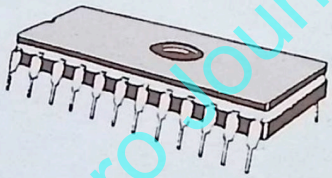
PRO-8 INSTRUCTION MANUAL

(VERSION 3.0)



MICRO CORNUCOPIA

PRO-8 INSTRUCTION MANUAL VERSION 3.0

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INTRODUCTION

Welcome To The Land Of Wide Open Spaces. We hope you'll enjoy the PRO-8, and although it won't solve all your problems, it'll help.

KAYPRO 2 OR KAYPRO 4?

You must have a Kaypro 4 in order to use the PRO-8. If your system is a Kaypro 4 (purchased before February 1984), then all you need to do is plug in the enclosed ROM, add one or more drives (if you want the larger disk storage), and you're on your way. If your Kaypro 4 was purchased after February 1, 1984, and has the same graphics capabilities as the Kaypro 10, then you need the Pro-884 or the Pro-884 MAX.

BUT IS IT REALLY A KAYPRO 2?

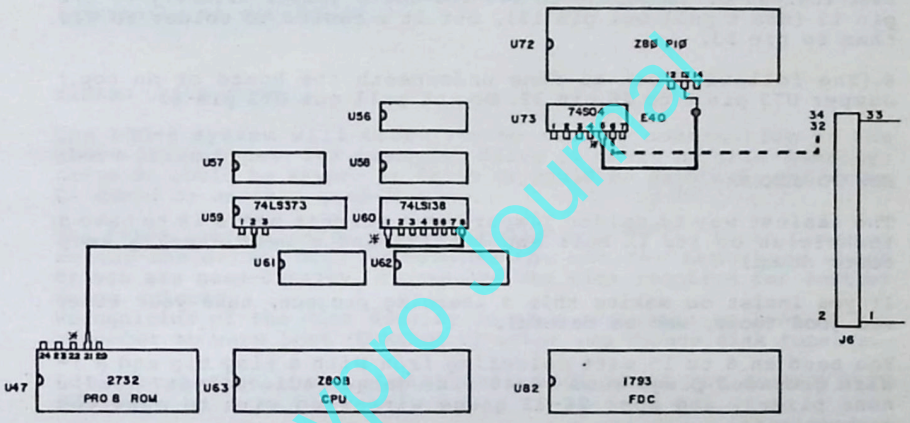
Even if your Kaypro is a 2 on the outside, it might be a 4 on the inside. You can tell by removing the lid. Inside you'll see two ICs with paper stuck to their tops. The one closest to the front of the Kaypro will be marked 81-149 or 81-232. If it's marked 81-149, you have a Kaypro 2, and need to modify the board to turn it into a 4. If the IC is marked 81-232, then your Kaypro is already a 4 at heart. Just plug in the Pro-8 and away you go. You can change or add drives when you want to.

MODIFICATIONS TO THE PROCESSOR BOARD

TURNING A 2 INTO A 4

If you have a 4 you can skip this section. Goto "Turning A 4 Into An 8". If you have a Kaypro 84 with graphics and half-wide drives, then you can't use this package; you need the Pro-884 or Pro-884 MAX.

The following diagram should make the 2 to 4 conversion clearer.



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1. Remove the ROM IC from U47 and wrap it in aluminum foil to protect it from static. (A jeweler's screwdriver is a good tool for removing the ROM.)

2. Bend out pin 21 on the Pro-8 ROM (just slightly), and insert the ROM into socket U47. Be sure the notch on the end of the ROM points in the same direction as the notches on all the other ICs on the board. (The notches are also shown on the diagram.)

