Section 1

General Description

FUJITSU

1. GENERAL DESCRIPTION

1.1 GENERAL DESCRIPTION

1.1.1 General Description

This manual describes the Fujitsu 8-inch rigid disk drives M2321/M2322. These units contain non-removable disks in a sealed module. A rotary actuator using a closed loop servo performs head positioning.

These drives have floppy disk drive dimensions and can be mounted horizontally two drives wide in a 19-inch rack (with 3 pitch) or mounted vertically in a system cabinet.

The contact start/stop (CSS) type heads and media are of the whitney technology type. These units feature high performance, high reliability and low cost.

The maximum unformatted storage capacities of the M2321 and M2322 units are 84MB and 168MB , respectively.

The M2321 and M2322 utilize the industry standard SMD interface, thereby allowing the drives to be added to an existing disk configuration.

By standardizing on the SMD interface, development time for controllers and software will be substantially reduced. Fixed and variable sector length formats are internally selectable.

To power the drives only DC voltages of +24, +5 and −12 volts are required. This allows for international use. Total nominal power consumption is less than 150 watts.

1.1.2 Features

(1) High reliability
   (a) Whitney type technology contact-start/stop (CSS) heads and media are used.
   (b) Each head has an LSI circuit on its arm to amplify the small signal thereby reducing read errors by increasing the signal to noise ratio.
   (c) The heads, media and positioning mechanism are sealed in a closed-loop air filtration system.
   (d) The electrical components located within the sealed disk area are minimized.

(2) Maintainability
   No scheduled maintenance is required.
   The use of a completely sealed DE, a belt-eliminating built-in DC spindle motor, as well as highly reliable printed circuit assemblies, the necessity of maintenance is greatly reduced.

(3) Compact, Lightweight
   This unit can be mounted, two drives across in a standard 19-inch rack. The dimensions are almost floppy disk drive compatible. The weight of the unit is approximately 30 pounds (13.6 kg). Mounting equipment for the 19-inch rack can be provided as an option.

(4) Vertical/horizontal Mount Capability
   These units are available to vertical-mount and horizontal-mount by setting the ON-END switch to OFF, and ON-END mount by setting the ON-END switch to ON.

(5) Low accoustical noise level and low vibration allow for installation in an office environment.

(6) Uses only DC voltages. No internal changes are necessary for changes in frequency or power.

1.2 SPECIFICATIONS

1.2.1 Unit Specifications

The basic specifications of the disk drive are as follows:

Table 1-2-1 Basic Specifications

Model	Specification	Storage capacity
M2321K	B03B-4745-B001A	84M bytes
M2322K	B03B-4745-B002A	168M bytes

1.2.2 Physical Specifications

Table 1-2-2 Physical Specifications

Item	Conditions	Specifications
Dimension	Height	127mm (5.0")
	Width	216mm (8.5")
	Depth	380mm (15.0")
Weight *		13.6 kg (30 lbs)
Temperature	Operating	5°C to 40°C (41°F to 104°F)
	Non-operating	−40°C to 60°C (−40°F to 140°F)
	Gradient	Less than ±15°C/hour
Humidity	Operating	20% to 80% RH
	Non-operating	5% to 95% RH (Non-condensation)
Vibration resistance	Operating	Less than 0.2G (3 to 60 Hz) (2 minutes in both ways x 30-cycle sine wave)
	Non-operating	Less than 0.4G (3 to 60 Hz) (2 minutes in both ways x 30-cycle sine wave)
	Transporting and storing	Less than 3G (non-cyclic)
Altitude	Operating	Less than 3,000m (10,000 feet)
	Non-operating	Less than 12,000m (40,000 feet)
Dust		Less than 0.168 mg/m³ (Stearic acid standard)

* Optional units are excluded.

1.2.3 Power Requirements

The M2321K and M2322K requires +5V, -12V and +24V DC voltages from an optional power supply or system power supply. Each load current required by the drive is shown in Table 1-2-3.

Table 1-2-3 DC Power Requirement

DC Voltage	Load Current (Basic)	Load Current (With Dual Port)
+5V ± 5%	3.5A	4.5A
−12V ± 5%	3.0A	4.0A
+24V ± 10%	3.6 Arms (Effective, typical) 7.2 Ao-p (Maximum) 4.6 Arms (POW ON; Effective typical)	

Note: The D. C. return lines must be made electrically common AT the Power Supply when using other then the optional Fujitsu Power Supply. Failure to commonize these lines will result in premature failure of the spindle motor circuit.

The load currents of +5V DC and −12V DC will be stable regardless of operation being performed within the disk drive, however, the load current of +24V DC will be varied during a power up sequence or DC motor acceleration and/or seek operation.

The +24V DC load current profile during power up sequence is shown in Figure 1-2-1.

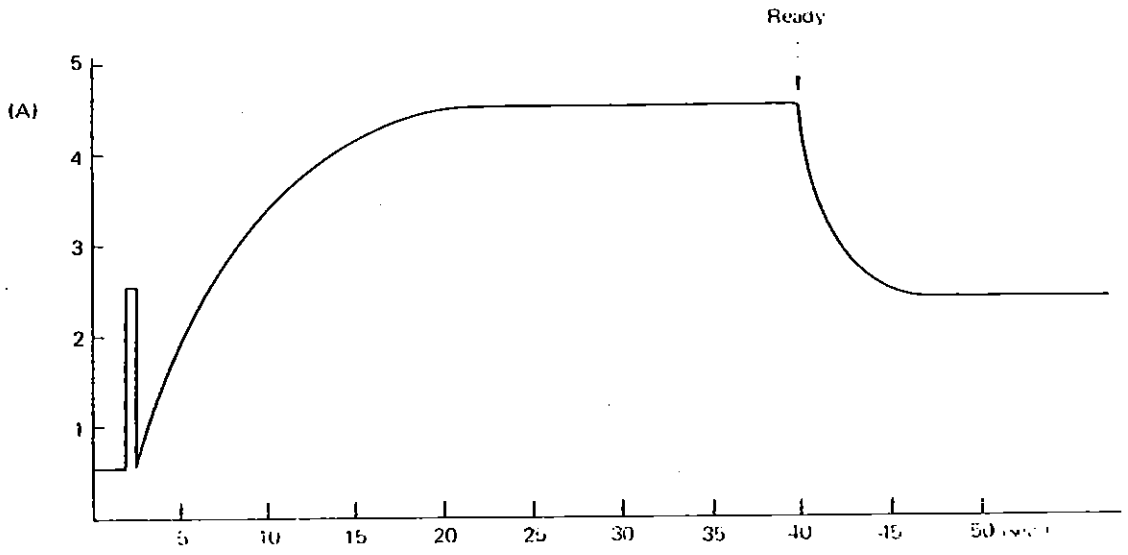


Figure 1-2-1 +24V DC Load Current on Power Up Sequence

The +24 DC load current profile during the repeated acceleration/inertia modes of DC motor and/or seek operation after Ready status is shown in Figure 1-2-2.

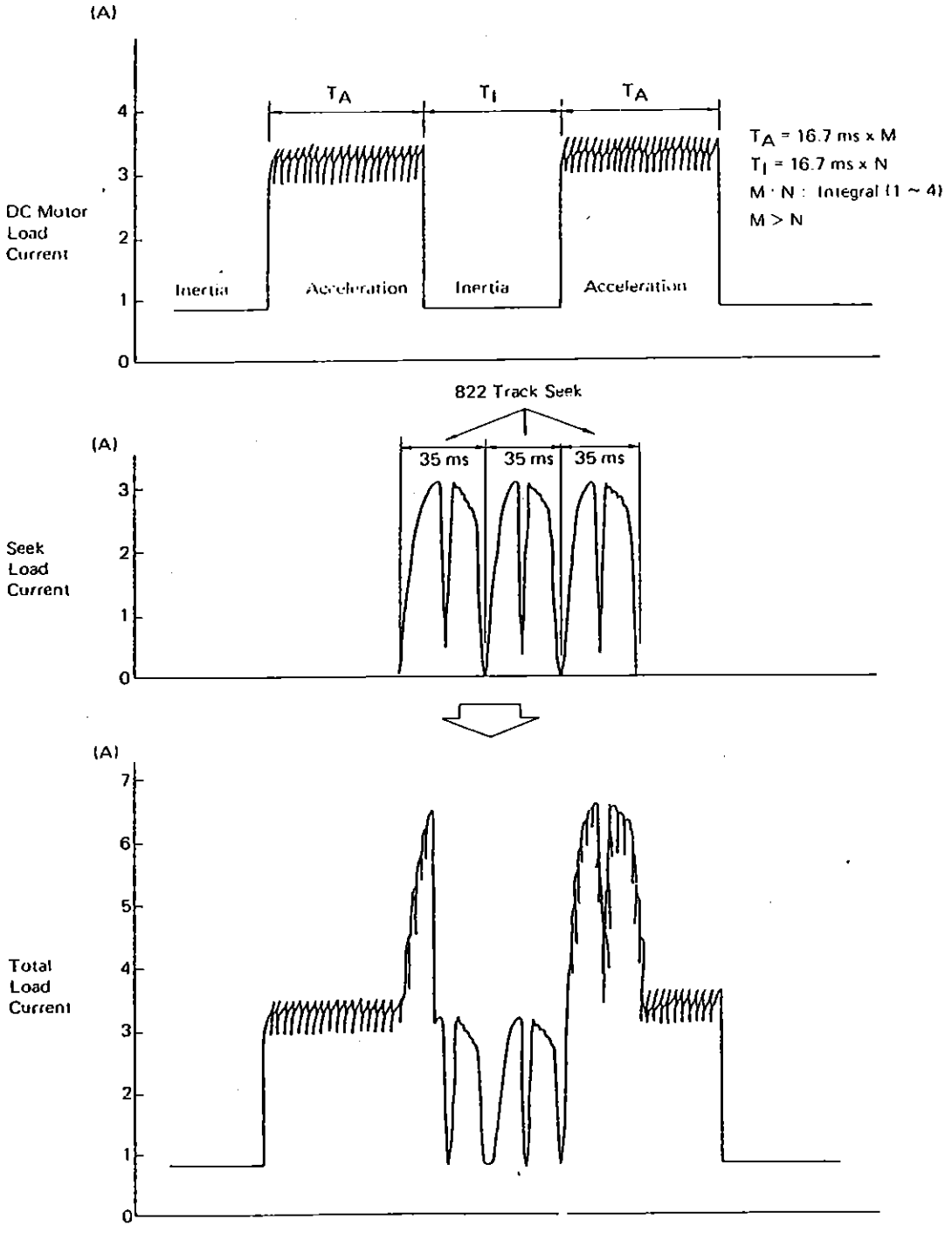


Figure 1-2-2 Total +24V DC Load Current (Ready)

1.2.4 Data Recording Specifications

Data recording specifications are presented in Table 1-2-4.

