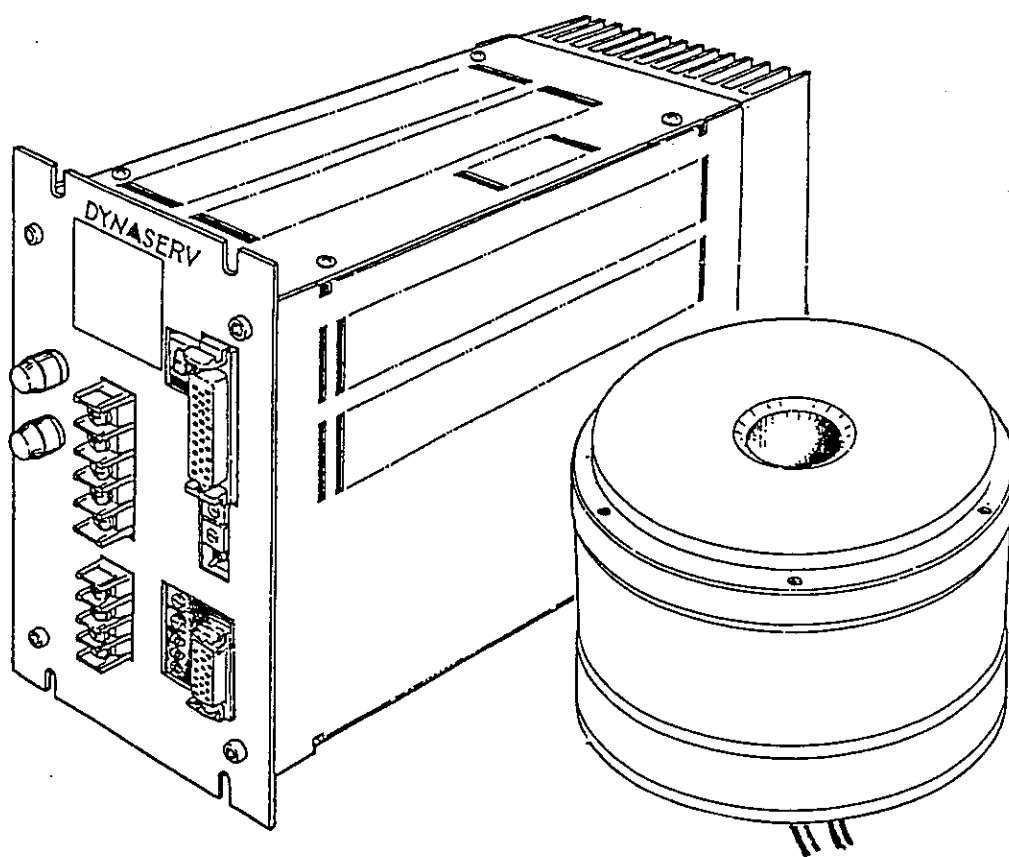


DD SERVO-ACTUATOR
DM/SR Series

— Serial Pulse Interface Model —



Introduction

Thank you for purchasing our DYNASERV DD servo actuator. The DYNASERV is a high torque, high speed, highly accurate outer rotor type servo actuator which can be used in a wide range of field applications related to factory automation, including with industrial robots, indexes, etc. Be sure to read this instruction manual prior to operating the DYNASERV.

Cautions

- ◆ It is prohibited to reproduce or copy part or whole of the contents of this instruction manual.
- ◆ The contents of this instruction manual may subject to change without notice.
- ◆ If you find an error or if you have any questions regarding the contents, please contact our sales section or the people in charge of service.
- ◆ For damage or indirect damage caused by our unintentional error occurring when our product is used, we may not bear the responsibility for the damage.

8. Since the motor surface is magnetically charged, do not place any magnetized objects or substances near the surface.
9. The motor is not dust, water or oil proof, so handle it with care.
10. Never disassemble or modify the motor and the driver. If they need to be disassembled or modified, contact us, as we take no responsibility for their operation after they have been disassembled and modified without our permission.
11. If the motor is reciprocally operated in succession at an extremely small angle (of less than 1'), perform reciprocal running-in of about 10 times at an angle of more than 10' every 100,000 reciprocal operations in order to prevent the bearing from uneven lubrication.
12. Never put to the withstanding voltage test for drive.
Circuit damage.

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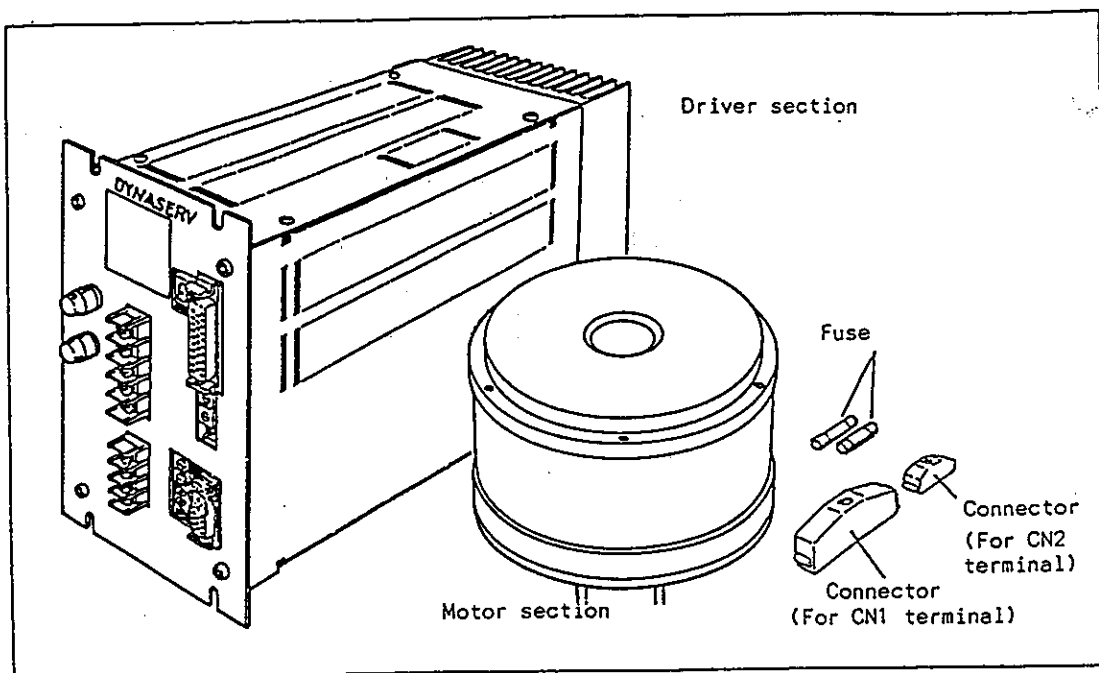