3. Now double check that you plugged in the ROM correctly (the notch is pointing in the right direction, right?).

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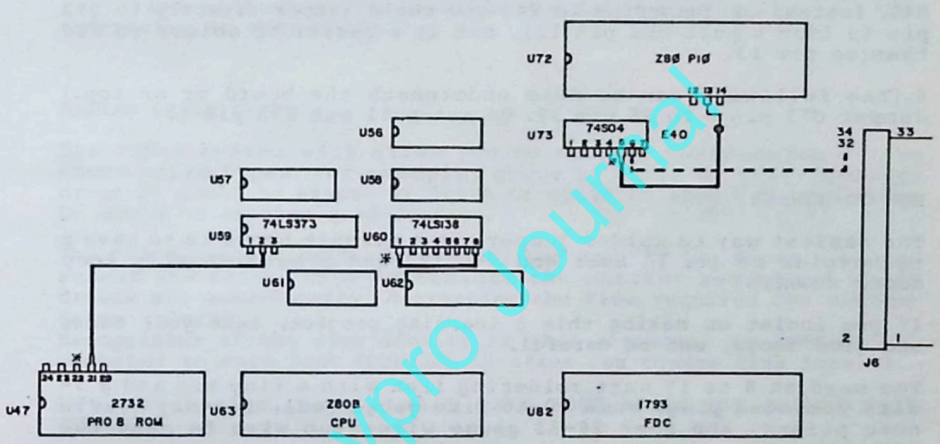

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3. Now double check that you plugged in the ROM correctly (the notch is pointing in the right direction, right?).

4. Jumper the bent-out pin 21 on the ROM to pin 2 on U59. Do NOT bend out pin 2 on U59.

5. Remove U60 from its socket and bend out pin 1. Replace U60 in its socket and then jumper pin 1 to pin 8. (U60 pin 1 is out of the socket; U60 pin 8 is in the socket.)

6. Remove the 74LS04 from socket U73. Bend out pin 5 on a new 74S04 and plug the chip into socket U73.

7. Jumper U73 Pin 5 to a solder pad on the circuit board marked E40. Instead of jumpering to E40 you could jumper directly to U72 pin 13 (don't pull out pin 13), but it's easier to solder to E40 than to pin 13.

8.(The following can be done underneath the board or on top.) Jumper U73 pin 6 to J6 pin 32. Do not pull out U73 pin 6.

HOW TO JUMPER

The easiest way to solder jumpers on a circuit board is to have a technician do it. (A beer and a pizza and a beer usually keep costs down.)

If you insist on making this a learning project, take your time, use good tools, and be careful.

You need an 8 to 15 watt soldering iron with a tiny tip and a 3-wire grounded plug, some 60-40 fine gauge radio solder, needle nose pliers, and some 26-32 gauge wire-wrap wire to make the connections.

TURNING A 4 INTO AN 8

Since everyone now has a 4, it's trivial to go to 8. All you need to do is plug in a new monitor ROM, and add FORMAT2 to your system disk (it came with your PRO-8).

You'll also be able to boot up with any format disk that drive A will read. In other words, if drive A is a 96 tpi double- sided drive, you'll be able to boot up with 191K, 390K, and 784K disks.

DISK DRIVES

To run Kaypro 8 format disks (784K per drive) you'll need double-sided 96 tpi (80 track) disk drives (often called quad-density).

Double-sided 48 tpi (40 track) drives are the drives shipped with

the Kaypro 4. These drives will permit you to run Kaypro 4 or Kaypro 2 format disks.

Single-sided 48 tpi drives are used in the Kaypro 2. If all of your drives are Kaypro 2 drives, you'll only be able to read and write Kaypro 2 disks. You won't be able to run any of the other formats without upgrading to one of the double-sided drives.

The PRO-8 monitor will allow you to use up to four disk drives on your Kaypro. To add extra drives you will also need to purchase the Micro Cornucopia Plus-4 Decoder Board. The board can be installed without any soldering. The extra drives can be added internally or externally.

MIXING DRIVE TYPES

The PRO-8 system will allow you to run any combination of the above drive types. For example, drive A: could be quad-density; drive B: could be Kaypro 4; drive C: could be Kaypro 2, and drive D: could be another quad-density.

The PRO-8 automatically determines the density the first time you access the drive. Once determined the monitor remembers which drives are quad-density, decreasing the time required for further drive selects.
Recognition of the disk density is also automatic as long as you remember to warm boot (CONTROL C) after you change disk formats.

Let's emphasize that: ALWAYS WARM BOOT AFTER YOU CHANGE DISK FORMATS!

QUAD-DENSITY DRIVES: PRECAUTIONS

The PRO-8 monitor can read and write Kaypro 2 or 4 disks in a quad-density drive, but there is one limitation. You shouldn't write to a disk formatted by a 48 tpi drive with a quad-density drive. The quad-density disk drives have a narrower head enabling them to fit twice as many tracks on the disk. The resulting track on the disk is narrower on quad-density drives than the track left by 48 tpi drives. When the quad drive writes in the wider track left by a 48 tpi drive, it renders the track unreadable by the 48 tpi drive.

