1980 WORKSHEET: Drive shipments

Manufacturer EMM

Date 3/17/80 DENNY KESSLER

	Cumulative shipments year end, 1978			1979 net shipments			Forecast 1980		1981		1982		1983	
	U.S.	Non-US	WW	U.S.	Non-US	WW	US	WW	US	WW	US	WW	US	WW
GROUP: B12														
TOTAL units (000)						0								
Captive units (000)														
PCM units (000)														
PCM AUP ($000)														
OEM units (000)														
OEM AUP ($000)														
GROUP: FIXED														
TOTAL units (000)						0								
Captive units (000)														
PCM units (000)														
PCM AUP ($000)														
OEM units (000)														
OEM AUP ($000)														
GROUP: CART L12														
TOTAL units (000)						2.5								
Captive units (000)														
PCM units (000)														
PCM AUP ($000)														
OEM units (000)				90	10	2.5		.647						
OEM AUP ($000)						2.962		3.3						

V. C. BROWN

203 – 0
303 – 120
~~206~~ 306 – 2400
210/MON.

1980 WORKSHEET: MISCELLANEOUS DATA FOR 1979

Manufacturer EMM

Date 3/17/80 DANNY KEESLER

GROUP: CRT

U.S. distribution channels for non-captive disk drives

Mainframe computer manufacturers			
Mini/micro computer manufacturers			10
System OEMs/systems houses	37%		35
Independent peripherals suppliers	50%		50
Direct to end user/retail dealers	8%		5

Non-captive drives sold as subsystems (%): 0

Service and parts (% of disk drive revenues): 8%

75 ÷ 600 =

EPMM — Denny Kessler
Surgical prod. div. 3/17/80

new prod. stopped YE 79
inventory sale thru mid 80

Plessey —

1979 DISK/TREND INTERVIEW CHECKLIST

Manufacturer EMM

Date 3/6/79

ROGER EVANS
JIM MOORELAND

___ Specifications worksheets
___ Shipment worksheets
___ Misc. data worksheets
___ Price lists
___ Catalog pages
___ Additional contacts

Drive licensees | Geographical area | Sales history | Sales Outlook

Major customers

PLESSY
DATA TERMINALS
ZILOG
UNIVAC - MLPS

Outside purchases -- unique/critical parts

shortage of 50 mil disks is a current problem for media division

Major advantages, own drives

312 - cart interface, ease of upgrade
- reduced maintenance, no head alignment

General

V.C. BROWN QUANTITIES < NOT YET IN PRODUCTION
312 EVOLVE TO CMD? YES > 316 MIX? - JAN/JULY FCS
WINCH? NO
8 INCH? NO

Net sales FY ending _____	1977	1978
Company net sales	___	___
Company net income	___	___

1979 WORKSHEET: Drive shipments

Manufacturer EMM

Date 3/16/79

		Cumulative shipments year end, 1977			1978 net shipments			Forecast 1979		1980		1981		1982	
		U.S.	Non-US	WW	U.S.	Non-US	WW	US	WW	US	WW	US	WW	US	WW
	GROUP: CART < 12 MB														
203-1 -2	TOTAL units (000)														
206-1 -2	Captive units (000)														
303-1 -2	PCM units (000)														
	PCM AUP ($000)														
306-1 -2	OEM units (000)	9.8	1.0	10.8	2.0	.4	2.4	85%	3.0-3.3		4.0				
	OEM AUP ($000)			2.8			3.2		3400-3500						
	GROUP: CART > 12 MB														
312-25 -50 -76	TOTAL units (000)														
	Captive units (000)	—													
316	PCM units (000)														
	PCM AUP ($000)														
	OEM units (000)	—	—	—		0	0	99%	.7		2.5-3.0				
	OEM AUP ($000)														
	GROUP: FIXED < 30 MB														
163	TOTAL units (000)														
	Captive units (000)														
	PCM units (000)														
	PCM AUP ($000)														
	OEM units (000)	1.3	.3	1.6			.150	0	0						
	OEM AUP ($000)			1.75											

1979 WORKSHEET: MISCELLANEOUS DATA FOR 1978

Manufacturer EXIDY

Date 3/16/79

GROUP: CART

U.S. distribution channels for non-captive disk drives

Mainframe computer manufacturers	
Mini/micro computer manufacturers	
System OEMs/systems houses	85-90
Independent peripherals suppliers	10
Direct to end user/retail dealers	5

Non-captive drives sold as subsystems (%): 0

Service and parts (% of disk drive revenues): 15%

1978 WORKSHEET: Drive shipments

Manufacturer: EMM

Date: 4/4/78

		Cumulative shipments year end, 1976			1977 net shipments			Forecast 1978		1979		1980		1981	
		U.S.	Non-US	WW	U.S.	Non-US	WW	AGR %	US %	AGR %	US %	AGR %	US %	AGR %	US %
	GROUP: CART <12MB														
203-1	Captive units (000)														
203-2															
206-1	PCM units (000)														
206-2	OEM units (000)	8.9	.9	9.8	.940	.050	.990	1730	200 CURRENT SO JAPAN						
303-1															
303-2	PCM AUP ($000)														
306-1	PCM ALP ($000)														
306-2	OEM AUP ($000)						2.8	3.2							
	GROUP: CART >12MB FCS 4/78														
312-25	Captive units (000)														
312-50	PCM units (000)														
312-76	OEM units (000)						—	.2/0							
	PCM AUP ($000)														
	PCM ALP ($000)														
	OEM AUP ($000)							404.5							
	GROUP: SMD														
412	Captive units (000)														
	PCM units (000)														
	OEM units (000)														
	PCM AUP ($000)														
	PCM ALP ($000)														
	OEM AUP ($000)														

1978 WORKSHEET: Drive shipments

Manufacturer: EMM

Date: 4/4/78

	Cumulative shipments year end, 1976			1977 net shipments			Forecast 1978		1979		1980		1981	
	U.S.	Non-US	WW	U.S.	Non-US	WW	AGR %	US %	AGR %	US %	AGR %	US %	AGR %	US %
GROUP: FIXED < 12MD														
103 Captive units (000)														
PCM units (000)														
OEM units (000)	1.0	.3	1.3	.280	—	.280	.1/0							
PCM AUP ($000)														
PCM ALP ($000)														
OEM AUP ($000)						1750								
GROUP:														
Captive units (000)														
PCM units (000)														
OEM units (000)														
PCM AUP ($000)														
PCM ALP ($000)														
OEM AUP ($000)														
GROUP:														
Captive units (000)														
PCM units (000)														
OEM units (000)														
PCM AUP ($000)														
PCM ALP ($000)														
OEM AUP ($000)														

1978 WORKSHEET: MISCELLANEOUS DATA FOR 1977

Manufacturer EMM

Date 4/4/78

DISK CART

GROUP: ___ ___ ___ ___ ___ ___ ___ ___

U.S. distribution channels for non-captive disk drives

Mainframe computer manufacturers	10	___	___	___	___	___	___	___
Mini/micro computer manufacturers	2	___	___	___	___	___	___	___
System OEMs/systems houses	60	___	___	___	___	___	___	___
Independent peripherals suppliers	28	___	___	___	___	___	___	___
Direct to end user/retail dealers	0	___	___	___	___	___	___	___

Non-captive drives sold as subsystems (%)	0	___	___	___	___	___	___	___
Service and parts (% of disk drive revenues)	30%	___	___	___	___	___	___	___

EMAM – JACK McLAUGHLIN 4/4/78

V.C. BROWN — BOUGHT NON-EXCLUSIVE MFG. RIGHTS.
PLANS TO PRODUCE 2,000 DRIVES IN NEXT 5 YEARS

EMAM CART. DRIVE CUSTOMERS: HONEYWELL (1977)
PLESSY
XYLOGIC
V-C. BROWN

EUROPEAN DISTRIBUTOR: TALLY

312 — EXPECT FCS 4/78
— PLAN TO INCREASE CAPACITIES TO MATCH PHOENIX/HUNTER
— ATTEMPTING TO SELECT CUSTOMERS WITH APPROPRIATE GROWTH PROFILE: SLOW-STARTING GROWTH CURVE, SO EMAM CAN PROVIDE PROPER SUPPORT
— 2250 SPINDLES IN 1978

TRIDENT — PHASING OUT

SUBSYSTEMS — CART: PHASING OUT
312: WILL EMPHASIZE

WINCH — NEXT PROGRAM: COULD DEVELOP OR BUY LICENSE

MEDIA: ① EMAM MEDIA OPERATION WILL ASSEMBLE 312 CARTRIDGE
② WINCH. HDA SOURCE UNKNOWN UNTIL PLANS ARE FIRM — BUT IT'S ASSUMED ~~THAT~~ HDA ASSY WILL BE INTERNAL.

DYSAN IS CURRENT SOURCE FOR 312 DISKS

WORKSHEET: Drive shipments

Manufacturer: EMM

Date: 2/23/77

	Cumulative shipments year end, 1975			1976 net shipments			Forecast 1977		1978		1979		1980	
	U.S.	Non-US	WW	U.S.	Non-US	WW	AGR %	US %	AGR %	US %	AGR %	US %	AGR %	US %
GROUP: DSK CART														
Captive units (000)														
End user AUP ($)														
Non-captive units (000)	MOSTLY		8750	100%		100 UNITS	0		+20/30					
OEM AUP ($)														
End user AUP ($)														
End user ALP ($)														
GROUP: FIXED (103)														
Captive units (000)														
End user AUP ($)														
Non-captive units (000)	MOSTLY		650	100%		80 UNITS								
OEM AUP ($)														
End user AUP ($)														
End user ALP ($)														
GROUP: SMD							NOMINAL							
Captive units (000)														
End user AUP ($)														
Non-captive units (000)														
OEM AUP ($)														
End user AUP ($)														
End user ALP ($)														

DISTRIBUTION CHANNEL SUMMARY
U.S. NON-CAPTIVE DISK DRIVES:

Includes U.S. public sales or leases by U.S. or non-U.S. drive manufacturers only; does not include shipments or internally manufactured drives by computer manufacturers or system OEMs to end users.

Distribution channel	1976 U.S. net shipments Units (000)	%	Forecast 1977 %	1978 %	1979 %	1980 %
Medium/large scale computer mfgrs						
Mini/micro computer manufacturers		20/30%				
System OEMs/system houses		70/80%				
Independent peripherals suppliers						
Direct to end user						
Total						

EMM – JACK MCLAUGHLIN 2/23/77

SMD: MODEL 412 (BD 50) – AVAILABLE TO TAKE ORDERS NOW, BUT NOT PUSHING IT.

NEW: MODEL 312 – UP TO 72 MB

	DISKS	DATA SURFACES
F:	3	5
R:	1	2

4444 BPI 370 TPI
TRANSFER RATE 388 KB/SEC
SEPARATE SERVO SURFACE
3330 HEADS/MEDIA
ANNOUNCE: 4/77
DELIVERY: LATE 4Q77

Electronic

VOL. 26, NO. 1320 MONDAY, DECEMBER 22, 1980 ONE DOLLAR

FCC Deregulation Plan Exempts Bell, WU, Independents

By M.J. RICHTER

— WASHINGTON — With an eye toward reducing regulatory costs, the Federal Communications Commission last week proposed to back off from regulation of all common carrier service except those of AT&T and the independent telephone companies and Western Union's telex and TWX.

Suggesting that market dominance was determined by the ability to control both access to facilities and prices, the FCC concluded there may be little justification for government regulation of specialized common carriers, resale firms, domestic satellite carriers, resellers of domestic satellite services and miscellaneous carriers.

Should the FCC eventually adopt its own proposal, companies such as MCI and Southern Pacific, ITT's Domestic Transmission Systems, Graphnet, RCA Global Communications, and Western Union's satellite ventures, American Satellite and Eastern Microwave, would be freed of virtually all government regulation.

In related action also aimed at replacing government regulation with market forces, the commission last week formally adopted its earlier Second Computer Inquiry ruling which allows AT&T to provide terminal equipment and enhanced services through a separate subsidiary (EN, April 14).

Early last month, acting on petitions for reconsiderations, the FCC rebuffed staff recommendations by orally voting to exclude GTE from the structural separation requirement (EN, Nov. 3) which was originally proposed.

Last week's adoption of official language

See FCC, Page 8

TAKING THE BOSS TO LAUNCH: Henry Hockheimer, president of Ford Aerospace & Communications, right, is momentarily distracted as he enters the launch area at Cape Canaveral with his boss, Philip Caldwell, Ford chairman. The two executives attended the first launch of the Intersat-5 global communications satellite built by the Ford subsidiary.

Estimate $3B Orders In U.S. NTT Accord

By JACK ROBERTSON

WASHINGTON — The U.S. and Japan late last week signed a bilateral agreement opening up Nippon Telephone & Telegraph (NTT) procurements to foreign competition — which departing U.S. Trade Representative Reubin Askew estimated would make $3.3 billion in purchases available to American telecommunication firms.

The complex agreement puts $1.5 billion in NTT purchases — mostly for routine items — under the legal conditions of the international GATT Code on Government Procurement.

Mr. Askew said the remaining $1.8 billion is covered by the separate U.S.-Japanese bilateral pact, involving mainline telephone switching, computing and transmission equipment. Because this gear is not under the GATT code, however, the Japanese pledged to follow open buying practices "consistent with the GATT government code."

The agreement included several specific procurement steps for NTT to take when dealing with U.S. telecommunications companies.

- NTT will issue in a timely manner an RFP on any potential purchase of the sophisticated telecommunication equipment, covering the nature and quantity of product, delivery date, information on supplemental procurement documents, economic and technical requirements, and assurance that firms which qualify will be considered for follow-on procurements.
- U.S. firms responding to the RFP will be provided adequate documents to form the basis of their proposals, with criteria for selection and award of contracts spelled out, including any factors for compatibility with existing systems, quality control and stable supply.
- Competing firms will have no fewer than 30 days

See U.S.-JAPAN, Page 4

127-PIECE TERMINAL ORDER

Rules Against Supplier For Pre-Empting Distributor

By JEFF MOAD

SAN FRANCISCO — A federal judge has ruled illegal the attempt by a peripherals manufacturer to pre-empt one of its distributors on a 127-piece terminal order by qualifying the account as an OEM and offering a lower counter-bid.

According to the ruling, Applied Digital Data Systems was found guilty of interference with the business of distributor Consolidated Data Terminals Corp., and has been ordered to pay CDT $655,544.50 in damages.

The ruling could set a precedent in small computer and peripherals' supplier/distributor relationships, which are seriously strained by charges of price aggressiveness and saturation distribution in the present soft market.

U.S. District Court Judge Daniel H. Thomas, in a ruling which followed a week-long trial here in September, found that ADDS "wrongfully interfered with CDT's economic relationship with Intel" when, in June, 1978, ADDS readjusted its bid on over 100 terminals to be purchased by Intel and won the order, which had initially been awarded to CDT, a distributor of ADDS Regent 100 and Regent 200 terminals.

CDT became an authorized non-exclusive distributor of ADDS terminals in 1976. The company dropped the ADDS products in July, 1978, just after it lost the Intel order to ADDS and added Televideo and Hazeltine terminals to its catalog.

Judge Thomas, in his ruling, said the June, 1978, order by Intel was for 127 terminals for internal use. The order attracted bids from CDT, ADDS and other companies, but the

See COURT, Page 34

EM&M CPU Div. Sold to Employes

By IRA SAGER

SAN JOSE, Calif. — Electronic Memories & Magnetics Corp. last week sold off its Computer Products division to a group of employes who will split the division into two companies.

The Computer Products division, which was purchased for an undisclosed amount of cash by an employe group headed by the division's general manager Ed Farris, will be divided into a leasing firm and a service and support company. Both firms will handle the entire range of

See EM&M, Page 6

worth of this equipment, including ruggedized versions of an Intel Corp. board microcomputer. Taylor sees his business rising to $70 million annually by 1985 as defense spending rises and computers move on to factory floors and other such industrial locations as oil drilling rigs.

But history may be repeating itself for EM&M. The company has run into a problem with its ruggedized computers that resembles those that got it into trouble with its high-growth businesses in the first place. It was hit with a patent infringement suit from Digital Equipment Corp. (DEC). That action delayed for two years the marketing of a ruggedized version of the PDP-11 minicomputer. "We didn't think DEC would care," says Taylor.

EM&M settled the case by signing a licensing agreement with DEC last spring, agreeing to pay royalties for using the computer. The agreement also limits sales to military markets, squelching EM&M's plans to sell the minicomputer for industrial applications. Taylor figures that he still will make his sales goal in this business. And at least one outsider believes that he may have a chance. "High growth is just not their style," says consultant Porter, but "there are tens of thousands of unglamorous companies in the U. S. Maybe it's plausible for EM&M to be one of them." ■

DATA COMMUNICATIONS

Northern Telecom's U. S. albatross

When Northern Telecom Ltd. swooped down in 1978 and purchased Sycor Inc. and Data 100 Corp., the acquisition of the two U. S. computer terminal companies seemed to be the perfect strategy to propel the big Canadian maker of telecommunications equipment to the forefront of the emerging U. S. market for automated office equipment. But a steady stream of management defections has decimated these organizations (BW—Jan. 28), and, rather than being an easy way into the U. S. marketplace, the two companies have turned into a heavy drag on profits.

Just how large a profit drain was made clear when Northern Telecom reported on July 25 that its second-quarter earnings had dived 98% to a mere $616,760 from $26.9 million in the corresponding quarter last year. On top of that, revenues, which have risen at a compound rate of 17.7% over the past five years, grew only 5.7% to $482.1 million in the quarter.

Surprised. To some degree, Northern is experiencing the same recessionary pressures that have caused lower second-quarter earnings throughout the telecommunications industry. Net income slumped 20% to $133 million at General Telephone & Electronics Corp., and United Telecommunications Inc. reported earnings off 7% to $43.7 million. But the magnitude of Northern Telecom's slide made it apparent that more than the state of the economy was involved. Indeed, the company had been warning of a poor second quarter but admits that even it was surprised by the bad results.

The major source of these disappointments was Northern Telecom Systems Corp., which had absorbed both Sycor and Data 100. Heading the list of problems at the U. S. subsidiary is continuing management turnover, which began two years ago at the time of the acquisitions. Marcelo A. Gumucio recently took over as the subsidiary's fourth president in two years after Leonard N. Mackenzie terminated his 16-month stint to join General Automation Inc. as president.

Sales at Northern Telecom Systems are not showing much signs of life either. Last year sales of existing products were flat, and efforts to create an "office of the future" product line fell by the wayside. Corporate executives concede that terminal sales in the quarter just ended were way below expectations.

Souring the outlook for any fast turnaround on profits at the U. S. subsidiary is a new leasing policy that eliminates third-party leasing, a practice in which Northern was paid for equipment going out on lease and a leasing company financed such customers. Now Northern says that it plans to finance its own leases. That can only hurt short-term profits, because the income from leases will be spread over several years. At the same time, Northern will be forced to put a lot of capital up front.

At the request of the new U. S. management team, Northern Telecom has also written off obsolete equipment and inventories at its U. S. operations. While this contributed to the second-quarter profit decline, it should mean higher earnings in the immediate quarters ahead.

Worthless goodwill. The only other major write-off expected sometime soon is a large portion of some $90 million in goodwill and other assets from the Data 100 and Sycor acquisitions that Northern Telecom has carried on its books since it acquired the two companies. Goodwill represents the difference between the amount paid for a company and the book value of its assets—essentially the price paid for its reputation. Because of the manifold problems at Northern Telecom Systems, many analysts believe that this goodwill is rapidly becoming worthless.

Northern, in fact, had hinted that it might take this write-off in the second quarter. But industry analysts speculate that the company decided to wait because taking it now would have meant a loss for the quarter. The move, however, is not far off, they believe. "The decision is being thrust at them because if the assets are not being carried at true book value, it's the company's obligation to reduce them," says William R. Becklean,

Gumucio: Battling Northern Telecom Systems' profit woes.

Ontel Melds U.S., Int'l Mktg. Roles

WOODBURY, N.Y. — Ontel Corp., seeking to expand both its domestic and international sales and marketing activities, has coordinated those functions under marketing vice-president Edward J. Heinze.

Heinze, until recently Ontel's domestic sales vice-president, now assumes additional international sales and marketing responsiblities formerly held by Frank Kirby, Ontel's previous international marketing vice-president.

Kirby, who was promoted to senior vice-president for business development, now is responsible for planning and implementing strategic corporate activities, with primary emphasis on overall business expansion.

Both Heinze and Kirby report to Ontel president David Ophir.

Additionally, Ontel has established three new sales and marketing positions, each reporting to Heinze.

Douglas Wagner, former Boston branch manager, was named national sales manager, assuming some of Heinze's previous domestic sales responsibilities.

Brian Stephens becomes general manager of Ontel's international sales and marketing organization, Ontel International Ltd. He had been European sales manager.

David Schiffer, former international sales manager, was appointed international marketing manager. Both Stephens and Schiffer assume duties previously held by Kirby.

Ontel also said it has opened seven domestic branch offices, a central European office headquartered in London and added nine systems and software technicians at the firm's headquarters here, in order to provide a higher level of customer support to Ontel's OEM customer base.

Electronic Memories & Magnetics Names Peripherals Division GM

SAN JOSE, CALIF. — Electronic Memories & Magnetics Corp.'s Peripheral Products Division has named Denman D. Kessler general manager, replacing Roger Evans who left EM&M to become terminals product manager at Plessey Peripheral Systems, Inc.

Former national sales manager for the division, Kessler is now responsible for sales, manufacturing, accounting and marketing.

He reports to vice-president Ed Farris.

The division will not fill Kessler's previous position immediately, it was noted.

Vance Reelected To IBM's Board

ARMONK, N.Y. — Cyrus R. Vance, former U.S. Secretary of State, has been reelected to IBM's board, increasing the number of corporate directors to 22.

Vance was a member of the board from June, 1969, until December, 1976. He became Secretary of State in January, 1977, and resigned that post last April.

He currently is a partner in the law firm Simpson, Thatcher & Bartlett, New York, and recently was elected a member of *The New York Times'* board of directors.

Decision Data Taps Nat'l Sales Director

HORSHAM, PA. — Decision Data Computer Corp. has promoted former national product manager Joseph T. Simone to the newly created position of national sales director.

Simone is now responsible for the entire field sales operation for North America.

Simone reports to marketing vice-president Kenneth R. Whitehouse, who formerly held those responsibilities.

Simone's previous duties have been assumed by Herb Dusinberre, product marketing director.

Asst. VP Of Mktg. Named At Reynolds

DAYTON, OHIO — Reynolds & Reynolds Co.'s Professional Systems Division, Walnut Creek, Calif., has named Douglas E. Strasser to the new assistant vice-president of marketing post.

Previously sales manager for the firm's Business Systems Division, Strasser is now responsible for product development, advertising, promotion and trade shows.

Wang Plans 1st Image Printer Shipment

By GEOFF LEWIS

LOWELL, Mass. — Wang Laboratories, Inc., said it will ship the first production model of its Image Printer by the end of the month a year after the originally scheduled shipment date, and after a variety of modifications to the original design.

The printer, which uses a fiber optic imaging technique to transfer text from a CRT to a plain paper copier mechanism, was introduced in December, 1978, and was slated for customer deliveries the following March. According to Thomas E. Turner, Wang's marketing manager for graphic systems, deliveries slipped as the company "went through a long learning cycle" with two unfamiliar technologies — fiber optics and copiers.

As a result, the firm has thus far only delivered machines to four "beta test" customer sites. The machines, each of which is supported by a duplicate unit at a nearby Wang office, have undergone a number of modifications and adjustments aimed at perfecting the non-impact printing technique and improving reliability. The improvements have been incorporated in production models which are scheduled to start reaching customers next month at a rate of four to six units a month, Wang said.

WP Quality

The main hurdle Wang has had to overcome in bringing the printer to market is understood to be deriving the required print quality for word processing. The printing mechanism itself is based on the Ubix plain paper copier manufactured by Konishiroku Photo of Japan and marketed in the U.S. by Royal Business Machines under the name Royfax.

The first modification Wang made was to abandon the convenience copier feature with which the machine was in-

Continued on Page 43

No Buyers Found, EM&M Will Shut Peripherals Unit

SAN JOSE, Calif. — Negotiations between Electronic Memories & Magnetics Corp. and several companies interested in acquiring EM&M's Peripheral Products division here have fallen through, and EM&M officials last week said the operation will be substantially closed down by the end of February.

EM&M had said late last summer it would close the disk drive operation by this month if no buyer could be found. The division is understood to have had annual sales of about $7.7 million.

According to EM&M finance vice-president Raymond C. Lawhon, the disk drive manufacturing facility, which grew out of Caelus Memories, purchased by EM&M in 1969, will produce only spare parts for installed disk drives after Feb. 29. He said the facility is expected to have a staff of from 15 to 20. Mr. Lawhon said the division had about 200 employes when purchased by EM&M.

Mr. Lawhon said talks with other companies interested in buying the Peripheral Products division broke off when "no satisfactory conditions could be agreed to." He would not identify any of the companies involved in the talks, but sources have indicated that Plessey was among them. Mr. Lawhon said the talks broke off not over financial disagreements but because none of the interested companies could fit Peripheral Products division products into their own lines.

Mr. Lawhon said the San Jose division will continue to produce disk drives until the end of February, and said several of the division's customers placed large last orders when notified last year that EM&M would either sell the division or close it (EN, Aug. 27, 1979).

Mr. Lawhon said the decision either to sell or close the division resulted from EM&M's realization that a substantial research and development investment would be required to keep the disk drive operation competitive.

Mr. Lawhon said John Barworth has been named general manager of the Peripheral Products division to replace Roger Evans who recently left the company.

Caelus Memories, the disk pack company which was split from Peripheral Products division, recently was sold to North American Corp. (EN, Dec. 24, 1979).

Find Ampex Guilty Of Patent Fraud; $100K to Memorex

SAN JOSE, Calif. — Ampex Corp. has been ordered by a U.S. District Court judge here to return to Memorex Corp. a $100,000 license fee, paid by Memorex on an invalid patent in 1966.

Judge William A. Ingram found Ampex guilty of licensing fraud and misrepresentation to the U.S. Patent Office on a patent, known as the Talley patent, on magnetic tape coating materials. The judge also found that Ampex violated two separate Memorex patents on disk drive head and arm assemblies.

The suit originally was filed by Ampex in November, 1974. Ampex at that time charged Memorex with patent infringement. Ampex later disclaimed the patent in question. The suit then reverted to counter charges brought by Memorex.

The Memorex patents, which Judge Ingram ruled were violated by Ampex included one known as Applequist involving disk recording arm assemblies and the Higgins-Massaro patent involving disk drive head positioning mechanism.

Memorex officials said the patents and licenses involved in the suit were all in previous-generation devices such as the Memorex 600 line of disk drives.

Caelus Media Sold to No. American

By JEFF MOAD

SAN JOSE, Calif. — Caelus Media Products, formerly a subsidiary of Electronic Memories & Magnetics Corp., has been sold to North American Corp., a New York-based peripherals leasing company, it was learned.

The cash transaction, which has been completed, followed an unsolicited offer by North American in October. Terms of the deal have not been released.

Caelus Media Products refurbishes and sells OEM disk packs and disk cartridges. Its fellow subsidiary, Caelus Peripherals, remains under the EM&M banner. EM&M, however, has said it is looking for a buyer. If a buyer cannot be found by the end of February, the Caelus Peripherals operation will be closed, EM&M has said (EN, Aug. 27).

Caelus Media Products and Caelus Peripherals became a part of EM&M in 1970. North American Corp. is privately-held.

According to Caelus Media director of operations, Pern Good, the subsidiary expects to report revenues of $5 million in 1979, a significant increase over previous years. The subsidiary currently has about 60 employes, up from about 40 a year ago, according to Mr. Good.

According to EM&M vice-president Edward Farris, Jr., the offer from North American Corp. came after Roger Evans, EM&M general manager at Caelus, left to join Piessey Ltd. as a new product manager. According to Mr. Farris, "We weren't looking to sell the subsidiary, but the North American offer was too good to turn down."

According to Mr. Good, who remains at Caelus, North American president, Martin Silverman, has said Caelus Media Products will continue to operate relatively independently. Mr. Good said Caelus plans to reduce its dependence on OEMs and to beef up its manufacture of 80-, to 300-megabyte disk packs.

17,500-Sq.-Ft. Facility Leased by Imlac Corp.

NEEDHAM, Mass. — Imlac Corp. said it has leased a 17,500-square-foot building near its headquarters, here.

The new facility will house manufacturing operations, which have been at the 40,000-square-foot headquarters, along with administrative, engineering and marketing staffs, the firm said.

Imlac, a subsidiary of Hazeltine Corp., makes computer graphics terminals.

Verbatim Sees 2d-Quarter Net Off

SUNNYVALE, Calif. — Verbatim Corp. said low sales volume and a severe quality control problem will push down the profit for the second quarter ending Dec. 31 "substantially lower" than both the previous and year-ago quarters.

Verbatim, which makes disk and tape media, said it received fewer orders than anticipated for its older line of single-sided diskettes and more orders than it could fill for its higher-capacity diskettes line.

Wiley L. Carter, vice-president of finance, said the company has taken steps to shift its production to the higher-density products and expects that its order rates and profit figures will recover by the end of the current fiscal year.

"Assuming no reduction in current order rates and a continuation of current operating performance, profits for the fiscal year will be above those of the prior year," Mr. Carter said.

Verbatim earned $2.3 million, or $1.70 a share, for fiscal 1978. For the first quarter ended Sept. 30, the company reported a profit of 30 cents a share; for last year's second quarter, earnings amounted to 36 cents a share.

Mr. Carter also said a problem with faulty material supplied for diskette jacket liners had a "severe effect" on second-quarter earnings.

Fujitsu, Amdahl Eye Mktg. Deal

Continued From Page 18

Siemens. The 2806 is about a year old.

Fujitsu owns an estimated 26.7 per cent of Amdahl's outstanding common stock and is a supplier to Amdahl for the latter's 470 line of IBM-compatible computers.

Amdahl's interest in developing a communications product line was documented earlier this year when the company made an unsuccessful bid for Comten, a maker of data communications computer systems eventually acquired by NCR.

Amdahl's recent abortive merger discussions with Memorex were also said by observers to have offered Amdahl a communications processor product potential, in addition to data storage peripherals. Memorex markets two front-end communications processors.

Sources said Fujitsu has informally talked to other U.S. companies about marketing the 2806 in this country but the Japanese firm has apparently settled on negotiating with Amdahl.

Beyond the obvious compatibility of a communications processor product line with Amdahl's current line of large-scale computers, sources said Amdahl is being pushed to consider directly entering the communications market by the probability that IBM will increase communications capability in its anticipated H-Series, the next line of large-scale IBM computers.

Memorex Sees Profit Sag In Qtr.; Cites 'Soft' Orders

SANTA CLARA, Calif. — Citing pricing pressures, production problems and inflationary cost increases, Memorex chairman and chief executive Robert C. Wilson last week said the company will report a fourth-quarter, 1979, profit sharply lower than the $12.4 million profit reported this time last year.

Mr. Wilson said Memorex' fourth quarter will show a profit, but net earnings will be "less than half" of the $7.1 million profit reported last quarter. Memorex' current problems will continue to plague the company in 1980, he said.

Memorex' fourth quarter ends this month. Results are expected in January, a spokesman said.

In addition to pricing pressures and production problems, Memorex blamed "softness in orders for consumer products" for the anticipated poor showing. Memorex officials were not available last week to detail the product areas that have been squeezed by pricing pressures and which consumer products experienced a softness in orders.

Memorex sources last week, however, said production and planning problems have plagued the Memorex 3650 and 3652 disk drive products. Responsibility for the 3650, a 317-megabyte drive introduced 2 years ago, has shifted from the Media group to the Large Storage Systems group, now headed by James Simpson, who is understood to be working to smooth out production problems. The 3652 is the double-density version of the 3650, introduced about 6 months ago. Sources said deliveries of both systems are below expectations.

Also behind schedule, according to sources, is the relatively new 3770 disk cache, based on Fairchild-made CCDs. Soon after introduction of the disk cache, Fairchild raised its CCD prices instead of lowering them, which had been expected at Memorex, sources said. Also cutting into the 3770's business, according to sources, have been IBM's main memory price cuts.

