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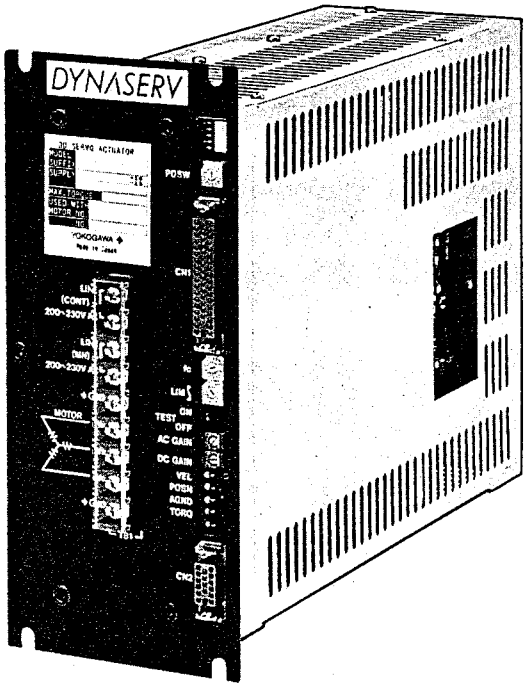
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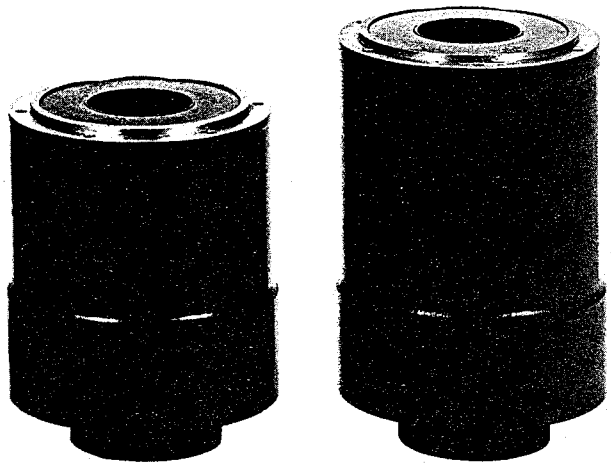
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Instruction Manual

DYNASERV

DD Servo-Actuator
DR / SR Series
(New Driver Model)





YOKOGAWA
Yokogawa Electric Corporation

IM A501E(CE)
2004 - 02 - 01

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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 DR / SR series. Be sure to read this instruction manual prior to operating the DYNASERV.

CAUTIONS

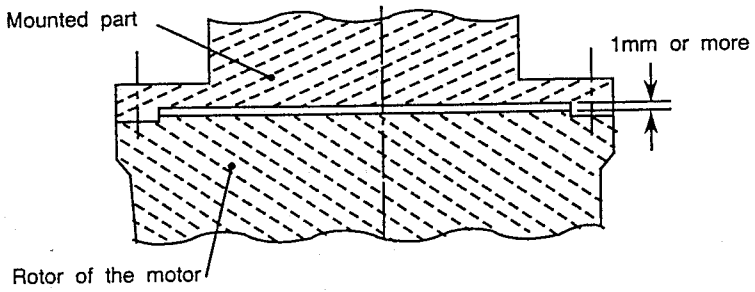
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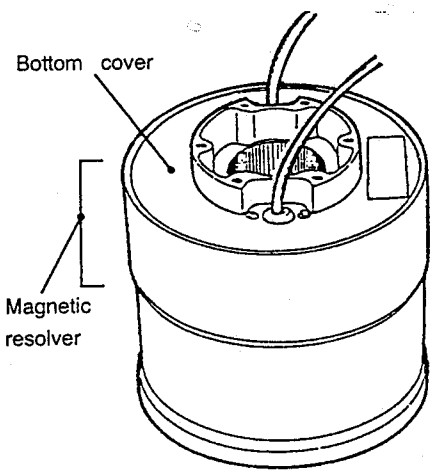
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Warning on Installation and Operation

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. Because a magnetic resolver is incorporated in the motor part shown in the figure on the right, avoid shock, mechanical pressure, or strong magnetic fields.
7. Use only such screws which shall not exceed the effective screw depth of the motor part in order to fix the load. The use of a long screw may cause damage on the motor.



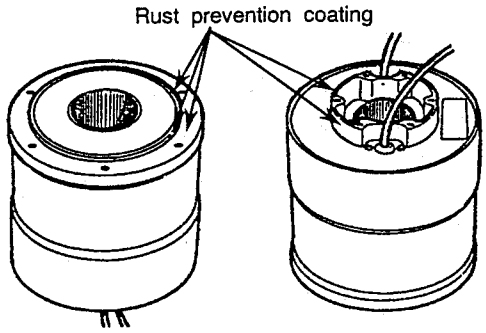
8. If the motor is used with oscillating rotation movements with a small angle (50° or less), then carry out a running-in operation with back-and-forth movement about 10 times, each move exceeding an angle of 90° at least. The running-in operation must be carried out every 10,000 times of back and forth oscillation movements in order to ensure proper lubrication of the bearings.
9. Materials easily affected by magnetism must never be brought, close to the motor as the surface of the motor is magnetized.
10. Install the motor in an appropriate location as the motor is not dust proof, watertight or oil proof.
11. 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 DR1□□□□50*1, and the driver code is SR1□□□□52, the □□□□ of the motor and the driver shall be the same.)

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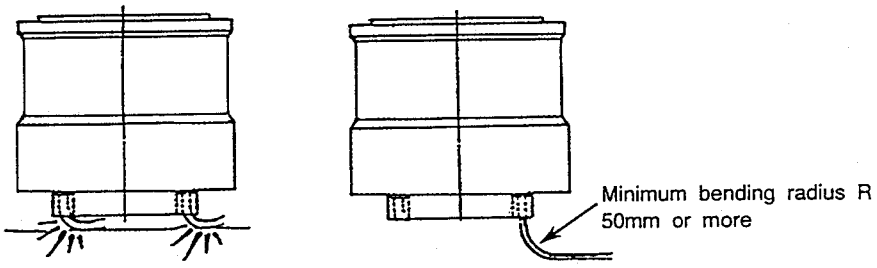
Warning on Installation and Operation

12. 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.

13. With the motors of the DYNASERV DR series, rust prevention coatings are applied to the load-mount part at the top and also to the fixed part at the bottom of the motor. Before assembling the motor, completely remove this coating using a cloth or paper dipped in petroleum solvent or chlorine solvent. The presence of the coating may lead to severe mechanical inaccuracies of the assembled system.

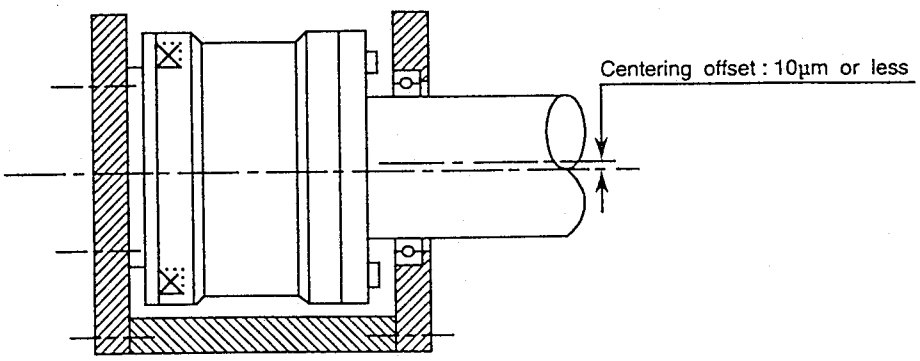


14. If the motor is placed on the floor or the like as shown below when carrying or installing the DYNASERV, the cable is bent by the weight of the motor and this bending may cut the conductor wire. When placing the motor, be sure to use a supporting base which protects the cable from being bent.
The 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.



15. 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.

16. 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.



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1. PRODUCT OUTLINE

1.1 DYNASERV, DR / SR Series

The DYNASERV, DR Series are practical DD motors developed to meet new needs based on our experience with the DM Series. The DR Series includes 6 models (50–400N·m) of the A type with an outer diameter of 264mm (10″), 7 models (30–250N·m) of the E type with an outer diameter of 205mm (8″) and 5 models (8–60N·m) of the B type with an outer diameter of 150 mm (6″), which together, should satisfy most users needs. In addition, DR5000 Series (5 models, high speed) are there. The corresponding drivers are called the SR Series, and they are available in two models: one for 100V power requirements (100–115V AC) and the other for 200V power requirements (200–230V AC). (Note : for the 5000B/E Series only the 200–230V power requirement is available.)

In addition, a mechanical resonance filter (optional) can be incorporated in the driver. Specific models other than those mentioned above are also available viz. The lightweight type, with-flange type, with-brake type , and high mechanical mounting accuracy type.

See the following page for the rules to configure the model types.

1.2 Standard Product Configuration

The standard product set consists of the following components. When unpacked, make sure that the product is the correct model, and that the types and quantities of standard accessories are also correct.

Table 1.1 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-8LM

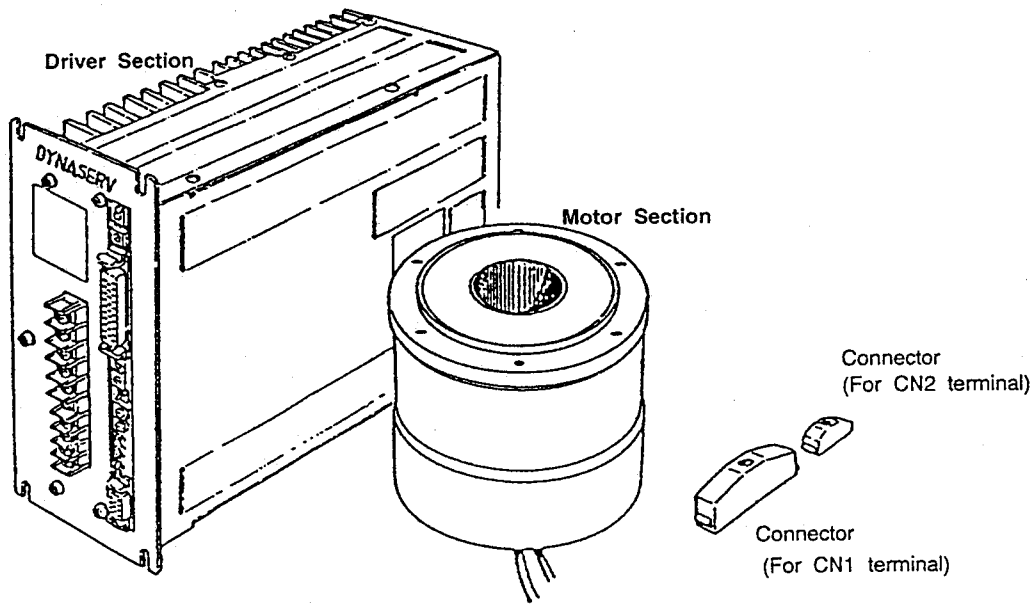


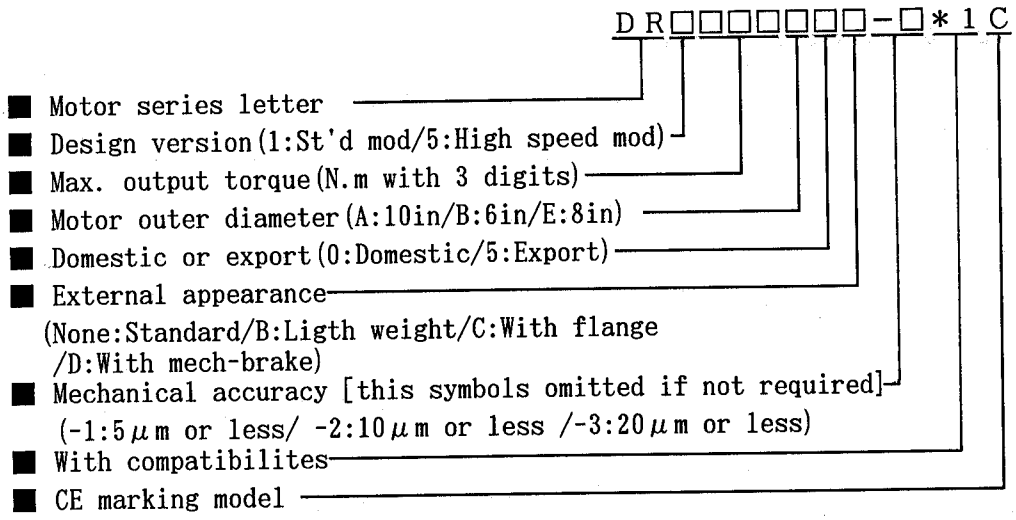
Figure 1.1 Standard Products

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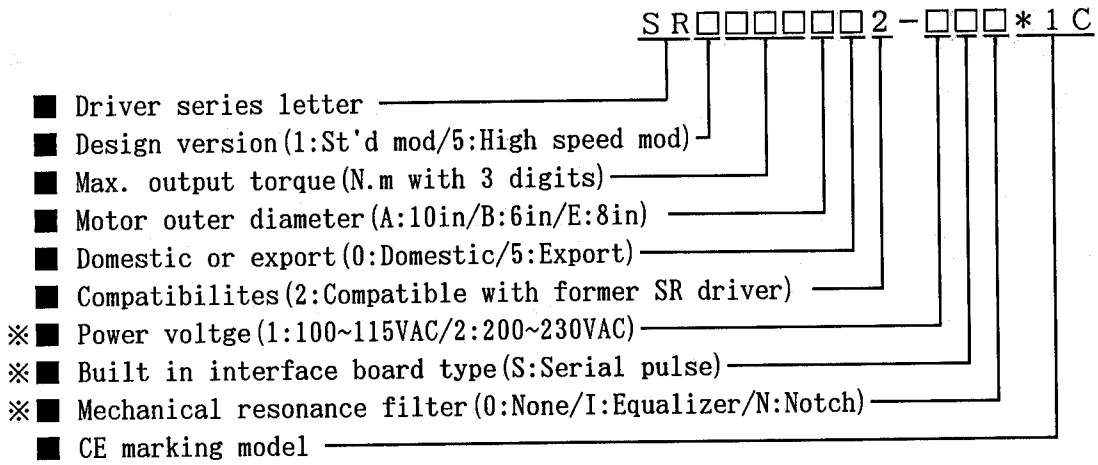
1.3 Model and Specification Code