Writing on the disk is not just copying files to the disk, however. The following operations also write to the disk:

Erasing Files
Editing Files
Renaming Files
Sysgening a disk

Any program that modifies files (like a database or a spread sheet) writes to the disk. If you don't know if your program writes to disk, place a write protect tab on 2 or 4 format disks you insert into quad-density drives.

Even if both of your drives are quad-density, you can still make Kaypro 2 or 4 format disks that are reliable and readable by 48 tpi disk drives.

Begin with a blank or completely erased disk. Format the disk in a quad-density drive with the copy/format program that came with your PRO-8 ROM. The resulting disk can be written to with a 96 tpi drive and can be read with a 48 tpi drive. It's only when the tracks of the 48 tpi drives are on the same disk with tracks from a quad-density drive that problems occur.

Disk quality is very important with the quad-density drives because of the increased data density. It's a good idea to test new brands of disks with the program 8DISKTST.COM before trusting them with valuable data.

All programs that use the BIOS for disk I/O should work fine with the quad-drives. A few programs like UNIFORM 1.0 for example, don't which is why it needed to be rewritten for the Kaypro 4. It's now available in version 3.0 and should work with quad-density.

CHANGING DISK DRIVES

Once again unplug your Kaypro and remove the cover. In order to get at the screws that secure the disk drives remove the main circuit board from the computer. Then, remove the plug at the left rear of the circuit board (it has 3 wires connecting the monitor to the video circuit). It can only go on one way so there's no need to mark the front for reassembly.

On the right side of the circuit board there are 3 connectors to disconnect. Farthest from the front is the power supply connector. Disconnect it and the ribbon cable which connects the disk drives to the circuit board. It must be pulled straight up but it may seem tight. If the circuit board seems to be bending as you pull, support it from the top with one hand while pulling the cable connector with the other. Pull only on the connector, not the cable. The plug next to it has connections for the reset switch and the power indicator light. Pull it straight up.

Now remove the two screws that secure the front of the circuit board to the nylon support posts. All of the other screws are accessible from the rear of the computer. Remove the Phillips screw that secures the left rear (as seen from the front) corner of the circuit board. Then remove the Phillips screws that thread into the parallel printer port connector. Finally remove the hex head machine screws that thread into the serial port connectors.

Remove the circuit board from the cabinet by pulling forward slightly to clear the keyboard and modem jacks,then up and out. Set the board aside.

In the cabinet you'll see the CRT and the disk drive enclosure. Be careful around the CRT since it can hold a charge after the computer is turned off. Before removing the old drive unplug the connectors at its rear (the ribbon cable, the power cable, and a green wire that plugs onto a spade connector).

There are two screws on each side of the disk drive enclosure for each drive that hold the drives in place. Remove these screws and slide the drive forward to remove from the front of the cabinet.

JUMPERING NEW DRIVES

Before installing the new drive, it must be configured (jumpered) for its assigned place in your computer. The B drive is the last drive on the ribbon cable so it must have a terminator. New drives all come with terminators in place. On the TEAC drives, the terminator is a shiny black object the same size as an integrated circuit but flatter, near the ribbon connector.

If you're putting the drive in the A position, remove the terminator by prying it from its socket. If the drive is going to be in the B position, leave it in place. The MITSUBISHI M4853 has its terminator soldered in, but it can be isolated from the circuit by removing the 7 jumpers that are just behind the terminator. Remove the jumpers for the A drive, but leave them in place for the B drive (the last physical drive on the cable).

On either the TEAC or the MITSUBISHI drives move the jumper block from the pins marked HS to the pins marked HM. Then move the drive select jumper block to DS0 for A or DS1 for B. There should be no jumper on MX. The new drive(s) can be installed by sliding them into the cabinet from the front and screwing them in. The drive select indicator light should be above the disk slot on the TEAC and below the disk slot on the MITSUBISHI. (Insert diskettes with the label facing up.)

Connect the power cables for the drives (they only plug in one way), and the green grounding wires to the spade connectors on the frames of the drives. The ribbon cable can be directly connected to the MITSUBISHI drives and any other drives with the red edge of the ribbon to the right (as seen from the Kaypro's front).

TEAC DRIVES

The pins on the TEAC data connector are backwards from everyone else's. If you are installing two TEAC drives, you can simply connect the 34-pin ribbon cable to the drives as usual, and then reverse the direction of the data cable where it plugs into the main processor board. (The red edge goes toward the rear of the computer.)

