

KAYPRO TECHNICAL MANUAL

SEPTEMBER 1985

Part Number 1484-F

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

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CONTENTS

SECTION		PAGE
1.0	Introduction	
1.1	Purpose Of Technical Manual	1—1
1.2	Scope Of Technical Manual	1—2
1.3	Service Warning	1—2
2.0	FCC Information	2—1
3.0	Model Specifications	
3.1	KAYPRO 2	3—1
3.2	KAYPRO 2/84 and 2X	3—2
3.3	KAYPRO 4	3—3
3.4	KAYPRO 4/84	3—4
3.5	KAYPRO 4X	3—5
3.6	KAYPRO 10	3—6
3.61	KAYPRO 10 with Clock and Modem	3—6.1
3.7	KAYPRO ROBIE	3—7
3.71	KAYPRO 12X	3—7.1
3.8	KAYPRO NEW 2	3—8
3.9	KAYPRO 1	3—9
4.0	KAYPRO ROM Revision—CP/M Version Compatibility	4—1
5.0	Chassis	
5.1	Chassis Hood Removal (Except KAYPRO ROBIE)	5—1
5.2	Touch-up Information	5—2
6.0	Mainboards—Troubleshooting Tips	6—1
6.1	KAYPRO 2 (81-110-n)	6—2
6.2	KAYPRO 2/4 (81-240-n)	6—8
6.3	KAYPRO 10 (81-180-n)	6—16
6.4	KAYPRO 2/84 and 2X (81-294-n)	6—26
6.5	KAYPRO 4/84 (81-184-n)	6—34
6.6	KAYPRO ROBIE (81-296-n)	6—42
6.61	KAYPRO UNIVERSAL BOARD (KAYPRO 2, 2X, 4, 4X, 10, 12X, ROBIE)	6—50
6.7	Removal/Installation Instructions	6—57
7.0	CRT Assemblies	
7.1	Hardware Descriptions And Adjustments	7—1
7.2	Video Alignment	7—3
7.3	Video Signals on KAYPRO Mainboard	7—4
7.4	Removal/Installation Instructions(Exc. ROBIE)	7—5
8.0	Power Supplies	
8.1	Introduction	8—1
8.2	Description and 220V Configuration	8—2
8.3	Removal/Installation Instructions	8—5

MODEM 6-49

CONTENTS (Continued)

SECTION		PAGE
9.0	Diskette Drives	
9.1	Introduction/Disk Drive Cleaning	9—1
9.2	Which Brand Of Drive Is It?	9—2
9.3	Jumping Diagrams	9—5
9.4	High-Density (Drivetec) Drives	9—9
9.5	Removal/Installation Instructions	9—10
10.0	Hard Disk Drives (KAYPRO 10 and 12X)	
10.1	Introduction	10—1
10.2	Description	10—2
10.3	Hard Drive Configuration	10—3
10.4	Hard Drive or Floppy Drive Removal/ Installation Instructions (KAYPRO 10, 12X)	10—4
11.0	Hard Disk Controller Board (KAYPRO 10, 12X)	
11.1	Description	11—1
11.2	Removal/Installation Instructions	11—2
12.0	Interface Board (KAYPRO 10, 12X)	
12.1	Description	12—1
12.2	Removal/Installation Instructions	12—2
13.0	Keyboards	13—1
14.0	ROBIE Removal/Installation Instructions	
14.1	Chassis Cover	14—1
14.2	Diskette Drives	14—2
15.0	Troubleshooting	
15.1	Introduction	15—1
15.2	KAYPRO 2 and 4 Symptom—Fix Guide	15—2
15.3	KAYPRO 10 Symptom—Fix Guide	15—8
15.4	KAYPRO ROBIE Symptom—Fix Guide	15—14
15.5	KAYPRO 2/84 and KAYPRO 2X Symptom—Fix Guide	15—19
15.6	KAYPRO 4X Symptom—Fix Guide	15—20
16.0	KAYPRO System I/O	
16.1	Video Command Protocol	16—1
16.2	Keyboard Codes and Functions	16—3
16.3	Connector Pin-Outs	16—4
16.4	I/O Port Addresses	16—10
17.0	Reference Section	
17.1	ASCII Chart	17—1
17.2	Memory Maps	17—2
17.3	Vendor Addresses	17—7
18.0	Suggested References	18—1

CONTENTS (Continued)

SECTION		PAGE
19.0	KAYPRO 16	19—1
19.1	Chassis	19—3
19.2	System Boards	19—4
21.21	IC List, KAYPRO 16	19—4.1
19.23	Board Assembly Removal	19—16
19.24	Card Removal	19—18
19.25	Mainboard Removal	19—21
19.26	Disk Controller Board Removal	19—22
19.3	CRT Assembly	19—23
19.33	CRT Removal	19—24
19.4	Power Supply	19—26
19.43	Power Supply Removal	19—29
19.5	Diskette Drives	19—31
19.53	Diskette Drive Removal	19—32
19.6	Hard Disk Drive	19—37
19.63	Hard Disk Drive Removal	19—38
19.7	Keyboard	19—41
19.8	System I/O	19—42
19.81	Parallel Printer	19—42
19.82	I/O Connectors	19—43
19.83	Serial Devices	19—44
19.84	DE-9S Serial Port	19—44
19.85	Serial Printer Cable (DCE)	19—44
19.86	Modem Cable (DTE)	19—45
19.87	DE-9P Serial Port	19—46
19.88	Serial Printer Cable (DCE)	19—46
19.89	Modem Cable (DTE)	19—46
19.9	Video Connector For External RGB Monitor	19—47
19.91	Video Connector For Composite Monitor	19—47
19.92	I/O Port Addresses	19—48
19.93	Memory Map of the KAYPRO 16 Computer	19—49
19.94	Switch Settings	19—50
19.95	Memory Expansion	19—52
20.0	KAYPRO 16/2	20—1
20.1	Diskette Drives	20—2

CONTENTS (Continued)

SECTION		PAGE
21.Ø	KAYPRO 286i	
21.1	Description	21—1
21.2	FCC Information	21—2
21.3	KAYPRO 286i Model A Specifications	21—3
21.4	KAYPRO 286i Model B Specifications	21—4
21.5	KAYPRO 286i Model C Specifications	21—5
21.6	KAYPRO 286i Model D Specifications	21—6
22.Ø	Chassis	
22.1	Chassis Cover Removal	22—1
22.2	Chassis Cover Replacement	22—2
23.Ø	System Boards	
23.1	Descriptions for different models	23—1
23.2	Adapter Cards	23—1
23.21	Controller Card	23—1
23.22	Color Card	23—1
23.23	Serial/Parallel Port Card	23—1
23.231	IC List	23—2
23.232	Schematics	23—4
23.24	Adapter Card Removal	23—6
23.25	Adapter Card Installation	23—6
23.3	Mainboard	23—8
23.31	Description	23—8
23.32	IC List, KAYPRO 286i Mainboard	23—9
23.33	Schematics	23—11
23.34	Mainboard Connector Pin Assignments	23—16
23.35	Mainboard Removal	23—18
23.36	Mainboard Installation	23—18
24.Ø	Disk Drives	
24.1	Floppy Diskette Drives	24—1
24.11	Description	24—1
24.12	Floppy Diskette Drive Configurations	24—1
24.13	Floppy Diskette Drive Removal	24—5
24.14	Floppy Diskette Drive Installation	24—6
24.2	Hard Disk Drive	24—8
24.21	Description	24—8
24.22	Hard Disk Drive Configuration	24—8
24.23	Hard Disk Drive Removal	24—8
24.24	Hard Disk Drive Installation	24—9
25.Ø	Streaming Tape Drive	
25.1	Description	25—1
25.2	Streaming Tape Drive Removal	25—1
25.3	Streaming Tape Drive Installation	25—2

CONTENTS (Continued)

SECTION		PAGE
26.0	Power Supply	
26.1	Description	26—1
26.2	230V Configuration	26—1
26.3	Power Supply Removal	26—2
26.4	Power Supply Installation	26—2
27.0	Keyboard	
27.1	Description	27—1
27.2	Keyboard Connector	27—1
28.0	Battery	
28.1	Description	28—1
28.2	Battery Removal	28—1
28.3	Battery Installation	28—2
29.0	System I/O	
29.1	Parallel Port Pin Assignments	29—1
29.2	Serial Port Pin Assignments	29—2
29.3	RGB Monitor Adapter Pin Assignments	29—3
29.4	I/O Port Addresses	29—4
29.5	Memory Map of the KAYPRO 286i Computer	29—5

INDEX

LIST OF ILLUSTRATIONS

FIGURE		PAGE
Figure 7.1	Dotronix Video Board	7—1
Figure 7.2	Elston Video Board	7—1
Figure 7.3	Toshiba Video Board	7—2
Figure 7.4	Micrex Video Board	7—2
Figure 7.5	Yoke Alignment	7—2.1
Figure 9.1	Tandon Half-Height Drive	9—2
Figure 9.2	Epson Drive	9—2
Figure 9.3	Shugard Drive	9—2
Figure 9.4	Tokyo Electric Drive	9—3
Figure 9.5	Toshiba Drive	9—3
Figure 9.6	Hi-Tech Drive	9—3
Figure 9.7	Drivetec Drive	9—4
Figure 9.8	Tandon Full-Height Drive	9—4
Figure 9.8	Tandon Drive Jumpering Diagram	9—5
Figure 9.9	Epson Drive Jumpering Diagram	9—5
Figure 9.10	Shugart Drive Jumpering Diagram	9—6
Figure 9.11	Tokyo Electric Drive Jumpering Diagram	9—6
Figure 9.12	Toshiba Drive Jumpering Diagram	9—7
Figure 9.13	Hi-Tech Drive Jumpering Diagram	9—8
Figure 9.14	Tandon Full-Height Drive Jumpering Diagram	9—8
Figure 9.15	Drivetec Drive Configuration	9—9
Figure 10.1	Microscience Hard Drive 9-Position Switch	10—3
Figure 10.2	Microscience Hard Drive 10-Position Switch	10—3
Figure 10.3	Shugart Hard Drive Configuration Diagram	10—3
Figure 10.4	Seagate Hard Drive Configuration Diagram	10—3.1
Figure 10.5	Seagate Hard Drive Configuration Diagram	10—3.1
Figure 19.1	Board Assembly Removal	19—15
Figure 19.13	Board Assembly	19—19
Figure 19.2	Board Assembly	19—20
Figure 19.23	Boschert Power Supply	19—27
Figure 19.28	Calif D.C. Power Supply	19—28
Figure 19.33	Plastic Standoff	19—30
Figure 19.4	Drive Assembly Unit	19—33
Figure 19.43	Diskette Drive Shield	19—35
Figure 19.5	Diskette Drive Shield	19—36
Figure 19.6	Hard Drive in Drive Shield	19—39
Figure 19.63	Hard Drive Shield	19—39
Figure 19.7	Keyboard DIN Connector	19—41
Figure 19.73	I/O Connectors	19—43
Figure 22-1	Cover Mounting Screws	22—1
Figure 22-2	Chassis Cover Removal	22—2
Figure 23-1	Expansion Slot Cover	23—4
Figure 23-2	Support Bracket	23—4
Figure 23-3	KAYPRO 286i Mainboard Layout	23—20
Figure 24-1	Mitsubishi Floppy Diskette Drive	24—3
Figure 24-2	Power Connector	24—4
Figure 24-3	Grounding Connector	24—4
Figure 24-4	Mounting Screws and Clips	24—5
Figure 24-5	Cover Plate	24—6
Figure 24-6	Drive Cable	24—7

LIST OF ILLUSTRATIONS (Continued)

FIGURE		PAGE
Figure 24-7	Drive Cables in the KAYPRO 286i	24—7
Figure 25-1	Power Supply Mounting Screws and Voltage Selector Switch	25—1
Figure 27-1	Location of Battery	27—1

21.0 KAYPRO 286i

21.1 Description

The KAYPRO 286i computer is based on the Intel 80286 16-bit microprocessor. It operates at a clock frequency of 6 MHz resulting in a clock cycle time of 167 nanoseconds. The 80286 supports 16-bit data transfers and can address up to 15 megabytes of physical memory. It also supports 1 gigabyte of virtual memory per task, mapped into a 15 megabyte physical address space.

The 80286 operates in conjunction with several support components: 8259A-2, 8254-2, 8237A-5, 82288, and 82284. The KAYPRO 286i uses two 8259A-2 programmable interrupt controllers to provide 16 levels of priority for vectored interrupt control.

The function of the 8254-2 programmable interval timer is to control the system timers. The 8254-2 is treated by systems software as an array of four I/O ports: 3 are treated as counters, the fourth is a control register for mode programming. Two 8237A-5 DMA controllers are designed to allow external devices to directly transfer data from the system memory. They also provide memory-to-memory transfer capabilities. Commands and control for the local and system bus are provided by the 82288 bus controller. It also provides address latch control, data transceiver control and command outputs. The 82284 clock generator is responsible for the clock, ready, and reset signals required by the 80286 and its support components.

The system board is socketed for and will support the addition of an Intel 80287 numeric processor. The 80287 extends the capabilities of the system by adding floating-point, extended-integer, and BCD data types.

The KAYPRO 286i is populated with 512K bytes of dynamic RAM, (640K bytes on the KAYPRO 286i model C), which is implemented using 256K x 1, 150ns dynamic RAM chips. This can be increased to 640K bytes by populating Bank 2 and Bank 3 on the system board with 64K x 1, 150ns dynamic RAM. By using expansion cards, RAM can be extended to the maximum the system will support, 15M bytes. (See 23.3 MEMORY EXPANSION.)