The DYNASERV, DR / SR 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



※ : Optional

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

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2. FUNCTIONAL DESCRIPTION

2.1 Motor Section

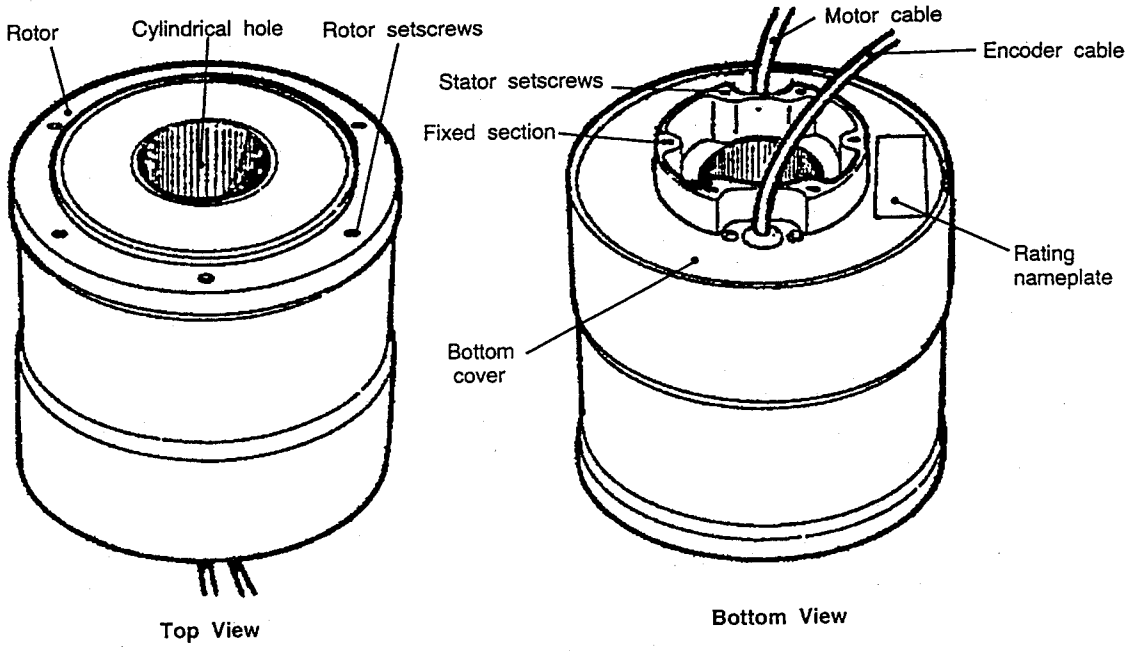


Figure 2.1 Parts Name of the Motor

2.2 Driver Section

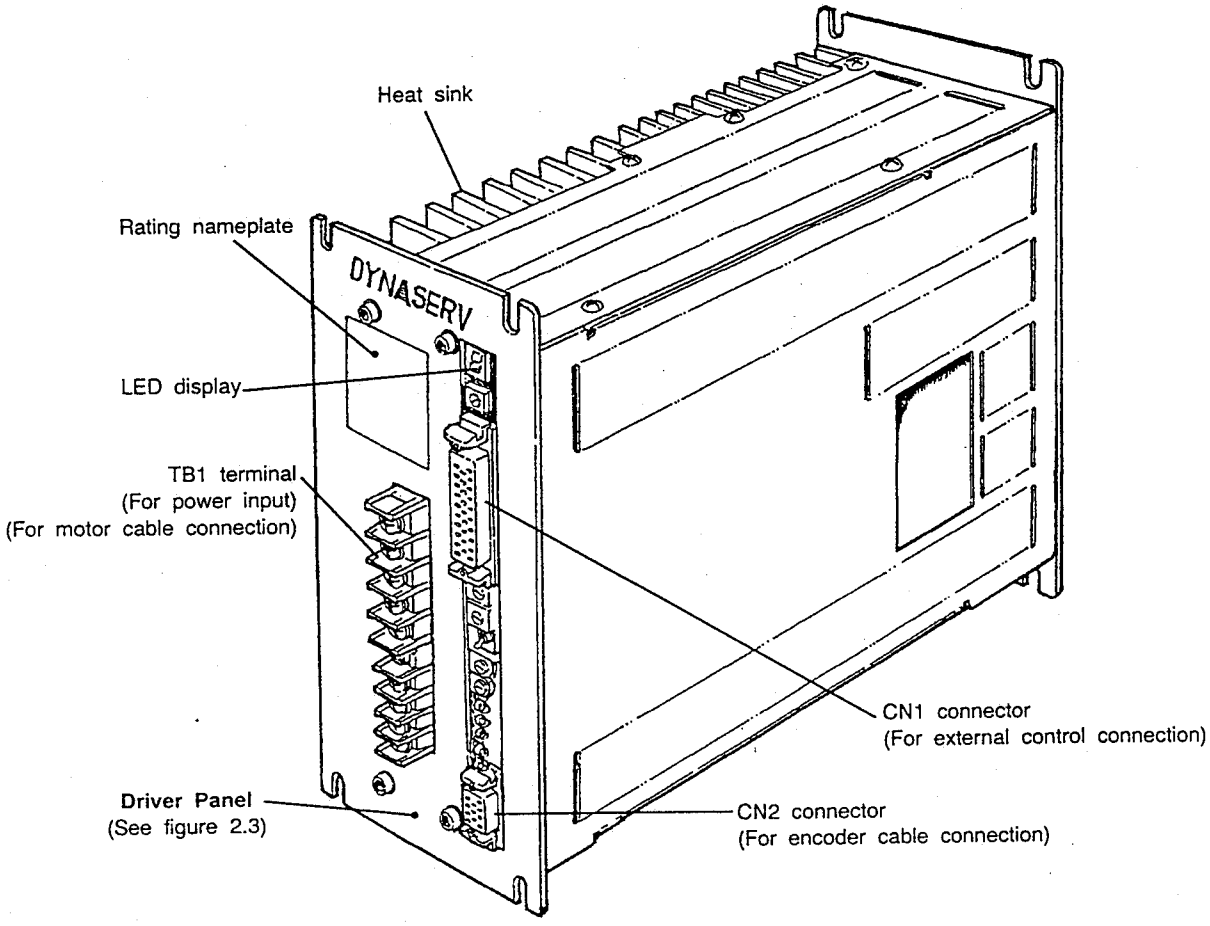
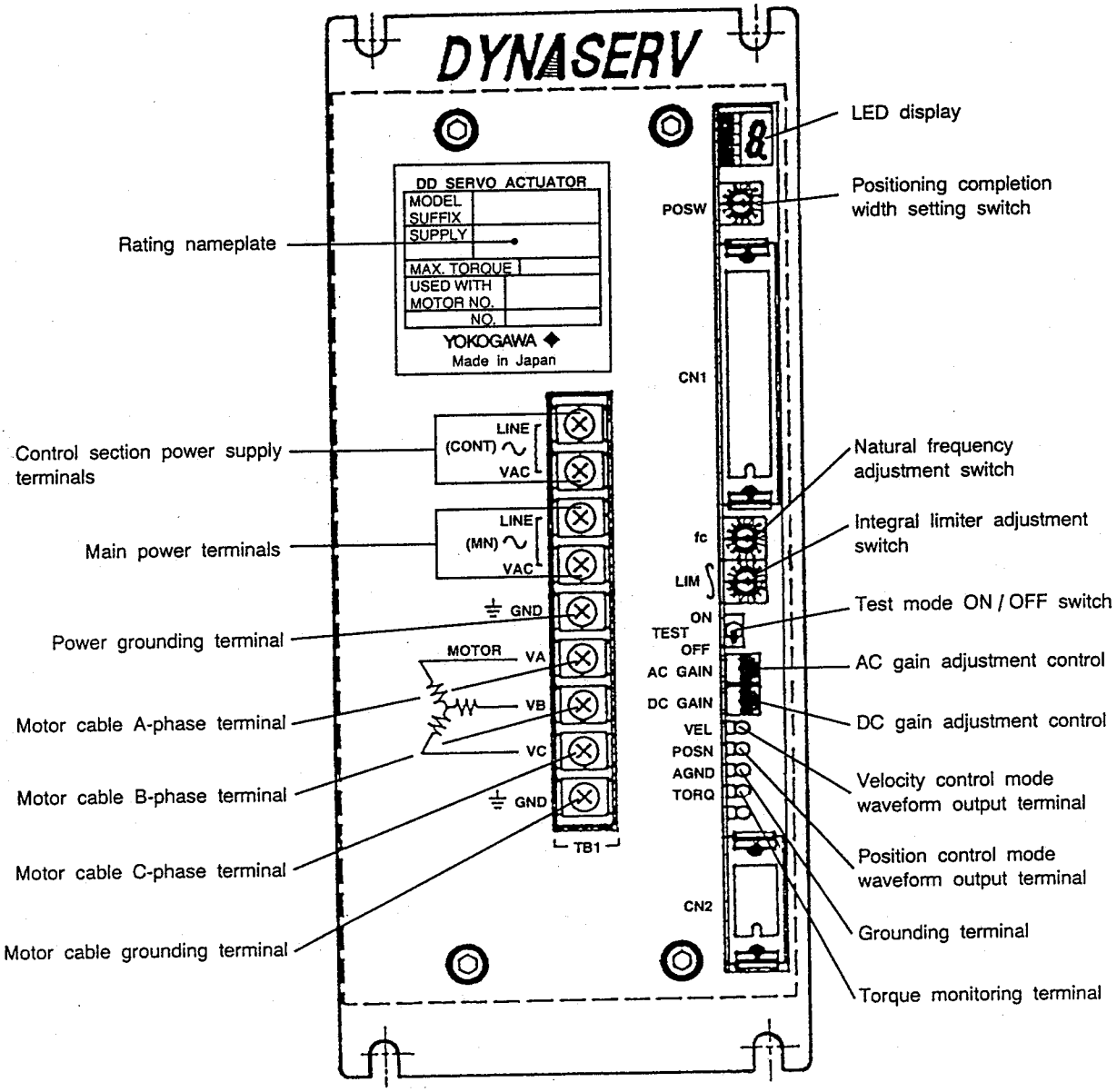


Figure 2.2 Parts Name of the Driver

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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

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3. PREPARATION FOR OPERATION

3.1 Initial Setting

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

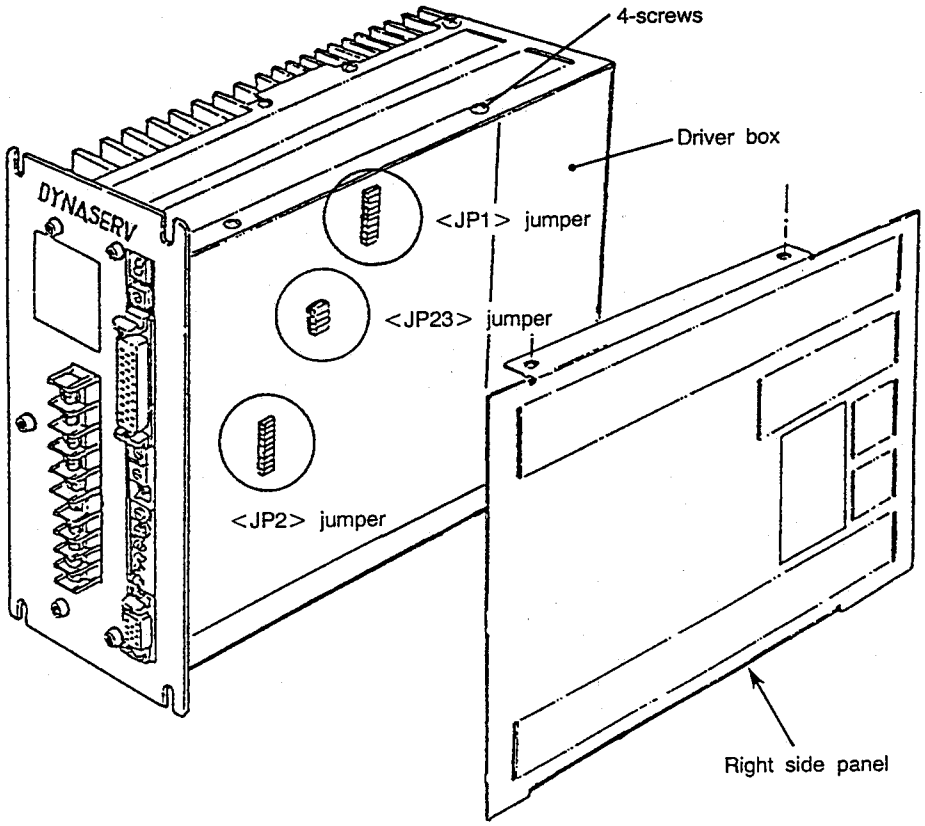


Figure 3.1 Setting of the Jumper Switches in the Driver Box

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.

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(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
- [•••] 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

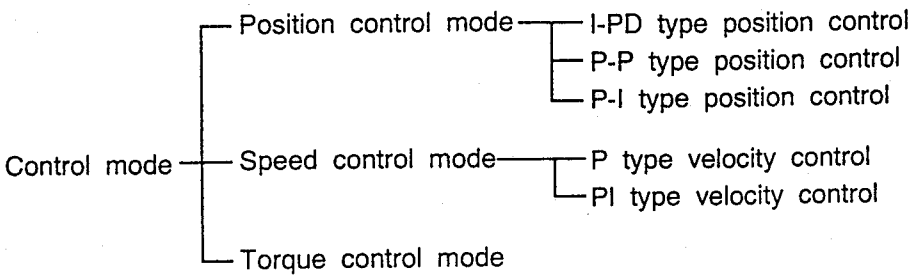
Switch Name / Volume Name	Setting Status
DC GAIN	Minimum position
AC GAIN	Minimum position
POSW	Set to "8"
fc	Set to "0"
I. LIM	Set to "0"
TEST	Set to "OFF"

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3.2 Control Mode Setting

(1) Control Mode Types

The following 6 control modes are available for the DYNASERV DR / SR 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
V1	DC GAIN	○	○	○	○	○	×
	AC GAIN	×	×	○	×	○	×
S1	POSW	○	○	○	×	×	×
S2	fc	○	○	○	×	×	×
	I. LIM	○	×	×	×	×	×
	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>.

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

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.)

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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.

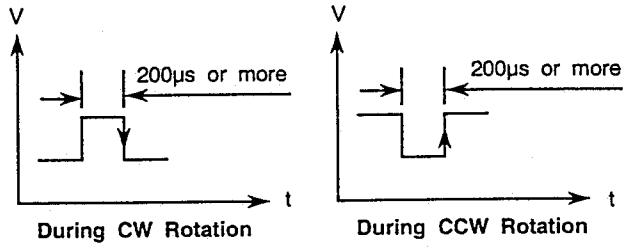
(3) Velocity Signal Filter Setting/JP2

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

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(clockwise) direction, or L changes to H when the motor rotates in the CCW(counterclockwise) direction, corresponds to the original position. The CW and CCW directions are direction of movement when the motor is viewed from the load side.

Origin reproducibility accuracy depends on the number of motor revolutions. The figure on the right shows the characteristics.



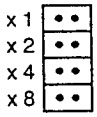
Origin Signal and Zero Position

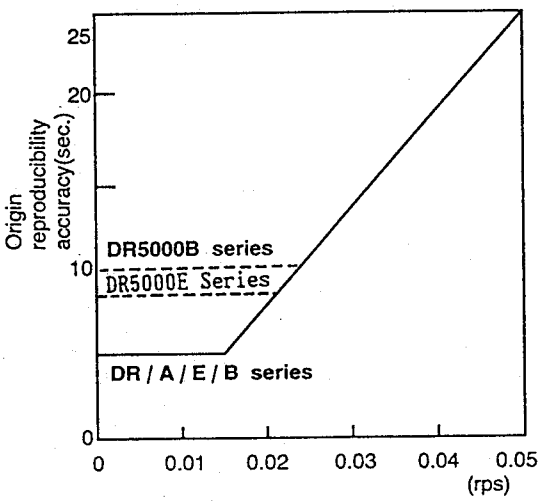
The number of origins per revolution can be selected with setting of jumper <JP23>.

The following table shows the relationship between the set values and the number of origins.

	A Series	B Series	E Series	5000B Series	5000E Series
×1 shorted with the others open	200	124	150	68	78
×2 shorted with the others open	400	248	300	136	156
×4 shorted with the others open	800	496	600	272	312
×8 shorted with the others open	1600	992	1200	544	624

<JP23> Jumper





Relationship between the Number of Motor Revolutions and Origin Reproducibility Accuracy

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(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 following table 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

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(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.

