

Core's Hard Disks: WORKHORSES of Performance Computing

Core International's big, fast, tough add-in mass-storage systems for the AT use proven technology to gain speed, quadruple capacity, and avoid the problems said to plague the AT's factory-issue hard disks.

Running a floppy disk-based AT system makes about as much sense to me as betting on a three-legged horse to come in first in the Preakness. The AT comes into its own only in performance computing—where results are more important than mere dollars—and where a floppy disk would seem to be a hindrance.

It comes as a surprise, then, to find that nearly half of the AT sales so far have been for floppy-only systems. The smart money, according to some experts, was being spent on the cheaper machines for two very good reasons: First, the initial short supply of enhanced ATs created waiting lists that stretched months beyond the horizon. Second, horror stories about hard disk malfunctions—whether true or not—frightened off even the most loyal fans of the boys from Boca Raton.

But even without these reasons, purchasing an AT sans Winchester can be an astute strategy if you buy one of the AT-plus series of add-in hard disk drives from Core International. Core promises a big, fast, tough mass-storage system without

the problems often attributed to the AT's factory-issue hard disks. Moreover, these Core drives can also expand an enhanced AT's native hard disk endowment, doubling or nearly quadrupling its straight-from-the-factory storage capacity.

The two Core drives I reviewed represent opposite ends of the ATplus product spectrum. The plus20 is as close to a direct replacement for IBM's own hard disk choice as you can get. The plus72 is Core's flagship unit, stuffing about three and a half times the megabytes of an ordinary AT hard disk into a package of the same physical size.

When tested, the drives matched most of their maker's claims. Both proved easy to install and operated perfectly. In fact, the biggest flaw was the optimism reflected in plus72's name—the number refers to unformatted disk capacity. Formatted, it stores only 66,879,488 bytes (split between two partitions). The plus20 is more appropriately named: it holds a total of 21,309,440 formatted bytes.

Adding a Winchester to an AT is not as simple as doing so for an older PC, into

ATplus HARD DISKS

which you can plug nearly any disk that spins. Getting the high performance that everyone—including IBM—expects from the AT requires a very high-performance hard disk. In fact, one of the principal rea-

sons why IBM chose Computer Memories, Inc. as a supplier for its AT line was that the new design of its drives offered low price combined with high speed, which could help make the AT both a price

and performance leader.

CMI's innovative mechanical engineering cut the average access time (how long it takes the read/write heads that fly over the hard disk to move between random tracks, settle down, and start reading) to under 40 milliseconds. Compared to the PC-XT's hard disk, whose average access time is about 110 milliseconds, that's blazing performance, indeed. Few low priced hard disks can even sort between tracks within 70 milliseconds (the XT takes over 100); hence the average bargain-basement hard disk impedes the performance the AT is capable of.

Unfortunately, the novel technology of the CMI drives is thought by some to be one of the AT's hard disk weaknesses. The Core drives avoid innovation, using proven technology so as to eliminate every possibility of a problem. That design objective is achieved with some impressive, heavy duty hardware.

The Core of the Matter

Sturdier hard disk drives than the AT pluses are difficult to imagine. Both Core units tested are massive, full-height drive solidly built by Control Data Corporation. The shells that cover the disk platters themselves are heavy aluminum casting; differing from one another only in that the plus72 forms a solid rectangle, while the plus20 is a half-circle with a few radial heat-sinking fins. Both are finished in natural aluminum.

Unlike the AT's standard CMI drive, most of the electronic circuitry in the AT plus units is physically protected. The primary electronics of the ATplus drives are tucked on the bottom. A heavy stamped and perforated steel cage covers the board and prevents just about any foreseeable damage to their components. Though the

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plus20 sports the unprotected bottom of a printed circuit board on its front face (much like the CMI does), no electronics show on the plus72. Not even the drive motors are visible. Manhandle either AT-

plus drive almost any way you want during installation, and it shouldn't be any worse for the wear.

The disadvantage of this sort of construction is that covering up all the compo-

nents makes them hard to get at when servicing. On the other hand, covering up the works generally prevents the accumulation of dirt that might make such service necessary. The point is probably moot, because most hard disk servicing consists of directly replacing the whole drive and leaving digging into the actual innards to the factory folk.

