

Internal use only

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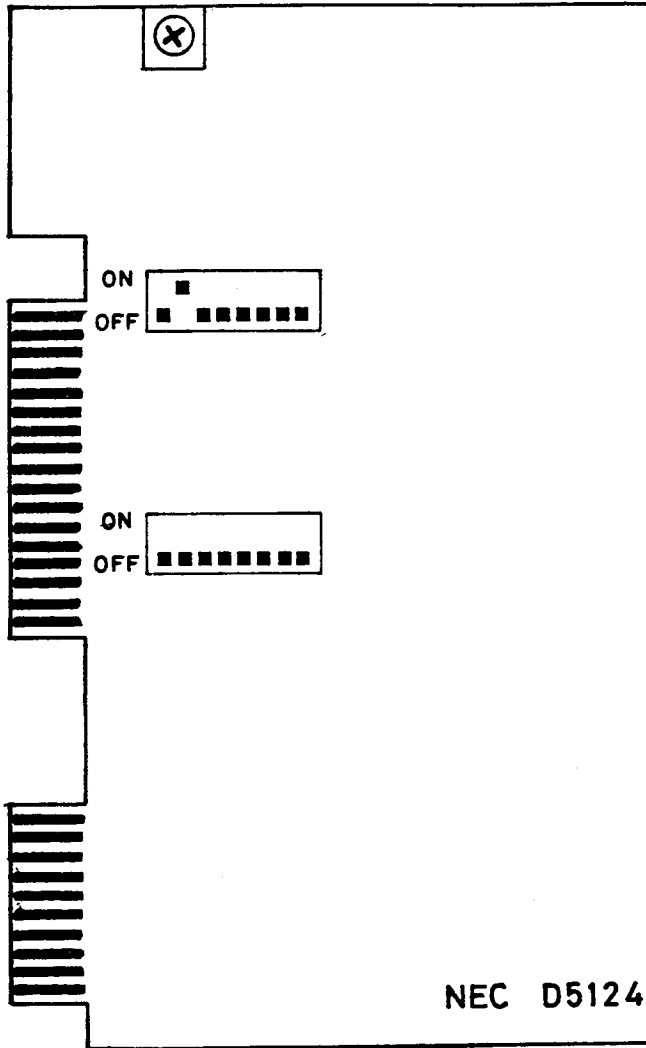
RC750, WDD705, WDD706, Winchesterdisk, 10 MB, NEC D5124.

Abstract:

This manual contains the NEC D5124 Product Description.

formatting of HDD.

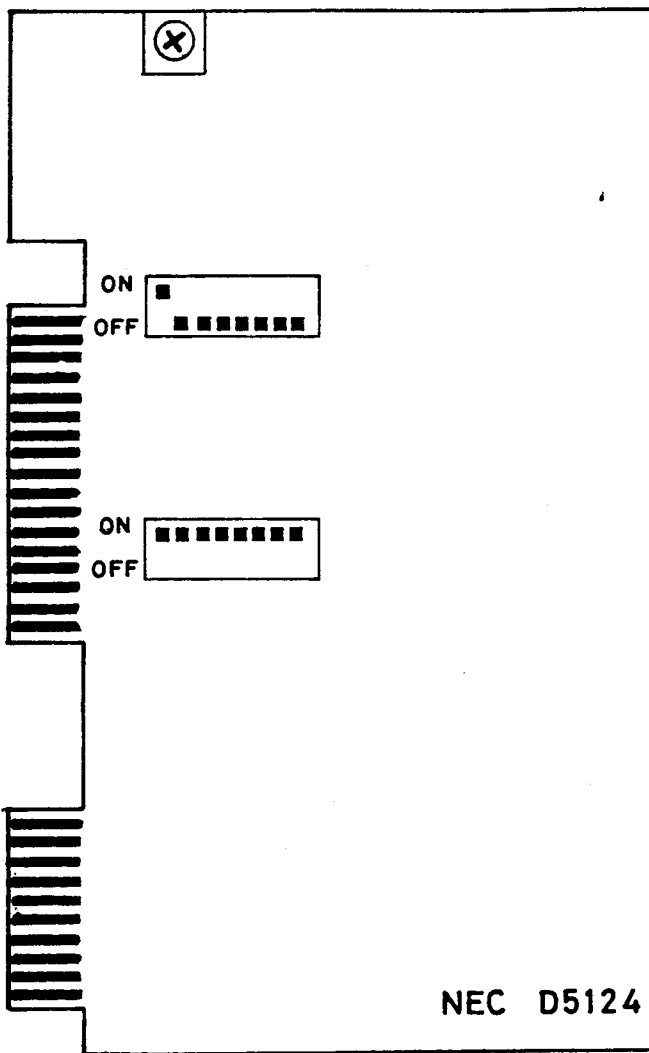
- type 1 10MB. MINISCRIBE
- type 2 10MB. NEC
- type 3 20MB NEC
- type 4 40MB NEC



NEC D5124

NEC D5126 20MB. type 3.

BETEGNELSE WDD 705 MONTABETEGNING.		UDGAVE	
PA PART NR.		02	07
PA TEGN. PART NR.		03	08
DESIGN HC		04	09
01 UDGAVE 840208	MONTAGE	05	10
		06	11
		TEGN NR. 76057280	



NEC D5124

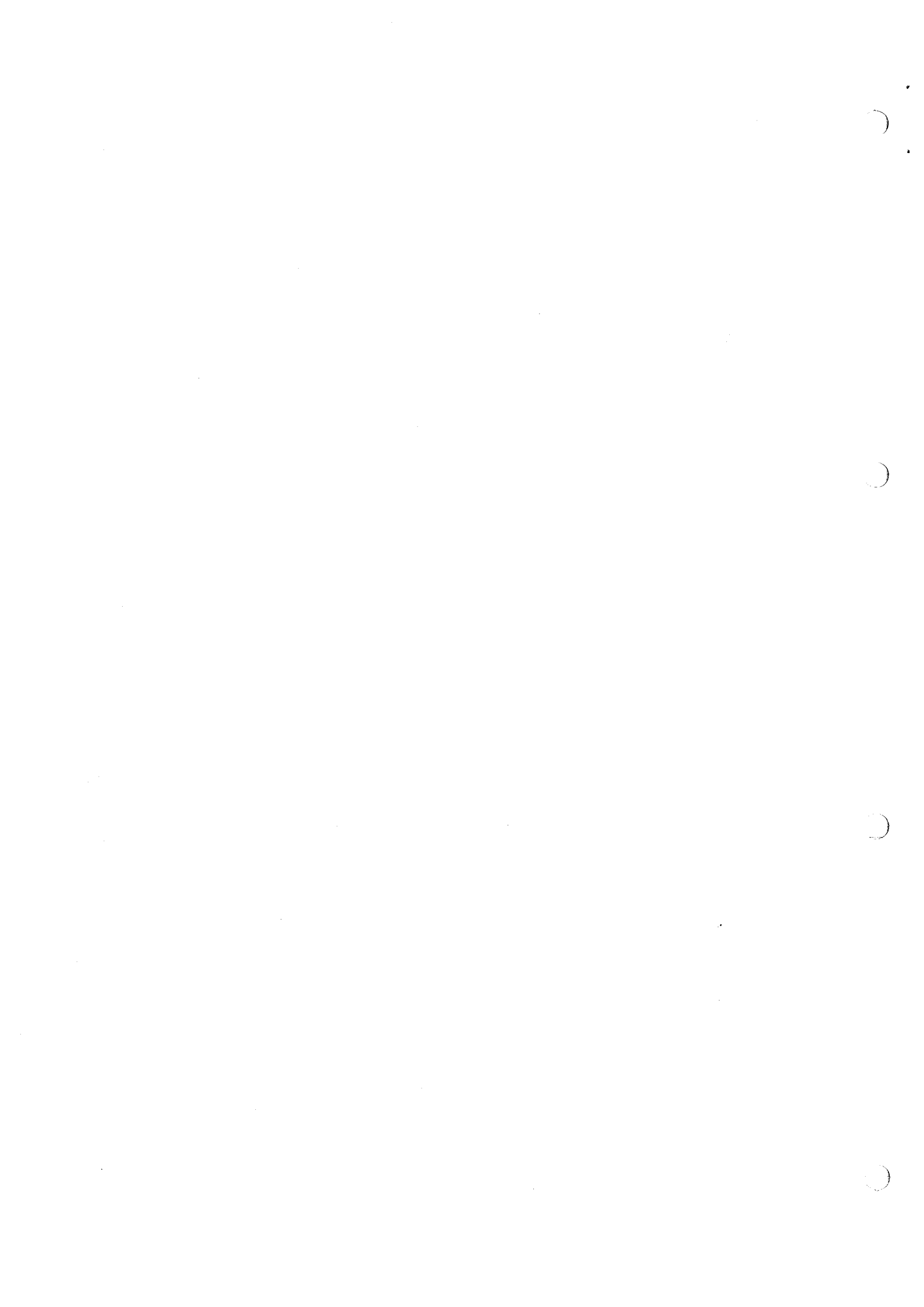
BETEGNELSE WDD 706 MONTAGETEGNING		UDGAVE	
PA PART NR.		02	07
PA TEGN. PART NR.		03	08
		04	09
		05	10
		06	11
DESIGN HC	MONTAGE	TEGN NR. 760 57390	
01 UDGAVE 840808			

