Intermediate 8

Megahertz Madness

Electrify your Kaypro II with more speed and storage

by Fred L. Ray

If you have an older Kaypro II ('83 series), you may have started to outgrow it. After all, it only stores 191K per drive and runs at a snail-like 2.5 megahertz. Maybe you've looked at a Kaypro 10 or 16 but just can't justify the price. Take heart; kits are available that allow you to convert your old II (or IV) into a machine that runs faster than the newer CP/M machines. Other upgrade kits let your improved machine store up to 784K per drive—more than any of Kaypro's current machines, except those with hard disks. Nor are you limited to two drives; you can run up to four floppy drives for even more storage.

So how much trouble and expense is all this, and how will it affect the day-to-day operation of your computer? If you have a Kaypro II, the cost to double your computer's speed and add two quad-density drives will probably be about $300 to $500. Most of the bundled software will still be usable (the only exceptions are the copy and format programs), and the machine will really fly on spreadsheets and spelling checkers. It's great to be able to have drive A contain NewWord (or WordStar) *plus* a spelling checker and a heap of utilities.

This article covers two kinds of kits—speed-up kits that increase the computing speed to four or five megahertz, and drive upgrade kits that allow you to install double-sided drives, either double- or quad-density. Obviously you get the most benefit by installing both kits together, although either type of kit can be used independently of the other.

Most of these kits can be installed by people with minimal skills. You need to know how to follow directions and, in some cases, how to solder, but you don't need to know anything about how the computer works. As you'd expect, some kits are easier to install than others, and there is a wide range of prices.

On which Kaypro models can you use these kits? Generally, the older the Kaypro II you have, the better off you are, since earlier models had all the IC chips socketed rather than soldered into the main board, making them considerably easier to modify. (If you need help with some of the terms used here, refer to "Beginner's Luck" in the November 1985 *PROFILES*.) In 1984 Kaypro changed the main board to one based on the Kaypro 10 and increased the operating speed to 4 MHz. These later machines are usually referred to as 4'84s (or '84 series) and can be identified by the two serial ports on the rear. This article will cover '83 series Kaypros only, although drive upgrade kits are available from the same vendors for newer Kaypros.

In order to assess the difficulty of installing these kits, you first need to find out what kind of main board is in your Kaypro. To do this, just remove the cover and look (*be sure the power is off first*). Merely looking at the machine's serial numbers won't tell you much, because if it has ever had warranty service, the main board may have been swapped. Are all the chips, including the smaller ones, installed in sockets? If so, you have an early board that will take the "plug-in" kits. If the smaller ICs are soldered in, you have a later board, and it will take some cutting and soldering to install most of the kits.

Now plug the computer back in, turn it on, and look at the message on the screen (*don't touch anything inside*). If it says "Kaypro II" you have a "II" board, and if it says "Kaypro" you probably have a "IV" board. Another, less easy check is to take the board out and look at the number silkscreened on the front left corner. If it says "PC81-240," it's a IV board.

Speed-up kits: a selection

Since the Kaypro already has the circuitry built in to run at twice its normal speed (5 MHz vs. 2.5 MHz), this modification is relatively simple. At 5 MHz the computer will process information *in the computer's RAM* twice as fast as at 2.5 MHz. Thus operations that require a lot of math, or other memory-intensive operations, will be done in half the time. Operations that require a lot of disk accesses, such as the normal operation of WordStar, will run faster, but not twice as fast, since the time required for the disk drive to search for and transfer information is not affected by install-

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ing a speed-up kit.

Speed-up kits can be divided into two categories: those that directly modify your existing main board, and kits that replace the CPU and some associated chips with a small board installed on top of the main board.

Although the circuitry on the main board is easily changed to increase operating speed, some of the chips may not be able to handle the faster speed, especially when they get warm. If so, you may have to replace the memory chips and some of the communications chips (mainly the Z-80 SIO that talks to the keyboard) with faster ones. Replacing the chips is simple to do, but it does add about $20 or $30 to the cost of the conversion. About 80 percent of Kaypros will run at the faster speed with no problems. Mine did not, and it began to "lock up" when it got warm. Installing the new SIO and memory chips cured the problem. Some software (copy and format programs are sensitive to timing changes) won't run at 5 MHz, so these kits usually include a small toggle switch to slow down the system while you run these programs.

At 5 MHz the computer will process information in its RAM twice as fast as at 2.5 MHz.