21.2 FCC INFORMATION

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

FCC INFORMATION FOR CLASS A

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

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

FCC INFORMATION FOR CLASS B

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

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

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

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

21.3 KAYPRO 286i MODEL A SPECIFICATIONS

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

21.4 KAYPRO 286i MODEL B SPECIFICATIONS

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

21.5 KAYPRO 286i MODEL C SPECIFICATIONS

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

21.6 KAYPRO 286i MODEL D SPECIFICATIONS

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

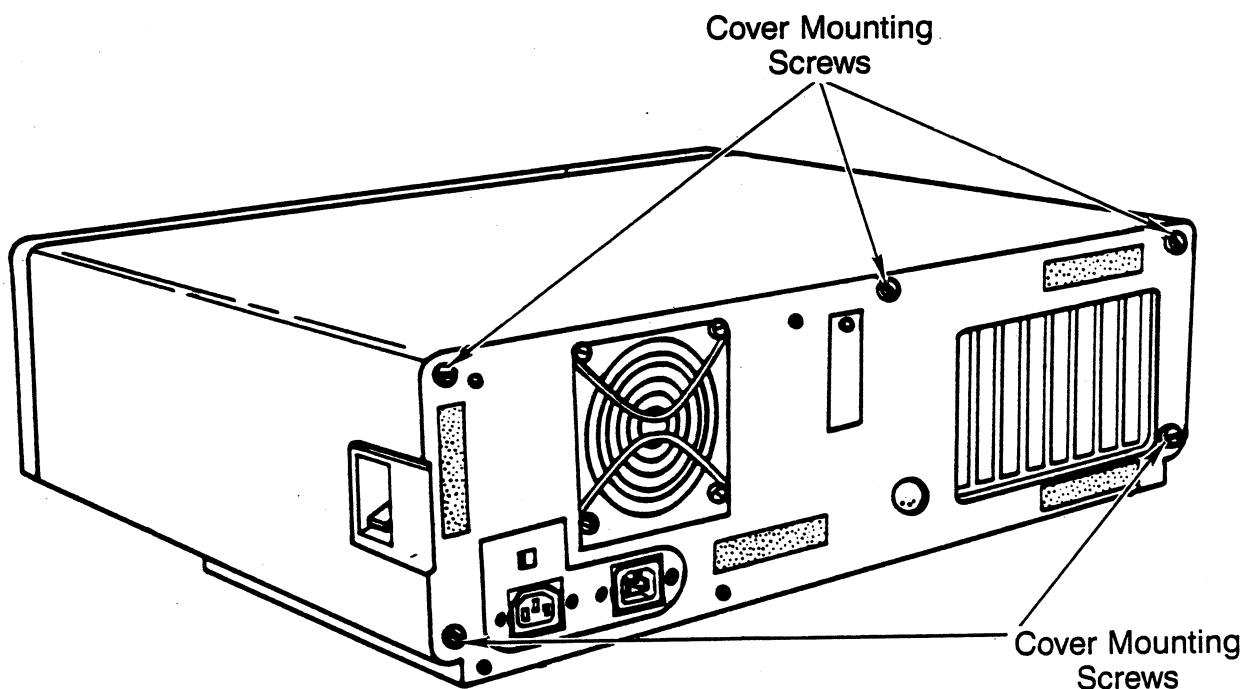
22.0 CHASSIS

22.1 CHASSIS COVER REMOVAL

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

1. Turn off the computer and disconnect AC power by unplugging the power cord from the back of the computer.
2. Disconnect all peripheral cords and cables from the back of the computer (printer cables, modem cable, et cetera).
3. Gently pull the back panel cover from the back of the computer. It is held onto the back panel of the chassis by four Velcro (tm) strips.
4. Remove the five cover mounting screws located on the back of the KAYPRO 286i in each corner and top center (refer to Figure 22-1).

Figure 22-1 Cover Mounting Screws

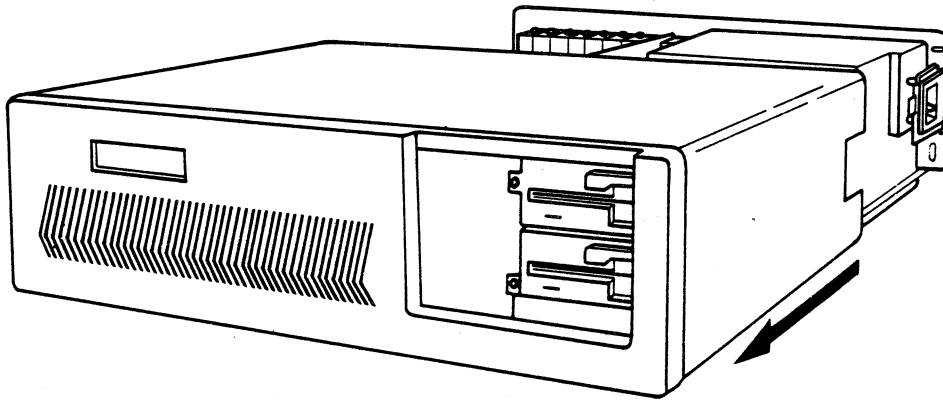


5. Slide the cover toward the front of the computer (refer to figure 22-2). If it sticks, find the obstruction (usually the back corners or the drive mounting clips), and free the cover.

22.2 CHASSIS COVER REPLACEMENT

1. Slide the cover toward the back of the computer until the cover is against the rear panel of the chassis.
2. Replace and tighten the five cover mounting screws.

Figure 22-2 Chassis cover removal



23.0 SYSTEM BOARDS

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

23.1 Descriptions for different models

KAYPRO 286i MODEL A

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

KAYPRO 286i MODEL B

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

KAYPRO 286i MODEL C

The KAYPRO 286i model C system boards include the mainboard with 640K bytes of RAM standard, a combination diskette drive/hard drive controller card, and a serial/parallel port card..

KAYPRO 286i MODEL D

The KAYPRO 286i model B system boards includes the mainboard with 640K bytes of RAM standard, a combination diskette drive/hard drive controller card, a serial/parallel port card, a color card, and a tape drive controller card.

23.2 ADAPTER CARDS

23.21 CONTROLLER CARD

The controller card is a Western Digital 1002 combination diskette drive/hard drive controller card and is not dealer serviceable.

23.22 COLOR CARD

The color card offers standard graphics resolutions of 320 by 200 with four colors or 640 by 200 black and white with any IBM compatible RGB monitor.

23.23 TAPE DRIVE CONTROLLER CARD

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

23.24 SERIAL/PARALLEL PORT CARD

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

23.241 IC LIST

Reference Designation

Description

Serial/Parallel Port Card, 81-623, KAYPRO 286i model B

U16	PAL 16L8	(81-693)
U12,13	74LS04	Hex inverter
U9	74LS125	Tri quad buffer
U10	74LS155	Hex "D" flip-flop
U17	74LS174	Hex "D" flip-flop
U11	74LS240	Octal inverter buffer
U6	74LS244	Tri octal buffer
U18	74LS245	Bi-directional 8-bit buffer
U7	74LS374N	Octal latch
U14	7405	Hex inverter
J1,2	DIP SWITCH	4 pos x 2 selects

23.242 SCHEMATICS: SERIAL/PARALLEL PORT CARD

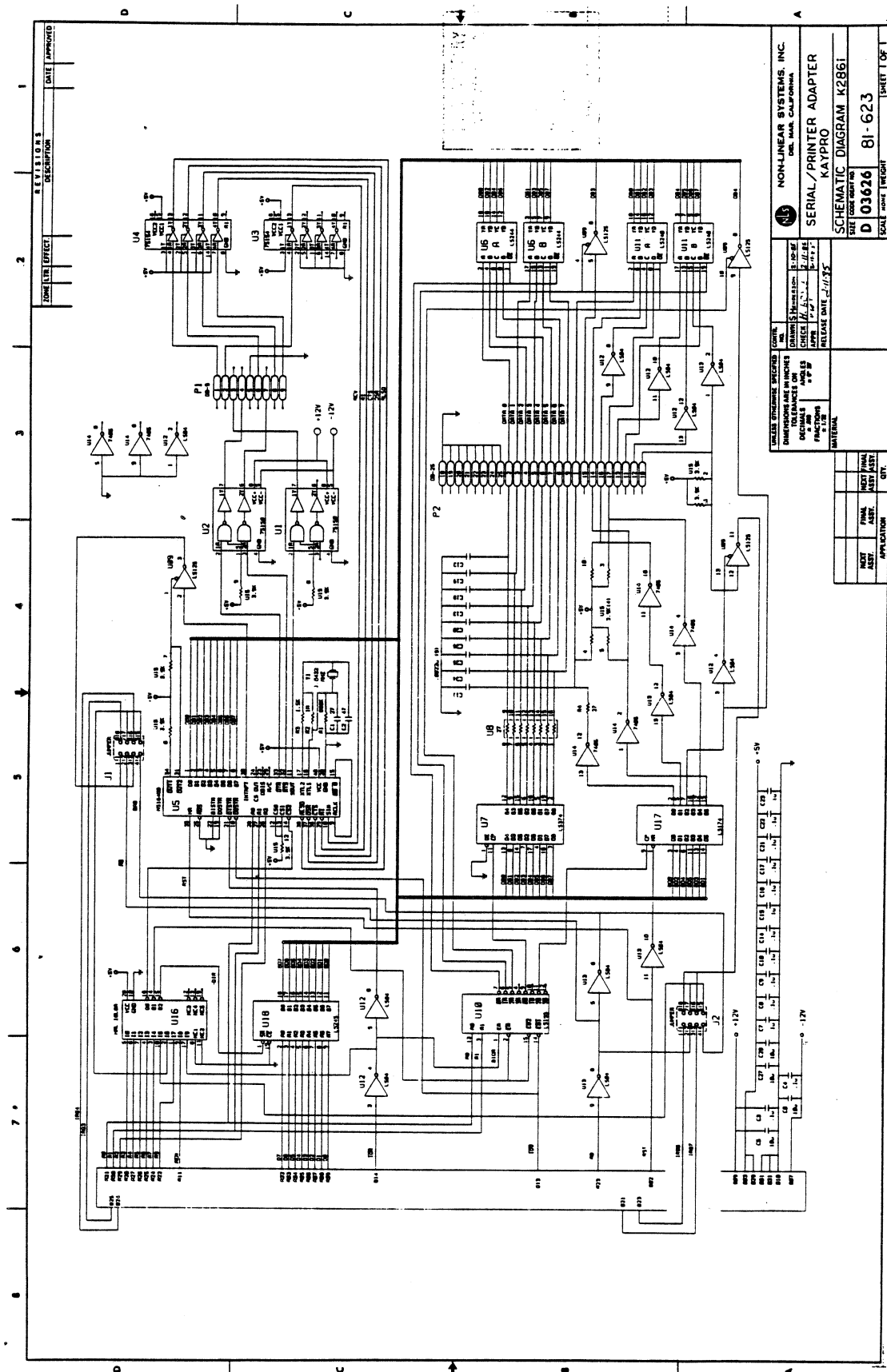


Figure 23-1 Expansion Slot Cover

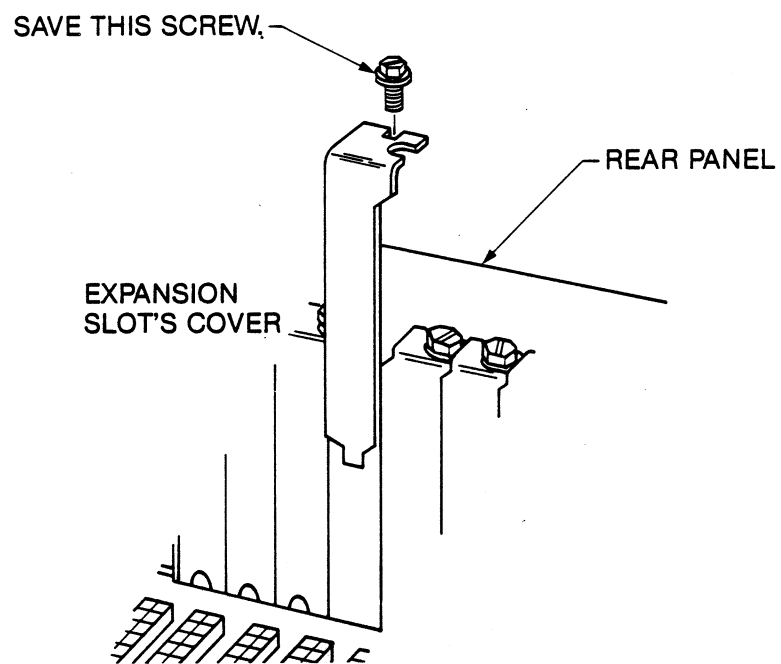
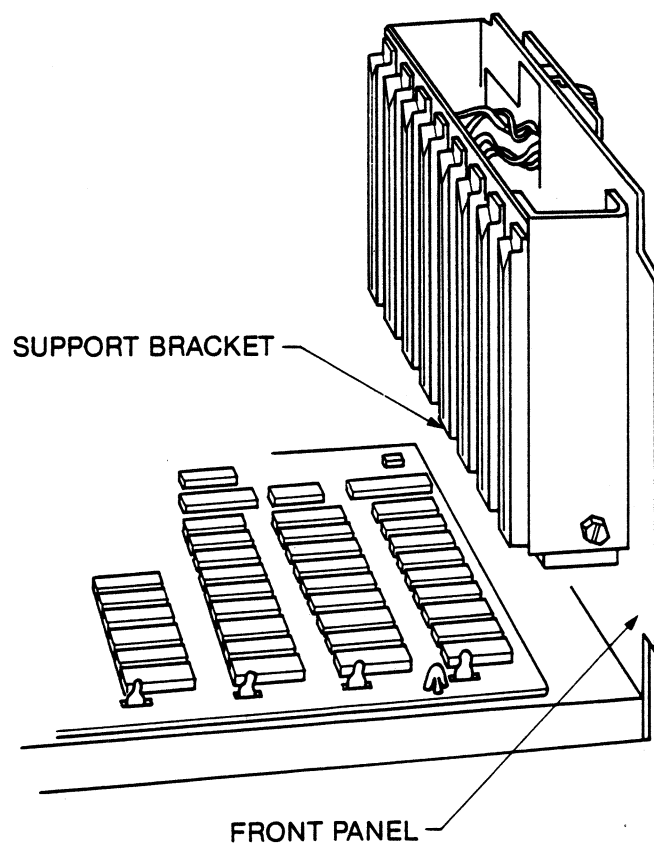


Figure 23-2 Support Bracket



23.25 ADAPTER CARD REMOVAL

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

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

1. Turn off the computer and disconnect the AC power.
2. Remove the chassis cover (22.1).
3. Remove all cables and connectors that are attached to the card, taking notice of the position of each of these cables and connectors.
4. Remove the screw that secures the card (located toward the rear panel of the computer).
5. Remove the card from the card cage by sliding it upward until the edge connector is separated from the expansion slot receptacle and the card is out of the card cage.

23.26 ADAPTER CARD INSTALLATION

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

1. If you are installing a new card, remove the expansion slot cover (refer to Figure 23-1).
2. Position the card above the card cage so that the edge connector is above the expansion slot receptacle.
3. Lower the card into the card cage so that the mounting bracket tab fits into the space between the mainboard and the side of the card cage, and the other side of the card slides into the plastic support bracket (refer to Figure 23-2).
4. Press the card until it is firmly seated in the expansion slot receptacle.

5. Replace and tighten the screw that secures the mounting bracket to the card cage.
6. Replace the chassis cover.
7. After installing a new card, it may be necessary to run the "Setup" program.

23.3 MAINBOARD

23.31 Description

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

80287 MATH CO-PROCESSOR

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

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

MEMORY EXPANSION

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

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

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

23.32 IC LIST, KAYPRO 286i MAINBOARD

Reference Designation		Description
Mainboard, 81-035 & 81-036 KAYPRO 286i models A and B		
U6, U12	74F280	Parity generator/checker
U49	74F257	Multiplexer
U92, U113	74F174	Hex "D" flip-flop
U10, U114	74F175	Quad "D" flip-flop
U48, U82, U83	74F158	Multiplexer
U18	74F139	Decoder
U59, U77, U129, U137	74F74	Dual "D" flip-flop
U55	74F20	Dual NAND gate
U125	74F11	Triple AND gate
U64, U70, U71, U122, U135	74F10	Triple NAND gate
U69, U91, U134	74F08	Quad AND gate
U72	74F00	Quad NAND gate
U78, U133	74LS125	Tri quad buffer
U60, U124	74LS51	Dual AND-OR-invert gate
U136	74LS02	Quad NOR gate
U87	74LS112	Dual J K flip-flop
U53, U126	74S51	Dual AND-OR-invert gate
U68	74LS646	Octal bus transceiver
U95	74LS612	Memory mapper
U51	74LS590	8-bit binary counter
U132	74LS245	Tri octal transceiver
U105, U117	8259A-2	Programmable interrupt controller
U104	8254-2	Programmable interval timer
U96, U106	8237A-5	DMA controller
U130	82288	Bus controller
U88	82284	Clock
U118	8742	Universal peripheral interface 8-bit microcomputer
U38	8284A	Clock
U80	80286	CPU
U103	MC14069U	CMOS hex
U116	MC146818P	Real time clock
U127	PAL 16L8A	(81-686)
U111	63S081 MMI	(81-689A)
U94	28S42 TI	(81-687C)
U1, 2, 7, 8, 13, 14, 19, 20, 23, 24, 28, 29, 33, 34, 39, 40, 43, 44	41256P-15	256K x 1, 150ns, dynamic RAM
U121	7407	Hex buffer
U56, 66, 67, 84, 97, 98	74ALS573	Tri octal "D" latch
U5, 11, 65, 73, 74, 75, 76, 81	74ALS245	Tri octal transceiver
U50, 61, 107	74ALS244	Tri octal buffer
U98	74ALS175	Quad "D" flip-flop
U120	74ALS138	Decoder/demultiplexer
U27	27128A-2	EPROM (81-691E)
U47	27128A-2	EPROM (81-692E)
U86, 90, 102, 109, 110, 112, 115	74ALS74	Dual "D" flip-flop
U58	74ALS32	Quad OR gate

Mainboard, 81-035 & 81-036 KAYPRO 286i models A and B cont'd.