NEC

**D5104 SERIES MAGNETIC DISK DRIVE
PRODUCT DESCRIPTION
(FIRST EDITION)**

Preliminary

NEC Corporation
TOKYO, JAPAN



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1. INTRODUCTION

1.1 General Outline and Features

The D5104 series magnetic disk drive is a random access storage device with 5.25" magnetic disks and mini-Winchester type magnetic heads.

There are two models in the series, D5114 and D5124 containing 1 and 2 magnetic disks respectively and each model's formatted storage capacity is 5 and 10 Megabytes.

Major Feature include:-

- * Light weight compact size

Size and installation requirement are the same as half height minifloppy disk drive. Horizontal and vertical installations are possible.

- * High-speed Seek

Microprocessor controlled 2-phase stepper motor and "Buffered Step Mode" reduces access times.

- * High reliability

Disk and Head section are included in an air-tight enclosure for full protection against dust.

Contact Start/Stop zone and Carriage lock mechanism are prepared.

- * Maintenance-free concept

Regular maintenance checks are not required.

- * Optical Data Separator PLL

Data separator PLL is available.

1.2 Specifications

Summary specifications are listed in Table 1.1.

Table 1.1

No.	Item	D5114	D5124
1.	Storage Capacity		
	(1) Unformatted		
	/drive (MB)	6.45	12.91
	/cylinder (bytes)	20,832	41,664
	/track (bytes)	10,416	10,416
	(2) Formatted *		
	/drive (MB)	5.079	10.158
	/cylinder (bytes)	16,384	32,768
	/track (bytes)	8,192	8,192
2.	Disk Configuration		
	Number of disks	1	2
	Number of heads (data sides)	2	4
3.	Number of cylinder	310	
4.	Data transfer rate (KB/sec)	625	
5.	Access time (ms)		
	Maximum seek time	215 ***	
	Average seek time	85 ***	
	Minimum seek time	18 **	
6.	Disk speed (rpm)	3,600±1%	
7.	Start/Stop times (sec)		
	Start time	15 max.	
	Stop time	15 max.	
8.	Recording method	MFM	

No.	Item	D5114	D5124		
9.	Recording density				
	Bit density (bpi)			9,000	
	Track density (tip)			350	
10.	Drive Selection	4			

- * 32 sectors/track, 256 bytes/sector
- ** including settling time.
- *** using "Buffered Seek Mode"/including settling time.

2. CONFIGURATION

2.1 Physical Configuration

D5104 consists of the following major component parts.

(1) DE assembly (Disk Enclosure assembly)

The Disk Enclosure assembly includes base plate, spindle assembly, carriage assembly, head arm assembly, magnetic heads, magnetic disks, air filter, read/write IC and so on.

With the interior shielded from the outside and kept clean by a circulator air flow, the D5104 is assured of stable operation under ordinary office condition.

(2) PWA assembly

Made up of microprocessor, custom LSI, interface Driver/Receiver, read circuit, motor driver and so on, this PWA handles signal interfacing with external control unit, execution of instructions, fault detection, seek operation, spindle motor drive and read/write operation.

2.2 Functional Configuration

The functional configuration of D5104 is outlined in Figure 2.1 below.

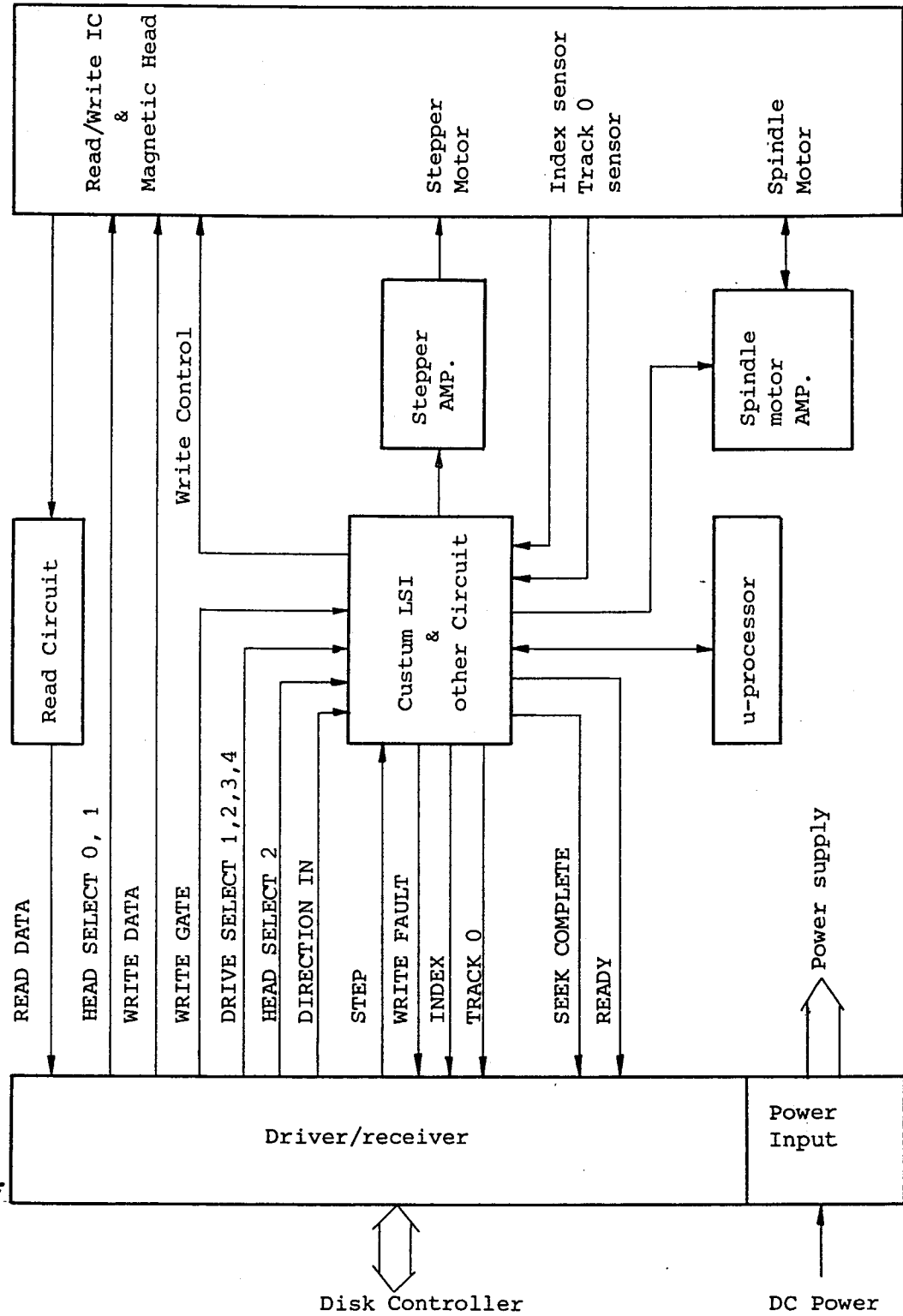


Fig.2.1 Functional Configuration

3. PHYSICAL SPECIFICATIONS

3.1 Structural Outline

The basic structural specifications of D5104 are listed in Table 3.1.

Table 3.1

Item	D5104	
Height (mm)	41	See Figure 3.1 for details.
Width (mm)	146	
Depth (mm)	208	
Weight (Kg)	1.8	

3.2 Interface Connector and Switch Layout

3.2.1 Interface connector layout

The position for mounting the connector for signal, power and ground cables are shown in Figure 3.2.

3.2.2 Drive address switch layout

Drive address switch must be set when installing D5104. The position is shown in Figure 3.2.

