

The Apple Of Your IBM

The Quadlink, an Apple-on-a-circuit card that fits snugly into your PC, converting it into an adaptable two-in-one microcomputer that can read software for either machine.

If the PC has any rival, it's the Apple IIe, a machine that's found a happy home in as many places as our favorite box from Boca Raton. Although for sheer computing power, the Apple pales beside the PC, it does have one great virtue: More business and educational software may be available for it than for any other personal computer.

The power edge of the PC makes most

Quadlink

Quadram Corporation
4355 International Blvd.
Norcross, GA 30093
(404) 923-6666

List Price: \$680 (\$695 for Columbia or Compaq, \$45 cables only for Columbia and Compaq).

CIRCLE 716 ON READER SERVICE CARD



worries about software advantages moot, except for a single point: The Apple came first, and many businesses have them already installed and have countless hours and keystrokes invested in its software. Besides, once people have become comfortable using one computer, getting them to switch is about as easy as convincing them a trip to the dentist will be fun. Thousands of businessmen have their fingers welded to Apple keyboards.

If only the PC could run Apple software, the world would be a better place. Your PC would have more than double its present program supply, businessmen could dance their fingers across a more advanced computer and keyboard, and that huge investment in programs and keystrokes now stuck on Apple disks would be fodder for your PC. All you would have

to do is take your favorite Apple program, slide it in your PC's drive slot, and calculate away.

But one major mountain blocks the way to such true bliss: incompatibility. If you do put an Apple disk in your PC, you'll find it as good as no disk at all. The IBM PC cannot read Apple disks, and it cannot run Apple programs.

Genius is hardly required to deduce that what the world needs now is some way of squeezing Apple programs into the PC or vice versa. Of course, the first seems more likely than the second. It's probably much easier to detune a race car to amble around in the daisies than it is to turbocharge a Volkswagen beetle and make it zoom away from traffic lights.

The Quadram Corporation was able to see behind the barriers and has created exactly what the doctor, and anyone who happens to work with both an Apple and an IBM PC ordered: The Quadlink, a compact card that drops into your PC and, with a little help from the software, turns it into an ordinary Apple II.

A Look at the Quadlink

The Quadlink itself bulges with computing power. In fact, it has so much power it has to be spread out on a circuit board slightly larger than a full-sized PC expansion card. Every place extra circuit board real estate could be found, Quadram tacked on more glass-epoxy. The Quadlink board rises a fraction of an inch higher than normal expansion boards, though not enough to interfere with putting the lid on your PC. The card dips down next to the edge connector that actually makes contact with the expansion slot and closely follows the contours of the PC motherboard. It fits as much circuitry as possible on a single, one-layer board.

All the extra area is necessary because the Quadlink is no mere expansion card. It's a complete computer that, once installed, nestles happily inside your PC. On board is a 6502 microprocessor and all the necessary support circuitry, including a full 64K of read/write memory. In

effect, a whole Apple II has been squeezed onto the single card, in roughly half the space the original takes up.

Because the Quadlink sports all the circuitry of a complete Apple computer, it also seems to generate as much heat as a



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complete computer. I noticed that the integrated circuit chips on the Quadlink card that felt the hottest were all mounted in sockets while the cooler chips were soldered down.

Overall, however, workmanship and design of the Quadlink appear to be very good. With that said, note that the first evaluation board that I received from Quadram refused to work with my composite monitor. While talking with an engineer at Quadram about the problem, my eyes wandered over the circuit card, and I noticed that a resistor had not been

properly soldered onto the board. The day after I had called, I received a replacement Quadlink that worked without a hitch.

Installing the Quadlink

Perhaps the most notable aspect of the circuit card is its profusion of connectors. The Quadlink does not slide into an expansion slot; it slithers, spreading out its octopuslike arms to connect to almost every part of your PC. The Quadlink intercepts the output of the PC disk drive controller and sends its own signals to your disk drives. It intercepts your PC's speaker output and sends its own signals to your ears. The Quadlink even comes with a short video cable that connects to the output of your resident video card (monochrome or color graphics), which connects on the outside of your PC.

Making all of these connections correctly proved to be the most troublesome aspect of installing the Quadlink. Quadram rightly advises totally dismembering your PC before putting the ungainly Quadlink in place. Every card should be cleaned out of your PC's expansion slots before you begin installation.

The octopus nature of the Quadlink also dictates which slot it must fill. Since it must attach to the ribbon cable running to your disk drives, it must be as close as possible to the drives. This means the slot adjacent to the drive controller (slot number four, if you count like IBM does).

