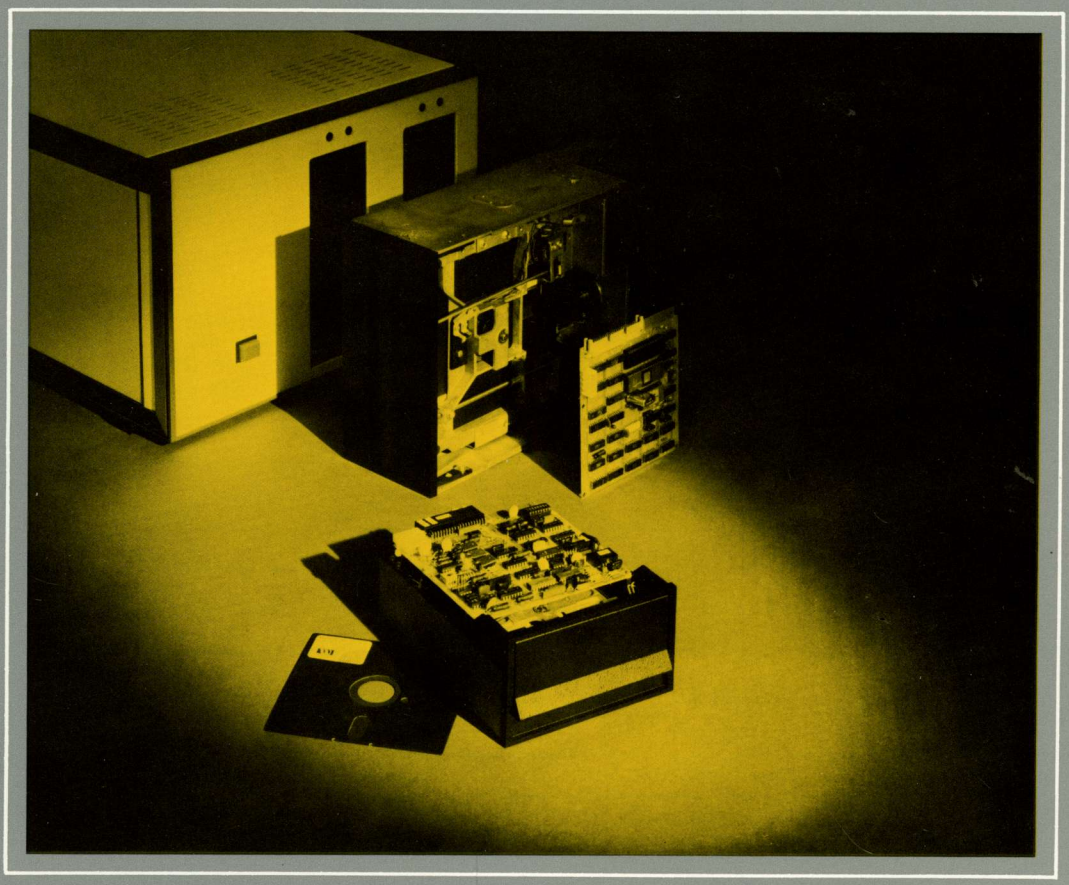
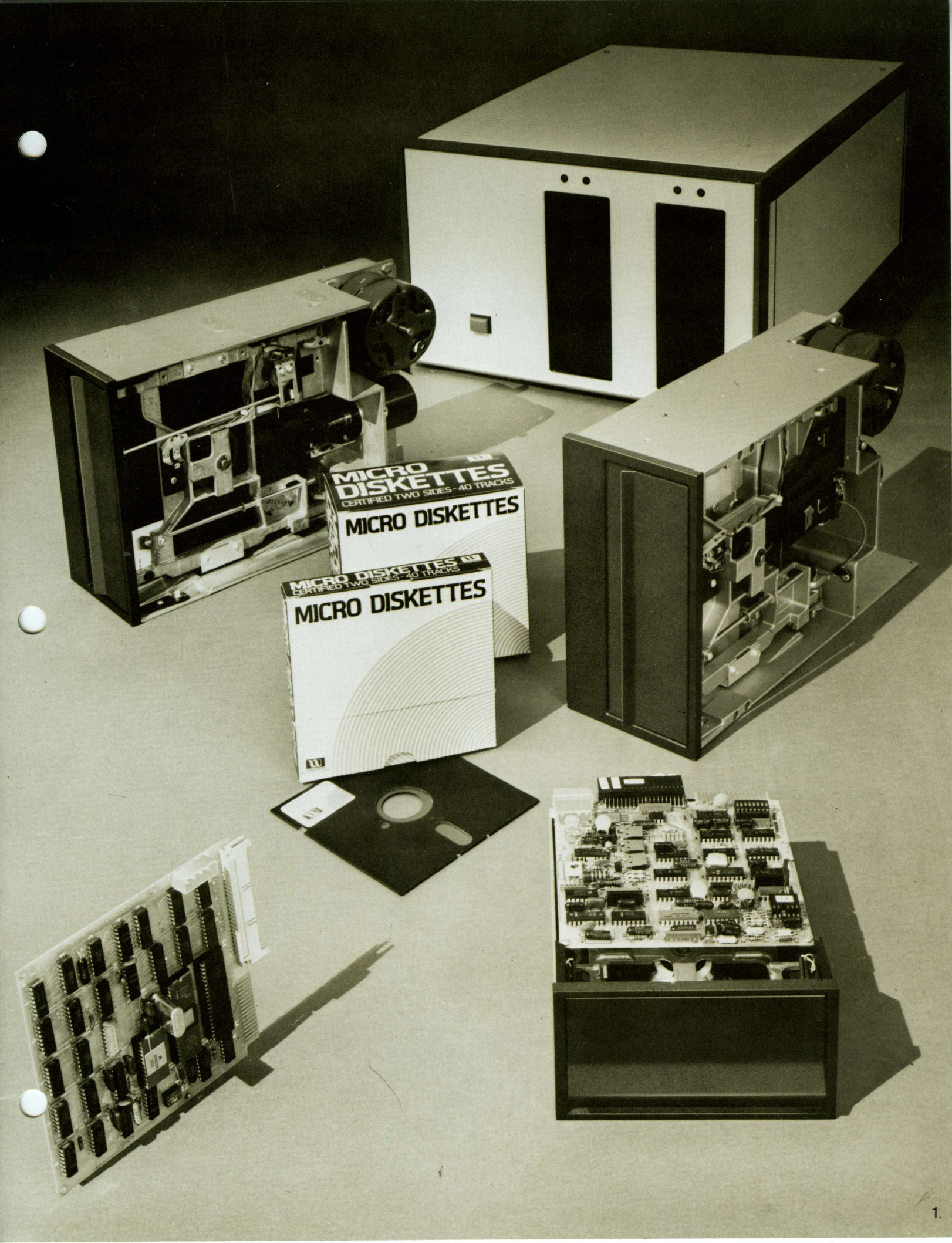
WANGCO
FLEXIBLE DISK PRODUCTS



A FLEXIBLE DISK PRODUCT FOR EVERY APPLICATION-FROM WANGCO.