3.2.3 Terminator resistor On/Off switch layout

Terminator resistor On/Off switch must be set in "Daisy chain" connection. The position is shown in Figure 3.2.

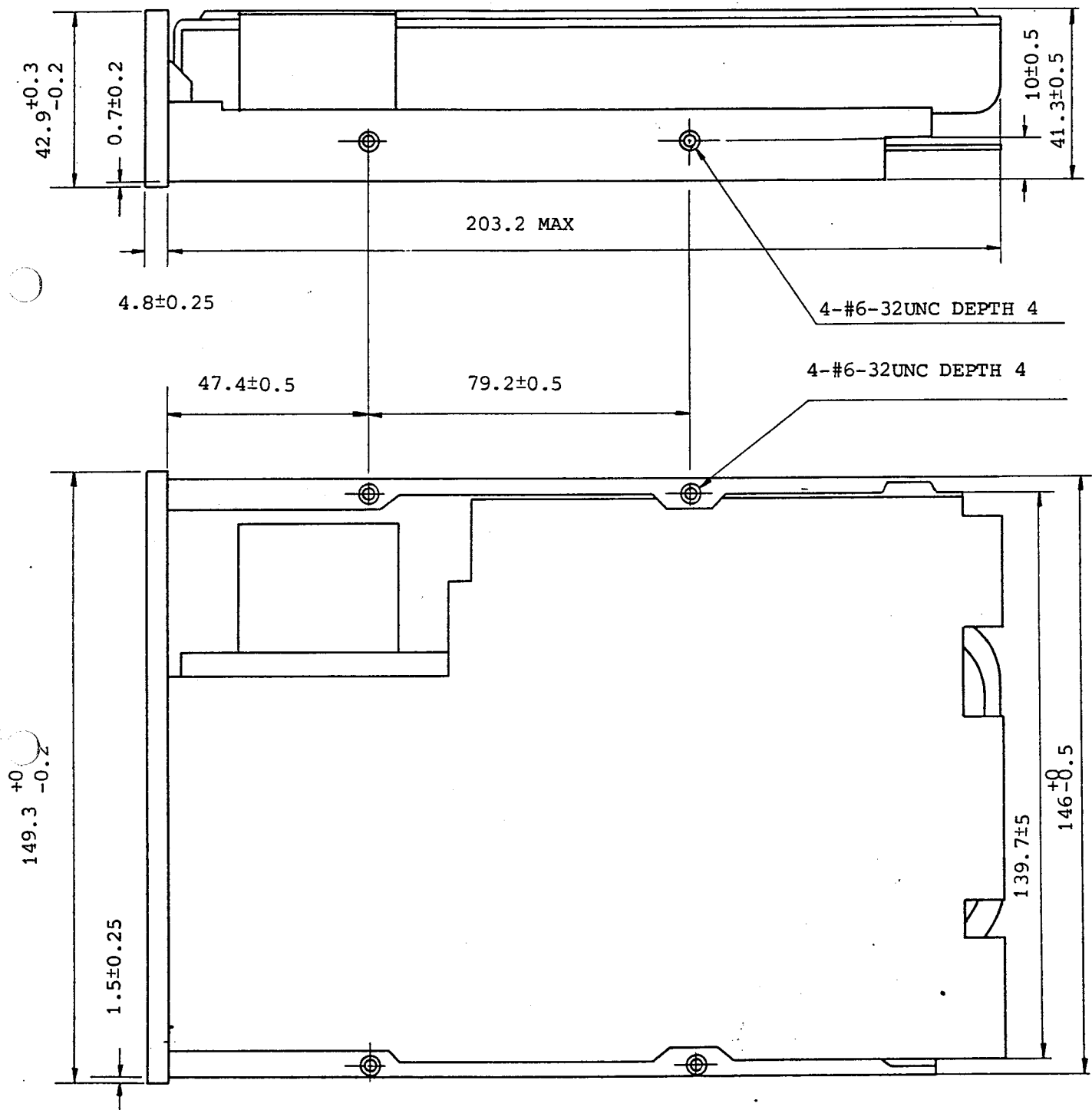


Fig.3.1 Installation Dimensions

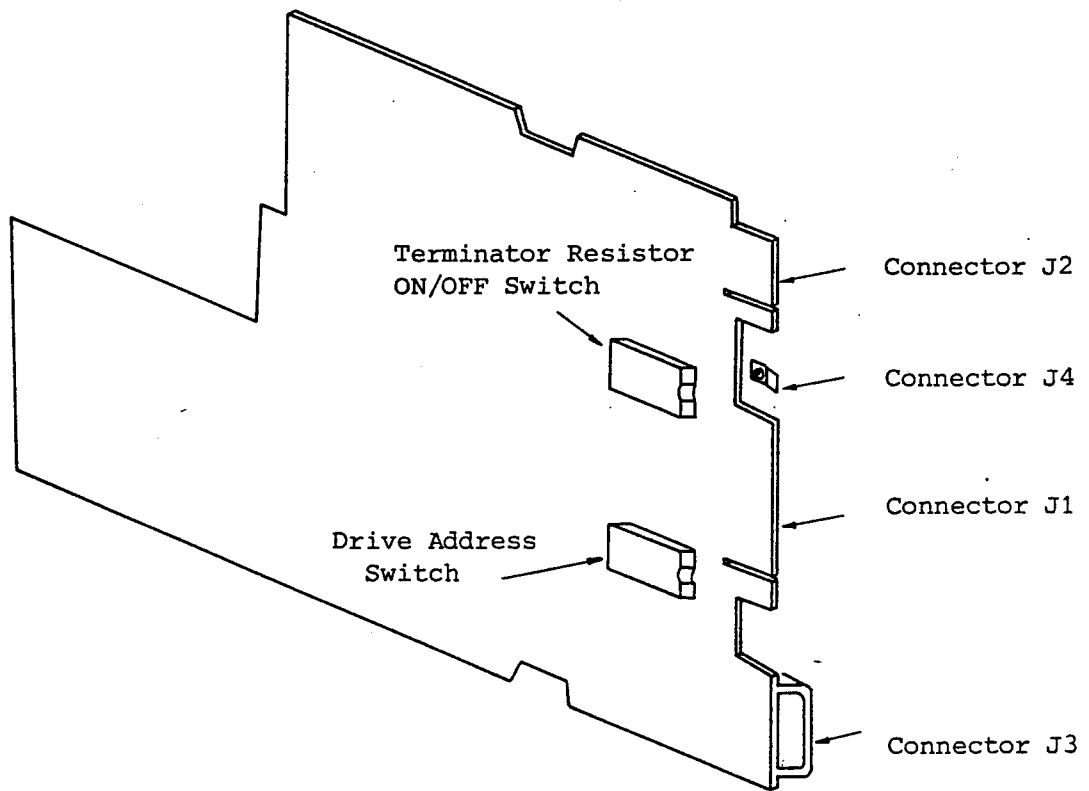


Fig.3.2 Connectors and Switches

3.3 Environmental Condition

The D5104 must always be handled under conditions conforming with the values given in the following table.

Table 3.2

No.	Item	Operating	Storage
1.	Temperagure	5°C - 50°C (40°F - 122°F)	-40°C - 60°C (-40°F - 140°F)
2.	Temperature gradient	10°C/H (18°F/H)	non-condensing
3.	Humidity	8% - 80%	non-condensing
4.	Max. Wet Bulb	29°C (84°F)	non-condensing
5.	Vibration *	0.2G	0.5G
6.	Shock	2G	15G
7.	Elevation	0 m - 3,000 m 0 feet - 10,000 feet	-300 m - 3,600 m -1,000 feet - 12,000 feet

* 0-60 Hz; amplitude less than 25 mm

4. INTERFACE SPECIFICATION

4.1 Outline

Signals transferred between D5104 and Disk Controller are passed through a 34-ply cable (Connector J1) and a 20-ply cable (Connector J2). Where a number of D5104 are used, these can be connected either by "daisy chain" or "radial" interface connection configuration. The system examples are shown in Figure 4.1.

4.1.1 Signal interface physical specifications

The physical and electrical specifications for signal interfaces between D5104 and Disk Controller are stipulated in this section.

