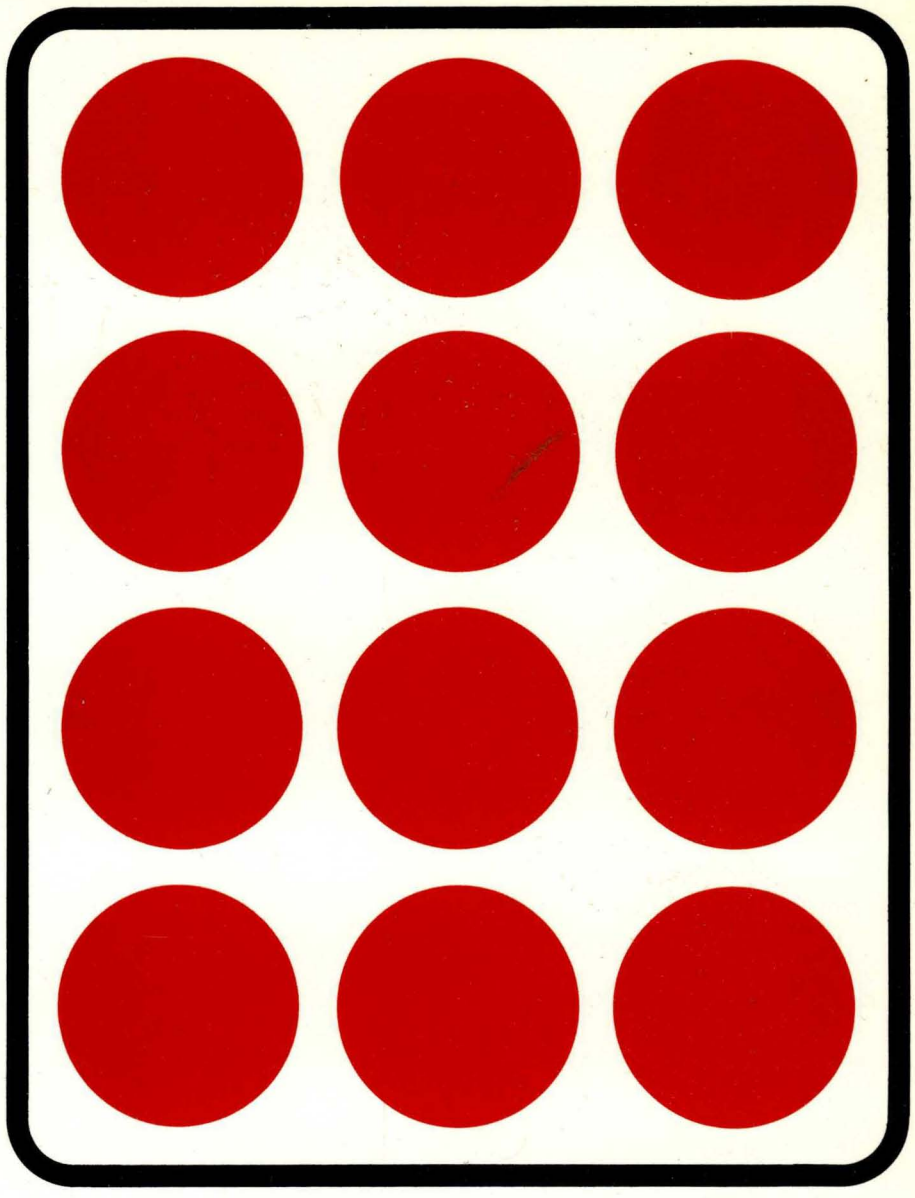
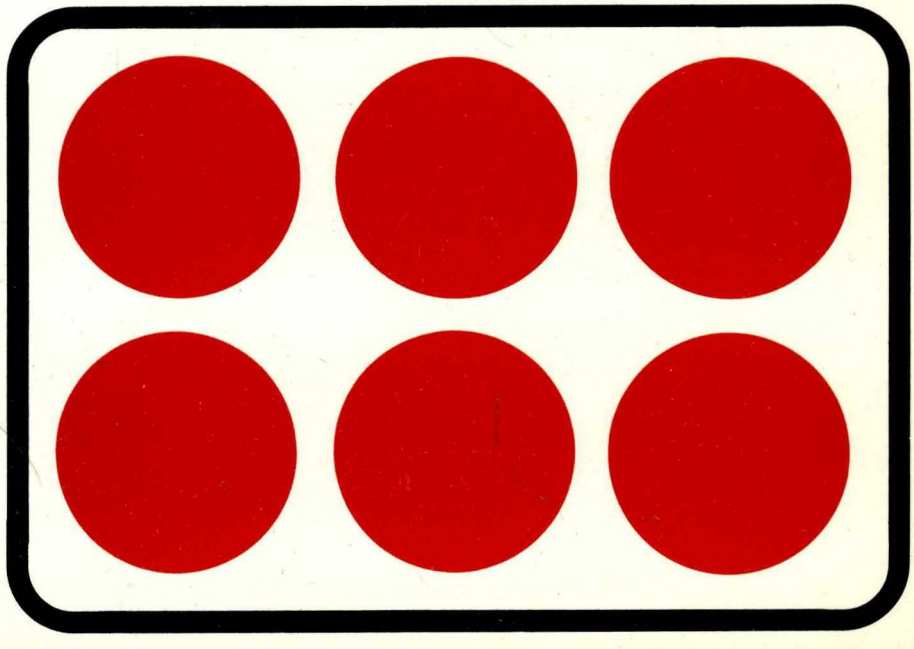


1984 DISK/TREND® REPORT

FLEXIBLE DISK DRIVES



1984 DISK/TREND® REPORT

FLEXIBLE DISK DRIVES

December, 1984

DISK/TREND, Inc.
5150 El Camino Real, Suite B-20
Los Altos, California 94022
415/961-6209

FOREWORD

After years of uncertainty over microfloppy standards and the best approach to higher densities for 5.25 inch flexible disk drives, IBM has finally ratified the choice of 3.5 inch microfloppies and the 1.6 megabyte 5.25 inch format. The industry is now poised for several more years of hectic growth, with many new drive manufacturers and more coming, mostly from Asia.

This section of the DISK/TREND Report, which was regretfully late again this year, covers flexible disk drives, and completes the eighth year of publication for the report. A separate section covering rigid disk drives was published in October.

Please let me know if I may assist you by providing additional information on the industry -- I am always happy to pass on any non-proprietary information I may have accumulated. Projects requiring elaborate research and analysis can be addressed on a normal consulting basis if desired.

And, as always, your suggestions for improvements in the report are always welcome -- and gratefully received.

James N. Porter

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INTRODUCTION

Several minor changes in this year's DISK/TREND Report

As most regular users of the DISK/TREND Report are aware, an effort is made to keep the report's organization the same each year, to provide a consistent basis of comparison between new and old. Nevertheless, we find it necessary to make minor changes from time to time. Here are this year's changes for flexible disk drives:

* The product group numbers used in the specification section and to identify each section of the report have been changed, in order to maintain consistency with the separate report of rigid disk drives.

* Tables have been added in the microfloppy section to display worldwide revenues and shipments broken down by disk diameters.

* When disk drives are produced for a drive manufacturer by a second manufacturer on a contract manufacturing basis, using designs in which the first manufacturer has a proprietary interest, we are crediting the first manufacturer in our revenue and shipment statistics.

* We have stopped reporting cumulative unit shipments at the bottom of each product section's unit shipment table. The numbers at that location of each shipment table now show cumulative shipments in each product group. This change was made in recognition of the fact that, with the industry's current complexity and volatility, there is no reasonably accurate way to estimate retirements of previously shipped drives. Accordingly, the shipment tables will no longer contain negative numbers to indicate reductions from the installed base -- all numbers in the shipment tables now show net new shipments.

Some of our definitions may be considered arbitrary

* All unit totals are given in spindles -- so that a disk drive with two spindles is counted in DISK/TREND statistics as two spindles. Drives which use a single actuator to control head movement on two flexible disks are counted as two spindles.

* Even if you are thoroughly familiar with the industry's terminology, you will find it helpful to review the definitions section of the report, since several terms with conflicting meanings have been resolved on an arbitrary basis.

SUMMARY

Industry size

12,540,000 flexible disk drives were shipped worldwide in 1983, an increase of 138.7% over the previous year. Worldwide revenues were $3,195,300,000, up only 42.6%. The difference in these growth rates was caused by the continuing decline in average unit prices, the growing importance of smaller diameter drives sold at lower prices, and the fact that shipment increases for OEM drives were significantly larger than the increases for captive drives sold at higher prices.

Future increases in total industry revenues are also expected to be at lower growth rates than those for unit shipments, due to the same reasons. Worldwide revenues are forecasted at $4,715,600,000 for 1987, an average annual increase of 10.2% from 1984 through 1987. Worldwide unit shipments are expected to increase an average of 26.5% for the same period, with 31,595,900 drives predicted for 1987.

5.25 inch and microfloppy drives continue to surpass previous forecasts. While single sided 5.25 inch drives grew 103.9% in worldwide unit shipments for 1983, little increase is occurring in 1984. On the other hand, two sided 5.25 inch drives were up 317.2% in 1983 and another 64.2% in 1984 -- the forecasted 10,126,500 two sided 5.25 inch drives in 1984 will exceed the the total of all other floppy drive formats. Microfloppy drives are forecasted at 1,959,000 unit shipments worldwide for 1984, up 346.9% over 1983. These increases are driven by dynamic growth in personal computers and other microcomputer systems, a trend which is expected to continue.

TABLE 1

CONSOLIDATED WORLDWIDE SHIPMENTS

ALL EXISTING FLEXIBLE DISK DRIVE GROUPS

REVENUE SUMMARY

	DISK DRIVE REVENUES, BY SHIPMENT DESTINATION ($M)									
	1983 Shipments		Forecast							
			1984		1985		1986		1987	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM Captive	287.9	429.2	394.8	548.5	438.8	596.4	617.6	809.8	865.0	1,102.2
Other U.S. Captive	333.1	411.4	322.1	403.9	306.2	373.5	239.2	285.2	207.3	240.7
TOTAL U.S. CAPTIVE	621.0	840.6	716.9	952.4	745.0	969.9	856.8	1,095.0	1,072.3	1,342.9
PCM	1.6	1.6	5.4	6.9	15.5	18.3	24.0	28.1	22.7	27.6
OEM	535.3	659.0	559.8	670.6	562.2	658.3	576.7	681.4	563.4	669.7
TOTAL U.S. NON-CAPTIVE	536.9	660.6	565.2	677.5	577.7	676.6	600.7	709.5	586.1	697.3
TOTAL U.S. REVENUES	1,157.9	1,501.2	1,282.1	1,629.9	1,322.7	1,646.5	1,457.5	1,804.5	1,658.4	2,040.2
Non-U.S. Manufacturers										
Captive	80.1	889.0	102.1	1,055.5	115.4	1,177.6	125.9	1,327.3	132.7	1,278.3
PCM	--	--	--	--	--	--	--	--	--	--
OEM	368.4	805.1	506.0	1,030.5	664.8	1,213.0	788.7	1,340.6	897.3	1,397.1
TOTAL NON-U.S. REVENUES	448.5	1,694.1	608.1	2,086.0	780.2	2,390.6	914.6	2,667.9	1,030.0	2,675.4
Worldwide Recap										
TOTAL WORLDWIDE REVENUES	1,606.4	3,195.3	1,890.2	3,715.9	2,102.9	4,037.1	2,372.1	4,472.4	2,688.4	4,715.6

Marketing channels

The number of flexible disk drive manufacturers listed in this year's DISK/TREND Report is 61, up nine from last year. 14 Asian manufacturers have been added, representing Japan, Korea, Taiwan, Hong Kong and Singapore -- and Asian manufacturers now constitute slightly over half of the worldwide total. The list of 20 United States manufacturers is down five from last year. Two new manufacturers were added, but seven were deleted, including two U.S. firms which were acquired and moved to Asian locations.

IBM is expected to retain its role as the leading producer of captive floppy drives, but with a fundamental change in product mix. IBM's 1983 worldwide floppy drive revenues of $429,200,000 were produced entirely from 8 inch drives. In 1987, IBM's floppy drive revenues are projected at $1,102,200,000, to be derived mostly from two sided 5.25 inch and 3.5 inch drives, as the firm becomes more self sufficient in supplying peripherals for its personal computer product family. During this period, IBM's share of worldwide floppy drive revenues will climb from 13.4% to 23.3%.

The share of worldwide revenues held by other captive producers will drop from 12.8% to 5.1% by 1987. With the exception of several Japanese manufacturers with both captive and OEM programs, many system manufacturers that previously might have made their own floppy drives will prefer to buy OEM drives at low prices and avoid the scramble to keep up with the continuing parade of new drive configurations.

Non-U.S. manufacturers of OEM drives are expected to increase their share of worldwide revenues slightly over current levels, but U.S. producers will drop from 20.6% to 14.2%, suffering from price declines and stiff competition.

TABLE 2

CONSOLIDATED WORLDWIDE SHIPMENTS

ALL EXISTING FLEXIBLE DISK DRIVE GROUPS

MARKET CLASS SUMMARY

WORLDWIDE REVENUES BY MANUFACTURER TYPE	1983 Shipments $M	1983 Shipments %	Forecast 1984 $M	Forecast 1984 %	Forecast 1985 $M	Forecast 1985 %	Forecast 1986 $M	Forecast 1986 %	Forecast 1987 $M	Forecast 1987 %
U.S. Manufacturers										
IBM Captive	429.2	13.4	548.5	14.7	596.4	14.7	809.8	18.1	1,102.2	23.3
Other U.S. Captive	411.4	12.8	403.9	10.8	373.5	9.2	285.2	6.3	240.7	5.1
PCM	1.6	--	6.9	.1	18.3	.4	28.1	.6	27.6	.5
OEM	659.0	20.6	670.6	18.0	658.3	16.3	681.4	15.2	669.7	14.2
Total U.S. Mfgr's.	1,501.2	46.8	1,629.9	43.6	1,646.5	40.6	1,804.5	40.2	2,040.2	43.1
Non-U.S. Manufacturers										
Captive	889.0	27.8	1,055.5	28.4	1,177.6	29.1	1,327.3	29.6	1,278.3	27.1
PCM	--	--	--	--	--	--	--	--	--	--
OEM	805.1	25.4	1,030.5	28.0	1,213.0	30.3	1,340.6	30.2	1,397.1	29.8
Total Non-U.S. Mfgr's.	1,694.1	53.2	2,086.0	56.4	2,390.6	59.4	2,667.9	59.8	2,675.4	56.9
Worldwide Total	3,195.3	100.0	3,715.9	100.0	4,037.1	100.0	4,472.4	100.0	4,715.6	100.0

Product mix

In 1984, over half of all flexible disk drives made will be two sided 5.25 inch configurations. That dominance will continue through 1987, while older floppy formats decline and the microfloppy market booms.

Comparative total revenue figures can provide a misleading impression of unit shipments when the proportion of captive drives for a product group is higher than the industry average, as it is with 8 inch drives. When using revenue figures alone, it is also necessary to keep in mind the large spread between selling prices for low cost drives, such as one sided 5.25 inch drives, and high end products, such as two sided 8 inch drives.

In 1983, 8 inch drives generated revenues of $1,397,200,000, 43.7% of total worldwide revenues, but representing only 12.9% of worldwide unit shipments. In contrast, 5.25 inch drives had revenues of $1,731,600,000, 54.2% of the worldwide total, but 83.7% of worldwide unit shipments.

8 inch drives, especially one sided versions, are being abandoned rapidly by manufacturers of small business systems and word processing equipment. Manufacturers of these systems must move to desktop system configurations, and 8 inch drives are judged too large and too costly.

Two sided 5.25 inch drives have the advantage of size small enough for most desktop systems, the availability of newer configurations which equal and exceed the capacity available from standard 8 inch floppies, and the blessing of IBM. These drives are positioned better than any others to exploit the high growth market for personal computers used in offices.

Shipments of microfloppy drives are expected to reach shipments of almost ten million drives in 1987, driven by the anticipated future strong market for small portables, and small-footprint desktop systems.

Figure 1
CHANGING PRODUCT MIX
WORLDWIDE FLEXIBLE DISK DRIVE SHIPMENTS
CONSOLIDATED REVENUE

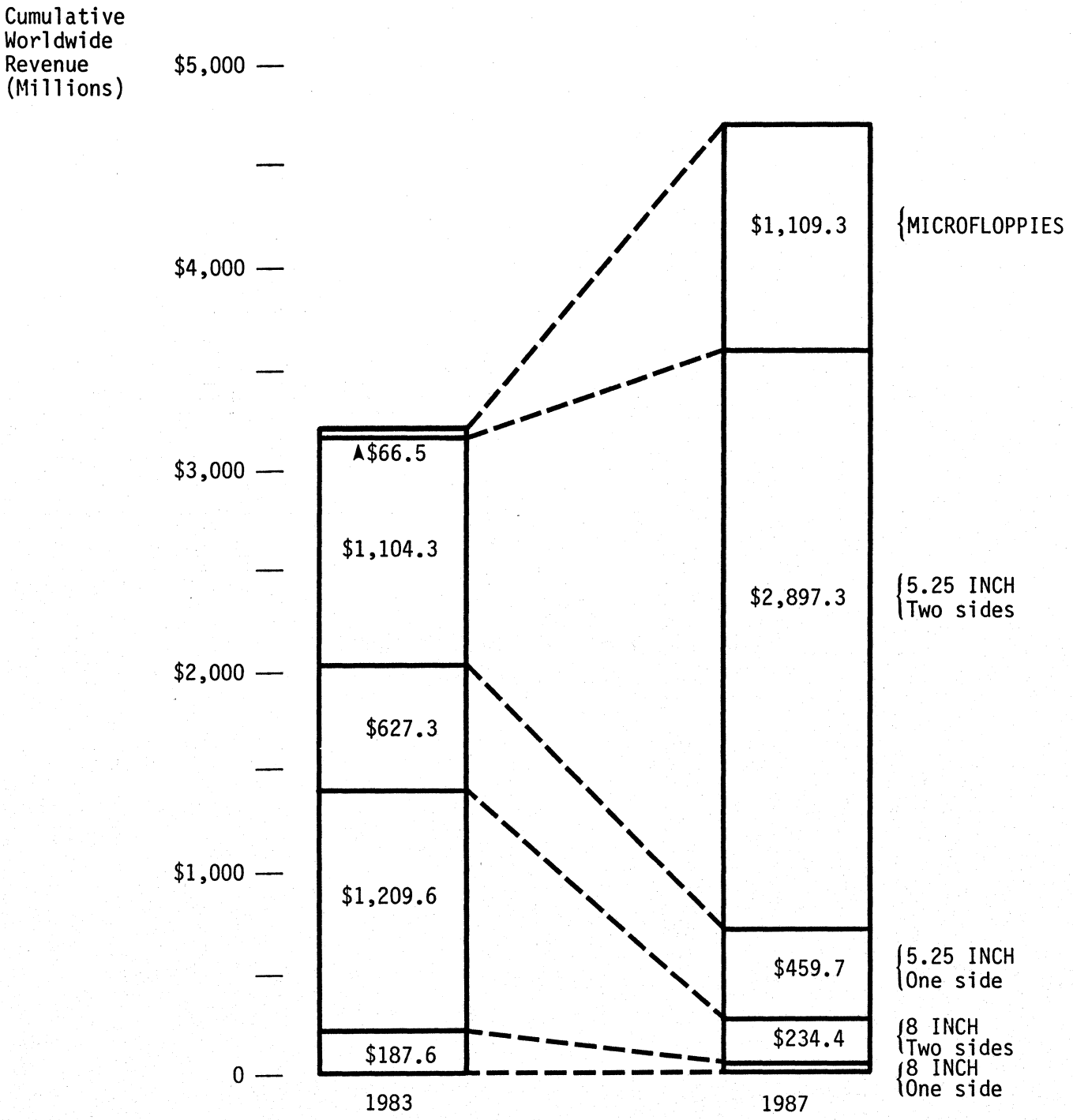

TABLE 3

WORLDWIDE SHIPMENTS

PRODUCT CATEGORY SUMMARY

ALL MANUFACTURERS

Units: Thousands Dollars: $ Million		1983 Shipments	%	1984 Forecast	%	1985 Forecast	%	1986 Forecast	%	1987 Forecast	%
8 INCH DRIVES											
One Side	Units	336.4	-43.7	227.9	-32.2	129.7	-43.0	68.7	-47.0	30.9	-55.0
	$M	187.6	-47.9	126.8	-32.4	67.0	-47.1	31.7	-52.6	14.9	-52.9
Two Sides	Units	1,275.9	+23.5	1,285.4	+.7	1,082.5	-15.7	832.8	-23.0	493.7	-40.7
	$M	1,209.6	+4.6	1,158.4	-4.2	912.7	-21.2	650.0	-28.7	234.4	-63.9
8 INCH TOTAL	Units	1,612.3	-1.0	1,513.3	-6.1	1,212.2	-19.8	901.5	-25.6	524.6	-41.8
	$M	1,397.2	-7.8	1,285.2	-8.0	979.7	-23.7	681.7	-30.4	249.3	-63.4
5.25 INCH DRIVES											
One Side	Units	4,323.7	+103.9	4,520.9	+4.5	4,531.1	+.2	4,253.4	-6.1	3,678.7	-13.5
	$M	627.3	+72.5	610.4	-2.6	563.8	-7.6	533.0	-5.4	459.7	-13.7
Two Sides	Units	6,165.7	+317.2	10,126.5	+64.2	13,412.3	+32.4	15,891.8	+18.4	17,681.4	+11.2
	$M	1,104.3	+212.3	1,596.8	+44.5	2,061.5	+29.1	2,528.1	+22.6	2,897.3	+14.6
5.25 INCH TOTAL	Units	10,489.4	+191.5	14,647.4	+39.6	17,943.4	+22.5	20,145.2	+12.2	21,360.1	+6.0
	$M	1,731.6	+141.4	2,207.2	+27.4	2,625.3	+18.9	3,061.1	+16.6	3,357.0	+9.6
MICROFLOPPY DRIVES											
	Units	438.3	+1618.8	1,959.0	+346.9	4,158.2	+112.2	6,674.5	+60.5	9,711.2	+45.4
	$M	66.5	+923.0	223.5	+236.0	432.1	+93.3	729.6	+68.8	1,109.3	+52.0
TOTAL ALL DRIVES											
	Units	12,540.0	+138.6	18,119.7	+44.4	23,313.8	+28.6	27,721.2	+18.9	31,595.9	+13.9
	$M	3,195.3	+42.6	3,715.9	+16.2	4,037.1	+8.6	4,472.4	+10.7	4,715.6	+5.4

Figure 2

CHANGING PRODUCT MIX

WORLDWIDE FLEXIBLE DISK DRIVE SHIPMENTS
ALL MANUFACTURERS

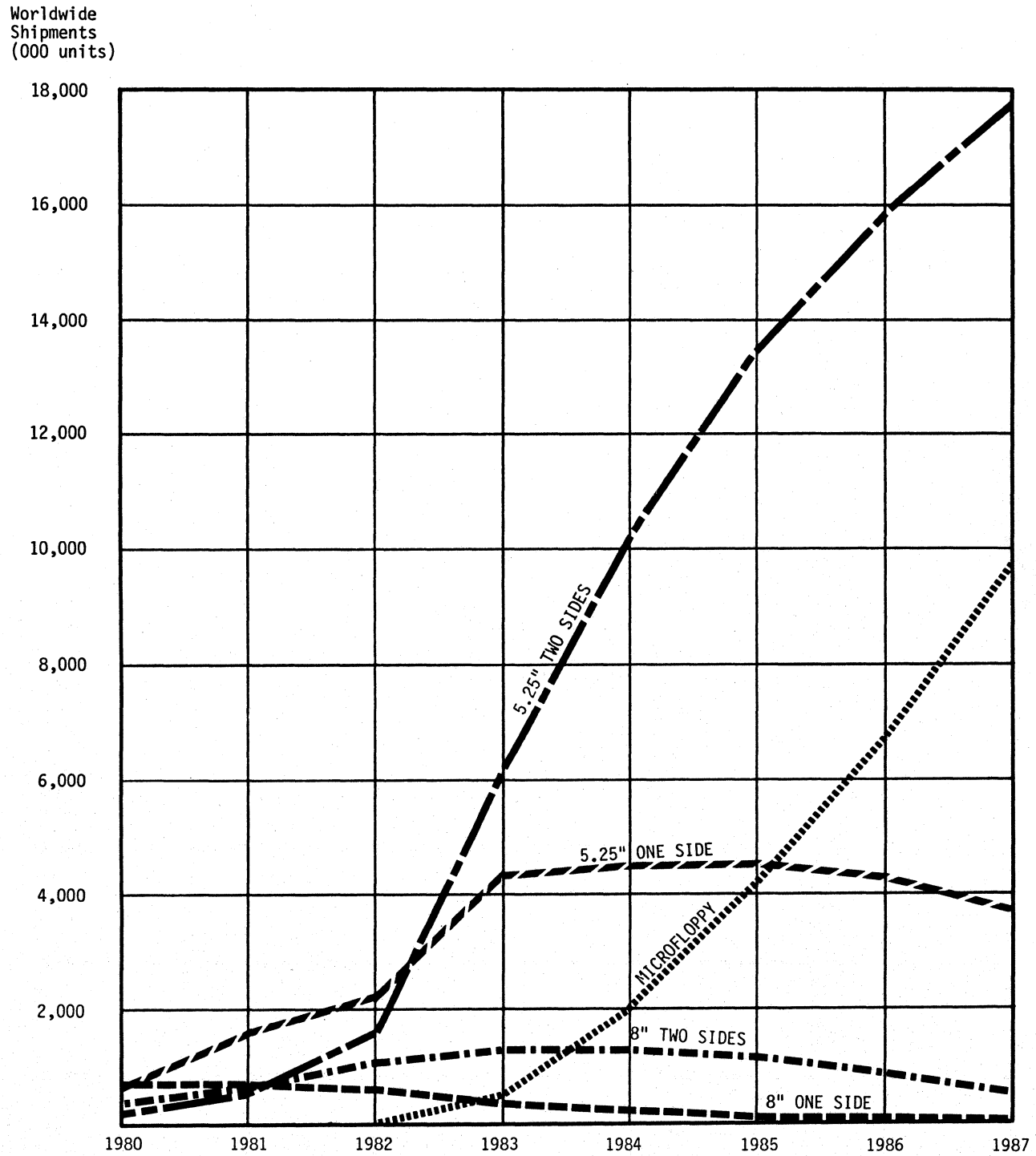

TABLE 4

WORLDWIDE SHIPMENTS

PRODUCT CATEGORY SUMMARY

MANUFACTURERS OF OEM DRIVES

Units: Thousands / Dollars: $ Million		1983 Ship	1983 %	1984 Ship	1984 %	1985 Ship	1985 %	1986 Ship	1986 %	1987 Ship	1987 %
		Shipments		Forecast							
8 INCH DRIVES											
One Side	Units	222.6	-34.5	149.9	-32.6	92.4	-38.3	55.5	-39.9	24.9	-55.1
	$M	70.6	-30.9	50.4	-28.6	32.9	-34.7	21.2	-35.5	10.2	-51.8
Two Sides	Units	677.9	+40.8	684.1	+.9	597.3	-12.6	477.1	-20.1	292.2	-38.7
	$M	186.7	+11.4	169.9	-8.9	139.2	-18.0	106.1	-23.7	61.9	-41.6
8 INCH TOTAL	Units	900.5	+9.6	834.0	-7.3	689.7	-17.3	532.6	-22.7	317.1	-40.4
	$M	257.3	-4.6	220.3	-14.3	172.1	-21.8	127.3	-26.0	72.1	-43.3
5.25 INCH DRIVES											
One Side	Units	3,648.1	+107.9	3,823.4	+4.8	3,881.6	+1.5	3,579.1	-7.7	3,047.4	-14.8
	$M	300.8	+70.1	272.5	-9.4	259.7	-4.6	229.9	-11.4	185.7	-19.2
Two Sides	Units	5,672.8	+346.8	8,891.0	+56.7	11,311.9	+27.2	12,914.2	+14.1	13,728.6	+6.3
	$M	846.2	+278.7	1,043.5	+23.3	1,135.9	+8.8	1,223.1	+7.6	1,239.8	+1.3
5.25 INCH TOTAL	Units	9,320.9	+208.2	12,714.4	+36.4	15,193.5	+19.4	16,493.3	+8.5	16,776.0	+1.7
	$M	1,147.0	+186.6	1,316.0	+14.7	1,395.6	+6.0	1,453.0	+4.1	1,425.5	-1.8
MICROFLOPPY DRIVES											
	Units	422.3	+2065.6	1,796.0	+325.2	3,767.3	+109.7	5,740.8	+52.3	7,796.0	+35.7
	$M	59.8	+1658.8	164.8	+175.5	303.6	+84.2	441.7	+45.4	569.2	+28.8
TOTAL ALL DRIVES											
	Units	10,643.7	+175.4	15,344.4	+44.1	19,650.5	+28.0	22,766.7	+15.8	24,889.1	+9.3
	$M	1,464.1	+117.4	1,701.1	+16.1	1,871.3	+10.0	2,022.0	+8.0	2,066.8	+2.2

Figure 3

CHANGING PRODUCT MIX

WORLDWIDE FLEXIBLE DISK DRIVE SHIPMENTS
MANUFACTURERS OF OEM DRIVES

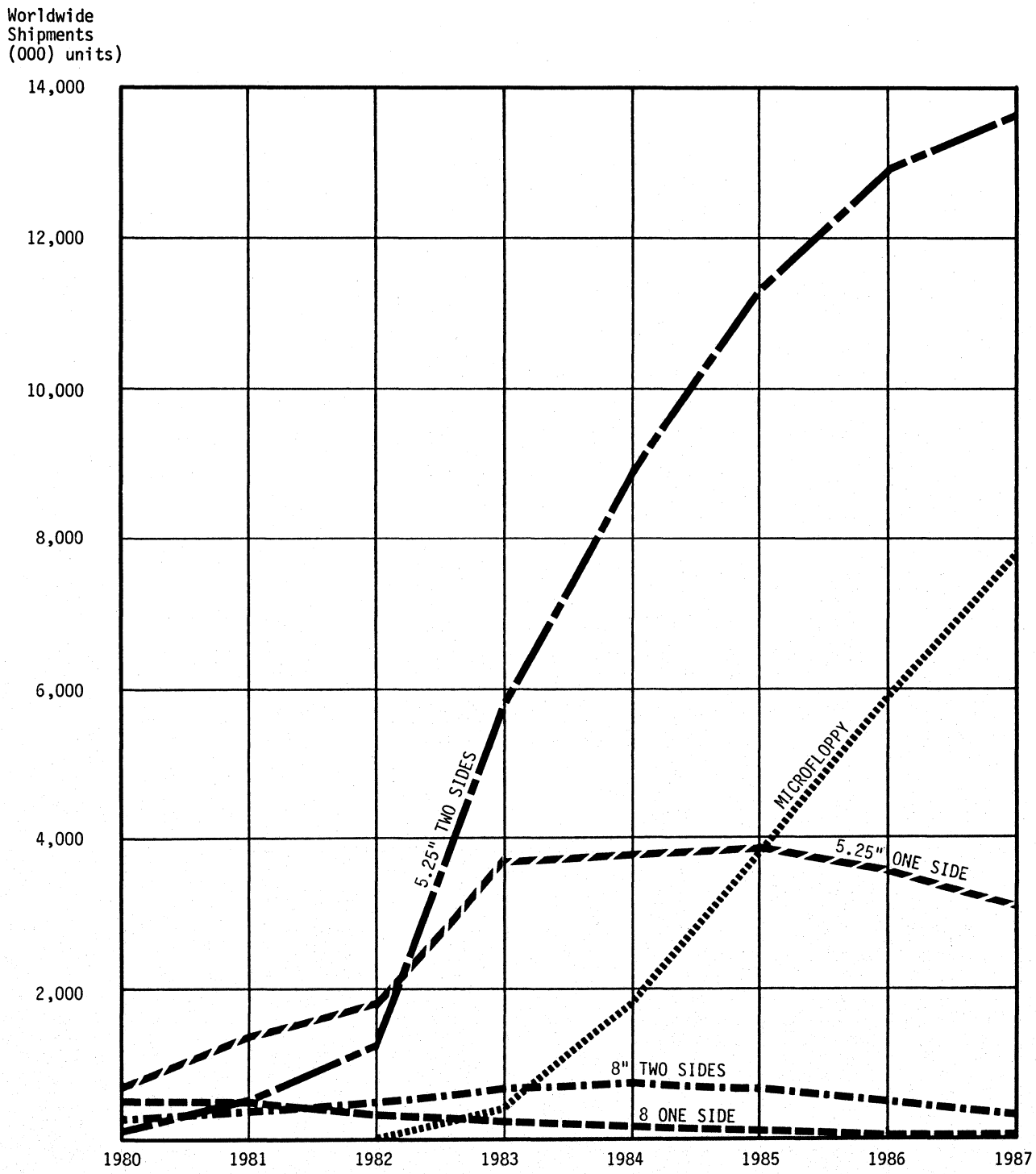

TABLE 5

1983 ESTIMATED MARKET SHARES

WORLDWIDE REVENUES OF ALL FLEXIBLE DISK DRIVES
(Value of non-U.S. currencies estimated at July, 1983, rates)

	CAPTIVE		OEM*		TOTAL INDUSTRY	
	$M	%	$M	%	$M	%
U.S. MANUFACTURERS						
Control Data	30.6	1.8	82.1	5.6	112.7	3.5
Digital Equipment	141.8	8.2	--	--	141.8	4.5
IBM	429.1	24.8	--	--	429.1	13.4
Micro Peripherals	--	--	67.2	4.6	67.2	2.1
Micropolis	--	--	17.7	1.2	17.7	.6
Qume	--	--	42.7	2.9	42.7	1.3
Shugart	70.9	4.1	145.0	9.9	215.9	6.8
Tandon	--	--	280.6	19.2	280.6	8.8
Tandy	145.2	8.4	--	--	145.2	4.5
Other U.S.	23.0	1.3	25.3	1.7	48.3	1.5
U.S. TOTAL	840.6	48.6	660.6	45.1	1,501.2	47.0
NON-U.S. MANUFACTURERS						
Alps Electric	--	--	128.1	8.7	128.1	4.0
BASF	--	--	38.1	2.6	38.1	1.2
Canon	13.5	.8	10.3	.7	23.8	.7
Epson	60.0	3.5	3.6	.2	63.6	2.0
Hitachi	52.4	3.0	39.5	2.7	91.9	2.9
ISOT	3.0	.2	11.5	.8	14.5	.5
Matsushita Com. Ind.	--	--	64.9	4.4	64.9	2.0
Mitsubishi	39.6	2.3	103.1	7.0	142.7	4.5
NEC	467.5	27.0	19.3	1.3	486.8	15.2
Oki Electric	11.1	.6	.4	--	11.5	.4
Olivetti	91.3	5.3	4.0	.3	95.3	3.0
Philips	43.5	2.5	4.3	.3	47.8	1.5
Ricoh	10.0	.6	.8	.1	10.8	.3
Sony	4.9	.3	43.8	3.0	48.7	1.5
Teac	--	--	198.7	13.6	198.7	6.2
Tokyo Electric	--	--	24.1	1.7	24.1	.8
Toshiba	91.1	5.2	10.2	.7	101.3	3.2
Wong's Technology	--	--	20.6	1.4	20.6	.6
YE Data	--	--	62.2	4.2	62.2	1.9
Other Non-U.S.	1.1	.1	17.6	1.2	18.7	.6
NON-U.S. TOTAL	889.0	51.4	805.1	54.9	1,694.1	53.0
WORLDWIDE TOTAL	1,729.6	100.0	1,465.7	100.0	3,195.3	100.0

*Includes PCM drives.

TABLE 6

Codes: C = Captive
P = PCM
O = OEM

CURRENT PRODUCT LINES
MANUFACTURERS OF FLEXIBLE DISK DRIVES

Numbers in table indicate TPI

U.S. MANUFACTURERS	TYPE	DISK/TREND PRODUCT GROUP: 11 — 8 INCH ONE SIDE	12 — 8 INCH TWO SIDES	13 — 5.25 INCH ONE SIDE	14 — 5.25 INCH TWO SIDES	15 — MICRO FLOPPIES	16 — SPECIAL
Au Peripheral Products	O					135	
Burroughs	C		64,150				
Caldisk	C,O	48	48				
Control Data	C,P,O	48	48	48	48,96		
Digital Equipment	C	48		96			
Drivetec	O				192		
Eastman Kodak	C,O				192		
Hi-Tech Peripherals	O			96	48,96		
IBM	C	48	48				
Innotronics	O	48					
Iomega	O						300,394
Micro Peripherals	O		48	48,96,100	48,96		
Micropolis	O			96,100	96,100		
Miltope	O	48	48				
Omek	O				48,96		
Qume	O		48		48		
Shugart	C,O	48	48	48	48,96	135	
Sykes Datatronics	C,O	48	48				
Tandon	O	48	48	48	48,96	135	
Tandy	C			48			
ASIAN MANUFACTURERS							
Alps Electric	O			48,96	48,96	67.5,135	
Canon	C,O			48	48,96	67.5,135	
Chinon	O			48	48,96	67.5,100,135	
Citizen	O					135	
Copal	O					67.5,135	
Epson	C,P,O				48,96	67.5,135	
Fujitsu	O				96		
Gold Star	C,O			48	48		
Hitachi	C,O		48,96		48,96,125	100	
Janome Sewing Machine	O					67.5,100,135	
Kyocera	O				96		
Matsushita Com. Ind.	C,O	48	48	48	48,96	67.5,135	
Matsushita Elect. Ind.	O					100,200	
Mitac	P,O			48			
Mitsubishi	C,O		48		48,96	135	
Mitsumi	O						72mm spiral
NEC	C,O		48		48,96	135	
Oki Electric	C,O				48,96		
Ricoh	C,O	48	48		48,96	67.5,135	
Samsung	C,O			48			
Sankyo Seiki	O					100,135	2.6" Spiral
Sony	C,O					135	
TEAC	O			48,96	48,96	67.5,135,100	
Tokyo Electric Company	O			48,96	48,96	135	2.6" Spiral
Tokyo Juki	O					67.5,135	
Toshiba	C,O		48		48,96	100,135	
Victor Co. of Japan	O				48,96	135	
Video Technology	P,O			48,96	48,96		
Weltec Digital	O			48,96	48,96		
Wong's Technology	O			48	48,96		
YE Data	O	48	48		48,96	67.5,135	
EUROPEAN MANUFACTURERS							
BASF	O	48	48	48	48,96	67.5,135	
Data Track Technology	O			96	96		
Elcomatic	O	48	48,96	48,96	48,96		
ISOT	C,O	48	48	48	48,96		
Metrimpex/BRG	O					100	
Metronex	C,O	48					
Olivetti	C,O	48	48	48	48,96	135	
Philips	C,O			48,96	48,96		
Robotron	C,O			48,96			
Videoton/MOM	C,O	48		48			

Application mix

The DISK/TREND classification of application areas has been changed for 1984. The new professional and business microcomputer systems group replaces the previous small business and professional systems group, and workstations used with mainframes and minicomputers combines the older general purpose mini/micro systems and terminals groups.

