TEAC FD-CR7

7-IN-1 MEDIA DRIVE

HARDWARE SPECIFICATION

Rev. C

6554c

24 sheets in Total

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1. OUTLINE

This specification provides a description for the hardware specifications of the TEAC FD-CR7 (2/1.6/1MB, 3-mode), 90mm (3.5-inch) micro floppy disk drive and the flash media drive with USB interface (hereinafter referred to as FD-CR7 or drive).

The FD-CR7 is a compound storage device to connect to a computer with the USB interface for reading and writing on various flash media *1 and FD media (floppy disk), and has the features as shown below.

*1 CompactFlash™(Type-I&II), MicroDrive™, SecureDigitalCard™, MultiMediaCard™, MemoryStick(Pro)™, SmartMedia™

(1) System Requirements
  (a) Platform
    PC/AT compatible PC with the USB port
  (b) OS
    Windows 2000*2, Windows Me, Windows XP*2

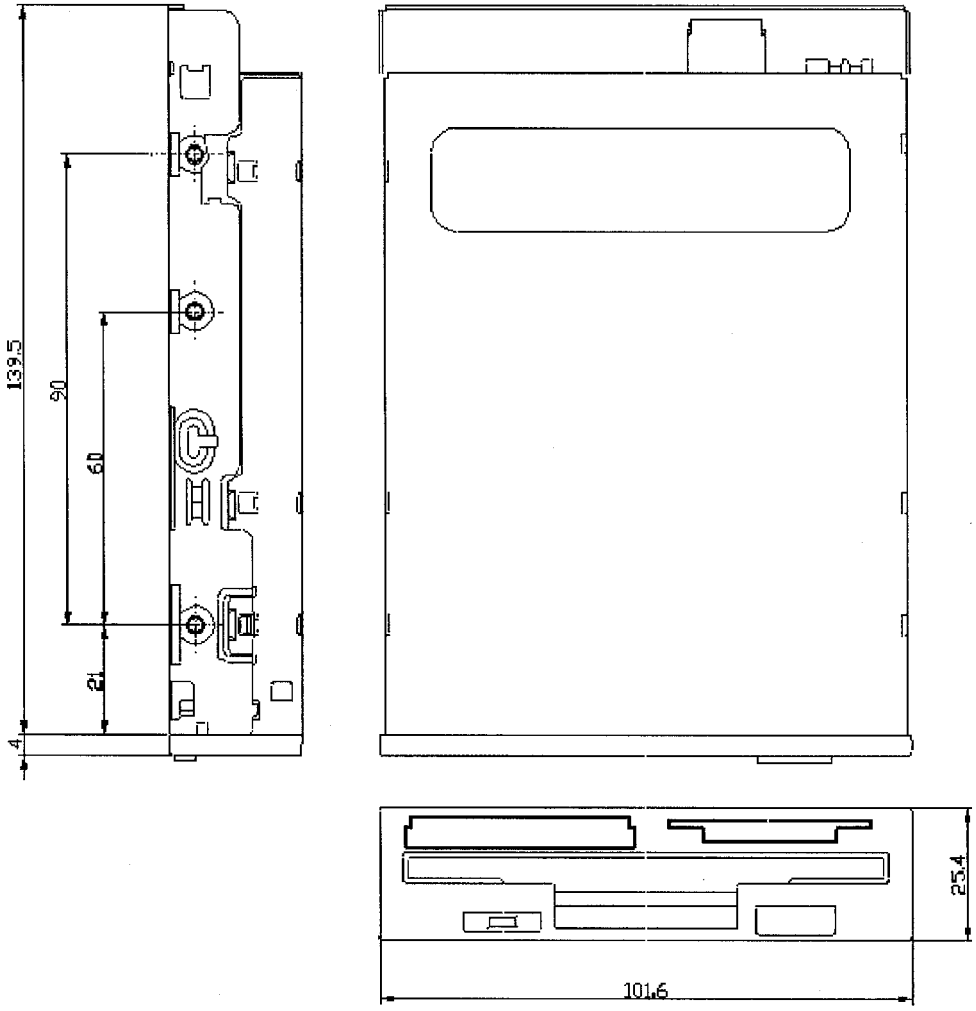
*2 Need to install the latest service pack for Windows 2000 and Windows XP.

(2) Standard USB Interface
  The FD-CR7 is equiped with the standard USB interface, and can be used with a host with the USB interface (root hub) or a port of hub connected.
  (a) Complying with USB 2.0 High-speed/Full-speed standards
  (b) Response to USB standard request
  (c) Standard descriptor
(3) Low Power Consumption
  The FD-CR7 is designed to consume as little power as possible and operates as USB bus-powered device. (Refer to 6.3 Power Supply)
(4) Compound storage device
  The FD-CR7 is a combo drive with the USB interface for the flash media drive and the 34-pins standard interface for FDD. And, the flash media drive is recognized as two logical unit devices, so it can transfer data between different flash media.