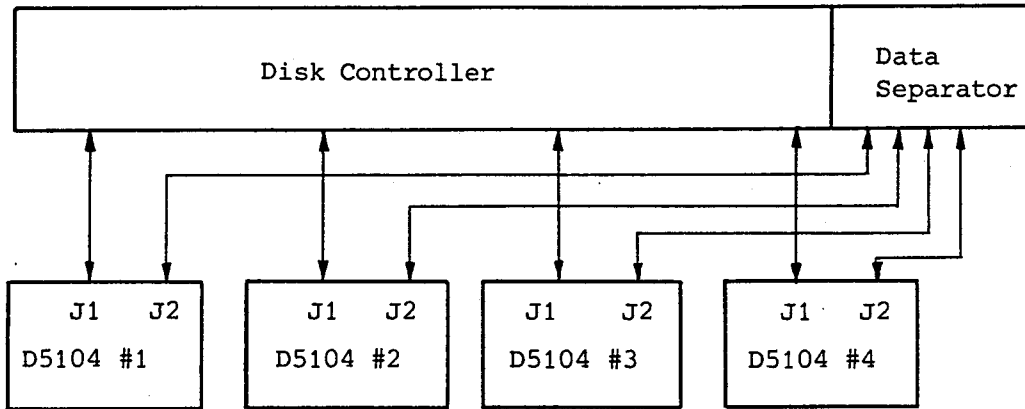
4.1.2 Cables and connectors

The dimensions of signal connector (J1 and J2) are shown in Figure 4.2 and the names of recommended mate connectors are listed in Table 4.2.

4.2 Terminator

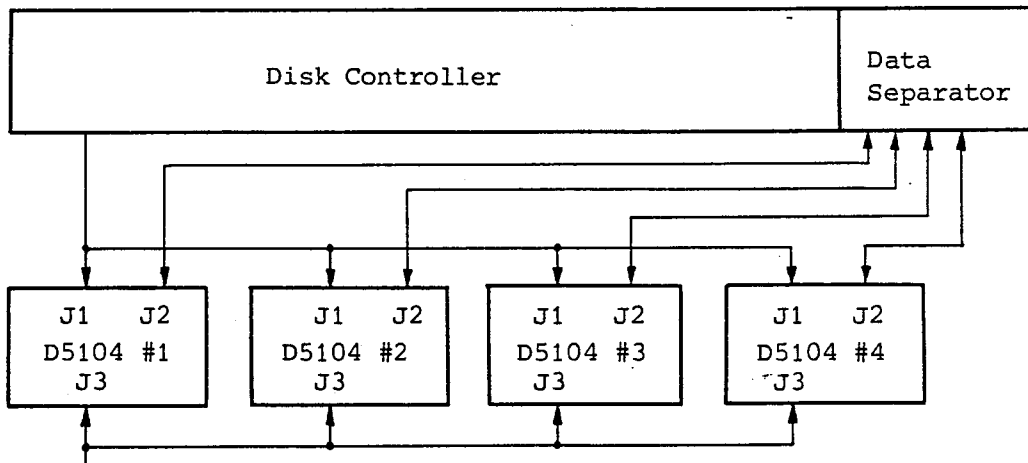
Disk controller and far-end D5104 require Terminator.

In "daisy chain", terminator register switch must be ON/OFF as Figure 4.1.



(1) Redial Type

* each cable to be less than 6 m



DC POWER

(2) Daisy chain Type

* each cable to be less than 6 m

** Terminator resistor Switch of #1, #2 and #3 must be OFF.

Fig.4.1 Interface Connection Examples

Table 4.1 List of Interface Signals (J1)

Pin No.		Signal Name	Input/Output
GND	SIG.		
1	2	(-REDUCED WRITE CURRENT)	Input
3	4	-HEAD SELECT 2	Input
5	6	-WRITE GATE	Input
7	8	-SEEK COMPLETE	Output
9	10	-TRACK 0	Output
11	12	-WRITE FAULT	Output
13	14	-HEAD SELECT 0	Input
15	16	(TO J2 PIN 7)	-
17	18	-HEAD SELECT 1	Input
19	20	-INDEX	Output
21	22	-READY	Output
23	24	-STEP	Input
25	26	-DRIVE SELECT 1	Input
27	28	-DRIVE SELECT 2	Input
29	30	-DRIVE SELECT 3	Input
31	32	-DRIVE SELECT 4	Input
33	34	-DIRECTION IN	Input

List of Interface Signals (J2)

I/O	Signal Name	Pin No.	Pin No.	Signal Name	I/O
Output	-DRIVE SELECTED	1	2	GND	-
Output	(RESERVED)	3	4	GND	-
-	(RESERVED)	5	6	GND	-
-	(TO J1 PIN 16)	7	8	GND	-
-	(RESERVED)	9	10	(RESERVED)	-
-	GND	11	12	GND	-
Input	+MFM WRITE DATA	13	14	-MFM WRITE DATA	Input
-	GND	15	16	GND	-
Output	+MFM READ DATA	17	18	-MFM READ DATA	Output
-	GND	19	20	GND	-

Table 4.2 Interface Cable Connector Specification

Item	Recommended Connector
J1 (34 ply)	AMP ribbon connector P/N 88373-3
J2 (20 ply)	AMP ribbon connector P/N 88373-6

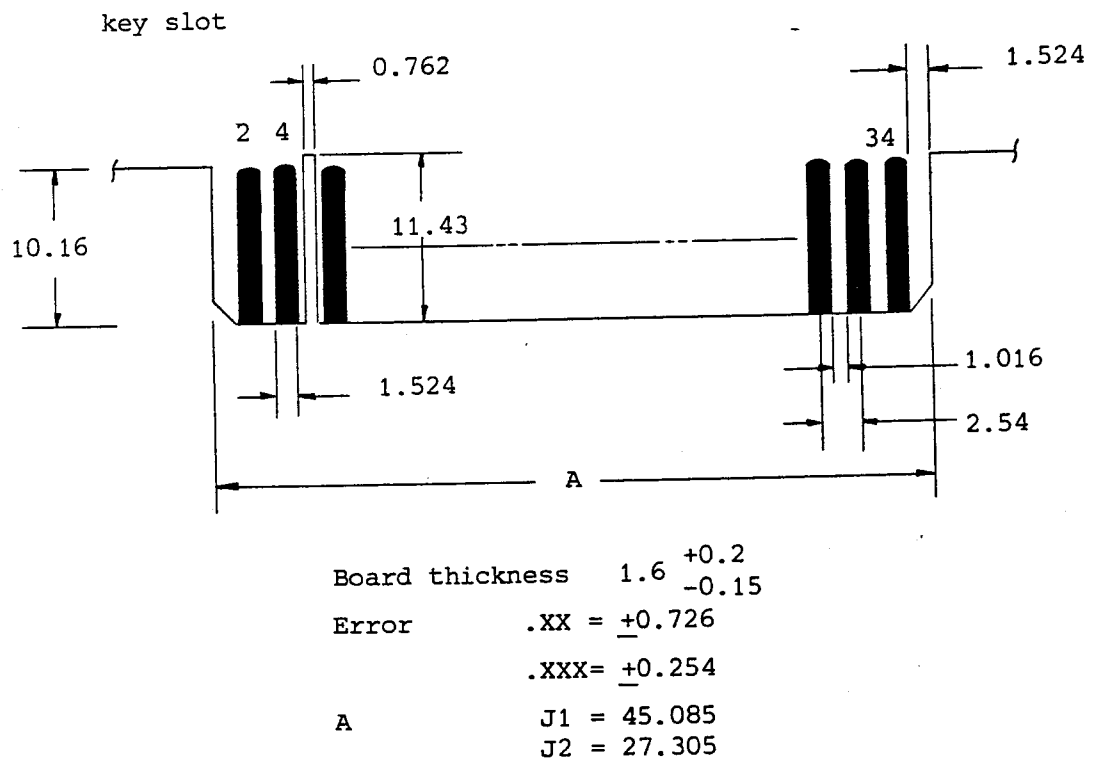


Fig. 4.2 D5104 J1/J2 Connector Dimensions

4.2.1 INTERFACE CIRCUIT

The signal interface circuits are outlined below in Figure 4.3.