The ATplus drives differ from most by using rotary voice-coil head positioning—a proven Winchester mechanism most of ten found on high-performance 8-inch units. The primary advantage that voice coil positioners have over the more com-

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Manhandle either of the two ATplus add-in hard disk drives almost any way you want during installation, and it shouldn't be any worse for the wear.

mon band-stepper mechanisms, such as those found in PCs, is speed. Voice-coil positioners are what makes the performance of the ATplus drives so brisk.

An additional benefit from voice-coil technology is relative freedom from head crashes. While the drive is in operation the voice coil is constantly kept in an energized state so that it pulls the head into the correct position above the disk, always against the tension of a spring. If perchance the power should fail, the spring automatically and almost instantaneously retracts the head away from the area of the disk used for data storage, so that no harm is done once it touches down. Moreover the head is locked into its retracted position so that an inadvertent bump when your computer is off won't send it skating across the disk surface, plowing a furrow in your files.

The plus20 sports one additional disk protection feature not present in either the plus72 or the standard AT-issue CM drive—a manual head lock on its back. Pulling out a small metal arm mechanically locks the read/write heads in place so that absolutely no damage will befall them or the disk surface during shipping.

ATplus HARD DISKS

Unfortunately, once the drive is installed, the lever is hidden inside your AT, where it is difficult to reach. Digging into your computer to lock the heads is not worth the effort unless you decide to ship

your AT across the country by stagecoach. When the test unit arrived, this slide was not in the locked position. If Core doesn't think much of locking the head, maybe you shouldn't either.

Putting the Core in Its Place

Physically installing the two ATplus hard disks tested entailed essentially the same procedure, made easy by IBM. In designing the AT, IBM evidently recognized the inadequacies of the XT's disk drive mounting scheme (two screws) and developed a system that was sturdier and, in some ways, easier to install.

To install any hard disk drive in an AT, simply pull the top cover off and remove the two small retaining brackets on either side of the drive slot you decide to use. Next, just slide the drive into the open hole in the front of the chassis. A guide rail on

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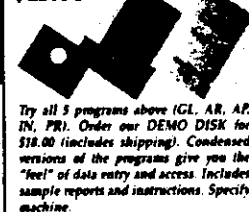
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The AT comes completely equipped with the proper cables and connectors for installing one hard disk drive already stuffed inside.

both sides aligns the drive in the slot and, because of the tight fit, holds the drive securely in place.

Before you slide the drive all the way in, however, you must connect the necessary wiring. One wide ribbon cable carries the data from the drive to your computer, a narrower ribbon cable from the computer conveys the instructions that tell the drive what to do, a connector with four wires supplies the drive with its lifeblood electricity, and a single black wire grounds the drive chassis to your computer.

In theory, all these connections should be straightforward. The AT comes completely equipped with the proper cables and connectors for installing one hard disk already stuffed inside. All you need do is match the proper connector to its mate on the drive. The different sizes and styles of connectors ensure that you can't go far wrong.

The drive control and data connectors are keyed with small plastic tabs inside so that they cannot be inadvertently plugged in backwards. Alas, the tiny key can fall out of the connector and ruin IBM's good intentions. In fact, the key was not present in the control cable of my test AT.

ATplus HARD DISKS

Fortunately, the IBM design follows a simple rule: a slot on the disk drive's edge connector corresponds to the side of the ribbon cable that is edged in color (usually blue). Match the colored edge to the slot, and you'll have it right.

However, what complicates installation is that you have a choice of two data connectors attached to the wide ribbon cable. The one with a section of the ribbon

Although IBM supplies no control cable for a second drive, Core includes one with every hard disk it sells.

cable twisted near the connector is the proper one to use on the C: drive, which is the first hard disk you install. The other data connector is used for the second hard disk in the system.

Although IBM supplies no control cable for a second drive, Core includes one with every hard disk it sells. To add a Core as the second hard disk in your AT system, simply plug one end of this extra cable into the hard disk and the other end into the vacant header—a double row of gold-plated pins—on the disk controller card, then plug the remaining connectors that are loose in the computer into the drive.