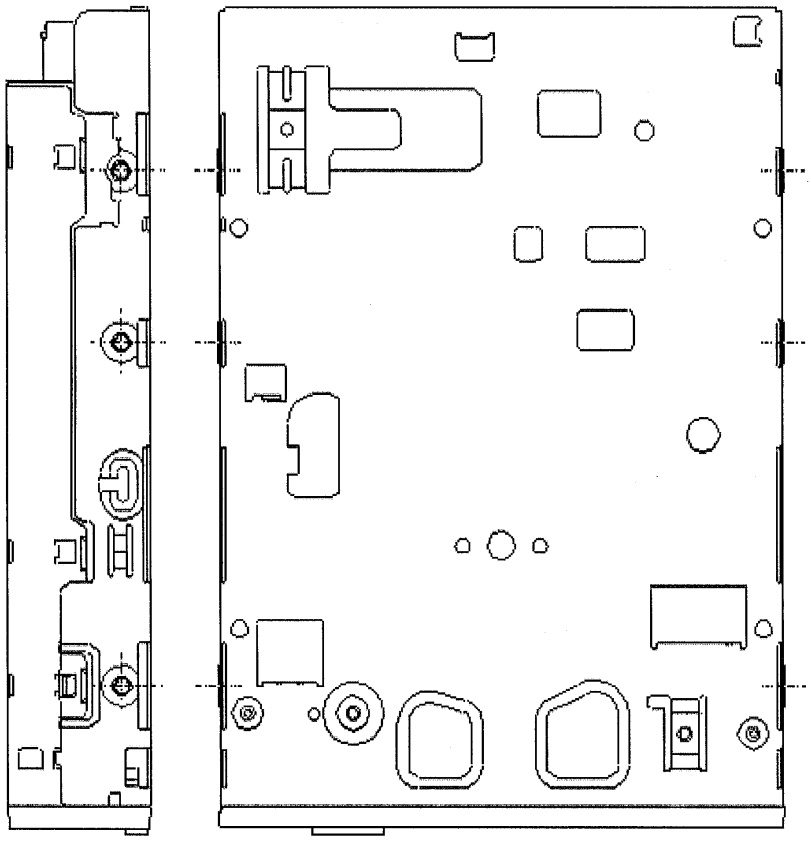
Precautions :
(1) SmartMedia™, MemoryStick™, SecureDigitalCard™, MultiMediaCard™ are mutually exclusive. Two types or more flash media cannot be used simultaneously.
(2) The flash media drive is bus-powered device with USB specification. The power shall be supplied from the host or self-powered hub port.

2. PHYSICAL SPECIFICATIONS

Dimensions : 101.6mm (width), 25.4mm (height), 144mm (depth)
Weight : 320g (Typ.)



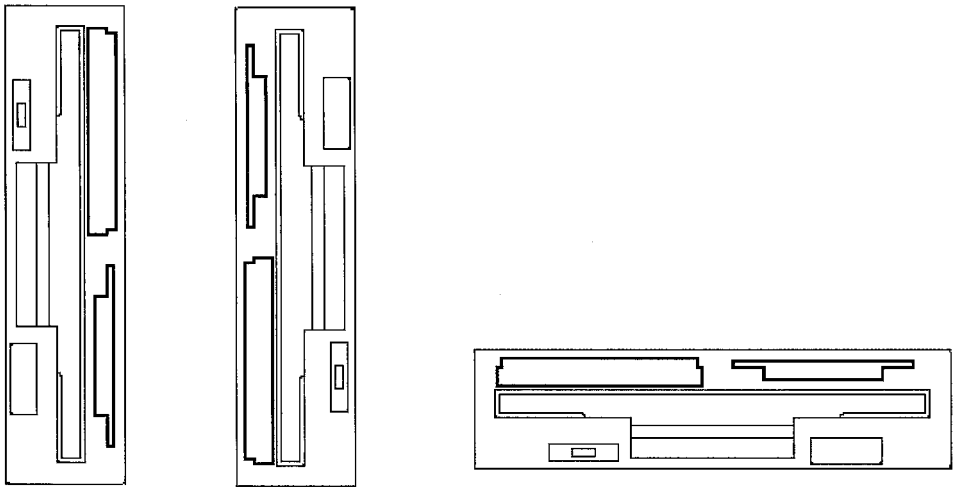
(Fig. 2-1) Front, top and side views



(Fig. 2-2) Bottom views

3. INSTALLATION

Installation direction



Vertical Horizontal

(Fig. 3.0-1) Installation direction

(1) The drive position shall be within ±20° in the vertical or horizontal direction. (The quantity of disk ejection may be more than specified with the front bezel inclined in the front direction.)
(2) The optimum setting condition and installation direction other than described above shall be discussed separately.
(3) Tightening torque at mounting shall be 4kg or less.

4. ENVIRONMENTAL CONDITIONS

(Table 4-1) Environmental conditions

Ambient temperature	During operation (°C)		5 ~ 40		
	During storage (°C)		-20 ~ 60		
	During transportation (°C) *2		-40 ~ 65		
	Temperature gradient		20 (°C)/H (max)		
Relative humidity	During operation (%) (Maximum wet bulb temperature shall be 29°C)		20 ~ 80 (No condensation)		
	During storage (%) (Maximum wet bulb temperature shall be 40°C)		10 ~ 90 (No condensation)		
	During transportation (%) *2 (Maximum wet bulb temperature shall be 40°C)		10 ~ 90 (No condensation)		
Vibration*1	During transportation	Acceleration (m/s^2)	19.6 (max)		
		Vibration (Hz)	5 - 500		
	During operation	Acceleration (m/s^2) (max)	14.7	9.8	4.9
		Vibration (Hz)	5~100	100~200	200~500
		Sweeping cycle (oct/min)	1		
Shock	During transportation	Acceleration (m/s^2)	784 (max)		
		Vibration time (msec)*3	11 (max)		

Notes :

*1 Excluding resonance frequency

*2 In the case of long-term transportation by ship and so on, the conditions during storage are applied.

