KAYPRO TECHNICAL MANUAL

AUGUST 1984

Part Number 1484-C

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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.

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	Z80-A 4.0 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 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.

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-80A 4.0 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 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.

3.6 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.

3.7 KAYPRO ROBIE SPECIFICATIONS

CPU	Z80A, 4.0 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 80 column display.
I/O CONNECTIONS	One "Centronics"type parallel port, two RS232C 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.

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

MODEL NAME	CP/M VERSION	KAYPRO PART # (for CP/M disk)	ROM VERSION
2/83	2.2F	Ø777	81-149-C or 81-232-A
4/83	2.2F	1475	81-232-A
4/83 + 88	2.2F	1475	81-232-A
2/84	2.2G	2619	81-292-A
4/84	2.2G	2622	81-292-A
4/84 + 88	2.2G	2622	81-292-A
2 X	2.2G	247Ø	81-292-A
4 X	2.2G	234Ø	81-326-E
ROBIE	2.2G	234Ø	81-326-E

5.Ø HARDWARE MODULES

——> COLORED TAB HERE: HARDWARE

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 to 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.

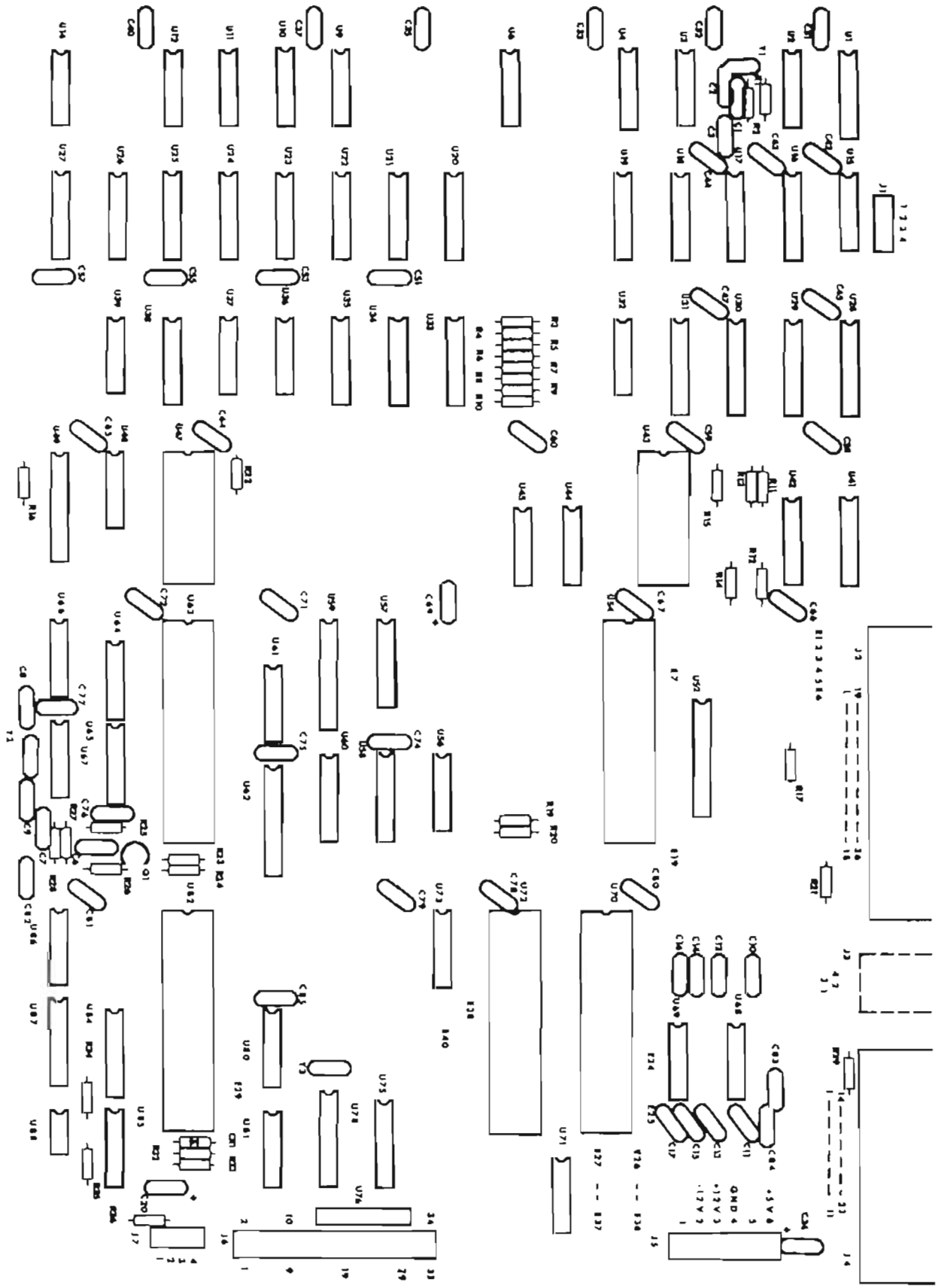
You can check the main RAM and associated circuitry quickly with a scope by looking at pin 14 on each of the RAM chips. There should be a pattern of signals like this:

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.

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

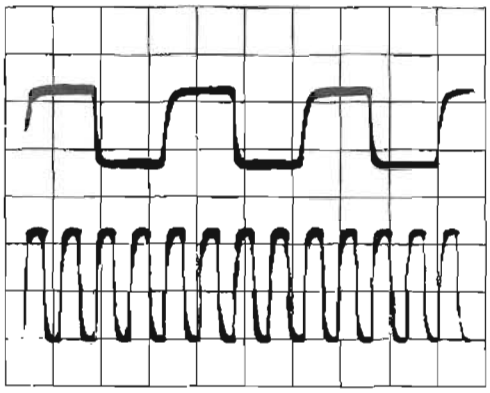


FIGURE 2

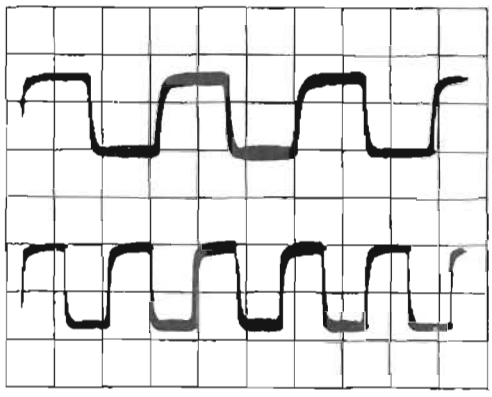


FIGURE 3

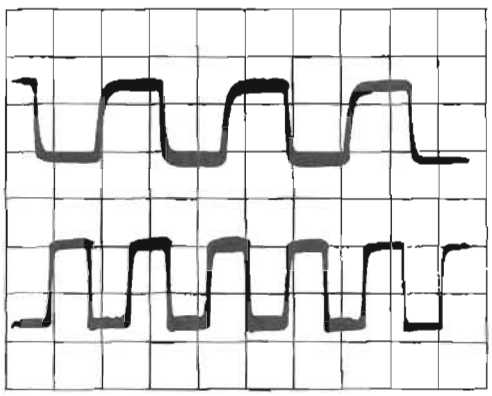


FIGURE 4

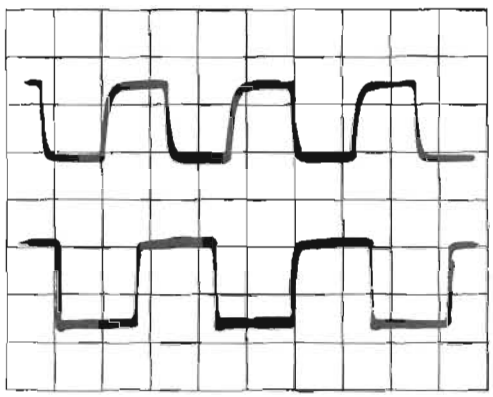


FIGURE 5

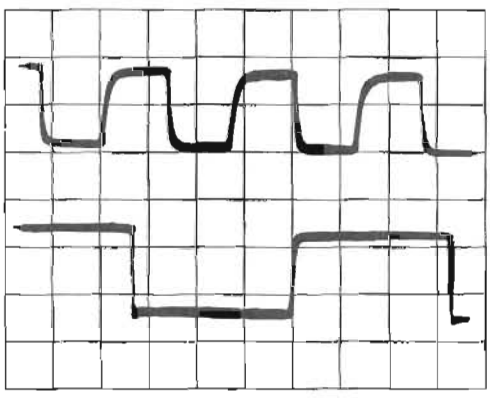
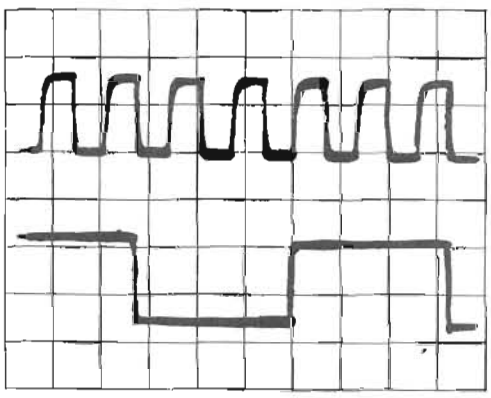
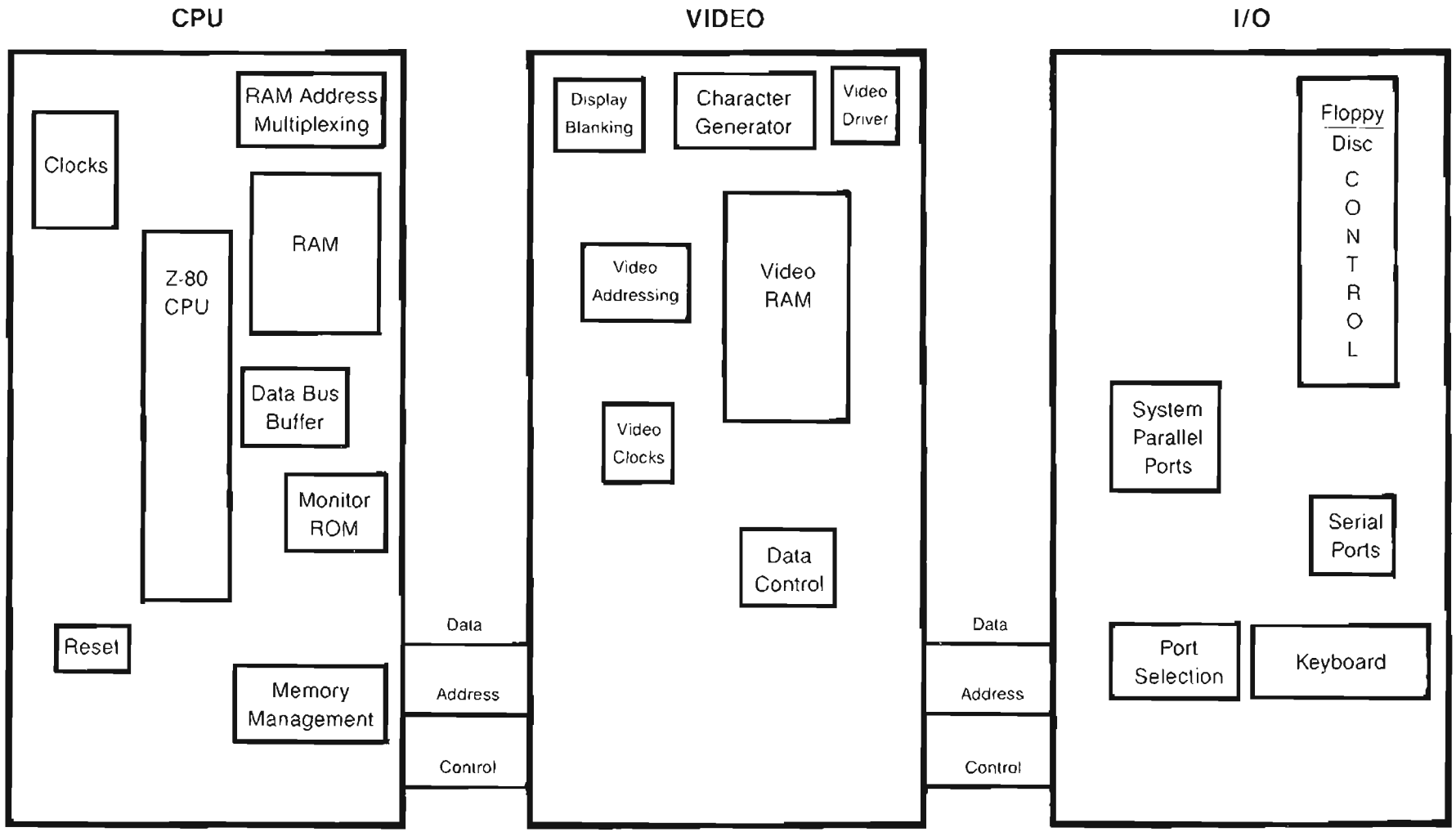


FIGURE 6



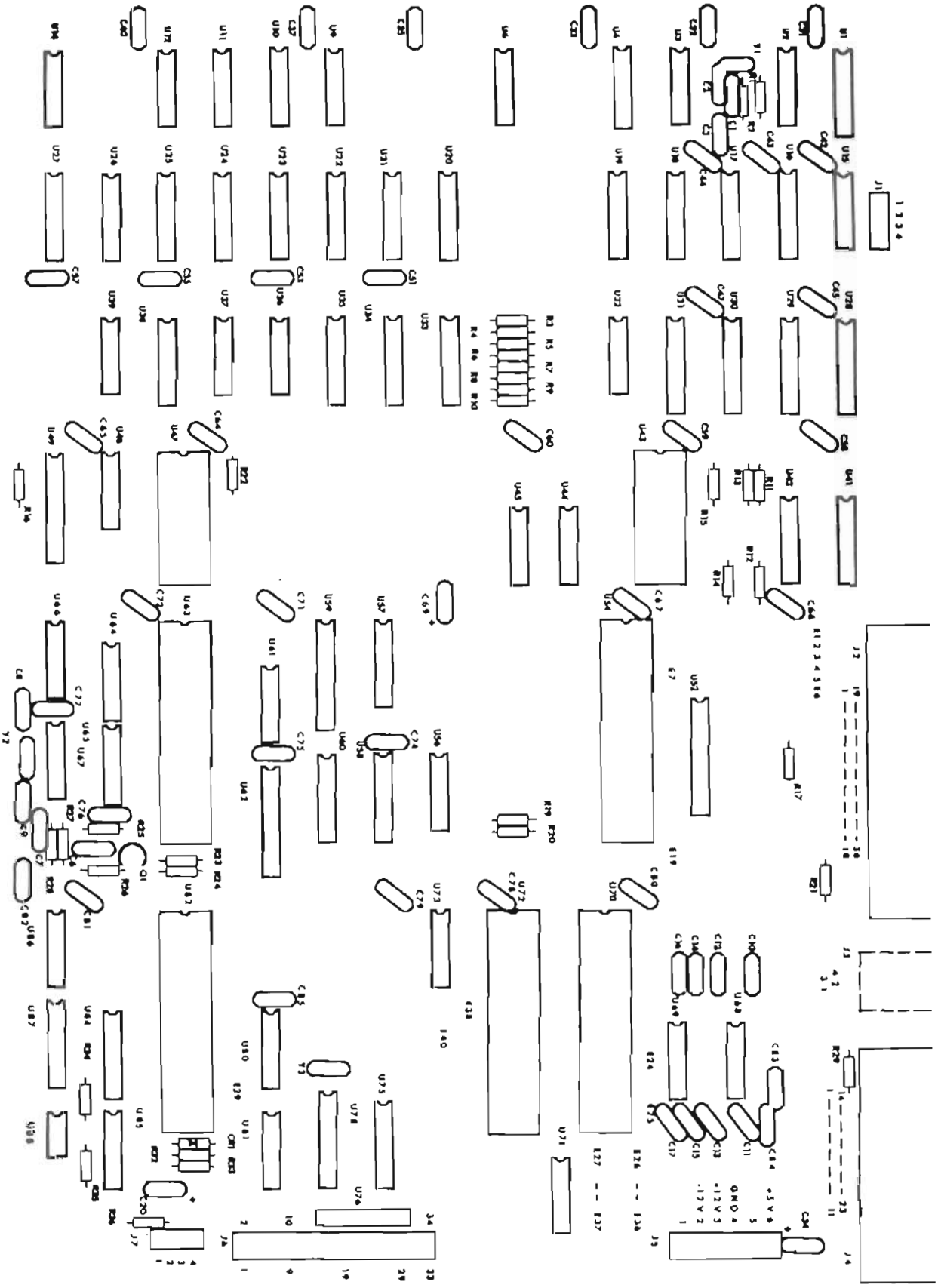
SIGNAL LOCATIONS ON MAINBOARD 81-110-n

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



KAYPRO 2 and 4 BLOCK DIAGRAM

6.2 KAYPRO 2/4 (81-240-n)



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 (CCØ 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.

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, CCØ.

Figure 4: Pin 4 of U6, CC1.

Figure 5: Pin 5 of U6, CC2.

Figure 6: Pin 6 of U6, CC3.

FIGURE 1

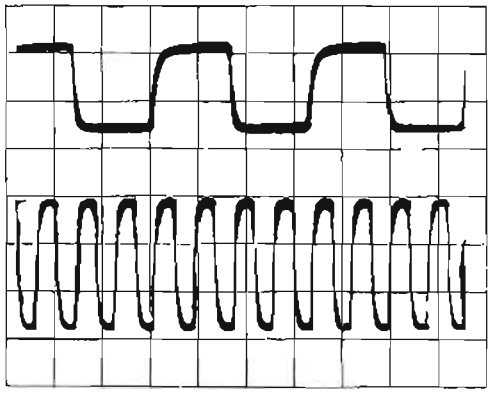


FIGURE 2

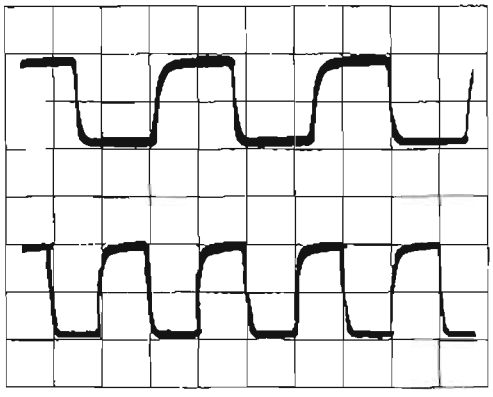


FIGURE 3

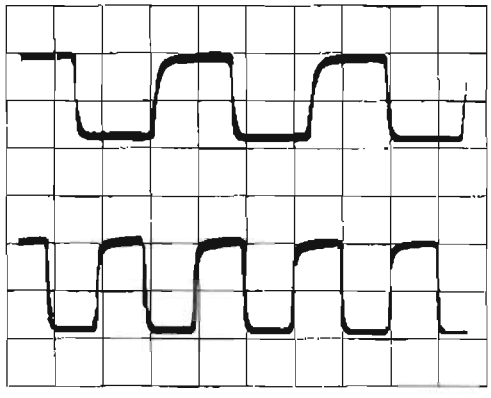


FIGURE 4

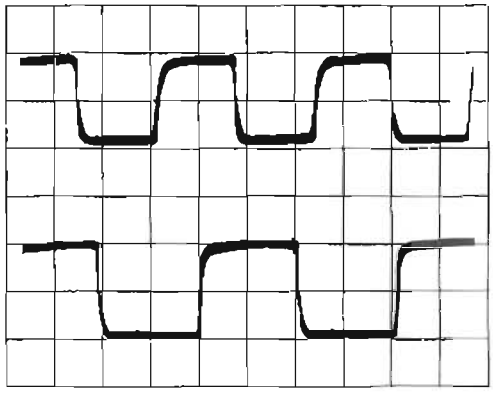


FIGURE 5

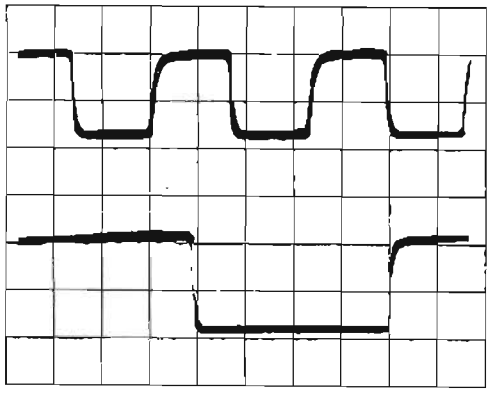
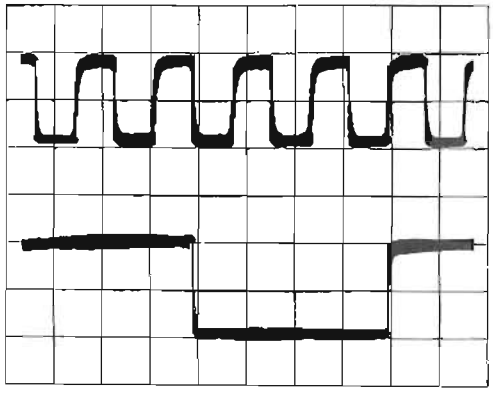
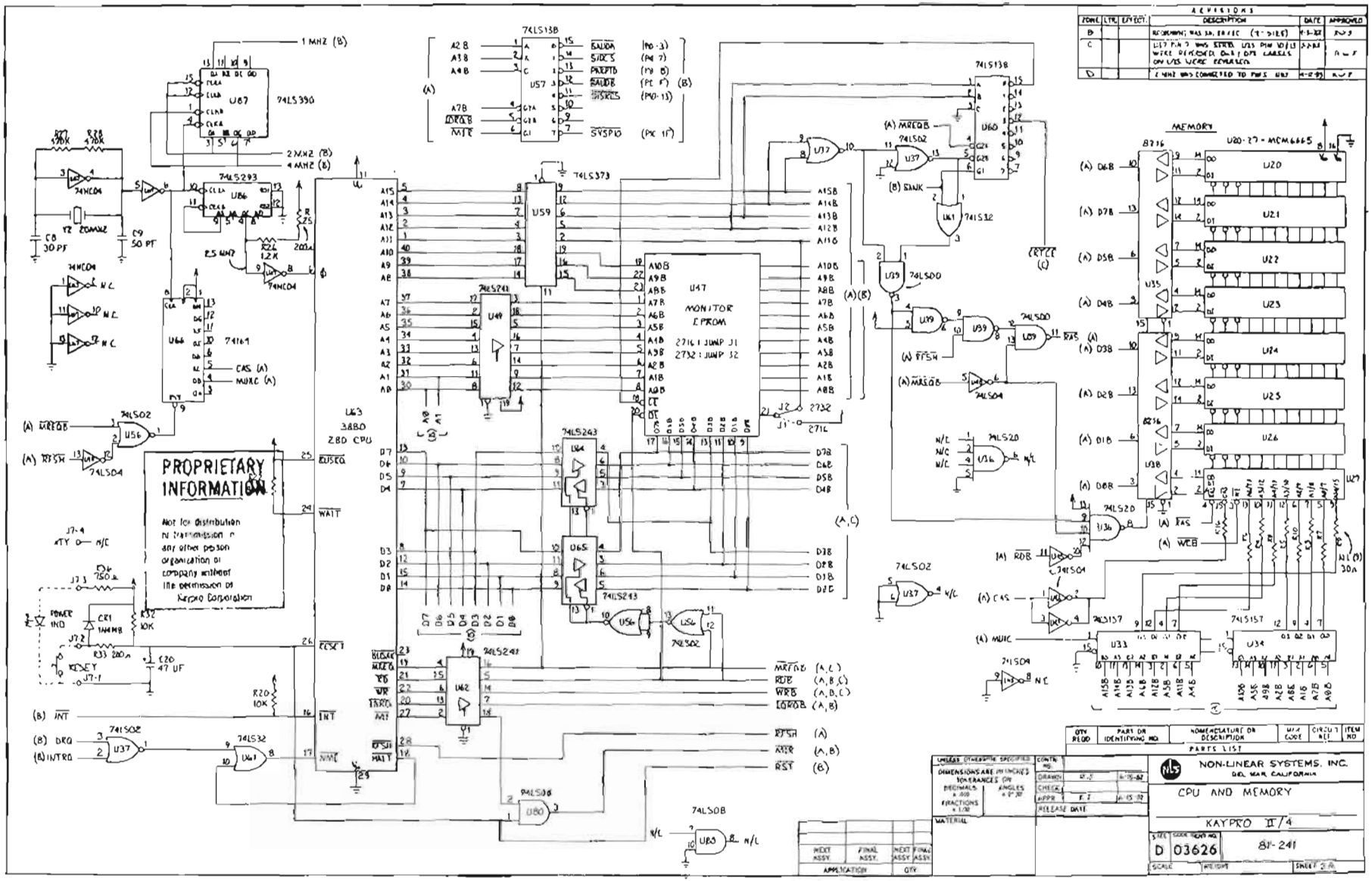


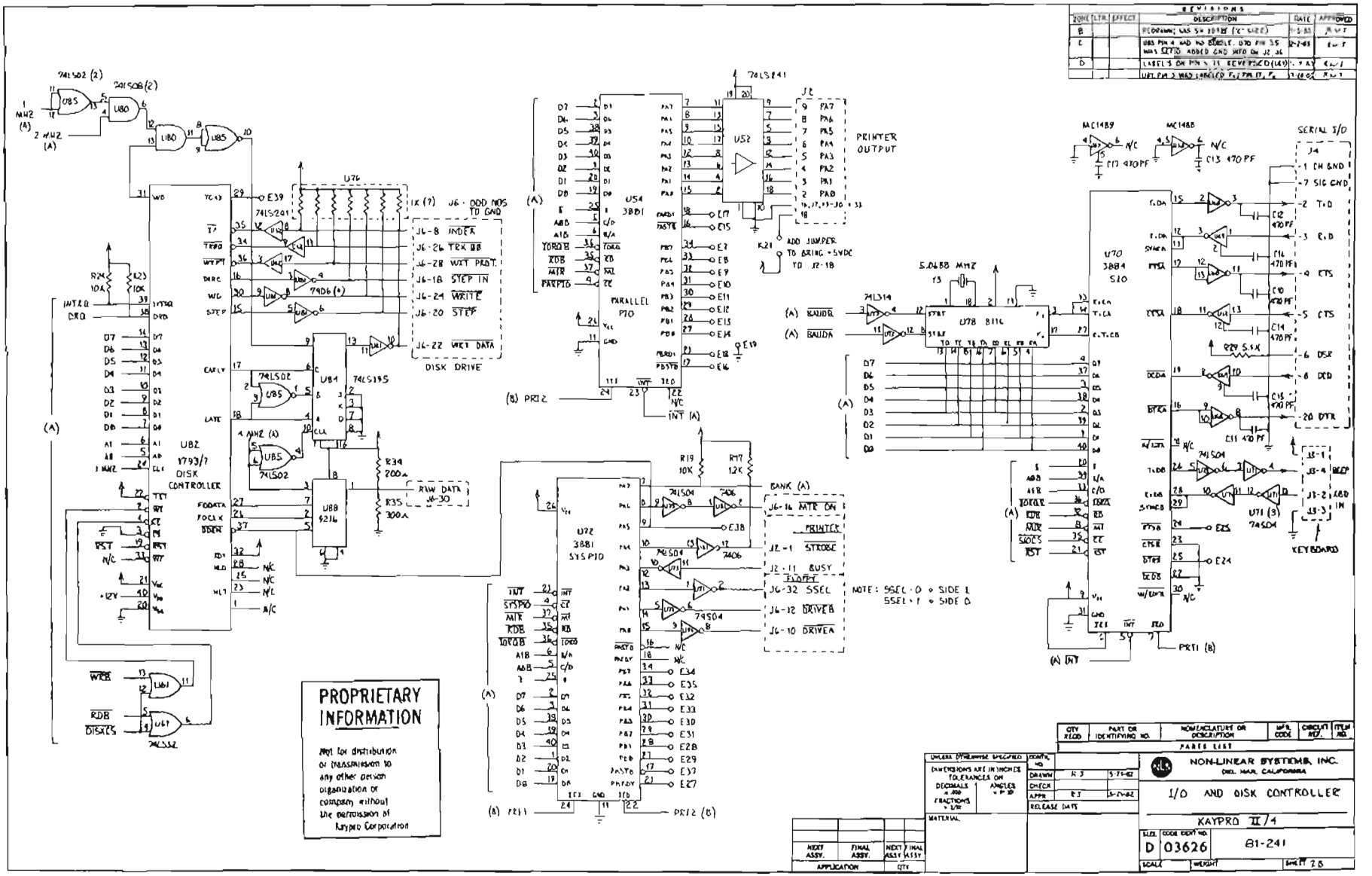
FIGURE 6



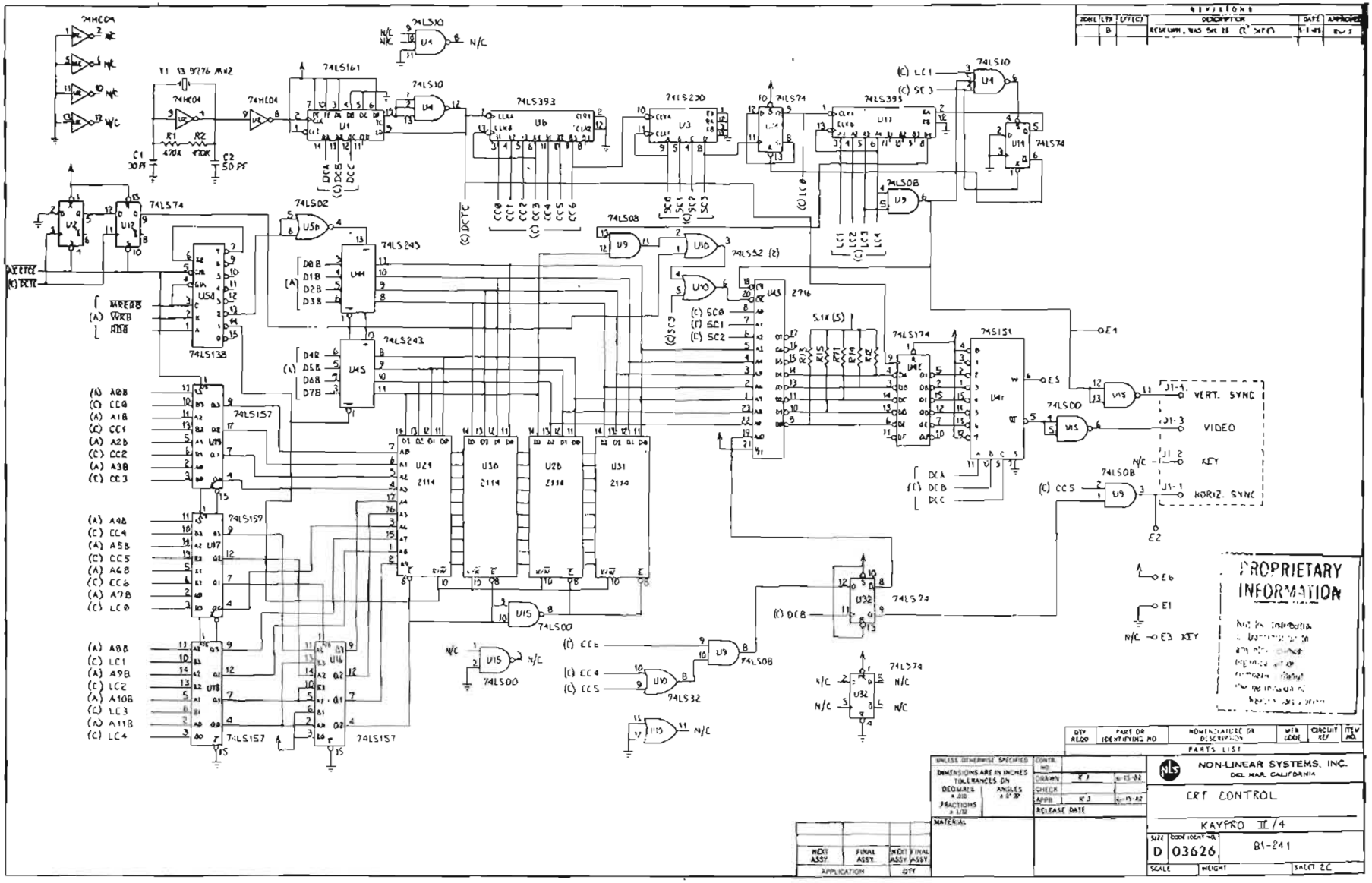
SIGNAL LOCATIONS, 81-240-n

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
CC0	U 6	3
CC1	U 6	4
CC2	U 6	5
CC3	U 6	6

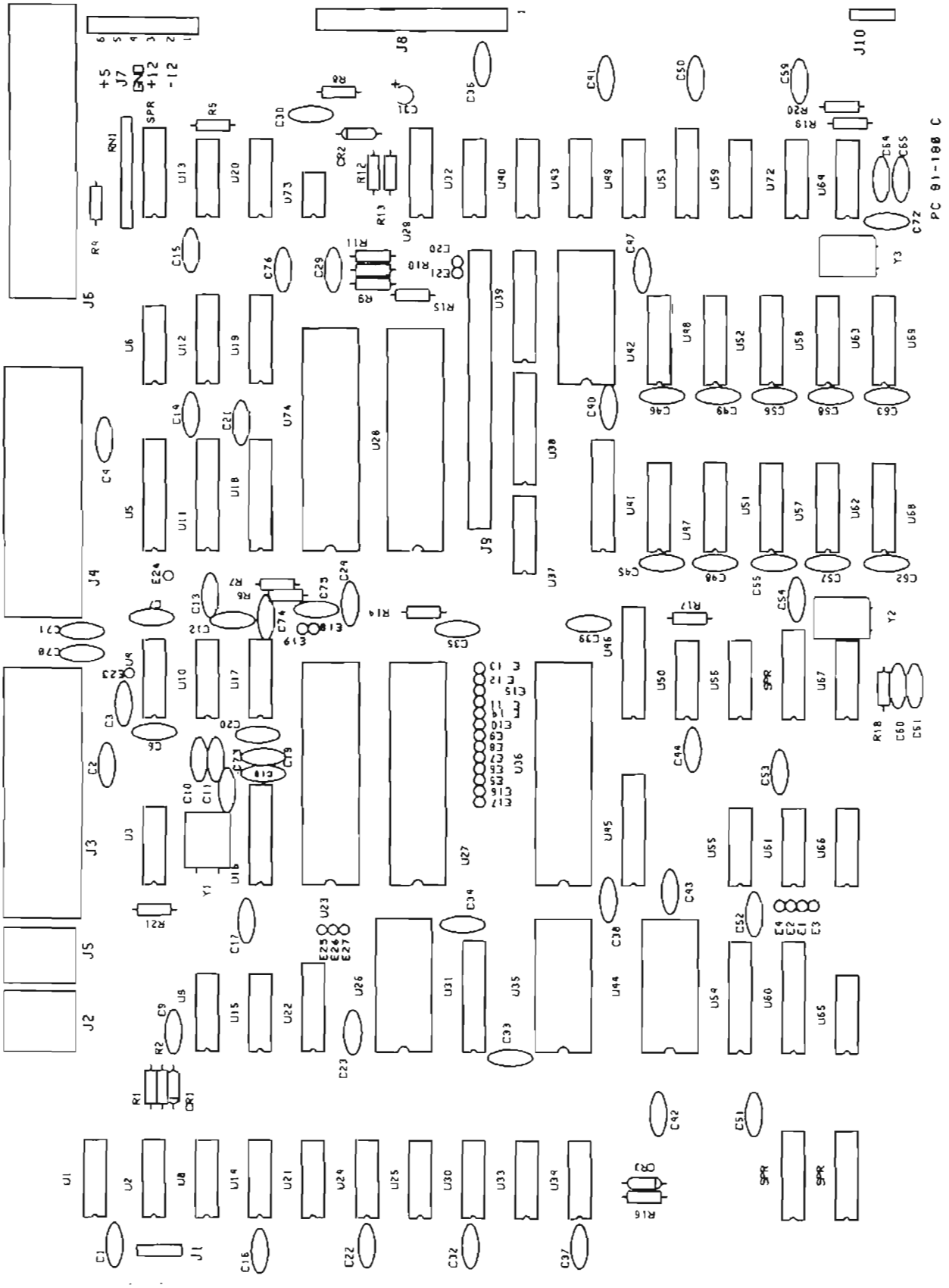

PROPRIETARY INFORMATION
Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation
U47 MONITOR EPROM
2716 : JUMP J1
2732 : JUMP J2
U63 3880 Z80 CPU
MEMORY
U20-27 - MCM6665
NON-LINEAR SYSTEMS, INC.
DEL MAR CALIFORNIA
CPU AND MEMORY
KAYPRO II/4
D 03626
81-241
PARTS LIST
REVISIONS



PROPRIETARY INFORMATION
Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation
U82 1793/7 DISK CONTROLLER
U84 74LS195
U88 9216
U76
DISK DRIVE
U54 3881 PARALLEL PIO
U52
PRINTER OUTPUT
U72 3881 SYS PIO
U78 8116
U70 3884 SIO
SERIAL I/O
KEYBOARD
NOTE: SSEL-0 = SIDE 1
SSEL-1 = SIDE 0
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
I/O AND DISK CONTROLLER
KAYPRO II/4
D 03626 81-241


PROPRIETARY INFORMATION
VERT. SYNC
VIDEO
KEY
HORIZ. SYNC
PARTS LIST
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
CRT CONTROL
KAYPRO II/4
D
03626
81-241
SHEET 2C

