Expanding on the PC

A survey of expansion boards for the IBM Personal Computer

by Mark J. Welch

Both the IBM Personal Computer and PC compatibles offer many features computer users want, but no one system can please everybody. Rather than try to predict which features most users will want and include those under the basic machine price, the PC and many PC compatibles include expansion slots. The result is a lower price for the basic machine plus greater flexibility for users who want to customize configurations to meet their needs.

Expansion slots, made famous by the Apple II, let you install printed-circuit boards to perform functions not provided by the computer's standard hardware.

Some of the add-on boards—disk-drive controllers, memory-expansion boards, and printer and communications interfaces—appeal to large numbers of computer buyers. Other boards—for prototyping, programming EPROMs (erasable programmable read-only memory chips), or converting analog signals for storage by the computer—target a much smaller percentage of PC and PC-compatible owners. Still, with these machines fast approaching the mark of 1 million units sold, a small percentage represents a very large number of users. Obviously, a substantial market for expansion boards, including dozens with distinct functions, exists.

Tables on the following pages provide detailed information about expansion boards produced by 107 different manufacturers. The tables organize the boards by their functions and list entries in alphabetical order by manufacturer within each category. (The exception is table 17, which lists miscellaneous boards alphabetically by function.) A separate listing of manufacturers' addresses begins on page 178.

Some expansion boards defy a simple description or are so unlike other boards that we couldn't include them in our survey listing. For example, Quadram Corp. offers a unique expansion board that enables the IBM Personal Computer to emulate an Apple computer. The $680 Quadlink board includes a 6502 processor and 64K bytes of RAM and can run most Apple II or II Plus software. According to Quadram, users can run programs concurrently in Apple and IBM modes, switching between the two at any time.

Quadlink won't run software written exclusively for the Apple IIe or software that uses a "half-track" copy-protect scheme, but it will run most other Apple software, including high-resolution graphics. Quadlink includes a game port that can be used in either IBM or Apple mode and can access other ports and expansion boards in the IBM PC.

The Futurex Encryptor, from Jones Futurex Inc., is a data-encryption board. The board encrypts, or translates, data into special codes that can be translated only by the Encryptor board. Data can thus be hidden from unauthorized users or can be transmitted to another IBM PC equipped with the board without risk of eavesdropping. Five versions of the Encryptor, ranging from $300 to $600, are available for the IBM PC.

Modular Expansion Boards

Two expansion-board suppliers let you choose any combination of features and upgrade already purchased boards by selling modular ex-

pansion boards. The boards plug into a standard expansion slot, and modules that perform particular functions then plug into the boards.

Maynard Electronics' Sandstar Multifunction card, with room for up to six modules, costs $110. The Sandstar Memory card, with room for up to 576K bytes of RAM (random-access read/write memory) and three modules, sells for $230. The Sandstar Disk Controller Card, for $265, includes either two 5¼-inch and two 8-inch disk-drive controllers or four 5¼-inch controllers, plus room for three modules. A clock/calendar module costs $85 more. Other available modules are a parallel port ($75), a serial port ($105), and a game adapter ($60).

Arby's Combination Board costs $110 and can be expanded with a $90 clock/calendar module, a $105 serial-port module, and a $75 parallel-port module, allowing up to six modules in all.

Take time to consider what you want from your IBM PC, and then carefully research the available products to determine which ones best meet your requirements. The information given here should get you started. With luck, you may find that the PC of your dreams is just an expansion board away.■

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A Key to the Tables

Because the tables accompanying this article cover a number of boards and their characteristics, some items are necessarily abbreviated. The following explanations of column headings and comments are therefore provided to help you get the most information from the tables.

A/D Lines: *How many analog-to-digital conversion lines are on the board, if any?*

Board Name: *Some expansion boards may have more than one name, while others may use the same name for several variations of the same board.*

Clock: *A clock/calendar with battery backup is on the board.*

D/A Lines: *How many digital-to-analog conversion lines are on the board, if any?*

Digital I/O Lines: *If the board can be used for special input/output functions, how many single-bit lines can be connected? These I/O lines can be used to transfer single-bit (on or off) information or to transmit or receive bytes of information in parallel.*

E/EPROM Capability: *The board can be used to program EPROMs or EEPROMs.*

Game Port: *A standard game controller port is included.*

IEEE-488 Interface Included: *A standard IEEE-488 port—also known as a GPIB (general-purpose interface bus) port—is included.*

Manufacturer's Name: *Addresses are in a separate list beginning on page 178.*

Modem Included: *A modem is included on the board.*

N.A.: *Information was not available.*

Parallel Ports: *How many standard Centronics-type parallel printer ports are there on the board, if any?*

Price: *Manufacturer's suggested retail price for the board with the options and memory indicated. Although prices are listed for boards with 64K, 128K, 192K, 256K, 512K, and 1024K bytes of memory, some boards are available in other configurations (usually multiples of 64K).*

Print Spooler: *Software is included permitting part of the memory to be used as a print buffer.*

Prototyping: *The board can be used to design and revise prototype versions of an expansion board. This is useful for creating boards with features not available from any company or for trying sample layouts of a board you plan to mass-produce and sell.*

Prototype Size: *The size of the expansion board, usually about 13 by 4 inches. Some boards are smaller to save money or to fit into the PC XT's smaller slots.*