*3 Half-sine shock pulses are applied.

5. RELIABILITY

5.1 General

(Table 5-2) Reliability

Mean time between failures (MTBF)		30,000H (min) (POH)
Mean time to repair (MTTR)		30 min (max)
Designed life of parts		5 years or 30000 POH
Disk life		3.0×10^6 passes /track
Number of times of disc insertion		3×10^4 times (min)
Preventive maintenance time (PM)		Unnecessary
Error rate	Soft read error	10^{-9} / bit or less
	Hard read error	10^{-12} / bit or les
	Seek error	10^{-6} / seek or less

Notes :

*1 MTBF is defined in normal operation frequency.

*2 Only one re-try is allowed in Soft read test.

5.3 Safety Standard

(1) UL 60950
(2) CAN/CSA C22.2 No. 60950
(3) EN60950
(4) EN55022-class B, EN55024
(5) CNS 13438-1997 class B

6. FLOPPY DISK DRIVE

The hardware specification of the micro floppy disk drive is described below.

6.1 Disk

The 90mm (3.5-inch) flexible disk (hereinafter referred to as "disk") agreed upon by Purchaser(s) of this FDD and TEAC Corporation shall be used.

6.2 Performance

(Table 6.2-1) Performance of the floppy disk drive

ITEM			1MB	1.6MB	2MB
Capacity (MFM)	Unformatted	Per track (k bytes)	6.25	10.416	12.50
		Per disk (k bytes)	1,000	1,666.56	2,000
	Formatted	Per sector [Sector] (k bytes)	0.256 [16]	0.256 [26]	0.256 [32]
			0.512 [9]	0.512 [15]	0.512 [18]
			1.024 [5]	1.024 [8]	1.024 [10]
		Per track [Sector] (k bytes)	4.096 [16]	6.656 [26]	8.192 [32]
			4.608 [9]	7.680 [15]	9.216 [18]
			5.120 [5]	8.192 [8]	10.24 [10]
		Per disk [Sector] (k bytes)	655.36 [16]	1,064.96 [26]	1,310.72 [32]
			737.28 [9]	1,228.80 [15]	1,474.56 [18]
			819.20 [5]	1,310.72 [8]	1,638.40 [10]
Recording density	Innermost track recording density (Side 1) (bpi)		8,717	14,528	17,434
	Data transfer rate (k bits/s)		250	500	
	Number of heads		2		
	Number of tracks used		160		
	Track density (tpi)		135		
Recording method			FM/MFM		
Spindle motor	Disk rotation (rpm)		300	360	300
	LSV (%) (Long-term speed variation)		±1.0 (max)		
	ISV (%) (Instantaneous speed variation)		±1.5 (max)		
	Drive motor starting time (msec)		400 (max)		
	1 track seek time (msec)		3 (min)		
	Settling time (msec)		15 (max)		
Disk insertion and ejection		Insertion (g)	400 (max)		
		Ejection (g)	1,300 (max)		
Sound (A weighted) (dB) (at a step rate of 3msec)			40 (max) (1m apart from FDD)		

6.3 Power Supply

(Table 6.3-1) Current and power consumption

+5Vdc	Maximum voltage tolerance			5V±10%	
	Allowable ripple voltage			100mVp-p	
	Current consumption	During operation	Seeking (A)	0.78 (typ)	0.95 (max)
			Reading (A)	0.32 (typ)	0.43 (max)
			Writing (A)	0.31 (typ)	0.41 (max)
		At drive motor start (A)		0.84 (typ)	0.90 (max)
		During stand-by (A)		0.008 (typ)	0.01 (max)
Power consumption		During operation	Seeking (W)	3.90 (typ)	5.23 (max)
			Reading (W)	1.60 (typ)	2.37 (max)
			Writing (W)	1.55 (typ)	2.26 (max)
		At drive motor start (W)		4.20 (typ)	4.95 (max)
		During stand-by (W)		0.04 (typ)	0.055 (max)

Notes :

*1 Current consumption during settling (15msec) ; 0.88A typ, 1.05A max
(Power consumption ; 4.4W typ, 5.8W max)