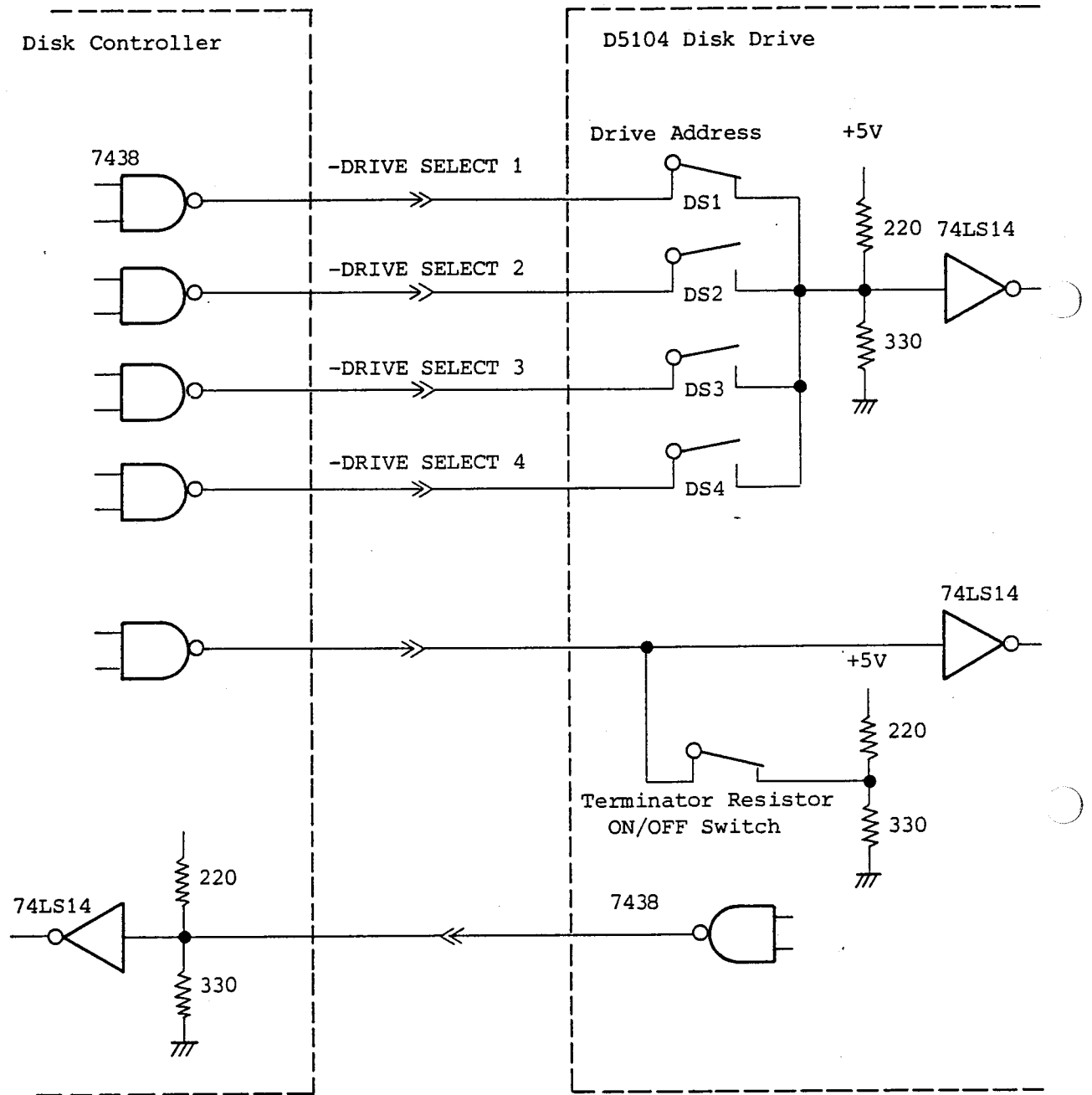


Fig.4.3-1 J1 Interface Circuit

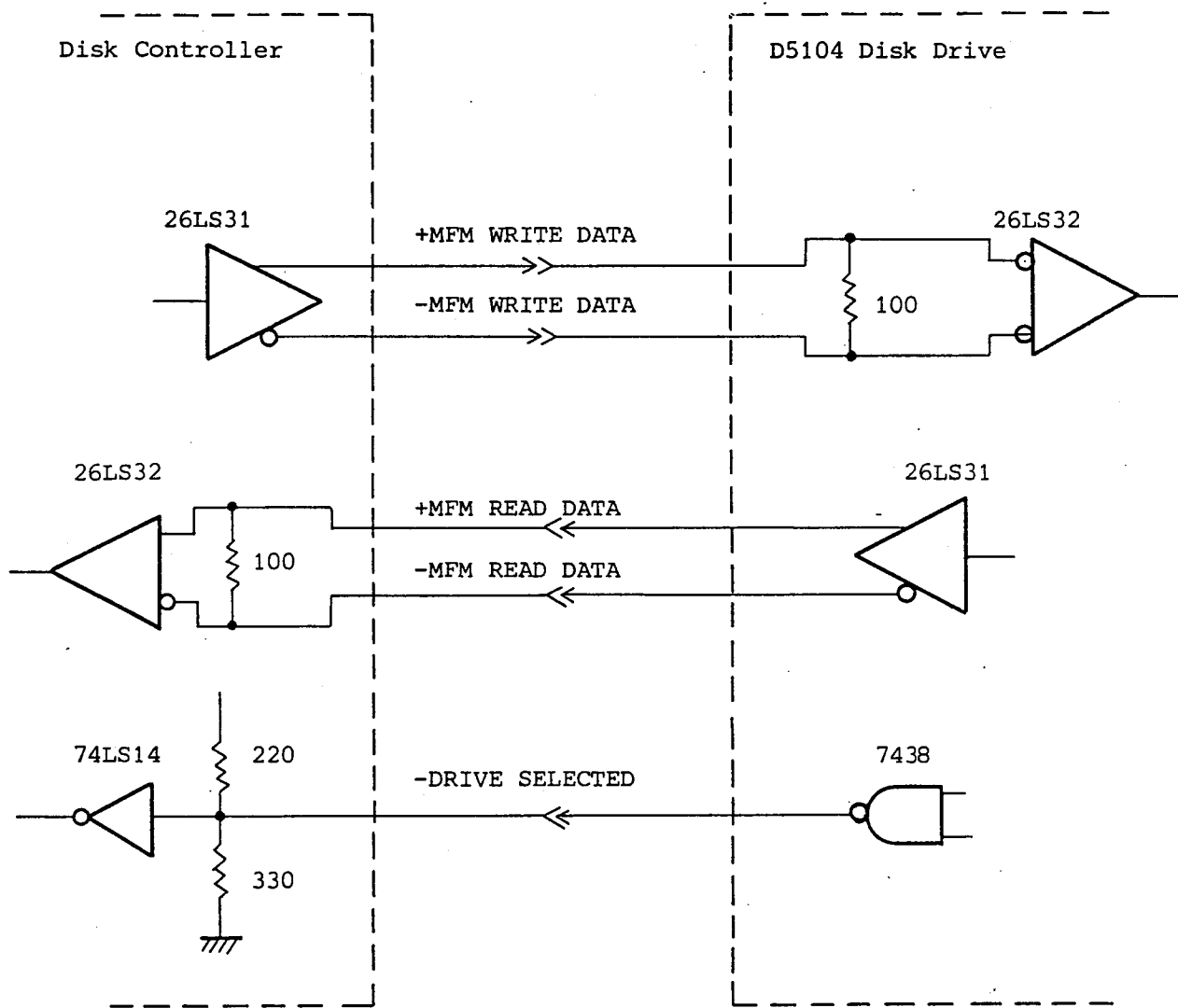


Fig. 4.3-2 J2 Interface Circuit

4.3 INTERFACE SIGNAL FUNCTION

The input lines have the following electrical specification.

TRUE	: 0.0 VDC to 0.4 VDC	@ I = -40 mA
FALSE	: 2.5 VDC to Vcc	@ I = 0 mA

(Where Vcc is 4.75 VDC to 5.25 VDC)

(1) -DRIVE SELECT 1,2,3,4

The -DRIVE SELECT 1,2,3,4 signals are control signals used for logical connection between the disk controller and the disk drive to be accessed.

With any one of the -DRIVE SELECT signals set to be 'true' the interface signal of connector J1 on the disk drive that has been given the same number by the drive address switch is effective.

At the time of shipment the drive address is preset to allow selection only when -DRIVE SELECT 1 is 'true'.

If only one disk drive is connected -DRIVE SELECT 1 can be used without change. If two or more disk drives are connected to a disk controller, change the drive address switch according to Table 4.3.

