M0005016F

SANMOTION

AC SERVO SYSTEMS

BL Super P Series

PY

PY0 TYPE A,H

Analogue / Pulse Input Type

For Rotary Motor

Instruction Manual

SANYO DENKI

Since this equipment does not come under strategic materials specified in the "Foreign Exchange and Foreign Trade Law", permission from the Ministry of Trade and Industry is not required prior to exporting it.
Customs, however, may request an explanation of non-conformance.
So please request the document explaining this matter.
When this product is combined with other equipment, refer to the other's conforming/non-conforming criteria.

PREFACE

This User's Manual covers the functions, wiring, installation, operation, maintenance and specifications of our AC Servo Amplifier "PY".
The 0AC Servo Amplifier "PY" is designed for a wide range of applications from small to medium capacity thanks to its multiple functions, high performance, small size and high cost performance.
Our AC Servomotor had been developed with the aim of realizing a multi-purpose, easy-to-use Servomotor series compatible with existing products.
Another aim was down-sizing in order to enable the motors to be easily handled and the entire machine to be miniaturized.
Our Servo Amplifiers, on the other hand, had been developed to satisfy the need for small control panels and a wide range of applications.
To completely utilize all functions of the PY series and operate them correctly, read this manual carefully.
After reading this manual, keep it handy so that it can be referred to by anyone at anytime.

⚠

In this manual,

"AC Servomotor" is sometimes abbreviated to "Servomotor" or "Motor".

"AC Servo Amplifiers" to "Servo Amps." or "Amps.".

"Wiring-saved incremental encoders" to "Incres." or "INC-E".

"Absolute Encoders" to "Absols." or "ABS-E".

In addition, "Encoders" refers to both "Wiring-saved incremental encoders" and "Absolute encoders", and "Sensors" to "Wiring-saved incremental encoders", "Absolute encoders" and "ABS-RⅡ".

This User's Manual is intended for PY with a wiring-saved incremental encoder, an absolute encoder (without request signals).

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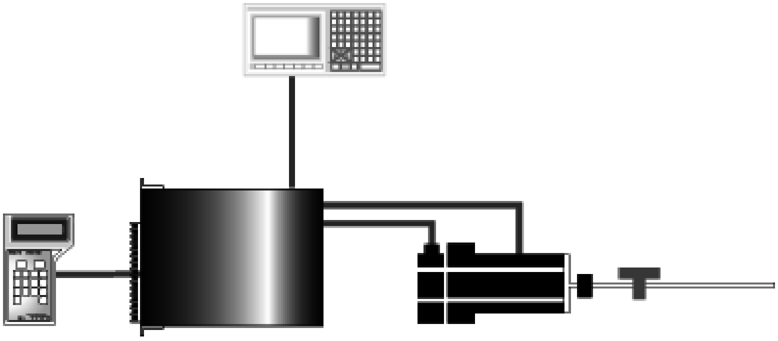
SAFETY PRECAUTIONS



0. SAFETY PRECAUTIONS

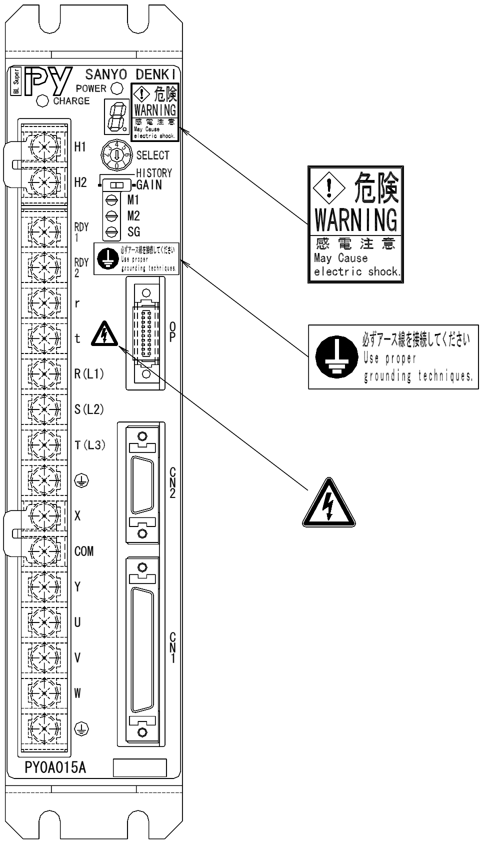
Since this chapter summarizes the precautions to be observed to operate the PY series in safety, be sure to read it before operation.

0.1 Introduction

- To ensure proper operation, thoroughly read the Instruction Manual before installation, wiring and operation.
- Do not modify the product.
- For installation or maintenance, consult our dealer or authorized agency.
- When using the product for the following purposes, special measures, such as system multiplication or emergency power generator installation, should be taken regarding operation, maintenance and management of the product. In this case, consult us.
  - (a) Use in medical equipment directly affecting people's lives.
  - (b) Use in equipment that may be lead to physical injury, for example, trains or elevators.
  - (c) Use in computers that are socially and publicly important.
  - (d) Use in other equipment related to physical safety or equipment that may affect the functions of public facilities.
- For use in an environment subject to vibration, for example, on-vehicle use, consult us.

0.2 "Warning Label" Location on Product

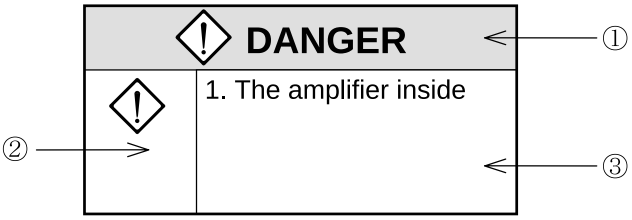
The warning label is on the front surface of the Servo Amplifier.



0.3 Meaning of Warning Indication

This chapter explains how warnings are indicated.
Please understand the details of indications before reading 0.4 Cautions on Safety.

0.3.1 Details of Indications: Section 0.4 describes as follows:



① : Rank of cautions on safety
② : Symbolic indication
③ : Meaning of each symbolic indication

0.3.2 Rank of Cautions on Safety

Cautions are divided into the following four ranks:

DANGER	Incorrect operation may result in such a dangerous situation as death or serious injury.
⚠ **CAUTION**	Incorrect operation may result in such a dangerous situation as medium or slight injury or may result in only physical damage. Note that some indications with ⚠ CAUTION may lead to serious results depending on situations. Since any indications are important, be sure to observe them.
⃠ **PROHIBITION**	What should not be done are indicated.
● **COMPULSION**	What should be done by all means are indicated.

0.3.3 Symbolic Indication

Symbolic indications are divided into the following eight kinds :

Kinds of symbols	Example of symbols		
Symbolic indications of danger	◇ DANGER, INJURY	◇ ELECTRIC SHOCK	
Symbolic indications calling attention	⚠ CAUTION	⚠ FIRE	⚠ BURN
Symbolic indications prohibiting actions	🛇 PROHIBITION	🛇 PROHIBITION OF DISASSEMBLING	
Symbolic indication urging actions	● COMPULSION		

0.4 Cautions on Safety

⚠ DANGER

<General>

⚠ 1. Don't operate the system in explosive environment, or you may be injured or fire may occur.

⚡ 2. Never touch any inside part of the amplifier, or you may be struck by electricity.

⚡ 3. Don't arrange wires nor conduct maintenance work and inspection under a hot-line condition.
Be sure to turn off the power more than 5 minutes in advance.
Otherwise, you may be struck by electricity.

⚡ 4. Ask experts in respective fields for transportation, installation, wiring, operation, maintenance and inspection.
Persons without expertise may receive electric shocks, be injured or fire may occur.

<Wiring>

⚡ 5. Be sure to ground the PE (protective earth) terminal of the amplifier. The grounding terminal of the motor must be connected to the PE (protective earth) terminal of the amplifier. Otherwise, an electric shock may occur.

⚡ 6. Don't damage cable, stress them abnormally, place heavy items on them nor get them caught between other parts or devices.
Otherwise, an electric shock may occur.

⚠ 7. Be sure to connect the power cable in accordance with the connection diagram or the User's Manual.
Otherwise, you may be struck by electricity, or fire may occur.

⚠ 8. Be sure to insert a UL-approved circuit breaker to the amplifier power supply input wiring to protect it and its peripherals.

<Operation>

⚠ 9. During operation, never touch the motor rotator, or you may be injured.

⚡ 10. While the power is supplied, never approach nor touch terminals, or you may be struck by electricity.

⚡ 11. While the power is supplied, never remove any terminal cover, or you may be struck by electricity.

0. SAFETY PRECAUTIONS

CAUTION

<General>

1. Before installation, operation, maintenance and inspection, be sure to read the User's Manual and follow instructions detailed in the manual.
   Otherwise, you may be struck by electricity or be injured, or fire may occur.

2. Don't use the amplifier and the motor in any situations where the specifications are not fully satisfied.
   Otherwise, you may be struck by electricity or injured, or they may be damaged.

3. Don't use the amplifier and the motor if they are damaged.
   Otherwise, you may be injured or fire may occur.

4. Use the amplifier and the motor only in the combination specified, or fire or a trouble may occur.

5. Note that the amplifier, the motor and their peripheral equipment are heated to high temperatures.
   Don't touch them, or you may be burnt.

<Unpacking>

6. Check which side is up before unpacking, or you may be injured.

7. Check if what you have received are as per your order.
   Installation of an incorrect product may result in injury to you or breakage of the product.

8. Don't apply static electricity to the motor encoder terminal, or the motor may get out of order.

CAUTION

<Wiring>

9. Don't measure insulation resistance and dielectric strength, or these units may be damaged.
   When you have to measure them, please contact us.
10. Arrange cables in accordance with the Technical Standard for Electric Facilities and the Extension Rules.
    Otherwise, cables may be burnt and fire may occur.
11. Arrange cables correctly and securely, or the motor may run away and you may be injured.
12. Don't apply static electricity or high voltage to the motor sensor terminal, or the motor may get out of order.

<Installation>

13. Don't climb up these units nor place heavy substance on them, or you may be injured.
14. Don't stop the air inlets and outlets nor put foreign matters in them, or fire may occur.
15. Be sure to observe the direction of installation, or a trouble will occur.
16. Decide the distances between the amplifier, the inside surface of the control panel and other equipment in accordance with the User's Manual.
    Otherwise, troubles may occur.
17. Don't shock these units badly, or they may get out of order.
18. During installation, take an extreme care not to drop nor overturn these units, or you may face serious dangers.
    When raising the motor, use the lifting bolt if it is fitted.
19. Never install these units where they are exposed to splash of water, in corrosive or inflammable gas atmosphere or near combustibles.
    Otherwise, fire may occur or they may get out of order.
20. Install them to any of nonflammables like metal, or fire may occur.

⚠ CAUTION

<Operation>

⚠ 21. This motor is not equipped with any protective device.
So, protect it with an overcurrent device, an earth leakage breaker, a thermal cutout or an emergency stop device.
Otherwise, you may be injured or fire may occur.

⚠ 22. During the power is supplied or for a while after the power is turned off, don't touch the amplifier radiator, the regenerative resistor and the motor because they are or have been heated to high temperatures.
Otherwise, you may be burnt.

⚠ 23. When any trouble has occurred, stop operating the system immediately, or you may be struck by electricity or injured, or fire may occur.

⚠ 24. An extreme adjustment change will make the system operate unstably. Never make such a change, or you may be injured.

⚠ 25. To check operation of the system in a trial run, fix the motor and separate from the mechanical system. After the trial run, mount it on the system. After the trial run, mount it on the system. Otherwise, you may be injured.

⚠ 26 The holding brake is not a stopping device to operate the system safely.
So, install a stopping device to the system for the purpose, or you may be injured.

⚠ 27. When an alarm occurs, remove the cause and check that the system is in safety.
Then, reset the alarm and resume the operation.
Otherwise, you may be injured.

⚠ 28. When the power is restored after momentary interruption, don't approach the system because it may suddenly start again.
(Design the system so that the operator can remain safe even if it may start again.)
Otherwise, you may be injured.

⚠ 29. Check that the power supply specification is normal.

⚠ CAUTION

<Maintenance>

30. Since the amplifier frame is heated to high temperature, beware of it at the time of maintenance and inspection, or you may be burnt.

31. Since the electrolytic capacitor inside the amplifier is recommended to be replaced with a new one every five years for preventive maintenance providing that the yearly ambient temperature is 104°F. The expected life of the cooling fan motor is 10 years at the yearly ambient temperature of 104°F. Regular replacement is recommended.

32. In case of repair, please contact us.
    If these units are disassembled by yourself, they may malfunction.

<Transportation>

33. During transportation, take an extreme care not to drop nor overturn these units, or you may face serious dangers.

34. During transportation, don't catch cables and the motor shaft, or these unit may get out of order or you may be injured.

<Disposal>

35. Dispose of the amplifier and the motor as general industrial wastes.

36. Dispose of used lithium battery following each municipality’s instructions. Be sure to cover the terminals (+ -) with adhesive insulation tape. If the electric capacity remains and touch the other metals, heating, explosion, and ignition may occur.

PROHIBITION

<Storage>

1. Don't store these units where they are exposed to water, rain drops, hazardous gas or liquid.
   Otherwise, they will get out of order.

<Operation>

2. The built-in brake of the motor is for holding and should not be used for braking in general.
   If used for braking, the brake will be broken.

<Maintenance>

3. Don't overhaul the system, or fire will occur and you will be struck by electricity.

<General>

4. Do not remove the nameplate.

MANDATORY

<Storage>

1. Store these units where they are not exposed to direct sunlight and in the specified ranges of temperature and humidity {–4°F to +149°F, below 90%RH (without dew condensation)}.
2. When the amplifier was stored for a long period (over 3 years as a guide), please contact us for how to treat it.
   When it is stored for a long time, the electrolytic capacitor capacity will decrease and any trouble may occur.

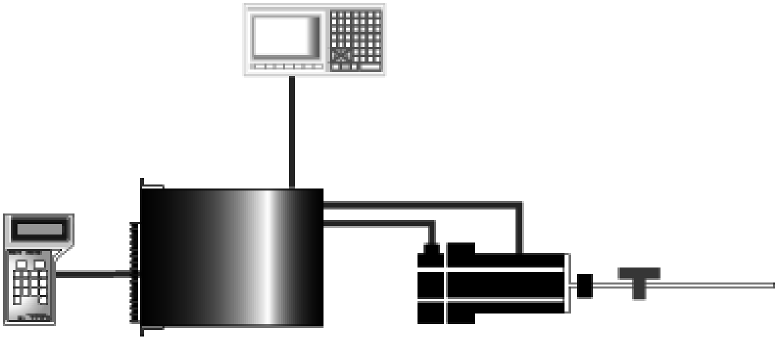
<Operation>

3. Install an emergency stop circuit outside the system so that operation can be stopped immediately and that the power supply can be shut off.
4. Operate the system in the specified ranges of temperature and humidity {Temperature : 32°F to 131°F for the amp. and 32°F to 104°F for the motor. Humidity : Below 90%RH (without dew condensation) for both.}

<Transportation>

5. Overloaded products will collapse.
   So, load them in accordance with the indication on the outer cases.
6. Use the lifting bolts on motors for carrying motors only and don't use them for carrying machines.

BEFORE OPERATION



1. BEFORE OPERATION

● ●

⚠ Please operate this system taking the contents of the following description into consideration. A miss operation will lead to an unexpected accident or damage.

● ●

1.1 Precaution on Purchasing

When unpacking this product after purchasing, care is needed to the following.

- When unpacking the Servo Amplifier, don't touch its printed circuit boards in any case.

1.2 Confirmation of the Product

Check the following after receiving the product. Contact us if any abnormality is detected.

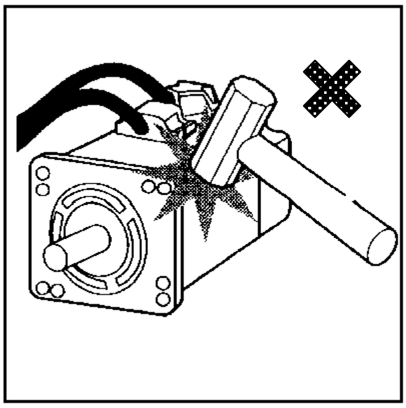
- Check if the model numbers of the Servomotor and the Servo Amplifier match those of the ordered ones (the numbers are described after "MODEL" on the main nameplate).
- Check the appearance of the Servomotor and the Servo Amplifier to confirm that they are free from any abnormality such as breakage or lack of parts.
- Check that all screws on the Servomotor and the Servo Amplifier are tightened properly.

1.3 Precautions on Operation

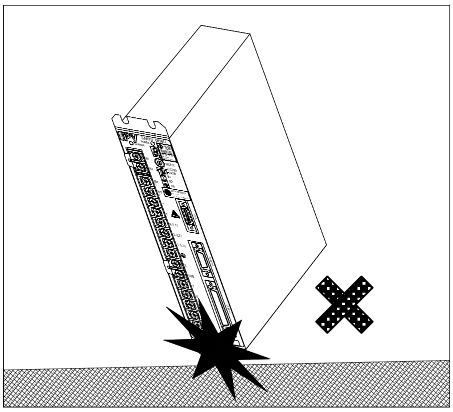
Take care the following during operation.

- At installation, don't give shocks to the Servomotor and the Servo Amplifier, or they may break. In particular, handle the Servomotor carefully since it is provided with an encoder.

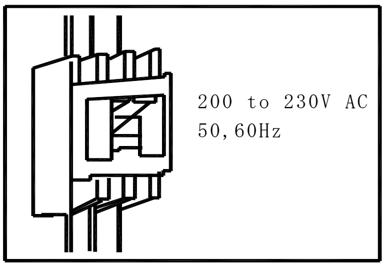
NO!



NO!

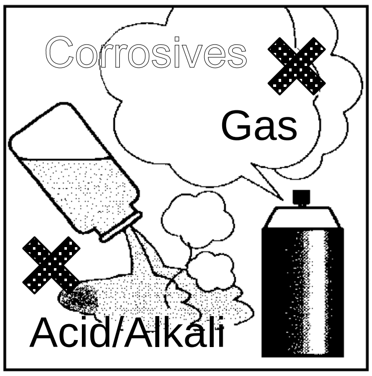


- Be sure to use 200V AC to 230V AC (+10%, −15%) 50/60Hz as a power supply. Otherwise an accident may result.

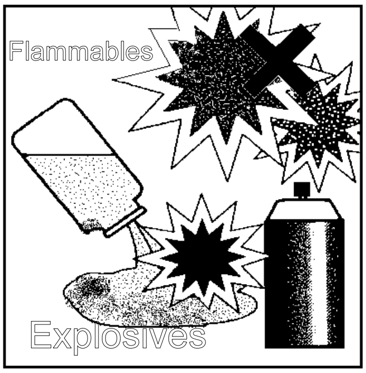


- When a surge voltage is produced in the power supply, connect a surge absorber or others between the powers to absorb the voltage before operation. Otherwise malfunction or breakage may result.
- Turn the power on and off during maintenance and inspection after safety (such as the situation of the load) is completely checked. If the power is turned on or off during the load is applied, an accident or breakage may result.
- Never use this product where corrosive (acid, alkali, etc.) liquid or gas exists to prevent it from deforming or breaking.
- Never use this product where flammable or explosive liquid or gas exists since the liquid or the gas may be ignited, causing great danger.

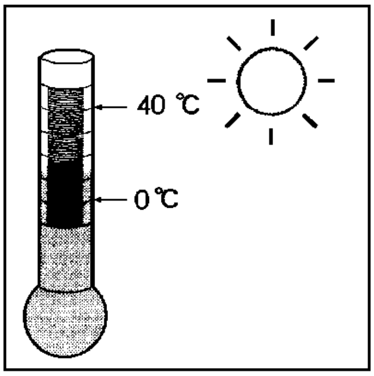
NO!

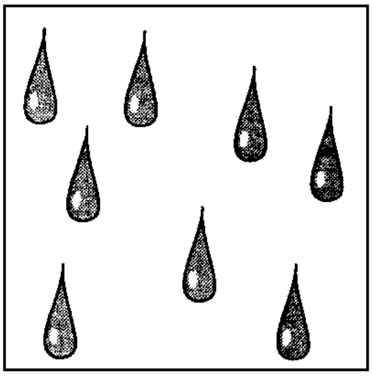


NO!



- Use this product within the ambient temperature range from 32°F to 104°F (32°F to 131°F for the Servo Amplifier) and below the relative humidity limit of 90%.
- The Servomotor and the Servo Amplifier should be kept away from water, cutting fluid or rainwater. Otherwise electric leakage or and electric shock may result.

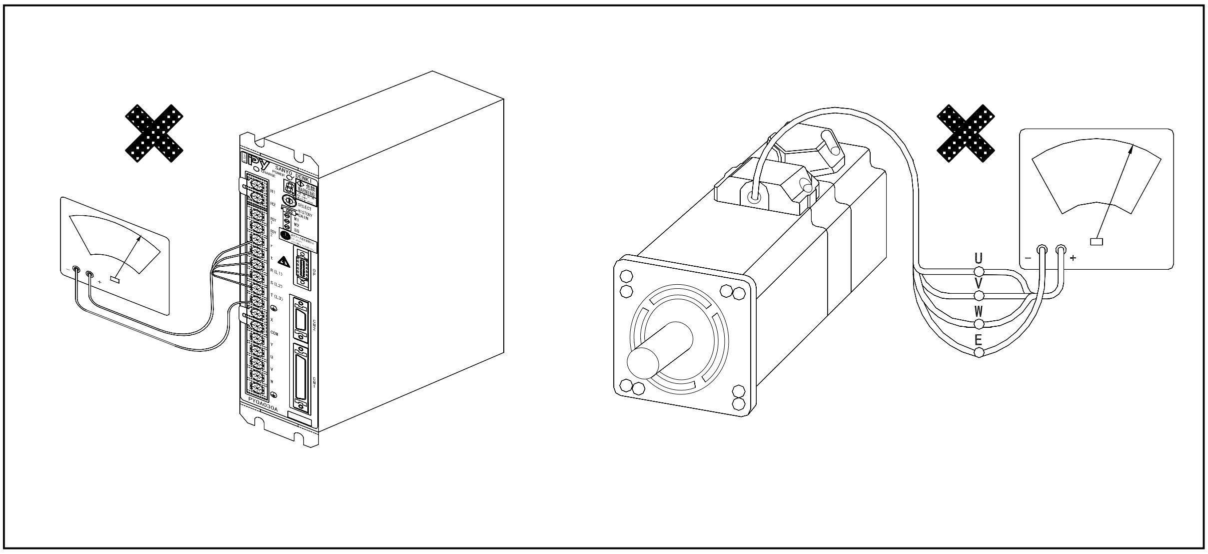




1. BEFORE OPERATION

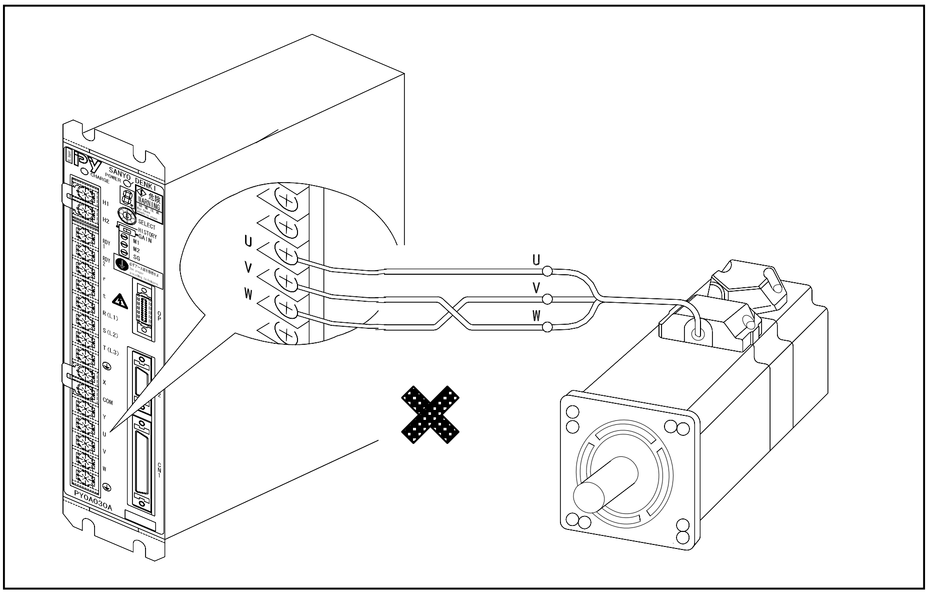
- For safety operation, check that the Servomotor and the Servo Amplifier are earthed by at least a class 3 (less than 100Ω) earth cable.
- Never perform a withstand voltage or an insulation resistant test of the Servomotor or the Servo Amplifier. In this product, 0V and the main body is earthed by the capacitor. If such test is necessary, consult with us.

NO! NO!



- Perform correct wiring by referring to Chapter 4, Wiring. Wrong wiring may cause Servomotor's or amplifier's breakage.
- Since the "P" series Servomotor is not an induction motor, the direction of revolution cannot be changed by swapping the phases. To change the direction, use the remote operator.

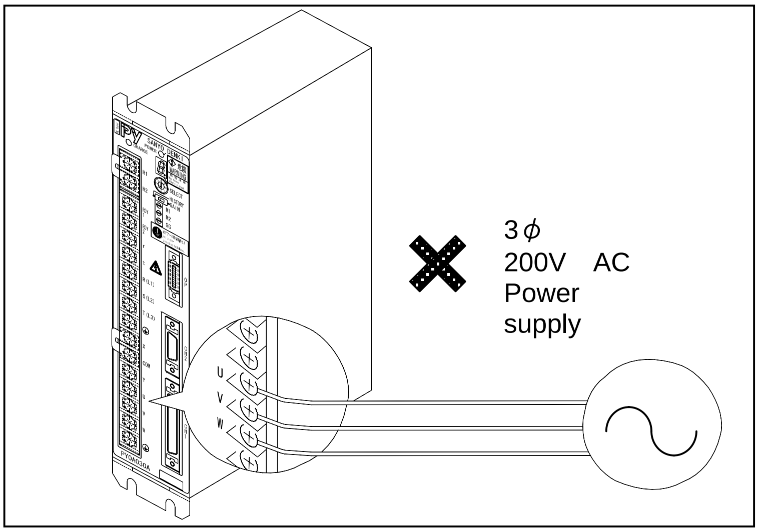
NO!



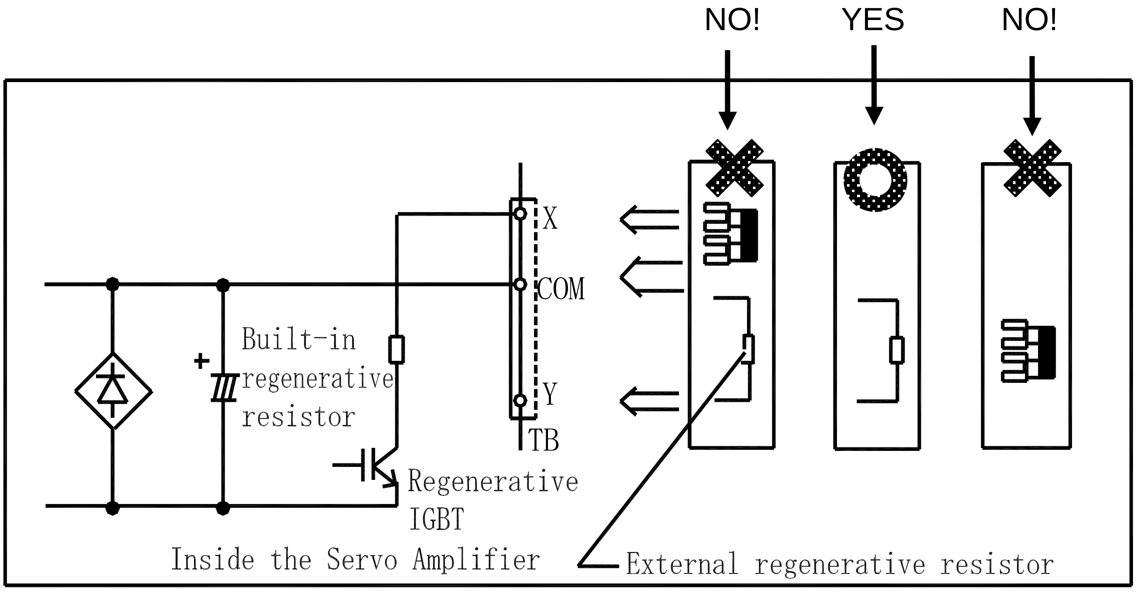
For safety operation, be sure to install a surge absorber on the relay, electromagnetic contactor, induction motor and brake solenoid coils.

- Connect a 200V-class power supply to the Servo Amplifier R, S and T terminals. When any different power supply is used, install a transformer. If a commercial power supply is applied to the U, V or W terminal, the amplifier will break.

NO!



- Do not connect an external regenerative resistor between COM and Y while X on the terminal board is short-circuited to COM, or the amplifier may break.
  In addition, do not short-circuit COM to Y to prevent the amplifier from breakage.
  (A tag sheet warning the above is attached on the amplifier.)
  If an external regenerative resister is connected between COM and Y while X is short-circuited to COM as shown below, the current in the regenerative IGBT becomes double at the time of regeneration, resulting in IGBT breakage.
  Furthermore, if COM is short-circuited to Y, overcurrent will occur in the IGBT, also resulting in IGBT breakage.



1.4 How to read model numbers

1.4.1 Model Number of Servo Amplifier

PY0 ☆ ○○○ × ▲ □□ △ ▽ □□

1. Indicates PY series

2. Type of power unit
   - A…For 200V AC, with dynamic brake
   - B…For 200V AC, without dynamic brake

3. Amplifier capacity

015… 15A	030… 30A	050… 50A
100…100A	150…150A	300... 300A

4. Hardware type of control unit
   - A…Wiring-saved incremental encoder (INC-E) or request signal-unavailable absolute encoder (ABS-E)
   - H...Request signal-available absolute sensor (ABS-RII)
   - T...Full close type

5. Number of input power phases
   - 0 : 3-phase 1 : Single-phase

6. Applicable motor (For details, refer to the standard combination table on the next page.)
   - Example M1…P50B03003D□S□□ PA…P60B13050H□S□□

7. Type of sensor
   - 1…Wiring-saved incremental encoder (2000P/R)
   - 2...Wiring-saved incremental encoder (6000P/R)
   - 3…Request signal-unavailable absolute encoder (ABS-E, 2048P/R)
   - 6…Request signal-available absolute sensor (ABS-RⅡ, 8192 P/R)
   - D…Request signal-available absolute sensor (ABS-RⅡ, 32768 P/R)

8. Interface specification
   - S…Speed control type. T…Torque control type. P…Position control type
   - X...Speed-torque switch type Y...Position-torque switch type U...Speed-position switch type
   - V...Internal speed control type

9. Discrete specification
   - 00…Standard product

Revision is indicated by an alphabet at the end of Ser No. on the nameplate

The following standard models are available for customers who wish to set up parameter on their PC interfaces.

PYOAO15AO, PYOAO3OAO, PYOAO5OAO, PYOA1OOAO, PYOA15OAO
(All is set up as Speed control type and wiring-saved incremental encoder(2000P/R).

1.4.2 Model Number of Servo Motor

○○○ B ○○ ○○○ △ □ ◇ ▽▽ ☆ ★

Ex. P50 B 08 100 D X S 00

1. Indicates P series

P10…P1 motor P20…P2 motor
P30…P3 motor P50…P5 motor
P60…P6 motor P80…P8 motor

2. Indicates BL motor

Indicates flange square size

03…35 mm 04…40 or 42 mm 05…54 mm
06…60 mm 07…76 mm 08…80 or 86 mm
10…100 mm 13…130 mm 15…150 mm
18…180 mm 22…220 mm

3. Indicates rated output

○○○×10 = rated output (W) ; (for ○○K, ○○×10^3= rated output (W)

4. Maximum revolution speed

S…1000 min^{-1} M…1500 min^{-1} D…4500 min^{-1}
R…2500 min^{-1} H…3000 min^{-1} B…2000 min^{-1}

5. Equipping of holding brake

X…Not equipped B…Equipped（90V） C…Equipped (24V)

6. Type of Detector

S…Wiring-saved incremental encoder
J…Absolute encoder with flange square of 60mm or less ; Request signal-unavailable type(ABS-E)
A…Absolute encoder with flange square of 76mm or more ; Request signal-unavailable type(ABS-E)
N…Absolute sensor ; Super-capacitor-unavailable, request signal-available type(ABS-RⅡ)
V…Absolute sensor ; Super-capacitor-built-in, request signal-available type(ABS-RⅡ)

7. Specification Identification

00…Standard motor

8. Standard Identification

E : CE, U : UL, M : CE & UL, No indication：No applicable standard

9. Gear Specification

Planet gear：A..1/3, B..1/5, C..1/9, D..1/15, E..1/25
Flat gear ：J..1/5, K..1/10, L..1/15
Backlash less planet gear：1/5..S, 1/11..T, 1/21..U, 1/33..V
No indication：No gear

Revision is indicated by an alphabet at the end of Ser No. on the nameplate.

1.5 PY Series Standard Combination Table

Check the model numbers of the motor and the amplifier on the standard combination table below.
If the combination is different, the system will not function properly

Table1-1 PY Series Standard Combination Table

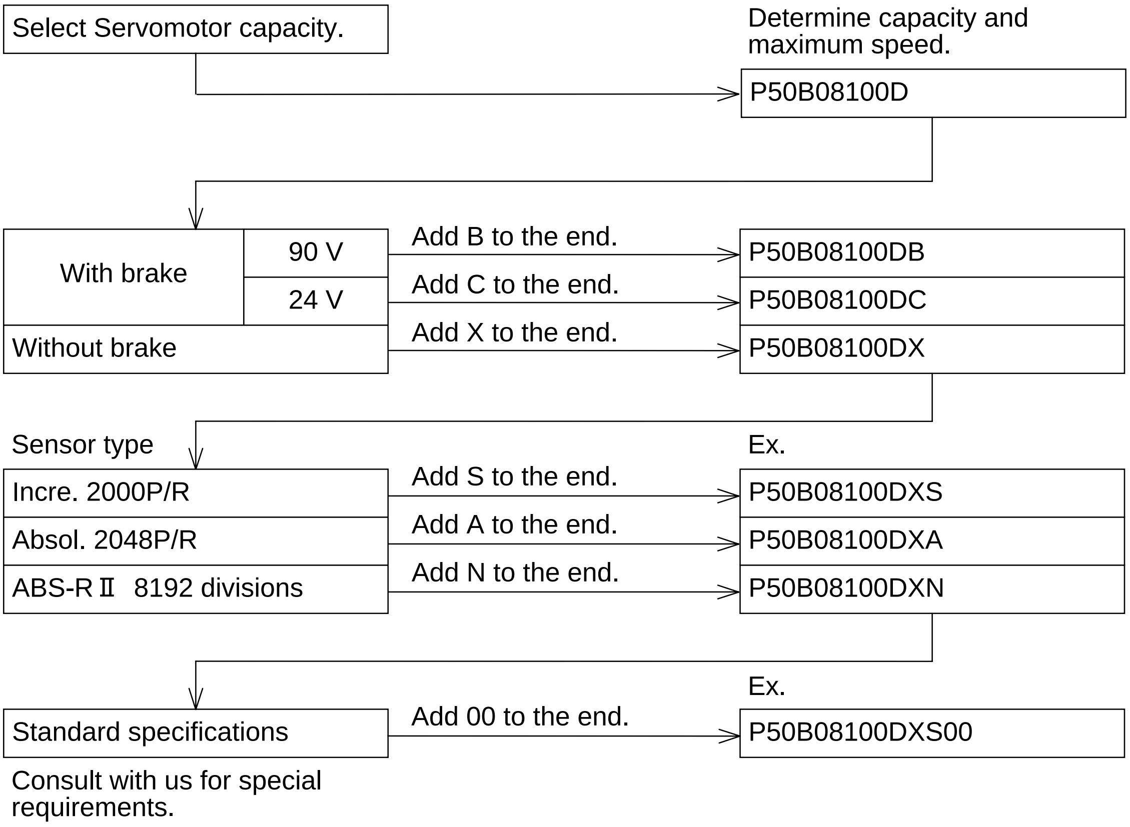
Servomotor P☆B○○○○○○○□◇▽▽		Servo Amplifier PY0A○○○A△△□◇▽▽	
	Flange square rated output maximum speed	Amplifier capacity	Type of motor
10	10030H	015	11
	10075H	030	12
	13050H	030	13
	13100H	050	14
	13150H	050	15
	18200H	100	16
	18350H	150	17
	18450R	150	18
	18550M	150	19
	13050B	030	1A
	13100B	030	1B
	13150B	050	1C
	18200B	050	1D
	18350B	100	1E
	18450B	100	1F
20	10100D	050	21
	10150D	050	22
	10200D	100	23
	10250D	100	24
	13300D	100	25
	13400D	150	26
	13500D	150	27
	10100H	030	28
	10150H	050	29
	10200H	050	2A
	10250H	100	2B
	13300H	100	2C
	13400H	100	2D
	13500H	150	2E
30	04003D	015	N1
	04005D	015	N2
	04010D	015	N3
	06020D	015	N4
	06040D	030	N5
	08075D	030	N6

Servomotor P☆B○○○○○○○□◇▽▽		Servo Amplifier PY0A○○○A○△△□◇▽▽	
	Flange square rated output maximum speed	Amplifier capacity	Type of motor
50	03003D	015	M1
	04006D	015	M2
	04010D	015	M3
	05005D	015	M4
	05010D	015	M5
	05020D	015	M6
	07020D	015	M8
	07030D	015	M9
	07040D	030	MA
	08040D	030	MB
	08050D	030	MC
	08075D	050	MD
	08100D	050	ME
	08075H	030	MF
	08100H	030	MG
60	13050H	030	PA
	13100H	050	P1
	13150H	050	P2
	13200H	100	P3
	15300H	150	P4
	18200H	100	P5
	18350H	150	P6
	18450H	150	P7
	18550R	150	PR
	18750R	300	PW
	22550M	150	P8
	22700S	150	P9
	2211KB	300	PG
	2215KB	300	PX
80	15075H	030	R2
	18120H	050	R3
	22250H	100	R4
	22350R	100	R9
	22350H	150	R5
	22450R	150	R6

(Note) For example, P10B10030H□◇▽▽ is to be combined with PY0A015A11□◇▽▽.

1.6 Flowchart for Determining Servomotor Model Number

Refer to the following flowchart to determine the Servomotor model number.



1.7 Servo Amplifier Accessories

The following parts are packed as accessories together with the Servo Amplifier.

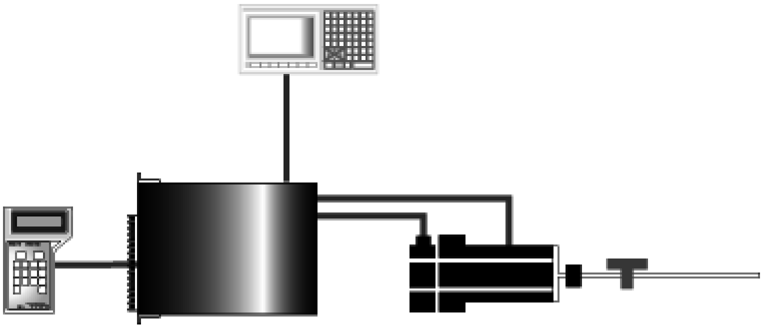
Although the Servomotor has no accessory, an optional connector is available for some motors.

Table 1-2 Servo Amplifier Accessories List

Part name	Model	Maker name	Q'ty	Use
Connector	10150-3000VE 10350-52A0-008	Sumitomo 3M Ltd.	1	Input/output signal connector (CN1)
Connector	10120-3000VE 10320-52A0-008	Sumitomo 3M Ltd.	1	Sensor signal connector (CN2)

2

FUNCTION & CHARACTERISTICS



2. FUNCTION & CHARACTERISTICS

2.1 “PYO” Servo Amplifier Built-in Function

This section describes the main built-in functions of the Servo Amplifier and additional functions specially for the PY series.

The functions with the indication **OP** require the remote operator.

- **Position, speed and torque control** **OP**

  The above three types are controlled as a package and can be selected using the remote operator. The control type can be changed during operation (velocity ↔ torque, position ↔ torque, position ↔ velocity).

- **Regenerative processing function**

  A regenerative processing circuit and a regenerative resistor are built in the system. When the resistor cannot perform all processing, however, another external regenerative resistor is required.

- **Dynamic brake function**

  When the main circuit power supply is cut off, the dynamic brake is actuated. However, this brake is operated regardless of the main circuit power supply when an alarm occurs.

- **Holding brake excitation timing output**

  The power supply to the holding brake is controlled with the timing of this output signal, thereby preventing a self-weight fall of the gravitational shaft at an emergency stop. Keep this output open when the system is not operated.

- **Vibration restraining function** **OP**

  If a vibration occurs when this function is incorporated in the system, the parameters "BEF" and "LPF" are set by the remote operator according to the vibration frequency, restraining the vibration. Measure the oscillation frequency with an oscilloscope on the current command monitor.

- **Separation of control power and main circuit power**

  The control power and the main circuit power are separated. When an alarm or an emergency stop occurs, the main circuit power alone can be cut off for safety, and the control power can remain activated. This enables the continuation of alarm output, making analysis and maintenance easy.

- **Servo tuning support function** **OP**

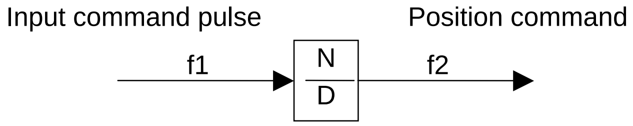
  When the remote operator sets a mode, the load inertia is automatically estimated and a proper parameter is set (see page 7-17).

  When more adequate tuning is required, make the remote operator set a parameter directly referring to the tuning value.

- ## Electric gear function **OP**

For position control type, the feed can be changed without changing the mechanical gear by using this electronic gear.

This gear is set by the remote operator (see page 7-35).



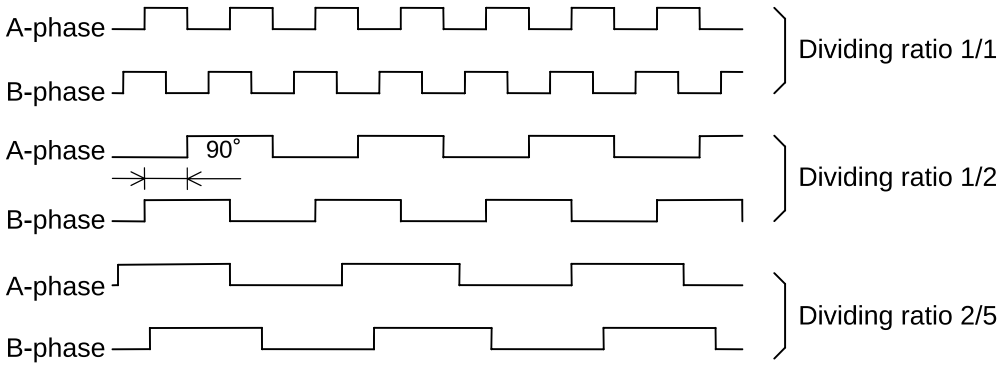
$$f2 = f1 \times \boxed{\frac{N}{D}}$$

When N = 1 to 32767 and
D = 1 to 32767

$$\frac{1}{32767} \leqq \frac{N}{D} \leqq 32767$$

- ## Dividing output function **OP**

Encoder signal pulses can be output by being divided into N/8192 (N=1 to 8191), 1/N (N=1 to 64) or 2/N (N=3 to 64) based on the setting by the remote operator.
Although the phase relation does not change, the 2/5 division is not the 90° phase difference.
To set the encoder signal dividing ratio, refer to the explanation on the parameters (see page 7-36).
The dividing ratio must be a value with which the encoder pulse number can be divided.
For a 2000 pulses/rev encoder, for example, 1/3, 1/6 or 1/7 cannot be used since they are aliquant.
Some typical divided encoder output waveforms are described below.



Typical encoder signal output waveforms (forward

- ## Alarm trace function **OP**

The past 7 alarm history data can be stored and reviewed from the remote operator or the front panel SELECT (see page 7-14), enabling easy troubleshooting.

- ## Applicable to wiring-saved incremental & absolute encoders **OP**

A single amplifier is applicable to both of the above encoders by only changing parameters using the remote operator (see page 7-57).
For motors, however, there are different types of those with an incremental encoder and with an absolute encoder

- **Applicable to an absolute sensor (ABS-RⅡ)**

Applicable to an absolute sensor (ABS-RⅡ).

> Internal circuits of the Servo Amplifier applicable to an absolute sensor (ABS-RⅡ) differ among incremental (INC-E) and absolute (ABS-E) encoder-type amplifiers.
>
> For the above application, a product applicable to an absolute sensor (ABS-RⅡ) is required to be used.

- **Additional function specially for the PY series (Compared to PZ Amplifiers)**

In addition to the various control functions provided in the PZ series, the following functions have been added to the PY series.

1. Control mode switching function **OP**
   - This function is for switching the control mode without power shutdown (see 9-3).
2. Internal velocity command function
   - The amplifier has three types of velocity commands, and this function is for switching the velocity command depending on the situation (see 9-36).
3. Function to correspond with the external encoder for full-close control **OP**
   - By providing an external incremental encoder process circuit in the amplifier, full-close control is enabled. (For full-close correspondence, as additional parts are required. see 9-151)
4. Gain switching using a rotary switch **OP**
   - By using a rotary switch, gain setting is enabled without connecting to a remote operator (see 7-33, 8-23).
5. Gain switching function **OP**
   - Two types of gain settings can be selected in the amplifier. Gain switching is enabled depending on the situation (see 7-33, 8-23).
6. Upgrading of the personal computer interface functions **OP**
   - Following upgrading of the personal computer interface functions, graphic indication of the monitor data and execution of various test modes have been enabled as well as parameter setting and editing using a PC. (see Chapter 11)
7. Input command auto offset function **OP**
   - Offset adjustment can be easily performed with the analog input command auto offset function while in the velocity or torque control mode (see 7-22).

2.2 Characteristics of PY Series

This section describes characteristics of the PY series.

2.2.1 Characteristics of Servomotor

- Down-sizing … 40 to 80% smaller design compared with the conventional models.
- Wide range of models … P1 series: from 0.3 to 5.5 kW
  P2 series: from 1 to 5 kW
  P3 series: from 30 to 750 W
  P5 series: from 30 W to 1 kW
  P6 series: from 0.5 to 15 kW
  P8 series: from 0.75 to 4.5 kW
- High-speed motor … Maximum speed of 4500 min^{-1} for P2, P3 and P5 series/3000 min^{-1} for P1, P6 and P8 series enable shortened positioning time.
  (For P1, P6/P8 series motor with output of 4.5 kW or above, however, maximum speed is little lower.)
- Compatibility … Compatible with the conventional models.
- Adoption of wiring-saved encoder … Like BL867Z, CS (commutation sensor) wiring is not required.

Table 2-1 Comparison of PY Servomotor (for reference)

		P1 series (high rigidity)	P2 series (low inertia)	P3 series (low inertia)	P5 series (high rigidity)	P6 series (high rigidity)	P8 series (flat type)
1	Features	> High servo performance > Compatible with "861" motor > High inertia > Series expanded > Flange size ☐100 added > Down-sizing 80% smaller than our conventional models	> Low inertia > High power rate > Successor to "862" series > Upper capacity model of P3 series > Down-sizing 40% smaller than our conventional models	> Low inertia > High power rate > Down-sizing 50% smaller than our conventional models	> Medium inertia, high rigidity > Compatible with "865Z" motor > Flange size ☐35 and ☐42 added > Down-sizing 70% smaller than our conventional models	> Medium inertia, high rigidity > Upper capacity model of P5 series > Compatible with “861” motor > Supplements P8 series > Down-sizing 50% smaller than our conventional models	> Medium inertia, super flat type > Compatible with "868Z" motor > Down-sizing 70% smaller and 60% flatter than our conventional models
2	Rated output	0.3 to 5.5 kW	1 to 5 kW	30 to 750 W	30 to 1000 W	0.5 to 15 kW	0.75 to 4.5 kW
3	Sensor	> Incremental. > Absolute ABS-E	> Incremental. > Absolute ABS-E ABS-RⅡ	> Incremental. > Absolute ABS-RⅡ	> Incremental. > Absolute ABS-E ABS-RⅡ	> Incremental. > Absolute ABS-E ABS-RⅡ	> Incremental. > Absolute ABS-E ABS-RⅡ
4	Waterproof	> IP67	> IP67	> IP40 (IP55 option)	> IP55 (☐55 to ☐86) IP55 (☐35 to ☐42) (IP55 option)	> IP67	> IP67
5	Holding brake	> Standard specifications (24V, 90V)	> Standard specifications (24V, 90V)	> Standard specifications (24V, 90V)	> Standard specifications (24V, 90V)	> Standard specifications (24V, 90V)	> Standard specifications (24V, 90V)
6	Oil seal	> Standard specifications	> Standard specifications	> Optional	> Standard specifications (☐54 to ☐86) > Optional (☐35 to ☐42)	> Standard specifications	> Standard specifications
7	Measures for CE	> TÜV obtained	> TÜV obtained	> TÜV obtained	> TÜV obtained	> TÜV obtained	> TÜV obtained

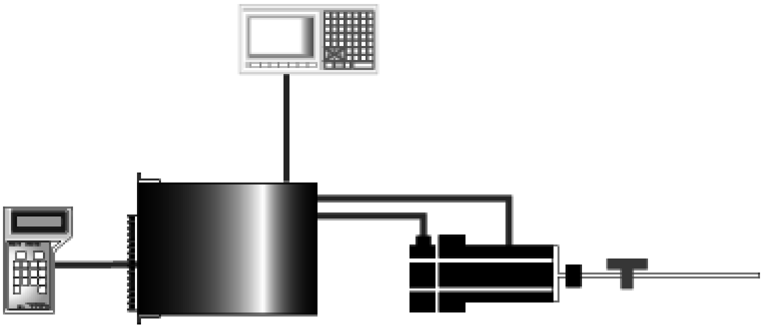
2.2.2 Characteristics of Servo Amplifier

- Compatibility … The amplifiers corresponding to the motors from 30 W to 7 kW is compatible with the conventional model「PZ」. However, 50A Type is corresponding to only「PZ1A050」
- Overseas Standard Compliance … Complies with TÜV and UL standard.
- High responsibility … Higher responsibility is provided, compared with the conventional model「PZ」.
- Multi-function … Functions such as remote operator are provided.
- High reliability and long life … Efficient circuit technology is developed from various manufacturing experience of the conventional models.

Table 2-2 Comparison of PY Series and Sanyo's Other Series (for reference)

	PY amplifier	PZ amplifier	PU amplifier	PR amplifier	PV amplifier
Input power	200V AC Single phase 3 phases	200V AC 3 phases	100V AC 200V AC Single phase	200V AC Single phase	200V AC Single phase
Features	> Multi function > High response, high performance	> Multi function > High response, high performance	> Small & compact > Easy connection due to adopting connector method > High cost performance	> Data transmission servo (Direct input of velocity, acceleration and feed data. Easy operation using PC or CPU.) > High cost performance > Down-sizing > Easy system design	> Wide range of interface • Position, velocity and torque command • Serial command (RS-485) • Contact input operation command • Small & compact > Easy connection due to adopting connector method
Motor combined	P1 series 0.3 to 5.5 kW P2 series 1 to 5 kW P3 series 30 to 750 W P5 series 30 to 1000 W P6 series 0.5 to 15 kW P8 series 0.75 to 4.5 kW	P1 series 0.3 to 5.5 kW P2 series 1 to 5 kW P3 series 30 to 750 W P5 series 30 to 1000 W P6 series 0.5 to 15 kW P8 series 0.75 to 4.5 kW	P3 series 30 to 750 W P5 series 30 to 1000 W	P3 series 30 to 750 W P5 series 30 to 1000 W	P3 series 30 to 750 W P5 series 30 to 1000 W
Sensor	Wiring-saved incremental ABS-RⅡ ABS-E	Wiring-saved incremental ABS-RⅡ ABS-E	Wiring-saved incremental ABS-RⅡ	Wiring-saved incremental	Wiring-saved incremental ABS-RⅡ ABS-E
I/F	Pulse train input or analog input	Pulse train input or analog input	Pulse train input or analog input	Centronics-based 8-bit parallel data input	Serial command (RS-485), pulse train input or analog input
Built-in functions	> Regenerative processing > Auto tuning > Electronic gear > Remote operator > Vibration restraining function > Dynamic brake > Holding brake excitation timing output > Rush prevention > Discharge circuit > Control mode switching > Internal velocity command > Gain change-over using a rotary switch > Gain change-over function > Personal computer interface functions	> Regenerative processing > Auto tuning > Electronic gear > Remote operator > Vibration restraining function > Dynamic brake > Holding brake excitation timing output > Rush prevention > Discharge circuit	> Regenerative processing > Auto tuning > Electronic gear > Remote operator	> Built-in pattern generator > Rush prevention > Discharge circuit	> Regenerative processing > Vibration restraining function > Dynamic brake > Rush prevention
Measures for overseas standards	TÜV recognition obtained UL recognition obtained	TÜV recognition obtained (PE type)			

SERVO SYSTEM CONFIGURATION



3. SERVO SYSTEM CONFIGURATION

3.1 Block Diagram

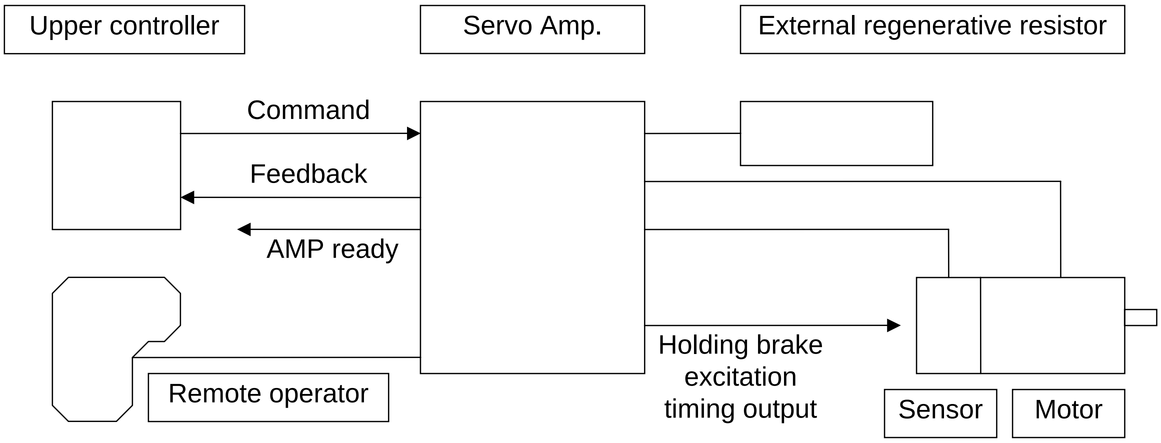


Fig. 3-1 System Configuration Schematic Diagram

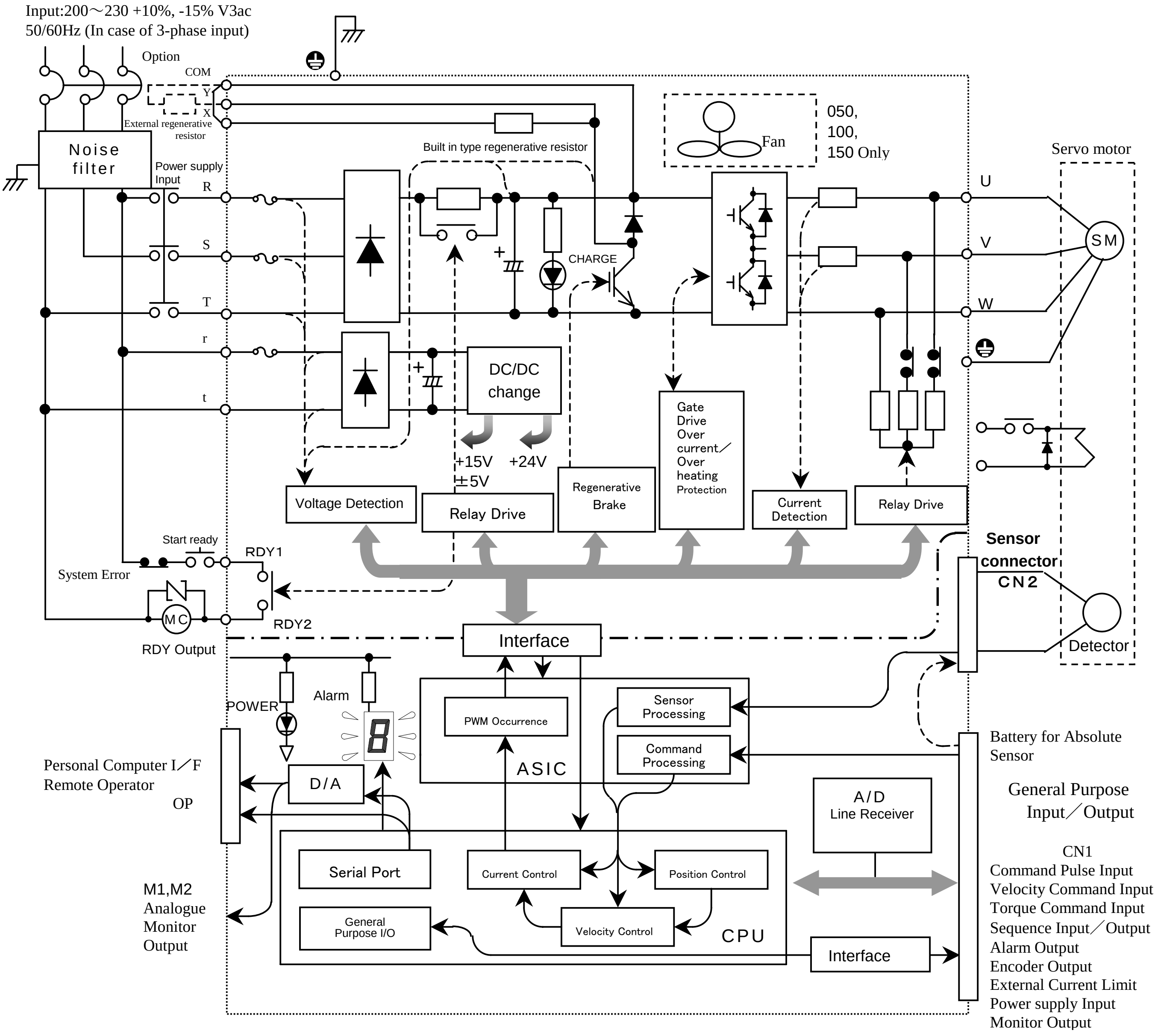
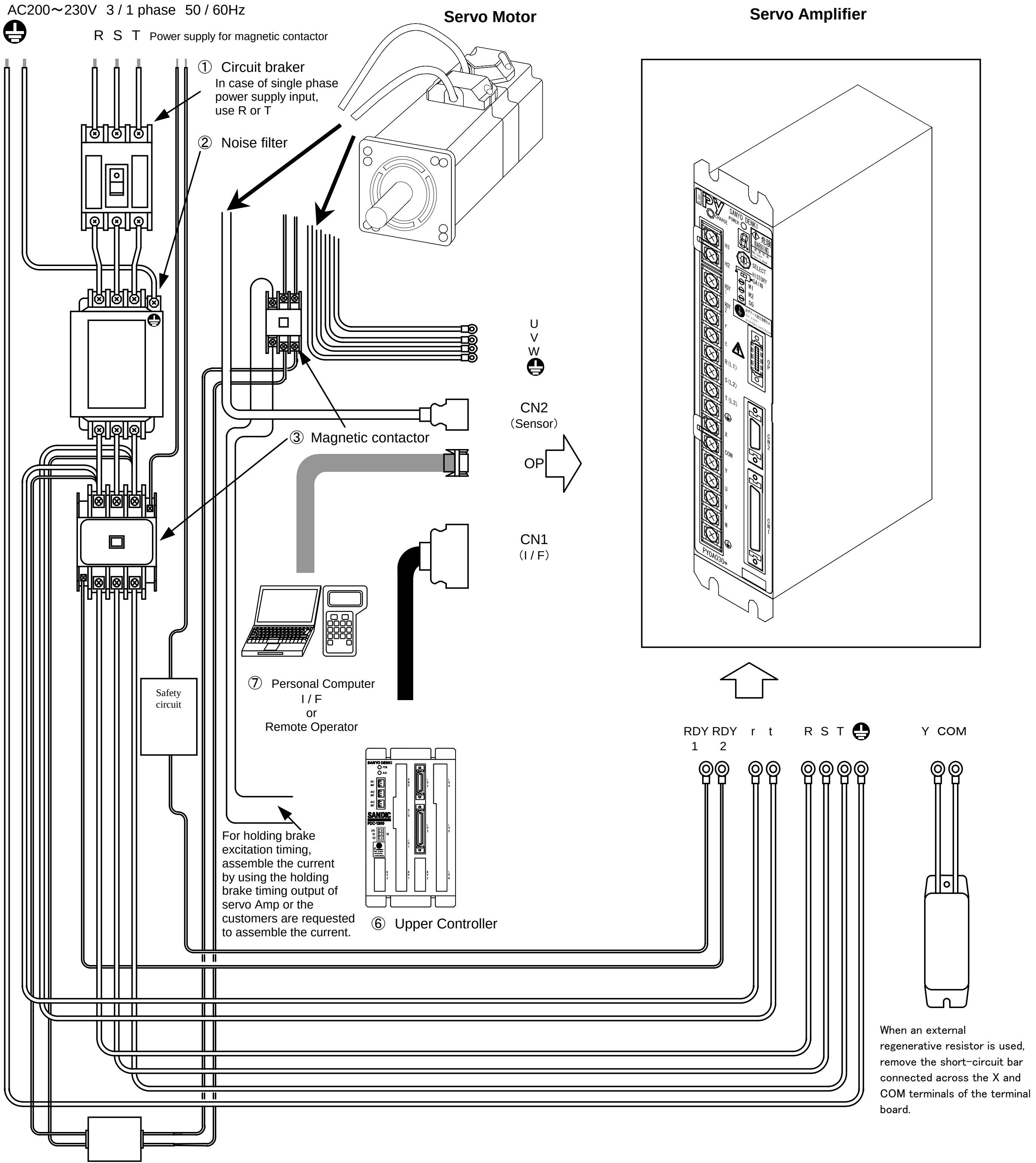


Fig. 3-2 Block Diagram

3. SERVO SYSTEM CONFIGURATION

3.2 External Mounting and Wiring Diagram

External Mounting and Wiring Diagram is described as follows.



⑤ Power supply for motor holding brake release (Power supply and voltage for brake release depend on the motor. Make sure to follow the motor specification.)

Fig. 3-3 External Wiring Diagram

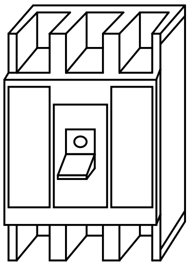
3.2.1 Peripheral Equipment

Standard peripheral equipments to be connected to the PY series are shown below.

① Circuit Breaker

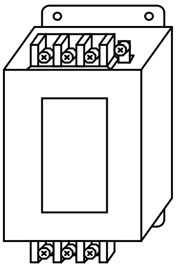
Used for the protection of power line.

Makes the circuit turn off in case of over-current or excessive leakage current.



② Noise Filter

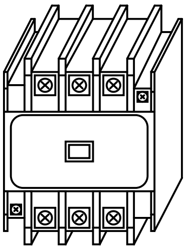
Used to protect the external noise from the power line and not to return the noise occurred from the servo unit to the power line.



③ Magnetic Contactor

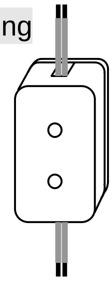
Turn the main circuit supply on and off. Install the surge absorber.

For exciting circuit, assemble the safety circuit shown in chapter 6.



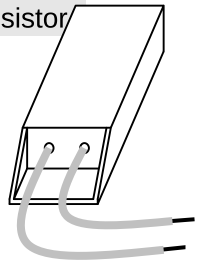
④ Power supply for motor holding brake release

Used to release brake when the servo motor is equipped with a brake.



⑤ External regenerative resistor

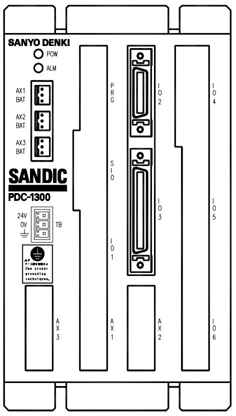
When the capacity of the built-in type regenerative resistor is in short supply, remove the short circuit bar of the terminal board and connect an external regenerative resistor to Y and COM terminals.



⑥ Upper controller

Servo Amplifier can be connected to the other company's product as well as our upper controller.

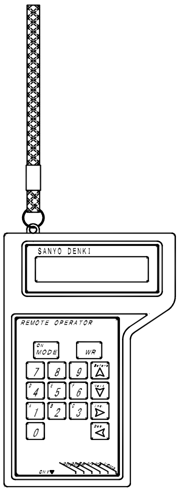
In case the upper controller is developed by the customers, make use of External Wiring Diagram and 〔Chapter 4 wiring〕, etc after confirming them.



Our Digital Controller PDC-1300,etc.

⑦ Remote Operator／Personal Computer

Connect remote operator and personal computer for option.

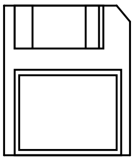


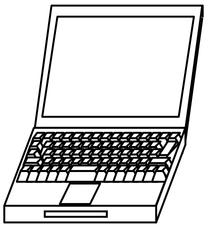
Remote operator（RP-001）

Set user's constants and executes operation , alarm trace and various tests modes.

Personal Computer Interface (Personal Computer)

Connected to RS-232C serial port and parameter change, package save／load, monitoring of operation status, wave from monitor and various tests on the personal computer are performed.





3.3 Names of Servo Amplifier Parts

Separate explanations are made for the parts of servo amplifier, PYO□300 and of other than that.

Other than PYO□300

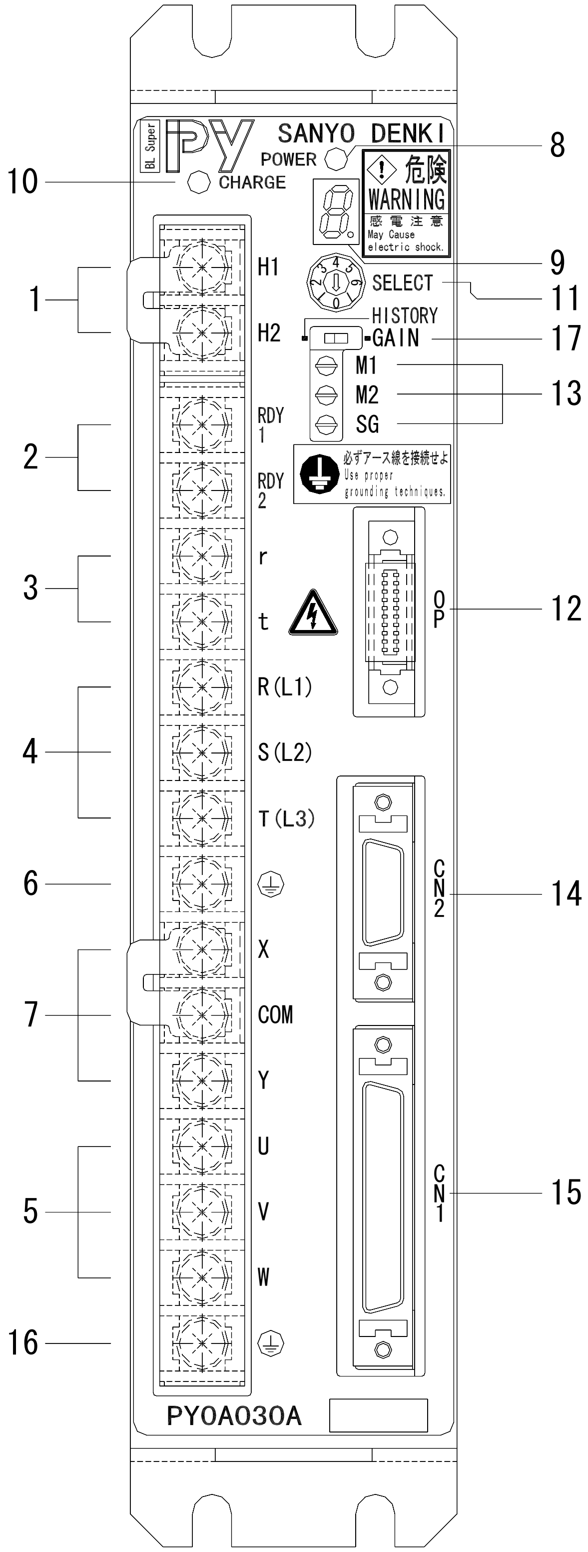


Fig. 3-4
Front View of Servo Amplifier

1. External thermostat input terminal (H1, H2)
   Normal close input.
   Connects the thermal, etc. of external regenerative resistor.
   Short-circuit when no external thermostat is used.
2. Amplifier ready output terminal (RDY1, RDY2)
   Comes off when the control power supply is not set up yet and no alarm occurs. (See 6-2)
   Normal open output 250V AC 2A, 30V DC 2A (applicable load : 5V DC, 20mA min.)
3. Control power supply input terminal (r, t)
   Connects the single-phase 200 V AC power supply.
4. Main circuit power supply input terminal (R, S, T)
   Connects the three-phase 200V AC.
5. Main circuit output terminal (U, V, W)
   Connects the power line of the Servomotor.
6. Earth terminal (⏚)
   Connects the earth cable of the Servomotor for class 3 grounding.
7. Regenerative resistor connecting input terminal (X, COM, Y)
   - Be sure to short-circuit between X and COM when no external regenerative resistor (internal use) is used.
   - When an external regenerative resistor is used, be sure to remove the short bar between X and COM terminals and connect the external regenerative resistor between Y and COM terminals. (See 9-45, 9-145)
8. 5 V power supply set-up (POWER)
   Comes on when the control power (r,t) is supplied.
9. 7-segment LED
   Indicates the status of the amplifier and the type of alarm issued.
10. Main circuit power supply charge (CHARGE)
    Indicates the charge of the smoothing capacitor of the main circuit power supply.
11. Rotary switch (SELECT)
    Used to confirm the alarm history and monitor the status. (See Chapter 8, Maintenance.)
12. Connector for remote operator (OP)
13. Monitor terminal (M1, M2, SG)
    Outputs the monitor output selected by the remote operator. Two channels are available.
14. Connector for encoder signal (CN2)
    Connects the sensor signal line from the motor. (See 4-6, 9-13)
15. Connector for input/output signal (CN1)
    Connected to a host controller, etc.
16. Earth terminal (⏚)
    Connects the cable for servomotor grounding.
17. GAIN/HISTORY changeover switch
    Selects alarm history or gain using the rotary switch.

3. SERVO SYSTEM CONFIGURATION

PYO□300

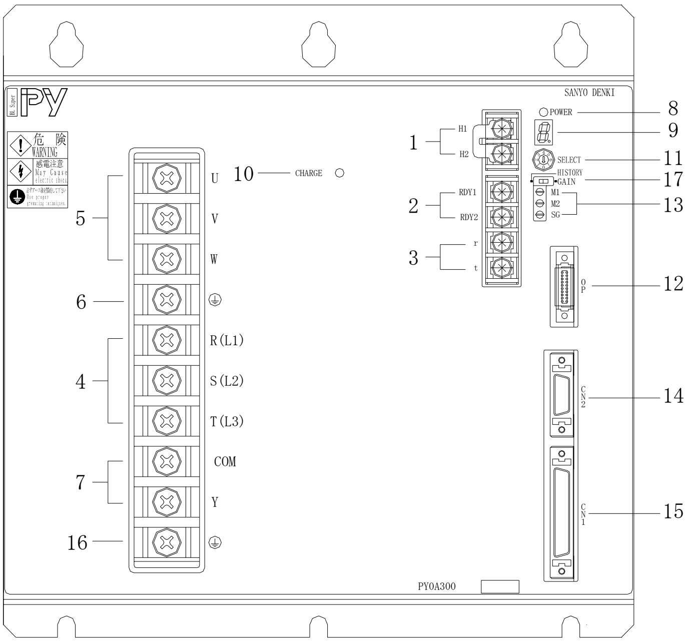


Fig. 3-5
Front View of Servo Amplifier

1. External thermostat input terminal (H1, H2) normal close input.
   Connects the thermal, etc. of external regenerative resistor. Short-circuit when no external thermostat is used
2. Amplifier ready output terminal (RDY1, RDY2)
   Comes off when the control power supply is not set up yet and no alarm occurs. (See 6-2)
   Normal open contact output 250V AC 2A, 30VDC 2A (applicable load : 5V DC, 20mA min.)
3. Control power supply input terminal (r, t)
   Connects the single-phase 200V AC power supply.
4. Main circuit power supply input terminal (R, S, T)
   Connects the three-phase 200V AC power supply.
5. Main circuit output terminal (U, V, W)
   Connects the power supply of the Servomotor.
6. Earth terminal (⏚)
   Connects the earth cable of the Servomotor for class 3 grounding.
7. External regenerative resistor connecting input terminal (COM, Y)
   Be sure to connect the external regenerative resistor between Y and COM terminals.
8. 5 V power supply set-up (POWER)
   Comes on when the control power (r,t) is supplied.
9. 7-segment LED
   Indicates the status of the amplifier and the type of alarm issued.
10. Main circuit power supply charge (CHARGE)
    Indicates the charge of the smoothing capacitor of the main circuit power supply.
11. Rotary switch (SELECT)
    Used to confirm the alarm history and monitor the status and gain switch.
    (See Chapter 8, Maintenance.)
12. Connector for remote operator (OP)
13. Monitor terminal (M1, M2, SG)
    Outputs the monitor output selected by the remote operator.
    Two channels are available.
14. Connector for encoder signal (CN2)
    Connects the sensor signal line from the motor.
15. Connector for input/output signal (CN1)
    Connected to a host controller, etc.
16. Earth terminal (⏚)
    Connects the cable for servomotor grounding.
17. GAIN/HISTORY changeover switch
    Selects alarm history or gain using the rotary switch.

3.4 Optional Peripheral Equipment List

The following optional peripheral equipment are available for the PY series.
Please order as necessary.

> Remote operator
Connected to the Servo Amplifier to set various parameters and check internal conditions.

Model No.	Remarks
P - 001	Remote operator and Cable for remote operator (2m) See page 7-2
AL - 00166853－01	Only remote operator cable (2m)

> External regenerative resistor
Use one when load with large inertia is to be operated or in other necessary cases.

Model No.	Model No.
REGIST - 120W 100B	REGIST - 500W 20B
REGIST - 120W 50B	REGIST - 500W 14B
REGIST - 220W 100B	REGIST - 500W 10B
REGIST - 220W 50B	REGIST - 500W 7B
REGIST - 220W 20B	REGIST - 1000W 6R7B

A type without a thermal is available by ordering without B at the end of the model No. See 9-149

> Cable
Only encoder cables are available. Terminals, however, are not treated.

Model No.	Remarks
00216167 – 01	For wiring-saved incremental encoder See 4-3
6870010 – 1	For absolute encoder

> Connector
Use one to wire the Servo Amplifier and the motor.

Model No.	Remarks
AL - 00292309	On the Servo Amp. side. CN1 and 2. See 4-15
MS06B24 - 11S - 16	Straight plug for the P6/P8 motor power line.
MS06B20 - 29S - 12	Straight plug for the P6/P8 encoder.

> Anti-noise parts
The following anti-noise parts are available.

Model No.	Remarks
CRE - 50500	Spark killer
R･A･V - 781BXZ - 2A	Surge protector See 4-14

For EMC-measure parts, see Chapter 10

> Personal computer interface
The following parts are available for communication with PC. The program is free of charge.

Model No.	Remarks
AL-00356620 - 01	Specialized cable (2.7m) See 11-32

The PC interface can be used only on Windows 95

> Batteries
Batteries can be used to back up the absolute sensor position.

Batteries Model No.	Remarks
ER6C	See next page

3.5 Batteries

Usage and prohibition of the optional batteries ER6C are described.

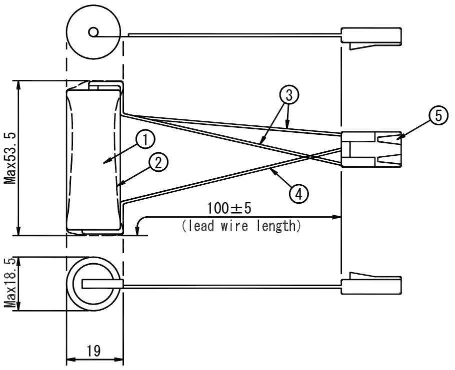
1 Structure

Lithium batteries: ER6VC56 (with connector)..... 1
Case: ER6 CASE HONTAI......1

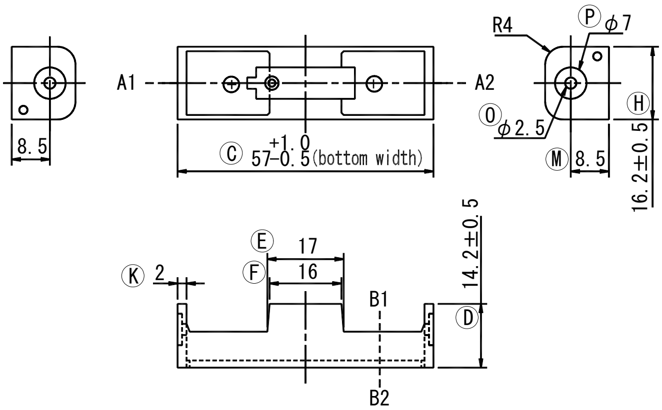
2 Configuration

Configuration of lithium battery and case

Lithium Battery



Case



No.	Item	Material
1	Lithium Battery	Maker : Toshiba Battery Co., Ltd Battery : ER6VC56
2	Shri Shrink Tube (clear)	PVC Shrink Tube
3	⊕ Lead Wire (blue)	AWG26 UL1007
4	⊖ Lead Wire (white)	AWG26 UL1007
5	Connector Housing No.1⊕ No.2⊖ No.3⊖	Maker : HONDA TSUSHIN KOGYO CO., LTD Housing : FKP-3MK Contact : FKP-M104R

Code : Name

C : Whole Length
D : Height 1
E : Hold Width
F : Hold Width
G : Hold Interval
H : Width
J : Height 2
K : Stopper Thickness
L : Bottom Thickness

Code : Name

M : Terminal Position
N : Screw Hole Position
O : Terminal Hole Diameter
P : Terminal Gouge
Q : Screw Hole Diameter

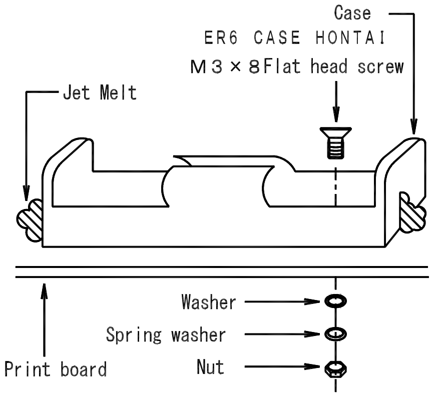
Unit : mm
Measurement : Approximate measurement
Material : Inorganic substance plugged polypropylene

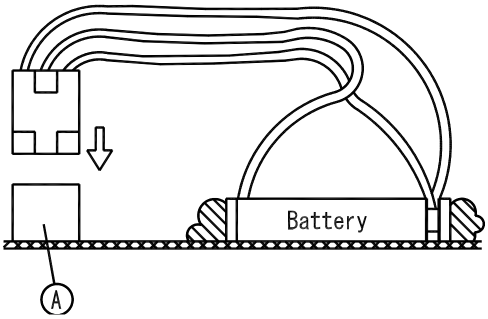
Quality of Lithium Battery

Maker	Toshiba Battery Co., Ltd
Service Life	6 years (for reference) (When Sanyo Servomotor is used)
Capacity	2000mAH
Voltage	3.6V DC

3 Recommended Usage

It is recommended to fix case and battery to the print board as shown below. For wiring to Servo Amplifier, see Chapter 4, Wiring.





A: Maker : HONDA TSUSHIN CO., LTD

Connector: FKP-3M

4 Prohibitions on handling batteries for security

Lithium batteries contain inflammables such as lithium and organic solvent. Mishandling of batteries may cause injury or fire due to overheating, burst and ignition. Please observe the following prohibitions to prevent accident.

1) Short Circuit

Short circuit occurs when positive and negative terminals of the battery contact by means of inductive materials such as metal flakes. For example, it occurs when batteries are laid upon one another resulting in layers of batteries. In these cases, overheating, burst or fire may occur.

2) Putting batteries into fire

When batteries are put into fire, burst or intensive burning may occur.

3) Heating

Heating batteries to above 212°F (100° C) may cause damages to resinous materials of gasket or separator resulting in leakage. It may also cause short inside the batteries resulting in burst and fire.

4) Soldering

Direct soldering to batteries may cause overheating and damages to resinous materials of gasket or separator resulting in leakage. It may also cause short inside the batteries resulting in burst and fire.

5) Charging

Charging the batteries may generate gases leading to sore throat and may cause swelling, burst or fire of the batteries.

6) Disassembling

Disassembling the batteries may generate gases leading to sore throat and may generate negative polarity lithium resulting in fire.

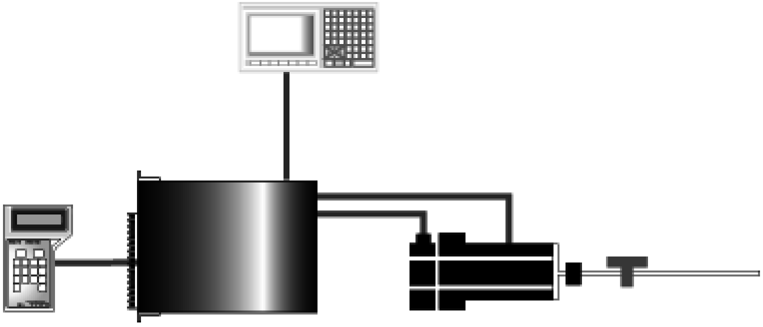
7) Pressed Transformation

Pressed transformation of the batteries may cause leakage due to the distortion of the battery seals, and short may occur in the batteries leading to overheating, burst or fire.

8) Reverse Application

When batteries are applied reversely between positive and negative sides, short may occur in the batteries and cause overheating, burst or fire.

WIRING



4.1 Applicable Wire Sizes

Refer to the following table for the Servo Amplifier external terminals and applicable wire sizes. The values in the table, however, are on condition that the rated current flows on three lead wiring harnesses at an ambient temperature of 104°F.

Table 4-1 Applicable Wire Sizes

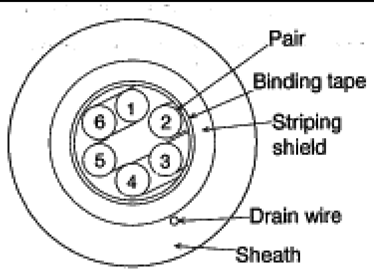
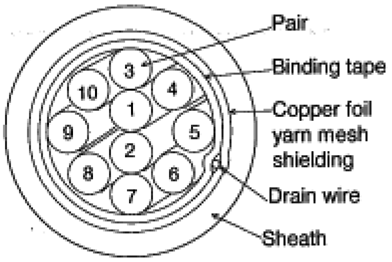
External terminal name		Model / Terminal code	Example of applicable wire size (mm^2)					
			PY0A015	PY0A030	PY0A050	PY0A100	PY0A150	PY0A300
Main circuit	Main circuit power input terminal	R S T	1.25 or more	2.0 or more	3.5 or more	5.5 or more	8 or more	14 or more
	Control power input terminal	r t	1.25 or more					
	Motor connecting terminal (power terminal)	U V W	1.25 or more	2.0 or more	3.5 or more	5.5 or more	8 or more	14 or more
	Earth terminal	E	2.0 or more					
Main circuit	External thermostat input terminal	H1 H2	0.5 or more					
	AMP ready output terminal	RDY1 RDY2	0.5 or more					
	External regenerative resistor connection input terminal	COM Y	1.25 or more		2.0 or more	3.5 or more		8 or more
Signal circuit	Input/output signal connector	CN1	0.2 mm^2 or more (A twisted pair lump shielded wire is partly used.)					
	Encoder signal connector	CN2	Twisted pair lump shielded wire 0.2 mm^2 or more					

1. Connectors CN1 and CN2 are packed together with the Servo Amplifier main body.
2. For wiring harness or putting wires in a duct, take the allowable current reduction ratio of the wire into consideration.
   When the ambient temperature is high, the lifetime will be shortened by thermal degradation. In such a case, use a heat-resistant vinyl cable (HIV).
3. Separate the main circuit wiring from the signal wiring as far as possible.
   Otherwise, noise trouble will be caused by it.
4. We prepare a cable as a encoder signal line connecting cable but not an accessory.
   You can purchase it by designating our model number. (See 4.2)
5. The size of the wire to be connected to the main circuit power supply input terminal or motor connecting terminal can be smaller than listed in the above table, depending on the capacity of the Servomotor. (Use a wire of suitable size, referring to Power Supply Capacity in Section 9.)

4.2 Specifications of Encoder Cable

The following table shows the specifications of encoder cables.

Table 4-2 Specifications of Encoder Cable

Items	Specifications	
	Wiring-saved incremental encoder	Absolute encoder
Connecting Method	By soldering	By soldering
Maker names	Tonichi Cable, Ltd.	Tatsuta Electric Wire and Cable Co., Ltd.
Approxi-mate specification	6-pairs × 0.2mm^2 (Tinned annealed copper wire)	10-pairs × 0.2mm^2 (High-strength copper alloy twisted wire)
Finished outside diameter	8.0 mm MAX	10.0 mm MAX
Bulk resistance	91 Ω/km MAX	123 Ω/km MAX
Internal composition and Lead color	 1 : Red-Black(Twisted pair) 2 : Blue-Brown(Twisted pair) 3 : Green-Purple(Twisted pair) 4 : White-Yellow(Twisted pair) 5 : Skyblue-Pink(Twisted pair) 6 : Orange-Gray(Twisted pair)	 1 : Blue-White(Twisted pair) 2 : Yellow-White(Twisted pair) 3 : Green-White(Twisted pair) 4 : Red-White(Twisted pair) 5 : Purple-White(Twisted pair) 6 : Blue-Brown(Twisted pair) 7 : Yellow-Brown(Twisted pair) 8 : Green-Brown(Twisted pair) 9 : Red-Brown(Twisted pair) 10: Purple-Brown(Twisted pair)
Our available specifications	Our Model No. 00216167-01, No terminal treatment (without connector)	Our Model No. 6870010-1, No terminal treatment (without connector)

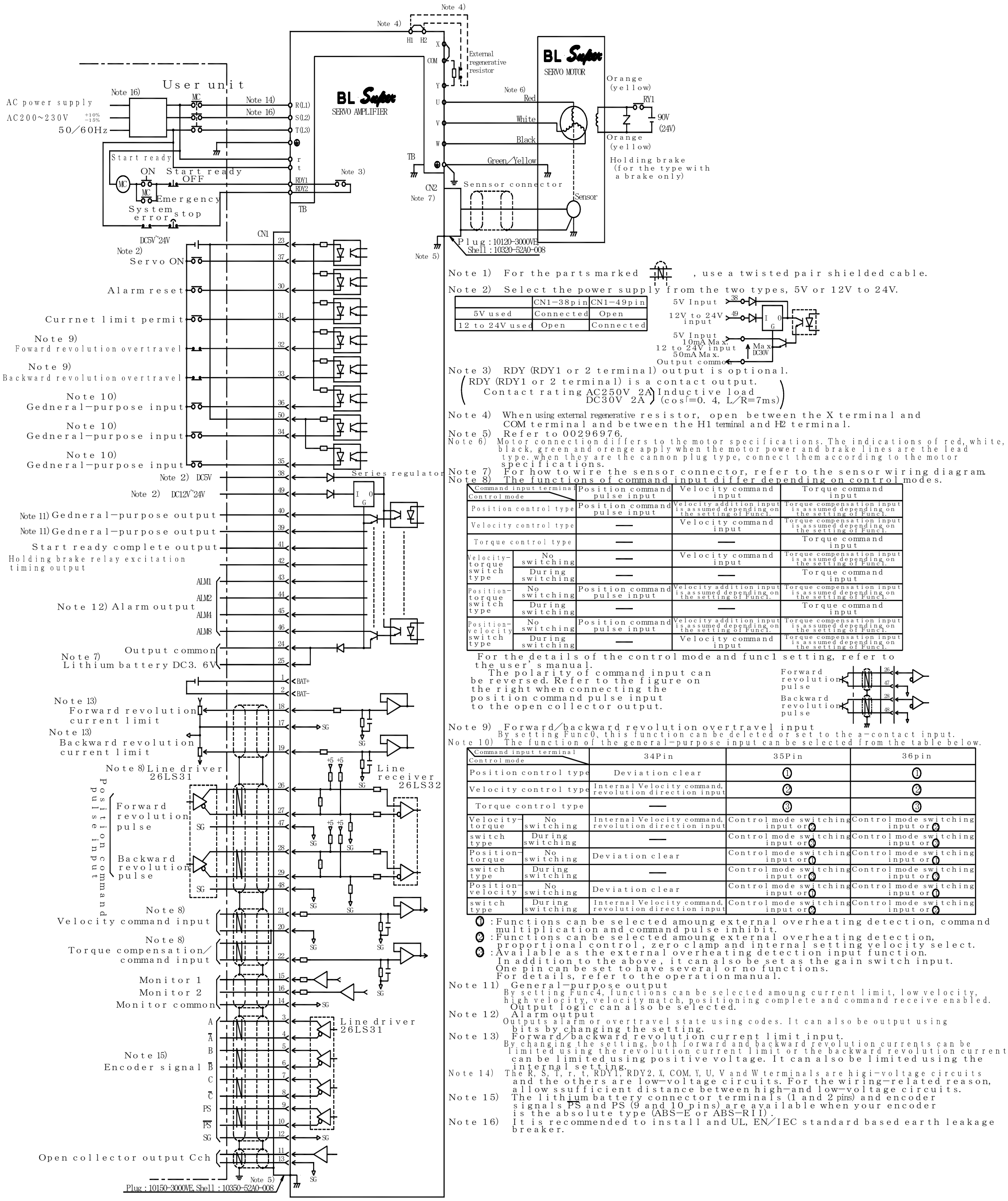
1 When applicable cables are used, the permissible distance between the Servo Amplifier and the motor (encoder) is up to 50m.

2 When ordering cables from us, please specify our Model Nos. and lengths.

3 Before using these cables to any moving elements, please consult with us.

4.3 External Wiring Diagram

4.3.1 External Wiring Diagram



Note 1) For the parts marked N, use a twisted pair shielded cable.

Note 2) Select the power supply from the two types, 5V or 12V to 24V.

	CN1−38pin	CN1−49pin
5V used	Connected	Open
12 to 24V used	Open	Connected

Note 3) RDY (RDY1 or 2 terminal) output is optional.
(RDY (RDY1 or 2 terminal) is a contact output.
Contact rating AC250V 2A, DC30V 2A) Inductive load (cos⌈=0. 4, L/R=7ms))

Note 4) When using external regenerative resistor, open between the X terminal and COM terminal and between the H1 terminal and H2 terminal.

Note 5) Refer to 00296976.

Note 6) Motor connection differs to the motor specifications. The indications of red, white, black, green and orenge apply when the motor power and brake lines are the lead type. when they are the cannon plug type, connect them according to the motor specifications.

Note 7) For how to wire the sensor connector, refer to the sensor wiring diagram.

Note 8) The functions of command input differ depending on control modes.

Command input terminal / Control mode		Position command pulse input	Velocity command input	Torque command input
Position control type		Position command pulse input	Velocity addition input is assumed depending on the setting of Func1.	Torque compensation input is assumed depending on the setting of Func1.
Velocity control type		—	Velocity command input	Torque compensation input is assumed depending on the setting of Func1.
Torque control type		—	—	Torque command input
Velocity−torque switch type	No switching	—	Velocity command input	Torque compensation input is assumed depending on the setting of Func1.
	During switching	—	—	Torque command input
Position−torque switch type	No switching	Position command pulse input	Velocity addition input is assumed depending on the setting of Func1.	Torque compensation input is assumed depending on the setting of Func1.
	During switching	—	—	Torque command input
Position−velocity switch type	No switching	Position command pulse input	Velocity addition input is assumed depending on the setting of Func1.	Torque compensation input is assumed depending on the setting of Func1.
	During switching	—	Velocity command input	Torque compensation input is assumed depending on the setting of Func1.

For the details of the control mode and func1 setting, refer to the user's manual.

The polarity of command input can be reversed. Refer to the figure on the right when connecting the position command pulse input to the open collector output.

Note 9) Forward/backward revolution overtravel input
By setting Func0, this function can be deleted or set to the a−contact input.

Note 10) The function of the general−purpose input can be selected from the table below.

Command input terminal / Control mode		34Pin	35Pin	36pin
Position control type		Deviation clear	①	①
Velocity control type		Internal Velocity command, revolution direction input	②	②
Torque control type		—	③	③
Velocity−torque switch type	No switching	Internal Velocity command, revolution direction input	Control mode switching input or ②	Control mode switching input or ②
	During switching	—	Control mode switching input or ③	Control mode switching input or ③
Position−torque switch type	No switching	Deviation clear	Control mode switching input or ①	Control mode switching input or ①
	During switching	—	Control mode switching input or ③	Control mode switching input or ③
Position−velocity switch type	No switching	Deviation clear	Control mode switching input or ①	Control mode switching input or ①
	During switching	Internal Velocity command, revolution direction input	Control mode switching input or ②	Control mode switching input or ②

① :Functions can be selected amoung external overheating detection, command multiplication and command pulse inhibit.
② :Functions can be selected amoung external overheating detection, proportional control, zero clamp and internal setting velocity select.
③ :Available as the external overheating detection input function.
In addition to the above, it can also be set as the gain switch input.
One pin can be set to have several or no functions.
For details, refer to the operation manual.

Note 11) General−purpose output
By setting Func4, functions can be selected amoung current limit, low velocity, high velocity, velocity match, positioning complete and command receive enabled.
Output logic can also be selected.

Note 12) Alarm output
Outputs alarm or overtravel state using codes. It can also be output using bits by changing the setting.

Note 13) Forward/backward revolution current limit input.
By changing the setting, both forward and backward revolution currents can be limited using the revolution current limit or the backward revolution current can be limited using positive voltage. It can also be limited using the internal setting.

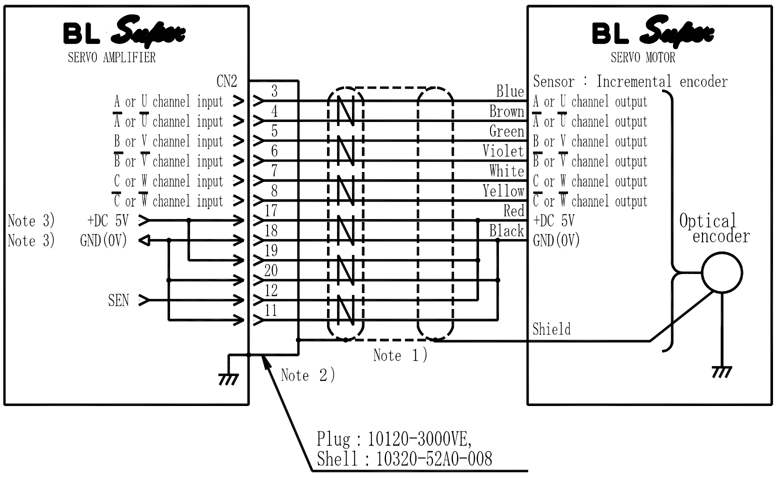
Note 14) The R, S, T, r, t, RDY1, RDY2, X, COM, Y, U, V and W terminals are higi−voltage circuits and the others are low−voltage circuits. For the wiring−related reason, allow ssufficient distance between high−and low−voltage circuits.

Note 15) The lithium battery connector terminals (1 and 2 pins) and encoder signals $\overline{PS}$ and PS (9 and 10 pins) are available when your encoder is the absolute type (ABS−E or ABS−RII).

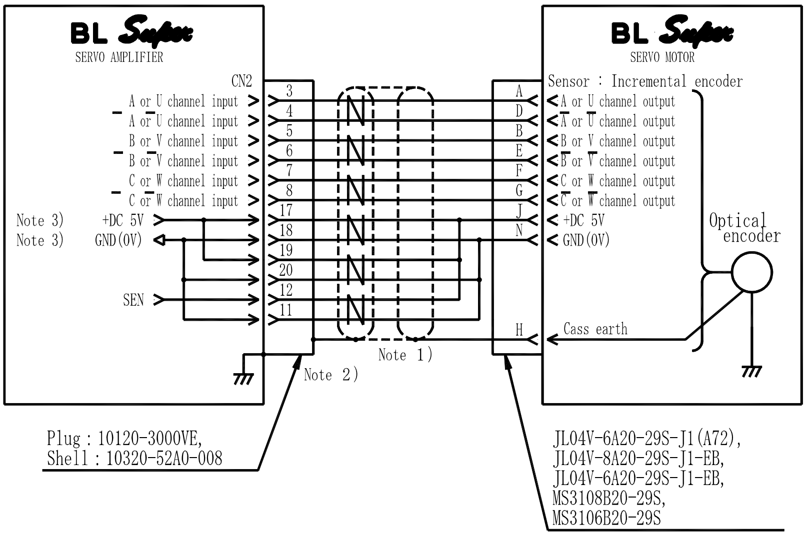
Note 16) It is recommended to install and UL, EN/IEC standard based earth leakage breaker.

4.3.2 Sensor Connection Diagram (Wiring-saved incremental encoder INC-E)

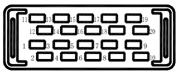
Incremental encoder （ＩＮＣ－Ｅ） Lead wire type



Incremental encoder （ＩＮＣ－Ｅ） Cannon plug type



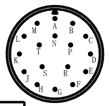
Note 4) CN2 pin arrangement



Note 1) For the parts marked N ,use a twisted pair shielded cable.

Note 2) Refer to 4.6.2

Note 5) Cannon plug pin arrangement

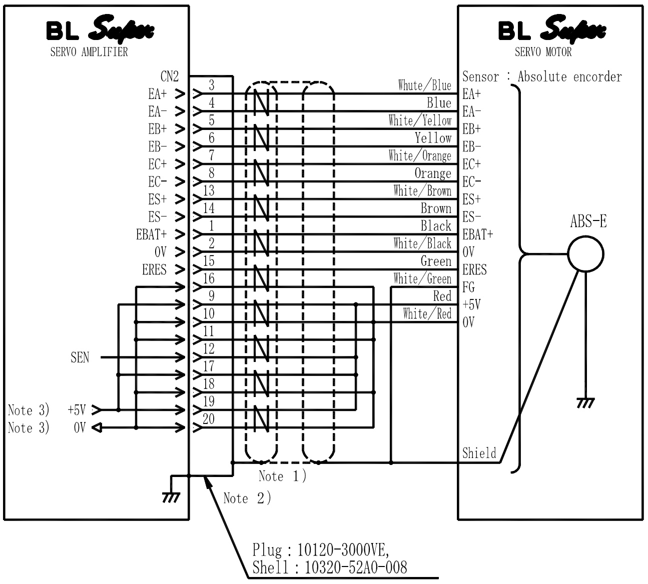


Note 3) The sensor power connection differs depending on the cable length.
Refer to the following table.

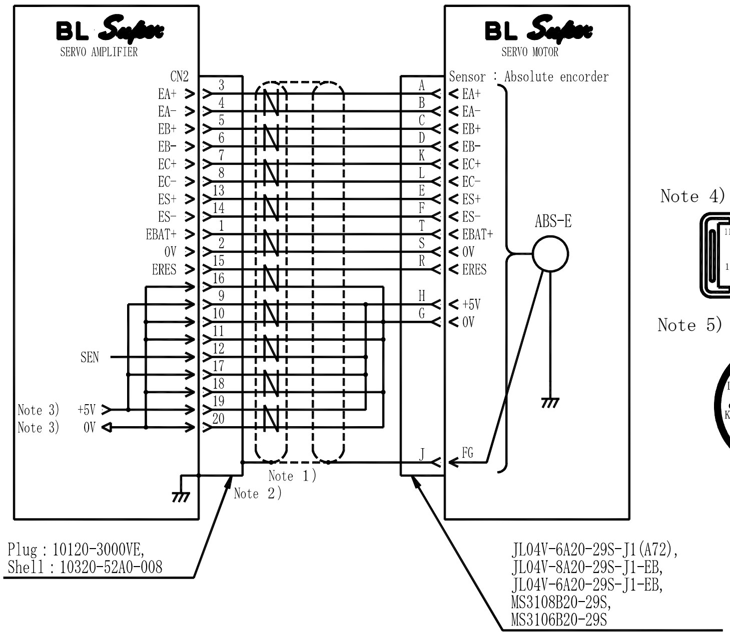
Sensor cable length	5m or less	10m or less	50m or less
+DC 5V wiring	19-pin connection (9, 12 and 17 pins need not be connected)	12- and 17-pin connection (9 and 19 pins need not be connected)	12-, 17- and 19-pin connection (9 pins need not be connected)
GND (0V) wiring	20-pin connection (10, 11, 16 and 18 pins need not be connected)	18- and 20-pin connection (10, 11 and 16 pins need not be connected)	11-, 18- and 20-pin connection (10 and 16 pins need not be connected)
Cable logarithmic	4	5	6

4.3.3 Sensor Connection Diagram (Request signal-unavailable absolute encoder ABS-E)

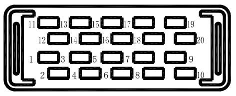
Absolute encorder (ＡＢＳ－Ｅ) Lead Wire type



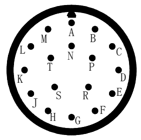
Absolute encorder (ＡＢＳ－Ｅ) Cannon plug type



Note 4) CN2 pin arrangement



Note 5) Cannon plug pin arrangement



Note 1) For the parts marked N ,use a twisted pair shielded cable.

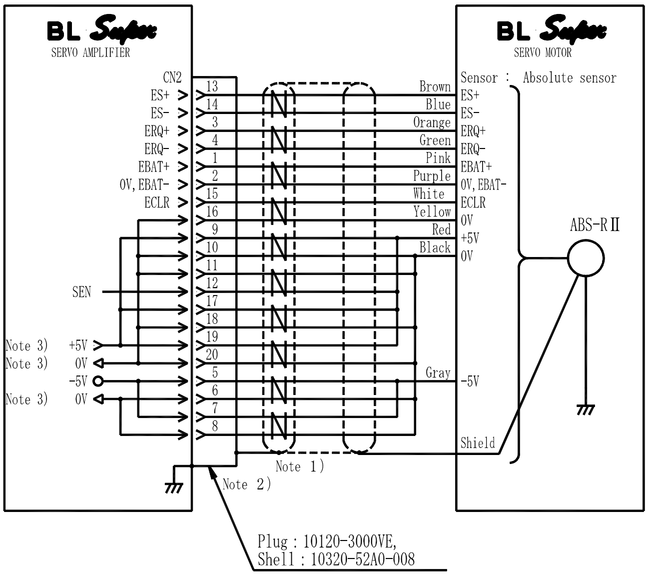
Note 2) Refer to 4.6.2

Note 3) The sensor power connection differs depending on the cable length.
Refer to the following table.

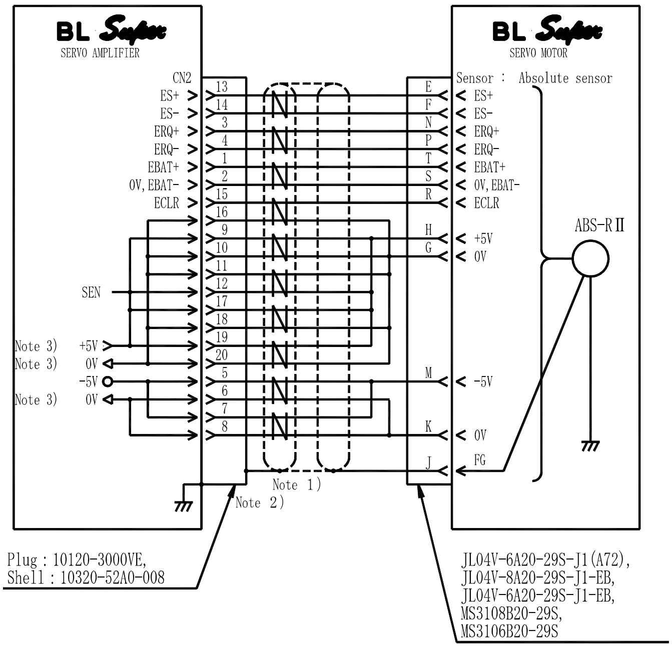
Sensor cable length	5m or less	10m or less	15m or less	50m or less
+DC 5V wiring	19-pin connection (9,12 and 17 pins need not be connected)	12- and 17-pin connection (9 and 19 pins need not be connected)	12-,17- and 19-pin connection (9 pins need not be connected)	9-,12-,17- and 19-pin connection
GND (0V) wiring	16- and 20-pin connection (10,11 and 18 pins need not be connected)	16-,18- and 20-pin connection (10 and 11 pins need not be connected)	11-,16-,18- and 20-pin connection (10 pins need not be connected)	10-,11-,16-,18- and 20-pin connection

4.3.4 Sensor Connection Diagram (Request signal-available absolute encoder ABS-RⅡ)

Absolute Sensor （ＡＢＳ－ＲⅡ） Lead wire type



Absolute Sensor （ＡＢＳ－ＲⅡ） Cannon plug type

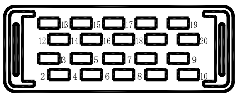


Note 1) For the parts marked N ,use a twisted pair shielded cable.

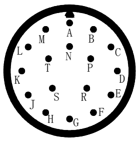
Note 2) Refer to 00296976.

Note 3) DC5V,0V wiring
When the sensor cable is less than 5m in length,
don't connect CN2-11,12,17 and 18 pins.
When the sensor cable is 5 to 50m in length, connect CN2-11,12,17 and 18 pins.

Note 4) CN2 pin arrangement



Note 5) Cannon plug pin arrangement



4.4 Connector Terminal Arrangement Input/Output Signal Diagram (CN1, CN2)

The table below shows terminal arrangement of CN1, CN2 input/output signal.

4.4.1 CN-1 Interface Connector

CN-1 is an interface connector to a host computer or the like.

The connector of the amplifier is “10250-52A2JL” (made by Sumitomo 3M)

24	22	20	18	16	14	12	10	8	6	4	2	
12VDC to 24V COM	Note2 TCMD	Note2 VCMDG / TCMDG	Note3 PIL	Note6 MON2	SG	SG	Note1 $\overline{PS}$	$\overline{C}$	$\overline{B}$	$\overline{A}$	Note1 BAT-	
Output sequence power common	Torque command	Velocity/ torque command	Forward revolution side current limit	Monitor output 2	Monitor common	Position signal output					Battery negative side	
25	23	21	19	17	15	13	11	9	7	5	3	1
12VDC to 24V COM	DC12V to 24V	Note2 VCMD	Note3 NIL	SG	Note5 MON1	COPG	COP	Note1 PS	C	B	A	Note1 BAT+
Output sequence power common	Input sequence power 1	Velocity command	Backward revolution side current limit	Current limit common	Monitor output 1	C-phase common	C-phase (open collector output)	Position signal output				Battery positive side
49	47	45	43	41	39	37	35	33	31	29	27	
12VDC to 24V	SG	Note6 ALM4	Note6 ALM1	SRDY	Note8 General-purpose output	SON	Note7 General-purpose input	Note4 NROT	Note3 ILM	Note2 $\overline{NPC}$	Note2 $\overline{PPC}$	
Output sequence power	Pulse command common	Alarm output		Operation ready complete	General purpose output	Servo ON	General purpose input	Backward revolution side over travel	Current limit permit	Backward revolution pulse command	Forward revolution pulse command	
50	48	46	44	42	40	38	36	34	32	30	28	26
12VDC to 24V	SG	Note6 ALM8	Note6 ALM2	Note9 HBON	Note8 General purpose output	5V	Note7 General-purpose input	Note7 General purpose input	Note4 PROT	Note6 RST	Note2 NPC	Note2 PPC
Input sequence power 2	Pulse command common	Alarm output		Holding brake timing output	General-purpose output	Output sequence power	General-purpose input	General-purpose input	Forward revolution pulse command	Alarm reset	Backward revolution pulse command	Forward revolution pulse command

Fig. 4-1 CN-1 Connector Terminal Arrangement Diagram

Notes :
1. Battery connector terminal and position signal output PS terminal : Available when being used together with the absolute encoder (ABS-E) or the absolute sensor (ABS-RⅡ)
2. Command input : Functions differ depending on the control modes.
3. Current limit : The input method can optionally be set.
4. Over travel : The input method can optionally be set.
5. Monitor output : The signal and output range to be monitored can be selected.
6. Alarm output : The output method and polarity can be selected.
7. General-purpose input: Selectable from multiple signals. The contents of signals differ depending on the control modes.
8. General-purpose output : Multiple signals can be selected.
9. Holding brake timing output : Timing output for operating the motor holding brake.

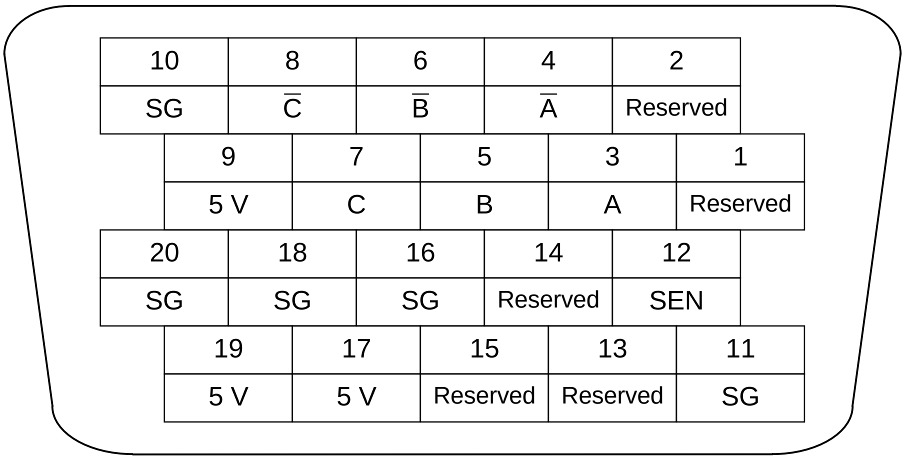
4.4.2 CN2 Sensor Connector

The amplifier-side connector is “10220-52A2JL” (made by Sumitomo 3M).

Connection differs depending on the type of the Servomotor sensor to be combined with Servo Amplifier.

Note that hardware inside the Servo Amplifier differs between the incremental encoder (INC-E) or the request signal-unavailable absolute encoder (ABS-E) and the request signal-available absolute sensor (ABS-RⅡ).

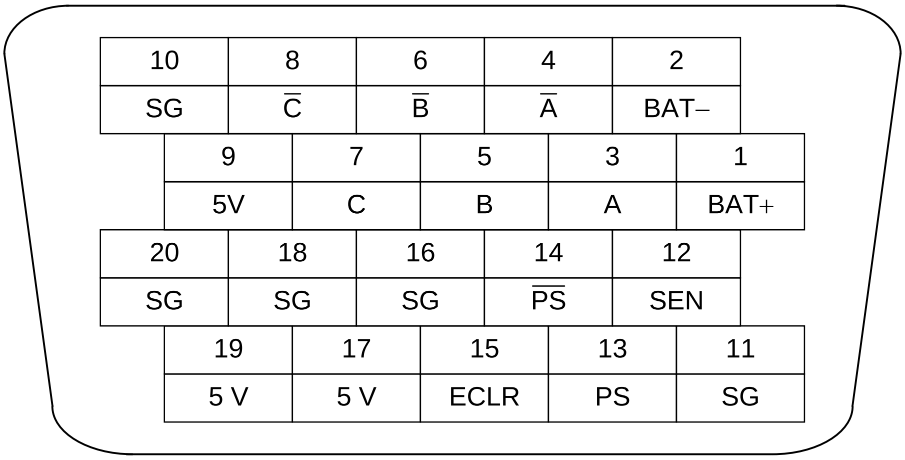
- Incremental encoder (INC-E) terminal arrangement diagram



10	8	6	4	2	
SG	$\overline{C}$	$\overline{B}$	$\overline{A}$	Reserved	
	9	7	5	3	1
	5 V	C	B	A	Reserved
20	18	16	14	12	
SG	SG	SG	Reserved	SEN	
	19	17	15	13	11
	5 V	5 V	Reserved	Reserved	SG

Fig. 4-2 CN2 Connector (INC-E Incremental Encoder) Terminal Arrangement Diagram

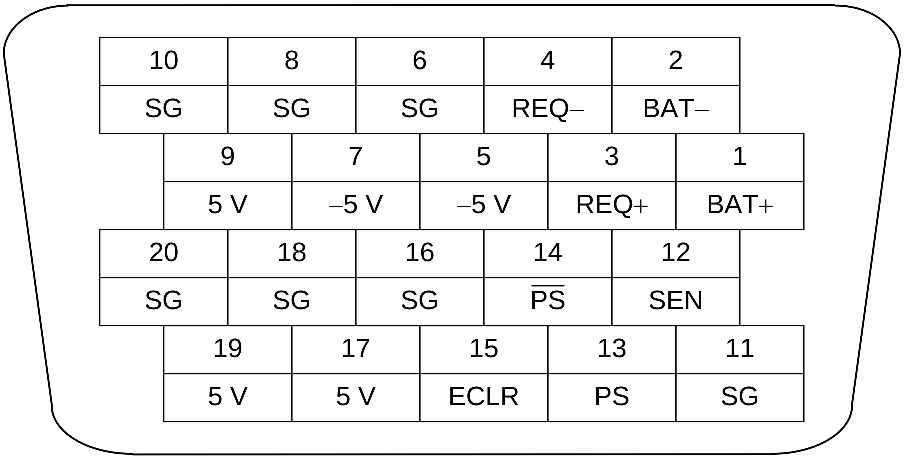
- Request signal-unavailable absolute encoder (ABS-E) terminal arrangement diagram



10	8	6	4	2	
SG	$\overline{C}$	$\overline{B}$	$\overline{A}$	BAT–	
	9	7	5	3	1
	5V	C	B	A	BAT+
20	18	16	14	12	
SG	SG	SG	$\overline{PS}$	SEN	
	19	17	15	13	11
	5 V	5 V	ECLR	PS	SG

Fig. 4-3 CB2 Connector (ABS-E Request Signal-unavailable Absolute Encoder) Terminal Arrangement Diagram

- Request signal-available absolute sensor (ABS-RⅡ) terminal arrangement diagram



10	8	6	4	2
SG	SG	SG	REQ–	BAT–
9	7	5	3	1
5 V	–5 V	–5 V	REQ+	BAT+
20	18	16	14	12
SG	SG	SG	$\overline{\text{PS}}$	SEN
19	17	15	13	11
5 V	5 V	ECLR	PS	SG

Fig. 4-4 CN-2 Connector (ABS-RⅡ Request Signal-available Absolute Sensor) Terminal Arrangement Diagram

Note that if incremental encoder (INC-E) or request signal-unavailable absolute encoder (ABS-E) is connected to Servo Amplifier for request signal-available absolute sensor (ABS-Ⅱ), the encoder is damaged.

4.5 Wiring Procedure

The Servo Amplifier is control unit to process signals of several mV or less.
Therefore, perform wiring observing the following items.

Input/output signal line Encoder signal line Main circuit line	Perform wiring observing the following. • For the input/output signal line, use multi-conductor twisted lump shielded wires or twisted wires. • For the encoder signal line, use the recommended cables. • The command input line should be 3 m or less. • The encoder signal line should be 50 m or less. • Make connections at a minimum distance. • Separate the main circuit line from the signal circuit line. • Don't perform wiring for the main circuit line on the side of the amplifier or near other amps.
Grounding cable	Observe the following for the grounding cable. • Earth the wire with the diameter of 2.0mm^2 at one point. • Perform class 3 grounding (earth resistance value: 100Ω max.). • Be sure to connect the motor ⏚ terminal (motor frame) and the servo amp. ⏚ terminal.
Measures against malfunction due to noise	Note the following to prevent malfunction due to noise. • Arrange the noise filter, the Servo Amplifier, and the upper controller as near as possible. • Be sure to install a surge absorbing circuit on the coils for the relay, the magnetic contactor, the induction motor and the brake solenoid. • Don't pass the main circuit and signal lines in the same duct or bind them together. • When a large noise source such as an electric welding machine or an electric discharge machine exists nearby, insert a noise filter into the power supply and the input circuit. • Don't bind the noise filter primary and secondary side wires together. • Don't make the grounding cable longer. • Don't make the terminal of the analog input signal wire open.
Measure against radio interference	Since the Servo Amplifier is an industrial equipment, no measure against radio interference has been taken to it. If the interference causes some problem, insert a line filter to the power line input.

For EMC measures, refer to Chapter 10.

4.6 Precautions on Wiring

Perform wiring observing the following completely.