(*Editors' note: Kaypro Corporation cannot recommend, nor does it support, any permanent modifications to the main board to increase operating speed. Neither can it supply any help should such modifications result in impaired operation of your computer.*)

The add-on board is a more convenient method, both in installation and use, than altering the existing circuitry. Add-on boards automatically slow down enough to "talk" to the slower chips such as the SIO or memory. They eliminate software compatibility problems by providing their own programs for disk formatting and system configuration. Installation is very simple on a socketed board and there's usually no need to change any other chips. But you pay for the convenience; most of these kits are in the $100 range and introduce "wait states" into the system.

The wait states (actually pauses inserted at critical points) are used to slow the system down so it can talk to slower components (such as the keyboard SIO). The presence of these wait states slows the overall "real" speed of operation to about 4 MHz or slightly less. A potential disadvantage of add-on boards is that if you plan to add any other boards, such as a video board, hard disk, or co-processor, you may have physical interference or interfacing problems.

Micro Cornucopia. Micro Cornucopia ("Micro-C") doesn't offer a kit per se, but a set of instructions expanded from an article in the June 1983 issue of *Micro Cornucopia* magazine. You buy the parts yourself and go to work. Installation involves replacing several chips with later and faster ones, cutting through a trace on the main board, and soldering in some jumper wires and installing a speed selector switch. The attractive thing about this route is the low cost ($35 to $50 for chips, switches, and all).

The only stumbling block is the documentation: It appears to be aimed at experienced, hardware oriented users and is not adequate for the novice—something all Micro-C products seem to have in common. If you're comfortable with electronic kits and already know something about Kaypros, you can save money this way. Otherwise, I'd advise trying one of the prepackaged kits. It took several false starts and some long-distance phone calls to get this one operating.

Highland Microkit. Dan Carl's finely crafted kits were easy to install and worked exactly as advertised. Highland is a garage operation in the grand tradition of microcomputing (some of the biggies, like Apple, started that way). Carl's kits are designed to plug in when possible to keep soldering to a minimum. The instructions are easy to follow, and Carl will be glad to talk to you about it on the phone, although he doesn't have a toll-free number and he's sometimes hard to catch. Highland's kit—complete with chips, switches, etc.—is $59.95. Carl recommends that you use a faster ROM with his speed-up kit (he recommends Micro-C's), which would increase the total cost by about $35 to $40. Thus, if you added the Micro-C ROM and had to change the SIO and memory chips, the cost of the kit would top $100. Installation on a socketed main board takes about an hour and requires no soldering. Since everything plugs in, it's simple to convert back to stock configuration.

Legacy. The Legacy kit is an add-on board that simply plugs into the main board after you remove the Z-80 CPU chip and one other chip. If you don't have a socketed board, you'll have to desolder a chip and add a socket, which requires some soldering. Legacy's directions are first rate and easy to follow, and this was one of the simplest of the tested kits to install. At $118 it was also the most expensive. But if ease of installation and plug-in compatibility are your primary concerns, this kit merits serious consideration.

Advent Products. The Advent TurboBoard ($74.95) is another plug-in speed-up board that is popular with Kaypro owners. To install the Advent TurboBoard you must shift your Z-80 CPU to Advent's board and disable pin 8 of chip U67. The Advent board then plugs into the CPU socket of your main board. If your main board is fully socketed, it's a simple matter to remove U67 and bend pin 8 up so that it will no longer make contact when the chip is replaced. On a soldered main board Advent's manual recommends desoldering the chip and installing a socket. Most users simply cut pin 8 with a small pair of wire cutters.

Installation instructions for the Advent board include photographs to help you identify components on your main board and on Advent's board. Ease of installation and product quality is equivalent to the Legacy kit. A more complete review of this board appeared in "Reviewing the Advent TurboBoard" by David Schall in the December '84/January '85 issue of *PROFILES*.

Install new drives for more storage

Kaypro II disk drives write to only one side of the disk and limit your storage to 191K per disk. A quick way to double drive capacity to 392K is to install double-sided drives like the ones used on a Kaypro IV. You can double disk capacity again by going from standard 48 tpi (tracks per inch) drives to quad-density (96 tpi) drives, which increase storage to almost 800K. (For a more detailed discussion of tracks, sectors, etc., see Ted Silveira's "DU to the Rescue," September 1985, *PROFILES*).

If quad-density is better, why doesn't everybody use it? One reason is that since the tracks are only half as wide as on a double-density disk, the drive alignment and the quality of the diskettes are much more critical. A second, more practical reason is that a machine with double-density drives cannot read quad-density disks, which limits information interchange and complicates software distribution.

One solution to the second problem is to use a quad-density drive as drive A to hold the word processor, spelling checker and utilities, and then use a double-density drive in B to hold data. My own solution was to use three drives—a quad-density as A, a double-density as B, and another quad-density as C. This way I can read or write to any format. If you have an early II with full height-drives and convert it to half-heights (recommended), you have room for four drives.