The Core plus72 drive that I tested matched with all the IBM cabling perfectly. The plus20 missed perfection by just one connection—it had no matching lug for the black IBM grounding wire. Apparently a brass screw post on the back of the plus20 is supposed to serve as a lug. Since Core didn't supply a screw for this post and I didn't want to cut the wire of the test AT to mate with the provided post, I did not connect the ground wire when I installed the plus20. The system seemed to work properly without it.

As delighted as I am with the AT's improved means of mounting the disk drive, I'm disappointed with the delicate manipulations the design requires you to make to connect these cables. Hooking everything up is an experience akin to installing a car radio: Although you know that everything will look and sound right in the end, you've got to squeeze your hand into very

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tight quarters around some sharp sheet metal edges that will almost inevitably bloody your knuckles during the installation.

Once you make all the connections, you need only push the drive all the way back into its slot and reinstall the two small retaining brackets, ensuring that they press firmly against the drive's guide rails. The drive will then be locked tightly in place, perhaps forever. In the case of the plus72, I was afraid for a while that the hard disk might indeed become a permanent addi-

tion to the test AT. The fit was so tight that I needed a crowbar to pry it out of the computer: It had stuck about halfway out, requiring abnormal persuasion and two pairs of hands to extract it successfully.

Upping the Chip Ante

Once you're past the hurdle of getting the hardware in place, Core plus20 installation follows the same standard IBM operating procedure as if it had been built into the AT at the factory. First you must configure your system for drive type by select-

ing the setup procedure from the diagnostics menu. Answer the question about the hard disk drive type by telling your computer that the Core plus20 is a type 2 drive, identical to the factory-issue CMI unit.

As with the official drive, after setup you must partition the hard disk using the DOS FDISK utility, then format it under DOS 3.0 with the FORMAT utility. If you use the /S option to the FORMAT program, your system will be able to boot from the Core hard disk.

Matters are more difficult with the Core

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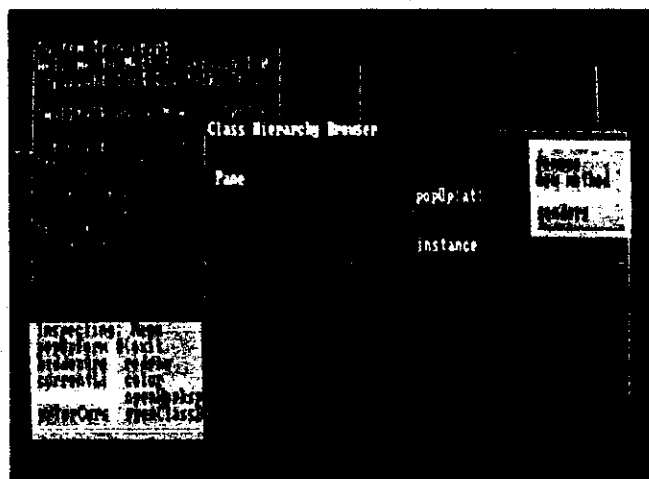
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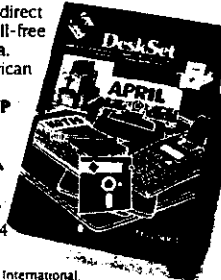
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plus72. After installing the drive hardware, you need to install firmware—ROM chips—so that your system does not reject the transplant. You must remove all the ROMs in your system, which may total two or four, and replace them with Core-supplied chips. The chips you remove contain IBM's cassette BASIC program as well as the BIOS, and this copyrighted code is faithfully duplicated in the Core chips, each of which bears an IBM copyright message in addition to Core's. To my knowledge, IBM has never permitted any other company to duplicate the valuable programming code held inside its ROM chips.

When I called Core and asked about this strange companionship, the technician to whom I spoke would not comment on the relationship between IBM and his company, saying only that IBM was a Core customer and that he therefore could not imagine why the computer giant might be upset about Core's distributing its code.

Unlike IBM, which supplies a special tool with the ROM upgrade kit it sells for the earliest PCs, Core does not supply a chip removal tool with its ROMs. This omission makes removal immensely more difficult. I discovered, however, that a blank slot cover from the back of the AT makes an excellent tool to pry out the chips. Work slowly and gently pry up first one end, then the other, of each chip, lifting it only a fraction of the way at a time.

