DYNABYTE

WINCHESTER TECHNICAL MANUAL

11 & 23MB VERSIONS

AVAILABLE IN 5500, 5600, 5615, 5700, 5011, 5013, & 5015

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CONTENTS

Page

ILLUSTRATIONS

TABLES

APPENDICES

1. GENERAL

The M2301A/M2302A mini-disk drive unit is a compact (floppy size), inexpensive, and highly reliable fixed disk drive developed for random access use in small computers, word processors, and terminals.

The storage capacities (unformatted) of the M2301A and M2302A are 11.7M bytes and 23.4M bytes, respectively.

2. FEATURES

2-1 Compact Size

Since the disks are 200mm in outer diameter and are driven by a DC motor directly connected to the spindle, the unit is extremely compact in size:

8.5in. (width) x 4.4in. (height) x 14.0in. (depth)

2-2 Inexpensive

The stepping motor positioning mechanism uses a steel band and viscose damper. This simplifies the structure and lowers the cost of the unit.

2-3 High Reliability

Heads, disks, and positioner (Winchester technology) are hermetically sealed inside a plastic cover, and the air inside the DE (disk enclosure) is kept clean by a breather filter and recirculation filter. This increases reliability by reducing the chance of a head crash.

2-4 Preventive maintenance is unnecessary.

2-5 DC Power Supply

The integral DC spindle motor requires no adjustment for line frequencies (50Hz/60Hz) or input power voltages (100, 115, 220, 240V).

2-6 Physical Dimensions

Because its physical size is the same as that of a floppy disk drive, this unit can replace a floppy disk drive without requiring a new locker.

2-7 Vertical or Horizontal Installation

The unit may be installed in its locker either vertically or horizontally, whichever is optimal.

2-8 Low Power Consumption

The power consumption is 60W when seeking and 50W when not seeking. This low power consumption enables the unit to be used in a very wide environmental temperature range (5° to 45°C) without a cooling fan.

2-9 Low Noise

The unit's low noise output, less than '55' dB, (A-scale weighting)even during seeking makes it ideal for office use.

2-10 Low Vibration

The unit is attached to the locker through four vibration-damping rubber mounts.

3. SPECIFICATIONS

3.1 Performance

Spec \ Model		Mini -Disk Drive M2301	Mini -Disk Drive M2302
Total storage capacity	Unformat [MB]	11.71	23.42
	* Format [MB]	9.99	19.98
Storage capa-city/track	Unformat [B]	12,000	
	* Format [B]	10,240	
Number of platters		2	4
Number of heads (R/W)		4	8
(Clock)		1	
Number of cylinders		244	
Number of tracks/cylinder		4	8
Number of sectors		Variable/Hard	
Recording density		6,100 BPI	
Track density		195 TPI	
Transfer rate		593 KB/S	
Rotational speed		2,964 RPM	
Average rotational Latency		10.1 ms	
Recording method		MFM	
Positioning time	Min	30 ms	
	Ave	70 ms	
	Max	140 ms	
Input voltage		+24V±10%, 1.6A (MAX 6.0A) + 5V± 5%, 4.1A (MAX 6.0A) - 5V± 5% or - 7V∼-16V 0.5A	
External size width x height x depth		8.5" x 4.4" x 14.0" (217mm x 111mm x 356mm)	
Disk size		OD ϕ200mm ID ϕ100mm	
Weight		14 lbs (6.3 kg)	

* Format based on 40 sectors/track.

3.2 Reliability

(1) MTBF

MTBF is defined as follows:

MTBF = operating time/number of malfunctions in the unit. The operating time refers to time during which the power is turned on (maintenance time is excluded). Malfunctions in the unit refer to those that require repair, adjustment, or replacement. Malfunctions caused by operator errors, power supply troubles, troubles in the controller or cables, and other environment problems not related to the device itself are excluded.

The MTBF of the M2301A/M2302A MDD is 10,000 hours (design value).

(2) MTTR

MTTR is the average time taken by a well-trained service technician to diagnose and repair a unit malfunction. The M2301A/M2302A is designed for an MTTR of 30 minutes or less.

(3) Service Life

Overhaul of M2301A/M2302A MDD is not required for five years or 20,000 hours of operation.

(4) Power Loss

Integrity of the data on the disk is guaranteed against all forms of abnormal DC power loss. (Data is not assured during a write operation).

3.3 Error Rate

Errors detected upon initialization and replaced by an alternate record are not included in the error rate.

(1) Recoverable error rate

A recoverable error is one which can be read correctly within one retry command and should not exceed one per 10^{10} bits.

(2) Non-recoverable error rate

Errors that cannot be recovered within 16 retries are included in the MTBF.

(3) Positioning error rate

The rate of positioning errors recoverable by one retry is one error or less per 10^6 seeks.

(4) Media error

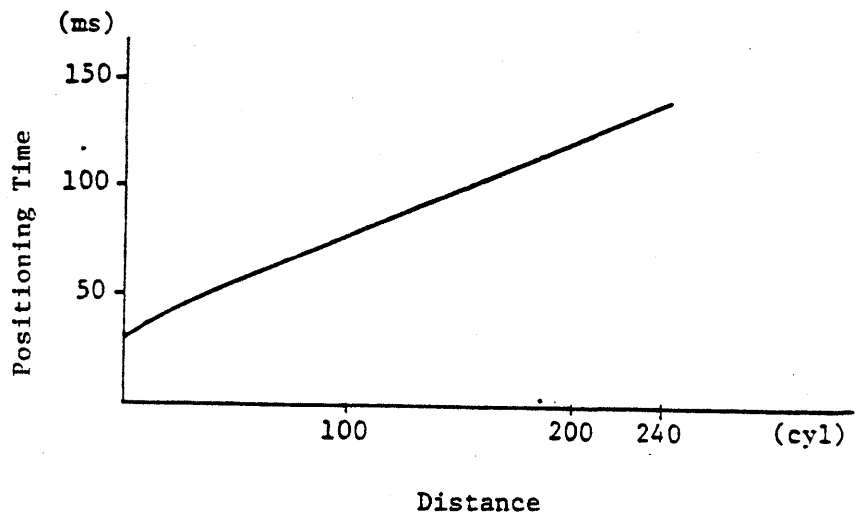
(a) No defects at H0 and H1 areas on cylinder 000.

(b) The number of defective sectors in the M2301A/M2302A (40-sector format) are as follows:

M2301A ..... maximum 20

M2302A ..... maximum 40

3.4 Positioning Time



3.5 Start and Stop Time

When the drive is powered down, dynamic braking is used to minimize wear on disks and heads. Start time (time from when power is turned on until unit is ready) and stop time (time to completely stop when power is turned off) are 20 seconds or less each.

3.6 Environmental Conditions

Temperature	Operating	41° to 113°F (5°C to 45°C)
	Non-operating	-40°F to 140°F (-40°C to 60°C)
	Gradient	15°C/H or less
Relative humidity	Operating	20% ∿ 80% RH
	Non-operating	5% ∿ 95% RH
		Moisture must not condense.
Vibration	Operating	0.2G (3∿60H2, except resonance conditions) 2min. x 30 cycles
	Non-operating (power-off state after installation)	0.4G (3∿60Hz) 2 min. x 30 cycles (sinusoidal)
	During transportation and storage	3G

Shock	During operation	2G maximum 10ms
	Non-operating time	3G maximum 10ms
	During transportation and storage	5G maximum 30ms
Altitude above sea level	During operation	10,000 ft (3,000m) or below
	Non-operating time	40,000 ft (12,000m) or below

4. STRUCTURE

4.1 External Size

See Fig. 4.1.

4.2 Unit Structure

The mini- disk drive unit consists of disks, heads, DC motor, carriage assembly, cover, recirculation filter, base, read switch (PCB), and logics (PCB).

(1) Disk

Disks are 100mm in inner diameter and 200mm in outer diameter and are coated with a special lubricating material (Winchester-type). Durability is over 10,000 starts and stops.

The number of disks per unit is two in the M2301A and four in the M2302A.

(2) Head

The Winchester-type heads are in contact with the disks when the disks are not moving, but begin to fly when the rotation reaches a certain speed.

The number of heads is four in the M2301A, and eight in the M2302A.

A similar head is used as the clock head, which reads the data written on the lower surface of the bottom disk to generate Index, Sector, Write clock, Read clock and PLO clock signals.

(3) DC motor

The disks are rotated by a direct-drive DC motor. This motor attains a very precise rotational speed of 2964 rpm±2% because the current is controlled by comparing the phases of the clock

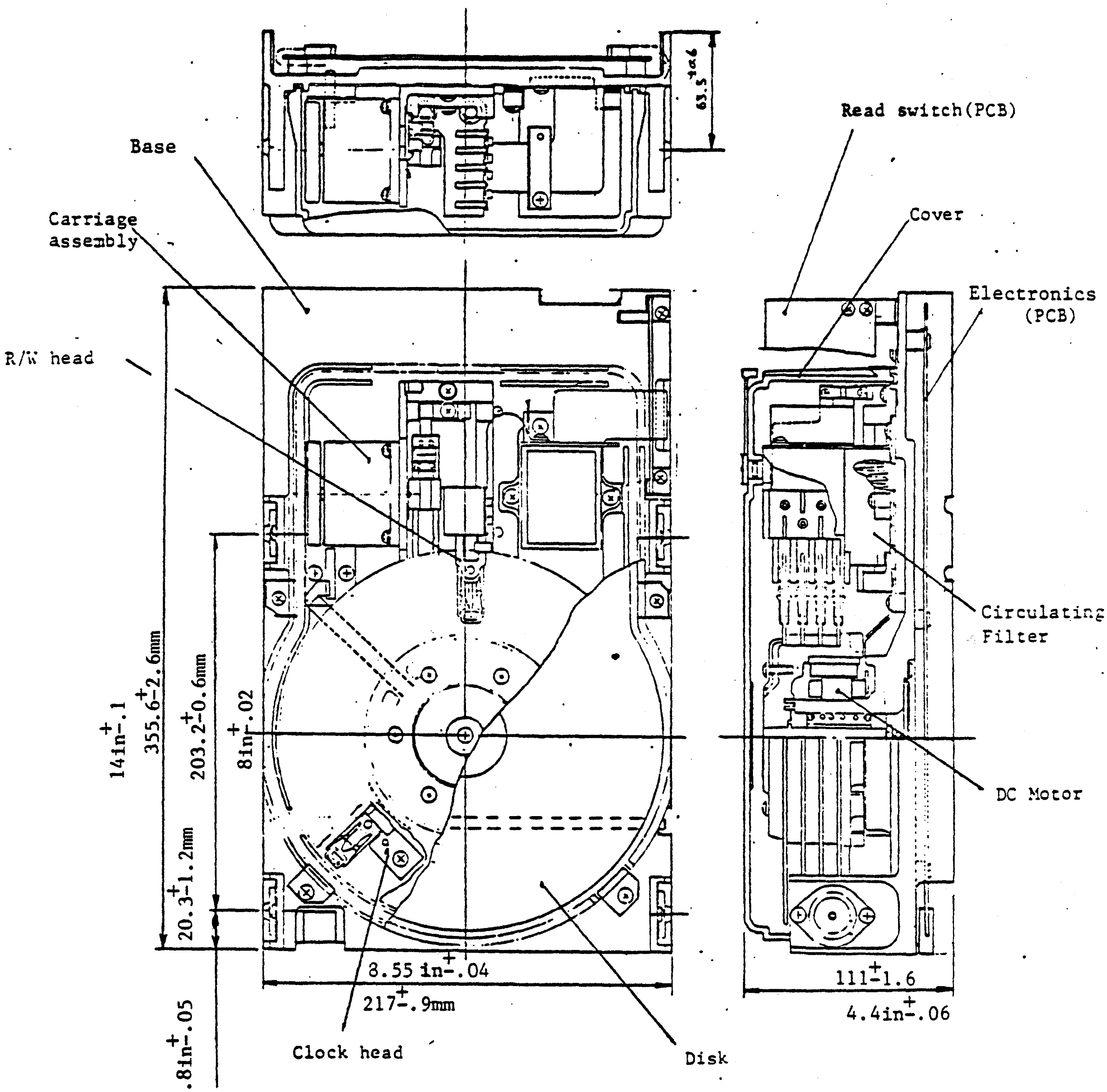


Fig. 4.1 Structure

signal from the control circuit oscillator and the clock signal read by the clock head.