RAM Disk: *Software is included (at no extra charge) permitting the extra memory to be used as if it were a disk drive.*

Serial Ports: *How many RS-232C serial interface ports (for printers, modems, and other communications uses) are included on the board?*

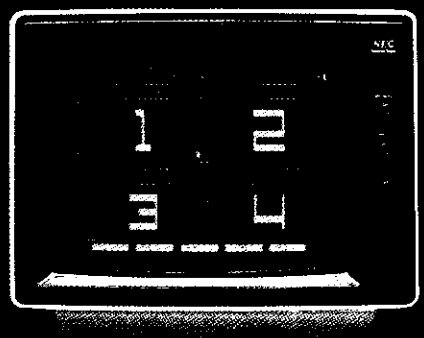
Manufacturer	Board Name	Serial Port	Parallel Port	Price	Comments
Automated Business Machines	CP/M-80 Adapter			$545	
Byad	DS2	1		$760	CP/M included
Byad	DS1			$660	CP/M included
California Computer Systems	Z/Plus	1		$875	CP/M 2.2 included; with 192K bytes, $995
Gateway Communications	PC-LNIM			$595	allows CP/M or networking
Microdisk	1-DOS			$850	allows CP/M to run under PC-DOS; has print-spooler capability
Microlog	Baby Blue			$600	has RAM-disk capability
Personal Data Systems	Pack-Z80	1		$450	
Quality Computer Services	Big Blue	1	1	$595	has a clock

Table 1: *Z80 coprocessors (all include 64K bytes of RAM). The Z80 replaces the PC's standard 8088 processor as the central processor, letting you use both CP/M-80 software, which runs on the Z80, and standard IBM PC software, which runs on the 8088. Be sure to find out whether buying a particular board gets you the CP/M operating system or merely lets you use CP/M-based software.*

Manufacturer	Board Name	RAM Disk	Print Spooler	0K-byte Price	32K-byte Price	64K-byte Price	128K-byte Price
AST Research	MP Series Memory Expansion	•	•			$295	$395
Alpha Byte Computer Products	Memory Expansion						
Apparat	Memory Card	•				$189	
Applied Business Computer	Mega Board AI-1512					$295	$385
Apstek	AIM-256			$199		$269	$339
Arby	Expansion Memory			$230		$295	
Automated Business Machines	Memory Expansion Modules					$329	
Bitstream	Memory Boards			$129		$169	$229
Chintronics	M-192 Memory						
Computer Technology Innovations	IRM Memory Boards					$199	$299
Datamac Computer Systems	DM Memory Expansion Boards					$395	$590
Davong Systems	DSI Memory Boards					$265	$408
Daystar Systems	UltraRAM						
Hammond Computer Products	PC/RAM Stack						
Hammond Computer Products	PC/RAM Pack					$495	
IDE Associates	IDEA Memory Card					$245	$320
IBM	32K Memory Expansion				$325		
Intermedia Systems	Memory Expansion Modules						
Macrolink	Memory Board					$375	$475
Maynard Electronics	MEM Memory Expansion Modules			$210		$305	$410
Memory Technologies	Versa-RAM	•	•	$259		$339	$419
Micro Express	Memory Boards					$299	$450
Micro Match	MM64 Memory Expansion Boards					$145	$200
Micro Network	High Density Memory						
Micro Synergy	Pro Series RAM			$195		$275	$350
Microlog	L'il Red RAM Plus	•				$249	$299
Microsoft	RAMCard	•				$495	$695
Microtek	HAL Series	•	•			$299	
PC²	MEM Memory Boards						
Professional Data Systems	Memory Boards					$189	$289
Pure Data	Memory Expansion RAM Card						
Quadram	Memory Expansion Board					$275	
RGB Systems	Mile RAM					$650	$720
RGB Systems	Error-Correcting RAM						
Raytronics	Fleximem			$229			
STB Systems	I 64/192		•			$294	
Semidisk System	Semidisk I						
Semidisk System	Semidisk II	•					
Sigma Designs	Memory Boards					$295	$445
Sigma Designs	SDI64					$150	
Tecmar	RAM/ROM Board			$195			
Tecmar	Forget-Me-Not CMOS				$995		
Tecmar	Dynamic Memory					$289	$369
VR Data Corp.	IBM PC RAM			$699		$799	$899
Vista Computer	Maxicard	•				$349	$449
Wesper Microsystems	Wizard PC Memory Card			$250		$322	$545
Zobek	Memory Board						
Personal Data Systems	Pack-RAM					$225	$335
Tall Tree Systems	JRAM	•	•				
Super Computer	Supermemory					$295	

Table 2: *Memory boards. Although most IBM PCs contain 64K bytes of RAM, many popular applications programs require more memory. The solution comes from memory-expansion boards available with 64K to 1024K bytes (1 megabyte) of RAM, usually in multiples of 64K.*

192K-byte Price	256K-byte Price	384K-byte Price	512K-byte Price	1024K-byte Price	Comments
$495	$595				
	$345		$579		
$475	$565	$745	$925		
$409	$479				
	$745				
$289	$349				
$259					
$399	$449				
$785	$980				
$552	$696				
	$695		$895		
			$1195		
	$995				
$385	$445				
	$299				
$575	$675				
$510	$615				
$499	$579	$739	$899		
	$750				
$255	$305				
		$400			
$425	$525		$825		
$349	$399				
$895	$1095				
	$799				
	$499		$799		
	$529				
$425					
$790	$860				
$999					error-correcting capability
					EPROM capability
$470					error-correcting capability
			$1495	$2350	
			$1795	$2650	
$595	$695				
					EPROM capability
					battery backup
$439	$489				
$999					error-correcting capability
$549	$649	$849	$1049		
$695	$845				
	$335				
$445					
			$800		
					EPROM capability



