M0005165B

AC SERVO SYSTEM

BL Super

PQ Series

Type M

Instruction Manual

E

ENGLISH

SANYO DENKI CO., LTD

PREFACE

This product does not qualify as strategic goods as specified by the Foreign Exchange and Foreign Trade Control Law. Accordingly, applying for an export permit from the Ministry of Export, Trade and Industry is not required. For customs purposes, however, an explanation may be required. Please ask us for the material explaining that this product is not applicable. In addition, when this product is incorporated into other equipment, the applicable regulations must be complied with.

This User's Manual explains the functions, wiring, installation, operation, maintenance and specification of the "PQM" series AC Servo Amplifier.

The "PQM" series AC Servo Amplifier is applicable to a wide range of applications from small to medium capacity thanks to its multiple functions, high performance, downsizing and high cost performance. The AC Servo Motor was developed to satisfy customers' specified needs for easier-to-use Servo Motor series. Shaft multiplication was introduced for easy handling of the Servo Motor and downsizing of the whole machine. The Servo Amplifier was developed to satisfy the needs for control panel downsizing and for wide range of applications.

To completely utilize all functions of the "PQM" series AC Servo Amplifier, read this manual carefully before use to ensure proper operation.

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 "INC-E".

"Absolute encoders" to "ABS-E".

Also, "Wiring-saved incremental encoders" and "Absolute encoders" are sometimes abbreviated to "Encoder", and

"Wiring-saved incremental encoders", "Absolute encoders" and "ABS-RII" to "Sensor".

Note that this User's Manual is for "PQM" series whose sensors are wiring-saved incremental encoders and absolute encoders (request signal-unavailable).

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0. SAFETY PRECAUTIONS

SAFETY PRECAUTIONS

This chapter summarizes the precautions to ensure safe operation of the PQM Servo Amplifier.

Be sure to read this chapter before operation.

0. SAFETY PRECAUTIONS

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This chapter summarizes the precautions to ensure safe operation of the PQM Servo Amplifier.　Be sure to read this chapter before operation.

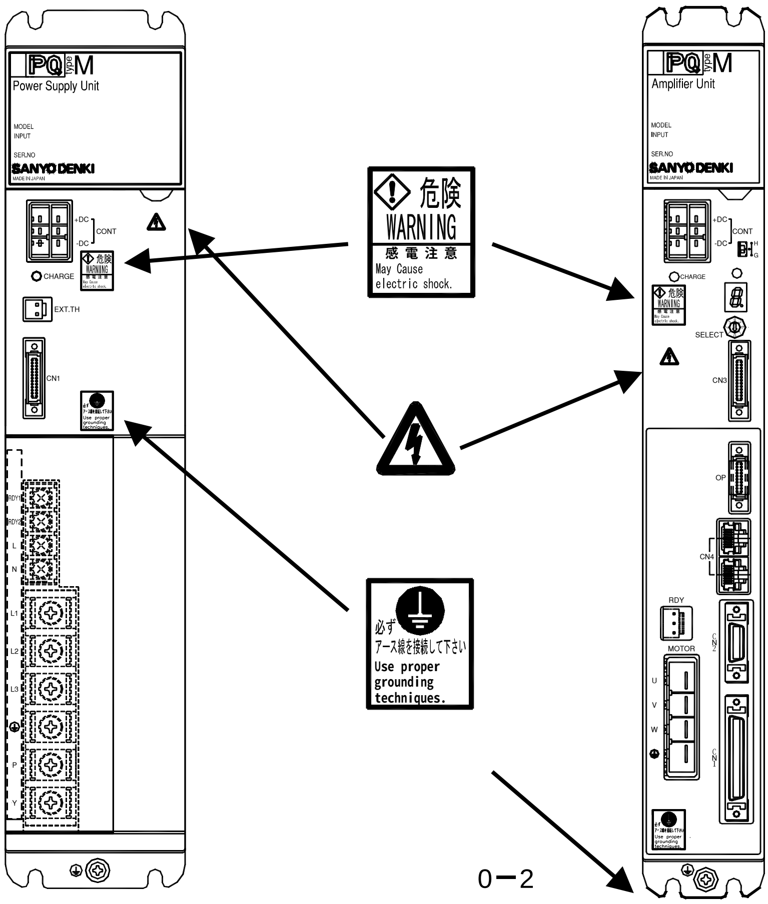
●●

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 should be taken regarding operation, maintenance and management of the product, such as system multiplication or emergency power generator installation,.　In this case, consult us.
  ① Use in medical equipment affecting people's lives.
  ② Use in equipment that may be lead to physical injury, for example, trains or elevators.
  ③ Use in a computer system that may be socially or publicly influential.
  ④ 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.
- The PQM servo amplifiers must be used under the pollution level 2 or above (pollution level 1 or 2) environment, as regulated in EN50178.

0.2 "Warning Label" Location on Product

The warning label is on the front surface of the power supply unit and of Servo Amplifier.

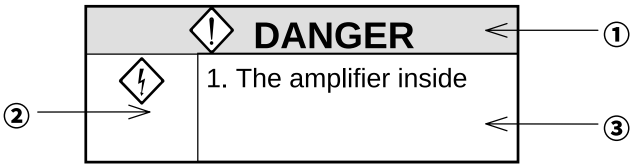


0.3 Meaning of Warning Indication

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 follow s:



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:

① **DANGER** — Incorrect operation may result in such a dangerous situation as death or serious injury.

② **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.

③ **PROHIBITION** — What should not be done are indicated.

④ **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	MANDATORY		

0. SAFETY PRECAUTIONS

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 the power off 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. Make sure to ground the earth terminals of the amplifier and the motor.

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.

<Operation>

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

9. While the power is supplied, never touch terminals, or you may be struck by electricity.

10. 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. Do not remove the nameplates.

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

6. 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>

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

8. 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.

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

0. SAFETY PRECAUTIONS

CAUTION

<Wiring>

10. Don't measure insulation resistance and dielectric strength, or these units may be damaged.
    When you have to measure them, please contact us.

11. Arrange cables in accordance with the Technical Standard for Electric Facilities and the Extension Rules.
    Otherwise, cables may be burnt and fire may occur.

12. Arrange cables correctly and securely, or the motor may run away and you may be injured.

13. Don't apply static electricity or high voltage to the motor sensor terminal, or the motor may get out of order.

<Installation>

14. Don't climb up these units nor place heavy substance on them, or you may be injured.

15. Don't stop the air inlets and outlets nor put foreign matters in them, or fire may occur.

16. Be sure to observe the direction of installation, or a trouble will occur.

17. 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.

18. Don't shock these units badly, or they may be get out of order.

19. 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.

20. 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.

21. Install them to any of nonflammables like metal, or fire may occur.

0. SAFETY PRECAUTIONS

CAUTION

<Operation>

22. 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.

23. 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.

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

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

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

27. 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.

28. 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.

29. 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.

30. Check that the power supply specification is normal.
    Otherwise, troubles may occur.

0. SAFETY PRECAUTIONS

CAUTION

<Maintenance>

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

32. The electrolytic capacitor inside the amplifier is subject to mechanical wear or deterioration over time. Therefore it is recommended to replace with a new one every five years (ambient temperature: 104°F). The expected life of the cooling fan and the fuse is about 10 years. Regular replacement is recommended for preventive maintenance.

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

<Transportation>

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

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

<Disposal>

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

0. SAFETY PRECAUTIONS

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.

0. SAFETY PRECAUTIONS

MANDATORY

<Storage>

1. Store these units where they are not exposed to direct sunlight and in the specified ranges of temperature and humidity {–20°C to +65°C (-4 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 within the specified ranges of the temperature and humidity as follows.
   Amplifier: Temperature = 0 to 55°C (32 to 131°F), Humidity = 90% RH or lower (no dew condensation)
   Motor: Temperature = 0 to 40°C (32 to 104°F), Humidity = 90% RH or lower (no dew condensation)

<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.

1. BEFORE OPERATION

BEFORE OPERATION

1. BEFORE OPERATION

●●

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

●●

1.1 Precaution on Unpacking

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

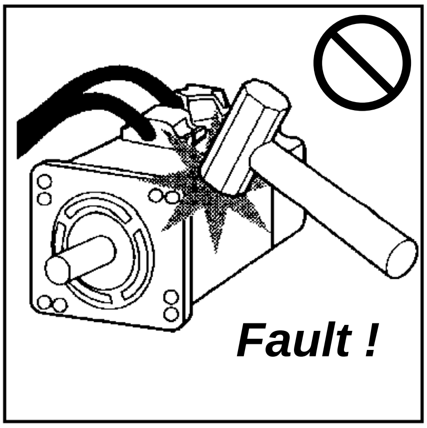
Check the following after receiving the product.　Contact us if any abnormality is detected.

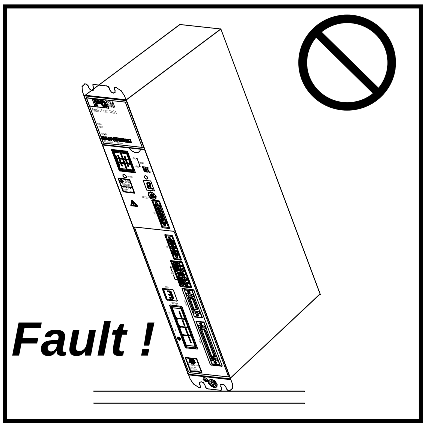
- Check if the model numbers of the Servomotor and the Servo Amplifier match those of the ordered ones (the numbers are described after "MODEL" on the main nameplate).
- Check the appearance of the Servomotor and the Servo Amplifier to confirm that they are free from any abnormality such as breakage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

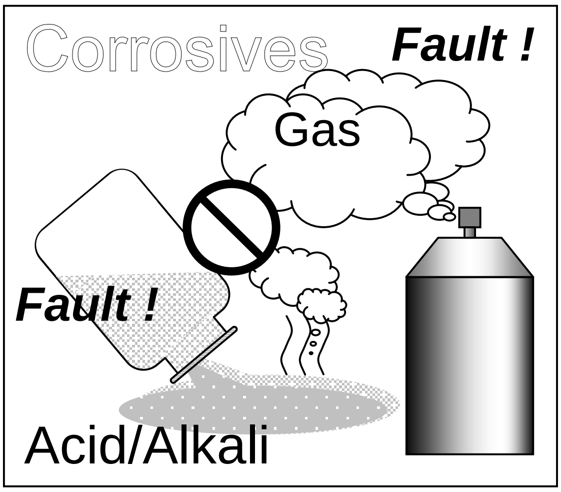


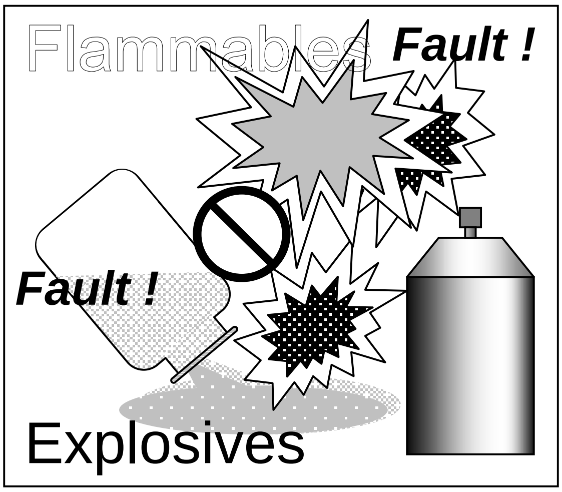


1. BEFORE OPERATION

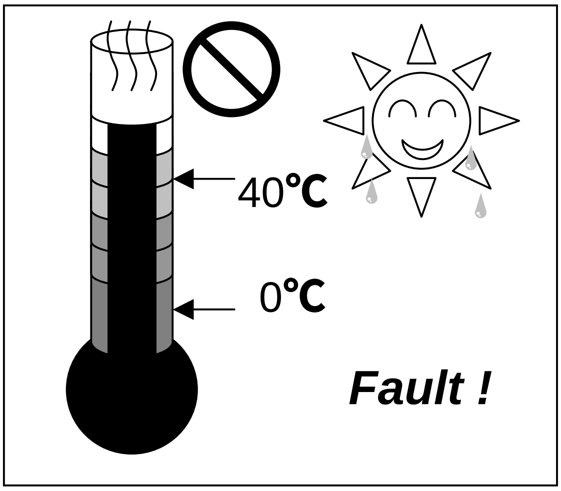
- Make sure to use a power supply within the specified range.
  200 VAC input type: PQM0PA…, PQM0PB…
  200 VAC –15% to 230 VAC +10% 50/60 Hz
  400 VAC input type: PQM0PC…
  400 VAC –15% to 460 VAC +10% 50/60 Hz
  If a power supply other than the above is used, an accident may result.

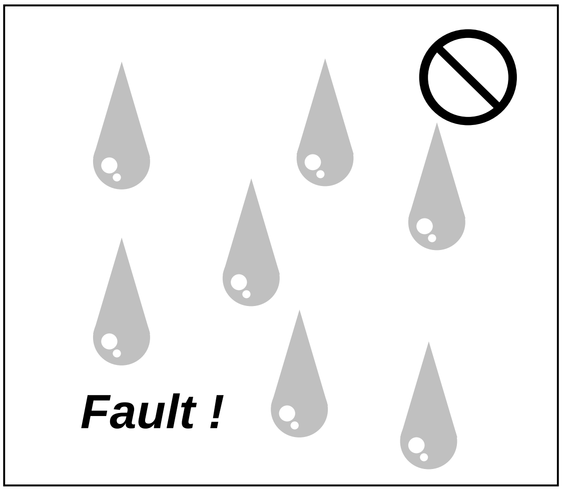
- When a surge voltage is produced in the power supply, connect a surge absorber or others between the powers to absorb the voltage before operation.
  Otherwise malfunction or breakage may result.
- Turn the power on and off during maintenance and inspection after safety (such as the situation of the 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.), flammable or explosive 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.





- 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 power supply unit <u>should be kept away from water, cutting fluid or rainwater</u>. Otherwise electric leakage or and electric shock may result.

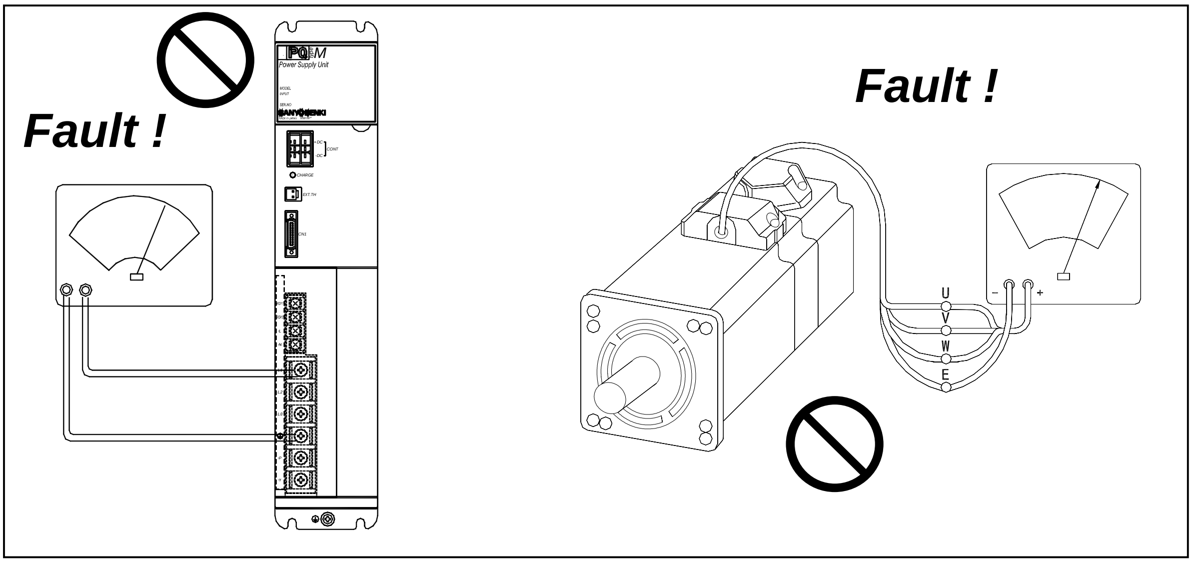




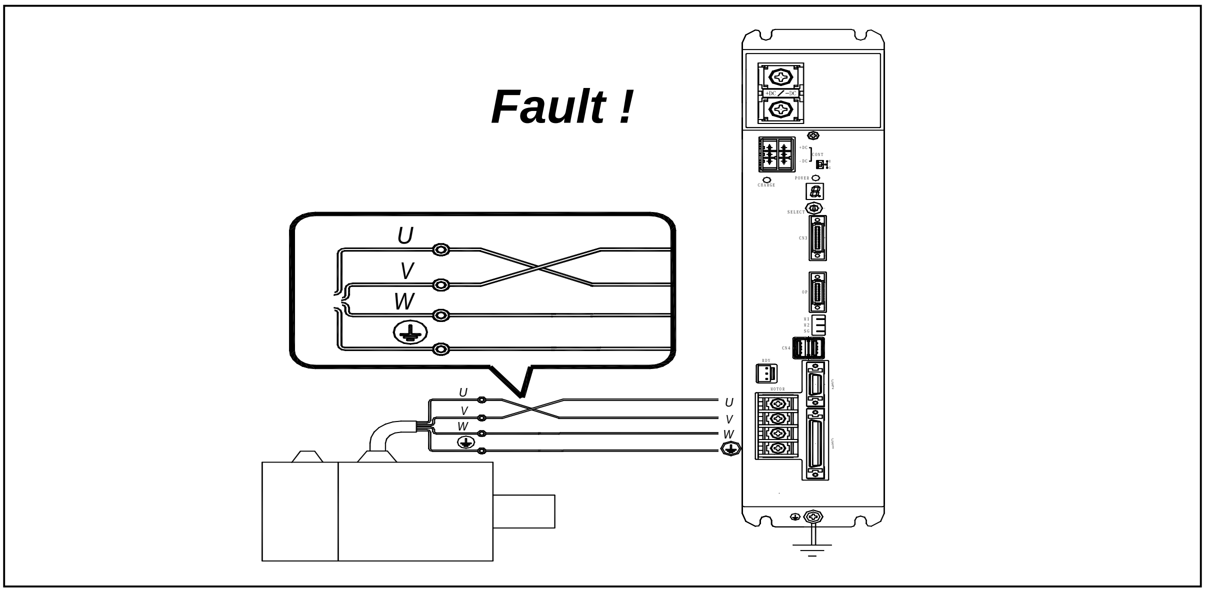
1. BEFORE OPERATION

- For operating safety, check that the Servo Amplifier is grounded by at least a class 3 (less than 100Ω) of the PE (protective earth) terminal ⏚ . In addition, the grounding terminal of the Servomotor must be connected to the PE (protective earth) terminal ⏚ .

- Never perform a withstand voltage or an insulation resistance test of the Servomotor or the power supply unit. In this product, 0V and the main body is earthed by the capacitor.
  If such test is necessary, consult with us.



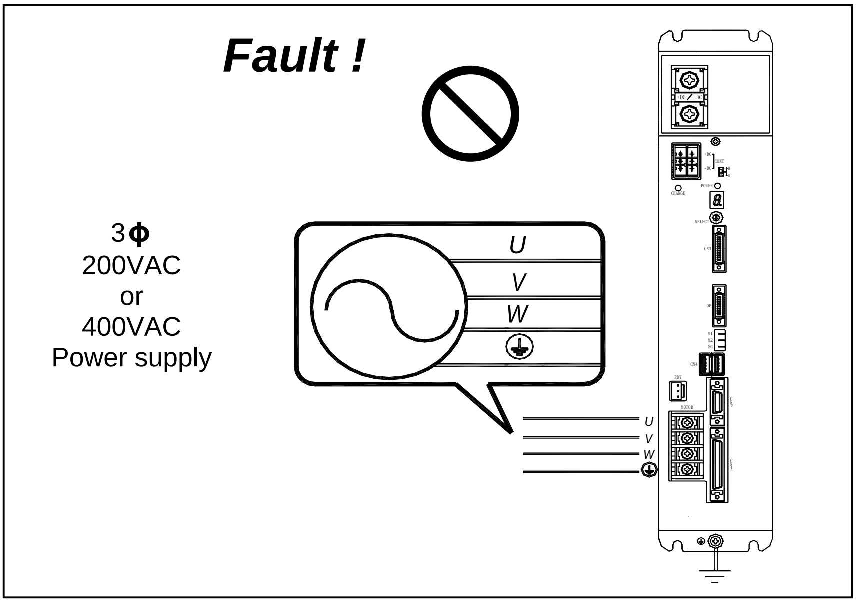
- Perform correct wiring by referring to the chapter "4. Wiring".
  Wrong wiring may cause Servomotor's or Amplifier's breakage.
- Since the "P" series Servomotor is not an induction motor, the direction of revolution cannot be changed by swapping the phases.
  To change the direction, use the remote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



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

1. BEFORE OPERATION

- Connect a power supply within the specified range to the Servo Amplifier's L1. L2, L3, T terminals respectively. When a power supply out of the specified range is used, install a transformer.
  If a commercial power supply is applied to the U, V or W terminal, the amplifier will break.



- Do not short-circuit between P and Y terminals on the terminal board, otherwise, a great amount of current may flow at the time of regeneration and damage the regenerative IGBT resulting in breakage of power supply unit.

1. BEFORE OPERATION

1.4 How to Read Model Numbers

1.4.1 Model Number of Servo Amplifier

PQM1 □ * * * A ××× △ ▽ ×××

Indicates a PQM servo amplifier

Type of power unit

- A… For 280 VDC input, with dynamic brake
- B… For 280 VDC input, without dynamic brake
- C…
- D… For 560 VDC input, without dynamic brake

Amplifier capacity

For 280 VDC Input
015… 15A 030… 30A 050...50A 100…100A 150…150A
300…300A 600…600A 900…900A
For 560 VDC Input
600…600A 800…800A

Hardware type of control unit

Applicable motor
Example M1…P50B03003D□S□□ XX…User selected motor

Type of applicable sensor

- 1... Wiring-saved incremental encoder (2000P/R)
- 2... Wiring-saved incremental encoder (6000P/R)
- 3... Absolute encoder (2048P/R)
- 6... Request signal-available absolute encoder (8192P/R) ABSR-II

Interface specification
S…Speed control type. T…Torque control type. P…Position control type.

Discrete specification
00… Standard product

> The design revision order is indicated by an alphabet at the end of Serial No. on the nameplate.

1.4.2 Model Number of Servomotor

○○○ B ○○ ○○○ △ □ ◇ ▽▽

BL series
- P10...P1 series P20...P2 series
- P30...P3 series P50...P5 series
- P60...P6 series P80...P8 series

Indicates the BL (Brushless) 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…100mm	13…130 mm	15…150 mm
18…180 mm	22…220 mm	28…280mm
38…380mm		

Indicates rated output

○○○ × 10 = rated output (W) ○○K : ○○X 10^3 = rated output (W)

Maximum revolution speed

200 V winding wire

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

400 V wire

E…2000 min^{-1}

Equipping of holding brake

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

Type of detector
- S… Wiring-saved incremental encoder
- J… Absolute encoder with the motor flange square of 60 mm or less;
- A…Absolute encoder with the motor flange square of 76 mm or more;

Specification identification

00… Standard motor

> The design revision order is indicated by an alphabet at the end of Serial No. on the nameplate.

1.4.3 Model Number of Power Supply Unit

PQM0P △ * * * ×××

Indicates a PQM Servo Amplifier

Power unit identification
- A… For 3-phase 200 VAC B… For single phase 200 VAC
- C… For 3-phase 400 VAC

Power unit capacity

For 200 V input type

7R8…7.8kW	120…12kW	160…16kW
270…27kW	370…37kW	

For 400 V input type

750…75kW

Specifications identification

00…Standard specification

> The design revision order is indicated by an alphabet at the end of Serial No. on the nameplate.

1.5 "PY2" Servo Amplifier Standard Combination

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

Table1-1 "PQM" Servo Amplifier Standard Combination Table (200 VAC input type)

Servomotor		Servo Amplifier	
P☆B○○○○○○□◇▽▽		PQM1□○○○A○△△□◇▽▽	
Series	Flange square Rated output Maximum speed	Amplifier capacity	Motor type
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
	108075D	030	N6
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

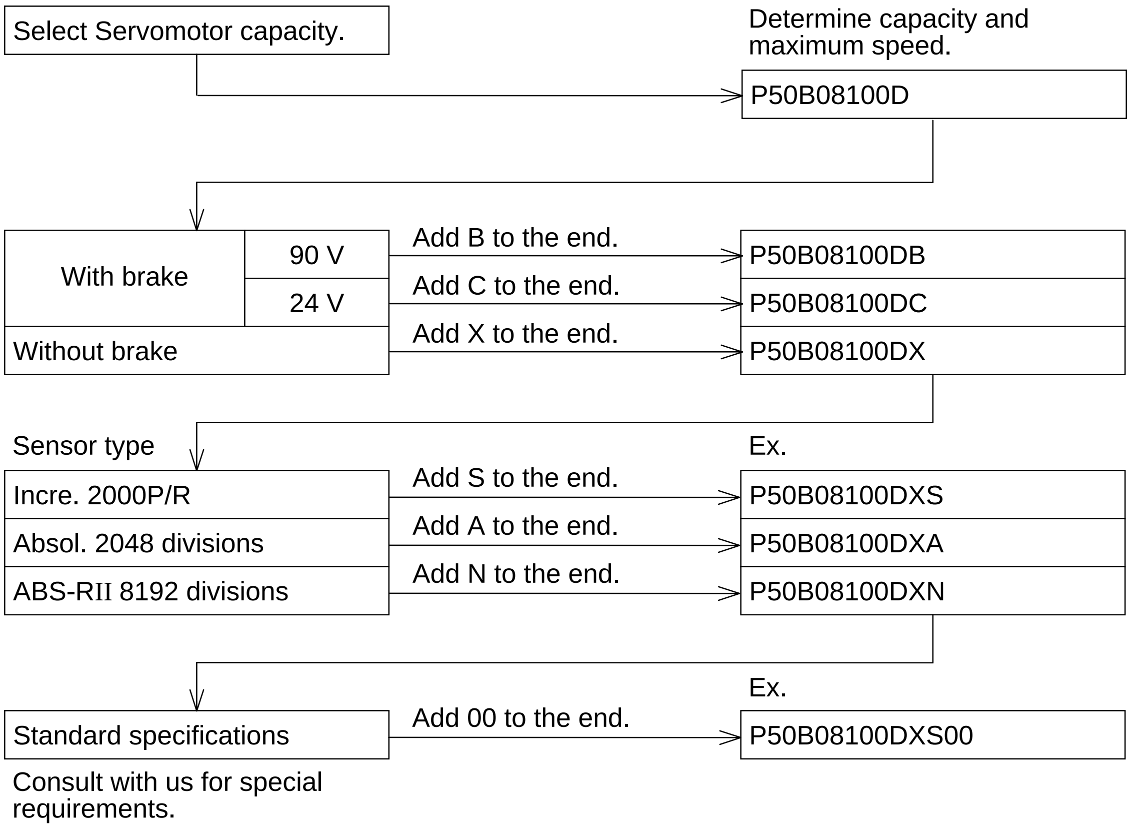
Servomotor		Servo Amplifier	
P☆B○○○○○○□◇▽▽		PQM1□○○○A○△△□◇▽▽	
Series	Flange square Rated output Maximum speed	Amplifier capacity	Motor type
50	07040D	030	MA
	08040D	030	MB
	08050D	030	MC
	08075D	050	MD
	08100D	050	ME
	08075H	030	MF
	08100H	030	MG
60	13050H	030	PA
	13100H	050	P1
	13150H	050	P2
	13200H	100	P3
	15300H	150	P4
	18200H	100	P5
	18350H	150	P6
	18450R	150	P7
	18550R	150	PR
	18750R	300	PW
	22550M	150	P8
	22700S	150	P9
	2211KB	300	PG
	2215KB	300	PX
	2220KB	600	T4
	2820KM	600	T5
	2825KM	600	T6
	2830KM	600	T7
	2830KB	900	T8
	2837KB	900	TH
80	15075H	030	R2
	18120H	050	R3
	2215KB	300	PX
	22250H	100	R4
	22350R	100	R9
	22350H	150	R5
	22450R	150	R6

400 VAC input type

Servomotor		Servo Amplifier	
P☆B○○○○○○□◇▽▽		PQM1□○○○A○△△□◇▽▽	
Series	Flange square Rated output Maximum speed	Amplifier capacity	Motor type
60	2845KE	600	TK
	3255KE	800	TL
	3275KE	800	TM

1.6 Flowchart for Determining Servomotor Model Number

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



FUNCTION, CHARACTERISTICS AND CONFIGURATION

2. FUNCTION, CHARACTERISTICS AND CONFIGURATION

2.1 "PQM" Servo Amplifier Built-in Functions

This section describes the main built-in functions of the Servo Amplifier and additional functions specially for the PQM series.
The functions marked **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 cannot be changed during operation (velocity ↔ torque, position ↔ torque, position ↔ velocity).

- **Regenerative processing function**

  A regenerative processing circuit is built into the system.
  An 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.
  DB resistor and electromagnetic contactor are required externally for PQM1B600A or above Servo Amplifiers.

- **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.

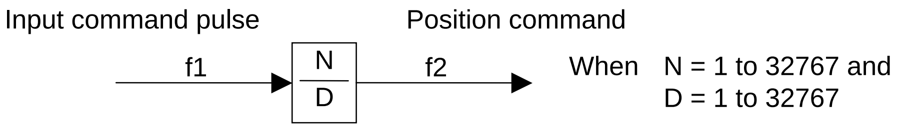
- **Servo tuning support function** **OP**

  When the remote operator sets a mode, the load inertia is automatically estimated and a proper parameter is set. (See page 7-20.)
  When more adequate tuning is required, make the remote operator set a parameter directly referring to the tuning value.

2. FUNCTION, CHARACTERISTICS AND CONFIGURATION

● Electric gear function **OP**

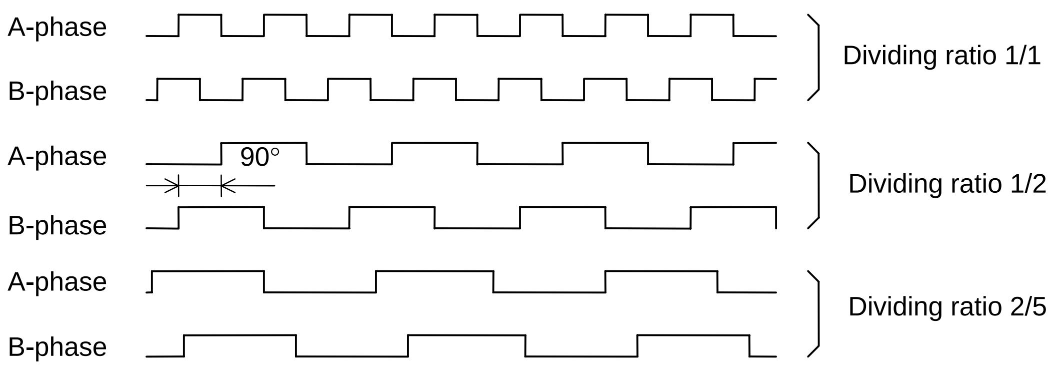
For a position control type, the feed can be changed without changing the mechanical gear by using this electronic gear.
This gear is set by the remote operator. (See page 7-35.)



$$f2 = f1 \times \boxed{\frac{N}{D}} \qquad \frac{1}{32767} \leqq \frac{N}{D} \leqq 32767$$

● 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 revolution)

● Alarm trace function **OP**

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

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

The same amplifier is applicable to an incremental encoder (INC-E) and an absolute encoder (ABS-E) simply by changing the appropriate parameters using the remote operator.
Different motors, however, are required for the INC-E and the ABS-E, respectively. (See page 7-57.)

2. FUNCTION, CHARACTERISTICS AND CONFIGURATION

2.2 Characteristics of PQM

This section describes the characteristics of PQM.

2.2.1 Characteristics of Servomotor

- **Downsizing**

Downsizing by 60 to 80% in terms of volume was realized 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 1000 W
P6 series: from 0.5 to 7 kW
P8 series: from 0.75 to 4.5 kW

- **High-speed motor**

Maximum speed of 4500 min^{-1} for P2, P3, P5 series
Maximum speed of 3000 min^{-1} for P1, P6, P8 series
The above enables the positioning time to be shortened.
(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.

- **Wiring-saved encoder adopted**

Commutation sensor (CS) wiring is not required as it was not for PY series.

Table 2-1 Comparison of PQM Servomotors (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)
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
Rated output	0.3 to 5.5 kW	1 to 5 kW	30 to 750 W	30 to 1000 W	0.5 to 7 kW	0.75 to 4.5 kW
Sensor	● Incre. ● Absolute ABS-E	● Incre. ● Absolute ABS-E ABS-R II	● Incre. ● Absolute ABS-R II	● Incre. ● Absolute ABS-E ABS-R II	● Incre. ● Absolute ABS-E ABS-R II	● Incre. ● Absolute ABS-E ABS-R
Waterproof	● IP67	● IP67	● IP40 (IP55 option)	● IP55 (□55 to □86) ● IP55 (□35 to □42) (IP55 option)	● IP67	● IP67
Holding brake	● Standard specifications (24 V, 90 V)	● Standard specifications (24 V, 90 V)	● Standard specifications (24 V, 90 V)	Standard specifications (24 V, 90 V)	Standard specifications (24 V, 90 V)	Standard specifications (24 V, 90 V)
Oil seal	● Standard specifications	● Standard specifications	● Optional	● Standard specifications (□54 to □86) ● Optional (□35 to □42)	● Standard specifications	● Standard specifications
Measures for CE	● TÜV obtained	● TÜV obtained	● TÜV obtained	● TÜV obtained	● TÜV obtained	● TÜV obtained

2.2.2 Characteristics of Servo Amplifier

- **Wide range of models**

  A variety of amplifiers applicable to wide range of motors from 30W to 75W are available.
- **Shaft multiplication**

  The power supply unit and the Servo amplifier are separated so as to save wiring and space.
- **Multiple functions**

  Multiple functions such as the one using remote operator are available.
- **High reliability and long life**

  Users can count on the models produced by our sophisticated circuit technology based on our abundant experiences with our conventional models.