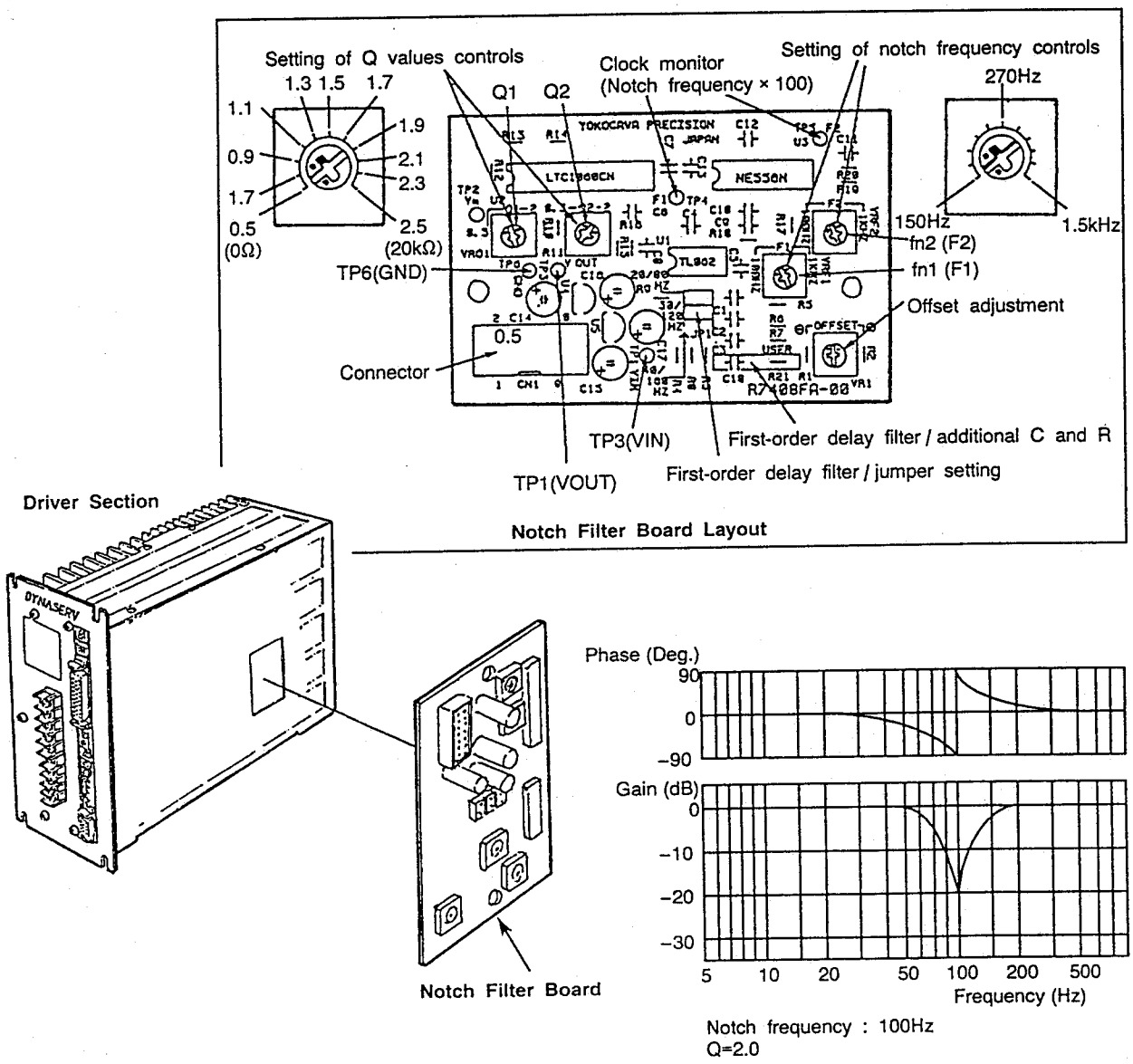
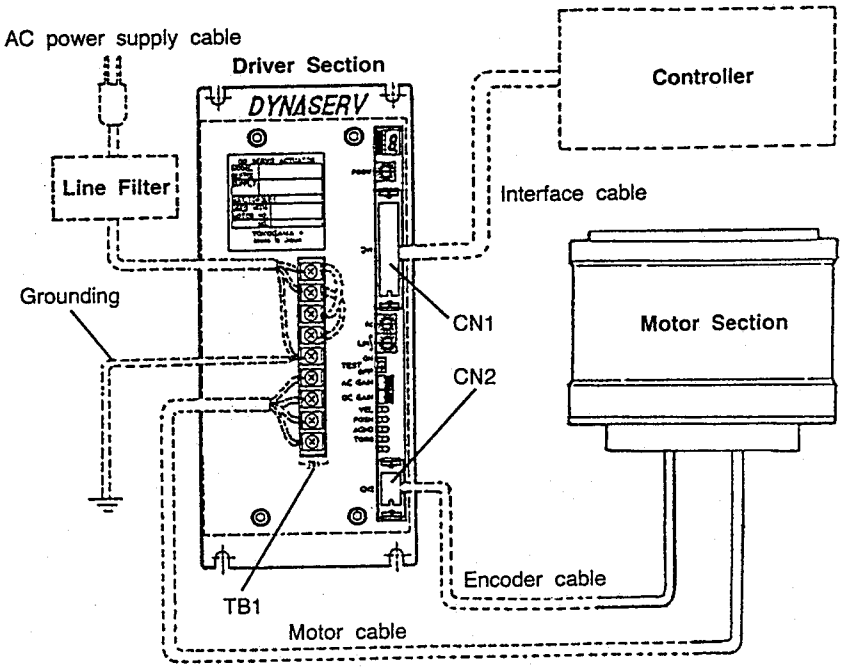


Figure 3.2 Mechanical Resonance Filter (Notch Type) Adjustment (Optional)

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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

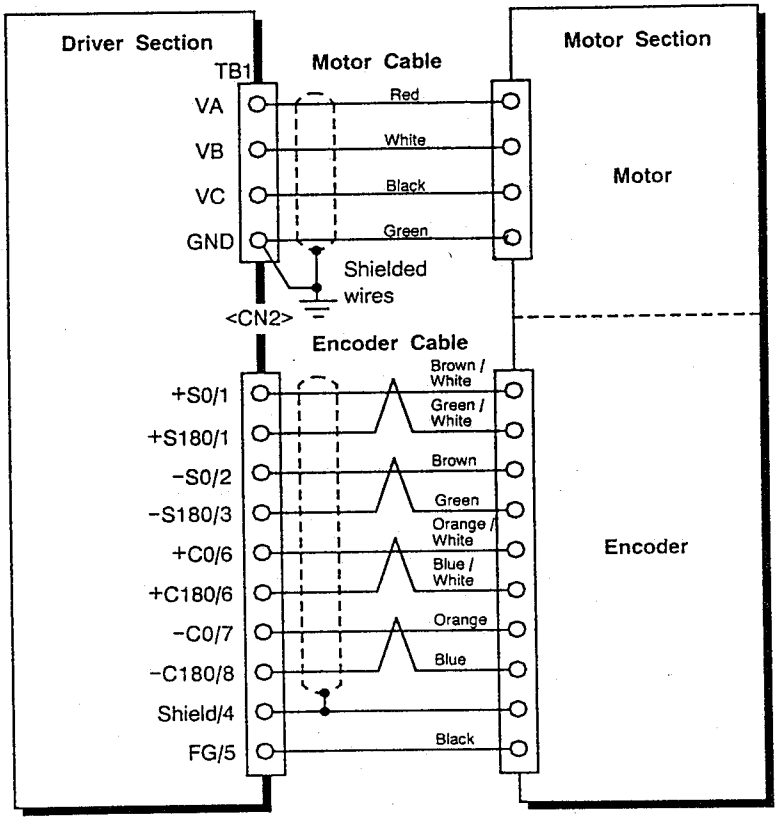


Figure 3.4 Connection between the Motor and the Driver

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

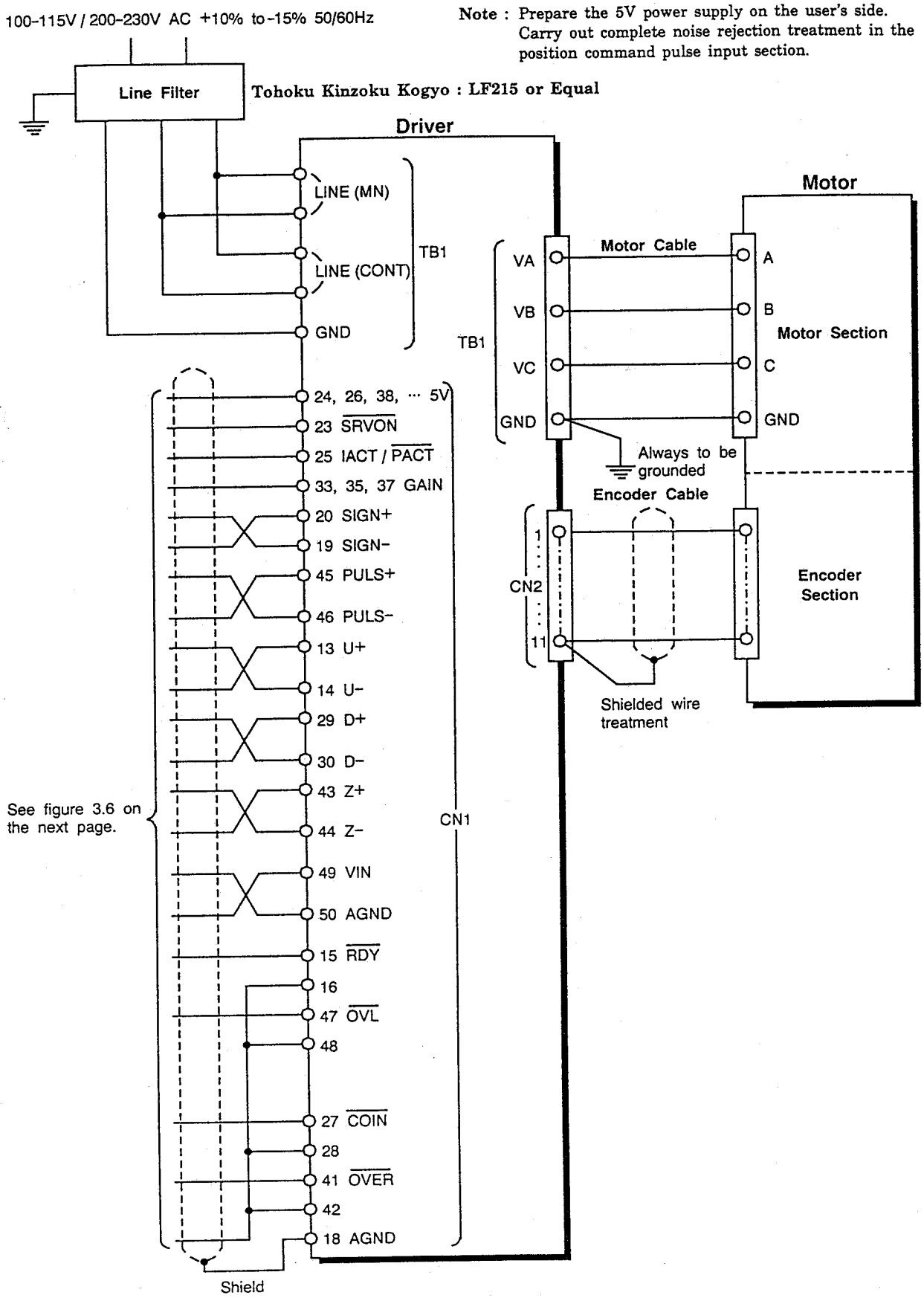
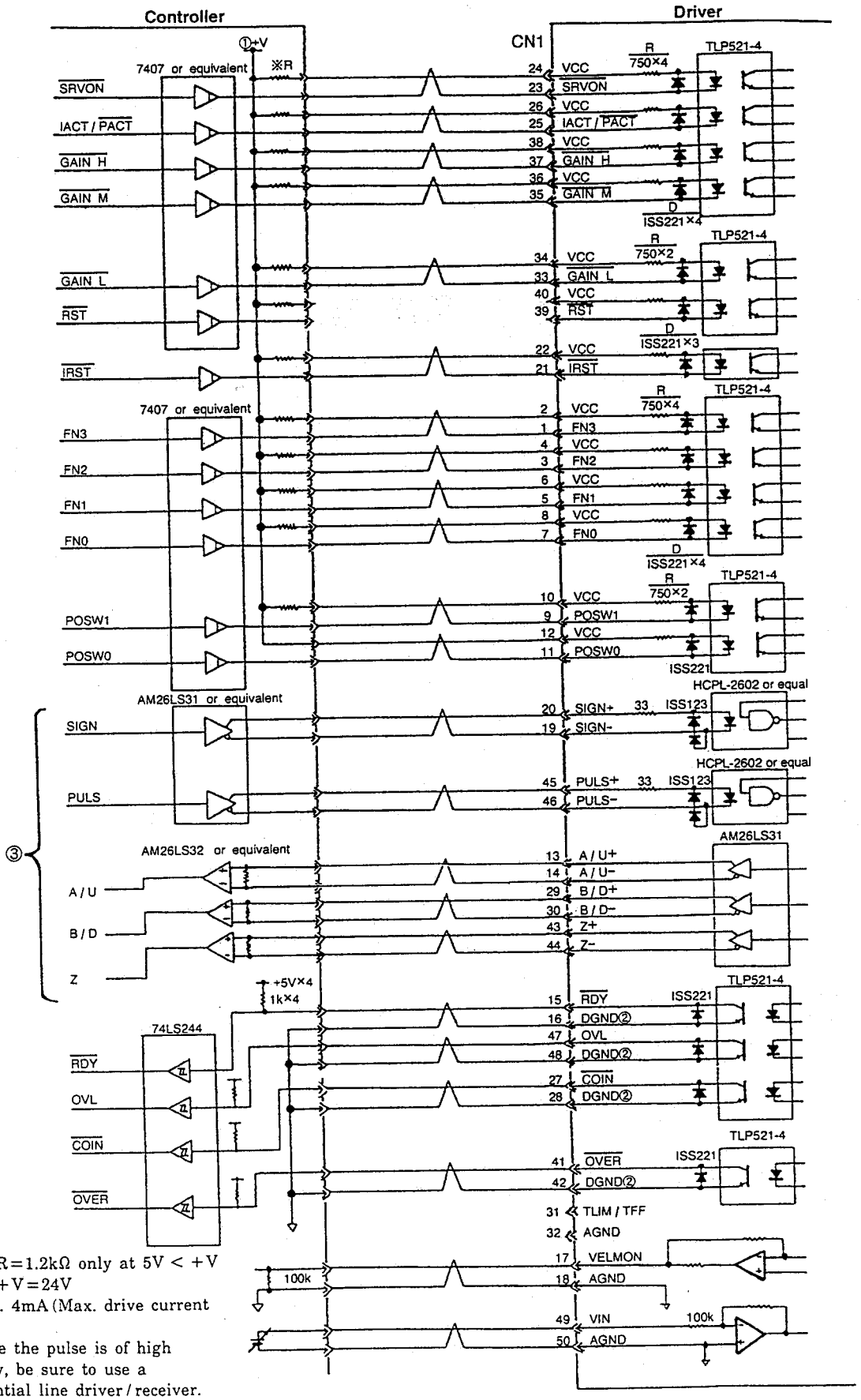


Figure 3.5 Typical Wiring Example

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(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 pulse is of high velocity, be sure to use a differential line driver / receiver.

