PC MAGAZINE FIRST LOOKS

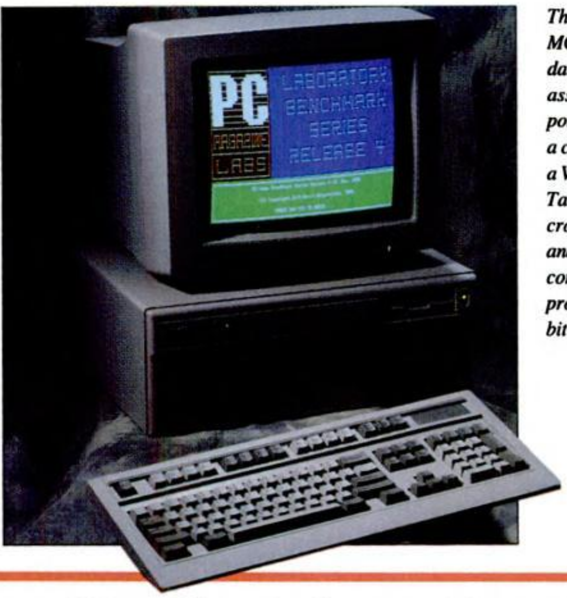
Tandy Ships First MCA Compatible: 5000 MC Features Five MCA Slots

PC HANDS ON

BY WINN L. ROSCH

Not with a bang but with just a little catalog entry does the first Micro Channel–compatible computer enter the PC market. Low-key and unassuming, Tandy's 5000 MC is a powerful competitor to IBM's Model 70.

Compared with more-conventional computers, the $4,999 Tandy 5000 MC rates as a medium-performance, small-footprint 20-MHz 80386-based PC. To match the fast 80386 of the 5000 MC to its slower 100-nanosecond main memory,



The Tandy 5000 MC ships standard with a full assortment of I/O ports, including a connection for a VGA monitor. Tandy put the microprocessor and static-RAM controller on a proprietary 32-bit board.

Tandy uses an Intel 82385 cache controller coupled to a 32KB static-RAM cache. A socket is provided for the addition of a 20-MHz 80387 numeric coprocessor.

The physical and electrical arrangement of the 5000 MC marks a notable break with tradition. Tandy puts the prime processing elements—the microprocessor, coprocessor, cache controller, and cache—on a proprietary 32-bit expansion board.

Main memory is also banished from the system board circuitry, using two additional pro-

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EISA Takes on IBM's Micro Channel

PC ANALYSIS

BY MARY KATHLEEN FLYNN

Like politics, competing against IBM can make for strange bedfellows. The nine PC compatible makers that recently formed the Extended Industry Standard Architecture consortium usually focus their campaigns on each other. But, in their efforts to wrest the future of the PC industry away from IBM, their common opponent is IBM's 32-bit Micro Channel architecture.

Only hours before IBM introduced its PS/2 Model 30 286, its reentry into the AT-bus market, the EISA consortium announced specifications for its own 32-bit multimastering bus. Dubbed the EISA bus, the new architecture promises to offer the advantages of IBM's MCA without sacrificing compatibility with the AT, or industry standard, bus.

The consortium members list reads like a Who's Who of compatible-maker heavyweights, featuring Compaq, Hewlett-Packard, Tandy, and Zenith. All the major players in the industry, with the obvious exception of IBM, have announced support for the EISA specification. Those companies include Intel, which is defining the chip level of the EISA specification, and Microsoft, which has announced OS/2 support for EISA machines.

Whether or not this unprecedented show of industry solidarity signals an end to IBM's near-autocratic leadership role is unclear. The full impact of the EISA specification, or lack thereof, will remain unrealized at least until the first EISA-based machines begin to hit the market toward the end of 1989. All that is certain at this point is that the battle is on, and the stakes are high.

The allure of both the EISA and the MCA lies in their support of multiple bus masters—processors that are incorporated into the design of adapter cards and are capable of temporarily taking control of the bus to transfer data, freeing up the CPU for other tasks. At least in theory, multimastering bus designs will deliver performance unheard of by today's standards.

Neither the MCA nor the EISA bus will offer buyers substantial advantages until OS/2

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● **EISA vs. MCA: Which Is Better? See Page 35.**

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Photograph: Thom O'Connor

EISA

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and its multitasking applications, written to support multimastering, come into their own. That means a 2- to 3-year wait.

