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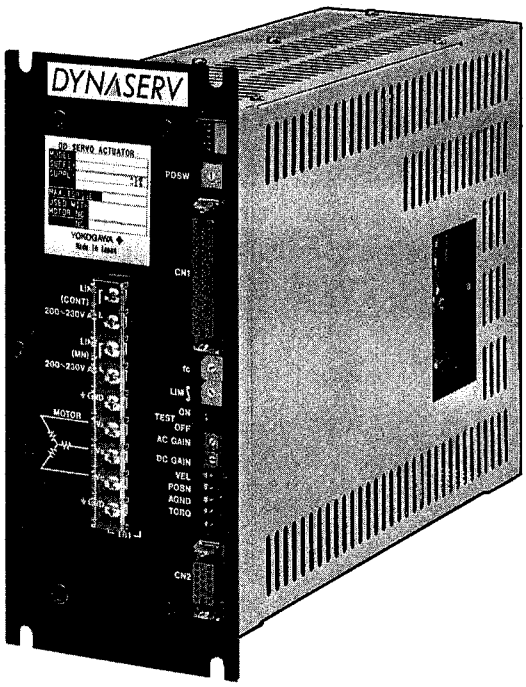
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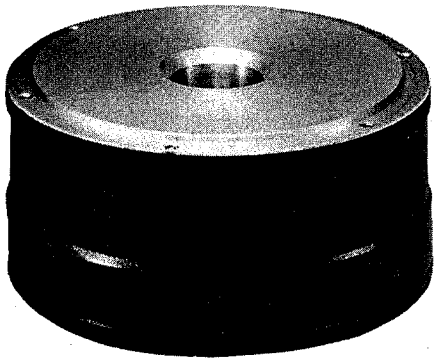
DYNASERV

DD Servo-Actuator DM / SD Series

(New Driver Model)

IM A301-E





YOKOGAWA ◆
Yokogawa Electric Corporation

IM A301 E
2004 - 02 - 01

INTRODUCTION

Thank you for purchasing our DYNASERV DD Servo-Actuator (New Driver Model). The DYNASERV is a high torque, high velocity, highly accurate outer rotor type servo-actuator which can be used in a wide range of field applications related to FA (Factory Automation), including industrial robots, indexes, etc.

This instruction manual covers the DM / SD series. Be sure to read this instruction manual prior to operating the DYNASERV.

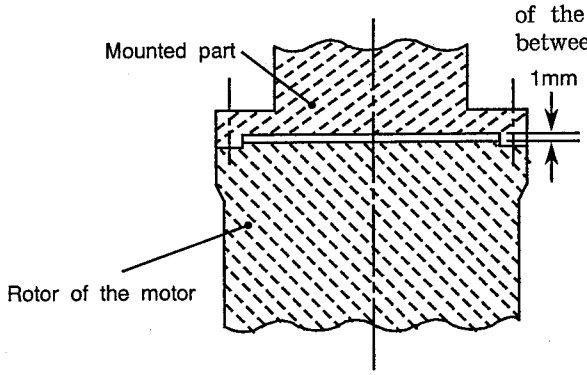
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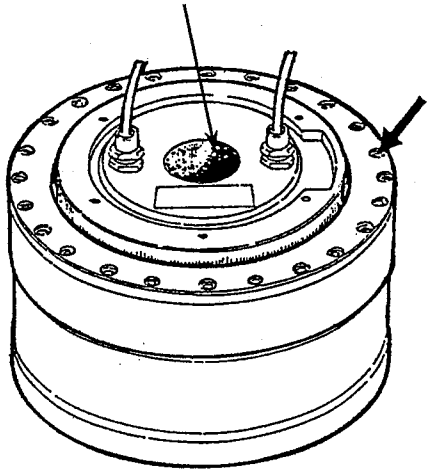
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Warning on Installation and Operation

1. Never install the motor with the rotor fixed and the stator set free for rotation.
2. Ensure that the power is switched off when removing the side panel of the driver for jumper setting, etc. Dangerously high voltage is present inside the unit.
3. The motor rotates at high speed with high torque. Beware of the rotating radius of the load when operating the motor with the load installed.
4. Ensure adequate grounding at the ground terminal.
5. When installing a load to the rotor of the motor, allow a space of 1mm or more between the top surface of the motor and the surface of the load in order to maintain the proper alignment of the surfaces. Never apply any force or press fit any materials into the center hole. (See the figure below.)



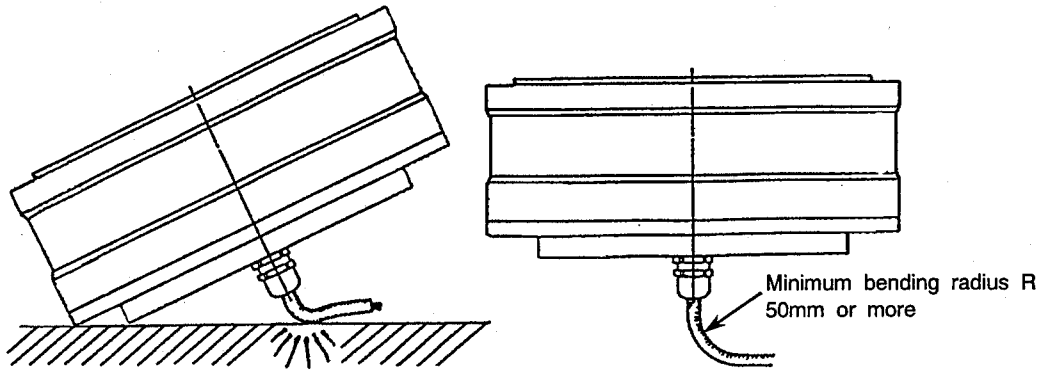
When an object is to be introduced inside the central hole of the motor, ensure a minimum gap of 1mm on either side between the object and the motor walls.



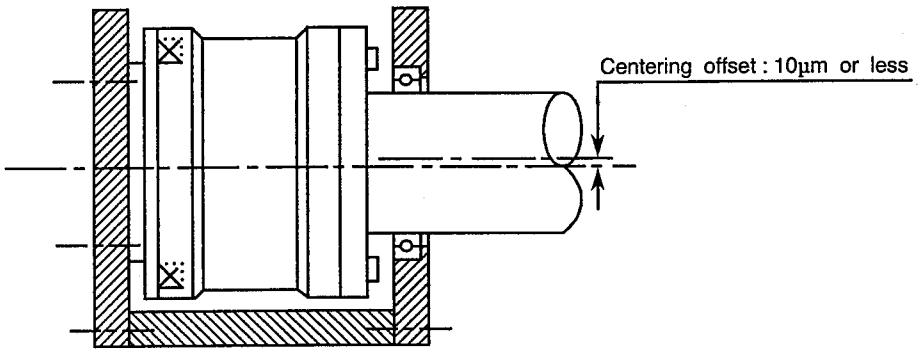
6. Never touch the bolts (indicated by arrow in the figure) which fix the bottom part of the rotor of the motor. (See the figure on the right.) Loosening or tightening these volts may change the electrical commutation angle, and may result in faulty rotation.
7. Materials easily affected by magnetism must never be brought, close to the motor as the surface of the motor is magnetized.
8. Install the motor in an appropriate location as the motor is not dust proof, watertight or oil proof.
9. If the motor is used with oscillating rotation movements with a small angle (50° or less), then carry out a running-in operation with back-and-forth movement about 10 times, each move exceeding an angle of 90° at least. The running-in operation must be carried out every 10,000 times of back and forth oscillation movements in order to ensure proper lubrication of the bearings.
10. Compatibility of the motor with the driver or vice versa when they are of a same model is possible only when they are of the same type. (i.e. when the motor code is DM1□□□□50*1, and the driver code is SD1□□□□52, the □□□□ of the motor and the driver shall be the same.)
11. Never disassemble or modify the motor or the driver. When such disassembling or modification is required, consult Yokogawa Electric Corporation or its authorized agency. Yokogawa Electric Corporation or its authorized agency, accepts no responsibility for disassembled or modified motor and driver.

Warning on Installation and Operation

12. If the motor is placed on the floor or the like as shown below when carrying or installing the DYNASERV, the cable is bent by the weight of the motor and this bending may cut the conductor wire. When placing the motor, be sure to use a supporting base which protects the cable from being bent.
    The minimum bending radius shall be 50mm or more when installing the motor with the cable being bent. Do not apply bending force repeatedly to the cable when it is used. The cable specifications do not include application with a robot.



13. Appropriate centering and alignment must be carried out when connecting the motor to a load. The shaft metal of the motor may get damaged if the centering offset remains 10µm or more.



14. Never carry out a withstanding voltage test. Carrying out this test ever accidentally may damage the circuits. When such withstanding voltage tests are required, consult Yokogawa Electric Corporation or its authorized agency.

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1. PRODUCT OUTLINE

1.1 DYNASERV, DM / SD Series

The DYNASERV series are high speed, high torque, highly accurate outer rotor type servo actuators which embody the measurement technology and control technology developed during Yokogawa Electric Co.'s long experience in the field.

The DYNASERV is composed of a motor section incorporating an encoder, and a driver section.

There are two DYNASERV mode types–the 4 models of A Series with an output torque of 50–200N·m, and 4 models of B Series with an output torque of 15–60N·m. The A and B Series have an outer diameter of 264mm and 160mm respectively and a cylindrical hole of 58mm and 25mm diameter respectively.

There is a driver model for each motor.

The drivers are available in types so that they can correspond to motor types. The drivers are available also with 100–115V power supply type and 200–230V power supply type.

Table 1.1 DYNASERV Models DM / SD Series

Motor Model No.		Driver Model No. (Former SR Driver Exchangeable)	Max. Torque (N·m)	Rated Output (W)	Rated Rotation Speed (rps)
A Series	DM1200A50*1	SD1200A52-□	200	820	1
	DM1150A50*1	SD1150A52-□	150	630	
	DM1100A50*1	SD1100A52-□	100	410	
	DM1050A50*1	SD1050A52-□	50	220	
B Series	DM1060B50*1	SD1060B52-□	60	450	1.5
	DM1045B50*1	SD1045B52-□	45	380	2
	DM1030B50*1	SD1030B52-□	30	250	
	DM1015B50*1	SD1015B52-□	15	125	

□ / 1 : 100–115V, 2 : 200–230V

1.2 Standard Product Configuration

The standard product set consists of the following components. When after unpacked, ensure that the product corresponds to the correct model, and also ensure that the types and quantities of standard accessories are also correct.

Table 1.2 Standard Products

Part Name	Q'ty	Remarks
Motor section	1	
Driver section	1	
Connector (for CN1 terminal)	1	Manufactured by Honda Tsushin Kogyo : MR-50LM
Connector (for CN2 terminal)	1	Manufactured by Honda Tsushin Kogyo : MR-16LM

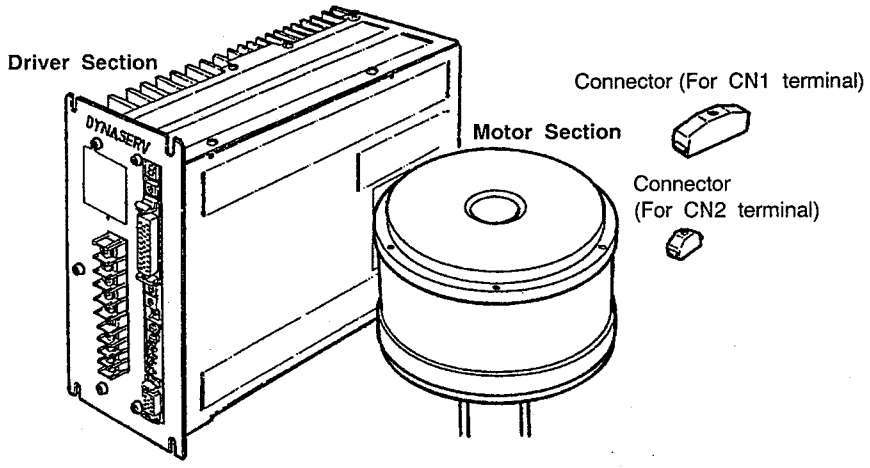
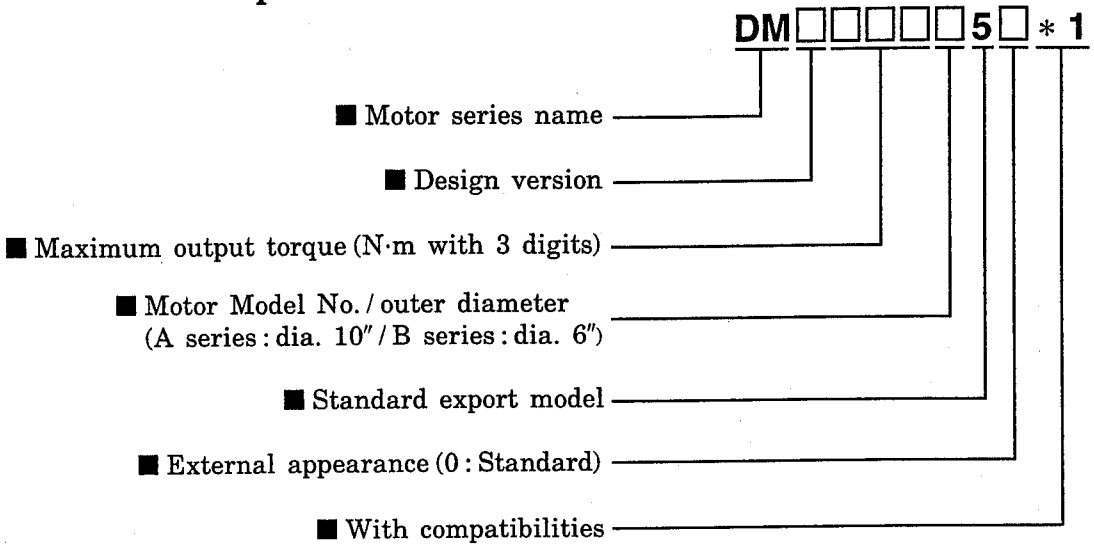


Figure 1.1 Standard Products

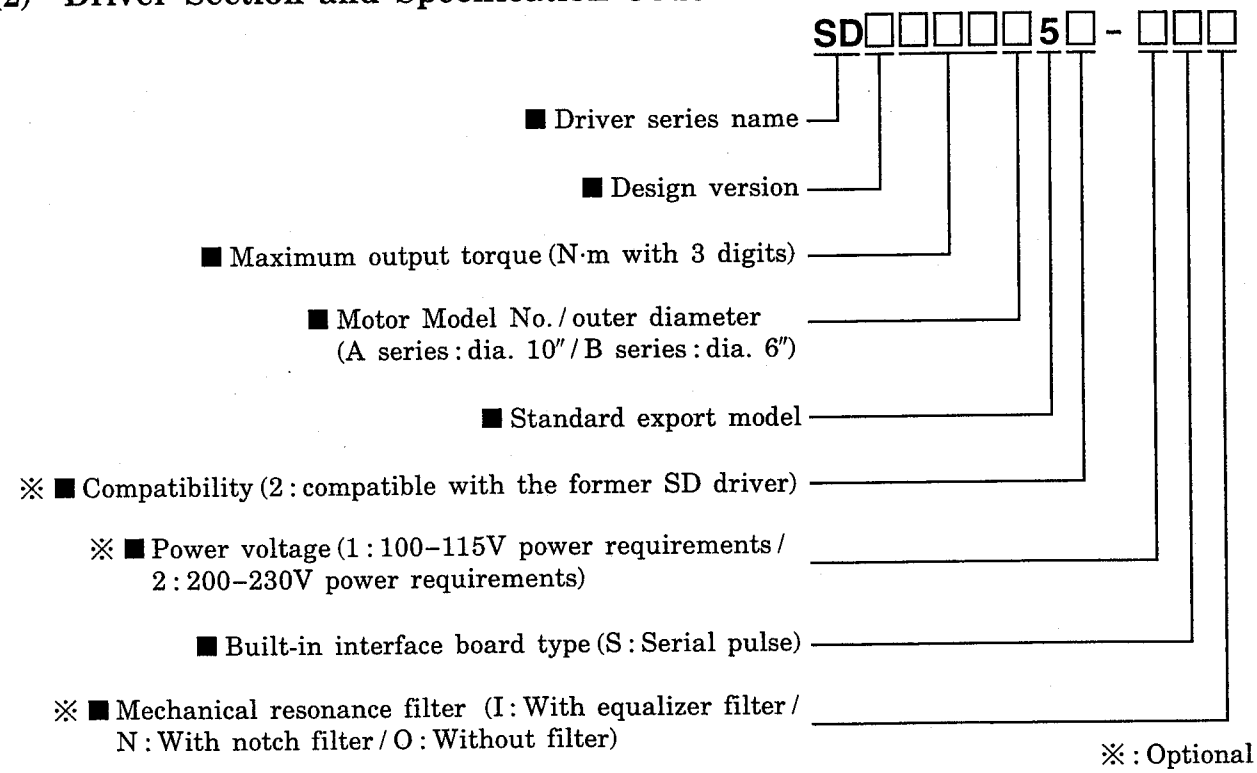
1.3 Model and Specification Code

The DYNASERV, DM / SD Series motor and driver Model Nos. specification code of the rating nameplate are as shown in the following.