Figure 3.6 Connection to External Connector

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(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	32	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 (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.

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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 (200 for the A series, 150 for the E series, 124 for the B series and 68 for the 5000B series, 78 for the 5000E 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)
DR1008B to DR1060B, DR1070E, DR1100E, DR1030E	5 / 2.0	3.0
DR1050A	5 / 1.5	2.3
DR1130E to DR1250E, DR1100A to DR1400A	5 / 1.0	1.5
DR5030B to DR5070B	1 / 1.0	7.5
DR5070E, DR5100E	1/1.0	5.0

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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

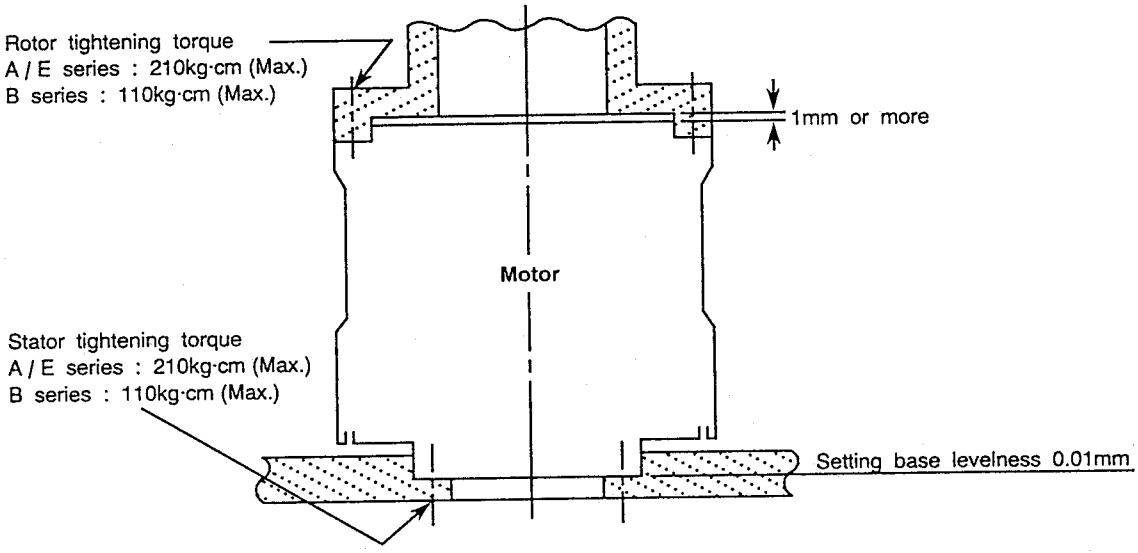
The motor section is designed for indoor use. Therefore, the installation location must be such that:

- 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

CAUTION

Kindly refer to the enclosed INSTALLATION MANUAL for details on proper procedures in a machine or device.

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(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.

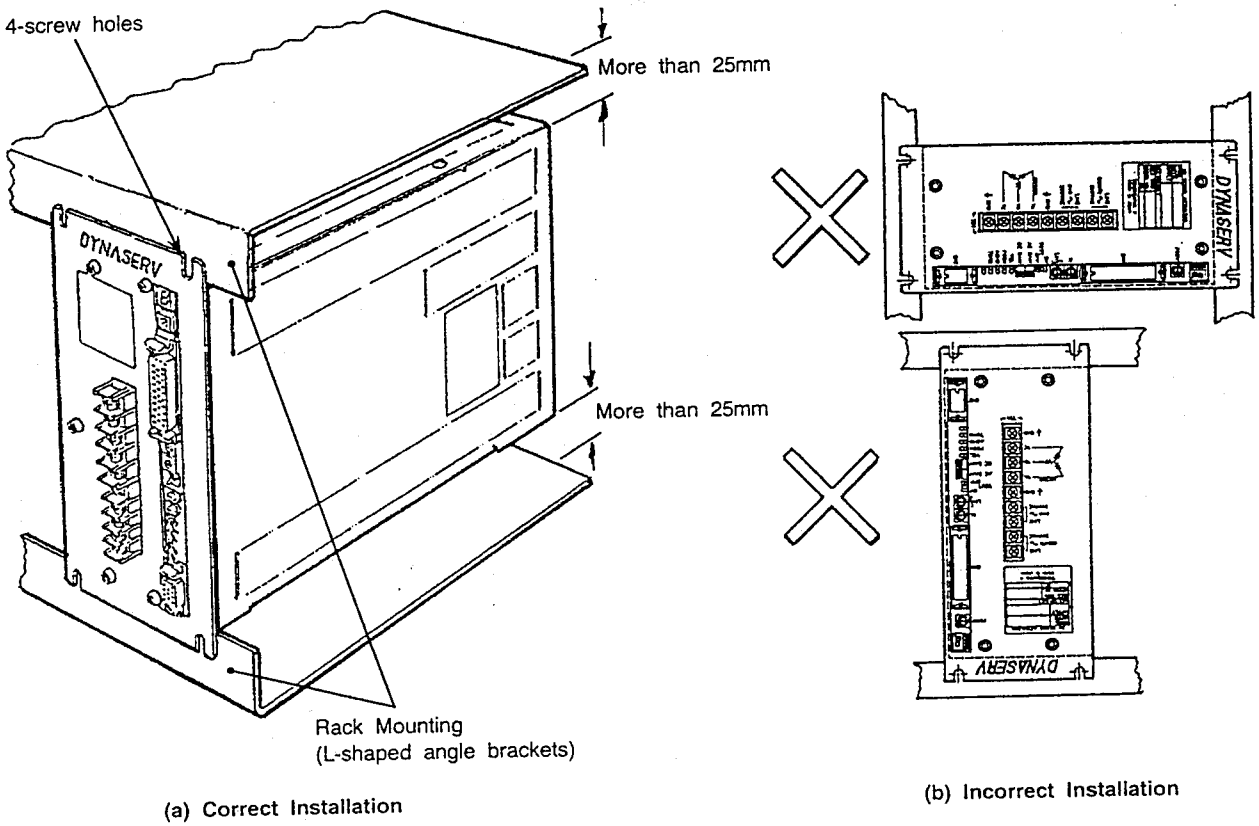


Figure 3.8 Driver Section Mounting

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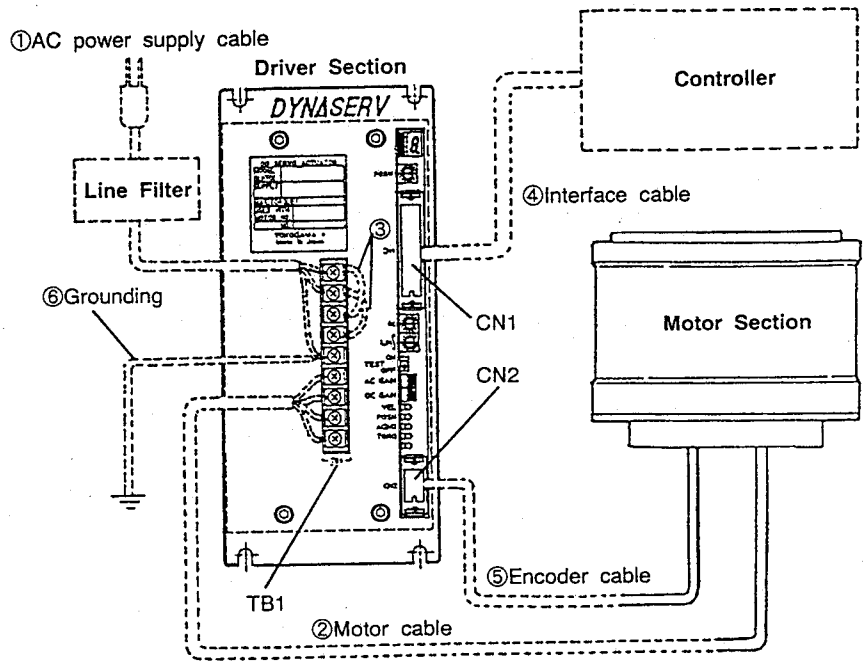
3.5 Wiring Cables

(1) Cable Sizes and Rated Currents

Table 3.5 Cable Sizes and Rated Currents

			A / E 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.

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4. OPERATION CAUTIONS

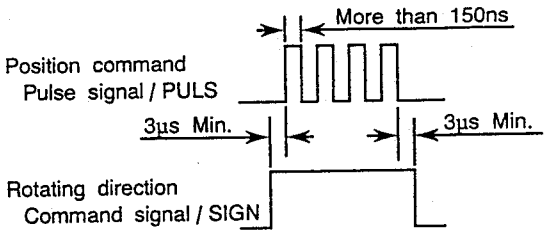
4.1 Input and Output Signal Cautions

(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±)

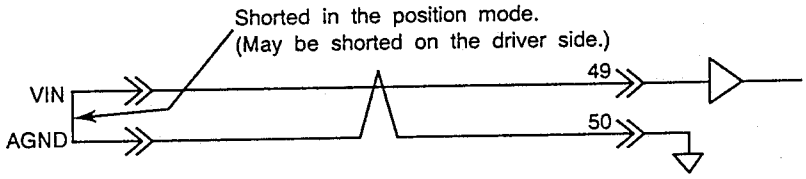
A signal indicating the motor rotation. The motor rotates in the CW direction with this signal set to H and CCW direction with this signal set to L. Timing of this signal with respect of the positioning command pulse signal at the output is as shown below.



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)

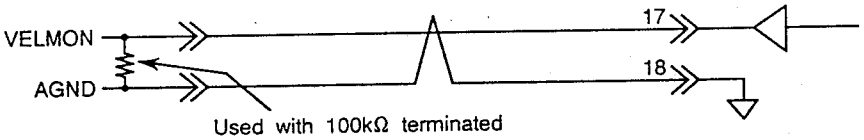
An analog input signal is used as the motor rotating velocity command value. The maximum velocity in the CW direction at +6V, and the maximum velocity in the CCW direction at −6V. (DR Std' Series) (In the −6V to +6V, input range, input impedance is 100kΩ.)



(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.)



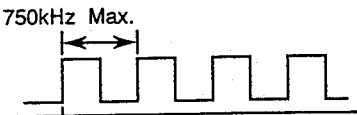
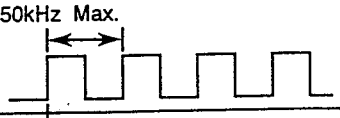
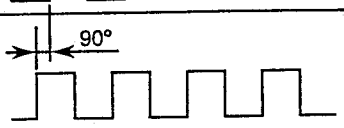
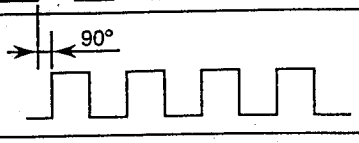
(5) A/B Phase, UP/DOWN Pulse Output Signals (A/U±, B/D±)

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

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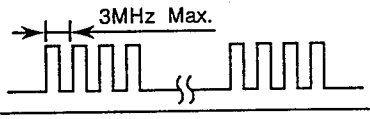
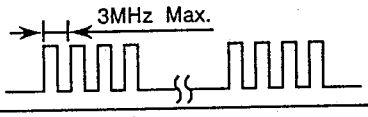
a) A / B Phase Output Pulse

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.

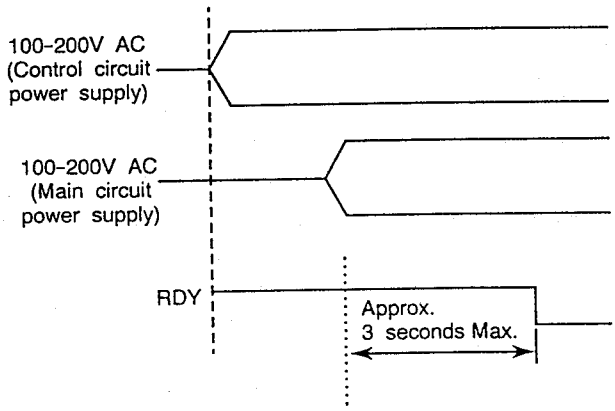
1) When turning ON the main and control circuit power supplies, turn them ON simultaneously or turn ON the control circuit power first.

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.



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4.3 Restrictions on Cyclic Operating Frequency (DR5000B Series only)

The maximum operating velocity of the DYNASERV DR5000B Series (DR5030B, DR5050B, DR5070B) is higher than the other DR Series motors. Owing to the special characteristcs of this series certain limiting restriction applies as to the cyclic stop-start frequency of move profile. Hence when desirous of using this motor is such a manner, kindly exercise sufficient caution.

(1) Restrictions on Motor Operation

Motor operating conditions are set assuming that the motor is operated at an ambient temperature of 45°C with the motor mounted on a metal base.

If motor load conditions and operating intervals are set as shown in Figure 4.1 then under the cyclic motor operations of : acceleration, constant velocity, deceleration to a stop, the following equations must be satisfied. Also, if either the average motor velocity (No. of revolutions) or the current duty is known, it is possible to obtain the other in a simplified manner from the graph shown in Figure 4.2.

For current I_1, I_2 or I_3, as shown in Figure 4.3 , the respective voltage is measured on the monitor terminals (TORQ) of the driver front panel and then is multiplied by <1.875>, thereby obtaining the respective current [A].

$$\eta_B = \frac{N_R}{2}(t_1+2t_2+t_3) \times \frac{1}{5t_{CY}} \times 100 \qquad \text{Equation (1)}$$

$$\eta_C = (t_1I_1^2 + t_2I_2^2 + t_3I_3^2) \times \frac{1}{15^2 t_{CY}} \times 100 \qquad \text{Equation (2)}$$

$$\eta_B + 2.6 \cdot \eta_C < 103 \qquad \text{Equation (3)}$$

η_B = Velocity duty
η_C = Current duty
I_1, I_2, I_3 = Current (A)
N_R = No. of revolutions
t_{CY} = Cyclic time (msec.)
t_1 , t_2, t_3 = Time (msec.)