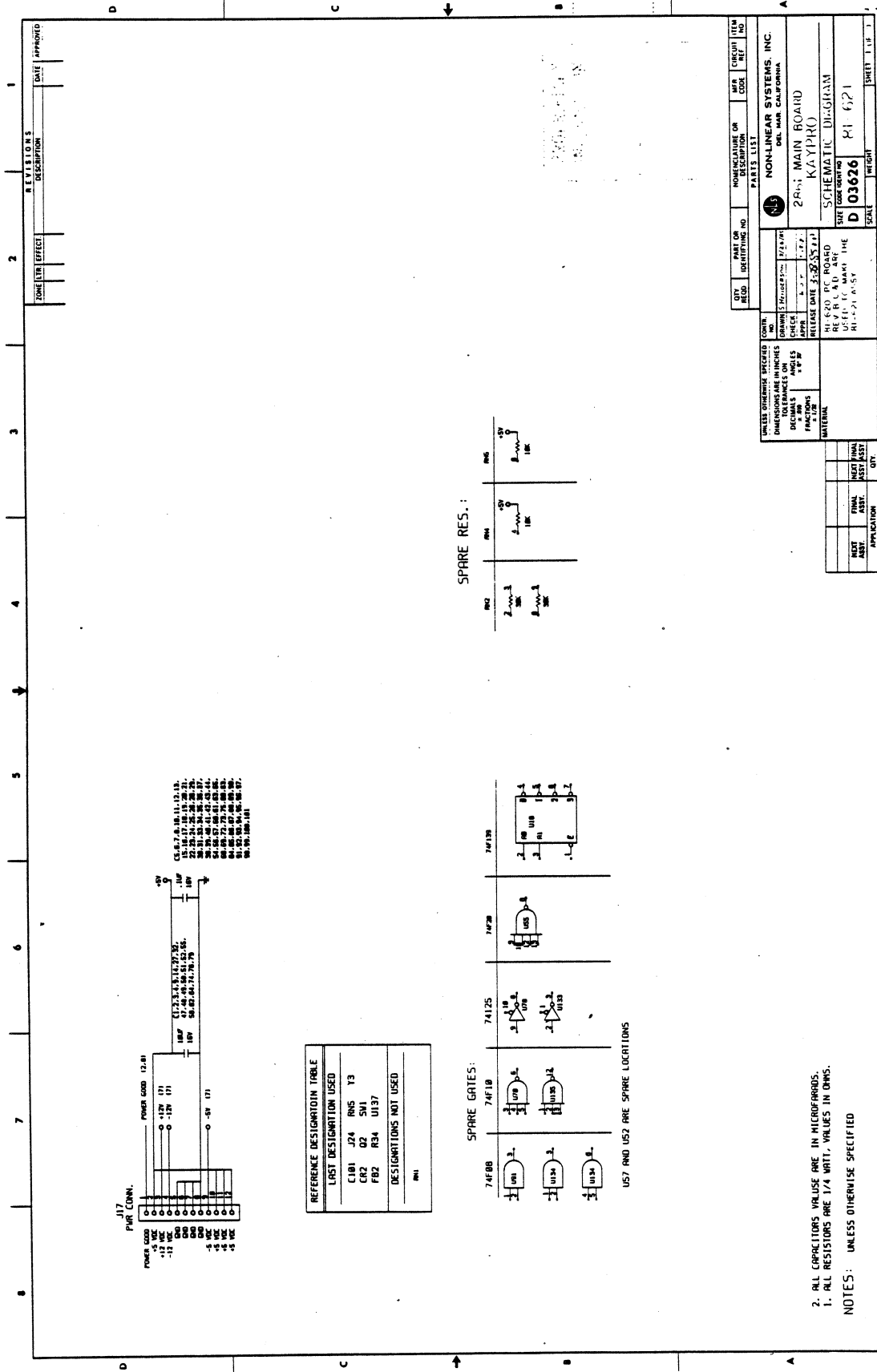
U85	74ALS27	Triple NOR gate
U54	74ALS10	Triple NAND gate
U89	74ALS08	Quad NAND gate
U79,123,131	74ALS04	Hex inverter
U100,108	74ALS02	Quad NOR gate
U99,128	74ALS00	Quad NAND gate

Mainboard, 81-037 KAYPRO 286i model C

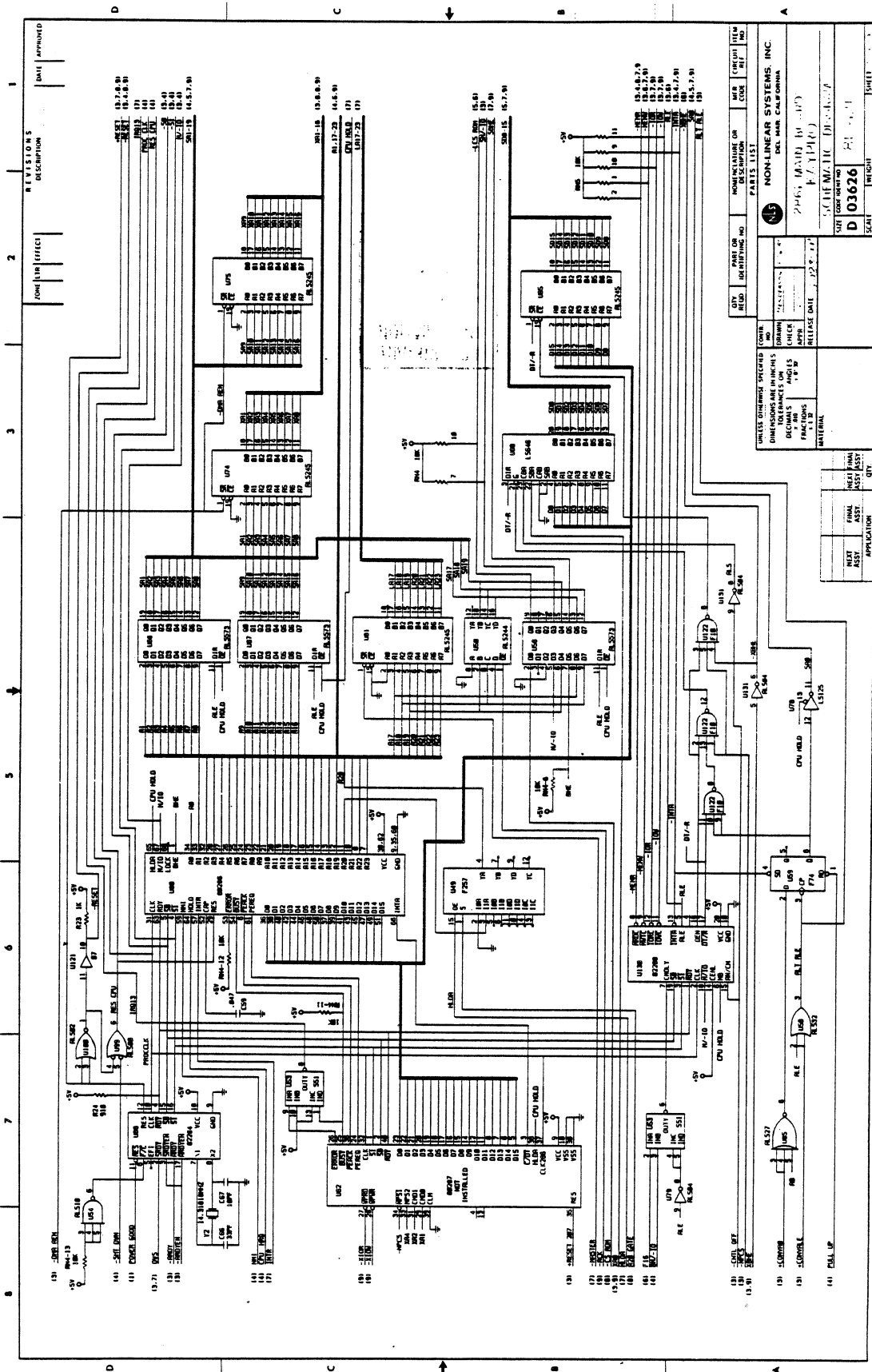
The KAYPRO 286i model C mainboard is the same as the KAYPRO 286i models A and B with the following addition:

U3,4,9,10,15,16,21,22,25, 26,30,31,35,36,41, 42,45,46	6665-AP15	64K x 1, 150ns, dynamic RAM
---	-----------	-----------------------------