Table 1-2-4 Data Recording Specifications

Item		Specifications	
		M2321	M2322
Storage capacity (unformatted)		84,275,200 bytes	168,550,400 bytes
Number of cylinders		823	823
Tracks per cylinder		5	10
Cylinder capacity		102,400 bytes	204,800 bytes
Track capacity		20,480 bytes	
Average rotational latency		8.3 ms	
Positioning time:	Track to track	5 ms	
	Average	20 ms	
	Maximum	40 ms	
Rotational speed		3,600 rpm ± 1%	
Transfer rate		1.229 MB/sec	
Encoding method		MFM	
Interface data		NRZ	
Recording density		9,867 BPI	
Track density		683 TPI	
Start/Stop time		<40/ <40 sec	
Interface		SMD	
Number of sectors		128 (maximum)	

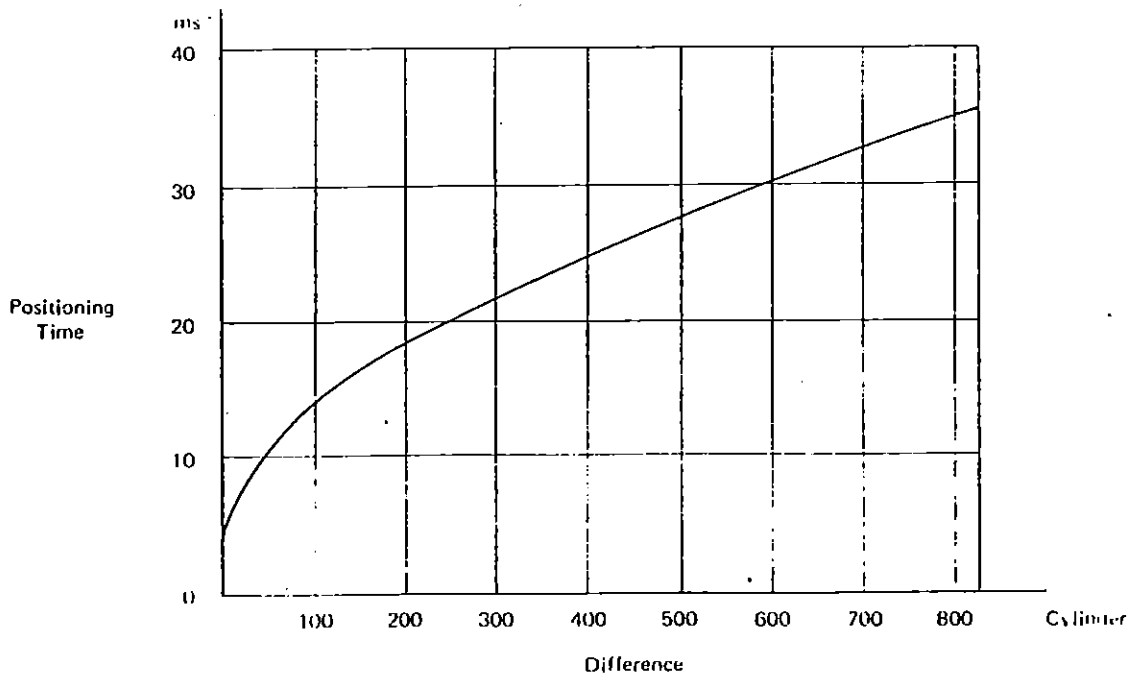


Figure 1-2-3 Positioning Time Profile

1.2.5 Reliability

(1) Mean Time between Failure (MTBF)

The MTBF is defined as follows:

$$MTBF = \frac{\text{Estimated Operating Hours}}{\text{Number of Equipment Failures}}$$

The MTBF shall exceed 10,000 hours (design value). Estimated operating hours should not include any maintenance time. Equipment failures means any stoppage or substandard performance of the equipment because of equipment malfunction, excluding that caused by operator error, cable failure, or other failure not due to the equipment. To establish a meaningful MTBF, operating hours must be greater than 6,000 hours and shall include field performance data from all field sites.

For the purpose of this specification, equipment failures are defined as those failures necessitating repair or replacement on an unscheduled basis.

(2) Mean Time to Repair (MTTR)

The mean time to repair shall not exceed 1.0 hour. It is defined as the time for an adequately trained and competent service technician to diagnose and correct a malfunction.

(3) Preventive Maintenance Time

No scheduled maintenance is required.

(4) Service Life

The M2321/M2322 drive is designed to provide a useful life of five (5) years before factory overhaul or replacement is required.

(5) DC Power Loss

Data integrity is assured in the event of a power loss (data is not assured during write operation).

1.2.6 Data Integrity

The following error rates assume that the M2321/M2322 is being operated within specification. Errors caused by media defects or equipment failures are excluded.

1.2.6.1 Read Errors

Prior to determination of a read error rate, the data shall have been verified as written correctly and all media defects flagged.

(1) Recoverable Error Rate

A recoverable read error is one which can be read correctly within fifteen retries when reading on track, and should not exceed ten per 10^{11} bits.

(2) Unrecoverable Error Rate

An unrecoverable read error is one which cannot be read correctly within sixteen retries and should not exceed ten per 10^{14} bits.

1.2.6.2 Positioning Error Rate

The positioning error which can be corrected within one retry should not exceed ten per 10^{8} seeks.

1.2.6.3 Media Defects

A media defect is defined as a repetitive read error that occurs on a properly adjusted drive within specific operating conditions.

Valid data must not be written over known media defects, therefore, sector/track deallocation or skip displacement techniques must be utilized.

(1) Media Defect Characteristics

a) The maximum number of defects per drive is as follows:

M2321K (84MB): 100
M2322K (168MB): 200

b) The maximum number of defective tracks per drive is as follows:

M2321K (84MB): 14
M2322K (168MB): 28

A defective track is defined as a track having any of the following:

1. Two or three defects.
2. Defective logging areas

Note: No track shall have more than three defects.

(2) Media defect free areas are defined as follows:

1. Cylinder 0, Head 0 through 2
2. Any error in logging area to extent defined in the Media Defect Format

1.2.6.4 Media Defect Information

All drive will have a Media Defect List which will list the following information.

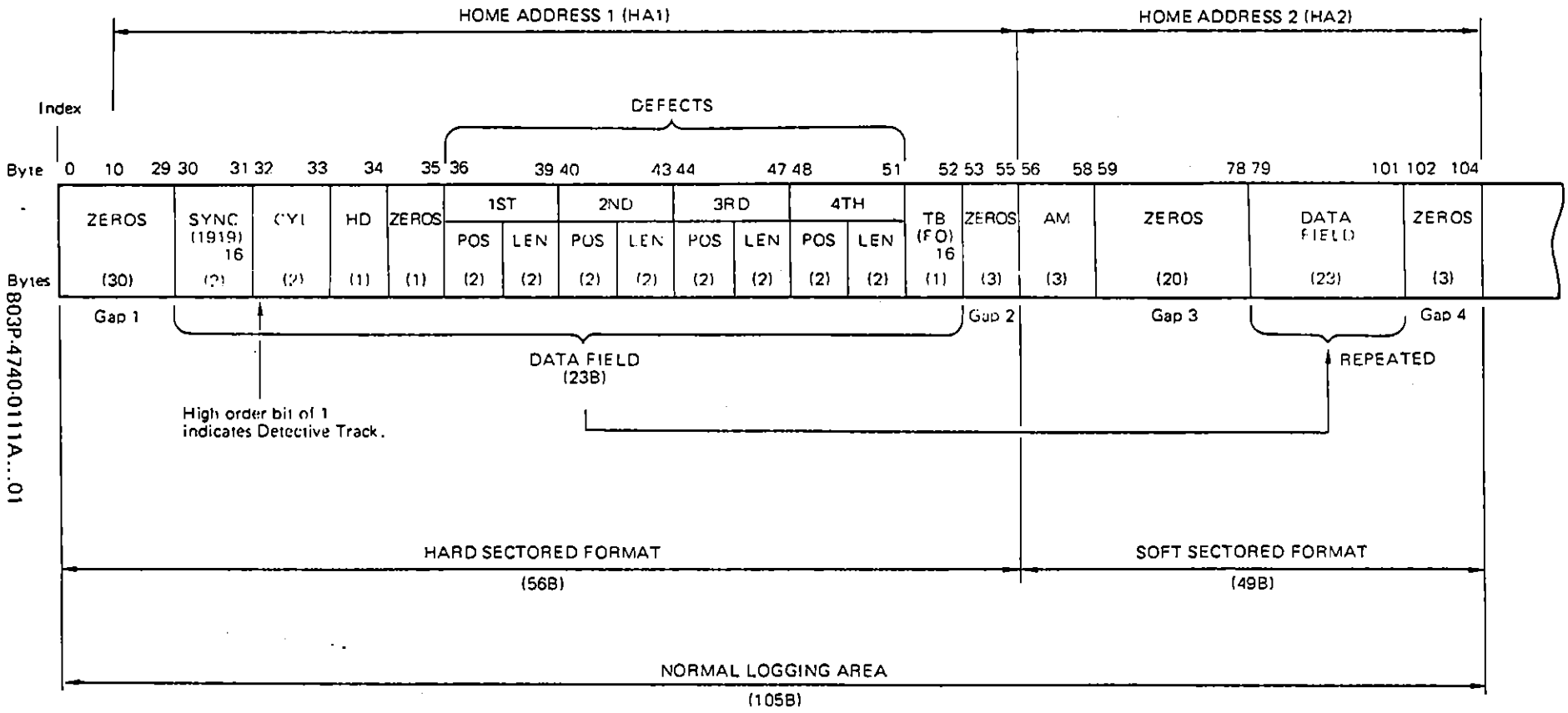
1. Cylinder Address
2. Head Address
3. Position (bytes from Index ±1 byte)
4. Length (bits ±1 bit)

The above information will be listed by hexadecimal code. The maximum media defect length at a defect is 64 bytes (512 bits).