(4) Carriage assembly

This assembly consists of a 4-phase stepping motor, band actuator, viscose damper, and carriage with a linear bearing. The carriage working with the special drive circuit, gives increased reliability and a very short average access time of 70ms.

(5) Air circulation

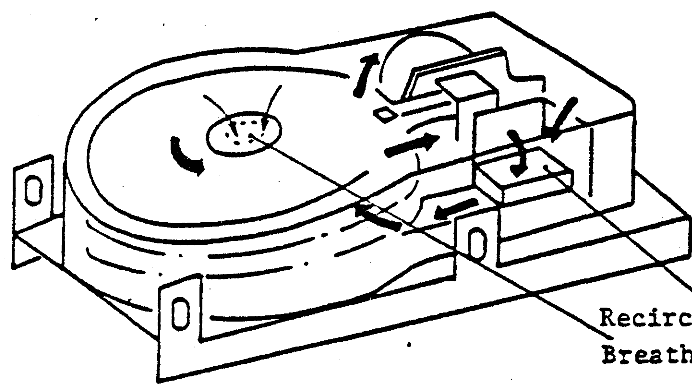


Fig. 4.2 Air Circulation

As shown in Fig. 4.2, the heads, disks and carriage are sealed hermetically inside a plastic cover to shut out any contamination. This head disk assembly has a closed-loop air recirculation system by using the blower effect of the rotating disks to continuously circulate air through the recirculation filter.This filter eliminates any dust generated inside the enclosure. To prevent dust intrusion due to pressure differences, a breather filter is attached at the center of the disk where the pressure is lowest. This breather filter equalizes the internal air pressure with atmospheric pressure due to start up conditions and temperature differences between the DE and its environment. The filters used here are all absolute filters with a dust elimination rate of 99.97% for particles 0.3μm or larger.

(6) Read/Write Circuit

The read/write circuits are designed using special analog LSIs developed for large disk drive units. Use of these LSIs simplifies circuitry and increases data reliability. A VFO circuit and modulation/demodulation circuit for MFM data are incorporated to reduce the controller's cost and facilitate controller design.

(7) Stepping Motor Drive Circuit

The speed of the stepping motor is controlled by a speed up/slow down control circuit that uses a ROM. It generates an optimal pulse train and shortens access time. The stepping motor is driven by two power supplies, so it performs fast access with low power consumption when not seeking.

When 255 or more step pulses and the FALSE direction signal (outer direction) are issued, the unit assumes the Return-to-Zero (RTZ) instruction and automatically seeks to track 0.

(8) DC Motor Drive Circuit

Rotational speed is controlled by comparing the byte clock recorded in the clock track and a crystal oscillator signal. This circuit thus maintains constant rotational speed.

(9) Index/sector circuit

Index/sector signals are obtained from the index information in the clock track and the byte clock. The number of sectors can be set at the required value using switches on the printed-circuit board.

5. INSTALLATION

5.1 Locker Installation

Fig. 5.1 shows the direction, method and frame structure of the unit at the locker installation.

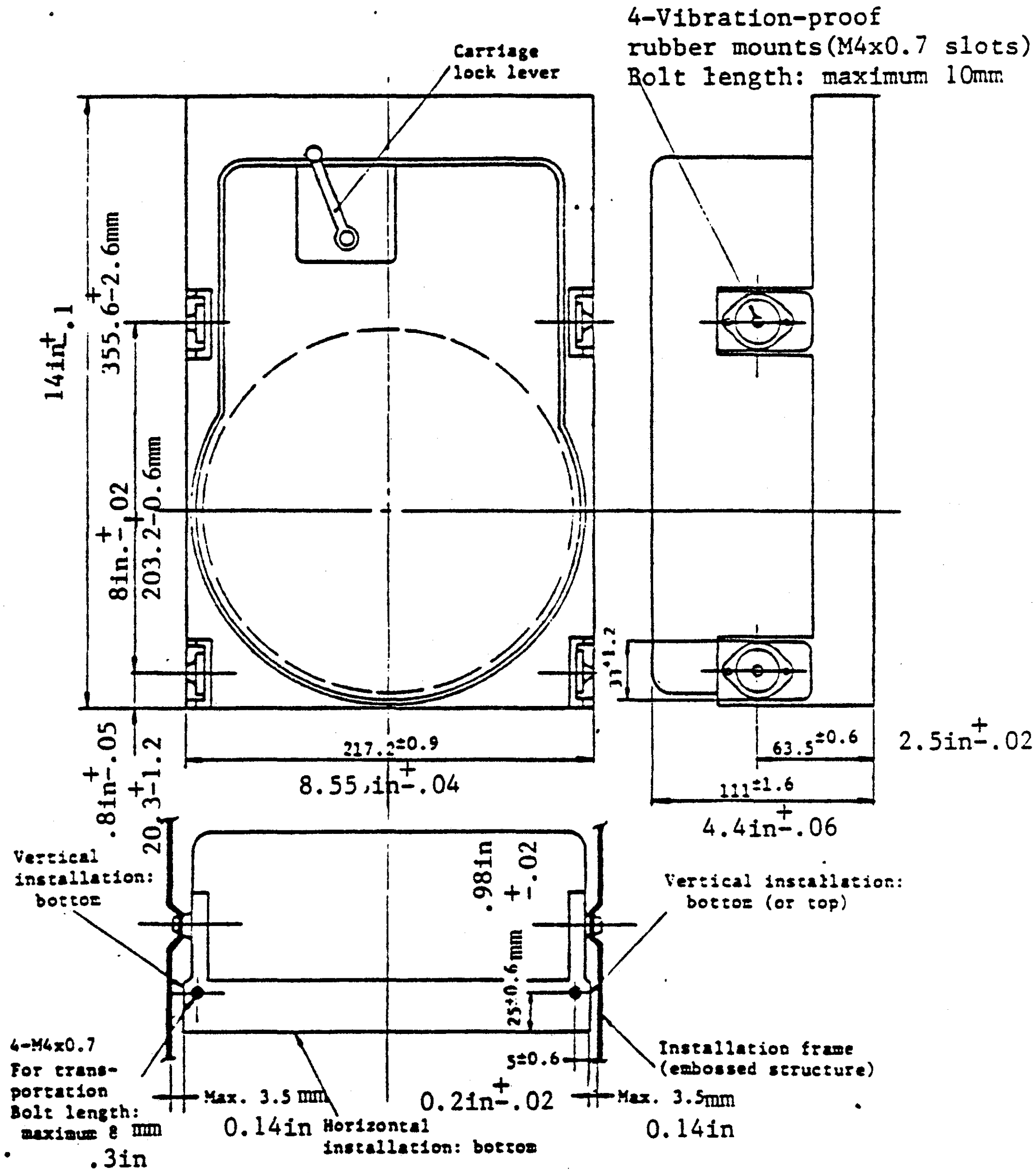
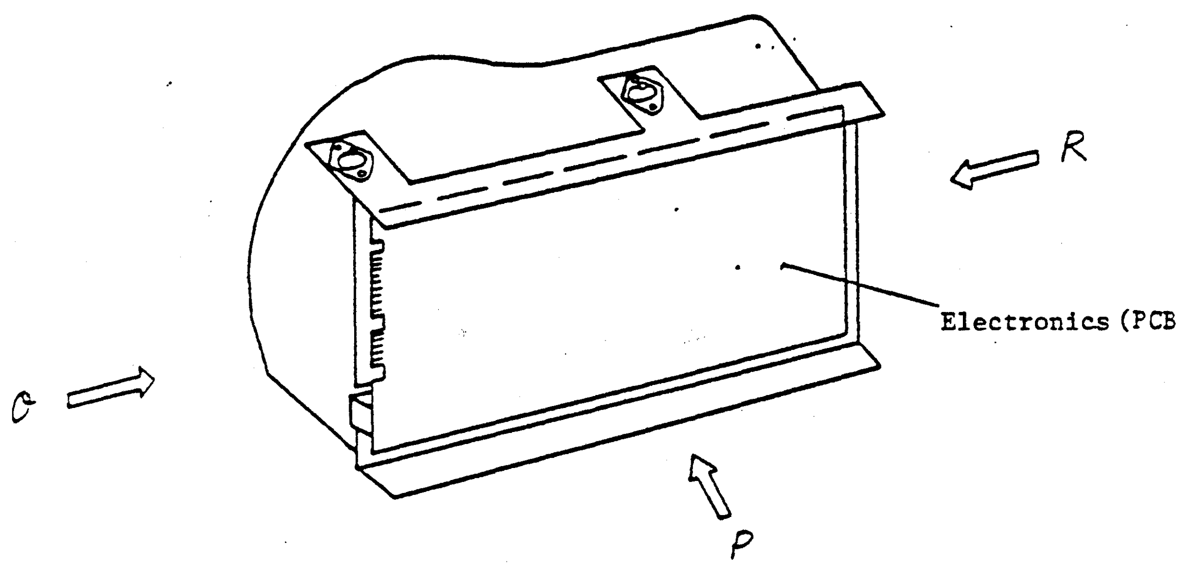


Fig. 5.1 Locker Installation

5.2 Service Areas

The areas used for maintenance, securing the unit for transportation, and cable connection are the P, Q, and R planes shown in Fig. 5.2. Ease of maintenance should be considered when deciding the system service clearance and locker installation.



P plane: PCB maintenance

Q plane: Cable connection
Bolt removal/installation for transportation

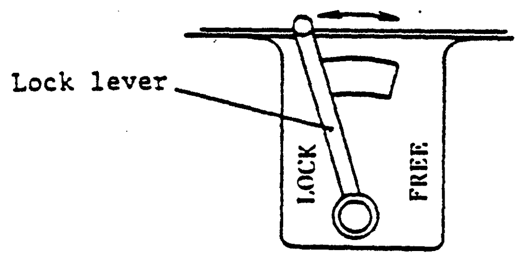
R plane: Lever lock for fixing the carriage
Bolt removal/installation for transportation
Bad track label and unit serial number.