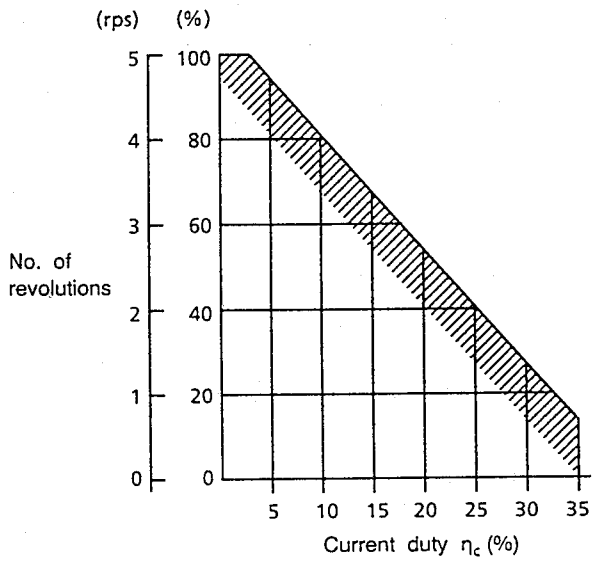


Figure 4.2 Average Velocity / Current Duty Graph

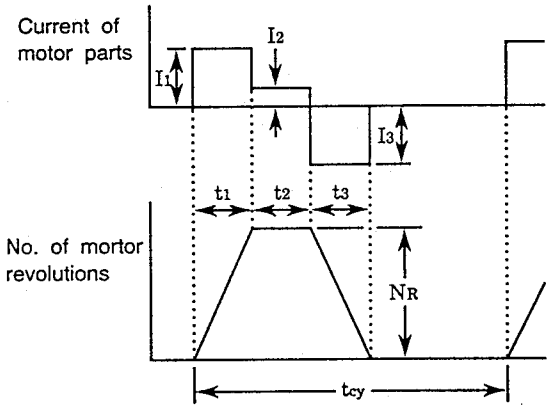


Figure 4.1

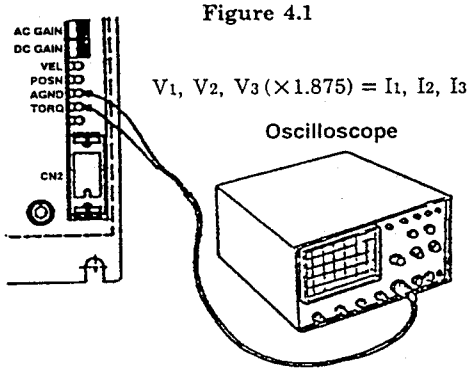


Figure 4.3

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<Example>

$N_R = 4$ (rps)

$I_1 = I_3 = 9$ (A)

$I_2 = 3$ (A)

$t_1 = t_2 = t_3 = 1/4\ t_{CY}$

From the above, η_B and η_C are obtained.

$$\eta_B = \frac{4}{2}\left(\frac{1}{4}t_{CY} + \frac{2}{4}t_{CY} + \frac{1}{4}t_{CY}\right) \times \frac{1}{5t_{CY}} \times 100$$

$$= \frac{2}{5} \times 100 = 40$$

$$\eta_C = \left(\frac{81}{4}t_{CY} + \frac{9}{4}t_{CY} + \frac{81}{4}t_{CY}\right) \times \frac{1}{225t_{CY}} \times 100$$

$$= \frac{17100}{900} = 19$$

For Equation (3),

$40 + 2.6 \times 19 = 98 < 103$

Thus, it is found that the conditions satisfy equation(3), resulting in confirmation of the correct settings.

(2) Restrictions on the Driver Operation

The DYNASERV cyclic operating frequency is also restricted to the maximum value of energy generated from the regenerative resistor built in to the driver. This means that if the DYNASERV is operated in a repetitive pattern shown in Figure 4.4, the cyclic operating frequency, as shown in Figure 4.5, is restricted by the load inertia with the number of revolutions set as a parameter.

If the load inertia exceeds 1kgm² or if the DYNASERV must be used beyond the rated load inertia, kindly contact Yokogawa Precision Corp. or it's authorized agent.

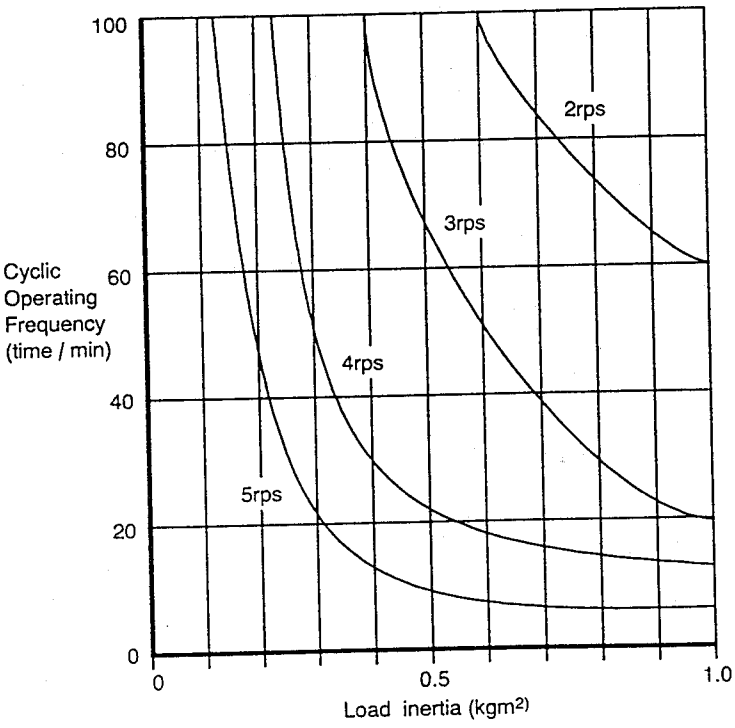
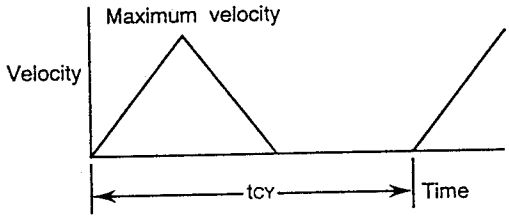


Figure 4.5



Cyclic operating frequency $= \frac{60}{t_{CY}}$ (time / min)

Figure 4.4

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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>**

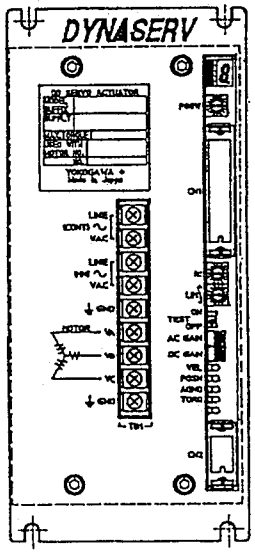
The 1 to 16Hz position control system band is selected from a scale of 0 to F. However, in this case CN1 connectors FN 0 to FN 3 must all be set to H.

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.

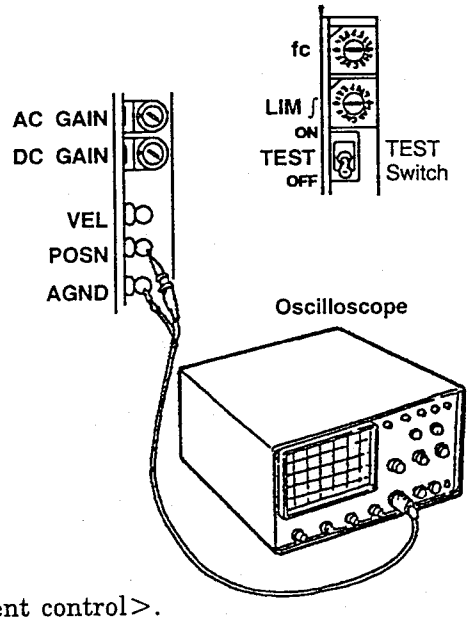
With the I type velocity control, a high tact positioning can be achieved. In this control mode, the amount of velocity feed forward is to be adjusted with a jumper in addition to <fc switch>, <DC gain control> and <AC gain control>.

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(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.

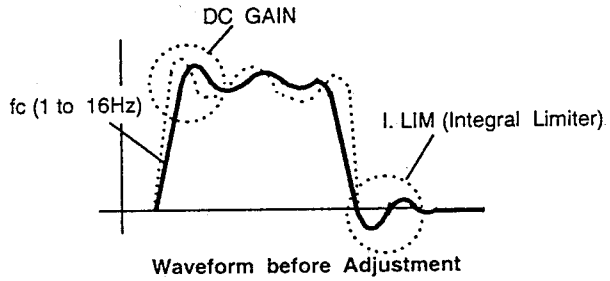
Step 2 : Set the CN1 connector <SERVO> signal to L. At this time, set the TEST switch to <OFF>.

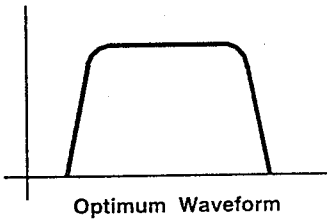
Step 3 : Set the <TEST switch> at the front of the driver to ON.

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.

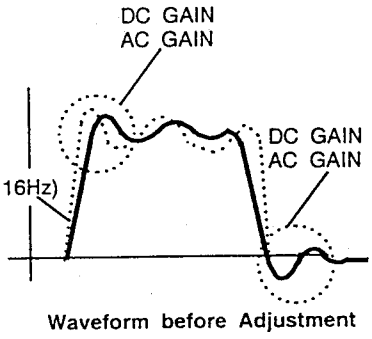
Step 5 : Set the <TEST switch> at the front of the driver to OFF.

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.

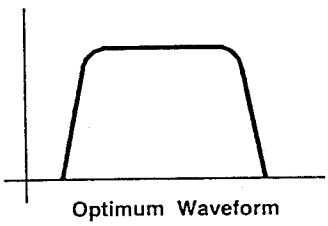
Step 2 : Set the CN1 connector <SERVO> signal to L. At this time, set the TEST switch to <OFF>.

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.



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(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 DR1200A ; 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

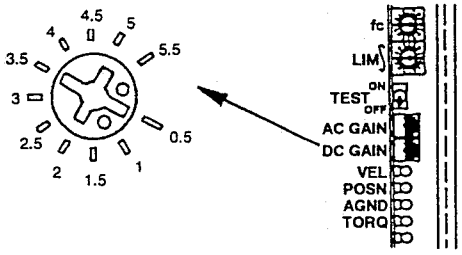


Table 5.1 Setting of the DYNASERV Controls (For A Series)

Range	Load Multiplication Factor : K					Setting Value		
	SR1400A	SR1300A	SR1200A	SR1150A	SR1100A	DC GAIN	fc	LIM ∫
1	to 1.2	to 0.9	to 0.5	to 0.4	to 0.1	3	E	5
2	1.2 to 2.3	0.9 to 1.9	0.5 to 1.3	0.4 to 1.2	0.1 to 0.6	4	D	3
3	2.3 to 5.6	1.9 to 4.8	1.3 to 3.6	1.2 to 3.3	0.6 to 2.3	8	C	2
4	5.6 to 11	4.8 to 9.7	3.6 to 7.5	3.3 to 6.9	2.3 to 5.1	13	B	2
5	11 to 22	9.7 to 19	7.5 to 15	6.9 to 14	5.1 to 11	25	A	2
6	22 to 55	19 to 49	15 to 38	14 to 36	11 to 27	50	9	2
7	55 to 77	49 to 68	38 to 54	36 to 50	27 to 38	65	8	2
8	77 to 110	68 to 97	54 to 77	50 to 72	38 to 55	80	7	2
9	110 to 166	97 to 146	77 to 116	72 to 108	55 to 82	100	5	3
10	166 to 331	146 to 292	116 to 232	108 to 215	82 to 165	110	2	6

Load Multiplication Factor : K	Setting Value		
SR1050A	DC GAIN	fc	LIM ∫
to 0.2	8	C	3
0.2 to 1.2	13	B	3
1.2 to 3.3	25	A	3
3.3 to 9.4	50	9	2
9.4 to 13	65	8	2
13 to 20	80	7	2
20 to 30	100	5	3
30 to 60	110	2	5

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Table 5.2 Setting of the DYNASERV Controls (For B Series)

Range	Load Multiplication Factor : K					Setting Value		
	SR1060B	SR1045B	SR1030B	SR1015B	SR1008B	DC GAIN	fc	LIM ∫
1	to 1.1	to 1.0	to 0.4			3	E	6
2	1.1 to 2.2	1.0 to 2.0	0.4 to 1.2	to 0.2		4	D	6
3	2.2 to 5.3	2.0 to 5.0	1.2 to 3.3	0.2 to 1.5	to 1.0	8	C	4
4	5.3 to 11	5.0 to 10	3.3 to 7.0	1.5 to 3.5	1.0 to 2.8	13	B	3
5	11 to 21	10 to 20	7.0 to 14	3.5 to 7.7	2.8 to 6.1	25	A	3
6	21 to 53	20 to 50	14 to 36	7.7 to 20	6.1 to 16	50	9	1
7	53 to 74	50 to 70	36 to 50	20 to 28	16 to 23	65	8	2
8	74 to 105	70 to 100	50 to 72	28 to 41	23 to 33	80	7	1
9	105 to 158	100 to 150	72 to 108	41 to 61	33 to 50	100	5	2
10	158 to 315	150 to 300	108 to 217	61 to 123	50 to 102	110	2	4

Table 5.3 Setting of the DYNASERV Controls (For E Series)

Range	Load Multiplication Factor : K				Setting Value		
	SR1250E	SR1220E	SR1160E	SR1130E	DC GAIN	fc	LIM ∫
1	to 1.4	to 1.3	to 1.0	to 0.8	3	E	4
2	1.4 to 2.6	1.3 to 2.4	1.0 to 2.0	0.8 to 1.7	4	D	3
3	2.6 to 6.2	2.4 to 5.9	2.0 to 5.0	1.7 to 4.4	8	C	3
4	6.2 to 12	5.9 to 12	5.0 to 10	4.4 to 8.8	13	B	3
5	12 to 24	12 to 23	10 to 20	8.8 to 18	25	A	2
6	24 to 60	23 to 57	20 to 50	18 to 44	50	9	1
7	60 to 85	57 to 80	50 to 70	44 to 62	65	8	1
8	85 to 121	80 to 115	70 to 99	62 to 89	80	7	1
9	121 to 181	115 to 172	99 to 149	89 to 134	100	5	1
10	181 to 362	172 to 344	149 to 298	134 to 267	110	2	5

Range	Load Multiplication Factor:K			Setting Value		
	SR1100E	SR1070E	SR1030E	DC GAIN	fc	LIM ∫
1						
2	~ 0.3			4	D	5
3	0.3~ 1.5	~ 1.0		8	C	5
4	1.5~ 3.6	1.0~ 2.6	~ 1.1	13	B	4
5	3.6~ 7.8	2.6~ 5.9	1.1~ 3.0	25	A	3
6	7.8~ 20	5.9~ 16	3.0~ 9.0	50	9	3
7	20~ 29	16~ 22	9.0~ 13	65	8	3
8	29~ 41	22~ 32	13~ 19	80	7	2
9	41~ 62	32~ 49	19~ 28	100	5	2
10	62~125	49~ 96	28~ 57	110	2	5

Table 5.4 Setting of the DYNASERV Controls (For 5000B/E Series)

Range	Load Multiplication Factor:K					Setting Value		
	SR5000B Series			SR5000E Series		DC GAIN	fc	LIM ∫
	SR5070B	SR5050B	SR5030B	SR5100E	SR5070E			
1								
2						4	D	6
3	~ 0.7	~ 0.5	~ 0.4			8	C	4
4	0.7~ 2.0	0.5~ 1.7	0.4~ 1.5	~ 0.2	~ 0.3	13	B	3
5	2.0~ 4.8	1.7~ 4.0	1.5~ 3.8	0.2~ 1.5	0.3~ 1.5	25	A	3
6	4.8~ 13	4.0~ 11	3.8~ 11	1.5~ 5.0	1.5~ 4.0	50	9	1
7	13~ 19	11~ 16	11~ 15	5.0~ 7.0	4.0~ 6.0	65	8	2
8	19~ 27	16~ 23	15~ 22	7.0~ 10	6~ 10	80	7	1
9	27~ 41	23~ 36	22~ 34	10~ 16	10~ 15	100	5	2
10	41~ 82	36~ 72	34~ 68	16~ 33	15~ 30	110	2	4

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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)
DR1008B to 1060B, DR1070E, DR1100E, DR1030E	2 / 10
DR1050A	1.5 / 10
DR1130E to 1250E, DR1100A to 1400A	1 / 10
DR5030B to 5070B	1/2
DR5070E, DR5100E	1/2

(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

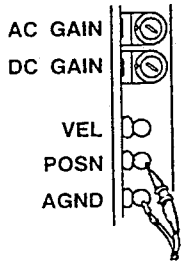
Since velocity control is effective only in proportional action, response is fast but is strongly influenced by disturbances in the controlled motor. In this control mode, only the <DC gain> variable resistor at the front of the driver is adjusted. While in this velocity mode, the test switch becomes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

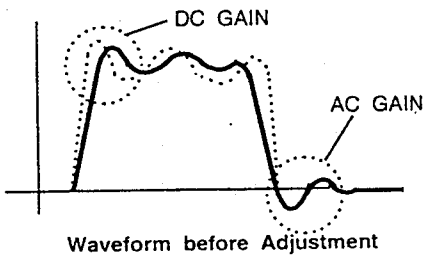
(3) Adjustment of Velocity Control System

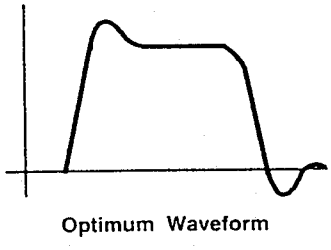
Adjustment of velocity control system can be carried out in the test mode.

