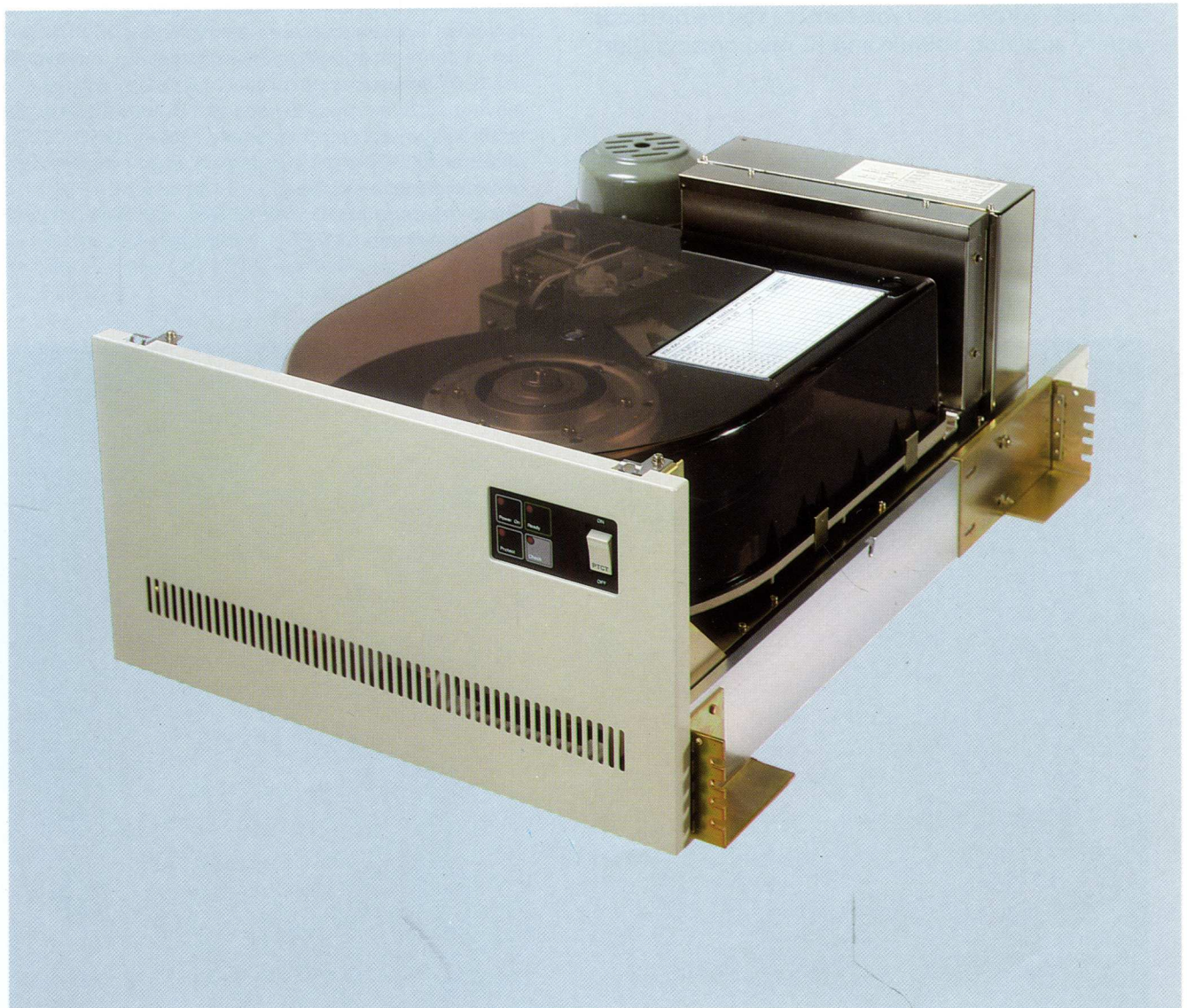


OEM FIXED DISK DRIVES

# M228X Series

M2280K/N    M2288K/N  
M2284K/N    M2289K/N

*14-inch Winchester-type fixed disk drives with 84.2 and 168.5 megabyte capacities, and 27 millisecond average positioning time*



M2284K



# OEM FIXED DISK DRIVES

M228X series fixed disk drives are 14-inch Winchester-type fixed disk drives offering large storage capacities, high performance and enhanced reliability. Four models are offered: the M2280 and M2289, each having an unformatted storage capacity of 84.2 megabytes, and the M2284 and M2288, each having 168.5 megabytes. The M2280 and M2284 adopt moving heads only, while the M2288 and M2289 have moving heads plus fixed heads for faster access. Each model is available in two types — K and N. The K-type is provided with 100/115 VAC power supply, while the N-type is equipped with 220/240 VAC power supply.