Figure 1.1

2. Functional Description

2.1 Motor Section

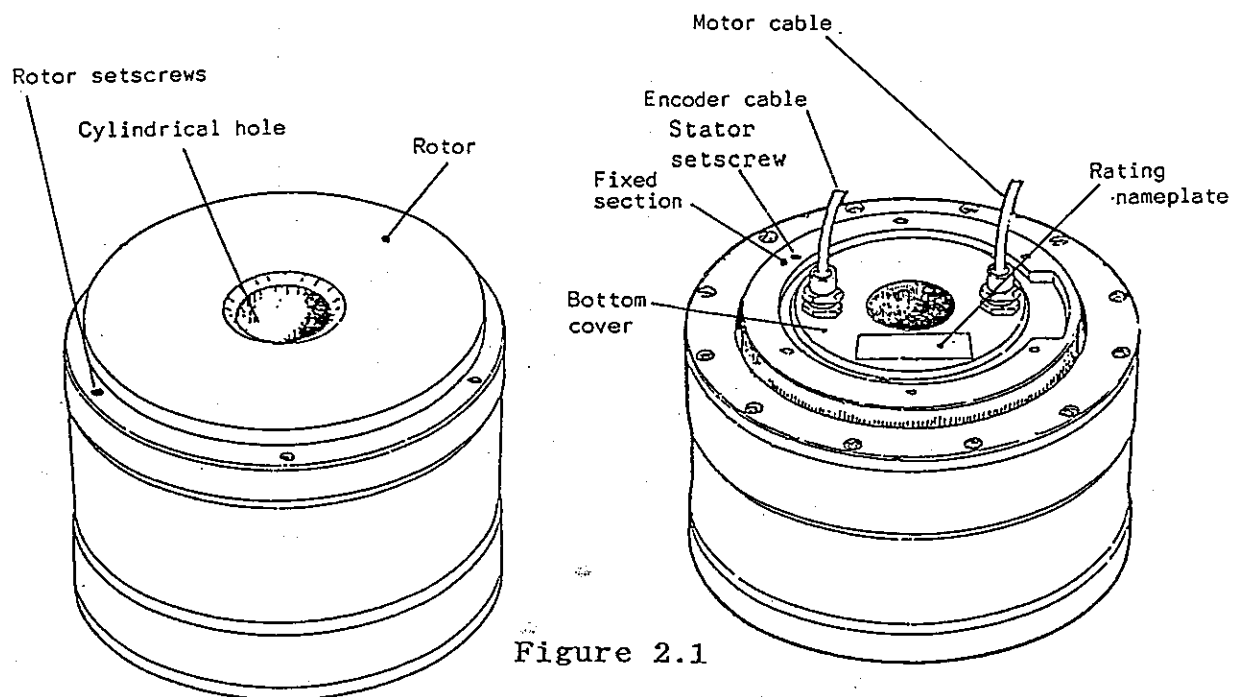


Figure 2.1

2.2 Driver Section

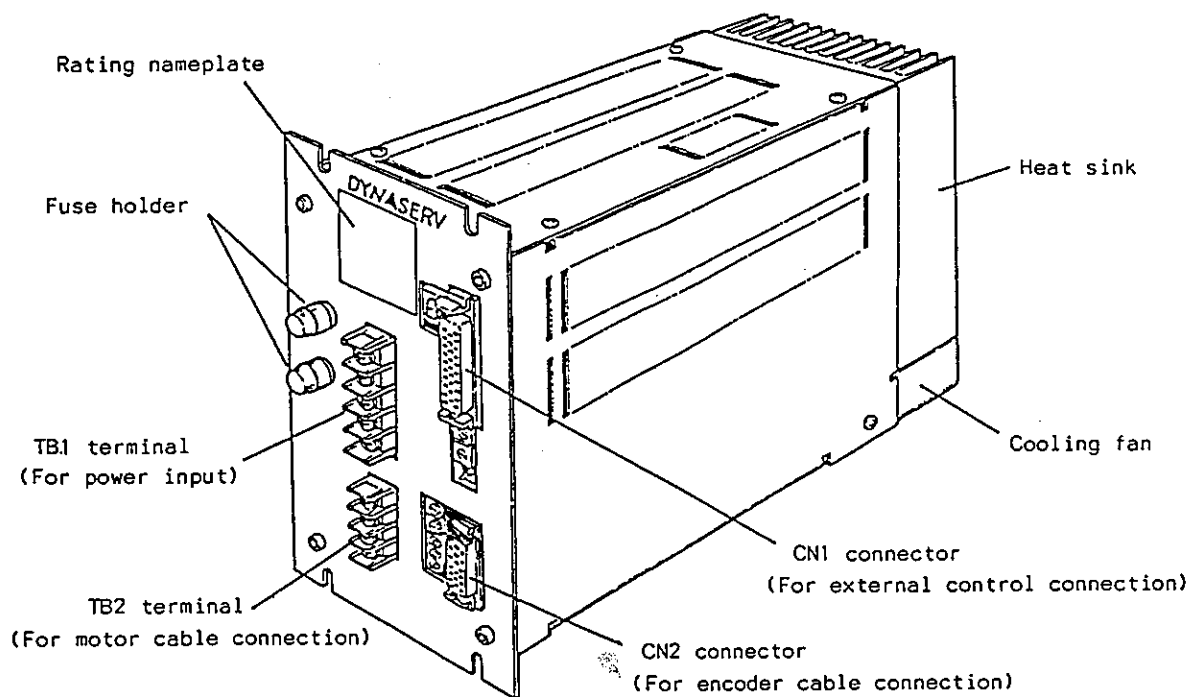


Figure 2.2

3. Preparation for Operation

3.1 Initial Setting

(1) Setting sections on the driver printed-circuit board

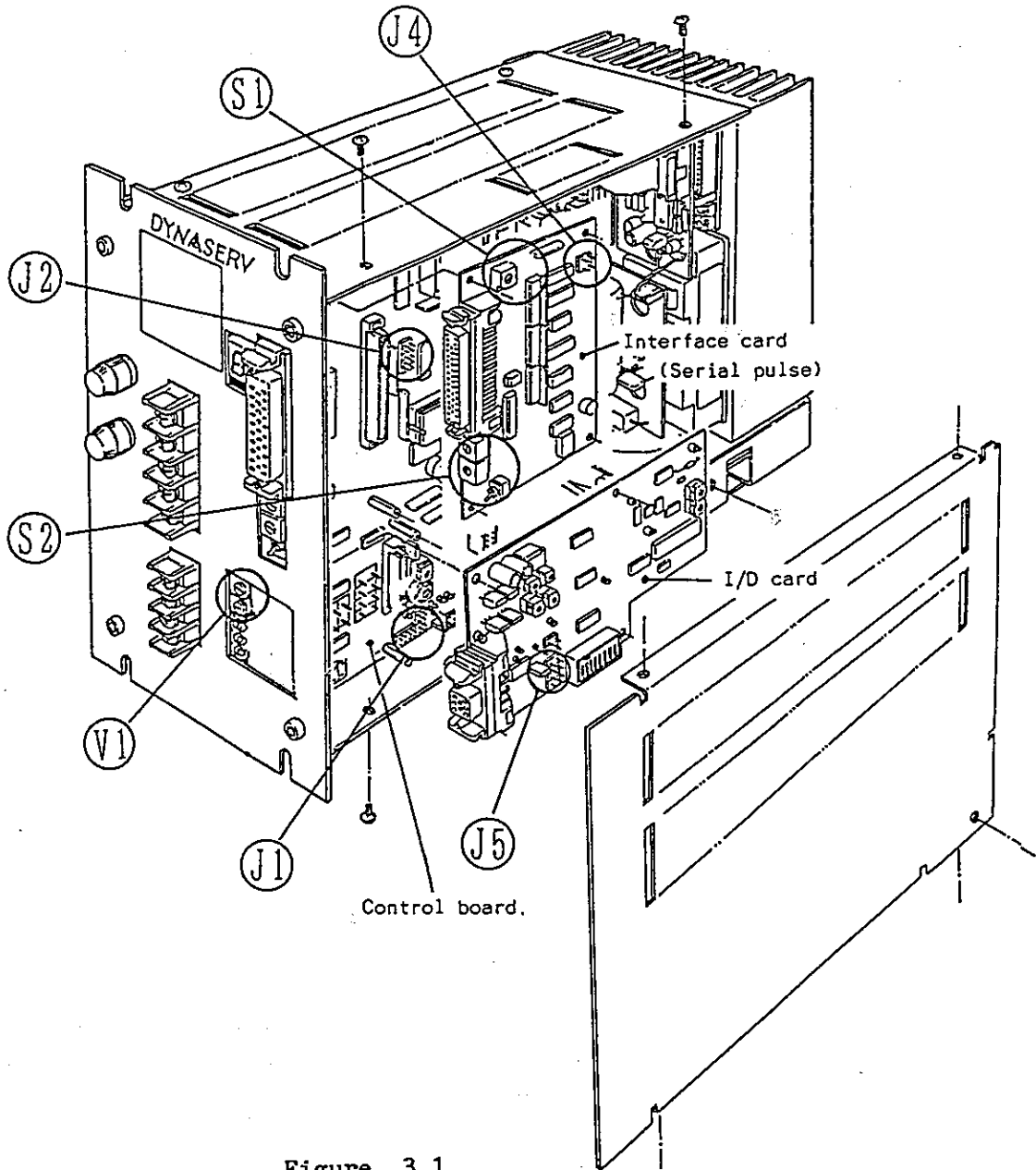


Figure 3.1

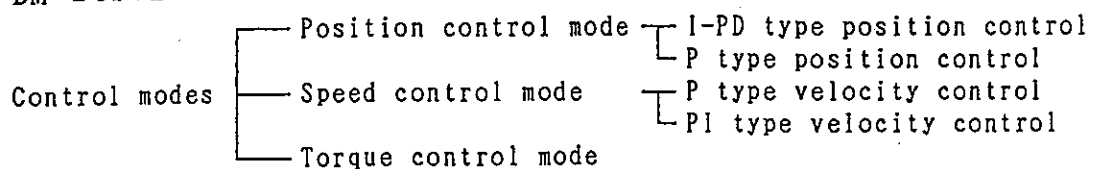
Some jumpers, switches and variable resistors within the driver box may need to be set by the customer. However, prior to shipment, they are set as shown on the next page. See the above Figure for their locations.

To remove the side plate of the driver box, unscrew the 5 screws shown in the above Figure. However, prior to doing work, always turn OFF the power. Also, never touch the high-voltage generation section, even with the power turned OFF. For setting and adjustment procedures, see the following pages. Never touch the switches and variable resistors other than those specified.

3.2 Setting Procedure and Meaning

(1) Control mode setting

The following 5 control modes are available for the DYNASERV DM Service.



The following table shows the validity or invalidity of the switches and variable resistors related to the control mode and the jumper pin settings and each control mode.

(2) Feedback pulse and position command pulse settings/J1

The servo driver receives a signal from the encoder built into the motor, then outputs an A/B phase or UP/DOWN pulse signal to a higher-level controller. Jumper pins related to the feedback pulse signal are <RATE#1 to 2> and <UD/AB>.

In addition, the position command pulse signal multiplication factor is determined by the setting of <RATE#1 to 2>.

Table 3.3

a) <RATE#1 to 2> jumpers

The adjustment of these jumpers can change the position command pulse signal by 1 to 1/8 times. (See the Figure at right.) However, changes in the multiplication factor also change the resolution.