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.

An approximate setting position of the <AC GAIN> control for obtaining an appropriate gain is the mechanical center position of the control.







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.

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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.

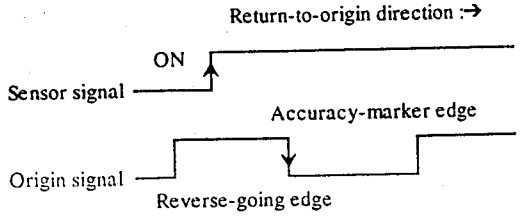
When the motor does not function normally, even after the following measures have been taken, immediately cease operation and contact the Yokogawa Electric Corporation or it's authorized agent.

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 11, 12
	◆The servo ON (SRVON) terminal is set to H.	Inspection	Set to L.	Page 13
	◆The CPU reset (RST) terminal is set to L.	Inspection	Set to H.	Page 13
	◆The integral capacitor reset (IRST) terminal is set to L.	Inspection	Set to H.	Page 13
	◆fc, I. LIM, DC gain is small.	Inspection	To be adjusted to an appropriate value.	Pages 22 to 25
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 11, 12
	◆fc, I. LIM, DC gain is small.	Inspection	To be adjusted to an appropriate value.	Pages 22 to 25
	◆ IRST input has been enabled.	Verify the CN 1 inputs.	Ensure that the IRST input is disabled.	Page 14
	◆ Velocity mode has been enabled.	Check to verify the status of the jumper JP2-PV inside the driver.	Change the internal setting to the posi -tioning control mode.	Page 6 to 7
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 11, 12
	◆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

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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 14, 15
	◆fc, I. LIM, DC gain is small.	Inspection	Adjust to appropriate value.	Pages 22 to 25
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 10
	◆Imperfect connection	Check motor / encoder connection.	Re-wire correctly by referring to the connection diagram.	Pages 11, 12
Position is dislocated.	◆Incorrect A/B-phase and U/D-pulse jumper, selection	To be inspected.		Pages 5 to 10
	◆Command pulse rate and width are not as specified.	Check the command pulse width.		Pages 20, 21
	◆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 20, 21
	◆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.		
The motor does not return to its origin accurately.	■ Connection with unmatched controller	Check the method for returnig the motor to its origin and reconfigure the settings.		
	■ Improper positioning of the "around-the-origin" sensor	Observe the positional relationship of the accuracy-marker edge of the "around-the-origin" sensor signal with the one for the origin signal using an oscilloscope to ensure that these two edges do not overlap.		
	■ Chattering in origin signal	Check for any chattering in the origin signal. Increasing the speed of the return-to-origin signal helps prevent chattering from occurring. If chattering still persists, adjust the position of the "around-the-origin" sensor. (If the reverse-going edge appears first, you may confuse it with the accuracy-marker edge.) 		

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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

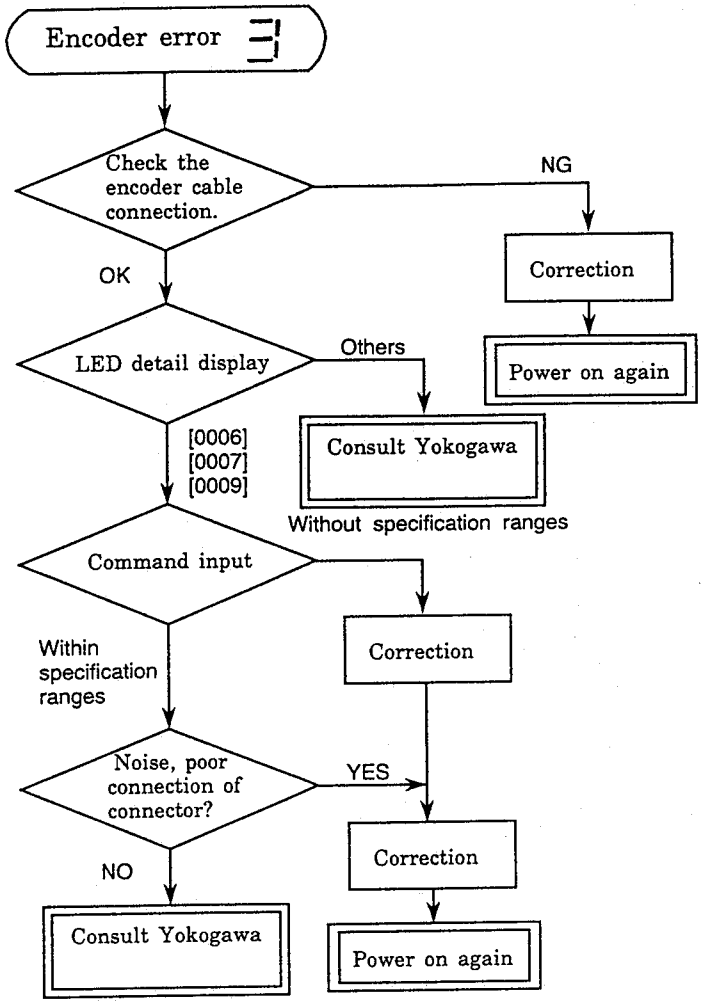
LED Display		Status	Display Details with TEST Switch ON (Serial display of 4-digit hexadecimal notation)	Measures / Page for Reference
Servo OFF	Servo ON			
0	0.	Normal status	No detail display	
1	1.	Speed over	No detail display	See pages 31 to 33
2		RAM error	Indiscriminate	Reparation required
3		Encoder 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) 0009 : Abnormal frequency (Divided error)	See pages 31 to 33
6		Over count shut down	Indiscriminate	See pages 31 to 33
	6.	Counter overflow	No detail display	See pages 31 to 33
7		ROM error	ROM checksum code 4 digits	Reparation required
8		Abnormal main power supply	No detail display	See pages 31 to 33
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 31 to 33
C	C.	Overload error	No detail display	See pages 31 to 33

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

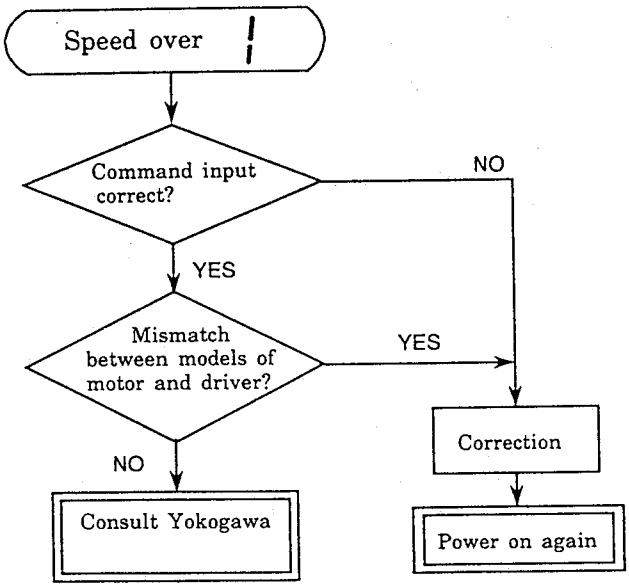
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7.3 Procedure for Error Correction