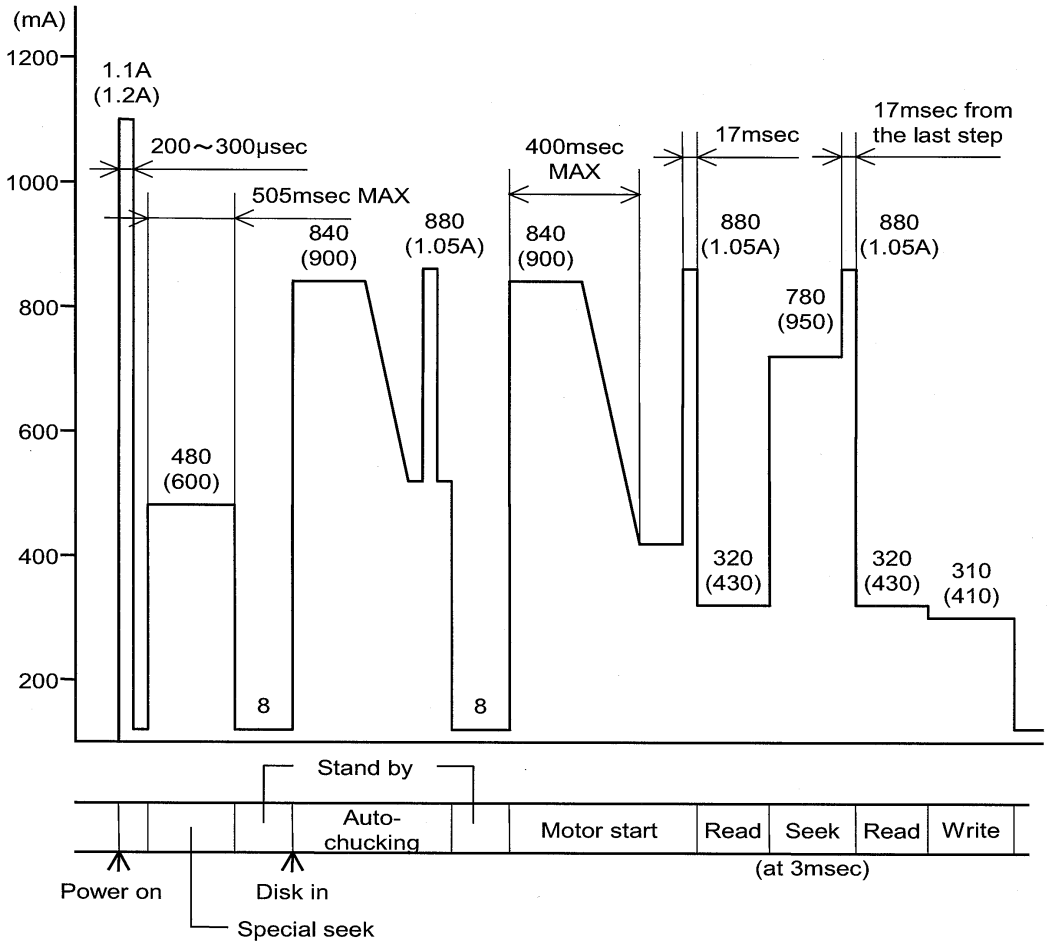
*2 Allowable ripple voltage includes spike noise.

*3 The order of power supply is not specified.
(The disk and recorded data shall not be damaged at power on/off.)

*4 During stand-by, both the DRIVE SELECT signal and the MOTOR ON signal are High level.

Current consumption profile

( ) : Maximum current value measured the with the TEAC standard disk



(Fig. 6.3-1) Current consumption profile

Notes :

*1. Stand-by

When both the DRIVE SELECT signal and the MOTOR ON signal are High level

*2. Special seek

(1) When the head is at Track 00 at power-on

The head seeks to inner track s until Tr00 cannot be detected with the sensor, and then seeks to outer tracks to reach Tr00.

(2) When the head is not at Track 00 at power-on

The head seeks to outer tracks until Tr00 is detected (at 6msec).

*3. Auto-chucking

While both the DRIVE SELECT signal and the MOTOR ON signal are High level, the motor starts when a disk is inserted, and then stops when the NDEX signal is counted twice.

6.4 Power Supply Connector

(Table 6.4-1) Power supply connector pin

Terminal number	Power supply
1	+5Vdc
2	GND
3	GND
4	OPEN

(Table 6.4-2) Parts used for the power supply connector

FDD side		Mitsumi Newtec, CPM-E85C or equivalent
Host side	Housing	AMP, 171822-4 or equivalent
	Contact pin	AMP, 170204-2 (AWG 20) or equivalent

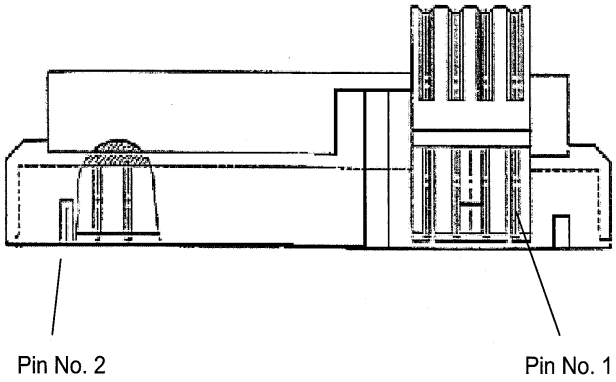
6.5 Signal Interface

6.5.1 Signal interface connector

(Table 6.5.1-1) Signal interface connector pin assignment

Signal name	I/O	Terminal number		Signal
MODE SELECT	IN	2	1	GND
HD OUT	OUT	4	3	—
N.C	-	6	5	GND
INDEX	OUT	8	7	—
N.C	-	10	9	—
DRIVE SELECT 1	IN	12	11	—
N.C	-	14	13	—
MOTOR ON	IN	16	15	—
DIRECTION SELECT	IN	18	17	—
STEP	IN	20	19	—
WRITE DATA	IN	22	21	—
WRITE GATE	IN	24	23	—
TRACK 00	OUT	26	25	—
WRITE PROTECT	OUT	28	27	—
READ DATA	OUT	30	29	GND
SIDE 1 SELECT	IN	32	31	GND
DISK CHANGE	OUT	34	33	—

Notes : There are no Terminal No. 3, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 33 pins.



