UNIVERSITY OF QUEENSLAND
MAINTENANCE

TEAC FD-55(E)

MINI FLEXIBLE DISK DRIVE

INSTRUCTION MANUAL

TEAC®

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DEPARTMENT OF COMPUTER SCIENCE
UNIVERSITY OF QUEENSLAND
MAINTENANCE

TEAC FD-55(L)

MINI FLEXIBLE DISK DRIVE

INSTRUCTION MANUAL

P/N 10131159-0CA

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2-1. INSTRUCTIONS FOR HANDLING

The TEAC FD-55(L) series mini flexible disk drive (hereinafter referred to as FDD) does not require specially delicate handling as long as it is handled according to the following instructions.
The same care as other similar mini flexible disk drives is required. Read through and referred to this Instruction Manual before your operation or system design so that the FDD can show the expected performance.

2-1-1. Disk

Two types are commercially available for 5.25 inch (mini) flexible disks (hereinafter referred to as disk) according to the sectoring of a track. One is hard sectored method, which detects each sector photo-electrically by means of sector holes. The other is soft sectored method which records an identification pattern on the initial position of each sector. The FD-55 may be used with either type of disks. Generally, hard sectored disk is used only for some specific applications.

Fig.201 shows the external view of the disks. The only difference is that the hard sectored disk has the same number of sector holes as the number of sectors, on a concentric circle together with an index hole. The disk itself on which data are recorded is made of 80μm thick polyethylene film with coated magnetic surfaces. The disk is protected in a vinyl chloride jacket with liner to retain dust without damage to the disk surface. The jacket has open areas; disk positioning and disk driving window (central window), oval window for magnetic head contact with the disk (head window), and index/sector hole detection window (index window).
In order to maintain high data reliability, it is recommended to use high quality disks.

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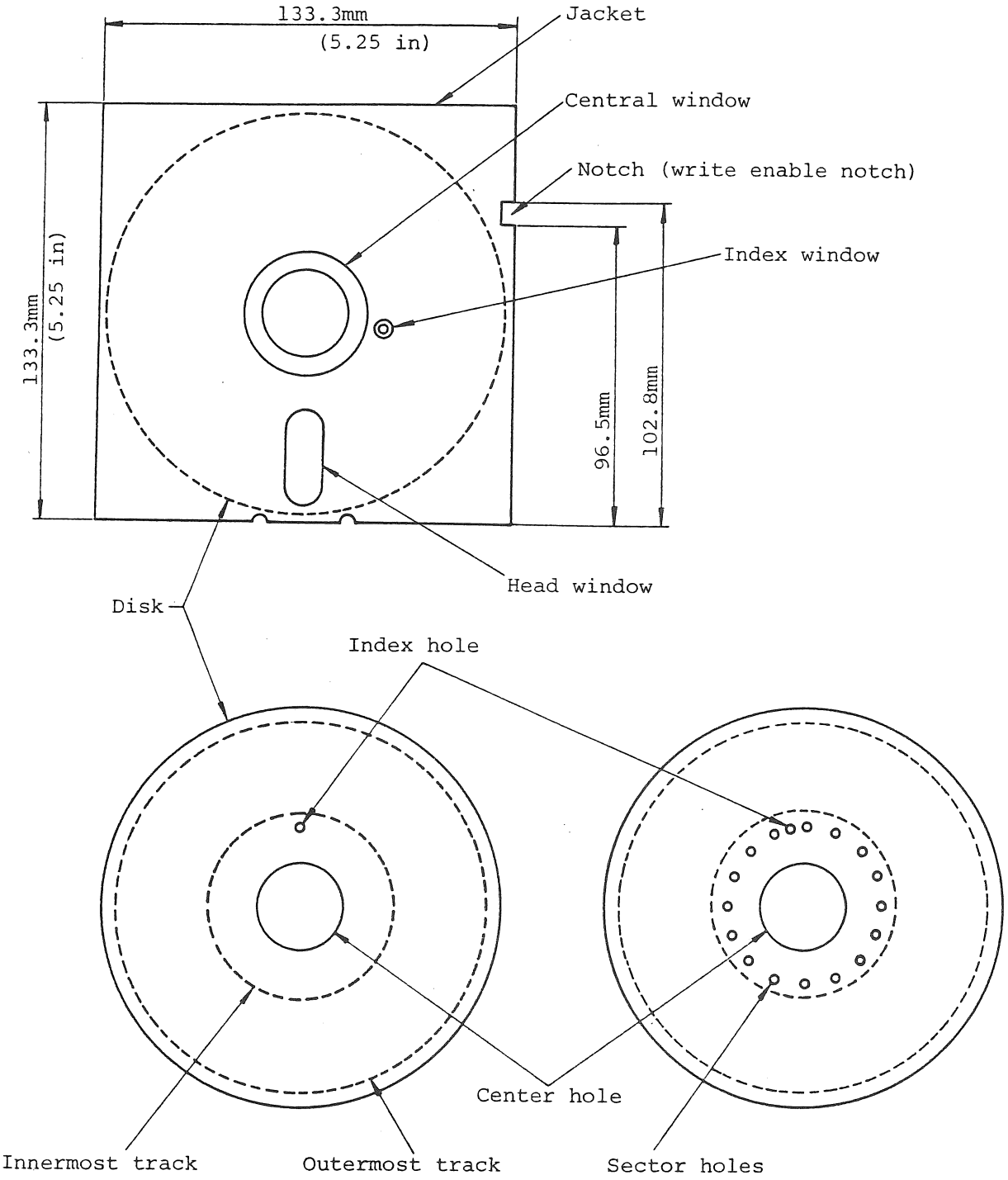

(Fig.201) External view of disk

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There are many types in the commercially available soft sectored disks which are classified according to the following factors. Select the most appropriate one for your application.

(1) Data recording density

Single density (FM method) or Double density (MFM method)

Do not use a single density disk for a double density recording. Expected data reliability will not be obtained and error may occur. A double density disk can be used for a single density recording. All the models of FD-55A∿F are used for both single and double density recordings.

(2) Number of used sides

Single sided (only side 0 can be used) or double sided (both sides 0 and 1 can be used).

Use a double sided disk for a double sided FDD. If a single sided disk is used for a double sided FDD, data reliability of the side 1 might be degraded.
A double sided disk can be used for a single sided FDD.

(3) Track density

48tpi or 96tpi.

It is recommended to use a disk of the same track density as the track density of an FDD. If a 48tpi disk is used for a 96tpi FDD, the data reliability might be degraded rarely.
Though such an application of using a 96tpi disk for a 48tpi FDD does not cause practical problem, it is not thoughtful to use in that way.

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(4) Track numbers

Some of commercially available 48tpi single sided FDDs can access only 35 tracks from track 00 to 34. And 35 track disks are used by some people in a few application.
The operation of the FD-55A is guaranteed for track 00 through 39 (total 40 tracks). However, the data reliability of five tracks from 35 to 39 are not guaranteed when a 35 track disk is used.
Almost all the disks commercially available are guaranteed for up to 40 tracks.

(5) High density disk

For the high density FDD (FD-55G) which is put to practical use recently, use an exclusive HD disk. Do not use disks for FD-55A ∿ F.
Generally, disks written by an FD-55A ∿ F cannot be read by an FD-55G.
Do not use an HD disk with FD-55A ∿ F. The data reliability may be degraded.

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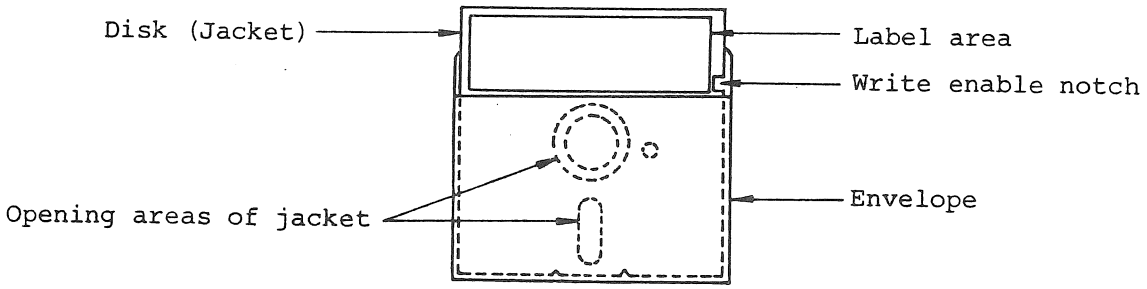
2-1-2. Disk Handling

Disk is a precision recording media. Be sure to observe the following precautions.

(1) Do not tear, fold, or distort the jacket or disk.

(2) Do not install a damaged disk in the FDD, damaged disk not only disturbs the normal read or write operation but also it may damage the FDD.

(3) Do not touch the opening areas of the jacket (magnetic coating area of the disk). Fingerprints left on the disk will cause errors.
For manual handling of the disk, it is recommended to hold the label area in Fig.202.



(Fig.202) Protective envelope and label area of the disk

(4) Return the disk to its envelope for the protection of the window area whenever it is removed from the FDD. The disk should not be left outside of the protective envelope such as on a desk even for a while.

(5) For a long term storage, keep the disk in a protective container with the envelope in an upright position.
For a short term storage, a few disks may be piled horizontally without a container. Do not lean the disks and do not place any heavy objects

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such as books on the disk, which will cause distortion of the disk.

(6) Keep and use the disk away from dust. Also do not install a dusty disk into the FDD. Such dust, if carried to the magnetic head, may cause data errors and may shorten the life of the disk and the FDD.

(7) Do not clip the jacket. The clipped portion will be distorted.

(8) Do not write on the index label of the jacket with a hard tipped object such as a lead pencil or a ball point pen which may damage the disk surface. Use a soft writing object which will not damage the disk such as a felt tip pen.
Generally, it is desirable not to write on a label which is already stuck on the disk. It is recommended to stick the label after writing the information.

(9) Do not rub out the information on the label with an eraser. Rubbish from the eraser may get into the jacket.

(10) Index label shold be applied on the label area shown in Fig.202.
Do not apply more than two labels on the same area.

(11) Keep the disks away from magnetic fields such as by magnets, transformers, motors, etc. These may degrade the recorded data on the disk. The ambient stray magnetic field should not exceed 50 Oersted.

(12) Do not smear the disk with a solvent such as thinner, freon, or alcohol, it damages the magnetic coating of the disk.

(13) Do not expose the disk to sunlight, micro-waves, or infrared ray. Keep the disk away from heater or stove. Also do not put the disk on the electric apparatus such as TV set.

(14) Disks should be operated within the following conditions:

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Ambient temperature: 10°C ∿ 51.5°C (50°F ∿ 125°F)
Relative humidity: 20% ∿ 80%
Wet bulb temperature: 29°C (84°F), Max.

The above temperature applies to the jacket surface. In the actual operating condition, approximately 15°C of temperature margin is required against the operating limit taking the temperature rise in the FDD assembled in a host system into consideration.
Generally upper limit of the temperature is determined by a deformation limit of the jacket material because the jacket deformation disturbs good contact between the disk and the magnetic head which may degrade performance characteristics.
Also a sudden change in environmental conditions should be avoided even within the specified range.

(15) Disks should be stored within the following conditions:

Ambient temperature: 4°C ∿ 51.5°C (40°F ∿ 125°F)
Relative humidity: 8% ∿ 80%

(16) For transportation, disks should be in the protective container. It is recommended that a sufficient space exists between the recorded disk and outer surface of the final container, so that risk of damage due to stray magnetic fields will be negligible.

Disks should be transported within the following conditions:

Ambient temperature: -40°C ∿ 51.5°C (-40°F ∿ 125°F)
Relative humidity: 8% ∿ 90%
Temperature gradient: 20°C/hour

(17) Disks which have been stored or transported at temperature and humidity exceeding the operating conditions may exhibit degradeed performance. Such disks should be subjected to a conditioning period of not less than

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24 hours within the operating environment prior to use.

(18) When you install the disk to the FDD, be careful to handle it slowly. Rough installation will accelerates the degration of the disk and it may cause incorrect installation.

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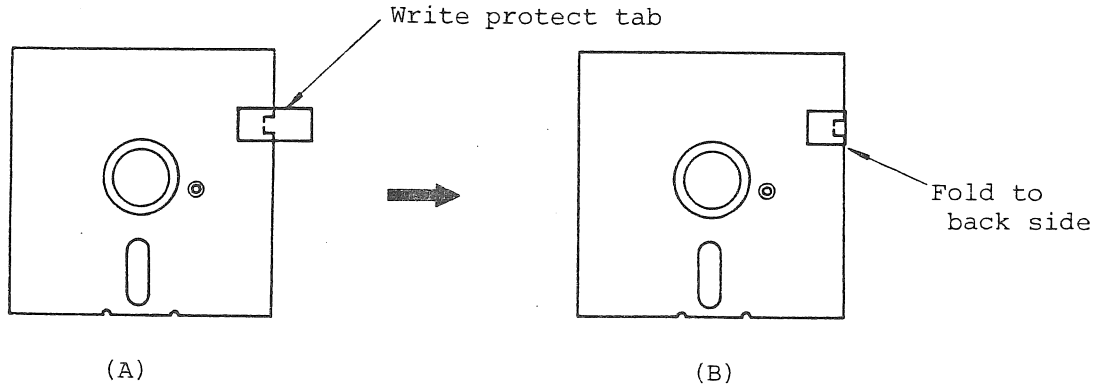
2-1-3. Write Protect

A write enable notch is located on the right side of the disk. For recording new data, use a disk with the notch in the condition shown in Fig.201 (notch open). When a disk with an open notch is installed in the FDD, the FDD enables record current to flow into the magnetic head in response to a write command.