1 Noise processing

The main circuit of the Servo Amplifier uses IGBTs under PWM control. If the wiring processing is not earthed properly, switching noise may occur by di/dt and dv/dt generated when IGBT is switched. Because the Servo Amplifier incorporates electronic circuits such as the CPU, it is necessary to perform wiring and processing so as to prevent external noise from invading to the utmost.

To prevent trouble due to this noise in advance, perform wiring and grounding securely. The power noise resistance (normal, common noise) of the Servo Amplifier is within 30 minutes at 1500 V, 1 μsec. Don't make a noise test exceeding this limit.

2 Motor frame grounding

When the motor is earthed to the ground through the frame on the machine side, the Cf × dv/dt current flows from the PWM power unit of the Servo Amplifier through the motor floating capacity (Cf). To prevent an effect due to this current, be sure to connect the terminal Ⓔ (motor frame) of the motor to the terminal Ⓔ of the Servo Amplifier and earth the terminal Ⓔ of the Servo Amplifier directly.

3 Wire grounding

When motor wire is put in a metal conduit or a metal box, be sure to earth the metal portion. In this case, perform one-point grounding.

4 Miswiring

Since miswiring in the Servo Amplifier and the Servomotor may damage equipment, be sure to check that wiring has been performed properly.

5 Protection of power line

Note the following when wiring the power line.

- Leakage current
  Be sure to use a circuit breaker or a fuse for the Servo Amplifier input to protect the power line. Even if the motor frame is earthed as specified, leakage current flows in the input power line. When selecting a leakage detection type breaker, refer to "Servo Amplifier/Servomotor Leakage Current" (See page 9-39) to prevent oversensitive operation due to a high frequency leakage current.
- Power supply surge
  When a surge voltage occurs in the power supply, connect a surge absorber between the powers to absorb the voltage before operation.

6 Lightning surge

When there is a possibility that a lightning surge over 2kV may be applied to the Servo Amplifier, take countermeasures against the surge at the control panel inlet.
For lightning surge protectors to be inserted to each Servo Amplifier inlet, the product in the following table or its equivalent is recommended.

4.6.1 Recommended Surge Protector

When purchasing the following, directly make a reference to the maker for it.

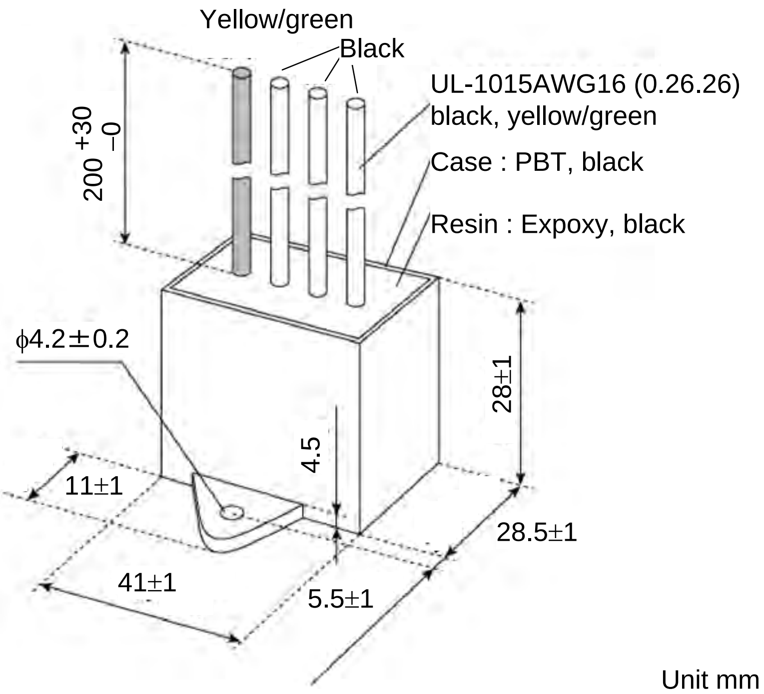
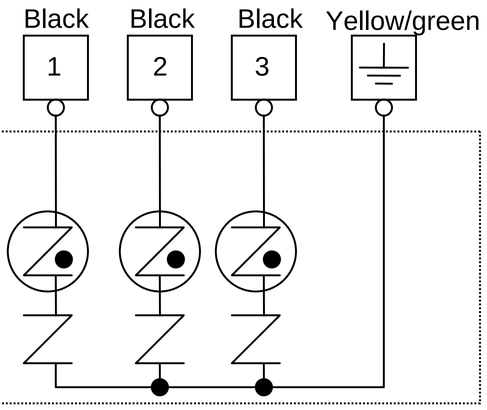
Item	Specification
Model No.	R.A.V-781BXZ-2A (Okaya Electric Industries Co., Ltd.)
External dimensions	
Maximum allowable circuit voltage	300 Vrms
Clamp voltage	783 V±10%
Surge-resistant current	2500 A (waveform) 8/20 μs
Surge-resistant voltage	20 kV (waveform) 1.2/20 μs
Connection diagram	
Weight	Approx. 100 g

Fig. 4-5 Recommended Surge Protector Specifications

4.6.2 CN1 & CN2 Shielding Procedure

The following figure shows the connector shielding procedure for the attached connectors CN1 and CN2.

There are two shielding procedures, clamp and soldering processing.

- Clamp processing

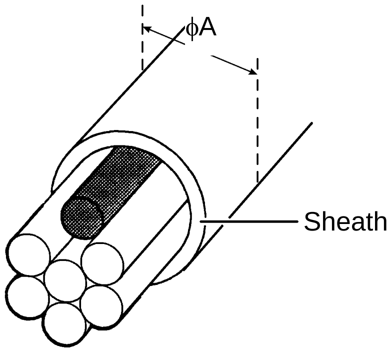
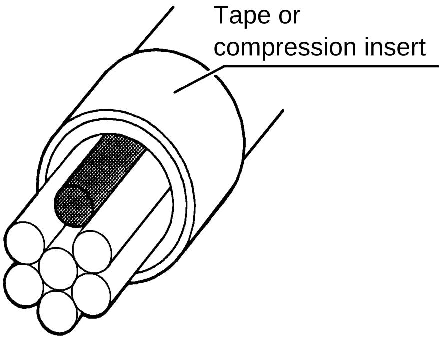
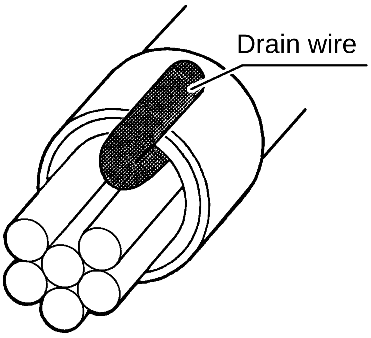
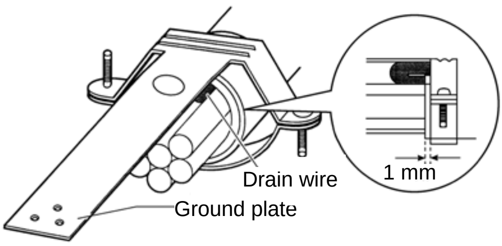
1		Remove the cable sheath.
2		Mount a tape or a compression insert. (Used when O.D. A is smaller than 15.0mm for CN1 and 10.5 mm for CN2.) At this time, the tape or the compression insert should be completely on the cable sheath.
3		Fold back the drain wire.
4		Tighten the cable clamp from on the drain wire. Set it about 1 mm away from the end face of the tape or the compression insert.

Fig. 4-6 Shielding Procedure (Clamp Processing)

Set the compression insert before soldering the cable to the connector.

- Soldering processing

Procedures 1 and 2 are the same as the clamp processing.

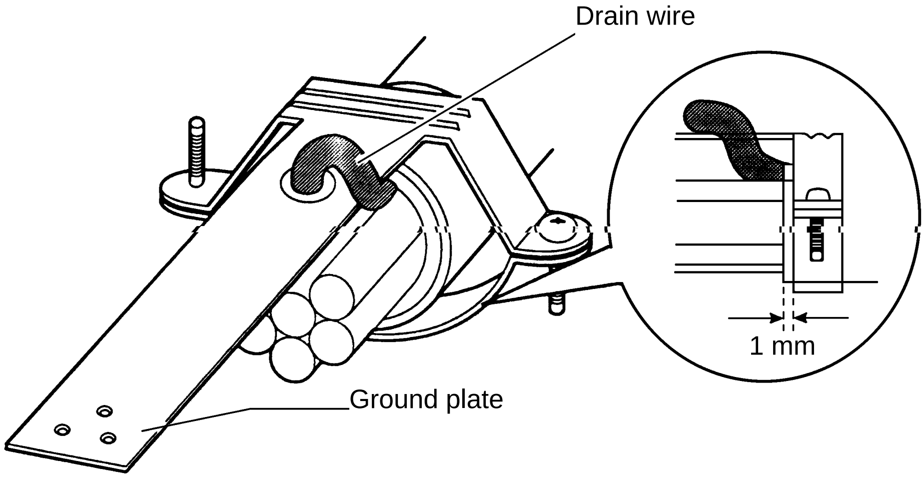
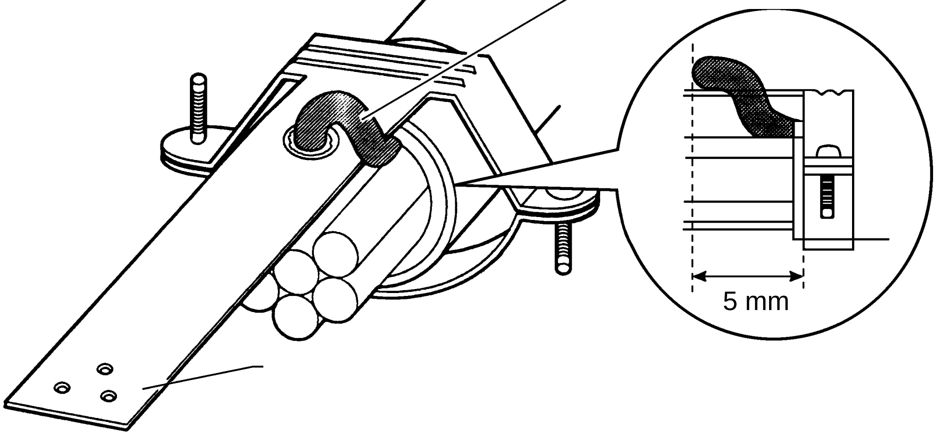
1	 Turn the cable and bring the drain wire near the ground plate.
2	Solder the drain wire (where ○ is marked.) 

Fig. 4-7 Shielding Procedure (Soldering Processing)

- Applicable CN1&CN2 O.D.A Size

The Applicable CN1&CN2 O.D.A sizes are shown in the following table. If the diameter is within the size, no compression insert is required.

Table 4-3 Applicable CN1&CN2 O.D. A Size

Connector No.	Applicable O.D. A size	Connector model name	Maker name
CN1	15.0 to 16.5 mm	10150-3000VE 10350-52A0-008	Sumitomo 3M Ltd.
CN2	10.5 to 12.0 mm	10120-3000VE 10320-52A0-008	Sumitomo 3M Ltd.

- Typical CN2 Compression Insert Application

The following products are recommended as a CN2 compression insert.

Table 4-4 CN2 Compression Inserts

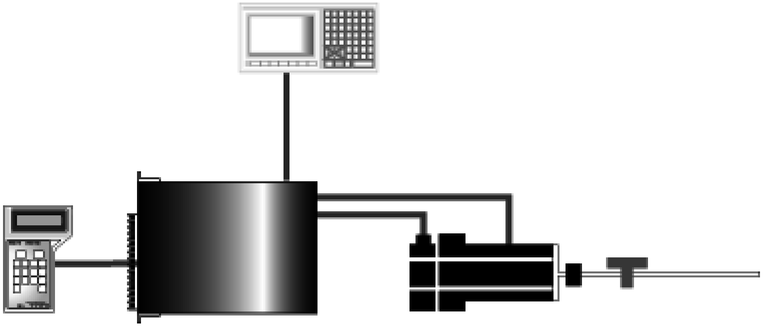
Compression insert No.	Applicable cable outside diameter (O.D.A)	Maker name
10607-C058	4.0 to 5.0 mm	Sumitomo 3M Ltd.
10607-C068	5.0 to 6.0 mm	
10607-C078	6.0 to 7.0 mm	
10607-C088	7.0 to 8.0 mm	
10607-C098	8.0 to 9.0 mm	

1 The above products are applicable to the connector CN2.

2 When purchasing the above products, directly make a reference to the maker for them or ask our company for information.

For inquiry: Sumitomo 3M Ltd., Tokyo Branch
Phone: +81(3)5716-7290

INSTALLATION



5. INSTALLATION

5.1 Servo Amplifier Installation

Refer to the following for the Servo Amplifier installation place and procedure.

5.1.1 Installation Place

Install the Servo Amplifier by referring to the following.

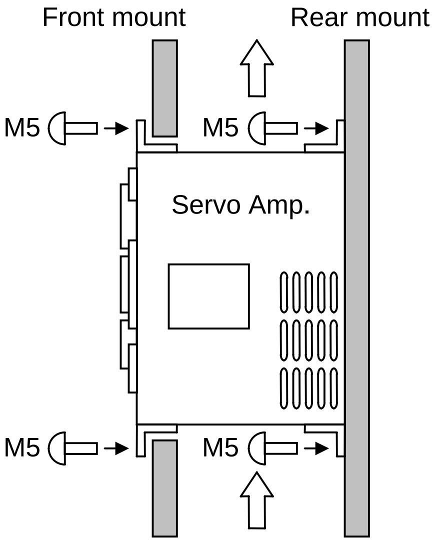
Case	Precautions
When installing the Servo Amplifier in a box	The temperature in the box may be higher than the outside temperature depending on the power loss of built-in equipment and the dimensions of the box. Be sure to determine the dimensions of the box, cooling and arrangement so that the temperature around the Servo Amplifier will be kept lower than 131°F (55°C). For a longer lifetime and higher reliability, operate the Servo Amplifier at an in-box temperature of lower than 104°F (40°C).
When there is a vibration source nearby	Install the Servo Amplifier at the base through a shock absorber so that vibration may not be transmitted directly to the Servo Amplifier.
When there is a heat generating source nearby	Even if there is a possibility that a temperature rise may be caused by convection or radiation, keep the temperature near the Servo Amplifier lower than 131°F (55°C).
When there is corrosive gas	If the Servo Amplifier is operated for a long time, contact failure will come to occur at contact parts (e.g., connectors). So, never install the Servo Amplifier in corrosive gas atmosphere.
When there is explosive gas or combustible gas	Never install the Servo Amplifier in explosive gas or combustible gas atmosphere. Relays and contactors, which generate arcs (sparks) inside boxes, and such parts as regenerative brake resistor may become ignition sources, causing fires and explosion.
When there is dust or oil mist	Never install the Servo Amplifier in such atmosphere containing dusts or oil mists. Dusts or oil mists adhered to or accumulated on the Servo Amplifier may lower insulation or cause leak between conductors of applicable parts, damaging the Servo Amplifier.
When there is a large noise source	Induction noise will enter input signals and the power supply circuit, causing Servo Amplifier's malfunction. When there is a possibility of noise entering, take proper measures such as inserting a noise filter, revising line wiring and preventing noise generation.

⚠ Refer to Chapter 10 for EMC measures.

5.1.2 Installation Procedure

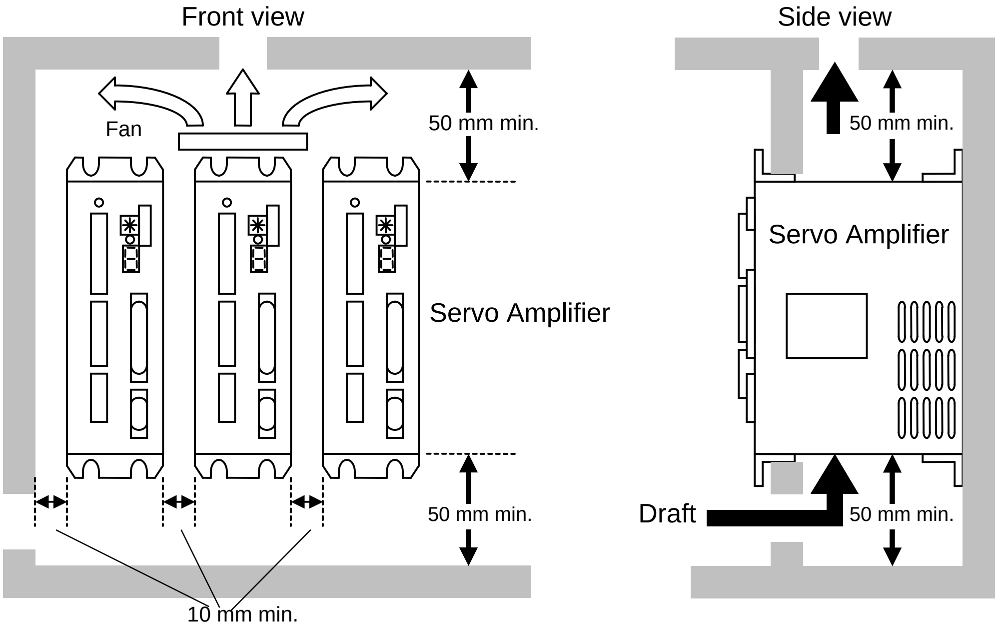
- **Direction and Installation Place**

When installing the Servo Amplifier, set it vertically as shown in the figure below.
Since it adopts natural convection cooling as a cooling method, be sure to observe the above rule at installation.
Fix the amplifier by tightening screws onto the four fixing holes as shown in the following figure.



- **Board arrangement conditions**

Provide a space between the top and bottom sides of the Servo Amplifier so as not to prevent air from flowing out of the radiator. If heat remains on the upper part of the amplifier, install a fan to force air to flow. Provide spaces also on the both sides of the amp. in such a degree as not to worsen operability.

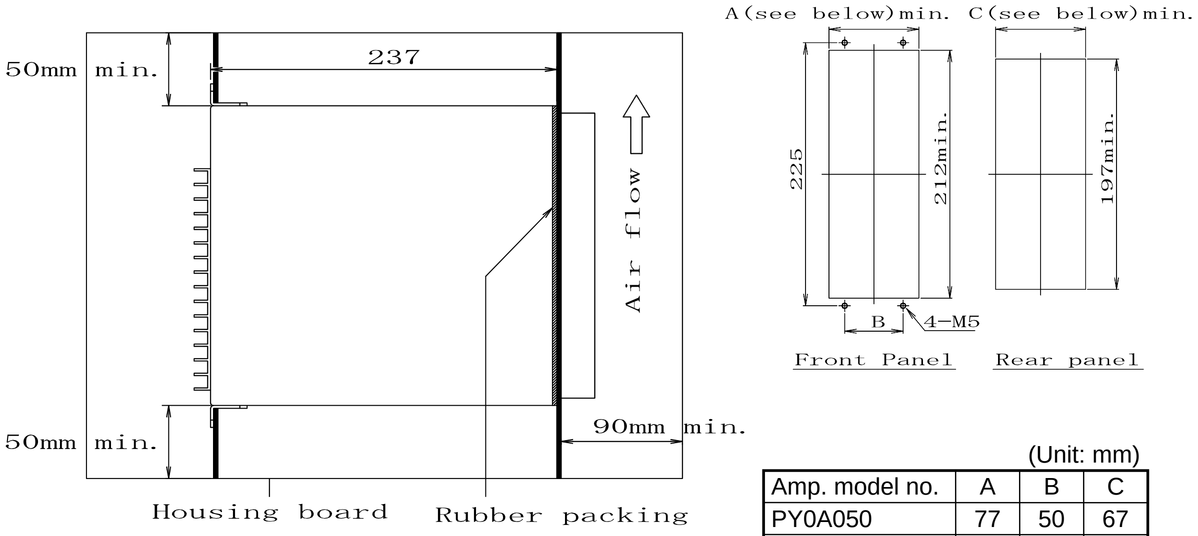


- **Duct draft (PY0A050, PY0A100 and PY0A150)**

Since a Servo Amplifier of more than 50A has a duct cooling structure, a heat sink unit of large heat generation can be housed in a duct.

The following figures show the installation methods.

- Front Mount Method (PY0A050, PY0A100 and PY0A150)

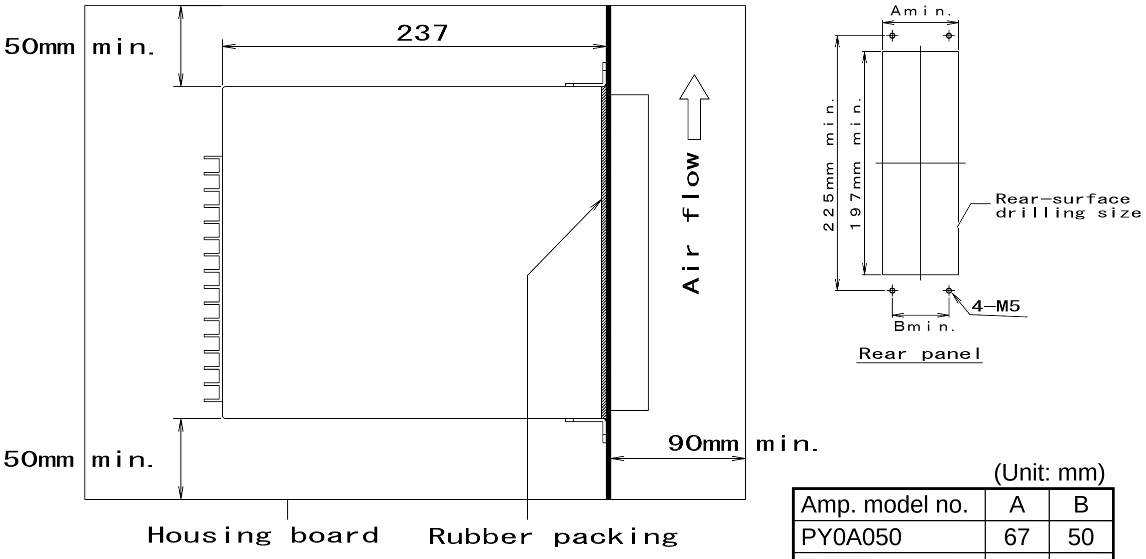


(Unit: mm)

Amp. model no.	A	B	C
PY0A050	77	50	67
PY0A100	102	50	92
PY0A150	145	75	142

Fig. 5-1 Front Mount Method (PY0A050, PY0A100 and PY0A150)

- Back Mount Method (PY0A050, PY0A100 and PY0A150)



(Unit: mm)

Amp. model no.	A	B
PY0A050	67	50
PY0A100	92	50
PY0A150	142	75

Fig. 5-2 Back Mount Method (PY0A050, PY0A100 and PY0A150)

- Back Mount Method (PY0A300)

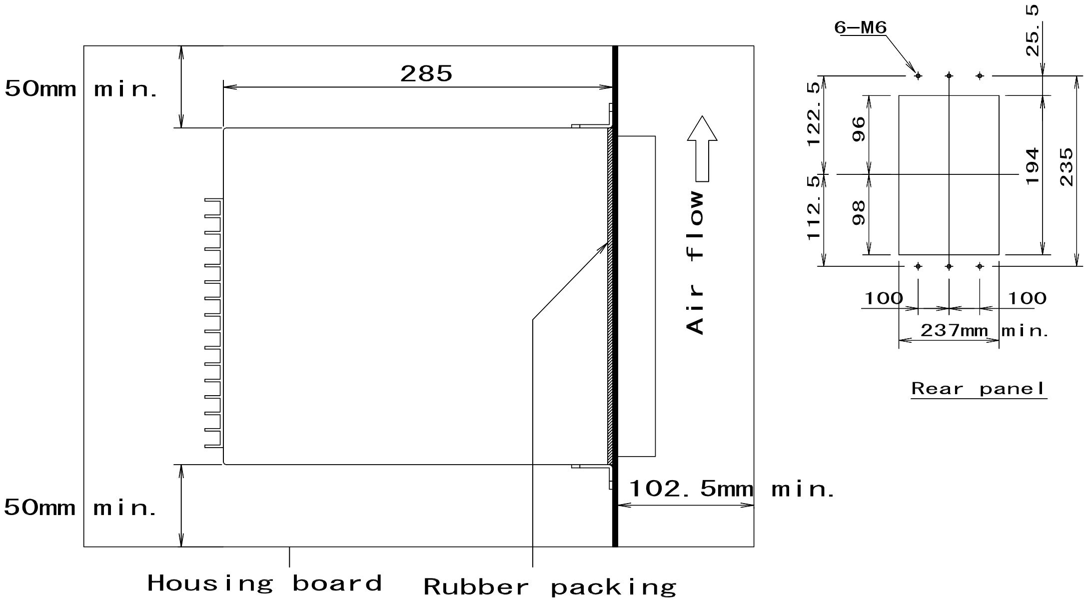


Fig. 5-3 Back Mount Method (PY0A300)

5.2 Servomotor Installation

Refer to the following for the Servomotor installation place and procedure.

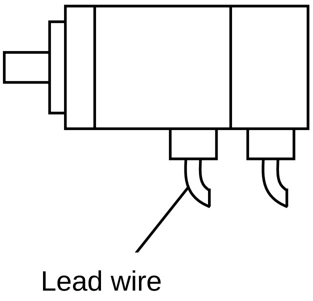
5.2.1 Installation Place

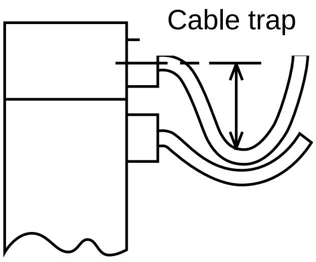
Install the Servomotor at an indoor site by referring to the following.

- Ambient temperature : 32 to 104°F (0 to 40°C)
- Storage temperature : –4 to 149°F (-20 to 65°C)
- Ambient humidity : 20 to 90%
- Well-ventilated places
- Places free from corrosive or explosive gas
- Places free from dust or foreign materials
- Places easy to check and clean
- Avoid operating the Servomotor in a condition that the oil seal lip is always exposed to oil or lots of water drop, oil drop or cutting fluid are splashed. The Servomotor can be protected from slight splashes by a means taken on the motor side.

5.2.2 Installation Procedure

- **Direction of installation**
  - The Servomotor can be installed horizontally or on/under the end of a shaft.
  - Set the cable from the motor with its end downward.
  - At vertical installation, provide a cable trap to prevent oil and water from going to the motor.



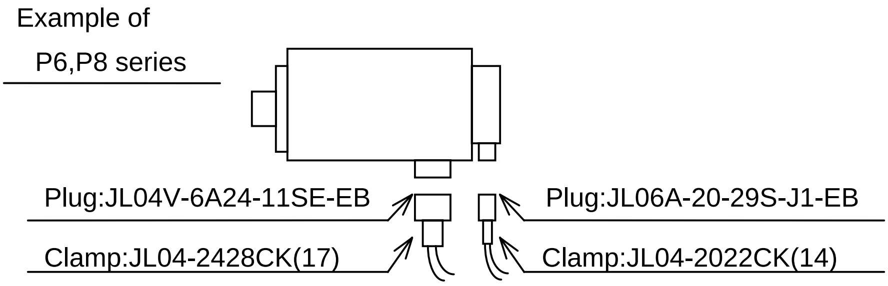


- **Prevention against wetting**

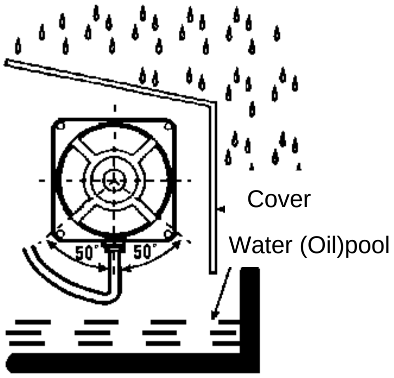
The motor, as a single unit, satisfies the IEC standard. Since the standard, however, is intended to check performance over a short period of time, the following measures against wetting are required for actual usage. Handle the system carefully, or the connector sheathes may be hit or damaged, deteriorating waterproof function.

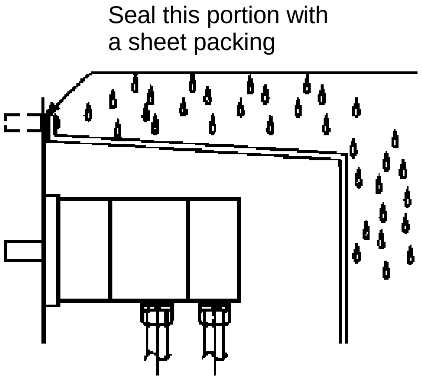
	P1	P2	P3	P5	P6	P8
Protection type	IP67		IP40	P50B03, 04: IP40 P50B05, 07, 08: IP55	IP67	

Cannon connector types P1, P2, P6 and P8 are applicable when a waterproof cannon connector or conduit is used for the other side.

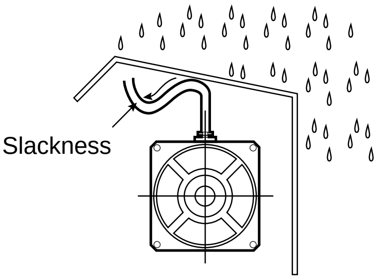


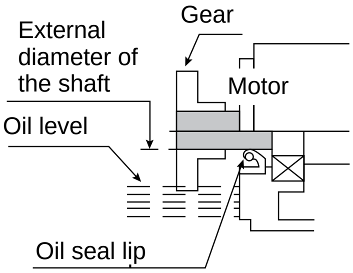
- Set the connector (lead outlet) with its end downward in the angle range shown in the following figure.
- Install the cover on the side to which water or oil will splash.
- Install the cover with a gradient so that water or oil may not stay.
- Avoid dipping the cable in water or oil.
- Slacken the cable outside the cover so that water or oil may not invade the motor side.



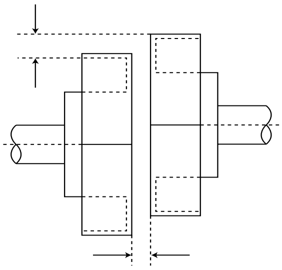


- When the connector (lead outlet) cannot be installed with its end downward by any means, slacken the cable so that water or oil may not invade it.
- Make the oil level of the gear box lower than the oil seal lip.
- Provide a vent to prevent the internal pressure of the gear box from rising.

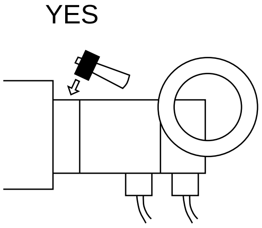


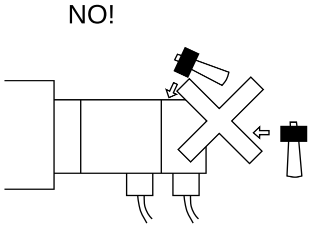


- **Connection to the opposite machine**
  - Perform centering accurately between the motor shaft and the opposite machine as shown in the figure below. Note that when a rigid coupling is used, a slight offset will lead to a damage of the output shaft.

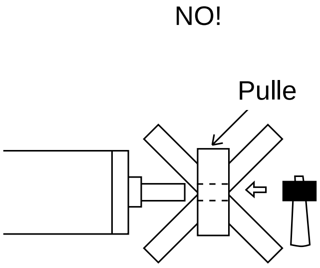


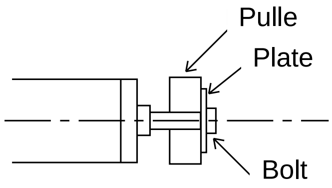
  - Since a precision encoder is directly connected to the motor shaft, be careful not to give shocks to it. If tapping on the motor is unavoidable for position adjustment or other reasons, tap on the front flange, if possible, with a rubber or plastic hammer.



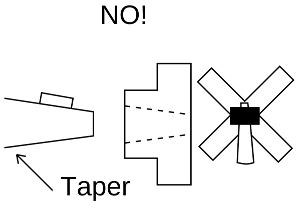


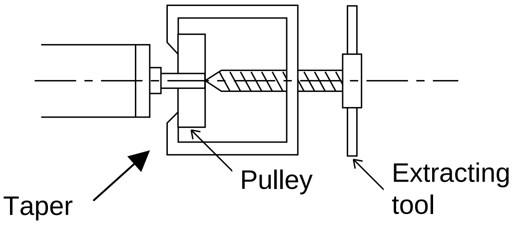
  - When installing the motor to the machine, make an installing hole precisely so that the motor joint can be smoothly connected. Also, make the installing surface as flat as possible, or the shaft or the bearing may be damaged.
  - When installing the gear, the pulley, the coupling, etc., avoid giving shocks to them by using the screw on the shaft edge.





  - Since torque is transferred, in the case of the tapered motor shaft, from the tapered surface, take care that the key can be engaged without being tapped. Also, make a hole so that at least 70% of the tapered surface is to be engaged.
  - When removing the gear, the pulley, etc., use a dedicated extracting tool.





  - When performing belt driving, check that the shaft-converted value of the belt tension does not exceed the allowable value shown in Table 5-1.

- **Allowable load of bearing**

Fig. 5-1 shows the load which the Servomotor can endure.
Do not apply an excessive thrust or radial load.
The thrust or radial load in the table indicates the value when it is independently applied to the shaft.

Table 5-1 P Series Motor Allowable Radial and Thrust Load

Motor	Models	During assembly			During operation		
		Allowable radial load (kg)	Allowable thrust load (kg)		Allowable radial load (kg)	Allowable thrust load (kg)	
		F_R	F Direction	F1 Direction	F_R	F Direction	F1 Direction
P1	P10B10030	60	80	80	40	10	10
	P10B10075	60	80	80	40	10	10
	P10B13050	100	140	140	50	10	10
	P10B13100	100	140	140	50	10	10
	P10B13150	100	140	140	70	10	10
	P10B18200	230	190	190	150	50	50
	P10B18350	230	190	190	150	50	50
	P10B18450	230	190	190	150	50	50
	P10B18550	400	200	200	180	60	60
P2	P20B10100	100	30	30	70	30	30
	P20B10150	100	30	30	70	30	30
	P20B10200	100	30	30	70	30	30
	P20B10250	100	30	30	70	30	30
	P20B13300	200	40	40	100	40	40
	P20B13400	200	40	40	120	40	40
	P20B13500	200	40	40	120	40	40
P3	P30B04003	10	8	8	5	3	3
	P30B04005	15	10	10	10	3	3
	P30B04010	15	10	10	10	3	3
	P30B06020	40	20	20	20	8	8
	P30B06040	40	20	20	25	10	10
	P30B08075	60	40	40	35	20	20
P5	P50B03003	7	7	7	6	2	2
	P50B04006	15	10	10	10	3	3
	P50B04010	15	10	10	10	3	3
	P50B05005	20	20	15	15	8	8
	P50B05010	20	20	15	15	8	8
	P50B05020	25	20	15	20	8	8
	P50B07020	25	50	20	20	10	10
	P50B07030	25	50	20	20	10	10
	P50B07040	25	50	20	25	10	10
	P50B08040	60	80	30	35	20	20
	P50B08050	60	80	30	35	20	20
	P50B08075	60	80	30	35	20	20
	P50B08100	60	80	30	35	20	20
P6	P60B13050	65	130	130	35	35	35
	P60B13100	100	140	140	65	50	50
	P60B13150	170	190	190	65	50	50
	P60B13200	170	190	190	90	40	40
	P60B15300	170	190	190	90	40	40
	P60B18200	230	190	190	150	50	50
	P60B18350	230	190	190	150	50	50
	P60B18450	230	190	190	150	50	50
	P60B18550	400	200	200	180	60	60
	P60B18750	310	200	200	200	110	110
	P60B22550	400	200	200	180	60	60
	P60B22700	400	200	200	250	110	110
	P60B2211K	400	200	200	250	110	110
	P60B2215K	300	200	200	230	150	150
P8	P80B15075	100	140	140	65	50	50
	P80B18120	150	140	140	95	50	50
	P80B22250	230	190	190	95	50	50
	P80B22350	230	190	190	150	50	50
	P80B22450	230	190	190	150	50	50

The allowable radial loads are the maximum loads that can be applied to the 1/3 point from the edge of the output shaft (see Fig. 5-4).

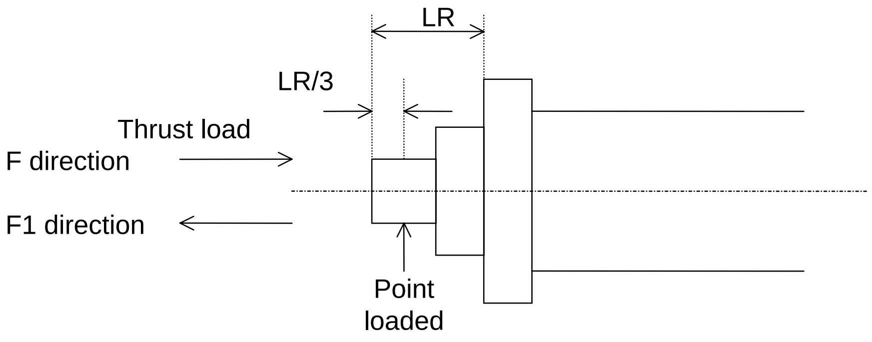


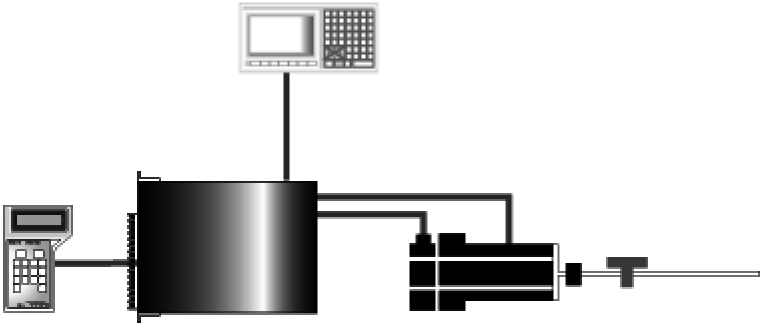
Fig. 5-4 Load Position

5.3 Cable Installation

- Be careful not to give stress or damage to cables.
- When the motor and cables are moved by cable bearer, determine a bending radius of each cable by the necessary flexure lifetime and type of wire. It is recommended that the cable of a movable portion should have a structure that permits periodic replacement. When you desire to use a recommended cable for a movable portion, consult with our company.

6

OPERATION

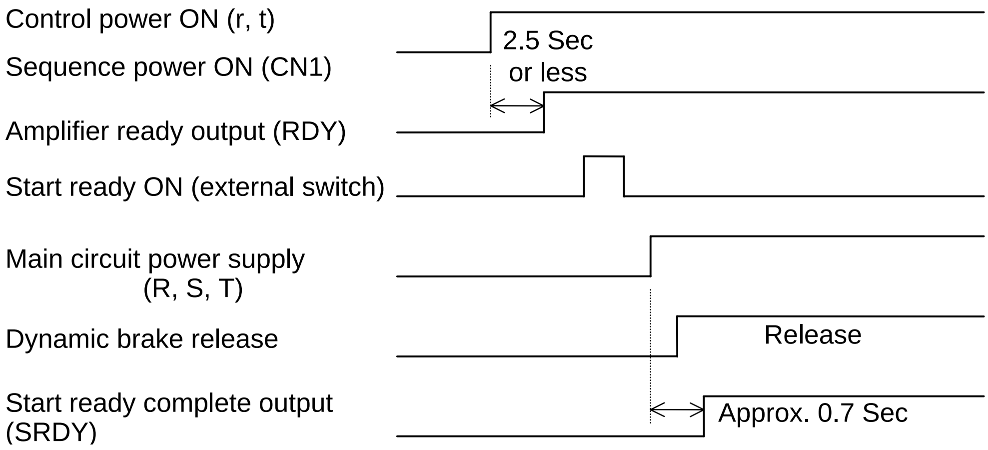


6. OPERATION

6.1 Operation Sequence

The frequency of power ON/OFF should be 5 times/H or less, and 30 times/day or less.

6.1.1 Power ON Sequence



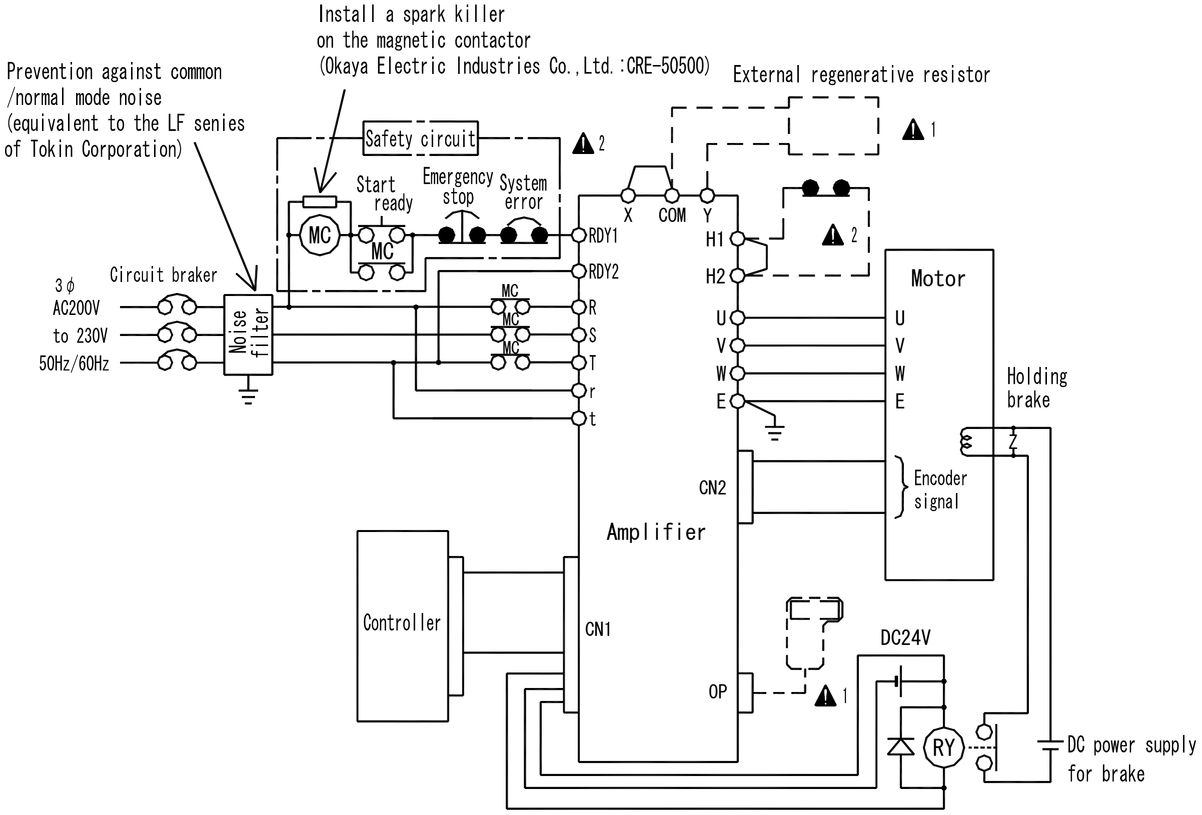
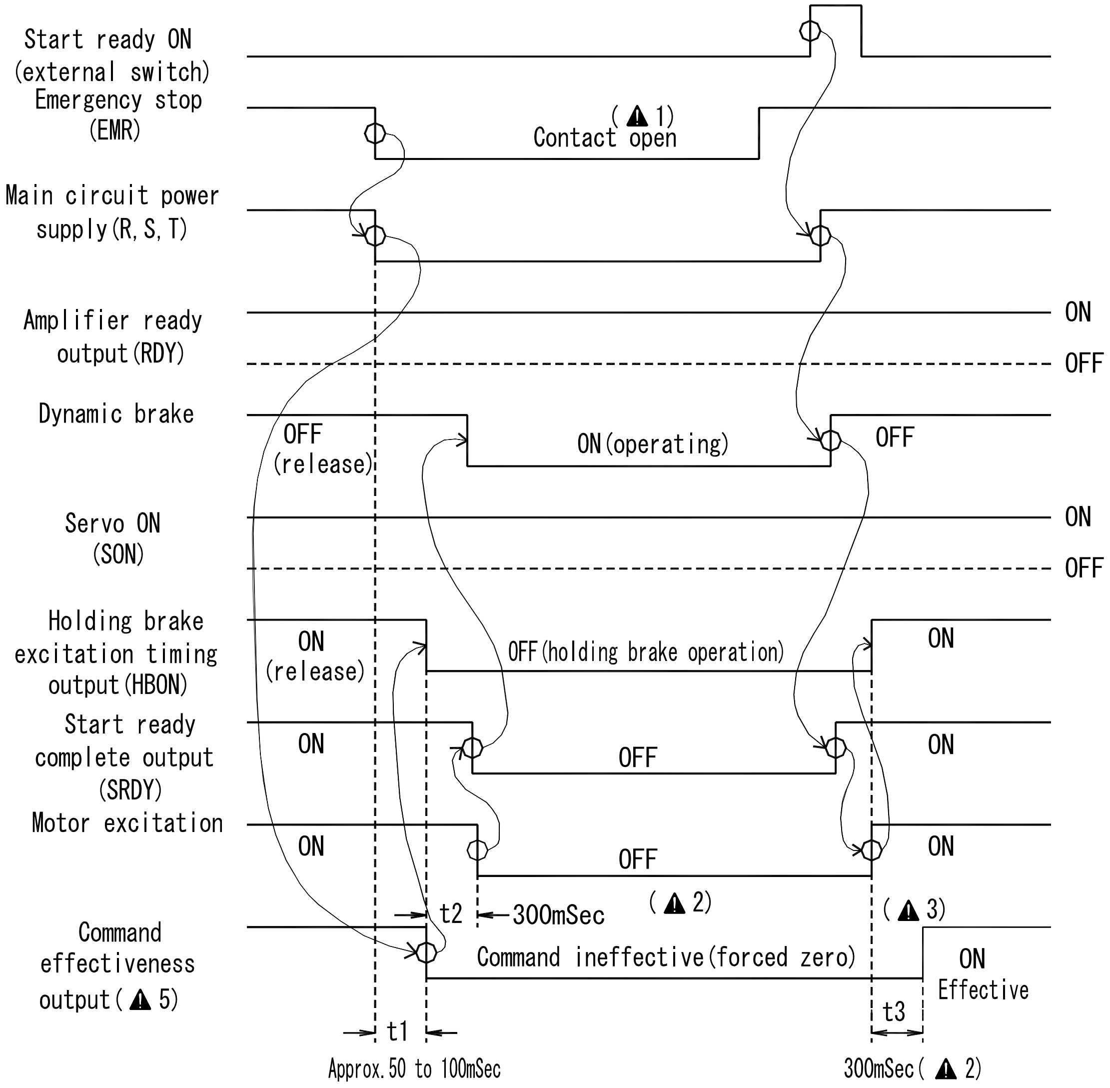


Fig. 6-1

1 The dotted line denotes an option.
2 When using an external regenerative resistor, remove the continuous line (short bar).

6.1.2 Stop Sequence

6.1.2.1 Stop and recovery due to emergency stop input



1 • Release "emergency stop" before inputting "start ready".

2 • The holding brake timing (standard value 300ms, in Parameter Mode 1 on page 13) can be changed to 0 to 1sec. However, when it is set at 0msec, command ineffective (forced zero) status continues for 4msec after SON.

• The current is limited by the sequence current limit value (standard value 120 %, in parameter Mode 1 on page 12) between t2 and t3.

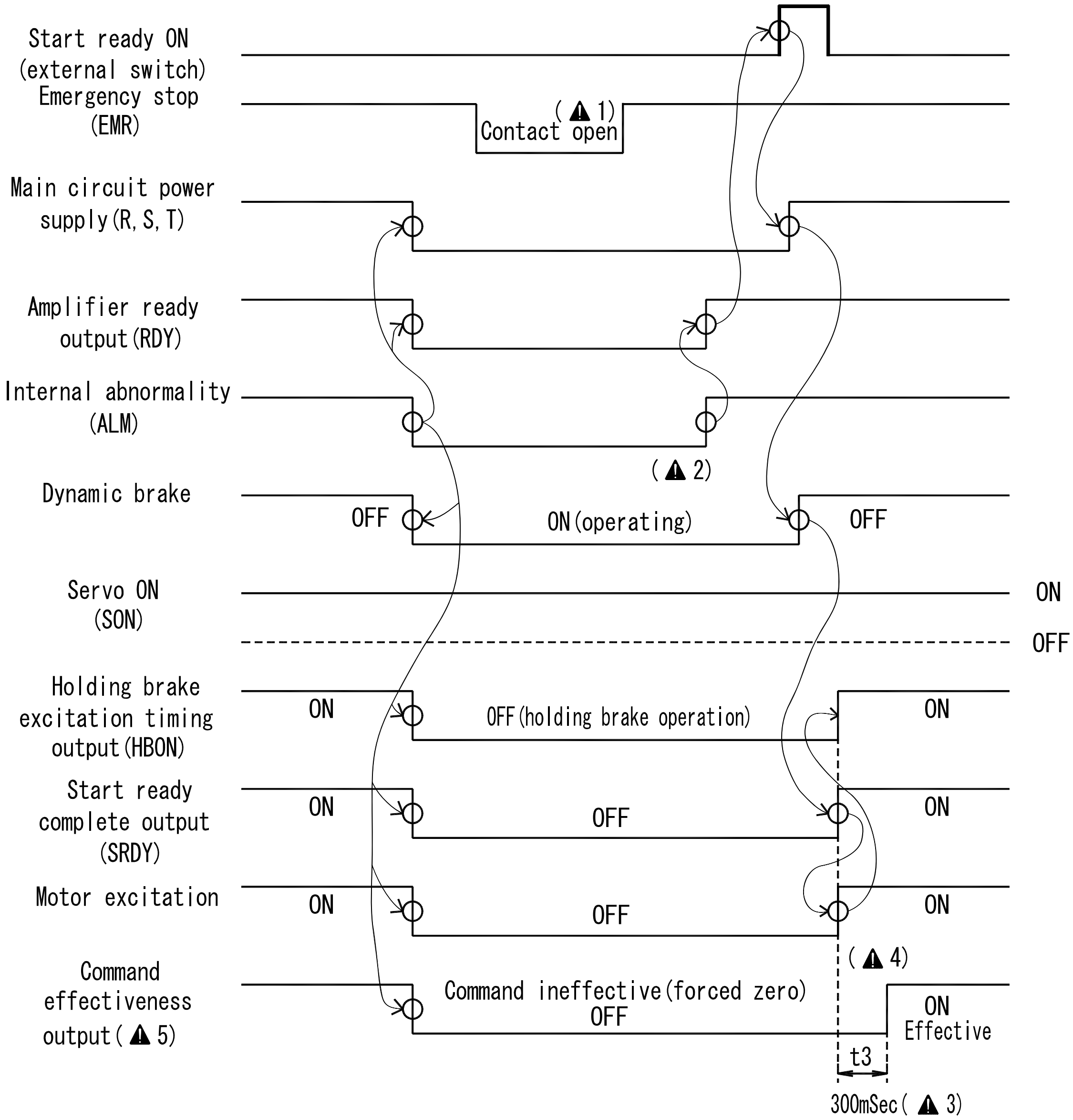
3 • It is possible to make commands ineffective (forced zero) during t3 after SON by setting Func1 bit5 to "0" when setting parameters. In case of the position control type, however, the command pulse remains as a deviation for t3.

• It is possible to make commands effective immediately after SON by setting Func1 bit5 to "1" when setting parameters. However, the sequence current limit value is applied when switching from SON to SOFF and is not applied when switching from SOFF to SON.

4 • If an emergency stop occurs in a heavy load status, MPE (Main circuit Power Error, alarm “9”) may be activated.

5 • It is possible to output the command effectiveness from CN1-39 and 40 pins by using parameter Func4.

6.1.2.2 Stop and recovery due to an internal error



1 • In an internal error status, inputting "emergency stop" has no effect.
However, release it before inputting "start ready".

2 • As per the alarm reset sequence.

3 • The holding brake timing (standard value 300ms, in Parameter Mode 1 on page 13) can be changed to 0 to 1sec. However, When it is set at 0msec, command ineffective (forced zero) status continues for 4msec after SON.

• The current is limited by the sequence current limit value (standard value 120 %, in parameter Mode 1 on page 12) within 300msec.

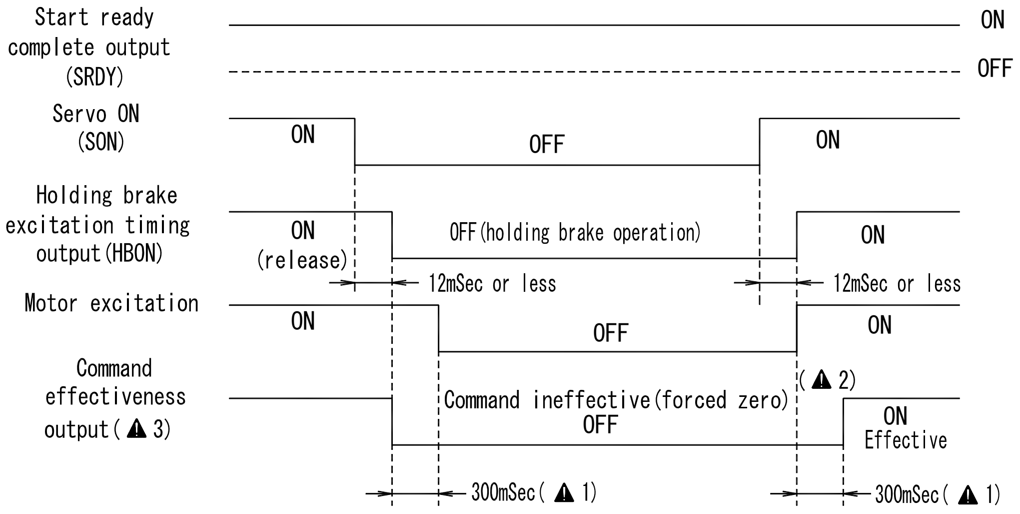
4 • It is possible to make commands ineffective (forced zero) for 300msec after SON by setting Func1 bit5 to "0" when setting parameters. In case of the position control type, however, the command pulse remains as a deviation for 300msec.

• It is possible to make commands effective immediately after SON by setting Func1 bit5 to "1" when setting parameters. However, the sequence current limit value is applied when switching from SON to SOFF and is not applied when switching from SOFF to SON.

5 • It is possible to output the command effectiveness from CN1-39 and 40 pins by using parameter Func4.

6.1.3 Servo OFF Sequence

6.1.3.1 When holding brake timing THB is set at 300msec (standard)



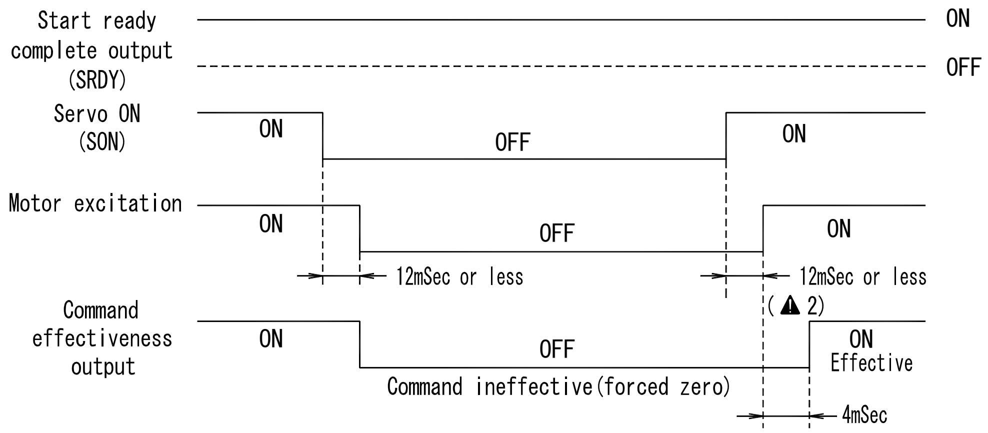
1 • The current is limited by the sequence current limit value (standard value 120%, which is changed in Parameter Mode 1 on Page 21) for 300mSec.

2 • It is possible to make commands ineffective (forced zero) for 300msec after SON by setting Func1 bit5 to "0" when setting parameters. In case of the position control type, however, the command pulse remains as a deviation for 300msec.

• It is possible to make commands effective immediately after SON by setting Func1 bit5 to "1" when setting parameters. However, the sequence current limit value is applied when switching from SON to SOFF and is not applied when switching from SOFF to SON.

3 • It is possible to output the command effectiveness from CN1-39 and 40 pins by using parameter Func4.

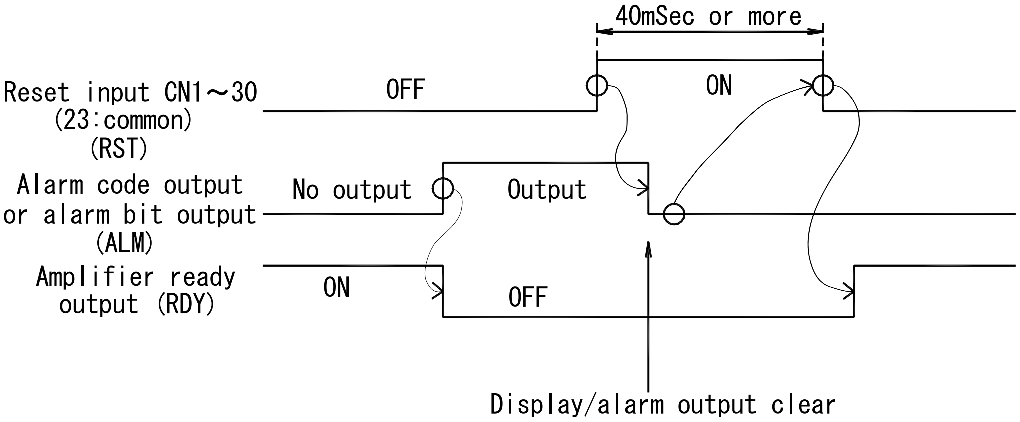
6.1.3.2 When holding brake timing THB is set at 0msec (⚠ 1)



1 This setting cannot prevent a self-weight fall by using "holding brake excitation timing output". Secure command input timing that does not hold off braking.

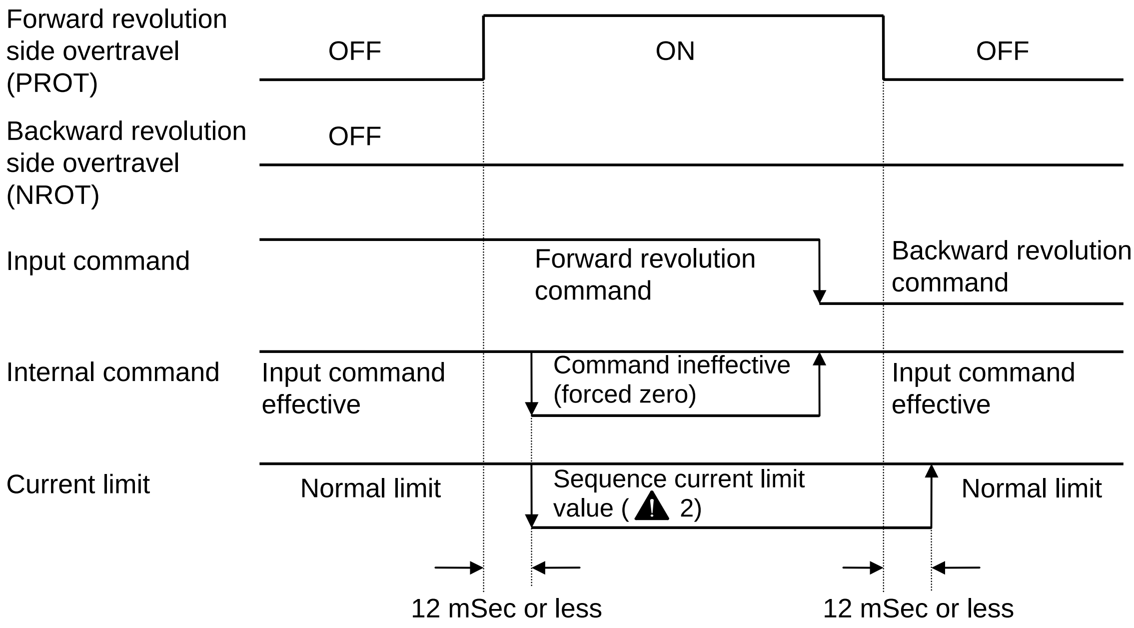
2 It is possible to make commands effective immediately after SON regardless of THB setting, by setting Func1 bit5 to "1" when setting parameters.

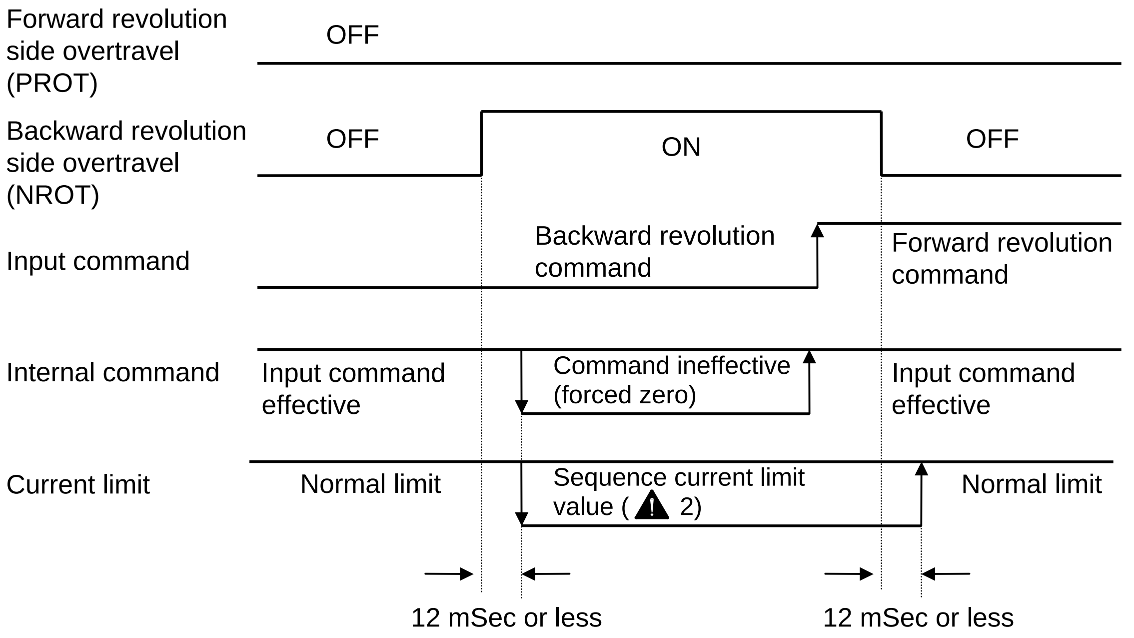
6.1.4 Alarm Reset Sequence



1. Regarding the upper controller, turn off "reset input" after checking that no alarm occurs by watching the alarm output.
2. When the alarm status continues in spite of "reset input", the alarm output is not cleared. It is necessary to set a time-out period of 40 mSec or more to return "reset input" to the original status.
3. Sensor error (DE), servo processor error (DSPE), memory error (MEME) and CPU error (CPUE) cannot be reset unless the control power supply is turned off.
4. The battery alarm (AEE) output will not be cleared unless "encoder clear" is operated.

6.1.5 Overtravel Sequence





1 Operation of command invalidation (forced zero) differs between the position and velocity control types. For the position control type, command pulses are inhibited, and for the velocity control type, the velocity command becomes zero (VCMD = 0). These settings are validated when the acceleration/deceleration time (Tvac, Tvde) or low pass filter (VLPF) parameter is set.

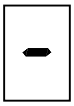
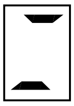
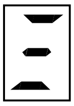
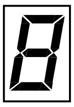
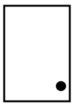
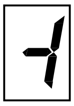
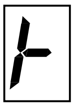
2 Sequence current limit value can be changed by SILM in the Parameter Mode 1 on Page 12.

6.2 Display

The Servo Amplifier status and alarms are displayed by LED and 7-segment LED .

6.2.1 Status Display

Table 6-1 Status Display

Display	Explanation of status
LED POWER ON	The control power supply of +5 V is set up.
7-segment LED 	The control power supply (r, t) is set up and the "amplifier ready output (RDY)" signal is ON.
7-segment LED 	The main power supply (R, S, T) is being turned on or set up but the "start ready complete" signal is OFF.
7-segment LED 	The main power supply (R, S, T) is set up and the start ready complete" signal is ON.
7-segment LED Rotates in the form of the figure 8. 	The "Servo ON" signal is ON.
7-segment LED 	This indicates a battery warning status due to the lowering of the external battery power when an absolute encoder is used. (Replace the external battery.) ⚠
7-segment LED 	In the position/velocity control type, the forward revolution side is in an overtravel status.
7-segment LED 	In the position/velocity control type, the backward revolution side is in an overtravel status.
LED CHARGE ON	The smoothing capacitor of the main power supply is being charged. <While this LED is ON, be careful about a high voltage.>

⚠ When the alarm history is displayed by 7-segment LED , the battery warning "." is not displayed.

6.2.2 Alarm Display

For alarm display, refer to the paragraph pertaining to troubleshooting in "Maintenance".

6.3 Make Sure to Check the Function at First

The parameter setting at the first power ON is assumed to be a standard setting.
In taking a runaway into consideration, be sure to fasten the motor to a fixing table or the like, and also do not apply any load to its shaft side.
Wire the power supply so that it can be immediately cut off in case of an emergency.

6.3.1 Minimum Wiring

1 Wire AC200V to terminals r and t of the terminal block of the Servo Amplifier (hereinafter shall be referred to amplifier).

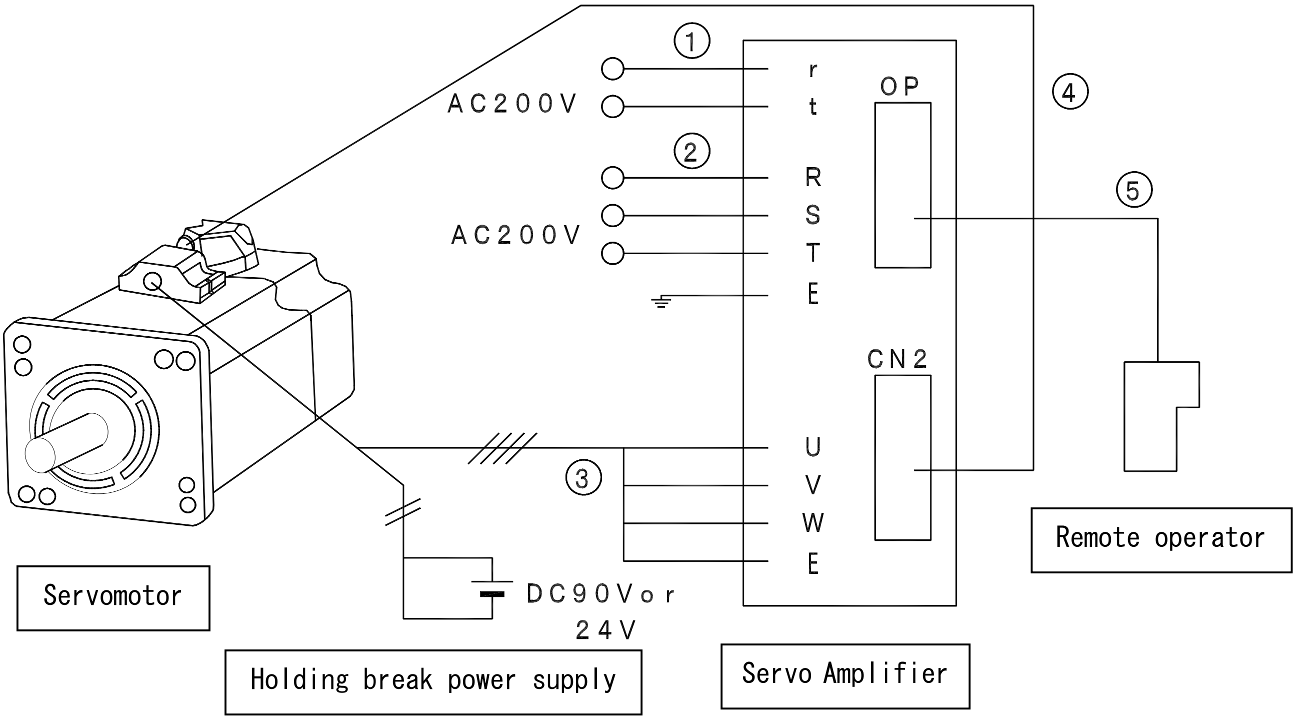
2 Wire AC200V to terminals R, S and T of the amplifier terminal panel.
Ground the E ⏚ terminal of the terminal panel.

3 Wire the motor power cable to terminals U., V., W. and E. of the amplifier terminal panel.

4 Wire the encoder cable to amplifier connector CN2.

5 Connect the remote operator to the amplifier connector OP.

6 When a brake is fitted with the motor, apply a specified voltage to the brake cable and release the brake.



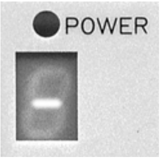
6.3.2 Jog Operation

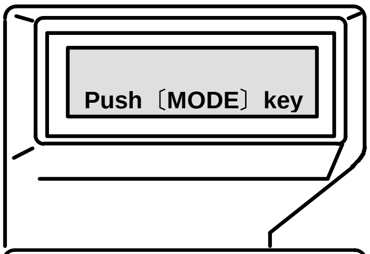
7 Turn ON the AC200V of r-t (① wires).

→ The servo amplifier POWER and the right-hand figure portion of 7-segment LED are lighted.

→ When the 7-segment LED displays “U”, proceed to section 6.4.

→ The remote operator screen display becomes the [Push Mode Key] screen as shown on the right and a “beep” sound is emitted.

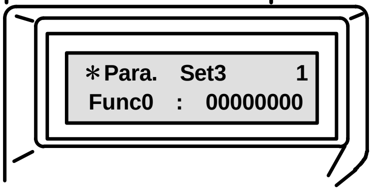




```
Push〔MODE〕key
```

8 Change the remote operator setting and reset the OT (over travel) signal.
The procedure is as follows :

Repeat pushing ON MODE , 2 and △ or ▽ keys
until the right screen appears.

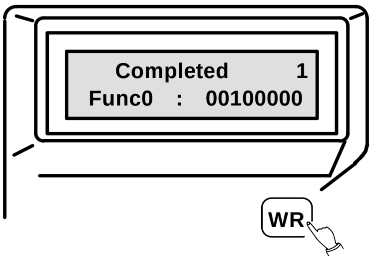


```
＊Para.  Set3       1
Func0  :  00000000
```

Push the ▷ , ▷ key twice and the 1 key once so that the right screen will appear.

```
＊Para.  Set3       1
Func0  :  00100000
```

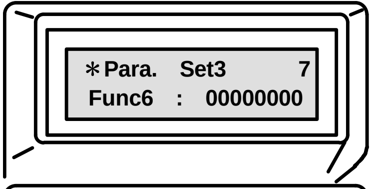
Push the WR key so that the right screen will appear.



```
  Completed        1
Func0  :  00100000
```

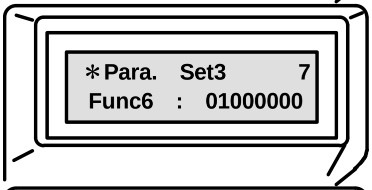
9 Make the JOG operation function effective using the remote operator.

Push the ▽ key a few times until the right screen appears.



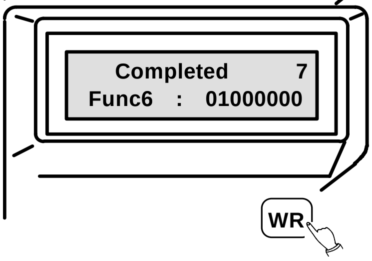
```
＊Para.  Set3       7
Func6  :  00000000
```

Push the ▷ and 1 keys in that order so that the right screen will appear.



```
＊Para.  Set3       7
Func6  :  01000000
```

Push the WR key so that the right screen will appear.

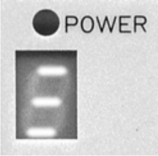


```
  Completed        7
Func6  :  01000000
```

The above-mentioned Func6 bit 6 returns to 0 from 1 when the power is turned on again.

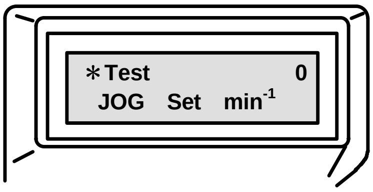
10 Turn on the AC200V (② wires) of R-S-T.

The 7-segment LED is light as shown in the right figure.

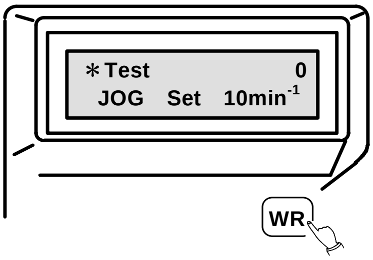


11 Start the JOG operation.

Push the ON MODE and 7 keys so that the right screen will appear.

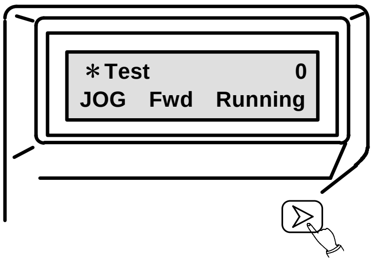

∗Test 0
JOG Set min^{-1}

Push the ▷ , 1 and WR keys so that the right screen will appear.


∗Test 0
JOG Set 10min^{-1}

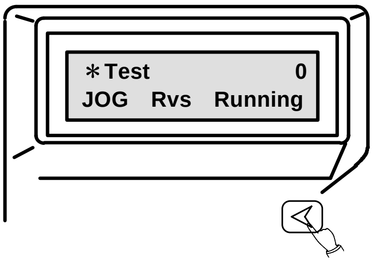
The 7-segment LED draws a figure of 8.

Continue pushing the ▷ key until the right screen appears.


∗Test 0
JOG Fwd Running

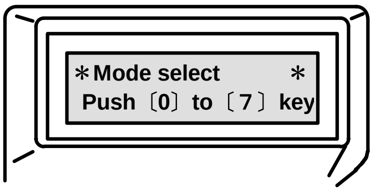
The remote operator keeps sounding “beep, beep” and the motor rotates counterclockwise (CCW) in 10 min^{-1} when viewed from its shaft side.

Then continue pushing the ◁ key until the right screen appears.
In this mode, the motor rotates clockwise (CW) in 10 min^{-1}.

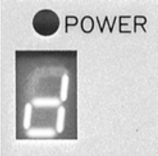

∗Test 0
JOG Rvs Running

12 Return to original mode.

Push the 0 and ON MODE keys so that the right screen will appear.


∗Mode select ∗
Push 〔0〕 to 〔7〕 key

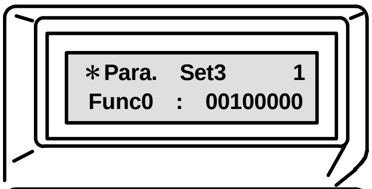
By this, the JOG operation ends.



6.3.3 Resetting and Turning the Power off

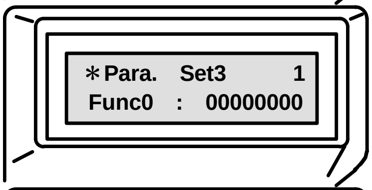
13 Change the remote operator setting and reset the OT.
Then, operate the remote operator according to the following procedure.

Repeat pushing the ON MODE , 2 and △ or ▽ keys until the right screen appears.



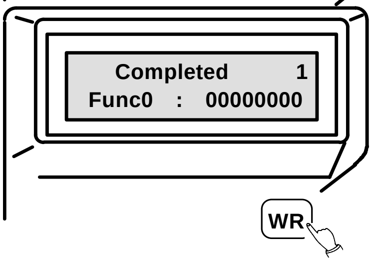
```
＊Para.   Set3        1
Func0   :   00100000
```

Push the ▷ , ▷ and 0 keys so that the right screen will appear.



```
＊Para.   Set3        1
Func0   :   00000000
```

Push the WR key so that the right screen will appear, completing operation.



```
   Completed         1
Func0   :   00000000
```

14 Turn off the AC200V of R-S-T.

15 Turn off the AC200V of r-t.

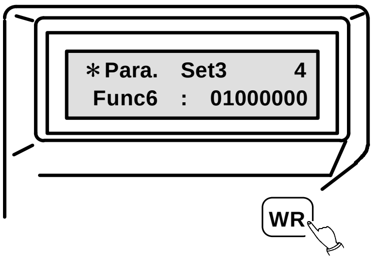
16 If the brake is fitted with the motor, turn off the brake power.

6.4 Encoder Clear Using Remote Operator (When Absolute Encoder is Used)

When the power is first turned on after the amplifier and the motor are wired, the alarm "U" (battery alarm) may come on even though a lithium battery is connected. This is because, when an absolute encoder is used, the absolute position is not fixed inside the encoder if the battery backup is less than 20 hours, causing an alarm to be output. The encoder can be cleared without wiring for CN1 encoder clear signal by executing ECLR (mode 7, page 4) using the remote operator and turning the power on again, which releases the battery alarm.

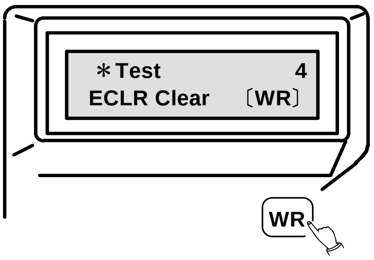
1 Make the test mode effective.

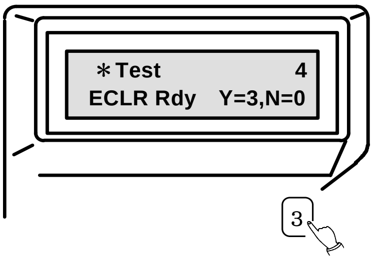
Press the ON MODE key and the 2 key, then select Func6 and set the bit6 to "1".
Press the WR key.



2 Perform ECLR.

Press the ON MODE key and the 7 key, then select ELCR on page 4.
Press the WR key, and press the 3 key down for 4 seconds or more.
Press the 0 key and the ON MODE key to terminate the test mode.



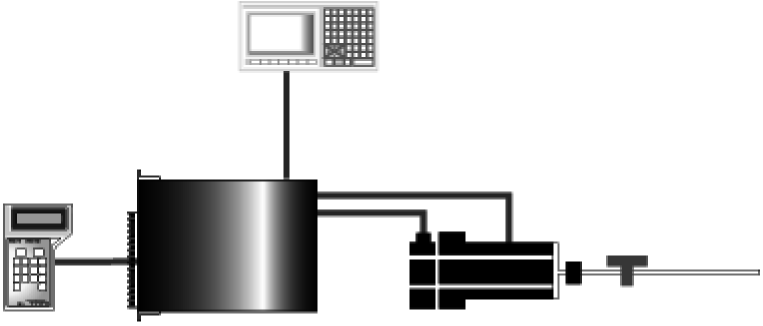


3 Turn on the power again.

4 The alarm "U" will be cleared.

1. Our recommendation: Use a Toshiba lithium battery (ER6V: 3.6V, 2,000mAh).
   The battery life is estimated at approximately 6 years.
2. On the ABS-E absolute encoder, alarm “8” (sensor error) may be issued after the power is turned on for the first time after the amplifier and motor are wired. This is because the voltage to be supplied to the sensor is lowered due to charging to the capacitor in the encoder. The alarm can be reset by turning the control power on again.

EXPLANATION OF PARAMETERS



7. EXPLANATION OF PARAMETERS

7.1 Remote Operator (Optional)

This section explains the basic operation of the remote operator. By using the remote operator, parameter change, monitoring of velocity and current, alarm trace and various tests are possible.

7.1.1 Outline of Remote Operator

The following figure shows the remote operator.

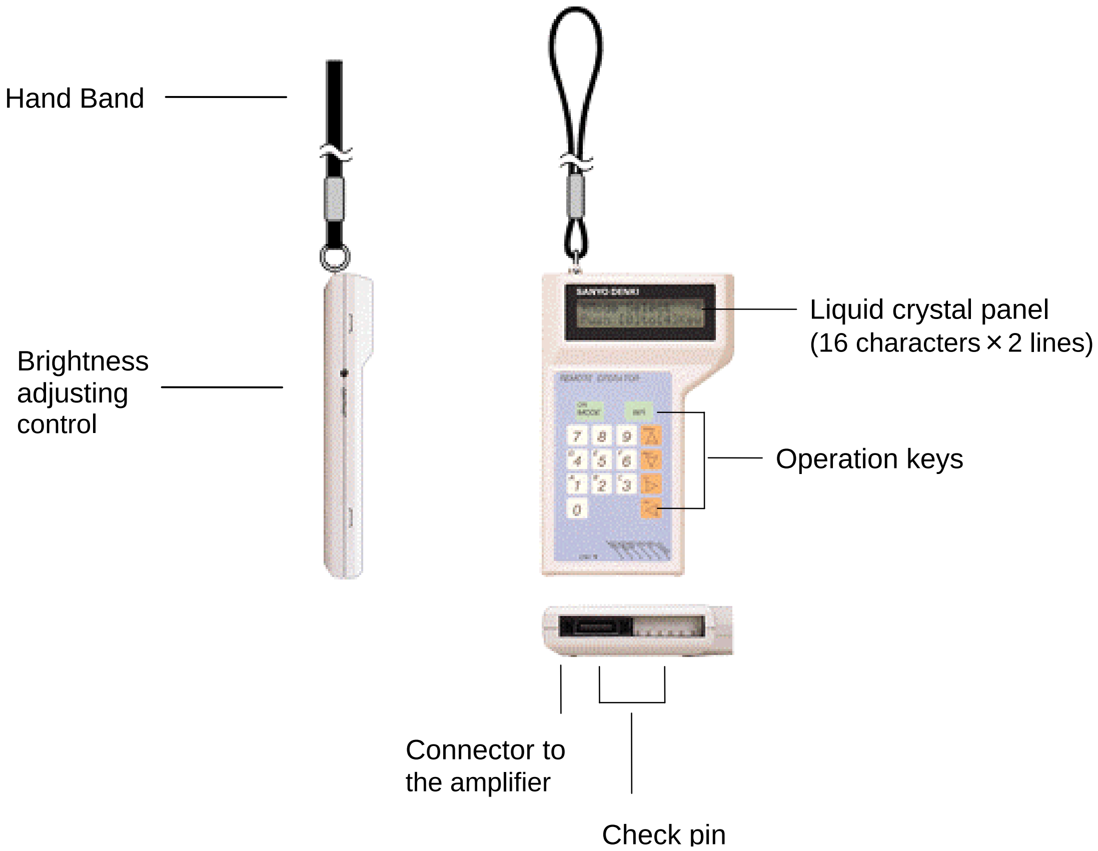


Fig. 7-1 Remote Operator

Since the liquid crystal panel may be broken if the remote operator is dropped, handle it with care.

Table 7-1 Specifications of Remote Operator

Item	Specification	
Power supply	Supplied from the Servo Amplifier	
Connection method	Connector connection using an exclusive cable (cable length: 2 m)	
Ambient temperature	During operation status 32°F to 122°F (0°C to 50°C)	During storage –4°F to +149°F (–20°C to +65°C)
Working atmosphere	Free from oil mist, corrosive gas and dust	

7.1.2 Function Table

The following table shows the function of the remote operator.

Table 7-2 Functions of Remote Operator

Mode	Screen No.	Function
Setting mode	0	Directly enters user parameters by key-in operation.
	1	Directly enters user parameters by key-in operation.
	2	Directly enters user parameters by key-in operation.
Up/down mode	3	Allows values to be incremented or decremented using the "1" (increment) and "0" (decrement) keys.
Select mode	4	Allows user parameters to be selected from the screen display.
Monitor mode	5	Displays various monitors on the screen. • Status monitor • Input monitor • Output monitor • Velocity command • Velocity • Current command • Current • Position deviation counter value • U-phase electric angle • Position command frequency • Absolute value • Position free-run counter value • Estimated effective torque value • Position loop gain • Velocity loop proportional gain • Velocity loop integral time constant
Alarm trace mode	6	Display 8 alarms (the current one plus the past seven alarms)
Test mode	7	Allows various test modes to be operated: • JOG operation • Servo tuning • Automatic offset (velocity and torque commands) • Encoder clear
Setting mode	8	Allows user parameters to be entered directly from the key pad.

Table 7-3 Functions of Remote Operator Check Pin

Name	Description
VCMD	Monitors the velocity command (CN1 - 21 pin input).
M1	Monitors the same as the amplifier monitor 1 output.
M2	Monitors the same as the amplifier monitor 2 output.
SG	Signal ground. (Common to amplifier SG)
DM1	Outputs the internal status to the monitor (motor excitation). (It goes high when the motor is excited.)
DM2	Outputs the internal status to the monitor (alarm). (It goes high when the alarm is on.)

7.1.3 Basic Operation Procedure

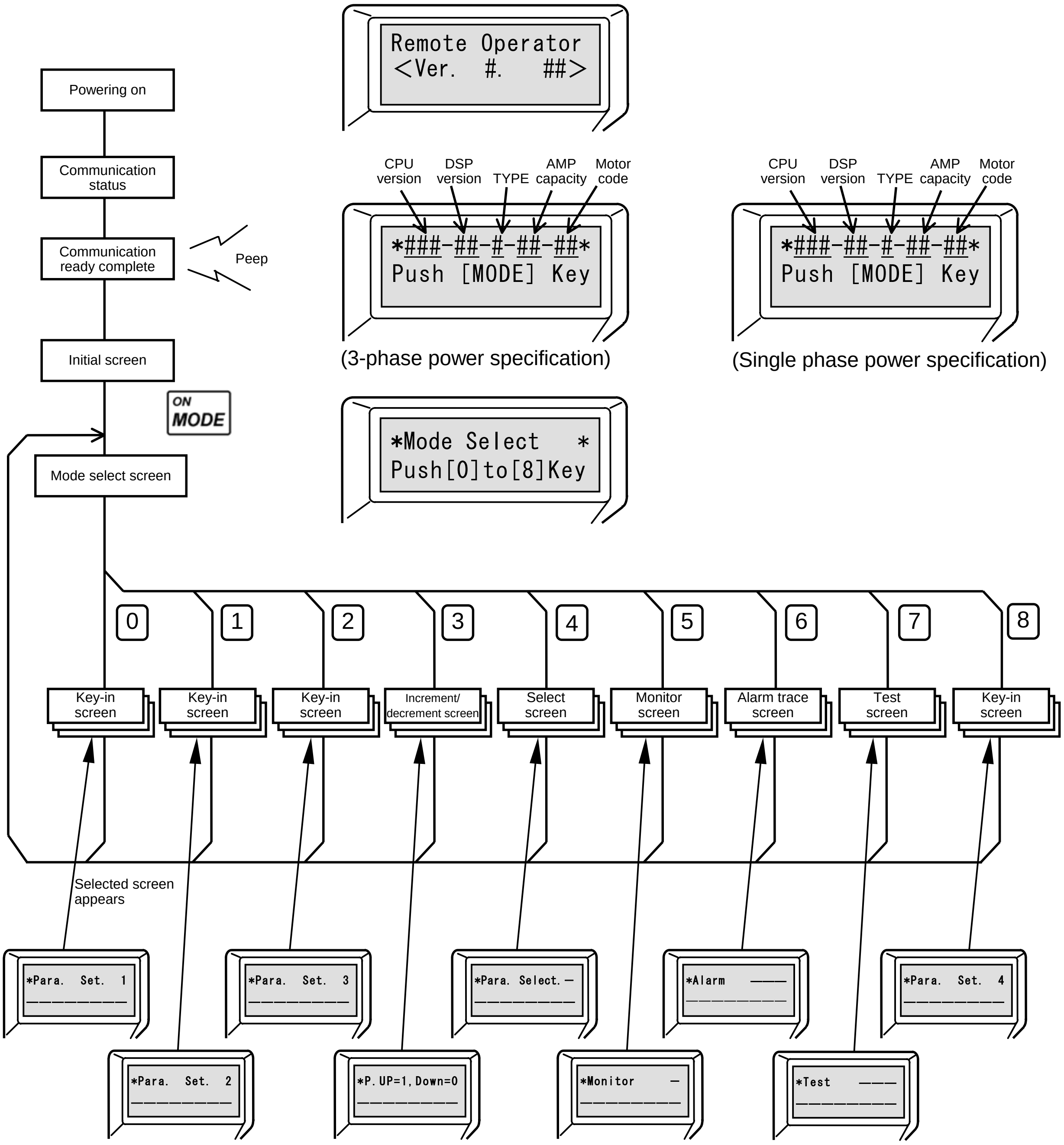


Fig. 7-2 Basic Operation of Remote Operator

The Mode 8 screen is available by choosing "Select" from Mode 4 Page 2 (GAIN).
This screen, however, is not available when the "Fix" mode is selected.

If a no-operation status continues for about 3 minutes, the liquid crystal display disappears.

To re-start, press the ON MODE key.

7.1.4 Parameter Setting Mode (Screen Mode 0 to 2 and 8)

Various Servo Amplifier parameters can be directly set in this mode from the keys.

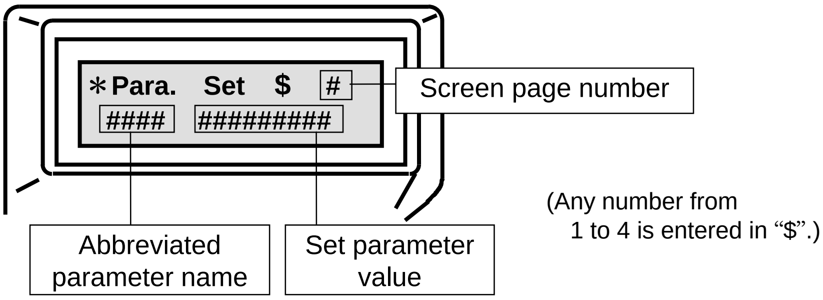


Fig. 7-3 Parameter Setting Mode Screen

Table 7-4 Parameters for Screen Mode 0

Page No.	Abbreviation	Name	Setting range	Unit
0	Kp	Position loop gain	1 to 1000	rad/S
1	Kff	Feed forward gain	0 to 100	%
2	Kvp	Velocity loop proportional gain	10 to 3000	Hz
3	Tvi	Velocity loop integral time constant	1 to 1000	mSec
4	FLPF	Feed forward LPF	1 to 1000	Hz
5	VLPF	Velocity command LPF	1 to 1000	Hz
6	ILPF	Current command LPF	1 to 1000	Hz
7	IBF1	Current command BEF1	200 to 1000	Hz
8	IBF2	Current command BEF2	IBF1 to 1000	Hz
9	Tpcm	Position command LPF time constant	0 to 4000	mSec
10	Tvac	Velocity command acceleration time	0 to 9999	mSec
11	Tvde	Velocity command deceleration time	0 to 9999	mSec
12	KvpA	Velocity loop proportional gain addition value	0 to 255	Hz

Table 7-5 Parameters for Screen Mode 1

Page No.	Abbreviation	Name	Setting range	Unit
0	INP	Positioning complete signal width	1 to 32767	P (+/–)
1	OVF	Excess deviation over value	1 to 32767	×256P
2	EGER	Electronic gear ratio	1/32767 to 32767/1	
3	PMUL	Command pulse multiplier	1 to 63	
4	ENCR	Output pulse dividing ratio	1 to 1/8192	
5	LTG	Low speed	0 to 32767	min^{-1}
6	HTG	High speed	0 to 32767	min^{-1}
7	SPE	Speed matching width	0 to 32767	min^{-1}
8	VCI1	Internal velocity command value 1	0 to 32767	min^{-1}
9	VCI2	Internal velocity command value 2	0 to 32767	min^{-1}
10	VCI3	Internal velocity command value 3	0 to 32767	min^{-1}
11	IILM	Internal current limit value	30 to (IP/IR)×100	%
12	SILM	Sequence current limit value	30 to (IP/IR)×100	%
13	THB	Holding brake excitation timing	0 to 1000	mSec
14	VCMS	Velocity command scale	0 to 3000	min^{-1}/V
15	TCMS	Torque command scale	0 to 400	%/V
16	MENP	Motor encoder pulse number	500 to 65535	P/R
17	EENP*	Full close encoder pulse number	500 to 65535	P/R

* Page 17(EENP) is available only for the servo system that supports the full close encoder.

* Page 16(MENP) and 17(EENP) are enabled only after the control power has been turned on.

Table 7-6 Parameters for Screen Mode 2

Page No.	Abbreviation	Name	Setting range	Unit
0	PMOD	Command pulse train format	0, 1	
1	Func0	Amplifier function select 0	0, 1	
2	Func1	Amplifier function select 1	0, 1	
3	Func2	Amplifier function select 2	0, 1	
4	Func3	Amplifier function select 3	0, 1	
5	Func4	Amplifier function select 4	0, 1	
6	Func5	Amplifier function select 5	0, 1	
7	Func6	Amplifier function select 6	0, 1	

Table 7-7 Parameters for Screen Mode 8

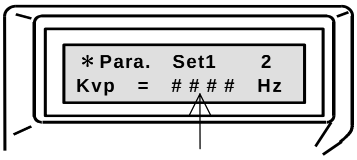
Page No.	Abbreviation	Name	Setting range	Unit
0	Kp2	Position loop gain 2	1 to 1000	rad/s
1	Kvp2	Velocity loop proportional gain 2	10 to 3000	Hz
2	Tvi2	Velocity loop integral time constant 2	1 to 1000	mSec

* You can turn on Screen Mode 8 by choosing "Select" from Mode 4 Page 2 (GAIN).
This screen, however, is not available when the "Fix" mode is selected.

- **Setting practice**

For example, set the speed loop proportional gain to 100 Hz.
According to the basic operating procedure, select 0 from the Mode Select screen, then implement the following operations:

1 Select page 2 using by △ or ▽ key.

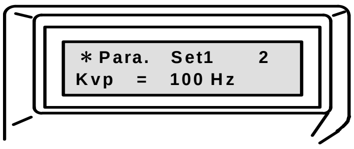


```
＊Para.  Set1     2
Kvp   =  ####  Hz
```

The cursor flashes.

2 Move the cursor to the position corresponding to the desired number of input digits using ▷ or ◁ key.

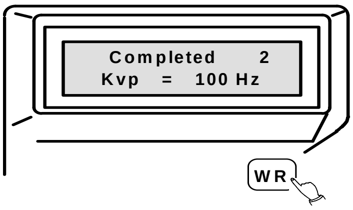
3 Continuously enter 1 0 0 using the 0 to 9 keys.



```
＊Para.  Set1     2
Kvp   =  100 Hz
```

4 The set value is stored in the nonvolatile memory using WR key and the remote operator operates with the set value.

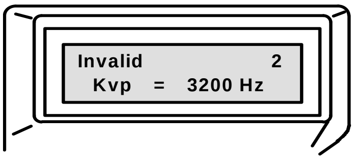
After completion of the setting, the screen turns as shown in the figure.



```
  Completed      2
  Kvp   =   100 Hz
```

If a value out of the setting range is to be stored in memory, the screen to the right appears and storing is not performed.

In this case, retry setting from step 2.



```
Invalid              2
  Kvp   =   3200 Hz
```

When, for instance,
you tried to store 3200 Hz.

5 Press ON MODE to return to the initial screen.
To set the next page, start with step 1.

7.1.5 Parameter Increment/Decrement Mode (Screen Mode 3)

This mode allows you to increment or decrement parameter values usig the increment (“1”) and decrement (“0”) keys.

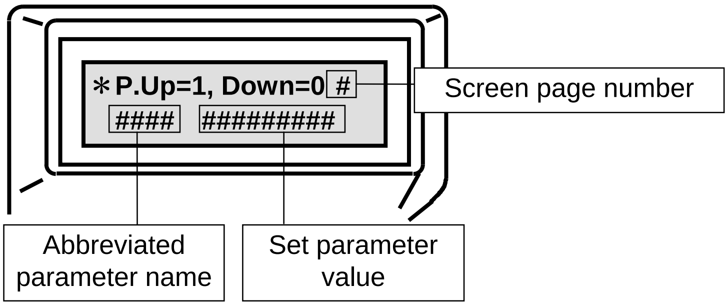


Fig. 7-4 Parameter Increment/Decrement Mode Screen

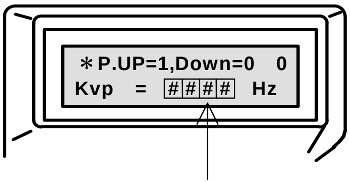
Table 7-8 Parameters for Screen Mode 3

Page No.	Abbreviation	Name	Setting range	Unit
0	Kp	Position loop gain	1 to 1000	rad/s
1	Kvp	Velocity loop proportional gain	10 to 3000	Hz
2	Tvi	Velocity loop integral time constant	1 to 1000	mSec
3	Vzero	Velocity command zero adjustment	±16383	
4	Tzero	Torque command zero adjustment	±16383	

- **Setting practice**

The following describes the procedure for selecting, for instance, 100 Hz for the position loop gain. According to the basic operating procedure, select 3 from the Mode Select screen.
Then,

1 Select page 0 using by △ or ▽ key.

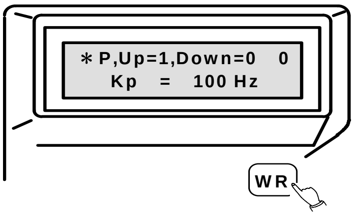


∗P.UP=1,Down=0 0
Kvp = #### Hz

The cursor flashes.

2 Using the ▷ or ◁ key, move the cursor to the digit(s) to be modified.

3 As needed, increase or decrease the number in each digit using the 1 or 0 key (the value you specify will be immediately reflected in the operation).

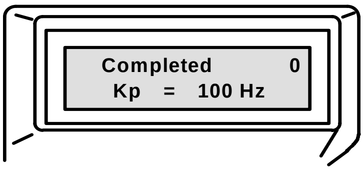


∗P,Up=1,Down=0 0
Kp = 100 Hz

4 Using the WR key, store your setting in the non-volatile memory.
(Current screen data is also stored in memory if you exit using the ON MODE or △ / ▽ keys.)

Upon completion of the setting, the screen shown to the right appears.

(The "Completed" message does not appear when you use the ON MODE or △ / ▽ keys.)



Completed 0
Kp = 100 Hz

5 Press the ON MODE to return to the initial screen.
For setting another page, repeat the above steps from 1.

In order to store a modified parameter value in the non-volatile memory, you must press
either the WR , ON MODE or △ / ▽ keys.
Otherwise, the modified data will not be stored.

7.1.6 Parameter Select Mode (Screen Mode 4)

This mode allows you to set data according to the screen display.

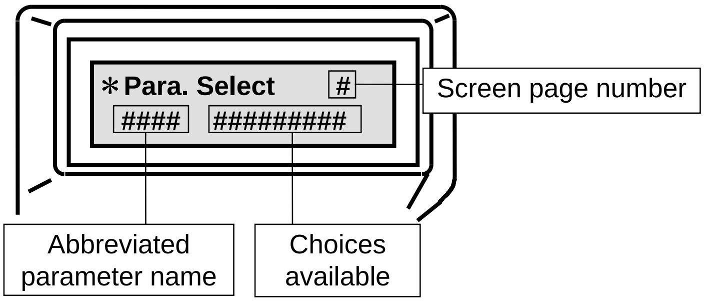


Fig. 7-5 Parameter Select Mode Screen

Table 7-9 Parameters for Screen Mode 4

Category	Page No.	Abbreviation	Name	Number of choices available
Normally used parameters	0	M1	Monitor 1 output	12
	1	M2	Monitor 2 output	12
	2	GAIN	Gain select	2
System parameters	3	TYPE	Control mode	6
	4	ENKD	Encoder type	3
	5	ABSF	ABS sensor format	11
	6	MOT.	Motor type	Any one from P1, P2, P3, P5, P6 and P8 series.

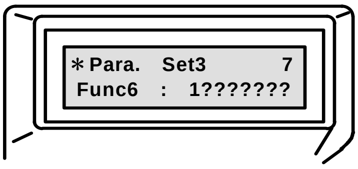
1 Modification of a system parameter is available only after you have set Func6 bit7 to “1” from Screen Mode 2 Page 7.

2 Note that modification of a system parameter is enabled only after the control power has been turned off.

- **Setting practice**

The following describes the procedure for selecting, for instance, the velocity control for the amplifier's control mode.
According to the basic operating procedure, select [4] from the Mode Select screen.
Then,

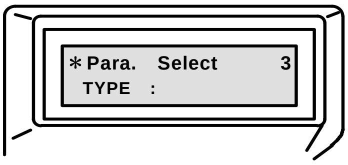
1 Set Func6 bit7 to “1” from Mode 2 Page 7.


∗Para. Set3 7
Func6 : 1???????

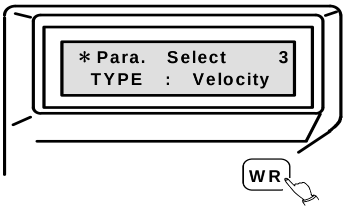
(?) appears before
the setting is down.

2 Select Mode 4.

3 Using the △ or ▽ key, select page 3.

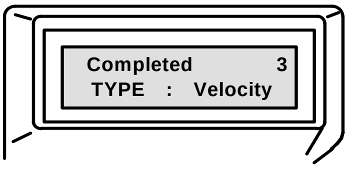

∗Para. Select 3
TYPE :

4 Using the ▷ or ◁ key, scroll the screen to select "Velocity".


∗Para. Select 3
TYPE : Velocity

5 Using the [WR] key, store your selection in the non-volatile memory.

As the setting completes, the screen shown on the right appears.


Completed 3
TYPE : Velocity

When you want to correct the setting, repeat the above steps from 4.

6 Press the [ON MODE] key to return to the initial screen.
For setting another page, repeat the steps from 3.

7 Turn the control power off to validate your setting (with normal parameters, you can validate the change using the [WR] key).

7.1.7 Monitor Mode (Screen Mode 5)

This mode is used for monitoring input/output status, velocity and current on the Servo Amplifier.

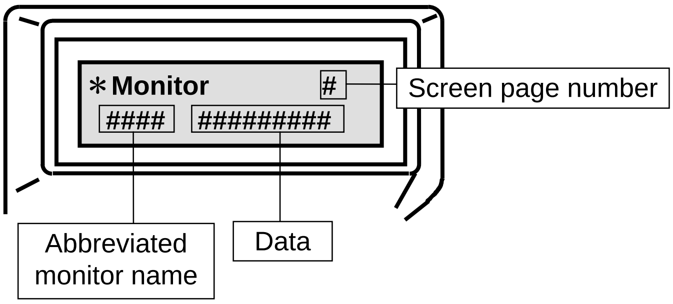


Fig. 7-6 Monitor Mode Screen

Table 7-10 Parameters for Screen Mode 5

Page No.	Abbreviation	Contents
0	STATUS	Indicates the internal status of the amplifier: Power off, servo ready, servo on and alarm.
1	INPUT	Indicates the CN1 input status in "1" or "0". bit 7 6 5 4 3 2 1 0 RST ILM PROT NROT CLE ECLR PCON SON Since bit2 and bit1 correspond to the input status of CN1-35 and 36 respectively, their input signals change according to the Func3 setting. The signal names shown in this table are the ones entered in the standard setting. The input becomes active at "1".
2	OUTPUT	Indicates the CN1 output status in "1" or "0". bit 7 6 5 4 3 2 1 0 ALM8 ALM4 ALM2 ALM1 HBON SRDY ILIM LTG (Note) Since bit 1 and bit0 correspond to CN1-40 and 39 respectively, their output signals change according to the Func4 setting. The signal names shown in the table are the ones output in the standard setting. Note) In the case of position control, the signal name is INP. "1" indicates the active output status.
3	VCMD	Indicates the velocity command. [min^{-1}] (⚠2)
4	VFBK	Indicates the velocity feedback. [min^{-1}]
5	ICMD	Indicates the current command. [I/IR×100%]
6	IFBK	Indicates the current feedback. [I/IR×100%]
7	Pos. E	Indicates the position deviation counter value. [pulse]
8	CSU	Indicates the U-phase electric angle. [deg]
9	PCMD f	Indicates the position command frequency. [pulse/s]
10	PS	Indicates the absolute value. [hexadecimal]
11	FCCNT	Indicates the position free-run counter value. [hexadecimal] (⚠1)
12	Trms	Indicates the effective torque. [Trms/TR×100%]
13	KpM	Indicates the position loop gain value. [rad/S]
14	KvpM	Indicates the velocity loop proportional gain value. [Hz]
15	TviM	Indicates the velocity loop integral time constant. [mSec]

1 Display of this parameter value is enabled only when the position loop full close encoder is selected. When the motor encoder is selected, "0" will be indicated.

2 It indicates input stage status of the analog velocity command.

<Monitoring method>

Select a page to be monitored using the △ or ▽ key.

Press the ON MODE key to return to the initial stage.

7.1.8 Alarm Trace Mode (Screen Mode 6)

This mode is used for displaying the alarm history.

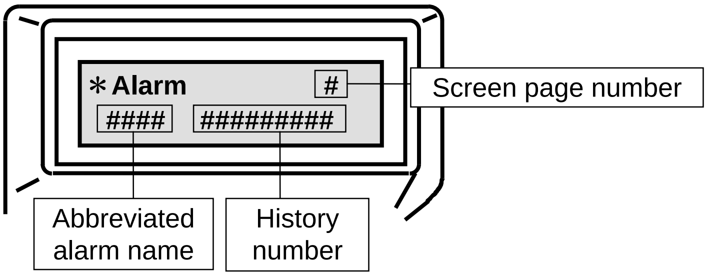


Fig. 7-7 Alarm Trace Mode Screen

Table 7-11 Screen Mode 6

Page No.	History No.	Abbrevi-ation	Name
0	Now		Current alarm
		None	No alarm
		OC	Power element error
		EXOH	External overheating
		OV	Overvoltage
		RGOH	Built-in regenerative resistor overheating
		PE	Control power supply voltage
		DE1	Sensor error
		DE2	Sensor error
		OL	Overload
		OS	Over-speed
		SE	Velocity control error
		OVF	Excessive deviation
		MPE	Main power error
		FP	Main power open-phase
		RGOL	Regenerative error
		DSPE	Servo processor error
		MEME	Memory error
		AEE1	Low battery
		DE3	Sensor error
		EXDE	Full close encoder error
		AEE2	Low battery
		DE4	Sensor error
1	Last 1		The last alarm
2	Last 2		The second alarm to the last
3	Last 3		The third alarm to the last
4	Last 4		The fourth alarm to the last
5	Last 5		The fifth alarm to the last
6	Last 6		The sixth alarm to the last
7	Last 7		The seventh alarm to the last

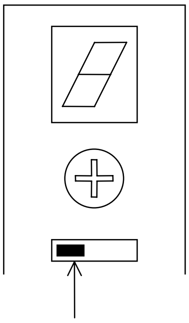
- **Tracing method**

The alarm history can be seen by using △ or ▽ key.

Press the ON MODE key to return to the initial screen.

○ Viewing the alarm history on the amplifier 7-segment LED.

- Set the GAIN/HISTORY selector switch located on the front of the amplifier to HISTORY.
- Using a small screwdriver, rotate the switch on the front of the amplifier.
- The numbers 1 and 2 on the switch correspond to the last alarm and the second to the last alarm, respectively.
- Selected alarm number is indicated on the [7-segment LED]. Its abbreviated name will appear in the adjacent [ALRM BLINK].



Set the switch to HISTORY to display the alarm history.

Fig. 7-8 Displaying the Alarm History

> As long as the alarm history is present on the 7-segment LED, display of the battery warning "." is not available.
>
> When the selector switch is set to HISTORY, the rotary switch must be positioned at "0".

The following table lists the abbreviated alarm names and corresponding errors.

Table 7-12 Abbreviated Alarm Names

7-seg.	Abbreviation	How to read
1	OC	Power element error
2	OL	Overload
5	OV	Overvoltage
6	OS	Over-speed
7	PE	Control power supply error
8	DE	Sensor error
9	MPE	Main power error
A	FP	Main power open-phase
C	SE	Speed control error
d	OVF	Excessive deviation
E	EXOH	External overheating
F	DSPE	Servo processor failure
H	RGOH	Built-in regenerative resistor overheating
J	RGOL	Regenerative error
P	MEME	Memory error
U	AEE	Low battery
No light	CPUE	CPU error

○ Clearing all alarm histories

- Select page 1 using the △ or ▽ key.
- Press the 0 and ◁ keys at the same time. This clears all the alarm histories (Last 1 to Last 7).
- Press the ON MODE key to return to the initial screen.

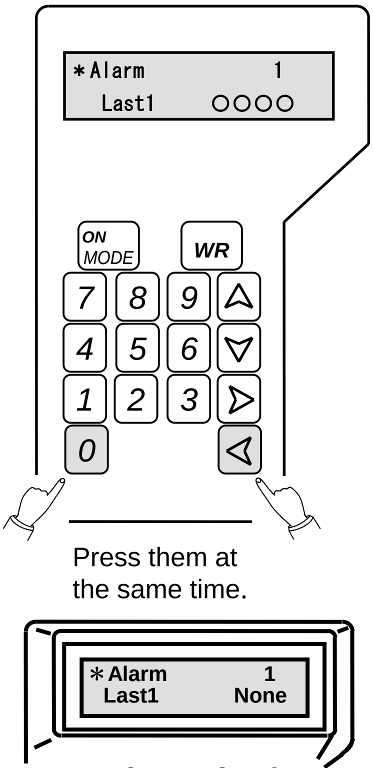


Fig. 7-9 Alarm Clearing Method

7.1.9 Test Mode (Screen Mode 7)

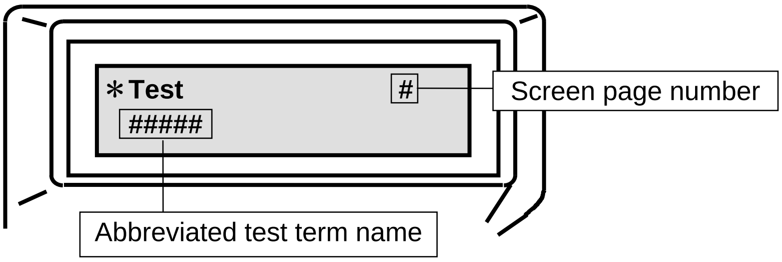


Fig. 7-10 Test Mode Screen

Table 7-13 Screen Mode 7

Page No.	Abbreviation	Description
0	JOG	Initiates JOG operation.
1	Tune	Implements servo tuning.
2	VCMD	Offers automatic offsets of the velocity command.
3	TCMD	Offers automatic offsets of the torque command.
4	ECLR	Performs encoder clear.

- **Before turning on the test mode**

1 Set Func6 bit6 to 1 from Screen Mode 2 Page 7.

- **When implementing JOG or Tune**

  1. When the control mode can be switched (between velocity and torque, position and torque, and position and velocity), turn off the input signal for switching.
  2. Set the command input to "0".
  3. Turn off the Servo ON (SON) signal.
     In the test mode, turn the forced Servo ON using the remote operator to output the holding braking excitation timing signal.
  4. Set up the main circuit power supply.
  5. When JOG or Tune is enabled in the test mode, the Servo ready signal is turned off.
  6. When the gain switching function through external input is enabled, turn the changeover input signal off (Tune only).
  7. When the side switch on the front of the amplifier is set to GAIN, change it to History (Tune only).
  8. Make sure to confirm the Servo ON state after pressing the WR key, and then perform the following operation.

- **After implementing JOG or Tune**

  1. If you return to the initial screen using the 1 key, the excessive deviation error will be indicated because a deviation can be left on the controller in this manner.
     This alarm, however, is not recorded in the alarm history.
     - Clear the alarm before starting normal operation of the remote controller.
     - You can suppress the excessive deviation alarm by setting parameter Func6 bit4 to "1".
     - For the position control type amplifier, you also need to enter the deviation clear.
  2. Since a deviation can be left on the user controller, you need to make sure that the command output from the controller is zero before turning on normal operation.
     (If the command is not zero, a sudden action can result.)

7.1.9.1 JOG Operation

- **Outline of JOG operation**

The motor can be rotated forward or backward at the revolution speed set from the remote operator. Pay attention to the following precautions.

- Starting the JOG operation turns on the velocity control mode whatever the currently selected control mode is.
- Forward revolution is performed by pressing the “→” key ("Fwd running" is indicated when the motor rotates counterclockwise as viewed from the load side).
- Secure enough motor operating range.
  In particular, when the load inertia is large or revolution speed is high, you must take the required deceleration time into consideration before operating the motor.
- During the JOG operation, current is limited by the sequence current limit value (standard value is 120% which can be changed from Parameter Mode 1 Page 12).
  So, large load inertia or load torque can increase the acceleration/deceleration time, thereby delaying the response time.
- If slow up/down is necessary for the motor speed, set the acceleration/deceleration time from Screen Mode 0 Page 10 and 11.
- During the JOG operation, overtravel is effective. For example, the motor is stopped if an overtravel status occurs on the forward revolution side while the motor is in forward revolution. No forward revolution input will be acceptable after that. Since the acceleration/deceleration time setting remains effective in the overtravel status, care should be taken with respect to the operating range.
- Since a position loop deviation may sometimes be left by JOG operation, be sure to perform "deviation clear" before returning to normal operation.

- **JOG operation procedure**

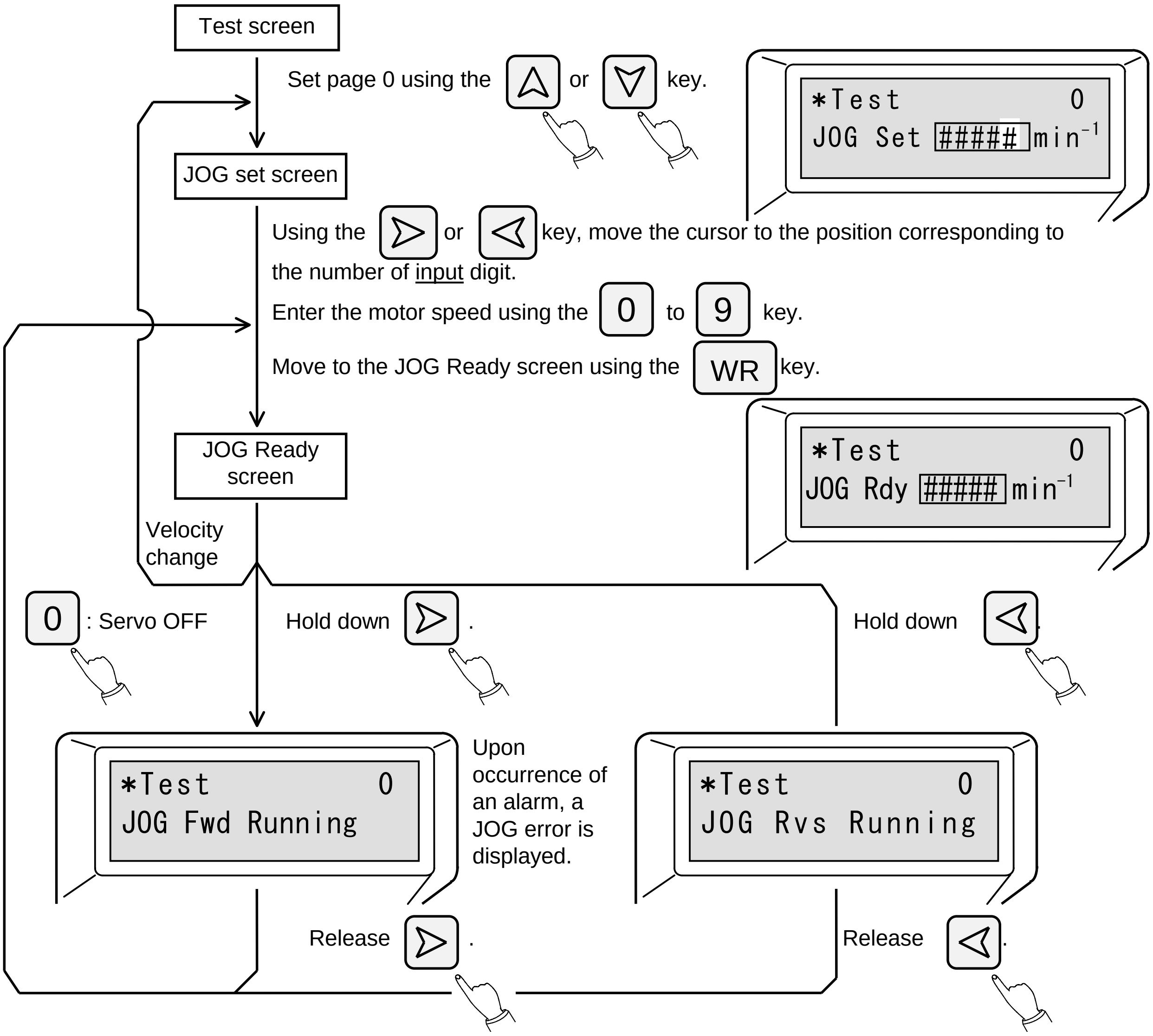
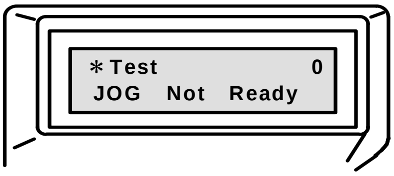


Fig. 7-11 JOG Operation Procedure

After [JOB] operation ends, press the 0 key to return to the set screen from the ready screen, then return to the initial screen using the ON MODE key.