(Fig. 6.5.1-1) Signal interface connector pin

(Table 6.5.1-1) Parts used for the interface signal connector

FDD side	Mitsumi Newtec, CPM-E85C or equivalent
Host side	Fujitsu, FUN-747B034-AU/0 or equivalent

(21-pin, 2.54 mm pitch)

6.5.2 Interface signal

(1) Input Signal

(a) MODE SELECT
(b) DRIVE SELECT 1
(c) MOTOR ON
(d) DIRECTION SELECT
(e) STEP
(f) WRITE DATA
(g) WRITE GATE
(h) SIDE 1 SELECT

(Table 6.5.2-1) Input signal

Low level	(True)	0 ~ 0.7V
High level	(False)	2.2V to power supply voltage limit

The maximum current is 6mA at the terminator in Low level.

(2) Output Signal

(a) INDEX
(b) TRACK 00
(c) WRITE PROTECT
(d) READ DATA
(e) DISK CHANGE
(f) HD OUT

(Table 6.5.2-2) Output signal

Low level	(True)	0 ~ 0.4V (Maximum sink current : 40mA)
High level	(False)	5.5V Max. (At the receiving terminator)

6.5.3 Input signal

(1) MODE SELECT

When the FDD is used for all 3 modes, this signal sets the density mode of 2HD (high density) to 1.6MB mode or 2MB mode.

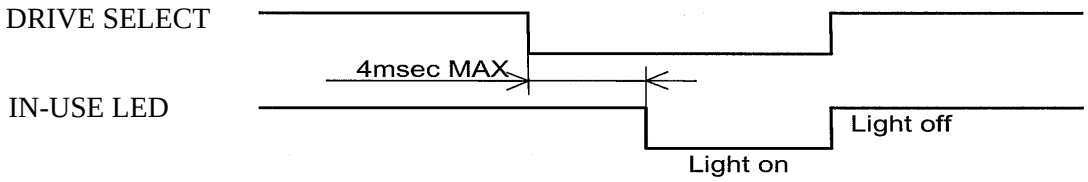
(Table 6.5.3-1) MODE SELECT signal

SIGNAL	MODE	INPUT SIGNAL
LDI	1.6M	LOW
	2M	HIGH

The 1MB mode is fixed when a 2DD (normal density) disk is inserted regardless of this signal.

(2) DRIVE SELECT 1

This signal selects the FDD, and it is available when the signal is Low level. When the signal is High level, all input/output signals except the MOTOR ON signal become unavailable . This signal controls the lighting of the LED of the front bezel.



(Fig. 6.5.3-1) DRIVE SELECT 1 signal

(3) MOTOR ON

When this signal becomes Low level, the drive motor starts, and it stops when the signal becomes High level with a disk inserted. Even if the signal becomes HIGH level during writing operation, the motor does not stop until writing operation is completed. (Auto-chucking is operated immediately after a disk is inserted.)

(4) DIRECTION SELECT

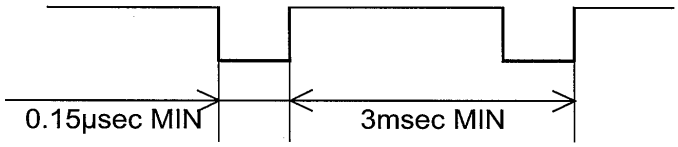
This signal specifies the seeking direction of the magnetic head when the STEP signal is input.

HIGH level : in outer track direction on disk

LOW level : in inner track direction on disk

(5) STEP

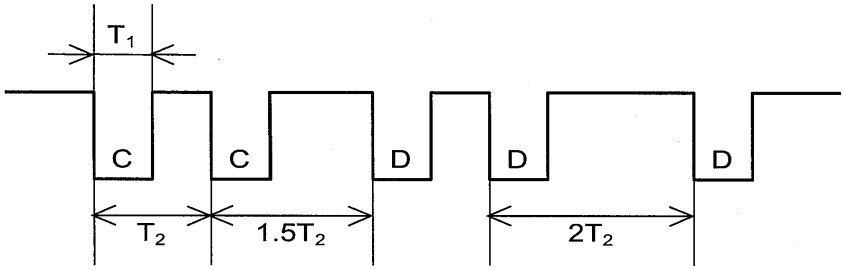
This signal shifts the magnetic head, and the head shifting starts at the leading edge of STEP signal (pulse trailing edge). The STEP operation is available even if a disk is not inserted into the drive. Even if the signal is input during writing operation, the signal is held until writing operation is completed.



(Fig. 6.5.3-2) STEP signal

(6) WRITE DATA (MFM)

This signal is data written on a disk. Whenever this signal switches from HIGH level to LOW level, the current flowing into the magnetic head is reversed, and the data bit is written on disk.



T1: 0.15µsec ~ 1.5µsec
T2: 2µsec NORMAL (2MB, 1.6MB)
T2: 4µsec NORMAL (1MB)

(Fig. 6.5.3-3) WRITE DATA (MFM)

(7) WRITE GATE

When this signal is LOW level, writing on a disk becomes possible. When this signal is HIGH level, the reading or seeking operation becomes possible.

