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PC CARDS AND PERIPHERALS

CHAPTER AT A GLANCE

Desktop computers have always provided a standardized interface—the "expansion bus." On the other hand, mobile computers have traditionally lacked all the most basic upgrade potential. By the late 1980s, it was clear that a standard would be needed to allow rapid and convenient upgrades for the exploding field of mobile computing. Neil Chandra of Poquet Computer (which became part of Fujitsu) took a vision originally conceived to provide memory for the handheld Poquet computer and brought together industry leaders to forge a standard. In 1989 Chandra's brainchild, the Personal Computer Memory Card International Association (or PCMCIA), was formed as a standards body and trade association. The objective of the PCMCIA is to provide universal, nonproprietary expansion capability for mobile computer systems (Figure 49-1). More than 500 organizations are affiliated with the PCMCIA, which also works closely with other major standards organizations such as the Japan Electronics Industry Development Association (JEIDA), the Electronics Industries Association (EIA), the Joint Electron Device Engineering Coun-

FIGURE 49-1 A PC Card SCSI adapter for mobile computers (copyright © 1995 Future Domain Corporation; reprinted with permission)

cil (JEDEC), and the International Standards Organization (ISO). This chapter explains the inner workings of a PCMCIA interface and cards that use it. You will also find a broad selection of trouble-shooting procedures intended to help you overcome many of the problems attributed to the PCMCIA interface and the difficulties it can encounter under Windows 95/98.

Understanding the PC Card

Ultimately, the universal expansion standard envisioned by the PCMCIA has taken the form of a card (called a *PC Card*) that is roughly the length and width of a credit card (Figure 49-2). This basic shape has remained virtually unchanged since the initial release of PCMCIA standards (version 1.0) in September 1990. The original specification (reflecting the original Poquet vision) defined an interface that was intended exclusively for memory cards such as DRAM, flash EEPROM, and ROM. However, a memory-only interface did not even come close to fulfilling the promise of mobile expansion capability. There is much more to PCs than memory.

PCMCIA release 2.0 followed a year later in September 1991. Version 2.0 took the quantum leap that version 1.0 ignored and incorporated I/O capability and software support into the PC Card. It was this addition of I/O capability that allowed PC Card technology to finally attract serious attention from mobile computer manufacturers. PC Card makers could now move past memory products and offer a wealth of

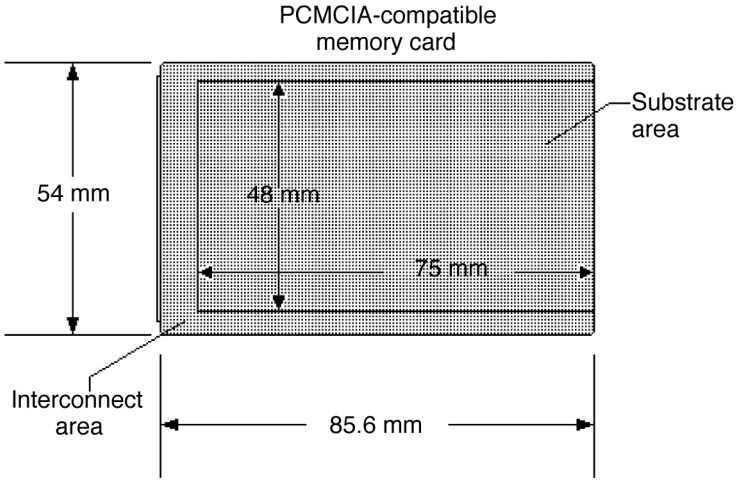

FIGURE 49-2 Basic PC Card dimensions

other expansion products, such as LAN cards, fax/modems, and disk drives. Release 2.1, which followed in July 1993, specifies software support and BIOS card and socket services. The newest set of PCMCIA standards appeared in February 1995 (loosely referred to as PCMCIA 95, or Release 3.0). Release 3.0 added support for multifunction PC Cards, such as modem/LAN cards, as well as support for 3.3 volt operation, DMA handling, and 32-bit CardBus bus mastering.

Since February 1995, there have been some important revisions of the PCMCIA standards, but no new revision levels. In May 1995, the second printing of PCMCIA standards addressed timing problems during card power-up/power-down sequences. In November 1995, the third printing of PCMCIA standards included provisions for custom card interfaces and indirect CIS addressing. The update in July 1996 provided for a Zoomed Video (ZV) interface for fast video systems and a Flash Translation Layer (FTL) for card reprogrammability. PCMCIA has published a March 1997 update to the PC Card standard. This update provided developers with a clean copy of all the changes made to the standard since February 1995 and added several enhancements and corrections. One of the significant enhancements was Thermal Management for PC Cards and host systems. The latest standards and collective updates over time have been consolidated into Release 7 of PC Card specifications.

In June 1998, PCMCIA approved a new Small PC Card specification. This new form factor offers the same functionality as a regular PC Card, but is 42 percent smaller. This enables manufacturers of portable handheld devices—from digital cameras to personal digital assistants (PDAs)—to expand their product features without sacrificing valuable product real estate. The Small PC Card offers the same I/O and memory capabilities as the full-size PC Card and utilizes the same software and electrical specifications as a full-size PC Card.

In October 1998, the PCMCIA accepted the PCI Power Management specification. This is the result of an industry desire to maintain as much compatibility as possible between desktop and portable systems. PCMCIA announced at the same time that the new CardX (later changed to CardBay) standard—which adapts the popular USB and 1394 serial interfaces into specifications compatible with the PC Card form factor—would begin its formal development process. CardBay offers the ability to use the 1394 and USB interfaces in the PC Card format. This is expected to be a real boon for laptop and PDA developers, and

can add high-performance functionality (such as real-time video capture, disk drives, gigabit Ethernet, and other high-speed applications), which USB and 1394 make possible.

MAKING IT WORK

Of course, integrating a PC Card into a computer is not as easy as just attaching a connector to the PC busses. A selection of system hardware and software is needed, as illustrated in Figure 49-3. This multilayered approach is typical of most PC peripherals. If you've ever installed a CD-ROM drive before, this type of diagram probably looks very familiar.

At the foundation of PC Card architecture is the hardware layer. This represents the physical card itself, its connectors, and the circuitry needed to interface the card to the PC busses. In most cases, PC Card support can be added to a computer with one or two VLSI (Very Large Scale Integration) chips and a bit of "glue" logic. You can see this hardware implemented for a desktop or tower PC in the PC Card drive shown in Figure 49-4.

The next layer above hardware is called the socket services layer. Socket services act as a supplement for system BIOS by providing the low-level routines needed to access the card hardware. It is important to note that socket services software is frequently implemented as firmware—either in the system BIOS itself (often in new BIOS versions) or on an expansion ROM included on the PC Card reader's adapter board. Socket services are used by the computer to identify how many sockets are in the system and whether cards are inserted or removed while system power is applied.

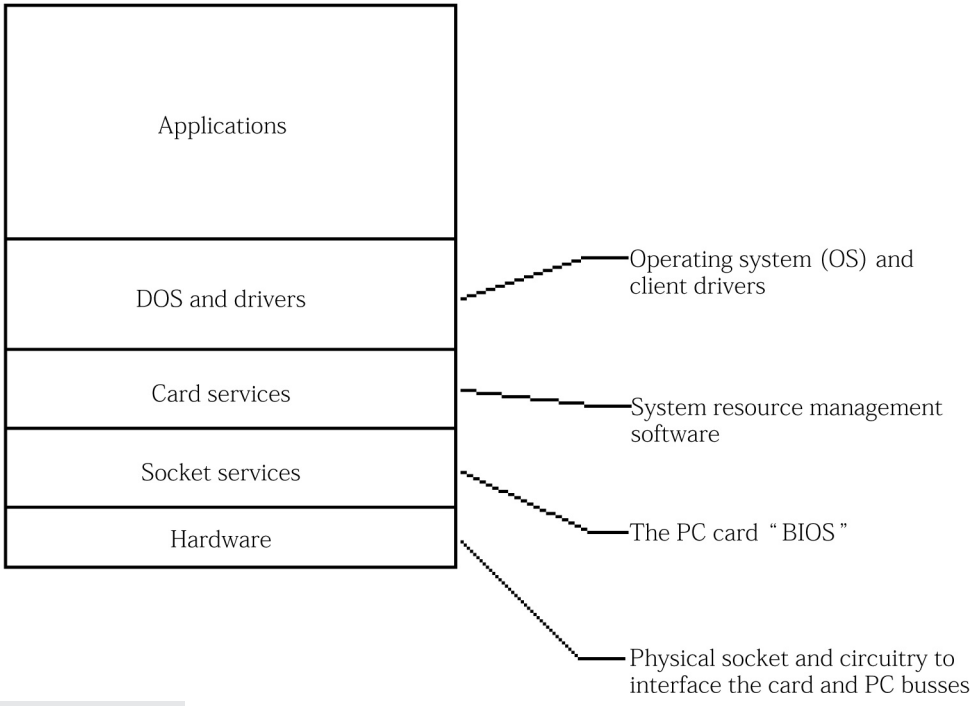

FIGURE 49-3 Simplified PC Card architecture

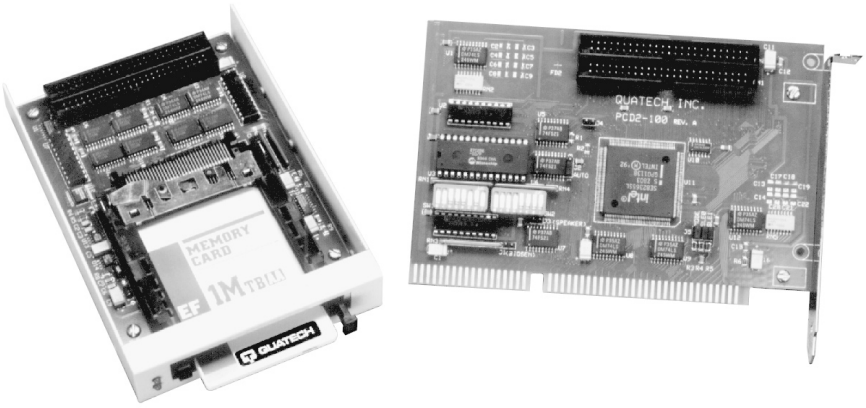

FIGURE 49-4 A commercial PC Card "drive" for desktop/tower PCs (Quatech)

The card services layer forms the interface between the operating system and socket services. When socket services detects the presence of a card, card services allocates and manages the system resources (interrupts, DMA channels, and addressing) needed by the card(s). When a card is removed, Card Services will free those system resources again. It is this unique ability to find, use, and then free system resources that gives PC Cards their powerful I/O capability and plug-and-play flexibility. Since card services software is universal across hardware platforms, it can be loaded either as a DOS or Windows 95/98 device driver, or it may be an integral part of the operating system, as in IBM's DOS 6.22 and OS/2 4.0.

Unfortunately, not all notebook and sub-notebook systems use socket and card services—this is a major reason for PC Card compatibility problems. Some PC Cards come with software device drivers that attempt to communicate directly with the system hardware. These cards were developed before the release of the PCMCIA card services standard, and such cards will *only* work on certain hardware platforms. Also, not all notebooks provide PCMCIA socket services. Some vendors provide proprietary BIOS firmware that supports a specific, limited set of PC Cards. Just recently, some vendors have begun bundling compatible card and socket services with their systems. These card support device drivers are loosely termed *enablers* and are discussed in detail below.

Above card services, you see the familiar DOS and Application layers. Specialized (client) device drivers that may be needed for particular cards (such as an ATA card driver or flash file driver) are considered as part of the DOS layer.

ENABLERS

Many PC Cards offer an additional wrinkle before they work on your system—they need an enabler. Although socket services interface the card to your hardware, and card services provide resource management, the PC Card is still not always fully configured. An enabler is often required to place the PC Card at a particular I/O address, memory address, or IRQ. There are three types of enabler software: generic enablers, specific enablers, and point enablers.

Perhaps the most common type of enabler is called a *generic enabler*. (Some vendors also refer to these as "super client drivers.") Generic enablers are capable of configuring a wide range of the most common card types, such as modems and network adapters, and are usually provided with PCMCIA system software. Generic enablers typically require socket services and card services to be loaded before they can

run. The problem with generic enablers is their demand on conventional memory. It is not uncommon to see a generic enabler demand 40KB to 50KB. Along with socket and card services, the memory requirements to support a PC Card can easily reach over 100KB. This memory problem is most acute when running large native DOS applications. However, unless you're running more than one type of PC Card, you might be able to use a specific enabler.