Set value		Multi- plying factor
<RATE#1>	<RATE#2>	
Shorted	Shorted	1
Open	Shorted	1/2
Shorted	Open	1/4
Open	Open	1/8

b) <UD/AB> jumpers

The selection of these jumpers enables the selection of the A/B phase and the UP/DOWN phase. The shorted jumper results in the A/B phase, and the open jumper, the UP/DOWN phase.

(3) Velocity signal filter setting/J1

These jumpers are used to select velocity signal filter cut-off frequency. The cut-off frequency is set to 100 Hz with <100> shorted, and it is set to 200 Hz with <200> shorted. However, they are all opened when the resonance filter is connected.

(4) Origin pulse output signal setting/J5

When the original position is detected by the original positions detection signal set to the positions obtained by dividing one motor revolution equally. When the original position is detected, the following pulse signal is output. The point at which H changes to L when the motor rotates in the CW direction, or L changes to H when the motor rotates in the CCW direction, corresponds to the original position. The CW and CCW directions are when the motor is viewed from the load side.

(6) Mechanical resonance filter (equalizer type) adjustment

This section is for adjustment when the mechanical resonance filter (equalize type) is built into the DYNASERV as an option. Therefore, this adjustment is not required for the standard type.

There are two variable resistors <VRs 1 and 2> on the mechanical resonance filter (equalizer type) board. Although you should not touch <VR 1>, turning <VR 2> can adjust corner frequency from 25 Hz to 100 Hz. Prior to shipment, this <VR 2> is set so that the corner frequency is 100 Hz.

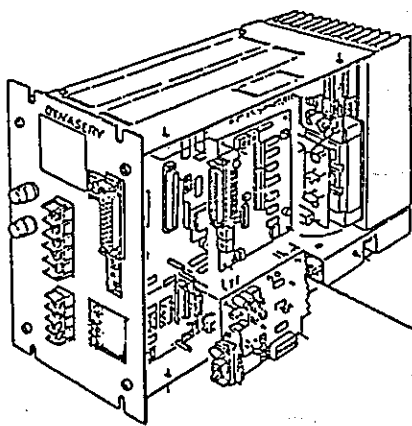


Figure 3.5

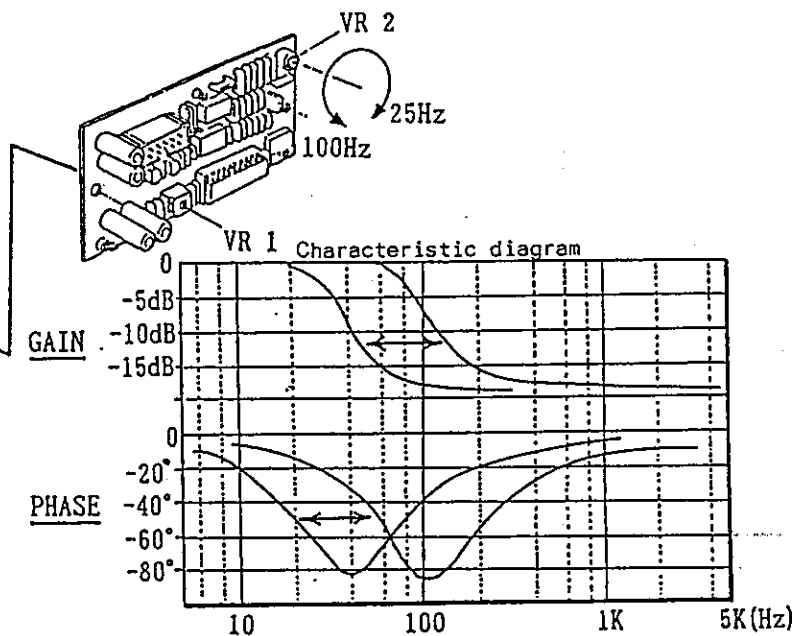


Figure 3.6 Characteristic Diagram

AC100/200V $\pm 10\%$
50/60Hz

Line filter

Tohoku Kinzoku Kogyo LF215 or equal

LINE(MN)