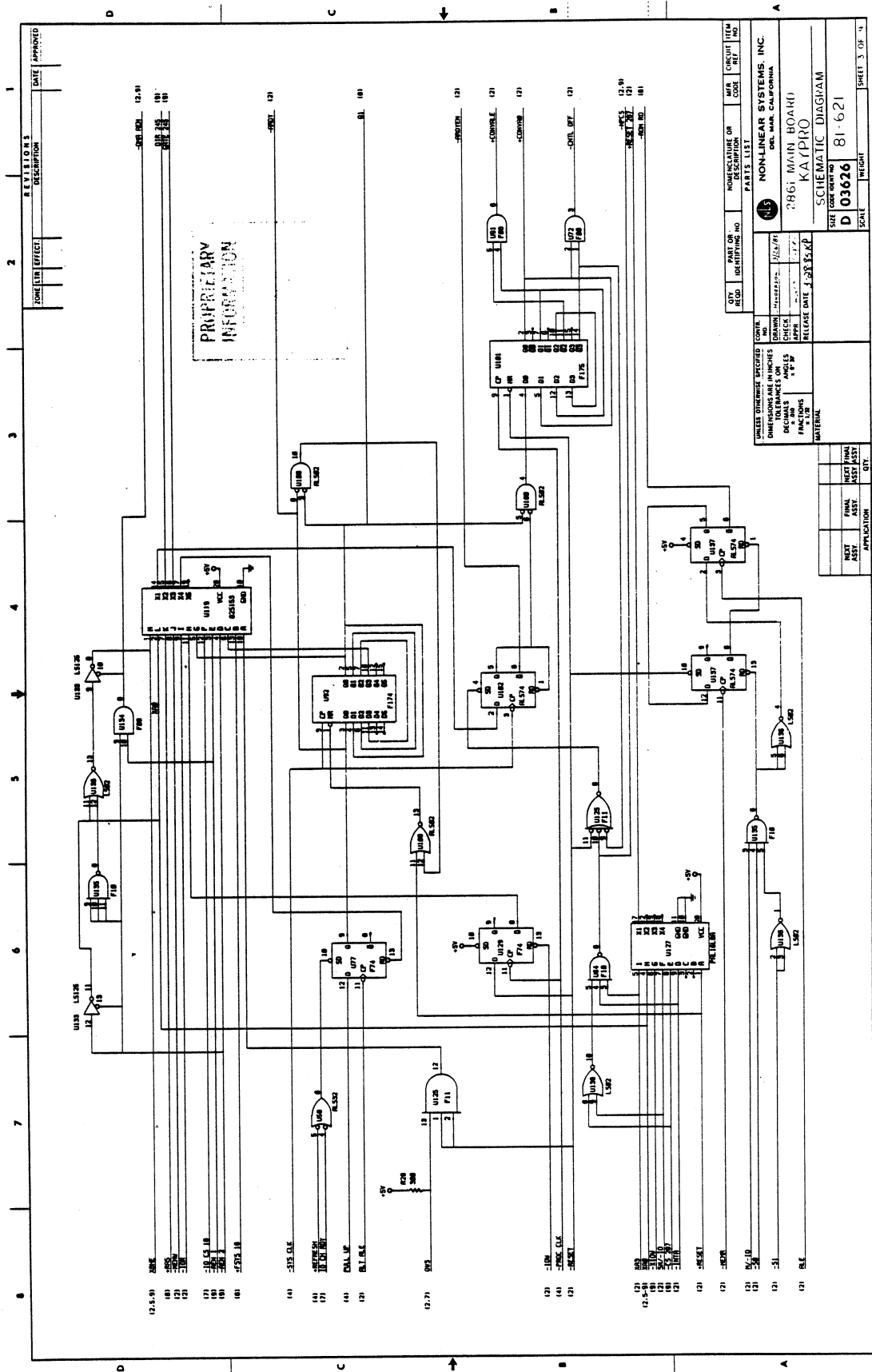
23.33 SCHEMATICS: MAINBOARD



SCHEMATICS: MAINBOARD



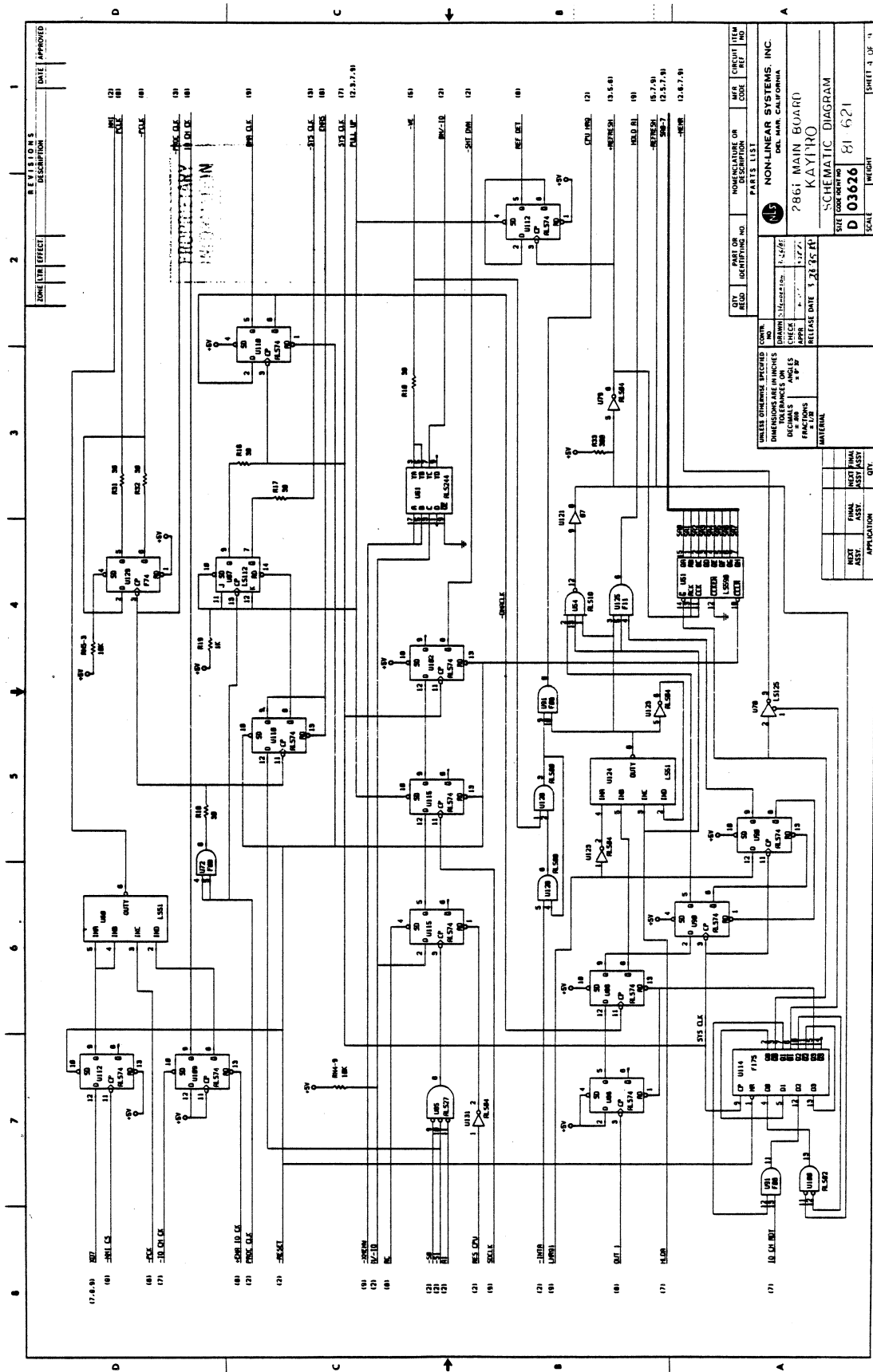
SCHEMATICS: MAINBOARD



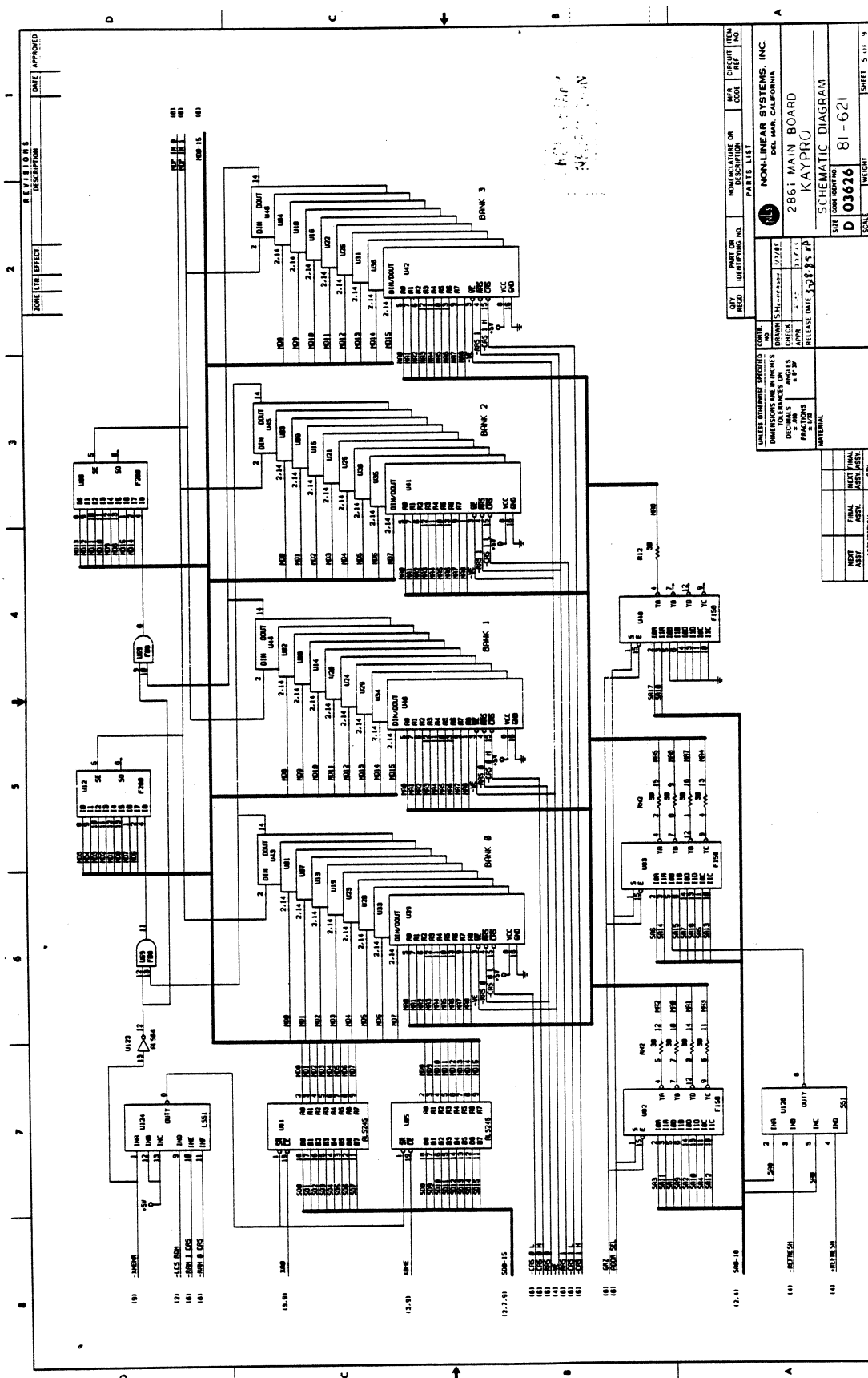
REV	DATE	DESCRIPTION	APPROVED
1			
2			
3			
4			
5			
6			
7			
8			

QTY	DESCRIPTION	WIRING	ITEM
1	NON-LINEAR SYSTEMS, INC.		
1	2861 MAIN BOARD		
1	KAYPRO		
1	SCHEMATIC DIAGRAM		
1	D 03626		
1	81-621		
1	SCALE		
1	WEIGHT		
1	SHEET 3 OF 4		