A *specific enabler* is a program designed to configure a single type of PC Card and may be provided by the PC Card maker (or by a third-party software company). There are two compelling advantages to specific enablers. First, a specific enabler demands only a fraction of the memory used by generic enablers. If you use only one specific type of card, a specific enabler can save up to 40KB of memory. Second, your generic enabler may not support a particular type of PC Card, so a specific enabler can supplement a generic enabler but use a minimum amount of additional RAM.

There is the potential for some problems when both a generic enabler and specific enabler are loaded and both recognize and configure a particular type of I/O card. An oversight in the PCMCIA specification allows the first enabler to be loaded and configure the card if the card is installed when the machine is booted; if the card is inserted after the machine is booted, however, the last enabler loaded will configure the card. This can create serious problems if the two enablers have different ideas about how the card should be configured, or if the application software depends on a particular enabler to configure the card. Here are the rules for loading generic and specific enablers together:

- If you need a generic enabler to configure your modem or another device that doesn't have a specific enabler, load it.
- If the only PC Card you use has a specific enabler, load the specific enabler instead of the generic one.
- If you have one or more cards that are configured by the generic enabler, and a card that needs a specific enabler, first see if the generic enabler can handle the particular card. (Or see if a new version is available that can handle the specific card.) If the generic enabler (or its updated version) can handle all the cards, don't load the specific enabler. Otherwise, load both.

There is also a third type of enabler called a *point enabler*. This is similar to a specific enabler in that it is designed to configure a single type of PC Card. Unlike generic or specific enablers, however, point enablers do not require socket services or card services to be loaded. Instead, they talk *directly* to the PCMCIA adapter hardware. This has both advantages and drawbacks. The most compelling advantage is memory. Since socket and card services are not needed, a point enabler takes up very little memory. Unfortunately, that is where the advantages end. In order to communicate with hardware directly, a point enabler must be designed for specific hardware. As a result, a point enabler usually doesn't work on all PC Card systems. Also, the point enabler will bypass the socket and card services if they are loaded. This can be a real problem if you want to use other cards at the same time. Generally speaking, bypassing your socket and card services is not a good idea, so reserve point enablers as a last resort (and only if you use no other PC Cards in the system at the same time).

CARD TYPES

PCMCIA standards also define the physical dimensions that a PC Card is limited to. There are three types of cards: Type I, Type II, and Type III. Although the length and width of each card remains the same, the thickness of their substrate area can vary to accommodate different applications (as shown in Figure 49-5). The classic Type I card is only 3.3mm thick. Although this is too thin for mechanical assemblies, it is ideal for most types of memory enhancements. Type II cards run 5.0mm thick, which makes them ideal for larger memory enhancements and most I/O cards such as modems or LAN adapters. Note in Figure 49-5 that the

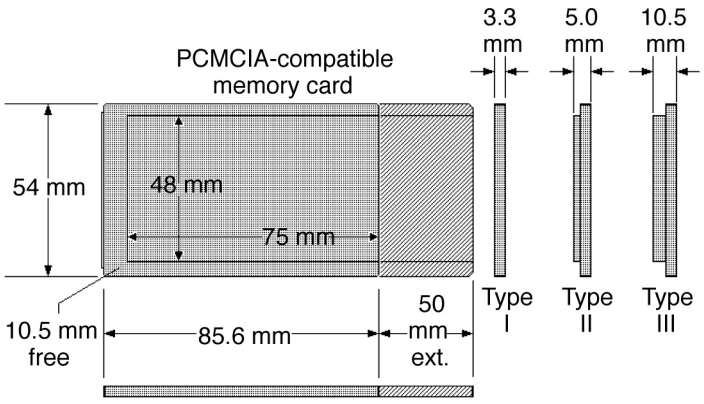

FIGURE 49-5 Comparison of PC Card thicknesses

edges and connector area (the *interconnect area*) of the card remain at 3.3mm to fit the card's slide rails. The Type III card is a full 10.5mm thick, which is large enough to accommodate the components for a complete hard drive or radio communication device like a cellular modem. Like Type II cards, the interconnect area remains 3.3mm. This 3.3mm rail height permits thinner cards to be inserted into thicker slots (but not vice versa).

The cards in Figure 49-5 are not to scale, but are provided for comparison only.

CARDBUS AND ZOOMED VIDEO

If you work with PC Cards at all, chances are that you're going to encounter CardBus and Zoomed Video architectures. The CardBus is a 32-bit implementation of the PC Card that appeared as part of the PCMCIA standard in February 1995. The CardBus supports bus mastering data transfers up to 133Mbps at 33MHz. In short, the CardBus is PCMCIA's answer to the PCI interface used on modern motherboards. Of course, CardBus is not identical to PCI, but it is as close as PC Cards have been able to come. Since CardBus performance approaches the same high level as the host platform's internal system bus architectures (PCI), CardBus is an ideal way to add 100Mbps LAN, SCSI II, video conferencing, and other high-performance capabilities to the notebook form factor. In addition, CardBus PC Cards operate at a power-saving 3.3 volts—extending the battery life of most configurations.

Zoomed Video (or ZV) is another enhancement to the PC Card that supports a high-speed connection between a PC Card and host computer system. This connection allows the card to write video data directly to the system's VGA controller. The data is transferred with no buffering requirements because it is transferred over the ZV bus, not the system bus. As a result, ZV cards are ideal for video capture, PC/TV applications.

INSIDE THE CARD

You can develop a tremendous respect for PC Cards by understanding the fragile and compact assemblies that are inside them. Consider the Maxtor MobileMax Lite shown in Figure 49-6. The drive contains a single platter, upper and lower R/W heads, a voice coil servo motor to position the heads, a spindle motor to spin the platters, and the circuitry required to handle all drive functions and interfacing. As you might imagine, each element of the PC Card must be kept extremely thin. Still, it is sometimes difficult to

FIGURE 49-6 Internal view of a PC Card ATA-type drive (Maxtor Corporation)

believe that the assembly actually fits into a shell only 0.5cm thick (Type II). Another important consideration in PC card design is the control and suppression of electrostatic discharge (ESD). Static electricity must be prevented from reaching the card's PC board where IC damage can occur. Once a card is inserted into a system, a discharge tab at the physical interface connector carries away any accumulation of charges to system ground. Until a card is inserted, a card protects its circuitry from damage using the Faraday cage principle—the same principle used by antistatic bags to protect their contents. The shell of most PC Cards is either constructed of a metal (such as stainless steel) or some sort of metalized plastic. Both shell halves are bonded together by a small spring. Any charge introduced to the card is quickly dispersed over the entire shell surface instead of being allowed to enter the card.

HOT INSERTION AND REMOVAL

One of the great disadvantages to most desktop expansion devices is that computer power must be completely off before the device can be installed or removed. Not only is this necessary to prevent accidental damage from improper insertion, but the traditional BIOS and DOS only allocate system resources when the system is first initialized—they were not designed to accommodate the allocation of system resources on-the-fly. Even plug-and-play devices allocate resources only during initialization. PC Cards take a major step toward this type of "dynamic resource allocation" with the support of hot swapping. *Hot swapping* (or *hot insertion and removal*) refers to the ability to insert and remove cards while the PC power is still on without any degradation or damage to the system or card. Ideally, software applications can recognize the card's function and adjust accordingly.

Although PC Cards support hot swapping, and can be inserted or removed without fear of damaging the card itself, very few operating systems or application programs are currently PC Card aware. That is, they do not automatically recognize when cards have been inserted or removed. Therefore, users of any computer with PC Card slots should close any open application programs before inserting or removing a PC Card. Otherwise, the application may not initialize a card that has been inserted, and may lock up when a card is removed.

When working with PC Cards, always be sure to close any open applications before inserting or removing cards from the system. If possible, shut the system down entirely.

UNDERSTANDING ATTRIBUTE MEMORY

One of the greatest challenges facing PC Cards is cross-compatibility—the ability to use various card species from diverse manufacturers in the same card slot. Quite a few card sizes and types are currently in production, and many more card models will be available by the time you read this book. How does the computer "know" when you have replaced your 2MB SRAM card with a 20MB flash card or a 100MB PCMCIA hard drive? You should understand that a computer capable of accepting PC Cards must be able to detect and adjust to the diverse attributes of each card it may encounter, even though each card may utilize the same physical card interface.

Hard drives provide the best analogy to this. Hard drives are available in a staggering array of capacities, heads, cylinders, sectors, and so on, but all those drives can use the same physical interface (ATA-2). A computer interacts properly with a hard drive because you enter the drive's key parameters in the computer's CMOS setup routine. The same basic problem exists for PC Cards. However, memory cards are intended to be "transient" items—inserted and removed at will. Imagine the inconvenience of having to reenter a card's key parameters each time a new card is inserted. Even a single typing error can be disastrous for some cards and their contents.

The PCMCIA has supported a standard for memory card services that defines the software interface for accessing cards. The interface can either be a device driver loaded when the computer boots, or it can be designed directly into BIOS ROM or the operating system. In order for this driver system to work, each card must be able to identify itself to the computer. The complete characteristic and ID data for a memory card is held in the *attribute memory* area of each individual card. Attribute memory contains a surprising amount of information—as it must, considering the huge number of potential differences in card layout and features. Attribute memory tells the computer how much storage a card contains, the particular device type (memory, disk, I/O, etc.), the card's data format, speed capabilities, and many other variables.

The contents of attribute memory typically contain setup information that falls into one of four categories of PCMCIA's Card Identification System (CIS)—otherwise known as the card's *meta-format*. Those four layers are the basic compatibility layer that indicates how the card's storage is organized, the data recording format layer specifying how blocks of card information are to be stored, the data organization layer defining the card's operating system format (DOS, Microsoft's FlashFile system, PCMCIA's XIP, etc.), and any specific standards (or system-specific standards) needed to support an operating system.

The CIS data contained in attribute memory is a collection of related data blocks that are interlinked rather like a chain. Each link in this chain (a *data block*) is called a *tuple*, and can be up to 128 bytes long. The first byte of a tuple encodes the function of that tuple and its parameters. The second byte in a tuple links to the next tuple (if any) and specifies the precise number of bytes in that tuple. Since you know how long the present tuple is, you know exactly where the next tuple begins. In addition to standard tuples, individual card manufacturers are also free to add their own unique tuples to support proprietary features. It is not necessary for you to know the precise operation of each tuple, but it can help you to be familiar with their nomenclature and general purpose. One of the most important tuples is the Function ID entry called CISTPL_FUNCID. This tuple tells the host computer exactly what kind of card is installed. Table 49-1 shows typical entries for the most popular PC Card types.

CONNECTIONS

The standard PC Card is connected to a PC through a 68-pin header arranged in two rows of 34 pins, as shown in Figure 49-7. If you look at the header pins closely, you'll notice that several of the pins are longer than the others—these are *ground* pins. By making them longer, a card will be attached to ground *first* when inserted (and last when removed). Figure 49-8 clearly illustrates how a PC Card interfaces to its

TABLE 49-1 TYPICAL FUNCTION ID ENTRIES FOR CISTPL_FUNCID

CISTPL_FUNCID: FUNCTION IDENTIFICATION TUPLE	
CODE	**NAME**
0	Multi-Function
1	Memory
2	Serial Port
3	Parallel Port
4	Fixed Disk
5	Video Adapter
6	Network Adapter
7	AIMS (auto indexing mass-storage)
8	SCSI
9	Security
A-FD	Reserved (allocated as new devices are introduced)
FE	Vendor-Specific
FF	Do Not Use

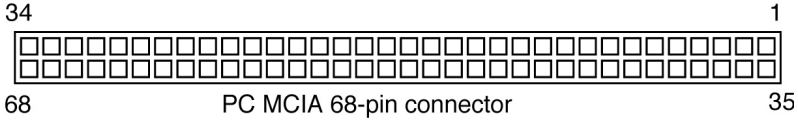

FIGURE 49-7 PC Card header diagram

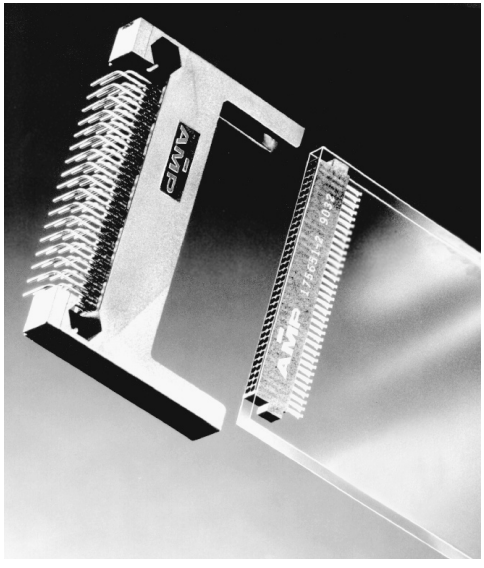

FIGURE 49-8 Typical PC Card connector scheme (AMP, Inc.)

mating connector. When the card is removed, ground will still be attached after the power pins have been disconnected. Good grounding helps to ensure the card's reliability, and permit "hot" insertion and removal. When you look at the assignment of each pin in Table 49-2, you will see that there are basically four types of signals at the PCMCIA interface: data pins, address pins, power (and ground), and control signals. It is this healthy mix of signals that makes it possible to support many of the PC Card applications that are available today. Also note that the CardBus PC Cards use the same 68-pin connector, but their signal assignments are vastly different.

