KayPLUS ROM Upgrade

for

Kaypro II, 2-83, 4-83

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A. Introduction

Congratulations on your purchase of the KayPLUS ROM Upgrade from MICROCode Consulting. With KayPLUS, your Kaypro can access a new dimension in power and versatility. The following is a list of just a few of the KayPLUS options:

- Mini-monitor operation
- 13 different 5.25" and 3.5" disk formats built-in, including all popular Kaypro and Xerox single and double sided formats
- Support for all common printer protocols
- Advent and SWP CoPower RAM drive support
- Menu driven system configuration with KPCNFG utility
- Logical-to-physical drive mapping
- Access to over 100 disk formats with the KPDSKDF utility
- Automatic screen blanking
- Dynamic screen pause
- Keyboard activated screen dump to printer
- Up to 8 keystrokes can be installed for each function key
- 32-stroke keyboard buffer

B. Installation of the KayPLUS ROM

!!! BEFORE YOU INSTALL YOUR ROM, PLEASE READ THE FOLLOWING !!!

(1) Before the KayPLUS ROM is installed, it is necessary to prepare a new system disk. You will need to boot up on your existing system, have a disk with the installation programs, and at least two formatted disks available for the new system. It is a good idea to create at least two KayPLUS system disks from your current Kaypro system disk in case of problems:

a. Run the KPCNFG program.

b. At the first question "READ system from which drive...", enter "A" (unless a system image is located on another drive).

c. If the system image has been successfully read, KayPLUS will respond that it has detected that the disk is NOT a KayPLUS system disk, then automatically install the new BOOT and BIOS routines. The MAIN MENU will appear next.

d. Enter "X" to write the system image. You may edit the configuration first if you desire; however, nothing will be written to your disk until the "X" command is executed.

e. At the "WRITE system to which drive... " prompt, enter the drive letter (A-P) on which you wish to write the KayPLUS system image. Make sure you have a blank disk in that drive.

f. If successful, KPCNFG will exit indicating it completed the configuration.

The above procedure should be completed at least TWICE, so that two bootable disks are available. (Two are recommended in case one becomes damaged.) For detailed instructions on changing KayPLUS user-definable parameters with KPCNFG, refer to section C.

(2) Make sure that your Kaypro is unplugged and remove its cover, preferrably in a low static environment. (This means do not attempt this operation on a rug while wearing your wool socks and cashmere sweater. The best place is on a kitchen counter with bare-feet on a non-carpeted floor.) CAREFULLY remove the ROM from location U47. (If you are not sure which Kaypro you have, refer to Appendix A.) Slide your screwdriver under both ends of the original ROM, and gently lift it EVENLY out of its socket. (Make sure the screwdriver is BETWEEN the ROM and the

socket, NOT between the socket and the circuit board.) You will need to make the ROM modifications as described in Appendix B or install the pre-soldered upgrade hardware. Next, install the KayPLUS ROM in the socket. The "notch" on the ROM should be at the same end as the other chips on the board. Great! Now replace the cover.

(3) You should now be able to boot either of the KayPLUS system floppy disks and operate normally. In order to use the hard drive, it first must have been formatted and installed with HDCNFG (see section D before using HDCNFG). Once installed, use SYSGEN (or KPCNFG; see section C) to move the system image to the hard drive.

C. Setting up KayPLUS for your system: KPCNFG

The KayPLUS ROM is designed to allow flexibility in its support of the many hardware and software configurations available for the Kaypro. Customization is accomplished through the KPCNFG utility, which has the following major features:

- generates KayPLUS bootable disk from either a single-density Xerox 820 system disk, Kaypro system disk, or another KayPLUS system disk

- allows you to change the BIOS/BOOT size by specifying the new system size desired

- specify hardware-dependent options, including real-time clock type, ROM clock type and accuracy factor, serial printer handshaking signals, Advent or SWP RAM disk, disk drive step rate, floppy disk motor delays, and type of disk drives (5.25" or 3.5")

- specifysoftwareoptions, such asclockdisplay, keyboard function key definitions, operating system size, screen dump and dynamic pause keys, serial printer protocol, and video attribute status

KPCNFG allows you to customize your particular system to fit your particular needs. KPCNFG can be aborted at any time by pressing <ESC>. Nothing is written to your disk until the session has been terminated with an "X"; the options selected are then stored onto the boot sector (track 0, sector 1) of your KayPLUS system disk. Every time a cold-boot is performed, KayPLUS will be reset to the values you have recorded on your system disk. Further, each time KPCNFG is executed, it reads the present configuration from your disk, allowing you to change just the parameters that need adjustment.

When KPCNFG is executed, you will see:

```
READ system from which drive <A-P>  -OR-  <ESC> to abort:
```

KPCNFG will read the system image on the specified drive when A through P is selected; it will not continue if it cannot find a system image. Instead, you will again be prompted to select another drive.

When a valid system image is detected, KPCNFG checks to see if a KayPLUS system has already been installed. If the system image is a KayPLUS system image, the user-specified parameters in the image are read. Otherwise, KPCNFG installs the KayPLUS BOOT and BIOS modules into the image and sets user-specified parameters to the initial values provided in the KPCNFG program.

Once a system image is present in memory, KPCNFG presents the MAIN MENU which consists of eleven options. In both the main menu and the seven sub-menus, an option is chosen by either moving the pointer with the arrow keys (on the Kaypro keyboard), then pressing <RETURN>, or by entering the letter in <> brackets. (The arrow keys are only usable under KayPLUS; if KPCNFG is executed on another Kaypro ROM and BIOS, only the letters in <> may be pressed to choose an option.) The "pointer" is located on the line with the flashing characters.

In the sub-menus, the entry may be modified by first pressing <RETURN> to select the entry for modification, and then either pressing the <SPACE BAR> to rotate through the options, or in some cases, entering the actual data such as the keyboard definitions. The <RETURN> key is then pressed to accept the selection, and you are free to move on to your next option. The <ESC> key is used to return an entry to its previous value or exit a menu. You may exit the program without updating your disk by pressing the <ESC> key while in the Main Menu. Nothing is written to your disk until the "X" option and its destination disk have been selected.

The MAIN MENU options are:

<A> Arrow keys. The sub-menu shows the current values of the four arrow key assignments (defaults: up-^K, down-^J, left-^H, right-^L). Each key can be redefined to generate between one and eight keystrokes.

<D> Disk drive. A sub-menu appears which displays the number of FLOPPY drives available (showing PHYSICAL drive letters), disk spinup delay (the amount of time that it takes for the floppy disk drive speed to stabilize when the motors have been off), retry count (how many times to retry if an error occurs), motor timeout (the amount of time between the last disk access and when the motors are turned off), whether to buffer disk writes (called WRITE SAFE by Kaypro), and the type and step rate for each of the floppy drives. It is recommended that the you enable the Write Buffer, as disabling the buffer results in very slow disk performance when writing to a disk. Data for up to four floppy disk drives may be entered.

<N> Numeric keypad. As with the arrow key sub-menu, this option allows you to modify the definition of each key on the numeric keypad. Each key can generate between one and eight keystrokes. Enter each key from the regular keyboard and the cursor will advance until the limit is reached for the entries. Control codes may be entered by first pressing the "^" (shifted 6) circumflex character, and then the corresponding letter key. An <ESC> code may be entered by pressing "^" followed by "[".

<P> Serial printer. Governs the initialization of the serial printer port. Options include 7- or 8-bit word length; 1 or 2 stop-bits; odd, even, or no parity; baud rate; and handshaking (none, ETX/ACK, XON/XOFF, or CTS). Consult your printer manual for the proper settings. Most generic serial printers use CTS handshaking to prevent loss of characters from the computer.

<S> System and keyboard. System choices include the type of operating system (QP/M versus CP/M), default console (keyboard/video, serial printer, serial data, or both serial data and keyboard/video), and default printer (keyboard/video, serial printer, serial data, or parallel printer). When QP/M is chosen, the TIMDAT vector location required by QINSTALL is also displayed. If you own an Advent RAMcard or SWP Co-power 88, the RAM drive option allows KayPLUS to recognize the additional hardware and automatically configure physical drive M: on cold-boot. KayPLUS requires the port address if you own the SWP unit. The keyboard options allow you to choose which keys are assigned as the dynamic pause key (the default is <CTRL> + <@>) and the screen dump key (<CTRL> + <\>).

<T> Initial logical-to-physical drive translation. Specifies the drive ASSIGNment that should take place immediately after boot. Since the physical designations for floppy drives are from A: up to D: and hard drive letters follow, it is desirable to automatically remap the drives so that the hard drive occupies the lower drive letters (especially A:) with floppy drive letters following. Identical to a built-in ASSIGN, the initial drive map is used whenever a cold-boot occurs. Note that the drive which the system boots up on initially is automatically swapped into the A: drive regardless of the mapping table.

<V> Video and clock. The four user-modifiable parameters for the Kaypro video are the type of cursor (blinking/solid underline/block), screen blanking time (screen blanks after 'x' minutes of both keyboard and video inactivity, restores when either becomes active), and whether to display the clock in the upper right-hand corner. The clock portion of the sub-menu has many options; each is described in more detail on the next page.

<C> Change system size. Any time that MOVCPM, QINSTALL, or any other method is used to generate a new system size for the CCP and DOS, this option MUST be selected to generate a new BOOT sector and BIOS of matching sizes. When KPCNFG is initially run, it only checks for the size of the operating system alone, without checking for matching BIOS and BOOT size. Any system size between 40k and 62k may be generated within the following guidelines:

a. The maximum system size is dependent on the number of floppies and the size of hard drives installed.

b. If KPCNFG is being used without the KayPLUS ROM, the maximum size defaults to 62k.

c. If KPCNFG is running under KayPLUS, KPCNFG will check memory usage and inform you of the maximum allowable size.

d. KPCNFG ONLY changes the BIOS size and BOOT information. KPCNFG DOES NOT alter the remainder of the operating system (DOS and CCP). In order to change the remainder of the operating system, you will need MOVCPM for CP/M or QINSTALL for QP/M. You must use 1k increments with CP/M, but QP/M will allow 1/4k increments.

(NOTE: Since MOVCPM usually installs its own BIOS, you should first create the proper size CP/M system disk, THEN use KPCNFG to install the KayPLUS BIOS. QINSTALL can generate 1/4k system sizes, and may be executed either before or after KPCNFG.)

<X> Exit and write image. Once all of the desired changes have been made, you are ready to save the modified system image. After successful completion, KPCNFG exits to the operating system. Note that any changes made during KPCNFG only become active after they are written to a disk and that disk is booted.

The clock options present in the clock menu are fairly complex and require further explanation.

The KayPLUS system uses a combination of methods to maintain its real-time clock. If a hardware real-time clock is installed on the system, it is read on boot up, and the data stored for updating via quicker internal methods.

Interrupt-driven ROM clock refers to the method which the KayPLUS ROM uses to get its clock signal. There are two options for this selection:

(a) Via vertical sync. This option uses part of the video display driver hardware to generate an interrupt-driven clock. This clock is very accurate and is the best method for generating the real-time clock pulses.

(b) None. There is an occassional Kaypro which cannot work with the vertical sync method; "none" disables the clock interrupts. In this case, the ROM will use a software generated timing loop to maintain the clock, which is less accurate since the time in the loop may vary depending on the other programs being run. This option MUST be chosen if you have not added the jumper necessary to use the vertical sync method. The ROM clock adjustment factor will affect the calibration.

Clock adjustment factor is used to calibrate the KayPLUS ROM clock; this only applies if the type of interrupt-driven ROM clock is "none". By measuring the KayPLUS clock accuracy over a few hours, you can determine its calibration and modify the clock adjustment factor proportionally. For example, if the current factor is 30 and the clock is 10% FAST, then the new adjustment factor should be 33.

Hardware real-time clock is chosen to inform KayPLUS that a hardware real-time clock is installed. KayPLUS-83 supports the Advent, Legacy, and Ztime-I hardware clocks. If a hardware clock is installed, KayPLUS will set the ROM time/date locations upon cold-boot and each time the BIOS time/date vector is called.

Ztime base address is only required when a Ztime-I hardware clock is installed. KPCNFG requires the I/O base address of the Ztime-I clock for proper interface.

D. Hard Drive Configuration: HDCNFG

INTRODUCTION

The KayPLUS ROM allows you to install up to two hard drives on your system. Expanding your current system to include a hard drive offers vastly increased storage capacity and faster disk throughput. The KayPLUS system includes all software necessary to install, format, and communicate with one or two hard disks on any system - WITHOUT any programming knowledge required!

On the initial software installation of the hard drive, HDCNFG writes the partitioning and drive parameter information on the first sector of the hard disk. This information is read back each time the system is cold-booted (reset) at which time KayPLUS can configure the system for the proper number and size of disk drives.

If you already have a Kaypro formatted hard drive, refer to the K10TOKP utility for transferring your data to the MICROCode format.