Wangco's flexible disk products—the most complete line of diskette-based peripherals and systems on the market—meet and exceed the OEM's requirements for high performance, low cost, random access data storage. Wangco's floppy disk drives span the field, from the tiny, 3 lb. Micro-Floppy™ Disk Drive ideal for microcomputers, word processors and all applications requiring very small size and low cost, to the complete dual drive subsystem, the most economical way to utilize flexible disk technology in minicomputer systems, NC, remote terminals, data entry and small business systems. All Wangco flexible disk drives combine the inherent advantages of diskette memory devices with a unique package of features for OEM applications including expandable data capacity, a variety of formatting techniques, fast access speeds, unmatched data reliability and media handling characteristics. Wangco's controllers employing microprogramming and LSI technologies set new standards in cost/performance effectiveness.

Advances in performance and reliability realized in Wangco flexible disk products are establishing the low cost disk memories as replacements, not only for cassettes, cartridges and punch cards, but also for larger, more costly disk and tape devices.


MICRO DISKETTES
CERTIFIED TWO SIDES - 40 TRACKS
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MICRO DISKETTES

THE MODEL 76 DISKETTE DRIVE - THE PROVEN CHOICE FOR OEM SYSTEMS.

In the growing field of floppy disk drives, Wangco's Model 76 stands out for its unique, high performance design and unsurpassed data reliability. Many thousands of these low cost, random access memory devices are currently in the field meeting the requirements of minicomputer systems, remote terminals, key entry devices, NC systems and point-of-sale terminals.

Data Capacity—IBM Compatible or Expanded Double Density.

A standard size (9" x 4½" x 14") diskette drive, the Model 76 will read and record data on a Mylar diskette in a variety of formats. In IBM 3740 compatible format, the 76 will store up to 237.5 Kbytes on a single side of a diskette with a data transfer rate of 31.2 Kbytes per second. Increased single density capacity to 400 Kbytes can be achieved using expanded hard and soft sectored formats with fewer sectors per track than the IBM type. To double bit capacity to 800 Kbytes, double density encoding techniques can be employed (MFM, M^2FM). In double density, data transfer is increased to 500 Kbps. Up to four Model 76 drives can be interfaced in daisy chain configuration providing a total of 25.6 Mbytes of data in a system.

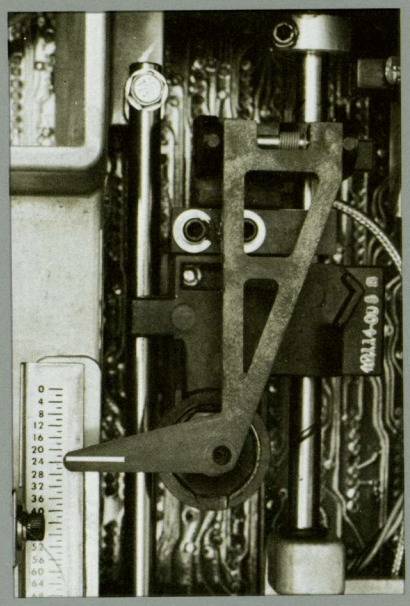
Fast Throughput.

Fast, direct access to data, one of the special advantages of diskette technology, is provided by the Model 76 at a rate of 6 ms track to track. A random average seek is 176 ms, the fastest among industry stepper motor based single head drives.

High Reliability Design—No Compromises.

An important measure of the quality of the Model 76 is its data reliability specification—only 1 in 10^{10} soft error rate—a figure comparable to costlier disk memories. This data integrity, as well as the high performance of the drive, is a result of the "no-compromise," quality design.

The mainframe of the Model 76 is rigid cast aluminum providing precise tolerances for accurate positioning of the diskettes and the head-to-media. Single piece construction resists thermal and humidity effects. The head carriage drive is a unique "uni-ball" design which greatly reduces friction prolonging the life of the assembly and assuring precise and rapid head positioning. An IBM-type ceramic ferrite read/write head with tunnel erase is rated for a minimum of 15,000 hours or 5 years of wear. Low pad force reduces head wear and protects media. A low power motor combined with the low friction positioning system results in total power consumption of only 40 watts for reliable, cool running operation. The combined reliability of the quality components and subsystems in the Model 76 as well as the high reliability design result in an MTBF of over 5,000 hours, with no field adjustments or recommended maintenance required.



