

# **MITSUBISHI ELECTRIC**

## **5.25 INCH FLEXIBLE DISK DRIVES**

<b>MF501B</b>	<b>0.5 MB</b>
<b>MF503B</b>	<b>1.0 MB</b>
<b>MF504B</b>	<b>1.6 MB</b>

### **SPECIFICATIONS and APPLICATION NOTES**

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The Mitsubishi MF500B range of double sided 5¼ inch flexible disk drives provide high performance and reliability giving a service life of over 20 000 hours.

- Industry standard types offering 360KB, 800KB and 1.2MB formatted capacity.
- New high compliance gimbal mounted head gives long media life and reliable data transfer
- Excellent timing margin and radial alignment guarantees perfect data interchange between systems
- MF504B (1.6MB) can read standard 360KB disks
- MF503B (1.0MB) can be switched for 40 or 80 track operation
- Dynamic clamping ensures perfect disk centring
- Industry standard interface and power connector
- Latest VLSI technology combines bipolar amplifiers and CMOS logic in a single 80 pin ASIC

This booklet gives guidance for applying the range of 5¼ inch floppy drives. For more details consult the standard specification manual for each model.

## Performance specifications

		MF501B	MF503B	MF504B Low density	MF504B High Density
MFM recording					
Unformatted capacity:-	Track	6.25KB	6.25KB	6.25KB	10.416KB
	Disk	500KB	1000KB	1000KB	1666KB
Formatted capacity:-	Sector	0.256KB	0.256KB	0.256KB	0.512KB
	Track	4.096KB	4.096KB	4.096KB	7.680KB
16 (15) sectors/Track	Disk	327.7KB	655.36KB	655.36KB	1228.8KB
Transfer rate		250kb/S	250Kb/s	250/300Kb/s	500Kb/s
Track density per inch		48 tpi	96 tpi	96 tpi	96 tpi
Total tracks		80	160	160	160
Access time					
Track to track		6 mS	3 mS	3 mS	3 mS
Average		103 mS	94 mS	94 mS	94 mS
Settling time		15 mS	15 mS	15 mS	15 mS
Motor speed		300rpm	300rpm	300/360rpm	300rpm
Motor start time		250 mS	400 mS	400 mS	500 mS
Ready time		700 mS	700 mS	700 mS	700 mS

Environmental conditions	Operating	Storage	Transportation
Ambient temperature	5°C to 43 °C	-20°C to 60°C	-40°C to 60°C
Relative humidity	20% to 80%	10% to 90%	5% to 95%
Dimensions	Height 41mm	Width 146mm	Depth 195mm
Weight	1.2Kg		

## Reliability

MTBF	10 000 POH or more	MTTR	30 minutes
Unit life	5 years or 20 000 POH	Media life	3.5 million
Error rate	Soft error		passes/track
	Hard error		
	Seek error		

## DC power connector

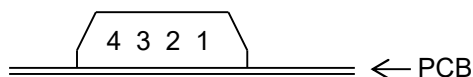
Pin number Voltage

1 +12V DC

2 0V

3 0V

4 +5 VDC



DC power requirements + 5V ±5% 0.5A typ 0.7A  
+12V ±5% 0.6A typ 1.0A max

A 0.25" frame ground connector is provided adjacent to the DC connector. The cut track option 'FG' isolates the DC 0V from the frame ground.

## Signal interface

Signal	I/O	Pin	OV	
* Spare	I/P	2	1	* MF504B) This line switches between high and low density
In use	I/P	4	3	
Drive select 3	I/P	6	5	
Index	O/P	8	7	** (MF501B) Standard ready or hold ready available
Drive select 0	I/P	10	9	** (MF5038 & MF504B) Standard ready, hold ready and disk-change available
Drive select 1	I/P	12	11	
Drive select 2	I/P	14	13	
Motor on	I/P	16	15	
Direction select	I/P	18	17	
Step	I/P	20	19	<u>TTL levels</u>  Low level (TRUE) OV to + 0.4V High level (FALSE) + 2.5V to + 5.25V Input impedance 150 Ohms Receiver: SN7414N or equivalent Driver: SN7438N or equivalent
Write data	I/P	22	21	
Write gate	I/P	24	23	
Track 00	O/P	26	25	
Write protect	O/P	28	27	
Read data	O/P	30	29	
Side one select	I/P	32	31	
** Ready	O/P	34	33	

## Cabling and termination

Up to four drives may be connected by a ribbon cable in a daisy change configuration. A SIL terminator, supplied installed on the PCB, should be fitted to the last drive in the chain. On MF503B and MF5048 jumper 'TD' is installed to terminate drive select.