Installing the chips proved trickier than I had at first anticipated. Being—in theory at least—an old pro at this sort of thing, I knew that ROM chips were delicate creatures that could not tolerate large stabs of static electricity or other mishandling. Consequently I used the utmost care in removing the stock IBM ROMs and replacing them.

My experience in chip matters proved to be my undoing, however. Anyone who has dabbled at integrated circuitry knows that chip sockets are marked to indicate the direction that the chips inserted into them are supposed to face, and I followed these socket markings as I installed the Core chips. When I turned the AT on afterwards, the ROMs acted much like flashbulbs, giving off minute and momentary flashes from the tiny windows underneath their labels. The lack of all other life in the

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44	2,100	6,600	6,600	6,600	6,600
45	2,500	2,500	2,500	2,500	2,500
46	500	2,000	1,000		3,000
47	300	400	500	750	750
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AT confirmed that I had made a very grievous error.

Reconstructing the crime, I discovered that IBM had installed half the ROM chip sockets in this particular AT backwards. Of course, IBM's assembly machines, unable to read socket markings, installed the chips correctly anyway. When I had properly installed a second chip set, the AT sprang to life. However, because I had already set up the system for a type 2 hard disk and another variety was now resident, the AT was at best lackadaisical about booting. In fact, it took several minutes for it to even admit that it had a disk error. Running the setup utility again and indicating the proper drive type—number 9—made booting up quick and painless. (Those who follow Peter Norton's column should know that a type 9 drive usually runs to 112 megabytes—and the Core totals only 72. Here, apparently, is one of Core's modifications to the IBM BIOS.)

Setup does not end the software installation procedure, however. Next you must run through the standard IBM hard disk installation with the FDISK and FORMAT utilities. Using the /S option with FORMAT allows your AT to boot from the plus72.

Following the Core instructions gives you only one option in partitioning the plus72: to set up the Core disk as a single 32-megabyte DOS partition. Accessing the missing megabytes of the big Core disk requires that you install a device driver in your CONFIG.SYS file to make DOS think that you have added a second disk, drive D:, to your system.

Once DOS realizes that there's more to your Core disk than meets the eye, you must set up its partition structure with a Core-supplied program called ATDISK, then format the partition with another program called ATFORMAT. When that is completed, your Core plus72 operates as if it were two separate 32-megabyte hard disks, drives C: and D:.

Premium Performance

Once you have an ATplus disk up and running, you'll see that the extra dollars you spent will reward you with top performance. Cheap hard disks (20-megabyte add-on hard disk drives can cost as little as \$600 or \$700) can't make the grade that

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IBM has set for the AT: that 40 millisecond average access time. It takes a pretty special drive to scamper through your data at that rate.

Core is so proud of its drives that it has bequeathed to the world a program called *DISKp* for checking out drives (available to readers through *PC Magazine's* Interactive Reader Service). As you would expect, both Core drives passed the test with flying colors.

Before I tested the ATplus drives, I first put a normal AT CMI fixed disk through its paces as a control. On the Core random test, it scored an average access time of 37.56 milliseconds, comfortably within IBM's specifications. The Core plus20 virtually duplicated CMI's results, turning in an average access time of 37.89 milliseconds. The Core plus72 was the speed demon of the group, racing through the same test in 25.48 milliseconds, more than 30 percent faster than either its sibling or the CMI.

The *PC Magazine* BASIC read/write tests were startling only because the results showed so little difference. In using records 512 bytes long, the scores for the three drives in the random writing, random reading, and sequential reading tests in seconds were, respectively, CMI: 6.15, 7.09, 4.06; plus20: 6.60, 8.29, 4.17; plus72: 6.48, 6.04, 4.12. Obviously, any of the threesome is so fast that the overhead inherent in compiled BASIC is the ultimate speed-determining factor.

Throughout my testing and trials, both ATplus drives performed smoothly, elegantly, and quietly—without the clangs, rings, burps, and belches I've heard from other voice-coil-based drives. I could hardly hear them purr above the whir of the AT's fan.

Like the standard-issue CMI drive, the ATplus units swing into action instantly and unobtrusively when you call on them. Once you screw the lid back on your AT, they will, in fact, be invisible to you. The sturdiness of their construction means that you can probably put them out of mind as easily as out of sight. You shouldn't have to worry about either one for a long, long time.

Winn L. Rosch is a contributing editor for PC Magazine.

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