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## 1. SCOPE

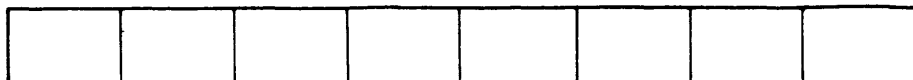
This document describes the characteristics and specification of the NP38 Disk Storage subsystem.

## 2. GENERAL DESCRIPTION

- (1) The NP38 Disk Drive is fixed Disk, random access memory device used for large capacity data storage and high speed data transfer which is designed to be suitable for the data processing system. There are three models AA4, A04, and B04. A one model AA4 or A04 can attach up to three B04s model.
- (2) The A04 model has two main parts, a controller and drive. The controller contains the logic necessary to control up to 16 NP38's address and Power Supply for control logic part. The drive part A04 module contains two Head Disk Assemblies (HDA). The HDA has two access mechanisms. The drive part also contains power supplies and Drive Logic circuitry which controls each actuator. The data to be written and read is transferred through shielded Read/Write cable between storage controller and A04 or AA4 control part. The data is encoded using new encoding technique 2-7 code and transferred between A04/AA4 controller parts and drive parts of A04, AA4 and B04.
  - An AA4 model has two controllers and one drive part. Each controller includes control functions to attach to two storage controllers and the logic required for dynamic path Selection (DPS). Other Parts are Same as A04 module.
  - A B04 module is same as the drive parts of the AA4 and A04 module.

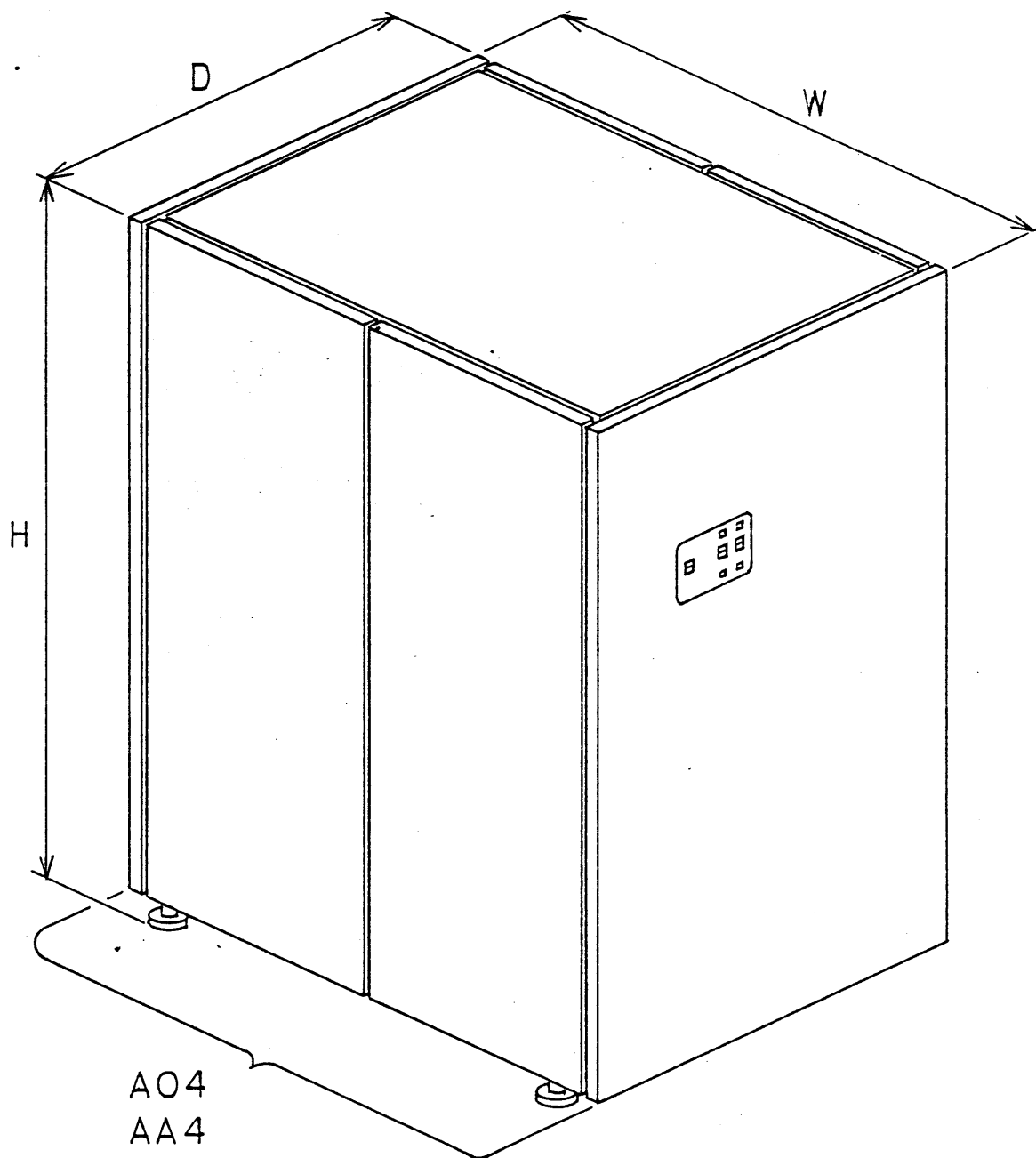
An HDA has two actuators which are actuated by separated each voice coil motors. Each actuator contains 15 movable read/write data heads and one servo head. (Totally 16 heads) The 16 heads access to 8 disk surfaces, two heads for each surfaces. (See Page 4.). Each surface is divided into two data areas associated with each data head, and composite servo surface is divided into one servo area and one data area associated. Each data area is separated into data cylinders numbered cylinder 000 through 885.

- Customer data cylinder 000 through 884.
- Alternate cylinder 885.