Professional and business microcomputer systems continue to dominate the market for most types of flexible disk drives. This group used 61.5% of the industry's total worldwide unit shipments in 1983, and the 1987 projection envisions almost as high a share, at 59.3%. But by 1987 the two sided 5.25 inch drives' share of this group is forecasted to increase to 84.0% of worldwide shipments for that drive, as business user's appetites for more capacity are satisfied. And by 1987 the share of microfloppies going to this application is expected to drop to 32.5%, serving mostly the portable segment of the professional and business market.

Consumer and hobby computer markets were the destinations of 15.8% of all floppy drives shipped in 1983, and this group is expected to absorb 18.4% of 1987's shipments. By that time, all shipments of 8 inch drives for this group will have ceased, and the battle will be between one sided 5.25 inch drives and microfloppies. The winner is expected to be the microfloppy drive with 1987 shipments of 5,525,000 units to this application, 56.9% of total microfloppy drive worldwide shipments.

Word processing is declining in relative importance, compared to the above applications, as personal and home computers grow in their ability to provide sophisticated word processing functions combined with other applications at low cost --dropping to 8.6% of all shipments for 1987.

TABLE 7

FLEXIBLE DISK DRIVE APPLICATION PROJECTION

CONSOLIDATED WORLDWIDE SHIPMENTS

	1983 ESTIMATE						1987 Projection					
	All FDD	8" One Side	8" Two Sides	5.25" One Side	5.25" Two Sides	Micro Floppies	All FDD	8" One Side	8" Two Sides	5.25" One Side	5.25" Two Sides	Micro Floppies
PROFESSIONAL AND BUSINESS MICRO-COMPUTER SYSTEMS												
Units (000)	7,708.3	55.6	548.4	2,965.9	3,713.1	425.3	18,751.4	2.5	222.0	512.0	14,849.4	3,165.5
Share %	61.5%	16.5%	43.0%	68.6%	60.2%	97.0%	59.3%	8.1%	45.0%	13.9%	84.0%	32.6%
WORKSTATIONS USED WITH MAIN-FRAMES, MINIS												
Units (000)	1,242.2	75.5	324.4	221.3	621.0	--	1,485.0	6.3	210.5	250.8	773.6	243.8
Share %	9.9%	22.5%	25.4%	5.1%	10.1%	--	4.7%	20.4%	42.6%	6.8%	4.4%	2.5%
WORD PROCESSING AND TYPESETTING SYSTEMS												
Units (000)	1,244.2	170.8	180.6	285.0	601.8	6.0	1,832.6	16.8	28.6	295.0	822.1	670.1
Share %	9.9%	50.8%	14.2%	6.6%	9.8%	1.4%	5.8%	54.4%	5.8%	8.0%	4.6%	6.9%
CONSUMER AND HOBBY COMPUTERS												
Units (000)	1,979.1	.7	184.9	760.5	1,031.1	1.9	8,958.2	--	--	2,554.7	878.5	5,525.0
Share %	15.8%	.2%	14.5%	17.6%	16.7%	.4%	28.4%	--	--	69.5%	5.0%	56.9%
OTHER APPLICATIONS												
Units (000)	366.2	33.8	37.6	91.0	198.7	5.1	568.7	5.3	32.6	66.2	357.8	106.8
Share %	2.9%	10.0%	2.9%	2.1%	3.2%	1.2%	1.8%	17.1%	6.6%	1.8%	2.0%	1.1%
TOTAL, ALL APPLICATIONS												
Units (000)	12,540.0	336.4	1,275.9	4,323.7	6,165.7	438.3	31,595.9	30.9	493.7	3,678.7	17,681.4	9,711.2
Share %	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

TECHNICAL REVIEW

Competing technologies

No competing technology has provided effective competition to flexible disk drives in their existing mainstream markets. The only significant competition for the principal floppy drive configurations has come from newer floppy drives offering more capacity, smaller size or lower price.

Because flexible disk drives themselves are evolving so rapidly to new sizes and capacities, and new designs and manufacturing methods are continually making them more cost effective, competitive data storage technologies have had limited success in breaking into floppies' established markets. And the rate of innovation currently enjoyed by floppy drives is not going to soon slow down -- in fact, the rate at which new technologies and capabilities are introduced will surely increase through the remainder of this decade.

The unique combination of low cost, random access and media removability provided by flexible disk drives is the reason for their growth. To have an impact on floppy drives, any competing technology must offer a significant improvement.

These products are the ones with the most potential to challenge flexible disk drives in selected markets:

* Small rigid disk drives: The rapid growth of small Winchester disk drives has displaced large quantities of floppy drives which otherwise would have been sold, but availability of these rigid disk drives has probably also served to increase the size of the total market for small computer systems, and therefore boost the market for floppy drives. For almost all small fixed disk drives

installed, a companion removable media recording device is necessary to provide for software distribution, save/restore of programs and files, and backup to protect against hardware, software or operator error. And most of the time that removable device is a floppy disk drive.

The rigid disk challenge to flexible disk drives will probably be most effectively presented by 5.25 inch and smaller rigid disk cartridge drives. Small disk cartridge drives are one of the best ways to accomplish fast save and restore of files in the 5-10 megabyte range, and offer access times fast enough to be satisfactory as a basic system disk, in lieu of a fixed Winchester drive. Availability has been the limiting factor in growth of the disk cartridge share of this market, with only a few manufacturers so far in production. Drives of this type may be expected to secure a significant share of the market requirement for 5-10 megabyte removable media devices, providing major competition to high capacity floppy drives.

* Non-reversible optical disks: The first optical disk recording systems to enter the market are "non-reversible" or "write-once" systems. Such systems are now starting to be introduced as actual products, after many years of costly development programs by several manufacturers located in the United States, Japan and Europe.

Write-once systems are capable of higher areal densities than magnetic recording techniques now in use, with some planned systems providing several gigabytes on a single removable disk, and the promise of mass storage systems which will be able to access large numbers of such disks under system control. Although not yet demonstrated, advocates of the various types of optical disk media technologies believe that their disks will provide archival lives which equal or exceed those of magnetic media.

In broad terms, two kinds of systems will be offered: Document storage and data storage systems. Systems intended to store images of documents are already on the market in Japan, offered by Toshiba and Matsushita Electric. Document storage systems do not require the extremely low error rates demanded for data storage, and can live with the relatively poor error rates common to all optical recording systems. At this time, it does not appear that optical document storge systems will be able to compete on a price per image basis with microfilm for bulk storage of images.

However, the fast and convenient access to stored images provided by optical disk systems will probably create a major place for them in the emerging office automation market, for numerous specialized applications. The early emphasis on optical document storage systems in the Japanese market is explained by the extremely complicated character of the Japanese alphabet. Since most business communication and records are in handwritten

characters, the emphasis first on copying machines, then facsimile transmission, and now optical document storage systems is understandable.

Optical data storage systems from a variety of firms, including Storage Technology, Control Data, Xerox, Alcatel Thomson, Hitachi, Toshiba, NEC and Fujitsu are now starting to appear. STC's 7600, with first shipments delayed until first quarter, 1985, is probably the most ambitious of these projects, involving a program intended to rapidly build a major market among users of large IBM mainframes. The disk subsystem carries a list purchase price of $130,000, uses the STC 8880 controller, and has a transfer rate of 3 megabytes/second, the same as the 3380 magnetic disk drive.

Each disk cartridge contains a single 14" disk, is priced from $140 to $225, depending on quantity, and has a capacity of four gigabytes. STC has identified a large number of target applications involving databases which are infrequently or never updated, and for which a write once system would not be at a disadvantage -- such as stock market history, legal files, seismic data and banking transaction logs. Replacement of magnetic tape for archival storage is also high on the target list. Until Storage Technology's status is clarified during the firm's current bankruptcy proceedings, the actual introduction timetable for this product is uncertain.

The other write-once systems about to enter the market use comparable, but different technologies, with capacities per disk in the range of one to three gigabytes. These systems will be marketed initially as OEM drives, and some will probably be used also in captive systems. Obviously, the market for this generation of optical disk systems will be limited to the niches which can tolerate nonreversability. It is believed that these niches do exist and that the low cost per byte stored will start to open selected markets to optical disk systems. But the markets will be specialized, with system manufacturers slow to act. Little displacement of magnetic disk drives will result in the foreseeable future, and any possible impact will be for applications requiring capacities far greater than the range covered by flexible disk drives.

* Erasable optical disks: The possibility for real inroads into the market for magnetic disk drives exists with reversible optical disk systems, when either of the principal proposed technologies reaches the status of a reliable production product. Magneto-optical recording has seen development activity for twenty years, and "phase change" optical recording has attracted considerable attention during the past few years.

Most current magneto-optical development programs involve using a low power laser to change the magnetic state of an amorphous gadolinium coating on a disk, by raising surface temperatures into the range of the coating's Curie point, while a magnetic field is present. These changes are detected during reading, as the aff-

ected spot on the disk causes a small rotation in the polarized light reflected from the surface or transmitted through the disk.

Phase change optical recording involves a different type of amorphous coating, in which individual spots on the disk are changed by polarized light from a crystalline state, during which light is reflected, to a noncrystalline state, during which light is absorbed.

Advocates of both technologies claim the ability to reverse the state at individual disk locations more times than would ever be necessary, and believe that their disks will be adequately stable for archival storage. Individual firms are also working on other proposed reversible optical recording technologies, but none of these are known to have overcome all of the problems, which have included: Slow completion of the reversal cycle, limitations on the number of reversals before degradation, poor shelf life, and low recording density.

Magneto-optical and phase change technologies have been developed to the point where they both appear to have some hope of becoming reliable, producible products. However, it is believed that the first volume shipments of major erasable optical disk drive systems will take another three to five years. Most of the technical problems may have been overcome by some of the U.S., Japanese or European companies working in the area, but none of these firms are yet known to have committed to the heavy investment required to establish volume production capability.

If reversible optical disk technologies have any commercial impact on flexible disk drives when they finally enter the marketplace, it will probably be through changes they will make in the role of fixed magnetic disk drives. Even small diameter reversible optical disk drives will probably have capacities in the range of several hundred megabytes, and will find usage as the basic system disk in lieu of current fixed magnetic disk drives. Since the optical disks will be removable, it will be possible to remove entire databases and large sets of files for safekeeping when systems are not in use. This pattern of usage may obviate the need for some floppy drives, but it is more likely that floppy drives will still be considered necessary for save/restore and interchange of smaller files, as well as distribution of software.

* Magnetic bubbles: If regarded as a specialized data storage product, magnetic bubbles now look like a product with a future, despite a serious loss of credibility after the 1981 departure of National Semiconductor, Texas Instruments and Rockwell International from the field. The rate at which the market for magnetic bubbles has developed was clearly not acceptable for the drop-outs, which had plans for much more immediate returns on their investments.

Bubbles' markets were obviously not the mainstream data storage applications so thoroughly dominated by magnetic disk and tape drives. As expected by disk and tape manufacturers, but not by many bubble manufacturers, the older magnetic recording products were well established, mostly multiple sourced, and getting better all the time. But there are many practical limitations for disk and tape, and numerous applications where they are unsuitable or marginal because of environmental limitations or minimum practical size thresholds.

So bubbles started to find suitable applications, once they were actually in production and support chips became available. The largest manufacturing levels are still maintained by Hitachi, with most production used by Nippon Telephone and Telegraph for a variety of telecommunication applications. AT&T is believed to be much further behind in developing internal bubble applications, despite the fact that the basic technology was invented at Bell Labs.

The successful bubble program of Intel Magnetics has been instrumental in developing a wide variety of applications. Intel led the market with 1 Mbit chips, the introduction of support circuits and a guaranteed future price reduction policy. The company has attracted a variety of customers in specialized and harsh environment applications -- at least sufficient to establish quantity production, and start down the learning curve. The hottest new market area for bubbles is potentially the largest one: Portable computers. Several of the new portable computer manufacturers have incorporated bubble memories as basic auxiliary memory devices, because of bubbles' advantages of physical size and durability while being transported.

The non-volatility of magnetic bubbles and their suitability for capacities too small to be cost effective for magnetic disk drives has also proven to be attractive to system manufacturers for applications such as industrial control systems, robots, point of sale terminals, medical instrumentation, avionic systems and militarized systems.

There is little doubt that the future market available to magnetic bubbles will be directly proportional to their price level as compared to magnetic disk for equivalent capacities. During the rest of the 1980's, it still seems probable that bubbles' prices will not approach disks' prices -- and bubbles' main markets will be smaller and more specialized.

* Tape drives: When disk drive capacities used with small computer systems rise above 20-30 megabytes, the functional requirements for a removable media backup device frequently cannot be met by a flexible disk drive. Floppies' comparatively limited capacity is usually adequate for systems on which the typical file is also small, such as with word processing systems, many small business systems, and most personal computers. But if files are typically

large, if a data base management system is used, or if it is necessary to back up an entire rigid disk for protection at the end of each day, most of today's floppies are usually not the best answer.

Digital cassette and tape cartridge drives were available before most of today's floppy drives, but production of these drives has never approached that for floppies. The reasons lie in the inability of tape drives to offer fast direct access to individual records, generally higher prices for the tape drives, and until recently, a lack of industry-wide standards for interfaces and media interchange. Today, however, the pressing demand for backup devices capable of handling the higher capacities offered by the newest small Winchester drives has created a new opportunity for small tape drives.

The streaming tape cartridge drives now offered by several manufacturers are likely to achieve a major penetration of this market. Streamers have been available from a few suppliers during the past few years, but with different interfaces and recording formats from each manufacturer -- a situation which discouraged many system manufacturers from investing in the controller and software development needed to use these drives. However, the advent of the high capacity 5.25 inch Winchester has provided the stimulus for most of the tape cartridge drive manufacturers to quickly agree on common standards for interfaces and recording formats.

These standards, plus new tape cartridge drives designed to the same form factor as 5.25 inch Winchesters, will probably result in major penetration by tape cartridge streamers of the back up market with 5.25 inch Winchesters in the 20-30 megabyte range and above. Will this development displace flexible disk drives? No, not significantly, since floppies never had a logical market opportunity with higher capacity 5.25 inch Winchesters, except for applications using files typically small enough to fit a floppy. Anything larger probably will create a demand for tape streamers or removable rigid disk drives. In any event, floppy drives will undoubtedly be used on many small systems with large capacity Winchester drives, for software distribution, and as a convenient backup method for the small files which usually accompany the large ones.

Flexible disk drive enhancements

IBM developed most of the basic technology used in flexible disk drives, but has failed to introduce a successful new floppy drive since the two sided 8 inch drive in 1976. In that same year, Shugart Associates shrunk IBM's technology down to the 5.25 inch format, pulling off one of the most influential repackaging jobs of all time.

In the meantime, the floppy formats which have created the most impact in recent years are the Sony 3.5 inch microfloppy and the Nippon Telephone & Telegraph 1.6 megabyte version of the 5.25 inch drive. Without IBM's heavy handed leadership the industry has taken years to find its way to a consensus on these formats, while passing others by. And after all the confusion, IBM has finally endorsed both the 3.5" and 1.6 megabyte 5.25 inch formats with recent product introductions.

The lesson of recent years is that there are many potential technical improvements in flexible disk drive recording technology, each waiting for the backing of an influential firm in the industry. Here are some of the leading contenders:

* Media: The polyester substrate used with flexible disks suffers from limitations in its dimensional stability which derive from the manufacturing process used. As a result, today's mainstream floppy drive products using open loop head positioning systems for low cost are limited to 48 TPI with 8 inch drives, 96/100 TPI with 5.25 inch drives, and 135 TPI with microfloppy drives. The relatively small tonnage of polyester required for diskettes did not inspire plastics manufacturers to invest heavily in research targeted at dimensional stability improvements until the last few years, when the quantities became too large to ignore. However, the magnetic recording industry has been actively developing several methods of increasing linear recording density.

  Longitudinal particulate coatings: The conventional 8 and 5.25 inch diskettes used for the last 10 years, with 300 Oersted oxide coatings, have generally been recorded at 5,000 to 6,000 flux reversals per inch (FCI). The 600 Oersted cobalt modified oxide coatings now used in high density 5.25 inch and microfloppy diskettes from several manufacturers are used in numerous production drives at 8,000 to 10,000 FCI, and special types are available for use at even higher densities. 2 megabyte 5.25 inch drives from Mitsubishi, Philips and Toshiba use diskettes at almost 12,000 FCI, and Hitachi is offering an 8 inch Hitachi drive with 9.6 megabyte capacity recording at about 13,700 FCI, plus a new 5.25 inch drive with 6.5 megabytes achieved with 125 TPI and 19,560 BPI. The Iomega Bernoulli effect 8 inch and 5.25 inch drives achieve up to 18,000 FCI, with a diskette using similar coercivity but a thinner coating. A few of the above drive/media systems use spin coated diskettes, but most employ diskettes with conventional web coating.

Several manufacturers of flexible disk media and magnetic particles have promising programs underway to improve the density of longitudinal particulate recording. Based on the information available, it appears that conventional recording methods could be stretched at least to 20,000 FCI now and to at least 40,000 FCI within a year or two. It is obvious that longitudinal particulate recording has many good years left, with the full exploitation of its potential recording density probably to be paced primarily by market forces.

Isotropic coatings: It is theoretically possible, by reducing the length of magnetic particles, which are normally very long and thin, to resolve magnetic flux changes at much higher densities. Spin Physics, a subsidiary of Eastman Kodak, has produced such particles and used them in manufacturing 5.25 inch flexible disks with greatly enhanced abilities to handle high recording densities. It has been demonstrated that such diskettes could be recorded at up to 50,000 BPI. Since diskettes suitable for isotropic recording could easily be produced in great quantities on coating equipment widely used by media manufacturers today, this technology will be of great interest to the industry if certain thermal instability problems associated with cobalt modification of very small particles can be resolved. In addition, it is known that some media manufacturers are working with barium ferrite technology, which also has the potential for very high density recording if stable materials become available in commercial quantities.

Sputtered disks for perpendicular recording: Perpendicular recording offers great potential for increased recording densities on flexible disks, and may have a better short-term outlook with flexible disk drives than with rigid disk drives because of floppies' slow spin rate. The flying head technology used with rigid disks requires a high revolution rate, which will result in very high data transfer rates with perpendicular recording -- faster than most systems and controllers are now ready to handle. However, the contact recording method used with flexible disk drives makes possible slower rates of revolution, with the result that even the very high densities of perpendicular recording produce transfer rates comparable to the small Winchester disk drives now in wide use.

Several firms have announced tentative specifications for small flexible disk drives using perpendicular recording. Sony's experimental 3.5 inch drive provides 4 megabytes using 65,500 FCI. Matsushita Electric has claimed the capability to record at 70,000 FCI. Vertimag plans to produce sputtered media for perpendicular recording, with densities over 35,000 FCI.

All planned flexible disk drives using perpendicular recording are expected to employ disks with sputtered magnetic surfaces. Sputtering technology is highly developed, but throughput is relatively slow, because it is usually a batch process. If the

millions of low cost diskettes necessary to support any significant penetration of the flexible disk market by perpendicular recording are to be produced by sputtering, major improvements in production rates are probably necessary. Continuous sputtering production processes have been announced by Vertimag, and by the Japanese firms which have active drive/media programs in the field. Commercial success for perpendicular recording in the flexible disk market during the next few years will probably depend upon these or similar programs.

Track density: As discussed above, media dimensional stability limitations effectively hold track densities to the ranges now employed, if low cost open loop head positioning systems are to be used. It is possible to increase track densities through the use of prerecorded servo information on disks combined with a closed loop head positioning system, but the industry has been slow to move in that direction because of the general desire to hold costs as low as possible and the lack of an industry standard, de facto or otherwise.

Until recently, two manufacturers of high capacity 5.25 inch drives were attempting to develop the market with different methods of achieving higher track density. However, Amlyn's late production start spoiled its chance for acceptance of the reference track technology employed in its 3.2 megabyte drive, and the firm has closed down operations. Drivetec was more successful in getting started, however, and has been shipping its 3.3 megabyte two sided drive since mid 1983. Drivetec uses embedded servo information on each diskette to provide tracking information and insure media interchange. The capacity of the Drivetec drive could be increased to 6.6 megabytes by doubling the track density to 384 TPI in early 1985 -- but a somewhat lower track density will probably be combined with a higher linear density, to accomodate arbitrary file organization limitations built into existing single chip floppy drive controllers. Eastman Kodak has taken a license to make and sell the Drivetec drive, and started production in 1984. Both firms have found an interesting market with specialized system manufacturers with a pressing need for floppies with more capacity, plus a significant add-on market with personal computers, filling a need many users have for removable media with more capacity. The long term outlook for these products, however, will probably be determined by the position IBM will eventually have to take on adding floppies to its personal computer systems with capacities above 1.6 megabytes. If IBM chooses this format, high shipment levels for embedded servo floppies will result -- but if IBM stays with open loop 96 TPI 5.25 inch drives and gets its increased capacity through increased linear density, the market for embedded servo drives will probably continue to be confined to specialized systems and the PC add-on market.

DEFINITIONS

Many basic terms have varying meanings within the computer industry, depending upon the role of the person speaking. In this report, such terms are used in the way most disk drive manufacturers use them.

Market class: Used here, arbitrarily, to differentiate captive, PCM and OEM disk drive marketing activities.

Captive: Disk drives manufactured internally or by a subsidiary of a computer manufacturer or system OEM, and sold primarily for use with systems offered by the manufacturer. Note that the term is used to describe the products, not the manufacturer; drives sold to the OEM market class are classified accordingly. Most DISK/TREND statistics separate data between "IBM captive" and "other captive", but the term still pertains to the disk drives involved, not the manufacturer. Examples:

* Drives sold by DEC, Burroughs or Sykes Datatronics are considered captive, if internally manufactured.

* In the case of a joint venture disk drive manufacturer such as Magnetic Peripherals, Inc., a joint venture of Control Data, Sperry and Honeywell, MPI drives sold with Honeywell or Sperry systems are included in captive, and MPI drives sold by CDC are captive, PCM or OEM groups, as appropriate.

Non-captive: Any public sale by any disk drive manufacturer, except that sales or leases or internally manufactured drives by computer manufacturers or system OEMs primarily for use with their own systems are excluded. All OEM shipments are included in the non-captive category. Examples:

* Shipments by Shugart are non-captive, except for drives sold with systems by parent companies or subsidiaries.

* CDC drive sales to NCR are non-captive, in that NCR does not share in ownership of MPI, and are included in OEM totals.

PCM: Disk drives sold or leased by "plug compatible manufacturers" directly to distributors or end users; to be included in this category, drives must be supplied in plug compatible configurations for add-on installation in connection with systems sold by other manufacturers. Although the PCM category currently consists primarily of drives intended for use with IBM systems, such as Series 1 or the Personal Computer family, it may include any drives which are suitably equipped to be connected without any additional hardware to systems of all types.

OEM: Floppy drives sold through any non-captive distribution channel except PCM. Drives are normally sold to OEMs to be included in complete systems or subsystems; such drives are included in OEM totals whether or not the OEM actually manufacturers the remainder of the system or subsystem, or merely assembles components and adds software. Sales by a disk drive manufacturer to a second drive manufacturer for resale are included only in shipment totals for the originating drive manufacturer, except for drives made on a contract manufacturing basis exclusively for the reselling manufacturer, using product designs developed by that manufacturer. Examples:

* Standard OEM drives sold by independent floppy drive manufacturers to IBM for use with personal computers are considered to be OEM drives.

* Floppy drives designed by IBM and manufactured for IBM by an outside contract manufacturing firm are considered to be captive drives.

U.S. vs. worldwide shipments: Shipments are classified U.S. or worldwide depending on the shipment destination of a drive's first public sale. Examples:

* An OEM shipment by a U.S. drive manufacturer to a European system manufacturer is included in worldwide shipment totals.

* An OEM shipment by a Japanese drive manufacturer to a U.S. system manufacturer is included in U.S. shipment totals.

U.S. vs. non-U.S. manufacturers: Manufacturers are classified U.S. or non-U.S., depending on the location of the firm's headquarters, regardless of the location of individual manufacturing plants. Examples:

* IBM and Tandon are considered U.S. manufacturers, even though each firm manufacturers disk drives in non-U.S. locations.

Revenue: Based on sale of disk drives alone, as normally sold by individual manufacturers, without auxiliary hardware or spare parts. When sold as an integral part of a system or subsystem, the value of the disk drive alone has been estimated for DISK/TREND purposes. Sale prices are estimated public sale transaction prices, whether at captive end user, PCM, or OEM levels. All projected prices are in 1984 constant dollars.

Spindles: The basic unit used in counting disk drives. One spindle consists of the disk drive mechanism required to utilize a single disk. All DISK/TREND unit totals are counted in spindles, even though some drive configurations include more than one spindle. On an arbitrary basis, drives which utilize a single actuator mechanism to control head movement on two separate flexible disks are counted as two spindles.

Forecasts: Expected shipments and revenues for current or announced products in new production. Evolutionary improvements within existing formats are included, but completely new configurations or technologies are not included. Examples:

* Enhancements such as double density versions of existing configurations and revised encoding schemes are anticipated in DISK/TREND forecasts.

* Innovations such as disks in non-standard sizes or new physical configurations may require establishment of new DISK/TREND product groups.

Distribution channels: Shipments of non-captive drives are analyzed by each of the following distribution channels:

Mainframe computer manufacturers: The major manufacturers of medium and large scale computers. In the U.S. this group consists of IBM, Sperry, Honeywell, Burroughs, Control Data and NCR.

Mini/micro computer manufacturers: Computer manufacturers primarily oriented to the minicomputer class, such as DEC, Hewlett-Packard or Data General, etc., and semiconductor manufacturers, such as Intel and National Semiconductor, which manufacture computer systems.

System OEMs/system houses: (1) OEMs which manufacture a system requiring floppy drives, such as Apple, Televideo or Tektronix. (2) Systems houses, of any size, which combine finished components and custom software to offer complete systems to end users.

Independent peripherals suppliers: Specialized manufacturers which buy drives, add controllers, interfaces, power supplies and other equipment or software, and offer complete subsystems to end users, system OEMs and system houses. Examples are Qualogy, Davong and Tecmar.

Distributors, dealers, end users: (1) Distributors which perform the classic wholesaler function, such as Hamilton Avnet or Arrow. (2) Dealers which act as local trading area outlets, frequently with stores suitable for walk-in trade, such as Byte shops, Computerland stores and Tandy's Radio Shack stores. (3) Direct sales to end users, usually of plug compatible drives, by the disk drive manufacturer.

FLEXIBLE DISK DRIVES, 8 INCH, ONE SIDE

1984 DISK/TREND REPORT

FLEXIBLE DISK DRIVES, 8 INCH, ONE SIDE

Coverage

Examples of flexible disk drives in this group include:

IBM	3740 series, 5280 series
BASF	6102
Caldisk	142M, 842D
Control Data	9404B
Digital Equipment	RX01, RX02
Elcomatic	ACP 500
Hitachi	FDD-102D
Innotronics	410, 420
ISOT	ES 5074
Matsushita Communication Ind.	JK-880, JK-881
Metronex	PLX45D
Micro Peripherals	41
Miltope	DD 400
Olivetti	FD 801
Ricoh	RD-2D
Shugart	S 800, S 801
Tandon	TM-848E-1
Videoton	MFM-2, Momflex 3200
World Storage Technology	FDD 100-8
YE Data	YD-74C

All drives designed to use single sided flexible disks of nominal 8 inch diameter are included in this group, including both "soft sector" and "hard sector" drives. Most soft sector drives use IBM compatible media, with a single index hole. Hard sector drives use additional holes to identify sectors.

Most drives in this group may be operated at "standard density" or "double density" at the option of the system integrator, dependent upon controllers used. Older OEM drives in this group were generally designed to the same physical dimensions as the Shugart S 801, but most of the OEM drives introduced in the last three years are "half high" models.

Market status

DISK/TREND estimate of total market size:

Worldwide sales ($M)	1983	1984	1985	1986	1987
U.S. manufacturers	162.8	107.3	51.6	20.1	8.4
All manufacturers	187.6	126.8	67.0	31.7	14.9

The end is in sight for the 8 inch, one side floppy drive, the configuration which started today's flexible disk drive industry. Since the 1981 peak in shipments, production has continued to drop, down 43.7% in 1983 and an estimated 32.3% in 1984. Worldwide unit shipments for 1984 are estimated at 227,900 drives.

It is the older, successful computer systems designed to use 8 inch, one side floppy drives which keep this product group alive. While most newer systems use smaller floppies, the older systems will generate shipments for 8 inch floppy drives as long as the system shipments hold up. Half high 8 inch drives apparently arrived too late to provide much help in total shipment levels. Half high drives peaked in 1983 with 9.9% of worldwide unit shipments, and will be down to an estimated 4.5% of 1984 shipments.

Small business systems, terminals and word processing used to be the main application areas for 8 inch, one side drives, but only word processing remains a major market, taking over 50% of 1983 shipments. The principal captive production remaining is that of IBM, Digital Equipment and Shugart, but all of these programs are also continuing to decline.

Shugart built its early leadership in the OEM floppy drive market with 8 inch, one side models, and has maintained its lead. 56.3% of 1983 worldwide unit shipments of non-captive drives were by Shugart. Tandon, shipping only half high drives, held 12.5%. ISOT, the Bulgarian

enterprise which makes disk drives for many of the Eastern Bloc countries, was third with 6.4%. Only a few other manufacturers still produce OEM floppy drives in this group, and the number is reduced each year.

Marketing trends

Most of the system manufacturers which have used 8 inch, one side floppy drives in the past have already moved on to other flexible disk drive configurations, and the few still shipping systems with 8 inch drives are designing new systems without them. DISK/TREND forecasts indicate an average annual decline in worldwide unit shipments of 48.4% for the period 1984-1987. 1987's worldwide shipments are forecasted at a nominal 30,900 drives.

The forecasted decline will affect all market classes. It now appears that IBM's continued reliance on its original floppy format for many word processing and terminal applications will end, in favor of smaller floppy drive configurations. The other few remaining captive programs will suffer the same fate. The customer base for OEM drives is much larger, but many OEM's are quick to adopt new disk drive formats, so shipments of OEM drives will also continue to slide.

Technical trends

Nothing new is expected in this product group. Drive manufacturers are unwilling to invest in the format, since they recognize that system OEMs wishing similar capacities will turn to 5.25 inch and smaller floppy formats and those wishing larger capacities will use two sided drives of various sizes.

Half high 8 inch, one side drives have appeared from several manufacturers, but they were not developed especially for this product group. The main interest of most drive manufacturers in half high 8 inch drives has been in two sided versions, and since the additional cost in offering them is low, several manufacturers have introduced them. As noted above, most system manufacturers which have added 8 inch, one sided drives in the last few years have used half high models -- but the total number has not been enough to turn the tide.

Forecasting assumptions

1. IBM usage of 8 inch, one side drives in new systems will decline in favor of smaller diameter flexible disk drives.

2. Although retaining momentum as a recognized data interchange standard, 8 inch, one side drives will be displaced in most new system design by smaller diameter drives.

TABLE 8

FLEXIBLE DISK DRIVES, 8 INCH, ONE SIDE

REVENUE SUMMARY

	DISK DRIVE REVENUES, BY SHIPMENT DESTINATION ($M)									
	1983		Forecast							
	---Shipments---		------1984-----		------1985-----		------1986-----		------1987-----	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM Captive	47.2	67.4	30.0	42.9	11.0	15.7	--	--	--	--
Other U.S. Captive	31.2	45.1	21.6	32.1	12.0	18.4	6.6	10.5	2.9	4.7
TOTAL U.S. CAPTIVE	78.4	112.5	51.6	75.0	23.0	34.1	6.6	10.5	2.9	4.7
PCM	--	--	--	--	--	--	--	--	--	--
OEM	41.2	50.3	28.7	32.3	15.1	17.5	8.2	9.6	3.1	3.7
TOTAL U.S. NON-CAPTIVE	41.2	50.3	28.7	32.3	15.1	17.5	8.2	9.6	3.1	3.7
TOTAL U.S. REVENUES	119.6	162.8	80.3	107.3	38.1	51.6	14.8	20.1	6.0	8.4
Non-U.S. Manufacturers										
Captive	--	4.5	--	1.4	--	--	--	--	--	--
PCM	--	--	--	--	--	--	--	--	--	--
OEM	.3	20.3	--	18.1	--	15.4	--	11.6	--	6.5
TOTAL NON-U.S. REVENUES	.3	24.8	--	19.5	--	15.4	--	11.6	--	6.5
Worldwide Recap										
TOTAL WORLDWIDE REVENUES	119.9	187.6	80.3	126.8	38.1	67.0	14.8	31.7	6.0	14.9
OEM Average Price ($000)	.296	.317	.309	.336	.313	.356	.333	.382	.348	.410

TABLE 9

FLEXIBLE DISK DRIVES, 8 INCH, ONE SIDE

UNIT SHIPMENT SUMMARY

	DISK DRIVE UNIT SHIPMENTS, BY SHIPMENT DESTINATION (000)									
	1983		Forecast							
	Shipments		1984		1985		1986		1987	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM	41.0	58.6	27.3	39.0	10.5	15.0	--	--	--	--
Other U.S. Captive	35.6	51.5	25.4	37.8	14.5	22.3	8.3	13.2	3.7	6.0
TOTAL U.S. CAPTIVE	76.6	110.1	52.7	76.8	25.0	37.3	8.3	13.2	3.7	6.0
PCM	--	--	--	--	--	--	--	--	--	--
OEM	138.7	171.7	93.0	105.8	48.3	55.8	24.6	28.9	8.9	10.5
TOTAL U.S. NON-CAPTIVE	138.7	171.7	93.0	105.8	48.3	55.8	24.6	28.9	8.9	10.5
TOTAL U.S. SHIPMENTS	215.3	281.8	145.7	182.6	73.3	93.1	32.9	42.1	12.6	16.5
Non-U.S. Manufacturers										
Captive	--	3.7	--	1.2	--	--	--	--	--	--
PCM	--	--	--	--	--	--	--	--	--	--
OEM	1.3	50.9	--	44.1	--	36.6	--	26.6	--	14.4
TOTAL NON-U.S. SHIPMENTS	1.3	54.6	--	45.3	--	36.6	--	26.6	--	14.4
Worldwide Recap										
TOTAL WORLDWIDE SHIPMENTS	216.6	336.4	145.7	227.9	73.3	129.7	32.9	68.7	12.6	30.9
Cumulative Shipments										
IBM	332.1	461.8	359.4	500.8	369.9	515.8	369.9	515.8	369.9	515.8
Non-IBM	2,442.9	3,808.4	2,561.3	3,997.3	2,624.1	4,112.0	2,657.0	4,180.7	2,669.6	4,211.6
WORLDWIDE TOTAL	2,775.0	4,270.2	2,920.7	4,498.1	2,994.0	4,627.8	3,026.9	4,696.5	3,039.5	4,727.4

TABLE 10

FLEXIBLE DISK DRIVES, 8 Inch, One Side

WORLDWIDE SHIPMENTS (000)

DRIVE HEIGHT ANALYSIS

	1983 --Shipments--		Forecast 1984		1985		1986		1987	
	Units	%	Units	%	Units	%	Units	%	Units	%
U.S. MANUFACTURERS										
Captive Total	110.1		76.8		37.3		13.2		6.0	
Full Size	110.1	100.0	76.8	100.0	37.3	100.0	13.2	100.0	6.0	100.0
OEM Total	171.7		105.8		55.8		28.9		10.5	
Full Size	138.5	80.7	95.5	90.3	50.3	90.1	28.9	100.0	10.5	100.0
Half High	33.2	19.3	10.3	9.7	5.5	9.9	--	--	--	--
Total U.S.	281.8		182.6		93.1		42.1		16.5	
Full Size	248.6	88.2	172.3	94.4	87.6	94.1	42.1	100.0	16.5	100.0
Half High	33.2	11.8	10.3	5.6	5.5	5.9	--	--	--	--
NON-U.S. MANUFACTURERS										
Captive Total	3.7		1.2		--		--		--	
Full Size	3.7	100.0	1.2	100.0	--	--	--	--	--	--
OEM Total	50.9		44.1		36.6		26.6		14.4	
Full Size	50.9	100.0	44.1	100.0	36.6	100.0	26.6	100.0	14.4	100.0
Total Non-U.S.	54.6		45.3		36.6		26.6		14.4	
Full Size	54.6	100.0	45.3	100.0	36.6	100.0	26.6	100.0	14.4	100.0
WORLDWIDE RECAP										
Total Shipments	336.4		227.9		129.7		68.7		30.9	
Full Size	303.2	90.1	217.6	95.5	124.2	95.8	68.7	100.0	30.9	100.0
Half High	33.2	9.9	10.3	4.5	5.5	4.2	--	--	--	--

TABLE 11

FLEXIBLE DISK DRIVES, 8 INCH, ONE SIDE

DISTRIBUTION CHANNEL SUMMARY
U.S. Non-Captive Disk Drives

Distribution channel	1983 U.S. Net Shipments Units (000)	%	FORECAST 1984 %	1985 %	1986 %	1987 %
Mainframe computer manufacturers	17.2	12.3	11.8	11.3	10.9	10.6
Mini/micro computer manufacturers	72.7	51.9	52.4	52.9	53.5	54.0
System OEMs/systems houses	20.2	14.5	14.2	13.9	13.2	12.4
Independent peripherals suppliers	.2	.1	.1	--	--	--
Distributors, dealers, end users	29.7	21.2	21.5	21.9	22.4	23.0
TOTAL	140.0					

TABLE 12

FLEXIBLE DISK DRIVES, 8 INCH, ONE SIDE

MARKET SHARE SUMMARY
Worldwide Shipments of Non-Captive Disk Drives

Drive Manufacturers	1983 Net Shipments To United States Destinations Units (000)	%	Worldwide Units (000)	%
SHUGART	110.8	79.2	125.3	56.3
TANDON	16.7	11.9	27.9	12.5
ISOT	--	--	14.3	6.4
BASF	--	--	12.6	5.7
OTHER U.S.	11.2	8.0	18.5	8.3
OTHER NON-U.S.	1.3	.9	24.0	10.8
TOTAL	140.0	100.0	222.6	100.0

FLEXIBLE DISK DRIVES, 8 INCH, TWO SIDES

1984 DISK/TREND REPORT

FLEXIBLE DISK DRIVES, 8 INCH, TWO SIDES

Coverage

Examples of flexible disk drives in this group include:

IBM	4964, 4966, Systems 23 & 34
BASF	6104
Burroughs	9489-21, 9489-23
Caldisk	143M
Control Data	9406, 210-10
Elcomatic	ACP 700, ACP 1500
Hitachi	FDD-412, FDD-441
Matsushita Communication Ind.	JK-885, JA-751
Micro Peripherals	42
Miltope	DD 450, DD 550
Mitsubishi Electric	M2894-63
NEC	FD 1160, FD 1165
Olivetti	FD 802
Qume	242
Ricoh	RF8160
Shugart	S 850, S 851
Tandon	TM-848E-2
Toshiba	ND-40D
YE Data	YD-174D, YD-180

Most of the flexible disk drives in this group are intended to use IBM's recording formats for two sided flexible disks, either "Diskette 2" for standard density or "Diskette 2D" for double density. IBM's diskette magazine drive is included in the group, since it uses standard media in a conventional drive, fed by a diskette-changing mechanism. OEM drives are usually available in either soft or hard sectored versions. Most OEM drives introduced in the last few years are half-high versions.