Table 2-2 Comparison of PQM and Sanyo's other series (for reference)

	PQ Amplifier	PY Amplifier	PZ and PE Amplifiers	PU Amplifier	PR Amplifier
Input power	200 VAC 400 VAC Single phase 3 phases	200 VAC Single phase 3 phases	200 VAC 3 phases	100 VAC 200 VAC Single phase	200 VAC Single phase
Features	● Multi function ● High response, high performance ● Multi shaft configuration	● Multi function ● High response, high performance	● Multi function ● High response, high performance ●High-cost 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 ● Downsizing ● Easy system design
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 75 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 7 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
Sensor	Wiring-saved incremental ANS-R II ABS-E	Wiring-saved incremental ABS-R II ABS-E	Wiring-saved incremental ABS-R II ABS-E	Wiring-saved incremental ABS-R II	Wiring-saved incremental
I/F	Pulse train input or Analog input	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
Built-in functions	● Regenerative processing ● Auto tuning ● Electronic gear ● Remote operator ● Vibration restraining function ● Dynamic brake ● Holding brake excitation timing output ● Rush prevention ● Control mode switching ● Internal velocity command function ● Gain changeover using a rotary switch ● Gain changeover functions ● 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 ● Control mode switching ● Internal velocity command function ● Gain change-over using a rotary switch ● Gain changeover functions ● 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
Measures for overseas standards	●TÜV recognition obtained ●UL recognition to be obtained (for some types)	●TÜV recognition obtained	●TÜV recognition obtained (PE type only)		

3. SERVO SYSTEM CONFIGURATION

SERVO SYSTEM CONFIGURATION

3. SERVO SYSTEM CONFIGURATION

3.1 External Mounting and Wiring Diagram

200V Input Type

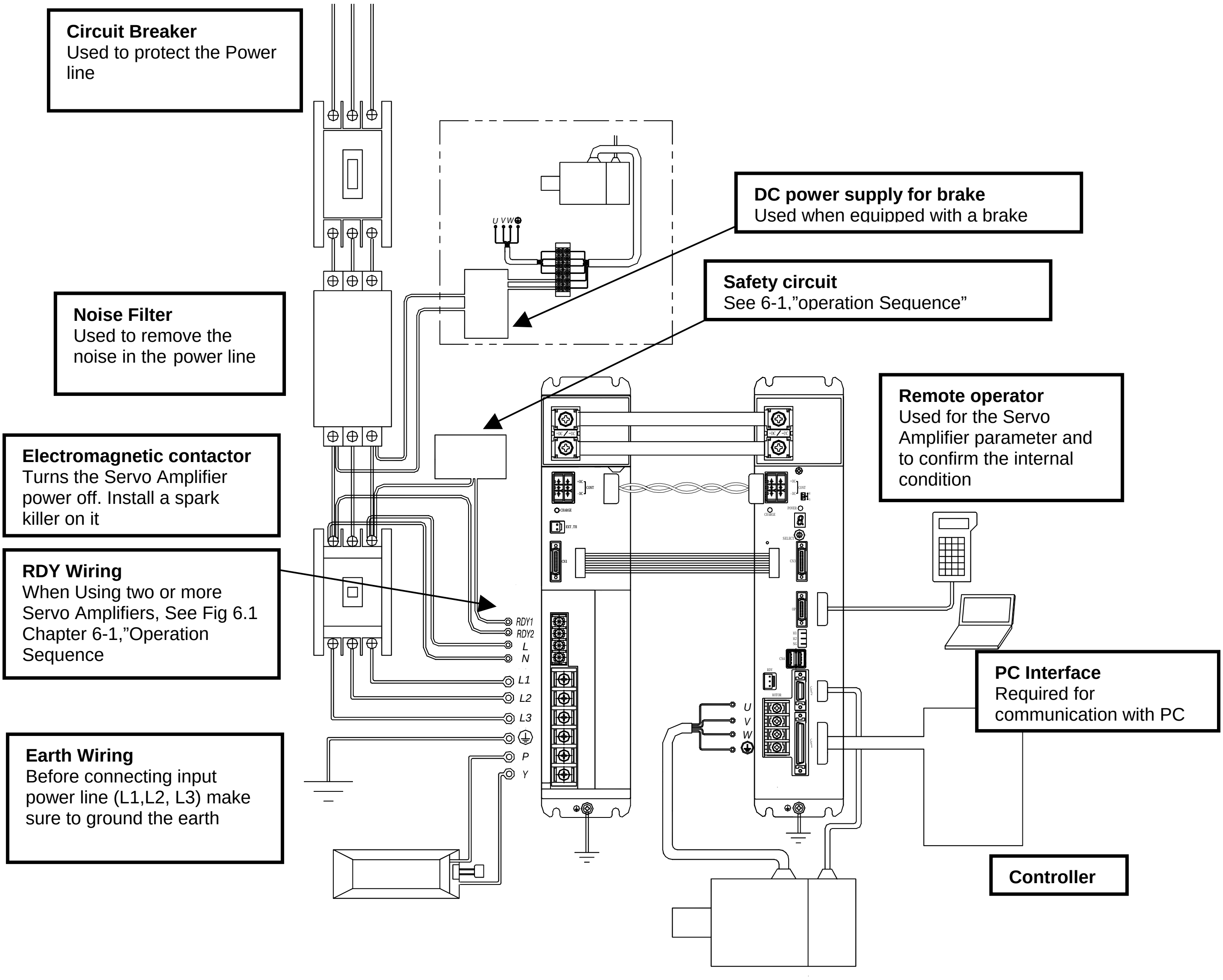
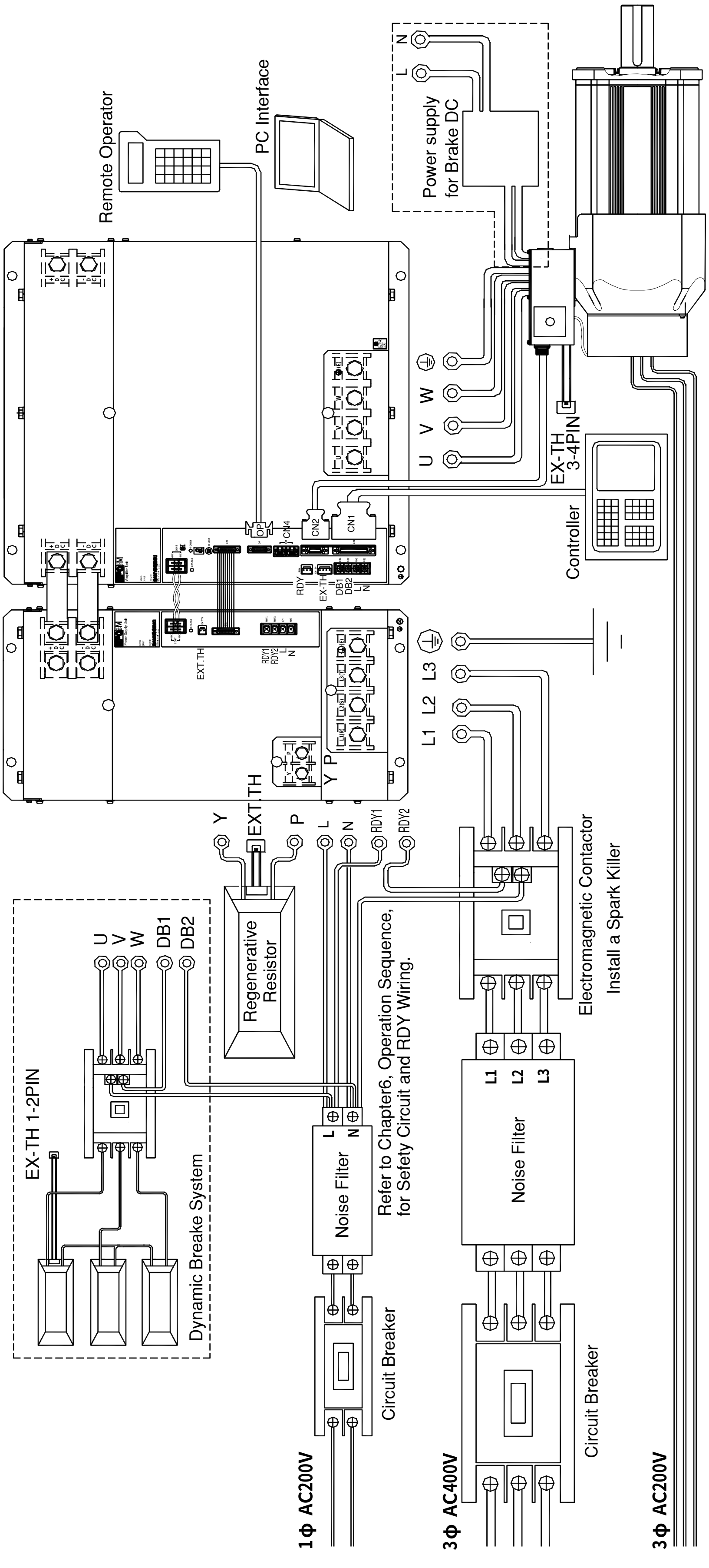


Fig. 3-2 External Mounting and Wiring Diagram

3. SERVO SYSTEM CONFIGURATION

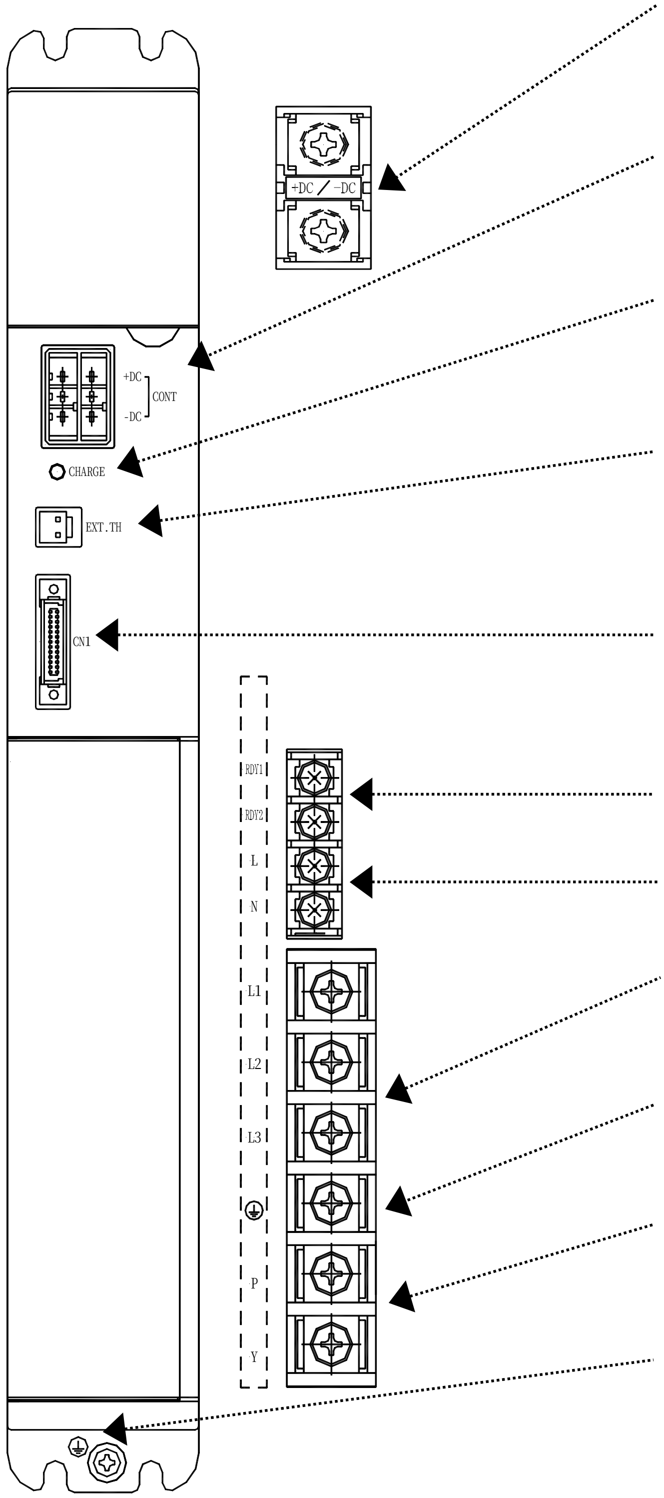
400V Input Type



3. SERVO SYSTEM CONFIGURATION

3.2 Names of Servo Amplifier Parts

PQM Power Supply Unit : 7.8kW, 12kW, 16kWk



+DC BUS, -DC BUS
Supplies DC main power to +DC BUS and -DC BUS terminals of each PQM Servo amplifier unit.

+DC CONT, -DC CONT
DC Power supply terminals for each Servo amplifier

CHARGE
Indicates the charge of the smoothing capacitor of the main circuit power supply.

EXT.TH
Protective thermal connector of external regenerative resistor. Short-circuit this connector when it is not used as regenerative resistor protection.

CN1
Monitoring connector of power supply unit. Make sure to connect to CN3 of Servo amplifier.

RDY1, RDY2
Outputs RDY signals.

L, N
Inputs 200 VAC control power supply

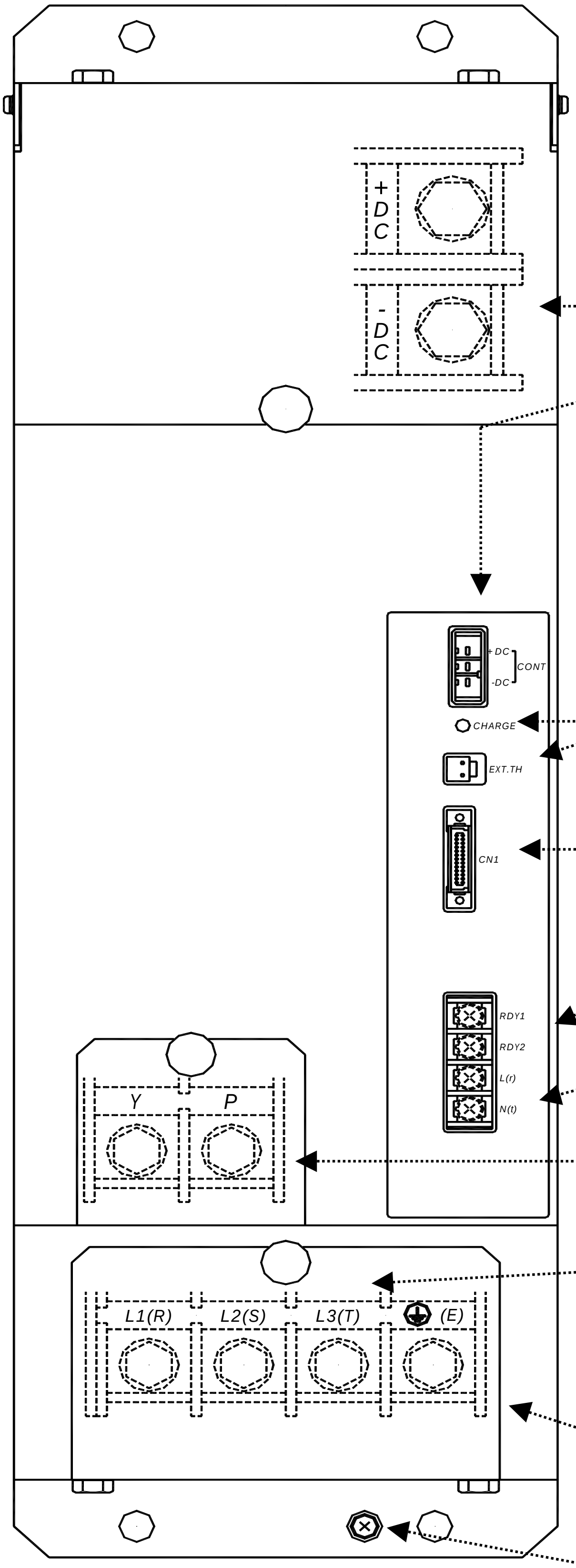
L1, L2, L3
Inputs 200 VAC main circuit power supply

⏚ Connects earth terminals. Make sure to connect.

P, Y
Connects external regenerative resistor between P and Y terminals.

⏚ Connects earth terminals. Make sure to connect.

PQM Power Supply Unit: 27kW, 37kW, 75kW



+DC BUS, -DC BUS
Supplies DC main power to +DC BUS and -DC BUS terminals of each PQM Servo amplifier unit.

+DC CONT, -DC CONT
DC Power supply terminals for each Servo amplifier

CHARGE
Indicates the charge of the smoothing capacitor of the main circuit power supply.

EXT.TH
Protective thermal connector of external regenerative resistor. Short-circuit this connector when it is not used as regenerative resistor protection.

CN1
Monitoring connector of power supply unit. Make sure to connect to CN3 of Servo amplifier.

RDY1, RDY2
Outputs RDY signals.

L, N
Inputs 200 VAC control power supply

P, Y
Connects external regenerative resistor between P and Y terminals.

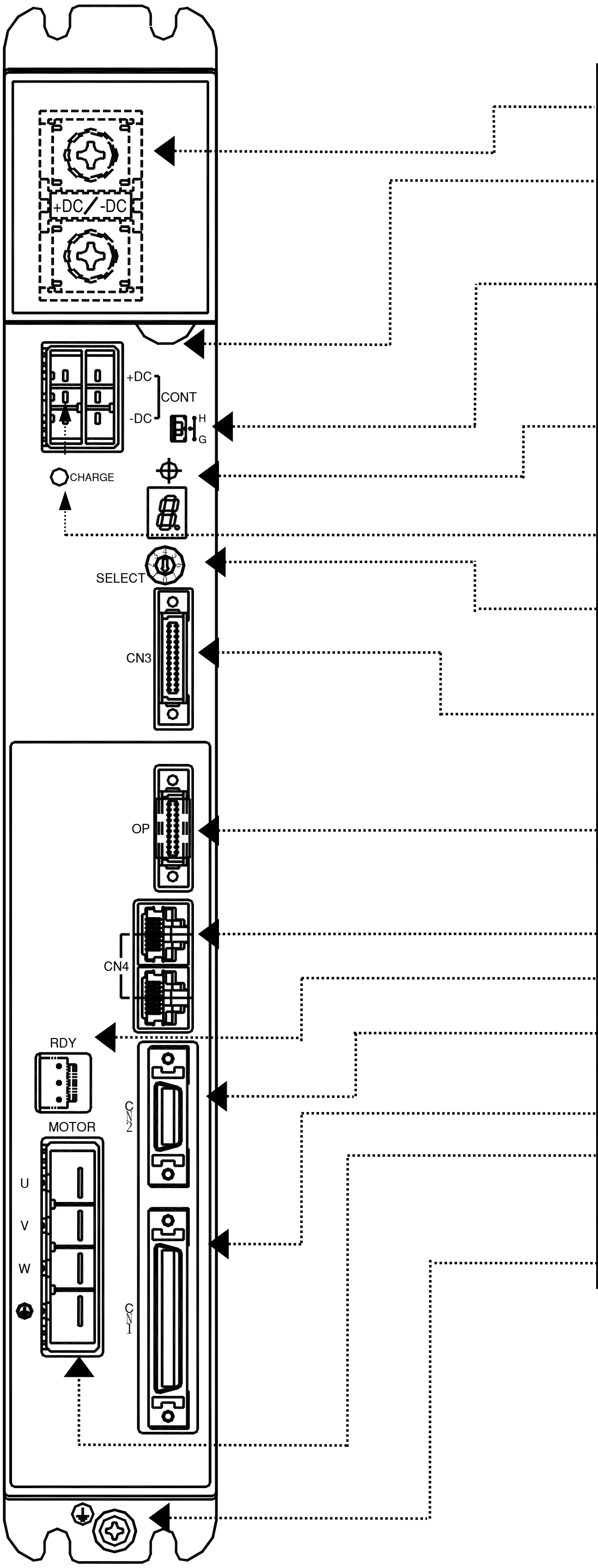
L1, L2, L3
Inputs 200 VAC main circuit power supply for 27kW and 37kW.
Inputs 400VAC main circuit power supply for 75kW.

⏚ Connects earth terminals. Make sure to connect.

⏚ Connects earth terminals. Make sure to connect.

3. SERVO SYSTEM CONFIGURATION

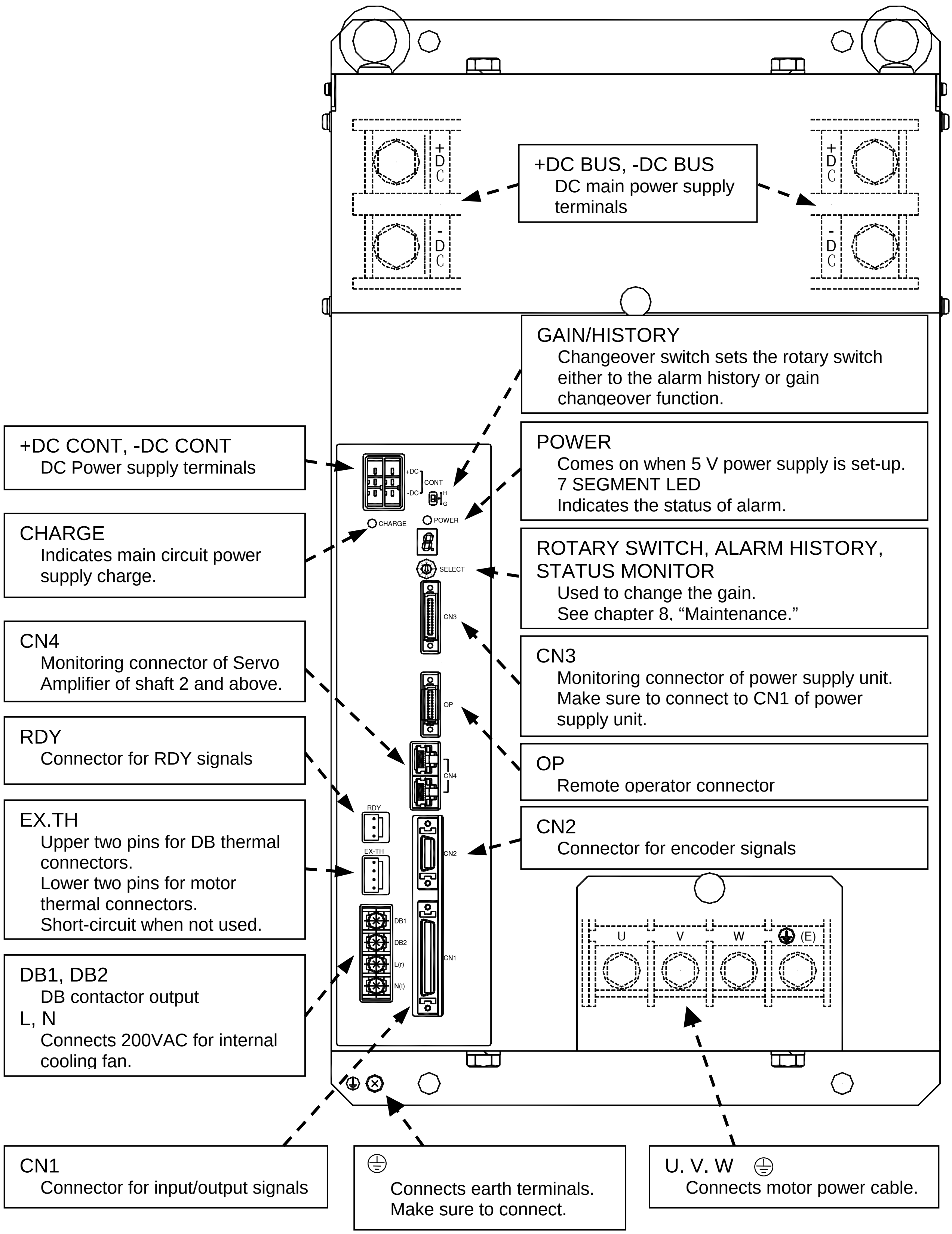
PQM Servo Amplifier : 015, 030, 050, 100, 300



+DC BUS, -DC BUS	DC main power supply terminals
+DC CONT, -DC CONT	DC Power supply terminals
GAIN/HISTORY	Changeover switch sets the rotary switch either to the alarm history or gain changeover function.
POWER	Comes on when 5 V power supply is set-up.
7 SEGMENT LED	Indicates the status of alarm.
CHARGE	Indicates main circuit power supply charge.
ROTARY SWITCH, ALARM HISTORY, STATUS MONITOR	Used to change the gain. See chapter 8, “Maintenance.”
CN3	Monitoring connector of power supply unit. Make sure to connect to CN1 of power supply unit.
OP	Remote operator connector
CN4	Monitoring connector when two or more Servo Amplifiers are used.
RDY	Connector for RDY signals
CN2	Connector for encoder signals
CN1	Connector for input/output signals
MOTOR	Connects motor power cable. Acts as a connector or terminal board.
⏚	Connects earth terminals. Make sure to connect.

3. SERVO SYSTEM CONFIGURATION

PQM Servo Amplifier: 600, 900, (280 VDC input), 600, 800, (560 VDC input)



3.3 Optional Peripheral Equipment List

The following optional peripheral devices are available for the PQ series.
Please order as necessary.

- **Remote operator**

Connected to the Servo Amplifier to set various parameters or check the internal status.

Model No.
RP-001

- **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 (no "B" at the end of the model number) is also available.

- **External dynamic brake resistors**

Used as necessary for the PQM1☐60A or above.

Model No.	Resistor Model No.	Quantity	Recommended Magnetic Contactor Model No.
PQM1☐600A	DB-220W0R5B	1	B-N20 3b(Mitsubishi Electric)
PQM1☐900A	REGIST-500W1R5GB REGIST-500W1R5G	1 8	B-A65 3b(Mitsubishi Electric)
PQM1D600A PQM1D800A	REGIST-500W1R5GB REGIST-500W1R5G	1 8	B-A65 3b(Mitsubishi Electric)

Customers are requested to prepare magnetic contactors.

- **Connector**

Use a connector to wire the Servo Amplifier and the motor.

Model No.	Remarks
AL-00292309	Servo amplifier side. CN1, 2
AL-00385594	Servo amplifier side. CN1
AL-00385596	Servo amplifier side. CN2
MS06B24-11S-16	Straight plug for the P6, P8 motor power line.
MA06B20-29S-12	Straight plug for the P6, P8 encoder.

- **Anti-noise parts**

The following anti-noise parts are available. 200 VAC input type

Model No.	Remarks
CRE-50500	Spark killer
R·A·V-781BXZ-2A	Surge protector

⚠ For EMC measure parts, see chapter 10.

3. SERVO SYSTEM CONFIGURATION

- **Personal computer interface**
  Available for communication with PC.

Model No.	Remarks
AL-00356620-01	Designated cable
SFY95-00	Communication program

⚠ The PC interface can be used only on Windows 95.

- **Cables, Copper bars**

  See Chapter 9, Specifications, for details on cables.

Cables

Model No.	Remarks	
6879019-1	For wiring-saved incremental encoder	–
6870010-1	For absolute encoder	–
AL-00397732-01	For PQM DC CONT	0.15m
AL-00397732-02	For PQM DC CONT	0.20m
AL-00397732-03	For PQM DC CONT	0.25m
AL-00397732-04	For PQM DC CONT	0.35m
AL-00397732-05	For PQM DC CONT	0.50m
AL-00397733-01	For PQM EXT.TH	SHORT
AL-00397733-02	PQM EXT.TH	1.5m
AL-00397733-03	PQM EXT.TH	3.0m
AL-00397733-04	PQM EXT.TH	5.0m
AL-00427658-01	For PQM RDY	0.50m
AL-00427657-01	For PQM RDY	AWG #24 to #18
AL-00397730-01	For PQM PS-AMP	0.20m
AL-00397730-02	For PQM PS-AMP	0.25m
AL-00397730-03	For PQM PS-AMP	0.30m
AL-00397730-04	For PQM PS-AMP	0.35m
AL-00443493-01	For PQM AMP-AMP	0.20m
AL-00443493-02	For PQM AMP-AMP	0.40m
AL-00443493-03	For PQM AMP-AMP	0.60m
AL-00397729-01	For PQM 30A MOT	1.5m
AL-00397729-02	For PQM 30A MOT	3.0m
AL-00397729-03	For PQM 30A MOT	5.0m
AL-00397734-01	For PQM 50A MOT	1.5m
AL-00397734-02	For PQM 50A MOT	3.0m
AL-00397734-03	For PQM 50A MOT	5.0m
AL-00453107-01	For PQM EXT.TH 4pin	1.5m
AL-00453107-02	For PQM EXT.TH 4pin	3.0m
AL-00453107-03	For PQM EXT.TH 4pin	5.0m
AL-00453107-04	For PQM EXT.TH 4pin (1-2SHORT)	1.5m
AL-00453107-05	For PQM EXT.TH 4pin (1-2SHORT)	3.0m
AL-00453107-06	For PQM EXT.TH 4pin (1-2SHORT)	5.0m

3. SERVO SYSTEM CONFIGURATION

Copper Bars for ±DC

Power supply unit model No. : PQM0PA7R8 PQM0PA120 PQM0PA160			
Power supply unit - Servo amplifier	PQM0PA	→	PQM1☐
AL-00385689-01	7R8	→	015A/030A/050A/100A/150A
AL-00385689-02	120/160	→	015A/030A/050A/100A/150A
AL-00385689-03	7R8	→	300A
AL-00385689-04	120/160	→	300A
Servo amplifier - Servo amplifier	PQM1☐	→	PQM1☐
AL-00385690-01	015A/030A	→	015A/030A/050A/100A/150A
AL-00385690-02	050A	→	015A/030A/050A/100A/150A
AL-00385690-03	100A/150A	→	015A/030A/050A/100A/150A
AL-00385690-04	300A	→	015A/030A/050A/100A/150A
AL-00385690-05	015A/030A	→	300A
AL-00385690-06	050A	→	300A
AL-00385690-07	100A/150A	→	300A
AL-00385690-08	300A	→	300A
Power supply unit model No. : PQM0PA270 PQM0PA370 PQM0PC750			
Power supply unit - Servo amplifier	PQM0PA	→	PQM1☐
AL-00426136-01	270/370	→	015A/030A/050A/100A/150A
AL-00426136-02	270/370	→	300A
AL-00423522-01	270/370	→	600A/900A (200V type)
AL-00423522-01	750	→	600A/800A (400V type)
Servo amplifier - Servo amplifier	PQM1☐	→	PQM1☐
AL-00409923-01	015A/030A	→	015A/030A/050A/100A/150A
AL-00409923-02	050A	→	015A/030A/050A/100A/150A
AL-00409923-03	100A/150A	→	015A/030A/050A/100A/150A
AL-00409923-04	300A	→	015A/030A/050A/100A/150A
AL-00409923-05	015A/030A	→	300A
AL-00409923-06	050A	→	300A
AL-00409923-07	100A/150A	→	300A
AL-00409923-08	300A	→	300A
AL-00423522-01	600A	→	600A/900A
AL-00426136-01	600A/900A	→	015A/030A/050A/100A/150A
AL-00426136-02	600A/900A	→	300A

4. WIRING

WIRING

4. WIRING

4.1 Applicable Wire Sizes

- Follow the table below for typical sizes of external terminals and wires used for the Servo Amplifier.
- Table 4-1 assumes 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		Terminal code \ Model	Example of applicable wire size (mm^2): PQM0PA 7R8	PQM0PA 120	PQM0PA 160	PQM0PA 270	PQM0PA 370	PQM0PC 750
Main circuit	Main circuit AC power supply input terminal	L1, L2, L3	3.5 or more	5.5 or more	8.0 or more	38.0 or more	60.0 or more	60.0 or more
Main circuit	Control circuit AC power supply input terminal	L, N	2.0 or more					
Main circuit	Earth terminal	⏚	3.5 or more	3.5 or more	5.5 or more	8.0 or more	60.0 or more	60.0 or more
Main circuit	Main circuit DC power supply input terminal	+DC BUS -DC BUS	14 or more		38	60		60
Main circuit	Control circuit DC power supply input terminal	+/- DC CONT	1.3 or more					
Main circuit	Regenerative resistor connection input terminal	P Y	3.5 or more	3.5 or more	5.5 or more	8.0 or more	14.0 or more	14.0 or more
Main circuit	External thermostat input terminal	EXT-TH	0.5 or more					
Main circuit	Amp ready output terminal	RDY1	0.5 or more					

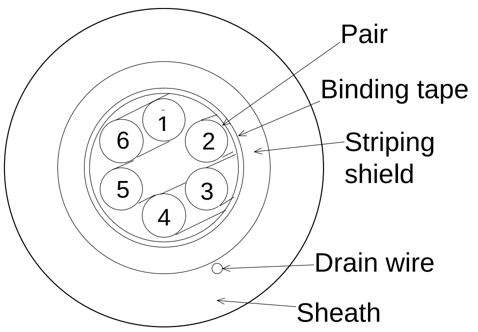
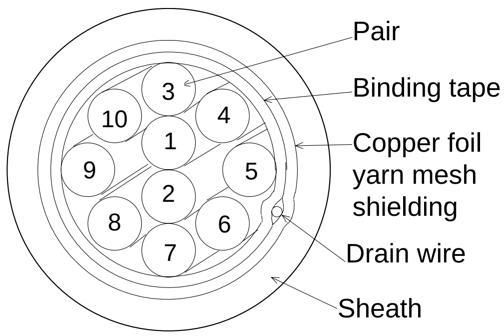
External terminal name		Terminal code \ Model	PQM1 A015	PQM1 A030	PQM1 A050	PQM1 A100	PQM1 A150	PQM1 A300	PQM1 B600	PQM1 B900	PQM1 D600	PQM1 D800
Main circuit	Motor connector terminal (power line)	U, V, W	1.25 or more	2.0 or more	3.5 or more	5.5 or more	8.0 or more	14.0 or more	38.0 or more	60.0 or more	60.0 or more	60.0 or more
Main circuit	Earth terminal	⏚	1.25 or more	2.0 or more	3.5 or more	5.5 or more	8.0 or more	14.0 or more	38.0 or more	60.0 or more	60.0 or more	60.0 or more
Main circuit	External thermostat input terminal	EX-TH	——						0.5 or more			
Main circuit	DB signal output terminal	DB1, DB2	——						2.0 or more			
Signal circuit	I/O signal connector	CN1	0.2mm^2 or greater (A twisted pair lump shielded wire is partly used.)									
Signal circuit	Encoder signal connector	CN2	0.2 mm^2 or greater twisted pair lump shielded wire									

1. For bundling wires or putting them in a duct, take the allowable current reduction ratio of the wires into consideration.
   When the ambient temperature is high, the life will be shortened due to thermal degradation. In this case, use a heat-resistant vinyl cable.
2. Make sure to separate the main circuit wire and signal wire, otherwise, noise troubles may occur.
3. We provide cables for encoder signal wire connection for purchase. When ordering cables from us, please specify our Model Numbers. (See 4.2, Specifications of Encoder Cables.)