Mr. Wilson predicted similar disappointing 1979 earnings results last July, blaming "IBM's aggressive actions," which he said had reduced prices and "caused customers to delay purchase decisions." Mr. Wilson in July said Memorex was "unlikely" to meet an earlier prediction of a 25 per cent increase in 1979 net income.

At that time, Memorex officials blamed IBM's spring 15-per cent price cut on its 3350 disk drives and on some controllers. Memorex subsequently cut its own prices.

Sources said Memorex' soft consumer products orders probably referred to its consumer tape and commercial video tape lines.

Mr. Wilson said that "actions are being taken to address all of these matters, although it is expected that they will continue to impact the company in 1980." No company officials were available to say what actions are being taken.

Mr. Wilson also said "International order rates for equipment and worldwide demand for computer media products continue to be strong."

—J.M.

I/O Spec Protesters Fear Monopoly Loss: Commerce

WASHINGTON — The Commerce Department has charged that four mainframe manufacturers were challenging implementation of federal I/O standards because they would no longer have "absolute monopoly" over sales to the federal government of peripheral devices used with their computers.

In papers filed in federal court here, the department acknowledged that the standards will have an undeniable — "indeed, intended" — impact on the four major computer manufacturers and other firms by making more competitive the government's procurement of automatic data processing equipment.

As reported (EN, Dec. 3) the department, which said it expects a quick resolution of the case, has asked the court to dismiss the suit filed by Sperry, Honeywell, Burroughs and Control Data.

Meanwhile, in a related action, Judge John G. Penn scheduled a hearing Jan. 3 on the department's motion to dismiss. The judge also slated another hearing Jan. 19 for the companies to designate the kind of documents they will request in support of their demand for summary judgment.

Despite the companies' claims that the standards are anti-competitive and outdated, government attorneys contend that the standards will actually open up the federal market for manufacturers of peripheral devices.

EMM Officer Turns Around Caelus Operation

ENCINO, Calif.— Managers at Electronic Memories and Magnetics Corp. (EMM) have been pumping new life into its Caelus division by reorganizing or eliminating unprofitable product lines.

Involved in the founding of Caelus Memories in the 1960s, EMM became committed to the disk drive and disk media business by purchasing Caelus in 1971. More than three years ago, EMM assigned the operation to Vice-President Ed Farris with a charter: make it profitable or get rid of it. Farris has a reputation for turning around some "doubtful" properties.

Prior to Farris' arrival, the Caelus drive operation had not moved with the changing market and lost out on the growth experienced by some of its competitors. Upon taking over, Farris established separate divisions and profit-and-loss status for the disk drive operation (now Peripherals Products Division) and the media operation (Media Products Division). He then evaluated three possible courses of action for the drive division:

- See what the market would bring for the operation and sell if the price was right.
- Make the changes necessary to make it profitable.
- Close it down if neither of the other options were feasible.

Farris brought in Fred Wolff, a long-time EMM associate known at the company as an austere operations manager. Together they evaluated the operation and started making changes. They pared down the general and administrative management, cutting out a layer they felt they could do without.

Wolff then started making changes in the manufacturing operation, designing a more efficient, streamlined plant to increase output without increasing labor content and introducing some assembly techniques. Concurrently, he took a careful look at the inventory that was being carried and made reductions and changes.

Sale to Ball

EMM had a separate R&D facility which was developing a specialized disk drive (compatible with the California Computer Products, Inc. Trident). This represented a significant overhead cost to the division.

Farris sold R&D and the product line to Ball Computer Products. Ball needed the product for its systems operation and couldn't wait for a startup operation to get off the ground; EMM needed the reduction in overhead costs.

Wolff found that in order to survive in a market dominated by a few suppliers, he had to improve the quality of product to ensure competitive pricing and a reasonable delivery. He found several products that weren't worth keeping and dropped them.

Growth also became dependent on having the latest generation of product. Farris made a detailed market study and then got the corporation to back his development of a new generation of drives in 1977 for delivery in 1978.

These drives will increase the company's product capacity range to 76M bytes. They use up to three fixed disks and a removable cartridge. Wolff is projecting volume shipments in late 1978.

EMM has attracted a cross-section of customers — from large OEMs to small, highly specialized systems houses. Another EMM division, Commercial Memory Products, has taken delivery of a number of drives for its small business system (the System 800).

Bottom Line Moves Up

As a result of all these moves, the bottom line in fiscal 1977 showed a net profit of about 8% on revenues of more than $4 million for the Peripheral Products Division.

Farris is very bullish for 1978. With the backlog in disk drives, he could almost double revenues in a year, he said.

He also noted the company is shipping drives at a record rate. "We feel that we're in a position to become aggressive in our marketplace. We've got the products, production capacity and commitment to make it all work — profitably," he added.

However, he doesn't rule out the possibility of selling out if the right price were offered. "You have to look at each deal on its own merit," he pointed out.

Three divisions once on the "doubtful" list now report to Farris. They are all profitable, representing collectively about 30% of the company's 1977 revenues and a significant contribution to the bottom line.

Contracts

MSI Data Corp. has received an order from Data Systems Corp. for 200 Source 6600 data entry terminals. The order is valued at approximately $750,000.

Beehive International has signed a two-year contract with Western Union Data Services Co., Inc. to supply a variety of terminals. The contract is valued at between $280,000 and $2,000,000 depending on the number of terminals ordered.

Imlac Corp. has received an OEM agreement in excess of $400,000 from Hughes Aircraft Co., Industrial Products Divison, Carlsbad, Calif., for interactive computer display systems. The systems will be used in the Hughes AM-1 automatic marking system for the garment manufacturing industry.

Heath Co., Benton Harbor, Mich., has opened a small business computer operation. This week, **Heath Data Systems** plans to introduce two systems, one based on the **Intel** 8080 and the other on **Digital Equipment's** LSI-11. The first is priced at approximately $2,200, while the second, consisting of several components, is to carry a $6,200 tag. Unlike many of Heath's other products, however, the small business machines will not be offered in kit form.

* * *

Declining sales of its word processing systems have prompted **Wordplex** to largely dismantle its Westlake Village, Calif., marketing operation. Reportedly, after the firm was taken over by **AES Data Ltd.** last year, AES' parent company **Canada Development Corp.** moved to eliminate Wordplex's fledgling direct sales force and shifted marketing support operations to **Lanier.** Lanier is a part-owner of AES and markets the Wordplex systems in the U.S. Meanwhile, in Montreal, AES' vice-president of marketing Robert Karp left early this month when his contract was not renewed.

* * *

IBM is remaining mum on further details of its software integration problems which have pushed backed delivery of its System/38 small business computer. "Frankly, we're in a no comment position and we're referring all calls to public relations," said G. Glenn Henry, programming manager for the System/38 in Rochester, Minn. Asked if the company planned to release any information in the near future, Mr. Henry said he doubted it.

EM&M Will End Disk Unit Through Sale or Shutdown

ENCINO, Calif. — Electronic Memories & Magnetics Corp. late last week said it is negotiating to sell its disk drive operations to an unidentified company but if it is unable to sell that part of the business, it will close its San Jose, Calif., plants by March, 1980.

Edward Farris, Jr., corporate vice-president and general manager of the Computer Products division, Hawthorne, Calif., said EM&M currently is negotiating with a privately-held firm to sell the disk drive operation.

Mr. Farris said "active discussions" have been under way for "about 2 weeks," but he would not identify the firm until it had set terms with its banks. He did say, however, the suitor "is an American company involved in the general industry but not in the rotating head field and it is not Plessey."

He said EM&M expected to know, by the end of September, whether the deal would go through.

"If this one doesn't develop and we can't find another buyer, we will close down as of Feb. 29, 1980," Mr. Farris said.

Continued on Page 32

this year under the university's prime contract with the U.S. Department of Energy, Cray said. The laboratory does energy and defense research, and was the site of the first Cray-1 computer, which was later upgraded to 1-megaword size, Cray said.

Cray vice-president of finance John Carlson said the firm had a letter of intent from Sandia Laboratories for the cancelled installation of the $6.5 million Cray-1B system in the fourth quarter of 1979 under its prime contract with the Department of Energy. It hadn't been decided whether the system would be leased or purchased.

The DOE rejected the proposed contract with Cray for containing specifications that weren't precise, Mr. Carlson said, adding that he didn't know what specifications were involved.

Cray president John Rollwagen said the loss of the fourth-quarter Sandia installation "will not have a significant impact on the company's 1979 results." Cray has experienced higher-than-expected revenues this year from the outright sale of systems rather than anticipated leasing, leaving it in a good cash position, the firm said earlier (EN, July 30).

It will be 6 to 9 months before the results of the rebidding on the Sandia Laboratories contract are known, Mr. Carlson said. Cray will try to book a replacement Cray-1 contract for the fourth quarter, but it isn't likely that can be done, he added.

Italy Gets Amdahl CPU

TURIN, Italy — Amdahl Corp. has installed a 470-V/5 mainframe at Fiat Auto Spa, here, which will be used for handling production and distribution of cars.

The $2.4 million machine will run with several IBM computers to match production to demand so auto dealers can order specific models or features in a minimum of time, according to Tarcisio Zucca, chief of the firm's information systems operation.

must purchase their present CPUs by Oct. 31, 1979 and machines to IBM by June 3 order to receive the trade-in IBM explained.

Industry observers last the plan as "very significan that IBM has more to gain trade-in policy than from th because of the larger numb ble customers.

The allowance is calcul sliding scale ranging from if the trade-in is made on J 7.3 per cent if made on June said the allowance is to be the purchase price of the ne long as it is not more than of the new purchase price. is determined as of the day

DEC Pares

By ERIC LU

MAYNARD, Mass. half its allocation on it has angered its distri

Distributors who had pla for 500 or more terminals, contract and discount al DEC, now receive 20 te month instead of the 40 they ting until a few weeks ago. is the successor to the which was phased out of last year.

"I think DEC didn't fore plosion of the market," sa minals distributor, who ask name not be used. "I thin poor planning on their par

DEC declined to give figures, but said ther problems in manufacturin

In addition, DEC has ad production to its plant in que, N.M., and sources sai turn the plant into its peripherals display mar facility.

A reporter's calls to Ton product manager for the V recently moved from P

Datapoint Adds Terminal, Printer

SAN ANTONIO, Texas — Datapoint has added a CRT terminal and a 160-character-per-second matrix printer for its Datashare time-sharing business computers.

The 8200 Datastation can be used to replace the earlier 3600 CRT terminal and uses an RS-232C interface and the manufacturer's 9462 multiport communications adaptor to transmit data at speeds up to 9,600 bits per second. It has a 1,920-character display with five by seven dot matrix characters and includes a 55-key typewriter keyboard and an 11-key numeric pad.

Features include 10 programmable function keys that can be used for brightness control, tab/cursor positioning and program branching, the manufacturer said. It supports a variety of printers ranging in speed between 80 cps and 340 lines per minute and lists for $1,450. Three-year lease pricing is $47 a month, with shorter leases available, Datapoint noted.

The manufacturer has also added the Model 9622 160-cps printer designed to replace earlier 80- and 160-cps Freedom printers. It is available with both parallel and serial interfaces. The parallel version lists for $2,745 or $88 monthly on a 3-year lease and the serial version is $2,495 with a lease available only when used with Datapoint's 1500 distributed processor.

The printers, Models 9621 and 9622, respectively, are priced at $1,850 and $1,795 each in quantities of 50. Both use a nine by nine dot matrix and produce lower-case descending letters and underlines, the manufacturer said.

EM&M Will Divest

Continued From Page 18

– Affected are the Peripheral Products and Media Products divisions, in adjoining buildings in San Jose. Roger Evans resigned as general manager of the two unprofitable divisions last week. His position is being filled by Mr. Farris.

The sale was prompted by EM&M's decision that disk drive production "is not really in line with the direction of the corporation," Mr. Farris stated.

Honeywell Offers Its 1st Har

WALTHAM, Mass. — Honeywell last week came out with a new cartridge module disk drive for its full line of Level 6 small computers, repriced the previous disk line and increased the disk capacity of the machines.

The new disk, manufactured by Honeywell's Magnetic Peripherals, Inc. joint venture, comes in two models offering 26 megabytes (13 fixed and 13 removable) and 80 megabytes (13 removable and 67 fixed), Honeywell said. The unit is front-loading, unlike the top-loading cartridge disk previously offered with the Level 6 line.

The firm also said it would discontinue marketing 33 and 128-megabyte drives previously offered as "mass storage units." Also withdrawn is a five-megabyte disk whose entry-level positions will be filled by a 10-megabyte (five fixed and five removable) cartridge disk.

The company said the price of the 10-megabyte disk has been lowered to $11,500, from $12,700.

The new disk is priced at $14,000 for the 26-meg version and $20,000 for the 80-meg version. Del rently under way.

Honeywell said tl disks for the Leve repriced so that the disk includes a Me which previously c purchase tag.

As a result, the 67 storage unit is now $2 $25,000, and the 256-r is $33,000, down fr prices apply only to and larger CPUs, the that cartridge modu available on the Mo lower net prices.

The restriction of

DEC Par

Continued F

ecutive who ask anonymous.

"It's a phenomena mand continues as s than in the past," sa president of Nationa munications Corp.,

"It's a very good much in demand — would give a da Loonam, president sociates, Minneapol

But a DEC spokes minal productio "meeting all the co denied there were a problems.

Earlier this year, VT-100 was interru while DEC was una supply of video contr sources said DEC a make the chips itse turned the job over nyvale, Calif.

According to one s were misplaced and delayed further; H Chalmers, termin manager, said: "A we had with Signet chips was a probl winter and was re spring."

To satisfy deman which uses a 13 screen, compared screens on most o CRTs, distributors

Pertec Of

Continued From

purchased.

The agreement Philips will not incr tage of ownership for third party seeks tender.

Currently, there a lion shares of Pe standing.

On completion of which requires ap boards of directors agencies, Phillips w

DISK & TAPE DRIVES

SEPTEMBER 10, 1979

The record growth of microcomputer-based processing systems and small business systems is opening new opportunities for the manufacturers of mass storage.

Disk and tape drive suppliers are building new technologies into their products and incorporating new marketing tactics, as competition becomes fierce. Independent peripherals suppliers are racing to keep up with the demand—in an effort to position themselves for future competitive markets.

In this editorial newsprint feature, Electronic News will take a close look at independent disk and tape suppliers, catering to the end-user, as compared with the OEM suppliers, who have the systems builder in mind.

As independents move ahead with plug-compatible products, the OEM suppliers are busy selling floppy disks, 8-inch hard disk products, and tape drives offering new levels of recording density.

EN will also focus on an exciting new challenge from the semiconductor houses—the so-called solid-state disk. Using bubble memories, charged-coupled devices and standard MOS RAM, new products are

Electronic News

L. 25, NO. 1266 MONDAY, DECEMBER 10, 1979 ONE DOLLAR

N.A. Philips Battles Dealers Over Computer Withdrawal

By GARY SLUTSKER

NEW YORK — A year after it quietly took a $10 million loss on its small business computer operation and exited from the market, North American Philips faces damages of more than $20 million in a breach of contract suit in Federal District Court, here.

The suit, brought by 13 former agent dealers of Philips office computers, charges Philips Business Systems, Inc., with breaching its contracts with them and alleges the subsidiary's parents, North American Philips Corp. and N.V. Philips, induced it to cancel its agreements with its dealer distributors.

The suit, filed in District Court for the Southern District of New York, is in the pretrial discovery stage before Judge Charles S. Haight, Jr.

The dealers, which accounted for about half of Philips' 4,000 small business system installations in the U.S., claim in their complaint that their contracts, some of which extended to 1982, were suddenly cancelled in November, 1978.

At that time, Philips Business Systems transferred software support and maintenance of systems installed by its direct sales branch offices — about 2,000 units — to Pertec Computer Corp. (EN, Nov. 20, 1978).

Faced with no outlet for its parent's products in this country, North American Philips began merger negotiations with Pertec and made an unsuccessful bid to acquire 41 per cent of the California peripherals firm. Observers saw the bid as a sign North American Philips wants to re-enter the U.S. computer business though recently it declined to better a higher bid from Triumph Adler, a

See N.A. PHILIPS, Page 12

loyd's Sees PU Losses t $340M

By JOHN BYRNE

ONDON (FNS) — Lloyd's ondon expects to lose $340 lion on computer leasing irance, the firm said last k in a rare disclosure that owed by several days Itel's cation that it might seek million in claims.

spokesman for Lloyd's ied, however, that the inance underwriter's projecis were connected with 's intentions.

loyd's estimate — ulated for Lloyd's in a ly by First National Bank Boston — represents a 45 cent increase in liability r a previous $234 million that Lloyd's initially exted on computer leasing. first estimate was made ly this year by Toplis & ding, loss adjusters.

loyd's said the liability esate was revised after a re detailed examination of tracts and other docuits by First National Bank Boston, which was commis-

See LLOYD'S, Page 37

—Photo by Guy de Lort

BUBBLING OVER: H. Dean Toombs, vice-president and head of Texas Instruments' Advanced Front End Prototype Center and magnetic bubble operations (left), and James A. Hutchby, technical program chairman for the International Electron Devices Meeting, respond to off-camera greetings in the lobby of the Washington Hilton last week before the start of sessions. Other photos and a story on the meeting appear on Page 66.

Jury Finds AT&T Blocked Rival's Interconnect Sales; Assess Damages Today

By JACK ROBERTSON

BRIDGEPORT, Conn. — A federal court jury here has found AT&T, Western Electric and Southern New England Telephone Co. (SNET) guilty of antitrust violations in blocking competitive sales of interconnect equipment — and will assess damages at a hearing today.

The jury found AT&T guilty of six monopolistic practices in violation of the Sherman and Clayton Acts — anticompetitive pricing, marketing, advertising and introduction of new products, and use of its utility function and protective coupler to bar rival products.

The antitrust suit was brought in 1975 by East Hartford, Conn.-based Northeastern Telephone Co., a supplier of independent PBX and key telephone sets. The interconnect firm charged that AT&T's predatory practices barred it from selling equipment to customers of SNET, which is 17.6 per cent owned by AT&T.

The same charges on a national scale have been made by the Justice Department in its antitrust suit against AT&T.

The antitrust ruling against AT&T, its supply arm and SNET affiliate, comes in the wake of two other adverse federal court rulings in separate antitrust cases in Philadelphia and Iowa.

As reported, a Philadelphia federal appeals court rejected AT&T arguments that the carrier's regulated utility status exempted it from antitrust laws, and ordered an antitrust suit brought by Essential Communications to go forward (EN, Nov. 19). An Iowa federal district court recently also ruled that AT&T and its affiliates had no immunity from antitrust laws.

A spokesman for Southern New England Telephone last

See JURY, Page 4

EM&M, Plessey Cross-Sue; Claim Disk Pact Breaches

By JOHN VERITY

NEW YORK — A dispute over manufacturing and supply of disk drives has embroiled Electronic Memories & Magnetics and Plessey Peripheral Systems, Inc., in a legal battle in which the two firms have sued each other for damages exceeding $10 million.

Plessey sued EM&M for failure to deliver disk drives covered by a 1977 OEM agreement, and for failure to deliver sufficient design details for Plessey to make its own drives. Plessey has asked for damages of at least $2.25 million.

EM&M, in a cross-complaint filed late last week, has denied Plessey's allegations and asked for exemplary damages of $10 million and compensatory damages of $4.5 million, plus legal expenses.

According to Plessey's suit, it ordered some 750 of EM&M's Model 206 and 306 disk drives — at between $2,390 and $2,570 — under the 1977 OEM deal, and amended that deal in July, 1978, to

See EM&M, Page 40

Ex-Itel President Buying Digital Sci.

SAN DIEGO — Peter Redfield, deposed president and chief executive of loss-plagued Itel, is acquiring Digital Scientific, San Diego-based small computer manufacturer that initially designed the IBM-compatible processor which eventually was made by National Semiconductor and marketed by Itel until the past summer.

A letter of intent was executed which will give Mr. Redfield all Digital Scientific's preferred stock and at least 90 per cent of its common stock, in exchange for an

See FORMER, Page 36

EM&M, Plessey Sue Over Disk Pact

Continued From Page One

include the granting by EM&M of rights and technical assistance for Plessey to build the drives itself. Plessey claimed, in its suit filed Nov. 5, that EM&M began delivering technical details for manufacturing the drives, but that in April of this year EM&M refused to deliver additional, required documents.

According to Plessey's suit, it ordered some 750 of EM&M's Model 206 and 306 disk drives — at between $2,290 and $2,570 — under the 1977 OEM deal, and amended that deal in July, 1978, to include the granting by EM&M of rights and technical assistance for Plessey to build the drives itself. Plessey claimed, in its suit filed Nov. 5, that EM&M began delivering technical details for manufacturing the drives, but that in April of this year EM&M refused to deliver additional, required documents.

Because of EM&M's alleged lack of cooperation, Plessey claimed, it has been unable to develop its own disk manufacturing capability, and has therefore been unable to take advantage of the "significant financial and other resources" it has devoted to the project.

Plessey, the suit continued, was further hurt by EM&M actions when the latter company disclosed in August this year that it would cease disk manufacturing early next year if it could not find a buyer for its San Jose disk operation (EN, Aug. 27).

Plessey claimed it tried unsuccessfully to buy the EM&M disk works and encountered difficulty with some of its customers who were uncertain of Plessey's ability to deliver the EM&M drives in the future. Plessey claimed in its suit that certain disk drive orders were cancelled, despite its efforts to stand behind the product.

Plessey in September, 1979, then began withholding money from EM&M because, the suit claimed, deliveries were behind schedule as covered by the original OEM agreement. Plessey claimed it lost profits because of its termination of the OEM agreement with EM&M.

Answering the Plessey suit, EM&M last week said its opponent "wrongfully, maliciously and unjustifiably cancelled its remaining outstanding orders for disk drives" and refused to pay EM&M more than $1 million for drives previously-ordered and delivered.

The firm also alleges that it assured Plessey it would fulfill its committments for disk drives. EM&M defended itself by calling Plessey's complaint "uncertain" and not continuing "any recognizable claim."

EM&M also filed a cross-complaint which claimed that Plessey owes it $1.044 million, and that Plessey has refused to pay any of that sum. EM&M's complaint also asks for exemplary damages of $10 million, calling Plessey's alleged breach of contract "intentional, willful, in bad faith, malicious and intended exclusively to injure EM&M."

The disputed EM&M disk drives, the Models 206 and 306, are 14-inch drives offering capacities ranging up to 12 megabytes, of which six megs are removable. Plessey has packaged the drives with controllers compatible with various models of Digital Equipment's PDP-11 small computer family.

IBM, State Farm Contract for 200 Special Echos

BLOOMINGTON, Ill. — State Farm Mutual Automobile Insurance Co. has contracted with IBM General Systems division for small business computers to be installed at agencies throughout the U.S.

The deal involves specially-designed computers, designated Echo Systems and based on a processor which IBM characterized as a Series/1 "derivative." At least 200 systems have been ordered for pilot installations scheduled to begin in October, 1980.

Neither IBM nor State Farm would disclose the value of the contract, but the insurance company noted that it has 13,500 agents who will be eligible to lease Echo Systems at prices ranging between $635 and $800 monthly. Configurations will be built around processors with 128K bytes of system memory and will include from one to five CRT terminals, one 13.9-megabyte disk drive, a 256K-byte floppy disk drive and a serial printer. The terminals are customized version's of IBM's recently-introduced Teletype-compatible CRTs, the manufacturer said.

The processors will be equipped with a specially-designed IBM operating system which supports PL/1 programming.

Wyly's Founder Is Sued by SEC

Continued From Page 26

vested in Data Transmission Co., a data communications business, which Wyly Corp. began in 1969, and which is currently being liquidated in bankruptcy proceedings, the suit said.

The company, in an effort to get back 7¼ per cent debentures due 1995, in September, 1977 registered with the commission 3.81 million shares of common stock, the suit said.

Mr. Shea, the suit stated, offered to tender $2 million face amount of the company's debentures on the condition that he was paid double the consideration Wyly Corp. had offered other securities holders.

The commission said that Messrs Shea and Wyly also agreed that Mr. Shea would be retained as a "consultant" to assist the company in an antitrust claim against AT&T.

Mr. Shea later backed out of this agreement and other agreements in which Mr. Vaughan also was involved, the suit said. However, a letter from Mr. Shea's attorney to the company referring to the arrangement was opened by a director who turned the letter over to the SEC, the suit said.

Following an SEC investigation, Mr. Wyly took a leave of absence from the company, and in February, 1979, resigned as both officer and director of Wyly Corp.

To Broaden Media Offerings

EMM to Acquire Group/3 From Informatics

HAWTHORNE, Calif. — Electronic Memories & Magnetics Corp. (EMM) has agreed to acquire Group/3 from Informatics, Inc.

The move is an extension of the firm's commitment to the media business and enables EMM to supply a broader range of media products, a spokesman said.

Group/3 sales and marketing will be moved here to EMM's facility while manufacturing and distribution will be handled in San Jose, where EMM's Media Products Division is based.

In fulfilling its growth requirements, EMM has emphasized guaranteed satisfaction to its media customers, the spokesman added.

By letting customer needs be its guide, the firm has expanded into the flexible diskette market from disk packs and cartridges.

Thus users are able to "fill their data storage and retrieval media needs from one source," according to Roger Evans, general manager of the Media Products Division.

EMM's involvement in the media business began in 1969 when it acquired Caelus Memories, Inc., a maker of disks. The Caelus line now includes over 150 versions of disks and diskettes.

In 1976, the firm sold part of its media operation to Univac, which enables it to purchase coated disks to its specifications from a variety of sources "at a cost less than we could coat the disk ourselves," Evans said.

Profitable Step

This action substantially improved EMM profit and cash generation. "The division has the manufacturing capability necessary to support its commitment to the media business. The future will be approached on a controlled basis with continuing emphasis on product quality and customer service," Evans said.

"We plan for a full line of media products and computer supplies. Our intent is to stay very close to the computer room and those supplies required to support computer operations," he added.

EMM's emphasis will be to serve and expand its media customer base, develop media business within the memory customer base and pursue new accounts.

Areas of Expansion

Heaviest revenue impact in 1977 comes from IBM compatible products predominantly in the 3330 Model I and Model II areas. According to Evans, "areas in which we are expanding include non-IBM compatible disk packs and cartridges, flexible diskettes and customer service including cleaning, verification and refurbishing of media regardless of original manufacturer or type."

EMM provides both sales and lease in addition to a refurbishment service. Again, EMM has stood by the old cliche of "what's good for our customers is good for us." Leasing has turned out to be extremely profitable for the company and the company has developed a strong lease base in media as well as 360/370 add-on memories.

"Since we had the resources to cater to our customers' needs, it was quite easy to offer various financial plans — sale or lease," Evans said.

Customer-owned packs can be returned to the San Jose facility for refurbishment — about 15% of the business. This combination provides for a balanced operation.

Intel Splits Micro Division

SANTA CLARA, Calif. — Intel Corp. said it has split its microcomputer division into a components divi-

was head of the single division, and will include all systems and board-level microcomputer products

Report Motorola Semicon Reorganizing Marketing

Continued From Page One

group director of world marketing, according to informed sources.

Also reporting to Mr. Pistorio under the new organization are said to be Robert Brown, as national sales manager; Ted Jaros as marketing/applications manager and Douglas Powell with responsibility for market research.

Mr. Brown had been consumer segment marketing manager while Mr. Powell had been marketing manager for the computer business segment. Mr. Jaros was sales manager for the eastern region.

Mr. Brown assumes the duties formerly handled by Mr. Jaros and western regional sales manager Hal Mumma.

According to sources, Mr. Mumma's name does not appear on the new organization charts, which are not completely finalized.

In addition, Motorola is also reportedly consolidating its number of sales regions from seven to four. The sales regions were Northwest, Northeast, Southeast, mid-Atlantic, Mid-Central, East Central and South Central. The new set-up is not yet clear.

The moves are being made by Mr. Pistorio who was brought in from Motorola-Europe last June over Mr. Thompson.

Mr. Pistorio confirmed reports he was reorganizing and that "Mr. Thompson's role would be changed," but he would not elaborate.

Mr. Thompson, asked if his Marketing group, currently with six market segments and two regional sales directors reporting to him, was being restructured, said "It would be totally inappropriate for me to comment." He would neither confirm nor deny the restructuring.

Meanwhile, when reached at an industry meeting last Thursday night in Palo Alto, Mr. Thompson said a "change in my responsibilities was coming up shortly." He added that he had been instructed not to discuss the matter.

When Mr. Mumma was asked last week what his new post would be under the new group, he said "No announcement has come out. It hasn't been finalized and I haven't been informed of things." He declined further comment.

years ago (EN, June 30, 1975), when the semiconductor group set up the six market segment areas — computer, consumer, federal, industrial, distributor, systems engineering — and the two regional posts.

Motorola observers had been expecting the reorganization ever since Mr. Pistorio arrived here. According to one Motorola source, Mr. Pistorio was brought in because of a lack of harmony between domestic and overseas marketing activities.

EM&M Buying Group/3 From Informatics in Cash Deal

HAWTHORNE, Calif. — Electronic Memories & Magnetics said last week it is acquiring Group/3, a distributor of disk drive media products and other supplies to users of IBM System/3 and other small computers.

EM&M is buying the operation from Informatics for an undisclosed amount of cash.

Sales and marketing will be moved from Group/3's Canoga Park location, to EM&M's media products division here. Distribution will be handled at the division's manufacturing plant in San Jose, formerly called Caelus Memories.

Although EM&M had sold its coating of raw disk media operation to Univac/ISS (EN, Dec. 29, 1975), the company has continued to assemble disk packs from components supplied by Memorex, Control Data and others.

This production will be enlarged to include packs for smaller computers, according to Roger Evans, general manager fo the media division.

The agreement in principle to acquire Group/3 confirms earlier reports (Data Topics, Nov. 14).

EM&M previously concentrated on selling disk packs and cartridges to larger computer users. "Group/3 has been a supplier of a broader range of media products than EM&M," said Mr. Evans.

Group/3 has more than 4,000 active customers, according to EM&M, including System/3, Digital Equipment, Data General, General Automation and other computer users.

Its products include floppy disk media, software packages, reel-to-reel tape, computer furniture and printer ribbons in addition to packs and cartridges.

Group/3 started as an IBM System/3 users group, but ended that status when Informatics purchased it in 1974.

Bill Leeds, former general manager of Group/3, becomes a consultant to EM&M, but on a short-term basis.

Edward Farris, vice-president and general manager of EM&M's computer products group which includes media products and end-user memory sales, said the company also has started operating service vans, beginning in the Cleveland and Los Angeles areas.

"If the operation proves successful, next year we will add more vans," he said last week. The van service operation also reports to Mr. Evans.

Macdonald Awarded OBE

DETROIT — Ray W. Macdonald, retiring chairman and chief executive of Burroughs, has been awarded the rank of Honorary Commander of the Most Excellent Order of the British Empire by Queen Elizabeth, according to the British Embassy in Washington, D.C.

DISK CARTRIDGES AND PACKS FOR COMPUTERS, MINICOMPUTERS AND TERMINAL SYSTEMS

Disk Cartridges

The EMM/Caelus CMI is compatible with the IBM 2315 cartridge and leading independents such as DEC, HP, DIABLO, BURROUGHS, and FOUR PHASE.

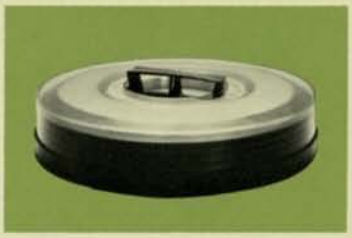
The EMM/Caelus CMIII is compatible with the IBM 5440 disk cartridge and leading independents such as NCR, DIABLO, UNIVAC, SANDERS and WANG.

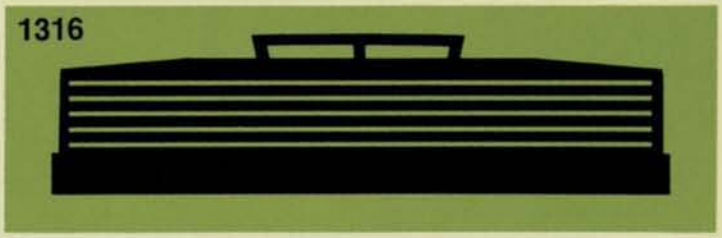
Disk Packs

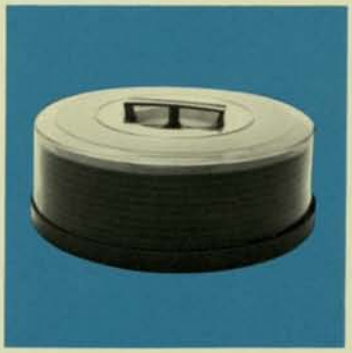
The EMM/Caelus CMVI disk pack is compatible with the IBM 1316 pack, providing 7.25 million 8-bit bytes of storage.