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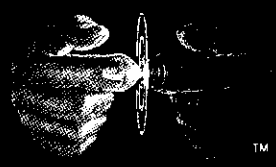

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Manufacturer	Board Name	Price	8-inch-disk Interface	5¼-inch-disk Interface	Comments
Arby	Disk Adapter	$275		•	
Arby	Disk Adapter	$395	•		includes parallel port
Computer Technology Innovations	IC5/8C	$175	•	•	
Maynard Electronics	Floppy Drive Controller	$275		•	includes parallel port
Maynard Electronics	Floppy Drive Controller	$285		•	includes serial port
Paso Com	Professional IV Series	$495	•	•	also includes hard-disk interface
Sigma Designs	Disk Drive Adapter	$265		•	includes clock
Tecmar	Floppy 5/8 Adapter	$495	•	•	
Vista Computer	Disk Master	$299	•	•	also includes 3½-inch-disk interface

Table 3: *Disk-drive controllers. If you use a disk drive, you need a disk-drive controller.*

Manufacturer	Board Name	Serial Ports	Parallel Ports	Price	Comments
Control Systems	Serial/Parallel Interface	2	2	$300	4 PROM sockets
Jack Strick & Associates	Parallel/Serial Controller	1	1	$225	
Paso Com	Professional III Series	1	1	$495	
Paso Com	Professional II Series	1		$159	has game port and clock
Tecmar	Scribe Tender	2	1	$195	
Tecmar	2nd Mate	2	2	$295	
Tecmar	Scribe Master	3		$495	24 digital I/O lines

Table 4: *Multiple interface boards such as these offer both parallel and serial ports (see tables 6 and 13).*

Manufacturer	Board Name	Memory (bytes)	Parallel Ports	Color	Price	Comments
California Computer Systems	Supervision	N.A.			$800	132 by 44 text format on monochrome display
Conographic	Cono Color	128K		•	$895	16 colors in 640- by 400-pixel format
Control Systems	Artist I	512K		•	$3195	1024- by 1024-pixel format
Control Systems	Artist II	512K		•	$1595	640 by 400 pixels
Hercules Computer Technology	Graphics Card	64K			$499	replaces IBM board; 720 by 348 pixels
IBM	Color/Graphics Adapter	N.A.		•	$244	
Orchid Technology	MGA Graphics Controller	64K			$395	requires IBM monochrome card; 720 by 350 pixels
Plantronics	Colorplus	N.A.	1	•	$475	320 by 200 pixels in 16 colors; 640 by 200 pixels in 4 colors
Quadram	Quadcolor	32K		•	$295	16 colors, 640 by 200 pixels
Scion	PC640 Professional Color Graphics	N.A.		•	$1595	16 colors, 640 by 480 pixels
Syntec	Professional Graphics Generator	N.A.		•	$7000	overlays; 512 by 512 pixels, 16 colors
Tecmar	Graphics Master	128K		•	$695	up to 720 by 700 pixels
USI Computer Products	Multi Display Card	32K		•	$449	

Table 5: *Advanced graphics boards allow higher resolution or color graphics for the IBM PC; some boards include special software or allow use of a light pen or other special input devices. Currently, few software programs make use of the high-resolution graphics or color provided by these boards. Until that situation changes, you may have to buy software from the graphics-board vendor or write it yourself.*

Manufacturer	Board Name	Parallel Ports	Price
Control Systems	Parallel Interface Adapter	1	$105
GM Enterprises	Parallel I/O Adapter	1	$149
IBM	Printer Adapter	1	$150
Quadram	IPIC	1	$110
Super Computer	Parallel Printer	1	$75

Table 6: *Parallel boards. Parallel (or "Centronics-compatible") ports enable the IBM PC to interface with one or perhaps several parallel printers.*

Manufacturer	Board Name	Price
Apparat	Clock/Calendar	$99
Quadram	Chronograph	$110
Tecmar	Time Master	$135

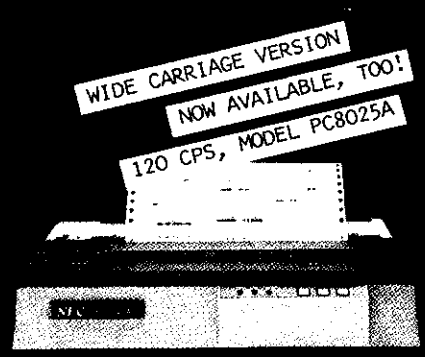
Table 7: *Clocks with battery backup. These enable the PC to keep continuous track of the date and time and are helpful for sending electronic mail and for automatically inserting the date in a form letter.*

Manufacturer	Board Name	Memory (bytes)	Clock	Serial Ports	Parallel Ports	Price
Apparat	Print Spooler	64K			1	$319
Periphex	I-Queue	64K	•			$495
Super Computer	Superbuffer	64K				$395
Wesper Microsystems	Wizard-Spooler S/P	16K		1	1	$349
Wesper Microsystems	Wizard-Spooler P	16K			1	$289