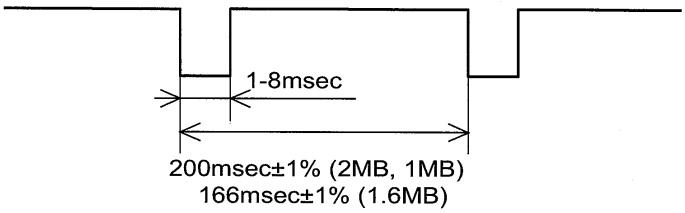
(8) SIDE 1 SELECT

When this signal is High level, the magnetic head on Side 0 is selected and the reading/writing operation becomes possible. When this signal is Low level, the magnetic head on Side 1 is selected. Even if the signal is switched during writing operation, the head will not be changed until writing operation is completed.

6.5.4 Output signal

(1) INDEX

This signal indicates the start of track, and is output every time the disk makes one revolution, but in the internal READY state only. (The leading edge of pulse is used.)



(Fig. 6.5.4-1) INDEX signal

(2) TRACK 00

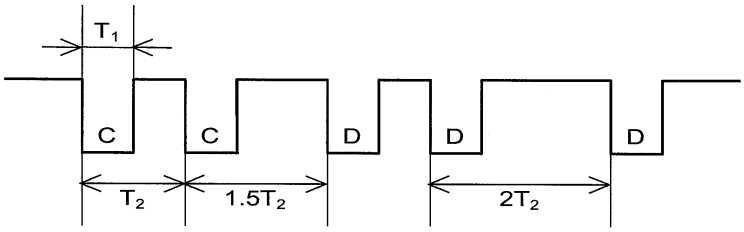
When this signal is Low level, it indicates that the magnetic head is at track 00 and the stepping motor is at the specified position.

(3) WRITE PROTECT

When this signal is Low level and the drive is selected, it indicates that the inserted disk is in write protected state. At that time, data cannot be written on the disk even if write operation is performed. The signal is High level except this state.

(4) READ DATA

This signal is the data read from a disk, and the read data is indicated when switching from High level to Low level. For the separation of clock bit from data bit, an edge of Low level from High level is used.



T1 : 0.5µsec ±20%

T2 : 2µsec Normal (1.6MB, 2MB)

T2 : 4µsec Normal (1MB)

(Fig. 6.5.4-2) READ DATA signal

(5) DISK CHANGE

This signal indicates that the disk is ejected (it is supposed that a disk is not inserted at power-on).

(a) This signal is Low level when the disk is removed from the FDD or not inserted (at DRIVE SELECT).

(b) This signal is High level when the STEP signal is input with a disk inserted (at DRIVE SELECT).

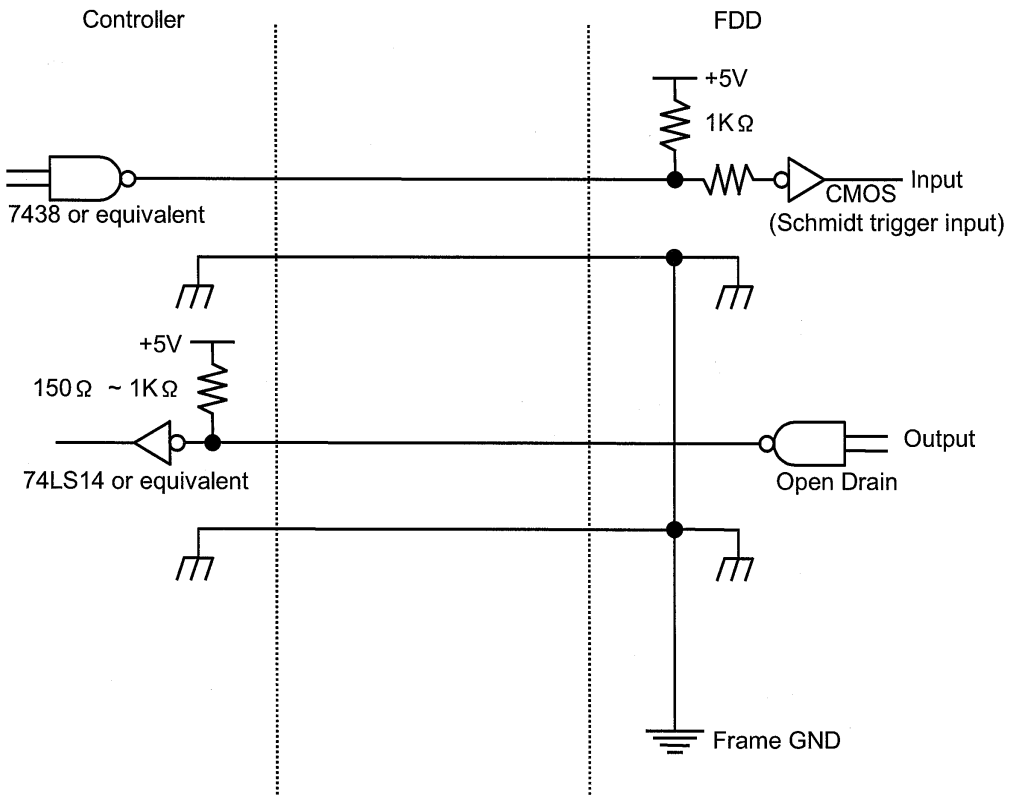
(6) HIGH DENSITY OUT

This signal distinguishes a type of the disk (2DD/2HD) inserted into the FDD.