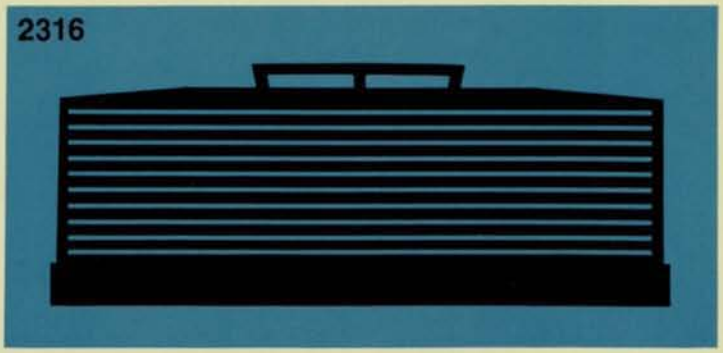
The EMM/Caelus CMXI is compatible with the IBM 2316 pack, records information on each disk surface in a 200-track format and can store 29.17 million 8-bit bytes.
The CMXI DD pack is compatible with the "double-density" version of the IBM 2316 pack, providing a 400-track format and capacity for 58.34 million 8-bit bytes.

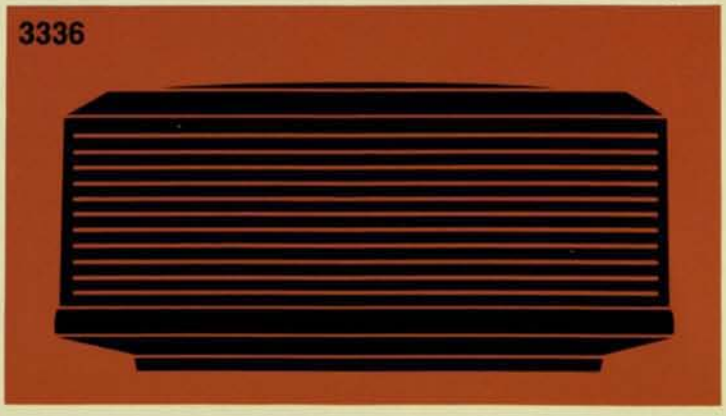
The EMM/Caelus CMCX Disk Pack is compatible with the IBM 3336 pack which is designed for use on 3330 Direct Access Storage Facilities and equivalent disk drive units.
The CMCX has a storage capacity of up to 100 million 8-bit bytes. The CXDD disk pack stores up to 1.6 billion bits (200 million bytes) on 19 recording surfaces, with a 20th used for servo information identifying each track.











CAELUS MEDIA

ORDERING INFORMATION

When ordering, please indicate product description and product number.

PRODUCT	DESCRIPTION	NUMBER
CMI	**FRONT LOADING DISK CARTRIDGES**	
	Low Density, 8 sector, IBM-compatible	SAI/700
	High Density, 8 sector	SAI/701
	High Density, 12 sector	SAI/703
	High Density, 16 sector	SAI/706
	High Density, 24 sector	SAI/708
	High Density, 32 sector	SAI/709
	High Density, 32 sector, w/write lockout	SAI/803
	Double Density (200 TPI), 32 sector, w/write lockout	SAI/945
CMIII	**TOP LOADING DISK CARTRIDGES**	
	Standard (1 index slot), IBM-compatible	SAI/146
	Single sector	SAI/814
	14 sector	SAI/795
	16 sector	SAI/796
	24 sector	SAI/797
CMXI	**DISK PACK**	
	Standard (1 index slot), IBM-compatible	SAI/816
	14 sector	SAI/819
	20 sector	SAI/711
	32 sector	SAI/749
CMXI DD	Standard (1 index slot), IBM-compatible	SAI/137
CMCX	Standard IBM-compatible	SAI/919-0
CMCX DD	Standard IBM-compatible	SAI/163
***CMXII**	The EMM/Caelus CMXII Disk Pack is designed to be compatible with the "100 megabyte, 11-high" type drives found on many of today's non-IBM systems. The actual data capacity of the CMXII Disk Pack is in the 117 megabyte range in a nominal 406 track format.	
	Compatible with Century Data 225 Disk Drives	SAI/966

Ask your representative for other Compatible Drives

*Not Pictured

EMM

Computer Products Division
967 Mabury Road, San Jose, California 95133
Phone (408) 298-7080

PR-9/75–5M–PRINTED IN USA

DISK CARTRIDGES AND DISK PACKS FOR MINICOMPUTER AND TERMINAL SYSTEMS

CAELUS CMI
DISK CARTRIDGE

The EMM/Caelus CMI is compatible with the IBM 2315 cartridge, has two recording surfaces, and accommodates a minimum 30,000 head loadings.

The CMI cartridge is available in low-density 12-million bits and high-density 24-million bits. The CMI-LD (low-density cartridge) has a single disk and is compatible with the IBM 2315. It is designed for operation on the IBM 2310, IBM 1810 and equivalent drives, and the Caelus CD11, CDD22 and 201 disk cartridge drives.

The CMI-HD (high-density cartridge) also has a single disk and is used as the storage medium for Caelus CD22, CDD44, 203 and similar high-density disk cartridge drives.

Index notch and eight sectors are standard, but various notch configurations are available. Both the low and high-density cartridges are supplied with identical, non-removable covers which protect the single magnetic disk.

CMI SPECIFICATIONS

All physical and electrical characteristics meet or exceed those specified by the American National Standards Institute, and those published by IBM.

Number of Recording Disks:
One

Number of Recording Surfaces:
Two

Sectoring:
Nickel-plated cast aluminum alloy sector hub with one index slot; and either 0, 8, 12, 14, 16, 24, or 32 sector slots.

Number of Cylinders:
200 cylinders plus 3 alternates.

Bit Packing Density:
Low Density (LD) = 1100 bits per inch.
High Density (HD) = 2200 bits per inch.

Storage Capacity:
Low Density (LD) = 12 million bits.
High Density (HD) = 24 million bits.

Durability:
The disk coating is capable of at least 30,000 head loadings with no deterioration in cartridge performance and will not chip, scrape or peel.

Cover:
Non-flammable, unbreakable and dust-proof Lexan® cover. Resistant to disk pack cleaning fluids.

Temperature:
Operating: 50°F to 120°F.

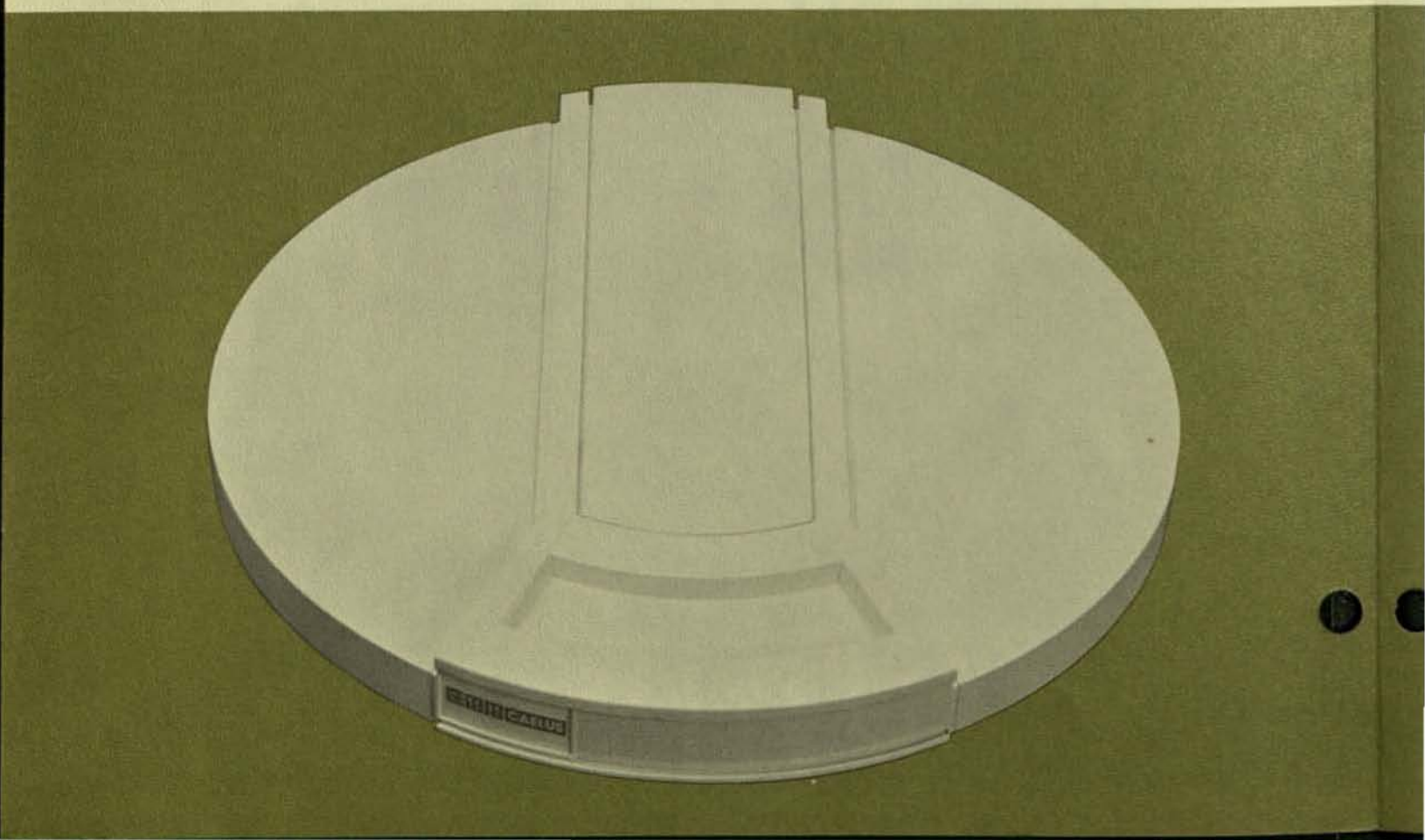
Disk Cartridge Dimensions:
Height: 1.43 inches
Diameter: 15.00 inches (with cover)

Shipping Container Dimensions:
Height: 6 inches
Width: 19¼ inches
Depth: 19¼ inches

Weight:
4 pounds (with cover)
8.5 pounds (shipping weight)

®Lexan is a registered trademark of the General Electric Co.

EMM/Caelus makes disk cartridges for more than 57 minicomputers. The listing faces this page.



MINICOMPUTERS AND TERMINAL SYSTEMS USING EMM/CAELUS CARTRIDGES AND PACKS

Basic/Four
Bendix
Bunker-Ramo
Burroughs
Business Computers
Centronics Data Computer
CII
Cincinnati Milacron
Computer Automation
Control Data
Cummin's Allison
Data 100
Data General
Datacraft
Datapoint
Digital Computer Controls
Digital Equipment
Digital Scientific
Electronic Processors
Electronics Associates
Entrex
Four-Phase
Fujitsu
General Automation
GRI
GTE
Hewlett-Packard
Hitachi
Honeywell
IBM
Infoton
Intel
Interdata
Linolex
Lockheed
Matsushita
Microdata
Mitsubishi
Modular
National Cash Register
Nippon
Norsk
Olivetti
Philips
Prime
Quantel
Raytheon
Raytheon Data Systems
Sanders Data Systems
Siemens
Sperry Univac
Sycor
Systems
Tektronix
Texas Instruments
The Braegan Corp.
Varian Data
Video Systems
Westinghouse
Westinghouse Canada
Xerox

CAELUS CMXI
DISK PACK

The EMM/Caelus CMXI is compatible with the IBM 2316 pack, records information on each disk surface in a 200-track format and can store 29.17 million 8-bit bytes.

The CMXI Disk Pack, compatible with IBM's 2316, is designed for use on 2314 Direct Access Storage Facilities and equivalent disk drive units, such as the IBM 5445 System 3 Disk storage.

A 200-cylinder format is standard for recording information on each disk surface. Three additional cylinders are also standard for use as alternate cylinders. All packs are tested and certified for conventional 100 TPI (IBM-compatible) use.

*Lexan is a registered trademark of the General Electric Co.

CMXI SPECIFICATIONS

All physical and electrical characteristics meet or exceed those specified by the American National Standards Institute, and those published by IBM.

Number of Recording Disks:
Eleven

Number of Recording Surfaces:
Twenty

Disk Substrate:
High quality, micro-finished aluminum substrate of specially selected memory disk alloy. Specifically heat treated for dynamic stability and flatness. Proprietary processes result in superior substrate-resin adhesion.

Disk Coating:
An IBM licensed coating formulation that has many years of field proven history to insure long life expectancy.

Surface Smoothness:
All finished disks subjected to low flying head tests to assure freedom from head-to-disk interference.

Maximum Runout:
12 mils total indicated runout.

Top Cover Disk:
Protective disk mounted on top of pack. Substrate material and coating formulation compatible with recording disk.

Sector Disk:
Provided with one slot which identifies starting of home address area. (Special sector disks available on request.)

Disk Pack Balance:
Dynamically balanced within 4 inch/grams, dual plane.

Disk Clamping Force:
35 (+10, −5) inch/pound torque on each of six assembly clamping bolts to prevent disk shifting.

Covers:
Non-flammable, unbreakable and dust-proof Lexan® top and bottom covers with superior strength and environmental durability.

Disk Pack Dimensions:

(with covers)

Height: 6 inches
Diameter: 15 inches

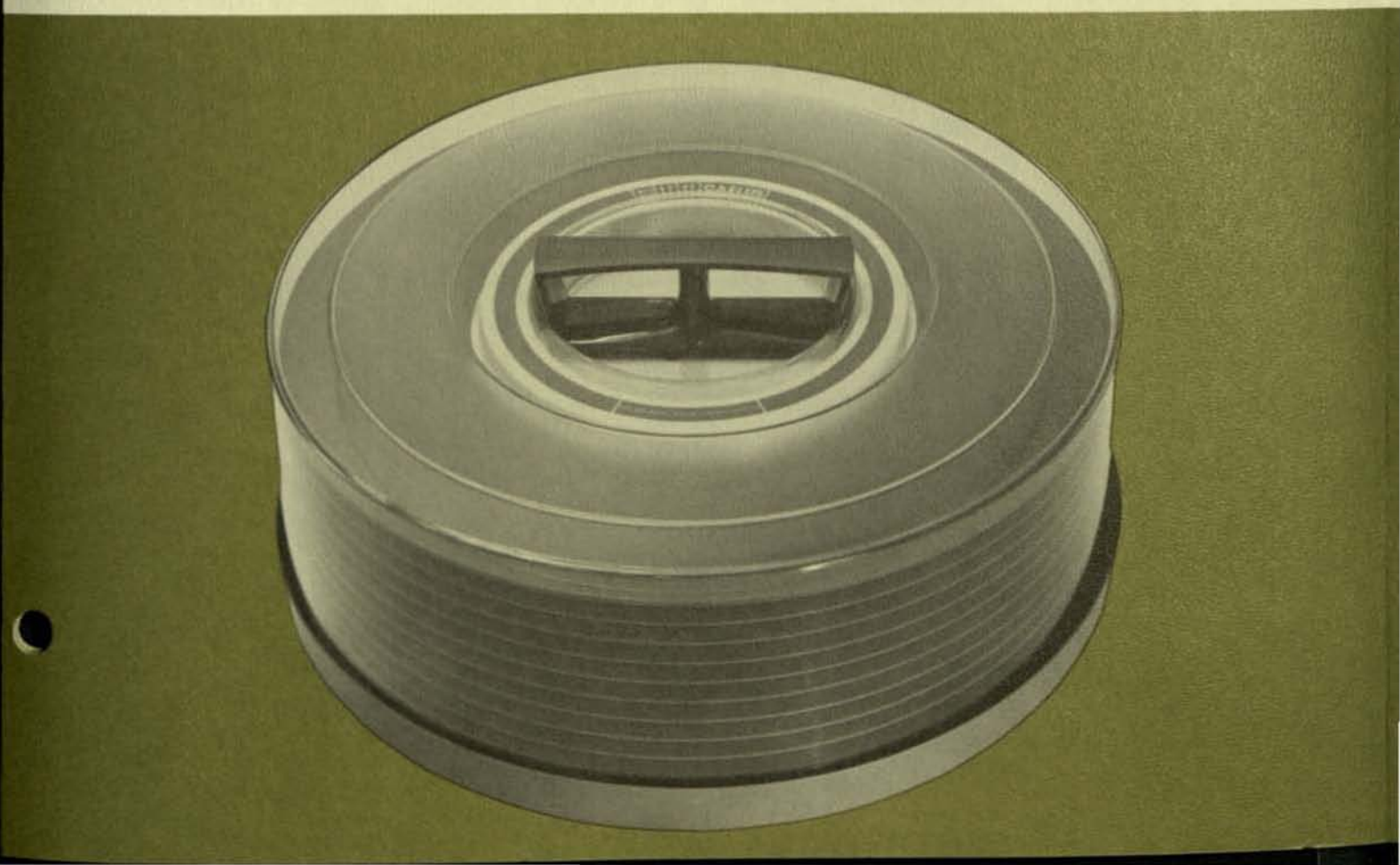
(with shipping container)

Height: 10 inches
Width: 21⅜ inches
Depth: 21⅜ inches

Disk Pack Weight:

Net: 15 pounds
Shipping: 21.5 pounds

EMM/Caelus makes disk packs for many, many minicomputers. The listing is on the overleaf.



CAELUS CMIII
DISK CARTRIDGE

The EMM/Caelus CMIII is compatible with the IBM 5440 disk cartridge, features a minimum of 30,000 head loadings and has two recording surfaces.

The CMIII cartridge is a single magnetic disk enclosed between a fixed top and bottom cover. It also has a removable bottom dust cover. Compatible with IBM's 5440 cartridge, it is designed to operate on the IBM 5444 Drive (System 3), Caelus 300 Series and equivalent drives.

Maximum data storage varies with the type of drive, number of cylinders and data formatting. When the CMIII is used on EMM/Caelus 300 Series Drives, maximum storage capacity is 24 million bits (3 million bytes) on the two recording surfaces. Data is written on 200 cylinders with an additional three cylinders available as alternate cylinders or as test tracks.

CMIII SPECIFICATIONS

All physical and electrical characteristics meet or exceed those specified by the American National Standards Institute, and those published by IBM.

Number of Recording Disks:
One

Number of Recording Surfaces:
Two

Sectoring:
Nickel-plated cast aluminum alloy sector hub with one index slot; and either 0, 8, 12, 14, 16, 24, or 32 sector slots. (One index slot and zero sector slots are IBM-compatible.)

Number of Cylinders:
Nominally, 200 +3 alternates (100 tpi). Compatible with IBM 5444 Drive (Models 1, 2, or 3).

Durability:
The disk coating is capable of at least 30,000 head loadings with no deterioration in cartridge performance and will not chip, scrape or peel.

Covers:
Non-flammable, unbreakable and dust-proof Lexan® top and bottom covers. Resistant to disk pack cleaning fluids.

Temperature:
Operating: 50°F to 120°F.

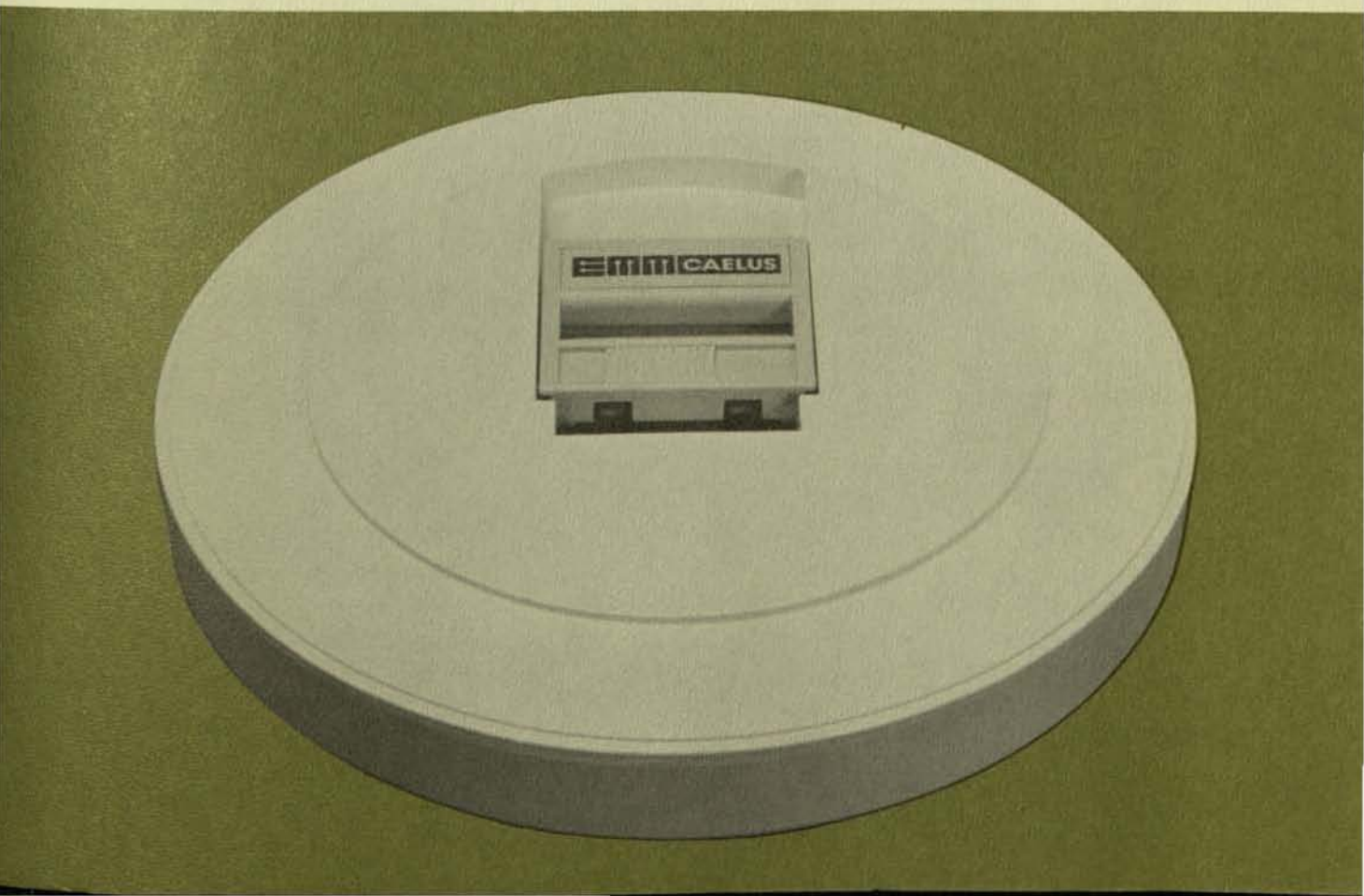
Disk Cartridge Dimensions:
Height: 2.40 inches
Diameter: 15.01 inches (w/covers)

Shipping Container Dimensions:
Height: 7 inches
Width: 19¼ inches
Depth: 19¼ inches

Weight:
5.5 pounds (with covers)
10.0 pounds (shipping weight)

*Lexan is a registered trademark of the General Electric Co.

EMM/Caelus makes disk cartridges for more than 57 minicomputers. The listing is on the back of this page.



MINICOMPUTERS AND TERMINAL SYSTEMS USING EMM/CAELUS CARTRIDGES AND PACKS

Basic/Four
Bendix
Bunker-Ramo
Burroughs
Business Computers
Centronics Data Computer
CII
Cincinnati Milacron
Computer Automation
Control Data
Cummin's Allison
Data 100
Data General
Datacraft
Datapoint
Digital Computer Controls
Digital Equipment
Digital Scientific
Electronic Processors
Electronics Associates
Entrex
Four-Phase
Fujitsu
General Automation
GRI
GTE
Hewlett-Packard
Hitachi
Honeywell
IBM
Infoton
Intel
Interdata
Linolex
Lockheed
Matsushita
Microdata
Mitsubishi
Modular
National Cash Register
Nippon
Norsk
Olivetti
Philips
Prime
Quantel
Raytheon
Raytheon Data Systems
Sanders Data Systems
Siemens
Sperry Univac
Sycor
Systems
Tektronix
Texas Instruments
The Braegan Corp.
Varian Data
Video Systems
Westinghouse
Westinghouse Canada
Xerox

ORDERING INFORMATION

When ordering, please indicate product description and product number.

PRODUCT	DESCRIPTION	NUMBER
CMI	**FRONT LOADING DISK CARTRIDGES**	
	Low Density, 8 sector, IBM-compatible	SAI/700
	Low Density, 12 sector	SAI/704
	Low Density, 16 sector	SAI/705
	Low Density, 24 sector	SAI/707
	Low Density, 32 sector	SAI/710
	High Density, 8 sector	SAI/701
	High Density, 12 sector	SAI/703
	High Density, 16 sector	SAI/706
	High Density, 24 sector	SAI/708
	High Density, 32 sector	SAI/709
	High Density, 32 sector, w/write lockout	SAI/803
	Double Density (200 TPI), 32 sector, w/write lockout	SAI/945
CMIII	**TOP LOADING DISK CARTRIDGES**	
	Standard (1 index slot), IBM-compatible	SAI/952
	Single sector	SAI/814
	8 sector	SAI/793
	12 sector	SAI/794
	14 sector	SAI/795
	16 sector	SAI/796
	24 sector	SAI/797
CMXI	**DISK PACK**	
	Standard (1 index slot), IBM-compatible	SAI/816
	14 sector	SAI/819
	20 sector	SAI/711
	32 sector	SAI/749

REPRESENTED BY:

CAELUS MEMORIES

A Division of Electronic Memories & Magnetics Corporation / 967 Mabury Road, San Jose, California 95133 / Phone (408) 298-7080

EMM/C-4-20-2/74 PRINTED IN U.S.A.,

EMM CAELUS SERIES 300 DISK DRIVE

FEATURES

- ☐ 24, 48, OR 96 MILLION BITS STORAGE
- ☐ TOP LOADING DISK CARTRIDGE
- ☐ 40 MILLISECOND ACCESS TIME
- ☐ AUTOMATIC BRUSH CLEANING CYCLE
- ☐ CLEAN AIR FILTRATION SYSTEM
- ☐ UNIVERSAL POWER SUPPLY
- ☐ TEMPERATURE COMPENSATED
- ☐ VOICE COIL HEAD POSITIONING

The Series 300 disk drives approach "big" drives in storage capacity, yet are only 8¾ inches high! Daisy-chain four drives and you have up to 384 million bits storage capacity. This big storage capacity along with big features like new faster access times make the 300 Series a big value at small system prices!

Faster access times mean faster throughput. Caelus has cut the average access time nearly in half—from 60 to 40 milliseconds. Data reliability of 1×10^{12} provides performance with unsurpassed value.

The 300 Series interface with all commonly used minicomputers. In fact, you can interchange the 300 series with any Caelus disk drive (Model 103, 203, 206, 303 or 306) without worrying about special interfaces, controllers, or software. This allows an infinite number of combinations to achieve the required storage.

Operation is simple too! There are only two switches: "main power" and "start/stop." A "write inhibit" function prevents accidental writing over data, and a safety interlock prevents removal of a disk cartridge while the drive is running.

CHARACTERISTICS

The series 300 disk drive contains a clean air filtration system that allows it to operate virtually error-free in almost any environment: office, assembly area, manufacturing, laboratory, you name it. The system circulates air through a 500-square-inch filter removing particles down to 0.3 microns.

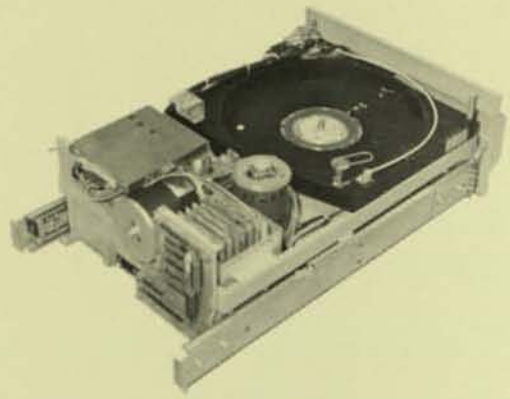
Model 303

The 303/1 Disk Cartridge Drive utilizes a single removable CMIII (5440 type) magnetic disk cartridge with mass random access storage of 3 million 8-bit bytes. In all other respects, the 303/1 is identical to the 303/2. As an add-on feature, the storage capacity of a 303/1 can be doubled on-site to 6 million bytes by the addition of a single fixed disk.

The Model 303/2 Disk Cartridge Drive has two disks which provide a total mass random access storage of 6 million 8-bit bytes. One disk is fixed, ideally suited for storage of system residence or other program data. The second disk is a removable Caelus CMIII Disk Cartridge (5440 type). This disk cartridge is mounted and removed from the top of the drive similar to System 3 drives.

ACCESSORIES

- Clean air replacement filter for clean air filtration system.
- Replacement cleaning brushes for brush cleaning system.
- Cleaning kit that includes all items required to clean heads and disks.
- DTU-1A Standard Drive Test Unit mounted in briefcase. Provides the controls and indicators for head positioning and checking read/write operations of the drive.
- DTU-2 hand-sized Test Unit used for head positioning. and activating read and write enable.
- Fixed Disk Conversion Kit for upgrading in the field to a dual disk drive.
- Fixed Disk Replacement Kit contains the disk, nylon glove, retaining rings and instructions for replacing the fixed disk.
- Tool Kit contains all tools required for drive parts replacement.



Model 306

The Model 306/1 uses a Caelus CMIII (5440 type) removable disk cartridge, with 200-track per-inch (TPI) capacity, to provide storage of 6 million 8-bit bytes. The 306/2 doubles the storage capacity to 12 million bytes by using the same top-loading CMIII cartridge and adding a 200-tpi fixed disk. For even greater flexibility, the fixed disk can be added to the 306/1 drive on-site at any time. This allows addition of storage capacity as required to meet system growth and added applications.

An important feature is Dynamic Temperature Compensation that allows ready condition to occur in less than 15 minutes. The average ready condition is reached in less than 3 minutes.

OPTIONS

- Data Formatting Option Boards—various board configurations available to accept double frequency or NRZI input data, and provide double frequency or NRZI output data and clock. Sector counting output also available.
- Daisy-chain operation allows up to four drives to be connected to operate in serial (daisy-chain) configuration. Interconnecting cables and terminator block available.
- Input/Output connector or cable with connector available.
- Sector Formatting for handling up to 48 sector formats on removable and optional fixed disk.
- Special Interfaces adapt the 303 drive to operate with most common controllers which have been designed to interface with other drives.
- Four index/sector lines can be provided to monitor index and sector data from the two disks.
- 2400-rpm operation and a data transfer rate of 2.5 MHz.
- Automatic address clear for resetting address counter upon receipt of illegal address.
- 50-Hz Line Frequency accommodated with a simple pulley change.
- Special Paint and Name Plates—available on quantity orders.

SPECIFICATIONS

Storage Capacity: 303/1: 24 million bits. 306/1: 48 million bits
303/2: 48 million bits. 306/2: 96 million bits

Disk Configuration: 303/1 or 306/1: One Disk – CMIII removable cartridge, 3 or 6 million bytes.
303/2 or 306/2: Two Disks – One CMIII removable cartridge, 3 or 6 million bytes.
One Fixed Disk, 3 or 6 million bytes.

Cartridge: 5440 type, Caelus Model CMIII – All disks 14 inches in diameter with the removable disk cartridge enclosed in a Lexan® dust cover. The cartridge is keyed with the drive to assure proper operator loading.

Disk Rotational Speed: 1500 rpm ±2% (2400 rpm optional).

Data Transfer Rate: 1.5885 MHz (2.5 MHz optional).

Mean Time Between Failure: 4000 hours minimum.

Mean Time to Repair: 30 minutes.

Periodic Maintenance: Under normal operating conditions using a Caelus CMIII cartridge or equivalent, periodic maintenance is limited to semi-annual head cleaning and an annual service of the air filter.