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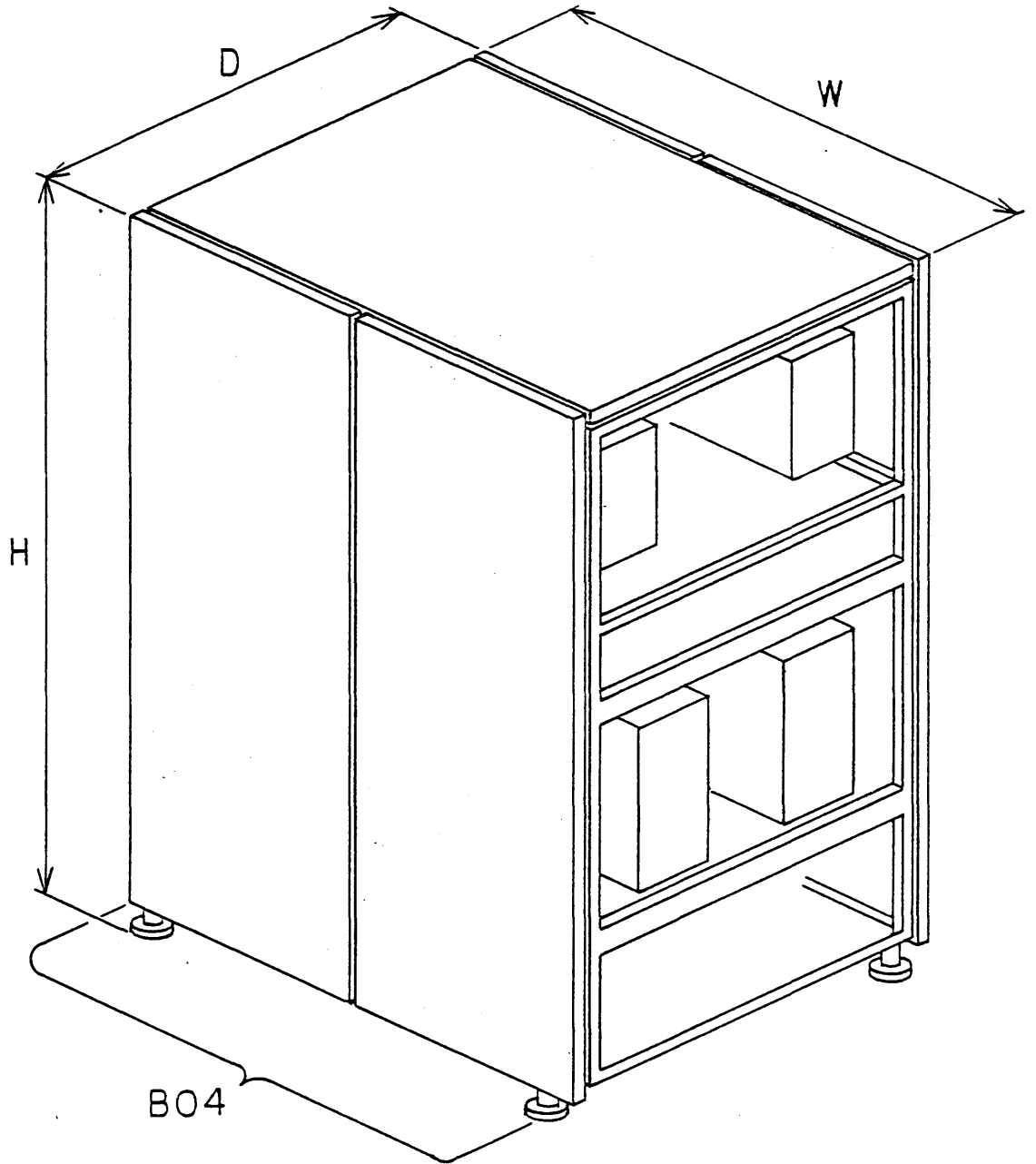
	W	D	H mm	Weight
AO4	1085	× 815	× 1500	575 Kg
AA4	1085	× 815	× 1500	575 Kg



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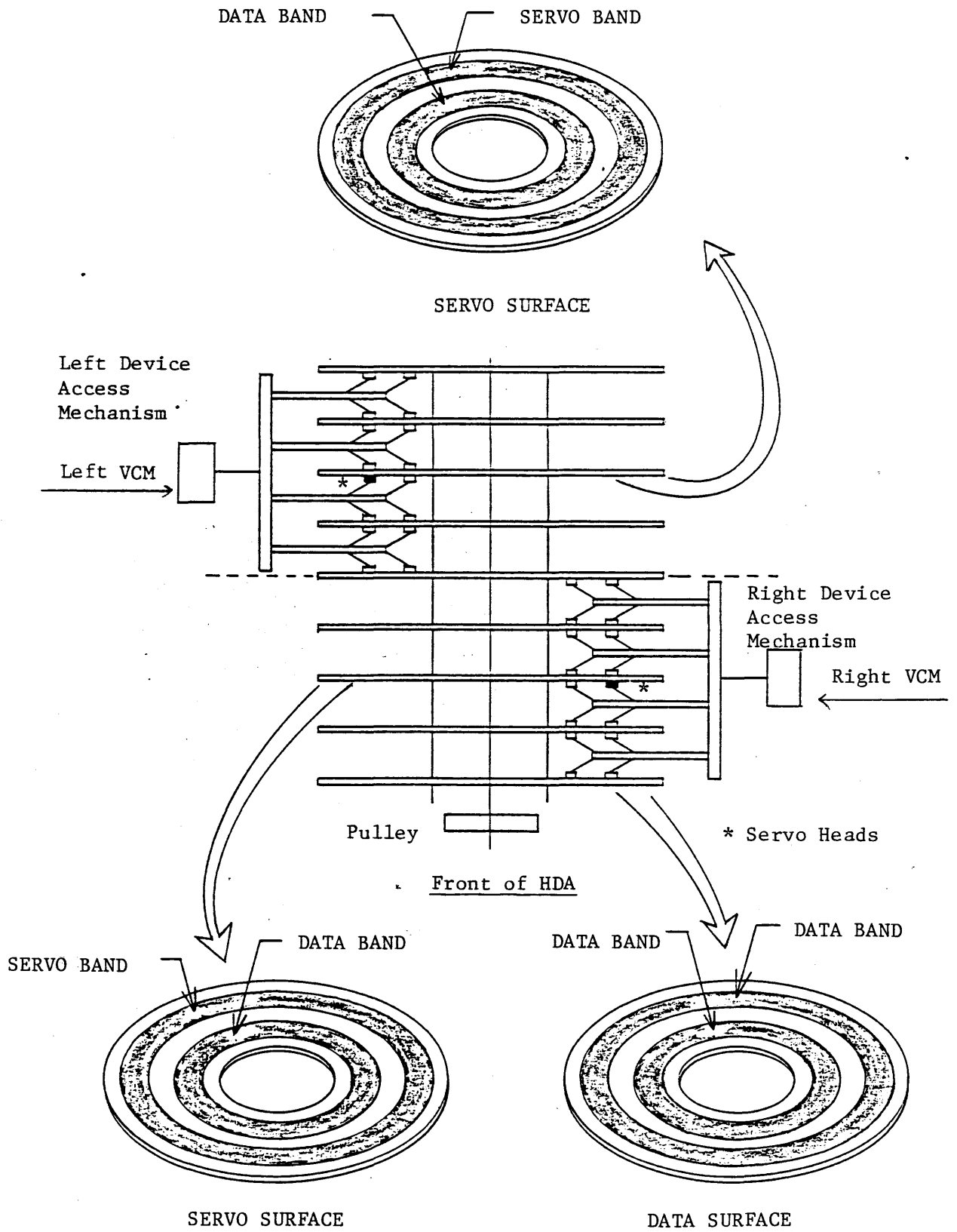
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	W	D	H <sub>mm</sub>	Weight
B04	1015	× 815	× 1500	500 Kg