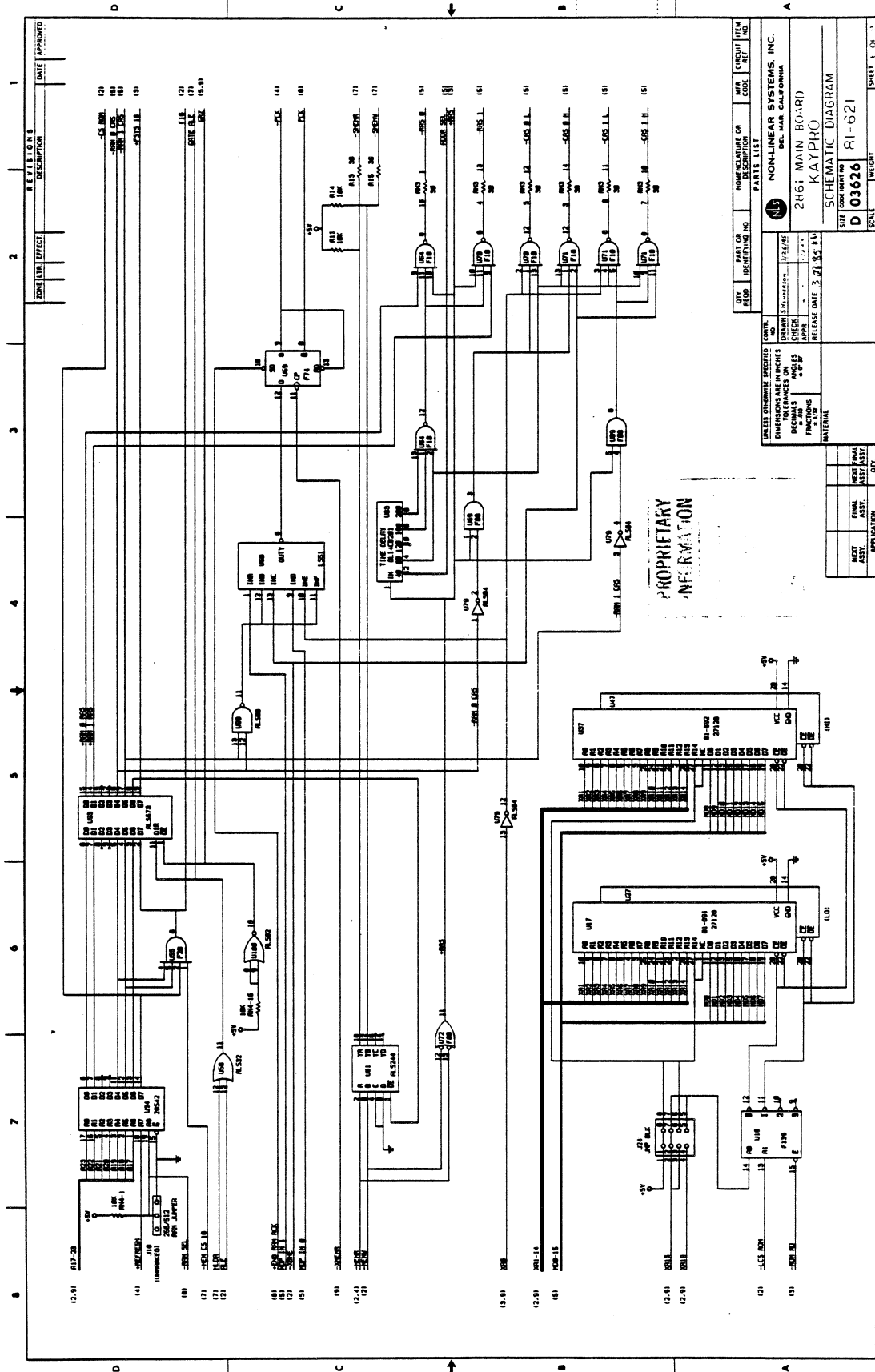
SCHEMATICS: MAINBOARD



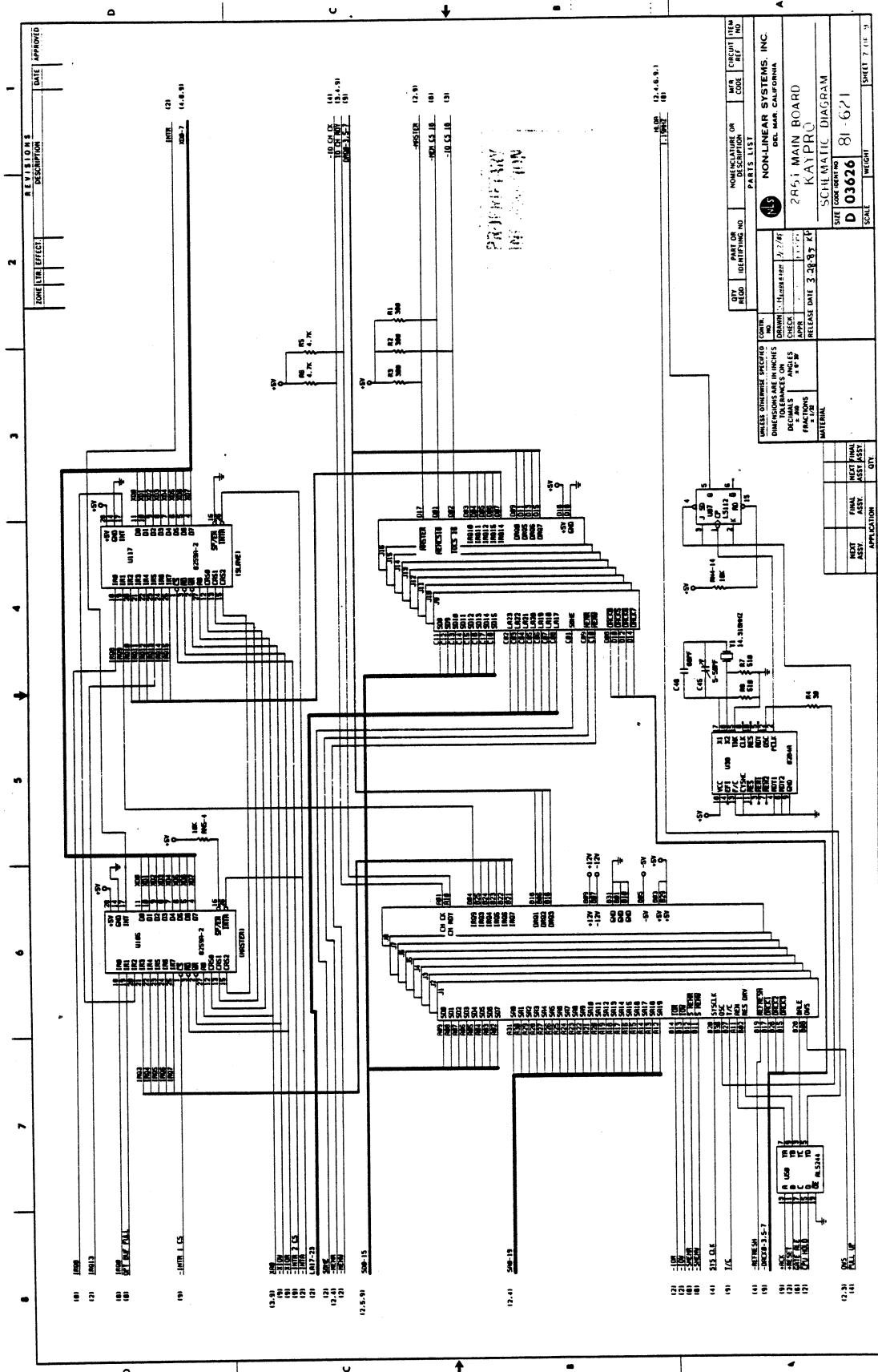
SCHEMATICS: MAINBOARD

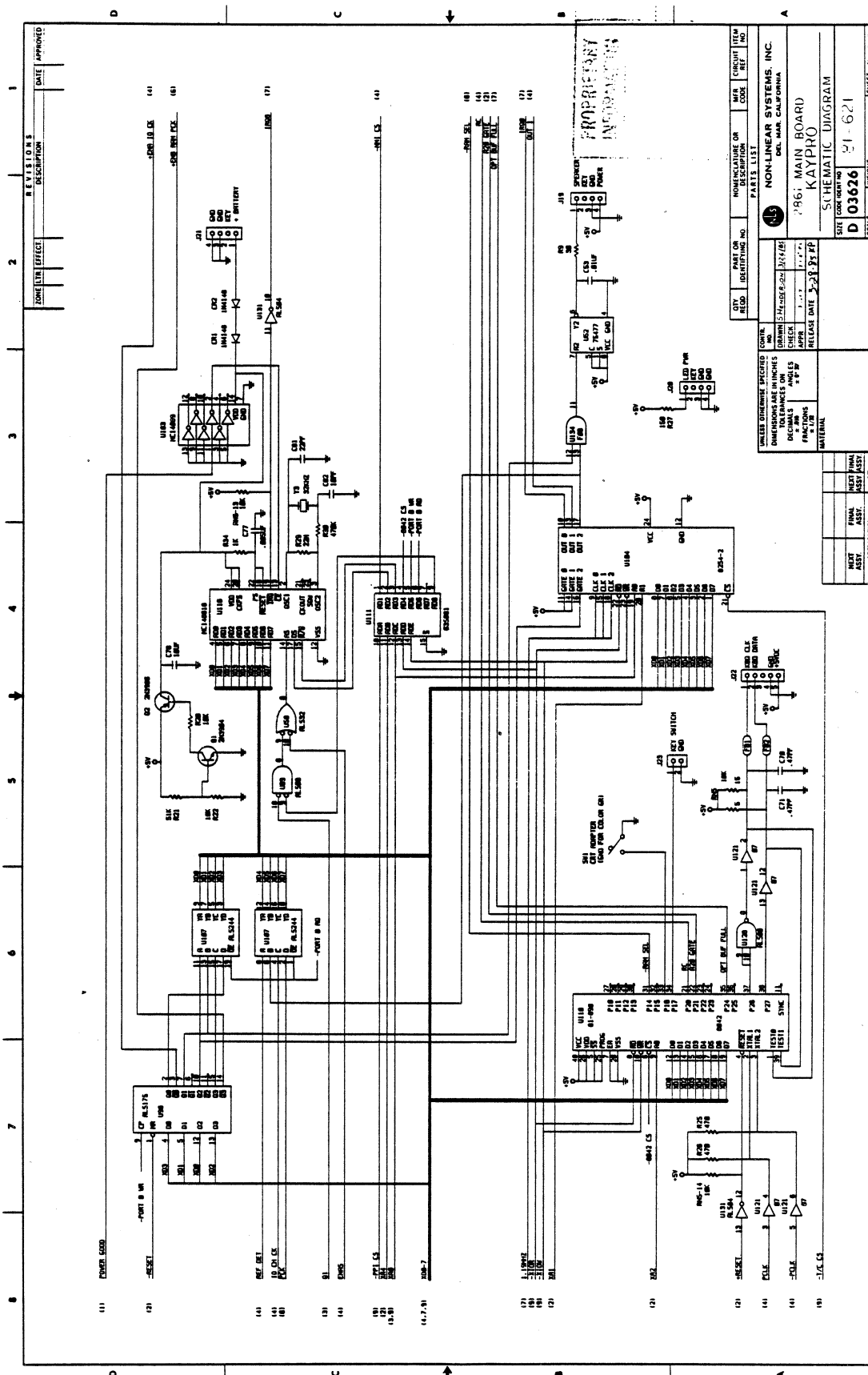


SCHEMATICS: MAINBOARD

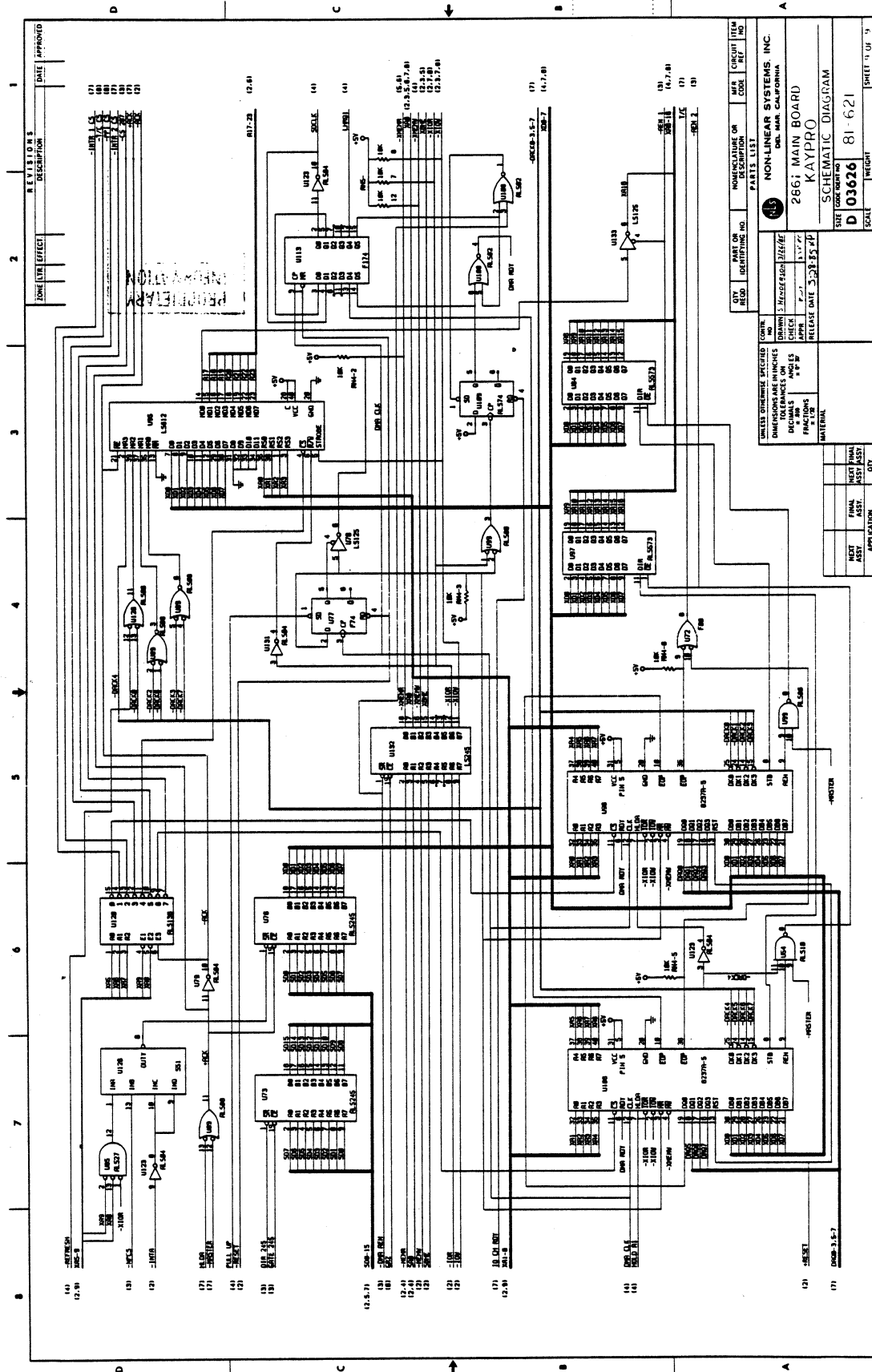


SCHEMATICS: MAINBOARD





SCHEMATICS: MAINBOARD



23.34 MAINBOARD CONNECTOR PIN ASSIGNMENTS

SPEAKER CONNECTOR (J19)

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

KEYBOARD CONNECTOR (J22)

Pin	Assignment
1	Keyboard Clock
2	Keyboard Data

power up.

RAM: 5 640 KB standard; expandable to 15 MB with +5VDC

POWER CONNECTOR (J17)

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

BATTERY CONNECTOR (J21)

KEYLOCK CONNECTOR (J23)

Pin	Assignment
1	Key Switch
2	Ground

Pin	Assignment
1	+ Battery
2	Key
3	Ground
4	Ground

RAM ENABLE/DISABLE SWITCH (J18)

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

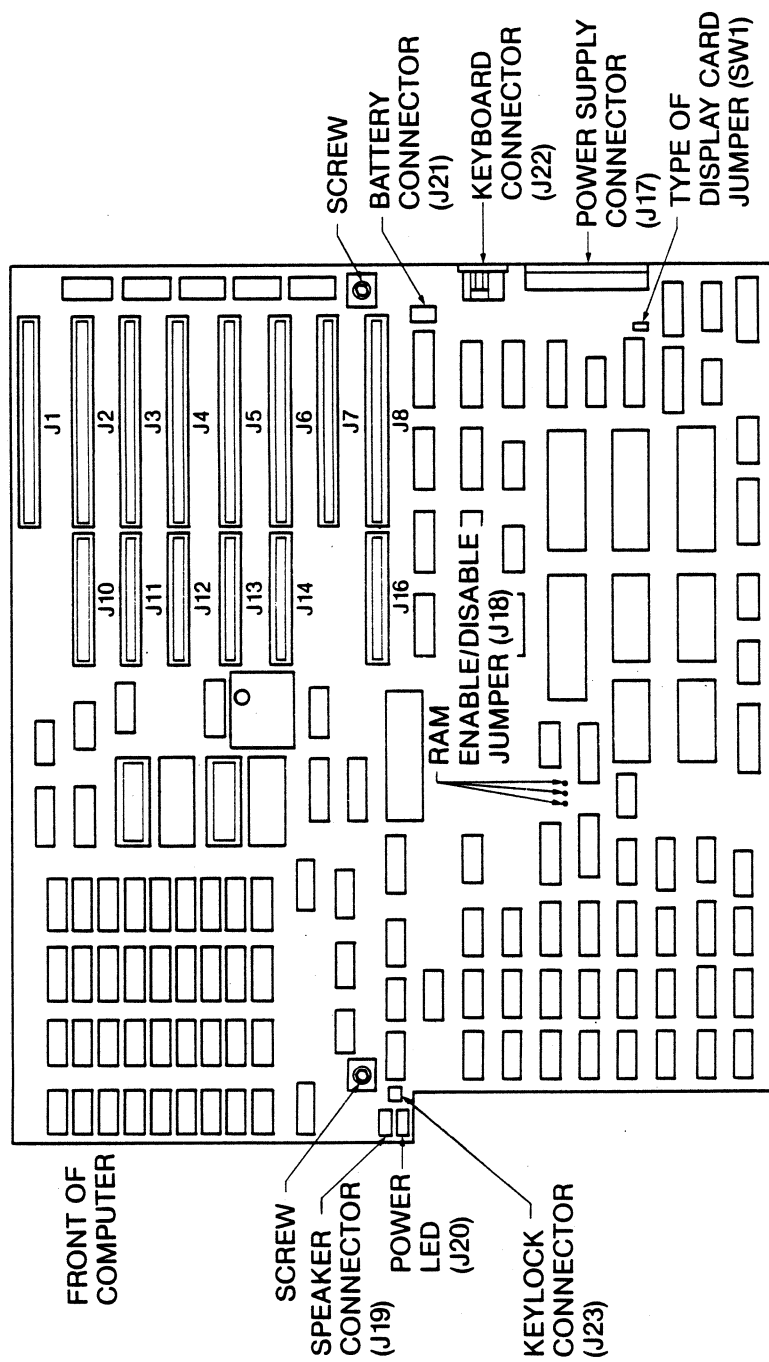
Note: Before the system RAM may be increased by installing additional memory expansion cards, either memory banks 2 and 3 on the mainboard must be filled, or this switch must be set to disable those banks. The default setting is "Not Jumpered". Please see section 23.3 Memory Expansion.

TYPE OF DISPLAY CARD JUMPER (SW1)

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

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

Figure 23-3 KAYPRO 286i Mainboard Layout



23.35 MAINBOARD REMOVAL

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

1. Turn off the computer and disconnect the AC power.
2. Remove chassis cover (22.1).
3. Remove all cards from expansion slots (23.24).
4. Refer to Figure 23-3 for mainboard layout.
5. Remove the 2 hex screws on the mainboard. One is located between J7 and J8 near the back of the computer, the other is directly opposite it near the front of the computer.
6. Remove the battery wires from J21 (the battery is the black box attached to the chassis by Velcro).
7. Remove the three sets of wires from J23 (keylock), J19 (the speaker), and J20 (the power LED). Note positions of all wires.
8. Remove the power supply cable from J17.
9. Slide board toward the left side of the computer and lift the mainboard out.

23.36 MAINBOARD INSTALLATION

1. Set the mainboard in the bottom of the computer with the expansion slots toward the left rear corner of the computer.
2. Slide the mainboard toward the right of the computer until you feel it catch the slots on the bottom of the computer and the screw holes on the mainboard are aligned with the screw holes on the bottom of the computer.
3. Replace the two screws on the mainboard.
4. Replace the power supply cable to J17. Note that the three red wires (+5V) go closest to the power supply.
5. Replace the battery wires to J21, the keylock wires to J23, the speaker wires to J19, and the power LED wires to J20.
6. Replace chassis cover.

24.0 DISK DRIVES

24.1 HIGH-DENSITY FLOPPY DISKETTE DRIVES

24.11 Description

The KAYPRO 286i's are equipped with high-capacity diskette drives. These drives use double-sided, 5 1/4 inch, 600 Oersted, 96 TPI diskettes. These diskettes are formatted 80 tracks per side, 15 sectors per track and have a storage capacity of 1.2 MB per diskette.

As an option, there are regular density diskette drives available from Kaypro. These drives are the same drives used in the 8-bit computers and in the KAYPRO 16 and 16/2. Refer to chapters 9.0 and 19.5 of this manual for identification of the different drives and their configuration. All of the diskette drives used in the KAYPRO 286i are jumpered the same as the drives used for the B drive in the 8-bit models of Kaypro computers.

24.12 FLOPPY DISKETTE DRIVE CONFIGURATIONS

Toshiba and Mitsubishi are two manufacturers of floppy diskette drives currently being used in the KAYPRO 286i computers. The jumpering instructions for each are as follows:

Toshiba Configuration

1. Locate the plug marked PJ13. The pin marked DE should be jumpered to the middle pin.
2. Locate the plug marked PJ4. On single diskette drive computers or the A drive of dual diskette drive computers, the jumpers should be in place at positions TM, LD, HM, and D2. On the B drive of a dual diskette drive computer, the jumpers should be at positions LD, HM, and D2.

Mitsubishi Configuration

1. Refer to drawing of Mitsubishi floppy diskette drive for plug positions.
2. Locate the plug closest to the capital letter A on the right side of the circuit board of the drive. The jumper should be at position 1.
3. The terminating resistor pack should be in place nearest the letter B on the right side if the diskette drive is at the end of the data cable.
4. The plug marked SS near the letter D on the left side should have its jumper removed.
5. The plug nearest the letter D on the left side should have all jumpers removed except the ones at positions IR and RR.
6. The plug nearest the letter E on the left side should have position 2 jumpered to the middle post.
7. The plug nearest the letter G on the left side is jumpered.
8. The plug nearest the letter H on the left side has positions MM and DC jumpered.
9. The plug nearest the letter J on the left side has position HM jumpered.