The first challenge of the installation is weaving the cable that goes to the drives around the other wires that connect to them, and then down onto the floor of the PC cabinet (so that the drive controller card could still be fitted inside the computer). There seemed no way to get the writhing, uncooperative cable to lie flat, short of creasing it several times in the center and folding it over. As it was, even after wallpapering the bottom of my PC with the disfigured cable as well as my tangled fingers could, the wiring still bunched up between the Quadlink and drive controller card (once the latter was installed). This cabling catastrophe meant that neither

board was able to properly fit into its slot.

But the biggest problem I had with these ribbon cables turned out to be a bit of short-sightedness in the design of the Quadlink's umbilicals. The cable to the disk drives is keyed to fit on a card edge connector only one way. This is a wise design that prevents your computer's circuitry from smoking should the connector be installed 180 degrees away from the optimum position, but it meant my disk drive cable had to be installed so that the ribbon cable leads away from the Quadlink card in the wrong direction (away from the disk drives). The result is that the drive cable must be folded over one more time directly under the Quadlink board, which shortens the cable's effective length and adds to the cable build-up in the bottom of the PC.

The drive cable is not the only one to suffer from misdirection. In addition a cable must be run from the Quadlink to the drive control card. The connector on the drive control end of the cable also sends the wire straggling 180 degrees off from the desired direction and requires another fold job. Cable installation for the Quadlink seemed more like origami than electronics.

The next wire I installed was to the speaker. A simple chore; just unplug the speaker from its PC-based connector and reinstall the wire to the connector on the Quadlink card. Then run a wire from the PC connector back to the card. With that done, it's safe to begin stuffing the PC back full of all the goodies that were inside in the first place.

Once you've got everything glued or screwed down, you connect the Quadlink to your PC's RGB or monochrome video output and plug your monitor into the Quadlink card. Total installation time was less than a half hour. (It's easier to do than to explain.) Nonetheless installation is not a process that anyone would like to make a daily routine.

Next step in getting the Quadlink up and running is software installation. Two disks are supplied with the Quadlink: one

in IBM disk format containing the program that boots the Quadlink system, and one in Apple disk format containing all the necessary Apple-compatible software, including Apple's own DOS 3.3.

At this point, the manual and reality are somewhat at variance. According to the manual, merely copying the Quadlink disk onto a normal IBM PC system disk and using the result as a boot disk will start up

Put an Apple disk in
while in the PC
mode, and your
computer will think
that there's nothing
there.

your PC with the Quadlink raring to go. My Quadlink however, was not so eager, probably because Quadram neglected to put an AUTOEXEC.BAT file on the first Quadlink disk I received.

The disk I received with the replacement Quadlink circuit board, however, had the necessary AUTOEXEC.BAT file already in place, ready to roll.

Starting It Up

If you buy a Quadlink and it does not automatically start as advertised, creating such a file should make it work as promised. The necessary file contains exactly one word (Quadlink), and a carriage return. You probably use your word processor to create the file, or you can type in the word "Quadlink" in response to an "A>" prompt, and you will be on your way to the electronic Big Apple.

Once you've run the Quadlink program, it's time to follow the directions on the screen. Remove the Quadlink disk and insert the other disk supplied by Quadram, called the Filer. Press AH-Ctrl-A on your keyboard, and you enter what Quadram calls the "pre-Quadlink" mode. The screen reverses (dark becomes light, and

light, dark), you're advised to press Ctrl-Alt-Del and voila!—your PC has turned into an Apple. To return to the realm of the PC, press Ctrl-Alt-I. You can bounce back and forth as often as you like.

The first thing you'll see in Apple mode is a menu that appears on the screen with a list of the utility programs supplied on the Filer disk. One of the menu choices is the Filer itself, which offers a collection of utilities including Catalog (the Apple version of the disk directory). Others include file copying, deleting, write-protecting and un-write-protecting procedures, disk and DOS copying utilities, and a program for changing the logged disk drive. Typing Esc puts you into Applesoft BASIC, where, if you've been running Apples all your life, you'll feel right at home.

If you've never touched an Apple before because you have bad memories of Eden, Applesoft amounts to a combination of both BASIC and DOS, chopped into fine pieces and stirred together. Confirmed IBM PC users may feel as if they're caught in the twilight zone.

Finding myself in a confusing land where every DOS command I typed led inevitably to a syntax error, I asked my friendly neighborhood Apple expert, Frank Bican (a microbiologist by day and a programmer by night), to drop in and give the Quadlink a spin. We worked together, and in no time at all made mincemeat of half-a-dozen programs.