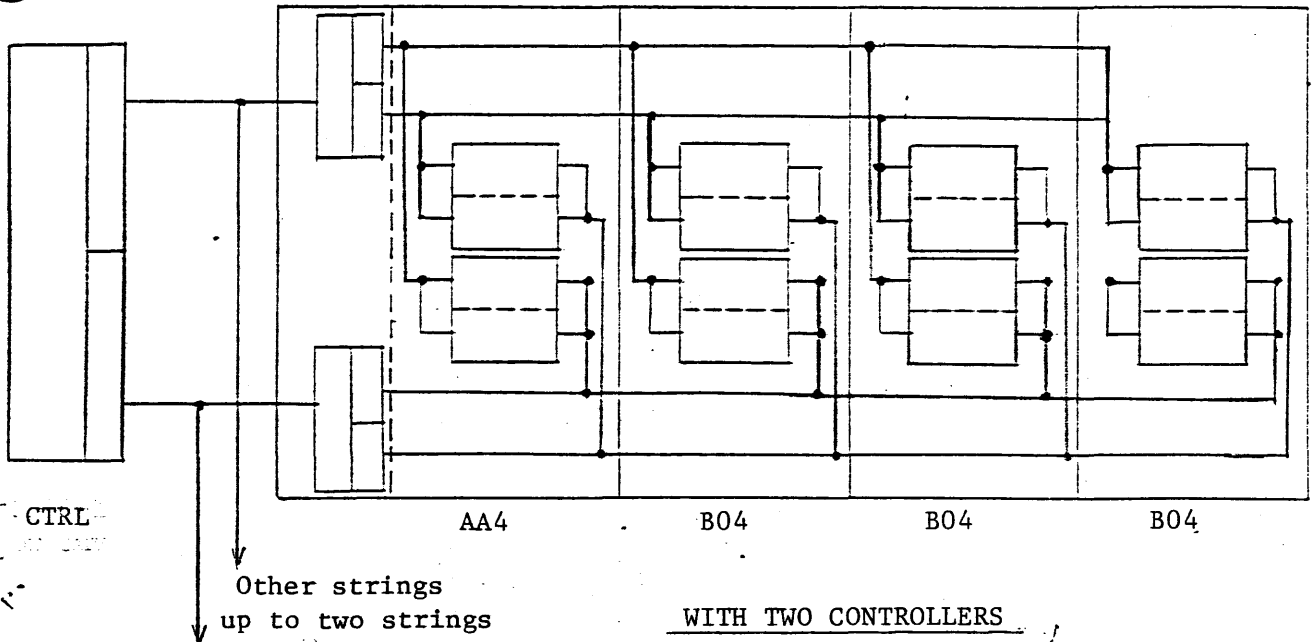
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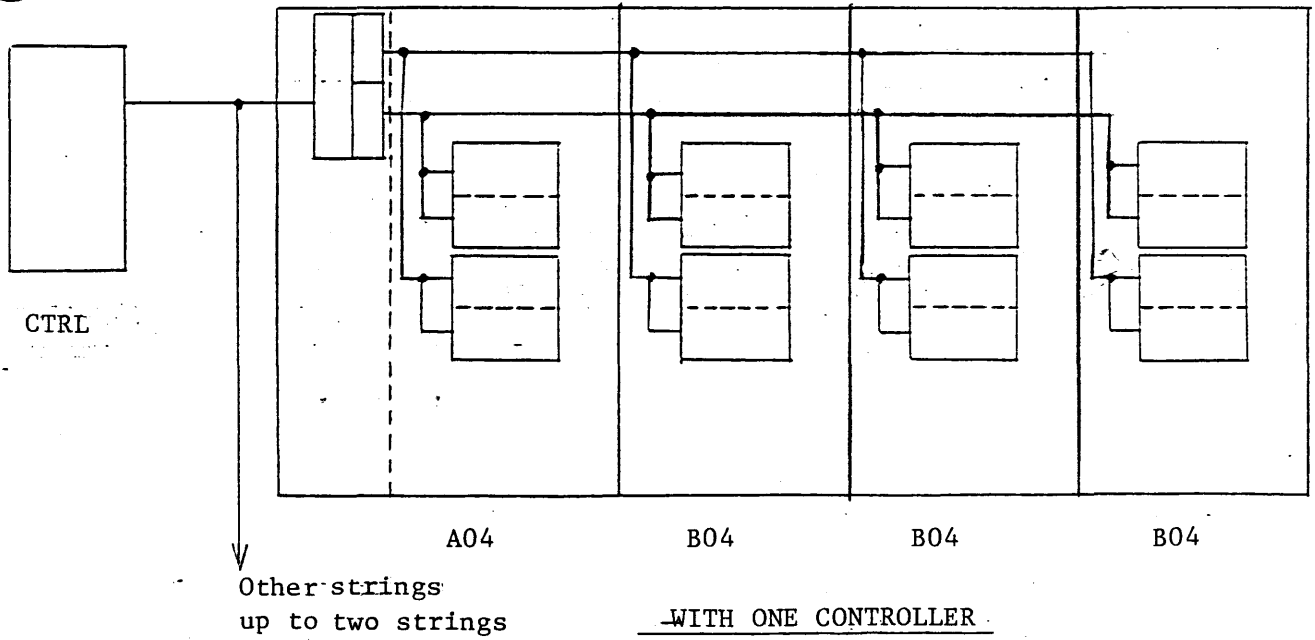
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①



Other strings up to two strings

②



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### 3. ENVIRONMENTAL REQUIREMENTS

The disk drive shall perform satisfactorily when operating under the following environmental conditions.

#### 3.1 Temperature

- a. Equipment operational : 16 to 32°C, with a max. gradient of 10°C per hour.
- b. Equipment non-operational : 4 to 43°C
- c. Temperature Cycling : No condensation shall result.
- d. Max. wet bulb temp : 26°C (Non operating 27°C)

#### 3.2 Relative Humidity

- a. Equipment operational : 8 to 80% R/H., provided there is no condensation.
- b. Equipment non-operational : 5 to 80% R.H., provided there is no condensation.

#### 3.3 Altitude

- a. Equipment operational : Mean sea level up to 6,000 ft above sea level.
- b. Equipment non-operational : From 1,000 ft. below sea level to 40,000 ft. above sea level.

#### 3.4 Vibration

- a. Equipment operational : The equipment shall withstand 0.2G and 3G for impact.
- b. With packing (Export) : The equipment shall withstand 0.5G and 5G for impact.

#### 3.5 Dust Control

The particle count, with a disk pack spinning and the heads loaded shall be less than 300 particles larger than 0.5 microns per cubic foot per minute.