Figure 24-1 Mitsubishi Floppy Diskette Drive

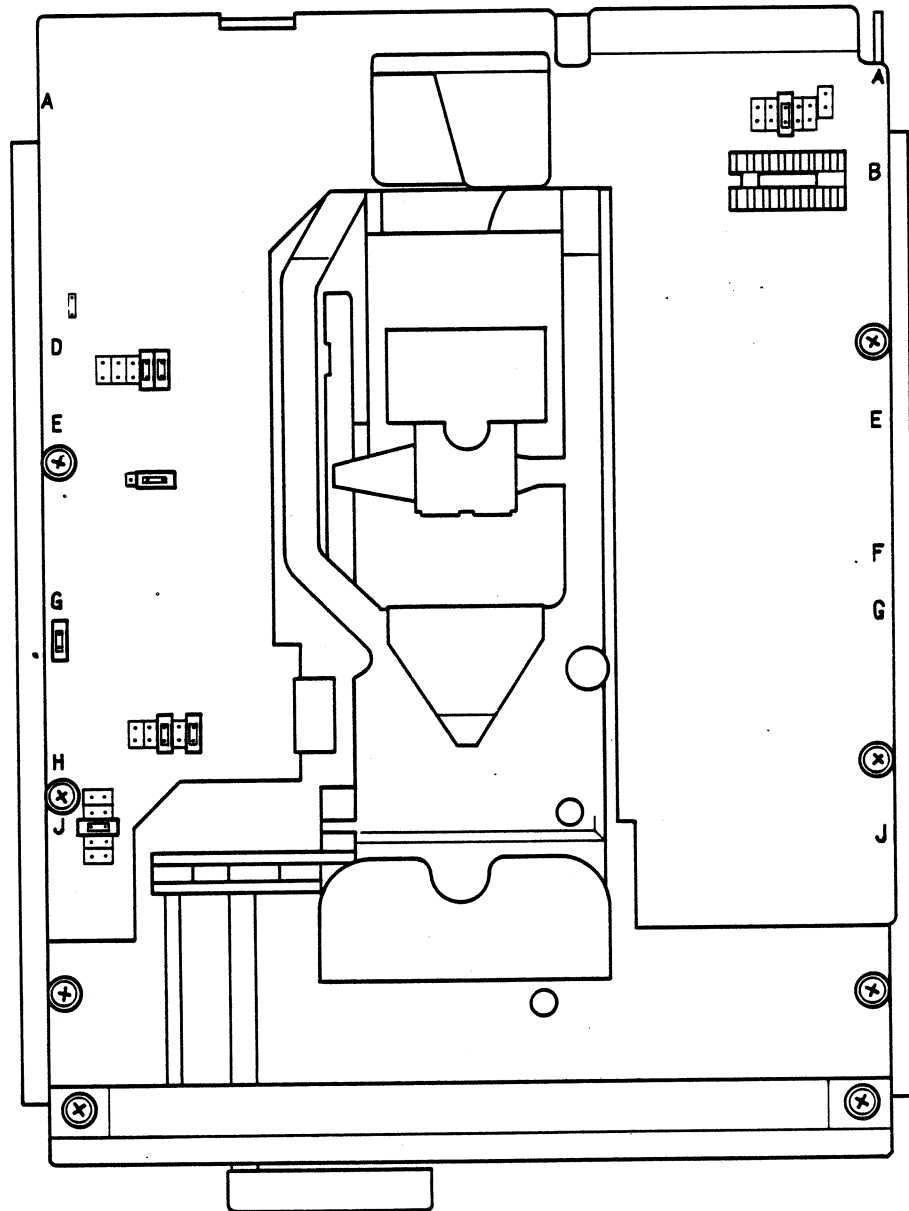


Figure 24-2
Power Connector

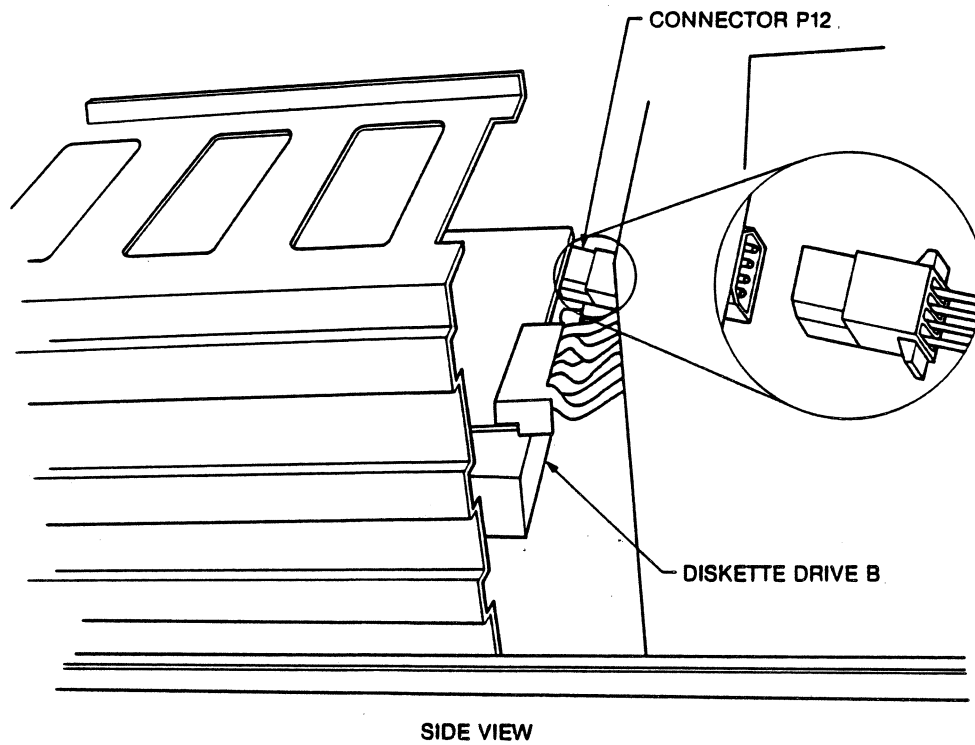
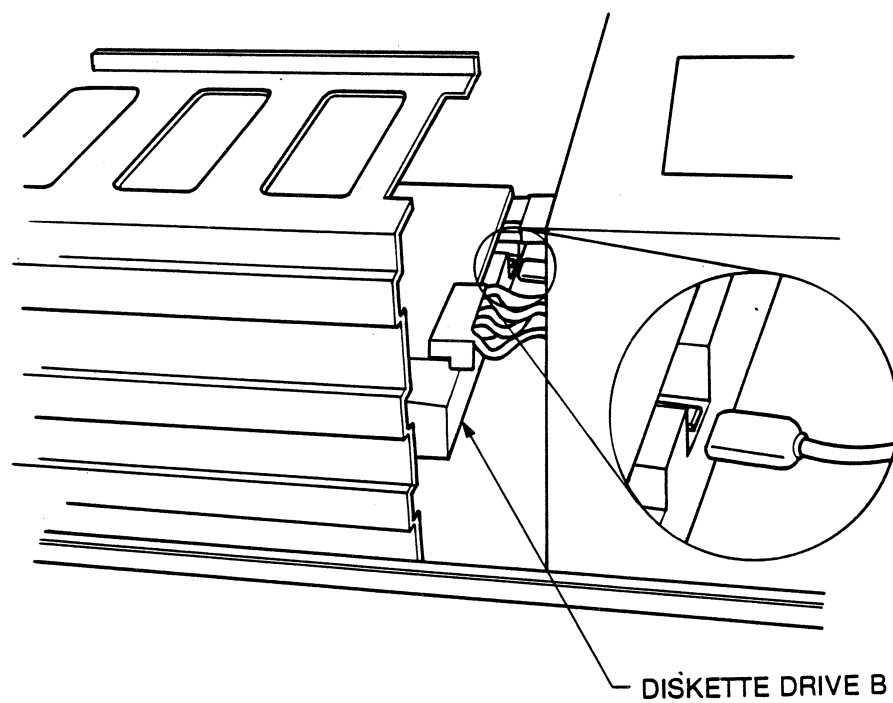


Figure 24-3
Grounding Connector

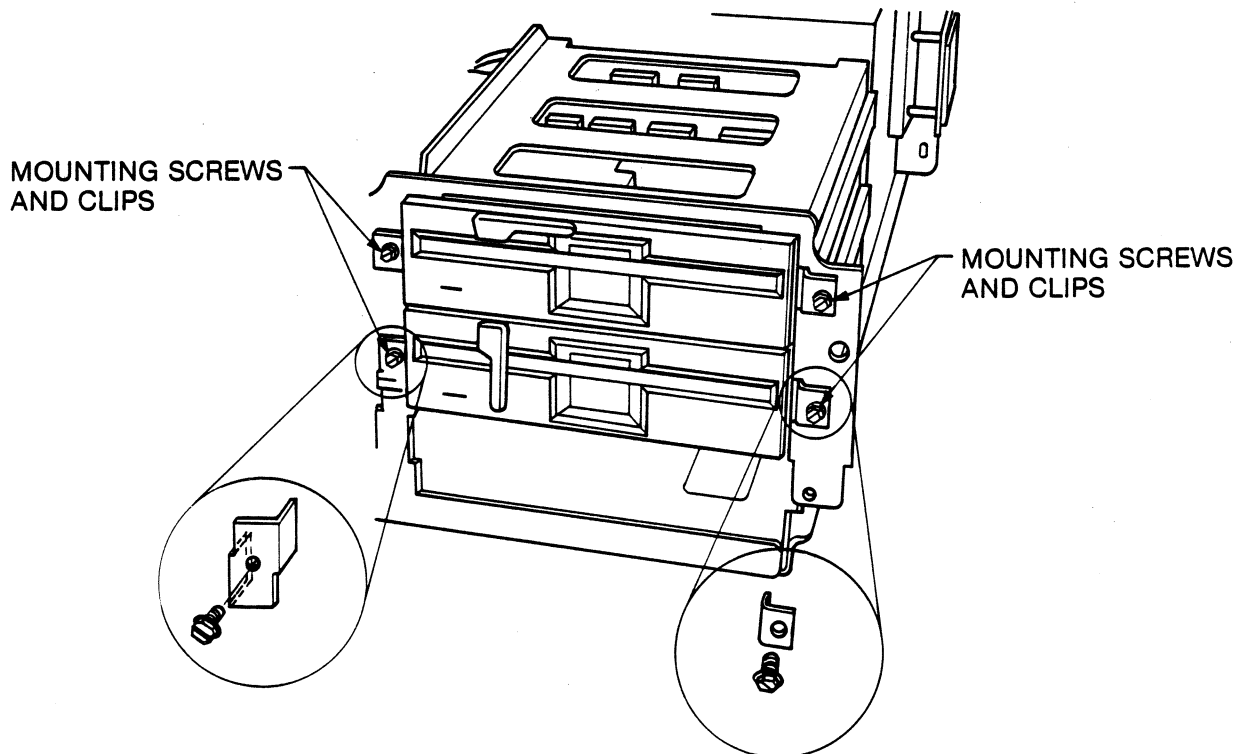


24.13 FLOPPY DISKETTE DRIVE REMOVAL

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

1. Turn off the computer and disconnect the AC power.
2. Remove chassis cover (22.1).
3. Remove data cables (see Figure 4-7), power connectors (see Figure 24-2), and grounding connectors (see Figure 24-3) from the back of the diskette drives.
4. Remove the mounting screws and clips (see Figure 24-4) from both sides of each drive.
5. Slide drive forward out of computer.
6. Remove black plastic slide rails on the sides of each drive. Note the position of each rail—left and right are different.

Figure 24-4 Mounting Screws and Clips



FRONT VIEW

24.14 FLOPPY DISKETTE DRIVE INSTALLATION

1. Install black plastic rails on the new drive(s). Remember that the left and right rails are different.
2. If you are installing a new diskette drive rather than replacing an old one, you must first remove the cover plate (see Figure 24-5).
3. Slide the drive forward into the computer.
4. Replace the mounting screws and clips (refer to Figure 24-4) to both sides of each drive.
5. Replace the data cables on the drives (refer to Figures 24-6 and 24-7). If there are two drives, the top one should be at the end of the data cable. If there is only one drive, it should be at the end of the data cable.
6. Replace the power connectors and the grounding connectors (refer to Figures 24-2 and 24-3).
7. Replace the chassis cover.
8. Any time you are installing a diskette drive, (a brand new drive, or a different type of drive), you should run the "Setup" program.