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

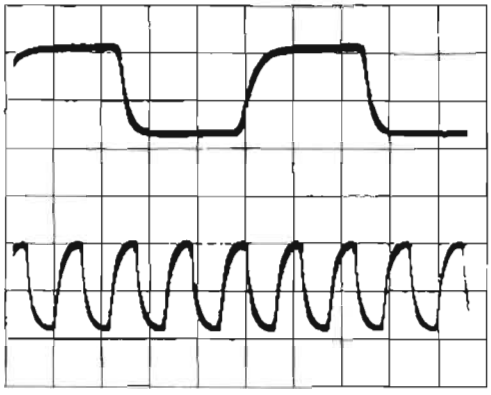


FIGURE 2

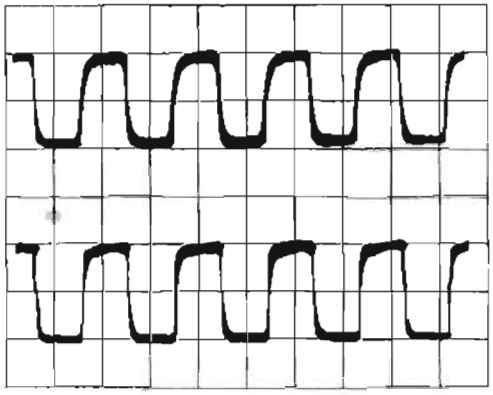


FIGURE 3

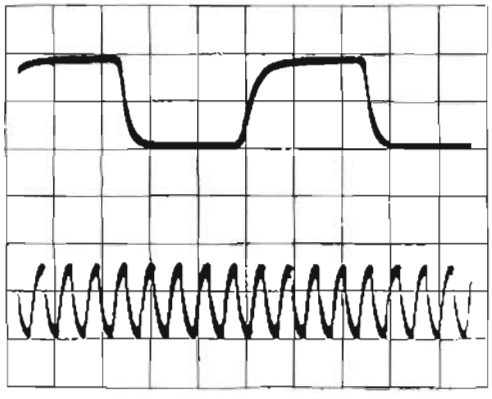


FIGURE 4

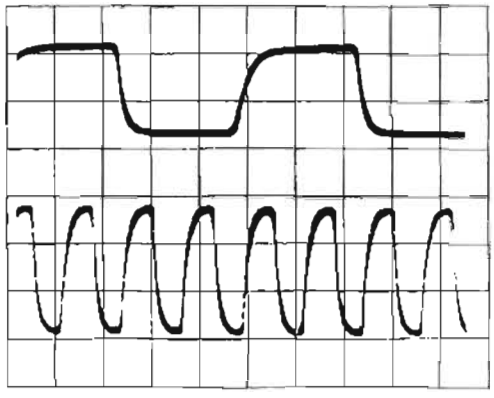


FIGURE 5

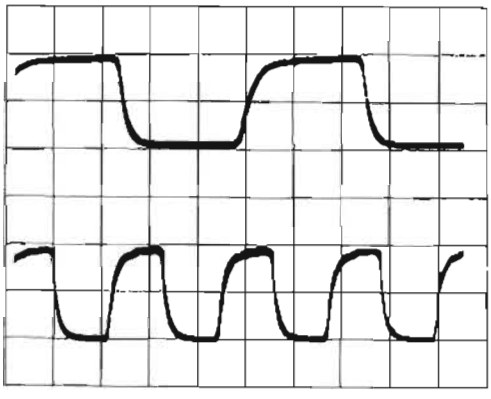
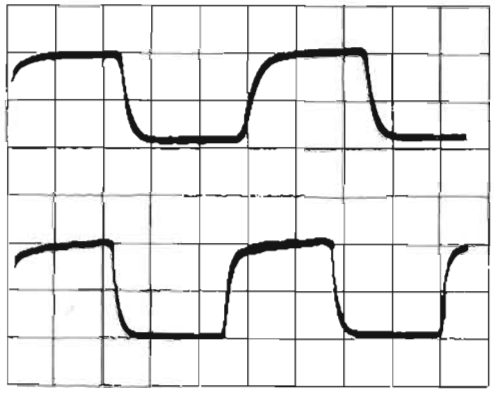
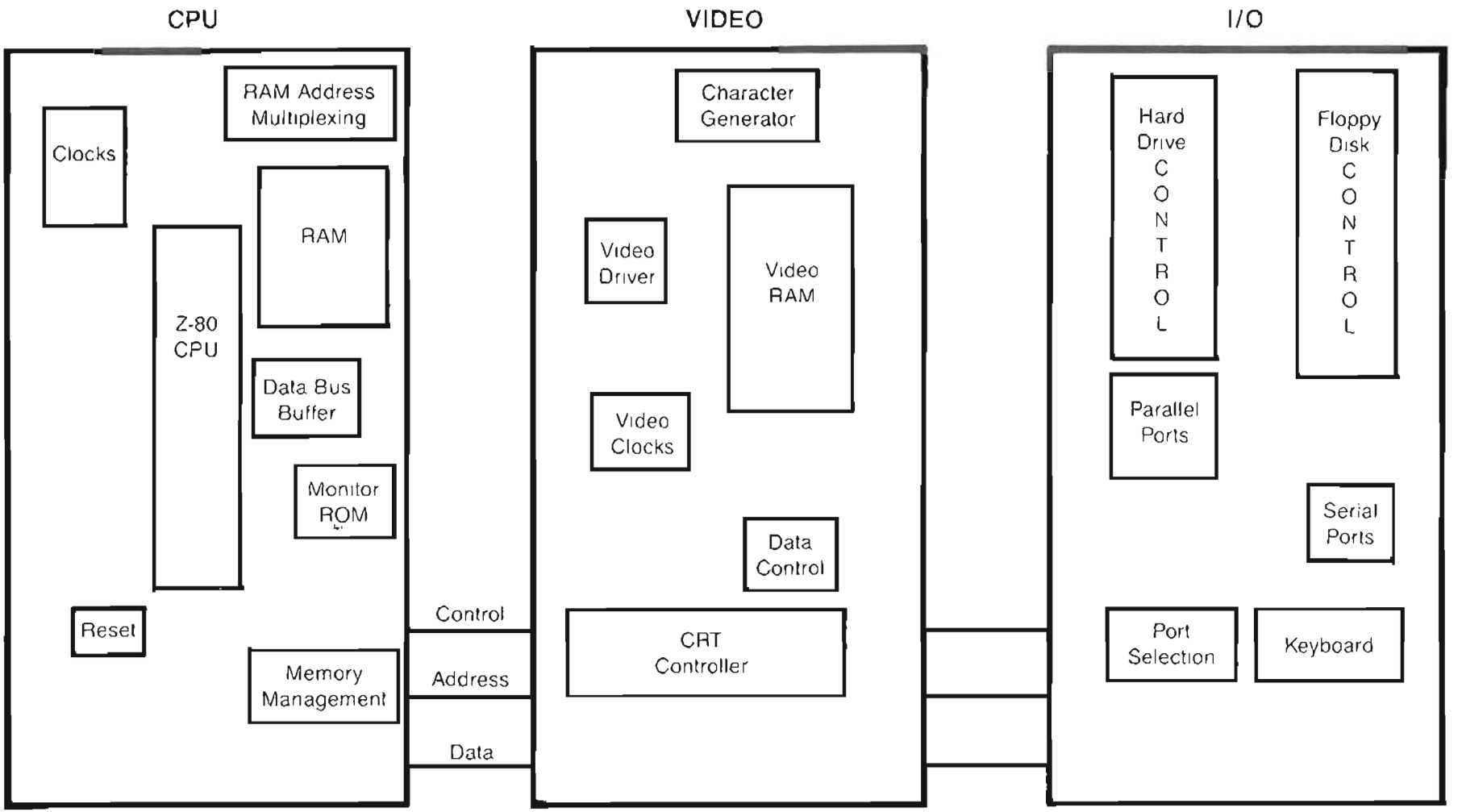
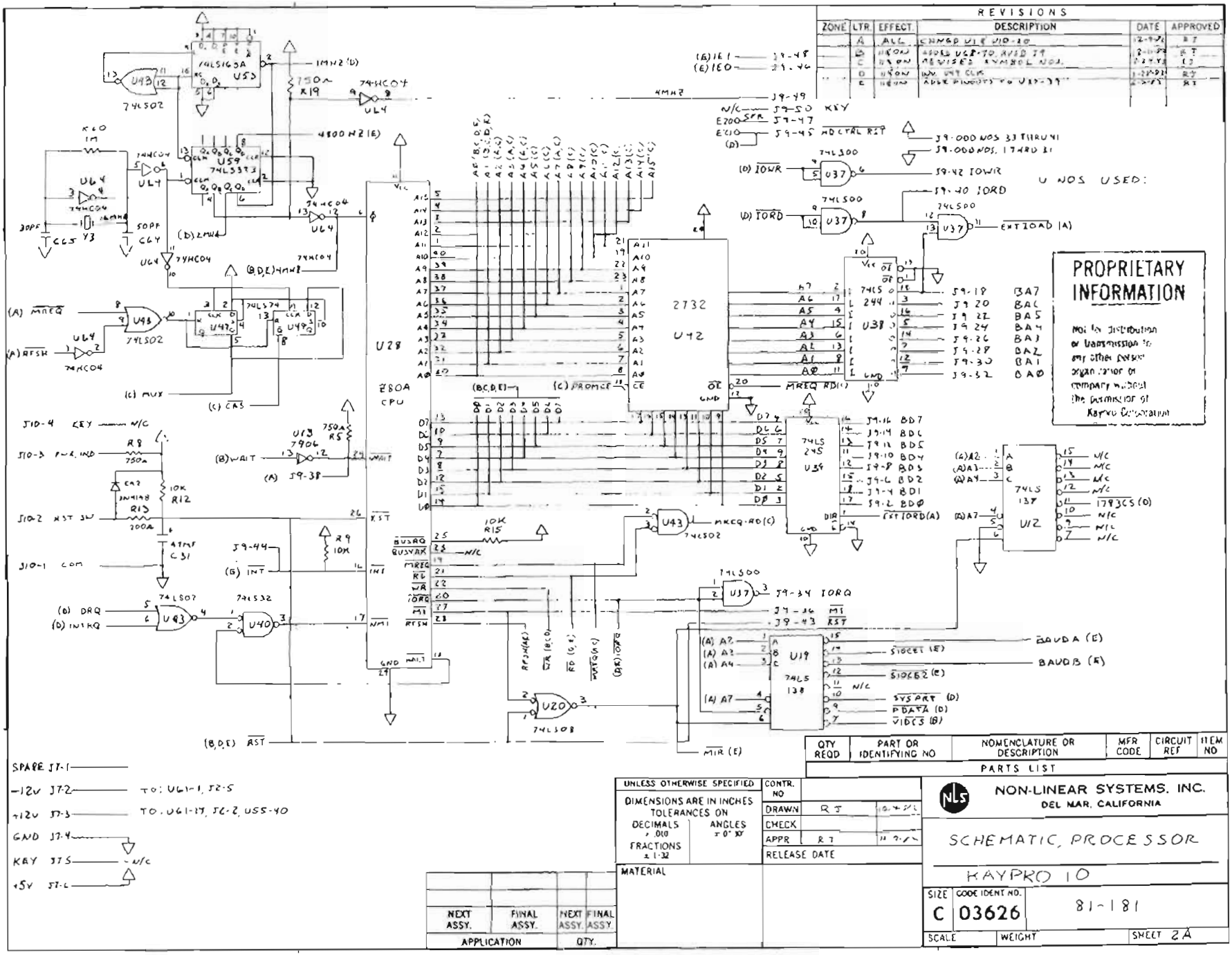


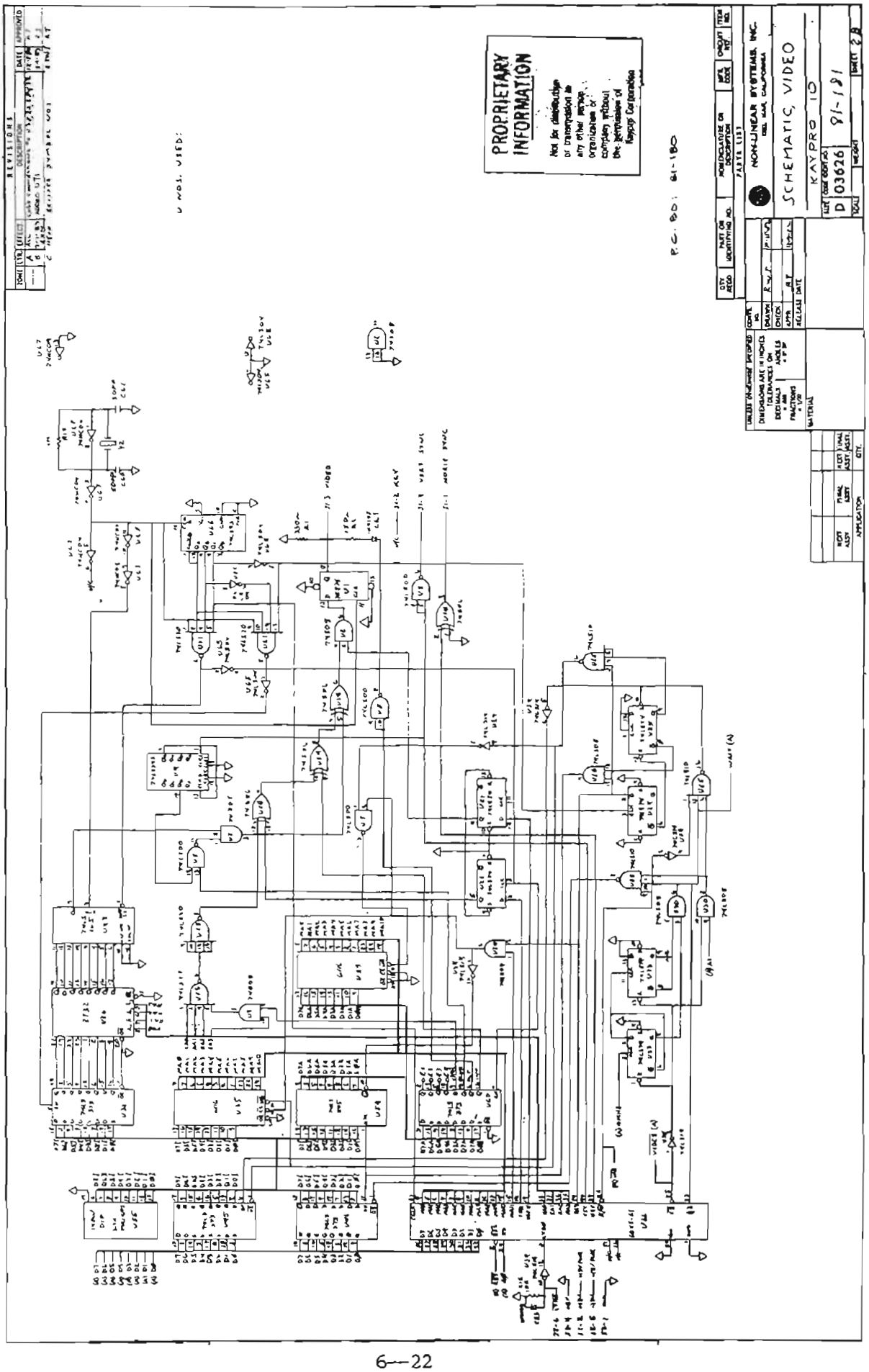
FIGURE 6

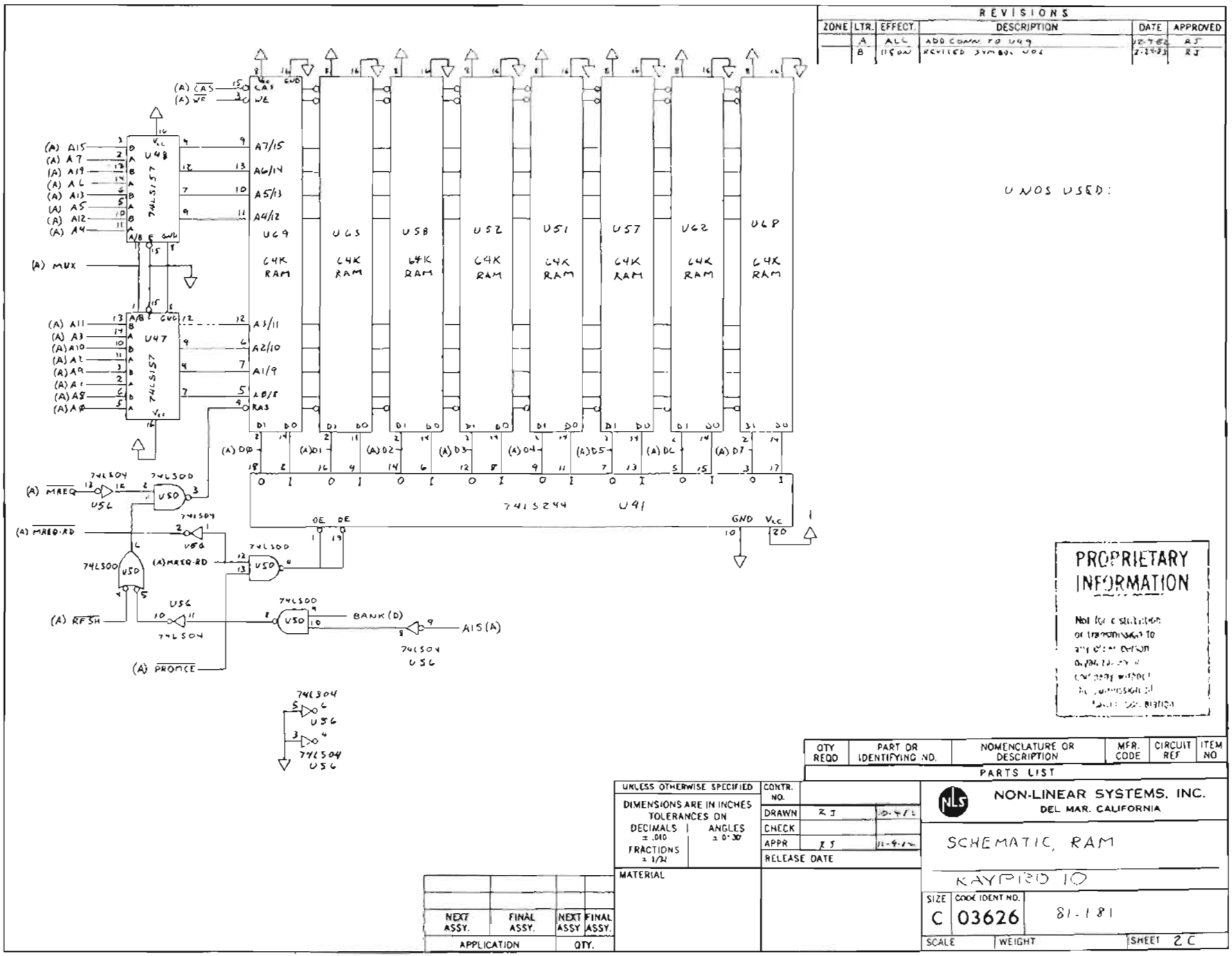


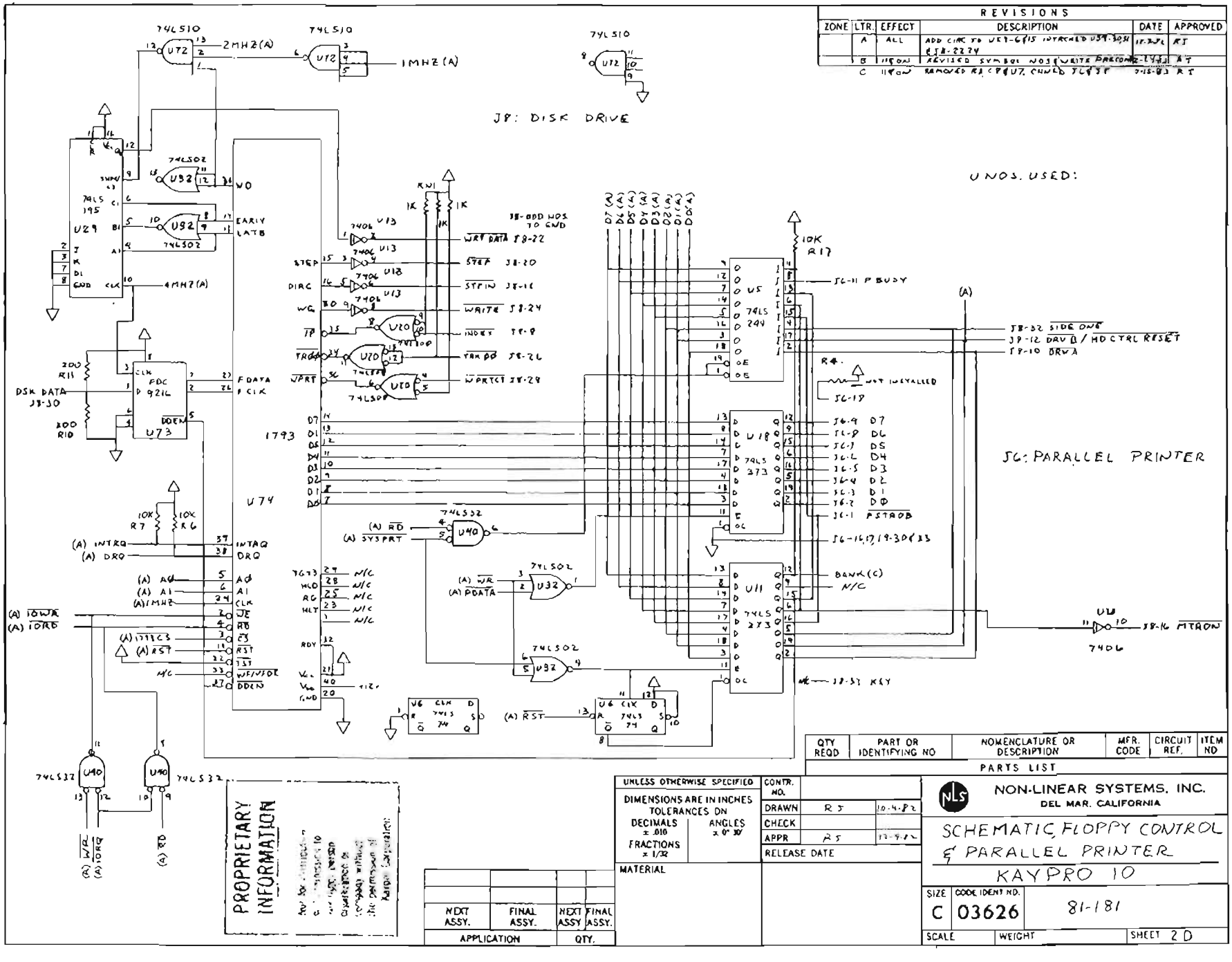


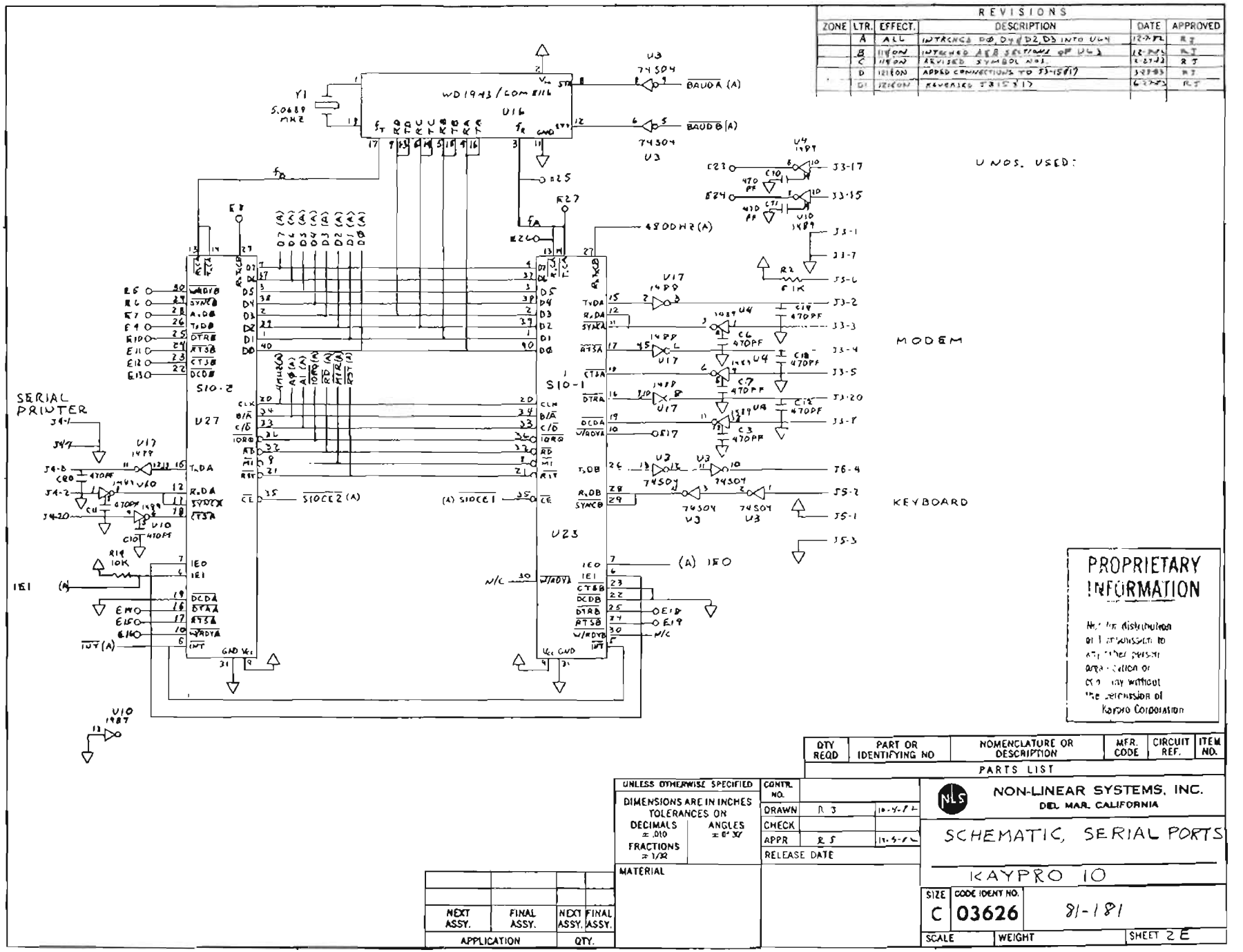
KAYPRO 10 BLOCK DIAGRAM


REVISIONS
ZONE | LTR | EFFECT | DESCRIPTION | DATE | APPROVED
A | ALL | CHNGD U18 VID-10 | 12-9-82 | RT
B | NON | ADDED U48 TO AVOID 74 | 2-10-83 | RT
C | NON | REVISED SYMBOL NOS. | 2-24-83 | EJ
D | NON | INV CNT CLK | 3-29-83 | RT
E | NON | ADDED PINOUTS TO U37-39 | 4-5-83 | RT
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person or company without the permission of Kaypro Corporation
U NOS USED:
74LS00 U37
74LS02 U43
74LS74 U48
74HC04 U64
74LS393 U59
74LS32 U40
74LS08 U20
74LS138 U19
74LS244 U38
74LS245 U34
74LS157 U12
2732 U42
Z80A CPU U28
74LS07 U93
74LS163A U53
74LS367 U13
2MHZ (D)
4MHZ
4800 HZ (E)
(A) MREQ
(A) RFSH
(B) WAIT
(C) MUX
(C) CAS
(B,D,E) 4MHZ
(B,D,E) RST
(C) PROMCE
MREQ·RD (C)
IORQ (B,C)
RD (B,E)
WR (B,C)
(B,D) IORQ
(B) INT
(B) DRQ
(D) INTRQ
(D) 2MHZ
(D) IOWR
(D) IORD
EXT IORD (A)
EXT LOAD (A)
J9-48 IEI
J9-49 IEO
J9-49 4MHZ
J9-50 KEY
J9-47 E200 SER
J9-45 MD CTRL RST
J9-000 NOS 33 THRU 41
J9-000 NOS. 17 AND 21
J9-42 IOWR
J9-40 IORD
J9-18 BA7
J9-20 BA6
J9-22 BA5
J9-24 BA4
J9-26 BA3
J9-28 BA2
J9-30 BA1
J9-32 BA0
J9-16 BD7
J9-14 BD6
J9-12 BD5
J9-10 BD4
J9-8 BD3
J9-6 BD2
J9-4 BD1
J9-2 BD0
J9-34 IORQ
J9-36 M1
J9-43 RST
J9-44 INT
J10-4 KEY N/C
J10-3 F-F IND
J10-2 RST SW
J10-1 COM
SPARE J7-1
-12V J7-2 TO: U61-1, J2-5
+12V J7-3 TO: U61-17, J2-2, U55-40
GND J7-4
KEY J7-5 N/C
+5V J7-6
BAUDA (E)
BAUDB (E)
SIOCE1 (E)
SIOCE2 (E)
SYSPRT (D)
PDATA (D)
VIDCS (B)
1793CS (D)
MIR (E)
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 RT 10-4-82
CHECK
APPR RT 11-2-82
RELEASE DATE
MATERIAL
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, PROCESSOR
KAYPRO 10
SIZE C | CODE IDENT NO. 03626 | 81-181
SCALE | WEIGHT | SHEET 2A

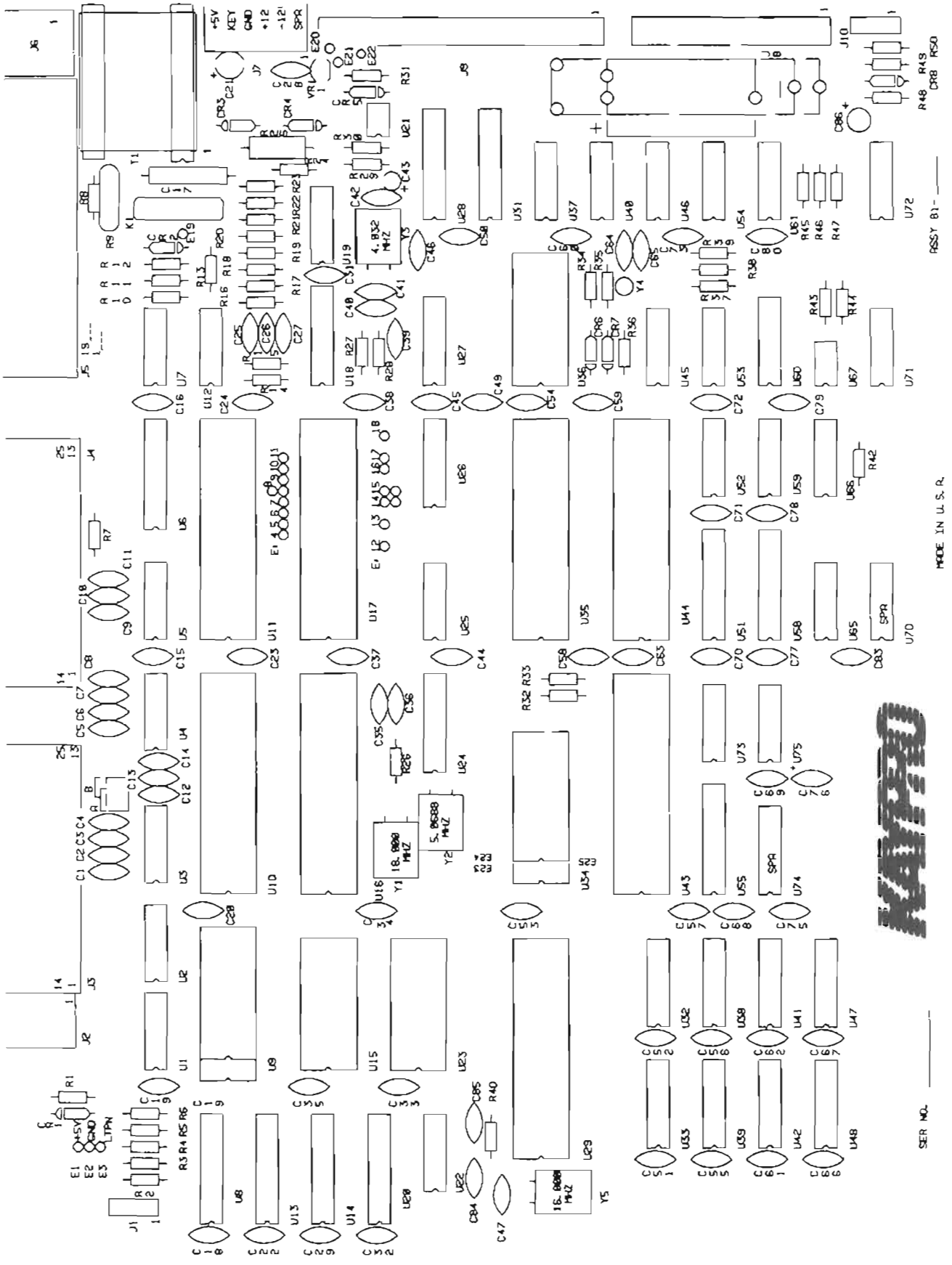

PROPRIETARY INFORMATION
SCHEMATIC, VIDEO
KAYPRO 10
D 03626
91-181


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
A | ALL | ADD CONN TO U49 | 12-7-82 | RJ
B | 11SON | REVISED SYMBOL NOS | 2-24-83 | RJ
U NOS USED:
U49 64K RAM
U63 64K RAM
U58 64K RAM
U52 64K RAM
U51 64K RAM
U57 64K RAM
U62 64K RAM
U68 64K RAM
U48 74LS157
U47 74LS157
74LS244 U41
(A) CAS
(A) WE
(A) MUX
(A) MREQ
(A) MREQ-RD
(A) RFSH
(A) PROMCE
BANK (D)
A15 (A)
74LS04 U56
74LS00 U50
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person
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 RJ
CHECK
APPR RJ
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 C
CODE IDENT NO. 03626
81-181
SCALE
WEIGHT
SHEET 2C


REVISIONS
ZONE | LTR | EFFECT | DESCRIPTION | DATE | APPROVED
A | ALL | ADD CIRC TO U67-6 PIS ISOLATED U59-3 PER ECN-2279
B | 11 THRU | REVISED SYMBOL NOS (WRITE PRECOMP-LATE) AT
C | 11 THRU | REMOVED R1 C PIN U7, CHANGED TO 81LS95
J8: DISK DRIVE
UNOS. USED:
J6: PARALLEL PRINTER
74LS10
74LS02
74LS32
74LS37
74LS00
74LS08
74LS74
74LS244
74LS373
74LS273
74LS95
1793
FDC 9216
2MHZ(A)
1MHZ(A)
4MHZ(A)
WD
EARLY
LATE
WRT DATA J8-22
STEP J8-20
STEP IN J8-18
WRITE J8-24
INDEX J8-8
TRK 00 J8-26
WPRTCT J8-28
DSK DATA J8-30
F DATA
F CLK
INTRQ
DRQ
SIDE ONE J8-32
DRV B / HD CTRL RESET J8-12
DRV A J8-10
P BUSY J6-11
J6-19
BANK(C)
N/C
PSTROBE
J6-1 DO
J6-2 D1
J6-3 D2
J6-4 D3
J6-5 D4
J6-6 D5
J6-7 D6
J6-9 D7
J6-16,17,19-30 GND
J8-16 MTRON
J8-34 KEY
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
FRACTIONS ± 1/32
ANGLES ± 0° 30'
CONTR. NO.
DRAWN R S 10-4-82
CHECK
APPR R S 12-9-82
RELEASE DATE
MATERIAL
NEXT ASSY. | FINAL ASSY. | NEXT ASSY | FINAL ASSY.
APPLICATION | QTY.
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 | INTRCHGD D0, D4 & D2, D3 INTO U64
B | 118 ON | INTRCHGD A&B SECTIONS OF U63
C | 118 ON | REVISED SYMBOL NOS.
D | 121 ON | ADDED CONNECTIONS TO J3-15 & 17
D1 | 121 ON | REVERSED J3-15 & 17
WD1943/COM 8116
U16
Y1
5.0689 MHZ
BAUD A (A)
BAUD B (A)
4800 HZ (A)
U NOS. USED:
MODEM
KEYBOARD
SERIAL PRINTER
S10-2
S10-1
U27
U23
S10CE2 (A)
(A) S10CE1
(A) IEO
IE1 (A)
INT (A)
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
CONTR. NO.
DRAWN R J 10-4-82
CHECK
APPR R J 10-5-82
RELEASE DATE
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, SERIAL PORTS
KAYPRO 10
SIZE C
CODE IDENT NO. 03626
81-181
SCALE
WEIGHT
SHEET 2 E

6.4 KAYPRO 2/84 AND 2X (81-294-n)



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

SCOPE SIGNALS, 81-294-n

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Scope signals for this mainboard will be available soon; the section will be sent to the dealers for insertion into the new Technical Reference Manual as soon as it is available.