1.2.6.5 Media Defect Format

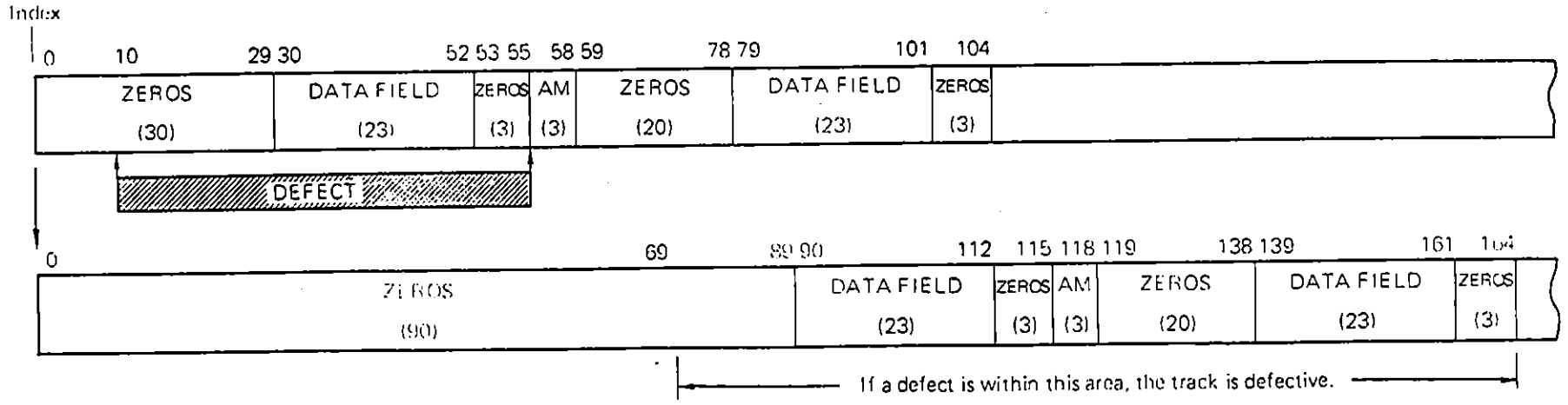
The drive will be formatted at the factory with standard Media Defect Format. The Media Defect Format is divided into two parts. The first part is a hard-sectored format and is normally included in the first 56 bytes following Index signal. The second part is a soft-sectored format and is normally included in the next 49 bytes following Index signal as shown in Figure 1-2-4 Format 1. The format rules are as follows:

1. A track which has more than one defect is defined and flagged as a defective track. The first four media defects are logged.
2. If the beginning of a defect is located between Byte 10 to Byte 55 (HA1) after Index, 60 bytes of zeros are added to gap 1 (90 bytes total).
   In this case, if any part of a defect is located between Byte 69 and Byte 164 (HA1' and HA2'), the track is flagged as defective. Refer to Figure 1-2-5 Format 2.
3. If the beginning of a defect is located between Byte 56 and Byte 104 (HA2) after Index, 60 bytes of zeros are added before Address Mark (AM). In this case, if any of a defect is located between Byte 116 and Byte 164 (HA2"), the track is flagged as defective. Refer to Figure 1-2-5 Formats.
4. If the track is defined as a defective track according to above-mentioned rule 1, 2 or 3, the high order bit of the first cylinder address byte is set to 1. Remaining information may or may not be valid.

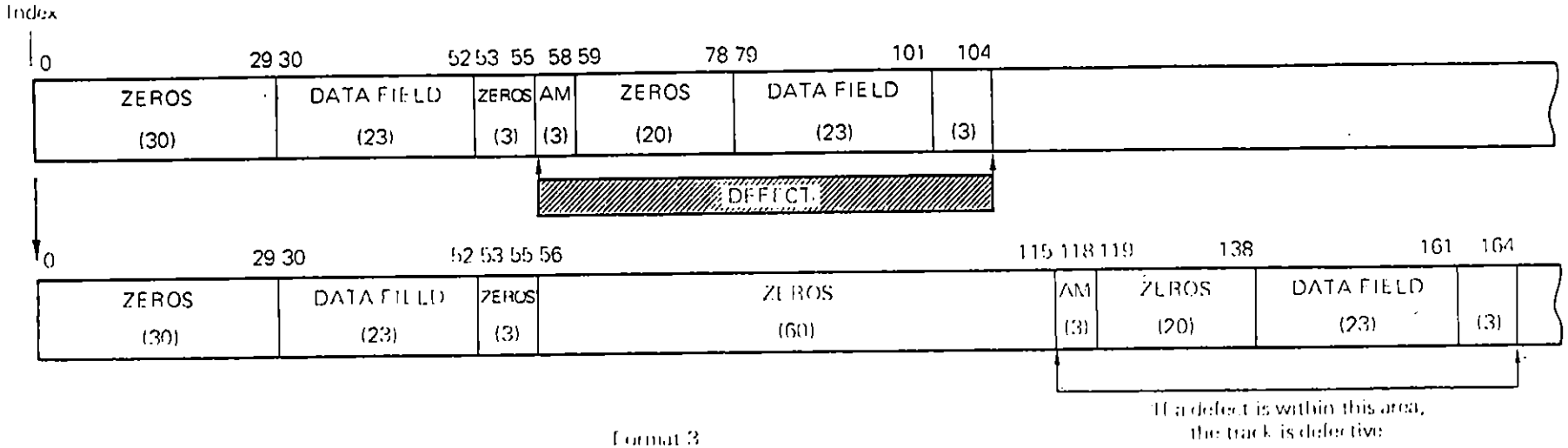


Note 1) Position (POS) of defect is in bytes after Index ±1 byte.
2) Length (LEN) of defect is in bits ±1 bit.
3) Unused defect locations are all zeros.

Figure 1-2-4 Media Defect Format 1



Format 2



Format 3

Figure 1-2-5 Skip Displaced Format

1.3 CONFIGURATION

1.3.1 Fundamental Unit Configuration

Figure 1-3-1 shows the fundamental configuration of the unit; Figure 1-3-2 shows the block diagram.