To protect the recorded data from accidental erasure due to operational errors, cover the notch with a write protect tab as shown in Fig.203. Writing or erasing by an erroneous write command is inhibited as the notch cannot be detected.

Be careful not to apply excessive pressure or not to distort the jacket whenever you attach a write protect tab to the notch. The tab should not be attached beyond the side line of the jacket. Also the notch should be completely covered by the tab.



(Fig.203) Write protect tab

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2-1-4. FDD Handling

The FDD should be handled according to the following instructions.

(1) Inserting and ejecting procedure of a disk should be performed according to item 2-1-5.
Insert a disk correctly and carefully.

(2) A sudden change in environmental conditions such as temperature or relative humidity should be avoided as far as possible even if it is within the specified range. Sufficient hours of storage is required at the new operating condition if there was a sudden change in the environmental condition.

(3) Keep and use the FDD away from dust and damp.

(4) Remove the disk from the FDD when it will not be operated for a long time.

(5) Keep the FDD away from stray magnetic or electromagnetic fields such as by transformer, magnet, CRT display, etc.
If such a part or equipment is not sufficiently shielded, it may cause data errors or degrades data reliability. Refer to item 2-2-4.

(6) Refer to item 2-2 for installation of the FDD.

(7) Do not touch the variable resistors or screw adjusting parts in the FDD except for trained technicians concerning FD-55.

(8) For transportation, refer to item 2-1-6 not to apply excessive impact to the FDD.

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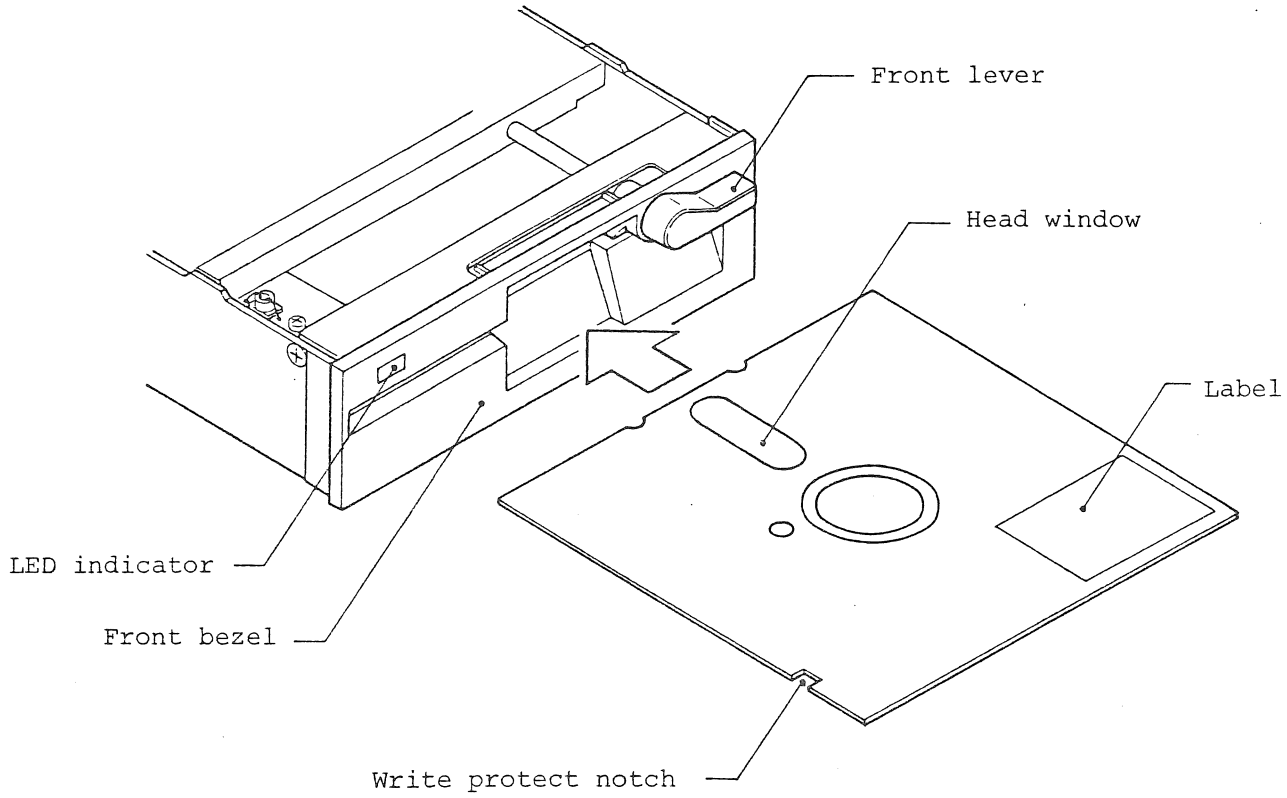
2-1-5. Installation and Ejection of Disk



(Fig.204) Inserting direction of the disk

(1) Installation of disk

(a) Set the front lever to the position shown in Fig.204.

(b) Take out a disk from its protective envelope.

(c) Hold the label side of the disk and insert it into the FDD with the head window facing the inner side and with the write enable notch located at the LED indicator side.
If the FDD is installed horizontally (Fig.204), the label side goes up, while the label side goes left side when the FDD is installed

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vertically with front lever up.

(d) Insert the disk fully and straightly into the FDD with enough care.

(d') For the models with disk eject option, a light depressing force is required for the full insertion of the disk from the point 1cm,approx. before the bottom.
When it is inserted to the bottom, a click sound can be heard. Be sure to insert it fully.

(e) Take off your fingers from the disk, and close the front lever by turning 90° in the clockwise direction.

Caution: Never close the front lever with depressing the disk with your fingers. If the disk is clamped with bent condition, the disk may be damaged.

(2) Ejection of disk

(a) Turn the front lever 90° in counterclockwise direction to open the lever.
It is recommended to pinch the lever with two fingers not to apply excessive impact.

(b) Hold the rear side of the disk with your fingers lightly and draw out from the FDD.

(b') For the models with disk eject option, disk pops out from the FDD when the lever is open.

(c) Put the disk back into the protective envelope (See Fig.202).

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2-1-6. Precautions for Transportation

The following precautions should be referred to for transportation of the FDD and the system in which the FDD is assembled.

(1) In order to protect the magnetic head assembly from vibration and impact during transportation, be sure to attach the protection sheet to the FDD. The protection sheet, which is made of thick paper shaped like a disk, is installed to all the FDDs at the shipment from the factory.

(a) The insertion of the protection sheet is done like a disk installation. After closing the front lever, pull up the projection of the sheet and fix the lever.

(b) When ejecting the protection sheet, open the lever depressing the projection of the sheet with your finger. Store the removed protection sheet for another transportation.

(2) Be careful not to expose the FDD to excessive moisture.

(3) Since the FDD is small and light, it might fall or be thrown down during transportation. To protect the FDD from such abuse, it is recommended to package several FDDs in one box.

(4) When the FDD is shipped assembled in a system, the system cabinet should be enough strong to withstand vibration and impact during transportation. Also the packaging of the system should be constructed to absorb impact so that the FDD will not suffer from excessive impact.

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2-2. INSTRUCTIONS FOR INSTALLATION

Refer to the following items for installing and assembling of the FDD into your system so that the FDD can exhibit the expected performance.

2-2-1. Precautions for Installation

(1) Keep the FDD away from dust.
For example, install the FDD away from the floor, without disturbing the operation ability of the FDD. Such care will protect the FDD from excessive dust.

(2) It is recommended to operate the FDD in a well ventilated situation (natural air cooling should not be obstructed) to dissipate the radiated heat.
When a fan is attached in the system cabinet, install it to draw out the air. If the FDD is blown strongly, a large quantity of dust may be adhered to the FDD.

(3) Do not place the FDD near a strong magnetic noise source or a electro-magnetic noise source. The magnetic head and read amplifier will pick up such noises which may cause errors. Be careful about the installing position. See item 2-2-4.

(4) Do not expose the FDD to sunlight. Keep the FDD away from heater or stove.

(5) Do not place the FDD in an environment with corrosive air.

(6) Do not place the FDD in a situation subject to strong vibration.

(7) The screws for installing the FDD should not protrude from the FDD surface more than 5mm.

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(8) Do not apply excessive force when installing the FDD in a system cabinet. Frame of the FDD may be distorted which causes misalignment of the magnetic head.

(9) For the connection of the cables, refer to item 2-2-2.

(10) For the setting of the straps (short bars) and the terminator on the FDD PCBA, refer to item 2-2-3.
The setting to match your system might be different from the setting at shipment. Confirm these settings before operation.

(11) After checking that the head cable of the FDD does not protrude nor that it is bent extraordinary, attach the FDD to the system cabinet. Protruding cable may be caught by other parts or increases load at head seek operation, which cause misalignment of the head or seek errors.

(12) Fundamentally, the FDD should be installed horizontally with the indicator and the front lever up (magnetic head up), or vertically with the left side down and the front lever up. In either orientation, the FDD should not form a greater angle than 30° for a 48tpi FDD and 15° for a 96tpi FDD against the horizontal plane with the front bezel up. Do not install the FDD with the magnetic head down in horizontal orientation or the front bezel up in vertical orientation (top loading of a disk). These orientation of the FDD may disturb the stable contact between the magnetic head and the disk or may cause misalignment of the head.
As to the other orientations than explained above (such as the orientation of the right side down with the indicator up or forming a greater angle against the horizontal plane than explained above), separate consideration is required.

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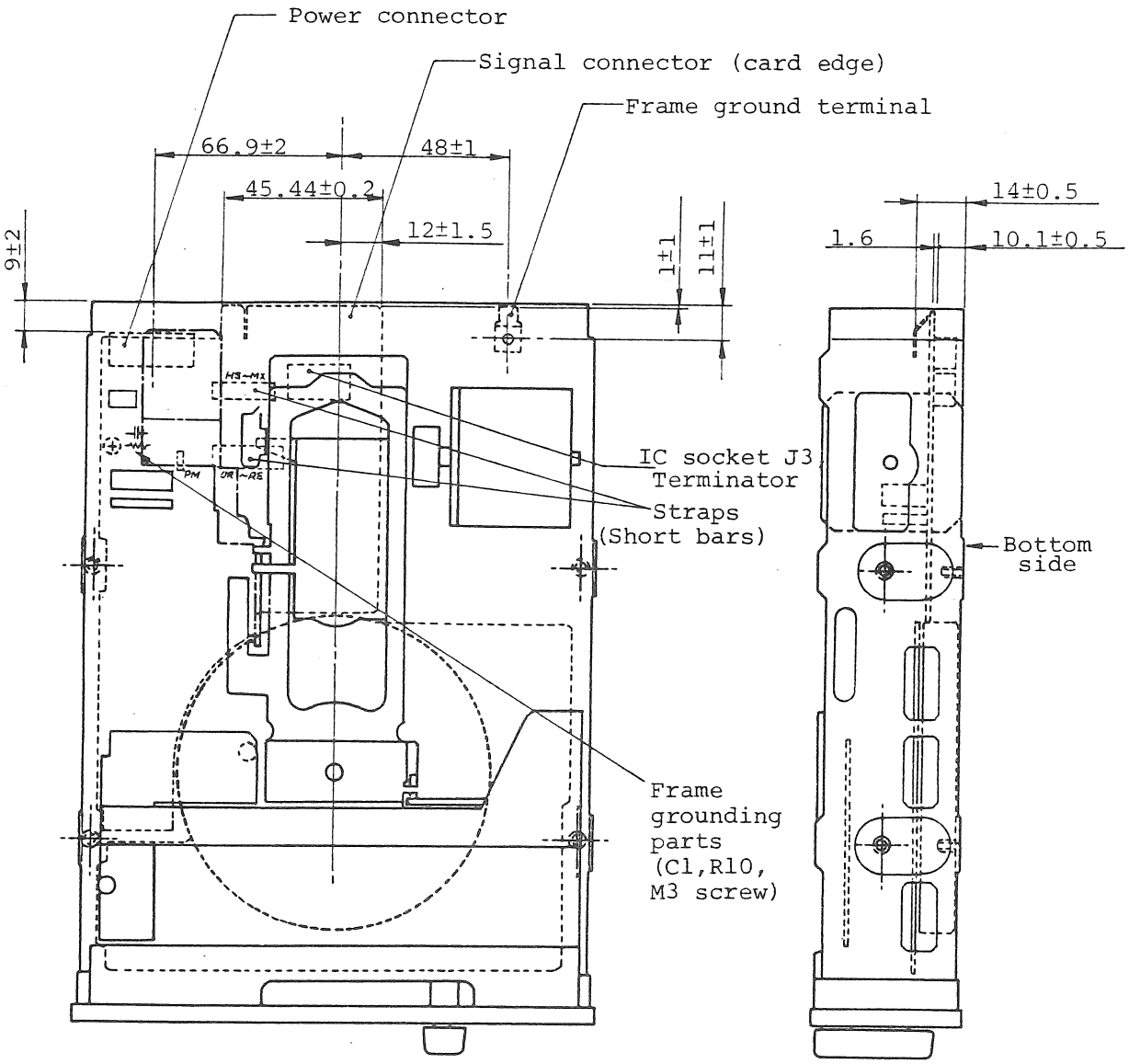
2-2-2. Connector and Cable Connection

The basical electric interface between the FDD and a host system is the daisy chaining method through the signal connector (J1) and the power connector (J2).