LINE(CONT)

GND

24, 26, 38, ... VCC

23 $\overline{\text{SRVON}}$

25 $\overline{\text{IACT/PACT}}$

33, 35, 37 GAIN

20 SIGN+

19 SIGN-

45 PULS+

46 PULS-

13 U+

14 U-

29 D+

30 D-

43 Z+

44 Z-

49 VIN

50 AGND

15 $\overline{\text{RDY}}$

16

47 $\overline{\text{OVL}}$

48

27 $\overline{\text{COIN}}$

28

41 $\overline{\text{OVER}}$

42

18 AGND

Shield

See the next page

Note : Prepare the 5V power supply on the user's side.
Carry out complete noise rejection treatment in the position command pulse input section.

Motor cable

A

B

C

GND

Motor

Always to be grounded

CN2

Encoder

Shielded wire treatment

CN1

Servo-driver

19

(5) Details of CN1 terminal I/O signals

a) Input <Note>: () Indicates Vcc signal power input.

Table 3.6

Signal name	Pin No.	Meaning	Details
FN 3 FN 2 FN 1 FN 0	1 (2) 3 (4) 5 (6) 7 (8)	Compliance setting (Servo stiffness setting)	The signal for setting the <fc> switch on an interface is a 4-bit positive logic binary number which can be set in 16 steps of fc = 1 to 16 Hz. (See Note 1.)
POSW 1 POSW 0	9 (10) 10 (12)	Positioning completion pulse width end	Signal of setting a deviation counting value for outputting the positioning completion pulses. Four step setting can be made in any range of 1 to 100, 2 to 200, 4 to 400 and 8 to 800 together with POSW switch setting.
SIGN+ SIGN-	20 19	Rotating direction command	The motor rotates CW with this signal set to H and CCW with the same signal set to L. (When viewed from the load side, it is the same hereafter.)
IRST	21 (22)	Integral capacitor reset	The integral capacitor in the velocity loop is shorted.
SRVON	23 (24)	Servo ON	The motor is set to the servo ON status 0.2 sec. after this signal is set to L to set the driver to the command wait status.
IACT/ PACT	25 (26)	Integral/ Proportional action selection	Integral action is selected when this signal is set to H and proportional action is selected when this signal is set to L in the position control mode.
GAIN H GAIN M GAIN L	37 (38) 35 (36) 33 (34)	Gain selection	Signal to select the variable DC gain range. DC gain can be varied in the range of 0.5 to 110 times. Set by the variable resistor. (See Note 2.)
RST	39 (40)	CPU reset	The driver control section is initialized with this signal set to L for more than 50 μ sec.
PULS+ PULS-	45 46	Position command pulse	Driver position command pulse signal
VIN	49 50	Velocity command input Torque command input	Set to the maximum number of revolutions at ± 6 V input. CW direction/+6 V, CCW direction/-6 V. #50 pin: GND For torque command: ± 8 V
AGND	50	Analog input GND	Velocity/torque input analog GND

(Note) FN 0 ~3 and POSW 0 to 1 are wired-ORed with the rotary switch on the interface card.

(Note 1) Table 3.8

FN 3	FN 2	FN 1	FN 0	fcSW posi- tion	fc (Hz)
H	H	H	H	0	1
H	H	H	L	1	2
H	H	L	H	2	3
H	H	L	L	3	4
H	L	H	H	4	5
H	L	H	L	5	6
H	L	L	H	6	7
H	L	L	L	7	8
L	H	H	H	8	9
L	H	H	L	9	10
L	H	L	H	A	11
L	H	L	L	B	12
L	L	H	H	C	13
L	L	H	L	D	14
L	L	L	H	E	15
L	L	L	L	F	16

(Note 2) Table 3.9

GH	GM	GL	Gain ※
H	H	H	1
H	H	L	4
H	L	H	7
H	L	L	10
L	H	H	13
L	H	L	16
L	L	H	19
L	L	L	22

(Note : The product of this GAIN value and the varriable resistor position (0.5 to 5) becomes the total gain.

(Note 3) Table 3.10

Model	Velocity detection sensitivity (V/rps)	No. of detection limit revolutions (rps)
DM1015B~DM1060B	5/2.0	3.0
DM1050A~DM1200A	5/1.0	1.5

(2) Driver section mounting

The standard driver is rack mounted.

a) Installation location

- When there is a heat generation body near the installation location, make sure that temperature does not exceed 50°C near the driver by providing a heat shield or cover, etc.
- When there is a vibration source near the driver, mount the driver to the rack with vibration insulators.
- In addition, avoid humidity high temperature environments containing dust, metal powder and corrosive gases.

b) Mounting procedure

- Normally, the driver is mounted with its front panel facing forward and its top and bottom surfaces horizontal. However, it may be mounted with its front panel facing upward. Always avoid mounting it with its panel surface facing sideways or upside down. (See Figure 3.13.)
- A self-cooling driver box with a built-in fan is employed, so it is necessary to have a ventilation space above the box. (See Figure 3.12.)
- Mount the driver using 4 holes at the top and bottom of the front plate.