There may be a small plastic key inserted into the data cable connector. You will need to remove the key with a pair of needle nose pliers in order to reverse the data cable. You may also have plastic keys in the 34-pin drive connectors. If you are reversing a connector, you might have to remove one of these keys.

MIXING: TEAC WITH OTHER DRIVES

Connecting the ribbon cable between a TEAC drive and a drive from another manufacturer is a little trickier. So, if only one of your drives is a TEAC, the connector at the end of the cable should be removed and reinstalled on the back side of the cable. (After you install the connector on the back side of the cable, lay the ribbon cable flat on a table with the unchanged drive connector facing up, your back-side connector will be facing down.)

If the TEAC is drive A, and another drive is B, connect the TEAC to the original data connector, twist the data cable 180 degrees and connect the normal drive to the connector you mounted on the back side of the cable. When you reinstall the main board you will reverse the way the data cable plugs into the main board (red edge toward the rear).

If the TEAC is drive B and a normal drive is in A, connect the normal drive to the original data connector, twist the data cable 180 degrees and connect the TEAC to the connector you mounted on the back side of the cable. You will plug the data cable into the board the way it originally was (red edge forward).

The point of this process is to connect pin 1 on the Kaypro's main board to pin 1 on the drives. The pins are marked on the drives, and they're marked on the Kaypro. If all this twisting and turning seems confusing, just look at your drives and your Kaypro. In under 3 minutes you should be an expert.

(Note: On some units the ribbon cable will be too short to connect between a TEAC and a standard drive. In these it will be necessary to install a third ribbon edge card connector between the top drive connector and the circuit board. The connectors are available from Radio Shack (among other sources) and are called 34 position edge card connectors. They are installed by carefully lining up the ribs in the ribbon cable with the "forks" on the connectors so the ribs rest in the "forks". Then the connector

can be squeezed together in a smooth jawed vise or with C clamps and a couple of wood blocks. Space the connector far enough from the old connector so that the twist can occur between the drives.)

GETTING IT BACK TOGETHER

The circuit board can now be reinstalled.

Before installing the screws make sure the plug at the left rear of the board hasn't fallen down. Also make sure you can reach the plug at the right front of the board. Install the screws and plug in the monitor plug (left rear), the reset/power light plug (front right), and the power connector (right rear). (All of these plugs only go in one way.)

Now install the drive data cable connector. If you have a "reversed ribbon cable" the red edge will go to the rear of the computer, otherwise the red edge is at the front of the computer. Set the cover back on your computer (don't screw it down yet) and plug your computer back in. Without any disks in the drives, turn on your computer. The monitor sign-on should appear. If you get the sign-on and drive A has its activity light on, insert your usual system disk and boot the computer.

USING THE PRO-8 SYSTEM

FORMATTING DISKS

The disk you received with your Pro-8 ROM has a program called CPY.COM which will allow you to format disks in any of 3 formats supported by the system. Do not use COPY.COM which came with your original system. It won't work with the upgrade. It will only work with your original drives.

CPY can also make full disk copies from any of the formats to a blank disk.

In all copy or format operations everything on the destination disk will be erased. If the source disk is a system disk (if it can be booted), then CP/M will be copied to the destination disk in a copy operation, but not in a format operation. To copy CP/M to a disk that you formatted, run SYSGEN.COM (which can be found on your Kaypro CP/M disk). If you don't know how to use SYSGEN see the section USING SYSGEN.

To run the formatter/copier enter: CPY <carriage return>

The program will print a menu of your options. You may Copy a disk, Format a disk, or Exit to CP/M.

To format a disk enter: F

and then answer the questions.

Select this option by entering an ""F´´.

Then answer the questions. If you make a mistake, you can hit the escape key and return to the beginning of the program to make your selections again.

The program prints each track number as it´s formatted, and then verifies that it was successful. It will retry unsuccessful attempts four times. If it´s still unsuccessful, try another disk.

To copy a disk enter: C

This program makes a duplicate of a disk in another drive. The resulting disk will be the same format as the source disk regardless of the type of destination drive. For this reason don´t try to make a copy of a double-sided disk to a single-sided drive or a quad-density disk to a 48 tpi drive. It can, however, make a copy of a 2 or 4 format disk to a quad-density drive.