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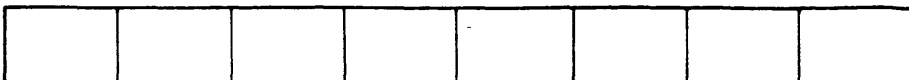
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### 3.6 A.C. Power

Voltage (standard) :	200, 208/230 VAC $\pm$ 10%, 60 Hz ( $\pm$ 1.5%) 3 phases, 4 wires.
Voltage (standard) :	380 VAC $\pm$ 10%, 50Hz ( $\pm$ 1.5%), 3 phases, 5 wires
Voltage (standard) :	200, 220/235 VAC $\pm$ 10%, 50 Hz ( $\pm$ 1.5%) 3 phases 4 wires.
current (starting) :	
Rush current	100 amperes (half cycle per drive)
Motor start current	35 amperes 5 seconds per spindle
current (operating)	15 amperes RMS/drive/phase maximum (200V/50Hz)

### 3.7 Service Life

The drive is designed and constructed to provide a useful life of 5 years or 35,000 operating hours, whichever occurs first, before a factory overhaul or replacement is required. Repair or replacement of parts will be permitted during the lifetime.



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### 3.8 Performance Specification

Average Machine Usage 500 hours/month

	AA4	A04	B04
1. MTBF hours	3,000	3,500	4,000
Unrecoverable Interrupt/month	0.167	0.143	0.125
2. Duration of Unrecoverable Interrupt			
Hours/Machine/Interrupt (without transit time)	1.0	1.0	1.0
3. Unscheduled Maintenance			
Hours/month/Machine	0.167	0.143	0.125
4. Scheduled Interrupt/month	0.25	0.25	0.25
5. Duration of scheduled Interrupt			
Hours/Machine/Interrupt	0.3	0.3	0.3
6. Scheduled Maintenance			
Hours/month/Machine (4 x 5)	0.075	0.075	0.075
7. Maintenance hours			
Hours/month/Machine (3 + 6)	0.242	0.218	0.200
8. Error Criteria			
Seek Errors	1 in 10 <sup>6</sup> access		
Data Errors	Correctable - less than 1 in 10 <sup>9</sup> bits Non-recoverable - less than 1 in 10 <sup>12</sup> bits		

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4. Specifications

4.1 Disk drive performance

Item \ Model	NP38-AA4	NP38-A04	NP38-B04
Total Capacity	2,521 Mbytes		
Positioning Time			
Min.	3 m sec		
Ave. less than	16 m sec		
Max.	30 m sec		
Average Latency Time	8.3 m sec		
Rotational speed	3600 rpm		
Data Transfer Rate	3 Mbytes/sec		
Number of spindle	2		
Physical dimensions (W x D x H)	1085 x 815 x 1500	1015 x 815 x 1500	
Weight	575 Kg	500 Kg	
Power Requirement	200, 220, 235, 380V/ 50Hz 3 phases 200,208,230V/ 60Hz 3 phases		
Power Consumption	2.4 KVA	2.2 KVA	
Heat output	6000 BTU/hr	5100 BTU/hr	
Operating Environment			
Temperature	16~32°C		
Humidity	20~80%RH		

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## 4.2 Head Disk Assembly (HDA)

### 4.2.1 Specification of HDA

Number of platters	9
Heads per actuator	Data 15 Servo 1
Actuators per Spindle	2
Byte Capacity per Spindle (M Bytes)	1,260
Byte Capacity per Actuator (M Bytes)	630
Cylinder per Actuator	885
Track per Cylinder	15
Byte Capacity per Track (Bytes)	47,476
Byte Capacity Per Cylinder (Bytes)	712,140
Bit Density (BPI)	15,293
Track Density (TPI)	800

Fig 4.2.1



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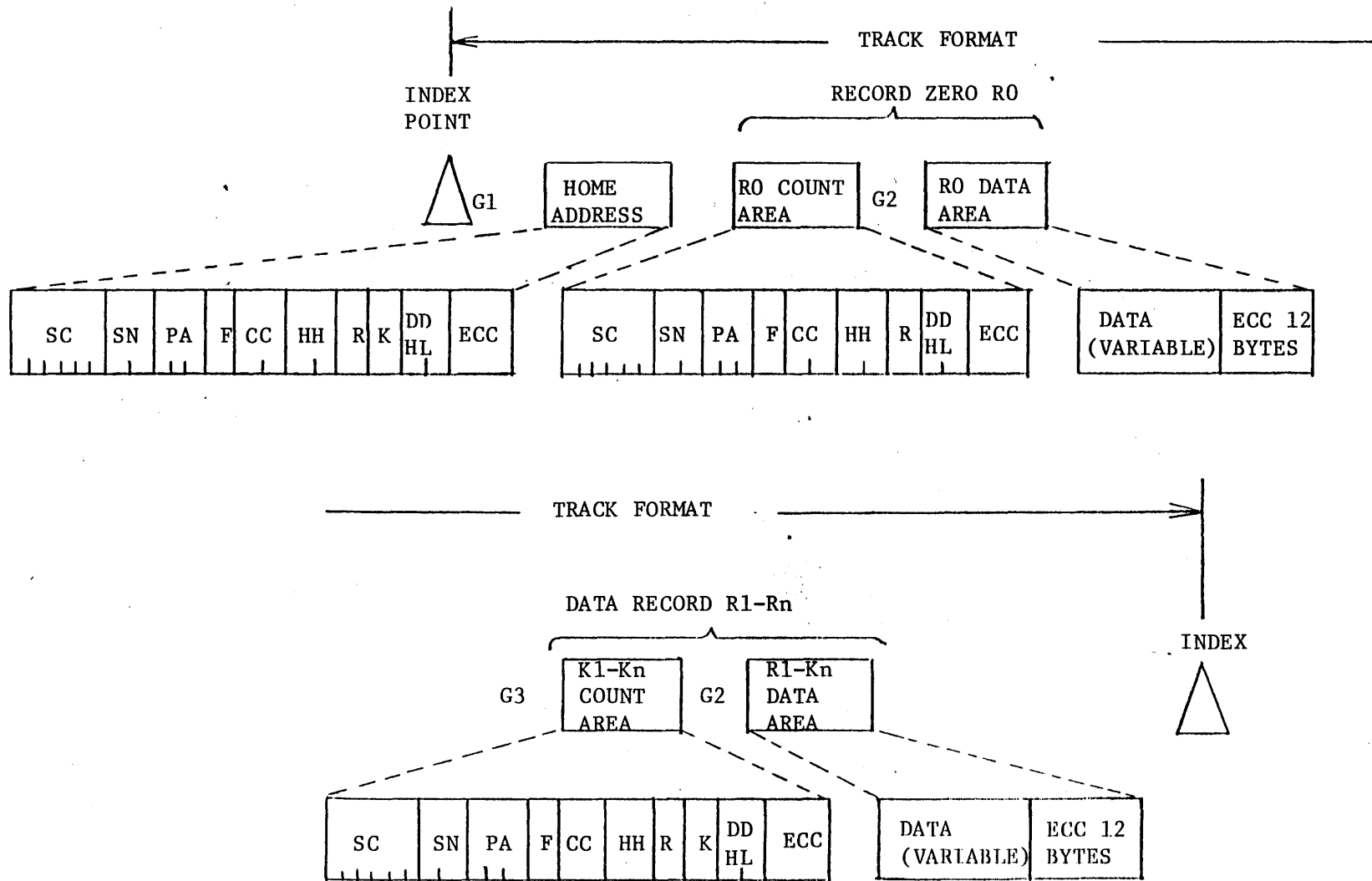
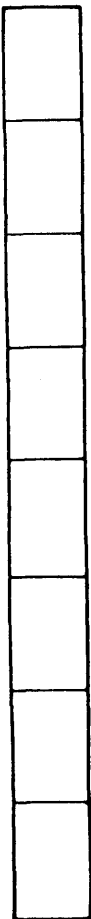