(1) Motor Section and Specification Code



(2) Driver Section and Specification Code



Note : The motor and the driver are compatible within the same model type. For compatibility, the upper five digits of the motor code type (DM□□□□□) and the driver code type (SD□□□□□) shall be the same.

2. FUNCTIONAL DESCRIPTION

2.1 Motor Section

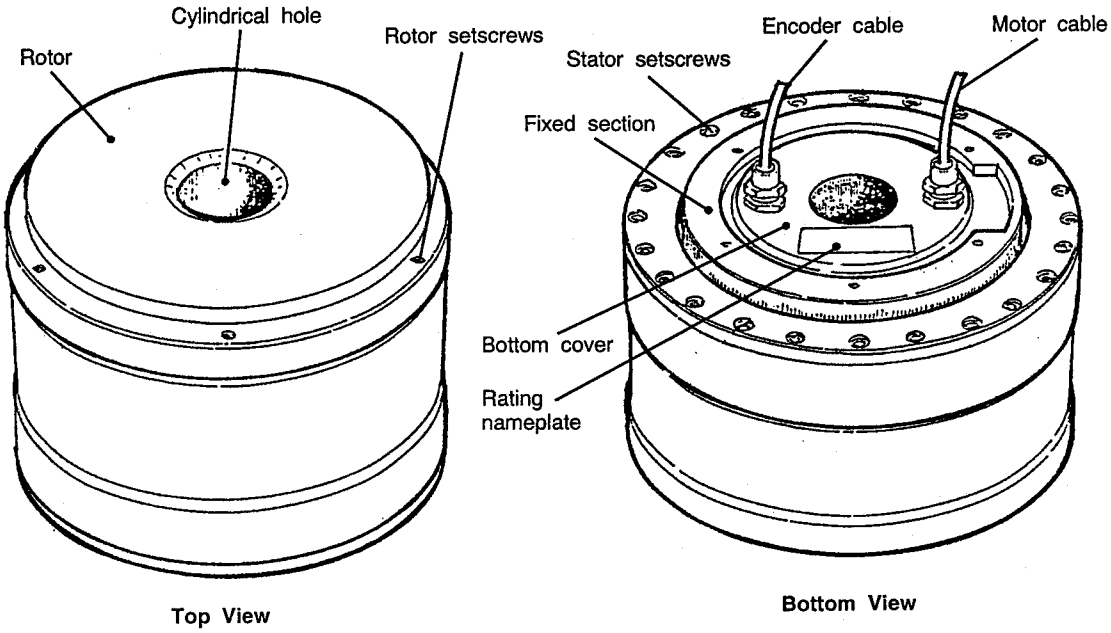


Figure 2.1 Parts Name of the Motor

2.2 Driver Section

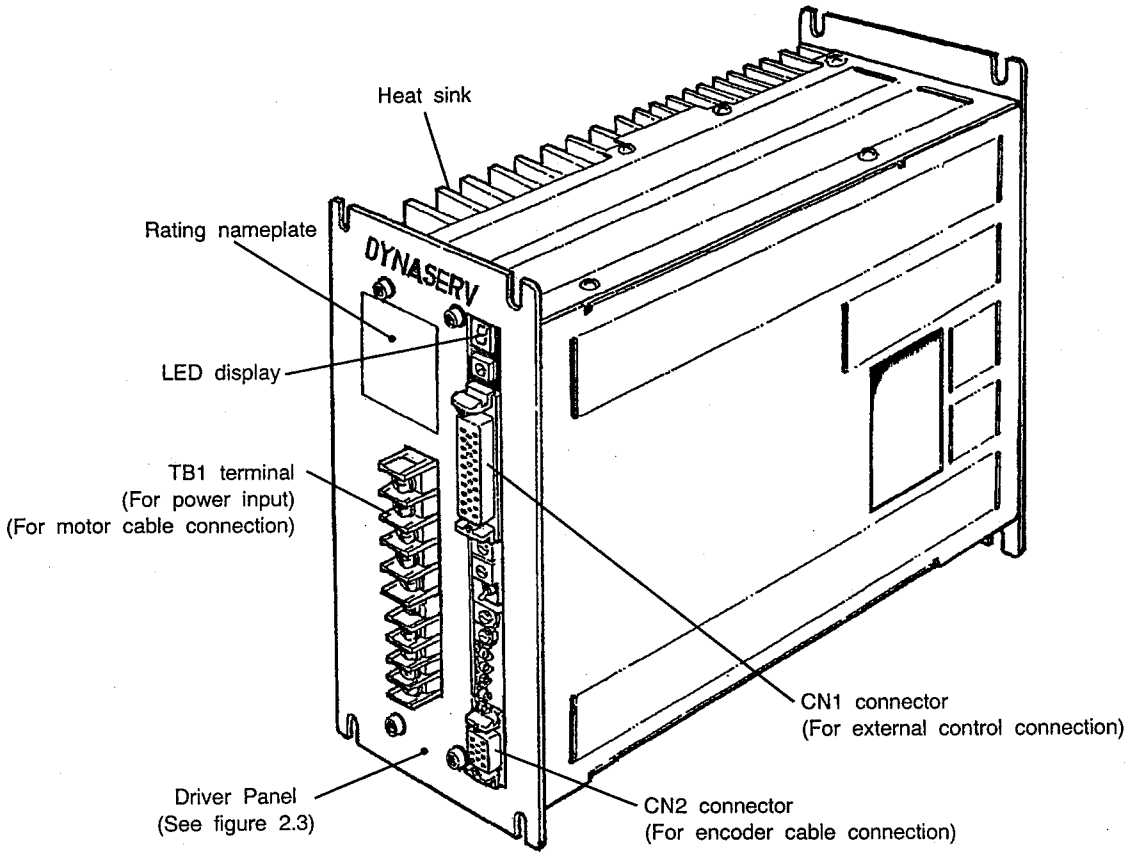
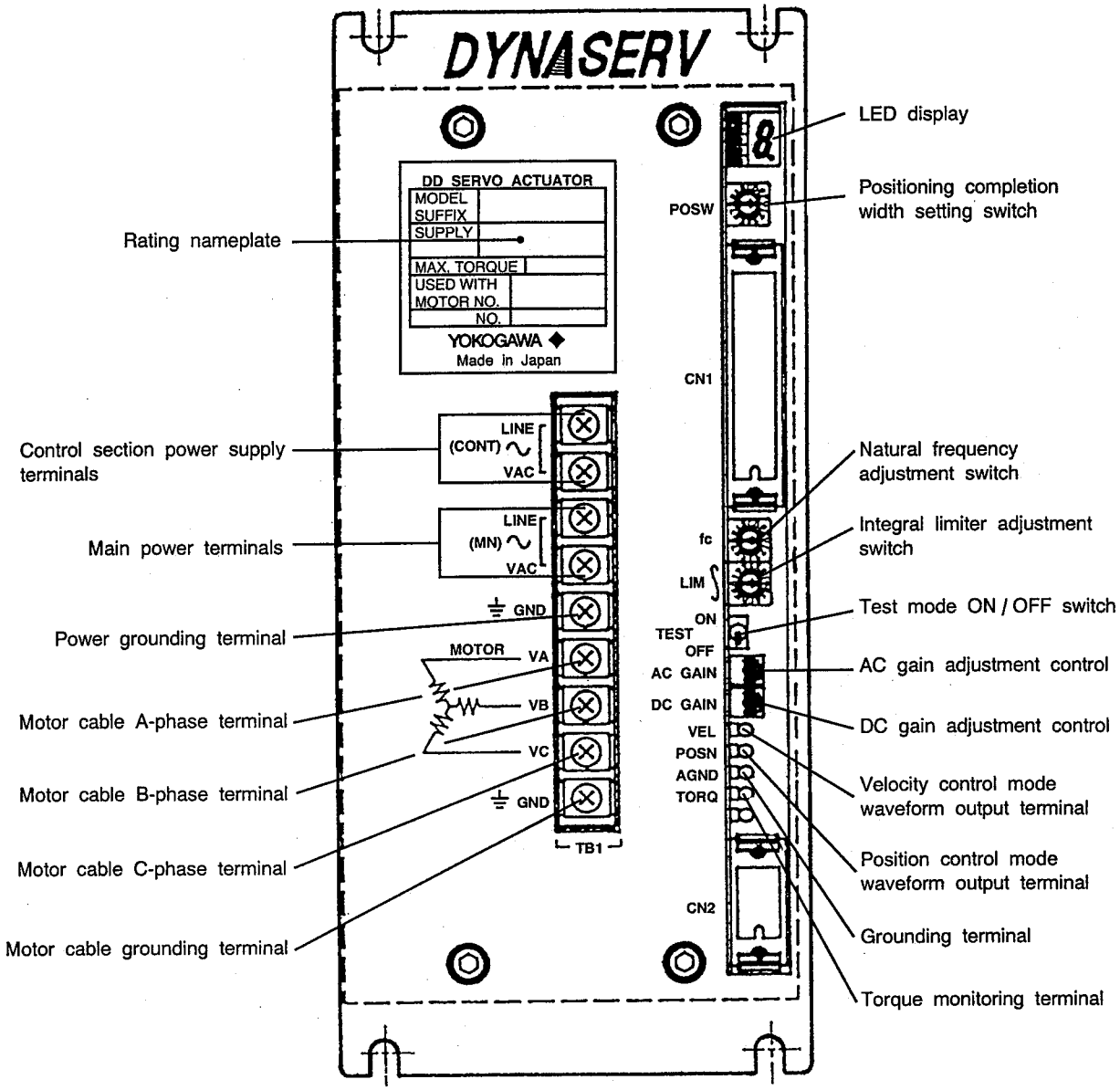


Figure 2.2 Parts Name of the Driver

2.3 Driver Panel Surface



*: Both GND terminals are connected.

Figure 2.3 Name and Exploration of the Controls and Terminals on the Driver Panel

3. PREPARATION FOR OPERATION

3.1 Initial Setting

(1) Setting of the Jumper Switches in the Driver Box

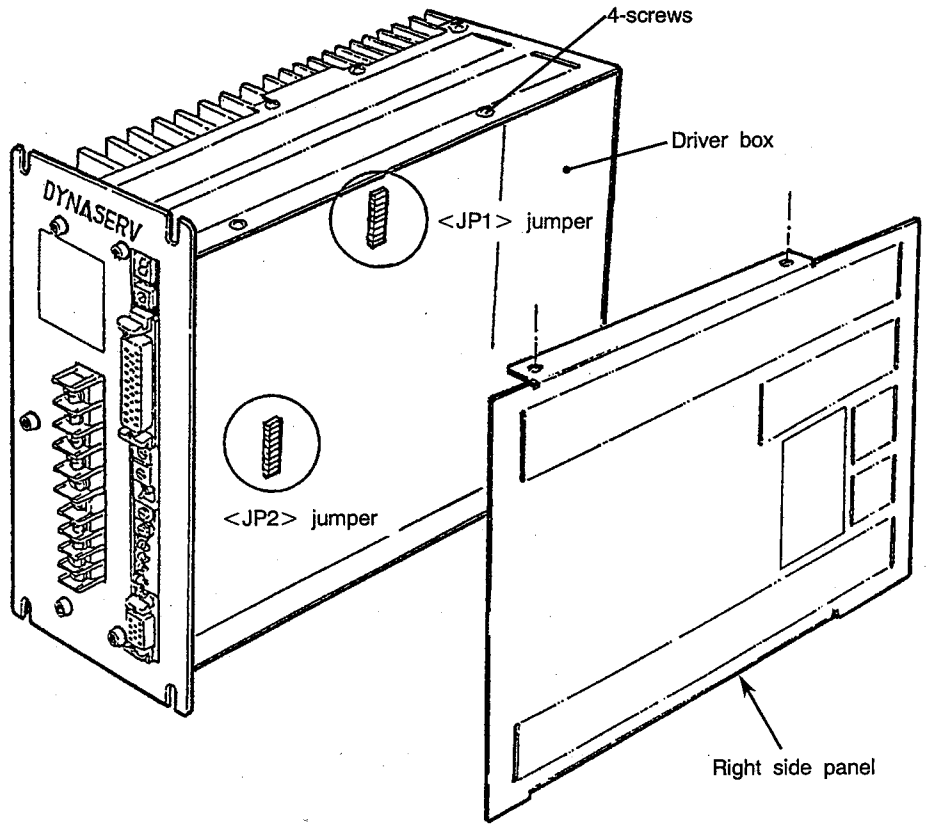


Figure 3.1 Setting of the Jumper Switches in the Driver Box

Certain 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 figure above for their locations.

To remove the side plate of the driver box, unscrew the 4-screws shown in the figure above.

CAUTION

However, prior to commencing any operation, always turn OFF the power. Further, 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.

(2) Jumper Settings Done Prior to Shipment

<JP1> Jumper

- ▪▪ MODE : See the next page
- •• CALIB : See the next page
- ▪▪ RATE#1 : Position command pulse multiplying factor setting
- ▪▪ RATE#2 : Position command pulse multiplying factor setting
- ▪▪ UD / AB : With jumper / A / B-phase, Without jumper / Up / Down pulse
- ▪▪ VFFH : Velocity feed forward amount setting (Note 1)
- ▪▪ VFFM : Velocity feed forward amount setting (Note 1)
- ▪▪ VFFL : Velocity feed forward amount setting (Note 1)
- •• GAIN H : DC gain magnification setting (Note 2)

<JP2> Jumper

- •• I : Velocity I type control
- ▪▪ P : Velocity P type control
- •• 100 : Velocity detection filter (Hz) selection (Open when a mechanical resonance filter is installed)
- ▪▪ 200 : Velocity detection filter (Hz) selection (Open when a mechanical resonance filter is installed)
- ▪▪ PV : Mode selection
- •• VEL : Velocity input
- •• TORQ : Torque input
- •• ALM
- •• TLIM : Open for standard models

Note : ▪▪ indicates setting prior to shipment.