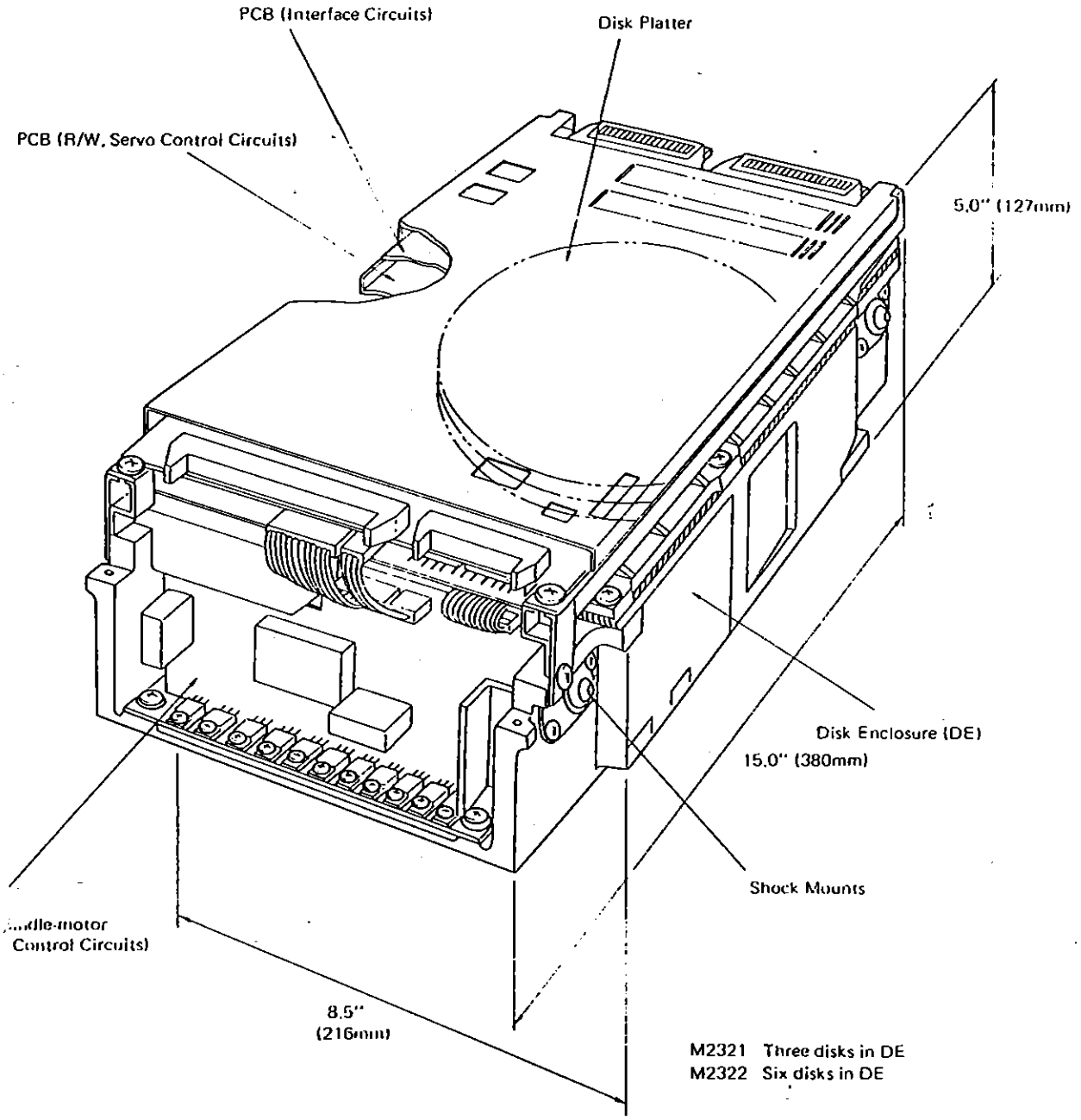


Figure 1-3-1 Fundamental Configuration

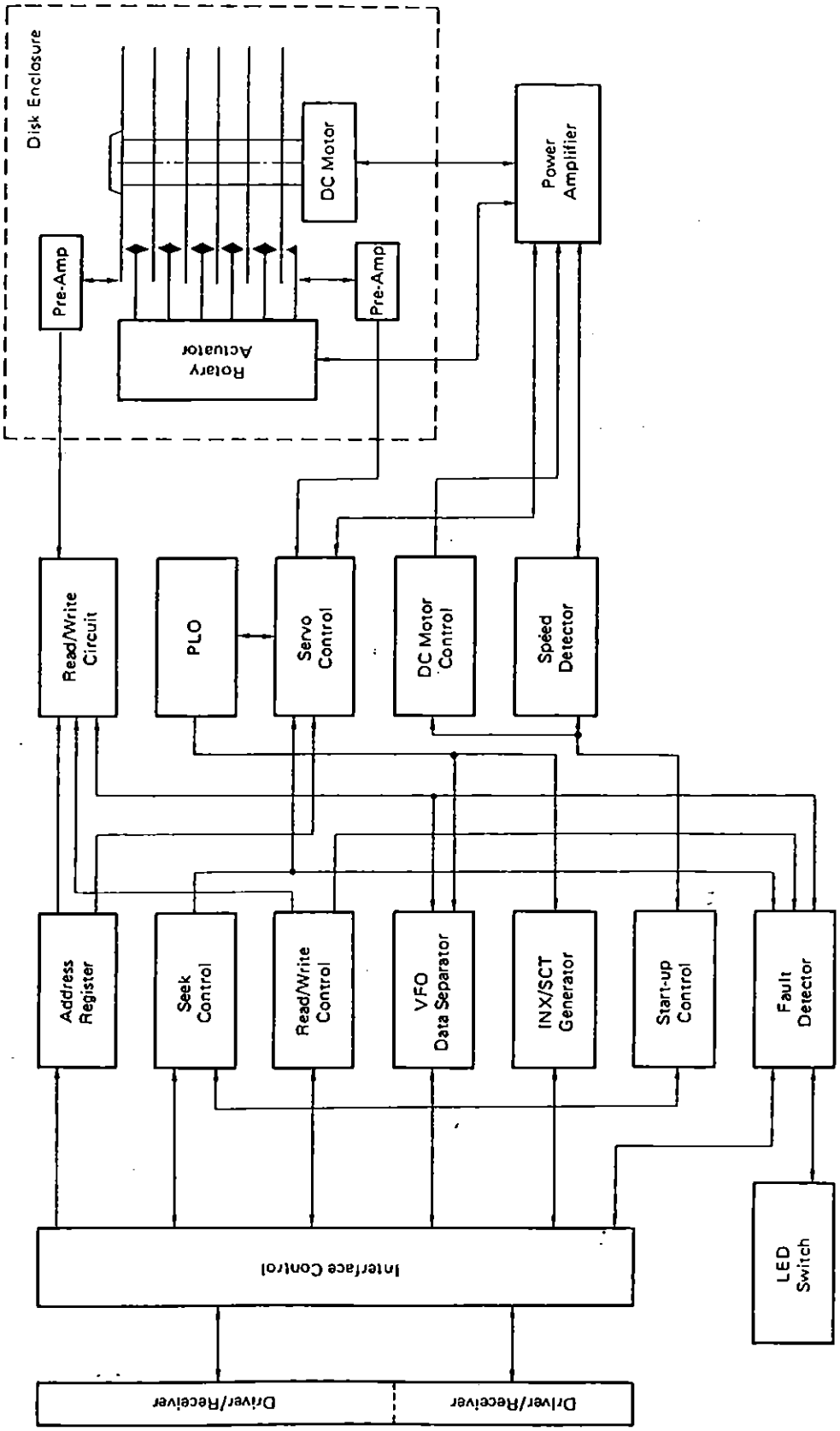


Figure 1-3-2 Block Diagram

1.3.2 Options

Optional items are presented in Table 1-3-1.

Table 1-3-1 Options

Item No.	Component name	Specification (Drawing No.)	Remarks
1-1	Fan unit	B03B-4740-E002A	100/115/120V AC; 50/60 Hz
1-2	Fan unit	B03B-4740-E003A	220/240V AC; 60 Hz
1-3	Fan unit	B03B-4740-E005A	+24V DC
2-1	Power supply unit	B14L-5105-0100A	• 100/115/120/220/240V AC. • With connectors for feeding power to fan units and dual channel printed board unit.
3-1	Cable	B660-1065-T006A	Interface cable (A) 60P flat cable
3-2	Cable	B660-1065-T008A	Interface cable (B) 26P flat cable
3-3	Cable	B660-1865-T020A	Interface cable (A) for 2 units daisy chain
3-4	Cable	B660-1865-T030A	Interface cable (A) for 3 units daisy chain
3-5	Cable	B660-1865-T040A	Interface cable (A) for 4 units daisy chain
3-6	Cable	B660-1865-T050A	Interface cable (A) for 5 units daisy chain
3-7	Cable	B660-1865-T060A	Interface cable (A) for 6 daisy chain
3-8	Cable	B660-1865-T070A	Interface cable (A) for 7 units daisy chain
3-9	Cable	B660-1865-T080A	Interface cable (A) for 8 units daisy chain
4-1	Panel unit	B03B-4590-E501A	Flat key type control panel board
5-1	Mounting tray	B21L-1810-0001A	For mounting two units of 19-inch rack with 3 pitches (inside frame)
5-2	Mounting tray	B21L-1810-0002A	For mounting two units of 19-inch rack with 3 pitches (inside frame), and the front panel has the windows for operating the panel unit.
6-1	Dual Channel	B03B-4740-E401A	To be mounted on optional PSU.
6-2	Dual Channel	B03B-4740-E402A	To be mounted on drive unit.
7-1	Power cable	B660-0625-T327A	Drive unit – power supply unit connecting
7-2	Power cable	B660-1995-T041A	Drive unit and DC (+24V) Fan unit-power supply unit connecting Cable.
8-1	Cable	B660-0625-T328A	E002A fan unit — power supply unit connecting
8-2	Cable	B660-0625-T355A	E003A fan unit connecting
9-1	Cable	B660-1995-T003A	E501A panel unit — drive unit connecting
10-1	Cable	B660-0625-T329A	Dual channel PCB assy. — Power supply unit connecting

Note: Items in the above table are optional and not fundamental components of this unit. These items must be ordered separately conforming to the above specifications as occasion demands.

1.3.2.1 Fan Unit

The M2321K/M2322K requires some means of cooling, since there is no internal blower motor. For this purpose, optional fan units are available in the event that adequate cooling is not provided within the mounting cabinet. This fan unit is directly mountable onto the rear of the device using the existing screws and taps.

The fan unit may be ordered in the following voltage ratings: 100/115/120V AC or 220/240V AC or +24V DC. When the input power of the fan unit is supplied from the optional power supply unit, the 100/115/120V AC (B03B-4740-E002A) fan unit should be specified regardless of system AC Voltage.

The DC fan unit (B03B-4740-E005A) may be used with the optional power supply unit. In this case, order power cable specification: B660-1995-T041A.

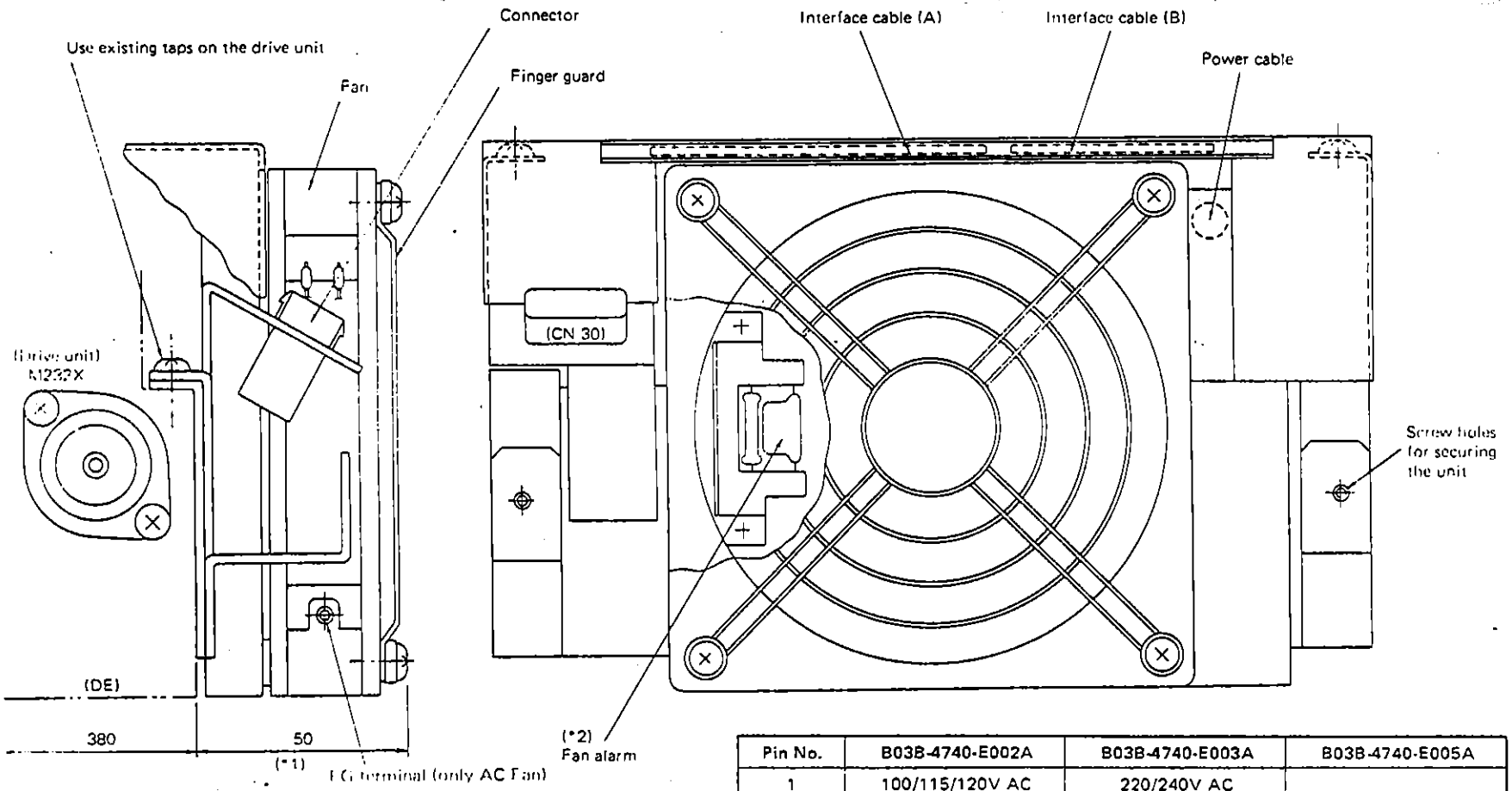
The Table 1-3-2 shows the specifications of fan units.