## Power on sequence

No read/write operation may be performed until 100 mS after DC power is applied. The drive becomes ready after 600 mS (700mS for MF501B). The head must be stepped out to track 00 to provide a reference before track seeking begins.

## Write precompensation

The drive uses high performance read/write heads with good compliance and media contact. This means that no write precompensation should be used. If write precompensation must be used, it should be 150 nS or less.

## 40 / 80 track switch option (MF503B)

The cut track option 'ST' may be cut to change to 40 track mode. A switch may be connected. An 80 track drive should not be used to write 40 track diskettes to be read by a 40 track drive. The PCB must not be damaged by track cuts or solder connections.

## Option settings

Brackets around jumper name:– (MM) indicates jumper plug should be installed to select the function.

Jumper name	Function
(DS0)	DRIVE SELECT 0 enables the drive.
(DS1)	DRIVE SELECT 1 enables the drive. DS2 & DS3 etc.
(MX)	Drive is selected regardless of DRIVE SELECT lines
(MM) MS	Motor controlled by MOTOR ON signal
MM (MS)	Motor controlled by DRIVE SELECT signal
MM MS	Motor controlled by DRIVE SELECT AND MOTOR ON signal
(MM) (MS)	Motor controlled by IN USE signal latched by DRIVE SELECT signal. Option IU must be jumpered. (MF501B motor controlled by MOTOR ON signal)
(SR) DC HR DD	Standard READY sent on pin 34
(SR) DC (HR) DD	HOLD READY sent on pin 34 (MF503B, MF504B)
SR (DC) HR (DD)	DISK CHANGE (reset by DS) on pin 34 (MF503B, MF504B)
SR (DC) HR DD	DISK CHANGE (reset by step) on pin 34
SR DC	No ready signal sent
(RD)	Read data pulses inhibited by READY (MF504B)
(RI)	Index pulses gated by ready signal
(SS) SB	360 rpm when high density signal sent (MF504B)
	300 rpm when low density signal sent (MF504B)
SS (SB)	360 rpm for high and low density (MF504)
(SS) SB (ND)	Low density 300 rpm set
	LED lighting conditions (MF503B & MF504B)
	MF501B LED is lit by IN USE OR DRIVE SELECT
(IU) (IS) (IL)	If IN USE is set, DRIVE SELECT latches LED on
(IU) ) IS (IL)	LED lit by sum of DRIVE SELECT above conditions
(IU) IS IL	LED lit by logical sum of DRIVE SELECT and IN USE.
(IV) (IS) IL	LED lit by IN USE signal
IU IS IL	LED lit by DRIVE SELECT signal
IU (IS) IL	LED will not light
(IR)	May be used with all the above. Requires that drive is ready before LED will light. Standard or Hold Ready must be selected if (IR) is used.

## INPUT SIGNALS

### Side one select

Logical '1' selects head 0, logical '0' selects head 1. A 100pS delay must be allowed after side select. After a write operation a 1mS delay (590pS for MF504B at high density) must be allowed before a side change or a track access. **Direction select**

Defines head stepping direction. Logical '1' causes heads to step from the centre outward. Logical '0' causes stepping inward.

### Step

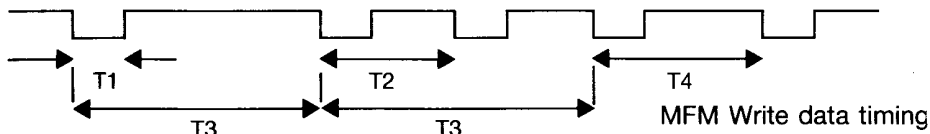
Pulses on this line move the head in the direction selected. The head steps one track on the trailing edge of a negative pulse ('0' to '1').

## Write gate

Logical '0' enables data on the write line to be written on the selected side and track. Logical '1' inhibits writing and enables reading. Data cannot be written if the write protect line is at '0' because a write protected disk is present. Read data is output 1mS (590ps for MF504B at high density) after write gate becomes inactive.

## Write data

Data written to the disk is sent on this line. The line is normally at '1' and reverses the write current at the leading edge of a negative-going pulse ('1' to '0'). Writing is enabled by '0' on the write gate.