Each M228X model consists mainly of a disk enclosure, spindle drive motor and five printed circuit boards. The disk enclosure integrates two disks (M2280, M2289) or three disks (M2284, M2288), Winchester-type contact start/stop heads, rotary actuator, spindle and IC read preamplifiers.

## Large storage capacity

The M228X series offer 823 cylinders with 20,480-byte track capacity, and its servo-controlled track-following system assures accurate head positioning on high-density tracks (680 tracks per inch). These permit large unformatted storage capacities such as 84.2 megabytes for the M2280 and M2289, and 168.5 megabytes for the M2284 and M2288.

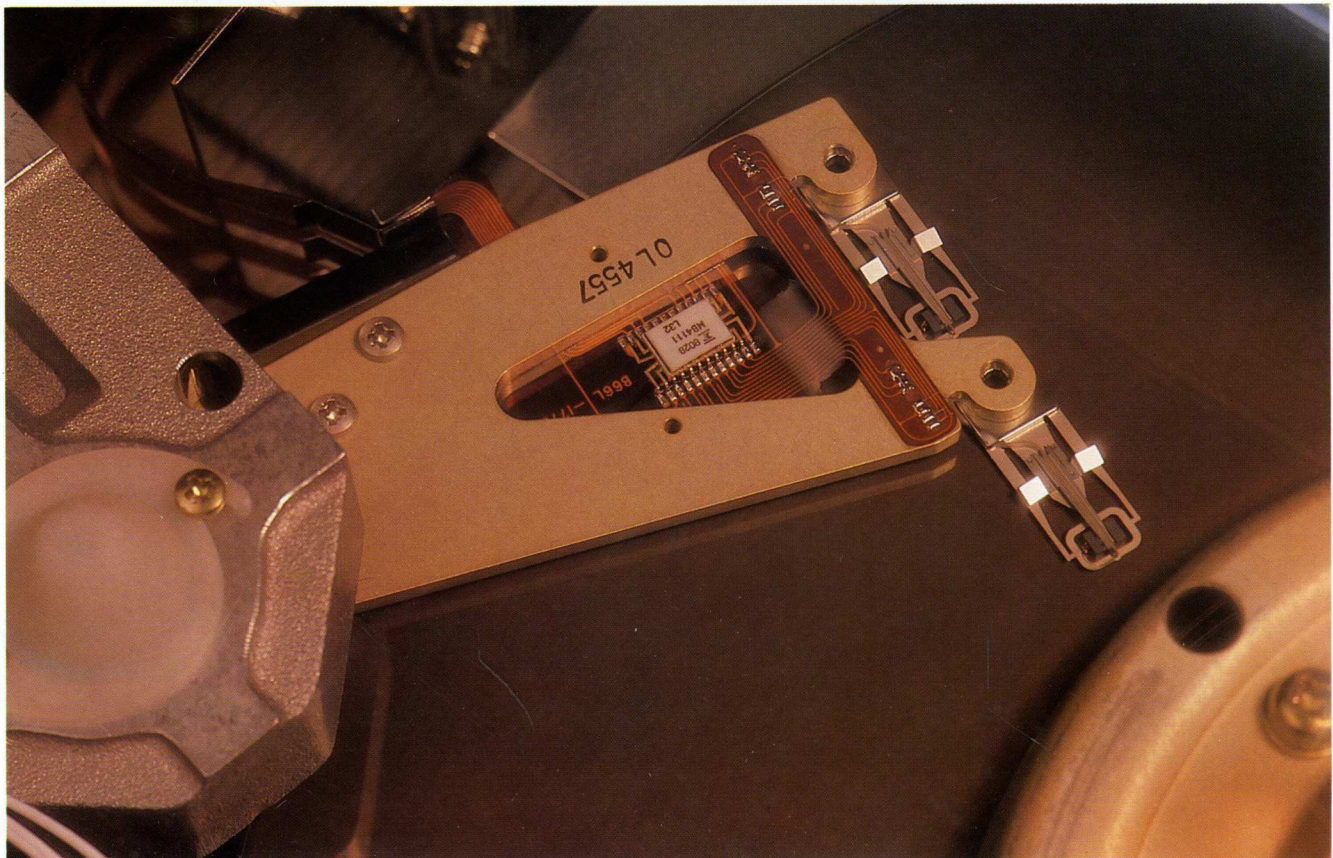
## High performance

With the adoption of a high-speed rotary actuator, the M228X series achieves fast head positioning — 6 milliseconds for track-to-track, 27 milliseconds average and 55 milliseconds maximum — and a high transfer rate of 1,012 kilobytes per second. With the M2288 and M2289, 32 fixed heads offer faster access to 655.3 kilobytes.