Kaypro's power supply will run either two full-height "full-power" or four half-height "half-power" drives. I used two half-height half-power Mitsubishi 4853 quad-density drives and a 2/3 height "full-power" Canon double-density drive. I bought the Canon as surplus for less than $50 and was able to get the quad-density drives for less than $100 each. If you shop around you may still be able to find new quad-density drives for about $100 each.

If quad-density is better, why doesn't everyone use it?

You should have already figured out which main board your Kaypro has; now you need to know what's needed to upgrade to larger capacity drives. If you have a Kaypro II board, you must add a "side-select" circuit and change the ROM (the Kaypro II ROM doesn't know about double-sided drives) before you can install the new drives. If your machine has a Kaypro IV board, the side-select circuit is already there and only the ROM and the drives need to be changed. The ROM chip contains the information on what kind of drives the computer will expect (i.e., double- or single-sided, and double or quad-density), so you must select a ROM that will handle the drives you plan to use.

Micro Cornucopia. The Micro-C kit is a frustrating blend of product excellence and instructional brevity, although it is very reasonably priced at $49.95. Their ROM is one of the best I tested. It runs flawlessly at 5 MHz, handles double- or quad-density drives in any combination, and has a screen dump, a choice of cursor shapes, and the ability to set the drives' step rates. It comes with a disk full of formatters and utilities and runs ZCPR1 (in ROM) and CPM 2.2E with no problems. Add Micro-C's plug-in decoder board ($39.95) and you can run up to four double- or quad-density drives. It will also read and format disks for single- or double-sided drives, either double- or quad-density (assuming you've installed quad-density drives) and determine the disk format automatically. It also allows you to have up to 96 directory entries instead of 64.

Installing the kit requires soldering some jumper wires for the side-select circuit (on the Kaypro II main board), plus replacing the ROM and one other chip. Instructions are marginal for novice computer users. You get a ten-page "manual" that assumes a good deal of knowledge on the part of the person installing the kit. The folks at Micro-C are very helpful on the phone but they're only available four hours a day and they don't have an 800 (toll-free) number.

Highland Microkit. Highland offers a plug-in side-select board for the Kaypro II owner with the socketed main board. Kits for later (non-socketed) boards require some cutting and soldering but remain within the capabilities of users who know how to solder electronic components. Instructions are adequate and it's pretty hard to get things wrong. Dan Carl does not include a ROM and recommends the Micro-C unit. A Kaypro IV ROM can be used to keep the cost down if you'll be using double-density drives. This kit rates very high in quality of construction (it has gold-plated contacts) and ease of installation. At $29.95 it is an excellent value, although the cost of a ROM chip must be added to the total cost of the kit.

Legacy. Legacy's approach to drive upgrades is quite different from its approach to speed-up boards. Its kit consists of a ROM chip, a spool of fine wire, and instructions. Installation requires cutting several traces on the circuit board and soldering some jumper wires. The instructions are unusually well written and clear, and Legacy has an excellent technical staff available to answer questions. They'll bail you out if you mess it up, or they'll install the kit for you if you prefer. This kind of technical backup must be kept in mind

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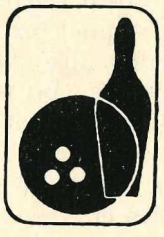

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when evaluating the kit's $118 price.

There are a few disadvantages, though. Legacy has chosen a non-standard disk format, which means that probably no one else will be able to read your disks, and although the Legacy ROM will read standard Kaypro format disks, it won't read anyone else's format (like Micro-C's). Legacy's format does allow up to 128 directory entries, which is handy if you have a lot of small files.

Legacy supplies its own operating system, which is not as flexible as some of the others, although it's certainly adequate. Plu*Perfect Systems' CPM 2.2E can be patched to work with the Legacy ROM,although it increases the expense by $40 or so.

Advent TurboROM. The Advent TurboROM will automatically recognize, read and write to Micro-C format disks and several others, including Kaypro single- and double-sided formats. The TurboROM is designed to run either with a modified version of CP/M 2.2E (the software is included to modify 2.2E if you already have it) or with ZCPR1, which, along with a couple of very useful utilities, comes with it. Advent's disk format permits an astonishing 256 directory entries.

The instructions are slanted towards experienced users, but less so than Micro-C instructions, and Advent's technical support is first rate. Installation requires some simple soldering (unless you use Advent's decoder board) and chip changes. The TurboROM costs $79.95, and Advent's decoder board ($39.95) is required if you want to run quad-density drives and recommended for double-sided drives on the Kaypro II main board. (Advent's decoder board provides its own side-select circuitry, so no jumpers need to be soldered to your board.) With the decoder board the Advent TurboROM supports up to four drives in any combination.