Fig.205 shows the location of each connector.

Refer to Fig.206 as to the cable connection. Also refer to Fig.101 in FD-55 Specification as to the external dimension of the FDD.



(Units:mm)

(Fig.205) Interface connector positions

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2-2-2-1. Signal connector and cable

(1) Connector

A 0.1 inch pitch, 34-pin (17 pins, double row) card edge connector is used for the signal connector (J1). Refer to Fig.103 in FD-55 Specification as to the detailed card edge dimension of the FDD PCBA. The even numbered pins of J1 are located on the parts side of the PCBA (at the bottom side of the FDD) and are used as the signal terminals. The odd numbered pins are located on the dip side of the PCBA and are used as the signal ground (0V) lines. (See Table 102 in FD-55 Specification). Table 201 shows examples of recommended connectors. Select a suitable one, taking the type of the cable used and the handling ability into consideration.

Manufacturers		3M	AMP	
Connection method		Crimping	Crimping	Soldering
Maker P/N	Housing	3463-0001	583717-5	583717-5
	Contactor	not used	1-583616-1	583854-3
	Polarizing key	3439-0000	583274-1	583274-1
	Locking key	not used	530213-1	530213-1
	Crimping tool	Press: 3440-A Locater plate: 3443-11 Platen: 3442-3	90268-1 (Hand tool)	not used
	Extraction tool	unable	91073-1	91073-1
Matched cable		Flat cable 3M P/N:3365/34 (AWG 28)	Twisted pair cable (AWG 28 ∿ 24)	

(Table 201) Cable side matched connectors for signal interface

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(2) Polarizing key

A polarizing key slot is fitted between pins No.4 (3) and No.6 (5) on the PCBA card edge. The polarizing key protects the connector from wrong connection (connection of pin No.1 to the position of No.34 and No.2 to the position of No.33). It is recommended to use a polarizing key in the cable side connector.
As far as the open collector type driver is used for the interface driver of the host system side (FDD controller side), the circuit will not be damaged even if the connector is inserted wrongly and power is turned on. However, if a disk is installed in this condition, recorded data on a track will be erased.

(3) Locking key

When you use two locking keys (AMP P/N 530213-1) with AMP P/N 583717-5, the two positions for locking key insertion (pin numbers 1 and 2, and pin numbers 33 and 34) cannot be used for signal and 0V lines. Pin No.34 is used for the READY signal.
For fixing the locking keys, ϕ2 holes above the pins No.2 and No.34 in Fig.103 (FD-55 Specification) are used.

(4) Cable length

The maximum cable length is easily influenced by disorder or distortion of transferred waveform which is caused by mismatching of the impedance.

For the simple model which has an interface driver at a cable end and an interface receiver having a terminator resistor at the another end of the cable, considerably long cable can be used. Contrarily, for a multiple connection of FDDs such as daisy chaining in Fig.206, the reflection of the output signals from the FDD connected on the halfway of the cable is greater since one end of the cable is open condition. Therefore, the maximum cable length allowed is shorter than the above

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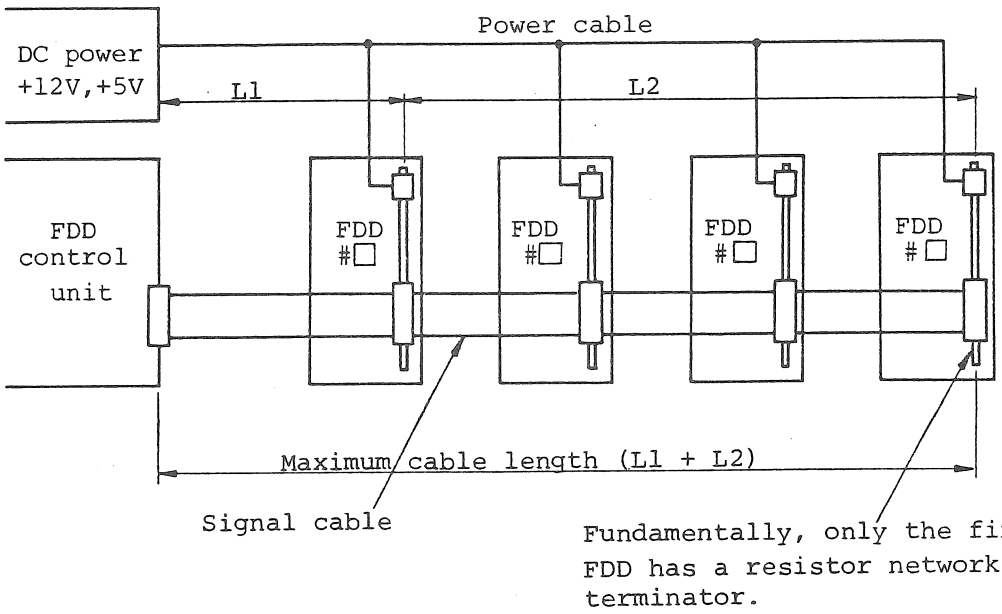
explained simple model. In the case of L1 < L2, shown in Fig.206, the allowable cable length is remarkably shortened.
Enough care is required for such a case.

For the system design, observe the input/output signal waveforms both at host and FDD sides carefully assuming the cable connections possible, and determine the maximum cable length which enables the interface receivers of both sides to receive the signals correctly. The shorter the total cable length, the better for the system performance.
Therefore, it is recommended to select the appropriate length of cable for the system construction.
Though the length is different depending on types of cable and types of host side receiver, the maximum cable length in a typical daisy chain connection is as follows:
(Refer to item 2-2-3-1).

Terminator resistor 330Ω : 3m,Max.
Terminator resistor 1KΩ : 1.5m,Max.



Note: □mark in the FDD shows the FDD address designated by straps DS0 ∿ DS3.

(Fig.206) Typical connecting scheme for up to 4 FDDs

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(5) Connecting and disconnecting the connector

Be sure to turn the power off first. When you plug-in the connector, check the orientation of the connector and plug-in straightly without excessive force. If you use a flat cable, never disconnect the connector by pulling the cable, since the outermost lines (corresponds to pin Nos. 1 and 34) of the cable are easily broken by excessive force).

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2-2-2-2. Power connector and cable

(1) Connector

A nylon housing, 4-pin connector is used as the power connector (J2). Table 202 shows an example of recommended connector for the cable side. This connector prevents wrong connection because of the housing construction.
Be sure to turn the power off before connecting or disconnecting the connector.

Manufacturer		AMP	
Connection method		Crimping	
Maker P/N	Housing	1-480424-0	
	Contactor	170148-1 or 60617-1	60619-1
	Crimping tool	90123-2	90124-2
	Extraction tool	1-305183-2	1-305183-2
Matched cable		AWG 24 ∿ 18	AWG 20 ∿ 14

(Table 202) Cable side matched connector for power interface

(2) Cable

Determine the thickness and the length of the cable so that the voltage at J2 connector will be in the specified tolerance range in item 1-4 (1) and (2) in FD-55 Specification, taking the voltage drop through the cable and the maximum power consumption of the FDD into consideration.

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Use the correct contactor and crimping tool to suit the cable thickness (see Table 202).

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2-2-2-3. Frame grounding

As described in item 1-10 of FD-55 Specification, DC 0V is connected to the frame of the FDD through C1 (0.01μF, 500V) and R10 (100KΩ) in parallel at shipping. Refer to Fig.109 in FD-55 Specification and Fig.205. C1 and R10 are mounted on the PCBA on which interface connectors are located, and they are connected to the frame through the M3 screw for frame grounding (see Fig.205).

DC 0V-Frame connection by 0.01μF// 100KΩ is sufficient for shipping or acceptance inspection purpose for FDD unit only (not assembled in the system). However, this connection is insufficient for the following applications from items (1) to (3). Secure connection by one of the methods in item (A) ∿ (C) is required.

Another frame grounding is required:

(1) When the FDD is assembled in a system cabinet.

(2) When the FDD is installed or placed on a metallic plate during tests. (For example, installed on the vibration tester, placed on a metallic plane in thermostatic oven).

(3) During electro-static noise test.

Another frame grounding method:

(A) Connect the FDD frame securely to the metallic cabinet (system cabinet with the installation taps (refer to Fig.101 in FD-55 Specification). It is required for the system cabinet to be connected to DC 0V of the power supply unit by an appropriate method.

(B) Utilizing the frame ground terminal (faston terminal) at the rear side of the FDD, connect the frame ground securely to DC 0V of the

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power supply unit through a low impedance cable (thicker than AWG 14).

(C) Connect the test plane or test equipment used for testing the FDD to DC 0V through a low impedance cable. Otherwise, insert a thick insulation plate between the FDD and the test plane (unsuitable for vibration tester).

If any of the above methods is executed, the frame grounding parts (C1, R10, M3 screw) in the FDD may still be mounted.
If it is unavoidable to remove these parts for system construction, cut off C1 and R10 with a cutting plier or replace the M3 screw with a plastic one and execute one of either (A) or (B) method.

If DC 0V and the frame are completely open, the FDD is easily suffered from electro-magnetic inductive noises and there is no way to discharge the static electricity generated by the moving parts in the FDD. And in result, expected reliability will not be obtained.

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2-2-3. Setting of Straps and Terminator

The FDD is equipped with 16 straps and a terminator resistor network. Users can select an appropriate setting for their systems.
Be sure to check that the short bars and the terminator are correctly set for your system before operation according to this item or items 1-11 and 1-12 in FD-55 Specification.

The short bars and the terminator resistor network are mounted on the double row pins and IC socket J3 on the bottom side PCBA.
Refer to Fig.206 as to the connection of several FDDs by daisy chaining (4 FDDs,Max.)

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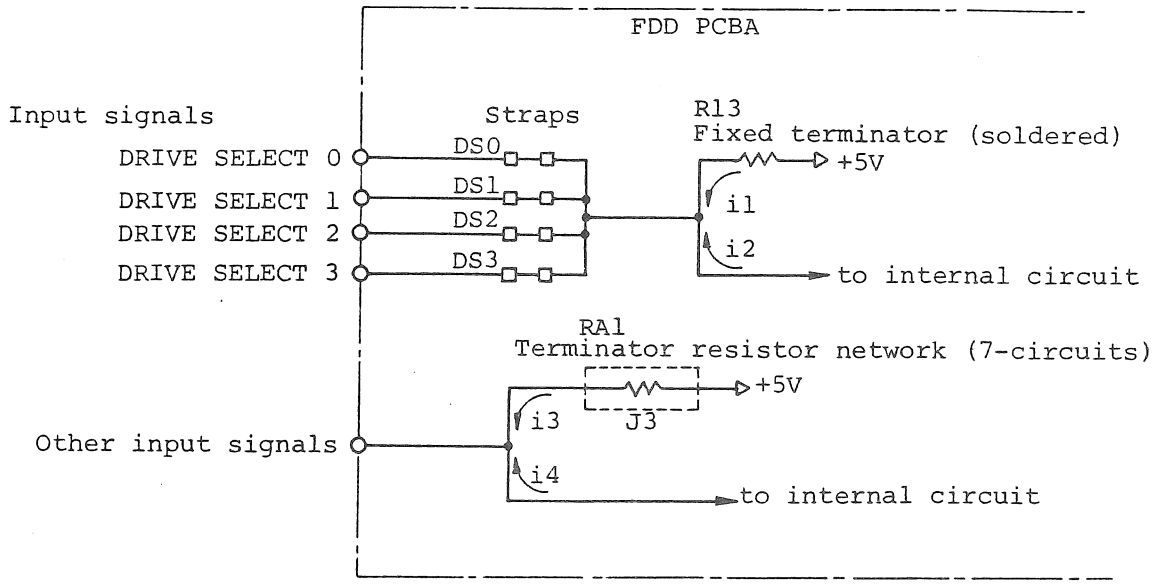
2-2-3-1. Terminators and interface drivers

(1) FDD side terminator

Terminators for the input interface signals are equipped to all the FDDs at shipment (refer to item 1-8-1 (3) in FD-55 Specification). Terminator resistor for the DRIVE SELECT 0 ∿ 3 input signals is separated from terminators for the other input signals and is soldered to the bottom side PCBA of the FDD (refer to Fig.102 in FD-55 Specification). All the terminators except for the DRIVE SELECT are packaged as a 14-pin resistor network and mounted on the IC socket J3.



(Fig.207) Terminator connection in FDD

FD-55(L) series has two types of termination (330Ω type and 1KΩ type). Table 203 shows the details of resistor values and LOW level current for each type of termination.
The feature of 330Ω type is a relatively longer cable length and that of 1KΩ type is the relatively low current consumption and low noise generation.

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Items		FD-55(L)	
		330Ω type termination	1KΩ type termination
Resistor value	DRIVE SELECT(R13)	330Ω	470Ω
	Other input signal(RA1)	330Ω	1KΩ
DRIVE SELECT line current (LOW level)	Terminator current(i1)	14.8mA	10.4mA
	Internal circuit current(i2)	1.6mA	1.6mA
	Total current(i1+i2)	16.4mA	12mA
Other input signal current (LOW level)	Terminator current(i3)	14.8mA	4.9mA
	Internal circuit current(i4)	0.4mA	0.4mA
Interface driver	Type	TTL 7438	TTL 74LS38 or 7438
	Sink current capability	48mA(0.4V)	12mA(0.4V) 24mA(0.5V)

Notes: 1. Resistor values and input signal line current are typical values.