TABLE 49-2 PIN ASSIGNMENTS FOR PC CARD AND CARDBUS INTERFACES

16-BIT PIN	32-BIT MEMORY	32-BIT I/O+MEM	CARDBUS	16-BIT PIN	32-BIT MEMORY	32-BIT I/O+MEM	CARDBUS
1	GND	GND	GND	35	GND	GND	GND
2	D3	D3	CAD0	36	CD1#	CD1#	CCD1#
3	D4	D4	CAD1	36	D11	D11	CAD2
4	D5	D5	CAD3	36	D12	D12	CAD4
5	D6	D6	CAD5	39	D13	D13	CAD6
6	D7	D7	CAD7	40	D14	D14	RSRVD
7	CE1#	CE1#	CCBE0#	41	D15	D15	CAD8
8	A10	A10	CAD9	42	CE2#	CE2#	CAD10
9	OE#	OE#	CAD11	43	VS1#	VS1#	CVS1
10	A11	A11	CAD12	44	RSRVD	IORD#	CAD13
11	A9	A9	CAD14	45	RSRVD	IOWR#	CAD15
12	A8	A8	CCBE1#	46	A17	A17	CAD16
13	A13	A13	CPAR	47	A18	A18	RSRVD
14	A14	A14	CPERR#	48	A19	A19	CBLOCK#
15	WE#	WE#	CGNT#	49	A20	A20	CSTOP#
16	READY	IREQ#	CINT#	50	A21	A21	CDEVSEL#
17	Vcc	Vcc	Vcc	51	Vcc	Vcc	Vcc
18	Vpp1	Vpp1	Vpp1	52	Vpp2	Vpp2	Vpp2
19	A16	A16	CCLK	53	A22	A22	CTRDY#
20	A15	A15	CIRDY#	54	A23	A23	CFRAME#
21	A12	A12	CCBE2#	55	A24	A24	CAD17
22	A7	A7	CAD18	56	A25	A25	CAD19
23	A6	A6	CAD20	57	VS2#	VS2#	CVS2
24	A5	A5	CAD21	58	RESET	RESET	CRST#
25	A4	A4	CAD22	59	WAIT#	WAIT#	CSERR#
26	A3	A3	CAD23	60	RSRVD	INPACK#	CREQ#
27	A2	A2	CAD24	61	REG#	REG#	CCBE3#
28	A1	A1	CAD25	62	BVD2	SPKR#	CAUDIO
29	A0	A0	CAD26	63	BVD1	STSCHG#	CSTSCHG
30	D0	D0	CAD27	64	D8	D8	CAD28
31	D1	D1	CAD29	65	D9	D9	CAD30
32	D2	D2	RSRVD	66	D10	D10	CAD31
33	WP	IOIS16#	CCLKRUN#	67	CD2#	CD2#	CCD2#
34	GND	GND	GND	68	GND	GND	GND

TABLE 49-2 PIN ASSIGNMENTS FOR PC CARD AND CARDBUS INTERFACES *(CONTINUED)*

Table 49-2 Legend:

Ax or CAx	Address line
BVDx	Battery voltage detect line
CADx	Multiplexed address/data line
CAUDIO	Audio line
CBEx or CCBEx	Command byte enable
CCLK	System clock
CCLKRUN	Clock status
CDEVSEL	Device select
CDx or CCDx	Card detect line
CEx	Card enable line
CFRAME	Address or data phase
CGNT	Grant line
CINT	Interrupt
CIRDY	Initiator ready
CPAR	Parity line
CPERR	Parity error
CREQ	System request
CRST	Reset
CSERR	System error
CSTOP	Stop transfer cycle
CTRDY	Target ready
Dx or CDx	Data line
IREQ	Interrupt request
OE	Output enable
RSRVDIORD	Reserved/IO read line
RSRVDIOWR	Reserved/IO write line
VSx	Refresh line
Vpp	Programming voltage
WE	Write enable

PC Card Applications

Now that PC Cards are being developed according to release 2.1 and the major updates to 1997, they offer a series of compelling advantages for mobile computer users:

- The I/O support offered by PCMCIA specifications allows virtually any product to be incorporated into a PC Card. Modems, network adapters, video capture modules, audio cards, and hard drives are just some of the devices that PCMCIA standards now embrace.
- PC Cards can be made to operate in a dual-voltage mode (either 5.0 volts or 3.3 volts) depending on the design of the mobile PC. Low-voltage compatibility saves power and extends battery life.
- The programs and applications stored on PC Cards can now be executed in place rather than having to load the card's contents into main memory. This *execute-in-place* (or XIP) technology reduces the demand for large amounts of onboard RAM.

- The socket services software defined by release 2.1 describes a BIOS-level interface that allows applications to access the card's hardware. The device drivers written to operate specific PC Cards will run on any PC that supports socket services.
- The card services software automatically allocates system resources (such as memory and IRQs) once a PC Card is inserted into a system (referred to as dynamic resource allocation). Information (called *tuple information*) contained in the Card Information Structure (CIS) of a card describes the characteristics and abilities of that card. In turn, the host system can automatically configure the card for proper operation. This type of operation is the earliest implementation of a plug-and-play architecture.

PC CARD PROBLEMS

Like all new PC technologies, there are some disappointing problems with the early implementations of PC Cards. Before you decide to buy that next "PC Card-compatible" system, you should understand some of the factors that have contributed to PCMCIA's poor early showing. When the PCMCIA issued release 1.0 in 1990, socket and card services did not exist—card makers had to supply their own specific drivers, which had to be tested on each specific computer. If the host computer were updated or upgraded, the cards that worked on the older systems would probably not work on the newer ones. This resulted in perplexing compatibility problems.

Socket and card services were added in 1991 with PCMCIA release 2.0, but the release also brought I/O devices into the PC Card picture. Although this made PCMCIA much more versatile, I/O brought in a host of new problems. Although all I/O cards are supposed to be treated as a generic device, an operating system does not see all devices the same way. For example, an operating system does not treat a hard drive and a modem the same way, but card makers did not take that into account, so compatibility between systems is still an issue. Also, most operating systems are designed to work with resources that are present when a system is *booted*, so although you may be able to insert and remove cards safely, the operating system can rarely adjust the system resources properly. As a result, many cards have to be installed *before* the system boots.

Today, most PCMCIA cards work in most systems, and can be inserted and removed without rebooting the computer—but there are no guarantees. The situation has gotten much better over the last year or so (especially with the release of Windows 98), but beware of older PCMCIA systems.

TODAY'S CARDS

PCMCIA cards have come a long way since the early memory cards of 1990. Virtually any device that can be implemented on an expansion card can be fabricated as a PC Card. As a technician, you should understand the range of devices that you may encounter when servicing notebook and sub-notebook systems:

- *Memory cards* Memory expansion devices continue to be popular PC Card devices—not so much for added system memory, but to run prefabricated applications directly off the card.
- *Modem cards* PCMCIA modems are rapidly replacing proprietary modems as internal communication devices. PCMCIA modems are easily matching the speed and performance of stand-alone modems, and are even being equipped with cellular connections for true mobile operation.
- *LAN cards* Local area networks are becoming more popular as businesses integrate their operations and add connections to such resources as the Internet. LAN cards allow mobile computers to play a constructive role on networks using topologies such as Ethernet, Token Ring, and 3270 Emulation.

- *Digital video cards* The soaring popularity of multimedia applications has dramatically increased the demand for real-time video and still-frame capture products. PCMCIA technology allows video and audio capture capability in PC Card products for high-quality multimedia "on-the-road."
- *Hard drive cards* Until the advent of PCMCIA, it was virtually impossible to add a second hard drive to a portable PC. Fortunately, the use of PCMCIA combined with the stunning advances in hard drive technology allow substantial hard drive capacities in a Type III form factor.
- *Audio cards* Games and music composition software demand high-quality sound reproduction. PCMCIA audio cards provide SoundBlaster-compatible sound to external speakers. The trend toward mobile multimedia is integrating sound systems and speakers right into the mobile PC, but stand-alone sound cards are available.
- *SCSI adapter cards* The Small Computer System Interface (SCSI) is a system-level interface scheme that allows a multitude of devices (CD-ROM, scanners, tape drives, etc.) to be connected to a system. A PCMCIA SCSI adapter card opens a whole new level of compatibility for a mobile computer.
- *Floppy drive cards* The recent trend among sub-notebook and palmtop computers has been to forgo the floppy drive in favor of a PCMCIA slot. However, PCMCIA floppy disk adapters such as the Accurite Technologies PassportCard bring a standard floppy drive to any mobile PC that lacks an internal floppy drive.

INSTALLING A PC CARD

Like so many things in PC service, proper installation can prevent a round of troubleshooting later on. This is particularly true for PC Cards because they are completely dependent on software for proper configuration and operation. This part of the chapter describes the general steps involved in setting up a typical PC Card. Of course, always be sure to read the manual that accompanies your card for specific instructions or caveats. Most PC Cards require access to four different pieces of software: the socket services, the card services, the enabler (or super client driver), and a resource manager (usually a high-level driver). Table 49-3 lists some typical PC Card drivers for DOS, and Table 49-4 lists the PC Card drivers for use under Windows.

The file names shown in Tables 49-3 and 49-4 are examples often used in Compaq laptops. Your own system may utilize entirely different file names, but their purpose and loading order will almost always remain the same.

If your system does not yet support PC Cards (or if you are restoring a failed hard drive), you'll need to install the socket and card services first. This should usually be done before installing the card itself. However, keep in mind that most mobile computers come with card and socket services installed already, so you should not reinstall those applications since they may be optimized for your particular hardware. Power-up the PC and read the driver banners. If you see mention of card and socket services, that software is probably installed already. Windows 95/98 has a small suite of card and socket service drivers. (Refer to the PCMCIA plug-and-play card wizard under your Control Panel.)

Next, you'll need to install the PC Card enabler. (You may also see this grouped with card services software.) In many cases, the disk accompanying the PC Card will have an installation routine that will add the enabler's command line to CONFIG.SYS. Otherwise, you will have to add the enabler's command line manually by editing the CONFIG.SYS file. Once the enabler is added to CONFIG.SYS, save the file and turn off the PC. Insert the card in its card slot, and then restart the PC. If the software is installed

TABLE 49-3 DOS PC CARD DRIVERS

FULL NAME	FILE NAME	FUNCTION	MEMORY	NOTES
Socket Services	SSVLSI.EXE SSCIRRUS.EXE	Provides a standard software interface to PCMCIA host controller chips and isolates the socket hardware from higher level software	3,760 (4K)	Must be loaded first
Card Services	CS.EXE	Manages system resources and configuration conflict issues	39,392 (36K)	Requires socket services
Card Services Resource Allocation	CSALLOC.EXE	Initializes Card Services resource table at boot time	—	Requires Socket and Card Services
Card Services Super Client	CARDID.EXE	Configures PC Cards that do not have CS client drivers and "exception" cases	20,320 (20K)	Requires Socket and Card Services
Memory Card Driver	MEMDRV.EXE	Block device driver for memory cards	17,184 (17K)	Required for SRAM or flash card support
ATA Card Driver Support	ATADRV.EXE	Provides support for ATA/ IDE mass storage cards such as rotating media or Sundisk-style cards	6,496 (6K)	Relies on CARDID to configure ATA cards
Microsoft Flash File System	MS-FLASH.SYS	Provides file system support for flash memory cards	70,240 (69K)	Requires MEMDRV.EXE
DoubleSpace for Flash File System	DBLFLASH.EXE	Provides DoubleSpace data compression support for the Microsoft Flash File System	13,504 (13K)	Requires MS-FLASH.SYS
Power Management Driver	PCMSMIX.EXE	Provides support for standby hibernation and ring resume for certain PCs	—	—

TABLE 49-4 WINDOWS PC CARD DRIVERS

FULL NAME	FILE NAME	FUNCTION	NOTES
Communications driver	SSCOMM.DRV	Card Services-aware version of Windows COMM.DRV	Replaces COMM.DRV
Card Services Serial Port Virtual Driver	CSVCD.366	Card Services-aware version of standard Windows VCD.366	Replaces *vcd
Card Services Windows API	SSWINCS.DLL	Provides the Card Services interface to Windows applications	—
Card Services Virtual Driver	CS.366	Provides the Card Services interface to Windows virtual sessions library (DLL) required to support hot plugability	—
Card Event Monitor	CPQEVENT.EXE	Displays pop-ups on insertion/removal of PC Card	—

correctly so far, you should hear a beep as the card is recognized. You will hear two beeps if the card is not recognized. (Check the card and software installation.)