If you have problems with the copy option, try formatting a disk, and using PIP.COM to copy the files. PIP uses slower disk read and write routines so it should work.

To return to CP/M enter: E

Drive A must have a bootable disk with this selection.

NOTE: Plu-Perfect users need a 63.75K system in order to use 2 drives and 63K for more than 2 drives.

If two of your drives are quad-density, then all you need do to create a bootable system disk is:

Format a disk in drive B, C, or D to a Kaypro 8 format.

Use SYSGEN.COM to copy CP/M onto it.

Place it in the A: drive and warm or cold boot.

If you only have one quad-density drive, and it´s drive A, you need another method of transfering your system from the Kaypro 2 or 4 disk you booted in A to a quad-density disk in A.

Format a disk in drive A to a Kaypro 8 format.

Place the disk that you received with your Pro 8 ROM in drive B.

Boot your regular CP/M disk (Kaypro 2 or 4 format) in drive A and enter:

B:SYS

When instructed to do so, insert the quad-density disk that you just formatted into drive A, and enter a carriage return.

The system will then boot from the quad-density disk in drive A, but it contains no files. Place your CP/M disk in drive B, and enter B:PIP A:=B:*.* to copy all the files from your old CP/M disk to your new quad-density system disk. You may then use PIP to copy programs from other disks in drive B to the quad-disk in drive A.

After this has been done, you may use SYSGEN to make other quad-density system disks by using drive A as the destination drive.

MORE THAN TWO DRIVES

The PRO-8 monitor can boot a 64K system, but will not allow you to access more than two drives. To get at the other two drives you must create a system disk with 63K system tracks. The extra space is needed to store the tables for the other two drives.

To create a 63K system you need to use the program MOVCPM.COM that came on your CPM disk with your Kaypro. Put a copy of this program and SYSGEN.COM on the disk in drive A. Place a disk in drive B that you want to copy the new 63K system onto.

Enter: MOVCPM 63 * <carriage return>

MOVCPM will say

CREATING A 63K SYSTEM
READY FOR SYSGEN OR 'SAVE 34 CPM63.COM'

Your Kaypro will then Warm Boot.

Now before you do anything else....

Enter: SYSGEN <carriage return>

When sysgen asks for a source drive, answer with a carriage return only.

It will then ask for a destination drive, answer with a B. Then it will ask you to confirm with a carriage return. Do this and wait until it says FUNCTION COMPLETE. Then move the disk from drive B to drive A, and press the reset button. The new sign on will say Kaypro 63K CPM Vers. 2.2. You will now be able to access drives C and D.

Life with a 63K system will be pretty much the same as a 64K system. To reconfigure your keypad or change the default baud rate you will need to use CONFIG83.COM that came on the disk with your PRO-8 ROM instead of CONFIG.COM that came with your CP/M disk.

USING CONFIG83.COM

CONFIG83.COM is a program that allows you to set the default characteristics of your system that will be used each time you boot. You may choose which character you want to use for a cursor character or which character to use for a screen dump character. You may also choose to step your disk drives at a slower rate, allowing you to use older disk drives if you have some. Most new drives will step at the fast rate used by the monitor.

The program is menu driven, and all you need to do is answer the questions. The changes will be written to the disk in drive A at the end of the session, so they'll be used each time you boot that disk. The changes will also be passed to any drive you sysgen with that disk as a source.

If drive A is a quad-density drive, make sure you boot a quad-density disk before using this program, since it writes to the disk.

The built in screen dump in ROM will print everything that's on your screen to your printer. The PRO8SET allows you to define that key.

Two cautionary notes about the screen dump.

1) Don't choose a key that you use often. A good choice would be ^@ (hold down the shift and control keys and press the @ key). It's sufficiently awkward so you can't hit it accidentally.

2) An attempt to dump the screen with the printer off (or in some cases not connected) will require a reset (or turn the printer on).

USING SYSGEN

SYSGEN.COM is a program which came with your Kaypro, and can be found on your CP/M system. Its sole purpose is to transfer CP/M from one disk to another so that a disk that's bootable can make another bootable disk.

The program refers to a source disk and a destination disk. The source disk is the disk that already contains CP/M; the destination disk is the disk you wish to copy CP/M to. The destination disk will always receive an identical copy of the CP/M that's on the source disk. If the source disk has a 63K system, then the destination disk will receive a 63K system. If the source disk has a special cursor character or screen dump character, the destination disk will have it as well.