Table 8: *Print-spooler boards combine printer ports and memory to provide a buffer (or spooler) that stores in a section of memory data that is to be printed. This lets the PC continue with other work while the printer is still printing. The boards listed here can only be used as buffers. Boards that include software for print spooling are listed in tables 2, 14, and 15.*

Manufacturer	Board Name	Price	Prototype Size (inches)
AST Research	WW-68 Wire-wrap Card	$75	N.A.
Advanced Computer Products	Prototype Card	$69	13.2 by 4
Apparat	Prototype Card	$29.95	8.1 by 3.9
Automated Business Machines	Development Card	$49	N.A.
GM Enterprises	Prototype Board	$25	8.1 by 3.9
IBM	Prototype Card	$45	N.A.
Micro Match	MM77-1 Prototyping Board	$45	N.A.
Sigma Designs	SDI Miniproto	$25	N.A.
Sigma Designs	SDI Proto	$45	N.A.
Super Computer	Prototyping Board	$45	N.A.
Tecmar	Protozoa	$45	42 square
Vector Electronic	Universal Wiring	$24.26 to $39	13.2 by 4.2

Table 9: *Prototype boards help you create your own specialized IBM PC board.*



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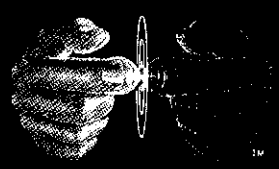

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Manufacturer	Board Name	Memory (bytes)	Parallel Ports	Price	Digital I/O lines
GM Enterprises	ParlePC Speech Synthesizer	N.A.	1	$199	24
Street Electronics	Echo PC Speech Synthesizer	16K		$225	
Tecmar	Speech Master	N.A.		$395	

Table 10: *Speech synthesizers. If you want your PC to talk back to you, then a speech-synthesizer board is the answer. Some boards include speakers, but some don't.*

Manufacturer	Board Name	Price
Apparat	PROM Blaster	$129
Super Computer	Superblaster	$225
Tecmar	E + EEPROM Programmer/Reader	$495

Table 11: *EPROM and EEPROM programming boards make it easier to program erasable and electrically erasable programmable ROMs.*

Manufacturer	Board Name	Price	Prototyping
AST Research	Extender	$55	
Advanced Computer Products	Extender Card	$40	
Micro Match	MM39-1 Extender	$35	
Personal Computer Products	Card Extender	$50	
Tecmar	Extender Card	$80	•
Vector Electronic	3690-22 Extender	$22.35	

Table 12: *Extenders. When testing a homemade expansion board, an extender board is a handy option. It effectively "lifts" a card slot above the PC's case by plugging into an expansion slot and providing an identical connector on top.*

Manufacturer	Board Name	Serial Ports	Price
AST Research	CC-232 Advanced Communication	2	$295
Computer Technology Innovations	ISCDA-0	2	$125
Control Systems	4 Serial I/O Ports	4	$395
Control Systems	Hostess Multiuser Host A	8	$795
Datamac Computer Systems	DMS-1	1	$139
Datamac Computer Systems	DMS-2	2	$199
IBM	Asynchronous Communication Adapter	1	$120
PC[2]	COMM-1	1	$85
PC[2]	COMM-1	2	$115
Personal Systems Technology	Asynchronous Communication Ports	2	$165
Personal Systems Technology	Asynchronous Communication Ports	1	$125
Quadram	RS-232C Asynchronous Adapter	1	$110
Zen/Tek	Dual COM Card	2	$120
Zen/Tek	Z-COM Card	1	$100
Zobek	2SP	2	$165

Table 13: *Serial boards. A serial interface permits communication to a modem, a printer, or another computer. Serial ports are also known as RS-232C or asynchronous ports. (For boards offering both serial and parallel ports, see table 4.)*