The EISA consortium's chief gripe against the Micro Channel isn't performance. According to EISA members, it isn't even IBM's 5-percent MCA royalty. What does have the EISA group up in arms is the MCA's incompatibility with the AT. PCs based on the AT bus still account for the fastest-growing segment of the PC market, and the majority of today's applications don't require the performance benefits of multimastering. The EISA bus, the so-called Gang of Nine argues, is an "elegant transition," like the 16-bit AT extension bus was for the 8-bit XT. EISA machines, the consortium members point out, will allow buyers who want 386 performance to stick with their AT peripherals while also providing the option of upgrading to bus-mastering peripherals.

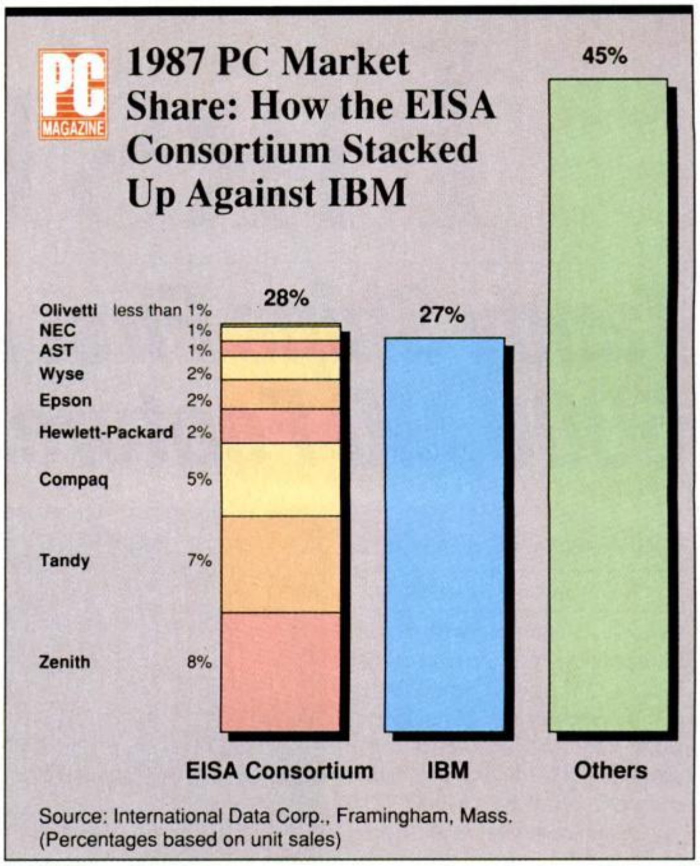
Despite their problems with MCA, however, most of the EISA companies say they will provide Micro Channel products if their customers want them. (Compaq says it will not.) After over a year of R&D on the MCA, most of them sound pretty well poised to deliver those products.

The technical merit of the EISA specification itself will surely play some role in determining the bus's success (see related story "EISA vs. MCA: Which Is Better?" page 35), but most of the industry agrees that the two architectures offer roughly the same performance. The question becomes, Which will gain acceptance?

If the number of industry supporters is any indication, the Extended Industry Standard Architecture consortium is doing very well. More than 80 companies have hopped onto the EISA bandwagon.

Board makers, who represent the first level of acceptance, are delighted by the EISA announcement. For them, EISA means the first standard 32-bit bus extension with widespread industry support. Until now, compatible makers such as Compaq, Tandy, and Dell each insisted on its own 32-bit bus extension. And, while MCA gave board makers the hope of a standard, satisfaction over MCA product sales is mixed.

Tecmar, which has announced support for EISA, says that Micro Channel products now account for 20 percent of the company's business. According to Dan Lucarini, Tecmar's director of marketing, the company has shipped 25,000 MCA boards in the last 12 months. IBM, Lucarini adds, is Tecmar's biggest client.



Figures based on worldwide PC-compatible sales throughout 1987.

Steve Hui, president and CEO of Everex, describes the Micro Channel as a "nonevent for the growth of our company." He estimates that less than 15 percent of the boards Everex has sold in the last year are Micro Channel–based. Everex plans to build EISA computers as well as EISA add-in cards.

Hauppauge has put its Micro Channel replacement board project "on the back burner," reports president Ken Auuperle, who is currently reviewing the EISA spec and licensing agreement.

Some EISA supporters, such as Intel's product line manager Brian Ekiss, assert that backwards compatibility will allow board makers to "put their efforts into designing the next generation of cards."

In the final analysis, however, it is buyers who will decide the fate of the EISA bus. Total sales combined, the consortium members sold more PCs last year than IBM (see chart "*1987 PC Market Share,*" this page). But those sales figures won't necessarily translate into EISA vs. MCA sales.