Drives using special recording formats are offered by three manufacturers. In 1983, Hitachi announced a half-high drive with 9.6 megabytes capacity, achieved with 96 TPI and 20,560 BPI, using a run length limited encoding algorithm, with cobalt modified oxide coated media. Elcomatic's ACP 1500 provides 3.2 megabytes by using 96 TPI and normal

recording densities. Burroughs' floppy drives, which offer capacities up to 3 megabytes, use special recording formats and employ a reference track technique to achieve track densities up to 150 TPI.

Market size

DISK/TREND estimate of total market size:

Worldwide sales ($M)	1983	1984	1985	1986	1987
U.S. manufacturers	502.7	498.6	371.1	254.5	137.5
All manufacturers	1,209.6	1,158.4	912.7	650.0	234.4

Although 1983 was another growth year for 8 inch, two sided drives, 1984 is expected to be flat, only .7% higher in worldwide unit shipments. It now seems clear that 1984's 1,285,400 drives will be the production peak for this product group, a level slightly below the previous DISK/TREND forecast.

The only reason for continued growth in this product group has been the momentum of the half high two sided 8 inch format in the Japanese domestic market, in contrast to the more rapid movement of U.S. system manufacturers to 5.25 inch formats. While unit shipments by U.S. floppy drive manufacturers declined 7.5% in 1983, shipments by non-U.S. manufacturers increased 53.4%. However, shipments by non-U.S. manufacturers are expected to go up only 5.8% in 1984, which is now seen as the peak year, as 1.6 megabyte 5.25 inch drives find their way into newer Japanese office computers.

While U.S. drive manufacturers shipped only 17.9% of their two sided 8 inch drives as half high models in 1983, non-U.S. manufacturers were shipping 83.3% of their total as half high units -- and the spread is increasing in 1984. The major reason for this anomaly is found in the

fact that IBM dominates U.S. captive shipments with full size drives, while NEC dominates Japanese captive shipments with half high drives.

The share of worldwide OEM drive shipments held by U.S. companies continues to lag. YE Data continued in the lead during 1983, with 24.5% of the worldwide total, representing 166,600 drives. Trailing behind were Shugart with 14.3%, NEC with 13.9% and Tandon with 10.0%.

Marketing trends

Following the expected 1984 shipment peak, two sided 8 inch drives are expected to decline in shipments at an average annual rate of 26.5% during 1984-1987.

It is believed that this product group's current lack of vigor is traceable to a combination of factors: (1) The reliability problems most manufacturers experienced with 8 inch, two sided drives in the late 1970's, which kept many OEMs from committing to the format, (2) Lack of further development of the 8 inch drive format by IBM, which inhibited manufacturers of OEM drives from investing in higher density versions, and (3) Rapid development of the 5.25 inch format by both U.S. and Japanese drive manufacturers, in a product area free from the dominance of IBM until recently.

In addition, certain specific developments will further change the future outlook. In Japan's domestic market, most manufacturers of small office computer systems have already felt the pressure to move to desktop versions of their older systems, and the 1.6 megabyte 5.25 inch floppy drive developed under the sponsorship of Nippon Telephone & Telegraph has made it possible to do so with a half high 5.25 inch drive. 1984 shipments of these drives are increasing rapidly in Japan, and they will

displace most of the growth which would have otherwise gone to 8 inch, two sided drives.

But the knockout punch for 8 inch, two side drives has been delivered by IBM, their originator. IBM is using 1.6 megabyte 5.25 inch drives in its multiple user personal computer, the PC AT, and is expected to broaden usage of these drives to additional new PC models and other small systems intended to office use. An obvious result will be the decline of IBM's production of 8 inch, two sided drives, combined with the firm's expected start of internal manufacturing for 1.6 megabyte 5.25 inch floppy drives. Another predictable effect of this action will be IBM's influence on other system manufacturers: Even more rapid movement to 5.25" formats.

The market for PCM drives in this group will remain small, and is expected to dry up altogether by 1986. The attachment possibilities for independent drives on IBM's Series/1 minicomputers are limited by the wide dispersion of the minicomputer market and the poor cost effectiveness of marketing efforts to sell individual floppy drive subsystems to minicomputer users. To the extent PCM floppy drives are sold to this market, they will probably be included in larger disk subsystems sold to IBM users and systems houses by Control Data.

Technical trends

Few serious attempts to introduce higher capacity drives in this group have occurred. Until recently, only two high capacity 8 inch, two sided drives had ever been announced, by Burroughs and PerSci. Burroughs successfully produced a 3 megabyte drive but attracted no following, and PerSci's announced 3.7 megabyte drive was never manufactured because of the firm's financial problems.

The key reason that development of 8 inch drives has been stuck at 1.6 megabytes since 1977 is IBM's lack of innovation in the area. Since the existing 8 inch diskette's physical design and recording format were defined by IBM, and because of IBM's dominant leadership in the applications for 8 inch, two sided floppies, most manufacturers of OEM drives hesitated to attempt the introduction of their own improvements.

Several manufacturers of OEM drives were ready to introduce new drives for years, with most planning various track following methods, to make possible doubling the track density. These plans were generally set back by the reliability problems which were experienced by two sided 8 inch floppy drives at the end of the 1970's, and by the hope of most manufacturers that IBM would lead in establishing a new high capacity format, preferably with an improved, higher density media standard.

In October, 1983, Hitachi announced a 9.6 megabyte drive which uses a special Maxell cobalt modified oxide coated diskette. The Hitachi drive uses 96 TPI and triples the effective linear density to 20,560 BPI, by roughly doubling the actual recording density and using a run length limited code. This drive has been sold mostly in the Japanese domestic market, as a backup device for fixed Winchester disk drives.

After all the waiting, the momentum has passed to the smaller diameter floppy formats. 600 Oersted magnetic coatings have been introduced in minifloppy and microfloppy formats by several media manufacturers, and 5.25 inch drives with capacities over 3 megabytes are in production. With the uncertainties of IBM's plans to contend with, combined with the high growth of desktop and portable systems, most manufacturers are now putting their development resources into smaller drives.

Forecasting assumptions

1. IBM will continue to transition to 1.6 megabyte 5.25 inch floppy drives for new versions of its personal computer and other small systems, reducing its requirement for 8 inch, two sided drives.

2. The Japanese domestic market will move away from 8 inch, two sided floppy drives starting in 1984, in favor of 1.6 megabyte 5.25 inch drives.

3. U.S. system manufacturers competing with IBM will follow IBM's move to 1.6 megabyte 5.25 inch drives, causing a continuing reduction in OEM shipments of 8 inch, two sided drives.

TABLE 13

FLEXIBLE DISK DRIVES, 8 INCH, TWO SIDES

REVENUE SUMMARY

	DISK DRIVE REVENUES, BY SHIPMENT DESTINATION ($M)									
	1983		Forecast							
	---Shipments---		------1984-----		------1985-----		------1986-----		------1987-----	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM Captive	240.7	361.8	254.5	383.0	187.9	289.1	130.8	201.3	73.0	112.2
Other U.S. Captive	43.7	58.5	41.1	55.3	25.6	34.6	13.6	18.0	3.6	4.9
TOTAL U.S. CAPTIVE	284.4	420.3	295.6	438.3	213.5	323.7	144.4	219.3	76.6	117.1
PCM	.2	.2	.2	.2	.2	.4	--	--	--	--
OEM	62.0	82.2	41.6	60.1	34.5	47.0	25.5	35.2	14.6	20.4
TOTAL U.S. NON-CAPTIVE	62.2	82.4	41.8	60.3	34.7	47.4	25.5	35.2	14.6	20.4
TOTAL U.S. REVENUES	346.6	502.7	337.4	498.6	248.2	371.1	169.9	254.5	91.2	137.5
Non-U.S. Manufacturers										
Captive	--	602.4	--	550.0	--	449.4	--	324.6	--	55.4
PCM	--	--	--	--	--	--	--	--	--	--
OEM	27.2	104.5	27.0	109.8	22.5	92.2	17.4	70.9	10.3	41.5
TOTAL NON-U.S. REVENUES	27.2	706.9	27.0	659.8	22.5	541.6	17.4	395.5	10.3	96.9
Worldwide Recap										
TOTAL WORLDWIDE REVENUES	373.8	1,209.6	364.4	1,158.4	270.7	912.7	187.3	650.0	101.5	234.4
OEM Average Price ($000)	.303	.275	.283	.248	.261	.233	.256	.222	.251	.212

TABLE 14

FLEXIBLE DISK DRIVES, 8 INCH, TWO SIDES

UNIT SHIPMENT SUMMARY

	DISK DRIVE UNIT SHIPMENTS, BY SHIPMENT DESTINATION (000)									
	1983 Shipments		Forecast							
			1984		1985		1986		1987	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM	133.7	201.0	145.4	218.8	110.5	170.0	79.3	122.0	45.6	70.1
Other U.S. Captive	26.9	36.0	26.1	35.1	16.8	22.7	9.2	12.2	2.6	3.5
TOTAL U.S. CAPTIVE	160.6	237.0	171.5	253.9	127.3	192.7	88.5	134.2	48.2	73.6
PCM	.1	.1	.1	.1	.1	.2	--	--	--	--
OEM	174.9	230.4	126.3	176.4	105.7	140.5	74.1	99.8	39.8	54.2
TOTAL U.S. NON-CAPTIVE	175.0	230.5	126.4	176.5	105.8	140.7	74.1	99.8	39.8	54.2
TOTAL U.S. SHIPMENTS	335.6	467.5	297.9	430.4	233.1	333.4	162.6	234.0	88.0	127.8
Non-U.S. Manufacturers										
Captive	--	360.9	--	347.3	--	292.3	--	221.5	--	127.9
PCM	--	--	--	--	--	--	--	--	--	--
OEM	119.5	447.5	116.0	507.7	112.3	456.8	93.5	377.3	59.4	238.0
TOTAL NON-U.S. SHIPMENTS	119.5	808.4	116.0	855.0	112.3	749.1	93.5	598.8	59.4	365.9
Worldwide Recap										
TOTAL WORLDWIDE SHIPMENTS	455.1	1,275.9	413.9	1,285.4	345.4	1,082.5	256.1	832.8	147.4	493.7
Cumulative Shipments										
IBM	542.8	808.6	688.2	1,027.4	798.7	1,197.4	878.0	1,319.4	923.6	1,389.5
Non-IBM	979.6	2,918.0	1,248.1	3,984.6	1,483.0	4,897.1	1,659.8	5,607.9	1,761.6	6,031.5
WORLDWIDE TOTAL	1,522.4	3,726.6	1,936.3	5,012.0	2,281.7	6,094.5	2,537.8	6,927.3	2,685.2	7,421.0

TABLE 15

FLEXIBLE DISK DRIVES, 8 Inch, Two Sides

WORLDWIDE SHIPMENTS (000)

DRIVE HEIGHT ANALYSIS

	1983 --Shipments--		Forecast 1984		1985		1986		1987	
	Units	%	Units	%	Units	%	Units	%	Units	%
U.S. MANUFACTURERS										
Captive Total	237.0		253.9		192.7		134.2		73.6	
Full Size	237.0	100.0	253.9	100.0	192.7	100.0	134.2	100.0	73.6	100.0
OEM Total	230.5		176.5		140.7		99.8		54.2	
Full Size	146.8	63.7	124.4	70.5	104.2	74.1	78.8	79.0	45.0	83.0
Half High	83.7	36.3	52.1	29.5	36.5	25.9	21.0	21.0	9.2	17.0
Total U.S.	467.5		430.4		333.4		234.0		127.8	
Full Size	383.8	82.1	378.3	87.9	296.9	89.1	213.0	91.0	118.6	92.8
Half High	83.7	17.9	52.1	12.1	36.5	10.9	21.0	9.0	9.2	7.2
NON-U.S. MANUFACTURERS										
Captive Total	360.9		347.3		292.3		221.5		127.9	
Full Size	39.9	11.1	32.3	9.3	23.4	8.0	13.3	6.0	5.1	4.0
Half High	321.0	88.9	315.0	90.7	268.9	92.0	208.2	94.0	122.8	96.0
OEM Total	447.5		507.7		456.8		377.3		238.0	
Full Size	95.1	21.3	68.0	13.4	38.4	8.4	16.6	4.4	3.3	1.4
Half High	352.4	78.7	439.7	86.6	418.4	91.6	360.7	95.6	234.7	98.6
Total Non-U.S.	808.4		855.0		749.1		598.8		365.9	
Full Size	135.0	16.7	100.3	11.7	61.8	8.2	29.9	5.0	8.4	2.3
Half High	673.4	83.3	754.7	88.3	687.3	91.8	568.9	95.0	357.5	97.7
WORLDWIDE RECAP										
Total Shipments	1,275.9		1,285.4		1,082.5		832.8		493.7	
Full Size	518.8	40.7	478.6	37.2	358.7	33.1	242.9	29.2	127.0	25.7
Half High	757.1	59.3	806.8	62.8	723.8	66.9	589.9	70.8	366.7	74.3

TABLE 16

FLEXIBLE DISK DRIVES, 8 INCH, TWO SIDES

DISTRIBUTION CHANNEL SUMMARY
U.S. Non-Captive Disk Drives

Distribution channel	1983 U.S. Net Shipments Units (000)	%	FORECAST 1984 %	1985 %	1986 %	1987 %
Mainframe computer manufacturers	6.1	2.1	2.0	1.8	1.6	1.3
Mini/micro computer manufacturers	74.6	25.3	25.6	26.4	27.1	27.8
System OEMs/systems houses	178.2	60.5	59.8	58.8	57.7	56.4
Independent peripherals suppliers	6.7	2.3	2.3	2.4	2.6	2.9
Distributors, dealers, end users	28.9	9.8	10.3	10.6	11.0	11.6
TOTAL	294.5					

TABLE 17

FLEXIBLE DISK DRIVES, 8 INCH, TWO SIDES

MARKET SHARE SUMMARY
Worldwide Shipments of Non-Captive Disk Drives

Drive Manufacturers	1983 Net Shipments To United States Destinations Units (000)	%	Worldwide Units (000)	%
YE DATA	40.0	13.6	166.6	24.5
SHUGART	58.8	20.0	96.8	14.3
NEC	45.2	15.3	94.5	13.9
TANDON	61.0	20.7	67.8	10.0
MITSUBISHI	33.0	11.2	55.1	8.1
HITACHI	--	--	50.0	7.4
MATSUSHITA COM. IND.	--	--	35.0	5.2
QUME	30.0	10.2	30.0	4.4
BASF	--	--	29.4	4.3
CONTROL DATA	20.6	7.0	28.8	4.2
OTHER U.S.	4.6	1.6	7.1	1.1
OTHER NON-U.S.	1.3	.4	17.5	2.6
TOTAL	294.5	100.0	678.0	100.0

FLEXIBLE DISK DRIVES, 5.25 INCH, ONE SIDE

1984 DISK/TREND REPORT

FLEXIBLE DISK DRIVES, 5.25 INCH, ONE SIDE

Coverage

Examples of flexible disk drives in this group include:

48 tracks per inch

Alps Electric	FDD 2125
BASF	6106
Canon	MDD 6106
Chinon	F-051D
Control Data	9408
Elcomatic	ACP548-25
Hi-Tech Peripherals	H548-25
ISOT	ES 5088
Matsushita Communication Ind.	JA-200
Micro Peripherals	51, 501, 501C
Mitac	MC-390, MC-395
Olivetti	FD 501
Philips	X 3111, X 3131
Robotron	K 5600.10
Shugart	S 200, S 400
Tandon	TM-100-1, TM-65-1L
TEAC	FD-53A, FD-55A
Tokyo Electric Company	FB-501
Video Technology	FDM 130
Videoton	Momflex 900
Weltec Digital	M 48S
Wong's Technology	WST 112-5

96/100 tracks per inch

Alps Electric	FDD 2745
Data Track Technology	Tracker 1.0
Digital Equipment	RX50
Elcomatic	ACP596-05
Hi-Tech Peripherals	H596-05
Micro Peripherals	91
Micropolis	1115-V
Philips	X 3113, X 3133
Robotron	K 5600.20
TEAC	FD-55E
Tokyo Electric Company	FB-502
Video Technology	FDM 140
Weltec Digital	M 96S

The basic standards for physical size and recording format for this product group were created by the introduction of the Shugart S 400, the original minifloppy, in 1976. Most of the manufacturers now active in minifloppies offer drives similar to the S 400, but the explosive growth in small microcomputer based systems has inspired extensive innovation in 5.25 inch drives.

An early pioneer was Micropolis, which introduced 100 TPI drives in 1977, matching the standard 77 track format of 8 inch floppy drives in the minifloppy form factor. In 1980 Tandon and Micro Peripherals joined Micropolis in offering 96 TPI drives in a standardized format, which established the existing 80 track standard.

Because of the continued shrinkage in the physical size of computer systems, reduced drive height has become an extremely active area of innovation. BASF introduced drives in 1978 which were two thirds the height of the S 400's 3.25 inches. Several other manufacturers joined BASF with two thirds high drives, but sales have been modest. However, half high drives, pioneered by Tandon and Alps Electric, are now offered by most drive manufacturers, and have become the dominant physical size standard for floppy drives using 5.25 inch diskettes.

Other innovative one sided 5.25 inch drives have been introduced, with varying levels of success. Early in 1982, Amlyn started shipping a drive using a special cartridge of five diskettes, each recorded on one side at 170 TPI and 9500 BPI. This drive had limited success, and Amlyn has discontinued operations. With first shipments also in 1982, Digital Equipment Corporation offers a one sided drive which uses a single head positioning system for two diskettes, and which is now produced in large quantities for use with DEC personal computers.

Market status

DISK/TREND estimate of total market size:

Worldwide sales ($M)	1983	1984	1985	1986	1987
U.S. manufacturers	393.4	349.5	251.5	167.5	116.8
All manufacturers	627.3	610.4	563.8	533.0	459.7

The growth pattern for 5.25 inch, one side drives continues to be as eccentric as ever. 1983's worldwide unit shipment total of 4,323,700 drives is up 103.9% over the previous year, but the increase for 1984 is estimated at only 4.6%.

Booming personal computer sales were behind the big shipment increase for 1983, which was felt mostly by manufacturers of OEM drives. Shipments of OEM drives by U.S. manufacturers were up 61.6% in 1983, to 1,231,300 units, but are expected to decline 25.3% in 1984. Non-U.S. manufacturers' 1983 OEM drive shipments increased 143.6%, to 2,416,800 units, and a further increase of 20.1% is forecasted for 1984.

OEM shipments in this product group are dominated by Alps Electric's sales to Apple and others. Alps held 52.9% of 1983 non-captive worldwide unit shipments, with 1,930,000 units. Shugart shipped 15.9% of the total, with Tandon at 9.2%.

Half high drives have won the battle for OEM drive markets, with 1984 unit shipments by U.S. manufacturers now 54.9% half high models, and non-U.S. manufacturers at 97.1%. The current surge in growth for captive non-U.S. full size drives is caused by the start of Eastern Bloc production, in support of fledgling personal computer programs. Digital Equipment's RX50 accounts for the continued high proportion of U.S. captive full size drives, as well as the high percentage of 96 TPI U.S. captive drives.

Marketing trends

1985 is expected to be a flat year in shipments for this group, with declines in subsequent years, as two sided 5.25 inch drives and 3.5 inch microfloppies assume complete dominance. From the peak of 4,531,100 drives in 1985, shipments in 1987 are forecasted to be down to 3,678,700 in 1987. The 1987 forecast could be depressed even further if Apple Computer, whose Apple II systems are the largest remaining market for OEM one sided 5.25 inch drives, should go to a different floppy drive format in the next year or two for the Apple II family.

IBM's actions in offering two sided 48 TPI 5.25 inch drives with various models in its personal computer product line have influenced the firm's competitors greatly. The outstanding success of IBM's personal computer family has made the industry hungry for compatibility. And, while 5.25 inch one side drives were offered with the original personal computer model, two sided drives have dominated shipments on that and subsequent models.

Microfloppy drives will directly displace 5.25 inch, one side drives which otherwise would have been used in portable and desktop computers. While the widespread use of 5.25 inch diskette media provides considerable momentum for the format, it is expected that microfloppies will gradually build up shipment momentum in the portable and "small-footprint" desktop computer markets, at the expense of 5.25 inch drives. And IBM's expected use of 3.5 inch drives for briefcase size portable computers starting in 1985 will consolidate this movement for any doubters.

With the apparent decision in Eastern Bloc countries to concentrate on full size 5.25 inch, one side drives for their emerging personal computer industry, non-U.S. half high drive shipments will stay low.

Technical trends

The industry has not invested heavily in development programs for this product group, and most of the work undertaken has been intended to result in smaller, cheaper floppy drives. Well publicized programs by Alps Electric, Tandon and Shugart resulted in mechanism-only versions of 5.25 inch, one side drives priced as low as $40 for very large quantities.

More significant to the entire industry, however, were the half high drives, just 1.625 inches in height. Although designed for both one sided and two sided models, the one sided versions have kept this product group going longer than would otherwise have been likely.

Significant changes in technology for this group during the next few years are not expected. 5.25 inch, one side drives offer neither the capacity potential of two sided 5.25 inch drives nor the smaller physical volume potential of 3.5 inch drives -- and will probably not see any further development.

Forecasting assumptions

1. After 1984, shipments of 5.25 inch, one side drives will be flat, due to competition from microfloppies and 5.25 inch, two sided drives.

2. Most growth in this product group will be generated by half high drives, with full size drives in decline, except in Eastern Bloc countries.

3. Average prices for OEM drives will continue to be depressed by shipment of a high proportion of OEM drives in mechanism-only versions, plus the transition to lower priced half high models.

TABLE 18

FLEXIBLE DISK DRIVES, 5.25 INCH, ONE SIDE

REVENUE SUMMARY

	DISK DRIVE REVENUES, BY SHIPMENT DESTINATION ($M)									
	1983		Forecast							
	---Shipments---		------1984-----		------1985-----		------1986-----		------1987-----	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM Captive	--	--	--	--	--	--	--	--	--	--
Other U.S. Captive	233.8	281.6	220.7	275.9	158.0	197.6	102.9	125.9	70.5	82.9
TOTAL U.S. CAPTIVE	233.8	281.6	220.7	275.9	158.0	197.6	102.9	125.9	70.5	82.9
PCM	--	--	--	--	--	--	--	--	--	--
OEM	98.1	111.8	65.3	73.6	48.4	53.9	37.4	41.6	30.5	33.9
TOTAL U.S. NON-CAPTIVE	98.1	111.8	65.3	73.6	48.4	53.9	37.4	41.6	30.5	33.9
TOTAL U.S. REVENUES	331.9	393.4	286.0	349.5	206.4	251.5	140.3	167.5	101.0	116.8
Non-U.S. Manufacturers										
Captive	28.0	44.9	17.6	62.0	18.2	106.5	15.1	177.2	11.4	191.1
PCM	--	--	--	--	--	--	--	--	--	--
OEM	143.4	189.0	155.3	198.9	176.1	205.8	161.9	188.3	131.2	151.8
TOTAL NON-U.S. REVENUES	171.4	233.9	172.9	260.9	194.3	312.3	177.0	365.5	142.6	342.9
Worldwide Recap										
TOTAL WORLDWIDE REVENUES	503.3	627.3	458.9	610.4	400.7	563.8	317.3	533.0	243.6	459.7
OEM Average Price ($000)	.076	.082	.066	.071	.066	.067	.063	.064	.060	.061

TABLE 19

FLEXIBLE DISK DRIVES, 5.25 INCH, ONE SIDE

UNIT SHIPMENT SUMMARY

	DISK DRIVE UNIT SHIPMENTS, BY SHIPMENT DESTINATION (000)									
	1983		Forecast							
	---Shipments---		------1984-----		------1985-----		------1986-----		------1987-----	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM	--	--	--	--	--	--	--	--	--	--
Other U.S. Captive	507.9	608.6	487.4	605.5	390.3	485.0	311.3	378.3	241.2	283.7
TOTAL U.S. CAPTIVE	507.9	608.6	487.4	605.5	390.3	485.0	311.3	378.3	241.2	283.7
PCM	--	--	--	--	--	--	--	--	--	--
OEM	1,081.5	1,231.3	820.7	919.9	644.6	717.5	527.8	586.7	448.2	498.0
TOTAL U.S. NON-CAPTIVE	1,081.5	1,231.3	820.7	919.9	644.6	717.5	527.8	586.7	448.2	498.0
TOTAL U.S. SHIPMENTS	1,589.4	1,839.9	1,308.1	1,525.4	1,034.9	1,202.5	839.1	965.0	689.4	781.7
Non-U.S. Manufacturers										
Captive	40.0	67.0	27.0	92.0	28.0	164.5	25.2	296.0	20.7	347.6
PCM	--	--	--	--	--	--	--	--	--	--
OEM	2,102.5	2,416.8	2,504.5	2,903.5	2,776.4	3,164.1	2,636.2	2,992.4	2,254.9	2,549.4
TOTAL NON-U.S. SHIPMENTS	2,142.5	2,483.8	2,531.5	2,995.5	2,804.4	3,328.6	2,661.4	3,288.4	2,275.6	2,897.0
Worldwide Recap										
TOTAL WORLDWIDE SHIPMENTS	3,731.9	4,323.7	3,839.6	4,520.9	3,839.3	4,531.1	3,500.5	4,253.4	2,965.0	3,678.7
Cumulative Shipments										
IBM	--	--	--	--	--	--	--	--	--	--
Non-IBM	7,652.4	9,278.9	11,492.0	13,799.8	15,331.3	18,330.9	18,831.8	22,584.3	21,796.8	26,263.0
WORLDWIDE TOTAL	7,652.4	9,278.9	11,492.0	13,799.8	15,331.3	18,330.9	18,831.8	22,584.3	21,796.8	26,263.0

TABLE 20

FLEXIBLE DISK DRIVES, 5.25 Inch, One Side

WORLDWIDE SHIPMENTS (000)

DRIVE HEIGHT ANALYSIS

	1983 --Shipments--		Forecast							
			1984		1985		1986		1987	
	Units	%	Units	%	Units	%	Units	%	Units	%
U.S. MANUFACTURERS										
Captive Total	608.6		605.5		485.0		378.3		283.7	
Full Size	576.7	94.8	483.5	79.9	307.0	63.3	125.0	33.0	50.0	17.6
Half High	31.9	5.2	122.0	20.1	178.0	36.7	253.3	67.0	233.7	82.4
OEM Total	1,231.3		919.9		717.5		586.7		498.0	
Full Size	980.9	79.7	414.8	45.1	173.7	24.2	34.6	5.9	--	--
Half High	250.4	20.3	505.1	54.9	543.8	75.8	552.1	94.1	498.0	100.0
Total U.S.	1,839.9		1,525.4		1,202.5		965.0		781.7	
Full Size	1,557.6	84.7	898.3	58.9	480.7	40.0	159.6	16.5	50.0	6.4
Half High	282.3	15.3	627.1	41.1	721.8	60.0	805.4	83.5	731.7	93.6
NON-U.S. MANUFACTURERS										
Captive Total	67.0		92.0		164.5		296.0		347.6	
Full Size	2.0	3.0	48.0	52.2	122.6	74.5	259.9	87.8	320.3	92.1
Half High	65.0	97.0	44.0	47.8	41.9	25.5	36.1	12.2	27.3	7.9
OEM Total	2,416.8		2,903.5		3,164.1		2,992.4		2,549.4	
Full Size	98.8	4.1	83.5	2.9	80.0	2.5	71.0	2.4	51.0	2.0
Half High	2,318.0	95.9	2,820.0	97.1	3,084.1	97.5	2,921.4	97.6	2,498.4	98.0
Total Non-U.S.	2,483.8		2,995.5		3,328.6		3,288.4		2,897.0	
Full Size	100.8	4.1	131.5	4.4	202.6	6.1	330.9	10.1	371.3	12.8
Half High	2,383.0	95.9	2,864.0	95.6	3,126.0	93.9	2,957.5	89.9	2,525.7	87.2
WORLDWIDE RECAP										
Total Shipments	4,323.7		4,520.9		4,531.1		4,253.4		3,678.7	
Full Size	1,658.4	38.4	1,029.8	22.8	683.3	15.1	490.5	11.5	421.3	11.5
Half High	2,665.3	61.6	3,491.1	77.2	3,847.8	84.9	3,762.9	88.5	3,257.4	88.5

TABLE 21

FLEXIBLE DISK DRIVES, 5.25 Inch, One Side

WORLDWIDE SHIPMENTS (000)

TRACK DENSITY ANALYSIS

	1983 --Shipments--		Forecast							
			1984		1985		1986		1987	
	Units	%	Units	%	Units	%	Units	%	Units	%
U.S. MANUFACTURERS										
Captive Total	608.6		605.5		485.0		378.3		283.7	
48 TPI	368.6	60.6	305.5	50.5	236.0	48.7	268.3	70.9	233.7	82.4
96/100 TPI	240.0	39.4	300.0	49.5	249.0	51.3	110.0	29.1	50.0	17.6
OEM Total	1,231.3		919.9		717.5		586.7		498.0	
48 TPI	1,075.6	87.4	857.4	93.2	694.5	96.8	581.4	99.1	498.0	100.0
96/100 TPI	155.7	12.6	62.5	6.8	23.0	3.2	5.3	.9	--	--
Total U.S.	1,839.9		1,525.4		1,202.5		965.0		781.7	
48 TPI	1,444.2	78.5	1,162.9	76.2	930.5	77.4	849.7	88.1	731.7	93.6
96/100 TPI	395.7	21.5	362.5	23.8	272.0	22.6	115.3	11.9	50.0	6.4
NON-U.S. MANUFACTURERS										
Captive Total	67.0		92.0		164.5		296.0		347.6	
48 TPI	22.0	32.8	61.0	66.3	131.6	80.0	266.4	90.0	323.3	93.0
96/100 TPI	45.0	67.2	31.0	33.7	32.9	20.0	29.6	10.0	24.3	7.0
OEM Total	2,416.8		2,903.5		3,164.1		2,992.4		2,549.4	
48 TPI	2,381.2	98.5	2,870.0	98.8	3,136.1	99.1	2,973.4	99.4	2,540.4	99.6
96/100 TPI	35.6	1.5	33.5	1.2	28.0	.9	19.0	.6	9.0	.4
Total Non-U.S.	2,483.8		2,995.5		3,328.6		3,288.4		2,897.0	
48 TPI	2,403.2	96.8	2,931.0	97.8	3,267.7	98.2	3,239.8	98.5	2,863.7	98.9
96/100 TPI	80.6	3.2	64.5	2.2	60.9	1.8	48.6	1.5	33.3	1.1
WORLDWIDE RECAP										
Total Shipments	4,323.7		4,520.9		4,531.1		4,253.4		3,678.7	
48 TPI	3,847.4	89.0	4,093.9	90.6	4,198.2	92.7	4,089.5	96.1	3,595.4	97.7
96/100 TPI	476.3	11.0	427.0	9.4	332.9	7.3	163.9	3.9	83.3	2.3

NOTE: Track densities greater than 100 TPI are grouped with 96/100 TPI totals in this table.

TABLE 22

FLEXIBLE DISK DRIVES, 5.25 INCH, ONE SIDE

DISTRIBUTION CHANNEL SUMMARY
U.S. Non-Captive Disk Drives

Distribution channel	1983 U.S. Net Shipments Units (000)	%	FORECAST 1984 %	1985 %	1986 %	1987 %
Mainframe computer manufacturers	64.0	2.0	1.5	1.1	.8	.5
Mini/micro computer manufacturers	369.4	11.6	11.5	9.3	7.3	5.5
System OEMs/systems houses	2,438.6	76.6	76.5	78.3	79.8	81.2
Independent peripherals suppliers	86.8	2.7	2.9	3.1	3.2	3.2
Distributors, dealers, end users	225.2	7.1	7.6	8.2	8.9	9.6
TOTAL	3,184.0					

TABLE 23

FLEXIBLE DISK DRIVES, 5.25 INCH, ONE SIDE

MARKET SHARE SUMMARY
Worldwide Shipments of Non-Captive Disk Drives

Drive Manufacturers	1983 Net Shipments To United States Destinations Units (000)	%	Worldwide Units (000)	%
ALPS ELECTRIC	1,910.0	60.0	1,930.0	52.9
SHUGART	476.3	15.0	578.6	15.9
TANDON	325.5	10.2	335.2	9.2
TEAC	28.0	.9	230.0	6.3
MICRO PERIPHERALS	204.9	6.4	224.4	6.1
TOKYO ELECTRIC	115.0	3.6	115.0	3.1
MICROPOLIS	38.0	1.2	54.3	1.5
WONG'S TECHNOLOGY	39.0	1.2	41.0	1.1
BASF	--	--	36.0	1.1
OTHER U.S.	36.8	1.2	38.8	1.1
OTHER NON-U.S.	10.5	.3	64.8	1.8
TOTAL	3,184.0	100.0	3,648.1	100.0

FLEXIBLE DISK DRIVES, 5.25 INCH, TWO SIDES

1984 DISK/TREND REPORT

FLEXIBLE DISK DRIVES, 5.25 INCH, TWO SIDES

Coverage

Examples of flexible disk drives in this group include:

48 tracks per inch

Alps Electric	FDD 212B
BASF	6108, 6128
Canon	210, 521, 413, 6108
Chinon	F-502
Control Data	9409, 9428
Elcomatic	ACP548-50
Epson	SD-321, SD-521
Hi-Tech Peripherals	H548-50
Hitachi	HFD 505C
ISOT	ES 5321
Matsushita Communication Ind.	JA-551, JK-875
Micro Peripherals	52, 502D
Mitsubishi Electric	M4851
NEC	FD 1053
Oki Electric	GM 3305H, GM 3315B
Olivetti	FD 502, FD 602
Omek	OM55
Philips	X 3112, X 3132
Qume	142
Ricoh	RF5050
Shugart	S 455
Tandon	TM-100-2, TM-65-2
TEAC	FD-53B, FD-55B
Tokyo Electric Company	FB-503
Toshiba	ND04D
Victor Company of Japan	MDP-200, MDP-2
Video Technology	FDM 145
Weltec Digital	M 48D
Wong's Technology	WST 211-5, WST 212-5
YE Data	YD-274, YD-580

96/100 tracks per inch (1.0 megabyte)

Alps Electric	FDD 222B
BASF	6118, 6138
Canon	MDD-220, MDD-221, MDD-423, 520
Chinon	F-504
Control Data	9429, 9409-T
Data Track Technology	Tracker 2.0
Elcomatic	ACP596-10
Epson	SD-540
Hi-Tech Peripherals	H596-10

Hitachi	HFD 510C
Isot	ES 5323
Kyocera	KFD-525
Matsushita Communication Ind.	JA-561
Micro Peripherals	92, 902D
Micropolis	1115-VI
Mitsubishi Electric	M4852, M4855
NEC	FD 1055
Oki Electric	GM 3405H, GM 3425B
Olivetti	FD 592, FD 692
Omek	OM56
Philips	X 3114, X 3134
Ricoh	RF5200
Shugart	S465
Tandon	TM-65-4
TEAC	FD-55F
Tokyo Electric Company	FB-504
Toshiba	ND-06D
Victor Company of Japan	MDP-100, MDP-300
Video Technology	FDM 160
Weltec Digital	M 96D
Wong's Technology	WST 221-5
YE Data	YD-280, YD-480

96/100 tracks per inch (1.6 megabytes)

BASF	6148
Canon	MDD 516A
Epson	SD-560, SD-580
Fujitsu	M3652A
Hi-Tech Peripherals	H596-16
Hitachi	HFD 516C
Matsushita Com. Ind.	JU-581, JU-591
Micropolis	1117-VI
Mitsubishi Electric	M4854
NEC	FD 1155B, FD 1155C
Olivetti	FD 595
Omek	OM57
Philips	X 3118, X 3118
Ricoh	RF5160
Shugart	S 475
Tandon	TM-65-8
TEAC	FD-55G, FD-55GF
Tokyo Electric Company	FB-505, FB-506
Toshiba	ND-08
Victor Company of Japan	MDP-1000, MDP-2000
YE Data	YD-380

96/100 tracks per inch (2.0 megabytes)

Mitsubishi Electric	M4855
Philips	X 3116
Toshiba	ND-09D

Over 100 tracks per inch

Drivetec	320
Eastman Kodak	Kodak 3.3
Hitachi	FDD 541

Two sided 5.25 inch floppy drives became a reality in 1978. The size of these drives was the same as the one sided SA 400 introduced in 1976 -- 3.25 inches high, 5.75 inches wide, and 8.0 inches deep.

The first two thirds high drives were offered by BASF, also in 1978, followed by a handful of others, with sales mostly in Europe. However, during the last three years most manufacturers of 5.25 inch drives have introduced half high models (1.625 inches high), with an enthusiastic reaction from system manufacturers. In addition, Canon, Oki Electric and Epson offer drives only one third the height of standard drives.

The original 48 TPI drives were joined by 96 TPI drives from Tandon, Micro Peripherals and Micropolis in 1980, and a major trend was started, with most manufacturers now offering 96 TPI models.

In 1982, 1.6 megabyte 5.25 inch drives were first shipped by YE Data, designed to a standard coordinated by Nippon Telephone and Telegraph. These drives match the capacity and file organization of two sided 8 inch drives by using 77 tracks (at 96 TPI) per side at 9600 BPI. Initial shipments were used mostly on systems sold in the Japanese domestic market. The 2.0 megabyte drives using slightly higher linear densities offered by Mitsubishi, Philips and Toshiba have so far generated only small sales. IBM's 1984 introduction of the PC AT, using YE Data's 1.6 megabyte drive, is expected to stampede the market into rapid worldwide usage of the 1.6 megabyte 5.25 inch format.

The battle to establish a media interchange standard at the 3 megabyte level has been resolved for the moment in Drivetec's favor, with the

discontinuance of operations by Amlyn, sponsor of the only competitive drive. Drivetec is shipping a half high drive using an embedded servo technique, with 192 TPI, and capacity of 3.3 megabytes -- and is expected to introduce a 6.6 megabyte version in 1985. Drivetec licensed Eastman Kodak in 1983, a new entry in the disk drive industry, and Eastman's production of a drive compatible with Drivetec's unit started in 1984. Hitachi has announced another high capacity drive, with 6.5 megabyte capacity achieved by using 125 TPI and 29,560 BPI. The drive uses cobalt modified particulate media, and is scheduled for delivery in the first quarter of 1985.

Market status

DISK/TREND estimate of total market size:

Worldwide sales ($M)	1983	1984	1985	1986	1987
U.S. manufacturers	441.8	667.1	937.2	1,235.1	1,474.1
All manufacturers	1,104.3	1,596.8	2,061.5	2,528.1	2,897.3

Last year's DISK/TREND report forecasted an increase of 271.6% in 1983 worldwide unit shipments for two sided 5.25 inch drives. The actual increase turned out to be even larger, with actual 1983 shipments of 6,165,700 units -- for a 317.2% increase. The percentage gain will not be as high in 1984, but worldwide unit shipments are nevertheless estimated at 10,126,500 drives.