Manufacturer	Board Name	Print Spooler	Clock	Serial Ports	Parallel Ports	Game Port	0K-byte Price
AST Research	Combo Plus	•	•	1	1		
AST Research	Megaplus II	•	•	1			
AST Research	Six Pack Plus	•	•	1	1		
Anatron	Multifunction RAM	•	•	2	1		
Amdek	Multiple Adapter Interface				1		
Applied Business Computer	Mega A+	•	•	2	1		
Apstek	AIC-256		•	1	1		$299
Chrislin Industries	CI-PCM+			1			
Computer Technology Innovations	IMF-APGC		•	1	1	•	
Computer Technology Innovations	ISC5A			1			
Datamac Computer Systems	Combo Board			1			
Davong Systems	ASYNC + RAM			2			
Daystar Systems	Ultra55		•	2	1	•	
Easitech	Easiboard II	•	•	2	1		$350
Easitech	Easiboard	•	•	1	1		$325
IDE Associates	IDEA Plus	•	•	1	1		
Indigo Data Systems	PC Multipak	•	•	1			$297
Intermedia Systems	Memory Expansion Module			2			
MK Research	RAM Card with RS-232C			1			$179
Maynard Electronics	Memory Board with Serial Ports			2			$370
Memory Technologies	Versa-RAM Plus II	•	•				
Memory Technologies	Versa-RAM Plus II	•	•	1	1		
Memory Technologies	Versa-RAM Plus II	•	•		1		
Memory Technologies	Versa-RAM Plus	•		2	1		$299
Memory Technologies	Versa-RAM Plus II	•	•	1			
Micro Network	Combination Memory Board		•	1	1		
Micro Synergy	Pro Series 5		•	1	1	•	$395
Micro Synergy	Pro Series 3			1	1		$275
Microcomputer Business Industries	Monte Carlo GT		•	1	1	•	
Microcomputer Business Industries	Monte Carlo Quatro		•	1	1		
Microcomputer Business International	MegaRAM			2			
Microtek	HAL (parallel and serial ports)	•		1	1		
Microtek	Tele-buffer PC	•	•		1		
Paso Com	Professional I Series			1	1		
Personal Data Systems	Pack-RAM+Combo Card		•	1	1		
Personal Systems Technology	Time-Spectrum		•	1			
Quadram	QuadRAM 512+			1			
Quadram	Quadboard		•	1	1		
Quadram	Quadboard II		•	2			
Raytronics	RAMPLUS Multifunction		•	1	1		$319
STB Systems	RIO Plus	•	•	1	1	•	
STB Systems	RIO	•		1	1	•	
STB Systems	Super RIO	•	•	2	1	•	
Seattle Computer	RAM+			1			$220
Seattle Computer	RAM+3 with Memory		•	1	1		$320
Sigma Designs	System Support+Memory		•	1	1	•	$295
Sigma Designs	System Support Card Stack			1			
Starware	Tenley Board		•				
Tava	Trump Card			1		•	
Tecmar	1st Mate		•	1	1		$319
Universal Micro	Clock/Memory		•				
Vista Computer	Multicard		•	1	1		
ZenTek	Memory	•		1	1		

Table 14: *Multifunction boards with memory. By combining many capabilities, these boards help you get the most use from the PC's five expansion slots. (For multifunction boards* without *memory, see table 15.)*

64K-byte Price	128K-byte Price	192K-byte Price	256K-byte Price	384K-byte Price	512K-byte Price	Comments
$395	$495	$595	$695			
$395	$495	$595	$695	$970	$1090	game, parallel, and extra serial ports $50 each
$395	$495	$595	$695	$895		game port $50 extra
$395			$595			
	$799					includes monochrome adapter
$325	$415	$505	$595			
$369	$439	$509	$579			
$445	$495	$545	$595		$795	includes memory battery backup
$495	$585	$675	$750			
$265	$355	$445	$520			
$550						
$385	$580	$736	$892			
			$595	$795		EPROM capability
$420			$620			
$395			$595			
$395	$470	$530	$595			
$365	$432	$499	$565			
			$749		$1095	
$99					$579	
$465	$570	$680	$785			
$429	$509	$589	$669			
$479	$559	$639	$719			
$455	$535	$615	$695			
$369	$439	$509	$579			
$455	$535	$615	$695			
				$645		modem included
$475	$550	$625	$695			
$360	$445	$520	$595			
$425	$505	$575	$645			
$375	$440	$510	$575			
$300			$500			
$499			$999			
$699			$1199			auto-dial/auto-answer programmable modem
$295	$375	$455	$535			
$495	$615	$735	$855			
$395	$485	$575	$665	$930	$1100	extra serial port and/or parallel port optional
$325			$550		$895	
$395			$595			
$395			$595			
$389	$459	$529	$599			
$475			$739	$899		includes hard-disk interface
$395		$572	$659			includes hard-disk interface
$475		$649	$739		$1336	includes hard-disk interface
$295	$370	$445	$520			
$395	$470	$545	$620			
$575			$875			
$195			$595			
$445						
			$499		$699	
$389	$469	$539	$589			
$398	$488	$578	$668			
$399	$499	$599	$699			
$395	$485	$575	$665		$1025	available with extra serial port instead of parallel port

Manufacturers' Addresses

Advanced Computer Products
1310B East Edinger Ave.
Santa Ana, CA 92705
(714) 558-8813

ALL Computers Inc.
110 Bloor St. W, Suite 501
Toronto, Ontario,
Canada M5S 2W7
(416) 960-0111

Alpha Byte Computer Products
31245 La Baya Dr.
Westlake Village, CA 91362
(213) 706-0333

Amdek Corp.
2201 Lively Blvd.
Elk Grove Village, IL 60007
(312) 364-1180

Anatron
202 West Bennett St.
Saline, MI 48176
(800) 521-0521, (313) 429-2678

Apparat Inc.
4401 South Tamarac Pkwy.
Denver, CO 80237
(303) 741-1778

Applied Business Computer Co.
330 East Orangethorpe Ave., Suite C
Placentia, CA 92670
(714) 993-1101

Apstek Inc.
2636 Walnut Hill Ln., Suite 335
Dallas, TX 75229
(214) 357-5288

Arby Corp.
1617A Massachusetts Ave.
Cambridge, MA 02138
(617) 864-5058

AST Research Inc.
2372 Morse Ave.
Irvine, CA 92714
(714) 540-1333

Automated Business Machines Inc.
29352 Avocet Ln.
South Laguna, CA 92677
(714) 859-6531