The Figure 1-3-3 shows the mounting status, of the fan unit.

Table 1-3-2 Specifications of fan units

	B03B-4740-E002A	B03B-4740-E003A	B03B-4740-E005A
Rated voltage	AC 115V	AC 230V	DC 24V
Frequency	50/60 Hz	50/60Hz	–
Ready current			0.5 A or less
50 Hz	0.26A or less (standard : 0.18A)	0.14A or less (standard: 0.08A)	
60 Hz	0.20A or less (standard: 0.12A)	0.10A or less (standard: 0.06A)	
Starting current			0.72 A or less
50 Hz	0.27A or less	0.15A or less	
60 Hz	0.21A or less	0.11A or less	
Consumption			15W or less
50 Hz	27W or less	27W or less	
60 Hz	19W or less	14W or less	
Phase/Pole	Single/2P	Single/2P	–
Environmental condition	Same as of unit	Same as left	Same as left
Thermal alarm	Blow-value detecting method alarm	–	Blow-value detecting method alarm
Motor protection	Impedance protect	Same as left	–
Weight	1 kg or less	1 kg or less	1 kg or less

Note: Values of voltage and current show in case of no-load state.



*1: The overall length after mounting the fan unit is 430 mm (380 mm + 50 mm).

*2: Fan alarm specification

Type of contact point:	Normal open
Contact capacity:	0.5A DC max. 200V DC max. * However, I (A) x E (V) ≤ 10W DC
Consumption:	4.2W (at 100V AC or 24V-DC)
Responce time:	5 – 300 sec.
Circuit:	See Figure 1-3-4

Pin No.	B03B-4740-E002A	B03B-4740-E003A	B03B-4740-E005A
1	100/115/120V AC	220/240V AC	
2	100/115/120V AC		
3	FG	FG	+24V Return
4		220/240V AC	+ 24V DC
5	ALARM (*2)		ALARM (*2)
6	ALARM (*2)		ALARM (*2)

Figure 1-3-3 Fan Unit

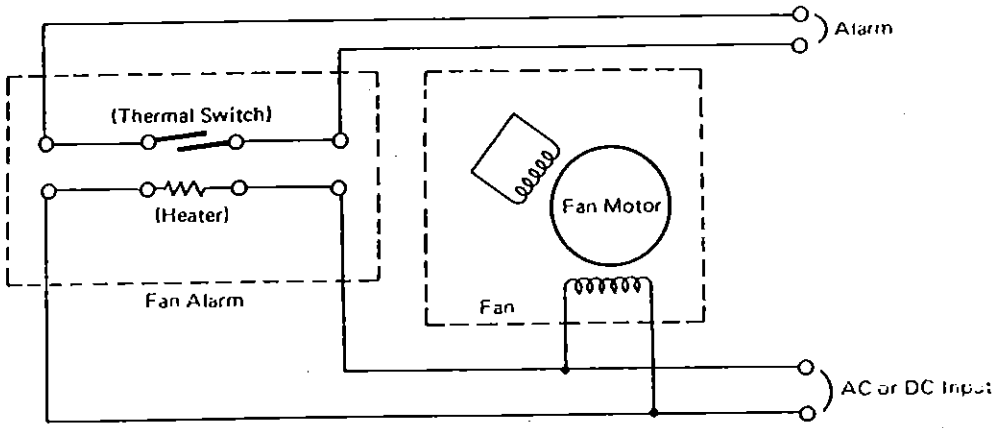


Figure 1-3-4 Optional Fan Unit Alarm

1.3.2.2 Power Supply Unit

A power supply unit may either be mounted horizontally behind the disk drive or may be mounted vertically. Figure 1-3-5 shows the details of I/O terminals and the external dimensions of the power supply unit.

Specification: B14L-5105-0100A

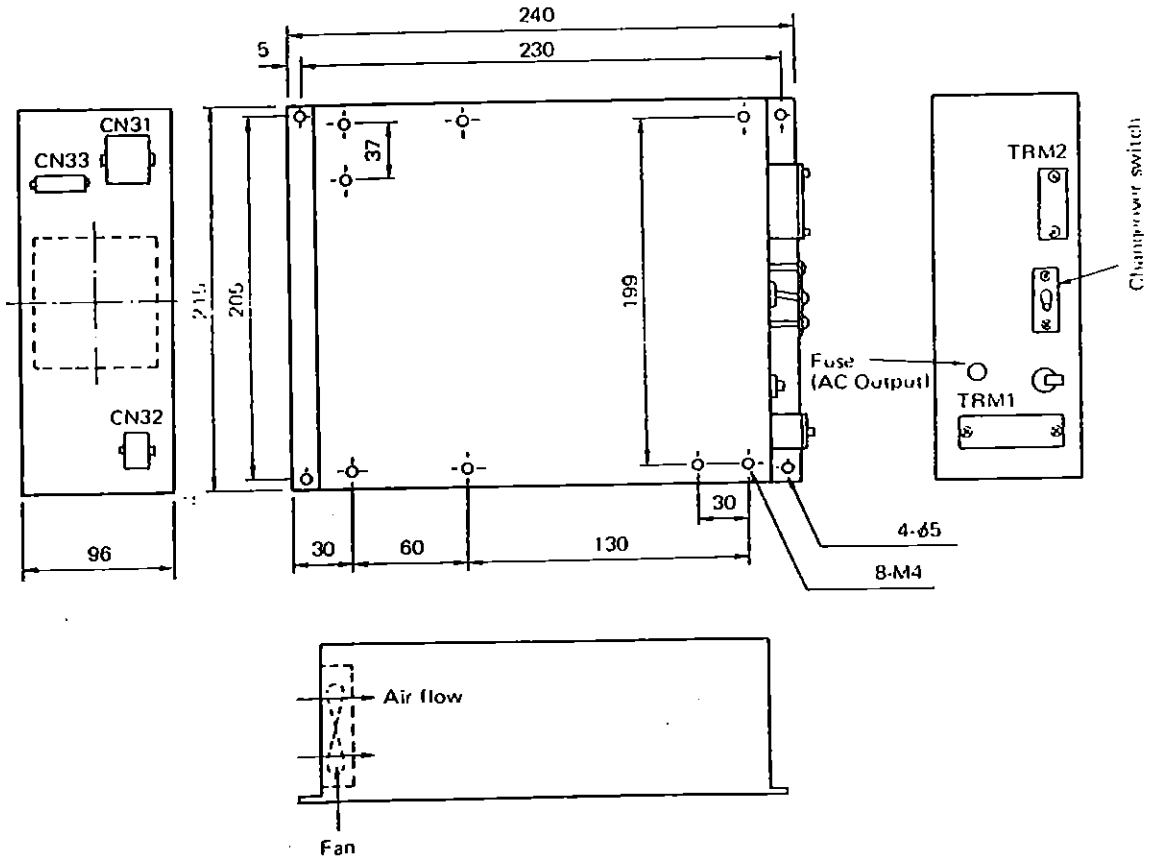


Figure 1-3-5 Power Supply Unit

TRM1: AC power input and alarm sending.
TRM2: FG-SG coupling terminal. (Normally open)
CN31: Drive unit power feeding connector
(for cable B660-0625-T327A (Option))
CN32: Fan unit power feeding connector
(for cable B660-0625-T328A/T355A (Option))
CN33: Dual channel PCB unit power feeding connector
(for cable B660-0625-T329A (Option))

AC input voltage selection from 100/115/120V AC to 220/240V AC is switch selectable.

Regardless of AC input voltage, AC output voltage from CN2 (AC fan unit power supplying connector) is kept 115V $^{+15\%}_{-24\%}$ AC.

Therefore when using the optional power supply only the 115V AC fan is required.

1.3.2.3 Panel Unit

The panel unit includes function lights which indicate power on, ready, write protect, check, and also includes a write protect switch and a check clear switch.

Figure 1-3-6 shows the mounting dimensions and mounting status of panel unit B03B-4590-E501A.