When the initial screen is displayed again, the "OVF (excessive deviation)" alarm occurs. This alarm, however, is not indicated when Func6 bit4 is set to 1.

When [JOG] operation is disabled by a main circuit power off status or an alarm, the following message is displayed :



```
*Test            0
JOG   Not   Ready
```

When [JOG] operation is enabled, the [JOG] set screen appears.

7.1.9.2 Servo tuning function

- **Outline of servo tuning function**

  The servo tuning function operates the motor through the remote operator and estimates load inertia from its operating status. With this, proper parameters are automatically set. Four parameters for position loop gain (Kp), velocity loop proportional gain (Kvp), velocity loop integral time constant (Tvi) and current command LPF (ILPF) are set using this function.

- **Precautions on working and load conditions**

  If the servo vibrates before tuning when turned on, reduce the proportional gain Kvp and increase the integral time constant Tvi beforehand.
  When servo tuning is executed, forward/backward revolution is performed. Accordingly, secure one turn or more for both forward and backward revolution as the motor operating range.
  Use this function only when safety is secured even under vibrating conditions and no damage to the machine occurs.
  In the following cases, proper parameters may not be set by the servo tuning function or a tuning error may occur ("Tune Error" is displayed).

  - The load inertia is significantly larger than that allowed.
  - The variation in load inertia or torque is large.
  - The backlash of ball screws and gears is large.
  - The machine rigidity including couplings is low, causing machine resonance.
  - While the servo tuning function is executed, the remote operator is dismounted from the amplifier main body (remote operator POWER OFF).
  - While the servo tuning function is executed, the main circuit power supply is cut off or an alarm occurs.
  - When the output current is limited by current limit permit input.

- **Servo tuning operation**

  - For tuning rigidity to be tuned, select Low, Middle or High according to machine rigidity.
  - When servo tuning is executed, forward/backward revolution is performed for about 0.5 seconds with a torque command (equivalent to the rated torque at the peak) of about 60 Hz sine waveform.
    For the motor operating range at this time, secure one turn or more as standard, though this varies depending on the load conditions.
  - When servo tuning is ended normally, proper parameters are automatically set from the estimated load inertia and the parameters are stored in the non-volatile memory.
  - After execution of this tuning function, a deviation of the position loop may be left.
    For this reason, be sure to clear the deviation before returning to normal operation.

- **Servo tuning procedure**

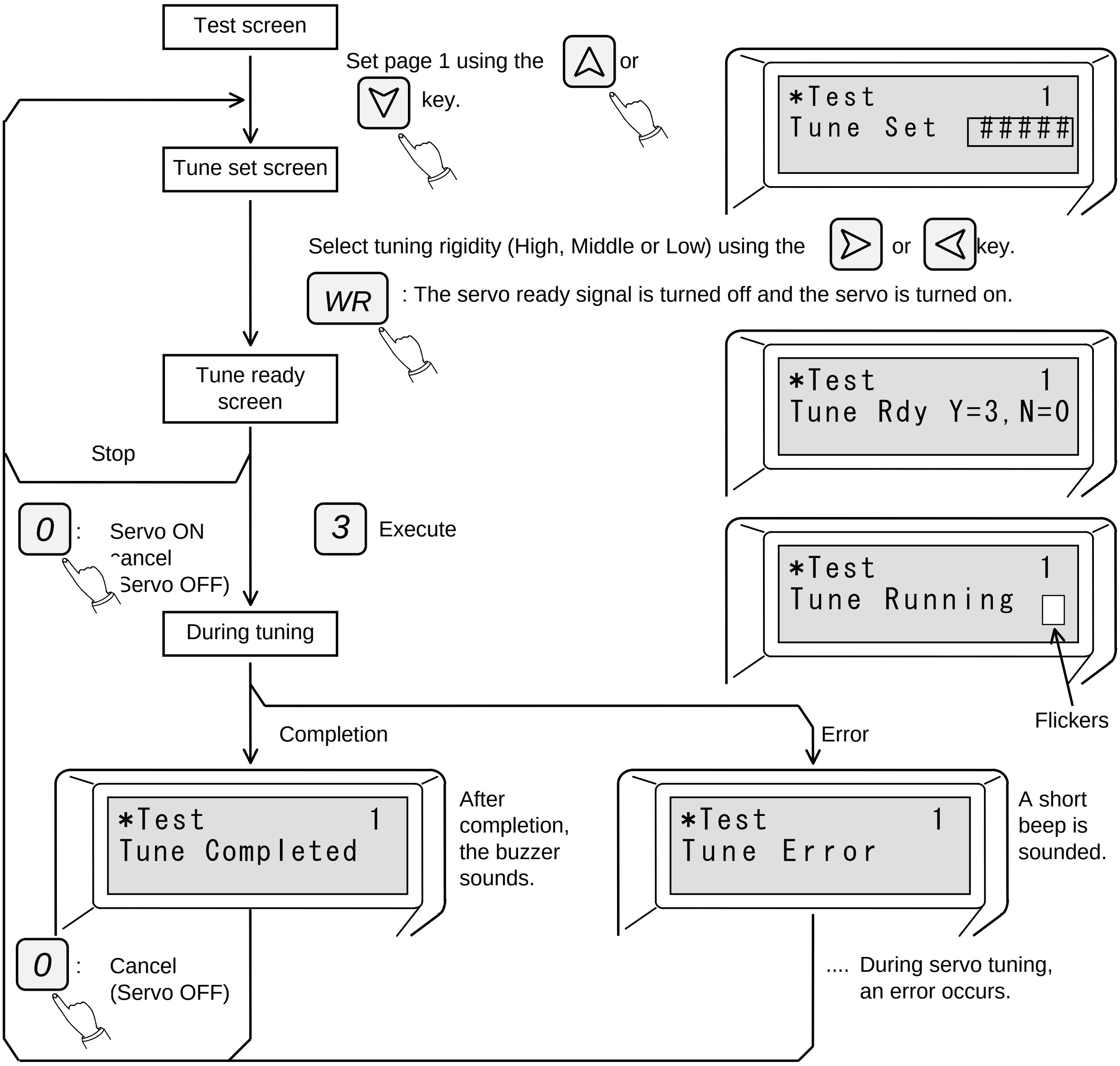
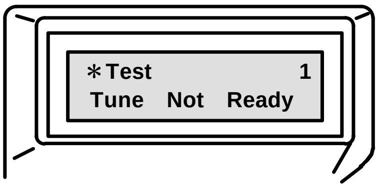


Fig. 7-12 Servo Tuning Operation

After servo tuning is completed, press the 0 key to return to the set screen from the ready screen, then return to the initial screen using the ON MODE key.

When the initial screen is displayed, the "OVF (excessive deviation)" alarm occurs.
When the servo tuning is disabled by a main circuit power off status or an alarm, the following is displayed :



The servo tuning is enabled, the Tune set screen appears.

7.1.9.3 Auto offset function

- **Outline of auto offset function**

This function enables an offset value for a velocity or torque command to be automatically selected.
It implements velocity command zero adjustment (Vzero) or torque command zero adjustment (Tzero).

- **Auto offset procedure**

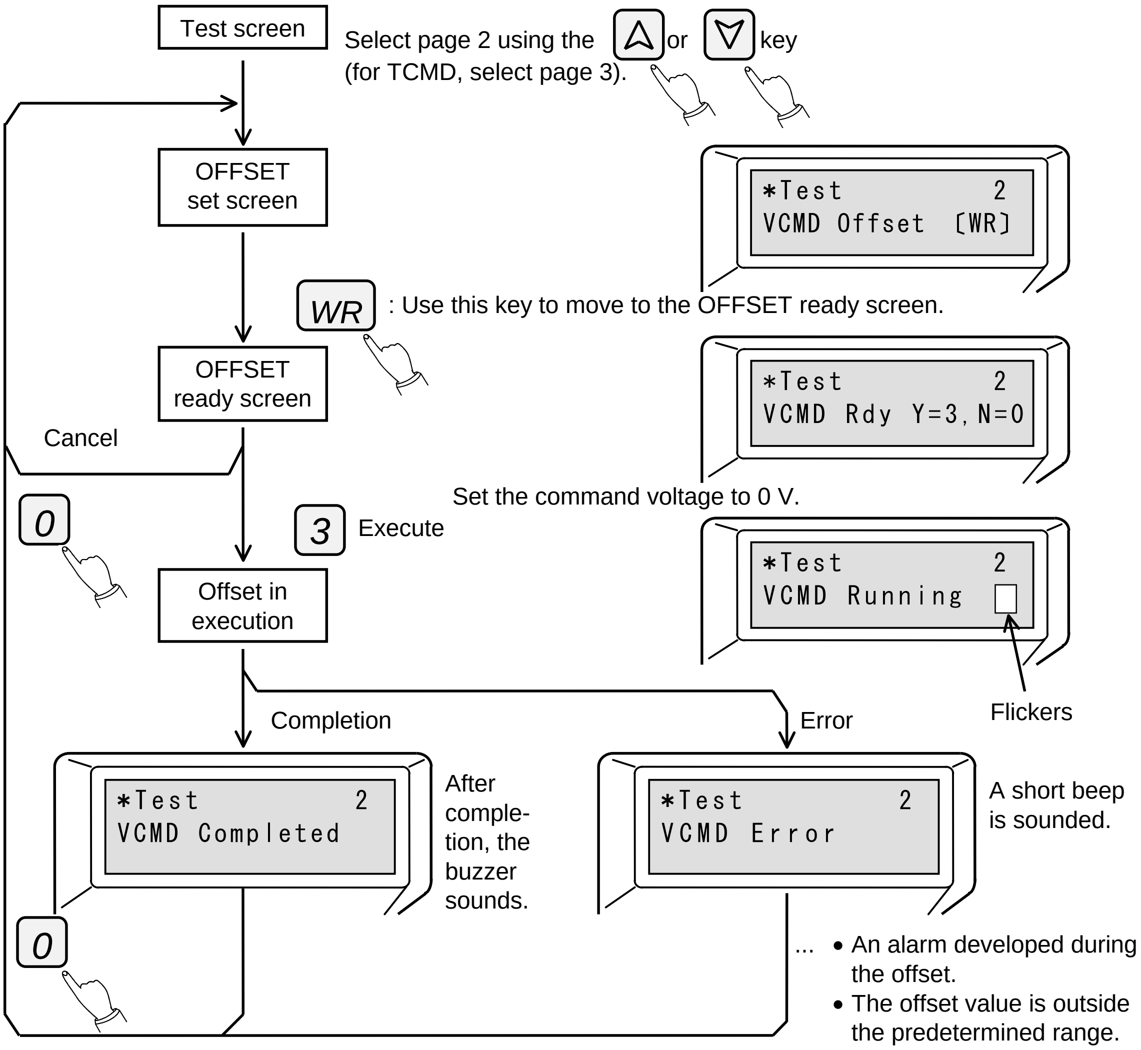
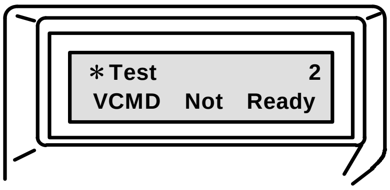


Fig. 7-13 Auto Offset Operation Procedure

Using the 0 key, return to the set screen from the ready screen, then return to the initial screen using the ON MODE key.

When the offset operation is disabled (when Func6 bit7 = 0), the following message appears on the screen:



```
∗Test            2
 VCMD   Not   Ready
```

When the offset function is enabled, the OFFSET screen appears.

The screen for the torque command offset differs from that for the velocity command as follows :

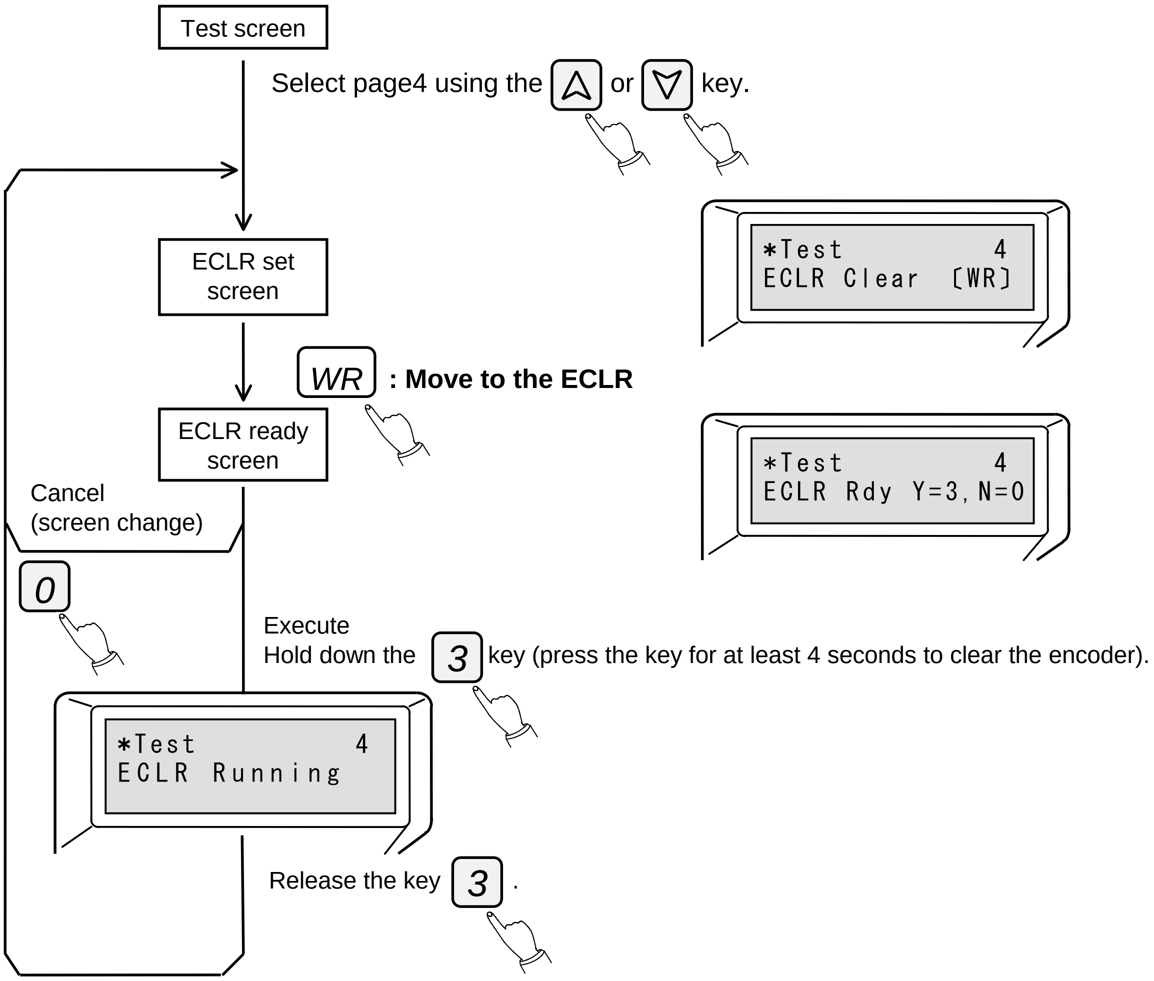
- Screen No. 2 → 3.
- VCMD → TCMD.

An ideal zero adjustment may not be expected if significant fluctuation exists in the commanded input voltage or substantial noise is present. In such case, manual zero adjustment shall be implemented in parallel from Screen Mode 3 Page 3 (Vzero) or 4 (Tzero).

7.1.9.4 Encoder clear function

This function is used for clearing the encoder multiple revolution counter or an encoder alarm.

- **Encoder clearing procedure**



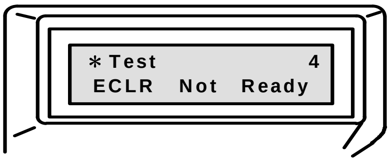
```
*Test          4
ECLR Clear  [WR]
```

```
*Test          4
ECLR Rdy Y=3,N=0
```

```
*Test          4
ECLR Running
```

Fig. 7-14 Encoder Clear Operation Procedure

Using the 0 key, return to the set screen from the ready screen, then return to the initial screen using the ON MODE key.
When the encoder clear is disabled (when Func6 bit7 is set to "0"), the following message appears on the screen:



```
*Test          4
ECLR  Not  Ready
```

When the encoder clear function is enabled, the ECLR screen appears.

This function is available only for the absolute encoder.
After executing the function, check the absolute value on the monitor mode screen.

7.2 Description of Parameters

7.2.1 Block Diagram of Position, Velocity and Torque Control Type Parameters

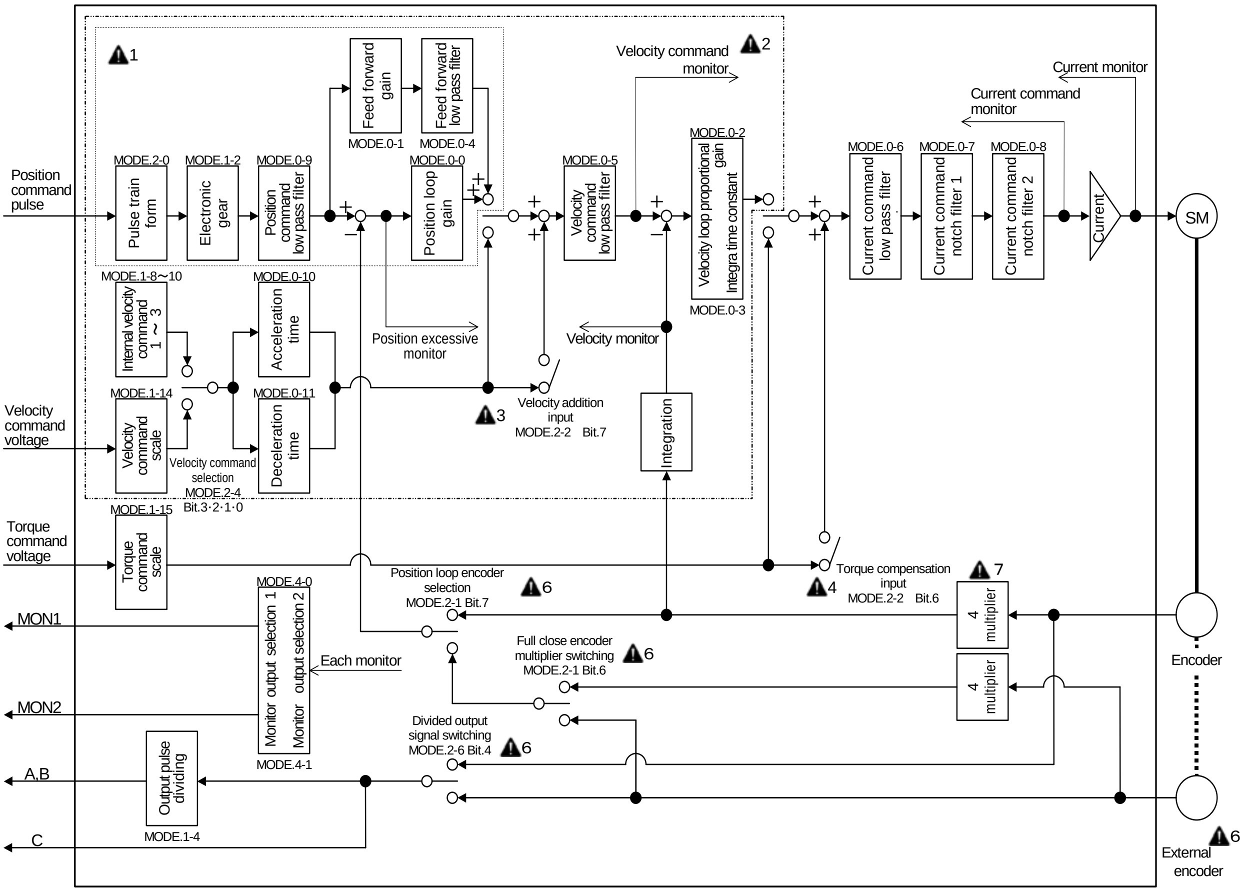


Fig. 7-15 Control System Block Diagram

1. The parts inside of ⬚ do not function in the velocity/torque control mode.
2. The parts inside of ⬚ do not function in the torque control type only.
3. Velocity addition input functions for the position control type only.
4. Torque compensation input functions for the position/velocity control type only.
5. Each low pass or notch filter is disabled at the setting of 1,000 Hz.
6. An external encoder can be connected on a fully closed servo system only.

   If your system is not fully closed, set bits 7 and 6 of MODE 2-1 and bit 4 of MODE 2-6 to zero.
7. 4 multiplier function of motor encoder is valid only in INC-E and ABS-E. 1 multiplier will be applied for ABS-RⅡ.

7.2.2 Parameter Summary Table

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
0	0	Kp	Position loop gain	45(30)	rad/S	1 to 1000	
	1	Kff	Feed forward gain	0	%	0 to 100	
	2	Kvp	Velocity loop proportional gain	100(70)	Hz	10 to 3000	
	3	Tvi	Velocity loop integral time constant	15(20)	mSec	1 to 1000	
	4	FLPF	Feed forward LPF	1000	Hz	1 to 1000	
	5	VLPF	Velocity command LPF	1000	Hz	1 to 1000	
	6	ILPF	Current command LPF	450	Hz	1 to 1000	
	7	IBF1	Current command BEF1	1000	Hz	200 to 1000	
	8	IBF2	Current command BEF2	1000	Hz	IBF1 to 1000	
	9	Tpcm	Position command LPF time constant	0	mSec	0 to 4000	
	10	Tvac	Velocity command acceleration time	0	mSec	0 to 9999	
	11	Tvde	Velocity command deceleration time	0	mSec	0 to 9999	
	12	KvpA	Velocity loop proportional gain addition value	0	Hz	0 to 255	

Figures in parentheses are applicable to other than P3 and P5 series.

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
1	0	INP	Positioning complete signal width	64	P(+/–)	1 to 32767	
	1	OVF	Excessive deviation value	256	×256P	1 to 32767	
	2	EGER	Electronic gear ratio	4/1		1/32767 to 32767	
	3	PMUL	Command pulse multiplication	1		1 to 63	
	4	ENCR	Output pulse division ratio	1/1		1 to 1/8192	
	5	LTG	Low velocity	50	min^{-1}	0 to 32767	
	6	HTG	High velocity	1000	min^{-1}	0 to 32767	
	7	SPE	Velocity matching width	50	min^{-1}	0 to 32767	
	8	VCI1	Internal velocity command value 1	500	min^{-1}	0 to 32767	
	9	VCI2	Internal velocity command value 2	1000	min^{-1}	0 to 32767	
	10	VCI3	Internal velocity command value 3	1500	min^{-1}	0 to 32767	
	11	IILM	Internal current limit value	100	%	30 to (⚠1)	
	12	SILM	Sequence current limit value	120	%	30 to (⚠1)	
	13	THB	Holding brake timing	300	mSec	0 to 1000	
	14	VCMS	Velocity command scale	500	min^{-1}/V	0 to 3000	
	15	TCMS	Torque command scale	50	%/V	0 to 400	
	16	MENP	Motor encoder pulse number	$$$$	P/R	500 to 65535	(⚠2)
	17	EENP*	Full close encoder pulse number	$$$$	P/R	500 to 65535	(⚠2)

* The page 17 (EENP) can only be used on the full-close type servo system.

⚠

1. Any value above "IP/IR × 100%" may not be selected for an internal current limit value or sequence current limit value.
2. Prior to this operation, Func6 bit7 of Screen Mode 2 must be set at “1” and the control power must be turned off once.

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Command pulse train form	00000000		0, 1	
	1	Func0	Amplifier function select 0	00000000		0, 1	
	2	Func1	Amplifier function select 1	00000000		0, 1	
	3	Func2	Amplifier function select 2	00100000		0, 1	
	4	Func3	Amplifier function select 3	00000001		0, 1	
	5	Func4	Amplifier function select 4	00000001*		0, 1	
	6	Func5	Amplifier function select 5	00000000		0, 1	
	7	Func6	Amplifier function select 6	00000000		0, 1	

* In the position control mode, page 5 (Func4) is set at 00000100.

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
3	0	Kp	Position loop gain	45(30)	rad/S	1 to 1000	
	1	Kvp	Velocity loop proportional gain	100(70)	Hz	10 to 3000	
	2	Tvi	Velocity loop integral time constant	15(20)	mSec	1 to 1000	
	3	Vzero	Zero adjustment of velocity command	$$$$		±16383	
	4	Tzero	Zero adjustment of torque command	$$$$		±16383	

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
8	0	Kp2	Position loop gain 2	45(30)	rad/S	1 to 1000	
	1	Kvp2	Velocity loop proportional gain 2	100(70)	Hz	10 to 3000	
	2	Tvi2	Velocity loop integral time constant 2	15(20)	mSec	1 to 1000	

The values in parentheses are applicable for other than P3 and P5 series.

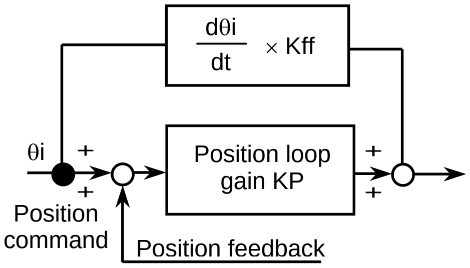
Mode	Page	Abbre-viation	Name	Standard value	Setting range	Remarks
4	0	M1	Monitor 1 output	Vm2mV/min^{-1}	12 ranges	IR: Rated armature current
	1	M2	Monitor 2 output	Ic2v/IR	12 ranges	
	2	GAIN	Gain select	Fix	2 ranges	
	3	TYPE	Control mode	$$$$	6 ranges	(⚠)
	4	ENKD	Encoder type	$$$$	3 ranges	(⚠)
	5	ABSF	ABS sensor format	$$$$	11 ranges	(⚠)
	6	MOT.	Motor type	$$$$	For motors of P1, P2, P3, P5, P6 and P8 series.	(⚠)

* The values denoted by $$$$ vary according to the specifications employed at the time of shipment.

⚠

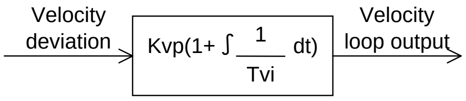
Prior to modifying a setting, Func6 bit 7 of Screen Mode 2 must be set at "1".
You are also required to turn the control power off once.

7.2.3 Parameter List

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
0	0	Kp	Position loop gain • Proportional gain of the position controller.	45 (30)	rad/s	1 to 1000	Position control (⚠)
	1	Kff	Position loop feed forward gain • Feed forward gain of the position loop. • When this parameter is set at 100%, the number of waiting pulses becomes 0 at constant-speed operation. • Response of the position loop can be improved. However, if the value is increased too much, vibration may result. 	0	%	0 to 100	Position control
	2	Kvp	Velocity loop proportional gain • Proportional gain of the velocity controller (proportional integral control). The setting unit indicates the value when the load inertia is 0.	100 (70)	Hz	10 to 3000	Position and velocity control (⚠)

⚠ The gain can be increased or decreased from Mode 3.

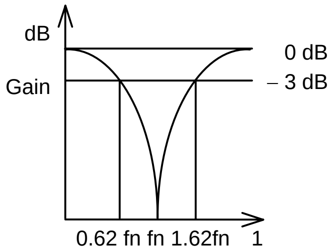
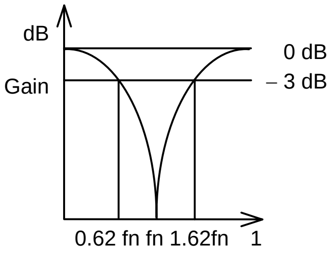
Values in parentheses are applicable to motors of other than P3 and P5 series.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
0	3	Tvi	Velocity loop integral time constant • Integral time constant of the velocity controller (proportional integral control). 	15 (20)	mSec	1 to 1000	Position and velocity control (⚠ 1) (⚠ 2)
	4	FLPF	Feed forward LPF • This parameter sets the cut off frequency of the low pass filter for the position loop feed forward command.	1000	Hz	1 to 1000	Position control (⚠ 3)
	5	VLPF	Velocity command LPF • This parameter sets the cut off frequency of the primary low pass filter for the velocity command.	1000	Hz	1 to 1000	Position and velocity control (⚠3)
	6	ILPF	Current command LPF • This parameter sets the cut off frequency of the primary low pass filter for the current command in the velocity loop.	450	Hz	1 to 1000	(⚠3)

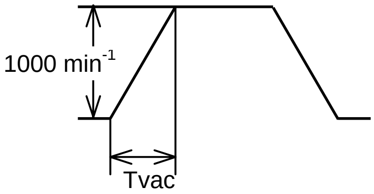
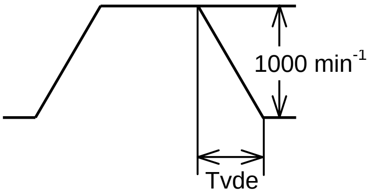
⚠

1 Increase or decrease is available from Mode 3 Page 2.
2 Selecting 1000 ms turns on the proportional control.
3 Selecting 1000 Hz disables the filter function.

Values in parentheses are applicable to motors of other than P3 and P5 series.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
0	7	IBF1	Current command BEF1 • For the current command in the velocity loop, this parameter specifies the notch filter center frequency of the following characteristics.  	1000	Hz	200 to 1000	In 10 Hz (⚠)
	8	IBF2	Current command BEF2 • For the current command in the velocity loop, this parameter sets the notch filter center frequency of the following characteristics. • This setting must satisfy the requirement, IBF1≦IBF2. Other settings are not available.  	1000	Hz	IBF1 to 1000	In 10 Hz (⚠)

⚠ Selecting 1000 Hz disables the filter function.

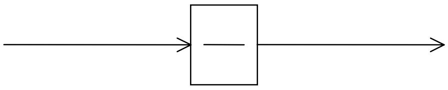
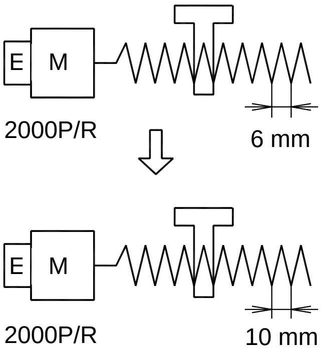
Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
0	9	Tpcm	Position command LPF time constant • When installing the first-order lag filter for the position control pulse, this parameter sets the time constant.	0	mSec	0 to 4000	Position control (⚠)
	10	Tvac	Velocity command acceleration time • This parameter is used for limiting acceleration time in the velocity control to 1000 min^{-1} minute.  	0	mSec	0 to 9999	Velocity control (⚠)
	11	Tvde	Velocity command deceleration time • This parameter is used for limiting deceleration time in the velocity command to 1000 min^{-1} minute.  	0	mSec	0 to 9999	Velocity control (⚠)

⚠ When configuring the position loop external to the servo amplifier, select 0 msec for the setting.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
0	12	KvpA	Velocity loop proportional gain addition value • This parameter is used for setting a weight per rotary switch 1. • The actual velocity loop proportional gain is: Kvp + (KvpA × RSW). When switching of the gain is done, it will be: Kvp2 + (KvpA × RSW). RSW : A value set on the rotary switch. ∗ Slide switch position Gain switching from the front panel slide switch is enabled when it is set at "GAIN".	0	Hz	0 to 255	Position and velocity control (⚠)

⚠ You can check the actual velocity loop proportional gain from monitor screen page 14(KvpM).

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	0	INP	In-position (positioning finish) signal width • This parameter selects the number of waiting pulses on the deviation counter that output the in-position signal. • The standard value is the encoder pulse multiplied by 4 irrespective of the electronic gear function or the command multiplier setting. INC-E, ABS-E: 4 multiplier of incremental pulse is standard. ABS-RⅡ: Absolute value (PS) of sensor is standard. [Example] When the parameter is set at 64 with a 2000 pulse encoder, the positioning complete signal is output when the value falls in the following range toward the target position. 64 × 1/(2000 × 4) × 360° = 2.88°	64	pulse (+/–)	1 to 32767	Position control
	1	OVF	Excess deviation value • When the deviation counter exceeds the setting range, an OVF alarm occurs.	256	× 256 pulses	1 to 32767	Position control

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	2	EGER	Electronic gear ratio  N : 1 to 32767 $f2 = f1 \times N/D$ D : 1 to 32767 1/32767≦N/D≦32767 [Example]  • When the ball screw pitch is changed, just set the electronic gear ratio to (4/1) × (6/10) = 24/10. No other change is required.	4/1		1/ 32767 to 32767	Position control (⚠)

⚠ The electronic gear ratio is intended for changing the multiplication ratio of the command pulse.
Changing this ratio does not change the position F/B resolution.
The resolution is dependent on encoder used.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	3	PMUL	Command pulse multiplier • Set the parameter so that the position command pulse is multiplied by 1 to 63. • the setting should be enabled by selecting the PMUL input terminal with the Func3 parameter, then turning on the input.	1		1 to 63	Position control
	4	ENCR	Output pulse dividing ratio • This parameter is used for selecting the dividing ratio of the encoder signal (A- and B-phase). Dividing ratio = β / α Where, α : 1 to 64, 8192 β : 1 (α = 1 to 64) 2 (α = 3 to 64) 1 to 8191 (α = 8192)	1/1		1 to 1/8192	
	5	LTG	Low speed • This parameter is used for selecting a revolution speed below which the low speed alarm is output. • If you specify LTG (low speed) with the Func4 parameter, the LTG alarm is output as the revolution speed goes below the setting. • When P-PI auto switch function is enabled : Proportional control-plus integral control when the speed is lower than the LTG setting, and proportional control when the speed is over the LTG setting.	50	min^{-1}	0 to 32767	

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	6	HTG	High speed • This parameter is used for selecting a revolution speed above which the HTG (high speed) alarm is output. The HTG alarm can be specified using the Func4 parameter. • Switching of the control mode The following switching enables a speed limit to be set in the torque control mode: Velo ↔ Torq Posi ↔ Torq	1000	min^{-1}	0 to 32767	
	7	SPE	Speed matching width • When the difference between the velocity command and velocity feedback is smaller than the specified value, a speed matching width can be output by selecting SPE with the Func4 parameter.	50	min^{-1}	0 to 32767	
	8	VCI1	Internal velocity command value 1 • Sets a velocity command value. • It is enabled by setting the Func3 parameter bits 3, 2, 1 and 0 to "1010", and turning the CN1-36 pin on and the 35 pin off.	500	min^{-1}	0 to 32767	Velocity control

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	9	VCI2	Internal velocity command value 2 • Set a velocity command value. • It is enabled by setting the Func3 parameter bits 3, 2, 1 and 0 to "1010", and turning the CN1-35 pin on and the 36 pin off.	1000	min^{-1}	0 to 32767	Velocity control
	10	VCI3	Internal velocity command value 3 • Sets a velocity command value. • It is enabled by setting the Func3 parameter bits 3, 2, 1 and 0 to "1010", and simultaneously turning both the CN1-35 pin and the 36 pin on.	1500	min^{-1}	0 to 32767	Velocity control
	11	IILM	Internal current limit value • You can clamp the current at the value set from this page by setting the Func1 parameter bit0 to 0, and entering ILM (CN1-31 pin). Setting of a value greater than IP is not available. • This setting is available within the range of IP/IR × 100. IP : Momentary maximum stall current on the armature. IR : Rated armature current.	100	%	30 to (IP/IR) × 100	

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	12	SILM	Sequence current limit value • Sets a current limit value for holding brake sequencing, overtravel or JOG operation. • This setting is available within the range of IP/IR × 100.	120	%	30 to (IP/IR) × 100	
	13	THB	Holding brake excitation timing • Sets the holding brake excitation timing. • Select "0" when this function is not used.	300	mSec	0 to 1000	Timing setting is available in multiples of 4 msec.
	14	VCMS	Velocity command scale • Sets a velocity command scale corresponding to 1V of the command voltage.	500	min^{-1}/V	0 to 3000	
	15	TCMS	Torque command scale • Sets a torque command scale corresponding to 1V of the command voltage.	50	%/V	0 to 400	

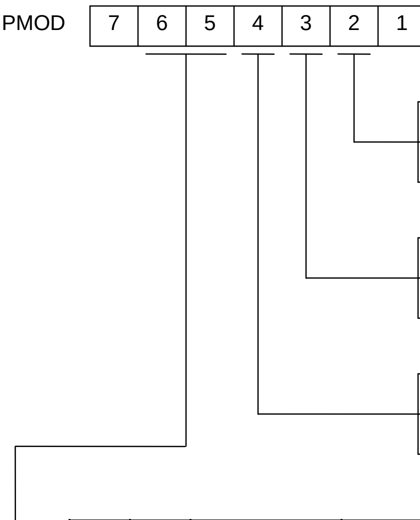
Mode	Page	Abbreviation	Name and description	Standard value	Unit	Setting range	Remarks
1	16	MENP	Motor encoder pulse number • Sets the number of pulses of the encoder used. • The following shows the number of encoder pulse in standard combination: Saved wiring incremental encoder --- 2000 P/R. Absolute encoder --- 2048 P/R.	$$$$	P/R	500 to 65535	(⚠ 1) (⚠ 2)
	17	EENP	Number of pulses of fully closed encoder • Sets the number of pulses of the encoder used in terms of the motor shaft. • This parameter is usable only on the servo system that supports the fully closed design.	$$$$	P/R	500 to 65535	(⚠ 1) (⚠ 2)

⚠

1 When changing your setting, set Func6 bit7 to "1" from Screen Mode 2 prior to the change.

2 Turn the control power off once before the change.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Position command pulse train form • The position command pulse train can be entered in 3 forms (forward revolution + backward revolution pulse train, code + pulse trains and 90° phase difference two-phase pulse train). Also, the rising/falling edge command, the revolution direction and digital filter clock can be specified.	0000-0000		0, 1	Position control (⚠ 1) (⚠ 2)



CCWP input polarity switching

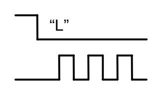
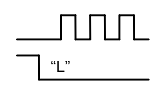
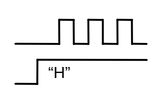
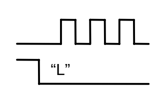
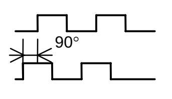
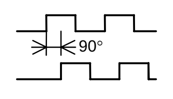
0	Counts at the rising edge.
1	Counts at the falling edge.

CWP input polarity switching

0	Counts at the rising edge.
1	Counts at the falling edge.

Selection of revolution direction (⚠3)

0	Standard.
1	Backward revolution.

Bit 6	Bit 6	Command pulse form	Motor forward revolution command	Motor backward revolution command	CN1	
0	0	Forward revolution pulse train + backward revolution pulse train			28, 29 26, 27	When the Revolution direction bit is set at “0”.
1	0	Code + pulse train			28, 29 26, 27	
0	1	90° phase difference two-phase pulse train.			28, 29 26, 27	
1	1	Prohibited				

⚠

1 For setting of bit7, bit 1, and bit 0, refer to the description provided on the following and succeeding pages.

2 Only "0" and "0" are allowed to be set for bit3 and bit2 of the 90° phase difference two-phase pulse train or the code + pulse train. (The rotating direction may vary.)

3 Bit4 of PMOD and bit2 of Func5 function the same. When set “1” to both bits, the system rotates forward (normal).

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Position command pulse train form				

0 and 1 of bit7 specify setting of the digital filter used for the position command pulse train input.
The following describes the digital filter setting corresponding to each input pulse form.

① Backward pulse train + Forward pulse train

PMOD	7	6	5	4	3	2	1	0

When bit7 = 0

bit	bit	Digital filter for command pulse input	
1	0	Maximum frequency	Minimum pulse width
0	0	666kpulse/S	750nS
0	1	2.6Mpulse/S	187.5nS
1	0	1.3Mpulse/S	375nS
1	1	333kpulse/S	1.5µS

When bit7 = 1

bit	bit	Digital filter for command pulse input	
1	0	Maximum frequency	Minimum pulse width
0	0	166kpulse/S	3.0µS
0	1	666kpulse/S	750nS
1	0	333kpulse/S	1.5µS
1	1	83.3kpulse/S	6.0µS

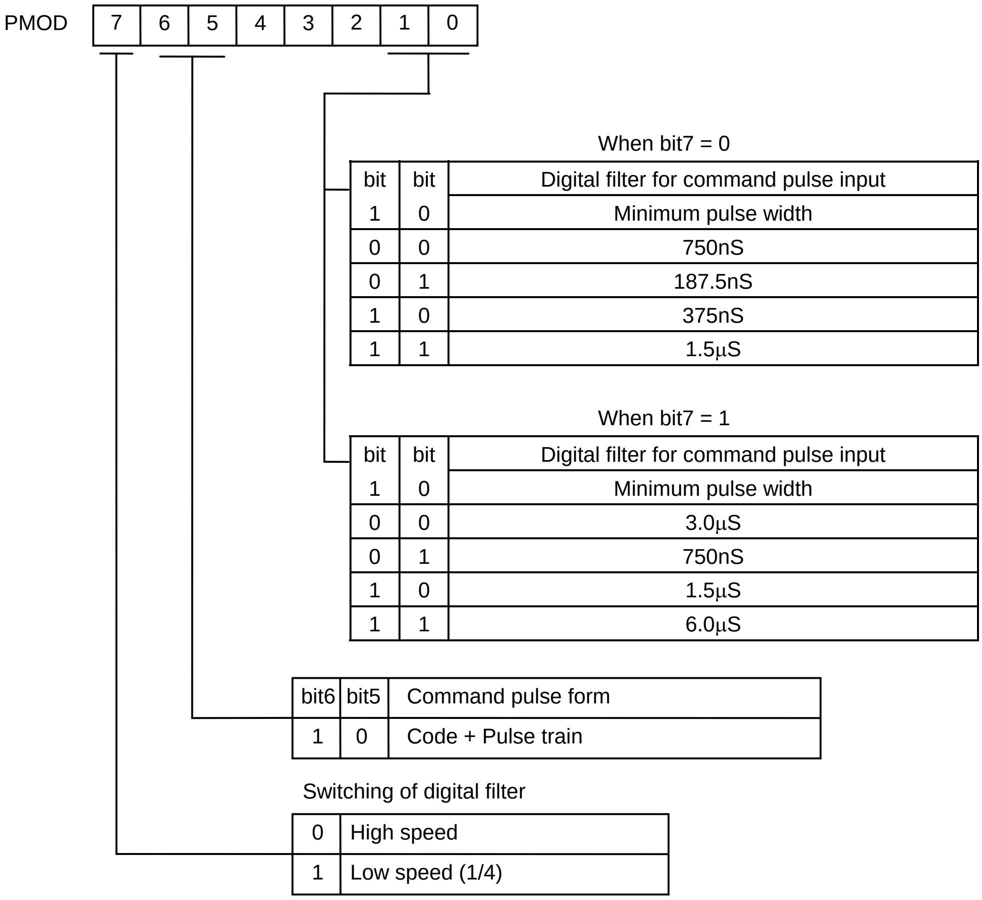
bit6	bit5	
0	0	Backward pulse train + Forward pulse train

Switching of digital filter

0	High speed
1	Low speed (1/4)

The minimum pulse width values shown at bit 0/1 of the digital filter are for both "H" and "L" pulses.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Position command pulse train form ② Code + Pulse train				



When bit7 = 0

bit 1	bit 0	Digital filter for command pulse input Minimum pulse width
0	0	750nS
0	1	187.5nS
1	0	375nS
1	1	1.5μS

When bit7 = 1

bit 1	bit 0	Digital filter for command pulse input Minimum pulse width
0	0	3.0μS
0	1	750nS
1	0	1.5μS
1	1	6.0μS

bit6	bit5	Command pulse form
1	0	Code + Pulse train

Switching of digital filter

0	High speed
1	Low speed (1/4)

The minimum pulse width values shown at bit 0/1 of the digital filter are for both "H" and "L" pulses.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Position command pulse train form ③ 90° phase difference two-phase pulse train				

PMOD	7	6	5	4	3	2	1	0

When bit7 = 0

bit	bit	Digital filter for command pulse input		
1	0	Maximum frequency	Minimum pulse width	Minimum edge distance between A- and B-phase
0	0	666kpulse/S	750nS	250nS
0	1	1.0Mpulse/S	500nS	250nS
1	0	1.0Mpulse/S	500nS	250nS
1	1	333kpulse/S	1.5μS	500nS

When bit7 = 1

bit	bit	Digital filter for command pulse input		
1	0	Maximum frequency	Minimum pulse width	Minimum edge distance between A- and B-phase
0	0	166kpulse/S	3.0μS	1.0μS
0	1	666kpulse/S	750nS	250nS
1	0	333kpulse/S	1.5μS	500nS
1	1	83.3kpulse/S	6.0μS	2.0μS

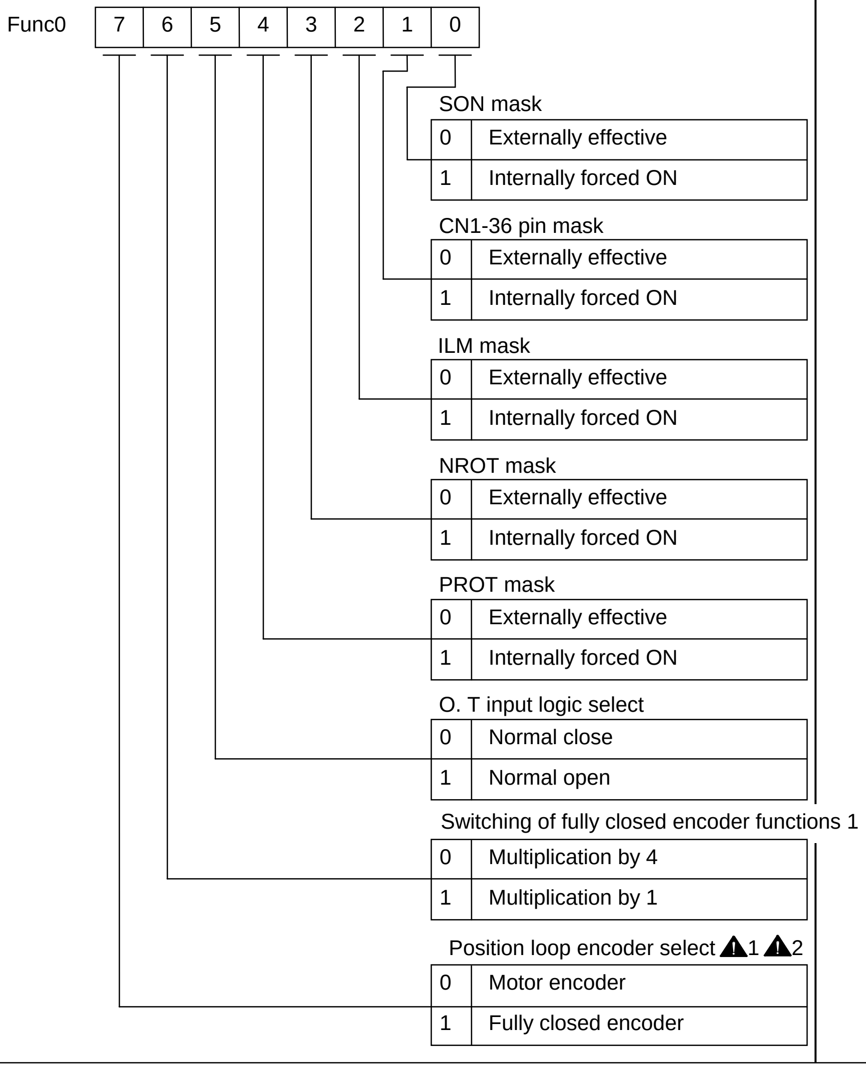
bit6	bit5	Command pulse form
0	1	90° phase difference two-phase pulse train

Switching of digital filter

0	High speed
1	Low speed (1/4)

The minimum pulse width values shown at bit 0/1 of the digital filter are for both "H" and "L" pulses.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	1	Func0	Amplifier function select 0 • This parameter selects whether external signals are made effective or are forcibly turned on internally. It also selects the overtravel input logic, the encoder used (between motor encoder and fully closed encoder) and the multiplication factor of the encoder.	0000-0000		0, 1	(⚠3) (⚠4)



SON mask

0	Externally effective
1	Internally forced ON

CN1-36 pin mask

0	Externally effective
1	Internally forced ON

ILM mask

0	Externally effective
1	Internally forced ON

NROT mask

0	Externally effective
1	Internally forced ON

PROT mask

0	Externally effective
1	Internally forced ON

O. T input logic select

0	Normal close
1	Normal open

Switching of fully closed encoder functions 1

0	Multiplication by 4
1	Multiplication by 1

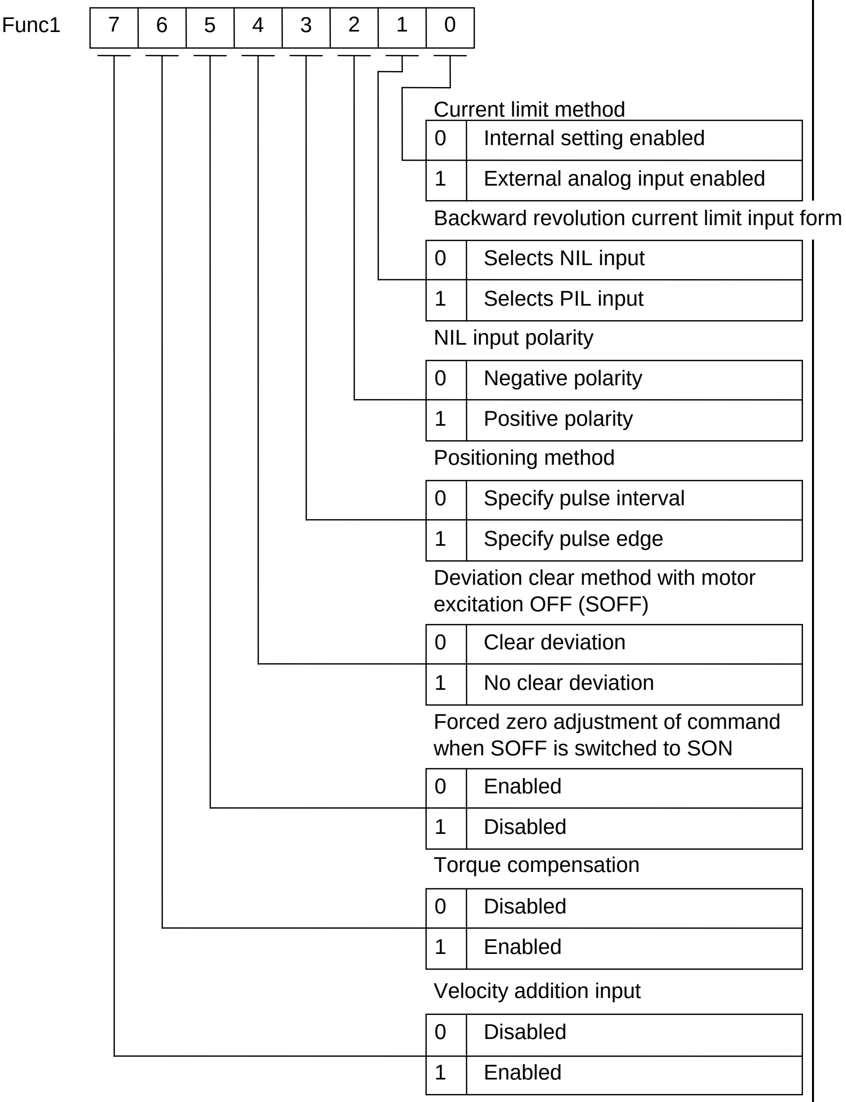
Position loop encoder select ⚠1 ⚠2

0	Motor encoder
1	Fully closed encoder

⚠

1 This function is available only with a servo system that supports the fully closed design.
2 Selecting a fully closed encoder does not change the divided output. Thus, when you need a divided output for the fully closed encoder, set Func5 bit4 to "1".
3 When overtravel bits 3 and 4 are internally turned on, they become ineffective if the overtravel input logic is b-contact. And, they are always in overtravel status if the overtravel input logic is a-contact.
4 When changing the setting of bit 7 or 6, you must turn the control power off once prior to marking the change.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	2	Func1	Amplifier function select 1 • A desired function can be set from the digital switch.	0000-0000		0, 1	(⚠)



Current limit method

0	Internal setting enabled
1	External analog input enabled

Backward revolution current limit input form

0	Selects NIL input
1	Selects PIL input

NIL input polarity

0	Negative polarity
1	Positive polarity

Positioning method

0	Specify pulse interval
1	Specify pulse edge

Deviation clear method with motor excitation OFF (SOFF)

0	Clear deviation
1	No clear deviation

Forced zero adjustment of command when SOFF is switched to SON

0	Enabled
1	Disabled

Torque compensation

0	Disabled
1	Enabled

Velocity addition input

0	Disabled
1	Enabled

* Bit7 is effective in the position control mode. Bit6 is effective in the position and velocity control modes.

⚠ When bit4 is set at "1", the position deviation is not cleared upon occurrence of an alarm.
Accordingly, be sure to clear the deviation before clearing the alarm.

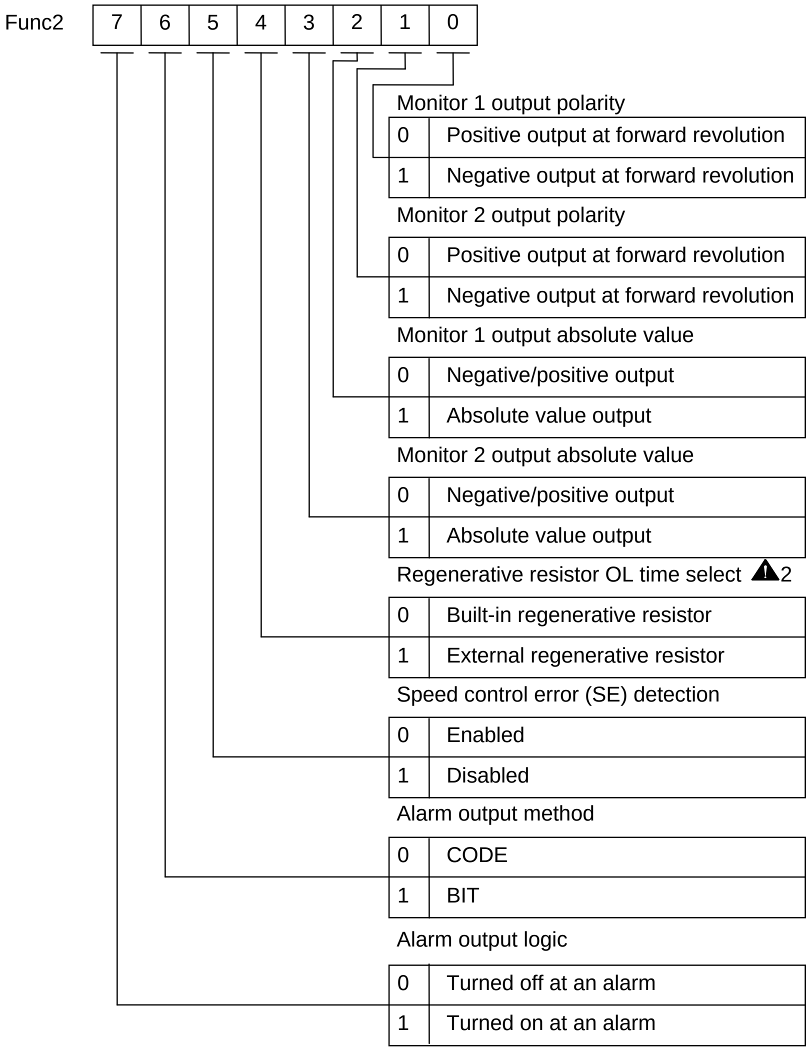
* For details of bits 2 to 0, refer to the following page.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	2	Func1	Amplifier function select 1 • How to use different current limit approaches Bits 2 to 0 are parameters relevant to current limit. The following describes their setting and the corresponding current limit method available.				

			Func1
When external analog input is used	Current for forward and backward revolution can be separately set.	Negative polarity •Inputs negative voltage to NIL input. •Input positive voltage to PIL input	*****001
		Positive polarity •Input external analog to PIL input.	*****101
	Current for forward and backward revolution is set at the same level. •Input external analog to PIL input.		******11
When internal current limit is used		• Sets the internal current limit value (IILM).	*******0

⚠ Whichever approach you select, the current limit is enabled only after the CN1-31 pins are turned on.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	3	Func2	Amplifier function select 2 • A desired monitor output method or regenerative resister OL time can be selected.	0010-0000		0, 1	(⚠1) (⚠3)



Monitor 1 output polarity

0	Positive output at forward revolution
1	Negative output at forward revolution

Monitor 2 output polarity

0	Positive output at forward revolution
1	Negative output at forward revolution

Monitor 1 output absolute value

0	Negative/positive output
1	Absolute value output

Monitor 2 output absolute value

0	Negative/positive output
1	Absolute value output

Regenerative resistor OL time select ⚠2

0	Built-in regenerative resistor
1	External regenerative resistor

Speed control error (SE) detection

0	Enabled
1	Disabled

Alarm output method

0	CODE
1	BIT

Alarm output logic

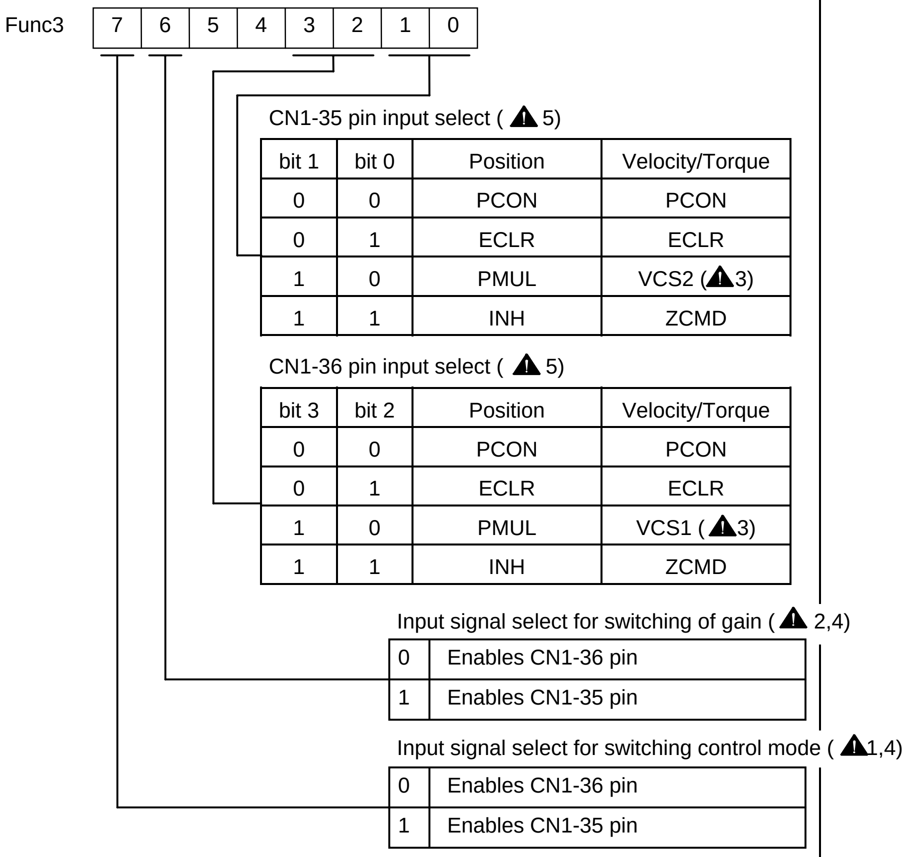
0	Turned off at an alarm
1	Turned on at an alarm

1 If bit 7 is set at "1", an alarm will not be indicated for a CPU error.

2 Bit 4 cannot be changed unless the control power is turned off.

3 Forward revolution refers to the counterclockwise revolution when viewed from the load (motor shaft) side.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	4	Func3	Amplifier function select 3 • This parameter allows you to set the CN1-35 and 36 pins to the desired terminals. It also allows you to select the input signal for switching the control mode or gain.	0000-0001		0, 1	(⚠3)



CN1-35 pin input select (⚠ 5)

bit 1	bit 0	Position	Velocity/Torque
0	0	PCON	PCON
0	1	ECLR	ECLR
1	0	PMUL	VCS2 (⚠3)
1	1	INH	ZCMD

CN1-36 pin input select (⚠ 5)

bit 3	bit 2	Position	Velocity/Torque
0	0	PCON	PCON
0	1	ECLR	ECLR
1	0	PMUL	VCS1 (⚠3)
1	1	INH	ZCMD

Input signal select for switching of gain (⚠ 2,4)

0	Enables CN1-36 pin
1	Enables CN1-35 pin

Input signal select for switching control mode (⚠1,4)

0	Enables CN1-36 pin
1	Enables CN1-35 pin

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	4	Func3	Amplifier function select 3 Notes with regard to Func3 setting:				

1 It is enabled when the switching mode is selected for the control mode.

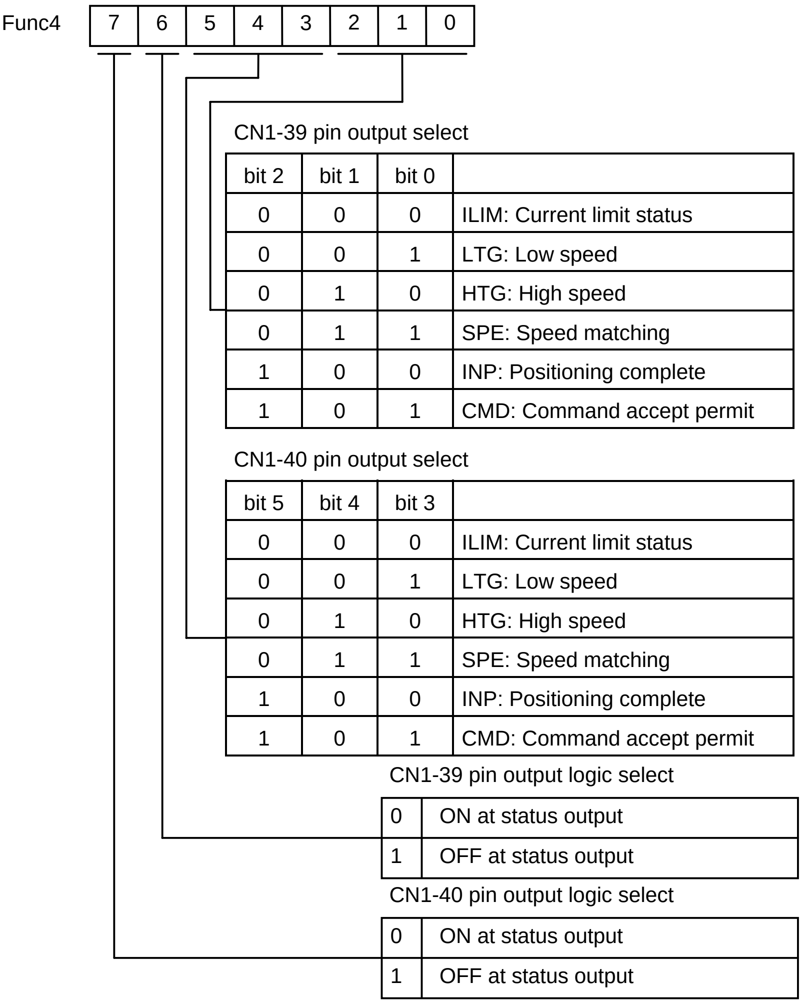
2 This signal select is enabled when the gain switching mode is selected.

3 Setting bits 3, 2, 1 and 0 at "1010" in the velocity control mode enables the internal velocity command. Setting bits 3 and 2 on, or 1 and 0 alone does not make this command valid.

4 "Note on switching of the control mode and input signal selection when gain switching is turned on" :
As long as the input signal for control mode or gain switching is assuaged to the CN1 35 pin, input signal selection with Func3 bits 1 and 0 is disabled except for the internal velocity select function. When the input signal for control mode or gain switching is assigned to the CN1 36 pin, input signal selection with Func3 bits 3 and 2 is disabled except for the internal velocity select function. If the internal velocity select function is enabled (Func3 bits 2 to 0 are set at "1010"), the internally velocity set with the 35 and 36 pins are enabled. At the same time, control mode and gain switching are made valid (this, however, is only effective when the velocity control mode including the control mode switching mode is selected).

5 When the same signal is selected for both the CN1-35 and 36 pins, pin 36 takes precedence over pin 35.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	5	Func4	Amplifier function select 4 • CN1-39 and 40 pins may be set for desired output terminals.	0000-0001		0, 1	⚠



CN1-39 pin output select

bit 2	bit 1	bit 0	
0	0	0	ILIM: Current limit status
0	0	1	LTG: Low speed
0	1	0	HTG: High speed
0	1	1	SPE: Speed matching
1	0	0	INP: Positioning complete
1	0	1	CMD: Command accept permit

CN1-40 pin output select

bit 5	bit 4	bit 3	
0	0	0	ILIM: Current limit status
0	0	1	LTG: Low speed
0	1	0	HTG: High speed
0	1	1	SPE: Speed matching
1	0	0	INP: Positioning complete
1	0	1	CMD: Command accept permit

CN1-39 pin output logic select

0	ON at status output
1	OFF at status output

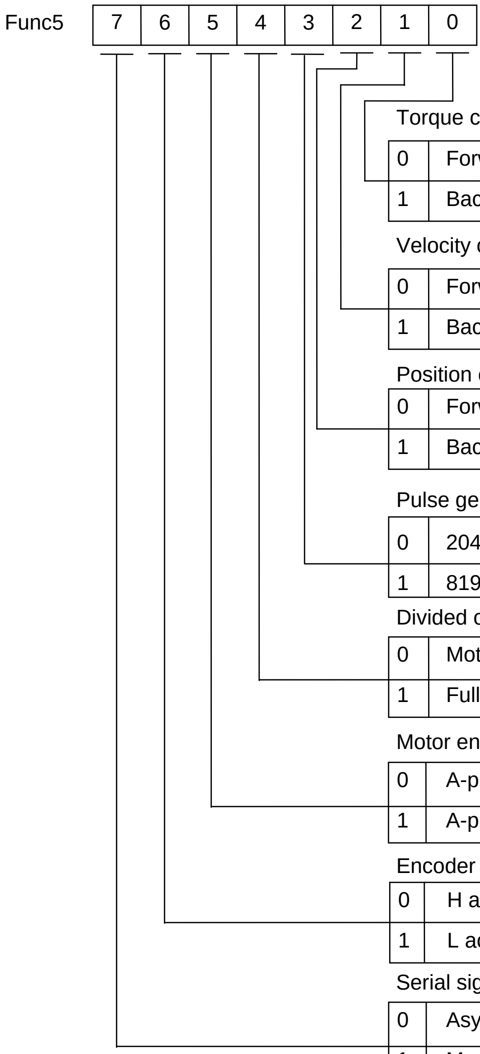
CN1-40 pin output logic select

0	ON at status output
1	OFF at status output

⚠ The standard value is set at 00000100 in the position control mode.

* For details of CMD:
Command accept permit, refer to 6.1 Operation Sequence.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	6	Func5	Amplifier function select 5 • Selects the encoder output format or the command input polarity.	0000-0000		0, 1	(⚠ 2) (⚠ 3)



Torque command polarity reversing bit

0	Forward revolution at positive input
1	Backward revolution at positive input

Velocity command polarity reversing bit

0	Forward revolution at positive input
1	Backward revolution at positive input

Position command polarity reversing bit (⚠4)

0	Forward revolution at positive input
1	Backward revolution at positive input

Pulse generation output select (⚠4)

0	2048P/R (8192 partition)
1	8192P/R (32768 partition)

Divided output signal switching (⚠1)

0	Motor encoder
1	Fully closed encoder

Motor encoder A-/B-phase signal output phase switching

0	A-phase signal not reversed
1	A-phase signal reversed

Encoder C-signal output logic select

0	H active
1	L active

Serial signal output method select

0	Asynchronization (9600 bps)
1	Manchester coding synchronization (1 Mbps or 2 Mbps)

⚠

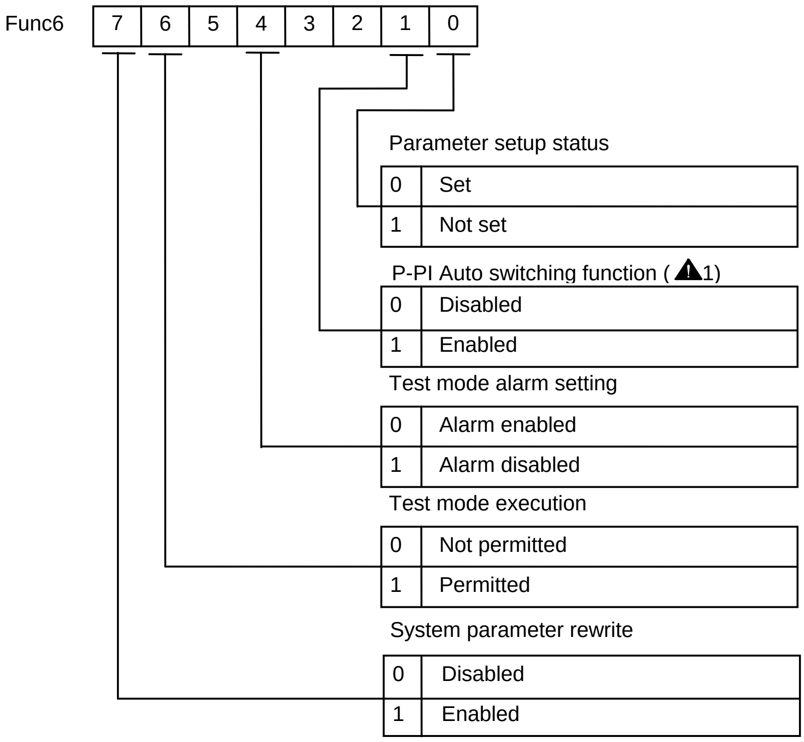
1 Even if you choose the fully closed encoder using the Func0 bit7 parameter, divided output remains the same. Fully closed encoder can be used only on a servo system that supports the fully closed design.

2 Before changing the setting of bits 7, 6, 5 and 4, you must turn off the control power.

3 Forward revolution means counterclockwise revolution as viewed from the load (motor shaft) side.

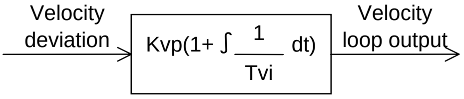
4 Bit3 is enabled when the ABS-RⅡ absolute sensor is used. The number of incremental pulses to be output from CN1-3 to 8 pins can be selected.

5 Bit2 of Func5 and bit4 of PMOD function the same. When 1 is set to both bits, the system is rotated forward at positive input.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	7	Func6	Amplifier function select 6 • This parameter is used for changing the contents of parameters or permitting execution of the test mode.  Parameter setup status 0 Set 1 Not set P-PI Auto switching function (⚠1) 0 Disabled 1 Enabled Test mode alarm setting 0 Alarm enabled 1 Alarm disabled Test mode execution 0 Not permitted 1 Permitted System parameter rewrite 0 Disabled 1 Enabled Note: Bits 5 and 3 to 1 are not set. * After operation, bits 7 and 6 must be set at "0" again. Turning off the control power also returns bits 7, 6 and 4 to "0". * If bit 0 is set at "1", an alarm (memory error) will be indicated. After necessary parameter setting is complete, set bit 0 to "0", then turn power on.	0000-0000		0, 1	

⚠ 1. Setting bit 1 to 1 enables the auto switching function between proportional and proportional-plus-integral control when the speed is at the setting in LTG on page 5 of Mode 1. Proportional control when the speed is higher than the setting in LTG on page 5 of Mode1.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
3	0	Kp	Position loop gain • Proportional gain of the position controller.	45 (30)	rad/S	1 to 1000	(⚠1)
	1	Kvp	Velocity loop proportional gain • Proportional gain of the velocity controller (proportional integral controller). Setting unit represents the value when the load inertia is 0.	100 (70)	Hz	10 to 3000	(⚠ 2)
	2	Tvi	Velocity loop integral time constant • Integral time constant of the velocity controller (proportional integral controller). 	15 (20)	mSec	1 to 1000	(⚠ 3) (⚠4)
	3	Vzero	Velocity command zero adjustment (offset adjustment) • Offset of the velocity command is adjusted.	$$$$		±16383	(⚠ 5)
	4	Tzero	Torque command zero adjustment (offset adjustment) • Offset of the torque command is adjusted.	$$$$		±16383	(⚠ 5)

1 It can also be specified from Mode 0 Page 0.
2 It can also be specified from Mode 0 Page 2.
3 It can also be set from Mode 0 Page 3.
4 If you specify 1000 msec, proportional control is selected.
5 The value varies according to the adjustment done at shipment.
You can change the setting by executing offset adjustment of the test mode (Pages 2 and 3).
6 When changing the value, store your setting in the non-volatile memory using either the WR , ON MODE , △ or ▽ key.
If you turn off the control power without this key operation, your setting will not be stored.

* The 1 and 0 keys increase and decrease a value, respectively.

* After changing a value, press either the WR , ON MODE , △ or ▽ key to store it.

* Values in parentheses apply to motors not belonging to the P3 or P5 series.

<table>
<tr><th>Mode</th><th>Page</th><th>Abbre-viation</th><th>Name and description</th><th>Standard value</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>4</td><td>0</td><td>M1</td><td>Monitor output select 1
• You can specify a desired output from 12 types of data for the monitor 1 output (CN-15 pin and check pin M1) as shown below.
<table>
<tr><th>Indication</th><th colspan="2">Contents</th></tr>
<tr><td>Im 2V/IR</td><td>Current monitor</td><td>2V/IR peak</td></tr>
<tr><td>Ic 2V/IR</td><td>Current command</td><td>2V/IR peak</td></tr>
<tr><td>Vm 2mV/min^{-1}</td><td>Velocity monitor</td><td>2mV/min^{-1}</td></tr>
<tr><td>Vm 1mV/min^{-1}</td><td>Velocity monitor</td><td>1mV/min^{-1}</td></tr>
<tr><td>Vm 3mV/min^{-1}</td><td>Velocity monitor</td><td>3mV/min^{-1}</td></tr>
<tr><td>Vc 2mV/min^{-1}</td><td>Velocity command</td><td>2mV/min^{-1}</td></tr>
<tr><td>Vc 1mV/min^{-1}</td><td>Velocity command</td><td>1mV/min^{-1}</td></tr>
<tr><td>Vc 3mV/min^{-1}</td><td>Velocity command</td><td>3mV/min^{-1}</td></tr>
<tr><td>Per 50mV/P</td><td>Position deviation</td><td>50mV/1 pulse</td></tr>
<tr><td>Per 20mV/P</td><td>Position deviation</td><td>20mV/1 pulse</td></tr>
<tr><td>Per 10mV/P</td><td>Position deviation</td><td>10mV/1 pulse</td></tr>
<tr><td>Rm 1V/Full</td><td>Regenerative load factor</td><td>1V/Full</td></tr>
</table>
Where,
IR : Rated armature current.
Full : Monitor standard power of regenerative load factor.</td><td>Vm2mV/min^{-1}</td><td>12 types</td><td></td></tr>
<tr><td></td><td>1</td><td>M2</td><td>Monitor output select 2
• You can specify a desired output from the 12 types of data (M1) for the monitor 2 output (CN1-16 pin and check pin M2) as shown below.</td><td>Ic2V/IR</td><td>12 types</td><td></td></tr>
</table>

⚠ The velocity command denotes the velocity loop input stage signal.
This signal is output only at SON. It is affected by the setting specified for the velocity acceleration/deceleration time and the velocity command low pass filter.
When the position control mode is selected, the position loop velocity command is output.

<table>
<tr><th>Mode</th><th>Page</th><th>Abbre-viation</th><th>Name and description</th><th>Standard value</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>4</td><td>2</td><td>GAIN</td><td>Gain switching select
• Enables gain switching by external input.
<table>
<tr><th>Indication</th><th>Contents</th></tr>
<tr><td>Fix</td><td>Gain switching enabled</td></tr>
<tr><td>Select</td><td>Gain switching disabled</td></tr>
</table></td><td>Fix</td><td>2 choices</td><td>(⚠)</td></tr>
<tr><td></td><td>3</td><td>TYPE</td><td>Control mode
• You can choose a desired control mode from position, velocity and torque control.
<table>
<tr><th>Indication</th><th>Contents</th></tr>
<tr><td>Position</td><td>Position control type</td></tr>
<tr><td>Velocity</td><td>Velocity control type</td></tr>
<tr><td>Torque</td><td>Torque control type</td></tr>
<tr><td>Velo ↔ Torq</td><td>Velocity-to-torque switch type</td></tr>
<tr><td>Posi ↔ Torq</td><td>Position-to-torque switch type</td></tr>
<tr><td>Posi ↔ Velo</td><td>Position-to-velocity switch type</td></tr>
</table>
For the switch type, you can specify a desired control mode from CN1-36 pin or 35 pin.
When
Func3, bit 7 is 0 : 36 pin is enabled.
1 : 35 pin is enabled.

$$$$: The standard value varies according to the specifications employed at the time of shipment.</td><td>$$$$</td><td>6 choices</td><td></td></tr>
</table>

⚠

Choosing Select allows you to switch the mode between Kp, Kvp and Tvi from Screen Mode 8 (use CN1-36 or 35 pin for switching). Note the following for changes to be conducted on Pages 3 to 6 and 8 (system parameters):

1 You must turn off the control power before making the change.

2 Your change is effective only after Func6 bit7 has been set at "1" from Screen Mode 2.

3 If the above operation (Func6 bit7 to "1") is ignored, the parameter change is invalid and, thus, the change does not take place.

<table>
<tr><th>Mode</th><th>Page</th><th>Abbre-viation</th><th>Name and description</th><th>Standard value</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>4</td><td>4</td><td>ENKD</td><td>Encoder type
• Selects the type of encoder used.<table><tr><th>Indication</th><th>Contents</th></tr><tr><td>INC.E</td><td>Incremental encoder with reduced wiring</td></tr><tr><td>ABS.E(1M)</td><td>Absolute encoder (1Mbps)</td></tr><tr><td>ABS.E(2M)</td><td>Absolute encoder (2Mbps)</td></tr></table>$$$$: The standard value varies according to the specifications employed at the time of shipment.</td><td>$$$$</td><td>3 types</td><td></td></tr>
<tr><td></td><td>5</td><td>ABSF</td><td>ABS sensor format
• A desired format can be selected from the following.

2048FMT
4096FMT
8192FMT
16384FMT
32768FMT
65536FMT
131072FMT
262144FMT
524288FMT
1048576FMT
2097152FMT</td><td>$$$$</td><td>11 formats</td><td></td></tr>
</table>

Note the following for changes to be conducted on Pages 3 to 6 and 8 (system parameters):

1 You must turn off the control power before making the change.

2 Your change is effective only after Func6 bit7 has been set at "1" from Screen Mode 2.

3 If the above operation (Func6 bit7 to "1") is ignored, the parameter change is invalid and, thus, the change does not take place.

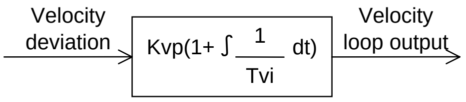
Mode	Page	Abbre-viation	Name and description	Standard value	Setting range	Remarks
4	6	MOT.	Motor type • Selects the motor used (in each series). • Selectable motor types vary with the amplifier capacity. $$$$: The standard value varies according to the specifications employed at the time of shipping.	$$$$	A motor from the P1, P2, P3, P5, P6 and P8 series.	

Note the following for changes to be conducted on Pages 3 to 6 (system parameters):

1 You must turn off the control power before making the change.

2 Your change is effective only after Func6 bit7 has been set at "1" from the Screen Mode 2.

3 If the above operation (Func6 bit7 to "1") is ignored, the parameter change is invalid and, thus, the change does not take place.

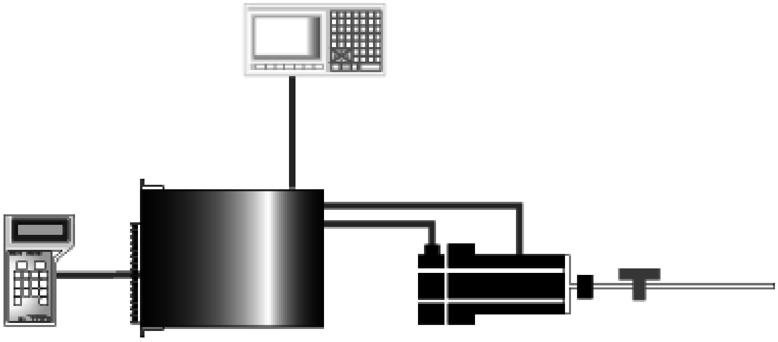
Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
8	0	Kp2	Position loop gain 2 • Proportional gain of the position controller.	45 (30)	rad/S	1 to 1000	Position control
	1	Kvp2	Velocity loop proportional gain 2 • Proportional gain of the velocity controller (proportional integral controller). Setting unit represents the value when the load inertial is 0.	100 (70)	Hz	10 to 3000	Position/ Velocity control
	2	Tvi2	Velocity loop integral time constant 2 • Integral time constant of the velocity controller (proportional integral controller). 	15 (20)	mSec	1 to 1000	Position/ Velocity control (⚠)

⚠ If 1000 msec is specified, the proportional control is turned on.
Values in parentheses apply to motors not belonging to the P3 or P5 series.

* When "Fix" is selected from Mode 4 Page 2 (GAIN), parameter setting and display are not available.

* The above can be enabled by choosing "Select" from Mode 4 Page 2 (GAIN) and then turning CN1-36 (or 35) pin on.

MAINTENANCE (TROUBLESHOOTING)



8. MAINTENANCE

8.1 Troubleshooting

The following pages explain possible causes of, investigating methods and corrective measures against an alarm occurrence and malfunction. Make sure to resume operation after rectifying the troubles and ensuring the safety, otherwise, you may be injured.

It is highly dangerous to investigate into the cause of troubles. Before investigation, please ensure safety of the servo amplifier, motors, mechanical devices and the surrounding areas. Knowing the circumstances at the time of malfunction will help narrow down the possible causes and reduce the troubleshooting process. When reproducing the troubles for the purpose of investigation, please secure safety.
In replacing Servo Amplifier and Servomotor, confirm that there should be no external cause to prevent dual breakage.
Please consult your Sanyo Denki dealer should the malfunction persist even after following the troubleshooting procedures recommended in this guide.

When alarm status “8”, “F”, “P” or “H” (DB overheat) is displayed, the alarm cannot be reset. Rectify the cause first and turn on the control power in this case.

When an alarm occurs, the 7-segment LED status display at the front panel of the servo amplifier will start blinking, and an alarm outputs from CN1. When an alarm occurs, execute the corrective measures indicated for each alarm display in the following procedure.

1. See the consensus status in the “Operating State when Alarm Occurred” and find the circle under the possible cause number.

↓

2. Execute the corrective measures in the “Corrective Measures” corresponding to the number above (with circle).

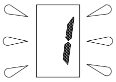
↓

3. If the malfunction persists after the process above, execute the corrective measures of number with triangle.

↓

4. If the malfunction still persists after No.3 above, consult with us.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0001	OC (MOC)	Power element error (Over current)	Possible	• Error detected in internal power module (IPM) of Amplifier • Abnormal value detected in current detection module of Amplifier.
		IFBE	Current detector error	Possible	• Current detector error of Servo Amplifier was detected.

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

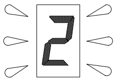
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on			○		△
When servo ON is inputted	○	○	○	△	
When motor is started or stopped	△	△	△	○	
After operating for a short period	△	△	△		○

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	U, V, W phases of wiring between amplifier and motor is short-circuited or grounded.	Check wiring between amplifier and motor. Correct or replace wiring.
2	U, V, W phases of servomotor is short-circuited or grounded.	Replace servomotor.
3	Faulty PC board Faulty power module	Replace amplifier.
4	Incorrect combination of amplifier and motor	Check if servomotor conforms to motor code. Replace with correct motor if necessary.
5	Overheating of power module (IPM)	• Check if cooling fan in amplifier is rotating. Replace amplifier if fan is not operating. • Check if temperature of control board (ambient temperature of amplifier) is exceeding 131°F (55℃). If exceeding, review installation and cooling methods of amplifier to ensure temperature stays below 55℃.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0010	OL	Overload	Possible	Overload was detected in servo amplifier and motor combination

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES								
	1	2	3	4	5	6	7	8	9
When control power supply is turned on	○								
When servo ON is inputted	○	○							○
After position command input (when motor is not rotating)		○			○	○	○		○
After position command input (after operating for a short period)			○	○	○		△	○	

Corrective Measures

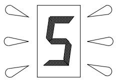
	CAUSES	CORRECTIVE MEASURES
1	Faulty amplifier control board or power module	Replace servo amplifier.
2	Faulty servomotor sensor circuit	Replace servomotor.
3	Effective torque is exceeding rated torque	Monitor torque generated by motor using the estimated effective torque (Trms) of MODE5/ page12 of remote operator to check if effective torque is exceeding rated torque. Or, calculate effective torque of motor from the load and operating conditions →If effective torque is higher than rated torque, review operating or load conditions, or replace with larger capacity motor.
4	Incorrect combination of amplifier and motor.	Check if motor code of Mode4/ page6 of remote operator conforms to servomotor. Correct if necessary.
5	Holding brake of servomotor is not released	Check brake wiring for errors. Replace servomotor if brake wiring is found to be correct (and voltage is applied as specified).
6	Incorrect wiring of U, V, W phases between amplifier and motor	Check and correct wiring.
7	One or all of the U, V, W phase wirings between amplifier and motor is disconnected	Check and correct wiring.
8	Mechanical interference	Review operating conditions and limit switch.
9	Encoder pulse does not meet motor	Set to encoder pulse number of motor

<Overload cause #3: Effective torque is exceeding rated torque>

Repeatedly turning the control power OFF→ON may cause the servomotor to burn.

While investigating this cause, please ensure that sufficient time is allowed for cooling down after power OFF (30 minutes or more).

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0101	OV	Over voltage	Possible	DC voltage of main circuit of amplifier exceeded allowable voltage

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

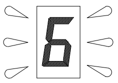
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	○				
When main circuit power supply is turned on	○	○			
When motor is started or stopped		△	○	○	○

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	Faulty amplifier control board	Replace servo amplifier.
2	Power voltage of main circuit is exceeding allowable voltage	Reduce voltage to within allowable range.
3	Load inertia is too high	Reduce load inertia to within allowable range.
4	Subject to using built-in regenerative resistor: • Short bar between COM - X terminals of terminal board is removed, or • Regenerative circuit is faulty	Short circuit between COM- X terminals. Replace servo amplifier if malfunction persists.
5	Subject to using external regenerative resistor: • Regenerative resistor is not connected • Regenerative resistor is broken • Regenerative circuit is faulty	Turn power OFF, check wiring and resistance value of regenerative resistor. Replace amplifier if malfunction persists.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0110	OS	Over speed	Possible	Rotating speed of servomotor exceeded allowable speed (1.2 times maximum rotating speed) during operation.

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

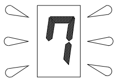
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	○	△			
Upon command input after Servo ON	△	○			○
When motor is started			○	○	
During operation (except when motor is started)		○	○		

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	Faulty amplifier control board	Replace servo amplifier.
2	Faulty servomotor sensor	Replace servomotor
3	Overshoot is too large during motor start.	Use the analog monitor of the remote operator to check the velocity. → If over shoot is too large, adjust the servo parameter → Change the acceleration/deceleration speed pattern command → Reducing the load inertia.
4	Incorrect wiring of U, V, W phases between amplifier and motor	Check and correct wiring.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0111	CPE	Control power supply error	Possible	Control power supply input voltage is below specified range

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

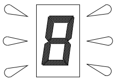
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES		
	1	2	3
When control power supply is turned on	△	○	
During operation	△		○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty amplifier internal circuit	Replace servo amplifier.
2	Power supply input voltage is below specified range	Set voltage within specified range (over 160V AC).
3	Fluctuation or momentary interruption of input power voltage	Check power supply

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1000	DE1	Encoder disconnection (sensor error)	Not possible	Disconnection of sensor signal (PS signal) line was detected
		DE2	Serial disconnection (sensor error)	Not possible	Disconnection of sensor signal (PS signal) line was detected
		DE3	Encoder initial error (sensor error)	Not possible	Initial data of motor sensor can not be read in.
		DE4	Serial receiving stop (sensor error)	Not possible	No feedback of absolute position data from absolute sensor

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

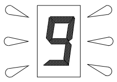
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	○	○	○	○	○
After servo ON				○	○
During operation	△			○	○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Encoder wiring: • Incorrect wiring • Loose connector • Poor connector contact • Encoder cable is too long • Encoder cable is too thin	• Check and correct wiring. • Check if sensor power voltage of motor is over 4.75V. Correct if necessary.
2	Wrong sensor classification setting of amplifier	Correct setting.
3	Sensor classification setting differs from actual sensor.	Replace with servomotor attached with correct sensor.
4	Faulty amplifier control circuit	Replace servo amplifier.
5	Faulty servomotor sensor	Replace servomotor.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1001	MPE	Main power supply drop	Possible	Main circuit power supply voltage drop

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

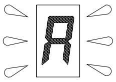
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on				○	△
After main circuit power supply is turned on	○	○			
During motor operation (alarm can be reset)		△	○		
During motor operation (alarm can not be reset)		○			

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Power supply voltage is below specified range	Set power supply to within specified range.
2	Main circuit fuse is flown, or rectifier is broken	Replace servo amplifier.
3	Input voltage fluctuated below 80V AC approx. Or momentary interruption occurred.	Check main power supply not to occur momentary interruption or power drop.
4	40 to 80V AC is supplying to main circuit (R.S.T)	Check main circuit voltage not to supply around power from other to R. S. T when main circuit OFF.
5	Faulty internal circuit of servo amplifier	Replace servo amplifier

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1010	FP	Main power supply phase loss	Possible	Phase loss detected in 3-phase main power supply input

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

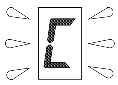
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES			
	1	2	3	4
When control power supply is turned on		△	○	
When main power supply is turned on	○	○		
During motor operation	△	○		
Alarm occurred although specified single phase power input		△		○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty input contact on one of the R, S, T phases	Check and correct wiring.
2	Blown fuse in amplifier	Replace servo amplifier
3	Faulty amplifier internal circuit	Replace servo amplifier
4	Servo amplifier is not specified for single phase	Confirm model number and delivery specification of servo amplifier. Replace with amplifier for single phase, if necessary.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1100	SE	Velocity control error	Possible	Velocity control is not functioning normally

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on					○
Upon servo ON input	○		○		
Upon command input	○	○	○		
When motor is started or stopped				○	

Corrective Measures

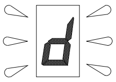
	CAUSE	CORRECTIVE MEASURES
1	Incorrect wiring of U, V, W phases between amplifier and motor	Check and correct wiring.
2	Incorrect wiring of A, B phases between INC-E and ABS-E encoder connection	Check and correct wiring.
3	Motor is vibrating (oscillating)	Adjust servo parameter to stop vibration (oscillation).
4	Overshoot and/or undershoot is too large	Use the analog monitor of the remote operator to check the velocity • Adjust servo parameter to reduce overshoot and/or undershoot. • Increase acceleration/deceleration command time. Or, mask the alarm by setting Func2 of remote operator.
5	Faulty servo amplifier control circuit	Replace servo amplifier.

Velocity control error alarm is set to “not detecting” as standard, but can be change to “detecting” by setting bit5 of Func2 to “0” when necessary.

This alarm may be detected during motor start or stop in cases where load inertia is high or for applications with G-force axis. In these cases, set bit5 of Func2 to “1” for “not detecting”.

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1101	OVF	Excess position deviation	Possible	Position loop deviation counter exceeded allowable value

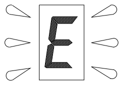
Operating State when alarm occurred

OPERATING STATE	POSSIBLE CAUSES												
	1	2	3	4	5	6	7	8	9	10	11	12	13
When control power supply is turned on										○			
During stoppage at servo ON						○					○		
When command input is started	○	△	○	○	○		○	△	○		△		
During high speed start or stoppage	○	○					○	○	○		△	○	
During operation with a long command		○					○	△			△		
After JOG/ Tune													○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Position command frequency is too high, or acceleration/deceleration time is too short.	Review controller position command.
2	Load inertia is too high or motor capacity is too low	Review load conditions, or change to larger capacity motor.
3	Holding break is not released	Check and correct wiring. Replace servomotor if wiring is correct (and voltage is applied as specified).
4	Motor is mechanically locked, or there is mechanical interference	Review mechanics
5	One or all of the U, V, W phases between amplifier and motor is disconnected.	Check and correct wiring.
6	Motor rotation caused by external force (gravity, etc.) during stoppage (completion of positioning).	Review load or change to larger capacity motor.
7	• Current limiter is activated by command from controller, with limit value set too low. • Set encoder pulse number does not match motors.	• Increase limit value or switch off current limiter. • Change to the encoder pulse number of motor
8	Improper servo parameter setting (position loop gain, etc.)	Revise parameter setting (increase position loop gain, etc.).
9	Excess deviation setting is too low	Increase excess deviation value from operator.
10	Faulty amplifier control board	Replace servo amplifier.
11	Faulty servomotor sensor	Replace servomotor.
12	Power supply voltage drops	Check power supply voltage again.
13	Normal and no problem	This is in considering to deviation left at controller after JOG operation or tuning from remote operator. Clear alarm to recover, or stop alarm by setting MODE2/ page7/ bit4 to “1” with remote operator to stop alarm.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0011	EXOH	External overheat	Possible	External input terminals (H1, H2) becomes open

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

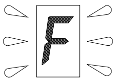
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES			
	1	2	3	4
When control power supply is turned on	○	○		△
After operating for a short period			○	△

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Short bar of H1, H2 terminals are removed	Short circuit H1 and H2 terminals
2	In case external thermal terminal is connected, wiring is disconnected.	Check and correct wiring.
3	External thermal terminal (external regenerative resistor) operated.	• Review operational conditions. • Increase capacity of external regenerative resistor
4	Faulty servo amplifier control board	Replace servo amplifier

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1111	DSPE	Servo processor error	Not possible	Built-in servo processor (DSP) of amplifier is malfunctioning.

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

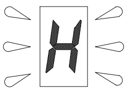
Operating state when alarm occurred

Alarm history	OPERATING STATE	POSSIBLE CAUSES	
		1	2
DSPE	When control power supply is turned on	△	○
	During operation		○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty amplifier control board	Replace servo amplifier
2	Malfunction due to noise	• Check that amplifier earth cable should be correctly grounded. • Add ferrite core as noise measure.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0101	RGOH	Overheat of built-in regenerative resistor	Possible	Overheating detected in internal regenerative resistor module.
			DB overheat	Not possible	

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

Operating state when alarm occurred

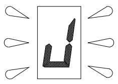
OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	△		○	△	
During operation	△	○	○	○	
After emergency stoppage					○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty amplifier internal circuit	Replace servo amplifier
2	Regenerative power is too high	• Review operating conditions. • Use an external regenerative resistor module
3	Regenerative power is within allowable range, but ambient temperature of amplifier is too high	Review cooling method to keep control board temperature below 131°F (55°C).
4	Regenerative power is within allowable range, but built-in cooling fan of amplifier is stopped	In case of amplifier with fun motor, check if cooling fan is functioning. Replace amplifier if fan motor is not longer functioning.
5	Brown temperature fuse in dynamic break resistor due to large regenerative energy in emergency stoppage.	• Replace servo amplifier • Review load conditions

Please note that after the thermal SW of the built-in regenerative resistor has detected an overheating, a cooling down period is necessary before operation returns to normal.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0101	RGOL	Regenerative error	Possible	Overload detected in regenerative resistor

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

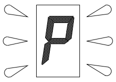
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES							
	1	2	3	4	5	6	7	8
When control power supply is turned on								○
When main circuit power supply is turned on							○	○
During operation	○	○	○	○	○	○		△

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	• Allowable regeneration power of built-in regenerative resistor is exceeded. • Load inertia is to high, or conducted time (for one cycle) is too short	Review load inertia and operational pattern • Use an external regenerative resistor module. • Lower load inertia within specified range • Increase deceleration time • Increase conducted time
2	External regenerative resistor is specified, but not selected at bit4 of Func2.	Select external regenerative resistor by setting bit4 of Func0 to “1”.
3	Built-in regenerative resistor module is specified, but COM-X terminals are not short-circuited	Short-circuit between COM-X.
4	External regenerative resistor module is specified, but resistor is not connected or is disconnected between Y-COM terminals.	Check and correct wiring.
5	Faulty regenerative resistor.	• Replace servo amplifier if using built-in regenerative resistor module. • Replace resistor if using external regenerative resistor module.
6	Resistance value of external regenerative resistor module is too high	Change to resistor that meets specification.
7	Input power voltage is over 280V AC	Review input power voltage
8	Faulty amplifier control circuit	Replace servo amplifier.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1111	MEME	Memory error	Not Possible	• Amplifier capacity does not match motor code • Motor code change alarm • Error detected in the built-in non-volatile memory of amplifier

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

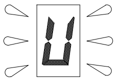
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES		
	1	2	3
When control power supply is turned on	○	△	
During remote controller operation		△	○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	CPU is unable to read correct value from built-in non-volatile memory in amplifier.	Replace servo amplifier
2	Faulty amplifier control board	Replace servo amplifier
3	Bit0 of Func6 was changed to “1” from remote operator.	• Reset remote operator and turn ON power again → Confirm no alarm occurs.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1000	AEE	Absolute sensor battery failure	Possible	Multiple-rotation data is indefinite due to battery back-up failure of absolute sensor.

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

Operating state when alarm occurred

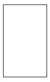
OPERATING STATE	POSSIBLE CAUSES			
	1	2	3	4
When control power supply is turned ON	○	○	○	△
During operation			○	△

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Weak battery (Lithium battery)	Replace the (lithium) battery →Encoder clear over 4 seconds
2	• No current flow over 20 hrs while battery is not connected to sensor. • Battery wiring is faulty	Check and correct wiring, or connect battery. →Encoder clear over 4 seconds
3	Faulty servo motor sensor	Replace servomotor
4	Faulty amplifier control board	Replace amplifier

At the initial setting of motor with absolute sensor (initial current flow), battery failure alarm will be displayed even in case of not week battery. Input encoder clear over 4 seconds to release the failure.

Alarm Status

Segment LED Display	Alarm Code ALM4,3,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
 (Comes off)	1111	CPUE	Amplifier error	Not Possible	Built-in CPU of amplifier is malfunctioning

Alarm code 0,1 indicates: when Func2/ bit7,6 =”0,0”, “0”= output open and “1”= output short.

Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES		
	1	2	3
When control power supply is turned on	△	○	
During remote controller operation	△	○	○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty amplifier control circuit	Replace servo amplifier
2	Weak internal 5V power due to short-circuit of input/output wiring of signal line of amplifier	Disconnect all connectors and turn power supply on → If 7 segment LED blinks, check and repair short-circuit on signal line.
3	Faulty operation due to noise	• Check if earth cable of amplifier is correctly grounded. • Add ferrite core as noise measure.

8.2 Troubleshooting (Non-Alarm)

The following are the causes and corrective measures for troubleshooting non-alarm malfunctions. Consult your Sanyo Denki dealer should the malfunctions persist even after performing these troubleshooting measures. Please take note that it is dangerous to perform some of these procedures without first switching off the main power supply.

Table 8-2 (1/2) Troubleshooting (Non-Alarm)

No	Malfunction	Inspection	Causes and corrective measures
1	7-segment LED does not display“≡ “ after control power supply is switched on	① Check voltage of control power input terminals	• Check power supply if voltage is low • Check wiring and tightening of screws if there is no voltage
		② Check if red “CHARGE” LED is on	• Blown fuse in amplifier • Faulty power supply circuit → Replace servo amplifier
2	7 segment LED is displaying a flashing “8” (servo ON status), but motor is not rotating	① Check if position command is inputted	• Input position command.
		② Check if servo lock is on	• Check tightening of screw as motor power line is not connected.
		③ Check if current limit is inputted	• Motor does not rotate, since current limiter is on and motor cannot output the torque over load torque.
		④ Check if deviation clear remains on	• Chancel the deviation clear input (CN1-34 pin)
3	Unstable servomotor rotation. Lower than command.	① Check if proportional control is on	• Switch off proportional control
		② Check if current limiter is on	• Switch off current limiter
		③ Check if 7 segment LED is displaying “ = ”	• EMR of serial communication line is on → Remove EMR
4	Servomotor rotates momentarily before stopping	① Check motor power lines	• One of the power lines is disconnected.
		② Check sensor dividing number setting	• Correct the setting and turn on the power.
5	Motor vibrates at frequencies over 200Hz		• Reduce velocity loop gain • Set current command low pass filter and notch filter.

Table 8-2 (2/2) Troubleshooting (Non-Alarm)

No	Malfunction	Inspection	Causes and corrective measures
6	Excessive overshoot/undershoot during start/stop		Servo tuning at “High” Lower velocity loop gain Increase integral time constant Loosen acceleration / deceleration command pattern Use position command low pass filter
7	Abnormal noise	Check for mechanical faults	Operate servomotor by itself Check centering and balance on coupling
		Operate at low speed and check for random abnormal noise	Check if sensor signal line is pair-twisted and shielded Check if sensor and power lines are connected to the same duct Check if power supply voltage drops

Alarm history will be displayed with Select switch after switching slider on front panel to “HISTORY”.

Table 8-2-2　Alarm History Display

Switch No.	Status
0	Display current alarm and status (Normal setting)
1	Display the last alarm
2	Display the second alarm to the last
3	Display the third alarm to the last
4	Display the fourth alarm to the last
5	Display the fifth alarm to the last
6	Display the sixth alarm to the last
7	Display the seventh alarm to the last

- In case that alarm occurred when select switch was set at other than “0”, current alarm will be displayed.　Return to “0” before setting to see alarm history.
- If there is no alarm in the alarm history, 0 will be displayed.
- Battery warning . cannot be displayed during alarm history is displayed on segment LED.　When slider switch is at “HISTORY” side, set rotary switch at “0” as standard.

8.3 Switching of Velocity Loop Proportional Gain Using Rotary Switch

8.3.1 Overview

The PY amplifier allows for easy switching of the velocity loop gain with 8-position rotary switch on the front.

8.3.2 Setting Procedure

Set the slide switch on the front of amplifier to “GAIN”, and set parameters as follows:

Operator

Mode0-12	Velocity loop proportional gain additional value (KvpA). This parameter defines weight per rotary switch 1. The actual velocity loop gain setting value is; Kvp + (KvpA × RSW) or Kvp 2 + (KvpA × RSW) RSW = Rotary switch position.

The set Kvp can be checked on the Kvp monitor (KvpM) of operator mode5-14.

Switching of Gain Using External Input Signal

Using external input signal (CN1-36 pin or 35 pin), the position loop gain, velocity loop proportional gain and velocity loop integral time constant will be switched.

Input signal OFF	:	Kp, Kvp and Tvi	valid.
Input signal ON	:	Kp2, Kvp2 and Tvi2	valid.

This function is enabled when the parameter gain select (Mode4, page2) is set to "select".

Selecting the CN1 input signal with Func3 bit6 parameter (0: 36 pin and 1: 35 pin).

Note 1:	There will be 2 msec delays at maximum from input signal change to gain switching.
Note 2:	The gain automatically set by the test mode servo tuning function is set at Kp, Kvp, Tvi and ILPF irrespective of the above selection.

Note that sliding to “HISTORY” clears setting and returns to the default.

8.4 Maintenance

Servomotors and amplifiers do not require special maintenance. To ensure optimum performance over their lifetimes, however, the user is expected to implement a reasonable level of inspection and maintenance, paying attention to the following points.

⚠

1. Performing of Insulation Resistance Test of the servo amplifier may damage the amplifier. We recommend using circuit tester.
2. Do not remove the cover from the detector of the Servomotor, or carry out any modification.

Table 8-4 Inspection Points

Inspection spot	Inspection conditions			Inspection items	Inspection methods	Corrective actions for failure
	Time	During operation	During stoppage			
Servomotor	Daily	OK		Vibration	Is oscillation larger than normal?	Contact us
	Daily	OK		Noise	Is abnormal noise present?	
	Occasionally		OK	Cleaning	Is there dirt and dust on the surface?	Clean with cloth or air. → ⚠ 1
	Annually		OK	Measurement of insulation resistance (value)	Contact us.	
	5000 hours → ⚠ 2		OK	Replace oil seal		
Servo Amplifier	Occasionally		OK	Cleaning	Is there dust on the equipment parts?	Clean with air. → ⚠ 1
	Annually		OK	Loose screws	Are external terminals and connector s loose?	Retighten
Battery	Regularly → ⚠ 3		OK	Battery voltage	Is battery voltage over 3.6VDC?	Replace battery
Temperature	Occasionally	OK		Temperature measurement	Ambient temperature and motor frame temperature	Ensure ambient temperature is within allowable range. Review load conditions and operating pattern.

⚠

1. Check that the air does not contain oil or water before cleaning.
2. Indicating the timing for inspection or replacement in case that waterproof and oil-proof functions are required.
3. For ABS-RⅡ Motors, customers are requested to regularly monitor battery voltage. Recommended battery: When using a lithium battery manufactured by Toshiba Battery Co., Ltd. (ER6V: 3.6 V, 2000 mAh), the estimated battery life is approximately six years.

8.5 Overhaul Parts

The parts listed in Table 8.5 will deteriorate with age. For maintenance, inspect periodically.

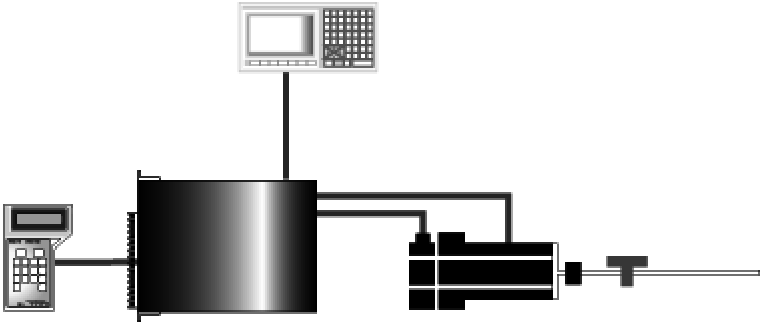
Table 8-5 Periodical Parts Inspection

No.	Parts		Average replacement interval	Method of replacement and others
1	Capacitors for main circuit smoothing		5 years	Replace with new one. Load rate : 50% maximum of the amplifier’s rated output current. Working condition : Year-round average temp. 106°F (40°C)
2	Cooling fan motor		5 years	Replace with new one. Working condition : Year-round average temp. 106°F (40°C)
3	Lithium battery for absolute sensor	ER3V	3 years	Replace with new one.
		ER6V	6 years	Replace with new one.

1. Capacitor for main circuit smoothing
   - If the Servo Amplifiers have been stored for over 3 years, consult us.
     The capacity of the capacitor for main circuit smoothing is reduced depending on the motor output current and the frequency of on-off switching of the power supply during operation. This can cause the capacitor to malfunction.
   - If the capacitor is used under conditions in which the average temp. is 106°F（40°C), and the Servo Amplifier’s rated output current exceeds 50% on average, replace it with a new one every 5 years.
   - If the capacitor is used in an application requiring the frequency of on-off switching the power to exceed 30 times a day, consult us.
2. Cooling fan motor
   - The PY2 Servo Amplifier is designed to comply with pollution level 2 (IEC 664-1/2.5.1).
     Since it is not designed to be oil- or dust-proof, use the Servo Amplifier in a pollution level 2 or better (i.e. pollution level 1 or 2) environment.
   - The PY0A050, PY0A100 and PY0A150 Servo Amplifiers have built-in cooling fan motors.
     Be sure to maintain a 50-mm spaces upper and below amplifier.
     If the space is narrower, the static pressure of the cooling fun will be reduced and the parts will deteriorate, causing the motor to malfunction.
     When an abnormal noise is heard, or oil or dust adheres to the cooling fan, it must be replaced.
     The estimated life of the cooling fan is 5 years under a year-round average temp. of 106°F（40°C).
3. Lithium battery
   - The normal replacement interval of our recommended lithium battery is its estimated life.
     The life of the lithium battery will be reduced if the frequency of power supply on-off switching is high or if the motor remains unused for a long time.
     If the battery voltage is 3.6 V or less when inspected, replace with new one.

⚠ Since all overhauled Servo Amplifiers are shipped with the user settings left as they are, be sure to confirm them before operating these Servo Amplifiers.

SPECIFICATIONS



9. SPECIFICATIONS

9.1 Servo Amplifier

Using figures and charts, the following section describes the specifications of the servo amplifiers.

9.1.1 Common Specifications

Table 9-1 Common Specifications

	Model No.		PY□□	015◇□□△▽	030◇□□△▽	050◇□□△▽	100◇□□△▽	150◇□□△▽	300◇□□△▽
Basic specification	Control function			Velocity, torque or position control (through switching of parameters).					
	Control method			IGBT PWM control, sine wave drive.					
	(*1) Input power	Main circuit		3-phase, 200 VAC to 230 VAC +10%, -15%, 50/60 Hz ± 3Hz.					
		Control circuit		Single phase, 200 VAC to 230 VAC +10%, -15%, 50/60 Hz ± 3Hz.					
	Environment	Operating ambient temperature (*2)		32 to 131°F (0 to 55°C)					
		Storage temperature		–4 to +149°F (–20 to +65°C)					
		Operating/storage temperature		90% RH maximum (no condensation)					
		Altitude		Up to 1,000 meters above sea level.					
		Vibration		0.5G when tested in the X, Y and Z directions for 2 hours in the frequency range between 10 Hz to 55 Hz.					
		Shock		2G					
	Structure			Equipped with a built-in, tray-type power supply.					
	Mass		kg	2.2	2.2	4.4	6.0	8.5	16
Performance	For the velocity control specification	(*3) Velocity control range		1 : 5000					
		(*4) Velocity variations	Load variation (0 to 100%)	±0.1% maximum/maximum revolution speed					
			Voltage variation (170V to 253V)	±0.1% maximum/maximum revolution speed					
			Temperature variation (0°C to 55°C)	±0.5% maximum/maximum revolution speed					
		(*6) Frequency characteristics		400 Hz (JL=JM)					
Built-in functions	Protection function			Overcurrent, overload, excessive main circuit power, over-speed, sensor error, low main circuit voltage, velocity control error, CPU error, phase loss, excessive deviation, regeneration error, memory error and low battery.					
	Display			Internal status and alarms.					
	Dynamic brake			Built-in					
	Regenerative processing			Built-in					
	Applicable load inertia			Within the applicable inertia of the Servomotor combined.					
	(*5) Monitor output	Velocity monitor (VMO)		2.0V ± 10% (at 1000 min^{-1})					
		Current monitor (IMO)		2.0V ± 20% (at rated armature current)					
Input / output signals	Velocity / torque control specification	Velocity command	Command voltage	±2.0 VDC (at 1000 min^{-1} command, forward motor revolution with positive command, maximum input voltage ±10 V).					
			Input impedance	Approximately 10 kΩ.					
		Torque command	Command voltage	±2.0 VDC (at 100% torque, forward motor rotation with positive command)					
			Input impedance	Approximately 10 kΩ.					
		Current limit input		±2.0 VDC ± 10% (at rated armature current)					
		Sequence input signals		Servo on, alarm reset, forward rotation inhibit, reverse rotation inhibit, proportional control, current limit and encoder clear.					
		Sequence output signals		Current limit status, low velocity, servo ready, holding brake timing and alarm code (4 bits).					
		Position output signals (pulse dividing)		N/8192 (N=1 to 8191), 1/N (N=1 to 64) or 2/N (N=3 to 64).					
		Absolute position output signal (serial output)		9600 bps start-stop synchronization or 1 Mbps/2 Mbps Manchester method (when an absolute encoder is used)					
	For the position control specification	Position command	Max. input pulse frequency	2.6M pulse/second (backward + forward pulse, code + pulse), 1M pulse/second (90° phase difference 2-phase pulse train command)					
			Input pulse form	Forward + reverse command pulses or code+ pulse train command, 90° phase difference 2-phase pulse train command.					
			Electronic gear	N/D (N=1 to 32767, D=1 to 32767), where 1/32767≦N/D≦32767.					
		Current limit input		±2.0 VDC ± 10% (at rated armature current)					
		Sequence input signal		Servo on, alarm reset, forward rotation inhibit, reverse revolution inhibit, proportional control, current limit and encoder clear.					
		Sequence output signal		Current control status, zero deviation, servo ready, holding brake timing and alarm code (N=3 to 64).					
		Position output signal (pulse dividing)		N/8192 (N=1 to 8191), 1/N (N=1 to 64) or 2/N (N=3 to 64).					
		Absolute position output (serial output)		9600 bps start-stop synchronization or 1Mbps / 2Mbps Manchester method (when an absolute encoder is used)					

*1: The supply voltage shall not exceed 230V+10% (253V).
If the voltage exceeds the specified level, a step-down transformer shall be added.

*2: When the amplifier is housed in a box, the temperature in the box should not exceed this specified level.

*3: The lower revolution speed limit in the velocity control range is determined on condition that the amplifier does not stop for a load (full load) equivalent to the maximum continuous torque.

*4: The velocity variation (load variation) is defined by the following expression:

$$\text{Velocity variation} = \frac{\text{Full load revolution} - \text{No-load revolution speed}}{\text{Maximum speed}} \times 100\ (\%)$$

The velocity variation due to variation in the input supply voltage and ambient temperature is defined and specified by the ratio of the change of revolution speed to the maximum speed in the same way.

*5: Method of calculating the speed (N) and load torque (TL) from each monitor (example).

- Speed (N) $\langle \text{min}^{-1} \rangle$: $N = 1000 \times \frac{(\text{Vm voltage}) \langle V \rangle}{2}$

  (When the standard VM 2mV/ min^{-1} is selected for the monitor output.)

- Load torque (TL) $\langle N \bullet m \rangle$: $TL = TR \times \frac{(\text{Im voltage}) \langle V \rangle}{2}$

  (When the standard Im 2V/IR is selected for the monitor output.)

*6: The value depends on the motor/amplifier combination and the load conditions.

9.1.2 Acceleration and Deceleration Time

The acceleration time (ta) and deceleration time (tb) under certain load conditions are calculated using the following expressions.

The expressions, however, are for within the rated speed, ignoring the viscosity torque and friction torque of the motor.

Acceleration time : $t_a = (J_M + J_L) \bullet \frac{2}{\substack{\pi \\ 6}} \bullet \frac{N_2 - N_1}{T_P - T_L}$ (sec)

Deceleration time : $t_b = (J_M + J_L) \bullet \frac{2}{\substack{\pi \\ 6}} \bullet \frac{N_2 - N_1}{T_P + T_L}$ (sec)

t_a : Acceleration time (sec)
t_b : Deceleration time (sec)
J_M : Motor inertia (kg•m^2)
J_L : Load inertia (kg•m^2)
N_1, N_2 : Motor speed (min^{-1})
T_P : Maximum stall torque (N•m)
T_L : Load torque (N•m)

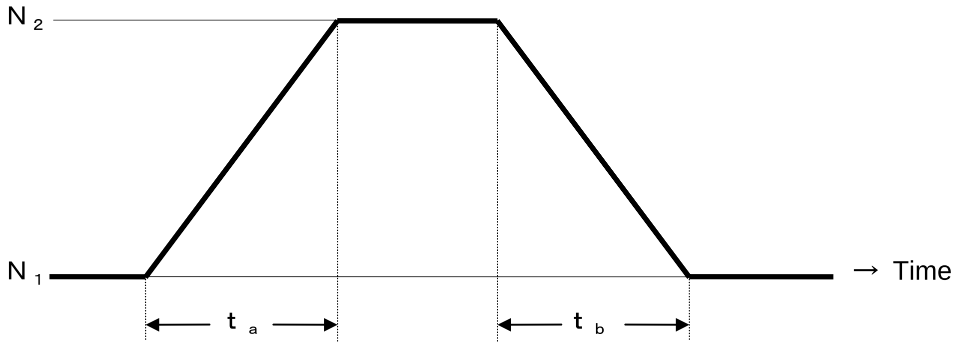


Fig. 9-1 Motor Revolution Speed Time Chart

For actually determining ta and tb, it is recommended that the above 0.8 × Tp be limited, making allowance for load.

Note that when power supply voltage is below 200V, the instantaneous torque in high speed zone drops.

9.1.3 Allowable Repetition Frequency

Start and stop repetition is limited by both the Servomotor and Servo Amplifier.
Consideration is required to satisfy the requirements of both at the same time.

- Allowable repetition frequency based on the Servo Amplifier

For use with a high frequency of starting and stopping, check that it is within the allowable frequency beforehand.
The allowable repetition frequency varies with each combined motor type, capacity, load inertia, acceleration/deceleration current value and motor speed.
When the starting/stopping repletion frequency up to the maximum speeds exceeds $\frac{20}{m+1}$ times/min under "load inertia = motor inertia × m" conditions, the effective torque and regenerative power must be accurately calculated.
In this case, consult us.

- Allowable repetition frequency based on the type of motor used

The starting/stopping frequency varies with motor working conditions including load conditions and operating duration.
Accordingly, this cannot be specified uniformly.
In the following, typical examples will be explained.

(1) When the motor repeats a constant-speed status and a stop status

This operating status is shown in Fig. 9-2, and the motor should be used at a frequency in which its effective torque is less than the rated torque (T_R).