Fig 4.2.2.

### 4.3 Signal Types and Names

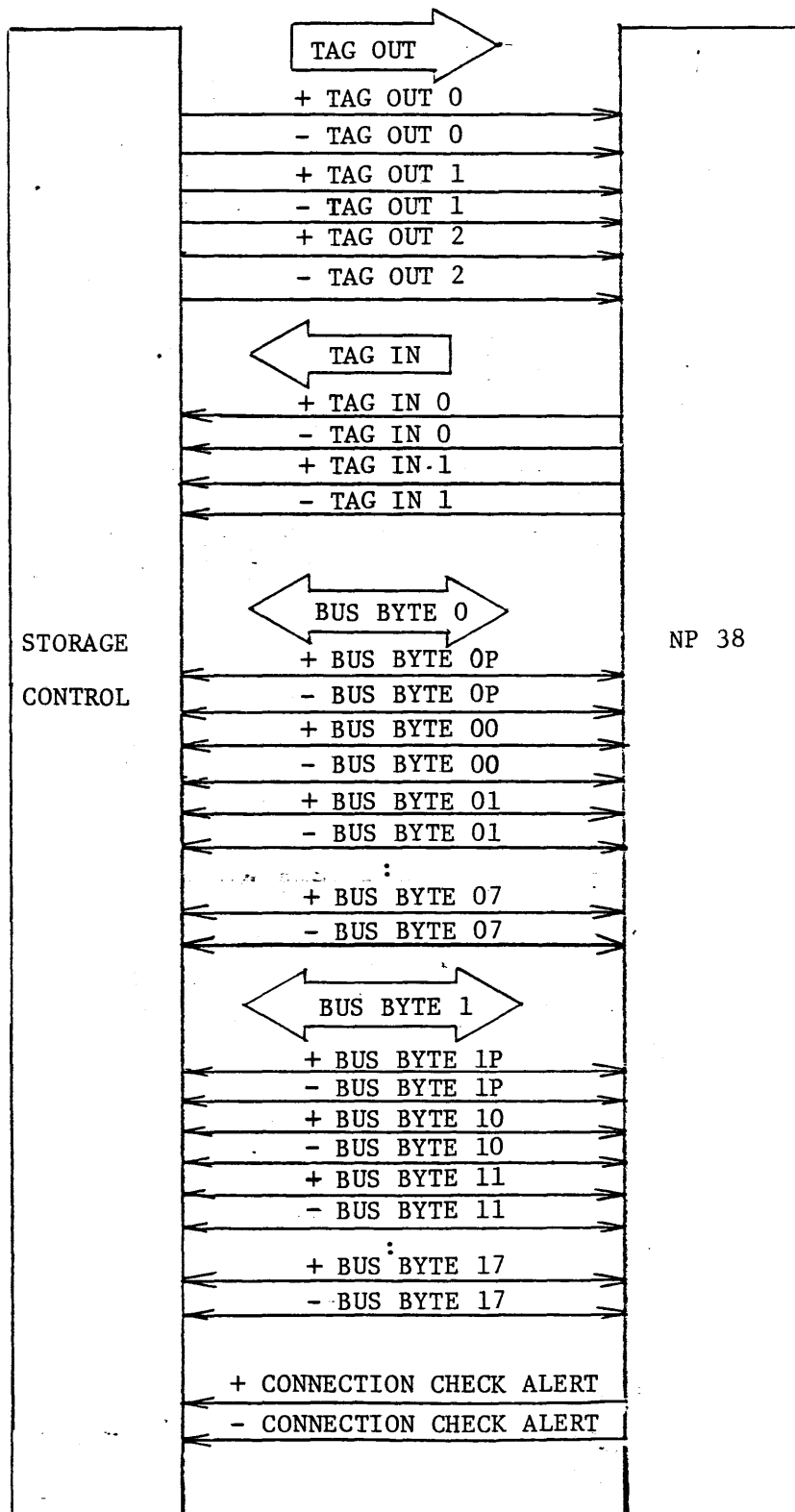
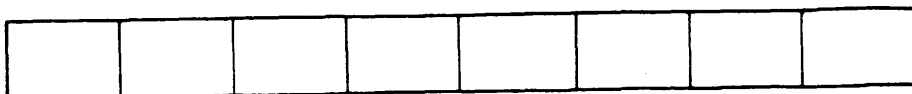


Fig 4.3



#### 4.4 Description of Signal Line

All signals are differential. Signal Name and Meaning are described as follows.

(1) TAG OUT 0,1,2.

These signals are activated by the storage control unit, and decoded by NP38. Each combination of 3 bit has the following meanings.

(i) Null Disconnect (0,0,0)

Release the selection of all Devices.

(ii) Select or Sync Out (0,0,1)

(a) In case of changing from (0,0,0)

Selects the Device designated on Bus Byte 0.

(b) In case of changing from (0,1,1) except (C)

Means that Bus Byte 0 have Modifier informations.

(c) In case of transferring data on read/write mode.

Means write data is on Bus Byte 0 and 1 during write operation. Means the storage control unit has received read Data on Bus Byte 0 and 1 during read operation.

(iii) Request Connection check 1 (0,1,0)

Causes NP38 to send the error informations to the Storage control unit.

(iv) Selected Null (0,1,1)

Means the Device is selected and no informations on interface.

(v) Poll (1,0,0)

Causes the NP38 to send the Device address, which has interrupt condition, on bus byte 1.

(Vi) Request connection check 2 (1,0,1)

Same as (iii)

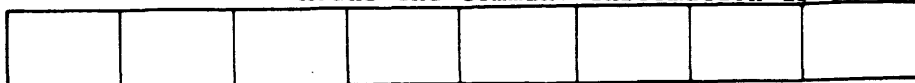
(Vii) Hardware Immediate (1,1,0)

Resets connection check alert.