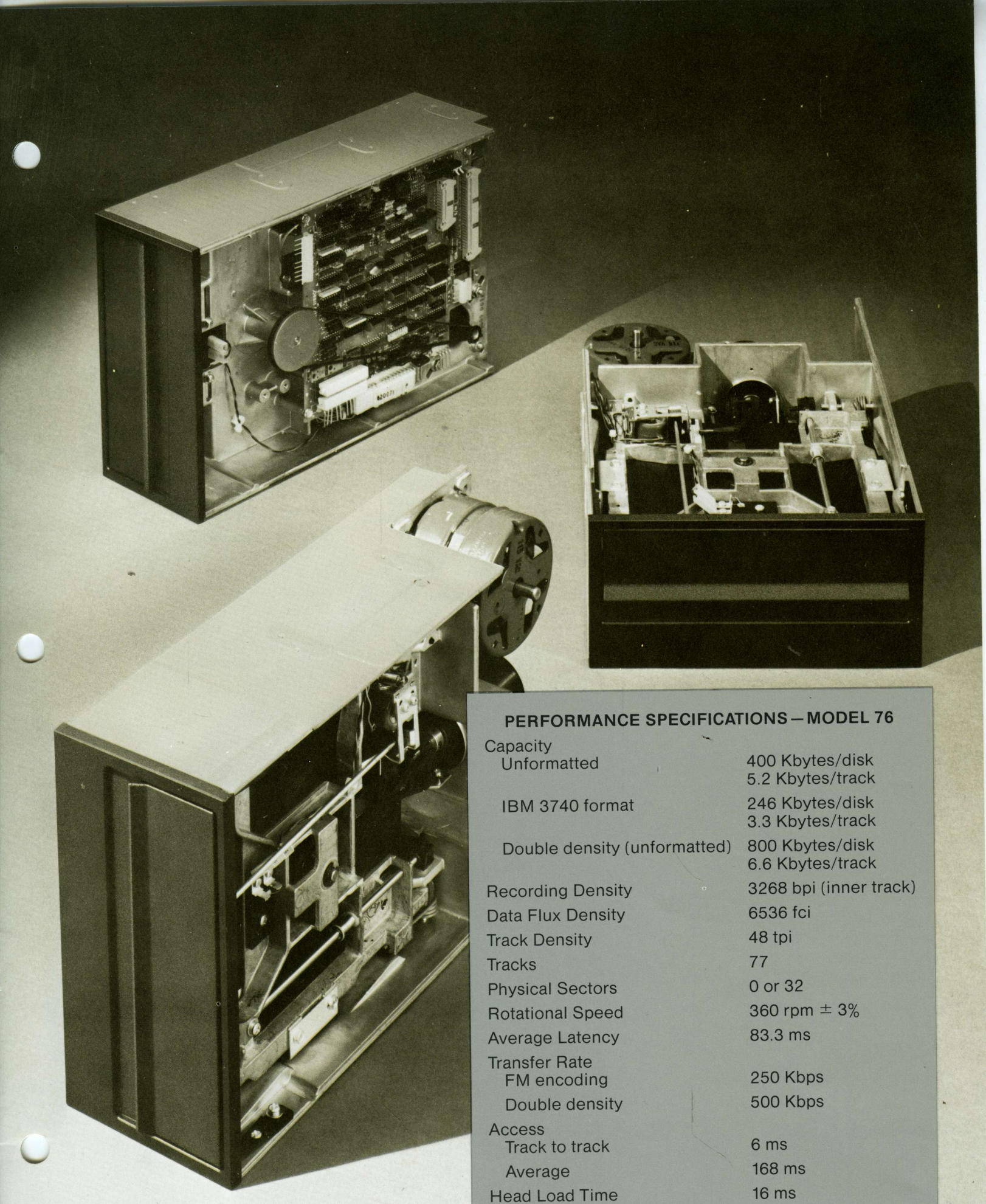
Low friction, uni-ball positioner.

The data reliability of the Model 76 is also a function of its media handling features. Diskettes are easily loaded into the drive through a wide-mouth door. The rigid carrier mechanism evenly distributes pressure on the medium as it is carried to the hub, where a self-centering "lotus-petal" clutch eases the diskette into perfect registration. An open and close door interlock prevents damage to the media and assures correct loading. The integrity of the file is maintained by an electro-mechanical write protect sensor. A hole on the medium is covered to permit writing on the disk. An optional mechanical write enable switch is also available.

System Oriented Design and Options.

Among the other options to the Model 76 are a data separator and a sector generator for hard sectoring without special media. Also available are cabling, a 50 Hz conversion kit, chassis slides and a special table-top enclosure.

The Model 76 is designed for mounting in any plane with or without the front bezel for greatest convenience and styling in system packaging.



PERFORMANCE SPECIFICATIONS — MODEL 76

Capacity	
Unformatted	400 Kbytes/disk 5.2 Kbytes/track
IBM 3740 format	246 Kbytes/disk 3.3 Kbytes/track
Double density (unformatted)	800 Kbytes/disk 6.6 Kbytes/track
Recording Density	3268 bpi (inner track)
Data Flux Density	6536 fci
Track Density	48 tpi
Tracks	77
Physical Sectors	0 or 32
Rotational Speed	360 rpm ± 3%
Average Latency	83.3 ms
Transfer Rate	
FM encoding	250 Kbps
Double density	500 Kbps
Access	
Track to track	6 ms
Average	168 ms
Head Load Time	16 ms
Head Settle Time	14 ms

(See general specifications page 13)

THE MODEL 276 DUAL HEAD DISKETTE DRIVE-STATE-OF-THE-ART IN STANDARD SIZE FLOPPYS.

Up to four times the data capacity of a 3740 compatible drive in a standard size configuration with full industry compatibility—Wangco's Model 276 Dual Head Diskette Drive extends the limits of flexible disk drive technology.

Data Capacity—4X With IBM Compatibility.

Using two IBM type, long-life ceramic ferrite read/write heads, the Wangco Model 276 will read and record data on a certified double sided flexible disk in single or double density encoding schemes. The drive will also accept single sided media, including the IBM Series/1 type. Maximum unformatted data capacity is 800 Kbytes per diskette in single density with a data transfer of 250 Kbps or 1.6 Mbytes in double density at 500 Kbps data rate. Designed for IBM format and media compatibility, the Wangco Model 276 will employ the IBM 2D diskette storing up to 985 Kbytes of data in 26 sector per track format or 1.2 Mbytes on 8 sectors per track.

Fastest Access.

A unique carriage positioning system on the Model 276 doubles the access speed over Model 76 drives. Track to track step is only 3 ms with an average access specification of 90 ms. The low friction positioner provides very high accuracy head positioning critical in dual head operation and assures IBM compatibility. The head carriage assembly allows simultaneous loading of the heads on the dual-sided diskette. Data seek and read may be accomplished alternately between diskette surfaces.

Standard Size/Proven Reliability Design.