Table 4.3 Drive Address Setting

Drive Address	DS1	DS2	DS3	DS4
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	ON

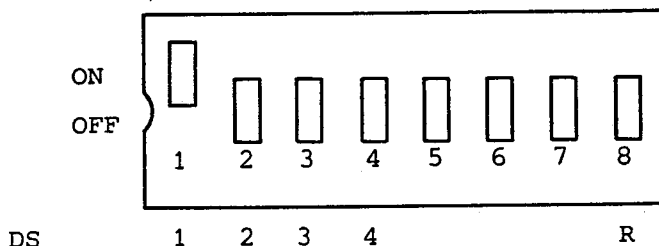


Fig.4-4 Drive Address Switch

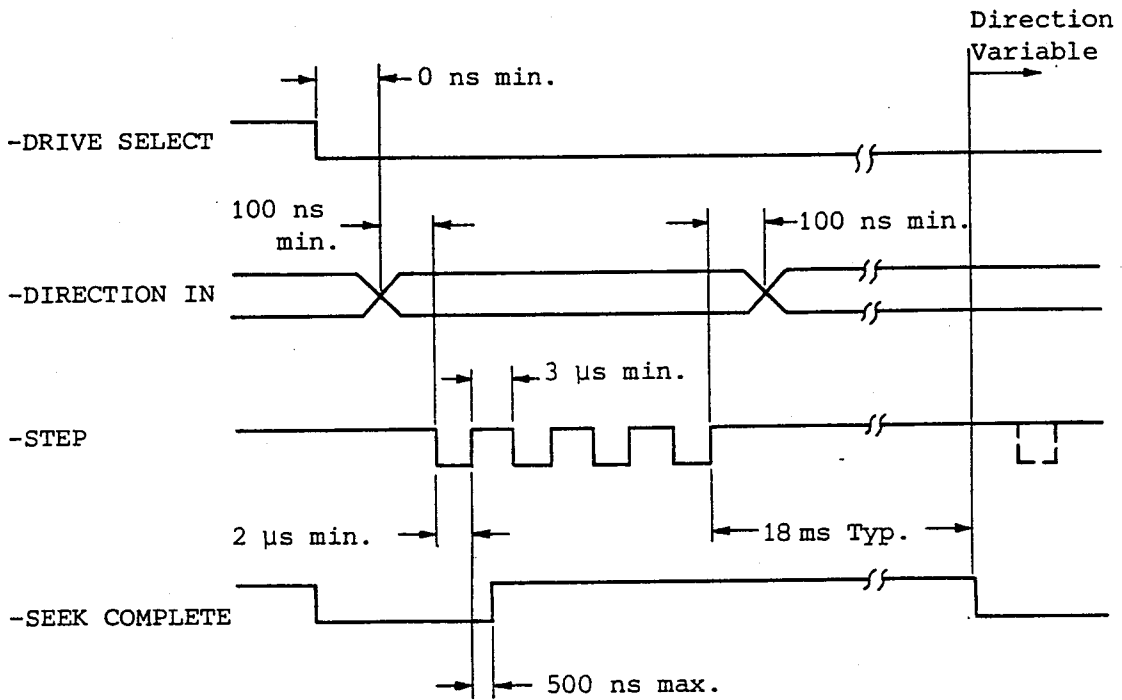
The front-panel LED illuminates when the disk drive is selected by the corresponding -DRIVE SELECT signal and is in the READY state.

This disk drive allows functional change of control signal (connector J1 signal) to the Radial system. Changing to the Radial system is available by setting the drive address switch "R" (Figure 4.4) to ON. In this condition all input and output signals are effective independently of the -DRIVE SELECT signal. There is no change in the turn-on conditions of the front-panel LED.

(2) -STEP

The -STEP signal is a 'true' pulse signal that causes the read/write head to move in the direction specified by the -DIRECTION IN signal. The read/write head moves one cylinder each time the -STEP signal to the -DRIVE SELECT, -DIRECTION IN and -SEEK COMPLETE signals are shown in Figure 4.4.

-DIRECTION IN needs to be settled earlier than 100 nsec before the -STEP signal transfers from 'false' to 'true' and be maintained until later than 100 nsec after the 'false' to 'true' transition. When direction of read/write head movement is to be changed, a -STEP signal must be issued after the -SEEK COMPLETE signal has transferred to 'true'.



* 18 ms typ. in low-speed seek mode. Seek time in high-speed seek mode is maximum 215 ms.

Fig.4-5 Step Timing

The disk drive operates in any of the two modes: low speed seek mode and high-speed mode.

In the high-speed seek mode (Buffered Seek mode) where the -STEP signal pulse interval is from 3 to 200 us the disk drive performs seek operation at an optimum step rate after storing the number of -STEP pulses and calculating the distance of head movement. In the low-speed seek mode where the -STEP signal pulse interval is more than 3ms the disk drive seeks one cylinder each time a -STEP signal is issued. For the -STEP signal whose pulse interval is between 200us and 3 ms, the disk drive operates in combinations of high-speed and low-speed seek modes, provided the -STEP signal is kept effective.

(3) -DIRECTION IN

This signal specifies the direction of read/write head movement effected by the -STEP signal. 'False' indicates the direction toward outer cylinder (cylinder 0); 'true' indicates the direction toward inner cylinder.

(4) -SEEK COMPLETE

This signal is 'true' when the read/write head has moved to the desired cylinder, indicating, together with the -READY signal, that read/write operation and seek operation including a change in the direction of head movement are available.

(5) -READY

This signal indicates the status of the disk drive. The signal, when 'true', indicates that the disk drive is ready for seek operation. When both the -READY and -SEEK COMPLETE signals are 'true', the disk drive is ready for read/write operation.

The -READY signal is 'false' under the following conditions.

- (i) During the time from power on to the completion of start-up operation.
- (ii) When +5V power is not supplied.
- (iii) When Write fault condition is detected (refer to (11) in this paragraph).

(6) -Track 0

This signal indicates that the read/write head is positioned at cylinder 0 (outermost cylinder). The 'true' state denotes cylinder 0.

(7) -INDEX

This is a pulse signal that indicates the beginning of a track. Each time the disk rotates one turn, a 'true' signal is generated. The transition point from 'false' to 'true' state indicates the beginning of a track.

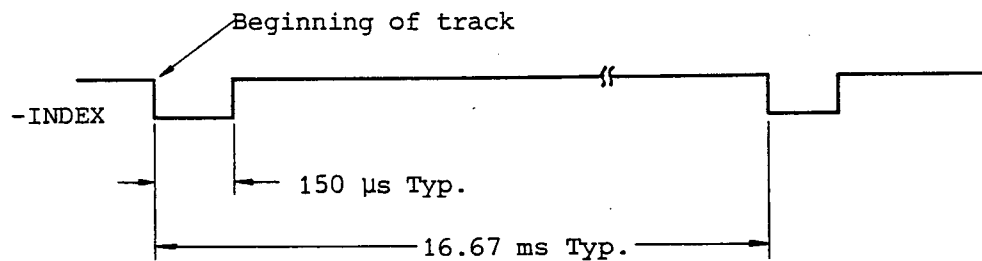


Fig.4-6 -INDEX timing

(8) -HEAD SELECT 0,1,2

The -HEAD SELECT 0,1,2 signals are used to select the desired read/write head of the disk drive. The relationships between signal status and read/write heads to be selected are shown in Table 4.4.

The timing relation of the -HEAD SELECT signals to -WRITE GATE, +MFM WRITE DATA and +MFM READ DATA are given in Figure 4.8.

Table 4.4 Selected Head No.
and -HEAD SELECT 0,1,2

Head No.		-HEAD SELECT		
D5114	D5124	0	1	2
0	0	false	false	false
1	1	true	false	false
-	2	false	true	false
-	3	true	true	false
-	-	false	false	true
-	-	true	false	true
-	-	false	true	true
-	-	true	true	true

Note: "-" denotes the absence of head to be selected. (Write Fault condition)

(9) -WRITE GATE

This signal, when 'true' causes write current to flow in the read/write head, so that data entry is made available by transferring write data on the +MFM WRITE DATA signal.

The -WRITE GATE signal cannot be 'true' while the -STEP signal is in the 'true' state. Write operation is inhibited by the protection circuit in the disk drive while the -READY or -SEEK COMPLETE signal is the 'false' state.

(10) -WRITE FAULT

This signal, when 'true' indicates the abnormal condition of the disk drive. When the -WRITE FAULT signal is 'true' both the seek and write operations are inhibited by the protection circuit in the disk drive.

This signal cannot be reset by the interface signal so far as the abnormal condition of the drive is not recovered. That is, when the abnormal condition is removed, the -WRITE FAULT signal goes back to the 'false' state. Detection of a short-time Write Fault state requires the disk controller to detect and maintain the 'false' to 'true' transition of the -WRITE FAULT signal.