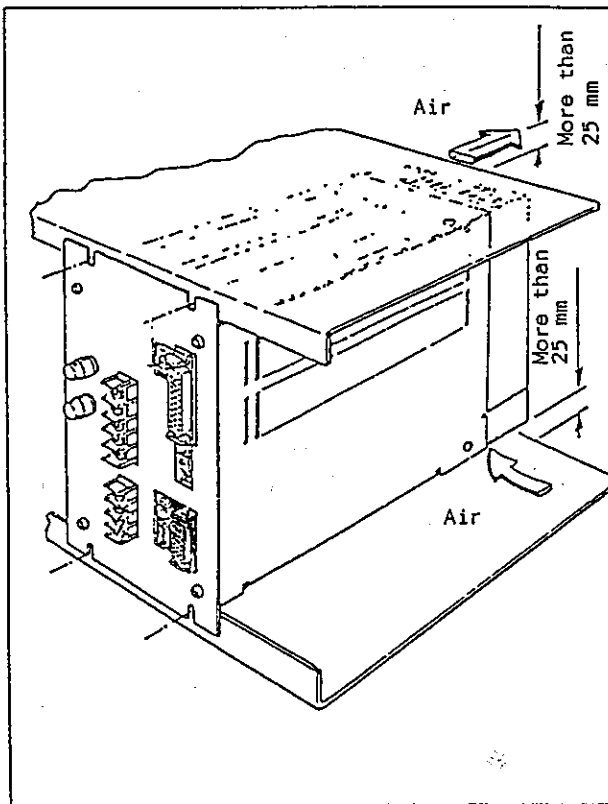


Figure 3.12

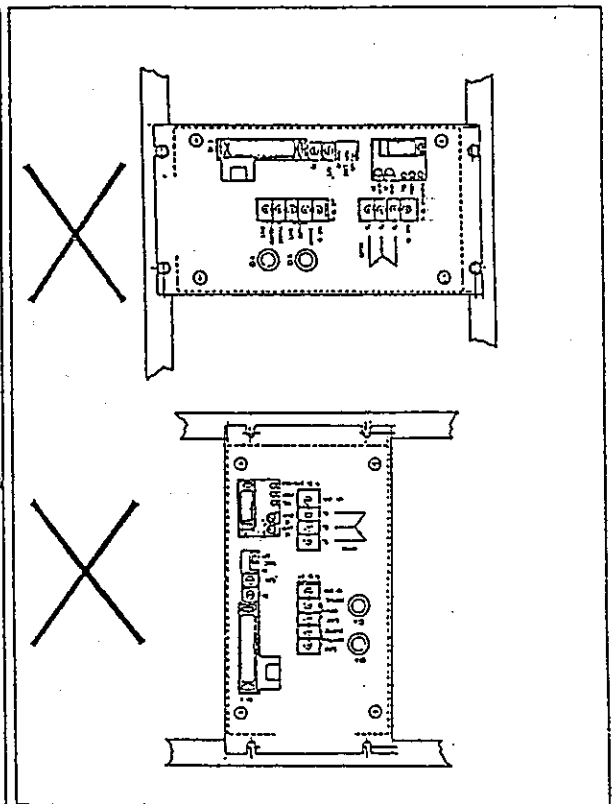


Figure 3.13

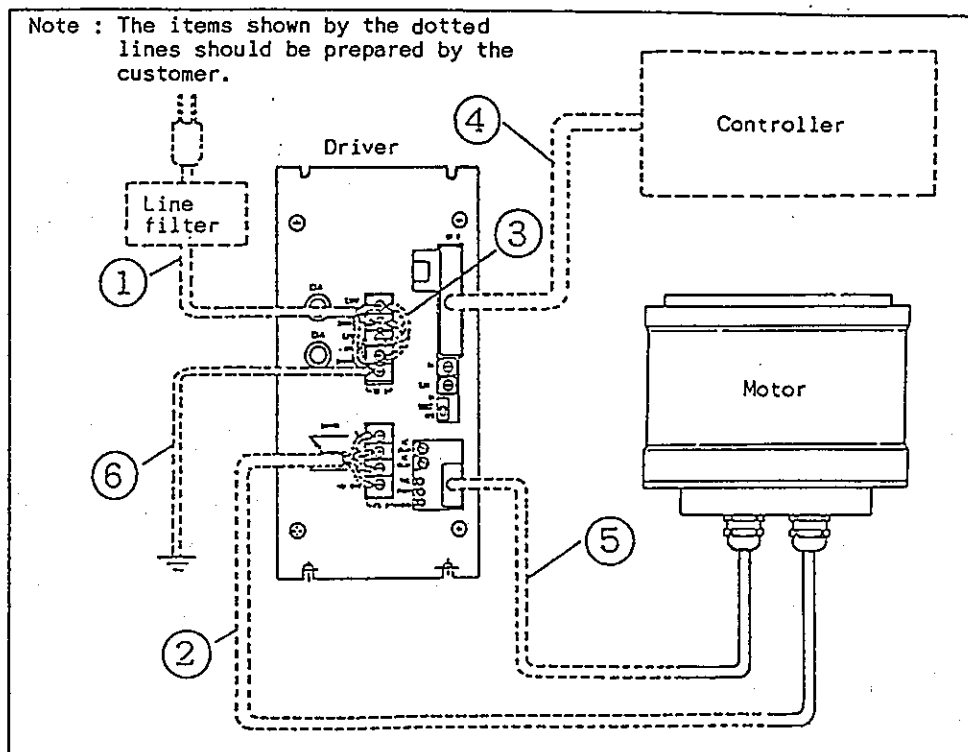


Figure 3.14

(2) Wiring cautions

- Use specified multi-core twisted pair cables with collective shielding for interface and encoder cables. Be sure conduct shield end treatment correctly.
- Use thick conductors as grounding cables as much as possible. Ground the DYNASERV through a resistance of less than $100\ \Omega$.
- Since high voltage large current flows through motor and AC power cables, make sure that their wirings are correct.

- (5) A/B phase, UP/DOWN pulse output signals (A/U \pm , B/D \pm)
Pulse signals to indicate the motor position. The following 2 pulse output statuses can be selected by jumpers on the controller board.

a) A/B phase output pulse

The following pulse signal is output with the jumper <UD/AB> on the controller board shorted.

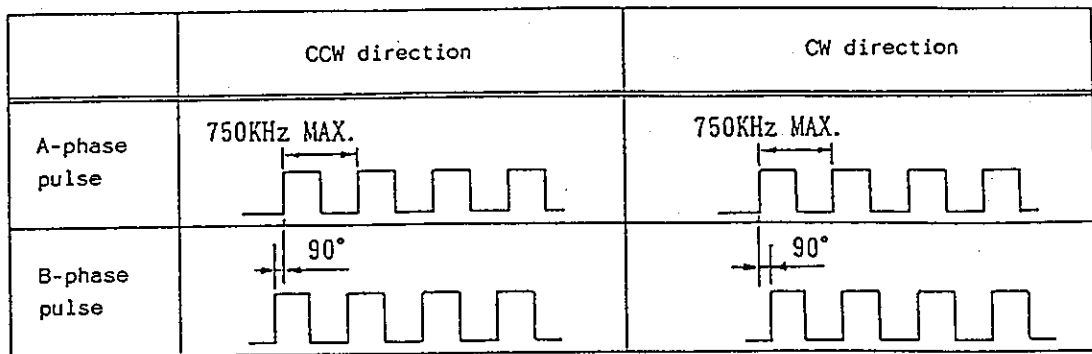


Figure 4.4

b) UP/DOWN output pulse

The following pulse signal is output with the jumper <UD/AB> on the controller board opened.