(Note 1)

VFFH	VFFM	VFFL	Velocity Feed Forward Amount (%)
Shorted	Shorted	Shorted	100
Shorted	Shorted	Open	95
Shorted	Open	Shorted	90
Shorted	Open	Open	85
Open	Shorted	Shorted	80
Open	Shorted	Open	75
Open	Open	Shorted	70
Open	Open	Open	65

(Note 2)

Type	Gain Magnification
With jumper	DC Gain×13
Without jumper	DC Gain×1

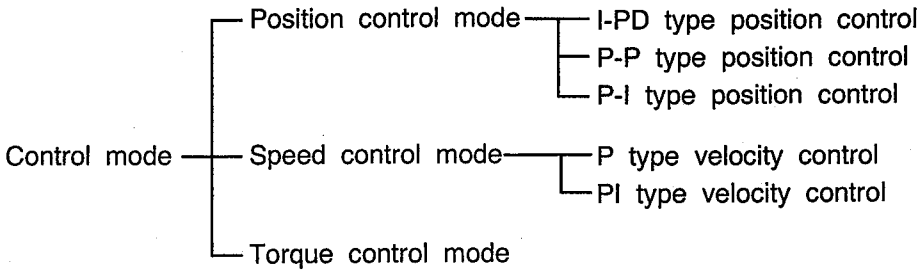
(3) Switch, Volume Settings Done Prior to Shipment

Switch Name Volume Name	Setting Status
DC GAIN	Minimum position
AC GAIN	Minimum position
POSW	Set to "0"
fc	Set to "0"
I. LIM	Set to "0"
TEST	Set to "OFF"

3.2 Control Mode Setting

(1) Control Mode Types

The following 6 control modes are available for the DYNASERV DM / SD Series.



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

Table 3.1 List of Control Modes and Jumper Pin Switch Settings

Section	Jumper Name Switch Name	Position Control			Velocity Control		Torque Control Mode
		I-PD Mode	P-P Mode	P-I Mode	P Mode	PI Mode	
JP1	MODE	Shorted	Shorted	Shorted	Open	Open	Open
	CALIB	Open	Open	Open	Open	Open	Shorted
	RATE #1	○	○	○	○	○	○
	RATE #2	○	○	○	○	○	○
	UD / AB	○	○	○	○	○	○
	VFFH	○	○	○	×	×	×
	VFFM	○	○	○	×	×	×
	VFFL	○	○	○	×	×	×
	GAIN H	○	○	○	○	○	×
JP2	I	Open	Open	Shorted	Open	Shorted	Open
	P	Shorted	Shorted	Open	Shorted	Open	Open
	100	○	○	○	○	○	○
	200	○	○	○	○	○	○
	PV	Shorted	Shorted	Shorted	Shorted	Shorted	Open
	VEL	Open	Open	Open	Shorted	Shorted	Open
	TORQ	Open	Open	Open	Open	Open	Shorted
	DC GAIN	○	○	○	○	○	×
	AC GAIN	×	×	○	×	○	×
	POSW	○	○	○	×	×	×
	fc	○	○	○	×	×	×
	ILIM	○	×	×	×	×	×
	TEST	○	○	○	○	○	×

Note : ○ : Validity, When the set value exerts an influence on motor operation.
× : Invalidity, When the set value does not exert an influence on motor operation.

(2) Feedback Pulse and Position Command Pulse Settings / JP1

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>.

a) **<RATE#1 to 2> Jumpers**

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

Set Value		Multiplying Factor
<RATE#1>	<RATE#2>	
Shorted	Shorted	1
Open	Shorted	2
Shorted	Open	4
Open	Open	8

b) **<UD/AB> Jumpers**

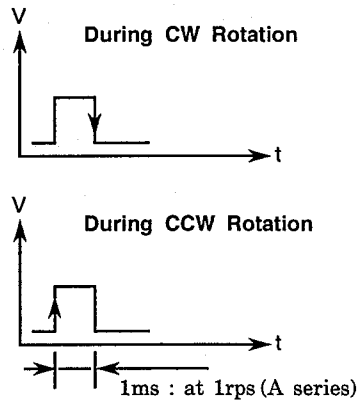
The selection of these jumpers enables the selection of the A/B phase or the UP/DOWN phase. The shorted jumper results in the A/B phase, and the open jumper, the UP/DOWN phase.

(3) Velocity Signal Filter Setting/JP2

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

(4) Origin Pulse Output Signal Setting/z+, z-(Pin#43, 44)

This setting for the detection signal of a reference zero (origin) position is achieved by equally dividing the angles of one rotation of the motor (for series A it is 100 and for series B it is 60). When the reference zero position is detected, the following potential signal will be output. Upon detecting the reference zero position, the potential of the detection signal changes from H (high) to L (low) when the motor is rotating in the CW (clockwise) direction; and it changes from L to H when the motor is rotating in CCW (counterclockwise) direction. The direction CW or CCW in this case are defined as direction of rotation upon viewing the motor from the load side.



(5) Positioning Completion Width Setting/S1

When positioning in the position control mode is completed, the CN1 connector COIN signal is set to ON. This positioning completion width can be selected by the [POSW] switch on the front panel.

The table on the right shows the relationship between [POSW] switches with <POSW 0, 1> signal of the CN1 connector set to H and the positioning completion width.

At the same time, when setting the position completion width using <POSW 0, 1> signal, set the [POSW] switch in 4 steps as shown in the table. With a combination of H and L of the <POSW> signals, the same selection as the [POSW] switch can be carried out.

Table 3.2 Setting of the Positioning Completion Width

[POSW] Switch Setting	Positioning Completion Width (Unit : Pulse)※	<POSW> Signal Setting		
		POSW 1	POSW 0	POSW Switch
0	1	H	H	0
1	5	H	L	
2	20	L	H	
3	100	L	L	
4	2	H	H	4
5	10	H	L	
6	40	L	H	
7	200	L	L	
8	4	H	H	8
9	20	H	L	
A	80	L	H	
B	400	L	L	
C	8	H	H	C
D	40	H	L	
E	160	L	H	
F	800	L	L	

※: 1 pulse=1/max. resolution

(6) Mechanical Resonance Filter (Notch Type) Adjustment (Optional)

The following explains the adjustment procedure when the mechanical resonance filter (notch type) is installed as an option. The board of the filter is located as shown below just inside the square cut-out on the side panel. The controls <fn_1> and <fn_2> on the board are used to set the notch frequencies at the first stage and the second stage respectively. The frequencies can be set within the range from 150Hz to 1.5kHz (the frequencies are factory-set to 1.5kHz when shipped).

Use the controls <Q1> and <Q2> to change the setting of the Q values. The Q values can be set within a range from 0.5 to 2.5 (0 to 20kΩ) (the Q values are factory-set to 2.5 at the time of shipping). The offset voltage shall be readjusted when the Q value has been changed. This voltage is to be adjusted using adjustment controls so that the voltage difference between <TP1> and <TP3> becomes 50mV or less.

The first-order delay filter is also located on this board. The frequencies can be selected from 20 / 80Hz, 30 / 120Hz and 40 / 160Hz, using a jumper. In addition, using an appropriate pair of C and R, a desired filter frequency can be set. The frequencies of the first-order delay filter are factory-set to 20 / 80Hz at the time of shipping.

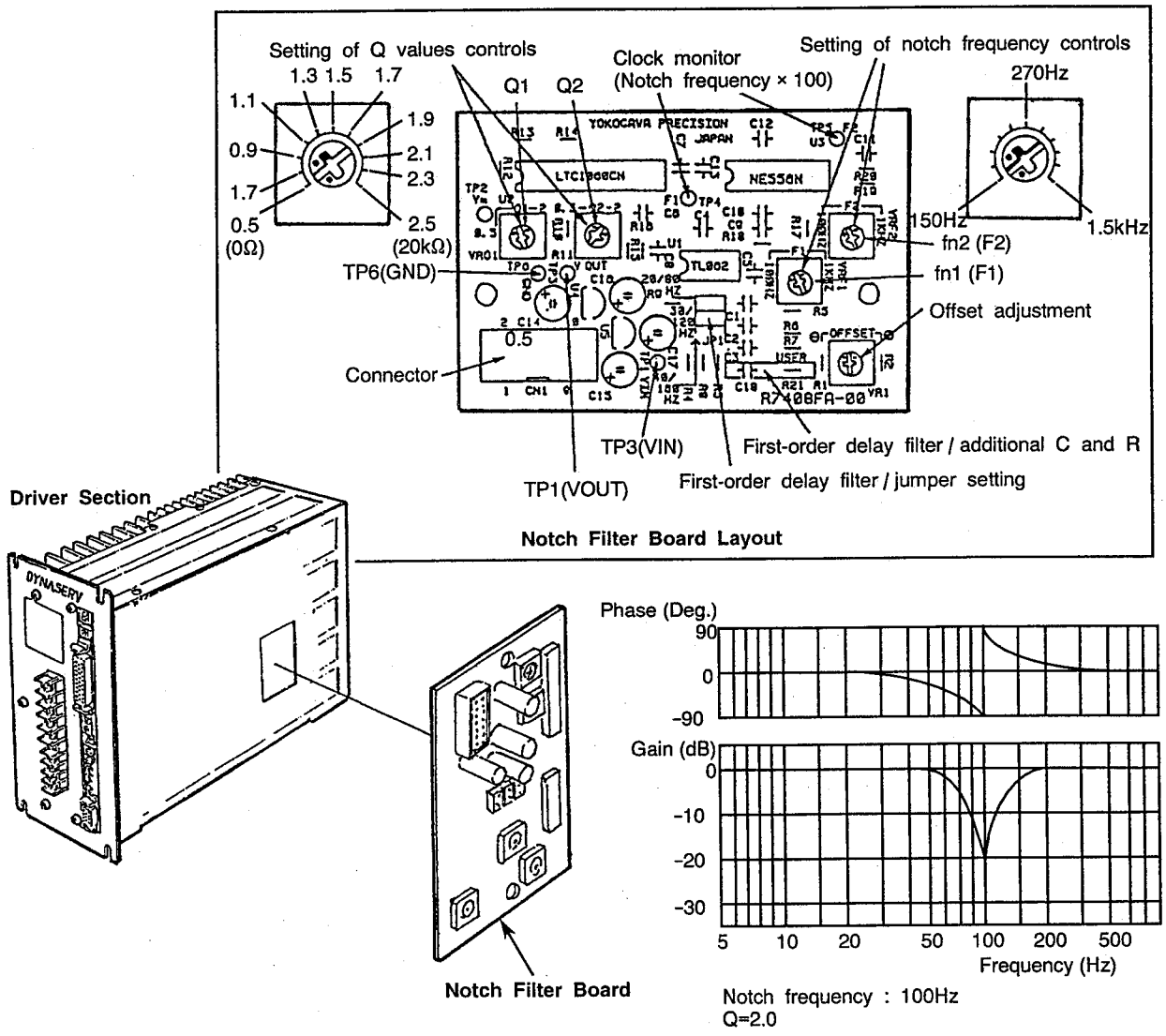
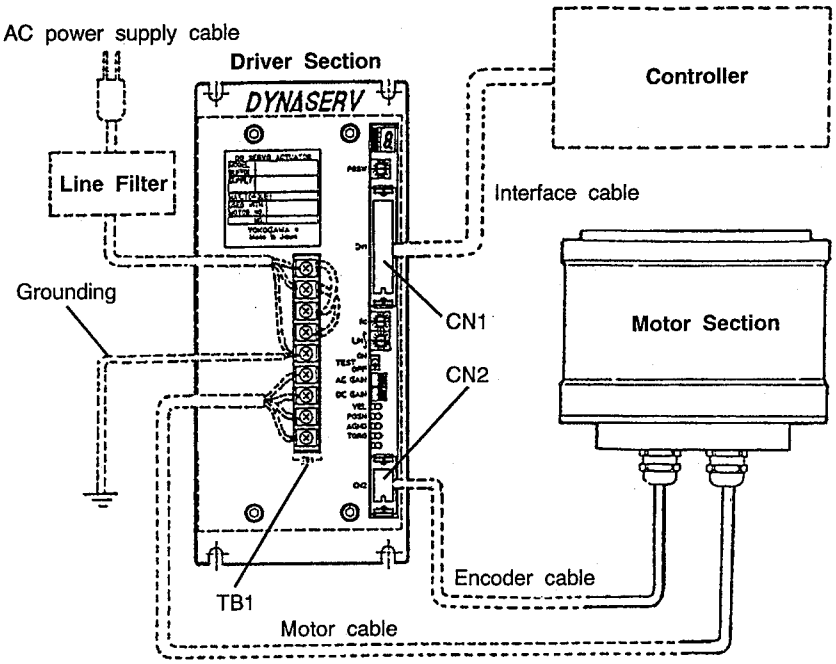


Figure 3.2 Mechanical Resonance Filter (Notch Type) Adjustment (Optional)

3.3 External Wiring

(1) External Connection Outline Diagram



Note : The items shown by the dotted lines should be prepared by the customer.

Figure 3.3 External Connection Outline Diagram

(2) Connection between the Motor and the Driver

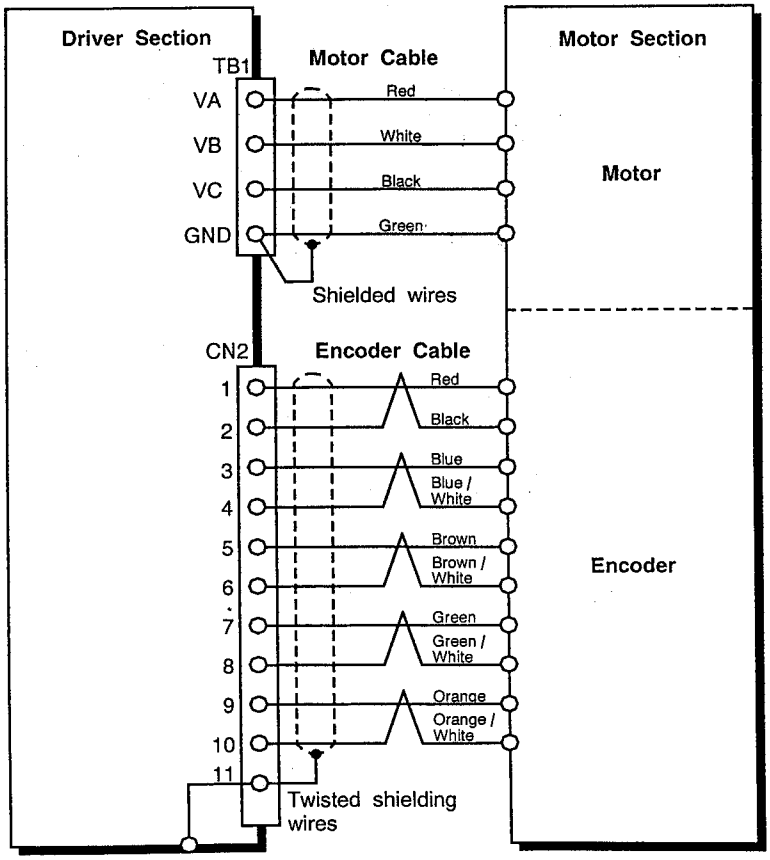


Figure 3.4 Connection between the Motor and the Driver

(3) Typical Wiring Example (In the Position Control Mode)