Bitstream Inc.
POB 809
Loxahatchee, FL 33470
(305) 798-0025

Byad Inc.
101 Liong Dr.
Barrington, IL 60010
(312) 539-4922

Cactus Technology Inc.
3024 North 33rd Dr.
Phoenix, AZ 85017
(602) 269-2440

California Computer Systems
250 Caribbean Dr.
Sunnyvale, CA 94086
(408) 734-5811

Manufacturer	Board Name	RAM Disk	Print Spooler	Clock	Serial Ports	Parallel Ports	Game Port	Price
AST Research	I/O Plus II	•	•	•	1			$165
Apparat	Combo Card			•	1	1	•	$189
Applied Business Computer	I/O A+	•	•	•	2	1	•	$225
Apstek	SIC-1			•	1			$149
Apstek	PIC-1			•		1		$149
Automated Business Machines	Omni-board			•	2	1	•	$485
Easitech	Easistart	•	•	•	1			$350
M & R Enterprises	Sup'r Access I				7			$695
Maynard Electronics	Floppy Controller							$195
Micro Network	Combination Peripheral				1			$400
Personal Data Systems	Pack-Combo			•	1	1		$245
Personal Data Systems	Pack-Combo			•	1			$175
Personal Systems Technology	Timeport			•	1	1		$225
Personal Systems Technology	Uniport			•		1		$155
RGB Systems	Three in One Board				2		•	$289
STB Systems	Super I/O	•	•	•	1	1	•	$249
STB Systems	STB I/O		•		2	1	•	$279
Seattle Computer	RAM+3			•	1	1		$210
Tecmar	Lab Master			•		3		$995
Vista Computer	PC Clock I/O			•	1	1		$210
Vista Computer	PC Master			•	2	1	•	$449
Vista Computer	PC Expander			•	2	1	•	$349
Vista Computer	PC Extender			•	2	1		$249
Vista Computer	PC Extender Plus			•	1	1	•	$299
Vista Computer	PC Extender + Voice			•	2	1	•	$399
Ziatech	ZT1488 GPIB Controller			•				$485

Table 15: *Multifunction boards without memory. (For multifunction boards* with *memory, see table 14.)*

Cermetek Microelectronics Inc.
1308 Borregas Ave.
Sunnyvale, CA 94089
(408) 734-8150

Chintronics Co.
19 Longmeadow Rd.
Chelmsford, MA 01824
(617) 256-7862

Chrislin Industries Inc.
31352 Via Colinas
Westlake Village, CA 91362
(213) 991-2254

Computer Technology Innovations
965 West Maude Ave.
Sunnyvale, CA 94086
(408) 245-4256

Conographic Corp.
2268 Golden Circle
Newport Beach, CA 92660
(714) 642-6778

Control Systems
2855 Anthony Ln.
Minneapolis, MN 55418
(612) 789-2421

Datamac Computer Systems
680 Almanor Ave.
Sunnyvale, CA 94086
(408) 735-0323

Data Translation
100 Locke Dr.
Marlborough, MA 01752
(617) 481-3700

Davong Systems Inc.
217 Humboldt Court
Sunnyvale, CA 94086
(408) 734-4900

Daystar Systems Inc.
10511 Church Rd., Suite A
Dallas, TX 75238-9990
(214) 341-8136

Easitech Corp.
2215 Perimeter Park, Suite 22
Atlanta, GA 30341
(404) 452-7576

Flagstaff Engineering
2820 West Darleen
Flagstaff, AZ 86001
(602) 774-5188

Force Technology Corp.
POB 20955, Almaden Valley Sta.
San Jose, CA 95160
(408) 268-3359

Gateway Communications Inc.
16782 Red Hill Ave.
Irvine, CA 92714
(714) 261-0762

Giltronix Inc.
3780 Fabian Way
Palo Alto, CA 94303
(415) 493-1300

GM Enterprises Inc.
485 East Granville Ave.
Roselle, IL 60172
(312) 893-1171

Hammond Computer Products Inc.
3800 Crossbend Pl.
Plano, TX 75023
(214) 596-0130

Hayes Microcomputer Products Inc.
5963 Peachtree Industrial Blvd.
Norcross, GA 30092
(404) 449-8791

Hercules Computer Technology
2550 Ninth St., Suite 210
Berkeley, CA 94547
(415) 654-2476

IBM Corp. System Products Division
POB 1328
Boca Raton, FL 33432
(800) 447-4700

IDE Associates
7 Oak Park Dr.
Bedford, MA 01803
(617) 275-4430

Indigo Data Systems Inc.
100 East Nasa Road One, Suite 107
Webster, TX 77598
(713) 488-8186

Information Technologies Inc.
7850 East Evans Rd.
Scottsdale, AZ 85260
(602) 998-1033

Intelligent Technologies International Corp.
151 University Ave.
Palo Alto, CA 94301
(415) 328-2411

Intermedia Systems
10601 South DeAnza Blvd.
Cupertino, CA 95014
(408) 996-0900

Jones Futurex Inc.
9700 Fair Oaks Blvd., Suite G
Fair Oaks, CA 95628
(916) 966-6836

Lifeboat Associates
1651 Third Ave.
New York, NY 10028
(212) 860-0300

Macrolink Inc.
1150 East Stanford Court
Anaheim, CA 92805
(800) 854-3332, (714) 634-8080

Comments
game, parallel, or extra serial ports, $50 each
fits small slots of PC XT version
fits small slots of PC XT version
monochrome adapter
includes 1200-bps modem
includes 5¼-inch-disk interface
includes 5¼-inch and hard-disk interfaces
extra serial port, $50; EPROM capability
includes hard-disk interface
includes hard-disk interface
16 A/D lines, 2 D/A lines, 24 digital I/O lines
includes speech synthesizer, hard-disk interface
includes speech synthesizer
includes IEEE-488 interface