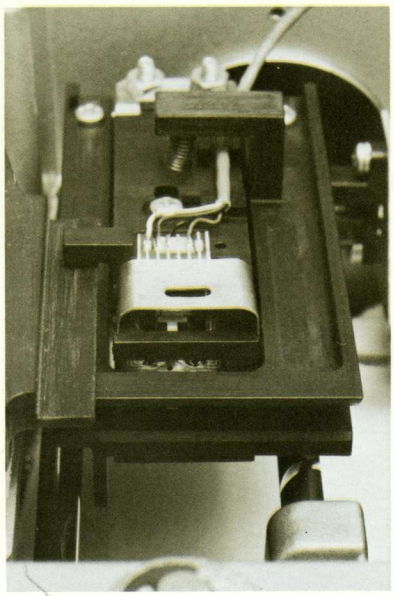
While offering quadruple data density, the Wangco Dual Head Drive is the industry standard configuration. Only 8.55" wide, two Model 276's mount horizontally, side-by-side in a 19" rack or, with optional extenders, will mount in systems designed for the Wangco Model 76.

Like the Model 76, the Model 276 Dual Drive has a precision cast, aluminum mainframe. Only 5V and 24V inputs, with no negative voltage, are required for convenient operation worldwide.

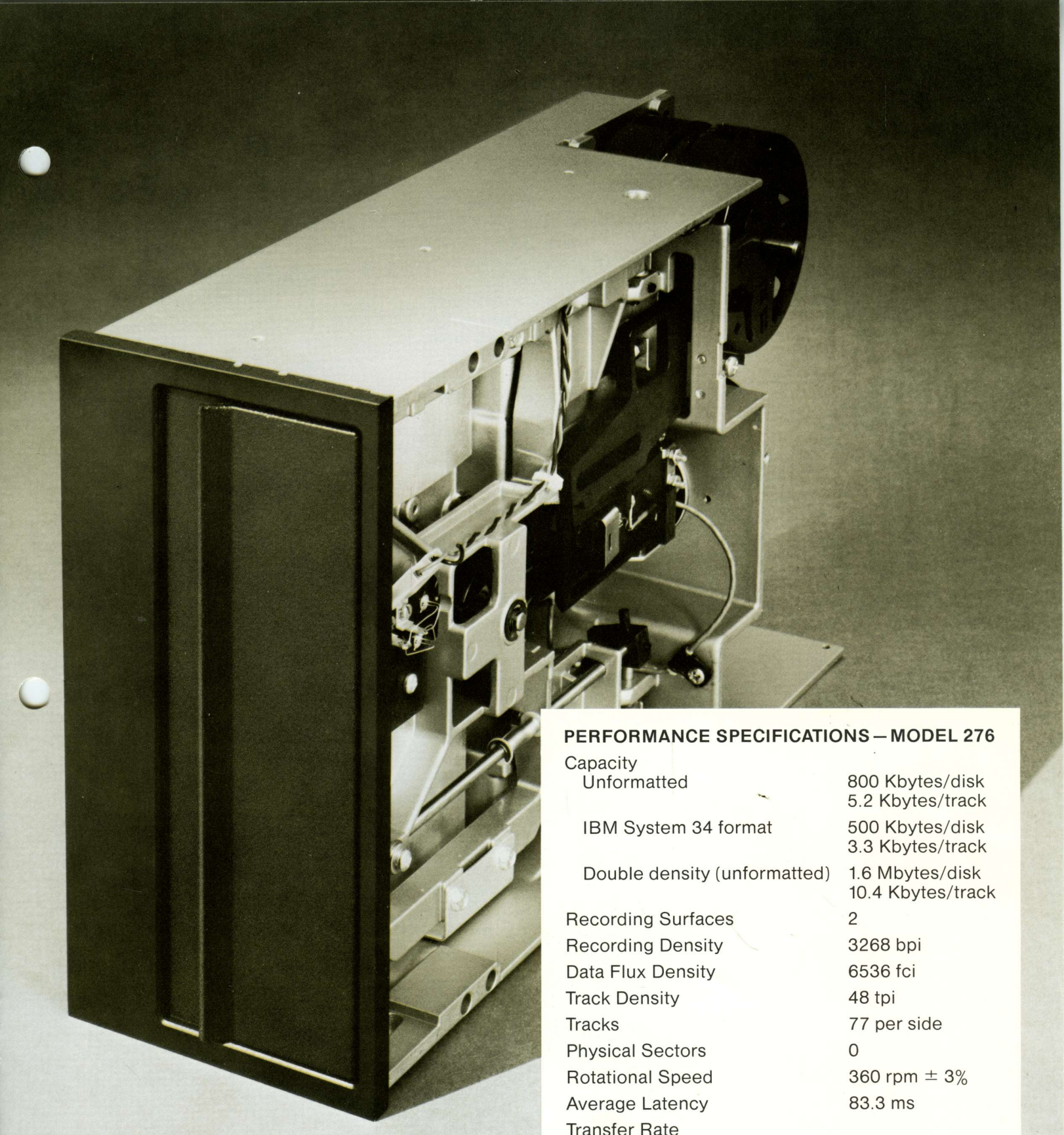
Gentle media handling is facilitated by Wangco's exclusive wide-mouth door and by an ANSI standard electro-optical write protect feature. In addition, a programmable door interlock maintains file integrity by prohibiting removal of media except by control of the host software.

System Designed.

The Wangco Model 276 is plug compatible with major industry drives. Up to four 276 drives (8 read/write heads) can be daisy chained on a single bus providing a total system data capacity of 6.4 Mbytes.



Dual ceramic ferrite read/write heads.



PERFORMANCE SPECIFICATIONS — MODEL 276

Capacity	
Unformatted	800 Kbytes/disk 5.2 Kbytes/track
IBM System 34 format	500 Kbytes/disk 3.3 Kbytes/track
Double density (unformatted)	1.6 Mbytes/disk 10.4 Kbytes/track
Recording Surfaces	2
Recording Density	3268 bpi
Data Flux Density	6536 fci
Track Density	48 tpi
Tracks	77 per side
Physical Sectors	0
Rotational Speed	360 rpm ± 3%
Average Latency	83.3 ms
Transfer Rate	
FM encoding	250 Kbps
Double density	500 Kbps
Access	
Track to track	3 ms
Average	90 ms
Head Load Time	35 ms
Head Settle Time	15 ms

(See general specifications page 13)

THE MODEL 87 DUAL DISKETTE STORAGE SYSTEM- THE TOTAL SYSTEM APPROACH.

For the designer who wants the advantages of floppy disk technology with maximum ease and economy, Wangco offers the Model 87 Diskette Storage System. The system is composed of a high performance controller, and one or two Model 76 Diskette Drives enclosed with necessary power supplies and cabling in an attractive desktop enclosure or a 19" rack mountable chassis.