Fig. 5.2 Maintenance considerations

5.3 Transportation

When the unit is to be transported inside its locker, the lock lever must be set and fixed to LOCK to avoid damage by shock.
The procedure is as follows:

(1) Fixing the carriage



The lock is fixed (LOCK) and released (FREE) by pulling up the lever and moving it in the direction of the arrows.

Fig. 5.3 shows the locked state.

Fig. 5.3 Fixing the carriage

(2) Fixing the unit

Use the slot for transportation and fix the unit on the installation frame.

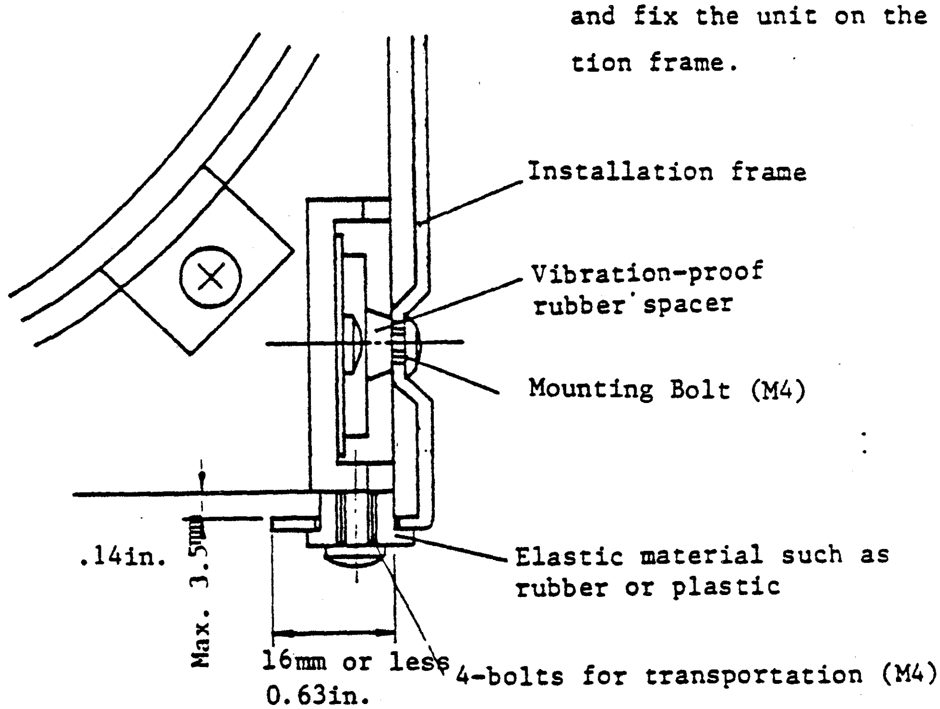


Fig. 5.4 Fixing the Unit

(3) Preventing connector disconnect

To prevent the connecting cables from disconnecting, they are retained by a cable holder as shown in Fig. 5.5.

The cable holder is fixed on the CNA and CNB surfaces by screws.

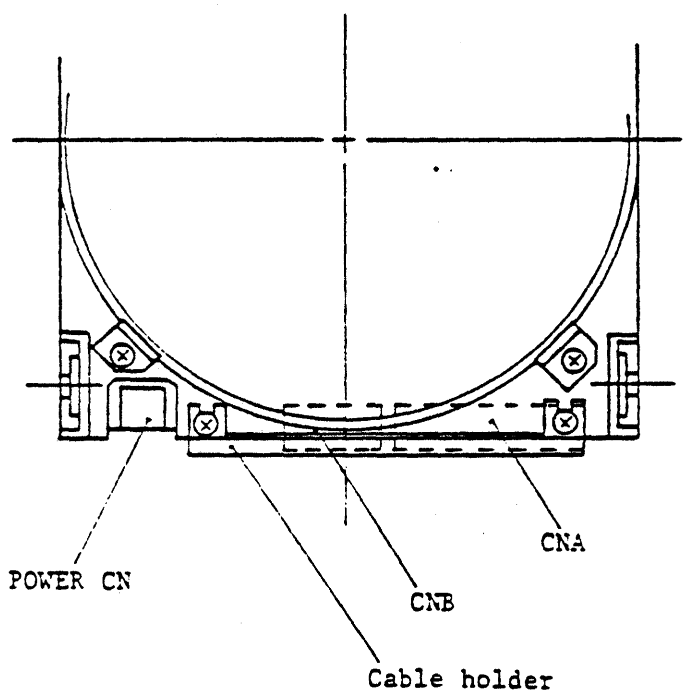


Fig. 5.5 Cable Holder

6. CABLE CONNECTION

Up to four mini-disk drive units can be connected by cables as follows.

6.1 Unit Connectors

Cable A/B card edges and the power connector are arrayed on the controller (PCB) at the bottom of the unit as shown in Fig. 6.1.

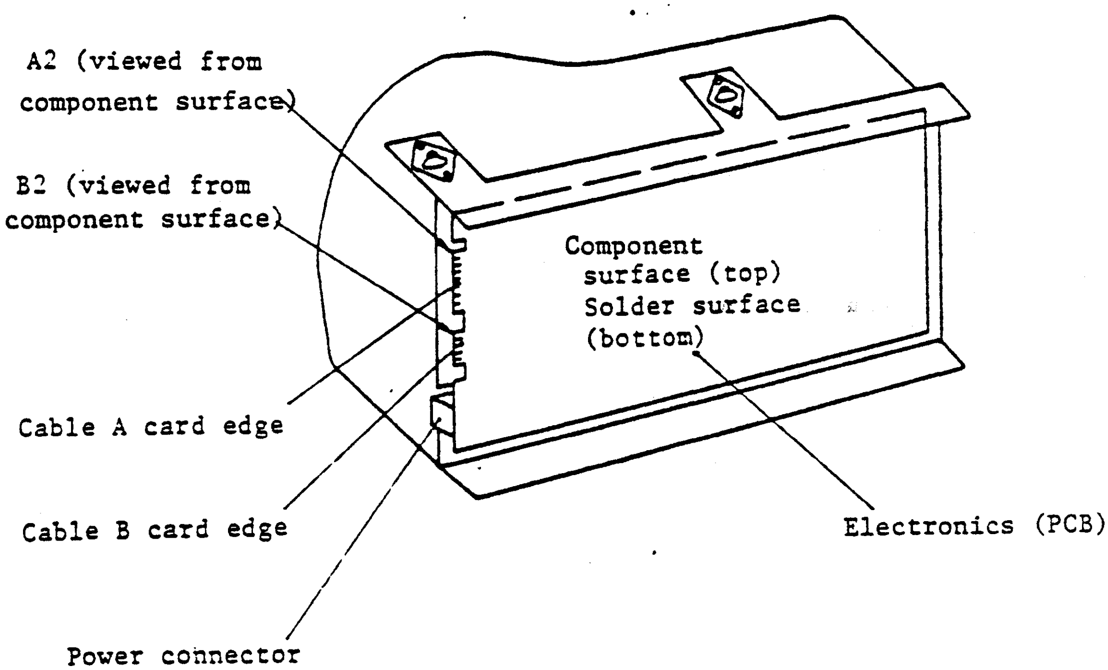


Fig. 6.1 Unit Connectors

6.2 Cable Connector Specifications

The recommended cable connector specifications are listed in Table 6.1.

Table 6.1 Cable Connector Specifications

Connector	Name	Spec. No.	Manufacturer
Cable A (50P)	Cable connector	FCN-767J050-AU/1 or 88373-1 or 3415-0001	FUJITSU AMP 3M
	Unit card edge	——	——
	Cable	455-248-50 or 171-50	SPECTRA-STRIP ANSLEY
Cable B (20P)	Cable connector	FCN-767J020-AU/1 or 88373-6 or 3461-0001	FUJITSU AMP 3M
	Unit card edge	——	
	Cable	455-248-20 or 171-20	SPECTRA-STRIP ANSLEY
Power cable (6P)	Cable connector	1-480270-0	AMP
	Unit connector	1-380999-0	AMP
	Contact	60619-1	AMP
	Cable	AWG 14(+5V,RTN) AWG 16(+24V, ") AWG 20(-5V, ")	——

Note) The maximum power cable length is 1.5m. The cable specifications indicate the minimum width; wider cables may be used. Applicable lines for 60619-1 are AWG14 to AWG20.

6.3 Single Connection

Connection of one unit to its controller is shown in Fig. 6.2.

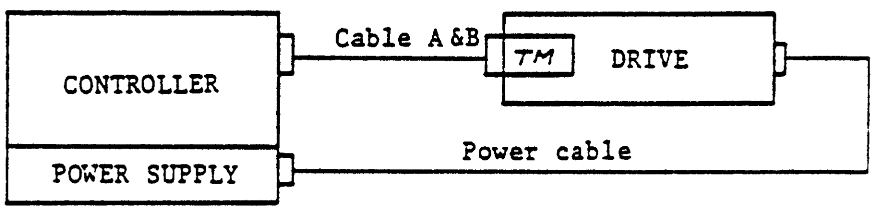


Fig. 6.2 Single Connection

6.4 Connecting Multiple Units

To connect two to four units, cable A (control signals) must be connected in daisy-chain and cable B (R/W signals) must be connected radially as shown in Figure 6.3.

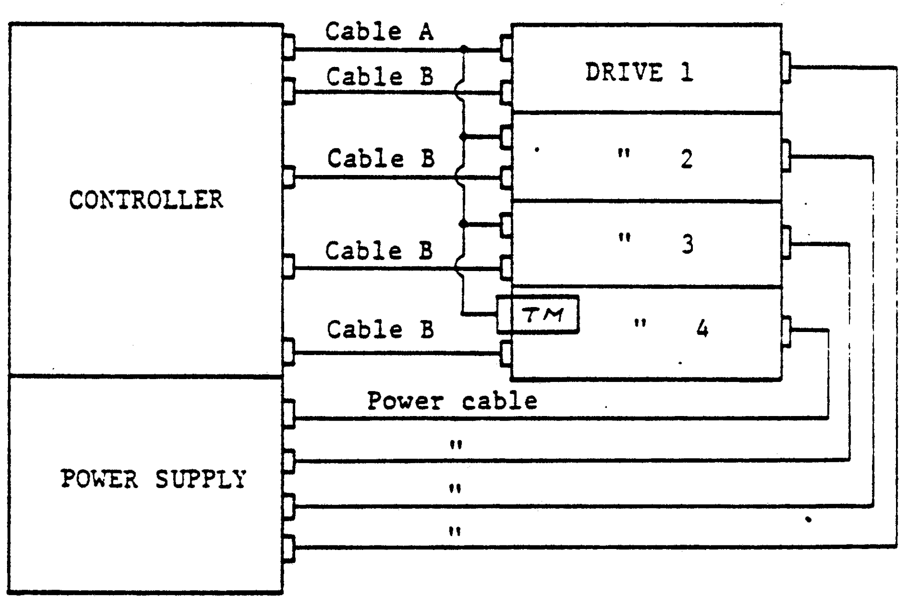


Fig. 6.3 Connecting Multiple Units

6.5 Driver/Receiver

See Fig. 6.4. The length specified is the maximum, and must not be exceeded when daisy-chained.