Finally, you will need to install the "resource manager" (or client driver) that accompanies the particular card. For example, a PC Card fax/modem usually requires a fax/modem client driver, or a PC Card hard drive requires an ATA IDE client driver, and so on. Client drivers are often card specific, so be sure to install the client driver that accompanies your particular card.

You can see an example of how this works by looking at the combination of software in Table 49-5. The program names are examples only. (Your particular software will use different names.) Notice that PC Card support requires several different pieces of software, and the software varies depending on the particular cards that you need to support. For example, an ATA IDE card and a fax/modem card use the same socket services, card services, and enabler, but require two different client drivers. With this type of relationship, you can load only the drivers that are needed to support specific card types.

Optimizing Memory in PC Card Systems

PC cards in the real mode are very demanding of conventional memory. For example, a typical PC Card–equipped PC must allocate almost 180KB of conventional memory in order to support the PCMCIA slot and PC Card devices. While this is not so much of a problem in Windows 95/98, DOS and Windows 3.1x environments can experience severe memory shortages. Fortunately, it is often possible to reclaim some conventional memory (sometimes as much as 115KB). The actual amount depends on the number of drivers required for proper PC Card support, and the size of each respective driver, but the process needed to reclaim memory often breaks down into four steps:

- Remove any unnecessary drivers.
- Recover unused memory areas.
- Utilize any PCMCIA reserved memory.
- Change the driver loading order.

TABLE 49-5 PC CARD SOFTWARE VS. APPLICATION

FILE NAME	ATA IDE	FLASH MEMORY	LAN	FAX/ MODEM	SRAM MEMORY
PCMSS.EXE (Socket Services)	Yes	Yes	Yes	Yes	Yes
PCMCS.EXE (Card Services)	Yes	No	Yes	Yes	Yes
PCMCSFUL.EXE (Card Enabler)	Yes	Yes	Yes	Yes	Yes
PCMSCD.EXE (Comm. Client)	No	No	Yes	Yes	No
PCMATA.EXE (HDD Client)	Yes	No	No	No	Yes
PCMFFCS.EXE (Flash Client)	No	Yes	No	No	Yes

REMOVE ANY UNNECESSARY DRIVERS

The first step in regaining the memory normally used by PCMCIA drivers is to remove (or disable) any drivers that are not required in your configuration. If there are PCMCIA drivers that are not currently being used by the particular PC Card, remove them by inserting the word "REM" (which stands for "REMark") or a single semicolon (;) at the beginning of the appropriate statement in your CONFIG.SYS file. This will prevent the driver(s) from being loaded the next time the system is booted, and will therefore reclaim the memory that the driver(s) would have used.

If you are not currently using PC Cards at all, you can add a REMark to all PCMCIA driver references and delete the X=D000-DFFF exclusion on the EMM366 command line in your CONFIG.SYS file. This disables PCMCIA support entirely. You will regain all the upper memory usually available in non-PCMCIA-based PCs, but you will not have access to PCMCIA capabilities.

For example, REMarking out the PCMCIA files ATADRV.EXE and MEMDRV.EXE will recover a bit more than 20KB of memory. REMarking out the files MS-FLASH.SYS and DBLFLASH.EXE will recover 83KB of memory. Just keep in mind that these drivers must be loaded later if you add an ATA, SRAM, or flash memory card to the PC.

RECOVER UNUSED MEMORY AREAS

Take control of memory regions in the UMA that you know are not being used. For example, Compaq recommends that if you are not using a monochrome controller in an expansion base, you can recover the monochrome region (B000h–B7FFh) to gain 32KB. To accomplish this, you'd use the "Include" statement in your EMM366 command line, such as:

```
I=B000-B7FF
```

Remember that you will lose the ability to utilize devices that need that memory region. For the Compaq example, you'd lose the ability to use monochrome cards in an Elite SmartStation.

If you have any problems entering Windows after making this change, you may need to add the following to the [366enh] section of the SYSTEM.INI file:

```
DEVICE=C:\DOS\MONOUMB.366
```

UTILIZE ANY PCMCIA RESERVED MEMORY

The next step is to make use of any reserved memory in the UMA not being used by PCMCIA cards. As an example, new Compaq PCMCIA-based PCs reserve a 64KB window of memory in the UMA from D000h through DFFFh for PC Cards to reside in. Card services requires 4KB of that memory, but most cards that you install do not require the balance of 60KB. In fact, some cards do not require any memory in this area other than the 4KB required by card services. (To determine how much memory your PC Cards require, consult the card's user guide or call the manufacturer.)

First, determine how much memory each of your PCMCIA cards require in order to initialize. For example, PCMCIA modems usually do not require any memory, and most PCMCIA Ethernet adapters require only 8KB to 12KB. If your memory requirements are relatively small, you can usually move the PCMCIA window out of the D000h range, allowing for larger contiguous UMBs. A good place to move this range is the C800h area (so long as no other devices have BIOS residing in this area).

Modify your CONFIG.SYS file by moving the PCMCIA card initialization area out of the D000h range and reducing the amount of memory used from 64KB to a smaller amount. As an example, a modem (with the 4KB card services overhead) and Ethernet Card will usually only require 16KB or less, so you can change the default EMM366.EXE statement of

```
X=D000-DFFF
```

to

```
X=C800-CBFF
```

The example above will yield a 48KB gain in the UMA. If you are unable to determine just how much memory your card requires in order to initialize, it may take several trial-and-error attempts to assess how much memory it requires. In this example, you may even be able to recover more memory since some Ethernet PCMCIA cards require less than 12KB. You will also need to modify the card services INI file (CSALLOC.INI) by adding or editing the MEMEXCLUDE entry to exclude the newly defined C800–CBFF range, such as:

```
MEMEXCLUDE=CC00-EFFF
```

This will tell card services to avoid using any memory above CC00h to configure PCMCIA cards.

Finally, modify the [366Enh] section of your SYSTEM.INI file to include an EMMEXCLUDE statement that matches the range excluded on the EMM366.EXE line in the CONFIG.SYS file. For this example, the line must read

```
EMMEXCLUDE=C800-CBFF
```


Whenever you alter the exclusion range in your EMM366 line, be sure to modify the MEMEXCLUDE statement in your card services INI file and the EMMEXCLUDE statement in the SYSTEM.INI file to match.

CHANGE THE DRIVER LOADING ORDER

Shifting the load order of your specific drivers (but not the PCMCIA drivers themselves—they must remain in the same order) may allow you to load more drivers into upper memory. To do this, you can manually adjust the driver order through trial and error by changing the execution order in the CONFIG.SYS file. Alternatively, you can try to force specific drivers into desired regions of upper memory by using the /L: option for DEVICEHIGH (CONFIG.SYS) and LOADHIGH (AUTOEXEC.BAT).

The load order of PCMCIA drivers themselves should not be modified.

Example: IBM Token Ring PC Card

As an example, let's look at some typical configuration files for an IBM Token Ring PC Card on a Compaq laptop. You'll need to attack the memory problem in four steps: optimize the card's resource assignments (the IBM Token Ring adapter uses a utility called PCCARD to change the card's I/O, IRQ, and memory assignments), modify CONFIG.SYS, modify SYSTEM.INI, and modify the card services INI file (CSALLOC.INI).

Here is an example of a modified CONFIG.SYS file:

```
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM366.EXE NOEMS I=B000-B7FF X=C800-D0FF I=D100-EFFF
DEVICEHIGH=C:\DOS\SETVER.EXE
FILES=60
BUFFERS=20
DOS=HIGH,UMB
LASTDRIVE=E
FCBS=4,0
STACKS=9,256
SHELL=C:\DOS\COMMAND.COM C:\DOS\ /E:512 /p

REM *** Begin PCMCIA Drivers, DO NOT Change Order ***
DEVICEHIGH=C:\CPQDOS\SSVLSI.EXE
DEVICEHIGH=C:\CPQDOS\CS.EXE /IRQ A
DEVICE=C:\CPQDOS\CSALLOC.EXE
REM DEVICEHIGH=C:\CPQDOS\ATADRV.EXE
DEVICEHIGH=C:\CPQDOS\CARDID.EXE C:\CPQDOS\CARDID.INI
REM DEVICEHIGH=C:\CPQDOS\MEMDRV.EXE
REM DEVICEHIGH=C:\CPQDOS\DBLFLASH.EXE
REM DEVICEHIGH=C:\CPQDOS\MS-FLASH.SYS
REM *** End PCMCIA Drivers ***

DEVICEHIGH=C:\DOS\POWER.EXE
DEVICEHIGH=C:\DXM\DXMA0MOD.SYS
DEVICEHIGH=C:\DXM\DXMC0MOD.SYS ,CC00
```

And here is the corresponding SYSTEM.INI file changes:

Add the entry

```
DEVICE=C:\DOS\MONOUMB.366
```

and change the entry

```
EMMEXCLUDE=D000-DFFF
```

to

```
EMMEXCLUDE= C800-D0FF
```

This range should reflect the exclude statement on the EMM366 line in your CONFIG.SYS file.

Here is an example of modifications to the CSALLOC.INI file:

```
MEM=C800-D0FF
RIO=170-177,2E8-2EF,360- 367,3E8-3F7,3F0-3F7
IOINCLUDE=3F0-3F7
MEMEXCLUDE=B000-B7FF,C000-C7FF,D100-EFFF
```

Troubleshooting PC Card Problems

The PCMCIA represents an *interface* rather than a particular card. As a consequence, PC Card troubleshooting is rather like solving problems with any other type of bus interface (SCSI, ISA, VL, etc.). The objective is not to repair a PC Card itself, but rather to isolate a functional problem to the card, the interface itself, or some portion of the host system's driver configuration and operating system. When you determine that a PC Card is defective, your best course is to replace the card outright, or return it to the manufacturer for repair.

MANAGING PCMCIA SUPPORT IN WINDOWS

Windows 95/98 supports many PCMCIA cards, including modems, network adapters, SCSI cards, and others. If Windows includes drivers for the PCMCIA card and the socket you are using, installation and configuration should be automatic. This part of the chapter provides some guidelines for enabling enhanced PCMCIA support in Windows 95/98 when automatic detection and configuration are not available for your card. Windows 95/98 setup automatically detects the presence of a PCMCIA socket, but to enable it, you must run the PCMCIA wizard.

To enable Windows 95/98 plug-and-play support for the PCMCIA socket, run the PCMCIA wizard. The PCMCIA wizard comments out the real-mode drivers in the AUTOEXEC.BAT and CONFIG.SYS files and enables the PCMCIA socket. In some cases, Windows 95/98 disables plug-and-play PCMCIA support if there is a risk of incompatibility. Note that when Windows identifies and loads the appropriate PCMCIA driver, the computer emits a beep when the new device is configured. You can run the PCMCIA wizard using the following steps:

1. Click Start, select Settings, and then click Control Panel.
2. Double-click the PCMCIA icon and allow the process to complete.

Windows 95/98 should work with real-mode drivers, although some plug-and-play capabilities (such as automatic installation and friendly device names) will not be available.

Verify that Windows 95/98 has properly detected your PCMCIA socket:

1. Click Start, select Settings, and then click Control Panel.
2. Double-click the System icon, and then click the Device Manager tab.
3. Look for a PCMCIA Socket listing.

If Windows 95/98 has not detected a PCMCIA socket, your socket controller might not be supported by Windows 95. Determine whether a PCMCIA socket is supported:

1. Click Start, highlight Settings, and then click Control Panel.
2. Double-click the Add New Hardware icon, and then click Next.
3. Click No, then Next.
4. In the Hardware Types box, click PCMCIA Socket, and then click Next.
5. Click the appropriate manufacturer, and then examine the Models list. If your socket does not appear in the list, you should contact the manufacturer to see if new drivers are available.

Determine whether Windows 95/98 has activated enhanced PCMCIA support:

1. Click Start, highlight Settings, and then click Control Panel.
2. Double-click the System icon, and then click the Device Manager tab.
3. Double-click the PCMCIA Socket entry.
4. Click the entry for your PCMCIA controller, and then click Properties.
5. Click the General tab. If a hardware profile is selected in the Device Usage box, PCMCIA support is enabled.