Early indications put the price of initial EISA-based machines near that of IBM's 386-based MCA systems, leaving little financial incentive for buyers to turn their backs on IBM. The decision, then, will depend on other factors, such as available add-ins and buying philosophy.

Large corporations that have invested a considerable amount in IBM equipment and IBM's future connectivity solutions will stay with IBM and MCA. The battle, then, will be for the remainder of the market.

Of course, IBM can employ several strategies to influence the outcome. Dropping royalties on the Micro Channel, opening up the specs, and lowering the prices of its PS/2 machines even further would help win MCA more support. Big Blue could even come out with its own EISA box, although Chet Heath, the principal architect of the Micro Channel, assures us that's one move that IBM won't make.

Whatever IBM does in response to the EISA bus, the user wins. At the very least, the EISA announcement puts one more bus on the ballot. PC

Tandy to Ride All Three Buses

At least one compatible maker plans to offer two product lines, one based on the Micro Channel architecture and one on the Extended Industry Standard Architecture. Tandy recently began shipping its 5000 MC—the only non-IBM MCA machine available today. (See First Looks, page 33 in this issue.) The EISA member also plans to roll out an EISA box, probably in the third quarter of next year.

Tandy's director of marketing, Ed Juge, anticipates the emergence of two markets for the high-performance buses. He defines the Micro Channel market as those Fortune 500 MIS shops that view PCs as a small piece of a large plan. The EISA bus will be aimed at users who don't want to depend on a single source for hardware and who don't see their PCs as mainframe extensions.

Tandy's Juge cautions, "There's nothing you can do with either [the MCA or the EISA machines] today." But some of IBM's and Tandy's customers are already planning for the future. IBM claims to have shipped 1½ million MCA machines, and Juge reports that early returns on the 5000 MC exceed company expectations.
—Mary Kathleen Flynn

EISA vs. MCA: Which Is Better?

ANALYSIS

BY STEPHEN R. DAVIS AND KEN A. STROUD

If the acceptance of one standard over another were based on technical considerations alone, the world would be a much different place. Factors having little to do with technical excellence often determine which standards survive. Still, the technical merits of the Extended Industry Standard Architecture specification will play a role in the success of the compatible makers' Micro Channel architecture alternative.

The most significant advance of the EISA bus over its AT predecessor is support for up to seven bus masters, allowing addition of as many as six bus-mastering adapters. This multiple bus mastering allows a hard disk controller, for instance, to manage the actual data transfer to and from the disk, leaving the system CPU free for other tasks. AT cards may have CPUs of their own, but they may not compete for access to the bus. The MCA also supports seven bus masters, but in existing PS/2s the motherboard CPU cannot access its own memory while the bus is being controlled by another bus master.

The EISA bus allows bus access to as many as eight Direct Memory Access (DMA) controllers. Single-cycle 32-bit data transfer using the full 32-bit address space delivers an effective burst rate of 33 million bytes per second. This number is reduced slightly for large transmissions by competition with the dynamic memory refresh.

DMA in existing MCA machines runs at a rate of 200 nanoseconds per transfer, yielding a lower DMA rate of 20 megabytes per second. After arbitration is calculated in, the effective rate is closer to 18.7 megabytes per second. This is not a limitation of the MCA bus, however, but of today's hardware designs. An MCA bus master card could be built capable of transferring data with a slave card at rates of at least 66 megabytes per second.

With multiple processors and DMA chips vying for access to the bus, architectures such as EISA and MCA must include a bus arbitration scheme to guard against conflicts. The EISA bus arbitration is implemented in hardware on the motherboard. This enables designers to know exactly how long it will take their devices to gain access to the bus resources.

The EISA rotates in round-robin style between the three types of bus requesters—bus masters, DMA controllers, and the Memory Refresh Controller. Arbitration among the DMA channels is on a strict priority basis, with the highest priority request getting the bus. Arbitration among bus masters is on a round-robin basis with one exception—in order to ensure compatibility with the AT bus, the system CPU always receives the control it requests.

The MCA implements a distributed local arbitration that is a much more flexible and more software-configured system. Each card must decode the arbitration signals and control the bus accordingly. Even some of the DMA channels can be reprogrammed to different priorities at different times during program execution.

The EISA allows the configuration of resources on the bus with jumper switches on the card or via software. Each of the 15 slots on the bus is assigned an address for a 32-bit product identifier. Configuration files supplied by each manufacturer are used by the software to configure and initialize the board. The dedicated I/O address for each slot allows multiple identical cards to run on the EISA bus without I/O conflicts.