Head Positioning System: Voice coil (linear motor) with closed loop servo utilizing optical positioning. Model 306 is temperature compensated.

Optical Detent Assembly: Electro-optical device eliminates wear and all adjustments. Accurately locates and locks on to any of 204 or 408 tracks on the disk.

Access Time:
(including head settling time)

	Model 303/303FA	Model 306
Track-to-Track:	14/9 milliseconds	11 milliseconds
Average:	60/35 milliseconds	40 milliseconds
Maximum:	85/60 milliseconds	70 milliseconds

Air Filtration: All drive air passed through a 500-square-inch filter to remove particles greater than 0.3 microns. The disks are purged with filtered air at a rate of 25 cubic feet per minute.

Data Reliability: Recoverable (soft) errors: 1×10^{10}
Unrecoverable (hard) errors: 1×10^{12}

Power Requirements: 120 volts ±10%, 60 Hz ±1%. Voltages from 100v to 240v can be selected by a transformer tap change. (50 Hz optional)

Electronic Packaging: TTL compatible.

Operational Environment: Temperature Range: 50°F to 104°F.
Relative Humidity: 10 to 80% at a wet bulb temperature of 85°F.

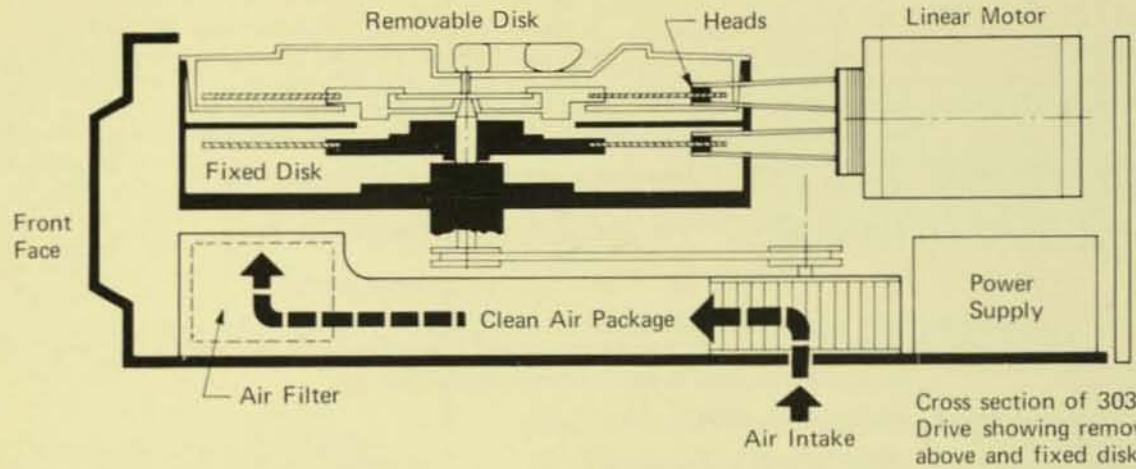
Brush-cleaning Cycle: Replaceable brushes sweep each disk to remove dust or loose contamination during start-up cycle and prior to loading the heads.

Emergency Head Retraction: The heads automatically retract to their "home" position in case of a line power failure.

Safety Interlock: The cartridge is "locked" into position preventing accidental operator damage while in operation or during a line power failure. The drive will start only with the cartridge properly in place.

Shipping or Storage Environment: Temperature Range: –40°F to 150°F.
Relative Humidity: 10 to 90%.

Physical Dimensions: Height: 8.75 inches
Width: 17.60 inches
Depth: 26.50 inches (less front face)
Weight: 75 pounds (less slides)



Cross section of 303 Disk Cartridge Drive showing removable disk cartridge above and fixed disk below.

INTERFACE DATA

CONTROLLER		DISK DRIVE
Input		
Unit Select	4	Level
Cylinder Address	8 (100 TPI) — 9 (200 TPI)	Level
Disk Select		Level
Head Select		Level
Cylinder Seek		Level
Address Clear		Pulse
200 TPI Indication		Pulse
Write Enable		Level
Track Offset (optional)		Level
Read Enable (optional)		Level
Write Data, Double Frequency (NRZ optional)		Pulse
Output		
Drive Ready		Level
Seek Complete		Level
Ungated Seek Complete	4	Level
Read Data, Double Frequency (NRZ optional)		Pulse
Data Clock (optional)		Pulse
Index (1 line standard, 2 optional)		Pulse
Sector (1 line standard, 2 optional)		Pulse
Sector Address (optional)	5	Level
Seek Incomplete		Level
Write Inhibit		Level

LEGEND

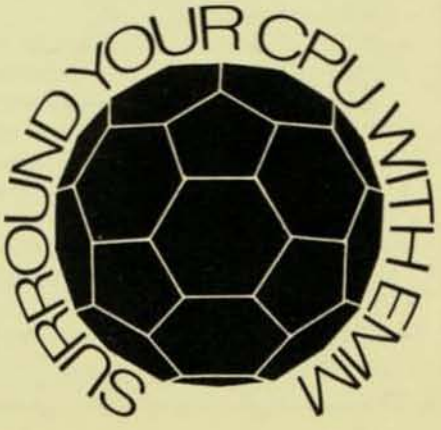
Data — Timing — Control

EMM COMPUTER PRODUCTS DIVISION
Electronic Memories & Magnetics Corporation
1015 Timothy Drive / San Jose, California 95133 / Telephone (408) 298-7080

EMM CAELUS SERIES 200 DISK DRIVE

FEATURES

- ☐ 24, 48, OR 96 MEGABIT STORAGE
- ☐ FRONT LOADING DISK CARTRIDGE
- ☐ LOW POWER CONSUMPTION
- ☐ 40 MILLISECOND ACCESS TIME
- ☐ VOICE COIL HEAD POSITIONING
- ☐ TEMPERATURE COMPENSATED
- ☐ OPTICAL DETENT
- ☐ CLEAN AIR FILTRATION SYSTEM



The front-loading 200 Series is big in performance and design flexibility, has significantly faster access times and up to 96 million bit storage capacity; yet, it's small in size (only 8¾ inches high!) and small in price too, when compared feature for feature with the competition.

Faster access times mean faster throughput. In the design of the 200 Series, Caelus has cut the average access time nearly in half – from 60 to 40 milliseconds. Data reliability of 1×10^{12} provides performance with unsurpassed value.

The 200 Series interfaces with all commonly used minicomputers and is designed to provide total system storage capacities up to 384 million bits by daisy-chaining up to four drives. In fact, you can interchange any 200 Series with any Caelus disk drive (Model 103, 203, 206, 303 or 306) without worrying about special interfaces, controllers or software. This allows an infinite number of combinations to achieve the exact amount of storage required.

The 200 Series is simple to operate, too! There are only two switches: "main power" and "start/stop." A "write inhibit" function prevents accidental writing over data, and a safety interlock prevents removal of a disk cartridge while the drive is running.

A clean air filtration system, similar to that used in large drives, allows the Caelus 200 Series to operate virtually error-free in almost any environment: office, assembly area, manufacturing, laboratory, you name it. The system circulates air through a 500-square-inch filter removing particles larger than 0.3 microns.

Reliability, economy and ease of maintenance added to Caelus' experience in designing and manufacturing drives make the 200 Series a value-packed member of our drive family.

CHARACTERISTICS

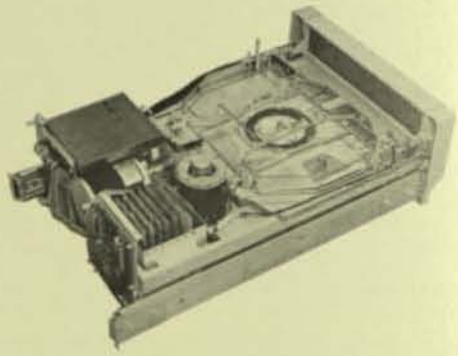
Model 203

The 203/1 Disk Cartridge Drive uses the single removable CMI-HD magnetic disk cartridge with mass random access storage of 24 million bits. In all other respects, the 203/1 is identical to the 203/2. As an add-on feature, the storage capacity of the 203/1 can be doubled on site to 48 million bits with the field addition of the single fixed disk.

The 203/2 Disk Cartridge Drive has two disks which provide a total mass random access storage of 48 million bits. One disk is fixed, ideally suited for storage of system residence or other program data. The second disk is the removable Caelus CMI-HD (2315 type) cartridge that offers infinite off-line storage.

ACCESSORIES

- Clean air replacement filter for clean air filtration system.
- Cleaning Kit that includes all items required to clean heads and disks.
- DTU-1A Standard Drive Test Unit mounted in briefcase. Provides the controls and indicators for head positioning and checking read/write operations of the drive.
- DTU-2 hand-sized Test Unit used for head positioning, and activating read and write enable.
- Fixed Disk Conversion Kit for upgrading the 203/1 or 206/1 to a 203/2 or 206/2.
- Fixed Disk Replacement Kit contains the disk, nylon glove, retaining rings and instructions for replacing the fixed disk.
- Tool Kit contains all tools required for drive parts replacement.



Model 206

The Model 206/1 utilizes the advanced 200-track-per-inch (TPI)(2315 type) Caelus CMI disk cartridge to provide storage of 6 million 8-bit bytes. Model 206/2 doubles the storage capacity to 12 million bytes by using the same front-loading CMI cartridge along with a 200-tpi fixed disk. The fixed disk can be added to the unit in minutes on-site. Thus, storage capacity can be added in stages as system growth and added applications dictate.

An important feature is Dynamic Temperature Compensation that allows ready condition to occur in less than 15 minutes. The average ready condition is reached in less than 3 minutes.

OPTIONS

- Data Formatting Option Boards—various board configurations available to accept double frequency or NRZI input data, and provide double frequency or NRZI output data and clock. Sector counting output also available.
- Daisy-chain operation allows up to four drives to be connected to operate in serial (daisy-chain) configuration. Interconnecting cables and terminator block available.
- Input/Output connector or cable with connector available.
- Sector Formatting for handling up to 48 sector formats on removable and optional fixed disk.
- Special interfaces adapt the 200 Series drive to operate with most common controllers which have been designed to interface with other drives.
- Four index/sector lines can be provided to monitor and sector data from the two disks.
- 2400-rpm operation and a data transfer rate of 2.5 MHz.
- Automatic address clear for resetting address counter upon receipt of illegal address.
- 50-Hz Line Frequency accommodated with a simple pulley change.
- Special Paint and Name Plates – available on quantity orders.

TECHNICAL SPECIFICATIONS

Storage Capacity: 203/1: 24 million bits. 206/1: 48 million bits
203/2: 48 million bits. 206/2: 96 million bits

Disk Configuration: 203/1 and 206/1: One Disk – CMI-HD removable cartridge, 3 or 6 million 8-bit bytes.
203/2 and 206/2: Two Disks – One CMI-HD removable cartridge, 3 or 6 million 8-bit bytes. One fixed disk, 3 or 6 million 8-bit bytes.

Cartridge: 2315 type, Caelus Model CMI-HD – All disks 14 inches in diameter enclosed in a Lexan® dust cover.

Disk Rotational Speed: 1500 rpm ±2% (2400 rpm optional).

Data Transfer Rate: 1.5885 MHz (2.5 MHz optional).

Data Reliability: Recoverable (soft) errors: 1×10^{10}
Unrecoverable (hard) errors: 1×10^{12}

Head Positioning System: Voice coil (linear motor) with closed loop servo utilizing optical positioning. Model 206 is temperature compensated.

Optical Detent Assembly: Electro-optical device eliminates wear and all adjustments. Accurately locates and locks on to any of 204 or 408 tracks on the disk.

Access Time (including head settling time):

	Model 203/203FA	Model 206
Track-to-Track	14/9 milliseconds	11 milliseconds
Average:	60/35 milliseconds	40 milliseconds
Maximum:	85/60 milliseconds	70 milliseconds

Safety Interlock: The cartridge is "locked" into position preventing accidental operator damage while in operation during a line power failure. The drive will start only with the cartridge properly in place.

Air Filtration: All drive air passed through a 500-square-inch filter to remove particles greater than 0.3 microns. The disks are purged with filtered air at a rate of 25 cubic feet per minute.

Power Requirements: 120 volts ±10%, 60 Hz ±1%. Voltages from 100v to 240v can be selected by a transformer tap change. (50 Hz optional).

Electronic Packaging: TTL compatible.

Operational Environment: Temperature Range: 50°F to 104°F
Relative Humidity: 10 to 80% with maximum wet bulb temperature of 85°F

Emergency Head Retraction: The heads automatically retract to the "home" position in case of a line power failure.

Mean Time Between Failure: 4000 hours minimum.

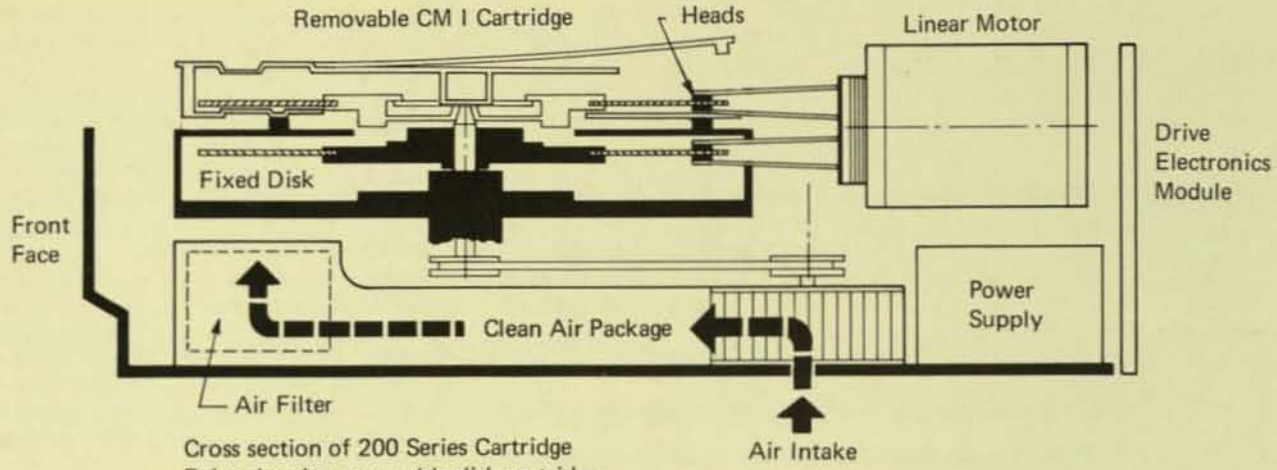
Mean Time to Repair: 30 minutes

Periodic Maintenance: Under normal operating conditions using a Caelus CMI-HD cartridge or equivalent, periodic maintenance is limited to semi-annual head cleaning and an annual service of the air filter.

Shipping or Storage Environment: Temperature Range: –40°F to 150°F
Relative Humidity: 10 to 90%

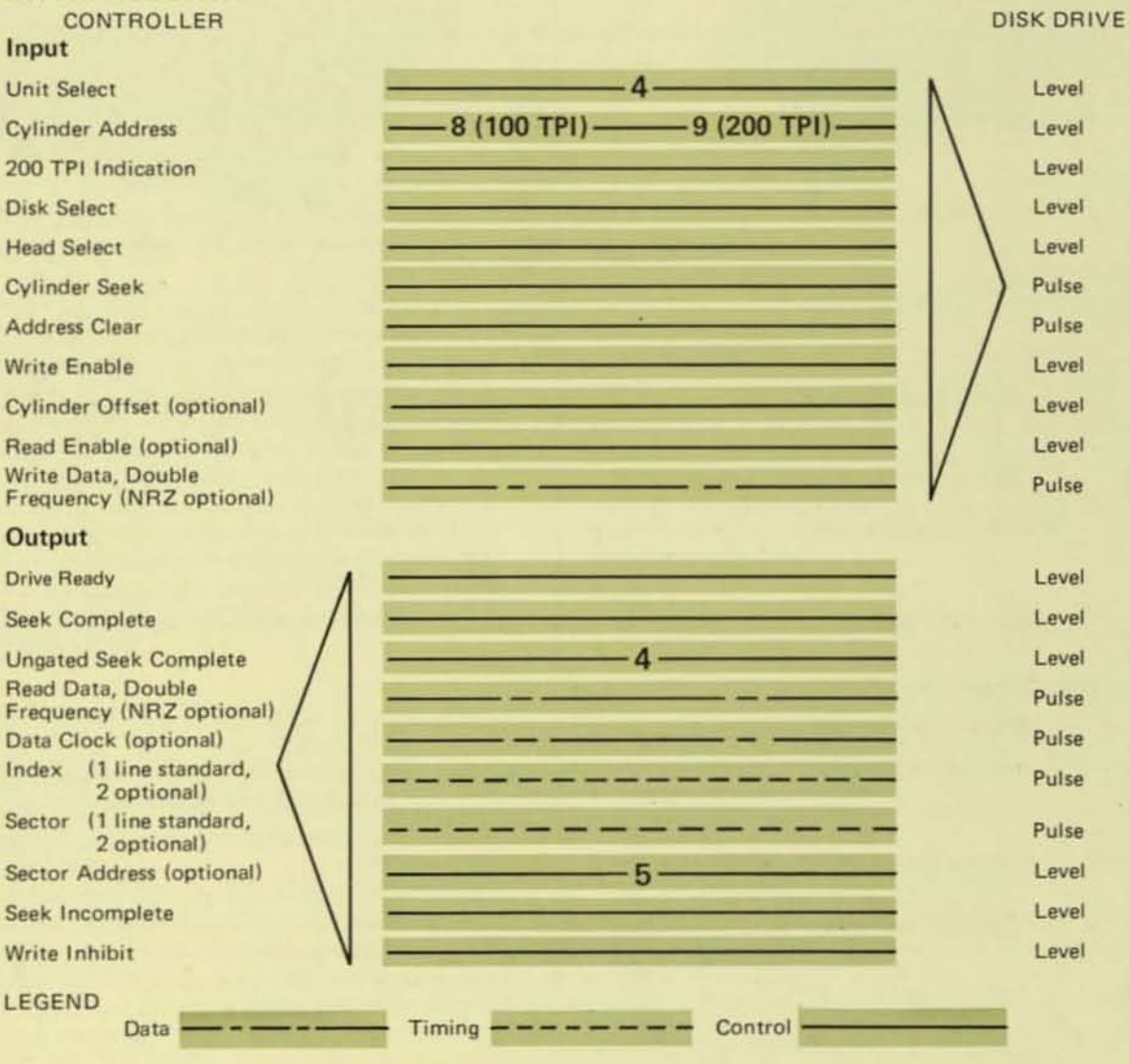
Physical Dimensions: Height: 8.75 inches
Width: 17.60 inches
Depth: 26.50 inches (less front face)
Weight: 84 pounds (without slides and disk cartridge)

®Lexan – Registered trademark of the General Electric Company



Cross section of 200 Series Cartridge Drive showing removable disk cartridge above and fixed disk below.

INTERFACE DATA



EMM COMPUTER PRODUCTS DIVISION
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DS-DD200-4/76-5M

DISK EXECUTIVE SUMMARY

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EMM

EMM is a $100 million NYSE listed company that does business in a wide range of computer OEM markets. It was founded in 1961, and has since established itself as a major supplier of memory to industry, and a leader in technological innovation. EMM made a major financial committment to vertical integration, providing a high level of control in its manufacturing process. The result: exceptional performance and reliability.

EMM manufactures its own memory cores and NMOS Static RAMs that are utilized in a wide range of memories, including several military products. EMM is one of the largest producers of NMOS RAM in the U.S., and manufacturer of the fastest static RAMs available. EMM produces, under the Caelus brand name, an entire line of disk drives that are sold as OEM products, and integrated with our microcomputers.

Military and commercial microcomputers and a full line of minicomputer add-in memories are other products produced by EMM. Our microcomputers cover the spectrum from low-end OEM systems, to completely standalone units for business and scientific applications. The company also manufactures a full line of IBM 360/370 add-on memories for the end-user market.

EMM is financially sound and technologically innovative and we're committed to computer solutions. We have the resources. We have the technology. We have the experience to meet your needs.

DISK EXECUTIVE SUMMARY

The Disk Executive System (DEX) provides necessary support for Enhanced BASIC and assembly language programming. The support is divided into three categories, each of which uses the I/O subsystem of DEX. The three categories are system commands, debug commands, and file commands. DEX can support up to 40 Mbytes of memory. DEX completely frees the user from tedious disk bookkeeping and I/O operations to provide a significant boost to programmer efficiency and system throughput. The commands shown below do not describe the qualifiers to each command, which provide great flexibility. Examples in the I/O section, however, are typical of all commands.

SYSTEM COMMANDS

System commands enable assembly language program editing, assembling, and loading.

COMMAND	USE
B	Bootstraps DEX into memory.
R	Reads a named program into memory with offset, if desired.
J	Assign physical I/O devices to logical I/O devices.
W	Writes a named program to a disk file.
E	Allows editing of a named disk file.
A	Assembles a named disk file.

Files may be either hex or binary, but they must be specified. The load address of a file is made an integral part of the file by DEX. Upon loading a program, DEX displays the load address for execution.

DEBUG COMMANDS

Debug commands provide for control of the CPU and memories to aid assembly language programming.

COMMAND	USE
D	Displays a block of memory.
S	Change a value in memory.
X	Examine and, if desired, modify the contents of any CPU register.
I	Examine and, if desired, modify the contents of an I/O register.
F	Fill a block of memory with a specified byte.
M	Move a block of memory to a new location.
H	Provides the hex sum and difference of two inputted values.
G	Go to a specified memory location and execute. Allows the setting of breakpoints.

FILE COMMANDS

File commands provide for disk support. They also provide for the generation of paper tapes and listings.

COMMAND	USE
C	Display the disk file catalog.
N	Rename a disk file.
T	Transfer a hex disk file to a new disk file.
U	Transfer a binary disk file to a new disk file.
V	List a file.
P	Write a disk sector.
G	Read a disk sector.

In managing named disk files, DEX generates all necessary catalog information as well as address pointers. DEX does not necessarily write a file contiguously. This non-contiguous write is done to maximize packing density on the disk. Each disk allocation unit points to the next allocation unit in the file.

I/O SUPPORT

DEX supports four logical I/O devices, each of which can be several different physical devices. This allows great flexibility in use. I/O services are available to user programs via CALL commands.

FILE FUNCTIONS

The following file functions are provided by the I/O subsystem and are available to the user:

FUNCTION	USE
CREATE	Establish a disk file.
OPEN	Open a disk file for use.
READ	Access the next record in a file.
WRITE	Write the next record in a file.
GET	Get the next character from a record.
PUT	Write the next character to a record.
CLOSE	Close a disk file.

PERIPHERALS SUPPORTED

Character by character I/O services are provided for:

Console input
Console output
Reader input
Punch output
List output

To provide for these services, the I/O system recognizes four logical I/O devices.

LOGICAL DEVICE CODE	DEVICE
C	Logical console device, input and output.
R	Logical reader device, input only.
P	Logical punch device, output only.
L	Logical list device, output only.

Five different physical devices plus a "null" device are supported by DEX. These physical devices are:

PHYSICAL DEVICE CODE	STANDARD
T	Teletype (ASR-33).
C	TTY compatible CRT (Lear Siegler ADM-3A).
L	Line printer (Centronics 700).
P	Paper tape reader/punch (REMEX 5120).
Dn	Disk drives 0 through 15 (Caelus 203 or 206).
N	Null (no input or output).

Physical devices may be dynamically assigned to logical devices as follows:

LOGICAL DEVICE	PHYSICAL DEVICES
C	T, C, Batch*
R	T, P, Dn, N
P	T, P, Dn, N
L	T, C, L, Dn, N

*Batch defines the logical console device to also be the R and L devices.

EX COMMAND STRUCTURE

Some examples of the use of DEX commands are presented here to demonstrate the flexibility and ease of use of the software.

List ASCII file "ABC" on the CRT

```
V ABC,/C
```

List ASCII file "ABC" on the line printer,

```
V ABC
```

Load binary program "DEMO"

```
RB, DEMO,0 (User)
4DB7 (DEX prints start address)
```

Execute "DEMO"

```
G4DB7
```

Assemble file "SOURCE" to file "OBJECT" and save the assembly listing on the disk as "LIST."

```
A SOURCE, OBJECT, LIST
```

Transfer binary file "OBJECT" to the fixed disk.

```
T OBJECT, OBJECT/D1
```

COMMERCIAL MEMORY PRODUCTS

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Printed in U.S.A. 11/76

ENHANCED BASIC SUMMARY

COMMERCIAL MEMORY PRODUCTS
ELECTRONIC MEMORIES & MAGNETICS CORP.

Enhanced BASIC Summary

Enhanced BASIC is a powerful, commercially oriented version of BASIC*, designed for the EMM SYSTEM 800 standalone computer system. While commercially oriented, Enhanced BASIC retains a complete scientific math library, double precision accuracy and the ability to CALL specialized assembly language subroutines. Enhanced BASIC is supported by a disk executive system (DEX) that provides both sequential and random access disk file operations, as well as formatted and unformatted I/O to the peripherals.

*BASIC is a trademark of Dartmouth College.

STRING FUNCTIONS

Enhanced BASIC can manipulate strings up to 255 characters in length. A highly sophisticated set of string commands are provided.

COMMAND	FUNCTION
+	Concatenate strings
LEFT$	Select the n leftmost characters
RIGHT$	Select the n rightmost characters
MID$	Select n characters within a string
STR$	Converts the numeric argument into a string
VAL	Converts the string argument into a number
ASC	Returns the ASCII numeric value of the first character of the string argument
CHR$	Returns the ASCII equivalent of a numeric value

LOGICAL OPERATORS

Enhanced BASIC has a complete set of logical and relational operators that allow complex logical decisions in single statements. Including logical statements within a logical statement is allowed and greatly enhances the sophistication of the software.

OPERATOR	FUNCTION
A = B	If A equals B
<>	If A is not equal to B
>	If A is greater than B
<	If A is less than B
>=	If A is greater than or equal to B
<=	If A is less than or equal to B
AND	If two or more expressions are TRUE
OR	If one of several expressions is TRUE
NOT	If negated expression is TRUE
THEN	If the results of the operator(s) are TRUE, do what follows
ELSE	If the results of the operator(s) are FALSE, do what follows

The following complex statement indicates the scope of Enhanced BASIC:

```
5 IF A = B THEN (IF A = C THEN PRINT "A = C" ELSE PRINT "A< >C" ELSE
PRINT "A< >B"
```

BOOLEAN ALGEBRA

Additionally, the AND, OR, and NOT can be used for Boolean operations and bit manipulation. For example, 4 OR 2 = 6. Since 4 in binary is 100 and 2 is 10, the OR'd result is binary 110 or 6.

I/O

Enhanced BASIC provides both formatted and unformatted input/output. Formatted input is done using READ and DATA statements with data part of the program. Type conversion is done, if possible, to minimize type mismatch errors. Unformatted input is done from the CRT using the INPUT statement. As many variables as desired may be input in free format with appropriate type conversion done.

Full Hollerith capability is available in the INPUT and all forms of the PRINT command to make headings and prompt messages simple. The PRINT and LPRINT statements do normal tabbed BASIC output to the CRT and line printer respectively. Tabbing may be easily suppressed. The PRINT USING and LPRINT USING statements create a FORTRAN FORMAT statement type

of formatted output. Although the total list of controls for formatted output are too numerous to list, the following examples demonstrate the sophistication of the PRINT USING:

In the examples a "b" represents a blank space.

CONTROL CHARACTER	EXAMPLE	PRINTED OUTPUT
!	PRINT "!"; A$ where A$ = "GEORGE"	G
/bb/	PRINT "/bb/!"; A$	bbbbG
# and	PRINT "###.###"; A where A = 12.52739	b12.527
	PRINT "####,.#"; A where A = 1932.557	1,932.6

PRECISION

Enhanced BASIC has a comprehensive computational set of instructions and functions as well as excellent precision. The range of values allowed are:

TYPE	RANGE
STRING	0 to 255 CHARACTERS
INTEGER	− 32768 to + 32767
SINGLE PRECISION	6 DIGITS, EXPONENT of 10 to the ± 38th
	POWER
DOUBLE PRECISION	16 DIGITS, EXPONENT of 10 to the ± 38th
	POWER

Number types may be changed dynamically during execution.

MATRIX OPERATIONS

Enhanced BASIC will allow matrices, both string and numeric, of up to 255 dimensions. Dimensions may be changed dynamically during program execution. No implied matrix operations are provided; however, the powerful FOR loop capability makes matrix manipulation easy to handle.

FOR LOOPS

FOR loops may use any evaluatable expression for each index, and can be nested indefinitely. The expression may evaluate as an integer or real number. Real number stepping is provided for in Enhanced BASIC.

UNCTIONS AND CAPABILITIES

Mathematical capabilities and the library functions are too numerous to completely list here. Some examples are:

OPERATOR/FUNCTION	USE
^	Exponentiation
*	Multiplication
/	Division
\	Integer division
SWAP	Exchanges the values of two variables
MOD	Modulo division
IF . . . GOTO	Conditional branching
ON . . . GOTO	Branches to the I'th line number in a list based on the value of an expression
IF . . . GOSUB	Jump to subroutine
ON . . . GOSUB	Jump to subroutine
ABS	Absolute value
RND	Random number generator
SIN	Sine
COS	Cosine
EXP	Naperian exponentiation
SQR	Square root
LOG	Common logarithm

GENERAL FEATURES

Enhanced BASIC has a comprehensive set of system and editing commands to simplify program development and debugging. Some of these commands are:

COMMAND	USE
RUN n	Start execution at line number n
LIST	List a specified range of lines. LLIST defines the line printer
DELETE	Delete a specified range of lines
TRON	Turns on a trace flag
EDIT	Enters edit mode
I	Inserts characters
D	Deletes characters
S	Finds a specified string
C	Changes characters
REM	Remarks
DEF FN	User defined function
INP	Reads a byte from a non-standard I/O port
OUT	Writes a byte to a non-standard I/O port
PEEK	Reads a byte from a specified memory location
POKE	Writes a byte to a specified memory location

DISK FILE OPERATIONS

Enhanced BASIC has the capability for both sequential and random disk files. All files are accessed by name and may be either binary packed or ASCII. Several utility commands are available:

COMMAND	USE
SAVE	Saves a source file on disk
LOAD	Reads and executes a source file from disk

COMMAND	USE
KILL	Deletes any disk file
MERGE	Merges two disk files
NAME	Renames disk files

SEQUENTIAL FILES

Sequential files are read and written from the disk as if it were the CRT. After opening a file as sequential, an INPUT statement, with the file number preceding the variable list, will read the file. In the same manner, a PRINT command will write a file. The PRINT USING command will generate a formatted file including Hollerith fields. An entire record may be associated with a single string variable through the LINE INPUT command. End of file detection allows a jump out of an INPUT loop.

RANDOM FILES

Random file operations allow for the reading or writing of a specified single record of a file. The generation of the record pointer must be done in the using program. The record pointer specifies the Ith record: Record 12, Record 117, etc. The Disk Executive System does all the addressing necessary to retrieve or write this record.

All random disk I/O operations are done through a 256 byte buffer. Simple commands are given to load and format the buffer. The buffer is always a string variable.

COMMAND	FUNCTION
PUT	Write the buffer to a file and record
GET	Load the buffer from a file and record
FIELD	Associates strings with the buffer. Similar to a FORTRAN FORMAT statement. Allows character by character association of the buffer and any set of string variables
MKI$	Converts an integer to a string
MKS$	Converts a single precision number to a string
MKD$	Converts a double precision number to a string
CVI	Converts a string to an integer

COMMAND	FUNCTION
CVS	Converts a string to a single precision number
CVD	Converts a string to a double precision number
LSET	Loads a variable to the buffer left justified
RSET	Loads a variable to the buffer right justified

DIAGNOSTICS

To complete the Enhanced BASIC package, a comprehensive set of plain English diagnostics and error messages are supplied. For example, if you try and delete (KILL) a non-existent disk data file, Enhanced BASIC will print "FILE NOT FOUND."