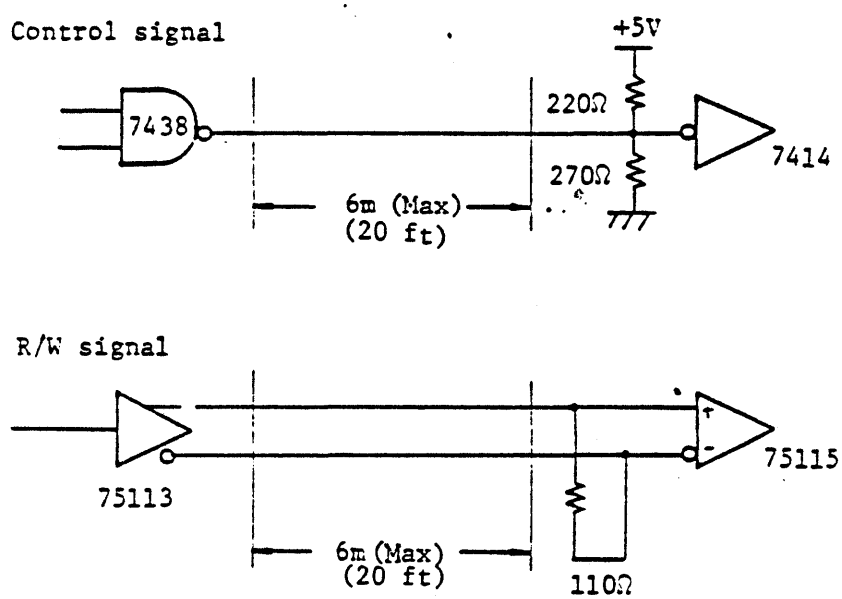


Fig. 6.4 Driver/ Receiver

6.6 DC Grounding

A tap (M4 x 0.7) is included for DC grounding at the location indicated in Fig. 6.5. The screw must be M4 x 8 or smaller.

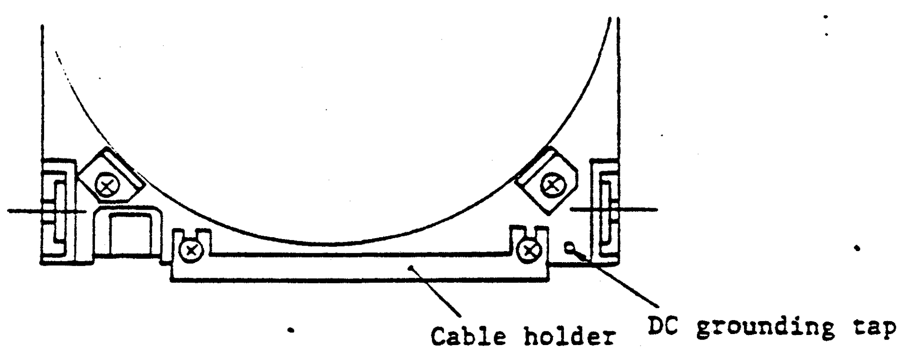


Fig. 6.5 DC Grounding

7. INTERFACE

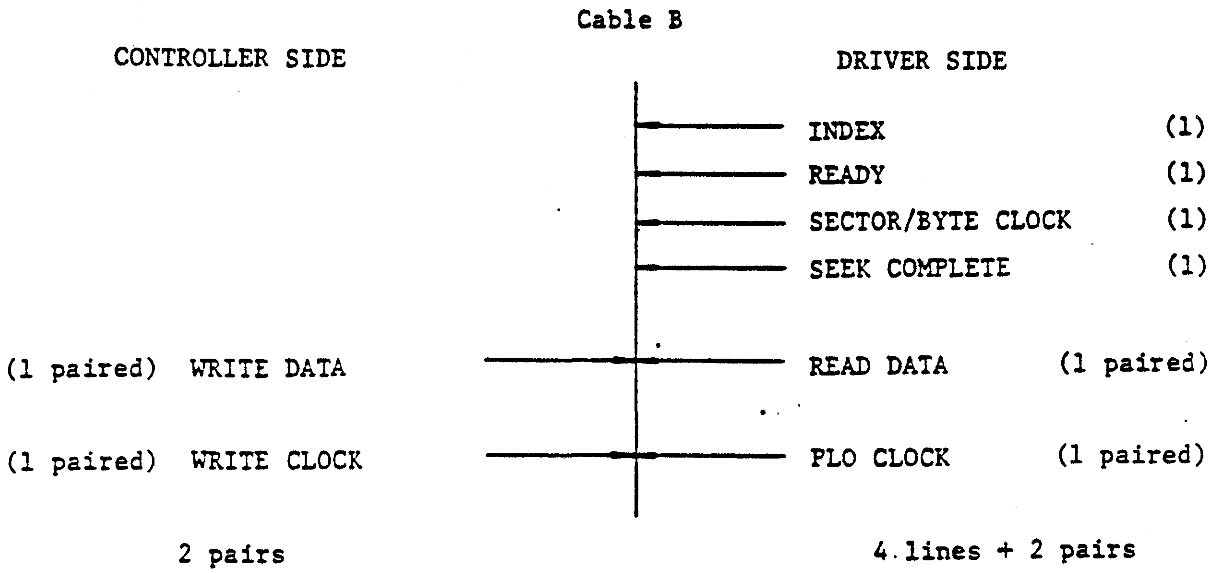
This section describes the physical and logical conditions of the signals transferred through the interface between the disk drive and the disk control unit. The timing is specified at the driver/receivers of the unit.

7.1 Signal Lines

Cable A

Controller side		Drive side	
(3)	HEAD SELECT 0~2	INDEX	(1)
		READY	(1)
(4)	DRIVE SELECT 1~4	SECTOR/BYTE CLOCK	(1)
(1)	DIRECTION	TRACK 0	(1)
(1)	STEP	WRITE FAULT	(1)
(1)	FAULT CLEAR		
(1)	WRITE GATE	(SEEK COMPLETE)	(1)*
(1)	READ GATE		
*(1 paired)	WRITE DATA	READ DATA	(1 paired)*
*(1 paired)	WRITE CLOCK	PLO CLOCK	(1 paired)*
	12 lines + 2 pairs	6 lines + 2 pairs	

* This signal line is connected by setting a switch on the PCB.



7.2 Input Signals

(1) Head Select 0 ∿ 2

This signal line is used to select one of the eight or four (in M2301A) data heads in the disk drive.

(2) Drive select 1 ∿ 4

This signal line is used to select one of the four drive units and validate the input/output signals of the selected disk drive. The Drive Select 4 signal can be altered to the Seek Complete signal by setting a swtich on the PCB.

(3) Direction

This signal line is used to determine the seek direction of the data heads when the step pulses are given to the disk drive. When this signal is true, seek is performaned in an inward direction; when false, seek in performed in an outward direction.

(4) Step

This makes the data heads seek to one track in the direction indicated by the Direction signal at one of the transients (fales→true) in the following modes:

(i) Controlled step mode

When the step pulse rate is 1 KHz or less, the drive responds to every step from the controller immediately.

(ii) Slave step mode

When the step pulse rate is between 3 KHz and 3MHz, the drive does not begin seeking until after receiving all the step pulses and responds with the Seek Complete signal after completing the seek operation.

(iii) Return to Zero Mode

When 255 or more step pulses are issued at slave mode, the date heads will move to Track 0 at a constant speed.

Note: Step rates between 1 KHz and 3 KHz are prohibited.

(5) Fault Clear

This signal line resets the write fault latch in the drive. The pulse width must be 100 ns or wider.

(6) Write Gate

This signal line gates write current to the selected data head in the drive.

(7) Read Gate

This signal is used to read from the selected data head in the drive. Read data is valid 8 bytes (13.5 μs) after Read Gate appears.

(8) Write Data (balanced transmission)

This is a write data signal in the NRZ format and is transmitted from the controller using balanced transmission lines. It is synchronized with the leading edge of the Write Clock signal in the drive.

(9) Write Clock (balanced transmission)

This is a write clock signal from the controller, and is synchronized with the Write Data signal.

7.3 Output Signals

(1) Index

This is a pulse signal with a width of 1.7μs and is sent through CNA/B once per revolution of the disks in the selected drive.

(2) Ready

This indicates that the rotational speed of the drive unit has reached nominal speed, the PLO circuit is synchronized with the rotational speed of the disk, and the drive is selected. This signal is sent out through CNA/B.

(3) Sector (Byte Clock)

Sector or Byte Clock is selected by a switch on the PCB in the drive unit. The signal is transmitted through CNA/B.

(i) Byte Clock

This is a pulse signal with a width of 0.84μs, set for 12,000 bytes per track.

(ii) Sector Mark

This is a pulse signal with a width of $1.7\mu s$. It is generated by counting the number of bytes per sector as selected on the PCB of the drive unit. Maximum is 4,096 bytes/sector.

(4) Track 0

This indicates the data heads are stopped on track 0.

(5) Write Fault

This indicates that one of the following abnormal states occurred during writing, and is retained until reset by Fault Clear.

(i) Write Gate was received before the drive unit was ready.

(ii) Write Gate and Read Gate were received simultaneously.

(iii) Write Gate was received during multiple head select.

(iv) Write Gate was received when not SKC.

(v) Appropriate write current did not flow through the head during writing.

(6) Read Data (balanced transmission)

This is a read data signal in the NRZ format. This signal is valid $13.5\mu s$ (8 bytes) after Read Gate, and is transmitted synchronously with the leading edge of PLO Clock.

(7) PLO Clock (balanced transmission)

This is a 1-bit interval pulse signal. When reading is not performed, PLO Clock is synchronized with the signal from the clock track. When reading is performed, the PLO is synchronized with the Read Data signal from the data head.

PLO Clock is used as Write Clock by the controller during writing.

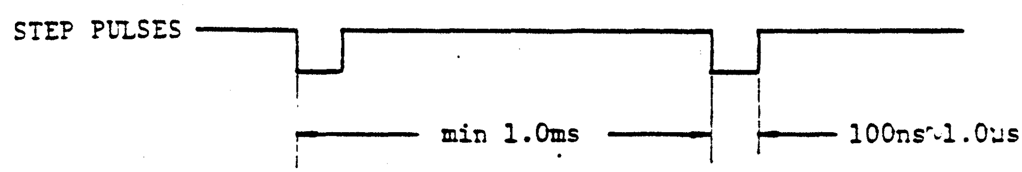
(8) Seek Complete

This indicates that the data heads are positioned at the requested track. This signal includes the settling time of the head, and when it is true, read/write operations are enabled. This signal is transmitted through CNA/B. Transmission through CNA is enabled by setting a switch on the PCB.