4.2 Specifications of Encoder Cable

The table below shows the specifications of encoder cable.

Table 4-2 Specifications of Cable

	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.
Approximate specification	6-pairs × 0.2 mm^2 (Tinned annealed copper wire)	10-pairs × 0.2 mm^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. 6879019-1, No terminal treatment (without connector)	Our Model No. 6870010-1, No terminal treatment (without connector)

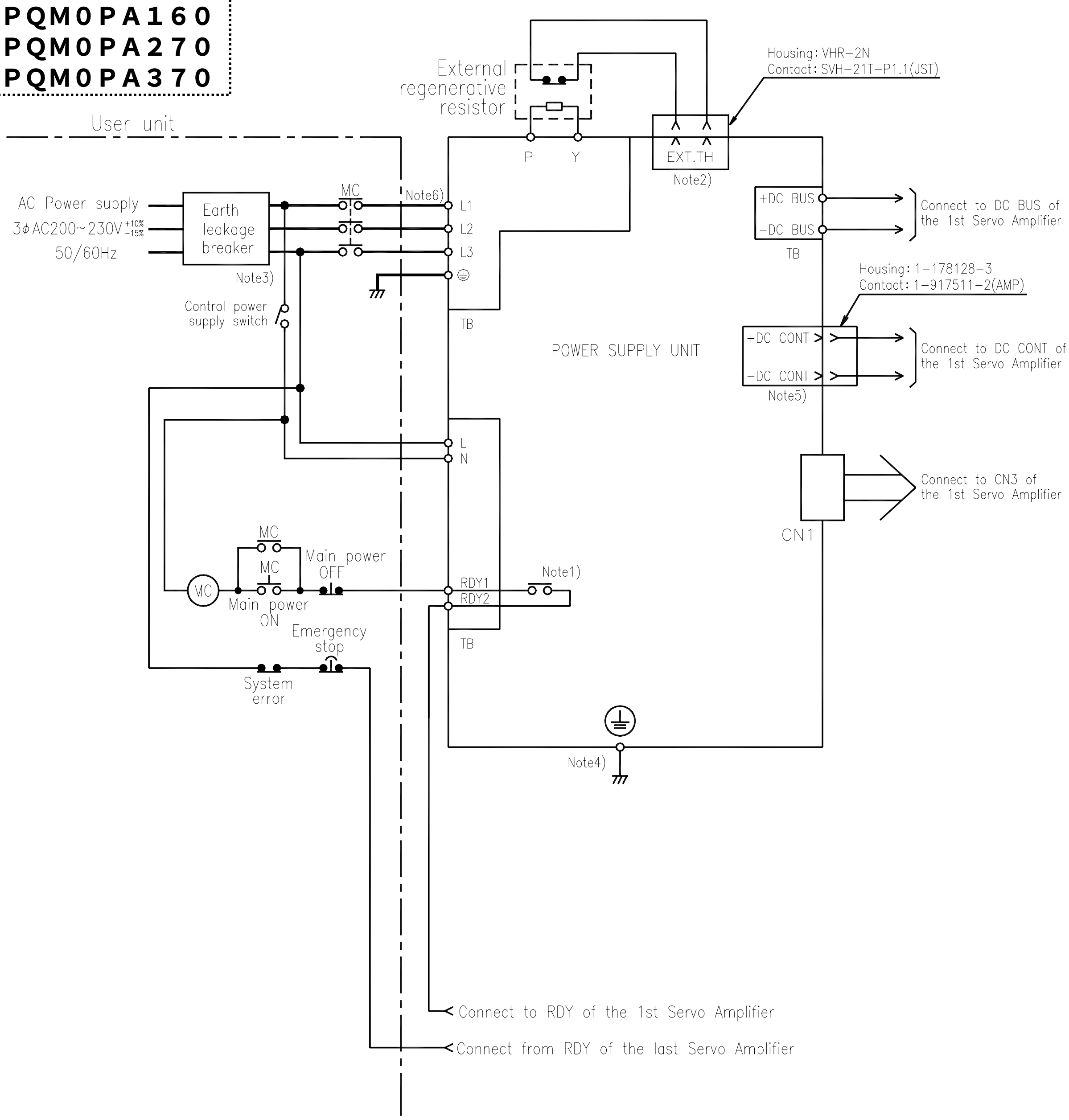
1 When applicable cable is used, the permissible wiring distance between Servo amplifier and motor (encoder) is 50m max.
2 When ordering cables from us, please specify our Model Nos. and lengths.
3 Before using these cables to any moving elements, please consult with us.

4. WIRING

4.3 External Connecting Diagram

4.3.1 External Connecting Diagram（200VAC input type power supply unit）

PQM0PA7R8
PQM0PA120
PQM0PA160
PQM0PA270
PQM0PA370



Note1) RDY output (RDY1, RDY2 terminals) is contact output.
Rated contact 250VAC 2A, 30VDC 2A: Induction load (COSϕ=0.4, L/R=7ms)

Note2) EXT. TH is a thermal for an external regenerative resistor.

Note3) UL standard conforming and IEC/EN standard conforming leakage breaker is recommended.

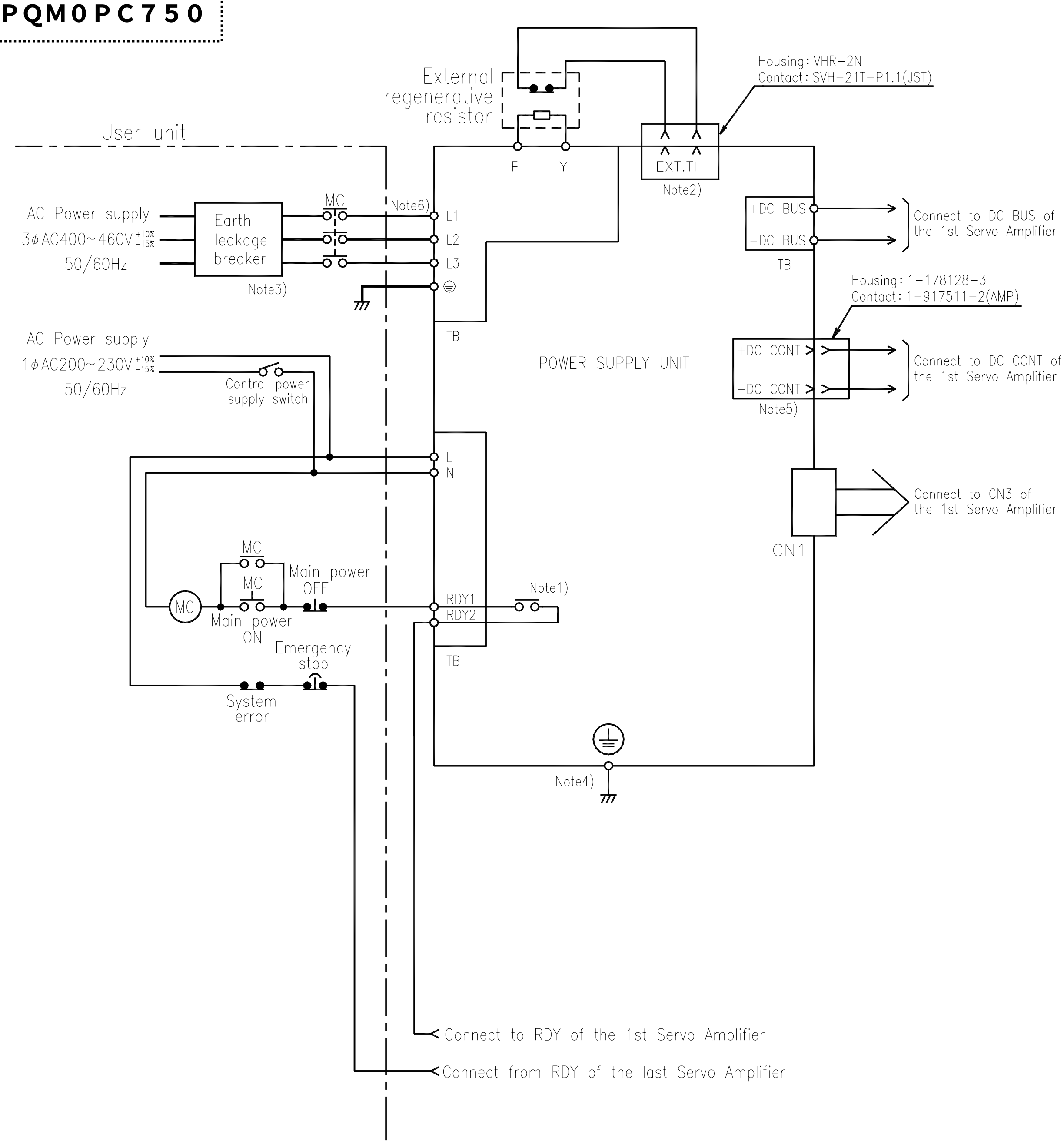
Note4) Ground the wire of 5.5mm^2 or more in diameter (yellow / green).

Note5) Connect nothing to the 2pin for DC CONT.

Note6) L1, L2, L3, P, Y, L, N, DC, BUS, DC CONT, RDY1 and RDY2 are for high voltage circuit, and other signals are for low voltage circuit.
Secure enough space between high and low voltage circuits when wiring.

4.3.2 External Connecting Diagram（400VAC input type power supply unit）

PQM0PC750



Note1) RDY output (RDY1, RDY2 terminals) is contact output.
Rated contact 250VAC 2A ⎫ Induction load
30VDC 2A ⎭ (COSΦ=0.4, L/R=7ms)

Note2) EXT. TH is a thermal for an external regenerative resistor.

Note3) UL standard conforming and IEC/EN standard conforming leakage breaker is recommended.

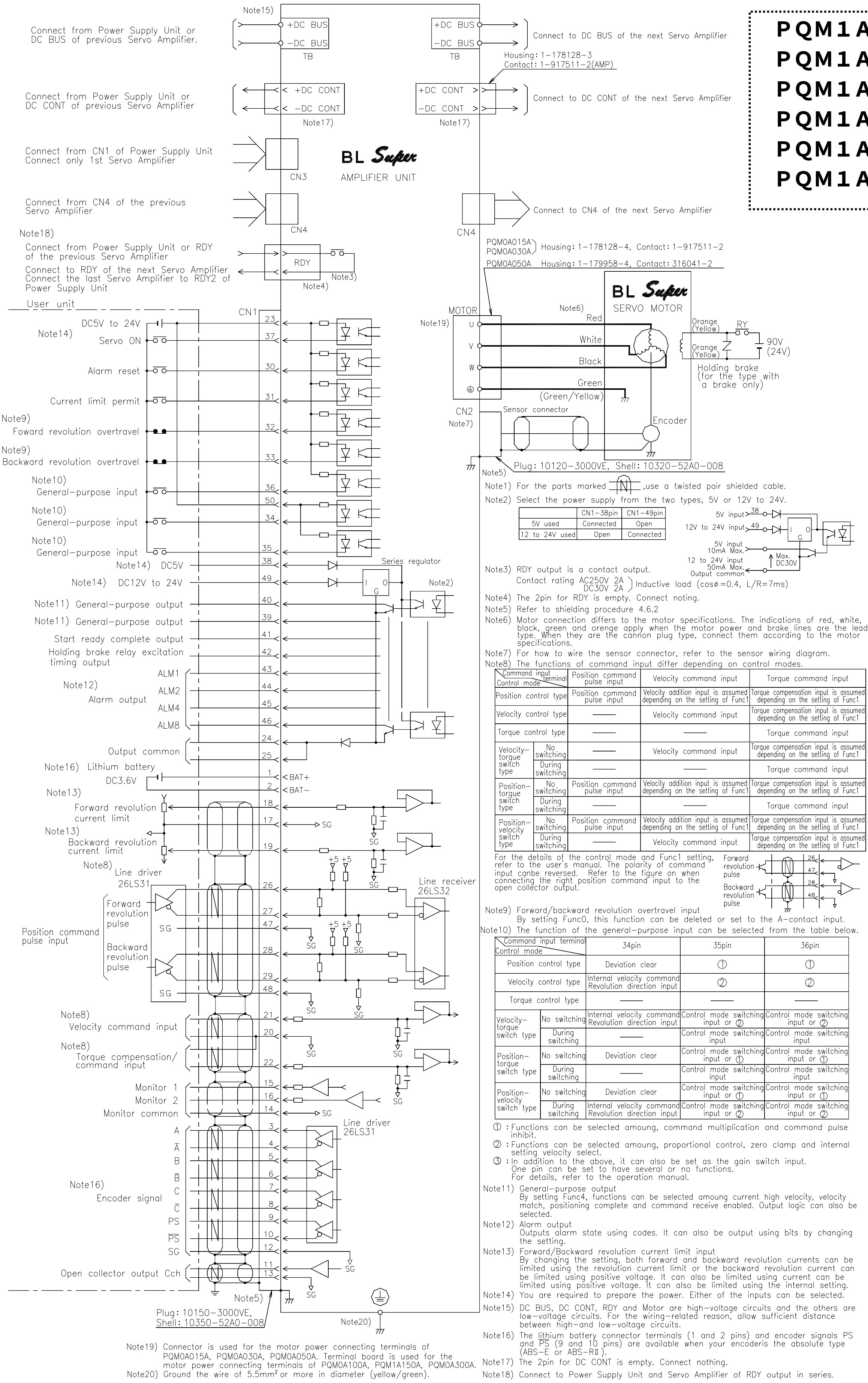
Note4) Ground the wire of $5.5mm^2$ or more in diameter (yellow / green).

Note5) Connect nothing to the 2pin for DC CONT.

Note6) L1, L2, L3, P, Y, L, N, DC, BUS, DC CONT, RDY1 and RDY2 are for high voltage circuit, and other signals are for low voltage circuit.
Secure enough space between high and low voltage circuits when wiring.

4.3.3 External Connecting Diagram（200VAC input type servo amplifier）

PQM1A015
PQM1A030
PQM1A050
PQM1A100
PQM1A150
PQM1A300



Note1) For the parts marked [N], use a twisted pair shielded cable.

Note2) 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

Note3) RDY output is a contact output.
Contact rating AC250V 2A, DC30V 2A) Inductive load (cosϕ=0.4, L/R=7ms)

Note4) The 2pin for RDY is empty. Connect noting.

Note5) Refer to shielding procedure 4.6.2

Note6) 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.

Note7) For how to wire the sensor connector, refer to the sensor wiring diagram.

Note8) The functions of command input differ depending on control modes.

Control mode \ Command input terminal		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 canbe reversed. Refer to the figure on when connecting the right position command input to the open collector output.

Note9) Forward/backward revolution overtravel input
By setting Func0, this function can be deleted or set to the A-contact input.

Note10) The function of the general-purpose input can be selected from the table below.

Control mode \ Command input terminal		34pin	35pin	36pin
Position control type		Deviation clear	①	①
Velocity control type		Internal velocity command Revolution direction input	②	②
Torque control type		——	——	——
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	Control mode switching input
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	Control mode switching input
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, command multiplication and command pulse inhibit.
② : Functions can be selected amoung, proportional control, zero clamp and internal setting velocity select.
③ : 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.

Note11) General-purpose output
By setting Func4, functions can be selected amoung current high velocity, velocity match, positioning complete and command receive enabled. Output logic can also be selected.

Note12) Alarm output
Outputs alarm state using codes. It can also be output using bits by changing the setting.

Note13) 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 current can be limited using positive voltage. It can also be limited using the internal setting.

Note14) You are required to prepare the power. Either of the inputs can be selected.

Note15) DC BUS, DC CONT, RDY and Motor are high-voltage circuits and the others are low-voltage circuits. For the wiring-related reason, allow sufficient distance between high-and low-voltage circuits.

Note16) The lithium battery connector terminals (1 and 2 pins) and encoder signals PS and $\overline{PS}$ (9 and 10 pins) are available when your encoderis the absolute type (ABS-E or ABS-RⅡ).

Note17) The 2pin for DC CONT is empty. Connect nothing.

Note18) Connect to Power Supply Unit and Servo Amplifier of RDY output in series.

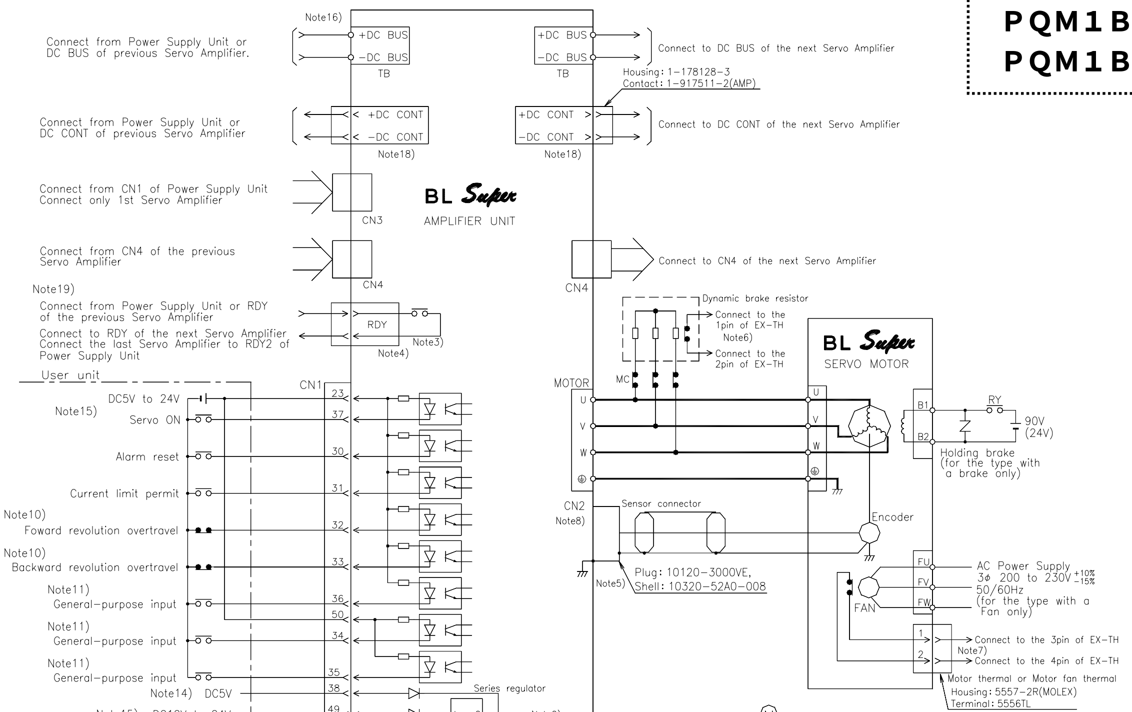
Note19) Connector is used for the motor power connecting terminals of PQM0A015A, PQM0A030A, PQM0A050A. Terminal board is used for the motor power connecting terminals of PQM0A100A, PQM1A150A, PQM0A300A.

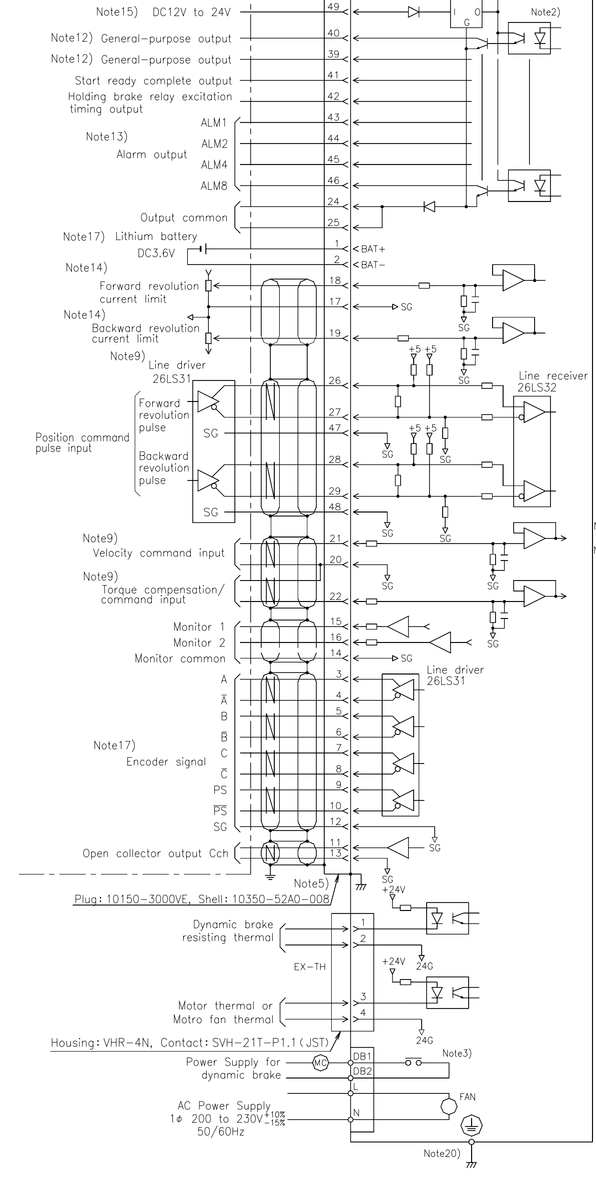
Note20) Ground the wire of 5.5mm² or more in diameter (yellow/green).

4. WIRING

4.3. 4 External Connecting Diagram（Servo amplifier）

PQM1B600
PQM1B900

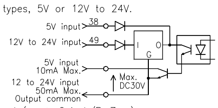




Note1) For the parts marked [N], use a twisted pair shielded cable.

Note2) 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



Note3) RDY output is a contact output.
Contact rating AC250V 2A, DC30V 2A) Inductive load (cosφ=0.4, L/R=7ms)

Note4) The 2pin for RDY is empty. Connect noting.

Note5) Refer to shielding procedure 4.6.2

Note6) Connect dynamic brake resisting thermal to the land 2pins of EX−TH.

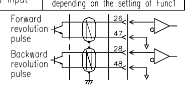
Note7) In case of using motor thermal or motor fan thermal, connect to the 3 and 4 pins of EX−TH.

Note8) For how to wire the sensor connector, refer to the sensor wiring diagram.

Note9) The functions of command input differ depending on control modes.

Control mode \ Command input terminal		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 canbe reversed. Refer to the figure on when connecting the right position command input to the open collector output.



Note10) Forward/backward revolution overtravel input
By setting Func0, this function can be deleted or set to the A−contact input.

Note11) The function of the general−purpose input can be selected from the table below.

Control mode \ Command input terminal		34pin	35pin	36pin
Position control type		Deviation clear	①	①
Velocity control type		Internal velocity command Revolution direction input	②	②
Torque control type		——	——	——
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	Control mode switching input
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	Control mode switching input
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, command multiplication and command pulse inhibit.
② : Functions can be selected amoung, proportional control, zero clamp and internal setting velocity select.
③ : 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.

Note12) General−purpose output
By setting Func4, functions can be selected amoung current high velocity, velocity match, positioning complete and command receive enabled. Output logic can also be selected.

Note13) Alarm output
Outputs alarm state using codes. It can also be output using bits by changing the setting.

Note14) 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 current can be limited using positive voltage. It can also be limited using the internal setting.

Note15) You are required to prepare the power. Either of the inputs can be selected.

Note16) DC BUS, DC CONT, RDY and Motor are high−voltage circuits and the others are low−voltage circuits. For the wiring−related reason, allow sufficient distance between high−and low−voltage circuits.

Note17) The lithium battery connector terminals (1 and 2 pins) and encoder signals PS and $\overline{PS}$ (9 and 10 pins) are available when your encoderis the absolute type (ABS−E or ABS−RⅡ).

Note18) The 2pin for DC CONT is empty. Connect nothing.

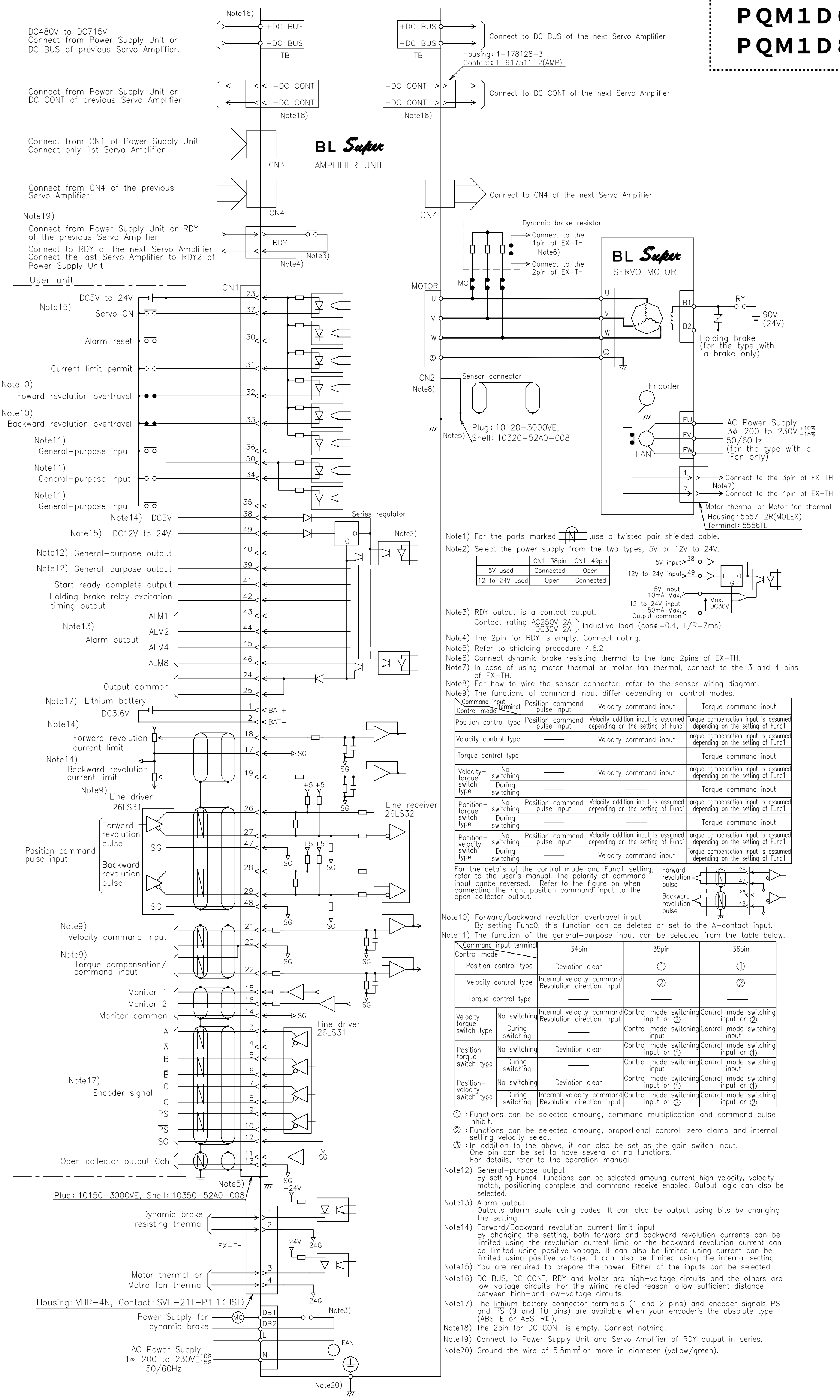
Note19) Connect to Power Supply Unit and Servo Amplifier of RDY output in series.

Note20) Ground the wire of 5.5mm² or more in diameter (yellow/green).

4. WIRING

4.3.5 External Connecting Diagram（Servo amplifier）

PQM1D600
PQM1D800



Note1) For the parts marked [N], use a twisted pair shielded cable.

Note2) 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

5V input 38; 12V to 24V input 49; 5V input 10mA Max.; 12 to 24V input 50mA Max.; Output common; Max. DC30V

Note3) RDY output is a contact output.
Contact rating AC250V 2A / DC30V 2A — Inductive load (cosφ=0.4, L/R=7ms)

Note4) The 2pin for RDY is empty. Connect noting.

Note5) Refer to shielding procedure 4.6.2

Note6) Connect dynamic brake resisting thermal to the land 2pins of EX−TH.

Note7) In case of using motor thermal or motor fan thermal, connect to the 3 and 4 pins of EX−TH.

Note8) For how to wire the sensor connector, refer to the sensor wiring diagram.

Note9) The functions of command input differ depending on control modes.

Control mode \ Command input terminal		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 canbe reversed. Refer to the figure on when connecting the right position command input to the open collector output.

Forward revolution pulse 26, 47; Backward revolution pulse 28, 48

Note10) Forward/backward revolution overtravel input
By setting Func0, this function can be deleted or set to the A−contact input.

Note11) The function of the general−purpose input can be selected from the table below.

Control mode \ Command input terminal		34pin	35pin	36pin
Position control type		Deviation clear	①	①
Velocity control type		Internal velocity command Revolution direction input	②	②
Torque control type		——	——	——
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	Control mode switching input
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	Control mode switching input
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, command multiplication and command pulse inhibit.
② : Functions can be selected amoung, proportional control, zero clamp and internal setting velocity select.
③ : 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.

Note12) General−purpose output
By setting Func4, functions can be selected amoung current high velocity, velocity match, positioning complete and command receive enabled. Output logic can also be selected.

Note13) Alarm output
Outputs alarm state using codes. It can also be output using bits by changing the setting.

Note14) 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 current can be limited using positive voltage. It can also be limited using the internal setting.

Note15) You are required to prepare the power. Either of the inputs can be selected.

Note16) DC BUS, DC CONT, RDY and Motor are high−voltage circuits and the others are low−voltage circuits. For the wiring−related reason, allow sufficient distance between high−and low−voltage circuits.

Note17) The lithium battery connector terminals (1 and 2 pins) and encoder signals PS and $\overline{PS}$ (9 and 10 pins) are available when your encoderis the absolute type (ABS−E or ABS−RⅡ).

Note18) The 2pin for DC CONT is empty. Connect nothing.

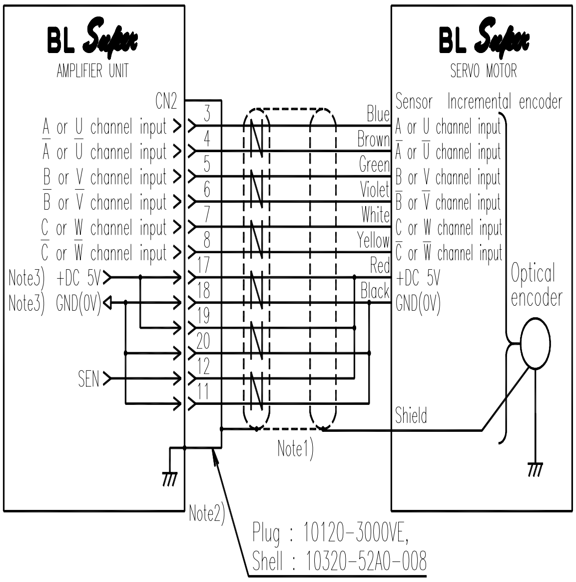
Note19) Connect to Power Supply Unit and Servo Amplifier of RDY output in series.

Note20) Ground the wire of 5.5mm² or more in diameter (yellow/green).

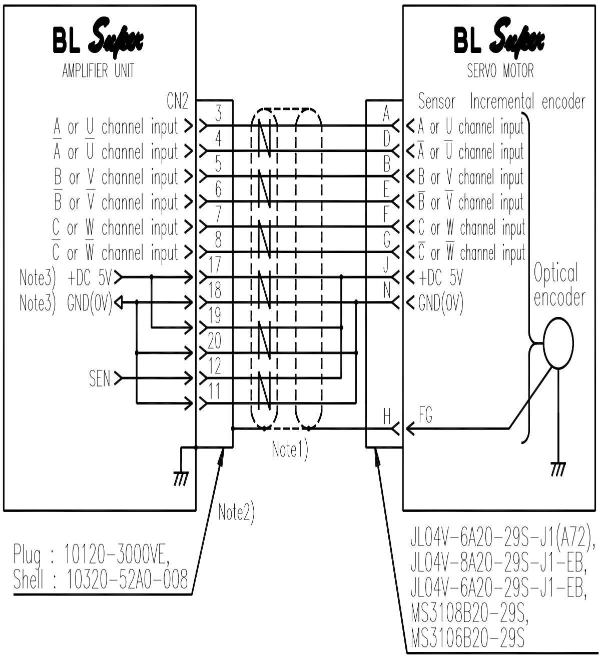
4. WIRING

4.3.6 Sensor Connection Diagram（Wiring-saved Incremental encoder INC-E）

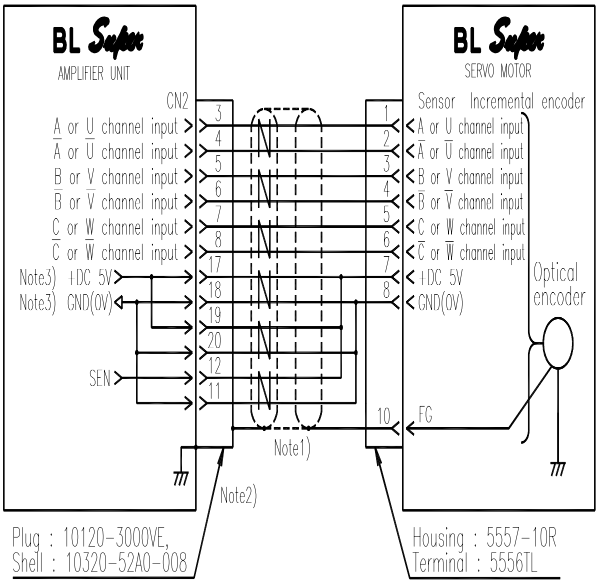
Incremental encoder(INC-E) Lead wire type



Incremental encoder(INC-E) Cannon plug type



Incremental encoder(INC-E) Connector type



Note1) For the parts marked N, use a 0.2mm^2 (AWG24) twisted pair shielded cable.