2. TTL 74LS38 or 7438 are used in an FDD of 1KΩ type termination as the interface driver.

(Table 203) Details of FDD termination types

(2) Installation and removal of terminators

For a multiple connection of FDDs in daisy chaining, leave the terminator network only on the final FDD as shown in Fig.206, and remove the resistor networks on the other FDDs using a pair of tweezers.
However, if the interface driver of the host side has sufficient margin in sink current capability, resistor networks may be left on multiple FDDs. For such a case that an FDD already systemed has resistor network and additional FDDs are externally connected in daisy chaining, multiple resistor networks are rather favorable.
Also when the distances between each FDD are rather short, an FDD in the halfway may have resistor network instead of the final FDD.
It is recommended to observe the input/output signal waveforms of the host and FDD sides actually for the design of the system.

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(3) Host side terminator

Use the same resistor value as the host side terminator. Or use a smaller resistor value within the allowable sink current capability of the FDD side driver.
If the FDD side driver is TTL 7438, 120Ω is the minimum, while 430Ω is the minimum for TTL 74LS38.

(4) FDD side driver

Refer to table 203 and item (2).

(5) Host side driver

Required current sink capability (IoL) for the host side driver should satisfy the following expression (refer to Fig.207).

For DRIVER SELECT signal line:
Driver capability > Terminator current(i1) + internal circuit current(i2)

For other input signal lines:
Driver capability > [Terminator current(i3) x No. of resistor networks mounted] + [Internal circuit current(i4) x No.of FDD connected]

LOW level output voltage (VoL) of the host side driver shall be less than 0.4V. For example, for the FDD with 330Ω terminator, such a driver as TTL 74LS38 cannot be used since only 12mA is guaranteed for VoL $\leq$ 0.4V even though it has 24mA capability. Especially, care is required for the WRITE DATA and IN USE/HEAD LOAD signals, since these signals are received with a Shumitt TTL which LOW level threshold is 0.5V(Min.)

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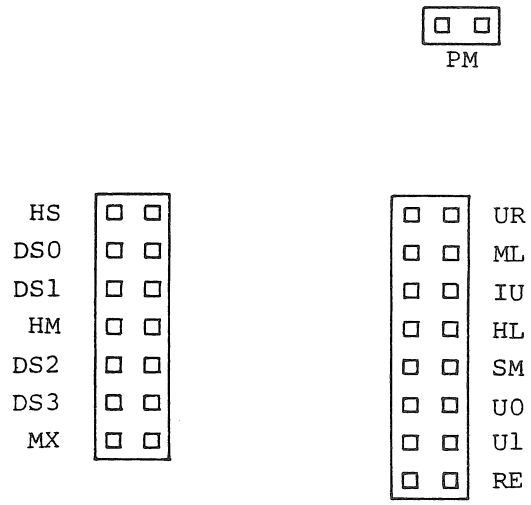
2-2-3-2. Straps

On the bottom side PCBA of the FDD, 16 straps are mounted. They are divided into three pin blocks that are HS ∿ MX block, UR ∿ RE block, and PM block.



(Fig.208) Straps and their locations

Insertion of a short bar onto the post pin is defined as the on-state of the strap. Straps are set to the condition in item 1-11-4 of FD-55 Specification at shipping. The setting can be easily changed by user to the most appropriate condition for the system construction. Reset the short bars referring to this item or to items 1-11, 1-12 in Specification. Since many combinations are possible for setting the short bars, it is desired to reset it by users to avoid the confusion at shipping stage.

(1) Installation and removal of short bars

Installation and removal of short bars must be done after turning off the power.

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(a) Installation

Install a short bar securely to short the two pins (left and right in parallel) in Fig.208. There is no restriction for the approach of the short bar insertion. However, for the easy visual checking of the on-state, it is recommended to insert the metal bar at the upper side of the post pins.

(b) Removal

To protect from unwanted removal due to vibration and impact, the short bars are very securely inserted. If it is not removed when nipped up with fingers, pull up slowly with a small round nose pliers. Be careful not to damage the parts around it.

(2) Ordering of short bars

If more short bars than the standard installation at shipping are required, or if short bars as spare parts are required, order with the following parts number.

Short bar TEAC P/N : 13121149

Maker P/N : Honda Tsushin Kogyo Co., Ltd. DIC-S252

(3) HS ∿ MX strap block

(a) MX strap

The on-state of this strap is used when only one FDD is connected to the system. All the input/output signals are valid in this condition independent of the DRIVE SELECT signal.
The off-state of this strap is used when multiple FDDs (4 FDDs, Max.) are daisy chained or when input/output signals are enabled by the DRIVE SELECT input signal for only one FDD connected. It is necessary to set the MX strap off of any daisy chained FDD in a multiple

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connection.
This strap has no relation to the turn-on condition of the front bezel indicator and the rotating condition of the spindle motor.

(b) DS0 ∿ DS3 straps

These straps designate the drive number (address) of the FDD in the multiple control by daisy cahin connection.
When the MX strap is off, the same number of the DRIVE SELECT signal as an on-state DS strap enables all the input/output signals.
Any of the four addresses 0 through 3 can be designated.
The DS strap must be set to different number for each FDD. If multiple FDDs are set to a single address, they start operation simultaneously for each input signal and cause function errors and data errors.
Refer to items 2-2-3-3 through 2-2-3-5 for the relation between these straps (or the DRIVE SELECT signals) and the operating conditions of the front bezel indicator, spindle motor, or head load solenoid.

(c) HS and HM straps

These straps determine the head load condition.

i) For the model with head load solenoid:

Only when the SM strap in the UR ∿ RE strap block is on-state, HS and HM straps become effective.
When the SM and the HS straps are on, the head loading will be executed by the DRIVE SELECT signal selected by DS0 ∿ DS3 straps, while the head loading will be executed by the MOTOR ON signal when the SM and the HM straps are on.
Never set both the HS and HM straps on at the same time. The MOTOR ON and DRIVE SELECT signals will be wired ORed which disturbs the inherent functions of these two signals.

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ii) For the model without head load solenoid (CSS model):

HS and HM straps have no meaning for CSS (Contact Start/Stop) models. Even though one of these straps is set to on-state, it will have no influence to the other functions. However, as a general rule, these straps should be set to off-state.

(4) UR ∿ RE strap block

(a) IU and HL straps

Straps to select the function of the IN USE/HEAD LOAD input signal (signal connector pin number is 4).

i) For the model with head load solenoid:

When the IU strap is on-state, the signal of pin number 4 functions as the IN USE signal. The IN USE function, independent of the DRIVE SELECT signal, is provided to turn on the front bezel indicator and to control the rotation of the spindle motor by setting the ML strap in item (d). Refer to items 2-2-3-3 and 2-2-3-4 for the operating conditions of the front bezel indicator and spindle motor.

If HL strap is on-state, the signal of pin number 4 functions as the HEAD LOAD signal. If the MX strap is on at this time, the head loading will be executed by the HEAD LOAD signal, while the MX strap is off, the head loading will be executed by the ANDed condition of the HEAD LOAD signal and the DRIVE SELECT signal selected by DS0 ∿ DS3 straps.

It is possible to set both of the IU and the HL straps on at the same time. In such a case, the signal of pin number 4 has two functions of the IN USE and the HEAD LOAD.

Also both straps may be set to off at the same time. In such a case both functions of the signal will be invalid.

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ii) CSS model:

For the CSS model without head load solenoid, the HL strap has no means. Even though the on-state of the HL strap has no influence to the other functions, set it to off-state as a general rule.
Only the IU strap is effective for the CSS models. Refer to previous item i) as to its function.

(b) SM strap

Strap to enable the HS and HM strap function in the HS ∿ MX strap block.

i) For the model with head load solenoid:

When used with the HS or the HM strap, head load condition is determined. (Refer to item (3)-(c)-i)).
For the model with head load solenoid, one of the straps HL and SM must be on-state. If both of them are off, head loading will not be executed. If both of them are on, the function of the HS strap becomes ineffective and this combination will not be used. Refer to item 2-2-3-5 as to the operating condition of the head load solenoid.

ii) CSS model:

For the CSS model without head load solenoid, the SM strap has no means. Even though the on-state of the SM strap has no influence to the other functions, set it to off-state as a general rule.

(c) U0, Ul, UR straps

Straps to determine the turn-on condition of the front bezel indicator. By the combination of four straps including the IU strap, six turn-on

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conditions in item 2-2-3-3 can be selected. Any other combinations than these six are not used practically.
Never set both the U0 and UR straps on at the same time. The internal circuit of the FDD might be damaged partially (READY signal circuit).

(d) ML strap

Strap to select the rotating condition of the spindle motor by an external command.
When this strap is off-state, start/stop of the spindle motor can be controlled, as a commercially available conventional FDD, by the MOTOR ON input signal.
When this strap is on-state, the spindle motor will rotate while the front bezel indicator turns on in addition to the TRUE state of the MOTOR ON signal.
For example, if "Selection 6" of the indicator turn-on conditions in item 2-2-3-3 and the on-state of the ML strap are combined, spindle motor of a desired one or desired multiple FDDs among the daisy chained (4 FDDs,Max.) can be rotated with a desired timing by the IN USE and the DRIVE SELECT signals. Rotating the spindle motor of only necessary FDDs improves the life of disks and heads and decreases the current consumption. Also shifting the start timing of multiple spindle motors respectively (start time: 400msec,Max.) to avoid the overlapping of a start (rush) current, peak current capability required (current limit value) can be decreased.
Select the most appropriate spindle motor rotating condition for your system referring to item 2-2-3-4.

(e) RE strap

This strap is effectively used in a high density FDD (FD-55G(L)).
When this strap is on-state, the head is automatically recalibrated to track 00 after power on and the track counter in the FDD is cleared.
And in the following operation, the FDD memorizes the track position

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and switches the low pass filter (switch filter) of the read amplifier between track 43 and track 44.
The automatic recalibration starts at the initial pre-ready condition (refer to item 1-8-1 (13) in FD-55 Specification) after power on completes within 255msec (if the head was located on the innermost track). The READY output signal maintains FALSE during automatic recalibration.
The RE strap should be set to on-state for FD-55G(L).
Since the switch filter is not used in FD-55A ∿ F, the on-state of this strap is effective only for the execution of previously mentioned automatic recalibration. Though there will be no influence to the other functions, set the strap to off-state (automatic recalibration is not executed) as a general rule.

(5) PM strap

Strap to make the spindle motor rotate automatically at the insertion of a disk.
When this strap is off-state, automatic rotation of the spindle motor by the FDD internal circuit will not be executed.
When this strap is on-state, automatic rotation of the spindle motor by the FDD internal circuit will be executed in either of the following two conditions.

(a) When a disk is inserted into the front bezel.
(b) When the disk is removed. (Note that automatic rotation will not start when a write protected disk is removed).

Automatic rotation will stop in either of the following two conditions.

(A) When the front lever is closed, disk starts rotation, and the FDD becomes the ready state (as far as an external command to rotate the spindle motor is not input, the READY signal maintains FALSE).
(B) 10sec, approx. after the removal of a disk from the FDD.

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Or in a rare case, when a disk is inserted at the index hole position and the front lever is not closed for losec, approx.

(6) Summary of strap selection

Table 204 shows the procedure of the strap selection.

Items	Related straps		Items to be referred
	With head load solenoid	CSS model	
Front bezel indicator turn-on condition	IU,UO,Ul,UR	IU,UO,Ul,UR	2-2-3-3
Spindle motor rotation condition	ML,PM	ML,PM	2-2-3-3 2-2-3-4
Head load solenoid operating condition	HL,SM,HS,HM	-	2-2-3-5
FDD address designation	DS0 ∿ DS3, MX	DS0 ∿ DS3, MX	2-2-3-2 (3)-(a),(b)
Automatic recalibration	RE(G model)	RE(G model)	2-2-3-2 (4)-(e)

(Table 204) Table of strap selection

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2-2-3-3. Turn-on conditions of front bezel indicator

Table 205 shows the turn-on condition of the front bezel indicator. Six combinations can be selected by four straps of IU, U0, Ul and UR.

Selection No.	Strap combination				Indicator turn-on conditions
	IU	U0	Ul	UR	
1	-	-	-	-	DRIVE SELECT
2	-	-	-	ON	DRIVE SELECT x Ready
3	ON	ON	-	-	IN USE
4	ON	ON	ON	-	IN USE latch
5	ON	-	-	-	DRIVE SELECT + IN USE
6	ON	-	ON	-	DRIVE SELECT + IN USE latch

Notes: 1. "-" mark indicates the off-state of the strap.
2. Any other combinations of straps than the above will not be used practically.
3. Never set U0 and UR straps on at the same time.

(Table 205) Front bezel indicator turn-on conditions

(1) Selection 1

When the DRIVE SELECT input signal selected by DS0 ∿ 3 straps is TRUE, the indicator turns on.

(2) Selection 2

When the condition of selection 1 is satisfied and also the FDD is in ready state, the indicator turns on. Ready state means that a disk is inserted, front lever closed, and the disk rotates normally. Refer to item 1-8-3 (13) in FD-55 Specification for details.