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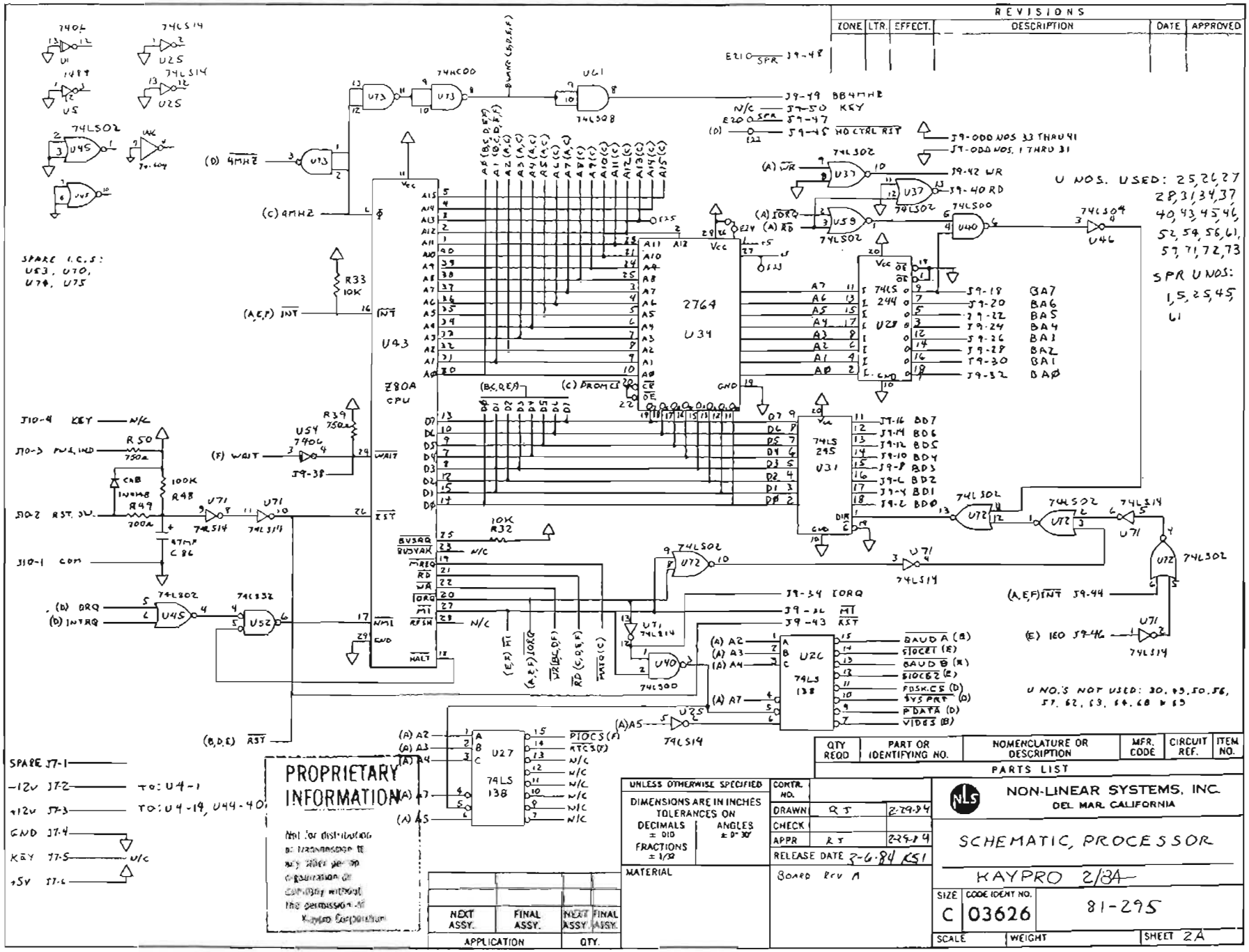
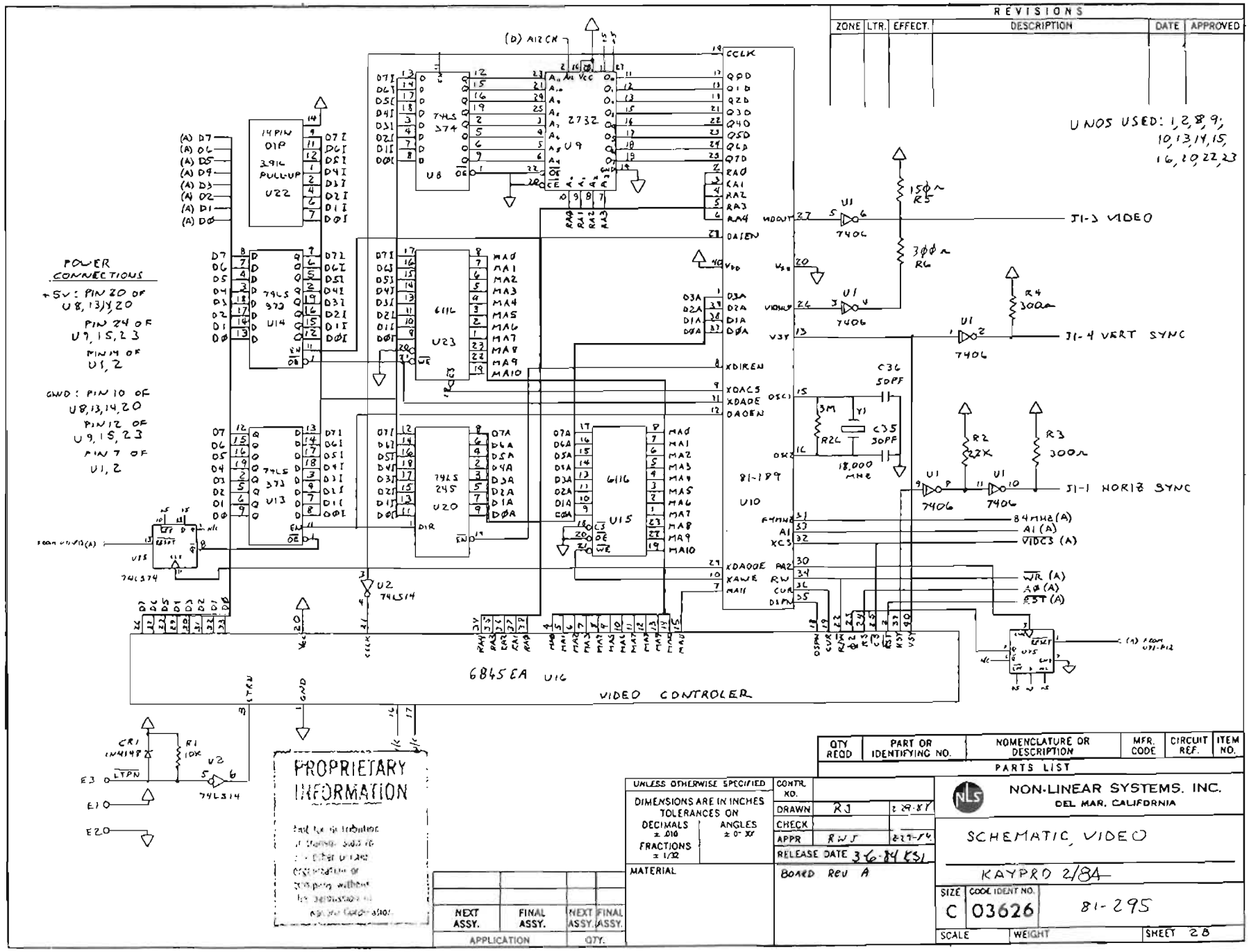
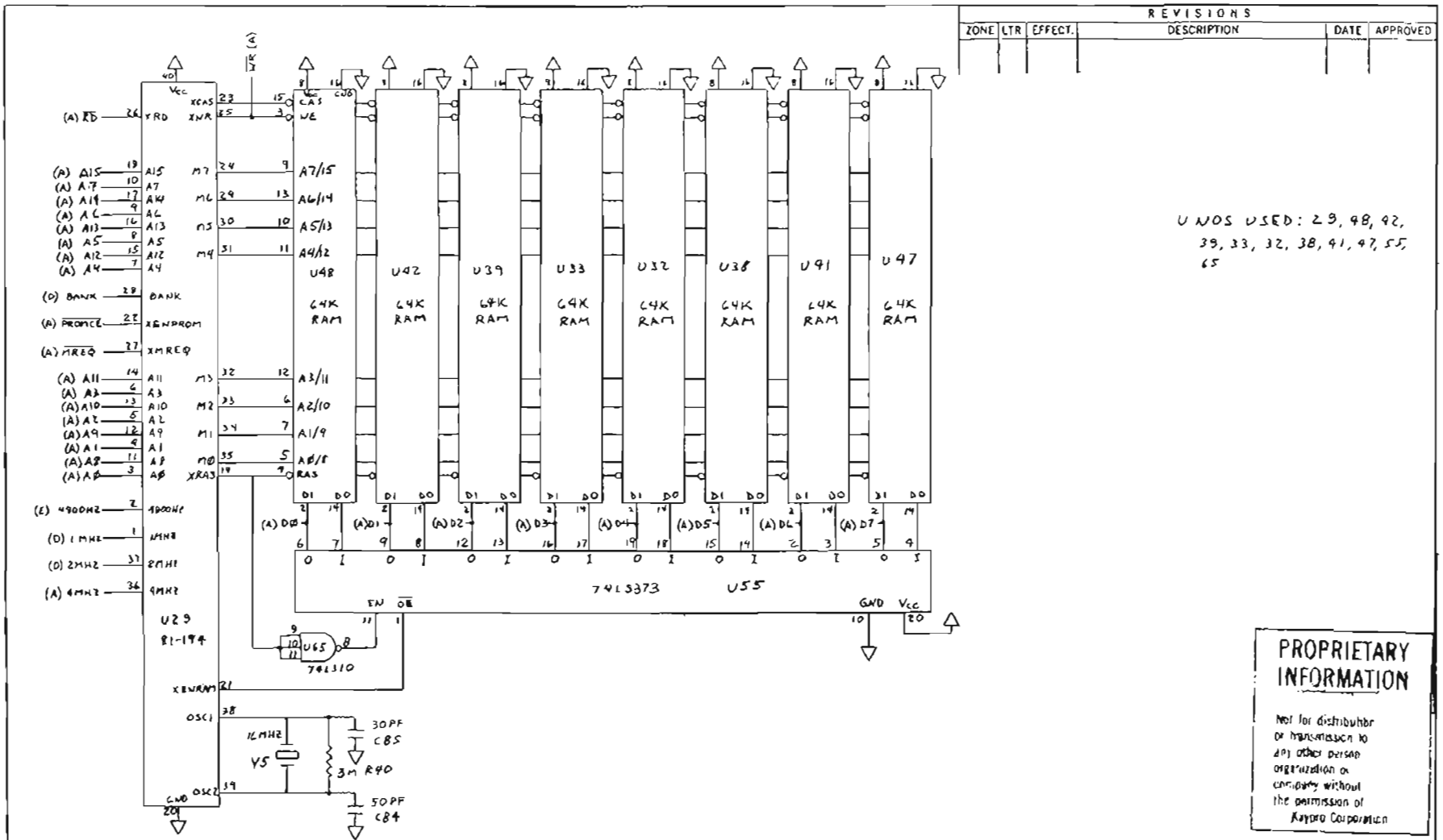

REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
U NOS. USED: 25,26,27 28,31,34,37 40,43,45,46, 52,54,56,61, 67,71,72,73
SPR UNOS: 1,5,25,45, 61
SPARE I.C.S: U53, U70, U74, U75
U NO.'S NOT USED: 30, 33, 50, 56, 57, 62, 63, 64, 68 & 69
PROPRIETARY INFORMATION
QTY REQD | PART OR IDENTIFYING 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'
MATERIAL
Board Rev A
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, PROCESSOR
KAYPRO 2/84
SIZE C
CODE IDENT NO. 03626
81-295
SCALE
WEIGHT
SHEET 2A
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.


REVISIONS
ZONE LTR. EFFECT. DESCRIPTION DATE APPROVED
UNOS 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
14PIN 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
J1-3 VIDEO
J1-4 VERT SYNC
J1-1 HORIZ SYNC
7406
6845EA U16
VIDEO CONTROLER
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 2-29-84
RELEASE DATE 3-6-84 KSI
BOARD REV A
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, VIDEO
KAYPRO 2/84
SIZE C
CODE IDENT NO. 03626
81-295
SCALE
WEIGHT
SHEET 28
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.



REVISIONS

ZONE	LTR	EFFECT.	DESCRIPTION	DATE	APPROVED

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 RS 2-29-84
CHECK
APPR RS 2-29-84
RELEASE DATE 3-6-84 KSJ
MATERIAL
BOARD REV A

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

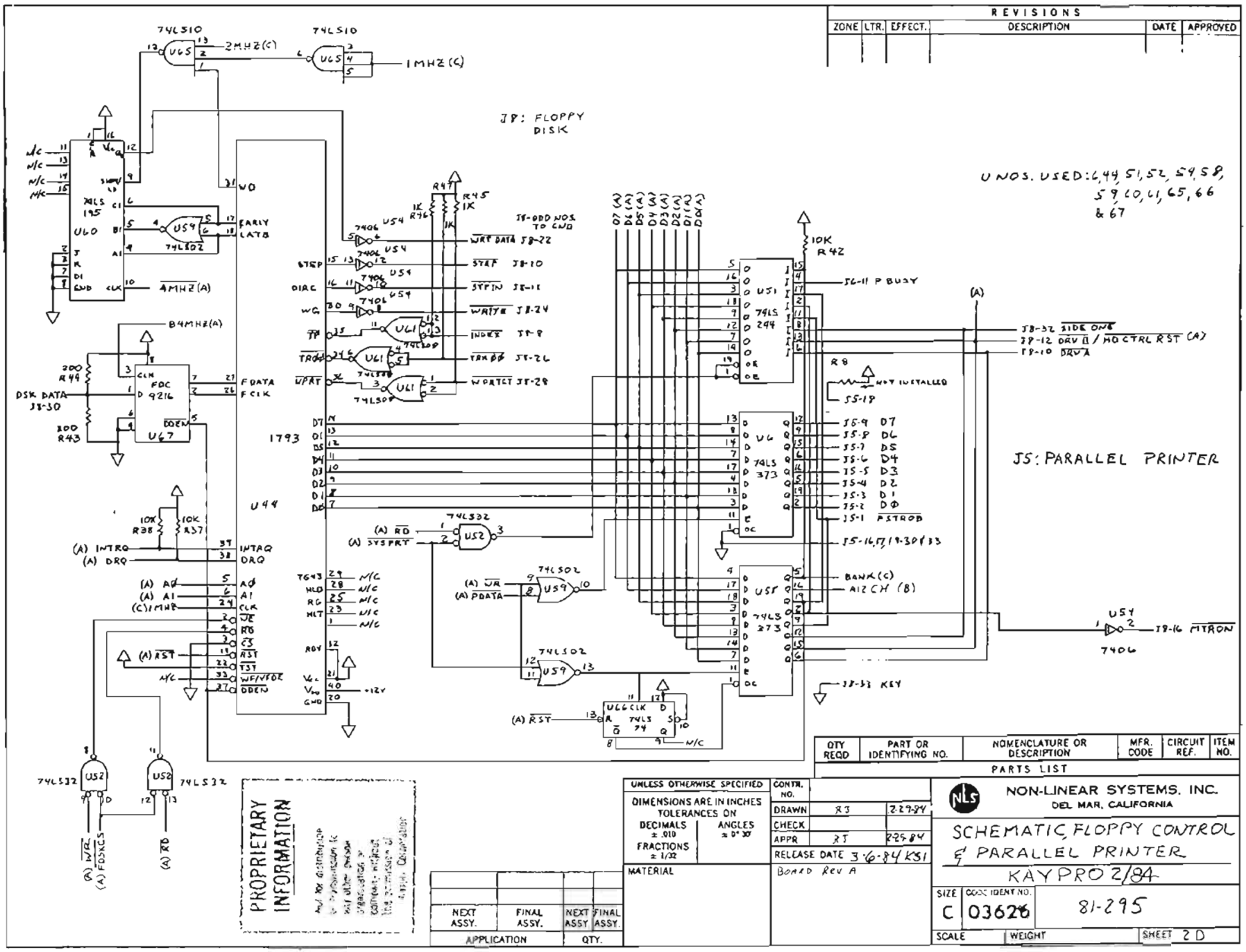
SCHEMATIC, RAM

KAYPRO 2/84

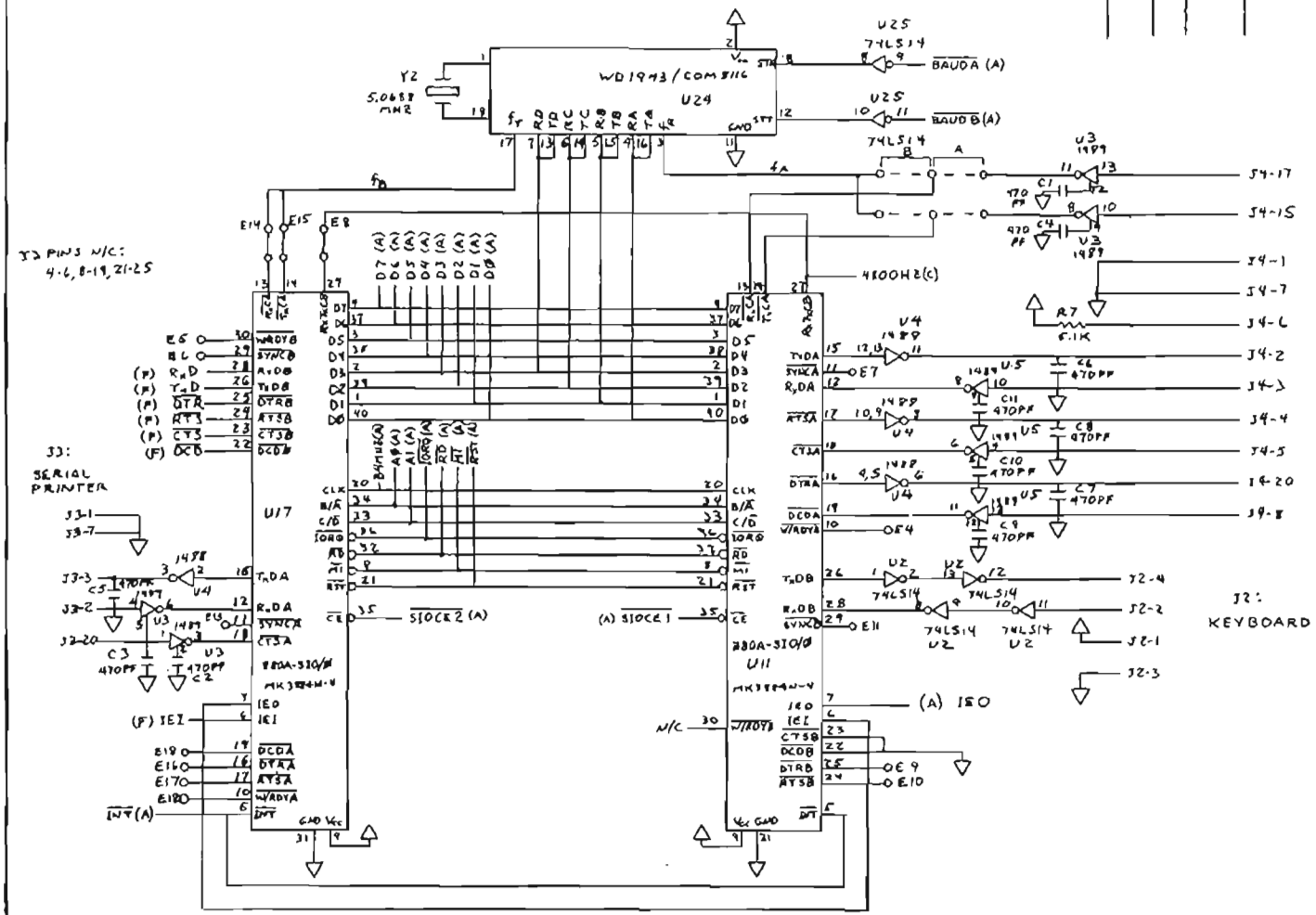
SIZE	CODE IDENT NO.	
C	03626	81-295

SCALE WEIGHT SHEET 2 C

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


REVISIONS
ZONE LTR. EFFECT. DESCRIPTION DATE APPROVED
J8: FLOPPY DISK
U NOS. USED: 6, 44, 51, 52, 54, 58, 59, 60, 61, 65, 66 & 67
J5: PARALLEL PRINTER
74LS510
2MHZ(C)
1MHZ(C)
74LS195
U60
4MHZ(A)
74LS02
EARLY
LATE
8MHZ(A)
FDC 9216
U67
DSK DATA J8-30
1793
U44
WD
FDATA
FCLK
DDEN
INTRQ
DRQ
RST
WE/VFDE
+12V
7406
U54
WRT DATA J8-22
STEP J8-10
STEP IN J8-11
WRITE J8-24
INDEX J8-9
TRK00 J8-26
WPRT CT J8-28
J8-ODD NOS. TO GND
74LS244
U51
J6-11 P BUSY
J8-32 SIDE ONE
J8-12 DRV B / MD CTRL RST (A)
J8-10 DRV A
R8
NOT INSTALLED
J5-18
74LS373
U6
J5-9 D7
J5-8 D6
J5-7 D5
J5-6 D4
J5-5 D3
J5-4 D2
J5-3 D1
J5-2 D0
J5-1 PSTROB
J5-16,17,19-30 & 33
74LS373
U55
BANK (C)
A12 CH (B)
J8-33 KEY
74LS32
U52
74LS02
U59
74LS74
U66
J8-16 MTRON
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
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
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, FLOPPY CONTROL & PARALLEL PRINTER
KAYPRO 2/84
SIZE C
CODE IDENT NO. 03626
81-295
SCALE
WEIGHT
SHEET 2D

REVISIONS					
ZONE	LTR.	EFFECT.	DESCRIPTION	DATE	APPROVED



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

J3: SERIAL PRINTER

J3-1
J3-7
J3-3
J3-2
J3-20

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

J4: SERIAL DATA CHANNEL

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

J2: KEYBOARD

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

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	DRAWN	R J	2-24-84
TOLERANCES ON DECIMALS ± .010 ANGLES ± 0° 30' FRACTIONS ± 1/32	CHECK		
	APPR	R S	2-29-84
	RELEASE DATE	3-6-84 RSJ	
MATERIAL	BOARD REV A		

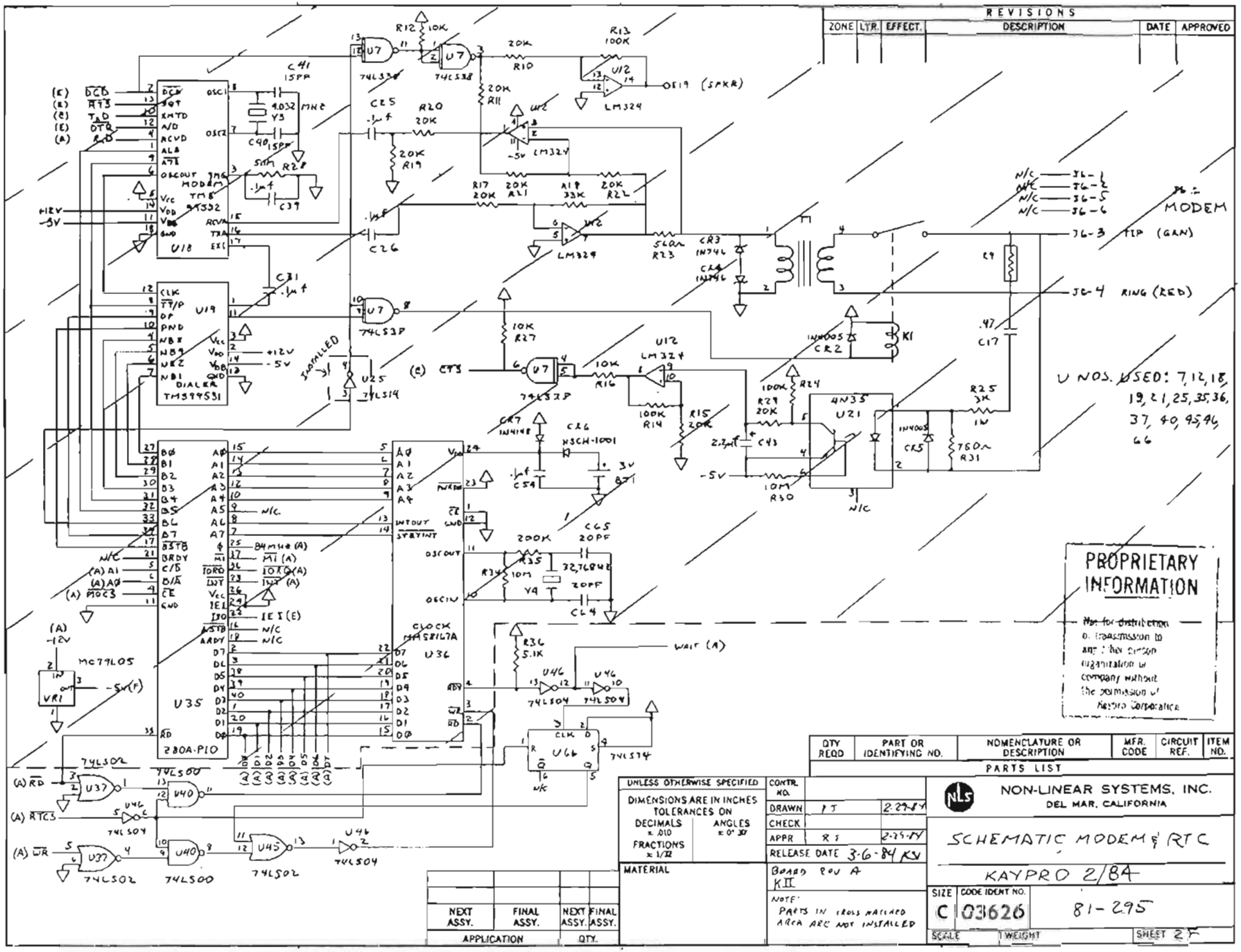
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, SERIAL PORTS

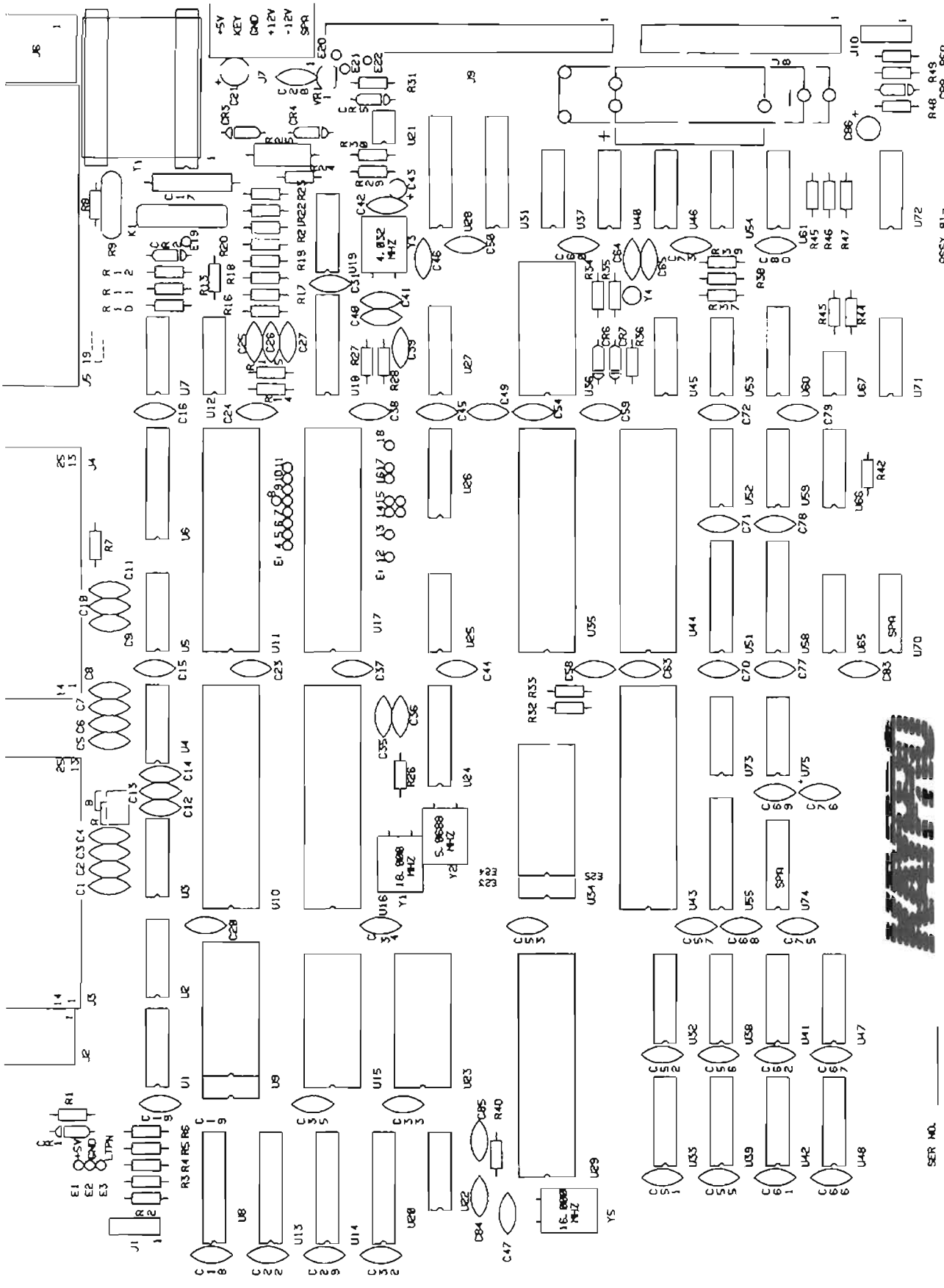
KAYPRO 2/84

SIZE	CODE IDENT NO.	
C	03626	81-295
SCALE	WEIGHT	SHEET 2 E

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


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
MODEM
U NOS. USED: 7, 12, 18, 19, 21, 25, 35, 36, 37, 40, 95, 96, 66
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
FRACTIONS ± 1/32
ANGLES ± 0° 30'
MATERIAL
CONTR NO.
DRAWN
CHECK
APPR
RELEASE DATE 3-6-84 KV
BOARD REV A
K II
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 2

6.5 KAYPRO 4/84 MAINBOARD (81-184-n)



SCOPE SIGNALS, 81-184-n

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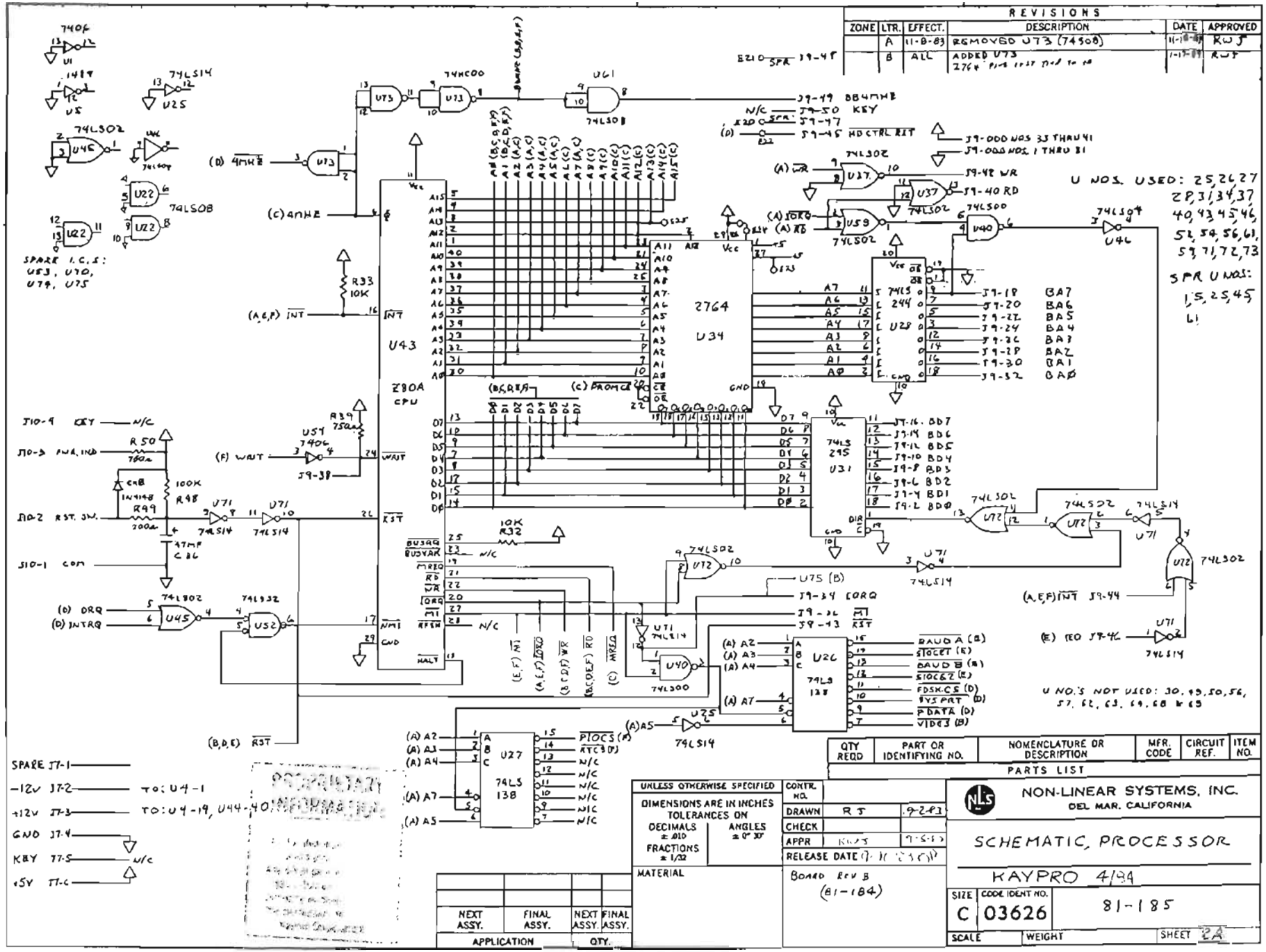
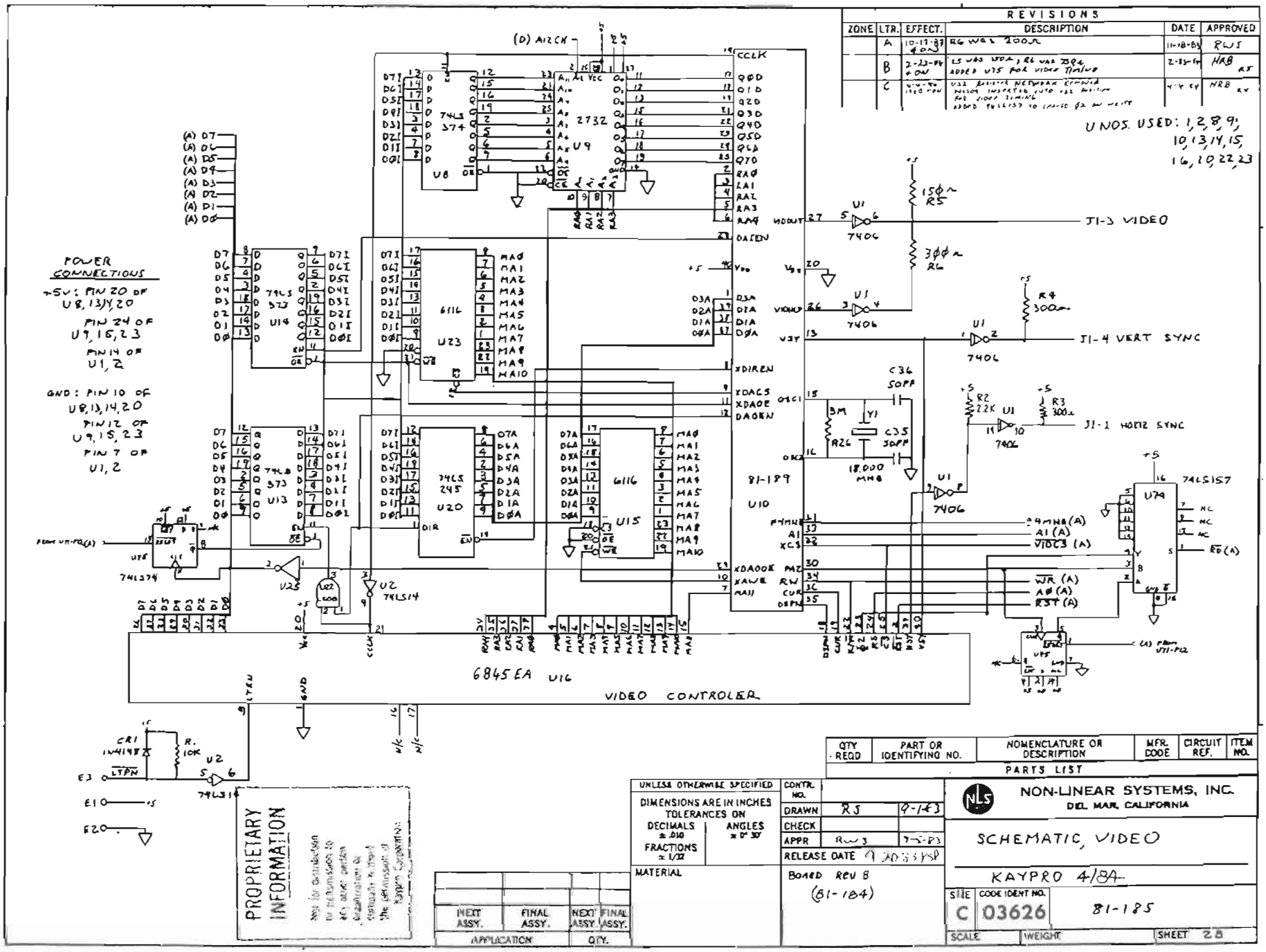
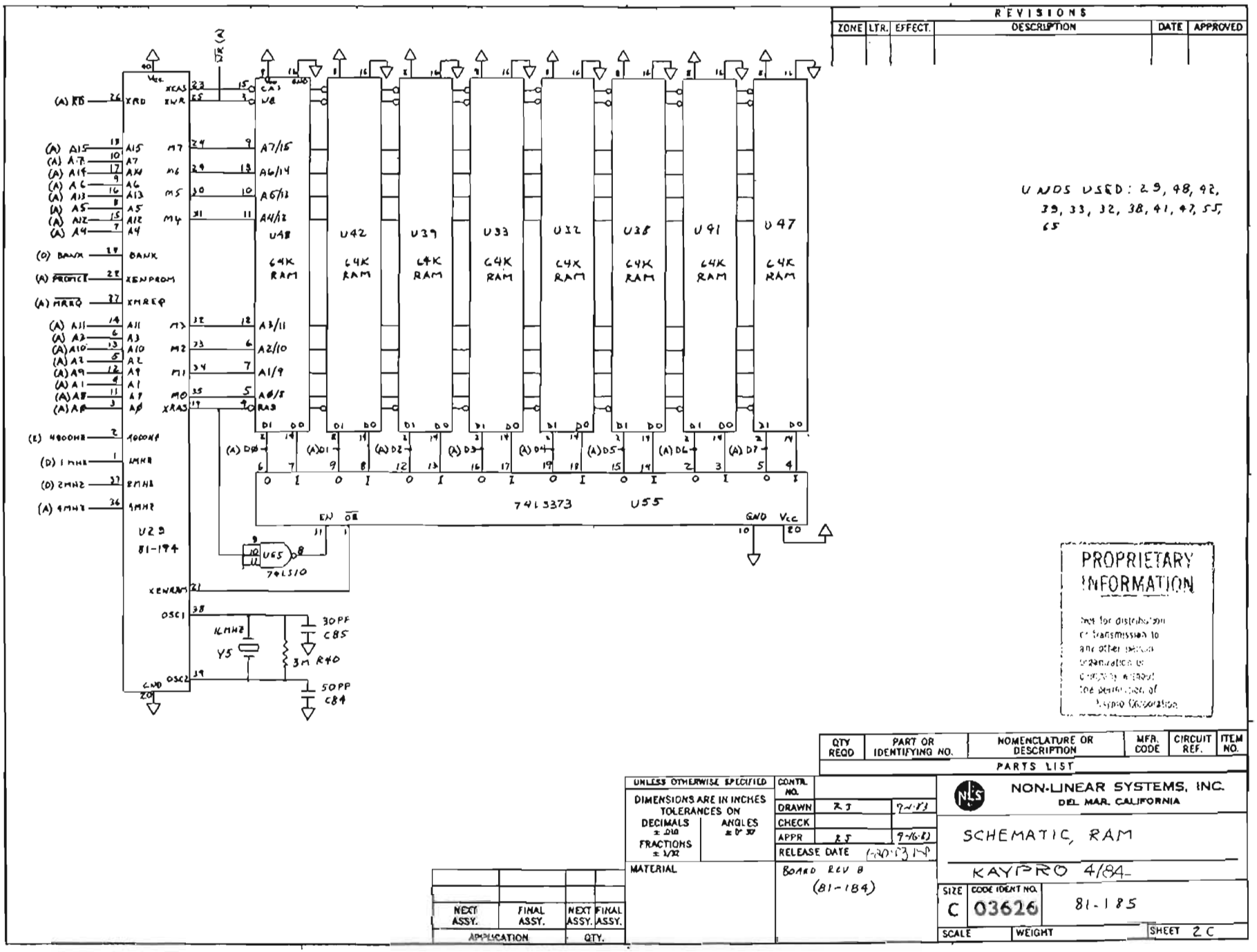
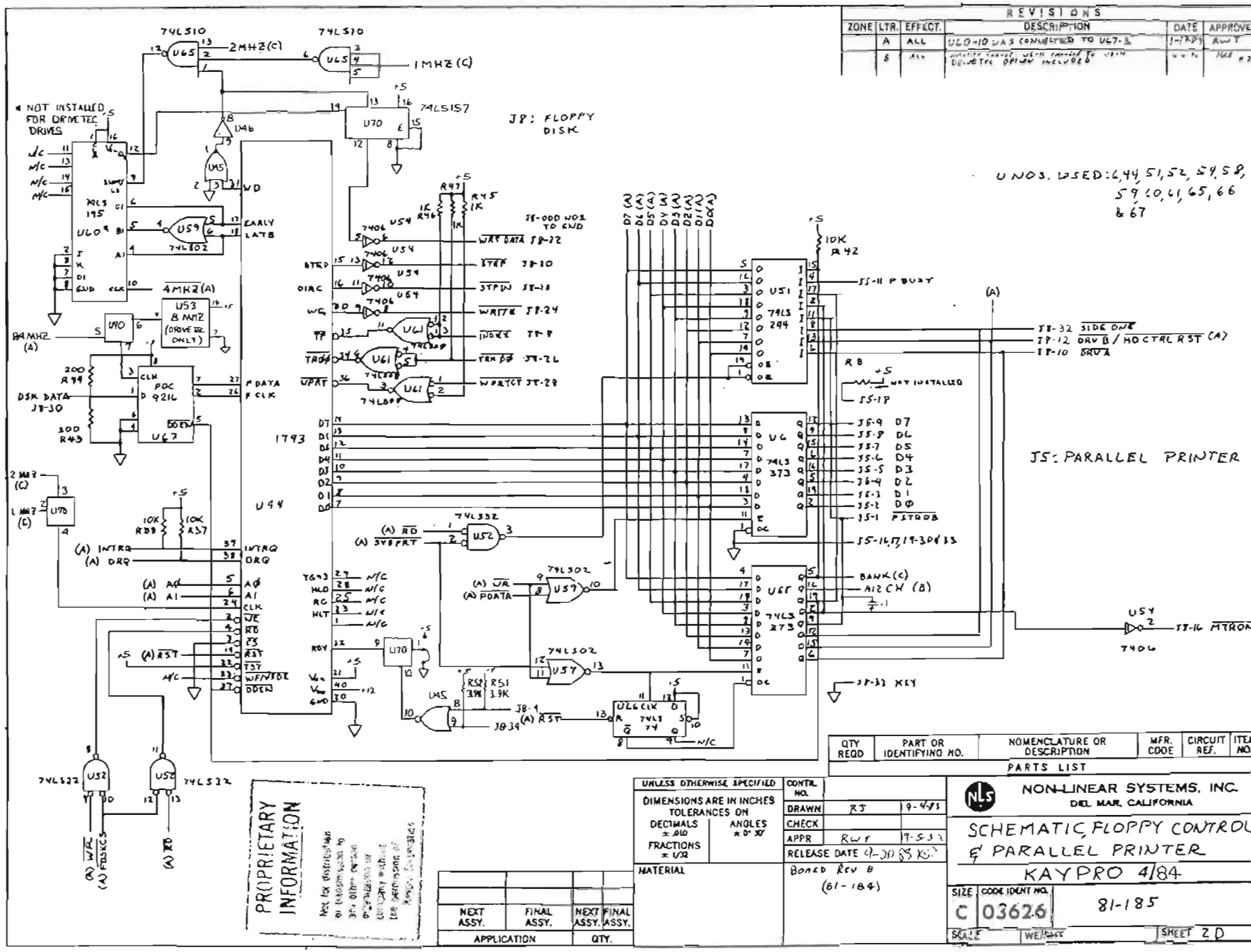
Scope signals for this mainboard will be available soon; the section will be sent to the dealers for insertion into the new Technical Reference Manual as soon as it is available.