Manufacturers' Addresses continued on page 180

Manufacturer	Board Name	Serial Ports	Parallel Ports	Price	Comments
Automated Business Machines	Telephone Receptionist Adapter			$995	auto-dial/auto-answer, 300/1200 bps, speech synthesizer
Cactus Technology	PC-COM-300			$349	
Cermetek Microelectronics	Info-Mate 212A PC			$495	auto-dial/auto-answer, 300/1200 bps
Hayes Microcomputer Products	Smartmodem 1200B			$599	
Micro Network	Advanced Communications Board			$895	
Microlog	Baby Talk	1	1	$895	includes Z80 coprocessor, 64K bytes, clock
Microperipheral	PConnection	1		$279	auto-dial/auto-answer, speaker, clock
Pacific Coast Peripherals	Communication Utility	1	1	$349	
SSM Microcomputer Products	PC Modemcard			$349	300 bps, $549 for 300/1200 bps
Tecmar	3rd Mate	1	2	$445	
Tecmar	Modem 1200			$695	300/1200 bps
Tecmar	Modem 300			$295	300 bps
Intelligent Technologies	PC Express	1		$895	

Table 16: *Integral-modem boards, like separate-unit modems, permit use of standard telephone lines for computer communications. Although the integral unit takes up one PC expansion slot, it requires no additional RS-232C port, cables, or desk space.*

Manufacturers' Addresses continued:

Maynard Electronics
400 East Semoran Blvd., Suite 207
Casselberry, FL 32707
(305) 331-6402

Memory Technologies Inc.
4343 Grand Prix Dr.
POB 508
Logansport, IN 46947
(800) 348-3377, (219) 722-1454

Microcomputer Business Industries Corp.
1019 8th St.
Golden, CO 80401
(303) 279-8438

Microcomputer Business International
POB 16115
Irvine, CA 92713
(714) 553-0133, (714) 727-0202

Microdisk
1422 Industrial Way
POB 1377
Gardnerville, NV 89410
(702) 782-8105

Micro Express
23392 Devonshire Dr.
Eltore, CA 92630
(714) 859-7575

Micro Interface Inc.
3111 South Valley View Blvd. #1-101
Las Vegas, NV 89102
(702) 871-3263

Microlog Inc.
222 Route 59
Suffern, NY 10901
(914) 368-0353

Micro Match
10049 Commerce Ave.
Tujunga, CA 91042
(213) 353-5929

Micro Network Corp.
511 11th Ave., Suite 429
Minneapolis, MN 55415
(612) 333-4303

Microperipheral Corp.
2643 151st Place NE
Redmond, WA 98052
(206) 881-7544

Microsoft Corp.
10700 Northup Way
Bellevue, WA 98004
(206) 828-8080

Micro Synergy
187 Ulmerton Rd.
Largo, FL 33544
(813) 535-6655

Microtek Inc.
4750 Viewridge Ave.
San Diego, CA 92123
(800) 854-1081, (619) 569-0900

Microware
POB 79
Kingston, MA 02364
(617) 746-7341

MK Research
17842 Irvine Blvd., Suite 122
Tustin, CA 92680
(714) 731-5201

Mountain Computer
300 El Pueblo Rd.
Scotts Valley, CA 95066
(408) 438-6650

M & R Enterprises
910 George St.
Santa Clara, CA 95050
(408) 980-0160

National Instruments
12109 Technology Blvd.
Austin, TX 78727
(800) 531-5066, (512) 250-9119

Orchid Technology
47790 Westinghouse Dr.
Fremont, CA 94539
(415) 490-8586

Manufacturers' Addresses continued on page 182

Manufacturers' Addresses continued:

Pacific Coast Peripherals
3480 Granada Ave., Suite 224
Santa Clara, CA 95051
(408) 247-1720

Paso Com
POB 2603
Mission Viejo, CA 92690
(714) 552-0130

PC²
595 Testoria Ave.
Sunnyvale, CA 94086
(408) 735-0323

Periphex Inc.
149 Palmer Rd.
Southbury, CT 06488
(800) 221-0732, (203) 264-7937

Personal Computer Products
1400 Coleman Ave., Suite C-18
Santa Clara, CA 95050
(408) 988-0164

Personal Data Systems Inc.
1110 Wrigley Way
Milpitas, CA 95035
(408) 262-7880

Personal Systems Technology Inc.
15801 Rockfield, Suite A
Irvine, CA 92714

Plantronics Division
Frederick Electronics
7630 Hayward Rd.
POB 502
Frederick, MD 21701-0502
(301) 662-5901

Professional Data Systems Inc.
2630 Walnut Ave., Suite H
Tustin, CA 92680
(800) 854-8428, (714) 730-7207

Pure Data Ltd.
950 Denison St., Unit 17
Markham, Ontario,
Canada L3R 3K5
(416) 498-1616

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

Quality Computer Services
178 Main St.
Metuchen, NJ 08840
(800) 631-5944, (201) 548-2135

Raytronics
4901 Morena Blvd., Bldg. 900
San Diego, CA 92117
(800) 854-1085, (619) 270-4000