IBM Compatible Controller

The microprocessor based controller of the Model 87 performs the functions of formatting standard diskette media in IBM 3740 compatible format with 26 sectors per track and 128 bytes per sector. Data capacity per disk is 237.5 Kbytes with a data transfer rate of 250 Kbps.

Other functions of the controller include update of diskette records, read/write head location for each drive, write data serialization for diskette recording and deserialization for diskette reading.

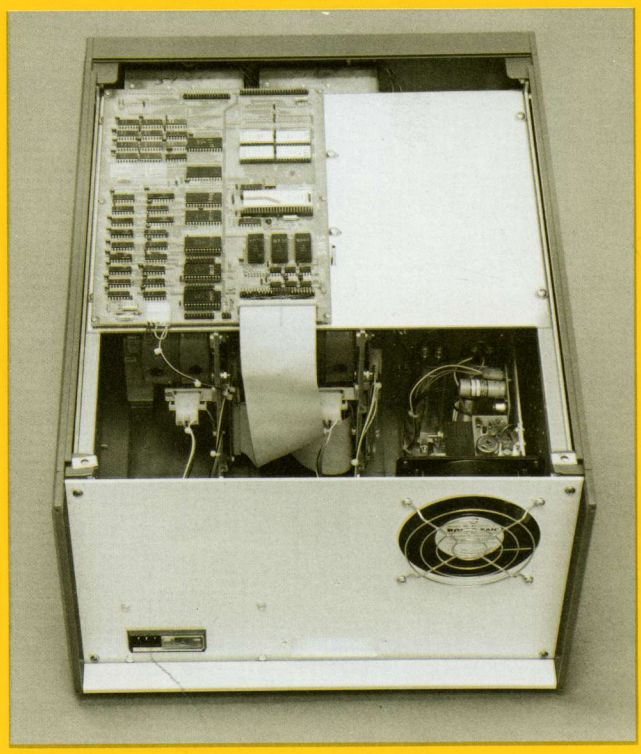
For maximum operating efficiency, 128 bytes of data buffering are provided for the read, write and WRDEL operations permitting data transfer between the host and disk, host and buffer or between buffer and disk.

General Purpose Interface.

Control by the host system is performed via a general purpose, byte oriented input/output interface through 18 TTL signal lines. Three I/O ports provide control, status and data paths between the host system and the controller.

High Performance With Economy.

The fast access (6 ms track to track) and high data reliability (1 in 10^{10} soft error rate) characteristics of the Model 87 system are attributable to the high performance of the Wangco Model 76 Diskette Drives. As a major manufacturer of diskette drives as well as systems, Wangco is able to pass on the economies of original design and quantity production to the OEM.



Interior view showing controller/formatter, two flexible disk drives and power supply.

PERFORMANCE SPECIFICATIONS — MODEL 87

Capacity	
IBM 3740 Format	492 Kbytes/system 246 Kbytes/disk 3.3 Kbytes/track
Drives	one or two
Recording Density	3268 bpi
Data Flux Density	6536 fci
Track Density	48 tpi
Tracks	77 per disk
Physical Sectors	0
Rotational Speed	360 rpm ± 3%
Average Latency	83 ms
Transfer Rate	
FM encoding	250 Kbps
Access	
Track to track	6 ms
Average	168 ms
Head Load Time	16 ms
Head Settle Time	14 ms

(See general specifications page 13)

THE MODEL 82 MICRO-FLOPPY™ DISK DRIVE - HIGH PERFORMANCE IN A MICRO SIZE

Measuring only 3.25 x 5.75 x 7.95 inches, the Wangco Model 82 Micro-Floppy Disk Drive stores and retrieves data on a 5¼ inch diskette. The combination of very small size and low cost plus high performance capability unique to Wangco make the Model 82 ideal for integration in microcomputer systems, word processors and intelligent terminals.

Data Capacity—Expandable to 500 KBytes

As the first true replacement for cassette and cartridge drives, the Wangco Micro-Floppy offers a series of expanded capacity features which provide data storage capability as high as 498.8 Kbytes.

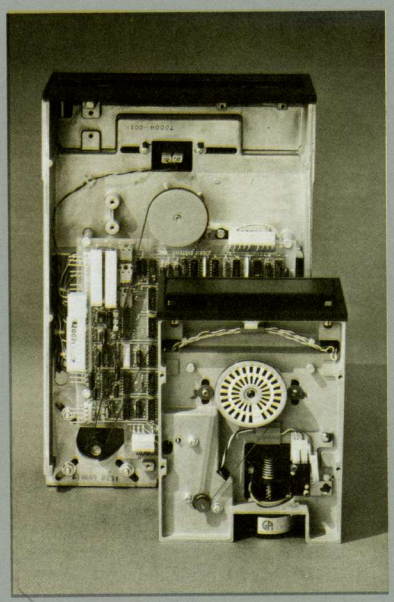
The basic unformatted capacity of the Micro-Floppy Disk Drive is 124.7 Kbytes on 40 tracks. Dual index and file protect sensors on the Model 82 permit recording of data on both sides of a Wangco Micro-Diskette, increasing single density storage to 249.4 Kbytes. To achieve maximum data storage on the micro-media, the design of the Model 82 is optimized for double density encoding on one or both sides of the diskette. When bit capacity is doubled, a single drive can store 498.4 Kbytes. Because up to four Wangco Model 82 units can be daisy chained on a single bus, the OEM can realize a total system data capacity approaching 2 Mbytes—big drive capacity using mailable, stackable 5¼ inch diskettes.

Format Versatility.

Data handled by the Micro-Floppy in single or double density encoding schemes can be stored on Micro-Diskettes™ which are hard or soft sectored to 10 sectors per track (256 bytes/sector) or 16 sectors/track (128 bytes/sector). Format flexibility permits increase of capacity and data handling efficiency as required by the application and assures maximum compatibility with existing systems.

Fast Throughput.

Track to track access time in the Micro-Floppy is 30 ms effecting a random average seek of 370 ms. Head load time is 60 ms. Data is transferred at a rate of 125 Kbps in FM encoding and 250 Kbps in double density. The rapid access to data of the Model 82 is largely a function of the low inertia, four-start lead screw positioning system, a field proven, high accuracy positioner technology. The low friction of the system prolongs positioner life. Fast throughput is also facilitated in daisy chain configuration by overlap seek which permits multiple drives to seek new tracks simultaneously.