If you have the correct drivers, and enhanced PCMCIA support is activated, but the device is still not available, your computer may be using the wrong memory address range for the device. Windows 95/98 selects a default set of commonly supported settings. Your socket might not support certain IRQ settings, so you may be able to get the PCMCIA socket to work by changing the IRQ setting. Similarly, the socket may not work with certain memory addresses, and changing the memory address might solve the problem. Try changing the memory address for your PCMCIA device:

1. Click Start, highlight Settings, and then click Control Panel.
2. Double-click the System icon, and then click the Device Manager tab.
3. Click the PCMCIA Socket entry, and then click Properties.
4. Click the Global Settings tab.
5. Click the Automatic Selection check box to clear it.
6. Change the start value based on information from your hardware manual. Typically, selecting a start value higher than 100,000 should work.
7. Restart Windows.

You might also change the interrupt for a PCMCIA device:

1. Click Start, highlight Settings, and then click Control Panel.
2. Double-click the System icon, and then click the Device Manager tab.
3. Double-click the PCMCIA Socket entry.
4. Click the entry for your PCMCIA controller, and then click Properties.
5. Click the Resources tab.
6. Click the Use Automatic Settings check box to clear it.
7. Double-click Interrupt Request and change the entry to a new value that does not conflict with other devices already installed on the system.
8. Click OK twice.
9. Restart Windows.

If Windows 95/98 still does not detect your PCMCIA card, you should disable the Windows 95/98 enhanced PCMCIA support:

1. Click Start, highlight Settings, and then click Control Panel.
2. Double-click the System icon, and then click the Device Manager tab.

3. Double-click the PCMCIA Socket entry.
4. Click the entry for your PCMCIA controller, and then click Properties.
5. Click the General tab, and then click the Current Hardware Profile check box to clear it.

WINDOWS 95/98 TROUBLESHOOTING GUIDELINES

When you encounter problems with PC Card configurations under Windows 95/98, you can use the following tips to help isolate the most common troubles.

Mixing Real-Mode and Protected-Mode Drivers

As a rule, you cannot use real-mode and protected-mode PCMCIA drivers at the same time under Windows 95/98. For example, if you use a real-mode driver for a PCMCIA (PC Card) device such as a CD-ROM drive, your PCMCIA card socket (and any other PCMCIA card devices) must also use real-mode drivers in Windows 95/98. You may encounter unpredictable results when mixing real- and protected-mode drivers in this fashion.

Redetect the PCMCIA Device(s)

Before you install Windows 95/98, make certain that your PCMCIA card device *works* in real mode. If you've already installed Windows 95/98, but you have not run the 32-bit PCMCIA Card Socket wizard, restart Windows directly to the command prompt using the Startup menu, and test your PC Card(s). If your PCMCIA devices work in real mode, follow these steps:

1. Restart Windows 95/98 normally.
2. Right-click the My Computer icon, and then click Properties on the menu.
3. On the Device Manager tab, double-click the device icon, click the PCMCIA device, and then click Remove.
4. Restart your computer.
5. Click Start, highlight Settings, click Control Panel, and then double-click the Add New Hardware icon.
6. Follow the Add New Hardware wizard instructions to redetect your PCMCIA hardware device(s).

Some devices do not appear in Device Manager if real-mode socket services are running (such as CD-ROM drives). If your device does not appear in Device Manager, contact your hardware manufacturer for driver or socket services updates.

Change Resources Through the Real Mode

If you use real-mode drivers for your PCMCIA card and you change its resources in Device Manager, the change does not take effect. These resources *must* be changed through the real-mode drivers and/or utilities that accompanied your particular PC Card. You may wish to check with the device manufacturer for software updates and patches that may ease real-mode resource management.

Trouble in the Real Mode

If your PCMCIA card device does not work in real mode, try restarting your computer with an earlier version of DOS, and then test your PCMCIA card again. If your PCMCIA card does not work in this configuration, the card may be defective, or the real-mode drivers are missing or damaged. You should contact

your hardware manufacturer for driver updates. If your PCMCIA card does work with an earlier version of DOS, follow these steps:

1. Start your computer by stepping through the startup files. To do this, choose Step-By-Step Confirmation from the Startup menu.
2. Answer yes to all prompts except two. Choose No when you're prompted "Process the system registry?" and choose No when you're prompted "Load the Windows graphical user interface?"
3. If your PCMCIA card still does not work, try the device on another computer. If problems persist, the card may be defective.

Enable Socket Services in the Protected Mode

To use a PCMCIA card device in protected mode, the device must be supported by Windows 95/98 (or the vendor must supply a current Windows-compliant driver). Before you attempt to use your PCMCIA card device in protected mode, you must first enable the protected-mode socket services:

1. Open the Control Panel, and then double-click the System icon.
2. On the Device Manager tab, make sure that the PCMCIA Card Socket device is listed (and that it is disabled). Disabled devices are indicated with a red *X*.
3. Open the Control Panel, and double-click the PCMCIA Card icon.
4. Follow the PCMCIA Card Socket wizard instructions.
5. Turn your computer off when you're prompted to do so. Make sure to leave your computer off for a few seconds, and then turn it back on. Do not press CTRL+ALT+DEL or use your computer's reset button to restart your computer.

Install the Protected-Mode Card Device

After the Windows protected-mode drivers for socket services are enabled, you can install your PCMCIA card device. Insert the device in the PCMCIA card socket. You can insert the device before you turn the computer on or after Windows has started. If the device is supported by Windows 95/98, Windows automatically installs the appropriate drivers and (if necessary) requests that you restart your computer. (Most PCMCIA cards do not require a restart.) If the device is not supported by Windows 95/98, Windows displays a dialog box with the prompt "Select which driver you want to install for your new hardware" and the following options:

1. Windows default driver (This option is probably unavailable.)
2. Driver from disk provided by hardware manufacturer
3. Do not install a driver (Windows will not prompt you again.)
4. Select from a list of alternate drivers

If you have a Windows driver disk from the manufacturer, click option 2. If you have information from the manufacturer that this device emulates another device that Windows 95/98 *does* support, click option 4 and select the appropriate device from the list.

Testing the Protected Mode

If your PCMCIA card device does not work in protected mode, perform the following steps:

1. Use Device Manager to remove the device, restart your computer, and then let Windows 95/98 redetect your PCMCIA hardware.

2. If your PCMCIA card is not detected and Windows 95/98 has a protected-mode driver for it, remove any EMMExclude= lines from the SYSTEM.INI file, or any exclusions on the EMM366.EXE line in the CONFIG.SYS file. Reboot your computer and let Windows 95/98 redetect your hardware. If the EMMExclude= line is the problem, you may hear one beep instead of the standard dual-tone beep when Windows 95/98 starts.
3. Force the PCMCIA card device to a specific configuration:
   - Open the Control Panel, and then double-click the System icon.
   - Click the Device Manager tab, double-click the device icon, highlight the suspect device, and then click Properties.
   - Click the Resources tab.
   - Click the Use Automatic Settings check box to clear it.
   - Click Change Setting and set the resources to the settings you want.
   - Save your changes and reboot the system if necessary.

If some of your PCMCIA card devices work while others do not, it's possible that the offending device is a *different* revision of a supported card, and that it will not work even though the driver is listed. Check with the manufacturer for an updated driver that may encompass later card revisions.

PC CARD SYMPTOMS

SYMPTOM 49-1 The SRAM or flash card loses its memory when powered down or removed from the system Since flash cards make use of advanced EEPROMs, you might wonder why batteries would be incorporated. Some flash cards use a small amount of SRAM to speed the transfer of data to or from the card. Batteries would be needed to back up the SRAM only. If your memory card does not appear to hold its memory, you should start your investigation by removing the memory card and testing its batteries. Make sure the card's batteries are inserted properly. Use your multimeter to check the battery voltage(s). Replace any memory card batteries that seem marginal or low. You should expect a two-to-five-year backup life from your memory card batteries depending on the amount of card memory—more memory results in shorter battery life. All battery contacts should be clean and bright, and contacts should make firm connections with the battery terminals.

Try a known-good card in your system. You may verify a new or known-good memory card on another computer with a compatible card slot. If another card works properly, your original memory card is probably defective and should be replaced. Under no circumstances should you actually open the card.

SYMPTOM 49-2 You are unable to access a memory card for reading, and you may not be able to write to the card either Begin troubleshooting by checking memory card compatibility. (Programmed OTPROM cards and Mask ROM cards cannot be written to.) If a memory card is not compatible with the interface used by your computer, the interface may not access the card. For example, a PCMCIA-compatible 68-pin card will probably not work in a 68-pin card slot that is not 100 percent PCMCIA compatible. Try a known-good compatible card in the suspect card slot. Also check your CONFIG.SYS or AUTOEXEC.BAT file to be sure that any required device drivers have been installed during system initialization. If you are having difficulty writing to an SRAM or flash card, take a moment and inspect the card's write-protect switch. A switch left in the "protected" position prevents new information from being written to the card. Move the switch to the "unprotected" position, and try the memory card again.

If you are having difficulty writing to EEPROM or flash EEPROM cards, check your programming voltages (Vpp1 and Vpp2). Without high-voltage pulses, new data cannot be written to such cards. Measure Vpp1 and Vpp2 with your oscilloscope with the card removed from your system. (It may be necessary to ground the card-detect lines (CD1 and CD2) to fool the host system into believing that a card is actually installed.) You will probably have to disassemble your computer's housing to gain easy access to the motherboard's card connector. If one or both programming pulses are missing during a write operation, check your power supply output(s). When high-voltage supplies are missing, troubleshoot your computer's power supply. If programming voltage(s) are present, there may be a defect in the card controller IC or board, or any discrete switching circuitry designed to produce the programming pulses. Try replacing the card controller (or motherboard).

The memory card may be inserted incorrectly. Two card-detect signals are needed from a PCMCIA-compatible card to ensure proper insertion. If the card is not inserted properly, the host system will inhibit all card activities. Remove the card and reinsert it completely. Make sure the card is straight, even, and fully inserted. Try accessing the card again.

If trouble remains, remove the card and inspect the connector on the card and inside the computer. Check for any contacts that may be loose, bent, or broken. It may be necessary to disassemble the mobile computer in order to inspect its connector, but a clear view with a small flashlight will tell you all you need to know. Connections in the computer that are damaged or extremely worn should be replaced with a new connector assembly. When a memory card connector is worn or damaged, the memory card should be replaced.

If your results are still inconclusive, try a known-good memory card in the system. Keep in mind that the new card must be fully compatible with the original one. Make sure that there are no valuable or irreplaceable files on the known-good card before you try it in a suspect system. If a known-good card works properly, then the old memory card is probably damaged and should be replaced. If a known-good card also does not work, the original card is probably working properly. Your final step is to disassemble your computer and replace the memory card controller or motherboard. A defective controller can prevent all data and control signals from reaching the card.

SYMPTOM 49-3 **You see an error message indicating that a PCMCIA card will not install or is not recognized** Chances are that one or more device drivers in the system are interfering with the offending PCMCIA card. Load your CONFIG.SYS file into an ordinary text editor and systematically edit out any other PCMCIA drivers. Try reinitializing the system after each change. Once you locate the offending driver, try reconfiguring the driver such that it will not interfere. (Maybe a new driver or patch is available.)

SYMPTOM 49-4 **Even though a desired card is installed, an error message or warning is displayed asking you to insert the card** The PCMCIA card may not be installed properly. Try removing the card, and then reinsert it carefully. The card socket may not be enabled, so the application may not be able to see it. Make sure the card socket is enabled. For most systems (such as the Canon NoteJet 486, which ships with the PCMCIA socket turned off), the solution is to get into the BIOS setup for the computer and enable the PCMCIA socket. Check the documentation for your system to find out how to get into the BIOS setup. Sometimes this feature is located in the "advanced settings" or in the "power management" area of the BIOS settings. After you have changed the settings, save the changes and restart your system. In more advanced systems (such as the Compaq Concerto), you can turn the PCMCIA socket off and on with the computer's setup utility under Windows. After changing the settings, save the changes and restart your system.

Another possibility might be that the application program interacting with the PCMCIA slot is addressing the wrong interrupt line for insertion or removal. Check for any card socket diagnostics and determine which interrupt(s) the application is trying to use for Card Status Change. Check the device driver for the card and add an explicit command-line switch to specify the desired interrupt. If an interrupt is already specified, make sure that this is the correct one.

SYMPTOM 49-5 You encounter a number of card service errors or other problems when antivirus programs are used Such errors include "Card Services Allocation Error," "Error: configuration file not found," "Error: Could Not Open Configuration File," or "Error using Card Services." Under some circumstances, an antivirus program can interfere with PCMCIA card services. The Norton antivirus program NAV&.SYS is known to cause this sort of problem if it is loaded *before* the card services software. There are typically three ways around this type of problem. First, rearrange the order of drivers called in your CONFIG.SYS file so that NAV&.SYS comes after the card services software. Second, use NAV_.SYS instead of NAV&.SYS. Although NAV_.SYS requires more space than NAV&.SYS, it coexists better with other memory-resident programs. Third, remove NAV&.SYS and use NAVTSR instead. If you are using antivirus programs, try REMarking them out of CONFIG.SYS or AUTOEXEC.BAT.