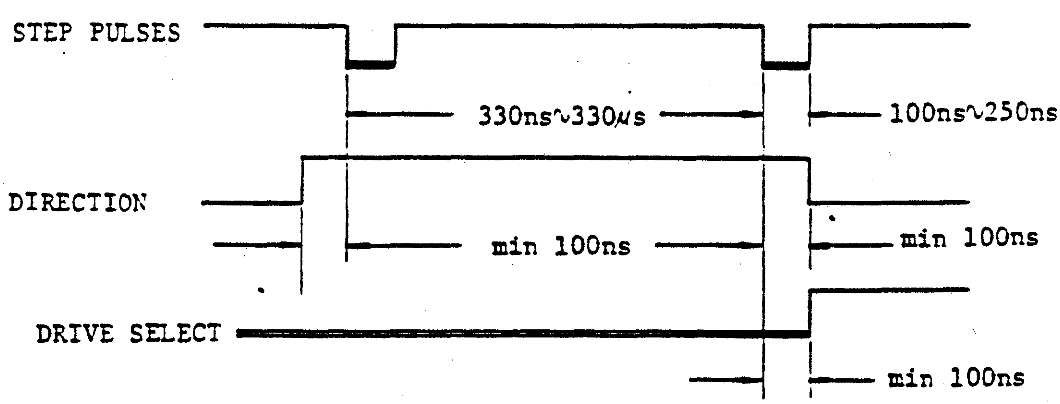
7.4 Timing Specifications

7.4.1 Seek timing

(1) CONTROLLED STEP MODE

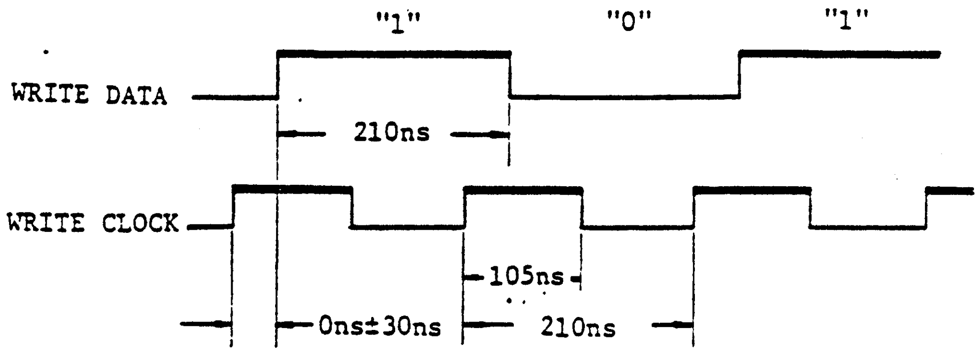


(2) SLAVE STEP MODE

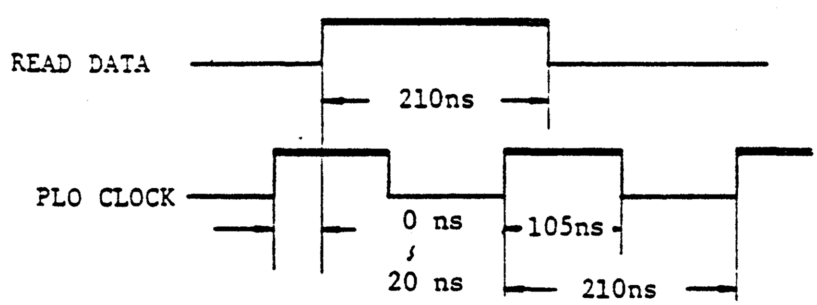


7.4.2 Read/Write Data Timing

(1) WRITE DATA, WRITE CLOCK



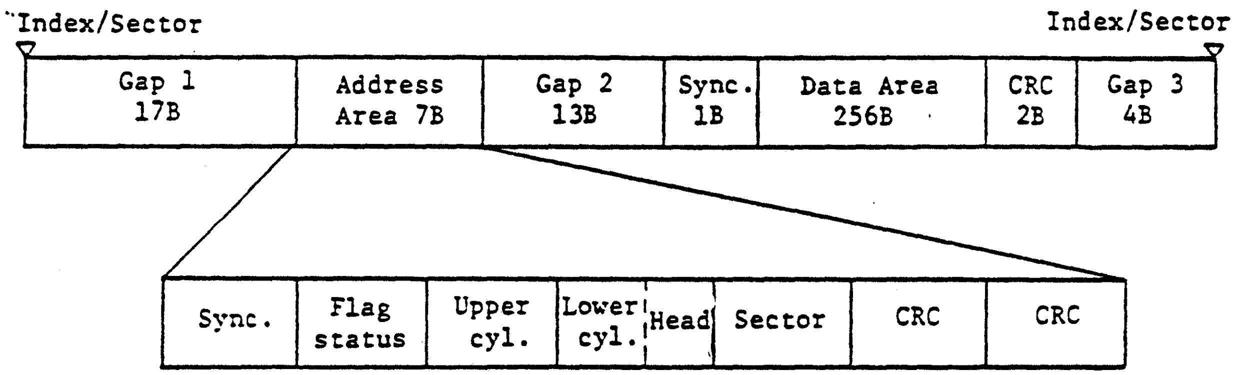
(2) READ DATA, PLO CLOCK



7.5 Formats

7.5.1 Track format

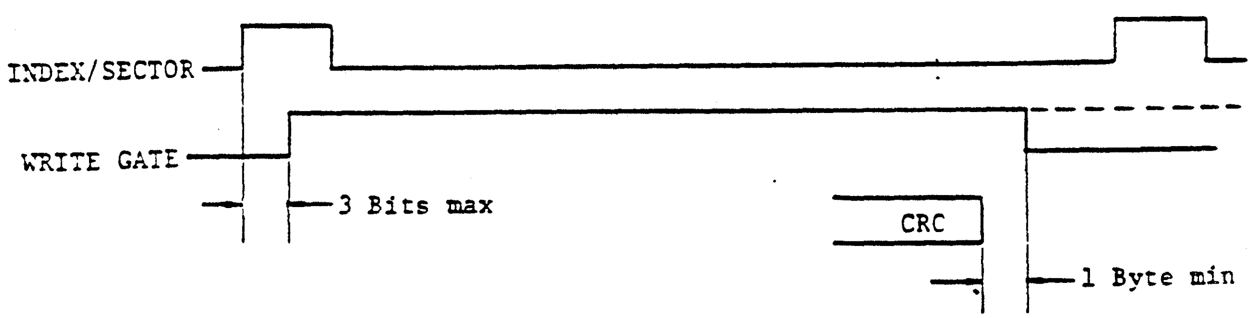
Example of a 40-sector format



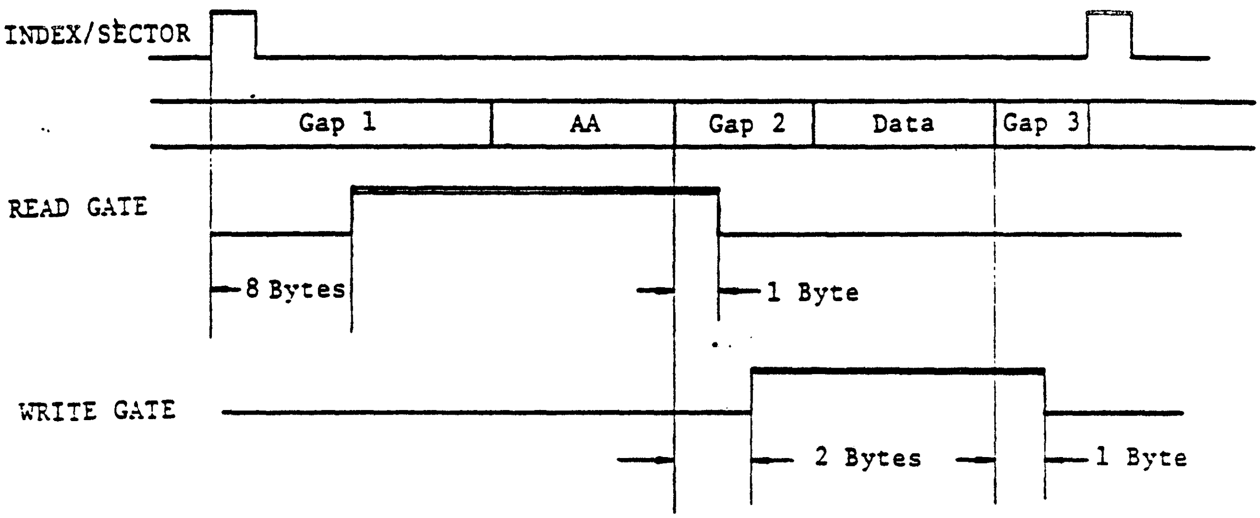
(1)	Gap 1,2,3	all "0"	
(2)	Sync. Pattern	Address Area	"0E"
		Data Area	"09"

7.5.2 Read/Write timing

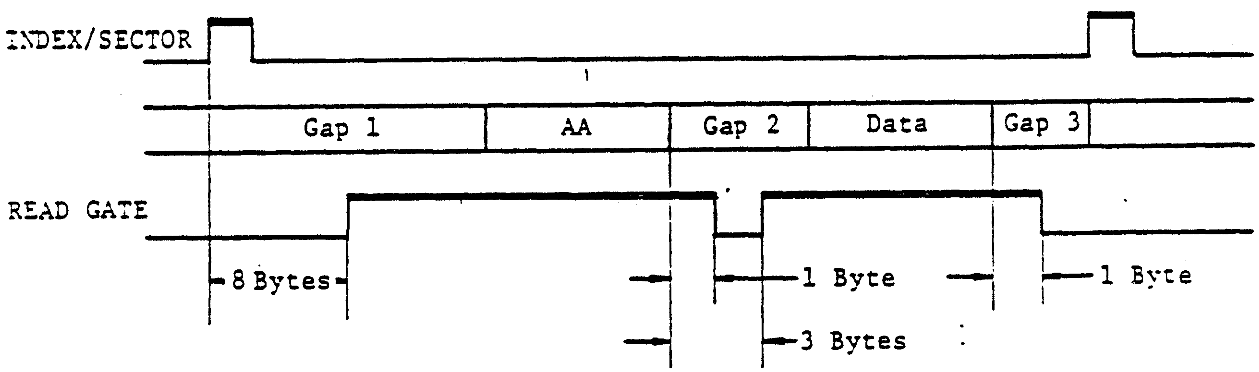
(1) Write format



(2) Write data



(3) Read data



7.6 Connector Positions

CNA

1	GND	2	- HEAD SELECT 0
3	"	4	" 1
5	"	6	" 2
7	"	8	SPARE
9	"	10	-INDEX
11	"	12	-READY
13	"	14	-SECTOR/BYTE CLOCK
15	"	16	-DRIVE SELECT 1
17	"	18	" 2
19	"	20	" 3
21	"	22	" 4
23	"	24	-DIRECTION
25	"	26	-STEP
27	"	28	-FAULT CLEAR
29	"	30	-WRITE GATE
31	"	32	-TRACK 0
33	"	34	-WRITE FAULT
35	"	36	-READ GATE
37	"	38	GND
39	+WRITE DATA	40	-WRITE DATA
41	GND	42	-WRITE CLOCK
43	+WRITE CLOCK	44	GND
45	+PLO CLOCK	46	-PLO CLOCK
47	GND	48	+READ DATA
49	-READ DATA	50	GND

Key slot: Between 4P and 5P

CNB

1	-INDEX	2	GND
3	-READY	4	"
5	-SECTOR/BYTE CLOCK	6	"
7	-SEEK COMPLETE	8	"
9	+WRITE DATA	10	-WRITE DATA
11	GND	12	+WRITE CLOCK
13	-WRITE CLOCK	14	GND
15	+PLO CLOCK	16	-PLO CLOCK
17	GND	18	+READ DATA
19	-READ DATA	20	GND

Key slot: Between 4P and 5P

7.7 Power Supply Input Connector

1	+24V	2	+24V RTN
3	- 5V RTN	4	- 5V
5	+ 5V	6	+ 5V RTN

8. POWER SUPPLY CONDITIONS

8.1 Input Voltage and Permissible Input Voltage Variation

	Input voltage
+24V	+24V±10%
+ 5V	+ 5V±5%
- 5V	- 5V±5% (or -7V~-16V if necessary)

The above values are voltages at the power supply input terminal section of the unit.