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OEM PRICE LIST

NOVEMBER 1976

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SYSTEM 800

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
S800	Computer, Microprogrammed CPU with 8080 Instruction Set, and includes:	$14,500.00
	1) CPU option pack with power monitor and auto restart, automatic program load ROM, maintenance control panel, direct memory access (DMA) bus, vectored priority interrupt logic, real-time clock, and precision crystal 110 to 9600 baud serial controller.	
	2) 32,768 bytes static semiconductor memory, RAM-450NSEC cycle.	
	3) 24-line, 80-character console video display with ASCII keyboard and cable (9600 baud).	
	4) Serial matrix printer, 60 CPS, 10 characters per inch, up to 132 characters per line with printer controller and cable. Character formation is with a 7 X 9 matrix.	
	5) 5.0 megabyte cartridge disk system, moving head (including one cartridge disk) with 2.5M bytes of removable and 2.5M bytes of fixed disk storage, with controller for four disk drives and one interconnect disk cable.	
	6) Office environment desk enclosure with all electronics mounted and power distribution, 60 inch by 32 inch work space.	
	7) Disk operating system software with commercial Enhanced BASIC.	

SYSTEM 800 OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8101	Additional 32,768 bytes of static semiconductor memory, RAM-450NSEC cycle. See Note 2.	$ 985.00
8199	Extended memory addressing, required for memory capacity above 65,536 bytes.	395.00
8411	Bi-directional print option for serial matrix printer (doubles effective print speed).	350.00
8513/8520	Additional 5 megabytes cartridge disk drive and interconnect cable. Maximum four per controller.	4,495.00
8601	Four port serial I/O controller RS-232 compatible with selectable baud rates from 110-9600 baud.	550.00
8815	Office environment desk enclosure compatible with S800 desk enclosure for mounting two additional disk drive subsystems.	500.00

SYSTEM 80

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
S80	Disk based processing system with applicable software. System includes:	**8,525.00**
	1) CPU, Microprogrammed with 8080 Instruction Set, option pack with power monitor and auto restart, automatic program load ROM, control console, direct memory access (DMA) bus, vectored priority interrupt logic, real-time clock, and precision crystal 110 to 9600 baud serial controller.	
	2) 32,768 bytes static semiconductor memory, RAM-450NSEC cycle.	
	3) 5.0 megabyte cartridge disk system, moving head (including one cartridge disk) with 2.5M bytes of removable and 2.5M bytes of fixed disk storage, with controller for four 5M byte cartridge disk drives and one interconnect disk cable.	
	4) 7 inch chassis and power supply for 19 inch rack with 12 card slot capacity (two large slots and four I/O slots available for customer I/O).	
	5) Disk Executive System software.	

MEMORY OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8101	16,384 byte core memory module (650NSEC cycle)	25.00
8102	32,768 byte core memory module (650NSEC cycle)	65.00
8103	65,536 byte core memory module (850NSEC cycle)	50.00
8111	16,384 byte static semiconductor memory module (450NSEC cycle)	35.00
8112	32,768 byte static semiconductor memory module (450NSEC cycle)	280.00
8113	65,536 byte static semiconductor memory module (450NSEC cycle)	2,265.00
8121	16,384 byte high speed static semiconductor memory module (180NSEC cycle)	1,325.00
8122	32,768 byte high speed static semiconductor memory module (180NSEC cycle)	2,025.00

DISPLAY OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8310	24-line, 80-character video display with ASCII keyboard and baud rate up to 19,200 baud. Allows full or half duplex operation. All options are switch selectable.	**$ 1,920.00**
8300	Asynchronous line controller with two EIA RS232-C I/O ports. Full duplex operation with jumper selectable baud rates to 9600 baud and full character buffering. Requires one I/O slot.	**375.00**
8320	Interconnect cable (25 ft.) between line controller and video display/keyboard.	**50.00**
8301	Same as 8300 with four EIA RS232-C I/O ports.	**550.00**

DISK OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8513	5 megabyte cartridge disk system, moving head with 2.5M bytes of removable and 2.5M bytes of fixed disk storage. Includes disk drive power supply, power cable, and terminator. 19 inch rack mountable.	$ 4,500.00
8516	10 megabyte cartridge disk system, moving head with 5M bytes of removable and 5M bytes of fixed disk storage. Includes disk drive power supply, power cable, and terminator. 19 inch rack mountable.	5,800.00
8500	Controller for 5 and 10 megabyte disk drives. Requires one large chassis slot and supports four disk drives. Data transfer via DMA channel at 200,000 bytes per second.	950.00
8530	Disk cartridge for 5 megabyte cartridge disk drive.	200.00
8540	Disk cartridge for 10 megabyte cartridge disk drive.	250.00
8520	Daisy chain or disk drive controller cable.	250.00

PRINTERS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8410	Serial matrix printer, 60 CPS, 10 characters per inch, up to 132 characters per line. Character formation is with a 7 X 9 matrix. Fully buffered.	$ 2,225.00
8400	Printer controller for serial printer with ASCII interface, character buffer, and parallel data transfer. Requires one I/O slot.	300.00
8420	Interconnect cable (25 ft.) between printer and controller.	75.00
8411	Bi-directional print option for serial matrix printer. Printer automatically seeks fastest direction to print next line based on termination position of current line. When printing full 132 character lines this option will effectively double the through put.	350.00

CPU OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8001	Microprogrammed microprocessor with 8080 instruction set. Processor has 7 accumulators, hardware stack register, programmed I/O, 8-level priority interrupt and DMA, and direct addressing to 65,536 bytes. Microprocessor cycle time is 175NSEC.	$ 995.00
8002	Option pack includes, real-time clock, programmer console, RS 232 or TTY current loop serial I/O, power monitor and auto restart, and automatic program load ROM. (Mounting is on CPU board and is not field installable).	285.00
8199	Extended memory addressing option provides for addressing memory from 65,536 bytes to 1,048,576 bytes and extends DMA addresses to 20 bits.	395.00

I/O OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8600	Asynchronous serial controller with two EIA RS232-C I/O ports. Full- or half-duplex operation with jumper selectable baud rates (75, 110, 134.5, 150, 300, 600, 1200, 2400, 4800, 9600) with full character buffering. Requires one I/O slot.	$
8601	Same as model 8600 except has four EIA RS232-C I/O ports.	
8602	General purpose programmable parallel I/O controller. 48 T²L compatible I/O lines which can be software configured for 8, 16, or 24 bit parallel I/O. Allows for data transfers to 100,000 bytes per second.	
8801	General purpose wiring board with assortment of 14, 16, and 24 pin sockets.	
8802	Extender board for large card.	
8803	Extender board for small I/O card.	

ENCLOSURES, POWER SUPPLIES, & MISC. OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8811	Electronic chassis with mother board and connectors for six (6) large card slots. Mounting provided for power supply option. Chassis is 7 inches by 18.75 inches by 15.7 inches and is 19-inch rack mountable.	$
8812	Auxiliary I/O card cage with mounting for five (5) small I/O cards. Card cage mounts on rear of 7" electronic chassis and provides for power and ground. Card cage is 5.25 inches deep.	
8813	Power supply for one 7" chassis and auxiliary I/O card cage. Power supply mounts in 7" chassis and provides 37 amps at +5V, 14 amps at +15V, and 4 amps at −15V. The power supply is 21.25 inches deep.	670.00
8616	Office environment desk enclosure for mounting 7" chassis, auxiliary I/O card cage, and disk drive. Provides for 59 inch by 32 inch work space.	920.00
8815	Auxiliary desk enclosure for mounting two additional disk drives.	795.00

SOFTWARE OPTIONS

MODEL NUMBER	DESCRIPTION	PURCHASE PRICE
8901	Standalone Operating System for minimum standalone non-disk systems includes:	$ 50.00
	1) Standalone monitor.	
	2) Relocatable Assembler.	
	3) Source Editor.	
	4) Linking Loader.	
8902	Disk Executive System (DEX) provides for file management of disk files as well as all systems I/O. Requires 32K bytes of memory, CPU, 5M byte disk and video display/keyboard.	250.00
8903	BASIC, standalone, requires 16K bytes of memory, CPU, and video display/keyboard.	250.00
8904	Disk Executive System (DEX) with Enhanced Commercial BASIC. Requires 32K bytes of memory, CPU, 5 Mbyte disk and video display/keyboard.	500.00

NOTES:

Note 1 Any of the optional model numbered equipment may be ordered with a System 800.

Note 2 The System 80 and 800 semiconductor memory board may contain either 32K or 64K bytes. The 32K expansion option will be accomplished by EM at the factory. Field expansion will be shipped as a kit of chips for customer installation.

Note 3 All memory modules require our large chassis slot.

OEM DISCOUNT SCHEDULE

The following discount schedule is based on unit prices of the November 1976 price list. The percentage discount applies only on achieved quantity (Stair-step). As each quantity level is reached, the corresponding discount will apply. The term is one year from date of first purchase order.

QUANTITY	% DISCOUNT
1	0
2-4	5
5-9	10
10-24	15
25-49	20
50-up	Consult Factory

COMMERCIAL MEMORY PRODUCTS

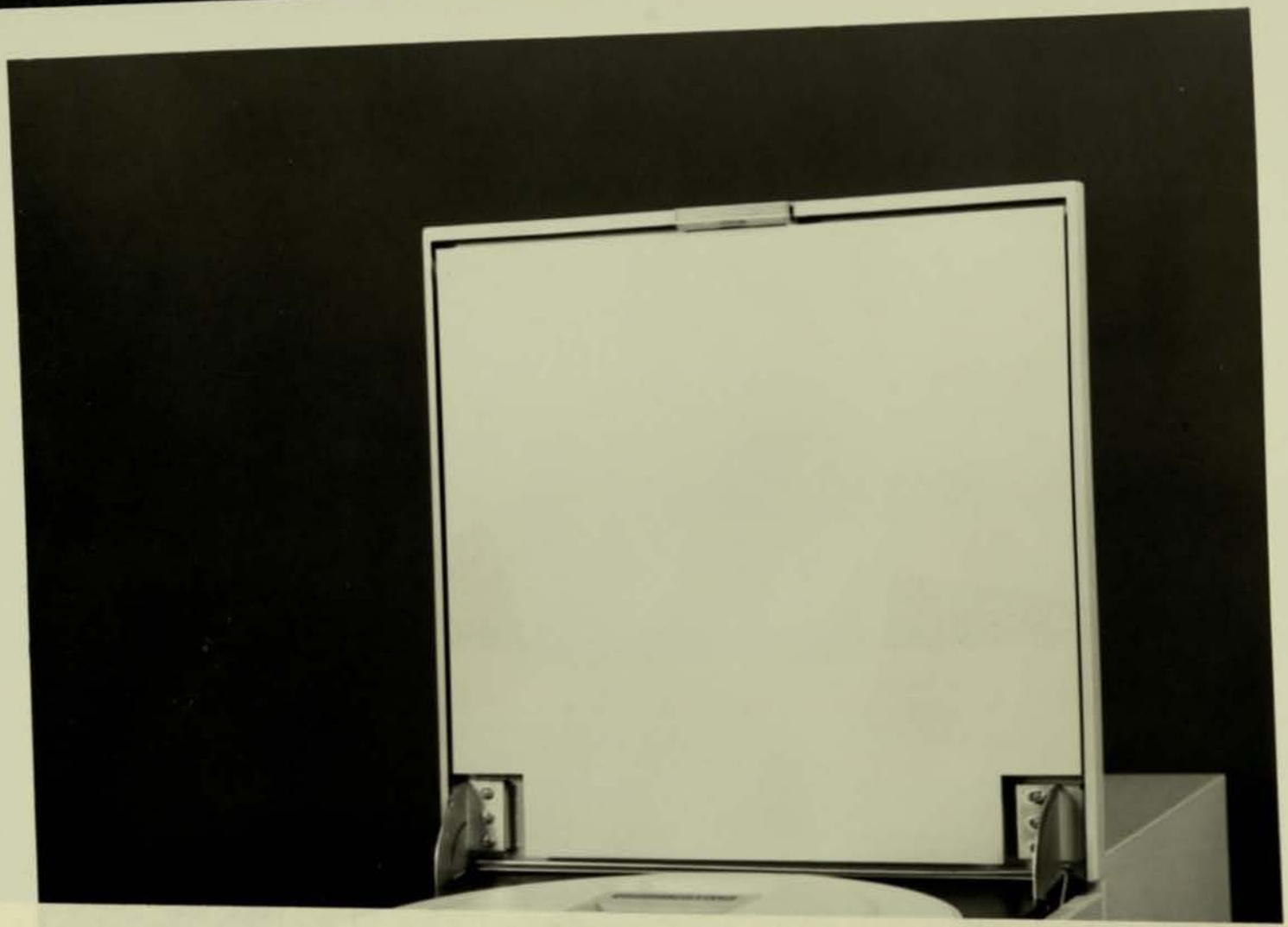
A Division of Electronic Memories & Magnetics Corp., 12621 Chadron, Hawthorne, California 90250 • Phone: (213) 644-9881

Printed in U.S.A. 11/76


PERIPHERAL PRODUCTS

EMM'S 312 DISK DRIVES AS FIRST SEEN AT THE 1977 NATIONAL COMPUTER CONFERENCE. 25-76 MEGABYTES FIXED AND REMOVABLE MEDIA.


EMM



EMM'S 312 DISK DRIVES AS FIRST SEEN AT THE 1977 NATIONAL COMPUTER CONFERENCE. 25-76 MEGABYTES FIXED AND REMOVABLE MEDIA.


EMM

EMM 312
DISK DRIVE

OEM Bottom Line Benefits

Price Drop
Proper Capacity
Faster Delivery
Spare Parts
No Warm-up
Standardization

Proven Technology

Proven technology is the key. This EMM 312 is a self-contained, random access storage unit. It has an integral power supply, logic chassis and clean air system. Our 312 uses one, two or three fixed disks plus a removable cartridge. Its fixed disk assembly uses only one dedicated servo surface. And its disk cartridge uses one of its surfaces for servo. All operator controls are on the front panel for easy access.

Price Drop 4½ to 1

Cost per million 8-bit bytes (Mbyte) is a typical measure of value. And compared to 200 track-per-inch (tpi) drives, our 312 gives you a 4½ to 1 price drop per Mbyte.

Capacity from 25 to 305 Mbytes

Choose what's *right* for you. Not what's 'near'. 312 capacity goes from 25.46 to 305 Mbytes. 312s usually sell with three fixed platters at 76.41 Mbytes. But you may order it with one or two fixed platters, or daisy chain up to four drives for 305 Mbytes. When you later increase capacity, there's nothing to redesign. Not even the cabinet.

On Time Planned Delivery

Fast delivery is something you've undoubtedly waited for and anguished over — unless you've ordered from us during the past two years. Our record over the past year is 95% on time deliveries. Nobody else equals this record.

Spare Parts Overnight

If you've waited for delivery from others, you could wait longer for spares. Not from us. Our spares ship in less than 30 days, and overnight on special request.

Faster Service

Time drags, even for resident servicemen, when components are not accessible. 312 components "blossom" with hinged power supply and card cage. Nothing is hidden.

312s have only one head to align vs Trident's five.

Drives returned for service are rebuilt, tested and shipped in two weeks or less.

Couple these benefits with our growing field service operation and you have strong, dependable support any time, any place.

Zero Warm-up

Cold cartridges on hot 312 drives are immediately addressable, even with a temperature difference of 50°.

The reason is dual servo track-following systems. One for fixed disks. One for the cartridge. They eliminate platter run-out and temperature-position distortion at any operating temperature. This dramatically boosts reliability over the optical detent approach.

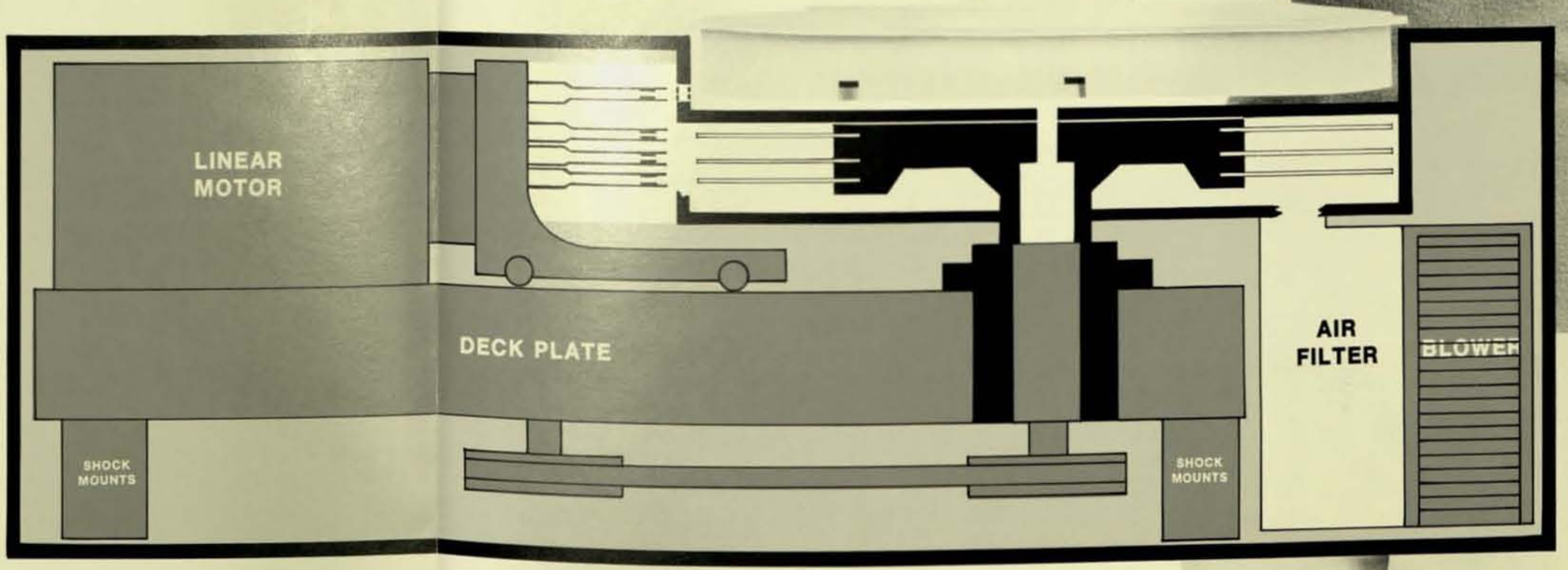
Standardization

Downwards compatibility: Our 312 can be compatible with controllers of 200 tpi/2200 bpi drives.

Interchangeable cartridges; A cartridge from any 312 fits all 312 drives.

Standard parts, not exotic ones, add reliability — like the voice coil, drive motor or IBM 3330-II type disks.

Interface compatibility exists between our 312 and products of other major disk cartridge manufacturers.



Reliability. The Whole Ball Game.

Continental Design

Conservative design, proven parts, special features, better construction, could describe a Cadillac or Continental. 312s are built with their design philosophy. Without their price tag.

Each design consideration previously mentioned inherently and deliberately adds to our 312's reliability, as do those which follow.

Rugged Construction

Rugged construction continues with the deck plate casting. It's small and ridgid, with only one level of very simple machining. This gives superior accuracy over multi-level castings.

Our casting floats on shock mounts inside the 312's metal frame. So critical components are isolated from outside forces.

Super Cooling

Super cooling forces filtered air through the electronics, power supply and disk areas, then efficiently exhausts out the back. This purges the unit and increases reliability.

Easy Interfaces

With our modular design, read/write and logic functions are on separate boards, servo functions on another, etc. This gives you flexibility for different interfaces, by replacing a single board.

In data formatting, write data is synchronous with the write clock. It's received in NRZ format from the controller. It's precompensated and internally encoded to MFM format prior to writing. Data is transmitted to the controller in NRZ as well.

Future Products

Our 312 begins a new product series; all modular, with the same interfaces and commonality of spare parts. We stand behind each of our products. Being multinational with eleven divisions and subsidiaries, we can't afford not to.

Bottom Line Benefits

Bottom line benefits are just that: EMM product benefits which enhance your profit picture. Your fiscal year's end will tell the tale. But don't wait till then to evaluate the 312. Capitalize on it now. Contact our marketing department for technical specifications, for your nearest EMM sales engineer, for a customer evaluation unit, or, of course, for placing your order.

Capacity
3 fixed, 1 cartridge: 76.41 Mbytes
2 fixed, 1 cartridge: 50.92 Mbytes
1 fixed, 1 cartridge: 25.46 Mbytes

Fixed Disks: IBM 3330-II

Cartridge
5440 type, with 3330-II disk

Rotation Speed: 2400 rpm

Transfer Rate: 5 MHz

Maintenance
Preventive maintenance is recommended every 6 mo. Mean time between failures: 4500 hrs. Mean time to repair: 30 min.

Head Positioning
Continuous track-following servo controlled linear motor

Access Time
Track-to-track: 10 ms
Average: 45 ms
Maximum: 65 ms

Density
Tracks per inch: 370
Recording density: 4680 bpi

Controls & Indicators
Start/stop switch, ready indicator, write protect switch/indicator

Power
All international single phase voltages & frequencies available

Environment
Operating temp: 50°F (10°C) to 105°F (41°C) with max gradient of 12°F (11.1°C) per hr.
Shipping temp: −40°F (−40°C) to 150°F (65°C)
Humidity: 5% to 95% noncondensing

Reliability
Recoverable (soft) errors: 1×10^{-9}
Unrecoverable (hard) errors: 1×10^{-12}

Electronic Packaging
TTL compatible

Physical (overall)
Height: 10.3" (26.16 cm)
Width: 17.5" (44.45 cm)
Length: 31.0" (78.74 cm)
Weight: 100 lbs (45.36 Kg)

OPTIONS

Daisy Chain up to 4 drives, I/O cables, terminator boards

Soft Sectoring to 128 sectors

Controller Interfaces to most common controllers

50 Hz Line Frequency

Special Paint & name plates on quantity orders

Mounting: rack or desk top

EMM
PERIPHERAL PRODUCTS
A DIVISION OF
ELECTRONIC MEMORIES & MAGNETICS CORPORATION
1015 Timothy Drive, San Jose, California 95133, Telephone: (408) 298-7080

577-10M Printed in U.S.A.

PERIPHERAL PRODUCTS
A DIVISION OF
ELECTRONIC MEMORIES & MAGNETICS CORPORATION

news release
FOR RELEASE UPON RECEIPT

EMM ENHANCES DISK PRODUCT LINE

SAN JOSE, California, May 27 - EMM's Peripheral Products Division has introduced a combination fixed and removable media disk storage system for use by midi, mini and microcomputer manufacturers and users.

The product designated EMM 312 has capacities of 25M-, 50M-, and 76 megabytes of fixed and removable storage. Multiple units can attain a capacity of up to 305 megabytes of storage. The EMM 312 has a data transfer rate of 5 MHz, and an average access time of 35 milliseconds.

EMM in its existing products is using IBM 3330 equivalent technology in very large disk files. "It is this technology that is being used in our 312," said Fred Wolff, division general manager. Wolff continued, "product using this technology has been manufactured since early 1975 and attained a proven quality and reliability record. With minor modifications it is this technology that will apply to our 312 disk file. Volume in this type of product has grown steadily over the last two years and customer acceptance of this technology was the prime reason for it being selected in our new family of disk products. In 1976 we were able to maintain a 95% on-time delivery record, with the average deliveries being specified by customers at 30 days."

As in the EMM family of 200 TPI products, it is not necessary for an EMM 312 user to go through any periods of warm-up. Users may apply a cold cartridge on a hot drive and immediately address either disk or cartridge. The ability of this product to operate over a 50° temperature variance is another characteristic.

More..

1015 Timothy Drive, San Jose, California 95133, Telephone: (408) 298-7080

The EMM Model 312 is a self-contained random access storage unit with power supply, logic chassis and clean air system as an integral part of the unit. Options exist for the use of two or three fixed disks plus a removable disk cartridge. The fixed portion of the disk requires only one dedicated servo surface and requires only one surface of the cartridge for servo writing. For convenience, all operator controls are on the front panel. EMM's Model 312 will be offered in rack mount or desk top configurations and will be interface compatible with products of other major disk cartridge manufacturers.

The family of 312 products is completely field upgradable to a maximum of 76 megabytes of storage.

The EMM 312 (three fixed disks plus one cartridge receiver) sells for $6,400 in single unit quantities. Volume prices are available on request. Evaluation units are scheduled for November deliveries.

A prototype, in full dress, will be at the NCC Booth 1493.

-o0o-

CONTACT: H. Jack McLaughlin

(408) 298-7080

(Photos Enclosed)

TECHNICAL SUPPLEMENT

EMM'S ENHANCED 312 DISK SYSTEM

Zero Warm-up is a function of the 312's dual servo track-following systems. One for fixed disks. One for the cartridge. Because a head follows its intended track (instead of ridgidly opposing it at a right angle) problems from platter run-out are eliminated.

And because 312 heads use no external reference for positioning (optical detent), temperature differences do not affect accurate head position or operation at any operating temperature.

Only One Head Alignment: There's only one head to align, vs Trident's five heads. This is done by simply applying a CE pack to the removable media's top surface.

3330 Technology: Disks are interchangeable IBM 3330-II's disks, with 5440 cartridges at 12.73M bytes per surface. Fixed disks are double sided, oxide coated IBM 3330-II types.

Other Specifications:

305.0M bytes;	4-drive daisy chain, optional
76.4M bytes;	3 fixed, 1 cartridge
50.9M bytes;	2 fixed, 1 cartridge
25.5M bytes;	1 fixed, 1 cartridge
2400 rpm	Rotation Speed
370	Tracks Per Inch
4680 bpi	Recording Density
50 Hz	Line Frequency, optional
Soft Sectoring	up to 128 sectors

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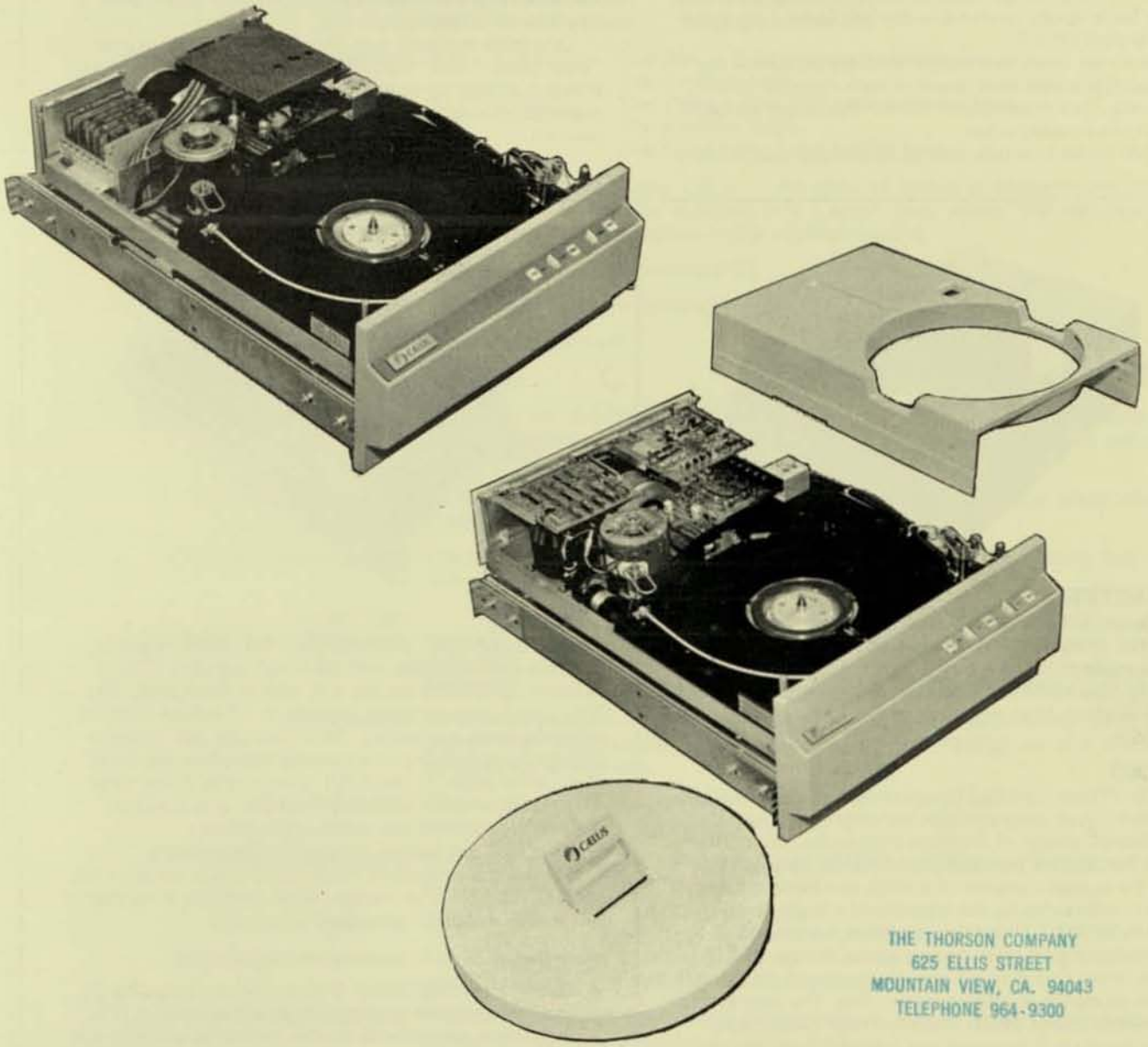
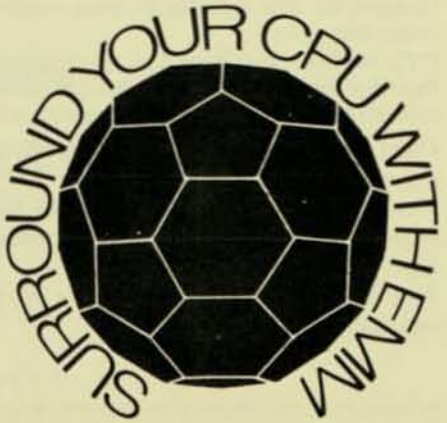
EMM CAELUS SERIES 300 DISK DRIVE



THE THORSON COMPANY
625 ELLIS STREET
MOUNTAIN VIEW, CA. 94043
TELEPHONE 964-9300

FEATURES

- ☐ 24, 48, OR 96 MILLION BITS STORAGE
- ☐ TOP LOADING DISK CARTRIDGE
- ☐ 40 MILLISECOND ACCESS TIME
- ☐ AUTOMATIC BRUSH CLEANING CYCLE
- ☐ CLEAN AIR FILTRATION SYSTEM
- ☐ UNIVERSAL POWER SUPPLY
- ☐ TEMPERATURE COMPENSATED
- ☐ VOICE COIL HEAD POSITIONING



The Series 300 disk drives approach "big" drives in storage capacity, yet are only 8¾ inches high! Daisy-chain four drives and you have up to 384 million bits storage capacity. This big storage capacity along with big features like new faster access times make the 300 Series a big value at small system prices!

Faster access times mean faster throughput. Caelus has cut the average access time nearly in half—from 60 to 40 milliseconds. Data reliability of 1×10^{12} provides performance with unsurpassed value.

The 300 Series interface with all commonly used minicomputers. In fact, you can interchange the 300 series with any Caelus disk drive (Model 103, 203, 206, 303 or 306) without worrying about special interfaces, controllers, or software. This allows an infinite number of combinations to achieve the required storage.

Operation is simple too! There are only two switches: "main power" and "start/stop." A "write inhibit" function prevents accidental writing over data, and a safety interlock prevents removal of a disk cartridge while the drive is running.

CHARACTERISTICS

The series 300 disk drive contains a clean air filtration system that allows it to operate virtually error-free in almost any environment: office, assembly area, manufacturing, laboratory, you name it. The system circulates air through a 500-square-inch filter removing particles down to 0.3 microns.

Model 303

The 303/1 Disk Cartridge Drive utilizes a single removable CMIII (5440 type) magnetic disk cartridge with mass random access storage of 3 million 8-bit bytes. In all other respects, the 303/1 is identical to the 303/2. As an add-on feature, the storage capacity of a 303/1 can be doubled on-site to 6 million bytes by the addition of a single fixed disk.

The Model 303/2 Disk Cartridge Drive has two disks which provide a total mass random access storage of 6 million 8-bit bytes. One disk is fixed, ideally suited for storage of system residence or other program data. The second disk is a removable Caelus CMIII Disk Cartridge (5440 type). This disk cartridge is mounted and removed from the top of the drive similar to System 3 drives.