Supposing the operating cycle is t, the usable range is represented in the following expression.

$$t \geqq \frac{T_a{}^2 t_a + T_L{}^2 t_s + T_b{}^2 t_b}{Trms^2} \quad \text{(sec)}$$

Where,	T_a	: Acceleration torque
	T_b	: Deceleration torque
	T_L	: Load torque
	Trms	: Effective torque
	T_R	: Rated torque

When the cycle time (t) has already been determined, find T_a, T_b, ta and tb satisfying the above expression.

When actually determining the system driving mode, you are recommended to limit Trms ≦ 0.7T_R approximately, making allowance for load.

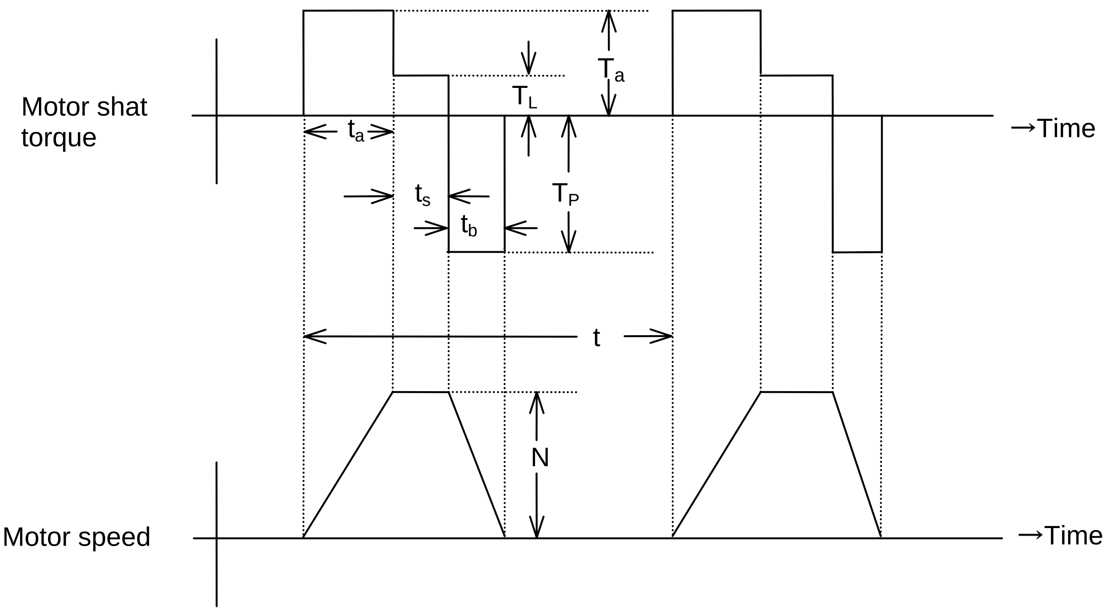


Fig. 9-2 Motor Shaft Torque Speed Timing Chart

(2) When the motor repeats acceleration, deceleration and stop statuses

This operating status is shown in Fig. 9-3, and the allowable value n (time/min) of repletion frequency can be obtained by the following expression.

$$n \geqq 2.86 \times 10^2 \times \frac{1}{N(J_M + J_L)} \times \frac{T_P{}^2 - T_L{}^2}{T_P{}^3} \times T_R{}^2 \quad \text{(times/min)}$$

T_R: Rated torque

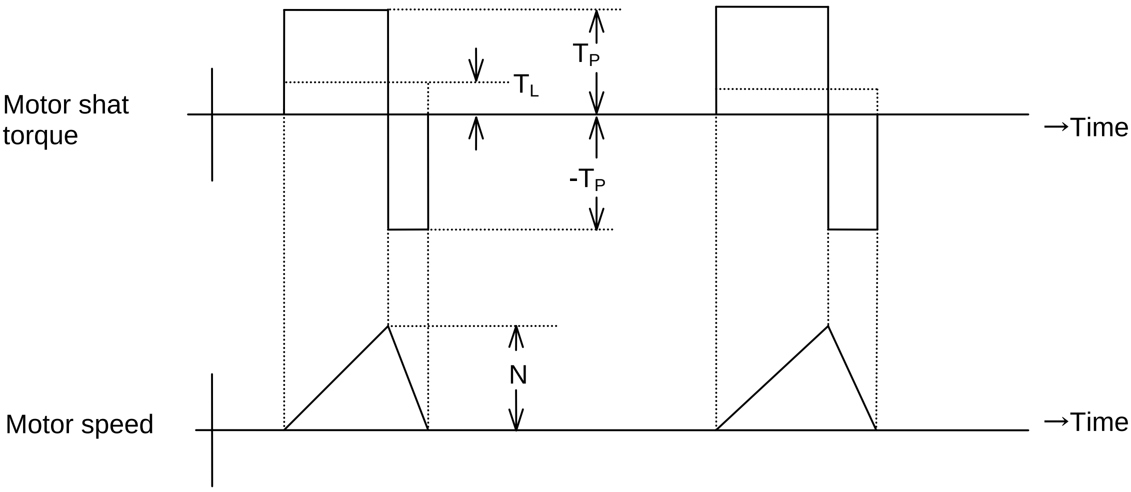


Fig. 9-3 Motor Shaft Torque Speed Timing Chart

(3) When the motor repeats acceleration, constant-speed and deceleration statuses

This operating status is shown in Fig. 9-4, and the allowable value n (times/min) of the repletion frequency can be obtained by the following expression.

$$n = 2.86 \times 10^2 \times \frac{1}{N(J_M + J_L)} \times \frac{T_P{}^2 - T_L{}^2}{T_P} \quad \text{(times/min)}$$

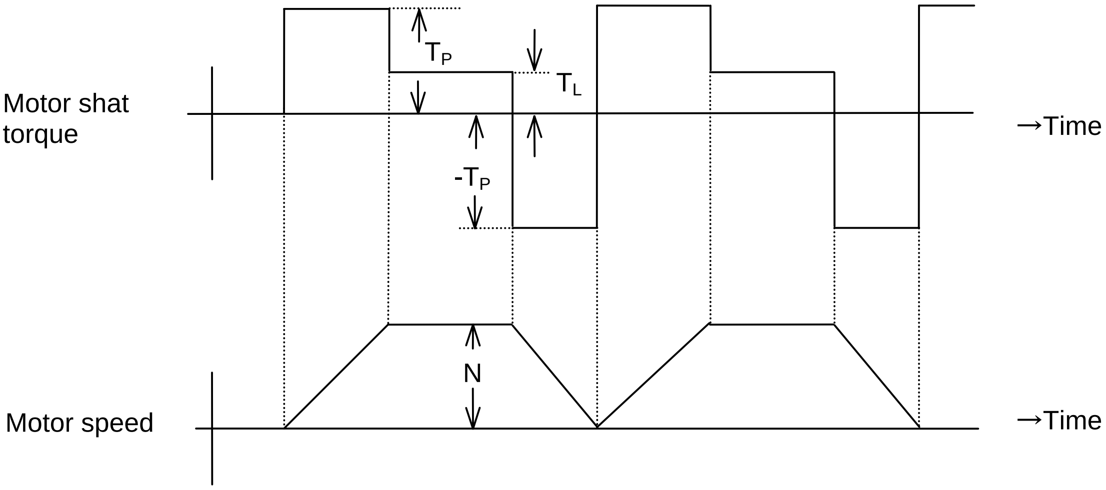


Fig. 9-4 Motor Shaft Torque Speed Timing Chart

9.1.4 Precautions on Load

(1) Negative load

The Servo Amplifier cannot perform such negative load operation as causes the motor to rotate continuously.

(Examples)

- Downward motor drive (when no counterweight is provided).
- Use like a generator, for example, the wind-out spindle of a winder.

When applying the amplifier to a negative load, consult us.

(2) Load inertia (J_L)

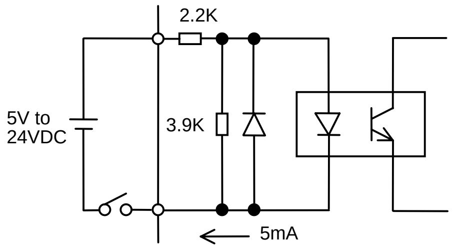
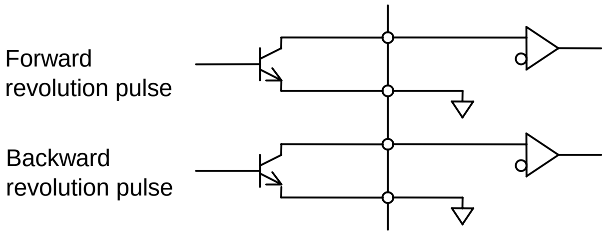
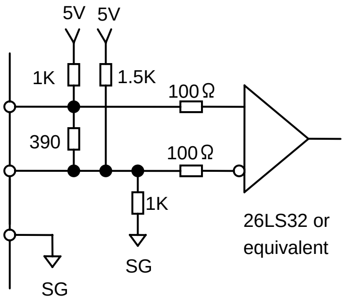
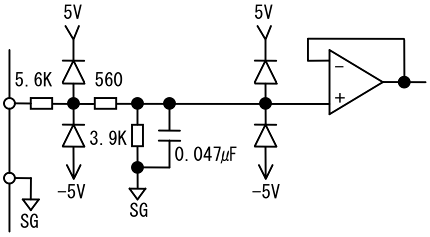
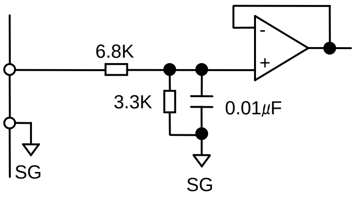
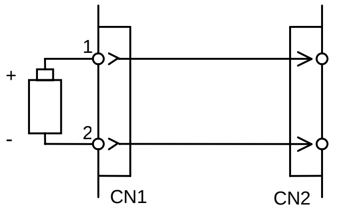
When used with a negative inertia exceeding the allowable load calculated in terms of the motor shaft, a main circuit power overvoltage detection or a regenerative error may occur, or the instantaneous allowable amount of the dynamic brake may be exceeded at the time of deceleration.

In this case, the following measures must be taken.

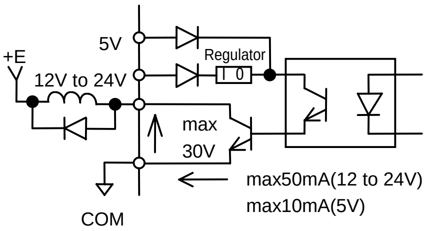
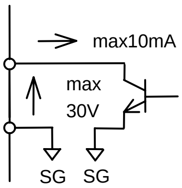
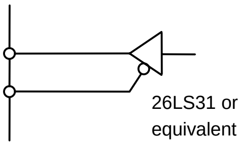
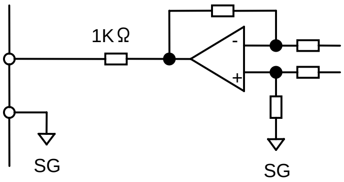
1 Lower the current limit.
2 Make the acceleration/deceleration time longer (slow down).
3 Reduce the maximum motor speed to be used.
4 Install an external regenerative resistor (optional).
For details, ask us for information.

9.1.5 CN1 Input/Output Interface Circuit Configuration

Input circuit configuration

(1) Type 1 (photocoupler input) This type of input circuit is a contactless circuit like the one shown on the right. The input signals of type 1 are Servo ON, alarm reset, forward revolution inhibit, backward revolution inhibit, current limit permit deviation clear, proportional control, command multiplier, command pulse inhibit (zero clamp) and encoder clear (for absolute encoder). The applicable power supply is 5 V to 24 V. The user must prepare this power supply. Required power specifications: 5 to 24 VDC ±10%, 100 mA minimum.	
(2) Type 2 (line driver input) This type of input circuit is like the one shown on the right. The applicable line receiver is equivalent to the 26LS32. This type permits only command pulse input of the position control type. This type can be connected to an open collector output.  Connection example	
(3) Type 3 (analog input 1) This type of input circuit is like the one shown on the right. Type 3 permits only analog velocity and torque commands (torque compensation) as input signals.	
(4) Type 4 (analog input 2) This type of input circuit is like the one shown on the right. This type permits only current limit for both forward and backward revolution as input signals.	
(5) Type 5 (through input) This type of input circuit is like the one shown on the right. This type permits only battery power (for absolute encoder) as input signals.	

Output circuit configuration

(1) Type 6 (open collector output 1) This type of output circuit is an isolated contactless circuit like the one shown on the right. The signals of type 6 are current limit status, low velocity (deviation zero), start ready complete, holding brake excitation timing signal and alarm code. One of the two power supplies of 5V and 12V to 24V can be selected (excluding input pins). The user must prepare these power supplies. Applicable power supply specifications: 5 VDC ±10%, 20 mA minimum or 12 to 24 VDC ±10%, 20 mA minimum.	
(2) Type 7 (open collector output 2) This type of output circuit is like the one shown on the right. This type permits only the C-phase encoder signal as output signals.	
(3) Type 8 (line driver output) This type of output circuit is like the one shown on the right. The line driver in use is equivalent to the 26LS31. The output signals of type 8 are A-, B- and C-phase encoder and absolute serial signals.	
(4) Type 9 (analog output) This type of output circuit is like the one shown on the right. The output signals of type 9 are monitor 1 and monitor 2.	

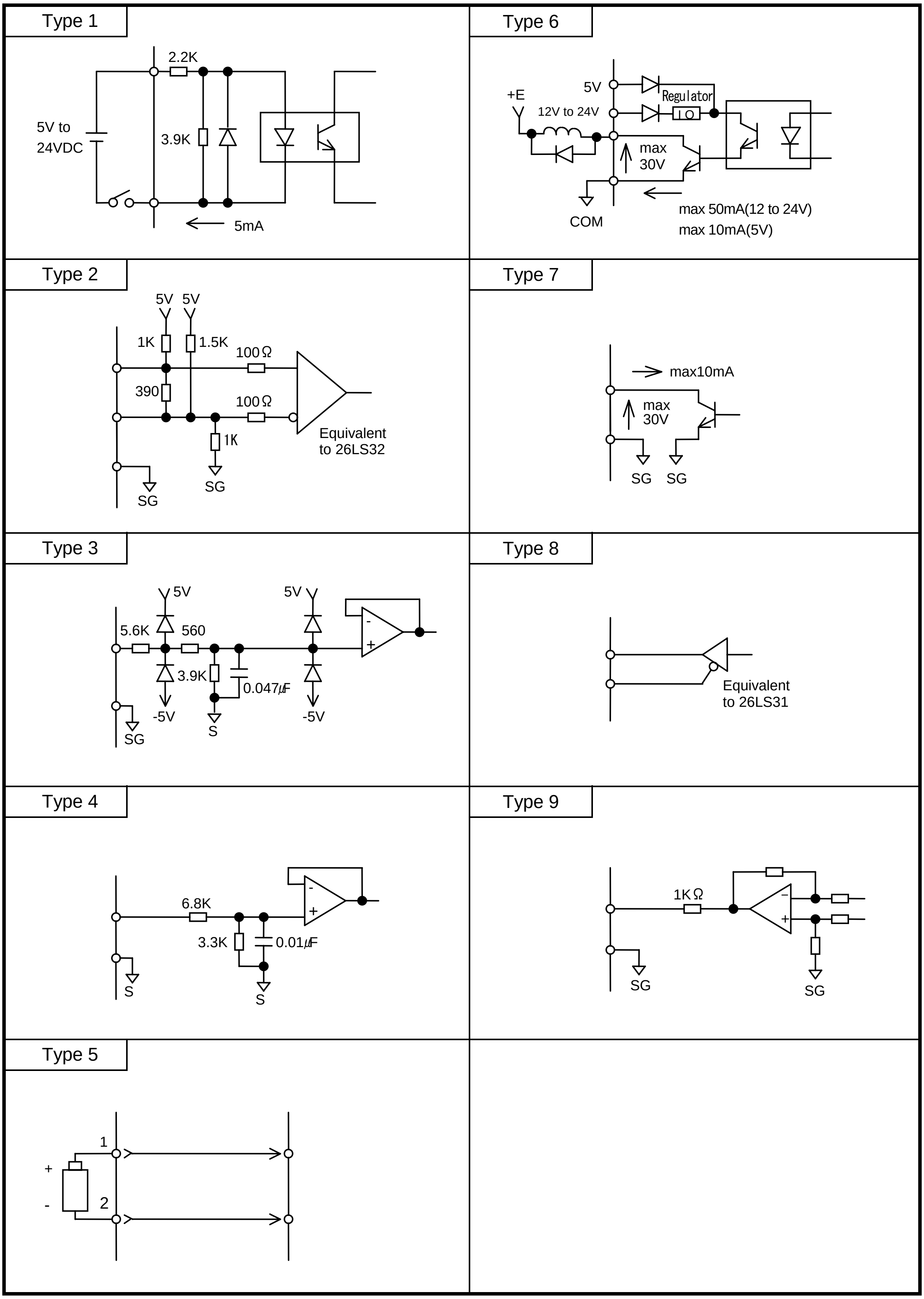


Fig. 9-5　CN1 Circuit Type

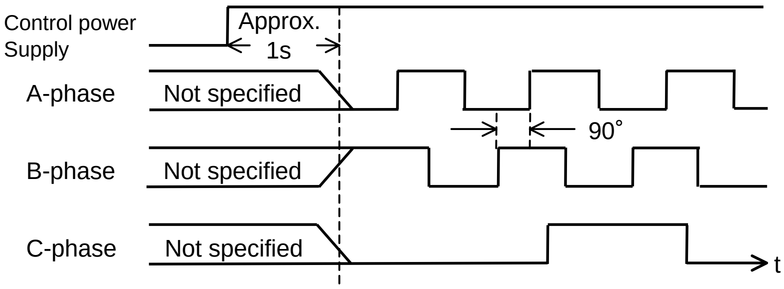
9.1.6 Position Signal Output

This section explains the position signal output specifications.

9.1.6.1 Pulse Output

CN1-3 to 8 output 90° phase difference 2-phase pulses (A- and B-phases) and the home position (C-phase) pulse.

＜Forward revolution＞



B-phase leads A-phase by a phase angle of 90˚

⚠ Not specified for approximately 1 second after the control power is turned on.
For ABS-RⅡ, (incremental) pulse output delays 500 μ sec. At C phase, outputs as 1 pulse of A phase at every rotational (once per a rotation).

9.1.6.2 Serial Output (output only when an absolute sensor is used)

In case of position signal output, either of two outputs can be selected with the remote operator. When FUNC5 bit 7 in Mode 2 on Page 6 is set at 0, synchronization is selected, but when bit 7 is set at 1, Manchester coding synchronization is selected. See FUNC5 of 7.2.3 Parameter list. The following explains the specifications.

(1) Output specifications (9600bps•1Mbps)

Table 9-2 Start-stop Synchronization Output (9600bps) Specifications

Transmission system	Synchronization
Baud rate	9600 bps
Number of transfer frames	6 frames (11 bits/frame)
Transfer format	See Fig. 9-6.
Transmission error check	(1 bit) even parity
Transfer time	6.9 mS (Typ.)
Transfer cycle	9.2 mS (See Fig. 9-8(1).)
Incremental direction	Increased at forward revolution ⚠

Table 9-3 Manchester Coding Synchronization Type Output (1Mbps) Spec.

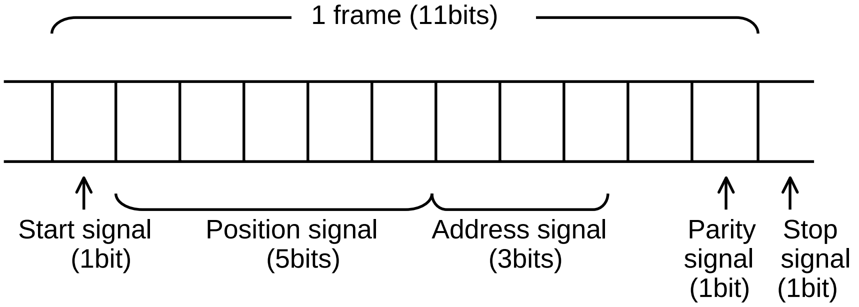
Transmission system	Manchester coding synchronization
Baud rate	1 Mbps
Number of transfer frames	2 frames (25 bits/frame)
Transfer format	See Fig. 9-7.
Transmission error check	(3 bits) CRC error check
Transfer time	66 μs (Typ.)
Transfer cycle	84 μs ±2 μs(See Fig. 9-8 (2).)
Incremental direction	Increase at forward revolution ⚠

⚠ Forward revolution means counterclockwise rotation as viewed from the motor shaft.
When the absolute value increases to the maximum, it returns to the minimum (0).

(2) Transfer format (9600bps•1Mbps)

(2-1) Synchronization (9600 bps)

① Configuration in a frame



② Configuration in each frame

	Start signal	Position signal					Address signal			Parity signal	Stop signal
・Frame 1	0	D0 (LSB)	D1	D2	D3	D4	0	0	0	0/1	1
・Frame 2	0	D5	D6	D7	D8	D9	1	0	0	0/1	1
・Frame 3	0	D10	D11	D12	D13	D14	0	1	0	0/1	1
・Frame 4	0	D15	D16	D17	D18	D19	1	1	0	0/1	1
ABS-E											
・Frame 5	0	D20	D21	D22	D23 (MSB)	BATE	0	0	1	0/1	1
・Frame 6	0	SOT	0	WAR	0	0	1	0	1	0/1	1
ABS-RⅡ											
・Frame 5	0	D20	D21	D22	D23	D24	0	0	1	0/1	1
・Frame 6	0	D25	0	0	AW0	AW1	1	0	1	0/1	1

Fig. 9-6

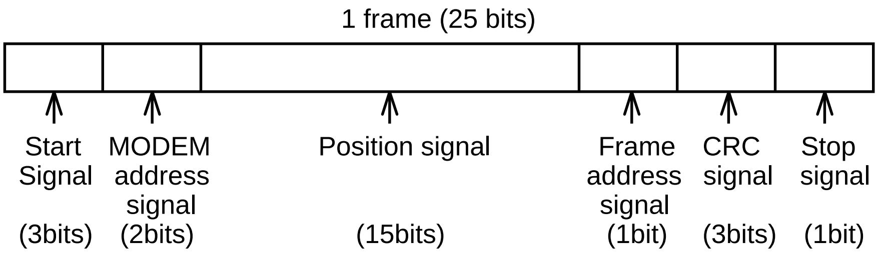
Transfer Format of Synchronization (9600bps)

Data contents

<table>
<tr><th>ABS-E</th><th>ABS-RⅡ</th></tr>
<tr><td>
<table>
<tr><td>D0 to D10</td><td>One-revolution absolute value</td></tr>
<tr><td>D11 to D23</td><td>Multi-revolution absolute value</td></tr>
<tr><td>BATE</td><td>Battery alarm</td></tr>
<tr><td>SOT</td><td>Absolute value range over</td></tr>
<tr><td>WAR</td><td>Battery warning</td></tr>
<tr><td>D0 to D10</td><td>One-revolution absolute value</td></tr>
<tr><td>D11 to D23</td><td>Multi-revolution absolute value</td></tr>
</table>
</td><td>
D0 to D12 One-revolution absolute value
D13 to D25 Multi-revolution absolute value
<table>
<tr><th></th><th>AW0</th><th>AW1</th></tr>
<tr><td>Battery Alarm</td><td>0</td><td>1</td></tr>
<tr><td>Sensor Error</td><td colspan="2">Low Output</td></tr>
<tr><td>Normal</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
</table>

(2-2) Manchester coding synchronization (1Mbps)

① Configuration in a frame



② Configuration in each frame

・Frame 1

Start signal (⚠1)					1	1	1								
MODEM address signal												0	0		
Position signal	D0 (LSB)	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14
Frame address signal			0												
CRC signal							0/1	0/1	0/1						
Stop signal													0		

・Frame 2

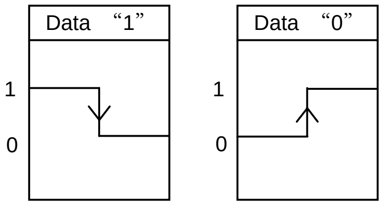
Position signal (ABS-E)	D15	D16	D17	D18	D19	D20	D21	D22	D23	BATE	SOT	0	WAR	0	0
Position signal (ABS-RⅡ)	D15	D16	D17	D18	D19	D20	D21	D22	(MSB) D23	D24	D25	0	0	AW0	AW1
Frame address signal			1												

The start signal, MODEM signal, CRC signal and stop signal are the same as those in frame 1.

Fig. 9-7 Transfer Format of Manchester Coding Synchronization (1 Mbps)

1 The first 2 bits of the start signal are output as a high (1) signal of the whole bit section.
The remaining 23 bits are all Manchester coded.

2 The data is the same as in page 9-14.



Manchester code

(3) Transfer cycle (9600bps•1Mbps)

(3-1) Synchronization (9600 bps)

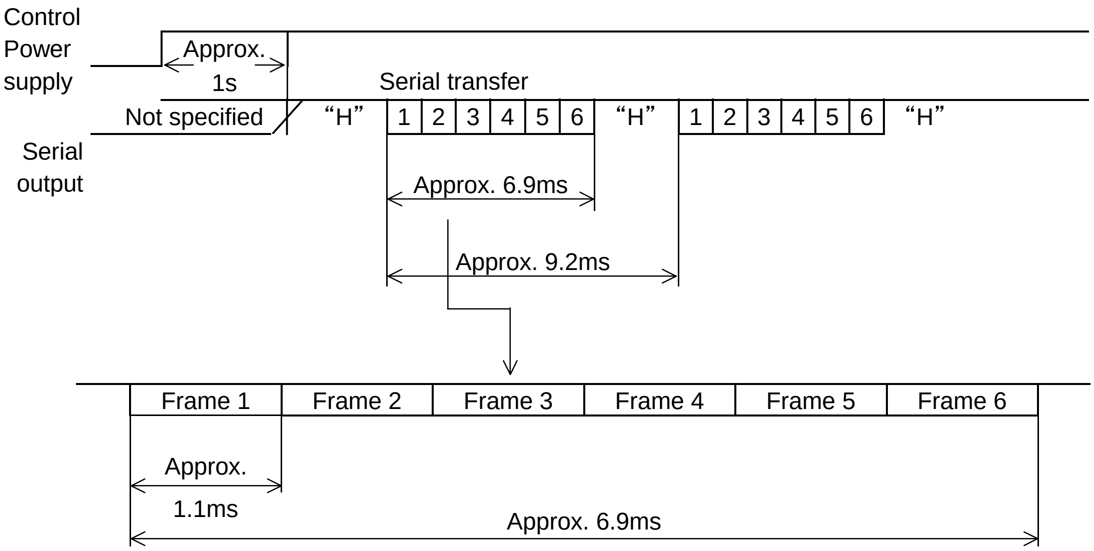


Fig. 9-8 (1) Transfer Cycle of Synchronization (9600 bps)

(3-2) Manchester coding synchronization (1 Mbps)

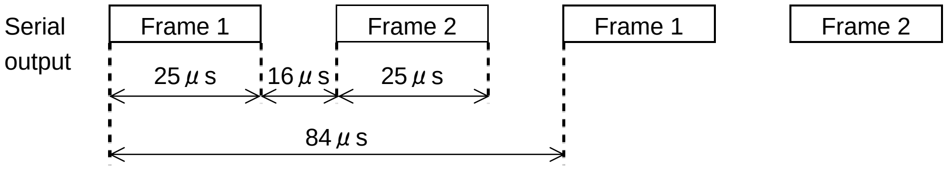


Fig. 9-8 (2) Transfer Cycle of Manchester Coding Synchronization (1 Mbps)

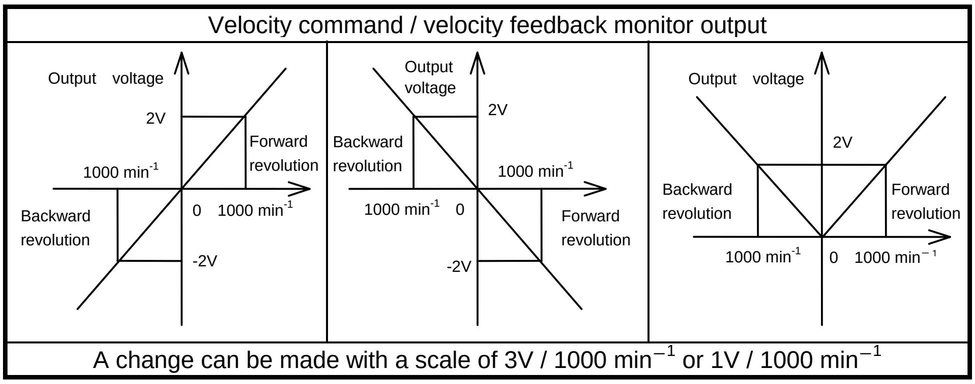
The serial output is not specified for about 1 sec after the power is turned on.
Communication does not always start with frame 1 in 1 sec.

9.1.7 Monitor Output

- The monitor 1 (MON1) and monitor 2 (MON2) output contents can be selected and output by the remote controller.
- The monitor 1 and 2 outputs are convenient for setting a check pin on the controller.
- The output contents can be selected by the remote monitor. However, the contents of the check pin on the front board of the amplifier will be changed at the same time.
- It can be changed in Mode 2 on Page 3 (Func2) and Mode 4 Page 0 or 1 of the remote operator. Refer to 4 mode4, page 1, 2 of 7.2.3 Parameter List.

(1) Velocity, torque and position deviation monitor

Refer to Fig. 9-9 (1) to (3).
The velocity command outputs internal data of the amplifier, and thus, is different from the value generated by the remote operator VCMD monitor.
In SOFF mode, the monitor output goes to zero (0).


Velocity command / velocity feedback monitor output

A change can be made with a scale of 3V / 1000 min^{-1} or 1V / 1000 min^{-1}

Fig. 9-9 (1)

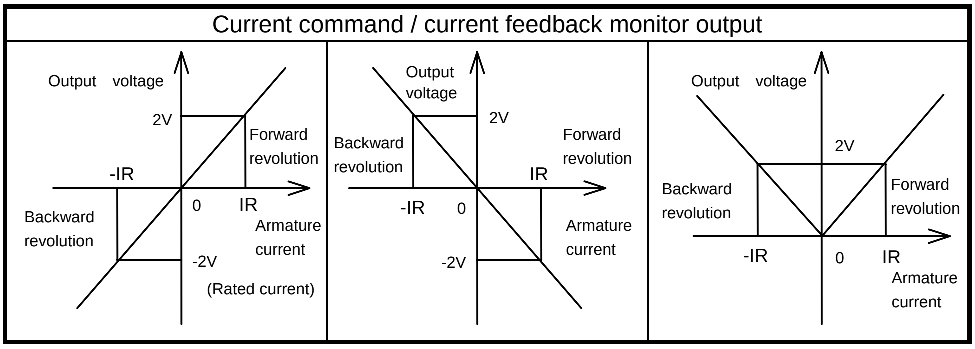
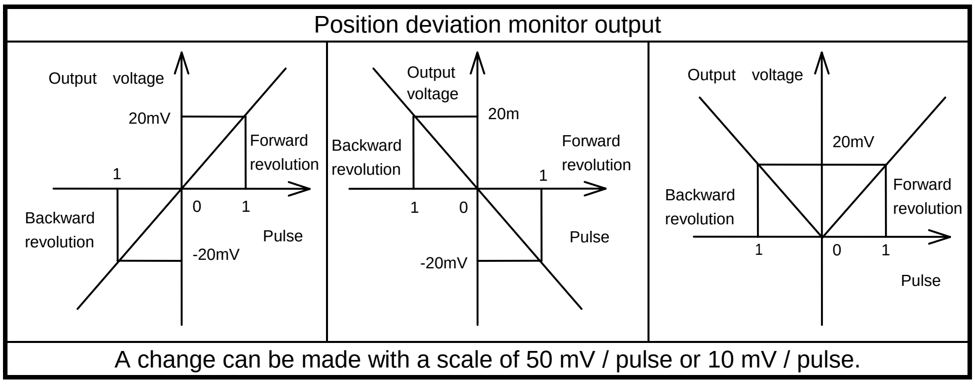

Current command / current feedback monitor output

Fig. 9-9 (2)


Position deviation monitor output

A change can be made with a scale of 50 mV / pulse or 10 mV / pulse.

Fig. 9-9 (3)

(2) Regenerative load factor monitor output

This monitor output is convenient for checking the usage rate of the built-in regenerative resistor and the power of the external regenerative resistor.
Regenerative load factor monitor signals are output by the absorbable power of the built-in regenerative power (= 1V), and the output voltage is renewed every second.

① A calculation example of the usage rate of the built-in regenerative resistor is as follows:

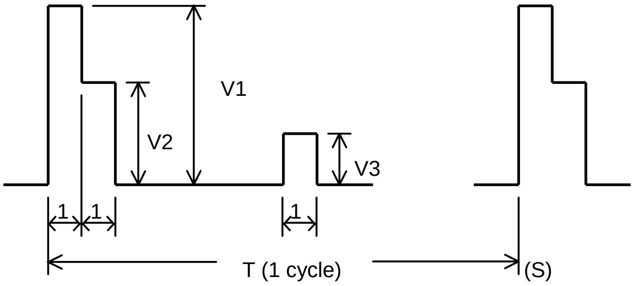


Fig. 9-9(4)

In the case of the above measurement, the usage rate is calculated as follows :

$$\text{Usage rate of the built-in regenerative resistor} = \frac{V1 + V2 + V3}{T} \times 100(\%)$$

When the usage rate is less than 100%, the built-in regenerative resistor is satisfactory.

1 When T (1 cycle) is less than 1 second, repeat the cycle for more than 1 second.

② A calculation example of the power of the external regenerative resistor is as follows:

In the case of an external regenerative resistor, the resistance value should be equal to any of those of the following built-in amplifier regenerative resistors as a precondition. When the usage rate is 200% as a result of calculation similar to the above example, the power of the external regenerative resistor should be 2 times that of any of the allowable effective powers of the following built-in regenerative resistors, or 3 times when the usage rate is 300%.

Table 9-4 Allowable Effective Power PRI [W] of Built-in Amplifiers Regenerative Resistors

Type of amplifier	PY0A015	PY0A030	PY0A050	PY0A100	PY0A150
Resistance value (Ω)	100	50	20	10	6.7
Allowable effective power PRI [W]	20	20	60	90	120

* For the allowable effective power of the external regenerative resistors, see the External Regenerative Resistor Combination Table (Table 9-21).

1 The maximum output voltage of the analog monitor is 10 V. So, if the power consumption with a regenerative resistor in a second is more than 10 times the absorption power of a built-in regenerative one, it will continue for the next 1 second.

2 The regenerative load factor monitor may cause errors of ±30%.

3 PY0A300 does not have built-in regenerative resistor.

(3) Typical monitor applications

This section explain typical applications of the velocity and current monitor.

Speed and current measurement

When connecting a measuring instrument to the velocity feedback monitor or current feedback monitor, use a both-swing type DC voltmeter and connect it as shown in Fig. 9-9 (5).
In this case, use a shielded wire and make the wiring as short as possible.

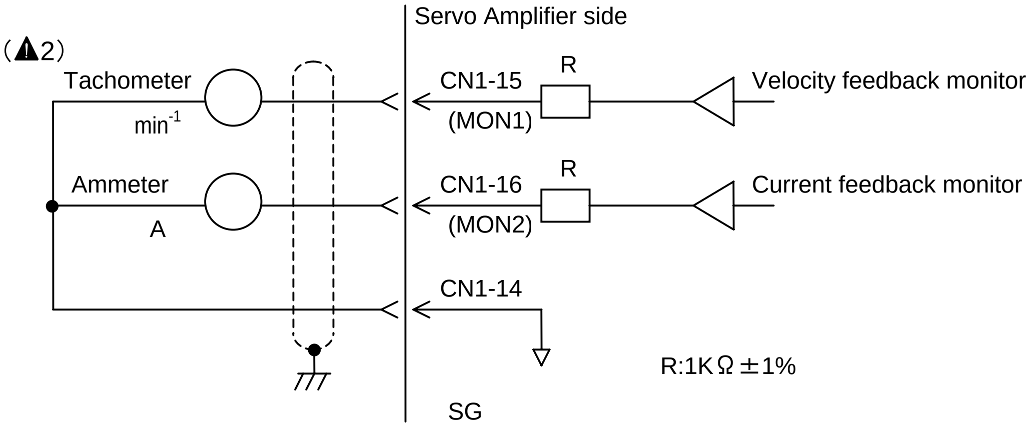


Fig. 9-9(5) Typical Connection of Monitor and Measuring Instrument

- Current feedback monitor output (CN1 - 16) : ±2.0V ±20% / rated armature current.
- Velocity feedback monitor output (CN1 - CN15) : ±2.0V ±10% / 1000 min^{-1}.
- The maximum monitor output voltage is ±10V.

⚠

1 When the contents of the monitor output are changed using the remote operator to observe them on the check pin on the front board of the amplifier, the contents of CN1 - 15 and CN1 - 16 are also changed. When the above usage is employed for CN1 - 15 and 16, therefore, change the contents carefully so as not to damage the measuring equipment.

2 For measuring the velocity/current monitor, use a DC voltmeter (both-swing type) of 10 kΩ or more.

9.1.8 Position Control Type Specifications

This section explains how to handle command pulses and other signals for the position control type.

(1) Command pulses

Three types of signals can be input as command pulses.

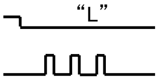
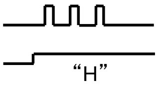
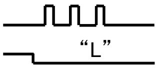
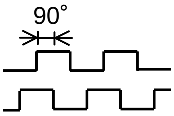
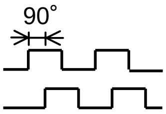
	Command pulse type	Input pin No. CN1-	For motor forward revolution command	For motor backward revolution command	PMOD in Mode 2 on Page 0 of remote operator ⚠ 2
When "0" is set in the revolution direction bit	Backward revolution pulse train + Forward revolution pulse train	㉘ ㉙ ㉖ ㉗			Bit 6 = 0 Bit 5 = 0
	Code + Forward revolution pulse	㉘ ㉙ ㉖ ㉗			Bit 6 = 1 Bit 5 = 0
	"90°" phase difference two-phase pulse train ⚠ 1	㉘ ㉙ ㉖ ㉗			Bit 6 = 0 Bit 5 = 1

Fig. 9-10 Command Pulse Type

⚠

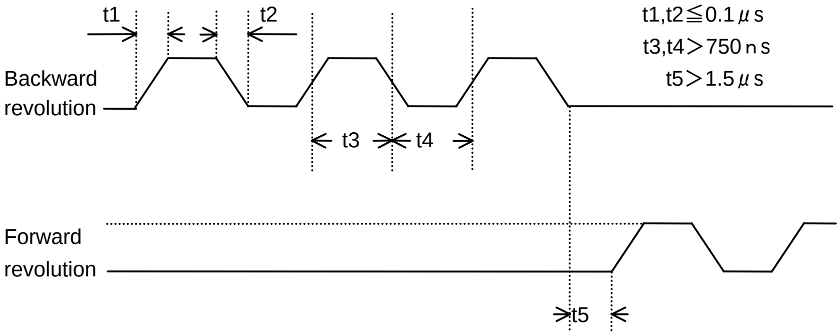
1 In case of a 90° phase difference two-phase train input, the multiplier is fixed at 4.

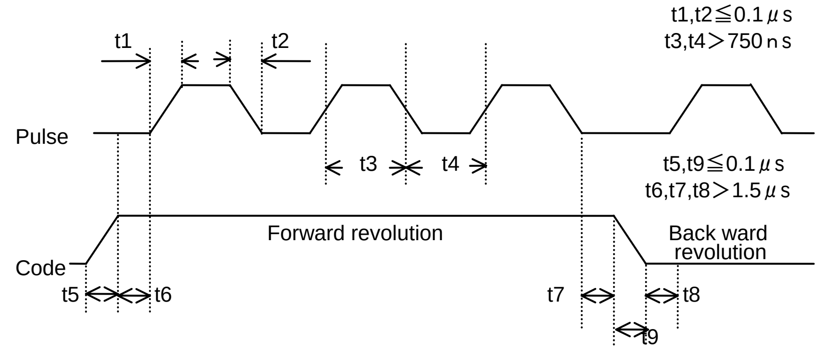
2 For details, see pages 7-41 to 43 of this manual.

(2) Command pulse timing

Each command pulse timing is as follows.

<table>
<tr><th>Command pulse</th><th></th></tr>
<tr><td>Backward revolution pulse train
+
Forward revolution pulse train.

Maximum command frequency: 666 Kpps</td><td>
</td></tr>
<tr><td>Code + Pulse train

Maximum command frequency: 666 Kpps</td><td>
</td></tr>
<tr><td>90° phase difference two-phase pulse

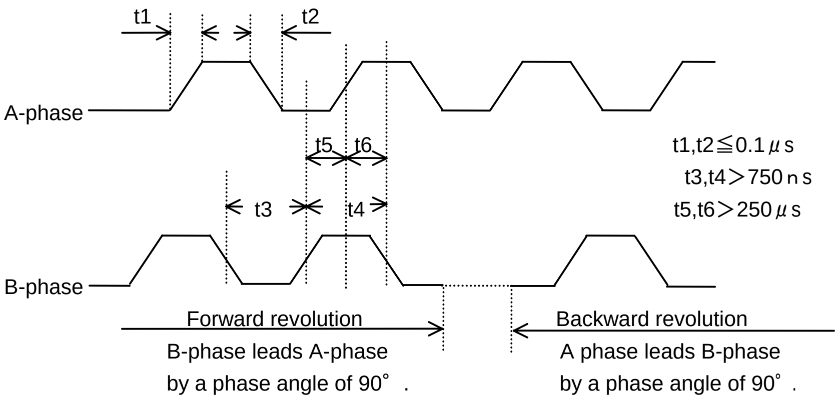
Maximum command frequency: 666 Kpps</td><td>
</td></tr>
</table>

Fig. 9-11　Command Pulse Timing

The above values apply only when screen mode 2-0 (PMOD) (digital filter DFC1 and 0 ="00", and bit 7 = 0) is selected.

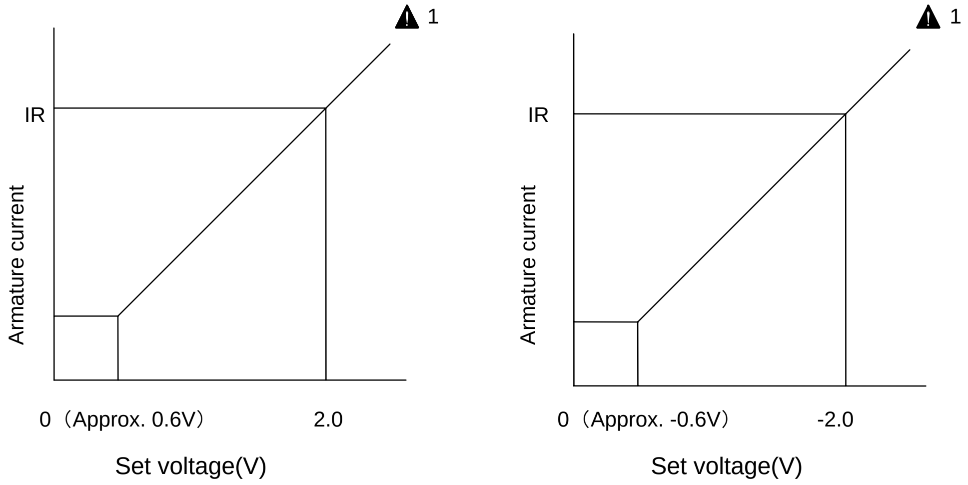
(3) External analog current limit input

Both the forward revolution driving current (positive side current) and the backward revolution driving current (negative current) can be independently limited externally (when parameter Func1 bit0 is set at "1").

Regarding the relationship with the motor armature current, the current is limited to 2V/rated current (IR) by the applied motor.

The same limit value for the backward revolution driving current as that for forward revolution can be selected. Switching of the polarity between positive and negative (see description on the parameter Func1 on page 7-46) is also possible.

Fig. 9-12 shows the relationship between the set voltage and the current limit value.



(a) Forward revolution side current limit(PIL)

(b) Backward revolution side current limit(NIL)
(When negative polarity is selected)

Fig. 9-12 Set Voltage and Current Limit Value

1 If a set value exceeds the instantaneous maximum stall current (Ip) of the Servomotor, it is saturated at Ip.

2 To lock the motor by means of a bump stop by applying an external current limit, set the current limit value below the rated armature current.

(4) Torque compensation input

For the characteristics of torque compensation input and motor torque, see Fig. 9-14 (the same as torque command input of torque control type).

This input is effective for decreasing the acceleration time or switching the quadrant.

(5) General specifications of CN1 input/output signals

This section explains the general specifications of CN1 input/output signals of the position control type. Fig. 9-13 shows the circuit types of CN1 input/output signals, and Tables 9-5 and 9-6 describe the general specifications.

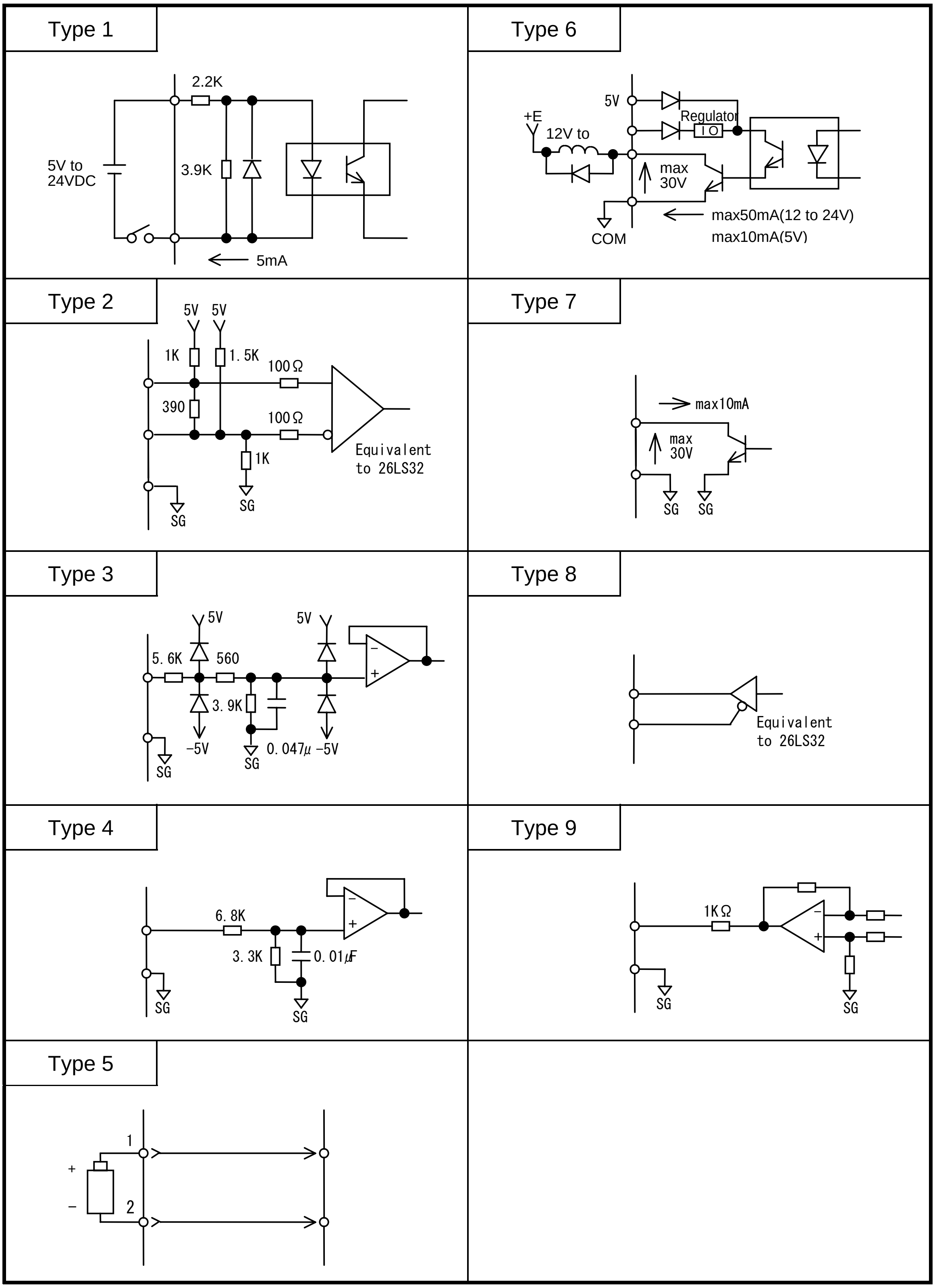


Fig. 9-13

Table 9-5 General Specifications of Position Control Type Input Signals (incremental encoder) 1/2

Signal name	Abbr.	Pin No. * 1	Circuit type * 2	General specification	
Forward revolution pulse train command	PPC PPC	26 27	Type 2	Pulse train for forward revolution	
Backward revolution pulse train command	NPC NPC	28 29	Type 2	Pulse train for backward revolution	
Torque compensation	TCOMP	22 (20)	Type 3	The rated torque (TR) is obtained by inputting ±2V, but is limited by the maximum instantaneous stall torque. To enable torque compensation, Func1 bit 6 must be set at 1.	
Servo ON	SON	37 (23)	Type 1	Servo ON status is provided by closing the contact, and entering the pulse train waiting status.	
Alarm reset	RST	30 (23)	Type 1	With this signal input, alarm code or alarm bit outputs and an error display are reset.	
Deviation clear	CLE	34 (50)	Type 1	By inputting the contact close signal for 10 ms or more, the contents of the deviation counter can be cleared to zero.	
Forward revolution overtravel Backward revolution overtravel	PROT NROT	32 (23) 33 (23)	Type 1	Contact open status is provided upon occurrence of overtravel. Input both the forward and backward revolution signals. When overtravel occurs, a 120% current limit is automatically applied, inhibiting the commands to the side to which this signal has been input. (This function can be canceled or changed into a c-contact input by setting the remote operator.)	
Proportional control (standard)	PCON	35 (50)	Type 1 For 35 and 36 pins, one of three functions can be selected by setting the remote operation.	With this signal input, the velocity loop becomes proportional control.	
Command multiplier	PMUL	36 (23)		With this signal input, command pulses are multiplied by the magnification ratio set on page 3 in Parameter set screen mode 1.	
Command pulse inhibit	INH			Inputting command pulses is inhibited.	
Forward revolution current limit	PIL	18 (17)	Type 4	The current is limited to the rated current at +2 V (effective when ILM is input).	To enable the external current limit, Func1 bit 10 must be set at "1".
Backward revolution current limit	NIL	19 (17)	Type 4	Current is limited to the rated current at -2 V (effective when ILM is input).	
Current limit permit	ILM	31 (23)	Type 1	The current is limited by closing the contact. It is ineffective during JOG or overtravel (the limit method is based on Func1 parameter).	
Input sequence power supply 1	DC5V to DC24V	23	——	External power supply for CN1-30, 31, 32, 33, 36 and 37.	
Input sequence power supply 2		50		External power supply for CN1-34 and 35.	
Velocity addition	VCOMP	21 (20)	Type 3	1000 min^{-1} is selected with entry of ±2 V (standard setting). In order to enable velocity addition, Func1 bit 7 must be set at 1.	

* 1 The pin numbers in parentheses denote the ground or common side o each signal.

* 2 For the circuit type, see Fig. 9-13.

Table 9-5 General Specifications of Position Control Type Input Signal (Incremental Encoder) 2/2

Signal name	Abbr.	Pin No. * 1	Circuit type * 2	General specification
Monitor 1	MON1	15 (14)	Type 9	2V ± 20%/1000 min^{-1} (velocity monitor). Load: less than 2 mA. Output resistance: 1 KΩ. Positive voltage at forward revolution
Monitor 2	MON2	16 (14)	Type 9	2V ±20%/rated current (current monitor). Load: Less than 2 mA. Output resistance: 1 KΩ. Positive voltage when forward revolution power is output.
Start ready completes	SRDY	41 (24) (25)	Type 6	When the "Servo ON signal" is ready to receive after the DC power supply of the main circuit is turned on, this comes on and goes low impedance.
Current limit status	ILIM	40 (24) (25)	Type 6	This signal comes on in current limit status and is effective as a bump end input or a standard for prevention against current saturation at acceleration/deceleration. ⚠
Encoder signal	$\overline{A}$, A $\overline{B}$, B $\overline{C}$, C	3, 4 5, 6 7, 8	Type 8	Output by the line driver (26LS31) after the encoder pulse is divided. The signal is received by the line receiver (26LS32).
Encoder channel C signal	COP	11 (13)	Type 7	Output by the open collector (the logic can be reversed using the Func5 bit 6 parameter).
Alarm code output or alarm bit output	ALM1 ALM2 ALM4 ALM8	43 (24) (25) 44 45 46	Type 6	Alarm code output and alarm bit output (ALM1) are switched by Func2 bit 6 of the remote operator. The alarm bit signal turns off in an alarm status. The alarm code outputs various alarms as 4-bit binary codes.
Deviation zero	INP	39 (24) (25)	Type 6	This signal indicates that the contents of the deviation counter have come within the setting range. ⚠
Holding brake relay excitation timing output	HBON	42 (24) (25)	Type 6	This signal outputs holding brake relay excitation timing.
Output sequence power supply	12 to 24 VDC 5V	49 38	——	External power supply for CN1-39, 40, 41, 42, 43, 45 and 46.

* 1 The pin numbers in parentheses denote the ground or common side of each signal.

* 2 For the circuit type, see Fig. 9-13.

⚠ The output contents depend on the Func4 parameter setting.

(6) General Specifications of CN1 Input/Output Signals (for absolute encoder)

This section explains the general specifications of CN1 input/output signals of the position control type

Table 9-6 General Specifications of Position Control Type Input Signals (Absolute Encoder) 1/2

Signal name	Abbr.	Pin No. * 1	Circuit type * 2	General specification	
Forward revolution pulse train command	$\underline{\text{PPC}}$ PPC	26 27	Type 2	Pulse train for forward revolution.	
Backward revolution pulse train command	$\underline{\text{NPC}}$ NPC	28 29	Type 2	Pulse train for backward revolution.	
Torque compensation	TCOMP	22 (20)	Type 3	The rated torque (TR) is obtained by inputting +2 V, but is limited by the maximum instantaneous stall torque. To enable torque compensation, Func1 bit6 must be set at "1".	
Servo ON	SON	37 (23)	Type 1	Servo ON status is provided by closing the contact, and entering the pulse train waiting status.	
Alarm reset	RST	30 (23)	Type 1	With this signal, alarm code or alarm bit outputs and an error display are reset.	
Deviation clear	CLE	34 (50)	Type 1	By inputting the contact close signal for 10 ms or more, the contents of the deviation counter can be cleared to zero.	
Forward revolution overtravel Backward revolution overtravel	PROT NROT	32 (23) 33 (23)	Type 1	Contact open status is provided upon occurrence of overtravel. Input both the forward and backward revolution signals. When overtravel occurs, a 120% current limit is automatically applied, inhibiting the commands to the side to which this signal has been input. (This function can be canceled or changed into an a-contact input by setting the remote operator.)	
Encoder clear (standard)	ECLR	35 (50)	Type 1 For 35 and 36 pins, one of four functions can be selected by setting the remote operation.	Inputting this signal for over 4 seconds will clear the encoder revolution counter (multiple revolution). When a battery alarm ("U") occurs, input this signal and reset the alarm.	
Proportional control (standard)	PCON	36 (23)		With this signal input, the velocity loop becomes proportional control.	
Command multiplier	PMUL			With this signal input, command pulses are multiplied by the magnification ratio set on page 5 in Parameter set screen mode 1.	
Command pulse inhibit	INH			Inputting command pulses is inhibited.	
Forward revolution current limit	PIL	18 (17)	Type 4	The current is limited to the rated current at +2V (effective when ILM is input).	To enable the external current limit, Func1 bit 0 must be set at "1".
Backward revolution current limit	NIL	19 (17)	Type 5	Current is limited to the rated current at -2V (effective when ILM is input).	
Current limit permit	ILM	31 (23)	Type 1	The current is limited by closing the contact. It is ineffective during JOG or overtravel (the limit method is based on the Func1 parameter).	
Battery power	BAT+ BAT–	1 2	Type 10	This signal connects a 3.6 VDC equivalent battery (ER6 2000 mA from Toshiba Battery is recommended).	
Input sequence power supply 1	5 to 24 VDC	23	——	External power supply for CN1-30, 31, 32, 33, 36 and 37.	
Input sequence power supply 2		50		External power supply for CN1-34 and 35.	

* 1 The pin numbers in parentheses denote the ground or common side of each signal.

* 2 For the circuit type, see Fig. 9-13.

Table 9-6 General Specifications of Position Control Type Output Signal (Absolute Encoder) 2/2

Signal name	Abbr.	Pin No. * 1	Circuit type * 2	General specification
Monitor 1	MON1	15 (14)	Type 9	2 V ±1 0%/1000 min^{-1} (velocity monitor). Load: less than 2 mA. Output resistance: 1 KΩ. Positive voltage at Forward revolution
Monitor 2	MON2	16 (14)	Type 9	2 V ± 20%/rated current (current monitor). Load: Less than 2 mA. Output resistance: 1 KΩ. Positive voltage when forward revolution power is output.
Start ready complete	SRDY	41 (24) (25)	Type 6	When the "Servo ON signal" is ready to receive after the DC power supply of the main circuit is turned on, this comes on and goes low impedance.
Current limit status	ILIM	40 (24) (25)	Type 6	This signal comes on in current limit status and is effective as a bump end input or a standard for prevention against current saturation at acceleration/deceleration. ⚠
Encoder signal	A, A B, B C, C	3, 4 5, 6 7, 8	Type 8	Output by the line driver (26LS31) after the encoder pulse is divided. The signal is received by the line receiver (26LS32).
Absolute value signal	PS PS	9 10	Type 8	The absolute value signal is output in serial form (1M/2Mbps) by the line driver (26LS31). The signal is received by the line receiver (26LS32).
Encoder channel C signal	COP	11 (13)	Type 7	Output by the open collector (the logic can be reversed using the Func5 bit6 parameter).
Alarm code output or Alarm bit output	ALM1 ALM2 ALM4 ALM8	43 (24) (25) 44 45 46	Type 6	Alarm code output and alarm bit output (ALM1) are switched by Func2 bit6 of the remote operator. The alarm bit signal turns off in an alarm status. The alarm code outputs various alarms as 4-bit binary codes.
Deviation zero	INP	39 (24) (25)	Type 6	This signal indicates that the contents of the deviation counter have come within the setting range. ⚠
Holding brake excitation timing output	HBON	42 (24) (25)	Type 6	This signal outputs holding brake relay excitation timing.
Output sequence power supply	12 to 24 VDC 5V	49 38	——	External power supply for CN1−39, 40, 41, 42, 43, 44, 45, and 46.

* 1 The pin numbers in parentheses denote the ground or common side of each signal.

* 2 For the circuit type, see Fig. 9-13.

⚠ The output contents depend on the Func4 parameter setting.

9.1.9 Velocity/Torque Control Type Specifications

This section explains how to handle input commands and other signals for the velocity/torque control type.

(1) Input command specifications

① Torque command input

Fig. 9-14 shows the torque command/motor-generated torque characteristics.
The torque command voltage is a voltage input from torque terminals CN1-22 and 20.
Positive motor torque (+) means torque that is generated in the counterclockwise direction when viewed from the load side.
The polarity can be switched by parameter Func5 bit0.

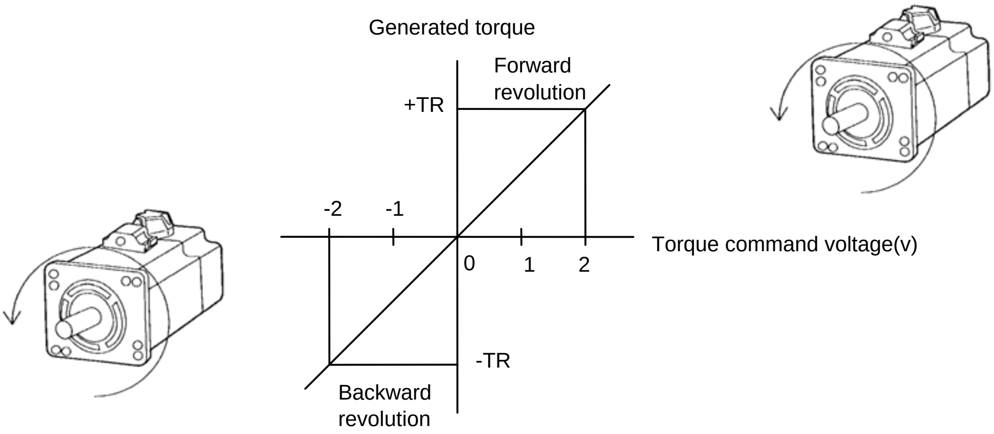


Fig. 9-14 Torque Command - Generated Torque

② Velocity command input

Fig. 9-15 shows the velocity command/motor revolution speed characteristics.
The velocity command voltage is a voltage input from velocity command input terminals CN1 - 21 and 20.
The positive motor revolution (+) means counterclockwise revolution when viewed from the load side.
The polarity can be switched by Func5 bit1 parameter.

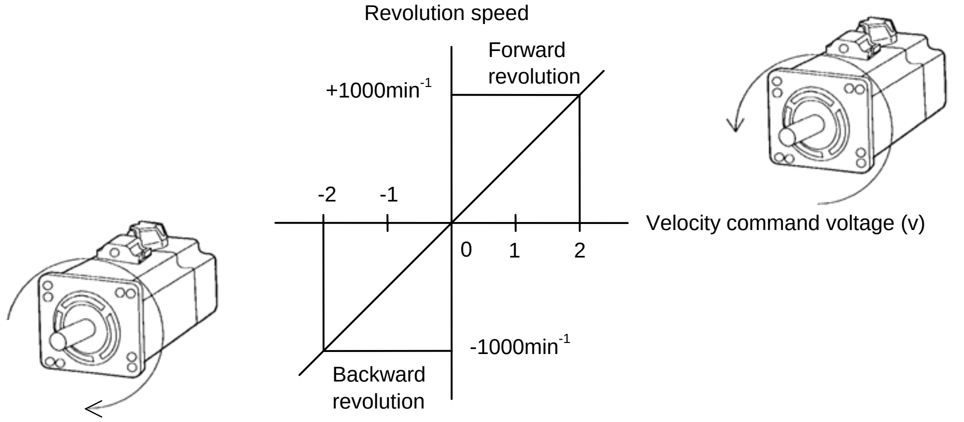


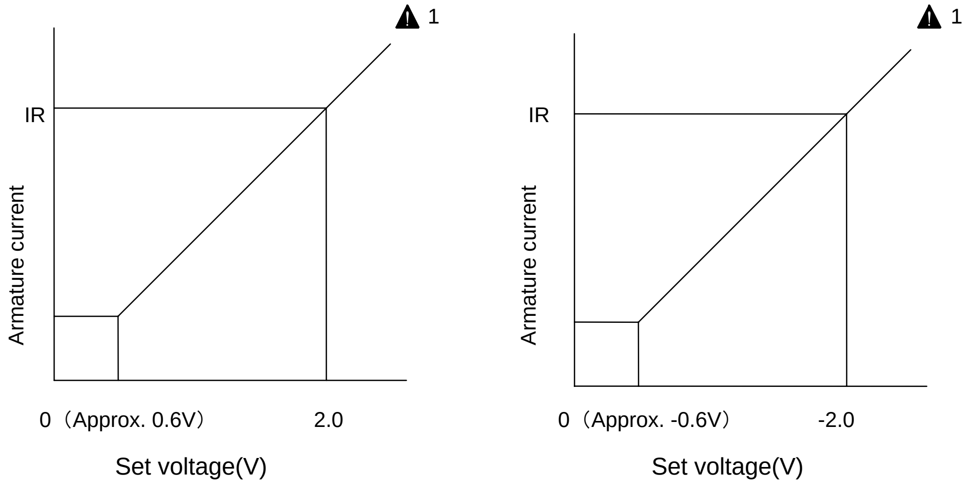
Fig. 9-15 Velocity Command - Speed Characteristics

When the velocity command voltage is tens of mV or less, the motor lock current may pulsate. If this is problematic, the current pulsation can be reduced by increasing the velocity command scale (VCMD).

(2) External analog current limit input

The forward revolution driving current (positive side) and the backward revolution driving current (negative side) can both be independently limited externally (when parameter Func1 bit0 is set at "1").

Regarding the relationship with the motor armature current, the current is limited to 2V/the rated current (IR) by the applied motor. The same limit value for the backward revolution driving current as that for forward revolution can be selected. Switching of the polarity between positive and negative is also available (see the description of section 7 Func1). Fig. 9-16 shows the relationship between the set voltage and the current limit value.



(a) Forward revolution side current limit(PIL)

(b) Backward revolution side current limit(NIL)
(When negative polarity is selected)

Fig. 9-16 Relationship Between Set Voltage and Current Limit Value

1 If a set value exceeds the instantaneous maximum stall armature current (Ip) of the Servomotor, it is saturated at Ip.
2 To lock the motor by means of a bump stop by applying an external current limit, the current limit value must be below the rated armature current.

(3) Torque compensation input

For the torque compensation input/motor-generated torque characteristics, refer to Fig. 9-14 (the same as the torque command input of the torque control type).
This input is effective for increasing the acceleration time or switching the quadrant.

(4) General specifications of CN1 input/output signals

This section explains the general specifications of CN1 input/output signals of the position control type. Fig. 9-17 shows the circuit types of CN1 input/output signals, and Tables 9-7 and 9-8 describe the general specifications.

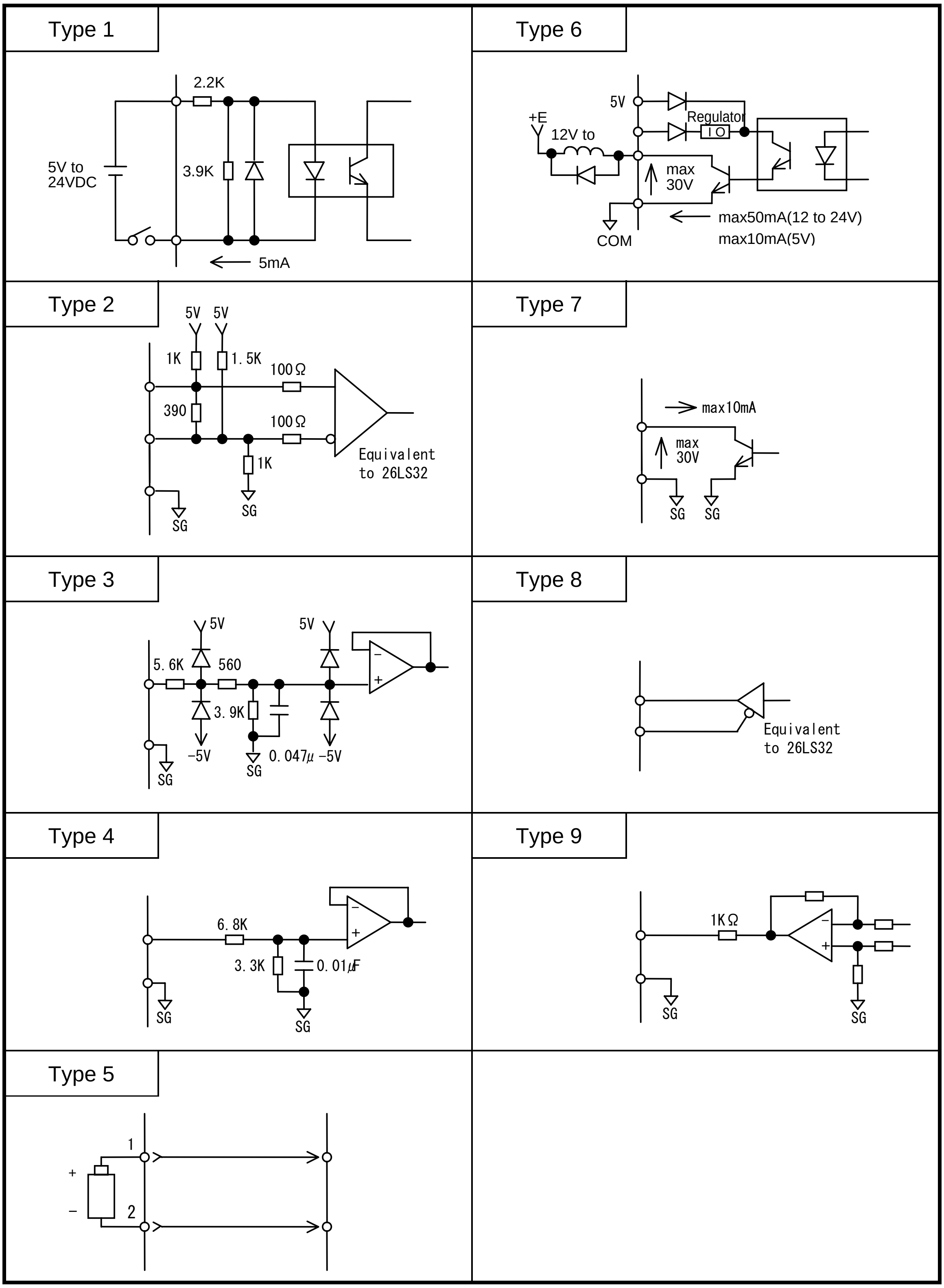


Fig. 9-17

Table 9-7 General Specifications of Velocity Control Type Input Signal (Wiring-saved Incremental Encoder) 1/2

Signal name	Abbr.	Pin No. ∗1	Circuit type ∗2	General specification	
Speed command	VCMD	21 (20)	Type 3	With a ±2 V input, the velocity becomes 1000 min^{-1} in the standard setting (maximum input voltage ±10 V).	
Torque compen-sation Torque command	TCOMP TCMD	22 (20)	Type 3	With a ±2 V input, the velocity becomes the rated one (TR) and is limited to the instantaneous maximum stall torque.	
Servo ON	SON	37 (23)	Type 1	Servo ON status is provided by closing the contact and entering the velocity command input (VCMD) waiting status.	
Alarm reset	RST	30 (23)	Type 1	With this signal input, alarm code or alarm bit outputs and error display are reset.	
Forward revolution current limit	PIL	18 (17)	Type 4	The current is limited to the rated current at +2V (effective when ILM is input).	To enable the external current limit, Func1 bit10 must be set at "1".
Backward revolution current limit	NIL	19 (17)	Type 4	The current is limited to the rated current with -2V (effective when ILM is input).	
Current limit permit	ILM	31 (23)	Type 1	The current is limited by closing the contact. It is ineffective during JOG or overtravel (The limit method is based on the Func1 parameter).	
Forward revolution overtravel Backward revolution overtravel	PROT NROT	32 (23) 33 (23)	Type 1	Contact open status is provided upon occurrence of overtravel. Input both forward and backward revolution signals. When overtravel occurs, a 120% current limit is automatically applied, making the speed of the side to which this signal has been input zero. (This function can be canceled or changed into a c-contact input by setting the remote operator.)	
Proportional control (standard)	PCON	35 (50)	Type 1 One of three functions can be selected by setting the remote operator.	When the motor drifts during a long stop time due to command input zero, inputting this signal stops the motor by friction torque.	
Zero clamp	ZCMD	36 (23)		Inputting this signal makes the speed command 0 (zero).	
Internally set velocity select	VCS2/ VCS1			Combining CN1 - 35 and 36 input signals enables a desired internally set velocity to be selected.	
Input sequence power supply 1	5 to 24 VDC	23	——	External power supply for CN1-30, 31, 32, 33, 36 and 37.	
Internal velocity command revolution direction	ROTS	34 (50)	Type 1	This signal specifies the revolution direction when the internal velocity command is turned on.	

* 1 The pin numbers in parentheses denote the ground or common side of each signal.

* 2 For the circuit type, see Fig. 9-17

Table 9-7 General Specifications of Velocity Control Type Input Signal (Wiring-saved Incremental Encoder) 2/2

Signal name	Abbr.	Pin No. ∗1	Circuit type ∗2	General specification
Monitor 1	MON1	15 (14)	Type 9	2V ± 10%/1000 min^{-1} (velocity monitor). Load: less than 2 mA. Output resistance: 1 kΩ. Positive voltage at foreword revolution
Monitor 2	MON2	16 (14)	Type 9	2V ± 20%/rated current (current monitor). Load: Less than 2 mA. Output resistance: 1 kΩ. Positive voltage when forward revolution power is output.
Start ready completes	SRDY	41 (24) (25)	Type 6	When the "Servo ON signal" is ready to receive after the DC power supply of the main circuit is turned on, this comes on and goes low impedance.
Current limit status	ILIM	40 (24) (25)	Type 6	This signal comes on in current limit status and is effective as a bump end input or a standard for prevention against current saturation at acceleration/deceleration. ⚠
Encoder signal	A, $\overline{\underline{A}}$ B, $\underline{B}$ C, C	3, 4 5, 6 7, 8	Type 8	Output by the line driver (26LS31) after the encoder pulse is divided. The signal is received by the line receiver (26LS32).
Encoder channel C signal	COP	11 (13)	Type 7	Output by the open collector (the logic can be reversed using the Func5 bit6 parameter).
Alarm code output or Alarm bit output	ALM1 ALM2 ALM4 ALM8	43 (24) (25) 44 45 46	Type 6	Alarm code output and alarm bit output (ALM1) are switched by Func2 bit6 of the remote operator. The alarm bit signal turns off in an alarm status. The alarm code outputs various alarms as 4-bit binary codes.
Low velocity	LTG	39 (24) (25)	Type 6	When the motor speed becomes ±50% or less of the set value, this signal goes to low impedance. ⚠
Holding brake relay excitation timing output	HBON	42 (24) (25)	Type 6	This signal outputs holding brake relay excitation timing.
Output sequence power supply	12 to 24 VDC 5V	49 38	——	External power supply for CN1-39, 40, 41, 42, 43, 45 and 46.

* 1 The pin numbers in parentheses denote the ground or common side of each signal.

* 2 For the circuit type, see Fig. 9-17.

⚠ The output contents depend on the Func4 parameter setting.

(5) General specifications of CN1 input/output signals (for absolute encoder)

This section explains the general specification of CN1 input/output signals of the velocity control type.

Table 9-8 General Specifications of Velocity Control Type Input Signal (Absolute Encoder) 1/2

Signal name	Abbr.	Pin No. ＊ 1	Circuit type ＊2	General specification
Speed command	VCMD	21 (20)	Type 3	With a ±2 V input, the velocity becomes 1000 min^{-1} in the standard setting (maximum input voltage ±10 V).
Torque compen-sation / Torque command	TCOMP / TCMD	22 (20)	Type 3	With a ±2 V input, the velocity becomes the rated one (TR). It is limited to the instantaneous maximum stall torque.
Servo ON	SON	37 (23)	Type 1	Servo ON status is provided by closing the contact and entering the velocity command input (VCMD) waiting status.
Alarm reset	RST	30 (23)	Type 1	With this signal input, alarm code or alarm bit outputs and an error display are reset.
Forward revolution current limit	PIL	18 (17)	Type 4	The current is limited to the rated current at +2V (effective when ILM is input). To enable the external current limit, Func1 bit0 must be set at "1".
Backward revolution side current limit	NIL	19 (17)	Type 5	The current is limited to the rated current with -2V (effective when ILM is input).
Current limit permit	ILM	31 (23)	Type 1	The current is limited by closing the contact. It is ineffective during JOG or overtravel (the limit method is based on the Func1 parameter).
Forward revolution overtravel Backward revolution overtravel	PROT NROT	32 (23) 33 (23)	Type 1	Contact open status is provided upon occurrence of overtravel. Input both the forward and backward revolution signals. When overtravel occurs, a 120% current limit is automatically applied, making the speed of the side to which this signal has been input zero. (This function can be canceled or changed into an a-contact input by setting the remote operator.)
Encoder clear (standard)	ECLR	35 (50)	Type 1 One of four functions can be selected by setting the remote operator.	Inputting this signal for over 4 seconds will clear the encoder revolution counter (multiple revolution). When a battery alarm ("U") occurs, input this alarm and reset the alarm.
Proportional control (standard)	PCON	36 (23)		When the motor drifts during a long stop time due to command input zero, inputting this signal stops the motor by friction torque.
Zero clamp	ZCMD			Inputting this signal makes the speed command 0 (zero).
Internally set velocity select	VCS2/ VCS1			Combining CN1 - 35 and 36 input signals enables a desired internally set velocity to be selected.
Battery power	BAT+ BAT–	1 2	Type 10	This signal connects a 3.6 VDC equivalent battery (ER6 2000 mAH from Toshiba Battery is recommended).
Input sequence power supply 1	5 to 24 VDC	23	——	External power supply for CN1-30, 31, 32, 33, 36 and 37.
Input sequence power supply 2		50		External power supply for CN1 - 35.
Internal velocity command revolution direction	ROTS	34 (50)	Type 1	This signal specifies the revolution direction when the internal velocity command is turned on.

* 1 The pin numbers in parentheses denote the ground or common side of each signal.

* 2 For the circuit type, see Fig. 9-17.

Table 9-8　General Specifications of Velocity Control Type Output Signal (Absolute Encoder) 2/2

Signal name	Abbr.	Pin No. ∗1	Circuit type ∗2	General specification
Monitor 1	MON1	15 (14)	Type 9	2V ± 10%/1000 min^{-1} (velocity monitor). Load: less than 2 mA.　Output resistance: 1 kΩ. Positive voltage at foreword revolution
Monitor 2	MON2	16 (14)	Type 9	2V ± 20%/rated current (current monitor). Load: Less than 2 mA.　Output resistance: 1 kΩ. Positive voltage when forward revolution power is output.
Start ready complete	SRDY	41 (24) (25)	Type 6	When the "Servo ON signal" is ready to receive after the DC power supply of the main circuit is turned on, this comes on and goes low impedance.
Current limit status	ILIM	40 (24) (25)	Type 6	This signal comes on in current limit status and is effective as a bump end input or a standard for prevention against current saturation at acceleration/deceleration. ⚠
Encoder signal	A, $\overline{A}$ B, $\overline{B}$ C, $\overline{C}$	3, 4 5, 6 7, 8	Type 8	Output by the line driver (26LS31) after the encoder pulse is divided.　The signal is received by the line receiver (26LS32).
Absolute value signal	PS $\overline{PS}$	9 10	Type 8	The absolute value signal is output in serial form (9600bps or 1M/2Mbps) by the line driver (26LS31). The signal is received by the line receiver (26LS32).
Encoder channel C signal	COP	11 (13)	Type 7	Output by the open collector (the logic can be reversed using the Func5 bit6 parameter).
Alarm code output or Alarm bit output	ALM1 ALM2 ALM4 ALM8	43 (24) (25) 44 45 46	Type 6	Alarm code output and alarm bit output (ALM1) are switched by Func2 bit6 of the remote operator.　The alarm bit signal turns off in an alarm status.　The alarm code outputs various alarms as 4-bit binary codes.
Low velocity	LTG	39 (24) (25)	Type 6	When the motor speed becomes ±50% or less of the set value, this signal goes to low impedance. ⚠
Holding brake relay excitation timing output	HBON	42 (24) (25)	Type 6	This signal outputs holding brake relay excitation timing.
Output sequence power supply	12 to 24 VDC 5V	49 38	——	External power supply for CN1-39, 40, 41, 42, 43, 44, 45 and 46.

* 1　The pin numbers in parentheses denote the ground or common side of each signal.

* 2　For the circuit type, see Fig. 9-17.

⚠ The output contents depend on the Func4 parameter setting.

9.1.10 Switching of the Control Mode

This section explains how to switch the control mode between velocity and torque control, torque and position control, and position and velocity control. This section also provides precautions on implementing the switching.

9.1.10.1 Switching the Control Type

CN1 input signal is used for the switching. When switching the control type using the input to CN1 - 35 pins, set Func3 bit7 at "1". When CN1 - 36 pin input is used, Func3 bit7 is set at "0". Each control mode switching pattern and its input signal equivalent are shown in the following table.

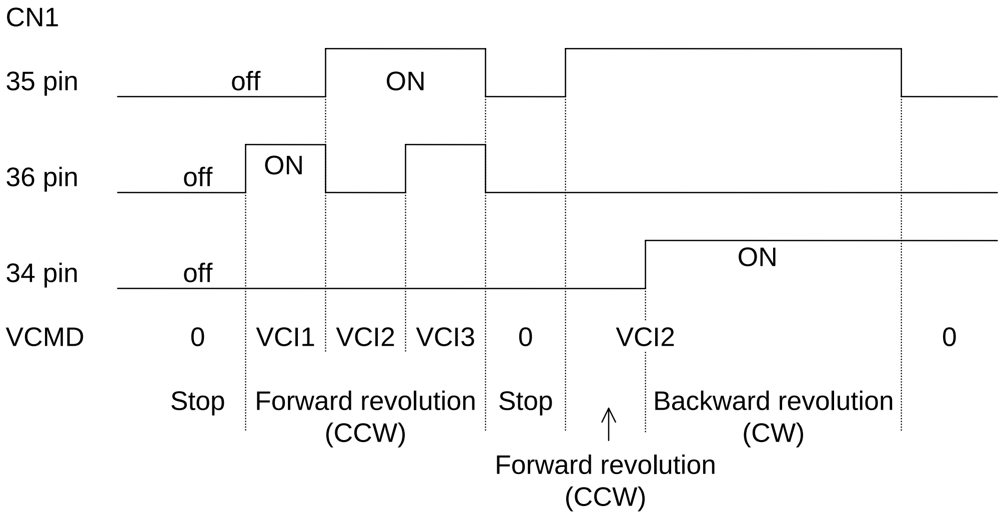
Switching pattern	OFF	ON
Velocity ↔ Torque	Velocity	Torque
Position ↔ Torque	Position	Torque
Position ↔ Velocity	Position	Velocity

9.1.10.2 Precautions

- Take utmost care when switching.
- During the test mode (JOG or Tune) is turned on, switching of the control mode is not available.
- When switching takes place from velocity or position control to torque control, the velocity will be limited according to the value set on the parameter (Mode 1 Page 6).
  (As the motor speed exceeds the predetermined speed limit, the torque command is forced to zero.)
  The speed limit is provided for the purpose of error detection when a radical change develops under a given load (no load or light load) to prevent motor runaway. This function, however, is not capable of running the motor at a constant speed.
  If a relatively small value is set as the maximum speed limit, and if the torque command value is large relative to the load inertia and load torque, the motor may rotate exceeding this speed limit. Never use the motor in this situation over a long time. When you don't turn on the speed limit, the maximum speed must be set at 32767 min^{-1}.
- Note that there is a maximum of 12 msec delay from changing the input signal to completion of control mode switching.
- During switching of the control mode is taking place (input signal is on), the test mode (JOG or Tune) is not available.
  The screen will display the "Not Ready" message.

9.1.11 Internal Velocity Command

Combining external input signals (3 bits), this command is capable of selecting speed (parameter) and direction.



The CN1 35 and 36 pins are used for selecting the speed, and 34 pin is used for selecting the revolution direction.

Note 1:	This function is enabled when parameter Func3 bits3, 2, 1 and 0 are all set at "1010" in the velocity control mode. In this case, the polarity reverse function of the external analog velocity command, the velocity command scale and the velocity command are all disabled.
Note 2:	If there is a lag between input timing to the CN1 35 and 36 pins, another speed can be selected. Switching of the signal must take place simultaneously.
Note 3:	Note that there is a 12 msec maximum delay from changing the input signal to completion of control mode switching.
Note.4	In case of internal velocity command in switching control mode, only two velocities shall be selected.

9.1.12 Power Supply Capacity

Table 9-9 shows the input power supply capacity under load at the rated output (200 VAC).

Table 9-9 Power Supply Capacity

Amplifier model No. PY☐A	Motor model No.	Power supply capacity per unit	
		Main circuit power supply (KVA)	Control power supply (VA)
PY0A015A	P10B10030H	1.0	40
	P30B04003D	0.2	
	P30B04005D	0.2	
	P30B04010D	0.3	
	P30B06020D	0.5	
	P50B03003D	0.2	
	P50B04006D	0.3	
	P50B04010D	0.4	
	P50B05005D	0.3	
	P50B05010D	0.4	
	P50B05020D	0.8	
	P50B07020D	0.8	
	P50B07030D	1.0	
PY0A030A	P10B10075H	1.9	40
	P10B13050H	1.3	
	P10B13050B	1.3	
	P10B13100B	2.5	
	P20B10100H	2.5	
	P30B06040D	1.0	
	P30B08075D	1.7	
	P50B07040D	1.3	
	P50B08040D	1.3	
	P50B08050D	1.5	
	P50B08075H	2.0	
	P50B08100H	2.2	
	P60B13050H	1.4	
	P80B15075H	1.8	
PY0A050A	P10B13100H	2.5	40
	P10B13150H	3.0	
	P10B13150B	3.0	
	P10B18200B	4.0	
	P20B10100D	2.5	
	P20B10150D	3.0	
	P20B10150H	3.0	
	P20B10200H	4.0	
	P50B08075D	2.0	
	P50B08100D	2.5	
	P60B13100H	2.5	
	P60B13150H	3.9	
	P80B18120H	3.1	
PY0A100A	P10B18200H	4.0	40
	P10B18350B	5.8	
	P10B18450B	7.5	
	P20B10200D	4.0	
	P20B10250D	4.2	
	P20B13300D	5.0	
	P20B10250H	4.2	
	P20B13300H	5.0	
	P20B13400H	6.7	
	P60B13200H	5.0	
	P60B18200H	5.0	
	P80B22250H	5.9	
	P80B22350R	5.9	
PY0A150A	P10B18350H	5.8	40
	P10B18450R	7.5	
	P10B18550M	9.2	
	P20B13400D	6.7	
	P20B13500D	8.3	
PY0A150A	P60B15300H	8.3	40
	P60B18350H	6.9	
	P60B18450R	7.4	
	P60B18550R	8.4	
	P60B22550M	10.1	
	P60B22700S	12.2	
	P80B22350H	7.4	
	P80B22450R	8.4	
PY0A300A	P60B18750R	12.6	40
	P60B2211KB	15.7	
	P60B2215KB	21.4	

1 When using two or more motors, add the power supply capacity per unit of each motor.

2 When accelerating or decelerating the motor, two-to-fourfold momentary power may be required.

Table 9-10 Rush Current

Amplifier model name	Control circuit (maximum value within 1 mS after power on)	Main circuit (maximum value within 600 mS after power on)
PY0A015	40 A (0 - P)	18 A (0 - P)
PY0A030	40 A (0 - P)	18 A (0 - P)
PY0A050	40 A (0 - P)	18 A (0 - P)
PY0A100	40 A (0 - P)	20 A (0 - P)
PY0A150	40 A (0 - P)	30 A (0 - P)
PY0A300	40 A (0 - P)	30 A (0 - P)

9.1.13 Servo Amplifier/Servomotor Leakage Current

Since the amplifier drives the motor under the PWM control of the IGBT, high frequency leakage current can flow through the ground floating capacity of the motor winding, power cable or amplifier, thereby causing a malfunction of the leakage circuit breaker or leakage protective relay installed on the power line on the power supply side. Therefore, use a leakage circuit breaker that matches the inverter so as not to cause such a malfunction.

Table 9-11 Leakage Current

Motor model No.	Leakage current per motor
P10B○○○○○○□◇▽▽	3.0 mA
P20B○○○○○○□◇▽▽	
P30B○○○○○○□◇▽▽	
P50B○○○○○○□◇▽▽	
P60B○○○○○○□◇▽▽	
P80B○○○○○○□◇▽▽	

1 When using two or more motors, add the leakage current per unit of each motor.
2 Since the above table shows the values in the case of a 2-meter cabltyre cable, the leakage current will increase or decrease if a shorter or longer cable is used. Therefore, the values shown in Table 9-11 are just the reference values.
3 Be sure to execute grounding (Class 3) of the machine so that a dangerous voltage may not leak to the machine body or operating panel.
4 The values shown in Table 9-11 are those measured with an ordinary leak checker with filter 700 Hz.

9.1.14 Calorific Value

Since the servo amplifier is designed so that heat radiation is duct cooled, the boards can be minimized and airtightened. Table 9-12 shows the calorific values of the amplifier under rated load.

Table 9-12 Calorific Value of Servo Amplifier

Amplifier model No.	Motor model No.	Total calorific values of Servo Amplifier (W)	Calorific values of the mounting part of the board (W)	Calorific values of the duct cooling part (W)	Remarks
PY0A015A	P10B10030H	31	—	—	⚠ 1, 2, 3
	P30B04003D	15	—	—	
	P30B04005D	17	—	—	
	P30B04010D	19	—	—	
	P30B06020D	26	—	—	
	P50B03003D	15	—	—	
	P50B04006D	16	—	—	
	P50B04010D	18	—	—	
	P50B05005D	17	—	—	
	P50B05010D	19	—	—	
	P50B05020D	23	—	—	
	P50B07020D	27	—	—	
	P50B07030D	21	—	—	
PY0A030A	P10B10075H	51	—	—	
	P10B13050H	41	—	—	
	P10B13050B	34	—	—	
	P10B13100B	52	—	—	
	P20B10100H	46	—	—	
	P30B06040D	31	—	—	
	P30B08075D	16	—	—	
	P50B07040D	33	—	—	
	P50B08040D	35	—	—	
	P50B08050D	40	—	—	
	P50B08075H	42	—	—	
	P50B08100H	47	—	—	
	P60B13050H	44	—	—	
	P80B15075H	51	—	—	
PY0A050A	P10B13100H	95	58	37	⚠ 2, 3
	P10B13150H	130	80	50	
	P10B13150B	90	59	31	
	P10B18200B	120	78	42	
	P20B10100D	80	50	30	
	P20B10150D	100	63	37	
	P20B10150H	85	55	30	
	P20B10200H	105	68	37	
	P50B08075D	70	44	26	
	P50B08100D	80	50	30	
	P60B13100H	90	55	35	
	P60B13150H	110	68	42	
	P80B18120H	120	70	50	
PY0A100A	P10B18200H	170	95	75	
	P10B18350B	195	120	75	
	P10B18450B	220	140	80	
	P20B10200D	165	93	72	
	P20B10250D	170	98	72	
	P20B13300D	175	103	72	
	P20B10250H	125	77	48	
	P20B13300H	165	100	64	
	P20B13400H	195	120	75	
	P60B13200H	160	90	70	
	P60B18200H	150	85	65	
	P80B22250H	220	125	95	
	P80B22350R	200	118	82	
PY0A150A	P10B18350H	240	136	104	
	P10B18450R	280	165	115	
	P10B18550M	275	166	109	
	P20B13400D	240	136	104	
	P20B13500D	260	150	110	
	P20B13500H	245	145	100	
	P60B15300H	250	135	115	
	P60B18350H	260	145	115	
	P60B18450R	260	150	110	
	P60B18550R	335	193	142	
	P60B22550M	310	180	130	
	P60B22700S	350	210	140	
	P80B22350H	240	130	110	
	P80B22450R	260	150	110	
PY0A300A	P60B18750R	620	370	250	
	P60B2211KB	580	350	230	
	P60B2215KB	750	450	300	

1 Regarding amplifiers Model Nos. PY0A015◇□□△▽and PY0A030◇□□△▽, heat radiator cannot undergo duct cooling.

2 Since the values in the table do not include the calorific values of the built-in regenerative resistors, they must be added as required. However, in the case of amplifiers Model Nos. PY0A050◇□□△▽, PY0A100 and PY0A150, a built-in regenerative resistor is provided in the duct cooling part. So, add its value to the calorific value of the duct cooling part. For the calorific value of the built-in regenerative resistor, refer to the section pertaining to options.

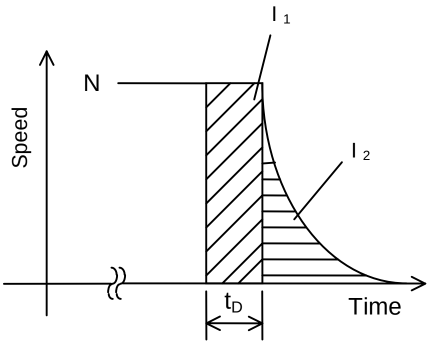
3 When using an external regenerative resistor, the built-in regenerative resistor is disconnected. So change the calorific value to that of the external regenerative resistor depending the installation place.

4 Regarding installation, strictly observe the installation procedure described in "5. Installation".

9.1.15 Dynamic Brake

This Servo Amplifier is designed with a built-in dynamic brake for emergency stopping. The brake is activated whenever an alarm is detected. The following describes the dynamic brake characteristics and allowable frequency.

(1) Slowing-down revolution angle by dynamic brake



N : Motor speed (min^{-1})
l_1 : Slowing-down revolution angle (rad) by AMP internal processing time t_D.
l_2 : Slowing-down revolution angle (rad) by dynamic brake operation.
t_D : Delay time (sec) from occurrence of a signal until the start of operation. (Based on AMP capacity. Refer to the following table.)

Fig. 9-18

[Standard expression] Supposing the load torque (T_L) is zero

$$l = l_1 + l_2$$

$$= \frac{2\pi N \cdot t_D}{60} + (J_m + J_L) \times (\alpha N + \beta N^3)$$

l : Overall slowing-down revolution angle (rad)
J_m : Motor inertia (kg • m^2)
J_L : Load inertia (calculated in terms of motor shaft) (kg • m^2)
α•β : Constant related to motor. See Table 9-15.

[Standard expression]When the load torque $T_L = T_L$

$$l_3 = \frac{1}{2} (J_m + J_L) \left(\frac{2\pi}{60} N\right)^2 \times \frac{1}{T_L}$$

$$l = l_1 + \frac{l_2 \bullet l_3}{l_2 + l_3}$$

T_L : Load torque (N • m)

Table 9-13 Dynamic Brake Operation Delay Time

Amplifier model No.	Delay time t_D (sec)
PY0A015	6.5×10^{-3}
PY0A030	6.5×10^{-3}
PY0A050	24.0×10^{-3}
PY0A100	24.0×10^{-3}
PY0A150	24.0×10^{-3}
PY0A300	42.0×10^{-3}

(2) Instantaneous resistance of dynamic brake

When the load inertia (J_L) substantially exceeds the applicable load inertia, abnormal heat can build up due to dynamic brake resistance, thereby burning out the thermal fuse.
If this occurs, resetting is no longer available. When such an application is anticipated, contact us before use.
The energy E_{RD} consumed by the dynamic brake operation at a single time is represented by the following expression. Use the dynamic brake so that the ERD value does not exceed the values shown in Table 9-14.

$$E_{RD} = \frac{2.5}{R\phi + 2.5} \times \left\{ \frac{1}{2} (J_M + J_L) \times \left(\frac{2\pi}{60} N \right)^2 - I \bullet T_L \right\}$$

$R\phi$: Motor phase winding resistance (Ω)
J_M : Motor inertia (kg • m^2)
J_L : Load inertia (calculated in terms of motor shaft) (kg • m^2)
N : Motor speed at the feed speed V (min^{-1})
I : Overall slowing-down revolution angle (rad)
T_L : Load torque (N • m)

Table 9-14 Dynamic Brake Instantaneous Resistance

Amplifier model No.	E_{RD} (J)
PY0A015	360
PY0A030	360
PY0A050	1800
PY0A100	2450
PY0A150	2450
PY0A300	14000

(3) Allowable frequency of dynamic brake

The allowable frequency (frequency of turning main circuit power supply on or off) of the dynamic brake should be a maximum of 10 times per hour and 30 times per day under the applicable load inertia and at the maximum speed.

As a rule of thumb, a six-minute interval shall be provided between the preceding and succeeding dynamic brake operations. If more frequent use is anticipated, the motor speed must be substantially reduced. The following expression can be used to compute an appropriate speed.

$$\frac{\text{6 minutes}}{\left(\dfrac{\text{Rated motor speed}}{\text{Maximum motor speed when operating}} \right)^2}$$

(4) Dynamic brake constant table

Table 9-15 Dynamic Brake Constant Table

Amplifier model No.	Motor model No.	α	β	J_M (Kg-m^2)
PY0A015A	P10B10030H	4.29	3.08×10^{-7}	3.9×10^{-4}
	P30B04003D	114	60.5×10^{-7}	0.024×10^{-4}
	P30B04005D	66.0	37.3×10^{-7}	0.031×10^{-4}
	P30B04010D	25.0	12.2×10^{-7}	0.051×10^{-4}
	P30B06020D	12.7	17.2×10^{-7}	0.144×10^{-4}
	P50B03003D	170	9.20×10^{-7}	0.02×10^{-4}
	P50B04006D	43.9	8.00×10^{-7}	0.054×10^{-4}
	P50B04010D	27.0	5.01×10^{-7}	0.079×10^{-4}
	P50B05005D	59.2	22.8×10^{-7}	0.060×10^{-4}
	P50B05010D	23.0	9.29×10^{-7}	0.098×10^{-4}
	P50B05020D	9.78	3.86×10^{-7}	0.173×10^{-4}
	P50B07020D	13.0	6.14×10^{-7}	0.398×10^{-4}
	P50B07030D	7.27	4.41×10^{-7}	0.507×10^{-4}
PY0A030A	P10B10075H	1.69	0.75×10^{-7}	14×10^{-4}
	P10B13050H	1.29	1.65×10^{-7}	12×10^{-4}
	P10B13050B	0.58	2.41×10^{-7}	12×10^{-4}
	P10B13100B	0.54	1.06×10^{-7}	25×10^{-4}
	P20B10100H	1.61	3.59×10^{-7}	1.55×10^{-4}
	P30B06040D	4.32	6.80×10^{-7}	0.255×10^{-4}
	P30B08075D	2.97	3.68×10^{-7}	0.635×10^{-4}
	P50B07040D	5.63	2.08×10^{-7}	0.74×10^{-4}
	P50B08040D	6.34	2.95×10^{-7}	0.828×10^{-4}
	P50B08050D	4.84	1.44×10^{-7}	1.17×10^{-4}
	P50B08075H	2.36	0.88×10^{-7}	1.93×10^{-4}
	P50B08100H	1.49	0.62×10^{-7}	2.66×10^{-4}
	P60B13050H	2.37	4.74×10^{-7}	2.8×10^{-4}
	P80B15075H	1.54	3.39×10^{-7}	5.3×10^{-4}
PY0A050A	P10B13100H	1.69	0.46×10^{-7}	25×10^{-4}
	P10B13150H	1.29	0.27×10^{-7}	35×10^{-4}
	P10B13150B	0.58	0.61×10^{-7}	35×10^{-4}
	P10B18200B	0.54	0.48×10^{-7}	73×10^{-4}
	P20B10100D	3.33	1.81×10^{-7}	1.55×10^{-4}
	P20B10150D	2.19	1.05×10^{-7}	2.04×10^{-4}
	P20B10150H	1.44	1.59×10^{-7}	2.04×10^{-4}
	P20B10200H	1.28	0.93×10^{-7}	2.83×10^{-4}
	P50B08075D	4.61	0.49×10^{-7}	1.93×10^{-4}
	P50B08100D	2.99	0.30×10^{-7}	2.66×10^{-4}
	P60B13100H	1.57	1.19×10^{-7}	5.6×10^{-4}
	P60B13150H	1.08	0.60×10^{-7}	8.3×10^{-4}
	P80B18120H	1.63	2.06×10^{-7}	12.1×10^{-4}
PY0A100A	P10B18200H	1.52	0.18×10^{-7}	73×10^{-4}
	P10B18350B	0.56	0.10×10^{-7}	144×10^{-4}
	P10B18450B	0.32	0.08×10^{-7}	206×10^{-4}
	P20B10200D	4.21	0.29×10^{-7}	2.83×10^{-4}
	P20B10250D	2.87	0.26×10^{-7}	3.71×10^{-4}
	P20B13300D	2.02	0.25×10^{-7}	7.14×10^{-4}
	P20B10250H	1.41	0.48×10^{-7}	3.71×10^{-4}
	P20B13300H	1.31	0.36×10^{-7}	7.14×10^{-4}
	P20B13400H	1.10	0.20×10^{-7}	9.79×10^{-4}
	P60B13200H	1.71	0.21×10^{-7}	12.1×10^{-4}
	P60B18200H	1.50	0.34×10^{-7}	22.1×10^{-4}
	P80B22250H	1.85	0.37×10^{-7}	27.1×10^{-4}
	P80B22350R	0.77	0.22×10^{-7}	43.1×10^{-4}
PY0A150A	P10B18350H	0.96	0.06×10^{-7}	144×10^{-4}
	P10B18450R	0.61	0.04×10^{-7}	206×10^{-4}
	P10B18550M	0.25	0.04×10^{-7}	330×10^{-4}
	P20B13400D	2.11	0.10×10^{-7}	9.79×10^{-4}
	P20B13500D	1.54	0.07×10^{-7}	12.58×10^{-4}
	P20B13500H	1.13	0.11×10^{-7}	12.58×10^{-4}
	P60B15300H	1.77	0.10×10^{-7}	20.1×10^{-4}
	P60B18350H	1.44	0.11×10^{-7}	34.1×10^{-4}
	P60B18450R	0.75	0.10×10^{-7}	47.1×10^{-4}
	P60B18550R	0.53	0.04×10^{-7}	61.9×10^{-4}
	P60B22550M	0.44	0.10×10^{-7}	90.1×10^{-4}
	P60B22700S	0.15	0.05×10^{-7}	177.0×10^{-4}
	P80B22350H	1.29	0.14×10^{-7}	43.1×10^{-4}
	P80B22450R	0.72	0.13×10^{-7}	58.1×10^{-4}
PY0A300A	P60B18750R	0.96	0.01×10^{-7}	95.1×10^{-4}
	P60B2211KB	0.36	0.01×10^{-7}	225×10^{-4}
	P60B2215KB	0.25	0.01×10^{-7}	248×10^{-4}

The α and β values are obtained on the assumption that the resistance value of the power line is 0.

9.1.16 Regenerative Processing Capacity

Since this Servo Amplifier incorporates a regenerative resistor, the regenerative processing capacity of the amplifier depends on the allowable power of the built-in regenerative resistor. Therefore, calculate the regenerative power PM and make sure that it is smaller than PRI (allowable power of the built-in regenerative resistor).

If the regenerative power PM exceeds the allowable power PRI of the built-in regenerative resistor, connect an optional external regenerative resistor to increase the regenerative capacity. At this time, calculate the regenerative power PM and make sure that the condition of PM < PRO (maximum allowable power of the external regenerative resistor) is satisfied.

When the regenerative power PM exceeds the maximum allowable power PRO of the external regenerative resistor, review the acceleration/deceleration time constant, load inertia, etc.

The following describes how to calculate the regenerative power PM to determine which of the built-in and external regenerative resistors are to be used.

(1) Calculation of regenerative power PM

Step 1 : Calculate the regenerative energy

The following is an example of how to calculate regenerative energy EM.

① For horizontal shaft driving

$$EM = EHb = \frac{1}{2} \times N \times 3 \bullet KE\phi \times \frac{Tb}{KT} \times tb - (\frac{Tb}{KT})^2 \times 3 \bullet R\phi \times tb$$

EM : Regenerative energy at horizontal shaft driving....[J]
EHb : Regenerative energy at deceleration ....[J]
KEϕ : Induced voltage constant ....[Vrms/min^{-1}] (motor constant)
KT : Torque constant..[N•m/Arms] (motor constant)
N : Motor speed...[min^{-1}]
Tb : Torque at deceleration...[N•m] (Tb = Tc – TF)
Rϕ : Armature resistance ....[Ω](motor constant)
tb : Deceleration time...[s]
Tc : Acceleration/deceleration torque...........................[N•m]
TF : Friction torque..[N•m]

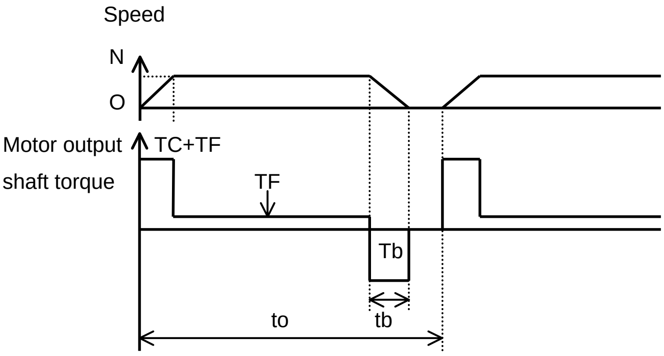


Fig. 9-19 (1)

② For vertical shaft driving (when a gravitational load is applied)

$$EM = EVUb + EVD + EVDb$$

$$= \frac{1}{2} \times N \times 3 \bullet KE\phi \times \frac{TUb}{KT} \times tUb - \left(\frac{TUb}{KT}\right)^2 \times 3 \bullet R\phi \times tUb$$

$$+ N \times 3 \bullet KE\phi \times \frac{TD}{KT} \times tD - \left(\frac{TD}{KT}\right)^2 \times 3 \bullet R\phi \times tD$$

$$+ \frac{1}{2} \times N \times 3 \bullet KE\phi \times \frac{TDb}{KT} \times tDb - \left(\frac{TDb}{KT}\right)^2 \times 3 \bullet R\phi \times tDb$$

EM : Regenerative energy at vertical shaft driving .... [J]
EVUb : Regenerative energy at decelerated upward driving. [J]
EVD : Regenerative energy at downward driving .... [J]
EVDb : Regenerative energy at decelerated downward driving [J]
TUb : Torque at decelerated upward driving....................... [N•m]
tUb : Decelerated upward drive time.................................. [s]
TD : Torque at downward driving .... [N•m] (TD = TM – TF)
tD : Downward drive time .... [s]
TDb : Torque at decelerated downward move .... [N•m] (TDb = TC – TF + TM)
tDb : Downward drive time .... [s]
TM : Gravitational load torque.. [N•m]

If EVD, EVDb or EVUb becomes negative as a result of calculation, calculate EM after changing the value 0.

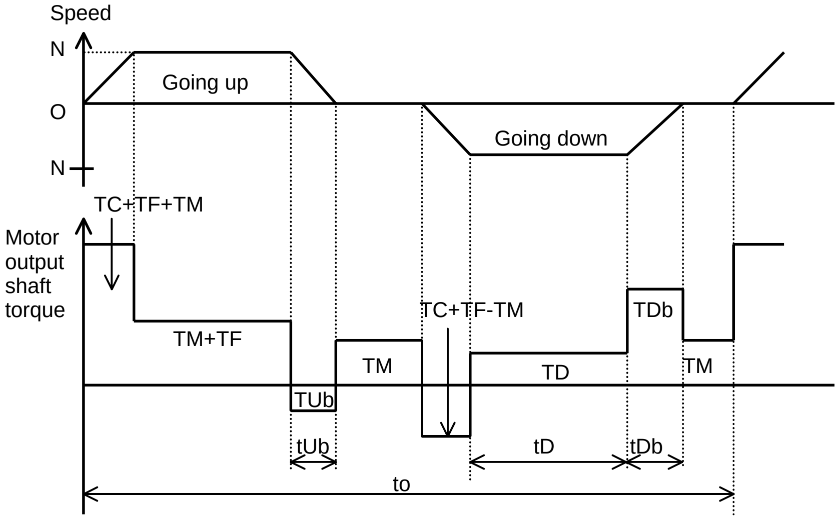


Fig. 9-19 (2)

Step 2 : Calculate the effective regenerative power

With the calculation obtained for regenerative power, check the regenerative capacities of the built-in regenerative resistor and the external regenerative resistor (optional).

① For horizontal shaft driving

$$PM = \frac{EM}{t\,o}$$

PM : Effective regenerative power....................................... [W]
EM : Regenerative energy at deceleration .... [J]
t o : Cycle time... [s]

② For vertical shaft driving

$$PM = \frac{EM}{t\,o}$$

PM : Effective regenerative power....................................... [W]
EM : Regenerative energy at upward driving, downward driving and decelerated downward driving . [J]
t o : Cycle time... [s]

(2) Judgment whether an external regenerative resistor is required

With the effective regressive power EM calculated in the above, judge if the operation can be performed by using a built-in regenerative resistor or if an external regenerative resistor is required.

① When PM ϕ PRI

No external regenerative resistor is required.

② When PRI < PM < PRO

Operation can be performed by using an external regenerative register.

③ When PM > PRO

Operation cannot be performed even if an external regenerative resistor is used. Recalculate the load inertia and acceleration/deceleration time constant.

Table 9-16 Resistance Value & Allowable Effective Power PRI (W) of Built-in Regenerative Resistor and Maximum Allowable Effective Power PRO (W) of External Regenerative Resistor

AMP model	PY0A015	PY0A030	PY0A050	PY0A100	PY0A150	PY0A300
Resistance value (Ω)	100	50	20	10	6.7	----
Allowable effective power PRI (W)	20	20	60	90	120	----
Maximum value of maximum allowable effective power PRO (W) of external regenerative resistor	600	600	1500	3000	4500	9000

For the allowable effective power of the external regenerative resistor, refer to the External Regenerative Resistor Combination Table (Table 9-21).

9.2 Servomotor

This section explains the Servomotor specifications using figures and tables.

9.2.1 Common Specifications

Table 9-17 Common Specifications of P1, P2, P3, P5, P6 and P8 Series Servomotors

Series	P1	P2	P3	P5	P6	P8
Time rating	Continuous					
Insulation class	Class F					
Dielectric strength	1500 VAC for 1 minute					
Insulation resistance	500 VDC and 10 MΩ minimum					
Protective system	Totally-enclosed and self-cooling type					
	IP67 ⚠		IP40	P50B03,04:IP40 P50B05,07,08: IP55	IP67 ⚠	
Sealing	Provided		Not provided	P50B03,04: Not provided P50B05,07,08: Provided	Provided	
Ambient temperature	32 to 104°F (0 to +40°C)					
Storage temperature	–4 to 149° F (–20 to 65°C)					
Ambient temperature	20% to 90% (no condensation)					
Vibration class	V10		V15			
Coating color	Munsell N1.5 equivalent (outside)					
Excitation system	Permanent magnet type					
Installation method	Flange type					

⚠ Conforms to IP67 using a waterproof connector, conduit, shell, clamp, etc. for the other side.

9.2.2 Revolution Direction Specifications

This section explains the direction of revolution for the Servomotor and the encoder respectively.

(1) Servomotor

For the standard setting, the Servomotor rotates counterclockwise against the "positive" velocity and forward revolution pulse command input when viewed from the load side.

By setting a parameter, the direction of revolution against the same command can be reversed.

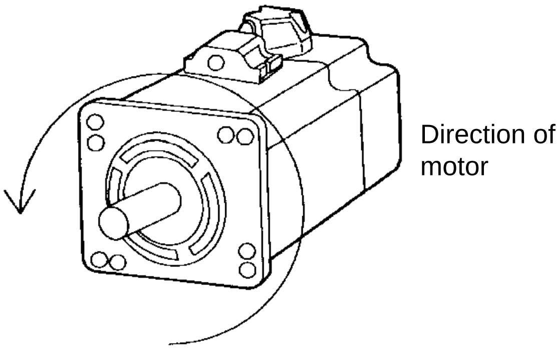
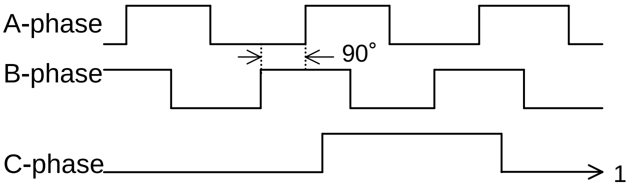


Fig. 9-20 Servomotor

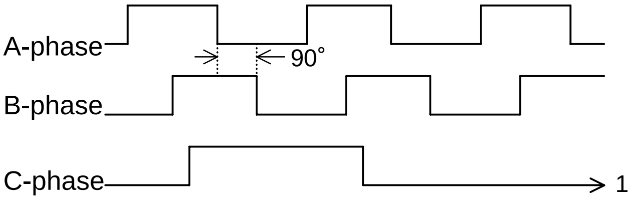
(2) Encoder signal phase

- **Incremental encoder**



<Forward revolution>

B-phase leads A-phase by a phase angle 90˚



<Backward revolution>

B-phase lags A-phase by a phase angle 90˚

Fig. 9-21 Encoder Signal Phase

When C-phase is high, both A- and B-phases cross the low level once every revolution.

- **Absolute encoder**

Forward revolution	:	Position data incremental output.
Backward revolution	:	Position data decremental output.

9.2.3 Mechanical Specifications

This section explains the mechanical specifications of the motor such as vibration resistance, shock resistance, working accuracy, vibration class, mechanical strength and oil seal.

(1) Vibration resistance

Install the Servomotor shaft horizontally as shown in Fig. 9-22 and apply vibration in 3 directions, up/down, left/right and back/forth. At this time, the Servomotor should withstand a vibration acceleration of 2.5G.

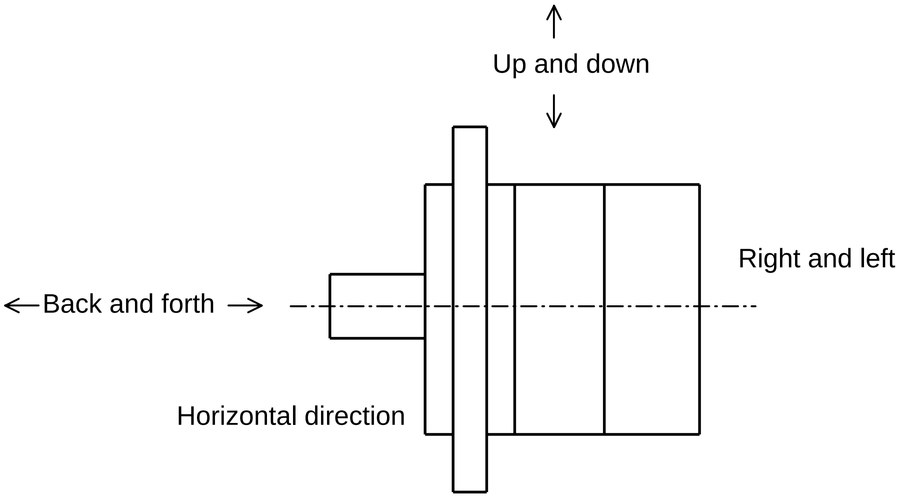


Fig. 9-22 Vibration Resistance Measurement

(2) Shock resistance

Install the motor shaft in the horizontal direction as shown in Fig. 9-23 and apply a shock in the up/down direction. At this time, the Servomotor should withstand an impact acceleration of 10G up to 2 times.

However, since the Servomotor is provided with a precision detector on the counter-load side, if a shock is applied to the shaft, the detector may be damaged. So do not apply shock to the shaft under any circumstances.

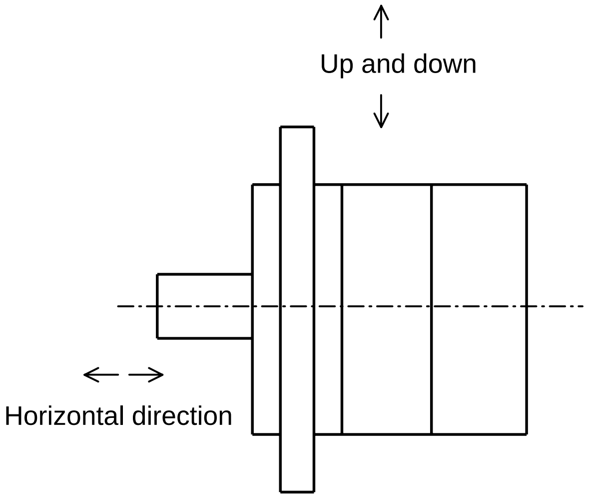
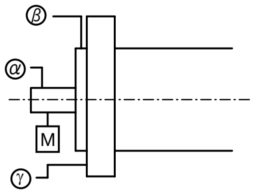


Fig. 9-23 Shock Measurement

(3) Working accuracy

Table 9-18 shows the accuracy (total indicator reading) of the Servomotor output shaft and installation.

Table 9-18

Item	P1	P10B18550	P2	P3, P5	P6, P8	P60B22700 P60B2211K P60B2215K	Reference diagram
Runout of output shaft end (α)	0.02	0.04	0.02	0.02	0.02	0.03	
Eccentricity of the external diameter of the flange on output shaft M (β)	0.04		0.08	0.06	0.08	0.08	
Perpendicularity of the flange face to output shaft M (γ)	0.04		0.08	0.07	0.08	0.10	

(4) Vibration class

At maximum speed, the vibration class of the Servomotor should be V15 or less (V10 or less for P10 and P20) when the Servomotor is independently measured as shown in Fig. 9-24.

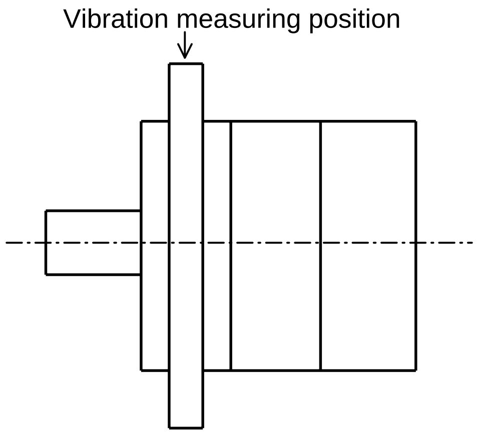


Fig. 9-24 Vibration Measurement

(5) Mechanical strength

The output strength of the Servomotor should withstand the instantaneous maximum stall torque.

(6) Oil seal

The output shaft of the Servomotor is provided with an S or TC type oil seal as shown in Table 9-19. Refer to the table for maintaining the motor.
Use an oil seal made by NOK or equivalent.