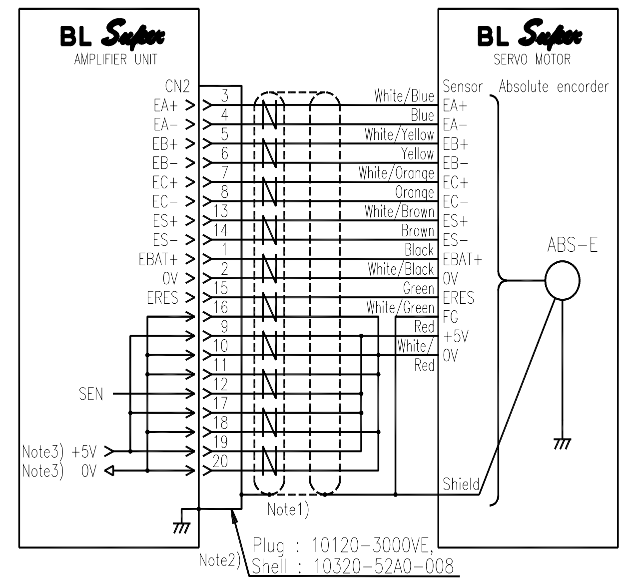
Note2) Refer to 4.6.2, CN1 & CN2 Shielding Procedure.

Note3) The sensor power connecting differs depending on the cable length. Refer to the following table.

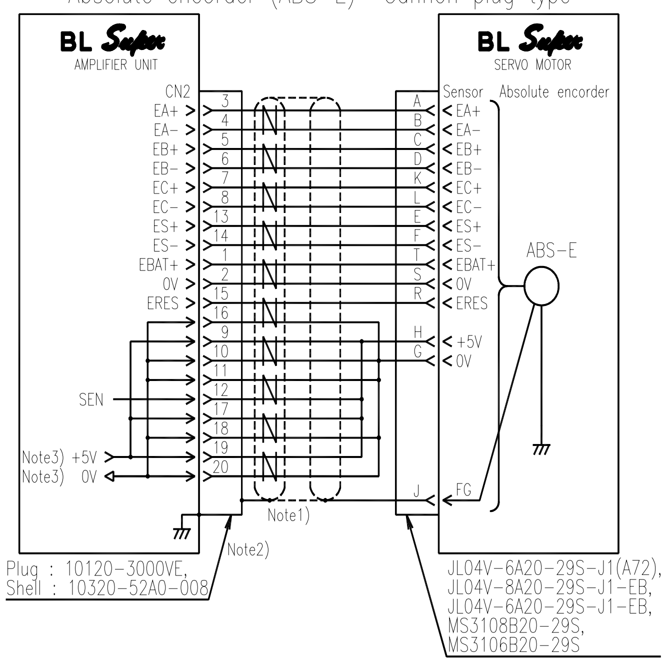
Sensor cable length	5m or less	10m or less	50m or less
+5V wiring	19 pin connection (12, 17 pins need not be connected)	12 and 17 pin connection (19 pin needs not be connected)	12, 17, 19 pin connection
0V wiring	20 pin connection (11, 18 pins need not be connected)	18 and 20 pin connection (11 pin needs not be connected)	11, 18, 20 pin connection
Number of cable pairs	4	5	6

4.3.7 Sensor Connection Diagram (Request Signal Unavailable Absolute Encoder ABS-E)

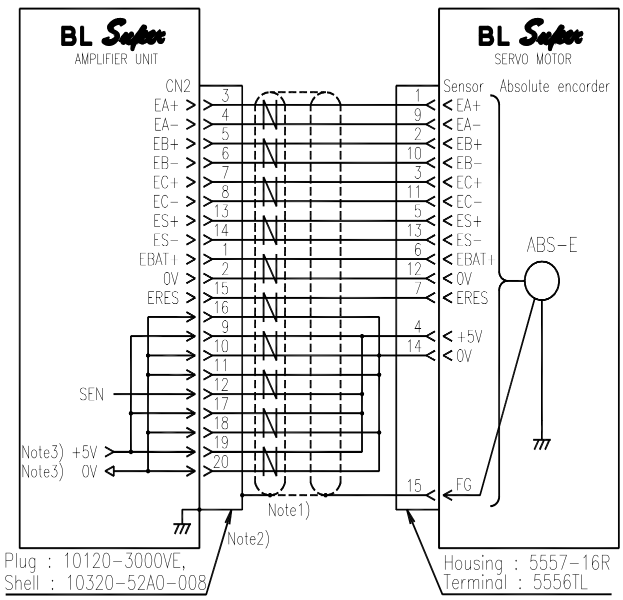
Absolute encorder (ABS-E) Lead wire type



Absolute encorder (ABS-E) Cannon plug type



Absolute encorder (ABS-E) Connector type



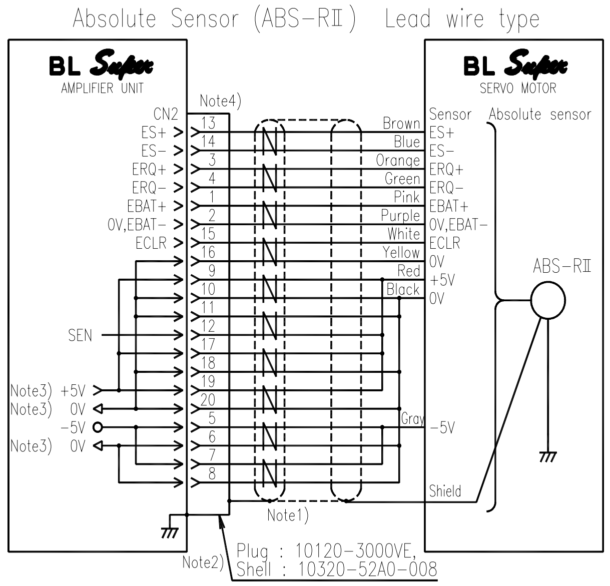
Note1) For the parts marked N, use a 0.2mm^2 (AWG24) twisted pair shielded cable.

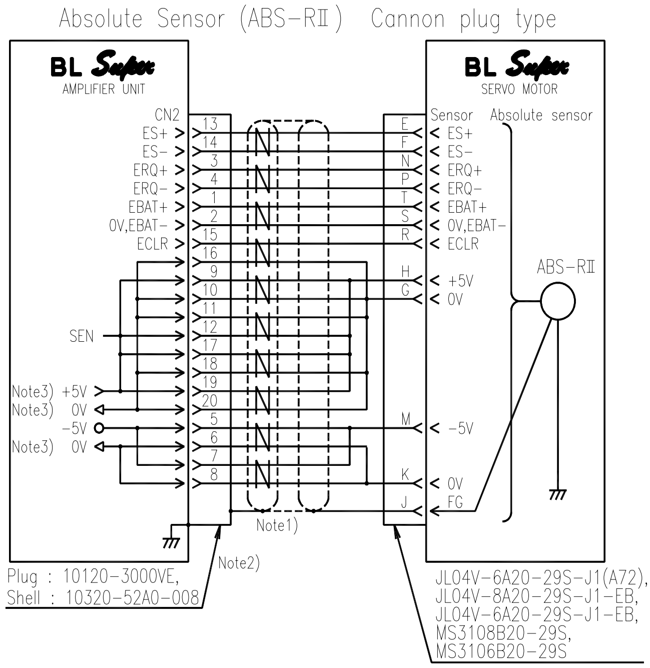
Note2) Refer to 4.6.2, CN1 & CN2 Shielding Procedure.

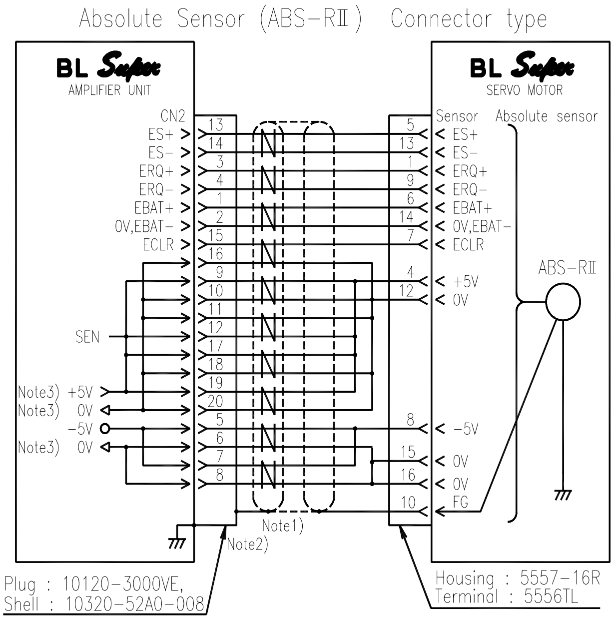
Note3) The sensor power connecting differs depending on the cable length. Refer to the following table.

Sensor cable length	5m or less	10m or less	15m or less	50m or less
+5V wiring	19 pin connection (9,12,17 pins need not be connected)	12 and 17 pin connection (9,19 pins needs not be connected)	12,17 and 19 pin connection (9 pin needs not be connected)	9,12,17,19 pin connection
0V wiring	16,20 pin connection (11, 18 pins need not be connected)	16,18 and 20 pin connection (10,11 pins need not be connected)	11,16,18 and 20 pin connection (10 pin needs not be connected)	10,11,16,18,20 pin connection
Number of cable pairs	7	8	9	10

4.3.8 Sensor Connection Diagram (Request Signal Available Absolute Encoder ABS-RⅡ)







Note1) For the parts marked , use a 0.2mm^2 (AWG24) twisted pair shielded cable.

Note2) Refer to 4.6.2, CN1 & CN2 Shielding Procedure.

Note3) 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-All.

4.4 Connector Terminal Arrangement Input / Output Signal Diagram

4.4.1 CN1: Interface Connector

CN1 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	Note5 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	5VDC 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 CN1 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. Overtravel: 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.
   The timing can be adjusted according to the machine.

> The above figure shows the arrangement when viewed from the wiring section of the connector.
>
> The cable side connector is not attached to the Servo Amplifier. Customers are requested to have it on their own.

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 the Servo Amplifier.
- Note that the 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	5 V
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
SG	C	B	A	BAT+
20	18	16	14	12
SG	SG	SG	$\overline{PS}$	5 V
19	17	15	13	11
5 V	5 V	ECLR	PS	SG

Fig. 4-3 CN2 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	$\overline{\text{PS}}$	5 V

19	17	15	13	11
5 V	5 V	ECLR	PS	SG

Fig. 4-4 CN2 Connector (ABS-RII Request Signal-available Absolute Sensor) Terminal Arrangement Diagram

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 by taking the following precautions into account. • For input/output signal line, use twisted wires or multi-conductor twisted lump shielded wires. • For encoder signal line, use recommended cables. • The length of the command input line is less than 3m. • The length of encoder signal line is less than 50m. • Wire them in the shortest distance. • Separate the main circuit line from the signal circuit line. • Do not wire the main circuit line on the side of the amplifier or near another amplifier.
Grounding cable	Observe the followings in grounding cables. • Earth the wire with the diameter of $2.0mm^2$ at one point. • Perform class 3 grounding (earth resistance : 100Ω max.) • Make sure to ground ⏚ terminal of the Servomotor (motor frame) and ⏚ terminal of the Servo Amplifier.
Measures against malfunction due to noise	Observe the followings to prevent malfunction due to noise. • Arrange the noise filter, the Servo Amplifier, and the upper controller as near as possible. • Make sure to install a serge absorbing circuit on the coils for the relay, the magnetic contactor, the induction motor and the brake solenoid. • 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. • Do not bind the noise filter primary and secondary side wires together. • Do not make the grounding cable longer. • Do not make the ending of analog input signal open.
Measures 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 problems, insert a line filter to the power line input.

For EMC countermeasures, see 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. Do not conduct a noise test for more than 30 minutes.

2 Motor frame grounding

When the machine is grounded through the frame, Cf x 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 motor terminal (motor frame) to the E terminal of the Servo Amplifier.
Also, directly connect the E terminal of the Servo Amplifier..

3 Wire grounding

When a motor is wired to a metal conduit or box, be sure to ground the metal. 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 followings when wiring the power line.

- Leakage current

  Make sure to use a circuit breaker or fuse in the Servo Amplifier input to protect the power supply line. Further, even if the motor frame grounding applies as specified, a leakage current flows in the input power supply line. When selecting a leakage detection type breaker, consider so that no oversensitive operation occur due to a high frequency leakage current with reference to “Servo Amplifier/Motor Leakage Current” of the specifications. (Page 9-43.)

- 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 power supply unit, take countermeasures against the surge at the control panel inlet.

For lightning surge protectors to be inserted to power supply unit inlet, the product in the following section or its equivalent is recommended.

4.6.1 Recommended Surge Protector

When purchasing the following, directly make a reference to the maker for it. (This product can not be used for 400 VAC input type.)

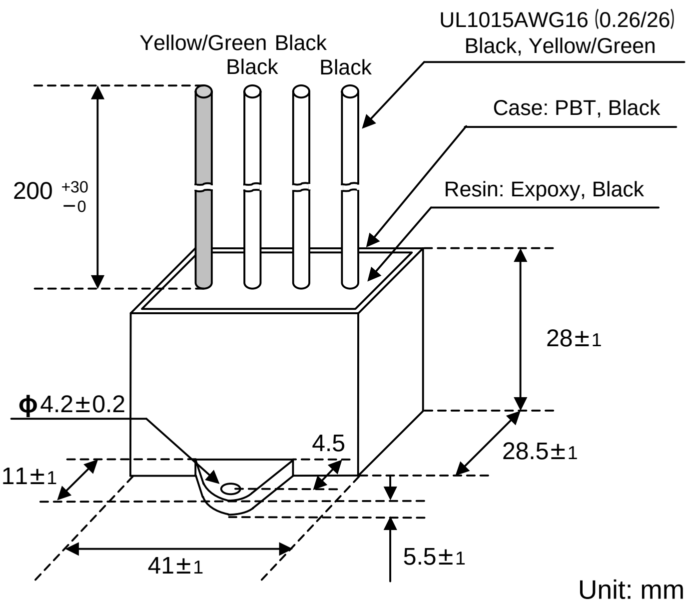
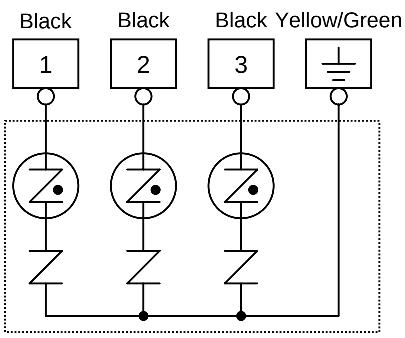
<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Model No.</td><td>R.A.V-781BXZ-2A (Okaya Electric Industries Co., Ltd.)</td></tr>
<tr><td>External dimensions</td><td>
</td></tr>
<tr><td>Maximum allowable circuit voltage</td><td>300 Vms</td></tr>
<tr><td>Clamp voltage</td><td>783 V±10%</td>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

Fig. 4-5 Specifications of Recommended Surge Protector

4.6.2 CN1 & CN2 Shielding Procedure

The following figure shows the connector shielding procedure for the attached CN1 or CN2 connector. There are two shielding procedures, clamp and soldering processing.

● **Clamp processing**

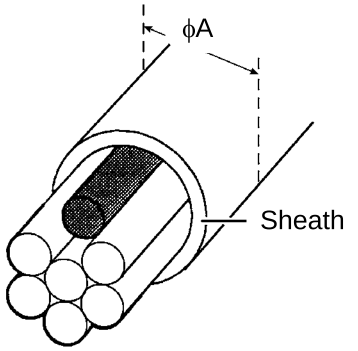
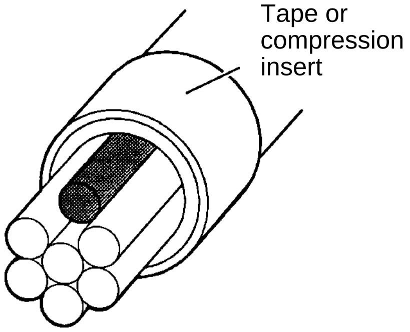
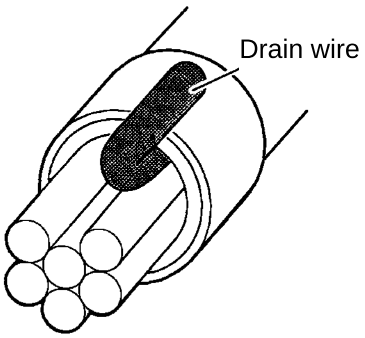
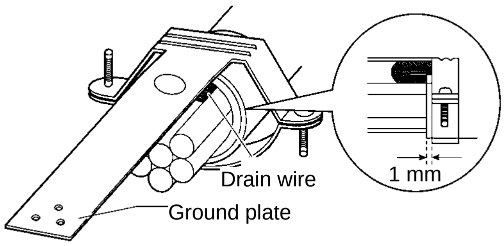
1		Remove the cable sheath.
2		Mount a tape or a compression insert. (CN1: Used when OD is less than 15.0mm CN2: Used when OD is less than 10.5mm.) At this time, the tape or the compression insert should be completely on the cable sheath.
3		Fold back the drain wire.
4		Tighten the cable clamp from on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

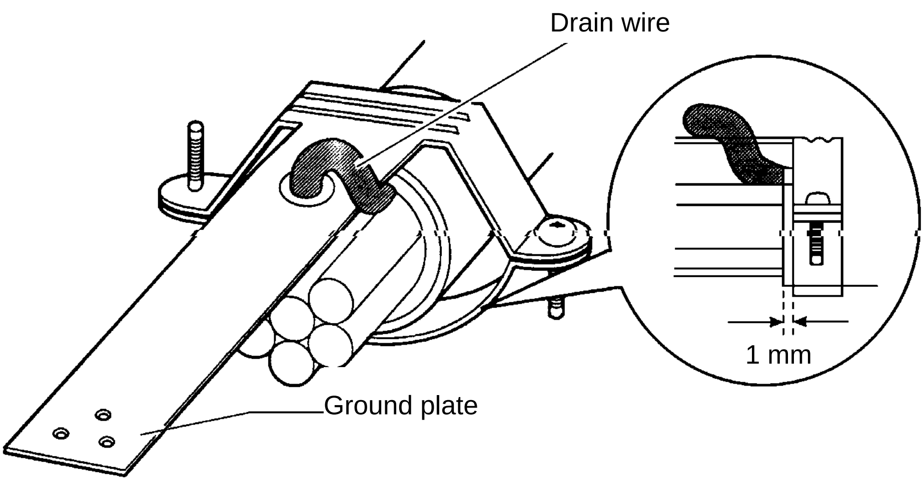
Fig. 4-6 Shielding Procedure (Clamp processing)

> ⚠ 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

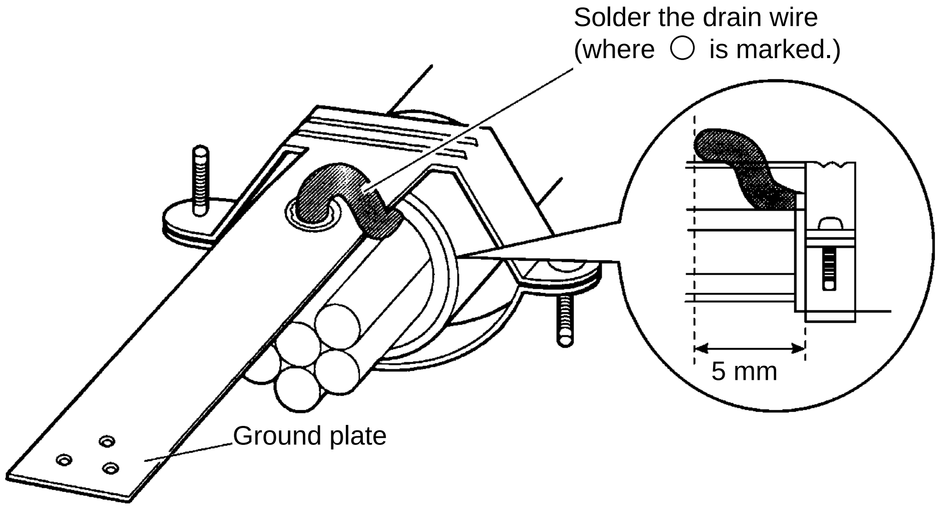


Fig. 4-7 Shielding Procedure (Soldering processing)

● Applicable CN2 OD Size

The applicable CN1 and CN2 OD sizes are shown in the following table.

Table 4-3 Applicable CN2 OD Size

Connector No.	Applicable OD 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 outer diameter (OD)	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.

Situation	Precautions
When installed in a box	The temperature inside the box may be higher than outside depending on the power loss of built-in equipment and the dimensions of the box. Make sure to keep the temperature around the Servo Amplifier at 55℃ (131F°) or lower by properly determining the dimensions of the box, the cooling system and the arrangement. For a longer lifetime and higher reliability, operate the Servo Amplifier at an in-box temperature of lower than 40℃ (104F°)
When installed near a source of vibration	Install the Servo Amplifier at the base through a shock absorber so that vibration may not be transmitted directly to the Servo Amplifier.
When installed near a source of heat generation	Even if there is a possibility of temperature rise caused by convection or radiation, keep the temperature near the Servo Amplifier lower than 55℃ (131F°)
When installed in a corrosive atmosphere	If the Servo Amplifier is operated for a long time, contact failure may result 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 the boxes, and such parts as regenerative brake resistor may become ignition sources, causing fires and explosion.
Where dust or oil mist exists	Never install the Servo Amplifier in an atmosphere containing dusts or oil mists. Dusts or oil mists adhered to or accumulated on the Servo Amplifier may lower the insulation or cause a leak between conductors of applicable parts, damaging the Servo Amplifier.
Where large noise source exists	Induction noise will enter the 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.

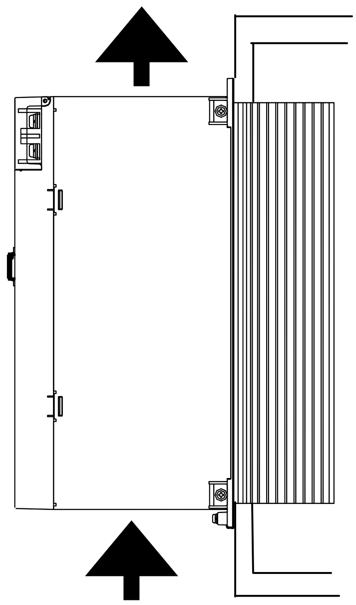
For EMC countermeasures, see Chapter 10.

5. INSTALLATION

5.1.2 Installation Procedure

- **Direction and Position of Installation**

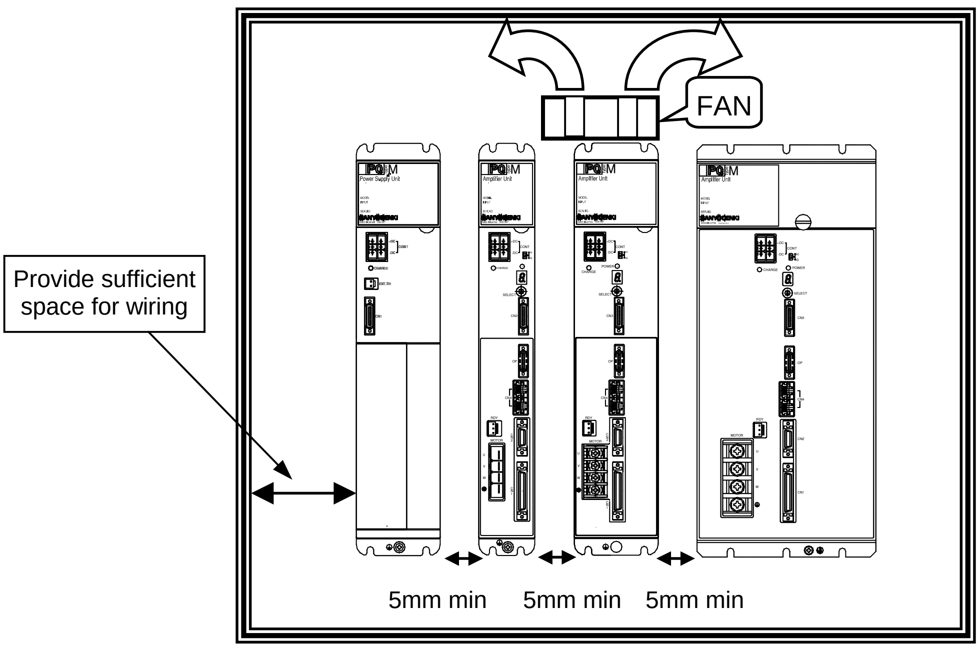
Install the Power supply unit and Servo Amplifier vertically as shown in the figure below.
Since the natural convection cooling method is implemented, make sure to keep the right direction.



- **Board arrangement conditions**

Fix the Servo Amplifier at right (when viewed from front face) to the power supply unit. Provide sufficient space for wiring at the left of the power supply unit. If the Servo Amplifier needs to be fixed at left to the power supply unit, consult with us.

Provide sufficient space around the Servo Amplifier and power supply unit 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 sufficient space in front of the Amplifier in such a degree that does not damage workability.

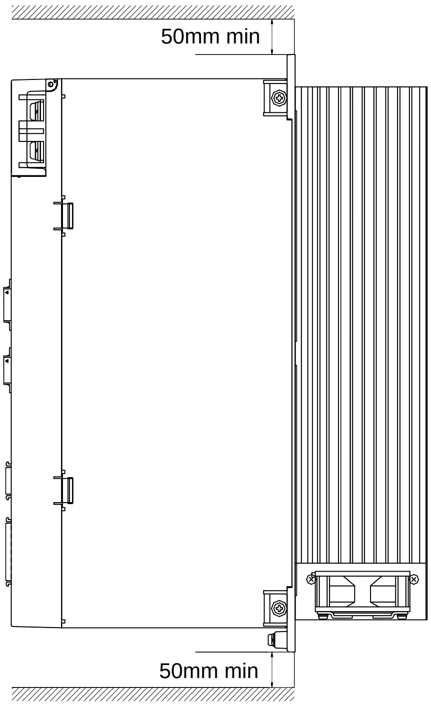


5. INSTALLATION

Duct Ventilation

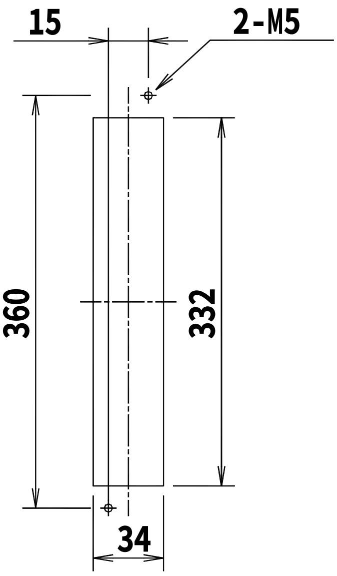
Since the duct ventilation is implemented for the PQM Servo system, the heat sink generating a large amount of heat must be embedded in the duct. Installation method is shown in the figure below.

PQM0PA7R8 PQM0PA120 PAM0PA160
PQM1A015 PQM1A030 PQM1A050 PQM1A100 PQM1A150 PQM1A300



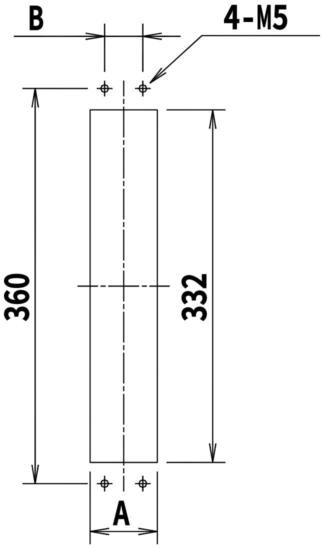
MODEL
PQM1A015
PQM1A030

How to Prepare Mounting Panel

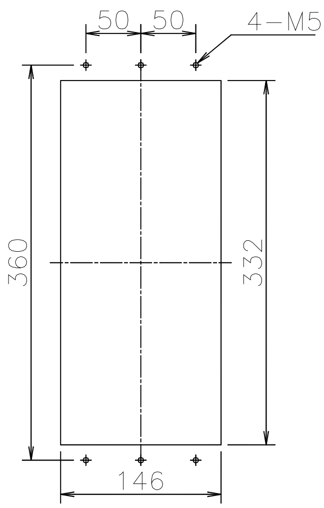


Model	A	B
PQM0PA7R8	44	25
PQM0PA120	69	50
PQM0PA160	69	50
PQM1A050	44	25
PQM1A100	69	50
PQM1A150	69	50

Unit: mm



PQM1A300



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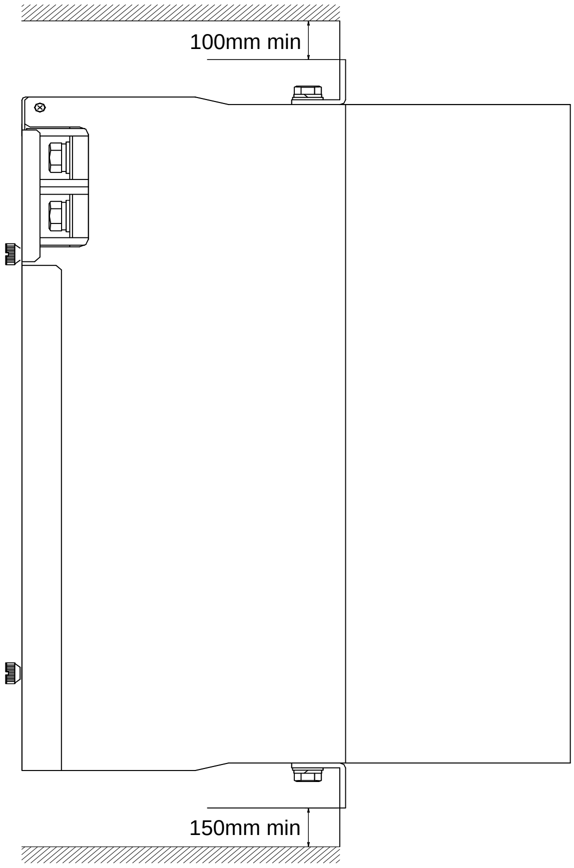
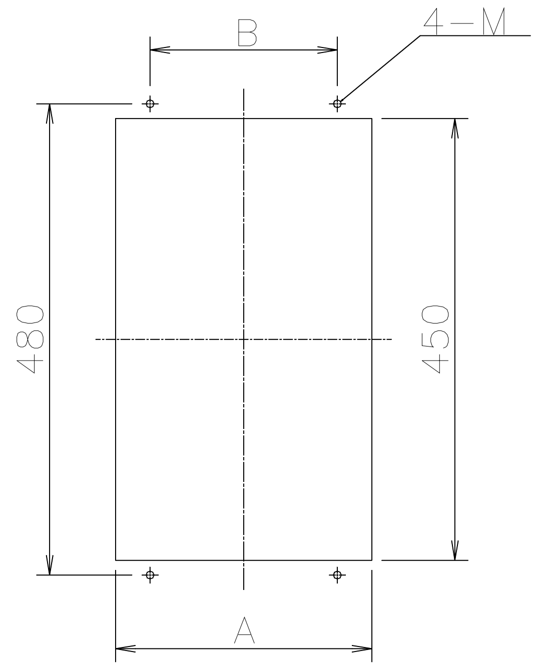
PQM0PA270 PQM0PA370 PQM0PC750
PQM1B600 PQM1B900 PQM1D600 PQM1D800



How to Prepare Mounting Panel



Model	A	B	M
PQM0PA270	135	85	M8
PQM0PA370	180	110	M10
PQM0PC750	230	150	M10
PQM1B600A	255	190	M8
PQM1B900A	430	360	M10
PQM1D600A	430	360	M10
PQM1D800A	430	360	M10

Unit: mm

5.2 Servomotor Installation

Refer to the following for the Servomotor installation and procedure.

5.2.1 Installation Place

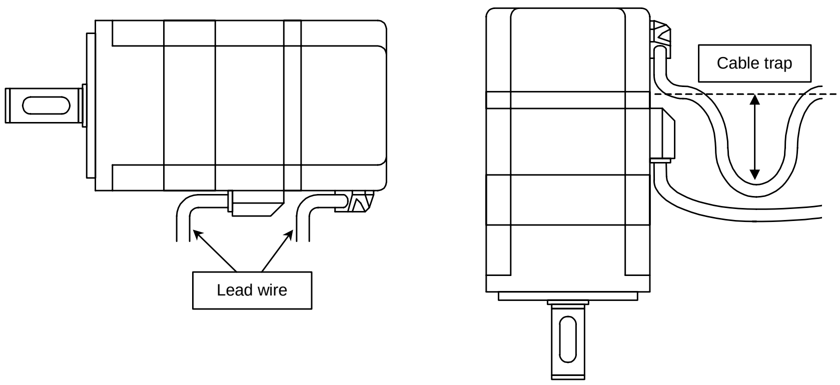
Install the Servomotor at an indoor site by referring to the following.

- Ambient temperature : 32 to 104°F
- Storage temperature : – 4 to 149°F
- Ambient humidity : 20 to 90%
- Well-ventilated places
- Places free from corrosive gas or explosive gas
- Places free from dust or foreign materials
- Places easy to check and clean
- Always keep the oil seal lip away from oil, and the Servomotor away from a large amount of water, oil or cut liquid. The Servomotor can be protected from slight splashes by means taken on it.

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 oily water from going to the motor.



5.2.3 Protection from Water/Dust

① The motor, as a single unit, satisfies the IEC standard (IEC34-5). However, as the standard 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.

② In case of a constant leakage of liquid, it may enter inside the motor due to the motor breathing, even when the IP7X class protection from liquid is applied.

