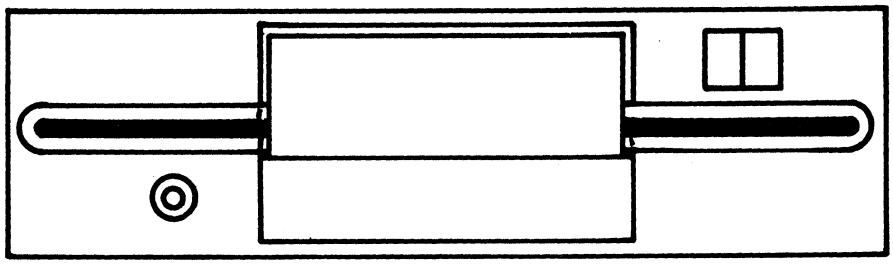


Fig. 9.6, HI-TECH

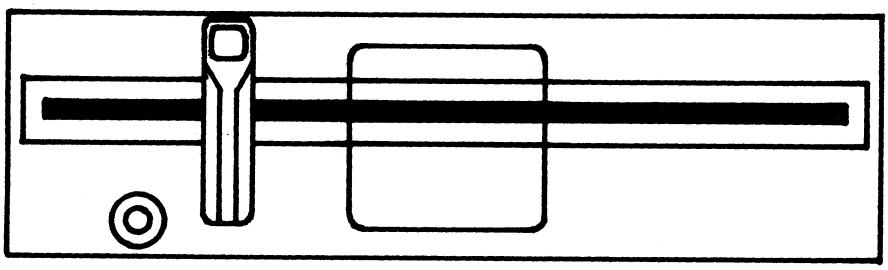


Fig. 9.7, DRIVETEC

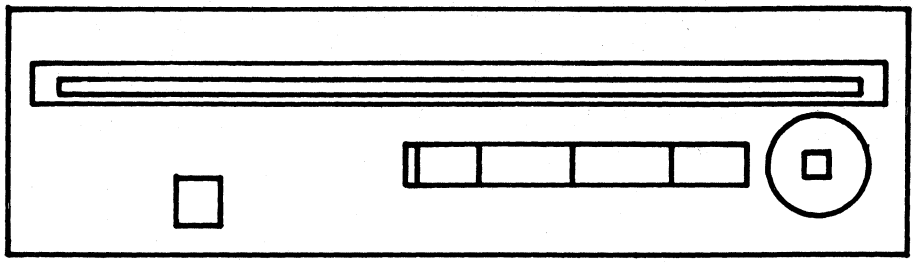
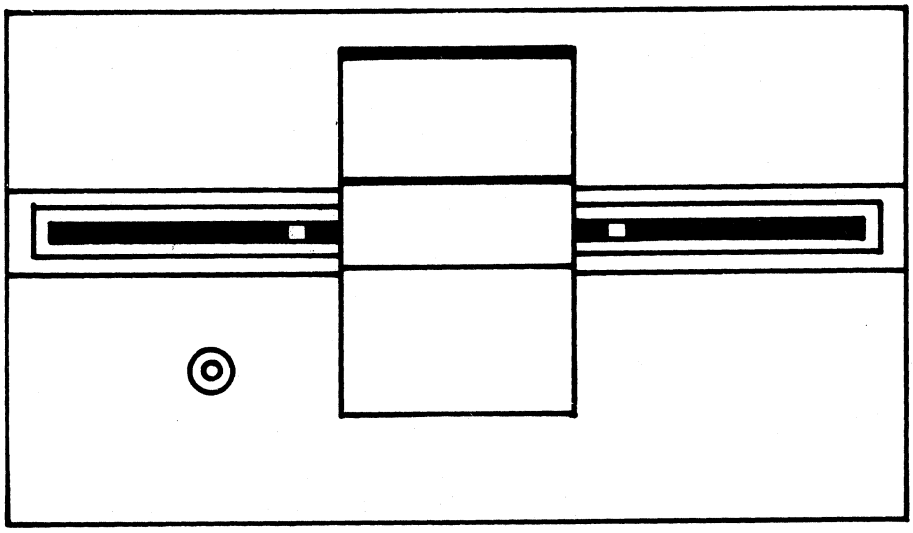
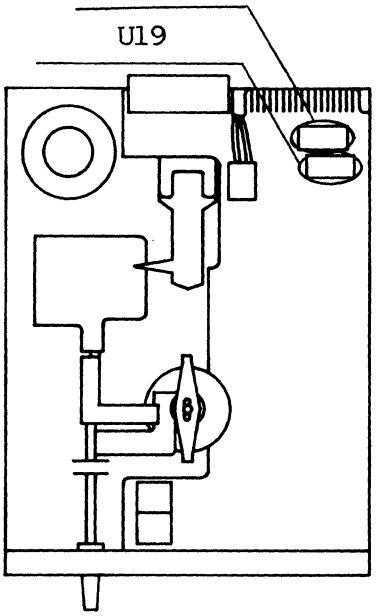


Fig. 9.8, TANDON Full-Height



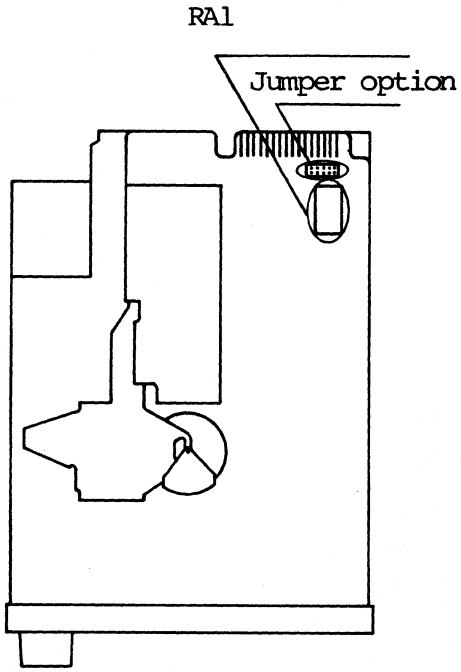
9.3 JUMPERING DIAGRAMS

Figure 9.8
Tandon diskette drive



TANDON
Used only on KAYPRO 1Ø, Pins 2 and 15 on U19 are jumpered and a 47Ø-ohm terminating resistor pack is inserted in RP11.

Figure 9.9
Epson diskette drive



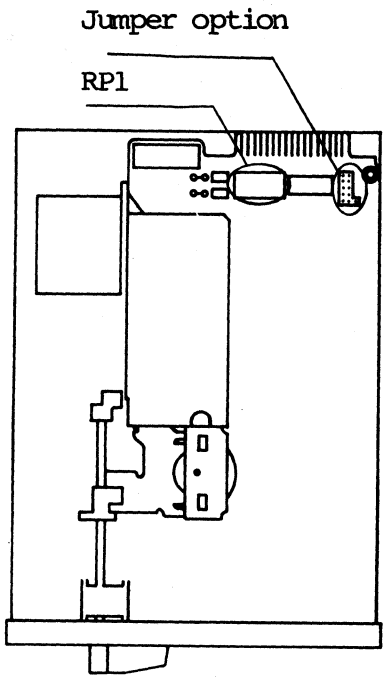
EPSON
Next to the connector for the data cable is a black plug with ten pins. These pins are jumpered to change the configuration of the drive. They are MX, Ø, 1, 2, 3.

KAYPRO 1Ø: The two pins in the "Ø" position should be jumpered and a 47Ø-ohm terminating resistor inserted in RA1.

A DRIVE: Jumper the two pins in the "Ø" position. No terminating resistor is needed.

B DRIVE: Jumper the two pins in the "1" position. Insert a 47Ø-ohm terminating resistor into RA1.

Figure 9.1Ø
Shugart diskette drive



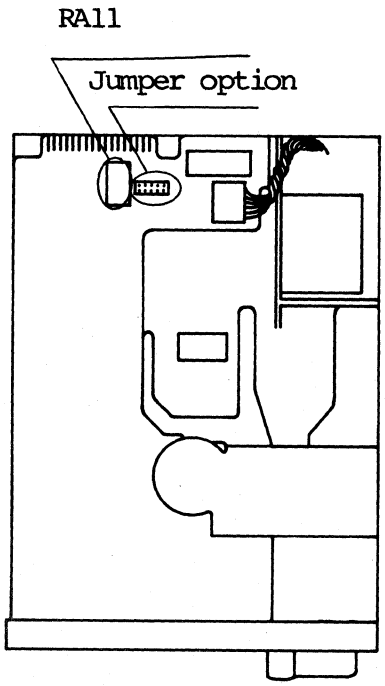
SHUGART
Next to the connector for the data cable is a blue plug with eleven pins. These pins are 1, 2, 3, 4, MX.

KAYPRO 1Ø: Jumper the two pins in the "1" position. In the "MX" position, there are three pins. Jumper the one in the center and the one on the left of it. Insert a 47Ø-ohm terminating resistor into RP1.

A DRIVE: Jumper the two pins in the "1" position. In the "MX" position, jumper the pin in the center and the pin on the left of it. No terminating resistor is necessary.

B DRIVE: Jumper the two pins in the "2" position. In the "MX" position, jumper the pin in the center and the pin on the left of it. Insert a 47Ø-ohm terminating resistor into RP1.

Figure 9.11
Tokyo Electric
diskette drive



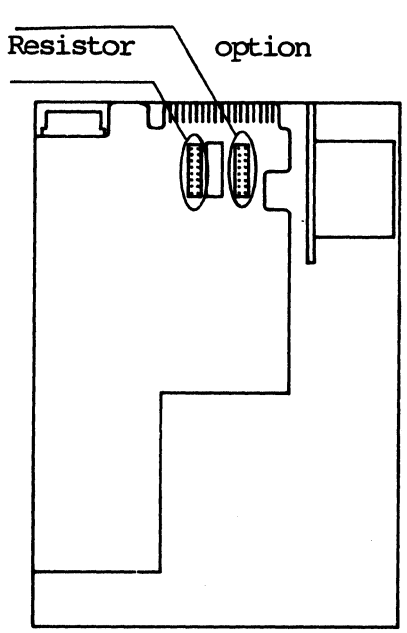
TOKYO ELECTRIC
Next to the connector for the data cable is a blue plug with ten pins. These pins are DSØ, DS1, DS2, DS3, MX.

KAYPRO 1Ø: Jumper the two pins in the "DSØ" position. Insert a 47Ø-ohm terminating resistor into RA11.

A DRIVE: Jumper the two pins in the "DSØ" position. No terminating resistor is necessary.

B DRIVE: Jumper the two pins in the "DS1" position. Insert a 47Ø-ohm terminating resistor into RA11.

Figure 9.12
Toshiba diskette drive



TOSHIBA

Next to the connector for the data cable is a black plug with sixteen pins. These are 1, 2, 3, 4, LI, LD, HD, HM. Next to the black plug, is a 470-ohm terminating resistor with the letters "DM" to the left of it. Locate this resistor. On the other side of the resistor is another black plug. This plug has the letters "RM" to the left of it and the letters "PJ5" to the right of it. It has sixteen pins. For the terminating resistor to function, all pins must be jumpered EXCEPT the two next to the letters "RM". When the resistor is not needed, none of the pins should be jumpered.

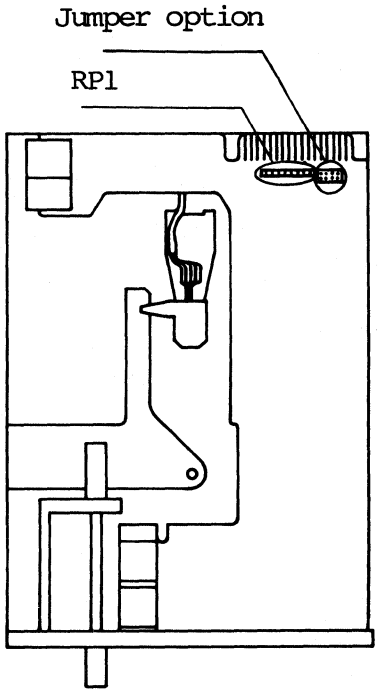
KAYPRO 10: Jumper the two pins in the "1" position, the two pins in the "LD" position, and the two pins in the "HM" position. The terminating resistor is needed.

A DRIVE: Jumper the two pins in the "1" position, the two pins in the "LD" position, and the two pins in the "HM" position. The terminating resistor is not needed.

B DRIVE: Jumper the two pins in the "2" position, the two pins in the "LD" position, and the two pins in the "HM" position. The terminating resistor is needed.

Note: Some Toshiba drives are manufactured using a circuit board that's different in appearance from the one in the above illustration. Although the board appears different, the circuitry is the same and the drive should be jumpered using the above instructions.

Figure 9.13
Hi-Tech diskette drive



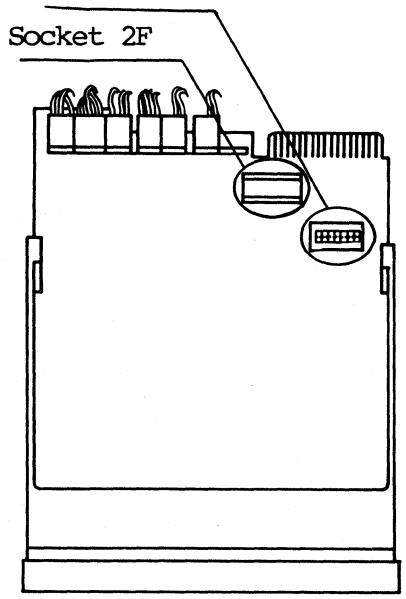
HI-TECH
Next to the connector for the data cable is a black plug with eight pins. These pins are DSØ, DS1, DS2, DS3.

KAYPRO 1Ø: Jumper the two pins in the "DSØ" position. Insert a 47Ø-ohm SIP terminating resistor into RP1.

A DRIVE: Jumper the two pins in the "DSØ" position. No terminating resistor is necessary.

B DRIVE: Jumper the two pins in the "DS1" position. Insert a 47Ø-ohm terminating resistor into RP1.

Figure 9.14
Tandon full-height diskette drive



TANDON
Used only in KAYPRO II AND KAYPRO 4.

A DRIVE: Pins 1-14 and 2-13 should be jumpered in option shunt block 1E.

B DRIVE: Pins 1-14 and 3-12 should be jumpered in option shunt block 1E. Insert a 47Ø-ohm terminating resistor into socket 2F.

9.4 HIGH-DENSITY (DRIVETEC) DRIVES

The high-density diskette drives are currently being offered in the KAYPRO ROBIE, 4X and 12X. These are 5-1/4 inch, double-sided drives with 192 tracks per inch. Each drive has 160 cylinders with a total of 320 tracks and a formatted storage capacity of 2.6 megabytes.

HIGH-DENSITY DISKETTES

The diskettes used with the high-density drives MUST be pre-formatted 17 sector, 192 TPI diskettes.

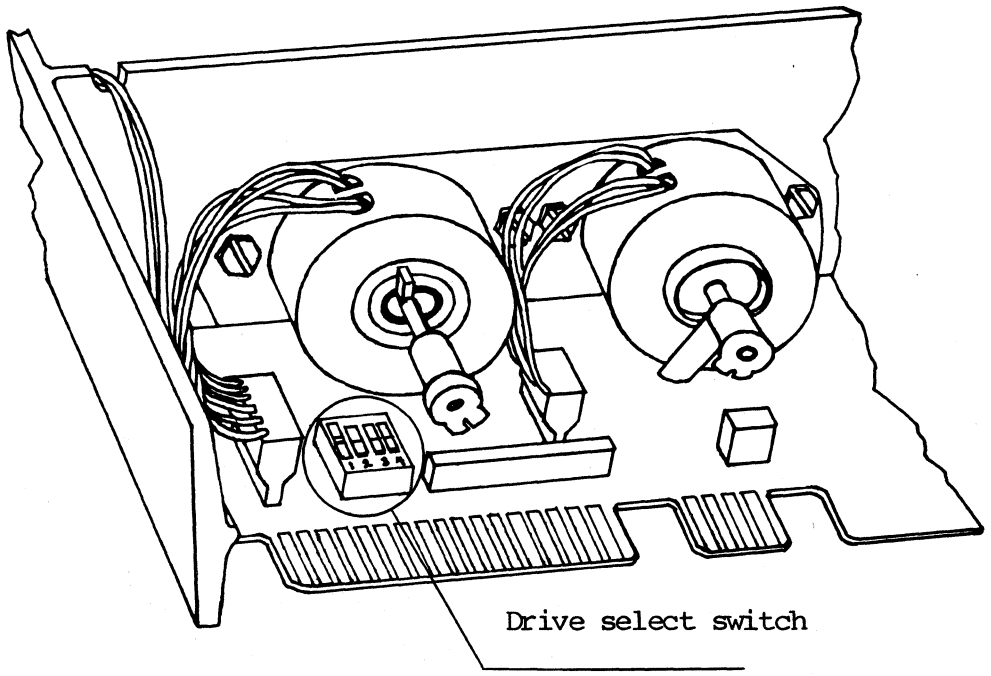
DRIVE CONFIGURATION

Next to the connector for the data cable is a drive select switch-- DS1 through DS4.

A DRIVE: DS1 should be in the "on" position. All other switches should be in the "off" position.

B DRIVE: DS2 should be in the "on" position. All other switches should be in the "off" position.

12X: DS1 should be in the "on" position. All other switches should be in the "off" position.



9.5 DISKETTE DRIVE REMOVAL

1. Turn off the machine and disconnect the AC power (5.1).
2. Remove the chassis hood (5.1).
3. Remove the ribbon cable, power plug, and ground wire from the rear of the drive.
4. Remove the four screws that secure the drive in the drive shield.
5. Slide the drive out of the drive shield through the front of the machine.

   Note: If the drive is hard to slide out of the drive shield unit, loosen the screws holding the other drive in place.

DISKETTE DRIVE INSTALLATION

1. Configure the new drive. (A Drive or B Drive) Refer to pages 9--4 to 9--8 explaining drive configuration.
2. Slide the drive into the drive shield.
3. Align the mounting holes on the drive with the holes on the drive shield.
4. Insert four screws through the shield and into the drive mounting holes.
5. After all the screws are inserted, tighten them securely.
6. Replace the ribbon cable, power plug, and ground wire on the rear of the new drive.

10.0 HARD DISK DRIVES (KAYPRO 10 and 12X)

10.1 INTRODUCTION

Kaypro Corporation uses hard disk drives from a number on different manufacturers. As with the diskette drives, all models of hard disk drives are functionally interchangeable.

No adjustments are meant to be made by dealers (or are made by Kaypro technicians) on hard drives. And, since recovering information from a hard disk which has "crashed" requires a clean room, no directions for performing such an operation are included in this manual. Be aware that true head crashes are very rare occurrences. Most apparent hard disk problems are actually problems within other components and can be corrected without replacing the hard drive itself. Refer to the symptom-fix guide for help in troubleshooting apparent hard drive problems.

We cannot stress strongly enough that dealers instruct their customers to ALWAYS back up their data while working on a hard disk. In many cases NOTHING can be done about the loss of data in a hard-drive failure.

10.2 DESCRIPTION

The hard disk drives used in the KAYPRO 10 and the 12X are industry standard, 5-1/4 inch half-height drives offering Winchester technology. This technology includes sealed media and drive heads, with an air filtration system that prevents contamination. Since the drives are sealed, there are no dealer serviceable components on the drive. The only authorized dealer service to the hard disk drives is drive configuration.

10.3 HARD DRIVE CONFIGURATION

MICROSCIENCE

Figure 10.1
Microscience
9 Position Switch

There are two types of drive selection switch banks available on Microscience drives. One type has nine (9) switches and one type has ten (10) switches. These switches are located on the drive PCB next to the power plug.

9 POSITION SWITCH: Pins 1, 2, and 4 should be in the "up" position .

Figure 10.2
Microscience
10 Position Switch

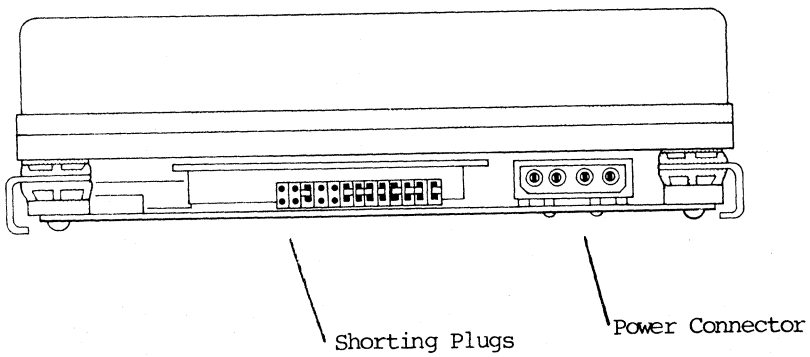
10 POSITION SWITCH: Pins 1, 3, 4, and 10 should be in the up position.

Refer to Figures 10.1 and 10.2 for Microscience drive configuration.

SHUGART

The Shugart hard drives should be jumpered according to figure 10.3. Next to the power connector on the rear of the drive, there are 13 sets of shorting plugs. With the rear of the drive facing you and the power connector on the right side, locate these shorting plugs. Starting on the right side (the side nearest the power connector), jumper the first eight sets of plugs, do not jumper the ninth and tenth sets, jumper the eleventh set, do not jumper the twelfth and thirteenth sets of plugs.

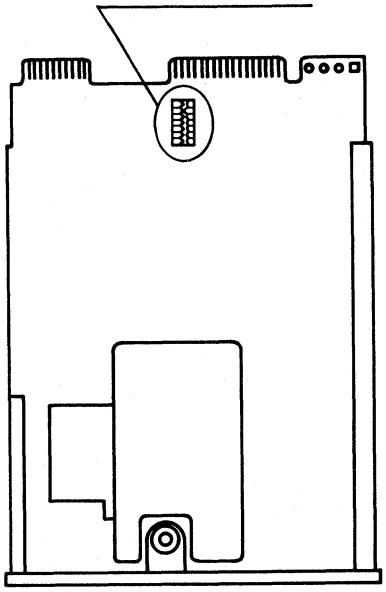
Figure 10.3
Shugart Hard Drive



SEAGATE

Figure 1Ø.4
Seagate Hard Drive

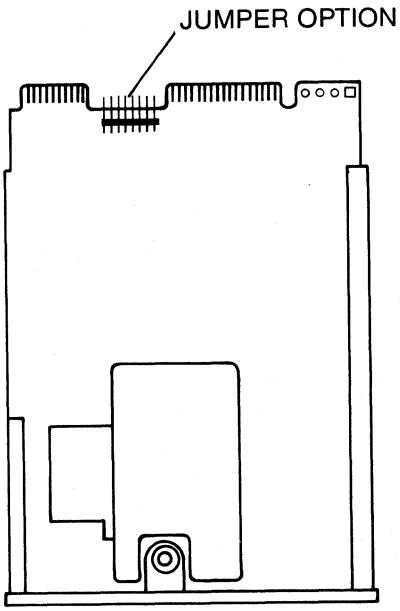
Option shunt block



There are two types of option jumpers available on the Seagate drives. One is an option shunt block and the other is a row of jumper pins that are jumpered in pairs. Illustrations of both types are shown below for reference.

Next to the connector for the data cable, is a 16 pin option shunt block. Pins 7 and 1Ø should be jumpered.

Figure 1Ø.5
Seagate Hard Drive



Next to the connector for the data cable is a double row of sixteen pins. With the front of the drive facing toward you and the P.C. board side facing up, jumper the two pins in the second position from the left. These are pins 7 and 1Ø.

10.4 HARD DRIVE OR FLOPPY DRIVE REMOVAL FOR KAYPRO 10 OR 12X

For all hard drives and all diskette drives used in KAYPRO 10 and 12X computers.

Note: If the KAYPRO 10 has an Epson or Tokyo Electric diskette drive, it will be necessary to tilt the drive unit at an angle while removing or installing the drive. Refer to section 9.2 to determine the brand of drive.

Note: As you remove the cables on the KAYPRO 10 or 12X, it's a good idea to label them. This will insure that they get replaced correctly. Also, the end of the data cable that has a different color wire (usually red) goes to pin #1 on the connector.

1. Turn off the machine and disconnect the AC power (5.1).

2. Remove the chassis hood (5.1).

3. Remove the two diagonal braces from the right side of the chassis.

4. Tilt the machine up so that the front of the machine is sitting on the work surface and parallel to the floor.

5. Remove the six screws from the bottom of the chassis that are under the drives. Set the machine back down.

6. Remove the ribbon cables from the mainboard.

7. Slide entire drive shield unit slightly to the rear, to make room for the face of the floppy to clear the opening.

8. Lift entire drive shield unit slightly and slide out the side of the chassis.

REMOVING THE DRIVES FROM THE DRIVE SHIELD

1. Remove the ribbon cables, power plug and the ground wire from the back of the drive (hard drive or floppy). Label these.

2. Remove the two screws that attach the bottom of the drive to the drive shield (hard drive or floppy).

3. Remove the two screws that attach the top of the drive to the drive shield.

4. Slide drive out through the front of the drive shield.

HARD DRIVE OR FLOPPY INSTALLATION FOR KAYPRO 10 OR 12X

1. Configure the new drive. Refer to page 10--3 for the hard drive, pages 9--5 to 9--7 for the floppy drive.
2. Slide the drive into the shield so that the mounting holes in the drive are aligned with those in the shield.
3. Insert two screws through the top of the shield and into the mounting holes of the drive.
4. Tighten these securely.
5. Insert two screws through the bottom of the shield and into the mounting holes of the drive.
6. Tighten these securely.
7. Replace the ribbon cable(s), power plug and ground wire.
8. Slide the entire drive shield unit into the chassis.
9. Align the mounting holes in the drive shield with those in the chassis.
10. Insert the six screws through the mounting holes and tighten securely.
11. Replace the two diagonal braces.
12. Replace the ribbon cable(s) on the mainboard.
13. Replace the chassis hood.

11.Ø HARD DISK CONTROLLER BOARD

11.1 DESCRIPTION

The hard disk controller board used in the KAYPRO 1Ø is a Western Digital board, and is not dealer-serviceable.

11.2 REMOVAL/INSTALLATION INSTRUCTIONS

HARD DRIVE CONTROLLER BOARD REMOVAL

1. Turn off the machine and disconnect AC power (5.1).
2. Remove chassis hood (5.1).
3. Remove the two diagonal braces from the right side of the machine.
4. Remove the power plug and the three ribbon cables from the hard disk controller board. Label these to insure correct replacement.
5. Remove the three screws that attach the hard disk controller board and the drive shield.
6. Remove the board.

HARD DRIVE CONTROLLER BOARD INSTALLATION

1. Position the hard disk controller board so that the mounting holes in the board are aligned with the holes in the drive shield.
2. Insert the three screws and tighten securely.
3. Replace the power plug and the three ribbon cables.
4. Replace the two diagonal braces.
5. Replace the chassis hood (5.1).

12.Ø INTERFACE BOARD, KAYPRO 1Ø AND 12X

12.1 DESCRIPTION

The interface board that is used on the KAYPRO 1Ø and 12X is the interface between the mainboard and the hard drive controller board. This board is not dealer serviceable.

12.2 INTERFACE BOARD REMOVAL

1. Turn off the machine and disconnect the AC power (5.1).
2. Remove the chassis hood (5.1).
3. Remove the mainboard (6.7).
4. Remove the two ribbon cables from the interface board.
5. Remove the four screws that attach the interface board and the drive shield.
6. Remove the interface board.

INTERFACE BOARD INSTALLATION

1. Position the interface board so that the mounting holes on the board are aligned with the holes on the drive shield.
2. Insert four screws and tighten securely.
3. Replace the two ribbon cables.
4. Replace the mainboard (6.7).
5. Replace the chassis hood (5.1).

13.Ø KEYBOARDS

The 76-key alphanumeric, detachable keyboard is connected to the computer by a four-wire cable and is powered by +5 VDC through the cable. The CAPS LOCK indicator light allows a quick check on whether the keyboard is receiving power.

The impedance of the connecting cable can be a critical factor in proper operation of the computer. Replacement of the standard cable with a phone cord can create malfunctions in signal transmission to the computer. This is because the wire in phone cords is too small; therefore, the impedance over the total length of the cord can be too high for reliable operation.

Wire in the standard keyboard cable is 28-gage copper, and the cable length is six feet. Should you desire a longer keyboard cable, restrict the length to not more than twelve feet, and use wire no smaller than 28 gauge.

Keyboard Cable Pinouts

Pin 4 (Black) - Serial Data out (to keyboard), TTL level.
Pin 3 (Red) - Ground
Pin 2 (Green) - Serial data in (from keyboard), TTL level.
Pin 1 (Yellow) - +5 VDC

14.Ø KAYPRO ROBIE REMOVAL/INSTALLATION INSTRUCTIONS

14.1 CHASSIS COVER REMOVAL

1. Turn off the machine and disconnect the AC power(5.1).

2. Remove the four screws securing the top chassis cover (two on each side of the machine).

3. Remove the eight screws securing the bottom chassis cover (four on each side of the machine).

4. Remove the two sections of the chassis cover from the machine.

CHASSIS COVER REPLACEMENT

1. Place the lower chassis cover on the machine and align the eight mounting holes with the mounting holes in the sides of the machine.

2. Insert the eight screws into the mounting holes and tighten securely.

3. Place the top chassis cover on the machine and align the four mounting holes with the mounting holes in the sides of the machine.

4. Insert the four screws into the mounting holes and tighten securely.

14.2 DISKETTE DRIVE REMOVAL

1. Remove the top chassis cover (5.1).

2. Remove the drive support unit from the chassis. There are three screws in the front and three screws in the rear.

3. Remove the ribbon cable and the power plugs from the drives.

4. Lift the drive support unit (drives still attached) off the chassis.

5. To remove either drive from the drive support unit, turn the unit over and remove the four screws that attach the specific drive to the support unit.

DISKETTE DRIVE REPLACEMENT

1. Align the drive mounting holes with the mounting holes in the drive support unit.

2. Insert four screws into the drive support unit and into the drive. Tighten these screws securely.

3. Set the drive support unit on the chassis and align the mounting holes in the support unit with those in the chassis.

4. Insert three screws into the front mounting holes and three screws into the rear mounting holes. Tighten these securely.

5. Replace the ribbon cable and the power plugs on the drives.

15.Ø TROUBLESHOOTING

15.1 INTRODUCTION

The symptom--fix guide's information is based on our experience repairing Kaypro computers. The guide is a summary of the records that Kaypro Repair maintains on each computer received.

****

Fixes for each problem noted are presented in **descending** order of occurrence.

****

15.2 KAYPRO 2 AND 4 SYMPTOM—FIX GUIDE

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
No power, no lights, no video	Power cord not plugged in	Check all cord connections
	Fuse is blown	Replace fuse
	Mainboard not getting power	Check harness connections; check for proper voltages; replace either harness or power supply
	Defective mainboard	Replace mainboard
	Defective fuse holder	Replace fuse holder
	Power switch shorted internally	Replace power switch
	Power supply jumpered for wrong supply	Correct jumpering on power supply
	Defective power supply	Replace power supply
	Defective harness	Replace harness
Fuse blows when power is turned on	Defective power supply	Disconnect all modules from power supply; replace power supply if fuse still blows
	One module has a short	Disconnect all modules, replace fuse, and re-connect modules, one at a time, until fuse blows. Replace that module
	Defective harness	Replace harness
High-pitched squeal or "chirp"	One module is shorted	Unplug modules, one at a time, from the harness. Replace the module whose unplugging causes the noise to stop

KAYPRO 2 AND 4 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
Power LED flickers	Shorted module	Disconnect modules from power, one at a time, until LED stays on; replace module whose unplugging caused LED to stay on.
	Defective power supply	Replace power supply
	Defective harness	Replace harness
No video display, or poor quality display	Brightness not adjusted	Turn up brightness knob on rear of chassis; adjust brightness pot on CRT board, if necessary
	CRT not connected	Check all connections to CRT; be sure plug on rear of CRT tube is square
	Defective CRT	Replace CRT assembly
	Defective mainboard	Replace mainboard
	Defective power supply	Replace power supply
	Defective harness	Replace harness
Video is on, but screen is filled with "garbage" characters	Defective mainboard	Replace mainboard
	Reset harness shorted to chassis	Check lugs of reset button for grounding to inside of chassis
	Defective reset harness	Replace reset harness

KAYPRO 2 AND 4 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
"Raster" (horizontal lines) on video	Brightness not adjusted properly	Turn up brightness knob on back of chassis; adjust brightness pot on CRT board if necessary
	Loose connection from mainboard or power supply	Check black plug from power supply to CRT board, 4-pin jumper from main board to CRT board; check that plug on rear of CRT tube is square
Strange video image	Short in brightness-adjusting knob	Check for shorts between wires in rear of brightness-adjusting knob
	Defective mainboard	Replace mainboard
Missing characters on video display	Defective mainboard	Replace mainboard
	Defective CRT	Replace CRT assembly
Will not boot	Defective diskette	Change diskettes
	Diskette has no system image	Change diskettes; use a diskette with a known good system image
	Wrong CP/M for model of machine	Check that you're not trying to boot a KP 2 with a KP 4 CP/M (KP 4 WILL boot a KP 2 CP/M)
	Defective drive B	Unplug data cable from drive B, and reset machine; if it boots, replace drive B
	Defective mainboard	Replace mainboard
	Defective drive A	Replace drive A
	Defective data cable	Replace data cable

KAYPRO 2 AND 4 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
Both drive LEDs are on, won't boot	Problem on power-up	Reset machine
	Diskette has no CP/M	Try known good sysgenned diskette
	Defective mainboard	Replace mainboard
	Select jumpers on drives incorrect	Check select jumpers
Drive A LED only on during reset	Drive select jumpering incorrect	Check jumpering on drive A
No LED on drive A at any time	Data cable poorly connected	Check all connections on data cable
	Defective data cable	Replace data cable
	Defective drive A	Replace drive A
	Defective mainboard	Replace mainboard
Computer boots CP/M, but no A> prompt appears	Defective diskette	Try known good, sysgenned diskette
	Defective mainboard	Replace mainboard
Rattling sound from drive when accessing	Defective drive	Replace the diskette drive
	Defective mainboard	Replace mainboard

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
Drive will not step through all tracks on diskette	Drive connectors loose	Check all connectors on rear of drive, esp. P12 (Tandon drives)
	Defective mainboard	Replace mainboard
	Defective drive	Replace diskette drive
	Defective data cable	Replace data cable
Errors on either drive during COPY	Defective diskette	Change the diskette (if problem is on drive B, insert another blank diskette; if on drive A, try to copy from a new master)
	Defective disk drive	Replace diskette drive
	Defective mainboard	Replace mainboard
No output to parallel printer	No power to printer	Check that printer is plugged in, and selected
	Poor cable connection	Check all cable connections from computer to printer
	Printer is assigned as serial by STAT	Use STAT to assign printer device as parallel, type: STAT LST:=LPT:
	Defective mainboard	Replace mainboard
No output to serial printer	No power to printer	Check that printer is plugged in and selected
	Poor cable connection	Check all cable connections from computer to printer; also check serial port connector pins for contamination
	Printer is assigned as parallel by STAT	Use STAT to assign printer device to serial; type: STAT LST:=TTY:

KAYPRO 2 AND 4 SYMPTOM—FIX GUIDE (CONTINUED)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
No output to serial printer (cont'd)	Baud rate of printer does not match baud rate of computer	Use CONFIG to set baud rate for serial port
	Defective power supply	Check voltages (esp.-12 V) at power supply output; replace power supply
	Defective harness	Check voltages (esp.-12V) at main board power connector; replace harness
	Defective mainboard	Replace mainboard
No characters on video when keys struck on keyboard	Defective keyboard coil cord	Replace coil cord
	Defective keyboard	Replace keyboard
	Keyboard connector on mainboard defective	Check for shorted contacts on keyboard plug; esp. soldering to main board
	Defective mainboard	Replace mainboard
Wrong characters or too many characters appear when a key is struck	Defective keyboard	Replace keyboard
	Defective mainboard	Replace mainboard (if "^@^@^@" appears, replace 8116 IC on mainboard)

15.3 KAYPRO 10 SYMPTOM—FIX GUIDE

IMPORTANT NOTE
****

Do not proceed with troubleshooting a Kaypro 10 until you verify that the computer has EPROM number 81-302-n (installed at the factory), or has been upgraded in the field with kit number 81-303.

This note only applies to Kaypro 10 computers with the 81-180-n mainboard; NOT to the Kaypro 10 computers with the 81-582-n mainboard.

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
No power, no lights, no video	Power cord not plugged in	Check all cord connections
	Fuse is blown	Replace fuse
	Mainboard not getting power	Check harness connections, then check for proper voltages from power supply; replace either harness or power supply
	Defective mainboard	Replace mainboard
	Defective fuse holder	Replace fuse holder
	Power switch shorted internally	Replace power switch
	Power supply jumpered for wrong supply voltage	Correct jumpering on power supply
	Defective power supply	Check for proper voltage output at power supply harness connector; replace power supply
	Defective harness	Replace harness
Fuse blows when power turned on	Defective power supply	Replace power supply
	One module has a short	Disconnect all modules, replace fuse, and re-connect one by one until fuse blows again; replace it
	Defective harness	Replace harness

KAYPRO 10 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
High-pitched squeal or "chirp" upon power-on	One module is shorted	Unplug modules, one at a time, from the harness. Replace the module whose unplugging causes the noise to stop.
Power LED flickers	Shorted module	Disconnect modules from power one at a time until LED stays on; replace module whose unplugging causes LED to stay on
	Defective power supply	Replace power supply
	Defective harness	Replace harness
No video display, or poor quality display	Brightness not adjusted	Turn up brightness knob on rear of chassis; turn up brightness pot on CRT board, if necessary
	CRT not connected	Check all connections to CRT; ensure CRT tube plug is square
	Defective CRT	Replace CRT assembly
	Defective mainboard	Replace mainboard
	Defective power supply	Replace power supply
	Defective harness	Replace harness
Extra pixels on video	Defective mainboard	Replace mainboard
	Defective CRT	Replace CRT assembly
Inverse video only	Defective mainboard	Replace mainboard
	Defective CRT	Replace CRT assembly

KAYPRO 10 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSES	RECOMMENDED ACTION
No graphics on video	Damaged system image	Run PUTSYS and PUTOVL
	Defective mainboard	Replace mainboard
	Defective CRT	Replace CRT assembly
No video; drives running	Poor cable connection	Check all cable connections, (esp. to/from video harness plug)
	Defective mainboard	Replace mainboard
	Defective CRT	Replace CRT assembly
	Elston CRT: fuse blown	Check continuity of pico-fuse on Elston video board (just above power connector) If open, replace
Hard drive boots, but no cursor on video	Defective system image	Run PUTSYS and PUTOVL from the diskette drive, push RESET
	Defective mainboard	Replace mainboard
Diskette drive boots, but no cursor on video	Defective system image on diskette	Run GENFLPY on the diskette; push RESET
	Defective mainboard	Replace mainboard
	Defective drive	Replace diskette drive
Diskette drive won't boot; or BDOS error on diskette drive	Diskette not centered	Remove diskette, center diskette in its jacket; try again
	No system image on diskette	Run GENFLPY on the diskette; push RESET
	Defective diskette	Try a known good diskette with a known good system image

KAYPRO 10 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
Diskette drive won't boot; or BDOS errors	Poor cable connection	Check all cable connections; esp. those to/from drives and the controller board
	No system image	Run GENFLPY
	Incorrect cable orientation	Verify that all cables are oriented properly
	Defective mainboard	Replace mainboard
	Defective drive	Replace diskette drive
Diskette drive won't format a disk	Diskette off center	Ensure that diskette is centered within its jacket
	Defective diskette drive	Replace diskette drive
	Defective mainboard	Replace mainboard
Diskette drive has BDOS errors or won't work if warm	Defective drive heads	Replace diskette drive
	Defective mainboard	Replace mainboard
Diskette drive makes a rattling noise, and won't boot	Defective diskette drive	Replace diskette drive
	Defective mainboard	Replace mainboard
High-pitched whine when diskette drive runs	Defective diskette drive ("singing heads")	Replace diskette drive

KAYPRO 10 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
Hard drive will not boot; or boots with "System Status 02" ("Read Fault") message	Machine not upgraded	Verify installation of eprom number 81-302-x (at the factory), or kit 81-303; install if needed
	Poor cable connection	Check all cable connections
	Incorrect cable orientation	Verify that all cables are oriented properly
	System image degraded	Boot on a disk in the diskette drive; then log onto hard drive. Run FINDBAD (or CHECK on cylinders 0 and 1) if no errors are found, run PUTSYS and PUTOVL
	Defective controller board	Replace controller board
	Degraded format on hard disk	Boot on a disk in the diskette drive; run FORMAT on entire hard drive; then run PUTSYS and PUTOVL
	Defective mainboard	Replace mainboard
	Defective hard drive	Replace hard drive
	Defective power supply	Replace power supply

Except in the case of an obvious head crash or brake assembly failure, ALWAYS suspect other modules first when a defect appears to be within the hard drive.