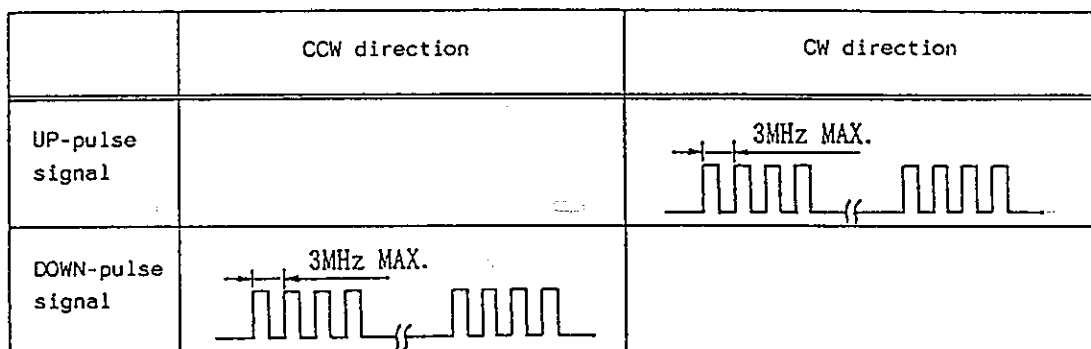


Figure 4.5

4.2 Power ON/OFF

Pay attention to the following when the power is turned ON.

- (1) When turning ON the main and control circuit power supplies, turn them ON simultaneously or turn ON the control circuit power first.
- (2) When turning them OFF, turn them OFF simultaneously (including after instantaneous power failure), or turn OFF the main circuit power first.
- (3) Rush current in both the main and control power circuits is about 25 A peak.
- (4) The motor is set to the servo status about 200 ms after SRVON is set to L.

5. Control Mode and Adjustment

5.1 Position Control Mode Adjustment

In the position control mode, motor positioning control is performed according to the command position sent from the higher-level controller. Two control methods are available in the velocity control mode: the I-PD type control system is selected with the CN1 connector <IACT/PACT> signal set to H, and the P type control system, with the same signal set to L. Usually, the I-PD type control system is selected in the positioning operation.

(1) I-PD type position control

This method uses position integral feedback and is suitable for highly accurate positioning. A stable control characteristic is also achieved even under load variation. In this mode, the adjustment of <fc switch>, <ILIM switch> and <DC gain variable resistor> becomes necessary.

a) <fc switch>

The 1 to 16 Hz position control system band is selected from a scale of 0 to F. However, in this case CN1 connectors FN 0 to FN 3 must all be set to H.

b) <ILIM switch>

This prevents the wind-up phenomenon by limiting the output of the digital integrator during software servo computation. The larger the switch No., the larger the limited value. The smaller the limited value, the smaller the wind-up and the shorter the setting time. However, if the limited value becomes too small, the motor output torque is limited. Therefore, it can be said that it is better to make the switch value large within the no wind-up range. The final adjustment is performed during the acceleration/deceleration operation.

c) <DC gain variable resistor>

The combination of driver CN1 connector GAIN H to L signals results in an adjustment range of from 0.5 to 110 times. The DC gain should be as large as possible. When there is inertia change, adjust the gain so that it becomes optimum at the maximum load.

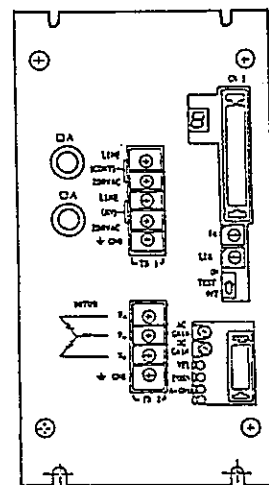


Figure 5.1

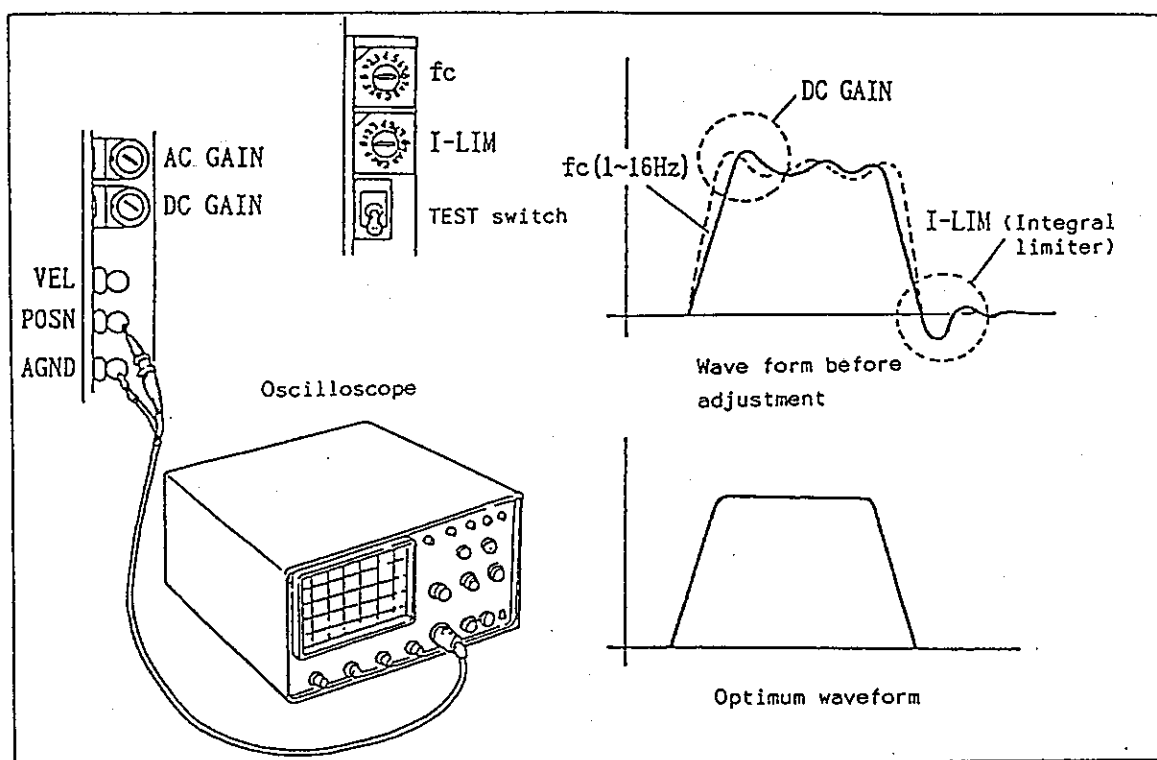


Figure 5.2

5.2 Velocity Control Mode Adjustment

In the velocity control mode, the motor rotating angle is controlled to correspond to the velocity command voltage (-6 V to $+6\text{ V}$) from the higher-level controller.