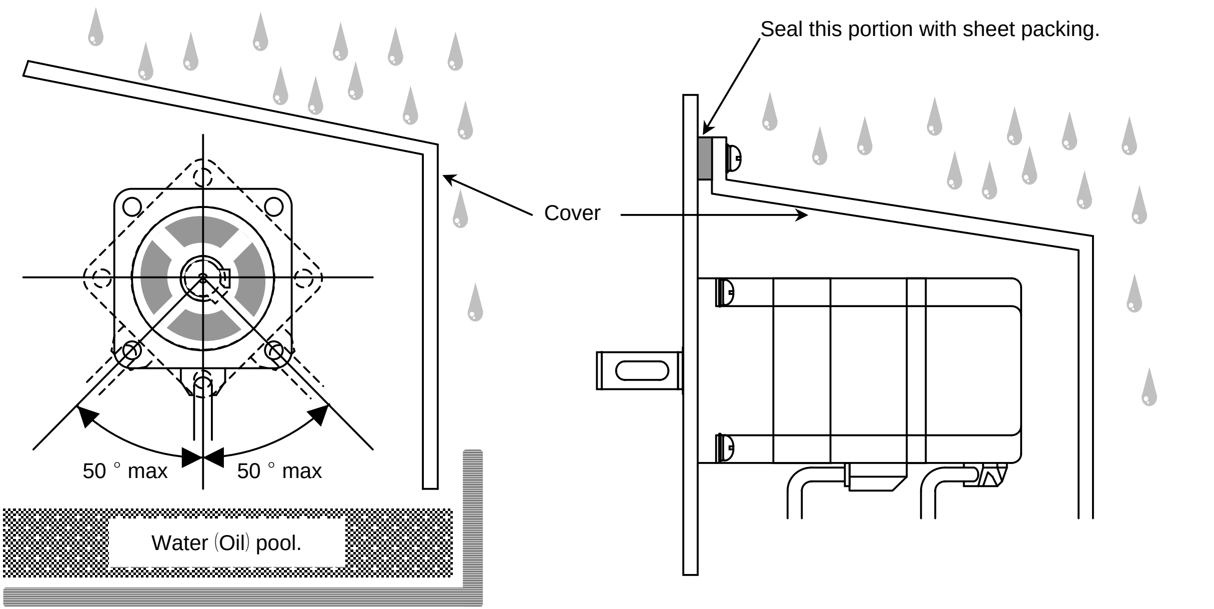
③ Some kinds of coolant (especially water-soluble one) may sometimes erode the coating or sealing. Therefore, install a protection cover.

	P10	P20	P30	P50	P60	P80
Protect type	IP67		IP40	P50B030, 040 : IP40 P50B050, 070, 080 : IP55	IP67	

The cannon connector type P10, P20, P60 and P80 series motors are water-proof when engaged with connectors. If water-proof function is required, use a water-proof connector or conduit on the other side of the cannon connector.

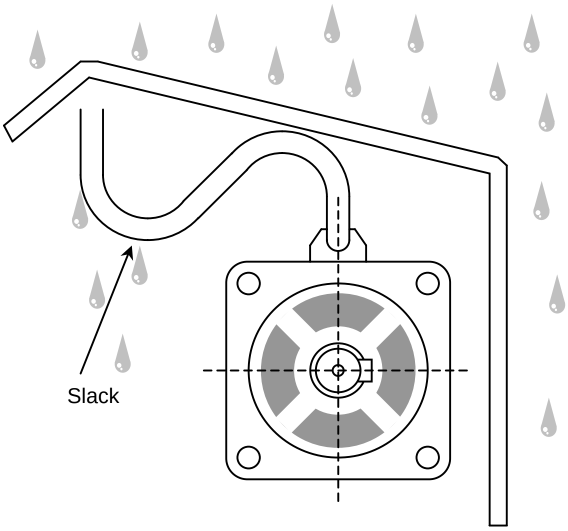
5.2.4 Installing a Protection Cover

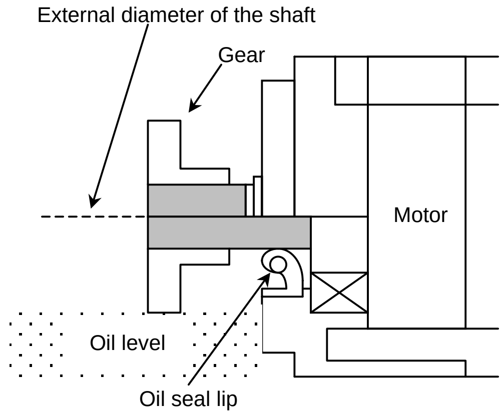
① Install a cover as shown below, when the motor is constantly exposed to liquid dripping.
② Set the connector (lead outlet) with its end downward in the angle range shown in the figure below.
③ Install a cover on the side to which water or oil will splash.
④ Install a cover with a gradient so that water or oil may not stay.
⑤ Avoid dipping the cable in water or oil.
⑥ Slacken the cable outside the cover to prevent water or oil from entering the motor side.



5. INSTALLATION

⑦ When the connector (lead outlet) cannot be installed with its end downward by any means, slacken the cable to prevent water or oil from entering inside the motor.





5.2.5 Installation of a Gear

Take the following precautions in the installation of a gear.

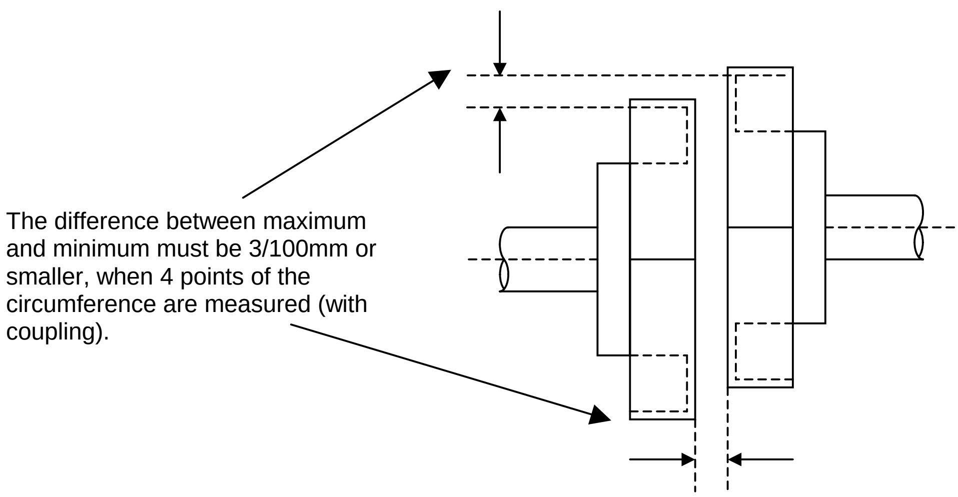
① Keep the oil level of the gear box lower than the oil seal lip. (A level allowing only splash on the oil seal lip.)

② Provide a vent to prevent the internal pressure of the gear box from rising, or water or oil may enter inside the motor through the oil seal.

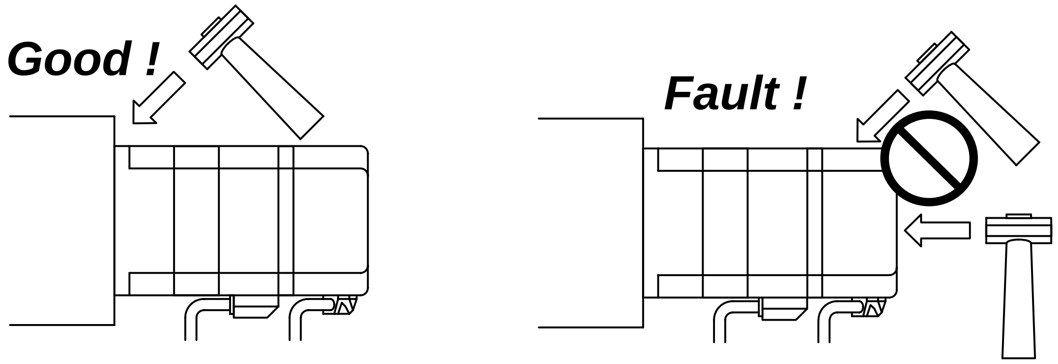
③ When the motor shaft faces upwards, it is recommended to install an oil seal at the opposite side, too. Also provide a drain to discharge the water or oil that has entered through the oil seal.

5.2.6 Connection to the opposite machine

① Perform centering accurately between the motor shaft and the opposite machine as in the figure below. Note that when a rigid coupling is used, especially, a slight offset will lead to damage of the output shaft.

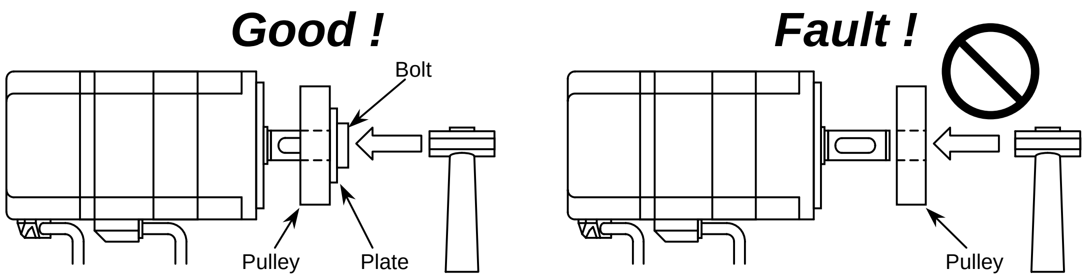


② Since a precision encoder is directly connected to the motor shaft, be careful not to give shocks to it. If tapping on the motor is unavoidable for position adjustment or other reasons, tap on the front flange, if possible, with a rubber or plastic hammer.



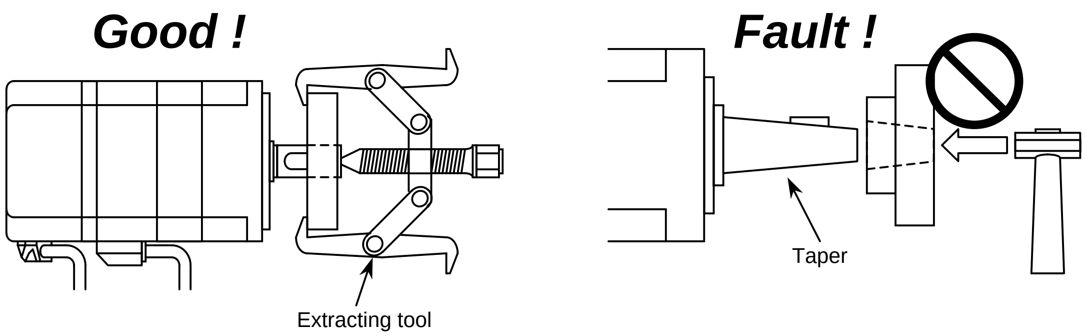
③ When installing the motor to the machine, make a installing hole precisely so that the motor joint can be smoothly connected. Also, make the installing surface as flat as possible, or the shaft or the bearing may be damaged.

④ When installing the gear, the pulley, the coupling, etc., avoid giving shocks to them by using the screw
of the shaft edge.



⑤ 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.

⑥ When removing the gear, the pulley, etc., use a dedicated extracting tool.



⑦ 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.

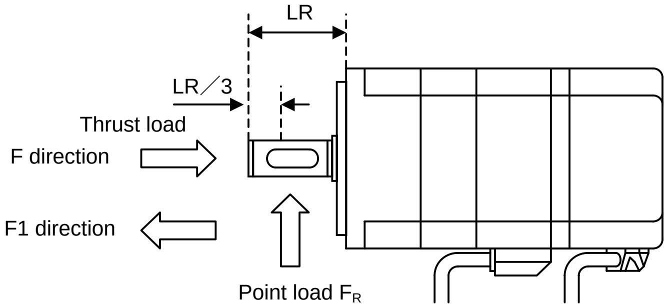
5.2.7 Allowable load of bearing

Table 5-1 shows the load 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

	Models	During Assembly			During Operation		
		Radial Load (kg)	Thrust Load(kg)		Radial Load(kg)	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	280	150	150
	P60B2215K	300	200	200	230	150	150
	P60B2220K	400	200	200	280	150	150
	P60B2820K	480	200	200	340	150	150
	P60B2825K	480	200	200	340	150	150
	P60B2830K	480	200	200	340	150	150
	P60B2837K	600	260	260	400	200	200
	P60B2845K	600	260	260	400	200	200
	P60B3255K	870	340	340	600	200	200
	P60B3275K	870	340	340	600	200	200
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 load refers to the maximum load applicable to the point one-third of the output shaft length away from the output shaft



5.3 Precautions on Cable Installation

① Be careful not to give stress or damage to the cables.

② When it is anticipated to move the servomotor, allow enough flexion radius of the cable to avoid stress.

③ Install the cables where there is no danger of their sheaths being damaged by cutting flakes or other sharp materials. Avoid contact with any corner of machines.
Take care not to step on the cables or not to have any machine mounted on them.

④ Clamp the cables to the machine to avoid stress and self-gravity at the connection point.

⑤ When the motor and cables are moved by cable bearer, determine a flexion radius of each cable by the necessary flexion lifetime and type of wire.

⑥ It is recommended that the cable of a movable portion should have a structure that enables periodic replacement. When you desire to use a recommended cable for a movable portion, consult with our company

6. OPERATION

OPERATION

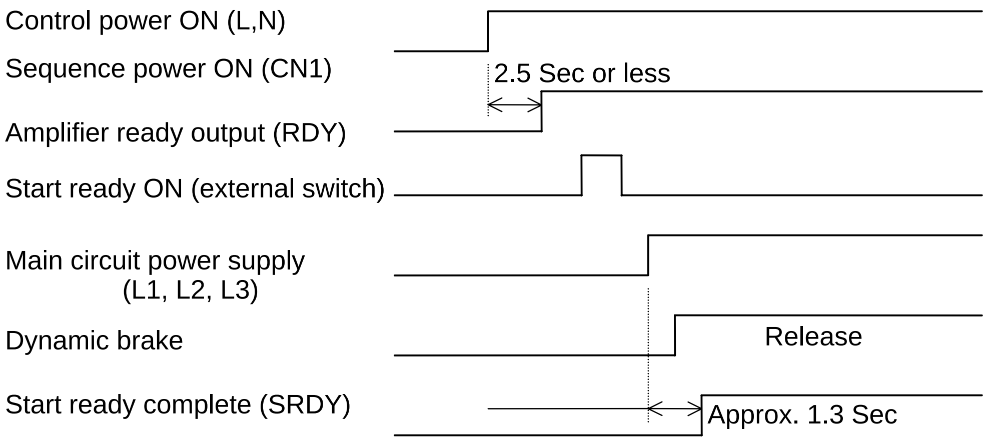
6. OPERATION

6.1 Operation Sequence

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

6.1.1 Power ON Sequence

6.1.1.1 When "dynamic brake function ineffective at SOFF" is selected. (⚠ 1)



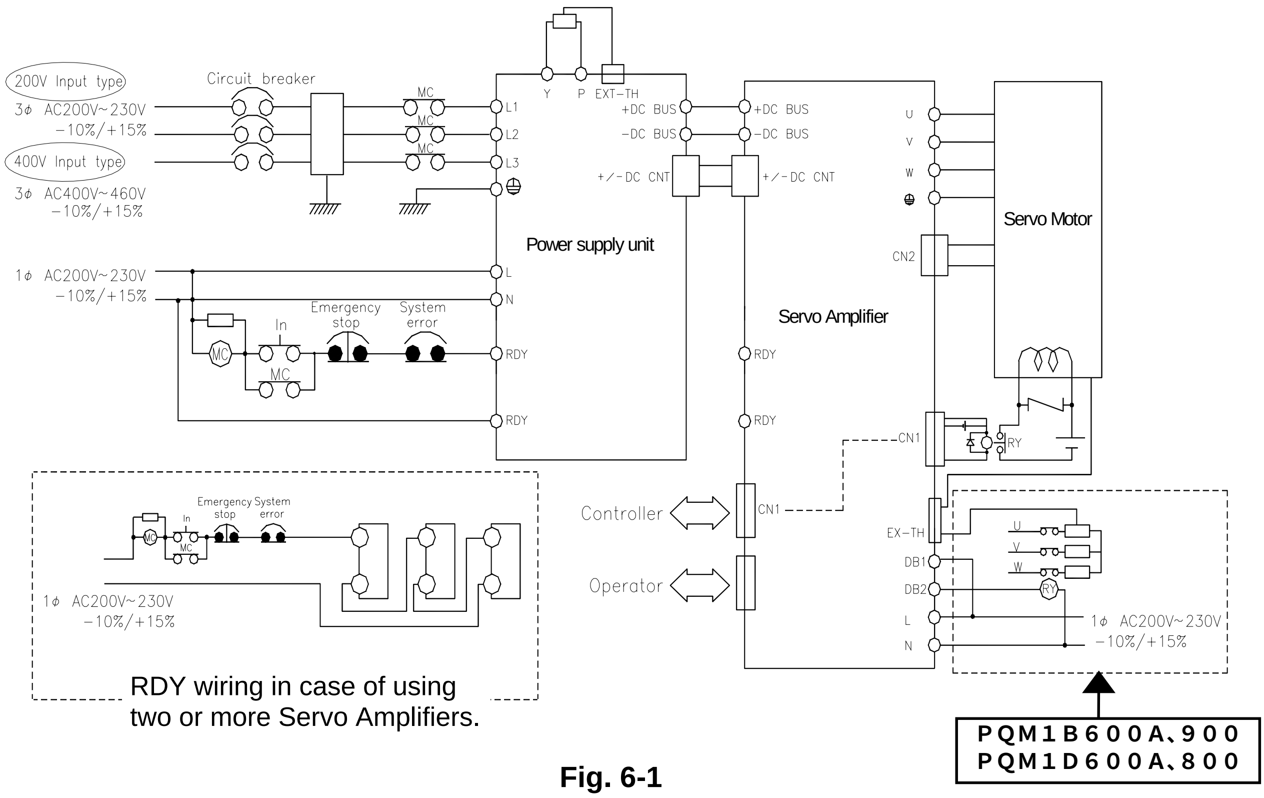
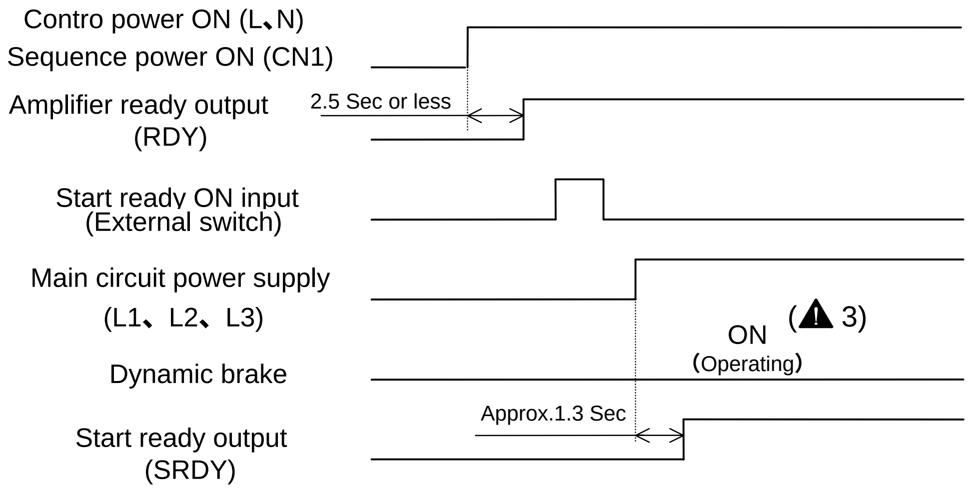


Fig. 6-1

6.1.1.2 When “dynamic brake functioin effective at SOFF” is seleted. (⚠2)

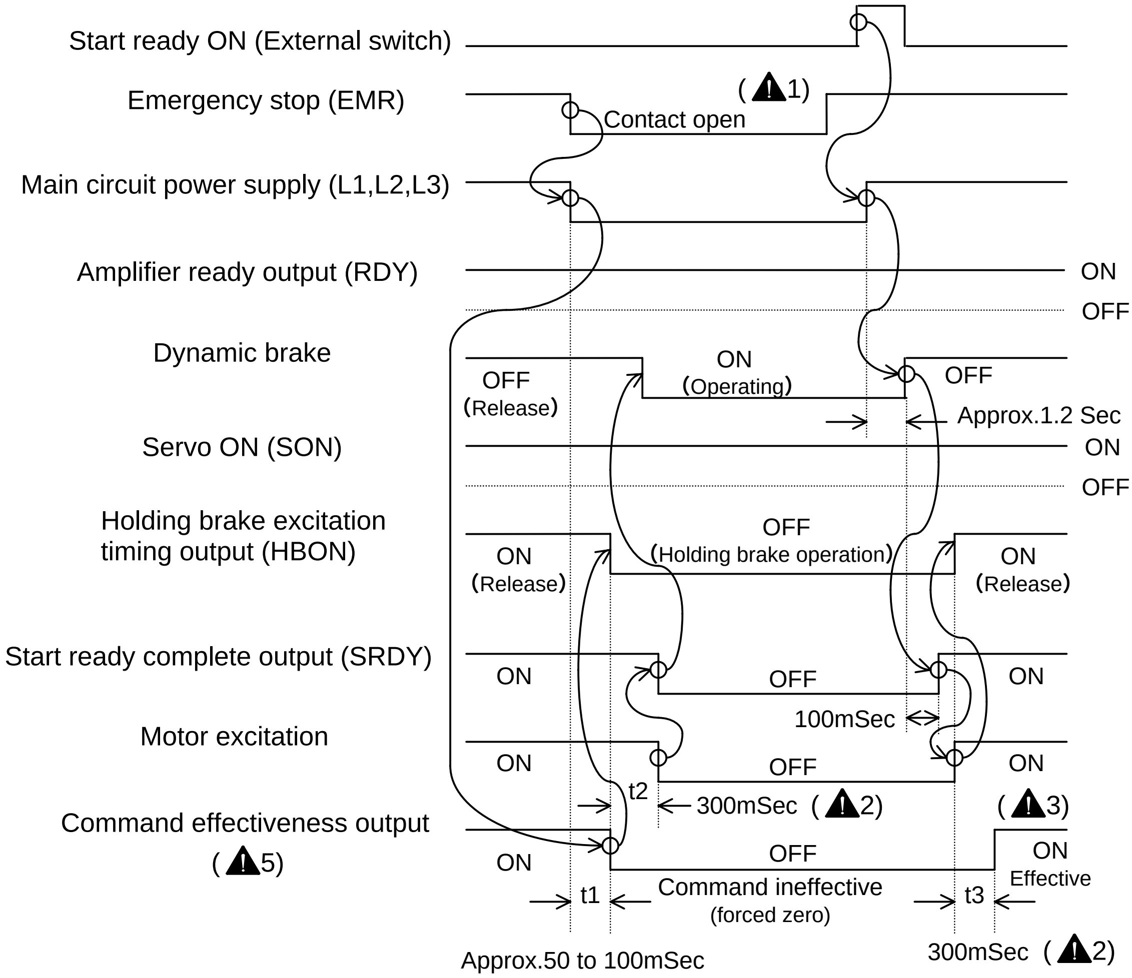


⚠

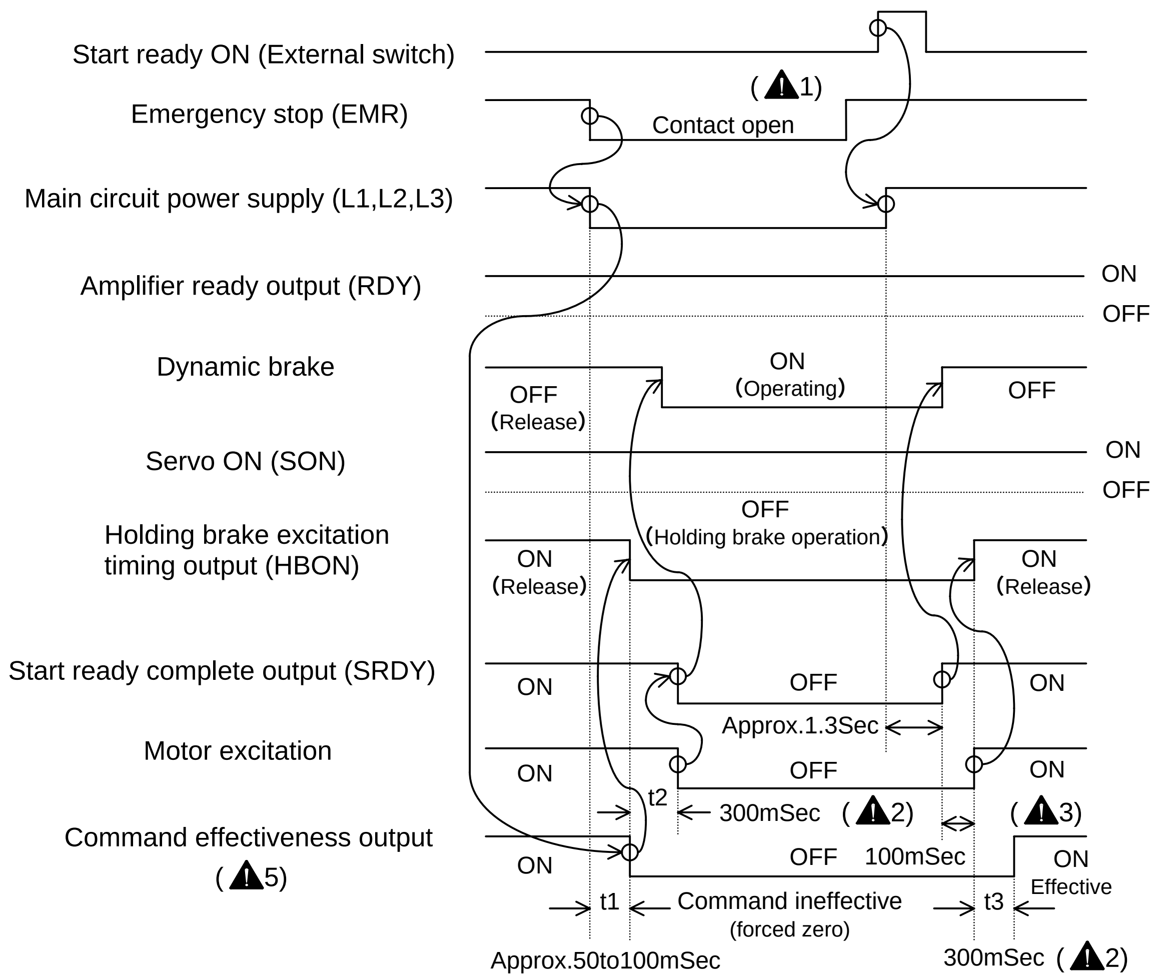
1. Setting the paramer Func bit 4 to ”1” disables the dynamic brake function at SOFF. Dynamic brake will be released 1.2 Sec after turning on the main circuit power supply. (L1, L2, L3),
2. Setting the parameter Funce bit 4 to “0” enables the dynamic brake function at SOFF.
3. Input servo ON command to release the dynamic brake. Refer to 6.1.3 Servo Off Sequence.

6.1.2 Stop Sequence

6.1.2.1 Stop and recovery due to emergency stop input when "dynamic brake function ineffective at SOFF" is selected.



6.1.2.2 Stop and recovery due to emergency stop input when “dynamic brake function effective at SOFF” is selected.



1 • Release it before inputting "start ready".

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

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

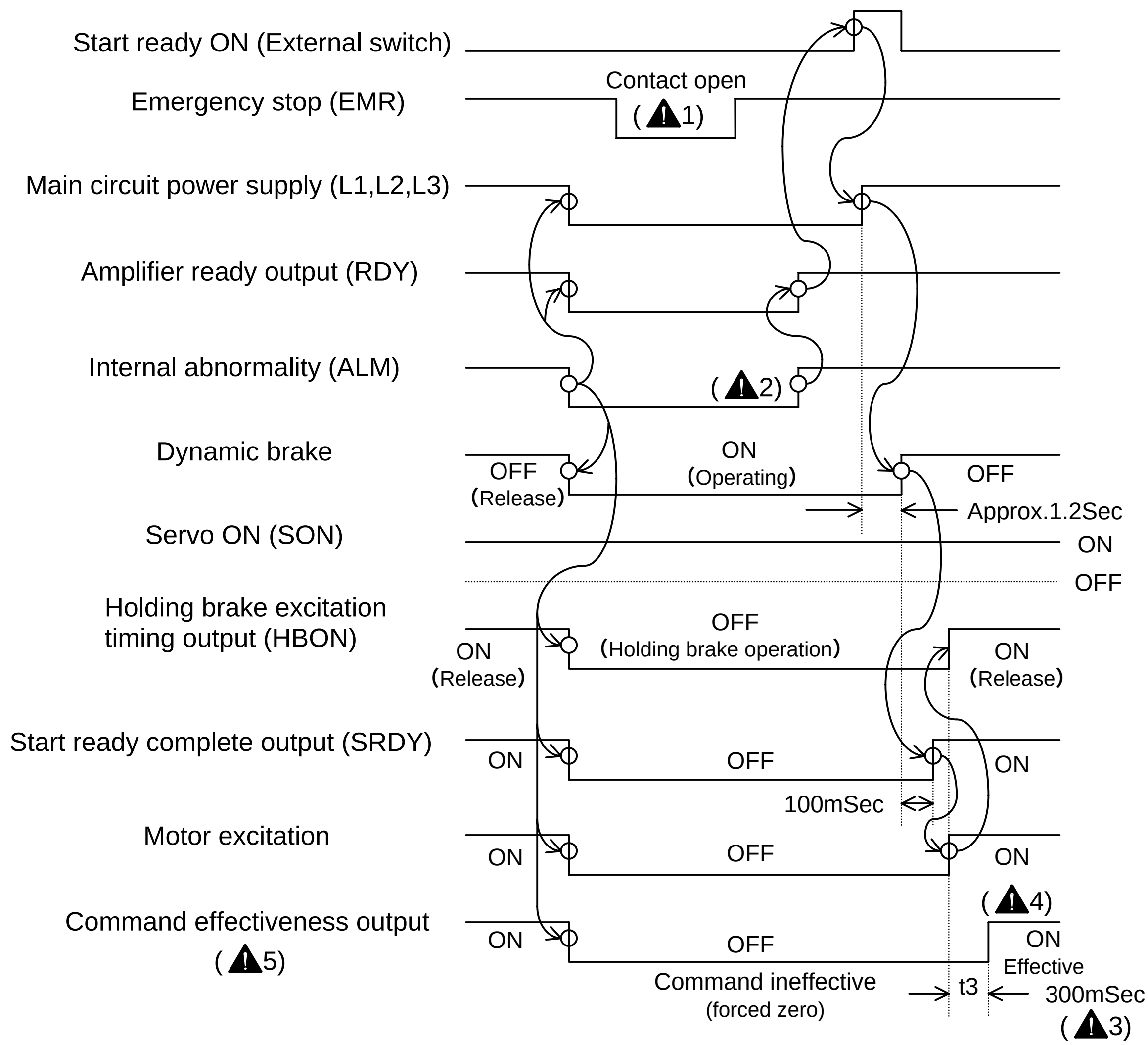
3 • It is possible to make commands ineffective (forced zero) for 300 msec (t3)after SON by setting Func1 bit5 to "0" when setting parameters. In case of the position control type, however, the command pulse remains as a deviation for 300 msec (t3).

• 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 but it its not when switching from SOFF to SON.

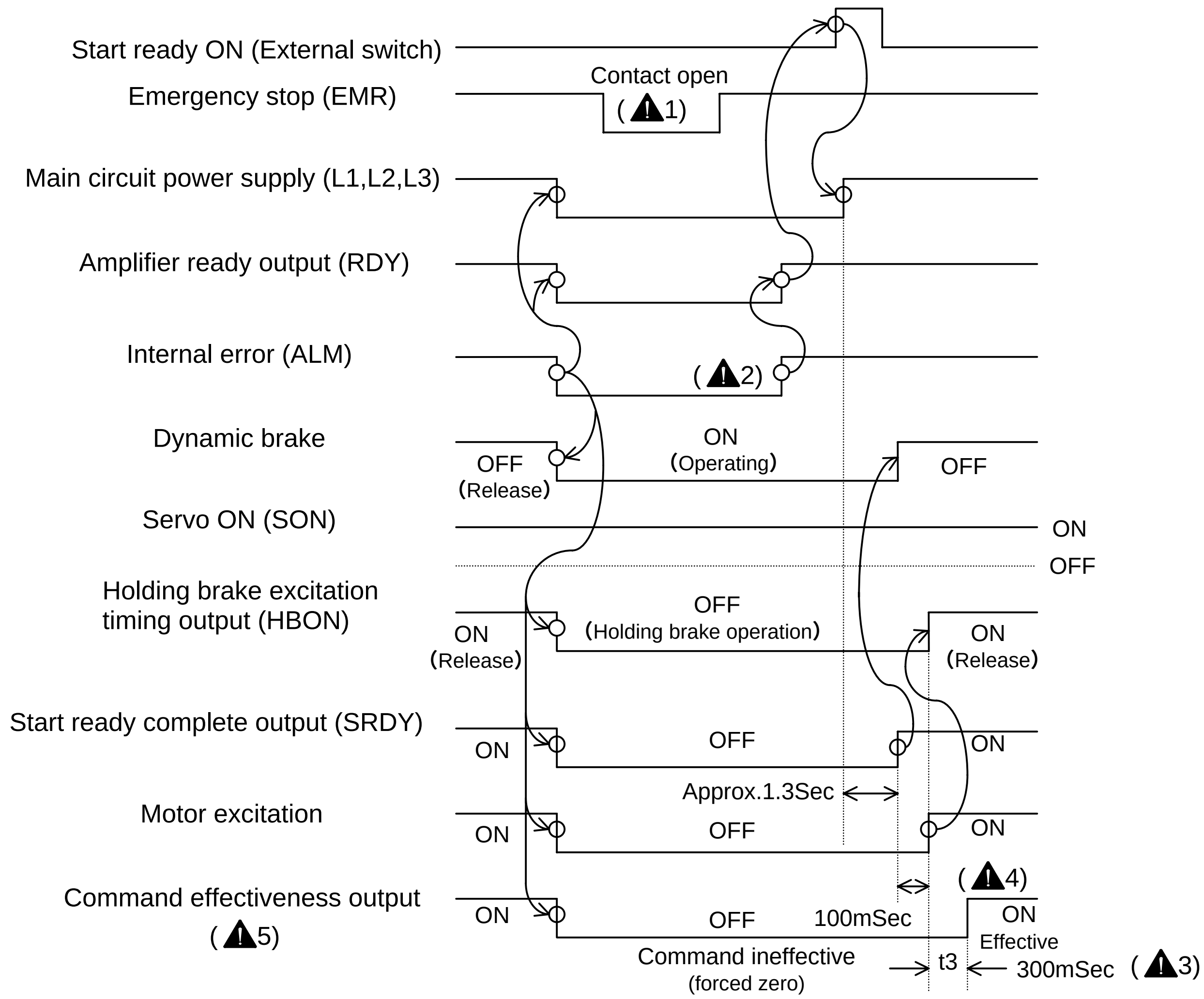
4. • Emergency stop is applied under a large load, MPE (main circuit power supply drop , alarlm 9) may be output.