HARDWARE REQUIREMENTS

In order to communicate with your hard drive, you must have a Western Digital WD-1002 controller interfaced to your Z-80 microcomputer. Communication between your system and the WD-1002 is via 8 input/output ports from 80H (128 decimal) to 87H (135 decimal) which is standard for all Kaypros.

Besides the Western Digital card, there should also be at least one hard drive attached as LUN (Logical Unit Number) 1. The drive attached as LUN 1 should be attached to J2 on the WD1002 board. If a second unit is added, it must be attached to J1 as LUN 0. **Do not attach a hard disk to LUN 2 since KayPLUS ignores that port.**

FEATURES

MICROCode has included all the necessary utilities to install and use your hard disk subsystem. The HDCNFG program, in conjunction with the WD1002 hard disk controller board, supports up to two hard drives. Each drive can range from 5 megabytes to 64 megabytes of storage and can be partitioned into as many as 8 logical QP/M or CP/M drives. To ensure data integrity and error-free operation, a non-destructive verify with bad-block lockout option is included in the HDCNFG program. Since this option is non-destructive it can be safely used even after your hard drives are filled with data! In addition, the KayPLUS BIOS incorporates full error checking with user-specified recovery.

RUNNING HDCNFG

HDCNFG is a fully menu-driven program which handles all installation options, including formatting, non-destructive verification, bad block lockout, and defining the logical disk layout. Briefly, KayPLUS hard drive support has the following major features:

- Handles Winchester (hard) drives of up to 64 Megabytes
- Allows one or TWO hard drives to be controlled
- User-definable logical drive partitions
- Simple menu-driven installation utility
- Non-destructive verify and bad-block lockout
- Full error recovery

SOFTWARE INSTALLATION

If you are a first-time user of HDCNFG, the number of options may seem quite overwhelming. However, once you understand them, you will be able to fine-tune the performance of your system to suit your needs.

Below is a step-by-step procedure to guide you through a first-time installation of a newly-attached hard drive. This example assumes that all of the necessary hardware has been installed and that there are no other hard drives on the system.

(1) Execute HDCNFG. When you run HDCNFG for the first time (or after installing a new hard drive in LUN 1), HDCNFG will respond with the error message:

Invalid hard disk boot sector

Press <N> for new system -OR- <X> to abort:

Since you are installing a new hard drive, you should enter 'N'. All options are chosen by entering the letter within the angle brackets < >. Should this message appear once the hard drive has had the parameter information installed with HDCNFG, you should select menu option <C> (Check controller and interface) to help diagnose and correct the problem.

At this point, the main menu is displayed. If you are installing for the first time, both LUN numbers <0> and <1> will be blank. Otherwise, the current drive name(s) will be displayed after the LUN. All menu options ONLY work with the currently-selected hard drive. Initially, LUN <1> is selected. Entering either a '0' or a '1' will select that LUN for further action. Remember that LUN <0> cannot be selected until LUN <1> has been defined.

NOTE: The hard drive information <D>efined or <M>odified is NOT usable by KayPLUS until it is <I>nstalled. Any changes that are made to the drive partitions, but not <I>nstalled, are ignored.

(2) At this point, you should run option <C> (Check controller and interface) anyway, to make sure that your WD1002 board and cables are functioning properly. If they are not, the program will respond with an error message giving more specific information about where the problem is located. Correct these problems before proceeding, as they will probably prevent successful completion of the installation.

(3) If the system passes this test, continue to option <D> (Define hard drive type). LUN 1 (Logical Unit Number 1) is automatically selected first, since it will contain the information which will control the system installation. Enter the drive name or model, "Shugart 640", for example. The program will then ask for an approximate drive size in megabytes.

(4) Next you will be asked to select a starting drive letter for the hard drive. The drive letter should be higher than your standard floppy drives are designated. For example, a system with two floppies would designate the starting hard drive as "C". A system with four floppies would select "E" for the first hard drive.

(5) The drive parameters and partition map are now displayed (see the next subsection for a snapshot of the menu). The drive parameters that are listed at the top of this menu are representative of most common drives of the size selected. At this point correct any of the drive parameters that do not match the drive that you are installing. You may need to consult your owner's manual for the drive for the proper values. These values will be used when you run the format and install options later on. Notice that the 10 Meg hard drive in the example has been partitioned into two logical drives. (By entering a <P>, you can change the number of partitions to 4, just like the snapshot.)

(6) You may now e<X>it this submenu. The main menu will reappear.

(7) If you have a Kaypro 10 and have already run the K10TOKP program, you should skip this step.

<F>ormat the hard drive. Since this process will destroy any data that is presently on the hard drive, the program will ask you to confirm by typing "YES". Formatting will not begin until this has been done. When formatting is complete, HDCNFG will begin a three-pass verify if you desire (recommended for new drives). You will be prompted before the verification starts, as it generally takes a long time to complete. Full verification will read and write to every sector on the drive. When the read/write verification is complete, HDCNFG asks if bad block lockout is desired. You should answer <Y>es. Any bad blocks currently present on the hard disk will be located and allocated to a [BLOCKS].BAD file, thereby preventing the operating system from trying to use them later on. On completion the main menu will reappear.

(8) Enter <I> - "Install hard disk software" to permanently install the parameter and partition information on the hard drive.

(9) e<X>it HDCNFG and reboot the system. The hard drive can now be used. If you wish to boot from the hard drive, SYSGEN should be used to move the system image from a floppy to the hard drive.

A more detailed explanation of each option in the main menu is included below.

<C> Check Interface: Performs a complete diagnostic check of the interface, cables, and WD-1002, then reports any errors. Since a majority of Kaypro 10's use the WD1002-HDO card, which does not have the floppy controller installed, a WD2797 error may be ignored. If the interface test fails, you will get an error message with the approximate location of the problem. If the controller board does not respond at all, power down the system, check all connections and cables, check the host board for proper addressing (Z80 host only), and verify that power is being supplied to both the hard disk and WD-1002.

<D> Define hard disk type: Use this option when defining the drive <u>for the first time</u>. When defining a drive, you should pick a name for it (something informative such as "SA604" or something friendly like "Chester") and specify its approximate size in Megabytes. HDCNFG will assign default values for number of cylinders, number of heads, step rate, and logical partitions; these can all be changed immediately as HDCNFG automatically executes the <M>odify option whenever the <D>efine option is chosen. These values are specific to the hard drive installed and must be correct if the format and verify options are to function properly. Consult your owner's manual for your hard drive for the correct values.

<F> Format winchester: This should ONLY be done when installing a drive into your system for the first time. Since the formatter also initializes the directory for each logical partition, you should first set up the desired logical partitions for the hard drive (using options <D>efine or <M>odify). If you do not define the partitions before formatting, you will need to clear each directory with the <Z>ap option. Note that <F>ormat does not automatically check for bad sectors; however, it does exit into the verify routine and asks how many verify passes to perform. It is recommended that a three-pass (default) verify be performed after formatting any new media.

Parameters required for the hard drive before formatting can take place are: number of cylinders, number of heads, and step rate. (Default values are assigned whenever a drive is <D>efined, but should be checked against your hard drive owner's manual.) The default track format is 9 sectors of 1024 bytes each with a skew factor of 1:1, and the sectors are numbered from 0 to 8.

Once formatting is complete, directory initialization of each logical partition takes place.

<I> Install hard disk software: Installing the software is the final step after <D>efining and/or <M>odifying the hard drive configuration. All hard drive information is saved onto cylinder 0, head 0, sector 0 of the hard drive(s); the information is used by the hard disk BIOS portion of KayPLUS, the head safety program, and by HDCNFG on subsequent executions.

NOTE: Unless the hard drive information has been installed, KayPLUS will NOT know that the hard drive exists.

It is recommended that the hard disk information such as number of partitions, number of directory entries, block size, and track offset be recorded and kept in a safe place. (The simplest method is to perform a screen dump while in the <M>odify menu.) Hard disk partition information is located in the boot sector of the hard drive. If the boot sector is damaged, the hard drive partition information will be lost. (All hard drive data will still be intact; you will just need to re-install the logical drive partitions.) Restoration of a damaged boot sector may be accomplished by running the read/write verification portion of the <T>est option, which will attempt to repair any bad sectors as they are found. You will need to reinstall the partitioning and parameter information after the sector has been repaired. See detailed description of the <M>odify command for more explanation of drive parameters and partitioning.

<M> Modify hard disk parameters: Modify is discussed in the next subsection.

<T> Test winchester/remove bad blocks: Complete testing of the hard drive consists of two processes: read/write verification, and bad block lockout.

Verification is a slow but thorough process whereby every sector on the hard disk is tested by writing and reading back three patterns. If a bad sector is discovered on a given track, two attempts are made to reformat it. Regardless of the success or failure of the test or the reformat operation, the previous contents of the sector are restored. Hence, a complete verification can be safely done even after data is stored on the hard drive.

The second step of the test operation is bad block lockout. HDCNFG reads every sector on the disk one or more times and tags it if an error occurs. A "[BLOCKS].BAD" file is generated for each logical partition where bad sectors were found, and this file is stored in USER 15.

Upon entry, HDCNFG will check for a "[BLOCKS].BAD" file. If a file already exists, you will be asked to decide whether or not to use the old bad block map. In general, you probably will not want to use the old bad block map if verification has just taken place; it is possible that a reformat cleared up a bad sector that was previously marked as bad blocks. In some cases, you may want to use the existing [BLOCKS.BAD] file if you suspect that some sectors are of intermittent quality.

Whenever bad blocks are found on the hard drive, HDCNFG lists all existing files containing bad blocks, giving you the option to delete these files. In most cases, you will want to delete these files; however, an experienced user may be able to reconstruct the original file from the damaged file and backups.

<Z> Zap hard disk directory: Allows you to selectively clear a directory on a logical partition. If you defined your drive partitions after <F>ormatting, each logical drive partition must have its directory cleared (or else the operating system will think the directory is full). Should you decide to repartition a previously-defined drive, only the directories of the changed partitions will need clearing.

<X> eXit: Exits the program. If a hard drive has been <D>efined or <M>odified, HDCNFG will verify that you wish to exit first. Remember that the hard drive information <D>efined or <M>odified must be <I>nstalled before it can be used. If you e<X>it without saving the new parameters, the previous hard drive information will be retained.

SETTING THE HARD DRIVE PARAMETERS

The <M>odify option is chosen to set almost any parameter of the selected hard drive. Since some hard drives do not match the defaults provided, each parameter may be set individually. (In particular, some drives have more usable cylinders allowing for greater storage.) When <M>odify is first entered (either from the main menu or after completing <D>efine), a menu appears as shown in the example below:

```
Drive <N>ame:      SA712              Approx. size: 10 Mbyte
<C>ylinders:       320                <H>eads:      4
Pr<E>comp at cyl:  128                <S>tep rate:  Buffered seek

                    Drive <P>artitions: 4

<D>rive  <B>lock  Di<R> Entries  Track <O>ffset  Storage
   E        4k         256             1         2712k <- poin<T>er
   F        4k         256           321         2712k
   G        4k         256           641         2712k
   H        4k         256           961         2700k

                    Allocation bytes: 340 (154H)
```

Each option is described below.

<N>ame: Used to change the name of the drive.

<C>ylinders: Specifies the number of cylinders on the hard drive. Many drives have a few more cylinders than the default value set by HDCNFG. If you do not know the exact number of cylinders, refer to the supplemental information in Appendix A for a list of most common hard drives and their parameters. If your drive is not listed, stick with the default. It is possible to later modify this number which would add more storage to the last logical drive partition without losing data.

<H>eads: Specifies the number of heads on the hard drive. The value can range from two to eight.

pr<E>comp: Specifies the cylinder where write pre-compensation starts. Your hard drive manual will list this value. When in doubt or if you do not have a manual, 128 should be chosen as that is the value in all but a few drives.

<S>tep rate: Most hard drives have a provision for buffered seek. This means that the hard drive itself controls its step rate, which is internally set for optimum speed. If your drive does NOT have buffered seek, you will have to select the desired step rate from the menu which will be displayed. These are the only step rates available; if the value you want is not shown, choose the next HIGHER number. If the step rate is too fast for your drive, you will find that the drive will not restore or seek reliably.

<P>artitions: This is the number of partitions (or logical drives) in which to divide the hard drive. When this option is chosen, HDCNFG makes all partitions approximately the same size. Each partition is treated as a separate disk drive by QP/M or CP/M, with its own directories, allocation bytes, and disk parameter block. The number of partitions that you select for your hard drive is largely a matter of personal preference. QP/M and CP/M have a limit of approximately 8 megabytes per disk drive. Thus a 10 megabyte hard drive must be partitioned into a minimum of two drives to take advantage of all of the available space. HDCNFG computes the minimum number of partitions that it would take to use the complete drive and automatically displays this combination. Each partition may be adjusted in size by changing track ofsets, up to the 8 megabyte limit.

poin<T>er: Specifies which logical drive partition will be modified when <D>rive, <B>lock, Di<R> Entries, or Track <O>ffset is selected.

<D>rive: Used to change the drive letter. You will need to move the pointer to the drive letter that you want to change before the change can be made.