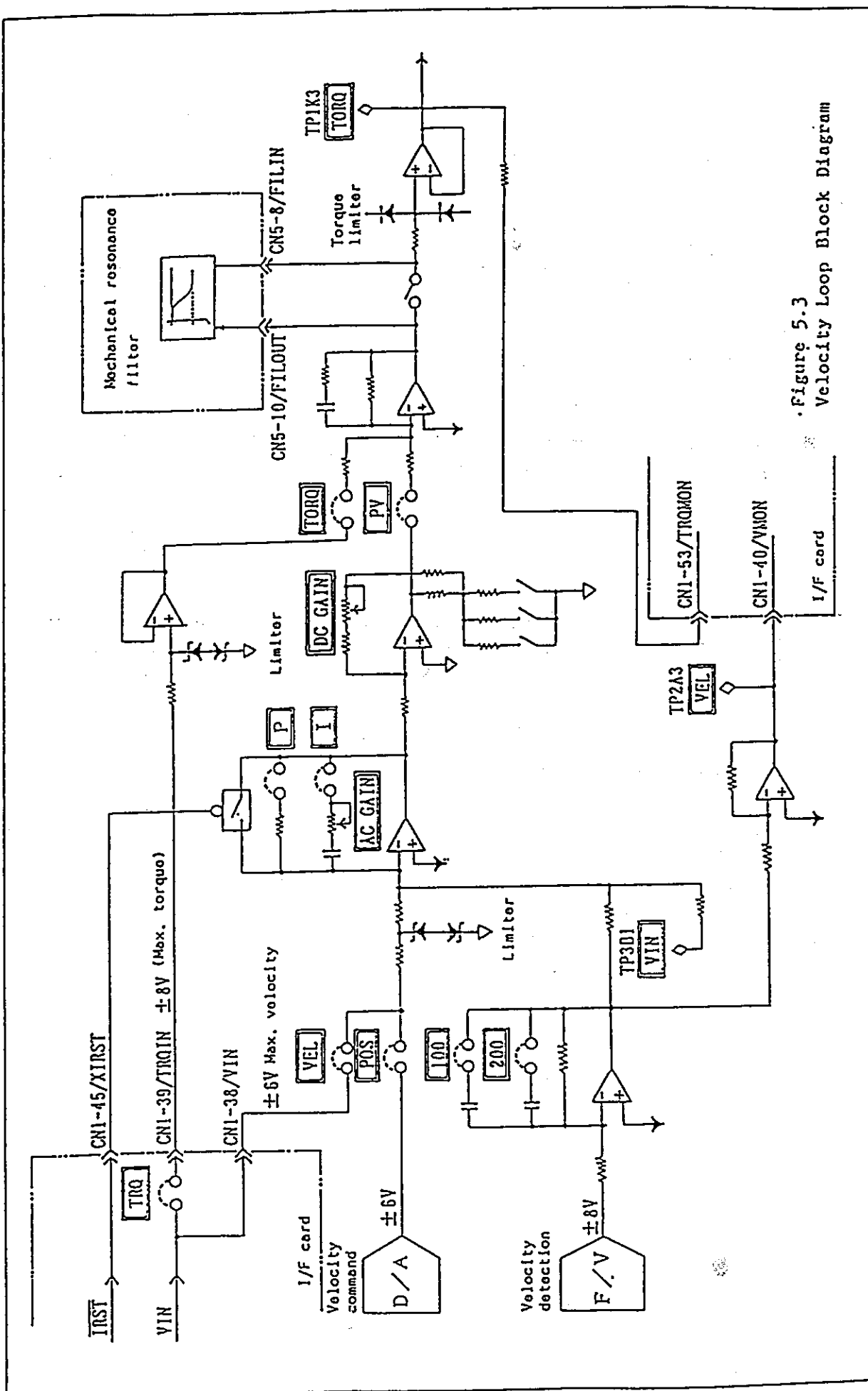
The two control methods can both be selected in the velocity control mode.

The following table shows the relationship between velocity command voltage and motor r.p.m.

Table 5.1

Model	No. of revolutions/Input voltage [rps/V]
DM1015B~DM1060B	2/5
DM1050A~DM1200A	1/5

(Note) The above table shows operation with a 200 V power supply.






7. Trouble and Measures

7.1 Motor Trouble

When trouble occurs during motor operation, take the appropriate measures in accordance with the following. When the motor does not work normally, even after the following measures have been taken, immediately stop operation and contact us.

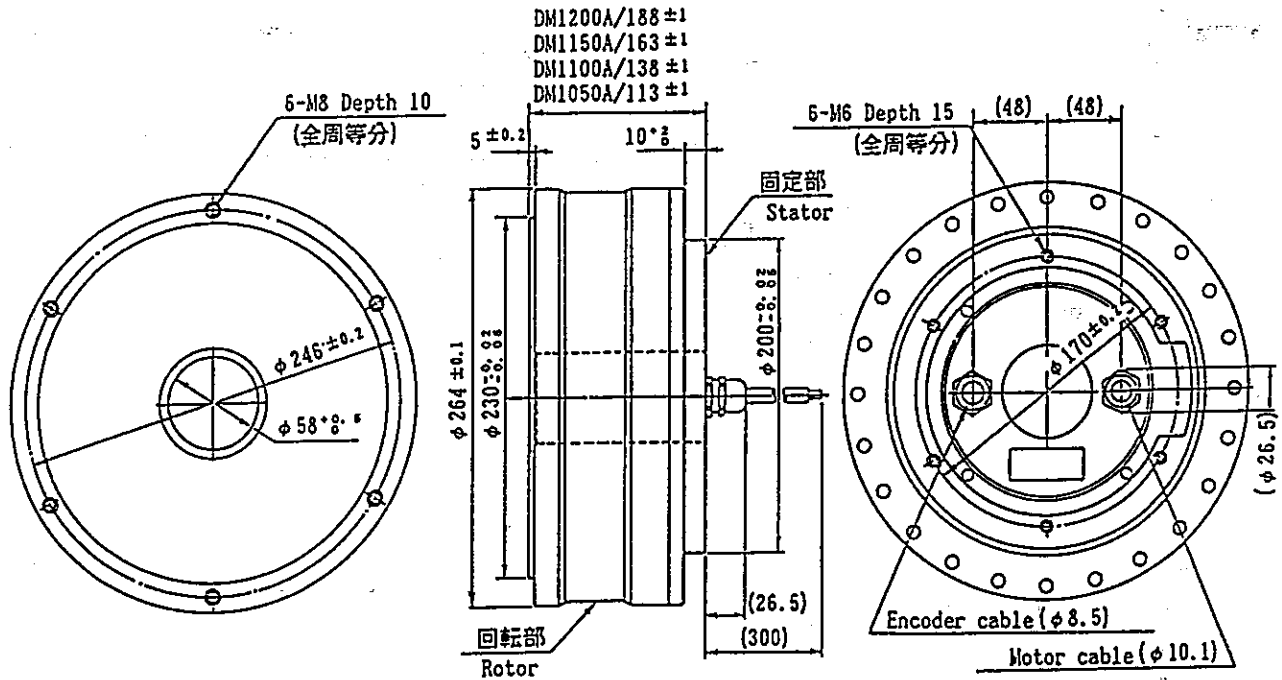
Trouble	Estimated cause	Inspected Item	Measures
The motor over-heats	◆ Ambient temperature is high.	Check to see if ambient temperature is more than 45°C.	Lower the temperature to below 45°C.
	◆ The motor is over-loaded.	Operate the motor under no load.	When starting the motor, lighten the load, or replace it with a large output motor.
Abnormal sound is produced.	◆ Incorrect mounting	Loose set screws.	Tighten the screws.
	◆ Bearing trouble	Check for sound and vibration near the bearing.	Motor replacement (Contact us.)
	◆ Mounting base vibration	Check the mounting base.	Reinforce the mounting base.
Position is dislocated.	◆ Incorrect A/B-phase and U/D-pulse jumper selection.	To be inspected.	
	◆ Command pulse rate and width are not as specified.	Check the command pulse width (160 n sec. Min.)	
	◆ Feedback pulse rate and receive circuit response speed are not as specified.	Check the feedback pulse rate (3 MHz Max.) and receive circuit response speed.	
	◆ Both ends of the feedback pulse transmission cable shield are not connected to the earth.	If so, connect the driver to AGND and the controller to SG.	