Figure 24-5 Cover Plate

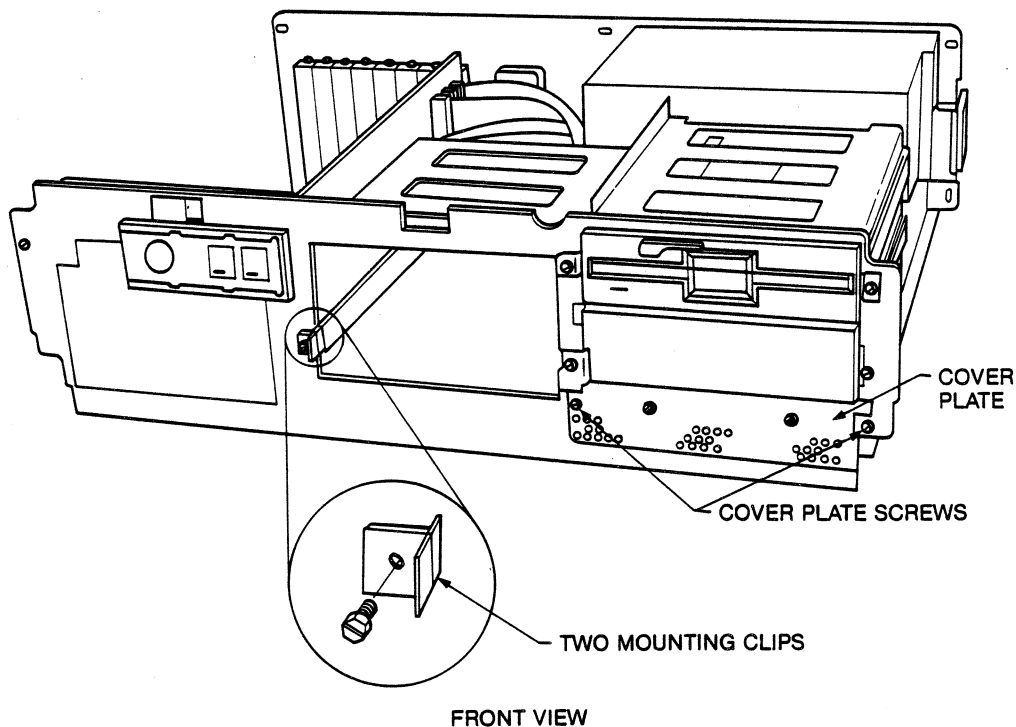


Figure 24-6 Drive Cable

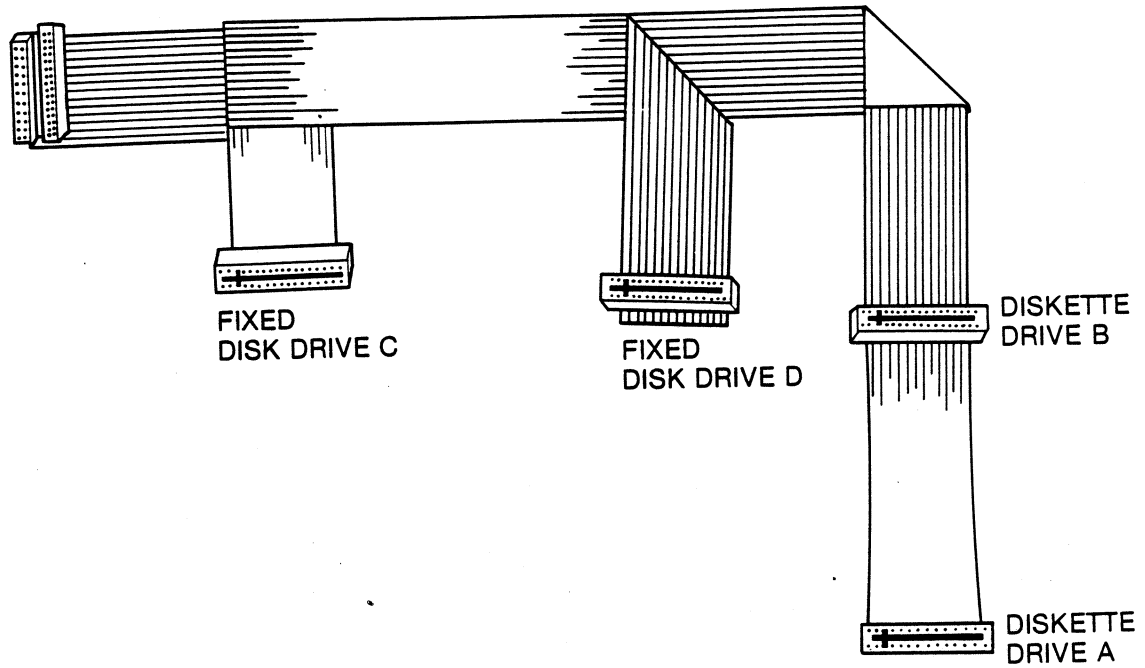
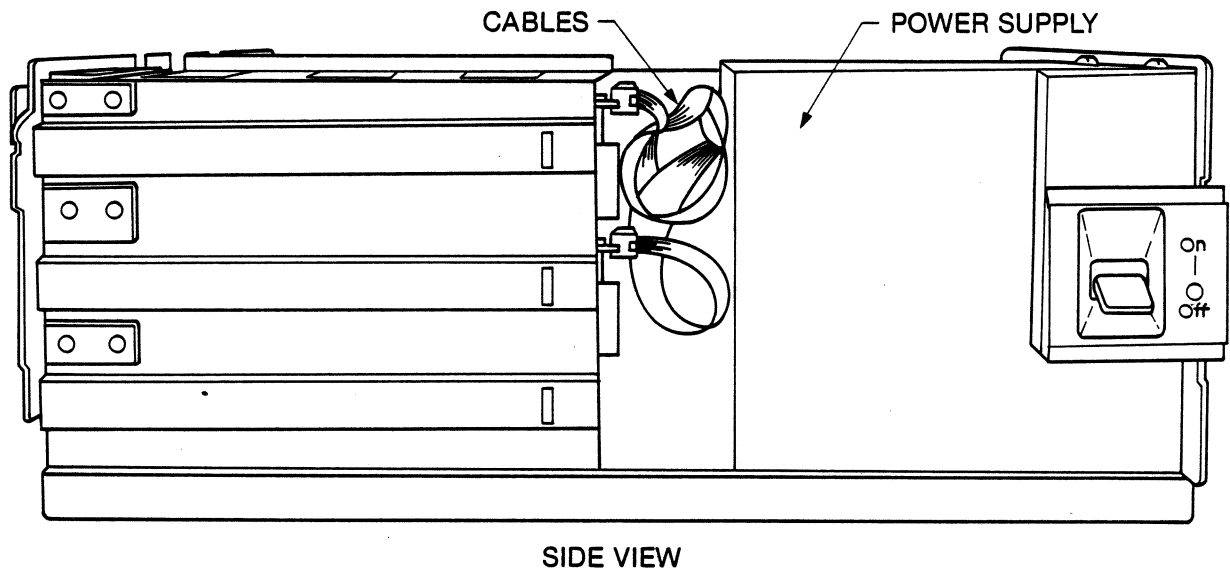


Figure 24-7 Drive Cables in the KAYPRO 286i



24.2 HARD DISK DRIVE

24.21 Description

The KAYPRO 286i models C and D are equipped with a 20M byte hard disk drive manufactured by Seagate.

24.22 HARD DISK DRIVE CONFIGURATION

Hold the hard disk drive with the face plate of the drive facing you, and the circuit board face up. Between the two edge connectors is a plug with four pins. All jumpers should be removed except for the left middle pin.

24.23 HARD DISK DRIVE REMOVAL

1. Turn off the computer and disconnect the AC power.
2. Remove the chassis cover (22.1).
3. Remove the data cables, power connector, and grounding connector from the hard disk drive.
4. Remove the mounting screws and clips from both sides of the hard disk drive (refer to Figure 24-5).
5. Slide hard disk drive forward out of the computer.
6. Remove the black plastic slide rails that are on the sides of the hard disk drive. Note the position of each rail—left and right sides are different.

24.24 HARD DISK DRIVE INSTALLATION

1. Install black plastic rails on the new hard disk drive. Remember that the left and right rails are different.
2. Slide the hard disk drive forward into the computer.
3. Replace the mounting screws and clips (refer to Figure 24-5) on both sides of the hard disk drive.
4. Replace the data cables (refer to Figures 24-6 and 24-7), power connector, and grounding connector on the hard disk drive.
5. Replace the chassis cover.
6. Any time you are installing a hard disk drive, (a brand new drive, or a different type of drive), you must format the disk using the "Format" program included with the KAYPRO 286i Service Test Utilities Diskette which will be available from Kaypro. After the disk is formatted, you should run the "Fdisk", "Format", and "Setup" programs from an MS-DOS diskette.

25.0 STREAMING TAPE DRIVE

25.1 Description

The KAYPRO 286i model D comes equipped with a 1/4-inch streaming tape cartridge drive. This drive uses standard 450-foot-long tape cartridges and can store 20 Mbytes or 45 Mbytes of data using the 4-track or 9-track format, respectively. The use of 600-foot-long tape cartridges allows a storage capacity of 26.7 Mbytes or 60 Mbytes using the 4-track or 9-track format, respectively.

25.2 STREAMING TAPE DRIVE REMOVAL

1. Turn off the computer and disconnect the AC power.
2. Remove the chassis cover (22.1).
3. Remove the data cables, power connector, and grounding connector from the streaming tape drive.
4. Remove the mounting screws and clips from both sides of the streaming tape drive (see Figure 24-4).
5. Slide streaming tape drive forward out of the computer.
6. Remove the black plastic slide rails that are on the sides of the streaming tape drive. Note the position of each rail—left and right sides are different.

25.2 STREAMING TAPE DRIVE INSTALLATION

1. Install black plastic rails on the new streaming tape drive. Remember that the left and right rails are different.
2. If you are installing a new tape drive rather than replacing an old one, you must first remove the cover plate (see Figure 24-5).
3. Slide the streaming tape drive forward into the computer.
4. Replace the mounting screws and clips on both sides of the streaming tape drive.
5. Replace the data cables, power connector, and grounding connector on the streaming tape drive.
6. Replace the chassis cover.

26.0 POWER SUPPLY

26.1 Description

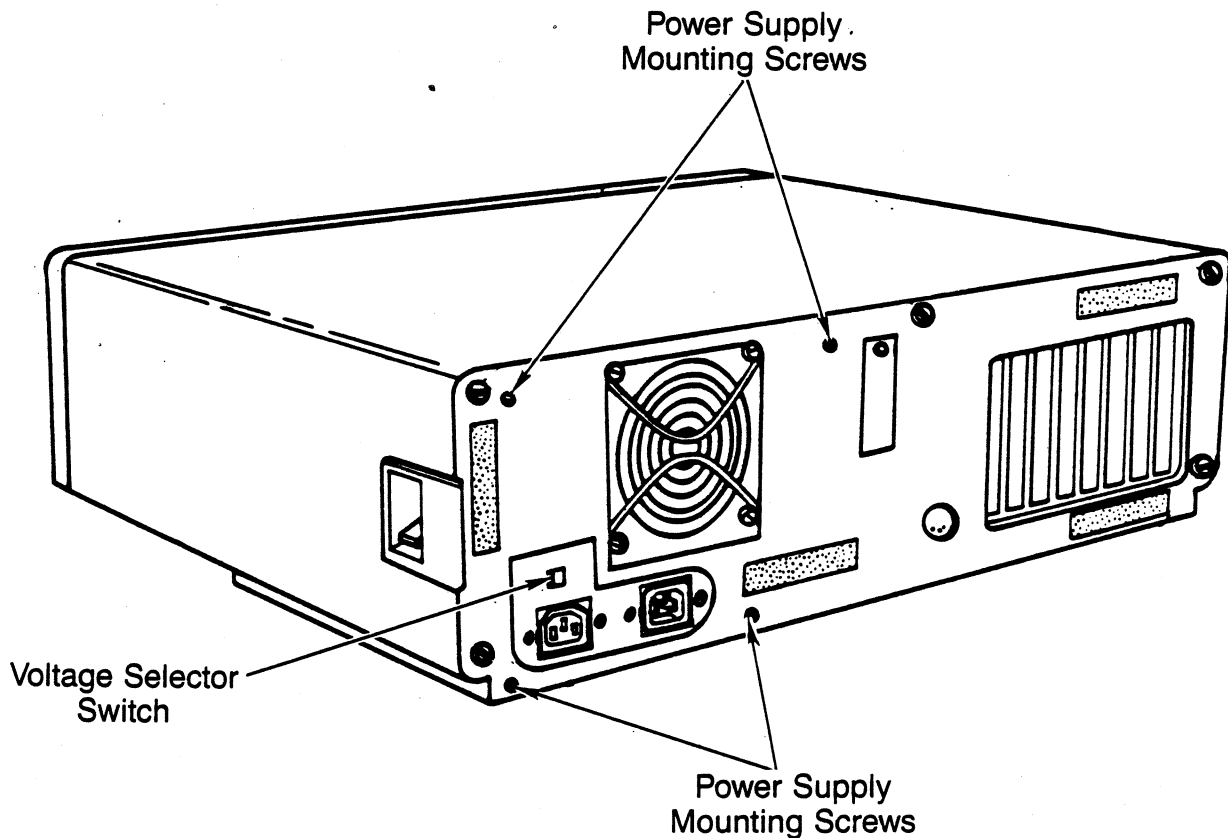
The power supply used in the KAYPRO 286i is a 192 watt switching type manufactured by either California D.C. or Tri Mag. The power supply unit includes the on/off switch, the fan, most of the wiring harness, and the voltage selector switch. If a problem is encountered with any of these items, the entire power supply must be exchanged. Opening the power supply unit will void the warranty.

26.2 230V CONFIGURATION

To configure the power supply for 230V use, simply locate the voltage selector switch (refer to Figure 26-1) on the back of the computer and select the 230V setting.

CAUTION: SETTING THE VOLTAGE SELECTOR SWITCH TO THE WRONG POSITION CAN CAUSE EXTENSIVE DAMAGE TO THE KAYPRO 286i.

Figure 26-1 Power Supply Voltage Selector Switch
Power Supply Mounting Screws



26.3 POWER SUPPLY REMOVAL

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

1. Turn off the computer and disconnect the AC power.
2. Remove the chassis cover (22.1).
3. Remove the power connectors and grounding connector from the diskette drive(s) and the hard disk drive (refer to Figures 24-2 and 24-3).
4. Remove the 12-pin connector from J17 on the mainboard.
5. Remove the four hex screws from the back of the computer (Refer to Figure 26-1).
6. Push the power supply toward the front of the computer and lift it out.

26.4 POWER SUPPLY INSTALLATION

1. Install the power supply in the computer until the holes in the power supply align with the screw holes in the back of the computer chassis.
2. Replace the four hex screws through the back of the computer chassis, into the power supply, and tighten them (refer to Figure 26-1).
3. Replace the 12-pin connector into J17 on the mainboard. Notice that the three red wires (+5VDC) go closest to the power supply.
4. Replace the power connectors and grounding connectors to the diskette drive and the hard disk drive (refer to Figures 24-2 and 24-3).
5. Replace the chassis cover.

27.0 KEYBOARD

27.1 Description

The keyboard carries signals between itself and the KAYPRO 286i through the use of a bidirectional serial interface.

The keyboard has a buffer that saves data until the interface is ready to receive it. This buffer stores 16 characters on a first-in-first-out basis.

All keys pressed on the keyboard will be detected, and scan codes sent to the interface in correct sequence, regardless of the number of keys depressed. Any keystrokes entered while the keylock is on will not be detected.

27.2 KEYBOARD CONNECTOR

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

DIN	SIGNAL NAME
1	Keyboard Clock
2	Keyboard Serial Data
3	Reset
4	Ground
5	+5VDC

28.0 BATTERY

28.1 Description

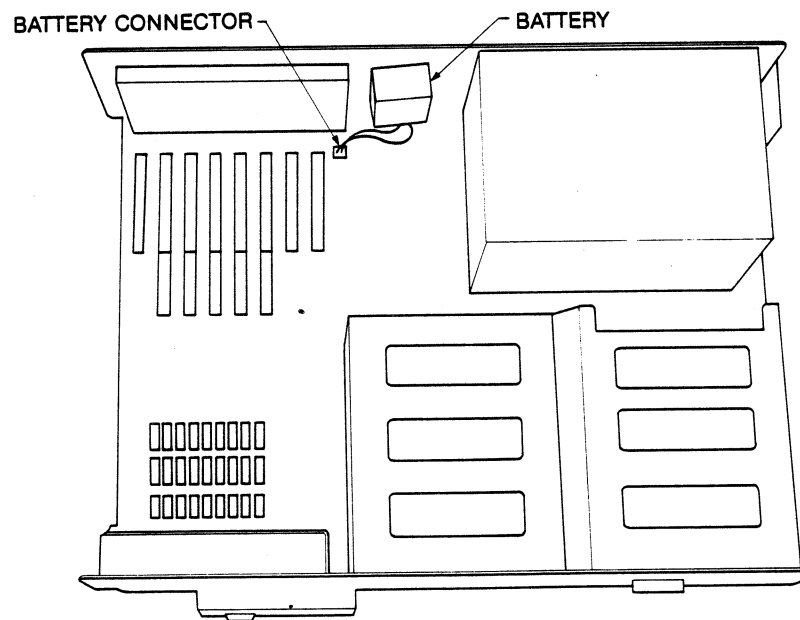
The battery powers the computer's clock and the system configuration memory. The life expectancy of this battery is three to five years. If the system clock starts running noticeably slow, or if the computer displays the message "Invalid configuration information", or "Time-of-day clock stopped", it is probably time to replace the battery. Any time the battery is removed or disconnected from the mainboard, the system configuration information is lost, and the "Setup" program must be run.

28.2 BATTERY REMOVAL

WARNING! The KAYPRO 286i contains static sensitive devices. Make sure that you are grounded before you remove the cover.

1. Turn off the computer and disconnect the AC power.
2. Remove the chassis cover (22.1).
3. Locate the battery to the right of the expansion slots attached to the back of the chassis by a Velcro (tm) strip (refer to Figure 28-1).
4. Remove the battery connector from the mainboard.
5. Gently pull the battery from the chassis.

Figure 28-1 Location of the Battery



28.3 BATTERY INSTALLATION

1. Press the side of the battery that has the Velcro (tm) strip to the Velcro (tm) strip on the chassis.
2. Attach the battery connector to the mainboard at position J1.
3. Replace the chassis cover.
4. Any time the battery is removed or disconnected from the mainboard, the system configuration information is lost, and the "Setup" program must be run.