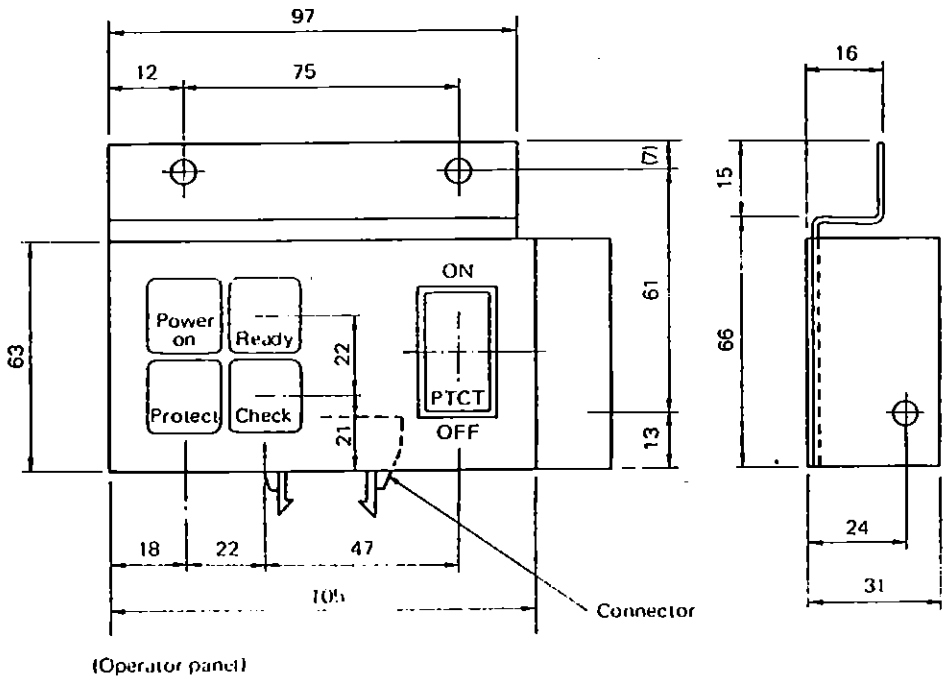


Figure 1-3-6 Panel Unit

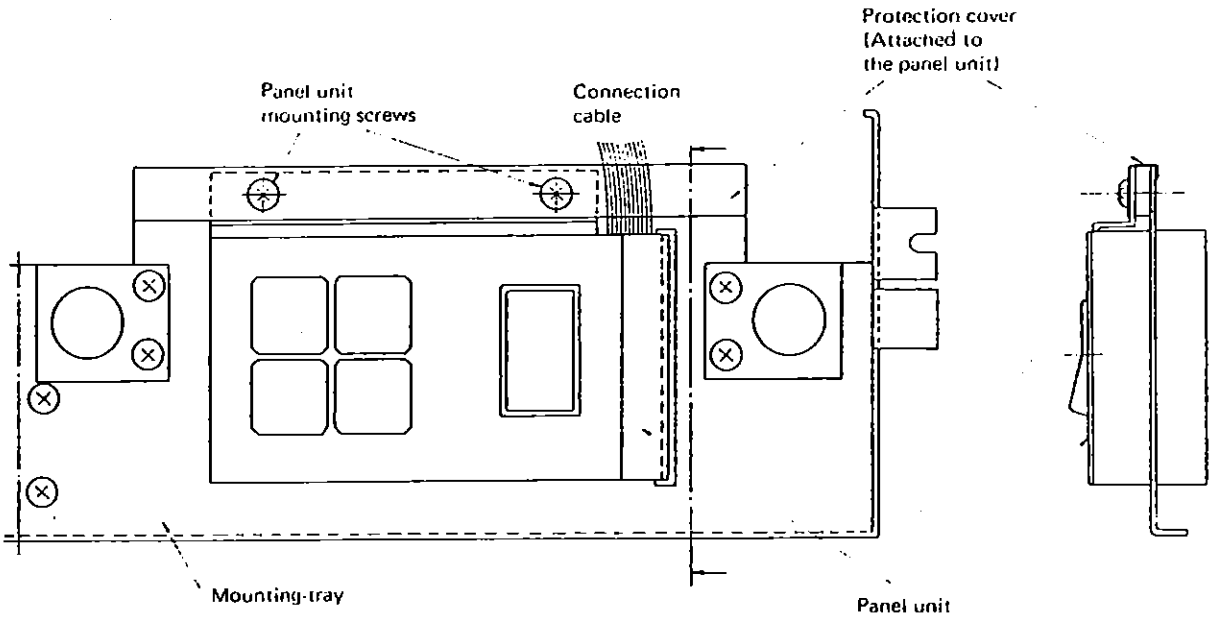


Figure 1-3-7 Mounting Dimensions of Panel Unit

1.3.2.4 19" Rack Mount Installation

A mounting-tray with brackets is available to install two drives, side by side in a 19" rack, three pitches. It can also accommodate the optional fan units and/or power supply units for each of the two drives.

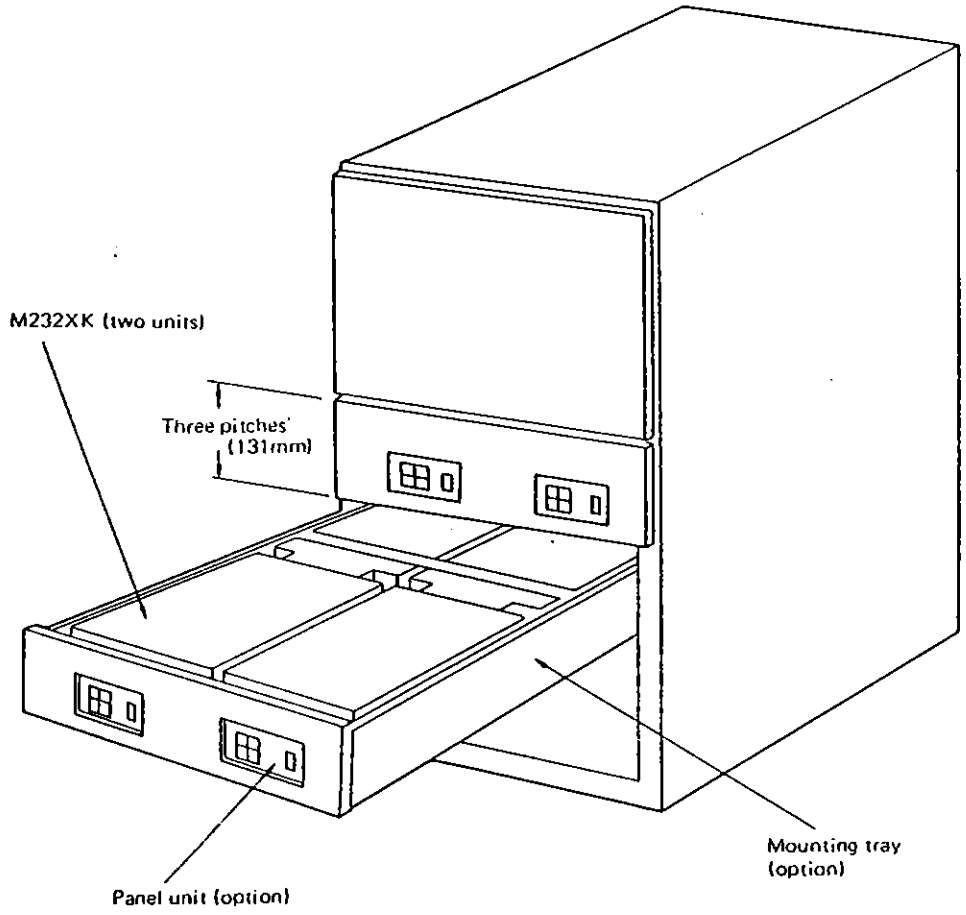
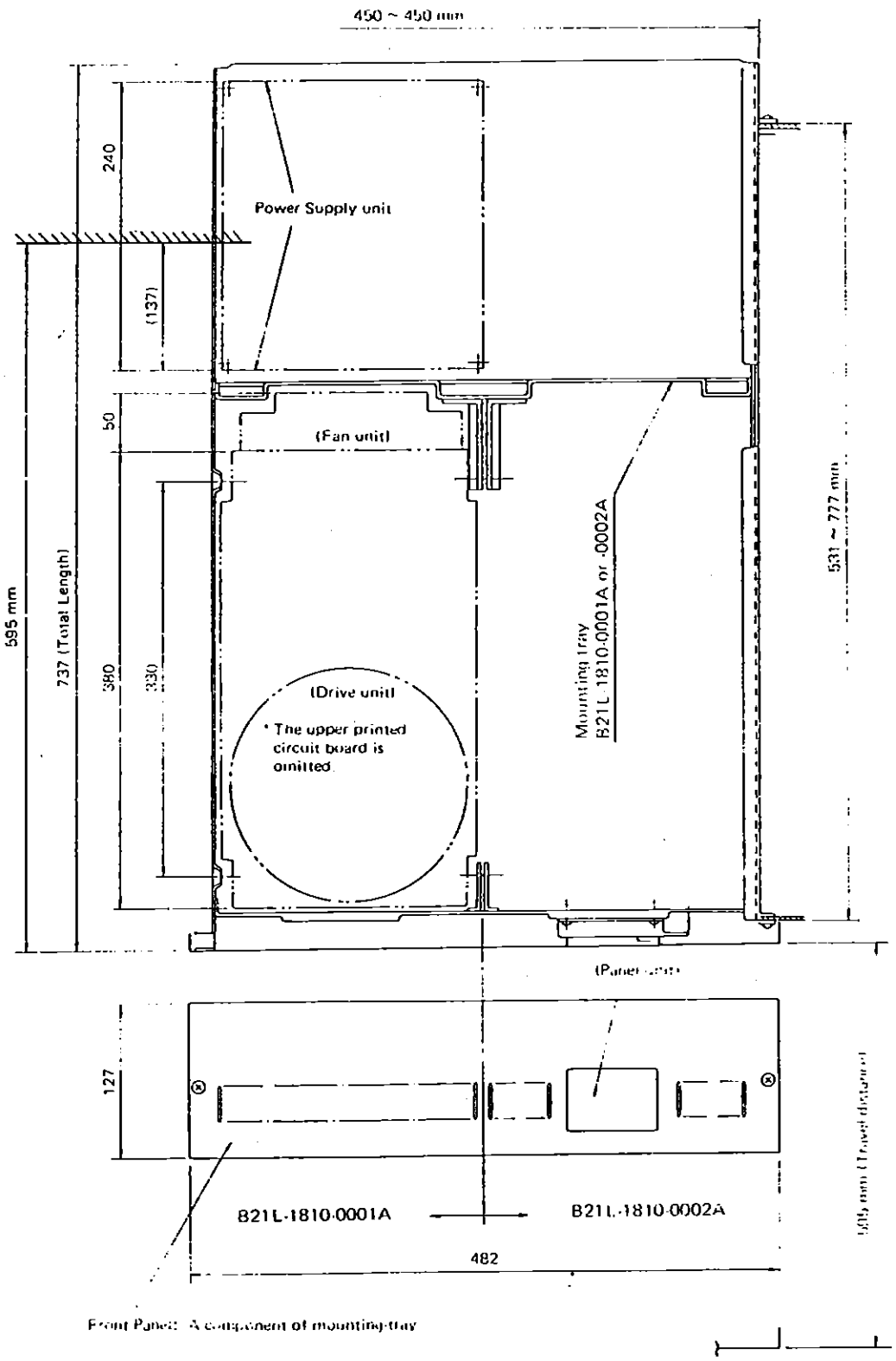


Figure 1-3-8 19" Rack Mount Installation

The mounting-tray (inner frame) guided by brackets (outer frame) can be drawn out forward. (Travel distance is approximately 24").
The 19" rack mounting method is illustrated in Figure 1-3-8. And Figure 1-3-9 shows the appearance when the units are mounted using the mounting-tray and brackets.