<B>lock: Allows you to select between 2k, 4k and 8k block sizes. (NOTE: A 'k' is 1024 bytes.) A 4k block size is recommended if most of your files are large (greater than 4k), and 2k is recommended if your files are small. Each group of 8 blocks requires a byte of memory in the hard disk module; these 'allocation bytes' take memory away from the memory that you use to run your programs. Hence, smaller drives use only a small portion of memory, whereas larger drives use more. With a 40Meg drive split into 8 logical drives, 5k of allocation bytes (in memory) would be required with a 2k block size! An 8k block size would reduce this to 1.25k which is more reasonable.

Di<R> Entries: Allows you to specify the number of directory entries dependent on the block size. The minimum/increment number is 64 entries for a 2k block size, 128 entries for a 4k block size, and 256 entries for an 8k block size. The number chosen should correspond to the expected file sizes: many small files require more directory entries whereas many large files require fewer. A good rule of thumb for the minimum number of entries is to divide the size of the logical drive partition, in "k", by 10.

Track <O>ffset: This value affects the storage size of both the selected drive AND the one above it (as shown on the screen and in the earlier example). By changing the track offset, you can make each drive partition any arbitrary size within the capacity of the drive. The track <O>ffset is restricted: it will not let you specify a track offset less than the partition shown above it or greater than the one above it (no overlap of partitions). Also, the maximum size of any partition is restricted to 8 megabytes (8192k).
NOTE: The track offset for the FIRST partition should ALWAYS be greater than or equal to 1.

E. KayPLUS Initialization

Upon pressing the RESET button, the monitor performs a CRC self-test of the ROM and a test/initialization of the monitor RAM memory (F000H-FFFFH). If an error occurs, the monitor will stop momentarily and display the error message on the screen. After a short pause, the monitor will reset and try again. Hence, if an error occurs, one of the two will be observed on the video display:

- ROM Error (damaged ROM)
- RAM Error (bad RAM)

After successfully finishing its testing, the monitor loads the RAM portion of the monitor into high memory, sets all monitor values to their default settings, and proceeds with "system initialization".

System initialization (re-)initializes the computer port configurations, sets the default baud rates, and resets the drive mapping table so that logical and physical drives are identical. Control is then passed to the Resident Monitor whose functions are described in section G.

The external serial port (Serial Printer Port) is initialized in the monitor as follows:

Serial Printer: 8-bit data, 1 stop bit, 16x clock, no parity, 1200 baud

F. KayPLUS v0.2 Features

Included below is a list of features offered in the KayPLUS v0.2 Monitor. All user-modifiable parameters can be changed under program control, but are usually defined in the boot sector of a KayPLUS bootable disk by the KPCNFG utility (so that your system always boots with your customized settings).

AUTOBOOT

Upon either power-up or reset, the monitor scans both the keyboard and physical (floppy) drive 'A'. If a disk is present (or inserted), the monitor will proceed with an operating system cold boot; it will exit into the monitor with the message 'SYSTEM?' if an error occurs. If no disk is inserted in drive 'A' and a key is pressed, the monitor will turn off the drive, display a help menu, and prompt ("*") for a command.

A third condition exists when a hard drive is installed on the system. In this case, KayPLUS will wait for four seconds for an input from the keyboard or floppy; it then proceeds to boot from the hard drive. If a disk without a valid system track is placed in floppy drive 'A', KayPLUS will attempt a boot, fail, display the message 'SYSTEM?', and immediately proceed to boot from the hard drive.

DISK FORMATS

A number of popular disk formats may be read directly by the KayPLUS ROM Upgrade. (Formats followed by '**' can be cold-and warm-booted.) The internal formats recognized are:

5.25 inch
- Xerox single-sided single-density
- Xerox double-sided single-density
- Xerox 820-II single-sided double-density
- Xerox 820-II double-sided double-density
- Kaypro single-sided double-density **
- Kaypro double-sided double-density **
- Kaypro quad (double-sided double-density 96-tpi) **
- Osborne single-sided single-density
- Osborne single-sided double-density
- Advent 1k single-sided double-density **
- Advent 1k double-sided double-density **
- Advent 1k quad (double-sided double-dens. 96-tpi) **

3.5 inch
- MICROCode 1k single-sided double-density **
- MICROCode 1k double-sided double-density **

DISK CONTROL

The monitor is written to accommodate motor control of a variety of 5.25- and 3.5-inch disk subsystems. When the drives are selected from a state where they are not currently spinning, a delay (sometimes referred to as a "MOTOR ON" delay) occurs while 5 sector holes are counted (user-modifiable), allowing the disk to achieve proper speed. If the drives do not have a satisfactory delay period, sector errors may occur that are caused by the drive turning too fast or slow. If a disk is not accessed after a period of 6 seconds (also user-modifiable), the drives are deselected. There is no delay when selecting a drive which is already spinning.

LOGICAL-TO-PHYSICAL DRIVE MAPPING

KayPLUS incorporates logical-to-physical drive mapping which allows you to name your drives in any manner. For example, if you boot on physical drive C, this becomes logical drive A. It is possible to map the logical drives to any physical drive A through P (or even the same physical drive). The physical drive mapping set up by KPCNFG becomes effective after booting up, with the exception that the drive that you boot up on is always swapped to 'A'. The drive that is swapped at boot up makes the change with the logical drive set as 'A' in the configuration map, not the physical drive 'A' (unless they are the same). The drive mapping may be changed at any time after boot up using the ASSIGN program.

AUTOMATIC DETECTION OF QUAD DRIVES

If you have or should you decide to install quad drives (double-sided 96-tpi) in your system, KayPLUS detects them without any modifications to your system disk. Any 48-tpi disk will also work properly in the quad drives. Further, you can even boot a 48-tpi KayPLUS system disk on a quad drive.

Care should be taken when using 48-tpi disks that must be read by a true 48-tpi disk drive. Since the physical track that is written by a 96-tpi disk drive is approximately half as wide as a true 48-tpi track, only disks formatted on a 96-tpi drive should be used to transfer data on the 48-tpi format. If the disk has been previously written to by a 48-tpi drive, then written to by the 96-tpi drive, only half of the 48-tpi track will contain the new data, with the balance of the track still holding the data written previously by the 48-tpi drive. The 48-tpi drive will no longer be able to accurately read this track, since it will be able to read both the old and the new data at the same time.

Any disk that is to be transferred between 96- and 48-tpi drives must be unformatted or bulk erased (erased using a device with a changing magnetic field) to destroy any existing magnetic patterns on the disk before formatting on the 96-tpi drive. In a similar manner, a diskette that has been previously used as a double-sided disk cannot be reformatted to a single-sided format unless it has been bulk erased. This is because the track on the back side will still exist and be used to identify the format.

REAL-TIME CLOCK

A real-time clock has been incorporated into the KayPLUS rom set, using either existing hardware, or an add-on real time clock board. If your system has a hardware real-time clock, KayPLUS can be configured to set its date and time using the hardware. Vectors are present in the monitor jump table which can be used by QP/M to fetch this information for time and date stamping.

The new monitor always runs the real-time clock and will start at 00:00:00 unless set. 24-hour format is used (e.g. the clock "rollover" to 00:00:00 occurs after 23:59:59).

Along with the real-time clock, a calendar has been incorporated into the monitor. This is a fully-functioning 365-day calendar (it does not check for leap years).

System re-initialization will not affect the current clock setting.

ADVENT AND SWP RAM DRIVE SUPPORT

The KayPLUS ROM along with the KayPLUS BIOS fully support the Advent RAMcard and SWP Co-power88 as a RAM drive. If you configure your system for the Advent or SWP card being attached, drive M: is available as a RAM drive immediately after boot (no other utilities need be executed).

SCREEN DISPLAY OF TIME

Another feature of the new monitor is an optional screen display of time. This display can be toggled on/off by sending a command to the KayPLUS video either from the keyboard or under program control.

SCREEN DUMP

A screen dump to the printer is accomplished every time the <CTRL> + <\> key is pressed on the Kaypro keyboard (user-definable). If the BIOS has not been loaded into memory, the monitor will use the parallel printer port as the LIST device. After the BIOS is loaded, the monitor will use whatever LIST device is implemented in your BIOS. Pressing any key terminates the screen dump.

Screen dump is indicated by a flashing 'P' in the upper right hand portion of the screen (just left of the time display).

There is also a monitor jump vector (see Section I) which activates screen dump under program control.

SCREEN PAUSE

The screen will freeze IMMEDIATELY every time the <CTRL> + <@> (you do not need to press the SHIFT key) is pressed. Pressing any key will cancel this command.

Screen pause is indicated by a flashing '*' (asterisk) in the upper right hand portion of the screen.

SCREEN BLANKING

After 6 minutes (user-definable) of keyboard and video inactivity, the screen will blank. The screen is reactivated when any key is pressed or a character is sent to the screen.

KEYBOARD INPUT BUFFER

KayPLUS has a full 32-keystroke interrupt-driven input buffer. Lost keystrokes are now a thing of the past.

SPECIAL KEYS

Shown in the table below are the default values of the special keys recognized by the monitor, along with their functions.

CTRL +	Hex Code	Function
\	1C	Send contents of screen to printer
@	00	Dynamic screen pause

G. Resident Monitor

When the system is powered-up or system re-initialization occurs, a keyboard/physical drive A scan takes place until one of three conditions occur: (1) a disk is present in drive A, (2) a key is pressed, or (3) four seconds have elapsed. The system power-up sequence is as follows:

(1) If a key is pressed before a floppy disk has been detected or the four second timeout, the Resident Monitor becomes active.

(2) If a floppy disk is present in drive A, it is checked for a KayPLUS system image. If it has one, the system is loaded. If not, an error message will appear on the screen and KayPLUS will proceed to sequence number 3.

(3) If the four second timeout has occurred or an invalid system image was detected on the floppy in drive A, KayPLUS will check the hard drive for a system image. If one exists, it is loaded. If not, KayPLUS activates the Resident Monitor.

There are only seven commands in the monitor (to make room for other features) which are useful for general display or debugging. Each command in the Resident Monitor starts with a single letter followed by either one or two parameters which are separated by either a blank or a comma (e.g., D7 or X0 35). All commands (with the exception of Boot and Help) are processed when the <RETURN> key is pressed. Parameters shown within angle brackets "<>" are required; parameters within "[]" are optional. ALL parameters are in hexadecimal unless otherwise specified.

Included below is a detailed description of each resident monitor function.

Table 1. Monitor Commands

Command	Format
Boot system disk	B <drive>
Dump memory	D [start address]
Go to address	G <execution address>
modify Memory	M <start address>
modify Port	P <port>
Terminal mode	T [baud]
eXtended memory test	X <start address> <end address>
Help menu	?

BOOT: Cold boot of operating system from disk in the designated <drive>. <Drive> can be any letter A-P and will boot the designated drive. When a physical drive other than A is selected, that drive becomes logical drive A and logical drive <drive> maps into physical drive A. The drive letter 'H' is reserved for booting from the hard drive.

For example, before the **BOOT** command, the logical drives are mapped into physical drives as:

Logical	A	B	C	D
Physical	A	B	C	D

After a command "B B", the logical-to-physical map will indicate:

Logical	A	B	C	D
Physical	B	A	C	D

DUMP: Dumps the contents of memory. If [start address] is specified, one page (256 bytes) will be dumped, beginning at [start address]. If not, one page will be dumped, starting from the last address of the most recent dump.

The format of the display is as follows:

```
aaaa  dd dd dd dd dd dd dd dd  dd dd dd dd dd dd dd dd  ccccccccccccc
```

where aaaa is the starting address of the line in hex;
dd is the value of memory at the given location;
c is the ASCII character for the same position;
characters which cannot be printed are designated by a period (.).

For example, if a line like the following was displayed

```
0150  00 01 48 65 6C 6C 6F 0D  13 05 FE 00 00 00 00 00  ..Hello...°...
```

you can see that location 0151H contains 01H; starting at 0152H is the string "Hello" followed by a carriage return (0D); and 0FEH is the value of location 015AH.

GO: Go execute the routine at <execution address>. GO is programmed such that a RETurn instruction can be used to re-enter the monitor.

MODIFY: Modify memory starting at <starting address>. This command steps sequentially through memory allowing you to modify the value at the displayed location. Each location is displayed as

```
aaaa dd
```

where aaaa is the memory address
dd is the value at that location

The cursor waits at the end of the line for your input. To change the contents, you can enter either:

(1) a two-digit hexadecimal number,
(2) a one-digit hexadecimal number followed by a <RETURN>,
or (3) a single quote (') followed by any character. In this case the ASCII representation of this character will be entered into the memory location.

In all cases, the monitor automatically advances to the next address.

If you do not wish to change the contents, press the <SPACE BAR> to re-display the contents of the current address. Pressing either <RETURN> or <+> will advance to the next location, while <-> decrements the address. <RETURN>, <+>, or <-> alone will leave the current value unchanged. Pressing any other key (or invalid hexadecimal number) terminates the **MODIFY** command.