Type	T1	T2	T3	T4
360rpm HD	150 to 1100ns	$2.0\mu\text{s} \pm 10\text{ns}$	$4.0\mu\text{s} \pm 20\text{ns}$	$3.0\mu\text{s} \pm 15\text{ns}$
360rpm LD	150 to 1800ns	$3.33\mu\text{s} \pm 17\text{ns}$	$6.7\mu\text{s} \pm 33\text{ns}$	$5.0\mu\text{s} \pm 25\text{ns}$
300rpm	150 to 2100ns	$4.0\mu\text{s} \pm 20\text{ns}$	$8.0\mu\text{s} \pm 40\text{ns}$	$6.0\mu\text{s} \pm 30\text{ns}$

For MF501B T1= 200 to 2100ns

## In use

Logical '0' lights the LED. (MF503B & MF504B have option jumpers for LED lighting conditions).

## Motor on

Logical '0' turns the motor on. The write gate does not go to '0' until 500mS after the motor on line goes to '0'.

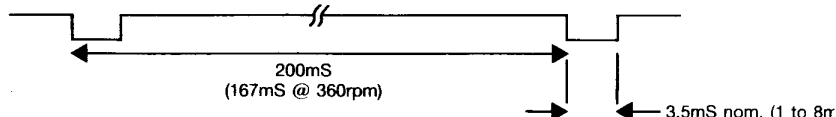
## Normal density (MF504B only)

Logical '1' selects high density read/write operation and logical '0' selects normal density. With option jumpers SS shorted and SB open, this line changes the motor rpm and read/write operations are performed 400mS after density change, to allow the motor speed to stabilize. When motor rpm is switched the head must be moved to track 00 before reading or writing. With SB shorted and SS open the motor speed is always 360rpm so no waiting or track 00 seek is necessary.

## OUTPUT SIGNALS

### Index

A '0' pulse of 3.5mS is output once for each revolution of the disk.



## Track 00

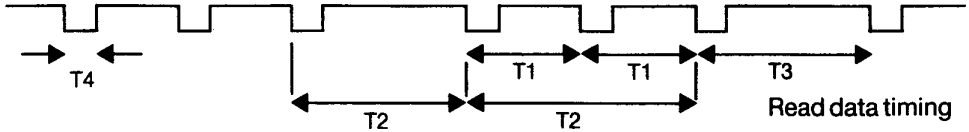
Logical '0' on this line indicates that the head is on track 00.

Ready

This line is at '1' if the door is opened or the lever is up. A '0' is produced when the DC power is applied, a diskette is properly clamped and 2 or more index pulses are detected. Option jumpers select the type of ready signal supplied.

Read data

This line outputs raw data (combined clock and data signals) converted into logical '0' pulses.



Type	T1	T2	T3	T4
360rpm HD	2.0µs ± 400ns	4.0µs ± 800ns	3.0µs ± 600ns	300ns ± 150ns
360rpm LD	3.33µs ± 66ns	6.67µs ± 1333ns	6.0µs ± 1200ns	300ns ± 150ns
300rpm	4.0µs ± 800ns	8.0µs ± 16000ns	6.0µs ± 1000ns	300ns ± 150ns
For MF503B T4= 1.0µs ± 250ns				
For MF501B T4= 0.8µs ± 250ns				

HD – High density LD – Low density

Write protect

This signal goes to '0' when a write protected disk is inserted into the drive. Writing is inhibited even if the write gate is active.