ACCESSORIES

- Clean air replacement filter for clean air filtration system.
- Replacement cleaning brushes for brush cleaning system.
- Cleaning kit that includes all items required to clean heads and disks.
- DTU-1A Standard Drive Test Unit mounted in briefcase. Provides the controls and indicators for head positioning and checking read/write operations of the drive.
- Fixed Disk Conversion Kit for upgrading in the field to a dual disk drive.
- Fixed Disk Replacement Kit contains the disk, retaining rings and instructions for replacing the fixed disk.
- Tool Kit contains all tools required for drive parts replacement.

Model 306

The Model 306/1 uses a Caelus CMIII (5440 type) removable disk cartridge, with 200-track per-inch (TPI) capacity, to provide storage of 6 million 8-bit bytes. The 306/2 doubles the storage capacity to 12 million bytes by using the same top-loading CMIII cartridge and adding a 200-tpi fixed disk. For even greater flexibility, the fixed disk can be added to the 306/1 drive on-site at any time. This allows addition of storage capacity as required to meet system growth and added applications.

An important feature is Dynamic Temperature Compensation that allows ready condition to occur in less than 15 minutes. The average ready condition is reached in less than 3 minutes.

OPTIONS

- Data Formatting Option Boards—various board configurations available to accept double frequency or NRZI input data, and provide double frequency or NRZI output data and clock. Sector counting output also available.
- Daisy-chain operation allows up to four drives to be connected to operate in serial (daisy-chain) configuration. Interconnecting cables and terminator block available.
- Input/Output connector or cable with connector available.
- Sector Formatting for handling up to 48 sector formats on removable and optional fixed disk.
- Special Interfaces adapt the 303 drive to operate with most common controllers which have been designed to interface with other drives.
- Four index/sector lines can be provided to monitor index and sector data from the two disks.
- 2400-rpm operation and a data transfer rate of 2.5 MHz.
- Automatic address clear for resetting address counter upon receipt of illegal address.
- 50-Hz Line Frequency accommodated with a simple pulley change.
- Special Paint and Name Plates—available on quantity orders.

SPECIFICATIONS

Storage Capacity: 303/1: 24 million bits. 306/1: 48 million bits
303/2: 48 million bits. 306/2: 96 million bits

Disk Configuration: 303/1 or 306/1: One Disk – CMIII removable cartridge, 3 or 6 million bytes.
303/2 or 306/2: Two Disks – One CMIII removable cartridge, 3 or 6 million bytes.
One Fixed Disk, 3 or 6 million bytes.

Cartridge: 5440 type, Caelus Model CMIII – All disks 14 inches in diameter with the removable disk cartridge enclosed in a Lexan® dust cover. The cartridge is keyed with the drive to assure proper operator loading.

Disk Rotational Speed: 1500 rpm ±2% (2400 rpm optional).

Data Transfer Rate: 1.5885 MHz (2.5 MHz optional).

Mean Time Between Failure: 4000 hours minimum.

Mean Time to Repair: 30 minutes.

Periodic Maintenance: Under normal operating conditions using a Caelus CMIII cartridge or equivalent, periodic maintenance is limited to semi-annual head cleaning and an annual service of the air filter.

Head Positioning System: Voice coil (linear motor) with closed loop servo utilizing optical positioning. Model 306 is temperature compensated.

Optical Detent Assembly: Electro-optical device eliminates wear and all adjustments. Accurately locates and locks on to any of 204 or 408 tracks on the disk.

Access Time (including head settling time):

	Model 303/303FA	Model 306
Track-to-Track:	16/12 milliseconds	12 milliseconds
Average:	60/40 milliseconds	40 milliseconds
Maximum:	95/70 milliseconds	70 milliseconds

Air Filtration: All drive air passed through a 500-square-inch filter to remove particles greater than 0.3 microns. The disks are purged with filtered air at a rate of 25 cubic feet per minute.

Data Reliability: Recoverable (soft) errors: 1×10^{10}
Unrecoverable (hard) errors: 1×10^{12}

Power Requirements: 120 volts ±10%, 60 Hz ±1%. Voltages from 100v to 240v can be selected by a transformer tap change. (50 Hz optional)

Electronic Packaging: TTL compatible.

Operational Environment: Temperature Range: 50°F to 104°F.
Relative Humidity: 10 to 80% (non-condensing).

Brush-cleaning Cycle: Replaceable brushes sweep each disk to remove dust or loose contamination during start-up cycle and prior to loading the heads.

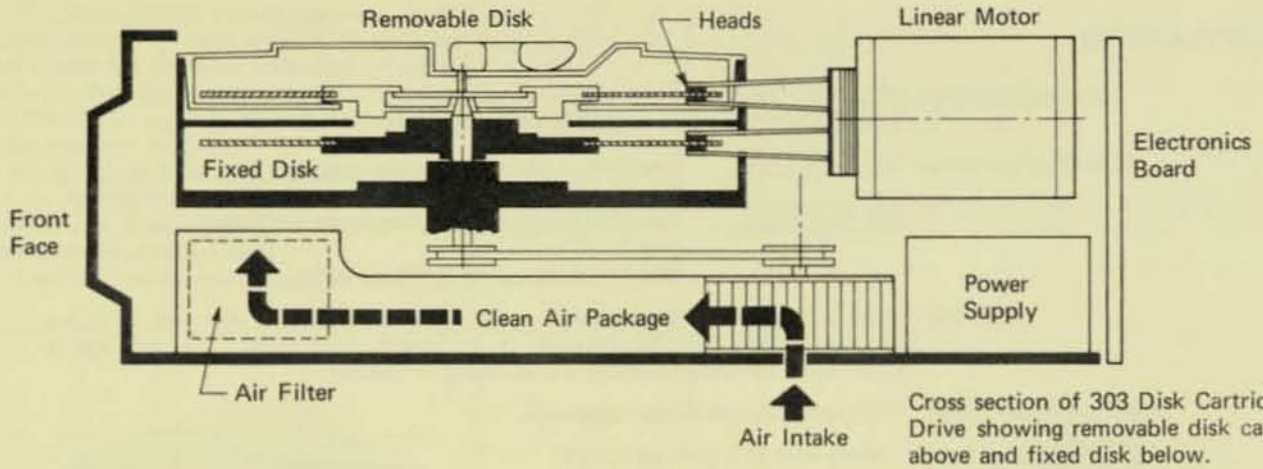
Emergency Head Retraction: The heads automatically retract to their "home" position in case of a line power failure.

Safety Interlock: The cartridge is "locked" into position preventing accidental operator damage while in operation or during a line power failure. The drive will start only with the cartridge properly in place.

Shipping or Storage Environment: Temperature Range: –40°F to 150°F.
Relative Humidity: 10 to 90% (non-condensing).

Physical Dimensions: Height: 8.75 inches
Width: 17.60 inches
Depth: 26 or 27.5 inches (less front face) Model 306
Weight: 84 pounds (less slides and disk cartridge)

®Lexan – Registered trademark of the General Electric Company



Cross section of 303 Disk Cartridge Drive showing removable disk cartridge above and fixed disk below.

INTERFACE DATA

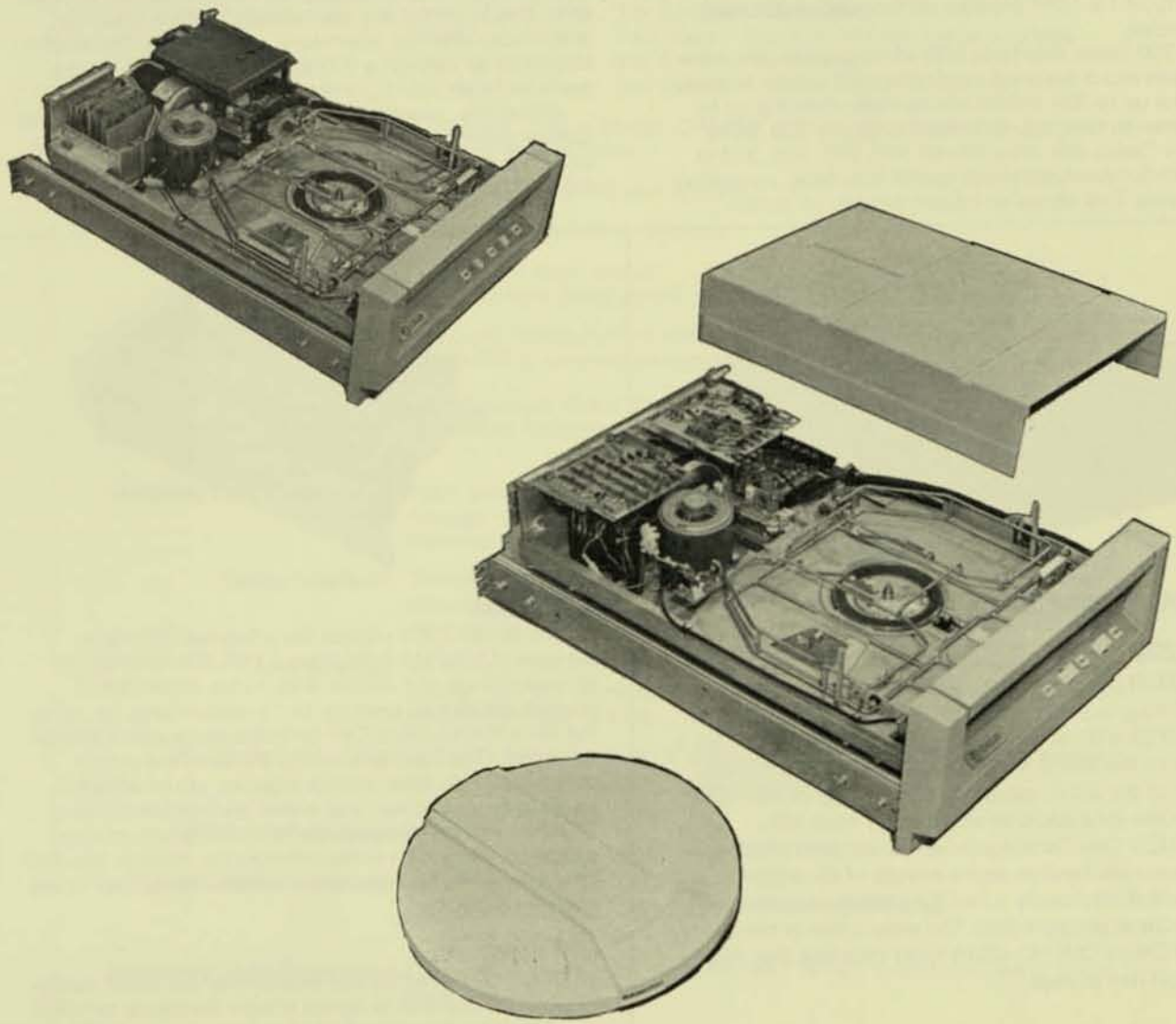
CONTROLLER		DISK DRIVE
Input		
Unit Select	4	Level
Cylinder Address	8 (100 TPI) — 9 (200 TPI)	Level
Disk Select		Level
Head Select		Level
Cylinder Seek		Level
Address Clear		Pulse
200 TPI Indication		Pulse
Write Enable		Level
Track Offset (optional)		Level
Read Enable (optional)		Level
Write Data, Double Frequency (NRZ optional)		Pulse
Output		
Drive Ready		Level
Seek Complete		Level
Ungated Seek Complete	4	Level
Read Data, Double Frequency (NRZ optional)		Pulse
Data Clock (optional)		Pulse
Index (1 line standard, 2 optional)		Pulse
Sector (1 line standard, 2 optional)		Pulse
Sector Address (optional)	5	Level
Seek Incomplete		Level
Write Inhibit		Level

LEGEND

Data — - — - — Timing - - - - - - - - Control ————

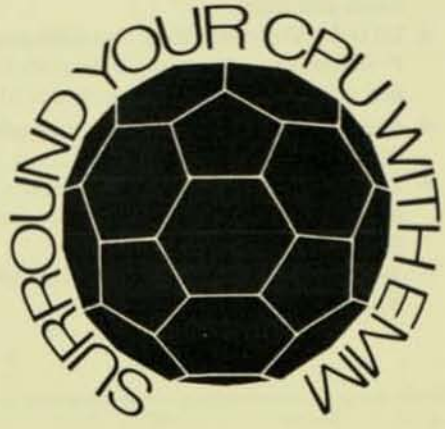
EMM PERIPHERAL PRODUCTS
A Division of Electronic Memories & Magnetics Corporation
1015 Timothy Drive/San Jose, California 95133/Telephone (408) 298-7080

EMM CAELUS SERIES 200 DISK DRIVE



FEATURES

- ☐ 24, 48, OR 96 MEGABIT STORAGE
- ☐ FRONT LOADING DISK CARTRIDGE
- ☐ LOW POWER CONSUMPTION
- ☐ 40 MILLISECOND ACCESS TIME
- ☐ VOICE COIL HEAD POSITIONING
- ☐ TEMPERATURE COMPENSATED
- ☐ OPTICAL DETENT
- ☐ CLEAN AIR FILTRATION SYSTEM



The front-loading 200 Series is big in performance and design flexibility, has significantly faster access times and up to 96 million bit storage capacity; yet, it's small in size (only 8¾ inches high!) and small in price too, when compared feature for feature with the competition.

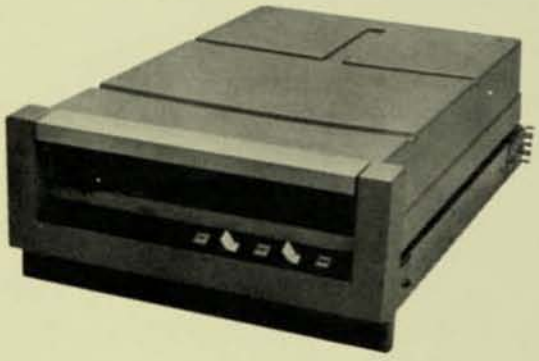
Faster access times mean faster throughput. In the design of the 200 Series, Caelus has cut the average access time nearly in half – from 60 to 40 milliseconds. Data reliability of 1×10^{12} provides performance with unsurpassed value.

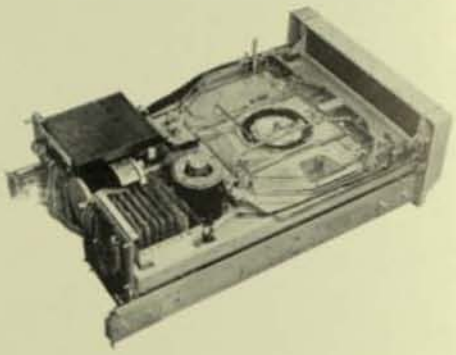
The 200 Series interfaces with all commonly used minicomputers and is designed to provide total system storage capacities up to 384 million bits by daisy-chaining up to four drives. In fact, you can interchange any 200 Series with any Caelus disk drive (Model 103, 203, 206, 303 or 306) without worrying about special interfaces, controllers or software. This allows an infinite number of combinations to achieve the exact amount of storage required.

The 200 Series is simple to operate, too! There are only two switches: "main power" and "start/stop." A "write inhibit" function prevents accidental writing over data, and a safety interlock prevents removal of a disk cartridge while the drive is running.

A clean air filtration system, similar to that used in large drives, allows the Caelus 200 Series to operate virtually error-free in almost any environment: office, assembly area, manufacturing, laboratory, you name it. The system circulates air through a 500-square-inch filter removing particles larger than 0.3 microns.

Reliability, economy and ease of maintenance added to Caelus' experience in designing and manufacturing drives make the 200 Series a value-packed member of our drive family.





CHARACTERISTICS

Model 203

The 203/1 Disk Cartridge Drive uses the single removable CMI-HD magnetic disk cartridge with mass random access storage of 24 million bits. In all other respects, the 203/1 is identical to the 203/2. As an add-on feature, the storage capacity of the 203/1 can be doubled on site to 48 million bits with the field addition of the single fixed disk.

The 203/2 Disk Cartridge Drive has two disks which provide a total mass random access storage of 48 million bits. One disk is fixed, ideally suited for storage of system residence or other program data. The second disk is the removable Caelus CMI-HD (2315 type) cartridge that offers infinite off-line storage.

ACCESSORIES

- Clean air replacement filter for clean air filtration system.
- Cleaning Kit that includes all items required to clean heads and disks.
- DTU-1A Standard Drive Test Unit mounted in briefcase. Provides the controls and indicators for head positioning and checking read/write operations of the drive.
- Fixed Disk Conversion Kit for upgrading the 203/1 or 206/1 to a 203/2 or 206/2.
- Fixed Disk Replacement Kit contains the disk, retaining rings and instructions for replacing the fixed disk.
- Tool Kit contains all tools required for drive parts replacement.

Model 206

The Model 206/1 utilizes the advanced 200-track-per-inch (TPI)(2315 type) Caelus CMI disk cartridge to provide storage of 6 million 8-bit bytes. Model 206/2 doubles the storage capacity to 12 million bytes by using the same front-loading CMI cartridge along with a 200-tpi fixed disk. The fixed disk can be added to the unit in minutes on-site. Thus, storage capacity can be added in stages as system growth and added applications dictate.

An important feature is Dynamic Temperature Compensation that allows ready condition to occur in less than 15 minutes. The average ready condition is reached in less than 3 minutes.

OPTIONS

- Data Formatting Option Boards—various board configurations available to accept double frequency or NRZI input data, and provide double frequency or NRZI output data and clock. Sector counting output also available.
- Daisy-chain operation allows up to four drives to be connected to operate in serial (daisy-chain) configuration. Interconnecting cables and terminator block available.
- Input/Output connector or cable with connector available.
- Sector Formatting for handling up to 48 sector formats on removable and optional fixed disk.
- Special interfaces adapt the 200 Series drive to operate with most common controllers which have been designed to interface with other drives.
- Four index/sector lines can be provided to monitor and sector data from the two disks.
- 2400-rpm operation and a data transfer rate of 2.5 MHz.
- Automatic address clear for resetting address counter upon receipt of illegal address.
- 50-Hz Line Frequency accommodated with a simple pulley change.
- Special Paint and Name Plates – available on quantity orders.

TECHNICAL SPECIFICATIONS

Storage Capacity: 203/1: 24 million bits. 206/1: 48 million bits
203/2: 48 million bits. 206/2: 96 million bits

Disk Configuration: 203/1 and 206/1: One Disk – CMI-HD removable cartridge, 3 or 6 million 8-bit bytes.
203/2 and 206/2: Two Disks – One CMI-HD removable cartridge, 3 or 6 million 8-bit bytes.
One fixed disk, 3 or 6 million 8-bit bytes.

Cartridge: 2315 type, Caelus Model CMI-HD – All disks 14 inches in diameter enclosed in a Lexan® dust cover.

Disk Rotational Speed: 1500 rpm ±2% (2400 rpm optional).

Data Transfer Rate: 1.5885 MHz (2.5 MHz optional).

Data Reliability: Recoverable (soft) errors: 1×10^{10}
Unrecoverable (hard) errors: 1×10^{12}

Head Positioning System: Voice coil (linear motor) with closed loop servo utilizing optical positioning. Model 206 is temperature compensated.

Optical Detent Assembly: Electro-optical device eliminates wear and all adjustments. Accurately locates and locks on to any of 204 or 408 tracks on the disk.

Access Time: (including head settling time)	Model 203/203FA	Model 206
Track-to-Track	16/12 milliseconds	12 milliseconds
Average:	60/40 milliseconds	40 milliseconds
Maximum:	95/70 milliseconds	70 milliseconds

Safety Interlock: The cartridge is "locked" into position preventing accidental operator damage while in operation during a line power failure. The drive will start only with the cartridge properly in place.

Air Filtration: All drive air passed through a 500-square-inch filter to remove particles greater than 0.3 microns. The disks are purged with filtered air at a rate of 25 cubic feet per minute.

Power Requirements: 120 volts ±10%, 60 Hz ±1%. Voltages from 100v to 240v can be selected by a transformer tap change. (50 Hz optional).

Electronic Packaging: TTL compatible.

Operational Environment: Temperature Range: 50°F to 104°F
Relative Humidity: 10 to 80% (non-condensing)

Emergency Head Retraction: The heads automatically retract to the "home" position in case of a line power failure.

Mean Time Between Failure: 4500 hours minimum.

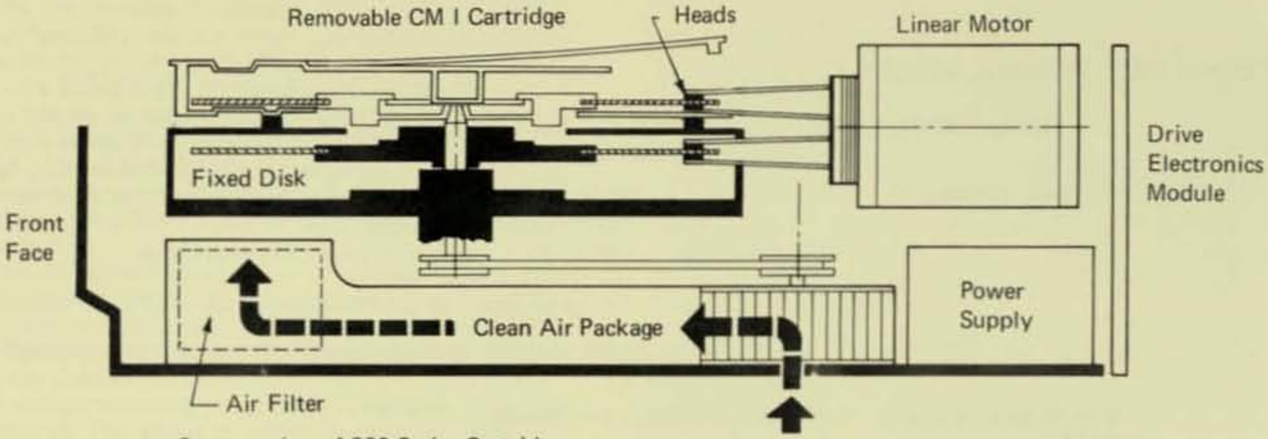
Mean Time to Repair: 30 minutes

Periodic Maintenance: Under normal operating conditions using a Caelus CMI-HD cartridge or equivalent, periodic maintenance is limited to semi-annual head cleaning and an annual service of the air filter.

Shipping or Storage Environment: Temperature Range: –40°F to 150°F
Relative Humidity: 10 to 90% (non-condensing)

Physical Dimensions: Height: 8.75 inches
Width: 17.60 inches
Depth: 26 or 27.50 inches (less front face) Model 206
Weight: 84 pounds (without slides and disk cartridge)

®Lexan — Registered trademark of the General Electric Company



Cross section of 200 Series Cartridge Drive showing removable disk cartridge above and fixed disk below.

INTERFACE DATA

Input

CONTROLLER		DISK DRIVE
Unit Select	4	Level
Cylinder Address	8 (100 TPI) — 9 (200 TPI)	Level
200 TPI Indication	Control	Level
Disk Select	Control	Level
Head Select	Control	Level
Cylinder Seek	Control	Pulse
Address Clear	Control	Pulse
Write Enable	Control	Level
Cylinder Offset (optional)	Control	Level
Read Enable (optional)	Control	Level
Write Data, Double Frequency (NRZ optional)	Data	Pulse

Output

CONTROLLER		DISK DRIVE
Drive Ready	Control	Level
Seek Complete	Control	Level
Ungated Seek Complete	4	Level
Read Data, Double Frequency (NRZ optional)	Data	Pulse
Data Clock (optional)	Data	Pulse
Index (1 line standard, 2 optional)	Timing	Pulse
Sector (1 line standard, 2 optional)	Timing	Pulse
Sector Address (optional)	5	Level
Seek Incomplete	Control	Level
Write Inhibit	Control	Level

LEGEND

Data — - — - —— Timing - - - - - - - - Control ————————

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Electronic Memories & Magnetics Corporation

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DS-DD200-4/76-5M

CAELUS 100
SERIES DISK DRIVE

FEATURES

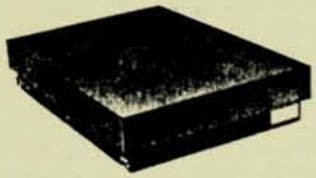
- ☐ 24 MILLION BITS STORAGE
- ☐ DUST PROOF SEALED ENCLOSURE WITH FILTERED, RECIRCULATED AIR FLOW
- ☐ COMPACT DESIGN – 5¼ INCHES HIGH WITH POWER SUPPLY
- ☐ VOICE COIL SERVO RAMP HEAD LOADING
- ☐ OPTICAL DETENT
- ☐ LOW POWER CONSUMPTION

The Caelus 100 Series Drive is a sealed, fixed disk drive that provides on-line memory for general purpose mini-computers and intelligent terminals. This convenient, reliable drive does not require operator controls, operator adjustments or preventive maintenance.

The 100 Series is totally self-contained within a sealed, dust-proof enclosure that is only 5¼ inches high, lending itself to rack, console or table top operation in almost any attitude or position. The sealed enclosure keeps the drive dust free under even the most adverse operating environments, virtually eliminating the most common cause of drive failure, i.e. head-to-disk interference due to contaminants.

Cleaning of heads and other preventive maintenance practices are recommended on a yearly basis.

Human operating errors have also been eliminated by the absolute simplicity of the 103 Drive — no operating controls or indicators. Just plug it in and let it run. All of these features contribute to a designed reliability of 4500 hours (MTBF) without failure.



CHARACTERISTICS

The Fixed Disk Drive is a high performance, economical drive capable of storing 24 million data bits (3 million bytes) utilizing a single fixed magnetic disk and movable read/write heads. Data is recorded at 2200 bits per inch at a transfer rate of 1.5 MHz on 204 data tracks per each of the two disk surfaces.

The 100 Series Disk Drives are plug compatible with the front-loading 200 Series and the top-loading 300 Series Disk Cartridge Drives. Controller and interface requirements for the entire Caelus family of drives are identical. Single configuration or mixed daisy chaining of up to four drives is accomplished without the need for non-standard interface cables, etc.

The integral power supply contains a multi-tap transformer that permits the drive to be field adapted to all standard international line voltages. Line frequency of 50 Hz is optional at no additional charge.

ACCESSORIES

- DTU-1A Drive Test Unit mounted in an attache case. Provides the controls and indicators for head positioning and checking read/write operations of the drive.

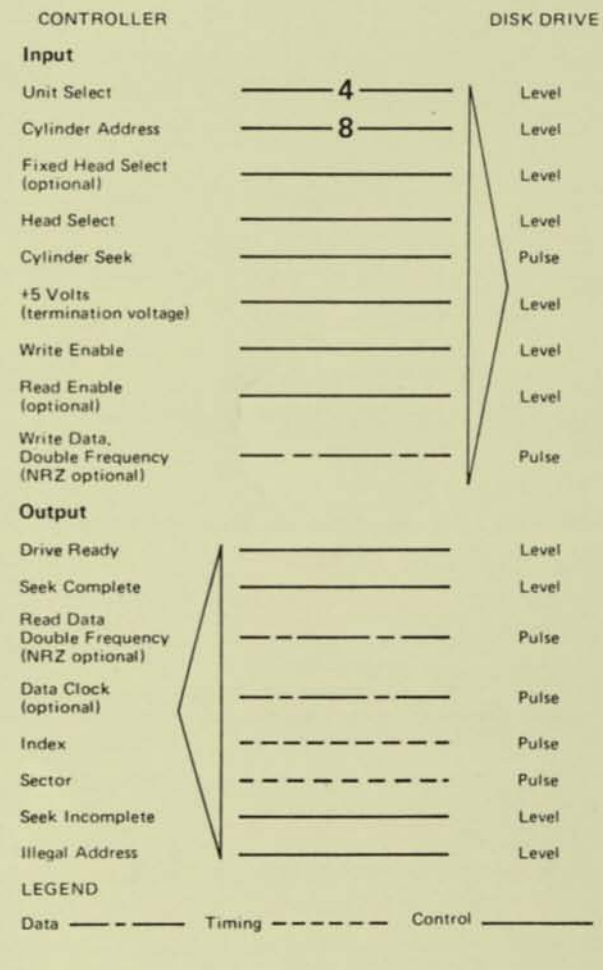
OPTIONS

- Daisy-chain operation allows up to four drives to be connected to operate in serial (daisy-chain) configuration. Interconnecting cables and terminator block available.
- Input/Output connector or cable with connector available.
- Sector formatting for handling up to 32 sector formats.
- Special interfaces adapt the 103 Drive to operate with most common controllers which have been designed to interface with other drives.
- 50-Hz line frequency accommodated with a simple pulley change.
- Special name plates available on quantity orders.

SPECIFICATIONS

Storage Capacity:	3,000,000 data bytes (24 million bits); 7,500 data bytes per track.
Number of Tracks:	204 per surface.
Number of Sectors:	Index plus 24 sector marks standard, others optional.
Disk Rotational Speed:	1500 rpm ±2% (±1% line frequency deviation).
Data Transfer Rate:	1588.5 kHz at 1500 rpm.
Access Time: (including head settling)	
Track-to-Track:	25 milliseconds maximum
Average Random:	75 milliseconds.
Maximum:	125 milliseconds (204 tracks).
Data Reliability:	Recoverable (soft) errors: 1×10^{10} Unrecoverable (hard) errors: 1×10^{12}
Head Positioning System:	Voice coil (linear motor) with closed loop servo utilizing a linear position transducer and electro-optical detent.
Emergency Head Retraction:	Heads automatically retract to home position in case of line power failure.
Mean Time Between Failure:	4500 hours minimum
Periodic Maintenance:	Cleaning of heads and disk, and other minor preventive maintenance practices are recommended on a yearly schedule.
Cooling:	Convection.
Power Requirements:	117 volts ±10%, 60 Hz ±1%. Voltages from 100v to 240v are selectable by taps on the power transformer. (50 Hz optional).
Operating Environment:	
Temperature Range:	50°F to 100°F.
Relative Humidity:	10 to 80% (non-condensing).
Shipping and Storage Environment:	
Temperature Range:	-40° F to 150° F
Relative Humidity:	10 to 90% (non-condensing)
Physical Dimensions:	
Depth:	25.50 inches (less I/O cover).
Height:	5.25 inches
Width:	17.50 inches (less slide).
Weight:	33 pounds (less slides)

INTERFACE DATA



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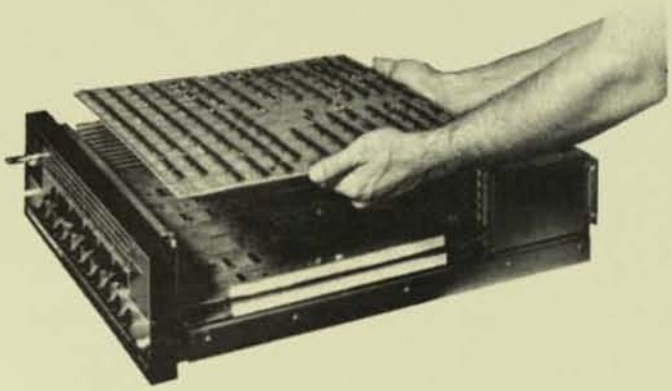
EMM 2003 DISK SUB-SYSTEM



FEATURES

- 6 - 24 MEGABYTES OF STORAGE
- IRIS & RDOS COMPATIBLE
- LOW POWER CONSUMPTION
- COMPLETE DATA ERROR CHECKING
- SIMPLE INSTALLATION
- COMPATIBLE TO ALL DATA GENERAL COMPUTERS

The EMM 2003 DISK SUB-SYSTEM is a 6 megabyte capacity CAELUS Disk Drive coupled with a DC-220 Controller which is compatible to all Data General and Data General emulating computers.

Transparent to RDOS and compatible to IRIS software packages this sub-system offers a reliable cost-effective alternative to other available drive systems used on the NOVA, Eclipse Series, DCC-116 and Keronix computers.

As part of the EMM 2003 DISK SUB-SYSTEM, the CAELUS 203 moveable head disk drive has proven to be one of the most relaible performers in the CAELUS family – over 3000 have been delivered.

The Caelus 203 is totally self-contained, supplied with chassis slides for rack mounting and features an integral power supply.

Utilizing advanced techniques, the DC-220 Controller has a single board embedded design which plugs into a single slot in the computer and connects with the disk drive through the rear of the computer using the standard back-plane panel. The DC-220 is capable of controlling 4 single-platter drives.

The EMM 2003 DISK SUB-SYSTEM is fully integrated, tested and shipped with a factory warranty.