For example, assume that you wanted the contents of 0207H to be 1BH, 208H to be 3, and 20AH to be 'Z'. The sequence would proceed as follows:

```
M207              <--- Enter command
0207 00 1B        <--- Value was 00; enter 1B (no <RETURN>)
0208 FF 3         <--- Enter 3 followed by <RETURN>
0209 FE           <--- Skip this location using a <RETURN>
020A 27 'Z        <--- Enter an ASCII 'Z' (no <RETURN>)
020b 11 .         <--- End of modify (press '.' and <RETURN>
```

PORT: Inputs the value of the <port>, displaying it in hexadecimal. Results are displayed as:

```
pp dd
```

where pp is the hexadecimal port number
dd is the value of the input port

The monitor waits at the end of each line for a keyboard response. Pressing the <SPACE BAR> will re-input and re-display the current port. Pressing either <RETURN> or <+> will increment to the next port address; <-> will decrement to the previous port address. Entering a hexadecimal number or ASCII character as described in **MODIFY** will OUTPUT that value to the port displayed and does NOT advance the port address. Any other key terminates the **PORT** command.

TERMINAL MODE: Enter the dumb terminal mode using the Serial Printer port. If [baud] is present, the Serial Printer baud rate is changed to the desired value as follows:

[Baud]	Baud Rate (bps)
2	110
5	300
6	600
7	1200
A	2400
C	4800
E	9600
F	19200

If [baud] is not present, the current baud rate is not changed. (On power-up, the Serial Printer port is set to 1200 baud.)

To exit the dumb terminal mode, press the <CTRL> and <¼> (above the <6> key; the SHIFT key is not needed) keys simultaneously.

EXTENDED MEMORY TEST: Perform extended memory test from the <start address> to the <end address>. The specified range may not extend into the monitor (to keep from destroying the monitor code). The test is very fast and thorough, performing a rolling one fill, rolling zero fill, and 9-bit walking-bit test. The memory test destroys the previous contents of memory, leaving every location cleared (set to zero).

HELP MENU: Pressing the <?> (question mark) at the prompt will bring up the Help menu which will list each command and its corresponding argument.

H. Hardware Considerations

In this section, a description of the Serial Printer, Centronics Parallel, and the system data ports are presented.

The system data port in the Kaypro is a bit-mapped parallel port. The table below describes the usage of each bit.

Table 2. System PIO Bit Description
(Control port is 1DH; data port is 1CH.)

Bit #	Name	Description
7	BANK	Memory bank: 0 = RAM, 1 = ROM/Video
6	MOTOR	Motor line: 0 = on, 1 = off
5	DENSITY	Density line: 0 = double, 1 = single
4	PSTROB	Centronics strobe, active high
3	PBUSY	Centronics busy: 0 = busy
2	SIDE	Side select: 0 = side 0, 1 = side 1
1	*DSEL1	Drive select bit 1: 1 = select
0	*DSEL0	Drive select bit 0: 1 = select

*On Kaypros with hardware capable of addressing four drives, the bit map is as follows:

Drive	DSEL1	DSEL0
A	0	1
B	1	0
C	0	0
D	1	1

PRINTER PORT DESCRIPTION

Included below is the pinout for the Serial Printer port should you choose to attach a modem or a serial printer to your Kaypro system. Only the significant data and control lines are described.

On the Kaypro, the Serial Printer port is permanently wired for the standard DTE configuration.

Table 3. Serial Printer Port Description

Serial Printer port is the 25-pin connector

(Control port 06H; data port 04H; baud rate 00H)
(Direction is with respect to the Kaypro.)

Pin #	Name	Direction	Description
1	GND	---	Ground
2	PRCV	In	Receive Data
3	PXMIT	Out	Transmit Data
4	PCTS	In	Clear-To-Send
5	PRTS	Out	Request-To-Send
6	PDSR	Out	Data-Set-Ready
7	GND	---	Ground
8	PDTR	Out	Data-Terminal-Ready
20	PDCD	In	Data-Carrier-Detect

CENTRONICS PORT DESCRIPTION

Should you choose to attach a Centronics-type parallel printer to your Kaypro system, the strobe direction and busy signal must match the table below. The Centronics connector is an inset connector with clips to hold the cable in place.

Table 4. Centronics Port and Printer Description

(Output port 08H; control bits on system PIO.)
(Direction is with respect to the Kaypro.)

Centronics connector	Signal	Direc	Comments
1	STROBE	Out	Strobe is low active; high standby
2	D0	Out	
3	D1	Out	
4	D2	Out	
5	D3	Out	
6	D4	Out	
7	D5	Out	
8	D6	Out	
9	D7	Out	
10	ACK	In	Not implemented on Kaypro
11	BUSY	In	Busy is active high; ready low

The software drivers for both the parallel and serial printer are always resident and selectable using the system IObyte. Although only a single printer may operate under CP/M and QP/M, the IObyte allows switching between a serial and parallel printer. You can then choose between two printers using program control, STAT or QSTAT.

I. KayPLUS Monitor Entry Points

This section details the monitor entry points in the KayPLUS v1.2 monitor.

KayPLUS ROM Entry Points

The KayPLUS ROM entry points are upward-compatible with the Kaypro x-84 or earlier ROMs, allowing your KayPLUS system to run programs specific to the Kaypro series. The KayPLUS BIOS makes extensive use of these calls.

Table 5. KayPLUS ROM Entry Points

How to Read

'Locn' is address in hex. 'Entry' shows registers and their values. 'Exit' shows useful data contained in registers upon return. 'Registers' shows all registers altered: '8080' = AF,BC,DE,HL and 'all' is every register on the Z80 except the IY and Z80 secondary registers (accessed with EXX and EX AF,AF').

Locn	Label	Name	Values/Description
0000	COLD	Cold boot	Entry: none Registers: all Exit: DOES NOT EXIT
0003	INITDSK	Init Disk	Entry: none Registers: AF Exit: none
0006	INITVID	Init Video	Entry: none Registers: AF Exit: none
0009	INITDEV	Init KPLUS	Entry: none Registers: 8080 Exit: none
000C	HOME	Home drive	Entry: none Registers: BC,HL Exit: none
000F	SELDSK	Select disk	Entry: C = drive code Exit: HL = DPH address A = drive status Registers: all
0012	SETTRK	Set track	Entry: BC = track Exit: none Registers: HL
0015	SETSEC	Set sector	Entry: C = sector Exit: none Registers: HL
0018	SETDMA	Set DMA	Entry: BC = DMA address Exit: none Registers: none
001B	READ	Read sector	Entry: none Registers: all Exit: A = status
001E	WRITE	Write Sector	Entry: none Registers: all Exit: A = status

0021	SECTRAN	Sector Translate	Entry: BC = sector Exit: HL = translated sector Registers: AF,BC,HL
0024	DISKON	Motor on	Entry: none Registers: AF,BC,HL Exit: none
0027	DISKOFF	Motor off	Entry: none Registers: AF Exit: none
002A	KBDSTAT	Keyboard Status	Entry: none Registers: AF Exit: keyboard status
002D	KBDIN	Keyboard Input	Entry: none Registers: HL,AF Exit: keyboard char
0030	KBDOUT	Keyboard Out	Entry: A = char Registers: 8080 Exit: none
0033	SIOSTI	Serin stat	Entry: none Registers: AF Exit: A = serial input status
0036	SIOIN	Serial in	Entry: none Registers: AF Exit: A = serial input char
0039	SIOOUT	Serial out	Entry: C = char Exit: none Registers: AF
003C	LISTST	List Status	Entry: none Registers: AF Exit: A = parallel printer status
003F	LIST	List out	Entry: C = char Exit: none Registers: AF
0042	SERSTO	Serout Status	Entry: none Registers: AF Exit: A = status
0045	VIDOUT	Video out	Entry: C = char Registers: all Exit: none
0048	DELAY	Delay	Entry: B = delay count Exit: none Registers: B,DE,AF
004B	TIMDAT	Time/date	Entry: none Registers: HL Exit: HL = TIMDAT address
004E	SCRDMP	Screen dump	Entry: none Registers: all Exit: none
0051	FLUSH	Flush Buffer	Entry: none Registers: 8080 Exit: A = status
0054	ETICK	External 1 sec. tick	Entry: none Registers: 8080 Exit: none

A brief description of each entry point is included below:

COLD: Resets entire computer system and is ALMOST like pressing the RESET button. See KayPLUS Initialization, part E.

INITDSK: Resets the disk input/output buffer status to empty. Any pending write is lost. Useful to perform a "soft" disk reset.

INITDEV: Initializes the KayPLUS system, including all I/O ports and high memory routines, monitor vectors and interrupt services. A "hard" disk reset is performed to the initial Kaypro double-density compatible format, and all previous disk configuration information is lost.

HOME: Sets track number to 0. No seek is actually performed until either a disk read or write occurs.

SELDSK: Selects logical drive in register C (value of 0 through 15, corresponding to drives A through P), with pre-select flag in E. Returns disk status in AF, C and HL. **SELDSK** is the heart of the disk routines and determines what type of disk (size, density, and format) is present in the drive.

Upon entry, register C contains the logical drive number (0-15), which is mapped into the physical drive. The LSB (least significant bit or low bit) of the E register determines whether a true select occurs. If the LSB of E is 0, the disk is treated as a new disk and its format is checked. If the LSB of E is 1, the disk is considered to have been selected before and no format check occurs.

Upon exit, the Z-80 Zero status flag indicates success (Z is set) or failure (Z is not set) unless the LSB of register E was 1, in which case the select is always successful. If the disk was selected without error, HL contains the address of the DPH (Disk Parameter Header). If an error occurs, HL is set to 0; the type of error encountered depends on the values in the A and C registers.

When an error occurs, the C register indicates the category as follows:

Table 6. Disk Error Categories

C = 0	disk error occurred, status in A register
1	quad disk installed in non-quad drive
2	unknown disk format encountered

When C is zero, disk status in the A register contains the type of disk error that occurred and is a bit-mapped error code as described on the next page:

Table 7. Disk Error Code

	Bit	Read/Write/Seldsk/Seek
(hi)	7	drive not ready
	6	write protected (can only occur during write)
	5	write fault (can only occur during write)
	4	record not found/seek error
	3	crc error
	2	lost data/cannot seek track 0
	1	---
(low)	0	---

SETTRK: Sets the track number to the value in register BC. No seek is actually performed until a disk read/write occurs.

SETSEC: Sets the logical sector number to the value in register C.

SETDMA: Specifies the DMA address where disk read/write occurs in memory. The address in register pair BC is used until another DMA address is specified.

READ: Reads the previously-specified logical sector from specified track and disk into memory at the DMA address. Note that on double-density disks and the hard drive, one physical sector may be composed of up to eight logical sectors, so a physical disk read may not actually occur. Returns disk status in A with zero indicating no error occurred and a non-zero value indicating an error as described in table 8.

WRITE: Same as above, but writes from memory to disk.

KBDSTAT: Simply returns status of keyboard queue. Returns 0FFH if a key is available, or 00H otherwise.

KBDIN: Gets character from keyboard buffer or waits for one, if none ready.

KBDOUT: Sends the character in register A to the keyboard port.

SIOSTI: Returns status of SIO-B input port. Returns 00H if no character is ready, or 0FFH otherwise.

SIOIN: Fetches character from SIO-B input port, or waits for one if none is ready.

SIOOUT: Sends character to SIO-B output port.

LISTST: Returns the list status of the Centronics port: 00H is returned if the printer is busy, 0FFH if ready.

LIST: Sends the character in register C to the Centronics port.

SERSTO: Returns status of SIO-B output port. Returns 0FFH if SIO-B is ready to accept a character for output, and 00H otherwise.

VIDOUT: Sends character in register C to video screen. All characters 20H (blank) to 7FH are directly displayed and screen scroll is done, if required. Characters below 20H are defined as control characters. The table below lists the control codes accepted and their meaning. Note that all other control characters and escape sequences are simply ignored, and screen display is not affected.

Table 8. Video Control Characters

Hex Code	Function
07	Ding!
08	Backspace or cursor left (does NOT erase character)
09	Horizontal tab (8 columns each)
0A	Line feed or cursor down
0B	Cursor up
0C	Cursor right
0D	Carriage return
11	Clear to end of screen (for Xerox and ADM-3A compatibility)
17	Clear to end of screen
18	Clear to end of line
1A	Clear screen and home cursor
1B	Activate escape sequence
1E	Home cursor
1F	Display next character sent

Table 9. Video Escape Sequences

(ESCape character followed by)

Hex Code	ASCII Char	Function
28	(	End blinking video attribute. ADM-31 and Xerox 820-II compatible.
29	)	Start blinking video attribute. ADM-31 and Xerox 820-II compatible.
3D	=	Set XY cursor position leadin (4 characters total). Whole sequence is: "ESCape, =, Y, X" where Y = row (0-23 dec.) + 20 hex and X = column (0-79 dec.) + 20 hex. Upper left of screen (home) is X = 0, Y = 0.
42	B	Begin attribute defined by next character.
43	C	End attribute defined by next character.
45	E	Line insert. Moves screen below cursor one line down and leaves cursor at present position (on the blank line).
51	Q	Character insert. Moves remainder of line one character right, inserting blank and leaving cursor over blank.
52	R	Line delete. Deletes line cursor is on, moving remainder of screen up to fill it. Blank line is left at bottom of screen.
54	T	Clear to end of line. ADM-31 compatible.
57	W	Character delete. Deletes character cursor is on, shifting remainder of line left to fill space. Blank is put at end of line.
58	Y	Clear to end of screen. ADM-31 compatible.