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

6.1.2.3 Stop and recovery due to an internal error when "dynamic brake function ineffective at SOFF" is selected.



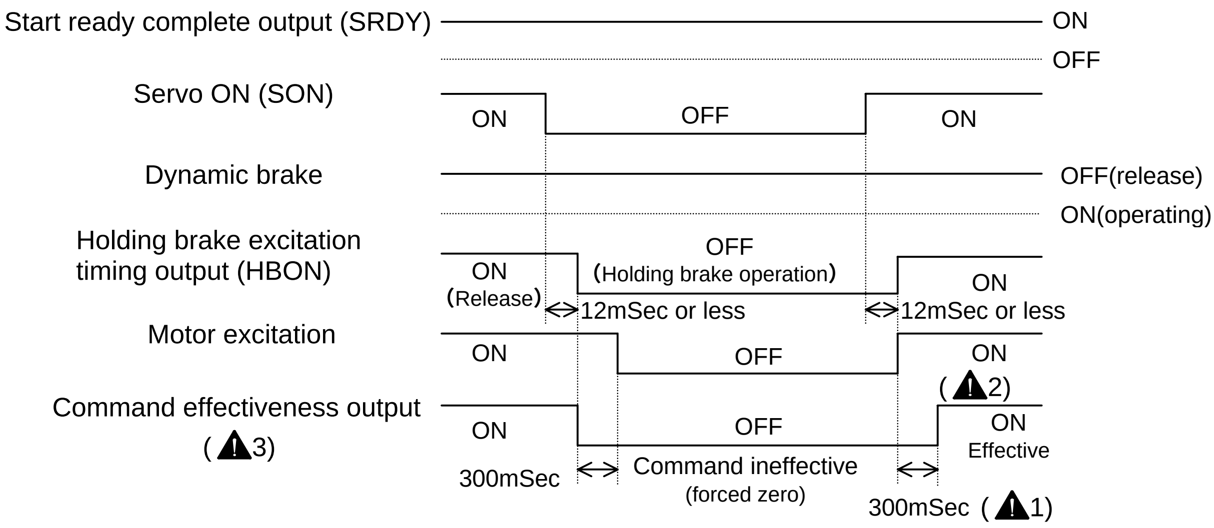
6.1.2.4 Stop and recovery due to an internal error when "dynamic brake function effective at SOFF" is selected.



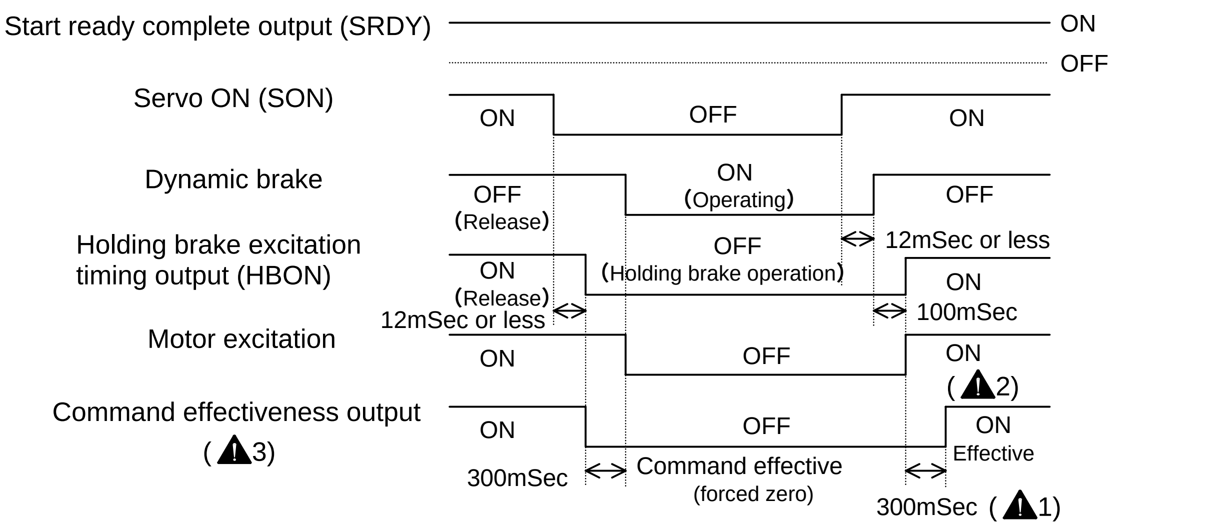
1	•	In an internal error status, inputting "emergency stop" has no effect. However, release it before inputting "start ready".
2	•	As per the alarm reset sequence.
3	•	The holding brake timing (standard value 300 ms, in Parameter Mode 1 on page 13) can be changed to 0 to 1 sec. However, When it is set at 0 msec, command ineffective (forced zero) status continues for 4 msec after SON.
	•	The current is limited by the sequence current limit value (standard value 120 %, in parameter Mode 1 on page 12) within 300 msec.
4	•	It is possible to make commands ineffective (forced zero) for 300 msec 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 300 msec.
	•	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 300 msec (standard), & when "dynamic brake function ineffective at Servo OFF" is selected.



6.1.3.2 When holding brake timing THB is set at 300 msec (standard), & when "dynamic brake function effective at Servo OFF" is selected.

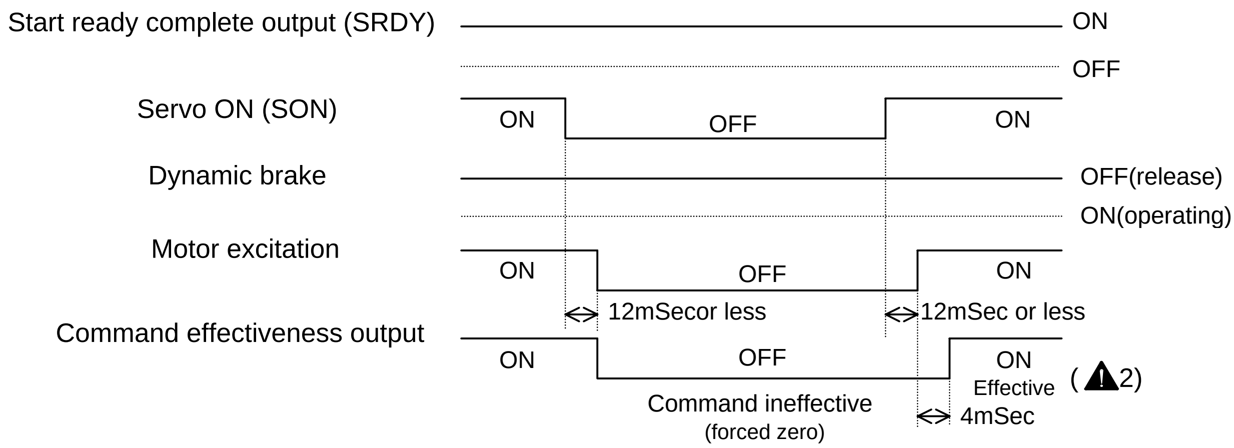


1
- The current is limited by the sequence current limit value (standard value 120%, which is changed in Parameter Mode 1 on Page 12) for 300 mSec.

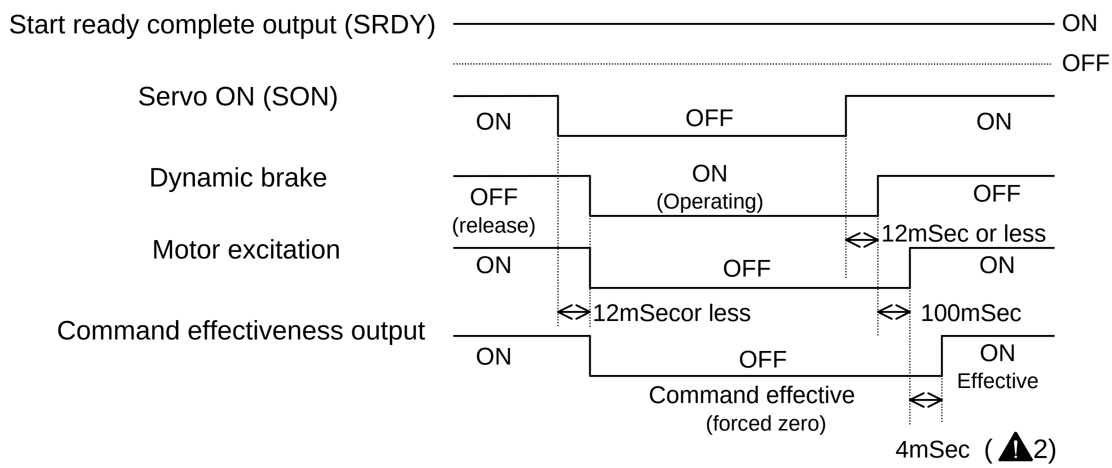
2
- It is possible to make commands ineffective (forced zero) for 300 msec after SON by setting Func1 bit5 to "0" when setting parameters. In case of the position control type, however, the command pulse remains as a deviation for 300 msec.
- It is possible to make commands effective immediately after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

6.1.3.3 When holding brake timing THB is set at 0 msec (standard), & when "dynamic brake function ineffective at Servo OFF" is selected. (⚠ 1)



6.1.3.4 When holding brake timing THB is set at 0 msec (standard), & when "dynamic brake function effective at Servo OFF" is selected. (⚠ 1)

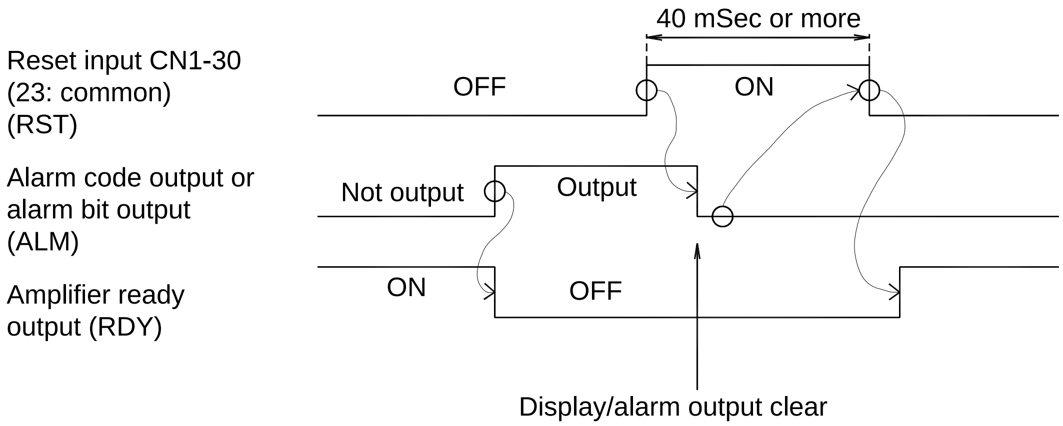


⚠

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.

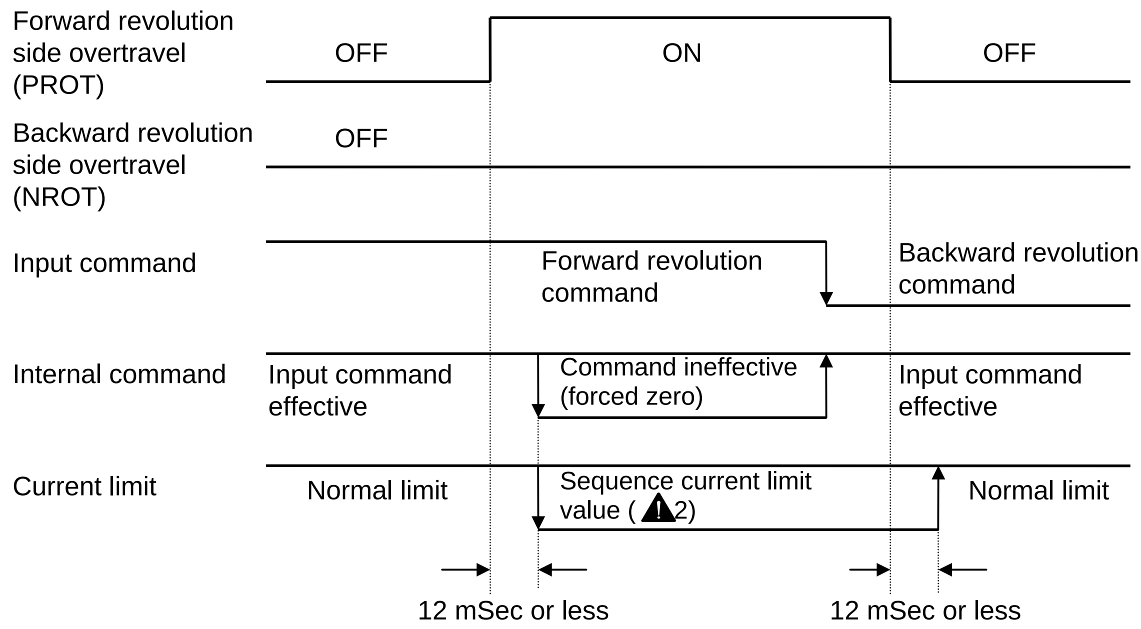
2 It is possible to make commands effective immediately after SON regardless of THB setting, by setting Func1 bit5 to "1" when setting parameters.

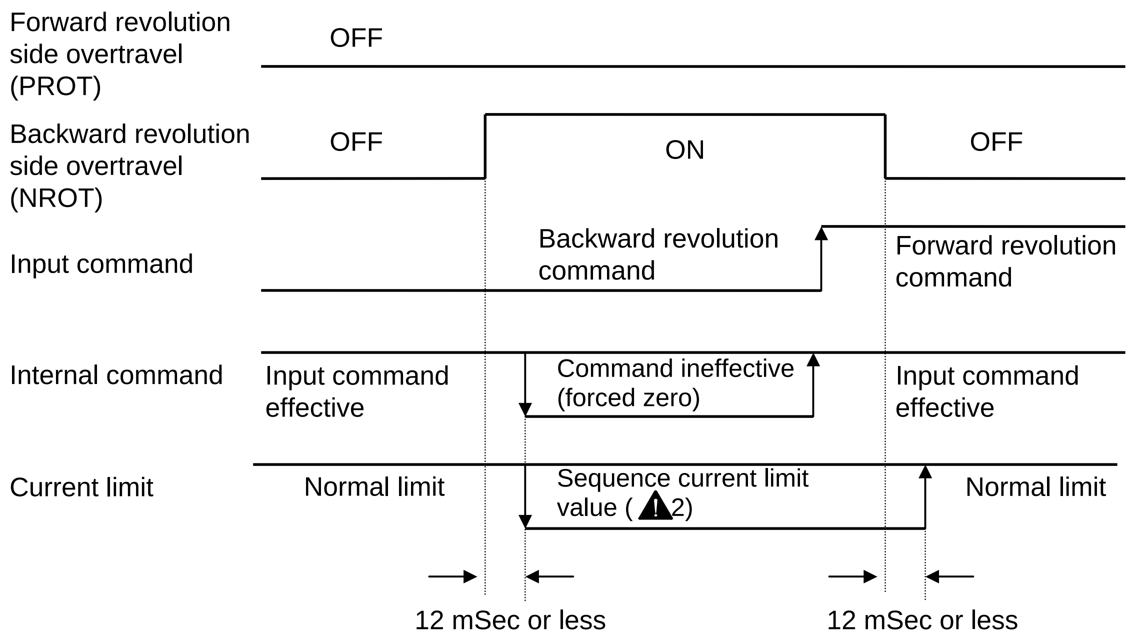
6.1.4 Alarm Reset Sequence



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





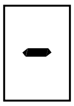
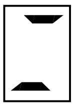
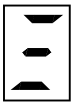
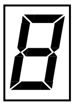
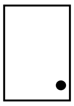
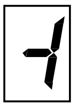
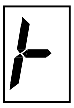
1. Operation of command invalidation (forced zero) differs between the position and velocity control types. For the position control type, command pulses are inhibited, and for the velocity control type, the velocity command becomes zero (VCMD = 0). These settings are validated when the acceleration/deceleration 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 (L, N) is set up and the "amplifier ready output (RDY)" signal is ON.
7-segment LED 	The main power supply (L1, L2, L3) is being turned on or set up but the "start ready complete" signal is OFF.
7-segment LED 	The main power supply (L1, L2, L3) 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 Functioning 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 200 VAC to L and N on the terminal board of power supply unit.

2 Ground the PE (protective earth ⏚) terminal of the power supply unit.
Wire 400 VAC or 200 VAC to L1, L2, L3 on the terminal board.
Wire DC BUS, DV CONT.

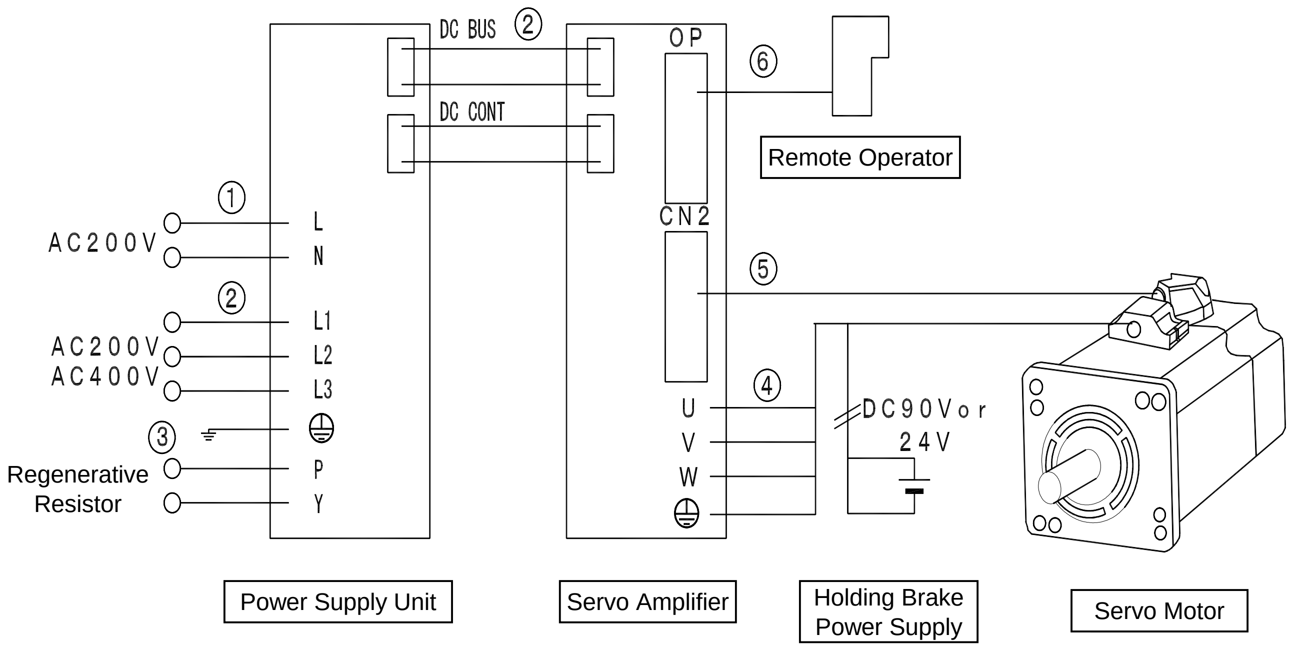
3 Connect the regerative resistor to P, Y of power supply unit.

4 Wire the motor power line to U, V, W (⏚) on the Servo Amplifier terminal board.

5 Wire the encoder line to the Amplifier connector CN2.

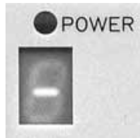
6 Connect the remote operator to the amplifier connector OP.

7 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

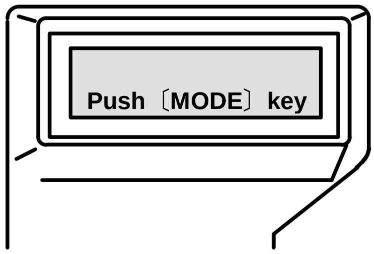
8 Turn ON the 200 VAC of L-N (① wires).



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

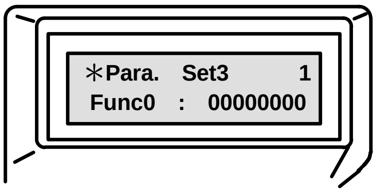
→ When the 7-segment LED displays "U", proceed to section 6.4.

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

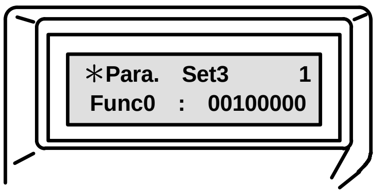


9 Change the remote operator setting and reset the OT (over travel) signal.
The procedure is as follows:

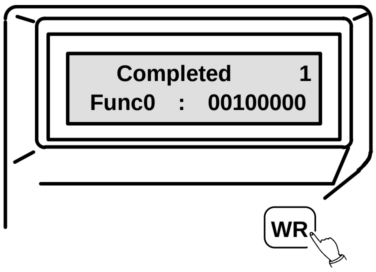
Repeat pressing ON MODE , 2 and △ or ▽ keys until the right screen appears.



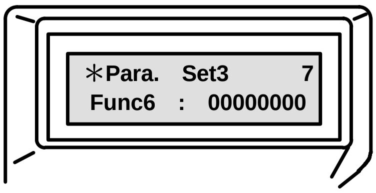
Press the ▷ , ▷ key twice and the 1 key once so that the right screen will appear.



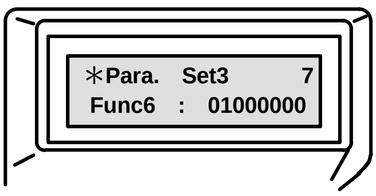
Press the WR key so that the right screen will appear.



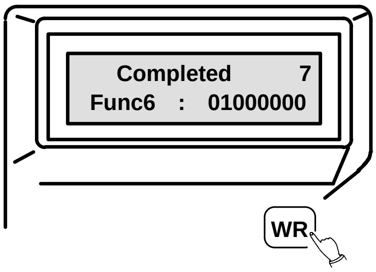
10 Make the JOG operation function effective using the remote operator.
Push the ▽ key a few times until the right screen appears.



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

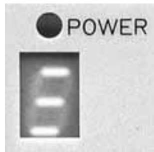


Press the WR key so that the right screen will appear.
(Func6 bit6 “1” described above returns to “0” by turning the power on again.)



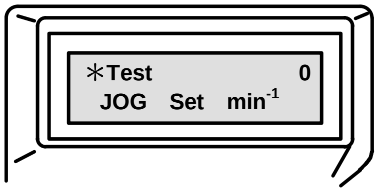
11 Turn on the 400 VAC (② wires) of L1-L2-L3.

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

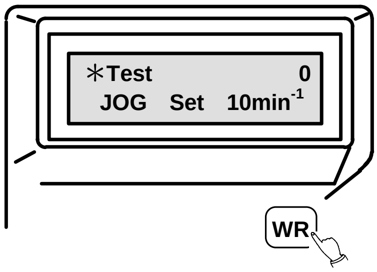


12 Start the JOG operation.

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

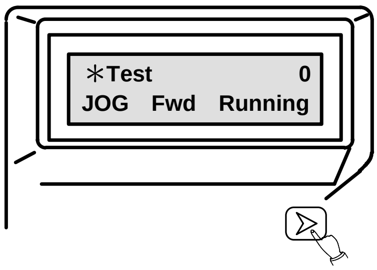


Press the ◁ , 1 and WR keys so that the right screen will appear.

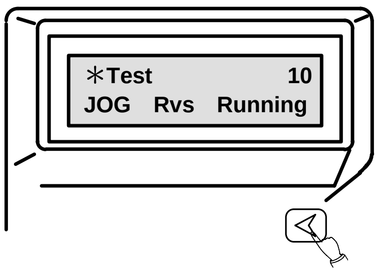


The 7-segment LED draws a figure of 8.
Continue pressing the ▷ key until the right screen appears.

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



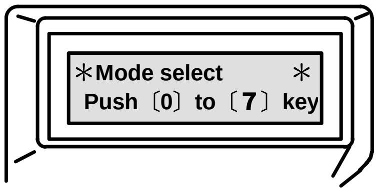
Then continue pressing the ◁ key until the right screen appears.
In this mode, the motor rotates clockwise (CW) in 10 min^{-1}.



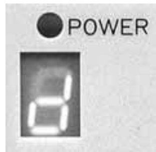
6. OPERATION

13 Return to original mode.

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



The d key in the 7-segment LED flickers.

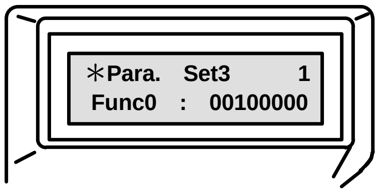


By this, the JOG operation ends.

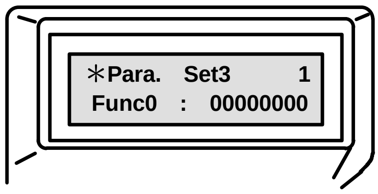
6.3.3 Resetting and Turning the Power Off

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

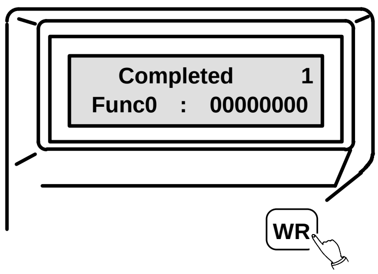
Repeat pressing the ON MODE , 2 and △ or ▽ keys until the right screen appears.



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



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



15 Turn off the 400 VAC of L1-L2-L3.

16 Turn off the 200 VAC of L-N.

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

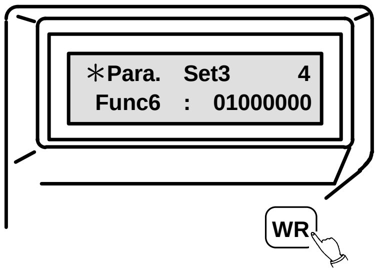
6.4 Encoder Clear Using Remote Operator (When Absolute Encoder is Used)

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".

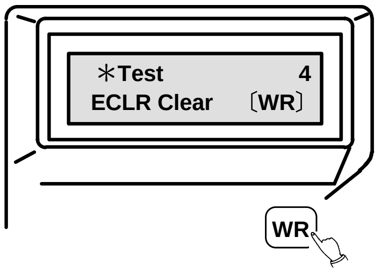
Press the WR key.



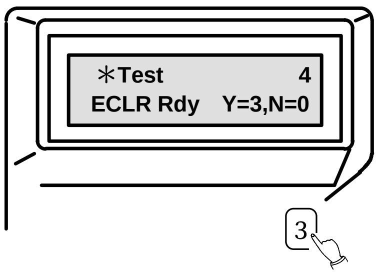
2 Perform ECLR.

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: 3.6 V, 2,000 mAh). The battery life is estimated at approximately 6 years.

7. EXPLANATION OF PARAMETERS

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.

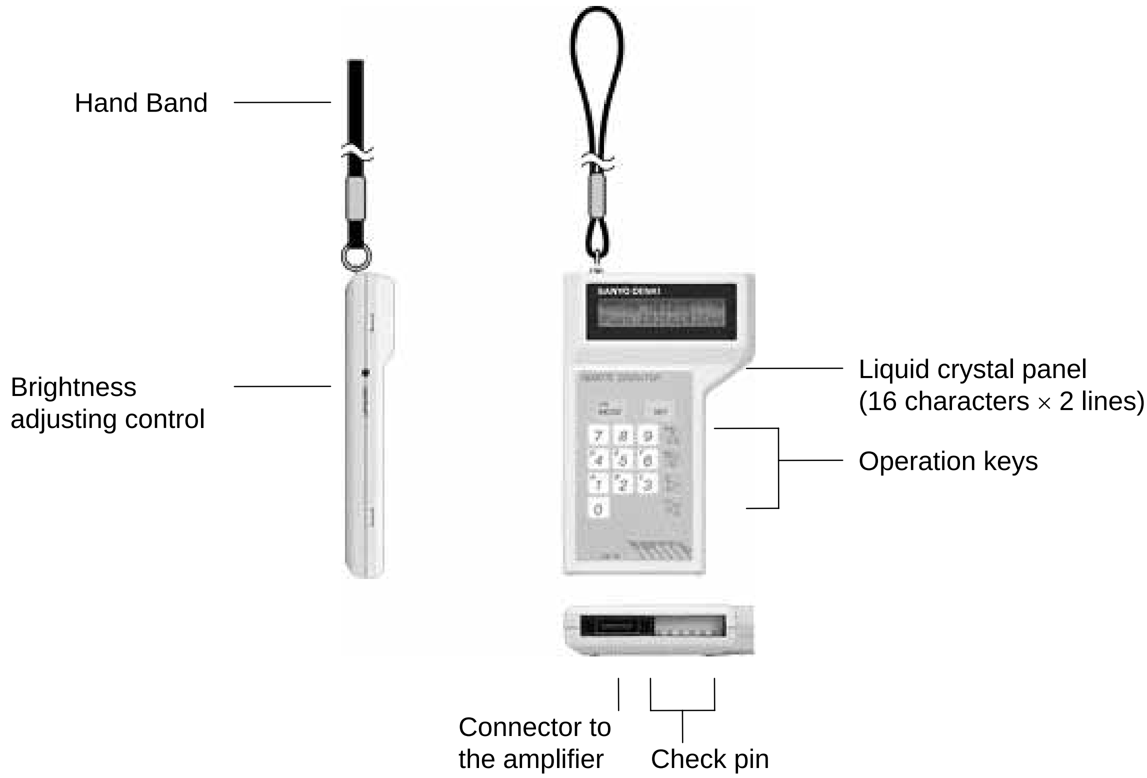


Fig. 7-1 Remote Operator

> 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)	During storage (–4°F to +149°F)
Working atmosphere	Free from oil mist, corrosive gas and dust	

7. EXPLANATION OF PARAMETERS

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. EXPLANATION OF PARAMETERS

7.1.3 Basic Operation Procedure

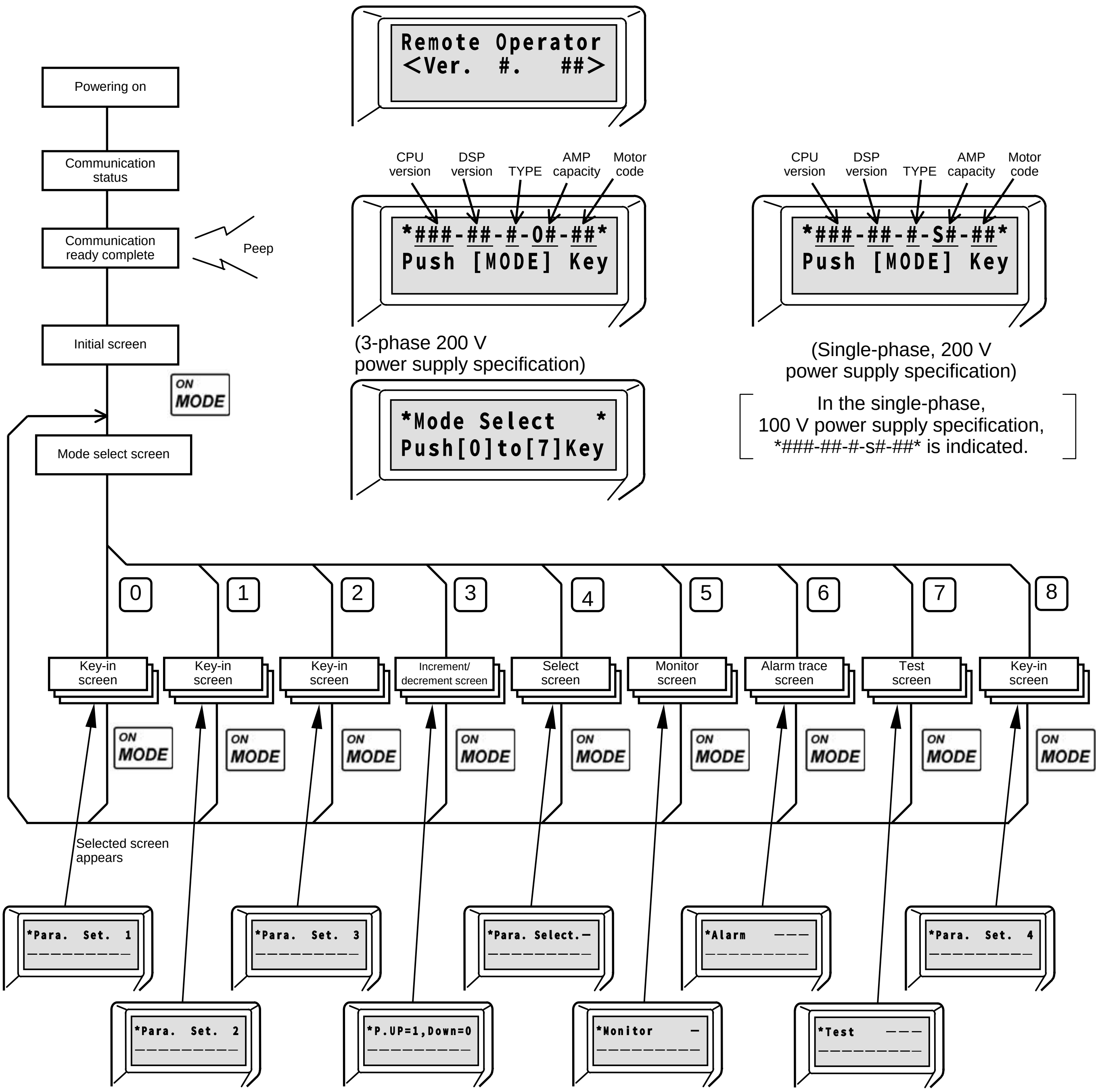


Fig. 7-2 Basic Operation of Remote Operator

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. EXPLANATION OF PARAMETERS

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.