The following are the conditions where the -WRITE FAULT signal is 'true'.

- (i) Write current is flowing in the read/write head when -WRITE GATE signal is 'false'.
- (ii) No write current is flowing in the read/write head when -WRITE GATE signal is 'true'.
- (iii) Two or more heads are selected at a time or no head is selected.
- (iv) DC voltage are out of tolerance.
- (v) Spindle speed is out of tolerance.
- (vi) Abnormality is present at the 0-track sensor while the disk drive is performing auto-recalibration at power on.

(vii) Starting of spindle motor is not available at power on.

(11) -REDUCED WRITE CURRENT (Not used)

This signal is used to vary the write current at the writing operation. However, this signal is not used in this disk drive because write current is automatically varied by the built-in microprocessor. But this signal is connected to terminator.

(12) +MFM WRITE DATA

These signals specify the reversal of magnetization of data to be written on the disk. The reversal is caused when the +MFM WRITE DATA voltage exceeds the -MFM WRITE DATA voltage.

To improve the reliability of the write data on the cylinders numbered 128 or more, Write Precompensation must be performed by the disk controller. The data pattern requiring Write Pre-compensation is shown in Figure 4.7, where the optimum value is 12 ns. Timing relations among -DRIVE SELECT, -HEAD SELECT and -WRITE GATE are shown in Figure 4.8.

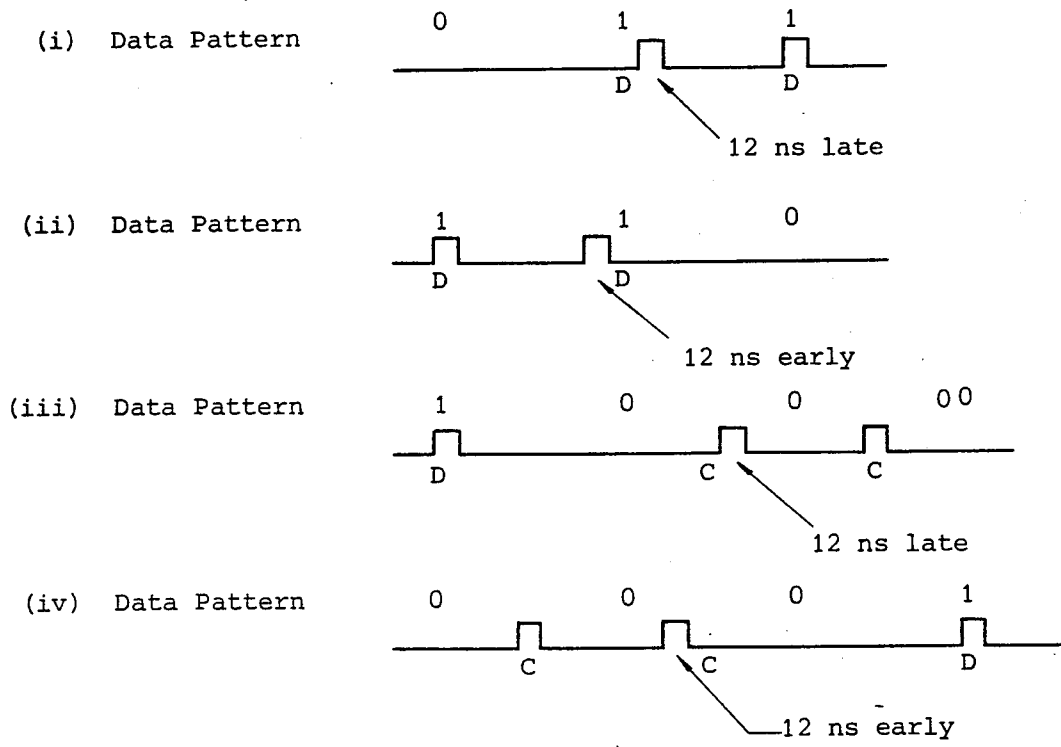


Fig.4-7 Data patterns Requiring Write Pre-Compensation

(13) +MFM READ DATA

These signals are used to transmit the data in the track. The reversal of magnetizing is indicated when the +MFM READ DATA voltage exceeds the -MFM READ DATA voltage. These signals are invalid when the -READY or -SEEK COMPLETE signal is 'false'. The timing relation among -DRIVE SELECT, -READ SELECT and -WRITE GATE are given in Figure 4.8.

(14) -DRIVE SELECTED

This signal indicates that the disk drive is selected. It is 'true' while the disk drive is being selected by the -DRIVE SELECT signal.

When the switch is set radially, the -DRIVE SELECTED signal is always in the 'true' state.

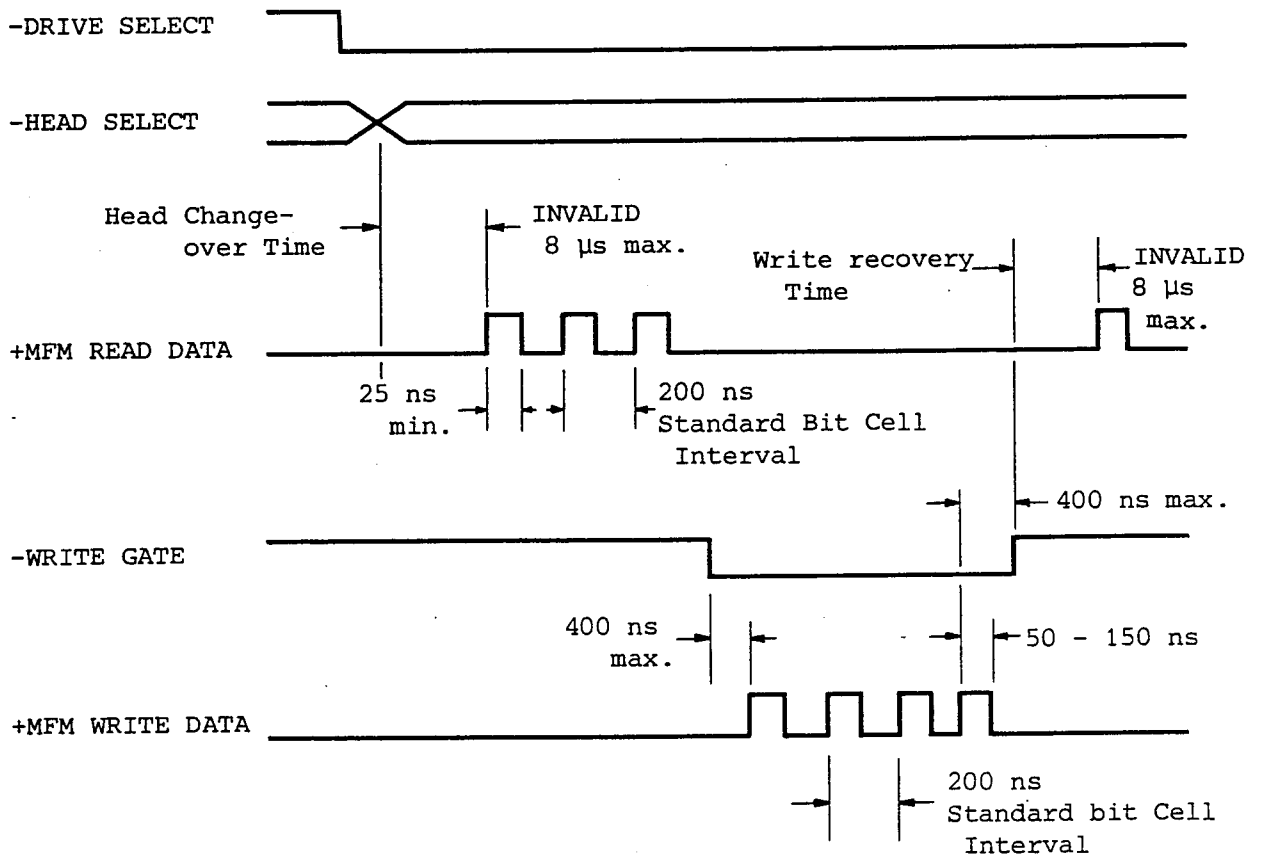
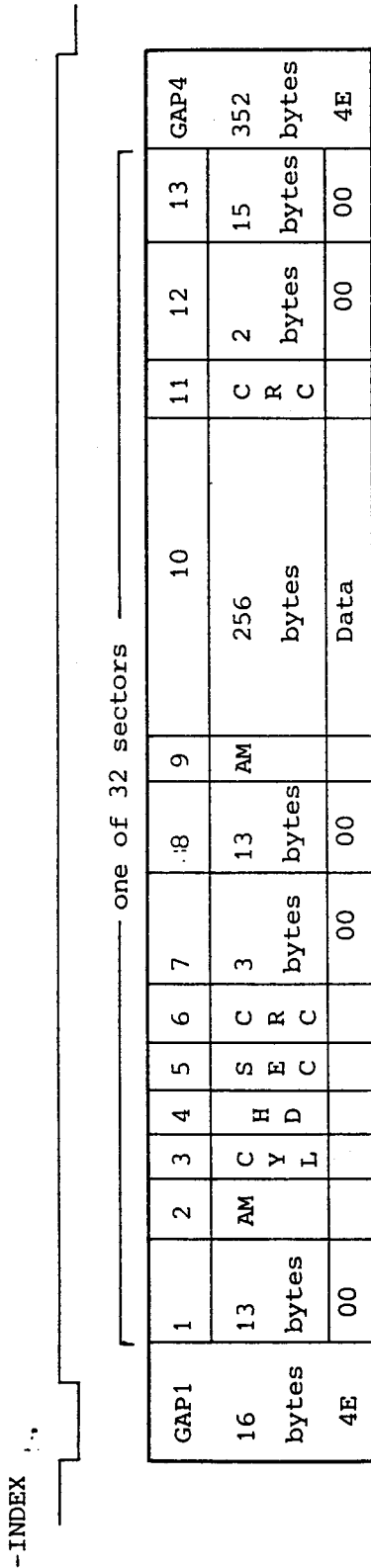