NOTE: Any other ESCape sequences are ignored.

Table 10. Video Attribute Sequences

(ESCape character followed by B to begin or C to stop followed by)

Hex Code	ASCII Char	Function (B/C)
32	2	Blinking start/stop
34	4	Cursor on/off
36	6	Remember cursor position/go to last remembered posn
38	8	Keyclick on/off
39	9	Clock display on/off

NOTE: Any other video attribute sequences are ignored.

DELAY: This entry point performs a "B times 10 mSec" delay. The 10 mSec delay is preset for 4 MHz. "B" is the value in the B-register and ranges from 1 to 256 decimal (0 is treated as 256).

TIMDAT: Returns HL register pair pointing to the DAY memory location. This is a very powerful entry point, as it indicates where a number of monitor variables are located. All values other than DAY are located relative to the HL register pair. Adding offset to the HL register gives access to these other locations. The table on the next page lists the accessible monitor variables:

Table 11. Location of Monitor Variables

The locations are relative to the address returned in HL after a call to TIMDAT.

Offset	Name	Description
HL - 10H	SCRBLK	16-bit screen blanking time (second
- 0EH	ATRMOD	Attributes ignored (7F in '83)
- 0CH	KBDTIK	Adjustment value for internal clock (default value: 30)
- 0BH	SDK	Screen dump key
- 0AH	PBK	Dynamic pause key
- 08H	ATTRIB	Video attributes: 7 = blinking mode 6 = keyclick off 5 = 4 = 3 = 2 = 1 = screen blanked 0 = clock display
- 02H	TIKCNT	16-bit one-second "tick"
HL + 00H	DAY	Day (01-31 decimal)
+ 01H	MONTH	Month (01-12 decimal)
+ 02H	YEAR	Year (00-99 decimal)
+ 03H	HOUR	Hour (00-23 decimal)
+ 04H	MINUTE	Minute (00-59 decimal)
+ 05H	SECOND	Second (00-59 decimal)
+ 06H	DSKMAP	Logical-to-physical drive map table
+ 16H	OFFDLY	Drive timeout (seconds)
+ 17H	ONDLY	Spinup in sector holes (times 2)
+ 18H	RETRYM	Retry maximum MINUS 1
+ 19H	MAXDRV	Maximum FLOPPY drive (1=A/B, 3=A/B/C If bit 7 set, hard drive information has been loaded (if it exists).

For example, after calling **TIMDAT**, you could obtain the cursor character by:

```
LD   DE,19H     ;offset from DAY location
ADD  HL,DE      ;point to the MAXDRV location
LD   A,(HL)     ;fetch maximum drive number into A
```

SCRDMP: Sends a copy of the screen display to the printer. If no system disk has been booted, KayPLUS will use the PRINTER port as the LIST device. After boot, KayPLUS will use whatever LIST is implemented in your BIOS. Any keypress terminates the screen dump.

FLUSH: Flushes disk buffers. Any pending disk writes are completed and the buffer flags are reset.

ETICK: When this entry is called, KayPLUS advances the internal timers by one second (real-time clock, drive turn-off, and screen blanking). This entry is called by the BIOS if the interrupt-driven ROM clock is disabled so that KayPLUS can still keep track of the time.

J. KayPLUS BIOS Features

The KayPLUS BIOS implements the operating system interface (QP/M or CP/M), using the KayPLUS ROM for a majority of its tasks: console input/output, device initialization, and disk routines. However, the IObyte mapping, printer interfaces, and disk error recovery are controlled within the KayPLUS BIOS.

It is **STRONGLY** recommended that any BIOS configuration be handled with the KPCNFG utility. KPCNFG contains the relocatable code for the BIOS and BOOT sector and is capable of configuring the BIOS for any system configuration (see section C).

Experienced users may still wish to modify the BIOS for a specific application; consequently, source code for the BIOS is provided. However, programmers should be aware that the BIOS cold boot routine should not be modified in any way. Adding program code to the end of the cold boot routine or modifying any other BIOS calls is allowed.

The KayPLUS BIOS code has a size of 1024 (400H) bytes.

IOBYTE MAPPING

The IObyte is partially implemented within the KayPLUS BIOS, mapping both the printer (LST:) and console (CON:) devices. The table below summarizes the bit mapping.

Table 12. IObyte Logical-to-Physical Device Map

Bit	7	6	5	4	3	2	1	0
	a	b	.	.	.	.	c	d

PRINTER (LST:)

a	b	Logical	Means
0	0	TTY	Serial printer port
0	1	CRT	Keyboard + video
1	0	LPT	Centronics printer
1	1	ULl	Modem/Serial Data I/O port

CONSOLE (CON:)

a	b	Logical	Means
0	0	TTY	Serial printer port
0	1	CRT	Keyboard/video
1	0	BAT	Modem/Serial Data I/O port
1	1	UCl	Modem I/O port AND keyboard/video

NOTE: The console configuration allows for BOTH the modem I/O and the keyboard/video to be the logical console at the same time; this is useful for remote applications.

The IObyte is set upon cold boot and can be changed directly (the IObyte is located at 0003 in memory) or via QSTAT/STAT. The logical-to-physical device names in QSTAT/STAT are assigned as follows:

Table 13. QSTAT/STAT Device Names

Logical	Physical	Description
CON:	TTY:	Serial Printer Port
	CRT:	Keyboard/video
	BAT:	Modem/Serial Data I/O port
	UC1:	Both CRT: and BAT:
LST:	TTY:	Serial printer port
	CRT:	Keyboard/video
	LPT:	Centronics printer
	UL1:	Modem/Serial Data I/O Port

Reader and punch are implemented in the BIOS as the Serial Data (Modem I/O) input and output ports, respectively.

DISK ERROR RECOVERY

When a disk error occurs during read and write, KayPLUS makes several attempts to recover from the error, if possible. If the error is still present, the BIOS displays a message like:

BIOS error on A: <A>ccept <I>gnore <R>etry?

Pressing the 'R' key forces the BIOS to make another read/write attempt. The 'A' key will return the error to the calling routine (most likely the DOS); 'I' will also return to the calling routine, but will return a success code as if no error occurred.

Disk errors can occur for a number of reasons, but three appear to be most common. If an error occurs, first verify the drive door is completely closed. If an error occurs during a write, check the write-protect label - it should be absent to write to 5.25" disks (switch closed on 3.5" disks). Finally, if you have changed disk types (different number of sides and/or densities) without re-logging the drive, an error may occur.

If you are running under QP/M, errors due to disk changes are far less frequent than running under CP/M (the BIOS was written to take advantage of QP/M's automatic disk re-log). However, if an error does occur, simply 'A'ccept the error and the disk will be re-logged automatically. If you are running under CP/M, then <CTRL> + <C> (to re-log the drive manually) is your only option.

K. Monitor Memory Usage

The memory usage of RAM in KayPLUS is at the absolute minimum All monitor routines are in ROM, with only essential drivers an interrupt service routines located in RAM. A general memory map specific interrupt vector address map, and disk parameter ma follow:

Table 14. Monitor Memory Usage

Range (Hex)	Description
F500-F600	RAM resident monitor routines; can be written over when mini-monitor no longer needed. (This area may be used by the hard drive and RAM drive which build their tables downward in memory.)
F600-F8DF	Disk Parameter Headers, Disk Parameter Blocks, checksum area, allocation area, and other disk variables
F8E0-FCDF	1024 byte disk buffer
FCE0-FD5F	Scratch directory buffer
FD60-FD7F	Disk Parameter Header Table
FD80-FEFF	RAM resident interrupt service and disk routines
FF00-FFFF	Monitor variables and stack area

The following locations contain the addresses of the specified interrupt service routine. For example, SIOVB2 (FF04H) contains the address of the keyboard input routine.

Table 15. KayPLUS Interrupt Vector Table

Range (Hex)	Variable	Used	Description
FF00-FF01	SIOVB0		Keyboard xmit buffer empty
FF02-FF03	SIOVB1		Keyboard ext/status change
FF04-FF05	SIOVB2	x	Keyboard receive data available
FF06-FF07	SIOVB3	x	Keyboard special receive condition
FF08-FF09	SIOVA0		Not used in '83 Kaypros
FF0A-FF0B	SIOVA1		
FF0C-FF0D	SIOVA2		
FF0E-FF0F	SIOVA3		
FF10-FF11	SIOVS0		Serial Printer xmit buffer empty
FF12-FF13	SIOVS1		Serial Printer ext/status change
FF14-FF15	SIOVS2		Serial Printer receive data available
FF16-FF17	SIOVS3		Serial Printer special receive condition
FF18-FF19	SIOVM0		Not used in '83 Kaypros
FF1A-FF1B	SIOVM1		
FF1C-FF1D	SIOVM2		
FF1E-FF1F	SIOVM3		
FF20-FF21	PIOCA		System PIO port A interrupt
FF22-FF23	PIOCB	*	System PIO port B interrupt

*Dependent on the interrupt-driven ROM clock chosen, this vector MAY be used. If the ROM clock interrupt is implemented "via vertical sync", then PIOCB is used. In the case where the ROM clock interrupt is "None", this vector is not used.

Whenever a disk is successfully selected, the Disk Parameter Header (address) is returned in the HL register pair. All disk information for a specific drive is continuous and is accessible by offsetting the HL register as detailed below:

Table 16. Disk Parameter Map: Floppy

Hex Offset	Name	Description
HL + 00	DPH	Disk Parameter Header (16 bytes)
10	DPB	Disk Parameter Block (15 bytes)
1F	STRTSC	Starting sector number on track (usually 0 or 1)
20	STRTSC2	Additional starting sector number offset for side 1 (usually 0)
21	DENS	Density (00 = double, 20 = single)
22	SECMSK	Sector mask - depends on sector size (128->0, 256->1, 512->3, 1024->7) (sector mask is 0, 1, 3, or 7)
23	SECSIZ	Sector size (128, 256, 512, 1024) (2 bytes)
25	DFLAG	Drive flag is bit mapped. Bit is 1 if value true, otherwise 0. bit 7 = is a quad DRIVE (auto-set) 6 = locked format* 5 = fast step rate 4 = 3.5" DRIVE (0 for 5.25) 3 = quad DISK present 2 = is a double-sided DISK 1,0 = step rate (0-3)
26	DTRACK	Current track number of drive
27	DFLAG2	Disk flag 2. Only high bit matters at present: bit 7 = 1 if is special Xerox double-sided format, else 0
28	ALLOC	Allocation vector (64 bytes)
68	CSV	Checksum vector (64 bytes)

*A "locked" format protects the current disk format. In essence, KayPLUS assumes the drive has been selected before, WHETHER IT WAS OR NOT. This is useful for setting a drive to an unknown KayPLUS format (e.g. Ampro) without requiring additional memory or a complex interchange program. A disk format remains "locked" until specifically unlocked or a RESET occurs. KPDSKDF uses the lock bit to prevent KayPLUS from tampering with its installed disk formats.

Table 17. Disk Parameter Map: Hard Disk

Hex Offset	Name	Description
HL + 00	DPH	Disk Parameter Header (16 bytes)
10	DPB	Disk Parameter Block (15 bytes)
1F	HDSHFT	Head shift factor: 1 for 2 heads, 2 for 4 heads, 3 for 8 heads, 0 for 3, 5, 6, or 7 heads.
20	HDMASK	Head mask. 1 for 2 heads, FA for 3 heads, 3 for 4 heads, F6 for 5 heads, F4 for 6 heads, F2 for 7 heads, 7 for 8 heads.
21	HDCODE	Hard disk code: C8 for LUN 1, C0 for LUN 0.
22	SECMSK	Sector mask: 7 for hard drive
23	SECSIZ	Sector size: 1024 for hard drive (2 bytes)
25	DFLAG	*Drive flag: 40H for hard drive

The allocation bytes for the hard drive are located below the DPH/DPB information.

*A hard drive format is ALWAYS considered locked.

L. KayPLUS Utilities

MICROCode Consulting has written a number of useful utilities fo the KayPLUS system. All of them offer on-screen prompting (jus enter the utility name without using any parameters), and ar easy to use. NONE of the utilities perform any major syste change unless specified by the user; hence, it is safe to run th utilities just to obtain a help/description menu.

A description of each utility is included on the following pages.

ASSIGN

ASSIGN is used to display or change the logical-to-physical drive mapping on the KayPLUS system. ASSIGN is very useful in changing the drive assignment so that another physical drive becomes the system drive. Another use is to assign two logical drives to a single physical drive to "fool" a program into using one drive if it normally requires two.