29.0 SYSTEM I/O

29.1 PARALLEL PORT PIN ASSIGNMENTS

The pin assignments for the primary parallel port (LPT 1) on the KAYPRO 286i are as follows:

PARALLEL PORT (PRN 1) PIN	SIGNAL	DIRECTION OF SIGNAL
1	Strobe	——>
2	Data 0	——>
3	Data 1	——>
4	Data 2	——>
5	Data 3	——>
6	Data 4	——>
7	Data 5	——>
8	Data 6	——>
9	Data 7	——>
10	Acknowledge	<——
11	Busy	<——
12	Paper End	<——
13	Select	<——
14	Auto Feed	——>
15	Fault	<——
16	Initiate	——>
17	Select In	——>
18-25	Ground	——

NOTE: ALL CABLES USED WITH THE KAYPRO 286i MUST BE SHIELDED IN ORDER TO COMPLY WITH FCC REGULATIONS.

29.2 SERIAL PORT PIN ASSIGNMENTS

The pin assignments for the serial port (COM 1) on the KAYPRO 286i are as follows:

SERIAL PORT PIN	SIGNAL	DIRECTION OF SIGNAL
1	Carrier Detect	<—
2	Receive Data	<—
3	Transmit Data	—>
4	Data Terminal Ready	—>
5	Signal Ground	—
6	Data Set Ready	<—
7	Request To Send	—>
8	Clear To Send	<—
9	Ring Indicator	<—

NOTE: ALL CABLES USED WITH THE KAYPRO 286i MUST BE SHIELDED IN ORDER TO COMPLY WITH FCC REGULATIONS.

29.3 RGB MONITOR ADAPTER PIN ASSIGNMENTS

The pin assignments for the RGB monitor adapter are as follows:

PIN	SIGNAL
1	Ground
2	Ground
3	Red input
4	Green input
5	Blue input
6	Intensity
7	No connection
8	Horizontal sync
9	Vertical sync

NOTE: ALL CABLES USED WITH THE KAYPRO 286i MUST BE SHIELDED IN ORDER TO COMPLY WITH FCC REGULATIONS.

29.4 I/O PORT ADDRESSES

PORT (HEX)	DEVICE/FUNCTION
000-01F	DMA chip, 8237A-5
020-03F	Interrupt, 8259A
040-05F	Timer, 8254-2
060-06F	Keyboard, 8042
070-07F	Real-time clock
080-09F	DMA Register, 74LS612
0A0-0BF	Interrupt controller, 8259A
0C0-0DF	DMA controller, 8237A-5
0F0	Math co-processor
0F1	Math co-processor
0F8-0FF	Math co-processor
1F0-1F8	Reserved
200-207	Game I/O
278-27F	Parallel port (secondary)
2F8-2FF	Reserved
300-31F	Reserved
360-36F	Reserved
378-37F	Parallel port (primary)
380-38F	SDLC, bisynchronous (secondary)
3A0-3AF	Bisynchronous (primary)
3B0-3BF	Reserved
3C0-3CF	Reserved
3D0-3DF	Color graphics
3F0-3F7	Diskette controller
3F8-3FF	Serial port

29.5 MEMORY MAP OF THE KAYPRO 286i COMPUTER

System ROM, BIOS	FFFFFFh
	FF0000h
Reserved	FEFFFFh
	FE0000h
Memory Expansion	FDFFFFh
	100000h
ROM	0FFFFFFh
	0F0000h
Reserved	0EFFFFh
	0E0000h
I/O Expansion	0DFFFFh
	0C0000h
Video RAM	0BFFFFh
	0A0000h
Memory Expansion	09FFFFh
	080000h
User Memory	07FFFFh
	000000h

INDEX

- 220V configuration
 - 8-bit computers, 8—2
 - KAYPRO 16, 19—27
- 230V configuration, KAYPRO 286i, 26—1
- 80287 math co-processor, KAYPRO 286i, 23—8
- adapter cards, KAYPRO 16
 - installation, 19—20
 - removal, 19—18
- adapter cards, KAYPRO 286i
 - color card, 23—1
 - controller card, 23—1
 - installation, 23—6
 - removal, 23—6
 - serial/parallel port card, 23—2
 - tape drive controller card, 23—1
- ASCII chart, 8-bit computers, 17—1
- battery, KAYPRO 286i
 - connector, 23—16
 - description, 28—1
 - installation, 28—2
 - removal, 28—1
- block diagram
 - KAYPRO 10, 6—20
 - KAYPRO 2 and 4, 6—7
- board assembly removal, KAYPRO 16, 19—16
- chassis cover, KAYPRO 286i, 22—1
- chassis cover, ROBIE, 14—1
- chassis hood, 8-bit computers, 5—1
- chassis hood, KAYPRO 16, 19—3
- chip layout
 - KAYPRO 10 (81-180-n), 6—16
 - KAYPRO 2 (81-110-n), 6—2
 - KAYPRO 2/4 (81-240-n), 6—8
 - KAYPRO 2/84 and 2X (81-294-n), 6—26
 - KAYPRO 4/84 (81-184-n), 6—34
 - KAYPRO ROBIE (81-296-n), 6—42
- color card, KAYPRO 286i, 23—1
- connectors, 8-bit computers
 - keyboard, 16—6, 16—8
 - keyboard KAYPRO 10, 16—7
 - modem, 16—9
 - modem port KAYPRO 10, 16—7
 - parallel printer connector KAYPRO 10, 16—7
 - parallel printer port, 16—5, 16—9
 - serial data channel, 16—8
 - serial port, 16—6
 - serial printer connector, 16—8
 - serial printer connector KAYPRO 10, 16—7.1
- connectors, KAYPRO 16, 19—43

INDEX (Continued)

- connectors, KAYPRO 286i
 - battery, 23—16
 - keyboard, 23—16, 27—1
 - keylock, 23—16
 - power, 23—16
 - speaker, 23—16
- controller board, 8-bit computers, 11—1
- controller board, KAYPRO 16, 19—22
- controller card, KAYPRO 286i, 23—1
- CRT, 8-bit computers
 - aligning yoke, 7—2.1
 - alignment, 7—3
 - brightness, 7—2
 - descriptions, 7—1
 - focus, 7—2
 - horizontal centering, 7—1
 - horizontal hold, 7—2
 - horizontal width, 7—1
 - installation (except ROBIE), 7—5
 - removal (except ROBIE), 7—5
 - vertical size and linearity, 7—1
- CRT, KAYPRO 16
 - adjustments, 19—23
 - installation, 19—25
 - removal, 19—24
- DE-9P serial port, KAYPRO 16, 19—46
- DE-9S connector, KAYPRO 16, 19—44
- diskette drives, 8-bit computers
 - cleaning, 9—1
 - configuration, 9—5
 - Drivetec, 9—1, 9—9
 - identification, 9—2
 - installation (except ROBIE), 9—10
 - installation (ROBIE), 14—2
 - removal (except ROBIE), 9—10
 - removal (ROBIE), 14—2
- diskette drives, KAYPRO 16
 - description, 19—31
 - installation, 19—34
 - removal, 19—32
 - removal (KAYPRO 16/2), 20—2
- diskette drives, KAYPRO 286i
 - configuration, 24—1
 - description, 24—1
 - installation, 24—6
 - removal, 24—5
- FCC information
 - 8-bit computers, 2—1
 - KAYPRO 286i, 21—2
- hard disk drive controller board
 - 8-bit computers, 11—1
 - KAYPRO 16, 19—22
 - KAYPRO 286i, 23—1

INDEX (Continued)

- hard disk drive, 8-bit computers
 - configuration, 10—3
 - description, 10—2
 - installation, 10—5
 - introduction, 10—1
 - removal, 10—4
- hard disk drive, KAYPRO 16
 - description, 19—37
 - installation, 19—40
 - removal, 19—38
- hard disk drive, KAYPRO 286i
 - configuration, 24—8
 - description, 24—8
 - installation, 24—9
 - removal, 24—8
- I/O port addresses
 - 8-bit computers, 16—10
 - KAYPRO 16, 19—48
 - KAYPRO 286i, 29—4
- IC list
 - KAYPRO 10 (81-180-n), 6—17
 - KAYPRO 16 color graphics card (81-517), 19—5
 - KAYPRO 16 floppy-RAM-I/O card (81-515), 19—5
 - KAYPRO 16 mainboard (81-511), 19—4.1
 - KAYPRO 16 processor card (81-513), 19—6
 - KAYPRO 2 (81-110-n), 6—3
 - KAYPRO 2/4 (81-240-n), 6—9
 - KAYPRO 2/84 and 2X (81-294-n), 6—27
 - KAYPRO 286i mainboard (81-621), 23—9
 - KAYPRO 286i serial/parallel port card (81-623), 23—3
 - KAYPRO 4/84 (81-184-n), 6—35
 - KAYPRO ROBIE (81-296-n), 6—43
- interface board, KAYPRO 10, 12—1
- internal modem, 8-bit computers, 16—14
- keyboard, 8-bit computers
 - cable pinouts, 13—1
 - codes and functions, 16—3
 - connector, 16—6
 - connector KAYPRO 10, 16—7
 - description, 13—1
- keyboard, KAYPRO 16, 19—41
- keyboard, KAYPRO 286i
 - connector, 23—16, 27—1
 - description, 27—1
- keylock connector, KAYPRO 286i, 23—16

INDEX (Continued)

- mainboard, 8-bit computers, 6—1
 - installation, 6—57
 - keyboard connector, 16—8
 - keyboard connector pin assignments, 16—6
 - keyboard connector pin assignments KAYPRO 10, 16—7
 - modem connector, 16—9
 - modem port pin assignments KAYPRO 10, 16—7
 - parallel printer connector KAYPRO 10, 16—7
 - parallel printer port, 16—9
 - parallel printer port pin assignments, 16—5
 - removal, 6—57
 - serial data channel, 16—8
 - serial port pin assignments, 16—6
 - serial printer connector, 16—8
 - serial printer connector KAYPRO 10, 16—7.1
 - troubleshooting tips, 6—1
 - video signals, 7—4
- mainboard, KAYPRO 16
 - installation, 19—17, 19—21
 - removal, 19—16, 19—21
- mainboard, KAYPRO 286i
 - 80287 math co-processor, 23—8
 - connectors, 23—16
 - description, 23—8
 - IC list, 23—9
 - installation, 23—18
 - memory expansion, 23—8
 - RAM enable/disable switch, 23—8
 - removal, 23—18
 - schematics, 23—11
- memory expansion, KAYPRO 286i, 23—8
- memory map
 - KAYPRO 10, 17—3
 - KAYPRO 16, 19—49
 - KAYPRO 2 and 4, 17—2
 - KAYPRO 2/84 and 4/84, 17—4
 - KAYPRO 286i, 29—5
 - KAYPRO ROBIE, 17—5
- modem cable (DTE), KAYPRO 16, 19—45, 19—46
- modem connector, 8-bit computers, 16—9
- modem port KAYPRO 10, 16—7
- option switch settings, KAYPRO 16, 19—50
- parallel port pin assignments, KAYPRO 286i, 29—1
- parallel printer cable, KAYPRO 16, 19—42
- parallel printer connector, KAYPRO 10, 16—7
- parallel printer port KAYPRO 2/84 and 4/84, 16—9
- parallel printer port, 8-bit computers, 16—5
- parallel printer, KAYPRO 16, 19—42

INDEX (Continued)

- pin assignments, KAYPRO 286i
 - parallel port, 29—1
 - RGB monitor, 29—3
 - serial port, 29—2
- power connector, KAYPRO 286i, 23—16
- power supply, 8-bit computers
 - 220V configuration, 8—2
 - fuse, 8—2
 - removal, 8—5
 - service warning, 8—1
- power supply, KAYPRO 16
 - 220V configuration, 19—27
 - description, 19—26
 - installation, 19—29
 - removal, 19—29
- power supply, KAYPRO 286i
 - 230V configuration, 26—1
 - description, 26—1
 - installation, 26—2
 - removal, 26—2
- RAM enable/disable switch, KAYPRO 286i, 23—8, 23—16
- real-time clock, 8-bit computers, 16—12
- RGB monitor adapter pin assignments, KAYPRO 286i, 29—3
- ROM revisions, 8-bit computers, 4—1
- schematics, 8-bit computers
 - KAYPRO 10, 6—21
 - KAYPRO 2, 6—6.1
 - KAYPRO 2/4, 6—13
 - KAYPRO 2/84, 6—28
 - KAYPRO 4/84, 6—36
 - KAYPRO ROBIE, 6—44
 - other, 6—50
- schematics, KAYPRO 16
 - color graphics card, 19—13
 - floppy-RAM-I/O card, 19—11
 - mainboard, 19—7
 - processor card, 19—10
- schematics, KAYPRO 286i
 - mainboard, 23—11
 - serial/parallel port card, 23—4
- scope signals
 - KAYPRO 10 (81-180-n), 6—18
 - KAYPRO 2 (81-110-n), 6—4
 - KAYPRO 2/4 (81-240-n), 6—10
- serial data channel, 8-bit computers, 16—8
- serial port KAYPRO 2 and 4, 16—6
- serial port pin assignments, KAYPRO 16, 19—44, 19—46
- serial port pin assignments, KAYPRO 286i, 29—2
- serial printer cable (DCE), KAYPRO 16, 19—46
- serial printer cable, KAYPRO 16, 19—44
- serial printer port KAYPRO 10, 16—7.1
- serial printer port KAYPRO 2/84 and 4/84, 16—8

INDEX (Continued)

- serial/parallel port card, KAYPRO 286i, 23—2
 - IC list, 23—3
 - schematics, 23—4
- service warning, 1—2
- signal locations
 - KAYPRO 2 (81-110-n), 6—6
 - KAYPRO 2/4 (81-240-n), 6—12
- speaker connector, KAYPRO 286i, 23—16
- specifications
 - KAYPRO 1, 3—9
 - KAYPRO 10, 3—6
 - KAYPRO 10 with clock and modem, 3—6.1
 - KAYPRO 12X, 3—7.1
 - KAYPRO 16, 19—2
 - KAYPRO 2, 3—1
 - KAYPRO 2/84 and 2X, 3—2
 - KAYPRO 286i model A, 21—3
 - KAYPRO 286i model B, 21—4
 - KAYPRO 286i model C, 21—5
 - KAYPRO 286i model D, 21—6
 - KAYPRO 4, 3—3
 - KAYPRO 4/84, 3—4
 - KAYPRO 4X, 3—5
 - KAYPRO NEW 2, 3—8
 - KAYPRO ROBIE, 3—7
- streaming tape drive, KAYPRO 286i
 - description, 25—1
 - installation, 25—2
 - removal, 25—1
- switch settings, KAYPRO 16, 19—50
- symptom/fix guide
 - KAYPRO 10, 15—8
 - KAYPRO 2 and 4, 15—2
 - KAYPRO 2/84 and 2X, 15—19
 - KAYPRO 4X, 15—20
 - KAYPRO ROBIE, 15—14
- system boards
 - KAYPRO 16, 19—4
 - KAYPRO 286i, 23—1
- tape drive controller card, KAYPRO 286i, 23—1
- touch-up information, 5—2
- troubleshooting, 8-bit computers, 15—1
 - KAYPRO 10, 15—8
 - KAYPRO 2 and 4, 15—2
 - KAYPRO 2/84 and 2X, 15—19
 - KAYPRO 4X, 15—20
 - KAYPRO ROBIE, 15—14
- type of display card jumper, KAYPRO 286i, 23—16
- vendor addresses, 17—7
- video command protocol, 8-bit computers, 16—1
- video connector (composite), KAYPRO 16, 19—47
- video connector (RGB), KAYPRO 16, 19—47
- voltage selector switch, KAYPRO 286i, 26—1