(1) Encoder Error

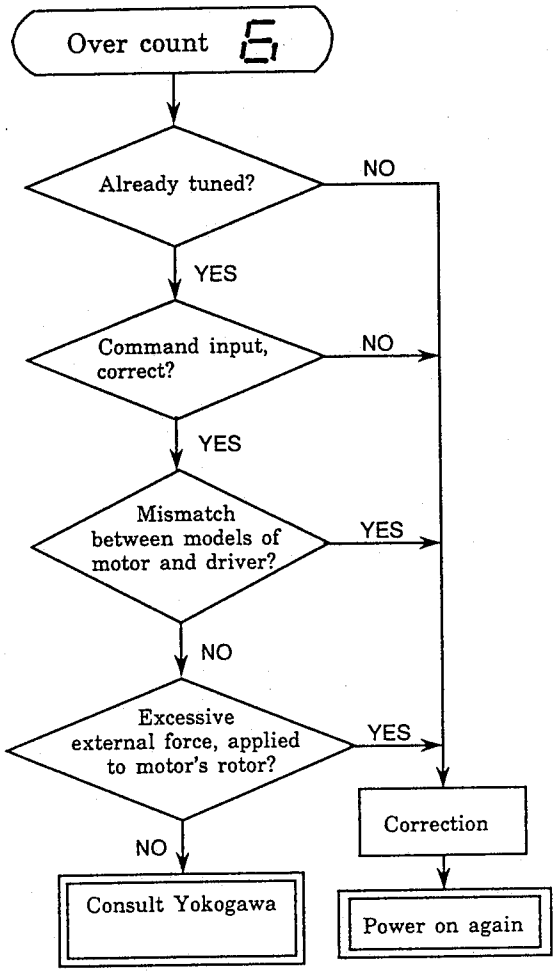


(2) Over Speed

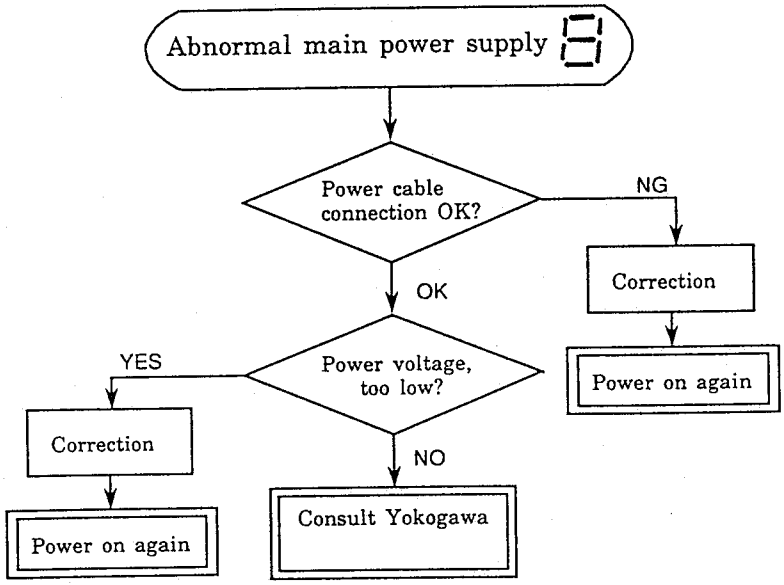


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(3) Over Count

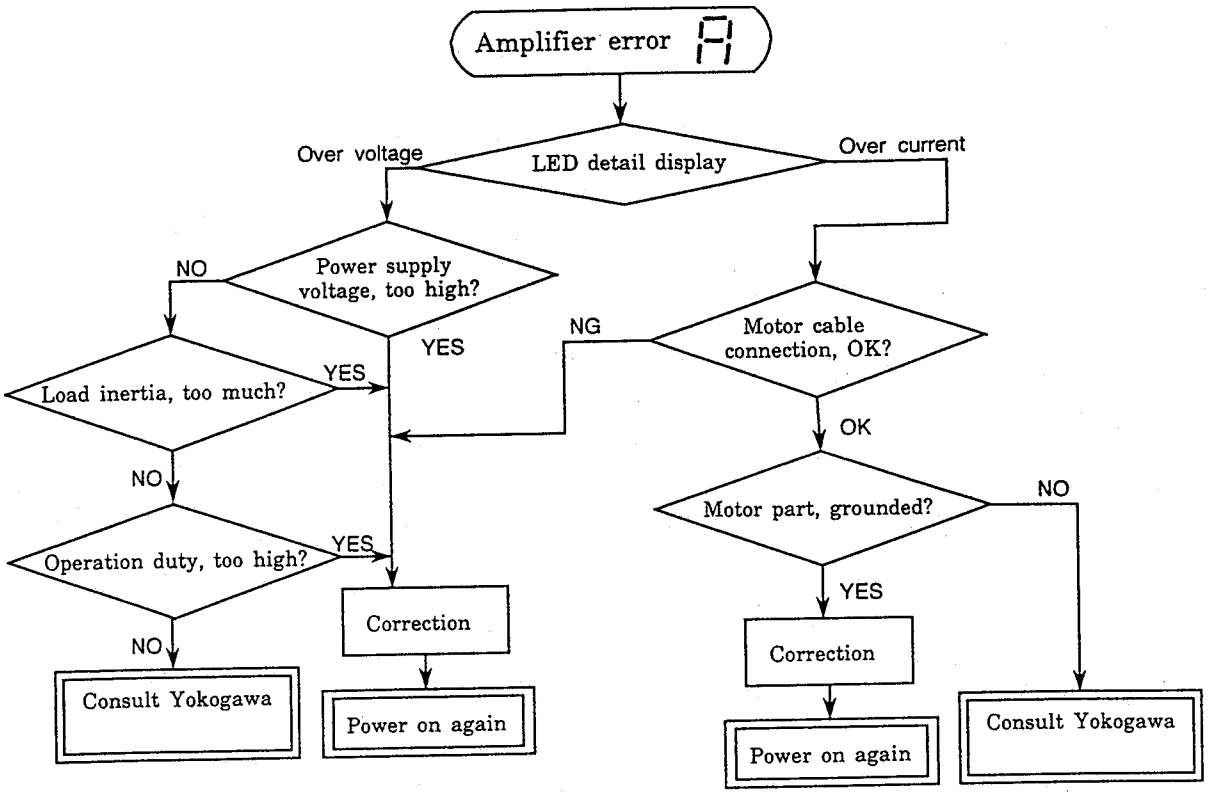


(4) Abnormal Main Power Supply

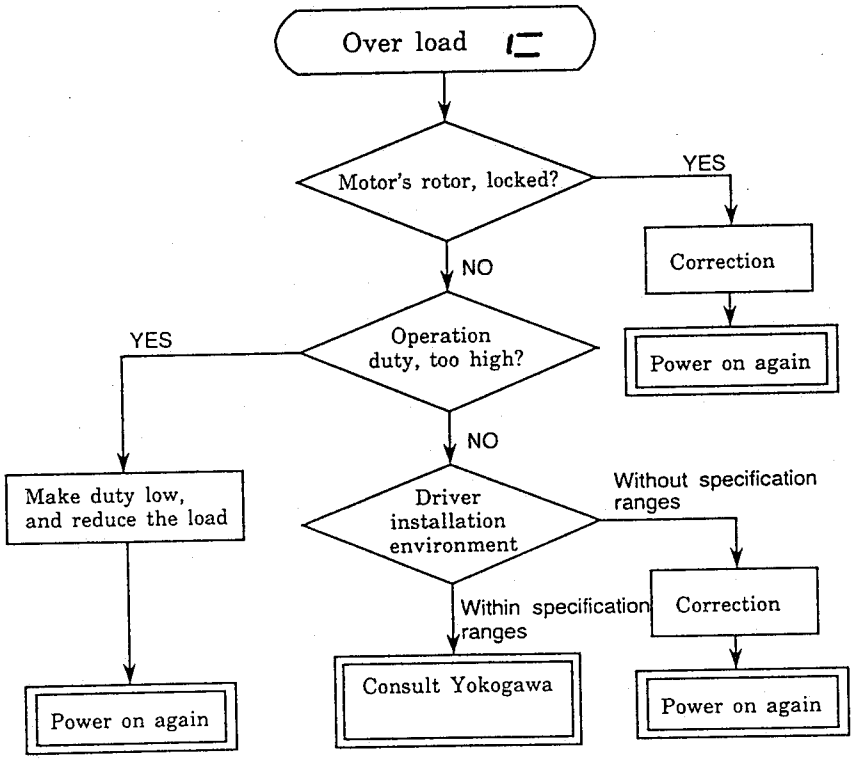


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(5) Amplifier Error



(6) Over Load



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8. OTHERS

8.1 Standard Specification

Series			DR-A Series						DR-B Series				
Model			DR1400A□0 •1C	DR1300A□0 •1C	DR1200A□0 •1C	DR1150A□0 •1C	DR1100A□0 •1C	DR1050A□0 •1C	DR1060B□0 •1C	DR1045B□0 •1C	DR1030B□0 •1C	DR1015B□0 •1C	DR1008B□0 •1C
Motor & driver coupling	Max. torque (N·m)		400	300	200	150	100	50	60	45	30	15	8
	Max. speed (rps)	100 to 115V AC Model	0.4	0.5	0.8	1.0	1.2	1.8	1.4	1.8	2.4		
		200 to 230V AC Model	0.8	1.0	1.2	1.2	1.2	1.8	2.4				
	Rated output (W)	100 to 115V AC Model	212	160	212	160	212	160	125	95	95	63	33.5
		200 to 230V AC Model	425	315	425	315	212	160	125	140	125	63	33.5
	Rated torque (N·m)		133	100	67	50	33	17	20	15	10	5	3
	Rated speed (rps)	100 to 115V AC Model	0.25	0.25	0.5	0.5	1.0	1.5	1.0	1.0	1.5	2.0	2.0
		200 to 230V AC Model	0.5	0.5	1.0	1.0	1.0	1.5	1.0	1.5	2.0	2.0	2.0
	Encoder resolution (p/rev)		819,200						507,904				
	Positioning accuracy (arc-sec)		±30						±45				
	Repeatability (arc-sec)		±5						±5				
	Max. power consumption(kVA)		3.2	3.2	3.0	3.0	2.5	2.5	2.3	2.1	1.8	1.4	1.0
Motor section	Rotor inertia (kg·m²)		400×10^{-3}	320×10^{-3}	285×10^{-3}	230×10^{-3}	200×10^{-3}	180×10^{-3}	33×10^{-3}	26×10^{-3}	24×10^{-3}	21×10^{-3}	15×10^{-3}
	Static max. load	Axial load (N) Compression	4.0×10^{4}						3.0×10^{4}				
		Axial load (N) Tension	2.0×10^{4}						1.0×10^{4}				
		Overhung load (N·m)	400						200				
	Torsional stiffness	Axial stiffness (mm/N) Compression	2.0×10^{-6}						2.5×10^{-6}				
		Axial stiffness (mm/N) Tension	3.0×10^{-6}						3.0×10^{-6}				
		Radial stiffness(rad/N·m)	4.0×10^{-7}						2.0×10^{-6}				
	Weight (kg)		65	55	45	36	31	26	15.5	13	11	9.0	6.0
	Dimensions(mm) Roter dia. ×L*		ϕ264×358	ϕ264×304	ϕ264×250	ϕ264×212	ϕ264×185	ϕ264×158	ϕ150×207	ϕ150×179	ϕ150×151	ϕ150×123	ϕ145×85
	Common item		Motor insulation: class F / Insulation resistance: 10MΩ Min.(500V DC) / Withstanding voltage: 1500V AC, 1 min. / Color: Black / Excitation: 3 Phase										
Driver section	Model	100 to 115V AC	SR1400A□2-1□□•1C	SR1300A□2-1□□•1C	SR1200A□2-1□□•1C	SR1150A□2-1□□•1C	SR1100A□2-1□□•1C	SR1050A□2-1□□•1C	SR1060B□2-1□□•1C	SR1045B□2-1□□•1C	SR1030B□2-1□□•1C	SR1015B□2-1□□•1C	SR1008B□2-1□□•1C
		200 to 230V AC	SR1400A□2-2□□•1C	SR1300A□2-2□□•1C	SR1200A□2-2□□•1C	SR1150A□2-2□□•1C	SR1100A□2-2□□•1C	SR1050A□2-2□□•1C	SR1060B□2-2□□•1C	SR1045B□2-2□□•1C	SR1030B□2-2□□•1C	SR1015B□2-2□□•1C	SR1008B□2-2□□•1C
	Input signal	Speed input Domestic model	Analog voltage: ±6V DC						Analog voltage: ±6V DC				
		Speed input Export model	Analog voltage: ±10V DC						Analog voltage: ±10V DC				
		Positioning input	Serial pulse 1.6MHz Max.						Serial pulse 1.6MHz Max.				
		Rotation direction command	+6V(CW) to –6V(CCW)						+6V(CW) to –6V(CCW)				
	Output signal	Speed output	H: CW L: CCW						H: CW L: CCW				
		Encorder output	Track A/B(400kHz Max.) Zero position signal(200p/rev)						Track A/B(400kHz Max.) Zero position signal(124p/rev)				
		Alarm output	Over current, Over voltage, Heat sink temperature rise, Voltage down, Encoder abnormal, CPU abnormal.						Over current, Over voltage, Heat sink temperature rise, Voltage down, Encoder abnormal, CPU abnormal.				
		Monitor output	2.5Hz Step response output (test mode)						2.5Hz Step response output (test mode)				
	Power source		100 to 115V AC±10% / 200 to 230V AC±10% 50/60Hz						100 to 115V AC±10% / 200 to 230V AC±10% 50/60Hz				
	Power consumption driver (VA)	100 to 115V AC Model	1120	900	1060	850	1120	1000	710	670	670	500	400
		200 to 230V AC Model	1800	1400	1900	1500	1120	1000	710	800	750	500	400
	Weight (kg)		6						6				

* See drawings

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Series				DR-E Series							
Model				DR1250E□0 •1C	DR1220E□0 •1C	DR1160E□0 •1C	DR1130E□0 •1C	DR1100E□0 •1C	DR1070E□0 •1C	DR1030E□0 •1C
Motor & driver coupling	Max. torque (N·m)			250	220	160	130	100	70	30
	Max. speed (rps)	100 to 115V AC Model		0.7	0.7	1.0	1.2	1.5	2.0	2.0
		200 to 230V AC Model		1.2	1.2	1.2	1.2	2.4	2.4	2.4
	Rated output (W)	100 to 115V AC Model		265	224	170	132	212	224	95
		200 to 230V AC Model		425	375	335	265	315	300	125
	Rated torque (N·m)			83	73	53	43	33	23	10
	Rated speed (rps)	100 to 115V AC Model		0.5	0.5	0.5	0.5	1.0	1.5	1.5
		200 to 230V AC Model		0.8	0.8	1.0	1.0	1.5	2.0	2.0
	Encoder resolution (p/rev)			614,400						
	Positioning accuracy (arc-sec)			±45						
	Repeatability (arc-sec)			±5						
	Max. power consumption (kVA)			3.2	3.0	2.8	2.5	2.3	2.0	1.8
Motor section	Rotor inertia (kg·m²)			185×10^{-3}	170×10^{-3}	140×10^{-3}	125×10^{-3}	100×10^{-3}	85×10^{-3}	72×10^{-3}
	Static max. load	Axial load (N)	Compression	4.0×10^{4}						
			Tension	2.0×10^{4}						
		Overhung load (N·m)		400						
	Torsional stiffness	Axial stiffness (mm/N)	Compression	2.0×10^{-6}						
			Tension	3.0×10^{-6}						
		Radial stiffness (rad/N·m)		4.0×10^{-7}						
	Weight (kg)			48	44	36	32	26	22	18
	Dimensions (mm) Roter dia. ×L *			ϕ205×355	ϕ205×327	ϕ205×271	ϕ205×243	ϕ205×210	ϕ205×183	ϕ205×156
	Common item			Motor insulation: class F / Insulation resistance: 10MΩ Min.(500V DC) / Withstanding voltage: 1500V AC, 1 min. / Color: Black / Excitation: 3 Phase						
Driver section	Model	100 to 115V AC		SR1250E□2-1□□•1C	SR1220E□2-1□□•1C	SR1160E□2-1□□•1C	SR1130E□2-1□□•1C	SR1100E□2-1□□•1C	SR1070E□2-1□□•1C	SR1030E□2-1□□•1C
		200 to 230V AC		SR1250E□2-2□□•1C	SR1220E□2-2□□•1C	SR1160E□2-2□□•1C	SR1130E□2-2□□•1C	SR1100E□2-2□□•1C	SR1070E□2-2□□•1C	SR1030E□2-2□□•1C
	Input signal	Speed input	Domestic model	Analog voltage: ±6V DC						
			Export model	Analog voltage: ±10V DC						
		Positioning input		Serial pulse 1.6MHz Max.						
		Rotation direction command		+6V(CW) to –6V(CCW)						
	Output signal	Speed output		H: CW L: CCW						
		Encorder output		Track A/B(400kHz Max.) Zero position signal(150p/rev)						
		Alarm output		Over current, Over voltage, Heat sink temperature rise, Voltage down, Encoder abnormal, CPU abnormal.						
		Monitor output		2.5Hz Step response output (test mode)						
	Power source			100 to 115V AC±10% / 200 to 230V AC±10% 50/60Hz						
	Power consumption driver (VA)	100 to 115V AC Model		1250	1120	900	750	1060	1120	710
		200 to 230V AC Model		1800	1600	1500	1250	1500	1400	900
	Weight (kg)			6						

* See drawings

Series				DR5000-B Series			DR5000-E Series	
Model				DR5070B□0 •1C	DR5050B□0 •1C	DR5030B□0 •1C	DR5100E□0 •1C	DR5070E□0 •1C
Motor & driver coupling	Max. torque (N·m)			70	50	30	100	70
	Max. speed (rps)			5.0			4.0	
	Rated output (W)			280	212	125	425	300
	Rated torque (N·m)			23	17	10	33	23
	Rated speed (rps)			2.0	2.0	2.0	2.0	2.0
	Encoder resolution (p/rev)			278,528			319,488	
	Positioning accuracy (arc-sec)			±90			±90	
	Repeatability (arc-sec)			±10			±8	
	Max. powre consumption (kVA)			3.1	3.1	3.1	3.3	3.1
Motor section	Rotor inertia (kg·m²)			37×10^{-3}	34×10^{-3}	27×10^{-3}	125×10^{-3}	100×10^{-3}
	Static max. load	Axial load (N)	Compression	3.0×10^{4}			4.0×10^{4}	
			Tension	1.0×10^{4}			2.0×10^{4}	
		Overhung load (N·m)		200			400	
	Torsional stiffness	Axial stiffness (mm/N)	Compression	3.0×10^{-6}			2.0×10^{-6}	
			Tension	4.0×10^{-6}			3.0×10^{-6}	
		Radial stiffness (rad/N·m)		2.0×10^{-6}			4.0×10^{-7}	
	Weight (kg)			18.0	16.0	13.5	32	26
	Dimensions (mm) Roter dia. ×L *			ϕ150×240	ϕ150×212	ϕ150×184	ϕ205×243	ϕ205×210
	Common item			Motor insulation: class F / Insulation resistance: 10MΩ Min.(500V DC) / Withstanding voltage: 1500V AC, 1 min. / Color: Brack / Excitation: 3 Phase				
Driver section	Model			SR5070B□2-2□□•1C	SR5050B□2-2□□•1C	SR5030B□2-2□□•1C	SR5100E□2-2□□•1C	SR5070E□2-2□□•1C
	Input signal	Speed input	Domestic model	Analog voltage: ±6V DC				
			Export model	Analog voltage: ±10V DC				
		Positioning input		Serial pulse 1.4MHz Max.			Serial pulse 1.6MHz Max.	
		Rotation direction command		+6V(CW) to –6V(CCW)				
	Output signal	Speed output		H:CW L:CCW				
		Encorder output		Track A/B (400kHz Max.) Zero position signal (68p/rev)			Track A/B (400kHz Max.) Zero position signal (78p/rev)	
		Alarm output		Over current, Over voltage, Heat sink temperature rise, Voltage down, Encoder abnormal, CPU abnormal.				
		Monitor output		2.5Hz Step response output (test mode)				
	Power source			200 to 230V AC±10% 50/60Hz				
	Power consumption driver (VA)			1180	950	670	1700	1250
	Weight (kg)			6				

* See drawings

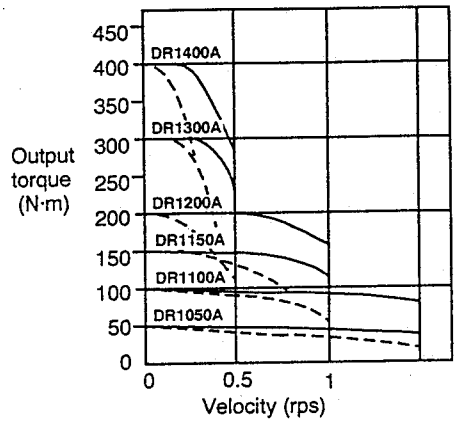
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Environmental Specification

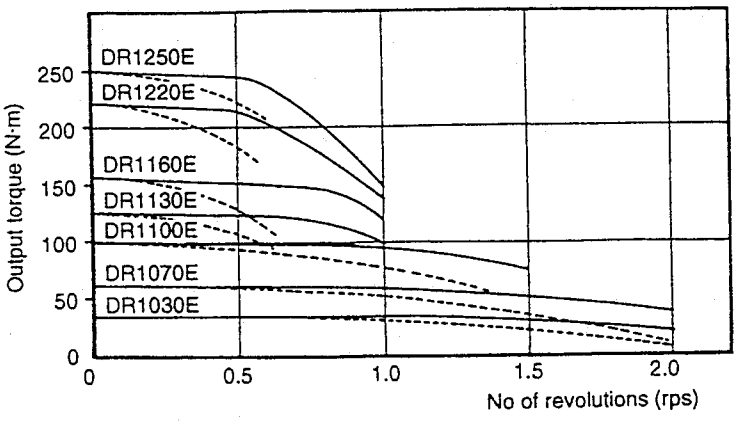
			Motor Section	Servo Dirve Section	Notes
Ambient operation conditions	Temperature	°C	5 to 40	5 to 40	
	Humidity	%R.H.	20 to 85	20 to 90	Non condensing
Storage conditions	Temperature	°C	–20 to 85	–20 to 85	
	Humidity	%R.H.	20 to 85	20 to 90	Non condensing
Atmosphere			No corrosive gases, Dust-free atmosphere		
Location			Do not use at locations exceeding 1000m above the sea level		