Professional and business microcomputer systems continue to provide the major stimulus to growth in this product group, with 60.2% of worldwide unit shipments, a share which grows each year. The largest influence in this growth has been IBM's choice of 48 TPI two sided 5.25 inch drives for most members of its personal computer family introduced to date. Most

of IBM's PC competitors have tried to be compatible, or at least comparable, in this choice.

But the mainstream two sided floppy drive configurations are now undergoing significant changes in the mix of product shipments. 1982 was the last year that full size drives held the majority of unit shipments. Half high drives accounted for 57.6% of 1983 worldwide unit shipments and are expected to represent 69.0% of 1984 unit shipments.

The track density mix is also changing. Although 96 TPI and 100 TPI two sided drives have never been very important in the U.S. market, shipments of the one megabyte version have risen to 33% of the non-U.S. total, driven by heavy usage in the Japanese market. With IBM's selection of 1.6 megabyte drives for the PC AT, and presumably for other PC models to follow, 1984 shipments of drives in this format are now increasing rapidly -- up from 3.2% of worldwide unit shipments in 1983, to 8.1% in 1984.

OEM drives still dominate this group with 92% of 1983 worldwide unit shipments. Tandon's 1,433,600 drives in 1983 provided 25.2% of the worldwide non-captive total, followed by TEAC with 15.8% and Mitsubishi with 11.3%.

Marketing trends

DISK/TREND forecasts for this group have been increased again, reflecting current patterns of growth and the earlier than expected decline of older flexible disk drive configurations. Worldwide unit shipments of 17,681,400 two sided 5.25 inch drives are forecasted for 1987.

Captive shipments are expected to provide 21.6% of the worldwide unit total in 1987, compared with 11.9% in 1984. IBM's expected internal

manufacturing program for 5.25 inch floppy drives is forecasted to generate almost half of the 1987 worldwide captive unit shipment total. Although the DISK/TREND forecast for IBM captive shipments has been lowered this year, in view of start up delays and the firm's continued heavy reliance on outside drive manufacturers, substantial production of 1.6 megabyte drives should be underway in the first half of 1985 in IBM facilities. Most of the 1984 IBM shipments shown in this year's DISK/TREND tables were 48 TPI drives designed by IBM, but assembled by an outside contract manufacturing firm.

IBM's choice of the 1.6 megabyte standard is destined to influence the design of most small systems intended for the office environment. Although IBM has announced usage of this format only with the PC AT so far, much broader application with the firm's personal computers and other systems is anticipated. It is expected that 1.6 megabyte 5.25 inch drives will be used with all new IBM systems intended for office applications in the U.S. or Europe, with complete replacement of existing PC models for office use during 1985. PCs intended for portable or home use will probably use 3.5 inch drives.

1.6 megabyte drives are expected to rapidly overtake other formats. Even though 1984 unit shipments are increasing rapidly, 1985 shipments are forecasted to be more than four times larger, and by 1987 1.6 megabyte drives will be 76.1% of worldwide product shipments for this product group. As a result of this shift in product mix, 48 TPI drives will reach their production peak in 1985, with sharp declines thereafter. 96 TPI drives with 1.0 megabyte capacity have been much more popular in Japan than in the U.S. due to the higher data storage requirements of Japanese language word processors, but this format is expected to peak in 1986, as

newer systems transition to the 1.6 megabyte standard. Shipments of 2.0 megabyte drives are expected to remain small.

The movement to half high drive configurations will accelerate in 1985, as IBM moves away from full size 48 TPI drives now used with the PC XT and basic PC models. 88.8% of 1985 worldwide unit shipments are forecasted to be half high drives, rising to 99.7% in 1987.

The share of total worldwide unit shipments held by U.S. drive manufacturers is expected to remain flat during the five year period covered by this report, at about 45%. But U.S. producers of OEM drives will not do as well, as their current 47.1% of worldwide shipments drops to 42.6% in 1987. One cause for this decline is the failure of the U.S. firms to initiate production of 1.6 megabyte drives during 1984.

The market for drives above 1.6 megabytes is now starting to develop, with quantity shipments during 1984 by both Drivetec and its licensee, Eastman Kodak. With current capacity of 3.3 megabytes and 1985 models expected to offer 6.6 megabytes, these drives are being used by specialized system manufacturers which have a pressing need for floppies with more capacity. They are also finding a good reception in the personal computer add-on market with users who have files larger than the floppies provided by IBM and other system manufacturers. Shipments of these drives are not broken out in current DISK/TREND tables, but are summarized below:

Worldwide OEM and PCM unit shipments (000)	1984	1985	1986	1987
Drives with capacities greater than 1.6 MB	42.0	210.8	328.0	419.6

Implicit in the above projection is the assumption that IBM will not introduce a higher capacity floppy drive format through 1987 -- an event

which would increase the projections sharply. The passage of time will undoubtedly see greatly increased demand for higher capacity floppy drives, and add-on sales to personal computer users will eventually force action by industry leaders such as IBM. But the relatively modest penetration of the potential market expressed by the above projections is believed to be the most likely pattern until then.

Technical trends

As discussed above, the eventual appetite for more capacity will result in large volume shipments of flexible disk drives with capacities well above 1.6 megabytes. The key question is which of the several potential recording systems will prevail. While perpendicular recording is frequently mentioned as a strong contender, an entirely new production system for media would be necessary, with a high level of investment required. Particulate recording continues to be the most likely contender, making use of existing coating equipment and demonstrably able to meet established criteria for durability. Several firms are already able to produce magnetic particles suitable for use in diskettes with linear densities in the range of 40,000 to 50,000 BPI.

As usual, the key question is which recording format will become the industry's mainstream choice. The Drivetec format, using embedded servo to achieve 192 TPI now and up to 384 TPI next year, is currently in the lead, based on actual shipments during the last year and establishment of Eastman Kodak as a very credible second source. Hitachi has recently announced a 6.5 megabyte drive, made possible by improving the dimensional stability of the polyester substrate, and using 125 TPI and 29,560 BPI. But, as usual, the real decision-maker will probably be IBM, when it

eventually decides which format to use after 1.6 megabytes. There are two obvious possibilities for IBM's next step: The firm could use the Drivetec format, at either 3.3 or 6.6 megabytes, or it could stay with 96 TPI open loop head positioning and increase linear density to provide similar capacities.

IBM's eventual choice for higher capacity floppy drives may well be based on reliability, after the firm gains extensive field experience in using 1.6 megabyte drives, at 96 TPI. If little or no problems are experienced by IBM with diskette interchangeability, they may decide to stay with 96 TPI open loop and double the linear density as a next step. But if extensive field problems occur, the next IBM move to higher diskette densities could well be with embedded servo drives, in order to achieve trouble free diskette interchange.

Forecasting assumptions

1. IBM will initiate internal production of half high 5.25 inch floppy drives, including 1.6 megabyte models, first half 1985.

2. Growth in personal computer demand for office applications will continue at a high rate.

3. The leadership taken by Japanese floppy drive manufacturers in 1.6 megabyte OEM drives will enable non-U.S. drive manufacturers to increase their lead over U.S. manufacturers in worldwide shipments of OEM drives.

TABLE 24

FLEXIBLE DISK DRIVES, 5.25 INCH, TWO SIDES

REVENUE SUMMARY

	DISK DRIVE REVENUES, BY SHIPMENT DESTINATION ($M)									
	1983		Forecast							
	Shipments		1984		1985		1986		1987	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM Captive	--	--	110.3	122.6	227.9	276.6	420.8	526.0	612.0	765.0
Other U.S. Captive	24.4	26.2	38.2	40.1	106.6	117.9	107.1	119.5	112.9	126.5
TOTAL U.S. CAPTIVE	24.4	26.2	148.5	162.7	334.5	394.5	527.9	645.5	724.9	891.5
PCM	1.4	1.4	5.2	6.7	15.3	17.9	24.0	28.1	22.7	27.6
OEM	333.5	414.2	417.8	497.7	451.4	524.8	478.8	561.5	472.7	555.0
TOTAL U.S. NON-CAPTIVE	334.9	415.6	423.0	504.4	466.7	542.7	502.8	589.6	495.4	582.6
TOTAL U.S. REVENUES	359.3	441.8	571.5	667.1	801.2	937.2	1,030.7	1,235.1	1,220.3	1,474.1
Non-U.S. Manufacturers										
Captive	51.2	230.5	83.0	383.9	94.4	513.2	103.6	631.4	107.0	738.4
PCM	--	--	--	--	--	--	--	--	--	--
OEM	158.1	432.0	233.8	545.8	290.7	611.1	335.4	661.6	373.8	684.8
TOTAL NON-U.S. REVENUES	209.3	662.5	316.8	929.7	385.1	1,124.3	439.0	1,293.0	480.8	1,423.2
Worldwide Recap										
TOTAL WORLDWIDE REVENUES	568.6	1,104.3	888.3	1,596.8	1,186.3	2,061.5	1,469.7	2,528.1	1,701.1	2,897.3
OEM Average Price ($000)	.147	.149	.116	.117	.101	.100	.096	.095	.091	.090

TABLE 25

FLEXIBLE DISK DRIVES, 5.25 INCH, TWO SIDES

UNIT SHIPMENT SUMMARY

	DISK DRIVE UNIT SHIPMENTS, BY SHIPMENT DESTINATION (000)									
	1983		Forecast							
	---Shipments---		------1984-----		------1985-----		------1986-----		------1987-----	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM	--	--	315.0	350.0	555.0	670.0	896.0	1,120.0	1,360.0	1,700.0
Other U.S. Captive	42.3	45.4	66.8	70.0	247.5	274.0	289.8	323.0	332.7	371.8
TOTAL U.S. CAPTIVE	42.3	45.4	381.8	420.0	802.5	944.0	1,185.8	1,443.0	1,692.7	2,071.8
PCM	7.0	7.0	23.6	31.0	60.0	73.0	96.4	115.5	110.2	136.0
OEM	2,247.1	2,779.9	3,538.6	4,186.3	4,448.5	5,169.1	4,852.1	5,694.9	4,974.8	5,848.4
TOTAL U.S. NON-CAPTIVE	2,254.1	2,786.9	3,562.2	4,217.3	4,508.5	5,242.1	4,948.5	5,810.4	5,085.0	5,984.4
TOTAL U.S. SHIPMENTS	2,296.4	2,832.3	3,944.0	4,637.3	5,311.0	6,186.1	6,134.3	7,253.4	6,777.7	8,056.2
Non-U.S. Manufacturers										
Captive	101.0	440.5	174.5	784.5	216.0	1,083.4	253.4	1,419.1	270.2	1,745.0
PCM	--	--	--	--	--	--	--	--	--	--
OEM	1,099.1	2,892.9	2,080.0	4,704.7	2,930.1	6,142.8	3,669.7	7,219.3	4,308.7	7,880.2
TOTAL NON-U.S. SHIPMENTS	1,200.1	3,333.4	2,254.5	5,489.2	3,146.1	7,226.2	3,923.1	8,638.4	4,578.9	9,625.2
Worldwide Recap										
TOTAL WORLDWIDE SHIPMENTS	3,496.5	6,165.7	6,198.5	10,126.5	8,457.1	13,412.3	10,057.4	15,891.8	11,356.6	17,681.4
Cumulative Shipments										
IBM	--	--	315.0	350.0	870.0	1,020.0	1,766.0	2,140.0	3,126.0	3,840.0
Non-IBM	4,744.9	8,500.5	10,628.4	18,277.0	18,530.5	31,019.3	27,691.9	45,791.1	37,688.5	61,772.5
WORLDWIDE TOTAL	4,744.9	8,500.5	10,943.4	18,627.0	19,400.5	32,039.3	29,457.9	47,931.1	40,814.5	65,612.5

TABLE 26

FLEXIBLE DISK DRIVES, 5.25 Inch, Two Sides

WORLDWIDE SHIPMENTS (000)

DRIVE HEIGHT ANALYSIS

	1983		Forecast							
	--Shipments--		-----1984----		-----1985----		-----1986----		-----1987----	
	Units	%	Units	%	Units	%	Units	%	Units	%
U.S. MANUFACTURERS										
Captive Total	45.4		420.0		944.0		1,443.0		2,071.8	
Full Size	19.5	43.0	377.0	89.8	221.0	23.4	12.0	.8	3.0	.1
Half High	25.9	57.0	43.0	10.2	723.0	76.6	1,431.0	99.2	2,068.8	99.9
OEM Total	2,786.9		4,217.3		5,242.1		5,810.4		5,984.4	
Full Size	2,297.8	82.5	2,614.8	62.0	1,203.7	23.0	161.0	2.8	--	--
Half High	489.1	17.5	1,602.5	38.0	4,038.4	77.0	5,649.4	97.2	5,984.4	100.0
Total U.S.	2,832.3		4,637.3		6,186.1		7,253.4		8,056.2	
Full Size	2,317.3	81.8	2,991.8	64.5	1,424.7	23.0	173.0	2.4	3.0	--
Half High	515.0	18.2	1,645.5	35.5	4,761.4	77.0	7,080.4	97.6	8,053.2	100.0
NON-U.S. MANUFACTURERS										
Captive Total	440.5		784.5		1,083.4		1,419.1		1,745.0	
Full Size	23.5	5.3	30.5	3.9	26.0	2.4	18.3	1.3	28.0	1.6
Half High	417.0	94.7	754.0	96.1	1,057.4	97.6	1,400.8	98.7	1,717.0	98.4
OEM Total	2,892.9		4,704.7		6,142.8		7,219.3		7,880.2	
Full Size	274.7	9.5	118.0	2.5	49.1	.8	28.9	.4	15.7	.2
Half High	2,618.2	90.5	4,586.7	97.5	6,093.7	99.2	7,190.4	99.6	7,864.5	99.8
Total Non-U.S.	3,333.4		5,489.2		7,226.2		8,638.4		9,625.2	
Full Size	298.2	8.9	148.5	2.7	75.1	1.0	47.2	.5	43.7	.5
Half High	3,035.2	91.1	5,340.7	97.3	7,151.1	99.0	8,591.2	99.5	9,581.5	99.5
WORLDWIDE RECAP										
Total Shipments	6,165.7		10,126.5		13,412.3		15,891.8		17,681.4	
Full Size	2,615.5	42.4	3,140.3	31.0	1,499.8	11.2	220.2	1.4	46.7	.3
Half High	3,550.2	57.6	6,986.2	69.0	11,912.5	88.8	15,671.6	98.6	17,634.7	99.7

TABLE 27

FLEXIBLE DISK DRIVES, 5.25 Inch, Two Sides

WORLDWIDE SHIPMENTS (000)

TRACK DENSITY ANALYSIS

	1983 --Shipments--		Forecast 1984		1985		1986		1987	
	Units	%	Units	%	Units	%	Units	%	Units	%
U.S. MANUFACTURERS										
Captive Total	45.4		420.0		944.0		1,443.0		2,071.8	
48 TPI	19.5	43.0	408.0	97.1	720.0	76.3	462.0	32.0	330.8	16.0
96/100 TPI	25.9	57.0	12.0	2.9	14.0	1.5	19.0	1.3	15.0	.7
96 TPI 1.6 MB	--	--	--	--	210.0	22.2	962.0	66.7	1,726.0	83.3
OEM Total	2,786.9		4,217.3		5,242.1		5,810.4		5,984.4	
48 TPI	2,406.1	86.3	3,918.5	92.9	4,163.0	79.4	1,710.5	29.4	689.4	11.5
96/100 TPI	380.4	13.6	291.8	6.9	458.9	8.8	497.5	8.6	487.6	8.1
96 TPI 1.6 MB	.4	--	7.0	.2	620.2	11.8	3,602.4	62.0	4,807.4	80.3
Total U.S.	2,832.3		4,637.3		6,186.1		7,253.4		8,056.2	
48 TPI	2,425.6	85.6	4,326.5	93.3	4,883.0	78.9	2,172.5	30.0	1,020.2	12.7
96/100 TPI	406.3	14.3	303.8	6.6	472.9	7.6	516.5	7.1	502.6	6.2
96 TPI 1.6 MB	.4	--	7.0	.2	830.2	13.4	4,564.4	62.9	6,533.4	81.1
NON-U.S. MANUFACTURERS										
Captive Total	440.5		784.5		1,083.4		1,419.1		1,745.0	
48 TPI	312.9	71.0	449.0	57.2	502.0	46.3	425.6	30.0	296.7	17.0
96/100 TPI	60.0	13.6	158.5	20.2	255.2	23.6	397.4	28.0	349.0	20.0
96 TPI 1.6 MB	67.6	15.3	177.0	22.6	326.2	30.1	596.1	42.0	1,099.3	63.0
OEM Total	2,892.9		4,704.7		6,142.8		7,219.3		7,880.2	
48 TPI	1,718.3	59.4	2,412.5	51.3	2,057.9	33.5	1,534.0	21.2	1,024.4	13.0
96/100 TPI	1,046.5	36.2	1,660.2	35.3	1,873.5	30.5	1,714.7	23.8	1,024.4	13.0
96 TPI 1.6 MB	128.1	4.4	632.0	13.4	2,211.4	36.0	3,970.6	55.0	5,831.4	74.0
Total Non-U.S.	3,333.4		5,489.2		7,226.2		8,638.4		9,625.2	
48 TPI	2,031.2	60.9	2,861.5	52.1	2,559.9	35.4	1,959.6	22.7	1,321.1	13.7
96/100 TPI	1,106.5	33.2	1,818.7	33.1	2,128.7	29.5	2,112.1	24.5	1,373.4	14.3
96 TPI 1.6 MB	195.7	5.9	809.0	14.7	2,537.6	35.1	4,566.7	52.9	6,930.7	72.0
WORLDWIDE RECAP										
Total Shipments	6,165.7		10,126.5		13,412.3		15,891.8		17,681.4	
48 TPI	4,456.8	72.3	7,188.0	71.0	7,442.9	55.5	4,132.1	26.0	2,341.3	13.2
96/100 TPI	1,512.8	24.5	2,122.5	21.0	2,601.6	19.4	2,628.6	16.5	1,876.0	10.6
96 TPI 1.6 MB	196.1	3.2	816.0	8.1	3,367.8	25.1	9,131.1	57.5	13,464.1	76.1

NOTE: Track densities greater than 100 TPI are grouped with 96/100 TPI totals in this table.

TABLE 28

FLEXIBLE DISK DRIVES, 5.25 INCH, TWO SIDES

DISTRIBUTION CHANNEL SUMMARY
U.S. Non-Captive Disk Drives

Distribution channel	1983 U.S. Net Shipments Units (000)	%	FORECAST 1984 %	1985 %	1986 %	1987 %
Mainframe computer manufacturers	683.1	20.4	23.1	22.8	19.8	17.5
Mini/micro computer manufacturers	919.7	27.4	26.7	26.0	25.3	24.5
System OEMs/systems houses	1,388.6	41.4	38.1	37.8	40.4	42.7
Independent peripherals suppliers	150.5	4.5	5.6	6.7	7.6	8.3
Distributors, dealers, end users	211.3	6.3	6.5	6.7	6.9	7.0
TOTAL	3,353.2					

TABLE 29

FLEXIBLE DISK DRIVES, 5.25 INCH, TWO SIDES

MARKET SHARE SUMMARY
Worldwide Shipments of Non-Captive Disk Drives

Drive Manufacturers	1983 Net Shipments To United States Destinations Units (000)	%	Worldwide Units (000)	%
TANDON	1,023.6	30.5	1,433.6	25.2
TEAC	313.0	9.3	896.0	15.8
MITSUBISHI	409.4	12.2	642.7	11.3
MATSUSHITA COM. IND.	--	--	431.0	7.6
CONTROL DATA	401.2	12.0	408.4	7.2
MICRO PERIPHERALS	282.5	8.4	328.7	5.8
QUME	286.2	8.5	292.0	5.1
YE DATA	3.0	.1	221.0	3.9
SHUGART	157.1	4.7	192.2	3.4
HITACHI	82.4	2.5	147.0	2.6
TOKYO ELECTRIC	103.5	3.1	115.0	2.0
WONG'S TECHNOLOGY	85.6	2.6	94.0	1.7
CANON	25.0	.7	87.0	1.5
BASF	--	--	84.0	1.5
TOSHIBA	20.0	.6	65.0	1.1
OTHER U.S.	103.5	3.1	132.0	2.3
OTHER NON-U.S.	57.2	1.7	110.2	2.0
TOTAL	3,353.2	100.0	5,679.8	100.0

FLEXIBLE DISK DRIVES, MICROFLOPPIES

1984 DISK/TREND REPORT

FLEXIBLE DISK DRIVES, MICROFLOPPIES

Coverage

Examples of flexible disk drives in this group include:

3.5" disk diameter, one side

Alps Electric	FDV-113A, FDV 213A
Au Peripheral Products	AP-300S
BASF	6161, 6163
Canon	MDD 351, MDD 353
Chinon	F-351, F-353
Citizen	OMDT-20A, ONDT-40A
Copal	F-3501, F-3503
Epson	SMD-110, SMD-170
Janome Sewing Machine Co.	MFD-91
Matsushita Com. Ind.	JU-313, JU-323
Mitsubishi Electric	MF351
NEC	FD 1034
Olivetti	FD 302
Sankyo Seiki	FD 301
Shugart	SA 300
Sony	OA-D31V, OA-D32V, OA-D33V
Tandon	TM-303
TEAC	FD-35A, FD-35E
Tokyo Electric Company	FB-352
Toshiba	ND-353
Victor Company of Japan	MDP-10, MDP-40

3.5" disk diameter, two sides

Alps Electric	FDV-223A
BASF	6164
Canon	MDD 350
Chinon	F-354
Citizen	OMDT-30A, ONDT-50A
Copal	F-3502, F-3504
Epson	SMD-140, SMD-180
Janome Sewing Machine Co.	MFD-91D
Matsushita Com. Ind.	JU-362, JU-363
Mitsubishi	MF 353, MF 353L2
NEC	FD 1035
Olivetti	FD 302
Ricoh	RF4100, RF4050
Sankyo Seiki	FDU-355-DA
Shugart	S 350
Sony	OA-D32W, OA-D33W
Tandon	TM-304
TEAC	FD-35B, FD-35F

3.5" disk diameter, two sides (continued)

Tokyo Electric Company	FB-354
Toshiba	ND-354
Victor Company of Japan	MDP-20, MDP-40
YE Data	YD-620, YD-640

3.0" disk diameter, one side

Hitachi	HFD 305SX
Janome Sewing Machine Company	MFD-80
Matsushita Electronic Comp.	EME-102, EME-150, EME-130
Metrimpex (BRG)	MCD-1
Sankyo Seiki	FDU-300-S
TEAC	FD-30A
Toshiba	ND-301D

3.0 disk diameter, two sides

Hitachi	HFD 305D
Matsushita Electronic Comp.	EME-202, EME-250, EME-230
Sankyo Seiki	FDU-300-D

This year's DISK/TREND Report continues to treat microfloppy drives as a single product group. It may be necessary to split the group into separate sections in future years, but the current combination of all types of microfloppy drives in a single group facilitates side by side comparisons of trends.

With the discontinuance of operations by Tabor, the manufacturer of 3.25 inch microfloppy drives, there are now only two principal media standards: (1) The 3.5 inch Sony-type diskette, for which over 20 manufacturers now offer drives, and (2) the 3.0 inch Hitachi/Matsushita Electric diskette, supported with announced drives from only six manufacturers at this time. Drives in each of these groups use 6,250 bytes per track, the same track capacity as "double density" 5.25 inch diskettes, and also use 40 or 80 tracks per side to maintain file compatibility with 5.25 inch diskettes.

Another 3 inch microfloppy drive is now in production by BRG in Budapest, with export by Metrimpex, an Hungarian export organization. This drive uses a unique rigid plastic cartridge, with 45 tracks per side, and capacities up to 250 Kbytes.

Market status

DISK/TREND estimate of total market size:

Worldwide sales ($M)	1983	1984	1985	1986	1987
U.S. manufacturers	.5	7.4	35.1	127.3	303.4
All manufacturers	66.5	223.5	432.1	729.6	1,109.3

With the noise from the prolonged microfloppy standards battle now dying down, shipments of 3.5 inch drives are now increasing rapidly. DISK/TREND forecasts have been increased from previous years, in recognition of the rapid growth now underway. 1983 was the first big year for microfloppies, with 438,300 units worldwide. 1984 will be more than four times larger, with an estimated 1,959,000 units to be shipped worldwide.

There is no doubt that the Sony-type diskette is the mainstream standard on a worldwide basis. 12.5% of 1984 worldwide unit shipments were 3.0 inch drives of the Hitachi/Matsushita type, but most of these drives were used with systems in Japan -- achieving little penetration of the critical U.S. and European markets. Even in Japan, the 3.5 inch format is becoming dominant, with adoption for personal computers offered by many leading system manufacturers, including Fujitsu, NEC and IBM. Few two sided 3.5" drives were available in 1984, but they have been widely used with newly introduced systems in 1984, and are expected to constitute 20.9% of unit shipments for the year.

1983 non-captive shipments represented almost all activity for the year, and Sony was in a dominant position with 290,000 units shipped worldwide, for 68.7% of the total. Hitachi's shipments of 3.0 inch drives captured 22.2% of the worldwide total.

Marketing trends

The DISK/TREND projection of average annual growth for microfloppy worldwide unit shipments is 72.8% for the period 1984-1987. 9,711,200 drives are forecasted for worldwide shipment in 1987, dominated by two sided 3.5 inch drives, with 88.9% of the total.

The principal growth stimulus for 3.5 inch drives has been adoption for personal and portable computers by major system manufacturers. The early boost came from Hewlett-Packard in 1982, followed by Apple in early 1984, then IBM, Fujitsu, Data General and Texas Instruments later in the year. It is expected that usage will be concentrated in briefcase-size portable computers and small-footprint desktop systems intended for office applications, followed by heavy adoption for high-end home computers.

As in most other portions of the industry, the large-scale plans of IBM will be the single biggest influence on the microfloppy area. It is expected that IBM will introduce significant new small portable computers and other systems in mid-1985 using two sided 3.5 inch microfloppy drives. The firm has already started shipping the JX personal computer in the Japanese market, using 3.5 inch drives. IBM now has purchase arrangements with three Japanese microfloppy drive producers and is also expected to start internal production of similar drives by the end of 1985.

U.S. manufacturers of OEM floppy drives have gotten off to a slow start in microfloppies, and probably will not come even close to the

production volumes of Japanese producers during the next few years. Shugart is the only U.S. OEM drive manufacturer currently at significant production levels, with more than 20 Japanese manufacturers expected to be in production by early 1985.

Technical trends

Because of the current wave of adoptions of the existing microfloppy technology, radical changes for mainstream microfloppy formats during the next few years are unlikely. It is considered likely that perpendicular recording will be introduced in this format, perhaps within the next year. But the impact on shipments of existing drives will be slight, due to the major investment required to establish large scale media production facilities, plus the liklihood that no agreement will be reached on a common media standard.

The next major change for microfloppies will be an evolutionary one -- a standard for 1.6 megabyte 3.5 inch drives now being coordinated by Nippon Telephone and Telegraph. Several Japanese flexible disk drive manufacturers are involved in the program, which will probably result in introduction of the first drives in second quarter of 1985. These drives will retain the standard 135 TPI used with 3.5 inch drives, but will increase BPI to about 14,000, and will maintain complete logical compatibility with 1.6 megabyte 8 and 5.25 inch drives.

Forecasting assumptions

1. Two sided 3.5 inch drives will become the dominant microfloppy standard for portable, personal and home computers.

2. IBM will use two sided 3.5 inch microfloppy drives on a briefcase size portable and other computers starting in 1985.

TABLE 30

FLEXIBLE DISK DRIVES, MICROFLOPPIES

REVENUE SUMMARY

	DISK DRIVE REVENUES, BY SHIPMENT DESTINATION ($M)									
	1983		Forecast							
	Shipments		1984		1985		1986		1987	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM Captive	--	--	--	--	12.0	15.0	66.0	82.5	180.0	225.0
Other U.S. Captive	--	--	.5	.5	4.0	5.0	9.0	11.3	17.4	21.7
TOTAL U.S. CAPTIVE	--	--	.5	.5	16.0	20.0	75.0	93.8	197.4	246.7
PCM	--	--	--	--	--	--	--	--	--	--
OEM	.5	.5	6.4	6.9	12.8	15.1	26.8	33.5	42.5	56.7
TOTAL U.S. NON-CAPTIVE	.5	.5	6.4	6.9	12.8	15.1	26.8	33.5	42.5	56.7
TOTAL U.S. REVENUES	.5	.5	6.9	7.4	28.8	35.1	101.8	127.3	239.9	303.4
Non-U.S. Manufacturers										
Captive	.9	6.7	1.5	58.2	2.8	108.5	7.2	194.1	14.3	293.4
PCM	--	--	--	--	--	--	--	--	--	--
OEM	39.4	59.3	89.9	157.9	175.5	288.5	274.0	408.2	382.0	512.5
TOTAL NON-U.S. REVENUES	40.3	66.0	91.4	216.1	178.3	397.0	281.2	602.3	396.3	805.9
Worldwide Recap										
TOTAL WORLDWIDE REVENUES	40.8	66.5	98.3	223.5	207.1	432.1	383.0	729.6	636.2	1,109.3
OEM Average Price ($000)	.150	.142	.091	.092	.080	.081	.077	.077	.073	.073

TABLE 31

FLEXIBLE DISK DRIVES, MICROFLOPPIES

UNIT SHIPMENT SUMMARY

	DISK DRIVE UNIT SHIPMENTS, BY SHIPMENT DESTINATION (000)									
	1983		Forecast							
	Shipments		1984		1985		1986		1987	
	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW	U.S.	WW
U.S. Manufacturers										
IBM	--	--	--	--	40.0	50.0	240.0	300.0	720.0	900.0
Other U.S. Captive	--	--	1.0	1.0	9.6	12.0	22.8	28.5	47.2	59.0
TOTAL U.S. CAPTIVE	--	--	1.0	1.0	49.6	62.0	262.8	328.5	767.2	959.0
PCM	--	--	--	--	--	--	--	--	--	--
OEM	3.8	3.8	53.5	58.0	151.3	178.0	336.0	420.0	549.0	732.0
TOTAL U.S. NON-CAPTIVE	3.8	3.8	53.5	58.0	151.3	178.0	336.0	420.0	549.0	732.0
TOTAL U.S. SHIPMENTS	3.8	3.8	54.5	59.0	200.9	240.0	598.8	748.5	1,316.2	1,691.0
Non-U.S. Manufacturers										
Captive	2.0	16.0	4.0	162.0	8.6	328.9	22.5	605.2	46.4	956.2
PCM	--	--	--	--	--	--	--	--	--	--
OEM	262.8	418.5	1,006.2	1,738.0	2,213.3	3,589.3	3,590.5	5,320.8	5,277.0	7,064.0
TOTAL NON-U.S. SHIPMENTS	264.8	434.5	1,010.2	1,900.0	2,221.9	3,918.2	3,613.0	5,926.0	5,323.4	8,020.2
Worldwide Recap										
TOTAL WORLDWIDE SHIPMENTS	268.6	438.3	1,064.7	1,959.0	2,422.8	4,158.2	4,211.8	6,674.5	6,639.6	9,711.2
Cumulative Shipments										
IBM	--	--	--	--	40.0	50.0	280.0	350.0	1,000.0	1,250.0
Non-IBM	277.6	466.8	1,342.3	2,425.8	3,725.1	6,534.0	7,696.9	12,908.5	13,616.5	21,719.7
WORLDWIDE TOTAL	277.6	466.8	1,342.3	2,425.8	3,765.1	6,584.0	7,976.9	13,258.5	14,616.5	22,969.7

TABLE 32

FLEXIBLE DISK DRIVES, MICROFLOPPIES

WORLDWIDE SHIPMENTS (000)

BREAKDOWN BY DISK DIAMETER

	1983 Shipments			Forecast 1984			1985			1986			1987		
	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS
U.S. MANUFACTURERS															
IBM Captive	--	--	--	--	--	--	--	--	50.0	--	--	300.0	--	--	900.0
Other U.S. Captive	--	--	--	--	1.0	--	--	7.2	4.8	--	11.4	17.1	--	8.9	50.1
OEM	--	3.8	--	--	45.0	13.0	--	98.0	80.0	--	122.0	298.0	--	66.0	666.0
TOTAL U.S. SHIPMENTS	--	3.8	--	--	46.0	13.0	--	105.2	134.8	--	133.4	615.1	--	74.9	1,616.1
NON-U.S. MANUFACTURERS															
Captive	4.0	10.0	2.0	25.0	67.0	70.0	42.8	131.5	154.6	42.4	169.5	393.3	28.7	143.4	784.1
OEM	118.0	290.5	10.0	219.0	1,191.5	327.5	430.7	1,740.9	1,417.7	372.4	1,394.0	3,554.4	211.9	614.6	6,237.5
TOTAL NON-U.S. SHIPMENTS	122.0	300.5	12.0	244.0	1,258.5	397.5	473.5	1,872.4	1,572.3	414.8	1,563.5	3,947.7	240.6	758.0	7,021.6
WORLDWIDE RECAP															
Total Shipments	122.0	304.3	12.0	244.0	1,304.5	410.5	473.5	1,977.6	1,707.1	414.8	1,696.9	4,562.8	240.6	832.9	8,637.7
ANNUAL SHARE, BY DIAMETER	27.8%	69.4%	2.8%	12.5%	66.6%	20.9%	11.4%	47.6%	41.0%	6.2%	25.4%	68.4%	2.5%	8.6%	88.9%

TABLE 33

FLEXIBLE DISK DRIVES, MICROFLOPPIES

WORLDWIDE REVENUES

BREAKDOWN BY DISK DIAMETER

	1983 Revenues			Forecast											
				1984			1985			1986			1987		
	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS	3.0"	3.5" SS	3.5" DS
U.S. MANUFACTURERS															
IBM Captive	--	--	--	--	--	--	--	--	15.0	--	--	82.5	--	--	225.0
Other U.S. Captive	--	--	--	--	.5	--	--	3.0	2.0	--	4.4	6.9	--	3.2	18.5
OEM	--	.5	--	--	4.8	2.1	--	7.9	7.2	--	9.1	24.4	--	4.7	52.0
TOTAL U.S. REVENUES	--	.5	--	--	5.3	2.1	--	10.9	24.2	--	13.5	113.8	--	7.9	295.5
NON-U.S. MANUFACTURERS															
Captive	1.7	4.0	1.0	9.3	21.6	27.3	13.7	40.7	54.1	13.5	50.8	129.8	8.7	41.6	243.1
OEM	13.9	43.6	1.8	23.0	103.4	31.5	38.1	128.8	121.6	31.6	96.1	280.5	17.2	40.0	455.3
TOTAL NON-U.S. REVENUES	15.6	47.6	2.8	32.3	125.0	58.8	51.8	169.5	175.7	45.1	146.9	410.3	25.9	81.6	698.4
WORLDWIDE RECAP															
Total Revenues	15.6	48.1	2.8	32.3	130.3	60.9	51.8	180.4	199.9	45.1	160.4	524.1	25.9	89.5	993.9
ANNUAL SHARE, BY DIAMETER	23.5%	72.3%	4.2%	14.5%	58.3%	27.2%	12.0%	41.7%	46.3%	6.2%	22.0%	71.8%	2.3%	8.1%	89.6%

TABLE 34

FLEXIBLE DISK DRIVES, MICROFLOPPIES

DISTRIBUTION CHANNEL SUMMARY
U.S. Non-Captive Disk Drives

Distribution channel	1983 U.S. Net Shipments Units (000)	%	FORECAST 1984 %	1985 %	1986 %	1987 %
Mainframe computer manufacturers	--	--	--	19.1	24.3	26.2
Mini/micro computer manufacturers	191.2	71.7	24.2	25.4	23.1	21.1
System OEMs/systems houses	58.9	22.1	68.0	45.3	40.4	38.6
Independent peripherals suppliers	16.5	6.2	4.3	5.6	6.7	7.5
Distributors, dealers, end users	--	--	3.5	4.6	5.5	6.6
TOTAL	266.6					

TABLE 35

FLEXIBLE DISK DRIVES, MICROFLOPPIES

MARKET SHARE SUMMARY
Worldwide Shipments of Non-Captive Disk Drives

Drive Manufacturers	1983 Net Shipments To United States Destinations Units (000)	%	Worldwide Units (000)	%
SONY	255.0	95.7	290.0	68.7
HITACHI	7.5	2.8	94.0	22.2
OTHER U.S.	3.8	1.4	3.8	.9
OTHER NON-U.S.	.3	.1	34.5	8.2
	266.6	100.0	422.3	100.0

1984 DISK/TREND REPORT

FLEXIBLE DISK DRIVES, SPECIAL

Coverage

The flexible disk drives included in this group are:

Iomega	Alpha 10, Beta 5, PC-10, MAC-5
Mitsumi	Quick Disk
Sankyo Seiki	FMC-170, FMC-270
Tokyo Electric Company	MC-108, MC-116, MC-132, MC-164

The flexible disk drives in this group are analyzed separately, because the drives included are significantly different from those in other DISK/TREND product groups. The functional and physical characteristics of these products are varied, and will be individually discussed below. Specific shipment and revenue forecasts for products in this section have not been included in this DISK/TREND Report.

Special flexible disk drive products and markets

Iomega Alpha-10 and Beta-5

Iomega's drives use the Bernoulli effect to control head/disk spacing. These are high performance drives, using flexible disks in a removable rigid cartridge, and a sophisticated internal air flow system to maintain the proper position of the disk relative to the recording head. A voice coil rotary head positioning system, in conjunction with an embedded servo, provides average seek times of about 35-40 milliseconds.

Iomega announced the 8 inch Alpha-10 in May, 1981, and deliveries of production drives started in September, 1982. Both this drive and a later half high version have 10 MB formatted capacity, using 300 TPI and 18,000 FCI, and spins at 1,500 RPM. The 5.25 inch Beta-5 was first shipped in

August, 1983, and uses the standard SA 400 form factor for minifloppies. The drive offers 5.25 MB formatted capacity, with 394 TPI at 17,200 BPI, and maintains the 625 KByte/second transfer rate standard with most 5.25 Winchester drives, by using 1,964 RPM.

The capacity, performance, and pricing of Iomega's drives place them in competition with small Winchester disks and removable rigid disk cartridge drives, rather than in the existing flexible disk drive market. Iomega has attracted great interest in the industry, but orders from system manufacturers were slow in coming.

One difficulty lies in lack of credible alternate sources for the drive. The products are unique, and system manufacturers, as always, are reluctant to take a chance on a sole-source product from a new company. The first step was taken with a license to SCI Systems to manufacture Iomega's drives, but no specific plans to enter the OEM market as a second source have been announced. In 1984 a license was granted to Nippon Chemi-Con, a major Japanese manufacturer of electrolytic capacitors, to manufacture and market Iomega drives in Japan. Also, Verbatim has a license to make and sell Iomega media. Further development of alternate sources for drives and media is probably essential to establish major shipments of Iomega's OEM drive configurations.