Table 9-19 Oil Seals

Servomotor model	Oil seal model No.
P10B10○○○○□◇▽▽	AE1538E5
P10B13○○○○□◇▽▽	AE2230E0
P10B18200○□◇▽▽ P10B18350○□◇▽▽ P10B18450○□◇▽▽	AE2965F1
P10B18550○□◇▽▽	AE3459A5
P20B10○○○○□◇▽▽	AC1306E0
P20B13○○○○□◇▽▽	AC1893E0
P30B○○○○○○□◇▽▽	(None)
P50B05○○○○□◇▽▽	AC0382A0
P50B07○○○○□◇▽▽	AC0687A0
P50B08○○○○□◇▽▽	AC0875A0
P60B13○○○○□◇▽▽ P60B15○○○○□◇▽▽ P80B15○○○○□◇▽▽	AC1677E1
P60B18○○○○□◇▽▽	AC2368E1
P60B22○○○○□◇▽▽	AC3152E0
P80B18○○○○□◇▽▽ P80B22○○○○□◇▽▽	AC2368E0

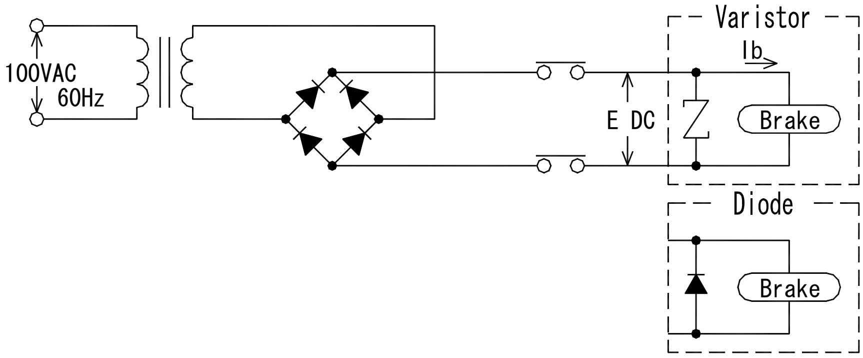
9.2.4 Holding Brake Specifications

A holding brake is optional on each motor. This brake is used for holding but cannot be used for braking except in an emergency. Turn brake excitation on or off by using the holding brake timing signal output.
When this signal is used, the command is forcibly made 0 min-1 in the Servo Amplifier for the brake release time. For the velocity command input timing, refer to the paragraph pertaining to operation sequences (on page 6-1).
To externally control the holding brake, a response time shown in Table 9-20 is needed.
When using a motor with a brake, determine the timing sequence taking this response delay time into account.

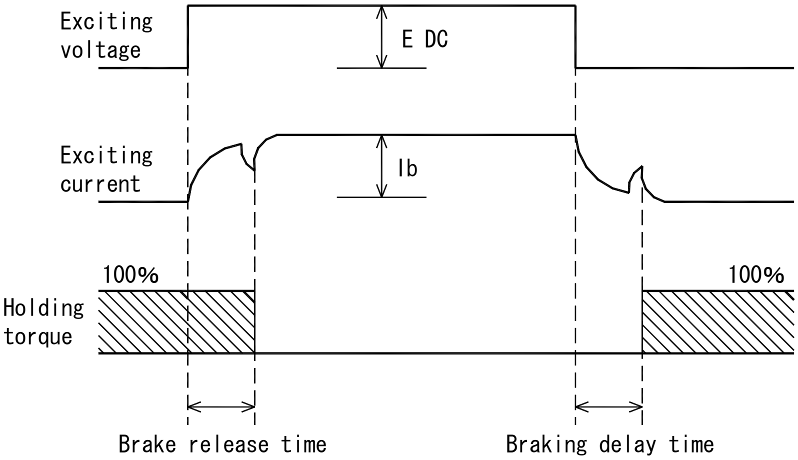
Table 9-20 Holding Brake Specifications

	Model No.	Static friction torque (N·m)	Brake release time (msec)	Braking delay time (msec)	
				Varistor	Diode
P1	P10B10030	3.9	40	30	120
	P10B10075				
	P10B13050	8.8	100	30	140
	P10B13100				
	P10B13150				
	P10B18200	32.4	120	40	150
	P10B18350				
	P10B18450				
	P10B18550	49	300	140	350
P2	P20B10100	3.92	40	30	120
	P20B10150	7.84	100	30	140
	P20B10200	7.84	100	30	140
	P20B10250	9.4	100	30	140
	P20B13300	11.4	100	30	140
	P20B13400	14.4	120	50	150
	P20B13500	18.1			
P3	P30B04003	0.098	25	15	100
	P30B04005	0.157			
	P30B04010	0.32			
	P30B06020	0.637	30	20	120
	P30B06040	1.274			
	P30B08075	2.38	40	20	200
P5	P50B03003	0.098	25	15	60
	P50B04006	0.191	25	15	100
	P50B04010	0.319			
	P50B05005	0.167	15	10	100
	P50B05010	0.353			
	P50B05020				
	P50B07020	0.69	25	15	100
	P50B07030	0.98			
	P50B07040				
	P50B08040	1.37	30	20	200
	P50B08050	1.96			
	P50B08075	2.94			
	P50B08100				
P6	P60B13050	3.5	40	30	120
	P60B13100	9.0	70	30	130
	P60B13150		100	30	140
	P60B13200	12.0			
	P60B15300	20.0	120	50	150
	P60B18200	12.0	100	30	140
	P60B18350	32.0	120	40	150
	P60B18450		150	40	250
	P60B18550	54.9	300	140	400
	P60B18750				
	P60B22550	90.0			
	P60B22700				
	P60B2211KB	90.0	300	140	400
	P60B2215KB				
P8	P80B15075	9.0	70	30	130
	P80B18120				
	P80B22250	32.0	100	60	140
	P80B22350		120	60	150
	P80B22450		150	60	250

1. The brake response time was measured in the following circuit.



2. The brake release and braking delay time refers to those in the Fig. below.



3. The brake release time is the same for both the varistor and the diode.

9.2.5 Motor Data Sheet P1

The following tables show the various constants for each motor. When the motor is used beyond the applicable load inertia, make sure that the dynamic brake instantaneous resistance is not exceeded.

P10B10030H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	300	W	300	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	1.5	N•m	15	kg·cm
∗ Continuous stall torque	T_S	1.5	N•m	15	kg·cm
∗ Instantaneous maximum stall torque	T_P	4.4	N•m	45	kg·cm
∗ Rated armature current	I_R	2.7	Arms	2.7	Arms
∗ Continuous stall armature current	I_S	2.5	Arms	2.5	Arms
∗ Instantaneous maximum stall armature current	I_P	7.9	Arms	7.9	Arms
Torque constant	K_T	0.67	N·m/Arms	6.8	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	23.4	mV/min^{-1}	23.4	V/krpm
Phase armature resistance	R_ϕ	3.63	Ω	3.63	Ω
Electrical time constant	t_e	1.9	msec	1.9	msec
Mechanical time constant (not including sensor)	t_m	9.6	msec	9.6	msec
Inertia (including wiring-saved INC)	J_M	3.98×10^{-4}	kg·m^2 (GD^2/4)	4.08	g·cm·s^2
Inertia (including ABS-E)	J_M	4.0×10^{-4}	kg·m^2 (GD^2/4)	4.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	3.98×10^{-4}	kg·m^2 (GD^2/4)	4.08	g·cm·s^2
Applicable load inertia	J_L	$J_M\times5$	kg·m^2 (GD^2/4)	$J_M\times5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	5.1	kg	5.1	kg
Weight (including ABS-E)	W_E	5.0	kg	5.0	kg
Weight (including ABS-RⅡ)	W_E	5.2	kg	5.2	kg

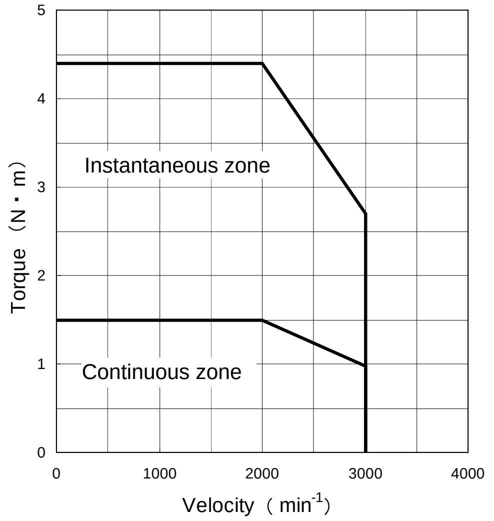
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.9 or more	N·m	40 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.76/0.23	A (DC)	0.76/0.23	A (DC)
Inertia	J_B	0.34×10^{-4}	kg·m^2 (GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

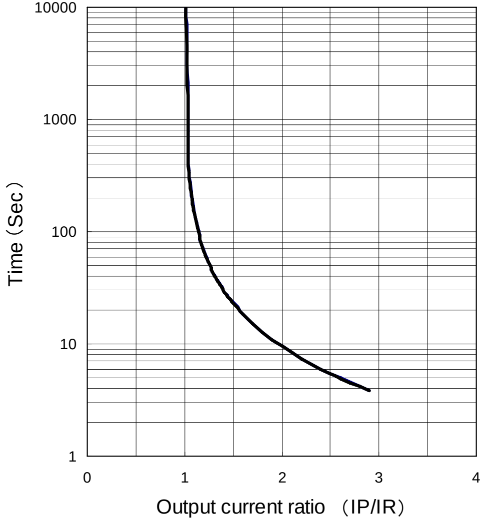
Velocity-torque characteristics

P10B10030H（300W）



Overload characteristics

P10B10030H(300W)



P10B10075H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	3.5	N•m	36	kg·cm
∗ Continuous stall torque	T_S	3.9	N•m	40	kg·cm
∗ Instantaneous maximum stall torque	T_P	10.8	N•m	110	kg·cm
∗ Rated armature current	I_R	5.1	Arms	5.1	Arms
∗ Continuous stall armature current	I_S	5.2	Arms	5.2	Arms
∗ Instantaneous maximum stall armature current	I_P	15.5	Arms	15.5	Arms
Torque constant	K_T	0.81	N·m/Arms	8.3	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	28.5	mV/min^{-1}	28.5	V/krpm
Phase armature resistance	R_ϕ	1.05	Ω	1.05	Ω
Electrical time constant	t_e	3.0	msec	3.0	msec
Mechanical time constant (not including sensor)	t_m	6.5	msec	6.5	msec
Inertia (including wiring-saved INC)	J_M	14.08×10^{-4}	kg·m^2 (GD^2/4)	14.08	g·cm·s^2
Inertia (including ABS-E)	J_M	14.1×10^{-4}	kg·m^2 (GD^2/4)	14.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	14.08×10^{-4}	kg·m^2 (GD^2/4)	14.08	g·cm·s^2
Applicable load inertia	J_L	$J_M\times4$	kg·m^2 (GD^2/4)	$J_M\times4$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	9.9	kg	9.9	kg
Weight (including ABS-E)	W_E	9.8	kg	9.8	kg
Weight (including ABS-RⅡ)	W_E	10.0	kg	10.0	kg

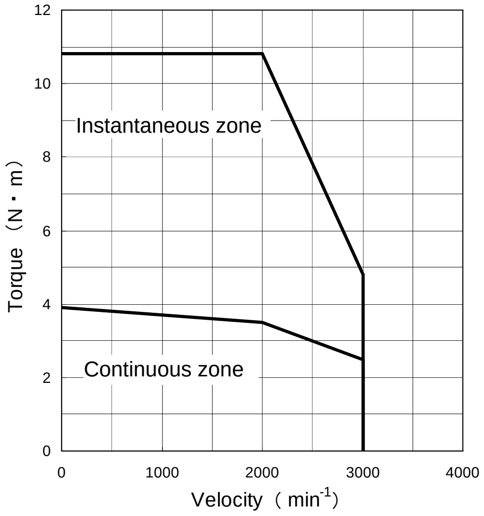
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.9 or more	N·m	40 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.76/0.23	A (DC)	0.76/0.23	A (DC)
Inertia	J_B	0.34×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

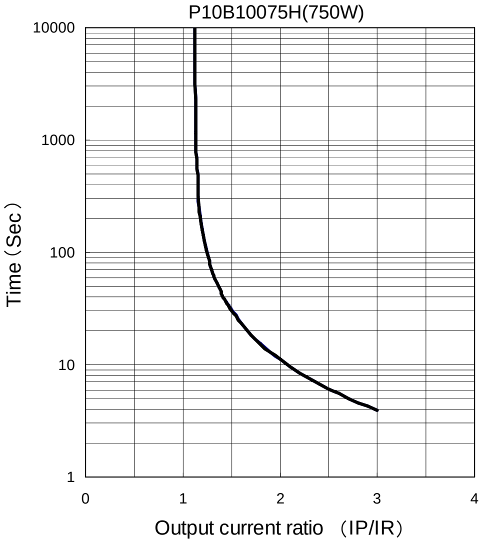
Velocity-torque characteristics

P10B10075H（750W）



Overload characteristics

P10B10075H(750W)



P10B13050H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	500	W	500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	2.4	N•m	24	kg·cm
∗ Continuous stall torque	T_S	2.9	N•m	30	kg·cm
∗ Instantaneous maximum stall torque	T_P	8.8	N•m	90	kg·cm
∗ Rated armature current	I_R	4.0	Arms	4.0	Arms
∗ Continuous stall armature current	I_S	4.6	Arms	4.6	Arms
∗ Instantaneous maximum stall armature current	I_P	15.1	Arms	15.1	Arms
Torque constant	K_T	0.72	N·m/Arms	7.3	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	25.1	mV/min^{-1}	25.1	V/krpm
Phase armature resistance	R_ϕ	1.31	Ω	1.31	Ω
Electrical time constant	t_e	3.2	msec	3.2	msec
Mechanical time constant (not including sensor)	t_m	9.0	msec	9.0	msec
Inertia (including wiring-saved INC)	J_M	12.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	12	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	12.1×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	12.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	12.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	12	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	$J_M\times5$	$kg\cdot m^2$ $(GD^2/4)$	$J_M\times5$	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	7.6	kg	7.6	kg
Weight (including ABS-E)	W_E	7.5	kg	7.5	kg
Weight (including ABS-RⅡ)	W_E	7.7	kg	8.7	kg

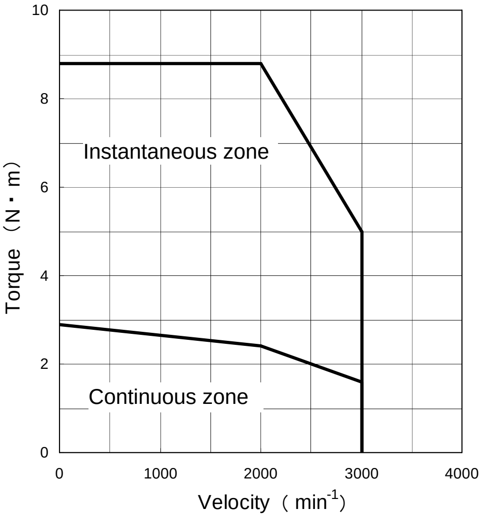
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.5	$g\cdot cm\cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

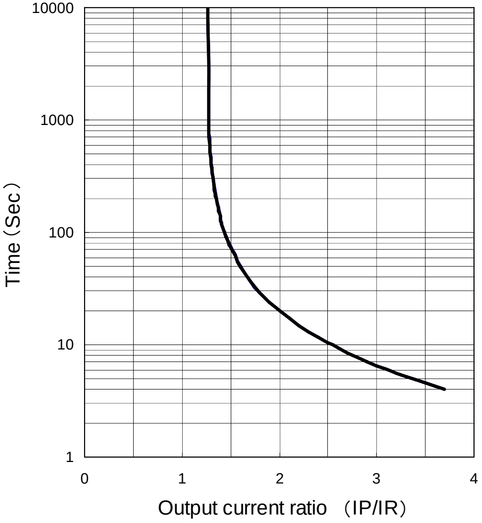
Velocity-torque characteristics

P10B13050H（500W）



Overload characteristics

P10B13050H(500W)



9. SPECIFICATIONS

P10B13100H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1000	W	1000	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	4.7	N•m	48	kg·cm
∗ Continuous stall torque	T_S	5.9	N•m	60	kg·cm
∗ Instantaneous maximum stall torque	T_P	15.2	N•m	155	kg·cm
∗ Rated armature current	I_R	8.3	Arms	8.3	Arms
∗ Continuous stall armature current	I_S	9.0	Arms	9.0	Arms
∗ Instantaneous maximum stall armature current	I_P	25.0	Arms	25.0	Arms
Torque constant	K_T	0.75	N·m/Arms	7.6	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	25.8	mV/min^{-1}	25.8	V/krpm
Phase armature resistance	R_ϕ	0.44	Ω	0.44	Ω
Electrical time constant	t_e	4.5	msec	4.5	msec
Mechanical time constant (not including sensor)	t_m	5.9	msec	5.9	msec
Inertia (including wiring-saved INC)	J_M	25.08×10^{-4}	kg·m^2 (GD^2/4)	25	g·cm·s^2
Inertia (including ABS-E)	J_M	25.1×10^{-4}	kg·m^2 (GD^2/4)	25.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	25.08×10^{-4}	kg·m^2 (GD^2/4)		g·cm·s^2
Applicable load inertia	J_L	$J_M \times 5$	kg·m^2 (GD^2/4)	$J_M \times 5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	11.7	kg	11.7	kg
Weight (including ABS-E)	W_E	11.6	kg	11.6	kg
Weight (including ABS-RⅡ)	W_E	11.8	kg	11.8	kg

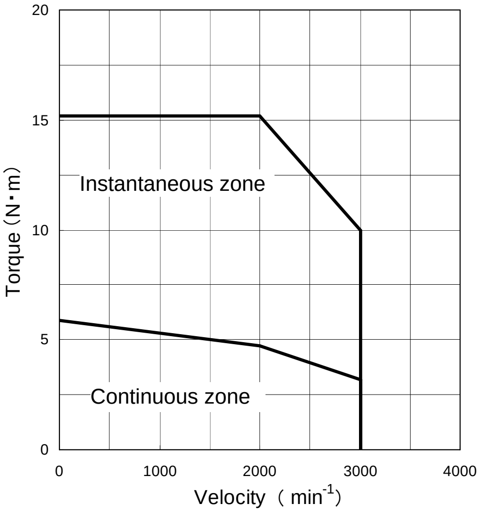
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

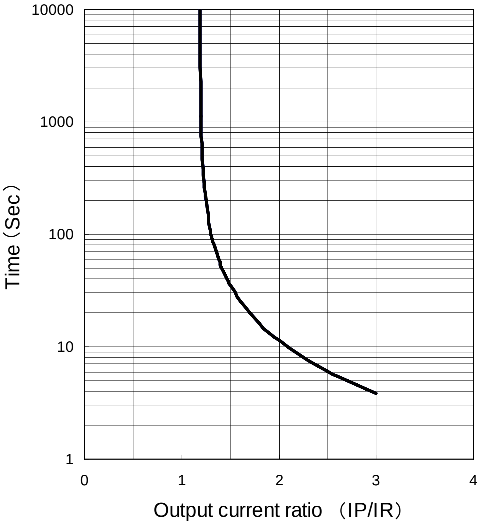
Velocity-torque characteristics

P10B13100H（1.0kW）



Overload characteristics

P10B13100H(1.0kW)



P10B13150H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	7.4	N•m	75	kg·cm
∗ Continuous stall torque	T_S	8.8	N•m	90	kg·cm
∗ Instantaneous maximum stall torque	T_P	18.6	N•m	190	kg·cm
∗ Rated armature current	I_R	11.2	Arms	11.2	Arms
∗ Continuous stall armature current	I_S	12.0	Arms	12.0	Arms
∗ Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.83	N·m/Arms	8.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	28.9	mV/min^{-1}	28.9	V/krpm
Phase armature resistance	R_ϕ	0.32	Ω	0.32	Ω
Electrical time constant	t_e	5.3	msec	5.3	msec
Mechanical time constant (not including sensor)	t_m	4.9	msec	4.9	msec
Inertia (including wiring-saved INC)	J_M	35.08×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	36.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	35.1×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	36.1	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RⅡ)	J_M	35.08×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	36.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	$J_M\times5$	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	$J_M\times5$	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	16.1	kg	16.1	kg
Weight (including ABS-E)	W_E	16.0	kg	16.0	kg
Weight (including ABS-RⅡ)	W_E	16.2	kg	16.2	kg

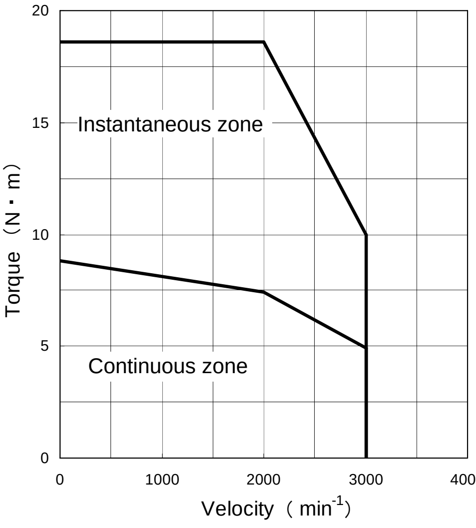
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.5	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

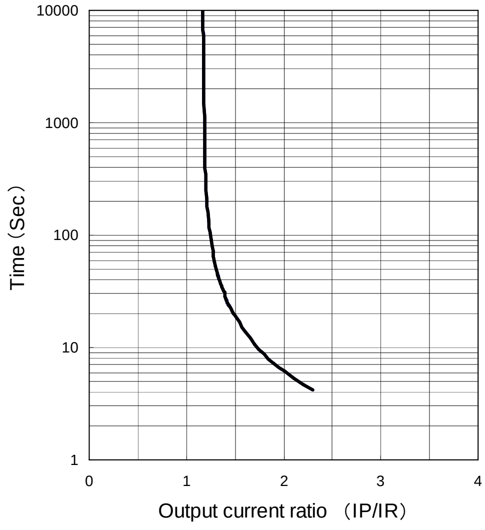
Velocity-torque characteristics

P10B13150H（1.5kW）



Overload characteristics

P10B13150H(1.5kW)



P10B18200H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	2000	W	2000	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	9.3	N•m	95	kg·cm
∗ Continuous stall torque	T_S	11.8	N•m	120	kg·cm
∗ Instantaneous maximum stall torque	T_P	29.4	N•m	300	kg·cm
∗ Rated armature current	I_R	16.9	Arms	16.9	Arms
∗ Continuous stall armature current	I_S	19.7	Arms	19.7	Arms
∗ Instantaneous maximum stall armature current	I_P	48.3	Arms	48.3	Arms
Torque constant	K_T	0.74	N·m/Arms	7.6	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	25.9	mV/min^{-1}	25.9	V/krpm
Phase armature resistance	R_ϕ	0.16	Ω	0.16	Ω
Electrical time constant	t_e	7.5	msec	7.5	msec
Mechanical time constant (not including sensor)	t_m	6.3	msec	6.3	msec
Inertia (including wiring-saved INC)	J_M	73.08×10^{-4}	kg·m^2 (GD^2/4)	74.08	g·cm·s^2
Inertia (including ABS-E)	J_M	73.1×10^{-4}	kg·m^2 (GD^2/4)	74.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	73.08×10^{-4}	kg·m^2 (GD^2/4)	74.08	g·cm·s^2
Applicable load inertia	J_L	$J_M\times4$	kg·m^2 (GD^2/4)	$J_M\times4$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	23.1	kg	23.1	kg
Weight (including ABS-E)	W_E	23.0	kg	23.0	kg
Weight (including ABS-RⅡ)	W_E	23.2	kg	23.2	kg

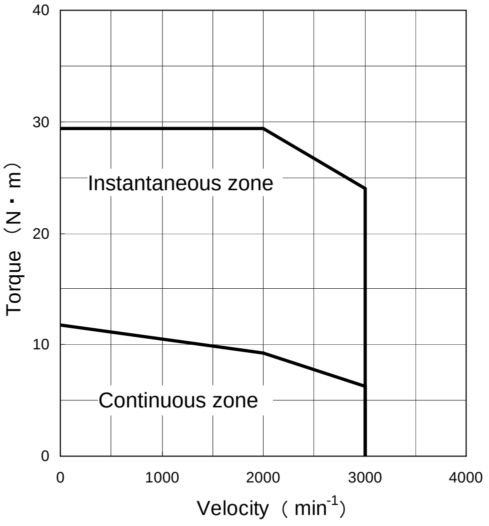
Holding Brake Data Sheet (Option)

Holding torque	T_B	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	kg·m^2 (GD^2/4)	3.5	g·cm·s^2
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

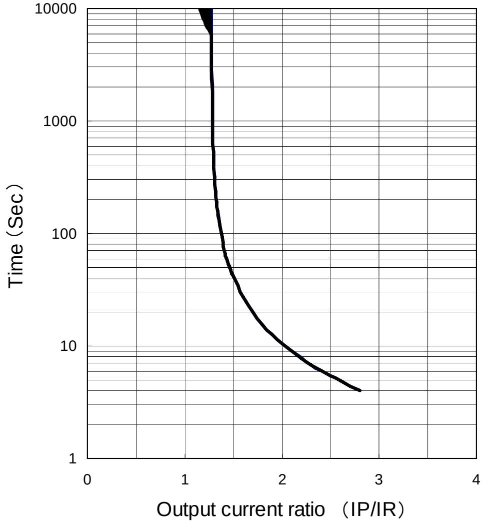
Velocity-torque characteristics

P10B18200H（2.0kW）



Overload characteristics

P10B18200H(2.0kW)



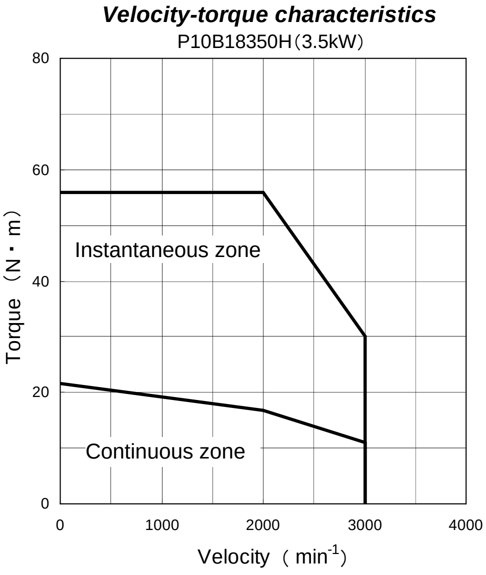
P10B18350H

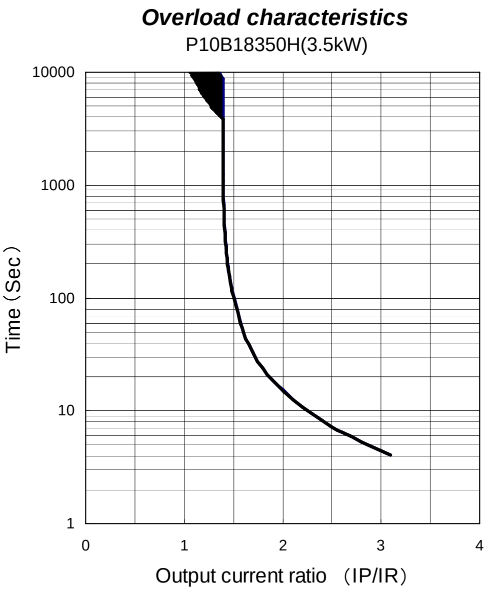
Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	3500	W	3500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	16.7	N•m	170	kg·cm
∗ Continuous stall torque	T_S	21.6	N•m	220	kg·cm
∗ Instantaneous maximum stall torque	T_P	55.9	N•m	570	kg·cm
∗ Rated armature current	I_R	23.3	Arms	23.3	Arms
∗ Continuous stall armature current	I_S	29.5	Arms	29.5	Arms
∗ Instantaneous maximum stall armature current	I_P	74.2	Arms	74.2	Arms
Torque constant	K_T	0.92	N·m/Arms	9.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	32.2	mV/min^{-1}	32.2	V/krpm
Phase armature resistance	R_ϕ	0.096	Ω	0.096	Ω
Electrical time constant	t_e	8.8	msec	8.8	msec
Mechanical time constant (not including sensor)	t_m	4.9	msec	4.9	msec
Inertia (including wiring-saved INC)	J_M	144.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	147.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	144.1×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	147.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	144.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	147.08	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	$J_M\times1.4$	$kg\cdot m^2$ $(GD^2/4)$	$J_M\times1.4$	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	32.6	kg	32.6	kg
Weight (including ABS-E)	W_E	32.5	kg	32.5	kg
Weight (including ABS-RⅡ)	W_E	32.7	kg	32.7	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	3.5	$g\cdot cm\cdot s^2$
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.





P10B18450R

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	4500	W	4500	W
	Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
	Maximum revolution speed	N_{max}	2500	min^{-1}	2500	rpm
∗	Rated torque	T_R	21.6	N•m	220	kg·cm
∗	Continuous stall torque	T_S	32.4	N•m	330	kg·cm
∗	Instantaneous maximum stall torque	T_P	78.5	N•m	800	kg·cm
∗	Rated armature current	I_R	26.0	Arms	26.0	Arms
∗	Continuous stall armature current	I_S	34	Arms	34	Arms
∗	Instantaneous maximum stall armature current	I_P	83.0	Arms	83.0	Arms
	Torque constant	K_T	1.16	N·m/Arms	11.8	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	40.2	mV/min^{-1}	40.2	V/krpm
	Phase armature resistance	R_ϕ	0.080	Ω	0.080	Ω
	Electrical time constant	t_e	11	msec	11	msec
	Mechanical time constant (not including sensor)	t_m	3.7	msec	3.7	msec
	Inertia (including wiring-saved INC)	J_M	206.08×10^{-4}	kg·m^2 (GD^2/4)	210.08	g·cm·s^2
	Inertia (including ABS-E)	J_M	206.1×10^{-4}	kg·m^2 (GD^2/4)	210.1	g·cm·s^2
	Inertia (including ABS-RⅡ)	J_M	206.08×10^{-4}	kg·m^2 (GD^2/4)	210.08	g·cm·s^2
	Applicable load inertia	J_L	$J_M\times1.4$	kg·m^2 (GD^2/4)	$J_M\times1.4$	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	44.7	kg	44.7	kg
	Weight (including ABS-E)	W_E	44.6	kg	44.6	kg
	Weight (including ABS-RⅡ)	W_E	45.7	kg	45.7	kg

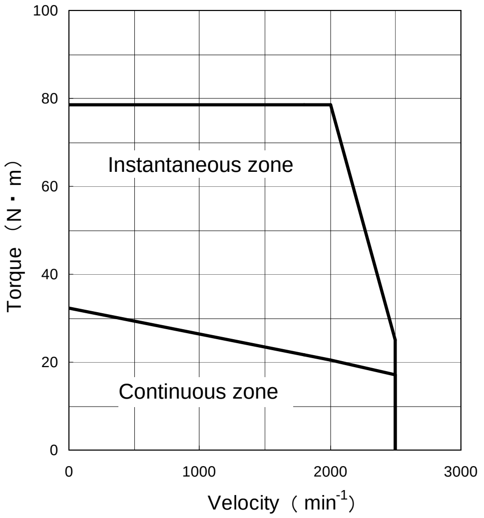
Holding Brake Data Sheet (Option)

Holding torque	T_B	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	kg·m^2 (GD^2/4)	3.5	g·cm·s^2
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

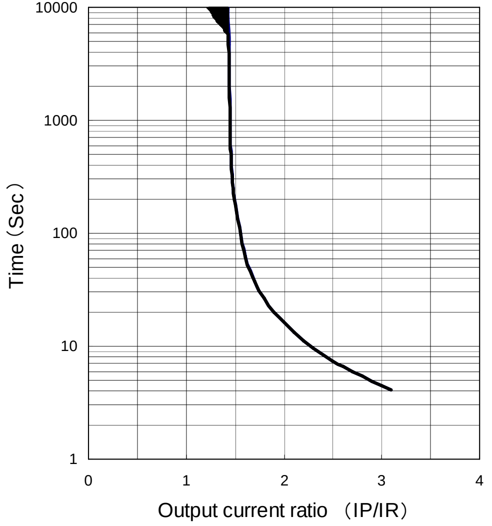
Velocity-torque characteristics

P10B18450R（4.5kW）



Overload characteristics

P10B18450R(4.5kW)



9. SPECIFICATIONS

P10B18550M

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	5500	W	5500	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	1500	min^{-1}	1500	rpm
* Rated torque	T_R	35.3	N•m	360	kg·cm
* Continuous stall torque	T_S	46.1	N•m	470	kg·cm
* Instantaneous maximum stall torque	T_P	118	N•m	1200	kg·cm
* Rated armature current	I_R	24.4	Arms	24.4	Arms
* Continuous stall armature current	I_S	30.2	Arms	30.2	Arms
* Instantaneous maximum stall armature current	I_P	79.0	Arms	79.0	Arms
Torque constant	K_T	1.81	N·m/Arms	18.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	63.3	mV/min^{-1}	63.3	V/krpm
Phase armature resistance	R_ϕ	0.113	Ω	0.113	Ω
Electrical time constant	t_e	12	msec	12	msec
Mechanical time constant (not including sensor)	t_m	3.4	msec	3.4	msec
Inertia (including wiring-saved INC)	J_M	330.08×10^{-4}	$\text{kg}\cdot\text{m}^2$ $(GD^2/4)$	336.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	330.1×10^{-4}	$\text{kg}\cdot\text{m}^2$ $(GD^2/4)$	336.1	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RⅡ)	J_M	330.08×10^{-4}	$\text{kg}\cdot\text{m}^2$ $(GD^2/4)$	336.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	$J_M\times3.3$	$\text{kg}\cdot\text{m}^2$ $(GD^2/4)$	$J_M\times3.3$	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	66.1	kg	66.1	kg
Weight (including ABS-E)	W_E	66.0	kg	66.0	kg
Weight (including ABS-RⅡ)	W_E	66.2	kg	66.2	kg

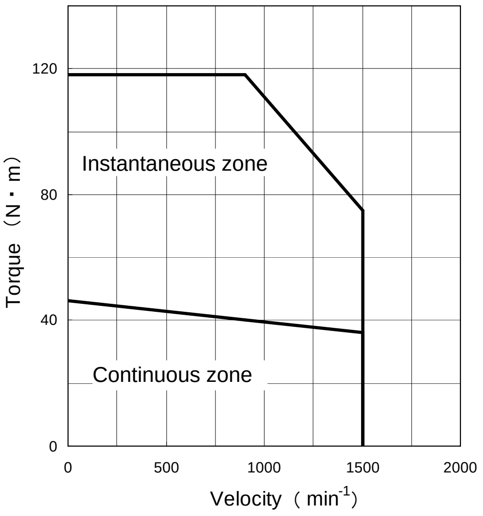
Holding Brake Data Sheet (Option)

Holding torque	T_B	49.0 or more	N·m	500 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.1/0.28	A (DC)	1.1/0.28	A (DC)
Inertia	J_B	7.8×10^{-4}	$\text{kg}\cdot\text{m}^2$ $(GD^2/4)$	8.0	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	7.0	kg	7.0	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

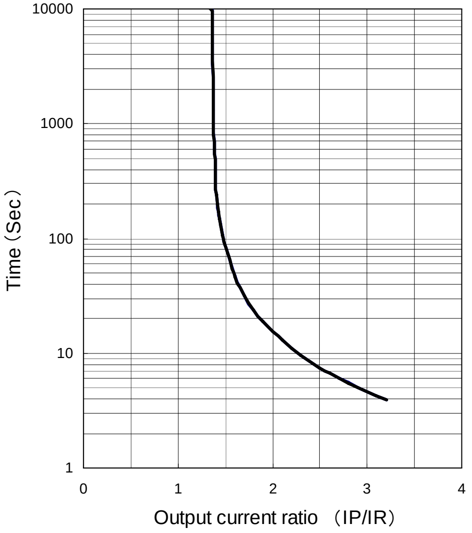
Velocity-torque characteristics

P10B18550M（5.5kW）



Overload characteristics

P10B18550M(5.5kW)



P10B13050B

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	500	W	500	W
	Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
	Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
∗	Rated torque	T_R	2.4	N•m	24	kg·cm
∗	Continuous stall torque	T_S	2.9	N•m	30	kg·cm
∗	Instantaneous maximum stall torque	T_P	8.8	N•m	90	kg·cm
∗	Rated armature current	I_R	2.9	Arms	2.9	Arms
∗	Continuous stall armature current	I_S	3.4	Arms	3.4	Arms
∗	Instantaneous maximum stall armature current	I_P	11.0	Arms	11.0	Arms
	Torque constant	K_T	0.98	N·m/Arms	10.0	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	34.3	mV/min^{-1}	34.3	V/krpm
	Phase armature resistance	R_ϕ	2.43	Ω	2.43	Ω
	Electrical time constant	t_e	3.2	msec	3.2	msec
	Mechanical time constant (not including sensor)	t_m	9.0	msec	9.0	msec
	Inertia (including wiring-saved INC)	J_M	12.08×10^{-4}	kg·m^2 (GD^2/4)	12.08	g·cm·s^2
	Inertia (including ABS-E)	J_M	12.1×10^{-4}	kg·m^2 (GD^2/4)	12.1	g·cm·s^2
	Inertia (including ABS-RⅡ)	J_M	12.08×10^{-4}	kg·m^2 (GD^2/4)	12.08	g·cm·s^2
	Applicable load inertia	J_L	$J_M\times5$	kg·m^2 (GD^2/4)	$J_M\times5$	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	7.6	kg	7.6	kg
	Weight (including ABS-E)	W_E	7.5	kg	7.5	kg
	Weight (including ABS-RⅡ)	W_E	7.7	kg	7.7	kg

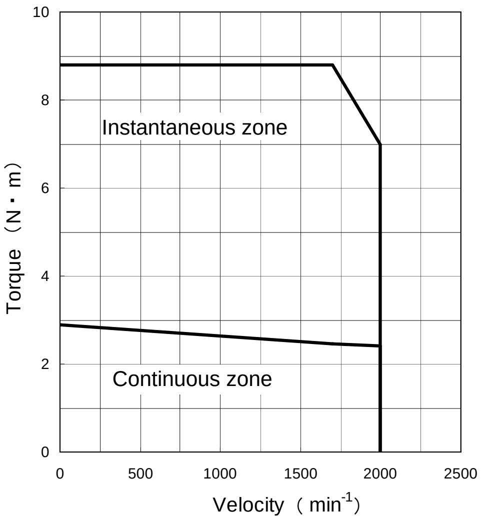
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 300 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

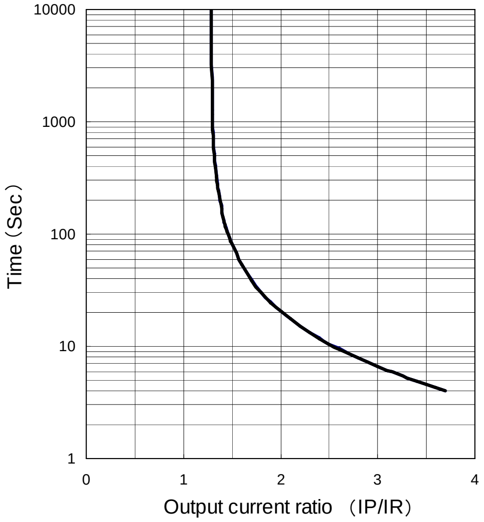
Velocity-torque characteristics

P10B13050B（500W）



Overload characteristics

P10B13050B(500W)



P10B13100B

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	1000	W	1000	W
	Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
	Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
∗	Rated torque	T_R	4.7	N•m	48	kg·cm
∗	Continuous stall torque	T_S	5.9	N•m	60	kg·cm
∗	Instantaneous maximum stall torque	T_P	15.2	N•m	155	kg·cm
∗	Rated armature current	I_R	4.8	Arms	4.8	Arms
∗	Continuous stall armature current	I_S	5.2	Arms	5.2	Arms
∗	Instantaneous maximum stall armature current	I_P	14.6	Arms	14.6	Arms
	Torque constant	K_T	1.27	N·m/Arms	13.0	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	44.6	mV/min^{-1}	44.6	V/krpm
	Phase armature resistance	R_ϕ	1.32	Ω	1.32	Ω
	Electrical time constant	t_e	4.5	msec	4.5	msec
	Mechanical time constant (not including sensor)	t_m	5.9	msec	5.9	msec
	Inertia (including wiring-saved INC)	J_M	25.08×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	25.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Inertia (including ABS-E)	J_M	25.1×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	25.1	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Inertia (including ABS-RⅡ)	J_M	25.08×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	25.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Applicable load inertia	J_L	$J_M\times5$	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	$J_M\times5$	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Weight (including wiring-saved INC)	W_E	11.7	kg	11.7	kg
	Weight (including ABS-E)	W_E	11.6	kg	11.6	kg
	Weight (including ABS-RⅡ)	W_E	11.8	kg	11.8	kg

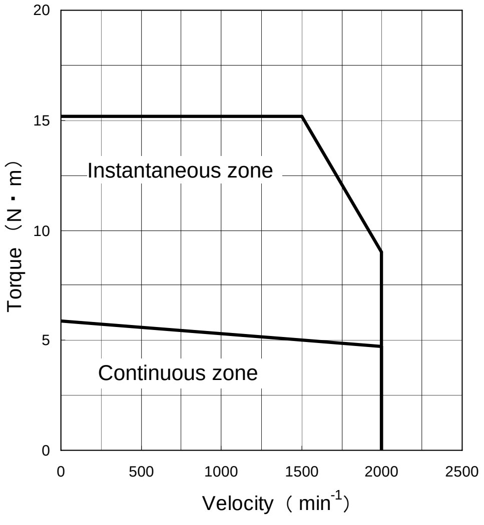
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.5	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

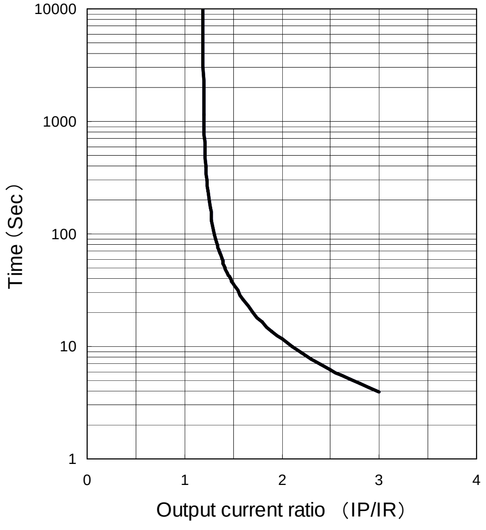
Velocity-torque characteristics

P10B13100B（1.0kW）



Overload characteristics

P10B13100B(1.0kW)



P10B13150B

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
∗ Rated torque	T_R	7.4	N•m	75	kg·cm
∗ Continuous stall torque	T_S	8.8	N•m	90	kg·cm
∗ Instantaneous maximum stall torque	T_P	19.6	N•m	200	kg·cm
∗ Rated armature current	I_R	6.9	Arms	6.9	Arms
∗ Continuous stall armature current	I_S	7.9	Arms	7.9	Arms
∗ Instantaneous maximum stall armature current	I_P	17.9	Arms	17.9	Arms
Torque constant	K_T	1.34	N·m/Arms	13.7	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	47.0	mV/min^{-1}	47.0	V/krpm
Phase armature resistance	R_ϕ	0.84	Ω	0.84	Ω
Electrical time constant	t_e	5.3	msec	5.3	msec
Mechanical time constant (not including sensor)	t_m	4.9	msec	4.9	msec
Inertia (including wiring-saved INC)	J_M	35.08×10^{-4}	kg·m^2 (GD^2/4)	36.08	g·cm·s^2
Inertia (including ABS-E)	J_M	35.1×10^{-4}	kg·m^2 (GD^2/4)	36.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	35.08×10^{-4}	kg·m^2 (GD^2/4)	36.08	g·cm·s^2
Applicable load inertia	J_L	J_M×5	kg·m^2 (GD^2/4)	J_M×5	g·cm·s^2
Weight (including wiring-saved INC)	W_E	16.1	kg	16.1	kg
Weight (including ABS-E)	W_E	16.1	kg	16.0	kg
Weight (including ABS-RⅡ)	W_E	16.2	kg	16.2	kg

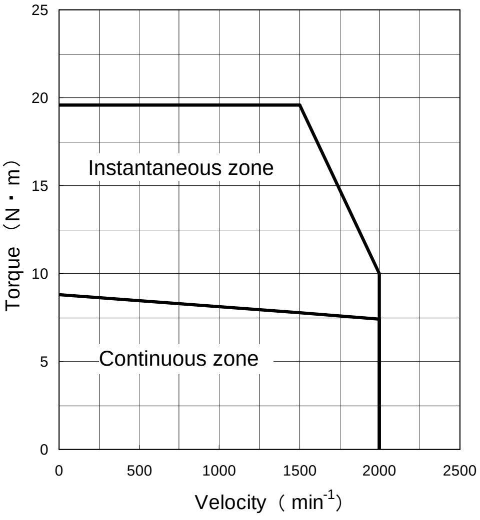
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

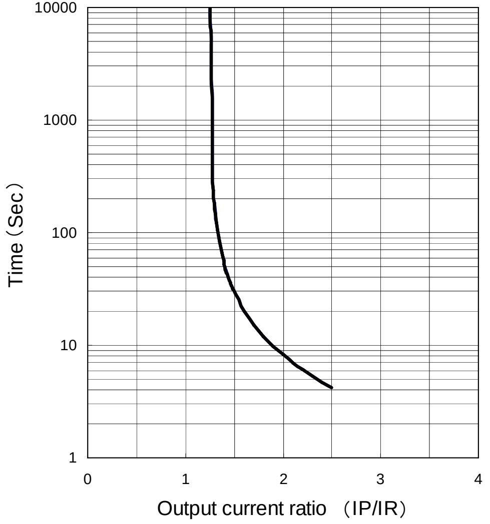
Velocity-torque characteristics

P10B13150B（1.5kW）



Overload characteristics

P10B13150B(1.5kW)



P10B18200B

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	2000	W	2000	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
∗ Rated torque	T_R	9.3	N•m	95	kg·cm
∗ Continuous stall torque	T_S	11.8	N•m	120	kg·cm
∗ Instantaneous maximum stall torque	T_P	29.4	N•m	300	kg·cm
∗ Rated armature current	I_R	9.5	Arms	9.5	Arms
∗ Continuous stall armature current	I_S	11.1	Arms	11.1	Arms
∗ Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	1.32	N·m/Arms	13.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	46.0	mV/min^{-1}	46.0	V/krpm
Phase armature resistance	R_ϕ	0.50	Ω	0.50	Ω
Electrical time constant	t_e	7.5	msec	7.5	msec
Mechanical time constant (not including sensor)	t_m	6.3	msec	6.3	msec
Inertia (including wiring-saved INC)	J_M	73.08×10^{-4}	kg·m^2 (GD^2/4)	74.08	g·cm·s^2
Inertia (including ABS-E)	J_M	73.1×10^{-4}	kg·m^2 (GD^2/4)	74.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	73.08×10^{-4}	kg·m^2 (GD^2/4)	74.08	g·cm·s^2
Applicable load inertia	J_L	$J_M\times5$	kg·m^2 (GD^2/4)	$J_M\times5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	23.1	kg	23.1	kg
Weight (including ABS-E)	W_E	23.0	kg	23.0	kg
Weight (including ABS-RⅡ)	W_E	23.2	kg	23.2	kg

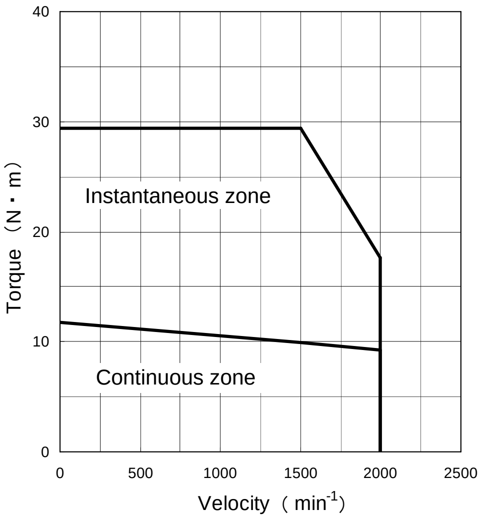
Holding Brake Data Sheet (Option)

Holding torque	T_B	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	kg·m^2 (GD^2/4)	3.5	g·cm·s^2
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

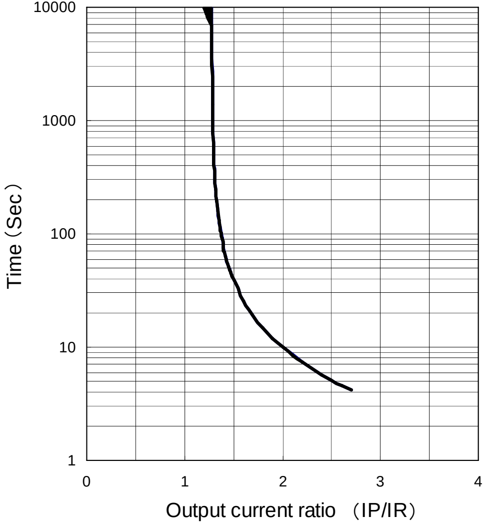
Velocity-torque characteristics

P10B18200B（2.0kW）



Overload characteristics

P10B18200B(2.0kW)



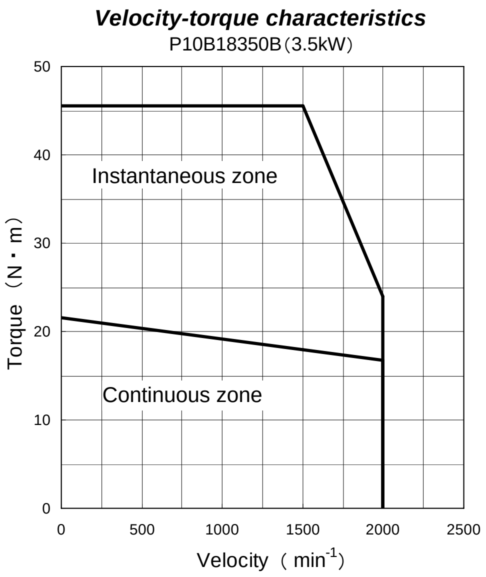
P10B18350B

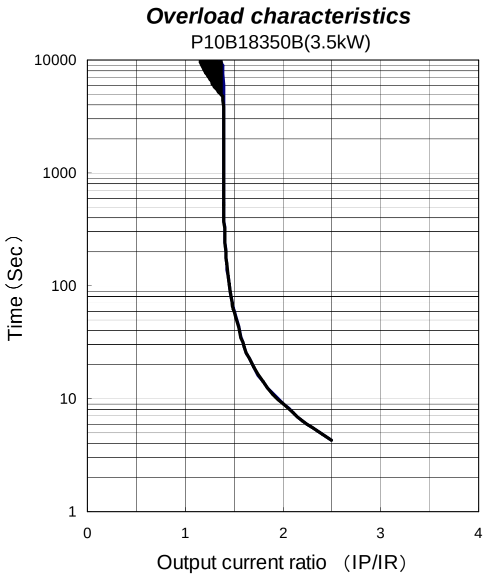
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	3500	W	3500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
* Rated torque	T_R	16.7	N•m	170	kg·cm
* Continuous stall torque	T_S	21.6	N•m	220	kg·cm
* Instantaneous maximum stall torque	T_P	45.6	N•m	465	kg·cm
* Rated armature current	I_R	17.5	Arms	17.5	Arms
* Continuous stall armature current	I_S	22.1	Arms	22.1	Arms
* Instantaneous maximum stall armature current	I_P	45.5	Arms	45.5	Arms
Torque constant	K_T	1.23	N·m/Arms	12.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	42.9	mV/min^{-1}	42.9	V/krpm
Phase armature resistance	R_ϕ	0.17	Ω	0.17	Ω
Electrical time constant	t_e	8.8	msec	8.8	msec
Mechanical time constant (not including sensor)	t_m	4.9	msec	4.9	msec
Inertia (including wiring-saved INC)	J_M	144.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	147.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	144.1×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	147.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	144.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	147.08	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	$J_M\times4.7$	$kg\cdot m^2$ ($GD^2/4$)	$J_M\times4.7$	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	32.6	kg	32.6	kg
Weight (including ABS-E)	W_E	32.5	kg	32.5	kg
Weight (including ABS-RⅡ)	W_E	32.7	kg	32.7	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	3.5	$g\cdot cm\cdot s^2$
Weight	W	5.0	kg	5.0	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.





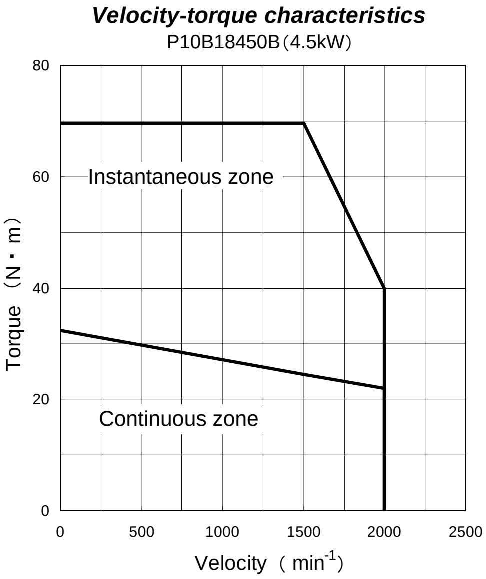
P10B18450B

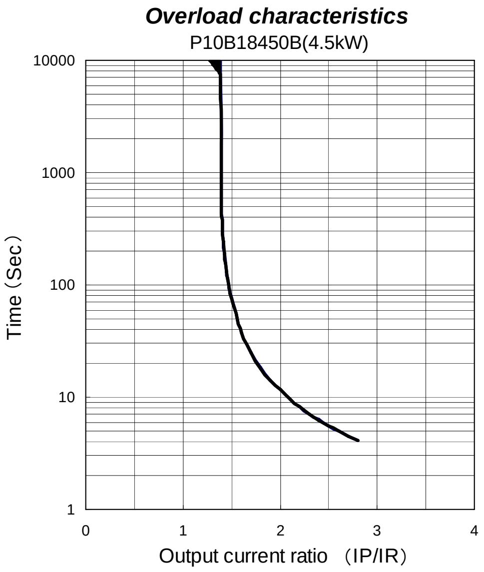
Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	4500	W	4500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
∗ Rated torque	T_R	21.6	N•m	220	kg·cm
∗ Continuous stall torque	T_S	32.4	N•m	330	kg·cm
∗ Instantaneous maximum stall torque	T_P	69.6	N•m	710	kg·cm
∗ Rated armature current	I_R	18.4	Arms	18.4	Arms
∗ Continuous stall armature current	I_S	23.2	Arms	23.2	Arms
∗ Instantaneous maximum stall armature current	I_P	52.7	Arms	52.7	Arms
Torque constant	K_T	1.62	N·m/Arms	16.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	56.3	mV/min^{-1}	56.3	V/krpm
Phase armature resistance	R_ϕ	0.157	Ω	0.157	Ω
Electrical time constant	t_e	11	msec	11	msec
Mechanical time constant (not including sensor)	t_m	3.7	msec	3.7	msec
Inertia (including wiring-saved INC)	J_M	206.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	210.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	206.1×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	210.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	206.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	210.08	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	$J_M\times3$	$kg\cdot m^2$ ($GD^2/4$)	$J_M\times3$	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	44.7	kg	44.7	kg
Weight (including ABS-E)	W_E	44.6	kg	44.6	kg
Weight (including ABS-RⅡ)	W_E	44.8	kg	44.8	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	3.5	$g\cdot cm\cdot s^2$
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.





9.2.5.2 Motor Data Sheet P2

P20B10100H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1000	W	1000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	3.19	N•m	32.5	kg·cm
∗ Continuous stall torque	T_S	3.92	N•m	40	kg·cm
∗ Instantaneous maximum stall torque	T_P	10.3	N•m	10.5	kg·cm
∗ Rated armature current	I_R	4.1	Arms	4.1	Arms
∗ Continuous stall armature current	I_S	4.7	Arms	4.7	Arms
∗ Instantaneous maximum stall armature current	I_P	14	Arms	14	Arms
Torque constant	K_T	0.89	N·m/Arms	9.1	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	31.2	mV/min^{-1}	31.2	V/krpm
Phase armature resistance	R_ϕ	1.6	Ω	1.6	Ω
Electrical time constant	t_e	10	msec	10	msec
Mechanical time constant (not including sensor)	t_m	0.89	msec	0.89	msec
Inertia (including wiring-saved INC)	J_M	1.55×10^{-4}	kg·m^2 (GD^2/4)	1.58	g·cm·s^2
Inertia (including ABS-E)	J_M	1.57×10^{-4}	kg·m^2 (GD^2/4)	1.6	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	1.55×10^{-4}	kg·m^2 (GD^2/4)	1.58	g·cm·s^2
Applicable load inertia	J_L	15.5×10^{-4}	kg·m^2 (GD^2/4)	15.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	5.4	kg	5.4	kg
Weight (including ABS-E)	W_E	5.3	kg	5.3	kg
Weight (including ABS-RⅡ)	W_E	5.5	kg	5.5	kg

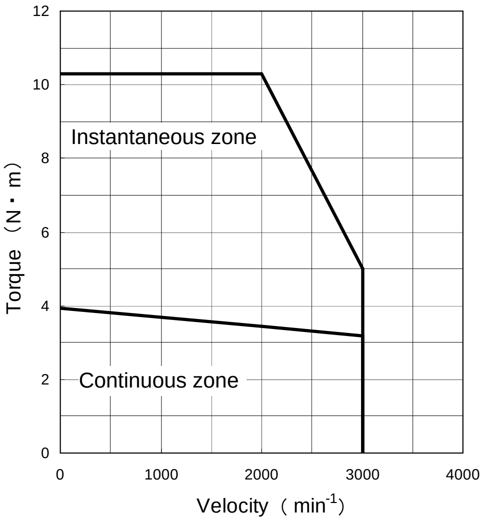
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.92 or more	N·m	40 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.60/0.16	A (DC)	0.60/0.16	A (DC)
Inertia	J_B	0.15×10^{-4}	kg·m^2 (GD^2/4)	0.15	g·cm·s^2
Weight	W	1.3	kg	1.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

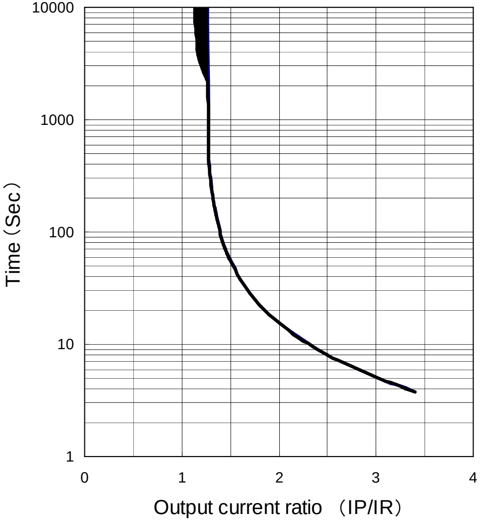
Velocity-torque characteristics

P20B10100H（1.0kW）



Overload characteristics

P20B10100H(1.0kW)



9. SPECIFICATIONS

P20B10150H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	4.79	N•m	48.8	kg·cm
∗ Continuous stall torque	T_S	4.90	N•m	50	kg·cm
∗ Instantaneous maximum stall torque	T_P	17.7	N•m	180	kg·cm
∗ Rated armature current	I_R	6.5	Arms	6.5	Arms
∗ Continuous stall armature current	I_S	6.3	Arms	6.3	Arms
∗ Instantaneous maximum stall armature current	I_P	25	Arms	25	Arms
Torque constant	K_T	0.83	N·m/Arms	8.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	29.0	mV/min^{-1}	29.0	V/krpm
Phase armature resistance	R_ϕ	0.67	Ω	0.67	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	0.57	msec	0.57	msec
Inertia (including wiring-saved INC)	J_M	2.04×10^{-4}	kg·m^2 (GD^2/4)	2.08	g·cm·s^2
Inertia (including ABS-E)	J_M	2.06×10^{-4}	kg·m^2 (GD^2/4)	2.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	2.04×10^{-4}	kg·m^2 (GD^2/4)	2.08	g·cm·s^2
Applicable load inertia	J_L	2.04×10^{-4}	kg·m^2 (GD^2/4)	20.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	6.5	kg	6.5	kg
Weight (including ABS-E)	W_E	6.4	kg	6.4	kg
Weight (including ABS-RⅡ)	W_E	6.6	kg	6.6	kg

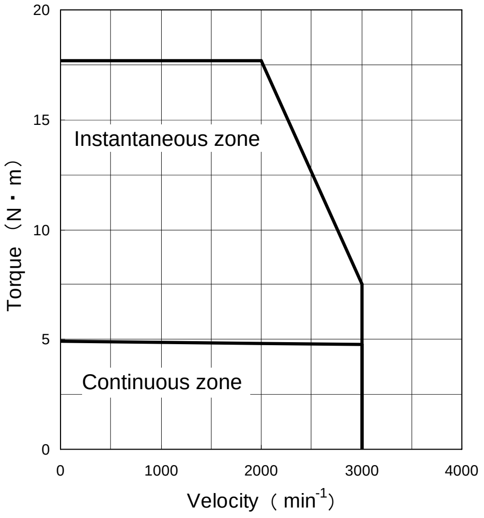
Holding Brake Data Sheet (Option)

Holding torque	T_B	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.83/0.22	A (DC)	0.83/0.22	A (DC)
Inertia	J_B	0.40×10^{-4}	kg·m^2 (GD^2/4)	0.39	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

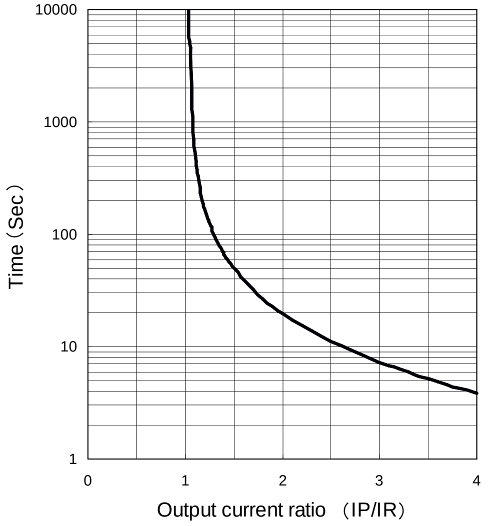
Velocity-torque characteristics

P20B10150H（1.5kW）



Overload characteristics

P20B10150H(1.5kW)



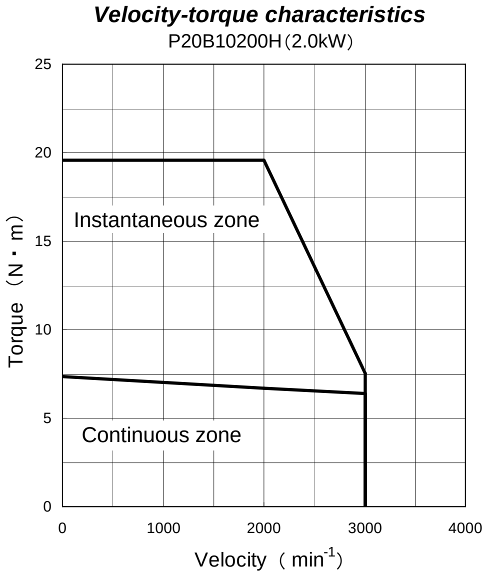
P20B10200H

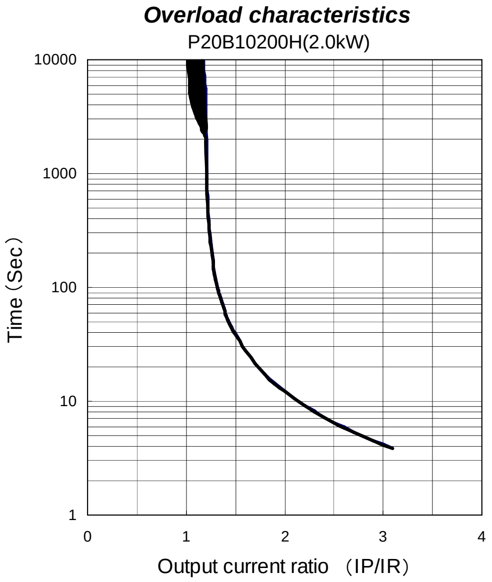
Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	PR	2000	W	2000	W
Rated revolution speed	NR	3000	min^{-1}	3000	rpm
Maximum revolution speed	Nmax	3000	min^{-1}	3000	rpm
∗ Rated torque	TR	6.37	N•m	65	kg·cm
∗ Continuous stall torque	TS	7.36	N•m	75	kg·cm
∗ Instantaneous maximum stall torque	TP	19.6	N•m	200	kg·cm
∗ Rated armature current	IR	8.5	Arms	8.5	Arms
∗ Continuous stall armature current	IS	9.3	Arms	9.3	Arms
∗ Instantaneous maximum stall armature current	IP	26.5	Arms	26.5	Arms
Torque constant	KT	0.85	N·m/Arms	8.7	kg·cm/Arms
Induced voltage constant	KEϕ	30.0	mV/min^{-1}	30.0	V/krpm
Phase armature resistance	Rϕ	0.50	Ω	0.50	Ω
Electrical time constant	te	13	msec	13	msec
Mechanical time constant (not including sensor)	tm	0.56	msec	0.56	msec
Inertia (including wiring-saved INC)	JM	2.83×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.88	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	JM	2.85×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.9	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	JM	2.83×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.88	$g\cdot cm\cdot s^2$
Applicable load inertia	JL	28.3×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	28.8	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	WE	8.7	kg	8.7	kg
Weight (including ABS-E)	WE	8.6	kg	8.6	kg
Weight (including ABS-RⅡ)	WE	8.8	kg	8.8	kg

Holding Brake Data Sheet (Option)

Holding torque	TB	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	VB	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	IB	0.83/0.22	A (DC)	0.83/0.22	A (DC)
Inertia	JB	0.40×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.39	$g\cdot cm\cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.





9. SPECIFICATIONS

P20B10250H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	2500	W	2500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	7.97	N•m	81.3	kg·cm
∗ Continuous stall torque	T_S	8.82	N•m	90	kg·cm
∗ Instantaneous maximum stall torque	T_P	34.3	N•m	350	kg·cm
∗ Rated armature current	I_R	11.0	Arms	11.0	Arms
∗ Continuous stall armature current	I_S	11.9	Arms	11.9	Arms
∗ Instantaneous maximum stall armature current	I_P	55	Arms	55	Arms
Torque constant	K_T	0.79	N·m/Arms	8.1	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	27.6	mV/min^{-1}	27.6	V/krpm
Phase armature resistance	R_ϕ	0.31	Ω	0.31	Ω
Electrical time constant	t_e	14	msec	14	msec
Mechanical time constant (not including sensor)	t_m	0.54	msec	0.54	msec
Inertia (including wiring-saved INC)	J_M	3.71×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	3.78	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	3.73×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	3.8	$g \cdot cm \cdot s^2$
Inertia (including ABS-RⅡ)	J_M	3.71×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	3.78	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	37.1×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	37.8	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	9.4	kg	9.4	kg
Weight (including ABS-E)	W_E	9.3	kg	9.3	kg
Weight (including ABS-RⅡ)	W_E	9.5	kg	9.5	kg

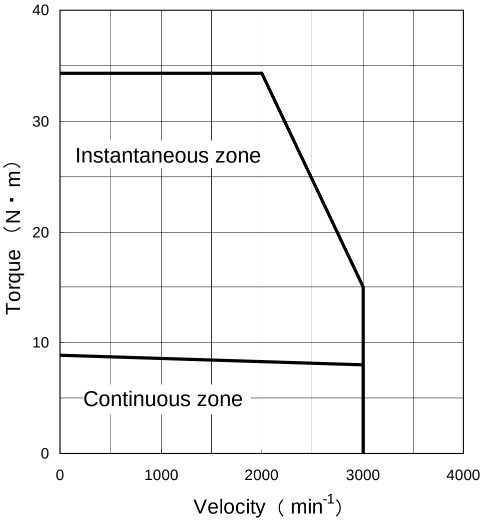
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.8 or more	N·m	100 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.83/0.22	A (DC)	0.83/0.22	A (DC)
Inertia	J_B	0.40×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	0.39	$g \cdot cm \cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

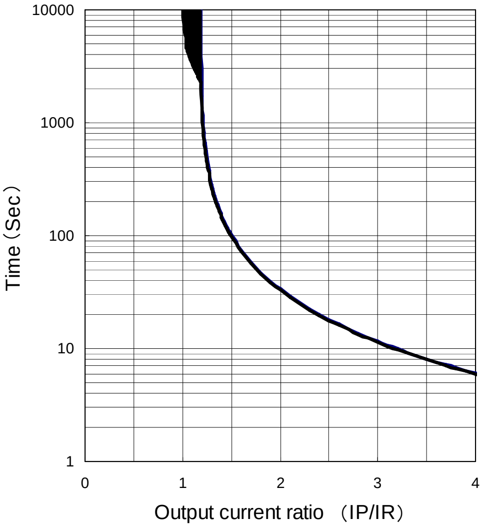
Velocity-torque characteristics

P20B10250H（2.5kW）



Overload characteristics

P20B10250H(2.5kW)



P20B13300H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	3000	W	3000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	9.51	N•m	97	kg·cm
∗ Continuous stall torque	T_S	10.8	N•m	110	kg·cm
∗ Instantaneous maximum stall torque	T_P	34.3	N•m	350	kg·cm
∗ Rated armature current	I_R	14.7	Arms	14.7	Arms
∗ Continuous stall armature current	I_S	14.4	Arms	14.4	Arms
∗ Instantaneous maximum stall armature current	I_P	52	Arms	52	Arms
Torque constant	K_T	0.80	N·m/Arms	8.2	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	28.0	mV/min^{-1}	28.0	V/krpm
Phase armature resistance	R_ϕ	0.19	Ω	0.19	Ω
Electrical time constant	t_e	19	msec	19	msec
Mechanical time constant (not including sensor)	t_m	0.62	msec	0.62	msec
Inertia (including wiring-saved INC)	J_M	7.14×10^{-4}	kg·m^2 (GD^2/4)	7.28	g·cm·s^2
Inertia (including ABS-E)	J_M	7.16×10^{-4}	kg·m^2 (GD^2/4)	7.3	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	7.14×10^{-4}	kg·m^2 (GD^2/4)	7.28	g·cm·s^2
Applicable load inertia	J_L	71.4×10^{-4}	kg·m^2 (GD^2/4)	72.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	11.4	kg	11.4	kg
Weight (including ABS-E)	W_E	11.3	kg	11.3	kg
Weight (including ABS-RⅡ)	W_E	11.5	kg	11.5	kg

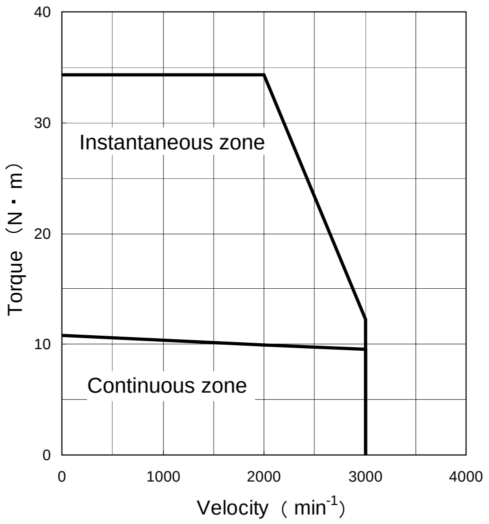
Holding Brake Data Sheet (Option)

Holding torque	T_B	11.8or more	N·m	120 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.28	A (DC)	1.0/0.28	A (DC)
Inertia	J_B	0.50×10^{-4}	kg·m^2 (GD^2/4)	0.49	g·cm·s^2
Weight	W	1.7	kg	1.7	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

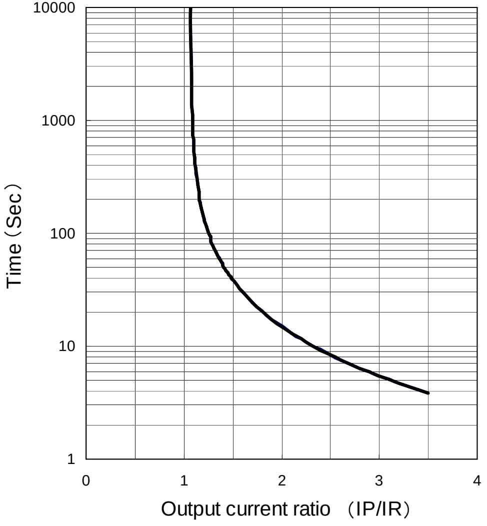
Velocity-torque characteristics

P20B13300H（3.0kW）



Overload characteristics

P20B13300H(3.0kW)



P20B13400H

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	4000	W	4000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	12.7	N•m	130	kg·cm
* Continuous stall torque	T_S	14.7	N•m	150	kg·cm
* Instantaneous maximum stall torque	T_P	39.2	N•m	400	kg·cm
* Rated armature current	I_R	17.0	Arms	17.0	Arms
* Continuous stall armature current	I_S	18.1	Arms	18.1	Arms
* Instantaneous maximum stall armature current	I_P	54	Arms	54	Arms
Torque constant	K_T	0.87	N·m/Arms	8.9	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	30.4	mV/min^{-1}	30.4	V/krpm
Phase armature resistance	R_ϕ	0.16	Ω	0.16	Ω
Electrical time constant	t_e	19	msec	19	msec
Mechanical time constant (not including sensor)	t_m	0.61	msec	0.61	msec
Inertia (including wiring-saved INC)	J_M	9.79×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	9.98	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	9.81×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	10.0	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RⅡ)	J_M	9.79×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	9.98	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	97.9×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	99.8	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	14.4	kg	14.4	kg
Weight (including ABS-E)	W_E	14.3	kg	14.3	kg
Weight (including ABS-RⅡ)	W_E	14.5	kg	14.5	kg

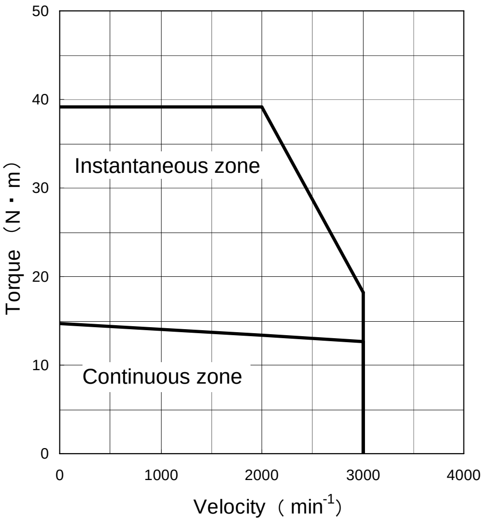
Holding Brake Data Sheet (Option)

Holding torque	T_B	19.6 or more	N·m	200 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.27	A (DC)	1.0/0.27	A (DC)
Inertia	J_B	0.58×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.56	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	2.2	kg	2.2	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

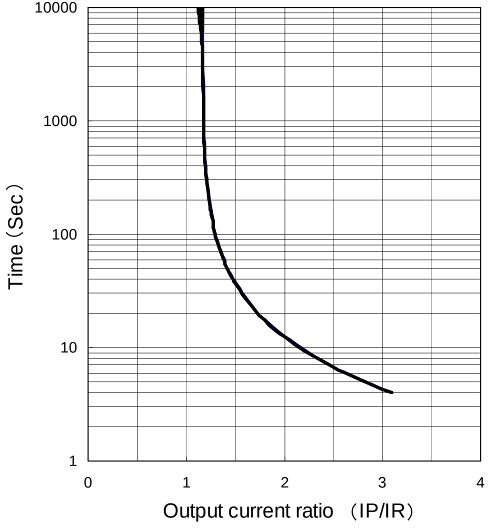
Velocity-torque characteristics

P20B13400H（4.0kW）



Overload characteristics

P20B13400H(4.0kW)



P20B13500H

	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	P_R	5000	W	5000	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
*	Rated torque	T_R	15.7	N•m	160	kg·cm
*	Continuous stall torque	T_S	18.1	N•m	185	kg·cm
*	Instantaneous maximum stall torque	T_P	53.9	N•m	550	kg·cm
*	Rated armature current	I_R	22.3	Arms	22.3	Arms
*	Continuous stall armature current	I_S	22.9	Arms	22.9	Arms
*	Instantaneous maximum stall armature current	I_P	76	Arms	76	Arms
	Torque constant	K_T	0.85	N·m/Arms	8.7	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	29.7	mV/min^{-1}	29.7	V/krpm
	Phase armature resistance	R_ϕ	0.11	Ω	0.11	Ω
	Electrical time constant	t_e	19	msec	19	msec
	Mechanical time constant (not including sensor)	t_m	0.57	msec	0.57	msec
	Inertia (including wiring-saved INC)	J_M	12.58×10^{-4}	kg·m^2 (GD^2/4)	12.78	g·cm·s^2
	Inertia (including ABS-E)	J_M	12.6×10^{-4}	kg·m^2 (GD^2/4)	12.8	g·cm·s^2
	Inertia (including ABS-RⅡ)	J_M	12.58×10^{-4}	kg·m^2 (GD^2/4)	12.78	g·cm·s^2
	Applicable load inertia	J_L	125.8×10^{-4}	kg·m^2 (GD^2/4)	127.8	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	17.4	kg	17.4	kg
	Weight (including ABS-E)	W_E	17.3	kg	17.3	kg
	Weight (including ABS-RⅡ)	W_E	17.5	kg	17.5	kg

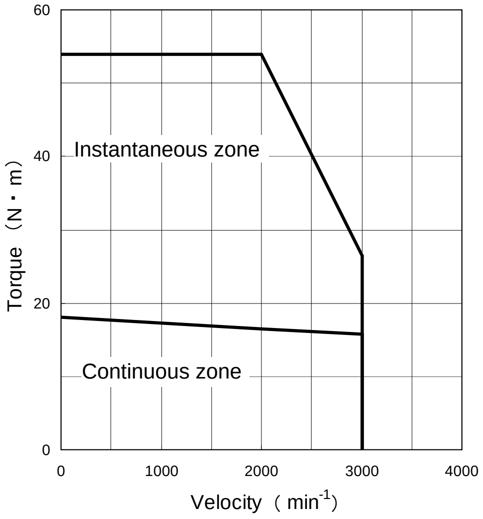
Holding Brake Data Sheet (Option)

Holding torque	T_B	19.6 or more	N·m	200 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.27	A (DC)	1.0/0.27	A (DC)
Inertia	J_B	0.58×10^{-4}	kg·m^2 (GD^2/4)	0.56	g·cm·s^2
Weight	W	2.2	kg	2.2	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

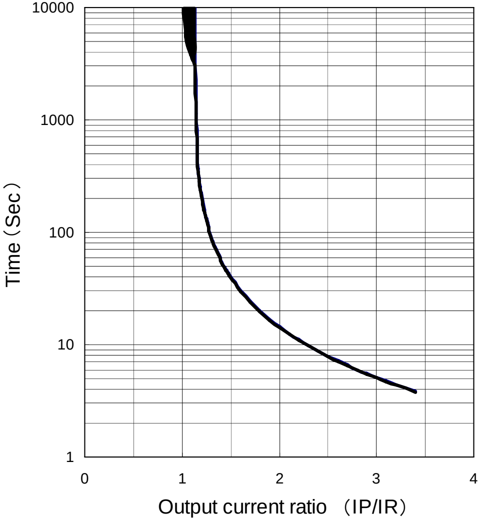
Velocity-torque characteristics

P20B13500H（5.0kW）



Overload characteristics

P20B13500H(5.0kW)



9. SPECIFICATIONS

P20B10100D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1000	W	1000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	3.19	N•m	32.5	kg·cm
∗ Continuous stall torque	T_S	3.92	N•m	40	kg·cm
∗ Instantaneous maximum stall torque	T_P	10.3	N•m	105	kg·cm
∗ Rated armature current	I_R	6.9	Arms	6.9	Arms
∗ Continuous stall armature current	I_S	8.0	Arms	8.0	Arms
∗ Instantaneous maximum stall armature current	I_P	23.2	Arms	23.2	Arms
Torque constant	K_T	0.53	N·m/Arms	5.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	18.6	mV/min^{-1}	18.6	V/krpm
Phase armature resistance	R_ϕ	0.51	Ω	0.51	Ω
Electrical time constant	t_e	11	msec	11	msec
Mechanical time constant (not including sensor)	t_m	0.80	msec	0.80	msec
Inertia (including wiring-saved INC)	J_M	1.55×10^{-4}	kg·m^2 (GD^2/4)	1.58	g·cm·s^2
Inertia (including ABS-E)	J_M	1.57×10^{-4}	kg·m^2 (GD^2/4)	1.6	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	1.55×10^{-4}	kg·m^2 (GD^2/4)	1.58	g·cm·s^2
Applicable load inertia	J_L	15.5×10^{-4}	kg·m^2 (GD^2/4)	15.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	5.4	kg	5.4	kg
Weight (including ABS-E)	W_E	5.3	kg	5.3	kg
Weight (including ABS-RⅡ)	W_E	5.5	kg	5.5	kg

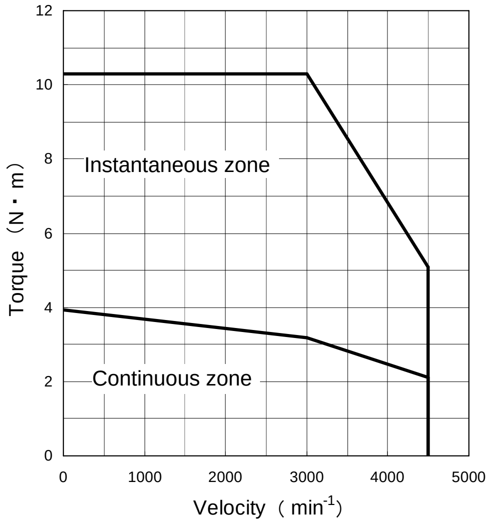
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.92 or more	N·m	40 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.60/0.16	A (DC)	0.60/0.16	A (DC)
Inertia	J_B	0.15×10^{-4}	kg·m^2 (GD^2/4)	0.15	g·cm·s^2
Weight	W	1.3	kg	1.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

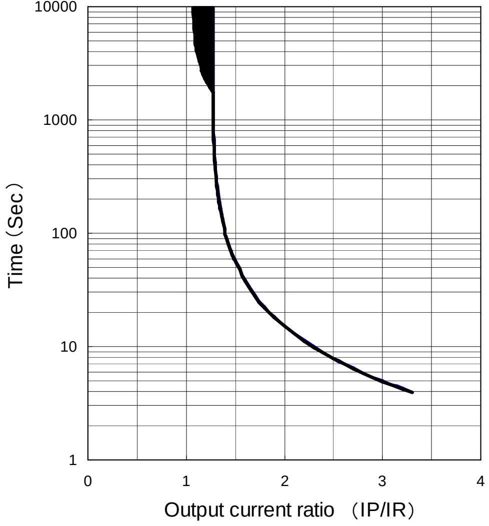
Velocity-torque characteristics

P20B10100D（1.0kW）



Overload characteristics

P20B10100D(1.0kW)



9. SPECIFICATIONS

P20B10150D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	4.79	N•m	48.8	kg·cm
∗ Continuous stall torque	T_S	4.90	N•m	50	kg·cm
∗ Instantaneous maximum stall torque	T_P	14.7	N•m	150	kg·cm
∗ Rated armature current	I_R	8.4	Arms	8.4	Arms
∗ Continuous stall armature current	I_S	8.1	Arms	8.1	Arms
∗ Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.65	N·m/Arms	6.6	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	22.6	mV/min^{-1}	22.6	V/krpm
Phase armature resistance	R_ϕ	0.42	Ω	0.42	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	0.59	msec	0.59	msec
Inertia (including wiring-saved INC)	J_M	2.04×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	2.06×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	2.04×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.08	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	20.4×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	20.8	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	6.5	kg	6.5	kg
Weight (including ABS-E)	W_E	6.4	kg	6.4	kg
Weight (including ABS-RⅡ)	W_E	6.6	kg	6.6	kg

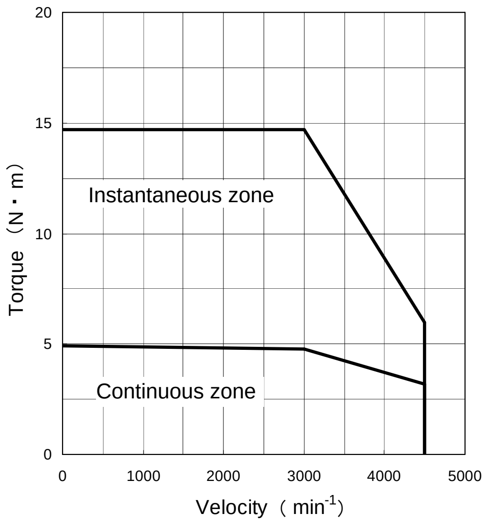
Holding Brake Data Sheet (Option)

Holding torque	T_B	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.83/0.22	A (DC)	0.83/0.22	A (DC)
Inertia	J_B	0.40×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.39	$g\cdot cm\cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

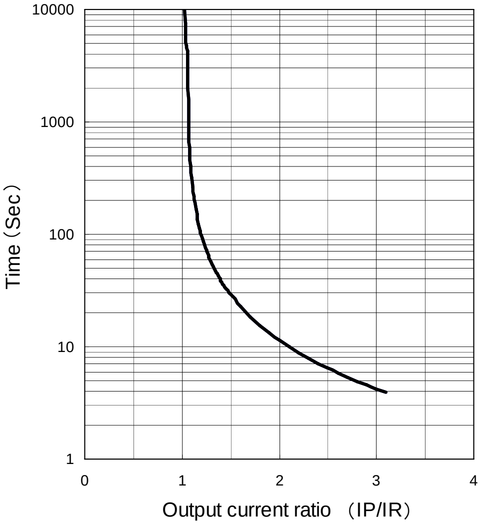
Velocity-torque characteristics

P20B10150D（1.5kW）



Overload characteristics

P20B10150D(1.5kW)



P20B10200D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	2000	W	2000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	6.37	N•m	65	kg·cm
∗ Continuous stall torque	T_S	7.36	N•m	75	kg·cm
∗ Instantaneous maximum stall torque	T_P	19.6	N•m	200	kg·cm
∗ Rated armature current	I_R	16.5	Arms	16.5	Arms
∗ Continuous stall armature current	I_S	17.9	Arms	17.9	Arms
∗ Instantaneous maximum stall armature current	I_P	53.0	Arms	53.0	Arms
Torque constant	K_T	0.44	N·m/Arms	4.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	15.5	mV/min^{-1}	15.5	V/krpm
Phase armature resistance	R_ϕ	0.14	Ω	0.14	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	0.59	msec	0.59	msec
Inertia (including wiring-saved INC)	J_M	2.83×10^{-4}	kg·m^2 (GD^2/4)	2.88	g·cm·s^2
Inertia (including ABS-E)	J_M	2.85×10^{-4}	kg·m^2 (GD^2/4)	2.9	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	2.83×10^{-4}	kg·m^2 (GD^2/4)	2.88	g·cm·s^2
Applicable load inertia	J_L	28.3×10^{-4}	kg·m^2 (GD^2/4)	28.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	8.7	kg	8.7	kg
Weight (including ABS-E)	W_E	8.6	kg	8.6	kg
Weight (including ABS-RⅡ)	W_E	8.8	kg	8.8	kg

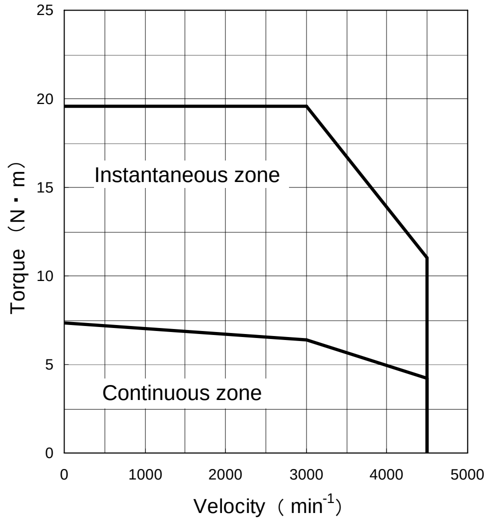
Holding Brake Data Sheet (Option)

Holding torque	T_B	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.83/0.22	A (DC)	0.83/0.22	A (DC)
Inertia	J_B	0.40×10^{-4}	kg·m^2 (GD^2/4)	0.39	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

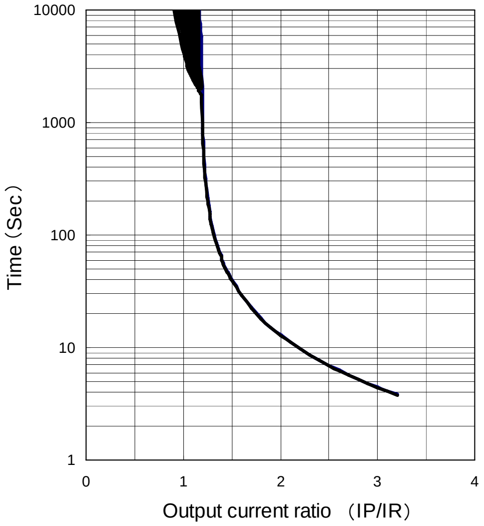
Velocity-torque characteristics

P20B10200D（2.0kW）



Overload characteristics

P20B10200D(2.0kW)



P20B10250D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	2500	W	2500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	7.97	N•m	81.3	kg·cm
∗ Continuous stall torque	T_S	8.82	N•m	90	kg·cm
∗ Instantaneous maximum stall torque	T_P	23.8	N•m	240	kg·cm
∗ Rated armature current	I_R	16.5	Arms	16.5	Arms
∗ Continuous stall armature current	I_S	17.6	Arms	17.6	Arms
∗ Instantaneous maximum stall armature current	I_P	52.0	Arms	52.0	Arms
Torque constant	K_T	0.54	N·m/Arms	5.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	18.8	mV/min^{-1}	18.8	V/krpm
Phase armature resistance	R_ϕ	0.15	Ω	0.15	Ω
Electrical time constant	t_e	14	msec	14	msec
Mechanical time constant (not including sensor)	t_m	0.56	msec	0.56	msec
Inertia (including wiring-saved INC)	J_M	3.71×10^{-4}	kg·m^2 (GD^2/4)	3.78	g·cm·s^2
Inertia (including ABS-E)	J_M	3.73×10^{-4}	kg·m^2 (GD^2/4)	3.8	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	3.71×10^{-4}	kg·m^2 (GD^2/4)	3.78	g·cm·s^2
Applicable load inertia	J_L	37.1×10^{-4}	kg·m^2 (GD^2/4)	37.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	9.4	kg	9.4	kg
Weight (including ABS-E)	W_E	9.3	kg	9.3	kg
Weight (including ABS-RⅡ)	W_E	9.5	kg	9.5	kg

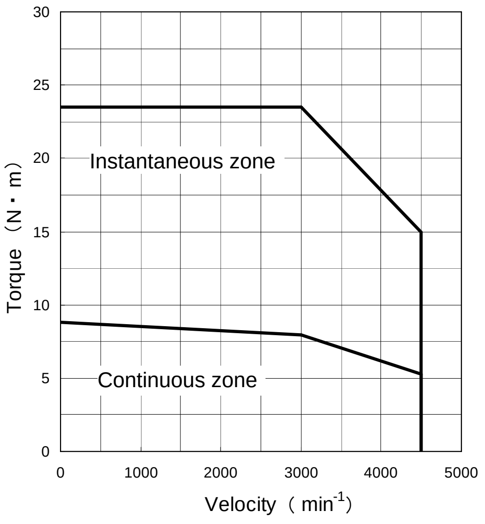
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.8 or more	N·m	100 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.83/0.22	A (DC)	0.83/0.22	A (DC)
Inertia	J_B	0.40×10^{-4}	kg·m^2 (GD^2/4)	0.39	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

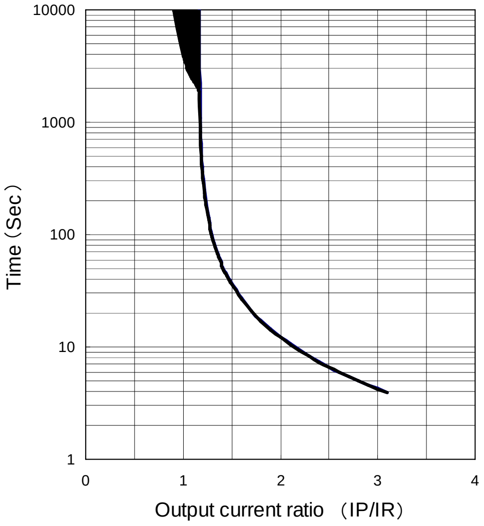
Velocity-torque characteristics

P20B10250D（2.5kW）



Overload characteristics

P20B10250D(2.5kW)



P20B13300D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	3000	W	3000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	9.51	N•m	97	kg·cm
∗ Continuous stall torque	T_S	10.8	N•m	110	kg·cm
∗ Instantaneous maximum stall torque	T_P	28.4	N•m	300	kg·cm
∗ Rated armature current	I_R	16.4	Arms	16.4	Arms
∗ Continuous stall armature current	I_S	18.2	Arms	18.2	Arms
∗ Instantaneous maximum stall armature current	I_P	55.0	Arms	55.0	Arms
Torque constant	K_T	0.64	N·m/Arms	6.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	22.3	mV/min^{-1}	22.3	V/krpm
Phase armature resistance	R_ϕ	0.13	Ω	0.13	Ω
Electrical time constant	t_e	18	msec	18	msec
Mechanical time constant (not including sensor)	t_m	0.68	msec	0.68	msec
Inertia (including wiring-saved INC)	J_M	7.14×10^{-4}	kg·m^2 (GD^2/4)	7.28	g·cm·s^2
Inertia (including ABS-E)	J_M	7.16×10^{-4}	kg·m^2 (GD^2/4)	7.3	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	7.14×10^{-4}	kg·m^2 (GD^2/4)	7.28	g·cm·s^2
Applicable load inertia	J_L	71.4×10^{-4}	kg·m^2 (GD^2/4)	72.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	11.4	kg	11.4	kg
Weight (including ABS-E)	W_E	11.3	kg	11.3	kg
Weight (including ABS-RⅡ)	W_E	11.5	kg	11.5	kg

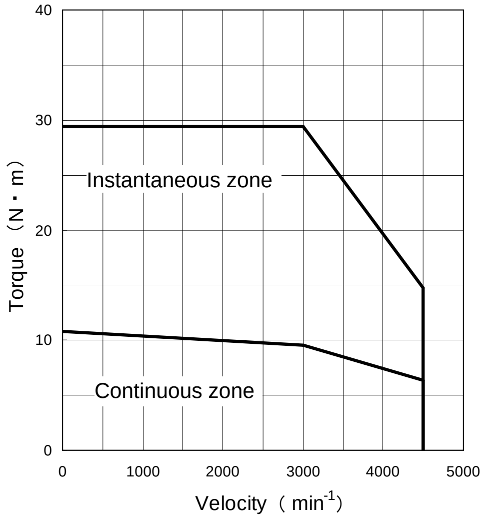
Holding Brake Data Sheet (Option)

Holding torque	T_B	11.8 or more	N·m	120 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.28	A (DC)	1.0/0.28	A (DC)
Inertia	J_B	0.50×10^{-4}	kg·m^2 (GD^2/4)	0.49	g·cm·s^2
Weight	W	1.7	kg	1.7	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

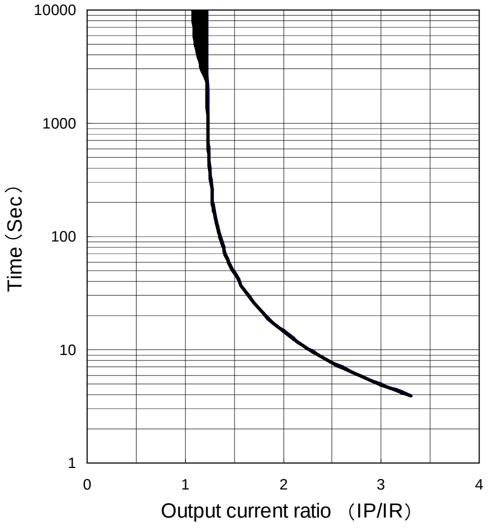
Velocity-torque characteristics

P20B13300D（3.0kW）



Overload characteristics

P20B13300D(3.0kW)



P20B13400D

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	4000	W	4000	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗	Rated torque	T_R	12.7	N•m	130	kg·cm
∗	Continuous stall torque	T_S	14.7	N•m	150	kg·cm
∗	Instantaneous maximum stall torque	T_P	39.2	N•m	400	kg·cm
∗	Rated armature current	I_R	23.4	Arms	23.4	Arms
∗	Continuous stall armature current	I_S	25.6	Arms	25.6	Arms
∗	Instantaneous maximum stall armature current	I_P	76.0	Arms	76.0	Arms
	Torque constant	K_T	0.62	N·m/Arms	6.3	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	21.6	mV/min^{-1}	21.6	V/krpm
	Phase armature resistance	R_ϕ	0.076	Ω	0.076	Ω
	Electrical time constant	t_e	20	msec	20	msec
	Mechanical time constant (not including sensor)	t_m	0.58	msec	0.58	msec
	Inertia (including wiring-saved INC)	J_M	9.79×10^{-4}	kg·m^2 (GD^2/4)	9.98	g·cm·s^2
	Inertia (including ABS-E)	J_M	9.81×10^{-4}	kg·m^2 (GD^2/4)	10.0	g·cm·s^2
	Inertia (including ABS-RⅡ)	J_M	9.79×10^{-4}	kg·m^2 (GD^2/4)	9.98	g·cm·s^2
	Applicable load inertia	J_L	97.9×10^{-4}	kg·m^2 (GD^2/4)	99.8	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	14.4	kg	14.4	kg
	Weight (including ABS-E)	W_E	14.3	kg	14.3	kg
	Weight (including ABS-RⅡ)	W_E	14.5	kg	14.5	kg

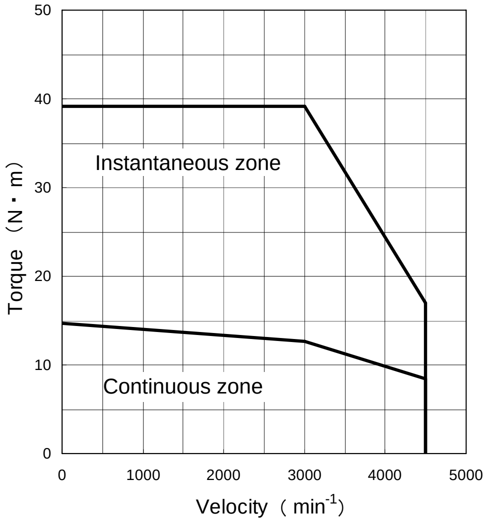
Holding Brake Data Sheet (Option)

Holding torque	T_B	19.6 or more	N·m	200 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.27	A (DC)	1.0/0.27	A (DC)
Inertia	J_B	0.58×10^{-4}	kg·m^2 (GD^2/4)	0.56	g·cm·s^2
Weight	W	2.2	kg	2.2	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

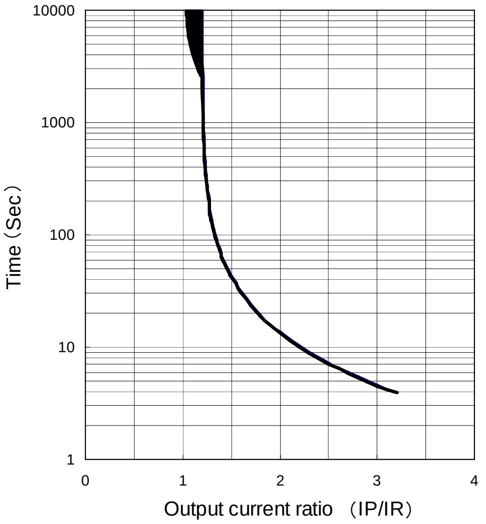
Velocity-torque characteristics

P20B13400D（4.0kW）



Overload characteristics

P20B13400D(4.0kW)



P20B13500D

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	5000	W	5000	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗	Rated torque	T_R	15.7	N•m	160	kg·cm
∗	Continuous stall torque	T_S	18.1	N•m	185	kg·cm
∗	Instantaneous maximum stall torque	T_P	47.6	N•m	480	kg·cm
∗	Rated armature current	I_R	24.5	Arms	24.5	Arms
∗	Continuous stall armature current	I_S	26.9	Arms	26.9	Arms
∗	Instantaneous maximum stall armature current	I_P	77.0	Arms	77.0	Arms
	Torque constant	K_T	0.73	N·m/Arms	7.4	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	25.3	mV/min^{-1}	25.3	V/krpm
	Phase armature resistance	R_ϕ	0.071	Ω	0.071	Ω
	Electrical time constant	t_e	20	msec	20	msec
	Mechanical time constant (not including sensor)	t_m	0.50	msec	0.50	msec
	Inertia (including wiring-saved INC)	J_M	12.58×10^{-4}	kg·m^2 (GD^2/4)	12.78	g·cm·s^2
	Inertia (including ABS-E)	J_M	12.6×10^{-4}	kg·m^2 (GD^2/4)	12.8	g·cm·s^2
	Inertia (including ABS-RⅡ)	J_M	$\times10^{-4}$	kg·m^2 (GD^2/4)		g·cm·s^2
	Applicable load inertia	J_L	125.8×10^{-4}	kg·m^2 (GD^2/4)	127.8	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	17.4	kg	17.4	kg
	Weight (including ABS-E)	W_E	17.3	kg	17.3	kg
	Weight (including ABS-RⅡ)	W_E		kg		kg

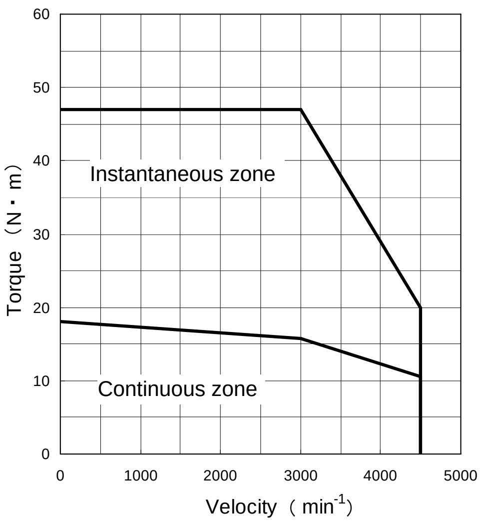
Holding Brake Data Sheet (Option)

Holding torque	T_B	19.6 or more	N·m	200 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.27	A (DC)	1.0/0.27	A (DC)
Inertia	J_B	0.58×10^{-4}	kg·m^2 (GD^2/4)	0.56	g·cm·s^2
Weight	W	2.2	kg	2.2	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

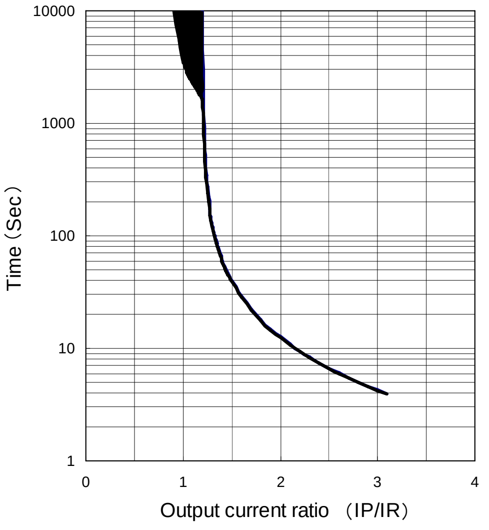
Velocity-torque characteristics

P20B13500D（5.0kW）



Overload characteristics

P20B13500D(5.0kW)



9.2.5.3 Motor Data Sheet P3

P30B04003D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	PR	30	W	30	W
Rated revolution speed	NR	3000	min^{-1}	3000	rpm
Maximum revolution speed	Nmax	4500	min^{-1}	4500	rpm
∗ Rated torque	TR	0.098	N•m	1.0	kg·cm
∗ Continuous stall torque	TS	0.108	N•m	1.1	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.322	N•m	3.3	kg·cm
∗ Rated armature current	IR	0.54	Arms	0.54	Arms
∗ Continuous stall armature current	IS	0.56	Arms	0.56	Arms
∗ Instantaneous maximum stall armature current	IP	1.79	Arms	1.79	Arms
Torque constant	KT	0.2	N·m/Arms	2.08	kg·cm/Arms
Induced voltage constant	KEϕ	7.1	mV/min^{-1}	7.1	V/krpm
Phase armature resistance	Rϕ	12.5	Ω	12.5	Ω
Electrical time constant	te	1.2	msec	1.2	msec
Mechanical time constant (not including sensor)	tm	1.8	msec	1.8	msec
Inertia (including wiring-saved INC)	JM	0.024×10^{-4}	kg·m^2 (GD^2/4)	0.025	g·cm·s^2
Inertia (including ABS-E)	JM	0.049×10^{-4}	kg·m^2 (GD^2/4)	0.05	g·cm·s^2
Inertia (including ABS-RⅡ)	JM	0.024 × 10^{-4}	kg·m^2 (GD^2/4)	0.025	g·cm·s^2
Applicable load inertia	JL	0.24×10^{-4}	kg·m^2 (GD^2/4)	0.25	g·cm·s^2
Weight (including wiring-saved INC)	WE	0.3	kg	0.3	kg
Weight (including ABS-E)	WE	0.63	kg	0.63	kg
Weight (including ABS-RⅡ)	WE	0.63	kg	0.63	kg

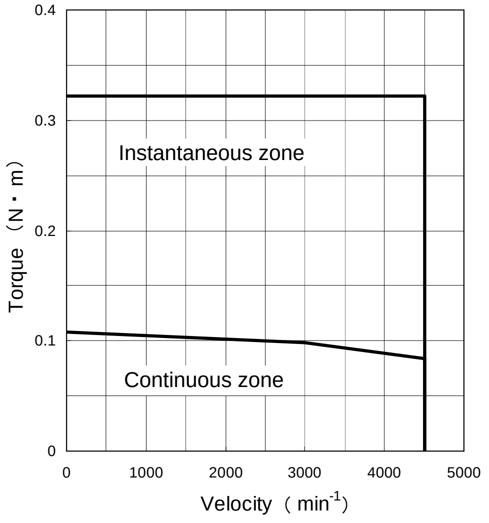
Holding Brake Data Sheet (Option)

Holding torque	TB	0.098 or more	N·m	1 or more	kg·cm
Exciting voltage	VB	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	IB	0.26/0.07	A (DC)	0.26/0.07	A (DC)
Inertia	JB	0.0078×10^{-4}	kg·m^2 (GD^2/4)	0.008	g·cm·s^2
Weight	W	0.24	kg	0.24	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

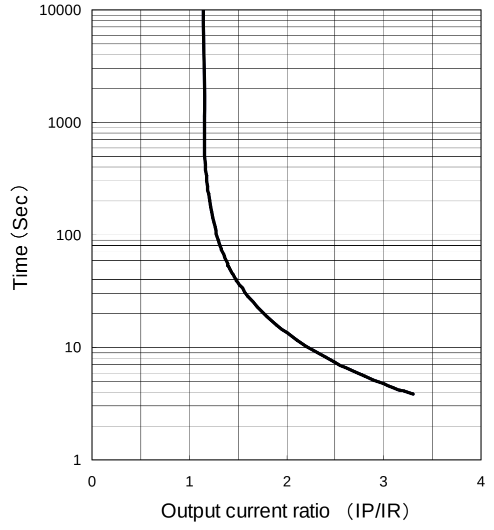
Velocity-torque characteristics

P30B04003D（30W）



Overload characteristics

P30B04003D(30W)



P30B04005D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	50	W	50	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.157	N•m	1.6	kg·cm
∗ Continuous stall torque	T_S	0.167	N•m	1.7	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.49	N•m	5.0	kg·cm
∗ Rated armature current	I_R	0.74	Arms	0.74	Arms
∗ Continuous stall armature current	I_S	0.75	Arms	0.75	Arms
∗ Instantaneous maximum stall armature current	I_P	2.4	Arms	2.4	Arms
Torque constant	K_T	0.235	N·m/Arms	2.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	8.2	mV/min^{-1}	8.2	V/krpm
Phase armature resistance	R_ϕ	9.1	Ω	9.1	Ω
Electrical time constant	t_e	1.2	msec	1.2	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	0.031×10^{-4}	kg·m^2 (GD^2/4)	0.032	g·cm·s^2
Inertia (including ABS-E)	J_M	0.056×10^{-4}	kg·m^2 (GD^2/4)	0.057	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.028×10^{-4}	kg·m^2 (GD^2/4)	0.029	g·cm·s^2
Applicable load inertia	J_L	0.31×10^{-4}	kg·m^2 (GD^2/4)	0.32	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.35	kg	0.35	kg
Weight (including ABS-E)	W_E	0.68	kg	0.68	kg
Weight (including ABS-RⅡ)	W_E	0.44	kg	0.44	kg

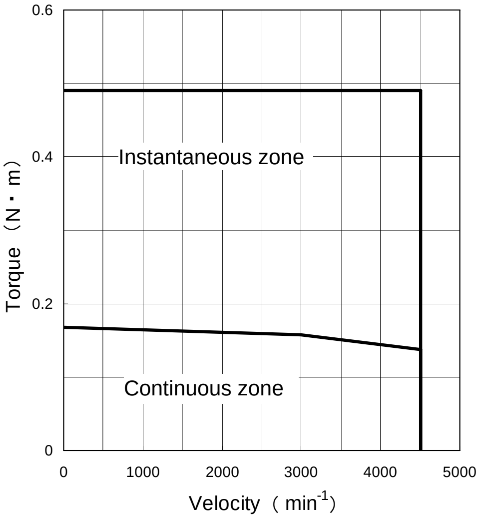
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.157 or more	N·m	1.6 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.26/0.07	A (DC)	0.26/0.07	A (DC)
Inertia	J_B	0.0078×10^{-4}	kg·m^2(GD^2/4)	0.008	g·cm·s^2
Weight	W	0.24	kg	0.24	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

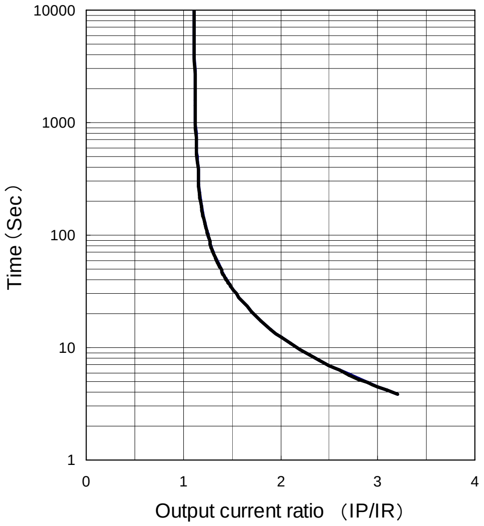
Velocity-torque characteristics

P30B04005D（50W）



Overload characteristics

P30B04005D(50W)



9. SPECIFICATIONS

P30B04010D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.32	N•m	3.25	kg·cm
∗ Continuous stall torque	T_S	0.353	N•m	3.6	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.98	N•m	10	kg·cm
∗ Rated armature current	I_R	1.1	Arms	1.1	Arms
∗ Continuous stall armature current	I_S	1.3	Arms	1.3	Arms
∗ Instantaneous maximum stall armature current	I_P	4.1	Arms	4.1	Arms
Torque constant	K_T	0.292	N·m/Arms	2.98	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	10.2	mV/min^{-1}	10.2	V/krpm
Phase armature resistance	R_ϕ	4.3	Ω	4.3	Ω
Electrical time constant	t_e	1.4	msec	1.4	msec
Mechanical time constant (not including sensor)	t_m	0.7	msec	0.7	msec
Inertia (including wiring-saved INC)	J_M	0.051×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.052	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	0.076×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.077	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RⅡ)	J_M	0.048×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.049	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	0.51×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.52	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	0.5	kg	0.5	kg
Weight (including ABS-E)	W_E	0.83	kg	0.83	kg
Weight (including ABS-RⅡ)	W_E	0.59	kg	0.59	kg

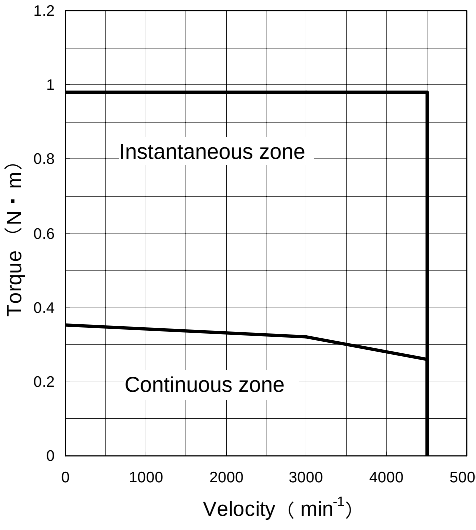
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.32 or more	N·m	3.25 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.26/0.07	A (DC)	0.26/0.07	A (DC)
Inertia	J_B	0.0078×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($GD^2/4$)	0.008	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	0.24	kg	0.24	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

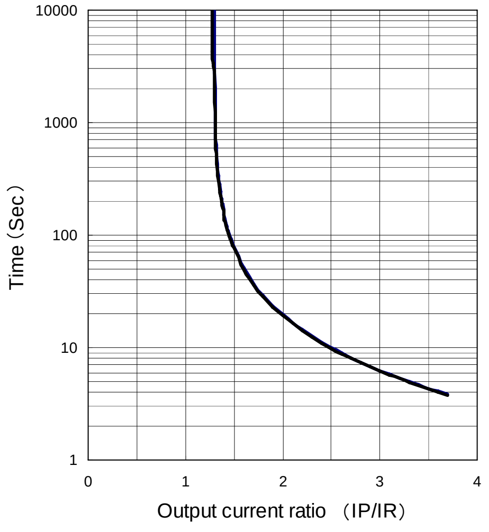
Velocity-torque characteristics

P30B04010D（100W）



Overload characteristics

P30B04010D(100W)



9. SPECIFICATIONS

P30B06020D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.637	N•m	6.5	kg·cm
∗ Continuous stall torque	T_S	0.686	N•m	7	kg·cm
∗ Instantaneous maximum stall torque	T_P	1.96	N•m	20	kg·cm
∗ Rated armature current	I_R	2.2	Arms	2.2	Arms
∗ Continuous stall armature current	I_S	2.3	Arms	2.3	Arms
∗ Instantaneous maximum stall armature current	I_P	7.5	Arms	7.5	Arms
Torque constant	K_T	0.316	N·m/Arms	3.22	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	11.0	mV/min^{-1}	11.0	V/krpm
Phase armature resistance	R_ϕ	1.5	Ω	1.5	Ω
Electrical time constant	t_e	3.8	msec	3.8	msec
Mechanical time constant (not including sensor)	t_m	0.63	msec	0.63	msec
Inertia (including wiring-saved INC)	J_M	0.144×10^{-4}	kg·m^2 (GD^2/4)	0.147	g·cm·s^2
Inertia (including ABS-E)	J_M	0.169×10^{-4}	kg·m^2 (GD^2/4)	0.172	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.141×10^{-4}	kg·m^2 (GD^2/4)	0.144	g·cm·s^2
Applicable load inertia	J_L	1.44×10^{-4}	kg·m^2 (GD^2/4)	1.47	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.15	kg	1.15	kg
Weight (including ABS-E)	W_E	1.37	kg	1.37	kg
Weight (including ABS-RⅡ)	W_E	1.35	kg	1.35	kg

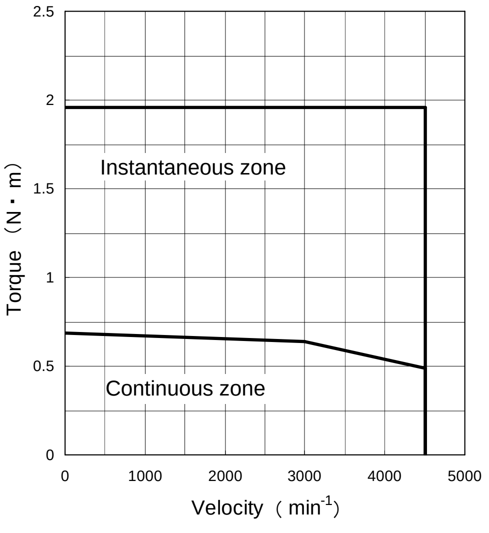
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.637 or more	N·m	6.5 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.31/0.07	A (DC)	0.31/0.07	A (DC)
Inertia	J_B	0.06×10^{-4}	kg·m^2(GD^2/4)	0.061	g·cm·s^2
Weight	W	0.44	kg	0.44	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