The TurboROM forms an excellent base for future expansion, since it will support Advent's real-time clock, their hard-disk upgrades, and Advent's RAM disk. The TurboROM quickly became my personal favorite, and in my opinion it's the best value for the money.

The choice of kits is up to you. The scariest part is taking off the cover for the first time. But if you're looking for a quick way to make your old Kaypro II bigger, faster, and better, this is the way. *(See related material on next page.)*

Freelance author and photographer Fred "Slim" Ray lives in the mountains of western North Carolina, where he runs a photo service. He is a frequent contributor to outdoor magazines, a contributing editor for Canoe *magazine, and co-author of the book* River Rescue.

Getting Help

One thing I've deliberately skipped over in this article is saying *who* can install a kit. There isn't any definite answer. I started this evaluation with little knowledge other than how to solder. Getting some of these kits operational was frustrating and required a lot of time on the phone. Each kit, and much of the hardware, has its own idiosyncrasies, and none of the kit suppliers can tell you exactly what will work with what, although each kit has its strong points.

For instance, when using the Mitsubishi quad drives with the Micro-C ROM, the "cookie" in the floppy disk housing must be carefully centered or it won't boot or read. With the Advent TurboROM you must put the disk in after turning on the computer but before the drives come on . . . and so on.

There are several ways to get around this. One is *the friend who knows what he's doing*. Approach this one with caution unless you've seen some of his work and are qualified to judge.

Another is *the friendly dealer*. Be aware, however, that many dealers would rather sell you a new machine, and a lot of them won't know much more about upgrades than you do. Kaypro gives most dealers a simple set of diagnostics and tells them to change a board if it fails. It's up to each dealer to determine how knowledgeable his employees are and how much technical support he is willing to deliver.

The major exceptions are the vendors who make the kits. Most of them will make every reasonable effort to bail you out if you run into trouble. Most are a bit optimistic in their claims about how long installation will take, so don't get into upgrading your Kaypro the week before an important deadline.

Probably the best source of help is *the users' group*, provided you can find one that is hardware oriented. A strong KUG can provide the kind of technical assistance that makes learning to modify your Kaypro a rewarding experience.

Space does not permit a complete discussion of where to get parts. Many of the kits come without the drives and other important parts, like cables. My recommendation for finding the best prices is to subscribe to *Computer Shopper*, ($15/year, P.O. Box F, Titusville, FL 32781). Quad-density drives, for example, are frequently advertised in it for under $100. I bought an excellent surplus DSDD Canon drive for under $50. As the computer market goes increasingly to MS-DOS, older equipment is being dumped on the market at very

(continued on next page)

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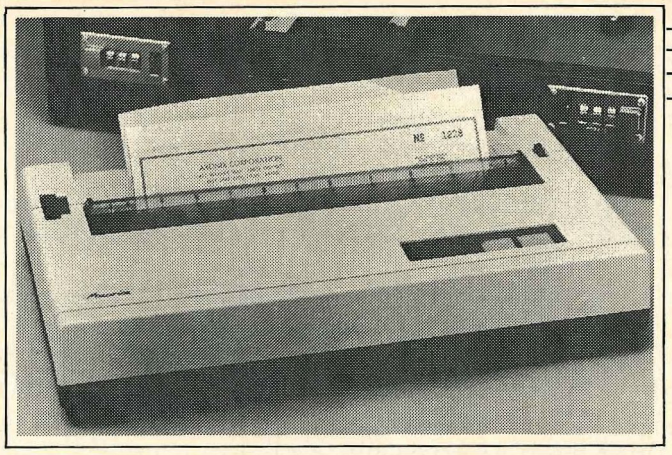

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Plano, TX 75074
(Good source for new or used drives and other hardware)

Quick Reference Summary

Manufacturer: Micro Cornucopia
P.O. Box 223
Bend, OR 97709
Phone: (503) 382-5060
Prices: Pro 8 Package $49.95; decoder board $39.95

Manufacturer: Highland Microkit
P.O. Box 21B
Highland, MD 20777
Phone: (301) 854-0115
Prices: Super Speed Up $59.95; disk drive upgrade $29.95

Manufacturer: Legacy Computer Systems
P.O. Box 2599
Monterey, CA 93942-2599
Phone: (408) 373-6191
Prices: CPU Hop Up kit $118; disk drive upgrade $118

Manufacturer: Advent Products
3154-F E. La Palma Ave.
Anaheim, CA 92806
Phone: (800) 821-8778, in CA (800) 521-7182
Prices: TurboROM $79.95; decoder board $39.95; TurboBoard $74.95