Iomega has achieved much better success through its program to offer subsystems in the personal computer add-on market. Since the second half of 1983, an 8 inch subsystem sold through dealers to IBM PC users has been growing in sales volume. A 5.25 inch subsystem for the Apple Mackintosh market was added in fourth quarter of 1984. Iomega's subsystems have provided most of the firm's growth during the last year and will dominate the more than 40,000 drives the firm expects to ship during 1984.

Mitsumi Quick Disk
Sankyo Seiki FMC-170, FMC-270
Tokyo Electric Company MC-108, MC-116

All of these drives record in a single spiral track on a flexible disk ranging from 2.6 to 2.8 inches in diameter. The drives' physical size, interfaces and media are not compatible between drives from different manufacturers. Olivetti offered a similar drive, starting in 1977, but phased it out a few years ago. Olivetti's drive was used as a program loader and data storage medium on a variety of word processing and data processing equipment, but has been replaced with Olivetti's internally manufactured 5.25 inch floppy drives. The drive was offered as an OEM product for several years, without much market impact.

Sankyo Seiki's drive was introduced in 1980, and the newer Tokyo Electric drives were introduced in 1982. The most recent introduction is the Mitsumi "Quick Disk", which became available in early 1984. All of these drives are, like Olivetti's, intended to develop the market for very small, low priced serial recording devices in applications such as electronic typewriters, POS terminals, personal computers, and for other specialized systems. Most early shipments were in connection with Japanese produced electronic typewriters.

Mitsumi's Quick Disk may be the most ambitious product in this group. The target market is low cost home computers, where the intent is to provide a very low cost serial recording device with 64 Kbyte capacity which will be usable in quickly loading programs and user files into main system memory. The drive is designed to sell for less than $30 to system manufacturers, and several home computers intended for the Japanese market have already appeared with Quick Disk drives. Maxell offers the media, providing a credible source.

FLEXIBLE DISK DRIVE SPECIFICATIONS

1984 DISK/TREND REPORT

FLEXIBLE DISK DRIVE SPECIFICATIONS

Coverage

This listing includes most flexible disk drives now in new production or announced, arranged alphabetically by manufacturer. Most of the listed drives are still in production, but a number of IBM drives no longer in new production are listed for reference.

Specifications on drive models sold by computer system manufacturers but purchased on an OEM basis from others have been included in only a few cases. Also not listed in most cases are captive drives which are similar to OEM models made by the same manufacturer. In some cases, drives made by one drive manufacturer and resold by another drive manufacturer have been included for identification purposes.

Generic type

Because they are generally understood throughout the industry, IBM media designations are used to define types of 8 inch media; Shugart's media designations are used to define 5.25 inch media types, except high density diskettes; Sony media designations are used to define 3.5 inch media types. However, usage of these model numbers is not intended to imply interchangeability. Individual drives may require media with a variety of special characteristics.

Capacities

Capacities are listed as "U" for unformatted or "F" for formatted. All capacities are per spindle. For DISK/TREND purposes, one spindle consists of the disk drive mechanism required to utilize a single

flexible disk. Drives which use a single head positioning mechanism with two diskettes are considered to be two spindles.

OEM prices

The 500 unit price is given for most OEM flexible disk drives sold in the United States, except where larger quantity prices are indicated. Since these prices may be changed by manufacturers without notice, please use them with the appropriate caution.

Accuracy

All information has been cross checked for accuracy. However, it is anticipated that some errors may be included, since many manufacturers' published specifications do not cover all of the items listed, and numerous verbal inquiries were necessary. Your corrections will be most welcome and will be included in the next edition.

DISK/TREND product groups

In most cases the product groups used for individual drives are clear, but a few arbitrary decisions have been made. The IBM magazine drive has been included in the 8 inch, two sided group, since the magazine mechanism uses a single drive.

DISK/TREND PRODUCT GROUPS FOR FLEXIBLE DISK DRIVES

11. 8 inch, one side
12. 8 inch, two sides
13. 5.25 inch, one side
14. 5.25 inch, two sides
15. Microfloppies, one and two sides
16. Special flexible disk drives

MANUFACTURER	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC
DRIVE	FDD 2125	FDD 2745	FDL 212B	FDL 222B	FDV 113A
DISK/TREND GROUP	13	13	14	14	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 114	SA 154	SA 164	Sony OM-D3440
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	3.5"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250	U: .5	U: .5	U: 1.0	U: .250
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	1	1	2	2	1
Tracks per surface	40	80	40	80	40
Track density (TPI)	48	96	48	96	67.5
Maximum linear density (BPI)	5536	5576	5876	5922	8130
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING:Track to track(msec)	6 or 12	3	6	3	6
Settling time (msec)	15	15	15	15	15
Head load time(msec)	35	35	35	35	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	31.25	31.25
SIZE (Inches: H x W x D)	1.69 x 5.75 x 8.0	1.69 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.46 x 4.1 x 4.9
FIRST CUSTOMER SHIPMENT	2/80	9/83	1984	1984	9/84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC
DRIVE	FDD 2125	FDD 2745	FDL 212B	FDL 222B	FDV 113A
DISK/TREND GROUP	13	13	14	14	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 114	SA 154	SA 164	Sony OM-D3440
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	3.5"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250	U: .5	U: .5	U: 1.0	U: .250
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	1	1	2	2	1
Tracks per surface	40	80	40	80	40
Track density (TPI)	48	96	48	96	67.5
Maximum linear density (BPI)	5536	5576	5876	5922	8130
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING:Track to track(msec)	6 or 12	3	6	3	6
Settling time (msec)	15	15	15	15	15
Head load time(msec)	35	35	35	35	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	31.25	31.25
SIZE (Inches: H x W x D)	1.69 x 5.75 x 8.0	1.69 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.46 x 4.1 x 4.9
FIRST CUSTOMER SHIPMENT	2/80	9/83	1984	1984	9/84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

Save for Possible

MANUFACTURER	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC	ALPS ELECTRIC
DRIVE	FDV 123A	FDV 213A	FDV 223A	FDV 253A	FDV 263A
DISK/TREND GROUP	15	15	15	15	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440
Nominal disk diameter	3.5"	3.5"	3.5"	3.5"	3.5"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5	U: .5	U: 1.0	U: .5	U: 1.0
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	2	1	2	1	2
Tracks per surface	40	80	80	80	80
Track density (TPI)	67.5	135	135	135	135
Maximum linear density (BPI)	8650	8190	8720	8190	8720
Rotational speed (RPM)	300	300	300	600	600
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING:Track to track(msec)	6	6	6	6	6
Settling time (msec)	15	15	15	15	15
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	50	50
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	62.5	62.5
SIZE (Inches: H x W x D)	1.46 x 4.1 x 4.9	1.46 x 4.1 x 4.9	1.46 x 4.1 x 4.9	1.46 x 4.1 x 4.9	1.46 x 4.1 x 4.9
FIRST CUSTOMER SHIPMENT	9/84	6/84	5/84	6/84	5/84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	AMLYN	AU PERIPHERAL PRODUCTS	BASF	BASF	BASF
DRIVE	1865	AP-300S	6102	6104	6106
DISK/TREND GROUP	14	15	11	12	13
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	High density	Sony OM-D3440	BASF 601 Diskette 1	Diskette 1,2,2D	BASF 606 SA 104
Nominal disk diameter	5.25"	3.5"	8"	8"	5.25"
Recording medium	High density, oxide coated	High Density Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 3.2	U: .250/.5	U: .401/.802	U: .8/1.6	U: .125/.250
Capacity per track (Bytes)	U: 10,416	U: 3,125/6,250	U: 5,208/10,416	U: 5,208/10,416	U: 3,125/6,250
Data surfaces per spindle	2	1	1	2	1
Tracks per surface	154	80	77	77	40
Track density (TPI)	170	135	48	48	48
Maximum linear density (BPI)	10250	4102/8204	3268/6536	3406/6816	2768/5536
Rotational speed (RPM)	360	300	360	360	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Cam, Stepping Motor
POSITIONING:Track to track(msec)	2	6	6	3	6
Settling time (msec)	25	15	14	14	15
Head load time(msec)	Continuous contact	Continuous Contact	40	40	Continuous Contact
Average rotational delay (msec)	83	100	83.3	83.3	100
Data transfer rate (KBytes/sec)	62.5	31.25	31.25/62.5	31.25/62.5	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 4.0 x 6.0	4.33 x 8.66 x 14.17	4.33 x 8.66 x 14.17	2.1 x 5.75 x 7.5
FIRST CUSTOMER SHIPMENT	7/84	4Q84	1976	1978	3Q78
U.S. OEM PRICE FOR 500 UNITS	$330	$150	--	--	--
COMMENTS					

MANUFACTURER	BASF	BASF	BASF	BASF	BASF
DRIVE	6108	6118	6128	6138	6148
DISK/TREND GROUP	14	14	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	BASF 606 SA 154	SA 164	SA154	SA164	Maxell MD2-HD
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .250/.5	U: .5/1.0	U: .8/1.6
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	40	80	40	80	80/77
Track density (TPI)	48	96	48	96	96
Maximum linear density (BPI)	2938/5876	2961/5922	2938/5876	2961/5922	4823/9646
Rotational speed (RPM)	300	300	300	300	360
PERFORMANCE					
Actuator type	Cam, Stepping Motor	Cam, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	6	6	6	3	3
Settling time (msec)	15	15	20	20	20
Head load time(msec)	Continuous Contact	Continuous Contact	25	25	25
Average rotational delay (msec)	100	100	100	100	83.3
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	31.25/62.5
SIZE (Inches: H x W x D)	2.1 x 5.75 x 7.5	2.1 x 5.75 x 7.5	1.28 x 5.75 x 8.5	1.28 x 5.75 x 8.5	1.28 x 5.75 x 8.5
FIRST CUSTOMER SHIPMENT	4Q78	1982	1983	1983	4Q84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS			Manufactured by Canon	Manufactured by Canon 6238 is dual drive version	Manufactured by Canon

MANUFACTURER	BASF	BASF	BASF	BASF	BURROUGHS
DRIVE	6161	6162	6163	6164	9489-11 9489-12
DISK/TREND GROUP	15	15	15	15	12
MARKET	OEM	OEM	OEM	OEM	Captive
MEDIA: Generic type	Sony OM-D3440	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440	Special
Nominal disk diameter	3.5"	3.5"	3.5"	3.5"	8"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .250/.5	U: .250/.5	U: .5/1.0	F: 1.014
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	F: 5,760
Data surfaces per spindle	1	2	1	2	2
Tracks per surface	40	40	80	80	88
Track density (TPI)	67.5	67.5	135	135	64
Maximum linear density (BPI)	4064/8128	4325/8650	4094/8188	4359/8718	4775
Rotational speed (RPM)	300	300	300	300	365
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Linear, Voice Coil
POSITIONING: Track to track(msec)	3	3	3	3	5
Settling time (msec)	20	20	20	20	50
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	85
Average rotational delay (msec)	100	100	100	100	82
Data transfer rate (KBytes/sec)	15.625/31.25	15.625/31.25	15.625/31.25	15.625/31.25	50
SIZE (Inches: H x W x D)	1.26 x 4.13 x 6.06	1.26 x 4.13 x 6.06	1.26 x 4.13 x 6.06	1.26 x 4.13 x 6.06	
FIRST CUSTOMER SHIPMENT					4Q76
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					9489-12 is dual version

MANUFACTURER	BURROUGHS	CALDISK	CALDISK	CALDISK	CANON
DRIVE	9489-21 9489-23	142M 842D	143M1	143M	MDD 6106
DISK/TREND GROUP	12	11	11	12	13
MARKET	Captive	OEM, Captive	OEM, Captive	OEM, Captive	OEM
MEDIA: Generic type	Special	Diskette 1	Diskette 1	Diskette 1,2,2D	SA 104
Nominal disk diameter	8"	8"	8"	8"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	F: 3.016	U: .401/.802	U: .401/.802	U: .8/1.6	U: .125/.250
Capacity per track (Bytes)	F: 10,620	U: 5,208/10,416	U: 5,208/10,416	U: 5,208/10,416	U: 3,125/6,250
Data surfaces per spindle	2	1	1	2	1
Tracks per surface	142	77	77	77	40
Track density (TPI)	150	48	48	48	48
Maximum linear density (BPI)	7040	3268/6536	3268/6536	3408/6816	2768/5536
Rotational speed (RPM)	524	360	360	360	300
PERFORMANCE					
Actuator type	Linear, Voice Coil	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Cam, Stepping Motor
POSITIONING:Track to track(msec)	40 (including settling)	6	6	6	12
Settling time (msec)	--	10	10	10	48
Head load time(msec)	--	30	30	30	35
Average rotational delay (msec)	57.25	83.3	83.3	83.3	100
Data transfer rate (KBytes/sec)	125	31.25/62.5	31.25/62.5	31.25/62.5	15.63/31.25
SIZE (Inches: H x W x D)	10.0 x 5.5 x 20.5	4.9 x 8.4 x 15.0	4.9 x 8.4 x 15.0	4.9 x 8.4 x 15.0	2.1 x 5.75 x 7.74
FIRST CUSTOMER SHIPMENT	3Q80	1/77	1/77	8/77	3/79
U.S. OEM PRICE FOR 500 UNITS	--	$420	$427	$505	--
COMMENTS	Dual drive, single head positioning system				

MANUFACTURER	CANON	CANON	CANON	CANON	CANON
DRIVE	520	521	MDD 210	MDD 211	MDD 220
DISK/TREND GROUP	14	14	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM, Captive
MEDIA: Generic type	SA 164	SA 154	SA 154	SA 154	SA 164
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.0	U: .5	U: .250/.5	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	80	40	40	40	80
Track density (TPI)	96	48	48	48	96
Maximum linear density (BPI)	5922	5876	2938/5876	2938/5876	2961/5922
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Belt, Stepping Motor	Belt, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	6	6	6	3
Settling time (msec)	20	20	30	20	15
Head load time(msec)	Continuous Contact	Continuous Contact	30	25	25
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	31.25	31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.2 x 5.75 . 8.0	1.2 x 5.75 . 8.0	2.26 x 5.75 x 7.7	1.28 x 5.75 x 8.5	2.26 x 5.75 x 7.74
FIRST CUSTOMER SHIPMENT	1984	1984	10/82	5/83	4/82
U.S. OEM PRICE FOR 500 UNITS	--	--	--	$126	--
COMMENTS					

MANUFACTURER	CANON	CANON	CANON	CANON	CANON
DRIVE	MDD 221	MDD 413	MDD 423	MDD 516A	MDD 6108
DISK/TREND GROUP	14	14	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM, Captive
MEDIA: Generic type	SA 164	SA 154	SA 164	Maxell MD2-HD	SA 154
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5/1.0	U: .250/.5	U: .5/1.0	U: .8/1.6	U: .250/.5
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	80	40	80	77	40
Track density (TPI)	96	48	96	96	48
Maximum linear density (BPI)	2961/5922	2938/5876	2961/5922	4823/9646	2768/5536
Rotational speed (RPM)	300	300	300	360	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Cam, Stepping Motor
POSITIONING:Track to track(msec)	3	6	3	3	12
Settling time (msec)	15	20	20	20	48
Head load time(msec)	25	25	25	25	35
Average rotational delay (msec)	100	100	100	83.3	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	31.25/62.5	15.63/31.25
SIZE (Inches: H x W x D)	1.28 x 5.75 x 8.5	2.26 x 5.75 x 8.5	2.26 x 5.75 x 8.5	1.28 x 5.75 x 8.5	2.1 x 5.75 x 7.74
FIRST CUSTOMER SHIPMENT	4/83	2/84	6/83	10/84	1/80
U.S. OEM PRICE FOR 500 UNITS	$146	$226	$252	$175	--
COMMENTS		Dual drive	Dual drive		

MANUFACTURER	CANON	CANON	CANON	CANON	CHINON
DRIVE	MDD 350	MDD 351	MDD 352	MDD 353	F-051D
DISK/TREND GROUP	15	15	15	15	13
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440	Sony OM-D3440	SA 104
Nominal disk diameter	3.5"	3.5"	3.5"	3.5"	5.25"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5/1.0	U: .250/.5	U: .250/.5	U: .125/.250	U: .125/.250
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	1	2	1	1
Tracks per surface	80	80	40	40	40
Track density (TPI)	135	135	67.5	67.5	48
Maximum linear density (BPI)	4359/8717	4094/8187	4324/8647	4063/8126	2768/5536
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	6	6	6
Settling time (msec)	20	20	20	20	20
Head load time(msec)	25	25	25	25	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.18 x 4.0 x 5.9	1.18 x 4.0 x 5.9	1.18 x 4.0 x 5.9	1.18 x 4.0 x 5.9	1.625 x 5.75 x 8.7
FIRST CUSTOMER SHIPMENT	11/84	11/84	11/84	11/84	1984
U.S. OEM PRICE FOR 500 UNITS	$121 (1000)	$110 (1000)	$113 (1000)	$101 (1000)	--
COMMENTS					

MANUFACTURER	CHINON	CHINON	CHINON	CHINON	CHINON
DRIVE	F-502	F-504	F-301	F-351	F-353
DISK/TREND GROUP	14	14	15	15	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 164	Maxell Compact Floppy Disk	SONY OM-D3440	SONY OM-D3440
Nominal disk diameter	5.25"	5.25"	3.0	3.5	3.5
Recording medium	Oxide Coated	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .125/.250	U: .125/.250	U: .250/.5
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	1	1	1
Tracks per surface	40	80	40	40	80
Track density (TPI)	48	96	100	67.5	135
Maximum linear density (BPI)	2938/5876	2961/5922	4473/8946	4062/8125	4093/8187
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	6	3	3	6	3
Settling time (msec)	20	20	20	20	20
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.7	1.625 x 5.75 x 8.7	1.625 x 3.5 x 5.9	1.26 x 4.0 x 6.38	1.26 x 4.0 x 6.38
FIRST CUSTOMER SHIPMENT	1984	1984	1984	1984	1984
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	CHINON	CITIZEN	CITIZEN	CITIZEN	CITIZEN
DRIVE	F-354	OMDT-20A	OMDT-30A	ONDT-40A	ONDT-50A
DISK/TREND GROUP	15	15	15	15	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D4440	SONY OM-D3440	SONY OM-D4440	SONY OM-D3440	SONY OM-D4440
Nominal disk diameter	3.5"	3.5"	3.5"	3.5"	3.5"
Recording medium	High Density Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5/1.0	U: .250/.5	U: .5/1.0	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	1	2	1	2
Tracks per surface	80	80	80	80	80
Track density (TPI)	135	135	135	135	135
Maximum linear density (BPI)	4359/8717	4094/8188	4359/8718	4094/8188	4359/8718
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	3	3	3
Settling time (msec)	20	15	15	15	15
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.26 x 4.0 x 6.38	1.0 x 3.9 x 5.2	1.0 x 3.9 x 5.2	1.0 x 4.0 x 5.2	1.0 x 4.0 x 5.2
FIRST CUSTOMER SHIPMENT	1984	3Q84	3Q84	1Q85	1Q85
U.S. OEM PRICE FOR 500 UNITS	--	$200	$245	$187	$207
COMMENTS		Top Loading	Top Loading	Front Loading	Front Loading

MANUFACTURER	CONTROL DATA	CONTROL DATA	CONTROL DATA	CONTROL DATA	CONTROL DATA
DRIVE	9404B	210-10	9406-4	9408	409
DISK/TREND GROUP	11	12	12	13	14
MARKET	OEM	PCM	OEM	OEM	PCM
MEDIA: Generic type	CDC 9821/9823 Diskette 1	CDC 9821/315 Diskette 1,2,2D	CDC 9825 Diskette 1,2,2D	SA 104	SA 154
Nominal disk diameter	8"	8"	8"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft	Soft/Hard	Soft/Hard	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .401/.802	F: .606208	U: .8/1.6	U: .125/.250	F: .320/.360
Capacity per track (Bytes)	U: 5,208/10,416	F: 4,096	U: 5,208/10,416	U: 3,125/6,250	F: 4,096/4,608
Data surfaces per spindle	1	2	2	1	2
Tracks per surface	77	74/3	77	40	40
Track density (TPI)	48	48	48	48	48
Maximum linear density (BPI)	3268/6536	3408/6816	3408/6816	2768/5536	5876
Rotational speed (RPM)	360	360	360	300	300
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	10	3	3	5	5
Settling time (msec)	15	20	15	15	15
Head load time(msec)	60	40	35	50	50
Average rotational delay (msec)	83.3	83.3	83.3	100	100
Data transfer rate (KBytes/sec)	31.25/62.5	31.25/62.5	31.25/62.5	15.63/31.25	31.25
SIZE (Inches: H x W x D)	4.97 x 8.78 x 14.0	4.97 x 8.78 x 14.0	4.65 x 8.55 x 14.0	3.38 x 5.88 x 8.0	3.38 x 5.88 x 8.0
FIRST CUSTOMER SHIPMENT	2Q79	1/79	1981	3/80	4Q83
U.S. OEM PRICE FOR 500 UNITS	$375	--	$510	$190 (1000)	--
COMMENTS		Series/1 interface	Shugart interface		

MANUFACTURER	CONTROL DATA	CONTROL DATA	CONTROL DATA	CONTROL DATA	COPAL
DRIVE	9409	9409-T	9428	9429	F-3501
DISK/TREND GROUP	14	14	14	14	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 164	SA 154	SA 164	Sony OM-D3440
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	3.5"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .250/.5	U: .5/1.0	U: .125/.250
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	1
Tracks per surface	40	80	40	80	40
Track density (TPI)	48	96	48	96	67.5
Maximum linear density (BPI)	2938/5876	2961/5922	2938/5876	2961/5922	4063/8126
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Cam, Stepping Motor
POSITIONING:Track to track(msec)	5	5	5	3	12
Settling time (msec)	15	15	15	15	15
Head load time(msec)	50	50	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.625/31.25	15.625/31.25	15.63/31.25
SIZE (Inches: H x W x D)	3.38 x 5.88 x 8.0	3.38 x 5.88 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.26 x 4.0 x 5.827
FIRST CUSTOMER SHIPMENT	1980	1981	11/83	12/83	2Q85
U.S. OEM PRICE FOR 500 UNITS	$196 (1000)	$225 (1000)	$165 (1000)	$195 (1000)	--
COMMENTS					

MANUFACTURER	COPAL	COPAL	COPAL	DATA TRACK TECHNOLOGY	DATA TRACK TECHNOLOGY
DRIVE	F-3502	F-3503	F-3504	Tracker 1.0	Tracker 2.0
DISK/TREND GROUP	15	15	15	13	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440	SA 114	SA 164
Nominal disk diameter	3.5"	3.5"	3.5"	5.25"	5.25"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.500	U: .250/.500	U: .500/1.0	Per Diskette: U: .5 Per Drive: U: 1.0	Per Diskette: U: 1.0 Per Drive: U: 2.0
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 6,250	U: 6,250
Data surfaces per spindle	2	1	2	1	2
Tracks per surface	40	80	80	80	80
Track density (TPI)	67.5	135	135	96	96
Maximum linear density (BPI)	4324/8648	4094/8187	4359/8717	5922	5922
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Cam, Stepping Motor	Cam, Stepping Motor	Cam, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	12	3	3	3	3
Settling time (msec)	15	15	15	15	15
Head load time (msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	31.25	31.25
SIZE (Inches: H x W x D)	1.26 x 4.0 x 5.827	1.26 x 4.0 x 6.063	1.26 x 4.0 x 6.063	3.25 x 5.75 x 8.0	3.25 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	2Q85	2Q85	2Q85	3Q83	3Q83
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS				Dual drive with single head positioning system	Dual drive with single head positioning system

MANUFACTURER	DIGITAL EQUIPMENT CORPORATION	DIGITAL EQUIPMENT CORPORATION	DIGITAL EQUIPMENT CORPORATION	DRIVETEC	EASTMAN KODAK
DRIVE	RX01	RX02	RX50	320	KODAK 3.3
DISK/TREND GROUP	11	11	13	14	14
MARKET	Captive	Captive	Captive	OEM	OEM, Captive
MEDIA: Generic type	RX01K Diskette 1	RX01K Diskette 1	SA 114	High density	High density
Nominal disk diameter	8"	8"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	High density, oxide coated	High density, oxide coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY			Per Diskette: U: 409 Per Drive:		
Total capacity (MBytes)	F: .256	F: .256/.512	U: 818	U: 3.33	U: 3.33
Capacity per track (Bytes)	F: 3,328	F: 3,328/6,656	F: 5,120	U: 10,416	U: 10,416
Data surfaces per spindle	1	1	1 per diskette 2 per drive	2	2
Tracks per surface	77	77	80	160	160
Track density (TPI)	48	48	96	192	192
Maximum linear density (BPI)	3268	3268/6536	5536	9908	9908
Rotational speed (RPM)	360	360	300	360	360
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Cam, Stepping Motor	Lead screw/dual stepping motors	Lead screw/dual stepping motors
POSITIONING:Track to track(msec)	6	6	6	3	3
Settling time (msec)	20	20		15	15
Head load time(msec)	16	16		Continuous contact	Continuous contact
Average rotational delay (msec)	83.3	83.3	100	83	83
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	62.5	62.5
SIZE (Inches: H x W x D)	17 x 10.5 x 19	17 x 10.5 x 19	3.25 x 5.75 x 8.5	1.625 x 5.75 x 8.5	1.625 x 5.75 x 8.5
FIRST CUSTOMER SHIPMENT	1976	4Q78	4Q82	6/83	1Q84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	$290 (1000)	$340 (1000)
COMMENTS	Dual drive	Dual drive	Dual drive with single head positioning system	Embedded servo	Embedded servo. Manufactured under Drivetec license; sold by Data Technology Corp.

MANUFACTURER	ELCOMATIC	ELCOMATIC	ELCOMATIC	ELCOMATIC	ELCOMATIC
DRIVE	ACP 500 ACP 550	ACP 700 ACP 750	ACP 1500	ACP548-25	ACP596-05
DISK/TREND GROUP	11	12	12	13	13
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Diskette 1,2,2D	Diskette 1,2,2D	--	SA 104	SA 114
Nominal disk diameter	8"	8"	8"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .401/.802	U: .8/1.6	U: 1.6/3.2	U: .250	U: .5
Capacity per track (Bytes)	U: 5,208/10,416	U: 5,208/10,416	U: 10,416	U: 6,250	U: 6,250
Data surfaces per spindle	1	2	2	1	1
Tracks per surface	77	77	154	40	80
Track density (TPI)	48	48	96	48	96
Maximum linear density (BPI)	3268/6536	3408/6816	3408/6816	5536	5576
Rotational speed (RPM)	360	360	360	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	1.5	6	3
Settling time (msec)	15	15	32	15	15
Head load time(msec)	35	35	35	Continuous Contact	Continuous Contact
Average rotational delay (msec)	83.3	83.3	83.3	100	100
Data transfer rate (KBytes/sec)	31.25/62.5	31.25/62.5	31.25/62.5	31.25	31.25
SIZE (Inches: H x W x D)	4.35 x 8.55 x 12.0	4.35 x 8.55 x 12.0	4.35 x 8.55 x 12.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	4Q81	4Q81	1983	1984	1984
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	ACP 500: AC ACP 550: DC	ACP 700: AC ACP 750: DC			

MANUFACTURER	ELCOMATIC	ELCOMATIC	ELCOMATIC	ELCOMATIC	EPSON
DRIVE	ACP596-08	ACP548-50	ACP596-10	ACP596-16	SD-320
DISK/TREND GROUP	13	14	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Maxell MD2-HD	SA 154	SA 164	Maxell MD2-HD	SA 154
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	High Density Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated	Oxide Coated
Sectoring	Soft	Soft/Hard	Soft/Hard	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8	U: .5	U: 1.0	U: 1.6	U: .250/.5
Capacity per track (Bytes)	U: 10,416	U: 6,250	U: 6,250	U: 10,416	U: 3,125/6,250
Data surfaces per spindle	1	2	2	2	2
Tracks per surface	77	40	80	77	40
Track density (TPI)	96	48	96	96	48
Maximum linear density (BPI)	4823	5876	5922	9646	2938/5876
Rotational speed (RPM)	360	300	300	360	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Linear, Voice Coil
POSITIONING:Track to track(msec)	3	6	3	3	15
Settling time (msec)	15	15	15	15	15
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	35
Average rotational delay (msec)	83.3	100	100	83.3	100
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	62.5	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.1 x 5.75 x 9.27
FIRST CUSTOMER SHIPMENT	1984	1984	1984	1984	10/83
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	$130 (1000)
COMMENTS					

MANUFACTURER	EPSON	EPSON	EPSON	EPSON	EPSON
DRIVE	SD-321	SD-521	SD-540	SD-560	SD-580
DISK/TREND GROUP	14	14	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 154	SA 164	Maxell MD2-HD	Maxell MD2-HD
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .250/.5	U: .5/1.0	U: .8/1.6	U: 1.0/1.6
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6250	U: 3,125/6250	U: 5,208/10,416	U: 6,250/10,416
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	40	40	80	77	80/77
Track density (TPI)	48	48	96	96	96
Maximum linear density (BPI)	2938/5876	2938/5876	2938/5876	4823/9646	5922/9646
Rotational speed (RPM)	300	300	300	360	300/360
PERFORMANCE					
Actuator type	Linear, Voice Coil	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	15	6	3	3	3
Settling time (msec)	15	15	15	15	15
Head load time (msec)	Continuous Contact	Continuous Contact	35	35	50
Average rotational delay (msec)	100	100	100	83.3	100/83.3
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	1.1 x 5.75 x 9.27	1.625 x 5.75 x 7.7	1.625 x 5.75 x 7.7	1.625 x 5.75 x 7.7	1.625 x 5.75 x 7.7
FIRST CUSTOMER SHIPMENT	10/83	10/83	10/83	10/83	1Q85
U.S. OEM PRICE FOR 500 UNITS	$130 (1000)	$130 (1000)	$150 (1000)	$170 (1000)	$120 (1000)
COMMENTS					

MANUFACTURER	EPSON	EPSON	EPSON	EPSON	EPSON
DRIVE	TF-20	SMD-110 SMD-150	SMD-120 SMD-160	SMD-130 SMD-170	SMD-140 SMD-180
DISK/TREND GROUP	14	15	15	15	15
MARKET	Captive, PCM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	Sony OM-D3440	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440
Nominal disk diameter	5.25"	3.5"	3.5"	3.5"	3.5"
Recording medium	Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated
Sectoring	Soft/Hard	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5 F: .164/.328	U: .125/.250	U: .250/.5	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	F: 4,100	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	1	2	1	2
Tracks per surface	40	40	40	80	80
Track density (TPI)	48	67.5	67.5	135	135
Maximum linear density (BPI)	2990/5980	4064/8128	4325/8650	4095/8190	4360/8720
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Linear, Voice Coil	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	15	6	6	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	20	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	3.15 x 6.5 x 13.78*	1.57 x 4 x 5.8	1.57 x 4 x 5.8	1.57 x 4 x 5.8	1.57 x 4 x 5.8
FIRST CUSTOMER SHIPMENT	9/82	10/83	10/83	10/83	10/83
U.S. OEM PRICE FOR 500 UNITS	--	$100/105 (1000)	$110/115 (1000)	$120/125 (1000)	$130/135 (1000)
COMMENTS	*Dual drive subsystem	SMD-150 is low power model (2.9 watts, operating)	SMD-160 is low power model (2.9 watts, operating)	SMD-170 is low power model (2.9 watts, operating)	SMD-180 is low power model (2.9 watts, operating)

MANUFACTURER	FUJITSU	HI-TECH PERIPHERALS	HI-TECH PERIPHERALS	HI-TECH PERIPHERALS	HI-TECH PERIPHERALS
DRIVE	M3652A	H596-05	H548-50 H548-50LS	H596-10	H596-16 H596-16AT
DISK/TREND GROUP	14	13	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Maxell MD2-HD	SA 114	SA 154	SA 164	Maxell MD2-HD
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	High Density Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density, Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .250/.5	U: .250/.5	U: .5/1.0	U: .8/1.6
Capacity per track (Bytes)	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416
Data surfaces per spindle	2	1	2	2	2
Tracks per surface	77	80	40	80	77
Track density (TPI)	96	96	48	96	96
Maximum linear density (BPI)	4823/9646	2788/5576	2938/5876	2961/5922	4823/9646
Rotational speed (RPM)	360	300	300	300	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	3	3	6	3	3
Settling time (msec)	15	15	15	15	15
Head load time (msec)	50	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	83.3	100	100	100	83.3
Data transfer rate (KBytes/sec)	31.25/62.5	15.63/31.25	15.63/31.25	15.63/31.25	31.25/62.5
SIZE (Inches: H x W x D)	1.625 x 5.8 x 8.1	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	7/84	8/83	8/83	8/83	8/83
U.S. OEM PRICE FOR 500 UNITS	--	$140	$120	$140	$195
COMMENTS					

MANUFACTURER	HITACHI	HITACHI	HITACHI	HITACHI	HITACHI
DRIVE	FDD-412 FDD-413B	FDD-441	FDD 541	HFD 505C	HFD 510C
DISK/TREND GROUP	12	12	14	14	14
MARKET	Captive, OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Diskette 1,2,2D	Maxell FD2-HD	Maxell MD2-EH	SA 154	SA 164
Nominal disk diameter	8"	8"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	High Density Oxide Coated	High Density, Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: 9.6	U: 6.5	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 5,208/10,416	U: 31,250	U: 31,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	77	154	104	40	80
Track density (TPI)	48	96	125	48	96
Maximum linear density (BPI)	3408/6816	20560*	29560	2938/5876	2961/5922
Rotational speed (RPM)	360	360	720	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	2	2	3	3
Settling time (msec)	35	15	37	15	15
Head load time(msec)	50	Continuous Contact	Continuous Contact	50	50
Average rotational delay (msec)	83.3	83.3	41.7	100	100
Data transfer rate (KBytes/sec)	31.25/62.5	187.5	375	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	2.24 x 8.54 x 13.0	2.24 x 8.54 x 12.9	1.625 X 5.75 X 8.6	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	2/82	2/84	1Q85	9/82	4Q83
U.S. OEM PRICE FOR 500 UNITS	--	--	$425	--	--
COMMENTS		*Uses 2,7 RLL Code			

MANUFACTURER	HITACHI	HITACHI	HITACHI	IBM	IBM
DRIVE	HFD 516C	HFD 305SX	HFD 305D	3470 Series 3770 Series 3790 Series 3601/3602 (33 FD Drive)	5265-A1X 5265-A2X 5265-B1X 5265-B2X
DISK/TREND GROUP	14	15	15	11	11
MARKET	OEM	OEM	OEM	Captive	Captive
MEDIA: Generic type	Maxell MD2-HD	Maxell Compact Floppy Disk	Maxell Compact Floppy Disk	Diskette 1	Diskette 1
Nominal disk diameter	5.25"	3"	3"	8"	8"
Recording medium	Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .125/.250	U: .250/.5	F: .242944	F: .246272
Capacity per track (Bytes)	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250	F: 3,328	F: 3,328
Data surfaces per spindle	2	1	2	1	1
Tracks per surface	77	40	40	74/3	74/3
Track density (TPI)	96	100	100	48	48
Maximum linear density (BPI)	4823/9646	4473/8946	4915/9830	3268	3268
Rotational speed (RPM)	360	300	300	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING: Track to track(msec)	3	3	3	50	50
Settling time (msec)	15	15	15	20	20
Head load time(msec)	50	Continuous Contact	Continuous Contact	80	80
Average rotational delay (msec)	83.3	100	100	83.3	83.3
Data transfer rate (KBytes/sec)	31.25/62.5	15.63/31.25	15.63/31.25	31.25	31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.57 x 3.54 x 5.83	1.57 x 3.54 x 5.83	--	--
FIRST CUSTOMER SHIPMENT	4/83	10/82	4Q83	1/75	--
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					5265 point of sale terminal

MANUFACTURER	IBM	IBM	IBM	IBM	IBM
DRIVE	5281-Z01/2/6 5282-Z01/2/6 5285-X01/2/6 5286-X02 5286-XXX	System/32 (33 FD Drive)	3601-2B/3B 3602-1A/1B 3631/3632 (43 FD Drive)	4701-1	4701-2
DISK/TREND GROUP	11	11	12	12	12
MARKET	Captive	Captive	Captive	Captive	Captive
MEDIA: Generic type	Diskette 1	Diskette 1	Diskette 1, 2	Diskette 1, 2	Diskette 1,2,2D
Nominal disk diameter	8"	8"	8"	8"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	F: .246272 or F: .284160 or F: .303104	F: .246272 or F: .303104	F: .492544 or F: .568320	F: .568320	F: .985088
Capacity per track (Bytes)	F: 3,328/3,840/ 4,096	F: 3,328/4,096	F: 3,328/3,840	F: 3,840	F: 6,656
Data surfaces per spindle	1	1	2	2	2
Tracks per surface	74/3	74/3	74/3	74/3	74/3
Track density (TPI)	48	48	48	48	48
Maximum linear density (BPI)	3268	3268	3408	3408/6816	3408/6816
Rotational speed (RPM)	360	360	360	360	360
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	50	50	5	5	5
Settling time (msec)	20	20	35	35	35
Head load time(msec)	80	80			
Average rotational delay (msec)	83.3	83.3	83.3	83.3	83.3
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	--	--	--	--	--
FIRST CUSTOMER SHIPMENT	10/80	1/75	1976 (3601/2)	1982	1982
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	5280 terminal system		3600 finance communication controller	4701 finance communication controller	4701 finance communication controller

MANUFACTURER	IBM	IBM	IBM	IBM	IBM
DRIVE	4964 (43 FD Drive)	4965	4966 (Magazine Drive)	5114 (43 FD Drive)	5120
DISK/TREND GROUP	12	12	12	12	12
MARKET	Captive	Captive	Captive	Captive	Captive
MEDIA: Generic type	Diskette 1, 2	Diskette 1,2,2D	Diskette 1,2,2D	Diskette 1,2,2D	Diskette 1,2,2D
Nominal disk diameter	8"	8"	8"	8"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	F: .492544 or F: .568320 or F: .606208	F: .985088 or F: 1.136640 or F: 1.212416	F: .985088 or F: 1.136640 or F: 1.212416	F: .303104 or F: .606208 or F: 1.212416	F: .303104 or F: .606208 or F: 1.212416
Capacity per track (Bytes)	F: 3,328/3,840/ 4,096	F: 6,656/7,680/ 8,192	F: 6,656/7,680/ 8,192	F: 4,096/8,192	F: 4,096/8,192
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	74/3	74/3	74/3	74/3	74/3
Track density (TPI)	48	48	48	48	48
Maximum linear density (BPI)	3408	3408/6816	3408/6816	3408/6816	3408/6816
Rotational speed (RPM)	360	360	720	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	5	5	5	5	5
Settling time (msec)	35	35	35	35	35
Head load time (msec)					
Average rotational delay (msec)	83.3	83.3	41.7	83.3	83.3
Data transfer rate (KBytes/sec)	31.25	31.25/62.5	62.5/125	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	--	--	--	--	--
FIRST CUSTOMER SHIPMENT	11/76	8/81	2/79	2/78	2/80
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	Similar drive included with some 4962 models Series/1	Similar drive included with 4952 Model C Series 1	Capacity is 2 10-diskette magazines and 3 diskettes Series 1	Add-on drive for 5110, 5120 desktop computers	Uses "Trim" drive, with smaller dimensions