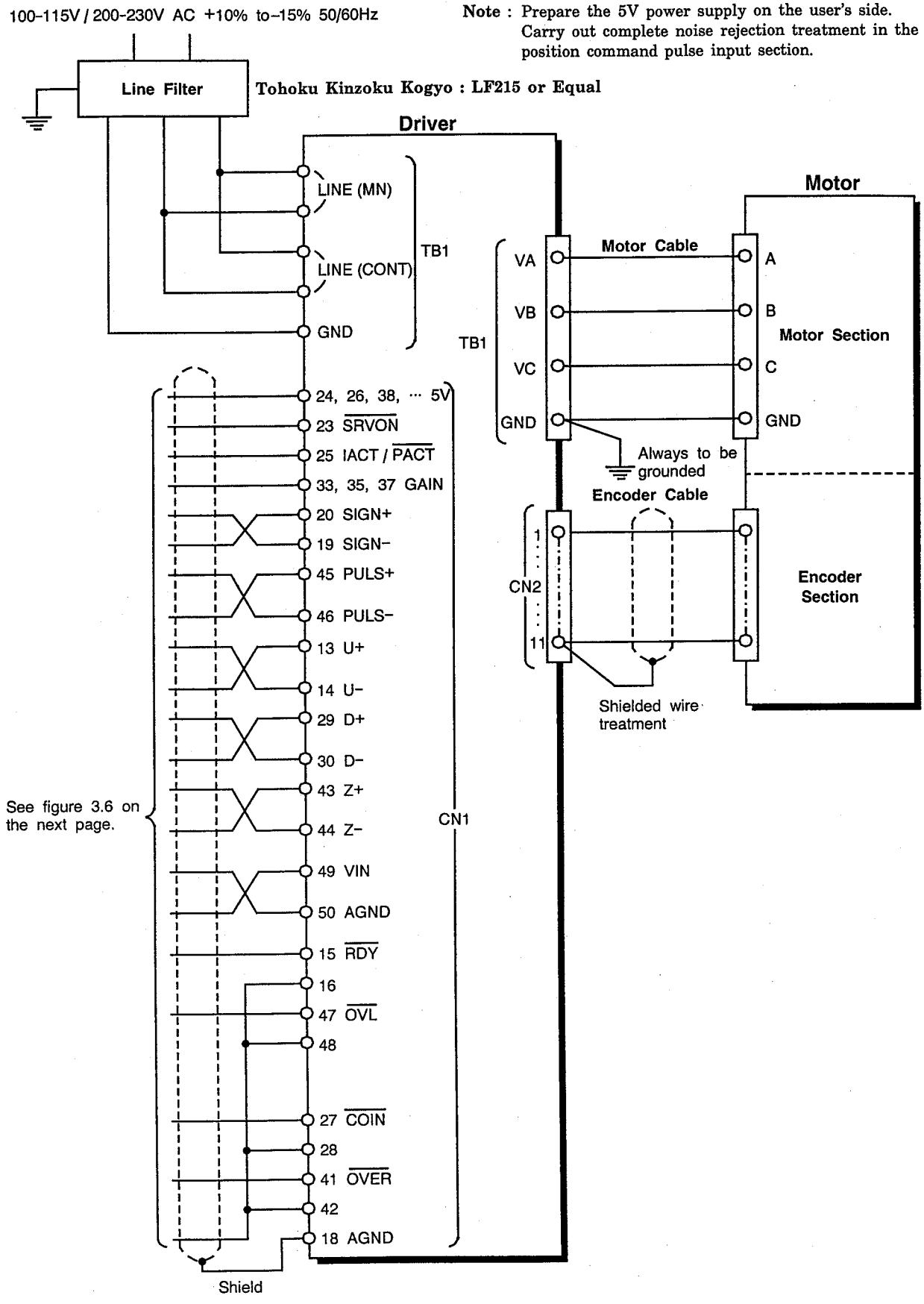
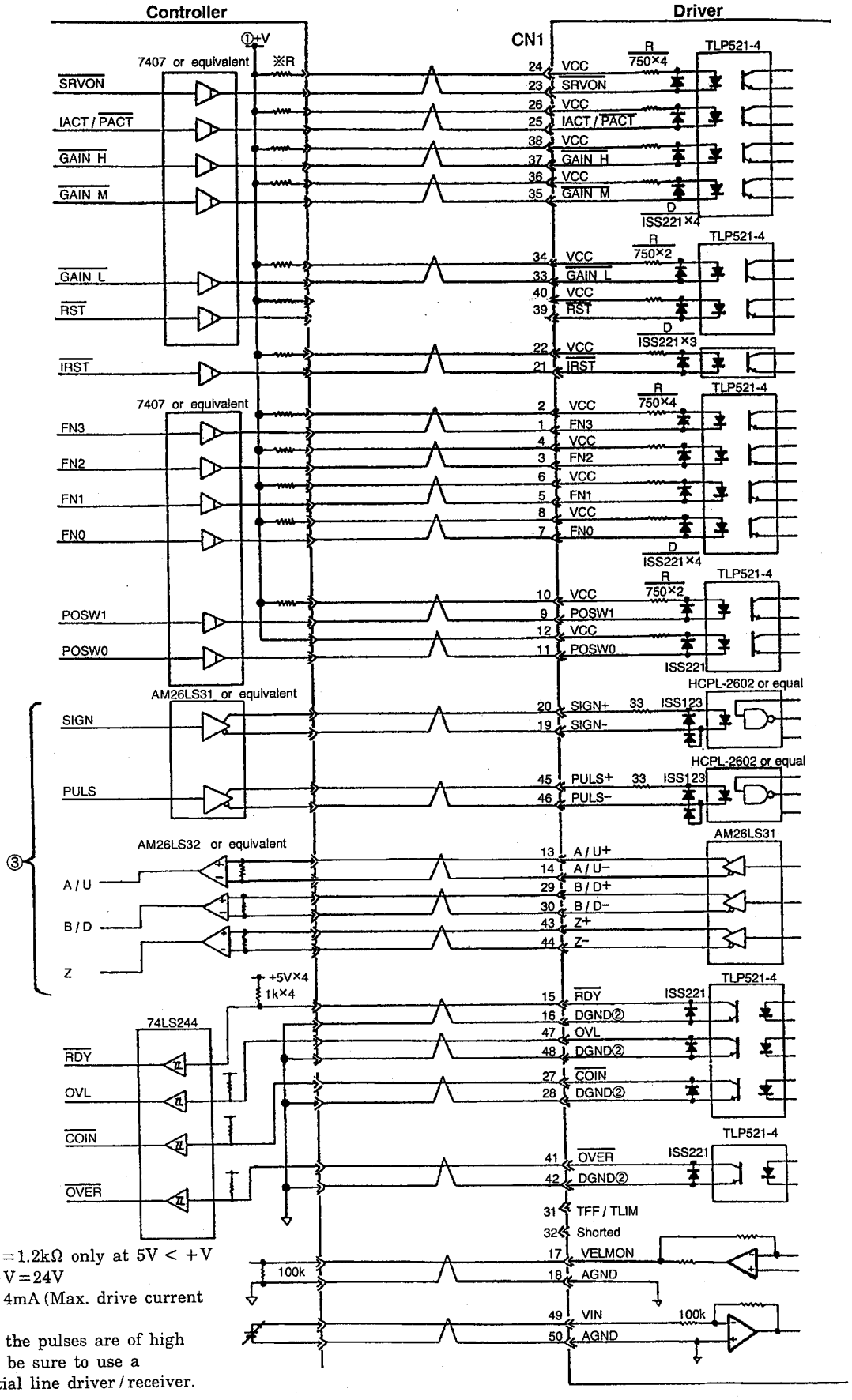


Figure 3.5 Typical Wiring Example

(4) Connection to External Controller

(CN1 terminal I/O signal connection and external signal processing)



① Insert R=1.2kΩ only at 5V < +V < 24V+V=24V

② Approx. 4mA (Max. drive current 15mA)

③ Because the pulses are of high velocity, be sure to use a differential line driver / receiver.

Figure 3.6 Connection to External Connector

(5) List of Interface

a) Input

Table 3.3 List of Input Interface

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) (See Note 1.)	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 16Hz (See Note 2.)
POSW 1 POSW 0	9 (10) 11 (12)	Positioning completion pulse width end (See Note 1.)	Signal for 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.)
$\overline{\text{IRST}}$	21 (22)	Integral capacitor reset	The integral capacitor in the velocity loop is shorted.
$\overline{\text{SRVON}}$	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 / $\overline{\text{PACT}}$	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.
TLIM / TFF	31 (32)	Torque Limit Torque feed forward	For input of torque limit and torque feed forward (option)
$\overline{\text{GAIN H}}$ $\overline{\text{GAIN M}}$ $\overline{\text{GAIN L}}$	37 (38) 35 (36) 33 (34)	Gain selection	Signal to select the variable DC gain range (See Note 3.)
$\overline{\text{RST}}$	39 (40)	CPU reset (Non connection)	The driver control section is initialized with this signal set to L for more than 50μ seconds.
PULS+ PULS–	45 46	Position command pulse	Driver position command pulse signal
VIN	49	Velocity command input Torque command input	Set to the maximum number of revolutions at ±10V input. CW direction / +10V, CCW direction / –10V. #50 pin : GND. For torque command ±8V
AGND	50	Analog input GND	Velocity / torque input analog GND

Note : ( ) indicates Vcc signal input's terminal.
(Note1) : FN0 to 3 and POSW 0, 1 are logically wired in the "OR" configuration with the rotary switch and jumper pin (JP1 / GAIN H)
When using external controller, set this rotary switch to the "0" position and GAIN H to open.

b) Output

Table 3.4 List of Output Interface (1/2)

Signal Name	Pin No.	Meaning	Details
A+ / U+ A– / U– B+ / D+ B– / D–	13 14 29 30	Position feedback pulse signal	Pulse signal to indicate the motor rotating position. Either A / B phase or UP / DOWN phase pulse can be selected by the jumper on the board.
$\overline{\text{RDY}}$	15 (16)	Servo ready	The motor is ready to operate with this signal set to L. This signal is set to the H level about 3 seconds after driver power-ON.
VELMON	17 (18)	Velocity monitoring	Signal for monitoring the number of motor revolutions to output positive voltage for CW rotation and negative voltage for CCW rotation. Velocity detection sensitivity is as shown on the following table. (See Note 3.) Velocity detection sensitivity is not guaranteed for the number of motor revolutions in the range exceeding ±7.5V.

Note : ( ) indicates GND signal output.

Table 3.4 List of Output Interface (2/2)

Signal Name	Pin No.	Meaning	Details
$\overline{\text{COIN}}$	27 (28)	Positioning completion signal	This signal is set to L when the deviation counter value becomes less than the POSW switch set-value.
$\overline{\text{OVER}}$	41 (42)	Deviation counter overflow or overspeed	Deviation counter overflow signal is output only in the position control mode, and this signal is set to L when the deviation counter value exceeds 32767. The overspeed signal is set to L when feedback pulse output frequency becomes greater than about 3MHz. It is set to L if the number of motor revolutions exceeds ±7.5 V in the position control or velocity control mode.
Z+ Z−	43 44	Origin pulse	Signal for detecting the original positions obtained by equally dividing 1 revolution of the motor (100 for the A series and 60 for the B series), and changes from H to L during CW rotation and from L to H during CCW rotation.
OVL	47 (48)	Overload	Set to H during overload, it simultaneously reduces motor current automatically to 1/3.

Note : ( ) indicates GND signal output.

(Note 2)

FN 3	FN 2	FN 1	FN 0	fcSW Position	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 3)

GAIN H	GAIN M	GAIN L	Gain * Magnification
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 variable resistor position (0.5 to 5.5) becomes the total gain.

(Note 4)

Model	Velocity Detection Sensitivity (V / rps)	Velocity Detection Limit (rps)
DM1015B to DM1060B	5 / 2.0	3.0
DM1050A to DM1200A	5 / 1.0	1.5

3.4 Installation

When the product is delivered, first check the product type and Model No. as well as for the presence or absence of accessories and for the exact combination of the motor and the driver.

(1) Motor-section Mounting

The motor-section can be mounted either vertically or horizontally. However, incorrect mounting and unsuitable mounting location may shorten the motor service life and cause trouble. Therefore, always observe the following.

a) Installation Location

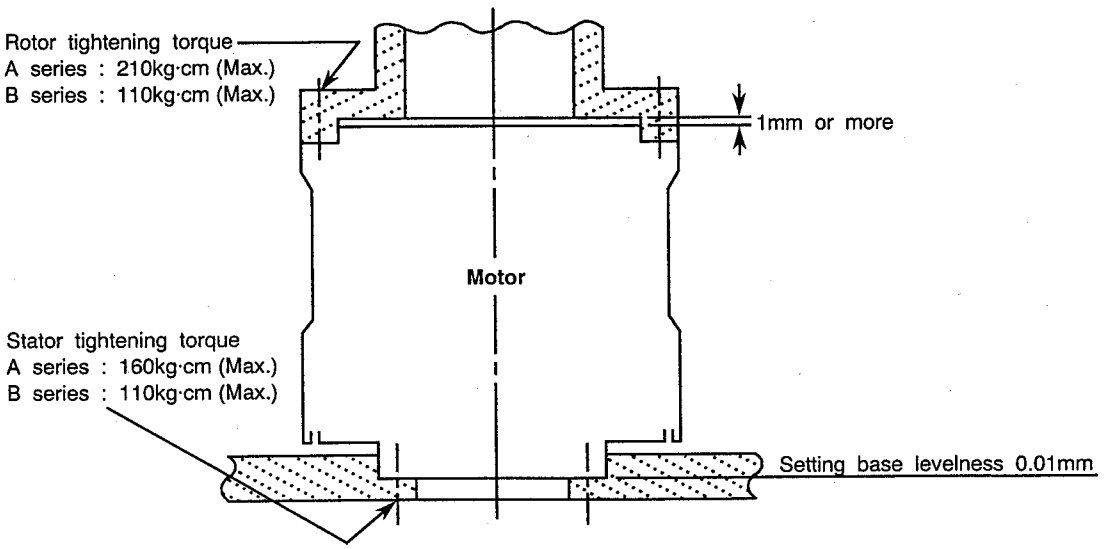
The motor section is designed for indoor use. Therefore, the installation location must be such that:

- There are no corrosive and explosive gases.
- Ambient temperature is between 0 and 45°C
- Dust concentration is low, with adequate air ventilation and low humidity.

Note : The DYNASERV is not drip proof or oil proof, so it should be covered by a suitable drip proof and oil proof cover.

b) Mechanical Coupling

- When coupling a load with the motor rotor section, make sure there is a clearance of more than 1mm between the motor upper surface and the load.
- Secure the motor rotor and stator by tightening the setscrew with torques of less than the following values as given below.
- Motor base levelness deviation must be maintained less than 0.01mm.



Note : When tightening the screws, always apply LOCTITE 601 or equivalent to these screws to lock them.

Figure 3.7 Tightening Torque

(2) Driver Section Mounting

The standard driver is designed for rack mounting.

a) Installation Location

- When there is a heat generation source near the installation location, ensure that temperature does not exceed 50°C in the approximately of the driver by providing an appropriate heat shield or cover, etc.
- When there is a vibration generating source near to the driver then mount the driver on the rack with appropriate vibration insulators.
- Further the installation must be at a location when the humidity is low, and when the surrounding environment is free from high temperature, dust, metal powders and corrosive gases.

b) Mounting Procedure

- Normally, the driver is rack mounted (L-shaped angle brackets) with its driver panel facing forward and its top and bottom surfaces horizontal. However, it may be mounted with its driver panel facing upward. Always avoid mounting it with its panel surface facing sideways or upside down. (See the figure(b) below.)
- Mount the driver using 4-screw holes at the top and bottom of the driver panel.