No output to parallel printer	No power to printer	Check that printer is plugged in, and selected
	Poor cable connection	Check all cable connections from computer to printer
	Printer is assigned as serial by STAT	Use STAT to assign printer device as parallel; type: STAT LST:=LPT:
	Defective mainboard	Replace mainboard

KAYPRO 10 SYMPTOM—FIX GUIDE (CONT'D)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
No output to serial printer	No power to printer	Check that printer is plugged in and selected
	Poor cable connection	Check all cable connections from computer to printer; also check serial port connector pins for contamination
	Printer is assigned as parallel by STAT	Use STAT to assign printer device to serial; type: STAT LST:=TTY:
	Baud rate of printer does not match baud rate of computer	Use CONFIG to set baud rate for serial port
	Defective power supply	Check voltages (esp.-12 V) at supply output; replace supply
	Defective harness	Check voltages (esp.-12V) at main board power connector; replace harness
	Defective mainboard	Replace mainboard

KAYPRO ROBIE SYMPTOM—FIX GUIDE

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
No video display	Defective CRT	Replace CRT assembly
	Defective mainboard	Replace mainboard
	Defective power supply	Replace power supply
	Defective harness	Replace harness
Video is on, but screen is filled with "garbage" characters	Defective mainboard	Replace mainboard
	Reset harness shorted to chassis	Check lugs of reset button for grounding to inside of chassis
	Defective reset harness	Replace reset harness
"Raster" (horizontal lines) on video	Brightness not adjusted properly	Turn up brightness knob on back of chassis; adjust brightness pot on CRT board if necessary
	Loose connection from mainboard or power supply	Check black plug from power supply to CRT board, 4-pin jumper from mainboard to CRT board; check that plug on rear of CRT tube is square
Strange video image	Defective mainboard	Replace mainboard
Missing characters on video display	Defective mainboard	Replace mainboard
Will not boot	Defective diskette	Change diskettes
	Diskette has no system image	Change diskettes; use a diskette with a known good system image
	Wrong diskette for model of machine	ROBIE will only boot on 17 sector, 192 TPI diskettes
	Defective drive B	Unplug data cable from drive B, and reset machine; if it boots, replace B drive

KAYPRO ROBIE SYMPTOM—FIX GUIDE (CON'T.)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
No video display	Defective CRT	Replace CRT assembly
	Defective mainboard	Replace mainboard
	Defective power supply	Replace power supply
	Defective harness	Replace harness
Video is on, but screen is filled with "garbage" characters	Defective mainboard	Replace mainboard
	Reset harness shorted to chassis	Check lugs of reset button for grounding to inside of chassis
	Defective reset harness	Replace reset harness
"Raster" (horizontal lines) on video	Brightness not adjusted properly	Turn up brightness knob on back of chassis; adjust brightness pot on CRT board if necessary
	Loose connection from mainboard or power supply	Check black plug from power supply to CRT board, 4-pin jumper from mainboard to CRT board; check that plug on rear of CRT tube is square
Strange video image	Defective mainboard	Replace mainboard
Missing characters on video display	Defective mainboard	Replace mainboard
Will not boot	Defective diskette	Change diskettes
	Diskette has no system image	Change diskettes; use a diskette with a known good system image
	Wrong diskette for model of machine	ROBIE will only boot on 17 sector, 192 TPI diskettes
	Defective drive B	Unplug data cable from drive B, and reset machine; if it boots, replace B drive

KAYPRO ROBIE SYMPTOM—FIX GUIDE (CON'T.)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
Will not boot	Defective mainboard	Replace mainboard
	Defective drive A	Replace drive A
	Defective data cable	Replace data cable
Both drive LEDs are on, won't boot	Problem on power-up	Reset machine
	Diskette has no CP/M	Try known good sysgenned diskette
	Defective mainboard	Replace mainboard
	Select jumpers on drives incorrect	Check select jumpers
Drive A LED only on during reset	Drive select jumpering incorrect	Check jumpering on drive A
No LED on drive A at any time	Data cable poorly connected	Check all connections on data cable
	Defective data cable	Replace data cable
	Defective drive A	Replace drive A
	Defective mainboard	Replace mainboard
Computer boots CP/M, but no master menu appears	Defective diskette	Try known good, sysgenned diskette
	Defective drive A	Replace drive A
	Defective mainboard	Replace mainboard
Rattling sound from drive when accessing	Defective drive	Replace the diskette drive
	Defective mainboard	Replace mainboard

KAYPRO ROBIE SYMPTOM—FIX GUIDE (CONT'D.)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
Drive will not step through all tracks on diskette	Drive connectors loose	Check all connectors on rear of drive
	Defective mainboard	Replace mainboard
	Defective drive	Replace diskette drive
	Defective data cable	Replace data cable
Errors on either drive during COPY	Defective diskette	Change the diskette (if problem is on drive B, insert another blank diskette; if on drive A, try to copy from a new master)
	Defective disk drive	Replace diskette drive
	Defective mainboard	Replace mainboard
No output to parallel printer	No power to printer	Check that printer is plugged in, and selected
	Poor cable connection	Check all cable connections from computer to printer
	Printer is assigned as serial by STAT	Use STAT to assign printer device as parallel, type: STAT LST:=LPT:
	Defective mainboard	Replace mainboard
No output to serial printer	No power to printer	Check that printer is plugged in and selected
	Poor cable connection	Check all cable connections from computer to printer; also check serial port connector pins for contamination

KAYPRO ROBIE SYMPTOM—FIX GUIDE (CONT'D.)

CONDITION	POSSIBLE CAUSE	RECOMMENDED ACTION
No output to serial printer (cont'd)	Printer is assigned as parallel by STAT	Use STAT to assign printer device to serial; type: STAT LST:=TTY:
	Baud rate of printer does not match baud rate of computer	Use CONFIG to set baud rate for serial port
	Defective power supply	Check voltages (esp.-12 V) at power supply output; replace power supply
	Defective harness	Check voltages (esp.-12V) at main board power connector; replace harness
	Defective mainboard	Replace mainboard
No characters on video when keys struck on keyboard	Defective keyboard coil cord	Replace coil cord
	Defective keyboard	Replace keyboard
	Keyboard connector on mainboard defective	Check for shorted contacts on keyboard plug; esp. soldering to main board
	Defective mainboard	Replace mainboard
Wrong characters	Defective keyboard	Replace keyboard

15.5 KAYPRO 2/84 AND KAYPRO 2X SYMPTOM—FIX GUIDE

See KAYPRO 2 AND 4 SYMPTOM--FIX GUIDE for the 2/84. The problems and solutions will not be different.

For troubleshooting information on the KAYPRO 2X, see the KAYPRO 2 AND 4 SYMPTOM--FIX GUIDE for all problems.

15.6 KAYPRO 4X SYMPTOM-FIX GUIDE

For help in troubleshooting the KAYPRO 4X, see the KAYPRO ROBIE SYMPTOM—FIX GUIDE.

16.Ø KAYPRO SYSTEM I/O

16.1 VIDEO COMMAND PROTOCOL

The Kaypro video section was designed to imitate most of the control sequences of a Lear-Siegler ADM-3A terminal. For most commercial software, this means that you can "install" or customize the display characteristics by choosing ADM-3A from the menu.

For custom software or those instances where there is no choice of "ADM-3A" on the menu, the complete command protocol for the KAYPRO 2, 4, or 1Ø is:

Control Characters

Action	Dec	Hex
Ring Bell	Ø7	Ø7
Cursor left (non-destructive)	Ø8	Ø8
Cursor Right	12	ØC
Cursor Down	1Ø	ØA
Cursor Up	11	ØB
Erase to end of screen	23	17
Erase to end of line	24	18
Clear screen, home cursor	26	1A
Home cursor	3Ø	1E

ESCape Sequences

Insert line	ESCape,R
Delete line	ESCape,E
Cursor address	ESCape,=,row+32,col+32

* Additionally, the following codes apply to: KAYPRO 2/84, 2X, 4/84, 4X, 10, and ROBIE (KAYPRO computers with graphics capability):

Reverse video start	ESCape,B,Ø
Reverse video stop	ESCape,C,Ø
Half intensity start	ESCape,B,1
Half intensity stop	ESCape,C,1
Blinking start	ESCape,B,2
Blinking stop	ESCape,C,2
Underline start	ESCape,B,3
Underline stop	ESCape,C,3
Cursor on	ESCape,B,4
Cursor off	ESCape,C,4
Video mode on	ESCape,B,5
Video mode off	ESCape,C,5
Remember current cursor position	ESCape,B,6
Return to last remembered cursor position	ESCape,C,6
Status line preservation on	ESCape,B,7
Status line preservation off	ESCape,C,7
Set pixel	ESCape,*,V1,H1
Clear pixel	ESCape, ,V1,H1
Set line	ESCape,L,V1,H1,V2,H2
Delete line	ESCape,D,V1,H1,V2,H2

16.2 KEYBOARD CODES AND FUNCTIONS

Control key functions in CP/M:

DEL	Delete and echo the last character typed at the console (same as rubout).
CTRL-C	CP/M system reboot (warm start).
CTRL-E	Physical, not logical, end of line. Carriage is returned, but line is not sent until RETURN key is pressed.
CTRL-G	Bell; sounds an audible bell (from keyboard).
CTRL-H	Backspace; move cursor left one character position.
CTRL-I	Horizontal tab, moves cursor to the next defined tab stop. CP/M assumes tab stops at every 8th position.
CTRL-J	Linefeed: move cursor down one line.
CTRL-M	Carriage return; return cursor to left margin.
CTRL-R	Retype current command line. Types a "clean line" following character deletion with rubouts.
CTRL-U	Delete the entire line typed at the console.
CTRL-X	Same as CTRL-U.

SEE ALSO: ASCII character chart, Section 17.1.

16.3 CONNECTOR PIN-OUTS

This section contains the pin assignments on various output ports on Kaypro computers, intended as an aid in building printer cables and in troubleshooting problems with peripherals.

CONNECTOR PIN-OUTS, KAYPRO 2/83 AND KAYPRO 4/83

PARALLEL PRINTER PORT: J2

	STROBE	1	19	
(LSB)	DATA Ø	2	2Ø	
	DATA 1	3	21	
	DATA 2	4	22	
	DATA 3	5	23	
	DATA 4	6	24	
	DATA 5	7	25	GROUND
	DATA 6	8	26	
(MSB)	DATA 7	9	27	
	N/C	1Ø	28	
	BUSY (IN)	11	29	
		12	3Ø	
		13	31	
	N/C			N/C
		14	32	
		15	33	GROUND
		16	34	
	GROUND			
		17	35	N/C
	N/C	18	36	

Top of connector Bottom of connector

Note that the BUSY line is read by the KAYPRO as active when it's disconnected (no cable). The computer will hang if you attempt to print to an unconnected parallel printer.

KAYPRO 2/83 AND KAYPRO 4/83 KEYBOARD CONNECTOR (J3)

TxD	4	2	RxD
GND	3	1	+5V

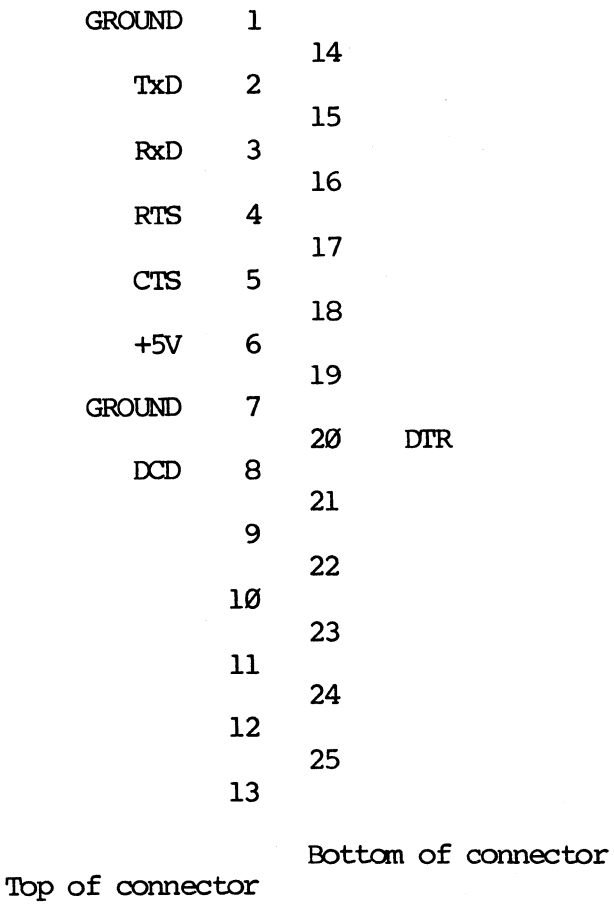
KAYPRO 2/83 AND KAYPRO 4/83 SERIAL PORT (RS232C — J4)

GROUND	1		
		14	
TxD	2		
		15	
RxD	3		
		16	
	4		
		17	
CTS	5		
		18	
	6		
		19	
GROUND	7		
		2Ø	DTR
	8		
		21	
	9		
		22	
	1Ø		
		23	N/C
N/C	11		
		24	
	12		
		25	
	13		

Top of connector

Bottom of connector

KAYPRO 10 MODEM PORT (J3)



KAYPRO 10 KEYBOARD CONNECTOR (J5)

The pin-out for this connector is the same as J3 on the KAYPRO 2/83 and KAYPRO 4/83. See page 16--6.

KAYPRO 10 PARALLEL PRINTER CONNECTOR (J6)

The pin-out for this connector is the same as J2 on the KAYPRO 2/83 and KAYPRO 4/83. See page 16--5.

KAYPRO 10 SERIAL PRINTER PORT (RS232C — J4)

GROUND	1		
		14	
RxD	2		
		15	
TxD	3		
		16	
	4		
		17	
	5		
		18	
	6		
		19	
GROUND	7		
		20	CTS
	8		
		21	
	9		
		22	
	10		
		23	N/C
	11		
		24	
	12		
		25	
	13		

Top of connector

Bottom of connector

KAYPRO 2/84, 2X, 4/84, 4X AND ROBIE KEYBOARD CONNECTOR (J2)

The pin-out for this connector is the same as J3 on the KAYPRO 2/83 and KAYPRO 4/83. See page 16--6.

KAYPRO 2/84, 2X, 4/84, 4X AND ROBIE SERIAL DATA CHANNEL (J4)

The pin-out for this connector is the same as J4 on the KAYPRO 2/83 and KAYPRO 4/83. See page 16--6.

KAYPRO 2/84, 2X, 4/84, 4X AND ROBIE SERIAL PRINTER CONNECTOR (J3)

GROUND	1		
		14	
RxD	2		
		15	
TxD	3		
		16	
	4		
		17	
N/C	5		
		18	
	6		
		19	
GROUND	7		
		2Ø	CTS
	8		
		21	
	9		
		22	
	1Ø		
		23	N/C
N/C	11		
		24	
	12		
		25	
	13		

KAYPRO 2/84, 2X, 4/84, 4X AND ROBIE PARALLEL PRINTER CONNECTOR (J5)

PSTROB	1	19	
DØ	2	2Ø	
D1	3	21	
D2	4	22	
D3	5	23	
D4	6	24	
D5	7	25	
D6	8	26	GROUND
D7	9	27	
	1Ø	28	
	11	29	
	12	3Ø	
	13	31	
	14	32	
	15	33	
GROUND	16	34	GROUND
	17	35	
SPARE	18	36	

KAYPRO 4/84, 4X AND ROBIE MODEM CONNECTOR (J6)

Note that this is <u>NOT</u> connected on the 2/84 and 2X.

N/C	1		
		2	N/C
TIP (Green)	3		
		4	RING (Red)
N/C	5		
		6	N/C

16.4 I/O PORT ADDRESSES

The port addresses below apply to KAYPRO 2/83 and 4/83 computers.

Port #	Use and/or Assignment
ØØ	Baud Rate (write only) - Writing a number between Ø and F hex (see baud rate table) to this port sets the RS-232C baud rate.
Ø4	RS-232C Serial Data (R/W) - Data register of the Z-8Ø SIO. Refer to Zilog/Mostek Microcomputer Data books for further information.
Ø5	Keyboard Data (R/W) - Eight-bit data from detachable keyboard.
Ø6	RS-232C Status (R/W) - Control/status port for the Z-8Ø SIO. Refer to Zilog/Mostek Microcomputer Data books for further information.
Ø8	Printer Port (write only) - Eight-bit data to parallel printer connector.
1C	System Port (R/W) - This port is used for system control. The various bits are used for memory bank selection, disk drive control, and printer handshaking.

The serial output is an 8-bit word with one start, one stop, and no parity.

Examples:

* Received character available is obtained by testing bit Ø of the status port. Character is available if this bit is high (a 1 rather than Ø).

* Transmit Buffer Empty is obtained by testing bit 2 of the status port. Buffer is empty when bit 2 is high (1).

Manuals on the Z-8Ø CPU, Z-8Ø PIO, Z-8Ø SIO are available from the ZILOG sales office nearest to you. Western Digital can sell you a copy of the manual for the Floppy Disk Controller. Refer to Reference Section for vendors' mailing addresses and phone numbers.

When ordering manuals for any of the chips mentioned above, remove the hood from the computer and write down the full model number that is on the top surface of the chip. This is the best way to be certain of getting the proper manual from either of the manufacturers listed above.

The following port address information applies to KAYPRO 10, KAYPRO 2/84, KAYPRO 2X, KAYPRO 4/84, KAYPRO 4X, and KAYPRO ROBIE.

I/O PORT ADDRESSES

Use	Port# (hex)	Device	Function
Keyboard:			
	05	ZSIO 1 Chan. B	Keyboard data(R/W). Eight-bit data from keyboard.
	07	ZSIO 1 Chan. B	Keyboard control/status I/O.
Video:			
	1C	6545/6845 EA	CRT controller status/control I/O.
	1D	6545/6845 EA	CRT controller data I/O.
Parallel Printer: (output only)			
	18 - 1B	74 373	Parallel printer port (write only).
Serial Printer I/O:			
	08 - 0B	WD 1943 COM 8116	Baud rate for serial printer port.
	0C	ZSIO 2 Chan. A	Serial printer data I/O (RS-232C).
	0E	ZSIO 2 Chan. A	Serial printer control/status I/O.
Serial Data I/O:			
	00 - 03	WD 1943 COM 8116	Baud rate for serial data port (write only).
	04	ZSIO 1 Chan. A	Serial data port (RS-232C). Data I/O.
	06	ZSIO 1 Chan. A	Serial data port (RS-232C). Status/control I/O.

Use	Port# (hex)	Device	Function
Real-time clock:		(NS-MM58167A)	
	2Ø	PIO Chan. A data.	Real-time clock register select and interrupt status. Bit functions: Ø lsb register select (output). 1 " 2 " 3 " 4 msb register select (output). 5 not used 6 rtc interrupt output (input). 7 rtc not standby interrupt output (input).
	22	PIO Chan. A	Real-time clock PIO control port.
	24	MM 58167A	Real-time clock data I/O.

Use	Port# (hex)	Device	Function
System:			
	14 - 17	74 373	System output port. Bit functions. Ø Ø=Select floppy A (C on K1Ø). 1 Ø=Select floppy B (Hard disk on K1Ø). 2 Ø=Select side 2. 3 PSTROB. 4 Ø=Floppy motor on (48 tpi drives). 1=Select high speed (High density drive). * see note 5 Ø=Select double-density. 6 Ø=Select normal character set. 7 Ø=Select 64K RAM. 1=Select ROM (RAM 8ØØØ-FFFF).
		74 244	System input port. Bit functions. Ø Ø=floppy A selected (C on K1Ø). 1 Ø=floppy B selected (Hard disk on K1Ø). 2 Ø=Side 2 selected. 3 PSTROB. 4 Ø=motor is on (48 tpi floppy). 5 Ø=Double-density is selected. 6 Ø=Parallel printer is busy. 7 Ø=64K RAM is selected. 1=ROM (RAM 8ØØØ-FFFF) selected.

* Note on high-density drives:

A 1 in bit position 4 will select high speed on the high-density diskette drive. To reset the drive to low speed it is necessary to change this bit to a Ø AND open the drive door, then close it.

Use	Port# (hex)	Device	Function
Internal Modem:			
	ØD	ZSIO 2 Chan. B	Internal modem data I/O port.
	ØF	ZSIO 2 Chan. B	Internal modem status/control I/O port.
	21	PIO Chan. B	Internal modem control lines. Bit functions. Ø lsb digit to dial (output). 1 " 2 " 3 msb digit to dial (output). 4 Ø=touch tone. 1=pulse dial. -ate on modem chip. 5 Ø=not loop back (test mode). 6 Ø=off hook (on line). 7 1=digit present to dialer chip, not BSTROBE input present next digit from dialer chip.
	23	PIO Chan. B	Modem PIO control port.

The internal modem on the KAYPRO uses Texas Instruments TMS99531 dialer and TMS99532 modem chips. Both of these chips are accessed through the Z8Ø PIO and Z8Ø SIO chips. Specification sheets on these chips are available from Texas Instruments and ZILOG respectively.

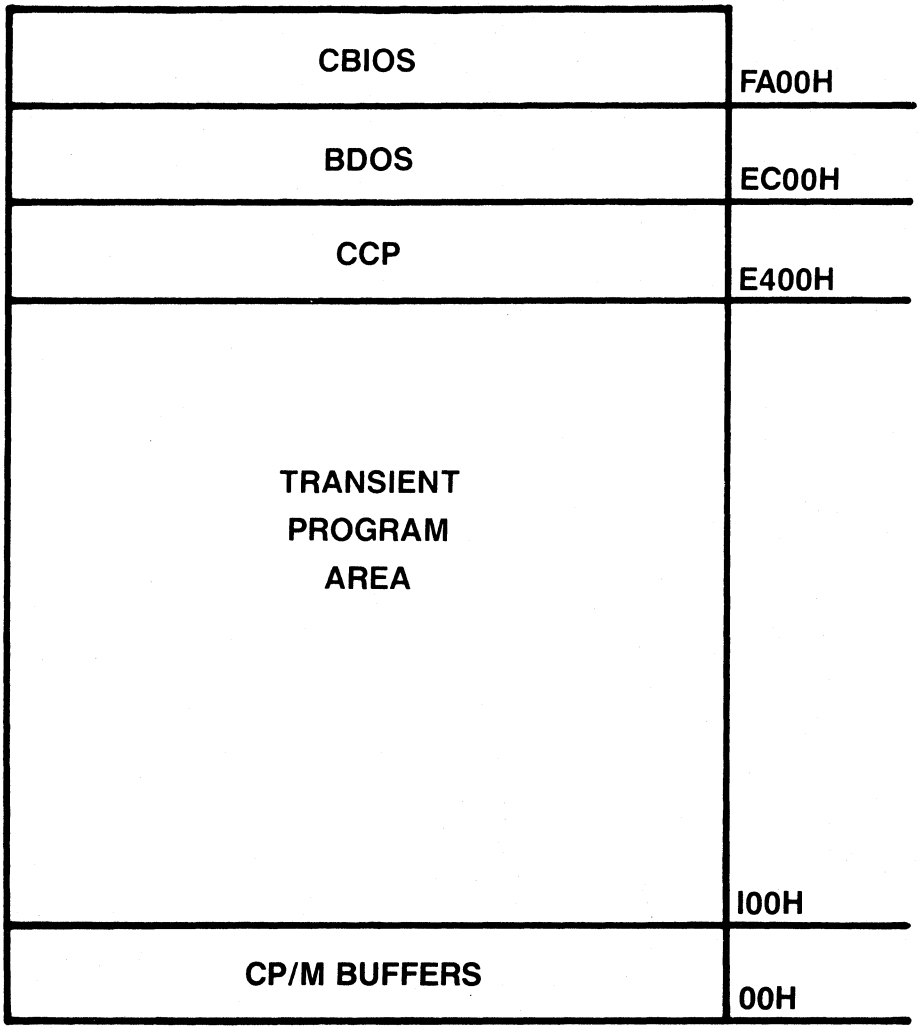
Disk Controller Ports:			
	1Ø	1793	Floppy disk controller status/command I/O port.
	11	1793	Floppy disk controller track register I/O port.
	12	1793	Floppy disk controller sector register I/O port.
	13	1793	Floppy disk controller data register I/O port.

Use	Port# (hex)	Device	Function
	80	WD 1002	Hard disk controller card data I/O port.
	81		Error Register (input). Write Precomp. (output).
	82		Sector count register I/O.
	83		Sector number register I/O.
	84		Cylinder low register I/O.
	85		Cylinder high register I/O.
	86		Size/drive/head register I/O.
	87		Status register for input. Command register for output.

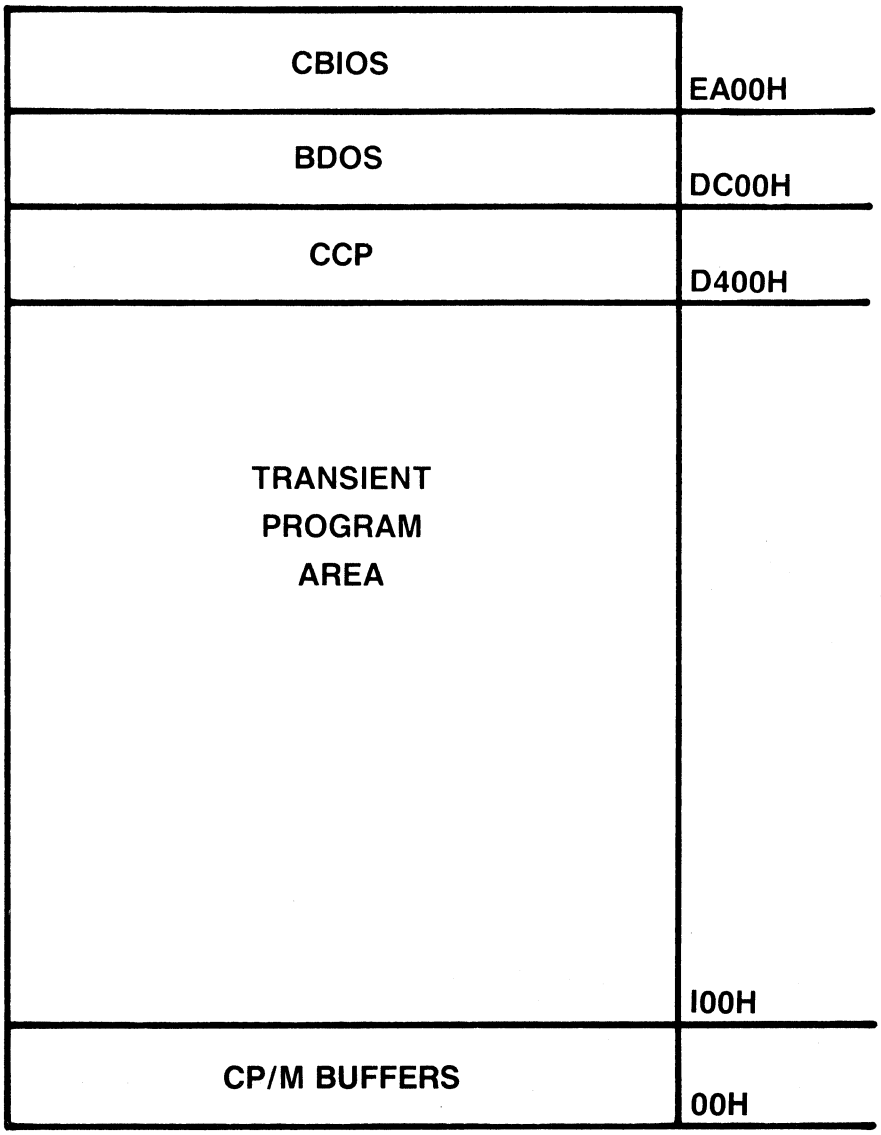
17.Ø REFERENCE SECTION
17.1 ASCII CHART

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
Ø	ØØ	NUL or ^@	32	2Ø	Space	64	4Ø	@	96	6Ø	`
1	Ø1	SOH or ^A	33	21	!	65	41	A	97	61	a
2	Ø2	STX or ^B	34	22	"	66	42	B	98	62	b
3	Ø3	ETX or ^C	35	23	#	67	43	C	99	63	c
4	Ø4	EOT or ^D	36	24	$	68	44	D	1ØØ	64	d
5	Ø5	ENQ or ^E	37	25	%	69	45	E	1Ø1	65	e
6	Ø6	ACK or ^F	38	26	&	7Ø	46	F	1Ø2	66	f
7	Ø7	BEL or ^G	39	27	'	71	47	G	1Ø3	67	g
8	Ø8	BS or ^H	4Ø	28	(	72	48	H	1Ø4	68	h
9	Ø9	HT or ^I	41	29	)	73	49	I	1Ø5	69	i
1Ø	ØA	LF or ^J	42	2A	*	74	4A	J	1Ø6	6A	j
11	ØB	VT or ^K	43	2B	+	75	4B	K	1Ø7	6B	k
12	ØC	FF or ^L	44	2C	,	76	4C	L	1Ø8	6C	l
13	ØD	CR or ^M	45	2D	-	77	4D	M	1Ø9	6D	m
14	ØE	SO or ^N	46	2E	.	78	4E	N	11Ø	6E	n
15	ØF	SI or ^O	47	2F	/	79	4F	O	111	6F	o
16	1Ø	DLE or ^P	48	3Ø	Ø	8Ø	5Ø	P	112	7Ø	p
17	11	DC1 or ^Q	49	31	1	81	51	Q	113	71	q
18	12	DC2 or ^R	5Ø	32	2	82	52	R	114	72	r
19	13	DC3 or ^S	51	33	3	83	53	S	115	73	s
2Ø	14	DC4 or ^T	52	34	4	84	54	T	116	74	t
21	15	NAK or ^U	53	35	5	85	55	U	117	75	u
22	16	SYN or ^V	54	36	6	86	56	V	118	76	v
23	17	ETB or ^W	55	37	7	87	57	W	119	77	w
24	18	CAN or ^X	56	38	8	88	58	X	12Ø	78	x
25	19	EM or ^Y	57	39	9	89	59	Y	121	79	y
26	1A	SUB or ^Z	58	3A	:	9Ø	5A	Z	122	7A	z
27	1B	ESC or ^[	59	3B	;	91	5B	[	123	7B	{
28	1C	FS or ^\	6Ø	3C	<	92	5C	\	124	7C	|
29	1D	GS or ^]	61	3D	=	93	5D	]	125	7D	}
3Ø	1E	RS or ^^	62	3E	>	94	5E	^	126	7E	~
31	1F	US or ^_	63	3F	?	95	5F	_	127	7F	DEL

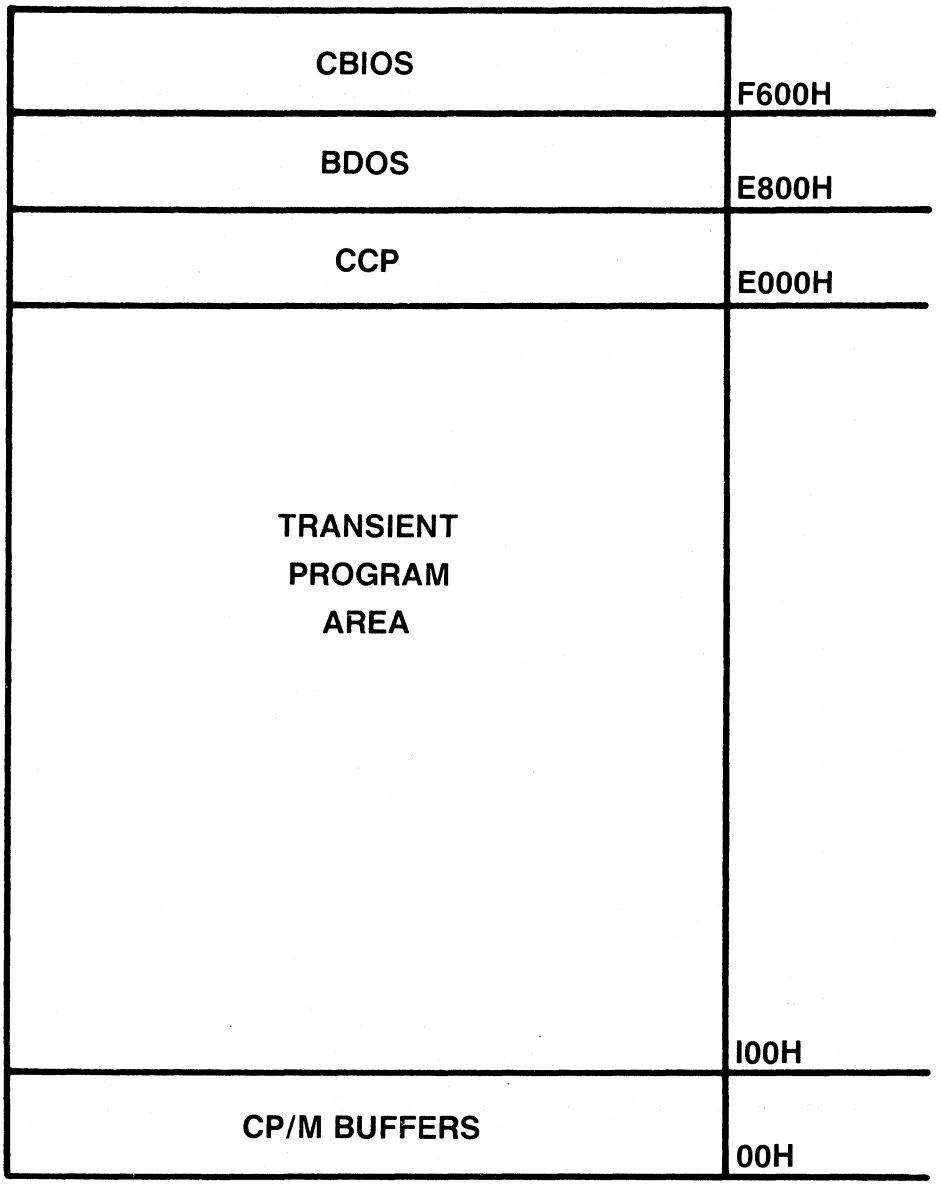
MEMORY MAP OF KAYPRO 2 AND KAYPRO 4



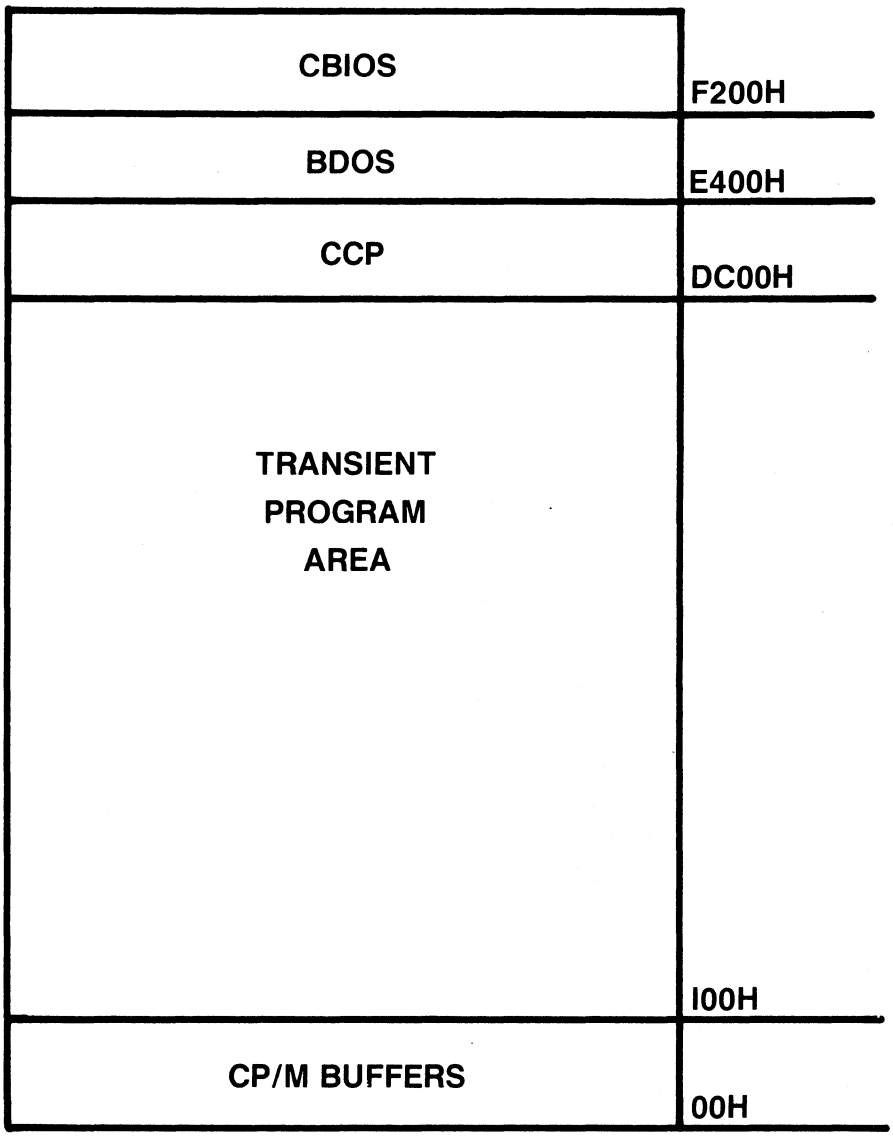
MEMORY MAP OF KAYPRO 10



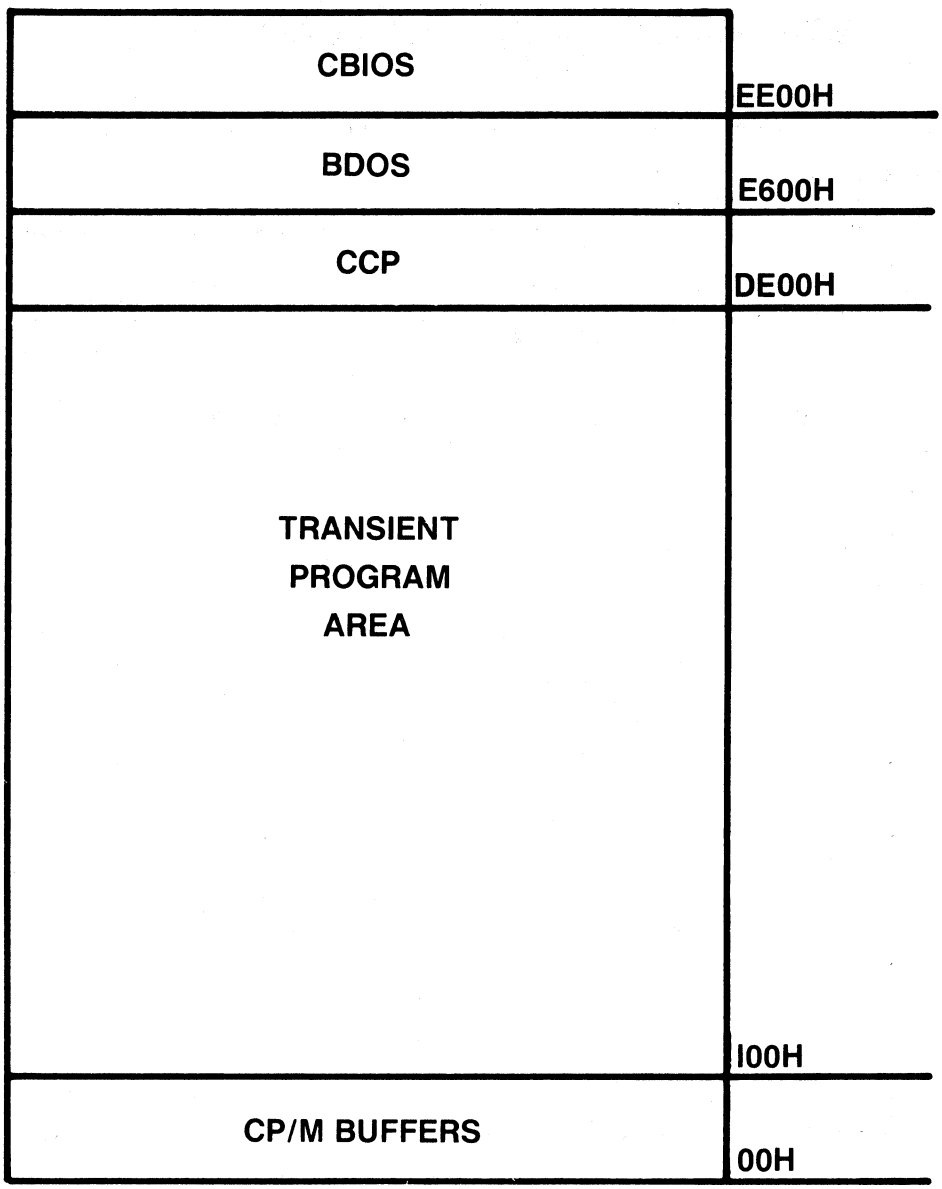
MEMORY MAP OF KAYPRO 2/84 AND 4/84



MEMORY MAP OF KAYPRO ROBIE



MEMORY MAP OF THE KAYPRO



2X WITH CLOCK AND MODEM — NEW 2

10 WITH CLOCK AND MODEM — KAYPRO 1

17.3 VENDOR ADDRESSES

Kaypro Corporation does not provide repair or reference manuals for other companies' products which are used in Kaypro computers. The list below does not presume to be complete, but is included for dealer convenience in ordering manuals directly from the manufacturer.