CAELUS 203 DISK DRIVE

CHARACTERISTICS

The fixed Disk Drive is a high performance, economical drive capable of storing 48 million data bits (6 Million Bytes) utilizing a single fixed magnetic disk and moveable read/write heads. Data is recorded at 2200 bits per inch at a transfer rate of 1.5 MHz on 204 data tracks per each of the four disk surfaces.

8¾ inches high, it lends itself to rack, console or table top operation. Single configuration or mixed daisy chaining of up to four drives is accomplished without the need for non-standard interface cables, etc.

The integral power supply contains a multi-tap transformer that permits the drive to be field adapted to all standard international line voltages. Line frequency of 50 Hz is optional at no additional charge.

ACCESSORIES

DTU-1A Drive Test Unit, mounted in an attache case, provides the controls and indicators for head positioning and checking read/write operations of the drive.

SPECIFICATIONS

Storage Capacity:	6,000,000 data bytes (48 million bits); 7,500 data bytes per track.
Number of Tracks:	204 per surface.
Number of Sectors:	Index plus 12 sector marks
Disk Rotational Speed:	1500 rpm ± 2% (± 1% line frequency deviation).
Data Transfer Rate:	1588.5 kHz at 1500 rpm.
Access Time: (Including head settling)	
Track-to-Track:	16 milliseconds maximum
Average Random:	60 milliseconds
Maximum:	95 milliseconds (204 tracks)
Data Reliability:	Recoverable (soft) errors: 1×10^{10} Unrecoverable (hard) errors: 1×10^{12}
Head Positioning System:	Voice coil (linear motor) with closed loop servo utilizing an electro-optical detent.
Emergency Head Retraction:	Heads automatically retract to home position in case of the line power failure.
Mean Time Between Failure:	4000 hours minimum
Periodic Maintenance:	Changing of air filter, cleaning of heads and disk, and other minor preventive maintenance practices are recommended on a yearly schedule.
Cooling:	Forced Air.
Power Requirements:	117 volts ± 10%, 60 Hz ± 1%, 2 amps (standard) Voltages from 100v to 240v are selectable by taps on the power transformer. (50 Hz optional).
Operating Environment:	
Temperature Range:	50° to 105°F
Relative Humidity:	10 to 80% at a maximum wet bulb temperature of 85° F
Shipping and Storage Environment:	
Temperature Range:	40° F to 150° F
Relative Humidity:	10 to 90% (non-condensing)
Physical Dimensions:	
Length:	30 inches (less I/O cover).
Rack Depth:	2.8 inches.
Rack Height:	8.75 inches minimum.
Width:	17.75 inches (less slide).
Rack Width:	19 inches (with slide).
Weight:	90 pounds (less slides).

DC-220 DISK CONTROLLER

CHARACTERISTICS

The DC-220 provides advanced capabilities at a minimum cost. By employing the latest IC's and IC technology, the DC-220 is able to do more than other disk controllers; single-board embedded design saves the cost of non-essential cabinetry and utilizes only one card slot inside the computer.

The DC-220 performs automatic SEEK as part of the read/write operation. The seek operation need not be issued seperately since it is performed automatically simply by issuing a DOA for the drive stipulating the desired track, and then issuing the read/write command with start pulse. Address verification formatting is standard as a validity check on drive seeking and complete data error checking is included.

A comprehensive diagnostic program is supplied with the sub-system and tests all the unique features of the DC-220 and insures compatibility with the standard Data General operating systems under dynamic operating conditions.

SOFTWARE

The DC-220 is totally compatible with the IRIS system produced by Educational Data Systems. The Controller is compatible with the Data General RDOS operating system, and it operates transparent to the Data General driver.

SPECIFICATIONS

COMMAND SET

The following functions are performed on command by the computer-stored program.

- Write (1 to 16 256-word sectors)
- Read (1 to 16 256-word sectors)
- Seek (1 of 203 cylinder address)
- Restore (position heads at cylinder zero)
- Select drive 0, 1, 2, 3

READ STATUS

- Read write done
- Seek done units 0, 1, 2, 3
- Seeking on drive 0, 1, 2, 3
- Selected disk ready
- Seek error
- End error
- Address error
- Check word error
- Data late error
- Buffer address
- Selected drive
- Selected surface
- Next sector to be operated on
- Number of sectors to be processed

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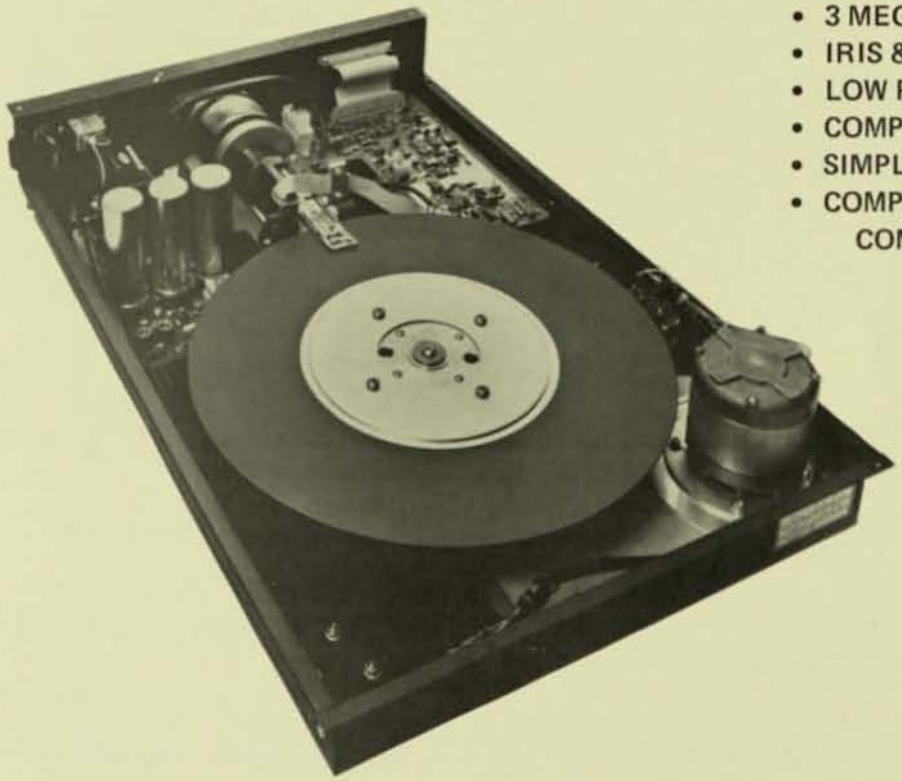
DS-DSS1000-276-1M

EMM 1000 DISK SUB-SYSTEM



FEATURES

- COST EFFECTIVE ALTERNATIVE TO FLOPPY DISCS
- 3 MEGABYTES OF STORAGE
- IRIS & RDOS COMPATIBLE
- LOW POWER CONSUMPTION
- COMPLETE DATA ERROR CHECKING
- SIMPLE INSTALLATION
- COMPATIBLE TO ALL DATA GENERAL COMPUTERS

The EMM 1000 DISK SUB-SYSTEM is a 3 megabyte capacity CAELUS Disk Drive coupled with a DC-220 Controller which is compatible to all Data General and Data General emulating computers.

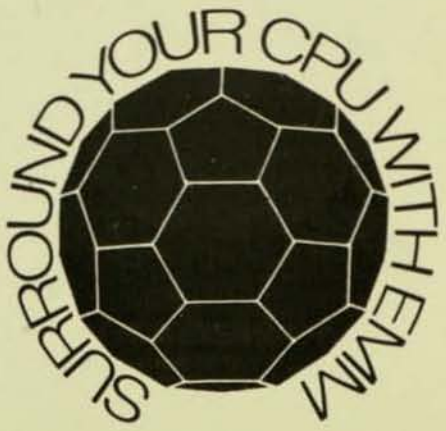
Transparent to RDOS and compatible to IRIS software packages this sub-system offers a reliable cost-effective alternative to the floppy disk drive systems used on the NOVA, Eclipse Series, DCC-116 and Keronix computers.

As part of the EMM 1000 DISK SUB-SYSTEM, the CAELUS 103 moveable head fixed disk drive has proven to be one of the most reliable performers in the CAELUS family – over 1000 have been delivered.

The Caelus 103 is totally self-contained within a sealed, dust-proof enclosure, does not require operator controls, adjustments or preventive maintenance and features an integral power supply.

Utilizing advanced techniques, the DC-220 Controller has a single board embedded design which plugs into a single slot in the computer and connects with the disk drive through the rear of the computer using the standard back-plane panel. The DC-220 is capable of controlling 4 single-platter drives.

The EMM 1000 DISK SUB-SYSTEM is fully integrated, tested and shipped with a factory warranty.



CAELUS 103 DISK DRIVE

CHARACTERISTICS

The fixed Disk Drive is a high performance, economical drive capable of storing 24 million data bits (3 Million Bytes) utilizing a single fixed magnetic disk and moveable read/write heads. Data is recorded at 2200 bits per inch at a transfer rate of 1.5 MHz on 204 data tracks per each of the two disk surfaces.

5¼ inches high, it lends itself to rack, console or table top operation. Single configuration or mixed daisy chaining of up to four drives is accomplished without the need for non-standard interface cables, etc.

The integral power supply contains a multi-tap transformer that permits the drive to be field adapted to all standard international line voltages. Line frequency of 50 Hz is optional at no additional charge.

ACCESSORIES

DTU-1A Drive Test Unit, mounted in an attache case, provides the controls and indicators for head positioning and checking read/write operations of the drive.

SPECIFICATIONS

Storage Capacity:	3,000,000 data bytes (24 million bits), 7,500 data bytes per track.
Number of Tracks:	204 per surface.
Number of Sectors:	Index plus 12 sector marks.
Disk Rotational Speed:	1500 rpm ± 2% (± 1% line frequency deviation).
Data Transfer Rate:	1588.5 kHz at 1500 rpm.
Access Time: (Including head settling)	
Track-to-Track:	24 milliseconds maximum.
Average Random:	75 milliseconds.
Maximum:	125 milliseconds (204 tracks).
Data Reliability:	Recoverable (soft) errors: 1×10^{10} Unrecoverable (hard) errors: 1×10^{12}
Head Positioning System:	Voice coil (linear motor) with closed loop servo utilizing a linear position transducer and electro-optical detent.
Emergency Head Retraction:	Heads automatically retract to home position in case of the line power failure.
Mean Time Between Failure:	4000 hours minimum.
Periodic Maintenance:	Changing of air filter, cleaning of heads and disk, and other minor preventive maintenance practices are recommended on a yearly schedule.
Cooling:	Convection.
Power Requirements:	117 volts ± 10%, 60 Hz ± 1%, 2 amps (standard) Voltages from 100v to 240v are selectable by taps on the power transformer. (50 Hz optional).
Operating Environment:	
Temperature Range:	50° to 100° F
Relative Humidity:	10 to 80% at a maximum wet bulb temperature of 85° F
Shipping and Storage Environment:	
Temperature Range:	40° F to 150° F
Relative Humidity:	10 to 90% (non-condensing)
Physical Dimensions:	
Length:	25.75 inches (less I/O cover).
Rack Depth:	28.50 inches.
Rack Height:	5.25 inches minimum.
Width:	17.50 inches (less slide).
Rack Width:	17.75 inches (with slide).
Weight:	33 pounds (less slides)

DC-220 DISK CONTROLLER

CHARACTERISTICS

The DC-220 provides advanced capabilities at a minimum cost. By employing the latest IC's and IC technology, the DC-220 is able to do more than other disk controllers; single-board embedded design saves the cost of non-essential cabinetry and utilizes only one card slot inside the computer.

The DC-220 performs automatic SEEK as part of the read/write operation. The seek operation need not be issued seperately since it is performed automatically simply by issuing a DOA for the drive stipulating the desired track, and then issuing the read/write command with start pulse. Address verification formatting is standard as a validity check on drive seeking and complete data error checking is included.

A comprehensive diagnostic program is supplied with the sub-system and tests all the unique features of the DC-220 and insures compatibility with the standard Data General operating systems under dynamic operating conditions.

SOFTWARE

The DC-220 is totally compatible with the IRIS system produced by Educational Data Systems. The Controller is compatible with the Data General RDOS operating system, and it operates transparent to the Data General driver.

SPECIFICATIONS

COMMAND SET

The following functions are performed on command by the computer-stored program.

- Write (1 to 16 256-word sectors)
- Read (1 to 16 256-word sectors)
- Seek (1 of 203 cylinder address)
- Restore (position heads at cylinder zero)
- Select drive 0, 1, 2, 3

READ STATUS

- Read write done
- Seek done units 0, 1, 2, 3
- Seeking on drive 0, 1, 2, 3
- Selected disk ready
- Seek error
- End error
- Address error
- Check word error
- Data late error
- Buffer address
- Selected drive
- Selected surface
- Next sector to be operated on
- Number of sectors to be processed

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DS-DSS1000-276-1M

CAELUS 100
SERIES DISK DRIVE

FEATURES

- ☐ 24 MILLION BITS STORAGE
- ☐ DUST PROOF SEALED ENCLOSURE WITH FILTERED, RECIRCULATED AIR FLOW
- ☐ COMPACT DESIGN – 5¼ INCHES HIGH WITH POWER SUPPLY
- ☐ VOICE COIL SERVO RAMP HEAD LOADING
- ☐ OPTICAL DETENT
- ☐ LOW POWER CONSUMPTION

The Caelus 100 Series Drive is a sealed, fixed disk drive that provides on-line memory for general purpose mini-computers and intelligent terminals. This convenient, reliable drive does not require operator controls, operator adjustments or preventive maintenance.

The 100 Series is totally self-contained within a sealed, dust-proof enclosure that is only 5¼ inches high, lending itself to rack, console or table top operation in almost any attitude or position. The sealed enclosure keeps the drive dust free under even the most adverse operating environments, virtually eliminating the most common cause of drive failure, i.e. head-to-disk interference due to contaminants. No external air flow is required, the air within the drive being circulated and filtered. Changing of the air filter, cleaning of heads and other preventive maintenance practices are recommended on a yearly basis.

Human operating errors have also been eliminated by the absolute simplicity of the 103 Drive – no operating controls or indicators. Just plug it in and let it run. All of these features contribute to a designed reliability of 4000 hours (MTBF) without failure.

CHARACTERISTICS

The Fixed Disk Drive is a high performance, economical drive capable of storing 24 million data bits (3 million bytes) utilizing a single fixed magnetic disk and movable read/write heads. Data is recorded at 2200 bits per inch at a transfer rate of 1.5 MHz on 204 data tracks per each of the two disk surfaces. The addition of optional fixed heads on one data track per surface provides rapid access to 127,000 bits of data that are frequently addressed.

The 100 Series Disk Drives are plug compatible with the front-loading 200 Series and the top-loading 300 Series Disk Cartridge Drives. Controller and interface requirements for the entire Caelus family of drives are identical. Single configuration or mixed daisy chaining of up to four drives is accomplished without the need for non-standard interface cables, etc.

The integral power supply contains a multi-tap transformer that permits the drive to be field adapted to all standard international line voltages. Line frequency of 50 Hz is optional at no additional charge.

ACCESSORIES

- DTU-1A Drive Test Unit mounted in an attache case. Provides the controls and indicators for head positioning and checking read/write operations of the drive.
- DTU-2 hand-sized Drive Test Unit used for head positioning and activating read and write enable.

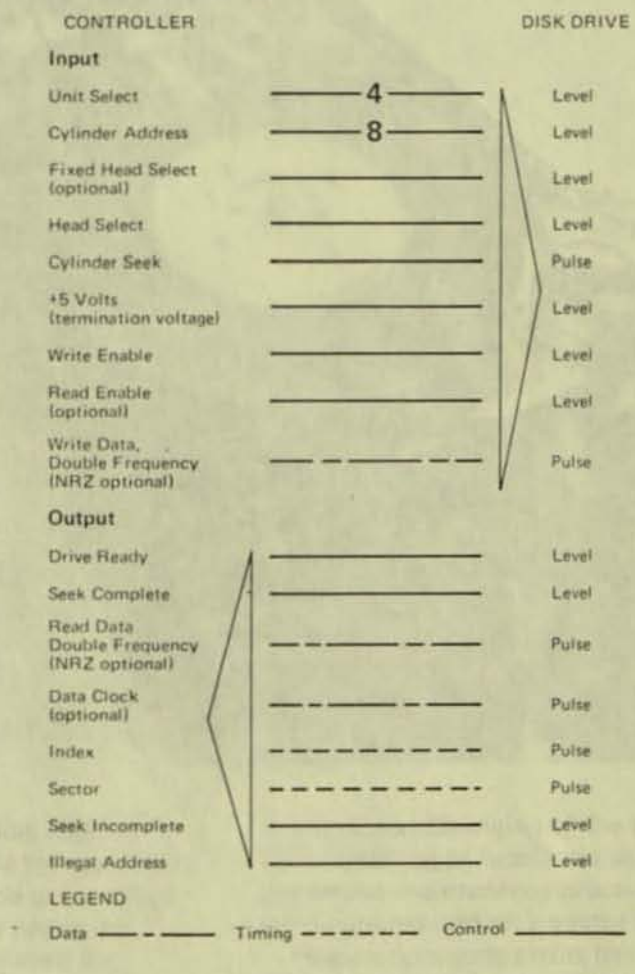
OPTIONS

- Daisy-chain operation allows up to four drives to be connected to operate in serial (daisy-chain) configuration. Interconnecting cables and terminator block available.
- Input/Output connector or cable with connector available.
- Sector formatting for handling up to 32 sector formats.
- Special interfaces adapt the 103 Drive to operate with most common controllers which have been designed to interface with other drives.
- 50-Hz line frequency accommodated with a simple pulley change.
- Special name plates available on quantity orders.
- Fixed heads providing 127K bits of data.

SPECIFICATIONS

Storage Capacity:	3,000,000 data bytes (24 million bits); 7,500 data bytes per track.
Number of Tracks:	204 per surface.
Number of Sectors:	Index plus 24 sector marks standard, others optional.
Disk Rotational Speed:	1500 rpm ±2% (±1% line frequency deviation).
Data Transfer Rate:	1588.5 kHz at 1500 rpm.
Access Time: (including head settling)	
Track-to-Track:	24 milliseconds maximum.
Average Random:	75 milliseconds.
Maximum:	125 milliseconds (204 tracks).
Data Reliability:	Recoverable (soft) errors: 1×10^{10} Unrecoverable (hard) errors: 1×10^{12}
Head Positioning System:	Voice coil (linear motor) with closed loop servo utilizing a linear position transducer and electro-optical detent.
Emergency Head Retraction:	Heads automatically retract to home position in case of line power failure.
Mean Time Between Failure:	4000 hours minimum.
Periodic Maintenance:	Changing of air filter, cleaning of heads and disk, and other minor preventive maintenance practices are recommended on a yearly schedule.
Cooling:	Convection.
Power Requirements:	117 volts ±10%, 60 Hz ±1%, 2 amps (standard). Voltages from 100v to 240v are selectable by taps on the power transformer. (50 Hz optional).
Operating Environment:	
Temperature Range:	50°F to 100°F.
Relative Humidity:	10 to 80% at a maximum wet bulb temperature of 85°F.
Shipping and Storage Environment:	
Temperature Range:	40°F to 150°F.
Relative Humidity:	10 to 90% (non-condensing).
Physical Dimensions:	
Length:	25.75 inches (less I/O cover).
Rack Depth:	28.50 inches.
Rack Height:	5.25 inches minimum.
Width:	17.50 inches (less slide).
Rack Width:	17.75 inches (with slide).
Weight:	33 pounds (less slides).

INTERFACE DATA



CAELUS MEMORIES
A Division of Electronic Memories & Magnetics Corporation
967 Mabury Road, San Jose, California 95133 / Telephone: (408) 298-7080 / Mail Address: P.O. Box 6297, San Jose, California 95150

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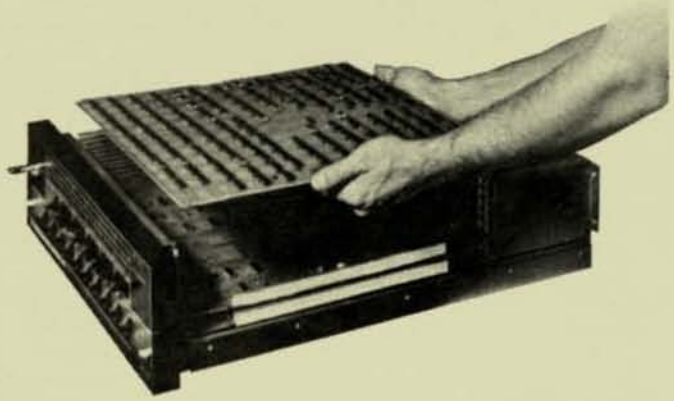
EMM 3003 DISK SUB-SYSTEM



FEATURES

- 6 - 24 MEGABYTES OF STORAGE
- IRIS & RDOS COMPATIBLE
- LOW POWER CONSUMPTION
- COMPLETE DATA ERROR CHECKING
- SIMPLE INSTALLATION
- COMPATIBLE TO ALL DATA GENERAL COMPUTERS

The EMM 3003 DISK SUB-SYSTEM is a 6 megabyte capacity CAELUS Disk Drive coupled with a DC-220 Controller which is compatible to all Data General and Data General emulating computers.

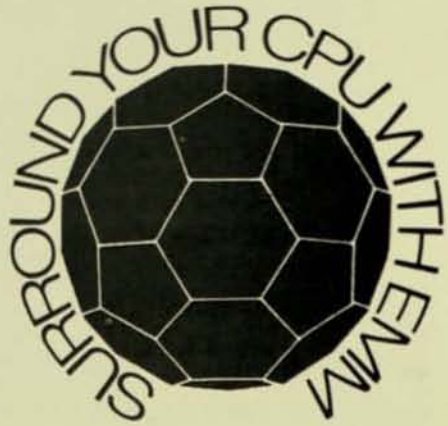
Transparent to RDOS and compatible to IRIS software packages this sub-system offers a reliable cost-effective alternative to the other disk drive systems used on the NOVA, Eclipse Series, DCC-116 and Keronix computers.

As part of the EMM 3003 DISK SUB-SYSTEM, the CAELUS 303 moveable head fixed disk drive has proven to be one of the most reliable performers in the CAELUS family – over 4000 have been delivered.

The Caelus 303 is totally self-contained, supplied with chassis slides for rack mounting and features an integral power supply.

Utilizing advanced techniques, the DC-220 Controller has a single board embedded design which plugs into a single slot in the computer and connects with the disk drive through the rear of the computer using the standard back-plane panel. The DC-220 is capable of controlling 4 single-platter drives.

The EMM 3003 DISK SUB-SYSTEM is fully integrated, tested and shipped with a factory warranty.



CAELUS 303 DISK DRIVE

CHARACTERISTICS

The fixed Disk Drive is a high performance, economical drive capable of storing 48 million data bits (6 Million Bytes) utilizing a single fixed magnetic disk and moveable read/write heads. Data is recorded at 2200 bits per inch at a transfer rate of 1.5 MHz on 204 data tracks per each of the four disk surfaces.

8¾ inches high, it lends itself to rack, console or table top operation. Single configuration or mixed daisy chaining of up to four drives is accomplished without the need for non-standard interface cables, etc.

The integral power supply contains a multi-tap transformer that permits the drive to be field adapted to all standard international line voltages. Line frequency of 50 Hz is optional at no additional charge.

ACCESSORIES

DTU-1A Drive Test Unit, mounted in an attache case, provides the controls and indicators for head positioning and checking read/write operations of the drive.

SPECIFICATIONS

Storage Capacity:	6,000,000 data bytes (48 million bits); 7,500 data bytes per track.
Number of Tracks:	204 per surface.
Number of Sectors:	Index plus 12 sector marks
Disk Rotational Speed:	1500 rpm ± 2% (± 1% line frequency deviation).
Data Transfer Rate:	1588.5 kHz at 1500 rpm.
Access Time: (Including head settling)	
Track-to-Track:	16 milliseconds maximum
Average Random:	60 milliseconds
Maximum:	95 milliseconds (204 tracks)
Data Reliability:	Recoverable (soft) errors: 1×10^{10} Unrecoverable (hard) errors: 1×10^{12}
Head Positioning System:	Voice coil (linear motor) with closed loop servo utilizing an electro-optical detent.
Emergency Head Retraction:	Heads automatically retract to home position in case of the line power failure.
Mean Time Between Failure:	4000 hours minimum
Periodic Maintenance:	Changing of air filter, cleaning of heads and disk, and other minor preventive maintenance practices are recommended on a yearly schedule.
Cooling:	Forced Air.
Power Requirements:	117 volts ± 10%, 60 Hz ± 1%, 2 amps (standard) Voltages from 100v to 240v are selectable by taps on the power transformer. (50 Hz optional).
Operating Environment:	
Temperature Range:	50° to 105° F
Relative Humidity:	10 to 80% at a maximum wet bulb temperature of 85° F
Shipping and Storage Environment:	
Temperature Range:	40° F to 150° F
Relative Humidity:	10 to 90% (non-condensing)
Physical Dimensions:	
Length:	30 inches (less I/O cover).
Rack Depth:	2.8 inches.
Rack Height:	8.75 inches minimum.
Width:	17.75 inches (less slide).
Rack Width:	19 inches (with slide).
Weight:	90 pounds (less slides).

DC-220 DISK CONTROLLER

CHARACTERISTICS

The DC-220 provides advanced capabilities at a minimum cost. By employing the latest IC's and IC technology, the DC-220 is able to do more than other disk controllers; single-board embedded design saves the cost of non-essential cabinetry and utilizes only one card slot inside the computer.

The DC-220 performs automatic SEEK as part of the read/write operation. The seek operation need not be issued seperately since it is performed automatically simply by issuing a DOA for the drive stipulating the desired track, and then issuing the read/write command with start pulse. Address verification formatting is standard as a validity check on drive seeking and complete data error checking is included.

A comprehensive diagnostic program is supplied with the sub-system and tests all the unique features of the DC-220 and insures compatibility with the standard Data General operating systems under dynamic operating conditions.

SOFTWARE

The DC-220 is totally compatible with the IRIS system produced by Educational Data Systems. The Controller is compatible with the Data General RDOS operating system, and it operates transparent to the Data General driver.

SPECIFICATIONS

COMMAND SET

The following functions are performed on command by the computer-stored program.

- Write (1 to 16 256-word sectors)
- Read (1 to 16 256-word sectors)
- Seek (1 of 203 cylinder address)
- Restore (position heads at cylinder zero)
- Select drive 0, 1, 2, 3

READ STATUS

- Read write done
- Seek done units 0, 1, 2, 3
- Seeking on drive 0, 1, 2, 3
- Selected disk ready
- Seek error
- End error
- Address error
- Check word error
- Data late error
- Buffer address
- Selected drive
- Selected surface
- Next sector to be operated on
- Number of sectors to be processed

EMM COMPUTER PRODUCTS DIVISION
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EMM CAELUS 412 DISK DRIVE

The newest member of the Caelus Family of removable pack disk drives, the EMM Caelus 412, has been designed to meet the most demanding requirements of the OEM systems designer. Incorporating exsisting technology with advanced disk file techniques, EMM's Caelus 412 is designed for multi-terminal systems, real time processors and most minicomputers that require random access, high speed mass storage in excess of 50 megabytes.

The EMM Caelus 412 features state of the art technology and hardware in the form of modular pull-out electronic components, edge connected PC boards, hinged electronic chassis and hinged deck plate, all geared for easy maintenance. The EMM Caelus 412's high efficiency filter system, designed and developed to meet stringent industry requirements, is one more feature that assures data reliability.

The EMM Caelus 412 uses a disk pack consisting of 3336-11 type components, manufactured by its own Media Operations, featuring a 370 TPI, 4040 BPI format. With a capacity equivalent to or greater than the IBM 3340, the Caelus 412 represents to users a significant savings in cost-per-bit of storage. It offers higher data tracking accuracy over temperature extremes with its track following servo system than disk drives using external reference servo systems with temperature compensation, thereby improving data integrity and insuring compatibility and pack interchangeability.

At rapidly increased data rates, interface integrity is of the utmost importance. The EMM Caelus 412 solves this problem by encoding your NRZ data for use in the drives, and then decoding the data within the unit so that NRZ is returned over the interface. The lack of analog circuitry in your controller not only decreases the cost, but substantially increases its reliability.