****


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
A | 11-8-83 | REMOVED U73 (74S08) | RWJ
B | ALL | ADDED U73 2764 PIN 1 OUT TIED TO +5
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
U NO.'S NOT USED: 30,49,50,56, 57,62,63,64,68 & 69
SPARE I.C.S: U53, U70, U74, U75
U43 Z80A CPU
2764 U34
74LS 244 U28
74LS 295 U31
74LS 138 U27
74LS 138 U26
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'
MATERIAL
CONTR. NO.
DRAWN R J 9-2-83
CHECK
APPR
RELEASE DATE
BOARD REV B (81-184)
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, PROCESSOR
KAYPRO 4/84
SIZE C | CODE IDENT NO. 03626 | 81-185
SCALE | WEIGHT | SHEET 2A


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
A | 10-17-83 4 ON | R6 WAS 200Ω | 11-18-83 | RWS
B | 2-23-84 4 ON | L5 WAS 150Ω, R6 WAS 250Ω ADDED U75 FOR VIDEO TIMING | 2-23-84 | HRB RS
C | 4-4-90 | U32 RESISTOR NETWORK REMOVED ADDED INSERTED INTO U32 POSITION FOR VIDEO TIMING ADDED 74LS157 TO CHANGE Ø2 ON WRITE | 4-4-84 | HRB RX
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
(D) A12CK
74LS 374 U8
2732 U9
74LS 373 U14
6116 U23
74LS 373 U13
74LS 245 U20
6116 U15
81-189 U10
7406
J1-3 VIDEO
J1-4 VERT SYNC
J1-1 HORIZ SYNC
74LS157 U74
6845 EA U16
VIDEO CONTROLER
74LS374
74LS14
74LS14
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 RS 9-1-83
CHECK
APPR RWS 9-5-83
RELEASE DATE
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
SHEET 28
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.


REVISIONS
ZONE
LTR.
EFFECT.
DESCRIPTION
DATE
APPROVED
UNDS USED: 29, 48, 42, 39, 33, 32, 38, 41, 47, 55, 65
U29
81-194
U48
64K RAM
U42
64K RAM
U39
64K RAM
U33
64K RAM
U32
64K RAM
U38
64K RAM
U41
64K RAM
U47
64K RAM
74LS373
U55
74LS10
U65
Y5
30PF C85
3M R40
50PF C84
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
CONTR. NO.
DRAWN
CHECK
APPR
RELEASE DATE
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
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
A | ALL | U60-10 WAS CONNECTED TO U67-3
B | ALL | DRIVETEC DRIVES INCLUDED
* NOT INSTALLED FOR DRIVETEC DRIVES
74LS10
74LS157
74LS02
74LS32
74LS38
74LS96
74LS74
74LS373
74LS273
74LS244
74LS95
74LS132
74LS138
74LS139
74LS00
74LS04
74LS06
74LS08
74LS14
74LS123
74LS125
74LS126
74LS132
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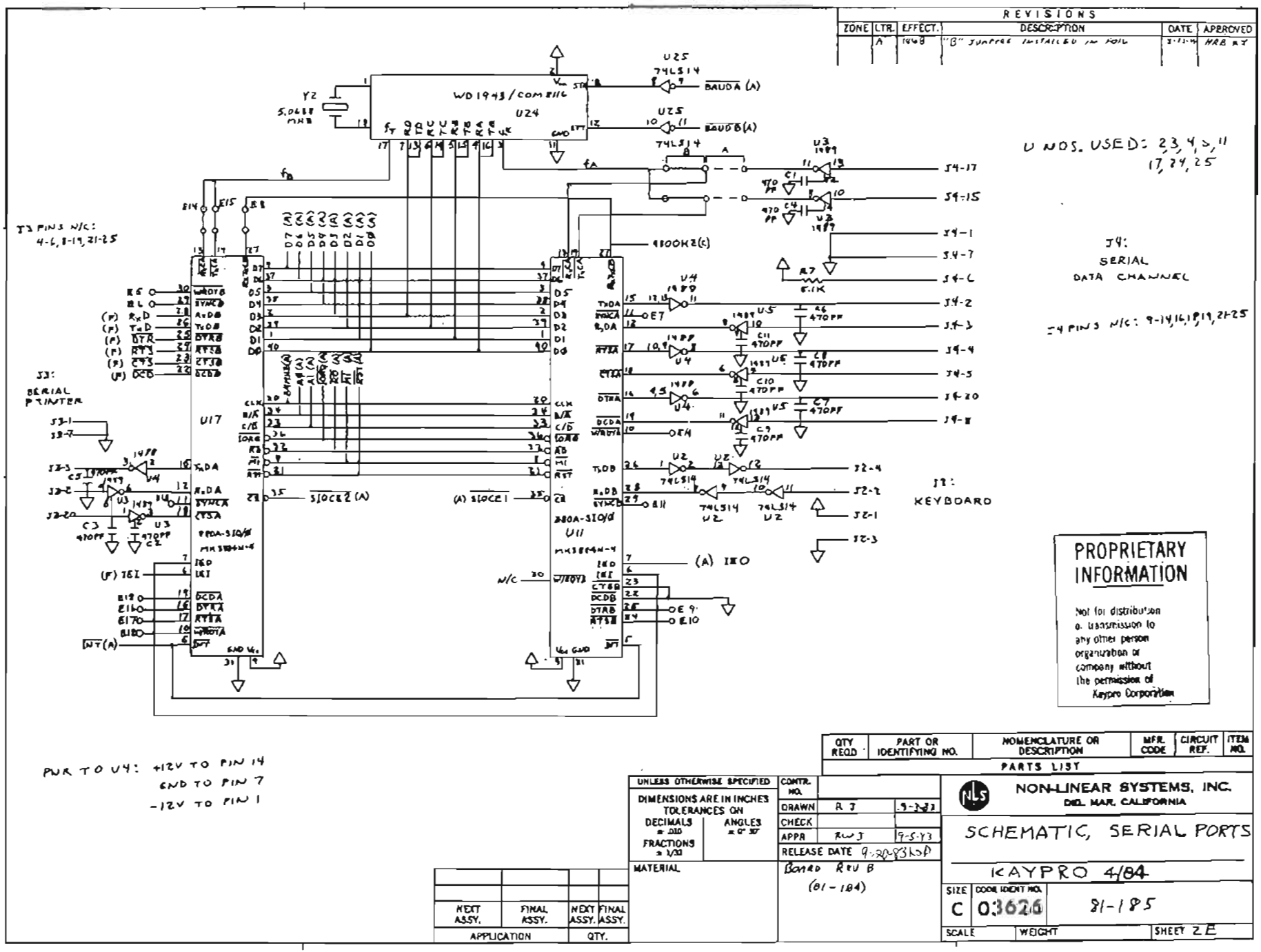
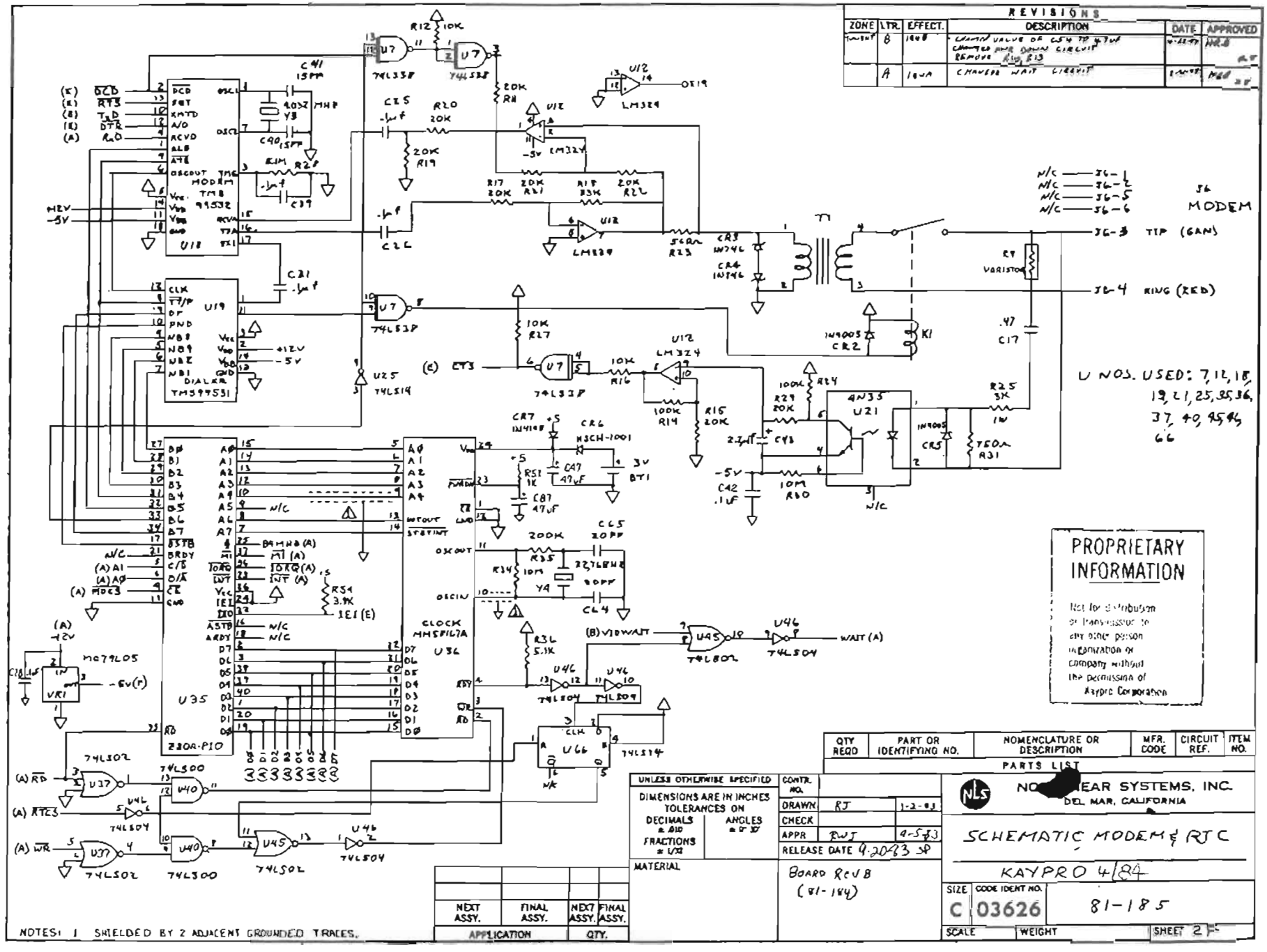
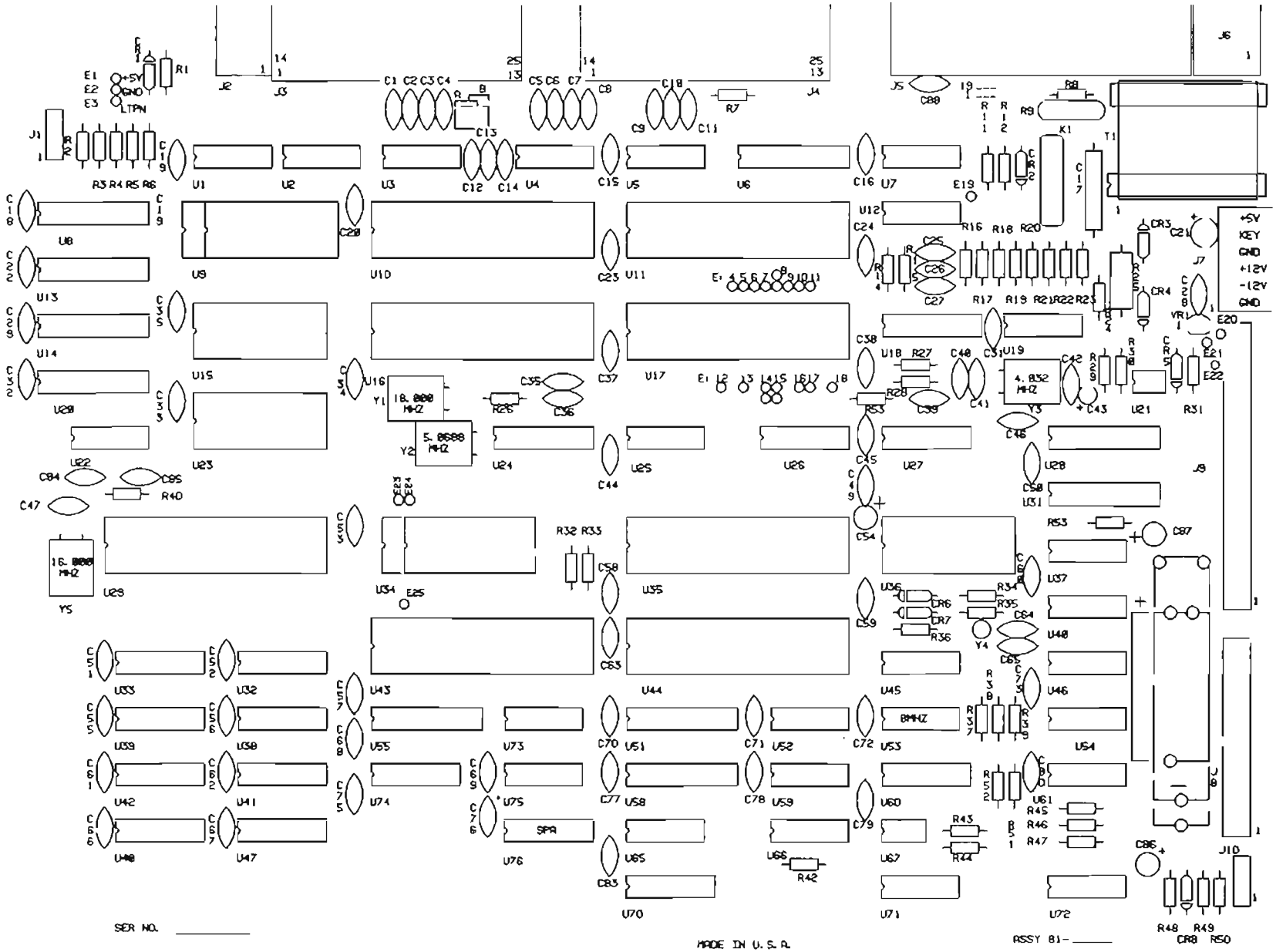
74LS139
74LS157
74LS244
74LS273
74LS302
74LS373
74LS374
74LS38
74LS96

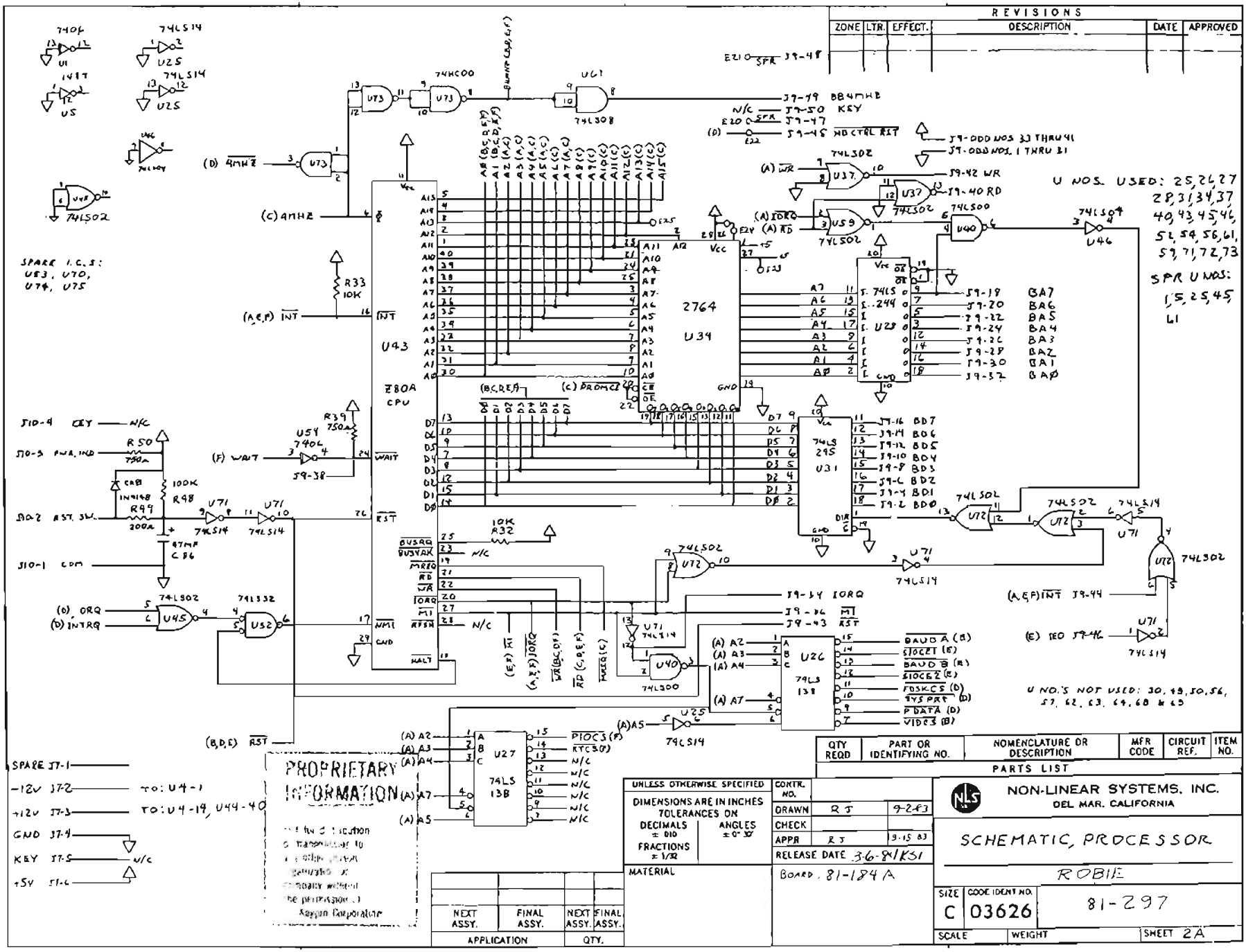

REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
A | 1968 | "B" JUMPER INSTALLED IN FOIL
U NOS. USED: 2,3,4,5,11 17,24,25
J4: SERIAL DATA CHANNEL
J4 PINS N/C: 9-14,16,18,19,21-25
J3 PINS N/C: 4-6,8-19,21-25
J3: SERIAL PRINTER
J2: KEYBOARD
WD1943/COM8116
U24
U17
U11
PWR TO U4: +12V TO PIN 14
GND TO PIN 7
-12V TO PIN 1
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
CONTR. NO.
DRAWN R J 9-3-83
CHECK
APPR RWJ 9-5-83
RELEASE DATE 9-20-83 KSP
Board Rev B (81-184)
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, SERIAL PORTS
KAYPRO 4/84
SIZE C
CODE IDENT NO. 03626
81-185
SCALE
WEIGHT
SHEET 2E
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.

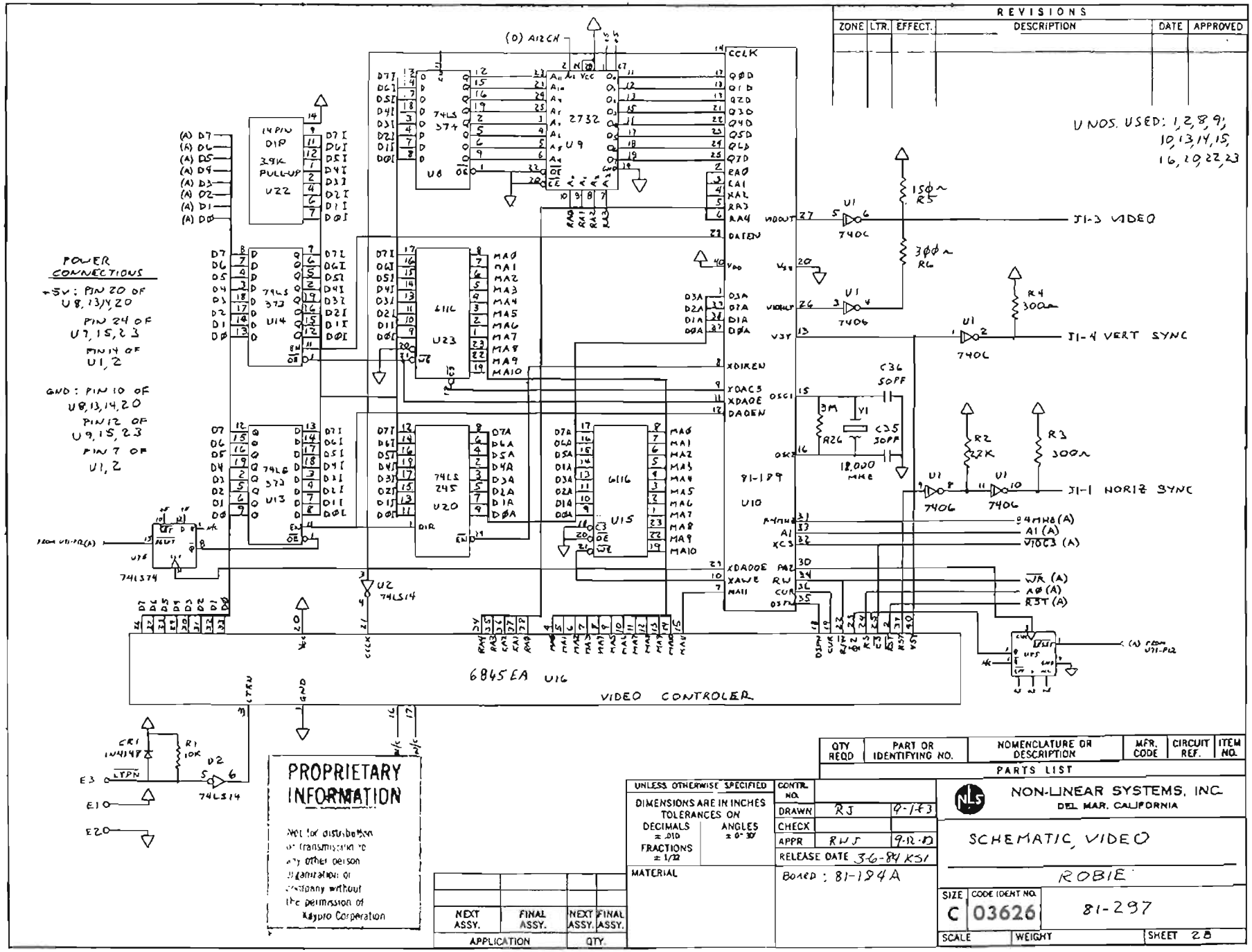

REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
B | 1948 | CHANGED VALUE OF C54 TO 47uF CHANGED PWR DOWN CIRCUIT REMOVE R19, R13
A | 1948 | CHANGED WAIT CIRCUIT
J6 MODEM
J6-3 TIP (GAN)
J6-4 RING (RED)
U NOS. USED: 7, 12, 18, 19, 21, 25, 35, 36, 37, 40, 45, 46, 66
PROPRIETARY INFORMATION
Not for distribution or transmission to any other person organization or company without the permission of Kaypro Corporation
MODEM TMB 99532
DIALER TMS99531
CLOCK MM5FIL7A
Z80A-PIO
U35
U36
U18
U19
U21
U66
74LS38
74LS14
74LS02
74LS00
74LS04
74LS08
74LS04
74LS02
74LS00
74LS02
74LS04
74LS04
74LS02
74LS04
74LS04
74LS02
74LS04
74LS00
74LS02
74LS00
74LS02
74LS04
74LS14
MC79L05
VR1
LM324
LM324
LM324
LM324
4N35
U21
T1
K1
VARISTOR
WAIT (A)
VIDWAIT
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 1-2-83
CHECK
APPR RWJ 4-5-83
RELEASE DATE 9-20-83 SP
BOARD REV B (81-184)
NO[redacted]EAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC MODEM & RTC
KAYPRO 4/84
SIZE C
CODE IDENT NO. 03626
81-185
SCALE
WEIGHT
SHEET 2
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.
NOTES: 1 SHIELDED BY 2 ADJACENT GROUNDED TRACES.

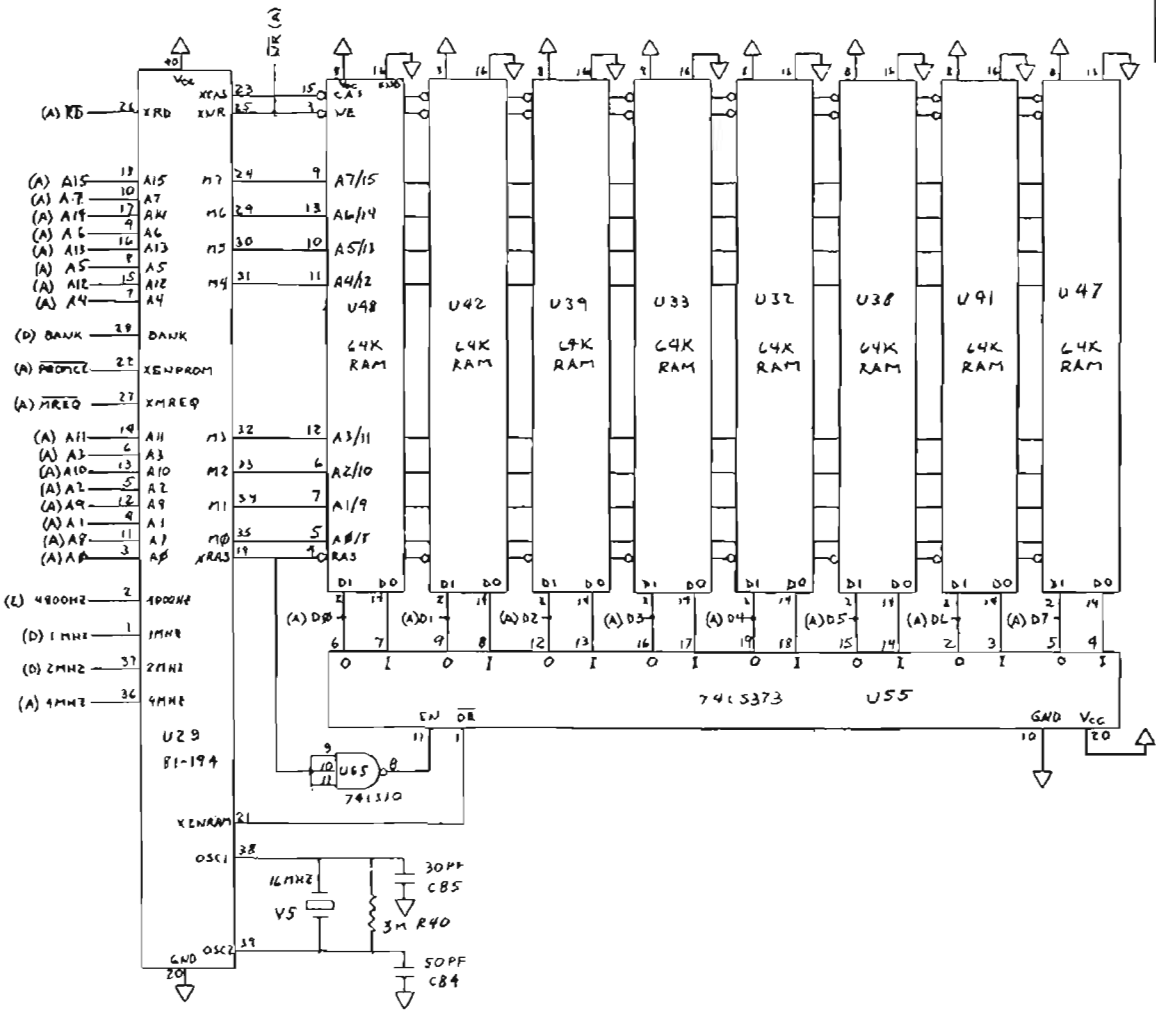

SER NO. _____
MADE IN U.S.A.
ASSY 81-_____
KAYPRO

IC LIST, 81-296-n

Reference Designation		Description
U1, U54	7406	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)
U10	81-189	Custom gate array
U11, U17	Z80A SIO	
U12	LM324	Op-Amp
U15, U23	6116	Video RAM
U16	6545EA	Video controller
U18	TMS 99532	Modem
U19	TMS 99531	Dialer
U20, 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	Z80A PIO	
U36	MM581678	Clock
U37, U45, U59, U72	74LS02	Quad NOR gate
U40	74LS00	Quad NAND gate
U43	Z80A CPU	
U44	1793	Floppy disk controller
U46	74LS04	Hex inverter
U52	74LS32	Quad OR gate
U70, U74, U75		Spares
U60	74LS195	4-bit shift register
U61	74LS08	Quad AND gate
U65	74LS10	Tri NAND gate
U66, U75	74LS74	Dual "D" flip-flop
U67	FDC9216	Data separator
U73	74HC00	Quad NAND gate


REVISIONS
ZONE
LTR.
EFFECT.
DESCRIPTION
DATE
APPROVED
U43
Z80A
CPU
2764
U34
74LS 244
U28
74LS 295
U31
74LS 138
U26
74LS 138
U27
74LS 138
U NOS. USED: 25,26,27 28,31,34,37 40,43,45,46, 52,54,56,61, 59,71,72,73
SPR U NOS: 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
Keygin 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
CONTR. NO.
DRAWN R J 9-2-83
CHECK
APPR R J 9-15-83
RELEASE DATE 3-6-84/KSI
BOARD 81-184 A
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, PROCESSOR
ROBIE
SIZE C
CODE IDENT NO. 03626
81-297
SCALE
WEIGHT
SHEET 2A
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.