Fig.4-8 Data Timing

4.4 RECORDING DATA FORMAT

The D5104 magnetic disk drive employs the soft sector format. An example of the recommended format is shown below.



- | | |
|---|--|
| <p style="text-align: center;">A1FE</p> <ol style="list-style-type: none"> 1. 13 bytes 2. 1 byte 3. 1 byte 4. 1 byte 5. 1 byte 6. 2 bytes, CRC 7. 3 bytes 8. 13 bytes 9. 256 bytes data 11. 2 bytes, CRC 12. 3 bytes 13. 15 bytes | <p style="text-align: center;">A1F8</p> <ol style="list-style-type: none"> (00) - VFO SYNC area (A1FE) - ID address mark (including missing clock) - Cylinder address - Head address (bit 7 = 1 denotes defective sector, bit 5 indicates higher bit of cylinder address) - Sector address - $G(X) = X^{16} + X^{12} + X^5 + X^0$ (00) - Write switching gap (00) - VFO SYNC area (A1F8) - Data address mark (including missing clock) - Data area - $G(X) = X^{16} + X^{12} + X^5 + X^0$ (00) - Write switching gap (4E) - Sector partitioning gap |
|---|--|

5. POWER AND GROUND INTERFACE

5.1 INPUT POWER

Power required by the D5104 is shown in Table 5.1.

Table 5.1

Nominal voltage	Permissible deviation	Maximum current	Permissible* ripple
+5V DC	<u>+5%</u>	1.0 A	50 mVp-p
+12V DC (Power up)	<u>+10%</u>	2.5 A	100 mVp-p
(Read /Write)	<u>+5%</u>	1.8 A	100 mVp-p

* Permissible ripple applies in the following range
50 Hz to 5 MHz

+5V and +12V may be applied in any order. The power settling time shall be within 1 second.

+12V current

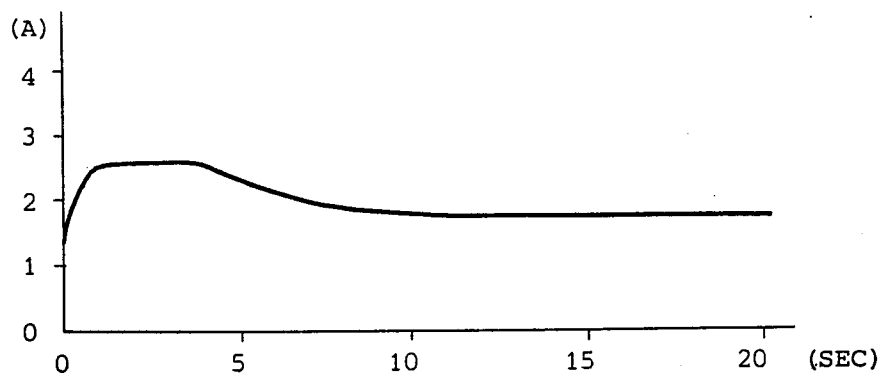


Fig.5-1 +12V Current Power Up Cycle

5.2 POWER INTERFACE PHYSICAL SPECIFICATIONS

Power interface parts listed in Table 5.2, and the pin assignment in Figure 5.2.

Table 5-2

D5104 connector J3	AMP Mate-N-Lock P/N 172294-1
Mate connector	AMP Mate-N-Lock P/N 1-480424-0

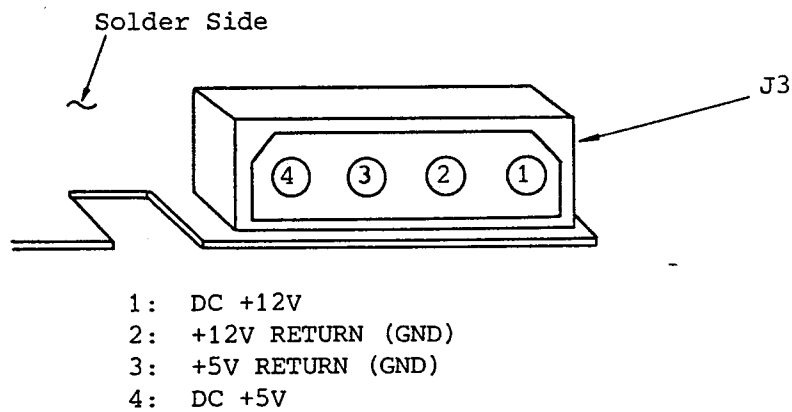


Fig.5-2

5.3 GROUND INTERFACE PHYSICAL SPECIFICATIONS

Ground J4 is a Faston AMP P/N 61761-2. The recommended mate connector is AMP 6218-1.

6. INSTALLATION

The D5104 magnetic disk drive can be installed either horizontally or vertically. When horizontal, the PWA side must be bottom.

The D5104 disk drive is mounted the same way as half height mini-floppy disk drive. See Figure 3.1 for details on mounting screw positions. There are eight screw holes for 6-32 UNC screws.

7. TRANSPORTATION

Cylinder 332 (Inner most cylinder) is provided for shipping.

Before power off, for transportation, it is recommended that controller commands the drive to seek to cylinder 332.

8. RELIABILITY AND MAINTENANCE

The D5104 magnetic disk drive has been designed to meet the following reliability levels when used correctly under the stipulated conditions and regular maintenance checks are not required.

(1) MTBF

11,000 POH

(2) MTTR

30 minutes max.

This time does not include parts transport and CE dispatch times.

(3) Component Design Life

5 years with normal operation.

(4) Error Rate

(a) Seek error rate

1 per 10^6 seeks max.

(b) Recoverable read error rate

1 per 10^{10} bits read max.

(within 16 retries including re-seek)

(c) Non-recoverable read error rate

1 per 10^{12} bits read max.

9. MEDIA DEFECTS

The D5104 magnetic disk drive is checked for presence of media defects before shipped from the factory.

Maximum defects allowed are 3 location per surface, and cylinder 0 is error free.

Table 9.1 Media defects

Model	D5114	D5124
Defects/surface	3	3
Defects/drive	6	12

Media defects are indicated by the presence of a "1" bit in bit position 7 of the HD byte in the ID field. (See RECODING DATA FORMAT).



RETURN LETTER

Title: RC750 Winchester disk
OEM Manual, WDD705 & WDD706

RCSL No.: 991 10098

A/S Regnecentralen af 1979/RC Computer A/S maintains a continual effort to improve the quality and usefulness of its publications. To do this effectively we need user feedback, your critical evaluation of this manual.

Please comment on this manual's completeness, accuracy, organization, usability, and readability:

Do you find errors in this manual? If so, specify by page.

How can this manual be improved?

Other comments?

Name: _____ **Title:** _____

Company: _____

Address: _____

Date: _____

Thank you

..... **Fold here**

..... **Do not tear - Fold here and staple**

**Affix
postage
here**

REGNECENTRALEN
af 1979

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