(3) Selection 3

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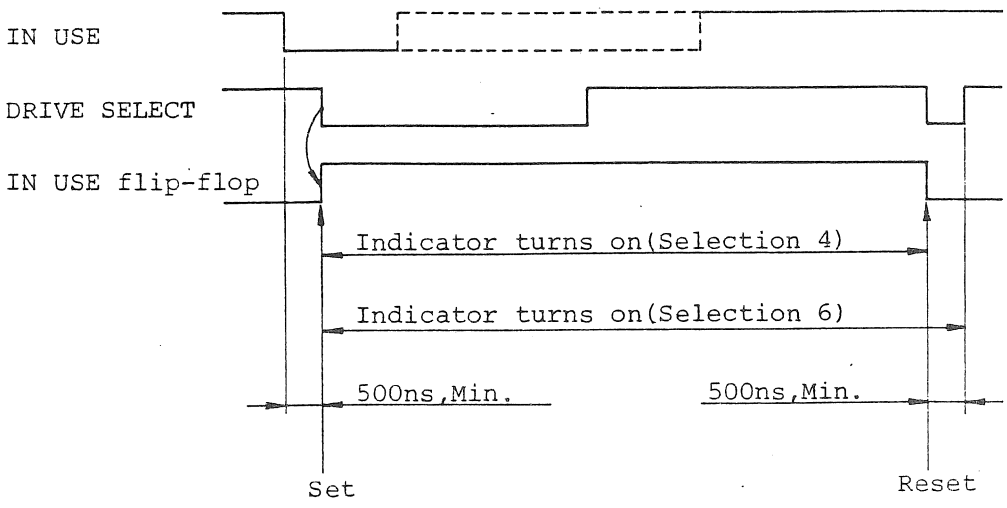
When the IN USE signal (signal connector pin No.4) is TRUE, the indicator turns on.

(4) Selection 4

When the IN USE flip-flop in the FDD is set, the indicator turns on.

(a) The IN USE flip-flop is set when the DRIVE SELECT signal selected by DS0 ∿ 3 straps becomes TRUE during TRUE-state of the IN USE signal (signal connector pin No.4).

(b) The IN USE flip-flop is reset when the DRIVE SELECT signal selected by DS0 ∿ 3 straps becomes TRUE during FALSE-state of the IN USE signal.



(Fig.209) IN USE signal latch (Selections 4 and 6)

(5) Selection 5

The indicator turns on in either of the conditions of Selections 1 and 3.

(6) Selection 6

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The indicator turns on in either of the conditions of Selections 1 and 4.

Note: The FDDs are set to the condition of Selection 5 at shipping from the factory.

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2-2-3-4. Rotating conditions of spindle motor

Table 206 shows the rotating condition of the spindle motor. Four basic selections are available by the ML and PM straps.

Selections	Straps		Spindle motor rotating conditions
	ML	PM	
7	-	-	MOTOR ON
8	-	ON	MOTOR ON + Automatic rotation at disk insertion
9	ON	-	MOTOR ON + On-state of front bezel indicator
10	ON	ON	MOTOR ON + Automatic rotation at disk insertion + On-state of front bezel indicator

(Table 206) Basic selection of spindle motor rotating conditions

(1) Selection 7

The spindle motor rotates when the MOTOR ON input signal is TRUE.

(2) Selection 8

The spindle motor rotates when the MOTOR ON input signal is TRUE, or when a disk is inserted (automatic rotation by the FDD internal circuit). Refer to item 2-2-3-1 (5) "PM strap" as to the details of the automatic rotation by the internal circuit.

(3) Selection 9

The spindle motor rotates when the MOTOR ON input signal is TRUE, or when the front bezel indicator turns on (when a turn-on condition in Table 205 is satisfied). However, the Selection 2 of the turn-on conditions cannot be applied for this purpose. Following shows all the possible combinations of the rotating conditions by Selection 9.

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Selection 9-1: MOTOR ON + DRIVE SELECT
Selection 9-2: MOTOR ON + IN USE
Selection 9-3: MOTOR ON + IN USE latch
Selection 9-4: MOTOR ON + DRIVE SELECT + IN USE
Selection 9-5: MOTOR ON + DRIVE SELECT + IN USE latch

Refer to item 2-2-3-3 as to the details of the turn-on conditions of the indicator.

(4) Selection 10

The spindle motor rotates when any one of the conditions in Selection 9 (9-1 through 9-5) is satisfied or when a disk is inserted (automatic rotation by the FDD internal circuit).
Refer to item 2-2-3-1 (5) "PM strap" as to the details of the automatic rotation by the internal circuit.

Notes: 1. The FDDs are set to the condition of Selection 8 at shipping from the factory.
2. Elongation in life and saving in power consumption can be done by utilizing the Selection 9 or Selection 10 (refer to item 2-2-3-2 (4)-(d) "ML strap"). Select the most appropriate rotating condition for your application.

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2-2-3-5. Operating conditions of head load solenoid

This item applies only for the models with the head load solenoid and not applies to the CSS models (without head load solenoid).
Table 207 shows the operating condition of the head load solenoid.
Three head load conditions can be selected by four straps of HL, SM, HS, and HM.

Selection No.	Strap combinations				Head load conditions
	HL	SM	HS	HM	
1	-	ON	-	ON	Ready + pre-ready
2	-	ON	ON	-	DRIVE SELECT x (Ready + Pre-ready)
3	ON	-	-	-	(DRIVE SELECT + MX) x (Ready + Pre-ready) x HEAD LOAD

Notes: 1. "-" mark indicates the off-state of the strap.
2. Any other strap combinations than the above will not be used practically.
3. Never set HS and HM straps on at the same time.

(Table 207) Head load conditions

(1) Selection 11

When the FDD is in ready or pre-ready state by an external rotation command of the spindle motor (MOTOR ON signal or front bezel indicator turn-on command), the head loading will be executed.
Ready state (or pre-ready state) means that a disk is inserted, front lever closed, and the disk rotates normally.

(2) Selection 12

When the condition of Selection 11 is satisfied and when the DRIVE SELECT signal selected by DS0 ∿ 3 straps is TRUE, the head loading is executed.

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(3) Selection 13

When the condition in Selection 11 is satisfied, and when the MX strap is on or the DRIVE SELECT signal selected by DS0 ∿ 3 straps is TRUE, and when the HEAD LOAD signal (signal connector pin No.4) is TRUE, the head loading is executed.

Notes: 1. The FDDs are set to the condition of Selection 12 at shipping from the factory.

2. The condition of Selection 11 is similar to the CSS model which has no head load solenoid. It is rather better to use the CSS model for this purpose because of fewer parts, shorter access time, and no head load impact.
The time required before enabling the read/write operations is 635msec for the Selection 11 and 400msec for the CSS model.

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2-2-4. Inductive Noise in Installed Environment

Since the FDD handles minute signals in data reproducing, sufficient consideration is required to reduce inductive noise and switching noise. Equipment installed around the FDD such as a CRT display, TV set, or switching regulator, parts such as transformers, or motors and in some cases cables may have a harmful effect on the FDD. This appears as noise on the read output from a disk and deterioration in symmetry of the read waveform or in peak shifts decreasing window margin of the data separator.

A single FDD or combined FDDs are protected in all conditions from inductive or magnetic noise generated by internal parts of the FDD such as motors, solenoid, and PCBA by shielding these parts and by shielding the magnetic head. Even though these shielding is also effective against the external noise, it is not perfect for relatively large noise sources such as a CRT flyback transformer, switching regulator, etc. In some cases, additional shielding against external noise sources, shielding by system cabinet, or consideration for the installation position may be required. The following shows examples to observe the influence of a noisy environment on the FDD.
Refer to the examples for your improvement of environmental conditions. Especially, it is required to confirm the noise influence at the time of system design if the FDD is installed near a CRT display or a switching regulator, or if the system in which the FDD is assembled is placed near a CRT display.

Observing method A for influence by external noise sources

(1) Lengthen the interface cable of the FDD to make apart from the noise sources.

(2) Install a disk and write 1F data (125KHz of WRITE DATA for FD-55A ∿ F, and 250KHz for FD-55G) on all over the innermost track.

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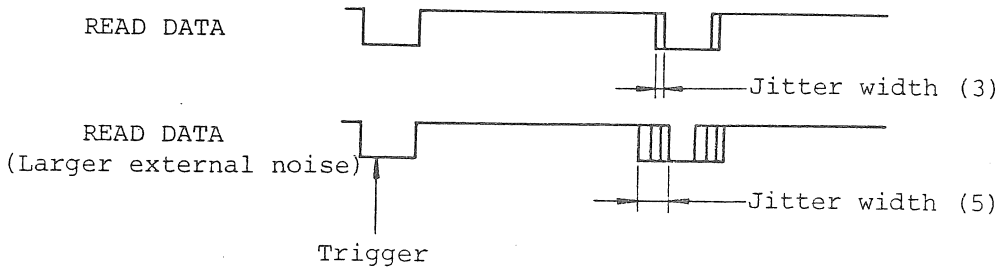
(3) Observe the READ DATA output signal in read operation with an oscilloscope. For this observation, set the time scale of the oscilloscope so that two pulses can be observed and then reduce the time scale by variable knob so that three pulses can be observed. In this adjustment, find the variable knob position at which the next pulse jitter width to the triggering pulse can be observed most clearly to measure the jitter width.



(Fig.210) Influence to the READ DATA waveform by external noises

(4) Shorten the interface cable length as it was and install the FDD in the specified position in the system.

(5) As in item (2), write new 1F data and measure the jitter width with the same time scale as in item (3).

(6) If the jitter width increases when compared with item (3), the increased jitter indicates the influence of external noises.
It is recommended to arrange not to increase the jitter width as much as possible.

Notes: 1. For a double sided FDD, both sides 0 and 1 should be tested.
2. By this method, it is rather difficult to judge how much jitter width is allowable or to know the noise influence correctly in figures. However, this is an easy method to know the noise influence without breaking down the system, provided that two FDDs are used.

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Observing method B for influence by external noise sources

(1) Install the FDD in the system properly.
Connect leading wires (shielded wires are recommended) from TP9, TP10, and TPG of the bottom side PCBA to the two channels of an oscilloscope. Refer to item 3-3 of FD-55 Maintenance Manual for the detailed position of the test points.

(2) Set one of the two channels of the oscilloscope to Invert mode and ADD them to be able to observe them as one waveform.
Connect the oscilloscope ground to TPG. Also set both channels to AC mode.

(3) Install a disk and set the head to the innermost track.

(4) Write 2F data (250KHz of WRITE DATA for FD-55A ∿ F, 500KHz for FD-55G) on all over the track.
If it is difficult to write 2F data, a disk initialization (formatting of the track) may be done by a command from host system.

(5) Measure the read output level (p-p value) after the above writing.
For the initialized disk, measure the read level of higher output portion on the innermost track (corresponds to 2F).

(6) Remove the disk and measure the noise level (p-p value).

(7) Calculate the S/N ratio according to the following expression.

$$\frac{\text{Noise level in item (6)}}{\text{2F read level in item (5)}} \times 100(\%)$$

(8) If the value calculated by the above expression is less than 5% (S/N: 26dB), the FDD is protected against the external noises. If the value is between 5% and 10%(S/N: 20 ∿ 26dB), there will be no problem in

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practical operation. However, as much improvement as possible is recommended.

If the value is more than 10% (S/N: 20dB or less), some improvement in shielding or reducing noises shall be required since desired reliability will not be obtained.

Notes: 1. For a double sided FDD, both sides 0 and 1 should be tested.

2. For a 96tpi FDD, the read output voltage is approximately half as that of a 48tpi FDD. Also taking a off-track between a recorded disk and head positioning of an FDD into consideration, it is required to pay enough care for the S/N ratio of a 96tpi FDD. It is recommended to design your system with the target of less than 5% (26dB).

3. Recommended S/N ratio in item (8) is applied only when PLO circuit in data separator operates correctly and sufficiently. If a poor PLO circuit is used in the host system side, the above S/N ratio becomes insufficient.

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2-2-5. Front Bezel

Fig.211 shows the detailed dimension of the standard dront bezel (front view).

Notes:

1. When the customer of the FDD designs the front bezel, detailed drawings (including the drawing of back side) are required. Ask for these drawings when required.

2. The standard color of the front bezel is black. "PPHOX (Xyron)" or "ABS" is used as the material. It is recommended to approve the use of these material for an optional order of color.

3. Fig.211 does not apply for the models with 1/1 size (twice in height than the standard slim line) front bezel. The standard color of this model is black and the material is "PPHOX(Xyron)".