Note: Mounting-tray (0001A) cannot accommodate the drive unit with Panel unit. In that case, 0002-type must be specified.

Figure 1-3-9 Mounting-Tray and Brackets

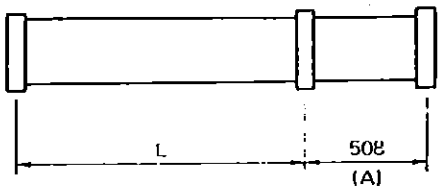
1.3.2.5 Cables

The interface cable (A) may be up to 30 m long (to the final unit in case of daisy chain mode). The length of the cable can be specified in 20 inches (508 mm) increments.

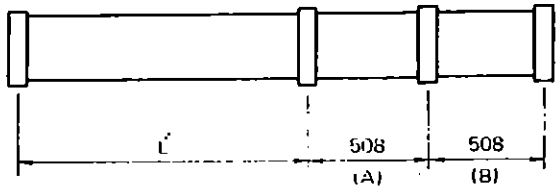
The interface cable (B) may be up to 15 m long. The length of this cable can be specified in 500 mm increments.

The (A) cables for daisy-chain connection shown at items 3-3 to 3-9 in Table 1-3-1 are of the forms as shown in Figure 1-3-10. Cable length "L" (specifiable by "#L") refers to the corresponding sections of the following drawings:

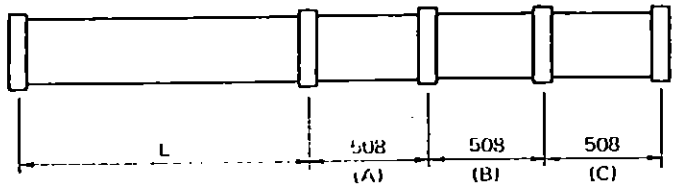
- For B660-1865-T020A



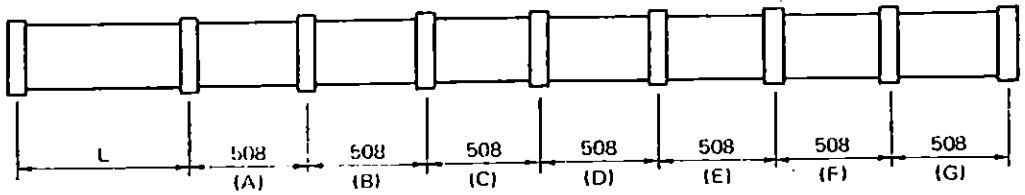
- For B660-1865-T030A



- For B660-1865-T040A



- For B660-1865-T080A



* The connectors at both ends are of close-end, while the intermediate connectors are of through-end.

Figure 1-3-10 A-Cables for Daisy-Chain

How to specify cable lengths

(For 3.5m: Example 1)

B660-1065-T008A / Cable specification — #L3R503 / 3.5×10^3 (mm)

(For 50cm: Example 2)

B660-0625-T327A / Cable specification — #L500R0 / 500×10^0 (mm)

The lengths of cables at Items 7, 8, 9 and 10 in Table 1-3-1 must also be specified.

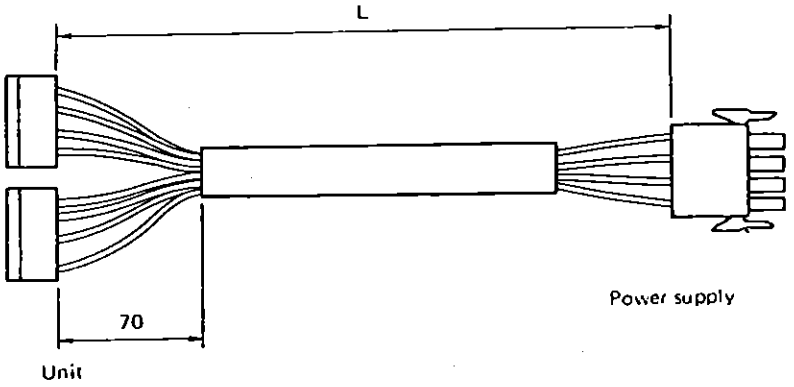


Figure 1-3-11 Power Cable B660-0625-T327A

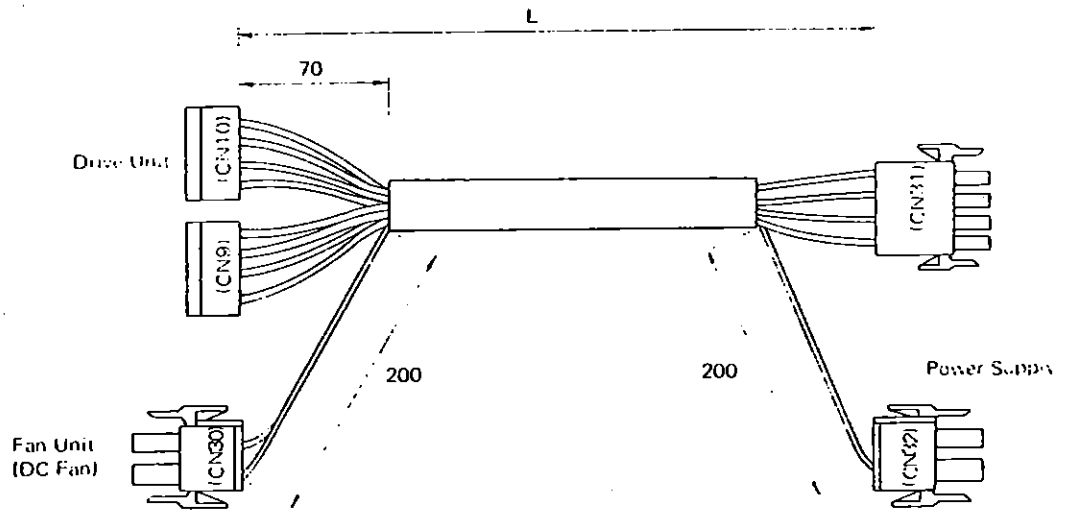


Figure 1-3-12 Power Cable B660-1995-T041A

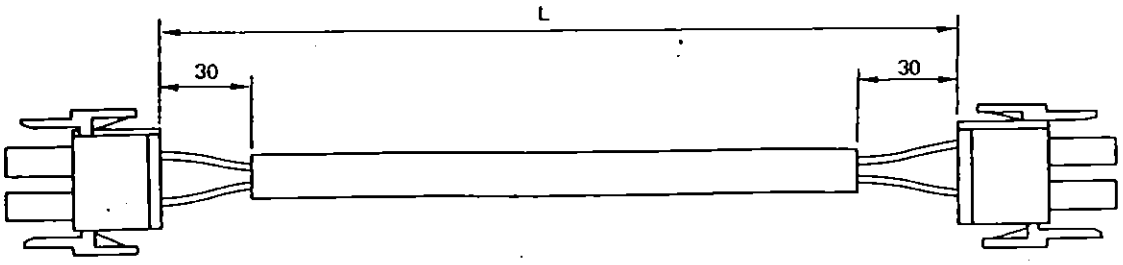


Figure 1-3-13 Cable B660-0625-T328A, T355A
(Fan unit – Power supply unit)

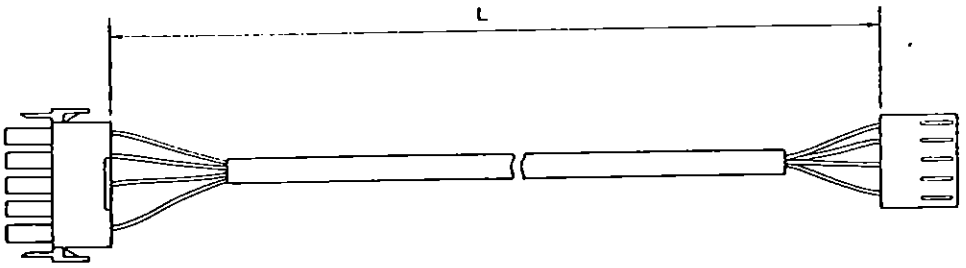


Figure 1-3-14 Cable B660-0625-T329A
(Dual Channel PCB assy. – Power supply unit)

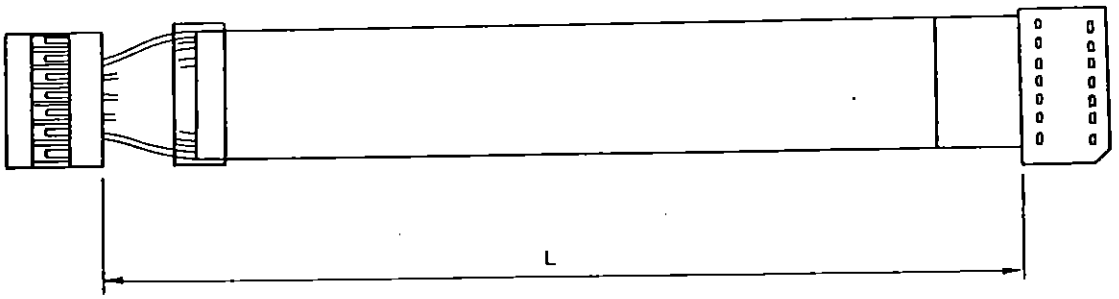


Figure 1-3-15 Cable B660-1995-T003A
(E501A Panel unit – Drive unit connecting)

The length of this cable can be specified in 60 mm increments (Minimum length is 90 mm.)