Drives

Drivetec
2140 Bering Drive
San Jose, Ca. 95131
(408) 946-2222

Epson
17752 Skypark #255
Irvine, Ca 92714
(714) 250-0111

HI-TEC
10150 Sorrento Valley Road
San Diego, Ca. 92121
(619) 452-5500

Microscience
575 E. Middlefield Road
Mountain View, Ca. 94043
(415) 961-2212

Seagate
920 Disc Drive
Scotts Valley, Ca. 95066
(408) 438-6550

Shugart
475 Oakmead Parkway
Sunnyvale, Ca. 94086
(408) 733-0100

Tandon
20320 Prairie Street
Chatsworth, Ca. 91311
(213) 993-6644

TEC
460 E. Middlefield Road
Mountain View, CA 94043
(415) 969-1100

Toshiba
9030 Carroll Canyon #7
San Diego, Ca. 92121
(619) 578-9171

Integrated Circuits

Mostek
18004 Skypark Circle
Suite 140
Irvine, Ca. 92714
(714) 250-0455

National Semiconductor
2900 Semiconductor Drive
Santa Clara, Ca. 95051
(408) 737-5000

Texas Instruments
17620 Fitch
Irvine, Ca. 92714
(714) 545-5210

Western Digital
3128 Red Hill Avenue
Costa Mesa, Ca. 92626

Zilog
18023 Skypark Circle
Suite J
Irvine, Ca. 92714
(714) 549-2891

CRT Assemblies

Audiotronics
7420 Belair Avenue
N. Hollywood, Ca. 91605
(213) 765-2645

Dotronix
160 1st Street S. E.
New Brighton, MN. 55112
(612) 633-1742

Elston
35 Lehigh Street
Geneva, N.Y. 14456
(315) 781-1350

Toshiba
9030 Carroll Canyon #7
San Diego, Ca. 92121
(619) 578-9171

Keyboards

Keytronics
7032 Owensmouth
Canoga Park, Ca. 91303
(714) 832-1685

Maxi-Switch
9697 E. River Road
Minneapolis, MN. 55433
(612) 755-7660

SMK
4617 Ruffner Street #206
San Diego, Ca. 92111
(619) 560-8330

Power Supplies

Astec
1101 Space Park
Santa Clara, Ca. 95050
(408) 727-3350

Boschert
384 Santa Trinita Avenue
Sunnyvale, Ca. 94086
(408) 732-2240

Cal D.C.
2150 Anehor Court
Newbury Park, Ca. 91320
(805) 499-3621

Disk Controller Board

Western Digital
2445 McCabe Way
Irvine, Ca. 92714
(714) 863-0102

18.Ø SUGGESTED REFERENCES

KAYPRO II Theory of Operation, by Dana Cotant-Micro Cornucopia, P.O. Box 223 - Bend, OR. 977Ø9

Modern Dictionary of Electronics, by Rudolf F. Graf, Radio Shack Catalog Number 62-231Ø

Some **colored markers or pencils** to mark the chip layout diagrams in this manual according to function (video, disk control, etc.) will be useful. Such "maps" can be time-saving devices.

The **CP/M Manual** included with each KAYPRO. You can devise excellent and effective tests for the machines through imaginative use of CP/M programs like PIP, SUBMIT, XSUB. To this end, books about CP/M (with an emphasis on programming; not for the beginner) can be helpful.

A good book containing information on the **Z8Ø microcomputer** and its family (SIO, PIO). Timing diagrams (or scope signals) in these books can help troubleshoot mainboards.

Any **component repair manuals** you feel necessary. See Section 17.4 for vendor addresses.

19.Ø KAYPRO 16

The KAYPRO 16 is an Intel 8Ø88 microprocessor based computer that supports 16-bit operations and runs at 4.77MHz. In addition to the 8Ø88, the KAYPRO 16 uses the 8237A-5 DMA, the 8253-5 timer, the 8255A-5 peripheral interface, the 8259A interrupt controller, the 8284A clock, and the 8288 bus controller. Data sheets for these chips can be found in the Microprocessor and Peripheral Handbook by Intel Corporation, order number: 21Ø844-ØØ1.

KAYPRO 16 SPECIFICATIONS

CPU	Intel 8088, operating at 4.77MHz.
RAM	256K bytes standard; expandable to 640K bytes.
MAINBOARD	81-510-n series.
EXPANSION	Four slots. Three are used for the system, leaving one slot for user options.
DISK STORAGE	One 5-1/4 inch, double-density, double-sided, floppy disk drive providing 360K bytes of storage per diskette. One hard disk drive providing 10M bytes of storage.
KEYBOARD	Detachable, IBM compatible keyboard.
VIDEO SCREEN	Non-glare, 9-inch, green phosphor screen with a 25 row x 80 column display.
I/O CONNECTIONS	One DB-25S parallel port (for parallel devices), one DE-9S or DE-9P serial port (for serial devices), one DE-9S video port (for an external RGB monitor), one composite video connector.

19.1 CHASSIS

CHASSIS HOOD REMOVAL

1. Turn off the machine.
2. Disconnect the AC power by unplugging the power cord from the wall outlet.
3. Remove the ten screws from the chassis hood; there are two on top and four on each side.
4. Remove the hood from the chassis.

CHASSIS HOOD REPLACEMENT

1. Set the hood on the chassis so that the two holes on top of the hood are aligned with the two holes on top of the chassis.
2. Insert the two flat-head screws into the holes on top of the hood. Start them, but do not tighten them yet.
3. Insert the eight round-head screws, four on each side, and start them.
4. Tighten each screw securely.

19.2 SYSTEM BOARDS

The KAYPRO 16 includes a mainboard and three cards as the standard system.

The mainboard is socketed for 512K bytes of RAM, one half is populated and one half is left open for expansion. The mainboard contains the video decoder circuitry which decodes RGB into 16 grey levels of monochrome. Also on the mainboard is the interface between the bus and the WD1ØØ2 disk controller board.

Three cards are standard in the expansion chassis, leaving one slot open for an optional card.

The processor card contains the keyboard interface circuitry, the 8237A-5 DMA, the 8253-5 Timer, the 8255A Programmable Peripheral Interface, the 8259A Programmable Interrupt Controller, the 8288 Bus Controller and the 8284A Clock Generator. The processor card is also socketed for an Intel 8Ø87 Numeric Data Co-Processor. The numeric co-processor is an option, therefore the socket is not populated.

The floppy-RAM-I/O card consists of the NEC uPD765 floppy disk controller, additional RAM sockets, and the I/O interfaces. There are two I/O connectors on this card, one is a DB-25S (parallel) and one is either a DE-9S or DE-9P (serial). The KAYPRO 16 uses the DB-25S connector for its parallel interface with peripherals. The DE-9S or DE-9P serial connector provides the interface for serial devices such as modems, plotters, or serial printers.

The color graphics card supplies the interface for an external RGB monitor through its DE-9S connector. There is also a connector for composite video on this card. Both of these connectors use industry standard cables.

IC LIST, KAYPRO 16

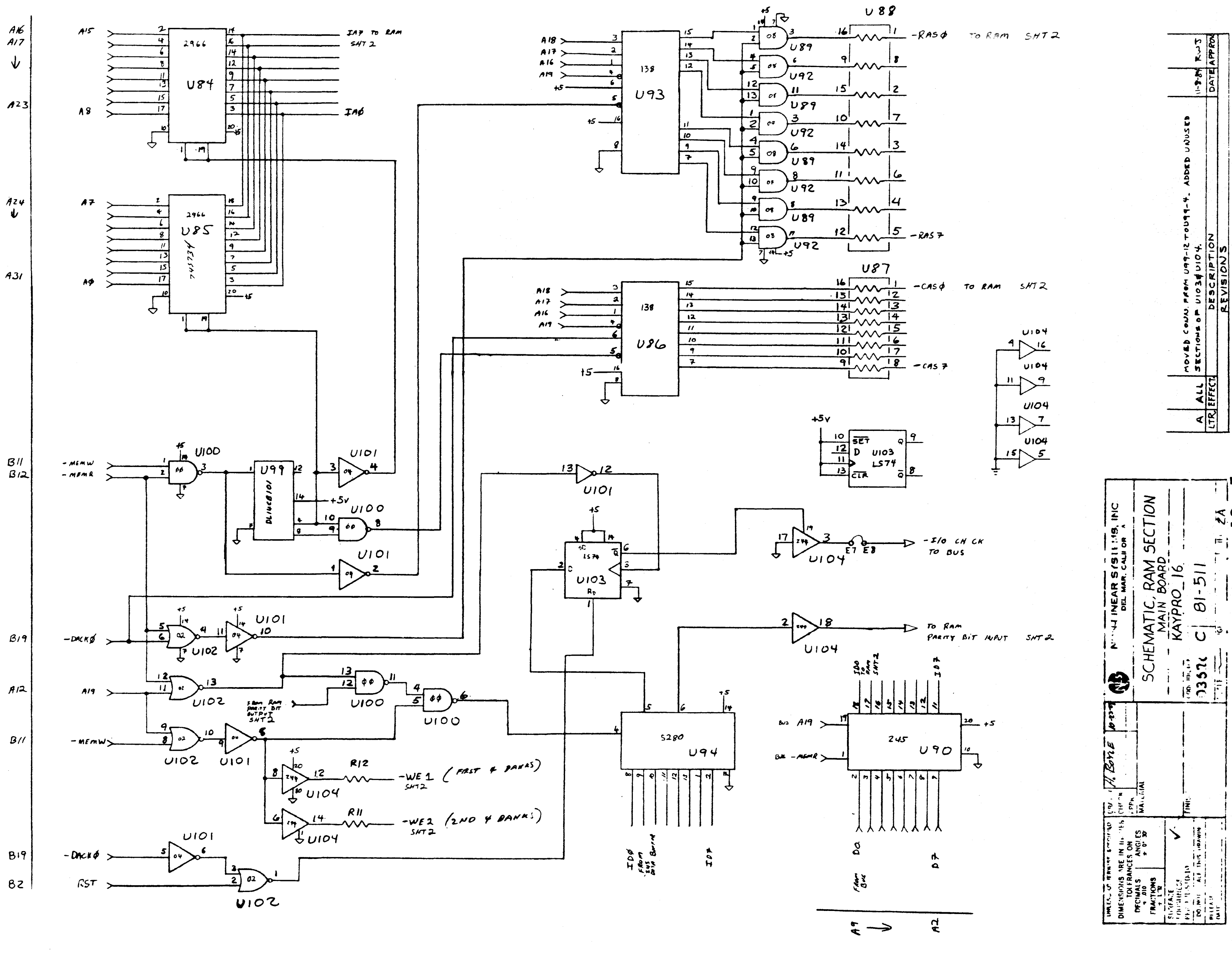
Reference Designation		Description
Mainboard, 81-511		
U1 - U36	6665-AP15	64K x 1, 150ns dynamic RAM
U73, U95, U104	SN74LS244N	Tri octal buffer
U74, U90	74LS245	Tri octal transceiver
U77, U103	74LS74	Dual "D" flip flop
U78, U89, U92	74LS08	Quad AND gate
U79, U100	74LS00	Quad NAND gates
U80	74LS32	Quad OR gate
U81, U97, U101	74LS04	Hex inverter
U82, U96	74LS30	Eight-input NAND gate
U83	7406	Hex inverter buffer/driver
U84, U85	74S734N	Memory driver
U86, U93	74LS138N	Decoder/demultiplexer
U90	74S280	Parity generator/checker
U91	2764-25	EPROM
U98	74LS156	Decoder/demultiplexer
U102	74LS02	Quad NOR gate
Floppy-RAM-I/O Card, 81-515		
U29	74LS155	Decoder/demultiplexer
U30, U34, U37	74LS240	Octal inverter buffer
U31, U47	74LS174	Hex "D" flip-flop
U32	74LS125	Quad tri buffer
U33	MC1488	Quad line driver
U35	74LS175	Quad SCHMITT transceiver
U36	PAL16R6A	Programmable array logic
Color Graphics Card, 81-517		
U1, U13	74LS10	Triple 3-input NAND gate
U2, U18	74LS86	Quad exclusive-OR gate
U3	74LS51	AND-OR-Invert gate
U4, U52	74LS32	Quad 2-input OR gate
U5	74LS157	Multiplexer
U6	74LS02	Quad 2-input NOR gate
U8, U29	74LS164	Shift register
U9, U66	74LS00	Quad 2-input NAND gate
U10	74LS151	Multiplexer
U11, U30	74S174	Hex "D" flip-flop
U12	74LS08	Quad 2-input AND gate
U14, U15, U54	74LS04	Hex inverter
U16	74LS125	Quad tri-state buffer
U17, U53	74LS74	Dual "D" flip-flop
U19, U34, U39, U51, U63	SN74LS244N	Tri octal buffer
U20, U21, U26, U31	74S74N	Dual "D" flip-flop
U22, U32	74LS153	Multiplexer
U23, U25, U33, U55	74LS174	Hex "D" flip-flop

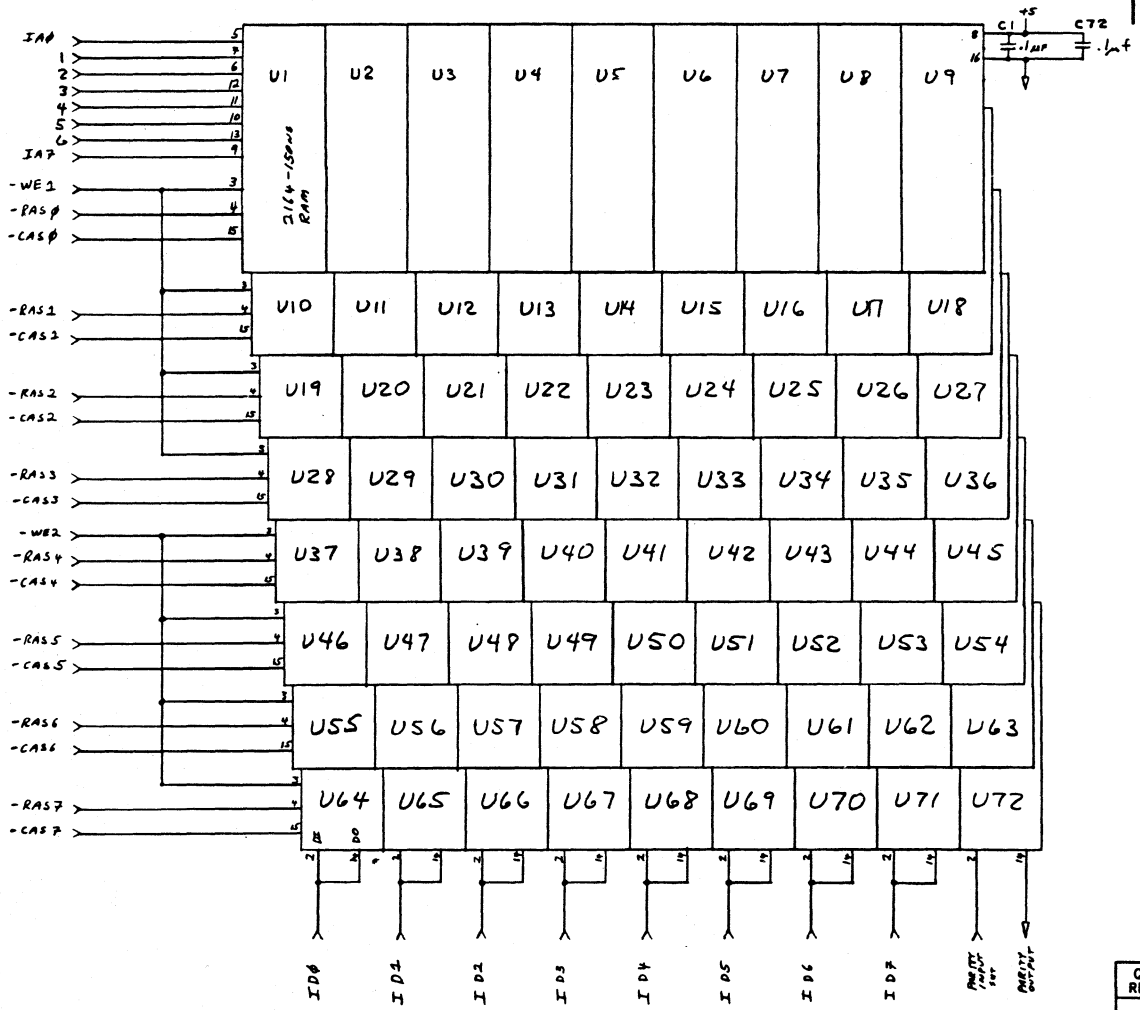
Color Graphics Card, 81-517, con't.

U27, U41	74SØØ	Quad 2-input NAND gate
U28	74LS138N	Decoder/demultiplexer
U29	74LS393	Binary ripple counter
U35, U36, U45, U46, U49, U5Ø, U61, U62	6665-AP15	64K x 1, 15Øns dynamic RAM
U37, U44, U47, U48	74LS374	Octal "D" flip-flop
U4Ø	6331	PROM
U42, U43, U59	SN74LS166N	Shift register
U56	74S163	Binary counter
U57	74SØ4	Hex inverter
U58	2732	EPROM
U6Ø	74LS273	Octal "D" flip-flop
U64, U65	74LS3Ø	8-input NAND gate
U67	74LS245	Octal transceiver

Processor Card, 81-513

U1	74LS322A	8-bit shift register
U2	8255	Programmable peripheral interface
U3	2764-25	EPROM
U4	8237A-5	DMA controller
U6	74LS67Ø	Register file
U7	74LS125	Quad tri buffer
U8, U17, U3Ø	74LS74	Dual "D" flip-flop
U9, U27	74LS175	Quad "D" flip-flop
U1Ø	8253-5	Programmable interval timer
U11, U16, U24, U25	74LS373	Octal latch
U12, U18, U22	SN74LS244N	Octal buffer
U13	8259A	Programmable interrupt controller
U14	8Ø88	CPU
U15	8288	Bus controller
U19	74LS37	Quad NAND buffer
U2Ø	74LSØ4	Hex inverter
U21	74LS32	Quad OR gate
U23, U26	74LS245	Octal transceiver
U28	74LS138N	Decoder/demultiplexer
U29	81-485	Programmable array logic
U31	74LS243	Quad transceiver
U32	81-484	Programmable array logic
U33	8284A	Clock generator/driver


SCHEMATIC, RAM SECTION
MAIN BOARD
KAYPRO 16
81-511
19—5
A ALL MOVED CONN. FROM U99-12 TO U99-4. ADDED UNUSED SECTIONS OF U103 & U104.
LTR EFFECT DESCRIPTION DATE APPROV
REVISIONS
U84
U85
U93
U86
U87
U88
U89
U92
U90
U94
U99
U100
U101
U102
U103
U104
2966
138
245
S280
DL14CB101
LS74
-RAS Ø TO RAM SHT 2
-RAS 7
-CAS Ø TO RAM SHT 2
-CAS 7
IA7 TO RAM SHT 2
IAØ
-MEMW
-MEMR
-DACKØ
RST
-WE 1 SHT 2 (FIRST 4 BANKS)
-WE 2 SHT 2 (2ND 4 BANKS)
R12
R11
-I/O CH CK TO BUS
TO RAM PARITY BIT INPUT SHT 2
FROM RAM PARITY BIT OUTPUT SHT 2
IDØ FROM 245 DATA BUFFER
ID7
D0
D7
FROM BUS
A9
A2
A16
A17
A23
A24
A31
B11
B12
B19
A12
B2



REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED

PARTS COUNT
72 - 2164A-150NS
72 - .1uF CAPS

NOTES:

1. IA0-IA7 ARE COMMON TO ALL RAM CHIPS
2. POWER + GROUND PINS 8+16 ARE COMMON TO ALL CHIPS
3. DATA INPUT + OUTPUT LINES, PINS 2+14, ARE COMMON TO ALL CHIPS ON A VERTICAL ROW

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.	
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	DRAWN	
	CHECK	
	APPR	RWS 10-23-84
	RELEASE DATE	
MATERIAL		

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

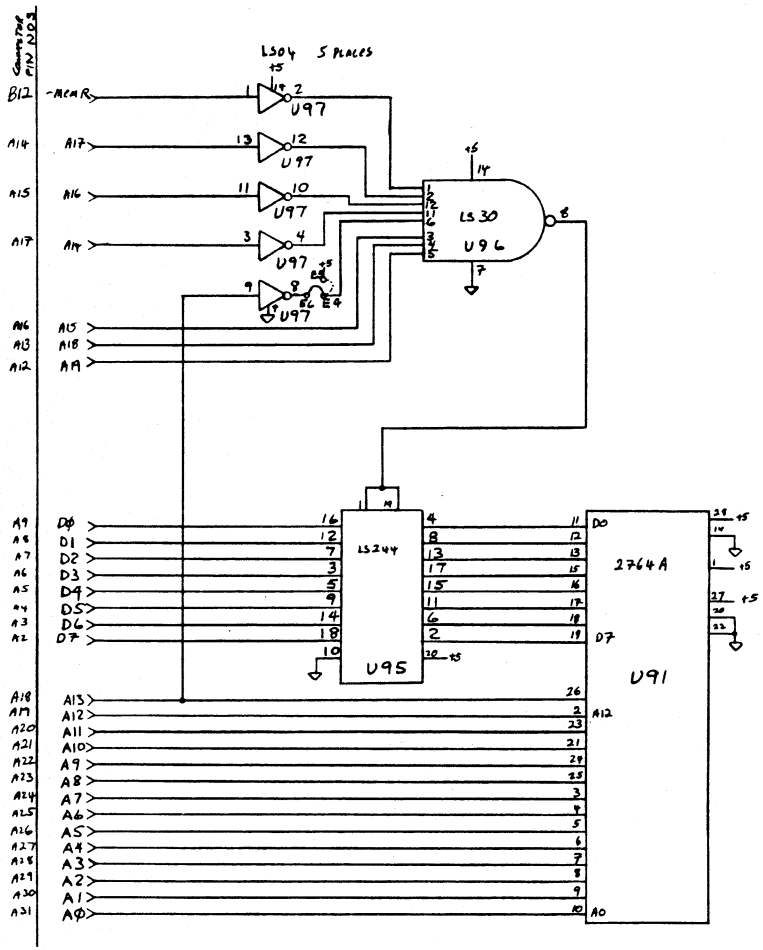
SCHEMATIC, MEMORY SECTION
MAIN BOARD

KAYPRO 16

SIZE	CODE IDENT NO.	
C	03626	81-511

SCALE | WEIGHT | SHEET 2B

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.
PARTS LIST					

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32	DRAWN		
	CHECK		
	APPR	RWJ	10-24-84
	RELEASE DATE		
MATERIAL			

NEXT ASSY.	FINAL ASSY.	NEXT ASSY	FINAL ASSY.
APPLICATION		QTY.	

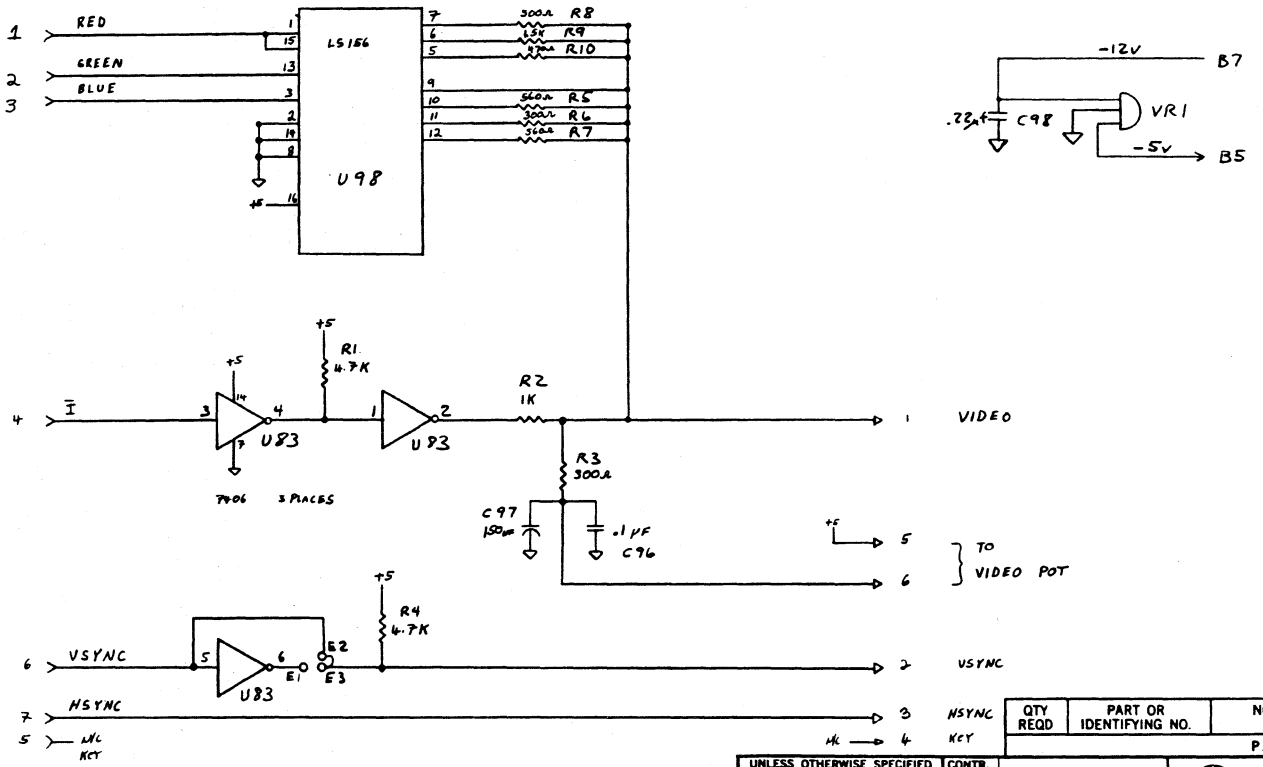
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, HARD DISK PROM SECTION
MAIN BOARD
KAYPRO 16

SIZE	CODE IDENT NO.	
C	03626	81-511

SCALE | WEIGHT | SHEET 2C

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED



QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED	CONTR. NO.		
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32	DRAWN		
	CHECK		
	APPR	RWT	10-24-74
	RELEASE DATE		
MATERIAL			

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

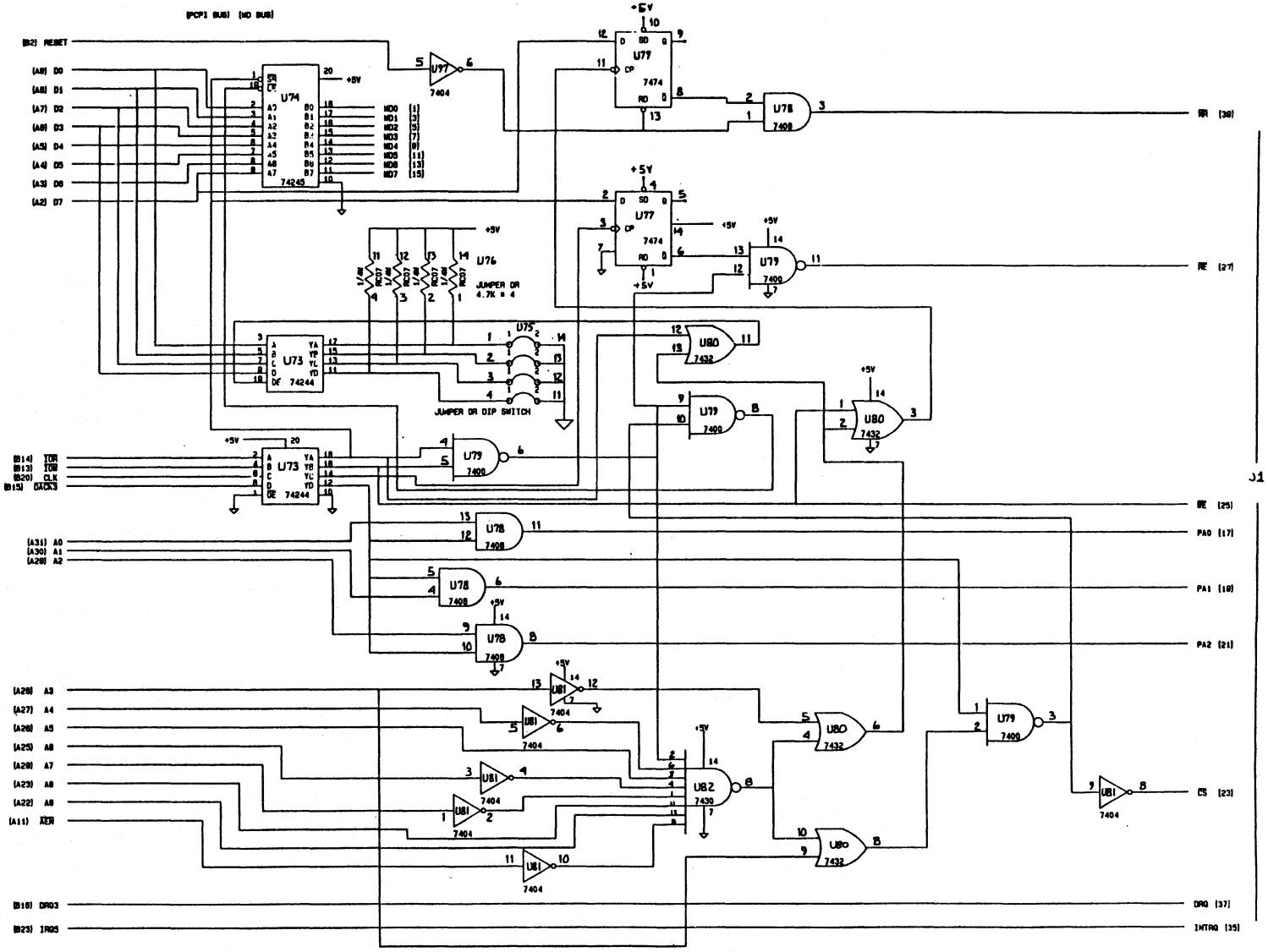
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, VIDEO SECTION MAIN BOARD

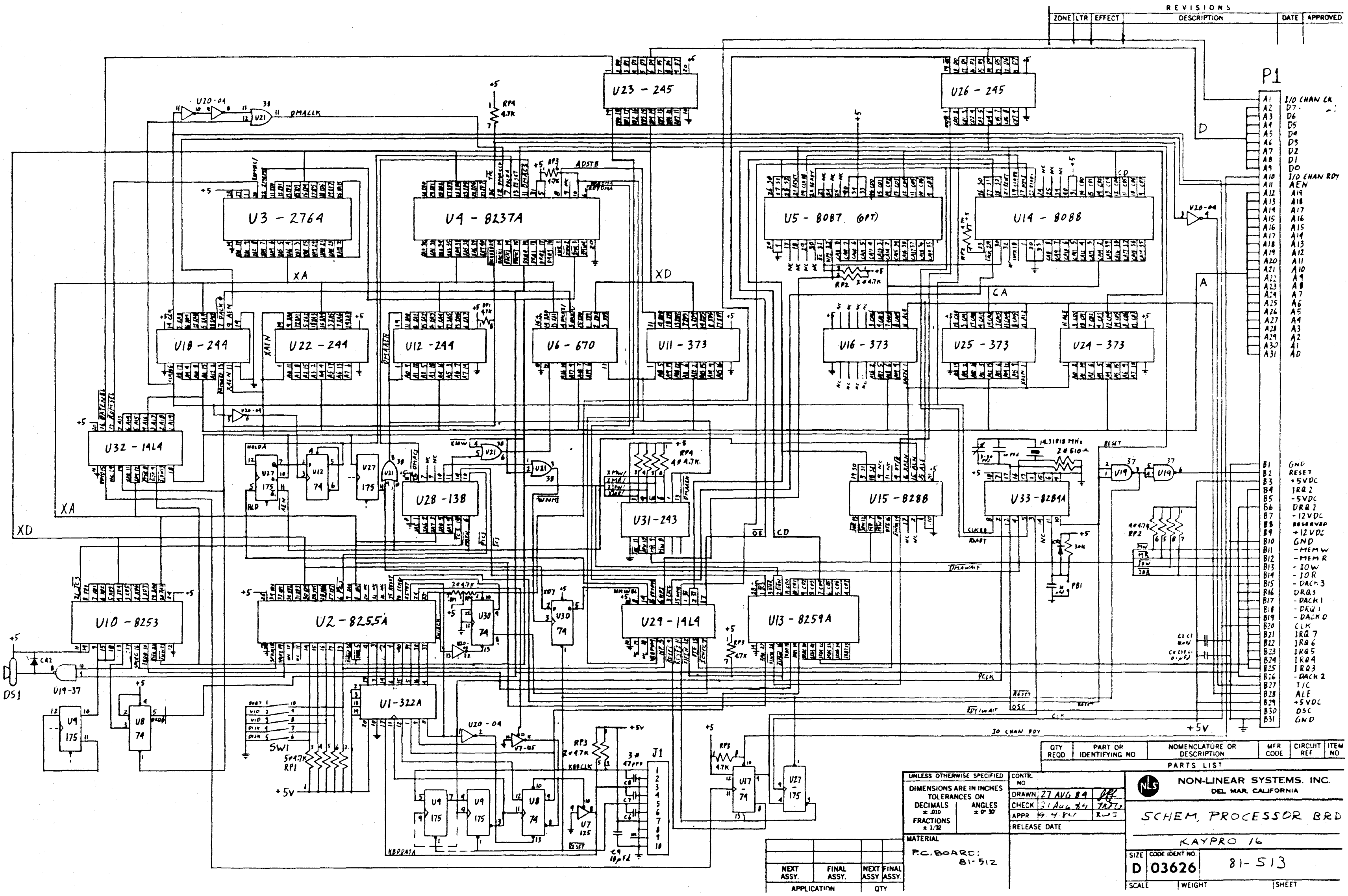
KAYPRO 16

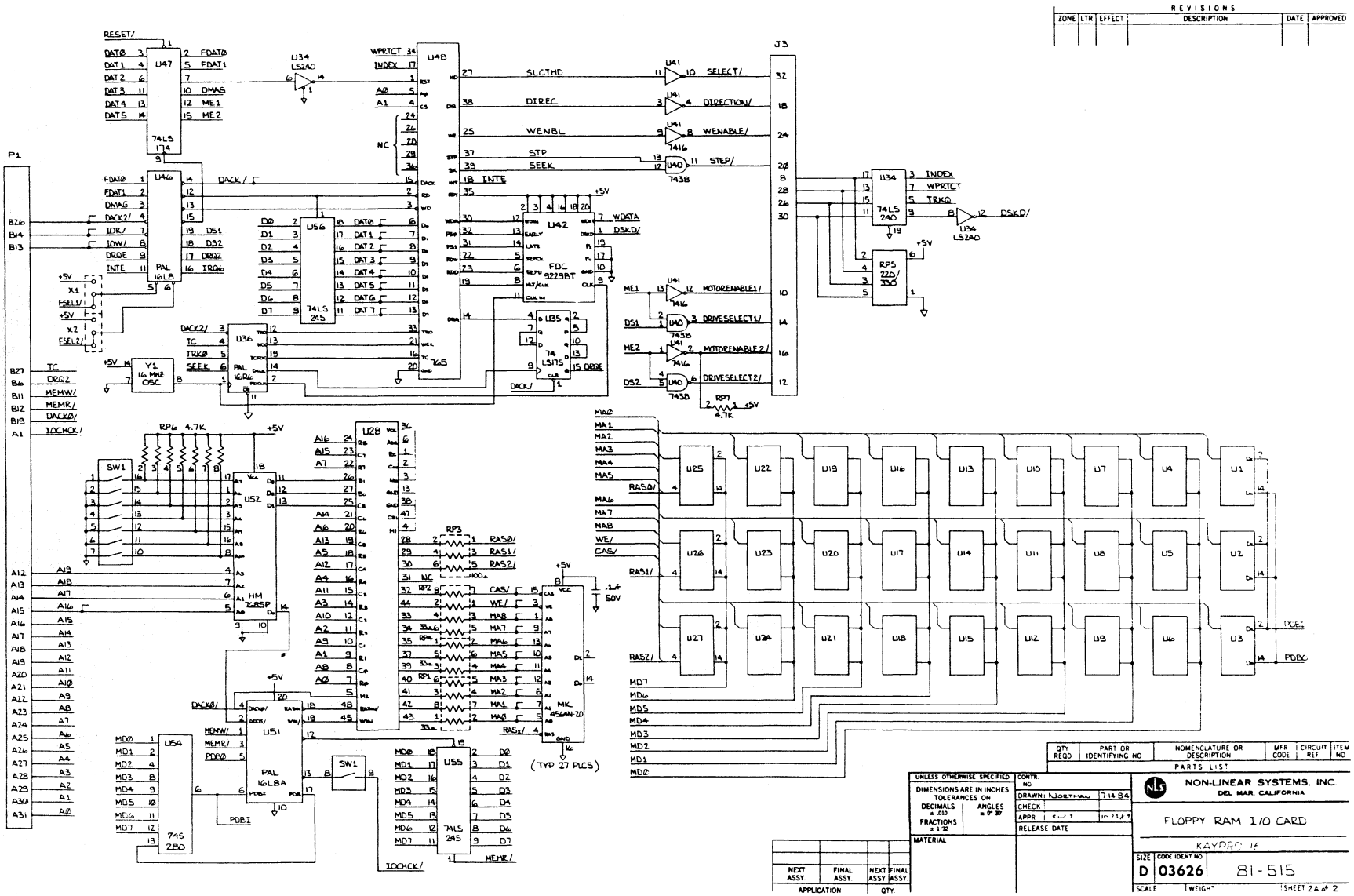
SIZE	CODE IDENT NO.	
C	03626	81-511

SCALE | WEIGHT | SHEET 2D



DRAWN	K. BILINSKI	7-23-84	NON LINEAR SYSTEMS, INC. DAVIS, CALIFORNIA
CHECK	J. R. LEMON	11-13-84	SCHEMATIC, HARD DISK INTERFACE SECTION, MAIN BOARD
APPR	R.O.F.	11-20-84	KAYPRO 16
MATERIAL			03626 | D | 81-511