(Table 6.5.4-1) HIGH DENSITY OUT signal

Signal	Disk inserted	Output signal
HDO	2DD	High
	2HD	Low

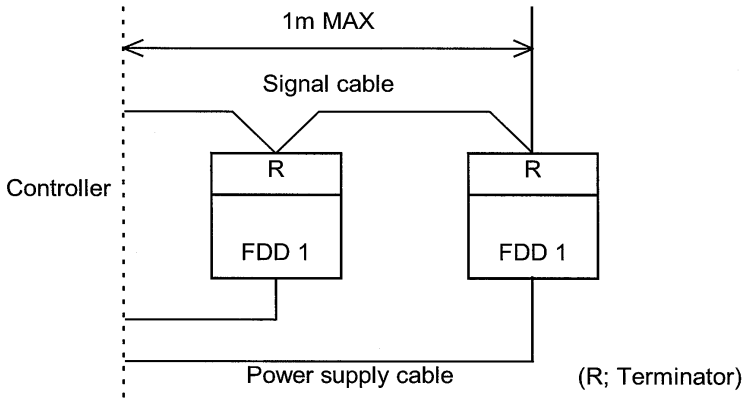
6.5.5 Recommended interface circuit



The terminator on the FDD side is fixed at 1kΩ.

(Fig. 6.5.5-1) Recommended interface circuit

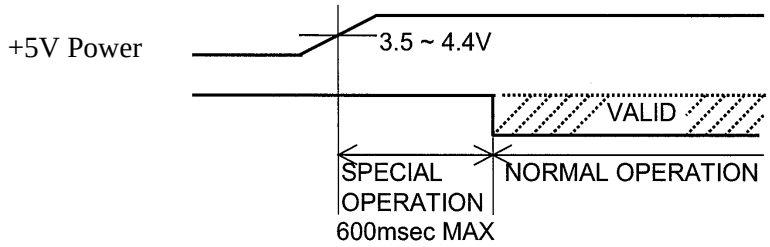
Daisychain connection



(Fig. 6.5.5-2) Daisychain connection

6.5.6 Control timing

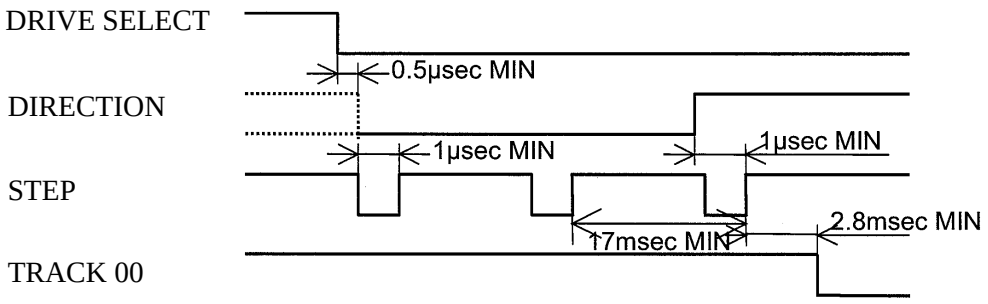
(1) Power-on Control Timing



(Fig. 6.5.6-1) Power on Control timing

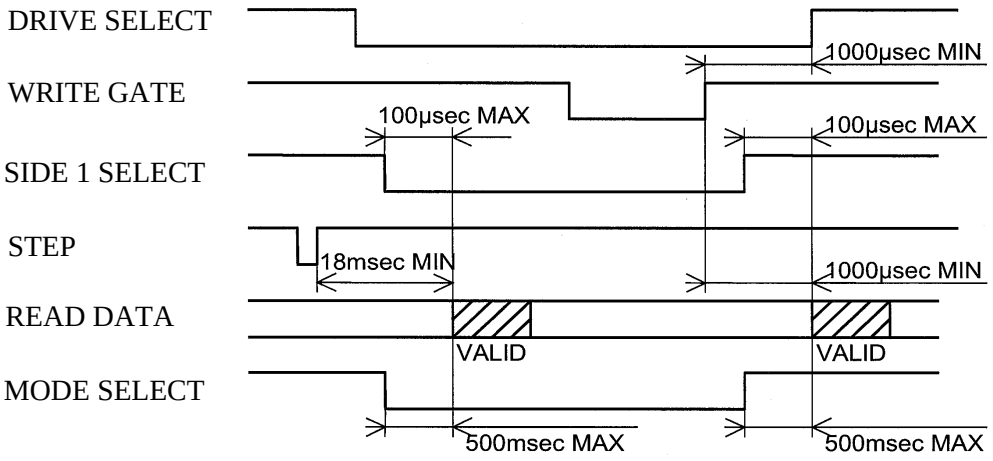
Special operation : It does not accept signals except the MOTOR ON signal.