To use SYSGEN.COM to copy CP/M from drive A to drive B enter:

```
SYSGEN <carriage return>
```

The program will print its sign-on and then print:

```
SOURCE DRIVE NAME (OR RETURN TO SKIP)
```

You would then enter an A. SYSGEN would respond with:

```
SOURCE ON A, THEN TYPE RETURN
```

You would enter a carriage return to indicate that A was indeed the source drive. SYSGEN would then read CP/M from drive A and print:

```
FUNCTION COMPLETE
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)
```

You would enter a B. SYSGEN would respond:

```
DESTINATION ON B, THEN TYPE RETURN
```

Now you enter a carriage return, and CP/M will be written to drive B. It would then print:

```
FUNCTION COMPLETE
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)
```

You would then enter a carriage return and be returned to CP/M. The disk in drive B now could be placed in drive A and would be bootable.

SYSGEN can also copy CP/M from a disk in drive A to another disk in drive A. Simply respond with an A when asked for a source disk, and then carriage return. When you get the message:

```
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)
```

you would remove the disk in drive A, and insert another disk OF THE SAME FORMAT and enter an A again. Another carriage return will copy CP/M onto the new disk in drive A. This is handy if drive A is your only quad-density disk drive, so you can pass a copy of CP/M from a quad-density system disk to a blank formatted quad-density disk.

THE PRO8+ DECODER BOARD

This board is available from Micro C and provides the additional drive select signals for C: and D: from the existing drive select signals. It's easily installed.

Remove the ribbon cable from the header at the right front of the circuit board. Note the position of the red stripe on one edge of the connector. Plug the decoder board onto the header so that the board overhangs the disk drive heat shields. If the shield is higher than the main circuit board you may want to place a strip of black electrical tape beneath the board so that it won't accidently short out against the shield. Now attach the clip to the metal leg of the large capacitor near the power connector marked with a "+" on the circuit board. The power connector is the white plug at the right rear of the circuit board. The capacitor is shaped like a punching bag and is glossy (probably blue in color).

If your board doesn't have the capacitor, the +5 volt supply for the decoder board may be taken directly from the power connector. If your connector is not labeled, +5 volts is on pin 6, the one farthest to the rear of the computer.

ADDING THE DRIVES

To add drives C: and D: you'll need some knowledge of electronics. Adding the drives externally will be described first because it's easiest. Adding a third drive internally should only be attempted by those who are very comfortable with hardware (both electronic and metallic).

EXTERNAL DRIVES

There are many mail order houses that offer disk drive cabinets with power supplies. Such a cabinet can be used to add external drives to your Kaypro which can be unplugged when you wish to move your Kaypro. You will also need a ribbon cable with two edge card connectors, a header socket (female) to connect to the main circuit board, and a header (male) at the other end to connect the extra drives. The only other thing that needs to be done is to modify the terminator on the internal and external drives.

You'll need to add (or build) a terminator, since one should be installed on the last drive on the cable. Then, if you're running external drives, this would be drive D:. The problem occurs when the external drives are disconnected. Now the internal drives have no terminator.

A good compromise is to terminate both the internal and external drives with a resistance that is 3 to 4 times the standard value of termination resistance (150 ohms). Now when the external drives are connected the effective resistance will be the same as the standard value, and when disconnected, there'll still be adequate termination resistance.

The problem with providing a terminator with the decoder board is that not all terminators are the same from manufacturer to manufacturer and Kaypro ships a variety of drives with their units. Therefore, you must use an ohm meter to determine the setup of your terminator, and then build a terminator of a higher resistance to replace it. The terminators may be built with DIP headers (available from Radio Shack). 470 or 600 ohms are good values to choose for each terminator resistance.

Adding A Third Internal Drive On The 84 (For Pros Only)

One additional drive can be added inside the cabinet if the section of metal between A: and B: is cut out. If you intend to do this you must be very careful.

Remove both disk drives from the cabinet and remove the heat shield (4 screws at the bottom of the cabinet hold it). It's very important that no metal shavings fall into the monitor circuit board or power supply, so take precautions accordingly. Drill new mounting holes in the heat shield by finding the middle point of the existing mounting holes and using that to position your new holes.