MANUFACTURER	IBM	IBM	IBM	IBM	IBM
DRIVE	5246	5265-X3X 5265-X4X 5265-X5X 5265-X6X 5265-X7X	5281-Z05/6/10 5281-Z05/6/10 5285-X05/6/10 5286-X10 5288-XXX	5322	5525-020 5525-030 5525-040
DISK/TREND GROUP	12	12	12	12	12
MARKET	Captive	Captive	Captive	Captive	Captive
MEDIA: Generic type	Diskette 1,2,2D	Diskette 2D	Diskette 1,2,2D	Diskette 1,2,2D	Diskette 2D
Nominal disk diameter	8"	8"	8"	8"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	F: .303104 or F: 1.136640	F: .985088	F: .985088 or F: 1.136640 or F: 1.212416	F: .303104 or F: 1.136640	F: 1.212416
Capacity per track (Bytes)	F: 4,096/7,680	F: 6,656	F: 6,656/7,680/ 8,192	F: 4,096/7,680	F: 8,192
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	74/3	74/3	74/3	74/3	74/3
Track density (TPI)	48	48	48	48	48
Maximum linear density (BPI)	3408/6816	3408/6816	3408/6816	3408/6816	6816
Rotational speed (RPM)	360	360	360	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	5	5	5	5	5
Settling time (msec)	35	35	35	35	35
Head load time(msec)					
Average rotational delay (msec)	83.3	83.3	83.3	83.3	83.3
Data transfer rate (KBytes/sec)	31.25/62.5	62.5	31.25/62.5	31.25/62.5	62.5
SIZE (Inches: H x W x D)	--	--	--	--	--
FIRST CUSTOMER SHIPMENT	8/81	--	10/80	8/81	2/80
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	Add-on drive for 5322 System/23 Datamaster Desktop Computer	5265 point of sale terminal	5280 terminal system	Uses "Trim" drive, with smaller dimensions System/23 Datamaster Desktop Computer	5520 administrative system

MANUFACTURER	IBM	IBM	IBM	IBM	IBM
DRIVE	5525-050 (Magazine Drive)	8101-A10 8101-A11 (43 FD Drive)	8130-All Models 8140-All Models (43 FD Drive)	Displaywriter 6360-20 Single 6360-22 Dual	System/34 (43 FD Drive)
DISK/TREND GROUP	12	12	12	12	12
MARKET	Captive	Captive	Captive	Captive	Captive
MEDIA: Generic type	Diskette 2D	Diskette 1,2,2D	Diskette 1,2,2D	Diskette 1, 2D	Diskette 1,2,2D
Nominal disk diameter	8"	8"	8"	8"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	F: 1.212416	F: .492544 or F: .985088	F: .492544 or F: .985088	F: .284160 or F: 1.136640	F: .985088 or F: 1.212416
Capacity per track (Bytes)	F: 8,192	F: 3,328/6,656	F: 3,328/6,656	F: 3,840/7,680	F: 6,656/8,192
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	74/3	74/3	74/3	74/3	74/3
Track density (TPI)	48	48	48	48	48
Maximum linear density (BPI)	6816	3408/6816	3408/6816	3408/6816	3408/6816
Rotational speed (RPM)	720	360	360	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track(msec)	5	5	5	5	5
Settling time (msec)	35	35	35	35	35
Head load time(msec)					
Average rotational delay (msec)	41.7	83.3	83.3	83.3	83.3
Data transfer rate (KBytes/sec)	125	31.25/62.5	31.25/62.5	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	--	--	--	--	--
FIRST CUSTOMER SHIPMENT	11/80	1980	1980	6/81	12/77
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	5520 administrative system	8100 system	8100 system		

MANUFACTURER	IBM	INNOTRONICS	INNOTRONICS	IOMEGA	IOMEGA
DRIVE	System/34 System/38 (Magazine Drive)	410	420	Alpha-10	Alpha-10H
DISK/TREND GROUP	12	11	11	16	16
MARKET	Captive	OEM	OEM	OEM	OEM
MEDIA: Generic type	Diskette 1,2,2D	Diskette 1	Diskette 1	Alpha-10 Cartridge	Alpha-10 Cartridge
Nominal disk diameter	8"	8"	8"	8"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated
Sectoring	Soft	Soft	Hard	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	F: .985088 or F: 1.212416	U: .401/.802	U: .401/.802	F: 10.027 or 10.497	F: 10.027 or 10.497
Capacity per track (Bytes)	F: 6,656/8,192	U: 5,208/10,416	U: 5,208/10,416	F: 32,768 or 34,304	F: 32,768 or 34,304
Data surfaces per spindle	2	1	1	1	1
Tracks per surface	74/3	77	77	306	306
Track density (TPI)	48	48	48	300	300
Maximum linear density (BPI)	3408/6816	3268/6536	3268/6536	24000 BPI 18000 FCI	24000 BPI 18000 FCI
Rotational speed (RPM)	360	360	360	1500	1500
PERFORMANCE					
Actuator type	Band, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Rotary, Voice Coil	Rotary, Voice Coil
POSITIONING:Track to track(msec)	5	8	8	10 (including settling)	10 (including settling)
Settling time (msec)	35	8	8	--	--
Head load time(msec)		30	30	Continuous Contact	Continuous Contact
Average rotational delay (msec)	41.7	83.3	83.3	20	20
Data transfer rate (KBytes/sec)	31.25/62.5	31.25/62.5	31.25/62.5	1130	1130
SIZE (Inches: H x W x D)	--	4.38 x 9 x 14	4.38 x 9 x 14	4.5 x 8.54 x 14.09	2.32 x 8.54 x 12.0
FIRST CUSTOMER SHIPMENT	1/79 (S/34)	2/77	2/77	9/82	4Q84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	see below	see below
COMMENTS	Capacity is 2 10-diskette magazines and 3 diskettes			1st Drive $1295 2nd Drive $625	1st drive $1295 2nd drive $ 695

MANUFACTURER	IOMEGA	IOMEGA	IOMEGA	ISOT	ISOT
DRIVE	Beta-5	MAC-5	PC-10	ES 5074	ES 5082
DISK/TREND GROUP	16	16	16	11	11
MARKET	OEM	PCM	PCM	OEM, Captive	Captive, OEM
MEDIA: Generic type	Beta-5 Cartridge	Alpha-5 Cartridge	Alpha-10 Cartridge	Diskette 1	SA 100
Nominal disk diameter	5.25"	5.25"	8"	8"	8"
Recording medium	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	F: 5.25	F: 5.25	F: 10.027 or 10.497	U: .401	U: .4/.8
Capacity per track (Bytes)	F: 13,312	F: 13,312	F: 32,768 or 34,304	U: 5,208	U: 5,208/10,416
Data surfaces per spindle	1	1	1	1	1
Tracks per surface	394	394	306	77	77
Track density (TPI)	394	394	300	48	48
Maximum linear density (BPI)	17200 MFM	17200 MFM	24000 BPI 18000 FCI	3268	3268/6536
Rotational speed (RPM)	1964	1964	1500	360	360
PERFORMANCE					
Actuator type	Rotary, Voice Coil	Rotary, Voice Coil	Rotary, Voice Coil	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING:Track to track(msec)	11 (including settling)	10 (including settling)	10 (including settling)	10	10
Settling time (msec)	--	--	--	10	25
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	40	40
Average rotational delay (msec)	15.3	15.3	20	83.3	83.3
Data transfer rate (KBytes/sec)	625	625	1130	31.25	31.25/62.5
SIZE (Inches: H x W x D)	3.25 x 5.75 x 8.0	5.1 x 10.7 x 12.5	5.5 x 19.5 x 18.9	5.2 x 10.3 x 16.1	5.2 x 10.3 x 16.1
FIRST CUSTOMER SHIPMENT	8/83	4Q84	3Q83	1978	1983
U.S. OEM PRICE FOR 500 UNITS	$595	$1895	$2695	--	--
COMMENTS		Subsystem for Apple MacIntosh	Subsystem for IBM PC PC-20 is 2 drive version priced at $3695 (500)		

MANUFACTURER	ISOT	ISOT	ISOT	ISOT	ISOT
DRIVE	ES 5083	ES 5088	ES 5088M	ES 5321	ES 5323
DISK/TREND GROUP	12	13	13	14	14
MARKET	Captive, OEM	OEM, Captive	Captive, OEM	Captive, OEM	Captive, OEM
MEDIA: Generic type	SA 150	SA 104	SA 104	SA 154	SA 164
Nominal disk diameter	8"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .125	U: .125/.250	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 5,208/10,416	U: 3,125	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	1	1	2	2
Tracks per surface	77	40	40	40	80
Track density (TPI)	48	48	48	48	96
Maximum linear density (BPI)	3408/6816	2768	2768/5536	2938/5876	2961/5922
Rotational speed (RPM)	360	300	300	300	300
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Cam, Stepping Motor	Cam, Stepping Motor	Cam, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	10	40	40	25	5
Settling time (msec)	20	10	10	15	15
Head load time(msec)	35	50	50	Continuous Contact	Continuous Contact
Average rotational delay (msec)	83.3	100	100	100	100
Data transfer rate (KBytes/sec)	31.25/62.5	15.63	31.25/62.5	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	5.2 x 10.3 x 16.1	3.25 x 5.75 x 8.0	3.25 x 5.75 x 8.0	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1983	1979	1982	1984	1985
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	JANOME SEWING MACHINE CO.	JANOME SEWING MACHINE CO.	JANOME SEWING MACHINE CO.	JANOME SEWING MACHINE CO.	KYOCERA
DRIVE	MFD-80	MFD-90	MFD-91	MFD-91D	KFD-525
DISK/TREND GROUP	15	15	15	15	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Maxell Compact Floppy Disk	Sony OM-D3440	Sony OM-D3440	Sony OM-D4440	SA 164
Nominal disk diameter	3"	3.5"	3.5"	3.5"	5.25"
Recording medium	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .125/.250	U: .250/.5	U: .5/1.0	U: .5/1.0
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	1	1	2	2
Tracks per surface	40	40	80	80	80
Track density (TPI)	100	67.5	135	135	96
Maximum linear density (BPI)	4473/8946	4065/8130	4094/8187	4359/8718	2961/5922
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	10	6	3	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.57 x 3.54 x 5.9	1.57 x 4.0 x 5.3	1.57 x 4.0 x 5.3	1.57 x 4.0 x 5.3	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	2Q84	4Q84	4Q84	4Q84	--
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	Capable of using 48 tracks per surface. Mechanism-only version is 3.25" wide.				

MANUFACTURER	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL
DRIVE	JK-880 JK-881	JA-751	JK-885 JK-886 JK-888	JA-200	JA-551
DISK/TREND GROUP	11	12	12	13	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Diskette 1	Diskette 1,2,2D	Diskette 1,2,2D	SA 104	SA 154
Nominal disk diameter	8"	8"	8"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .401/.802	U: .8/1.6	U: .8/1.6	U: .125/.250	U: .5
Capacity per track (Bytes)	U: 5,208/10,416	U: 5,208/10,416	U: 5,208/10,416	U: 3,125/6,250	U: 6,250
Data surfaces per spindle	1	2	2	1	2
Tracks per surface	77	77	77	40	40
Track density (TPI)	48	48	48	48	48
Maximum linear density (BPI)	3268/6536	3408/6816	3408/6816	2768/5536	5876
Rotational speed (RPM)	360	360	360	300	300
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Cam, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	10	3	3	26	6
Settling time (msec)	8	15	15	20	15
Head load time(msec)	35	50	50	Continuous Contact	50
Average rotational delay (msec)	83.3	83.3	83.3	100	100
Data transfer rate (KBytes/sec)	31.25/62.5	31.25/62.5	31.25/62.5	15.63/31.25	31.25
SIZE (Inches: H x W x D)	JK-881: 4.62 x 8.55 x 14.25	2.2 x 8.6 x 12.1	JK-886: 4.62 x 8.55 x 14.25	2.05 x 5.75 x 7.87	1.625 x 5.75 x 8.5
FIRST CUSTOMER SHIPMENT	9/76	1/82	12/77	3/83	6/82
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	Shugart Associates license: S 800 S 801		Shugart Associates license: S 850 S 851		

MANUFACTURER	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL
DRIVE	JA-561	JK-875	JU-581	JU-591	JU-312
DISK/TREND GROUP	14	14	14	14	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 164	SA 154	Maxell MD2-HD	Maxell MD2-HD	Sony OM-D3440
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	3.5"
Recording medium	Oxide Coated	Oxide Coated	High Density, Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.0	U: .250/.5	U: .8/1.6	U: .5/1.0 or U: .8/1.6	U: .125/.250
Capacity per track (Bytes)	U: 6,250	U: 3,125/6,250	U: 5,208/10,416	U: 6,250/10,416	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	1
Tracks per surface	80	40	77	77/80	40
Track density (TPI)	96	48	96	96	67.5
Maximum linear density (BPI)	5876	2768/5456	4823/9646	5876/9646	4102/8204
Rotational speed (RPM)	300	300	360	300/360	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Cam, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	3	20	3	3	6
Settling time (msec)	15	15	15	15	15
Head load time (msec)	50	75	50	50	Continuous Contact
Average rotational delay (msec)	100	83.3	83.3	100/83.3	100
Data transfer rate (KBytes/sec)	31.25	15.63/31.25	31.25/62.5	31.25/62.5	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.5	3.25 x 5.75 x 8.25	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.26 x 4.0 x 6.3
FIRST CUSTOMER SHIPMENT	6/82	3Q79	2/83	4Q83	2Q83
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS		Shugart Associates license: S 450		Uses both Standard and High Density Diskettes	

MANUFACTURER	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL	MATSUSHITA COMMUNICATION INDUSTRIAL
DRIVE	JU-313	JU-322	JU-323	JU-362	JU-363
DISK/TREND GROUP	15	15	15	15	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D3440	Sony OM-D3440	Sony OM-D3440	Sony OM-D4440	Sony OM-D4440
Nominal disk diameter	3.5"	3.5"	3.5"	3.5"	3.5"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .250/.5	U: .250/.5	U: .5/1.0	U: .5/1.0
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	1	1	2	2
Tracks per surface	40	80	80	80	80
Track density (TPI)	67.5	135	135	135	135
Maximum linear density (BPI)	4102/8204	4093/8186	4093/8186	4359/8717	4359/8717
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	6	3	3	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.26 x 4.0 x 5.9	1.26 x 4.0 x 6.3	1.26 x 4.0 x 5.9	1.26 x 4.0 x 6.3	1.26 x 4.0 x 5.9
FIRST CUSTOMER SHIPMENT	1984	2Q83	1984	2Q83	1984
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS	Low Power Version		Low Power Version		Low Power Version

MANUFACTURER	MATSUSHITA ELECTRONIC COMPONENTS	MATSUSHITA ELECTRONIC COMPONENTS	MATSUSHITA ELECTRONIC COMPONENTS	MATSUSHITA ELECTRONIC COMPONENTS	MATSUSHITA ELECTRONIC COMPONENTS
DRIVE	EME-102	EME-130	EME-150	EME-202	EME-230
DISK/TREND GROUP	15	15	15	15	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Matsushita EBF-CF2		Matsushita EBF-CF2	Matsushita EBF-CF2D	
Nominal disk diameter	3"	3.0	3"	3"	3.0
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .250/.5	U: .125	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	1	1	2	2
Tracks per surface	40	80	40	40	80
Track density (TPI)	100	200	100	100	200
Maximum linear density (BPI)	4473/8946	4498/8996	4473/8946	4915/9830	4945/9890
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	3	6	12	3	6
Settling time (msec)	30	15	15	30	15
Head load time (msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.57 x 3.5 x 5.9	1.57 x 3.5 x 5.9	1.4 x 3.5 x 5.9	1.57 x 3.5 x 5.9	1.57 x 3.5 x 5.9
FIRST CUSTOMER SHIPMENT	12/83	1Q85	4/84	12/83	1Q85
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	MATSUSHITA ELECTRONIC COMPONENTS	METRIMPEX (BRG)	METRONEX	MICRO PERIPHERALS	MICRO PERIPHERALS
DRIVE	EME-250	MCD-1	PLX45D	41	42
DISK/TREND GROUP	15	15	11	11	12
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Matsushita EBF-CF2D	MCD Cassette	Diskette 1	Diskette 1	Diskette 1,2,2D
Nominal disk diameter	3"	3"	8"	8"	8"
Recording medium	High Density Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250	U: .100/.200	U: .401	U: .4/.8	U: .8/1.6
Capacity per track (Bytes)	U: 3,125/6,250	U: 2,221/4,442	U: 5,208	U: 5,208/10,416	U: 5,208/10,416
Data surfaces per spindle	2	1	1	1	2
Tracks per surface	40	45	77	77	77
Track density (TPI)	100	100	48	48	48
Maximum linear density (BPI)	4915/9830	3125/6250	3268	3268/6536	3268/6536
Rotational speed (RPM)	300	422	360	360	360
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Cam, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track(msec)	12	20	2.5	3	3
Settling time (msec)	15	10	27.5	15	15
Head load time(msec)	Continuous Contact	35	90	35	35
Average rotational delay (msec)	100	71	83.3	83.3	83.3
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	31.25	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	1.4 x 3.5 x 5.9	1.65 x 3.35 x 4.6	8.66 x 12.2 x 12.4	2.0 x 8.55 x 11.5	2.0 x 8.55 x 11.5
FIRST CUSTOMER SHIPMENT	4/84	1984	1977	9/82	9/82
U.S. OEM PRICE FOR 500 UNITS	--	--	--	$320	$370
COMMENTS					

MANUFACTURER	MICRO PERIPHERALS	MICRO PERIPHERALS	MICRO PERIPHERALS	MICRO PERIPHERALS	MICRO PERIPHERALS
DRIVE	51	91	101	501	501C
DISK/TREND GROUP	13	13	13	13	13
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 104	Micropolis 1081	SA 104	SA 104
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .250/.5	U: .262/.525	U: .125/.250	U: .125/.250
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	1	1	1	1
Tracks per surface	40	80	84	40	40
Track density (TPI)	48	96	100	48	48
Maximum linear density (BPI)	2768/5536	2788/5576	2788/5576	2768/5536	2768/5536
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	5	5	5	6	20
Settling time (msec)	15	25	25	10	10
Head load time(msec)	35	35	35	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	3.25 x 5.75 x 7.75	3.25 x 5.75 x 7.75	3.25 x 5.75 x 7.75	1.625 x 5.75 x 7.5	1.625 x 5.75 x 7.5
FIRST CUSTOMER SHIPMENT	10/77	4/80	1981	11/82	10/82
U.S. OEM PRICE FOR 500 UNITS	$155	$200	$220	$125	$120
COMMENTS					

MANUFACTURER	MICRO PERIPHERALS	MICRO PERIPHERALS	MICRO PERIPHERALS	MICRO PERIPHERALS	MICROPOLIS
DRIVE	52	92	502D	902D	1115-II
DISK/TREND GROUP	14	14	14	14	13
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 164	SA 154	SA 164	Micropolis 1081
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .250/.5	U: .5/1.0	U: .480
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 6,250
Data surfaces per spindle	2	2	2	2	1
Tracks per surface	40	80	40	80	77
Track density (TPI)	48	96	48	96	100
Maximum linear density (BPI)	2938/5876	2961/5922	2938/5876	2961/5922	5246
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING: Track to track (msec)	5	5	6	3	6
Settling time (msec)	15	25	10	10	15
Head load time (msec)	35	35	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	31.25
SIZE (Inches: H x W x D)	3.25 x 5.75 x 7.75	3.25 x 5.75 x 7.75	1.625 x 5.75 x 7.5	1.625 x 5.75 x 7.5	3.25 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	3/79	4/80	2/83	3/83	7/82
U.S. OEM PRICE FOR 500 UNITS	$195	$230	$155	$210	$208
COMMENTS					

MANUFACTURER	MICROPOLIS	MICROPOLIS	MICROPOLIS	MICROPOLIS	MILTOPE
DRIVE	1115-V	1115-IV	1115-VI	1117-VI	DD 400
DISK/TREND GROUP	13	14	14	14	11
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 114	Micropolis 1081	SA 164	UHR-1	Diskette 1
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	High Density, Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5	U: .960	U: 1.0	U: 1.666	U: .401/.802
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 6,250	U: 10,416	U: 5,208/10,416
Data surfaces per spindle	1	2	2	2	1
Tracks per surface	80	77	80	80	77
Track density (TPI)	96	100	96	96	48
Maximum linear density (BPI)	5577	5549	5921	9868	3268/6536
Rotational speed (RPM)	300	300	300	360	360
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING: Track to track(msec)	6	6	6	6	6
Settling time (msec)	15	15	15	15	10
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	16
Average rotational delay (msec)	100	100	100	100	83.3
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	62.5	31.25/62.5
SIZE (Inches: H x W x D)	3.25 x 5.75 x 8.0	3.25 x 5.75 x 8.0	3.25 x 5.75 x 8.0	3.375 x 5.875 x 8.25	5.44 x 8.44 x 18.0
FIRST CUSTOMER SHIPMENT	7/82	7/82	7/82	9/82	1977
U.S. OEM PRICE FOR 500 UNITS	$208	$258	$258	$314	$4950
COMMENTS					Sold as militarized subsystem

MANUFACTURER	MILTUPE	MILTOPE	MITAC	MITAC	MITSUBISHI ELECTRIC CORPORATION
DRIVE	DD 450	DD 550	MC-390	MC-395	M2894-63
DISK/TREND GROUP	12	12	13	13	12
MARKET	OEM	OEM	OEM,PCM	OEM,PCM	Captive, OEM
MEDIA: Generic type	Diskette 2, 2D	Diskette 2, 2D	SA 104	SA 104	Diskette 1,2,2D
Nominal disk diameter	8"	8"	5.25"	5.25"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .8/1.6	U: .125/.5	U: .125/.5	U: 1.6
Capacity per track (Bytes)	U: 5,208/10,416	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250	U: 10,416
Data surfaces per spindle	2	2	1	1	2
Tracks per surface	77	77	40	40	77
Track density (TPI)	48	48	48	48	48
Maximum linear density (BPI)	3408/6816	3408/6816	2768/5536	2768/5536	6816
Rotational speed (RPM)	360	360	300	300	360
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Band, Stepping Motor	Stepping Motor	Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	5	5	20	6	3
Settling time (msec)	10	10	15	20	15
Head load time(msec)	16	16	75	Continuous Contact	50
Average rotational delay (msec)	83.3	83.3	100	100	83.3
Data transfer rate (KBytes/sec)	31.25/62.5	31.25/62.5	15.63/31.25	15.63/31.25	62.5
SIZE (Inches: H x W x D)	5.44 x 8.44 x 18.0	5.44 x 8.44 x 18.0	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8.0	4.62 x 8.55 x 14.18
FIRST CUSTOMER SHIPMENT	1980	1982	6/82	1Q85	1978
U.S. OEM PRICE FOR 500 UNITS	$5400	$4000	--	--	$360
COMMENTS	Sold as militarized subsystem	Sold as militarized subsystem			

MANUFACTURER	MITSUBISHI ELECTRIC CORPORATION	MITSUBISHI ELECTRIC CORPORATION	MITSUBISHI ELECTRIC CORPORATION	MITSUBISHI ELECTRIC CORPORATION	MITSUBISHI ELECTRIC CORPORATION
DRIVE	M2896-63	M4851	M4852	M4853	M4854
DISK/TREND GROUP	12	14	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Diskette 1,2,2D	SA 154	SA 164	SA 164	Maxell MD2-HD
Nominal disk diameter	8"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density, Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .5	U: 1.0	U: 1.0	U: 1.0/1.6
Capacity per track (Bytes)	U: 5,208/10,416	U: 6,250	U: 6,250	U: 6,250	U: 6,250/10,416
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	77	40	80	80	80/77
Track density (TPI)	48	48	96	96	96
Maximum linear density (BPI)	3408/6816	5877	5922	5922	5877/9870
Rotational speed (RPM)	360	300	300	300	300/360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	6	3	3	3
Settling time (msec)	15	25	15	15	15
Head load time(msec)	50	50	50	50	50
Average rotational delay (msec)	83.3	100	100	100	100/83.3
Data transfer rate (KBytes/sec)	31.25/62.5	31.25	31.25	31.25	31.25/62.5
SIZE (Inches: H x W x D)	2.25 x 8.55 x 12.4	1.625 x 5.75 x 8.0	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1982	2/83	8/82	1982	1982
U.S. OEM PRICE FOR 500 UNITS	$350	$180	$210	$210	$230
COMMENTS					

MANUFACTURER	MITSUBISHI ELECTRIC CORPORATION	MITSUBISHI ELECTRIC CORPORATION	MITSUBISHI ELECTRIC CORPORATION	MITSUBISHI ELECTRIC CORPORATION	MITSUMI
DRIVE	M4855	MF351	MF353	MF353L2	QUICK DISK
DISK/TREND GROUP	14	15	15	15	16
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	High Density	Sony OM-D3440	Sony OM-D4440	Sony OM-D4440	Maxell QD-2
Nominal disk diameter	5.25"	3.5"	3.5"	3.5"	72 mm
Recording medium	High Density, Oxide Coated	High density Oxided coated	High Density, Oxide Coated	High Density, Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	N/A
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 2.0	U: .250/.5	U: .5/1.0	U: .5/1.0	U: .064
Capacity per track (Bytes)	U: 12,500	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 64,000
Data surfaces per spindle	2	1	2	2	1
Tracks per surface	80	80	80	80	1
Track density (TPI)	96	135	135	135	59
Maximum linear density (BPI)	11844	4094/8187	4358/8717	4358/8717	4410
Rotational speed (RPM)	300	300	300	300	423
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	N/A
POSITIONING:Track to track(msec)	3	3	3	3	N/A
Settling time (msec)	15	15	15	15	N/A
Head load time(msec)	50	50	Continuous Contact	Continuous Contact	N/A
Average rotational delay (msec)	100	100	100	100	N/A
Data transfer rate (KBytes/sec)	62.5	15.63/31.25	15.63/31.25	15.63/31.25	12.63
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 4.0 x 5.87	1.625 x 4.0 x 5.87	1.26 x 4.0 x 5.87	1.73 x 4.6 x 4.1
FIRST CUSTOMER SHIPMENT	4/83	1983	6/84	1Q85	1984
U.S. OEM PRICE FOR 500 UNITS	$245	$120	$150	--	--
COMMENTS					64,000 bytes in single spiral track

MANUFACTURER	NEC	NEC	NEC	NEC	NEC
DRIVE	FD 1165	N 7707 FD 1160	FD 1053	FD 1055	FD 1155B
DISK/TREND GROUP	12	12	14	14	14
MARKET	Captive, OEM	Captive, OEM	Captive, OEM	Captive, OEM	OEM
MEDIA: Generic type	Diskette 1,2,2D	Diskette 1,2,2D	SA 154	SA 164	Maxell MD2-HD
Nominal disk diameter	8"	8"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .8/1.6	U: .5	U: 1.0	U: 1.0/1.6
Capacity per track (Bytes)	U: 5,208/10,416	U: 5,208/10,416	U: 6,250	U: 6,250	U: 6,250/10,416
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	77	77	40	80	80/77
Track density (TPI)	48	48	48	96	96
Maximum linear density (BPI)	3408/6816	3408/6816	5876	5922	5922/9646
Rotational speed (RPM)	360	360	300	300	300/360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	5	6	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	30	50	35	35	35
Average rotational delay (msec)	83.3	83.3	100	100	100/83.3
Data transfer rate (KBytes/sec)	31.25/62.5	31.25/62.5	31.25	31.25	31.25/62.5
SIZE (Inches: H x W x D)	2.28 x 8.68 x 13.19	4.62 x 8.68 x 14.45	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	4Q81	8/81	1984	1984	1984
U.S. OEM PRICE FOR 500 UNITS	$330 (500)	--	$165 (1000)	$170 (1000)	$170 (1000)
COMMENTS					

MANUFACTURER	NEC	NEC	NEC	OKI ELECTRIC	OKI ELECTRIC
DRIVE	FD 1155C	FD 1034	FD 1035	GM 3305H	GM 3315B
DISK/TREND GROUP	14	15	15	14	14
MARKET	Captive, OEM	Captive, OEM	Captive, OEM	Captive, OEM	OEM
MEDIA: Generic type	Maxell MD2-HD	Sony OM-D3440	Sony OM-D4440	SA 154	SA 154
Nominal disk diameter	5.25"	3.5"	3.5"	5.25"	5.25"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.6	U: .5	U: 1.0	U: .5	U: .5
Capacity per track (Bytes)	U: 10,416	U: 6,250	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	2	1	2	2	2
Tracks per surface	77	80	80	40	40
Track density (TPI)	96	135	135	48	48
Maximum linear density (BPI)	9646	8187	8717	5876	5876
Rotational speed (RPM)	360	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Linear, Stepping Motor	Linear, Stepping Motor
POSITIONING:Track to track(msec)	3	3	3	6	6
Settling time (msec)	15	15	15	15	15
Head load time(msec)	35	35	35	50	50
Average rotational delay (msec)	83.3	100	100	100	100
Data transfer rate (KBytes/sec)	62.5	31.25	31.25	31.25	31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 4.0 x 5.2	1.625 x 4.0 x 5.2	1.1 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1984	1984	1984	10/82	1984
U.S. OEM PRICE FOR 500 UNITS	$160 (1000)	$124 (1000)	$148 (1000)	$143	$149
COMMENTS					

MANUFACTURER	OKI ELECTRIC	OKI ELECTRIC	OLIVETTI PERIPHERAL EQUIPMENT	OLIVETTI PERIPHERAL EQUIPMENT	OLIVETTI PERIPHERAL EQUIPMENT
DRIVE	GM 3405H	GM 3415B	FD 801	FD 802	FD 501
DISK/TREND GROUP	14	14	11	12	13
MARKET	Captive, OEM	OEM	Captive, OEM	Captive, OEM	Captive, OEM
MEDIA: Generic type	SA 164	SA 164	Diskette 1	Diskette 2, 2D	SA 104
Nominal disk diameter	5.25"	5.25"	8"	8"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.0	U: 1.0	U: .401/.802	U: .8/1.6	U: .125/.250
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 5,208/10,416	U: 5,208/10,416	U: 3,125/6,250
Data surfaces per spindle	2	2	1	2	1
Tracks per surface	80	80	77	77	40
Track density (TPI)	96	96	48	48	48
Maximum linear density (BPI)	5922	5922	3268/6536	3408/6816	2768/5536
Rotational speed (RPM)	300	300	360	360	300
PERFORMANCE					
Actuator type	Linear, Stepping Motor	Linear, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Cam, Stepping Motor
POSITIONING:Track to track(msec)	3	3	3	3	25
Settling time (msec)	15	15	15	15	20
Head load time(msec)	50	50	35	35	60
Average rotational delay (msec)	100	100	83.3	83.3	100
Data transfer rate (KBytes/sec)	31.25	31.25	31.25/62.5	31.25/62.5	15.63/31.25
SIZE (Inches: H x W x D)	1.1 x 5.75 x 8.0	1.625 x 5.75 x 8.0	4.52 x 9.05 x 12.3	4.52 x 9.05 x 12.3	2.51 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	5/83	1984	1974	1979	1980
U.S. OEM PRICE FOR 500 UNITS	$173	$179	--	--	$176
COMMENTS					

MANUFACTURER	OLIVETTI PERIPHERAL EQUIPMENT	OLIVETTI PERIPHERAL EQUIPMENT	OLIVETTI PERIPHERAL EQUIPMENT	OLIVETTI PERIPHERAL EQUIPMENT	OLIVETTI PERIPHERAL EQUIPMENT
DRIVE	FD 502	FD 592	FD 595	FD 602	FD 692
DISK/TREND GROUP	14	14	14	14	14
MARKET	Captive, OEM	Captive, OEM	Captive, OEM	Captive, OEM	Captive, OEM
MEDIA: Generic type	SA 154	SA 164	Maxell MD2-HD	SA154	SA164
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	High Density, Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .8/1.6	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	40	80	77	40	80
Track density (TPI)	48	96	96	48	96
Maximum linear density (BPI)	2938/5876	2961/5922	4935/9870	5922	5922
Rotational speed (RPM)	300	300	360	300	300
PERFORMANCE					
Actuator type	Cam, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	25	3	3	6	3
Settling time (msec)	20	15	15	15	15
Head load time(msec)	60	25	25	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	83.3	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	31.25/62.5	15.625/31.25	15.625/31.25
SIZE (Inches: H x W x D)	2.51 x 5.75 x 8.0	3.25 x 5.75 x 8.0	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1981	6/82	1983	1Q84	2Q84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	OLIVETTI PERIPHERAL EQUIPMENT	OLIVETTI PERIPHERAL EQUIPMENT	OMEK	OMEK	OMEK
DRIVE	FD 301	FD 302	OM55	OM56	OM57
DISK/TREND GROUP	15	15	14	14	14
MARKET	Captive, OEM	Captive, OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D3440	Sony OM-D4440	SA 154	SA 164	Maxell MD2-HD
Nominal disk diameter	3.5"	3.5"	5.25"	5.25"	5.25"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5	U: 1.0	U: .5	U: 1.0	U: 1.6
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	1	2	2	2	2
Tracks per surface	80	80	40	80	80
Track density (TPI)	135	135	48	96	96
Maximum linear density (BPI)	8191	8717	5877	5922	9646
Rotational speed (RPM)	300	300	300	300	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	6	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	83.3
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	31.25	62.5
SIZE (Inches: H x W x D)	1.625 x 4.0 x 5.0	1.625 x 4.0 x 5.0	1.625 X 5.75 X 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1985	1985	3Q84	3Q84	3Q84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	PHILIPS	PHILIPS	PHILIPS	PHILIPS	PHILIPS
DRIVE	X 3111	X 3113	X 3131	X 3133	X 3112
DISK/TREND GROUP	13	13	13	13	14
MARKET	Captive, OEM	Captive, OEM	OEM	OEM	Captive, OEM
MEDIA: Generic type	SA 104	SA 114	SA 104	SA 114	SA 154
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft	Soft	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250	U: .5	U: .250	U: .5	U: .5
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	1	1	1	1	2
Tracks per surface	40	80	40	80	40
Track density (TPI)	48	96	48	96	48
Maximum linear density (BPI)	5536	5576	5536	5576	5876
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	5	5	6	3	5
Settling time (msec)	20	20	15	15	20
Head load time (msec)	Continuous Contact	Continuous Contact	30	30	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	31.25	31.25
SIZE (Inches: H x W x D)	2.1 x 5.75 x 8.0	2.1 x 5.75 x 8.0	1.625 x 5.75 x 7.9	1.625 x 5.75 x 7.9	2.1 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1982	1982	10/83	10/83	4Q80
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	PHILIPS	PHILIPS	PHILIPS	PHILIPS	PHILIPS
DRIVE	X 3114	X 3116	X 3118	X 3132	X 3134
DISK/TREND GROUP	14	14	14	14	14
MARKET	Captive, OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 164	High Density	Maxell MD2-HD	SA 154	SA 164
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.0	U: 2.0	U: 1.6	U: .5	U: 1.0
Capacity per track (Bytes)	U: 6,250	U: 12,500	U: 10,416	U: 6,250	U: 6,250
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	80	80	80	40	80
Track density (TPI)	96	96	96	48	96
Maximum linear density (BPI)	5876	11844	9646	5876	5876
Rotational speed (RPM)	300	300	360	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	5	3	3	6	3
Settling time (msec)	20	15	15	15	15
Head load time (msec)	Continuous Contact	30	30	30	30
Average rotational delay (msec)	100	100	83.3	100	100
Data transfer rate (KBytes/sec)	31.25	62.5	62.5	31.25	31.25
SIZE (Inches: H x W x D)	2.1 x 5.75 x 8.0	2.26 x 5.75 x 8.2	2.26 x 5.75 x 8.2	1.625 x 5.75 x 7.9	1.625 x 5.75 x 7.9
FIRST CUSTOMER SHIPMENT	1982	1984	1/84	10/83	10/83
U.S. OEM PRICE FOR 500 UNITS	--	--	--	$135	$170
COMMENTS					

MANUFACTURER	PHILIPS	QUME	QUME	RICOH	RICOH
DRIVE	X 3138	242 Qume Trak	142 Qume Trak	RD-2D	RF8160
DISK/TREND GROUP	14	12	14	11	12
MARKET	Captive,OEM	OEM	OEM	Captive	Captive/OEM
MEDIA: Generic type	Maxell MD2-HD	Diskette 1,2,2D	SA 154	Diskette 1,2,2D	Diskette 2D
Nominal disk diameter	5.25"	8"	5.25"	8"	8"
Recording medium	High Density Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.6	U: .8/1.6	U: .250/.5	F: .568 or F: .985	U: .8/1.6
Capacity per track (Bytes)	U: 10,416	U: 5,208/10,416	U: 3,125/6,250	F: 3,840/6,656	U: 5,208/10,416
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	77	77	40	74/3	77
Track density (TPI)	96	48	48	48	48
Maximum linear density (BPI)	9870	3408/6816	5876	3408/6816	3408/6816
Rotational speed (RPM)	360	360	300	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	12	6	3
Settling time (msec)	15	15	15	10	15
Head load time(msec)	30	50	Continuous Contact	50	50
Average rotational delay (msec)	83.3	83.3	100	83.3	83.3
Data transfer rate (KBytes/sec)	62.5	31.25/62.5	15.63/31.25	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	1.625 x 5.75 x 7.9	2.25 x 8.55 x 12.6	1.625 x 5.75 x 8.0		2.2 x 8.5 x 12.6
FIRST CUSTOMER SHIPMENT	4Q84	6/82	3Q82	12/79	6/83
U.S. OEM PRICE FOR 500 UNITS	--	$415	$185	--	--
COMMENTS				TC 2200 TC 2400 small business systems	