EMM CAELUS 412 DESCRIPTION & SPECIFICATIONS

- TOP LOADING/CAPABLE OF RACK OR DESK TOP MOUNTING

- DISK PACK (TRIDENT COMPATIBLE)

  5 Surfaces + 1 Servo Surface
  2 Cover Disks
  IBM 3336 Compatible Hardware

- STORAGE CAPACITY – 50 MEGABYTES (8 Bits/Byte)

Number of Cylinders	–	815
Tracks Per Inch	–	370
Bytes Per Track	–	13,440 (Unformatted)
Bits Per Inch	–	4040

- DATA TRANSFER RATE – 6.45 MEGAHERTZ

- PERFORMANCE CHARACTERISTICS

Pack Rotational Speed	–	3600 RPM
Access Times:		
Track to Track	–	6 Milliseconds
Maximum Length	–	50 Milliseconds
Average Access Time	–	30 Milliseconds
Recording Method	–	MFM bit serial with write pre-compensation
Start Time	–	20 seconds
Stop Time	–	20 seconds

- DATA RELIABILITY

Recoverable Errors	–	1×10^{10}
Unrecoverable Errors	–	1×10^{12}

- RELIABILITY

MTBF	–	$\geq$2500 Hours
MTTR	–	$\leq$1.5 Hours
PMT	–	0.5 Hours /1000 Operating Hours
Service Life	–	5 Years or 30,000 Hours

- CONTROLS & INDICATORS

  Start/Stop Switch
  Read Only Switch
  Fault Reset Switch
  Ready Indicator
  Read Only Indicator
  Fault Indicator

- INTERFACE – ALL I/O SIGNALS DIGITAL (TRIDENT COMPATIBLE)

Control & Address Lines	–	Single Ended Open Collector
Clock & Data Lines	–	Differential, ± 0.6 Volts

- EXTERNAL DIMENSIONS

Overall Length	–	30 Inches
Height	–	10.5 Inches
Width	–	17.25 Inches
Weight	–	185 Pounds

- ENVIRONMENTAL CONDITIONS

Operating Temperature	–	60° F to 90° F
Humidity	–	10% to 80% noncondensing
Altitude	–	–1000 feet to +6000 feet

- POWER SUPPLY (SELF CONTAINED)

Input Voltages	–	115 ± 15% VAC, 60HZ, 1 Ø
	–	215 ± 15% VAC, 60HZ, 1 Ø
	–	225 ± 15% VAC, 50HZ, 1 Ø

- OPTIONS

  Rack Mount Kit
  NRZ Data Interface

EMM COMPUTER PRODUCTS DIVISION
Electronic Memories & Magnetics Corporation
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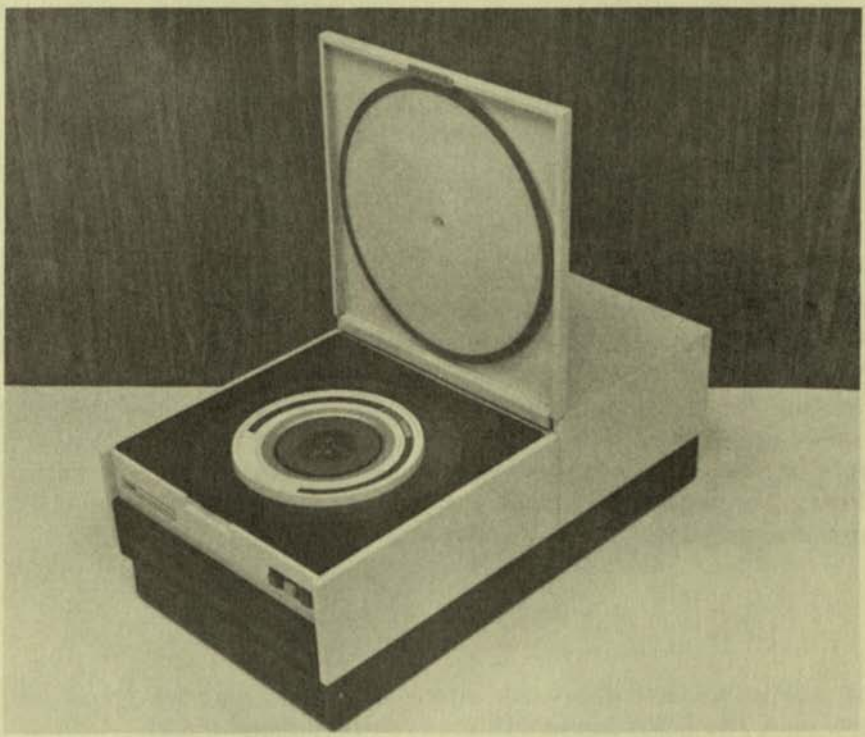
EMM CAELUS 412 DISK DRIVE



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EMM CAELUS 412 DESCRIPTION & SPECIFICATIONS

- TOP LOADING/CAPABLE OF RACK OR DESK TOP MOUNTING

- DISK PACK (TRIDENT COMPATIBLE)

  5 Surfaces + 1 Servo Surface
  2 Cover Disks
  IBM 3336 Compatible Hardware

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Average Access Time	–	30 Milliseconds
Recording Method	–	MFM bit serial with write pre-compensation
Start Time	–	20 seconds
Stop Time	–	20 seconds

- DATA RELIABILITY

Recoverable Errors	–	1×10^{10}
Unrecoverable Errors	–	1×10^{12}

- RELIABILITY

MTBF	–	$\geq$2500 Hours
MTTR	–	$\leq$1.5 Hours
PMT	–	0.5 Hours /1000 Operating Hours
Service Life	–	5 Years or 30,000 Hours

- CONTROLS & INDICATORS

  Start/Stop Switch
  Read Only Switch
  Fault Reset Switch
  Ready Indicator
  Read Only Indicator
  Fault Indicator

- INTERFACE – ALL I/O SIGNALS DIGITAL (TRIDENT COMPATIBLE)

Control & Address Lines	–	Single Ended Open Collector
Clock & Data Lines	–	Differential, ± 0.6 Volts

- EXTERNAL DIMENSIONS

Overall Length	–	30 Inches
Height	–	10.5 Inches
Width	–	17.25 Inches
Weight	–	185 Pounds

- ENVIRONMENTAL CONDITIONS

Operating Temperature	–	60° F to 90° F
Humidity	–	10% to 80% noncondensing
Altitude	–	–1000 feet to +6000 feet

- POWER SUPPLY (SELF CONTAINED)

Input Voltages	–	115 ± 15% VAC, 60HZ, 1 Ø
	–	215 ± 15% VAC, 60HZ, 1 Ø
	–	225 ± 15% VAC, 50HZ, 1 Ø

- OPTIONS

  Rack Mount Kit
  NRZ Data Interface

EMM COMPUTER PRODUCTS DIVISION
Electronic Memories & Magnetics Corporation
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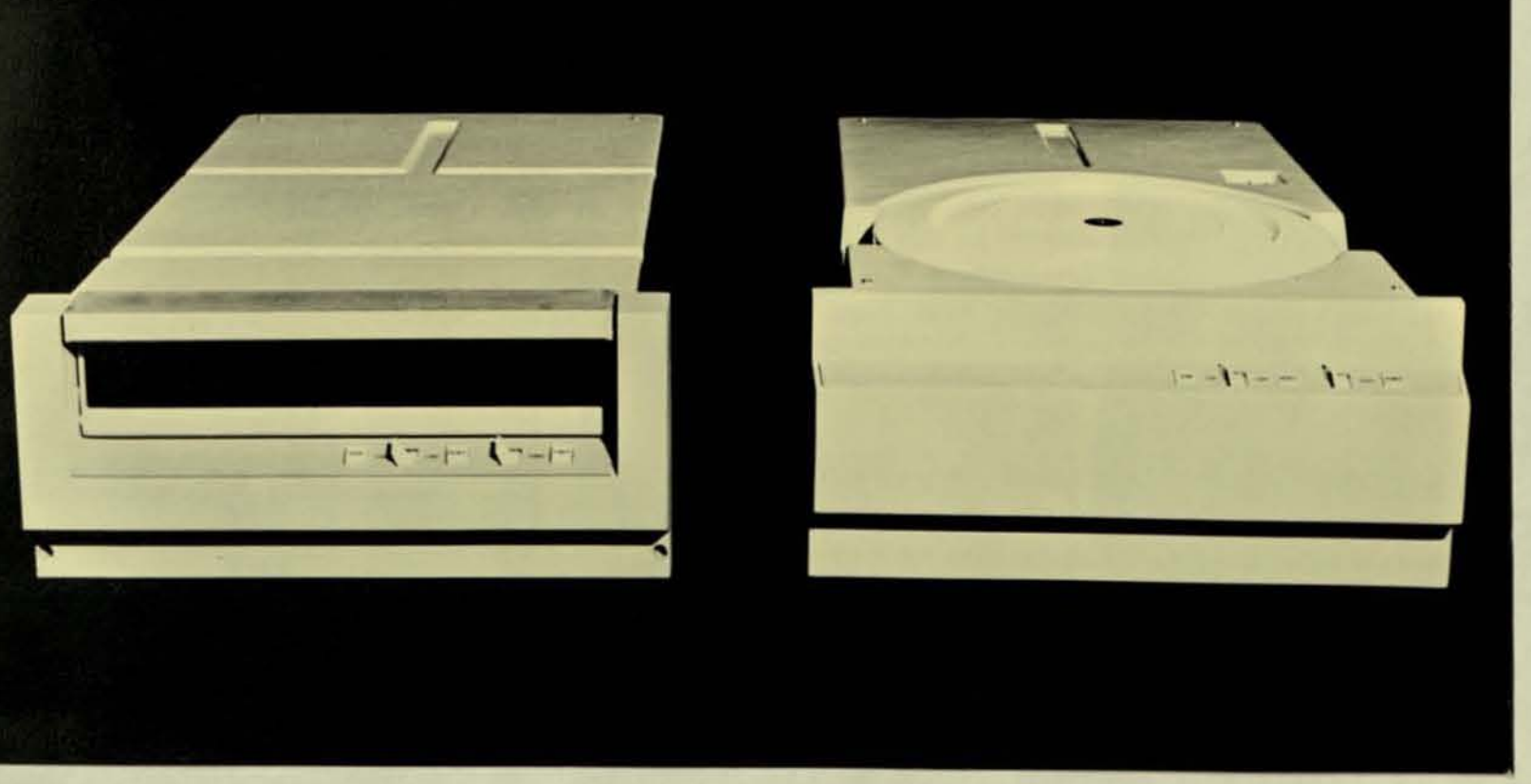
EMM Disk Drives
3 to 12 MB Series



Turn-key drives with a new twist.

Four Versions

Four versions of the same random access storage unit provide attractive computer system advantages. Your basic choices are 100 or 200 track-per-inch (tpi) units, and front or top cartridge access.

After selecting your track density, storage from 3 to 12 megabytes is a matter of ordering your drives with or without a fixed disk. And you may daisy chain up to four drives. So you are assured the configuration you want, with the capacity you require.

The difference between our 100 and 200 tpi drives is slight: heads and one pc board. Upgrade kits may be sent to you. Or we'd be happy to upgrade them when the time comes.

They're Turn-Key

They're turn-key because our prices include everything for immediate operation. Some manufacturers charge extra for an integral power supply, slides, terminator boards, and phase lock loop. With us, they're standard.

The New Twist

The new twist is an EMM exclusive. We solved the universal track registration problem when manufacturers upgrade 100 tpi drives to 200 tpi. The solution is "Dynamic Temperature Compensation". This lets you run a cold cartridge on a hot drive in 90 seconds (typical), and still maintain hard and soft error specifications. Actual testing with a 60°F cartridge in a 105°F drive shows 4½ minutes before operation. Other such drives make you wait 15 minutes or longer. They have only steady state compensation, which we employ as well.

Continuous Dynamic Temperature Compensation uses "thermistors" at the base plate and cartridge area to sense temperature deltas and to dictate head compensation of ±600 microinches. That's reliability.

Superior Track Registration

Superior track registration is also the benefit of our stronger base plate castings. Compared to other drives, you'll notice improved MTBF and better error ratio. Our castings reduce adverse effects of torque and other distortion. It's more built-in EMM reliability.

Compatibility

Compatibility with other major disk drive manufacturers is *plug-to-plug, scrambler cable* and *controller* compatibility. It's a big plus for add-ons and replacements.

26 Inch Rack Mounts

26 inch rack mount units are also available. And you don't need to modify a thing.

Lower Cost of Ownership

Lower cost of ownership results from our modular electronics approach. We use small, quick-access printed circuit boards. Read/write and logic functions are on separate boards, interface functions on another, etc. Each board plugs into a mother board for a clean design, with minimal harnesses and connectors. This lowers mean time to repair by simplifying trouble shooting. And changing interfaces can be easy as swapping a board, or merely using jumpers on your existing board. This ends the big board puzzle, and cost.

Our Track Record

Our track record exceeds 12,000 EMM drives of this type out there humming along. IDC's 1977 report on the OEM storage market states, "The OEM market was born in 1969 when Caelus Memories, a media supplier, (now EMM with eleven multinational divisions and subsidiaries) announced and shipped the first independent cartridge drives . . ." Last year, 95% of our shipments were on-time. Usually within 30 days.

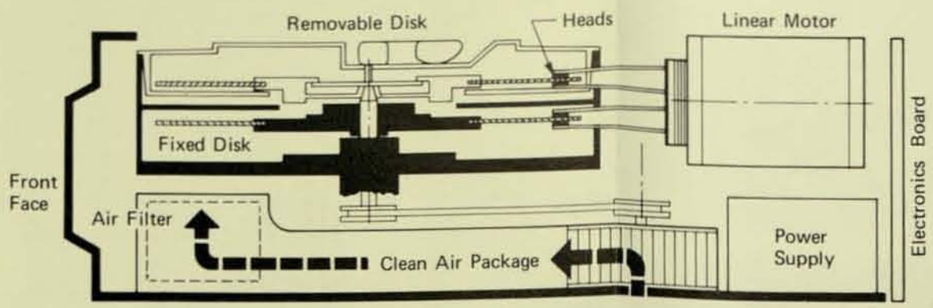
OEM Contracts

OEM contracts, of course, enjoy low unit pricing. Included is a full week of comprehensive training for your service, quality, and engineering people. Curriculum is thorough, with complete documentation and hands-on experience. A video tape for post training reference is available. We're the only manufacturer to provide the video tape advantage.

The Clincher

The clincher is spare parts support. Top OEM service managers want to stock spare parts—even before the first disk drive enters their territory. With us, you have that security. Your EMM sales engineer will assist you.

Contact our marketing department for technical specifications, for your nearest EMM sales engineer, for a customer evaluation unit, or, of course, for placing your order. EMM user references furnished as appropriate.



EMM Disk Drives: 3 to 12 MB Series

Capacity & Configuration: **Front or Top Cartridge Access Drives**

	100 tpi	200 tpi
No Fixed Disk	3 megabytes	6 megabytes
One Fixed Disk	6 megabytes	12 megabytes

Cartridge: Front Access 2315 Type; Top Access 5440 Type

Disk Rotation Speed: 1500 rpm ±2% (2400 rpm optional)

Data Transfer Rate: 1.5885 MHz (2.5 MHz optional)

Data Reliability: Recoverable (soft) errors: 1×10^{10}
Unrecoverable (hard) errors: 1×10^{12}

Head Positioning System: Voice coil linear motor with closed loop servo using optical positioning. 200 tpi drives have dual temperature compensation.

Optical Detent Assembly: Electro optical device eliminates wear and all adjustments. Accurately locates and locks on to any track on the disk.

Access Time: (including head settling time)

Track-to-track:	12 milliseconds
Average:	40 milliseconds
Maximum:	70 milliseconds

Safety Interlock: The cartridge is "locked" into position preventing accidental operator damage while in operation during a line power failure. The drive will start only with the cartridge properly in place.

Air Filtration: All drive air passes through a 500-square-inch filter to remove particles greater than 0.3 microns. The disks are purged with filtered air at the rate of 25 cubic feet per minute.

Power Requirements: All international single phase voltages and frequencies are available.

Operational Environment: Temperature Range: 50°F (10°C) to 104°F (40°C)
Relative Humidity: 10 to 80% noncondensing

Shipping Environment: Temperature Range: −40°F (−40°C) to 150°F (65°C)
Relative Humidity: 10 to 90% noncondensing

Emergency Head Retraction: The heads will automatically retract to the "home" position in case of a line power failure.

Mean Time Between Failure:
4500 hours minimum

Mean Time to Repair:
30 minutes

Periodic Maintenance:
Under normal operating conditions, periodic maintenance is limited to semi-annual head cleaning and an annual service of the air filter.

Physical Dimensions:
Height: 8.75 inches (22.2 cm)
Width: 17.60 inches (44.7 cm)
Depth: 27.50 inches (69.9 cm) less front face
Weight: 84 lbs. (38.1 Kg.) less slides & cartridge
Short Cabinet: 26 inches (66 cm)

ACCESSORIES

- Replacement air filter
- Replacement cleaning brushes
- Cleaning kit for heads and disks
- Fixed disk conversion kit for field upgrades to a dual disk drive.

OPTIONS

Data formatting option boards: various board configurations available to accept double frequency or NRZ input data, and provide double frequency or NRZ output data and clock.

- **Daisy chain** up to four drives with interconnecting cables and terminator block.
- **Sectoring** up to 48 sectors.
- **Interfaces** to most common controllers.
- **Scrambler cables** emulating various drives.
- **50 Hz line frequency**
- **Special paint** and name plates.

EMM
PERIPHERAL PRODUCTS
A DIVISION OF
ELECTRONIC MEMORIES & MAGNETICS CORPORATION
1015 Timothy Drive, San Jose, California 95133, Telephone (408) 298-7080

677-10M Printed in U.S.A.

Ted Gettelman
Account Representative
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Telephone: (415) 692-4250

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100 SERIES FIXED DISK DRIVE

The 100 Series Fixed disk drives provide on-line memory for general purpose minicomputers and intelligent terminals. The unit is sealed, contains an internal clean air system, and does not require operator controls, operator adjustments, or preventative maintenance.

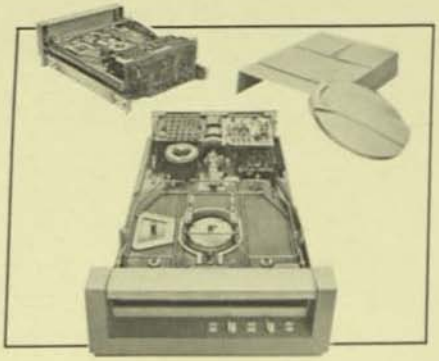
Specifications

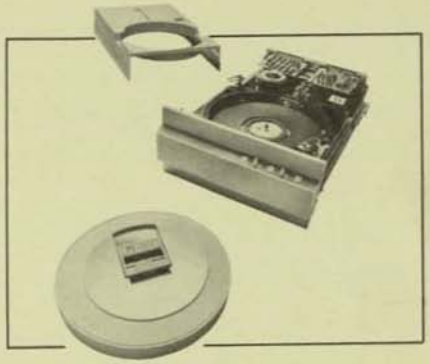
Capacity	24 million bits 7,500 data bytes per track
Number of tracks	204 per surface
Number of sectors	Index plus 24 sector marks standard, others optional
Disk Rotational Speed	1500 rpm ±2% (±1% line frequency deviation)
Data transfer rate	1588.5 KHz @ 1500 rpm
Access time: (Including head setting)	
Track-to-track	24 milliseconds max
Average Random	75 milliseconds
Maximum	125 milliseconds (204 tracks)
Power	117V, 60 Hz
Operating temperature	50°F to 100°F
Dimensions	27.75 x 5.25 x 17.5 inches
Weight	33 pounds

200 SERIES DISK DRIVES

The 200 series front loading disk cartridge drives interface with all commonly used minicomputers and are designed for mounting in standard 19-inch rack, console, or desk. Outstanding features include low power, high speed, and clean air filtration system.

Specifications	Model 203-1	Model 203-2	Model 206-1	Model 206-2
Capacity	24 million bits	48 million bits	48 million bits	96 million bits
Configuration	one disk	two disks	one disk	two disks
Disk Rotational speed	1500 rpm ±2%, 2400 rpm optional			
Data Transfer rate	1.5885 MHz, 2.5 MHz optional			
Access time track to track Average Maximum	14 milliseconds 60 milliseconds 85 milliseconds		9 milliseconds 35 milliseconds 60 milliseconds	
Power	120V, 60Hz, 100V - 240V, 50Hz optional			
Operating temperature	50°F to 104°F			
Dimensions	8.75 x 17.60 x 26.5 inches			
Weight	84 pounds			





300 SERIES DISK DRIVES

The 300 series top loading disk cartridge drives were designed for the small-to-medium business, scientific, manufacturing, communications, and general purpose computer user. These units incorporate many of the major features found in the more costly 2311/2314 type disk files. The Series 300 drives interface with all commonly used minicomputers.

Specifications	Model 303-1	Model 303-2	Model 316-1	Model 306-2
Capacity	24 million bits	48 million bits	48 million bits	96 million bits
Configuration	one disk	two disks	one disk	two disks
Disk Rotational speed	1500 rpm ±2%, 2400 rpm optional			
Data transfer rate	1.5885 MHz, 2.5 MHz optional			
Access time track-to-track Average Maximum	14 milliseconds 60 milliseconds 85 milliseconds		9 milliseconds 35 milliseconds 60 milliseconds	
Power	120V, 60Hz, 100V - 240V, 50Hz optional			
Operating temperature	50°F to 104°F			
Dimensions	8.75 x 17.60 x 26.50 inches			
Weight	75 pounds			

NOTES

CAELUS CMVI DISK PACK

The Caelus CMVI is a 6-high magnetic disk pack designed for operation on all 1311/2311 compatible drive units. Consistent, highly reliable, CMVI's are assured by rigid internal inspections at all critical manufacturing points and extensive tests performed after each manufacturing and assembly stage. The substrate preparation and precise control of disk coating (whose formulation has over five years of field proven performance) provide durable and long lasting disk recording surfaces.

CAELUS CMCX DISK PACK

The Caelus CMCX Disk Pack is compatible with the IBM 3336 pack which is designed for use on 3330 Direct Access Storage Facilities and equivalent disk drive units.

The CMCX has a storage capacity of up to 100 million 8-bit bytes.

Each disk surface within the pack can contain up to 404 primary tracks with an additional seven tracks available as alternates. Track density is a maximum of 4040 bits per inch.

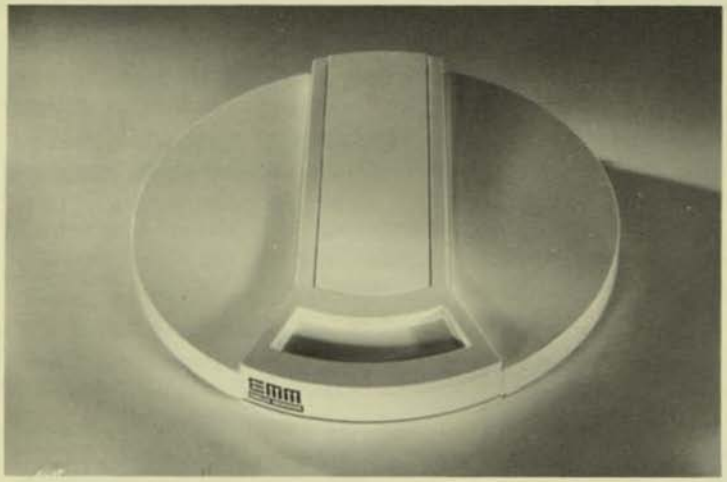
Using specially developed proprietary techniques, Caelus precisely records all rotational position sensing and track location information on the servo surface of the CMCX. This information provides the electrical and physical reference for all other recording surfaces in the pack, thus assuring complete compatibility of the CMCX with the 3330 System.

CAELUS CMXI DISK PACK

The Caelus CMXI Disk Pack is compatible with IBM's 2316 pack which is designed for use on 2314 Direct Access Storage Facilities and equivalent disk drive units. It has a storage capacity of 29.17 million 8-bit bytes or 58.35 million packed decimal digits.

Information is recorded on each disk surface in a 200-track format. Three additional tracks are provided as alternates for each recording surface.

The EMM Micromemory 3650/30, 40, and 50 are Processor Storage Systems offered for use on IBM 360



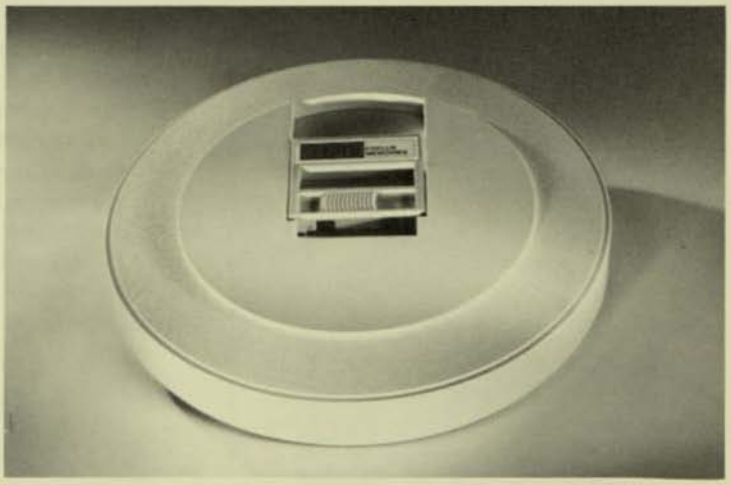
The CMI disk cartridge is available with two storage capacities: 11-million bits (low-density cartridge) and 22-million bits (high-density cartridge).

The low-density cartridge (CMI-LD) contains a single disk and is compatible with the IBM 2315 cartridge. It is designed for operation on the IBM 2310, IBM 1810 and equivalent drives, and the Caelus CD11, CD22, and 200 series disk cartridge drives.

The high-density cartridge (CMI-HD) also contains a single disk and is used as the storage medium for Caelus CD22, CDD44, 200 Series and similar high-density disk cartridge drives.

Various sector notch configurations are available. Index notch and eight sectors are supplied as standard. Both the high- and low-density cartridges are supplied with identical, non-removable covers which protect the single magnetic disk.

When ordering, the number of sectors are specified as part of the model number. For example, the low-density cartridge with eight sectors is identified as CMI-LD8.



Caelus' CMIII Disk Cartridge is a single magnetic disk enclosed between a fixed top dust cover and a removable bottom dust cover. It is compatible with IBM's 5440 Disk Cartridge and is designed to operate on the IBM 5444 Drive (System 3), Caelus 300 Series type disk cartridge drives, and equivalent drives.

The CMIII features a "locking" cover handle that permits the cartridge to be easily mounted on top-loading drives. Positive locking action assures proper seating when the cartridge is installed on the drive spindle and secures the bottom cover in place for dust-free storage.

Maximum data storage varies with the type of drive, number of cylinders and data formatting. When the CMIII is used on the Caelus 300 Series Drives, maximum storage capacity is 24 million bits (3 million bytes) on the two recording surfaces. Data is written on 200 cylinders with an additional three cylinders available as alternate cylinders or as test tracks.

DISK CARTRIDGES CMI CMIII

DISK PACKS CMVI CMVX CMXI

The EMM Micromemory 3650/30, 40, and 50 are Processor Storage Systems offered for use on IBM 360 Models 30, 40 and 50. Several improved features provide advantages over previous series of similar models [illegible] these features are modularity, reliability, ease of maintenance.

The EMM Micromemory 3650/65 is a functionally equivalent plug compatible high speed core storage module for the System 360, Model 65 computer. Due to the utilization of advanced design and manufacturing techniques, configurations of the Micromemory system above 262,144 bytes require less than one-fourth the floor space of the IBM 2365 memory.

The Micromemory 3650/65 is available in cabinet configurations containing either 262,144 bytes or 524,288 bytes. Each configuration may be attached to any of up to eight ports now available from EMM for 2065 processors. Total system memory capacity is available from 262,144 bytes to 4,194,304 bytes in 262,144 byte increments.

BASIC CORE STORAGE MODULE. Either one or two core storage modules each containing 262,144 bytes are included in one cabinet. Each basic module is comprised of 16 memory boards each containing 16,384 bytes.

SYSTEM INTERFACE MODULE. The system interface module is comprised of nine logic cards to perform storage protection, addressing, error checking, signal timing and data control functions. This module accepts commands from the central processing unit and synchronizes them with the Micromemory 3650/65.

TEST MODULE (optional) The test module is composed of one logic card and the test panel. The test panel is comprised of a series of manual switches, which control test operations while the Micromemory is either off-line or on-line with the computer. Associated with these switches are lights which display address and data information. While off-line, patterns of various types may be written into memory, read back and compared. Due to the highly organized structure of the memory unit, maintenance problems are normally diagnosed off-line. Additionally, information may be written into the Micromemory from the central processor and then read out visually on the test panel to verify data and address transfers.

POWER MODULE. The power module includes power supply units and power supply control cards for each memory. This power system includes voltage sequencing which prevents the loss of stored information when power is shut down by accident or intentionally. A logical power interlock is included which allows power to remain on in the Micromemory when off in the central processor.

AVAILABLE MODELS

CPU MODEL 2065

Micromemory Model	Capacity/Port*
3650/65-2	262,144
3650/65-4	524,288

*Up to eight ports are available from EMM for the 2065 CPU.

MICROMEMORY 3650/65

DISK CARTRIDGES CMI CMIII

DISK PACKS CMVI CMCX CMXI

The EMM Micromemory 3650/30, 40, and 50 are Processor Storage Systems offered for use on IBM 360 Models 30, 40 and 50. Several improved features provide advantages over previous series of similar models of compatible memory systems. Included in these features are modularity, reliability, ease of maintenance, flexiblity, compactness, and simplicity of installation. The above features result from a design concept

The EMM Micromemory 3650/165 is a processor storage system offered for use on System 370, Model 165 computers. The 3650/165 is functionally equivalent to IBM 3360 models 4 and 5 with the added feature of allowing model changes to be easily installed at the customer's site.

The 3650/165 is available in two basic memory configurations with capacities of 262,144 and 524,288 bytes. These basic configurations are then combined to achieve the total required storage capacity. Total processor storage capacity is available from 524,288 bytes to 3,145,728 bytes.

FUNCTIONAL MODULES

BASIC CORE STORAGE MODULE. Each core storage module is comprised of the memory boards required to store data under control of the System Interface Module. Since each memory board contains all of the elements required to store 16,384 bytes and each BCS Module supports up to 16 memory boards, the maximum BCS Module capacity is 262,144 bytes. Up to two BCS Modules are contained on a single Cabinet which requires 35% less floor space than the corresponding IBM unit. A 524,288-byte unit utilizes two full BCS Modules.

SYSTEM INTERFACE MODULE. The System Interface Module is comprised of seven logic cards. The logic cards provide the signal timing and data control functions required to guarantee that the Micromemory 3650/165 is precisely compatible with the 370/165 computer mainframe.

POWER MODULE. Each Basic Core Storage Module is provided with its own Power Module which supplies the specific voltages and currents required to operate the memory cards. The System Interface Module also is equipped with a Power Module for the same purpose. This power system includes a voltage sequencing feature which prevents the loss of stored information when power is turned off either by accident or intentionally.

AVAILABLE MODELS

CPU MODEL 3165

Micromemory Model	Capacity
3650/165-4	262,144 bytes
3650/165-5	524,288 bytes

MICROMEMORY 3650/165
MICROMEMORY 3650/65
DISK CARTRIDGES CMI CMIII
DISK PACKS CMVI CMCX CMXI

The EMM Micromemory 3650/30, 40, and 50 are Processor Storage Systems offered for use on IBM 360 Models 30, 40 and 50. Several improved features provide advantages over previous series of similar models of compatible memory systems. Included in these features are modularity, reliability, ease of maintenance, flexiblity, compactness, and simplicity of installation. The above features result from a design concept which divides the total memory system into only three (3) functional modules.

[illegible] by the individual 360 computer system.

The EMM Micromemory 3650/155 is a processor storage system offered for use on System 370, Model 155 computers. The 3650/155 is functionally equivalent to IBM 3360 Models 1 and 3 with the added feature of allowing model changes to be easily installed at the customer's site.

The 3650/155 is available in two basic memory configurations with capacities of 262,144 and 524,288 bytes. These basic configurations are then combined to achieve the total required storage capacity. Total processor storage capacity is available from 262,144 bytes to 2,097,152 bytes.

BASIC CORE STORAGE MODULE. Each core storage module is comprised of the memory boards required to store data under control of the System Interface Module. Since each memory board contains all of the elements required to store 16,384 bytes and each BCS Module supports up to 16 memory boards, the maximum BCS Module capacity is 262,144 bytes. Up to two BCS Modules are contained in a single cabinet which requires 35% less floor space than the corresponding IBM unit. A 524,288-byte unit utilizes two full BCS Modules.

SYSTEM INTERFACE MODULE. The System Interface Module is comprised of five logic cards and three auxiliary memory cards. The logic cards provide the signal timing and data control functions required to guarantee that the Micromemory 3650/155 is precisely compatible with the 370/155 computer mainframe. The auxiliary memory cards provide the 8192 bytes of "local storage" required by the 370/155 system design.

POWER MODULE. Each Basic Core Storage Module is provided with its own Power Module which supplies the specific voltages and currents required to operate the memory cards. The System Interface Module also is equipped with a Power Module for the same purpose. This power system includes a voltage sequencing feature which prevents the loss of stored information when power is turned off either by accident or intentionally.

AVAILABLE MODELS
CPU MODEL 3155*

Micromemory Model	Capacity
3650/155-1	262,144 bytes
3650/155-3	524,288 bytes

*All processor upgrades required to support EMM memory are provided by EMM.

MICROMEMORY 3650/155

MICROMEMORY 3650/165

MICROMEMORY 3650/65

DISK CARTRIDGES CMI CMIII

DISK PACKS CMVI CMCX CMXI

The EMM Micromemory 3650/30, 40, and 50 are Processor Storage Systems offered for use on IBM 360 Models 30, 40 and 50. Several improved features provide advantages over previous series of similar models of compatible memory systems. Included in these features are modularity, reliability, ease of maintenance, flexiblity, compactness, and simplicity of installation. The above features result from a design concept which divides the total memory system into only three (3) functional modules.

CORE STORAGE MODULE. Each Core Storage Module is comprised of the memory boards required to store data under control of the System Interface Module. Each memory board contains all of the elements required to store 16,384 bytes and each Core Storage Module supports up to sixteen (16) memory boards. Variations in the total capacity of a memory system are accomplished through the simple addition or deletion of memory boards. This allows complete flexibility in establishing capacities which can vary from 16,384 to 262,144 bytes all contained in a single enclosure. Larger capacities are accomplished by combining Processor Storage Systems. Physical size of the individual enclosure is approximately one quarter the size of other compatible systems.

SYSTEM INTERFACE MODULE. The System Interface Module is comprised of a maximum of two (2) logic cards and one (1) auxiliary memory card. The logic cards provide the signal timing and data control functions required to guarantee that the Micromemory 3650 is precisely compatible with the 360 computer main frame to which it is attached. The auxiliary memory cards provide "local storage" as required by the individual 360 computer system. A System Interface Module is provided with each Micromemory 3650 regardless of its storage capacity and compatibility with specific 360 models is established completely by the types of the System Interface Module cards installed. This facilitates model changes through simple logic card exchanges.

POWER MODULE. Each Core Storage Module is provided with its own power module which supplies the specific voltages and currents required to operate the memory cards. The System Interface Module is also equipped with a power module for the same purpose. This power system includes a voltage sequencing feature which prevents the loss of stored information when power is turned off either by accident or intentionally.

USER BENEFITS. The Micromemory 3650 modularity insures complete flexibility in both capacity and model type and allows both types of changes to be accomplished in the field. The reduced number of printed circuit boards simplifies wiring and provides increased reliability while insuring ease of maintenance. The reduced physical size saves floor space and the top of the enclosure may be used as additional working surface. All system components are contained within the EMM cabinet thus reducing installation time. In summary, extensive user benefits are provided by a modern design based on proven EMM products.

CAPACITY RANGE, Bytes

	From	To
Model 30	16,384	262,144
Model 40	32,768	458,752
Model 50	131,072	1,048,576

MICROMEMORY 3650/30/40/50

MICROMEMORY 3650/155

MICROMEMORY 3650/165

MICROMEMORY 3650/65

DISK CARTRIDGES CMI CMIII

DISK PACKS CMVI CMCX CMXI

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