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 U7,15,23
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 39K 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
74LS14
6845EA U16
VIDEO CONTROLER
J1-3 VIDEO
J1-4 VERT SYNC
J1-1 HORIZ SYNC
R5 150Ω
R6 300Ω
R4 300Ω
R2 22K
R3 300Ω
C36 50PF
C35 50PF
R26 3M
Y1 18,000 MHz
CR1 1N4148
R1 10K
D2 74LS14
E3
E1
E2
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
CONTR. NO.
DRAWN RJ 9-1-83
CHECK
APPR RWJ 9-12-83
RELEASE DATE 3-6-84 KSI
BOARD: 81-184A
NEXT ASSY. FINAL ASSY. NEXT ASSY. FINAL ASSY.
APPLICATION QTY.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, VIDEO
ROBIE
SIZE C CODE IDENT NO. 03626
81-297
SCALE WEIGHT SHEET 28



REVISIONS					
ZONE	LTR	EFFECT.	DESCRIPTION	DATE	APPROVED

PROPRIETARY INFORMATION

Not for distribution or transmission to any other person or 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	DRAWN	R J 7-14-83
TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	CHECK	
	APPR	R S 9-16-83
	RELEASE DATE	3-6-84 KSI
MATERIAL	BOARD	81-184A

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

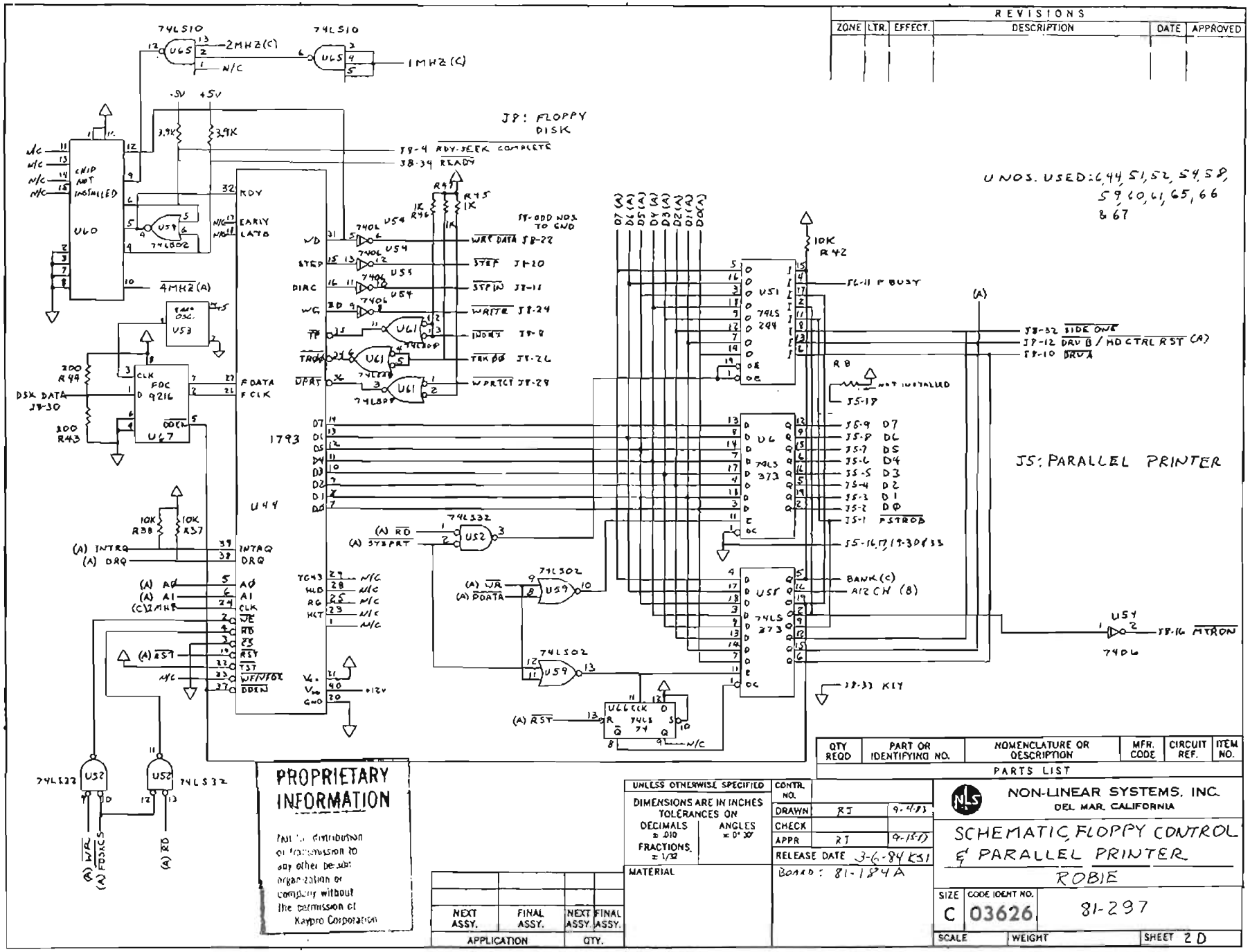
SCHEMATIC, RAM

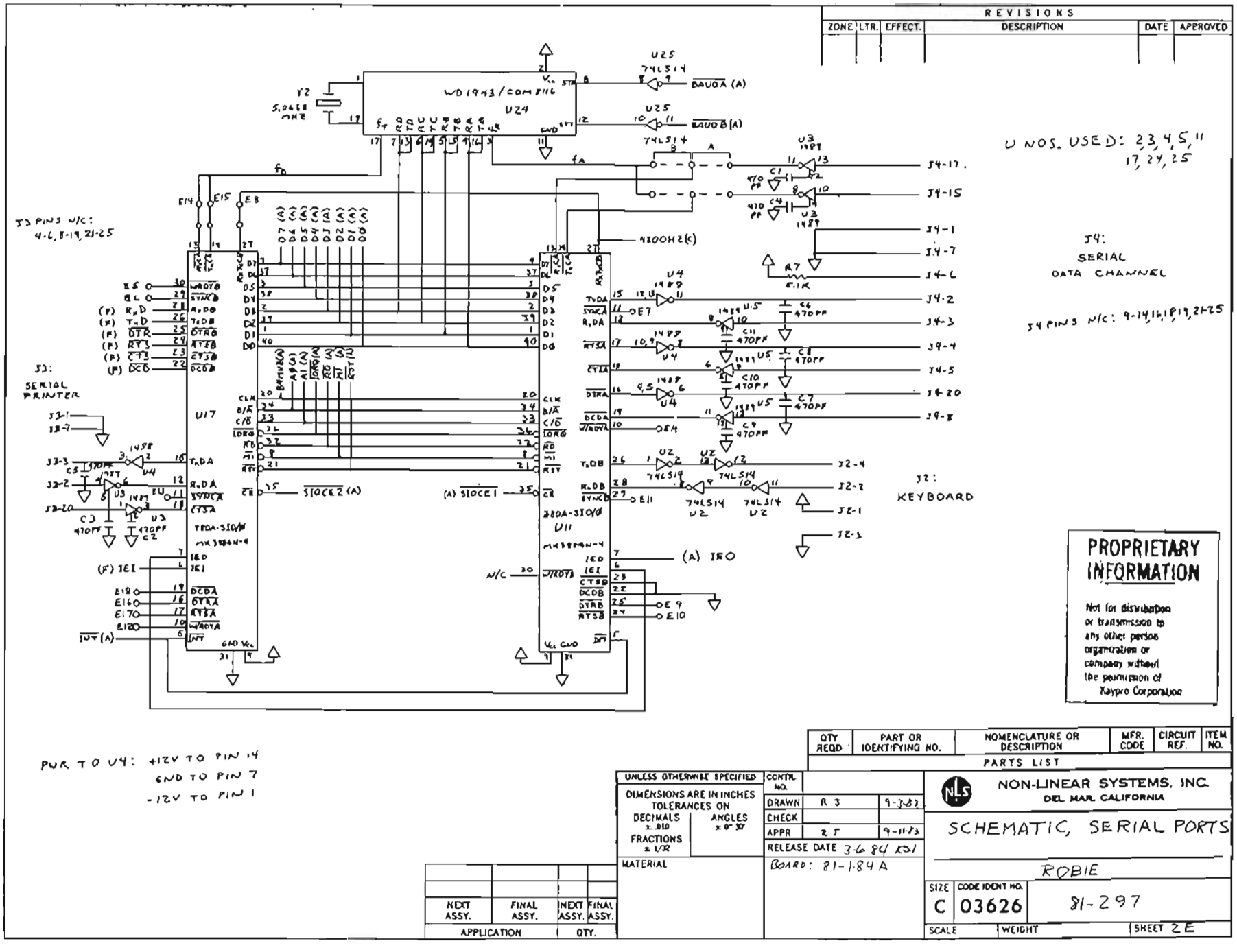
ROBIE

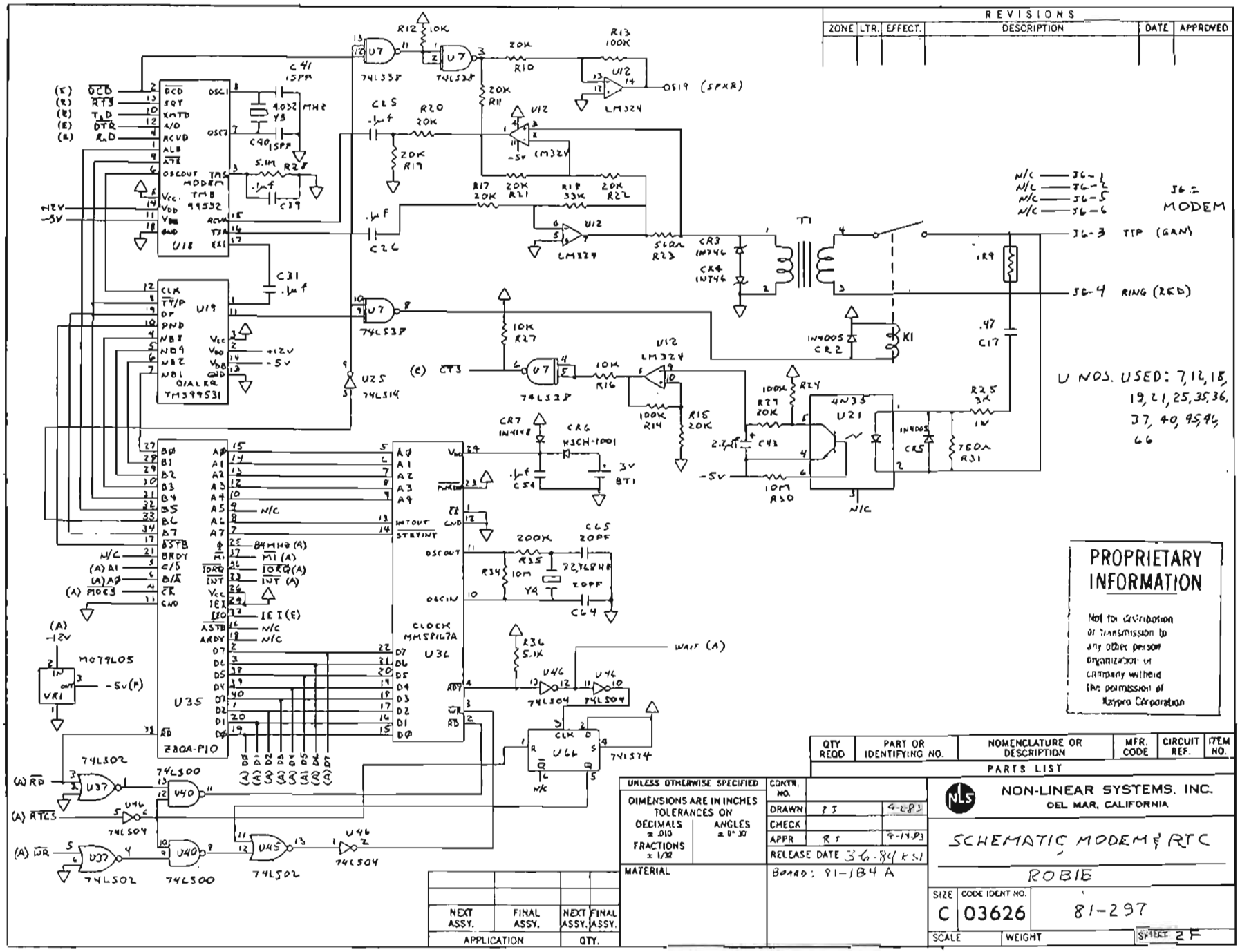
SIZE	CODE IDENT NO.	
C	03626	81-297

SCALE	WEIGHT	SHEET 2 C

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


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
74LS10
2MHZ(C)
1MHZ(C)
N/C
-5V
+5V
3.9K
J8: FLOPPY DISK
J8-4 RDY-SEEK COMPLETE
J8-34 READY
U NOS. USED: 44, 51, 52, 54, 58, 59, 60, 61, 65, 66 & 67
CHIP NOT INSTALLED
U60
4MHZ(A)
BAUD OSC.
U53
FDC 9216
U67
DSK DATA J8-30
200 R44
200 R43
F DATA
F CLK
1793
U44
10K R38
10K R37
(A) INTRQ
(A) DRQ
INTAQ
DRQ
(A) A0
(A) A1
(C) 2MHZ
(A) RD
(A) WR
(A) RST
(A) DDEN
+12V
74LS32
74LS74
74LS04
74LS00
74LS132
74LS02
74LS32
74LS244
74LS373
74LS273
74LS299
10K R42
FC-11 F BUSY
SIDE ONE
DRV B / HD CTRL RST (A)
DRV A
R8 NOT INSTALLED
J5-19
J5: PARALLEL PRINTER
J5-9 D7
J5-8 D6
J5-7 D5
J5-6 D4
J5-5 D3
J5-4 D2
J5-3 D1
J5-2 D0
J5-1 PSTROBE
J5-16,17,19-30 & 33
BANK (C)
A12 CH (8)
J8-16 MTRON
J8-33 KEY
(A) RD
(A) SYSPRT
(A) WR
(A) DDATA
(A) RST
PROPRIETARY INFORMATION
Not to disclosure 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 RJ 9-4-83
CHECK
APPR RJ 9-15-83
RELEASE DATE 3-6-84 KSI
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 C | CODE IDENT NO. 03626 | 81-297
SCALE | WEIGHT | SHEET 2D


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
U NOS. USED: 2,3,4,5,11 17,24,25
J4: SERIAL DATA CHANNEL
J4 PINS N/C: 9-14,16,18,19,21-25
J3: SERIAL PRINTER
J3 PINS N/C: 4-6, 8-19, 21-25
J2: KEYBOARD
PUR TO U4: +12V TO PIN 14
GND TO PIN 7
-12V TO PIN 1
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 FRACTIONS ± 1/32 ANGLES ± 0° 30'
MATERIAL
CONTR NO.
DRAWN R J 9-3-83
CHECK
APPR R J 9-11-83
RELEASE DATE 3-6 84 XD1
BOARD: 81-184 A
NON-LINEAR SYSTEMS, INC. DEL MAR CALIFORNIA
SCHEMATIC, SERIAL PORTS
ROBIE
SIZE C | CODE IDENT NO. 03626 | 81-297
SCALE | WEIGHT | SHEET 2E
NEXT ASSY. | FINAL ASSY. | NEXT ASSY. | FINAL ASSY.
APPLICATION | QTY.


REVISIONS
ZONE | LTR. | EFFECT. | DESCRIPTION | DATE | APPROVED
U18 MODEM TMS 99532
U19 DIALER TM399531
U35 Z80A-PIO
U36 CLOCK MM5P167A
J6 = MODEM
J6-3 TIP (GRN)
J6-4 RING (RED)
U NOS. USED: 7, 12, 18, 19, 21, 25, 35, 36, 37, 40, 95, 96, 66
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 FRACTIONS ± 1/32 ANGLES ± 0° 30'
MATERIAL
CONTR. NO.
DRAWN R S 4-28-83
CHECK
APPR R S 9-19-83
RELEASE DATE 3-6-84 KSI
BOARD: 81-184 A
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC MODEM & RTC
ROBIE
SIZE C | CODE IDENT NO. 03626 | 81-297
SCALE | WEIGHT | SHEET 2 F
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

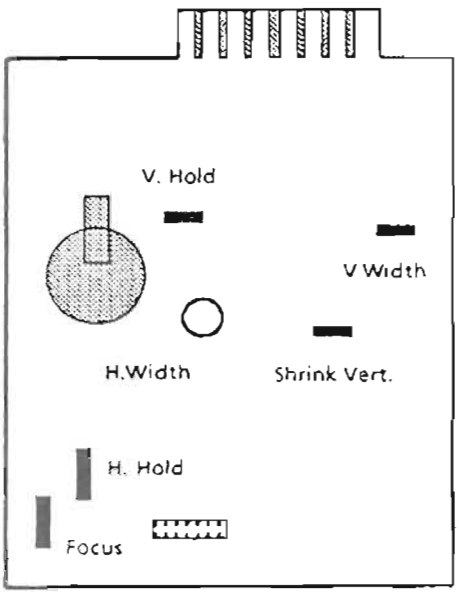
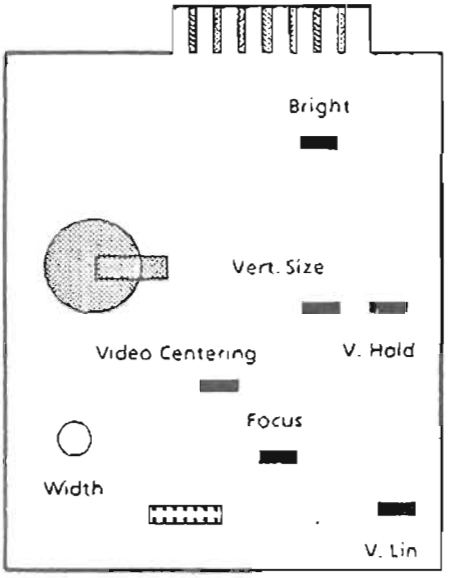


Figure 7.2
Elston video board



VIDEO ADJUSTMENTS

At the current time Kaypro is using CRT assemblies produced by Dotronix, Elston, and Toshiba. The adjustment pots are positioned in different locations on the boards and can be located by using figures 7-1, 7-2, and 7-3. 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

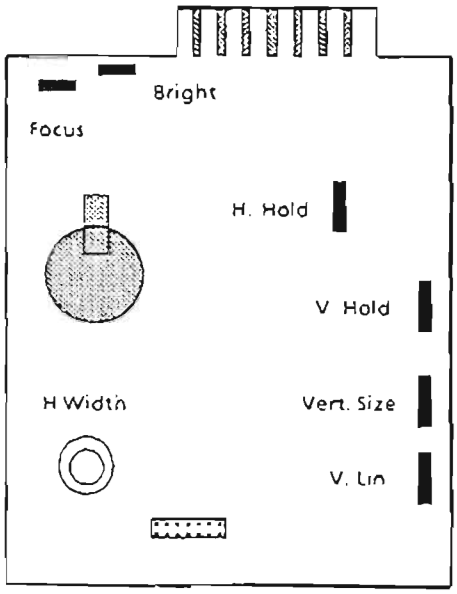
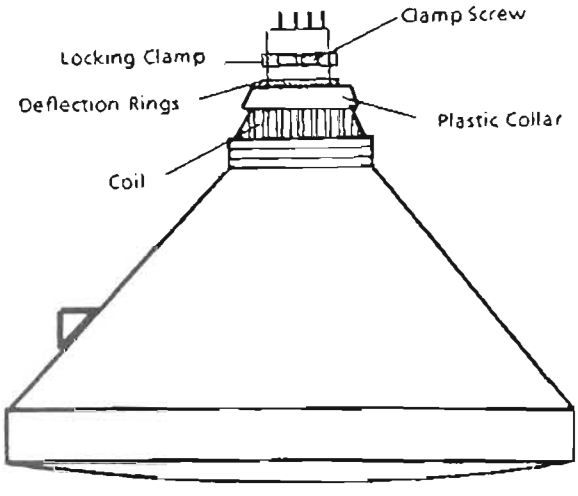


Figure 7.4
Yoke alignment



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

Loosen the screw on the locking clamp (figure 7-4).

Grasp the white collar on the rear of the coil.

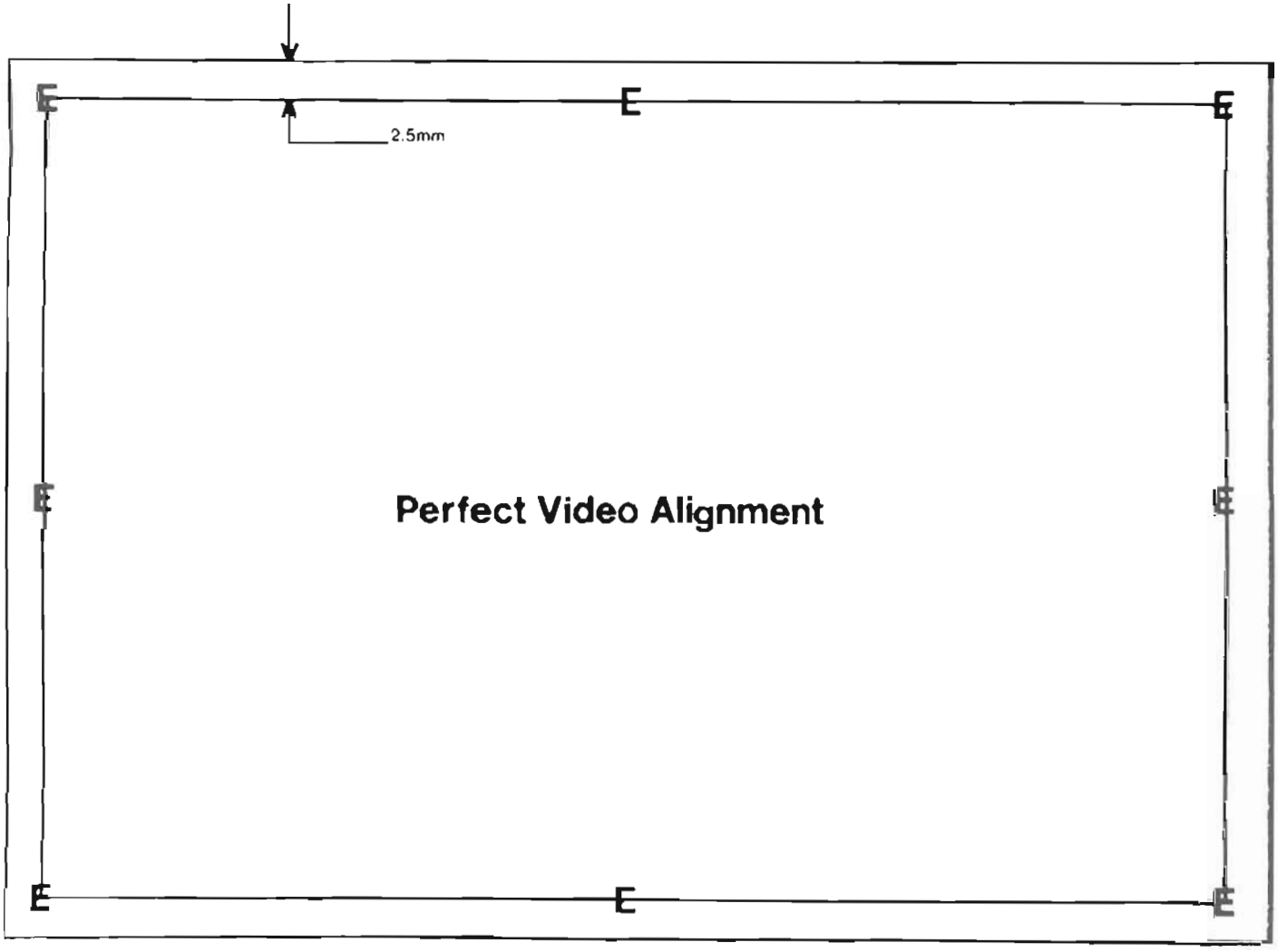
Turn the collar in the direction required to square the display.

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 LISTING OF ALIGN.MAC

If you have the assembly language utilities M-80 and L-80, this diagnostic can be typed into the KAYPRO, then turned into a COM file by running M-80, then L-80.

```
     ************************************************************************

; kaypro alignment test routine
;
; first a program to move this routine above 8000h
; so we can turn on the other page of memory
; and address the video page directly
;
start:
        ld      hl,first+1
        ld      de,dest
        ld      bc,last-first1
        ldir
        jp      dest
;
dest    equ     08000h
first:  defb    0
;
        .phase dest
;
;beginning of the program
; first turn off the drives and turn on the vid page
;
first1:
        in      a,(01ch)
        set     7,a     ;turn on the vid page
        set     6,a     ;turn off drives
        res     0,a     ;turn off drive a light
        res     1,a     ;turn off drive b light
        out     (01ch),a
;
        ld      hl,3000h        ;beginning of the vid page
        ld      (hl),'H'
        ld      de,3000h+1
        ld      bc,3*1024               ;how many
        ldir
;
;       now vid page filled with H
;
        ld      hl,msg1
        ld      de,03580h       ;line 12
        ld      bc,80
        ldir
;
        ld      hl,msg2
        ld      de,03600h       ;line 13
        ld      bc,80
        ldir
```

7.4 ALIGN.MAC LISTING (CONTINUED)

```
;
loop:
        call    delay
        call    aon
        call    delay
        call    aoff
        call    delay
        call    bon
        call    delay
        call    boff
        jp      loop
;
;
aon:
        in      a,(Ø1ch)
        set     Ø,a
        out     (Ø1ch),a
        ret
aoff:
        in      a,(Ø1ch)
        res     Ø,a
        out     (Ø1ch),a
        ret
bon:
        in      a,(Ø1ch)
        set     1,a
        out     (Ø1ch),a
        ret
boff:
        in      a,(Ø1ch)
        res     1,a
        out     (Ø1ch),a
        ret
;
delay:
        ld      bc,2
delayØ:
        ld      hl,Ø
delay1:
        dec     hl
        ld      a,h
        or      l
        jp      nz,delay1
        dec     bc
        ld      a,b
        or      c
        jp      nz,delayØ
        ret
;
```

7.4 ALIGN.MAC LISTING (CONTINUED)

```
;
;                '12345678901234567890123456789012
msg1:   defb     'HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH'
        defb     '    KAY','P' OR 080H,'R' OR 080H,'O II    '
        defb     'HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH'
msg2:   defb     'HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH'
        defb     ' crt ad','j' or 080h,'u' or 080h,'stment '
        defb     'HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH'
;
last:
        defb     0,0,0
        end      start
;
```

7.5 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 220V configuration. Each brand of power supply can be configured for 220V 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.

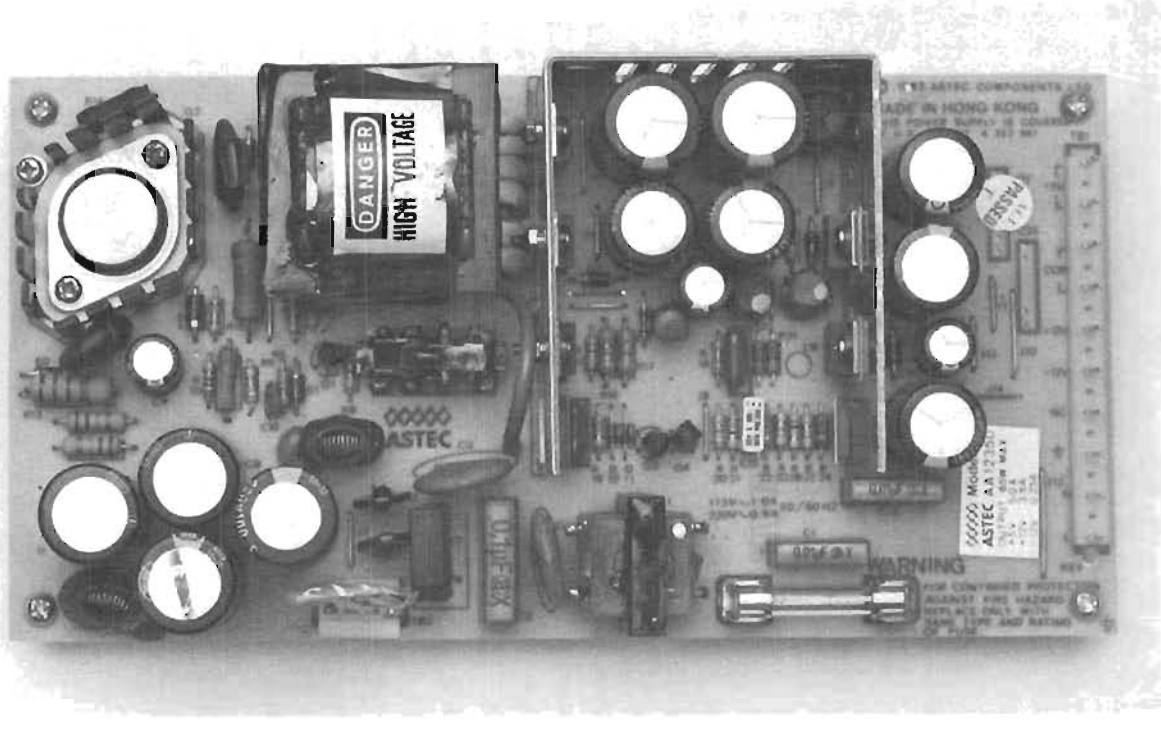
220V CONFIGURATION

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.



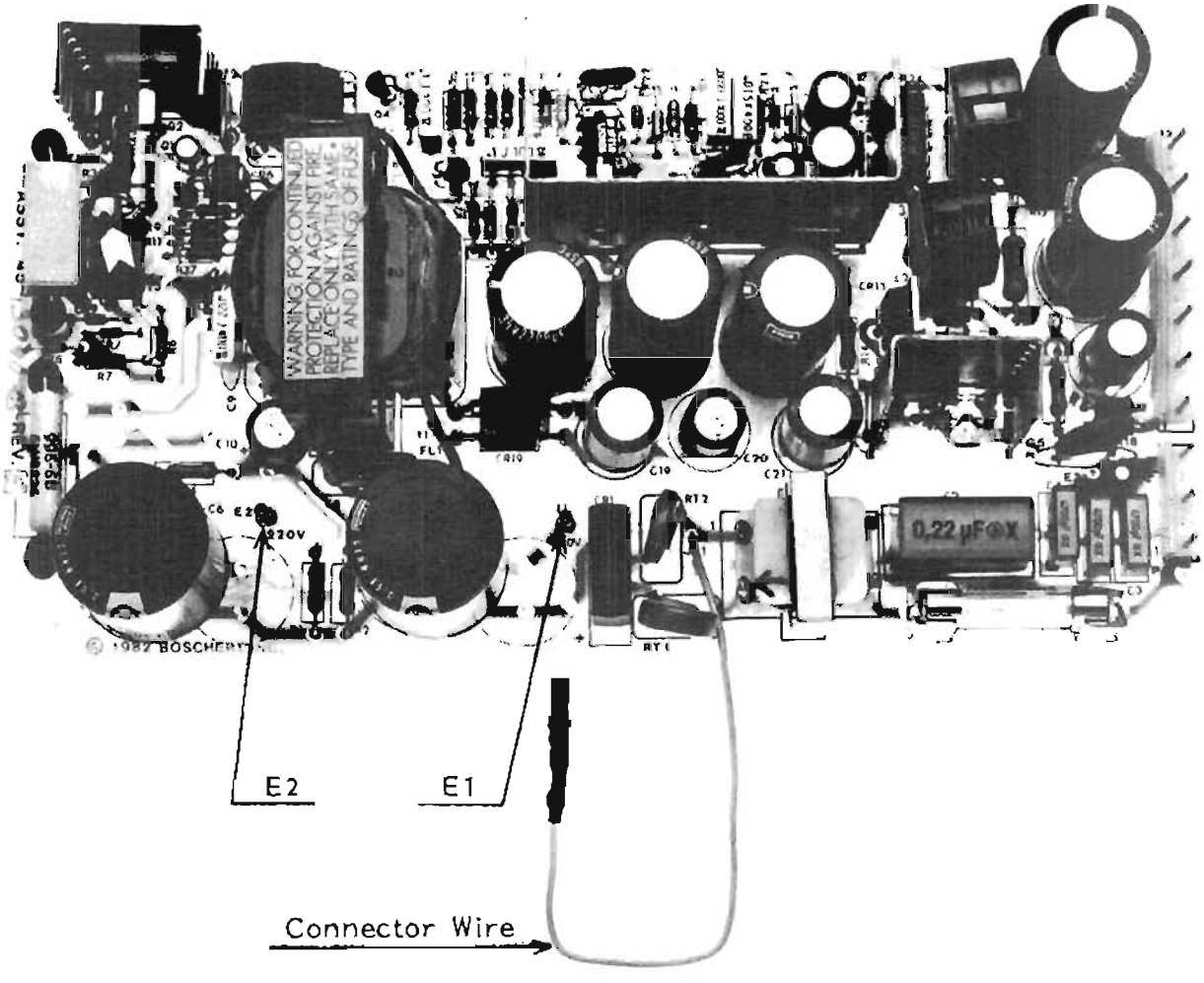
220V CONFIGURATION

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

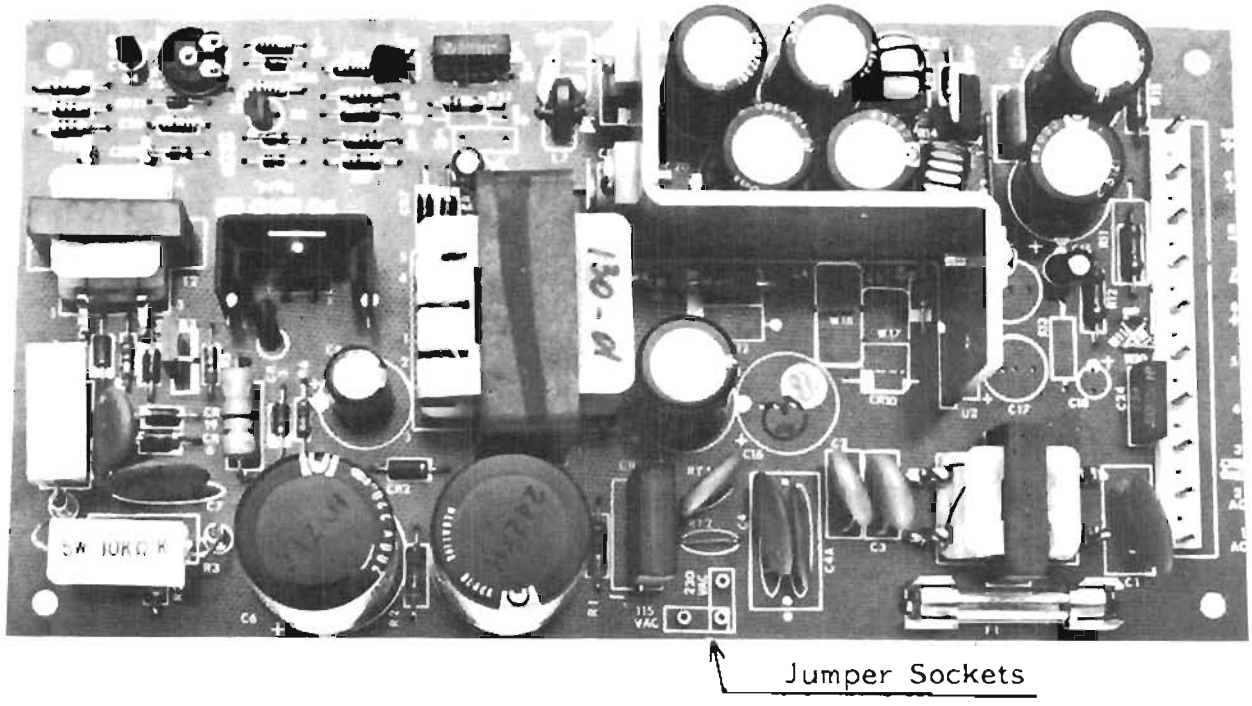
Identified by a bright blue circuit board. A white sticker with "California DC", model, and serial number is located on solder side of board.

There are two ceramic power resistors in the upper right-hand corner of the board. These resistors get quite hot during operation. Wiring should be tied down AWAY FROM THESE COMPONENTS.

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 replace it in the socket labelled 230VAC. The power supply is now configured for 220V use.

CALIFORNIA DC POWER SUPPLY



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 each of the drives. If you have access to a drive manual for a particular model, and have the Dysan Alignment Diskette (Dysan's part number: 224/2A) the knowledge, and an oscilloscope, go ahead and align away. Kaypro Corporation's policy is to do no repairs on these components.

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 #7440
> 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

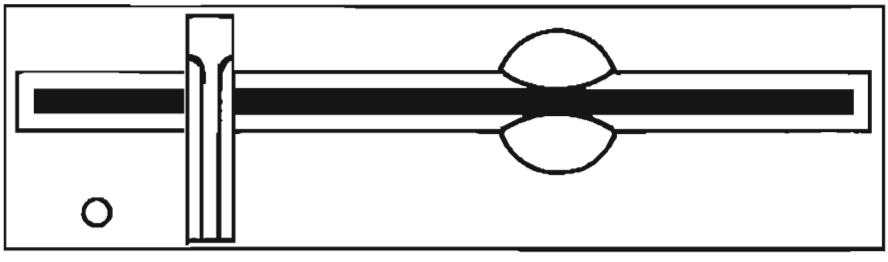


Fig. 9.2, EPSON

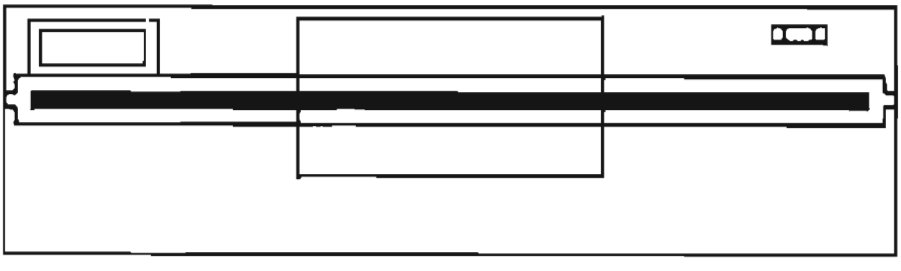


Fig. 9.3, SHUGART

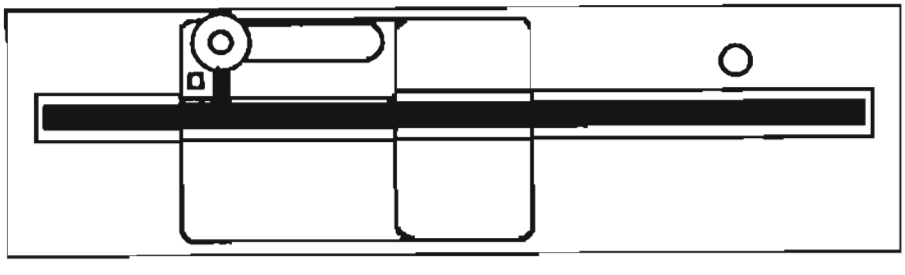


Fig. 9.4, TOKYO ELECTRIC

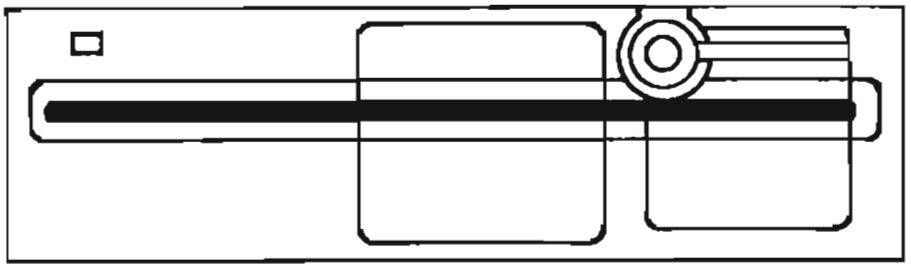


Fig. 9.5, TOSHIBA

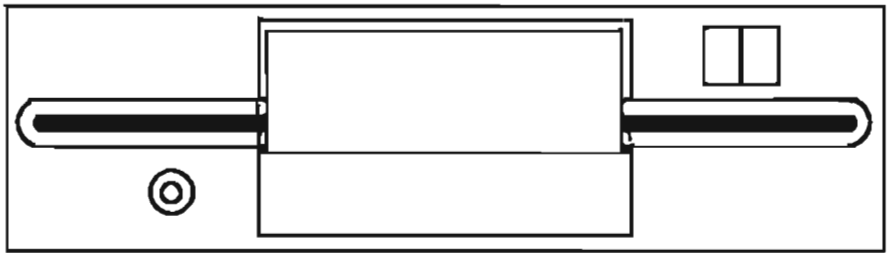


Fig. 9.6, HI-TECH

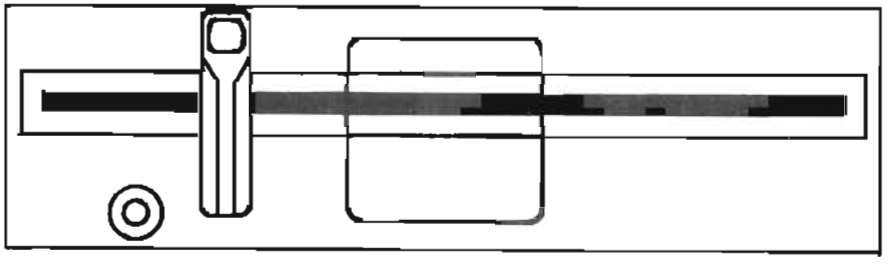


Fig. 9.7, DRIVETEC

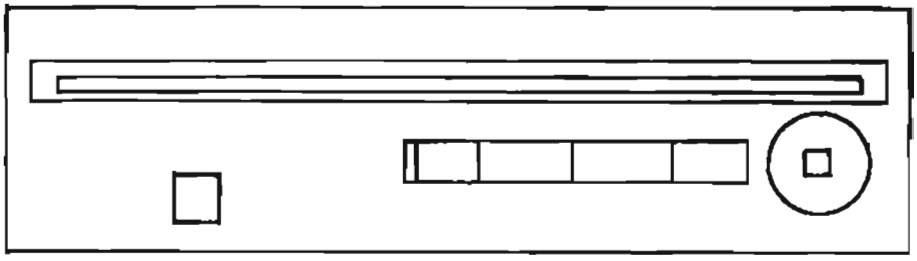
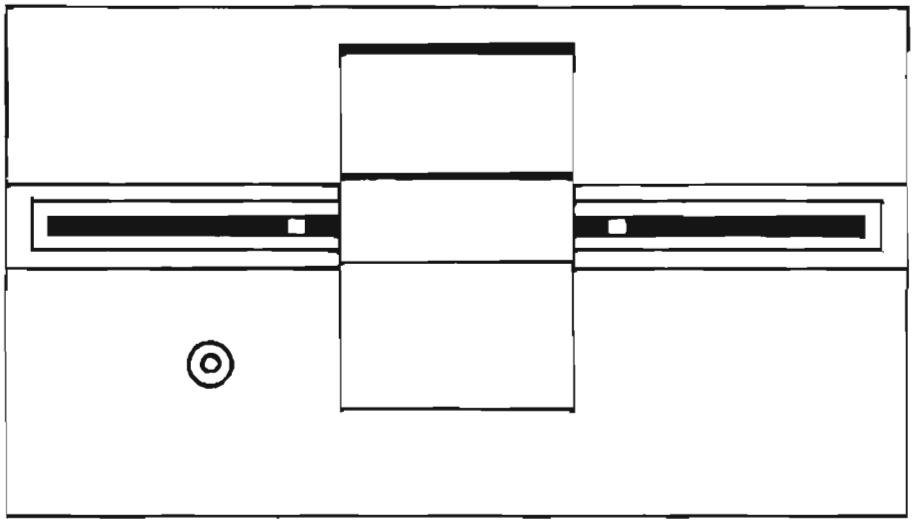
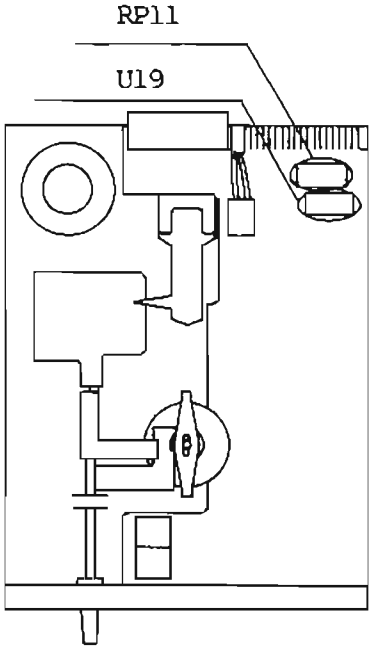


Fig. 9.8, TANDON Full-Height



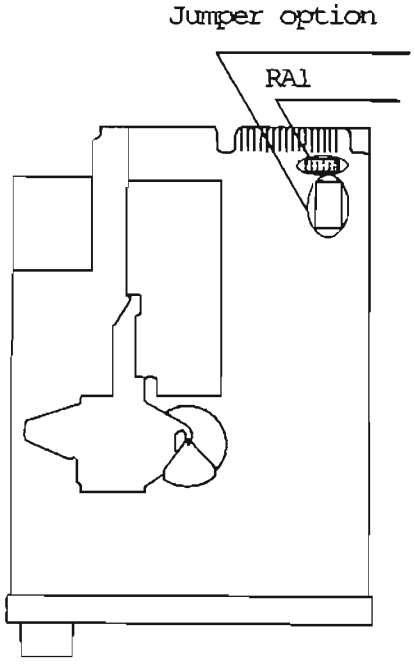
9.3 JUMPERING DIAGRAMS

Figure 9.8
Tandon diskette drive



TANDON
Used only on KAYPRO 10, Pins 2 and 15 on U19 are jumpered and a 470-ohm terminating resistor pack is inserted in RP11.