To change the current logical-to-physical drive assignment, type:

```
ASSIGN logical=physical
```

For example, assume that you wish to assign physical drive C: to logical drive A: (a different system drive). Both of the following commands have the same result.

```
ASSIGN A=C
ASSIGN A:=C:
```

The colon is optional when specifying the drive and ONLY drives A through P can be mapped.

To restore the original assignment (so that drive A: is physical drive A:), type:

```
ASSIGN A=A
```

ASSIGN also accepts multiple drive assignments so that the following is also valid (either a comma or a blank can be used as separators).

```
ASSIGN A=C:,B:=D C=A
```

Finally, to display the current logical-to-physical drive map, type:

```
ASSIGN ?
```

AUTOBOOT

AUTOBOOT is used to enter, erase, or change the cold-boot comma on a KayPLUS system disk. The KayPLUS system fully supports th QP/M and CP/M autoboot feature. 'Autoboot' is a command that i executed ONCE upon cold-boot; it will not be automaticall executed again until the next cold-boot.

When executed, AUTOBOOT asks for the working drive, checks for a proper KayPLUS system disk, and displays the current 'auto-boot command for that drive, if any.

There are only two actions within AUTOBOOT:

<C> Enter a new 'auto-boot' command (up to 64 characters) b pressing <C> for change. A blank line (no input removes any existing command.

<RETURN> Leave the current command alone by pressing <RETURN>.

FORMAT

FORMAT is used to initialize a disk for use under the KayPLUS system or another system. Supporting thirteen different formats in 5.25- and 3.5-inch, FORMAT is menu-driven to simplify operation. FORMAT does NOT support any hard drive; use HDCNFG for formatting hard disks.

When executed, FORMAT first asks for the PHYSICAL drive to format. PHYSICAL refers to the true drive designation; any logical-to-physical mapping is discarded. (Mapping occurs whenever the system is booted from other than drive A: or via the ASSIGN utility.)

FORMAT supports eleven 5.25-inch formats.

Xerox 820	(single-side, single-density)
Xerox 820-II	(single-side, double-density)
Xerox 820-II	(double-side, double-density)
Kaypro 2	(single-side, double-density)
Kaypro 4	(double-side, double-density)
Kaypro 8	(double-side, double-density, 96-tpi)
Osborne I	(single-side, single-density)
Osborne DD	(single-side, double-density)
Advent 1k	(single-side, double-density)
Advent 1k	(double-side, double-density)
Advent 1k	(double-side, double-density, 96-tpi)

NOTE: The Kaypro 8 and Advent quad format options will only appear if the drive is quad density (double-side, 96-tpi, 80 tracks per side).

FORMAT also supports two 3.5-inch formats.

MICROCode	(single-side, double-density)
MICROCode	(double-side, double-density)

After choosing the format name, several options will appear sequentially:

- Enter number of sides to format:
  single, double, (or quad, if applicable)
- Format the entire disk or a single track
- Verify (one-pass search and count of bad sectors)
- Change the skew factor (default is usually best)

Formatting now proceeds and can be interrupted by pressing any key. FORMAT also allows you to repeat the operation with the same options, just by entering 'F'.

HDCNFG

HDCNFG is used to configure a hard disk for use under KayPLUS. detailed description of operation is included in section please refer to it for more information.

KBACKUP

KBACKUP is a utility which performs archival backup and restore operations on the selected logical hard drive partition. The backup/restore media is a group of encoded floppy disks which contain all the hard disk information; the number of floppy disks required depends on the size of the hard drive and the floppy disk format chosen.

When first executed, KBACKUP asks whether you want to perform a backup or restore operation. Next, it requests the physical drive letter of hard drive partition to backup or restore and checks that the drive selected is not a floppy. If restore has been chosen, KBACKUP requests the floppy disk letter at this time. KBACKUP examines the directory of the source drive totalling the files and their sizes. (The source drive is the hard drive for backup and the floppy drive for restore.)

If a backup is being performed, another option allows you to perform complete backup, archival backup, or selective backup. Complete backup tags every file for transfer to floppy disks. If archival backup is chosen, only those files that do NOT have the archive bit set are tagged for backup. Selective backup enters a menu similar to the public-domain program NSWEEP so that you may individually choose (tag) the files you want to backup.

If instead a restore operation is being performed, you have the option of restoring all files or selective files. Selective restore enters a menu similar to the public-domain program NSWEEP so that you may individually choose the files you want to restore.

Once the list of files to backup/restore is chosen, KBACKUP begins the process. If backup is being performed, the floppy disk drive onto which the backup data will be written is entered.

The first disk required in the floppy drive is encoded as 'd00' where 'd' is the hard drive partition letter. If no such disk exists, KBACKUP will encode the new disk if desired. For the backup operation, KBACKUP will request the floppy disks it requires in ascending order; any disks not required are automatically skipped. Since KBACKUP performs the backup on a block-by-block basis, the process is fast.

Restoring data with KBACKUP is more time consuming. Since retrieval must be done on a file-by-file basis, disk swaps are required for each file that is restored.

There are a few guidelines that you should follow using KBACKUP to backup the hard disk:

(1) When the floppy drive is selected for backup, the media in that drive (Kaypro 2, Kaypro 8, Advent 1k, etc.) is used as the basis for all backup. Quite simply, this means that the disk type selected MUST be the same for all floppy disks assigned to a specific hard drive partition. Different hard drive partitions may have different backup media types, but the backup media type for any ONE partition must be the same.

(2) Always choose the biggest floppy format as the backup media. Not only does this minimize the number of disks required for the hard drive partition backup, it also reduces the amount of media swaps you have to perform. MICROCode Consulting strongly recommends the purchase of a quad drive or 3.5" double-sided drive. The Advent 1k quad and MICROCode 1k (3.5") offer the highest storage at the fastest speed.

(3) Backup operations using the "archive bit" are only effective on operating systems which fully support archiving. Neither CP/M nor ZCPR3 support this bit; QP/M and the ZRDOS extension to ZCPR3 both support the archive bit.

KPCNFG

KPCNFG is used to configure or reconfigure a system disk for use under KayPLUS. A detailed description of operation is included in section C; please refer to it for more information.

KPDSKDF

KPDSKDF is a utility allowing recognition and use of disk formats which are not inherent to KayPLUS. For example, in the current version, disks such as 5.25-inch Morrow Systems and Epson QX-10 can be installed into KayPLUS. KPDSKDF has provisions for 12 different disk formats, any or all of which can be specified by the user. KPDSKDF consists of three files: KPDSKDF.COM, KPDSKDF.LIB which contains the actual disk parameter data, and KPDSKDF.SKW which contains the skew tables if required.

Using KPDSKDF to install a format is fairly simple. After executing KPDSKDF, a main menu appears which describes major functions. In general, you will probably wish to assign a disk format to a given drive.

After the drive is selected, KPDSKDF will display a list of formats that can be used on that drive. Only formats which correspond to the physical characteristics of that drive (5.25-inch or 3.5-inch; single- or double-sided; single-, double-, or quad-density) will be displayed. After choosing the format, KPDSKDF installs it into the KayPLUS system and locks the format (read the LOCK utility description). Hence, KayPLUS will ONLY recognize that format on that specific drive until the disk format is unlocked or the next cold-boot.

If you know the format to be installed before executing KPDSKDF, it is possible to avoid the program menus by typing:

```
KPDSKDF d:=[format]
```

where 'd' is the drive letter (the colon is optional)
'format' is a named format as defined in your disk library files (KPDSKDF.LIB and KPDSKDF.SKW).

KPDSKDF can accept one or more install commands; each command must be separated by a comma.

Installing a new format in KPDSKDF can be somewhat complicated the first time. It is important that you have all of the following information before installing a new format:

- PHYSICAL sectors per track
- PHYSICAL sector size
- type of disk (5.25- or 3.5-inch, single- or double-sided)
- if it is 5.25-inch, is it a quad-format
- sector translation table, if any
- DPB (block size, directory entries, reserved tracks, allocation mask, and extent mask)
- PHYSICAL sector skew

Once you have answered these questions, the format can be installed into KPDSKDF. Be patient, as it is easy to make mistakes (remember you can always delete a format).

As you become familiar with the program, you may be able to decipher the format of an unknown disk using KPDSKDF and one of the disk utilities such as DU. This is often a slow and tedious task, which should be left to a time when you feel that you have a pretty good idea of how the disk parameters work.

LOCK

LOCK is used to "lock" a given format on the specified drive, as well as "unlock" or check the lock status. A "locked" drive has its current disk format protected; neither warm-boot nor disk reset will affect the format until it is specifically unlocked or a cold-boot occurs. LOCK is useful under three conditions:

(1) A particular disk is not being detected properly, but another disk of the same format is detected correctly. First, obtain the format by installing the "good" disk, LOCK the format, then install the "bad" disk.

(2) You have manually patched the disk parameter table to install a disk format not inherent to KayPLUS. If the format is not locked, the next warm-boot or drive reset will lose the format.

(3) To unlock a drive that was previously locked under KPDSKDF or LOCK.

To lock a drive format (C: in the following example), type:

```
LOCK C
```

To unlock the format (drive C: again), type:

```
LOCK -C
```

To check the current lock status of all drives, type:

```
LOCK ?
```

Note that hard drives cannot be locked or unlocked.

PARK

PARK puts the heads into the safety zone. Since the WD-1002 cannot seek to the landing zone of some hard drives, the safety zone is chosen as the first cylinder past the last usable cylinder (all drives can get there). If you have two hard drives, PARK will move the heads of both to their respective safety zones.

SETCLK

SETCLK is used to set or reset the KayPLUS ROM real-time clock; it is used when you require the correct time but lack a hardware real-time clock.

When your system is configured for operation under QP/M, SETCLK will be automatically executed on cold-boot IF you have not specified a hardware real-time clock (using KPCNFG) while leaving any designated auto-boot program intact.

If your system has a hardware real-time clock, SETCLK is not needed. (See **KAYCLK.**)

SETCLK only provides KayPLUS with the initial settings for the ROM clock; KayPLUS keeps track of the actual time.

SETCLK will only accept numeric values for the second, minute, hour, day, month, and year. Editing is accomplished with <BACKSPACE> to delete a single digit and <ESCape> to delete the entire line.

SWAP

SWAP is a program which performs multiple hard disk and floppy drive designation swaps as specified by the user during installation with SWPCNFG. There are two options with SWAP: S and R. 'SWAP S' SETS the specified (as set in SWAP by the SWPCNFG utility) logical-to-physical drive mapping. 'SWAP R' RESTORES the logical-to-physical drive map to its original cleared configuration (i.e. A=A, B=B, etc.).

For example, after hard disk BIOS installation, you might have:

A: = floppy 1, B: = floppy 2, E: = hard 1, F: = hard 2

After executing:

```
d>SWAP S
```

A: = hard 1, B: = hard 2, E: = floppy 1, F: = floppy 2

Executing:

```
d>SWAP R
```

will restore the original drive map.

SWPCNFG

To specify the swapping that will actually occur when SWAP is executed, it is necessary to run SWPCNFG. (SWAP is shipped unconfigured.) You probably will at least want drive A: swapped with the lowest letter hard drive to speed up warm boot. In general, and to be less confusing, it is recommended that you totally swap the hard and floppy drives. Whereas in the initial configuration floppies have letters A: on up followed by the hard drive letters, the swapped configuration should put hard drive partitions into the lower drive letters followed by floppy drive letters.

Remember that the KayPLUS ROM performs an initial ASSIGNment of the drive map upon boot (based on the assignment given in KPCNFG). As such, if you are always executing SWAP after boot-up, you should consider changing the logical-to-physical drive mapping in KPCNFG to automatically make the changes.

SYSGEN

SYSGEN is used to move a system image to any system disk (hard or floppy) from either another system disk, disk file, or system image in memory. The system image need not be a KayPLUS system image.

There are three methods for obtaining the system image:

(1) Have the system image in memory. In this case, type:

```
SYSGEN
```

When SYSGEN inquires from which drive to read the system image, just press <RETURN>.

(2) Have the system image in a disk file. Type:

```
SYSGEN filename.ext
```

where 'filename.ext' is the name of the file which contains the operating system. KayPLUS will verify that the file contains a valid image before continuing.

(3) Read the system image from another disk. Type:

```
SYSGEN
```

When SYSGEN inquires for the disk which contains the system image, enter the letter <A-P>, followed by a <RETURN> to read the disk.

In all three cases, SYSGEN checks for the existence of a valid system image, its size, and whether it is a KayPLUS system that was detected. At that time, SYSGEN will inquire for the drive to which the system image will be written.

Since the KayPLUS system internally detects hard drives, 5.25- and 3.5-inch disk sizes, the same KayPLUS system works on all three.