(2) Seek Timing



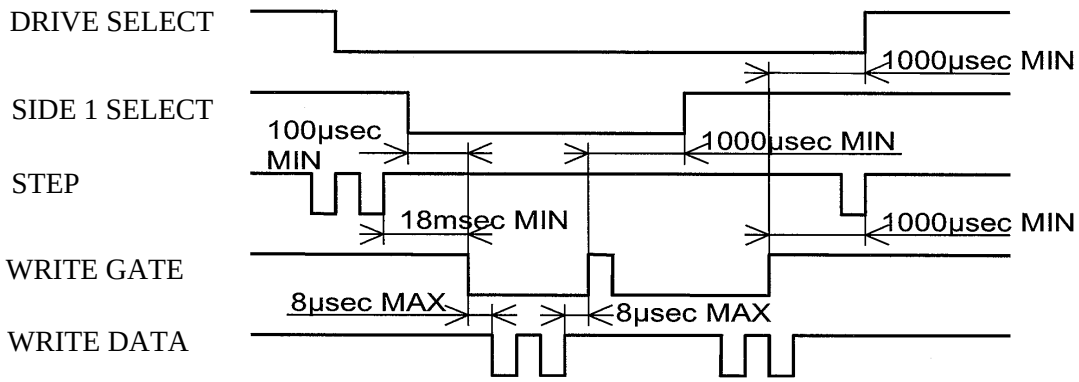
(Fig. 6.5.6-2) Seek timing

(3) Read Timing



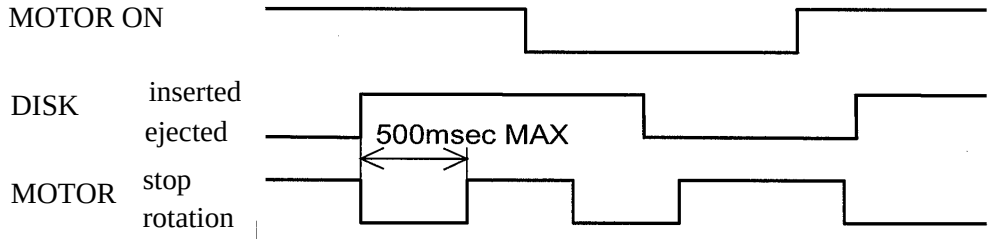
(Fig. 6.5.6-3) Read timing

(4) Write Timing



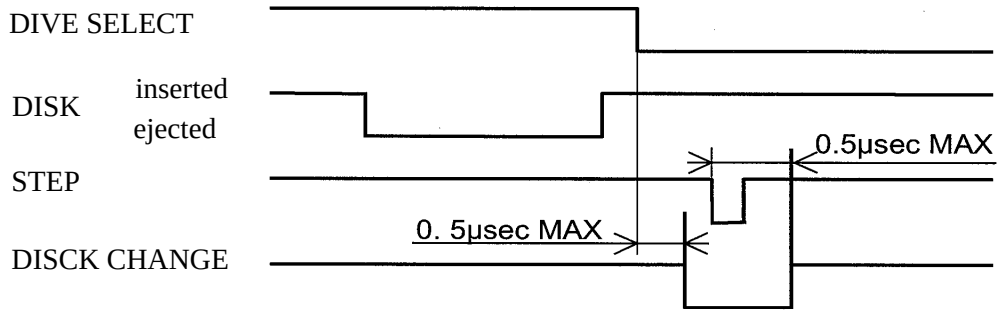
(Fig. 6.5.6-4) Write timing

(5) Drive Motor Start timing



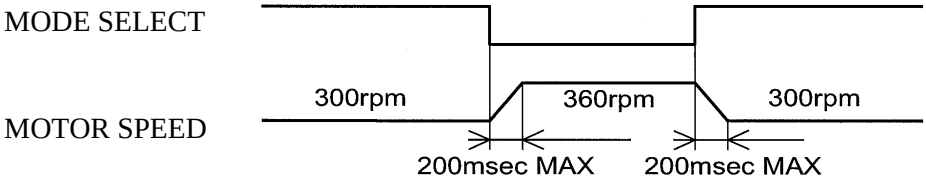
(Fig. 6.5.6-5) Drive Motor Start timing

(6) Disk Change Timing



(Fig. 6.5.6-6) Disc Change timing

(7) Motor Speed Timing



(Fig. 6.5.6-7) Motor Speed timing

7. FLASH MEDIA DRIVE

The hardware specification of the flash media drive is described below.

7.1 General Description

7.1.1 System control

(1) Complies with the USB specification revision 2.0
(2) Complies with the USB mass storage class, and the bulk-only-protocol is adopted

7.1.2 Data transfer rate

480Mbps, maximum

7.2 Electrical Description

7.2.1 Power supply

(Table 7.2.1-1) Power-supply voltage and current comsumption

Item		Min.	Typ.	Max.
Power supply voltage*1 (V)		4.75	-	5.25
Current consumption	Suspend (μA)	-	-	500
	Stand-by (mA)	-	105	-
	Operation (mA)	-	-	500

*1 : Supplied from USB VBUS
*2 : The current consumption during opertion differs depending on the flash media used.

7.3 Interface Cable

The cable complying with the USB high-speed standard is provided.

7.3.1 Signal of the interface cable

(Table 7.3.1-1) Signal of the interface cable

Terminal No.	Signal name	Details
1	VBUS	Red (AWG 24)
2	D-	White (AWG 28)
3	D+	Green (AWG 28)
4	Ground	Black (AWG 24)

7.3.2 Cable length and terminal specification

Designated in accordance with the specifications specified by a customer