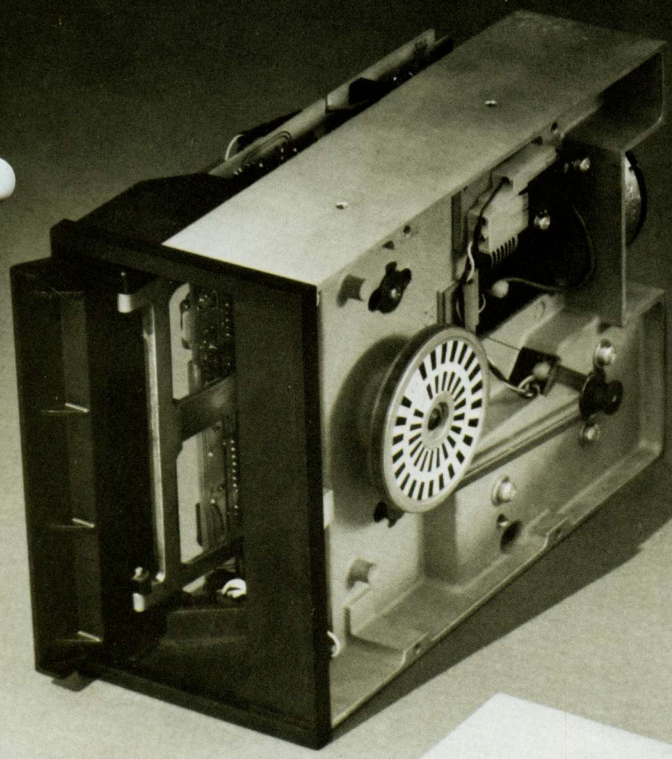


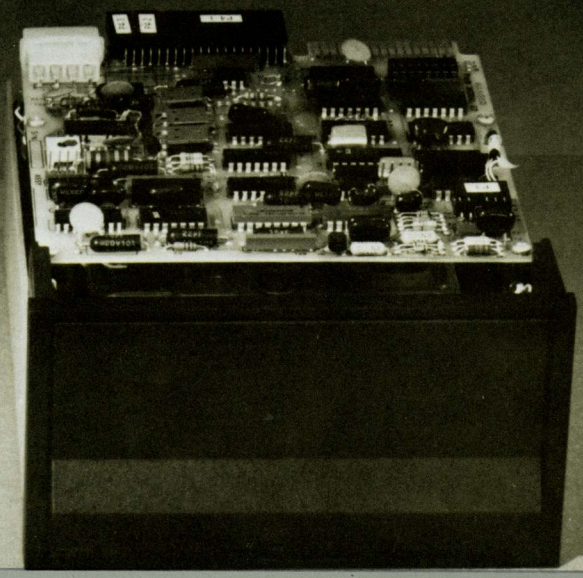
Measuring half the size of a standard floppy.

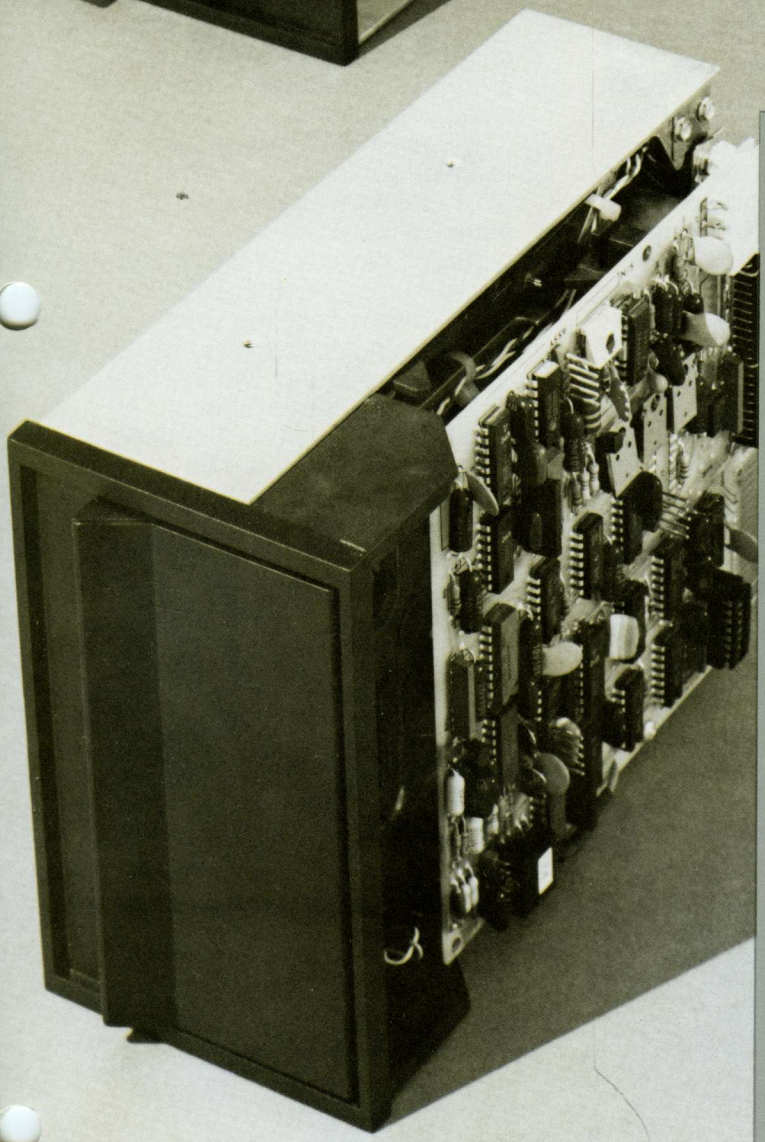
High Reliability, Long Life.

The Micro-Floppy is housed in a precise-tolerance cast aluminum mainframe and is driven by a precision DC drive motor; power dissipation is only 15 watts operating and 6 watts standby. A ceramic ferrite head (comparable to IBM design) extends head and diskette life. The MTBF specification resulting from this overall high reliability design is 8500 power-on hours with no recommended maintenance.