MANUFACTURER	RICOH	RICOH	RICOH	RICOH	RICOH
DRIVE	RF5050	RF5100	RF5160	RF4050	RF4100
DISK/TREND GROUP	14	14	14	15	15
MARKET	OEM	Captive/OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 164	Maxell MD2-HD	Sony OM-D4440	Sony OM-D4440
Nominal disk diameter	5.25"	5.25"	5.25"	3.5"	3.5"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .8/1.6	U: .5/1.0	U: .250/.5
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	40	80	77	40	80
Track density (TPI)	48	96	96	67.5	135
Maximum linear density (BPI)	2938/5876	2961/5922	4823/9646	4358/8717	4325/8649
Rotational speed (RPM)	300	300	360	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	6	3	3	6	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	50	50	50	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	83.3	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	31.25/62.5	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.57 x 4.0 x 5.85	1.57 x 4.0 x 5.85
FIRST CUSTOMER SHIPMENT	3Q84	3Q84	4Q84	2Q85	2Q85
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	ROBOTRON	ROBOTRON	SANKYO SEIKI	SANKYO SEIKI	SANKYO SEIKI
DRIVE	K 5600.10	K 5600.20	FDU-300-D	FDU-300-S	FDU-355-DA
DISK/TREND GROUP	13	13	15	15	15
MARKET	Captive,OEM	Captive,OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 114	Maxell Compact Floppy Disk	Maxell Compact Floppy Disk	Sony OM-D4440
Nominal disk diameter	5.25"	5.25"	3"	3"	3.5"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .250/.5	U: .250/.5	U: .125/.250	U: .5/1.0
Capacity per track (Bytes)	U: 3,250/6,250	U: 3,250/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	1	2	1	2
Tracks per surface	40	80	40	40	80
Track density (TPI)	48	96	100	100	135
Maximum linear density (BPI)	2768/5536	2788/5576	4915/9830	4473/8946	4359/8717
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	10	8	3	3	3
Settling time (msec)	12	10	30	30	30
Head load time(msec)	40	40	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	2.36 x 5.55 x 7.87	2.36 x 5.55 x 7.87	1.57 x 3.54 x 5.9	1.57 x 3.54 x 5.9	1.575 x 4.0 x 6.0
FIRST CUSTOMER SHIPMENT	1984	1984	6/83	6/83	11/84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	SANKYO SEIKI	SANKYO SEIKI	SANKYO SEIKI	SHUGART	SHUGART
DRIVE	FDU-355-SA	FMC-170	FMC-270	S 800 S 801	S 850 S 851
DISK/TREND GROUP	15	16	16	11	12
MARKET	OEM	OEM	OEM	OEM, Captive	OEM, Captive
MEDIA: Generic type	Sony OM-D3440	Special Disk	Special Disk	SA 100 Diskette 1	SA 150 Diskette 1,2,2D
Nominal disk diameter	3.5"	2.598"	2.598"	8"	8"
Recording medium	High Density Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	N/A	N/A	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .008	U: .016	U: .401/.802	U: .8/1.6
Capacity per track (Bytes)	U: 3,125/6,250	U: .008	U: .016	U: 5,208/10,416	U: 5,208/10,416
Data surfaces per spindle	1	1	1	1	2
Tracks per surface	80	1	1	77	77
Track density (TPI)	135	N/A	N/A	48	48
Maximum linear density (BPI)	4094/8187	1069	2138	3268/6536	3408/6816
Rotational speed (RPM)	300	405	405	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	N/A	N/A	Lead Screw, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	N/A	N/A	8	3
Settling time (msec)	30	N/A	N/A	8	15
Head load time(msec)	Continuous Contact	N/A	N/A	35	45
Average rotational delay (msec)	100	N/A	N/A	83.3	83.3
Data transfer rate (KBytes/sec)	15.63/31.25	2	4	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	1.575 x 4.0 x 6.0	2.677 x 3.047 x 4.902	2.677 x 3.047 x 4.902	SA 801: 4.62 x 8.55 x 14.25	SA 851: 4.62 x 8.55 x 14.25
FIRST CUSTOMER SHIPMENT	6/84	5/83	5/83	9/75	6/77
U.S. OEM PRICE FOR 500 UNITS	--	--	--	$376	$453
COMMENTS		8,000 bytes in single spiral track	16,000 bytes in single spiral track		

MANUFACTURER	SHUGART	SHUGART	SHUGART	SHUGART	SHUGART
DRIVE	S 200	S 400	S 455	S 465	S 475
DISK/TREND GROUP	13	13	14	14	14
MARKET	OEM, Captive	OEM, Captive	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 104	SA 154	SA 164	Maxell MD2-HD
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .125/.250	U: .250/.5	U: .5/1.0	U: .8/1.6
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416
Data surfaces per spindle	1	1	2	2	2
Tracks per surface	40	40	40	80	77
Track density (TPI)	48	48	48	96	96
Maximum linear density (BPI)	2768/5536	2768/5536	2938/5876	2961/5922	4823/9646
Rotational speed (RPM)	300	300	300	300	360
PERFORMANCE					
Actuator type	Cam, Stepping Motor	Cam, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	26	20	6	3	3
Settling time (msec)	20	15	15	15	15
Head load time(msec)	Continuous Contact	75	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	83.3
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	31.25/62.5
SIZE (Inches: H x W x D)	2.05 x 5.75 x 7.87	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1982	9/76	10/82	10/82	8/84
U.S. OEM PRICE FOR 500 UNITS	$135	$149	$151	$188	$207
COMMENTS					

MANUFACTURER	SHUGART	SHUGART	SONY	SONY	SONY
DRIVE	S 300	S 350	OA-D31V	OA-D32V	OA-D32W
DISK/TREND GROUP	15	15	15	15	15
MARKET	OEM	OEM	OEM, Captive	OEM	OEM
MEDIA: Generic type	Sony OM-D3440	Sony OM-D4440	Sony OM-D3320	Sony OM-D3440	Sony OM-D4440
Nominal disk diameter	3.5"	3.5"	3.5"	3.5"	3.5"
Recording medium	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .2188/.4375	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	2	1	1	2
Tracks per surface	80	80	70	80	80
Track density (TPI)	135	135	135	135	135
Maximum linear density (BPI)	4102/8204	4102/8204	3805/7610	4094/8187	4359/8717
Rotational speed (RPM)	300	300	600	600	600
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING:Track to track(msec)	6	6	15	12	12
Settling time (msec)	15	15	15	30	30
Head load time(msec)	Continuous Contact	Continuous Contact	60	60	60
Average rotational delay (msec)	100	100	50	50	50
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	31.25/62.5	31.25/62.5	31.25/62.5
SIZE (Inches: H x W x D)	1.625 x 4.0 x 6.0	1.625 x 4.0 x 6.0	2.0 x 4.0 x 5.1	2.0 x 4.0 x 5.1	2.0 x 4.0 x 5.1
FIRST CUSTOMER SHIPMENT	2Q83	1Q84	11/82	9/83	1Q84
U.S. OEM PRICE FOR 500 UNITS	$145	$167	$185	$185	--
COMMENTS					

MANUFACTURER	SONY	SONY	TANDON	TANDON	TANDON
DRIVE	OA-D33V	OA-D33W	TM-848E-1	TM-848E-2	TM-100-1
DISK/TREND GROUP	15	15	11	12	13
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D3440	Sony OM-D4440	Diskette 1	Diskette 1,2,2D	SA 104
Nominal disk diameter	3.5"	3.5"	8"	8"	5.25"
Recording medium	High Density Oxide Coated	High Density, Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .401/.802	U: .8/1.6	U: .125/.250
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416	U: 5,208/10,416	U: 3,125/6,250
Data surfaces per spindle	1	2	1	2	1
Tracks per surface	80	80	77	77	40
Track density (TPI)	135	135	48	48	48
Maximum linear density (BPI)	4094/8187	4359/8717	3268/6536	3406/6816	2768/5535
Rotational speed (RPM)	300	300	360	360	300
PERFORMANCE					
Actuator type	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track(msec)	12	12	3	3	5
Settling time (msec)	30	30	15	15	15
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	83.3	83.3	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	31.25/62.5	31.25/62.5	15.63/31.25
SIZE (Inches: H x W x D)	2.0 x 4.0 x 5.1	2.0 x 4.0 x 5.1	2.3 x 8.55 x 13.125	2.3 x 8.55 x 13.125	3.25 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	9/83	2Q84	4/81	4/81	11/78
U.S. OEM PRICE FOR 500 UNITS	$185	--	$250 (2500)	$285 (2500)	$110 (2500)
COMMENTS					

MANUFACTURER	TANDON	TANDON	TANDON	TANDON	TANDON
DRIVE	TM-65-1L	TM-100-2	TM-65-2L	TM-65-4	TM-65-8
DISK/TREND GROUP	13	14	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 154	SA 154	SA 164	Maxell MD2-HD
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .250/.5	U: .250/.5	U: .5/1.0	U: .8/1.6
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 6,250	U: 6,250	U: 5,208/10,416
Data surfaces per spindle	1	2	2	2	2
Tracks per surface	40	40	40	80	77
Track density (TPI)	48	48	48	96	96
Maximum linear density (BPI)	2768/5536	2938/5877	2938/5877	2961/5922	4823/9646
Rotational speed (RPM)	300	300	300	300	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	6	5	6	3	3
Settling time (msec)	15	15	15	15	15
Head load time (msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	83.3
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	3Q82	11/78	10/82	10/82	1984
U.S. OEM PRICE FOR 500 UNITS	$79 (2500)	$130 (2500)	$88 (2500)	$113 (2500)	--
COMMENTS					

MANUFACTURER	TANDON	TANDON	TEAC	TEAC	TEAC
DRIVE	TM-303	TM-304	FD-53A FD-55A	FD-55E	FD-53B FD-55B
DISK/TREND GROUP	15	15	13	13	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D3440	Sony OM-D4440	SA 104	SA 114	SA 154
Nominal disk diameter	3.5"	3.5"	5.25"	5.25"	5.25"
Recording medium	High Density, Oxide Coated	High Density, Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .5/1.0	U: .125/.250	U: .250/.5	U: .250/.5
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	2	1	1	2
Tracks per surface	80	80	40	80	40
Track density (TPI)	135	135	48	96	48
Maximum linear density (BPI)	4094/8188	4359/8718	2768/5536	2788/5576	2938/5876
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Rack & Pinion, Stepping Motor	Rack & Pinion, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	6	6	6	3	6
Settling time (msec)	15	15	15	15	15
Head load time (msec)	Continuous Contact	Continuous Contact	50	50	50
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 4.0 x 6.0	1.625 x 4.0 x 6.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	1Q85	1Q85	4/82	4/82	4/82
U.S. OEM PRICE FOR 500 UNITS	--	--	$97 (1000)	$109 (1000)	$103 (1000)
COMMENTS					

MANUFACTURER	TEAC	TEAC	TEAC	TEAC	TEAC
DRIVE	FD-55F	FD-55G	FD-55GF	FD-30A	FD-35A
DISK/TREND GROUP	14	14	14	15	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 164	Maxell MD2-HD	Maxell MD2-HD	Maxell Compact Floppy Disk	Sony OM-D3440
Nominal disk diameter	5.25"	5.25"	5.25"	3"	3.5"
Recording medium	Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High Density, Oxide Coated	High density oxide coated
Sectoring	Soft/Hard	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5/1.0	U: .8/1.6	U: .5/1.0 or U: .8/1.6	U: .125/.250	U: .125/.250
Capacity per track (Bytes)	U: 3,125/6,250	U: 5,208/10,416	U: 6,250/10,416	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	2	1	1
Tracks per surface	80	77	80/77	40	40
Track density (TPI)	96	96	96	100	67.5
Maximum linear density (BPI)	2961/5922	4823/9646	5922/9646	4473/8946	4064/8128
Rotational speed (RPM)	300	360	300/360	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor	Band, stepping motor
POSITIONING:Track to track(msec)	3	3	3	12	6
Settling time (msec)	15	15	15	15	15
Head load time(msec)	50	50	50	50	Continuous contact
Average rotational delay (msec)	100	83.3	100/83.3	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	31.25/62.5	31.25/62.5	15.625/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8	1.625 x 5.75 x 8.0	1.57 x 3.54 x 5.9	1.625 x 4.0 x 5.3
FIRST CUSTOMER SHIPMENT	6/82	4/83	3/84	9/83	2Q84
U.S. OEM PRICE FOR 500 UNITS	$121 (1000)	$129 (1000)	$141 (1000)	$86 (1000)	$93 (1000)
COMMENTS			Dual Speed		

MANUFACTURER	TEAC	TEAC	TEAC	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY
DRIVE	FD-35B	FD-35E	FD-35F	FB-501	FB-502
DISK/TREND GROUP	15	15	15	13	13
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440	SA 104	SA 114
Nominal disk diameter	3.5"	3.5"	3.5"	5.25"	5.25"
Recording medium	High density oxide coated	High density oxide coated	High density oxide coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .250/.5	U: .250/.5	U: .5/1.0	U: .250	U: .5
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 6,250	U: 6,250
Data surfaces per spindle	2	1	2	1	1
Tracks per surface	40	80	80	40	80
Track density (TPI)	67.5	135	135	48	96
Maximum linear density (BPI)	4325/8650	4094/8188	4359/8718	5536	5576
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, stepping motor	Band, stepping motor	Band, stepping motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	6	3	3	6	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	Continuous contact	Continuous contact	Continuous contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	31.25	31.25
SIZE (Inches: H x W x D)	1.625 x 4.0 x 5.3	1.625 x 4.0 x 5.3	1.625 x 4.0 x 5.3	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	2Q84	2Q84	2Q84	3Q82	3Q82
U.S. OEM PRICE FOR 500 UNITS	$104 (1000)	$95 (1000)	$122 (1000)	--	--
COMMENTS					

MANUFACTURER	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY
DRIVE	FB-503	FB-504	FB-505	FB-506	FB-352
DISK/TREND GROUP	14	14	14	14	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 164	Maxell MD2-HD	Maxell MD2-HD	Sony OM-D3440
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	3.5"
Recording medium	Oxide Coated	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5	U: 1.0	U: 1.6	U: 1.0/1.6	U: .5
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 10,416	U: 6,250/10,416	U: 6,250
Data surfaces per spindle	2	2	2	2	1
Tracks per surface	40	80	77	80/77	80
Track density (TPI)	48	96	96	96	135
Maximum linear density (BPI)	5876	5922	9646	5922/9646	8187
Rotational speed (RPM)	300	300	360	300/360	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	6	3	3	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	35	35	Continuous Contact	Continuous Contact	
Average rotational delay (msec)	100	100	83.3	100/83.3	100
Data transfer rate (KBytes/sec)	31.25	31.25	62.5	31.25/62.5	31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 X 5.75 X 8.0	1.625 X 5.75 X 8.0	1.625 x 4.0 x 6.0
FIRST CUSTOMER SHIPMENT	3Q82	1Q83	1Q85	1Q85	3/84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS				Dual Speed	

MANUFACTURER	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY	TOKYO ELECTRIC COMPANY
DRIVE	FB-354	MC-108	MC-116	MC-132	MC-164
DISK/TREND GROUP	15	16	16	16	16
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Sony OM-D4440	Special	Special	Special	Special
Nominal disk diameter	3.5"	66 mm OD	66 mm OD	66 mm OD	66 mm OD
Recording medium	High Density Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	N/A	N/A	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.0	F: .008	F: .016	F: .032	F: .064
Capacity per track (Bytes)	U: 6,250	F: 8,000	F: 16,000	F: 32,000	F: 64,000
Data surfaces per spindle	2	1	1	1	1
Tracks per surface	80	1	1	1	1
Track density (TPI)	135	33	33	N/A	N/A
Maximum linear density (BPI)	8717	1069	2138	2768	5140
Rotational speed (RPM)	300	405	405	425	425
PERFORMANCE					
Actuator type	Band, Stepping Motor	N/A	N/A	N/A	N/A
POSITIONING:Track to track(msec)	3	N/A	N/A	N/A	N/A
Settling time (msec)	15	N/A	N/A	N/A	N/A
Head load time(msec)		N/A	N/A	N/A	N/A
Average rotational delay (msec)	100	N/A	N/A	N/A	N/A
Data transfer rate (KBytes/sec)	31.25	3.1	6.25	10.4	20.8
SIZE (Inches: H x W x D)	1.625 x 4.0 x 6.0	1.61 x 3.0 X 4.9	1.61 x 3.0 X 4.9	1.61 x 3.0 X 6.3	1.61 x 3.0 X 6.3
FIRST CUSTOMER SHIPMENT	3/84	4Q82	4Q82	4/84	4/84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS		8,000 bytes in single spiral track	16,000 bytes in single spiral track	Up to 32,000 bytes in single spiral track	Up to 64,000 bytes in single spiral track

MANUFACTURER	TOSHIBA	TOSHIBA	TOSHIBA	TOSHIBA	TOSHIBA
DRIVE	ND-40D ND-40DL	ND-04D	ND-06D	ND-08D	ND-08DE
DISK/TREND GROUP	12	14	14	14	14
MARKET	Captive, OEM	Captive, OEM	Captive, OEM	Captive, OEM	Captive, OEM
MEDIA: Generic type	Diskette 1,2,2D	SA 154	SA 164	Maxell MD2-HD	Maxell MD2-HD
Nominal disk diameter	8"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .250/.5	U: .5/1.0	U: .8/1.6	U: 1.0/1.6
Capacity per track (Bytes)	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250	U: 5,208/10,416	U: 6,250/10,416
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	77	40	80	77	80/77
Track density (TPI)	48	48	96	96	96
Maximum linear density (BPI)	3408/6816	2938/5876	2961/5922	4823/9646	5922/9646
Rotational speed (RPM)	360	300	300	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	5	3	3	3
Settling time (msec)	18	15	15	15	15
Head load time(msec)	50	50	50	35	35
Average rotational delay (msec)	83.3	100	100	83.3	100/83.3
Data transfer rate (KBytes/sec)	31.25/62.5	15.63/31.25	15.63/31.25	31.25/62.5	37.5/62.5
SIZE (Inches: H x W x D)	2.24 x 8.54 x 12.4	1.625 x 5.75 x 8.3	1.625 x 5.75 x 8.3	1.625 x 5.75 x 8.3	1.625 x 5.75 x 8.3
FIRST CUSTOMER SHIPMENT	1Q82	2Q83	2Q82	2Q84	1984
U.S. OEM PRICE FOR 500 UNITS	$230 (1000)	$129 (1000)	$148 (1000)	$164 (1000)	--
COMMENTS					

MANUFACTURER	TOSHIBA	TOSHIBA	TOSHIBA	TOSHIBA	VICTOR COMPANY OF JAPAN
DRIVE	ND-09D	ND-301D	ND-353	ND-354	MDP-100 MDP-1
DISK/TREND GROUP	14	15	15	15	14
MARKET	Captive, OEM	Captive, OEM	Captive, OEM	Captive, OEM	OEM
MEDIA: Generic type		Maxell Compact Floppy Disk	Sony OM-D3440	Sony OM-D4440	SA 164
Nominal disk diameter	5.25"	3.0"	3.5"	3.5"	5.25"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.0/2.0	U: .125/.250	U: .250/.5	U: .5/1.0	U: 1.0
Capacity per track (Bytes)	U: 6,250/12,500	U: 6,125	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	2	1	1	2	2
Tracks per surface	80	40	80	80	80
Track density (TPI)	96	100	135	135	96
Maximum linear density (BPI)	5922/11844	4473/8946	4096/8187	4359/8717	5922
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	3	3	3
Settling time (msec)	15	54	15	15	15
Head load time(msec)	35	Continuous Contact	Continuous Contact	Continuous Contact	50
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	31.25/62.5	15.63/31.25	15.63/31.25	15.63/31.25	31.25
SIZE (Inches: H x W x D)	1.625 x 5.75x 8.3	1.625 x 3.5 x 5.9	1.625 x 4.0 x 5.9	1.625 x 4.0 x 5.9	1.625 x 5.75 x 8.6
FIRST CUSTOMER SHIPMENT	4Q84		3Q84	3Q84	2Q84
U.S. OEM PRICE FOR 500 UNITS	--	--	$114 (5000)	$124 (5000)	--
COMMENTS					

MANUFACTURER	VICTOR COMPANY OF JAPAN	VICTOR COMPANY OF JAPAN	VICTOR COMPANY OF JAPAN	VICTOR COMPANY OF JAPAN	VICTOR COMPANY OF JAPAN
DRIVE	MDP-200 MDP-2	MDP-300	MDP-1000	MDP-2000	MDP-10
DISK/TREND GROUP	14	14	14	14	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 164	Maxell MD2-HD	Maxell MD2-HD	Sony OM-D3440
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	3.5"
Recording medium	Oxide Coated	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5	U: 1.0	U: 1.6	U: 1.0/1.6	U: .5
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 10,416	U: 6,250/10,416	U: 6,250
Data surfaces per spindle	2	2	2	2	1
Tracks per surface	40	80	77	80/77	80
Track density (TPI)	48	96	96	96	135
Maximum linear density (BPI)	5876	5922	9646	5922/9646	8187
Rotational speed (RPM)	300	300	360	300/360	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	6	3	3	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	50	35	35	35	35
Average rotational delay (msec)	100	100	83.3	100/83.3	100
Data transfer rate (KBytes/sec)	31.25	31.25	62.5	31.25/62.5	31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.6	1.625 x 5.75 x 7.9	1.625 x 5.75 x 7.9	1.625 x 5.75 x 7.9	1.625 x 4.0 x 5.1
FIRST CUSTOMER SHIPMENT	3Q84	4Q84	4Q84	4Q84	1Q85
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS				Dual Speed	

MANUFACTURER	VICTOR COMPANY OF JAPAN	VICTOR COMPANY OF JAPAN	VICTOR COMPANY OF JAPAN	VIDEO TECHNOLOGY	VIDEO TECHNOLOGY
DRIVE	MDP-20	MDP-30	MDP-40	FDM 130	FDM 140
DISK/TREND GROUP	15	15	15	13	13
MARKET	OEM	OEM	OEM	OEM, PCM	OEM, PCM
MEDIA: Generic type	Sony OM-D4440	Sony OM-D3440	Sony OM-D4440	SA 104	SA 114
Nominal disk diameter	3.5"	3.5"	3.5"	5.25"	5.25"
Recording medium	High Density Oxide Coated	High Density Oxide Coated	High Density Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 1.0	U: .5	U: 1.0	U: .250	U: .5
Capacity per track (Bytes)	U: 6,250	U: 6,250	U: 6,250	U: 6,250	U: 6,250
Data surfaces per spindle	2	1	2	1	1
Tracks per surface	80	80	80	40	80
Track density (TPI)	135	135	135	48	96
Maximum linear density (BPI)	8717	8187	8717	5536	5576
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING: Track to track (msec)	3	6	6	12	6
Settling time (msec)	15	30	30	15	15
Head load time (msec)	35	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	31.25	31.25
SIZE (Inches: H x W x D)	1.625 x 4.0 x 5.1	1.1 x 4.0 x 5.1	1.1 x 4.0 x 5.1	1.625 x 5.75 x 7.6	1.625 x 5.75 x 7.6
FIRST CUSTOMER SHIPMENT	1Q85	1Q85	1Q85	1984	1984
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS				FDM 110 & FD 100 are Apple II PCM versions	FDM 120 & FD 200 are Apple II PCM versions

MANUFACTURER	VIDEO TECHNOLOGY	VIDEO TECHNOLOGY	VIDEOTON INDUSTRIE-AUSSENHALDELS	VIDEOTON INDUSTRIE-AUSSENHALDELS	VIDEOTON INDUSTRIE-AUSSENHALDELS
DRIVE	FDM 145	FDM 160	MFM-2 MFM-4	Momflex 3200	Momflex 6400
DISK/TREND GROUP	14	14	11	11	11
MARKET	OEM, PCM	OEM, PCM	OEM	OEM	OEM
MEDIA: Generic type	SA 154	SA 164	Diskette 1	Diskette 1	Diskette 1
Nominal disk diameter	5.25"	5.25"	8"	8"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft	Soft	Soft	Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .5	U: 1.0	F: .256	U: .401	U: .4/.8
Capacity per track (Bytes)	U: 6,250	U: 6,250	F: 3,328	U: 5,208	U: 5,208/10,416
Data surfaces per spindle	2	2	1	1	1
Tracks per surface	40	80	77	77	77
Track density (TPI)	48	96	48	48	48
Maximum linear density (BPI)	5876	5922	3268	3268	3268/6536
Rotational speed (RPM)	300	300	360	360	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	12	6	10	10	4
Settling time (msec)	15	15	40	25	15
Head load time(msec)	Continuous Contact	Continuous Contact	40	40	35
Average rotational delay (msec)	100	100	83.3	83.3	83.3
Data transfer rate (KBytes/sec)	31.25	31.25	31.25	31.25	31.25/62.5
SIZE (Inches: H x W x D)	1.625 x 5.75 x 7.6	1.625 x 5.75 x 7.6	10.5 x 19.0 x 22.0	5.28 x 8.5 x 14.8	4.4 x 8.5 x 13.9
FIRST CUSTOMER SHIPMENT	1984	1984	1977	1978	1980
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS		FDM 150 is Apple II PCM version			

MANUFACTURER	VIDEOTON INDUSTRIE-AUSSENHALDELS	WELTEC DIGITAL	WELTEC DIGITAL	WELTEC DIGITAL	WELTEC DIGITAL
DRIVE	Momflex 900	M 48S	M 96S	M 48D	M 96D
DISK/TREND GROUP	13	13	13	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 104	SA 114	SA 154	SA 164
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: 109.4	U: .125/.250	U: .250/.5	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 3,125	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	1	1	1	2	2
Tracks per surface	35	40	80	40	80
Track density (TPI)	48	48	96	48	96
Maximum linear density (BPI)	2616	2768/5536	2788/5576	2938/5876	2961/5922
Rotational speed (RPM)	300	300	300	300	300
PERFORMANCE					
Actuator type	Cam, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	40	5.6	2.8	5.6	2.8
Settling time (msec)	10	10	10	10	10
Head load time(msec)	75	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact
Average rotational delay (msec)	100	100	100	100	100
Data transfer rate (KBytes/sec)	15.63	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	3.27 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8.0
FIRST CUSTOMER SHIPMENT	4Q83	7/83	7/83	7/83	7/83
U.S. OEM PRICE FOR 500 UNITS	--	$89 (1000)	$104 (1000)	$99 (1000)	$114 (1000)
COMMENTS					

MANUFACTURER	WONG'S TECHNOLOGY	WONG'S TECHNOLOGY	WONG'S TECHNOLOGY	WONG'S TECHNOLOGY	YE DATA
DRIVE	WST 112-5 TITAN	WST 211-5 ZEUS	WST 212-5 TITAN	WST 221-5 ZEUS	YD-74C
DISK/TREND GROUP	13	14	14	14	11
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	SA 104	SA 154	SA 154	SA 164	Diskette 1
Nominal disk diameter	5.25"	5.25"	5.25"	5.25"	8"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .125/.250	U: .250/.5	U: .250/.5	U: .5/1.0	U: .401
Capacity per track (Bytes)	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 5,208
Data surfaces per spindle	1	2	2	2	1
Tracks per surface	40	40	40	80	77
Track density (TPI)	48	48	48	96	48
Maximum linear density (BPI)	2768/5536	2938/5876	2938/5876	2961/5922	3268
Rotational speed (RPM)	300	300	300	300	360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor
POSITIONING:Track to track(msec)	6	5	6	5	9
Settling time (msec)	20	15	20	15	20
Head load time(msec)	Continuous Contact	Continuous Contact	Continuous Contact	Continuous Contact	35
Average rotational delay (msec)	100	100	100	100	83.3
Data transfer rate (KBytes/sec)	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25	31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8.0	3.25 x 5.75 x 8.0	4.5 x 9.0 x 14.1
FIRST CUSTOMER SHIPMENT	4/83	4/82	4/83	11/81	10/73
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER	YE DATA	YE DATA	YE DATA	YE DATA	YE DATA
DRIVE	YD-174D	YD-180	YD-274	YD-280	YD-380-1714
DISK/TREND GROUP	12	12	14	14	14
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Diskette 1,2,2D	Diskette 1,2,2D	SA 154	SA 164	Maxell MD2-HD
Nominal disk diameter	8"	8"	5.25"	5.25"	5.25"
Recording medium	Oxide Coated	Oxide Coated	Oxide Coated	Oxide Coated	High Density, Oxide Coated
Sectoring	Soft/Hard	Soft/Hard	Soft/Hard	Soft/Hard	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .8/1.6	U: .250/.5	U: .5/1.0	U: .5/1.0 or U: .8/1.6
Capacity per track (Bytes)	U: 5,208/10,416	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250	U: 6,250/10,416
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	77	77	40	80	80/77
Track density (TPI)	48	48	48	96	96
Maximum linear density (BPI)	3408/6816	3408/6816	2938/5876	2961/5922	5922/9646
Rotational speed (RPM)	360	360	300	300	300/360
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Lead Screw, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	20	3	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	35	50	50	50	50
Average rotational delay (msec)	83.3	83.3	100	100	100/83.3
Data transfer rate (KBytes/sec)	31.25/62.5	31.25/62.5	15.63/31.25	15.63/31.25	31.25/62.5
SIZE (Inches: H x W x D)	4.5 x 8.55 x 14.57	2.25 x 8.55 x 12.6	3.25 x 5.75 x 8.0	3.25 x 5.75 x 8.0	1.625 x 5.75 x 8
FIRST CUSTOMER SHIPMENT	1977	9/81	1/79	4/81	1984
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					Dual Speed

MANUFACTURER	YE DATA	YE DATA	YE DATA	YE DATA	
DRIVE	YD-380T YD-380-1710	YD-480	YD-580	YD-620 YD-625	
DISK/TREND GROUP	14	14	14	15	
MARKET	OEM	OEM	OEM	OEM	
MEDIA: Generic type	Maxell MD2-HD	SA 164	SA 154	Sony OM-D4440	
Nominal disk diameter	5.25"	5.25"	5.25"	3.5"	
Recording medium	High Density, Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated	
Sectoring	Soft	Soft/Hard	Soft/Hard	Soft	
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .5/1.0	U: .250/.5	U: .250/.5	
Capacity per track (Bytes)	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	
Data surfaces per spindle	2	2	2	2	
Tracks per surface	77	80	40	40	
Track density (TPI)	96	96	48	67.5	
Maximum linear density (BPI)	4823/9646	2961/5922	2938/5876	4324/8647	
Rotational speed (RPM)	360	300	300	300	
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	
POSITIONING:Track to track(msec)	3	3	5	5	
Settling time (msec)	15	15	15	15	
Head load time(msec)	50	50	50	Continuous Contact	
Average rotational delay (msec)	83.3	100	100	100	
Data transfer rate (KBytes/sec)	31.25/62.5	15.63/31.25	15.63/31.25	15.63/31.25	
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8	1.625 x 5.75 x 8	1.625 x 4.0 x 6.0	
FIRST CUSTOMER SHIPMENT	2/82	4Q82	4Q82	4/84	
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	
COMMENTS					

MANUFACTURER	YE DATA	YE DATA	YE DATA	YE DATA	YE DATA
DRIVE	YD-380T YD-380-1710	YD-480	YD-580	YD-620 YD-625	YD-640 YD-645
DISK/TREND GROUP	14	14	14	15	15
MARKET	OEM	OEM	OEM	OEM	OEM
MEDIA: Generic type	Maxell MD2-HD	SA 164	SA 154	Sony OM-D4440	Sony OM-D4440
Nominal disk diameter	5.25"	5.25"	5.25"	3.5"	3.5"
Recording medium	High Density, Oxide Coated	Oxide Coated	Oxide Coated	High Density Oxide Coated	High Density Oxide Coated
Sectoring	Soft	Soft/Hard	Soft/Hard	Soft	Soft
CAPACITY/RECORDING DENSITY					
Total capacity (MBytes)	U: .8/1.6	U: .5/1.0	U: .250/.5	U: .250/.5	U: .5/1.0
Capacity per track (Bytes)	U: 5,208/10,416	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250	U: 3,125/6,250
Data surfaces per spindle	2	2	2	2	2
Tracks per surface	77	80	40	40	80
Track density (TPI)	96	96	48	67.5	135
Maximum linear density (BPI)	4823/9646	2961/5922	2938/5876	4324/8647	4358/8717
Rotational speed (RPM)	360	300	300	300	300
PERFORMANCE					
Actuator type	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor	Band, Stepping Motor
POSITIONING:Track to track(msec)	3	3	5	5	3
Settling time (msec)	15	15	15	15	15
Head load time(msec)	50	50	50	Continuous Contact	Continuous Contact
Average rotational delay (msec)	83.3	100	100	100	100
Data transfer rate (KBytes/sec)	31.25/62.5	15.63/31.25	15.63/31.25	15.63/31.25	15.63/31.25
SIZE (Inches: H x W x D)	1.625 x 5.75 x 8.0	1.625 x 5.75 x 8	1.625 x 5.75 x 8	1.625 x 4.0 x 6.0	1.625 x 4.0 x 6.0
FIRST CUSTOMER SHIPMENT	2/82	4Q82	4Q82	4/84	4/84
U.S. OEM PRICE FOR 500 UNITS	--	--	--	--	--
COMMENTS					

MANUFACTURER PROFILES

1984 DISK/TREND REPORT

MANUFACTURER PROFILES

All manufacturers now producing flexible disk drives, or which have indicated specific plans to enter the market, are listed in this section. The heading "1983 FDD sales" refers to the DISK/TREND estimate of flexible disk drive sales only -- no sales of other disk drive types are included, nor are sales of parts or other related products. "1983 total net sales" covers the fiscal year ending in 1983 for each listed firm unless noted otherwise, or for the parent company if the disk drive manufacturer is a subsidiary.

U.S Manufacturers

AMLYN CORPORATION
2450 Autumnvale Drive
San Jose, CA 95131 408/946-8616

Amlyn ceased operations in the second half of 1984, not able to raise the additional funds needed to continue its attempt to introduce the half high version of its 3.2 megabyte 5.25 inch floppy drive. Amlyn pioneered in the high capacity 5.25 inch floppy field, using a single prerecorded reference track to control head positioning. After finding a cool reception for its first product, a 5.25 inch drive using high density diskettes in a plastic cartridge, Amlyn tried to recover with newer drives designed for single diskettes. However, the half high model was late in getting into production, and competition captured the available market.

APPLE COMPUTER, INC.
20525 Mariani Avenue
Cupertino, CA 95014 408/996-1010

1983 total net sales: $983,000,000 Net income: $76,700,000

In recent years Apple has been one of the world's largest OEM customers for 5.25 inch one side drives, and during much of that time was quietly preparing to manufacture floppy drives on a captive basis. The firm's "Twiggy" project finally emerged in a late 1982 announcement as Apple's floppy drive for the original Lisa system. An odd combination of features was used, ostensibly for engineering reasons, but probably also to discourage outside subsystem builders from attempting to sell competitive

drives to Apple dealers and users. Production for the Twiggy was dropped in late 1983, after Apple experienced considerable technical problems and difficulty in maintaining adequate shipment levels. Apple has gone back to being purely a customer for OEM floppy drives, one of the largest of all. For Mackintosh and the second version of Lisa, Twiggy was replaced with a special version of the Sony 3.5 inch microfloppy, designed, as Twiggy was, to spin at eight different motor speeds.

AU PERIPHERAL PRODUCTS
832 Jury Court
San Jose, CA 95112 408/297-3088

Composed of veterans from IBM's San Jose facility, Au has developed a 3.5 inch microfloppy and hopes to start production by the end of 1984. The initial product is a conventional one sided 3.5 inch drive, using 135 tracks per inch density, with Sony-type diskettes.

BURROUGHS CORPORATION
Burroughs Place
Detroit, MI 48232 313/972-7000

1983 FDD sales: $4,300,000
1983 total net sales: $4,296,500,000 Net income: $196,900,000

Burroughs initiated a floppy drive manufacturing program in 1976 for a unique 1.0 MB 8 inch two sided drive, with a follow-on 3.0 MB drive in 1980. The second drive used a single voice coil actuator to position heads on two 8 inch diskettes at 150 TPI, using two precorded servo tracks as references for the closed loop head positioning system. Attempts to market these drives as OEM products drew little response, and they were used basically as captive drives with Burroughs systems. No further development of the Burroughs flexible disk drives has apparently been undertaken, and production is now declining. Memorex was acquired by Burroughs in late 1981, and the Memorex 651, the first OEM flexible disk drive, was phased out in 1982.

CALDISK
Subsidiary of Billings Corporation
18600 East 37th Terrace South
Independence, MO 64067 816/373-0000

Billings has spent years developing both hydrogen powered vehicles and small computer systems, without developing a profitable business. The Calcomp flexible disk drive product line was acquired in 1979 and moved to the company's facilities in Provo, then to the firm's headquarters location in Missouri. After an abortive introduction of 5.25 inch drives, the firm now manufactures only 8 inch drives, used with Billings computers and sold in a limited OEM marketing program.

CONTROL DATA CORPORATION
8100 - 34th Avenue South
Minneapolis, MN 55440 612/853-8100

1983 FDD sales: $112,700,000
1983 total net sales: $4,583,000,000 Net income: $162,000,000

Although an early supplier of 8 inch flexible disk drives, Control Data was a latecomer to 5.25 inch drives, starting shipments in 1980. Large production increases for 5.25 inch drives during the last few years are attributable partly to purchases by IBM. The firm also has ambitious plans for a new program to sell PCM 5.25 inch two sided drives through various distribution channels for use with IBM personal computers. An older program for 8 inch PCM floppy drives aimed at IBM's Series/1 minicomputers has resulted in negligible shipments. Manufacturing responsibility for floppy drives credited to CDC in DISK/TREND statistics is held by Magnetic Peripherals, Inc., a joint venture with ownership now shared by CDC, Honeywell, Sperry and Cii-Honeywell Bull. Control Data manages the joint venture and has exclusive responsibility for sales of its products in the OEM and PCM markets. MPI drives offered for sale with any of the parent company's systems are considered captive CDC drives for the purposes of DISK/TREND statistics. Magnetic Peripherals, Inc., plans to transfer production of flexible disk drives from its Oklahoma City facility by the end of 1984 to Asian facilities operated by MPI and outside contractors.

DIGITAL EQUIPMENT CORPORATION
146 Main Street
Maynard, MA 01754 617/897-5111

1983 FDD sales: $141,800,000
1983 total net sales: $4,271,854,000 Net income: $283,622,000

Since 1976, DEC has produced large quantities of 8 inch one sided floppy drives, originally under a Calcomp license. All of these drives were produced for captive use with its own systems, and production has topped out. Somewhat tardily, DEC introduced its first 5.25 inch floppy, the RX50, which was shipped for the first time in late 1982, along with the company's personal computer systems. The RX50 uses a single stepping motor to position heads on two 96 TPI one sided diskettes, and is adapted from a product acquired originally from T & E Engineering, a late 1970's floppy drive startup that never achieved large scale production.

DRIVETEC
2140 Bering Drive
San Jose, CA 95131 408/942-1515

Drivetec's first product is one of the most advanced 5.25 inch floppy drives announced to date, and models with even higher capacity are expected to be introduced soon. Using a preformatted high density diskette,

Drivetec's 320 is a half high 5.25 inch drive offering 3.3 megabytes capacity, and employing embedded servo techniques to achieve adequate interchangability at 192 TPI. Two stepping motors are used, the second for fine adjustments of head position. The next drive will probably offer 6.6 megabytes capacity, through a combined increase of BPI and TPI, with the actual file organization designed to conform to the requirements of existing single chip floppy drive controllers. Drivetec was founded in 1981 by veterans of the floppy drive programs at IBM, Memorex and Shugart Associates, and made its first shipments in June, 1983. In November, 1983, the firm announced a license agreement allowing Eastman Kodak to market the drive.

EASTMAN KODAK COMPANY
343 State Street
Rochester, NY 14650 716/724-4000

1983 total net sales: $10,170,000,000 Net income: $565,000,000

Although the Spin Physics operation of Eastman Kodak had previously introduced flexible disk media using isotropic particulate coatings, Kodak's action in licensing the Drivetec embedded servo 5.25 inch drive is the firm's first step into disk drive hardware. Production started in 1984 at the Rochester, New York, facilities. Worldwide OEM marketing for the floppy drive will be handled by Data Technology Corporation, a Santa Clara controller manufacturer in which Kodak has an investment, and will include direct marketing of a floppy subsystem in the IBM PC add-on market. Although not specifically announced, captive applications on Kodak equipment are also likely, eventually. Kodak plans to introduce 600 Oersted versions of its isotropic diskettes, intended for use with this drive.