Once the cabinet has been remodeled remount the drives. Remember --the terminator must be in the last drive on the cable. A new edge card connector needs to be added to the ribbon cable between the circuit board and the existing edge card connectors. If you're installing a TEAC drive make sure you have enough cable length to put the twist in the cable. A power connector must also be added. Unless you have the CO-POWER board (or Kaypro changes their harness) you'll find a connector already available. 5 volts and GROUND are already provided to this connector. To make it ready for a disk drive, remove the pin from the connector on the end opposite the white wire. Connect a wire between this pin and 12 volts, and then reinsert the pin.

REPLACING YOUR KAYPRO CHARACTER OR MONITOR ROM

INSTRUCTIONS:

(READ ALL THESE INSTRUCTIONS CAREFULLY BEFORE STARTING!!!)

1. Do NOT remove the ROM(s) from the plastic tube until instructed. They are very sensitive to static.

2. Remove the cover from your KayPro. Use a medium/small phillips screwdriver to remove the 10 screws from the sides and top. Collect them in a small container (a tunafish can works nicely). Then carefully pull the cover straight up until it's free.

3. Now look at the main processor board (the large circuit board directly above the CRT). You will see two medium-large ICs with white paper labels on them.

   The one toward the rear of the computer (usually marked 81-146) is the character ROM. It determines what the screen characters will look like. If the ROM you purchased has the word "Character" on it then this is the ROM you will replace.

   The one toward the front of the computer (usually marked 81-149) is the monitor ROM. It contains the power-up prompt, the cursor character, and a number of other bits of information for the system. If the ROM you purchased says "Monitor" on it then this is the ROM you will replace.

4. NOTICE THAT EACH ROM HAS A NOTCH AT ONE END AND THAT THE NOTCHES ARE POINTING IN THE SAME DIRECTION (TO THE LEFT IF YOU FACE THE BOARD FROM THE FRONT OF THE COMPUTER). WHEN YOU INSTALL THE NEW ROM, ITS NOTCH MUST POINT IN THE SAME DIRECTION.

5. To remove the old ROM:
   a. Find a small, flat-bladed, screwdriver (somewhat larger than a jeweler's screwdriver).
   b. Discharge any static potential by touching some bare aluminum on the KayPro cabinet with your hand.
   c. Insert the screwdriver between the ROM and its socket, and pry upward, first at one end of the ROM and then at the other, slowly working the IC upward and out of its socket. (The screwdriver works better than commercial IC pullers for these larger chips.)
   d. Grasp the IC with one finger at each end so you won't touch the pins and place it on a piece of black foam, in a piece of IC tubing, or stick its pins through a piece of aluminum foil (kitchen foil). That way it will be protected from static damage.

(continued on other side)

(new ROMs continued)

6. To insert the new ROM:
   a. Discharge any static by touching some bare aluminum on the KayPro catinet with your hand.
   b. Remove the new ROM from its tube. Try to hold it by its body only and not touch its pins. If you need to set it down, set it on the the KayPro circuit board (you just touched the chassis so you and it shouldn't have any static difference).
   c. Check that the notch on the new ROM is pointing the same direction that the old one did.
   d. Insert the pins on ONE SIDE of the ROM VERY SLIGHTLY into their socket holes. You may have to rock the ROM to get all the pins into their holes.
   e. Now use both thumbs and with medium firm pressure press the ROM toward the pins that are already slightly in their holes. (You will have to touch the unsocketed pins when you do this.) When the unsocketed pins line up with their holes, press them gently down into place (you may need to rock the ROM a little to get all to go). When this second side starts to go into place, press down on both sides equally to firmly seat all the pins.
   f. Look carefully at the ROM to be sure it is seated solidly and that none of the pins are bent out or under. Make sure that the notch is at the proper end.

7. Now you can power up the KayPro and test it out.

8. If all works, power it down, and replace the cover.
   If it doesn't work (not likely) then triple check for a bent pin, make sure you replaced the correct ROM, and make sure the ROM is not in backwards.

FINAL NOTES:

If you powerup the system with a ROM in backwards, the ROM will be destroyed. Be sure that the notch is pointing the same direction as the notches on all the other large ICs.

Also, static is particularly bad when the humidity is low or when you are shuffling around on a rug. If you have either of these situations, you might even lean a bare arm against the cabinet or use a clip lead to connect your metal watchband to bare metal.

We are including a 74S04 chip at no charge. It is necessary only for the Kaypro 2 to 4 upgrade.
If you have a Kaypro 4, please disregard.

Micro C