8.2 Current Values

Current / Voltage	Peak current	Average current	
		Not seeking	Seeking
+24V	6.0A	1.2A	1.6A
+5V	6.0A	4.0A	4.1A
-5V	0.5A	0.5A	0.5A

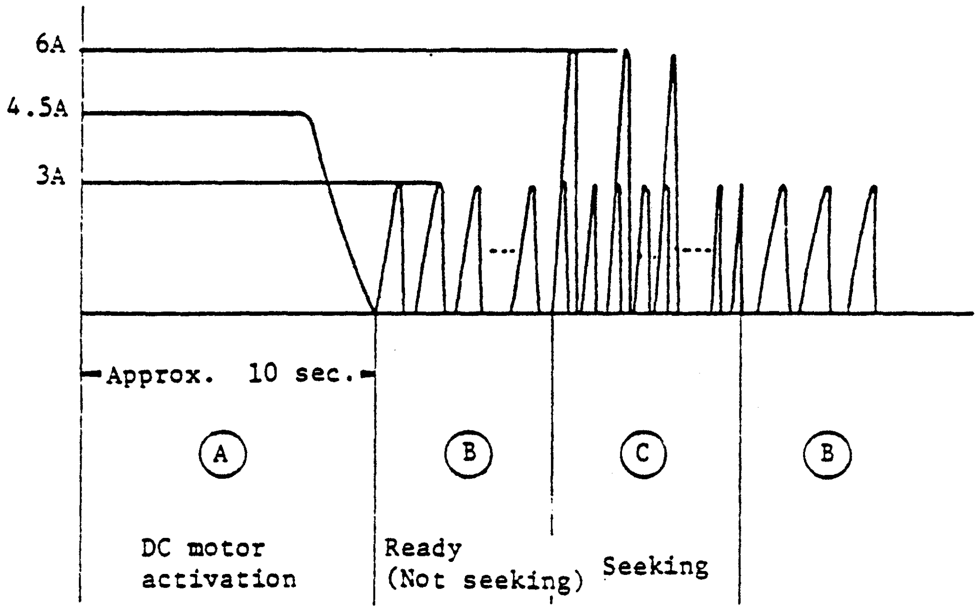
The average current during seeking is the value at the time of: (average seek) + (latency time) + (reading or writing during one revolution).

8.3 Power Consumption

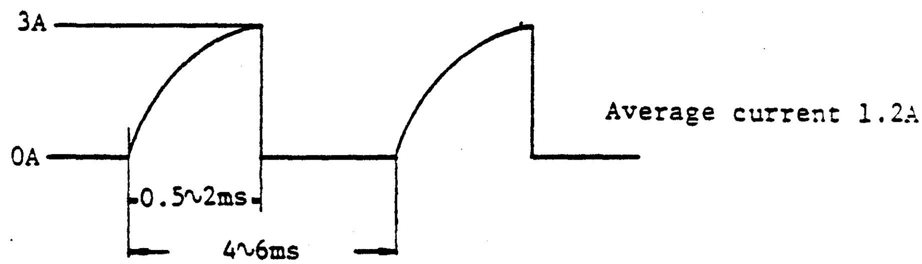
Not seeking	51.3W
Seeking	61.4W

8.4 Current Waveforms

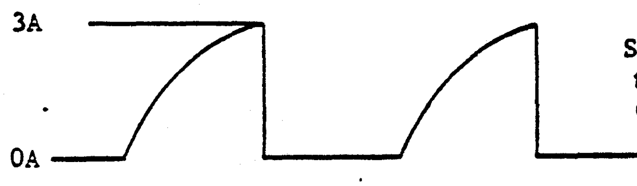
(1) +24V current waveform



Expansion of B section

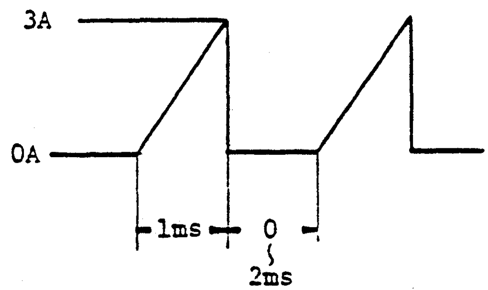


Expansion of C section



Same waveform as that of B section (average current 1.2A)

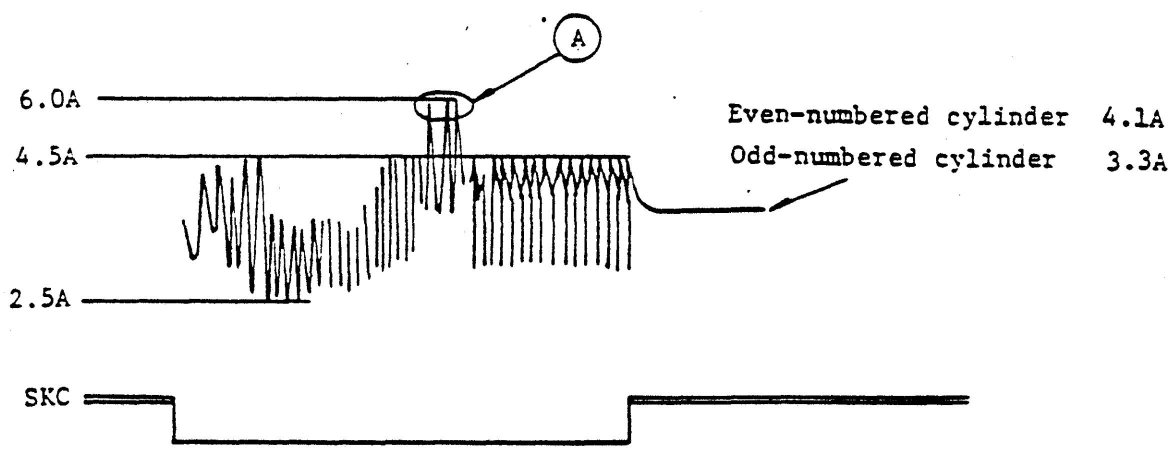
+



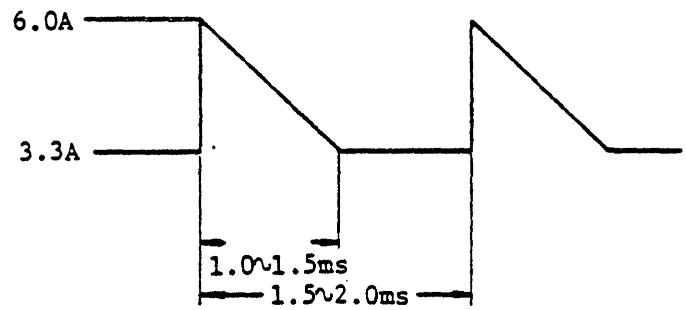
The waveform of the C section is obtained by superimposing the above two waveforms asynchronously.

(2) +5V current waveform

+5V current has a sawtooth waveform during seeking, as shown below.



Expansion of A section

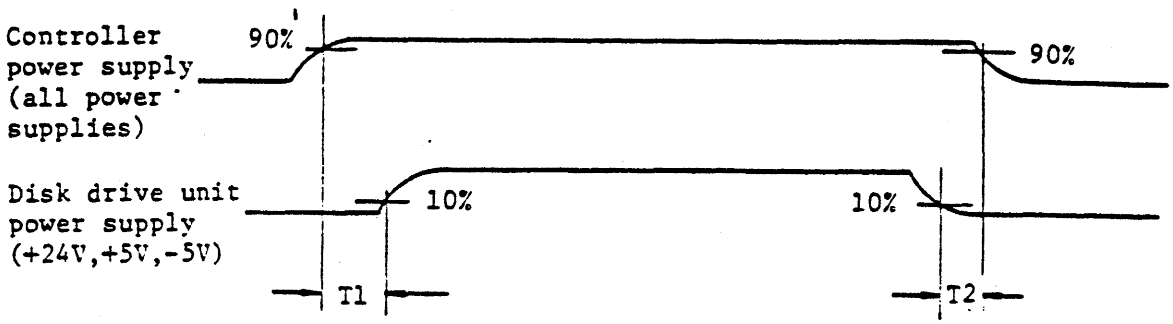


Note) The peak current (6A) in the A section flows only 3 or 4 times during one seek.

8.5 Power ON/OFF Sequence

When the Write Gate signal from the controller is off before the power is on or off, the power (+24V, +5V, -5V) need not be sequenced. That is, recorded data will not be destroyed and mechanical or electric troubles will not occur. To maintain the Write Gate signal in the off state at the time of unit power-on or -off, the power supply of the controller and drive unit must be sequenced as follows:

(1) Basic sequence



T1, T2: 0 sec. or longer

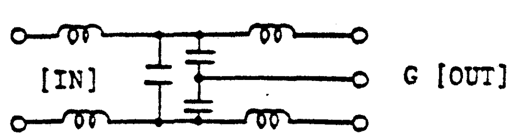
Note) The power supplies of the disk drive unit (+24V, +5V, -5V) need not be sequenced.

(2) When the +5V for the disk drive is supplied from the controller power supply and the interface signal from the controller is determined by the +5V controller power supply, the voltage level of +5V is detected in the drive unit and Write Gate signal is inhibited. Sequencing is therefore unnecessary.

8.6 Others

(1) To eliminate AC line noise, a noise filter of the specifications given below should be incorporated in the AC input terminal of the disk drive power supply.

Attenuation characteristic	40dB or greater at 10MHz
Circuit configuration	T type shown below is recommended.



9. MAINTENANCE PARTS

The maintenance parts replaceable in the field are shown in Table 9.1.

Table 9.1 Maintenance Parts

Item	Part name	Part No.	Qty/unit
1	Controller (PCB)	B16B-6840-8020A	1
2	Head pre-amplifier (PCB)	B16B-6990-0020A	1

Notes for connecting the M2301/M2302 to a controller.

1. Power Supply

   (a) The M2301/M2302 needs DC +5V, +24V and -5V. The current of each voltage is as follows:

(1)	+5V DC	Average	4.1A	
		Peak	6.0A	(Pulse current)
(2)	+24V DC	Average	1.7A	
		Peak	4.5A	(Start-up cycle, 10 seconds)

   Note: For +24V, we recommend using a 4.5A power supply.