## High reliability

The completely sealed disk enclosure incorporates a breathing filter and an absolute recirculation filter to provide a contamination-free environment for the low-flying heads. Winchester-type contact start/stop heads eliminate moving parts for head loading and unloading. A read preamplifier on each head arm called the head IC (HIC) amplifies small read signals to prevent read errors caused by external electrical noise.

These features assure the M228X series a mean-time-between-failures (MTBF) exceeding 10,000 power-on hours.



Enlarged photo of head IC (HIC)

**Compact, economical**

Despite their large capacities, M228X series disk drives can be mounted in a 19-inch rack in 6 pitches, thus saving installation space. Each model can also be mounted vertically in a system cabinet. Thanks to the rotary actuator, M228X series power consumption as well as heat dissipation are greatly reduced.

**Dual-port option**

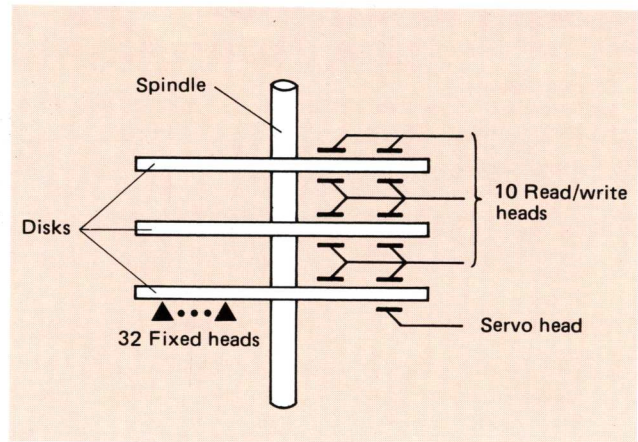
Each M228X model can be connected with two controllers when a dual-port option is provided. This option is available as a separate printed circuit board which is mounted on the PCB chassis.

**Compatibility**

The M228X series has an industry standard Storage Module Device (SMD) interface. This means that the M228X models can be added to or replaced with existing disk drives or lower capacity M228X models for increased storage capacity, thereby allowing smooth upgrading in disk configuration.

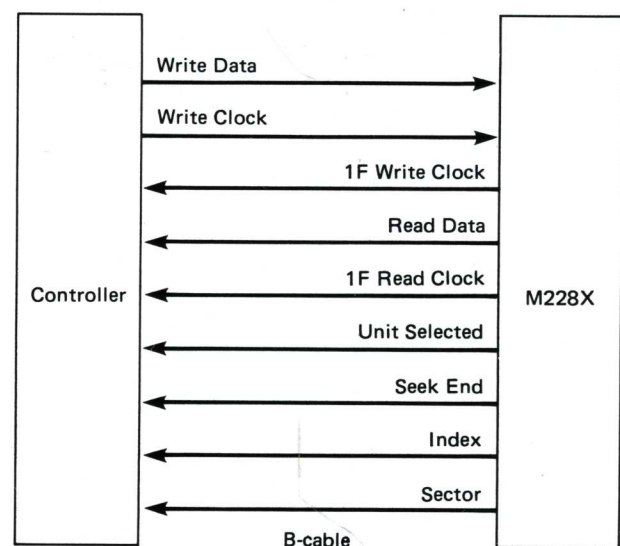
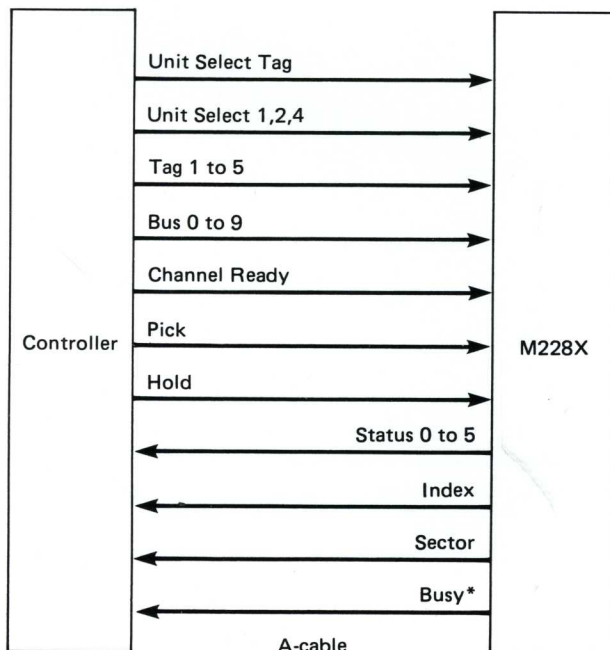
**Maintenance-free**

With their completely sealed disk enclosure and other highly reliable printed circuit boards, M228X series disk drives require substantially reduced maintenance: no preventive maintenance is required. The compact disk enclosure can be easily replaced by customer engineers, and mean-time-to-repair (MTTR) is less than one hour.