EXXON OFFICE SYSTEMS COMPANY
Subsidiary of Exxon Corporation
777 Long Ridge Road
Stamford, CT 06902 203/329-5000

1983 total net sales: $88,561,134,000 Net income: $4,977,957,000

Captive production of 5.25 inch one sided flexible disk drives was initiated by Qyx in 1978 for use in the firm's intelligent typewriter. Qyx and several other Exxon startups were combined into Exxon Office Systems in 1980, but the new organization has been unable to maintain momentum in the rapidly changing office equipment market and has experienced repeated retrenchments and layoffs. The future of the floppy drive manufacturing program is probably questionable.

HI-TECH PERIPHERALS CORPORATION
15192 Triton Lane
Huntington Beach, CA 92649 714/891-0027

Hi-Tech Peripherals was started in 1982, with founders from Xerox and Remex, to develop and manufacture 5.25 inch half high OEM flexible disk drives. Production started third quarter, 1983, at its Huntington Beach facility, and in Hong Kong. In late 1984, Hi-Tech went into bankruptcy, caught in a cash shortage as a major customer suddenly returned excess purchases.

INTERNATIONAL BUSINESS MACHINES CORPORATION
Route 22
Armonk, NY 10504 914/765-1900

1983 FDD sales: $429,100,000
1983 total net sales: $40,180,000,000 Net income: $5,485,000,000

IBM introduced the original one and two sided 8 inch flexible disk drives, and has used them on a wide variety of business systems, word processing systems, terminals and specialized equipment. After years of neglecting the minifloppy product area, IBM emerged as the world's largest buyer of OEM floppy drives, when it started purchasing two sided 48 TPI 5.25 inch drives for the hugely successful PC program. This choice established the two sided 48 TPI format as the mainstream minifloppy configuration for the worldwide computer industry. More recently, the IBM blessing has been given to 1.6 megabyte 5.25 inch drives and to two sided one megabyte 3.5 inch microfloppies, and these configurations may now be expected to become industry standards. But those who expect IBM to rely in perpetuity on outside vendors for all of the company's small flexible disk drives are probably naive. Current DISK/TREND forecasts are based on the assumptions that IBM will start multinational internal production of 5.25 inch drives, including 1.6 megabyte models, in the first half of 1985, and that internal production of 3.5 inch microfloppy drives will be underway by the end of 1985.

INNOTRONICS
Brooks Road
Lincoln, MA 01773 617/259-0600

Innotronics has been in operation since late 1977, when the key employees of Innovex, a pioneer floppy drive manufacturer, purchased the assets of the original firm at an auction forced by impatient bankers. Innotronics still makes 8 inch one sided drives at Fall River, Massachusetts, but the firm's emphasis is now on subsystems.

IOMEGA CORPORATION
4646 South 1500 West
Ogden, UT 84405 801/399-2171

Iomega has been successful in establishing production capability for its unique 8 inch drive, which uses a flexible disk spinning at 1500 RPM and maintains control of head/disk contact with the Bernoulli effect. A 5.25 inch version was added in mid-1983, and these OEM drives have been supplemented with 8 and 5.25 inch subsystems sold in the personal computer add-on market. The 8 inch subsystem for the IBM PC market has been shipping since 1983 and will provide a large portion of the more than 40,000 drives Iomega expects to ship in 1984. SCI Systems has been licensed to make Iomega drives for use with its own systems and for sale by Iomega. Nippon Chemi-Con has been licensed to make and sell Iomega drives in Japan, and Verbatim has been granted a media license.

MICRO PERIPHERALS, INC.
Subsidiary of CTS Corporation
9754 Deering Avenue
Chatsworth, CA 91311 213/709-4202

1983 FDD sales: $67,200,000
1983 total net sales: $306,000,000 Net income: $9,100,000

Micro Peripherals was acquired in mid-1983 by CTS Corporation, a diversified manufacturer of electronic components. After management changes, abortive product introductions and the collapse of major customers, CTS announced in September, 1984, that it plans to sell Micro Peripherals, intact or in pieces -- or close it down if no purchasor is found. Although its growing shipments of 5.25 inch drives placed MPI among the major producers of floppy drives, the company had just barely been able to stay in the black in recent years. The firm's 1984 problems with ailing customers which cancelled orders or went into bankruptcy apparently were too much for CTS.

MICROPOLIS CORPORATION
21123 Nordhoff Street
Chatsworth, CA 91311 213/709-3300

1983 FDD sales: $17,700,000
1983 total net sales: $51,598,000 Net income: $3,536,000

As the pioneer in 100 TPI floppies, Micropolis was able to establish a thriving business, even though it remained the only source for the drives for the first three years. However, with many microcomputers oriented to business applications, the higher capacity of Micropolis' drives developed a following, and finally, the introduction of competitive drives, the first 96 TPI models. However, with floppy drives now subject to intense price competition, the firm has indicated that it plans to confine its future development efforts to Winchester disk drives.

MILTOPE CORPORATION
1770 Walt Whitman Road
Melville, NY 117473 516/420-0200

1983 FDD sales: $3,500,000

8 inch flexible disk drives are manufactured internally by Miltope for use in its line of militarized peripherals, which includes disk, tape and bubble memory subsystems. Both one and two sided 8 inch drives are manufactured.

OMEK
44844 Grimmer Boulevard
Fremont, CA 94538 415/490-7173

Omek is a new manufacturer of 5.25 inch flexible disk drives, started by veterans of various Memorex disk drive operations. The firm has placed major emphasis on low power and quiet operation, with first product shipments made in third quarter, 1984.

PER SCI, INC.
Subsidiary of EF Industries
12624 Daphne
Hawthorne, CA 20250 213/777-7536

After suffering a decline in shipments for its fast but expensive 8 inch floppy drive, PerSci was sold in late 1982 to EF Industries, a firm which has acquired other declining computer industry manufacturing operations in the past few years. PerSci's activities now include service and low volume manufacturing of the old PerSci floppy drive line, plus similar functions for discontinued 14 inch rigid disk cartridge lines acquired from other firms.

QUME CORPORATION
Subsidiary of International Telephone & Telegraph Corporation
2350 Qume Drive
San Jose, CA 95150 408/942-4000

1983 FDD sales: $42,700,000
1983 total net sales: $14,155,000,000 Net income: $675,000,000

Qume's floppy drive operations started in 1979, with a manufacturing license from YE Data. Except for some confusion when the firm reorganized its marketing and manufacturing programs in 1981, Qume has maintained continuous growth in the OEM market -- and received a big boost in 1983 by being selected as a vendor for half high 5.25 inch floppy drives to IBM for the PC Junior. In early 1984, all Qume floppy drive manufacturing operations were transferred from San Jose to Taiwan, while management and engineering functions were maintained in California.

REMEX DIVISION
EX-CELL-O CORPORATION
2991 East White Star
Anaheim, CA 92806 714/630-7020

After an up and down history since it started making floppy drives in 1975, Ex-Cell-O's Remex operation was reorganized in the first half of 1984 and the floppy drive product line was sold, with a majority of the new operation held by Wearnes Brothers, a Singapore electronics manufacturing firm. The new company is known as Weltec Digital, Inc., and will be grouped with Asian manufacturers in DISK/TREND Report listings.

SHUGART CORPORATION
Subsidiary of Xerox Corporation
475 Oakmead Parkway
Sunnyvale, CA 94086 408/733-0100

1983 FDD sales: $215,900,000
1983 total net sales: $8,465,500,000 Net income: $466,400,000

From the beginning of the OEM flexible disk drive industry, Shugart was always number one in total shipments, but was passed up in 1982 by Tandon Corporation. The firm's growth rate slowed during recent years as the result of several factors: Loss of certain major customers which set up internal manufacturing programs or switched to other suppliers, prolonged technical difficulties in the late 1970's on two sided drives, and failure to achieve early introduction of new floppy drive configurations and features. Shugart's management used entrepreneurial-style rewards for the development and production teams assigned to the company's microfloppy and other projects in order to speed things up, resulting in timely production starts for some new products, including microfloppies. However, the firm's major growth products are half high 5.25 inch floppy drives manufactured on a contract basis by Matsushita Communication Industrial, with declining shipments for several older floppy configurations. After a series of layoffs, Shugart's workforce is down to less that half of its peak level.

SYKES DATATRONICS, INC.
159 East Main Street
Rochester, NY 14604 716/325-9000

1983 FDD sales: $5,600,000
1983 total net sales: $33,883,000 (FY end 2/84) Net income: ($8,213,000)

Sykes became a technology growth stock for several years, when the firm's communications and storage systems were adopted by all of the AT&T operating companies. These systems use 8 inch floppy drives, manufactured on a captive basis. But growth and profitability stopped with the breakup of AT&T, and Sykes is trying again with new products aimed at communications markets.

TABOR CORPORATION
Lyberty Way
Westford, MA 01886

Tabor was started at the beginning of 1982 with seed capital from Dysan, to develop and market a microfloppy drive using Dysan's soft-jacketed 3.25 inch diskette. After a futile two year campaign by Tabor and Dysan to turn the tide against the Sony-type 3.5 inch microfloppy, Tabor ceased operations in August, 1984. Toward the end, Tabor management tried to raise additional funds to bring out a 3.5 inch drive, an action taken too late in view of Dysan's own financial problems and a lack of enthusiasm by other potential investors.

TANDON CORPORATION
20320 Prairie Street
Chatsworth, CA 91311 213/993-6644

1983 FDD sales: $280,600,000
1983 total net sales: $303,369,000 (FY end 9/83) Net income: $23,658,000

Tandon Corporation started shipment of two sided 5.25 inch floppy drives in 1979, following a successful campaign to become the world's leading independent manufacturer of heads for flexible disk drives. By 1982, Tandon had also become the world leader in OEM floppy drives by aggressive introduction of new products and development of low cost manufacturing facilities through extensive vertical integration. The firm still makes many of its own heads, and has added motors and subassemblies from a related company in India, while establishing an assembly facility in Singapore. But with industry leadership comes the very tough challenge to stay on top in one of the most competitive industries in the world. Will Tandon be able to obtain follow-on purchases from IBM, now the firm's largest customer? Will the company be able to compete effectively against the many Asian floppy drive manufacturers now entering Tandon's primary market in North America? Will the firm be successful in getting several key new products into production smoothly? We'll all be watching.

TANDY CORPORATION
One Tandy Center
Fort Worth, TX 76102 817/390-3700

1983 FDD sales: $145.200,000
1983 total net sales: $2,475,188,000 Net income: $278,521,000

Texas Peripherals was established in 1980, as a joint venture by Tandy and Datapoint Corporation. Production got underway in 1981 for both 5.25 and 8 inch drives, but Datapoint sold its interest in the joint venture to Tandy in late 1982, and the operation has been moved to Fort Worth. 8 inch drives are no longer in production, but 5.25 inch drives are still being manufactured in significant quantities for captive sale with Tandy's personal computer systems.

VERTIMAG SYSTEMS CORPORATION
2545 West County Road C
Roseville, MN 55113 612/633-7161

Perpendicular recording technology is widely expected to be an important part of the future of magnetic recording, and Vertimag plans to use it in developing the market for high capacity flexible disk drives. After several delays, the firm still plans to install a continuous sputtering production line with the capability to produce several million diskettes per year. After first indicating that it would also offer drives, Vertimag's current strategy is to concentrate on making the media for perpendicular recording available, and provide licensing and technical assistance to existing manufacturers of floppy drives which would be able to upgrade current products to use the Vertimag media.

WORLD STORAGE TECHNOLOGY
14251 Franklin Avenue
Tustin, CA 92680

World Storage Technology was the name for the California flexible disk drive manufacturing facilities sold by Siemens to an entity managed by former Siemens executives and financed by Wong's Technology, of Hong Kong. Siemens had acquired two California operations to enter the floppy drive business: General Systems International and the Orbis (later Wangco, then Perkin Elmer) floppy product lines. All manufacturing has been transferred to Hong Kong, the U.S. operations are now limited primarily to sales, and Wong's Technology has assumed complete ownership and management. This firm will now be listed with Asian manufacturers in the DISK/TREND Report.

Asian Manufacturers

Several additional manufacturers in Asian countries are expected to start production of flexible disk drives during the next year -- all of which will be covered in future DISK/TREND editions, when production is established.

(Exchange basis used for Japanese companies: 240 Yen = $1)

ALPS ELECTRIC CO., LTD.
1-7, Yukigawa Ohtsuka-cho
Ohta-ku, Tokyo 145
Japan (03) 726-1211

1983 FDD sales: $128,100,000
1983 total net sales: $911,758,000 Net income: $31,879,000

Alps Electric is a high-growth manufacturer of electronic components and subassemblies for television, audio, instruments and computer applications. Production of captive 5.25 inch floppy drives for use with Alps systems started several years ago, but has not been emphasized. The firm's big increase in floppy drive shipments came in 1981, with a rapid build-up of shipments to Apple Computer. Alps' shipments of one sided 5.25 inch drives have topped all other floppy drive manufacturers worldwide since 1981. Alps also started shipping 3.5 inch microfloppy drives in mid-1984, and is reported to have been selected by IBM as a microfloppy drive supplier for an unannounced new personal computer.

BROTHER INDUSTRIES
9-35, Horitadori
Mizuhoku, Nagoya 467
Japan (052) 824-2511

1983 total net sales: $670,446,000 Net income: $34,454,000

Brother is Japan's largest manufacturer of sewing machines, knitting machines and typewriters, with rapid growth in recent years in printers and other office equipment. Brother has developed a 3.5 inch microfloppy drive, not yet formally announced, intended to be sold as a very low cost OEM product.

CANON ELECTRONICS CO., INC.
Subsidiary of Canon, Inc.
1248, Shimokagemori, Chichibu-city
Saitama, 369-18
Japan (04942) 3-3111

1983 FDD sales: $23,800,000
1983 total net sales: $2,738,854,000 Net income: $118,417,000

Canon Electronics produces electronic subassemblies for Canon cameras, as well as other electronic components and systems. One and two sided 5.25 inch floppy drives have been in production since 1979 under a BASF license, and the firm has added captive and OEM one third high drives of its own design. Canon also developed its own unique microfloppy using a 97 mm disk, but these drives are being dropped, and the firm hopes to start shipments of 3.5 inch microfloppies in late 1984. Floppy drives are produced for both captive applications and for sale to the OEM market, both domestic and export.

CHINON INDUSTRIES, INC.
21-17 Takashima 1-chome
Suwa-City, Nagano 392
Japan (0266) 52-2700

Chinon is a manufacturer of cameras and auto radios, with worldwide distribution. During 1984, the firm introduced its flexible disk drive product line, consisting of half high 5.25 inch drives and 3.5 inch microfloppies.

CITIZEN WATCH CO., LTD.
2-1-1, Nishi-Shinjuku
Shinjukuku, Tokyo 160
Japan (03) 342-1231

1983 total net sales: $957,708,000 Net income: $25,729,000

Citizen is steadily expanding its diversification into additional products, from its basic position of strength as Japan's second largest watch manufacturer. Watches are now down to 78% of sales, while machine tools and office equipment are rapidly rising. In addition to printers, Citizen introduced 3.5 inch microfloppies in 1984, offering the thinnest floppy drive so far introduced, a bare one inch in height, and has begun an aggressive sales program for the U.S. and Europe, aimed at the OEM market.

COPAL CO., LTD.
2-16-20, Shimura
Itabashi-ku, Tokyo 174
Japan (03) 965-1111

1983 total net sales: $217,313,000 Net income: $3,813,000

Starting with camera shutters, still the firm's largest product, Copal has diversified into a wide range of electronic components, photographic equipment, clocks, machine tools and printers. Copal has been involved in contract manufacturing for floppy drives, and has announced its own 3.5 inch microfloppy drives for shipment in early 1985.

EPSON CO., LTD.
80 Hirooka, Shiojiri-city
Nagano, 399-07 (02635) 2-2552

1983 FDD sales: $63,600,000

Epson is a member of the privately held Suwa Seikosha/Epson group owned by members of the Hattori family, which also control Japan's Seiko companies active in watches and electronics. Epson is best known for the firm's matrix printers, now widely used with personal computers worldwide. Epson also manufactures line printers, LCD's, paper tape equipment, watch components, and its own portable computer. The first Epson floppy drive was a captive 5.25 inch one third high unit first shipped in 1982 and used with the Epson portable computer. Starting in October, 1983, Epson added an OEM floppy drive product line with a variety of 5.25 and 3.5 inch models, including 3.5 inch drives with very low power requirements. The 5.25 inch drives include both one third high and half high units.

FUJITSU LIMITED
6-1, Marunouchi 2-chome
Chiyoda-ku, Tokyo 100
Japan (03) 216-3211

1983 total net sales: $3,986,763,000 Net income: $201,104,000

Despite its role as Japan's leading computer manufacturer and a major participant in the worldwide market for OEM rigid disk drives, Fujitsu has not been a participant in the flexible disk drive industry until 1984, except as a buyer of OEM drives for use with its systems. However, the firm announced in Japan this year a 1.6 megabyte half high 5.25 inch floppy drive and is expected to add 3.5 inch microfloppies.

GOLD STAR TELE-ELECTRIC CO., LTD.
Kukdong Building, #60-1, Choongmu-Ro 3-Ka
Choong-Ku, Seoul
South Korea (260) 4141

A member of the Lucky-Gold Star Group, one of Korea's major industrial families, Gold Star Tele-Electric is a diversified manufacturer of telecommunication equipment, automation systems and computer peripherals. In an effort to expand beyond existing terminal and printer products, the company set up an arrangement with Format Corporation in Westlake Village, California, to design and market half high 5.25 inch floppy drives which were to be manufactured by Gold Star Tele-Electric. However, this program appears to be delayed due to a lawsuit by Tandon Corporation claiming improper use of Tandon product designs by ex-employees.

HITACHI, LTD.
6-2, Otemachi 2-chome
Chiyoda-ku, Tokyo 100
Japan (03) 270-2111

1983 FDD sales: $91,900,000
1983 total net sales: $16,431,946,000 Net income: $627,245,000

While Hitachi is Japan's largest electric and electronics manufacturer, only about a fifth of its total sales are generated by the computer industry. Hitachi has been making 8 inch floppy drives since 1976 for both captive and OEM applications, and is currently a leader in the Japanese domestic OEM market for two sided 8 inch drives. In 1982, the firm entered the two sided 5.25 inch market, and also joined in the 3.0 inch microfloppy standard being promoted by Hitachi, Matsushita Electric Industrial, and Hitachi's magnetic media subsidiary, Maxell. Hitachi has taken something of a leadership role in introducing high capacity flexible disk drives designed to use high density particulate media developed by Maxell, including a 9.6 megabyte 8 inch drive and a 6.5 inch 5.25 inch drive.

JANOME SEWING MACHINE CO., LTD.
1-1, Kyobashi 3-chome
Chuo-ku, Tokyo 104
Japan (03) 277-2066

1983 total net sales: $334,767,000 Net income: $12,142,000

Janome is one of the world's leaders in consumer and industrial sewing machines, and supplies private label sewing machines to Sears. Due to slow growth in its basic field, Janome has started to expand into such fields as printers and disk drives. In October, 1983, the firm announced a 3 inch OEM microfloppy drive for delivery in mid-1984, and followed up with a 3.5 inch OEM drive planned for delivery by the end of 1984.

KYOCERA CORPORATION
52-11, Inouecho, Higashino
Yamashinaku, Kyoto 607
Japan (075) 592-3851

1983 total net sales: $722,800,000 Net income: $87,008,000

Kyocera has 70% of the worldwide market for ceramic IC packages, and has launched a broad program of expansion into manufacture of audio equipment, office automation and other electronic equipment. Included in the expansion plans are disk drives, and the firm made its first showing of a 5.25 inch flexible disk drive this year at Hanover Fair.

MATSUSHITA COMMUNICATION INDUSTRIAL CO., LTD.
4-3-1 Tsunashima-Higashi
Kohoku-ku, Yokohama 223
Japan (045) 531-1231

1983 FDD sales: $64,900,000
1983 total net sales: $1,044,488,000 Net income: $51,204,000

Matsushita Communication Industrial is a member of the Matsushita Electric Industrial group, a worldwide giant in appliances and electronics. MCI manufactures most of the Shugart Associates floppy drive line, under license for the Japanese OEM market. During recent years, MCI added floppy drives of its own design, including half high 5.25 inch and 3.5 inch microfloppy drives, with high level production now underway at a new plant at Hanamaki. The firm makes half high 5.25 inch drives on a contract manufacturing basis for Shugart and has major customers for its OEM drives in Japan, including IBM.

MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
1006, Kadoma, Kadoma City
Osaka 571
Japan (06) 908-1121

1983 total net sales: $16,618,829,000 Net income: $761,450,000

MEI's Panasonic, National, Technics and Quasar brandnames are among the most widely known in the world for appliances, consumer electronic equipment and communications equipment. MEI has joined with Hitachi in attempting to establish a 3.0 inch microfloppy standard, and now manufactures microfloppy drives for the worldwide OEM market.

MITAC, INC
75 Nanking E. Road, Sec. 4
Taipei
Taiwan (02) 7136980

Mitac is a ten year old firm which started as an importer and system integrator of U.S. and European computer systems and has evolved into a manufacturer of microcomputers, terminals and flexible disk drives. The firm initially acquired a Shugart license, and has more recently designed its own half high 5.25 inch drive, sold mainly in the Apple add-on market, but also as an OEM drive.

MITSUBISHI ELECTRIC CORPORATION
2-3, Marunouchi 2-chome
Chiyoda-ku, Tokyo 100
Japan (03) 218-2111

1983 FDD sales: $142,700,000
1983 total net sales: $6,489,833,000 Net income: $145,920,000

Mitsubishi Electric is a leader in the Japanese domestic small business systems market, and one of the country's leading electronic and electrical products manufacturers. Captive 8 inch drives, in both one and two sided versions, have been used with the firm's Melcom systems for several years, and the firm also participates in the domestic OEM market. A family of half high two sided 5.25 inch drives was introduced in 1982, with capacities up to 2.0 MB. Mitsubishi also started shipping a 3.5 inch micro-floppy drive in 1983. Production of flexible disk drives has been moved to expanded facilities at Mitsubishi's Koriyama Works

MITSUMI ELECTRIC CO., LTD.
8-8-2, Kokuryomachi
Chofu-City, Tokyo 182
Japan (03) 489-5333

1983 total net sales: $228,321,000 Net income: ($3,346,000)

Mitsumi is a leading manufacturer of electronic subassemblies and components, including magnetic heads. The firm is setting up a joint venture facility with Commodore to produce floppy drives. In 1984 Mitsumi introduced a very low cost drive using a special Maxell disk under the name "Quick Disk", which uses a single spiral track with 64,000 kilobytes capacity.

NEC CORPORATION
33-1 Shiba Gochome
Minato-ku, Tokyo 108
Japan (03) 454-1111

1983 FDD sales: $486,800,000
1983 total net sales: $6,012,746,000 Net income: $33,031,000

About one fifth of NEC's revenues are generated by computer mainframes, small business systems, minicomputers and desktop systems -- and the firm is a leader in the growing personal computer market. Since 1978 the company has manufactured two sided 8 inch floppy drives, and was one of the earliest firms to offer half high 8 inch drives, with shipments starting in late 1981. Most of NEC's floppy drive shipments have been for captive applications, with total revenues putting the firm in a leadership position in total DISK/TREND revenues. 3.5 inch microfloppy drives and half high 5.25 inch drives were introduced in 1984.

OKI ELECTRIC INDUSTRY CO., LTD.
1-17-12, Toranomon
Minato-ku, Tokyo 105
Japan (03) 501-3111

1983 FDD sales: $11,500,000
1983 total net sales: $1,165,233,000 Net income: $10,467,000

Oki is a diversified manufacturer of electronic communications and data processing equipment, with a major role in the Japanese market for terminals. For several years the firm has manufactured 8 inch one side floppy drives at low levels for captive applications. In 1983, the firm introduced one third high 5.25 inch drives for captive and OEM usage.

RICOH CO., LTD.
1-3-6 Naka-Magome
Ohta-ku, Tokyo 143
Japan (03) 543-5111

1983 FDD sales: $10,800,000
1983 total net sales: $1,623,600,000 Net income: $42,112,000

Copiers, sensitized papers and photographic equipment provide the major part of Ricoh's revenues, but the firm has been investing in the growing line of data processing equipment now manufactured. Since 1979, Ricoh has made 8 inch floppy drives, in both one and two sided versions, originally under a Calcomp manufacturing license. The firm is currently introducing half high 5.25 inch drive and 3.5 inch microfloppy drives intended for both captive and OEM applications.

SAMSUNG PRECISION INDUSTRIES CO., LTD.
Subsidiary of the Samsung Group
Seoul
South Korea

Shugart granted a license to Samsung in 1983, for manufacturing and marketing the Shugart 5.25 inch floppy drives in South Korea. The firm is currently making only full size drives.

SANKYO SEIKI MFG. CO., LTD.
17-2, 1-chome, Shinbashi
Minato-ku, Tokyo 105
Japan (03) 508-1154

1983 total net sales: $248,225,000 Net income: $2,883,000

Sankyo Seiki is a leading manufacturer of musical movements, industrial robots and a wide variety of small electromechanical components used in cameras, video recorders, timers and other products. Since 1981, the firm has been shipping a small spiral track flexible disk drive, wiith substantial success in developing the OEM market in word processing, program loading and special industrial applications. Since mid-1983, the company has also been shipping a 3 inch microfloppy, and in mid-1984 added 3.5 inch microfloppies.

SEIKOSHA CO., LTD.
Subsidiary of Hattori Seiko Co., Ltd.
4-1-1, Taihei
Sumida-ku, Tokyo 130
Japan (03) 623-8111

Seikosha is a diversified manufacturer of clocks, camera shutters, semiconductors, small computers and printers, and a key member of the Seiko group. As part of an expansion in the computer area, Seikosha designed and was preparing to manufacture microfloppy drives using the Dysan 3.25 inch diskette by the end of 1984 -- but has apparently been left stranded by the collapse of the Dysan/Tabor efforts in the U.S.

SONY CORPORATION
6-7-35, Kita-Shinagawa
Shinagawa-ku, Tokyo 141
Japan (03) 448-2111

1983 FDD sales: $48,700,000
1983 total net sales: $4,629,254,000 Net income: $124,129,000

As it becomes more difficult to meet Sony's growth objectives in the consumer electronics market, several portions of which appear saturated, the firm's management has made it clear that major expansion in office products markets is planned. Among the products announced so far are word

processing and personal computer equipment -- both of which use the Sony 3.5 inch microfloppy which has been shipping since late 1981. The drive has also been offered worldwide as an OEM product, with growing success. Sony's microfloppy design has had the advantage of being in production about a year before its principal competitors. After initially taking a somewhat stiff posture on granting licenses, Sony demonstrated flexibility in working with the U.S. manufacturers concerned with establishing common standards. The result was agreement on the 3.5 inch media standard by Sony and several U.S. drive and media manufacturers -- and a growing number of Japanese firms rushing to make 3.5 inch microfloppy drives. After a big early boost when Hewlett-Packard selected Sony's drive for a variety of personal computers, there was a two year period of attack from contentious sponsors of rival standards, but the industry consensus on the Sony media standard now seems established. Sony's microfloppy drive and media shipments have skyrocketed, as Apple chose the drive for its Mackintosh system and other systems manufacturers signed on.

TEAC CORPORATION
3-7-3, Naka-cho
Musashino, Tokyo 180
Japan (0422) 53-1111

1983 FDD sales: $,98,700,000
1983 total net sales: $221,496,000 Net income: $4,942,000

TEAC is a leading manufacturer of consumer and professional audio recorders, but digital recording equipment is a growing portion of the firm's product mix, now accounting for over 70% of total revenues. Shipments of 5.25 inch floppies for the worldwide OEM market started in 1978, and rapid growth has boosted TEAC to the second place position in worldwide OEM floppy drive revenues. Major products today are half high 5.25 inch drives, plus 3.0 and 3.5 inch microfloppy drives.

TOKYO ELECTRIC COMPANY, LTD.
14-10, 1-chome, Uchikanda
Chiyoda-ku, Tokyo
Japan (03) 292-1011

1983 FDD sales: $24,100,000
1983 total net sales: $642,183,000 Net income: $13,804,000

Tokyo Electric is a member of the Toshiba group, and manufactures electronic cash registers, POS systems, lighting fixtures, household appliances, and a growing family of data processing products. The firm has introduced 5.25 inch floppy drives for the worldwide OEM market, with half high models added late in 1982. The company also added late in 1982 a small spiral track drive using 66 mm flexible disks, plus 3.5 inch microfloppy drives in early 1984.

TOKYO JUKI INDUSTRIAL CO., LTD.
1-23-3, Kabukicho
Shinjukuku, Tokyo 160
Japan (03) 205-2041

1983 total net sales: $314,975,000 Net income: $1,129,000

Tokyo Juki is Japan's largest manufacturer of industrial sewing machines and offers a broad line of electric appliances, home sewing machines and typewriters. The firm is diversifying into computer peripherals and is currently introducing 3.5 inch microfloppy drives.

TOSHIBA CORPORATION
1-1-1, Shibaura
Minato-ku, Tokyo 105
Japan (03) 457-4511

1983 FDD sales: $101,300,000
1983 total net sales: $10,004,217,000 Net income: $160,158,000

Toshiba is one of Japan's major diversified electric and electronics manufacturers, with products ranging from heavy electric machinery to home electric appliances and communications equipment. Toshiba has a major share of the Japanese minicomputer and small business system markets. 8 inch floppy drives for both captive and OEM markets have been produced since 1977, and the product line now consists of both 8 and 5.25 inch drives, in one and two sided versions. Half high two sided drives were added in 1982, with the more recent addition of both 3.0 and 3.5 inch microfloppy drives.

VICTOR COMPANY OF JAPAN, LIMITED
4-1, Nihonbashi-Honcho
Chuo-ku, Tokyo 103
Japan (03) 241-7811

1983 total net sales: $2,458,054,000 Net income: $89,329,000

JVC's revenues are generated mostly by consumer electronics products; the firm has been the beneficiary of sharp growth in home video tape recorder shipments, and VTRs account for almost 70% of total revenues. JVC is now expanding into computer peripherals, with 5.25 inch Winchester and flexible disk drives among its first products in the field. Half high 5.25 inch drives were first shipped in mid-1984 and the firm plans to start shipping 3.5 inch microfloppies in early 1985.

VIDEO TECHNOLOGY, LTD.
23/F, Tai Ping Ind. Centre, Blk.1, Lot No. 1637
Ting Kok Road, Nam Hang
Tai Po, N.T.
Hong Kong (0) 6587662

Video Technology is an eight year old Hong Kong firm active in manufacture of consumer electronics, personal computers and computer peripherals. The firm is now making half high 5.25 inch floppy drives which are marketed as OEM and add-on drives in the personal computer market.

WELTEC DIGITAL, INC.
Subsidiary of Wearnes Brothers
2991 E. White Star Avenue
Anaheim, CA 92806 714/630-7020

The Remex flexible disk drive operation was sold to a group controlled by Wearnes Brothers, Singapore manufacturers of electronics products, in mid-1984. All manufacturing is now in Singapore, with marketing responsibility still maintained at the old Remex Anaheim location.

WONG'S TECHNOLOGY, LTD.
Subsidiary of Wong's Industrial (Holdings) Ltd.
Sime Darby Industrial Building
8/F, 420 Kwun Tong Road
Kwun Tong, Kowloon
Hong Kong (3) 411305

1983 FDD sales: $20,600,000

The Wong's Group is a major Hong Kong manufacturer of printed circuit boards and assembler of electronic products. The origins of this floppy drive manufacturing organization go back to the mid-1970s, in the form of Orbis and General Systems International, pioneer makers of OEM floppy drives. Both firms' product lines eventually ended up under Siemens ownership, and then were sold to World Storage Technology. In late 1983 Wong acquired complete ownership of World Storage Technology from other investors, and in the second half of 1984 completed moving manufacturing and engineering from California to Hong Kong. Only sales responsibility is now retained in the U.S.

YE DATA, INC.
Subsidiary of Yaskawa Electric Mfg. Co., Ltd.
60, 1-1, Higashi-Ikebukuro 3-chome
Toshima-ku, Tokyo 170 (03) 989-8001

1983 FDD sales: $62,200,000
1983 total net sales: $504,200,000 Net income: $13,950,000

Yaskawa Electric's heavy electric equipment is the largest segment of the company, but factory automation and data processing equipment is growing fast. The data processing products are the responsibility of YE Data, which has manufactured 8 inch one side floppy drives since 1974, under an Orbis license. YE Data became an early leader in the Japanese OEM markets for both 8 and 5.25 inch two sided drives, and has introduced half high drives in both disk dimensions. YE Data also cooperated with NTT on the standard for 1.6 MB 5.25 inch drives and has been shipping its version since early 1982. Microfloppy drives were added in 1984. YE Data's biggest sale of all came in 1984, with IBM's selection of the firm's 1.6 megabyte 5.25 inch drive for use with the PC AT.

European Manufacturers (Exchange basis indicated for each firm)

BASF AG
D-6700 Ludwigshafen
West Germany (0621) 4 00 81

1983 FDD sales: $38,100,000
1982 total net sales: $15,140,000,000 Net income: $206,800,000
(Basis: DM 2.40 = U.S.$1)

BASF stopped manufacturing floppy drives in the U.S., but continues with both 8 and 5.25 inch drives produced in Germany. The company first produced 8 inch one side drives in 1976, using rights to designs originated by GSI. 8 inch two sided drives were added in 1978, as were one and two sided 5.25 inch drives. BASF pioneered the two thirds high 5.25 inch drive, which has achieved major market share only in the European market, but has attracted several second source suppliers.

DATA TRACK TECHNOLOGY LIMITED
7 Queensway, New Milton
Hampshire BH25 5NN
England (0425) 619650

Data Track Technology initiated production in mid-1983 of a 5.25 inch flexible disk drive using a single stepping motor to position heads on two diskettes. Both one and two sided models are available, both 96 TPI. This firm was formerly the UK distributor for comparable drives manufactured a few years ago by T & E Engineering, a California company which sold its product design to Digital Equipment Corporation after exhausting its working capital.

ELCOMATIC LTD
Subsidiary of British & Commonwealth Shipping Co., Ltd.
Kirktonfield Road
Nielston, Glasgow
Scotland (041) 881-5825

In July, 1981, Elcomatic acquired the 8 inch flexible disk product line of MFE. These drives had been manufactured mostly in a two sided version at plants in Salem, Massachusetts, and in Livingston, Scotland. Elcomatic has moved manufacturing to a Glasgow plant and is continuing with plans to develop the European OEM market for 8 inch two sided floppy drives. The firm has announced a 96 TPI version of its 8 inch drives, plus half high 5.25 inch drives.

ISOT
51, Chapaev St.
1113 Sofia 49
Bulgaria 72-39-09

Isotimpex is the foreign trade organization for Bulgarian computer equipment and other electronic products. Disk drives manufactured by ISOT, the Bulgarian state computer organization, are exported to Eastern bloc countries and to China, with some magnetic media products also exported to Western countries. Rigid disk drives, in several older IBM configurations, have been produced for several years, later joined by one sided 8 inch and 5.25 inch floppy drives.

METRIMPEX/BRG
V. Munnich F. u. 21
1051 Budapest
Hungary

Metrimpex, the Hungarian trading company for electronic instruments, has introduced a microfloppy drive manufactured by Budapesti Radiotechnikai Gyar, the "Budapest Radio Works". This drive uses 72 mm flexible disks in a rigid plastic cartridge, with recording at 100 TPI and 6250 BPI, offering a capacity of 200 KBytes. BRG's manufacturing start up for this drive has suffered delays, but there are still plans to establish OEM marketing programs in both Western Europe and Eastern bloc countries.

MERA/METRONEX
Al. Jerozolimskie 44
00-950 Warszawa
Poland

Since 1977, 8 inch one side floppy drives have been manufactured by MERA, which is the acronym for the Polish Union of Automation and Measuring Instruments Industry, the state organization for manufacture of computer systems and peripherals. Flexible disk drives are manufactured under a 1975 license from Logabax, a French firm which is no longer in floppy drive production. Actual production is at the MERA Krakowska Fabryka Aparatow Pomiarowych facility at Krakow. Exports throughout Eastern Europe and to the USSR are the responsibility of Metronex.

OLIVETTI PERIPHERAL EQUIPMENT
Subsidiary of Ing. C. Olivetti & C., S.p.A.
via Torino, 603
10090 S. Bernardo d'Ivrea (Torino)
Italy (0125) 525

1983 FDD sales: $95,300,000

Olivetti is undergoing numerous changes in organization and product lines under its current management. In order to stay competitive in the rapidly

changing office equipment market, investments have been made in a long list of high technology growth firms, and older Olivetti products have been discontinued. In 1980 Olivetti Peripheral Equipment was established as a consolidation of the firm's printer and disk memory activities. OPE now makes 8 and 5.25 inch Winchester and floppy drives at Ivrea, for OEM markets as well as the firm's established captive requirements. The firm also plans to start production of 3.5 inch microfloppy drives in 1985. In 1983, Olivetti withdrew from Irwin Olivetti, the Ann Arbor, Michigan, firm which was to have had marketing responsibility for Olivetti peripherals in the United States, and is re-establishing its own marketing organization. During 1984, Olivetti has been engaged in a major build up of production for AT&T, its new major customer and part owner.

PHILIPS DATA SYSTEMS
Subsidiary of N. V. Philips Gloeilampenfabrieken
Eiserfelder Strasse 316
5900 Siegen-Eiserfeld
West Germany (0271) 3 85 01

1983 FDD sales: $47,800,000

Although Philips' computer industry revenues contribute less than 5% of total company revenues, the firm's minicomputer, terminal and office computer products are sold throughout Europe. Despite the fact that the firm has phased out production of rigid disk drives, which were manufactured in Holland for several years, a floppy drive program in Germany is growing rapidly. Shipments of a family of two thirds high 5.25 inch drives in both one and two sided models, including 96 TPI versions, were initiated in late 1980, and supplemented in 1983 with half high models. These drives are used as captive products on a variety of Philips systems and as OEM products for worldwide sale.

ROBOTRON
VEB Robotron-Buchungsmaschinenwerk Karl-Marx-Stadt
Annabergerstrasse 93
DDR-9010 Karl-Marx-Stadt
East Germany

The Robotron group is the East German organization responsible for manufacture of computing and office equipment, communication equipment, electronic instruments and consumer electronics devices. The Robotron facility for peripheral equipment initiated manufacture of 5.25 inch one sided floppy drives during 1984, after several years of buying similar drives from outside sources for Robotron equipment.

VIDEOTON INDUSTRIE-AUSSENHALDELS AG
1068 Budapest VI., Szofiz u. 9
Hungary

Videoton is an Hungarian electronics manufacturing organization which makes peripherals and minicomputers for domestic use and for export to Eastern bloc countries. 8 inch, one side floppy drives have been in production for several years, offered as various subsystems and as OEM drives. A 5.25 inch, one side drive was added in 1980.