Software board configuration is not optional on the MCA. Critical setup parameters are stored in battery-backed RAM. Manufacturers are assigned unique identification numbers for each card by IBM so that cards may be uniquely identified at power-up. The MCA provides a means of accessing several identical cards through software configuration at power-up.

The EISA bus can support level or edge-triggered interrupts, thus supplying a mechanism for shared interrupts. MCA cards have a bit in their POS register that is set when the card generates an interrupt. This bit is reset by the service routine software. Several cards can use the same interrupt, and the service routine can determine which card generated the interrupt via this bit.

The EISA bus is very power generous, specifying 22.5 watts of 5 volts per slot. With 15 slots and an estimated 10 amps for the motherboard, a 400-watt power supply will probably be a minimum. Power usage on the MCA is much more limited. Two amps of 5 volts, 175 milliamps of +12 volts, and 40 milliamps of -12 volts is all that is available per 32-bit slot.

The EISA bus extension has been implemented by adding an additional connector beside the standard AT connectors. While this design retains compatibility with present AT cards, it leaves a lot to be desired from an electro-magnetic interference (EMI) standpoint.

Numerous and carefully specified power and ground planes give the MCA excellent EMI characteristics. The only part of the interface that is not shielded is the connector. Layout of the MCA connector signals also shows a superior design. AC ground signals are spaced every four pins on each side of the connector. This layout ensures a low level of signal crosstalk, allowing a higher theoretical data transfer rate.

The EISA boards are the same size as AT boards, some 63 square inches. MCA cards measure about half that size. But, with today's surface-mount technology, card size becomes a secondary issue.

The bottom line? On a performance level, EISA-based machines and their bus-mastering adapter cards should compare favorably with today's PS/2s. From a technical standpoint, however, the EISA specification falls short of the MCA, primarily because of its growth limitations. The EISA features that allow compatibility with the AT bus also limit performance gains over the current specification. The MCA's cleaner and more flexible design, on the other hand, will allow IBM to design higher-performance MCA implementations into future PS/2s.

EISA vs. Micro Channel: Functions and Features

	AT	EISA	MCA
AT-compatible	●	●	○
Expansion board size	63 sq. in.	63 sq. in.	36 sq. in.
Auto system configuration	○	Optional	●
Multiple bus masters	○	●	●
Arbitration method	Centralized	Centralized	Distributed
Shared interrupt suppport	○	●	●
Interrupt trigger	Edge	Level or edge	Level
Bus speed	8 MHz	8 MHz	10 MHz
Data path width	8, 16 bits	16, 32 bits	16, 32 bits
Address path width	24 bits	32 bits	24, 32 bits
Standard data transfer rate	4MB/second	16.7MB/second	10MB/second
Maximum data transfer rate	5.5MB/second	33MB/second	20MB/second
DMA support	8-, 16-bit	8-, 16-, 32-bit	8-, 16-bit
Maximum DMA transfer rate	2MB/second	33MB/second	5MB/second

● —Yes ○—No

Tandy 5000 MC

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prietary connectors. Each of the two memory boards holds eight Single In-line Memory Modules (SIMMs), either of 256K or 1MB rating. All SIMMs must be the same in a single system, permitting system capacities of 2, 4, 8, or 16MB. One board with 2MB is standard.

The odd, almost chevron-shaped system board holds only expansion slots and support circuitry. None of the notorious Micro Channel VLSI chip sets is used. Overall, construction was very good, some of the best work that Tandy has done.

Of the eight expansion slots in the system, only five are available for third-party accessories, and all of these are equipped with Micro Channel connectors. Two use the full 32-bit bus, two are plain 16-bit, and one adds the VGA Feature.

In our evaluation machine, one 16-bit slot was filled with an optional Adaptec hard disk controller. The floppy disk control circuitry is built into the system board, along with parallel and serial ports, VGA video, and a mouse port. All connectors follow the PS/2 standard: 25-pin male D-shell for serial, 25-pin female D-shell for parallel, 15-pin high-density D-shell for VGA, and miniature 6-pin DIN for keyboard and mouse.

Mass storage adds refreshing options when compared with the IBM desktop PS/2s. Beneath the two side-by-side 3½-inch drive bays are an over-and-under pair of 5¼-inch half-height bays. Standard equipment puts a 1.44MB high-density 3½-inch floppy disk drive in the top right. The evaluation machine was also equipped with an optional 84MB Rigidyne 3½-inch hard disk. Connectors are provided so that a second floppy disk drive can use either the 3½-inch or 5¼-inch connection scheme.