The Two for One Sale

According to the manual, the Quadlink board turns your PC into a new computer also called the "Quadlink." Actually, the board turns your PC into two computers—a PC and an Apple. The two computers function independently. You can have one program running on one while a completely different program is running on the other. Your two programs won't necessarily run simultaneously, however. What happens depends on the direction in which you shift modes. When you flip from the Apple to the PC, the Apple doesn't stop

dead in its tracks, but it keeps on dashing through whatever program you've stuffed into its memory, unless it requires input/output processing. When you flip from the PC to the Apple, however, the PC program is put on hold; when you flip back, you're at exactly the same spot as before.

Although both the description and process seem confusing, the explanation is not. No matter what the mode, your original PC is used for all input/output processing. This means it handles the disk drives, the keyboard, the printer, and so forth, no matter whether you're in Apple or PC mode. When the Quadlink/Apple takes command, the PC is put to work helping it out. Consequently, the PC must put its own data processing on hold. The Quadlink/Apple, on the other hand, doesn't have anything to do when the IBM is running, so it can continue processing data. The Apple part only jams up with an I/O error if the program that is running on it tries to access a disk, the printer, or the keyboard while you're using that part of the PC. In technical terms, the Quadlink's 6502 microprocessor uses the PC's 8088 for I/O processing.

The separation between computers is both complete and effective. When you are in PC mode, a reset—pressing the infamous Ctrl-Alt-Del—only resets the PC. It does not touch the Apple-cum-Quadlink computer. In Apple mode, the same key combination resets the Apple without affecting the PC. I can't help but salute the engineer who done think that one up.

Even the disk drives shift between modes. In Apple mode, both drives think they're attached to an Apple. In PC mode, they function as IBM drives. Put an Apple disk in while in the PC mode, and your computer will think that there's nothing there.

No matter what you may actually have for your PC, the Quadlink can only handle two disk drives. I have a non-IBM hard disk drive that worked flawlessly when the Quadlink was in the PC mode, but became

invisible during Apple emulation. Similarly, virtual disks and RAM disks work normally in IBM mode but cannot be used by the Apple part of the Quadlink. (Data in virtual drives stays intact when shifting back and forth between modes.)

With the Quadlink running, the division between the two computers inside

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your PC's case is complete. Normally they do not share their thoughts with each other. Except for an intriguing comment in the manual that you can transfer text files between IBM and Apple disks, Quadram gives you no hint about how to make these two independent computers talk to each other. The Apple has no idea of what the PC is doing, and the PC hasn't the foggiest notion of what's going on in slot 4. A quick consultation with Quadram revealed that it is possible to get the two to communicate, but you need the proper software.

Although still undocumented at the time I received my sample Quadlink, the necessary program is included on the Quadlink Filer disk (providing the disk is dated 10-31-83, or thereafter). An earlier date (or none at all) indicates that you do not have this valuable program. Quadram will supply it free for the asking to early-model Quadlink owners.

The program is called *Quadcopy* and can be run either by selecting it from the appropriate menu or by typing Brun Quadcopy at the Applesoft prompt, which is a closing square bracket (]). The program is

self-documenting, which means that if you have a modicum of intelligence, you can probably figure it out.

However, shifting text files around runs afoul of another compatibility problem that has nothing to do with the Quadlink: Word processors use different methods of storing characters. I managed to transfer an IBM *WordStar* text file to an Apple file, but reading it through Applesoft BASIC only revealed gibberish. I was able to transfer an Apple text file to a PC file and read it through *WordStar* without a hitch.

When Frank and I attempted to run *Quadcopy*, we discovered an undocumented feature of the Quadlink. The PC's cursor control pad does not work in Apple mode, yet the first menu presented in Apple mode advises that you use the arrow keys to make your selection from the offerings (which include *Quadcopy*). If, when the PC's cursor keys do not control the cursor, your first reaction is like mine—to punch down the NumLock key—you'll discover that in the Apple mode, pressing NumLock moves the cursor forward and pressing the backspace moves the cursor backwards.

This limited cursor control is no great problem when picking a favorite from a menu, but one of the first programs my friend Frank decided to try was his global program editor. The two-key control makes using a global editor about as enjoyable for the fingers as a walking tour of the entire planet earth would be for your feet.

Dedicated PC users not privy to the secrets of the Apple will make another unwanted discovery. In Apple mode, there is no lowercase. The only way to pry lower case from the Quadlink's character ROM chip seems to be with a CHR\$ command. If you try this, you'll find that there are indeed lowercase characters locked inside the Quadlink and, compared to Apple's characters, they look good. They even sport true descenders, a feature Apple believes is unnecessary.