SYMPTOM 49-6 There are no pop-up displays when a PC card is inserted or removed Normally, when a card is installed or removed, a dialog box will appear indicating the card that has been inserted or removed. However, there are three reasons why the pop-ups might not display. First, the DOS pop-up function—also called a "card event manager"—is disabled under DOS (but still works under Windows). Check the card services software and make sure the proper command-line switches are set to enable the DOS pop-up. Second, there may be an upper memory area (UMA) conflict. Many card managers require 10KB or more of UMA (each). If there is no free UMA, the card manager cannot read the card's attribute memory to install the card. Make sure there is plenty of UMA space available for the card services software, and check that it loads properly. Third, the PCMCIA card may not be supported by the card services software—the two might not be fully compatible. Try a different card, or update the card services software.

SYMPTOM 49-7 The application locks up when a PC card is inserted or removed Not all applications are fully PCMCIA aware—that is, they do not recognize card insertion and removal properly. If your application crashes or locks up when a card is inserted or removed, chances are that the application is not written to handle hot insertion or removal with the card services software being used. Try inserting the card before starting the application, or close the application before removing it.

SYMPTOM 49-8 The fax/modem card works fine in DOS, but refuses to work in Windows 9x In virtually all cases, the port addresses and IRQ assigned by Windows 9x do not match the assignments the card is expecting. Go to the Control Panel, double-click on Ports, and double-click on the COM port you are assigning to your fax/modem. Then go to Advanced and check to see if the port address and IRQ match your fax/modem settings. If they don't, put in the proper settings and restart Windows 9x.

SYMPTOM 49-9 The mouse/trackball locks up or acts strangely after a fax/modem card is installed Chances are that the pointing device is sharing the same IRQ as the fax/modem card. In most cases, changing the fax/modem card IRQ assignments will correct the problem (though you may also change the pointing device IRQ instead).

SYMPTOM 49-10 My peripheral (sound card, scanner, etc.) no longer works now that the PC Card is installed This type of problem almost always indicates a hardware conflict. In most cases, the IRQ assigned to the PC Card is conflicting with the IRQ assigned to the malfunctioning device. Survey your system and determine the IRQs used by every device. You can change the IRQ of the PC Card, or change the IRQ of the other conflicting device. In either case, you'll need to restart the PC after you make those changes.

SYMPTOM 49-11 The PCMCIA CardSoft enabler software won't install You probably have a PCMCIA enabler already installed on the system. If enabler software is already installed, it may support your card. If so, you can skip the new enabler software. If not, you need to remove the current enabler software, and then install the new enabler software.

SYMPTOM 49-12 When installing a PC Card such as a fax/modem card, you find that the desired COM port or IRQ is not available In virtually all cases, the needed COM port or IRQ is being used by another device. Check for hardware conflicts, and reset the PC Card to use different resources.

SYMPTOM 49-13 You don't hear the proper number of beeps when inserting a PCMCIA card When the PC Card is inserted into a slot properly, you should hear a certain number of beeps. In most cases, this will be either one or two beeps (depending on your particular card software). If you don't hear the correct number of beeps, chances are that the card has not been inserted properly into its socket.

SYMPTOM 49-14 The card's configuration refuses to accept memory addresses (if needed) Some PC Cards require certain memory resources for proper operation. If you are prohibited from assigning those addresses to the PC Card, chances are that those memory locations are being used by another device in the system. Check for resource conflicts. You can usually resolve memory conflicts by changing the address assigned to the PC Card or the address assigned to the conflicting device.

SYMPTOM 49-15 Other programs stop working or change their behavior after the card software is installed In most cases, new DLL files installed to support the PC Card have changed shared files used by other programs. Check with the technical support for your particular PC Card maker to see if any problem files have been identified and if any updated files are available. If so, you can usually download the corrected file and copy it to the /Windows/System directory (or other suitable directory). If no corrected file is available, you will need to uninstall the PC Card and restore the original shared files from installation disks or tape backups.

SYMPTOM 49-16 When starting a client driver under Windows 9x, the message "Client registration failed" appears In most cases, the client driver is not installed, or not installed properly. In principle, you'll need to remove any traces of the client driver, then reinstall the client driver from scratch. You may also have resource conflicts that prevent the client driver from loading. For example, consider problems with Nogatech's CaptureVision 95 client driver:

1. Open the Control Panel, and then double-click on the System icon.
2. Click the Device Manager tab and select View Devices by Type.
3. If you have the line "Other Devices," and under it you see "NOGATECH NOGAVISION," do the following:

- Highlight the "NOGATECH NOGAVISION" entry and click the Remove button. Now, remove the card from your computer.
- Go to the Windows\INF directory.
- Look for an OEMx.INF file (where x can be any digit). Don't worry if you can't find any OEMx.INF files.
- Rename the file(s) to OEMx.BAK (where x is the digit).
- Look for a NOGATECH.INF file and delete the file. Don't worry if you can't find the file.
- Now go to the Windows\System directory.
- Look for any files starting with "noga" and delete them.
- Reinstall the software and start CaptureVision 95 when finished with the setup.

If you do not have the line "Unknown Device," continue with the following:

4. Double-click the line Sound, Video, and Game Controllers.
5. You should see the line Nogatech Nogavision Video Capture.
6. If you do not get this line, try to install the software once again.
7. If you see an exclamation mark in front of the line Nogatech Nogavision Video Capture, you have resource problems and the drivers have not been loaded.

SYMPTOM 49-17 The PC Card will not configure properly, and an I/O address conflict message is displayed There is a resource conflict between several PC Cards. For example, network and SCSI PC Cards often require the same I/O addresses. You will need to find available I/O space, then reconfigure one of the conflicting devices to use that available space.

Check for point enablers. Most PC Cards depend on card and socket services software, as well as generic enablers, for proper configuration. However, point enablers bypass card and socket services. If you can use a generic enabler instead of a point enabler, try removing the point enabler. As a rule, point enablers should not be used when there is more than one PC Card in the system.

Check for I/O resources using a program such as MSD (Microsoft Diagnostics), and note any regions of I/O space that are unused. If the cards provide several different "prefabricated" configurations, try each of those configurations. Chances are that one of those configurations will work on your computer. If none of the prefabricated configurations resolves the problem, you will need to manually change one of the cards to use free space available in the system. In many cases, this can be accomplished by making command-line changes to the card's enabler or client driver. Once you finish making changes, you'll need to reboot the computer for your changes to take effect.

SYMPTOM 49-18 The system hangs when card services loads First, check to see that you are only loading one copy of card services software—attempting to load a second copy can sometimes hang the system. It is also possible that the PC Card software configuration file (typically an INI file such as PCM.INI) is set up improperly. You may need to modify the configuration file to place the card services software in the "poll" mode (/POLL). Refer to the documentation that accompanied your software or system for more information on configuration modes.

SYMPTOM 49-19 You get an "Invalid command line switch" message displayed when loading services or client drivers You may be placing command-line switches in the wrong places. Traditionally, command-line switches are placed on the actual command lines in CONFIG.SYS or AUTOEXEC.BAT. For some PC Card installations, however, command-line switches must be entered in

the PC Card configuration file (an INI file such as PCM.INI). In some cases, switches must be entered in the configuration file *instead* of the actual command-line entry.

SYMPTOM 49-20 You have a Xircom Combo card (fax/modem and LAN) and cannot get it to work with standard card manager software This is typically because Xircom developed a non-PCMCIA-compliant combo card (marked "Combo Card") prior to the ratification of the new PCMCIA standards. As a consequence, the card is supported with proprietary software. You will have to install proprietary software in order to use the Xircom Combo Cards. Only cards marked "PC Card compliant multi-function cards" are supported by standard software.

SYMPTOM 49-21 You get the message "Abort, Retry, Ignore" when accessing an ATA PC Card In most cases, you are missing the client driver for your ATA PC Card (in CONFIG.SYS), or the wrong client driver is installed. You will need to install the proper client driver for your ATA PC Card, and then reboot the system and watch for the drive letter assigned to the socket.

SYMPTOM 49-22 You can't get any sound from the PC Card sound device, or you get an error message saying that it can't talk to card services As with many network cards, most PC Card sound devices have their own client driver software that configures the card. If you try to use the card with standard card management software, you will need to remove the sound device from that software, then install the PC Card-specific software *after* socket and card services (or other card management software) has been loaded.

SYMPTOM 49-23 When you insert a Practical Peripherals PractiCard 14,400bps modem (revision A) in a PCMCIA slot, the modem may not be initialized This is a hardware problem with older Practical Peripherals PC Card modems. You will need to upgrade the modem to revision B or later in order to correct the problem.

SYMPTOM 49-24 The SRAM card refuses to work In many cases, this is a software problem. SRAM cards are supported by an ATA PC Card driver. In effect, the SRAM card is treated like a drive. Make sure that the proper client driver is installed for your particular SRAM card. Also make note of the drive letter assigned to the SRAM card during system initialization. Point enablers for an SRAM card can also cause problems when other cards in the system are being supported with socket and card services or other enablers.

SYMPTOM 49-25 When you first install your PC Card software, you get the error message "No PCMCIA Controller found" In virtually all cases, the software version that you are using does not support the PCMCIA controller used in your system. You will need to contact the software maker (or the system maker) and see if an updated version or patch is available for the PC Card software. It is also possible that the system's PCMCIA controller is disabled (in CMOS), or that it is defective.

SYMPTOM 49-26 When a program attempts to identify or check the status of a PC Card modem, the program may stop responding (or cause the computer to hang) if the modem has been powered off using power management features The problem occurs when the program makes calls to the modem, but the modem had been powered off with power management features. Ideally, you should not be able to make calls to a device while it is in idle or power-down mode, but some programs allow this to happen. In turn, the program making the calls can crash, or take the system with it. This is a known problem in Microsoft's OSR2 for Windows 95. For now, the only way around the problem

is to disable power save functions on the PC Card, or shut down the offending program before allowing the PC Card to go idle.

SYMPTOM 49-27 When you eject a PC Card network adapter from a CardBus socket without stopping the card in PC Card properties, your computer may restart This is a software-related problem encountered under Windows 95. The PC Card network adapter is removed from the CardBus socket without properly notifying VMM (the software that controls the resources used by the PC Card). The software continues to "think" the PC Card is installed, even after the card is removed, and subsequent access causes the system to crash. The only work-around at this time is to stop the PC Card network adapter using the PC Card tool in your Control Panel (or the PC Card icon on the task bar) before you remove the network adapter PC Card. Windows 98 has improved PCMCIA support, but you should still consider this possibility if you experience a similar symptom.

SYMPTOM 49-28 After a multifunction PCMCIA adapter is installed, the adapter may appear as a "parent" node below a "child" node in the Windows 9x Device Manager In almost all cases, this is due to a problem during device installation. The INF file used to install the device has been processed incorrectly. Unfortunately, this is not a Windows 9x problem, but a manufacturer-specific INF file problem. Contact the PC Card manufacturer and see if there is an updated INF file or other work-around for the problem.

SYMPTOM 49-29 After a second boot with a CardBus PCMCIA controller installed in your computer, the Device Manager may display a red X for one or more PCMCIA sockets on your system Red *X*s mean that the sockets are disabled. CardBus controllers are dynamically enabled during the first boot after installation (even though they are installed disabled). On the second boot, Windows 9x recognizes that the device is disabled and reports this to the Device Manager. Enable the PCMCIA CardBus controller:

1. Open the Control Panel and double-click the System icon.
2. Click the PCMCIA controller, and then click Properties.
3. In the Device Usage box, click the "(Current)" check box to select it, and then click OK.
4. Click Close, and then restart the computer when prompted.

When Windows 9x restarts, the PCMCIA wizard runs to help you configure the PCMCIA controller. CardBus controllers must be explicitly enabled to start the PCMCIA wizard on the second boot.

SYMPTOM 49-30 After installing Windows 95 OSR2, the Device Manager may display a PCIC-compatible PCMCIA controller as a conflicting resource (an exclamation point in a yellow circle) This typically happens with CardBus PCMCIA controllers. CardBus controllers had been initialized by BIOS into the PCIC-compatible mode for backward compatibility. Unfortunately, OSR2 disables the PCIC compatibility mode in BIOS and configures the controller straight to CardBus mode. However, it neglects to remove the PCIC-compatible controller entry from your Device Manager. You will have to remove the PCIC-compatible entry from your Device Manager manually:

1. In the Device Manager, click the PCIC-compatible controller to select it.
2. Click Remove, and then select Yes.
3. Click OK to save your changes.