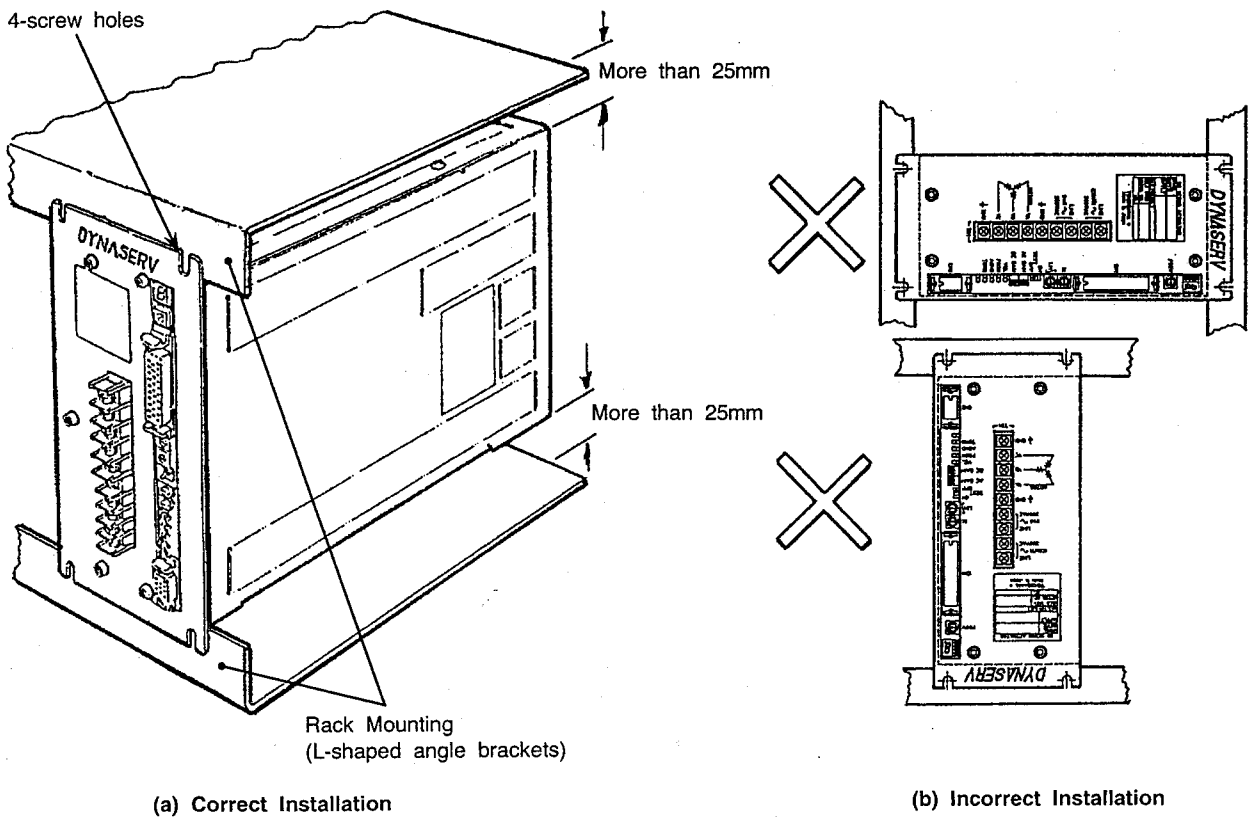


Figure 3.8 Driver Section Mounting

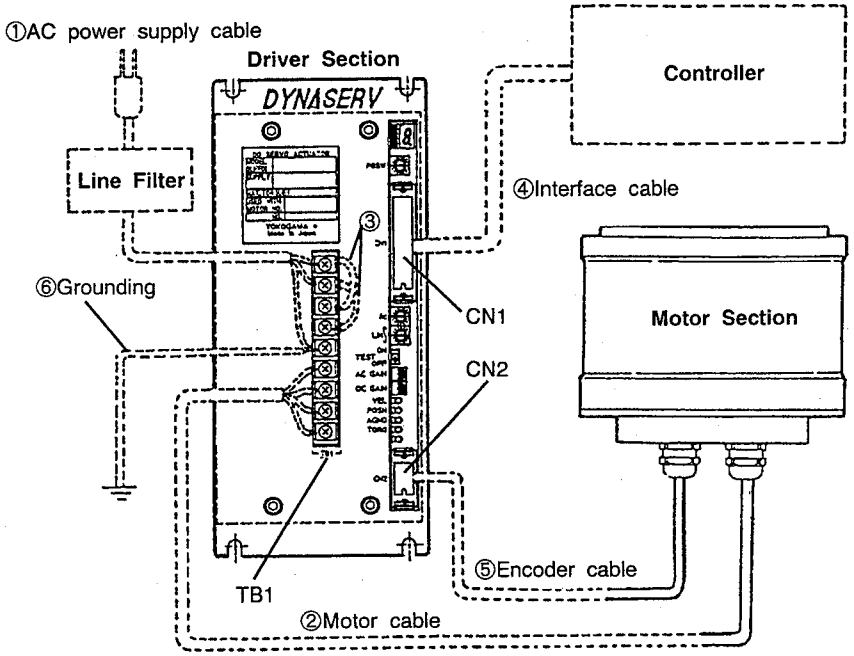
3.5 Wiring Cables

(1) Cable Sizes and Rated Currents

Table 3.6 Cable Sizes and Rated Currents

			A Series	B Series
Input	①AC power supply cable	Current (A)	20	15
		Cable size	HIV : More than 2.0, Length : Within 30m	
	②Motor cable	Current (A)	20	15
		Cable size	HIV : More than 2.0, Length : Within 30m	
	③Jumper wire	Current (A)	20	15
		Cable size	HIV : More than 2.0	
Output	④Interface cable	Current (A)	DC100mA·Max.	
		Cable size	※Twisted pair collectively shielded wire, Length : Within 3m	
	⑤Encoder cable	Current (A)	DC150mA · Max.	
		Cable size	※Twisted pair collectively shielded wire, Length : Within 30m	
	⑥Grounding	Cable size	HIV : More than 2.0	

Notes : 1. Current values: r.m.s. of rated currents
2. Cable size : Cross sectional area in mm^2
3. Cross sectional area of conductor marked with ※ : More than $0.2mm^2$ tin-plated twisted wire
4. Outer sizes of the cables used for CN1 and CN2 : Less than dia. 14mm or dia. 9mm, respectively
5. Cable size is obtained under the condition that ambient temperature is 40°C and the rated current flows through 3 bundled leadwires.
6. HIV : Heat resistant polyvinyl chloride insulated wire maintains insulation resistance up to an operation temperature of 75°C



Note : The items shown by the dotted lines should be prepared by the customer.

Figure 3.9 Wiring Cables

(2) Wiring Cautions

- Use the specified multi-core twisted pair cables with collective shielding for the interface and the encoder cables. Ensure proper end shield connections.
- Use thick conductors as grounding cables as much as possible. Ground the DYNASERV through a resistance of less than 100Ω
- Since high voltage, large current flows through the motor and the AC power cables, ensure proper wiring connections.

4. OPERATION CAUTIONS

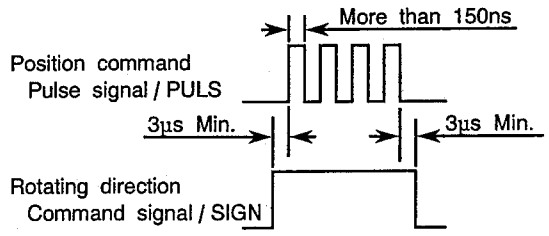
4.1 Input and Output Signal Cautions

(1) Position Command Pulse Input Signal (PULSE±)

This is a drive position command pulse signal. The pulse signal uses positive switching logic with a minimum pulse width of 150ns.

(2) Motor Rotating Direction Command Input Signal (SIGN±)

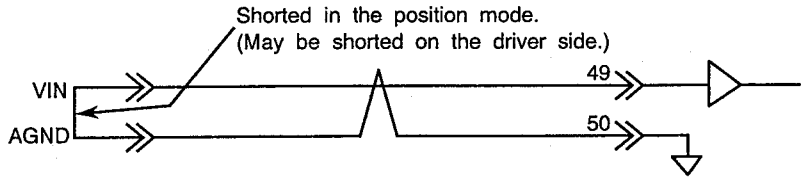
A signal indicating the motor rotation. The motor rotates in the CW direction with this signal set to H and CCW direction with this signal set to L. Timing of this signal with respect of the positioning command pulse signal at the output is as shown below.



Note : The pulse should be set to active H. This means that current does not flow through the driver photo-coupler when the pulse is not output.

(3) Velocity Command Input (VIN)

An analog input signal is used as the motor rotating velocity command value. The maximum velocity in the CW direction at +6V, and the maximum velocity in the CCW direction at −6V. (DR Std' Series) (In the −6V to +6V, input range, input impedance is 100kΩ.)

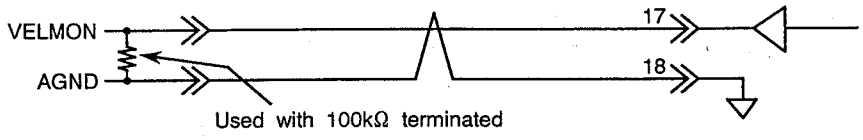


(4) Velocity Monitoring Output (VELMON)

Motor analog velocity monitoring output

Output voltage : At maximum velocity +6V (CW)

At maximum velocity −6V (CCW) (output impedance is 1kΩ.)

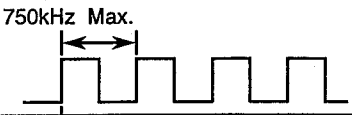
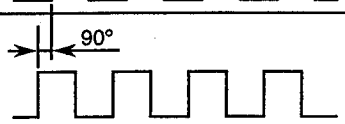
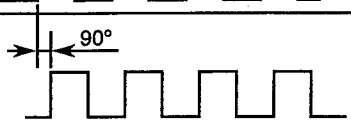


(5) A/B Phase, UP/DOWN Pulse Output Signals (A/U±, B/D±)

Pulse signals to indicate the motor position. The following 2 pulse output status can be selected by jumpers on the controller board.

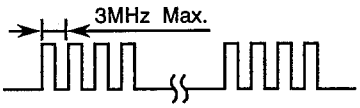
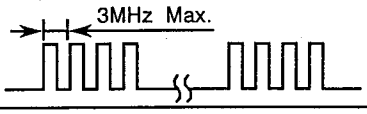
a) A / B Phase Output Pulse

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

	CCW Direction (counterclockwise)	CW Direction (clockwise)
A-phase pulse		
B-phase pulse		

b) UP / DOWN Output Pulse

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

	CCW Direction (counterclockwise)	CW Direction (clockwise)
UP-pulse signal		
DOWN-pulse signal		

Note : Because PULS±, SIGN±, A / U±, and Z± are high speed pulses signals, a differential I/O interface is required.

4.2 Power ON / OFF

Kindly pay attention to the following when the power is turned ON.

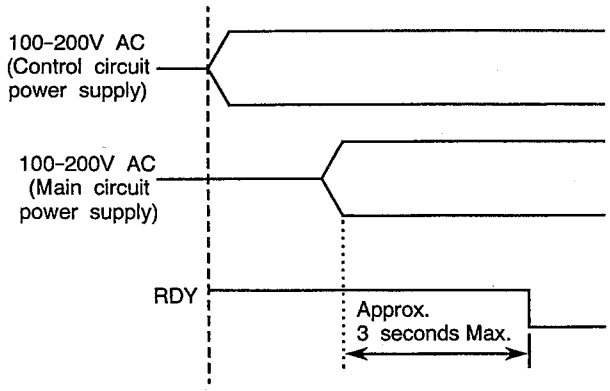
1) When turning ON the main and control circuit power supplies, turn them ON simultaneously or turn ON the control circuit power first.

2) When turning them OFF, turn them OFF simultaneously (including after instantaneous power failure), or turn OFF the main circuit power first.

3) Inrush current in both the main and control power circuits is about 35A (200VAC Source) peak and 20A (100VAC Source) peak.

4) The motor is set to the servo status about 200ms after SRVON is set to L.

5) When the main power circuit is active, RDY = H indicates driver trouble. Therefore, use a sequence circuit to turn OFF the main power circuit at RDY = H. However, after the control and main circuit power supplies are turned ON, the RDY = H condition is maintained for up to 3 seconds. Therefore, hold the power-ON signal for more than 3 seconds.



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 mode of 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>, <I. LIM switch> and <DC gain adjustment control> becomes necessary.

a) **<fc Switch>**

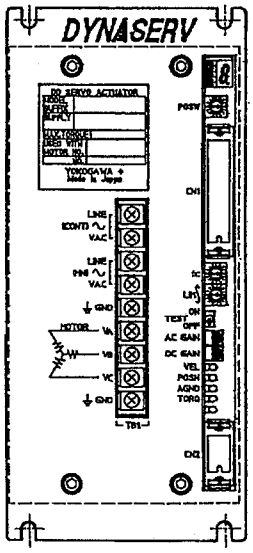
The 1 to 16Hz position control system band is selected from a scale of 0 to F. However, in this case CN1 connectors FN 0 to FN 3 must all be set to H.

b) **<I. LIM 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 also limited. Therefore, it can be said that it is better to make the switch value large within the no wind-up range. The fine adjustment is performed during the acceleration / deceleration operation.

c) **<DC Gain Adjustment Control>**

The combination of driver CN1 connector GAIN H to L signals results in an adjustment range of from 0.5 to 120 times. The DC gain should be as large as possible. When there is a change in inertia adjust the gain so that it becomes optimum at the maximum load.



(2) P Type Position Control

Positioning accuracy is not high because proportional control is used for positioning feedback. The velocity controls which can be set for simultaneous selection are P and I types, and they can be set with a jumper.

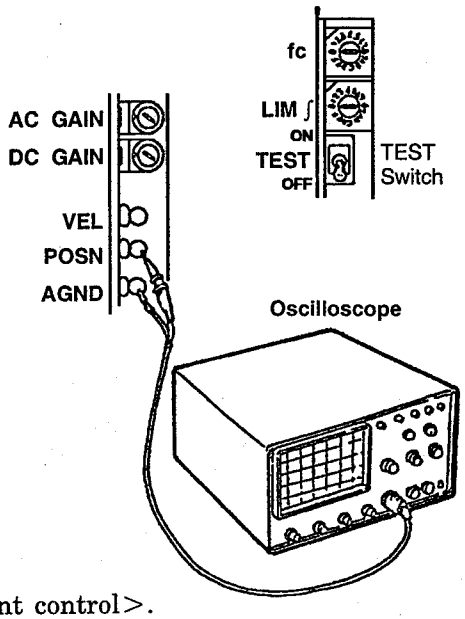
With the P type velocity control (P-P type), a torque output which is proportional to the positioning error is obtained, and compliance control is possible. In this control mode, only <fc switch> and <DC gain control> are to be adjusted.

With the I type velocity control, a high tact positioning can be achieved. In this control mode, the amount of velocity feed forward is to be adjusted with a jumper in addition to <fc switch>, <DC gain control> and <AC gain control>.

(3) Position Control System Adjustment Procedure (See the Following Figure.)

The position control system can be adjusted in the test mode. Turning ON the test switch at the front of the driver generates a 2.5Hz square-wave position command signal inside the driver to output the motor position to the POSN signal terminals. At this time, ensure that the motor exhibits reciprocal action at very small rotating angles.

① The adjustment procedure for I-PD type position control in the test mode is as follows.



Step 1 : Connect an oscilloscope to the <POSN> signal terminals.