The precision engineering of the Micro-Floppy is reflected in its data reliability rating—1 in 10^9 soft error rate, 1 in 10^{12} hard error rate. The integrity of the file is further assured by a photoelectric write protect sensor. Errors which might result from mishandling of diskettes are prevented by the Model 82's wide loading door and a unique design door interlock which prevents diskette damage.







PERFORMANCE SPECIFICATIONS—MODEL 82

Capacity	
Unformatted (FM encoding)	
—35 tracks	109.4 Kbytes/disk 3.1 Kbytes/track
—40 tracks	124.7 Kbytes/disk
Initialized (FM encoding)	
—18 sectors/track	80.6 Kbytes/disk 2.3 Kbytes/track 128 bytes/sector
—10 sectors/track	89.6 Kbytes/disk 2.6 Kbytes/track 256 bytes/sector
Double Density (MFM, M²FM encoding)	
—40 tracks	249.4 Kbytes
Recording Density	2768 bpi
Data Flux Density	5536 fci
Track Density	48 tpi
Tracks	40
Physical Sectors	0, 10 or 16
Rotational Speed	300 rpm
Average Latency	100 ms
Transfer Rate	
FM encoding	125 Kbps
Double density	250 Kbps
Access	
Track to track	30 ms
Average—35 tracks	370 ms
Settle	20 ms
Head Load Time	60 ms
Power Up Delay	1 sec

(See general specifications page 13)

THE 8200 SERIES OF MICRO-CONTROLLERS™ - THE INTELLIGENT MICROPERIPHERALS.

Employing TTL and MOS LSI technology to achieve intelligence with extremely small size and low cost, the 8200 series is a family of complete, pre-programmed, intelligent controllers for "micro-sized" diskette drives. Providing a general-purpose host interface, the 8200 Series is easily employed in 6800 and 8080 based microcomputer systems, minicomputers and other byte oriented systems.

The 8200 controllers perform all the functions necessary to transfer data between from one to four micro-sized drives and a host system. The user can select an 8-bit bidirectional bus for data status and control word transfers, or separate in and out data buses, S-100 compatible, can be employed.

Formatting performed by the 8201 controller is of a soft sectored, modified IBM type, with 16 sectors per track of 128 bytes per sector. The system provides a 128 byte sector buffer, or multiple sector transfer without buffering can be accomplished. The 8200 Series includes both single and double density models.

Computer on a Chip.

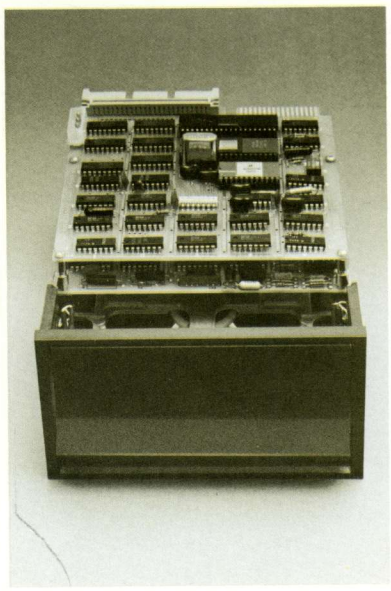
The heart of the 8200 Series controllers is the Intel MCS 8048, a powerful state-of-the-art microprocessor providing 1K of ROM plus RAM and I/O ports on a single chip. The "intelligence" of the microprocessor makes possible a nine macro-command structure which greatly reduces host overhead requirements, an advantage in low cost systems.

The functions of the 8200 Series include drive initiation, seek, read, read ID, write, write/delete and format plus two unique functions which are customarily performed in the host system. A diagnostic function of the 8200 permits self test operations to be performed on all diskettes. The DIAG commands cause the controller to format and verify a diskette, read and write worst case data on all tracks, randomly seek and verify, terminate, and provide error information. Another exclusive controller function (DUP) automatically copies diskette information from one drive to another at a single command from the host.

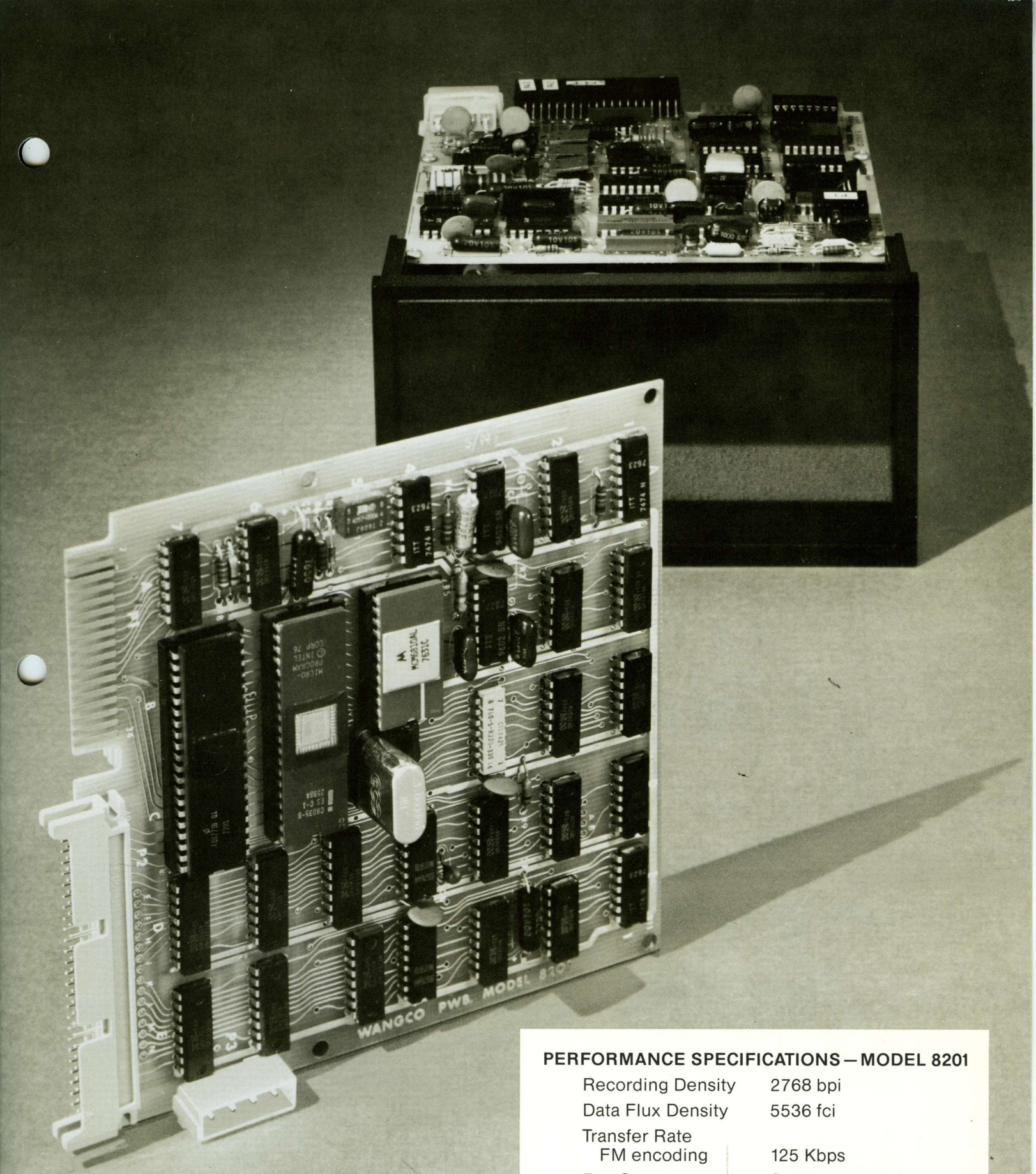
MOS/LSI.

