

ADDITIONAL/REPLACEMENT HARD DISKS
for
CP/M Kaypros with TurboROM

The Advent TurboROM allows any CP/M Kaypro (except Robie) to use up to two Hard Disks of up to 56 Mb (formatted) each. Adding a hard disk is not difficult and does not require a great deal of technical knowledge. It does require care and reasonable manual dexterity. Some situations require the use of tools other than simple screw drivers and these will be outlined later.

The components required to interface a hard disk are as follows:

- a) Host Adaptor or Clock. This special circuit board plugs into the Z-80 socket on the main circuit board and provides a 40 pin connector to which a Western Digital WD-1002-HDD (or -05) hard disk controller can be connected. A Kaypro 10 has the interface for the WD-1002-HDD built-in and the host adaptor is not needed unless an Advent RAM disk is also being used.
- b) A hard disk controller. The only controllers supported by the TurboROM is the WD-1002-HDD (and the WD-1002-05 which is the same controller with a floppy controller also on the board). A Kaypro 10 already has this controller mounted on the side of the floppy disk housing.
- c) Hard Disk(s). Any drive which supports the Seagate 506 interface can be used. (In fact some drives with Seagate 412 interface can be used but you should know what you are doing before you embark on this.)
- d) Power Cables. The Hard disk controller requires 5 volts at about 1.4 amps. The Hard disk requires 5 volts and 12 volts, the actual power required depends on the drive chosen. The standard method of providing power for an internal installation is to use 'Y' cables which are plugged into an existing disk power outlet and provide one additional outlet.
- e) Signal cables. The WD Controller is connected to the host adapter via a 40 conductor cable with a socket on each end (it may have up to two additional sockets for RAM disks). It is recommended that this cable be limited to 3 feet or less. Each hard disk is connected to the controller via a 20 conductor radial cable. The controller has a plug for each radial cable. All hard disks are connected to a main daisy chained 34 conductor select cable. Both the radial and select cables can, if correctly terminated, be extended for a considerable distance (up to 15 feet) without any problem.

RECOMMENDED HARD DRIVES

Many drives will work. However, if you are purchasing a new drive you should look for the following features.

- a) Low Power. This is particularly important if you are considering mounting the drive internally. A Kaypro 10 can usually support up to two half high drives or one modern full high drive. Some older full high drives are beyond the capabilities of the power supply (and cooling fan).

b) Quiet operation.

c) The number of heads is preferably 2, 4, or 8 rather than 3, 5, 6, or 7. This improves performance. Other things being equal, a 20 Mb drive of 8 heads and 306 cylinders will perform better than a 20 MB drive of 4 heads and 612 cylinders. However, for characteristic (a) above the Seagate ST225 is still a desirable drive as half high 8 head drives are rare or non-existent.

Plu*Perfect Systems supplies the following drive types:

1) Rodime RQ252. This is an 11 Mb half height drive. Actually it is a 3.5 inch drive that has been mounted in a 5.25 inch frame and incorporates liberal shock mounting. It is also low power, quiet and reliable.

2) Seagate ST225. This is a 22 Mb half height drive. It is also low power, quiet and reliable. It does not have special shock mounting but does have specifications similar to the Rodime (40G non-operational and 10G operational). This drive is excellent for adding (or replacing) a Kaypro 10 drive, external mounting on any machine and for a Kaypro II/4 that is NOT portable it can be mounted internally.

Many other drives have been used successfully, including Ampex, big Rodime, Atasi, Shugart SA604, SA712 etc, though most of these have been in external enclosures. In some cases it has been necessary to replace the Kaypro power supply when drives are internally mounted.

We specifically do not recommend MicroScience drives. These will work with the 84 TurboROMs (which supports both 512 and 1024 byte per sector formats) but will have less capacity than other similar drives. These drives cannot be reliably formatted to 1024 byte sectors and are thus not supported by the 83 Roms (which only supports a 1024 bytes/sector format).