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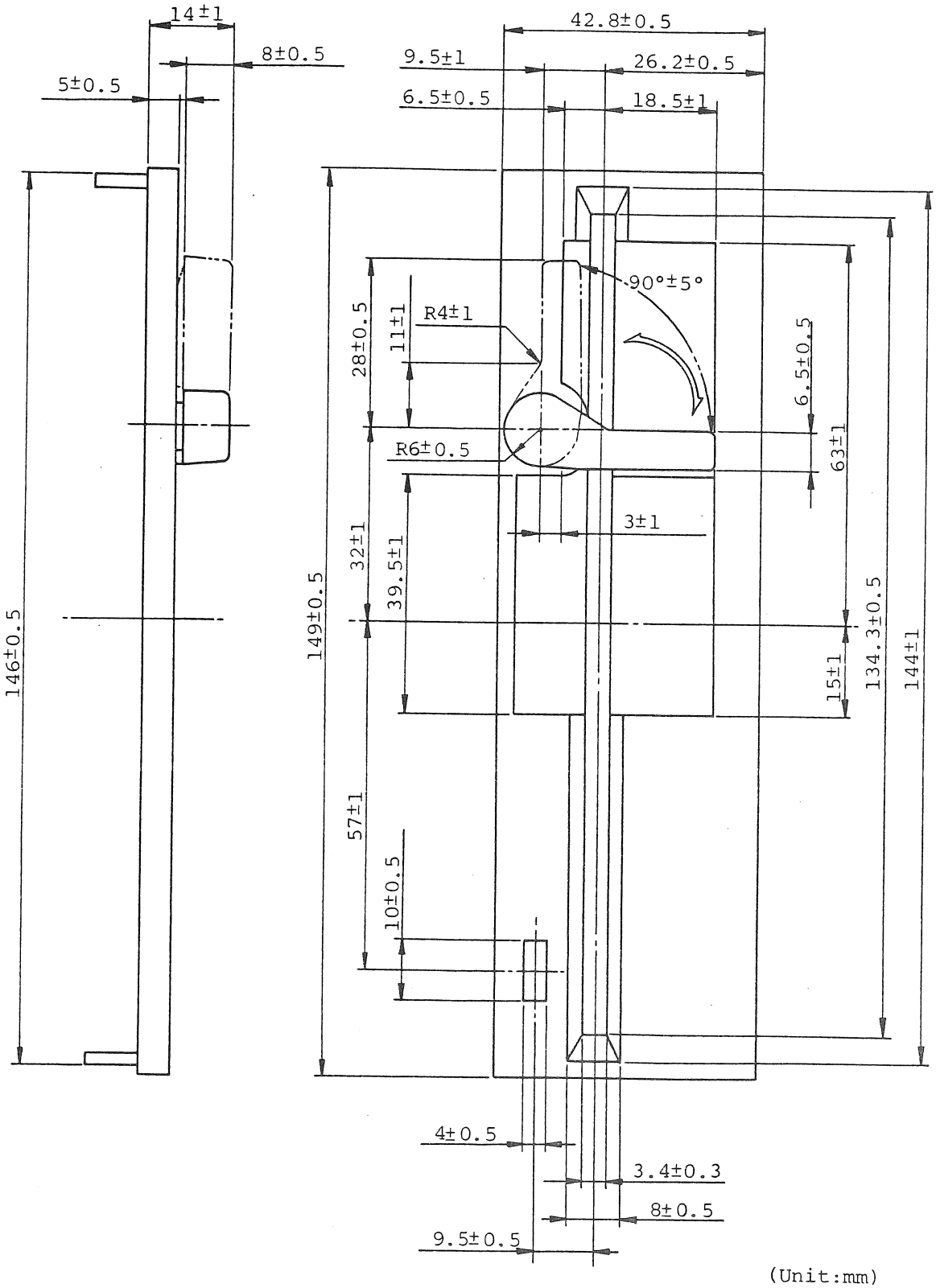

(Fig.211) Standard front bezel dimensions

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2-3. CONTROL PROCEDURE

The following controls are required for the FDD to write and read data on a desired track. Read the explanation for the input/output signals in item 1-8-3 of FD-55 Specification when you design the system for the correct control of the FDD.

(1) Recalibration to track 00

At the initial power on, the host system does not know which track the magnetic head is positioned on. It is necessary, therefore, to step out the head until the TRACK 00 output signal becomes TRUE (recalibration). The maximum track seeking distance (when the head carriage is in contact with the innermost stopper) for this step-out operation will be within the following range.

48tpi FDD: 48 tracks, Max.
96tpi FDD: 96 tracks, Max.

Even if the TRACK 00 signal is TRUE before recalibration, it is ideal to execute step-in operations first for 4 through 8 tracks and then execute the above recalibration.
The TRACK 00 output signal becomes valid 5.8msec for 48tpi and 2.8msec for 96tpi after the trailing edge of the STEP pulse. Be sure to check for the TRACK 00 immediately before the input of the next STEP pulse.

Note: If the RE strap is on-state (FD-55G), automatic recalibration (refer to item 2-2-3-2 (4)-(e)) is executed by the FDD internal circuit at the first pre-ready condition (refer to item 1-8-1 (13)) in Specification) after power on, and the input of the first recalibration command is not necessary.

(2) Starting of spindle motor

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Start the spindle motor by the MOTOR ON input signal or by a front bezel turn-on command (when the ML strap is on-state). Refer to item 2-2-3-4. Installed disk speed is settled to the stable rotation within 400msec after the above motor start command, and data read or write operation can be done from this timing for the CSS model without head load solenoid. The READY output signal becomes TRUE within 800msec after the start of the disk (or motor).

For a CSS model, control the FDD to rotate the disk by the external spindle motor start command only for data read, data write, and head seek operations since the head is always in loaded condition which is effective for the life of disk and head. However, since the start time of the spindle motor is longer than the actuating time of the head load solenoid, it will be more convenient to use a method (program) to stop the motor rotation when the access to the FDD paused for more than a certain period (e.g. 3 through 10sec).
For a model with head load solenoid, it is recommended to stop the motor when the access to the FDD paused for more than a certain time. This is because that the side 0 head usually be in contact with the disk with a slight pressure even though in head unloading condition.

Disk life is specified more than 3×10^6 passes/track with head loading and motor rotating conditions. This corresponds to 167 hrs., approx. of continuous operation on one track.

(3) Head loading

For a CSS model, the FDD is in head load condition as far as a disk is inserted and the front lever is closed. Therefore, the data read or write operation can be always executed from 400msec after the start of the spindle motor.

For a model with head load solenoid, data read or write operation can be executed from 35msec after satisfying the head load conditions

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(refer to item 2-2-3-5). In order to execute the head loading, it is necessary that the disk rotates at a specified speed. The head loading will not be executed even if the head load command is input when the spindle motor stops.

If the FDD is used with the SM and HM straps on, the pre-ready state is detected 600msec, Max. after the start of the spindle motor and the head load operation completes after 35msec (635msec is required in total). The operation executed by this strap combination is almost the same as the CSS model operation. Therefore, it is recommended to use the CSS models for this purpose only.
For the head load operation by the other strap combinations than the above, pay enough care so that the impact by head loading (tapping impact) does not concentrate at a point on a track (e.g. do not synchronize the operation with index pulse).

(4) Head seek

With a combination of the STEP and the DIRECTION SELECT signals, the head will be moved to the desired track. For successive movement in the same direction, the STEP pulses should be input with a space of more than 6msec for 48tpi FDDs and 3msec for 96tpi FDDs, while the STEP pulses should be input with a space of more than 21msec for 48tpi and 18msec for 96tpi FDDs for a change of step direction (settling time is added).
The access motion and settling will be completed 21msec for 48tpi FDDs and 18msec for 96tpi FDDs after the trailing edge of the last STEP pulse and data write or read operation can be performed.
During these periods, keep the WRITE GATE signal FALSE.
After the WRITE GATE signal becomes FALSE, do not make the DRIVE SELECT signal FALSE nor input the STEP pulse at least for 1msec for FD-55A ∿ F and 590μsec for FD-55G.

If a desired sector cannot be found even by 4 through 8 retries after the head seek operation, a seek error might have occurred. Execute the

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same recalibrate operation as after power-on in order to try to set to the desired track again. If a desired sector cannot be found still after several times of this series of operation, regard it as a hard error (unrecoverable error).
If error occurs in read operation of data field, execute retry including the recalibrate operation as well as the above.

In read operation when the disk and the drive operate normally, it is specified that the recoverable error (soft error) may occur less than one per 10^9 bits. This error rate corresponds to one error per 24 hrs., approx. in continuous randum seek operation.

For the head seek operation, a method to unload the head before the seek is often adopted. However, taking the disk damage caused by repetitious impacts of head loading (tapping impact), access speed, and tapping noise into consideration, it is desirable to perform the seek operation with head load condition.
Tapping damage is negregible for a single sided FDD.
For a double sided FDD, it is specified that no error occurs by 3×10^4 taps to a single point on a track. In practical operation, tappings do not concentrate on a specific position, and 1×10^6 taps are allowable on a track if they are distributed evenly on the track.

(4) Side selection

For a double sided FDD, it is required to designate a desired disk side by the SIDE ONE SELECT signal. Do not change the level of the SIDE ONE SELECT signal at least 1msec for FD-55A ∿ F and 590μsec for FD-55G after the change of the WRITE GATE signal to FALSE (completion of write operation). The signal may be changed at any time except for the above period.
Do not make the WRITE GATE signal TRUE at least 100μsec after the change of the SIDE ONE SELECT signal.

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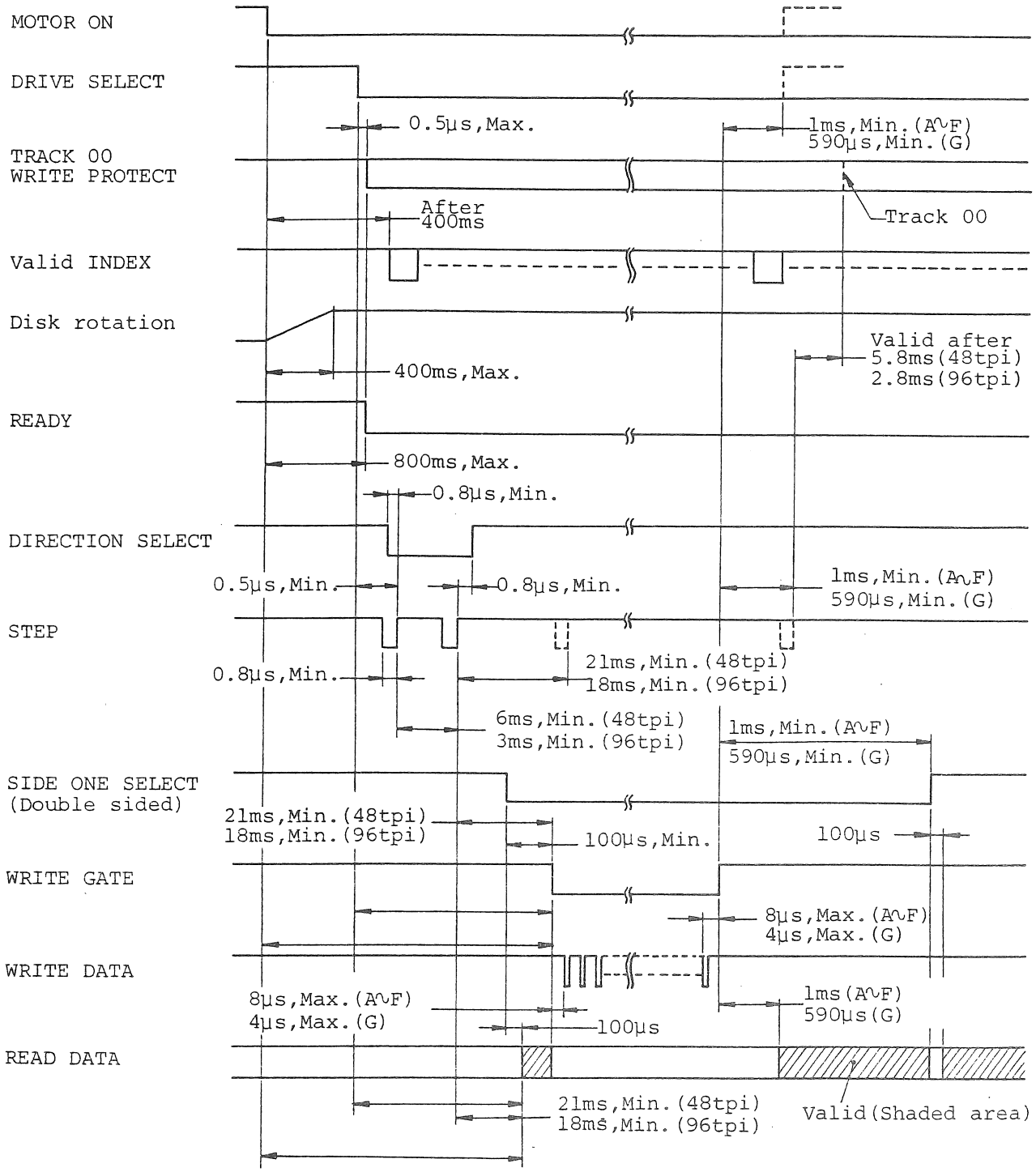

Notes:

1. READ DATA pulse may be output when the conditions such as the DRIVE SELECT are satisfied, even if a disk is not installed.
2. For a single sided FDD, the timings concerning the SIDE ONE SELECT signal will be eliminated.
3.

FDD model	* timing	** timing
With head load solenoid	635ms,Min.	35ms,Min.(head loading by DRIVE SELECT)
CSS model	400ms,Min.	0.8µs,Min.

(Fig.212) Composite control timing

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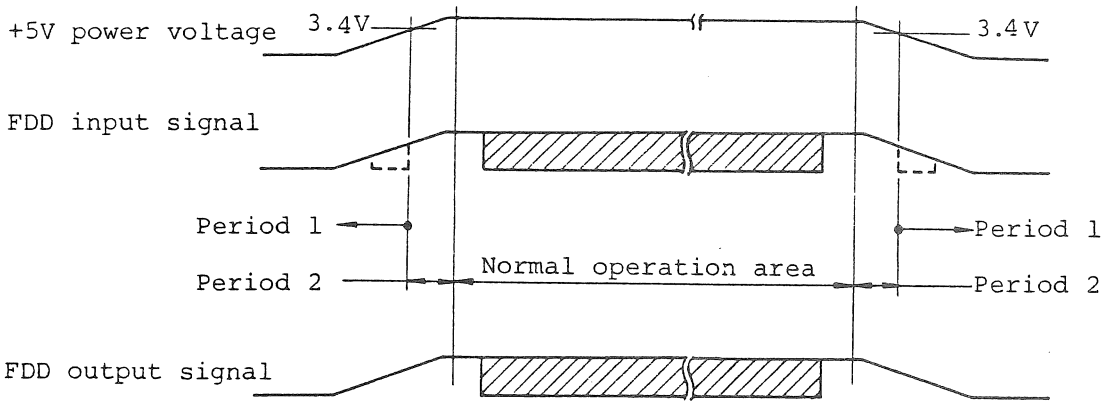
2-4. POWER SUPPLY

2-4-1. Power On and Off

There is no restriction for power on or off sequence of +12V and +5V. The WRITE GATE input signal shall be kept FALSE state during unstable DC power condition, if the FDD power is turned on or off simultaneously with the host system or if only the power of the host system side is cut off.