Commands received from the host system are interpreted by internal microcode and implemented by the 8200 controllers. Due to this simplified, state-of-the-art design, only 30 IC's are required to achieve the controller performance, improving reliability and greatly reducing cost over first generation micro-sized controllers.

The simplified design also reduces controller size. The 8201 unit measures only 5½ inches square and can be mounted directly on top of the Micro-Floppy or other small-sized drive; hence, no separate housing or space in the system is required. The 8200 power supply requirement of +5 and +12 volts is identical with that of the Model 82 Micro-Floppy.



5½ inch square size permits mounting on Micro-Floppy Drive.



PERFORMANCE SPECIFICATIONS — MODEL 8201

Recording Density	2768 bpi
Data Flux Density	5536 fci
Transfer Rate FM encoding	125 Kbps
Bus Structure	S-100 compatible
Commands	9 macro commands
Buffer Size	128 bytes
MPU	Intel MCS 8048

(See general specifications page 13)

WANGCO MICRO-DISKETTES™ – THE NEW STANDARD IN MICRO-MEDIA.

Wangco's Model 820 Series Micro-Diskettes™ are unique in the marketplace. Measuring only 5¼ inches square, the Micro-Diskettes are certified for 40 tracks of recording on each side of the media. When this capability is combined with double density data encoding, the total storage capacity on a single Micro-Diskette can be as high as 498.8 Kbytes. Micro-Diskettes are available from Wangco and other major media suppliers in quantity packaging at competitive costs.

Designed for electro-optical write protect.

PERFORMANCE SPECIFICATIONS – SERIES 820 MEDIA

Capacity	
Unformatted	250 Kbytes/diskette
Double density (unformatted)	500 Kbytes/diskette
Recording Surfaces	2
Recording Density	2768 bpi
Data Flux Density	5536 fci
Track Density	48 tpi
Tracks	40 per side
Physical Sectors	0, 10, 16

(See general specifications page 13)

GENERAL SPECIFICATIONS

	Model 76 Diskette Drive	Model 276 Dual Head Drive	Model 87 System	Model 82 Micro-Floppy	Model 8201 Micro-Controller	Series 820 Micro-Diskette
Physical Specifications						
Dimensions	4.53" H x 9.01" W x 14.125" D	4.62" H x 8.55" W x 14.25" D	10.5" H x 16.75" W x 22.625" D	3.25" H x 5.75" W x 7.95" D	5.50" square	5.25" square
Weight	13 lbs.	13 lbs.	35 lbs.	3.5 lbs.	N/A	N/A
Media Requirements	8.0" diskette IBM 3740 compatible or equivalent	8.0" diskette IBM Diskette 2	8.0" diskette IBM 3740 compatible or equivalent	5.25" diskette Wangco Series 820 or equivalent	N/A	N/A
Environmental Specifications						
Ambient Temperature (operating)	50°-100°F	40°-115°F	50°-100°F	50°-105°F	50°-105°F	50°-105°F
Relative Humidity	20-80%	20-80%	20-80%	20-80%	20-80%	20-80%
Electrical Specifications						
Power Requirements	100/115 VAC ±10%, 50/60 Hz ±.5Hz, 0.6 A 208/230 VAC ±10%, 50/60 Hz ±.5Hz, 0.3 A +5VDC ±5%, 1.0 A +24VDC ±10%, 1.2 A	100/115 VAC ±10%, 50/60 Hz ±.5Hz, 0.4 A 208/230 VAC ±10%, 50/60 Hz ±.5Hz, 0.2 A +5VDC ±5%, 0.8 A +24VDC ±5%, 1.3 A	110/220 VAC, 3 A	+12VDC ±5%, 1.0 A +5VDC ±5%, 0.5 A	+5VDC ±5%, 1.0A +12VDC ±5%, .02A	N/A
Power Dissipation	40 watts, VDC; 40 watts, VAC	70 watts total	300 watts	15 watts operating 6 watts standby	8 watts	N/A
Reliability Specifications						
MTBF	5,000 hrs.	8,000 hrs.	5,000 hrs.	8,500 hrs.	N/A	N/A
MTTR	0.5 hr.	0.5 hr.	0.5 hr.	0.5 hr.	0.5 hr.	N/A
Media Life	N/A	N/A	N/A	N/A	N/A	3×10^6 passes
Design Life	5 yrs.	5 yrs.	5 yrs.	5 yrs.	5 yrs.	N/A
Data Integrity:						
Soft errors	1 in 10^{10} bits	1 in 10^9 bits	N/A	1 in 10^9 bits	N/A	N/A
Hard errors	1 in 10^{12} bits	1 in 10^{12} bits	N/A	1 in 10^{12} bits	N/A	N/A
Seek errors	1 in 10^6 seeks	1 in 10^6 seeks	N/A	1 in 10^6 seeks	N/A	N/A

WANGCO

PERKIN ELMER DATA SYSTEMS

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