Operator Panel Connection
The CZFM PCB allows for connection of an optional control panel. At location B30 on this PCB, there is a 14 pin DIP socket for the control panel connection. Following is pin-out for this DIP socket.

PIN NUMBER	SIGNAL MNEMONIC	DEFINITION
1	+5V	+5 Volt
2	*FPTK	File Protect Switch
3	*CKCLR	Check Clear Switch
4	*LRDY	Ready LED
5	0V	Signal Ground
6	*LUSLD	Unit Selected LED
7	0V	Signal Ground
8	0V	Signal Ground
9	*PWRDY	Power Ready LED
10	*LFPT	File Protect LED
11	*LDVCK	Device Check LED
12	0V	Signal Ground
13	0V	Signal Ground
14	+5V	+5 Volt

"*" Indicates a low active signal.

1.3.2.6 Dual Channel PCB Assembly

This unit can be provided with a dual channel option to add the crosscall function. Versions are available which permit the mounting of this option on the unit or the power supply.

Drive's height is:

- In case of mounting on the unit; 154 mm
- In case of mounting on the power supply;
  It is possible to be mounted in the 19-inch rack with 3-pitch by using the optional power supply (B14L-5105-0100A), the mounting-tray (B21L-1810-0001A or 0002A).

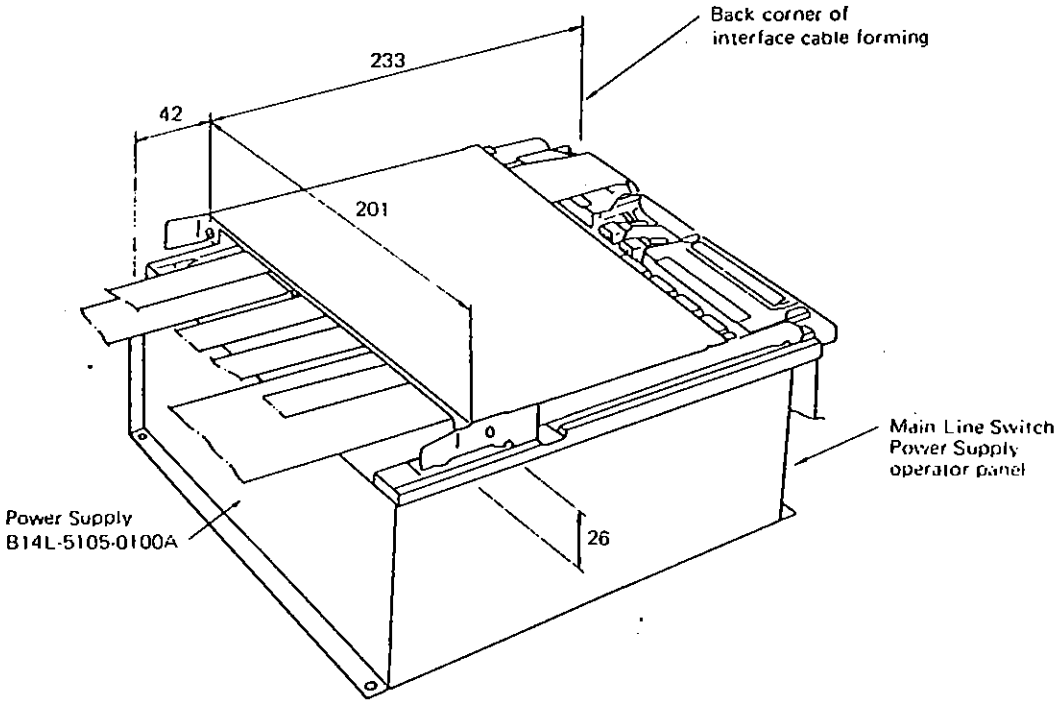
The specifications and the rating of dual channel option are shown in Table 1-3-3.

Table 1-3-3 Dual Channel Option

Specifications	B03B-4740-E401A	B03B-4740-E402A
Mounting location	On the power supply	On the unit
Input condition	+5V, 4.5A −12V, 4.0A (Including the basic drive)	

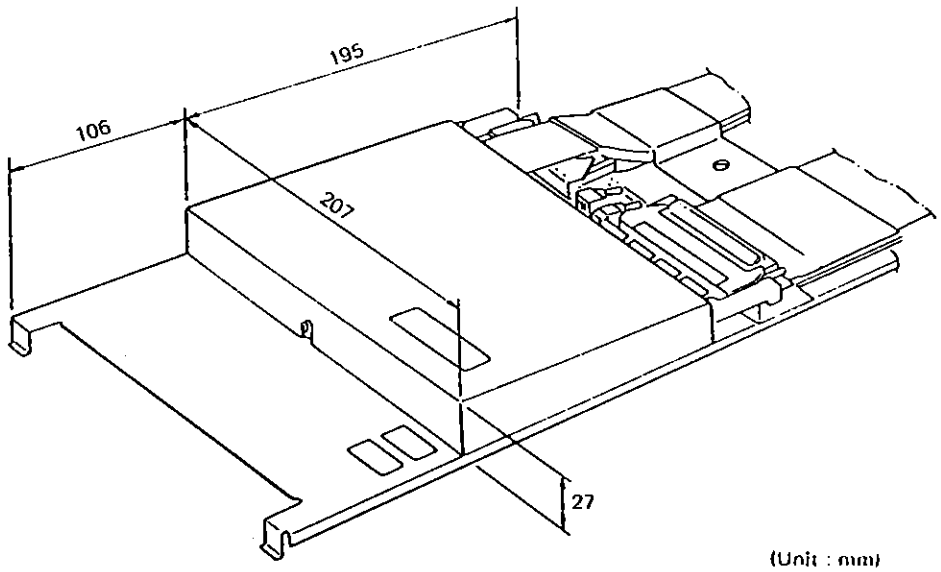
Note: The dual channel option is connected with optional power supply by using the connecting cable. (See Item 1.3.2.5)

Dimensions after mounting of Dual channel PCB Assembly are shown in Figure 1-3-16 (E401A) or Figure 1-3-17 (E402A).



Note: In case of mounting on the power supply, fix Brackets with screws on the power supply.

Figure 1-3-16 Dual Channel Option (E401A)



(Unit : mm)

Note: In case of mounting on the unit, change the usual unit cover to the cover for this option.

Figure 1-3-17 Dual Channel Option (E402A)

Connector location on the PCB are shown in Figure 1-3-18.

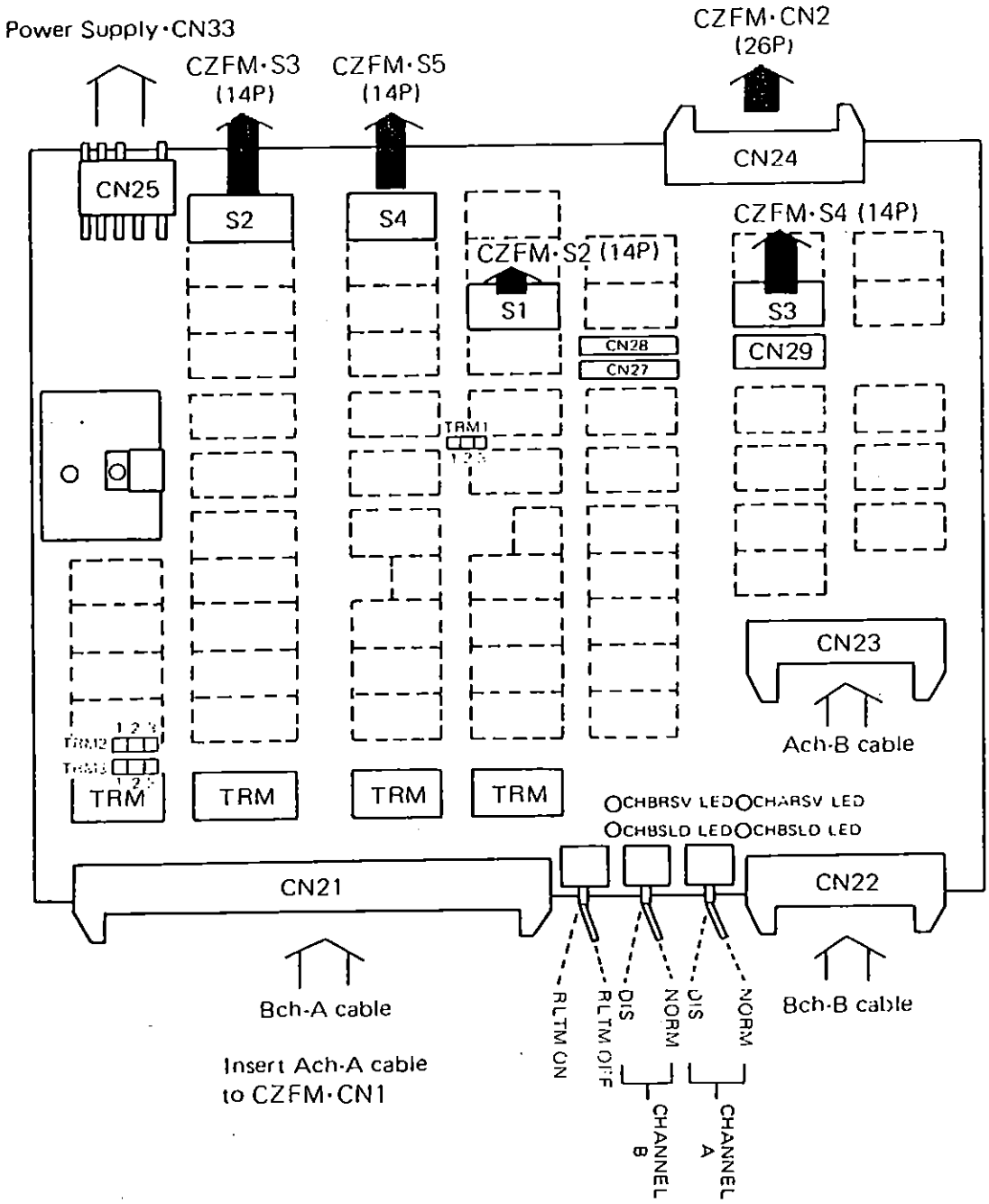


Figure 1-3-18 Dual Channel PCB Assembly Connector Location