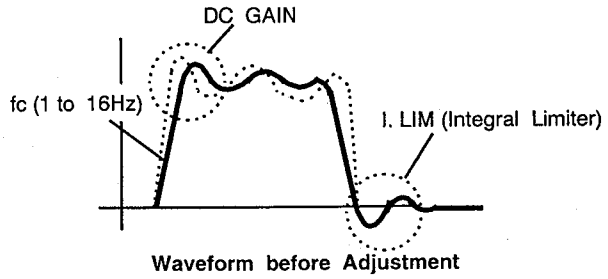
Step 2 : Set the CN1 connector <SERVO> signal to L. At this time, set the TEST switch to <OFF>.

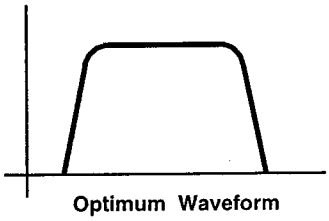
Step 3 : Set the <TEST switch> at the front of the driver to ON.

Step 4 : Adjust the <fc switch>. Its variable range is from 1 to 16Hz and it should be set to about 10Hz (scale graduation : 9) under normal load conditions.
Set the <I. LIM switch> to a large value within the range where there is no hunting.
Select the GAIN H to L signal so that they match the load condition.
Fine adjustment is done by the <DC gain adjustment control>.
Perform the above adjustments such that the POSN signal becomes a square wave.

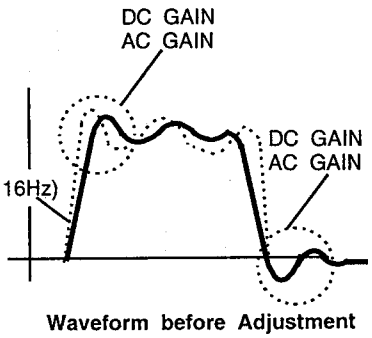
Step 5 : Set the <TEST switch> at the front of the driver to OFF.

Step 6 : Set the CN1 connector <SERVO> signal to H.





② The adjustment procedure for P-I type position control in the test mode is as follows.



Step 1 : Connect an oscilloscope to the <POSN> signal terminals.

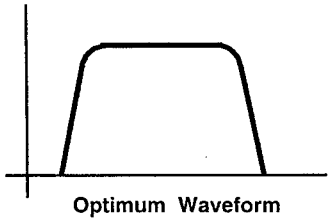
Step 2 : Set the CN1 connector <SERVO> signal to L. At this time, set the TEST switch to <OFF>.

Step 3 : Set the <TEST switch> at the front of the driver to ON.

Step 4 : Adjust the <fc switch>. Its variable range is from 1 to 16Hz and it should be set around the center position under normal load conditions.
Set the <AC gain control> to a large value within the range in which there is no hunting. Fine adjustment is done by the <DC gain control>.
Perform the above adjustments such that the POSN signal becomes a square wave.

Step 5 : Set the <TEST switch> at the front of the driver to OFF.

Step 6 : Set the CN1 connector <SERVO> signal to H.



(4) Procedure for Adjustment without Measuring Instruments

The preceding section demonstrates the procedure for performing adjustments while monitoring the waveform ; this section demonstrates an adjustment procedure that does not use any measuring instruments. These adjustment methods are valid only in the case of the position control mode (I-PD type, the setting at the time of shipping).

1) Calculate or otherwise verify the load inertia. In order to make use of this adjustment method, the load inertia must be known accurately. At this time, calculate the load multiple (K) by dividing the load inertia (J_L : kg·m^2 units) by the motor (DYNASERV) rotor inertia (J_M).
2) Set the <TEST> switch on the driver front panel to [ON].
3) Take the computed load multiple and refer to the tables of adjustment settings for the individual DYNASERV models (see pages 22 through 23). For example, suppose that K is [15] for a DM1200A ; thus the "5" range applies for this case. Next, follow this row to the right for the setting values.
4) First, look at the value in <DC gain> "Column 1". Because the value is [25], turn the <DC gain> control to [25].
   When the value for either A or B series is within range 1 or 2 (DC gain to be set is 5 or less), change the DC gain switching signal to <H> before carrying out the setting.
5) Similarly, take the "Column 1" values for <fc> and <LIM ∫> in the same row, and set their respective controls to those values.
6) When the above settings have been completed, set the <TEST> switch to [OFF] to complete the adjustments.

Note : The GAIN value for signal selection shown below is multiplied by the DC GAIN level value to obtain the total gain.

GAIN H	H	H	H	H	L	L	L	L
GAIN M	H	H	L	L	H	H	L	L
GAIN L	H	L	H	L	H	L	H	L
GAIN	1	4	7	10	13	16	19	22

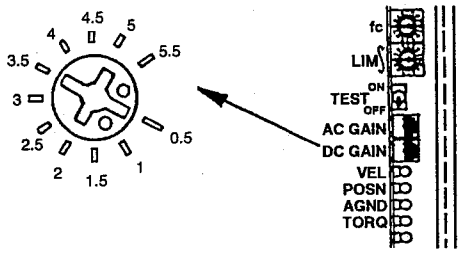


Table 5.1(a) Setting of the DYNASERV Controls (for A Series)

Range	Load Multiple: K			Setting Value		
	SD1200A52	SD1150A52	SD1100A52	DC GAIN	fc	LIM ∫
1	to 1.1	to 0.9	to 0.5	3	E	6
2	1.1 to 2.2	0.9 to 1.8	0.5 to 1.2	4	D	6
3	2.2 to 5.4	1.8 to 4.6	1.2 to 3.5	8	C	4
4	5.4 to 11	4.6 to 9.3	3.5 to 7.2	13	B	3
5	11 to 21	9.3 to 19	7.2 to 15	25	A	3
6	21 to 53	19 to 47	15 to 37	50	9	1
7	53 to 75	47 to 66	37 to 52	65	8	2
8	75 to 107	66 to 94	52 to 75	80	7	1
9	107 to 160	94 to 141	75 to 112	100	5	2
10	160 to 320	141 to 282	112 to 224	110	2	4

Load Multiple: K	Setting Value		
SD1050A52	DC GAIN	fc	LIM ∫
No load	3	E	6
to 0.4	4	D	6
0.4 to 1.8	8	C	4
1.8 to 4.1	13	B	3
4.1 to 8.7	25	A	3
8.7 to 23	50	9	1
23 to 32	65	8	2
32 to 46	80	7	1
46 to 69	100	5	2
69 to 138	110	2	4

Table 5.1 (b) Setting of the DYNASERV Controls (for B Series)

Range	Load Multiple: K				Setting Value		
	SD1060B52	SD1045B52	SD1030B52	SD1015B52	DC GAIN	fc	LIM ∫
1	to 1.9	to 1.6	to 1.2	to 0.4	3	E	6
2	1.9 to 3.4	1.6 to 3.0	1.2 to 2.4	0.4 to 1.1	4	D	6
3	3.4 to 7.7	3.0 to 6.9	2.4 to 5.7	1.1 to 3.2	8	C	4
4	7.7 to 15	6.9 to 14	5.7 to 11	3.2 to 6.7	13	B	3
5	15 to 30	14 to 27	11 to 22	6.7 to 14	25	A	3
6	30 to 73	27 to 67	22 to 56	14 to 35	50	9	1
7	73 to 103	67 to 93	56 to 78	35 to 49	65	8	2
8	103 to 146	93 to 133	78 to 112	49 to 70	80	7	1
9	146 to 219	133 to 199	112 to 168	70 to 105	100	5	2
10	219 to 438	199 to 398	168 to 336	105 to 209	110	2	4

5.2 Velocity Control Mode Adjustment

In the velocity control mode, the motor rotating angle is controlled so as to correspond to the velocity command voltage (−10V to +10V) from the higher-level controller. The two control methods can be selected in the velocity control mode.

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

Model	Velocity / Input Voltage (rps / V)
DM1015B to DM1060B	2 / 10
DR1050A to DM1200A	1 / 10

(1) PI Type Velocity Control

The use of integral / proportional action in velocity control achieves smooth, disturbance-resistant control. This is the same control mode used in the conventional DC/AC servo motor control. In this control mode, only the two <DC gain> and <AC gain> adjustment controls are adjusted.

a) <DC Gain>

The combination of the driver CN1 connector GAIN 0 to 2 signals results in an adjustment range of from 0.5 to 120 times.

b) <AC Gain>

Velocity loop band damping is adjusted.

(2) P Type Velocity Control

Since velocity control is effective only in proportional action, response is fast but is strongly influenced by disturbances in the controlled motor. In this control mode, only the <DC gain> variable resistor at the front of the driver is adjusted. While in this velocity mode, the test switch becomes invalid.

(3) Adjustment of Velocity Control System

Adjustment of velocity control system can be carried out in the test mode.

By turning the test switch on the front of the driver to ON, applies a 2.5Hz square waveform signal to the speed input in the driver, and the motor starts moving back and forth movements, repeatedly, at a small rotating angle. Under this condition, observe the <VEL signal> at the front panel on an oscilloscope, and adjust <DC gain> and <AC gain> so that <VEL signal> becomes an optimum waveform as shown in the figure below.

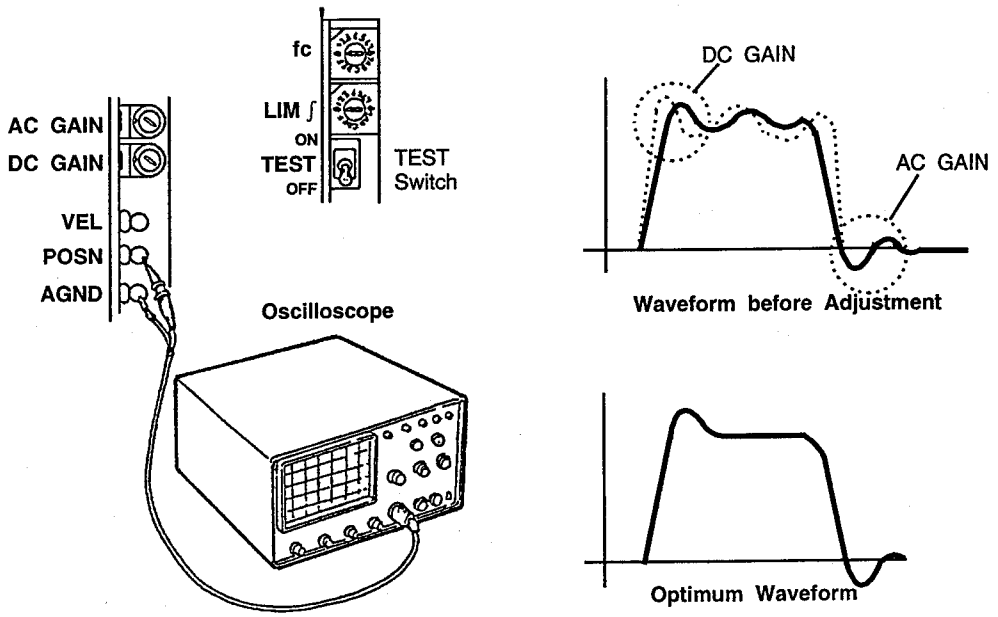


Figure 5.1 Adjustment in the Speed Control System

5.3 Torque Control Mode Adjustment

In the torque control mode, current flows through the motor corresponding to the current command voltage (−8V to +8V) from the higher-level controller. Motor output torque depends on the current. Therefore, torque is 0 at 0V of command voltage, and the maximum torque is produced at 8V.

Note : When desirous of using the torque control mode, carefully plan and design the velocity & position control loops and a proper interlocking system such that, the final control system meets the exact specifications of the application.

6. MAINTENANCE AND INSPECTION

6.1 Motor Section

Only simple daily checks need be carried out on the Motor section. Check for noise or excessive vibration which is not normal. Never disassemble the Motor section. If the condition of the Motor section is not normal after **20,000 hours of use or after five years** from the installation, replace the Motor section together with the Driver section. This time duration may change depending on the environmental and operating conditions where the Motor is used.

6.2 Driver Section

There is no need of daily maintenance for the Driver part. However, clean the Driver part periodically to prevent it from poor insulation caused by accumulated dust.

7. TROUBLESHOOTING AND MEASURES

7.1 Motor Trouble and Measures

Whenever any abnormal condition occurs while operating the motor, check the LED display on the front panel of the driver. Take appropriate countermeasures as shown below if the cause of the abnormal condition is determinable by the indication of the LED display.

When the motor does not function normally, even after the following measures have been taken, immediately cease operation and contact the Yokogawa Electric Corporation or it's authorized agent.

Table 7.1 Motor Troubleshooting and Measures (1/2)

Trouble	Estimated Cause	Inspected Item	Measures	Page for Reference
The motor is not servo locked.	◆No AC power is fed.	Wiring inspection	Apply the specified AC power	Pages 10, 11
	◆The servo ON (SRVON) terminal is set to H.	Inspection	Set to L.	Page 12
	◆The CPU reset (RST) terminal is set to L.	Inspection	Set to H.	Page 12
	◆The integral capacitor reset (IRST) terminal is set to L.	Inspection	Set to H.	Page 12
	◆fc, I. LIM, DC gain is small.	Inspection	To be adjusted to an appropriate value.	Pages 21 to 24
The motor does not start.	◆Under over load	Operate the motor under no load.	When starting the motor, lighten the load or replace the motor with a large output motor.	
	◆Incorrect external wiring	Inspect wiring.	Re-wire correctly by referring to the connection diagram.	Pages 10, 11
	◆fc, I. LIM, DC gain is small.	Inspection	To be adjusted to an appropriate value.	Pages 21 to 24
Motor rotation is unstable.	◆Imperfect connection	Check the connection of each phase of A, B, C and GND.	Re-wire correctly by referring to the connection diagram.	Pages 10, 11
	◆The motor and driver combination is inappropriate.	Check the combination Nos. on the nameplate.	If the combination is incorrect, then return the pair to YPC or it's authorized agent.	Page 2

Table 7.1 Motor Troubleshooting and Measures (2/2)

Trouble	Estimated Cause	Inspected Item	Measures	Page for Reference
The motor overheats.	◆Ambient temperature is high.	Check to see if ambient temperature is more than 45°C	Lower the ambient temperature to below 45°C	
	◆The motor is overloaded.	Operate the motor under no load.	When starting the motor, lighten the load, or replace the motor with a larger output motor.	
Abnormal sound is produced.	◆Incorrect mounting	Loosen 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.	
Abnormally small motor torque	◆Incorrect motor / driver combination	Check the combination Nos. on the nameplate.	If the combination is incorrect, then return the pair to YPC or it's authorized agent.	Page 2
	◆Motor is overloaded.	Check the OVL signal.	Recheck the operation. Lighten the load.	Pages 13, 14
	◆fc, I. LIM, DC gain is small.	Inspection	Adjust to appropriate value.	Pages 21 to 24
Motor runs out of control.	◆Incorrect motor / driver combination	Check the combination Nos. on the nameplate.	If the combination is incorrect, then return the pair to YPC or it's authorized agent.	Page 2
	◆Inappropriate jumper setting	Inspection	Perform correct jumper setting.	Pages 5 to 9
	◆Imperfect connection	Check motor / encoder connection.	Re-wire correctly by referring to the connection diagram.	Pages 10, 11
Position is dislocated.	◆Incorrect A/B-phase and U/D-pulse jumper, selection	To be inspected.		Pages 5 to 9
	◆Command pulse rate and width are not as specified.	Check the command pulse width.		Pages 19, 20
	◆Feedback pulse rate and receive circuit response speed are not as specified.	Check the feedback pulse rate (3MHz Max.) and receive circuit response speed.		Pages 19, 20
	◆Both ends of the feedback pulse transmission cable shield are not connected to the earth.	To be inspected. If so, connect the driver to AGND and the controller to SG.		