REVISIONS
ZONE
LTR
EFFECT
DESCRIPTION
DATE
APPROVED
P1
U23 - 245
U26 - 245
U3 - 2764
U4 - 8237A
U5 - 8087 (OPT)
U14 - 8088
U18 - 244
U22 - 244
U12 - 244
U6 - 670
U11 - 373
U16 - 373
U25 - 373
U24 - 373
U32 - 14L4
U28 - 138
U31 - 243
U15 - 8288
U33 - 8284A
U10 - 8253
U2 - 8255A
U29 - 14L4
U13 - 8259A
U1 - 322A
DS1
SW1
J1
XA
XD
CD
CA
DMACLK
14.31818 MHz
I/O CHAN CK
I/O CHAN RDY
AEN
GND
RESET
+5VDC
-5VDC
-12VDC
+12VDC
-MEM W
-MEM R
-IOW
-IOR
CLK
ALE
OSC
QTY REQD
PART OR IDENTIFYING NO
NOMENCLATURE OR DESCRIPTION
MFR CODE
CIRCUIT REF
ITEM NO
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ±.010
ANGLES ±0°30'
FRACTIONS ±1/32
CONTR. NO
DRAWN 27 AUG 84
CHECK
APPR
RELEASE DATE
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEM, PROCESSOR BRD
KAYPRO 16
MATERIAL
P.C. BOARD: 81-512
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY
SIZE D
CODE IDENT NO. 03626
81-513
SCALE
WEIGHT
SHEET



QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MFR CODE	CIRCUIT REF	ITEM NO

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL

CONTR NO
DRAWN: NJOOTMAN 7-14-84
CHECK
APPR
RELEASE DATE

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

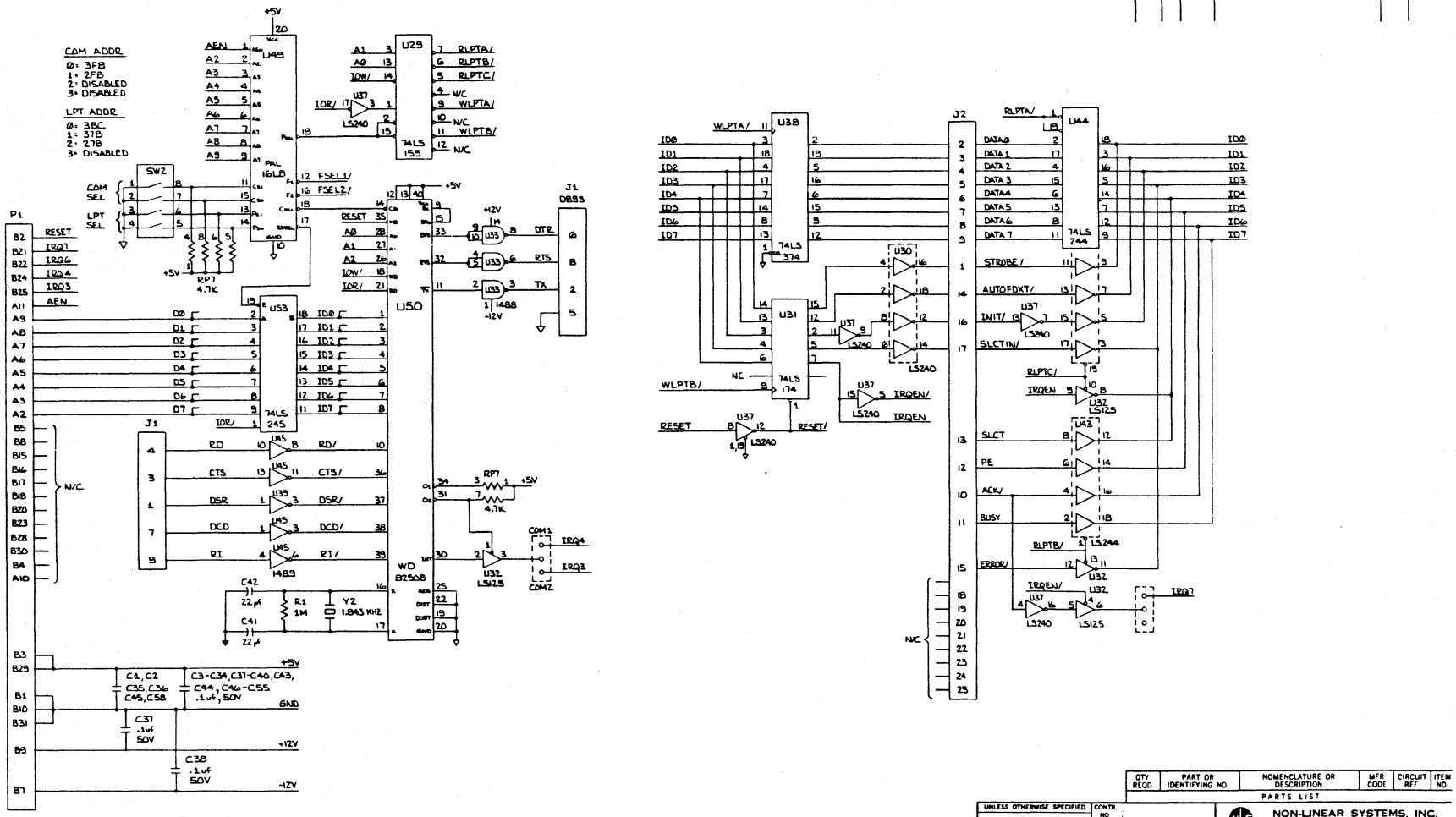
FLOPPY RAM I/O CARD

KAYPRO II

SIZE D | CODE IDENT NO 03626 | 81-515

SCALE | WEIGHT | SHEET 2A of 2

NEXT ASSY.	FINAL ASSY.	NEXT ASSY	FINAL ASSY
APPLICATION		QTY.	



REVISIONS

ZONE	LTR	EFFECT.	DESCRIPTION	DATE	APPROVED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR CODE	CIRCUIT REF.	ITEM NO.

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL

CONTR. NO.
DRAWN Wagman 7-15-84
CHECK
APPR [illegible] 11-23-84
RELEASE DATE

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

FLOPPY RAM I/O CARD

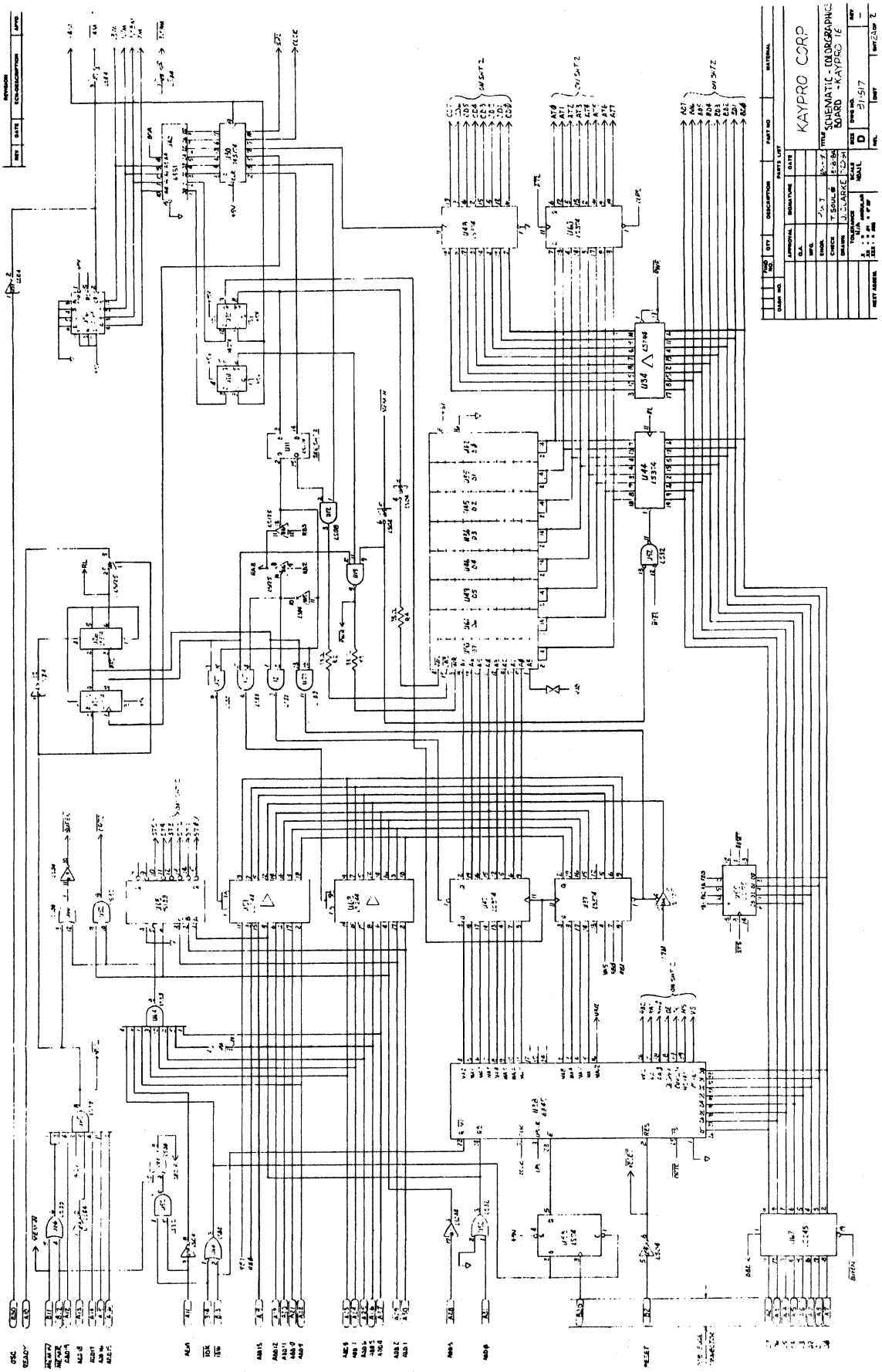
KAYPRO 16

SIZE D | CODE IDENT NO. 03626 | 81-515

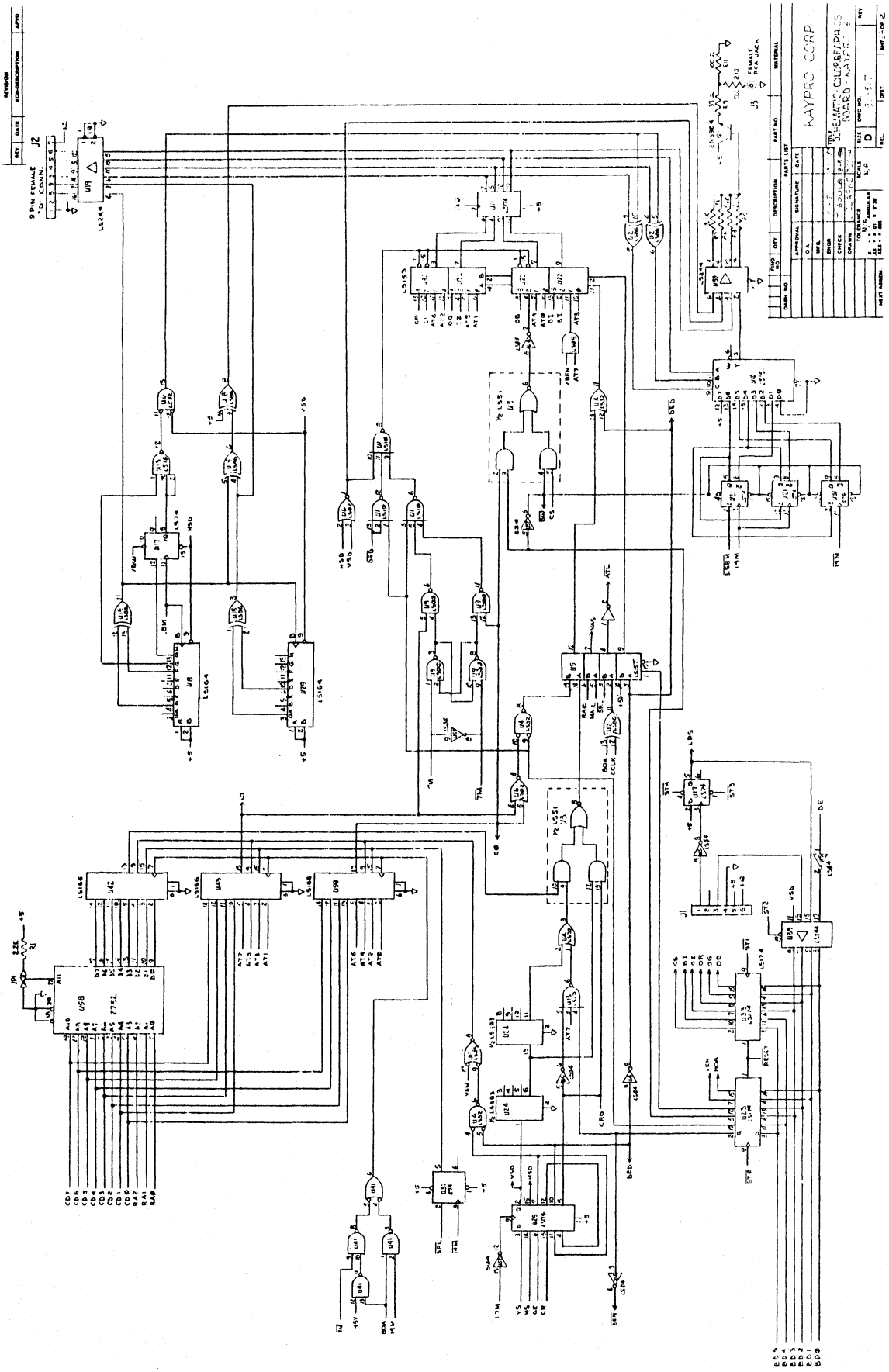
SCALE | WEIGHT | SHEET 28 of 2

NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
APPLICATION		QTY.	

SCHEMATICS: COLOR GRAPHICS CARD



SCHEMATICS: COLOR GRAPHICS CARD



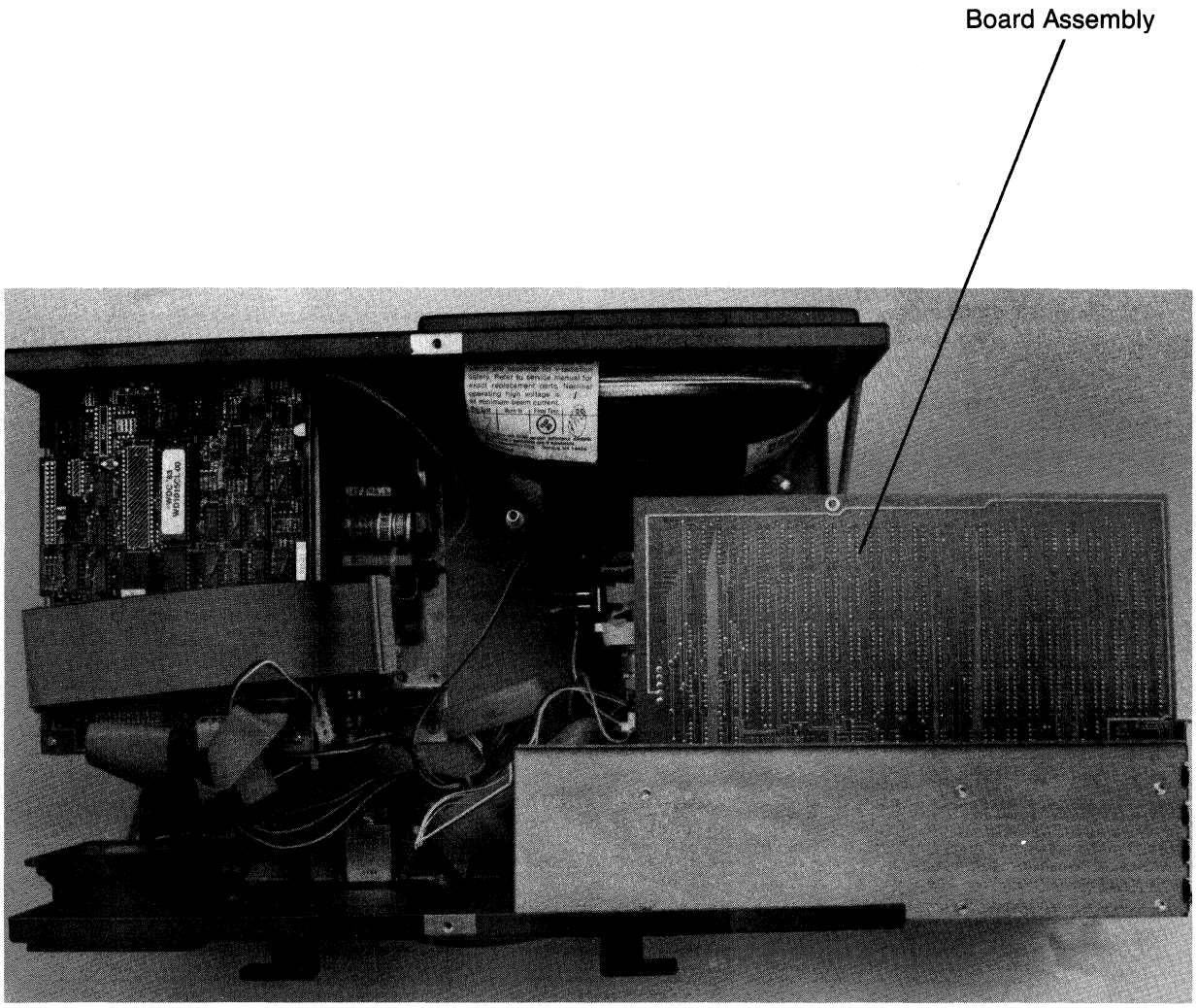


Figure 19.1
Board Assembly Removal

19.23 BOARD ASSEMBLY REMOVAL

1. Remove the chassis hood (19.1).

2. Remove the screw that attaches the plastic standoff and the front, center of the mainboard.

3. Position the machine so that the rear of it is facing you.

4. Remove the two video plugs from the right side of the mainboard.

5. Remove the power connector from the disk controller board.

6. Remove the 40-pin ribbon cable from the disk controller board.

7. Remove the 34-pin ribbon cable from the floppy disk drive.

Note: Support the bottom of the board assembly with one hand while following the instructions in step 8.

8. Remove the four screws from the rear of the chassis that attach the board assembly and the computer chassis.

9. Slide the board assembly to the right about three inches and disconnect the power supply connector from the bottom, left side of the mainboard.

10. Continue sliding the board assembly to the right and remove it from the chassis.

11. Remove the keyboard connector from the processor card.

BOARD ASSEMBLY INSTALLATION

1. With the rear of the computer facing you, set the board assembly on the rear of the machine chassis and connect the keyboard plug to the processor card. (J1 on the processor card)

2. Turn the board assembly so that the mainboard is parallel to the bottom of the machine and connect the plug from the power supply to the mainboard.

3. Position the board assembly inside the chassis so that the mounting holes are aligned with those in the rear of the machine chassis.

4. Insert two screws in the top mounting holes of the chassis, but do not tighten them yet.

5. Insert two screws in the bottom mounting holes of the chassis.

6. Tighten the four screws. (Occasionally, if two of the screws are tightened before the other two are inserted, the mounting holes won't align properly)

7. Replace the power connector on the disk controller board.

8. Replace the 40-pin ribbon cable on the disk controller board.

9. Replace the 34-pin ribbon cable on the floppy disk drive.

10. Replace the two video plugs on the side of the mainboard.

11. Replace and tighten the screw that connects the front of the mainboard and the plastic standoff.

19.24 CARD REMOVAL

1. Remove the chassis hood (19.1).

2. Remove the board assembly (19.23).

3. Refer to figure 19.13.

4. Position the board assembly so that the mainboard is parallel to the work surface and the component side of the board is face up.

Note: The board assembly should now be in this position: The I/O connectors are on the right side of the board assembly and the air-flow louver is on the left side. The top, right side of the card cage has four screws. Three of these screws each hold a card in place and one holds a spacer for an optional card. The top, left side of the card cage has a retainer plate secured with two screws.

The cards are in this order in the slots:
A. Empty space for optional card. (This should be closest to you)
B. Color Graphics card.
C. Floppy-RAM-I/O card.
D. Processor card. (This should be farthest from you)

5. Remove the two screws that secure the retainer plate to the card cage. (Top left side of the card cage)

6. Remove the screw that secures the card being replaced. (Top right side of card cage)

7. Remove the card from the card cage by sliding it upward until the edge connector is separated from the expansion slot receptacle and the card is out of the card cage.

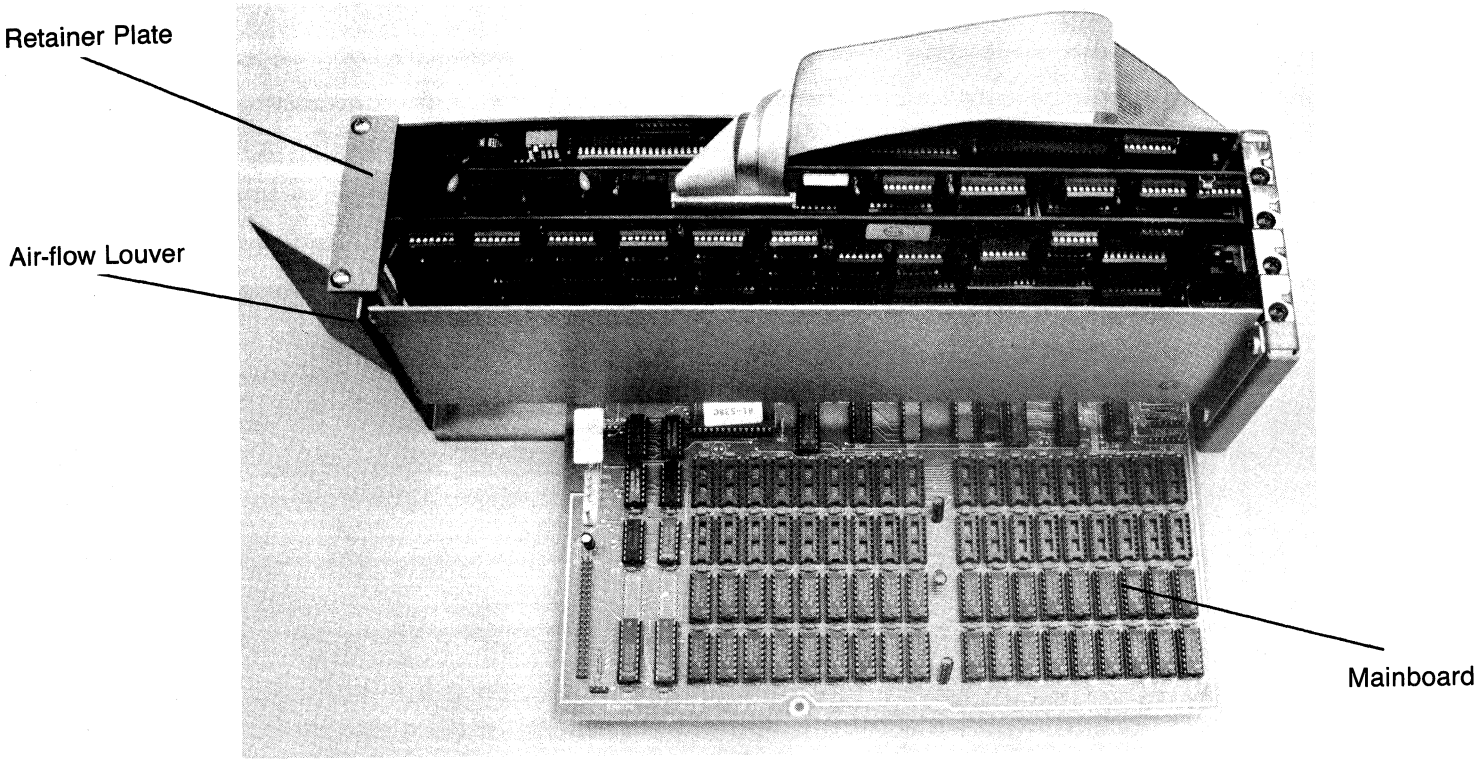


Figure 19.13
Board Assembly

CARD INSTALLATION

1. Refer to figure 19.13.
2. Position the card above the card cage so that the edge connector is above the expansion slot receptacle.
3. Refer to figure 19.2.
4. Lower the card into the card cage so that the mounting bracket tab fits into the space between the mainboard and the side of the card cage.
5. Press the card until it is firmly seated in the expansion slot receptacle.
6. Replace and tighten the screw that secures the mounting bracket and the card cage.
7. Position the retainer plate on the card cage so that the mounting holes are aligned.
8. Replace and tighten the two screws that secure the retainer plate and the card cage.
9. Replace the board assembly (19.23).
10. Replace the chassis hood (19.1).

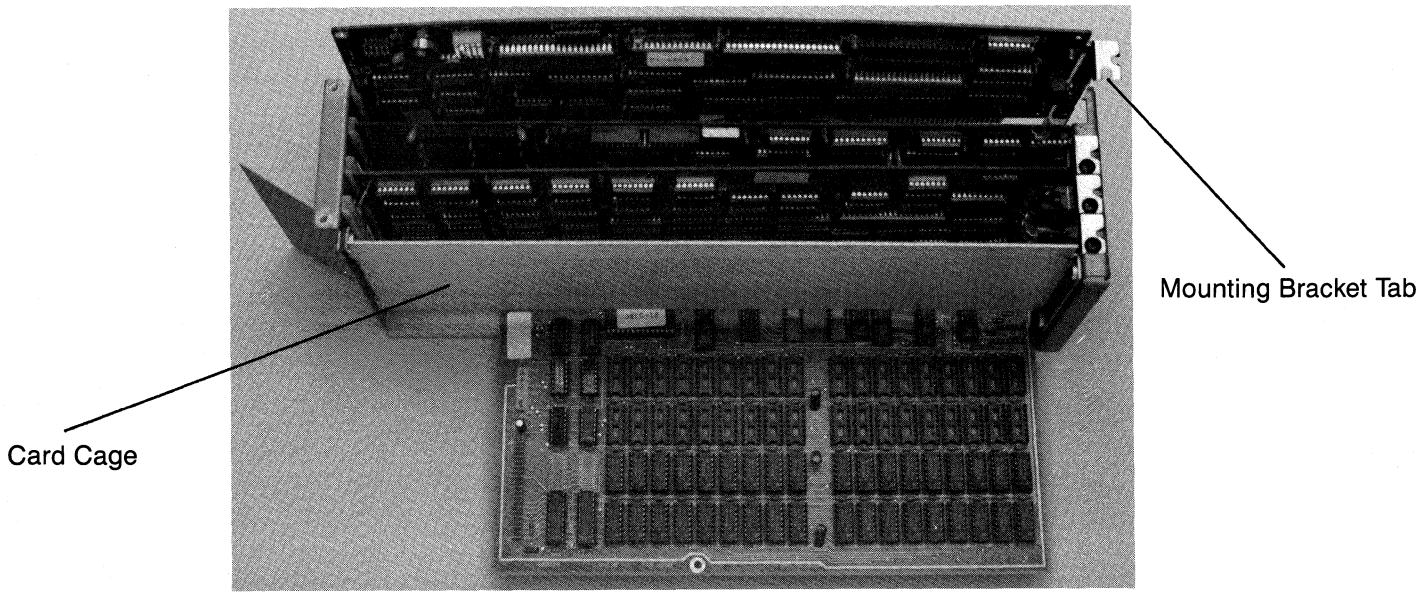


Figure 19.2
Board Assembly

19.25 MAINBOARD REMOVAL

1. Remove the chassis hood (19.1).
2. Remove the board assembly (19.23).
3. Remove the three cards from the card cage (19.24).
4. Remove the six screws that secure the mainboard to the card cage.
5. Slide the mainboard out of the card cage.

MAINBOARD INSTALLATION

1. Slide the mainboard into the card cage and position it so that the mounting holes in the board are aligned with the standoffs on the cage.
2. Insert six screws into the mounting holes and tighten them.
3. Replace the three cards (19.24).
4. Replace the board assembly (19.23).
5. Replace the chassis hood (19.1).

19.26 DISK CONTROLLER BOARD REMOVAL

1. Remove the chassis hood (19.1).

2. Position the computer so that the front is facing you.

3. Remove the three ribbon cables from the disk controller board (40 pin, 34 pin and 20 pin).

4. Remove the power connector from the disk controller board.

5. Remove the three screws that secure the disk controller board to the drive shield. Notice that the front left corner of the disk controller board is not secured; instead, there is a black plastic screw inserted in the standoff; this screw should not be removed.

6. Remove the disk controller board.

DISK CONTROLLER BOARD INSTALLATION

1. Position the disk controller board so that the mounting holes in the board are aligned with the standoffs on the drive shield.

2. Insert screws in three of the mounting holes and tighten them.

3. Replace the three ribbon cables (40 pin on J5, 34 pin on J7 and 20 pin on J2).

4. Replace the power connector.

5. Replace the chassis hood (19.1).

19.3 CRT ASSEMBLY

ADJUSTMENTS

The KAYPRO 16 uses a CRT assembly produced by Elston Electronics Corp. Even though other models of Kaypro computers use CRT assemblies made by Elston, they are not interchangeable, since the circuitry on the video board is different.

The adjustment points on the KAYPRO 16 video board are in the same position as those on the Elston CRT used in other Kaypro computers.

Refer to pages 7--1 and 7--2 in the Kaypro Technical Manual for adjustment procedures of this CRT assembly. The figure (7.2, Elston video board) on page 7--1 should be used to reference the adjustment points on the video board.

19.33 CRT REMOVAL

1. Remove the chassis hood (19.1).

2. Remove the board assembly (19.23).

3. With the rear of the computer facing you, remove the diagonal brace on the front, right side.

4. Position the computer so that the left side (the side with the drives) is on the work surface.

5. Remove three of the four screws that secure the video board and the bottom of the chassis (the black screws on the outside of the chassis).

6. Support the video board as the last screw is removed.

7. Position the computer so that the bottom is on the work surface.

8. Remove the video connector from the rear of the video board.

9. Remove the bottom two screws that attach the CRT to the front of the chassis.

1Ø. Support the bottom of the CRT and remove the top two screws from the chassis.

11. Remove the CRT assembly from the chassis.

CRT ASSEMBLY INSTALLATION

Note: Before starting with CRT installation, check to see if there are small plastic standoffs attached to the bottom of the video board. If not, use the ones from the old board.

1. Position the CRT assembly in the chassis so that the mounting holes on the front of the CRT are aligned with those on the chassis.

2. Support the bottom of the CRT and insert two screws in the top mounting holes. Partially tighten these screws.

3. Insert two screws in the bottom mounting holes of the CRT. Tighten these.

4. Tighten the top two screws completely.

5. Support the video board while positioning the computer so that the left side (the side with the drives) is on the work surface.

6. Insert four screws in the mounting holes on the chassis and into the standoffs on the bottom of the video board. Tighten these.

7. Position the computer so that the bottom is on the work surface.

8. Replace the video connector on the rear of the video board.

9. Replace the board assembly (19.23).

10. Replace the chassis hood (19.1).

19.4 POWER SUPPLY

The power supply used in the KAYPRO 16 is an 85 Watt switching type made by either Boschert or Calif D.C. These power supplies are not interchangeable with the power supplies used in other models of KAYPRO computers.

Two fuses are associated with each computer. F1 (2A, 250 VAC) is located on the rear of the chassis and is accessible from outside the computer. The other fuse is located on the power supply board. The Boschert uses a 3A, 250VAC and the Calif D.C. uses a 5A, 250VAC fuse. If it's necessary to change a fuse, make sure the new one is the same size as the one being replaced and that the AC power has been disconnected from the computer. Use of a fuse replacement tool is recommended when changing the fuse on the power supply board due to the difficulty of reaching this component.

There are no authorized dealer repairs on any power supplies. The ONLY authorized dealer service to power supplies is 220V configuration.

220V CONFIGURATION

Boschert Power Supply

Identified by the name "Boschert" on the component side of the board.

Locate the four-inch wire jumper that is soldered to point JP1. For 110V configuration the other end of the wire is attached to point E1.

For 220V configuration, remove the wire from point E1 and attach it to point E2. The wire jumper now connects point JP1 and point E2, and the power supply is configured for 220V use.

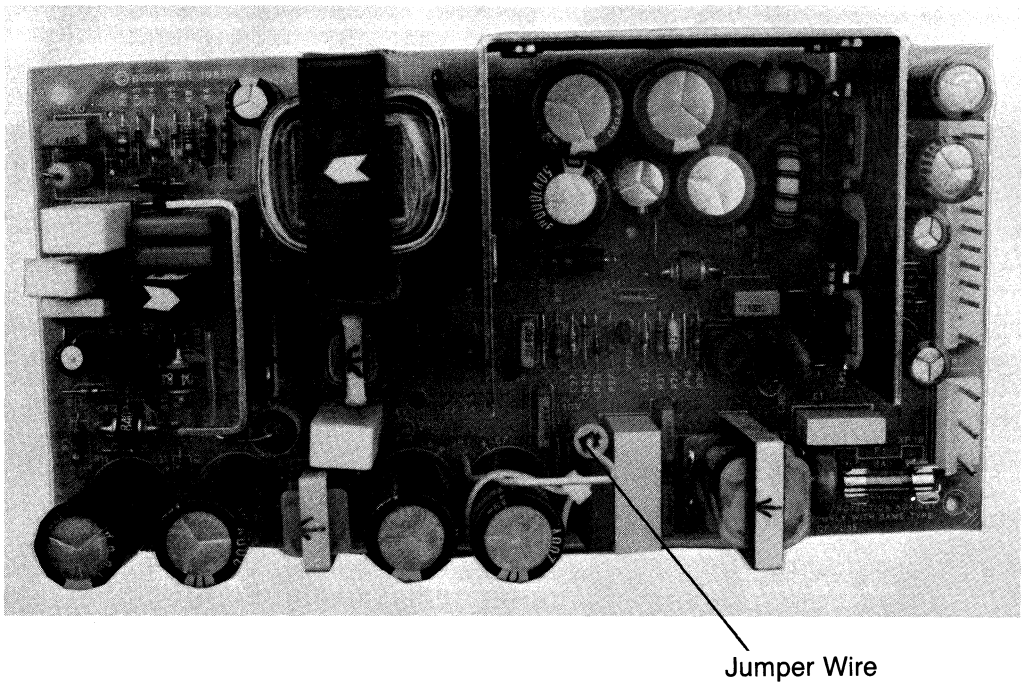


Figure 19.23
Boschert Power Supply

220V CONFIGURATION

Calif D.C. Power Supply

Identified by the name "Calif D.C." on the component side of the board.

Locate a jumper block labeled 115VAC and 230VAC. With the jumper in the 115VAC position, the power supply is configured for 110V.

For 220V use, remove the jumper from the socket labeled 115VAC and place it in the socket labeled 230VAC. The power supply is now configured for 220V use.

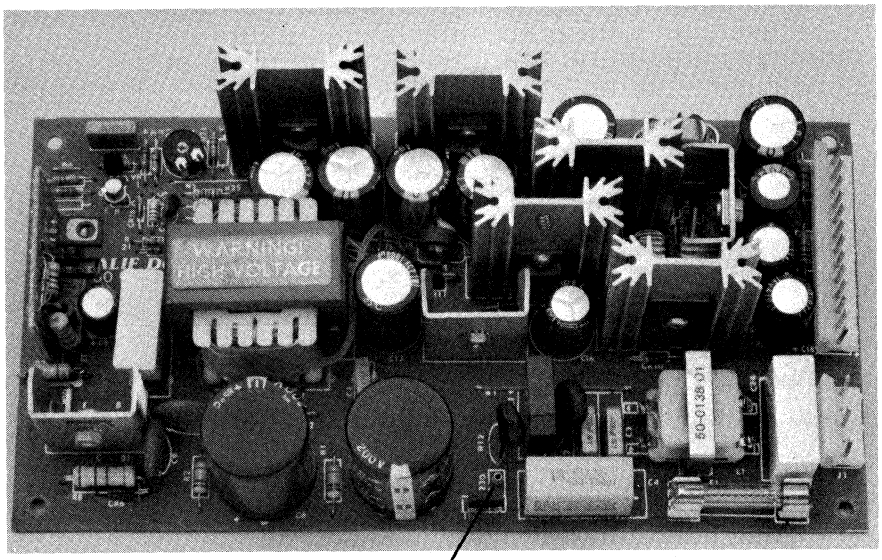


Figure 19.3
Calif D.C. Power Supply

19.43 POWER SUPPLY REMOVAL

1. Remove the chassis hood (19.1).

2. Remove the board assembly (19.23).

3. Position the computer so that the rear of it is facing you.

4. Set the computer so that the left side (the side with the drives) is on the work surface.

5. From outside the chassis, remove the four screws that connect the power supply shield and the bottom of the chassis.

6. Remove the power plug from the power supply.

7. Remove the power supply (with the shield still attached) from the chassis.

8. Remove the five screws that connect the power supply and the power supply shield.

9. Refer to figure 19.33.

1Ø. Remove the power supply from the shield by depressing the sides of the four plastic standoffs and lifting the power supply off the shield.

POWER SUPPLY INSTALLATION

1. Position the power supply on the power supply shield so that the mounting holes on the power supply are aligned with the standoffs on the shield.

2. Press the power supply onto the shield with even pressure until the power supply is firmly seated on the shield.

3. Replace the five screws that attach the power supply and the shield.

4. Set the power supply (with the shield attached) in the chassis so that the mounting holes in the bottom of the shield are aligned with the mounting holes in the bottom of the chassis.