(3)	-5V DC	Average	0.5A	(Stable)

   Note: -12V cannot currently be substituted for -5V. See Section 5.

   Before connecting the power supply to the drive, please make sure that the above requirements are satisfied. FAI can, if necessary, provide a power supply for your evaluation of the drive.

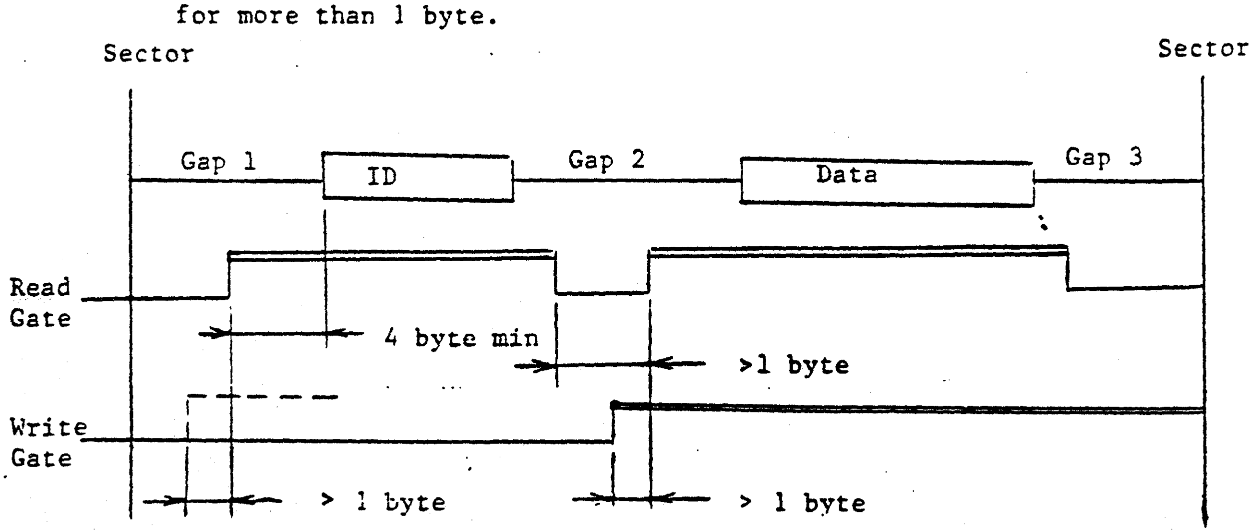
2. Switch Options

   (a) The M2301/M2302 has several switch options for SA4000 interface compatibility.

   Before you exercise the drive, please verify all switch settings, using the operation manual. The PLO signal on the interface is already inverted.

3. Data Format

   (a) At Gap 2 on the data format, the signal Read Gate should be low for more than 1 byte.



(b) The timing signals, Write Gate and Read Gate, should satisfy t>1 byte, as in the diagram, in order to avoid a write splice.

4. Cabling

(a) If two cables (50 pin and 20 pin) are used with the controller, Read Data Clock and Write Data should not appear on the "A" cable. This is accomplished through the switch settings on Switch 4.

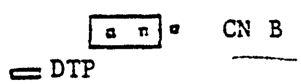
(b) The PCB connectors for the cables are labeled on the component side as even numbers, 02 - 20 and 02 - 50. When the drive is in the horizontal place, Pin 1 is on the right, (facing the connectors) upper side of the PCB.

5. Jumper Options

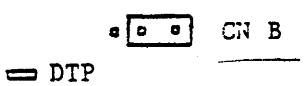
(a) PLO Clock ±

-- location: B,C,3,4

-- position for normal clock



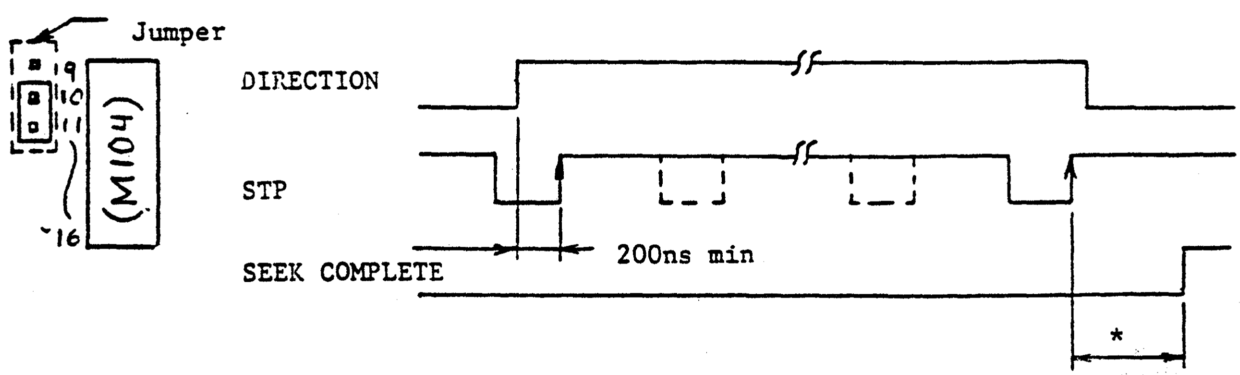
-- position for inverted PLO Clock



(b) DIRECTION/STP Timing (Logic levels)

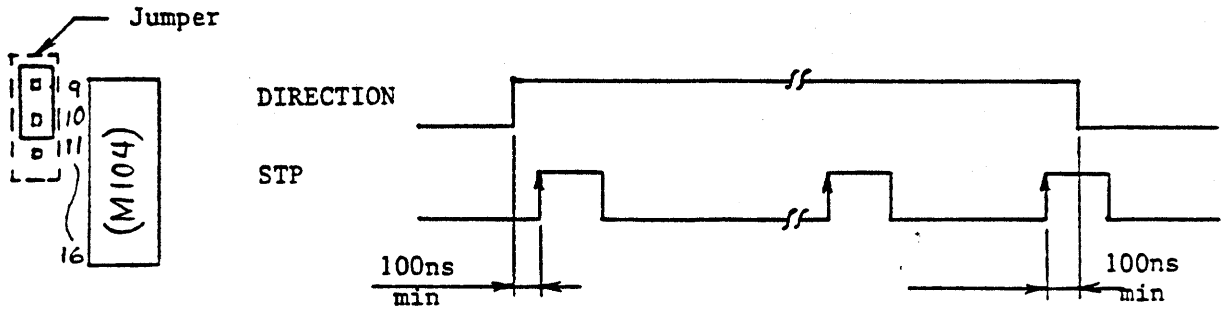
-- location: C4

-- Position when triggering on trailing edge of STP (SA4000)



* SEEK COMPLETE must occur 1ms after last STP

-- position when triggering on leading edge of STP



(c) Voltage selection

-- Location: E3

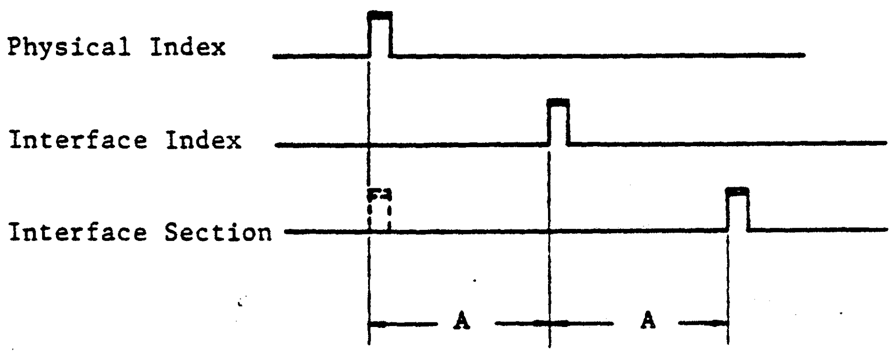
-- Currently the drive will operate only with pins 1-2 jumpered for -5V.

-- later versions of M2301/2 will allow jumpering pins 2-3 in order to accept -12V.

APPENDIX 1. MEDIA ERROR

(1) Media Error Display Method

A defective area of the M2301/M2302 media is located with reference to the Physical Index by the number of bytes from the Physical Index. The Physical Index represents the Index Pattern Division recorded on the clock track. The relationships of the Physical Index and Interface Index/Sector are as shown below.



A: This represents the number of bytes of one sector.

(2) Relation of the Defective Area Display Value and the Defective Sector.

The defective sector number can be calculated from the defective area display value by using the following formula.

$$\text{Defective Sector Number} = \left[\frac{X}{A}\right] - 1$$

Note 1: X: Defective position display value

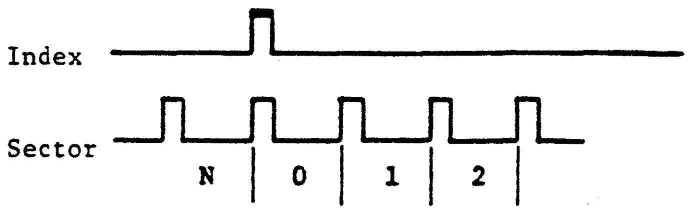
A: Number of bytes of one sector

[ ]: This indicates that all the numbers after the decimal point are to be omitted.

For example: $[2.3] = 2$

1: Compensates for the difference between Physical and Interface Index.

Note 2: The sector next to the index is assumed to be the 0 sector.



The following 2 examples indicate how the defective sector number can be calculated.

[Example 1] $X = 800$
$A = 300$

$$\text{Defective sector number} = \left[\frac{800}{300}\right] - 1$$
$$= 2 - 1$$
$$= 1$$

<u>1 sector is defective</u>

[Example 2] $X = 200$
$A = 300$

$$\text{Defective sector number} = \left[\frac{200}{300}\right] - 1$$
$$= 0 - 1$$
$$= -1$$

<u>N (last) sector is defective</u>

APPENDIX 2. SWITCH SETTING PROCEDURES

The functions and assignment procedures of the different switches on the PCB of the M2301/M2302 system are described below.

(1) DRIVE SELECT (Device Number Selector)

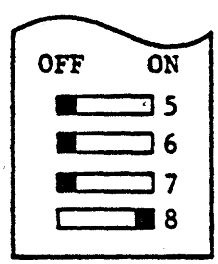
The drive select switch is used to select one of the maximum 4 devices to be connected. Of the 4 keys, you are to turn ON only the relevant key, while turning OFF the other 3. The device number selection configurations are shown in Table 1 and Figure 1.

Table 1 Device Number Selection

Device Number	SW3 Switch			
	Key 8	Key 7	Key 6	Key 5
1	o	x	x	x
2	x	o	x	x
3	x	x	o	x
4	x	x	x	o

o: ON
x: OFF

SW3 (Mounting position B6)



Key 5
Key 6
Key 7
Key 8

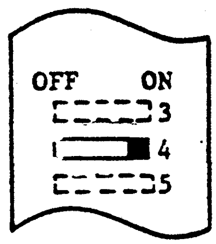
The figure at left shows the configuration for selecting Device Number 1.