SYMPTOM 49-31 When using a 3COM Elnk3 PCMCIA network card and a Xircom CE2ps PCMCIA network card together on a DEC HiNote Ultra CT475 computer, the Xircom card is not recognized You'll find that the Xircom card does not appear in the Device Manager or the PCMCIA tool in your Control Panel. This is a system-specific problem that can be rectified by inserting the Xircom CE2ps card first, then inserting the 3COM Elink3 card.

SYMPTOM 49-32 When you use the Suspend command on certain Gateway laptop computers, battery power continues to drain This is a known problem with Gateway ColorBook 4SX25, ColorBook 4SX33, ColorBook 4DX33, Liberty, and Solo systems and is due to a BIOS bug. When the Suspend mode is implemented, the PCMCIA slots should receive 0.0 volts. Instead, the slots are receiving 2.5 volts. This continues to drain the battery. Upgrade the BIOS on those systems to correct the problem.

SYMPTOM 49-33 When you insert a Hayes Optima 14.4 PCMCIA modem into a PC Card socket, you hear a single (low) tone (or other indication) that the PCMCIA modem has not been recognized This is typically a modem hardware problem. Versions of the Hayes Optima PCMCIA 14.4 modem before version 2.6H do not work with Windows 9x PC Card socket services. These older modems can be easily identified by their beige color (later modems are silver). In a situation like this, there is no work-around other than to upgrade the PCMCIA modem to a later version.

SYMPTOM 49-34 When you use the Windows 95 Compression Agent with a removable PCMCIA hard disk, the Compression Agent may restart continuously at 10 percent finished This can occur if the drive is marked as "removable" in the Device Manager. Fortunately, there is a work-around:

1. In the Control Panel, double-click the System icon.
2. Click the Device Manager tab, and then double-click Disk Drives.
3. Double-click the appropriate drive to display its properties.
4. Click the Settings tab, and then click the Removable check box to clear it.
5. Click OK to save your changes, and then restart the PC when prompted.

Unfortunately, once the PCMCIA drive is no longer marked as "removable," you may no longer be able to swap drives on-the-fly.

SYMPTOM 49-35 When you start Windows 9x with a PCMCIA hard disk inserted in the computer's PCMCIA slot, the hard disk seems to be recognized, but may not be available in Windows 9x This is a problem with Windows 9x that can occur if your computer does not have an IDE hard disk controller installed. If there is no IDE hard disk controller installed, the PCMCIA hard disk is assigned IDE port 1F0h. Since this port is normally associated with the primary hard disk controller, Windows 9x treats it differently from other IDE ports and does not assign it a drive letter. To get around this problem, remove the PCMCIA hard disk after Windows 9x starts, and then insert the disk into the PCMCIA slot again.

SYMPTOM 49-36 When you start Windows 9x with a PCMCIA hard disk inserted in the computer's PCMCIA slot, the hard disk seems to be recognized, but may not be available in Windows 9x When you insert a PCMCIA disk drive into a PCMCIA slot, your computer beeps (indicating that the PCMCIA card is recognized), but the disk drive is unavailable in Windows 9x. This is

often due to a hardware conflict. The PCMCIA disk controller may be configured to use I/O ports 170–177, and your computer may use the same ports for other purposes. Check the resource settings in Device Manager. If the PCMCIA disk controller is using ports 170–177, you can try reserving I/O ports 170–177 (forcing Windows 9x to configure the PCMCIA disk controller at another I/O address):

1. In the Control Panel, double-click the System icon.
2. On the Device Manager tab, click Properties.
3. On the Reserve Resources tab, click the Input/Output (I/O) option button, and then click Add.
4. In the Start Value box, enter **170**.
5. In the End Value box, enter **177**.
6. Click OK to save your changes.
7. Restart the computer.

As an alternative, try disabling any secondary disk controller that uses I/O ports 170–177 in the computer's CMOS settings.

SYMPTOM 49-37 When you attempt to dial under Windows 9x using an Integrated Services Digital Network (ISDN) connection, your computer may hang This is a hardware-specific problem that has been known to occur with Eicon PCMCIA ISDN adapters. The hardware version of the adapter does not support dialing under Windows 9x properly. Unfortunately, you will have to correct this hardware problem by updating to a new ISDN adapter.

SYMPTOM 49-38 When you try to send a fax from a cellular phone using Microsoft Exchange and a Motorola Power 14.4 PCMCIA modem, your fax feature may not work This is a problem with Microsoft Exchange. The default initialization string sent to the modem from Microsoft Exchange initializes the modem for noncellular calls only (regardless of the status of the Use Cellular Protocol option in Modems properties). You will need to edit your Windows 9x registry with REGEDIT.EXE to correct the problem.

Altering registry values can have devastating effects on your Windows 9x system. Always make a backup copy of the registry files (SYSTEM.DAT and USER.DAT) before starting your edit.

The following registry key contains the initialization strings for installed modems (where <xxxx> is the modem ID number). To determine which ID is the correct modem, see the DriverDesc key.

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Class\Modem\<xxxx>\Init
```

Use the following value to use the modem with a cellular phone:

```
"2"="AT&F1&D2&C1\\V1S0=0E0V1<cr>"
```

To return the initialization string to normal (land use), change the key to:

```
"2"="AT&F&D2&C1\\V1S0=0E0V1<cr>"
```

You can reset these values to their default values by removing the modem in Device Manager and then reinstalling it.

SYMPTOM 49-39 When you run Windows 9x on a Dell Latitude XP Notebook computer with a port replicator, PC Card services may not be available There will probably be no listing for the PC Card socket in the Device Manager, and the PC Card icon may be missing in your Control Panel. The Dell port replicator is fitted with a SCSI adapter, but by default, both the PC Card socket and the SCSI port use the same IRQ (often IRQ 11). You will have to change the setting for the PC Card socket:

1. Detach the port replicator from the computer, and then use the Add New Hardware wizard in your Control Panel to search for new hardware.
2. After the PC Card socket is detected and installed, restart the computer when you are prompted to do so.
3. In Control Panel, double-click the System icon, and then click the Device Manager tab.
4. Double-click the PCMCIA Socket entry, double-click the PCMCIA controller, and then click the Resources tab.
5. Click the Use Automatic Settings check box to clear it, click Interrupt Request, and then click Change Settings.
6. In the Value box, click an available IRQ setting.
7. Click OK to save your changes.
8. Shut down Windows 9x, and then turn your computer off and back on (cold boot).
9. Reattach the port replicator unit.

SYMPTOM 49-40 When you try to undock a laptop computer with a PCMCIA card installed in a Databook PCMCIA controller socket, you may receive the following error message: "The computer failed to undock" This is generally a problem where the PC Card adapter is interfering with the docking port adapter. The only known work-around to this problem is to remove all PC Cards from their sockets before undocking the mobile computer. Afterward, the Eject command on your Start menu should work correctly.

SYMPTOM 49-41 When you insert a PCMCIA SRAM or flash memory card into a Windows 9x computer that has been configured to use protected-mode PCMCIA card drivers, there may be no drive letter in My Computer or Windows Explorer associated with the PCMCIA card This can occur even though the card seems to be recognized properly and the appropriate driver appears to be installed. The problem is often that while the drivers may be installed, they are not installed correctly. The protected-mode drivers for SRAM and flash PC Cards must be installed differently from drivers for other cards. To install a PCMCIA SRAM card in Windows 9x, you must place one or more entries in the CONFIG.SYS file, such as,

```
device=c:\<windows>\system\csmapper.sys
device=c:\<windows>\system\carddrv.exe /slot=<x>
```

where <windows> is the Windows folder and <x> indicates the number of PCMCIA card slots in the computer. To install a PCMCIA flash memory card in Windows 9x, you must also place some driver entries in CONFIG.SYS, such as,