5. Insert four screws through the bottom of the chassis and into the mounting holes of the shield.

6. Tighten the screws securely.

7. Replace the power connector.

8. Replace the board assembly (19.23).

9. Replace the chassis hood (19.1).

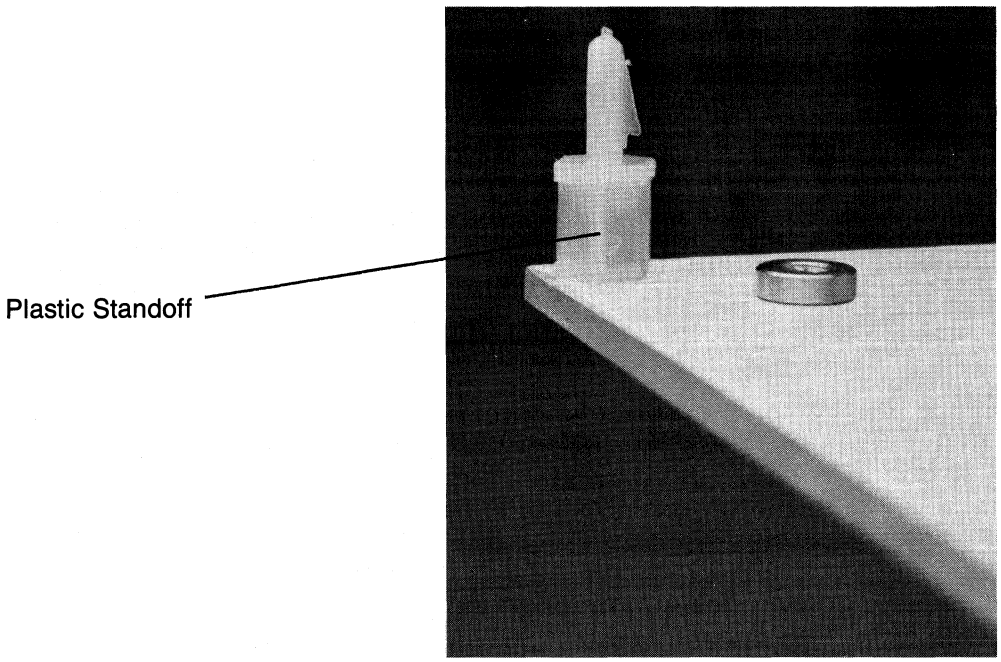


Figure 19.33
Plastic Standoff

19.5 DISKETTE DRIVES

The KAYPRO 16 comes equipped with one of four brands of diskette drive; Epson, Shugart, Tokyo Electric, or Toshiba. These drives are all functionally the same as the drives used in other models of Kaypro computers.

Illustrations of the different drives are on pages 9--2 and 9--3 of the Technical Manual and should be used for reference.

All of the diskette drives used in the KAYPRO 16 are jumpered the same as the drives used for the B drive in other models of Kaypro computers. Refer to the diagrams on pages 9--5 through 9--8 of the Technical Manual and use the instructions for jumpering the B drive.

19.53 DISKETTE DRIVE REMOVAL

Note: The diskette drive and the hard disk drive are both housed in a single drive shield, making it necessary to remove both drives and the shield as one unit. The shield is composed of several individual pieces; figures 19.4 and 19.43 should be used for reference.

1. Remove the chassis hood (19.1).

2. Remove the board assembly (19.23).

3. Remove the disk controller board (19.26).

4. Remove the 34-pin ribbon cable, the power plug and the ground wire from the diskette drive.

5. Remove the 2 ribbon cables, the power plug, and the ground wire from the hard disk drive.

6. Remove the wire from the 10MB LED (gently pull it away from the LED).

7. Position the computer so that the rear of it is on the work surface and the bottom is facing you.

8. Remove the top three screws that secure the drive shield and the chassis.

9. Support the drives while removing the bottom three screws that secure the drive shield and the chassis.

10. Remove the drive assembly unit from the chassis.

Note: To remove the diskette drive from the drive shield unit, six screws need to be removed. Two on top of the shield, two on the side and two on the bottom.

11. Remove the two screws that attach the top of the drive and the drive shield. Refer to figure 19.4.

12. Remove the two screws on the side of the drive shield. Refer to figure 19.4.

13. Remove the two screws that attach the bottom of the drive and the drive shield.

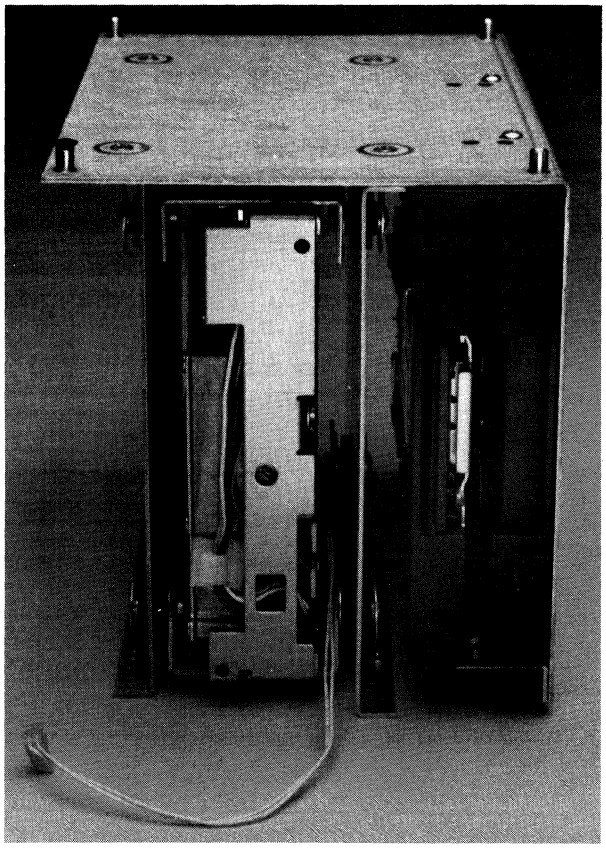


Figure 19.4
Drive Assembly Unit

DISKETTE DRIVE INSTALLATION

Note: Before installing a diskette drive, check to see if it's jumpered correctly.

1. Position the drive so that the drive shield and the mounting holes in the bottom of the drive are aligned.

2. Insert two screws through the shield and into the mounting holes and tighten securely.

3. Insert two screws through the top of the drive shield and into the top mounting holes of the drive and tighten.

4. Insert two screws through the side of the shield and into the shield that's attached to the bottom of the drive.

5. Position the drive assembly unit inside the chassis so that the mounting holes in the bottom of the shield are aligned with the mounting holes in the bottom of the chassis.

6. Insert six screws into the mounting holes on the bottom of the chassis and into the bottom of the shield. Tighten these securely.

7. Replace the ribbon cables, power plugs and the ground wires on the rear of the drives.

8. Replace the disk controller board (19.26).

9. Replace the board assembly (19.23).

10. Replace the chassis hood (19.1).

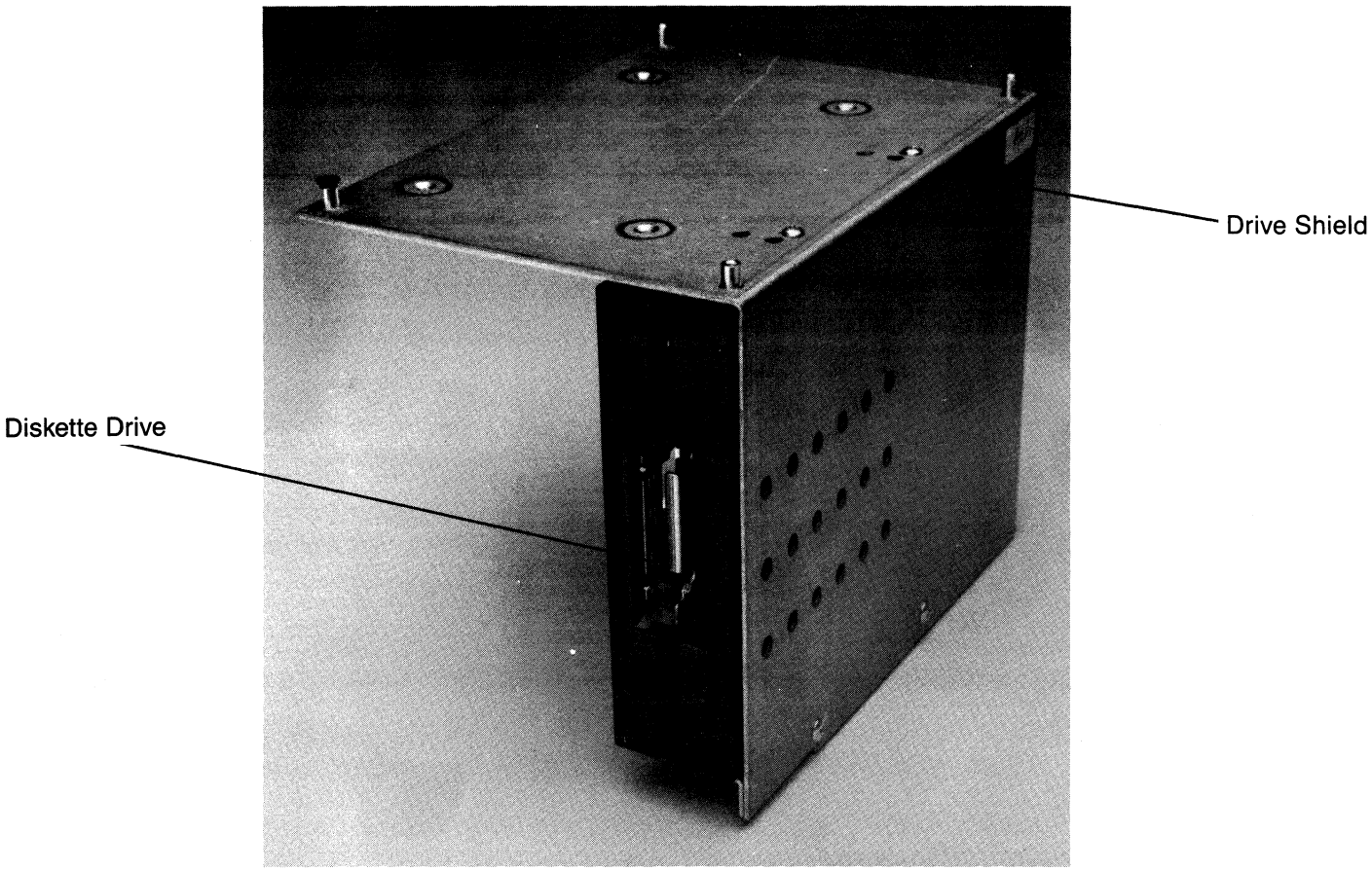


Figure 19.43
Diskette Drive Shield

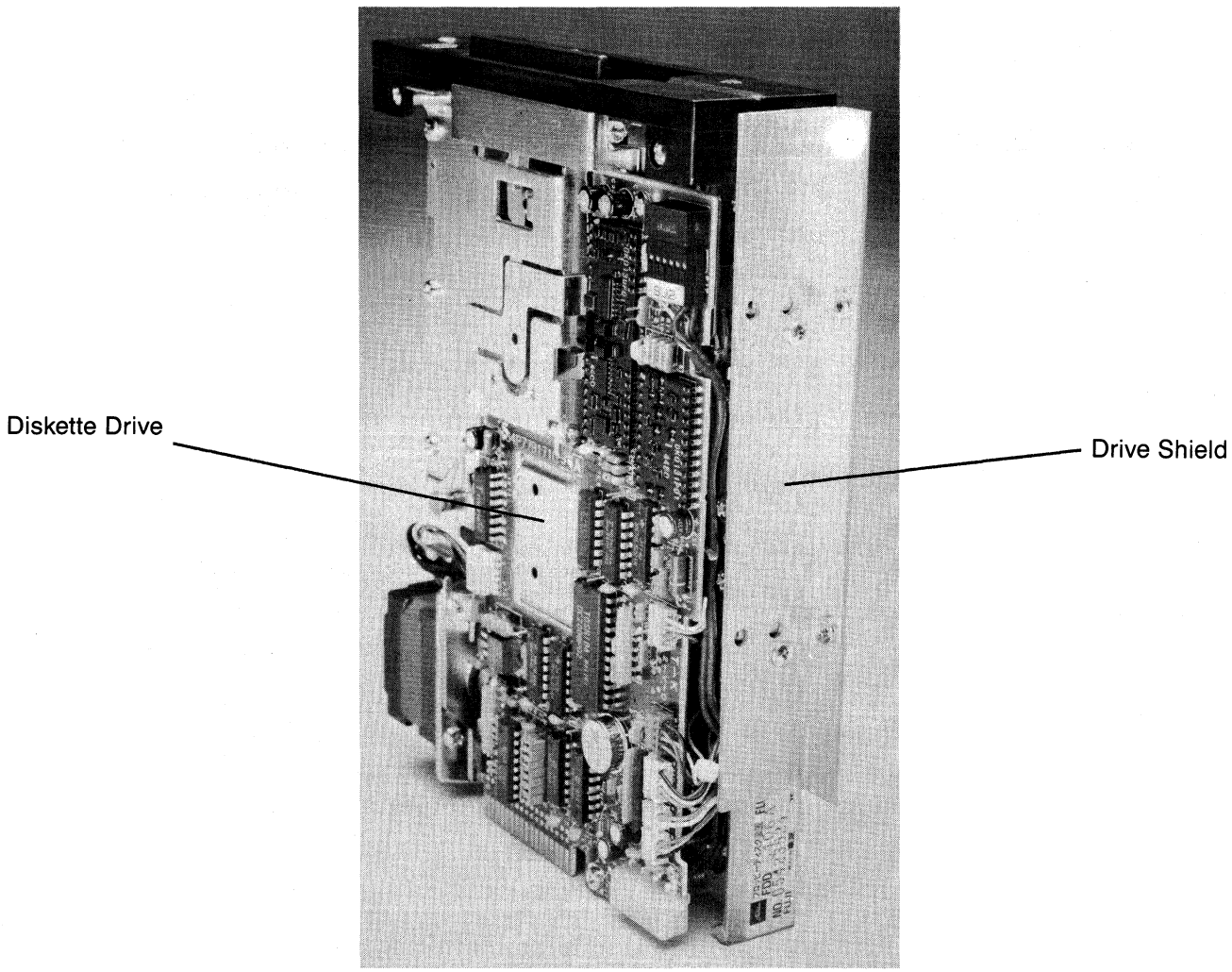


Figure 19.5
Diskette Drive Shield

19.6 HARD DISK DRIVE

The KAYPRO 16 uses hard disk drives manufactured by either Seagate, Microscience, or Shugart. These are functionally the same as the hard drives used in the KAYPRO 10.

Refer to pages 10--1 to 10--3.1 in the Technical Manual for jumpering instructions for the hard drives. These drives should be jumpered the same as the hard disk drives used in the KAYPRO 10.

19.63 HARD DISK DRIVE REMOVAL

Note: The diskette drive and the hard disk drive are both housed in a single drive shield, making it necessary to remove both drives and the shield as one unit. The shield is composed of several individual pieces; figures 19.4, 19.6 and 19.63 should be used for reference. This unit will be referred to as the drive assembly unit in the instructions for removing and installing drives.

1. Remove the chassis hood (19.1).

2. Remove the board assembly (19.23).

3. Remove the disk controller board (19.26).

4. Remove the 34-pin ribbon cable, the power plug and the ground wire from the diskette drive.

5. Remove the 2 ribbon cables, the power plug, the ground wire and the wire from the 10MB LED from the hard drive.

6. Position the computer so that the rear of it is on the work surface and the bottom is facing you.

7. Remove the top three screws that secure the drive shield and the chassis.

8. Support the drives and remove the bottom three screws that secure the drive shield and the chassis.

9. Remove the drive assembly unit from the chassis.

10. Remove four screws from the top of the drive assembly unit. Refer to figure 19.4.

11. Remove the hard drive (still in its shield) from the drive assembly unit.

12. Remove the four mounting screws from the hard drive shield (two on the top and two on the bottom).

Note: The screw used in the top, front mounting hole is shorter than the other screws and must be used in the same mounting hole when installing a new hard drive.

13. Remove the hard drive from the drive shield.

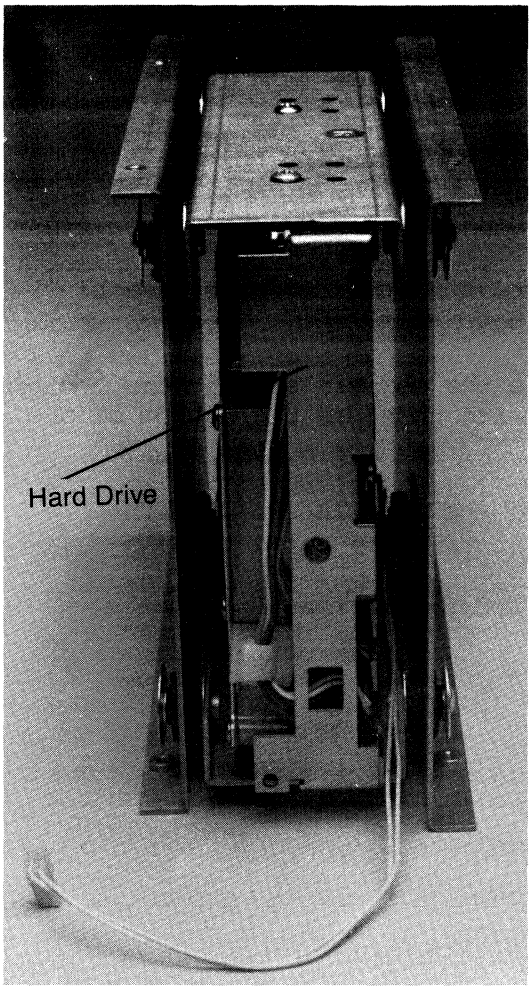


Figure 19.6
Hard Drive in Drive Shield

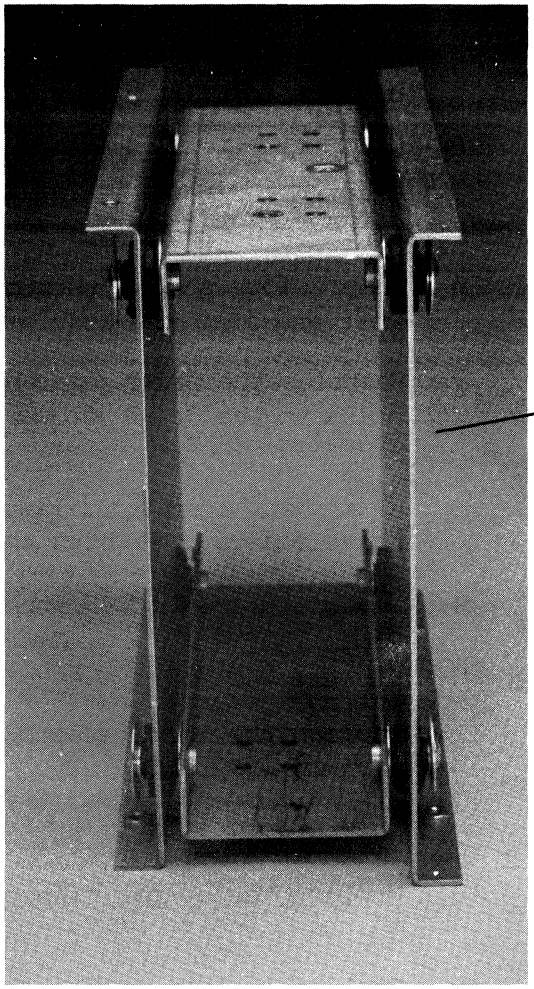


Figure 19.63
Hard Drive Shield

HARD DISK DRIVE INSTALLATION

1. Check the new hard drive to see if it's jumpered correctly.

2. Position the disk drive in the drive shield so that the mounting holes in the drive are aligned with those in the shield.

3. Insert two screws in the top mounting holes (the short screw is used in the top front mounting hole).

4. Insert two screws in the bottom two mounting holes and tighten these and the top two screws securely.

5. Position the drive assembly unit so that the mounting holes are aligned with the mounting holes in the hard drive shield. Refer to figure 19.4.

6. Insert four screws through the mounting holes of the drive assembly unit and into the hard drive shield. Tighten the screws.

7. Position the drive assembly unit inside the chassis so that the mounting holes in the drive shield are aligned with those in the bottom of the chassis.

8. Insert six screws through the bottom of the chassis and into the drive shield. Tighten the screws.

9. Connect the 1ØMB LED wire from the hard drive to the LED.

1Ø. Replace the disk controller board (19.26).

11. Replace the board assembly (19.23).

12. Replace the two ribbon cables, power plug and the ground wire on the hard drive.

13. Replace the 34-pin ribbon cable, the power plug and the ground wire on the diskette drive.

14. Replace the chassis hood (19.1).

19.7 KEYBOARD

The keyboard has a five pin DIN connector with the following keyboard interface signals:

DIN	SIGNAL NAME
1	KEYBOARD CLOCK
2	KEYBOARD SERIAL DATA
3	RESET
4	GROUND
5	+5VDC

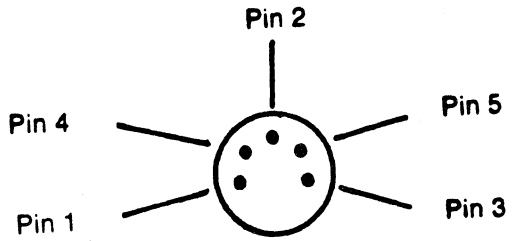


Figure 19.7
DIN Connector

19.8 SYSTEM I/O

The KAYPRO 16 supports parallel and serial I/O operations through its DB-25 (parallel) and either DE-9S or DE-9P (serial) connectors. These are located on the left side of the machine and can be referenced using figure 19.73.

The pin assignments for the parallel and serial ports and cable pin-outs are on the following pages. Notice that although a serial printer and an external modem both use the serial port, they require different cables. If a serial plotter is used with a KAYPRO 16, a serial printer cable should be used.

19.81 PARALLEL PRINTER

PARALLEL PRINTER CABLE

DB-25 CONNECTOR (KAYPRO 16) PIN	SIGNAL	CENTRONICS (PRINTER) PIN
1	/STROBE	1
2	DATA Ø	2
3	DATA 1	3
4	DATA 2	4
5	DATA 3	5
6	DATA 4	6
7	DATA 5	7
8	DATA 6	8
9	DATA 7	9
1Ø	ACKNOWLEDGE	1Ø
11	BUSY	11
12	PAPER END	12
13	SELECT	13
14	AUTO FEED	14
15	FAULT	32
16	/INITIATE	31
17	SELECT IN	36
18	GROUND	19
19	GROUND	2Ø
2Ø	GROUND	21
21	GROUND	23
22	GROUND	25
23	GROUND	27
24	GROUND	29
25	GROUND	3Ø
N/C	SHIELD	17

NOTE: ALL CABLES USED ON THE KAYPRO 16 MUST BE SHIELDED IN ORDER TO COMPLY WITH FCC REGULATIONS.

/ indicates an active low signal.

19.82 I/O CONNECTORS

The following figure should be used as reference for the I/O interface between the KAYPRO 16 computer and any peripherals used with it. The figure also references the reset button.

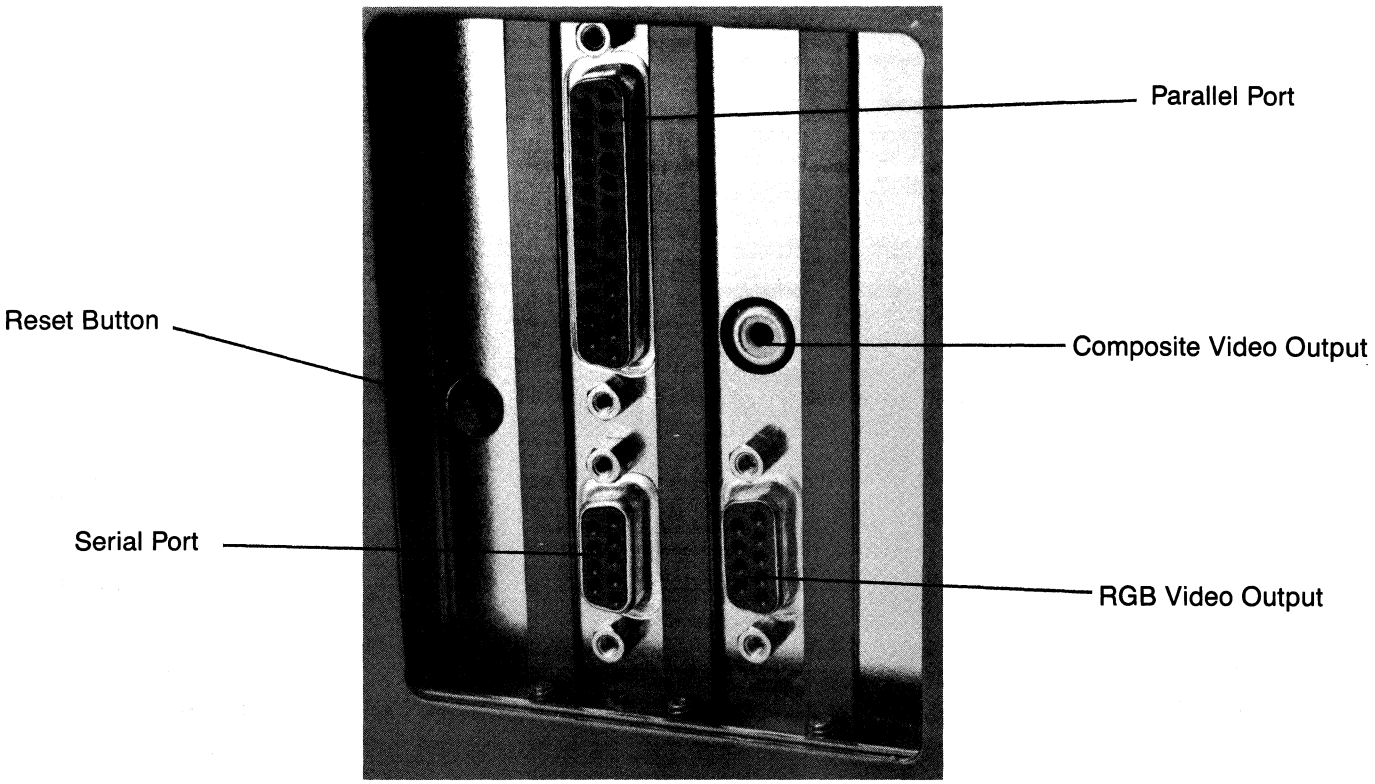


Figure 19.73
I/O Connectors

19.83 SERIAL DEVICES

The serial port pin-out assignments on the KAYPRO 16 are implemented in two different manners. These are easily distinguished from each other by the connector itself; one is a DE-9S female connector, the other a DE-9P male connector. Since the pin-outs are different, two sets of serial port assignments are given for reference. Be sure to check the connector type before using the following information.

19.84 DE-9S SERIAL PORT

THESE SERIAL PORT PIN ASSIGNMENTS SHOULD BE USED FOR KAYPRO 16 COMPUTERS WITH DE-9S CONNECTORS ONLY.

KAYPRO 16 SERIAL PORT PIN ASSIGNMENTS
(PRIMARY ASYNCHRONOUS COMMUNICATIONS)

DE-9S CONNECTOR PIN	SIGNAL
1	DATA SET READY
2	TRANSMIT DATA
3	CLEAR TO SEND
4	RECEIVE DATA
5	SIGNAL GROUND
6	DATA TERMINAL READY
7	CARRIER DETECT
8	REQUEST TO SEND
9	RING DETECT

19.85 SERIAL PRINTER CABLE (DCE)

DE-9P CONNECTOR (KAYPRO) PIN	SIGNAL	DB-25P CONNECTOR (PRINTER) PIN
1	DATA SET READY	20
2	TRANSMIT DATA	3
3	CLEAR TO SEND	4
4	RECEIVE DATA	2
5	SIGNAL GROUND	7
6	DATA TERMINAL READY	8
7	CARRIER DETECT	6
8	REQUEST TO SEND	5
9	RING INDICATOR	22

19.86 MODEM CABLE (DTE)

DE-9P CONNECTOR (KAYPRO) PIN	SIGNAL	DB-25P CONNECTOR (MODEM) PIN
1	DATA SET READY	6
2	TRANSMIT DATA	2
3	CLEAR TO SEND	5
4	RECEIVE DATA	3
5	SIGNAL GROUND	7
6	DATA TERMINAL READY	20
7	CARRIER DETECT	8
8	REQUEST TO SEND	4
9	RING DETECT	22

19.87 DE-9P SERIAL PORT

THESE SERIAL PORT PIN ASSIGNMENTS SHOULD BE USED FOR KAYPRO 16 COMPUTERS WITH DE-9P CONNECTORS.

KAYPRO 16 SERIAL PORT PIN ASSIGNMENTS
(PRIMARY ASYNCHRONOUS COMMUNICATIONS)

DE-9P CONNECTOR PIN	SIGNAL
1	CARRIER DETECT
2	RECEIVE DATA
3	TRANSMIT DATA
4	DATA TERMINAL READY
5	SIGNAL GROUND
6	DATA SET READY
7	REQUEST TO SEND
8	CLEAR TO SEND
9	RING INDICATOR

19.88 SERIAL PRINTER CABLE (DCE)

DE-9S CONNECTOR (KAYPRO) PIN	SIGNAL	DB-25P CONNECTOR (PRINTER)
1	CARRIER DETECT	6
2	RECEIVE DATA	2
3	TRANSMIT DATA	3
4	DATA TERMINAL READY	8
5	SIGNAL GROUND	7
6	DATA SET READY	20
7	REQUEST TO SEND	5
8	CLEAR TO SEND	4
9	RING INDICATOR	22

19.89 MODEM CABLE (DTE)

DE-9S CONNECTOR (KAYPRO) PIN	SIGNAL	DB-25P CONNECTOR (MODEM)
1	CARRIER DETECT	8
2	RECEIVE DATA	3
3	TRANSMIT DATA	2
4	DATA TERMINAL READY	20
5	SIGNAL GROUND	7
6	DATA SET READY	6
7	REQUEST TO SEND	4
8	CLEAR TO SEND	5
9	RING DETECT	22

19.9 VIDEO CONNECTOR FOR EXTERNAL RGB MONITOR

PIN ASSIGNMENTS

1. GROUND
2. GROUND
3. RED INPUT
4. GREEN INPUT
5. BLUE INPUT
6. INTENSITY
7. NO CONNECTION
8. HORIZONTAL SYNC
9. VERTICAL SYNC

19.91 VIDEO CONNECTOR FOR COMPOSITE VIDEO MONITOR

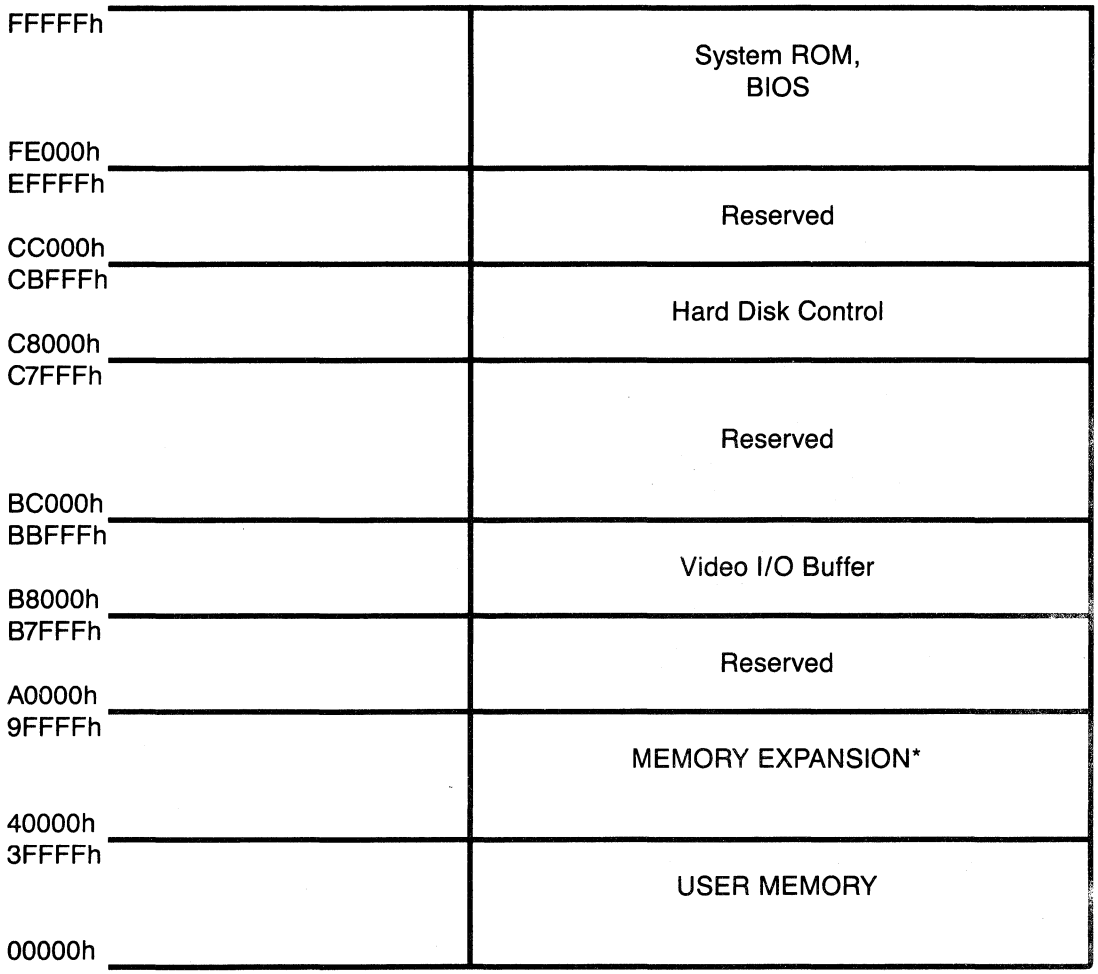
This connector uses a standard composite video cable.

19.92 I/O PORT ADDRESSES

PORT # (HEX)	DEVICE/FUNCTION
000-00F	DMA Chip 8237A-5
020-021	Interrupt 8259A
040-043	Timer 8253-5
060-063	PPI 8255A-5
080-083	DMA Page Registers
0A0-0AF	NMI Mask Register
2F8-2FF	Asynchronous Communications (Secondary)
320-32F	Hard Disk
378-37F	Parallel Printer
3D0-3DF	Color/Graphics
3F0-3F7	Floppy Diskette
3F8-3FF	Asynchronous Communications (Primary)

19.93 MEMORY MAP OF THE KAYPRO 16 COMPUTER

MEMORY MAP OF THE KAYPRO 16 COMPUTER



* AVAILABLE AS AN OPTION

19.94 SWITCH SETTINGS

The KAYPRO 16 uses several DIP switches that are preset at the factory. The switches and their functions are in this section for reference and as an aid in troubleshooting, check to see if they're in the proper position before replacing a card. Notice that there are two DIP switches labeled "SW1", but that they're on different cards.

SW1 on the PROCESSOR CARD:

Position 1 is used to specify the numeric processor option.
Positions 2 and 3 are used to specify the size and type of display interface.
Positions 4 and 5 are used to specify the number of disk drives.

The settings for SW1 on the processor card are:

Position 1 is on.
Position 2 is off.
Position 3 is on.
Position 4 is on.
Position 5 is on.

SW1 on the FLOPPY-RAM-I/O CARD:

Positions 1, 2, 3, and 4 are used to specify the starting address for the RAM on the FLOPPY-RAM-I/O card (the memory expansion).
Positions 5 and 6 indicate the number of RAM banks on the FLOPPY-RAM-I/O card.
Position 7 is used to specify whether those banks contain 64K or 256K.
Position 8 is used to enable or disable parity checking.

The settings for SW1 on the FLOPPY-RAM-I/O card are:

Position 1 is off.
Position 2 is on.
Position 3 is on.
Position 4 is on.
Position 5 is on.
Position 6 is off.
Position 7 is on.
Position 8 is on.

SW2 on the FLOPPY-RAM-I/O card:

Positions 1 and 2 are used to select the serial port.
Positions 3 and 4 are used to select the parallel port.

The settings for SW2 on the FLOPPY-RAM-I/O card are:

Position 1 is on.
Position 2 is on.
Position 3 is on.
Position 4 is off.

Serial Port Select

This jumper is located on the FLOPPY-RAM-I/O card and can be referenced using figure 19.8. It should be set in the "COM1" position.

Parallel Port Select

This jumper is located on the FLOPPY-RAM-I/O card and can be referenced using figure 19.8. It should be set in the "IRQ7" position.

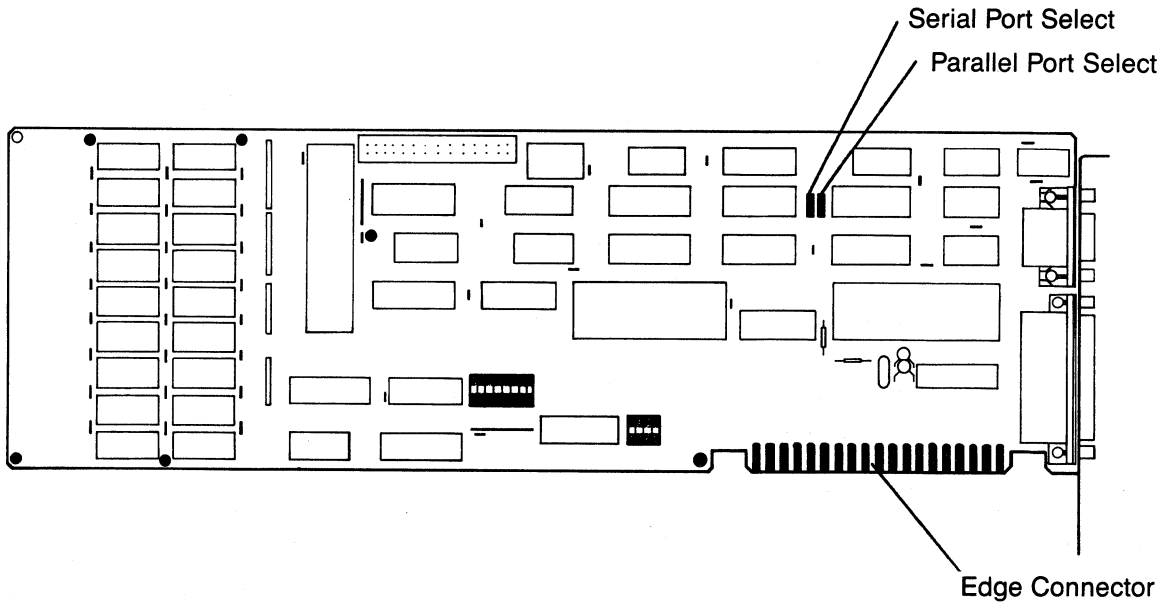


Figure 19.8
Floppy-RAM-I/O Card

19.95 MEMORY EXPANSION

The mainboard on the KAYPRO 16 is populated with 256K bytes of RAM and is socketed for an additional 256K bytes. By populating the additional 256K RAM on the mainboard, the total dealer serviceable memory expansion is completed. The additional 256K bytes of RAM on the mainboard can be implemented by populating the sockets with 64K x 1, 150ns, RAM chips. The additional RAM chips need to be installed in these positions: U37-U45, U46-U54, U55-U63, U64-U72.

The RAM expansion from 512K to 640K is a "factory only upgrade". Kaypro does not support memory expansion from 512K to 640K unless it is done at Kaypro.

20.0 KAYPRO 16/2

The KAYPRO 16/2 is an Intel 8088 microprocessor based computer that is similar in many ways to the KAYPRO 16 computer. Because of these similarities, Section 19 in the Technical Manual is used as a reference for the KAYPRO 16/2. The KAYPRO 16/2 is equipped with two double-density, double-sided disk drives providing 360K of storage per diskette. This is the main difference between the KAYPRO 16/2 and the KAYPRO 16.

The three cards that are used in the KAYPRO 16/2 are the same as those used in the KAYPRO 16 with one exception: SW1 on the processor card is set differently.