(Viii) Command Gate or Sync out Stop (1,1,1)

(a) Command Gate

Means the command information is on Bus Byte 0.



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- (b) Sync Out Stop
- Means the residual number of Sync Out is 7 during transferring read/write data.
- (2) TAG IN 0,1
- These signals are activated by NP38, and informs the status of NP38 to the storage control unit. Each combination of 2 bits has the following meanings.
- (i) Null (0,0)
- Means the Device is not selected.
- (ii) Valid or Sync In (0,1)
- (a) Valid
- Means NP38 has received the in formations from the storage control unit.
- (b) Sync In
- Means read data is on Bus Byte 0 and 1 during read operation.  
Means NP38 is ready to receive write data during write operation.
- (iii) End Operation (1,0)
- Means the operation has completed.
- (iv) Selected Null (1,1)
- Means the Device is selected and waiting for the next command or modifier information.
- (3) BUS BYTE 0 (00~07,0P)
- (a) Transfer the command code or modifier byte to NP38.
- (b) Transfer the write data to NP38 during write operation, and the read data to the storage control unit during read operation.
- (4) BUS BYTE 1 (10~17,1P)
- (a) Transfer the device status to the storage control unit.
- (b) Transfer the write data to NP38 during write operation, and the read data to the storage control unit during read operation.
- (5) CONNECTION CHECK ALERT
- This signal is activated by NP38, when any significant error is detected on the interface between the storage control unit.



#### 4.5 Interface Signal Connectors

- (1) Interface signal connector of two types

A-type connector

B-type connector

Fig.4.5.1, Fig.4.5.3 show the pin layout of the interface signal connector.

- (2) NP38-AA4 has four connectors.

(connector Numbers 01T1,01T2,02T1 and 02T2.)

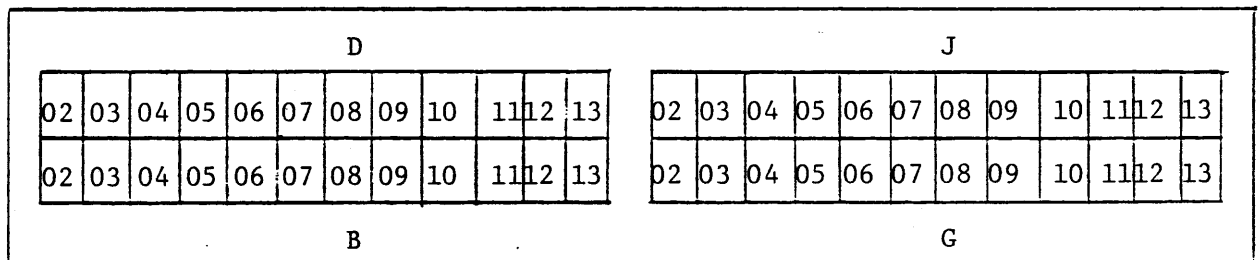
NP38-A04 has two connectors.

(connector Numbers 01T1 and 01T2)

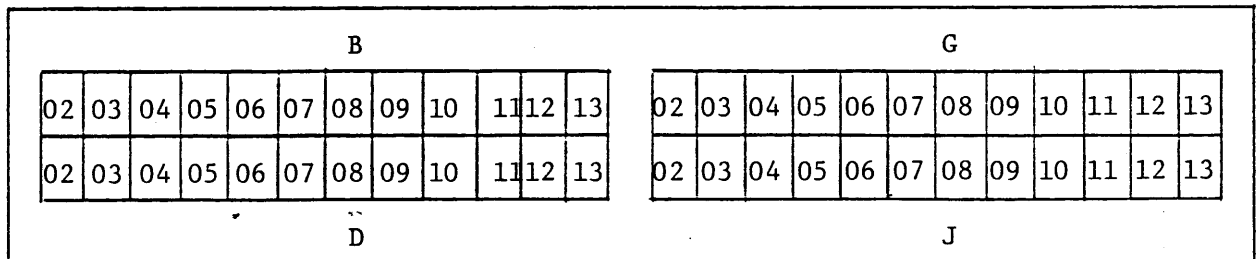
Fig.4.5.2 shows the type of each connectors

- (3) Fig.4.5.4 to Fig. 4.5.5 show the signal names and pin numbers for each connector.

- (4) Interface cable terminators (50 ohm + 2%) should be connected to the Interface connectors 01T1 and 02T1 of the last string.



A-type connector pin layout  
(From the view of the cable side)

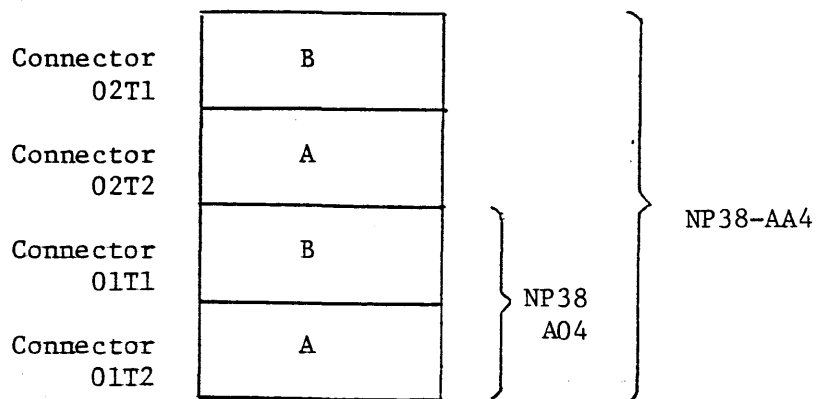


B-type connector pin layout  
(From the view of the cable side)

Fig. 4.5.1 Interface Connector Pin Layout







Note : The boxed A and B indicate the connector type (cable side)

Fig. 4.5.2 Connector Type

Connector Number	Connector Type	
	For Panel	For Cable
01T1	A-type (Brown)	B-type (Black)
02T1	Fujitsu Ltd. C630-5170-T801	Fujitsu Ltd. C630-5170-T802
01T2	B-type (Black)	A-type (Brown)
02T2	Fujitsu Ltd. C630-5170-T802	Fujitsu Ltd. C630-5170-T801