RGB Systems
3375 Woodward Ave.
Santa Clara, CA 94050
(408) 748-0400

Scion Corp.
12310 Pinecrest Rd.
Reston, VA 22091
(703) 476-6100

Seattle Computer
1114 Industry Dr.
Seattle, WA 98188
(800) 426-8936, (206) 575-1830

Semidisk System
POB GG
Beaverton, OR 97075
(503) 642-3100

Sigma Designs Inc.
3866 Eastwood Circle
POB 3765
Santa Clara, CA 95055
(408) 496-0536

SSM Microcomputer Products Inc.
2190 Paragon Dr.
San Jose, CA 95131
(408) 946-7400

Starware
1701 K Street NW, Suite 800
Washington, DC 20006
(202) 466-7351

STB Systems Inc.
1701 North Greenville, Suite 703
Richardson, TX 75075
(214) 234-8750

Street Electronics Corp.
1140 Mark Ave.
Carpinteria, CA 93013
(805) 684-4593

Jack Strick & Associates
949 South Southlake Dr.
Hollywood, FL 33019
(305) 925-7004

Super Computer Inc.
1710 East Newport Circle, Suite P
Santa Ana, CA 92705
(714) 540-1880

Symtec
15933 West 8 Mile
Detroit, MI 48235
(313) 272-2950

Tall Tree Systems
1036 Los Altos Ave.
Los Altos, CA 94022
(415) 941-5500

Tava Corp.
1711 Corinthian Way, Suite 1011
Newport Beach, CA 92660
(714) 261-0200

Tecmar Inc.
6225 Cochran Rd.
Cleveland, OH 44139
(216) 349-0600

Universal Micro Inc.
6302 Odana Rd.
Madison, WI 53719
(608) 274-6100

USI Computer Products
71 Park Ln.
Brisbane, CA 94005
(415) 468-4900

Vector Electronic Co. Inc.
12460 Gladstone Ave.
Sylmar, CA 91342
(213) 365-9661

Vista Computer Co. Inc.
1317 East Edinger
Santa Clara, CA 92705
(714) 953-0523

VR Data Corp.
777 Henderson Blvd., N-6
Folcraft, PA 19032
(800) 345-8102, (215) 461-5300

Wesper Microsystems
14321 Myford Rd.
Tustin, CA 92680
(800) 854-8737, (714) 730-6250

Zen/Tek Corp.
455 Whitepine Dr.
Salt Lake City, UT 84107
(801) 263-3925

Ziatech Corp.
3433 Roberts Ln.
San Luis Obispo, CA 93401
(805) 541-0488

Zobek
7343 J. Ronson Rd.
San Diego, CA 92111
(714) 571-6971

Board Type	Manufacturer	Board Name	Price	Comments
analog/digital interface	Data Translation	DT2801	$1195	16 A/D,2 D/A,16 digital I/O lines; clock
analog/digital interface	Data Translation	DT2805	$1295	16 A/D,2 D/A,16 digital I/O lines; clock
BSR X10 interface	Automated Business Machines	BSR-X10 Adapter	$215	
BSR X10 interface	Tecmar	Device Master	$245	includes clock
bus analyzer	Personal Computer Products	Bus Analyzer	$295	
communications	Information Technologies	Linkup	$795	auto-dial/auto-answer (no modem); includes two serial ports
communications	Personal Data Systems	Pack-Comm	$495	
communications coprocessor	Personal Systems Technology	DCPI-88 Communications Processor	$695	includes 8088, 64K bytes, two serial ports
controller/sensor	Tecmar	Distance Tender	$495	allows sensors to measure distance
digital/analog interface	Tecmar	DADIO	$395	4 D/A, 24 digital I/O lines
digital/analog interface	Tecmar	Lab Tender	$495	32 A/D,16 D/A,24 digital I/O lines
digital I/O	Tecmar	Base Board	$345	96 digital I/O lines
emulator	Personal Systems Technology	3278-Coax	$395	provides 3278-terminal emulation
game controller	IBM	Game Control Adapter	$55	
GPIB/IEEE-488 interface	National Instruments	GPIB-PC	$385	includes IEEE-488 interface
hard-disk interface	Tecmar	Winchester Share System Adapter	$395	allows four PCs to share one hard disk
modular multifunction	Arby	Combination Board	$110	
motor controller	Tecmar	Stepper Motor Controller	$495	CY512 interface; includes four serial ports
network interface	Davong Systems	Multilink Network Card	$595	compatible with ARCNET and Xerox network protocols
network interface	Orchid Technology	PC-net Adapter Card	$695	requires 128K bytes
network interface	Tecmar	Ethernet Link	$950	
PAL programmer	Force Technology	PAL Programmer	$995	programs 20- to 24-pin PAL chips
speech digitizer	Mountain Computer	Supertalker II	$350	includes 32K bytes
speech recording/playback	Flagstaff Engineering	Voice Connection	$179	digitize message, playback, auto-dial/auto-answer
VCR controller	Tecmar	VCR Controller	$495	controls videocassette recorder
video digitizer	Tecmar	Video Van Gogh	$345	digitizes video-camera output
voice digitizer	Tecmar	Ethernet Companion	$695	
voice recognition	Tecmar	Voice Recognition	$995	software included, 200-word vocabulary; 8K-byte RAM

Table 17: *Miscellaneous boards.*