7.2 List of LED Display

A seven segment LED is mounted on the front panel of the driver to display the normal / abnormal status of the motor and driver. Display details are as shown in the following tables.

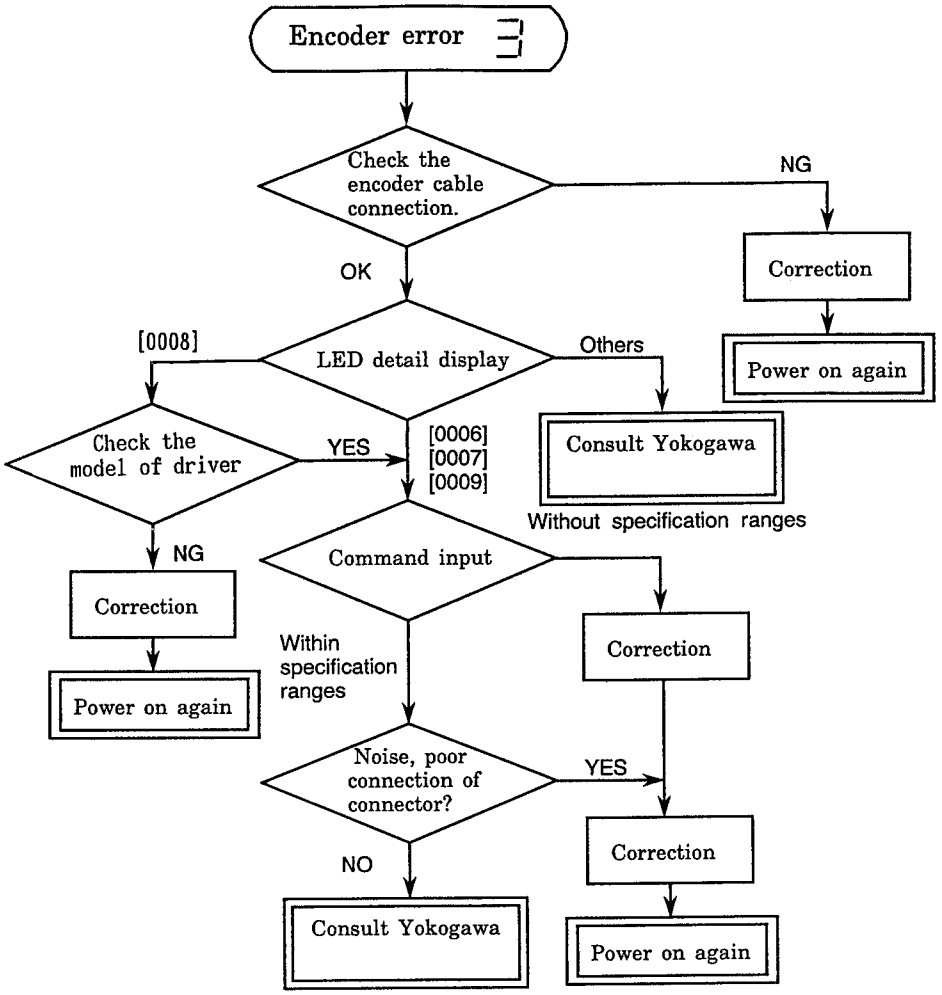
Table 7.2 List of LED Display

LED Display		Status	Display Details with TEST Switch ON (Serial display of 4-digit hexadecimal notation)	Measures / Page for Reference
Servo OFF	Servo ON			
0	0.	Normal status	No detail display	
1	1.	Speed over	No detail display	See pages 28 to 30
2		RAM error	Indiscriminate	Reparation required
3		Encoder error	0000 : Open circuit (SIG Ø, SIG 1 stop) 0001 : Open circuit (SIG 1 stop) 0002 : Open circuit (SIG Ø stop) 0006 : Abnormal frequency (Smoother error) 0007 : Abnormal frequency (Incorrect interruption, detected) 0008: Error induced due to mechanical eccentricity of motor's internal construction. 0009 : Abnormal frequency (Divided error)	See pages 28 to 30
5		Eerror of power supply	Indiscriminate	Reparation required
6		Over count shut down	Indiscriminate	See pages 28 to 30
	E.	Counter overflow	No detail display	See pages 28 to 30
7		ROM error	ROM checksum code 4 digits	Reparation required
8		Abnormal main power supply	No detail display	See pages 28 to 30
8.		Reset status of driver Power supply error	No detail display	Release reset Reparation required
9		CPU error	0000 : Watch dog timer (WDT) error	Reparation required
A		Amplifier error	0001 : Over voltage (OVV) signal ON 0003 : Over current (FAULT) signal ON	See pages 28 to 30
C	C.	Overload error	No detail display	See pages 28 to 30

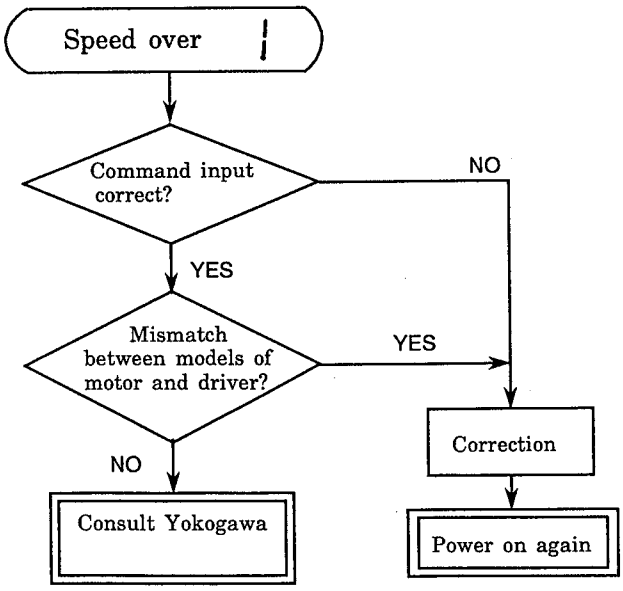
Note : Consult Yokogawa Precision Corp. or it's authorized agency when reparation is required.

7.3 Procedure for Error Correction

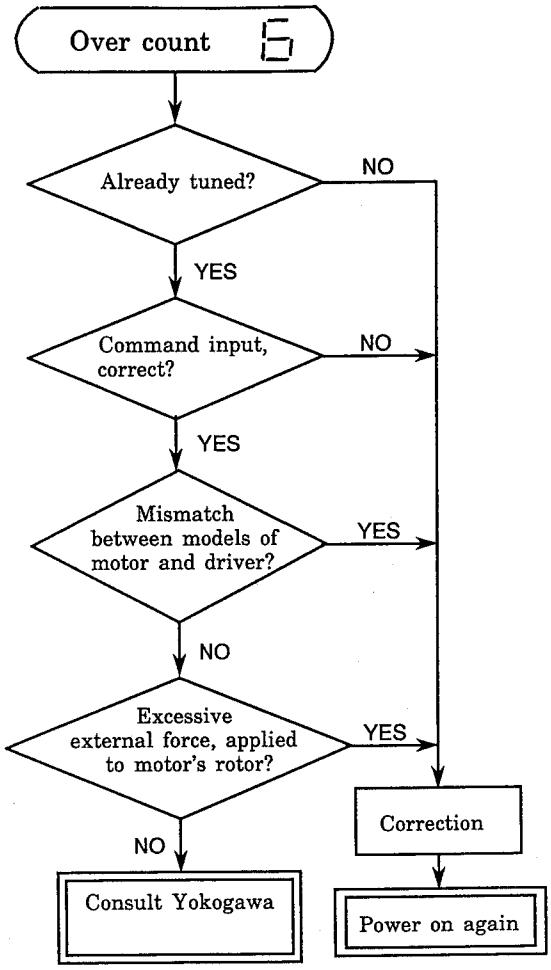
(1) Encoder Error



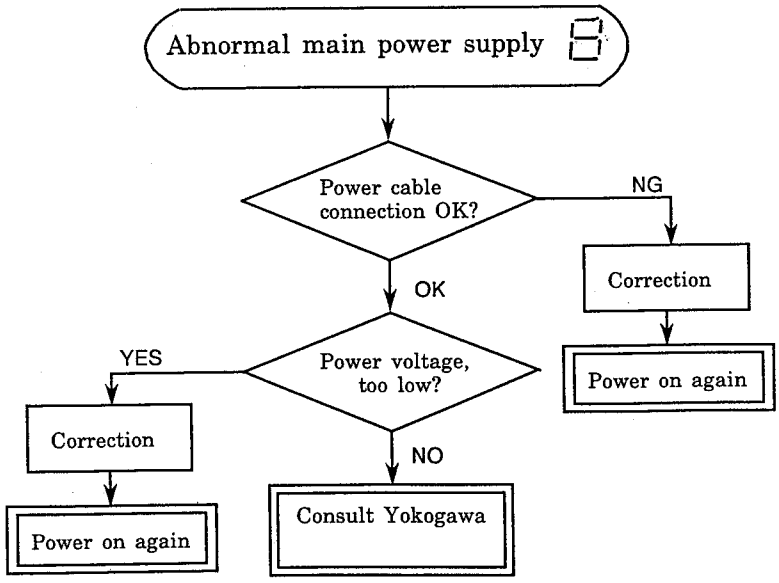
(2) Over Speed



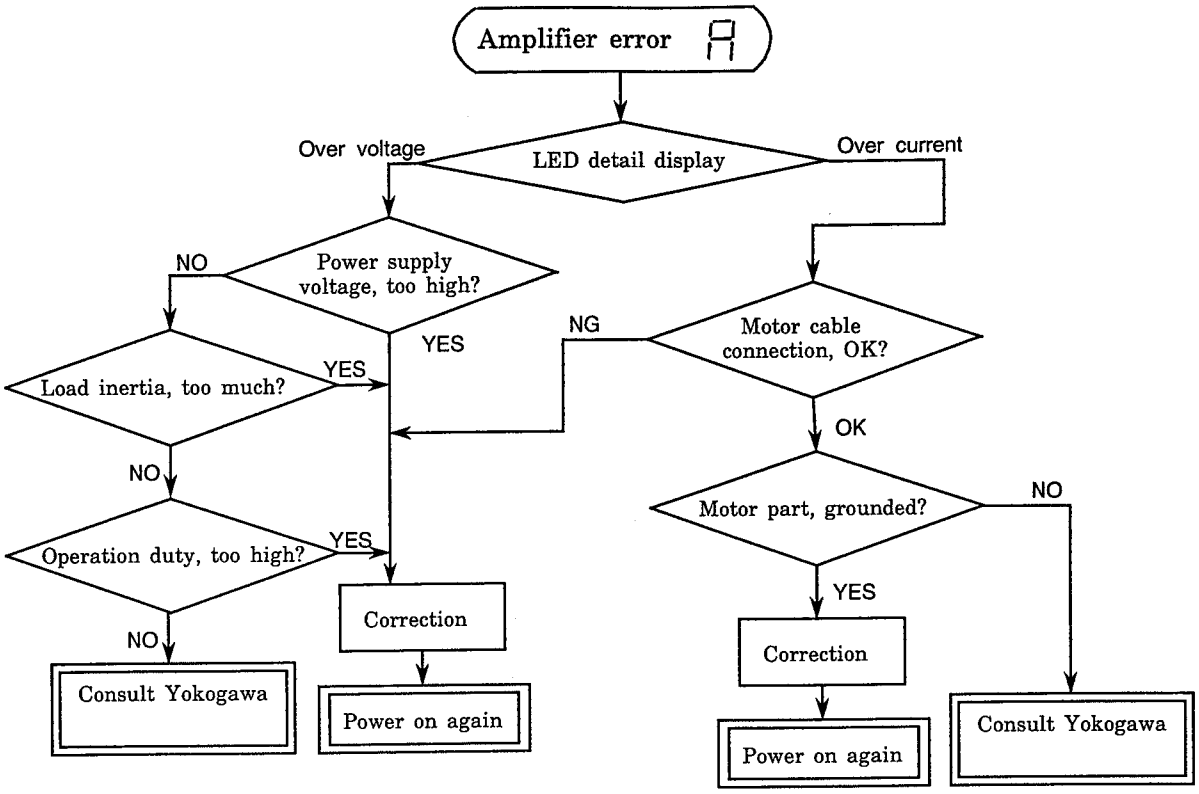
(3) Over Count



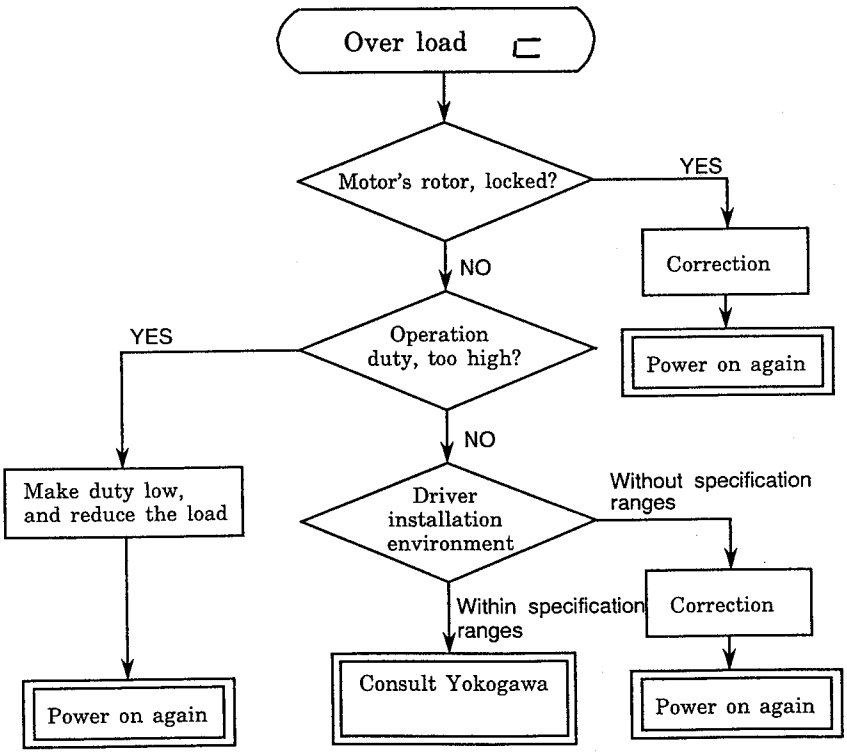
(4) Abnormal Main Power Supply



(5) Amplifier Error



(6) Over Load



8. OTHERS

8.1 Standard Specification

(1) Standard Motor Specification

Item				Unit	A Series				B Series			
					□DM1200A50*1	□DM1150A50*1	□DM1100A50*1	□DM1050A50*1	□DM1060B50*1	□DM1045B50*1	□DM1030B50*1	□DM1015B50*1
Motor & driver coupling	Maximum output torque			N·m (kgf·m)	200 (20)	150 (15)	100 (10)	50 (5.0)	60 (6.0)	45 (4.5)	30 (3.0)	15 (1.5)
	Rated rps (100V / 200V)			rps	0.5 / 1.0		1.0 / 1.0		1.0 / 1.5	1.0 / 2.0	1.5 / 2.0	2.0 / 2.0
	Positioning	Encoder resolution		p / rev	1,024,000				655,360			
		Repeatability		sec	±2				±2			
		Positioning accuracy		sec	±15				±15			
	Velocity ripple			%	3				3			
Motor section	Permissible axial load		Normal	N(kgf)	4×10^4 (4×10^3)				3×10^4 (3×10^3)			
			Reverse		2×10^4 (2×10^3)				1×10^4 (1×10^3)			
	Permissible moment load			N·m (kgf·m)	400 (40)				200 (20)			
	Axial stiffness		Normal	mm/N (mm/kgf)	2×10^{-6} (2×10^{-5})				2.5×10^{-6} (2.5×10^{-5})			
			Reverse		3×10^{-6} (3×10^{-5})				3×10^{-6} (3×10^{-5})			
	Moment stiffness			rad/N·m (rad/kgf·m)	4×10^{-7} (4×10^{-6})				1×10^{-6} (1×10^{-5})			
	Weight			kg	29	24	19	14.5	12	9.5	7.5	5.5
	Length L (See dimensional view.)			mm	188	163	138	113	168	143	118	92.5
	Rotor inertia			$kg\cdot m^2$	167×10^{-3}	142×10^{-3}	119×10^{-3}	96×10^{-3}	23×10^{-3}	19×10^{-3}	15×10^{-3}	12×10^{-3}