Figure 1. Device Selecting Switch

(2) SEEK COMPLETE

When sending the SEEK COMPLETE signal (name: SEEK COMPLETE) onto the A cable of the interface, turn on Key 4 of SW3. However, at this point, be sure not to leave DRIVE SELECT 4 in the ON status (see Figure 2).

SW3 (Mounting position B6)



Key 3
Key 4
Key 5

The procedures shown in the figure at left are to be used when sending the SEEK COMPLETE signal.

Figure 2. SEEK COMPLETE SWITCH

(3) SECTOR/BYTE CLOCK

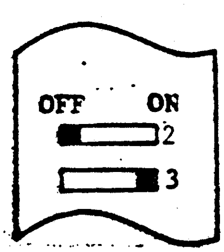
This switch is used to send either the SECTOR or BYTE CLOCK signal into the interface cable. The switch configurations are shown in Table 2 and Figure 3 below.

Table 2 SECTOR/BYTE CLOCK

Signal Name	SW2 Switch	
	Key 3	Key 2
SECTOR	o	x
BYTE CLOCK	x	o

o: ON
x: OFF

SW2 (Mounting position T4)



Key 2
Key 3

The figure at left shows the configuration for sending the Sector Signal.

Figure 3 SECTOR/BYTE CLOCK

(4) SECTOR During the Generation of INDEX

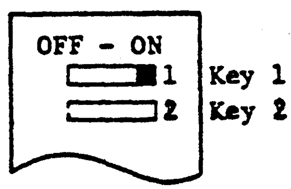
This is used to select whether or not to send the sector mark generated in the same timing with the index onto the interface. The switch configurations are shown in Table 3 and Figure 4.

Table 3 SECTOR During the Generation of INDEX

Selection content	SW2
	Key 1
Send the SECTOR	x
Do not send the SECTOR	o

o:ON
x:OFF

SW2 (Mounting position T4)



The figure at left shows the switch configuration when the INDEX/SECTOR is not sent simultaneously.

Figure 4. SECTOR During the Generation of INDEX

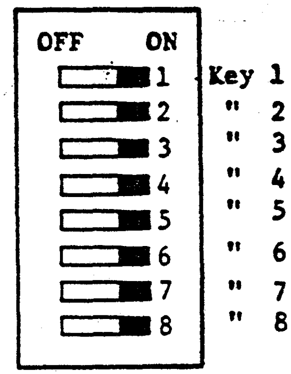
(5) WRITE/READ DATA and WRITE/PLO CLOCK

The method of sending the WRITE/READ DATA and WRITE/PLO CLOCK signals onto the A cable of the interface is shown in Table 4 and Figure 5.

Table 4 W/R DATA and W/P CLOCK

Signal Name	Assigned Switch SW4
±WRITE DATA	Key 7, Key 8 ON
±READ DATA	Key 1, Key 2 ON
±WRITE CLOCK	Key 5, Key 6 ON
±PLO CLOCK	Key 3, Key 4 ON

SW4 (Mounting position B5)



The figure at left shows the switch configuration when all the signals are to be sent.

Figure 5. W/R DATA and W/P CLOCK

(6) Sector Count Selection

The number of sectors can be selected by using the keys of switches SW1 and SW2. The key of the respective switches corresponds to 2^0 through 2^{11} bytes. (See Table 5)

Table 5 Sector Counter Byte Table

SW1	No of Bytes	SW2	No of Bytes
Key 8	1	Key 8	256
Key 7	2	Key 7	512
Key 6	4	Key 6	1024
Key 5	8	Key 5	2048
Key 4	16		
Key 3	32		
Key 2	64		
Key 1	128		

Various configurations of the switches are shown in Table 6 and Figure 6, where the LAST SECTOR indicates the number of excess bytes. This also indicates that only the number of excess bytes becomes longer.

Table 6 Sector Configurations

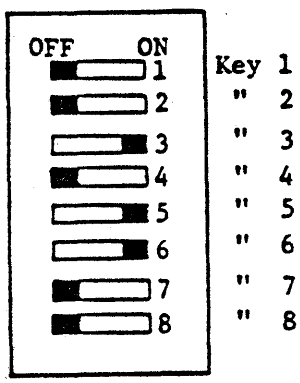
SECTORS	SW1								SW2				BYTES/SECTOR	LAST SECTOR
	8	7	6	5	4	3	2	1	8	7	6	5		
2	1	1	1	1	1	1	1	1	1	1	1	1	4095	$+3810^{+32}_{-0}$
3	0	0	0	0	0	1	0	1	1	1	1	1	4000	0 "
4	0	0	0	1	1	1	0	1	1	1	0	1	3000	0 "
5	0	0	0	0	0	1	1	0	1	0	0	1	2400	0 "
6	0	0	0	0	1	0	1	1	1	1	1	0	2000	0 "
7	0	1	0	0	1	1	0	1	0	1	1	0	1714	+2 "
8	0	0	1	1	1	0	1	1	1	0	1	0	1500	0 "
9	1	0	1	0	1	1	0	0	1	0	1	0	1333	+3 "
10	0	0	0	0	1	1	0	1	0	0	1	0	1200	0 "
11	0	1	0	0	0	0	1	0	0	0	1	0	1090	+10 "
12	0	0	0	1	0	1	1	1	1	1	0	0	1000	0 "
13	1	1	0	1	1	0	0	1	1	1	0	0	923	+1 "
14	1	0	0	1	1	0	1	0	1	1	0	0	857	+2 "
15	0	0	0	0	0	1	0	0	1	1	0	0	800	0 "
16	0	1	1	1	0	1	1	1	0	1	0	0	750	0 "
17	1	0	0	0	0	0	1	1	0	1	0	0	705	+15 "
18	0	1	0	1	1	0	0	1	0	1	0	0	666	+12 "
19	1	1	1	0	1	1	1	0	0	1	0	0	631	+11 "
20	0	0	0	1	1	0	1	0	0	1	0	0	600	0 "
21	1	1	0	1	1	1	0	0	0	1	0	0	571	+9 "
22	1	0	0	0	0	1	0	0	0	1	0	0	545	+10 "
23	1	0	0	1	0	0	0	0	0	1	0	0	521	+17 "
24	0	0	1	0	1	1	1	1	1	0	0	0	500	0 "
25	0	0	0	0	0	1	1	1	1	0	0	0	480	0 "
26	1	0	1	1	0	0	1	1	1	0	0	0	461	+14 "
27	0	0	1	1	1	1	0	1	1	0	0	0	444	+12 "
28	0	0	1	1	0	1	0	1	1	0	0	0	428	+16 "
29	1	0	1	1	1	0	0	1	1	0	0	0	413	+23 "
30	0	0	0	0	1	0	0	1	1	0	0	0	400	0 "
31	1	1	0	0	0	0	0	1	1	0	0	0	387	+3 "
32	0	0	0	1	1	1	1	0	1	0	0	0	375	0 "
33	1	1	0	1	0	1	1	0	1	0	0	0	363	+21 "
34	0	0	0	0	0	1	1	0	1	0	0	0	352	+32 "
35	0	1	1	0	1	0	1	0	1	0	0	0	342	+30 "
36	1	1	0	1	0	0	1	0	1	0	0	0	333	+12 "
37	0	0	1	0	0	0	1	0	1	0	0	0	324	+12 "
38	1	1	0	1	1	1	0	0	1	0	0	0	315	+30 "
39	1	1	0	0	1	1	0	0	1	0	0	0	307	+27 "
40	0	0	1	1	0	1	0	0	1	0	0	0	300	0 "
50	0	0	0	0	1	1	1	1	0	0	0	0	240	0 "
60	0	0	0	1	0	0	1	1	0	0	0	0	200	0 "
70	1	1	0	1	0	1	0	1	0	0	0	0	171	+30 "
80	0	1	1	0	1	0	0	1	0	0	0	0	150	0 "

Table 6 Sector Configuration (cont'd)

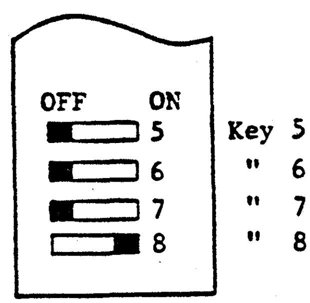
SECTORS	SW1								SW2				BYTES/SECTOR	LAST SECTOR
	8	7	6	5	4	3	2	1	8	7	6	5		
90	1	0	1	0	0	0	0	1	0	0	0	0	133	$+30^{+32}_{-0}$
100	0	0	0	1	1	1	1	0	0	0	0	0	120	0 "
110	1	0	1	1	0	1	1	0	0	0	0	0	109	+10 "
120	0	0	1	0	0	1	1	0	0	0	0	0	100	0 "
130	0	0	1	1	1	0	1	0	0	0	0	0	92	+40 "

"0" indicates the OFF and "1" indicates the ON status.

SW1 (Mounting position T5)



SW2 (Mounting position T4)



The figure at left indicates the switch selection configuration for 40 sectors.

Figure 6. Sector Configuration

(7) DELAY SKC

This is used to select whether or not to send SEEK COMPLETE (signal name: SEKC) with SETTLING TIME or SEEK COMPLETE (signal name: SKC) without SETTLING TIME to SEEK COMPLETE on the interface. The switch configurations are shown in Table 7 and Figure 7.

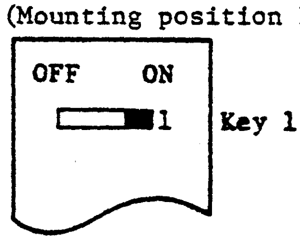
Table 7 DELAY SKC

Signal Name	SW3
	Key 1
SEKC	o
SKC	x

o: ON

x: OFF

SW3 (Mounting position B6)



The figure at left shows the switch configuration for sending the SEKC.

Figure 7. DELAY SKC

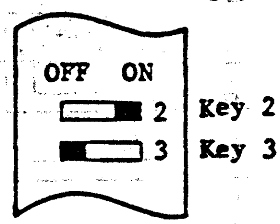
(8) Controlling the Basic DRIVE SELECT Signals

Even when the relevant devices are not selected, the four basic signals (INDEX, DRIVE READY, SECTOR/BYTE CLOCK and SEEK COMPLETE) can be sent to the interface cable (both A and B). The configurations for sending these signals are shown in Table 8 and Figure 8.

Table 8 Controlling the DRIVE SELECT Signals

A cable	SW3 Key 2	B cable	SW3 Key 3	
Gates	o	Gates	o	o: ON
Does not gate	x	Does not gate	x	x: OFF

SW3 (Mounting position B6)



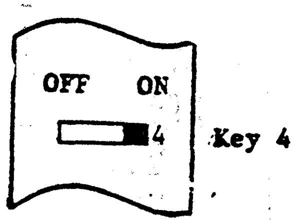
The figure at left shows the switch configuration when the A cable is gated leaving the B cable ungated.

Figure 8 Controlling the DRIVE SELECT Signals

(9) Time Margin Measuring Switch

This switch is usually used in the "ON" status. However, when measuring the margin, this is turned "OFF".

SW2 (Mounting position T4)



The configuration at left indicates the normal operating position of the switch.

Figure 9 Time Margin Measuring Switch