The settings for SW1 on the processor card are:
Position 1 is on.
Position 2 is off.
Position 3 is on.
Position 4 is on.
Position 5 is off.

The mainboard is the same with these exceptions: J1, U73, U74, U77, U78, U79, U80, U81, U82, U91, U95, U96 and U97 are deleted.

The keyboard, CRT assembly, power supply and fan are the same as those used in the KAYPRO 16.

Refer to Section 19 in the Technical Manual for adjustment procedures, removal/replacement of components and information regarding the following topics for the KAYPRO 16/2:

DISKETTE DRIVES

The diskette drives in the KAYPRO 16/2 are the same double-density, double-sided drives used in other models of Kaypro computers. The brands that are currently being used are Epson, Shugart, Tokyo Electric and Toshiba. These drives are all functionally the same and therefore interchangeable.

Refer to the illustrations of the drives on pages 9--2 through 9--8 of the Technical Manual for identification and jumpering instructions.

The diskette drives used in the KAYPRO 16/2 are both jumpered using the instructions for jumpering the B drive, with one exception; the drive in the B position needs a terminating resistor and the drive in the A position does not. The B drive is the drive farthest from the CRT assembly and is the last drive on the ribbon cable.

DISKETTE DRIVE REMOVAL

1. Follow the instructions on page 19--3 of the Technical Manual and remove the chassis hood.

2. Remove the 34-pin ribbon cable, the power plug and the ground wire from the diskette drive.

3. Position the computer so that the rear of it is on the work surface and the bottom is facing you.

4. Remove three of the four screws that attach the drive shield and the bottom of the chassis.

5. Support the drives while removing the final screw that attaches the drive shield and the chassis.

6. Remove the two diagonal braces from the side of the chassis.

7. Remove the drive shield unit (the drives are still attached) from the chassis.

8. Remove the four screws that attach the bottom of the drives to the drive shield. Remove this portion of the drive shield.

9. There are two screws that attach each drive to the drive shield. Remove the two screws that attach the drive being replaced and the drive shield.

10. Remove the drive from the drive shield.

DISKETTE DRIVE REPLACEMENT

For diskette drive replacement, verify that the drive is jumpered correctly and reverse the preceding instructions.

Note: The ribbon cable has two twists in it for wires 10 through 16. A standard point to point cable will not work.

21.Ø KAYPRO 286i

21.1 Description

The KAYPRO 286i computer is based on the Intel 8Ø286 16-bit microprocessor. It operates at a clock frequency of 6 MHz resulting in a clock cycle time of 167 nanoseconds. The 8Ø286 supports 16-bit data transfers and can address up to 15 megabytes of physical memory. It also supports 1 gigabyte of virtual memory per task, mapped into a 15 megabyte physical address space.

The 8Ø286 operates in conjunction with several support components: 8259A-2, 8254-2, 8237A-5, 82288, and 82284. The KAYPRO 286i uses two 8259A-2 programmable interrupt controllers to provide 16 levels of priority for vectored interrupt control.

The function of the 8254-2 programmable interval timer is to control the system timers. The 8254-2 is treated by systems software as an array of four I/O ports: 3 are treated as counters, the fourth is a control register for mode programming. Two 8237A-5 DMA controllers are designed to allow external devices to directly transfer data from the system memory. They also provide memory-to-memory transfer capabilities. Commands and control for the local and system bus are provided by the 82288 bus controller. It also provides address latch control, data transceiver control and command outputs. The 82284 clock generator is responsible for the clock, ready, and reset signals required by the 8Ø286 and its support components.

The system board is socketed for and will support the addition of an Intel 8Ø287 numeric processor. The 8Ø287 extends the capabilities of the system by adding floating-point, extended-integer, and BCD data types.

The KAYPRO 286i is populated with 512K bytes of dynamic RAM, (64ØK bytes on the KAYPRO 286i model C), which is implemented using 256K x 1, 15Øns dynamic RAM chips. This can be increased to 64ØK bytes by populating Bank 2 and Bank 3 on the system board with 64K x 1, 15Øns dynamic RAM. By using expansion cards, RAM can be extended to the maximum the system will support, 15M bytes. (See 23.3 MEMORY EXPANSION.)

21.2 FCC INFORMATION

As Kaypro keeps in step with computer technology, the models have changes which affect FCC ratings. The proper rating is affixed to the back of each computer, and the appropriate FCC information is given here.

FCC INFORMATION FOR CLASS A

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a class A computing device pursuant to subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

If this computer is used with peripheral devices, such as a printer or modem, then well-shielded cables must be used to preserve the radio interference characteristics.

FCC INFORMATION FOR CLASS B

This equipment generates and uses radio frequency energy and, if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type-tested and found to comply with the limits for a class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient the receiving antenna.
Relocate the computer with respect to the receiver.
Move the computer away from the receiver.
Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communication Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U. S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

21.3 KAYPRO 286i MODEL A SPECIFICATIONS

CPU:	80286 microprocessor, 6.0 MHz clock; socket for 80287 math co-processor.
ROM:	32 KB; includes automatic self test of system on power up.
RAM:	512 KB standard; expandable to 640 KB on the mainboard; expandable to 15 MB with installation of additional boards.
DISK STORAGE:	One double-sided, high-density floppy diskette drive; 1.2 MB of storage.
BOARD EXPANSION:	Eight expansion slots; one is used for the system, leaving seven IBM PC AT compatible slots for user options and workstation growth.
KEYBOARD:	Detachable, 84 keys, IBM PC AT compatible in layout and function keys; may be locked to prevent unauthorized use; bi-directional interface.
COLOR GRAPHICS:	Color graphics may be added with the installation of an additional board.
TIME DEVICES:	Real time clock/calendar with lithium battery back-up; also features three user programmable timers.
SOUND SYSTEM:	Includes speaker to allow user programmable tones.
I/O CONNECTIONS:	IBM PC AT compatible parallel and serial ports may be added with the installation of additional boards.
CASE:	Metal construction; desk-top configuration.
DIMENSIONS:	Length 21 1/4 inches; depth 17 inches; height 6 3/8 inches; weight 38 lbs.
POWER:	115/230 volts, 60/50 cycles.

21.4 KAYPRO 286i MODEL B SPECIFICATIONS

CPU:	80286 microprocessor, 6.0 MHz clock; socket for 80287 math co-processor.
ROM:	32 KB; includes automatic self test of system on power up.
RAM:	512 KB standard; expandable to 640 KB on the mainboard; expandable to 15 MB with installation of additional boards.
DISK STORAGE:	Two double-sided, high-density floppy diskette drives; 1.2 MB of storage each.
BOARD EXPANSION:	Eight expansion slots; three are used for the system, leaving five IBM PC AT compatible slots for user options and workstation growth.
KEYBOARD:	Detachable, 84 keys, IBM PC AT compatible in layout and function keys; may be locked to prevent unauthorized use; bi-directional interface.
COLOR GRAPHICS:	Standard; IBM PC AT compatible; RGB output.
TIME DEVICES:	Real time clock/calendar with lithium battery back-up; also features three user programmable timers.
SOUND SYSTEM:	Includes speaker to allow user programmable tones.
I/O CONNECTIONS:	One parallel port; IBM PC AT compatible. One serial port; IBM PC AT compatible.
CASE:	Metal construction; desk-top configuration.
DIMENSIONS:	Length 21 1/4 inches; depth 17 inches; height 6 3/8 inches; weight 38 lbs.
POWER:	115/230 volts, 60/50 cycles.

21.5 KAYPRO 286i MODEL C SPECIFICATIONS

CPU:	80286 microprocessor, 6.0 MHz clock; socket for 80287 math co-processor.
ROM:	32 KB; includes automatic self test of system on power up.
RAM:	640 KB standard; expandable to 15 MB with installation of additional boards.
DISK STORAGE:	One double-sided, high-density floppy diskette drive; 1.2 MB of storage. One hard disk drive; 20 MB of storage.
BOARD EXPANSION:	Eight expansion slots; two are used for the system, leaving six IBM PC AT compatible slots for user options and workstation growth.
KEYBOARD:	Detachable, 84 keys, IBM PC AT compatible in layout and function keys; may be locked to prevent unauthorized use; bi-directional interface.
COLOR GRAPHICS:	Color graphics may be added with the installation of an additional board.
TIME DEVICES:	Real time clock/calendar with lithium battery back-up; also features three user programmable timers.
SOUND SYSTEM:	Includes speaker to allow user programmable tones.
I/O CONNECTIONS:	One parallel port; IBM PC AT compatible. One serial port; IBM PC AT compatible.
CASE:	Metal construction; desk-top configuration.
DIMENSIONS:	Length 21 1/4 inches; depth 17 inches; height 6 3/8 inches; weight 38 lbs.
POWER:	115/230 volts, 60/50 cycles.

21.6 KAYPRO 286i MODEL D SPECIFICATIONS

CPU:	80286 microprocessor, 6.0 MHz clock; socket for 80287 math co-processor.
ROM:	32 KB; includes automatic self test of system on power up.
RAM:	640 KB standard; expandable to 15 MB with installation of additional boards.
MEDIA STORAGE:	One double-sided, high-density floppy diskette drive; 1.2 MB of storage. One hard disk drive; 20 MB of storage. One 1/4-inch streaming tape cartridge drive.
BOARD EXPANSION:	Eight expansion slots; four are used for the system, leaving four IBM PC AT compatible slots for user options and workstation growth.
KEYBOARD:	Detachable, 84 keys, IBM PC AT compatible in layout and function keys; may be locked to prevent unauthorized use; bi-directional interface.
COLOR GRAPHICS:	Standard; IBM PC AT compatible; RGB output.
TIME DEVICES:	Real time clock/calendar with lithium battery back-up; also features three user programmable timers.
SOUND SYSTEM:	Includes speaker to allow user programmable tones.
I/O CONNECTIONS:	One parallel port; IBM PC AT compatible. One serial port; IBM PC AT compatible.
CASE:	Metal construction; desk-top configuration.
DIMENSIONS:	Length 21 1/4 inches; depth 17 inches; height 6 3/8 inches; weight 38 lbs.
POWER:	115/230 volts, 60/50 cycles.

22.Ø CHASSIS

22.1 CHASSIS COVER REMOVAL

WARNING! The KAYPRO 286i contains static sensitive devices. Make sure that you are grounded before you remove the cover. The preferred method is to have a grounding strap attached to the wrist with the drain lead connected to a common earth ground and to have the computer positioned on a conductive grounded mat. With the above precautions observed, and the power disconnected, one may remove and install components or adapters.

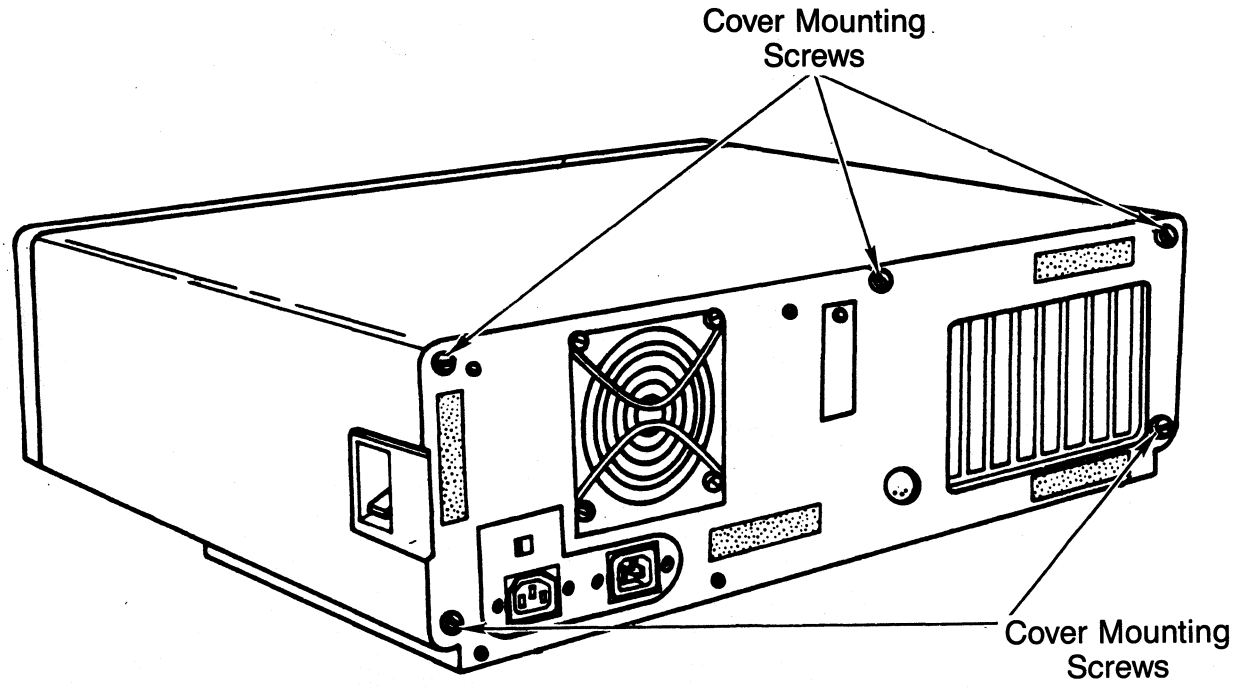
1. Turn off the computer and disconnect AC power by unplugging the power cord from the back of the computer.

2. Disconnect all peripheral cords and cables from the back of the computer (printer cables, modem cable, et cetera).

3. Gently pull the back panel cover from the back of the computer. It is held onto the back panel of the chassis by four Velcro (tm) strips.

4. Remove the five cover mounting screws located on the back of the KAYPRO 286i in each corner and top center (refer to Figure 22-1).

Figure 22-1 Cover Mounting Screws



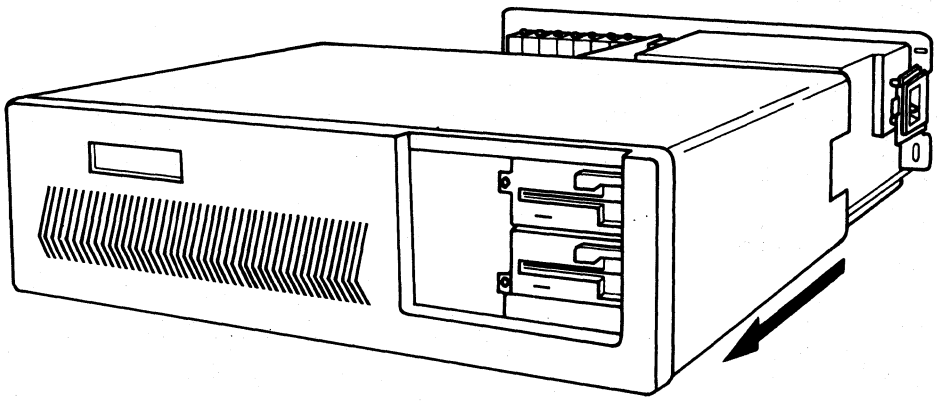
5. Slide the cover toward the front of the computer (refer to figure 22-2). If it sticks, find the obstruction (usually the back corners or the drive mounting clips), and free the cover.

22.2 CHASSIS COVER REPLACEMENT

1. Slide the cover toward the back of the computer until the cover is against the rear panel of the chassis.

2. Replace and tighten the five cover mounting screws.

Figure 22-2 Chassis cover removal



23.Ø SYSTEM BOARDS

The term "System Boards" in this manual is defined as the mainboard plus any adapter cards that make up the standard system for a particular computer.

23.1 Descriptions for different models

KAYPRO 286i MODEL A

The KAYPRO 286i model A system boards include the mainboard with 512K bytes of RAM standard and a combination diskette drive/hard drive controller card.

KAYPRO 286i MODEL B

The KAYPRO 286i model B system boards includes the mainboard with 512K bytes of RAM standard, a combination diskette drive/hard drive controller card, a serial/parallel port card, and a color card.

KAYPRO 286i MODEL C

The KAYPRO 286i model C system boards include the mainboard with 64ØK bytes of RAM standard, a combination diskette drive/hard drive controller card, and a serial/parallel port card.

KAYPRO 286i MODEL D

The KAYPRO 286i model B system boards includes the mainboard with 64ØK bytes of RAM standard, a combination diskette drive/hard drive controller card, a serial/parallel port card, a color card, and a tape drive controller card.

23.2 ADAPTER CARDS

23.21 CONTROLLER CARD

The controller card is a Western Digital 1ØØ2 combination diskette drive/hard drive controller card and is not dealer serviceable.

23.22 COLOR CARD

The color card offers standard graphics resolutions of 32Ø by 2ØØ with four colors or 64Ø by 2ØØ black and white with any IBM compatible RGB monitor.

23.23 TAPE DRIVE CONTROLLER CARD

The tape drive controller card is a Wangtek PC-36 Controller and is not dealer serviceable.

23.24 SERIAL/PARALLEL PORT CARD

The serial/parallel port card consists of two I/O ports. One is a DB-25S connector for use with parallel peripheral devices, and the other is a DE-9S serial connector for serial devices such as modems, plotters, or serial printers. The serial/parallel port card ports are selectable as COM 1 and LPT 1 or COM 2 and LPT 2 by reversing the DIP switch settings or jumpers (J1 and J2) on the card.

23.241 IC LIST

Reference Designation		Description
Serial/Parallel Port Card, 81-623, KAYPRO 286i model B		
U16	PAL 16L8	(81-693)
U12,13	74LSØ4	Hex inverter
U9	74LS125	Tri quad buffer
U1Ø	74LS155	Hex "D" flip-flop
U17	74LS174	Hex "D" flip-flop
U11	74LS24Ø	Octal inverter buffer
U6	74LS244	Tri octal buffer
U18	74LS245	Bi-directional 8-bit buffer
U7	74LS374N	Octal latch
U14	74Ø5	Hex inverter
J1,2	DIP SWITCH	4 pos x 2 selects

23.242 SCHEMATICS: SERIAL/PARALLEL PORT CARD

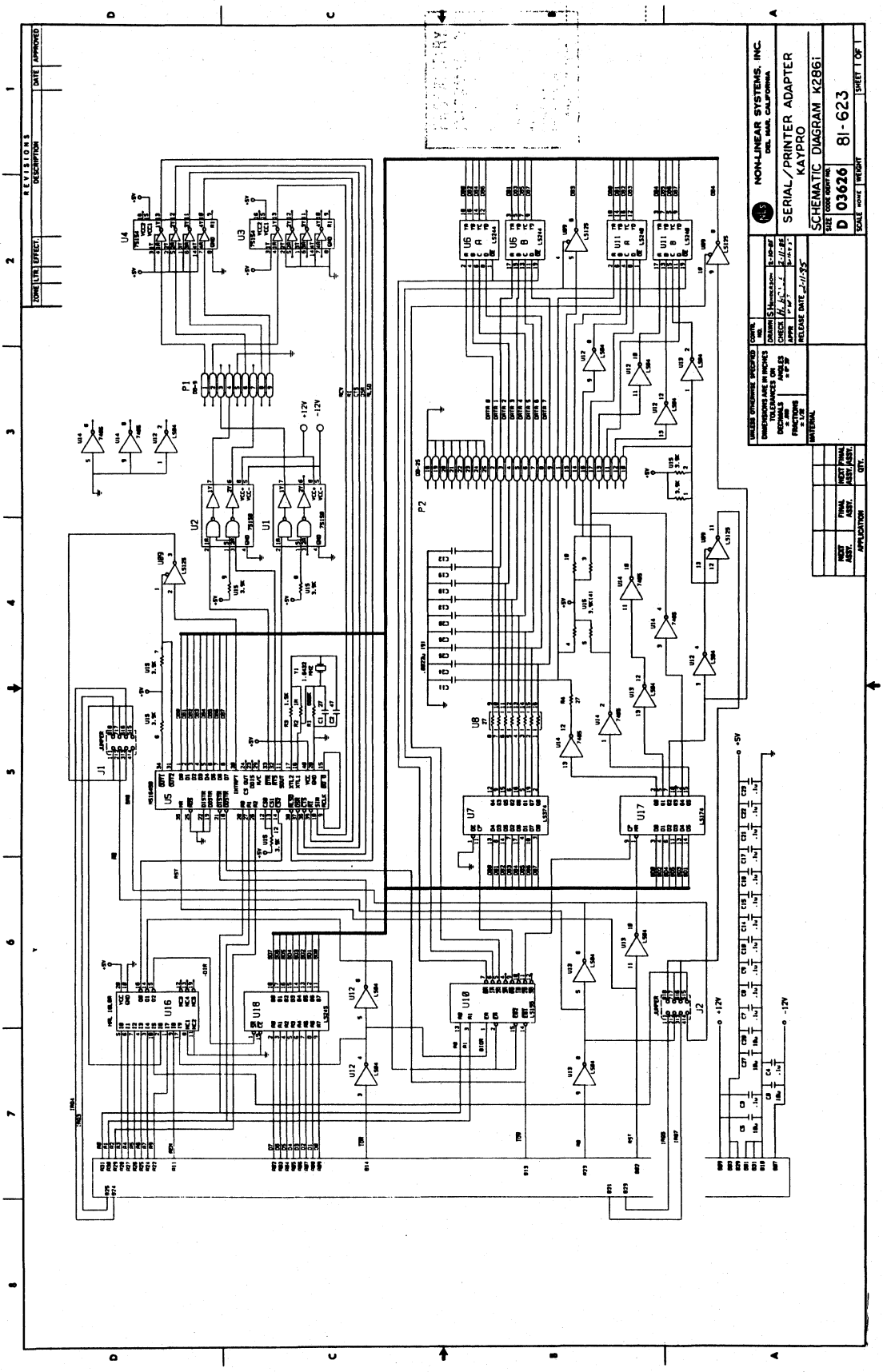


Figure 23-1 Expansion Slot Cover

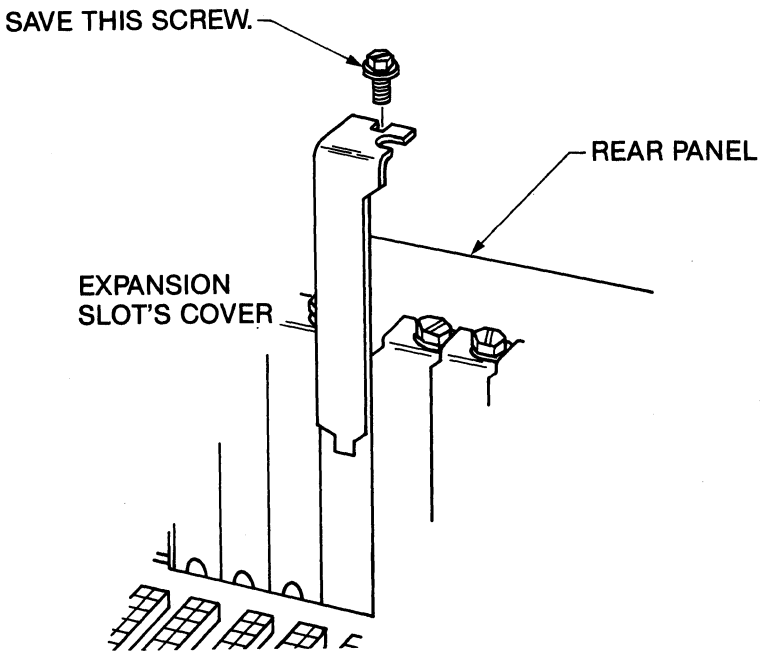
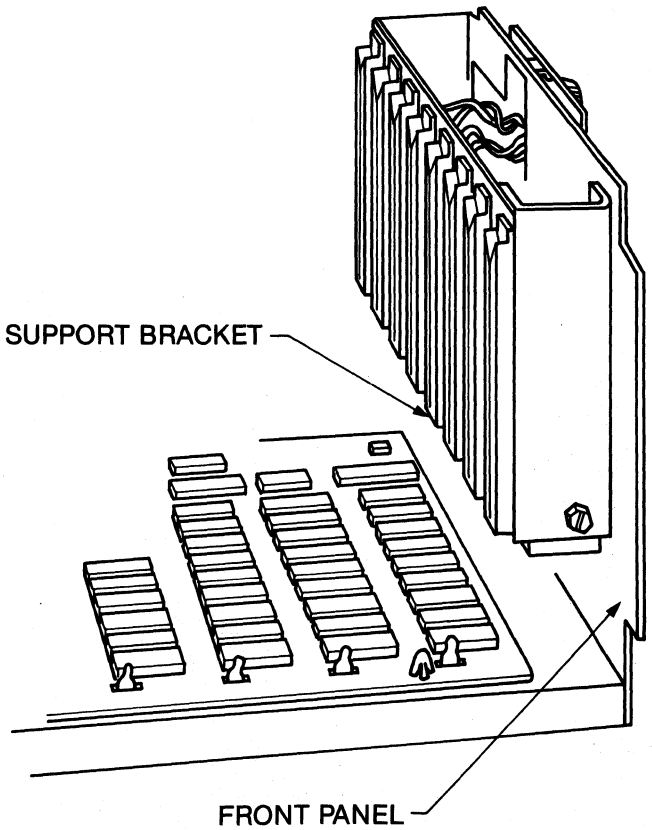


Figure 23-2 Support Bracket



23.25 ADAPTER CARD REMOVAL

WARNING! The KAYPRO 286i contains static sensitive devices. Make sure that you are grounded before you remove the cover. The preferred method is to have a grounding strap attached to the wrist with the drain lead connected to a common earth ground and to have the computer positioned on a conductive grounded mat. With the above precautions observed, and the power disconnected, one may remove and install components or adapters.

Note: All cards that are installed by Kaypro Corporation may be removed, but must be returned to the expansion slots assigned to them.

1. Turn off the computer and disconnect the AC power.

2. Remove the chassis cover (22.1).

3. Remove all cables and connectors that are attached to the card, taking notice of the position of each of these cables and connectors.

4. Remove the screw that secures the card (located toward the rear panel of the computer).

5. Remove the card from the card cage by sliding it upward until the edge connector is separated from the expansion slot receptacle and the card is out of the card cage.

23.26 ADAPTER CARD INSTALLATION

NOTE: Some of the smaller expansion cards may not fit in most slots of the KAYPRO 286i because of an extra tab on the card that hangs down. These cards must be placed in the expansion slots marked J1 and J7, or another compatible card that does fit must be used.

1. If you are installing a new card, remove the expansion slot cover (refer to Figure 23-1).

2. Position the card above the card cage so that the edge connector is above the expansion slot receptacle.

3. Lower the card into the card cage so that the mounting bracket tab fits into the space between the mainboard and the side of the card cage, and the other side of the card slides into the plastic support bracket (refer to Figure 23-2).

4. Press the card until it is firmly seated in the expansion slot receptacle.

5. Replace and tighten the screw that secures the mounting bracket to the card cage.

6. Replace the chassis cover.

7. After installing a new card, it may be necessary to run the "Setup" program.

23.3 MAINBOARD

23.31 Description

The mainboard on the KAYPRO 286i is populated with 512K bytes of RAM (640K bytes on KAYPRO 286i models C and D), and is socketed to allow the memory to be expanded to 640K bytes. To implement the RAM expansion on the system board, see section on "Memory Expansion" below.

80287 MATH CO-PROCESSOR

The KAYPRO 286i mainboard is socketed for and will support the addition of an Intel 80287 math co-processor. The co-processor should be installed in the socket labeled U-62. Position the co-processor so that pin number 1 is towards the front of the computer and is in the left side of the socket.

After the 80287 math co-processor is installed, it will be necessary to run the "Setup" program.

MEMORY EXPANSION

The increase on the system board from 512K bytes to 640K bytes can be increased by populating Bank 2 and Bank 3 on the mainboard with 64K x 1, 150ns dynamic RAM. The increase in system memory is not required before any memory expansion cards are installed, but that 128K of memory must be blocked out.

The memory can be blocked out by installing a jumper between pins 1 and 2 of the RAM Enable/Disable switch (J18) on the mainboard. By using expansion cards, RAM can be extended to the maximum the system will support, which is 15M bytes.

Any time the system memory is increased either by populating the empty banks on the mainboard or installing memory expansion cards, the "Setup" program must be run.

23.32 IC LIST, KAYPRO 286i MAINBOARD

Reference Designation		Description
Mainboard, 81-Ø35 & 81-Ø36 KAYPRO 286i models A and B		
U6, U12	74F28Ø	Parity generator/checker
U49	74F257	Multiplexer
U92, U113	74F174	Hex "D" flip-flop
U1Ø, U114	74F175	Quad "D" flip-flop
U48, U82, U83	74F158	Multiplexer
U18	74F139	Decoder
U59, U77, U129, U137	74F74	Dual "D" flip-flop
U55	74F2Ø	Dual NAND gate
U125	74F11	Triple AND gate
U64, U7Ø, U71, U122, U135	74F1Ø	Triple NAND gate
U69, U91, U134	74FØ8	Quad AND gate
U72	74FØØ	Quad NAND gate
U78, U133	74LS125	Tri quad buffer
U6Ø, U124	74LS51	Dual AND-OR-invert gate
U136	74LSØ2	Quad NOR gate
U87	74LS112	Dual J K flip-flop
U53, U126	74S51	Dual AND-OR-invert gate
U68	74LS646	Octal bus transceiver
U95	74LS612	Memory mapper
U51	74LS59Ø	8-bit binary counter
U132	74LS245	Tri octal transceiver
U1Ø5, U117	8259A-2	Programmable interrupt controller
U1Ø4	8254-2	Programmable interval timer
U96, U1Ø6	8237A-5	DMA controller
U13Ø	82288	Bus controller
U88	82284	Clock
U118	8742	Universal peripheral interface 8-bit microcomputer
U38	8284A	Clock
U8Ø	8Ø286	CPU
U1Ø3	MC14Ø69U	CMOS hex
U116	MC146818P	Real time clock
U127	PAL 16L8A	(81-686)
U111	63SØ81 MMI	(81-689A)
U94	28S42 TI	(81-687C)
U1,2,7,8,13,14,19,2Ø,23,24, 28,29,33,34,39,4Ø,43,44	41256P-15	256K x 1, 15Øns, dynamic RAM
U121	74Ø7	Hex buffer
U56,66,67,84,97,98	74ALS573	Tri octal "D" latch
U5,11,65,73,74,75,76,81	74ALS245	Tri octal transceiver
U5Ø,61,1Ø7	74ALS244	Tri octal buffer
U98	74ALS175	Quad "D" flip-flop
U12Ø	74ALS138	Decoder/demultiplexer
U27	27128A-2	EPROM (81-691E)
U47	27128A-2	EPROM (81-692E)
U86,9Ø,1Ø2,1Ø9,11Ø,112,115	74ALS74	Dual "D" flip-flop
U58	74ALS32	Quad OR gate

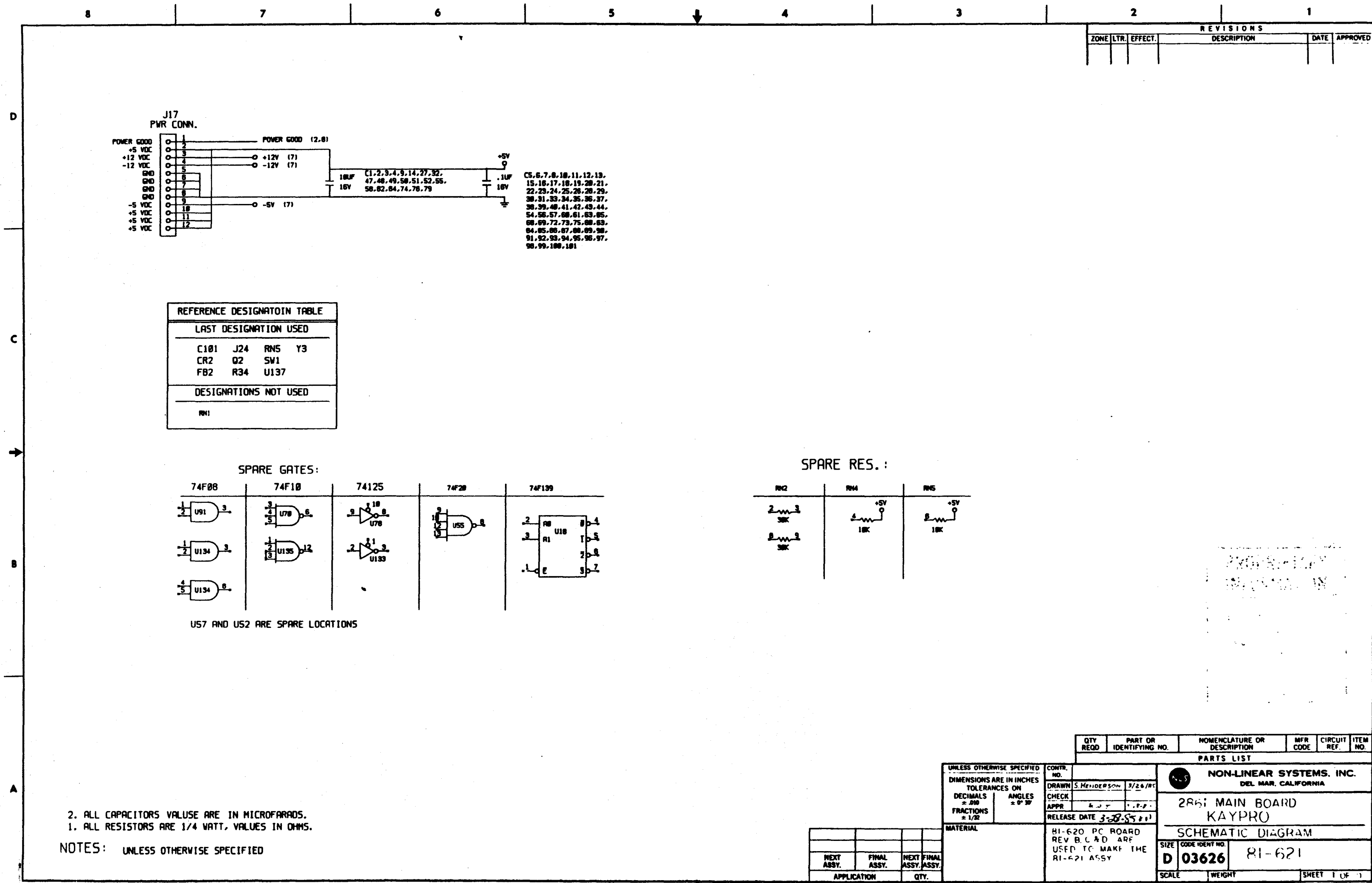
Mainboard, 81-Ø35 & 81-Ø36 KAYPRO 286i models A and B cont'd.