Frank toted along with him a tower of his favorite Apple program disks, and we

were amazed that the overwhelming majority of them ran without a problem. There were even a few surprises. Frank made calls to the Apple monitor, which, on the Apple, peeks inside the Apple's ROM. They worked fine on the Quadlink. Frank has written a large number of programs he uses on his Apple at work, and every one of his compiled and interpreted Applesoft programs ran on the Quadlink flawlessly. He did note that an interpreted program that runs on his Apple II+ in 40 seconds took a full minute on the Quadlink, but the same program compiled runs in 7 seconds on either machine. The Quadlink was happy to display Apple graphics and even played Apple music through the IBM PC speaker. It worked and played just like a real Apple computer does.

Not All Apples

Quadram claims that the Quadlink/PC combination will run a wide variety of Apple programs, but not every Apple program. Any program that requires a special peripheral, such as a special Apple expansion card, will not run on the Quadlink. There's simply no place to plug in the peripheral. Currently, the Quadlink will not run Apple programs requiring an 80-column text display, but Quadram is working on the necessary software.

Quadram says the Quadlink will run UCSD p-System programs for the Apple on one condition: Your PC must have two disk drives. On Apple computers, the p-System always looks for a second drive. If it doesn't find one on a real Apple system, the search just "times out," and the program starts running. This doesn't happen with the Quadlink, so the programs just hang up indefinitely. Frank tried disks zero and three of his Apple Pascal Compiler Version 1.1 and was not successful. These disks are for a single-drive Apple system, but will work on a two drive system if the second drive is not ready. In other words, our results confirmed Quadram's claims.

According to Quadram, copy-protected programs cause Quadlink's biggest prob-

lem. Many Apple programs are copy-protected by half-tracking (the protected program causes the disk drive read/write head to skate across the disk half-a-track at a time). In essence, part of the program is written in between the normal tracks. The process works fine with Apple disk drives, but the read/write head of the PC drives are so big that half-tracking is impossible.

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So half-tracked programs cannot be used. According to Quadram, some programs published by Broderbund Software, Sirius, Budge Company, and Stoneware (in particular *DB Master*) are copy-protected by half-tracking and will not run on the Quadlink/PC system. We tried Broderbund's *Serpentine* and confirmed that it would not run. We got as far as the opening display and then the Quadlink jammed up and required a reset to do anything else.

The PC side of the Quadlink's two modes has a compatibility problem, because the Quadlink is quite hardware specific to the IBM PC. A PC-clone is not an IBM PC, so don't expect the *Quadlink* to run on your non-IBM computer, unless you happen to own either a Compaq or a Columbia. The Quadram factory has tried out both of these PC-clones and found that they worked successfully. However, each one requires special cables, which are available separately or in conjunction with the Quadlink board. Further, the Quadlink will not operate the Compaq's internal monitor, although it will operate an external monitor.

Even inside a real IBM PC, the Quad-

link has some particular needs. Specifically, the manual advises that the Quadlink is only guaranteed to operate properly with genuine IBM or Quadram expansion boards. However, my PC is stuffed with extra memory and a color/graphics adapter, neither of which is *Quadlink*-approved, but so far, the memory and the adapter work fine. In fact, in the PC mode, all of my IBM PC's peripherals functioned properly, except for the color of the on-screen displays.

I use a medium-resolution composite color monitor instead of a top-dollar RGB monitor. When I tried my color monitor, no amount of coaxing could elicit hues other than black and white from the composite output of the *Quadlink*. On a monochrome monitor brightness levels appeared to be somewhat scrambled when using the composite output. I checked and made sure that true colors were available on my color/graphics adapter's composite output. I was unable to determine whether the colorlessness of my display was a compatibility or a Quadlink problem.

Quadlink as Art

Overall, I found the Quadlink to be amazing—pressing a few keys changed one computer into another and back again. As with any work of art or even with a masterpiece, if you look hard enough, you'll find flaws. But the whole of the work transcends these flaws and becomes something of great value.

If you want to make a transition from the world according to Apple to the world according to IBM, the Quadlink will make the going much easier. You can transfer all of your valuable text files, from client lists and form letters to novels and instruction manuals, from one disk format and computer to another. If you have Apple programs that you still regularly use but want access to both the IBM PC's power and library with only one machine cluttering your desk, the Quadlink is the perfect solution. If you have a PC at work and an Apple at home, the Quadlink will bring the two together, for better or worse. ■