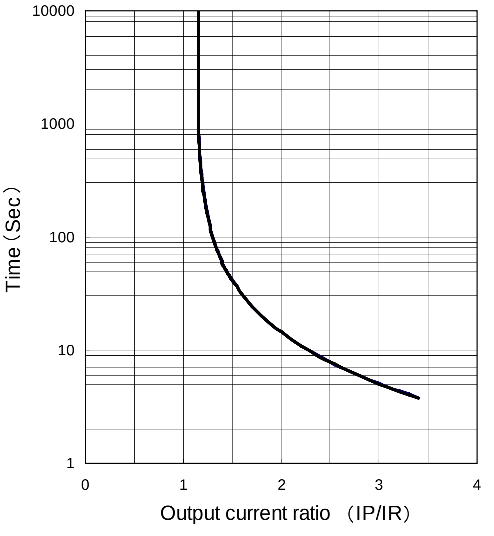
Velocity-torque characteristics

P30B06020D（200W）



Overload characteristics

P30B06020D(200W)



P30B06040D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	1.274	N•m	13	kg·cm
∗ Continuous stall torque	T_S	1.372	N•m	14	kg·cm
∗ Instantaneous maximum stall torque	T_P	3.82	N•m	39	kg·cm
∗ Rated armature current	I_R	2.7	Arms	2.7	Arms
∗ Continuous stall armature current	I_S	2.8	Arms	2.8	Arms
∗ Instantaneous maximum stall armature current	I_P	8.6	Arms	8.6	Arms
Torque constant	K_T	0.533	N·m/Arms	5.44	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	18.6	mV/min^{-1}	18.6	V/krpm
Phase armature resistance	R_ϕ	1.4	Ω	1.4	Ω
Electrical time constant	t_e	4.6	msec	4.6	msec
Mechanical time constant (not including sensor)	t_m	0.38	msec	0.38	msec
Inertia (including wiring-saved INC)	J_M	0.255×10^{-4}	kg·m^2 (GD^2/4)	0.265	g·cm·s^2
Inertia (including ABS-E)	J_M	0.280×10^{-4}	kg·m^2 (GD^2/4)	0.290	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.252×10^{-4}	kg·m^2 (GD^2/4)	0.262	g·cm·s^2
Applicable load inertia	J_L	2.55×10^{-4}	kg·m^2 (GD^2/4)	2.65	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.7	kg	1.7	kg
Weight (including ABS-E)	W_E	1.92	kg	1.92	kg
Weight (including ABS-RⅡ)	W_E	1.90	kg	1.90	kg

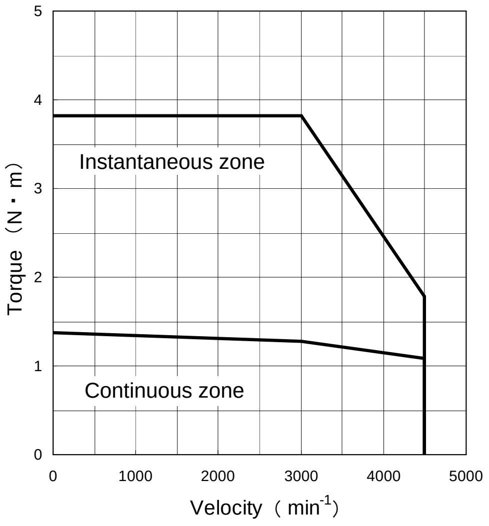
Holding Brake Data Sheet (Option)

Holding torque	T_B	1.274 or more	N·m	13 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.31/0.07	A (DC)	0.31/0.07	A (DC)
Inertia	J_B	0.06×10^{-4}	kg·m^2(GD^2/4)	0.061	g·cm·s^2
Weight	W	0.44	kg	0.44	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

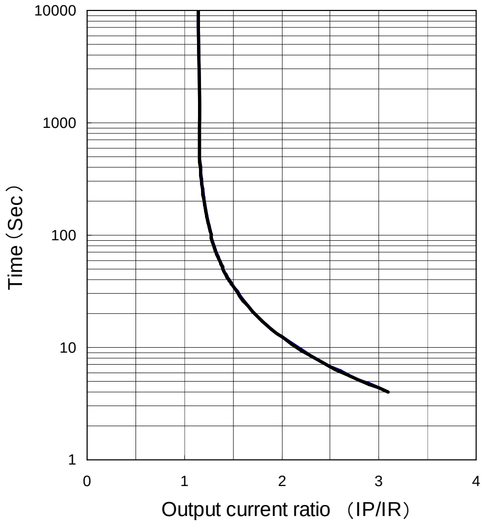
Velocity-torque characteristics

P30B06040D（400W）



Overload characteristics

P30B06040D(400W)



9. SPECIFICATIONS

P30B08075D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	2.38	N•m	24.3	kg·cm
∗ Continuous stall torque	T_S	2.55	N•m	26	kg·cm
∗ Instantaneous maximum stall torque	T_P	7.15	N•m	73	kg·cm
∗ Rated armature current	I_R	4.6	Arms	4.6	Arms
∗ Continuous stall armature current	I_S	4.8	Arms	4.8	Arms
∗ Instantaneous maximum stall armature current	I_P	15.0	Arms	15.0	Arms
Torque constant	K_T	0.565	N·m/Arms	5.77	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	19.74	mV/min^{-1}	19.74	V/krpm
Phase armature resistance	R_ϕ	0.52	Ω	0.52	Ω
Electrical time constant	t_e	8.3	msec	8.3	msec
Mechanical time constant (not including sensor)	t_m	0.3	msec	0.3	msec
Inertia (including wiring-saved INC)	J_M	0.635×10^{-4}	kg·m^2 (GD^2/4)	0.645	g·cm·s^2
Inertia (including ABS-E)	J_M	0.78×10^{-4}	kg·m^2 (GD^2/4)	0.79	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.647×10^{-4}	kg·m^2 (GD^2/4)	0.657	g·cm·s^2
Applicable load inertia	J_L	6.35×10^{-4}	kg·m^2 (GD^2/4)	6.45	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.3	kg	3.3	kg
Weight (including ABS-E)	W_E	3.71	kg	3.71	kg
Weight (including ABS-RⅡ)	W_E	3.49	kg	3.49	kg

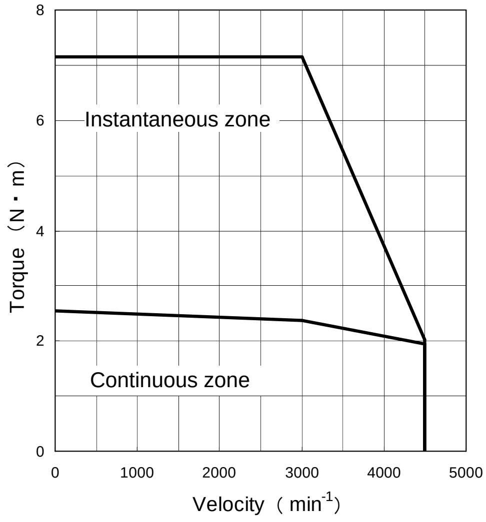
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.38 or more	N·m	24.3 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.37/0.08	A (DC)	0.37/0.08	A (DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

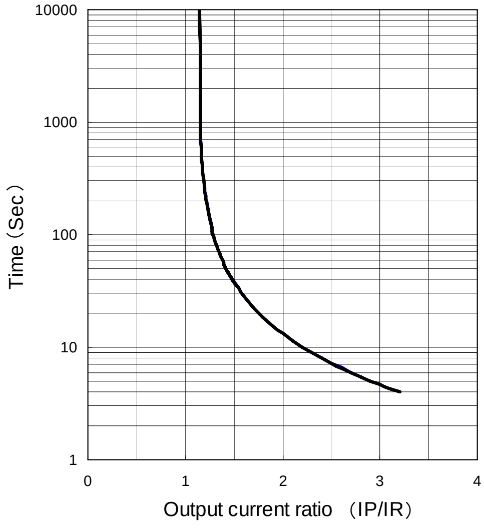
Velocity-torque characteristics

P30B08075D（750W）



Overload characteristics

P30B08075D(750W)



9.2.5.4 Motor Data Sheet P5

P50B03003D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	30	W	30	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.098	N•m	1	kg·cm
∗ Continuous stall torque	T_S	0.108	N•m	1.1	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.323	N•m	3.3	kg·cm
∗ Rated armature current	I_R	0.5	Arms	0.5	Arms
∗ Continuous stall armature current	I_S	0.53	Arms	0.53	Arms
∗ Instantaneous maximum stall armature current	I_P	1.8	Arms	1.8	Arms
Torque constant	K_T	0.206	N·m/Arms	2.11	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	7.2	mV/min^{-1}	7.2	V/krpm
Phase armature resistance	R_ϕ	20.5	Ω	20.5	Ω
Electrical time constant	t_e	0.7	msec	0.7	msec
Mechanical time constant (not including sensor)	t_m	2.1	msec	2.1	msec
Inertia (including wiring-saved INC)	J_M	0.0197×10^{-4}	kg·m^2 (GD^2/4)	0.02	g·cm·s^2
Inertia (including ABS-E)	J_M		kg·m^2 (GD^2/4)		g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.0167×10^{-4}	kg·m^2 (GD^2/4)	0.0173	g·cm·s^2
Applicable load inertia	J_L	0.197×10^{-4}	kg·m^2 (GD^2/4)	0.2	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.24	kg	0.24	kg
Weight (including ABS-E)	W_E		kg		kg
Weight (including ABS-RⅡ)	W_E	0.31	kg	0.31	kg

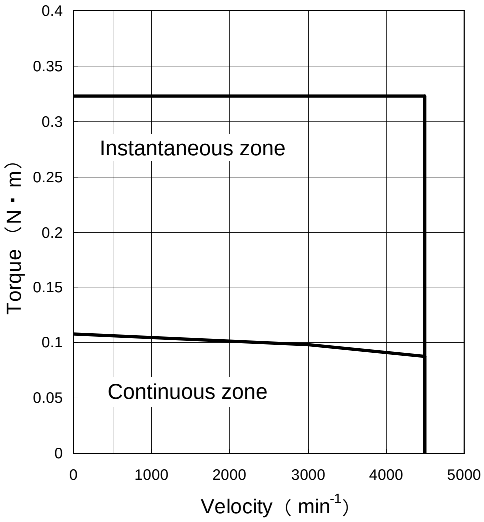
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.098 or more	N·m	1 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.25/0.07	A (DC)	0.25/0.07	A (DC)
Inertia	J_B	0.0021×10^{-4}	kg·m^2 (GD^2/4)	0.0022	g·cm·s^2
Weight	W	0.15	kg	0.15	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

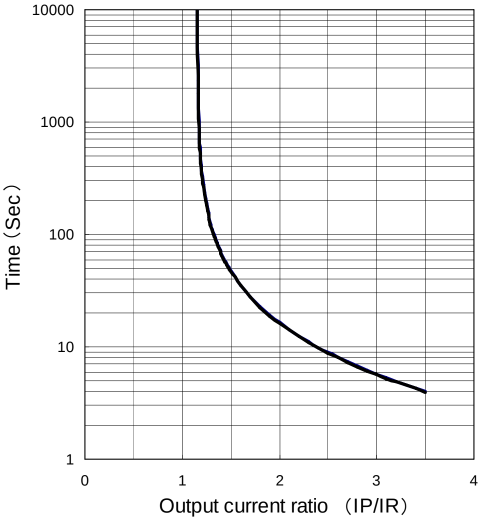
Velocity-torque characteristics

P50B03003D（30W）



Overload characteristics

P50B03003D(30W)



P50B04006D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	60	W	60	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.191	N•m	1.95	kg·cm
∗ Continuous stall torque	T_S	0.216	N•m	2.2	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.647	N•m	6.6	kg·cm
∗ Rated armature current	I_R	0.7	Arms	0.7	Arms
∗ Continuous stall armature current	I_S	0.76	Arms	0.76	Arms
∗ Instantaneous maximum stall armature current	I_P	2.7	Arms	2.7	Arms
Torque constant	K_T	0.304	N·m/Arms	3.1	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	10.6	mV/min^{-1}	10.6	V/krpm
Phase armature resistance	R_ϕ	10.4	Ω	10.4	Ω
Electrical time constant	t_e	1.4	msec	1.4	msec
Mechanical time constant (not including sensor)	t_m	1.6	msec	1.6	msec
Inertia (including wiring-saved INC)	J_M	0.054×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.055	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	0.054×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	0.051×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.0520	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	0.54×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.55	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	0.46	kg	0.46	kg
Weight (including ABS-E)	W_E	0.76	kg	0.76	kg
Weight (including ABS-RⅡ)	W_E	0.89	kg	0.89	kg

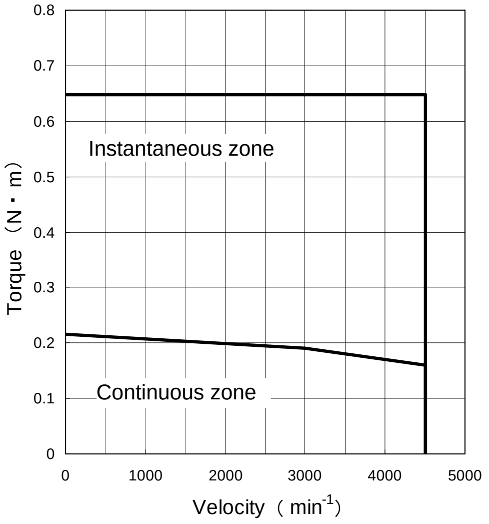
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.191 or more	N·m	1.95 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.26/0.07	A (DC)	0.26/0.07	A (DC)
Inertia	J_B	0.0078×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.008	$g\cdot cm\cdot s^2$
Weight	W	0.24	kg	0.24	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

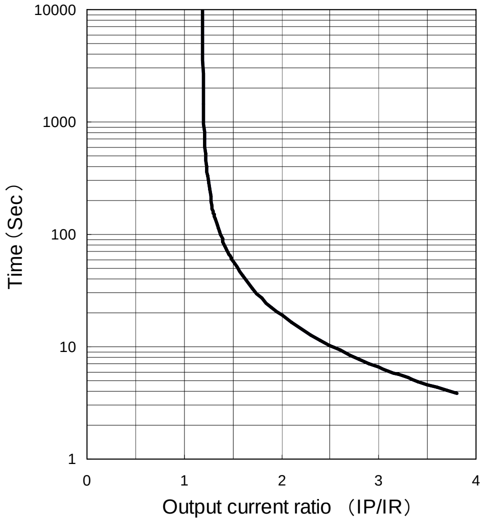
Velocity-torque characteristics

P50B04006D（60W）



Overload characteristics

P50B04006D(60W)



P50B04010D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.319	N•m	3.25	kg·cm
* Continuous stall torque	T_S	0.353	N•m	3.6	kg·cm
* Instantaneous maximum stall torque	T_P	0.98	N•m	10	kg·cm
* Rated armature current	I_R	1.0	Arms	1.0	Arms
* Continuous stall armature current	I_S	1.2	Arms	1.2	Arms
* Instantaneous maximum stall armature current	I_P	3.6	Arms	3.6	Arms
Torque constant	K_T	0.333	N·m/Arms	3.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	11.6	mV/min^{-1}	11.6	V/krpm
Phase armature resistance	R_ϕ	7.0	Ω	7.0	Ω
Electrical time constant	t_e	1.5	msec	1.5	msec
Mechanical time constant (not including sensor)	t_m	1.4	msec	1.4	msec
Inertia (including wiring-saved INC)	J_M	0.079×10^{-4}	kg·m^2 (GD^2/4)	0.08	g·cm·s^2
Inertia (including ABS-E)	J_M	0.104×10^{-4}	kg·m^2 (GD^2/4)	0.105	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.0760×10^{-4}	kg·m^2 (GD^2/4)	0.077	g·cm·s^2
Applicable load inertia	J_L	0.79×10^{-4}	kg·m^2 (GD^2/4)	0.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.59	kg	0.59	kg
Weight (including ABS-E)	W_E	0.89	kg	0.89	kg
Weight (including ABS-RⅡ)	W_E	0.65	kg	0.65	kg

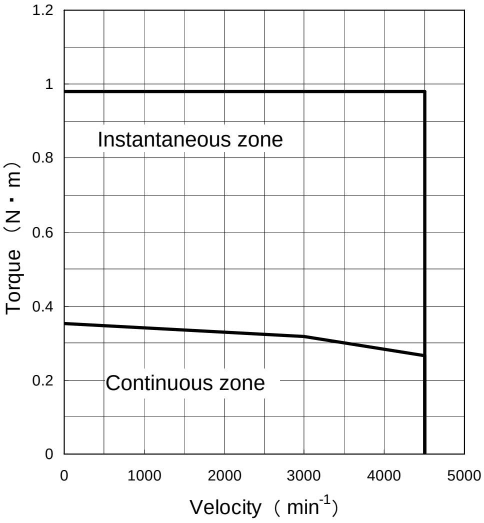
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.319 or more	N·m	3.25 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.26/0.07	A (DC)	0.26/0.07	A (DC)
Inertia	J_B	0.0078×10^{-4}	kg·m^2(GD^2/4)	0.008	g·cm·s^2
Weight	W	0.24	kg	0.24	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

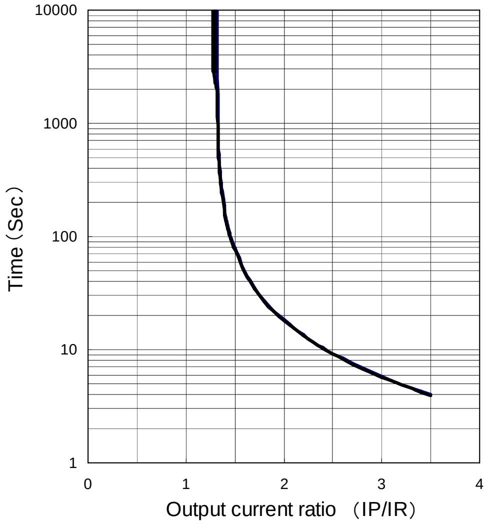
Velocity-torque characteristics

P50B04010D（100W）



Overload characteristics

P50B04010D(100W)



P50B05005D

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	50	W	50	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗	Rated torque	T_R	0.159	N•m	1.62	kg·cm
∗	Continuous stall torque	T_S	0.167	N•m	1.7	kg·cm
∗	Instantaneous maximum stall torque	T_P	0.49	N•m	5	kg·cm
∗	Rated armature current	I_R	0.85	Arms	0.85	Arms
∗	Continuous stall armature current	I_S	0.85	Arms	0.85	Arms
∗	Instantaneous maximum stall armature current	I_P	2.9	Arms	2.9	Arms
	Torque constant	K_T	0.249	N·m/Arms	2.54	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	8.7	mV/min^{-1}	8.7	V/krpm
	Phase armature resistance	R_ϕ	9.2	Ω	9.2	Ω
	Electrical time constant	t_e	2.1	msec	2.1	msec
	Mechanical time constant (not including sensor)	t_m	2.6	msec	2.6	msec
	Inertia (including wiring-saved INC)	J_M	0.063×10^{-4}	kg·m^2 (GD^2/4)	0.064	g·cm·s^2
	Inertia (including ABS-E)	J_M	0.088×10^{-4}	kg·m^2 (GD^2/4)	0.089	g·cm·s^2
	Inertia (including ABS-RⅡ)	J_M	0.060×10^{-4}	kg·m^2 (GD^2/4)	0.061	g·cm·s^2
	Applicable load inertia	J_L	0.63×10^{-4}	kg·m^2 (GD^2/4)	0.64	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	0.53	kg	0.53	kg
	Weight (including ABS-E)	W_E	0.8	kg	0.8	kg
	Weight (including ABS-RⅡ)	W_E	0.61	kg	0.61	kg

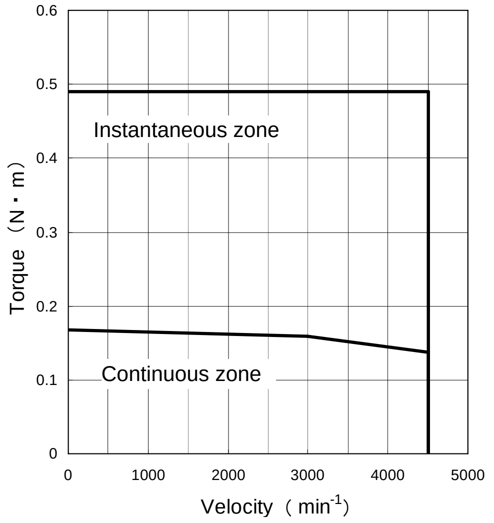
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.167 or more	N·m	1.7 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.40/0.11	A (DC)	0.40/0.11	A (DC)
Inertia	J_B	0.029×10^{-4}	kg·m^2 (GD^2/4)	0.03	g·cm·s^2
Weight	W	0.3	kg	0.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

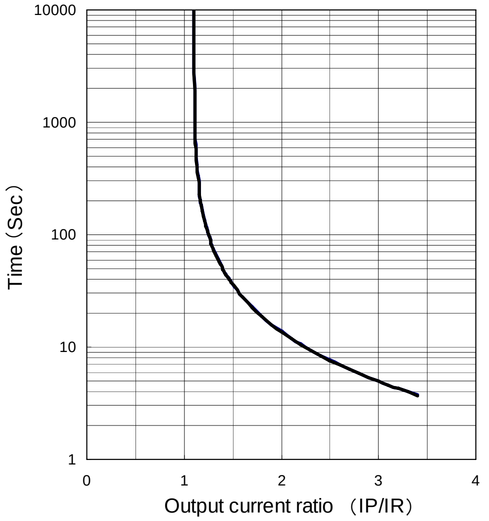
Velocity-torque characteristics

P50B05005D（50W）



Overload characteristics

P50B05005D(50W)



P50B05010D

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	100	W	100	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗	Rated torque	T_R	0.319	N•m	3.25	kg·cm
∗	Continuous stall torque	T_S	0.353	N•m	3.6	kg·cm
∗	Instantaneous maximum stall torque	T_P	0.98	N•m	10	kg·cm
∗	Rated armature current	I_R	1.1	Arms	1.1	Arms
∗	Continuous stall armature current	I_S	1.2	Arms	1.2	Arms
∗	Instantaneous maximum stall armature current	I_P	3.7	Arms	3.7	Arms
	Torque constant	K_T	0.319	N·m/Arms	3.25	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	11.1	mV/min^{-1}	11.1	V/krpm
	Phase armature resistance	R_ϕ	4.9	Ω	4.9	Ω
	Electrical time constant	t_e	2.5	msec	2.5	msec
	Mechanical time constant (not including sensor)	t_m	1.4	msec	1.4	msec
	Inertia (including wiring-saved INC)	J_M	0.101×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.103	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	0.126×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.128	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RⅡ)	J_M	0.098×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.100	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	1.01×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	1.03	$g\cdot cm\cdot s^2$
	Weight (including wiring-saved INC)	W_E	0.74	kg	0.74	kg
	Weight (including ABS-E)	W_E	1.01	kg	1.01	kg
	Weight (including ABS-RⅡ)	W_E	0.82	kg	0.82	kg

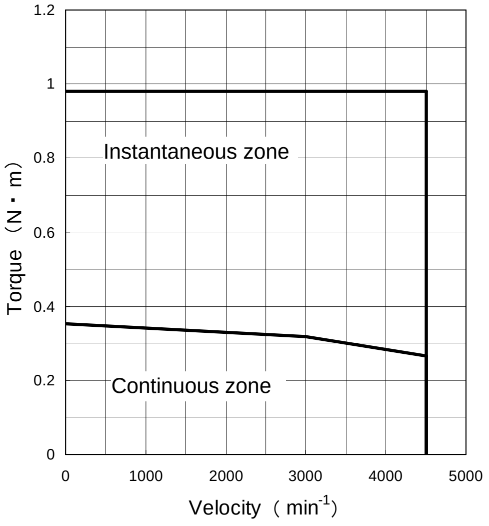
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.353 or more	N·m	3.6 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.40/0.11	A (DC)	0.40/0.11	A (DC)
Inertia	J_B	0.029×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.03	$g\cdot cm\cdot s^2$
Weight	W	0.3	kg	0.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

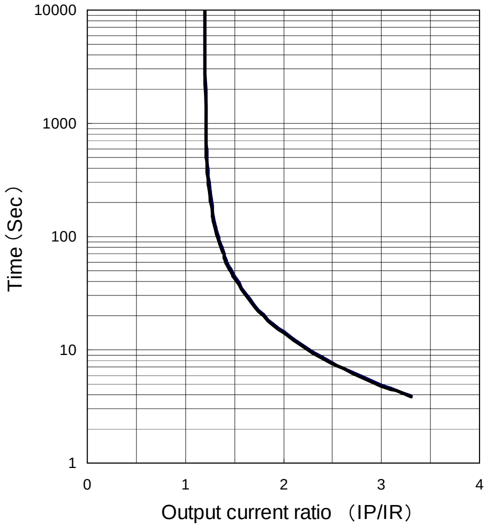
Velocity-torque characteristics

P50B05010D（100W）



Overload characteristics

P50B05010D(100W)



P50B05020D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.637	N•m	6.5	kg·cm
∗ Continuous stall torque	T_S	0.686	N•m	7	kg·cm
∗ Instantaneous maximum stall torque	T_P	1.96	N•m	20	kg·cm
∗ Rated armature current	I_R	1.6	Arms	1.6	Arms
∗ Continuous stall armature current	I_S	1.7	Arms	1.7	Arms
∗ Instantaneous maximum stall armature current	I_P	5.5	Arms	5.5	Arms
Torque constant	K_T	0.436	N·m/Arms	4.45	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	15.2	mV/min^{-1}	15.2	V/krpm
Phase armature resistance	R_ϕ	3.4	Ω	3.4	Ω
Electrical time constant	t_e	2.9	msec	2.9	msec
Mechanical time constant (not including sensor)	t_m	0.9	msec	0.9	msec
Inertia (including wiring-saved INC)	J_M	0.173×10^{-4}	kg·m^2 (GD^2/4)	0.176	g·cm·s^2
Inertia (including ABS-E)	J_M	0.198×10^{-4}	kg·m^2 (GD^2/4)	0.201	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.170×10^{-4}	kg·m^2 (GD^2/4)	0.173	g·cm·s^2
Applicable load inertia	J_L	1.73×10^{-4}	kg·m^2 (GD^2/4)	1.76	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.07	kg	1.07	kg
Weight (including ABS-E)	W_E	1.34	kg	1.34	kg
Weight (including ABS-RⅡ)	W_E	1.20	kg	1.20	kg

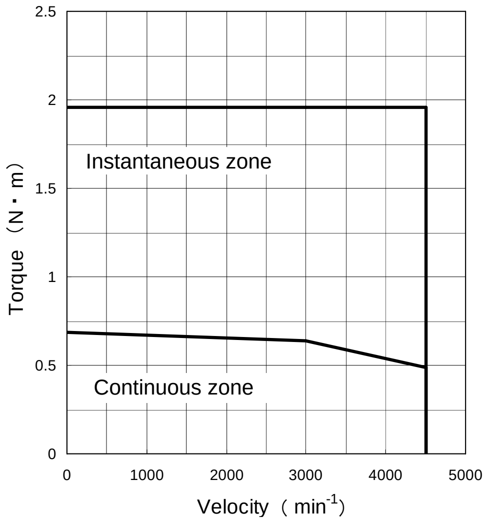
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.353 or more	N·m	3.6 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.40/0.11	A (DC)	0.40/0.11	A (DC)
Inertia	J_B	0.029×10^{-4}	kg·m^2 (GD^2/4)	0.03	g·cm·s^2
Weight	W	0.3	kg	0.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

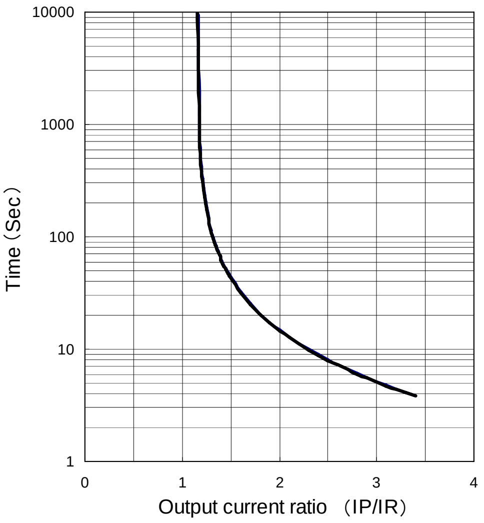
Velocity-torque characteristics

P50B05020D（200W）



Overload characteristics

P50B05020D(200W)



9. SPECIFICATIONS

P50B07020D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.637	N•m	6.5	kg·cm
* Continuous stall torque	T_S	0.686	N•m	7	kg·cm
* Instantaneous maximum stall torque	T_P	1.96	N•m	20	kg·cm
* Rated armature current	I_R	2.2	Arms	2.2	Arms
* Continuous stall armature current	I_S	2.3	Arms	2.3	Arms
* Instantaneous maximum stall armature current	I_P	7.4	Arms	7.4	Arms
Torque constant	K_T	0.348	N·m/Arms	3.55	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	12.15	mV/min^{-1}	12.15	V/krpm
Phase armature resistance	R_ϕ	2.5	Ω	2.5	Ω
Electrical time constant	t_e	3.6	msec	3.6	msec
Mechanical time constant (not including sensor)	t_m	2.4	msec	2.4	msec
Inertia (including wiring-saved INC)	J_M	0.386×10^{-4}	kg·m^2 (GD^2/4)	0.394	g·cm·s^2
Inertia (including ABS-E)	J_M	0.531×10^{-4}	kg·m^2 (GD^2/4)	0.539	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.398×10^{-4}	kg·m^2 (GD^2/4)	0.406	g·cm·s^2
Applicable load inertia	J_L	3.86×10^{-4}	kg·m^2 (GD^2/4)	3.94	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.57	kg	1.57	kg
Weight (including ABS-E)	W_E	1.87	kg	1.87	kg
Weight (including ABS-RⅡ)	W_E	1.60	kg	1.60	kg

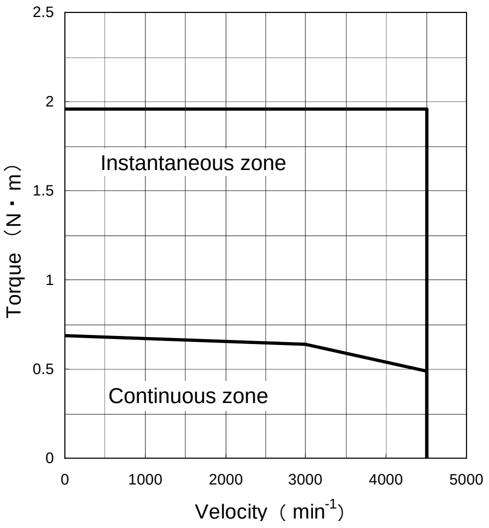
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.69 or more	N·m	7 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.30/0.08	A (DC)	0.30/0.08	A (DC)
Inertia	J_B	0.245×10^{-4}	kg·m^2 (GD^2/4)	0.25	g·cm·s^2
Weight	W	0.57	kg	0.57	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

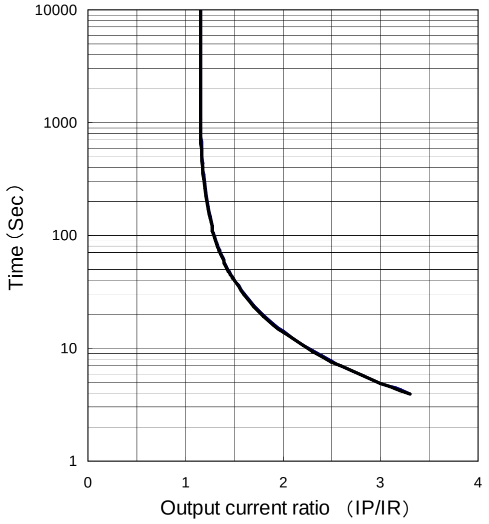
Velocity-torque characteristics

P50B07020D（200W）



Overload characteristics

P50B07020D(200W)



P50B07030D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	300	W	300	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.931	N•m	9.5	kg·cm
∗ Continuous stall torque	T_S	0.98	N•m	10	kg·cm
∗ Instantaneous maximum stall torque	T_P	2.94	N•m	30	kg·cm
∗ Rated armature current	I_R	2.2	Arms	2.2	Arms
∗ Continuous stall armature current	I_S	2.2	Arms	2.2	Arms
∗ Instantaneous maximum stall armature current	I_P	7.5	Arms	7.5	Arms
Torque constant	K_T	0.483	N·m/Arms	4.93	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	16.86	mV/min^{-1}	16.86	V/krpm
Phase armature resistance	R_ϕ	2.9	Ω	2.9	Ω
Electrical time constant	t_e	3.8	msec	3.8	msec
Mechanical time constant (not including sensor)	t_m	1.8	msec	1.8	msec
Inertia (including wiring-saved INC)	J_M	0.495×10^{-4}	kg·m^2 (GD^2/4)	0.505	g·cm·s^2
Inertia (including ABS-E)	J_M	0.64×10^{-4}	kg·m^2 (GD^2/4)	0.65	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.507×10^{-4}	kg·m^2 (GD^2/4)	0.517	g·cm·s^2
Applicable load inertia	J_L	4.95×10^{-4}	kg·m^2 (GD^2/4)	5.05	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.71	kg	1.71	kg
Weight (including ABS-E)	W_E	2.01	kg	2.01	kg
Weight (including ABS-RⅡ)	W_E	1.80	kg	1.80	kg

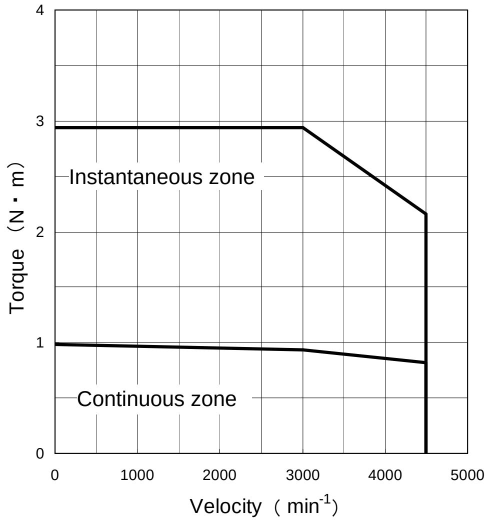
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.98 or more	N·m	10 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.30/0.08	A (DC)	0.30/0.08	A (DC)
Inertia	J_B	0.245×10^{-4}	kg·m^2(GD^2/4)	0.25	g·cm·s^2
Weight	W	0.57	kg	0.57	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

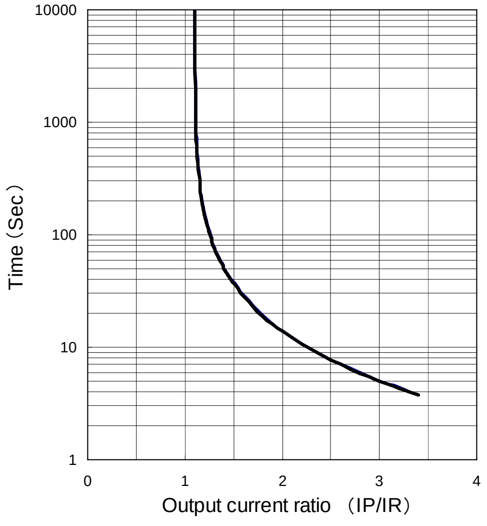
Velocity-torque characteristics

P50B07030D（300W）



Overload characteristics

P50B07030D(300W)



9. SPECIFICATIONS

P50B07040D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	1.274	N•m	13	kg·cm
∗ Continuous stall torque	T_S	1.372	N•m	14	kg·cm
∗ Instantaneous maximum stall torque	T_P	3.92	N•m	40	kg·cm
∗ Rated armature current	I_R	3.0	Arms	3.0	Arms
∗ Continuous stall armature current	I_S	3.1	Arms	3.1	Arms
∗ Instantaneous maximum stall armature current	I_P	10	Arms	10	Arms
Torque constant	K_T	0.481	N·m/Arms	4.91	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	16.8	mV/min^{-1}	16.8	V/krpm
Phase armature resistance	R_ϕ	1.65	Ω	1.65	Ω
Electrical time constant	t_e	4	msec	4	msec
Mechanical time constant (not including sensor)	t_m	1.6	msec	1.6	msec
Inertia (including wiring-saved INC)	J_M	0.74×10^{-4}	kg·m^2 (GD^2/4)	0.755	g·cm·s^2
Inertia (including ABS-E)	J_M	0.885×10^{-4}	kg·m^2 (GD^2/4)	0.9	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.752×10^{-4}	kg·m^2 (GD^2/4)	0.767	g·cm·s^2
Applicable load inertia	J_L	7.4×10^{-4}	kg·m^2 (GD^2/4)	7.55	g·cm·s^2
Weight (including wiring-saved INC)	W_E	2.1	kg	2.1	kg
Weight (including ABS-E)	W_E	2.4	kg	2.4	kg
Weight (including ABS-RⅡ)	W_E	2.10	kg	2.10	kg

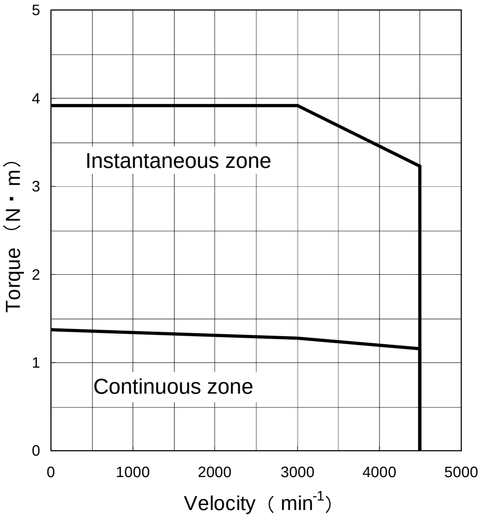
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.98	N·m	10 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.30/0.08	A (DC)	0.30/0.08	A (DC)
Inertia	J_B	0.245×10^{-4}	kg·m^2 (GD^2/4)	0.25	g·cm·s^2
Weight	W	0.57	kg	0.57	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

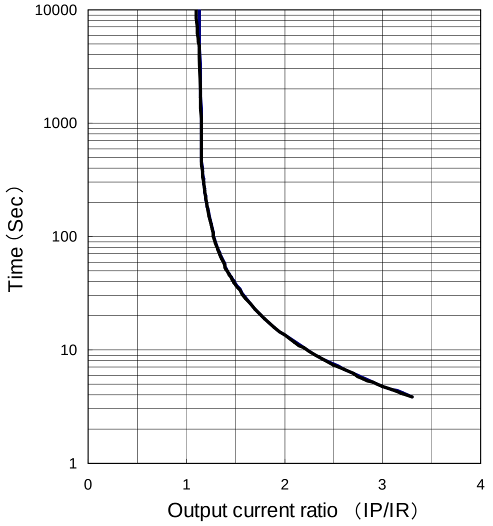
Velocity-torque characteristics

P50B07040D (400W)



Overload characteristics

P50B07040D(400W)



P50B08040D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	1.274	N•m	13	kg·cm
* Continuous stall torque	T_S	1.372	N•m	14	kg·cm
* Instantaneous maximum stall torque	T_P	3.92	N•m	40	kg·cm
* Rated armature current	I_R	3.3	Arms	3.3	Arms
* Continuous stall armature current	I_S	3.5	Arms	3.5	Arms
* Instantaneous maximum stall armature current	I_P	10.8	Arms	10.8	Arms
Torque constant	K_T	0.438	N·m/Arms	4.47	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	15.29	mV/min^{-1}	15.29	V/krpm
Phase armature resistance	R_ϕ	1.37	Ω	1.37	Ω
Electrical time constant	t_e	5	msec	5	msec
Mechanical time constant (not including sensor)	t_m	1.8	msec	1.8	msec
Inertia (including wiring-saved INC)	J_M	0.828×10^{-4}	kg·m^2 (GD^2/4)	0.845	g·cm·s^2
Inertia (including ABS-E)	J_M	0.973×10^{-4}	kg·m^2 (GD^2/4)	0.99	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	0.840×10^{-4}	kg·m^2 (GD^2/4)	0.857	g·cm·s^2
Applicable load inertia	J_L	8.28×10^{-4}	kg·m^2 (GD^2/4)	8.45	g·cm·s^2
Weight (including wiring-saved INC)	W_E	2.45	kg	2.45	kg
Weight (including ABS-E)	W_E	2.71	kg	2.71	kg
Weight (including ABS-RⅡ)	W_E	2.45	kg	2.45	kg

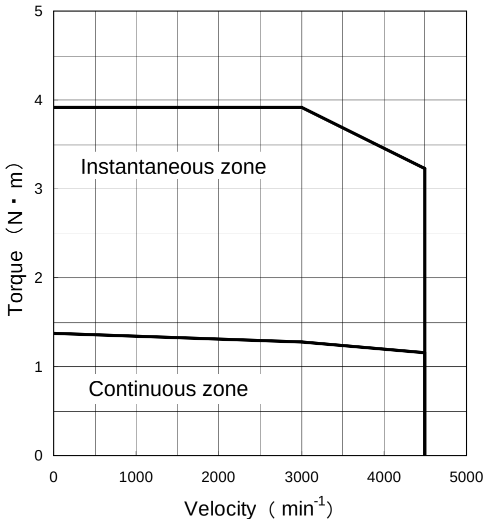
Holding Brake Data Sheet (Option)

Holding torque	T_B	1.37 or more	N·m	14 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.33/0.08	A (DC)	0.33/0.08	A (DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2 (GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

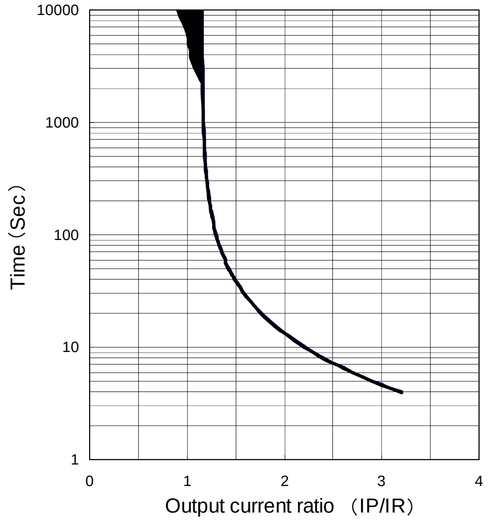
Velocity-torque characteristics

P50B08040D（400W）



Overload characteristics

P50B08040D(400W)



P50B08050D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	500	W	500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	1.589	N•m	16.2	kg·cm
∗ Continuous stall torque	T_S	1.96	N•m	20	kg·cm
∗ Instantaneous maximum stall torque	T_P	5.88	N•m	60	kg·cm
∗ Rated armature current	I_R	3.9	Arms	3.9	Arms
∗ Continuous stall armature current	I_S	4.5	Arms	4.5	Arms
∗ Instantaneous maximum stall armature current	I_P	15	Arms	15	Arms
Torque constant	K_T	0.473	N·m/Arms	4.83	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	16.5	mV/min^{-1}	16.5	V/krpm
Phase armature resistance	R_ϕ	0.94	Ω	0.94	Ω
Electrical time constant	t_e	5.2	msec	5.2	msec
Mechanical time constant (not including sensor)	t_m	1.5	msec	1.5	msec
Inertia (including wiring-saved INC)	J_M	1.161×10^{-4}	kg·m^2 (GD^2/4)	1.185	g·cm·s^2
Inertia (including ABS-E)	J_M	1.306×10^{-4}	kg·m^2 (GD^2/4)	1.33	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	1.173×10^{-4}	kg·m^2 (GD^2/4)	1.197	g·cm·s^2
Applicable load inertia	J_L	11.6×10^{-4}	kg·m^2 (GD^2/4)	11.9	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.0	kg	3.0	kg
Weight (including ABS-E)	W_E	3.26	kg	3.26	kg
Weight (including ABS-RⅡ)	W_E	3.00	kg	3.00	kg

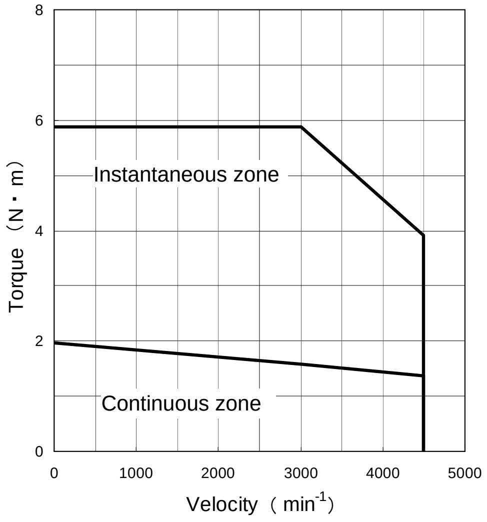
Holding Brake Data Sheet (Option)

Holding torque	T_B	1.96 or more	N·m	20 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.33/0.08	A (DC)	0.33/0.08	A (DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2 (GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

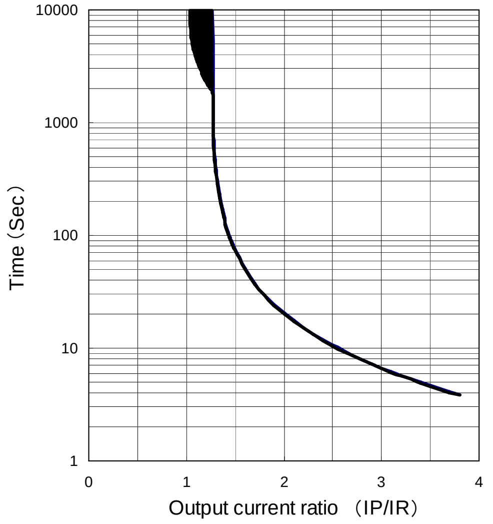
Velocity-torque characteristics

P50B08050D（500W）



Overload characteristics

P50B08050D(500W)



9. SPECIFICATIONS

P50B08075H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	2.381	N•m	24.3	kg·cm
∗ Continuous stall torque	T_S	2.94	N•m	30	kg·cm
∗ Instantaneous maximum stall torque	T_P	8.82	N•m	90	kg·cm
∗ Rated armature current	I_R	3.9	Arms	3.9	Arms
∗ Continuous stall armature current	I_S	4.6	Arms	4.6	Arms
∗ Instantaneous maximum stall armature current	I_P	15.3	Arms	15.3	Arms
Torque constant	K_T	0.689	N·m/Arms	7.03	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	24.05	mV/min^{-1}	24.05	V/krpm
Phase armature resistance	R_ϕ	1.07	Ω	1.07	Ω
Electrical time constant	t_e	5.3	msec	5.3	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	1.926×10^{-4}	kg·m^2 (GD^2/4)	1.965	g·cm·s^2
Inertia (including ABS-E)	J_M	2.071×10^{-4}	kg·m^2 (GD^2/4)	2.11	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	1.938×10^{-4}	kg·m^2 (GD^2/4)	1.977	g·cm·s^2
Applicable load inertia	J_L	19.26×10^{-4}	kg·m^2 (GD^2/4)	19.65	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.9	kg	3.9	kg
Weight (including ABS-E)	W_E	4.16	kg	4.16	kg
Weight (including ABS-RⅡ)	W_E	3.90	kg	3.90	kg

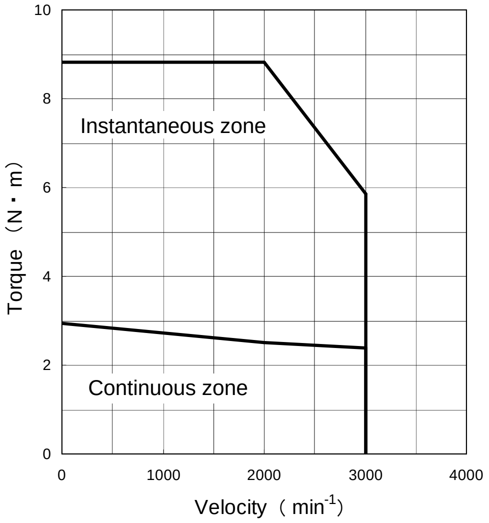
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94 or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.33/0.08	A (DC)	0.33/0.08	A (DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

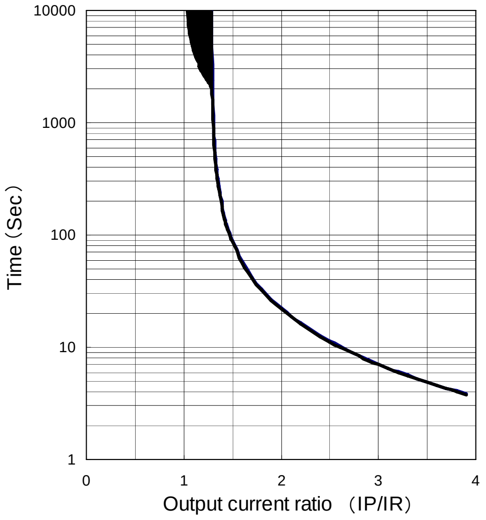
Velocity-torque characteristics

P50B08075H（750W）



Overload characteristics

P50B08075H(750W)



P50B08100H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1000	W	1000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	3.185	N•m	32.5	kg·cm
∗ Continuous stall torque	T_S	3.92	N•m	40	kg·cm
∗ Instantaneous maximum stall torque	T_P	8.82	N•m	90	kg·cm
∗ Rated armature current	I_R	4.3	Arms	4.3	Arms
∗ Continuous stall armature current	I_S	5.0	Arms	5.0	Arms
∗ Instantaneous maximum stall armature current	I_P	12.3	Arms	12.3	Arms
Torque constant	K_T	0.860	N·m/Arms	8.78	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	30.02	mV/min^{-1}	30.02	V/krpm
Phase armature resistance	R_ϕ	1.0	Ω	1.0	Ω
Electrical time constant	t_e	5.9	msec	5.9	msec
Mechanical time constant (not including sensor)	t_m	1.1	msec	1.1	msec
Inertia (including wiring-saved INC)	J_M	2.651×10^{-4}	kg·m^2 (GD^2/4)	2.705	g·cm·s^2
Inertia (including ABS-E)	J_M	2.796×10^{-4}	kg·m^2 (GD^2/4)	2.85	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	2.663×10^{-4}	kg·m^2 (GD^2/4)	2.717	g·cm·s^2
Applicable load inertia	J_L	26.5×10^{-4}	kg·m^2 (GD^2/4)	27.1	g·cm·s^2
Weight (including wiring-saved INC)	W_E	5.05	kg	5.05	kg
Weight (including ABS-E)	W_E	5.31	kg	5.31	kg
Weight (including ABS-RⅡ)	W_E	5.1	kg	5.1	kg

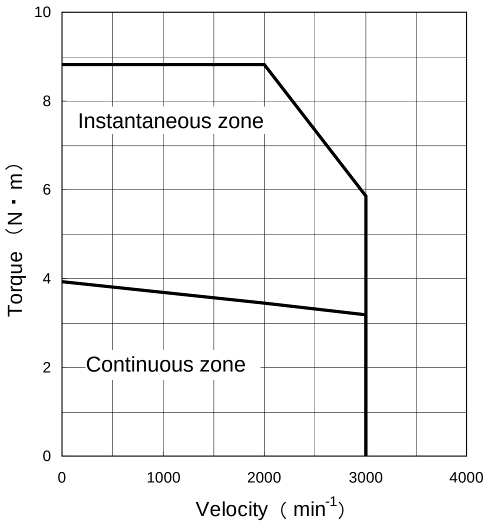
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94 or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.33/0.08	A (DC)	0.33/0.08	A (DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

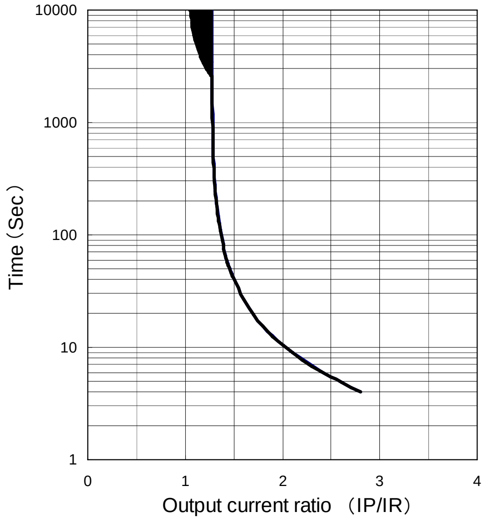
Velocity-torque characteristics

P50B08100H（1.0kW）



Overload characteristics

P50B08100H(1.0kW)



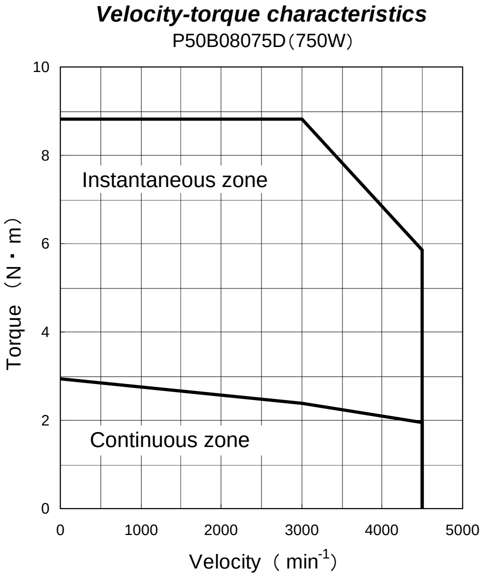
P50B08075D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	2.381	N•m	24.3	kg·cm
∗ Continuous stall torque	T_S	2.94	N•m	30	kg·cm
∗ Instantaneous maximum stall torque	T_P	8.82	N•m	90	kg·cm
∗ Rated armature current	I_R	6.0	Arms	6.0	Arms
∗ Continuous stall armature current	I_S	7.1	Arms	7.1	Arms
∗ Instantaneous maximum stall armature current	I_P	23.7	Arms	23.7	Arms
Torque constant	K_T	0.447	N·m/Arms	4.56	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	15.6	mV/min^{-1}	15.6	V/krpm
Phase armature resistance	R_ϕ	0.43	Ω	0.43	Ω
Electrical time constant	t_e	5.8	msec	5.8	msec
Mechanical time constant (not including sensor)	t_m	1.2	msec	1.2	msec
Inertia (including wiring-saved INC)	J_M	1.926×10^{-4}	kg·m^2 (GD^2/4)	1.965	g·cm·s^2
Inertia (including ABS-E)	J_M	2.071×10^{-4}	kg·m^2 (GD^2/4)	2.11	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	1.938×10^{-4}	kg·m^2 (GD^2/4)	1.977	g·cm·s^2
Applicable load inertia	J_L	19.26×10^{-4}	kg·m^2 (GD^2/4)	19.65	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.9	kg	3.9	kg
Weight (including ABS-E)	W_E	4.16	kg	4.16	kg
Weight (including ABS-RⅡ)	W_E	3.90	kg	3.90	kg

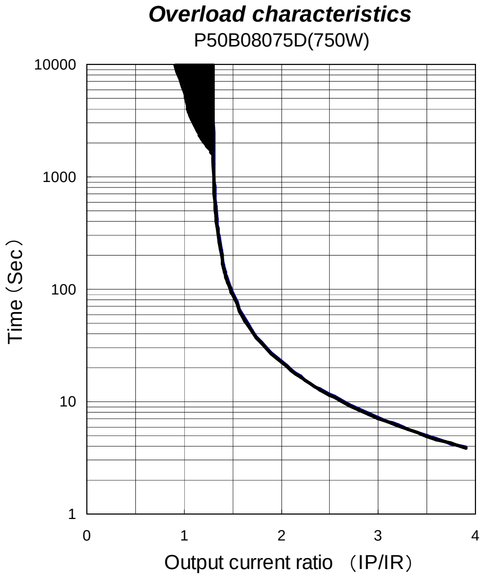
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94 or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.33/0.08	A (DC)	0.33/0.08	A (DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2 (GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.


Velocity-torque characteristics

P50B08075D（750W）


Overload characteristics

P50B08075D(750W)

P50B08100D

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	1000	W	1000	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗	Rated torque	T_R	3.185	N•m	32.5	kg·cm
∗	Continuous stall torque	T_S	3.92	N•m	40	kg·cm
∗	Instantaneous maximum stall torque	T_P	11.76	N•m	120	kg·cm
∗	Rated armature current	I_R	6.7	Arms	6.7	Arms
∗	Continuous stall armature current	I_S	7.5	Arms	7.5	Arms
∗	Instantaneous maximum stall armature current	I_P	25.7	Arms	25.7	Arms
	Torque constant	K_T	0.553	N·m/Arms	5.65	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	19.3	mV/min^{-1}	19.3	V/krpm
	Phase armature resistance	R_ϕ	0.41	Ω	0.41	Ω
	Electrical time constant	t_e	5.9	msec	5.9	msec
	Mechanical time constant (not including sensor)	t_m	1.1	msec	1.1	msec
	Inertia (including wiring-saved INC)	J_M	2.651×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.705	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	2.796×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.85	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RⅡ)	J_M	2.663×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.717	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	26.5×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	27.1	$g\cdot cm\cdot s^2$
	Weight (including wiring-saved INC)	W_E	5.05	kg	5.05	kg
	Weight (including ABS-E)	W_E	5.31	kg	5.31	kg
	Weight (including ABS-RⅡ)	W_E	5.05	kg	5.05	kg

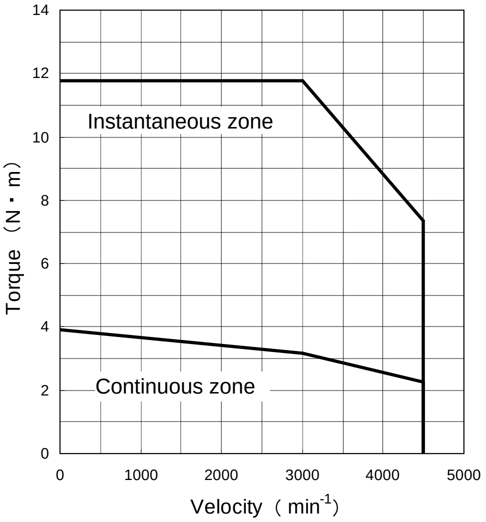
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.33/0.08	A (DC)	0.33/0.08	A (DC)
Inertia	J_B	0.343×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.35	$g\cdot cm\cdot s^2$
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

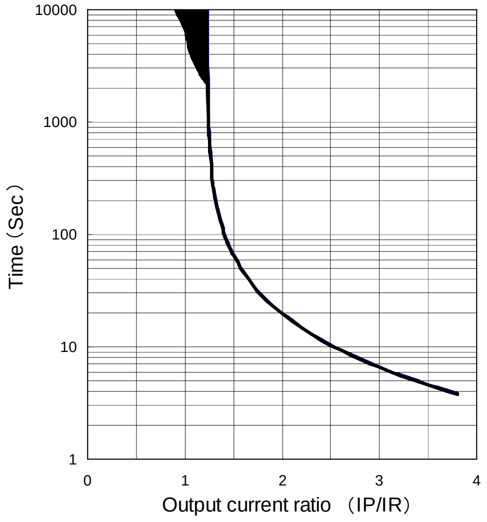
Velocity-torque characteristics

P50B08100D（1.0kW）



Overload characteristics

P50B08100D(1.0kW)



9.2.5.5 Motor Data Sheet P6

P60B13050H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	500	W	500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	2.5	N•m	25	kg·cm
∗ Continuous stall torque	T_S	3.0	N•m	31	kg·cm
∗ Instantaneous maximum stall torque	T_P	7.0	N•m	71	kg·cm
∗ Rated armature current	I_R	4.5	Arms	4.5	Arms
∗ Continuous stall armature current	I_S	5.2	Arms	5.2	Arms
∗ Instantaneous maximum stall armature current	I_P	15.0	Arms	15.0	Arms
Torque constant	K_T	0.65	N·m/Arms	6.6	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	22.5	mV/min^{-1}	22.5	V/krpm
Phase armature resistance	R_ϕ	0.64	Ω	0.64	Ω
Electrical time constant	t_e	9.1	msec	9.1	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	2.78×10^{-4}	kg·m^2 (GD^2/4)	2.88	g·cm·s^2
Inertia (including ABS-E)	J_M	2.85×10^{-4}	kg·m^2 (GD^2/4)	2.95	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	2.78×10^{-4}	kg·m^2 (GD^2/4)	2.88	g·cm·s^2
Applicable load inertia	J_L	27.8×10^{-4}	kg·m^2 (GD^2/4)	28.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	4.7	kg	4.7	kg
Weight (including ABS-E)	W_E	4.7	kg	4.7	kg
Weight (including ABS-RⅡ)	W_E	4.8	kg	4.8	kg

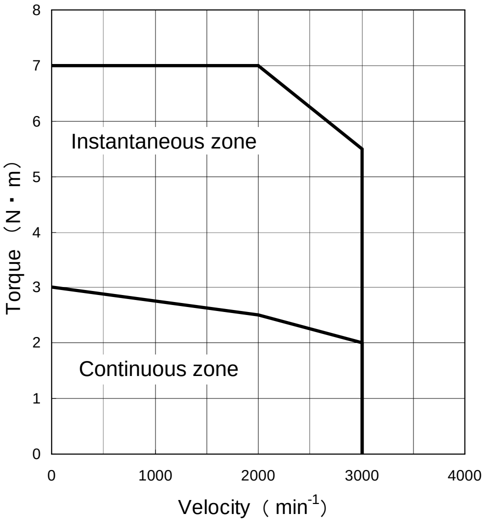
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.5 or more	N·m	36 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.91/0.25	A (DC)	0.91/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2 (GD^2/4)	0.5	g·cm·s^2
Weight	W	1.3	kg	1.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

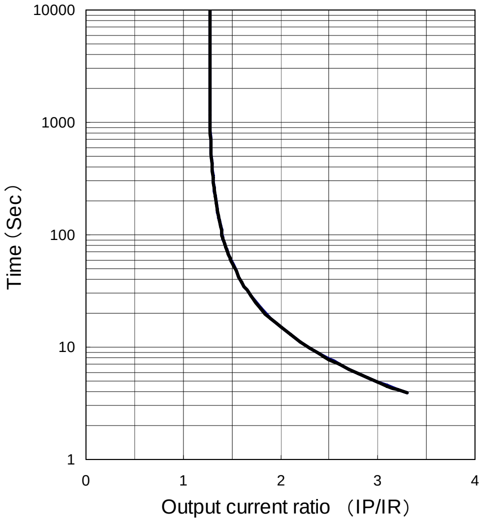
Velocity-torque characteristics

P60B13050H（500W）



Overload characteristics

P60B13050H(500W)



P60B13100H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1000	W	1000	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	5.0	N•m	51	kg·cm
∗ Continuous stall torque	T_S	6.0	N•m	61	kg·cm
∗ Instantaneous maximum stall torque	T_P	15.0	N•m	153	kg·cm
∗ Rated armature current	I_R	7.8	Arms	7.8	Arms
∗ Continuous stall armature current	I_S	8.7	Arms	8.7	Arms
∗ Instantaneous maximum stall armature current	I_P	23.7	Arms	23.7	Arms
Torque constant	K_T	0.76	N·m/Arms	7.7	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	26.2	mV/min^{-1}	26.2	V/krpm
Phase armature resistance	R_ϕ	0.31	Ω	0.31	Ω
Electrical time constant	t_e	10	msec	10	msec
Mechanical time constant (not including sensor)	t_m	0.90	msec	0.90	msec
Inertia (including wiring-saved INC)	J_M	5.58×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	5.68	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	5.65×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	5.75	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	5.580×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	5.680	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	55.8×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	56.8	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	6.6	kg	6.6	kg
Weight (including ABS-E)	W_E	6.6	kg	6.6	kg
Weight (including ABS-RⅡ)	W_E	6.7	kg	6.7	kg

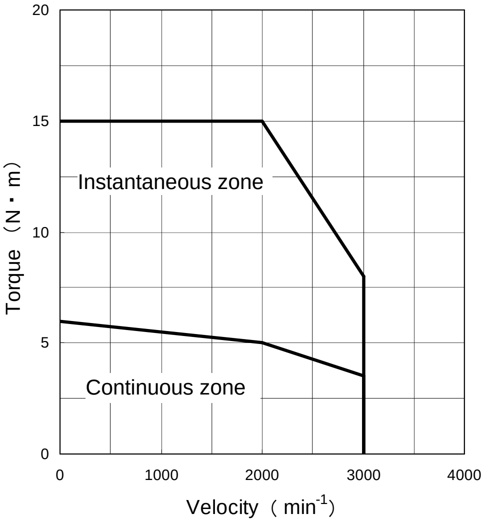
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.0 or more	N·m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.5	$g\cdot cm\cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

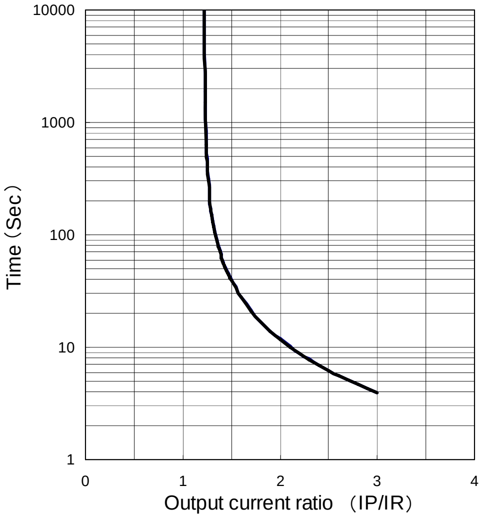
Velocity-torque characteristics

P60B13100H（1.0kW）



Overload characteristics

P60B13100H(1.0kW)



9. SPECIFICATIONS

P60B13150H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	7.5	N•m	76	kg·cm
∗ Continuous stall torque	T_S	9.0	N•m	92	kg·cm
∗ Instantaneous maximum stall torque	T_P	20.0	N•m	204	kg·cm
∗ Rated armature current	I_R	9.4	Arms	9.4	Arms
∗ Continuous stall armature current	I_S	10.7	Arms	10.7	Arms
∗ Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.90	N·m/Arms	9.2	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	31.4	mV/min^{-1}	31.4	V/krpm
Phase armature resistance	R_ϕ	0.27	Ω	0.27	Ω
Electrical time constant	t_e	10	msec	10	msec
Mechanical time constant (not including sensor)	t_m	0.82	msec	0.82	msec
Inertia (including wiring-saved INC)	J_M	8.28×10^{-4}	kg·m^2 (GD^2/4)	8.48	g·cm·s^2
Inertia (including ABS-E)	J_M	8.35×10^{-4}	kg·m^2 (GD^2/4)	8.55	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	8.280×10^{-4}	kg·m^2 (GD^2/4)	8.443	g·cm·s^2
Applicable load inertia	J_L	82.8×10^{-4}	kg·m^2 (GD^2/4)	84.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	7.8	kg	7.8	kg
Weight (including ABS-E)	W_E	7.8	kg	7.8	kg
Weight (including ABS-RⅡ)	W_E	8.9	kg	8.9	kg

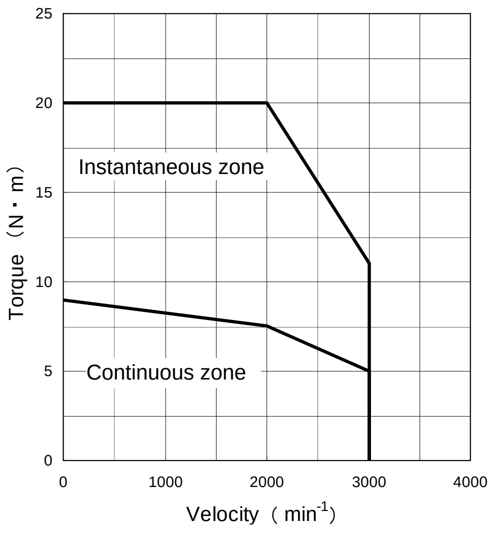
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.0 or more	N·m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2 (GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

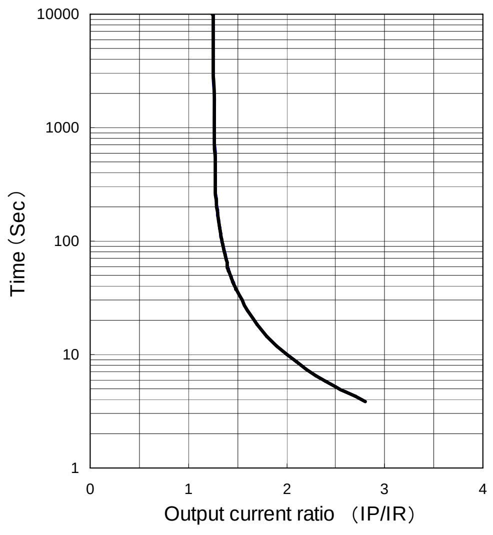
Velocity-torque characteristics

P60B13150H（1.5kW）



Overload characteristics

P60B13150H(1.5kW)



P60B13200H

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	2000	W	2000	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	9.5	N•m	97	kg·cm
* Continuous stall torque	T_S	12.0	N•m	122	kg·cm
* Instantaneous maximum stall torque	T_P	30.0	N•m	306	kg·cm
* Rated armature current	I_R	15.5	Arms	15.5	Arms
* Continuous stall armature current	I_S	18.3	Arms	18.3	Arms
* Instantaneous maximum stall armature current	I_P	52.4	Arms	52.4	Arms
Torque constant	K_T	0.69	N·m/Arms	7.0	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	24.1	mV/min^{-1}	24.1	V/krpm
Phase armature resistance	R_ϕ	0.10	Ω	0.10	Ω
Electrical time constant	t_e	12	msec	12	msec
Mechanical time constant (not including sensor)	t_m	0.75	msec	0.75	msec
Inertia (including wiring-saved INC)	J_M	12.1×10^{-4}	kg·m^2 (GD^2/4)	12.1	g·cm·s^2
Inertia (including ABS-E)	J_M	12.2×10^{-4}	kg·m^2 (GD^2/4)	12.2	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	12.10×10^{-4}	kg·m^2 (GD^2/4)	12.34	g·cm·s^2
Applicable load inertia	J_L	121×10^{-4}	kg·m^2 (GD^2/4)	121	g·cm·s^2
Weight (including wiring-saved INC)	W_E	9.8	kg	9.8	kg
Weight (including ABS-E)	W_E	9.8	kg	9.8	kg
Weight (including ABS-RⅡ)	W_E	9.9	kg	9.9	kg

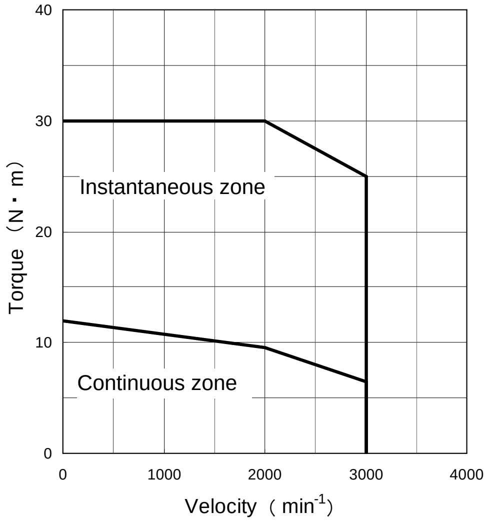
Holding Brake Data Sheet (Option)

Holding torque	T_B	12 or more	N·m	122 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.28	A (DC)	1.0/0.28	A (DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.7	kg	1.7	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

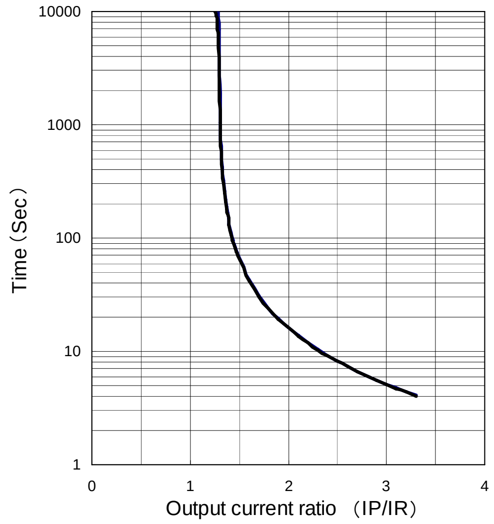
Velocity-torque characteristics

P60B13200H（2.0kW）



Overload characteristics

P60B13200H(2.0kW)



P60B15300H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	3000	W	3000	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	14.5	N•m	148	kg·cm
∗ Continuous stall torque	T_S	18.0	N•m	184	kg·cm
∗ Instantaneous maximum stall torque	T_P	44.0	N•m	449	kg·cm
∗ Rated armature current	I_R	25.0	Arms	25.0	Arms
∗ Continuous stall armature current	I_S	28.1	Arms	28.1	Arms
∗ Instantaneous maximum stall armature current	I_P	77.7	Arms	77.7	Arms
Torque constant	K_T	0.68	N·m/Arms	6.9	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	23.5	mV/min^{-1}	23.5	V/krpm
Phase armature resistance	R_ϕ	0.048	Ω	0.048	Ω
Electrical time constant	t_e	17	msec	17	msec
Mechanical time constant (not including sensor)	t_m	0.65	msec	0.65	msec
Inertia (including wiring-saved INC)	J_M	20.1×10^{-4}	kg·m^2 (GD^2/4)	21.1	g·cm·s^2
Inertia (including ABS-E)	J_M	20.2×10^{-4}	kg·m^2 (GD^2/4)	21.2	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	20.10×10^{-4}	kg·m^2 (GD^2/4)	20.50	g·cm·s^2
Applicable load inertia	J_L	201×10^{-4}	kg·m^2 (GD^2/4)	211	g·cm·s^2
Weight (including wiring-saved INC)	W_E	13.4	kg	13.4	kg
Weight (including ABS-E)	W_E	13.4	kg	13.4	kg
Weight (including ABS-RⅡ)	W_E	14.5	kg	14.5	kg

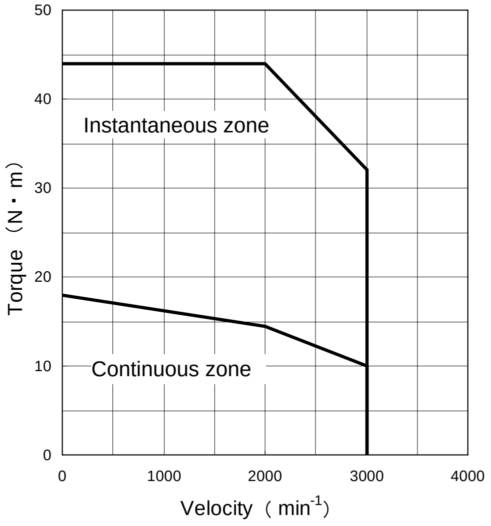
Holding Brake Data Sheet (Option)

Holding torque	T_B	20 or more	N·m	204 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.27	A (DC)	1.0/0.27	A (DC)
Inertia	J_B	0.68×10^{-4}	kg·m^2(GD^2/4)	0.68	g·cm·s^2
Weight	W	2.6	kg	2.6	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

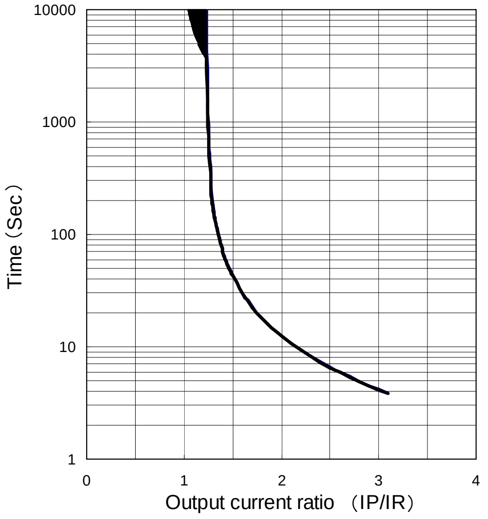
Velocity-torque characteristics

P60B15300H（3.0kW）



Overload characteristics

P60B15300H(3.0kW)



P60B18200H

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	2000	W	2000	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	9.5	N•m	97	kg·cm
* Continuous stall torque	T_S	12.0	N•m	122	kg·cm
* Instantaneous maximum stall torque	T_P	30.0	N•m	306	kg·cm
* Rated armature current	I_R	14.6	Arms	14.6	Arms
* Continuous stall armature current	I_S	17.0	Arms	17.0	Arms
* Instantaneous maximum stall armature current	I_P	48.7	Arms	48.7	Arms
Torque constant	K_T	0.74	N·m/Arms	7.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	25.7	mV/min^{-1}	25.7	V/krpm
Phase armature resistance	R_ϕ	0.079	Ω	0.079	Ω
Electrical time constant	t_e	20	msec	20	msec
Mechanical time constant (not including sensor)	t_m	0.94	msec	0.94	msec
Inertia (including wiring-saved INC)	J_M	22.1×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	22.1	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	22.2×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	22.2	$g \cdot cm \cdot s^2$
Inertia (including ABS-RⅡ)	J_M	22.10×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	22.53	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	221×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	221	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	13.6	kg	13.6	kg
Weight (including ABS-E)	W_E	13.6	kg	13.6	kg
Weight (including ABS-RⅡ)	W_E	13.7	kg	13.7	kg

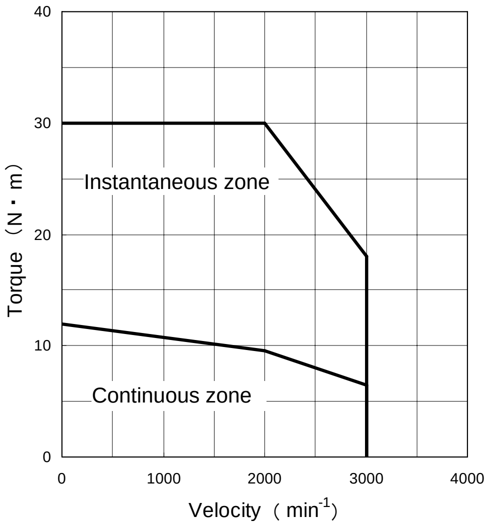
Holding Brake Data Sheet (Option)

Holding torque	T_B	12 or more	N·m	122 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.0/0.28	A (DC)	1.0/0.28	A (DC)
Inertia	J_B	0.5×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	0.5	$g \cdot cm \cdot s^2$
Weight	W	1.9	kg	1.9	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

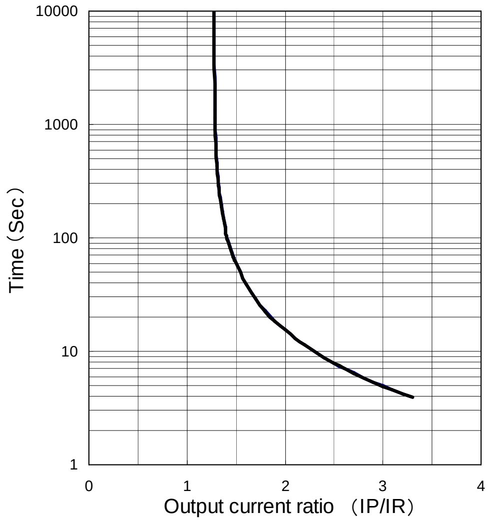
Velocity-torque characteristics

P60B18200H（2.0kW）



Overload characteristics

P60B18200H(2.0kW)



P60B18350H

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	3500	W	3500	W
	Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
	Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗	Rated torque	T_R	17.0	N•m	173	kg·cm
∗	Continuous stall torque	T_S	22.0	N•m	224	kg·cm
∗	Instantaneous maximum stall torque	T_P	50.0	N•m	510	kg·cm
∗	Rated armature current	I_R	26.4	Arms	26.4	Arms
∗	Continuous stall armature current	I_S	32.3	Arms	32.3	Arms
∗	Instantaneous maximum stall armature current	I_P	80.2	Arms	80.2	Arms
	Torque constant	K_T	0.75	N·m/Arms	7.6	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	26.0	mV/min^{-1}	26.0	V/krpm
	Phase armature resistance	R_ϕ	0.048	Ω	0.048	Ω
	Electrical time constant	t_e	19	msec	19	msec
	Mechanical time constant (not including sensor)	t_m	0.89	msec	0.89	msec
	Inertia (including wiring-saved INC)	J_M	34.1×10^{-4}	$\text{kg}\cdot\text{m}^2$ (GD^2/4)	35.1	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Inertia (including ABS-E)	J_M	34.2×10^{-4}	$\text{kg}\cdot\text{m}^2$ (GD^2/4)	35.2	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Inertia (including ABS-RⅡ)	J_M	34.10×10^{-4}	$\text{kg}\cdot\text{m}^2$ (GD^2/4)	34.88	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Applicable load inertia	J_L	341×10^{-4}	$\text{kg}\cdot\text{m}^2$ (GD^2/4)	351	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
	Weight (including wiring-saved INC)	W_E	17.7	kg	17.7	kg
	Weight (including ABS-E)	W_E	17.7	kg	17.7	kg
	Weight (including ABS-RⅡ)	W_E	17.8	kg	17.8	kg

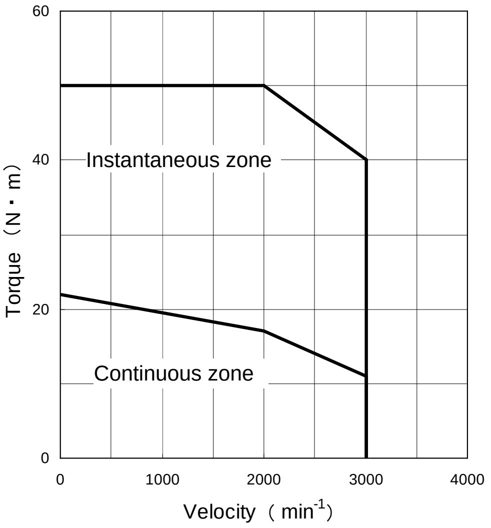
Holding Brake Data Sheet (Option)

Holding torque	T_B	32 or more	N·m	326 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	$\text{kg}\cdot\text{m}^2$ (GD^2/4)	3.47	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

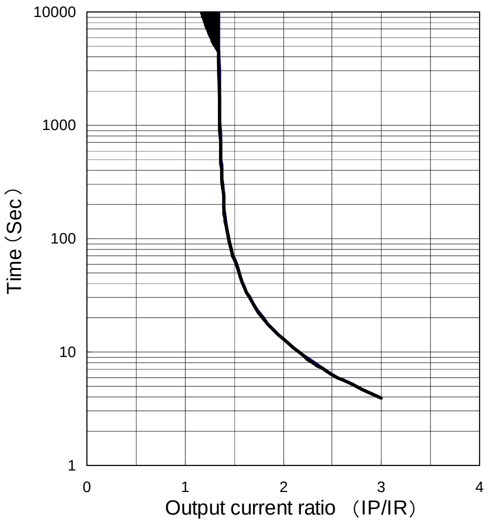
Velocity-torque characteristics

P60B18350H（3.5kW）



Overload characteristics

P60B18350H(3.5kW)



P60B18450R

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	4500	W	4500	W
	Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
	Maximum revolution speed	N_{max}	2500	min^{-1}	2500	rpm
∗	Rated torque	T_R	21.5	N•m	219	kg·cm
∗	Continuous stall torque	T_S	32.0	N•m	326	kg·cm
∗	Instantaneous maximum stall torque	T_P	70.0	N•m	714	kg·cm
∗	Rated armature current	I_R	24.9	Arms	24.9	Arms
∗	Continuous stall armature current	I_S	34.0	Arms	34.0	Arms
∗	Instantaneous maximum stall armature current	I_P	81.2	Arms	81.2	Arms
	Torque constant	K_T	1.03	N·m/Arms	10.5	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	36.0	mV/min^{-1}	36.0	V/krpm
	Phase armature resistance	R_ϕ	0.052	Ω	0.052	Ω
	Electrical time constant	t_e	23	msec	23	msec
	Mechanical time constant (not including sensor)	t_m	0.69	msec	0.69	msec
	Inertia (including wiring-saved INC)	J_M	47.1×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	48.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	47.2×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	48.2	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RⅡ)	J_M	47.10×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	48.03	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	471×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	481	$g\cdot cm\cdot s^2$
	Weight (including wiring-saved INC)	W_E	21.7	kg	21.7	kg
	Weight (including ABS-E)	W_E	21.7	kg	21.7	kg
	Weight (including ABS-RⅡ)	W_E	21.8	kg	21.8	kg

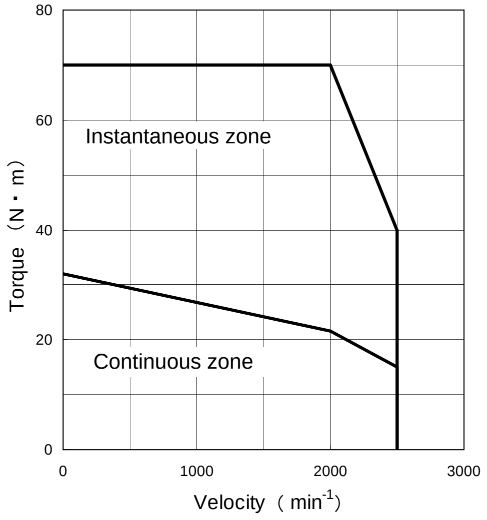
Holding Brake Data Sheet (Option)

Holding torque	T_B	32 or more	N·m	326 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	3.4×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	3.47	$g\cdot cm\cdot s^2$
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

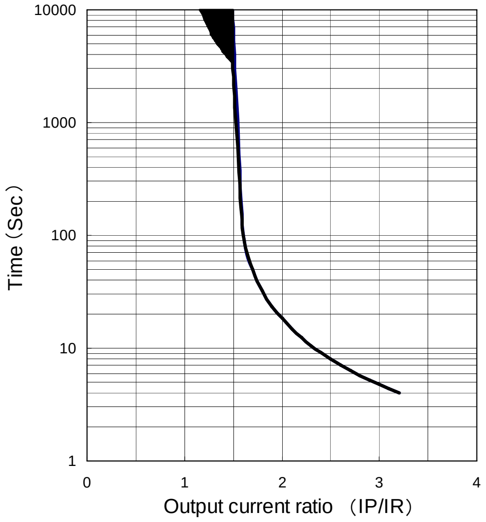
Velocity-torque characteristics

P60B18450R（4.5kW）



Overload characteristics

P60B18450R(4.5kW)



9. SPECIFICATIONS

P60B18550R

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	5500	W	5500	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	2500	min^{-1}	2500	rpm
∗ Rated torque	T_R	35.0	N•m	357	kg·cm
∗ Continuous stall torque	T_S	37.3	N•m	380	kg·cm
∗ Instantaneous maximum stall torque	T_P	88.3	N•m	900	kg·cm
∗ Rated armature current	I_R	32	Arms	32	Arms
∗ Continuous stall armature current	I_S	33	Arms	33	Arms
∗ Instantaneous maximum stall armature current	I_P	83	Arms	83	Arms
Torque constant	K_T	1.23	N·m/Arms	12.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	42.7	mV/min^{-1}	42.7	V/krpm
Phase armature resistance	R_ϕ	0.042	Ω	0.042	Ω
Electrical time constant	t_e	23	msec	23	msec
Mechanical time constant (not including sensor)	t_m	0.52	msec	0.52	msec
Inertia (including wiring-saved INC)	J_M	61.9×10^{-4}	kg·m^2 (GD^2/4)	63.1	g·cm·s^2
Inertia (including ABS-E)	J_M	61.9×10^{-4}	kg·m^2 (GD^2/4)	63.1	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	61.9×10^{-4}	kg·m^2 (GD^2/4)	63.1	g·cm·s^2
Applicable load inertia	J_L	619×10^{-4}	kg·m^2 (GD^2/4)	631	g·cm·s^2
Weight (including wiring-saved INC)	W_E	31.7	kg	31.7	kg
Weight (including ABS-E)	W_E	31.7	kg	31.7	kg
Weight (including ABS-RⅡ)	W_E	31.8	kg	31.8	kg

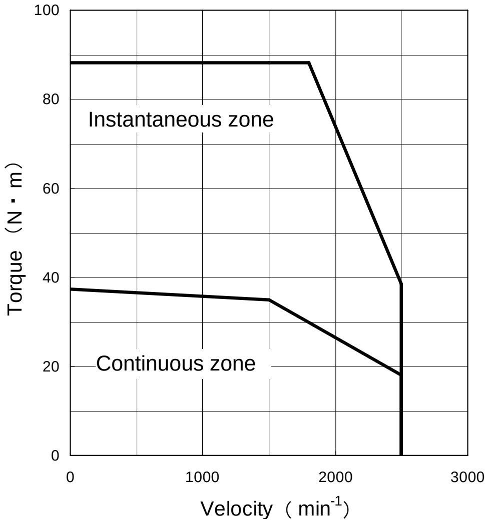
Holding Brake Data Sheet (Option)

Holding torque	T_B	54.9	N·m	560	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	4.5×10^{-4}	kg·m^2 (GD^2/4)	4.59	g·cm·s^2
Weight	W	6.0	kg	6.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

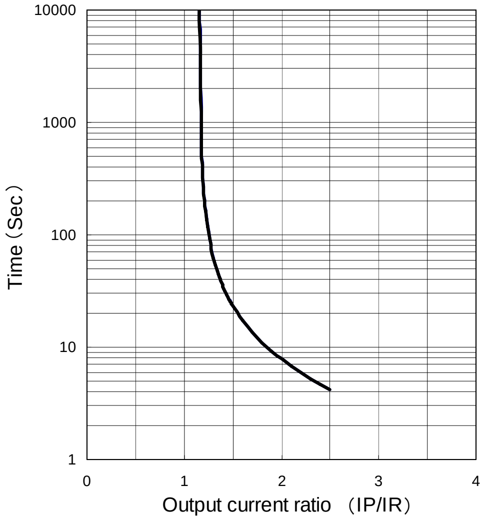
Velocity-torque characteristics

P60B18550R（5.5kW）



Overload characteristics

P60B18550R(5.5kW)



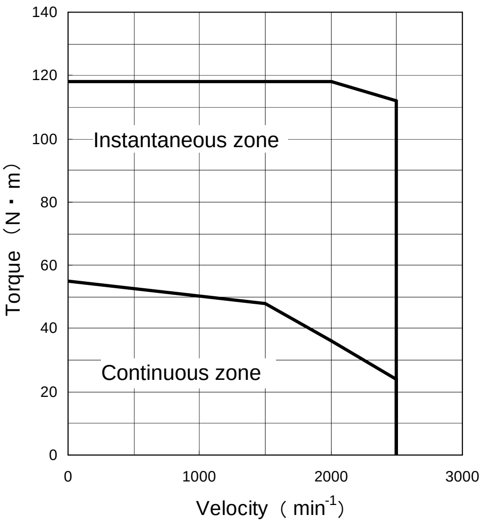
P60B18750R

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	7500	W	7500	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	2500	min^{-1}	2500	rpm
∗ Rated torque	T_R	48	N•m	490	kg·cm
∗ Continuous stall torque	T_S	54.9	N•m	560	kg·cm
∗ Instantaneous maximum stall torque	T_P	118	N•m	1200	kg·cm
∗ Rated armature current	I_R	58	Arms	58	Arms
∗ Continuous stall armature current	I_S	65	Arms	65	Arms
∗ Instantaneous maximum stall armature current	I_P	155	Arms	155	Arms
Torque constant	K_T	0.90	N·m/Arms	9.2	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	31.6	mV/min^{-1}	31.6	V/krpm
Phase armature resistance	R_ϕ	0.014	Ω	0.014	Ω
Electrical time constant	t_e	26	msec	26	msec
Mechanical time constant (not including sensor)	t_m	0.49	msec	0.49	msec
Inertia (including wiring-saved INC)	J_M	95.1×10^{-4}	kg·m^2 (GD^2/4)	97.0	g·cm·s^2
Inertia (including ABS-E)	J_M	95.1×10^{-4}	kg·m^2 (GD^2/4)	97.0	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	95.1×10^{-4}	kg·m^2 (GD^2/4)	97.0	g·cm·s^2
Applicable load inertia	J_L	951×10^{-4}	kg·m^2 (GD^2/4)	970	g·cm·s^2
Weight (including wiring-saved INC)	W_E	43.0	kg	43.0	kg
Weight (including ABS-E)	W_E	43.0	kg	43.0	kg
Weight (including ABS-RⅡ)	W_E	43.0	kg	43.0	kg

Holding Brake Data Sheet (Option)

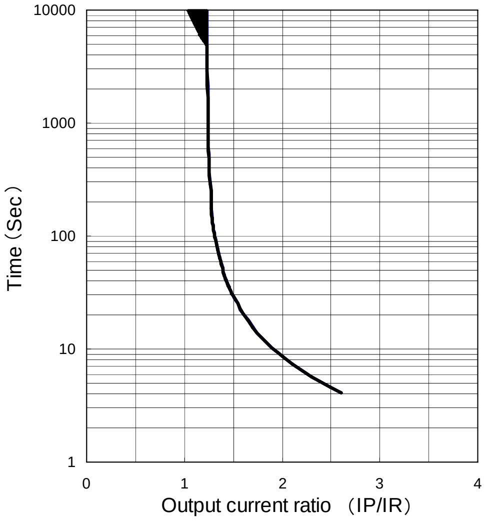
Holding torque	T_B	54.9	N·m	560	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	J_B	4.5×10^{-4}	kg·m^2(GD^2/4)	4.59	g·cm·s^2
Weight	W	6.0	kg	6.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 300A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P60B18750R（7.5kW）



Overload characteristics

P60B18750R(7.5kW)

P60B22550M

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	5500	W	5500	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	1500	min^{-1}	1500	rpm
∗ Rated torque	T_R	35.0	N•m	357	kg·cm
∗ Continuous stall torque	T_S	42.0	N•m	428	kg·cm
∗ Instantaneous maximum stall torque	T_P	90.0	N•m	918	kg·cm
∗ Rated armature current	I_R	28.8	Arms	28.8	Arms
∗ Continuous stall armature current	I_S	33.4	Arms	33.4	Arms
∗ Instantaneous maximum stall armature current	I_P	79.5	Arms	79.5	Arms
Torque constant	K_T	1.35	N·m/Arms	13.8	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	47.3	mV/min^{-1}	47.3	V/krpm
Phase armature resistance	R_ϕ	0.051	Ω	0.051	Ω
Electrical time constant	t_e	31	msec	31	msec
Mechanical time constant (not including sensor)	t_m	0.75	msec	0.75	msec
Inertia (including wiring-saved INC)	J_M	90.1×10^{-4}	kg·m^2 (GD^2/4)	92.1	g·cm·s^2
Inertia (including ABS-E)	J_M	90.2×10^{-4}	kg·m^2 (GD^2/4)	92.2	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	90.10×10^{-4}	kg·m^2 (GD^2/4)	91.87	g·cm·s^2
Applicable load inertia	J_L	901×10^{-4}	kg·m^2 (GD^2/4)	921	g·cm·s^2
Weight (including wiring-saved INC)	W_E	34.8	kg	34.8	kg
Weight (including ABS-E)	W_E	34.8	kg	34.8	kg
Weight (including ABS-RⅡ)	W_E	34.9	kg	34.9	kg

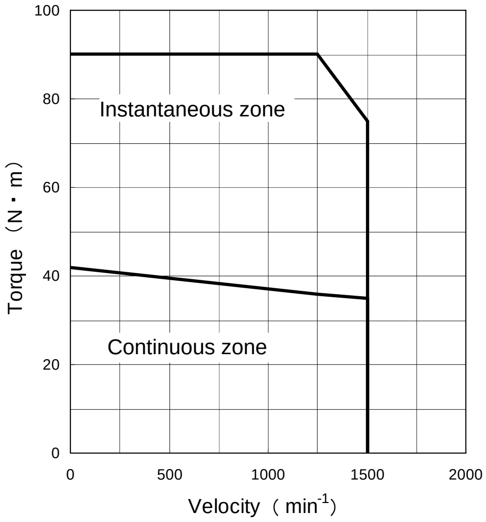
Holding Brake Data Sheet (Option)

Holding torque	T_B	90 or more	N·m	918 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.7/0.44	A (DC)	1.7/0.44	A (DC)
Inertia	J_B	24×10^{-4}	kg·m^2 (GD^2/4)	24	g·cm·s^2
Weight	W	10.4	kg	10.4	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

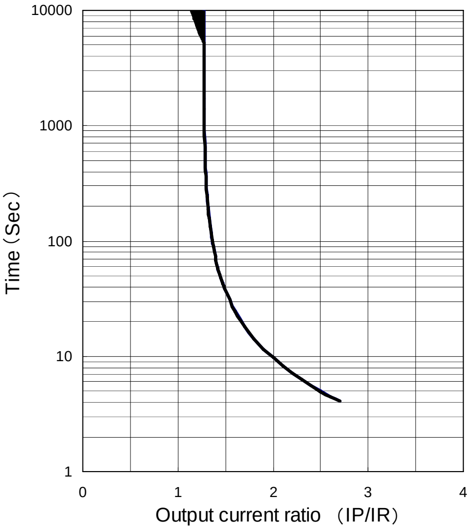
Velocity-torque characteristics

P60B22550M（5.5kW）



Overload characteristics

P60B22550M(5.5kW)



9. SPECIFICATIONS

P60B22700S

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	7000	W	7000	W
Rated revolution speed	N_R	1000	min^{-1}	1000	rpm
Maximum revolution speed	N_{max}	1000	min^{-1}	1000	rpm
* Rated torque	T_R	67.0	N•m	683	kg·cm
* Continuous stall torque	T_S	70.0	N•m	714	kg·cm
* Instantaneous maximum stall torque	T_P	150	N•m	1530	kg·cm
* Rated armature current	I_R	31.3	Arms	31.3	Arms
* Continuous stall armature current	I_S	32.4	Arms	32.4	Arms
* Instantaneous maximum stall armature current	I_P	77.1	Arms	77.1	Arms
Torque constant	K_T	2.32	N·m/Arms	23.7	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	80.9	mV/min^{-1}	80.9	V/krpm
Phase armature resistance	R_ϕ	0.063	Ω	0.063	Ω
Electrical time constant	t_e	32	msec	32	msec
Mechanical time constant (not including sensor)	t_m	0.62	msec	0.62	msec
Inertia (including wiring-saved INC)	J_M	177×10^{-4}	kg·m^2 (GD^2/4)	180	g·cm·s^2
Inertia (including ABS-E)	J_M	177×10^{-4}	kg·m^2 (GD^2/4)	180	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	177.0×10^{-4}	kg·m^2 (GD^2/4)	180.0	g·cm·s^2
Inertia (including ABS-RⅢ)	J_M	177.0×10^{-4}	kg·m^2 (GD^2/4)	180.0	g·cm·s^2
Applicable load inertia	J_L	1770×10^{-4}	kg·m^2 (GD^2/4)	1800	g·cm·s^2
Weight (including wiring-saved INC)	W_E	52.8	kg	52.8	kg
Weight (including ABS-E)	W_E	52.8	kg	52.8	kg
Weight (including ABS-RⅡ)	W_E	52.9	kg	52.9	kg
Weight (including ABS-RⅢ)	W_E	53.9	kg	53.9	kg

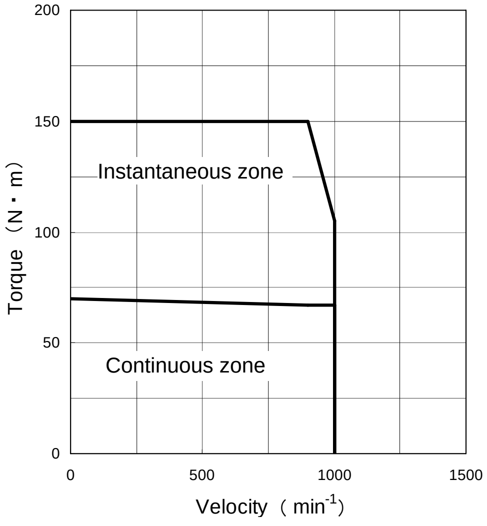
Holding Brake Data Sheet (Option)

Holding torque	T_B	90 or more	N·m	918 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.7/0.44	A (DC)	1.7/0.44	A (DC)
Inertia	J_B	24×10^{-4}	kg·m^2(GD^2/4)	24	g·cm·s^2
Weight	W	10.4	kg	10.4	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

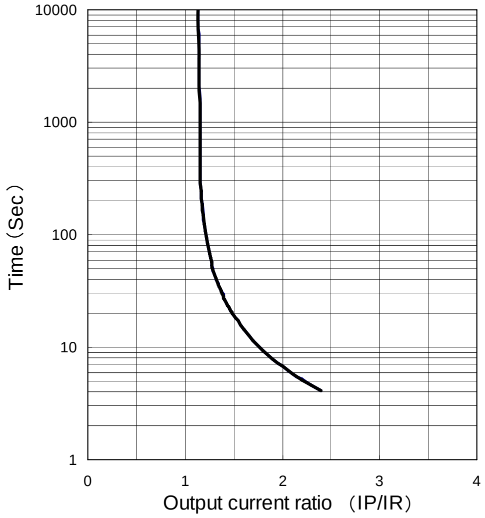
Velocity-torque characteristics

P60B22700S（7.0kW）



Overload characteristics

P60B22700S(7.0kW)



P60B2211KB

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	11000	W	11000	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
∗ Rated torque	T_R	70.0	N•m	714	kg·cm
∗ Continuous stall torque	T_S	88.3	N•m	900	kg·cm
∗ Instantaneous maximum stall torque	T_P	181	N•m	1850	kg·cm
∗ Rated armature current	I_R	51	Arms	51	Arms
∗ Continuous stall armature current	I_S	64	Arms	64	Arms
∗ Instantaneous maximum stall armature current	I_P	142	Arms	142	Arms
Torque constant	K_T	1.48	N·m/Arms	15.1	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	51.5	mV/min^{-1}	51.5	V/krpm
Phase armature resistance	R_ϕ	0.0155	Ω	0.0155	Ω
Electrical time constant	t_e	37	msec	37	msec
Mechanical time constant (not including sensor)	t_m	0.53	msec	0.53	msec
Inertia (including wiring-saved INC)	J_M	225×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	230	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	225×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	230	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	225×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	230	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	2250×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	2300	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	62.5	kg	62.5	kg
Weight (including ABS-E)	W_E	62.5	kg	62.5	kg
Weight (including ABS-RⅡ)	W_E	67.5	kg	67.5	kg

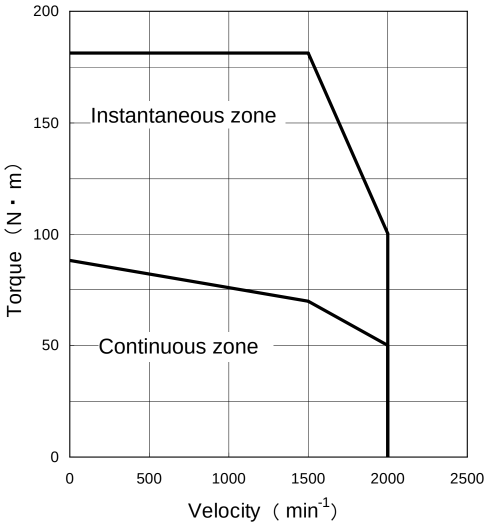
Holding Brake Data Sheet (Option)

Holding torque	T_B	90	N·m	918	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.7/0.44	A (DC)	1.7/0.44	A (DC)
Inertia	J_B	24×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	24	$g\cdot cm\cdot s^2$
Weight	W	10.4	kg	10.4	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t30 × 610 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 300A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

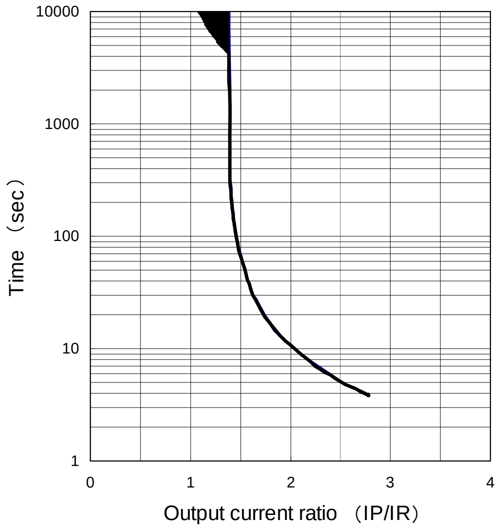
Velocity-torque characteristics

P60B2211KB（11kW）



Overload characteristics

P60B2211KB (11kW)



P60B2215KB

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	15000	W	15000	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
∗ Rated torque	T_R	95.5	N•m	974	kg·cm
∗ Continuous stall torque	T_S	95.5	N•m	974	kg·cm
∗ Instantaneous maximum stall torque	T_P	240	N•m	2450	kg·cm
∗ Rated armature current	I_R	58	Arms	58	Arms
∗ Continuous stall armature current	I_S	58	Arms	58	Arms
∗ Instantaneous maximum stall armature current	I_P	155	Arms	155	Arms
Torque constant	K_T	1.78	N·m/Arms	18.2	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	62.3	mV/min^{-1}	62.3	V/krpm
Phase armature resistance	R_ϕ	0.020	Ω	0.020	Ω
Electrical time constant	t_e	37	msec	37	msec
Mechanical time constant (not including sensor)	t_m	0.47	msec	0.47	msec
Inertia (including wiring-saved INC)	J_M	248×10^{-4}	kg·m^2 (GD^2/4)	253	g·cm·s^2
Inertia (including ABS-E)	J_M	248×10^{-4}	kg·m^2 (GD^2/4)	253	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	248×10^{-4}	kg·m^2 (GD^2/4)	253	g·cm·s^2
Applicable load inertia	J_L	2480×10^{-4}	kg·m^2 (GD^2/4)	2530	g·cm·s^2
Weight (including wiring-saved INC)	W_E	73.7	kg	73.7	kg
Weight (including ABS-E)	W_E	73.7	kg	73.7	kg
Weight (including ABS-RⅡ)	W_E	73.7	kg	73.7	kg

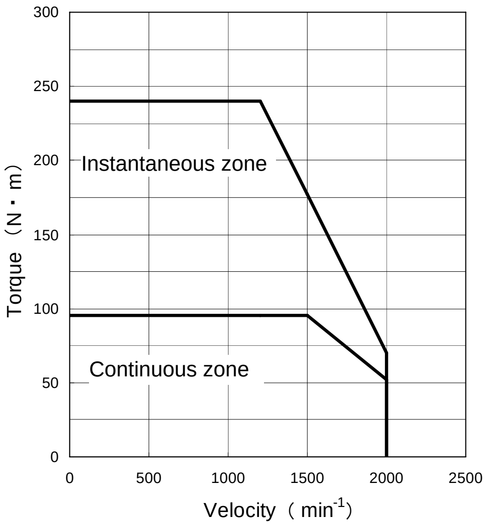
Holding Brake Data Sheet (Option)

Holding torque	T_B	90	N·m	918	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.7/0.44	A (DC)	1.7/0.44	A (DC)
Inertia	J_B	24×10^{-4}	kg·m^2(GD^2/4)	24	g·cm·s^2
Weight	W	10.4	kg	10.4	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t30 × 610 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 300A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

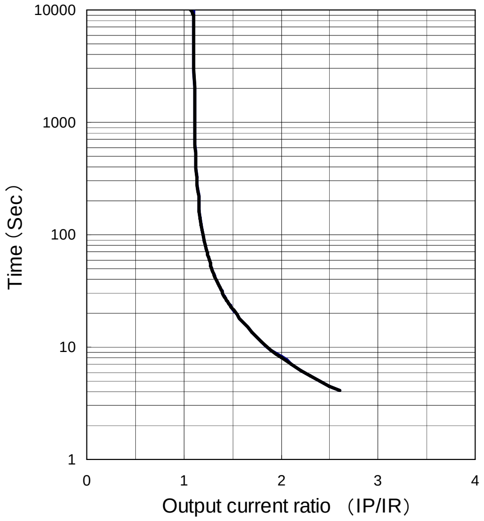
Velocity-torque characteristics

P60B2215KB（15kW）



Overload characteristics

P60B2215KB(15kW)



9.2.5.6 Motor Data Sheet P8

P80B15075H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	3.6	N•m	37	kg·cm
∗ Continuous stall torque	T_S	3.7	N•m	38	kg·cm
∗ Instantaneous maximum stall torque	T_P	9.0	N•m	92	kg·cm
∗ Rated armature current	I_R	5.2	Arms	5.2	Arms
∗ Continuous stall armature current	I_S	5.2	Arms	5.2	Arms
∗ Instantaneous maximum stall armature current	I_P	13.9	Arms	13.9	Arms
Torque constant	K_T	0.78	N·m/Arms	7.9	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	27.0	mV/min^{-1}	27.0	V/krpm
Phase armature resistance	R_ϕ	0.44	Ω	0.44	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	1.1	msec	1.1	msec
Inertia (including wiring-saved INC)	J_M	5.28×10^{-4}	kg·m^2 (GD^2/4)	5.38	g·cm·s^2
Inertia (including ABS-E)	J_M	5.35×10^{-4}	kg·m^2 (GD^2/4)	5.45	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	5.280×10^{-4}	kg·m^2 (GD^2/4)	5.383	g·cm·s^2
Applicable load inertia	J_L	52.8×10^{-4}	kg·m^2 (GD^2/4)	53.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	6.2	kg	6.2	kg
Weight (including ABS-E)	W_E	6.2	kg	6.2	kg
Weight (including ABS-RⅡ)	W_E	6.3	kg	6.3	kg

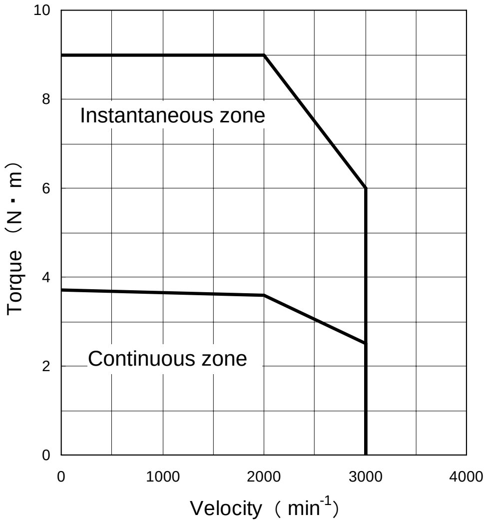
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.0 or more	N·m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2 (GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

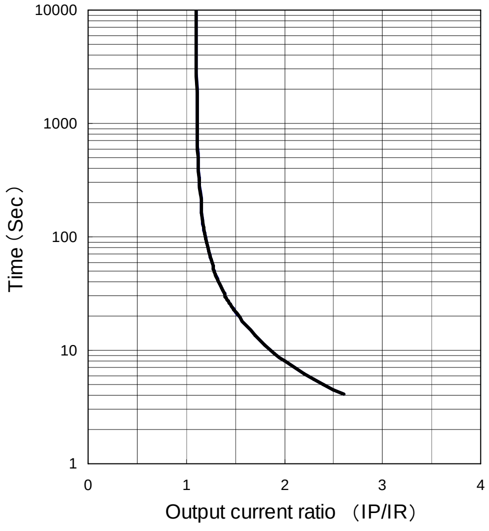
Velocity-torque characteristics

P80B15075H（750W）



Overload characteristics

P80B15075H(750W)



P80B18120H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1200	W	1200	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	5.6	N•m	57	kg·cm
∗ Continuous stall torque	T_S	6.5	N•m	66	kg·cm
∗ Instantaneous maximum stall torque	T_P	14.0	N•m	143	kg·cm
∗ Rated armature current	I_R	10.4	Arms	10.4	Arms
∗ Continuous stall armature current	I_S	10.8	Arms	10.8	Arms
∗ Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.73	N·m/Arms	7.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	25.3	mV/min^{-1}	25.3	V/krpm
Phase armature resistance	R_ϕ	0.22	Ω	0.22	Ω
Electrical time constant	t_e	18	msec	18	msec
Mechanical time constant (not including sensor)	t_m	1.5	msec	1.5	msec
Inertia (including wiring-saved INC)	J_M	12.1×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	12.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	12.2×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	12.2	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	12.10×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	12.34	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	121×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	121	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	10.0	kg	10.0	kg
Weight (including ABS-E)	W_E	10.0	kg	10.0	kg
Weight (including ABS-RⅡ)	W_E	10.1	kg	10.1	kg

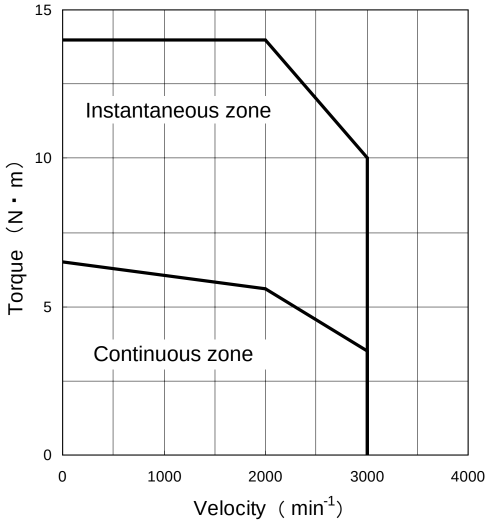
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.0 or more	N·m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	0.86/0.25	A (DC)	0.86/0.25	A (DC)
Inertia	J_B	0.5×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.5	$g\cdot cm\cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

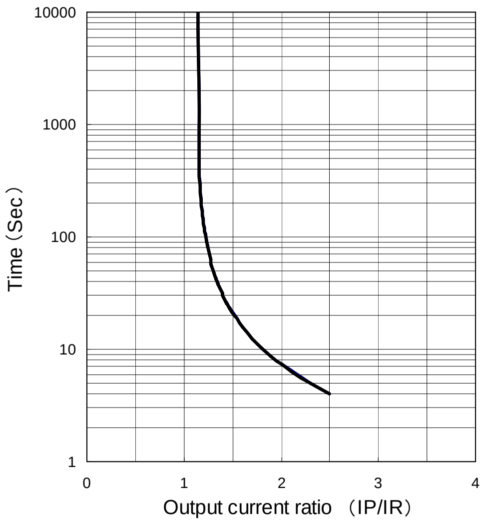
Velocity-torque characteristics

P80B18120H（1.2kW）



Overload characteristics

P80B18120H(1.2kW)



P80B22250H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	2500	W	2500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	12.0	N•m	122	kg·cm
∗ Continuous stall torque	T_S	13.5	N•m	138	kg·cm
∗ Instantaneous maximum stall torque	T_P	30.0	N•m	306	kg·cm
∗ Rated armature current	I_R	21.4	Arms	21.4	Arms
∗ Continuous stall armature current	I_S	22.4	Arms	22.4	Arms
∗ Instantaneous maximum stall armature current	I_P	55.0	Arms	55.0	Arms
Torque constant	K_T	0.66	N·m/Arms	6.7	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	23.0	mV/min^{-1}	23.0	V/krpm
Phase armature resistance	R_ϕ	0.056	Ω	0.056	Ω
Electrical time constant	t_e	27	msec	27	msec
Mechanical time constant (not including sensor)	t_m	1.1	msec	1.1	msec
Inertia (including wiring-saved INC)	J_M	27.1×10^{-4}	kg·m^2 (GD^2/4)	28.1	g·cm·s^2
Inertia (including ABS-E)	J_M	27.2×10^{-4}	kg·m^2 (GD^2/4)	28.2	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	27.10×10^{-4}	kg·m^2 (GD^2/4)	27.63	g·cm·s^2
Applicable load inertia	J_L	271×10^{-4}	kg·m^2 (GD^2/4)	281	g·cm·s^2
Weight (including wiring-saved INC)	W_E	15.5	kg	15.5	kg
Weight (including ABS-E)	W_E	15.5	kg	15.5	kg
Weight (including ABS-RⅡ)	W_E	15.6	kg	15.6	kg

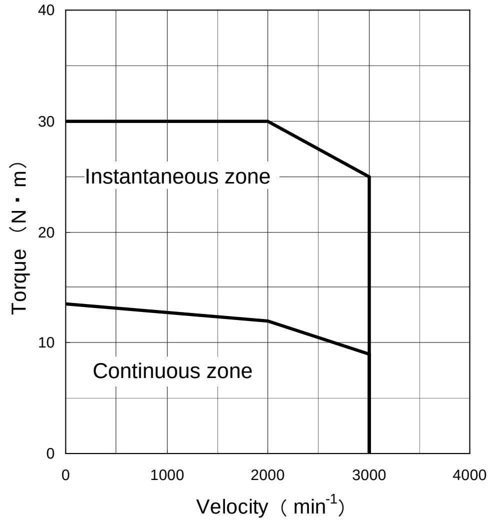
Holding Brake Data Sheet (Option)

Holding torque	T_B	32 or more	N·m	326 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.6/0.42	A (DC)	1.6/0.42	A (DC)
Inertia	J_B	9.9×10^{-4}	kg·m^2 (GD^2/4)	10.1	g·cm·s^2
Weight	W	5.9	kg	5.9	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

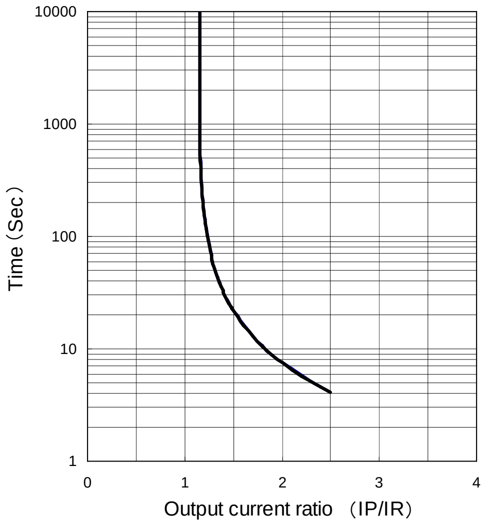
Velocity-torque characteristics

P80B22250H（2.5kW）



Overload characteristics

P80B22250H(2.5kW)



P80B22350R

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	3500	W	3500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2500	min^{-1}	2500	rpm
∗ Rated torque	T_R	17.0	N•m	173	kg·cm
∗ Continuous stall torque	T_S	22.0	N•m	224	kg·cm
∗ Instantaneous maximum stall torque	T_P	47.1	N•m	480	kg·cm
∗ Rated armature current	I_R	18.5	Arms	18.5	Arms
∗ Continuous stall armature current	I_S	22.9	Arms	22.9	Arms
∗ Instantaneous maximum stall armature current	I_P	54.6	Arms	54.6	Arms
Torque constant	K_T	1.03	N·m/Arms	10.5	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	35.8	mV/min^{-1}	35.8	V/krpm
Phase armature resistance	R_ϕ	0.063	Ω	0.063	Ω
Electrical time constant	t_e	29	msec	29	msec
Mechanical time constant (not including sensor)	t_m	0.77	msec	0.77	msec
Inertia (including wiring-saved INC)	J_M	43.1×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($\text{GD}^2/4$)	44.1	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	43.2×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($\text{GD}^2/4$)	44.2	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RⅡ)	J_M	43.10×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($\text{GD}^2/4$)	43.94	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	431×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($\text{GD}^2/4$)	441	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	18.5	kg	18.5	kg
Weight (including ABS-E)	W_E	18.5	kg	18.5	kg
Weight (including ABS-RⅡ)	W_E	18.6	kg	18.6	kg

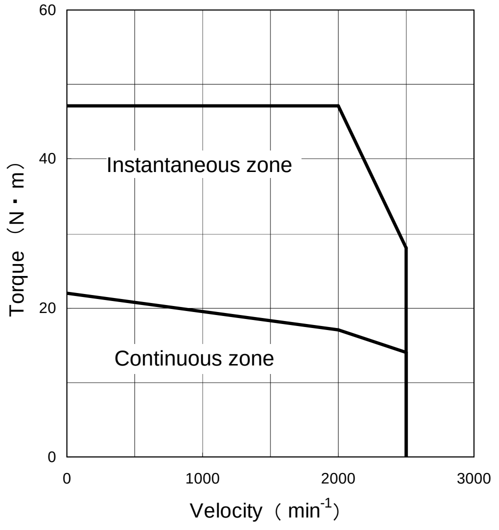
Holding Brake Data Sheet (Option)

Holding torque	T_B	32 or more	N·m	326 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.6/0.42	A (DC)	1.6/0.42	A (DC)
Inertia	J_B	9.9×10^{-4}	$\text{kg}\cdot\text{m}^2$ ($\text{GD}^2/4$)	10.1	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	5.9	kg	5.9	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 100A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

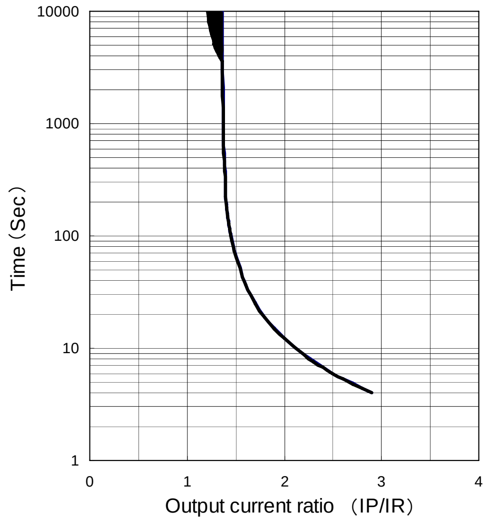
Velocity-torque characteristics

P80B22350R（3.5kW）



Overload characteristics

P80B22350R(3.5kW)



P80B22350H

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	3500	W	3500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	17.0	N•m	173	kg·cm
* Continuous stall torque	T_S	22.0	N•m	224	kg·cm
* Instantaneous maximum stall torque	T_P	50.0	N•m	510	kg·cm
* Rated armature current	I_R	24.3	Arms	24.3	Arms
* Continuous stall armature current	I_S	29.3	Arms	29.3	Arms
* Instantaneous maximum stall armature current	I_P	76.1	Arms	76.1	Arms
Torque constant	K_T	0.78	N·m/Arms	8.0	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	27.4	mV/min^{-1}	27.4	V/krpm
Phase armature resistance	R_ϕ	0.036	Ω	0.036	Ω
Electrical time constant	t_e	31	msec	31	msec
Mechanical time constant (not including sensor)	t_m	0.76	msec	0.76	msec
Inertia (including wiring-saved INC)	J_M	43.1×10^{-4}	kg·m^2 (GD^2/4)	44.1	g·cm·s^2
Inertia (including ABS-E)	J_M	43.2×10^{-4}	kg·m^2 (GD^2/4)	44.2	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	43.10×10^{-4}	kg·m^2 (GD^2/4)	43.94	g·cm·s^2
Applicable load inertia	J_L	431×10^{-4}	kg·m^2 (GD^2/4)	441	g·cm·s^2
Weight (including wiring-saved INC)	W_E	18.5	kg	18.5	kg
Weight (including ABS-E)	W_E	18.5	kg	18.5	kg
Weight (including ABS-RⅡ)	W_E	18.6	kg	18.6	kg

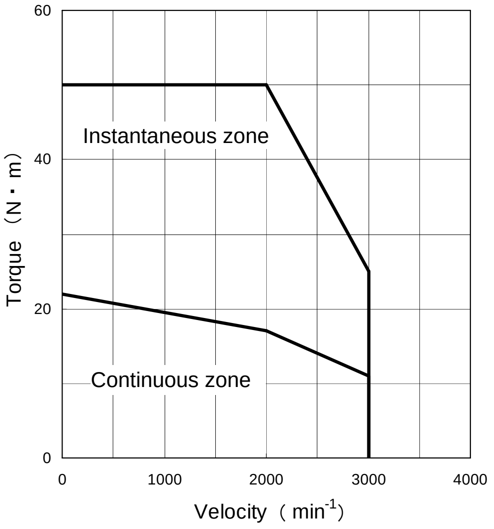
Holding Brake Data Sheet (Option)

Holding torque	T_B	32 or more	N·m	326 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.6/0.42	A (DC)	1.6/0.42	A (DC)
Inertia	J_B	9.9×10^{-4}	kg·m^2 (GD^2/4)	10.1	g·cm·s^2
Weight	W	5.9	kg	5.9	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

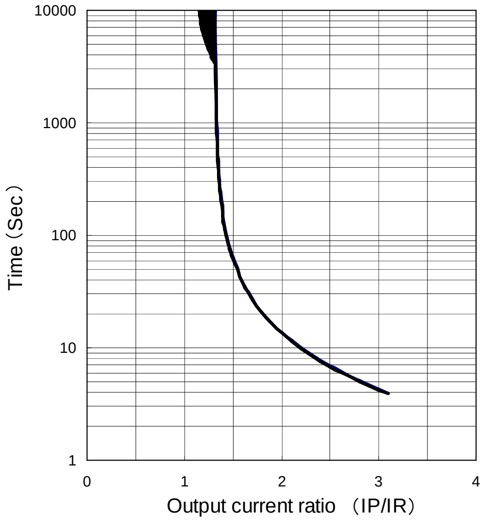
Velocity-torque characteristics

P80B22350H（3.5kW）



Overload characteristics

P80B22350H(3.5kW)



P80B22450R

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	4500	W	4500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2500	min^{-1}	2500	rpm
* Rated torque	T_R	21.5	N•m	219	kg·cm
* Continuous stall torque	T_S	32.0	N•m	326	kg·cm
* Instantaneous maximum stall torque	T_P	70.0	N•m	714	kg·cm
* Rated armature current	I_R	24.1	Arms	24.1	Arms
* Continuous stall armature current	I_S	31.6	Arms	31.6	Arms
* Instantaneous maximum stall armature current	I_P	79.7	Arms	79.7	Arms
Torque constant	K_T	1.05	N·m/Arms	10.7	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	36.7	mV/min^{-1}	36.7	V/krpm
Phase armature resistance	R_ϕ	0.043	Ω	0.043	Ω
Electrical time constant	t_e	33	msec	33	msec
Mechanical time constant (not including sensor)	t_m	0.68	msec	0.68	msec
Inertia (including wiring-saved INC)	J_M	58.1×10^{-4}	kg·m^2 (GD^2/4)	59.1	g·cm·s^2
Inertia (including ABS-E)	J_M	58.2×10^{-4}	kg·m^2 (GD^2/4)	59.2	g·cm·s^2
Inertia (including ABS-RⅡ)	J_M	58.10×10^{-4}	kg·m^2 (GD^2/4)	59.24	g·cm·s^2
Applicable load inertia	J_L	581×10^{-4}	kg·m^2 (GD^2/4)	591	g·cm·s^2
Weight (including wiring-saved INC)	W_E	22.0	kg	22.0	kg
Weight (including ABS-E)	W_E	22.0	kg	22.0	kg
Weight (including ABS-RⅡ)	W_E	22.1	kg	22.1	kg

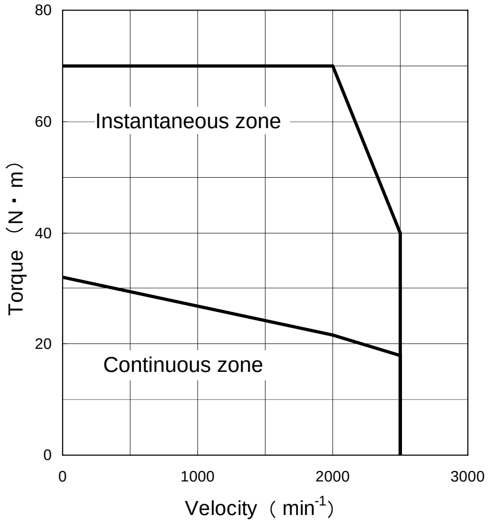
Holding Brake Data Sheet (Option)

Holding torque	T_B	32 or more	N·m	326 or more	kg·cm
Exciting voltage	V_B	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	I_B	1.6/0.42	A (DC)	1.6/0.42	A (DC)
Inertia	J_B	9.9×10^{-4}	kg·m^2 (GD^2/4)	10.1	g·cm·s^2
Weight	W	5.9	kg	5.9	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F (20°C). Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 150A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

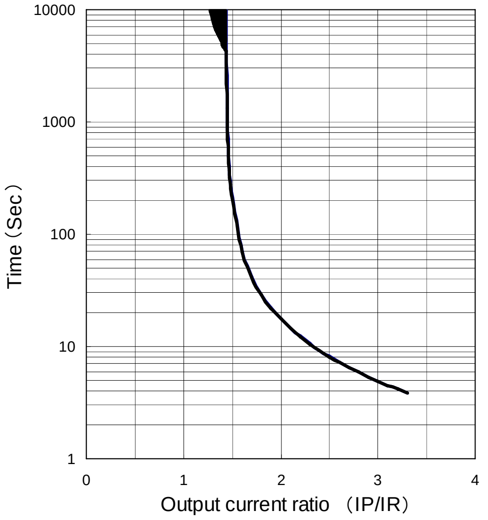
Velocity-torque characteristics

P80B22450R（4.5kW）



Overload characteristics

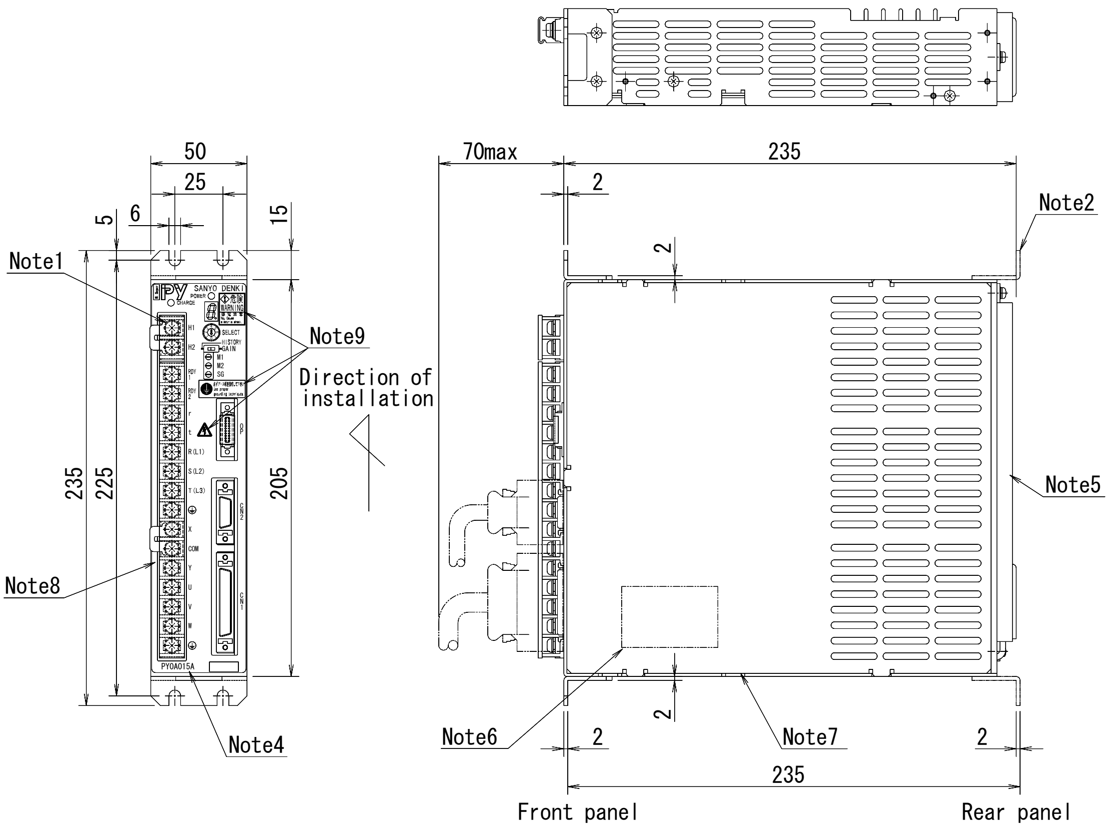
P80B22450R(4.5kW)



9.3 External Views

9.3.1 Servo Amplifier

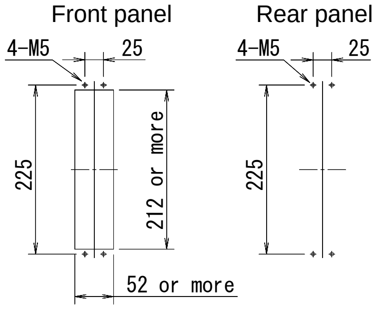
PY0A015,030



Note 1: Terminal screw M4
Tightening torque 1.18 N･m (12kg･cm)

Note 2: Mountable on the rear side.