U85	74ALS27	Triple NOR gate
U54	74ALS1Ø	Triple NAND gate
U89	74ALSØ8	Quad NAND gate
U79,123,131	74ALSØ4	Hex inverter
U1ØØ,1Ø8	74ALSØ2	Quad NOR gate
U99,128	74ALSØØ	Quad NAND gate

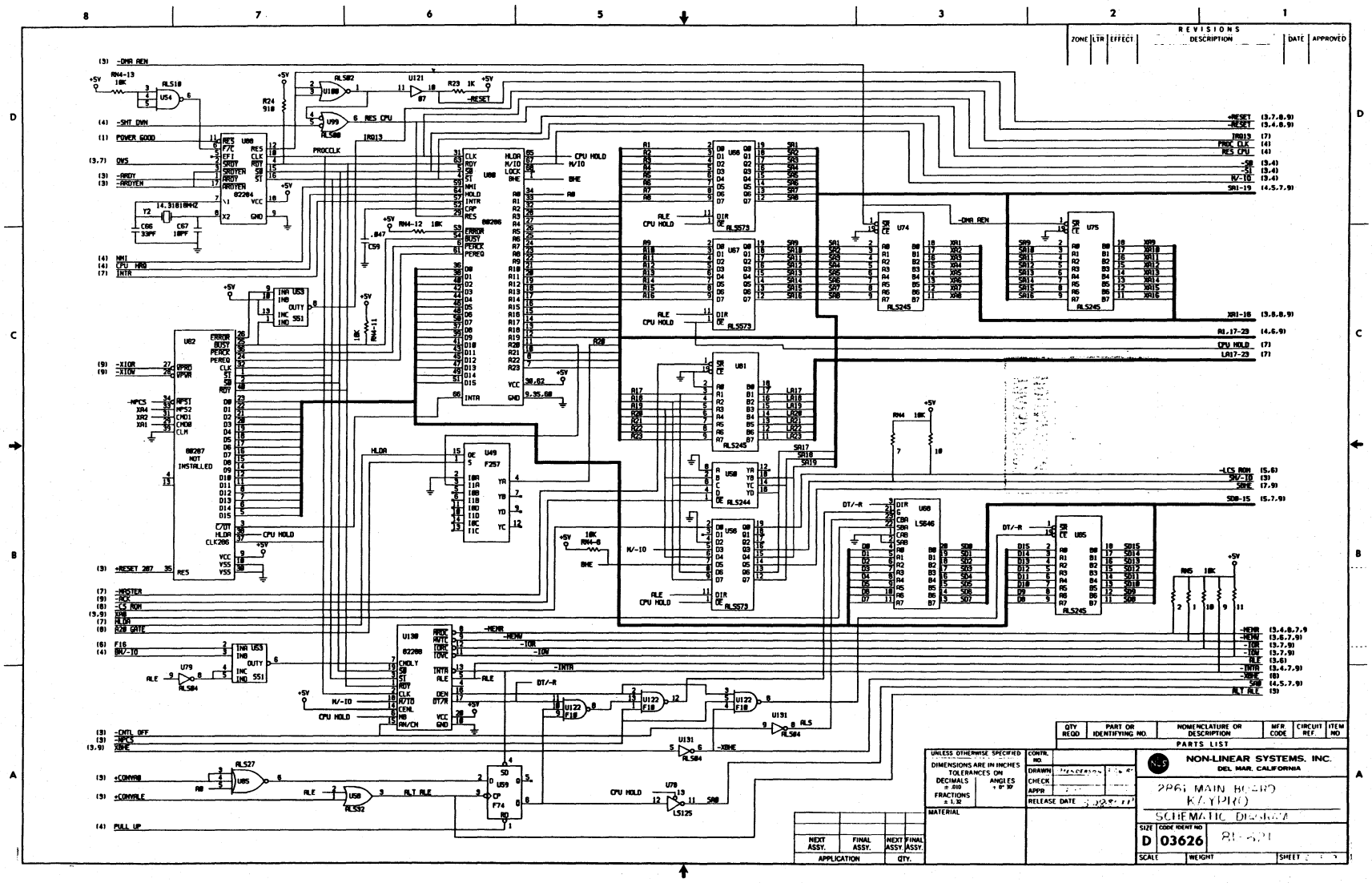
Mainboard, 81-Ø37 KAYPRO 286i model C

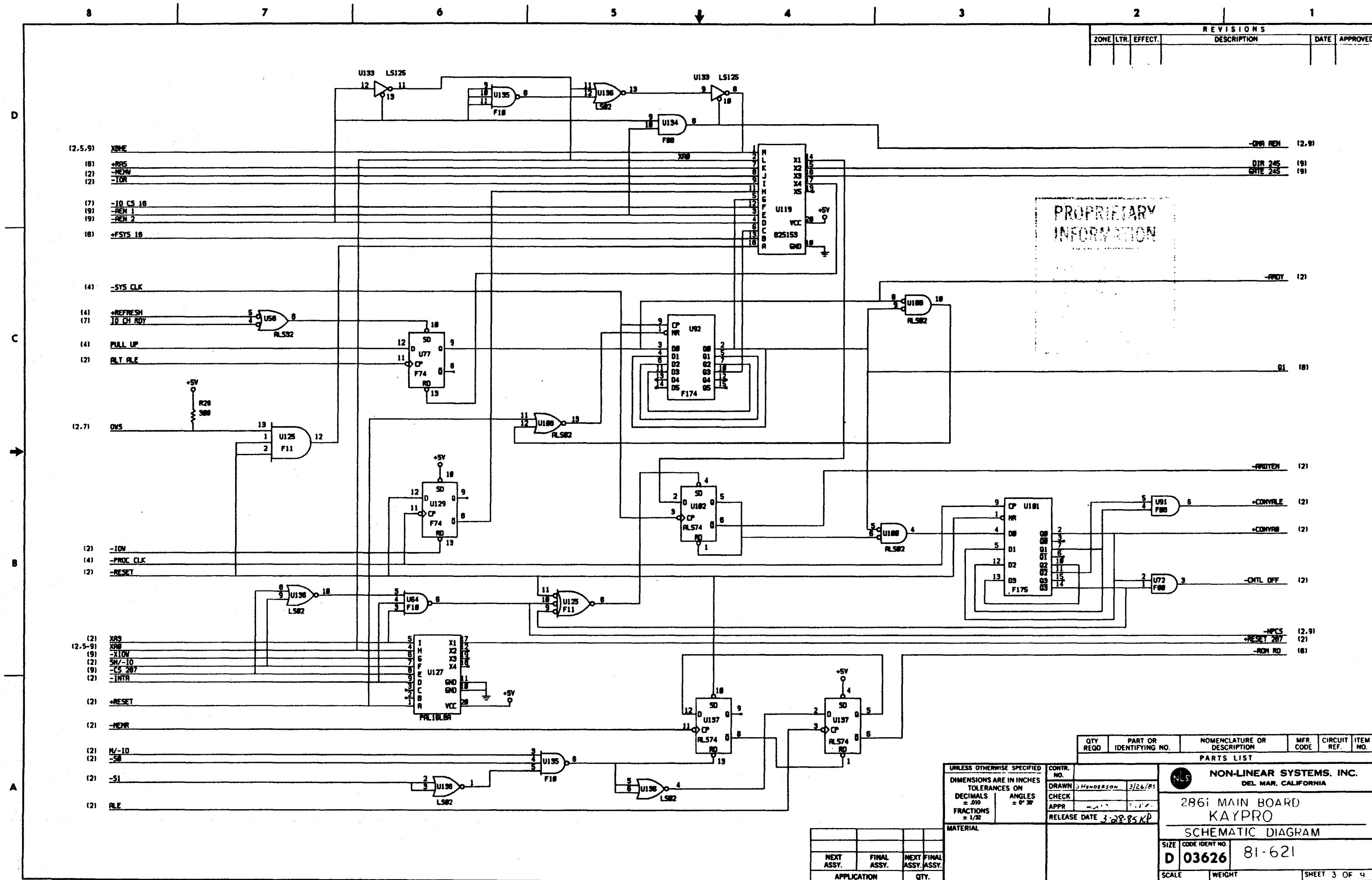
The KAYPRO 286i model C mainboard is the same as the KAYPRO 286i models A and B with the following addition:

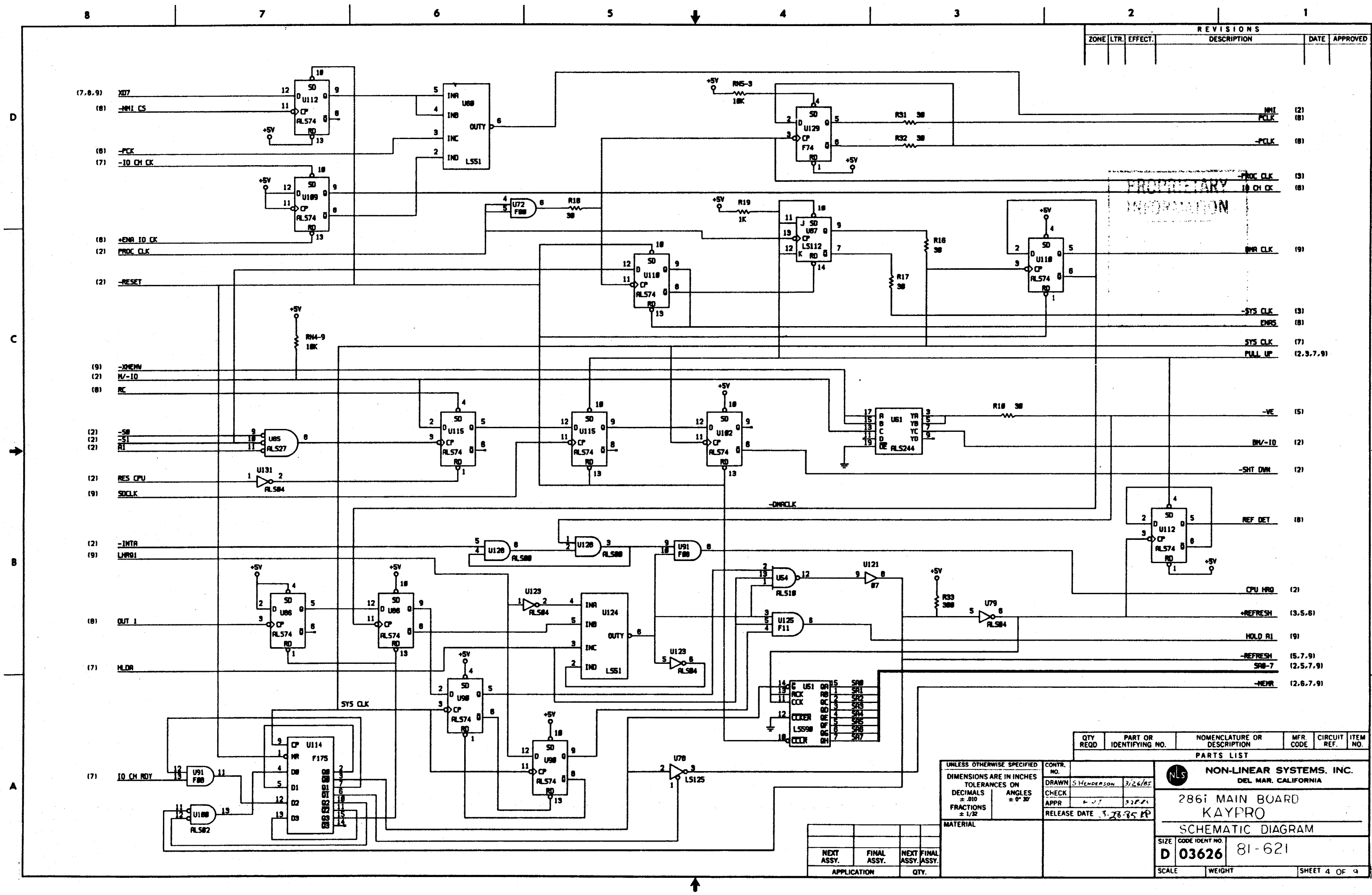
U3,4,9,1Ø,15,16,21,22,25, 26,3Ø,31,35,36,41, 42,45,46	6665-AP15	64K x 1, 15Øns, dynamic RAM

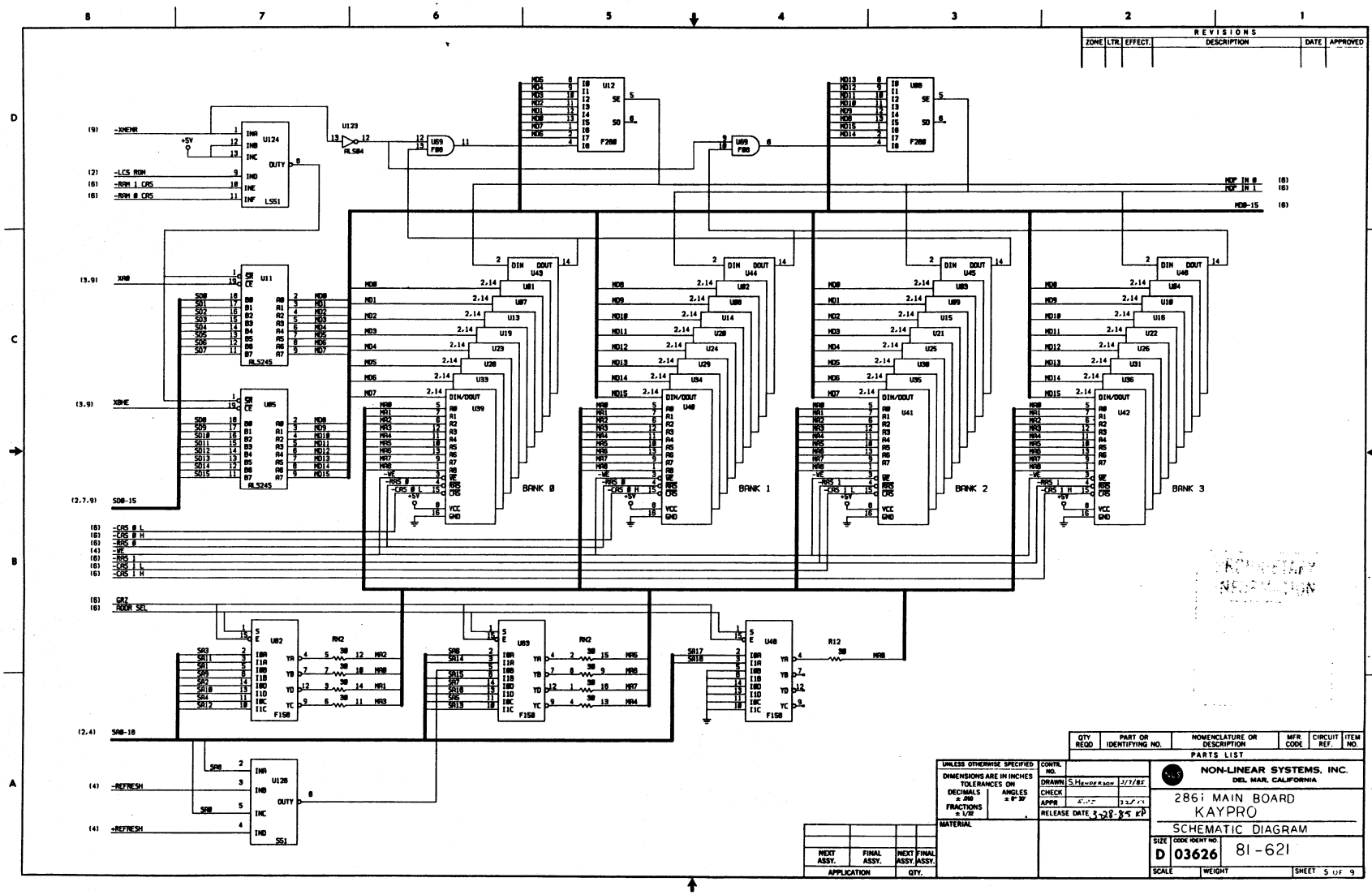


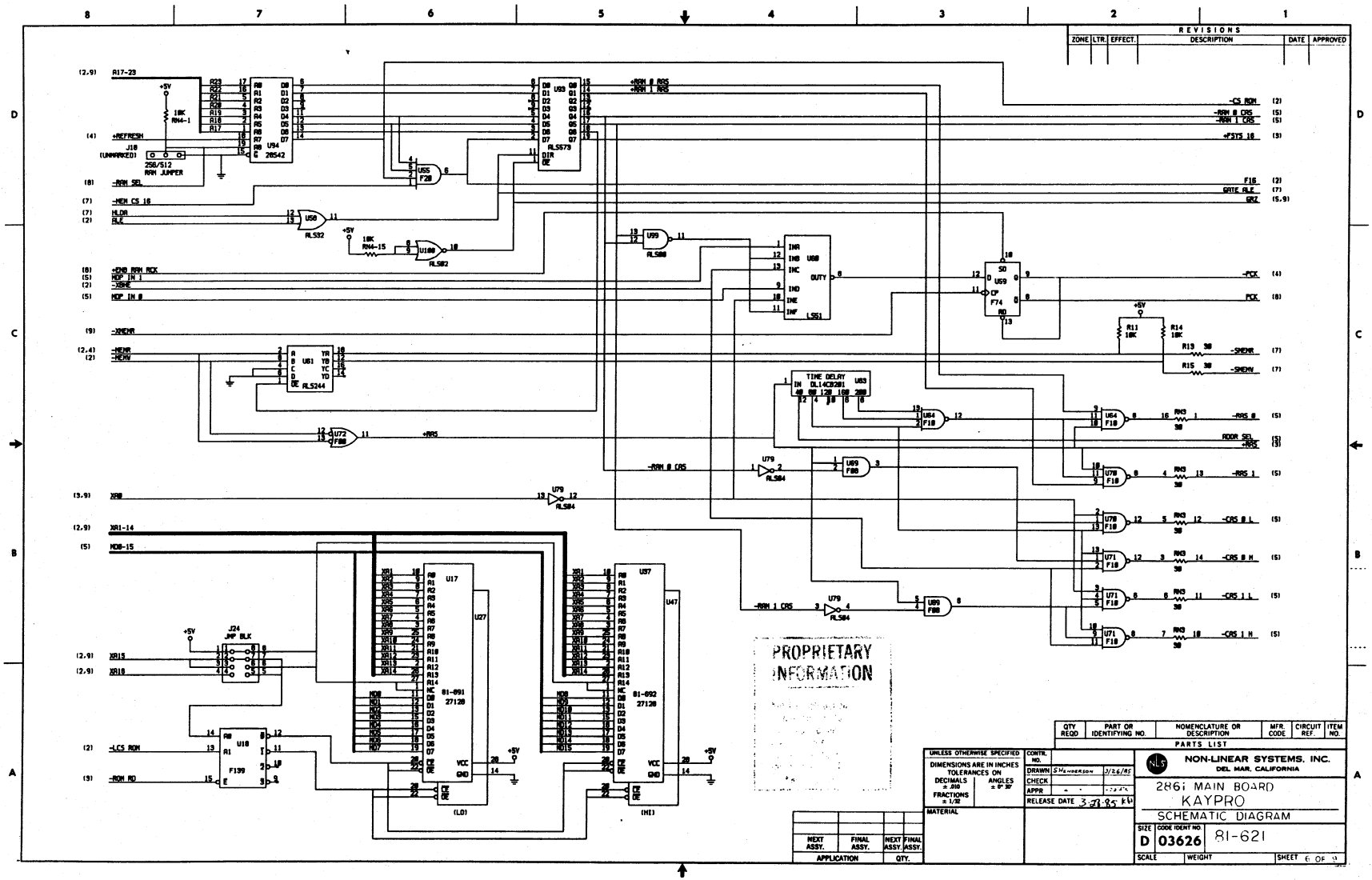
J17
PWR CONN.
POWER GOOD
+5 VDC
+12 VDC
-12 VDC
GND
-5 VDC
POWER GOOD (2,8)
+12V (7)
-12V (7)
-5V (7)
+5V
10UF
16V
.1UF
16V
REFERENCE DESIGNATOIN TABLE
LAST DESIGNATION USED
C101 J24 RN5 Y3
CR2 Q2 SW1
FB2 R34 U137
DESIGNATIONS NOT USED
RN1
SPARE GATES:
74F08
74F10
74125
74F20
74F139
US7 AND US2 ARE SPARE LOCATIONS
SPARE RES.:
RN2
RN4
RN5
2. ALL CAPACITORS VALUSE ARE IN MICROFARADS.
1. ALL RESISTORS ARE 1/4 WATT, VALUES IN OHMS.
NOTES: UNLESS OTHERWISE SPECIFIED
REVISIONS
ZONE
LTR.
EFFECT.
DESCRIPTION
DATE
APPROVED
PARTS LIST
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
286i MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
D
03626
81-621
81-620 PC BOARD
REV B,C & D ARE
USED TO MAKE THE
81-621 ASSY

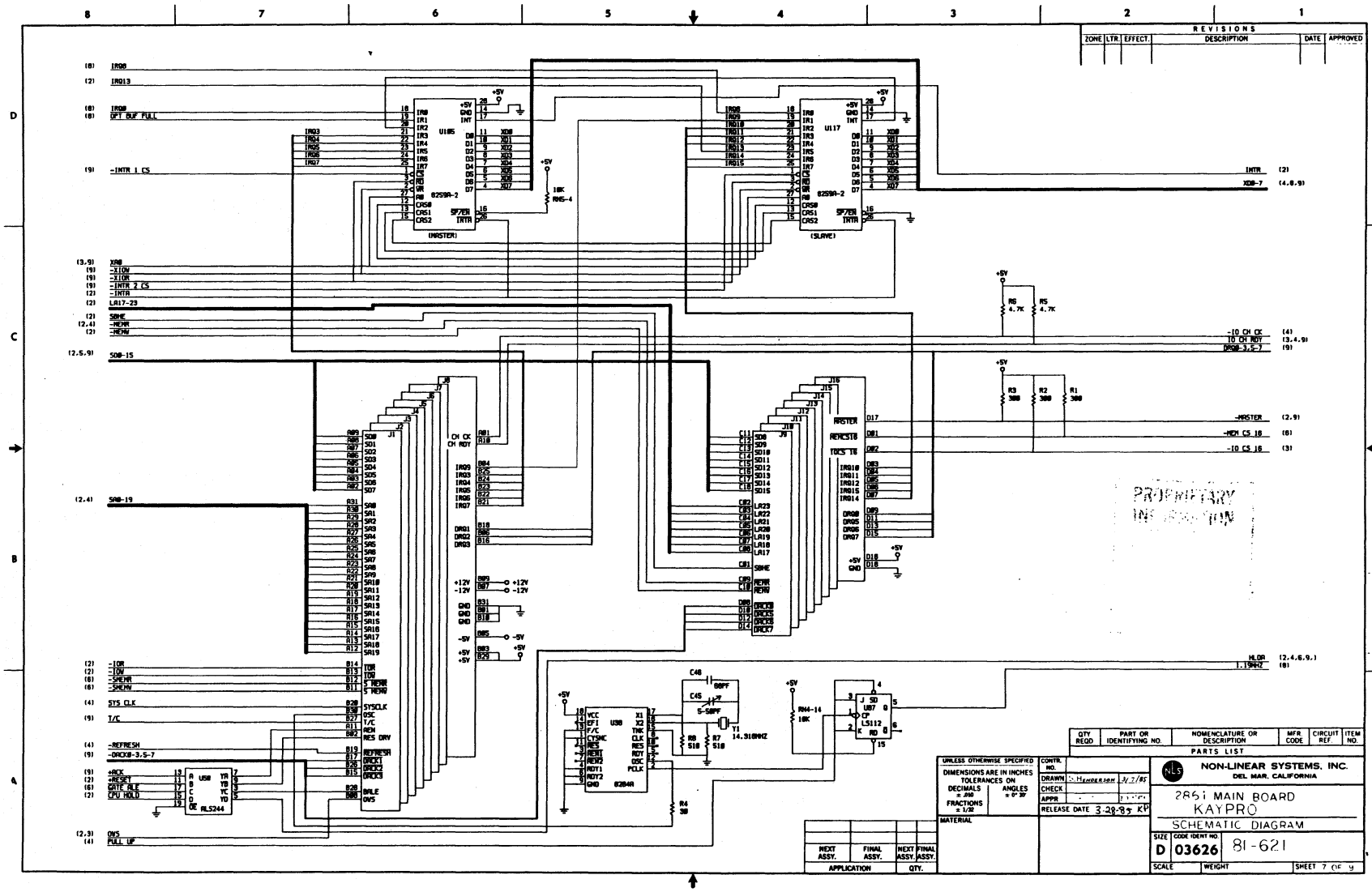

REVISIONS
ZONE | LTR | EFFECT | DESCRIPTION | DATE | APPROVED
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
286 MAIN BOARD
K/YPRO
SCHEMATIC DIAGRAM
D 03626
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR CODE | CIRCUIT REF. | ITEM NO
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'
CONTR NO.
DRAWN
CHECK
APPR
RELEASE DATE
MATERIAL
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
SIZE | CODE IDENT NO | SCALE | WEIGHT | SHEET

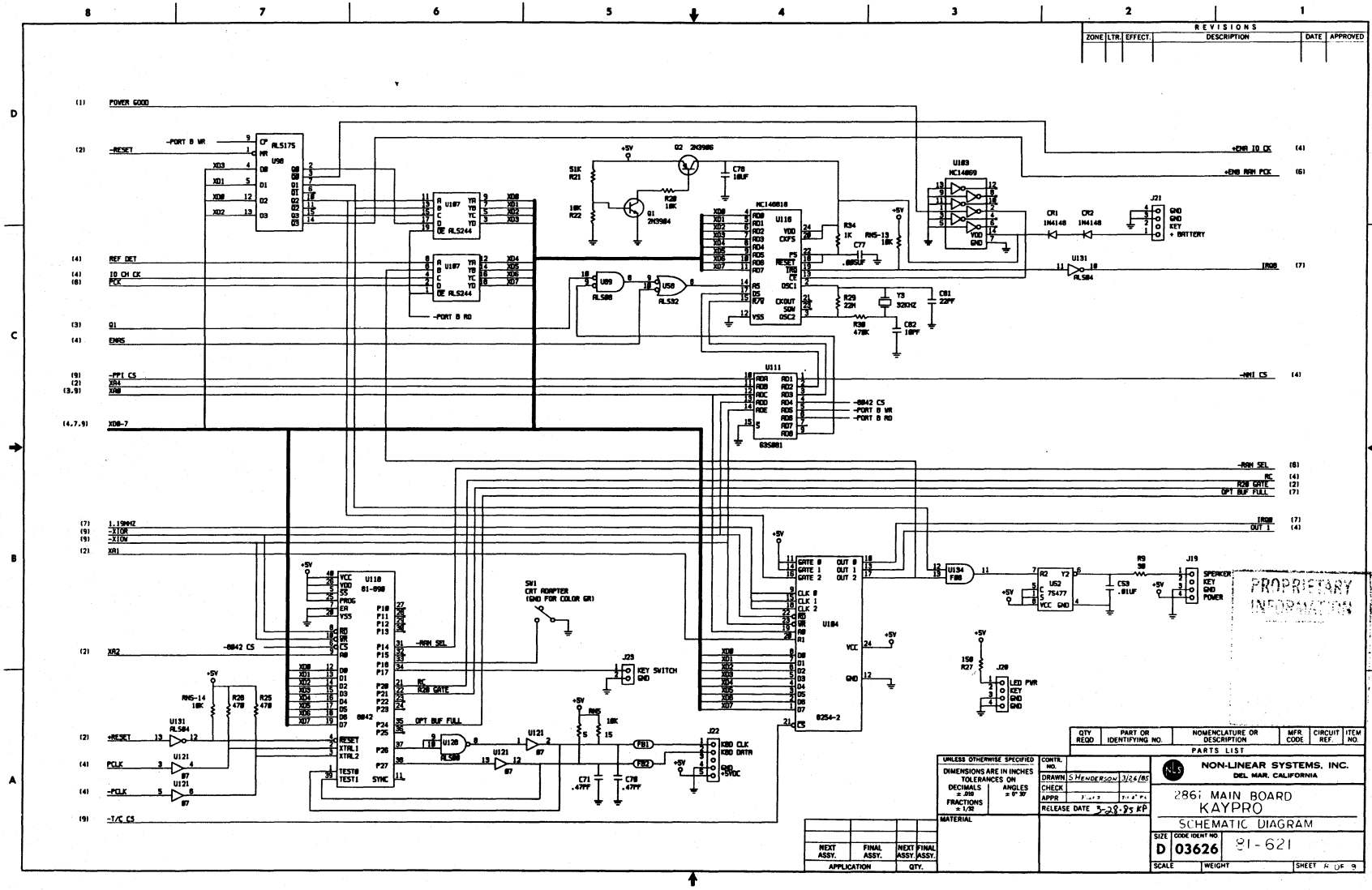

REVISIONS
ZONE LTR. EFFECT. DESCRIPTION DATE APPROVED
XBHE
+RAS
-MEMW
-IOR
-IO CS 16
-REN 1
-REN 2
+FSYS 16
-SYS CLK
+REFRESH
IO CH RDY
PULL UP
ALT ALE
OVS
-IOW
-PROC CLK
-RESET
XA3
XA0
-XIOW
SM/-IO
-CS 287
-INTA
+RESET
-MEMR
M/-IO
-S0
-S1
ALE
-DMA REN
DIR 245
GATE 245
-ARDY
Q1
-ARDYEN
+CONVALE
+CONVA0
-CNTL OFF
-NPCS
+RESET 287
-ROM RD
U119 82S153
U92 F174
U77 F74
U129 F74
U182 ALS74
U181 F175
U127 PAL16L8A
U137 ALS74
PROPRIETARY INFORMATION
QTY REQD
PART OR IDENTIFYING NO.
NOMENCLATURE OR DESCRIPTION
MFR. CODE
CIRCUIT REF.
ITEM NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.
CONTR. NO.
DRAWN J. HENDERSON 3/26/85
CHECK
APPR
RELEASE DATE 3-28-85 KP
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
286i MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
SIZE D
CODE IDENT NO. 03626
81-621
SCALE
WEIGHT
SHEET 3 OF 4

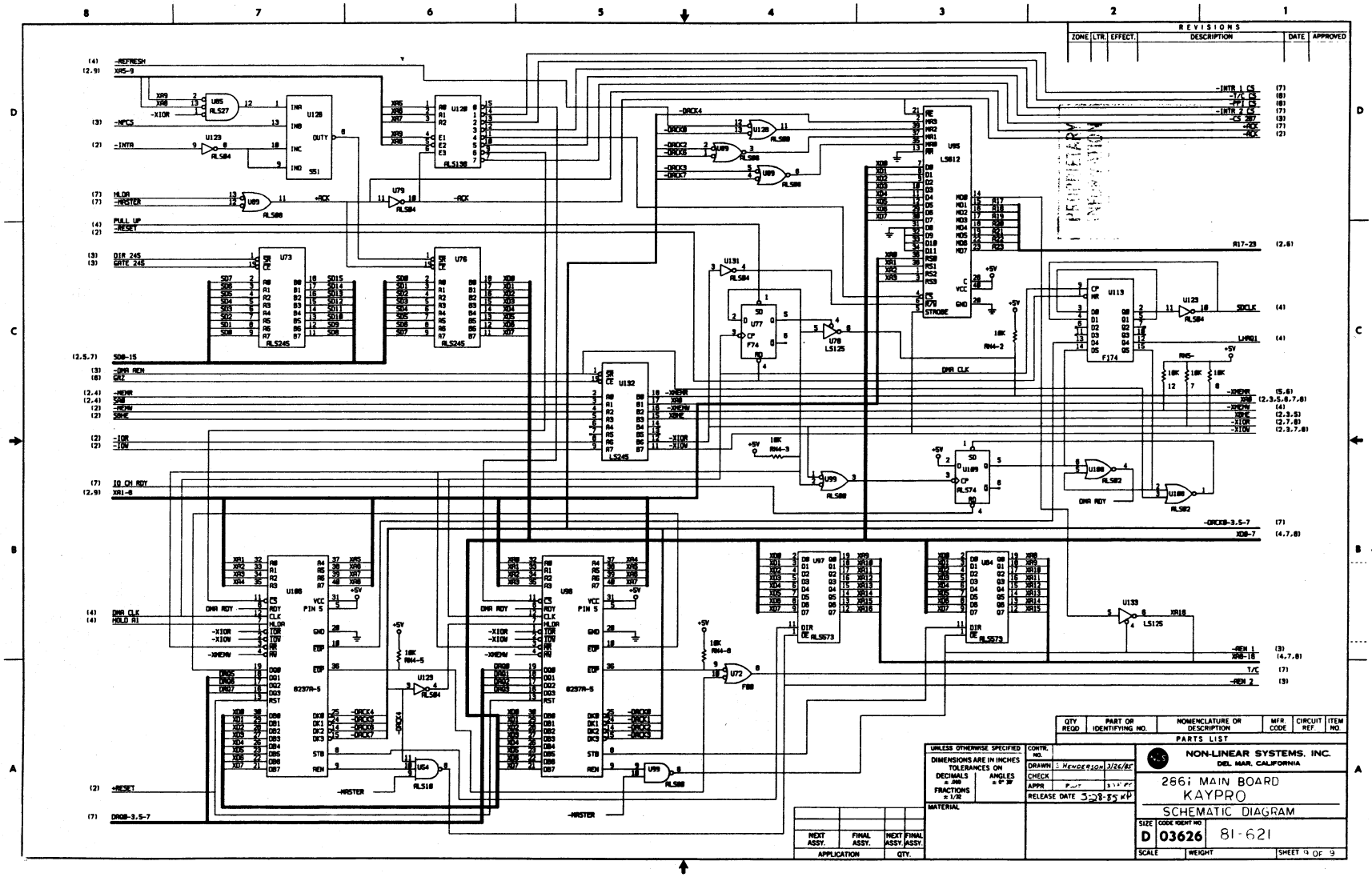

REVISIONS
ZONE
LTR.
EFFECT.
DESCRIPTION
DATE
APPROVED
PROPRIETARY INFORMATION
QTY REQD
PART OR IDENTIFYING NO.
NOMENCLATURE OR DESCRIPTION
MFR. CODE
CIRCUIT REF.
ITEM NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ±.010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL
CONTR. NO.
DRAWN S.Henderson 3/26/85
CHECK
APPR
RELEASE DATE 3-28-85
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
286i MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
SIZE D
CODE IDENT NO. 03626
81-621
SCALE
WEIGHT
SHEET 4 OF 9
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.


REVISIONS
ZONE LTR EFFECT. DESCRIPTION DATE APPROVED
BANK 0
BANK 1
BANK 2
BANK 3
-XMEMR
-LCS ROM
-RAM 1 CAS
-RAM 0 CAS
XA9
XA8
SDB-15
-CAS 0 L
-CAS 0 H
-RAS 0
-WE
-RAS 1
-CAS 1 L
-CAS 1 H
CRT
ADDR SEL
SA8-18
-REFRESH
+REFRESH
MDF IN 0
MDF IN 1
MDB-15
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR CODE | CIRCUIT REF. | ITEM NO.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL
CONTR. NO.
DRAWN S.HENDERSON 3/7/85
CHECK
APPR
RELEASE DATE 3-28-85 KP
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
286i MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
SIZE D | CODE IDENT NO. 03626 | 81-621
SCALE | WEIGHT | SHEET 5 OF 9


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
PROPRIETARY INFORMATION
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
CONTR. NO.
DRAWN S Henderson 3/26/85
CHECK
APPR
RELEASE DATE 3-28-85 KH
MATERIAL
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
286i MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
SIZE D
CODE IDENT NO. 03626
81-621
SCALE
WEIGHT
SHEET 6 OF 13
NEXT ASSY.
FINAL ASSY.
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.


REVISIONS
ZONE | LTR | EFFECT. | DESCRIPTION | DATE | APPROVED
PROPRIETARY INFORMATION
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR CODE | CIRCUIT REF. | ITEM NO.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
2861 MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
SIZE D | CODE IDENT NO. 03626 | 81-621
SCALE | WEIGHT | SHEET 7 OF 9
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL
DRAWN
CHECK
APPR
RELEASE DATE 3-28-85 KP
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
POWER GOOD
-RESET
-PORT B WR
REF DET
IO CH CK
PCK
Q1
ENRS
-PPI CS
XA4
XA9
XD0-7
-PORT B RD
-8042 CS
-PORT B WR
-PORT B RD
-NMI CS
-RAM SEL
AC
R28 GATE
OPT BUF FULL
IRQ8
OUT 1
1.19MHZ
-XIOR
-XIOW
XA1
XA2
-RAM SEL
KEY SWITCH
SW1
CRT ADAPTER
(GND FOR COLOR GR)
OPT BUF FULL
R28 GATE
KBD CLK
KBD DATA
+5VDC
SPEAKER
KEY
GND
POWER
LED PWR
KEY
GND
GND
+RESET
PCLK
-PCLK
-T/C CS
+CHR IO CK
+CHR RAM PCK
IRQ8
-NMI CS
-RAM SEL
AC
R28 GATE
OPT BUF FULL
IRQ8
OUT 1
PROPRIETARY INFORMATION
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
FRACTIONS ± 1/32
ANGLES ± 0° 30'
CONTR. NO.
DRAWN S HENDERSON 3/24/85
CHECK
APPR.
RELEASE DATE 5-28-85 KP
MATERIAL
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
2861 MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
SIZE D | CODE IDENT NO 03626 | 81-621
SCALE | WEIGHT | SHEET 4 OF 9


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
PARTS LIST
QTY REQD | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MFR. CODE | CIRCUIT REF. | ITEM NO.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
2861 MAIN BOARD
KAYPRO
SCHEMATIC DIAGRAM
SIZE D | CODE IDENT NO 03626 | 81-621
SCALE | WEIGHT | SHEET 9 OF 9
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'
MATERIAL
DRAWN
CHECK
APPR
RELEASE DATE 3-28-85
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.

23.34 MAINBOARD CONNECTOR PIN ASSIGNMENTS

SPEAKER CONNECTOR (J19)

Pin	Assignment
1	Data Out
2	Key (N/C)
3	Ground
4	+5VDC

KEYBOARD CONNECTOR (J22)

Pin	Assignment
1	Keyboard Clock
2	Keyboard Data

power up.

RAM: 640 KB standard; expandable to 15 MB with

5 +5VDC

KEYLOCK CONNECTOR (J23)

Pin	Assignment
1	Key Switch
2	Ground

POWER CONNECTOR (J17)

Pin	Assignment
1	Power Good
2	+5VDC
3	+12VDC
4	-12VDC
5	Ground
6	Ground
7	Ground
8	Ground
9	-5VDC

1Ø n

BATTERY CONNECTOR (J21)

Pin	Assignment
1	+ Battery
2	Key
3	Ground
4	Ground

RAM ENABLE/DISABLE SWITCH (J18)

Jumper Positions	Function
1 and 2 (towards the front of the computer)	Disable last 128K of RAM on the mainboard
2 and 3 (towards the back of the computer)	Enable last 128K of RAM on the mainboard
Not Jumpered	Enable last 128K of RAM on the mainboard

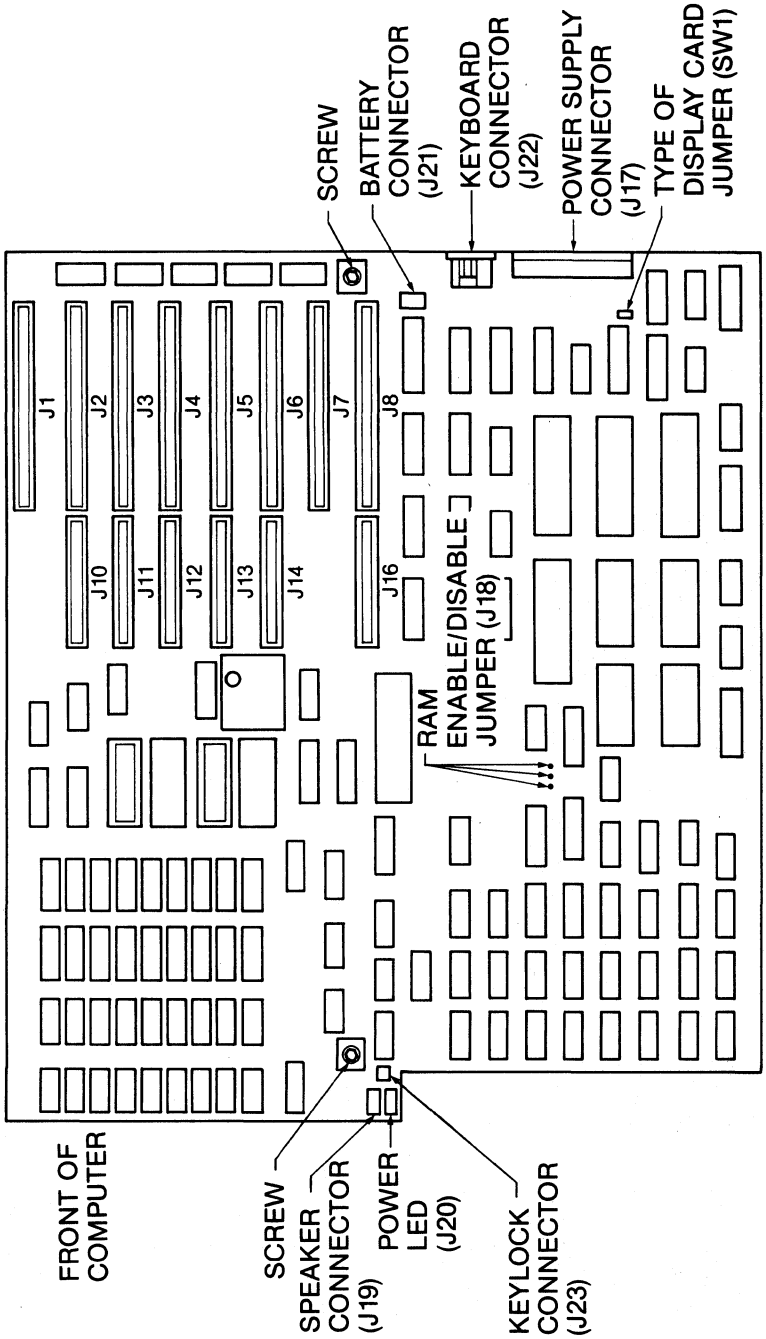
Note: Before the system RAM may be increased by installing additional memory expansion cards, either memory banks 2 and 3 on the mainboard must be filled, or this switch must be set to disable those banks. The default setting is "Not Jumpered". Please see section 23.3 Memory Expansion.

TYPE OF DISPLAY CARD JUMPER (SW1)

The purpose of this jumper is to tell the KAYPRO 286i into which display card the primary display is attached. The primary display is activated when the system is turned on.

Jumper Positions	Function
Pins 1 and 2 (the pins closest to the power supply)	The primary display is attached to the color/graphics monitor card.
Pins 2 and 3 (the pins closest to the expansion slots)	The primary display is attached to the monochrome display card.

Figure 23-3 KAYPRO 286i Mainboard Layout



23.35 MAINBOARD REMOVAL

WARNING! The KAYPRO 286i contains static sensitive devices. Make sure that you are grounded before you remove the cover. The preferred method is to have a grounding strap attached to the wrist with the drain lead connected to a common earth ground and to have the computer positioned on a conductive grounded mat. With the above precautions observed, and the power disconnected, one may remove and install components or adapters.

1. Turn off the computer and disconnect the AC power.

2. Remove chassis cover (22.1).

3. Remove all cards from expansion slots (23.24).

4. Refer to Figure 23-3 for mainboard layout.

5. Remove the 2 hex screws on the mainboard. One is located between J7 and J8 near the back of the computer, the other is directly opposite it near the front of the computer.

6. Remove the battery wires from J21 (the battery is the black box attached to the chassis by Velcro).

7. Remove the three sets of wires from J23 (keylock), J19 (the speaker), and J20 (the power LED). Note positions of all wires.

8. Remove the power supply cable from J17.

9. Slide board toward the left side of the computer and lift the mainboard out.

23.36 MAINBOARD INSTALLATION

1. Set the mainboard in the bottom of the computer with the expansion slots toward the left rear corner of the computer.

2. Slide the mainboard toward the right of the computer until you feel it catch the slots on the bottom of the computer and the screw holes on the mainboard are aligned with the screw holes on the bottom of the computer.

3. Replace the two screws on the mainboard.

4. Replace the power supply cable to J17. Note that the three red wires (+5V) go closest to the power supply.

5. Replace the battery wires to J21, the keylock wires to J23, the speaker wires to J19, and the power LED wires to J20.

6. Replace chassis cover.

24.Ø DISK DRIVES

24.1 HIGH-DENSITY FLOPPY DISKETTE DRIVES

24.11 Description

The KAYPRO 286i's are equipped with high-capacity diskette drives. These drives use double-sided, 5 1/4 inch, 6ØØ Oersteds, 96 TPI diskettes. These diskettes are formatted 8Ø tracks per side, 15 sectors per track and have a storage capacity of 1.2 MB per diskette.