8.2 Torque vs Velocity Characteristic

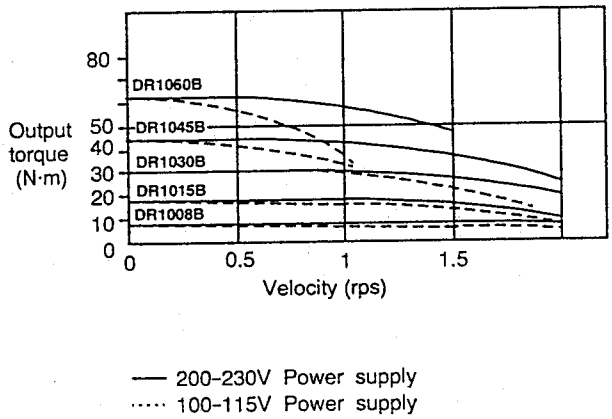
A Series



E Series

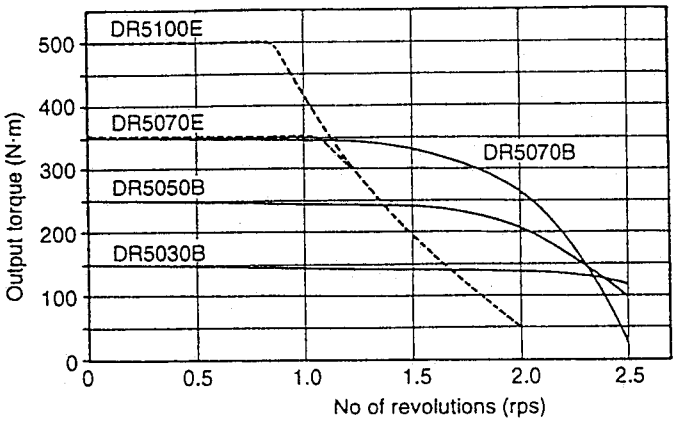


B Series



—— 200–230V Power supply
····· 100–115V Power supply

DR5000B/E Types

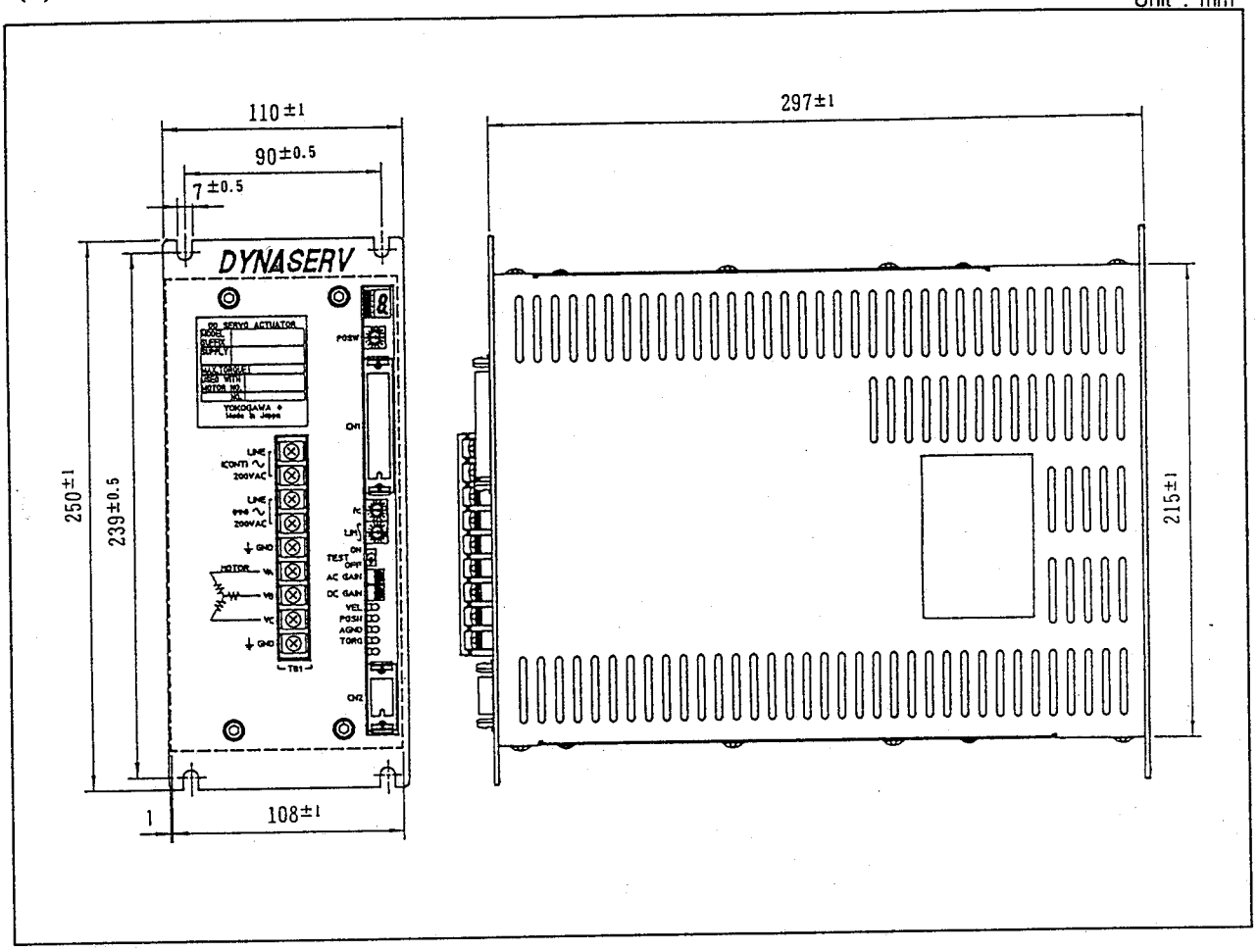


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8.3 Dimensional Outline Drawing

(1) Driver

Unit : mm

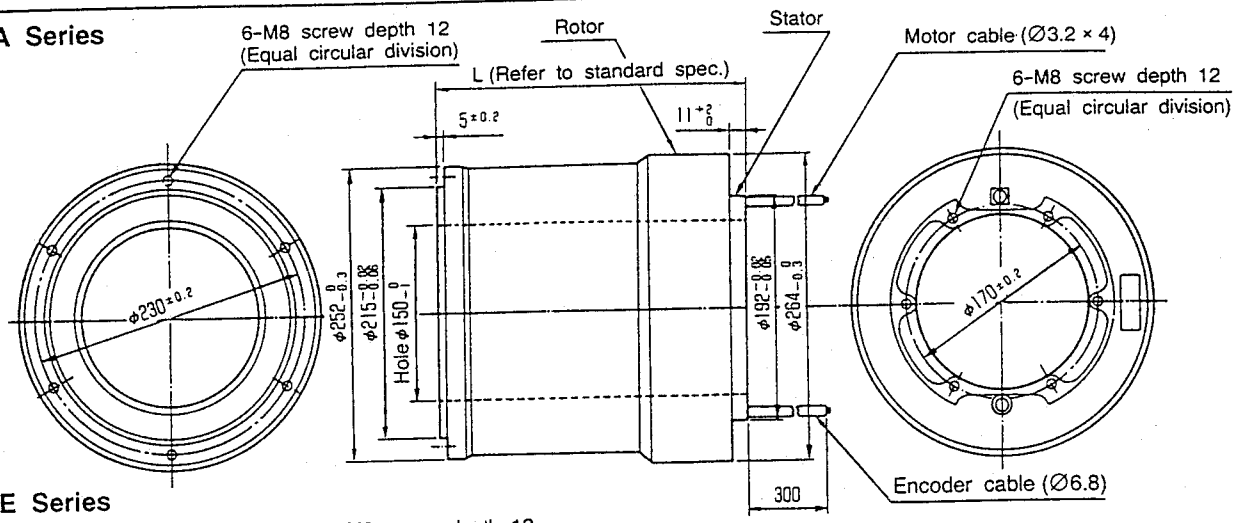


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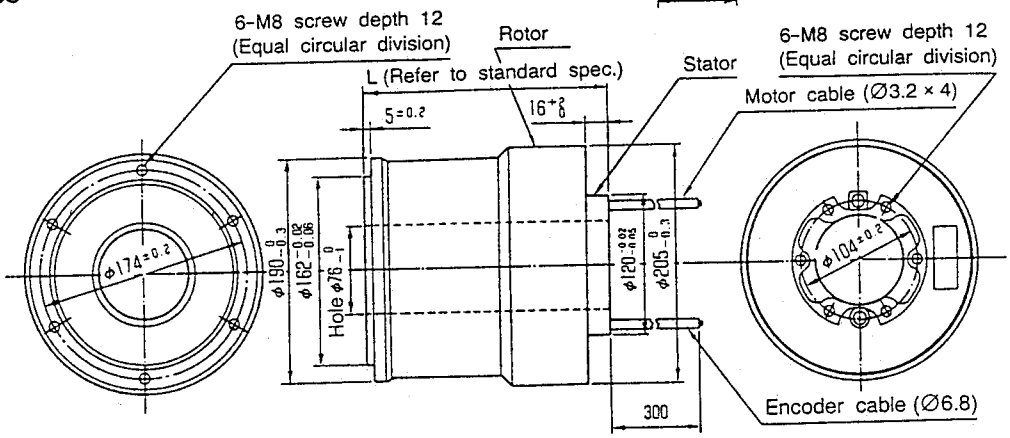
(2) Motor

Unit : mm

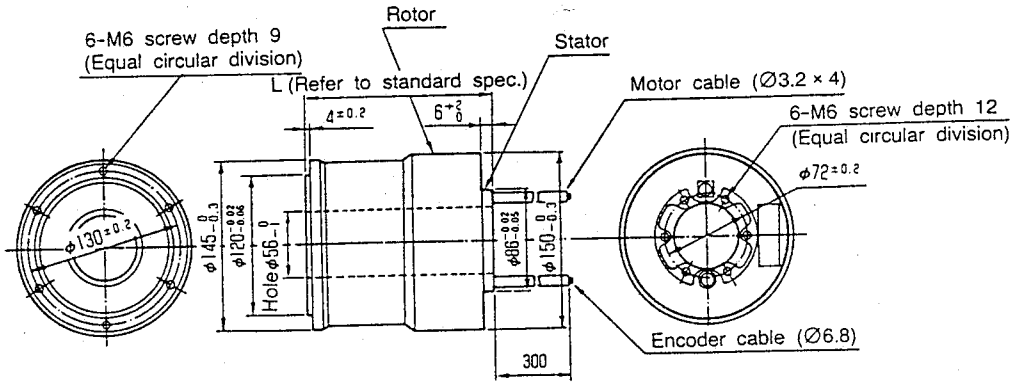
A Series



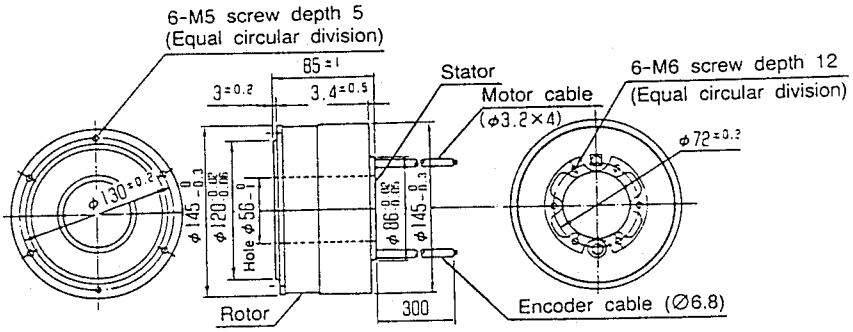
E Series



B Series

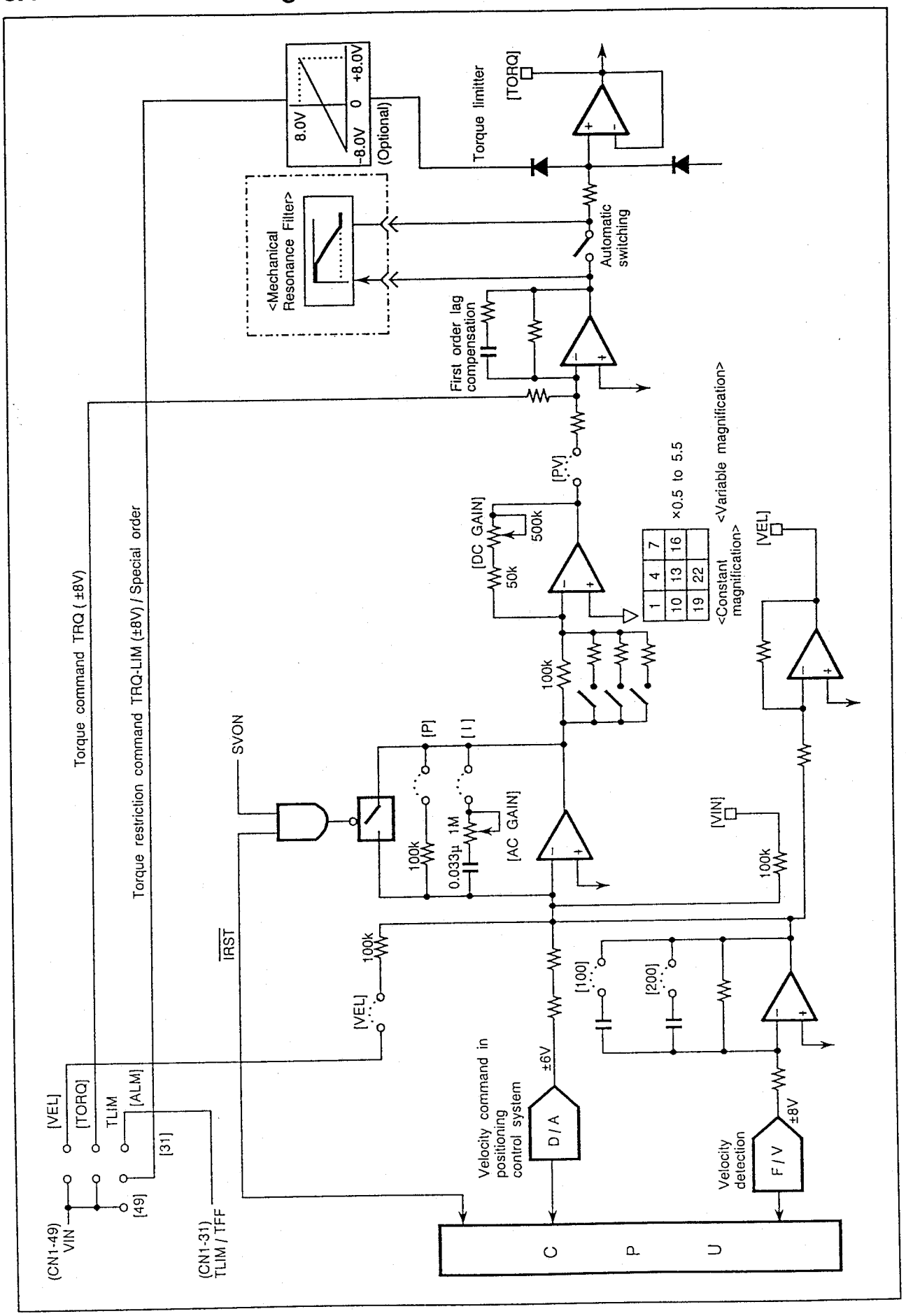


B Series (For the DR1008B only)



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8.4 Driver Block Diagram



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