LED Display	Display Details	Cause/Measures
	Power amp. error occurrence	<ul style="list-style-type: none"> ◎High main power supply voltage ◎Imperfect connector contact/requirement for repair ◎Power board trouble/requirement for repair
	Overload occurrence (Servo ON status)	<ul style="list-style-type: none"> ◎Heavy load operation/load check, operation procedure review ◎Motor locked status/locked status release ◎Excessively high ambient temperature Lower environmental temperature
	Overload occurrence (Servo OFF status)	
Other than the above	Trouble of elements relating to LED output	<ul style="list-style-type: none"> ◎Control board trouble/requirement for repair

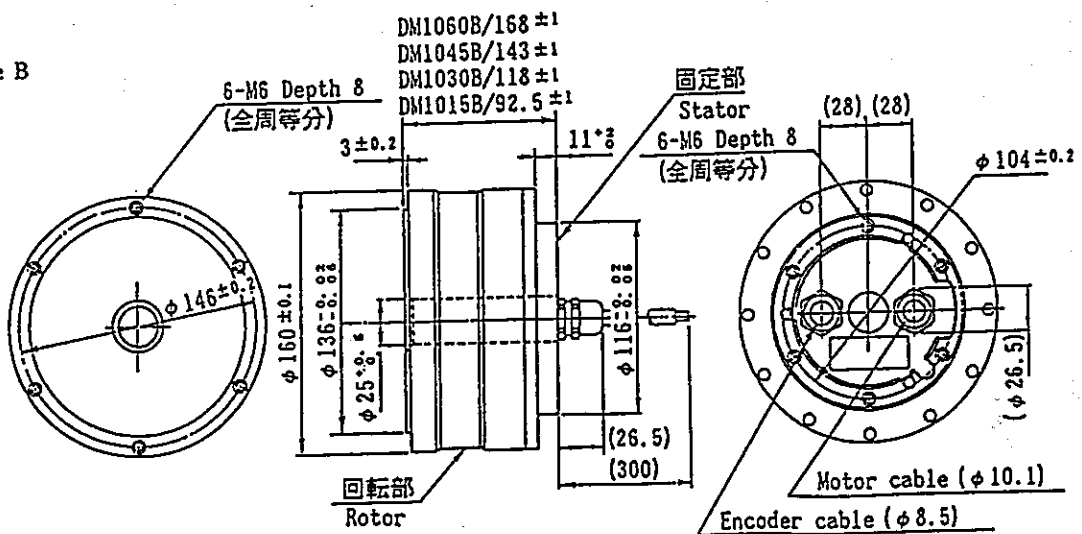
(Note) For "requirement for repair" (trouble of control board/power board), contact us.

8.3 Dimensional Outline Drawing Unit: mm
 (1) Motor (L: Indicated in motor specification)

Type A



Type B



8.4 Driver Block Diagram

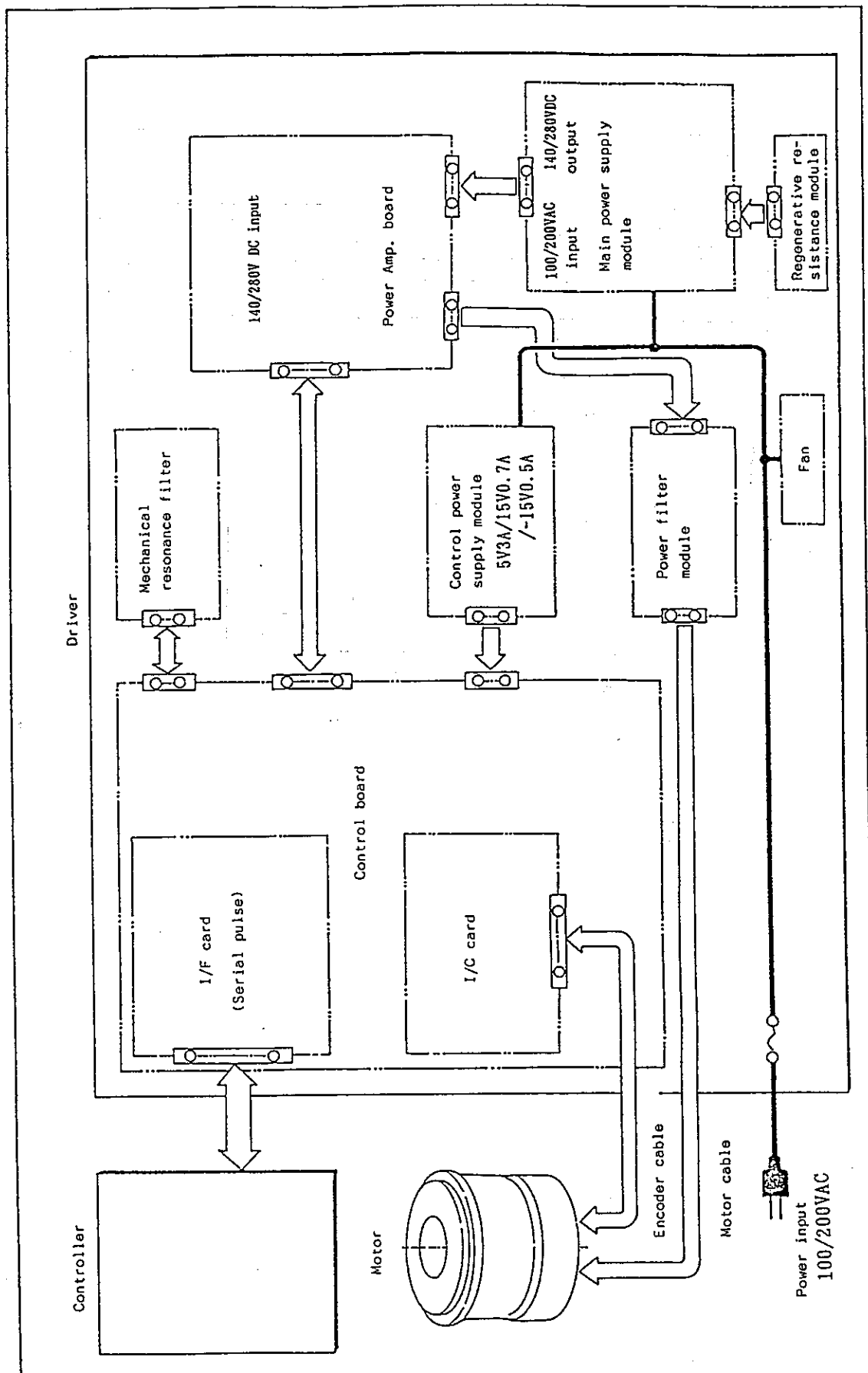


Figure 8.9