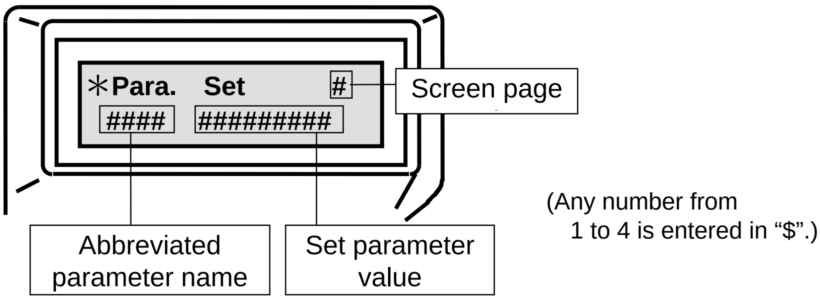


Fig. 7-3 Parameter Setting Mode Screen

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

7. EXPLANATION OF PARAMETERS

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 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 is 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	

7. EXPLANATION OF PARAMETERS

Table 7-7 Parameters for Screen Mode 8

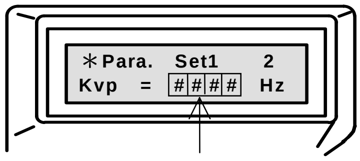
Page No.	Abbreviation	Name	Setting range	Unit
0	Kp2	Position loop gain 2	1 to 1000	rad/s
1	Kvp2	Velocity loop proportional gain 2	10 to 3000	Hz
2	Tvi2	Velocity loop integral time constant 2	1 to 1000	mSec

* 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:

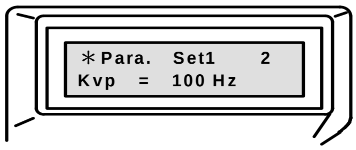
1 Select page 2 using by [△] or [▽] key.



The cursor flashes.

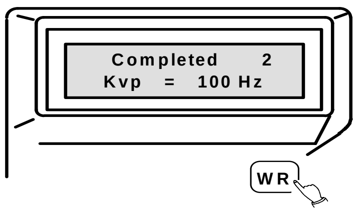
2 Move the cursor to the position corresponding to the desired number of input digits using [▷] or [◁] key.

3 Continuously enter [1] [0] [0] using the [0] t[9] 9 keys.



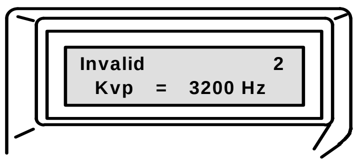
4 The set value is stored in the nonvolatile memory using [WR] key and the remote operator operates with the set value.

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



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.



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. EXPLANATION OF PARAMETERS

7.1.5 Parameter Increment/Decrement Mode (Screen Mode 3)

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

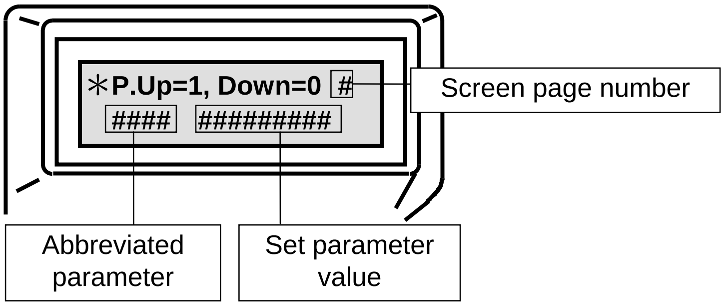


Fig. 7-4 Parameter Increment/Decrement Mode Screen

Table 7-8 Parameters for Screen Mode 3

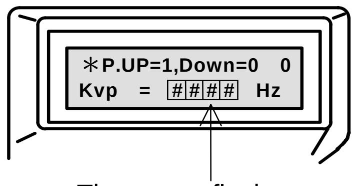
Page No.	Abbreviation	Name	Setting range	Unit
0	Kp	Position loop gain	1 to 1000	rad/s
1	Kvp	Velocity loop proportional gain	10 to 3000	Hz
2	Tvi	Velocity loop integral time constant	1 to 1000	mSec
3	Vzero	Velocity command zero adjustment	±16383	
4	Tzero	Torque command zero adjustment	±16383	

7. EXPLANATION OF PARAMETERS

● 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,

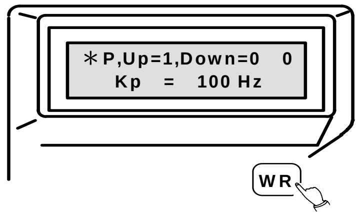
1 Select page 0 using by [△] or [▽] key.



The cursor flashes.

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

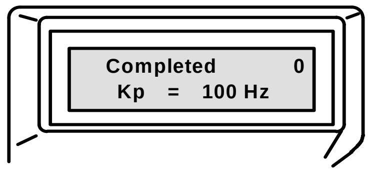
3 As needed, increase or decrease the number in each digit using the [1] or [0] key (the value you specify will be immediately reflected in the operation).



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.)



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.

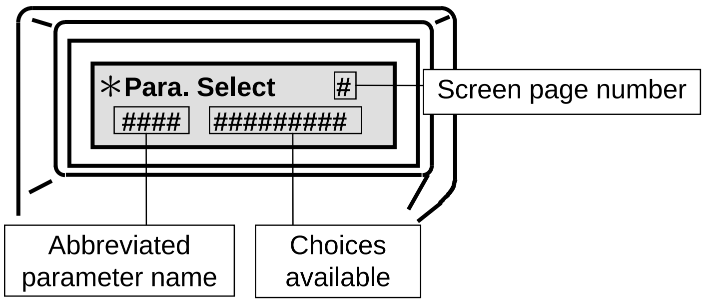


Fig. 7-5 Parameter Select Mode Screen

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	11
	1	M2	Monitor 2 output	11
	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.
	7	MOKD	Motor configuration	Rotary IPM

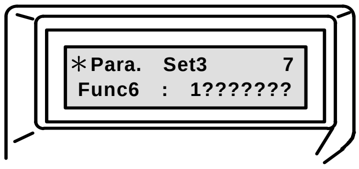
1. Modification of a system parameter is available only after you have set Func6 bit7 to “1” from Screen Mode 2 Page 7.
2. Note that modification of a system parameter is enabled only after the control power has been turned off.

7. EXPLANATION OF PARAMETERS

● Setting practice

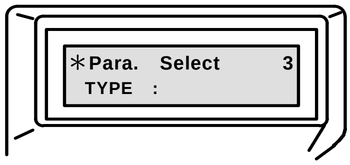
The following describes the procedure for selecting, for instance, the velocity control for the amplifier's control mode.
According to the basic operating procedure, select [4] from the Mode Select screen. Then,

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



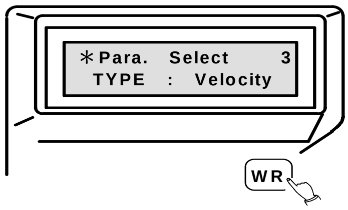
(?) appears before
the setting is down.

2 Select Mode 4.



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

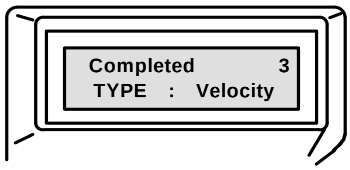
4 Using the [▷] or [◁] key, scroll the screen to select "Velocity".



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

When the setting is completed, “Completed” is indicated.

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.

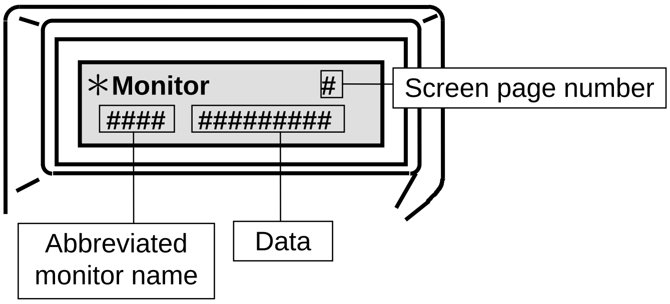


Fig. 7-6 Monitor Mode Screen

Table 7-10 Parameters for Screen Mode 5 (1/2)

<table>
<tr><th>Page No.</th><th>Abbreviation</th><th colspan="2">Contents</th></tr>
<tr><td>0</td><td>STATUS</td><td colspan="2">Indicates the internal status of the amplifier:
Power off, servo ready, servo on and alarm.</td></tr>
<tr><td>1</td><td>INPUT</td><td colspan="2">Indicates the CN1 input status in "1" or "0".
<table>
<tr><td>bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td>RST</td><td>ILM</td><td>PROT</td><td>NROT</td><td>CLE</td><td>ECLR</td><td>PCON</td><td>SON</td></tr>
</table>
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".</td></tr>
<tr><td>2</td><td>OUTPUT</td><td colspan="2">Indicates the CN1 output status in "1" or "0".
<table>
<tr><td>bit</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td></td></tr>
<tr><td></td><td>ALM8</td><td>ALM4</td><td>ALM2</td><td>ALM1</td><td>HBON</td><td>SRDY</td><td>ILIM</td><td>LTG</td><td>(Note)</td></tr>
</table>
Since bit1 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.</td></tr>
<tr><td>3</td><td>VCMD</td><td>Indicates the velocity command.</td><td>[min^{-1}] (⚠ 2)</td></tr>
<tr><td>4</td><td>VFBK</td><td>Indicates the velocity feedback.</td><td>[min^{-1}]</td></tr>
<tr><td>5</td><td>ICMD</td><td>Indicates the current command.</td><td>[I/IR × 100%]</td></tr>
<tr><td>6</td><td>IFBK</td><td>Indicates the current feedback.</td><td>[I/IR × 100%]</td></tr>
<tr><td>7</td><td>Pos. E</td><td>Indicates the position deviation counter value.</td><td>[pulse]</td></tr>
<tr><td>8</td><td>CSU</td><td>Indicates the U-phase electric angle.</td><td>[deg]</td></tr>
</table>

7. EXPLANATION OF PARAMETERS

Table 7-10 Parameters for Screen Mode 5 (2/2)

Page No.	Abbreviation	Contents	
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.

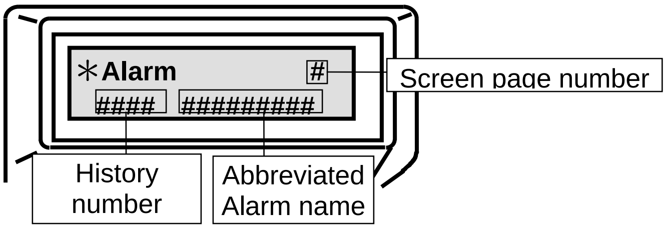


Fig. 7-7 Alarm Trace Mode Screen

Table 7-11 Screen Mode 6

Page No.	History No.	Abbreviation	Name
0	Now		Current alarm
		None	No alarm
		OC	Power element error
		PSOH	Power supply unit overheating
		AOH	Amplifier overheating
		EXOH	External overheating
		OV	Amplifier Overvoltage
		PSOV	Power supply unit overvoltage
		DBOH	DB resistor overheating
		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
		AOH	Amplifier overheating
		IFBE	Current detector error
		MOH	Motor overheating
		SONE	Servo ON error
1	Last 1		The last alarm
2	Last 2		The alarm second to last
3	Last 3		The alarm third to last
4	Last 4		The alarm fourth to last
5	Last 5		The alarm fifth to last
6	Last 6		The alarm sixth to last
7	Last 7		The alarm seventh last

7. EXPLANATION OF PARAMETERS

● 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 [ALARM BLINK].

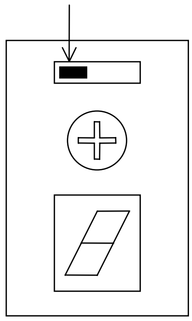


Fig. 7-8 Displaying the Alarm History

> 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 IFBE	Power element error Current detector error
2	OL	Overload
3	PSOH AOH	Power supply unit overheating Amplifier overheating
5	OV PSOV	Overvoltage Power supply unit 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

7-seg.	Abbreviation	How to read
C	SE	Speed control error
c	SONE	Servo ON error
d	OVF	Excessive deviation
E	EXOH	External overheating
F	DSPE	Servo processor failure
H	DBOH	DB resistor overheating
h	MOH	Motor 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.

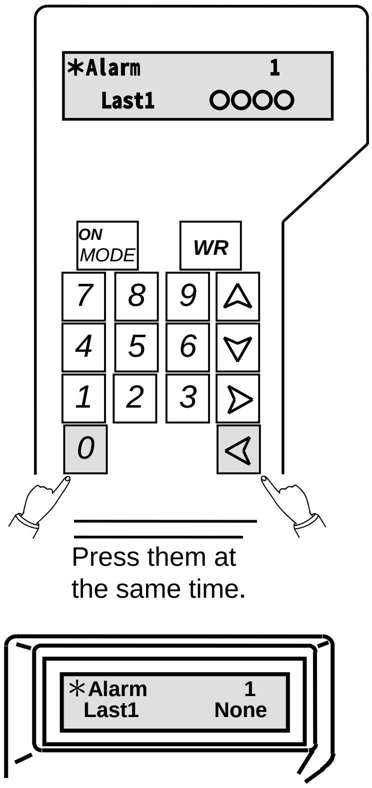


Fig. 7-9 Alarm Clearing Method

7.1.9 Test Mode (Screen Mode 7)

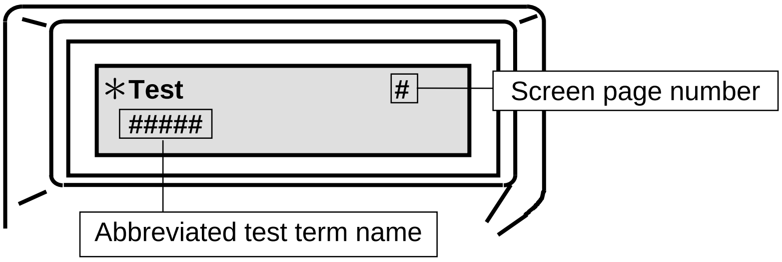


Fig. 7-10 Test Mode Screen

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 $\boxed{1}$ 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 brake 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 slide switch on the front of the amplifier is set to GAIN, change it to History (Tune only).
8 Be 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 ON MODE 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**

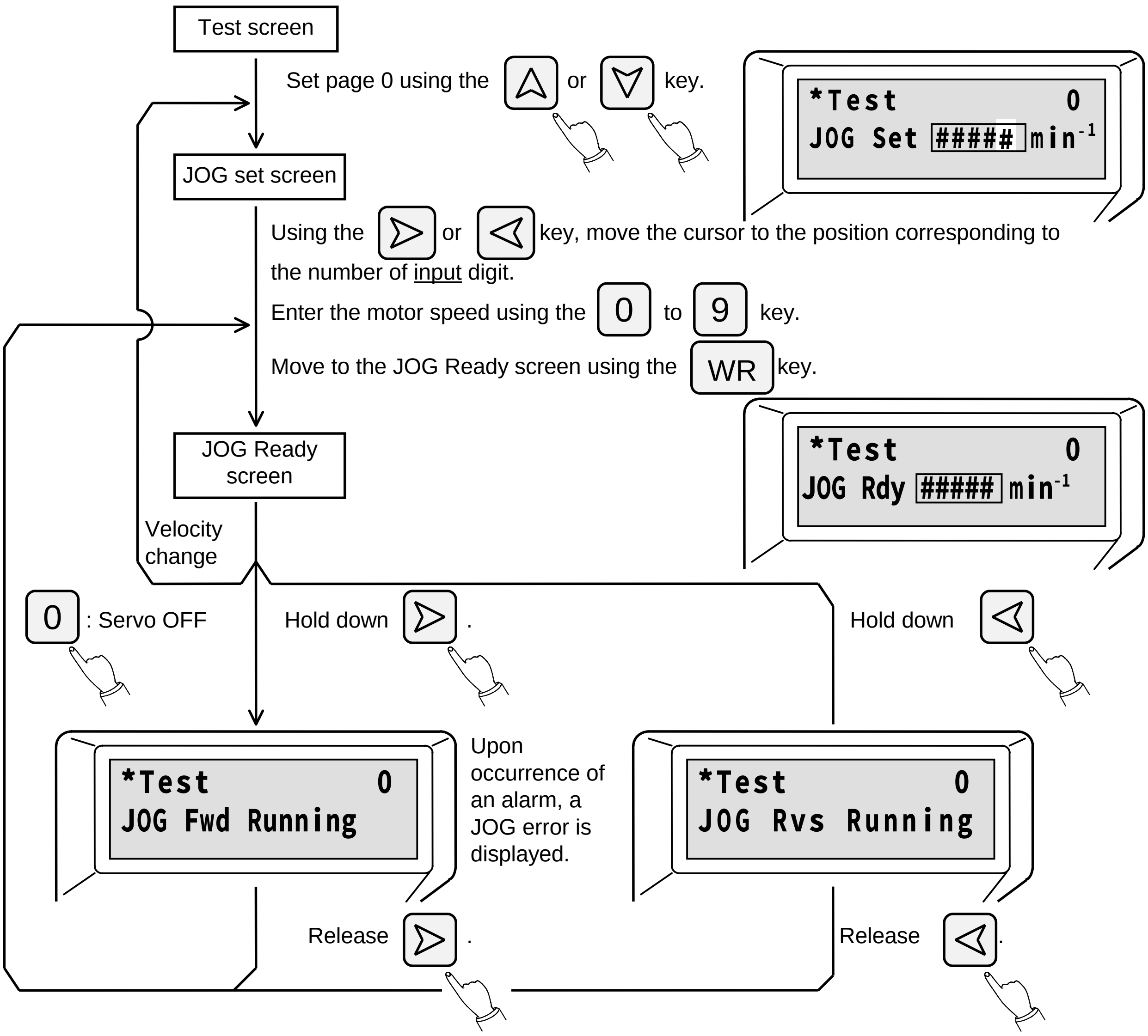
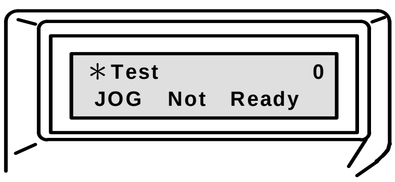


Fig. 7-11 JOG Operation Procedure

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:



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.
- The sequence current limit value (page 12 of Mode 1) is set to 100% or low.
- The gain switching through external input is enabled and the changeover input signal is ON (during gain switching).
- The slide switch on the front of the amplifier is set to GAIN and the rotary switch is set to other than 0.
- The status is in overtravel.

● 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.

7. EXPLANATION OF PARAMETERS

● **Servo tuning procedure**

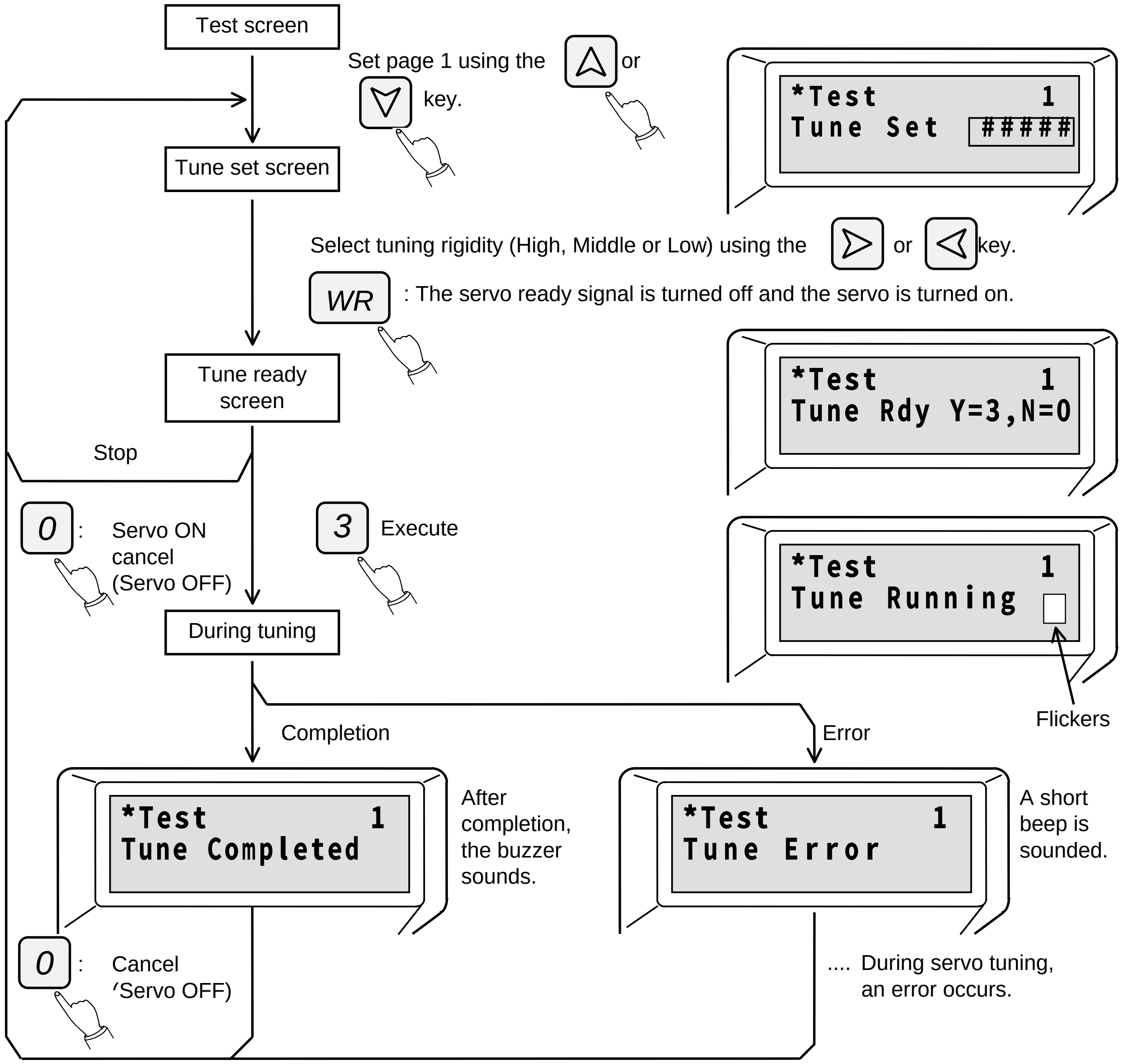
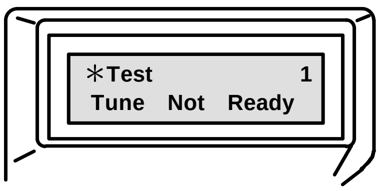


Fig. 7-12 Servo Tuning Operation

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 **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**

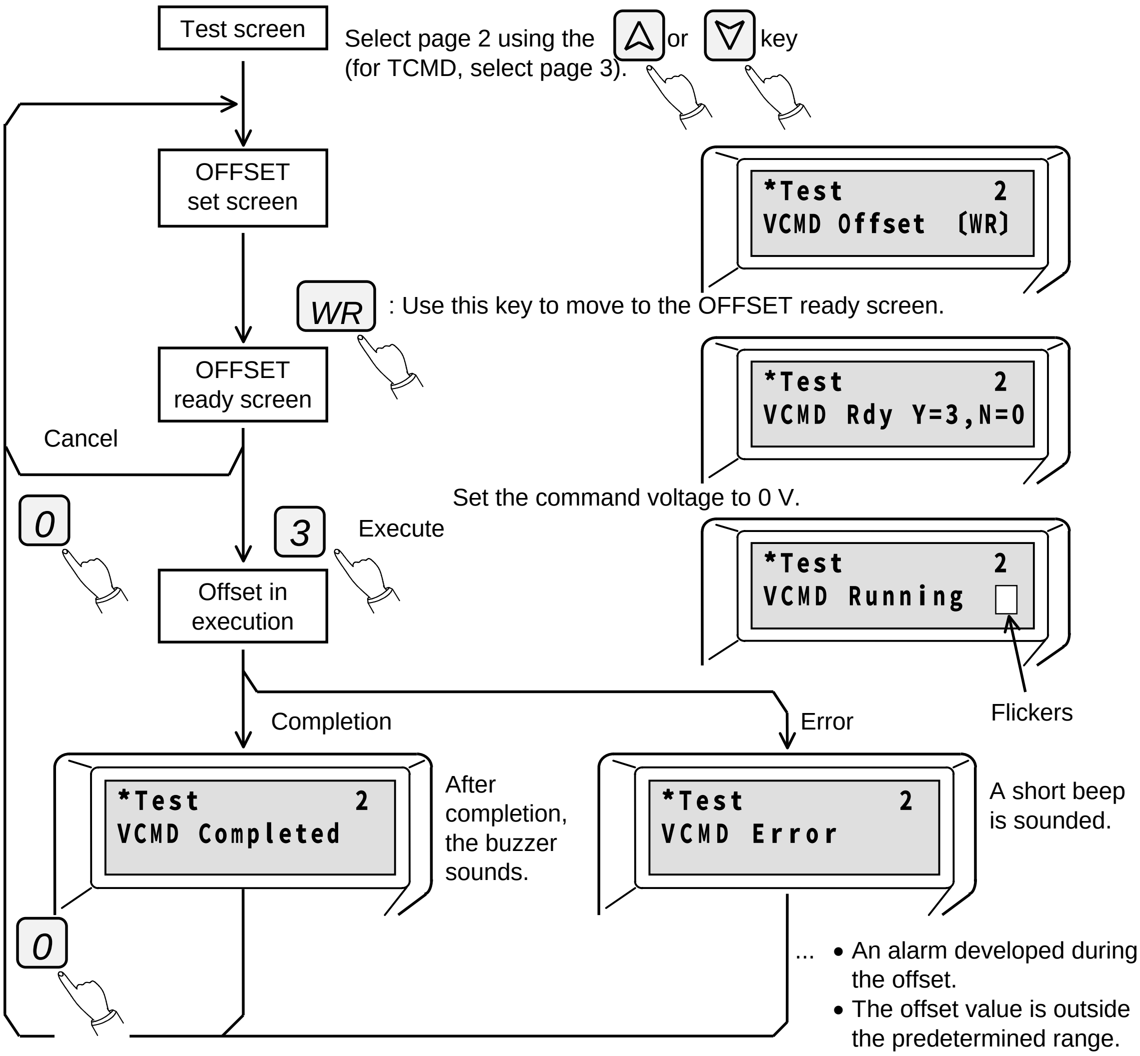
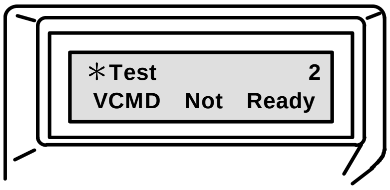


Fig. 7-13 Auto Offset Operation Procedure

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:



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**

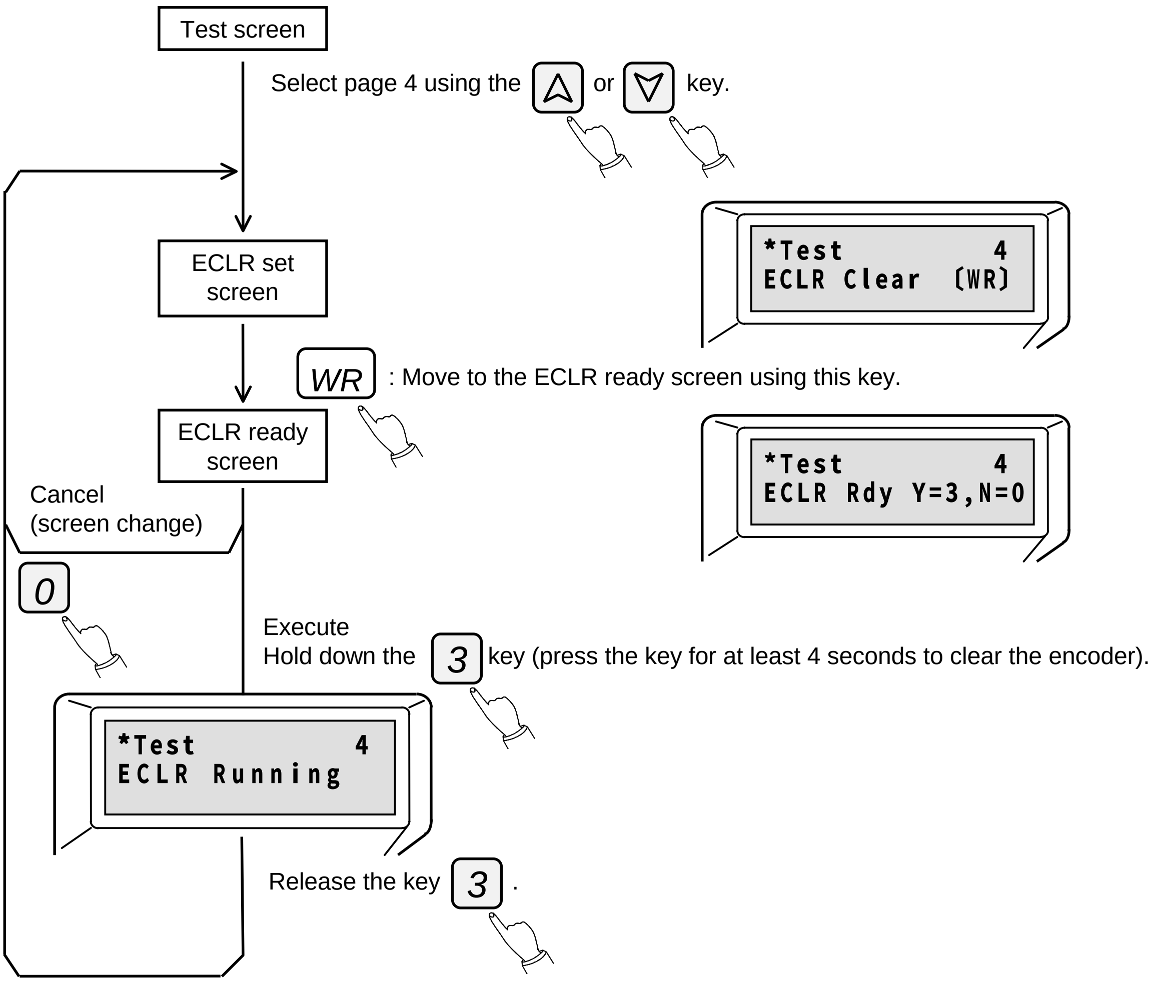
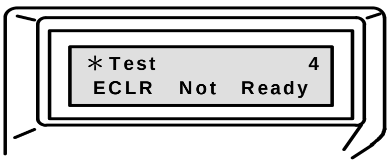


Fig. 7-14 Encoder Clear Operation Procedure

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 = 0), the following message appears on the screen:



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. EXPLANATION OF PARAMETERS

7.2 Description of Parameters

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

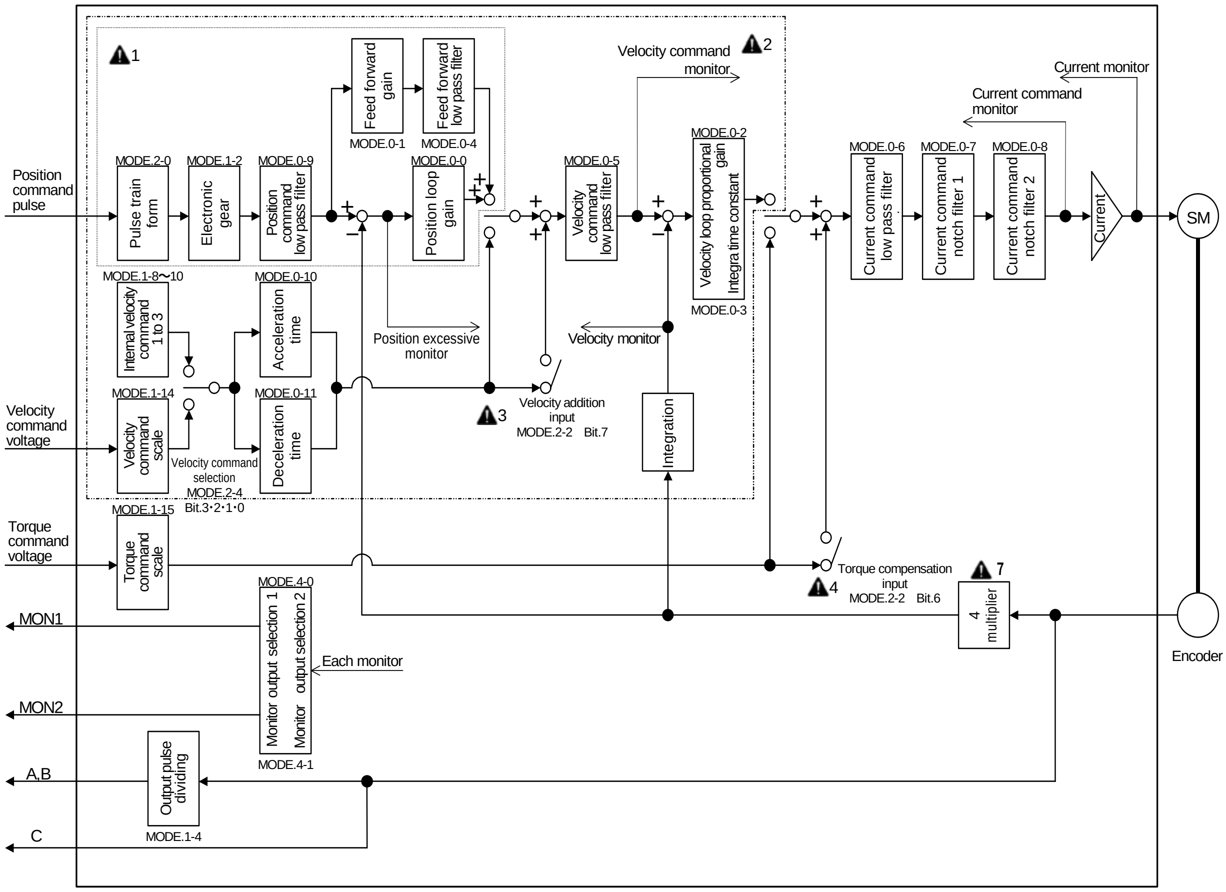


Fig. 7-15 Control System Block Diagram

1 Parts inside [dotted box] do not function in the velocity/torque control mode.
2 Parts inside [dash-dot box] do not function in the torque control mode.
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.