Fig. 4.5.3 Interface Signal Connector

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Connector Pin No.	Signal Name
B 02	+ DDC TAG OUT 0
03	- DDC TAG OUT 0
04	+ DDC TAG OUT 2
05	- DDC TAG OUT 2
06	+ DDC TAG IN 1
07	- DDC TAG IN 1
08	- DDC BUS OUT/BUS IN BYTE 01
09	+ DDC BUS OUT/BUS IN BYTE 01
10	- DDC BUS OUT/BUS IN BYTE 03
11	+ DDC BUS OUT/BUS IN BYTE 03
↓ 12	- DDC BUS OUT/BUS IN BYTE 05
B 13	+ DDC BUS OUT/BUS IN BYTE 05
D 02	- DDC TAG OUT 1
03	+ DDC TAG OUT 1
04	- DDC TAG OUT 0
05	+ DDC TAG OUT 0
06	+ DDC CON CHECK ALERT
07	- DDC BUS OUT/BUS IN BYTE 00
08	+ DDC BUS OUT/BUS IN BYTE 00
09	- DDC BUS OUT/BUS IN BYTE 02
10	+ DDC BUS OUT/BUS IN BYTE 02
11	- DDC CON CHECK ALERT
↓ 12	+ DDC BUS OUT/BUS IN BYTE 04
D 13	- DDC BUS OUT/BUS IN BYTE 04

Connector Pin No.	Signal Name
G 02	+ DDC BUS OUT/BUS IN BYTE 06
03	- DDC BUS OUT/BUS IN BYTE 06
04	+ DDC BUS OUT/BUS IN BYTE 0P
05	- DDC BUS OUT/BUS IN BYTE 0P
06	+ DDC BUS OUT/BUS IN BYTE 11
07	- DDC BUS OUT/BUS IN BYTE 11
08	- DDC BUS OUT/BUS IN BYTE 14
09	+ DDC BUS OUT/BUS IN BYTE 14
10	- DDC BUS OUT/BUS IN BYTE 16
11	+ DDC BUS OUT/BUS IN BYTE 16
↓ 12	- DDC BUS OUT/BUS IN BYTE 1P
G 13	+ DDC BUS OUT/BUS IN BYTE 1P
J 02	- DDC BUS OUT/BUS IN BYTE 07
03	+ DDC BUS OUT/BUS IN BYTE 07
04	- DDC BUS OUT/BUS IN BYTE 10
05	+ DDC BUS OUT/BUS IN BYTE 10
06	+ DDC BUS OUT/BUS IN BYTE 12
07	- DDC BUS OUT/BUS IN BYTE 13
08	+ DDC BUS OUT/BUS IN BYTE 13
09	- DDC BUS OUT/BUS IN BYTE 15
10	+ DDC BUS OUT/BUS IN BYTE 15
11	- DDC BUS OUT/BUS IN BYTE 12
↓ 12	+ DDC BUS OUT/BUS IN BYTE 17
J 13	- DDC BUS OUT/BUS IN BYTE 17

Fig. 4.5.4. connectors 01T1 and 02T1



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Connector Pin No.	Signal Name
B 02	- DDC TAG OUT 1
03	+ DDC TAG OUT 1
04	- DDC TAG IN 0
05	+ DDC TAG IN 0
06	+ DDC CON CHECK ALEAT
07	- DDC BUS OUT/BUS IN BYTE 00
08	+ DDC BUS OUT/BUS IN BYTE 00
09	- DDC BUS OUT/BUS IN BYTE 02
10	+ DDC BUS OUT/BUS IN BYTE 02
11	- DDC CON CHECK ALEAT
↓ 12	+ DDC BUS OUT/BUS IN BYTE 04
B 13	- DDC BUS OUT/BUS IN BYTE 04 <sup>D</sup>
D 02	+ DDC TAG OUT 0
03	- DDC TAG OUT 0
04	+ DDC TAG OUT 2
05	- DDC TAG OUT 2
06	+ DDC TAG IN 1
07	- DDC TAG IN 1
08	- DDC BUS OUT/BUS IN BYTE 01
09	+ DDC BUS OUT/BUS IN BYTE 01
10	- DDC BUS OUT/BUS IN BYTE 03
11	+ DDC BUS OUT/BUS IN BYTE 03
↓ 12	- DDC BUS OUT/BUS IN BYTE 05
D 13	+ DDC BUS OUT/BUS IN BYTE 05

Connector Pin No.	Signal Name
G 02	-DDC BUS OUT/BUS IN BYTE 07
03	+DDC BUS OUT/BUS IN BYTE 07
04	-DDC BUS OUT/BUS IN BYTE 10
05	+DDC BUS OUT/BUS IN BYTE 10
06	+DDC BUS OUT/BUS IN BYTE 12
07	-DDC BUS OUT/BUS IN BYTE 13
08	+DDC BUS OUT/BUS IN BYTE 13
09	-DDC BUS OUT/BUS IN BYTE 15
10	+DDC BUS OUT/BUS IN BYTE 15
11	-DDC BUS OUT/BUS IN BYTE 12
↓ 12	+DDC BUS OUT/BUS IN BYTE 17
G 13	-DDC BUS OUT/BUS IN BYTE 17
J 02	+DDC BUS OUT/BUS IN BYTE 06
03	-DDC BUS OUT/BUS IN BYTE 06
04	+DDC BUS OUT/BUS IN BYTE 0P
05	-DDC BUS OUT/BUS IN BYTE 0P
06	+DDC BUS OUT/BUS IN BYTE 11
07	-DDC BUS OUT/BUS IN BYTE 11
08	-DDC BUS OUT/BUS IN BYTE 14
09	+DDC BUS OUT/BUS IN BYTE 14
10	-DDC BUS OUT/BUS IN BYTE 16
11	+DDC BUS OUT/BUS IN BYTE 16
↓ 12	-DDC BUS OUT/BUS IN BYTE 1P
J 13	+DDC BUS OUT/BUS IN BYTE 1P

Fig 4.5.5 connectors 01T2 and 02T2



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## 4.6 Power supply

AC power for NP38 string should be supplied to AC power input terminals, then it is sent to subsequent each B04s.

There each drives of Model AA4, A04 and B04 has power sequence control circuitry, it is sequentially power ON/OFF by the control circuits. AA4/A04 also has phase rotation detector and indicator prevents from wrong phase connection. If the phase rotation is wrong, power on sequence cannot be initiated.

There are two controlling modes of power ON/OFF : Remote and local, which is determined by the manual switch inside the AA4/A04.

### 4.6.1 Specification for Input Power

#### (1) Input voltage

AC 3 phases 200, 220, 235, 380V/50Hz  
AC 3 phases 200, 208, 230V/60Hz

#### (2) AC Input terminal

Terminal screw diameter	M6
Terminal board name	TB1
Terminal number	R.S.T.N.G

#### (3) Input breaker capacity 40 Amp

### 4.6.2 Power Control Signal

#### (1) Connector

Connector Number	Part Number
P175	AMP
P176	171433-1

Fig. 4.6.1 Power Control Signal Connector

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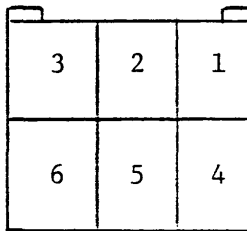


Fig. 4.6.2 Connector Pin Layout

(From the view of the cable side)

Pin No.	Signal Name
1	UNIT SOURCE (+24V)
2	Not used
3	SYSTEM SOURCE
4	SOURCE COMPLETE
5	POWER ON
6	Not used

Fig. 4.6.3 Connector Pin Numbers



#### 4.6.2

- (2) Meaning of power control signals NP38-AA4/A04 has two power control modes selected by internal manual switch.  
In the remote mode, power ON/OFF sequence is controlled by the power control signals sent from storage controller. Each signal has following meanings.  
In the local mode, power ON/OFF sequence is performed by Internal switches.

a) Unit source

This is +24V DC power generated in NP38-AA4/A04. This signal should be used for making power on signal as the signal source.

b) System source

This is DC power sent from storage controller and the voltage should be determined by storage controller side. This is used for making power complete signal as the signal source.