There will be no function errors such as unintended erasing of the data or unexpected writing of noise caused by the internal circuits of the FDD by any power on or off.

Generally it is recommended to turn the power on or off after removing the disk from the FDD in order to avoid accidents.



Notes: 1. In period 1, the low voltage sensor in the FDD inhibits the erroneous recording or erasing even if a wrong input signal is received.

2. In period 2, take care not to make the WRITE GATE signal TRUE since the FDD mostly functions for each input signal.

(Fig.213) Power on and off timing chart

The following capacitors are attached to the power line of the FDD PCBAs. If you want to know the surge current at power on, put them at the end

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of power cable for testing purposes.

+5V power line: 130μF, Max.

+12V power line: 160μF, Max.

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2-4-2. Internal Current Consumption of the FDD

Table 208 shows the detailed current consumption of +12V and +5V power for each use in the FDD.

Use	Operating condition	+12V (mA)		+5V (mA)	
		Typical	Maximum	Typical	Maximum
Spindle motor Ass'y	Rotation stops	25	40	25	30
	Rotating, disk not installed	45	70	↑	↑
	Rotating, disk installed, head unloaded (Note 4,12)	130	350	↑	↑
	Rotating, disk installed, head loaded (Notes 4,5)	180	410	↑	↑
	Peak at rotation start (Note 6)	700	800	↑	↑
	Average at rotation start (Note 6)	620	750	↑	↑
	Forced stop (Note 7)	620	800	↑	↑
Stepping motor Ass'y	Seek operation (Note 8)	145	180	-	-
	Seek stops (Note 8)	-	-	50	65
Head load solenoid (Note 12)	Energization start (Note 9)	200	250	-	-
	After starting (Note 9)	-	-	85	105
PCBA circuit	Waiting (Note 10)	15	30	150	205
	Read operation	30	40	220	300
	Write operation	125	155	220	300

(Table 208) Detailed current consumption for each use

Notes for table 208:

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(1) The symbol "-" indicates that the power is not used for that item.

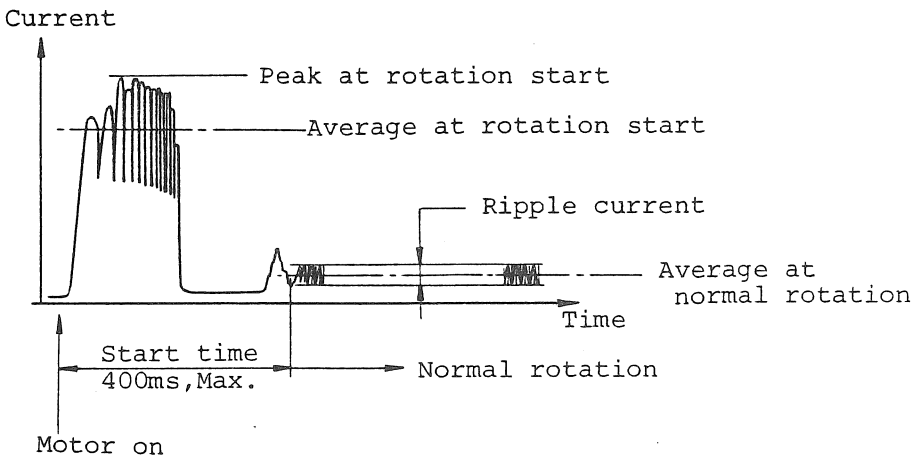
(2) "Typical" current means the practical value of the average current consumption measured with a typical FDD in room temperature and with nominal voltage.

(3) "Maximum" current means that the average value of the current consumption does not exceed the "Maximum" value in any normal operations.
"Maximum" in the item of "Peak at rotation start" means the upper limit of the peak value.

(4) "Typical" current of the spindle motor Ass'y at "Rotating, disk installed" shows when a commercially available disk of typical running torque (150g.cm, approx. with the spindle axis load) is used.
Also "Maximum" current of the spindle motor Ass'y shows when a disk of the maximum running torque (300g.cm, approx.) specified in the 130mm flexible disk standards such as ISO, ANSI, ECMA, or JIS.

(5) "Rotating, disk installed, head loaded" includes data write or data read operations.

(6) Fig.214 shows a typical waveform of the spindle motor current at rotation start.



(Fig.214) A typical waveform of spindle motor start current

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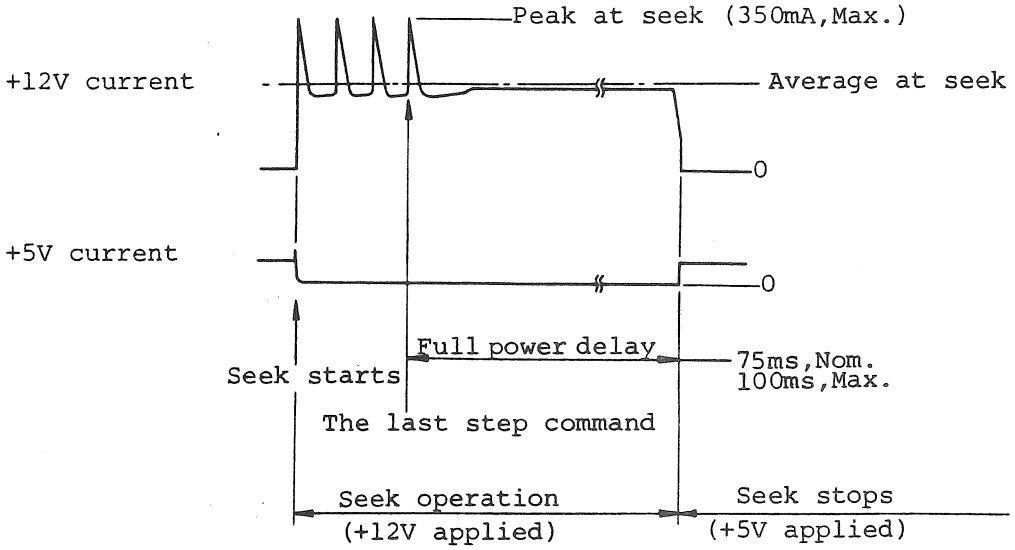
The lasting time of the start current is 400msec, Max.(The same as the upper limit of the start time). And the ripple current is specified as within 85% of the absolute value of the average current.

(7) "Forced stop" means that the rotation of the spindle motor is stopped compulsively after the rotation start. Motor servo circuit will not be broken by the continuous restriction.

(8) To the stepping motor for executing the head seek, +12V full power is applied only at head positioning time (during track access period including settling time) in order to decrease the temperature rise. During other operation than positioning, -- for example, during waiting period, during data write or read after the stop on a desired track, +5V is applied.
Fig.21 shows a typical waveform of the stepping motor current.



(Fig.215) A typical waveform of stepping motor current

(9) To the head load solenoid, +12V full power is applied only when the operation starts in order to decrease the temperature rise. During nominal condition after the energization start (during head load

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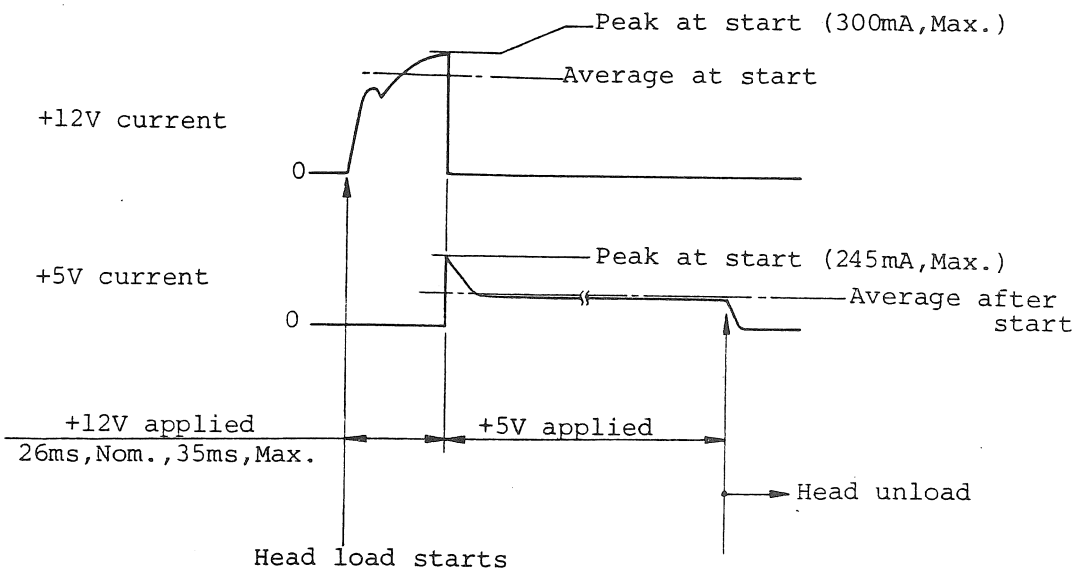
condition), +5V is applied. Fig.216 shows a typical waveform of the head load solenoid current.

At start of the head loading, it is required in order to assure the head position against the shock of the solenoid motion that +12V is applied to the stepping motor as well as item (8).



(Fig.216) A typical waveform of head load solenoid current

(10) "Waiting" means that all the input interface signals are FALSE (HIGH level).

(11) "Write operation" means the period when the WRITE GATE input signal is TRUE.

(12) For a CSS model, the item of "Head load solenoid" is not applied. As far as the disk is installed, head load condition continues and the spindle motor current during head unload is not applied.

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2-4-3. Current Consumption Timing Chart

Fig.217 shows the timing chart of the typical average current consumption.
Fig.218 shows the timing chart of the maximum average current consumption.

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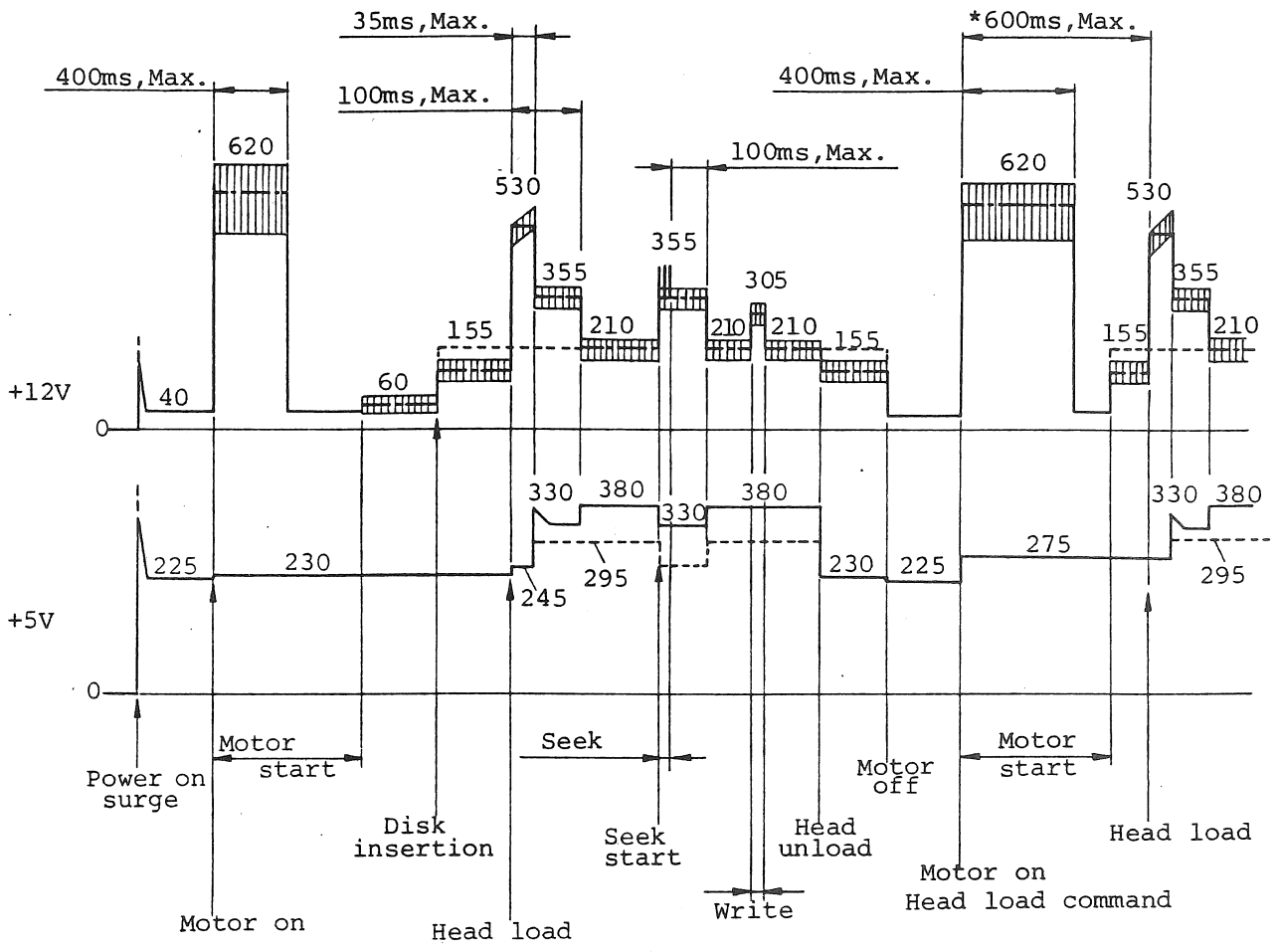

Notes: 1. The figures show the typical average current (mA) at each operation.