The KayPLUS system image can reside on any of:

- 5.25-inch Xerox 820 (single-density, single- or double-sided)
- 5.25-inch Kaypro formats (single/double-sided or quad)
- 5.25-inch Advent formats
- 3.5-inch MICROCode formats
- ANY hard drive

Appendix A - SUPPLEMENTAL HARD DRIVE INFORMATION

This list is the basic specifications for a number of common hard drives. All begin write precompensation at cylinder 128 and have buffered seek, unless otherwise specified.

Drive Name	Size	Cylinders	Heads	Comments
ATASI 3051	40M	704	7	
CMI CM5206	5M	306	2	
CMI CM5412	10M	306	4	
CMI CM5619	15M	306	6	
CMI CM6426	20M	640	4	
CMI CM6640	30M	640	6	
CMI CM6853	40M	640	8	
CMI CM7660	45M	960	6	
CMI CM7880	60M	960	8	
Micropolis 1302	20M	815	3	
MicroSci. HH312	10M	306	4	
MicroSci. HH325	20M	612	4	
MicroSci. HH612	10M	612	4	
MicroSci. HH725	20M	612	4	no precomp
MiniScribe 3012	10M	612	2	
Mitsubishi MR521	10M	612	2	
Mitsubishi MR522	20M	612	4	
NEC D3126	20M	615	4	
NEC D5124	10M	310	4	
NEC D5126	20M	612	4	
Rodime 201E	10M	640	2	
Rodime 202E	20M	640	4	
Rodime 203E	30M	640	6	
Rodime 204E	40M	640	8	
Rodime RO251/351	5M	306	2	
Rodime RO252/352	10M	306	4	
Seagate ST506	5M	153	4	3.5 ms.
	Seagate ST506 continued		Precomp - all tracks	
Seagate ST213	10M	615	2	
Seagate ST225	20M	612	4	
SeagateST412	10M	306	4	precomp all tracks
Seagate ST4026	20M	615	4	
Seagate ST4038	30M	733	5	
Seagate ST4051	40M	977	5	
Shugart 604	5M	160	4	
Shugart 606	8M*	160	6	
Shugart 607	5M	311	2	
Shugart 612	10M	311	4	
Shugart 706	5M	320	2	
Shugart 712	10M	320	4	
Tokico 503	10M	320	4	
Tokico 505	20M	615	4	

*For sizes that are not included in the HDCNFG options, select the next higher size. For sizes greater than 40M, just select the 40M size and <M>odify the cylinder and head parameters.

Appendix B - IDENTIFYING YOUR KAYPRO

On some models of the Kaypro you may need to make a number of minor modifications to your main CPU board to take full advantage of all of the KayPLUS features. It is important to accurately identify the model of your main board to decide whether you will need to make these modifications (or even if you have the correct version of the KayPLUS ROMset). If the modification looks too complicated, you may wish to order modification kits with the soldering already completed, or send your board in for modification to qualified dealers.

The most common problem encountered when selecting hardware and software for your Kaypro, is proper identification of the Kaypro model. The only way that you may be able to positively identify your Kaypro is to open up your unit and look at the computer board. The 8-bit Kaypros came as Kaycomp II, Kaypro II, Kaypro 4, and Kaypro 10 in what is referred to as the '83 (1983 design) series Kaypros. In the '84 series, there is the Kaypro 2 (2, not II; also known as the New 2), Kaypro 2X, Kaypro 4-84, Kaypro 10, Kaypro 1, and Robie (KayPLUS will not work with the Robie). Each of these versions may have slightly different hardware installed on the main board, and actually may have different boards installed in them.

There are at least 6 different versions (etches) of the Kaypro board itself. These are the Kaycomp II, the Kaypro II, the Kaypro 4, the Kaypro 10 ('83), the Kaypro universal (2, 2x, 484, and others), and the Kaypro 10 (10 '84, 1, and Robie). Both Kaypro 10 boards are very similar to the '84 series universal board, as all have bit mapped graphics capabilities. All of the '84 series boards have optional modems, real-time clocks, and hard drive interfaces, although the components may not be installed for each.

Included below is a brief description of each machine to aid in identification. The KayPLUS ROMset you will need (83 or 84) is included in each description.

Kaycomp II - This board is found in the very early Kaycomps and Kaypros. It has one serial RS232 connector, one Centronics parallel connector, and one keyboard connector on the back. The board has sockets (only one is installed) for two 2716 ROMs, and a CTC chip. The floppy controller chip is probably a 1791. This board also has a hardware scroll register (not used by the software), that may cause the later versions of Uniform to confuse the screen. Use KayPLUS-83.

Kaypro II - This is the most common of the '83 series boards. It has the same connectors as the Kaycomp, but the board can only address one 2716 ROM, and has no provision for side select for double-sided disk drives. The ROM is generally labeled 81-149. This board is only found in Kaypro II's. Use KayPLUS-83.

Kaypro 4 ('83) - This board is identical to the Kaypro II, except that it has two jumpers, J1 and J2, labeled on the board next to U47. These allow either a 2732 or a 2716 ROM to be installed. This board is fully capable of running double-sided disk drives. The ROM is generally labeled 81-232 and the board labeled PC81-240A. This board may be found in Kaypro II's and 4's. Use KayPLUS-83.

Kaypro 10 ('83) - Labelled PC81-180B, with ROM 81-302. The Kaypro 10 board has two serial RS232 connectors, one Centronics parallel connector, one 6 contact light pen, and one keyboard connector. The light pen and keyboard connectors are right next to each other. The hard disk interface connector is J9 which is located near the middle of the board. Use KayPLUS-84.

Kaypro Universal Board - This board is the most common of the '84 series computers. It can be used in almost all of the later model 8-bit machines. The board has two RS232, one Centronics parallel, one 6 pin modem, and one keyboard connector. The modem and keyboard connectors are at opposite ends of the board. The board will have spare socket locations at U70 and U74. The board may also be missing almost all of the components near the Centronics connector on the Kaypro 2 models. Hard drives may be connected at J9, which is located between the power and the floppy disk interface connectors, on the edge of the board. J9 -may not be installed. The ROM and character generator sockets are both 28 pin sockets, which can address ROMs as large as 2764's without modification. Larger ROMs may be used by adding jumpers on the board. Use KayPLUS-84.

Kaypro 10 ('84, 1, and Robie) - This board is almost identical to the universal board, except that the modem and keyboard connectors are right next to each other. There will be a spare socket located at U76 on this board. The modem connector will not be connected to anything unless the modem components are installed. Use KayPLUS-84.

Appendix C - KayPLUS HARDWARE MODIFICATIONS

There are three hardware modifications described here:

- Changing the ROM capability from 2716/2732 to 2764 is required for ALL 83 series Kaypros
- Adding the vertical sync jumper is only necessary if you wish to use the "interrupt-driven ROM clock via vertical sync" for ALL 83 series Kaypros
- Drive side-select modification is only required if you wish to change to double-sided drives for Kaycomps and Kaypro IIs. (Kaypro 4 has side-select capability as shipped from the factory.)

***** Notes on Modifications *****

There is often more than one way to accomplish each modification discribed in this manual. We have tried to make each as simple as possible, but you may find that another method is easier, since we have tried to make each mod with a minimum of soldering and trace cutting. Where we have called out a 'cut', this simply means that the circuit is disconnected, and the same result may be obtained by simply pulling a pin out of a socket. The modification diagrams at the end of each section show additional wiring (jumpers) with bold lines.

Installing a 2764 in place of a 2716/2732

This modification is necessary to allow the larger ROM chip to be used on the Kaypro. The modification entails plugging another chip socket (28 pin) into the existing socket (24 pin), with the necessary wiring done on the piggy-back socket so that the ROM may be replaced easily should an upgrade become available. Additional address lines needed for the larger chip are also connected.

Parts and tools required: 28 pin chip socket (.6 inch pin spacing), several inches of 28 or 30 gage wire, small amount of rosen core solder, diagonal cutters, soldering iron, and long nosed pliers.

(1) Remove the existing ROM from socket at U47. If you are using a screwdriver to pry the ROM out, be sure that you have the tip between the chip and the socket, NOT between the board and the socket.

(2) Prepare the new socket by bending out pins 1, 2, 27, and 28. If you have a machine (round) pin socket, trim these pins back so that they are shorter, but still long enough to solder to (about 1/16"). Pin 1 is on the end of the socket marked with a notch, and is generally labeled. See Figure 1.

(3) If you have a Kaycomp or Kaypro II, bend out or trim back pin 23 of the socket and attach a wire about 2" long to this pin (you do NOT have to do this if you have a Kaypro 4). Place a small piece of tape over this pin if necessary to insulate it from the existing socket. This is the A11 address signal.

(4) Solder a short jumper(s) between pins 1, 26, 27, and 28 of the socket. This will give +5v to these pins.

(5) Attach a wire about 3" long to pin 2 of the socket. This will be the A12 address signal.

(6) Plug the socket, with wires attached, into the existing socket. Pin 3 of the piggy-back socket should fit into pin 1 of the existing socket. Four pins, 1, 2, 27, and 28 should hanging out past the end of the existing socket. Check to make sure that they do not short to any other components.

(7) Remove the 74LS373 at U59. Attach a small drop of solder to the wide portion of the leg near the plastic on pin 2 and pin 5 on the 74LS373. If this chip is not socketed, carefully do this to the chip on the computer board.

(8) Attach the wire from pin 2 of the socket to pin 5 of the 74LS373. Attach the wire as near as possible to the plastic, and be careful not to short it to any other pins.

(9) Attach the wire from pin 23 of the socket to pin 2 of the 74LS373. (Not used on the Kaypro 4.)

(10) Reinstall the 74LS373 in its socket. All pins should be firmly installed.

(11) Plug the KayPLUS ROM into the piggy-back socket.

(12) Remove the 74LS138 at U60 from its socket.

(13) Place a small amount of solder on pins 1, 2, and 3 of the 74LS138 if you have a Kaycomp or Kaypro II board (see Fig. 2); pins 1 and 2 only if you have a 4-83 board (Fig. 3)

(14) Bend out pins 1 and 2 on the 74LS138 for the Kaycomp and the Kaypro II; pin 1 only for the 4-83.

(15) Jumper pins 1, 2, and 3 together for the Kaycomp and Kaypro II; only pins 1 and 2 for the Kaypro 4-83.

(16) Plug the 74LS138 back into the socket. Pins 1 and 2 should be out for the Kaycomp and Kaypro II; and pin 1 should be out on the Kaypro 4-83.

You are now ready to try out the installation. If you power up the system, and you get junk characters (patterned or the same)

all over the screen, you should go back and check all of the steps in the installation. If you get RANDOM junk characters, check your 20 MHz crystal to make sure that it has not been damaged while performing the upgrade. As a diagnostic, you may remove the 28 pin socket (you can leave it dangling, but make sure that it doesn't short anything) and plug your original ROM back in. It should operate as it did originally, since none of the circuit has been removed or altered.

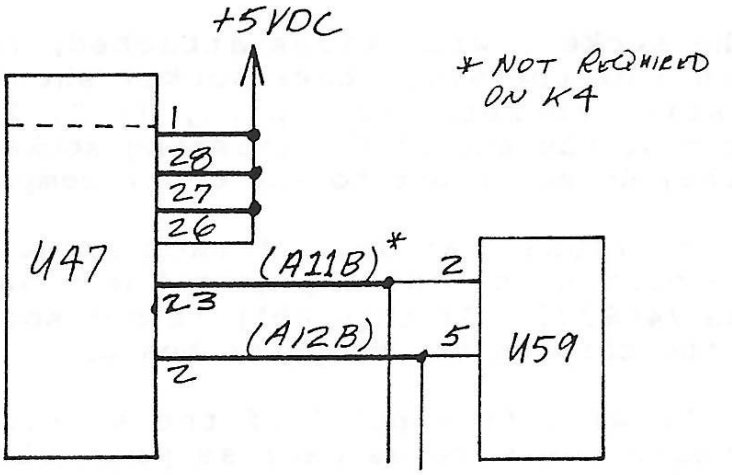

FIG. 1 - Kaypro II & 4 expanded ROM addressing

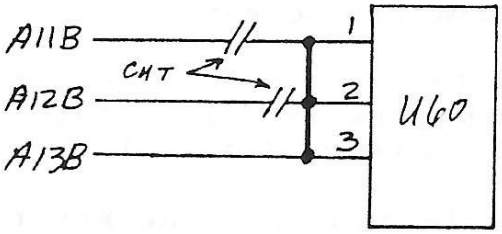

FIG. 2 - Kaypro II ROM select

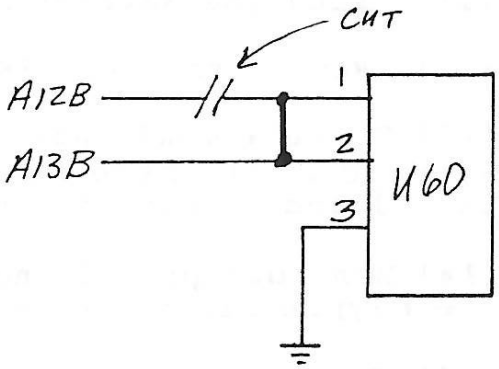

FIG. 3 - Kaypro 4 ROM select

Installing vertical sync jumper

If you wish to use the "interrupt-driven ROM clock" on KayPLUS "via vertical sync", it is necessary to perform this complicated upgrade. Give yourself plenty of time for completion.