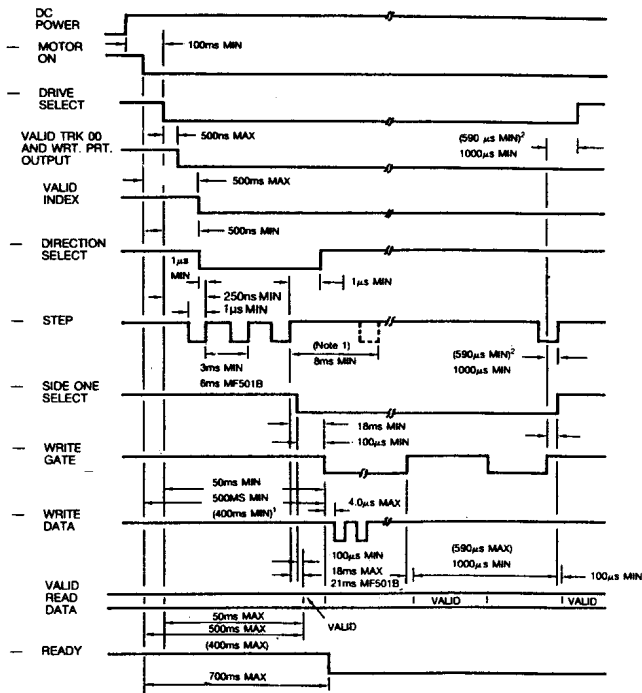
Control and data timing

Note 1

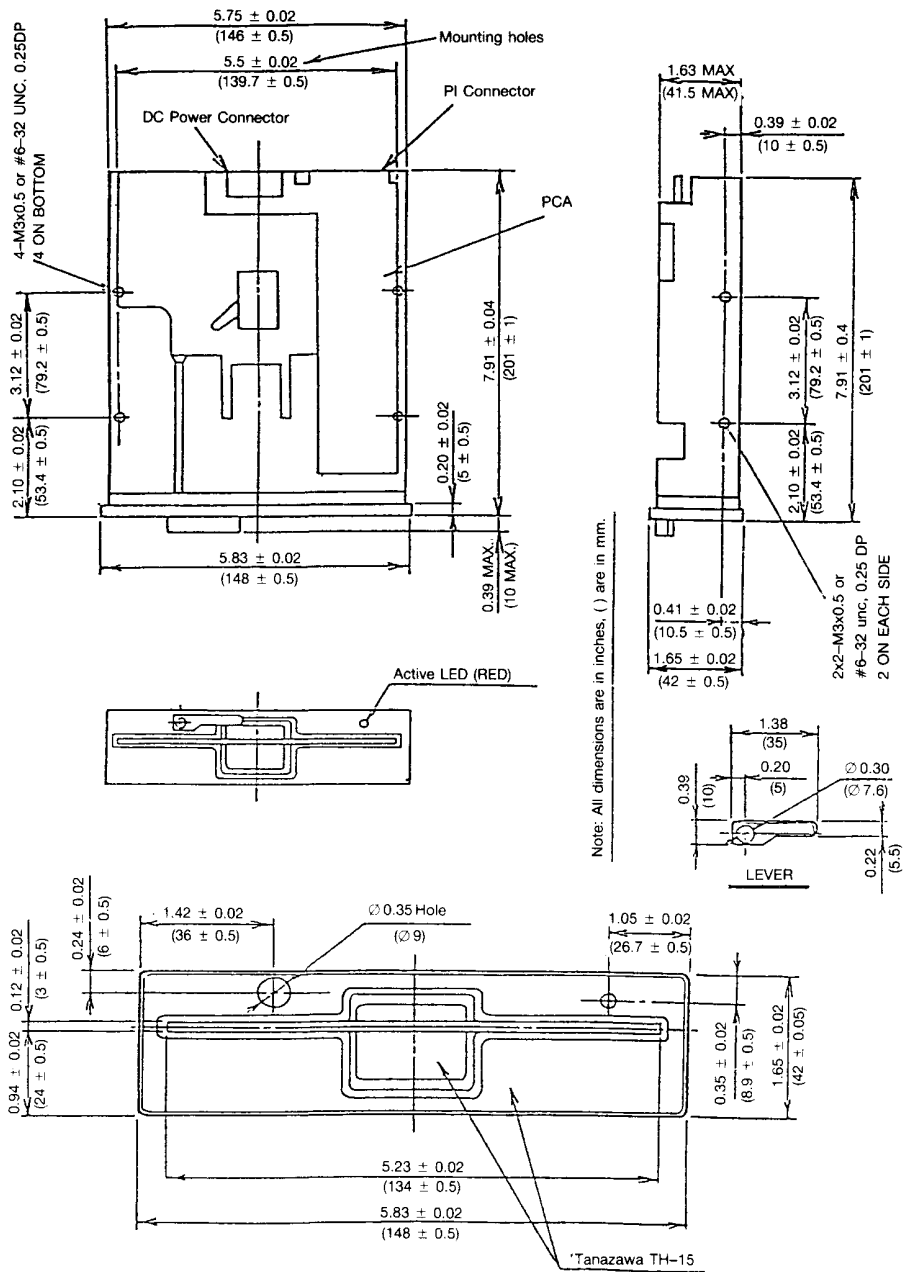
Wait 8ms before issuing a step pulse after changing direction.

Note 2

Applies to MF504B at high density.



Disk Drive and front bezel dimensions



Test points for alignment procedures

	MF501B	MF503B	MF504B
Track 00 sensor	TPA 1	TPA 1	TPA 4
Read data output	TPA 3	TPA 3	TPA 3
Track 00 output	TPA 13	TPA 13	TPA 2
Index output	TPA 14	TPA 14	TPA 1
Differential head output	TPB 9 TPB 10	TPB 9 TPB 10	TPB 5 TPB 6

Option jumper locations