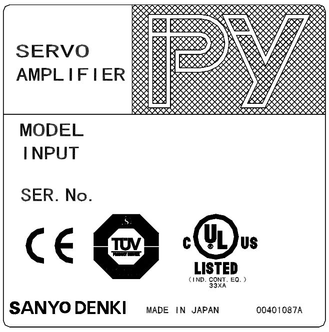
Note 3: Mounting panel working drawing
(in case of rear-side-mounting)



Note 4: Indication of AMP model No.

Note 5: Regenerative resistance

Note 6: Main nameplate (left side, Scale 1:1)



Nameplate may change according to the standard acquisition.

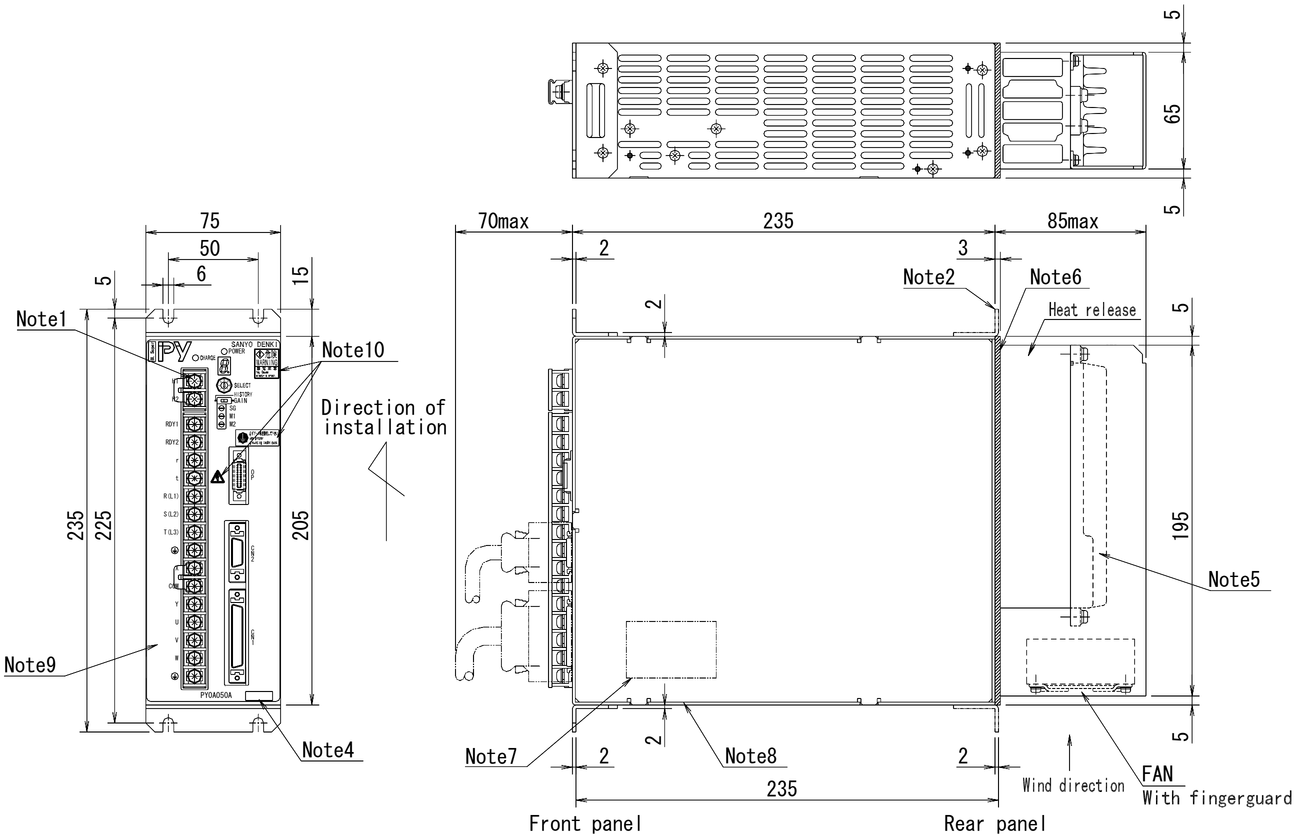
Note 7: Main body material : SPCC/chromated

Note 8: Front panel: Resin sheet

Note 9: Warning label (Scale 1:1)

9. SPECIFICATIONS

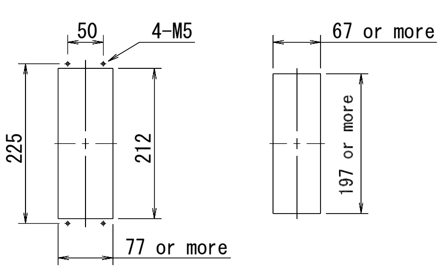
PY0A050



Note 1: Terminal screw M4
Tightening torque 1.18 N･m (12kg･cm)

Note 2: Mountable on the rear side.

Note 3: Mounting panel working drawing
(in case of rear-side-mounting)

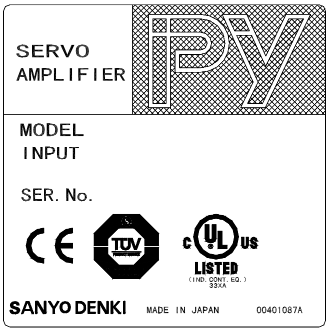


Note 4: Indication of AMP model No.

Note 5: Regenerative resistance

Note 6: Rubber packing

Note 7: Main nameplate (left side, Scale 1:1)



SERVO
AMPLIFIER
MODEL
INPUT
SER. No.
LISTED
(IND. CONT. EQ.)
33XA
SANYO DENKI MADE IN JAPAN 00401087A

Nameplate may change according to the standard acquisition.

Note 8: Main body material : SPCC/chromated

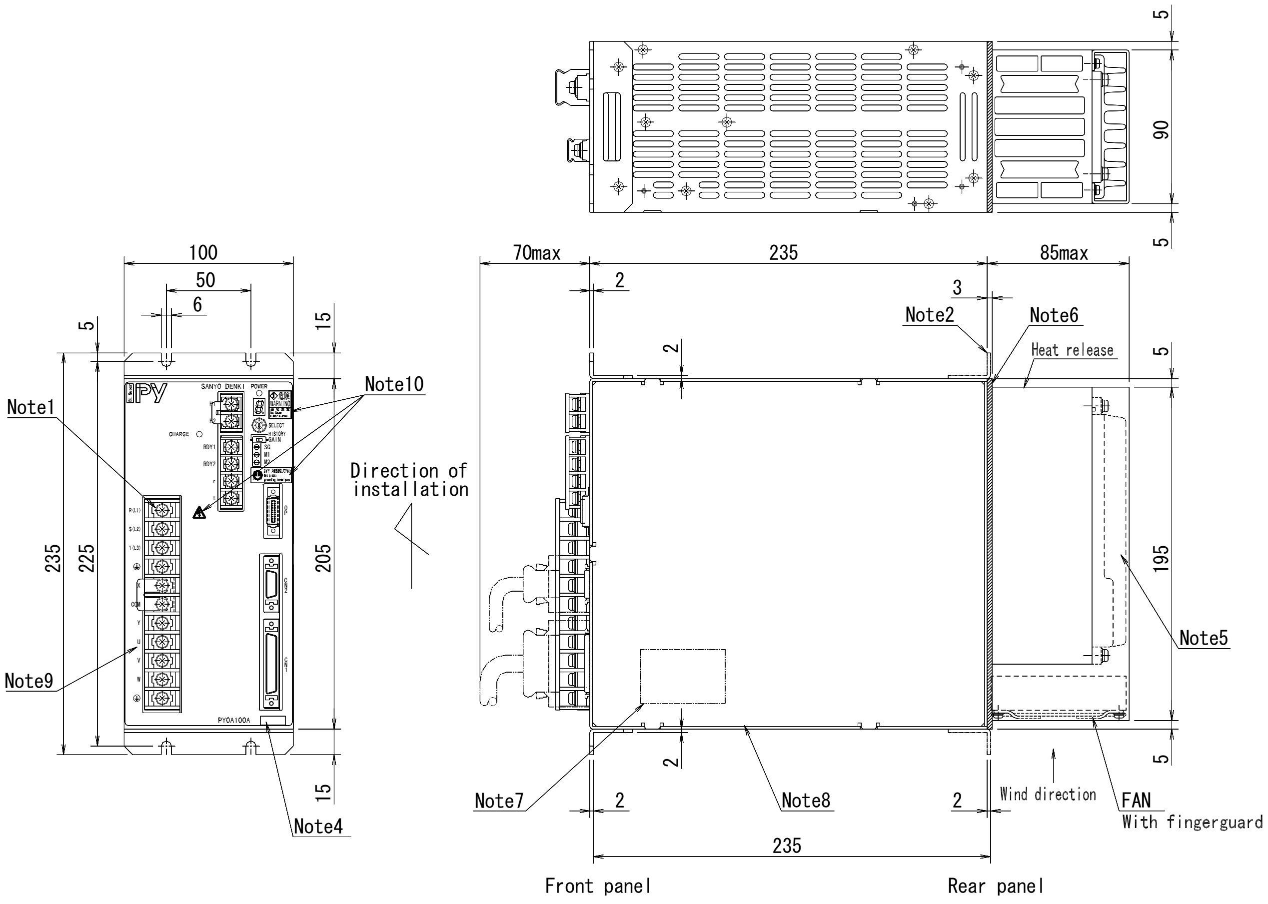
Note 9: Front panel: Resin sheet

Note 10: Warning label (Scale 1:1)

危険
WARNING
感 電 注 意
May Cause electric shock.

必ずアース線を接続して下さい
Use proper grounding techniques.

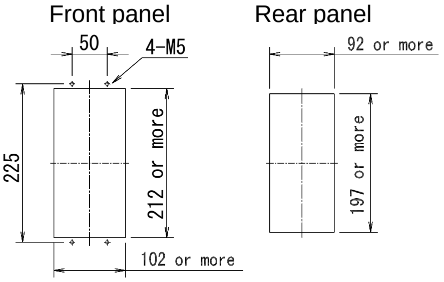
PY0A100



Note 1: Terminal screw M4
Tightening torque 1.18 N･m (12kg･cm)

Note 2: Mountable on the rear side.

Note 3: Mounting panel working drawing
(in case of front-side-mounting)

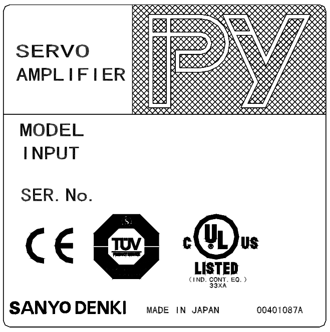


Note 4: Indication of AMP model No.

Note 5: Regenerative resistance

Note 6: Rubber packing

Note 7: Main nameplate (left side, Scale 1:1)



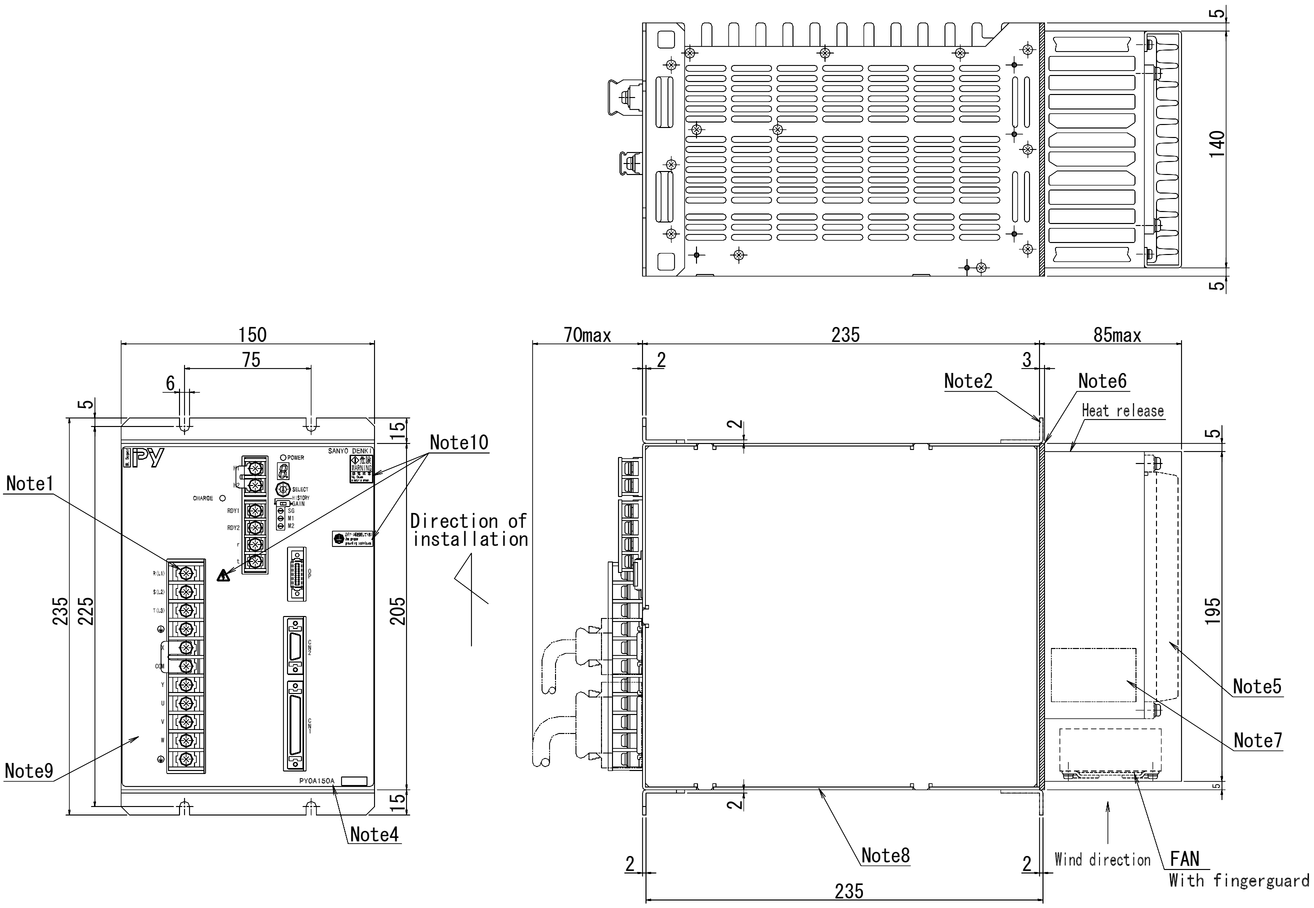
Nameplate may change according to the standard acquisition.

Note 8: Main body material : SPCC/chromated

Note 9: Front panel: Resin sheet

Note 10: Warning label (Scale 1:1)

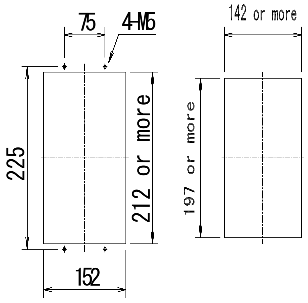
PY0A150



Note 1: Terminal screw M4
Tightening torque 1.18 N･m (12kg･cm)

Note 2: Mountable on the rear side.

Note 3: Mounting panel working drawing
(in case of front-side-mounting)

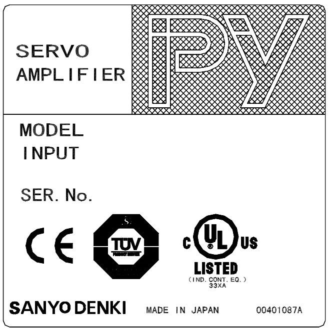

Front panel Rear panel

Note 4: Indication of AMP model No.

Note 5: Regenerative resistance

Note 6: Rubber packing

Note 7: Main nameplate (left side, Scale 1:1)



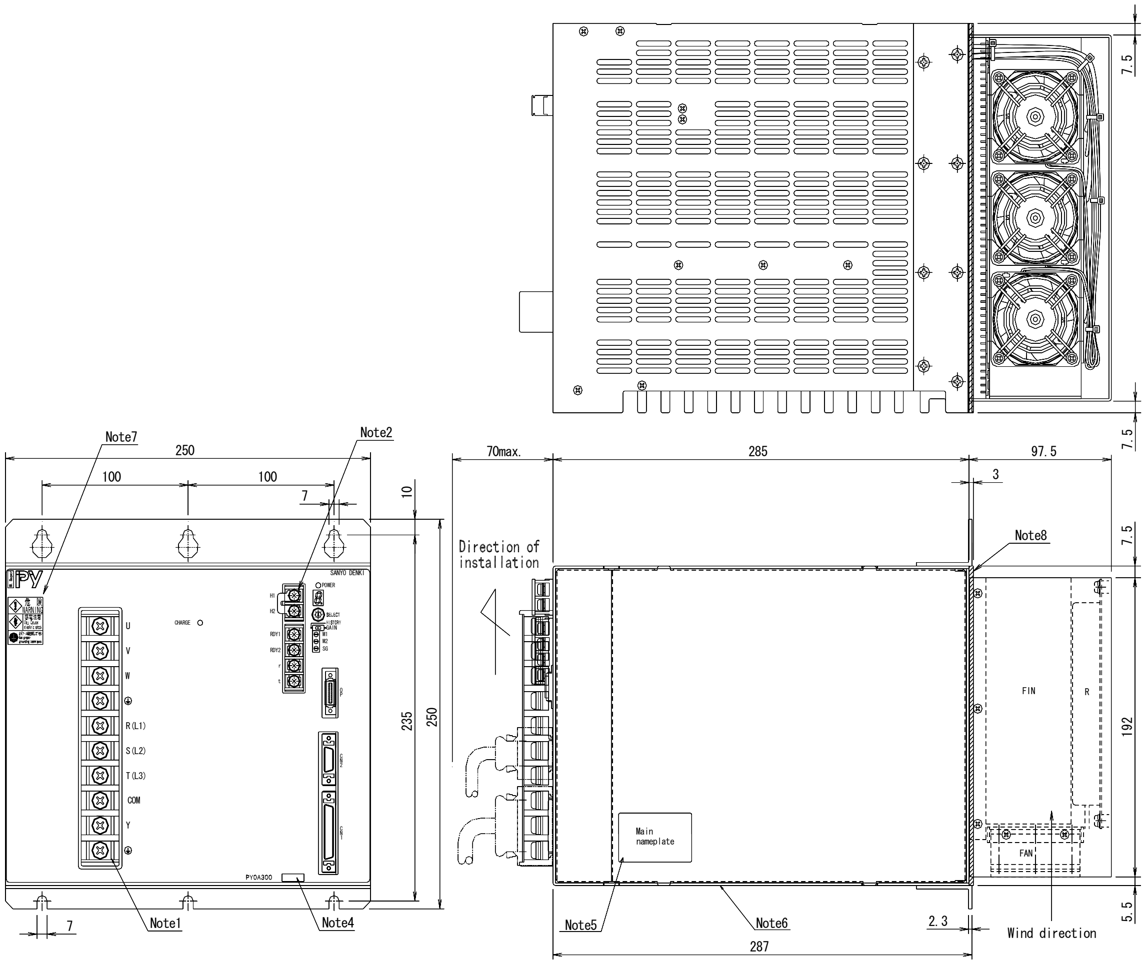
Nameplate may change according to the standard acquisition.

Note 8: Main body material : SPCC/chromated

Note 9: Front panel: Resin sheet

Note 10: Warning label (Scale 1:1)

PY0A300

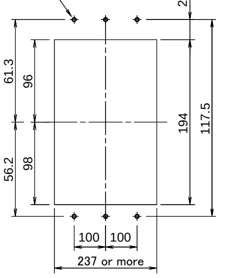


Note 1: Terminal screw M6
Tightening torque 5.4 N･m (55kg･cm)

Note 2: Terminal screw M4
Tightening torque 1.18 N･m (12kg･cm)

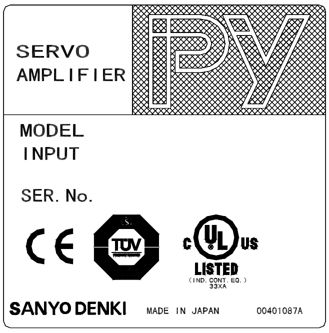
Note 3: Mountable working drawing

Rear panel



Note 4: Indication of AMP model No.

Note 5: Main nameplate (right side, Scale 1:1)



Nameplate may change according to the standard acquisition.

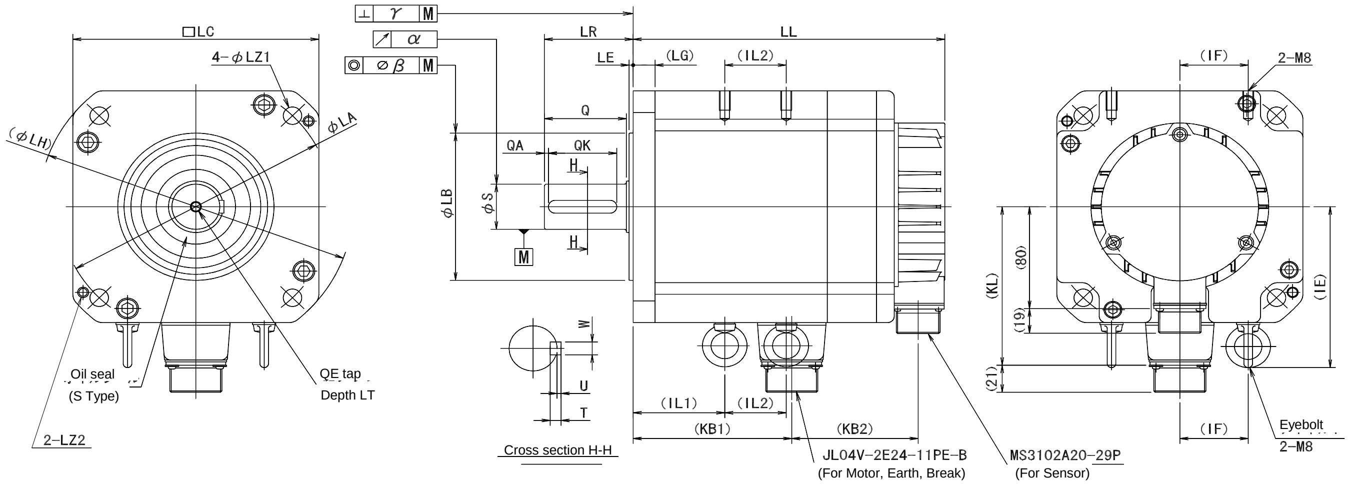
Note 6: Main body material : SPCC/chromated

Note 7: Warning label (Scale 1:1)

Note 8: Rubber packing

9.3.2 Servomotor

P1 Motor (incremental encoder type)
(absolute sensor type)



Unit：mm

	Incremental encoder Absolute sensor				Connector (Motor) ⚠										
	Without B		With B		Motor earth			B (With B only)							
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH
P10B10030△□◇	182	53	225	96	18-10P	76	19	20-15P	76	19	10	115	0 95-0.035	3	130
P10B10075△□◇	272		315												
P10B13050△□◇	176	56	216	97	18-10P	91	19	20-15P	91	19	12	145	0 110-0.035	6	165
P10B13100△□◇	221		261												
P10B13150△□◇	272		312												
P10B18200△□◇	230	52	278	100	22-22P	118	19	24-11P	118	21	16	20	0 114.3-0.035	3	230
P10B18350△□◇	280		328												
P10B18450△□◇	350		398		24-10P										
P10B18550△□◇	501		565	116			21				19				

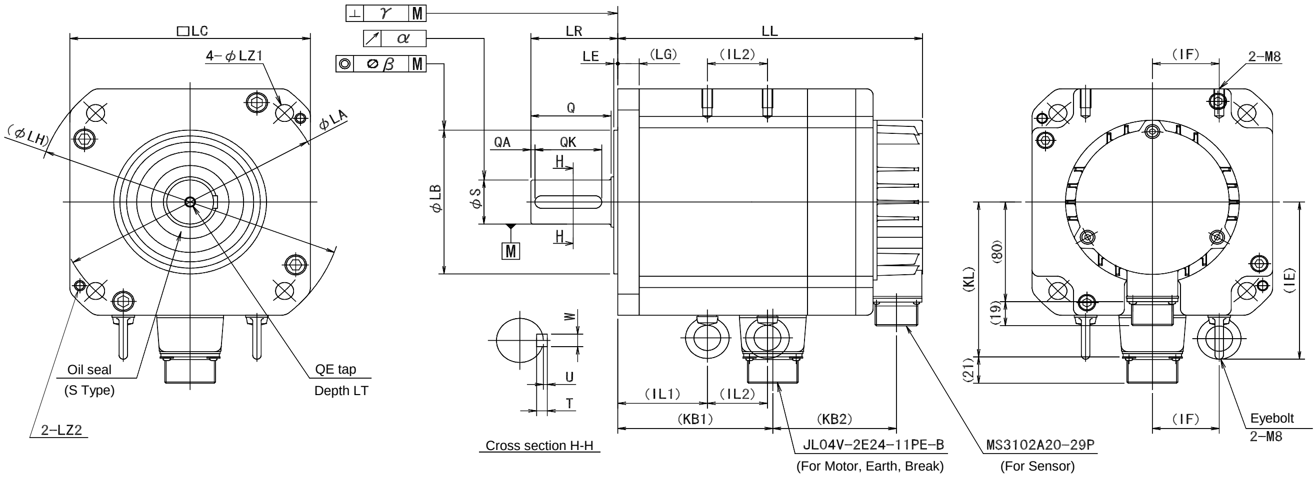
				Shaft												
				Standard (61BM compatible)			High rigidity									
MODEL	LC	LZ1	LZ2	LR	S	Q	LR	S	Q	KB1	KL3	α	β	γ	IL1	IL2
P10B10030△□◇	100	9	-	35	0 16-0.011	30	45	0 22-0.013	40	108	64	0.02	0.04	0.04	-	-
P10B10075△□◇								0 25-0.013		198						
P10B13050△□◇	130	9	M6	58	0 19-0.013	52	58	0 25-0.013	40	100	80	0.02	0.04	0.04	-	-
P10B13100△□◇										145						
P10B13150△□◇					0 21-0.013	40		0 35-0.016		196						
P10B18200△□◇	180	13.5	M8	79	0.01 35.0	76	79	0 48-0.016	76	158	80	0.02	0.04	0.04	27	113
P10B18350△□◇										208						163
P10B18450△□◇										278						233
P10B18550△□◇				110	0 42-0.016	110	110	0 63-0.019	110	429		0.04	0.04	0.04	30	381

⚠

Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

P10B18550H Motor has cooling fan. Since its external view is different, consult with us when required.

P1 Motor (absolute encoder type)



Unit：mm

	Absolute encoder				Connector ⚠										
	Without B		With B		Motor earth			B (With B only)							
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH
P10B10030△□◇	234	73	277	116	18-10P	76	19	20-15P	76	19	10	115	0 95-0.035	3	130
P10B10075△□◇	324		367												
P10B13050△□◇	214	61	253	100	18-10P	91	19	20-15P	91	19	12	145	0 110-0.035	6	165
P10B13100△□◇	259		298												
P10B13150△□◇	310		349												
P10B18200△□◇	269	58	317	106	22-22P	118	19	24-11P	118	21	16	20	0 114.3-0.035	3	230
P10B18350△□◇	319		367												
P10B18450△□◇	389		437		24-10P										
P10B18550△□◇	554		604	122			21				19				

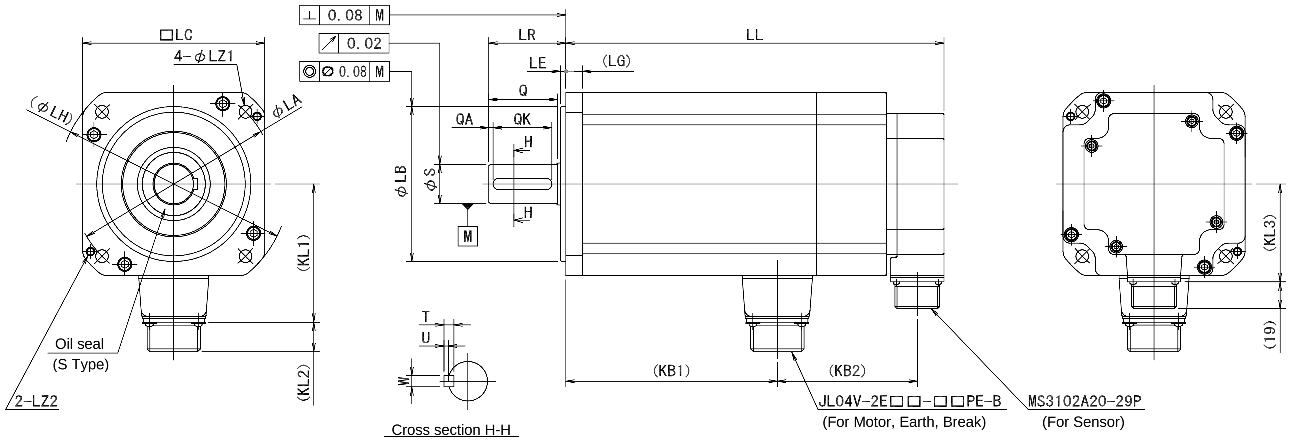
				Shaft												
				Standard (61BM compatible)			High rigidity									
MODEL	LC	LZ1	LZ2	LR	S	Q	LR	S	Q	KB1	KL3	α	β	γ	IL1	IL2
P10B10030△□◇	100	9	-	35	0 16-0.011	30	45	0 22-0.013	40	108	96	0.02	0.04	0.04	-	-
P10B10075△□◇								0 25-0.013		198						
P10B13050△□◇	130	9	M6	58	0 19-0.013	52	58	0 25-0.013	40	100	96	0.02	0.04	0.04	-	-
P10B13100△□◇										145						
P10B13150△□◇					0 21-0.013	40		0 35-0.016		196						
P10B18200△□◇	180	13.5	M8	79	0.01 35.0	76	79	0 48-0.016	76	158	111	0.02	0.04	0.04	27	113
P10B18350△□◇										208						163
P10B18450△□◇										278						233
P10B18550△□◇				110	0 42-0.016	110	110	0 63-0.019	110	429		0.04	0.04	0.04	30	381

⚠

Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

P10B18550H Motor has cooling fan. Since its external view is different, consult with us when required.

P2 Motor (incremental encoder type)



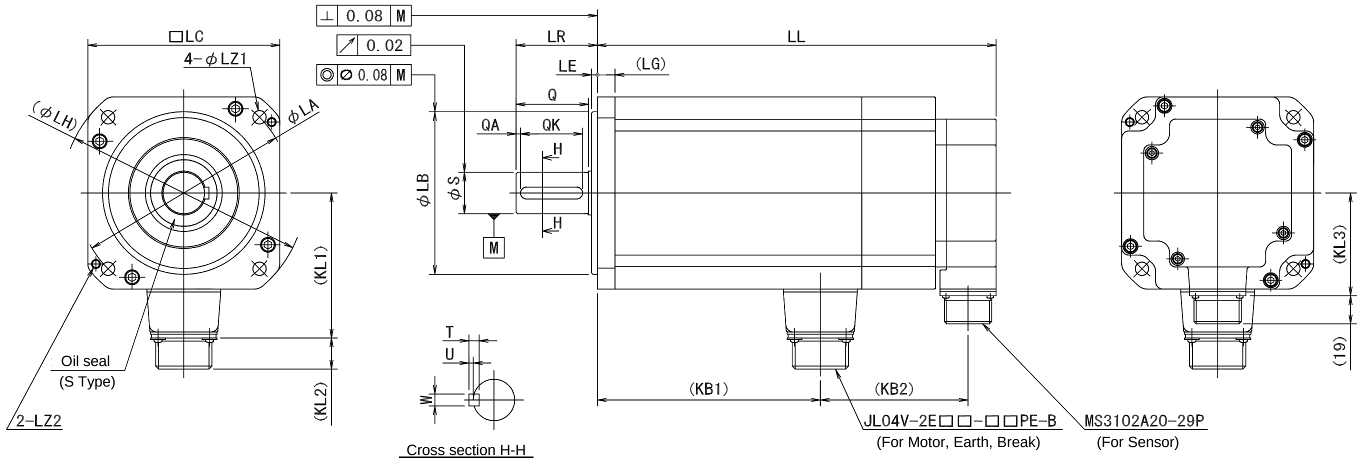
Unit : mm

	Without B		With B		Connector	⚠								
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH	LC	LZ1
P20B10100△□◇	147	48	191	92	20-15P	76	19	10	115	0 95-0.035	3	130	100	9
P20B10150△□◇	172		216											
P20B10200△□◇	197		241											
P20B10250△□◇	222		266											
P20B13300△□◇	194	58	236		24-11P	98	21	12	145	0 110-0.035	4	165	130	9
P20B13400△□◇	228		270											
P20B13500△□◇	267		309											

MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	KL3
P20B10100△□◇	-	45	0 22-0.013	40	3	32	0 6-0.030	6	2.5	80	70
P20B10150△□◇										105	
P20B10200△□◇										130	
P20B10250△□◇										155	
P20B13300△□◇	M6	55	28-0.013	50	3	42	0 8-0.036	7	3	117	
P20B13400△□◇										151	
P20B13500△□◇										190	

Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

P2 Motor (absolute encoder type)



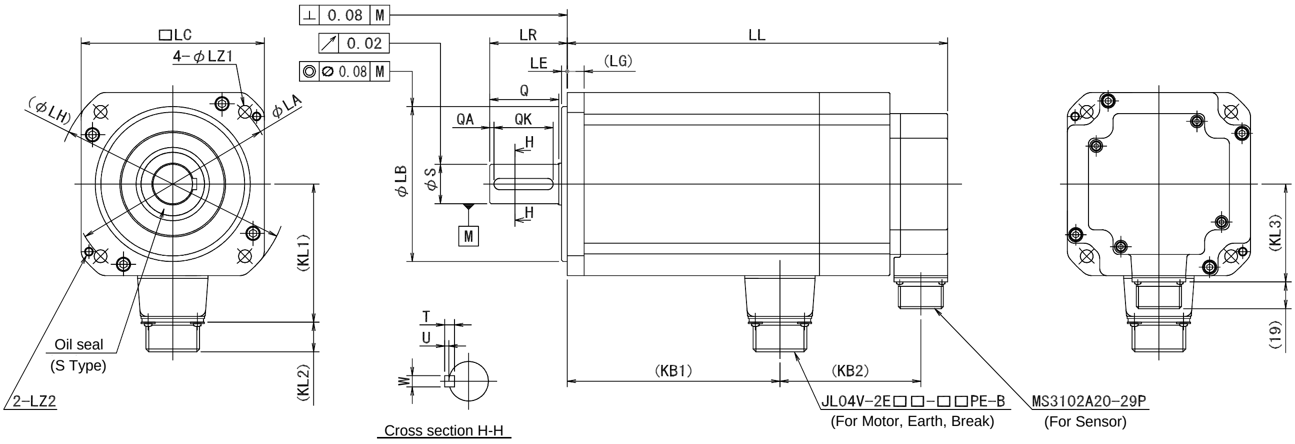
Unit : mm

	Without B		With B		Connector	⚠								
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH	LC	LZ1
P20B10100△□◇	187	88	231	132	20-15P	76	19	10	115	0 95-0.035	3	130	100	9
P20B10150△□◇	212		256											
P20B10200△□◇	237		281											
P20B10250△□◇	262		306											
P20B13300△□◇	234	98	276	140	24-11P	98	21	12	145	0 110-0.035	4	165	130	9
P20B13400△□◇	268		310											
P20B13500△□◇	307		349											

MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	KL3
P20B10100△□◇	-	45	0 22-0.013	40	3	32	0 6-0.030	6	2.5	80	80
P20B10150△□◇										105	
P20B10200△□◇										130	
P20B10250△□◇										155	
P20B13300△□◇	M6	55	28-0.013	50	3	42	0 8-0.036	7	3	117	
P20B13400△□◇										151	
P20B13500△□◇										190	

⚠ Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

P2 Motor (absolute sensor type)



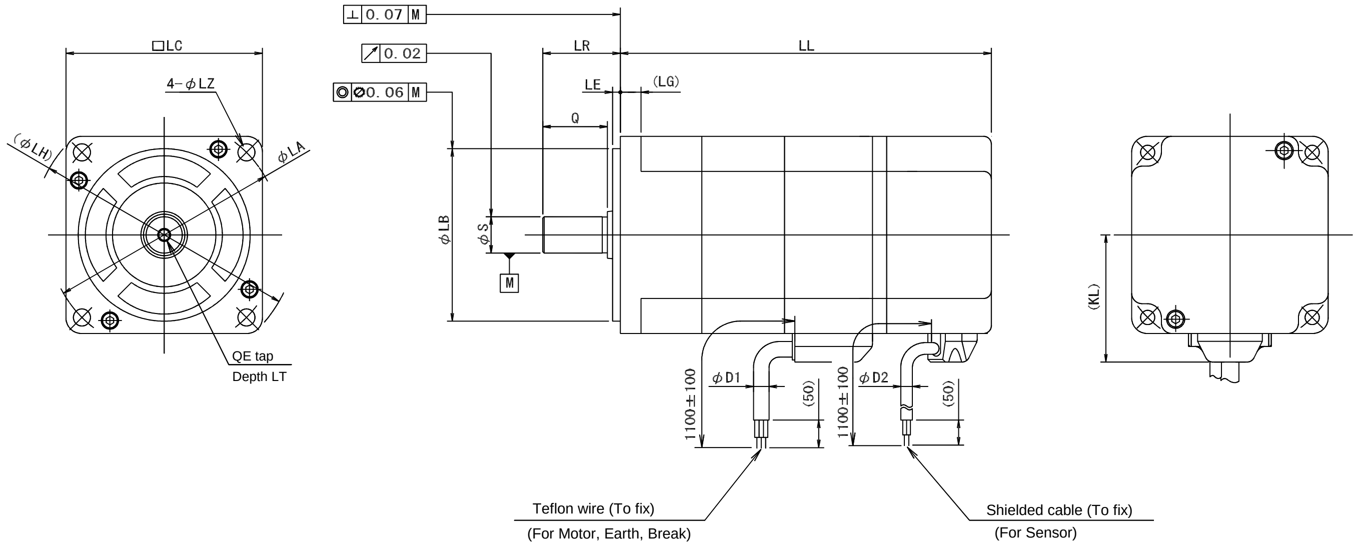
Unit：mm

	Without B		With B		Connector	⚠								
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH	LC	LZ1
P20B10100△□◇	177	78	221	122	20-15P	76	19	10	115	0 95-0.035	3	130	100	9
P20B10150△□◇	202		246											
P20B10200△□◇	227		271											
P20B10250△□◇	252		296											
P20B13300△□◇	224	88	266	130	24-11P	98	21	12	145	0 110-0.035	4	165	130	9
P20B13400△□◇	258		300											
P20B13500△□◇	297		339											

MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	KL3
P20B10100△□◇	-	45	0 22-0.013	40	3	32	0 6-0.030	6	2.5	80	80
P20B10150△□◇										105	
P20B10200△□◇										130	
P20B10250△□◇										155	
P20B13300△□◇	M6	55	28-0.013	50	3	42	0 8-0.036	7	3	117	
P20B13400△□◇										151	
P20B13500△□◇										190	

⚠ Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

P3 Motor (incremental encoder type)
(absolute sensor type)



Incremental encoder type

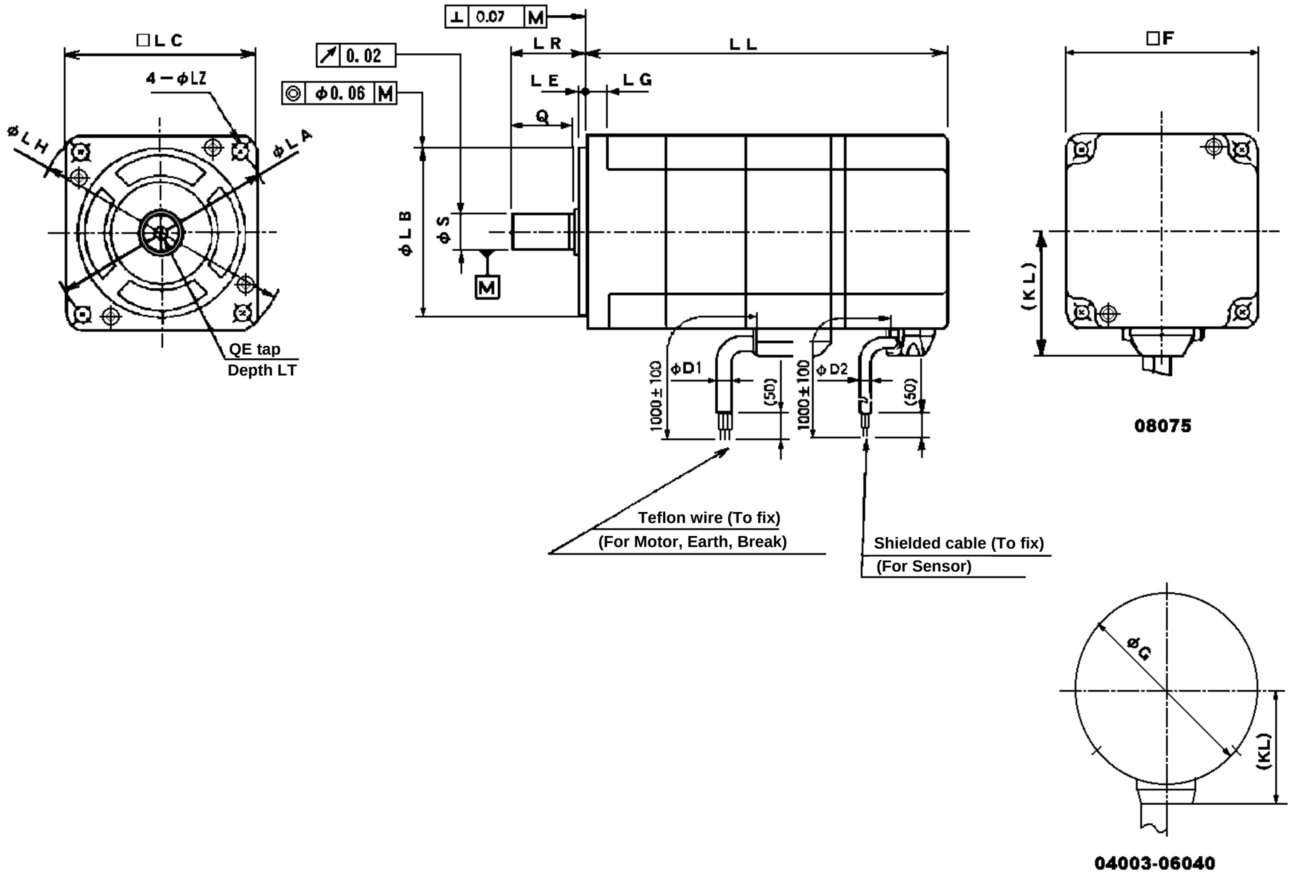
Unit：mm

	Without B	With B															
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2
P30B04003△□◇	64	102.5	5	30	46	0 30-0.021	2.5	54	40	4.5	25	0 6-0.008	–	–	–	6	4.7
P30B04005△□◇	70	108.5										0 8-0.009		–	–		
P30B04010△□◇	88	126.5															
P30B06020△□◇	95.5	133.5	6	41	70	0 50-0.025	3	81	60	5.5	30	0 14-0.011		M5	12	6.7	
P30B06040△□◇	123.5	161.5															
P30B08075△□◇	140	180.5	8	52	90	0 70-0.030	3	107	80	6.6	40	0 16-0.011	35				

Absolute sensor type

	Without B	With B															
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2
P30B04003△□◇	70	108.5	5	30	46	0 30-0.021	2.5	54	40	4.5	25	0 6-0.008	–	–	–	6	5.1
P30B04005△□◇	76	114.5										0 8-0.009					
P30B04010△□◇	94	132.5															
P30B06020△□◇	101	149.5	6	41	70	0 50-0.025	3	81	60	5.5	30	0 14-0.011		M5	12	6.7	
P30B06040△□◇	129	167															
P30B08075△□◇	140	180.5	8	52	90	0 70-0.030	3	107	80	6.6	40	0 16-0.011	35				

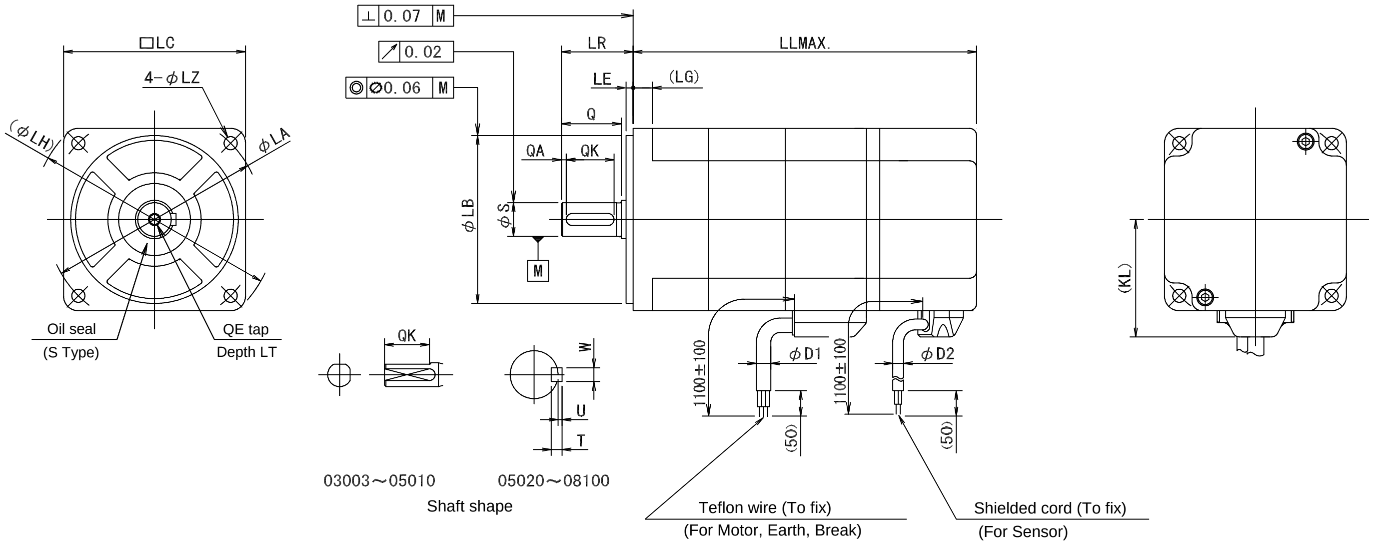
P3 Motor (absolute encoder type)



Unit：mm

	Without B	With B																	
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	F	G	S	Q	QE	LT	D1	D2
P30B04003△□◇	101.5	140	5	38	46	$30^{0}_{-0.021}$	2.5	54	40	4.5	25	—	60	$6^{0}_{-0.008}$	—	—	—	6	7.1
P30B04005△□◇	107.5	146												$8^{0}_{-0.009}$		—	—		
P30B04010△□◇	125	163.5																	
P30B06020△□◇	134	172	6	41	70	$50^{0}_{-0.025}$	3	81	60	5.5	30	—	90	$14^{0}_{-0.011}$		M5	12	6.7	
P30B06040△□◇	162	200																	
P30B08075△□◇	177	217.5	8	52	90	$70^{0}_{-0.030}$	3	107	80	6.6	40	80	—	$16^{0}_{-0.011}$	35				8

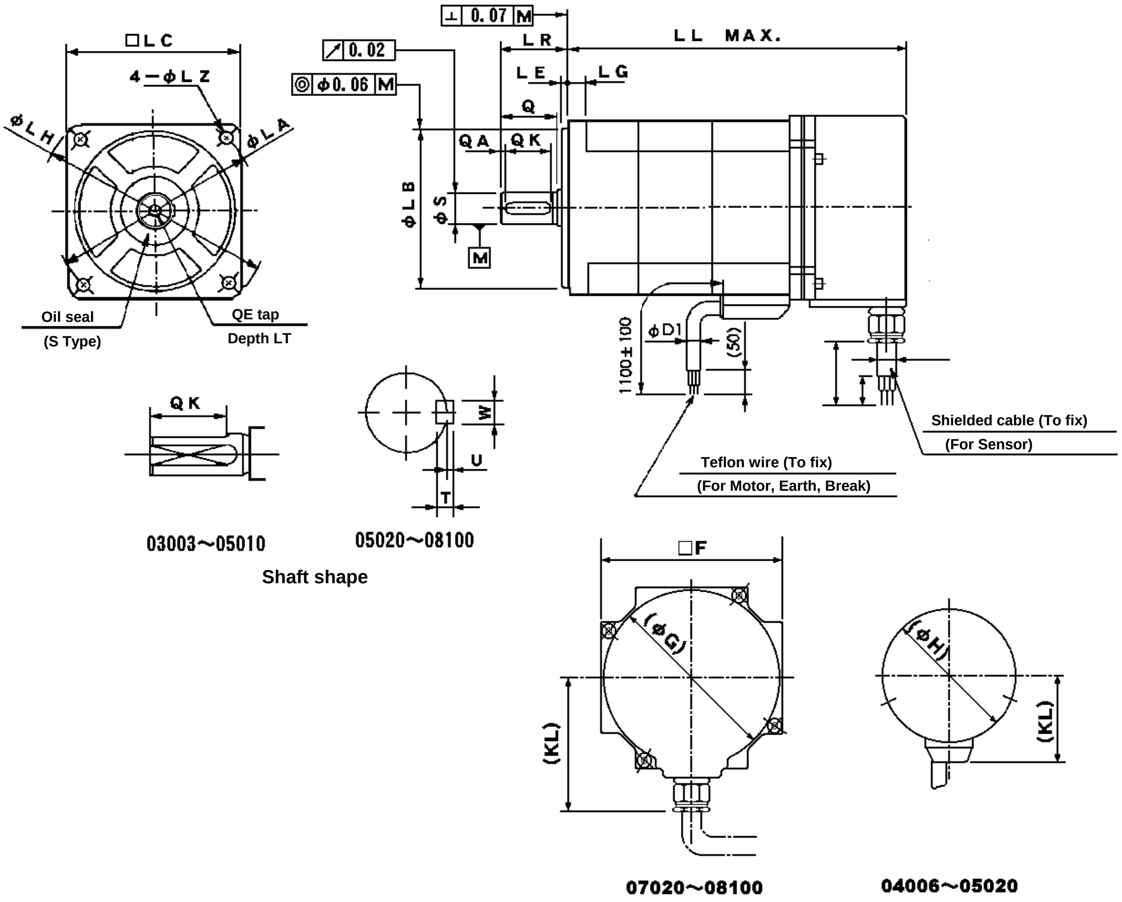
P5 Motor (incremental encoder type)



Unit：mm

	Without B	With B																			D1			
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	Without B and Brake 90V DC	Brake 24V DC	D2	Oil seal
P50B03003△□◇	67.5	98	4.5	27.5	40	$30^{\ 0}_{-0.021}$	2	47	35	3.5	15	$5^{\ 0}_{-0.008}$	-	-	11	Slotted, 2 places 4.5±0.2			-	-	6	7	4.7	Not fitted
P50B04006△□◇	82	114	5	31	48	$34^{\ 0}_{-0.025}$	2	57	42	3.5	24	$7^{\ 0}_{-0.009}$	20	-	15	Slotted, 2 places 6.5±0.2			-	-				
P50B04010△□◇	95	127																						
P50B05005△□◇	76	105	5	38	60	$50^{\ 0}_{-0.025}$	2.5	71.5	54	4.5	24	$8^{\ 0}_{-0.009}$	20	-	15	Slotted, 2 places 7.5±0.2			M3	8	6.7	7.5		Fitted
P50B05010△□◇	86	115																						
P50B05020△□◇	105	134									30	$11^{\ 0}_{-0.011}$	25	2	20	4	4	1.5	M4	10				
P50B07020△□◇	97	124	8	50	90	$70^{\ 0}_{-0.030}$	3	102.5	76	5.5	30	$14^{\ 0}_{-0.011}$	25	2	20	5	5	2	M5	12				
P50B07030△□◇	103	130																						
P50B07040△□◇	113	140																						
P50B08040△□◇	116	156	8	55	100	$80^{\ 0}_{-0.030}$	3	115	86	6.6	35	$16^{\ 0}_{-0.011}$	30	2	25	5	5	2	M5	12				
P50B08050△□◇	126	166																						
P50B08075△□◇	149	189																						
P50B08100△□◇	172	212																						

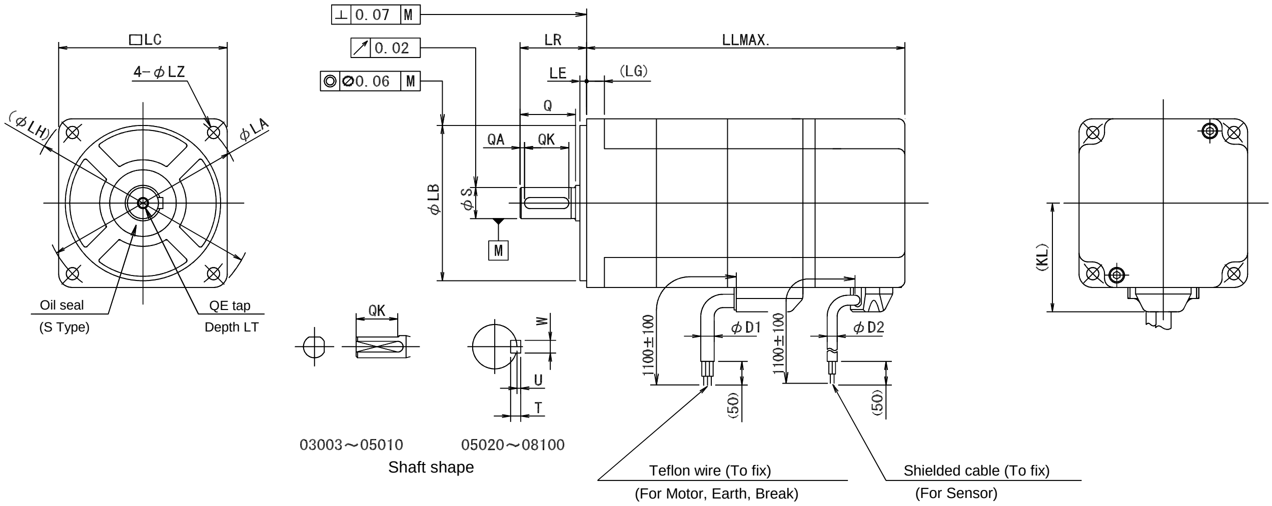
P5 Motor (absolute encoder type)



Unit：mm

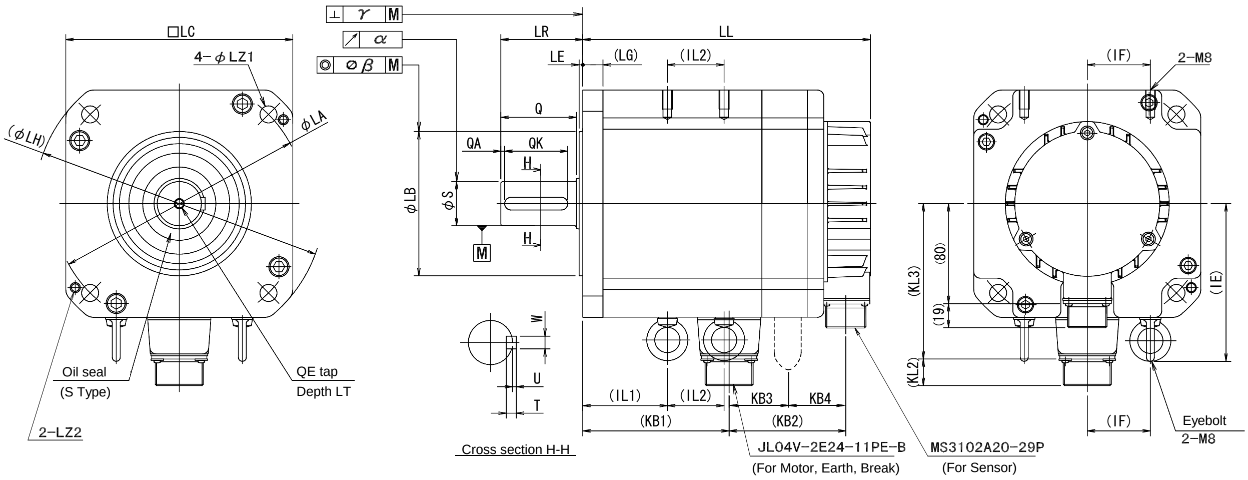
	Without B	With B																								
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	F	G	H	S	Q	QA	QK	W	T	U	QE	LT	D1	D2	Oil seal
P50B04006△□◇	114	146	5	38	48	0 34-0.025	2	57	42	3.5	24	—	—	60	0 7-0.009	20	—	15	Slotted, 2 places 6.5±0.2			—	—	6	7.1	Not fitted
P50B04010△□◇	127	159																								
P50B05005△□◇	111	139	5	38	60	0 50-0.025	2.5	71.5	54	4.5	24	—	—	60	0 8-0.009	20	—	15	Slotted, 2 places 7.5±0.2			M3	8	6.7		Fitted
P50B05010△□◇	121	149																								
P50B05020△□◇	140	169									30				0 11-0.011	25	2	20	4	4	1.5	M4	10			
P50B07020△□◇	136	164	5	67	90	0 70-03030	3	102.5	76	5.5	30	82	78	—	0 14-0.011	25	2	20	5	5	2	M5	12		8	
P50B07030△□◇	142	170																								
P50B07040△□◇	152	180																								
P50B08040△□◇	152	192	5	67	100	0 80-0.030	3	115	86	6.6	35	82	78	—	0 16-0.011	30	2	20	5	5	2	M5	12			
P50B08050△□◇	162	202																								
P50B08075△□◇	185	225																								
P50B08100△□◇	208	248																								

P5 Motor (absolute sensor type)



	With out B	With B	D2＝4.7mm Unit：mm																		D1			
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	Without B and Brake 90V DC	Brake 24V DC	D2	Oil seal
P50B03003△□◇	73	103.5	4.5	27.5	40	$30^{0}_{-0.021}$	2	47	35	3.5	15	$5^{0}_{-0.008}$	-	-	11	Slotted, 2 places 4.5±0.2			-	-	6	7	4.7	Not fitted
P50B04006△□◇	86	118	5	31	48	$34^{0}_{-0.025}$	2	57	42	3.5	24	$7^{0}_{-0.009}$	20	-	15	Slotted, 2 places 6.5±0.2			-	-				
P50B04010△□◇	99	131																						
P50B05005△□◇	82	111	5	38	60	$50^{0}_{-0.025}$	2.5	71.5	54	4.5	24	$8^{0}_{-0.009}$	20	-	15	Slotted, 2 places 7.5±0.2			M3	8	6.7	7.5		Fitted
P50B05010△□◇	92	121																						
P50B05020△□◇	111	140									30	$11^{0}_{-0.011}$	25	2	20	4	4	1.5	M4	10				
P50B07020△□◇	97	124	8	50	90	$70^{0}_{-0.030}$	3	102.5	76	5.5	30	$14^{0}_{-0.011}$	25	2	20	5	5	2	M5	12				
P50B07030△□◇	103	130																						
P50B07040△□◇	113	140																						
P50B08040△□◇	116	156	8	55	100	$80^{0}_{-0.030}$	3	115	86	6.6	35	$16^{0}_{-0.011}$	30	2	25	5	5	2	M5	12				
P50B08050△□◇	126	166																						
P50B08075△□◇	149	189																						
P50B08100△□◇	172	212																						

P6 Motor (incremental encoder type)
(absolute sensor type)



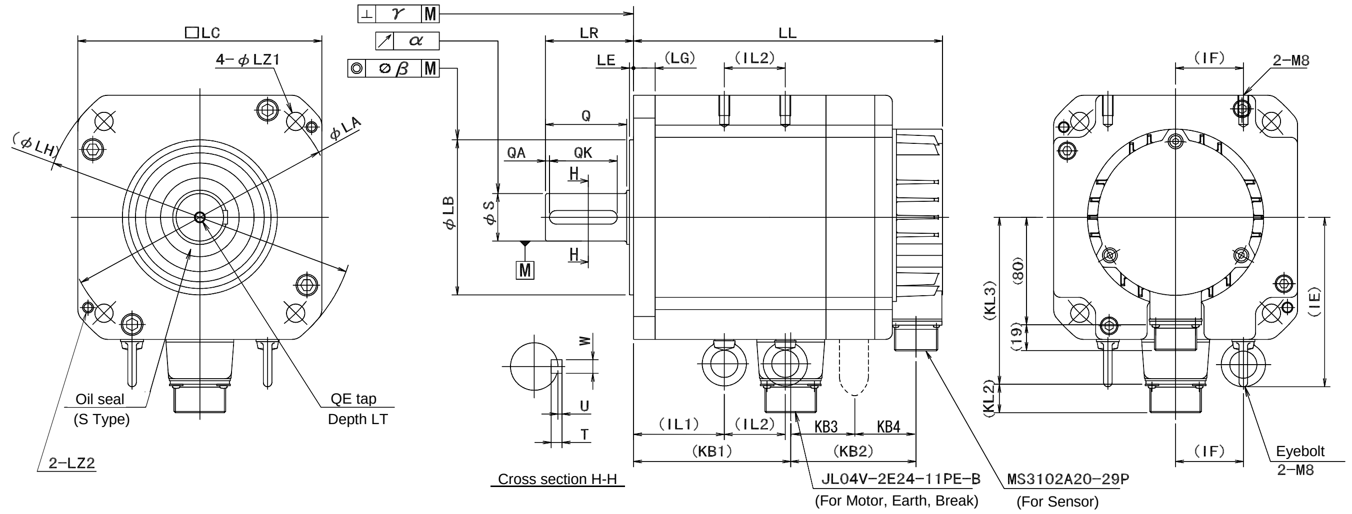
Unit：mm

	Incremental encoder Absolute sensor						Connector										
	Without B	With B					Motor earth	B (With B only)									
MODEL	LL	KB2	LL	KB2	KB3	KB4	MS3102A	MS3102A	KL1	KL2	KL3	LG	LA	LB	LE	LH	LC
P60B13050△□◇	113	56	143	86	—	—	24-11P		98	21	—	12	145	0 110-0.035	4	165	130
P60B13100△□◇	133	57	166	90	—	—											
P60B13150△□◇	152		185														
P60B13200△□◇	171		208	94	—	—											
P60B15300△□◇	182	56	225	99	—	—	24-11P		106	21	—	12	165	0 130-0.040	4	190	150
P60B18200△□◇	144	56	179	91	—	—	24-11P		123	21	—	16	200	0 114.3-0.035	3	230	180
P60B18350△□◇	169		204														
P60B18450△□◇	192		227														
P60B18550△□◇	267	72	314	119	59	60	32-17P	10SL-4P	144	22	115	19	200	0 114.3-0.035	3	230	180
P60B18750△□◇	332		379														
P60B22550△□◇	209	60	256	107	—	—	24-11P		141	21	—	19	235	0 200-0.046	4	270	220
P60B22700△□◇	285		332														
P60B2211K△□◇	352	77	399	124	59	65	32-17P	10SL-4P	162	22	132	19	235	0 200-0.046	4	270	220
P60B2215K△□◇	395		442														

⚠ Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

MODEL	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	α	β	γ	QE	LT	IE	IF	IL1	IL2
P60B13050△□◇	9	M6	55	0 22-0.013	50	3	42	0 6-0.030	6	2.5	37	0.02	0.08	0.08	M6	20	—	—	—	—
P60B13100△□◇											56									
P60B13150△□◇											75									
P60B13200△□◇				0 28-0.013				0 8-0.036	7	3	94				M8	25				
P60B15300△□◇	11	M6	55	0 22-0.013	50	3	42	0 8-0.036	7	3	106	0.02	0.08	0.08	M8	25	—	—	—	—
P60B18200△□◇	13.5	M8	65	0 35-0.016	60	3	50	0 10-0.036	8	3	68	0.02	0.08	0.08	M8	25	—	—	—	—
P60B18350△□◇											93						124	50	64	20
P60B18450△□◇											116								62	45
P60B18550△□◇	13.5	M8	79	0 42-0.016	75	3	67	0 12-0.043	8	3	175	0.02	0.08	0.08	M10	25	124	50	60	70
P60B18750△□◇											240									135
P60B22550△□◇	13.5	M10	79	0 55-0.019	75	3	67	0 19-0.043	10	4	129	0.03	0.08	0.10	M10	25	142	60	53	40
P50B22700△□◇											205								69	100
P60B2211K△□◇	13.5	M10	79	0 55-0.019	75	3	67	0 16-0.043	10	4	256	0.03	0.08	0.10	M10	25	142	60	69	130
P50B2215K△□◇											299								69	170

P6 Motor (absolute encoder type)



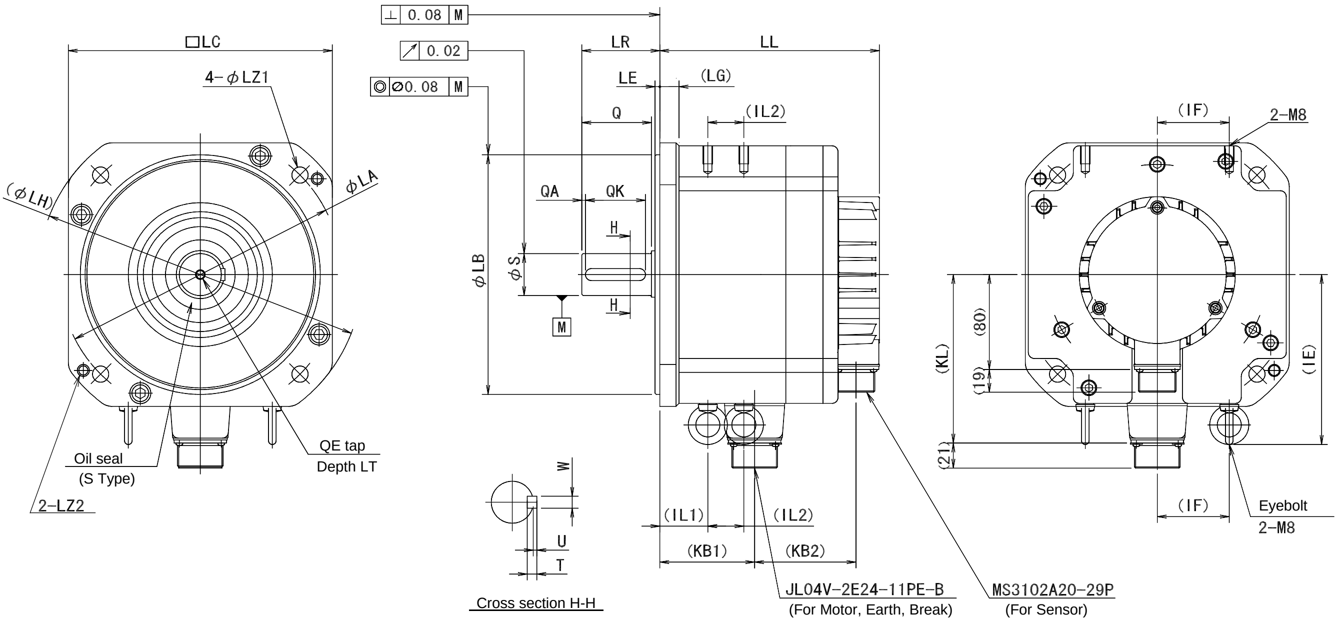
Unit：mm

	Absolute sensor						Connector								
	Without B		With B				Motor earth	B (With B only)							
MODEL	LL	KB2	LL	KB2	KB3	KB4	MS3102A	MS3102A	KL1	KL2	KL3	LG	LA	LB	LE
P60B13050△□◇	123	66	153	96	—	—	12 - 11P		98	21	—	12	145	0 110-0.035	4
P60B13100△□◇	143	67	176	100	—	—									
P60B13150△□◇	162		195												
P60B13200△□◇	181		218	104	—	—									
P60B15300△□◇	192	66	235	109	—	—	24 - 11P		106	21	—	12	165	0 130-0.040	4
P60B18200△□◇	154	66	189	101	—	—	24 - 11P		123	21	—	16	200	0 114.3-0.035	3
P60B18350△□◇	179		214												
P60B18450△□◇	202		237												
P60B18550△□◇	277	82	324	129	59	90	32-17P	10SL-4P	144	22	115	19	200	0 114.3-0.035	3
P60B18750△□◇															
P60B22550△□◇	219	70	266	117	—	—	24 - 11P		141	21	—	19	235	0 200-0.046	4
P60B22700△□◇	295		342												
P60B2211K△□◇	382	107	429	154	59	95	32-17P	10SL-4P	162	22	132	19	235	0 200-0.046	4
P60B2215K△□◇	425		472												

⚠ Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

MODEL	LH	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	α	β	γ	QE	LT	IE	IF	IL1	IL2
P60B13050△□◇	165	130	9	M6	55	0 22-0.013	50	3	42	0 6-0.030	6	2.5	37	0.02	0.08	0.08	M6	20	—	—	—	—
P60B13100△□◇													56									
P60B13150△□◇													75									
P60B13200△□◇						0 28-0.013				0 8-0.036	7	3	94				M8	25				
P60B15300△□◇	190	150	11	M6	55	0 28-0.013	50	3	42	0 8-0.036	7	3	106	0.02	0.08	0.08	M8	25	—	—	—	—
P60B18200△□◇	230	180	13.5	M8	65	0 35-0.016	60	3	50	0 10-0.036	8	3	68	0.02	0.08	0.08	M8	25	—	—	—	—
P60B18350△□◇													93						124	50	64	20
P60B18450△□◇													116								62	45
P60B18550△□◇	230	180	13.5	M8	79	0 42-0.016	75	3	67	0 12-0.043	8	3	175	0.02	0.08	0.08	M10	25	124	50	60	70
P60B22550△□◇	270	220	13.5	M10	79	0 55-0.019	75	3	67	0 16-0.043	10	4	129	0.03	0.08	0.10	M10	25	142	60	53	40
P60B22700△□◇													205								69	100
P60B2211K△□◇	270	220	13.5	M10	79	0 55-0.019	75	3	67	0 16-0.043	10	4	256	0.03	0.08	0.10	M10	25	142	60	69	130
P60B2215K△□◇													299								69	170

P8 Motor (incremental encoder type)
(absolute sensor type)



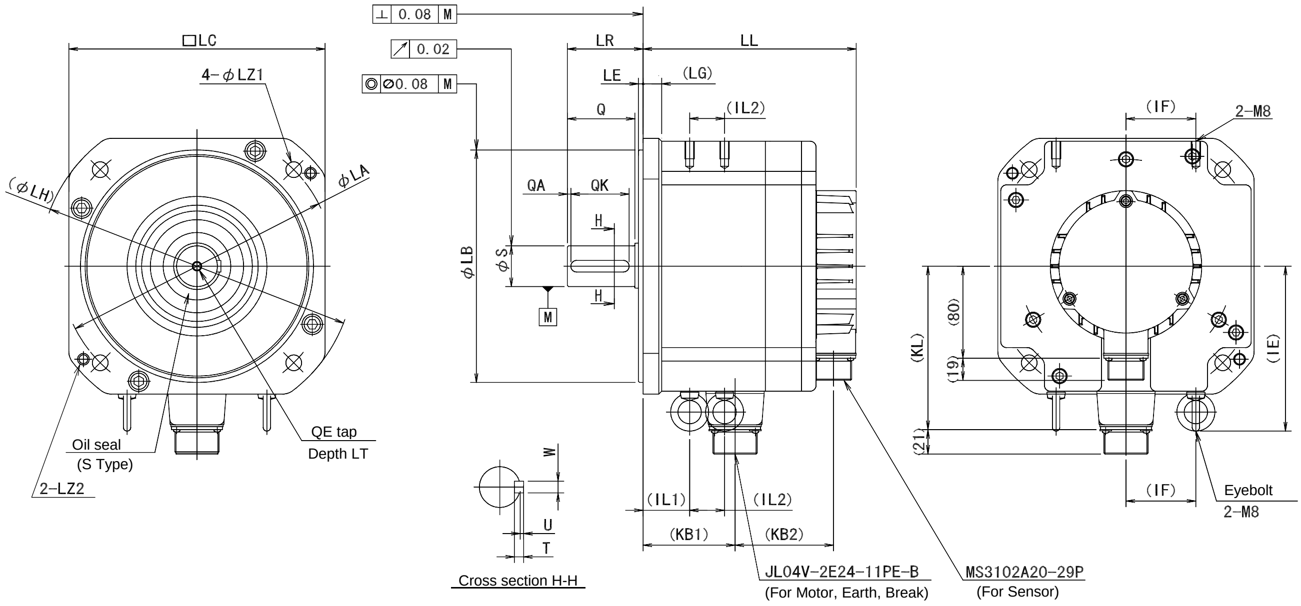
Unit：mm

	With-out B	With B												
MODEL	LL	KB2	LL	KB2	LG	KL	LA	LB	LE	LH	LC	LZ1	LZ2	LR
P80B15075△□◇	116	56	150	90	12	106	165	$130^{\ 0}_{-0.040}$	4	190	150	11	M6	55
P80B18120△□◇	119	55	152	88	12	123	200	$114.3^{\ 0}_{-0.035}$	3	230	180	13.5	M8	55
P80B22250△□◇	122	52	154	84	16	141	235	$200^{\ 0}_{-0.046}$	4	270	220	13.5	M10	65
P80B22350△□◇	136		168											
P80B22450△□◇	151		183											

MODEL	S	Q	QA	QK	W	T	U	KB1	QE	LT	IE	IF	IL1	IL2
P80B15075△□◇	$22^{\ 0}_{-0.013}$	50	3	42	$6^{\ 0}_{-0.030}$	6	2.5	40	M6	20	–	–	–	–
P80B18120△□◇	$28^{\ 0}_{-0.036}$	50	3	42	$8^{\ 0}_{-0.036}$	7	3	44	M8	25	–	–	–	–
P80B22250△□◇	$35^{\ 0}_{-0.016}$	60	3	50	$10^{\ 0}_{-0.036}$	8	3	50	M8	25	142	60	41	–
P80B22350△□◇								64					40	15
P80B22450△□◇								79					40	30

⚠ Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

P8 Motor (absolute encoder type)



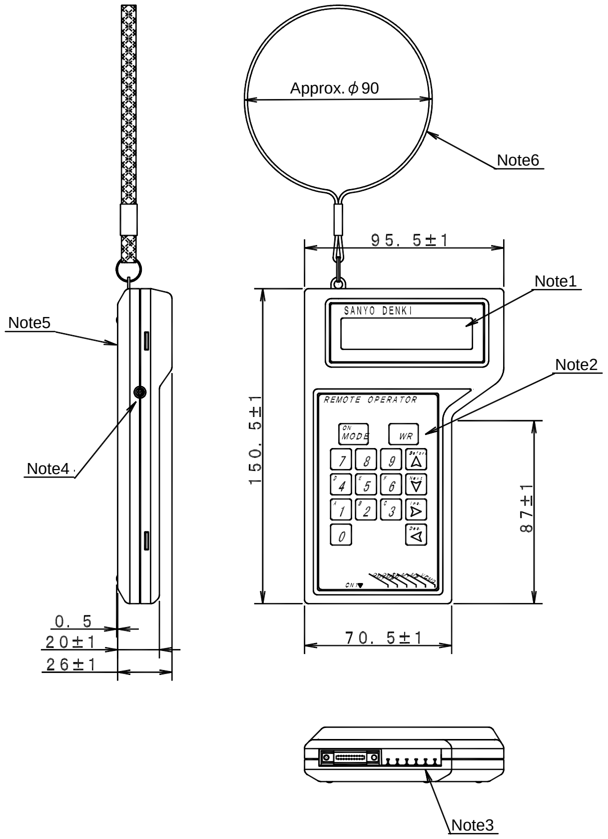
Unit : mm

	Without B		With B											
MODEL	LL	KB2	LL	KB2	LG	KL	LA	LB	LE	LH	LC	LZ1	LZ2	LR
P80B15075△□◇	126	66	150	90	12	106	165	$130^{0}_{-0.040}$	4	190	150	11	M6	55
P80B18120△□◇	129	65	152	88	12	123	200	$114.3^{0}_{-0.035}$	3	230	180	13.5	M8	55
P80B22250△□◇	132	62	154	84	16	141	235	$200^{0}_{-0.046}$	4	270	220	13.5	M10	65
P80B22350△□◇	146		168											
P80B22450△□◇	161		183											

MODEL	S	Q	QA	QK	W	T	U	KB1	QE	LT	IE	IF	IL1	IL2
P80B15075△□◇	$22^{0}_{-0.013}$	50	3	42	$6^{0}_{-0.030}$	6	2.5	40	M6	20	–	–	–	–
P80B18120△□◇	$28^{0}_{-0.036}$	50	3	42	$8^{0}_{-0.036}$	7	3	44	M8	25	–	–	–	–
P80B22250△□◇	$35^{0}_{-0.016}$	60	3	50	$10^{0}_{-0.036}$	8	3	50	M8	25	142	60	41	–
P80B22350△□◇								64					40	15
P80B22450△□◇								79					40	30

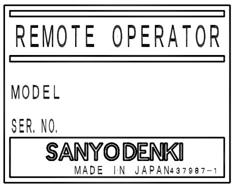
Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

9.3.3 Remote operator (Option)



Unit : mm

1. Liquid crystal display (Display in 2 lines)
2. Key (16keys, Control element)
3. Check pins (DM1:DM2:SG:M1:M2:VCMD from the left)
4. Volume knob (For adjusting liquid crystal brightness)
5. Nameplate



6. Hand band

9.4 External Regenerative Resistor

9.4.1 How to Connect and Set External Regenerative Resistor (Optional)

An external regenerative resistor will be used when allowable power of the built-in regenerative resistor (see 9.1.16 Regenerative Processing Capacity) is exceeded.

The following explains how to use an external one.

(1) Parameter setting

Mode	Page	Cord	Name and contents	Remark
2	3	Func2	Amplifier function selection 2 bit 7 6 5 4 3 2 1 0 Regeneration resistance OL time selection (bit 4) 0 when internal regenerative register 1 when external regeneration resistance	See p.7-48

(2) Connection of the outside regeneration resistor

i) Remove the short bar between H1 and H2 of servo amplifier, and between X and COM.

ii) Connect the thermostat of the external regeneration resistor between H1 and H2, and connect the resistance terminal of the external regeneration resistor between Y and COM.

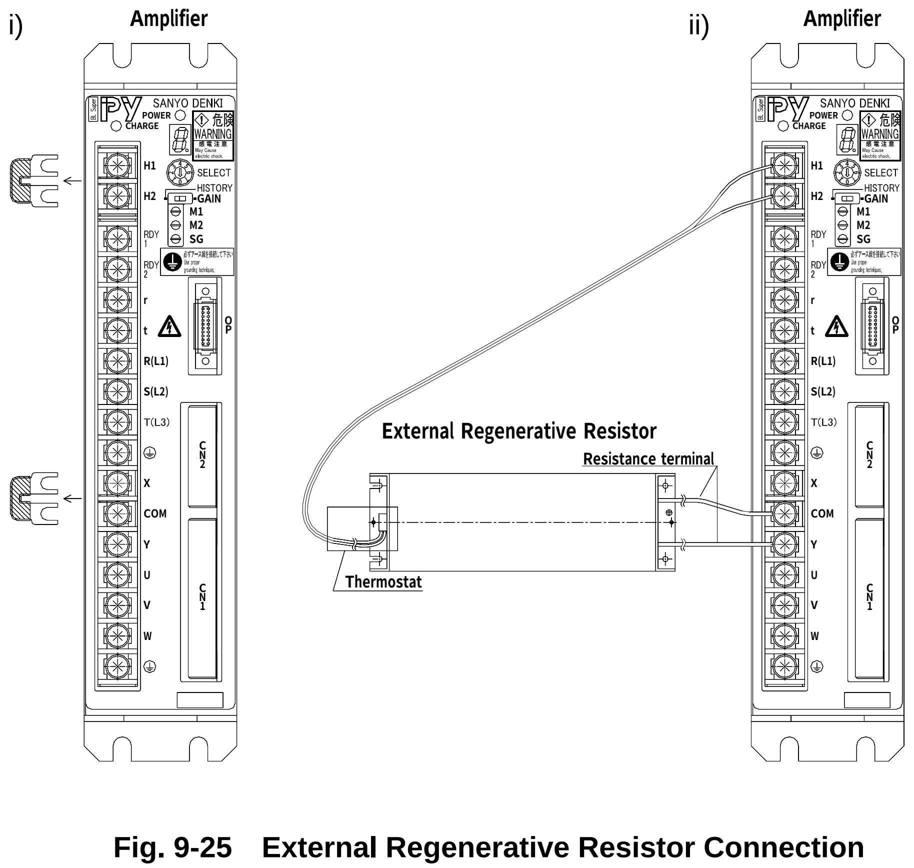


Fig. 9-25 External Regenerative Resistor Connection

Operational precautions

1 For details about how to connect the external regenerative resistor, refer to Detailed Connecting Methods of External Regenerative Resistors (Fig. 9-26).

2 Be sure to remove the short bar between the X and COM terminals (making it open) when connecting the external regenerative resistor.
Otherwise, the amp. may break.

3 Install the external regenerative resistor between the Y and COM terminals.

4 When installing the external regenerative resistor equipped with a thermostat, install it after removing the short bar between H1 and H2 terminals. Unless it removes the short bar between H1 terminal-H2 terminals, ON/OFF of the thermostat of the external regeneration resistor is undetectable.

5 Be sure to use a twisted wire for wiring the external regenerative resistor and make wiring as short as possible (up to 5m).

6 Since the external regeneration resistor serves as high temperature, use a heat-resistant and non-combustible cable or perform non-combustible treatment (silicon tube, etc.) for a connecting cable and wire an external regenerative resistor so as not to come in contact with the built-in one.

7 Since the external regeneration resistor serves as high temperature, under turning on electricity or after power supply interception for a while, do not touch the external regeneration resistor.

8 Set bit4 of remote operator Func2 to "1" at the time of the external regeneration resistor usage. (Keep in mind that reviving may become abnormal if "0" is set up at the time of the external regeneration resistor usage.)

9. Set bit4 of a remote operator's Func2 to "0" at the time of the internal regeneration resistor usage.
(Keep in mind that the internal regeneration resistor may be damaged by fire if "1" is set up at the time of the internal regeneration resistor usage.)

10. Give as a standard the regeneration electric power computed from a monitor value. Regeneration electric power changes with the voltage variation of input power supply, secular changes of servo amplifier and load equipment, etc.

11. Selection of a regeneration resistor should compute and select the regeneration electric power PM from a pattern of operation by the calculation method of the regeneration electric power PM at any cost. Refer to the clause (p.9-45) of regeneration thraughput for the calculation method of the regeneration electric power PM.

12. Install the external regeneration resistor on equipment, and measure the temperature of the external regeneration resistor by the operating condition that the regeneration electric power PM becomes the maximum. Then do sufficient mounting check of alarm not being generated. In addition, it takes 1 to 2 hours until the temperature of the external regeneration resistor is saturated. Since insulated degradation, corrosion, etc. may arise in the place where corrosive gas has occurred, or a place with much dust, be careful of an attachment place.

13. The place where corrosive gas has occurred, and when there is much dust, insulated degradation, corrosion, etc.may arise. There fore be careful of an attachment place.

14. Arrangement of the external regeneration resistor should open an interval so that it is not influenced by generation of heat from other parts.

9.4.2 External Regenerative Resistor Combination Table

Referring to Table 9-21, determine the type, number of pieces and connecting method of the external regenerative resistor based on the effective regenerative power PM obtained by the operation pattern and the Servo Amplifier type.

Table 9-21 External Regenerative Resistor Combination Table

PM / Amplifier type	Up to 20W	Up to 30W	Up to 55W	Up to 60W	Up to 90W	Up to 110W	Up to 120W	Up to 125W	Up to 220W	Up to 250W	Up to 500W	Up to 1000W
PY0A015		Resistor Ⓐ × 1 pc.	Resistor Ⓒ × 1 pc.	Resistor Ⓑ × 2 pcs.	Resistor Ⓓ × 2 pcs.		Resistor Ⓒ × 4 pcs.			Inquire		
	Built-in	Connection (Ⅰ)	Connection (Ⅰ)	Connection (Ⅱ)	Connection (Ⅱ)		Connection (Ⅳ)					
PY0A030		Resistor Ⓑ × 1 pc.	Resistor Ⓓ × 1 pc.	Resistor Ⓐ × 2 pcs.	Resistor Ⓒ × 2 pcs.		Resistor Ⓓ × 4 pcs.			Inquire		
	Built-in	Connection (Ⅰ)	Connection (Ⅰ)	Connection (Ⅲ)	Connection (Ⅲ)		Connection (Ⅳ)					
Y0A050					Resistor Ⓕ × 1 pc.				Resistor Ⓖ × 2 pcs.		Resistor Ⓕ × 4 pcs.	Inquire
	Built-in				Connection (Ⅰ)				Connection (Ⅱ)		Connection (Ⅳ)	
PY0A100						Resistor Ⓖ × 1 pc.			Resistor Ⓕ × 2 pcs.		Resistor Ⓖ × 4 pcs.	Inquire
	Built-in					Connection (Ⅰ)			Connection (Ⅲ)		Connection (Ⅳ)	
PY0A150								Resistor Ⓗ × 1 pc.	Resistor Ⓘ × 2 pcs.		Resistor Ⓗ × 4 pcs.	Inquire
	Built-in							Connection (Ⅰ)	Connection (Ⅲ)		Connection (Ⅳ)	
PY0A300	Resistor Ⓗ × 1 pc.								Resistor Ⓙ × 1 pc.		Resistor Ⓙ × 2 pcs.	Inquire
	Connection (Ⅰ)								Connection (Ⅰ)c		Connection (Ⅰ)	

For external resistors Ⓐ to Ⓙ, refer to Table 9-22.
For connecting methods (Ⅰ) to (Ⅳ), refer to Table 9-26.
For "Inquire", consult with us.
PM: Effective regenerative power

Precautions for use

1 The external regeneration resistance is set up so that a regeneration resistance usage rate may become a maximum of 25%.

2. A regeneration resistance usage rate can be raised about a maximum of 50% by doing air-cooling with blower using a cooling fan.

3. Install the external regeneration resistor and measure the temperature of the external regeneration resistor by the operating condition that the regeneration electric power PM becomes the maximum. Then check that alarm is not generated.

9.4.3 External Regenerative Resistor List

Table 9-22 External Regenerative Resistor List

Symbol	Types	Permissible effective power	Resistance value	Outside dimensions	Thermostat Detection temperature (Contact specification)	Outline drawing
Ⓐ	REGIST-120W100B	30W	100Ω	W42, L182, D20	135℃±7℃ (Normal close)	See fig.9-14
Ⓑ	REGIST-120W50B	30W	50Ω	W42, L182, D20		See fig.9-14
Ⓒ	REGIST-220W100B	55W	100Ω	W60, L230, D20		See fig.9-15
Ⓓ	REGIST-220W50B	55W	50Ω	W60, L230, D20		See fig.9-15
Ⓔ	REGIST-220W20B	55W	20Ω	W60, L230, D20		See fig.9-15
Ⓕ	REGIST-500W20B	125W	20Ω	W80, L250, D40	100℃±5℃ (Normal close)	See fig.9-16
Ⓖ	REGIST-500W10B	125W	10Ω	W80, L250, D40		See fig.9-16
Ⓗ	REGIST-50W7B	125W	7Ω	W80, L250, D40		See fig.9-16
Ⓘ	REGIST-500W14B	125W	14Ω	W80, L250, D40		See fig.9-16
Ⓙ	REGIST-1000W6R7B	250W	6.7Ω	W140, L340, D57	140℃±5℃ (Normal close)	See fig.9-17

9.4.4 Detailed Connecting Methods of External Regenerative Resistors

The following figures describe detailed connecting methods of external regenerative resistors.

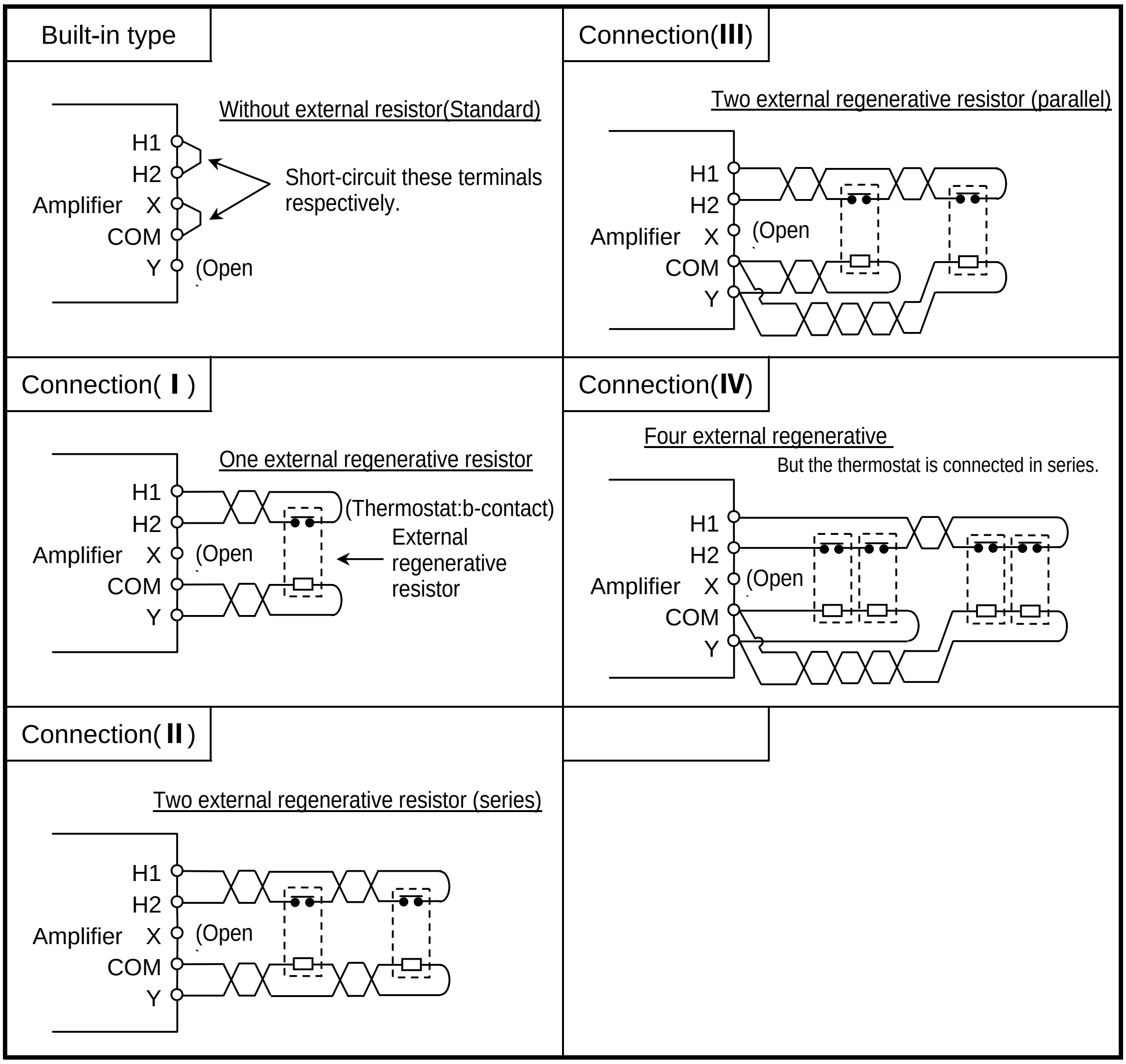
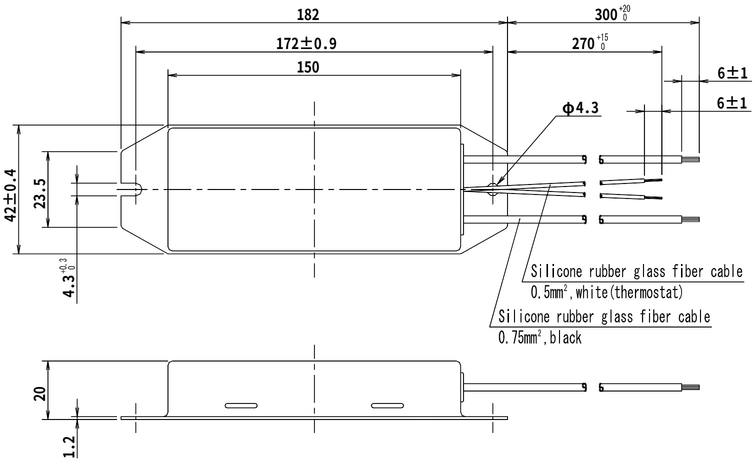


Fig. 9-26 Detailed Connecting Methods of External Regenerative Resistors

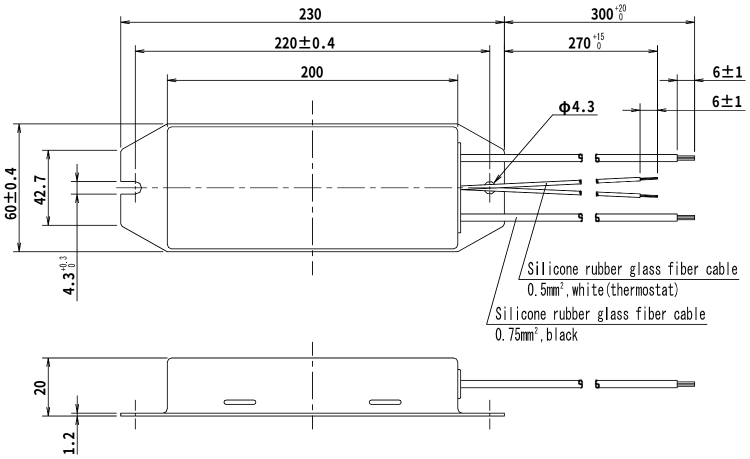
9.4.5 External Regenerative Resistor Outline Drawings

①



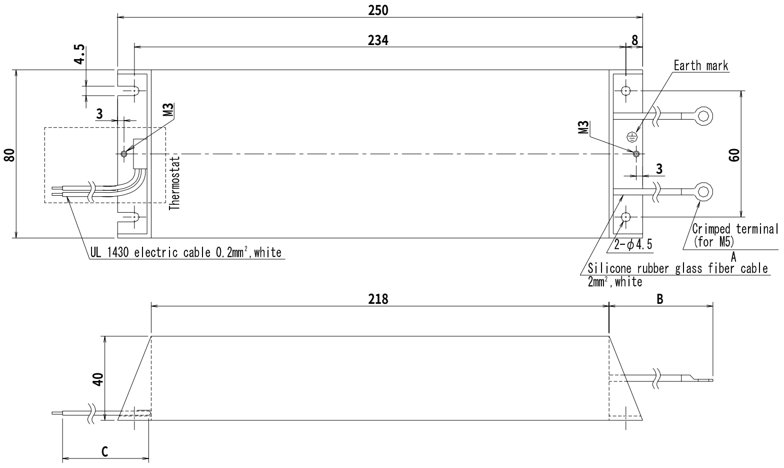
	Model No.	Thermostat
1	REGIST-120W100B	Normal close
2	REGIST-120W50B	Normal close

②



	Model No.	Thermostat
1	REGIST-220W50B	Normal close
2	REGIST-220W20B	Normal close
3	REGIST-220W100B	Normal close

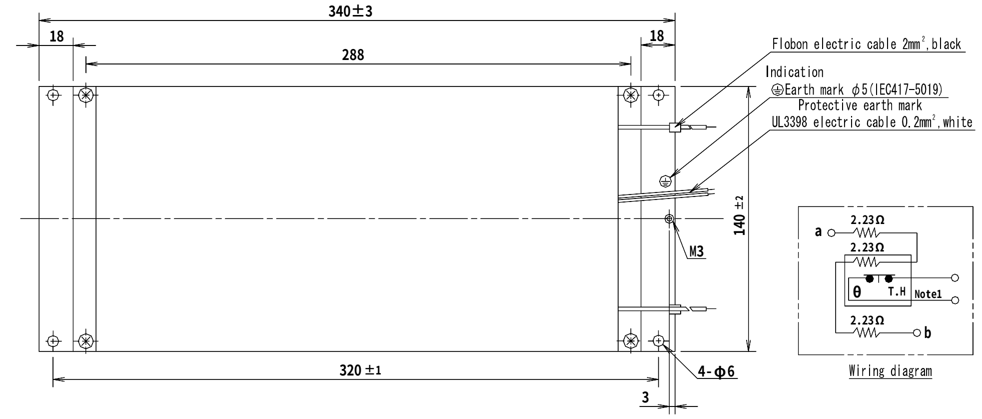
③

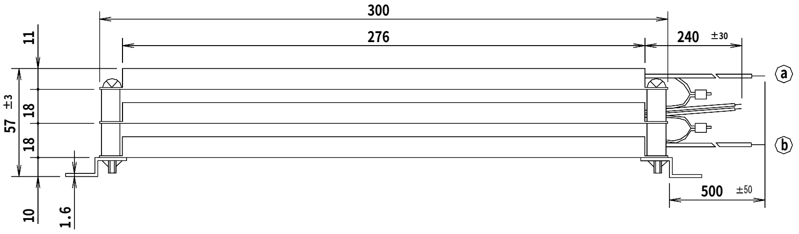


	Model No.	A/B/C	Thermostat
1	REGIST-500W20B	350±15	Normal close
2	REGIST-500W20	−	Without
3	REGIST-500W10B	350±15	Normal close
4	REGIST-500W10	−	Without
5	REGIST-500W7B	350±15	Normal close
6	REGIST-500W7	−	Without
7	REGIST-500W14B	350±15	Normal close
8	REGIST-500W14	−	Without

Unit：mm

④





Note1 : Thermostat spec.
- b-contact
- Operating temperature:140±5℃

	Model No.	Thermostat
1	REGIST-1000W6R7B	Normal close

Unit：mm

9.5 Full Close Function (Option)

In this function, encoder shall be set externally and used as position controller. Since this function requires the different hardware from the standard PY Amplifier, the decision and request should be made before purchase.

9.5.1 Rough Diagram of Full Close Function (Option)

- Full Close PY

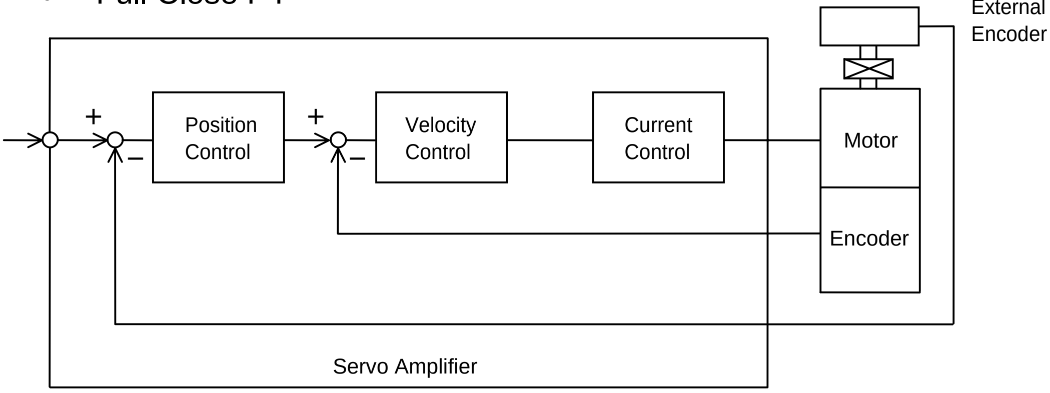


Fig. 9-27 Full Close Rough Diagram

- Standard PY (as a reference)

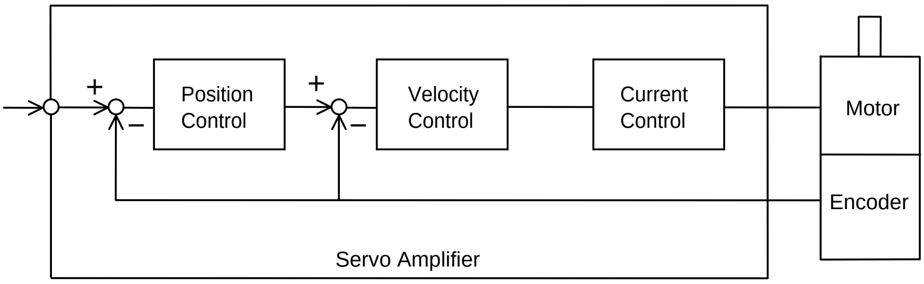


Fig. 9-28 Standard Rough Diagram

The advantage of Full Close is high accuracy positioning control (controlling the accurate position of device) by obtaining the feedback of position loop and accurate device position from external encoder.

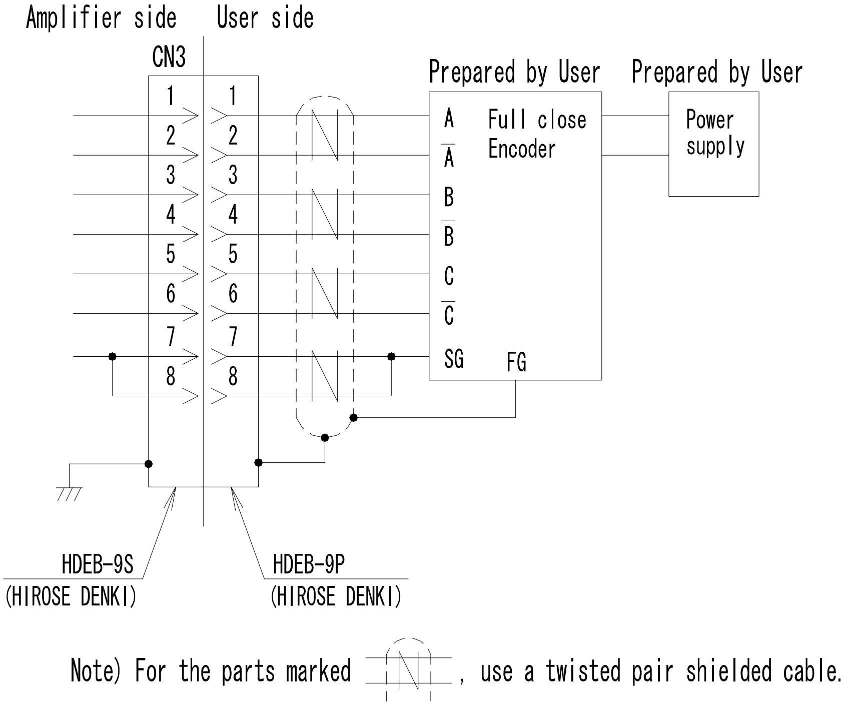
9.5.2 Hardware of Full Close Function (Optional)

- Configuration

  Amplifier shall be wider by 15mm with regard to PY0A015, PY0A030, PY0A050 and PY0A100. And configuration is the same for PY0A150 and PY0A300.