(2) Standard Driver Specification

Series Name		A Series				B Series			
Driver Name	For 100V Power Requirements	SD1200A52-1	SD1150A52-1	SD1100A52-1	SD1050A52-1	SD1060B52-1	SD1045B52-1	SD1030B52-1	SD1015B52-1
	For 200V Power Requirements	SD1200A52-2	SD1150A52-2	SD1100A52-2	SD1050A52-2	SD1060B52-2	SD1045B52-2	SD1030B52-2	SD1015B52-2
Input signal	Speed input signal	Analog voltage : DC±10V / 1.2rps				Analog voltage : DC±10V / 2.4rps			
	Positioning input signal	Serial pulse / 1.229MHz MAX.				Serial pulse / 1.572MHz MAX.			
	Torque command signal	Analog voltage ±8V / Maximum torque							
	Rotation direction command signal	H : CW / L : CCW							
Output signal	Speed output	+6V (CW) to −6V (CCW)							
	Encoder output	Phase A, Phase B (307kHz Max.) Zero positioning signal (100p / rev.)				Phase A, Phase B (393kHz Max.) Zero positioning signal (60p / rev.)			
	Alarm output	Over-current, Over-voltage, Heat sink temperature alarm, Voltage low alarm, Encoder abnormal, CPU abnormal							
	Monitor output	2.5Hz Step response output (Test mode)							
Maximum input power capacity (kVA)		3.0	3.0	2.7	2.4	2.2	2.0	2.0	1.6
Power source		100–115V or 200–230V AC +10%, −15% 50/60Hz							
Weight (kg)		6							

(3) Environmental Specification

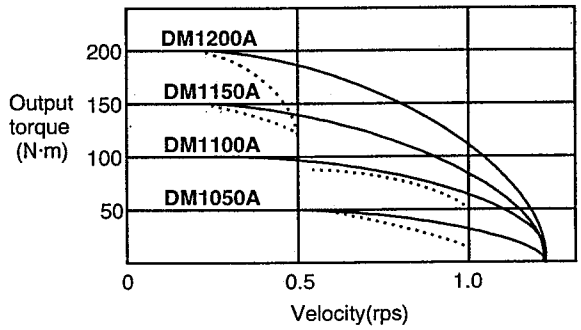
		Motor Section	Drive Section	Notes
Ambient operating conditions	Temperature	0 to 45°C	0 to 50°C	
	Humidity	20 to 85% R.H	20 to 90% R.H	Non condensing
Stage conditions	Temperature	−20 to 85°C	−20 to 85°C	
	Humidity	20 to 85% R.H	20 to 90% R.H	Non condensing
Operating environment		No corrosive gases, Dust-free environment		

8.2 Torgue vs Velocity Characteristic

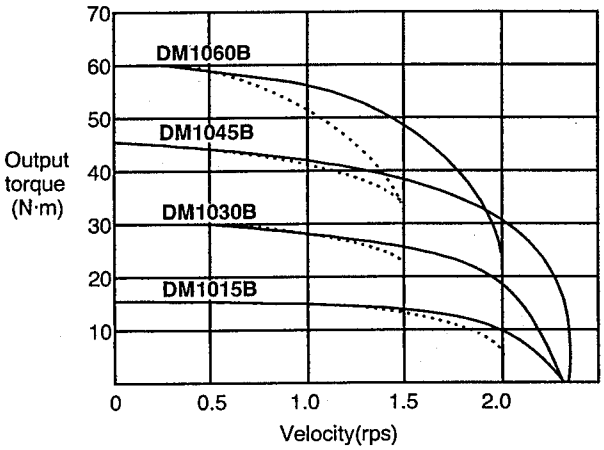
A Series

——— 200–230V Power supply

····· 100–115V Power supply



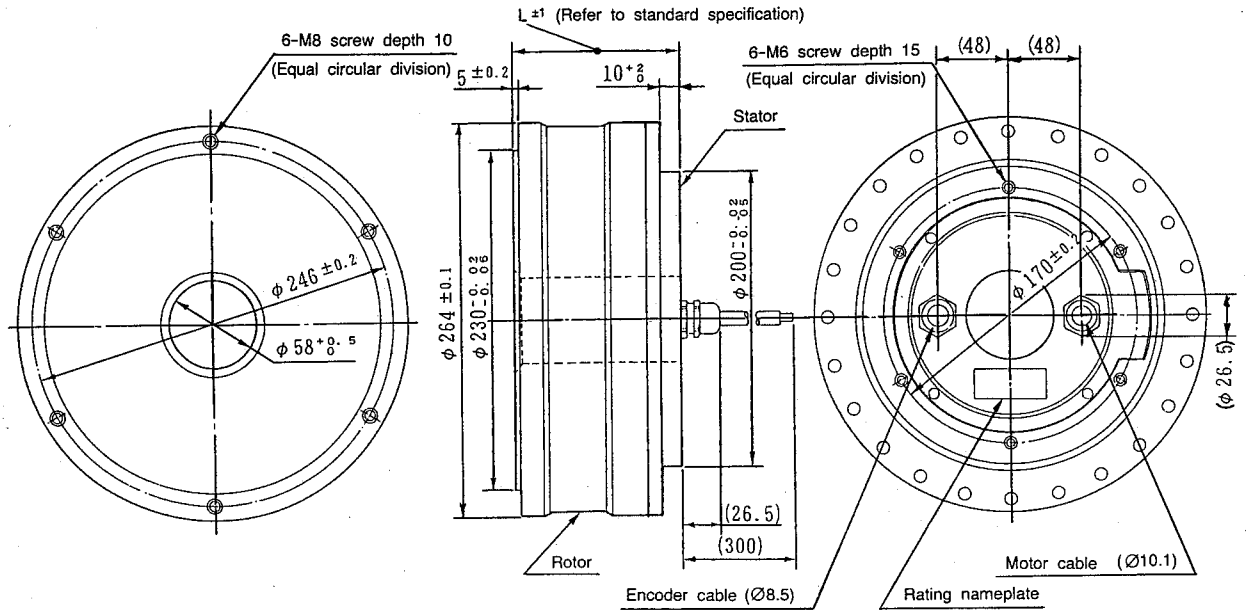
B Series



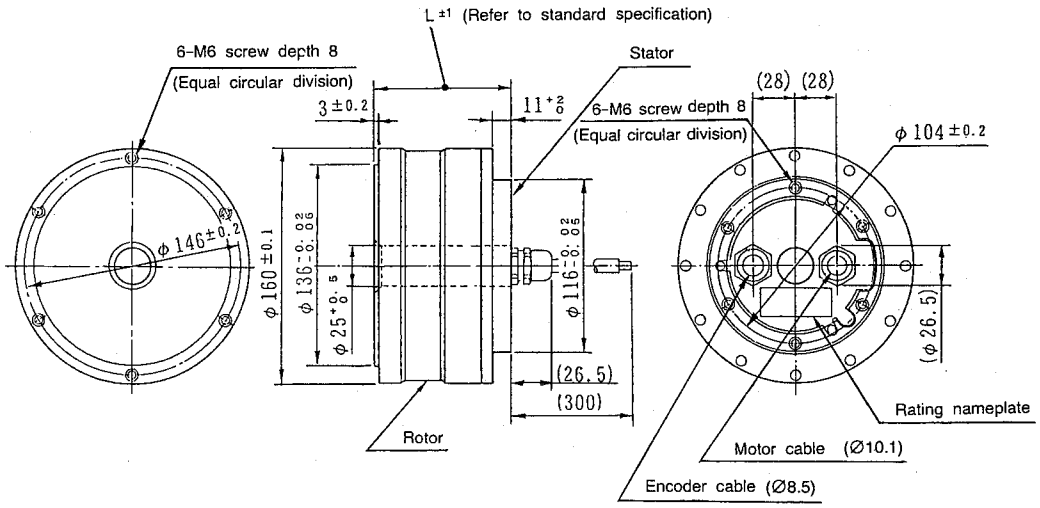
8.3 Dimensional Outline Drawing

Unit : mm

(1) Motor (A Series)

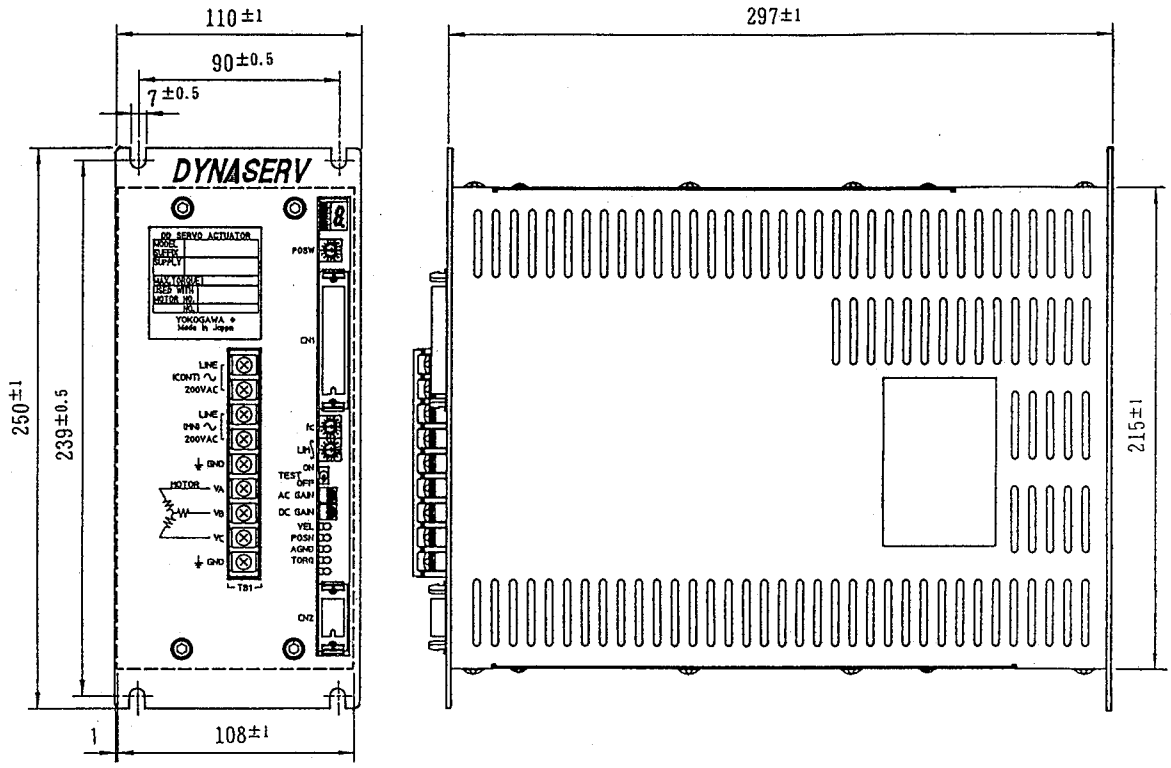


(2) Motor (B Series)

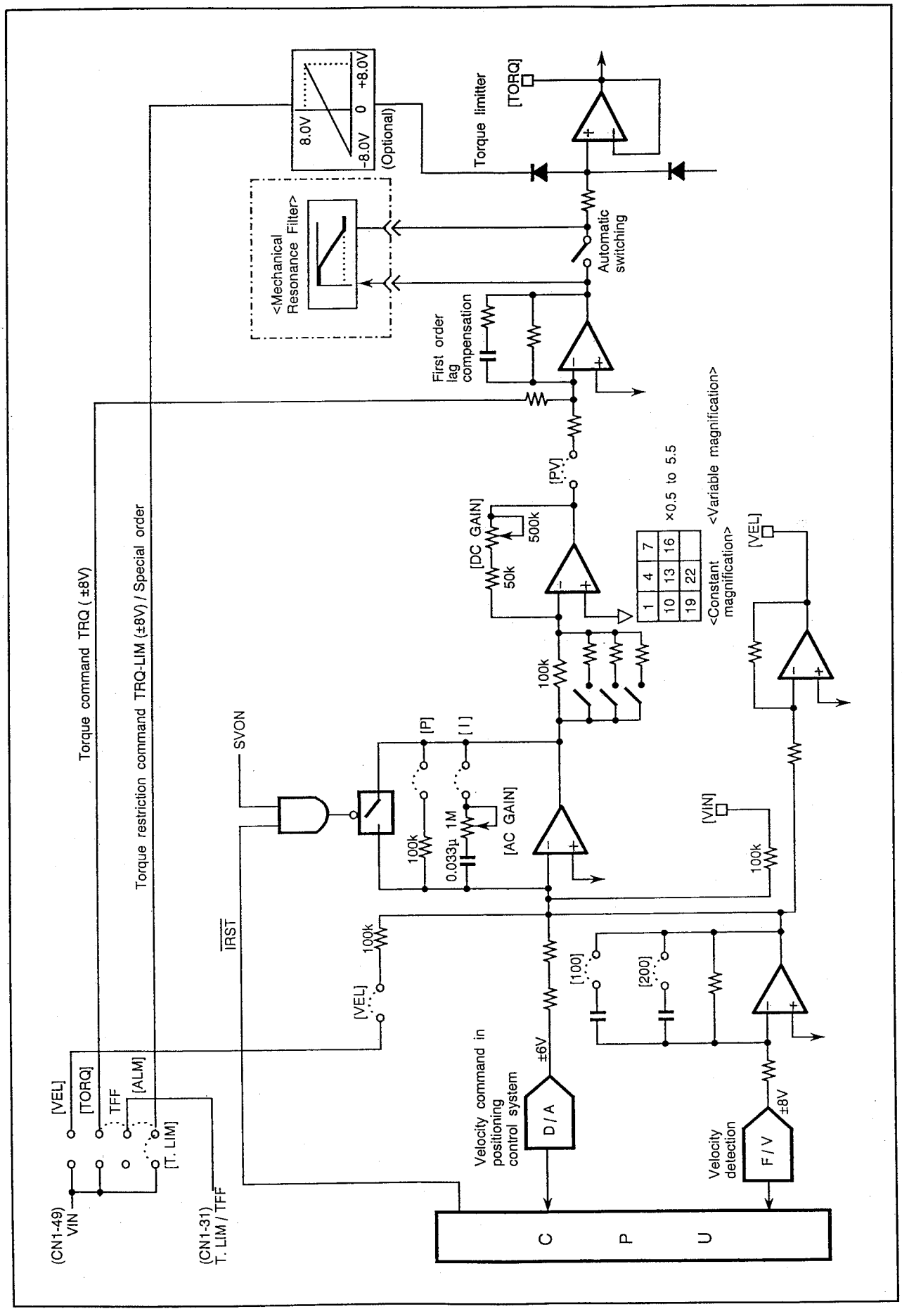


Unit : mm

(3) Driver



8.4 Driver Block Diagram



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