CONNECTING THE DRIVE

Hard drives are similar to floppy drives in that they have to be configured for the application. The two options the user must set are:

a) Terminating Resistor - only one of the two drives can have a resistor installed. You should consult the drive manual for the location of this option. If you are adding a drive to a Kaypro 10 the present drive will already have a resistor pack installed. All drives purchased from Plu*Perfect Systems have the terminating resistors installed, these must be removed if the drive is to be used in multiple drive system.

Note that the drive manufacturers all recommend that the drive with the termination resistor should be that which is electrically most distant from the controller. With internal mounting in a Kaypro this is not a problem, but if long cables are being used from the drive to the controller this must be done correctly.

b) Drive Select Jumper - each drive must be set to select at a different address. On the TurboROM, the drives must be configured as either drive 1 or 2. (Note that drive manufacturers are not consistent about how they number their select options. Some use DS0, DS1, DS2, and DS3, and others DS1, DS2, DS3, and DS4 -- our terminology refers to 0, 1, 2, and 3.) All drives purchased from Plu*Perfect Systems with a Hard Disk

Controller are formatted using that controller before being shipped, so they are set up correctly for use in a single drive system. The Rodime drives which are purchased without a controller are shipped with DSO selected and must be changed before use. The Seagate drive without a controller has all 4 select jumpers installed, 3 of these must be removed before use (see manual excerpts included with the drive).

Note that MicroScience drives used in many Kaypro 10's use a DIP switch for both select and termination. However, there are two variants and you should have reliable data before modifying the switch settings.

c) Power Connection - Hard disk drives require both 5 and 12 volts. This is connected via a 3 or 4 wire cable which has a white nylon plug. This plug is keyed so it cannot be inserted incorrectly into the drive. Where the power is being derived from the Kaypro we usually use 'Y' connectors to expand the number of available outlets. Be especially careful on a Kaypro 10 because the power connector to the hard disk controller only provides 5 volts and cannot be used as a source of power for a drive. (It is useful for RAM disk power however.) On 84 machines, the same wiring harness was used as on the Kaypro 10 and thus there is often this spare 5 volt only connector available which can be used to power your controller.

d) Select Cable - All hard drives are connected in parallel to the controller via a 34 conductor cable. On the drive end the card edge (connector) is usually slotted near the end nearest pin 1. You generally will need to examine the legend silk screened on the circuit board to determine which side has the odd numbered pins. Pin 1 on the cable is usually marked with some identifying mark and is on the edge with the cable stripe. At the controller end pin one of the 34 pin plug is clearly marked with either a '1' or '^'.

e) Radial Cable - Each hard drive is connected to the controller via its own 20 conductor radial cable. The pin and cable markings are the same as outlined above for the select cable. Physical drive 1 (DS1) should connect to J2 of the controller and physical drive 2 (DS2) should connect to J3 of the controller. On modern versions of the WD 1002 this is no problem. On older revisions there is often a problem (on some boards the plugs were J1 J2 J3 and on others J3 J2 J1) with physically getting the radial cable connector over plug J3. Western Digital had a layout error which had placed plug J3 too close to the power connector. To resolve this requires some patience and care. We have found that a stiff backed razor blade (be very careful) can be used to remove much of the power connector plastic housing, then gently use a file to remove as much of the material from the connector on the radial cable without destroying its mechanical integrity.

MOUNTING THE DRIVE

A. Kaypro 10

The Kaypro 10 is in principal the simplest installation. However, if you are adding a second half height drive internally you must completely disassemble the disk drive enclosure/shock mount and drill mounting holes for the second drive. In some cases it may be advisable to drill new holes for the original drive. When jumpering the drive selects you should always make the drive that is slowest to start in position 1 or the TurboROM may not sense its presence.

It is a good idea if adding a second drive, to make some provision for

displaying the "select" light. Some people have simply drilled another hole in the front panel for and appropriate bezel. Others have gone to some trouble to obtain a red/green LED for mounting in the existing hole.