As an option, there are regular density diskette drives available from Kaypro. These drives are the same drives used in the 8-bit computers and in the KAYPRO 16 and 16/2. Refer to chapters 9.Ø and 19.5 of this manual for identification of the different drives and their configuration. All of the diskette drives used in the KAYPRO 286i are jumpered the same as the drives used for the B drive in the 8-bit models of Kaypro computers.

24.12 FLOPPY DISKETTE DRIVE CONFIGURATIONS

Toshiba and Mitsubishi are two manufacturers of floppy diskette drives currently being used in the KAYPRO 286i computers. The jumpering instructions for each are as follows:

Toshiba Configuration

1. Locate the plug marked PJ13. The pin marked DE should be jumpered to the middle pin.

2. Locate the plug marked PJ4. On single diskette drive computers or the A drive of dual diskette drive computers, the jumpers should be in place at positions TM, LD, HM, and D2. On the B drive of a dual diskette drive computer, the jumpers should be at positions LD, HM, and D2.

Mitsubishi Configuration

1. Refer to drawing of Mitsubishi floppy diskette drive for plug positions.

2. Locate the plug closest to the capital letter A on the right side of the circuit board of the drive. The jumper should be at position 1.

3. The terminating resistor pack should be in place nearest the letter B on the right side if the diskette drive is at the end of the data cable.

4. The plug marked SS near the letter D on the left side should have its jumper removed.

5. The plug nearest the letter D on the left side should have all jumpers removed except the ones at positions IR and RR.

6. The plug nearest the letter E on the left side should have position 2 jumpered to the middle post.

7. The plug nearest the letter G on the left side is jumpered.

8. The plug nearest the letter H on the left side has positions MM and DC jumpered.

9. The plug nearest the letter J on the left side has position HM jumpered.

Figure 24-1 Mitsubishi Floppy Diskette Drive

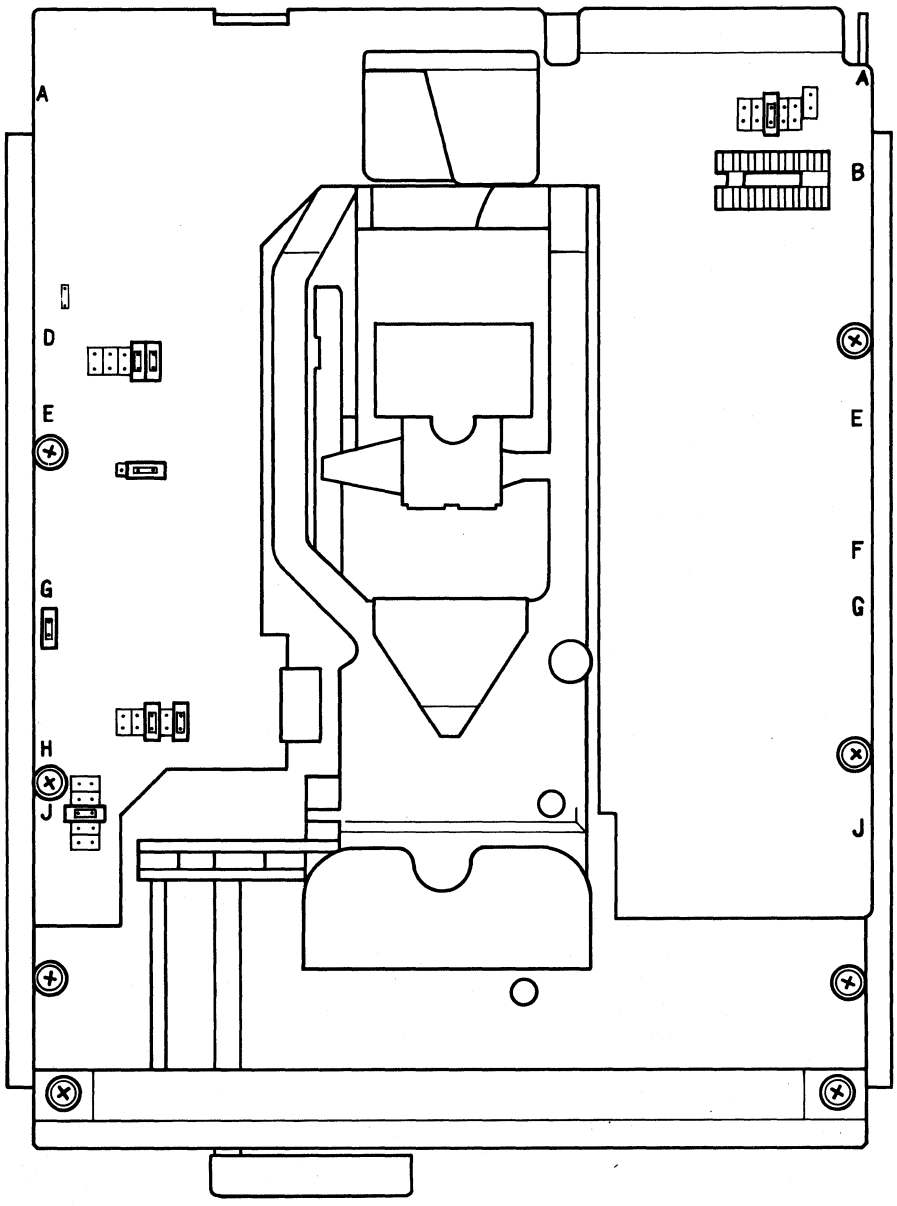
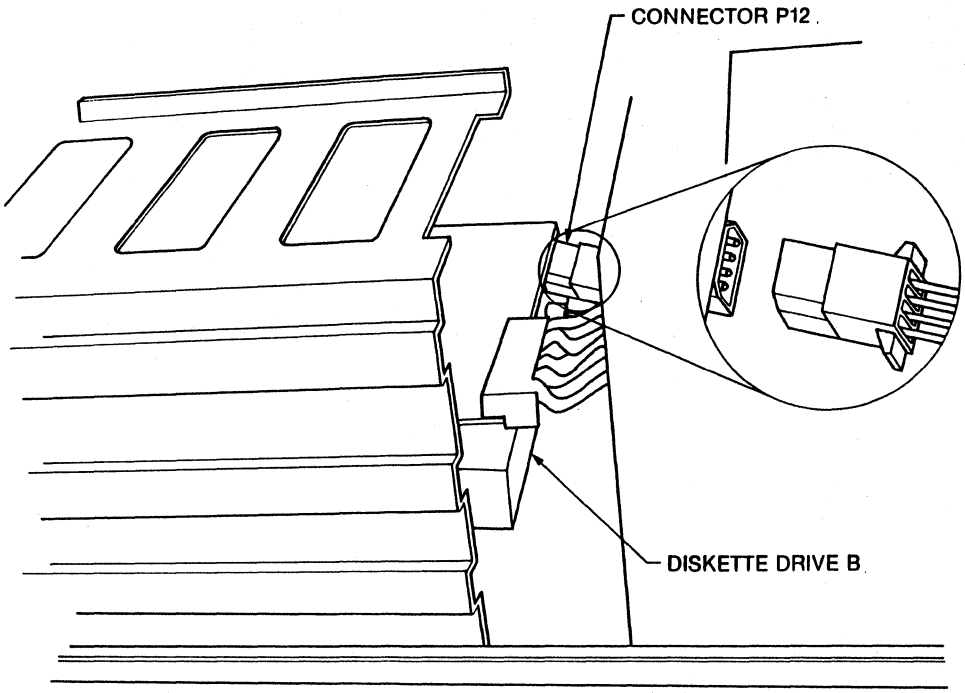
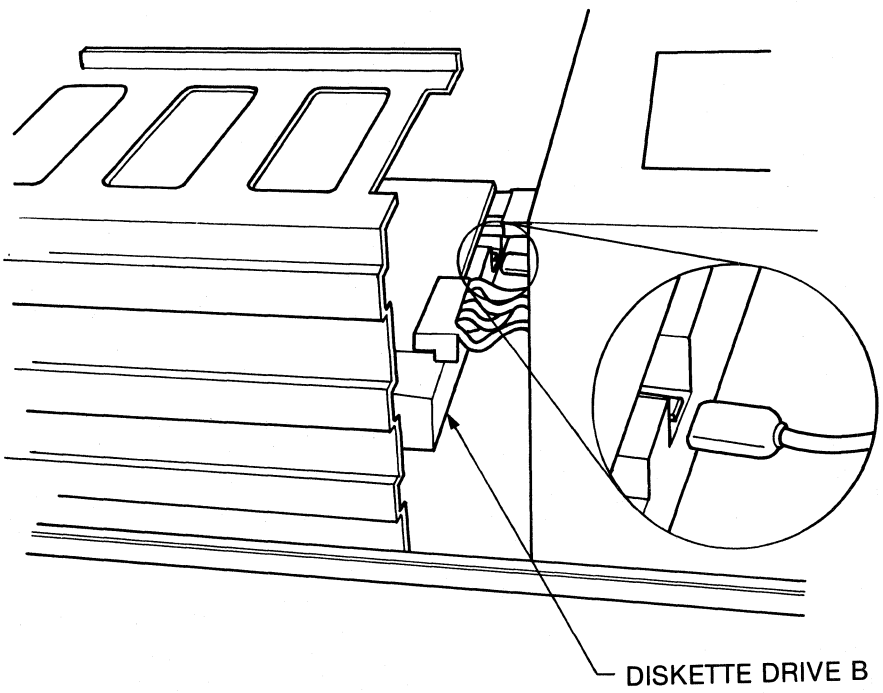


Figure 24-2
Power Connector



SIDE VIEW

Figure 24-3
Grounding Connector



24.13 FLOPPY DISKETTE DRIVE REMOVAL

WARNING! The KAYPRO 286i contains static sensitive devices. Make sure that you are grounded before you remove the cover. The preferred method is to have a grounding strap attached to the wrist with the drain lead connected to a common earth ground and to have the computer positioned on a conductive grounded mat. With the above precautions observed, and the power disconnected, one may remove and install components or adapters.

1. Turn off the computer and disconnect the AC power.

2. Remove chassis cover (22.1).

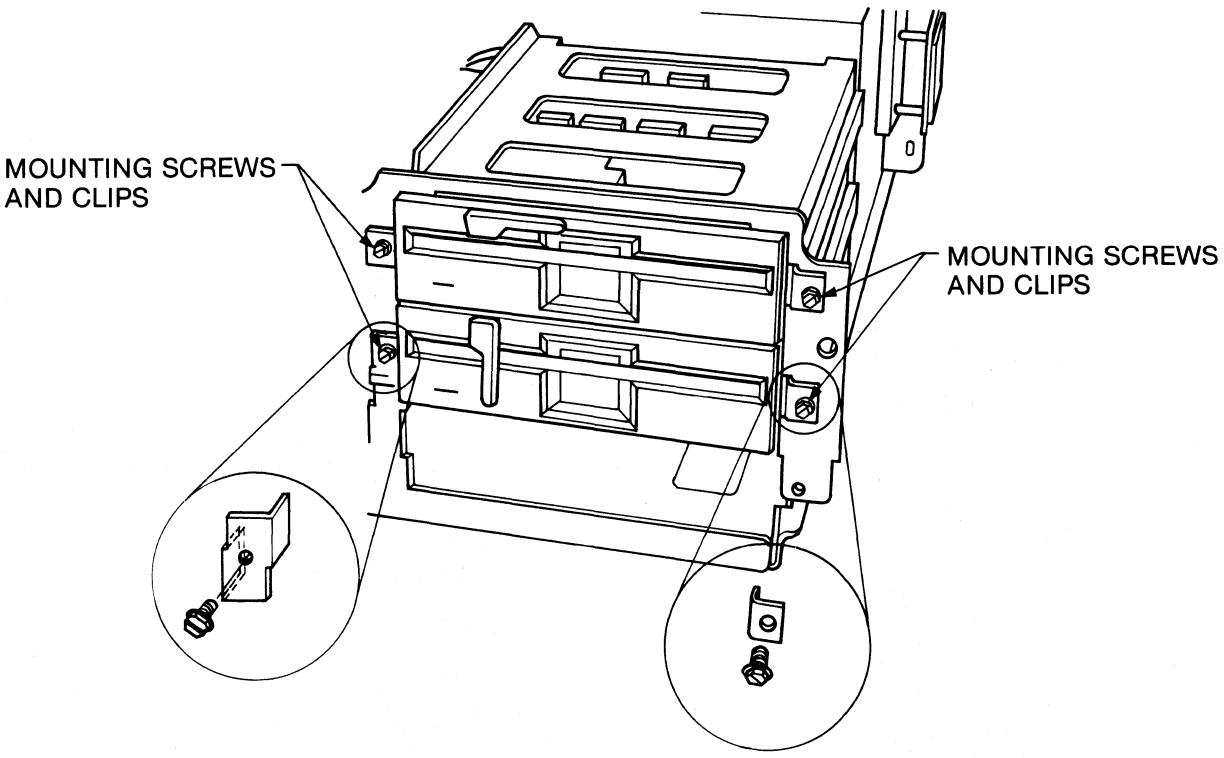
3. Remove data cables (see Figure 4-7), power connectors (see Figure 24-2), and grounding connectors (see Figure 24-3) from the back of the diskette drives.

4. Remove the mounting screws and clips (see Figure 24-4) from both sides of each drive.

5. Slide drive forward out of computer.

6. Remove black plastic slide rails on the sides of each drive. Note the position of each rail--left and right are different.

Figure 24-4 Mounting Screws and Clips



24.14 FLOPPY DISKETTE DRIVE INSTALLATION

1. Install black plastic rails on the new drive(s). Remember that the left and right rails are different.

2. If you are installing a new diskette drive rather than replacing an old one, you must first remove the cover plate (see Figure 24-5).

3. Slide the drive forward into the computer.

4. Replace the mounting screws and clips (refer to Figure 24-4) to both sides of each drive.

5. Replace the data cables on the drives (refer to Figures 24-6 and 24-7). If there are two drives, the top one should be at the end of the data cable. If there is only one drive, it should be at the end of the data cable.

6. Replace the power connectors and the grounding connectors (refer to Figures 24-2 and 24-3).

7. Replace the chassis cover.

8. Any time you are installing a diskette drive, (a brand new drive, or a different type of drive), you should run the "Setup" program.

Figure 24-5 Cover Plate

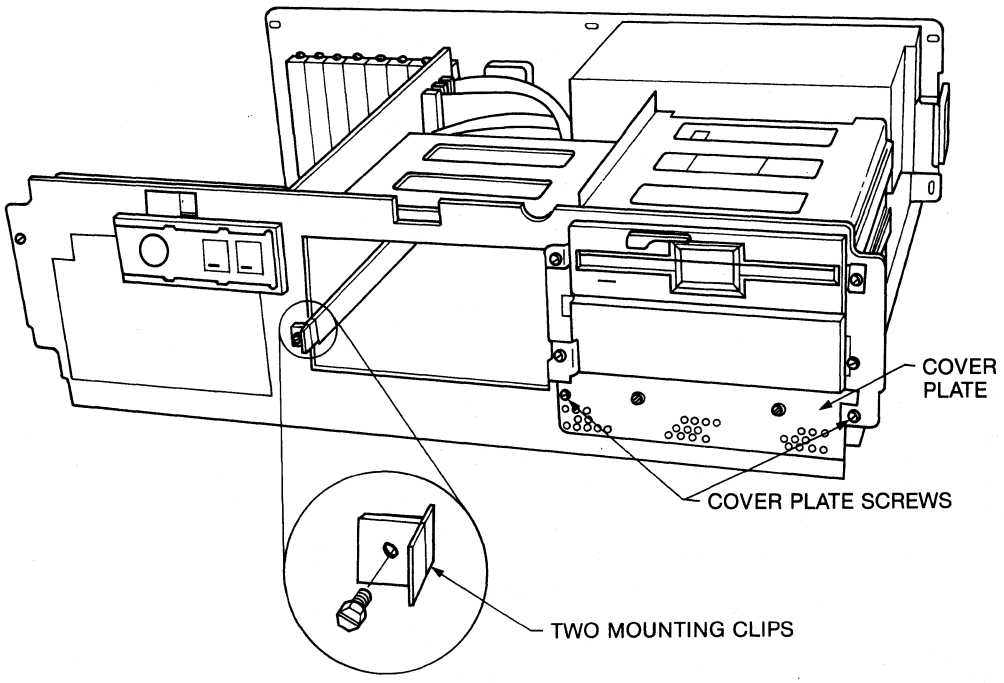


Figure 24-6 Drive Cable

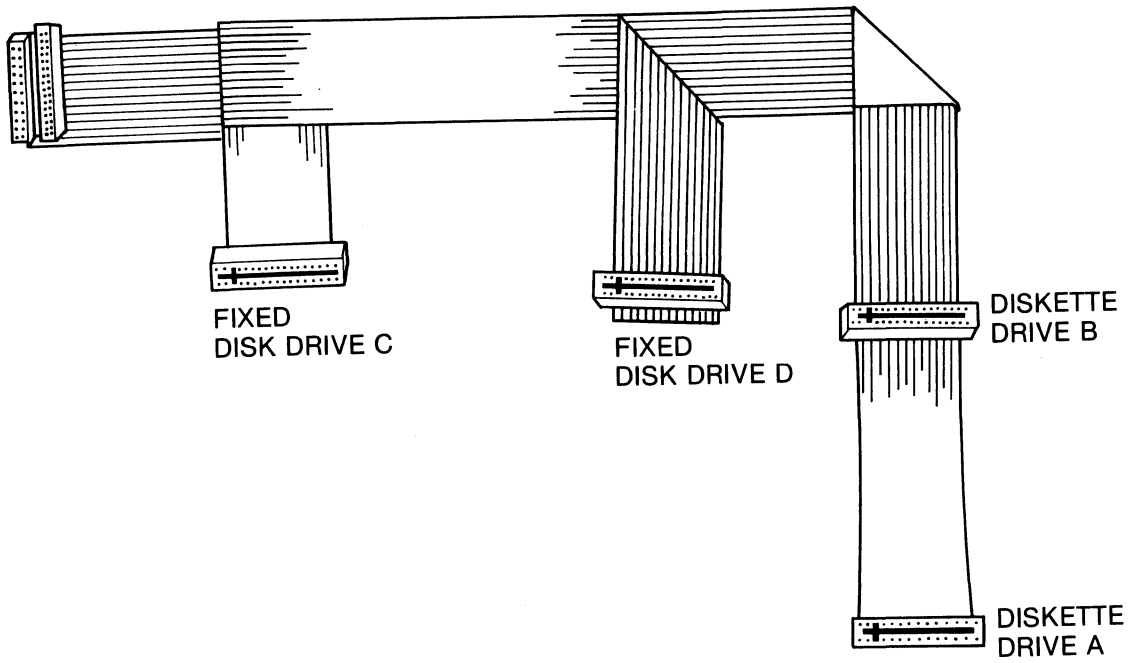
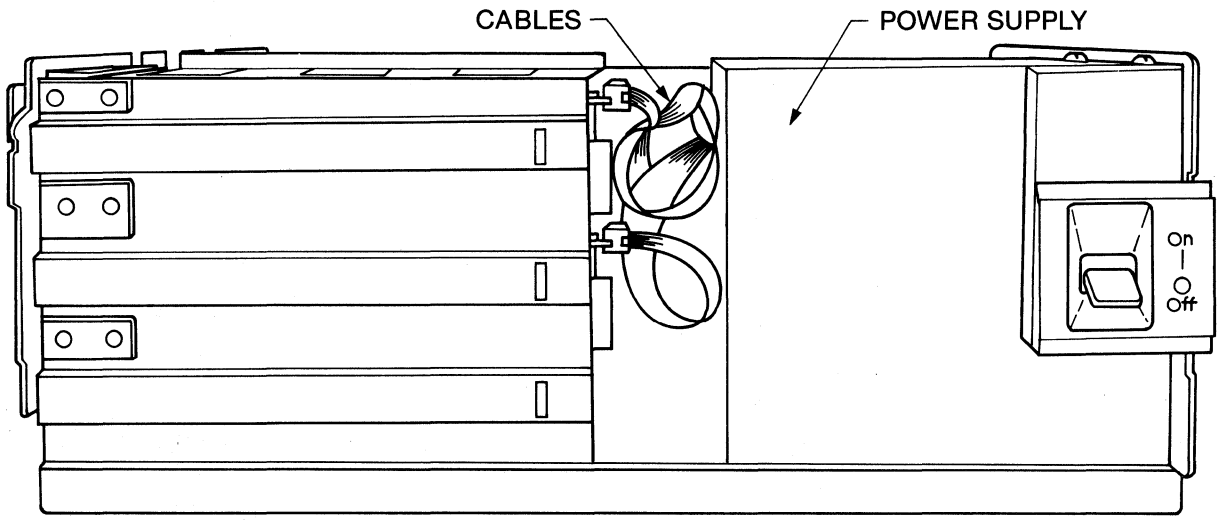


Figure 24-7 Drive Cables in the KAYPRO 286i



SIDE VIEW

24.2 HARD DISK DRIVE

24.21 Description

The KAYPRO 286i models C and D are equipped with a 20M byte hard disk drive manufactured by Seagate.

24.22 HARD DISK DRIVE CONFIGURATION

Hold the hard disk drive with the face plate of the drive facing you, and the circuit board face up. Between the two edge connectors is a plug with four pins. All jumpers should be removed except for the left middle pin.

24.23 HARD DISK DRIVE REMOVAL

1. Turn off the computer and disconnect the AC power.
2. Remove the chassis cover (22.1).
3. Remove the data cables, power connector, and grounding connector from the hard disk drive.
4. Remove the mounting screws and clips from both sides of the hard disk drive (refer to Figure 24-5).
5. Slide hard disk drive forward out of the computer.
6. Remove the black plastic slide rails that are on the sides of the hard disk drive. Note the position of each rail--left and right sides are different.

24.24 HARD DISK DRIVE INSTALLATION

1. Install black plastic rails on the new hard disk drive. Remember that the left and right rails are different.

2. Slide the hard disk drive forward into the computer.

3. Replace the mounting screws and clips (refer to Figure 24-5) on both sides of the hard disk drive.

4. Replace the data cables (refer to Figures 24-6 and 24-7), power connector, and grounding connector on the hard disk drive.

5. Replace the chassis cover.

6. Any time you are installing a hard disk drive, (a brand new drive, or a different type of drive), you must format the disk using the "Format" program included with the KAYPRO 286i Service Test Utilities Diskette which will be available from Kaypro. After the disk is formatted, you should run the "Fdisk", "Format", and "Setup" programs from an MS-DOS diskette.

25.Ø STREAMING TAPE DRIVE

25.1 Description

The KAYPRO 286i model D comes equipped with a 1/4-inch streaming tape cartridge drive. This drive uses standard 45Ø-foot-long tape cartridges and can store 2Ø Mbytes or 45 Mbytes of data using the 4-track or 9-track format, respectively. The use of 6ØØ-foot-long tape cartridges allows a storage capacity of 26.7 Mbytes or 6Ø Mbytes using the 4-track or 9-track format, respectively.

25.2 STREAMING TAPE DRIVE REMOVAL

1. Turn off the computer and disconnect the AC power.

2. Remove the chassis cover (22.1).

3. Remove the data cables, power connector, and grounding connector from the streaming tape drive.

4. Remove the mounting screws and clips from both sides of the streaming tape drive (see Figure 24-4).

5. Slide streaming tape drive forward out of the computer.

6. Remove the black plastic slide rails that are on the sides of the streaming tape drive. Note the position of each rail—left and right sides are different.

25.2 STREAMING TAPE DRIVE INSTALLATION

1. Install black plastic rails on the new streaming tape drive. Remember that the left and right rails are different.

2. If you are installing a new tape drive rather than replacing an old one, you must first remove the cover plate (see Figure 24-5).

3. Slide the streaming tape drive forward into the computer.

4. Replace the mounting screws and clips on both sides of the streaming tape drive.

5. Replace the data cables, power connector, and grounding connector on the streaming tape drive.

6. Replace the chassis cover.

26.Ø POWER SUPPLY

26.1 Description

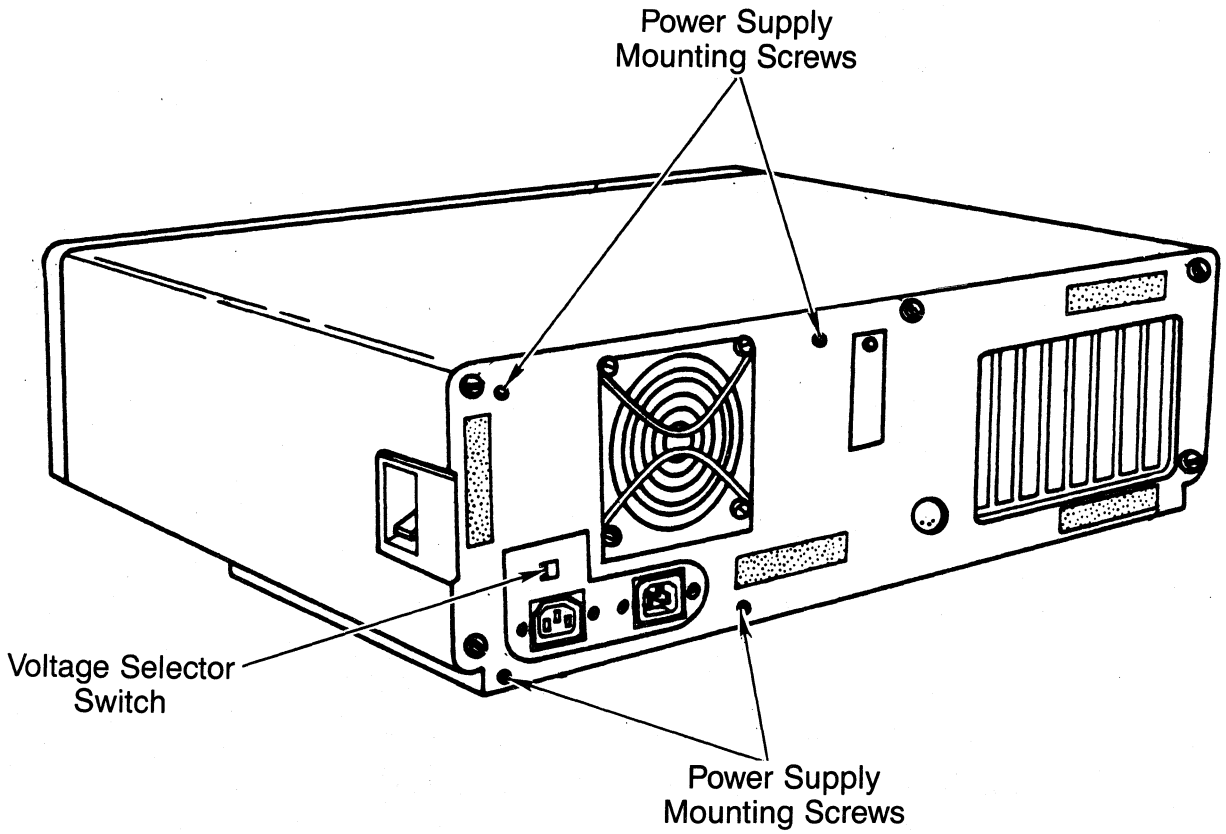
The power supply used in the KAYPRO 286i is a 192 watt switching type manufactured by either California D.C. or Tri Mag. The power supply unit includes the on/off switch, the fan, most of the wiring harness, and the voltage selector switch. If a problem is encountered with any of these items, the entire power supply must be exchanged. Opening the power supply unit will void the warranty.

26.2 23ØV CONFIGURATION

To configure the power supply for 23ØV use, simply locate the voltage selector switch (refer to Figure 26-1) on the back of the computer and select the 23ØV setting.

CAUTION: SETTING THE VOLTAGE SELECTOR SWITCH TO THE WRONG POSITION CAN CAUSE EXTENSIVE DAMAGE TO THE KAYPRO 286i.

Figure 26-1 Power Supply Voltage Selector Switch
Power Supply Mounting Screws



26.3 POWER SUPPLY REMOVAL

WARNING! The KAYPRO 286i contains static sensitive devices. Make sure that you are grounded before you remove the cover. The preferred method is to have a grounding strap attached to the wrist with the drain lead connected to a common earth ground and to have the computer positioned on a conductive grounded mat. With the above precautions observed, and the power disconnected, one may remove and install components or adapters.

1. Turn off the computer and disconnect the AC power.

2. Remove the chassis cover (22.1).

3. Remove the power connectors and grounding connector from the diskette drive(s) and the hard disk drive (refer to Figures 24-2 and 24-3).

4. Remove the 12-pin connector from J17 on the mainboard.

5. Remove the four hex screws from the back of the computer (Refer to Figure 26-1).

6. Push the power supply toward the front of the computer and lift it out.

26.4 POWER SUPPLY INSTALLATION

1. Install the power supply in the computer until the holes in the power supply align with the screw holes in the back of the computer chassis.

2. Replace the four hex screws through the back of the computer chassis, into the power supply, and tighten them (refer to Figure 26-1).

3. Replace the 12-pin connector into J17 on the mainboard. Notice that the three red wires (+5VDC) go closest to the power supply.

4. Replace the power connectors and grounding connectors to the diskette drive and the hard disk drive (refer to Figures 24-2 and 24-3).

5. Replace the chassis cover.

27.Ø KEYBOARD

27.1 Description

The keyboard carries signals between itself and the KAYPRO 286i through the use of a bidirectional serial interface.

The keyboard has a buffer that saves data until the interface is ready to receive it. This buffer stores 16 characters on a first-in-first-out basis.

All keys pressed on the keyboard will be detected, and scan codes sent to the interface in correct sequence, regardless of the number of keys depressed. Any keystrokes entered while the keylock is on will not be detected.

27.2 KEYBOARD CONNECTOR

The keyboard has a five pin DIN connector with the following keyboard interface signals:

DIN	SIGNAL NAME
1	Keyboard Clock
2	Keyboard Serial Data
3	Reset
4	Ground
5	+5VDC

28.Ø BATTERY

28.1 Description

The battery powers the computer's clock and the system configuration memory. The life expectancy of this battery is three to five years. If the system clock starts running noticeably slow, or if the computer displays the message "Invalid configuration information", or "Time-of-day clock stopped", it is probably time to replace the battery. Any time the battery is removed or disconnected from the mainboard, the system configuration information is lost, and the "Setup" program must be run.

28.2 BATTERY REMOVAL

WARNING! The KAYPRO 286i contains static sensitive devices. Make sure that you are grounded before you remove the cover.

1. Turn off the computer and disconnect the AC power.

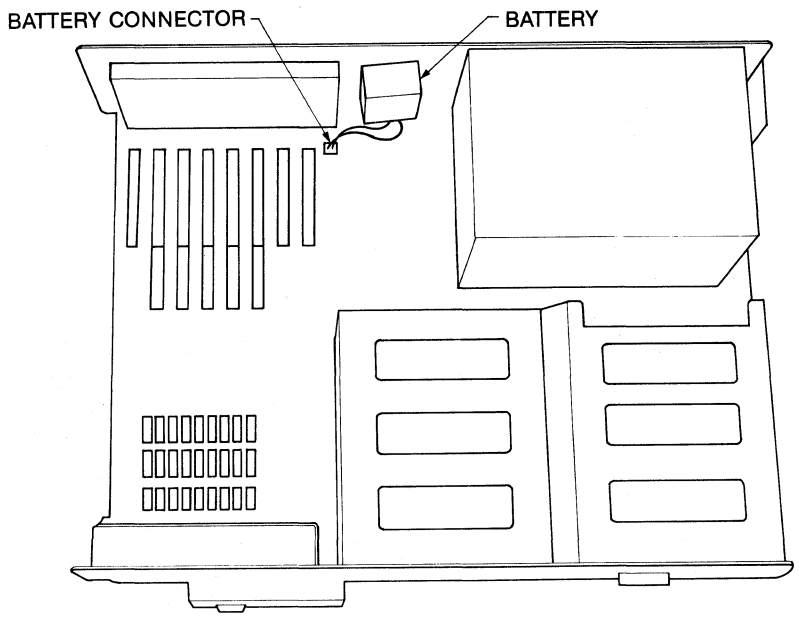
2. Remove the chassis cover (22.1).

3. Locate the battery to the right of the expansion slots attached to the back of the chassis by a Velcro (tm) strip (refer to Figure 28-1).

4. Remove the battery connector from the mainboard.

5. Gently pull the battery from the chassis.

Figure 28-1 Location of the Battery



28.3 BATTERY INSTALLATION

1. Press the side of the battery that has the Velcro (tm) strip to the Velcro (tm) strip on the chassis.

2. Attach the battery connector to the mainboard at position J1.

3. Replace the chassis cover.

4. Any time the battery is removed or disconnected from the mainboard, the system configuration information is lost, and the "Setup" program must be run.

29.Ø SYSTEM I/O

29.1 PARALLEL PORT PIN ASSIGNMENTS

The pin assignments for the primary parallel port (LPT 1) on the KAYPRO 286i are as follows:

PARALLEL PORT (PRN 1) PIN	SIGNAL	DIRECTION OF SIGNAL
1	Strobe	---->
2	Data Ø	---->
3	Data 1	---->
4	Data 2	---->
5	Data 3	---->
6	Data 4	---->
7	Data 5	---->
8	Data 6	---->
9	Data 7	---->
1Ø	Acknowledge	<----
11	Busy	<----
12	Paper End	<----
13	Select	<----
14	Auto Feed	---->
15	Fault	<----
16	Initiate	---->
17	Select In	---->
18-25	Ground	-----

NOTE: ALL CABLES USED WITH THE KAYPRO 286i MUST BE SHIELDED IN ORDER TO COMPLY WITH FCC REGULATIONS.

29.2 SERIAL PORT PIN ASSIGNMENTS

The pin assignments for the serial port (COM 1) on the KAYPRO 286i are as follows:

SERIAL PORT PIN	SIGNAL	DIRECTION OF SIGNAL
1	Carrier Detect	<----
2	Receive Data	<----
3	Transmit Data	---->
4	Data Terminal Ready	---->
5	Signal Ground	-----
6	Data Set Ready	<----
7	Request To Send	---->
8	Clear To Send	<----
9	Ring Indicator	<----

NOTE: ALL CABLES USED WITH THE KAYPRO 286i MUST BE SHIELDED IN ORDER TO COMPLY WITH FCC REGULATIONS.

29.3 RGB MONITOR ADAPTER PIN ASSIGNMENTS

The pin assignments for the RGB monitor adapter are as follows:

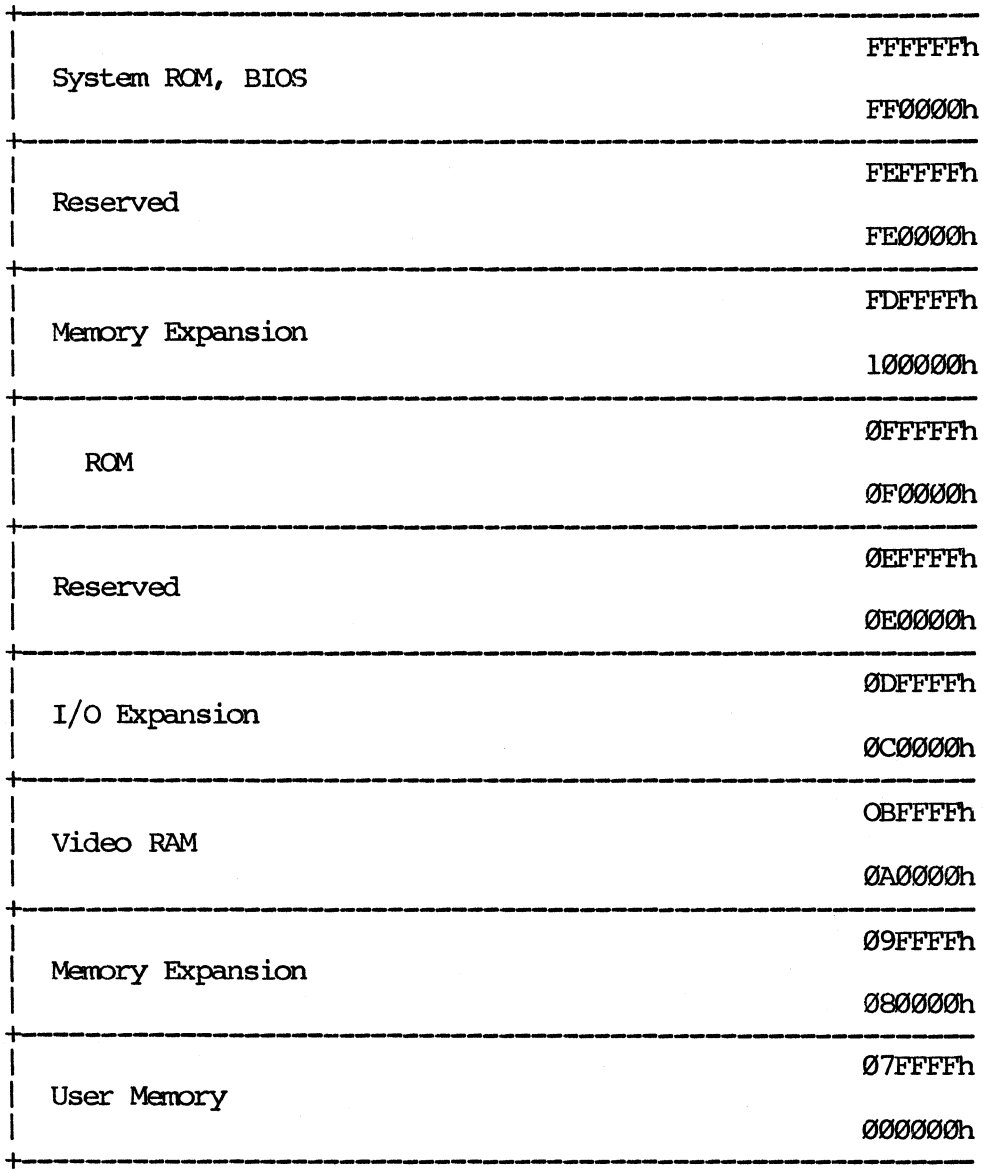
PIN	SIGNAL
1	Ground
2	Ground
3	Red input
4	Green input
5	Blue input
6	Intensity
7	No connection
8	Horizontal sync
9	Vertical sync

NOTE: ALL CABLES USED WITH THE KAYPRO 286i MUST BE SHIELDED IN ORDER TO COMPLY WITH FCC REGULATIONS.

29.4 I/O PORT ADDRESSES

PORT (HEX)	DEVICE/FUNCTION
000-01F	DMA chip, 8237A-5
020-03F	Interrupt, 8259A
040-05F	Timer, 8254-2
060-06F	Keyboard, 8042
070-07F	Real-time clock
080-09F	DMA Register, 74LS612
0A0-0BF	Interrupt controller, 8259A
0C0-ODF	DMA controller, 8237A-5
0F0	Math co-processor
0F1	Math co-processor
0F8-0FF	Math co-processor
1F0-1F8	Reserved
200-207	Game I/O
278-27F	Parallel port (secondary)
2F8-2FF	Reserved
300-31F	Reserved
360-36F	Reserved
378-37F	Parallel port (primary)
380-38F	SDLC, bisynchronous (secondary)
3A0-3AF	Bisynchronous (primary)
3B0-3BF	Reserved
3C0-3CF	Reserved
3D0-3DF	Color graphics
3F0-3F7	Diskette controller
3F8-3FF	Serial port

29.5 MEMORY MAP OF THE KAYPRO 286i COMPUTER



INDEX