### 5. Switches and Indicators

#### 5.1 Operator panel

##### 5.1.1 Unit emergency switch

This switch is normally set at the power enable position. In the power enable position, NP38 power can be controlled by power on sequence signal from storage controller or internal power ON/OFF switch. In the power off position, NP38 power is stopped and inhibits the power on sequence from storage controller. The normal power off sequence is not performed and all NP38 operations are stopped.

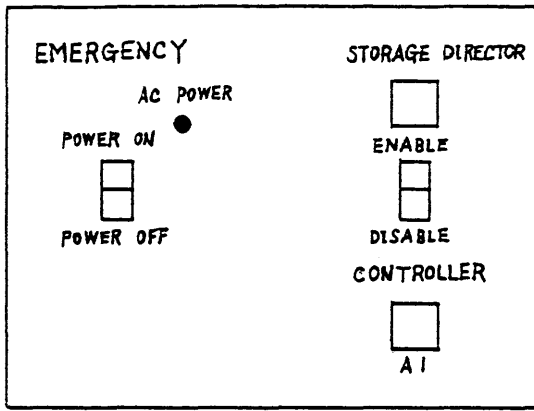
##### 5.1.2 Enable/Disable switch

This switch functions to connect or disconnect the control line between the equipments AA4/A04 and storage controller.

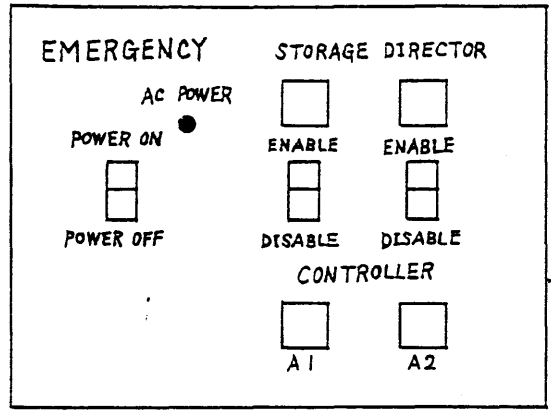
##### 5.1.3 AC Power on lamp (L.E.D)

This lamp lightes up as long as the equipment is supplied with AC Power.

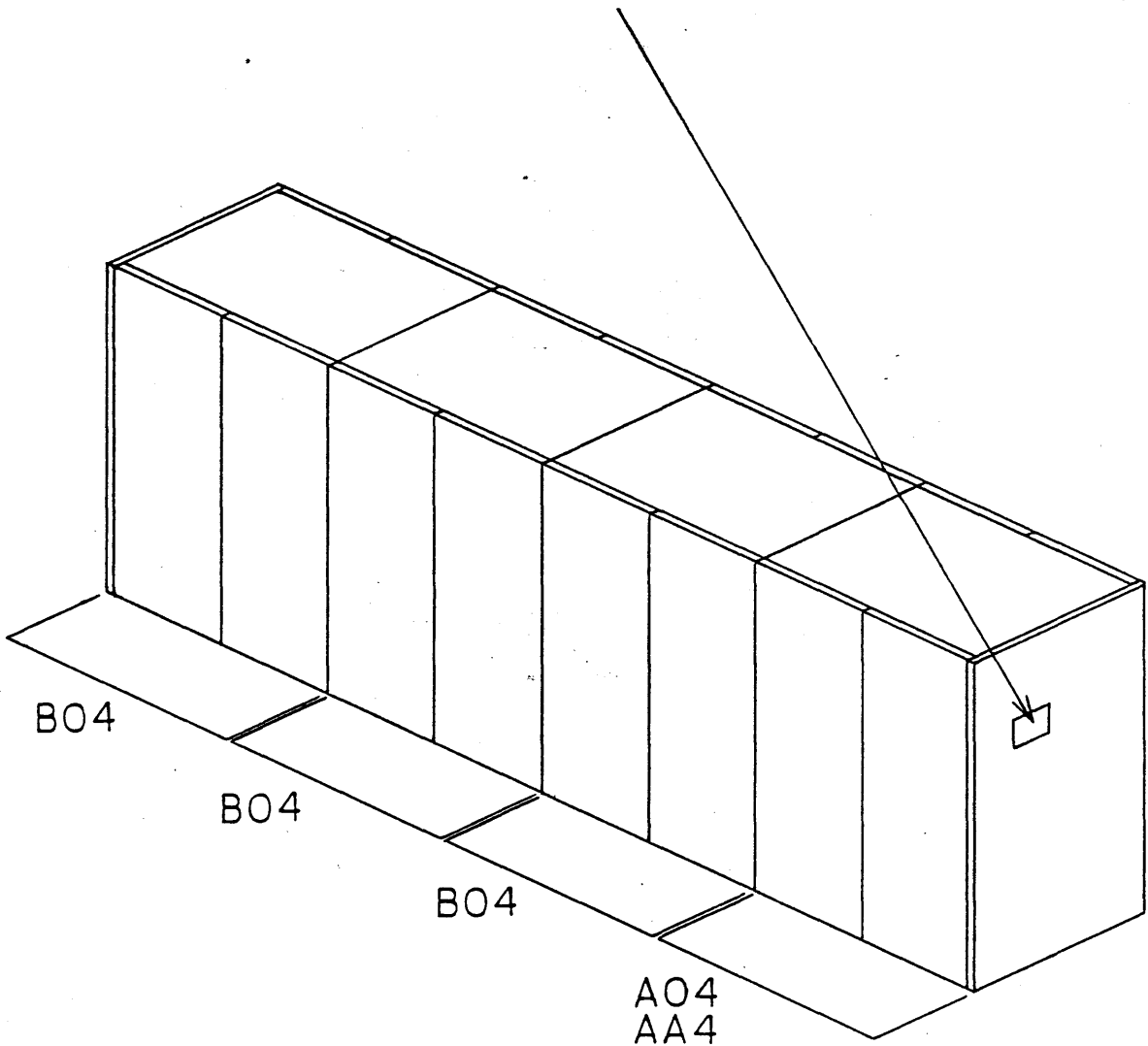




A04



AA4



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