Figure 9.9
Epson diskette drive



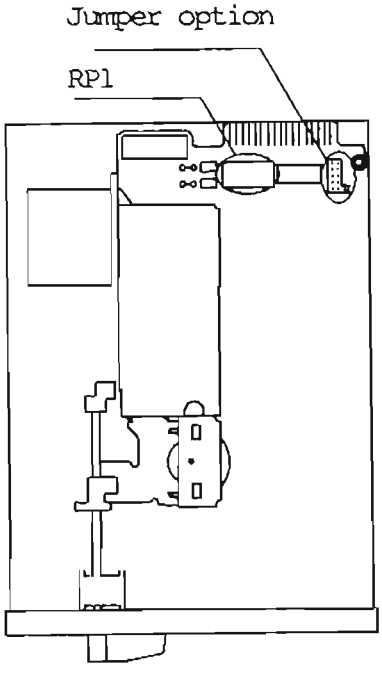
EPSON
Next to the connector for the data cable is a black plug with ten pins. These pins are jumpered to change the configuration of the drive. They are MX, 0, 1, 2, 3.

KAYPRO 10: The two pins in the "0" position should be jumpered and a 470-ohm terminating resistor inserted in RA1.

A DRIVE: Jumper the two pins in Epson diskette drive the "0" position. No terminating resistor is needed.

B DRIVE: Jumper the two pins in the "1" position. Insert a 470-ohm terminating resistor into RA1.

Figure 9.1Ø
Shugart diskette drive



SHUGART

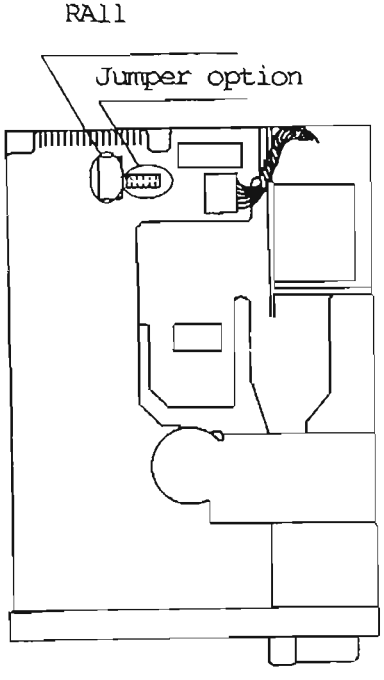
Next to the connector for the data cable is a blue plug with eleven pins. These pins are 1, 2, 3, 4, MX.

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

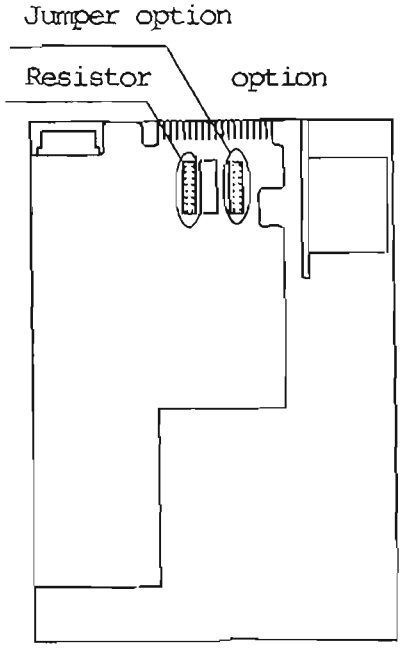
Next to the connector for the data cable is a blue plug with ten pins. These pins are DSØ, DS1, DS2, DS3, MX.

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

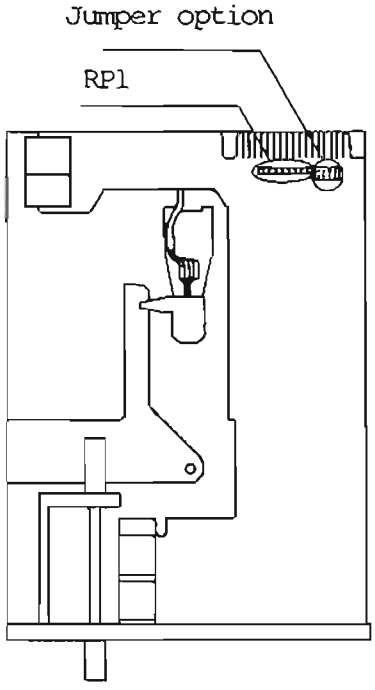
Next to the connector for the data cable is a black plug with sixteen pins. These are 1, 2, 3, 4, LI, LD, HD, HM. Next to the black plug, is a 470-ohm terminating resistor with the letters "DM" to the left of it. Locate this resistor. On the other side of the resistor is another black plug. This plug 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.

Figure 9.13
Hi-Tech diskette drive



HI-TECH

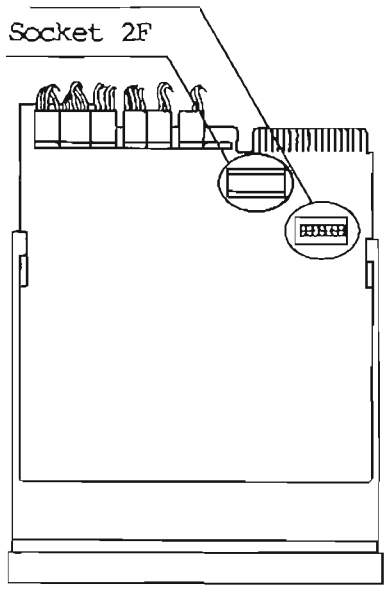
Next to the connector for the data cable is a black plug with eight pins. These pins are DSØ, DS1, DS2, DS3.

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 2 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, and KAYPRO 4X. 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

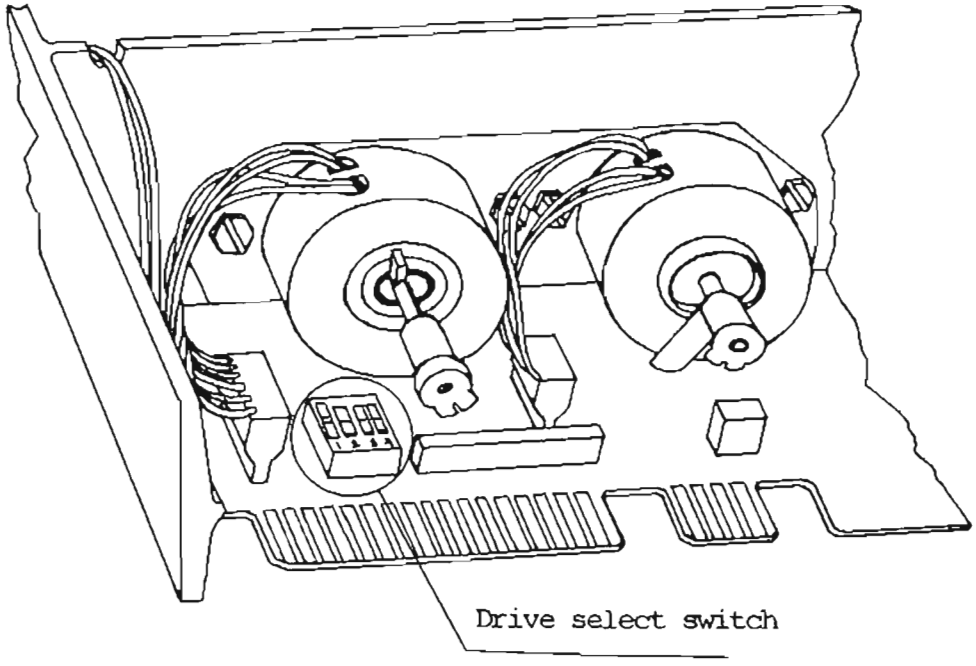
The diskettes used with the high-density drives MUST be pre-formatted 17 sector, 192 TPI diskettes.

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.

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



10.0 HARD DISK DRIVES (KAYPRO 10)

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, for that matter) on these 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, however---most hard disk problems can be corrected without the need to replace the drive itself. (See the symptom-fix guide.) 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 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

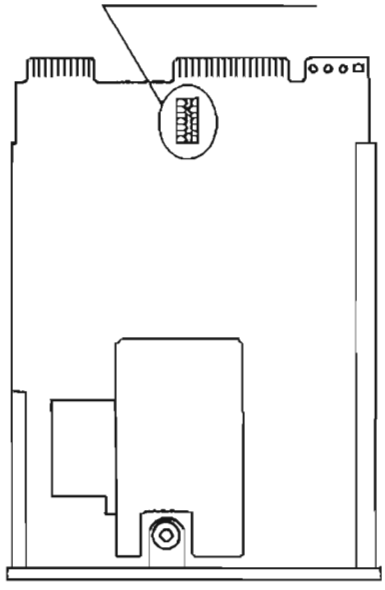
10 POSITION SWITCH: Pins 1, 3, 4, and 10 should be in the up position.

Refer to Figures 10.1 and 10.2 for Microscience drive configuration.

SEAGATE

Figure 10.3
Seagate Hard Drive

Option shunt block



Next to the connector for the data cable, is a 16 pin option shunt block. Pins 7 and 10 should be jumpered.

Refer to figure 10.3 for Seagate drive configuration.

10.4 HARD DRIVE OR FLOPPY DRIVE REMOVAL FOR KAYPRO 10

For all hard drives and all diskette drives used in KAYPRO 10 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, 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

1. Configure the new drive. Refer to page 10--3 for the hard drive, pages 9--4 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 DRIVE 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

12.1 DESCRIPTION

The interface board that is used on the KAYPRO 1Ø 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.

—→ COLORED TAB: TROUBLESHOOTING

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

KAYPRO 2 AND 4 SYMPTOM—FIX GUIDE (CONTINUED)

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-x (installed at the factory), or has been upgraded in the field with kit number 31-303 (consisting of eprom number 81-302-x, a modified interface board, and a utilities reload diskette.)

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

15.4 KAYPRO ROBIE 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 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
No video 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; be sure plug on rear of CRT tube is square

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.

---> COLORED TAB: I/O AND REFERENCE

16.Ø KAYPRO SYSTEM I/O

16.1 VIDEO COMMAND PROTOCOL

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

The above is no longer true for the current Kaypro line. The change to graphics and the differences in cursor control keys caused the change.

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

	VERSION 2.2F AND LOWER		VERSION 2.2G	
Action	Dec	Hex	Dec	Hex
Ring Bell	Ø7	Ø7		
Cursor left (non-destructive)	Ø8	Ø8	19	13
Cursor Right	12	ØC	Ø4	Ø4
Cursor Down	1Ø	ØA	24	18
Cursor Up	11	ØB	Ø5	Ø5
Erase to end of screen	23	17		
Erase to end of line	24	18	Remaining codes	
Clear screen, home cursor	26	1A	are the same as in	
Home cursor	3Ø	1E	2.2G (and lower).	

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 drawings of 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
	DATA 6	8	26
(MSB)	DATA 7	9	27
	N/C	1Ø	28
	BUSY (IN)	11	29
		12	3Ø
	N/C	13	31
		14	32
		15	33
	GROUND	16	34
		17	35
	N/C	18	36

GROUND

N/C

N/C

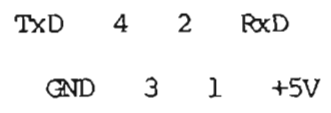
GROUND

N/C

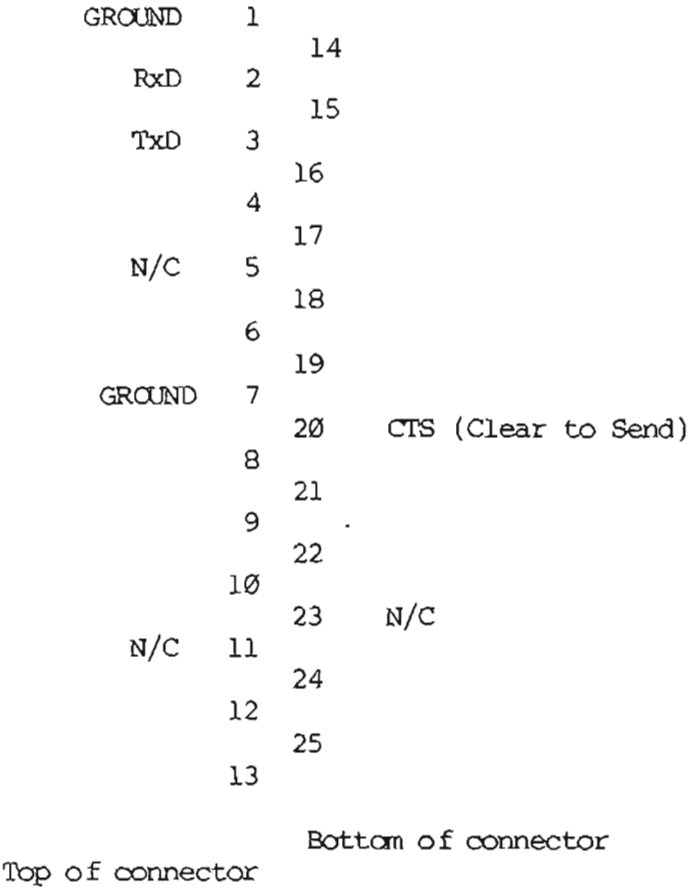
Top of connector Bottom of connector

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.

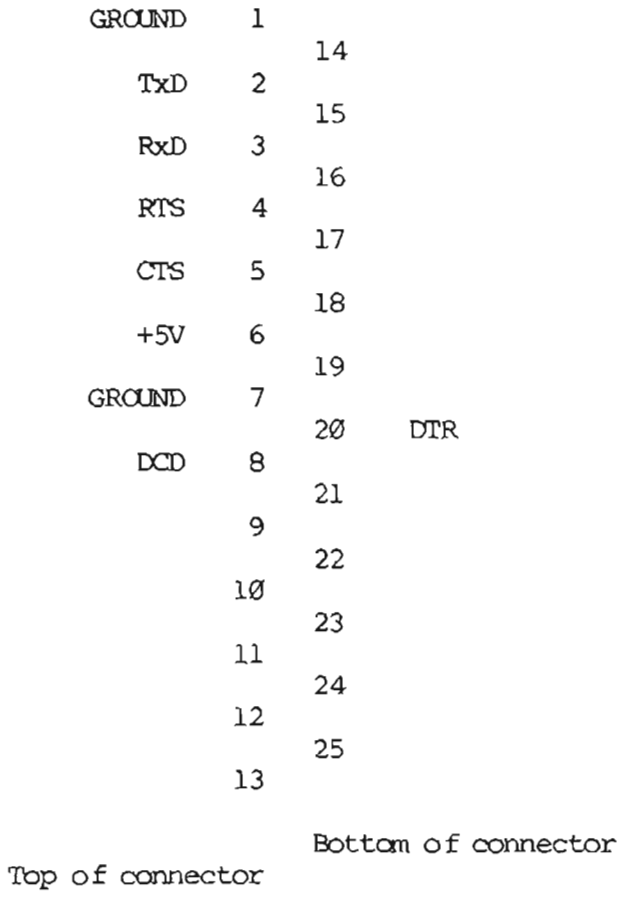
KAYPRO 2/83 AND KAYPRO 4/83 KEYBOARD CONNECTOR (J3)



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



KAYPRO 10 MODEM PORT (J3)



KAYPRO 10 SERIAL PRINTER PORT (RS232C — J4)

The pin-out for this connector is the same as J4 on the KAYPRO 2/83 and KAYPRO 4/83. See page 16—5.

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—5.

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—4.

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—5.

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

The pin-out for this connector is the same as J4 on the KAYPRO 2/83 and KAYPRO 4/83. See page 16—5.

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

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, KAYAPRO 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)	
	20	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 KlØ). 1 Ø=Select floppy B (Hard disk on KlØ). 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 KlØ). 1 Ø=floppy B selected (Hard disk on KlØ). 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.

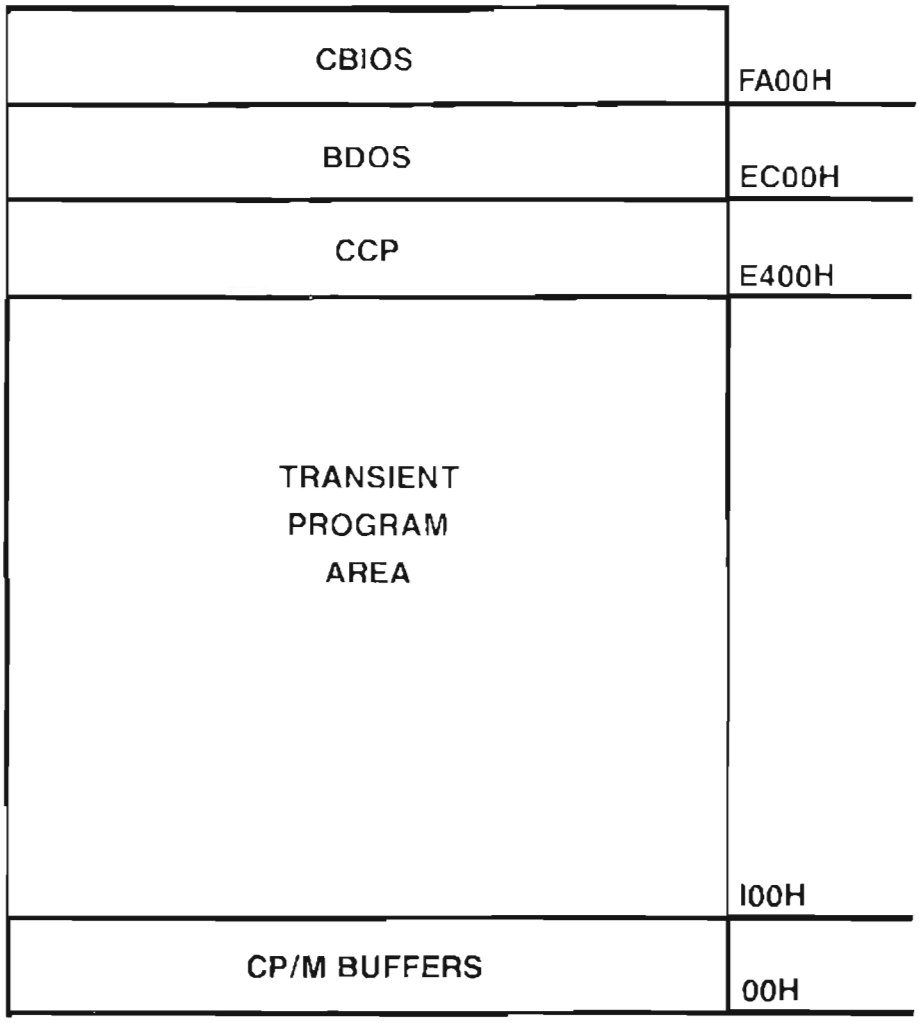
Use	Port# (hex)	Device	Function
	80	WD 1002	Hard disk controller card data I/O port.
	81		Error Register (input). Write Precomp. (output).
	82		Sector count register I/O.
	83		Sector number register I/O.
	84		Cylinder low register I/O.
	85		Cylinder high register I/O.
	86		Size/drive/head register I/O.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

17.Ø REFERENCE SECTION

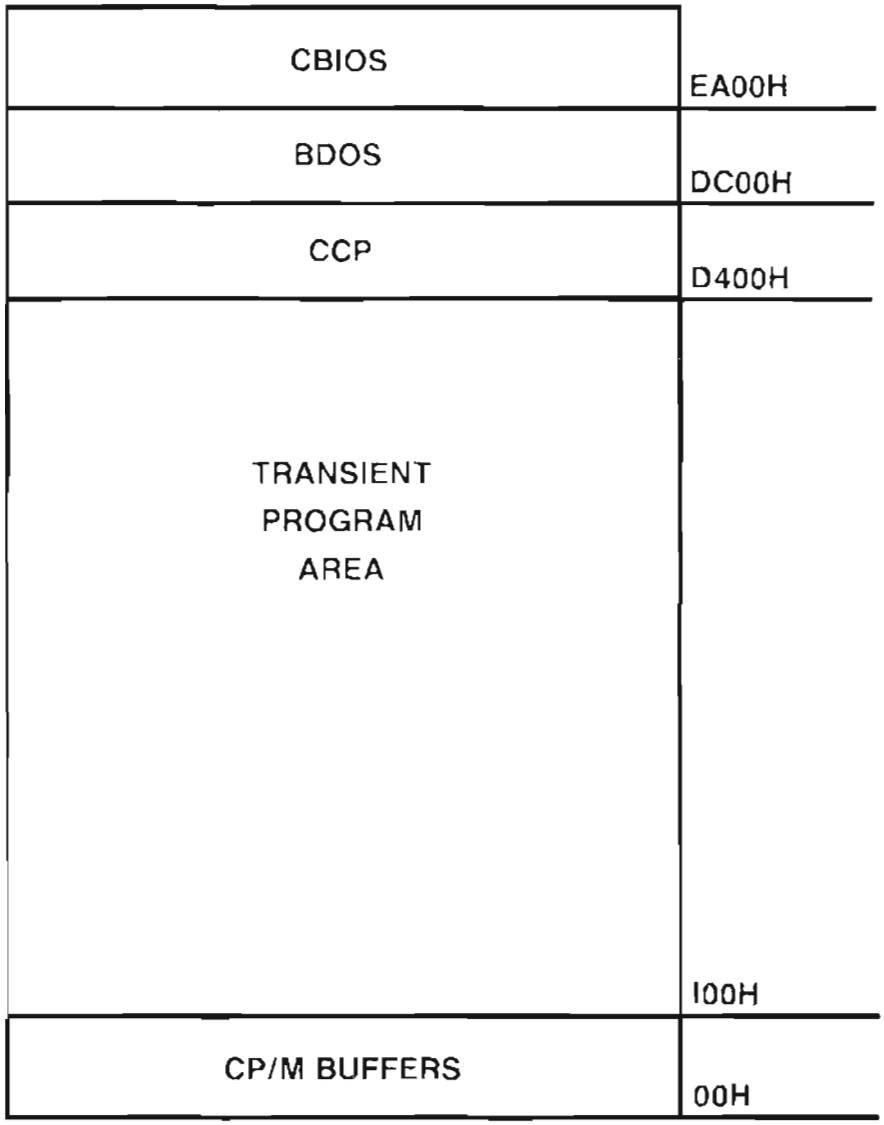
17.1 ASCII CHART

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

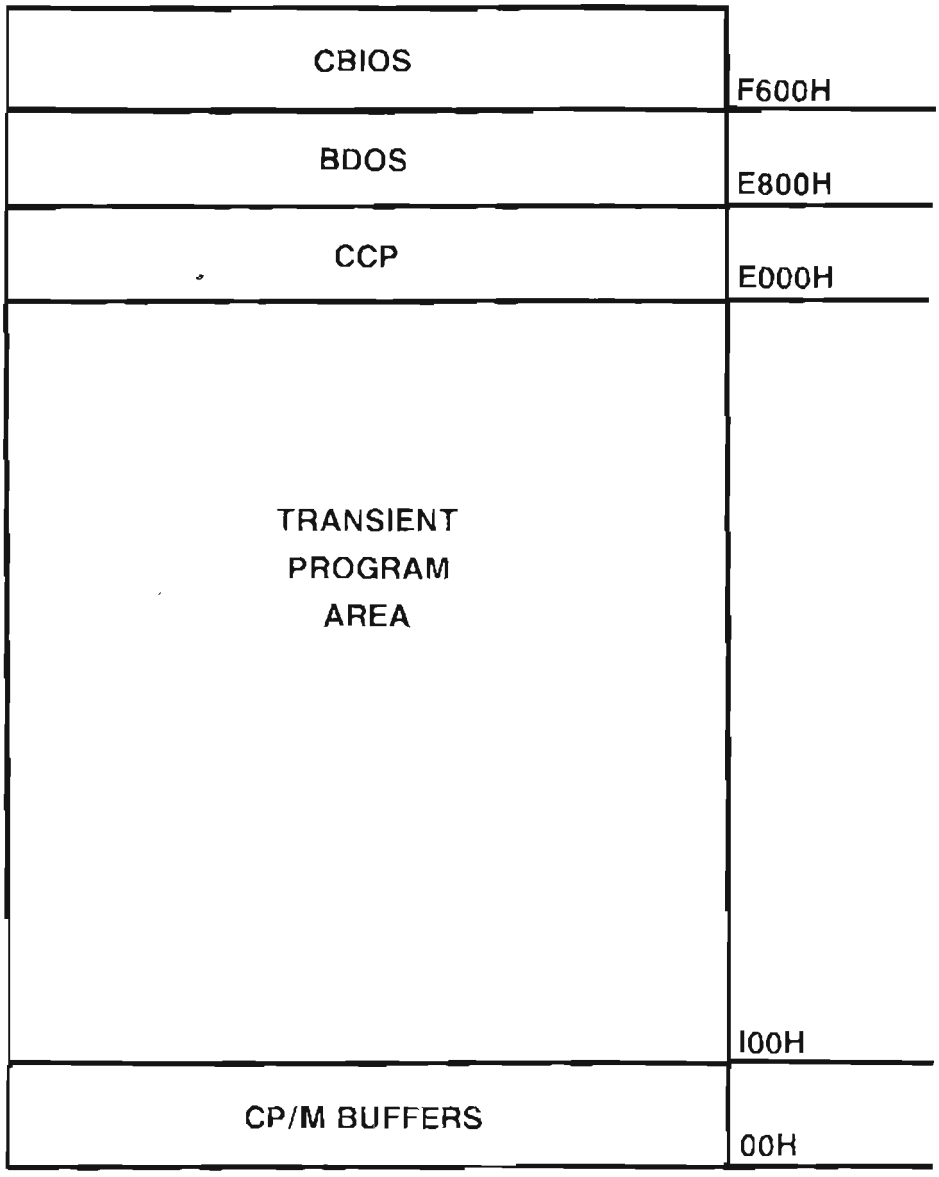
MEMORY MAP OF KAYPRO 2 AND KAYPRO 4



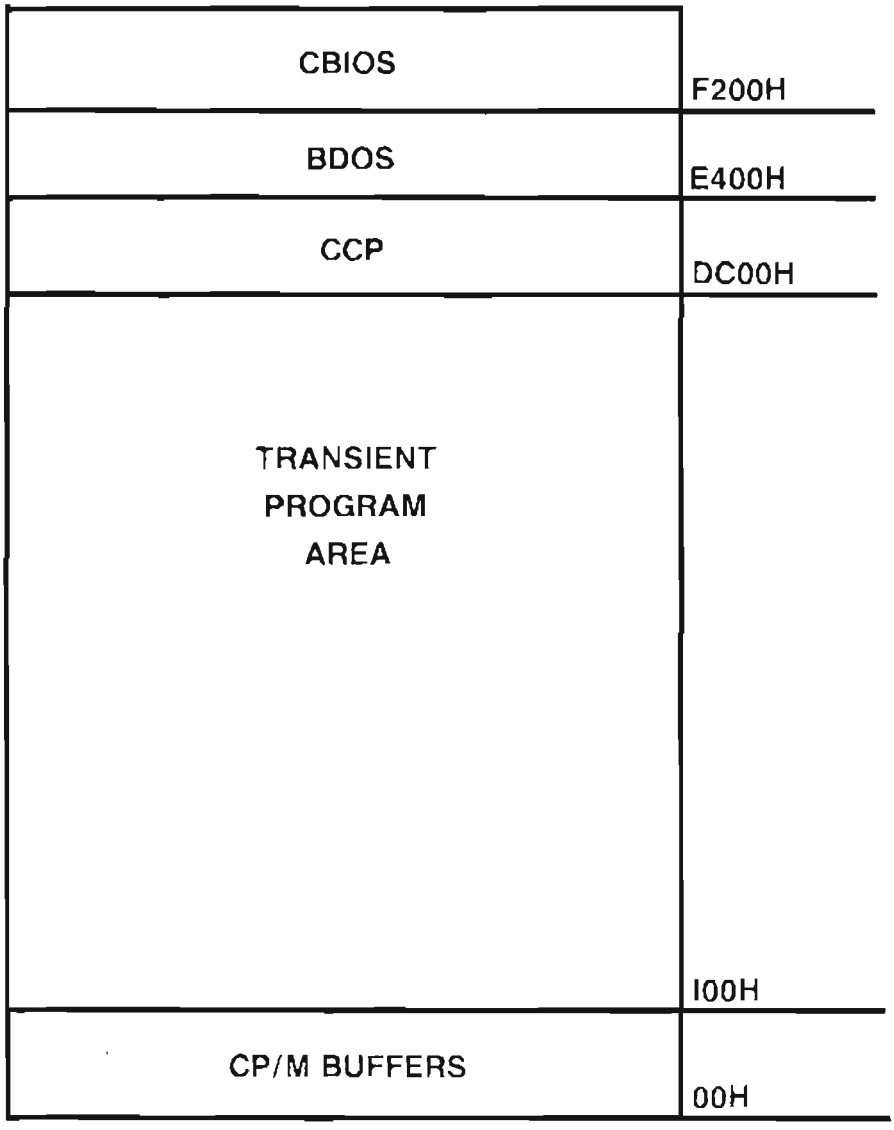
MEMORY MAP OF KAYPRO 10



MEMORY MAP OF KAYPRO 2/84 AND 4/84



MEMORY MAP OF KAYPRO ROBIE



17.4 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 Rd.
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 St.
Chatsworth, Ca. 91311
(213) 993-6644

TEC
1000 E. Walnut St.
Pasadena, Ca. 91106
(213) 681-5631

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 Ave.
Costa Mesa, Ca. 92626

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

CRT Assemblies

Audiotronics
7420 Belair Ave.
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 Ave.
Sunnyvale, Ca. 94086
(408) 732-2240

Cal D.C.
2150 Anehor Court
Newbury Park, Ca. 91320
(619) 275-0671

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. 97709Ø

Modern Dictionary of Electronics, by Rudolf F. Graf, Radio Shack Catalog Number 62-2310

Some **colored markers or pencils** with which 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. (Because of printing costs and problems, Kaypro is unable to supply colored "maps" in the Technical Manual.)

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 WD1002 disk controller board.

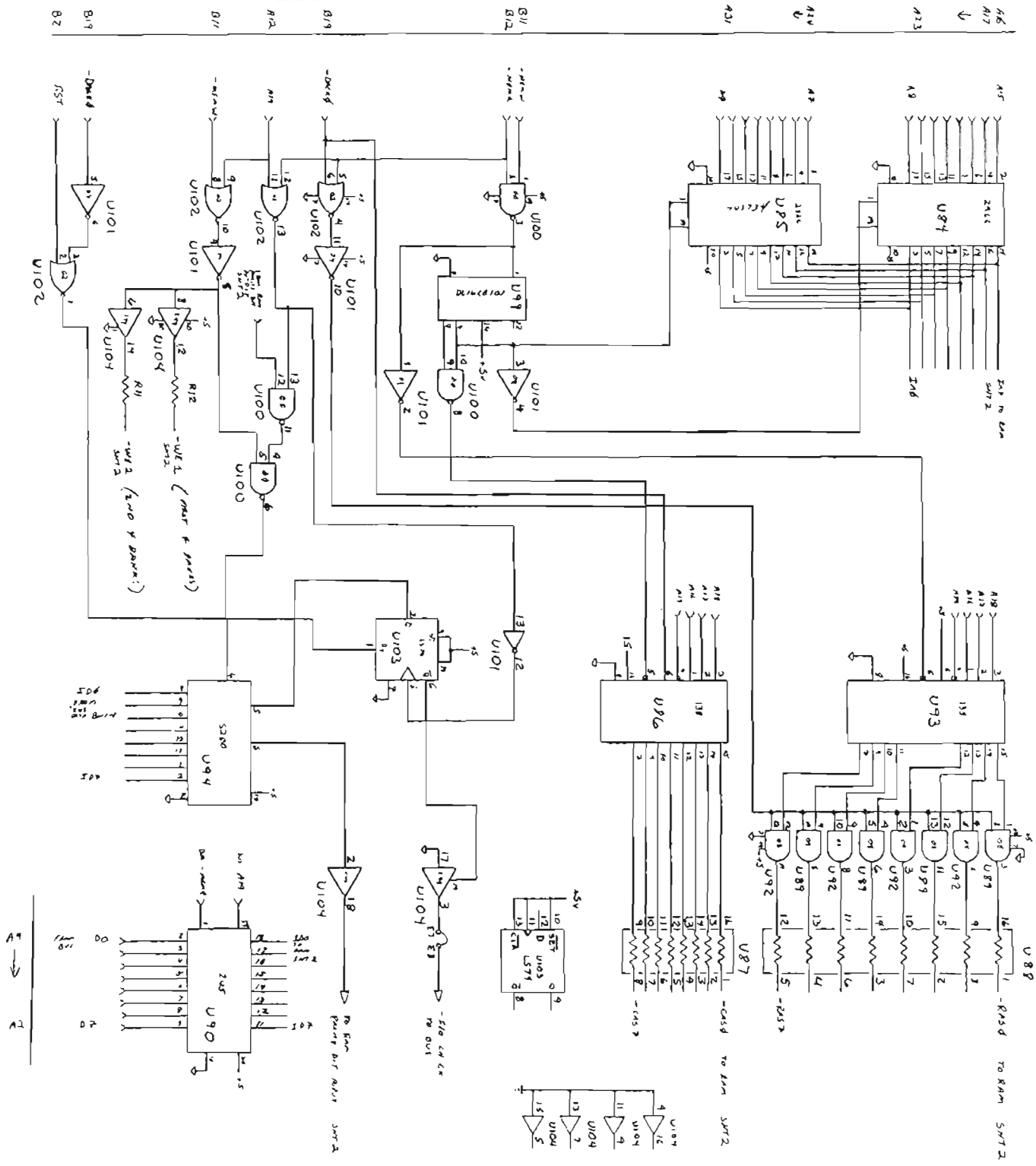
Three cards are standard in the expansion chassis, leaving one slot open for an optional card.

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 8087 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.