```
device=c:\<windows>\system\csmapper.sys
device=c:\<windows>\system\carddrv.exe /slot=<x>
device=c:\<windows>\ms-flash.sys
```

where <windows> is the Windows folder and <x> indicates the number of PCMCIA slots in the computer.

Not all SRAM and flash card drivers are included with Windows 9x. In many cases, you will need to use drivers provided with the particular cards.

If you use only protected-mode drivers for SRAM and flash cards, you will not have access to the cards if you boot your computer to a command prompt.

SYMPTOM 49-42 **You are logged on without a password** When you remove a plug-and-play network adapter in Device Manager and then restart your computer, the network adapter is redetected, and you are logged on to the network and validated by a Microsoft Windows NT server without entering a password. This problem also manifests itself when you remove a PCMCIA network adapter from the PCMCIA socket in your computer, restart your computer, and then reinsert the PCMCIA network adapter. You are logged on to the network and validated by a Windows NT server without entering a password. This can occur under three circumstances: you have a null Windows password, password caching is enabled, or user profiles are enabled.

To correct these problems, configure Windows 9x so that your Windows password is not null, or use the System Policy Editor to disable password caching. To configure Windows 9x so that your Windows password is not null, follow these steps:

1. In the Control Panel, double-click on Passwords.
2. Click Change Windows Password.
3. If you want your network password to be the same as your Windows password, click the Microsoft Networking check box to select it, and then click OK. If you do not want your network password to be the same as your Windows password, verify that the Microsoft Networking check box is *not* selected, and then click OK.
4. Type your new password in the New Password and Confirm New Password boxes, and then click OK.

Use the following steps to edit the registry with System Policy Editor and disable password caching in Windows 9x:

1. Click the Start button, and then click Run.
2. Type **POLEDIT** in the Open box, and then click OK.
3. On the File menu, click Open Registry, and then double-click Local Computer.
4. Click the plus sign (+) next to Network, and then click the plus sign next to Passwords.
5. Click the Disable Password Caching check box to select it, and then click OK.
6. Save the changes to the registry, exit the System Policy Editor, and then restart Windows 9x.

SYMPTOM 49-43 **You have trouble with incompatible NDIS driver versions** When you are using a portable computer with a PCMCIA network adapter that uses NDIS 2.0 (16-bit) drivers, the computer may stop responding (hang) or reboot when you try to start it while it is not docked in its docking station *if* the docking station contains a network card that is capable of using NDIS 3.x (32-bit) network adapter drivers. This happens because Windows 9x detects the NDIS 2.0 drivers for the PCMCIA network adapter and forces the loading of NDIS 2.0 drivers for the other network adapter (which is not currently present because the computer is undocked). Because one of the network adapters is

not present, an incomplete binding occurs, which can cause the computer to hang or reboot. To enable Windows 9x to start whether the computer is docked or undocked, create a multiple-boot configuration.

Before you attempt to create a multiboot configuration, make sure you have a docked state that requires an NDIS 3.x driver to be loaded and an undocked state that requires an NDIS 2.0 driver to be loaded (or vice versa).

SYMPTOM 49-44 You can't set up the PCMCIA slot in an AT&T Globalyst 130 laptop

This is because the Globalyst 130 requires an unusual PCMCIA card setup compared to other Globalyst laptops. The AT&T Globalyst 130 does not have any options in the BIOS for enabling/disabling the PCMCIA socket services on the laptop. Instead, the socket must be enabled by loading the device driver, SS365SL.EXE, in the CONFIG.SYS file. This file is a socket enabler and must be loaded so that protected-mode socket services can initialize in Windows 9x. Without this file, the PCMCIA socket services are disabled.

SYMPTOM 49-45 When you are using a Motorola Power 14.4 Cellular Modem with Windows 9x, you may not be able to dial the second time you try to use the modem

The initialization string used for this modem in Windows 9x enables a "dial suffix" (also known as "staged dialing"), which enables transmission of tones after the connection has been made without breaking the connection. This feature is often used in such applications as electronic banking. With staged dialing enabled, you must remove and reinsert the PC Card modem each time you want to dial. You can disable staged dialing by editing the MDMMOTO.INF file:

1. Use any text editor to open the MDMMOTO.INF file in the Windows\Inf folder. (Note that this is a hidden folder.)
2. Add the following line to the end of the [Modem16.AddReg] section of the file:

   ```
   HKR, Settings, DialSuffix,, ""
   ```

3. Save and then close the file.
4. Remove the Motorola Power 14.4 modem using the Modems tool in Control Panel.
5. Remove and reinsert the modem.

Be sure to make a backup of the INF file before beginning your edit.

SYMPTOM 49-46 A PCMCIA Token Ring network adapter refuses to work in the computer This type of problem can occur when the following combination of conditions exists. First, the Token Ring network adapter uses an address range of A20h–A2Fh. Second, the PC has a sound board or other device in the address range of 220h–22Fh. And third, only the ten least significant digits are used to resolve I/O addresses. Since the Windows 95 I/O arbitrator only pays attention to the first 10 bits of any I/O allocation, devices that have I/O allocations that conflict in a 10-bit decode are registered by the system as having an I/O address conflict. As a consequence, this is a problem with Windows 95. You can work around this problem by manually configuring both devices:

1. In the Control Panel, double-click the System icon.
2. On the Device Manager tab, double-click "IBM Token-Ring Credit Card Adapter II or compatibles."

3. Click the Resources tab and note the resources the network adapter is using. To change a resource, click the Use Automatic Settings check box to clear it, click the resource, and then click Change Setting.
4. Change the Interrupt Request (IRQ) setting so that it does not conflict with the IRQ used by any other device.
5. Change the first memory range to **D4000-D5FFF**. Change the second memory range to **E0000-EFFFF**.

If these values continue to conflict with other devices, you may have to use different values.

6. Click OK to save those resource changes.
7. Double-click Sound, Video, and Game Controllers, and then double-click the sound card or the conflicting device.
8. Make sure that the Use Automatic Settings check box is clear.
9. Click OK and return to the Control Panel.
10. Restart the computer.

SYMPTOM 49-47 You restart the computer improperly after installing PCMCIA drivers After you run the PCMCIA wizard to install protected-mode socket services for a PC Card, you are instructed to shut down Windows 9x and then turn your computer off and back on. If you restart your computer by pressing CTRL+ALT+DEL *instead* of turning the computer off and back on, you may receive an error message stating that the PCMCIA drivers are not working correctly. The problem is that the protected-mode drivers for the PCMCIA controller may not initialize correctly when you perform a warm boot because the real-mode drivers still have control of the device. Correct the problem by performing a cold reboot of the system.

Here's a little twist—some computer systems don't reset the PC Card socket controller when they are restarted using the CTRL+ALT+DEL key sequence. Any configured PC Cards installed when the system is restarted may be incorrectly detected by the system's BIOS as peripherals that reside on the motherboard (or in an adapter board installed in an expansion bus). The BIOS then believes it should handle the operation of these peripherals—creating a conflict with the CardWare software. This situation may often be corrected by updating the system's BIOS. When a computer manufacturer realizes that the BIOS fails to reset the socket controller hardware, they typically release a BIOS update that fixes this problem. Until an updated BIOS is available, there are two possible solutions:

- Remove all installed PC Cards before restarting your system with the CTRL+ALT+DEL key sequence.
- Restart your system by cycling the power off and then back on. (Most computers have a Reset button that safely cycles power in such a manner.)

SYMPTOM 49-48 In System Agent, the Last Result column for a ScanDisk task may report "Check was stopped because of an error" However, the SCANDISK.LOG file does not list any errors, and you do not encounter any errors if you run ScanDisk manually. This problem may be caused by an invalid drive in ScanDisk's DrivesToCheck registry setting. The setting can become invalid if a drive that existed when the ScanDisk task was created is subsequently removed. For example, this problem can occur when you remove a PCMCIA drive, uncompress or unmount a compressed drive,

or remove a laptop computer from its docking station. The way around this problem is to delete the existing ScanDisk task and schedule a new task—or run ScanDisk manually.

SYMPTOM 49-49 When you start Windows 9x on a Zenith ZDS 1762 laptop computer, the computer may stop responding (hang) while Windows 9x is running the CONFIG.SYS file This problem occurs if PCENABLE.EXE (Zenith's PCMCIA driver) is loaded before MZTINIT.SYS (Zenith's Mozart sound system driver) in the CONFIG.SYS file. When this occurs, PCENABLE.EXE installs a hook for IRQ 7, which MZTINIT.SYS also tries to use. Edit the CONFIG.SYS file and move the Mozart sound driver above any PC Card drivers. Save your changes, and then restart the computer.

SYMPTOM 49-50 When you use the Suspend feature on a Dell Latitude XP laptop computer connected to a port replicator, your PCMCIA devices may not reactivate when you exit the Suspend mode This problem can occur with BIOS version A05 or earlier. BIOS versions A05 and earlier do not send an Advanced Power Management (APM) "resume" event to reactivate PCMCIA devices when the computer is connected to a port replicator. You may avoid this problem by not using the Suspend feature while the laptop is connected to a port replicator. To resolve the problem on a more permanent basis, you will need to update the laptop's BIOS version.

SYMPTOM 49-51 You have trouble using similar cards simultaneously For example, if you start Windows 9x with one Xircom PCMCIA network card inserted in the computer, the card works correctly until you insert a second Xircom PCMCIA network card. When you insert the second card, the second card works correctly and the first stops working. If you remove and reinsert the first card, it works correctly and the second card stops working. This happens because both cards have the same PCMCIA ID but different checksums. The cards both appear to be the *same* card to Windows 9x, so Windows 9x switches system resources from one card to the other. Ultimately, if you must run two network cards at the same time, they cannot both be Xircom network cards.

SYMPTOM 49-52 The Zenith Zplayer PCMCIA CD-ROM adapter does not function correctly using Windows 95 32-bit drivers In virtually all cases, the 32-bit PCMCIA drivers included with Windows 95 are not compatible with the Zenith Zplayer PCMCIA adapter. You will need to disable the 32-bit PCMCIA drivers:

1. In the Control Panel, double-click the System icon.
2. On the Device Manager tab, double-click the PCMCIA adapter.
3. Click the check box for the current configuration to clear it.
4. Click OK or Close until you return to Control Panel, and then restart your computer.
5. To use the PCMCIA adapter with real-mode drivers, use the installation program included with the adapter.

Do not run the PCMCIA wizard to install the 32-bit PCMCIA drivers.

SYMPTOM 49-53 On a computer with only one PCMCIA socket, Windows 9x cannot set up a new PCMCIA card if the original PCMCIA card is being used to access the Windows 9x source files If you remove the PCMCIA card that is providing access to Windows 9x source files in order to set up a new card, Windows 9x cannot access the source files. When you are prompted to provide the source files, you cannot remove the new card and insert the original card because

Windows 9x does not detect the removal and insertion of PCMCIA cards during the configuration of the new card. To get around this problem, use the Add New Hardware wizard to manually install the new PCMCIA card. This process preinstalls the necessary driver files so that you can set up the new card without accessing Windows 9x source files.

SYMPTOM 49-54 You cannot format an SRAM card using the Windows 9x graphical user interface because the Full and Quick format options are not available In almost all cases, there is a problem with the device driver for the SRAM card. The device driver is probably returning device parameters for a 128KB SRAM card regardless of what card is actually inserted in the PC Card slot. You will need to contact the SRAM card maker to obtain an updated driver that corrects the problem.

SYMPTOM 49-55 After you dock or undock a Compaq Elite laptop computer, the computer's PCMCIA devices may stop working Also, multiple disabled PCMCIA controllers may appear in Device Manager. This is a problem with early versions of Compaq Elite PnP BIOS. Some versions report incorrect PCMCIA resources. When this happens, Windows 9x disables the PCMCIA controller. To correct this problem on a permanent basis, you'll need to update the Compaq BIOS with a current version (5/95 or later). To remove incorrect PCMCIA devices in the meantime:

1. In the Control Panel, double-click the System icon.
2. On the Device Manager tab, click each PCMCIA device, and then click Remove. (Remove all the PCMCIA devices.)
3. Click Computer, and then click Refresh. (This will redetect the correct PCMCIA device.)
4. Click OK to save your changes.

SYMPTOM 49-56 When you set up Windows 9x, it will not install more than one PCMCIA network adapter correctly This is because the Windows 9x 32-bit socket drivers are not enabled. To install the Windows 9x 32-bit PCMCIA socket drivers:

1. Double-click on My Computer.
2. Double-click the Control Panel.
3. Start the 32-bit PCMCIA wizard, and follow the instructions on the screen.

Windows 9x is specifically designed to detect and install only one PCMCIA network card during setup.

SYMPTOM 49-57 When you try to connect to a network using an IBM Token Ring PCMCIA network card on an Omnibook 600 computer, you are unable to view any resources There is a resource conflict between the Omnibook's proprietary PCMCIA controller and the IBM Token Ring PCMCIA network card. The Omnibook's proprietary PCMCIA controller supports I/O ranges up to 3FFh. The IBM Token Ring PCMCIA network card can only reside at I/O address A20h. There is no solution to this problem. The IBM Token Ring PCMCIA network card cannot be used on an Omnibook 600 computer.

SYMPTOM 49-58 When you run ScanDisk, the "Select the drive you want to check for errors" box may show drives that do not exist, or may not show drives that do exist In most cases, you have removed or inserted an ATA PC Card. Unfortunately, the drive list in ScanDisk is static. That list is generated when you start ScanDisk, and it is not updated while ScanDisk is running. If

you add or remove drives (such as PCMCIA drives or DriveSpace-compressed drives) while ScanDisk is running, the list is not updated to reflect the changes. You must update the drive list by exiting and then restarting ScanDisk.

SYMPTOM 49-59 When you insert a Xircom CE2 PCMCIA network adapter card, the card may not work and the computer may not be connected to the network When this occurs, your computer may stop responding. The network adapter may require a real-mode enabler or different client drivers to work properly. To correct this problem, load the real-mode card and socket services drivers in the CONFIG.SYS file. The actual drivers that are required vary from one system to another, but they typically look like this:

```
device=cs.exe
device=sscirrus.exe
```

SYMPTOM 49-60 PCMCIA cards are not configuring properly on your Compaq computer In many cases, you have an outdated or buggy BIOS in the system. You can usually correct this kind of problem by updating the BIOS version.

SYMPTOM 49-61 When the system boots, you see the error message "Divide Overflow" before entering Windows 9x—this forces you to boot Windows 9x in Safe Mode The drivers installed for the PCMCIA card are obsolete or otherwise incompatible with Windows 9x. You will need to disable those real-mode drivers in CONFIG.SYS and AUTOEXEC.BAT and, ultimately, install the current drivers for Windows 9x.

SYMPTOM 49-62 Your PC Card client drivers refuse to load, and an error message appears when starting Windows 9x In most cases you have real-mode PCMCIA drivers starting in CONFIG.SYS and AUTOEXEC.BAT that are causing problems for Windows 9x. Try disabling those real-mode PC Card drivers in CONFIG.SYS and AUTOEXEC.BAT first. Turn off the PC and remove the PC Card. Boot to Windows 9x normally, and then insert the card. You may need to run the PCMCIA wizard to install the proper card drivers. You may also need to download the latest protected-mode drivers from the PC Card maker, then install the new drivers with the "Have Disk" option.

SYMPTOM 49-63 PCMCIA cards are not configuring properly on IBM Thinkpads This is because you must first run a specific IBM utility to update the BIOS on IBM Thinkpads. Install IBM WIN95SETUP *before* installing Windows 95. This utility updates the BIOS, which has several plug-and-play fixes. This utility can be obtained from **www.pc.ibm.com** or IBM's BBS. You can then install Windows 95 and proceed to reinstall your PCMCIA cards.

SYMPTOM 49-64 The computer produces a single low beep when the PCMCIA card is inserted, but the PC Card icon will show no information about the socket, and the "stop" feature shows the error that a "Device Cannot Be Removed" In almost all cases, the PC Card has not been assigned the proper memory exclusion and is experiencing a memory conflict with another device in the system. Go into the Control Panel, and then select the PC Card icon. Choose Global Settings and make sure that the "Automatic setting" check box is checked. Then restart Windows 9x. This should clear the problem.

SYMPTOM 49-65 **Windows 9x does not recognize the parameters of the PCMCIA Note Disk** You will have to perform a hard disk drive setup for an unformatted drive. Before proceeding, be sure to back up any vital information on the PC Card disk—it will be erased.

1. Choose My Computer and select the Control Panel icon.
2. Choose the System icon and select the Device Manager tab.
3. Select Disk Drives, and then choose the Settings tab.
4. Select Int. 13 unit.
5. Save your changes, and restart the system when prompted.
6. When Windows 9x has fully rebooted, choose Start, then Run.
7. Type **FDISK**, and choose OK.
8. When you start FDISK, make sure to choose DISK 2 before partitioning the drive.
9. Create partition(s) as required.
10. Repeat the first four steps and remove the check mark from Int. 13 unit.
11. Save your changes, and restart the system when prompted.
12. When Windows 9x is fully rebooted, choose My Computer.
13. Click the right mouse button on the D: drive, and then select Format.
14. After formatting the drive, run ScanDisk.

The PCMCIA disk should now be ready for use.

Further Study

PC Card Frame Grabbers: **http://www.ct-oy.com/artsi/pcmcia.html**

PC Card newsgroup: **alt.periphs.pcmcia**

PC Card suppliers: **http://www.apresearch.com/databaselist.htm**

PCMCIA: **http://www.pc-card.com/**

PC Card Support Group: **http://fortezza-support.com/index.html**

Making Sense of PCMCIA: **http://www.execpc.com/~sunfish/pcmcia/**

PC Card FAQ: **http://www.rdrop.com/~cary/html/pc_card_faq.html**