B. Kaypro II/2 and 4 '83

These machines have a disk enclosure which is large enough for 2 full height or 4 half height drives. These machines also have marginal power supplies. If you are adding an internal hard drive you may be faced with replacing the power supply, this is hard to predict in advance due to the great variability in the supplies used by Kaypro. For example, we are currently running a 2 '83 with (2) Mitsubishi 96 tpi floppies, (1) Shugart 48 tpi floppy, (1) Rodime R0252 hard disk, 1 Mb of RAM disk. This is however getting very near the limits of this individual power supply and we will probably replace it in the near future just to be conservative. We have also run an ST 225 hard disk and a standard Tandon floppy drive in another 2 '83 with no signs of power supply distress. On the other hand a 4'83 we converted suffered power supply overload with a single Tandon floppy and Rodime hard disk.

Physically mounting either a Rodime or a Seagate in these machines is simple. We recommend mounting in the bottom position where no holes require drilling and some air flow is available from the bottom slots. Both the Rodime and Seagate use #6 screws for mounting, be careful of using long screws that either bottom out in the Rodime or interfere with the case on the Seagate. Do not permanently mount the drive if you are going to use a blanking plate to fill the panel hole above the drive.

If you are using a half height blanking plate to fill the space above these drives, the recommended mounting procedure is as follows.

1/ With the drive temporarily in position slide the blanking plate into position above it.

2/ The securing latches on the side will prevent it from completely going into position. Use a marker to mark on the inside of the drive housing the position of these latches.

3/ Now dismount all drives and remove the drive enclosure.

4/ Using a small file, notch the front of the enclosure in a position corresponding to these latches. Make the notches deep enough to clear the back of the latches.

5/ Reassemble the drive enclosure.

6/ Mount the hard drive permanently. It is a good idea to connect the cables to the drive at this point when the rest of the enclosure is empty.

7/ Slip the blanking plate into position. It has to be bent gently in the middle so that the side latches can get past the front panel. When the bend is released it will snap securely into position.

8/ Now mount the floppy drive(s).

C Kaypro 2 and 4 '84

These machines have half height floppy drive cutouts and the same power

supply as a Kaypro 10. When mounting a hard drive in these machines the simplest is to replace the bottom floppy drive. However, if you wish to retain two floppy drives some mechanical work is required.

1/ Replacing a floppy.

If you are replacing a floppy with a ST225 then it is slipped in from the front exactly as a floppy drive would be. The RD 252 is more complicated due to the depth of the drive. The Rodime face plate should be removed by undoing the two Allen headed screws. The drive can then be slipped in from the rear (it is a good idea to attach the power and signal cables to the drive before this is done). Now slip the drive forward so that the face plate mounting holes stick out through the front panel. Reattach the face plate and then slip the drive back and secure it in the normal manner.

If you remove the old 'B' drive remember to move the terminating resistor pack up to the A drive. If you are not going to use the Advent Personality decoder it is a good idea to jumper the remaining drive as both DSO and DS1 so that the two drives that appear to be present to the RDM actually can be addressed. This will save some aggravation when using TURBOCOPY, though remember that you really only have one floppy and cannot use the copy option.

2/ Adding a Hard Drive.

You can either cutout the metal part of the panel between the two drives and slip the drive in from the front or blind mount the drive without a face plate behind the front panel. Blind mounting is much more difficult as the space between the floppy drives is very tight.

Do not attempt the metalwork required to cut out the front panel unless you are a reasonably competent craftsman or you will cosmetically scar your Kaypro for life.

1/ Remove both floppy drives.

2/ Carefully remove the sheet metal between the drive holes using a fine hacksaw. Cut on the interior of final opening so that the hole can be trimmed up with a file later.

3/ Now position both floppy drives to the top of the opening and mark the holes needed to mount the bottom floppy drive in this position.

4/ Check that the existing mounting holes in the bottom position are in the appropriate position for mounting the hard drive. If not mark any corrections needed.

5/ Remove the complete drive enclosure to drill the holes. Make them slightly oversize so that fine adjustment of drive position is possible.

6/ Reassemble the enclosure and now mount the hard drive in the bottom position. As above it is a good idea to connect its cables before mounting the floppy drives.

7/ Now mount the floppy drives. Beware of some brands of drive that can interfere with adjacent drive when the locking handle is in some positions. Double check that there is no interference between the any of the drives.