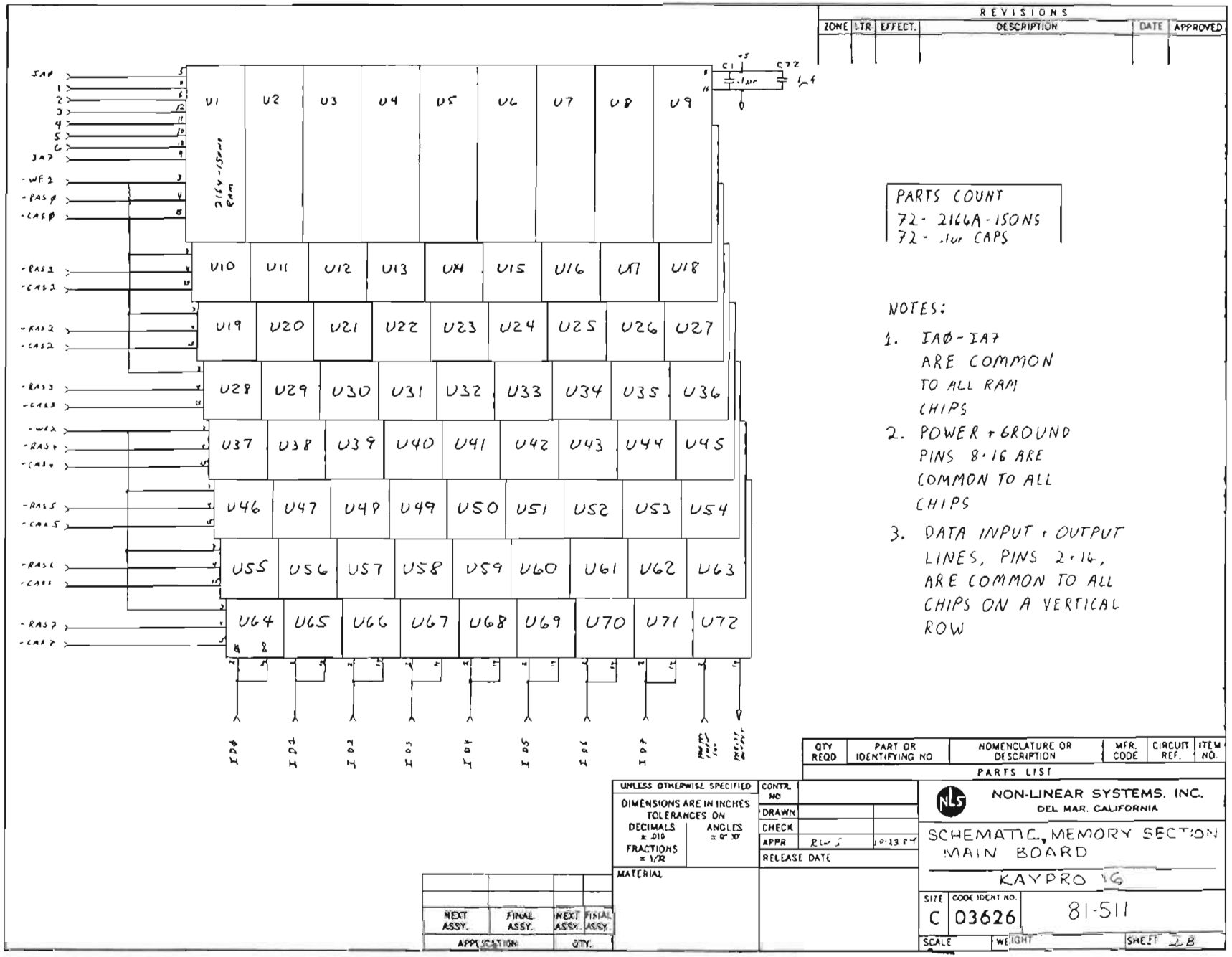
The color graphics card supplies the interface for an external RGB monitor through its DE-9S connector. There is also a connector for composite video on this card. Both of these connectors use industry standard cables.

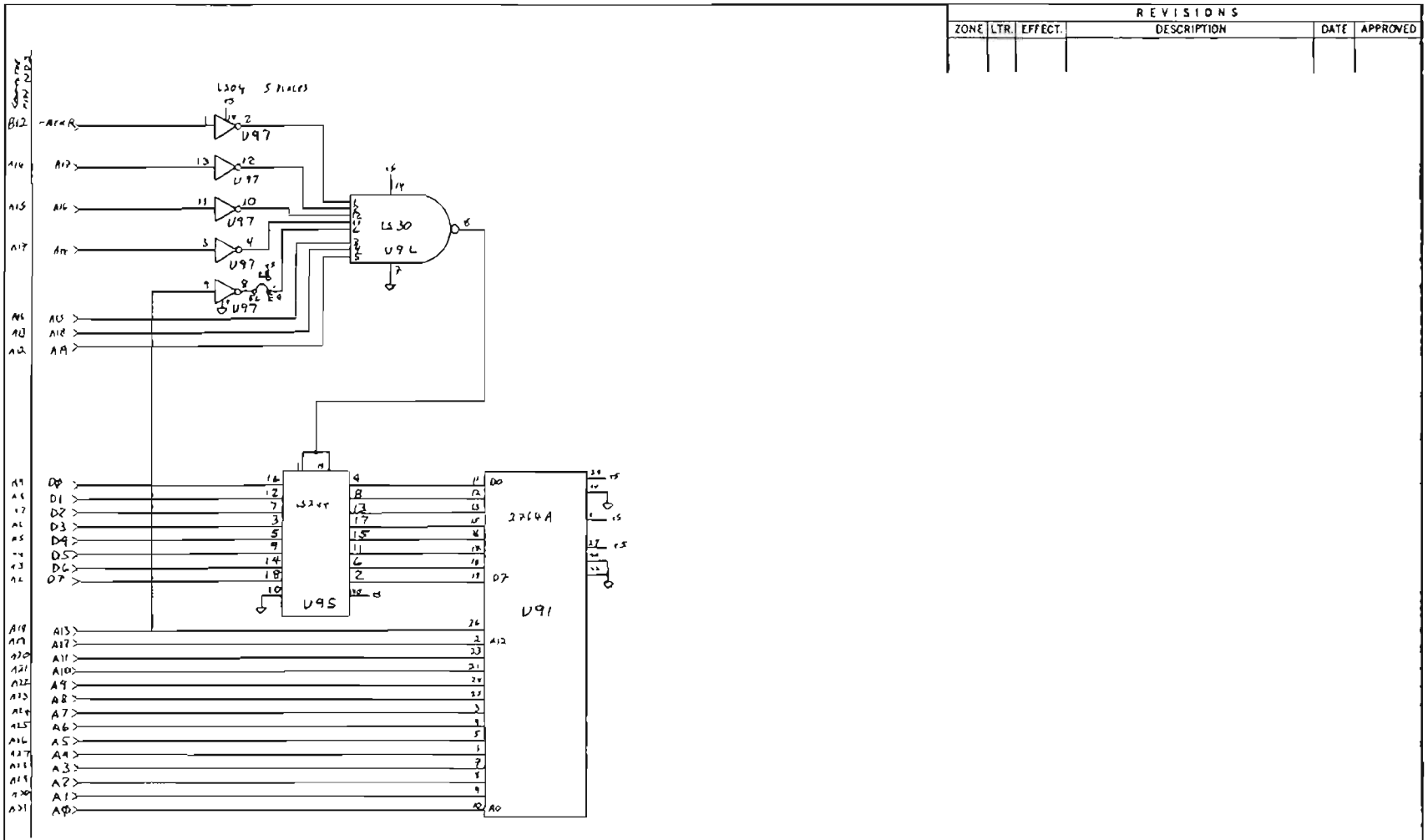
SCHEMATICS: MAINBOARD



A	ALL	MOVED CONN FROM U99-12 TO U99-4. ADDED UNUSED SECTIONS OF U103 & U104	11-9-84 RWJ
LTR	EFFECT	DESCRIPTION	DATE APPRD
		REVISIONS	

SCHEMATIC, RAM SECTION
MAIN BOARD
KAYPRO 16
C 81-511


REVISIONS
ZONE | LTR | EFFECT. | DESCRIPTION | DATE | APPROVED
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 U30 U31 U32 U33 U34 U35 U36
U37 U38 U39 U40 U41 U42 U43 U44 U45
U46 U47 U49 U49 U50 U51 U52 U53 U54
U55 U56 U57 U58 U59 U60 U61 U62 U63
U64 U65 U66 U67 U68 U69 U70 U71 U72
2164-ISONS RAM
C1 .1uF C72 1uF
IA0 IA1 IA2 IA3 IA4 IA5 IA6
-WE1 -RAS0 -CAS0
-RAS1 -CAS1
-RAS2 -CAS2
-RAS3 -CAS3
-WE2 -RAS4 -CAS4
-RAS5 -CAS5
-RAS6 -CAS6
-RAS7 -CAS7
ID0 ID1 ID2 ID3 ID4 ID5 ID6 ID7
PARTS COUNT
72 - 2164A-ISONS
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
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.
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, MEMORY SECTION
MAIN BOARD
KAYPRO 16
SIZE C | CODE IDENT NO. 03626 | 81-511
SCALE | WEIGHT | SHEET 28



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
ANGLES ± 0° 30'
FRACTIONS ± 1/32

MATERIAL

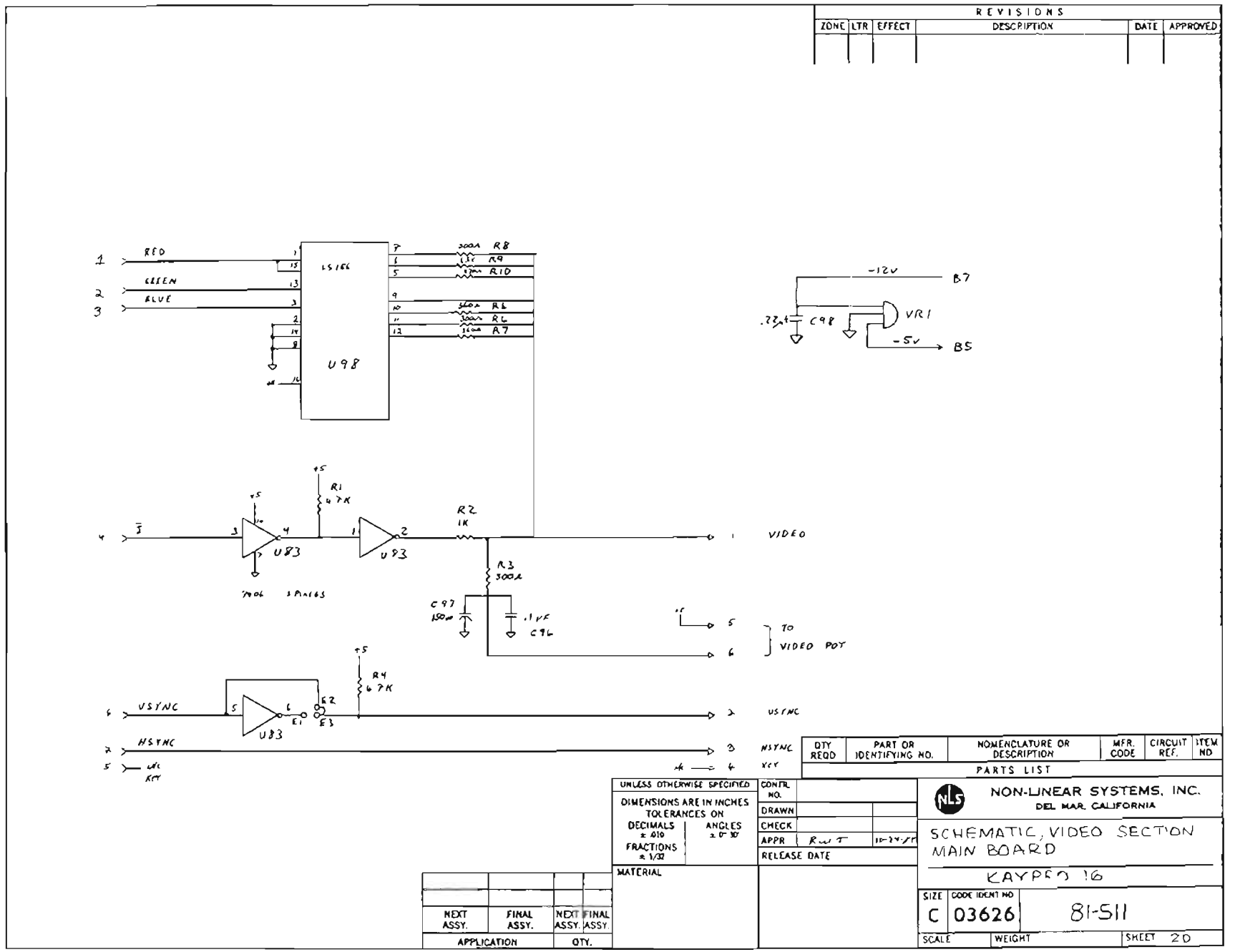
CONTR NO
DRAWN
CHECK
APPR R.W.T 10-14-82
RELEASE DATE

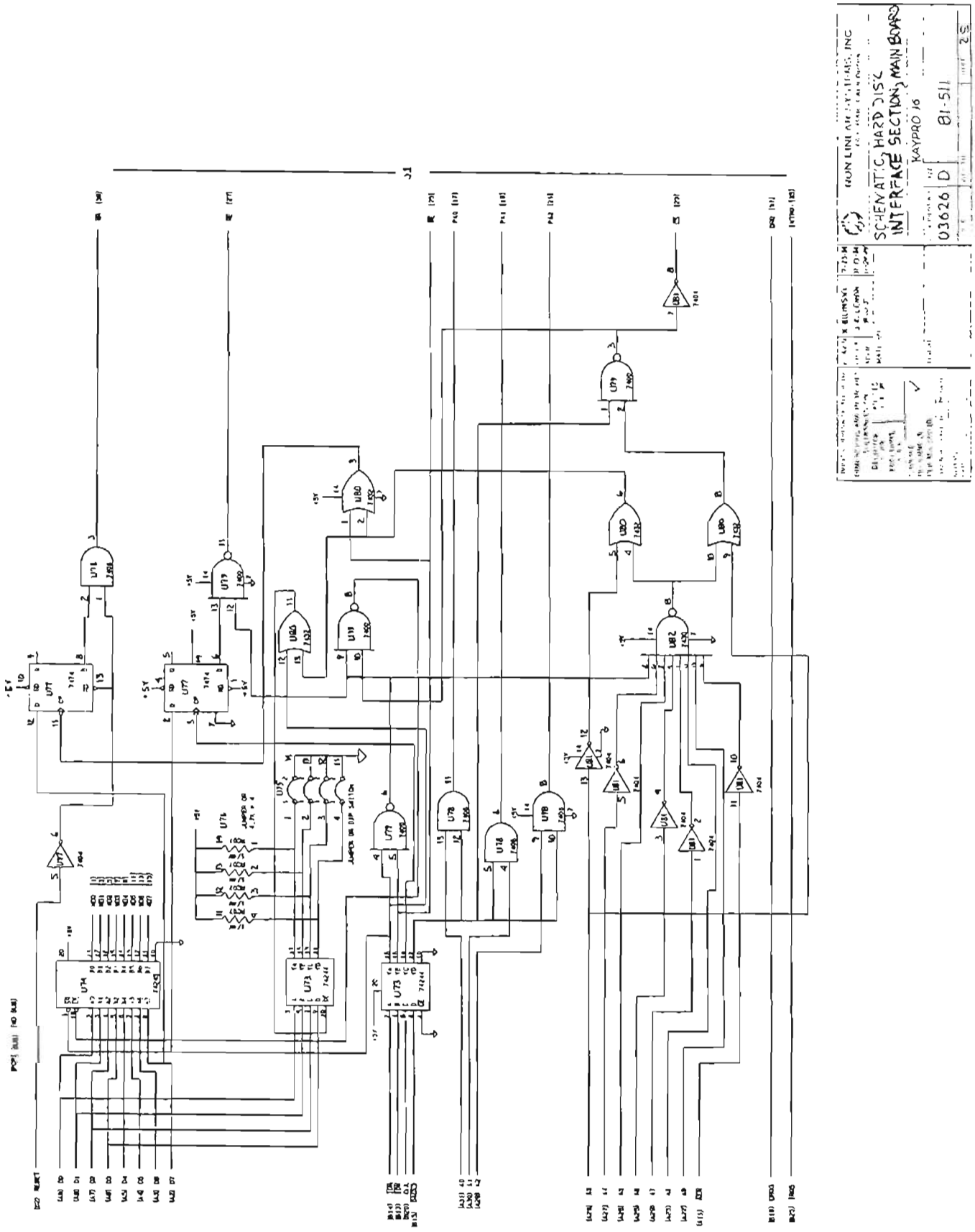
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC, HARD DISK PROM SECTION
MAIN BOARD
KAYPRO 10

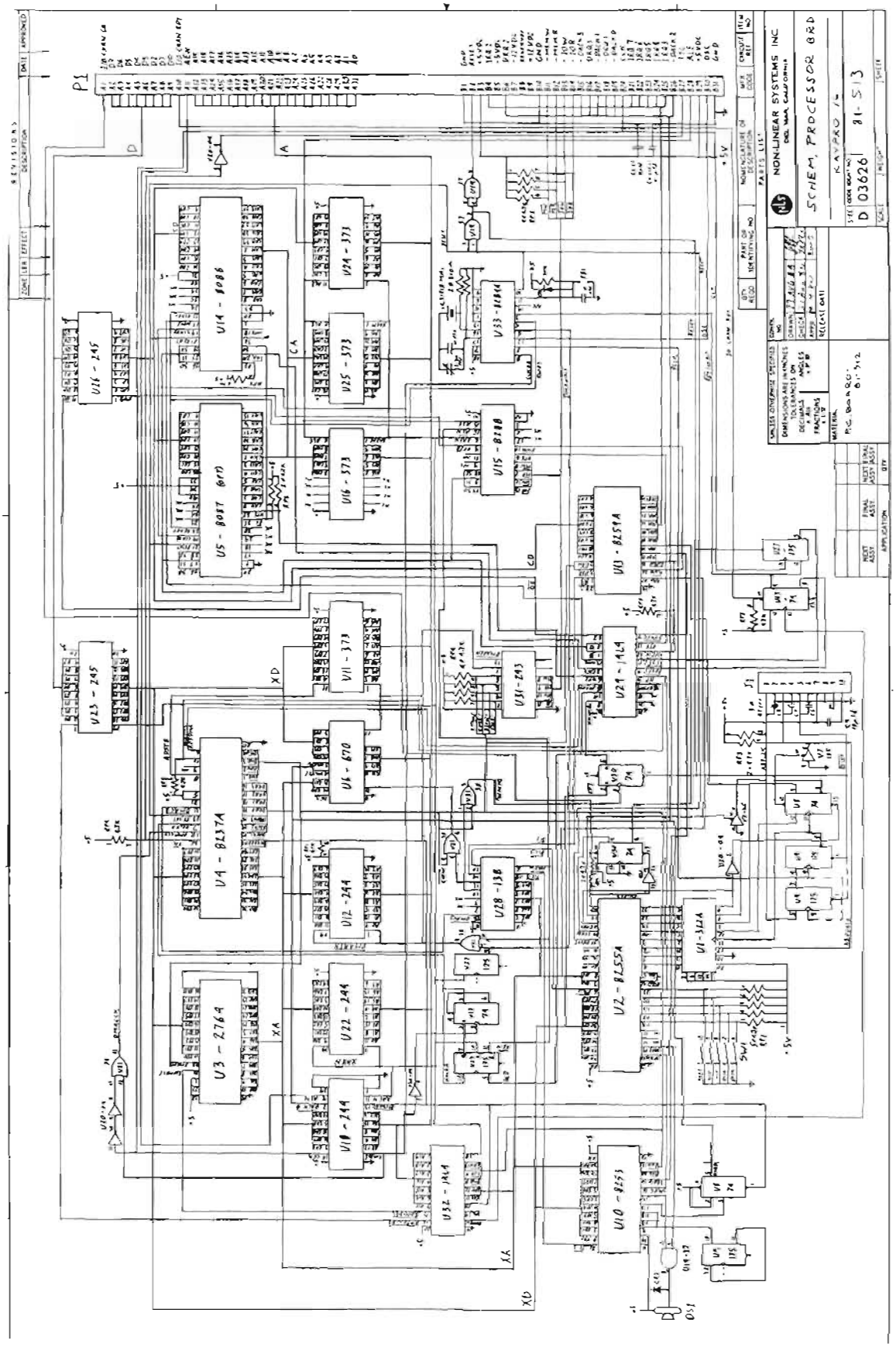
SIZE	CODE IDENT NO.	
C	03626	81-511

SCALE | WEIGHT | SHEET 2C

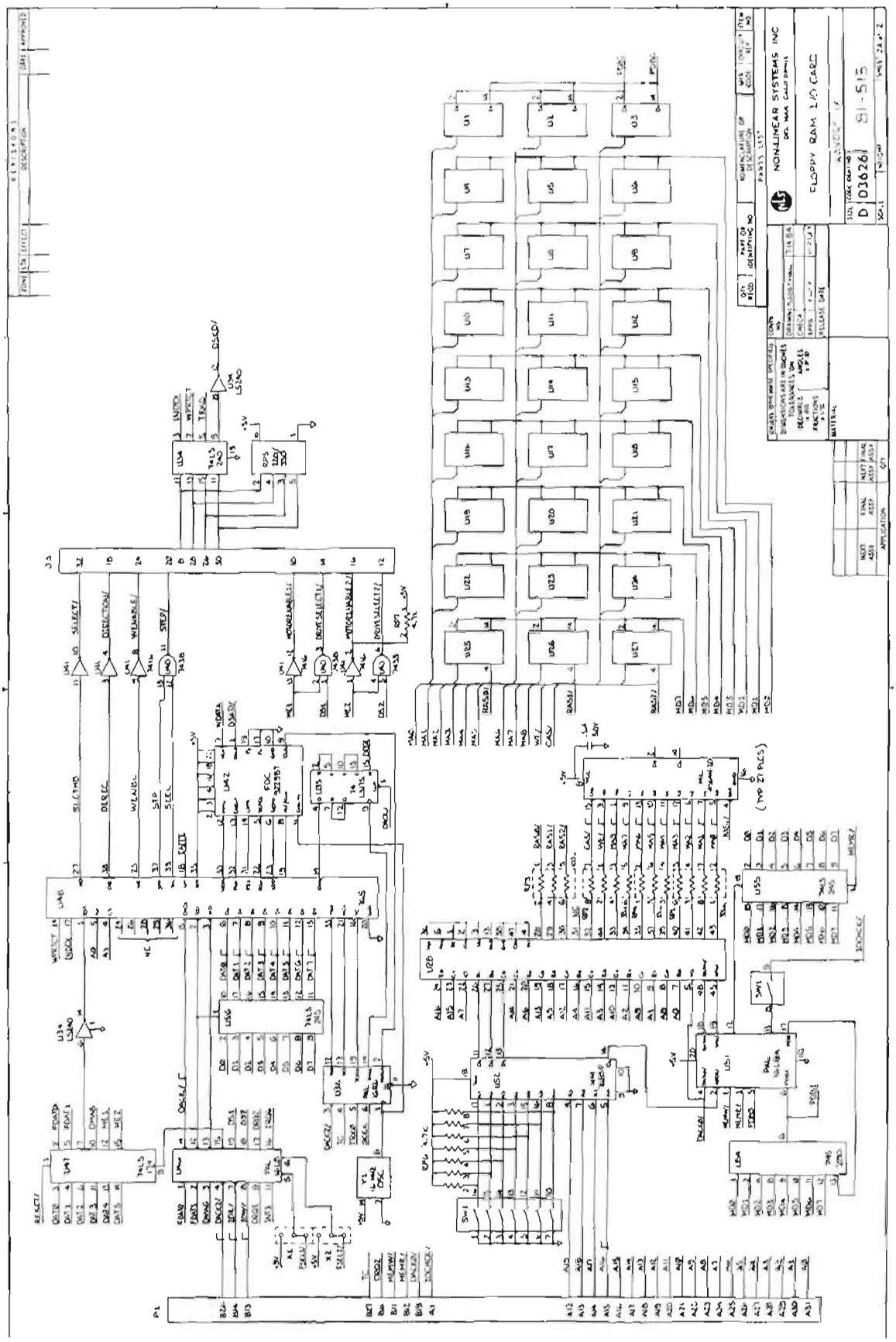

REVISIONS
ZONE
LTR
EFFECT
DESCRIPTION
DATE
APPROVED
RED
GREEN
BLUE
LS166
U98
R8
R9
R10
R5
R6
R7
-12V
B7
C98
VR1
-5V
B5
R1
4.7K
R2
1K
U83
U83
R3
300Ω
C97
150pF
.1μF
C96
VIDEO
TO
VIDEO POT
R4
6.7K
VSYNC
HSYNC
E1
E2
E3
QTY REQD
PART OR IDENTIFYING NO.
NOMENCLATURE OR DESCRIPTION
MFR. CODE
CIRCUIT REF.
ITEM NO
PARTS LIST
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
MATERIAL
CONTR. NO.
DRAWN
CHECK
APPR
RELEASE DATE
NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA
SCHEMATIC, VIDEO SECTION
MAIN BOARD
KAYPRO 16
SIZE
C
CODE IDENT NO
03626
81-511
SCALE
WEIGHT
SHEET 20
NEXT ASSY.
FINAL ASSY.
NEXT ASSY.
FINAL ASSY.
APPLICATION
QTY.


SCHEMATIC, HARD DISK
INTERFACE SECTION, MAIN BOARD
KAYPRO 16
03626 D
81-511

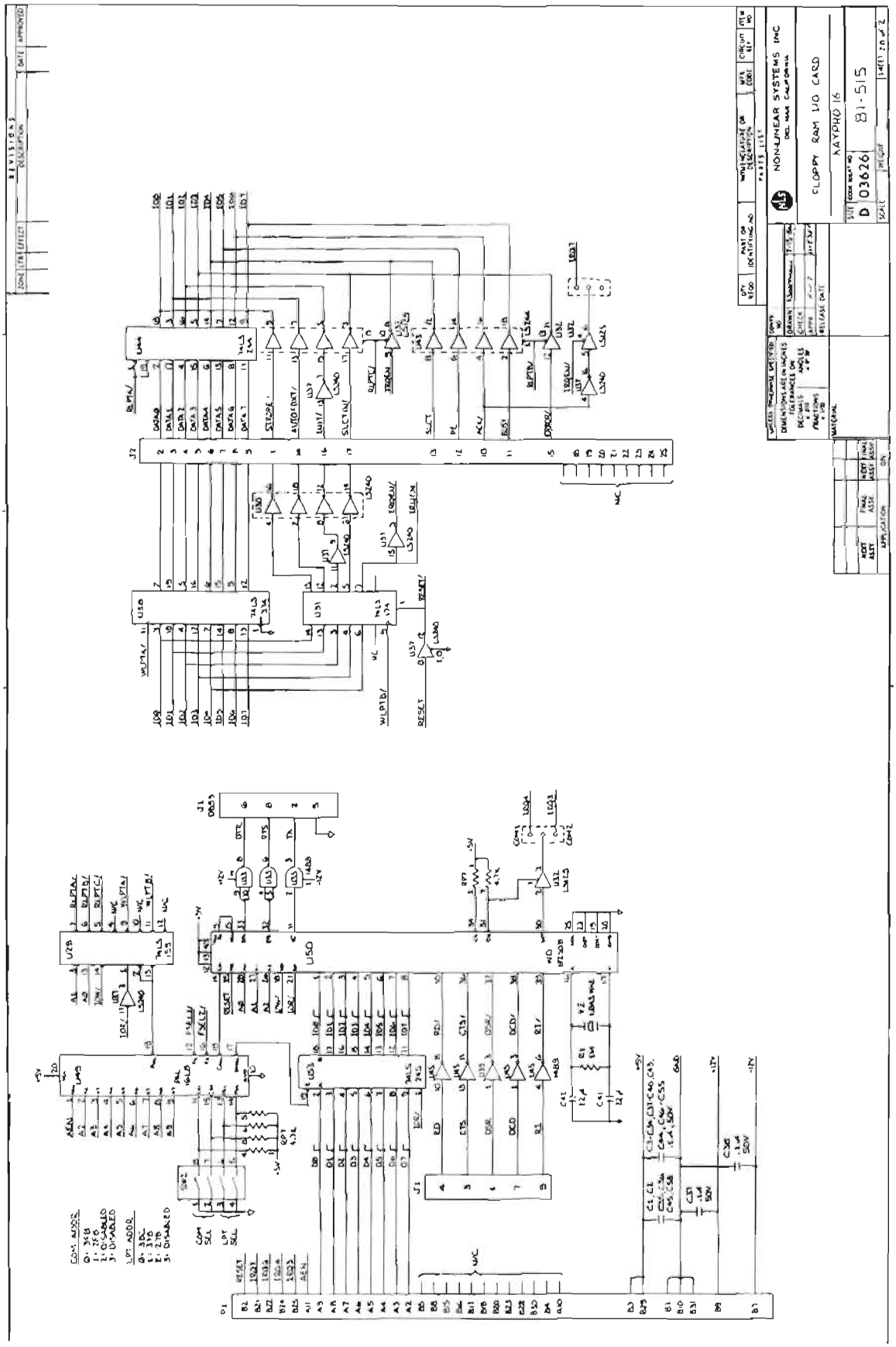
SCHEMATICS: PROCESSOR CARD



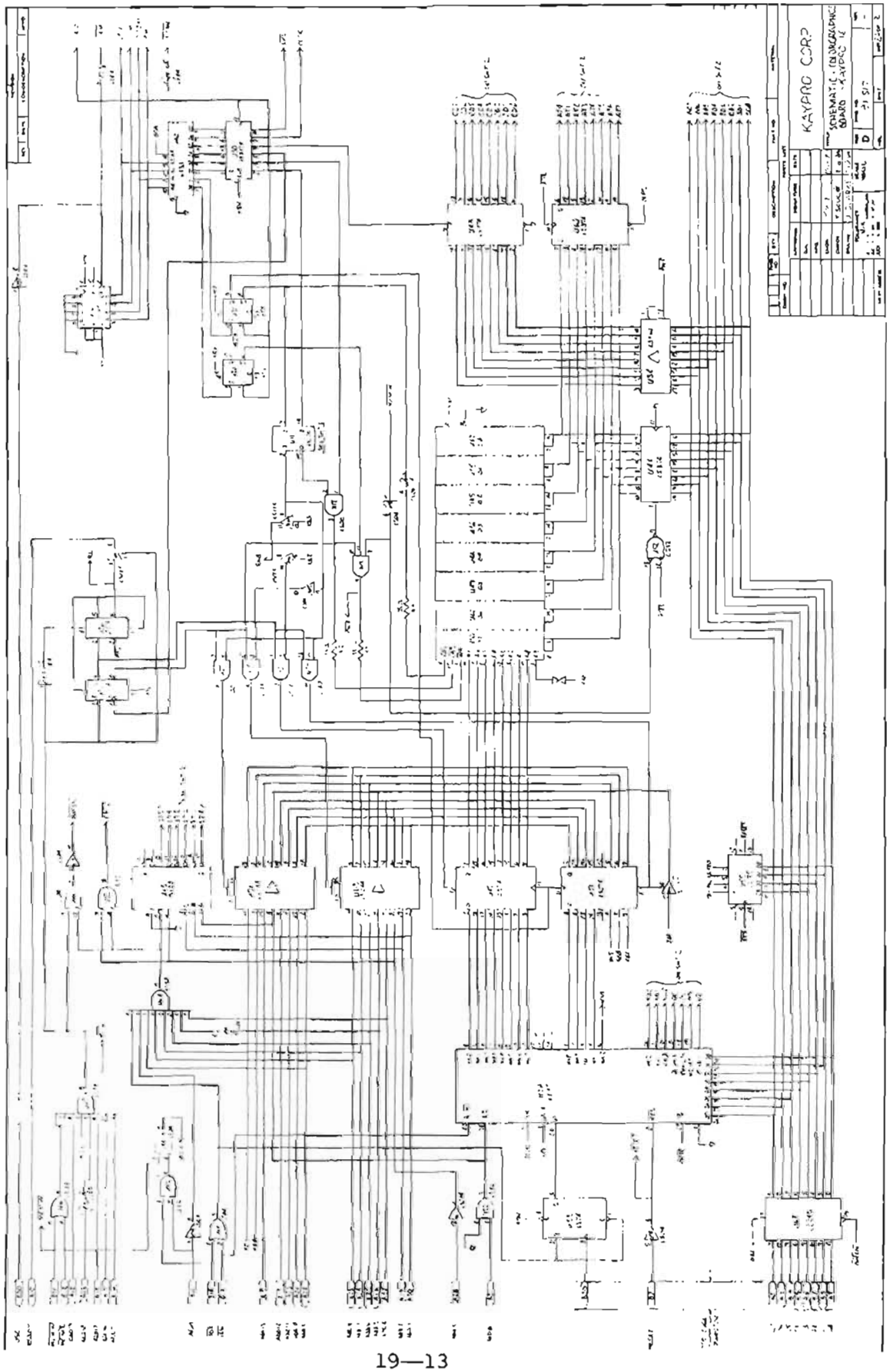
SCHEMATICS: FLOPPY-RAM-I/O CARD



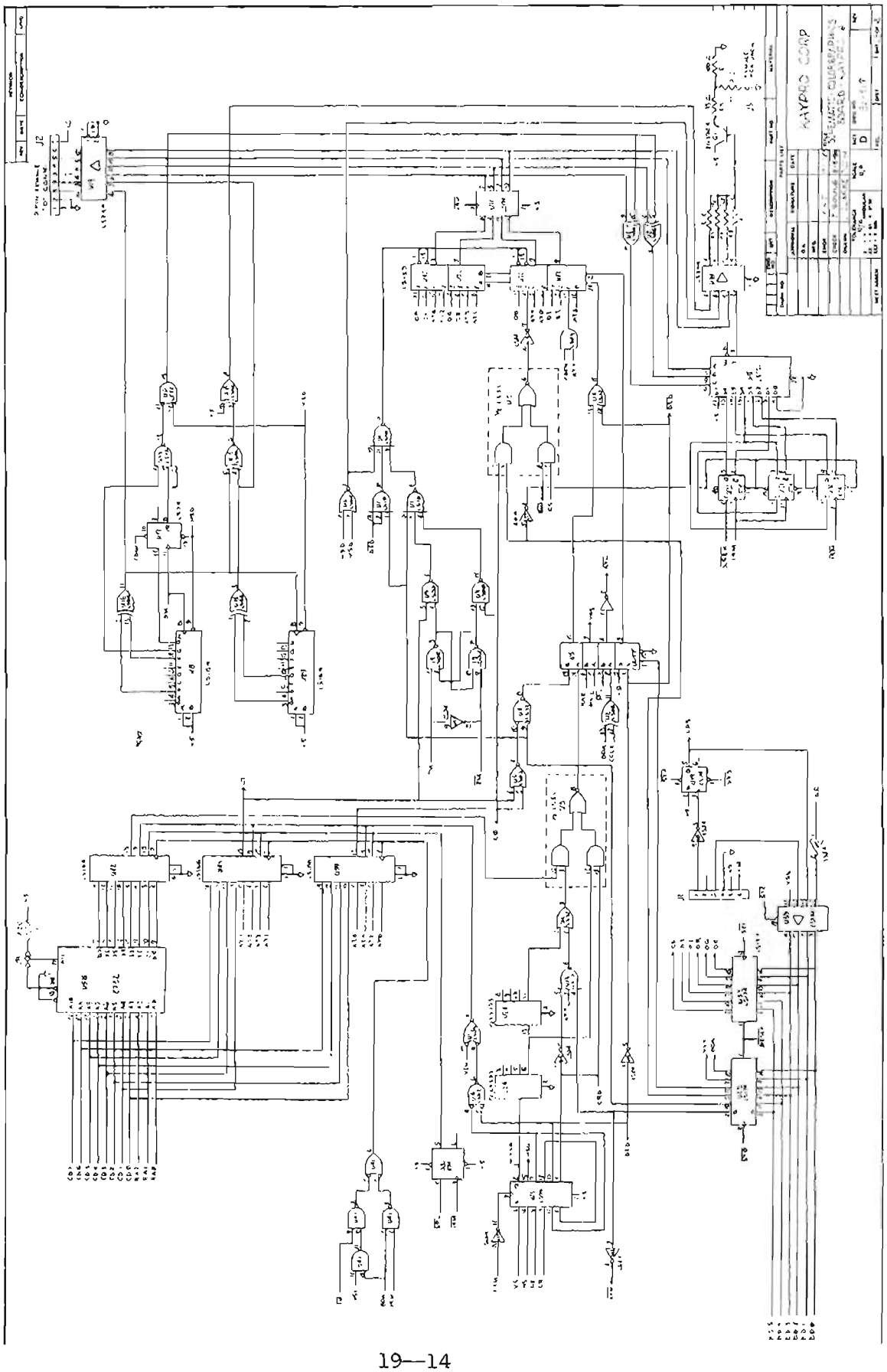
SCHEMATICS: FLOPPY-RAM-I/O CARD



SCHEMATICS: COLOR GRAPHICS CARD



SCHEMATICS: COLOR GRAPHICS CARD



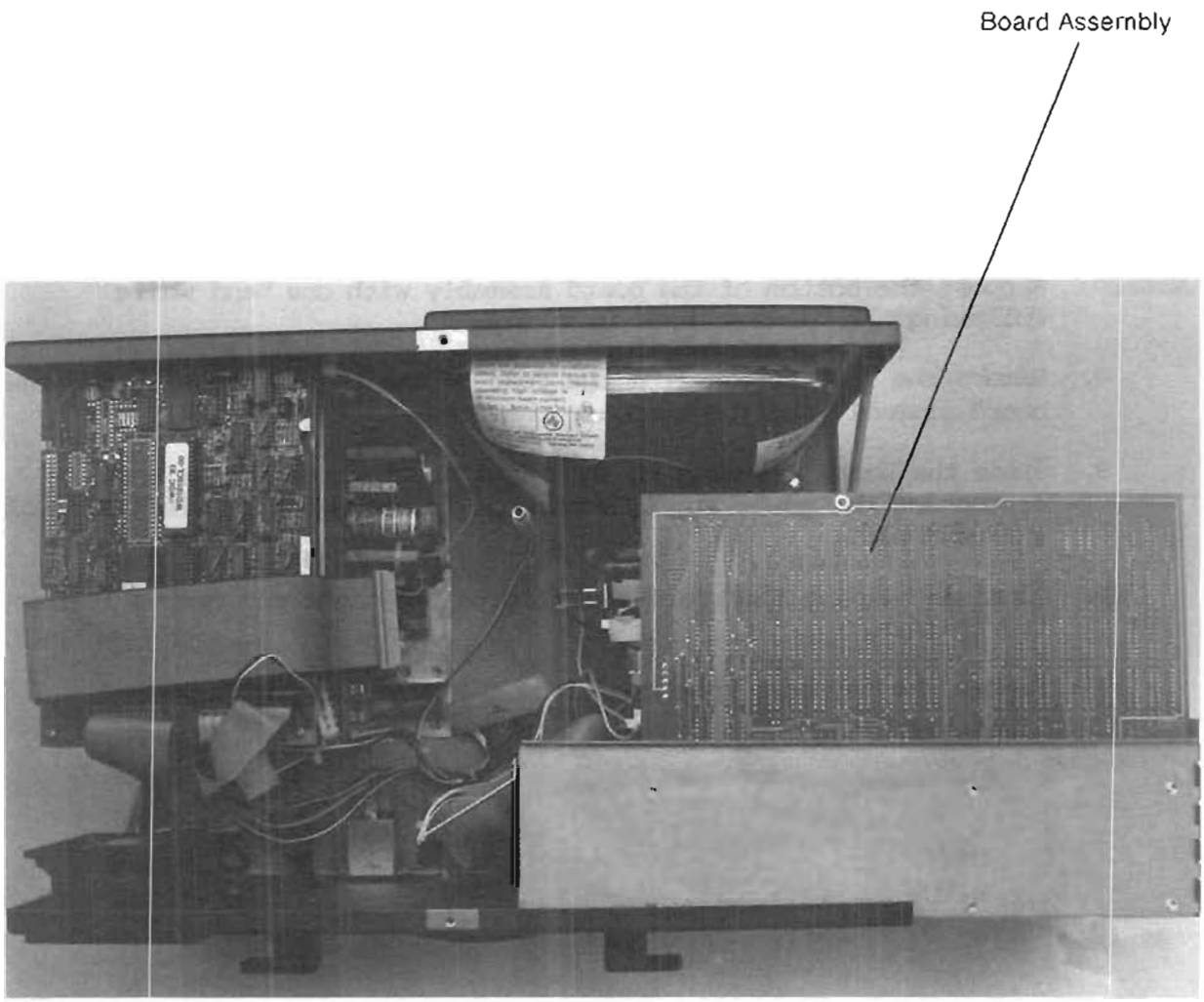


Figure 19.1
Board Assembly Removal

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.