Average current ——▦▦▦▦—— Ripple current caused by spindle motor

2. Typical average current means practical value of average current consumption measured with a typical FDD in room temperature and with nominal voltage. Rotation torque is supposed to be a typical one obtained by a commercially available disk.

3. *: Head loading is executed after the FDD becomes pre-ready condition (refer to item 1-8-3 of FD-55 Specification).

4. Dotted line shows the case of CSS model.

(Fig.217) Typical average current timing chart

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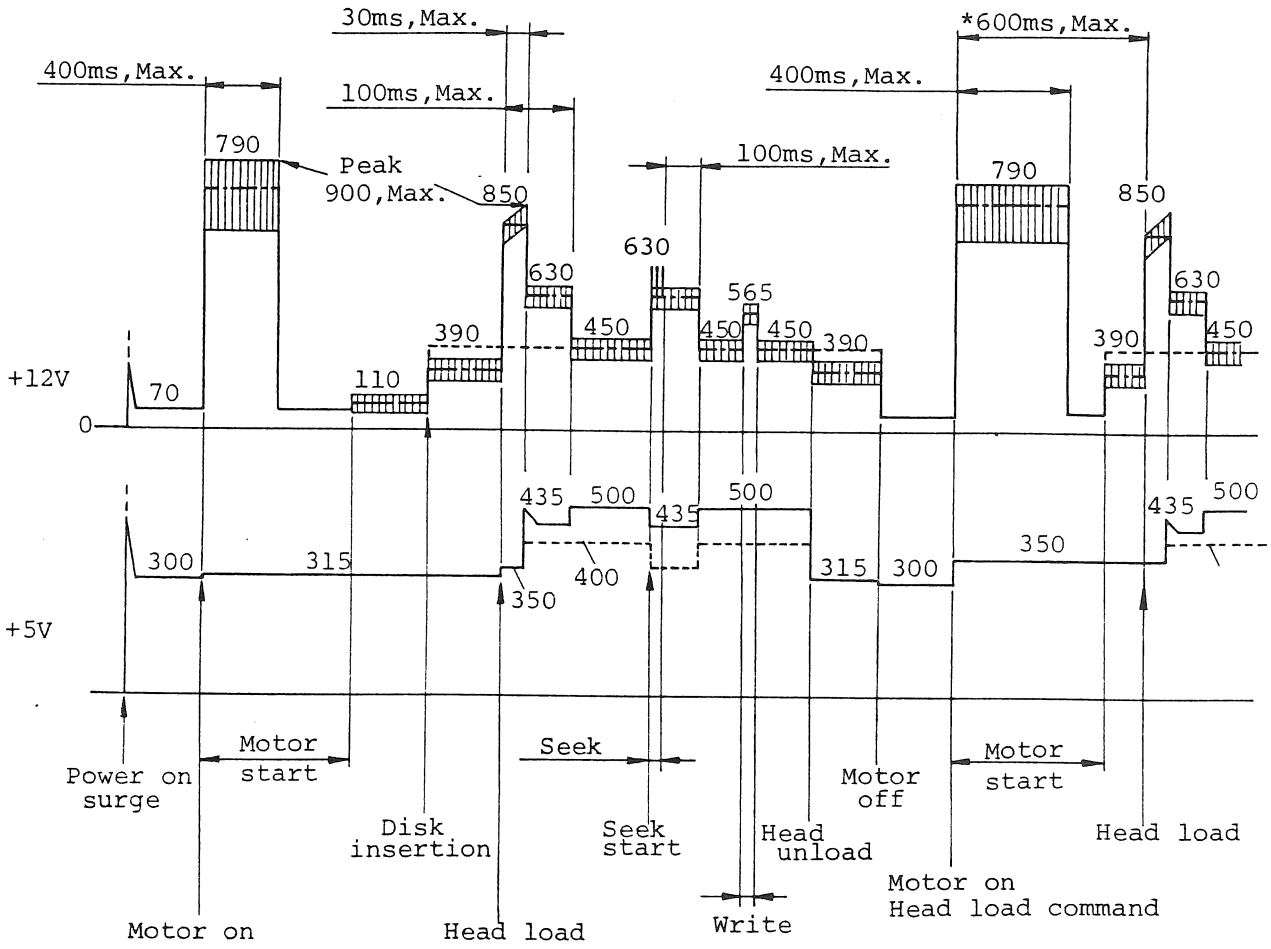

Notes: 1. The figures show the maximum average current (mA) at each operation.

2. The actual average value of current consumption does not exceed the "maximum average" under any operating conditions except for some abnormal conditions such as installing a disk of out of specification, or forced stop of the spindle motor.

3. Refer to Notes 1, 3, and 4 in Fig.217.

(Fig.218) Maximum average current timing chart

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2-5. WRITE/READ METHOD

The FDD has been designed for excellent stability and easily handled recording in both FM (single density) and MFM (double density) modes. Improved electrical and mechanical characteristics together with the data compatibility with ISO, ECMA, ANSI, and JIS standards for 130mm (5.25 inches) flexible disk, assures a better error margin.

Improvements cover many areas, including disk rotational speed accuracy (LSV, ISV), head magnetic characteristics, head-disk contact, improved track positioning, optimized write/read circuitry, improved shielding against inductive noise, elimination of spindle motor noise, reduction in bit shifts, improved signal-to-noise ratio and so on. Careful consideration of the FDD controller parameters, such as the data separator window positioning, PLO (or VFO) response speed, optimum write pre-compensation and environmental considerations such as inductive noise, power line noise, dust, temperature, humidity, vibration and so on also contribute greatly to the reliability of the system as a whole.

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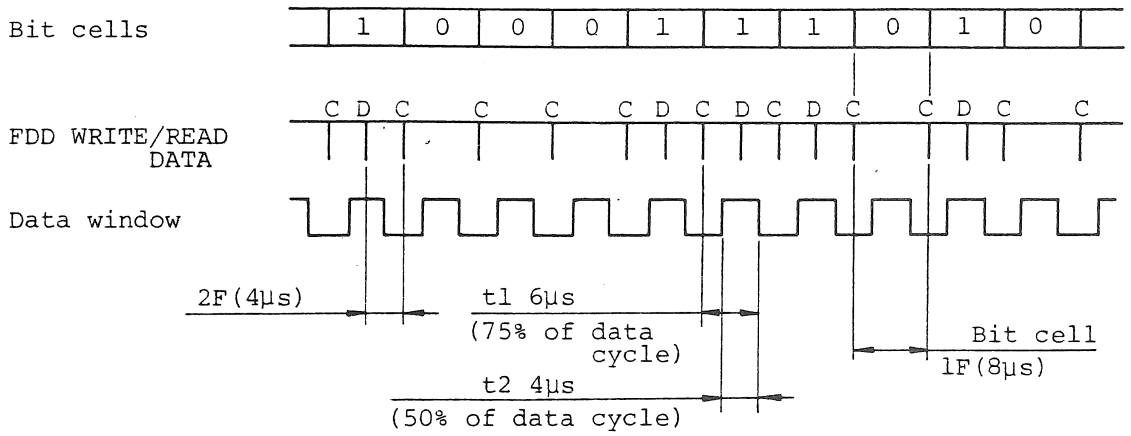
2-5-1. Single Density

FM method is generally used for single density recording.
The FDD has been designed to use the FM method for single density recording.

The FM method utilizes two frequency components (1F and 2F) and the data density to flux transition density ratio is 0.5, giving a redundancy ratio of 0.5, without taking into consideration the necessity of gaps, and ID field (track formatting). Data transfer rate is 125KHz for FD-55A ∿ F and 50KHz for FD-55G.

Summary of FM method"

(1) Data bit (D) is located in the center of the bit cell.
(2) Clock bit (C) is located at the leading edge of the bit cell.



Note: The above timings (µs) are for FD-55A ∿ F. Timings for FD-55G are a half of the indicated values.

(Fig.219) Bit correspondance and data window in FM method

A PLO circuit is not necessary when only the FM method is adopted with the FDD and a fixed window can be adopted. The most appropriate window

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is 6μs for t1 and 4μs for t2 in the figure above. The t2 width may be wider provided that it is widened in the trigger pulse direction of the window (towards the left in the figure above).

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2-5-2. Double Density

MFM method is generally used for double density recording. The FDD has been designed to use the MFM method for double density recording. M^2FM method and GCR method do not match the standard model of the FDD.

By eliminating the redundancy of the FM method, the MFM method enables the data density to be doubled without increasing the flux transition density on the disk. FDD controller will necessarily be more compricated with the addition of PLO circuit, but this is compensated for by the great increased in the recording capacity.
The MFM method has three frequency components, 1F, 4/3F and 2F. The data density to flux transition density ratio is 1 (redundancy :0) without taking into consideration the necessity of gaps and ID field (track formatting). Data transfer rate is 250KHz for FD-55A ∿ F and 500KHz for FD-55G.

Summary of MFM method:

(1) Data bit (D) is located at the center of the bit cell.
(2) Clock bit (C) is located at the leading edge of a bit cell when the following two conditions are satisfied:
  (a) No data bit has been written in the praceding bit cell.
  (b) No data bit will be written in the present bit cell.

In the MFM method, a clock bit at the leading edge of each bit cell is not always necessary as the clock will be regenerated in the FDD controller. Phase locked oscillator (PLO) is used to generate the clock and data window.
The most appropriate window is 1μs for t1 and 2μs for t2 in Fig.220. The phase shall be locked so that the leading edge of the READ DATA pulse from the FDD locates at the center between two data window transitions.

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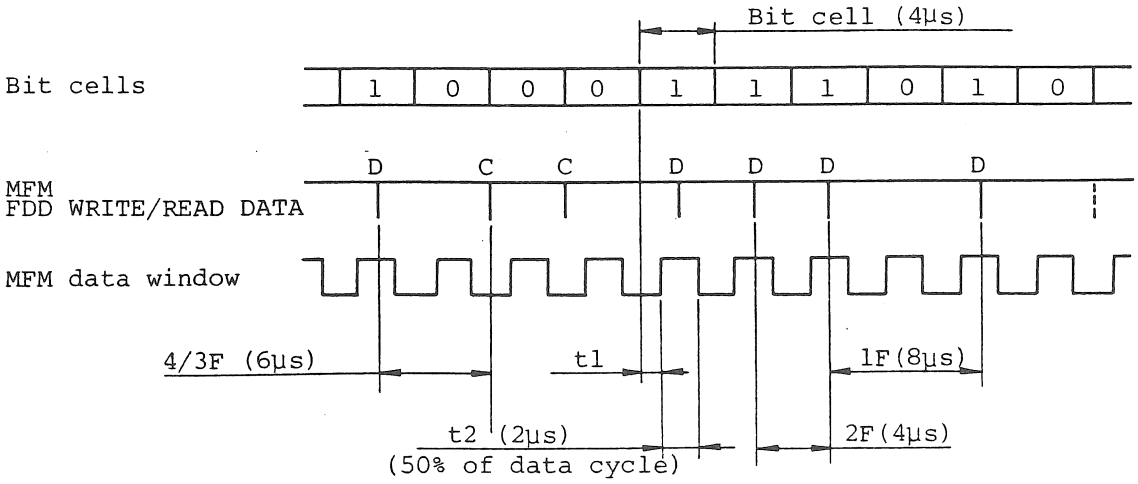

Note: The above timings (µs) are for FD-55A ∿ F. Timings for FD-55G are a half of the indicated values.

(Fig.220) Bit correspondance and data window in the MFM method

It is important for the PLO circuit to generate an accurate window as possible to obtain the widest window margin for data reading. It is therefore necessary that the PLO does not respond to bit shift caused by the read output peak shift from the magnetic head. It must be designed to respond slowly so that the data window will be phase-locked during several synchronizing bytes at the head of ID field or data field.

Write pre-compensation is generally used as the active compensation method for the bit shift which contributes to the window margin effectively. Since the direction of bit shift can be predicted by the bit pattern, the position of the flux transition can be shifted in the opposite direction in anticipation.
However, the degree of bit shift during read operation depends largely on the overall frequency characteristics of the FDD system and the most appropriate value of write pre-compensation should be determined for each FDD and disk. Large pre-compensation value results in undesirable effects such as an increase in bit shift at the outer tracks, decrease

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in read output and a poorer S/N ratio due to the increased use of the bandwidth. Disk interchangeability suffers as a result.
From these considerations it will be seen that bit shift should be reduced by increasing the frequency characteristics of the FDD and the minimum of write pre-compensation should be used.
The simplest solution is to perform no write pre-compensation and the FDD has been designed to provide reliability and sufficiently wide window margin in this way.
When you use the write pre-compensation, be careful to use the value less than ±250nsec for FD-55A ∿ F and less than ±62.5nsec for FD-55G, not to cause the undesirable effect by over compensation.

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