- Additional Connector

  Connector CN3 is added to connect with encoder for full close (refer to the wiring below). In this case, the connector for full close is the standard attachment of PY Servo Amplifier, but encoder (output: RS422 spec.) and the power supply should be prepared by customers.



Note) For the parts marked , use a twisted pair shielded cable.

Fig. 9-29 Full Close Additional Wiring Diagram

- Maximum Input Frequency

  The maximum input frequency from full close encoder output to Amplifier should be 2MHZ.

9.5.3 Parameter of Full Close Function (Optional)

- Setting of Full Close

  In case of using the encoder for Full Close, Mode2/ page1/ Func0/ bit7 should be set to “1” as Full Close setting at ex-factory.

- Setting of Multiplier Function

  Mode2/ page1/ Func0/ bit6 should be set to “0” as Full Close setting at ex-factory in order to 4-multiply feedback signals from encoder for Full Close. For 1-multiplication, set to “1”.

- Setting of Dividing Function

  Mode2/ page6/ Func5/ bit4 should be set to “1” as Full Close setting at ex-factory in order to divide and input the feedback signals from encoder for Full Close. Dividing ratio can be set at Mode1/ page4/ ENCR as standard.

- Rough Diagram

  See the parameter rough diagram as follows:

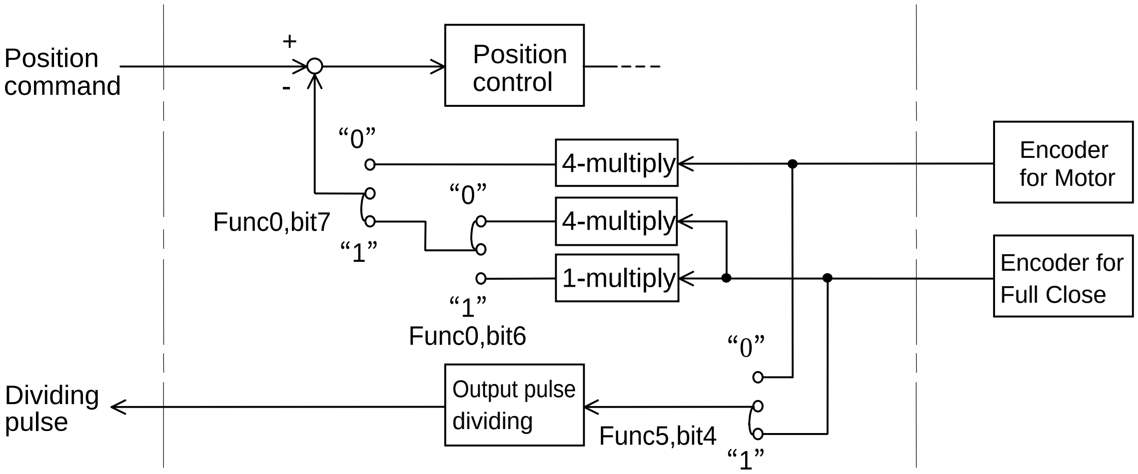
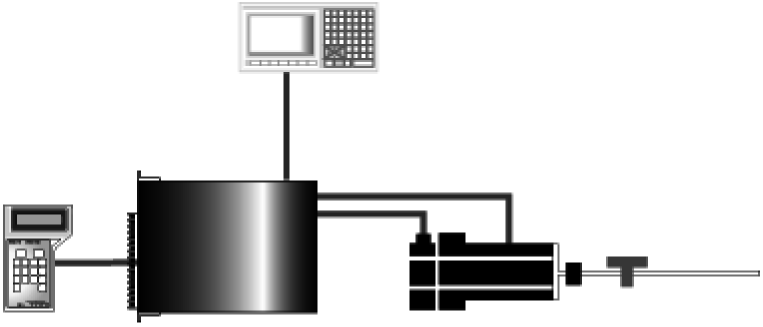


Fig. 9-30 Rough Diagram of Full Close Parameter

SAFETY PRECAUTIONS



10 INTERNATIONAL STANDARDS

10.1 International Standard Conformity

10.1.1 Outline

North America

UL (Underwriters Laboratories inc.)

UL is a non-profit test organization established in 1894 by the US cooperative for Fire Insurance Companies.　Obtaining UL recognition is compulsory in some states in the US regulated by state law or ordinance of each municipality.　When electric products need to obtain UL recognition, their built-in parts also need to be the UL recognized ones in principle. There are two different recognizing methods, Listing and Recognition.

Listing is for end products with the mark shown in the upper left.

Recognition is for built-in parts used for the products with the mark shown in the lower left.

UL has succeeded in conforming its standard with CSA, was given the status of CO (Canadian Organization of Safety) and TO (Test Organization) by SCC (Standard Council of Canada) in 1992 and was authorized to perform safety test and to issue recognition certificates for Canadian standard conformity.　The marks are shown in the right.

EU Nations

TÜV（TÜV Product Service Japan, Ltd.）

Industrial products used in EU nations must have CE marking on them regulated by EC Directives (for machinery, EMC and low voltage).　Products with CE marking must meet every item of EC Directives. TÜV issues its recognition mark as shown in the left based on the EN standard to make it easy to obtain CE marking.

10.1.2 International Standard Conformity for PY0 Servo System

The PY0 Servo Amplifiers comply with the following international standards.

Mark	International Standard	Standard Number	Recognizing Organization
c ® US	UL	UL508C	UL （Underwriters Laboratories inc.）
	CSA	UL508C	
TÜV	EN	EN50178 EN61000-6-2	TÜV （TÜV Product Service Japan, Ltd.）

10 INTERNATIONAL STANDARDS

For P series Servomotors, the following international standards are available.

Mark	International Standard	Standard Number	Recognizing Organization
®	UL	UL508C	UL （Underwriters Laboratories inc.）
TÜV PRODUCT SERVICE	EN	IEC34-1 IEC34-5 IEC34-9	TÜV （TÜV Product Service Japan, Ltd.）

The last letter of the model number differentiates standard products of the Servomotor.

Last letter of model number	International Standard Conformity
U	UL
E	EN
M	UL／EN

International standard conforming Servomotors are different in specifications from standard ones in some cases because of some conditions necessary to conform with international standard.
In such cases, consult with us.

10.2 Cautions for International Standard Conformity

10.2.1 Cautions Common to UL／TÜV Standard Conformity

① Combination of PY0 Servo Amplifier and Servomotor

1. For the combination of Servo Amplifier and Servomotor, see Chapter 1, page 1-8, "Standard Combination of PY series".

② Working environment for each unit

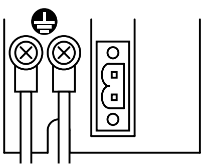
1. Make sure to set the PY0 series Amplifiers in the customer's control panel under the pollution level 2 or above (pollution level 1 or 2) environment, as regulated in EN50178 or IEC664. Therefore, it must be installed in the control panel, whose configuration (IP54) is free from any intrusion of water, oil, carbon or dust.

③ Power supply

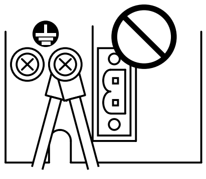
1. The PY series Amplifiers must be used under the conditions specified in overvoltage category Ⅱ, EN50178.　Use a reinforced insulation transformer conforming to the IEC or EN standard for power supply input.
2. For the interface, use a DC power supply whose input and output sections have reinforced insulation.

④ Grounding

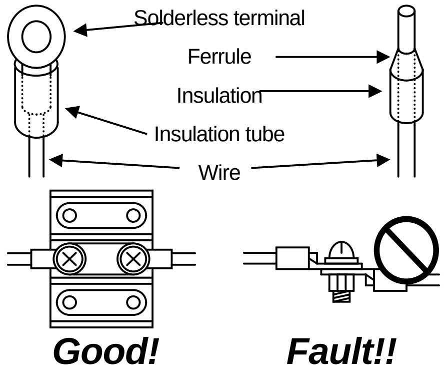
1. Make sure to ground the protective earth terminals of the Servo Amplifier to power supply earth (PE).
2. When connecting grounding wires to the protective earth terminals, make sure to connect one line to one terminal, never connect jointly with multiple wires or terminals.
3. When connecting a leakage stopper, make sure to connect the protective earth terminals to power supply earth (PE), too.



Good!



Fault!!



⑤ Wiring

1. Use solderless terminals with insulation tube for grounding wires, so that the wires connected to Servo Amplifiers do not contact the neighboring terminals.
2. When relaying wires, use a fixed terminal board to connect wires. Never connect wire to wire directly.

⑥ Peripheral equipment

1. Connect EMC filter before the input power supply of the unit.
2. Use EN/IEC conforming no-fuse circuit-breaker and electromagnetic contactors.

10.3 UL / cUL / TÜV Standard Conformity

10.3.1 UL / cUL Conformity and File Numbers

Servo Amplifiers of the PY0 Servo system are qualified by UL (Underwriters Laboratories Inc.) to have the UL (U.S. version) and cUL (Canada version) LISTING mark for equipment. Servomotors are qualified by UL (Underwriters Laboratories Inc.) to have UL (U.S. version) RECOGNITION mark for parts.

In case you need a certificate of the PY0 Servo system or P series Servomotor when obtaining UL or cUL standard recognition, let our sales representative know the following file number.

Classification	File number	Category	Recognizing organization
UL / cUL (Servo Amplifier)	E179775 (Volume 3, Section 7)	Power Conversion Equipment (CCN:NMMS, NMMS7)	UL (Underwriters Laboratories Inc.)
UL (Servomotor)	E179832	Motors-Component	UL (Underwriters Laboratories Inc.)

Information is also available at the UL homepage：http://www.ul.com/database/.

10.3.2 TÜV Conformity and File Numbers

The PY0 Servo system is qualified to have the TÜV mark by TÜV Product Service Japan, Ltd. in order to make TÜV marking and CE marking easy to be attached on customer's machines and equipment. We are claiming self-declaration for low voltage and EMC directives regulated by the EC Directives according to the certification issued by TÜV.

In case you need certification and/or declaration of the PY0 Servo system for your machines or equipments when performing conformity test, let our sales representative know the following file number. Note that file numbers may sometimes change for some reason or other, such as addition of specifications.

Classification of directive	Certification or Declaration	File No.	Recognizing Organization
Low Voltage Directive (Servo Amplifier)	Declaration	C000723C	-
	Certification	B 99 07 21206 030	TÜV Product Service Japan, Ltd.
EMC Directive (Servo Amplifier/ Servomotor)	Declaration	C0000720D	-
	Certification	E9 99 05 30982 005	TÜV Product Service Japan, Ltd.
Low Voltage Directive (Servomotor)	Declaration	C0000183	-
	Certification	B 97 12 21206 014	TÜV Product Service Japan, Ltd.

10.4 Conformity with EC Directives

10.4.1 Outline

EC Directive was enacted to make smooth distribution of the limited products whose safety has been guaranteed by unifying the standard among EU member nations. For products sold in EU member nations, it is compulsory to meet the basic safety requirements, such as machine directive, EMC directive or low voltage directive as well as to have CE marking attached on them. CE marking is for end products incorporating PY0 series Amplifiers sold in EU member nations.

10.4.2 Conformity with EC Directives

At SANYO DENKI, we are performing tests on the PY0 Servo system for its conformity with low voltage directive and EMC directive regarding CE marking through a third party recognizing organization. However, for EMC directive, tests are being performed on typical combinations with typical installing method and countermeasures, since machines and system configuration differ depending on the customer.

According to the result of this conformity test, the CE mark shown in the left is attached to the PY0 Servo Amplifier based on the recognition certificate issued by a third party recognizing organization.

Accordingly, customers are requested to perform the final conformity test on their machines or systems.

10.4.3 CE Marking Conformity Standard

The following conformity tests are performed for PY0 Servo system.

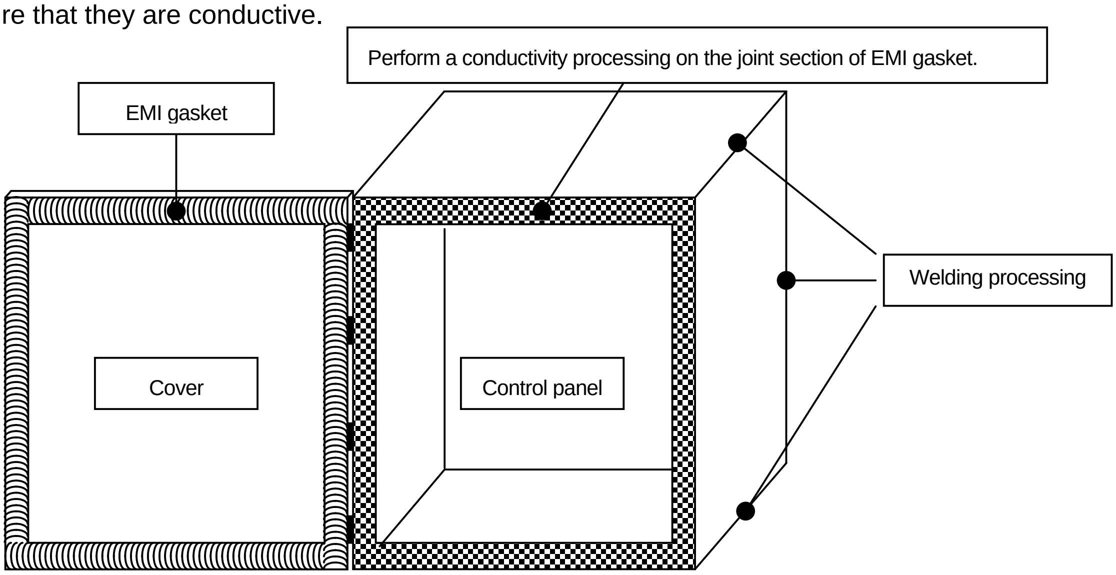
Classification of directive	Classification	Test	Test standard
Low voltage directive (Servo Amplifier)	–	–	EN50178
EMC directive (Servo Amplifier/ Servomotor)	Emission	Conducted emission	EN55011: A1/1999
		Radiated emission	EN55011: A1/1999
	Immunity test	Electrostatic discharge immunity	EN61000-4-2: A2/2000
		Radiated electromagnetic field immunity	EN61000-4-3: A2/2000
		Keyed carrier	ENV50204: 1995
		Electrical first transient/ burst immunity	EN61000-4-4: A1/2000
		Conducted disturbance immunity	EN61000-4-6: A1/2000
Low voltage directive (Servomotor)	–	Rotating electrical machines Part1: Rating and performance	IEC34-1
		Rotating electrical machines Part5: Classification of degrees of protection provided by enclosures of rotating electrical machines (IP code)	IEC34-5
		Rotating electrical machines Prat9: Noise limits	IEC34-9

10.4.4 Cautions for EMC Directive Conformity

Observe the followings for the conformity of customer's machines or systems incorporating the PY0 Servo system.

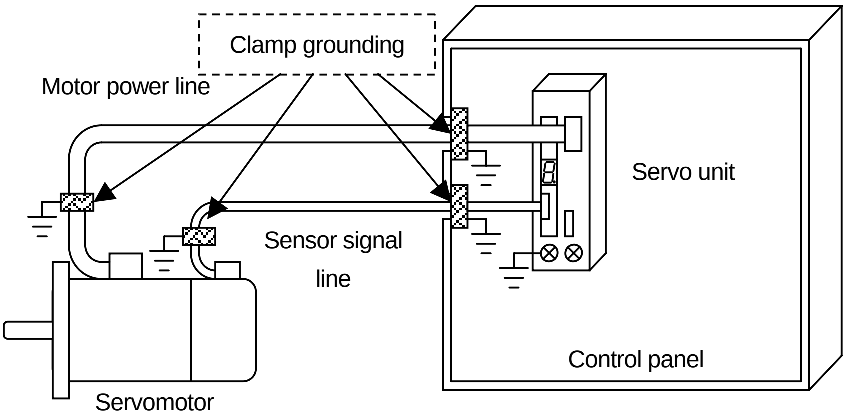
① Structure of the control panel

1. A metallic material is used for the control panel and its cover.
2. The joint of the roof and the side board shall be masked and welded.
3. The screw fixed joint shall be welded to prevent noise from leaking from the gap in the joint.
4. In the case of fixing with screws or spot welding, the welding space shall be within 10 cm.
5. Use an EMI gasket to prevent clearance between the cover and the control panel.
6. The EMI gasket shall be installed uniformity on the joint section of the cover and the control panel.
7. Perform a conductivity processing on the EMI gasket, the cover and the control panel to make sure that they are conductive.

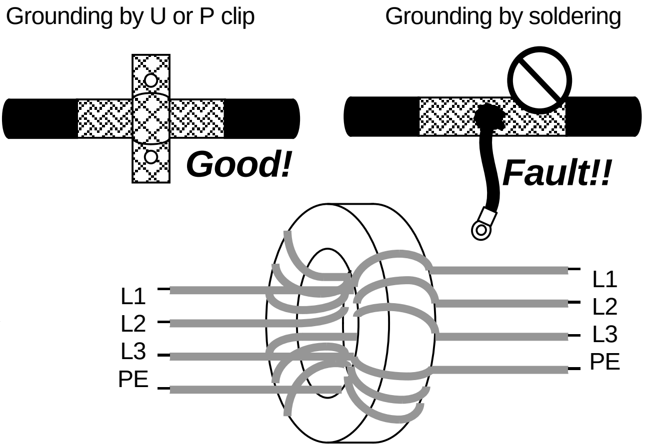


② Installation and wiring of the peripheral equipment inside the control panel

1. Ground the noise filter frame on the control panel.
2. Make sure to ground the box of customer's unit.
3. Use the shield cables for motor power line and sensor cable.
4. Motor power line and the shield of sensor cable shall be clamped and grounded on the control panel.
5. Motor power line and the shield of sensor cable shall be clamped and grounded on the frame at the Servomotor side (machines of customer's equipment and system).



6. Install and ground the clamp directly with a metal screw using a metal conductive P or U clip.
   Do not clamp by soldering the power line to the shield.
7. Wind the zero-phase reactor five turns around the primary side of the noise filter.
8. Perform wiring from the secondary side of the noise filter to the Servo amplifier, keeping it as short as possible
9. The wiring for the primary and secondary sides of the noise filter must keep a certain distance apart.



③ How to install Servo Amplifier

Refer to the figures below for installing 3-phaze/single-phase Servo Amplifiers.

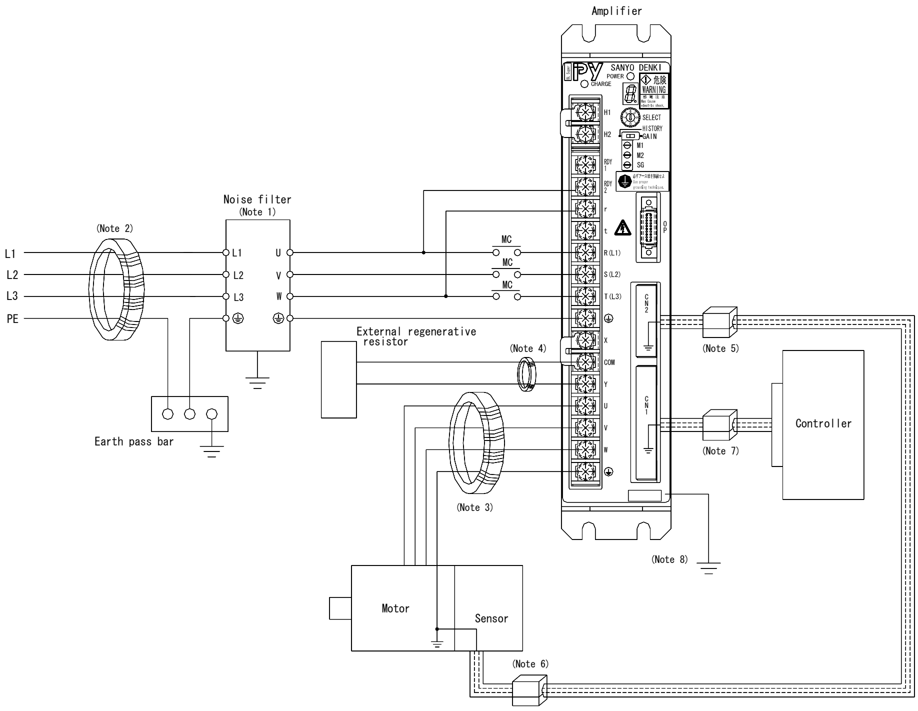


Fig. 10-1 3-phase Installation

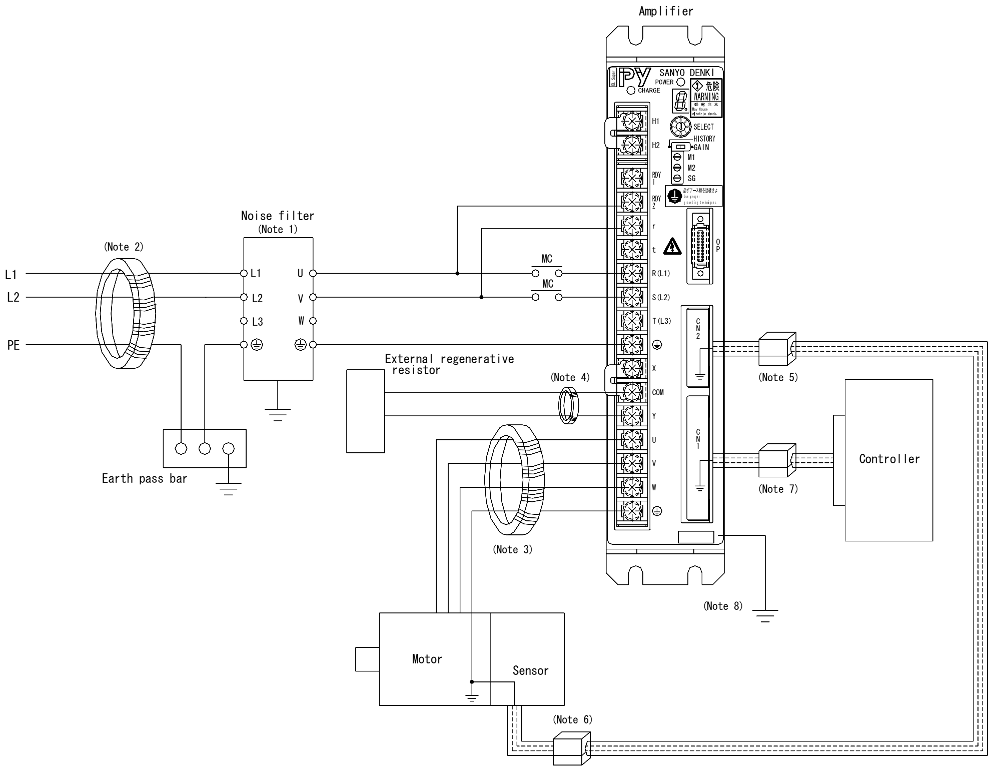


Fig. 10-2 Single-phase Installation

④ Recommended parts for EMC countermeasures and their installation

(Note #) indicates those in the figures 10-1, and 10-2.

(Note1) Noise filter

Model type (Sanyo's model number)	Specifications	Maker
RF3020-DLC	Rated voltage: Line-Line 440-550V Rated current: 20A	RASMI ELECTRONICS LTD,.
RF3030-DLC	Rated voltage: Line-Line 550V Rated current: 30A	RASMI ELECTRONICS LTD,.
RF1010-DLC	Rated voltage: Line-Neutral 250V Rated current: 10A	RASMI ELECTRONICS LTD,.
HF-3030A-TM (AL-00251228-01)	Rated voltage: 250 VAC Rated current: 30A	

* Make sure to ground the frame of the noise filter.

* The wiring for the primary and secondary sides of the noise filter must be as far apart as possible.

* Keep wiring from the noise filter to the Servo Amplifier as short as possible.

* Connect Servo Amplifier to the secondary side of the noise filter.

(Note2) Wiring of power supply cable

Toroidal core

Model type (SANYO's model number	Outside diameter	Inside diameter	Maker
H5C2 T60×20×36 (AL-00251225-01)	60.0 mm	36.0 mm	TDK

* Wind the power cable five turns around the toroidal core.

(Note3) Wiring of motor power line

Toroidal core

Model type (SANYO's model number	Outside diameter	Inside diameter	Maker
TR-40-27-15 (AL-00251226-01)	40.6 mm	27.4 mm	KITAGAWA INDUSTRIES Co., Ltd.

- * Make sure to use shield cable for wiring the motor power line and to ground the sheathe of the shield.
- * Wind the power cable four turns around the toroidal core.

(Note4) Wiring for external regenerative resistor

Toroidal core

Model type (SANYO's model number	Outside diameter	Inside diameter	Maker
TR-40-27-15 (AL-00251226-01)	40.6 mm	27.4 mm	KITAGAWA INDUSTRIES Co., Ltd.

- * When the external regenerative resistor is necessary, wind the resistor wire four turns around the toroidal core
- * Install the toroidal core as near as possible to the Servo Amplifier.
- * Wiring between the external regenerative resistor and the Servo Amplifier must be kept within 2.8m.

(Note5), (Note6) Wiring cables

Ferrite core

Model type (SANYO's model number	Outside diameter	Maker
SFC-10 (AL-00113483-01)	9.5～10.5 mm	KITAGAWA INDUSTRIES Co. Ltd.

- * Make sure to use shield cable for wiring the sensor cable and to ground the sheath of the shield.
- * For Servo Amplifier connectors, shield sheath can be grounded by connector shell.
- * Wiring between the Servo Amplifier and the motor must be kept within 30cm.
- * Install the ferrite core (cut type) around the exit of the Servomotor sensor cable and near the Servo Amplifier connector.

(Note7) Wiring between Servo Amplifier and controller

Ferrite core

Model type (SANYO's model number	Outside diameter	Maker
SFC-10 (AL-00113483-01)	9.5～10.5 mm	KITAGAWA INDUSTRIES Co. Ltd.

- * Make sure to use shield cable for wiring and to ground the sheath of the shield.
- * For Servo Amplifier connectors, shield sheath can be grounded by connector shell.
- * Wiring between the Servo Amplifier and the controller must be kept within 2.8m.
- * Install the ferrite core (cut type) near the Servo Amplifier connector.

(Note8) Grounding of the Servo Amplifier box

- * Make sure to ground the Servo Amplifier box.

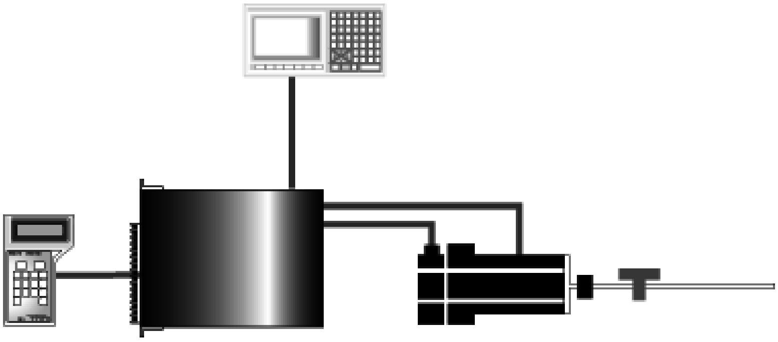
Information is available at makers’ homepages (as of June, 2001) as follows：

Soshin : http://www.soshin.co.jp/.
TDK : http://www.tdk.co.jp/
KITAGAWA INDUSTRIES C., Ltd. : http://www.kitagawa-ind.com/

⑤ EMC Test

The EMC test on the PY0 Servo system incorporated machines or equipments must meet the requirements of emission and immunity standard (electromagnetic compatibility) in the customer’s working environment and the operating conditions of the electric equipments. Upon observing the cautions mentioned previously, customers are requested to perform the final conformity test.

APPENDIX : PY PC INTERFACE



APPENDIX: PY PC INTERFACE

11. APPENDIX: PY PC INTERFACE

11. PY PC INTERFACE

Introduction

This chapter describes how to set up, connect, and use the PY Servo Amplifier PC Interface.
The PY PC Interface has been designed as a tool for helping users of “PY” series servo systems to do operational checks safely and to do adjustments and setup easily.
To prepare for achieving full use of the PY PC Interface, thoroughly read this user's manual as well as the accompanying instruction manual of your PY Servo Amplifier.

Conventions Used in This Manual

The following conventions are used to describe mouse and key operations.

Mouse operation

- Click: Indicates a quick press and release of the left mouse button.
- Double-click: Indicates two quick clicks of the left mouse button.
- The product can be operated only with click and double-click operations.

Key operation

[Enter] : Key names are enclosed in brackets ([ ]).

[Shift] + [F 1] : A plus sign (+) indicates a two-key combination.
This example indicates to press the [F1] key while pressing the [Shift] key.

[Return] : Commands and menu buttons are also enclosed in brackets ([ ]).

Arrow key : Indicates [←] , [→] , [↑] , or [↓] key.

Key notation

This guide uses standard generic key notation to explain key operations.
Keyboard notation may be different depending on manufacture or machine type.
For details, refer to the section explaining "keys list" in your Windows manual or the manual provided with your computer

11. PY PC INTERFACE

11.1 Before Starting

11.1.1 Overview

PY PC Interface allows you to change servo amplifier parameters, perform batch saves and loads, monitor operational conditions, display waveforms, and run miscellaneous test modes by means of serial communication between your computer and servo amplifier.

11.1.2 Package contents

Confirm that the package contains the following items :

• This User's Manual	one
• Cable for connecting amplifier and computer (Model type: AL-00356620-01)	one
• Software: Latest version 1.30	one

11.1.3 Hardware requirements

The following hardware is required as well as a servo amplifier and servo motor.
Configure the system according to the instructions provided with the devices.

Computer	: Personal computer running Windows 95® 3.5" floppy disk drive Hard drive : At least 4 MB free space At least one free serial port (depending on the connector type of the serial port, third-party converting connector may be necessary).
Display	: Supporting at least 800 x 600-pixel resolution and 256 colors.

11.1.4 Setup

Set up the software by following this procedure :

1. Stop all applications that are running.
2. Insert the installation floppy disk into the floppy disk drive, and find and double-click setup.exe on the floppy disk, or press the Start button and use “Run..." to execute setup. exe.
   When the installation process starts, follow the instructions appearing on the screen.

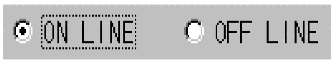
   > NOTE : Copying the shortcut from the PY PC Interface window to PYIF.exe onto the desktop makes starting the PY Remote Operator for Windows more convenient.

   This completes installation.
3. Connect the OP connector on the PY servo amplifier to the serial terminal (COM) on the computer with the provided cable.
   This completes the setup procedure. To start the software, click [Start] from the Start menu, [Programs], [PY Remote Operator], and [PYIF]

11.2 Basic Operations

11.2.1 Radio buttons

Use these buttons to select one of the preset value groups. A black circle indicates the selected value.
To select a value using the mouse, place the mouse cursor on the circle and click.
To select a value using the keyboard, use arrow keys to select the value and press the **[Enter]** key.

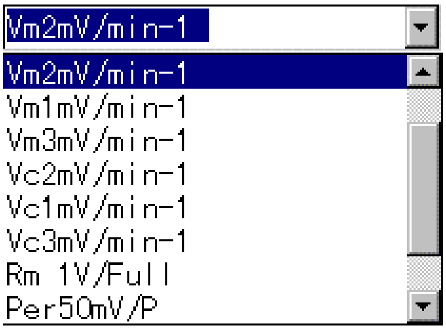


● ON LINE ○ OFF LINE

←The example in the left figure shows "ON LINE" selected.

11.2.2 Combo boxes

Use a combo box to select a value from a range or from a number of data, including masters. Selecting a value from a list is far easier than remembering a specific value and typing it in.



Vm2mV/min-1

Vm2mV/min-1
Vm1mV/min-1
Vm3mV/min-1
Vc2mV/min-1
Vc1mV/min-1
Vc3mV/min-1
Rm 1V/Full
Per50mV/P

←To display the selection box, click the ▼ button.
If an entire list is not visible, use the ▲ or ▼ key to scroll through the list until desired value appears.

←The scroll bar indicates the current position in the Combo box.

11.2.3 Confirmation dialog box

The system displays a confirmation dialog box to confirm your decision; for example, to make sure that you really want to save data.
To proceed to the next step, check the message and select the appropriate response.
The following figure shows an example of the confirmation dialog box that appears after parameter settings have been modified and the **[Main Menu]** button has been pressed. Selecting **[Yes]** opens the existing screen, selecting **[No]** returns to the Main menu without saving the changes, and selecting **[Cancel]** closes the displayed confirmation dialog box and returns to the [Set parameters] dialog box.

Conformation dialog box for exiting from parameter setting

Exit the Parameter setting. Save Data to File?

11.2.4 Notes on operation

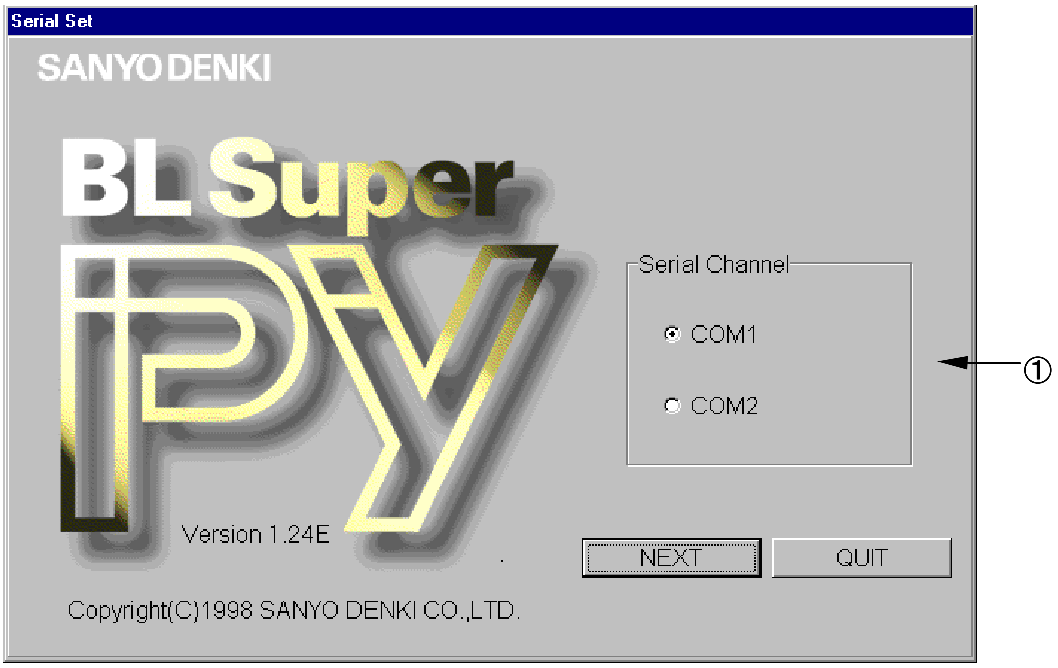
- Numeric values entered into the [Edit/Set parameters] dialog box must be half-size characters. Full-size characters can be used for filenames and comment entries.
- This software does not support removal of a parameter file

11.3 Initial Screen and Main Menu

11.3.1 Initial screen

Use the PY PC Interface initial screen to select the RS232C port on the computer that connects to the servo amplifier.

Initial screen



11.3.1.1 Setting up RS232C port

Click either COM1 or COM2 in section ①. A black dot indicates the selected radio button. Then click the **[NEXT]** button to set up the RS232C port. The Main menu reappears.

Description of items

[RS232C port] : This section is for selecting the RS232C port on the computer that connects to the servo amplifier.

[NEXT] : Accesses the Main menu.

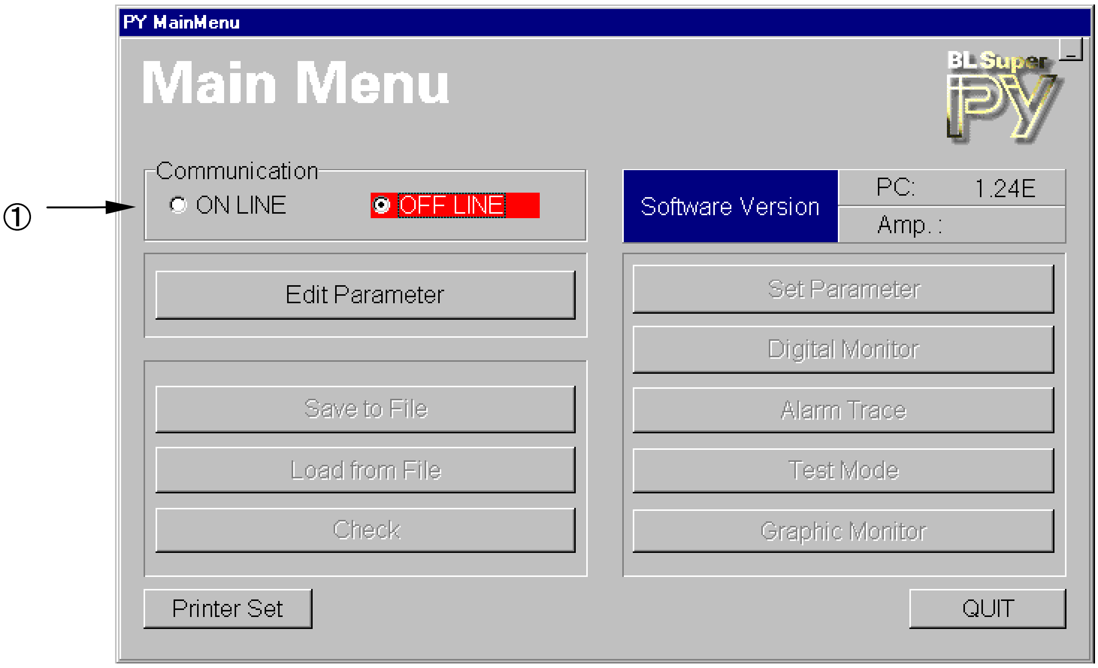
[QUIT] : Exits from the PY Remote Operator for Windows.

11.3.2 Main Menu screen

11.3.2.1 Main Menu screen

Change from the initial screen to the Main menu.
From the Main menu, you can connect to the servo amplifier, set up or edit the parameters or display the alarm history, test mode, or operation waveform.
As the system moves from the initial screen to the Main menu, the connection to the servo amplifier appears as OFF LINE status. In the OFF LINE status, only editing parameters (see page 11-13) is available.

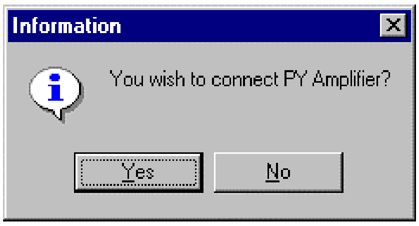
Main Menu screen under OFF LINE status



11.3.2.2 Connecting servo amplifier to computer

1. Use the provided cable to connect the serial terminal (COM) to the OP connector of the PY servo amplifier.
2. Turn on the servo amplifier.
3. Click [ON LINE] in section ①. The connection to the servo amplifier is confirmed. Click the **[Yes]** button in the message dialog box to establish the connection. When the connection is established, the process buttons (parameter settings, monitors display, etc.) are enabled.

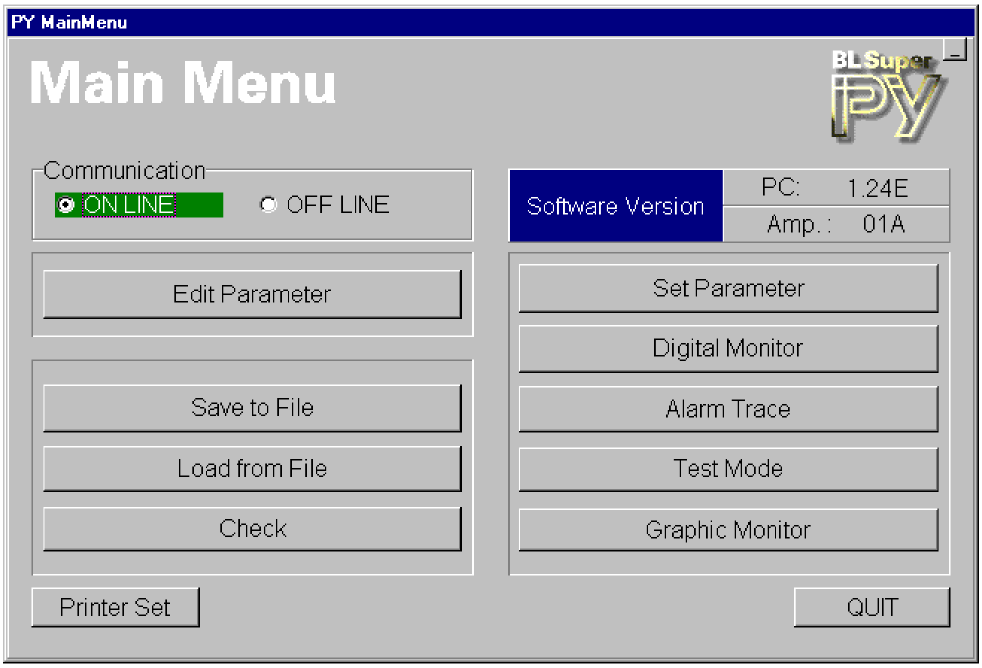
Confirmation Dialog Box


Information

You wish to connect PY Amplifier?

11. PY PC INTERFACE

Main Menu screen under ONLINE status



Communication: ● ON LINE ○ OFF LINE

Software Version PC: 1.24E Amp. : 01A

Description of items

[Software version] : Displays the versions of this software and servo amplifier CPU.

Pressing any of the following buttons starts its associated action.

[Driver <-> PC] : Connects/Disconnects the computer to/from the servo amplifier.
[Edit parameters] : Edits the parameters on the disk.
[Save onto disk] : Saves the set parameters of the servo amplifier onto the disk.
[Load from disk] : Loads the parameters from the disk to the servo amplifier.
[Match parameter] : Matches the parameters on the servo amplifier on the disk.
[Set parameters] : Sets the parameters of the servo amplifier.
[Display monitored values] : Displays the monitored values.
[Display alarm history] : Displays alarm history.
[Test mode] : Runs the following test mode operations :

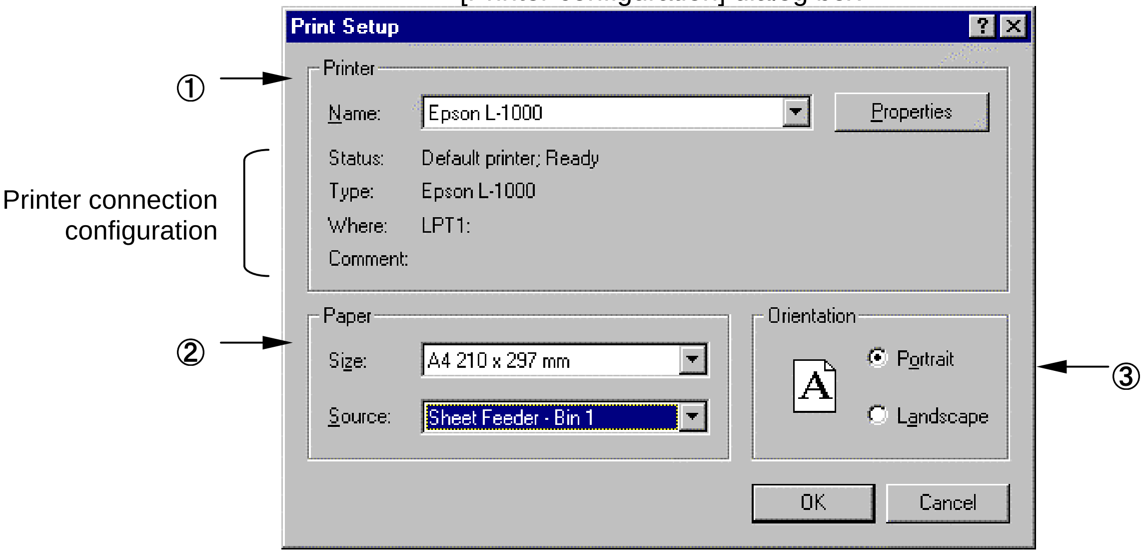
- Jog operation
- Servo tuning
- Directed offset adjustment
- Absolute encoder clear

[Display operation waveform] : Displays the operation waveform.
[Printer configuration] : Change the printer configuration.
[QUIT] : Exits from the PY PC Interface.

11.3.3 Printer configuration

The [Printer configuration] dialog box is for selecting the destination printer and the form size before printing a parameter editing list or alarm history list.

[Printer configuration] dialog box



Name: Epson L-1000
Status: Default printer; Ready
Type: Epson L-1000
Where: LPT1:
Comment:
Size: A4 210 x 297 mm
Source: Sheet Feeder - Bin 1
● Portrait
○ Landscape

① Printer

In section ① Printer, the name of the printer driver configured for printing from the PY PC Interface for Windows appears in the [Name (N)] field and the connection configuration appears under the field.

② Form

- Size: For selecting the form size for printing. (Select A4 size for this application.)
- Feeding: For selecting printer form feed method.

Example : Cut-sheet guide : Manually feeds sheets one by one.
Automatic-sheet feeder : Sets more than one sheet of paper together.
Cut-sheet feeder: Same as the automatic-sheet feeder.

NOTE : For some printers, an auto-sheet feeder (and/or cut-sheet feeder) is a separate option.

③ Printing orientation

Specifies the direction of printing, either landscape or portrait, without regard to the direction of paper insertion.

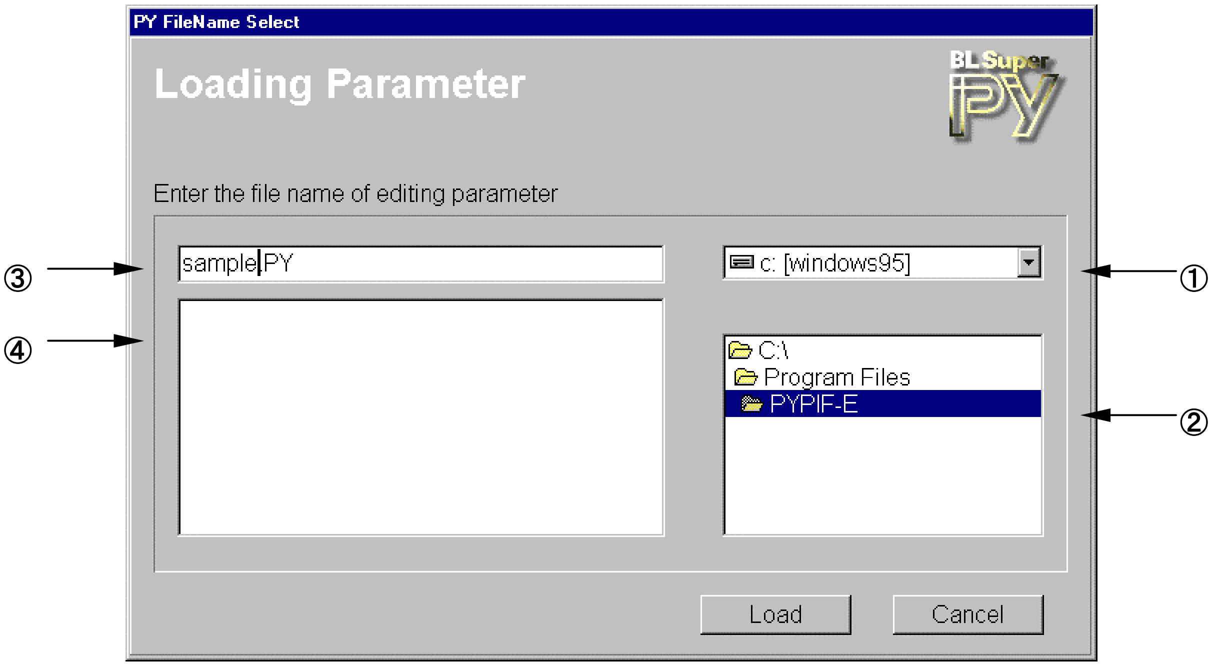
(1) Portrait ABC ↑ Direction of feeding (2) Landscape ABC ↑ Direction of Feeding

NOTE : Select Printer configuration SIZE : A4
Printing orientation : Portrait
Please don’t select other configuration.

11.3.4 Loading files

1. The following [Load parameters from disk (File name confirmation)] dialog box appears when data is loaded from a file.

[File name confirmation] dialog box



PY FileName Select

Loading Parameter

Enter the file name of editing parameter

sample.PY

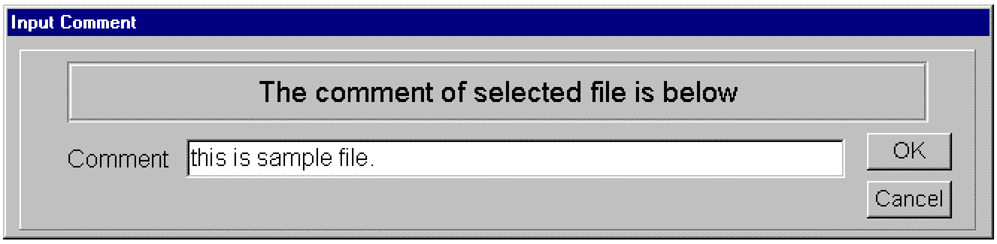
c: [windows95]

C:\
Program Files
PYPIF-E

The dialog box has the following four panels:

① Drive : ... The drive where parameter folders reside.
② Folder : ... The folder containing parameter files.
③ Parameter file name : ... The parameter file to be edited.
④ File list : ... The list of files in the folder in ②.

1. Make sure the files are listed in ③ Parameter file name (or type in the desired file name directly) and click the **[Load]** button.
2. The comment on the selected parameter appears. Read the comment and click the [OK] button to retrieve the file.



Input Comment

The comment of selected file is below

Comment this is sample file.

To cancel the loading, click the [Cancel] button.

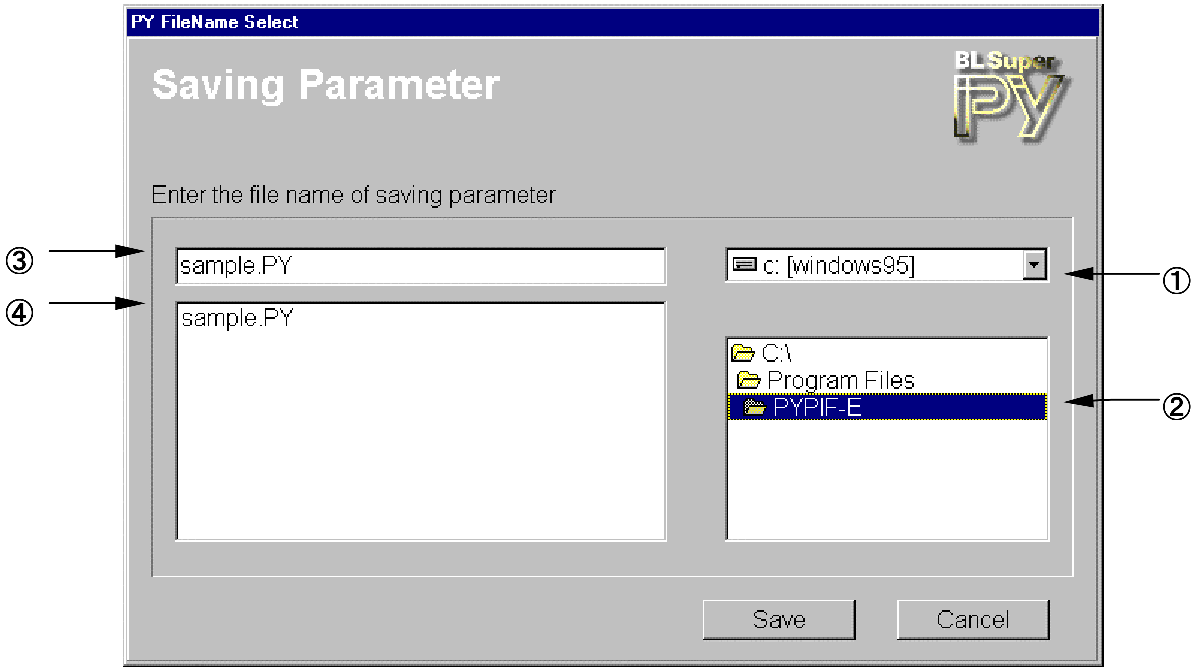
Description of items (excluding ①, ②, ③ and ④)

[Cancel] : Returns to the Main menu.

11.3.5 Saving files

1. The following [Save parameters onto disk (File name confirmation)] dialog box appears when data is saved to a file.

[File name confirmation] dialog box



PY FileName Select

Saving Parameter

Enter the file name of saving parameter

sample.PY

sample.PY

c: [windows95]

C:\
Program Files
PYPIF-E

The dialog box has the following four panels :

① Drive	:	The drive where parameter folders reside.
② Folder	:	The folder containing parameter files.
③ Parameter file name	:	The parameter file to be edited.
④ File list	:	The list of files specified in the folder in ②.

Select the drive of the target folder in ① Drive and the target folder in ② Folder, type in a new file name, and click the **[Save]** button.

2. The [Comment Entry] dialog box appears. Type in a comment and click the **[OK]** button. You may omit the comment. The new file has been saved.

NOTE : If you save the file with an existing file name, the existing file is overwritten and its contents are erased.

11.4 Editing Parameters

The [Edit parameters] dialog box is used for accessing a parameter file stored on disk in order to modify it. This only changes the parameters on a file instead of transmitting parameters to the servo amplifier directly.

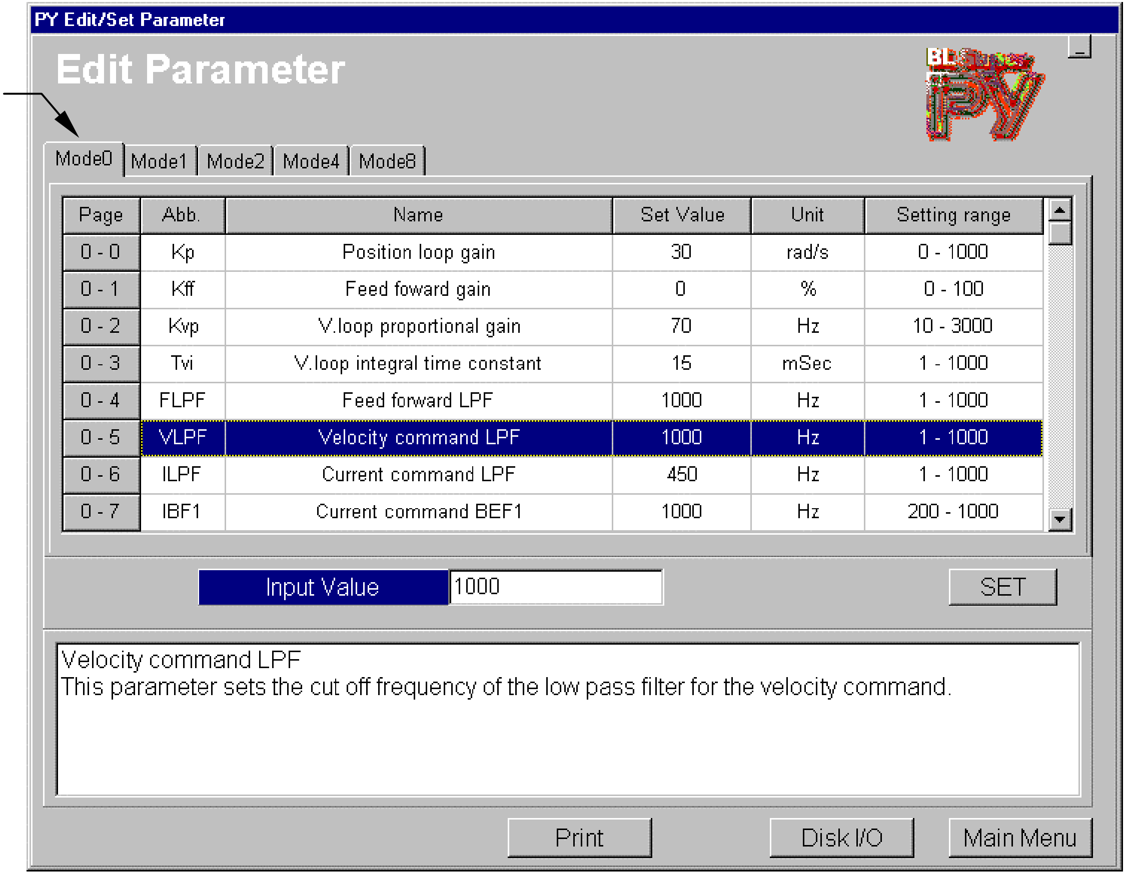
11.4.1 Accessing parameter file

Before you can edit parameters, you must access the existing parameter file.
For the instructions on accessing, see page 11-17 “Loading from Disks,” and load the parameter file (with an extension .PY).

11.4.2 Parameter mode

The [Edit parameters] dialog box has five tabs for selecting modes: modes 0, 1, 2, 4, and 8. Modes 0, 1, 2 and 8 can be changed with key entries. Mode 4 represents the mode of the parameters that can be modified by making selection from the existing items list. A description of each parameter appears in the lower panel.

Edit parameter（Mode0）



Mode selection

Page	Abb.	Name	Set Value	Unit	Setting range
0 - 0	Kp	Position loop gain	30	rad/s	0 - 1000
0 - 1	Kff	Feed foward gain	0	%	0 - 100
0 - 2	Kvp	V.loop proportional gain	70	Hz	10 - 3000
0 - 3	Tvi	V.loop integral time constant	15	mSec	1 - 1000
0 - 4	FLPF	Feed forward LPF	1000	Hz	1 - 1000
0 - 5	VLPF	Velocity command LPF	1000	Hz	1 - 1000
0 - 6	ILPF	Current command LPF	450	Hz	1 - 1000
0 - 7	IBF1	Current command BEF1	1000	Hz	200 - 1000

Input Value: 1000

Velocity command LPF
This parameter sets the cut off frequency of the low pass filter for the velocity command.

11.4.3 Editing parameters

1. Click the mode where the parameter to edit is stored.
2. Click the target parameter in the mode.
3. The parameter value on the clicked line appears in the [Parameter Entry] field.
   Specify any value within the available range.

4. After entering the parameter and checking the value or item, pressing the [Enter] key or clicking the **[SET]** button sets the entered value as the parameter value. If you do not press the [Enter] key or click the **[SET]** button, the entered value is discarded.
5. To save the changed parameters, click the [Disk I/O] button and select **[Save onto disk]**. Also, on the way to returning to the Main menu by clicking the **[Main Menu]** button you can save the parameters.

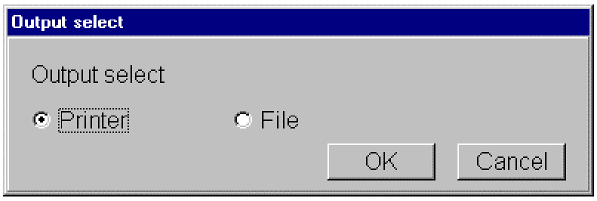
The buttons on the [Edit] dialog box and their functions are as follows :

[SET]	: Sets up the changed parameter. This is the same as pressing the [Enter] key.
[Disk I/O]	: Accesses the [Save parameters] or [Load parameters] dialog box.
[Main Menu]	: Exits from the [Edit] dialog box and displays the [Save confirmation] dialog box.

11.4.4 Printing parameters

You can print the parameters from the [Edit parameters] dialog box,. The following is the printing procedure :

1. Click the **[Print]** button.
2. The following dialog box appears. Select a printer or file as the output destination and click **[OK]**.

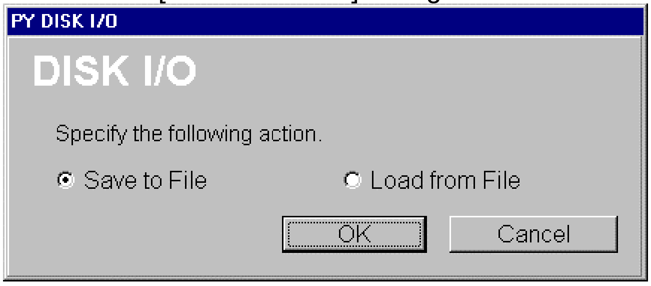


If you selected a file for the output destination, a dialog box prompting the file name appears.

11.4.5 Disk I/O

If you click the **[Disk I/O]** button, you can save or load a parameter file during editing, and you can edit the parameters repetitively.

[Select Disk I/O] dialog box



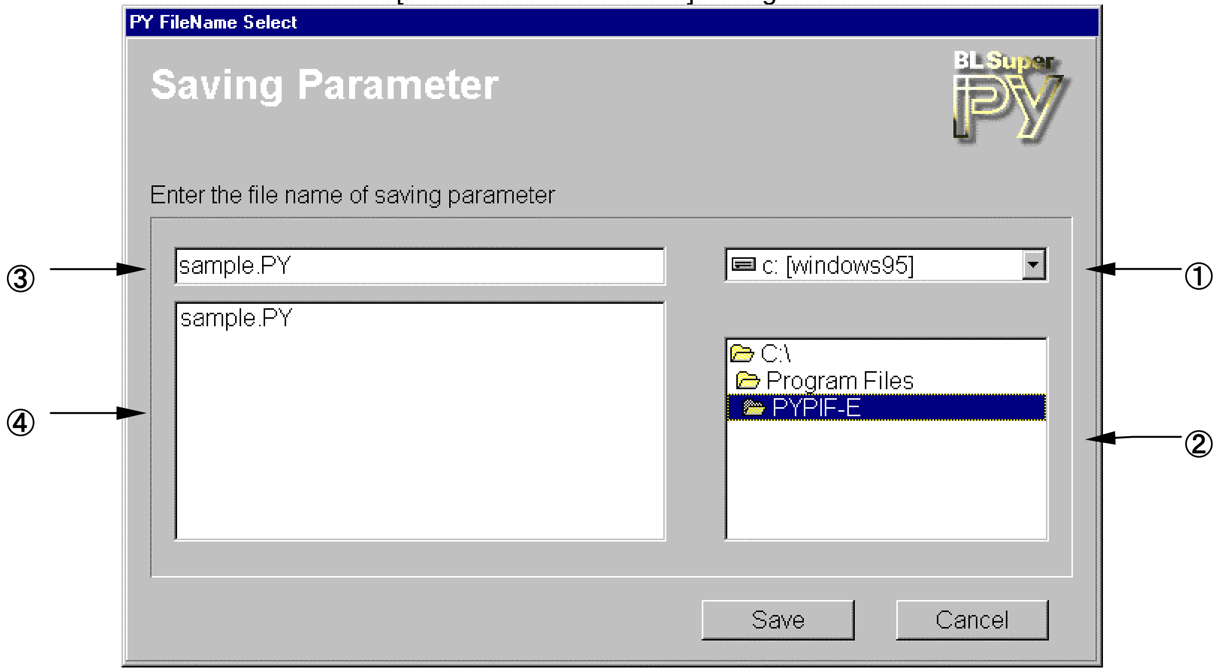
- Select [Save onto disk] and click **[OK]** button and the [Save parameters to disk] dialog box appears. You can save the currently editing parameters to a file.
- Select [Load from disk] and click **[OK]** and [Load parameters from disk] dialog box appears. You can edit another parameter file further.

NOTE : If you save the file with an existing file name, the existing file is overwritten and its contents are erased.

11.5 Save Onto Disk

[Save onto disk] saves all the current parameter settings on the servo amplifier and stores them together in a parameter file. At this time, the parameters are not displayed on the dialog box but directly saved into the disk. If you want the parameter settings at this time, use the [Edit parameters] dialog box and check them.

[File name confirmation] dialog box



PY FileName Select

Saving Parameter

Enter the file name of saving parameter

sample.PY

sample.PY

c: [windows95]

C:\
Program Files
PYPIF-E

11.5.1 Saving onto disk

1. Click the **[Save onto disk]** button from the Main menu.
2. Select the drive of the target folder in ① Drive and the target folder in ② Folder.
3. Type in a new file name and click the **[Save]** button. The new parameter file is stored.
   If you use an existing file name, the file is overwritten.

NOTE : If you save the file with an existing parameter file name, the existing file is overwritten and the parameter settings in the file are erased.

Description of items (excluding ①, ②, ③ and ④)

[Save] : Saves the parameters into a file with the specifications in ① , ② , and ③.
After clicking the **[Save]** button, the [Comment Entry] dialog box appears for the saved file.
Enter a comment and click the **[OK]** button to save the parameters into the file.
(The comment may be omitted.)

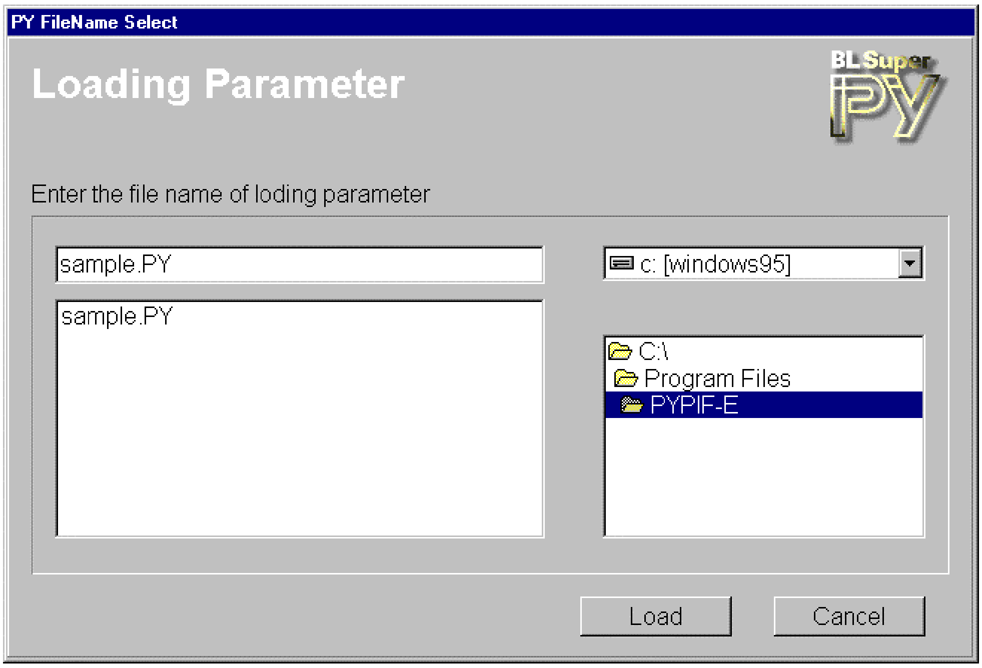
[Cancel] : Returns to the Main menu without saving the parameters.

11.6 Loading From Disk

[Load from disk] loads all the parameters from a parameter file into the servo amplifier for configuration.

11.6.1 Loading parameters into the servo amplifier

1. Click [Load from disk] from the Main menu.
2. Specify the parameter file to load into the servo amplifier.



Enter the file name of loding parameter

sample.PY

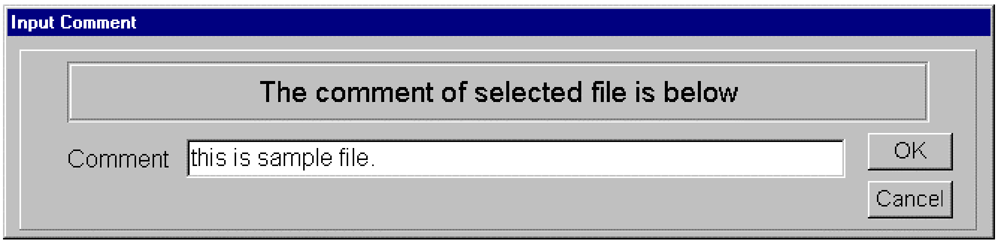
sample.PY

c: [windows95]

C:\
Program Files
PYPIF-E

Make sure the file name appears in Parameter file name (or directly type in the file name) and click the **[Load]** button.

3. When the comment on the selected parameter file appears, check the comment and click the **[OK]** button to start loading the parameters into the servo amplifier.



The comment of selected file is below

Comment: this is sample file.

4. To make the loaded parameters effective, turn off the servo amplifier and again turn it on. At the same time, also put the PY PC Interface off_ line from the Main menu (see page 11-7).

NOTE : - This dialog box does not show the set values in the selected parameter file. To check the value, use the [Edit parameters] dialog box.
- After these steps, the current driver parameters are overwritten.
- If a power failure or communication failure occurs when loading, restart it.

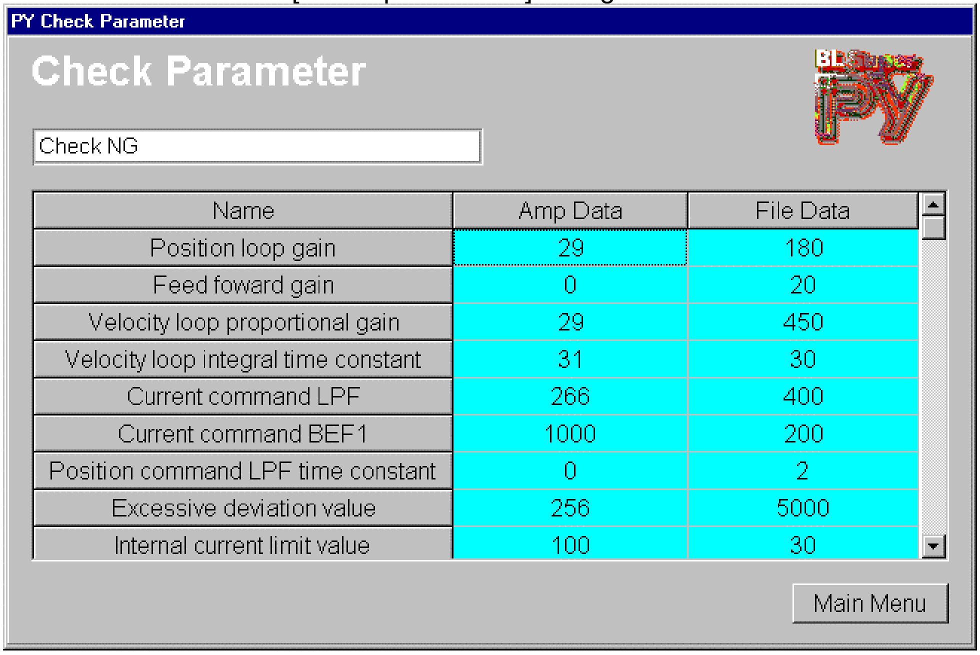
11.7 Parameter Matching

The [Match parameters] dialog box matches the parameters in the servo amplifier with the parameters in the disk and creates a list of mismatches if applicable. This feature does not save the result of the task.

11.7.1 Matching parameters

1. Click **[Match parameter]** from the Main menu.
2. Specify the matching parameter file in the [Select file] dialog box.
   For instructions on how to specify the file, refer to Section 3-4, “Loading files.”
3. Click the **[Load]** button. The comment on the selected file appears. Check the comment and click the **[OK]** button to start matching parameters.
4. After matching parameters, if any difference is found between the driver data and file data, the following list appears.

[Match parameters] dialog box



Check NG

Name	Amp Data	File Data
Position loop gain	29	180
Feed foward gain	0	20
Velocity loop proportional gain	29	450
Velocity loop integral time constant	31	30
Current command LPF	266	400
Current command BEF1	1000	200
Position command LPF time constant	0	2
Excessive deviation value	256	5000
Internal current limit value	100	30

Description of other items

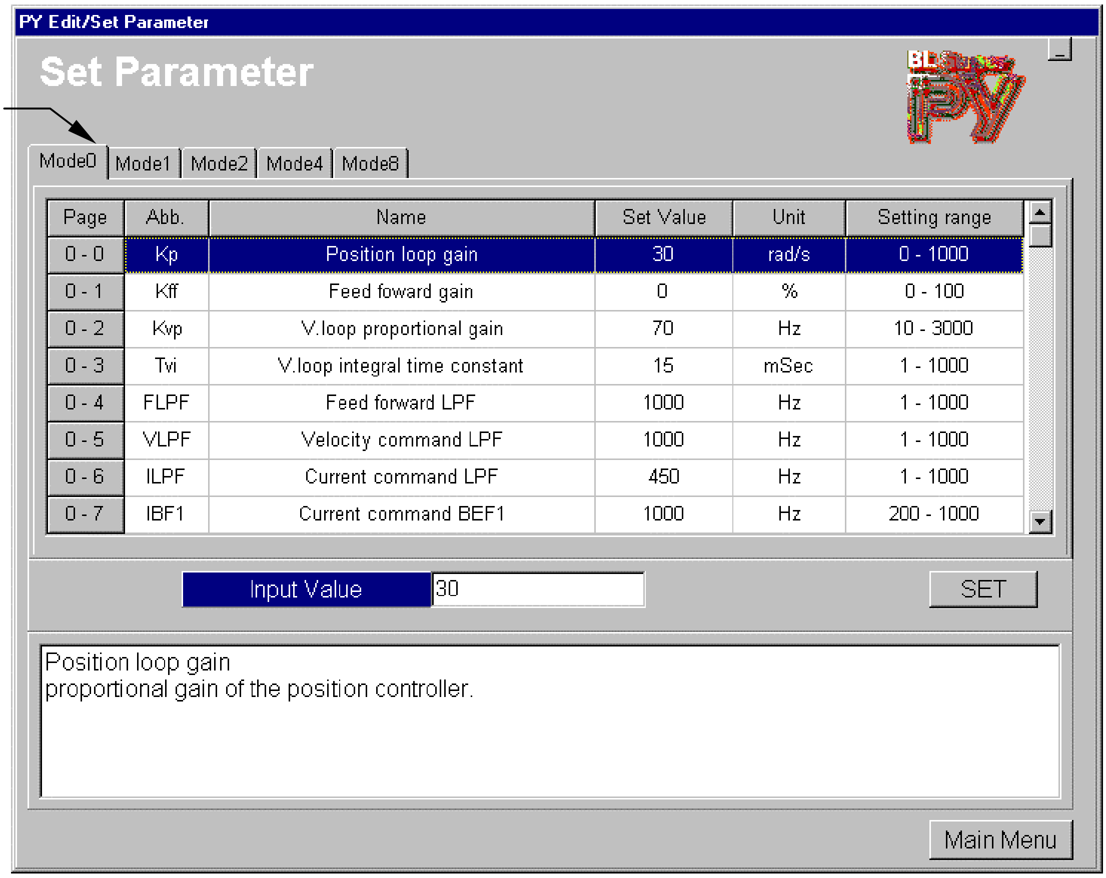
[Main Menu] : Returns to the Main menu.

NOTE : If you have any parameter whose name is represented as "system area," consult our technical service

11.8 Set parameters

The [Set parameters] dialog box displays the parameters in the connected servo amplifier. Whenever you change any of them, the parameters in the servo amplifier are updated. The [Set parameters] dialog box has five mode tabs: modes 0, 1, 2, 4 and 8. Modes 0, 1, 2 and 8 are parameters that can be modified by typing from the keyboard. Mode 4 is a parameter that can be selected from the predefined item lists. The comments in the bottom panel describe the selected line.

The [Edit parameters] dialog box edits the set value in a file, and the [Set parameters] dialog box directly configures the set value in the servo amplifier.



Page	Abb.	Name	Set Value	Unit	Setting range
0 - 0	Kp	Position loop gain	30	rad/s	0 - 1000
0 - 1	Kff	Feed foward gain	0	%	0 - 100
0 - 2	Kvp	V.loop proportional gain	70	Hz	10 - 3000
0 - 3	Tvi	V.loop integral time constant	15	mSec	1 - 1000
0 - 4	FLPF	Feed forward LPF	1000	Hz	1 - 1000
0 - 5	VLPF	Velocity command LPF	1000	Hz	1 - 1000
0 - 6	ILPF	Current command LPF	450	Hz	1 - 1000
0 - 7	IBF1	Current command BEF1	1000	Hz	200 - 1000

Input Value: 30

Position loop gain
proportional gain of the position controller.

11.8.1 Set Parameters

1. Click the [Set parameters] button in the Main menu to read the parameters in the connected servo amplifier and display the set values in the [Set parameters] dialog box.
2. Select a mode, click the item to change, type a value in the [Parameter entry] field, or select from the Combo box. Then, press the [Enter] key or click the [SET] button to send the modified value to the servo amplifier.
3. Click the [Main Menu] button to return to Main menu. At this time you can select whether to save the change into a file.

NOTE : When changing a parameter, do not deviate from the specified range.

Description of items

[SET] : Send the values selected in the Parameter Entry field to the Driver.

[Main Menu] : Closes the setting dialog box and opens the [Save confirmation] dialog box.

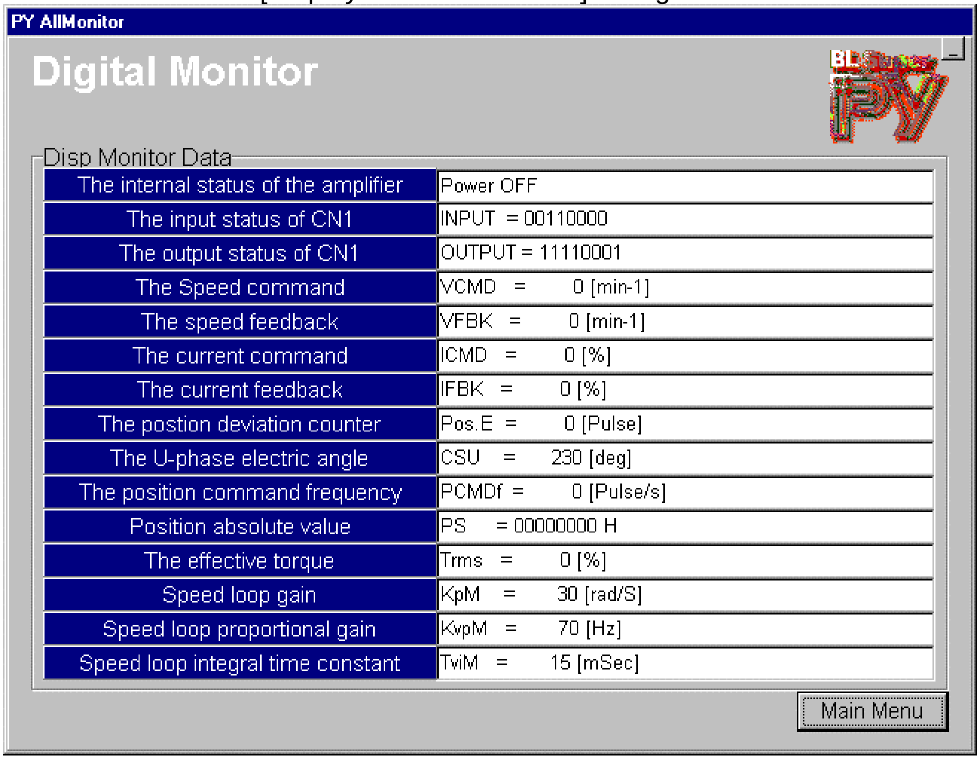
11.9 Monitor Display

[Display monitored values] lists the monitored conditions of the connected driver.

The following items are monitored :

- Status - Status of CN1 input pin - Status of CN1 output pi
- Directed speed - Speed feedback - Directed current
- Current feedback - Electric angle of phase U - Absolute position
- Frequency of directed position - Effective torque
- Position loop gain - Speed loop proportional gain
- Speed loop integral time-constant - Positioning deviation counter value

[Display monitored values] dialog box



Disp Monitor Data

The internal status of the amplifier	Power OFF
The input status of CN1	INPUT = 00110000
The output status of CN1	OUTPUT = 11110001
The Speed command	VCMD = 0 [min-1]
The speed feedback	VFBK = 0 [min-1]
The current command	ICMD = 0 [%]
The current feedback	IFBK = 0 [%]
The postion deviation counter	Pos.E = 0 [Pulse]
The U-phase electric angle	CSU = 230 [deg]
The position command frequency	PCMDf = 0 [Pulse/s]
Position absolute value	PS = 00000000 H
The effective torque	Trms = 0 [%]
Speed loop gain	KpM = 30 [rad/S]
Speed loop proportional gain	KvpM = 70 [Hz]
Speed loop integral time constant	TviM = 15 [mSec]

11.9.1 Displaying monitored values

1. Click the [Display monitored values] button on the Main menu. The [Monitor] dialog box appears, enabling you to monitor various signals.
2. By clicking [?] button on the CN1 input /output status, pin numbers of the displayed data can be displayed on the screen.

Description of other items

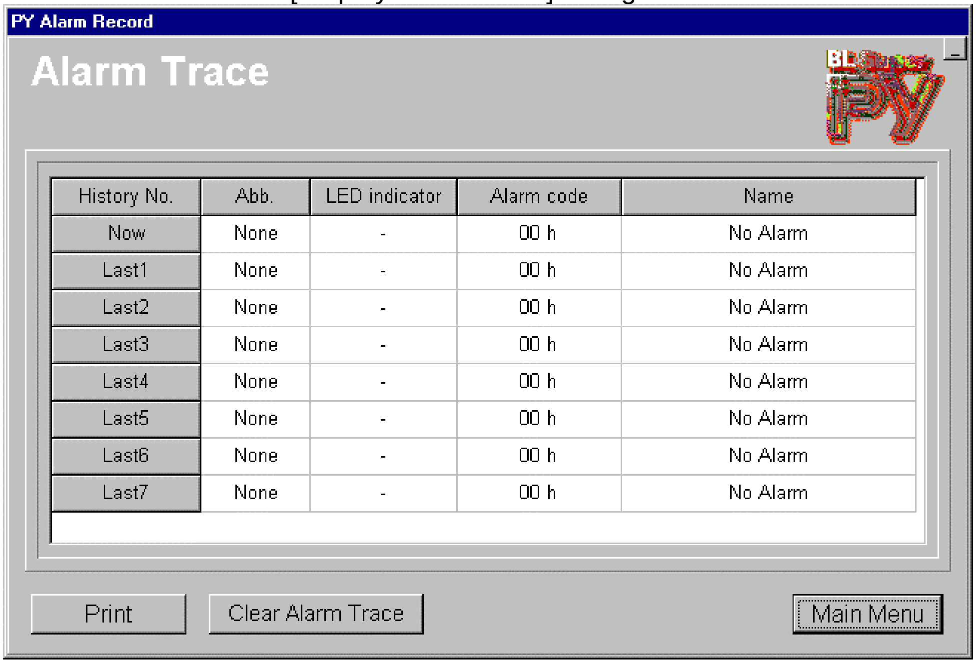
[?] : Calls pin numbers of display data

[Main menu] : Returns to Main Menu.

11.10 Displaying Alarm History

The [Display alarm history] dialog box displays the history of the eight most recent alarms emitted by the servo amplifier. **[Now]** in the first cell under the title of History Number indicates the current alarm status (if there is no current alarm, "No alarm" appears), **[Last 1] to [Last 7]** record the history of the seven most recent events. History information is updated as necessary.

[Display alarm Trace] dialog box



History No.	Abb.	LED indicator	Alarm code	Name
Now	None	-	00 h	No Alarm
Last1	None	-	00 h	No Alarm
Last2	None	-	00 h	No Alarm
Last3	None	-	00 h	No Alarm
Last4	None	-	00 h	No Alarm
Last5	None	-	00 h	No Alarm
Last6	None	-	00 h	No Alarm
Last7	None	-	00 h	No Alarm

11.10.1 Displaying Alarm Trace

1. Click the [Alarm Trace] button from the Main menu. The [Display alarm Trace] dialog box appears.
2. The alarm history information is updated as necessary.
3. Click the [Main Menu] button to return to the Main menu.

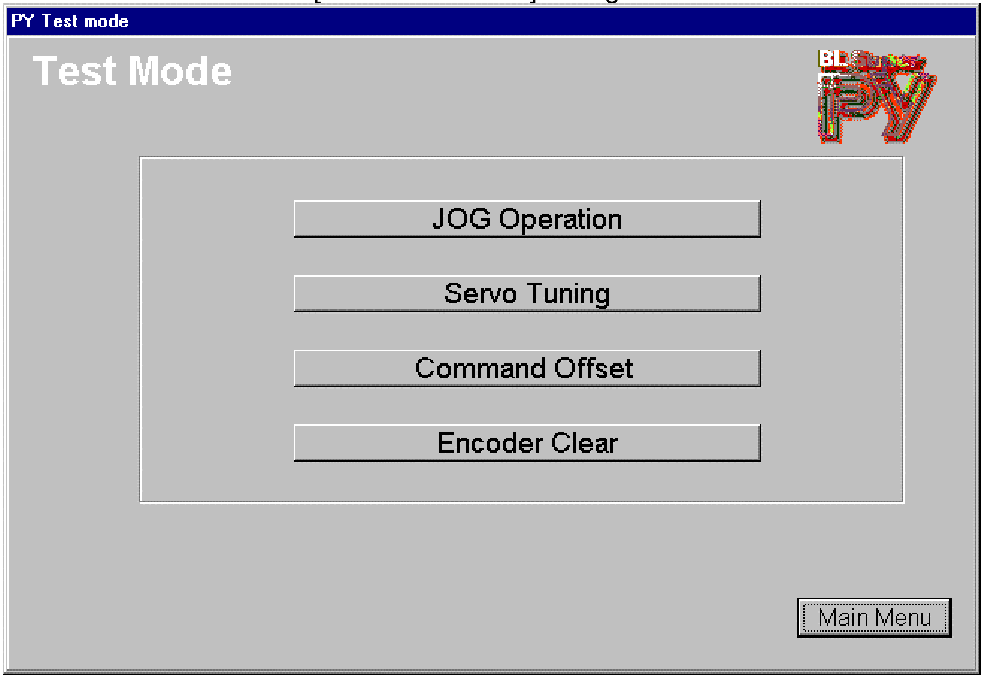
Description of other items

[Print]	: Prints the current history list.
[Clear History]	: Clears the history list.
[Main Menu]	: Turns to Main menu.

11.11 Test mode

In the **[Test mode]** dialog box, the following four different operations are available :

[Select test mode] dialog box



11.11.1 Selecting test mode

1. Click the [Test mode] button in the Main menu to open the above dialog box.
2. Click the desired mode to display its associated message on processing.

Description of other items

[Main Menu] : Returns to Main menu.

To start jog operation and servo tuning :

1) If the control mode type is switching type (velocity <-> torque, position <-> torque, position <-> velocity), turn off the switching input signal.
2) Set the command input to 0.
3) Turn off the Servo On (SON) signal. In the Test mode, the computer forces the servo amplifier to start (servo ON) to output the hold-brake excite-timing signal.
4) Turn on the main circuit power.
5) [Servo ready] is disabled when [JOG] or [Tune] is selected in the Test mode.

After JOG operation and servo tuning :

1) When starting a mode, if you have selected the deviation error alarm for the status after exiting the test mode, you must clear the driver excessive deviation alarm before starting a normal operation. This operation is not recorded in the alarm history.
For a position control type driver, also perform the deviation clear.
2) In case any deviation remains in the user controller, make sure the controller command output is set to 0. (**If the command output is set to a non-zero value, sudden action starts**.)

11.11.2 JOG operation

JOG operation allows running the motor in the normal/reverse direction at a specified speed.

Also note the following :

a. Regardless of the selected control mode, the system operates in the [Velocity control mode] during a JOG operation.

b. The motor operates in the normal direction (CCW when viewed from the load side) when ≪ is clicked, and in the reverse direction (CW when viewed from the load side) when ≫ is clicked.

c. Allocate adequate space for the motor operation. Especially for cases with larger load inertia or set speed, take the deceleration time into account for operation.

d. Since JOG operations are subject to the sequence current limit (Standard value 120%: may be modified in parameter mode 1-12), response may be delayed if the load inertia or load torque is higher.

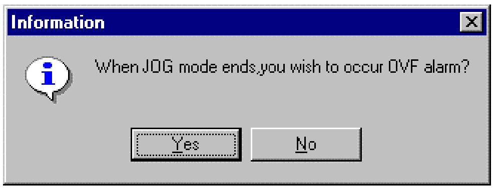
e. If the motor must be accelerated or decelerated, set up the associated time with parameter mode 0-10 (for Directed speed, acceleration time) or parameter mode 0-11 (for Directed speed, deceleration time).

f. Over-travel is also effective during a JOG operation. For example, if an over-travel condition occurs in the normal direction when the motor is operating in the normal direction, the motor stops and rejects any further normal input. Consider the operation time, since the acceleration /deceleration time is also effective under a over-travel condition.

g. A JOG operation may leave a deviation in the position loop. Be sure to clear any deviation before returning to a normal operation.

11.11.2.1 Starting JOG operation

1. Click **[JOG operation]** in the [Select test mode] dialog box to display the following [confirmation] dialog box.

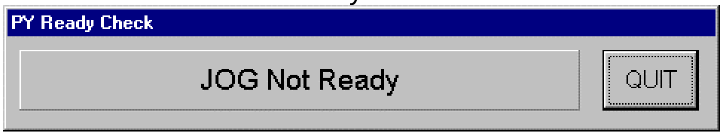


When JOG mode ends,you wish to occur OVF alarm?

The [confirmation] dialog box asks whether you want the servo amplifier to generate the deviation error alarm after a JOG operation. If you require an alarm to be generated click **[Yes]**, otherwise click **[No]**.

2. If the servo amplifier is not in the Ready condition, the following dialog box appears.

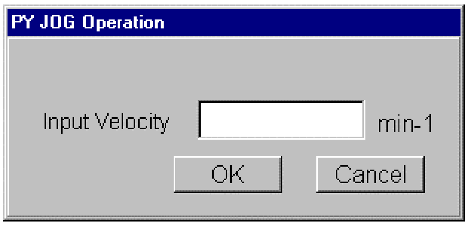
Not ready condition



JOG Not Ready

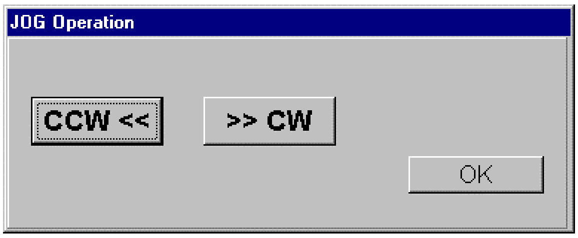
The system is not set up for a JOG operation (the main circuit power is inactive or under an alarm condition, etc.).
If JOG operation becomes available, the [Velocity entry] dialog box appears.
At this time, click **[QUIT]** to return to the [Select test mode] dialog box.

3. If the servo amplifier is under the Ready status, the JOG Operation's [Velocity entry] dialog box appears.



Type a desired speed in the [Directed speed] field, and click the **[OK]** button to open the [Select direction] dialog box. Click the **[Cancel]** button to return to the [Select test mode] dialog box.

4. Select the direction of the JOG operation.



The CCW button causes a counterclockwise operation (as viewed from the motor shaft), and the CW button causes a clockwise operation. To start and continue a JOG operation, click and hold the desired direction button until you want to stop the operation.
To return to the [Velocity entry] dialog box, click the **[OK]** button.

> After JOG operation, the deviation of the position loop may remain. Be sure to clear any remaining deviation before returning to a normal operation.

11.11.3 Servo tuning

With Servo tuning, you can automatically configure appropriate parameters by only issuing the tuning command. When you issue the command, Servo tuning starts the motor and determines the load inertia by monitoring the operation status.
This feature sets the four parameters: Position loop gain (Kp), Velocity loop gain (Kvp), Velocity loop integral time-constant (Tvi) and Directed current LPF (ILPF).

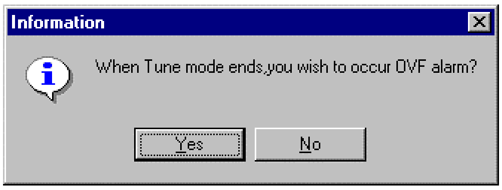
11.11.3.1 Precautions under operational conditions and load conditions

Before starting the Servo tuning, be sure to adhere to the following :

1) If the servo amplifier starts to vibrate when it is turned on for Servo on, decrease the proportional gain Kvp and increase the integral time-constant Tvi.
2) As the Servo tuning starts, the motor is turned in the normal and reverse directions for about 0.5 seconds by the approximate 60 Hz sine-wave-like torque command (equivalent to rated torque at the peak). As the allowable limits for this motor operation, allocate at least one turn either to the normal or reverse direction. Before using Servo tuning, make sure the machine is safe and will not be damaged even if it is vibrated.
3) In the following conditions, setting appropriate parameters may be unavailable or tuning errors may be encountered.
   a. The load inertia is excessively higher than the allowable load inertia.
   b. Load inertia and/or load torque varies largely.
   c. Excessive backlash in the ball gears or other gears.
   d. Mechanical stiffness is weak at a coupling or other connection and mechanical resonance may arise.
   e. A connection cable was disconnected during Servo tuning.
   f. The main circuit power supply failed or an alarm occurred during Servo tuning.
   g. The output current is interrupted by the current limit allowed input.

11.11.3.2 Using servo tuning

1. Click [Servo tuning] in the [Select test mode] to display the [Confirmation] dialog box.



When Tune mode ends,you wish to occur OVF alarm?

The [Confirmation] dialog box asks whether you want the servo amplifier to generate the deviation error alarm after a Servo tuning. If you require an alarm to be generated, click **[Yes]** ; otherwise click **[No]**.

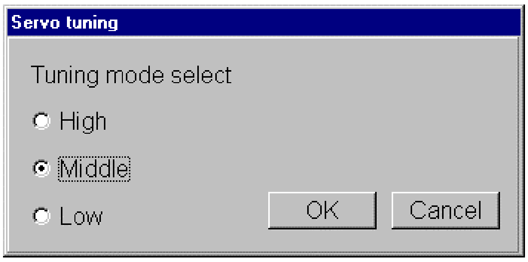
2. If the servo amplifier is not in the Ready condition, the following dialog box appears.

Not ready condition

Tune Not Ready

The system is not set up for a Servo tuning (the main circuit power is inactive or under an alarm condition, etc.). As the machine becomes available for Servo tuning, the [Select tuning mode] dialog box appears. If you click **[QUIT]**, the [Select test mode] dialog box is returned.

3. Make sure the servo amplifier is at the Ready condition, and select a tuning mode.



Servo tuning

Tuning mode select

○ High
● Middle
○ Low

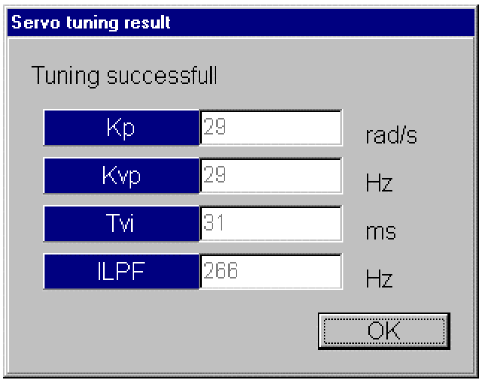
One of the three stiffness levels (Low, Middle and High) can be selected based on the actual mechanical stiffness. After selecting a level, click the **[OK]** button.
To return to the [Select test mode] dialog box, click **[Cancel]**.

4. The [Start tuning confirmation] dialog box opens.
   To start tuning, select **[Yes]** on the [Confirmation] dialog box.

Servo tuning Start

Servo tuning Start OK?

5. Results of the tuning process appear when the process is completed.



Servo tuning result

Tuning successfull

Kp	29	rad/s
Kvp	29	Hz
Tvi	31	ms
ILPF	266	Hz

The above four parameters are automatically updated after successful tuning.
Click the **[OK]** button to return to the [Select tuning mode] dialog box.

> After Servo tuning, the deviation of the position loop may remain. Be sure to clear any remaining deviation before returning to a normal operation.

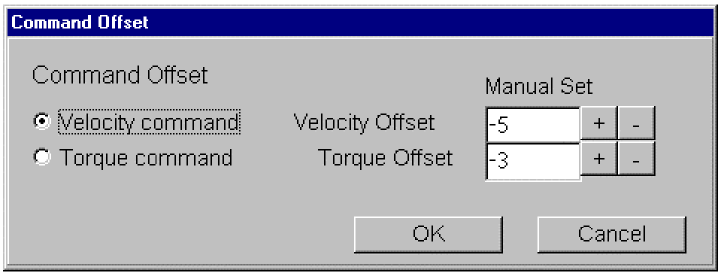
6. To return to the [Select test mode] dialog box, click the **[Cancel]** button.

11.11.4 Adjusting directed offset

Before you can automatically or manually adjust the offset values for the input analog command used in controlling the speed or torque, perform the Adjust directed offset.

11.11.4.1 Using Adjust directed offset

1. Click **[Adjust directed offset]** in the [Select test mode] dialog box to open the [Auto offset adjustment] dialog box.



Command Offset

Command Offset

● Velocity command
○ Torque command

Manual Set

Velocity Offset: -5
Torque Offset: -3

In this dialog box, select the target for the [Auto offset adjustment] dialog box either from the velocity or torque. Click the directed item and then the **[OK]** button.

2. The [Confirmation] dialog box appears. Select **[Yes]** on the [Confirmation] dialog box to start "Auto offset adjustment".

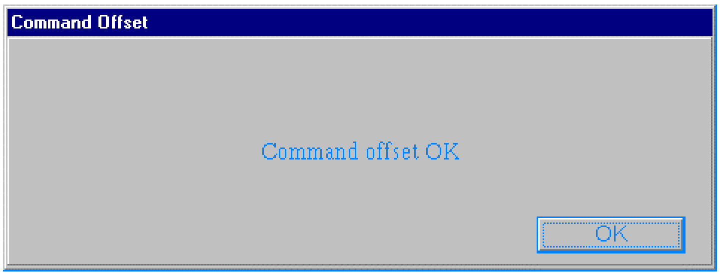
Information

Command offset Start OK?

If you select **[No]**, the [Select test mode] dialog box reappears.

3. If the process successfully completed, the following dialog box appears. Click the **[OK]** button.

Process successful



Command Offset

Command offset OK

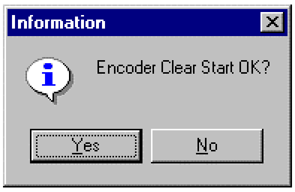
4. The [Auto offset adjustment] dialog box is returned and the adjusted value appears.
Offset value can also be set manually by clicking +/- button on this screen.
The moment +/- button is clicked, the setting is completed at the amplifier.
5. To return to the [Select test mode] dialog box, click the **[Cancel]** button.

11.11.5 Absolute encoder clear

This clears the multi-rotor section data when using the absolute encoder, causing an encoder alarm reset.

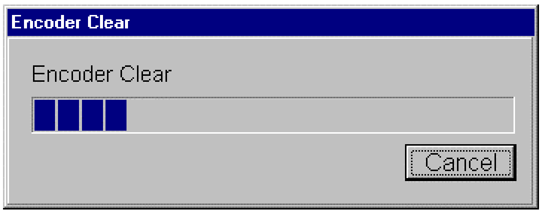
11.11.5.1 Using Absolute encoder clear

1. Click [Absolute encoder clear] in the [Select test mode] dialog box to open the [Start confirmation] dialog box.



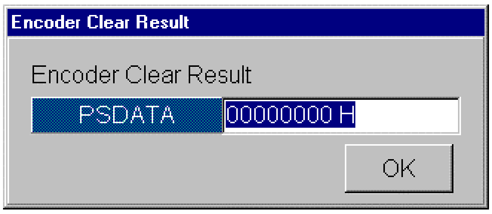
Encoder Clear Start OK?

2. Respond **[Yes]** to the confirmation message to start clearing the encoder. If you select **[No]**, the [Select test mode] dialog box is returned.



Encoder Clear

3. The indicator bar shows the progress of the encoder clearing process. When the clearing process is completed, the result appears. (The process takes about ten seconds.)
If you click the **[Cancel]** button, the clearing process is interrupted and the positioning data appears.



Encoder Clear Result

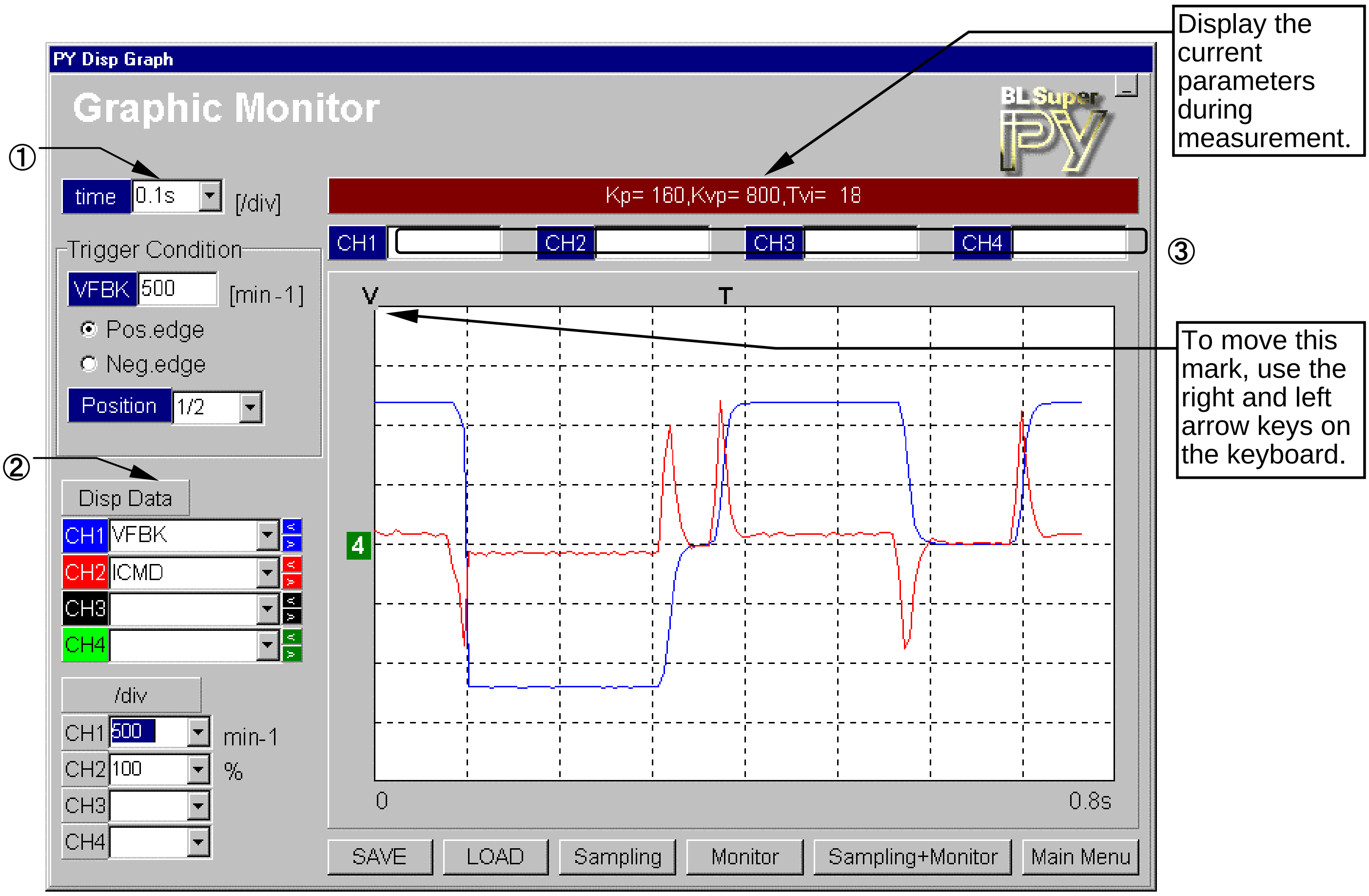
PSDATA 00000000 H

4. To return to the [Select test mode] dialog box, click the **[OK]** button.

After JOG operation, the deviation of the position loop may remain. Be sure to clear any remaining deviation before returning to a normal operation.

11.12 Display Graphic Monitor

The [Display Graphic Monitor] dialog box interprets the operating status of the connected servo amplifier to display waveforms with different aspects.



PY Disp Graph

Graphic Monitor

Kp= 160,Kvp= 800,Tvi= 18

time 0.1s [/div]

Trigger Condition

VFBK 500 [min-1]

● Pos.edge

○ Neg.edge

Position 1/2

Disp Data

CH1 VFBK

CH2 ICMD

CH3

CH4

/div

CH1 500 min-1

CH2 100 %

CH3

CH4

Display the current parameters during measurement.

To move this mark, use the right and left arrow keys on the keyboard.

11.12.1 Using Graphic Monitor

1. Click **[Graphic Monitor]** in the Main menu to open the Operation Waveform dialog box.
2. Select the time base and displayed data, configure the trigger (trigger signal is fixed to the velocity feedback), and click the **[Sampling + Monitor]** button to enter the wait trigger status.
3. If the process is triggered, the data is loaded and displayed graphically.
4. For this task, you can change the scaling for CH 1 to 4 of the displayed data, display the data indicated by the arrow marking, or save the current screen into a file(*.csv).
   (The time base cannot be changed after monitoring the waveform.)

NOTE :

A Time base ①

- The time base must be set up from the Combo box.
- A whole waveform may not be displayed depending on the selection of a time base, and the triggering position may be deviated accordingly.

Description of items

[Sampling] : Sends a signal that starts sampling to the servo amplifier.
Sampling continues until the servo amplifier triggers to stop sampling.

[Monitor]	: Clicking this button starts monitoring of the sampling status of the driver. During sampling (wait for triggering), "On-sampling" appears. When sampling stops, the collected data is loaded and appears on the graphical display. Clicking the **[Cancel]** button during sampling forcefully terminates sampling. Data up to the time of termination are interpreted and shown on the graphical display.
[Sampling + Monitor]	: Issues a start sampling signal to the servo amplifier. Then, this process monitors the sampling status of the driver. If sampling is on the way, "On sampling" appears. When sampling stops, the collected data are loaded and displayed on the panel graphically. Clicking the **[Cancel]** button during sampling forcefully terminates the sampling. Data up to the termination are interpreted and shown on the graphical display.

11.12.1.1 Changing displayed data on CH 1 to 4 (②)

- The offset of the displayed data can be adjusted by clicking the up or down arrow next to the displayed data name for a channel. The ground position appears on the left of the waveform display XY dialog box.
- To hide signals from a channel, clear the signal name by pressing the backspace key after clicking the displayed data name.
- The scaling for the displayed data is available from the Combo box. This setting can be changed after measurement.
- For a waveform on CH 1 to 4, the following items can be selected from the Combo box.

Positioning deviation	ABS.E position (decimal)	Directed Velocity
Velocity feedback	Directed current	Current feedback

The values at V markings on channels CH 1 to 4 can be checked from fields ③.
The V position can be changed pressing the right and left arrow keys.

> NOTE : Four-channel full display is unavailable with "Positioning deviation" or "ABS.E position" selected.

11.12.2 Loading existing waveform data

Click the **[LOAD]** in the Graphic Monitor dialog box to open the Load parameters from disk dialog box.
For specifying the file to load, refer to 11.3.4, "Loading files” (page 11-11).
*.CSV is used as the extension.

> NOTE : Never read a file not saved from PC Interface.

11.12.3 Saving waveform data

This saves the current waveform data and trigger setting on the Graphic Monitor dialog box. Click the **[SAVE]** button to open the **[Save parameters onto disk]** dialog box. For saving a file, refer to 11.3.5, "Saving files" (page 11-12). .CSV is used as the extension. Files with a .CSV extension can be loaded into other applications supporting the extension, such as Microsoft Excel, for computing or graphical representation.

11.13 Troubleshooting

11.13.1 Unable to install

1) Was a correct folder or file name specified?
2) Is the color specification less than 256 colors?

11.13.2 Unable to set up parameters

1) Is the connection to the amplifier established on the Main menu?
2) Was a valid range specified?

11.13.3 Unable to print

1) Change the printer resolution to about 300 dpi before printing.

11.13.4 Unable to display waveforms

1) Was a valid trigger setting configured? (Level, Slope (rising or falling edge, etc.)

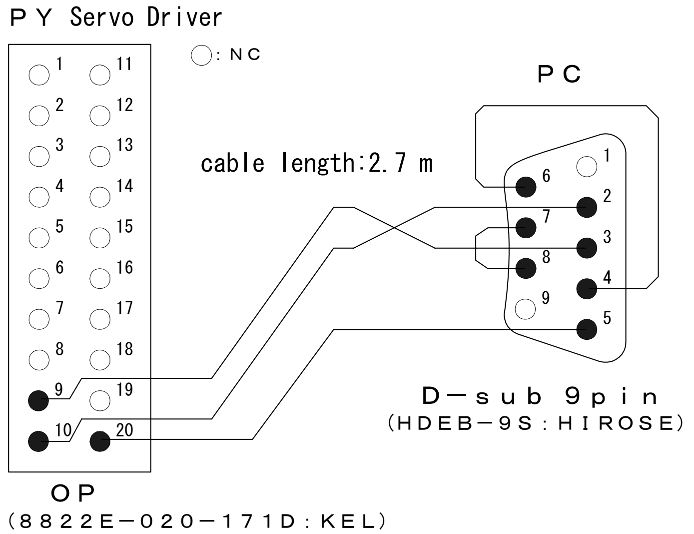
11.13.5 Unable to perform Test mode

1) Is the connection to the driver established on Main menu?
2) Is the main power turned on?
3) Is the system under an alarm condition?

11. PY PC INTERFACE

Appendix A Cable Connection Diagram

The following diagram shows how the provided cable is to be connected :



Pin number

PY servo amplifier (OP connector)

1	NC	11	NC
2	NC	12	NC
3	NC	13	NC
4	NC	14	NC
5	NC	15	NC
6	NC	16	NC
7	NC	17	NC
8	NC	18	NC
9	RXD	19	GND
10	TXD	20	GND

COM

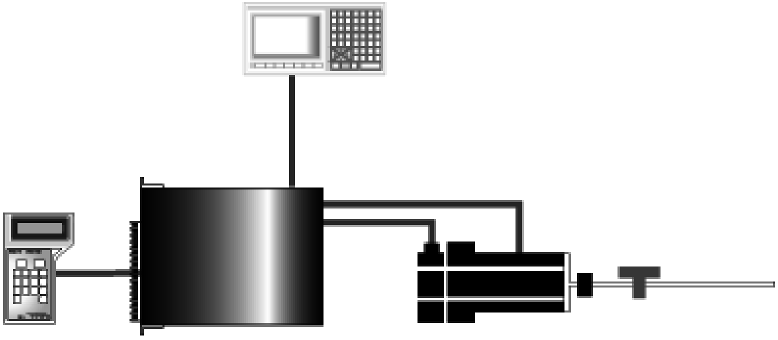
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

NOTE : Do not connect to NC.

<Revision History>

Date	program ver.	information
10/97	Ver. 1.10	First edition
12/97	Ver. 1.11	Correction
9/98	Ver. 1.12	for PYIF Ver.1.22
5/99	Ver. 1.13	for PYIF Ver. 1.23
3/00		for PYIF Ver. 1.30 (Latest version)
8/01		for PYIF Ver. 1.40 (Scheduled to be updated. Revised from PY2)

SUPPLEMENTS: GLOSSARY REVISION



12. GLOSSARY REVISION

12.1 GLOSSARY

■ A

ABS-E

An absolute encoder.

We occasionally call an optical type absolute encoder "ABS-E" to differentiate it from a resolver type sensor.

ABS-R **II**

An absolute sensor combining resolver and Hall elements.

Amplifier Ready Output

The amplifier internal relay ON is output during the main circuit power input is permitted after the control power is turned on (when control is ready and no alarm occurs). Abbreviated as RDY1 and RDY2.

■ B

Backlash

Play between gears.

Bit

A digit in binary number and indicates with 0 and 1.

■ C

CRC

Cyclic Redundancy Check

■ D

Dynamic brake resistor (DB resistor)

Resistor consuming motor revolution energy to stop the motor as early as possible in case of emergency stop or power outage.

■ J

JOG Operation

Test operation for checking that the Servomotor and Amplifier are wired properly.

■ L

LED

Light Emitting Diode

LSB

Least Significant Bit

■ M

Megger Test

Insulation resistance test.

MSB

Most Significant Bit

■ N

Non-volatile Memory

Memory for storing data even when the power is not turned on. The contents can be changed using electric signals. In this Servo Amplifier, it is used for storing parameters.

■ O

Oil Seal

Rubber seal for the rotation shaft to be inserted between the motor mounting surface and the shaft for preventing oil, water or dust from entering inside.

Overtravel

A mechanism with a limit switch for detecting that the movable range of the system is exceeded to turn the command for the forward or backward rotation side (to which overtravel is input) to zero and limit current.

■ P

P Control

Control subtracting integral action from PI (proportional & integral) control. Although the servo system becomes stable, the steady-state deviation becomes larger.

12. GLOSSARY REVISION

■ R

Radial Load

Load applied perpendicular to the shaft.

Regenerative Resistor

Resistor consuming certain amount of energy returned from the motor to the Servo Amplifier due to motor deceleration or negative load.

Rotor Inertia

Inertia moment related to the motor rotor shaft.

■ S

Start Ready Complete Output

Turned on during “Servo ON signal” input can be received after the main circuit power is turned on and outputs low impedance. Abbreviated as SRDY.

Servo OFF

Status where Servo ON input is turned off or the motor is not excited due to an alarm, etc.

Servo ON

Status where Servo ON is input and the motor is excited. In this Servo Amplifier, the 7-seg LED rotates in the form of the “8” figure.

■ T

Thrust Load

Load applied parallel to the shaft from the shaft edge.

Twisted Pair Wire

Wire twisted for countermeasures against noise.

12.2 Servo Amplifier Software Version

12.2.1 Caution on Servo Amplifier Software Version

Confirm the Servo Amplifier to be used, referring to the following table:

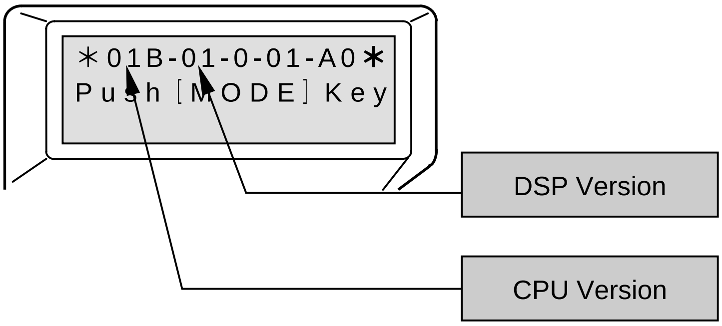
Table 12-1 PY0 type Amplifier Revision

Software Version No.		Revised Since	Change
CPU	DSP		
AYC00E	01	Launched Dec. 1997	-
AYC00E	01	Jan. 1998 (E0014098)	1) TUV, CE application Acquired TUV recognition, and self declared CE.
AYC01A	01	Feb.1998 (E0014351)	1) CPU program revision Higher speed gain switch processor.
AYC01B	01	July 1998 (E0017373)	1) CPU program revision Addition of P-PI switch function to bit1 of Func6.
AYC02G	01	Feb. 2003	1) CPU program revision Current detector error alarm is added.
AYC03A	01	Jan. 2007	1) CPU program revision The program is changed with EEPROM change.

12.2.2 Version Confirmation Method

Software Version : Confirm on the initial display when connecting remote operator “RP-001”.

[Sample]



Release	
Revision A	Apr.1998
Revision B	Oct.2001
Revision C	Jan.2002
Revision D	Sep.2002
Revision E	Feb.2003
Revision F	Mar.2008

Precautions For Adoption

⚠ Cautions

The possibility of moderate or minor injury
and the occurrence of physical damage are assumed
when the precautions at right column are not observed.
Depending on the situation,
this may cause serious consequences.
Be sure to follow all listed precautions.

⚠ Cautions

- Be sure to read the instruction manual before using this product.
- Take sufficient safety measures and contact us before applying this product to medical equipment that may involve human lives.
- Contact us before adapting this product for use with equipment that could cause serious social or public effects.
- The use of this product in high motion environments where vibration is present, such as in vehicles or shipping vessels, is prohibited.
- Do not convert or modify any equipment components.

* Please contact our Business Division for questions and consultations regarding the above.

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http://www.sanyodenki.com

SANYO DENKI CO., LTD.
1-15-1, Kita-Otsuka, Toshima-ku, Tokyo 170-8451, Japan
Phone: +81 3 3917 2223

SANYO DENKI *AMERICA,INC.*
468 Amapola Avenue Torrance, CA 90501 U.S.A.
Phone: +1 310 783 5400

SANYO DENKI *EUROPE SA.*
P.A. Paris Nord II 48 Allee des Erables-VILLEPINTE BP.57286 F-95958 ROISSY CDG Cedex France
Phone: +33 1 48 63 26 61

SANYO DENKI *GERMANY GmbH*
Frankfurter Strasse 63-69 65760 Eschborn Germany
Phone: +49 6196 76113 0

SANYO DENKI *KOREA CO., LTD.*
9F 5-2, Sunwha-dong Jung-gu Seoul, 100-130, Korea
Phone: +82 2 773 5623

SANYO DENKI *SHANGHAI CO., LTD.*
Room 2116, Bldg B, FAR EAST INTERNATIONAL PLAZA, No.317 XianXia Rd., Shanghai 200051 China
Phone: +86 21 6235 1107

SANYO DENKI *TAIWAN CO., LTD.*
Room 1208,12F, No.96 Chung Shan N, Rd., Sec.2, Taipei 104, Taiwan, R.O.C.
Phone: +886 2 2511 3938

SANYO DENKI *(H.K.)CO., LIMITED*
Room 2305, 23/F, South Tower, Concordia Plaza, 1 Science Museum Rd., TST East, Kowloon, Hong Kong
Phone: +852 2312 6250

SANYO DENKI *SINGAPORE PTE. LTD.*
10 Hoe Chiang Road #14-03A/04 Keppel Towers Singapore 089315
Phone: +65 6223 1071