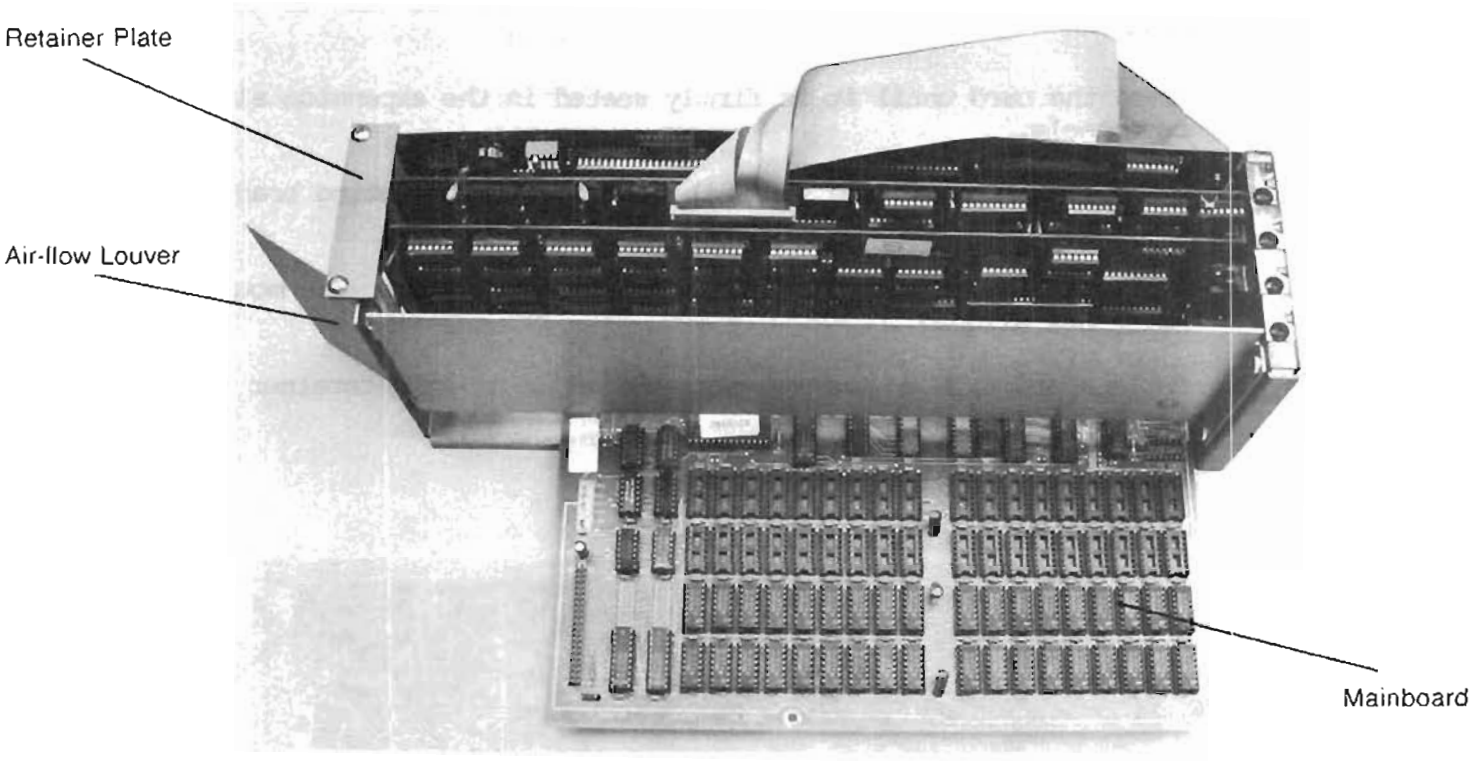


Figure 19.13
Board Assembly

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).

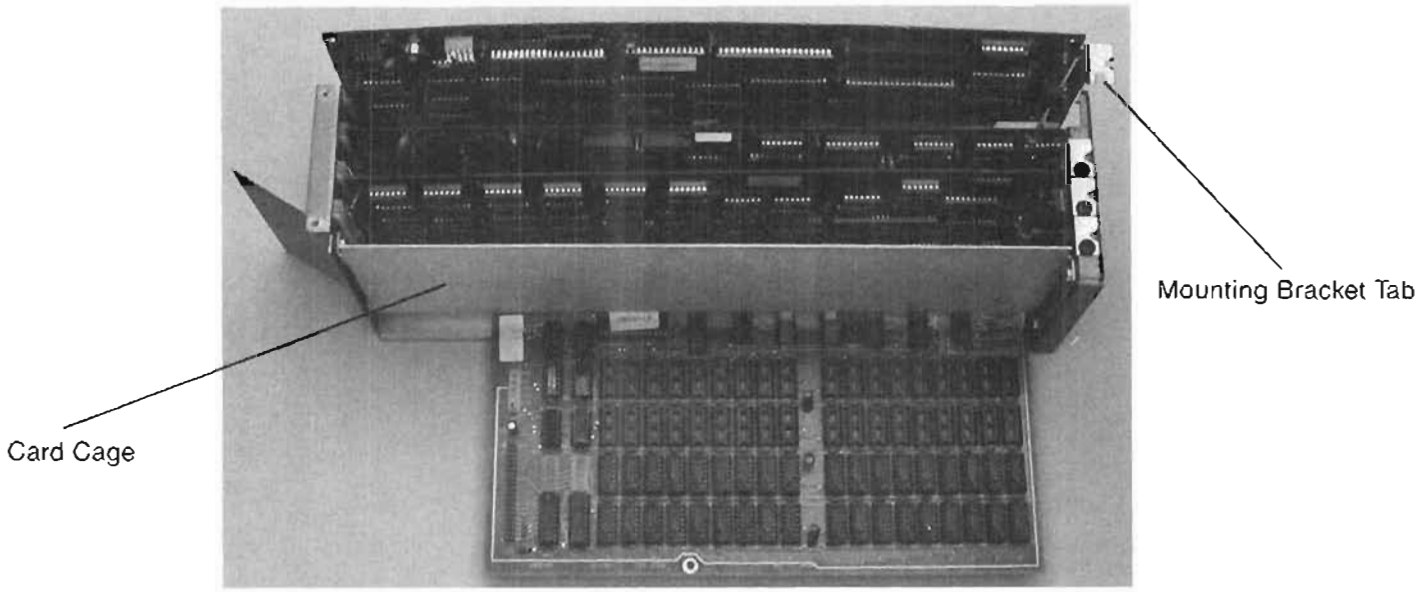


Figure 19.2
Board Assembly

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.

10. 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.

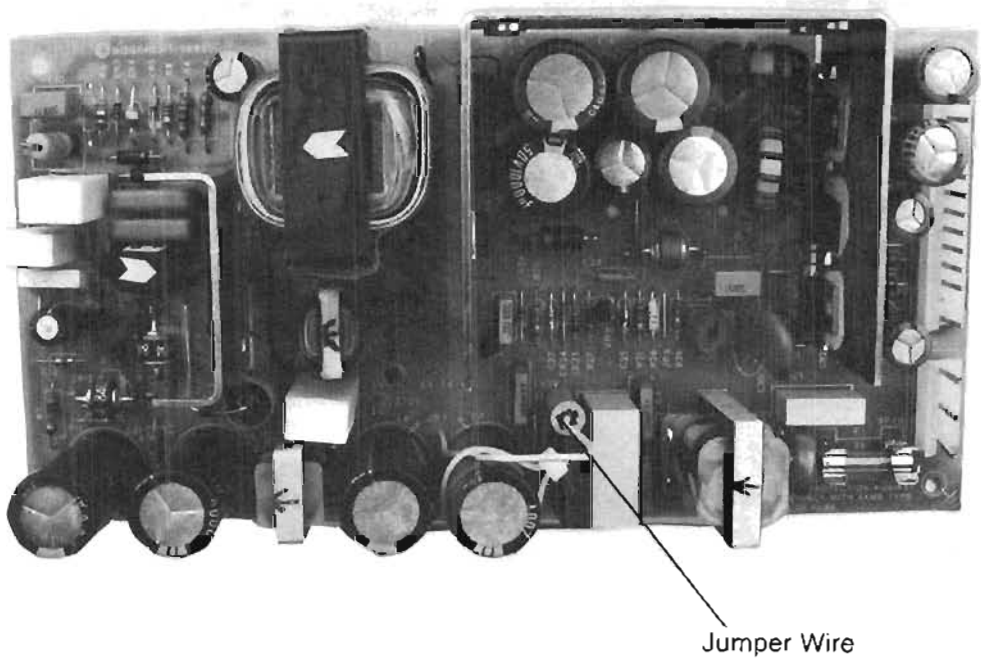


Figure 19.23
Boschert Power Supply

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.

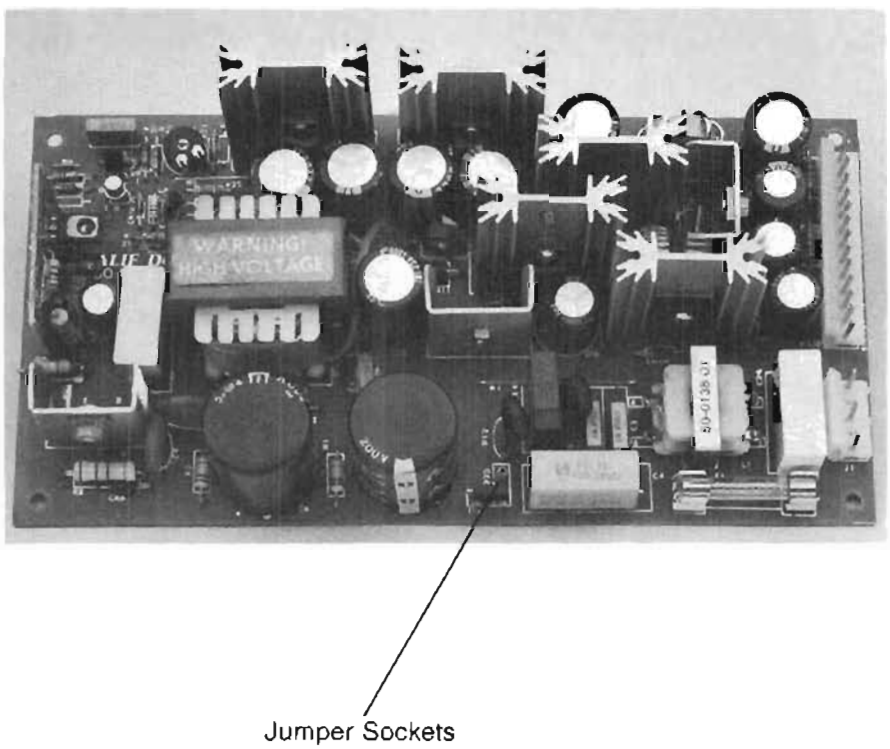


Figure 19.3
Calif D.C. Power Supply

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.

10. 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).

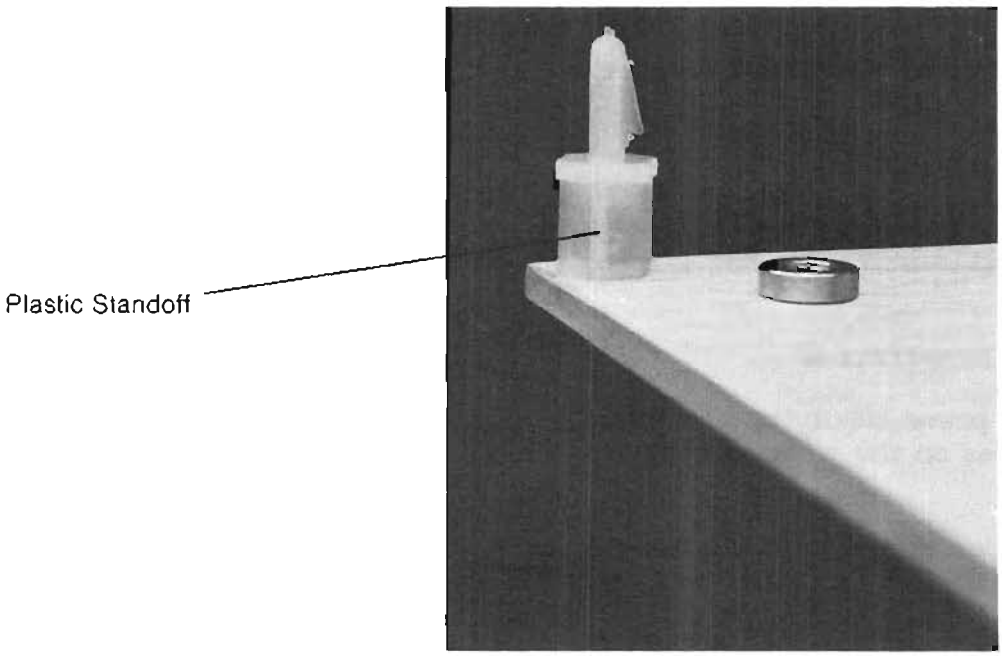


Figure 19.33
Plastic Standoff

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.

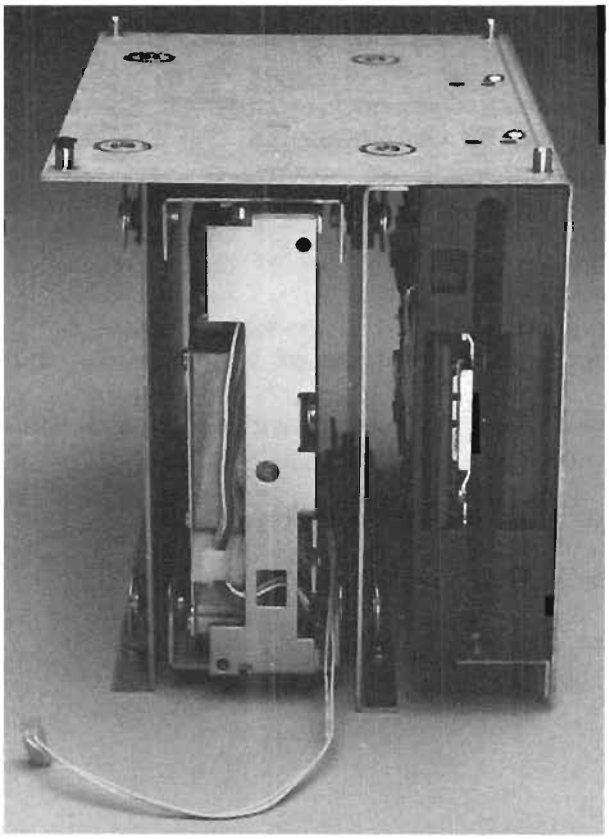


Figure 19.4
Drive Assembly Unit

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).

1Ø. Replace the chassis hood (19.1).

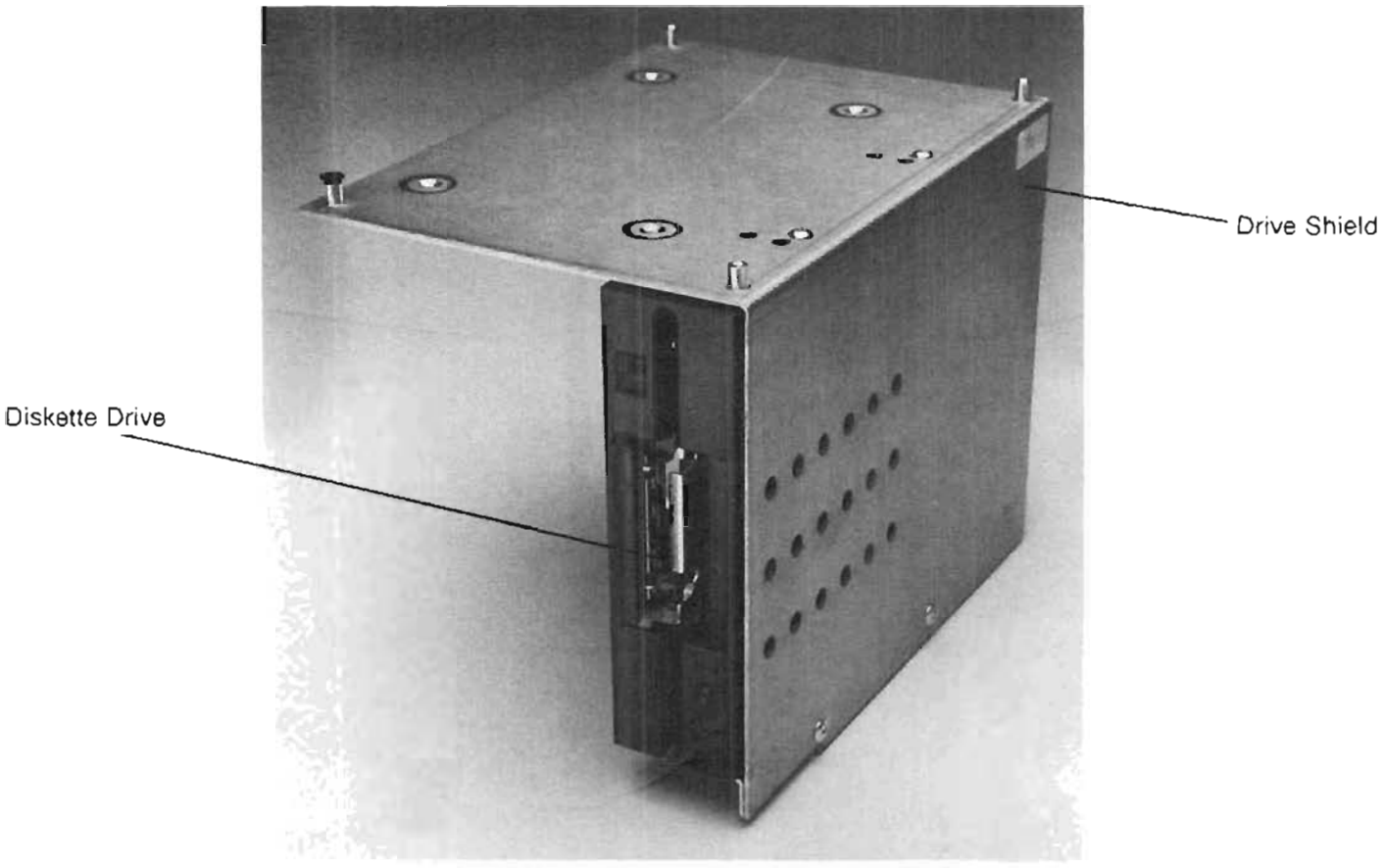


Figure 19.43
Diskette Drive Shield

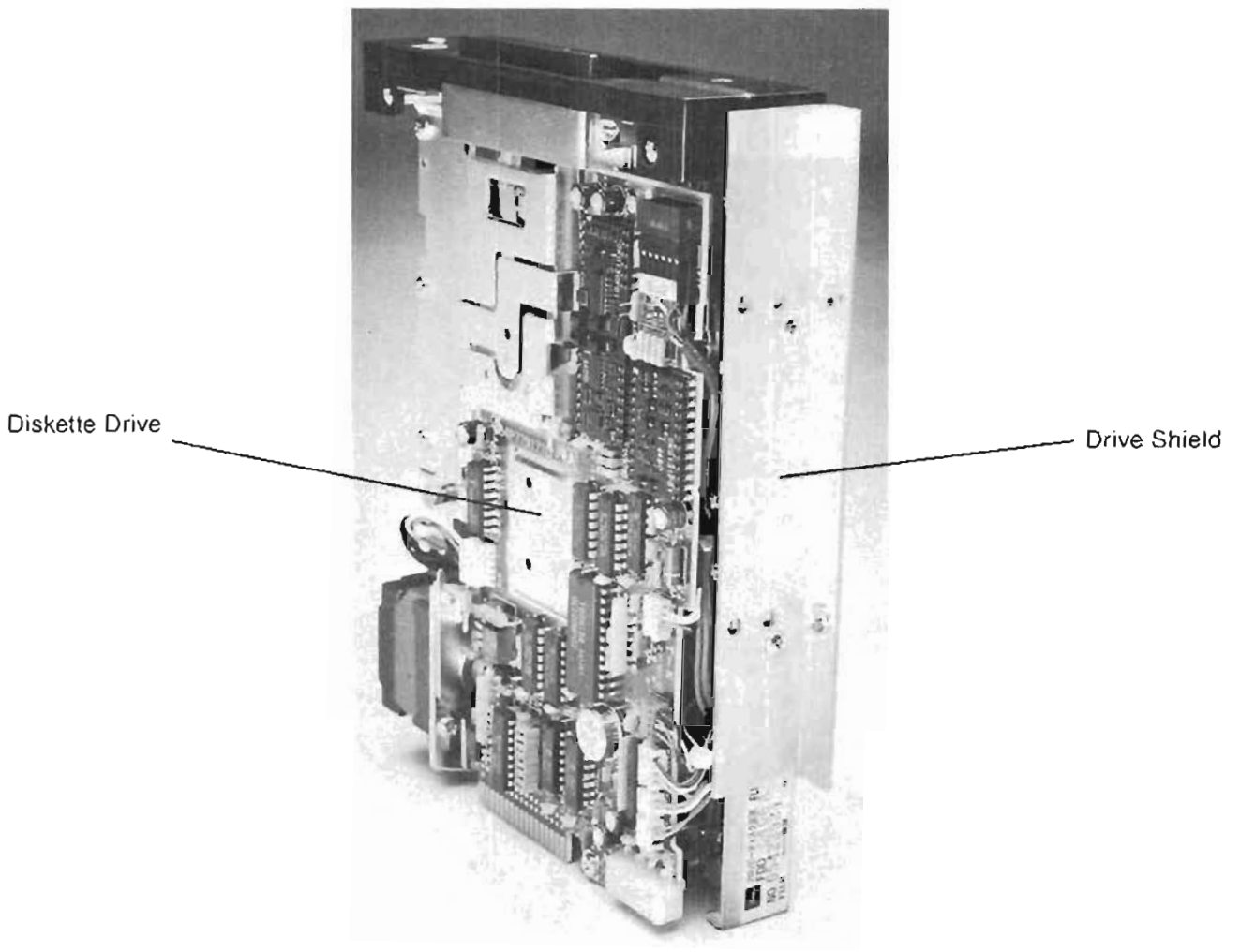


Figure 19.5
Diskette Drive Shield

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 in the Technical Manual for jumpering instructions for the Seagate and Microscience hard drives. These drives should be jumpered the same as the hard disk drives used in the KAYPRO 10.

The Shugart hard drives should be jumpered according to figure 19.53. 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.

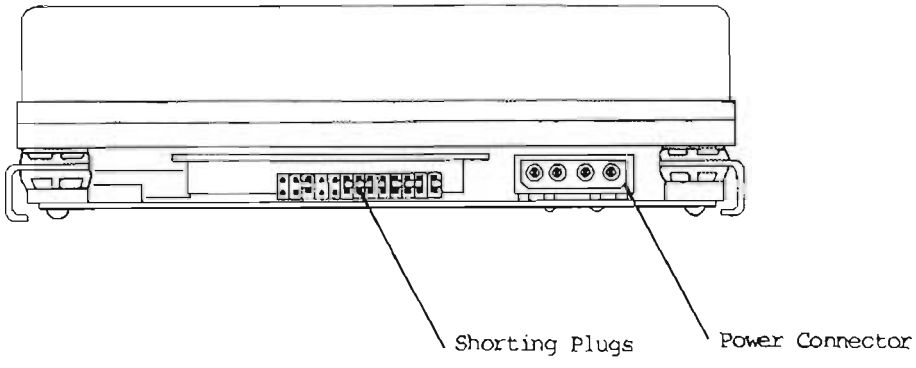


Figure 19.52
Shugart Hard Drive

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.

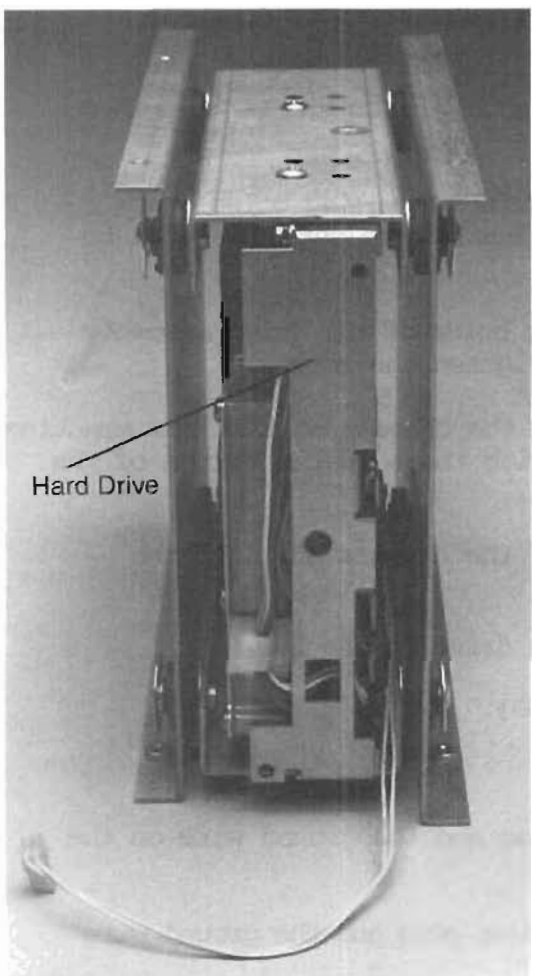


Figure 19.6
Hard Drive in Drive Shield

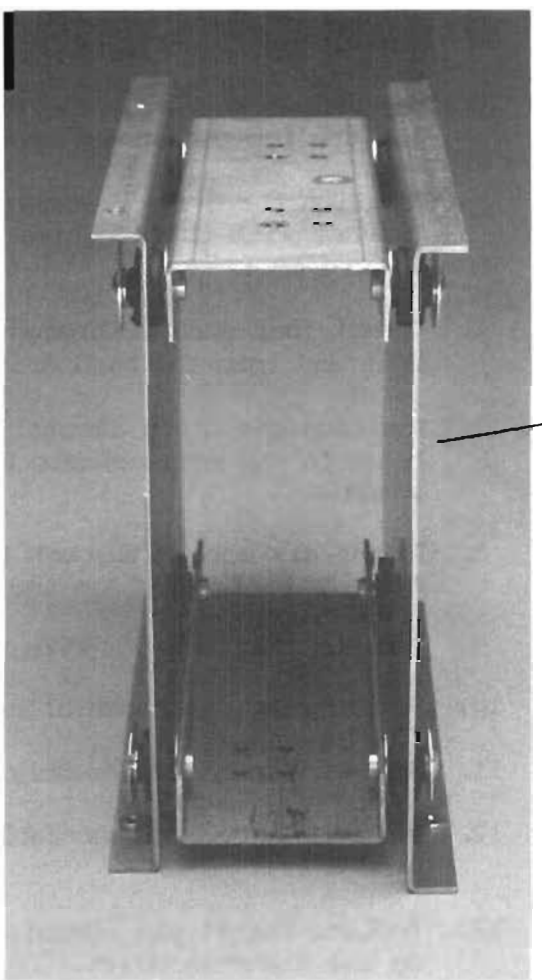


Figure 19.63
Hard Drive Shield

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 10MB LED wire from the hard drive to the LED.

10. 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

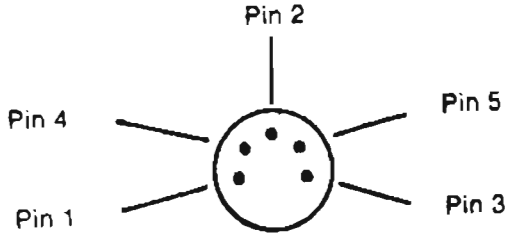


Figure 19.7
DIN Connector

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.

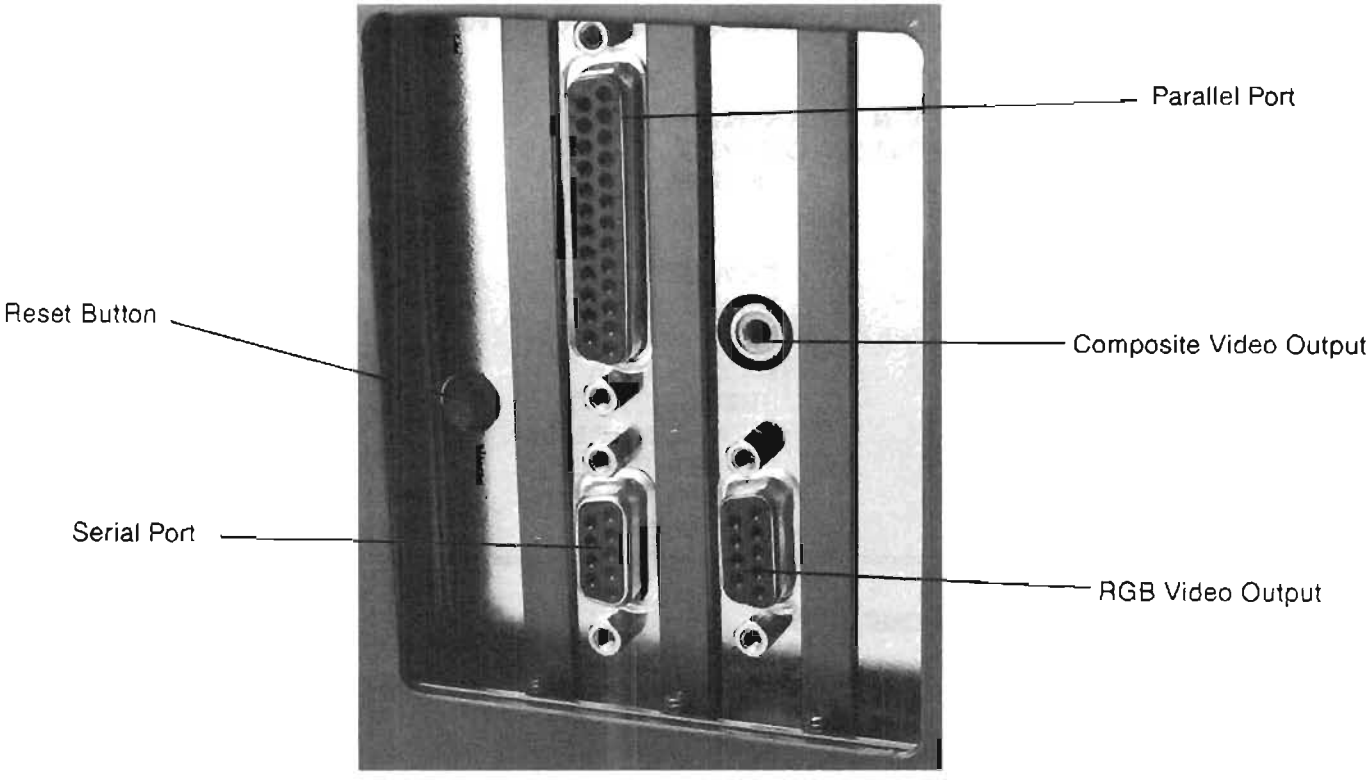


Figure 19.73
I/O Connectors

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

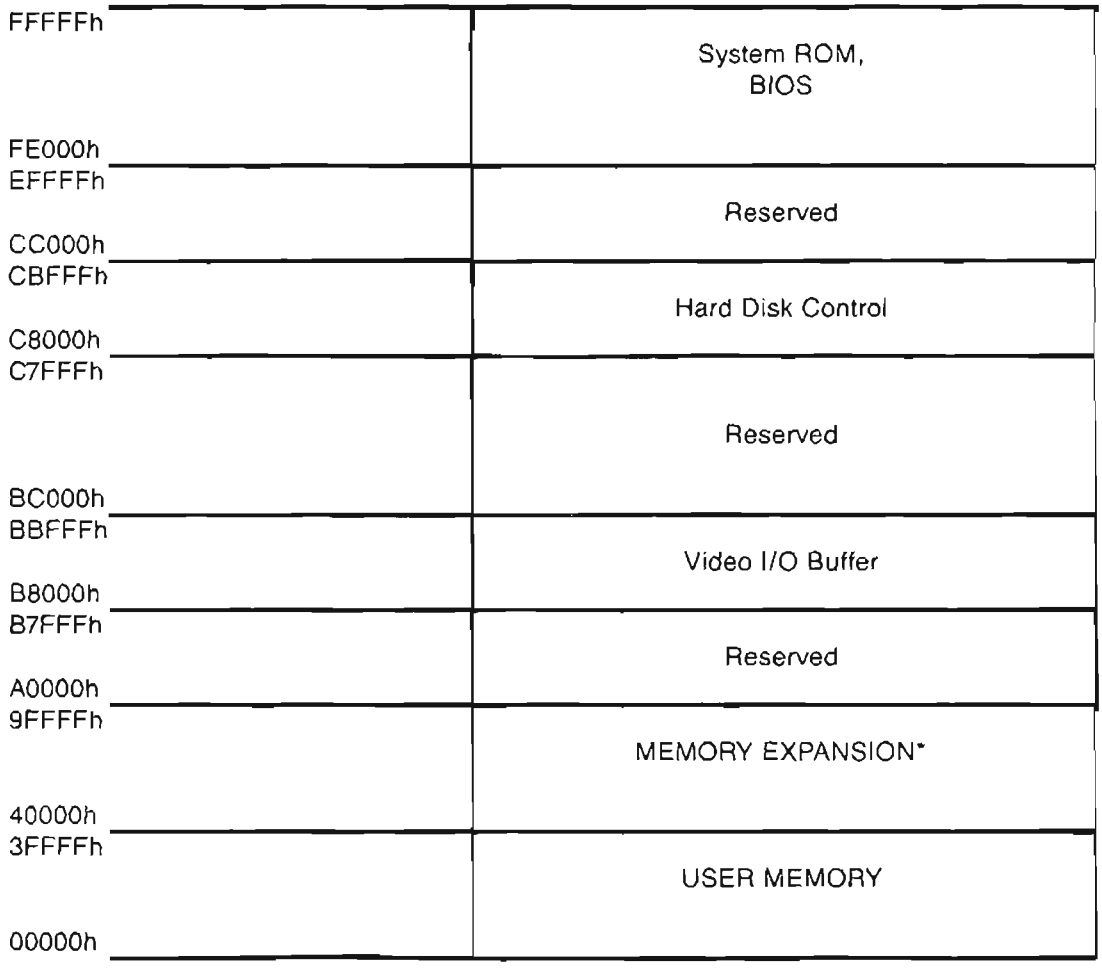
This connector uses a standard composite video cable.

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.

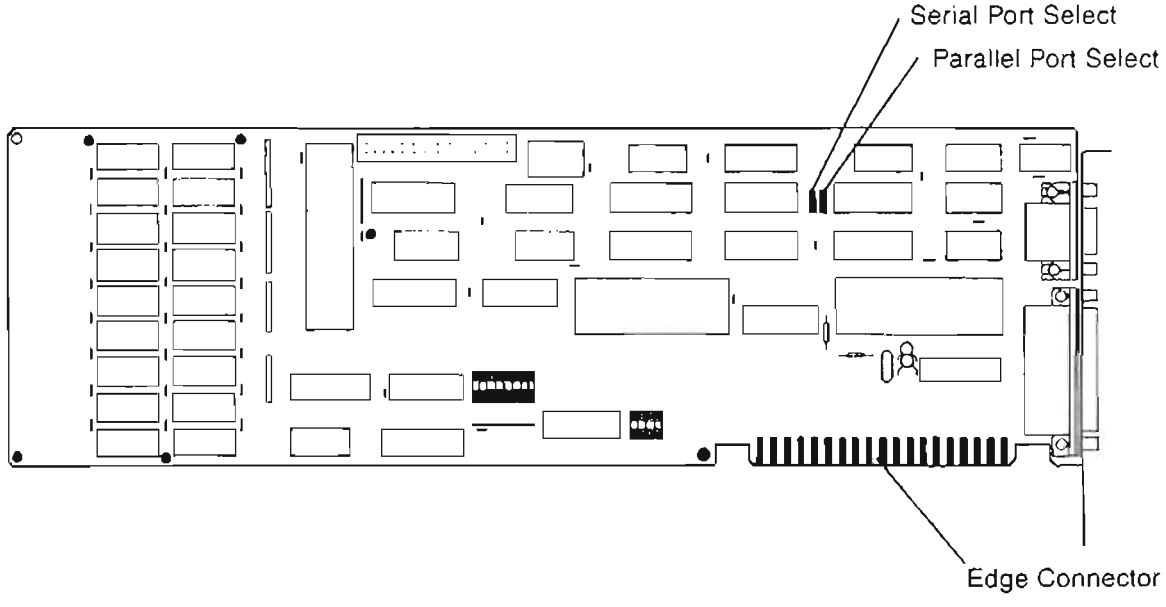


Figure 19.8
Floppy-RAM-I/O Card

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.

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