*M2288 K/N disk head structure*

**SMD interface**



\*Busy signal is used with the dual-port option.

# OEM FIXED DISK DRIVES

## FUNCTIONAL SPECIFICATIONS

	M2280K/N	M2289K/N	M2284K/N	M2288K/N
Storage capacity (unformatted)	84,275,200 bytes	84,275,200 bytes	168,550,400 bytes	168,550,400 bytes
Moving heads	—	655,360 bytes	—	655,360 bytes
Fixed heads	—	—	—	—
Disks	2		3	
Heads				
Read/write	5	5	10	10
Servo	1	1	1	1
Fixed	—	32	—	32
Bytes per track	20,480			
Tracks per cylinder				
Moving heads	5	5	10	10
Fixed heads	—	8	—	8
Cylinders				
Moving heads	823	823	823	823
Fixed heads	—	4	—	4
Sectors	2 or more Available			
Fixed				
Variable				
Positioning time				
Track-to-track	6 ms			
Average	27 ms			
Maximum	55 ms			
Average latency time	10.12 ms			
Rotational speed	2,964 rotations/minute			
Recording density	6,580 bits/inch			
Track density	680 tracks/inch			
Data transfer rate	1,012 kilobytes/second			
Recording code	MFM (Modified Frequency Modulation)			
Interface code	NRZ (Non-Return-to-Zero)			
Interface	SMD (Storage Module Device)			
Head positioning method	Servo-controlled track-following			
Start time	Less than 40 seconds			
Stop time	Less than 30 seconds			

## RELIABILITY SPECIFICATIONS

	M2280K/N, M2284K/N
Mean-time-between-failures (MTBF)	More than 10,000 power-on hours
Mean-time-to-repair (MTTR)	Less than 1 hour
Component life	5 years
Error rates	
Recoverable errors	10 per 10 <sup>11</sup> bits read
Unrecoverable errors	10 per 10 <sup>14</sup> bits read
Seek errors	1 per 10 <sup>7</sup> seeks

## PHYSICAL SPECIFICATIONS

	M2280K M2284K M2288K M2289K	M2280N M2284N M2288N M2289N
Power requirements		
Operating	100VAC±10% 50/60Hz±½%, 2.5A 115VAC±1½%, 60Hz±1%, 3A	220 <sup>±2½</sup> <sub>37</sub> VAC, 50Hz±½%, 2A 240 <sup>±2½</sup> <sub>37</sub> VAC, 50Hz±½%, 2A
Start-up	100VAC±10% 50/60Hz±½%, 8A 115VAC±1½%, 60Hz±1%, 9.5A	220 <sup>±2½</sup> <sub>37</sub> VAC, 50Hz±½%, 5A 240 <sup>±2½</sup> <sub>37</sub> VAC, 50Hz±½%, 5A
Dimensions and weight		
Height	250 mm ( 9.84 inches)	
Width	416 mm (16.38 inches)	
Depth	650 mm (25.59 inches)	
Weight	40 kg (88 lbs)	
Ambient temperature		
Operating	5 to 40°C ( 41 to 104°F)	
Non-operating	-40 to 60°C (-40 to 140°F)	
Gradient	Less than 15°C (27°F)/hour	
Relative humidity		
Operating	20 to 80% (Non-condensation)	
Non-operating	5 to 95%	
Vibration		
Operating	Max. 0.2G ( 5 to 50Hz), Max. 1G (50 to 500Hz), Shock: max. 2G (max. 10 ms)	
Non-operating	Max. 0.4G ( 5 to 50Hz), Max. 1G (50 to 500Hz), Shock: max. 3G (max. 10 ms)	
In storage or during transportation	Max. 3G, Shock: max. 5G (max. 10 ms)	
Altitude		
Operating	3,000 m (10,000 feet)	
Non-operating	12,000 m (40,000 feet)	

Specifications are subject to change without notice. For the latest information, contact your local Fujitsu representative.

## FUJITSU AMERICA, INC.

2945 Oakmead Village Court  
Santa Clara, CA 95051 (408) 727-4300  
Telex: 171182 TWX: 910-338-0047, 910-338-0190

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