Tools and parts required: Soldering iron, rosen core solder, and about 7 inches of small wire (28 or 30 gage is good).

(1) Solder one end of the wire into pad "E4" located near the Centronics parallel connector.

(2) Solder the other end of the wire into pad "E34" located near the power supply connector.

This tedious modification is now complete.

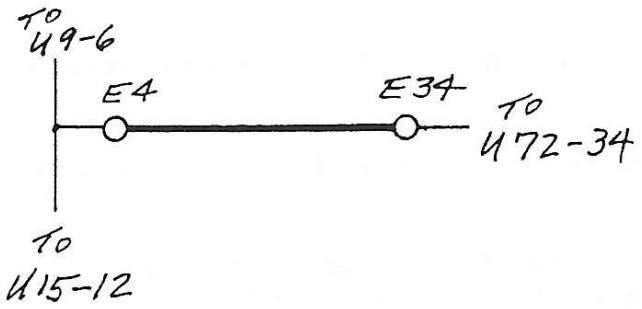

FIG. 4 - Kaypro video sync RTC

Installing side select - Kaycomp II and Kaypro II

The side select modification is very simple if you have a board with sockets. It involves passing a signal from the PIO to an unused gate which passes it on to the 34-pin drive interface connector.

Tools and parts required: Soldering iron, rosen core solder, about 4 inches of small wire (28 or 30 gage is good), long nose pliers, diagonal cutters, and a 74S04 chip.

(1) Remove the 74LS04 at U73. Save it for other projects.

(2) Bend out pins 5 and 6 of your 74S04 (an 'S' part is necessary for its additional current sinking capability, an 'LS' part will often give you random errors).

(3) Attach about an inch of wire to pin 5, and about 3 inches to pin 6.

(4) Plug the chip back into the socket, with pins 5 and 6 out.

(5) Attach the wire from pin 5 to the pad labeled 'E40' on the Kaypro board.

(6) Attach the wire from pin 6 to pin 32 of J6, the drive interface connector. The wire should be attached as near as possible to the base of the pin, to allow normal connections with the disk drive cable.

(7) The modification is complete. The existing cable may be used as it is to connect either single- or double-sided drives.

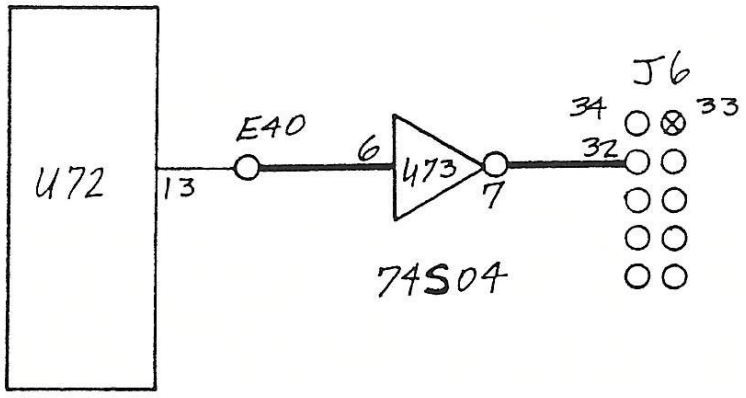

FIG. 5 - Kaypro II side select

Appendix D - OPTIONAL MODIFICATIONS

There are two optional modifications that are useful on the '83 series Kaypros. The first is the 5Mhz. system clock speed-up modification. We recommend that you DO make this modification if your Kaypro II or 4 is still running 2.5 Mhz., since this will DOUBLE your system clock speed. There is nothing else that you can do to equal the performance improvement that you can get with this modification. The speed of your disk I/O may not improve perceptably, but screen operations and actual program execution speed will be noticably faster.

The second modification is the addition of a decoder circuit that will allow you to access two additional disk drives. This is most useful in large database operation, where your database files exceed the limits of your disk size. Although this will give you more space, it is often better to go directly to a hard drive system that will give you faster access as well as the additional space.

5 Mhz. System Clock Speed-up

This modification requires that you replace your Z80 components with faster parts. The KayPLUS rom set is programmed on parts that should be fast enough to maintain 5 Mhz. The system clock will be a true 5 Mhz., with no wait states. Parts required are:

Z80B-CPU (3880-6)
Z80A-PIO (3881-4) two required
Z80A-SIO (3884-4)
rosen core solder
28 or 30 gauge wire

1. Remove U86 (74LS293) from its socket and bend out pins 4 and 5.

2. Replace the 74LS293 in the U86 socket (with pins 4 & 5 out).

3. Jumper pin 5 of the 74LS293 to pin 4 of the U86 socket.

4. Remove U66 (74161) from its socket and bend out pins 3, 4, and 5.

5. Replace the 74161 in the U66 socket (with pins 3, 4, & 5 out).

6. Jumper pin 3 of the 74161 to pin 4 of the U66 socket, and jumper pin 4 of the 74161 to pin 5 of the socket.

7. The clock rate can be made switchable (2.5 to 5) if you desire, by connecting a SPDT switch to pins 4 and 5 of the 74LS293 at U86, with the switch 'common' connected to pin 4

of the U86 socket. Only the clock signal itself needs to be switched.

8. Replace the Z80 chips one at a time with the corresponding faster components.

All of the programs that we have tried (with the exception of the original Kaypro COPY.COM) have run fine at 5 Mhz., although it may not be any fun to play some games at the higher speed.

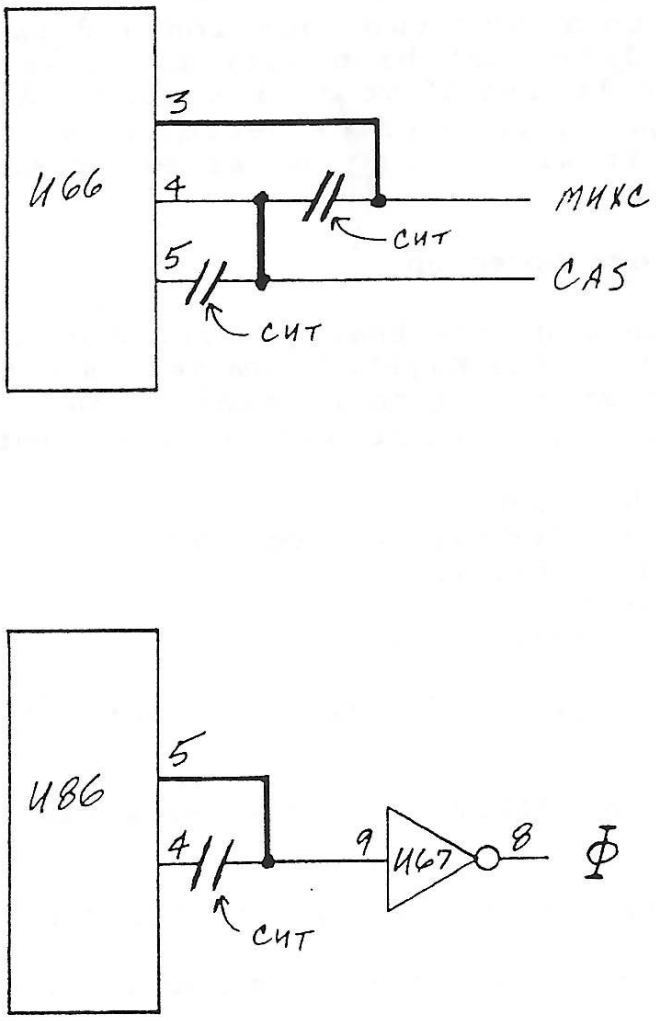

FIG. 6 - 5 Mhz. system clock speed-up

FOUR DRIVE DECODER

This modification is fairly extensive due to the amount of signals that must be added. Do not attempt this mod unless you have more advanced soldering experience. A decoder board is available from Emerald Microware that performs the same function with a minimum of soldering. We also recommend that this modification be done on the bottom of the board.

1. Remove the Kaypro main board from the cabinet. Remove the RF shield (a thin copper plated board mounted below the main board).

2. Remove the solder from the holes in the spare chip location at U75.

3. Install a 16 pin socket in location U75.

4. On the bottom of the board, cut the two traces between two pads next to U75, and pins 10 and 12 of J6, the floppy connector.

5. Jumper the pad that was connected to J6-10, to U75-15.

6. Jumper the pad that was connected to J6-12, to U75-14.

7. Make the following additional jumpers:

    U75-13 to U75-8
    U75-12 to U81-2
    U75-4 to J6-14
    U75-3 to J6-10
    U75-2 to J6-12
    U75-1 to J6-6

8. Install a 7445 in the socket at U75.

This modification allows the 'A' and 'B' signals to be selected exactly as before, with the exception that all of the drive lights will be turned off when the motors time out and turn off. This modification is also required even if only three drives are to be used. The only other modifications required to install additional drives are: adding the additional data connectors to the ribbon cable for the drives, adding the two additional power connectors to the power cable, and drilling the additional holes to mount the new drives. The +5 VDC and ground are already connected to the spare chip location at U75.

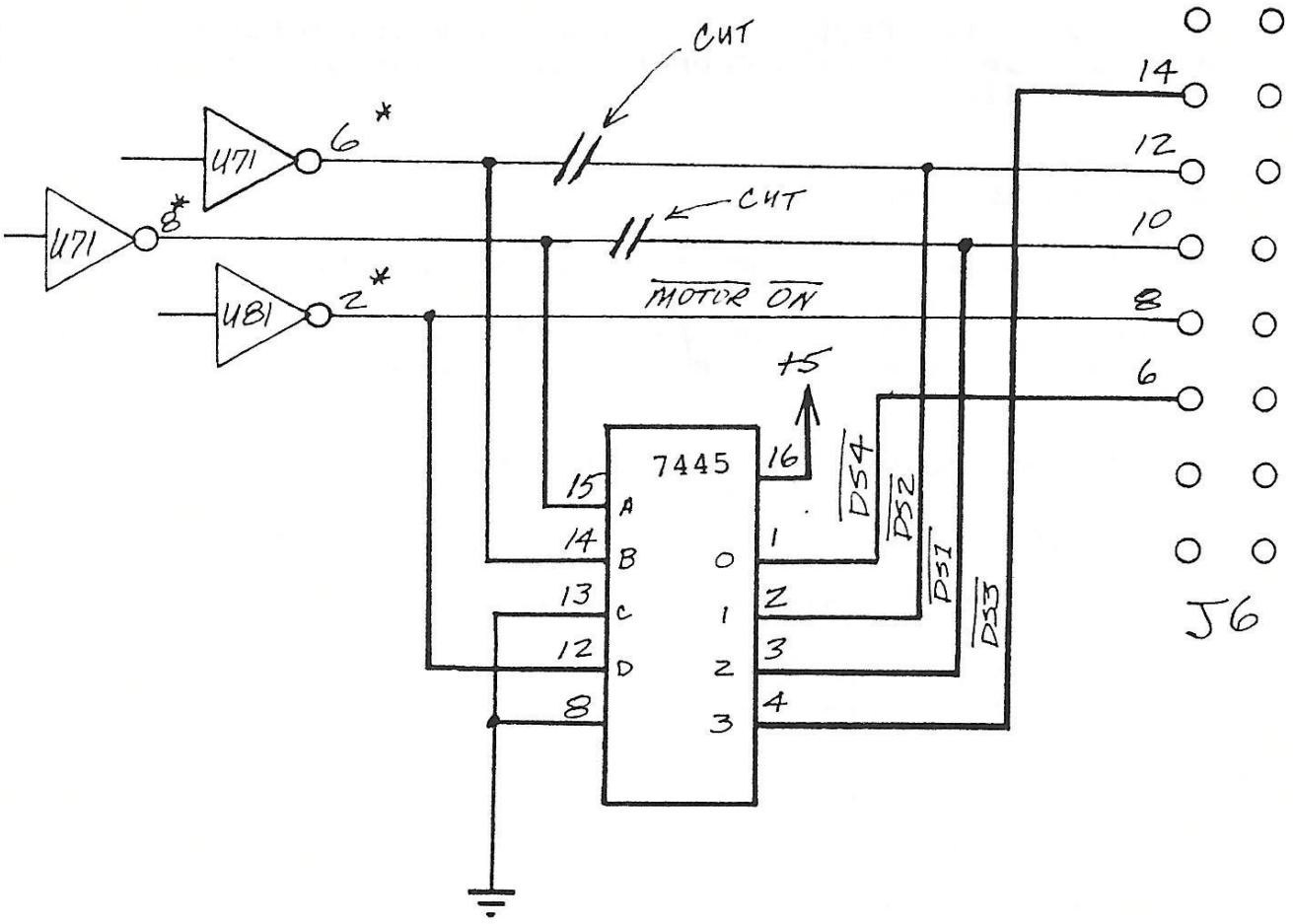

FIG. 7 - Four drive decoder