The 5000 MC is paired with a new Tandy keyboard, which follows the IBM 101-key Advanced layout. This keyboard delivers a good feel coupled with a light, almost too-sensitive touch.

Unlike the IBM PS/2 design, the 5000 MC is not totally free from setup jumpers and DIP switches. Several switches are used for indicating system memory size. Another jumper is provided to clear the CMOS configuration memory. Otherwise system setup is accomplished using a Reference Diskette that's included with the system.

The important question about the first Micro Channel compatible is, of course, how compatible it is. The 5000 MC falls short of perfection.

The important part of the system—its Micro Channel architecture—worked fine with several memory and multifunction expansion boards. Note, however, that no currently available Micro Channel boards take advantage of the system's bus arbitration. The VGA subsystem of the 5000 MC system board fell short of complete register compatibility, however, scoring about at the level of the last generation of third-party VGA boards.

Our evaluation machine also demonstrated an inability to run the PC Labs extended memory tests, although it was capable of running extended-mode programs like *Microsoft Windows/386*. Tandy attributed this problem to an early version of the system's Phoenix BIOS.

The Tandy 5000 MC is a worthy competitor to IBM's 20-MHz Model 70, delivering equal performance and good (but not perfect) compatibility. Its roomier case and extra option of internal 5¼-inch drives make the 5000 MC a better choice for the office in transition between PC bus and Micro Channel architecture standards. Its obscurity will likely be only temporary.

PC MAGAZINE FACT FILE

Tandy 5000 MC
Tandy Corp.
1700 One Tandy Center
Fort Worth, TX 76102
(817) 878-4969
List Price: $4,999 for base system; $6,499 with 40MB hard disk; $6,999 with 80MB hard disk.
In Short: A 386 system based on an MCA-compatible bus. Its MCA compatibility is good but not perfect.

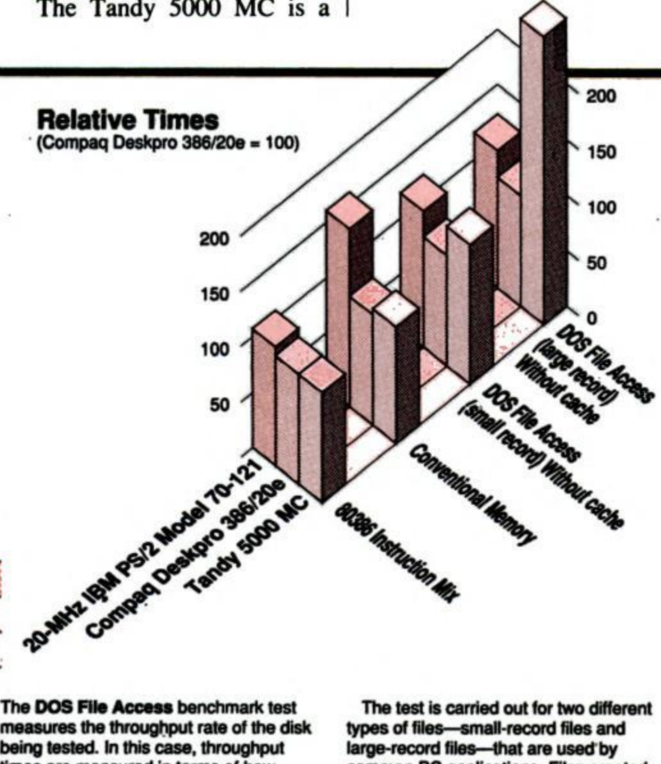
CIRCLE 447 ON READER SERVICE CARD

PC LABS Benchmark Tests: Tandy 5000 MC vs. Compaq Deskpro 386/20e and 20-MHz IBM PS/2 Model 70-121

The Tandy 5000 MC lags behind the Compaq 386/20e and the 20-MHz IBM PS/2 Model 70-121 in hard disk throughput, despite an 18-millisecond random access time. Its processor and memory test performance is comparable to that of the Compaq and superior to that of the IBM.

Performance Times
(Times given in seconds)

	80386 Instruction Mix	Conventional Memory	DOS File Access (small record) without cache	DOS File Access (large record) without cache
20-MHz IBM PS/2 Model 70-121	3.13	0.61	77.33	8.57
Compaq Deskpro 386/20e	2.91	0.38	62.93	6.92
Tandy 5000 MC	2.90	0.40	79.29	17.97



The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed.

The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.