7.2.2 Parameter Summary Table

Mode	Page	Abbrevi-ation	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	Abbrevi-ation	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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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	01100000		0, 1	
	4	Func3	Amplifier function select 3	00010001*		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	

* The dynamic brake function is enabled at SOFF when Page4 (func3) bit 4 is set to “0”.

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

Mode	Page	Abbrevi-ation	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	Abbrevi-ation	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.
Screen Mode 6 can be set by selecting “Select” on the Mode 4 Page 2(GAIN). It cannot appear at “Fix” status.

7. EXPLANATION OF PARAMETERS

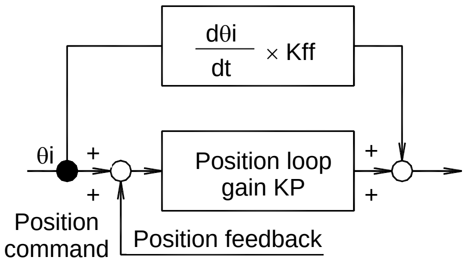
Mode	Page	Abbrevi-ation	Name	Standard value	Unit	Setting range
4	0	M1	Monitor 1 output	Vm2 mV/min^{-1}	11ranges	IR: Rated armature current
	1	M2	Monitor 2 output	Ic2 V/IR	11 ranges	
	2	GAIN	Gain select	Fix	2 ranges	
	3	TYPE	Control mode	$$$$	6 ranges	(⚠)
	4	ENKD	Encoder type	$$$$	3 ranges	(⚠)
	5	ABSF	ABS sensor format	$$$$	11 ranges	(⚠)
	6	MOT.	Motor type	$$$$	For motors of P1, P2, P3, P5, P6 and P8 series.	(⚠)
	7	MOKD	Motor configuration	$$$$	2 ranges	(⚠)

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

Prior to modifying a setting, Func6 bit7 of Screen Mode 2 must be set at "1".
You are also required to turn the control power off once.

7. EXPLANATION OF PARAMETERS

7.2.3 Parameter List

Mode	Page	Abbrevi-ation	Name	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.

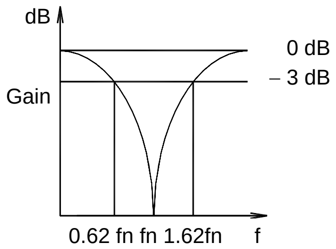
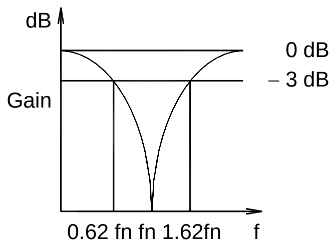
Values in parentheses are applicable to motors of other than P3 and P5 series.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	Name	Standard value	Unit	Setting range	Remarks
0	3	Tvi	Velocity loop integral time constant • Integral time constant of the velocity controller (proportional integral control). Velocity deviation → $Kvp(1+\int \frac{1}{Tvi} dt)$ → Velocity loop output	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)

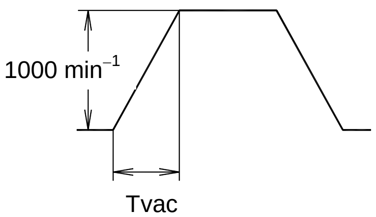
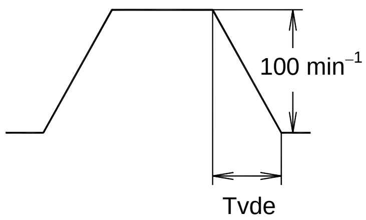
⚠
1 Increase or decrease is available from Mode 3 Page 2.
2 Selecting 1000 ms turns on the proportional control.
3 Selecting 1000 Hz disables the filter function.

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

Mode	Page	Abbreviation	Name	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. [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. [Characteristics] 	1000	Hz	IBF1 to 1000	In 10 Hz (⚠)

⚠ Selecting 1000 Hz disables the filter function.

7. EXPLANATION OF PARAMETERS

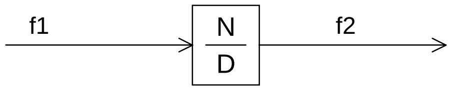
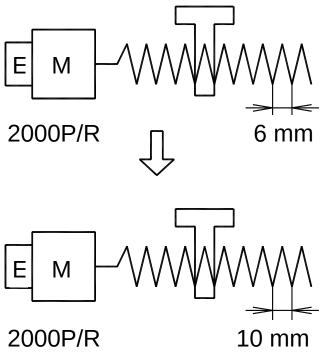
Mode	Page	Abbrevi-ation	Name and description	Standard value	Unit	Setting range	Remarks
0	9	Tpcm	Position command LPF time constant • When installing the first-order lag filter for the position control pulse, this parameter sets the time constant.	0	mSec	0 to 4000	Position control (⚠)
	10	Tvac	Velocity 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	Abbrevi-ation	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	Abbrevi-ation	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. [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. $64 \times 1/(2000 \times 4) \times 360° = 2.88°$	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	Abbrevi-ation	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 $1/32767 \leqq N/D \leqq 32767$ [Example]  • When the ball screw pitch is changed, just set the electronic gear ratio to $(4/1) \times (6/10) = 24/10$. 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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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. • You can enable the setting 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 the P-PI auto switching function is enabled: Proportional-plus-integral control is set when the speed is lower than the LTG setting, and proportional control is set when it exceeds the LTG setting.	50	min^{-1}	0 to 32767	

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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	

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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 1 V of the command voltage.	500	min^{-1}/V	0 to 3000	
	15	TCMS	Torque command scale • Sets a torque command scale corresponding to 1 V of the command voltage.	50	%/V	0 to 400	

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbreviation	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)

PMOD | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

CCWP input polarity switching (bit 2)

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

CWP input polarity switching (bit 3)

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

Selection of revolution direction ⚠ 3 (bit 4)

0	Standard.
1	Backward revolution.

Command pulse form (bits 6, 5)

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	"L"	"L"	28, 29 26, 27	When the revolution direction bit is set at "0".
1	0	Code + pulse train	"H"	"L"	28, 29 26, 27	
0	1	90° phase difference two-phase pulse train.	90°	90°	28, 29 26, 27	
1	1	Prohibited				

⚠
1 For setting of bit7, bit1, and bit0, 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 1 is set to both bits, the system rotates forward (normal).

Mode	Page	Abbreviation	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 1	bit 0	Digital filter for command pulse input Minimum pulse width
0	0	0.8 μs
0	1	0.2 μs
1	0	0.4 μs
1	1	1.6 μs

When bit7 = 1

bit 1	bit 0	Digital filter for command pulse input Minimum pulse width
0	0	3.2 μs
0	1	0.8 μs
1	0	1.6 μs
1	1	6.4 μs

bit6	bit5	Command pulse form
0	0	Backward pulse train + Forward pulse

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	Abbreviation	Name and description	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Position command pulse train form ② Code + Pulse train				

PMOD

7	6	5	4	3	2	1	0

When bit7 = 0

bit 1	bit 0	Digital filter for command pulse input Minimum pulse width
0	0	0.8 μs
0	1	0.2 μs
1	0	0.4 μs
1	1	1.6 μs

When bit7 = 1

bit 1	bit 0	Digital filter for command pulse input Minimum pulse width
0	0	3.2 μs
0	1	0.8 μs
1	0	1.6 μs
1	1	6.4 μs

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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbreviation	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 1	bit 0	Digital filter for command pulse input: Minimum pulse width	Digital filter for command pulse input: Minimum edge distance between A- and B-phase
0	0	0.8 µS	250 nS
0	1	0.5 µS	250 nS
1	0	0.5 µS	250 nS
1	1	1.6 µS	500 nS

When bit7 = 1

bit 1	bit 0	Digital filter for command pulse input: Minimum pulse width	Digital filter for command pulse input: Minimum edge distance between A- and B-phase
0	0	3.2 µS	1.0 µS
0	1	0.8 nS	250 nS
1	0	1.6 µS	500 nS
1	1	6.4 µS	2.0 µS

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

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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbreviation	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)

Func0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Bit 0 – SON mask

0	Externally effective
1	Internally forced ON

Bit 1 – CN1-36 pin mask

0	Externally effective
1	Internally forced ON

Bit 2 – ILM mask

0	Externally effective
1	Internally forced ON

Bit 3 – NROT mask

0	Externally effective
1	Internally forced ON

Bit 4 – PROT mask

0	Externally effective
1	Internally forced ON

Bit 5 – O. T input logic select

0	b-contact
1	a-contact

Bit 6 – Switching of fully closed encoder functions ⚠1

0	Multiplication by 4
1	Multiplication by 1

Bit 7 – 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	Abbrevi-ation	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	(⚠)

Func1	7	6	5	4	3	2	1	0

Bit 0 – Current limit method

0	Internal setting enabled
1	External analog input enabled

Bit 1 – Backward revolution current limit input

0	Selects NIL input
1	Selects PIL input

Bit 2 – NIL input polarity

0	Negative polarity
1	Positive polarity

Bit 3 – Positioning method

0	Specify pulse interval
1	Specify pulse edge

Bit 4 – Deviation clear method with motor excitation OFF (SOFF)

0	Clear deviation
1	No clear deviation

Bit 5 – Forced zero adjustment of command when SOFF is switched to SON

0	Enabled
1	Disabled

Bit 6 – Torque compensation

0	Disabled
1	Enabled

Bit 7 – 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	Abbrevi-ation	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.

<table>
<tr><th></th><th></th><th></th><th>Func1</th></tr>
<tr><td rowspan="3">When external analog input is used</td><td rowspan="2">Current for forward and backward revolution can be separately set.</td><td>Negative polarity
• Inputs negative voltage to NIL input.
• Input positive voltage to PIL input</td><td>*****001</td></tr>
<tr><td>Positive polarity
• Input external analog to NIL and PIL input.</td><td>*****101</td></tr>
<tr><td colspan="2">Current for forward and backward revolution is set at the same level.
• Input external analog to PIL input.</td><td>******11</td></tr>
<tr><td colspan="2">When internal current limit is used</td><td>• Sets the internal current limit value (IILM).</td><td>*******0</td></tr>
</table>

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

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbreviation	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.	0011 0000		0, 1	(⚠1) (⚠3)

Func2

7	6	5	4	3	2	1	0

Bit 0 – Monitor 1 output polarity

0	Positive output at forward revolution
1	Negative output at forward

Bit 1 – Monitor 2 output polarity

0	Positive output at forward revolution
1	Negative output at forward

Bit 2 – Monitor 1 output absolute value

0	Negative/positive output
1	Absolute value output

Bit 3 – Monitor 2 output absolute value

0	Negative/positive output
1	Absolute value output

Bit 4 – Regenerative resistor OL time select ⚠2 ⚠4

0	Built-in regenerative resistor
1	External regenerative resistor

Bit 5 – Speed control error (SE) detection

0	Enabled
1	Disabled

Bit 6 – Alarm output method

0	CODE
1	BIT

Bit 7 – 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.
4 The PQM Servo System does not have built-in regenerative resistors. Make sure to select external regenerative resistors.

Mode	Page	Abbreviation	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, and to select the input signal for switching the control mode or gain. It also sets the selection of ineffective/effective of the dynamic brake function at SOFF.	0001 0001		0, 1	(⚠3)

Func3

7	6	5	4	3	2	1	0

CN1-35 pin input select (⚠ 5)

bit 1	bit 0	Position	Velocity/Torque
0	0	PCON	PCON (⚠ 6)
0	1	ECLR	ECLR
1	0	PMUL	VCS2 (⚠ 3,6)
1	1	INH	ZCMD(⚠ 6)

CN1-36 pin input select (⚠ 5)

bit 3	bit 2	Position	Velocity/Torque
0	0	PCON	PCON(⚠ 6)
0	1	ECLR	ECLR
1	0	PMUL	VCS1 (⚠ 3, 6)
1	1	INH	ZCMD (⚠ 6)

0	Dynamic brake function effective
1	Dynamic brake function ineffective

Selection of dynamic brake function, effective/ineffective, at SOFF

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

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)

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbreviation	Name and description	Standard value	Unit	Setting range	Remarks
2	4	Func3	Amplifier function select 3 Precautions on setting Func3.				

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. Notes on switching of the control mode and input signal selection when gain switching is turned on:
   - When the control mode or gain switching input signal is assigned to the connector CN1 35 pin, input signal selection with Fuc3 bit 1 or 0 is disabled except for the internal velocity setting function.
   - When the control mode or gain switching input signal is assigned to the connector CN1 36 pin, input signal selection with Fuc3 bit 3 or 2 is disabled except for the internal velocity setting function.
   - When the control mode and gain switchings are assigned to the same pin, both switchings work at the same time.
   - When the internal velocity control is valid, (Func3 bit2 to 0 at “1010”), the internal velocity setting selected in 35 and 36 pins are made valid as well as the control mode and gain switchings.
5. When the same signal is selected for both the CN1-35 and 36 pins, pin 36 takes precedence over pin 35.
6. In case of the torque control type, functions other than “ECLR” selected at bit 3, 2, 1, 0 is disabled.

Mode	Page	Abbrevi-ation	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	⚠

Func4	7	6	5	4	3	2	1	0

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
1	1	0	GCO: Gain switching

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
1	1	0	GCO: Gain switching

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.

* Gain switching by external input signal is only enabled. Refer to 8.2 for gain switching.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbreviation	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)

Func5	7	6	5	4	3	2	1	0

Bit 0: Torque command polarity reversing bit

0	Forward revolution at positive input
1	Backward revolution at positive

Bit 1: Velocity command polarity reversing bit

0	Forward revolution at positive input
1	Backward revolution at positive

Bit 2: Position command polarity reversing bit (⚠4)

0	Forward revolution at positive input
1	Backward revolution at positive

Bit 3: Pulse generation output select (⚠4)

0	2048 pulses (8,192 division)
1	8192 pulses (32,768 division)

Bit 4: Divided output signal switching (⚠1)

0	Motor encoder
1	Fully closed encoder

Bit 5: Motor encoder A-/B-phase signal output phase switching

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

Bit 6: Encoder C-signal output logic select

0	H active
1	L active

Bit 7: Serial signal output method select

0	Start-stop synchronization (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 once.
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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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.	0000 0000		0, 1	

Func6

7	6	5	4	3	2	1	0

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.

⚠ 1 Setting bit1 to 1 enables the auto switching function between proportional and proportional-plus-integral controls. When the auto switching function is enabled, the control type is as follows:
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 Mode 1.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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). Velocity deviation → $\boxed{Kvp(1+\int \frac{1}{Tvi} dt)}$ → Velocity loop output	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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbreviation	Name and description	Standard value	Setting range	Remarks
4	0	M1	Monitor output select 1 • The contents of monitor 1 output (CN1-15 pin) can be selected among the following 11 types.	Vm2 mV/min^{-1}	11 types	

Indication	Contents	
Im 2 V/IR	Current monitor	2 V/IR peak
Ic 2 V/IR	Current command	2 V/IR peak
Vm 2 mV/min^{-1}	Velocity monitor	2 mV/min^{-1}
Vm 1 mV/min^{-1}	Velocity monitor	1 mV/min^{-1}
Vm 3 mV/min^{-1}	Velocity monitor	3 mV/min^{-1}
Vc 2 mV/min^{-1}	Velocity command	2 mV/min^{-1}
Vc 1 mV/min^{-1}	Velocity command	1 mV/min^{-1}
Vc 3 mV/min^{-1}	Velocity command	3 mV/min^{-1}
Per 50 mV/P	Position deviation	50 mV/1 pulse
Per 20 mV/P	Position deviation	20 mV/1 pulse
Per 10 mV/P	Position deviation	10 mV/1 pulse

Where,

IR : Rated armature current.

Mode	Page	Abbreviation	Name and description	Standard value	Setting range	Remarks
	1	M2	Monitor output select 2 • You can specify a desired output from the 11 types of data (M1) for the monitor 2 output (CN1-16 pin and check pin M2) as shown below.	Ic2 V/IR	11 types	

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>Abbrevi-
ation</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

7. EXPLANATION OF PARAMETERS

<table>
<tr><th>Mode</th><th>Page</th><th>Abbrevi-ation</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 (1 Mbps)</td></tr>
<tr><td>ABS.E(2M)</td><td>Absolute encoder (2 Mbps)</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.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbrevi-ation	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.	$$$$	A motor from the P1, P2, P3, P5, P6 and P8 series.	
	7	MOKD	Motor configuration • Rotary Motor • IPM Motor	$$$$	Rotary IPM	

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 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.

Page 7 (motor configuration) is for reference only and cannot be edited or changed.

Mode	Page	Abbrevi-ation	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 inertia 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). Velocity deviation → $Kvp(1+\int \frac{1}{Tvi} dt)$ → Velocity loop output	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.

8. MAINTENANCE

MAINTENANCE

8. MAINTENANCE

8.1 Troubleshooting

In the following pages, explanations will be provided on the possible causes of each alarm and malfunction, and of the investigative methods and corrective measures. To avoid injury, please ensure that the cause is rectified and safety is ensured before attempting to resume operation in the event of an alarm or malfunction.

> It is highly dangerous to proceed with an investigation into the causes of a malfunction without ensuring the safety of power supply unit, servo amplifier, motors, mechanical devices and the surrounding area. Understanding the conditions prevailing at the time of a malfunction will help in narrowing down the possible causes of the malfunction and shorten the troubleshooting process. Ensure that it is safe to do so before attempting to reenact the malfunction, and pay close attention to the prevailing conditions during the reenactment.
>
> In replacing Servo Amplifier and Servomotor, confirm that there should be no external parameter causing any trouble 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” or “P” 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).

↓

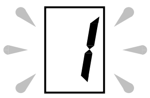
3. If the malfunction persists after the process above, execute the corrective measures of number with triangle.

↓

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

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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 F/B error	Possible	• Feedback current value 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

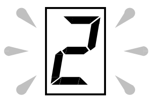
OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	High		High		Low
When servo ON is inputted	High	High	High	Low	
When motor is started or stopped	Low	Low	Low	High	
After operating for a short period	Low	Low	Low		High

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	• U, V, W phases of wiring between amplifier and motor is short-circuited or grounded. • UVW phases between amplifier and motor is not connected, or contact failure.	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 of servo amplifier 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) of servo amplifier	• Check if cooling fan in amplifier is rotating. Replace amplifier if fan is not operating. • Check if 200VAC power supply for cooling fan built in servo amplifier is connected to L and N terminals. → If cooling fan does not rotate in spite of being connected, replace cooling fan. (Only in servo amplifier with 600A or more.) • 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 131°F (55℃).

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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	H								
When servo ON is inputted	H	H							H
After position command input (when motor is not rotating)		H			H	H	H		H
After position command input (after operating for a short period)			H	H	H		L	H	

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 controller 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

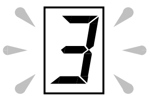
<Overload cause #3: Effective torque is exceeding rated torque>

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).

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0011	PSOH	Power supply unit Overheat	Not Possible (7.8Kw to 16kW) Possible (27kW or more)	• Overheat was detected in Power supply unit and Amplifier.
		AOH	Amplifier Overheat	Possible	• Overheat was detected in Amplifier. (Only in servo amplifier with 600A or more)

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

Operating state when alarm occurred

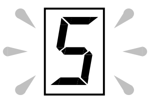
OPERATING STATE	POSSIBLE CAUSES			
	1	2	3	4
When control power supply is turned on	Low		High	
During operation	Low	High	High	High

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	Faulty internal circuit of power supply unit Faulty internal circuit of Servo Amplifier	Replace power supply unit. Replace amplifier.
2	Incorrect combination of amplifier and power supply unit	• Review the combination.
3	Operating ambient temperature of power supply unit and Servo Amplifier is too high.	Review cooling method so that temperature in control board not become over 131°F (55℃).
4	Cooling fun in power supply unit and Servo Amplifier stop.	• Check if cooling fan in amplifier is rotating. Replace amplifier if fan is not operating. • Check if 200VAC power supply for cooling fan built in servo amplifier is connected to L and N terminals. → If cooling fan does not rotate in spite of being connected, replace cooling fan. (Only in servo amplifier with 600A or more.)

After overheat in power supply unit and amplifier was detected, thermal SW in regenerative resistor will not recover to normal operation without cooling down period for a while. When overheat in power supply unit with 7.8kW to 16kW was detected, replace power supply unit as it will not recover.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0101	PSOV	Power supply unit Over voltage	Possible	DC voltage of main circuit of power supply unit exceeded allowable voltage
		OV	Amplifier 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.

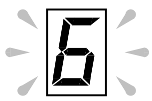
Operating state when alarm occurred

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

Corrective Measures

CAUSES		CORRECTIVE MEASURES
1	Faulty internal circuit of power supply unit Faulty internal circuit of Servo Amplifier	Replace power supply unit. 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	Resistance value of external regenerative resistor is too large.	Turn power off and check resistance value of external regenerative resistor connected to power supply unit. → When resistance value is large, lower it to within allowable range of power supply unit.
5	Faulty regenerative circuit of power supply unit	Replace power supply unit

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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

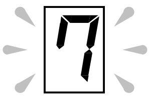
OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	High	Low			
Upon command input after Servo ON	Low	High			High
When motor is started			High	High	
During operation (except when motor is started)		High	High		

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 controller 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.

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0111	PE	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.

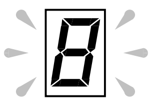
Operating state when alarm occurred

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

Corrective Measures

CAUSE		CORRECTIVE MEASURES
1	Faulty internal circuit of power supply unit Faulty internal circuit of amplifier	Replace power supply unit. Replace servo amplifier.
2	Input power supply voltage is below specified range	Set voltage within specified range.
3	Fluctuation or momentary interruption of input power voltage	Check power supply

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1000	DE1	Encoder disconnection (sensor error)	Not possible	Disconnection of sensor signal (A, B, C or 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
		EXDE	External encoder disconnection	Possible	Disconnection of full close sensor signal line 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

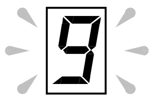
OPERATING STATE	POSSIBLE CAUSES					
	1	2	3	4	5	6
When control power supply is turned on	High	High	High	High	High	High
After servo ON				High	High	
During operation	Low			High	High	

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.
6	Parameter setting is for full close servo system.	Set parameters for semi-close system (Mode2-page0 Func0-bit7).

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1001	MPE	Main power supply drop	Possible	Main circuit power supply voltage dropped.

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

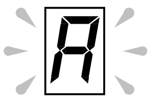
Operating state when alarm occurred

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

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Power supply voltage is below specified range.	Set power supply to within specified range.
2	Main circuit rectifier and fuse of power supply unit are broken.	Replace power supply unit.
3	Input voltage dropped. Or momentary interruption occurred.	Check main power supply not to occur momentary interruption or power drop.
4	Low voltage without specification is supplying to main circuit (L1. L2. L3).	Check main circuit voltage not to supply around power from other to L1. L2. L3 when main circuit OFF.
5	Faulty internal circuit of power supply unit Faulty internal circuit of servo amplifier	Replace power supply unit. Replace servo amplifier.
6	DC_BUS between power supply unit and amplifier is not wired.	Check and correct the wire.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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.

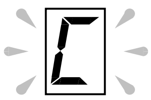
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES		
	1	2	3
When control power supply is turned on		High	
When main power supply is turned on	High		High
During motor operation	Low		

Corrective Measures

CAUSE		CORRECTIVE MEASURES
1	Faulty input contact on one of three phases power input R, S, T.	Check and correct wiring.
2	Faulty rectifier and fuse of power supply unit are blown.	Replace power supply unit.
3	Faulty internal circuit of power supply unit Faulty internal circuit of servo amplifier	Replace power supply unit Replace servo amplifier

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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					High
Upon servo ON input	High		High		
Upon command input	High	High	High		
When motor is started or stopped				High	

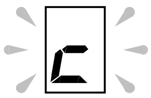
Corrective Measures

	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 controller 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 controller.
5	Faulty servo amplifier control board	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”.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1100	SONE	Servo ON error	Possible	When the motor speed is 10rpm or more, Servo ON was 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
When control power supply is turned on	High	
Upon servo ON input		High

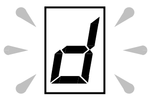
Corrective Measures

CAUSE		CORRECTIVE MEASURES
1	Faulty servo amplifier control board	Replace servo amplifier.
2	When the motor speed is 10rpm or more, Servo ON is input.	When the motor speed is below 10rpm, Servo ON is input.

SONE alarm is not detected when “dynamic brake function ineffective at SOFF” is selected.
In order to select “dynamic brake function effective at SOFF”, set bit4 of Func3 to “0”.

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	1101	OVF	Excess position deviation	Possible	Position loop deviation counter exceeded allowable value

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

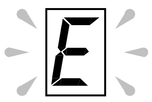
Operating State when alarm occurred

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

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 controller.
10	Faulty amplifier control board	Replace servo amplifier.
11	Faulty servomotor sensor	Replace servomotor.
12	Input power supply voltage dropped.	Set input power supply voltage within specified range.
13	Normal and no problem	This is in considering to deviation left at controller after JOG operation or tuning from remote controller. Clear alarm to recover, or stop alarm by setting MODE2/ page7/ bit4 to “1” with remote controller to stop alarm.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0011	EXOH	External overheat	Possible	External overheat 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

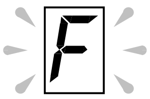
OPERATING STATE	POSSIBLE CAUSES			
	1	2	3	4
When control power supply is turned on	Low	High	High	
During operation	Low		Low	High

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty internal circuit of power supply unit Faulty internal circuit of servo amplifier	Replace power supply unit. Replace servo amplifier.
2	The EXT.TH terminal of power supply unit is open.	Short-circuit or wire the thermal of external regenerative resistor. When short-circuit, make sure that external regenerative resistor does not heat.
3	Faulty thermal of external regenerative resistor	Replace external regenerative resistor
4	Thermal of external regenerative resistor operated.	• Review operational conditions. • Increase capacity of external regenerative resistor

⚠ After external overheat was detected, thermal SW in regenerative resistor will not recover to normal operation without cooling down period for a while.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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.

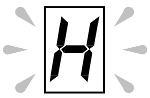
Operating state when alarm occurred

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

Corrective Measures

CAUSE		CORRECTIVE MEASURES
1	• Faulty amplifier control board • Weak control power supply 5V	Replace servo amplifier
2	Malfunction due to noise	• Check that earth cable should be correctly grounded. • Add ferrite core as noise measure.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0011	DBOH	Overheat of DB resistor	Not possible (15A to 150A) Possible (300A or more)	Overheating was detected in internal or external DB resistor of servo 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	4	5
When control power supply is turned on	Low	High		High	
During operation	Low		High	High	High

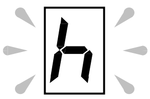
Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty amplifier internal circuit	Replace servo amplifier
2	The 1 and 2 terminals of amplifier are open.	Short-circuit or wire the thermal of external DB resistor. (Only in servo amplifier of 600A or more)
3	Incorrect combination of amplifier and servomotor	Review the combination.
4	Operating ambient temperature of servo amplifier is too high.	Review cooling method so that temperature in control board not become over 131 °F(55℃)
5	Cooling fun in servo amplifier stops.	Check if cooling fan in amplifier is rotating. Replace cooling fan if it is not operating.

After overheat of DB resistor was detected, thermal SW in regenerative resistor will not recover to normal operation without cooling down period for a while. When overheat of DB resistor in servo amplifier with 15A~150A was detected, replace servo amplifier as it will not recover.

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0011	MOH	Overheat of servomotor	Possible	Overheating was detected in servomotor. (Only in servo amplifier of 600A or more)

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

Operating state when alarm occurred

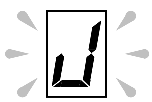
OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	Low	High	High	High	
During operation	Low		Low	High	High

Corrective Measures

CAUSE		CORRECTIVE MEASURES
1	Faulty amplifier internal circuit	Replace servo amplifier
2	The 3 and 4 terminals of amplifier EX-TH are open.	Short-circuit or wire the thermal of servomotor.
3	Faulty thermal of servomotor	Replace servomotor.
4	Operating ambient temperature of servomotor is too high.	Review cooling method so that temperature in control board not become over 104°F(40°C)
5	Cooling fun in servomotor stops.	Check if cooling fan in servomotor is rotating. Replace cooling fan if it is not operating.

After overheat of servomotor was detected, thermal SW in regenerative resistor will not recover to normal operation without cooling down period for a while.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0101	RGOL	Regenerative error	Possible	Overload was 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

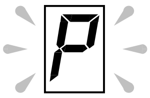
OPERATING STATE	POSSIBLE CAUSES					
	1	2	3	4	5	6
When control power supply is turned on						High
When main circuit power supply is turned on		High	High		High	High
During operation	High			High		Low

Corrective Measures

CAUSE		CORRECTIVE MEASURES
1	• Allowable regeneration power is exceeded. • Load inertia is too high, or conducted time (for one cycle) is too short	Review load inertia and operational pattern • Lower load inertia within specified range • Increase deceleration time • Increase conducted time
2	External regenerative resistor is not wired, or faulty wiring.	Check and correct wiring.
3	Faulty external regenerative resistor.	Replace external regenerative resistor
4	Resistance value of external regenerative resistor is too high.	Change to resistor that meets specification.
5	Input power supply voltage is over 280V AC	Set input power supply voltage within specified range.
6	Faulty internal circuit of power supply unit Faulty internal circuit of servo amplifier	Replace power supply unit. Replace servo amplifier.

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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.

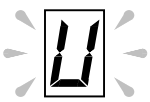
Operating state when alarm occurred

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

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 controller.	• Reset remote controller and turn ON power again → Confirm no alarm occurs.

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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	High	High	High	Low
During operation			High	Low

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.

In case of wiring-saved absolute sensor (ABS-E.S1) with application not using multiple rotational data without connecting lithium battery, set bit5 of Func6 to “1” and turn on the control power again. Then alarm “U” (battery error) will not be detected in turning on the control power.

8. MAINTENANCE

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	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	4
When control power supply is turned on	Low	High		High
During operation	Low	High	High	

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 is correctly grounded. • Add ferrite core as noise measure.
4	In maintenance mode.	• Maintenance mode SW on the front of Amplifier is at maintenance mode. → Shut down the control power and return the SW to normal mode.

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 8-1 Troubleshooting (Non-Alarm)

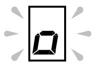
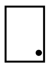
No	Malfunction	Inspection	Causes and corrective measures
1	7-segment LED does not display "≡" after control power supply is switched on	① Check voltage of control power input terminals	• Check power supply if voltage is low • Check wiring and tightening of screws if there is no voltage
		② Check if red "CHARGE" LED is on	• Faulty internal power supply circuit of power supply unit → Replace power supply unit • Faulty internal power supply circuit of servo amplifier → 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
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.
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

No	Malfunction	Inspection	Causes and corrective measures
7	Abnormal noise	① Check for mechanical faults	• Operate servomotor by itself • Check centering and balance on coupling
		② 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

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

Table 8-2 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,  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 PQ amplifier allows for easy switching of the velocity loop gain with its 8-position rotary switch located on the front of the amplifier.

8.3.2 Setting Procedure

Set the slide switch on the front of the amplifier to GAIN. Then, set the following parameters.

Operator
Mode0-12 Velocity loop proportional gain add value (KvpA)
This parameter sets a weight per rotary switch 1.
The following shows the velocity loop gain actually set:
Kvp + (KvpA × RSW) or Kvp 2 + (KvpA × RSW).
Where, RSW is a rotary switch position.

You can check the Kvp actually set on the Kvp monitor (KvpM) for operator mode5-14.

Switching of Gain Using External Input Signal

Using external input signal (CN1-36 pin or 35 pin), this function performs switching of the position loop gain, velocity loop proportional gain and velocity loop integral time constant.

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

This function is enabled when the parameter servo function select (Mode 4, Page 2) is set to "select".

The Func3 bit6 parameter is used for selecting the CN1 input signal (0: 36 pin and 1: 35 pin).

Note 1: There is a 2 msec maximum time lag between switching of the input signal and that of the gain.

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 setting the slide switch to HISTORY clears your setting and returns to the original one.

8.4 Maintenance

The Servomotor and amplifier do not require any special inspection. 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 megger test of the Servo Amplifier may damage the amplifier.
2 We recommend that you conduct a continuity check using the tester.
3 Do not remove the cover from the detector of the Servomotor.
4 Do not overhaul the Servo Amplifier and the Servomotor.

[Inspection Procedure]

Table 8-3 Inspection Procedure

Check point	Check conditions			Check item	Check method	Corrective measure
	Timing	In-operation	Out-of-operation			
Servomotor	Routine	○		Vibration	Check if vibration is larger than usual.	Contact us.
	Routine	○		Noise	Check if abnormal noise unlike in normal status is present.	
	As needed		○	Cleaning	Check for dirt or dust.	Clean the Servomotor using a cloth or blow down with air. ⚠1
	Yearly		○	Insulation resistance measurement	Contact us.	
	Every 5000 hours ⚠2		○	Replacement of oil seal		
Servo amplifier	As needed		○	Cleaning	Check the parts for settling of dust.	Clean by blowing down with air. ⚠1
	Yearly		○	Looseness of screws	Check external terminals and CN1, 2 connectors for looseness.	Tighten loose terminals or connectors.
Battery on absolute encoder	As needed ⚠3		○	Battery voltage	Check if the battery voltage is 3.6 VDC or above.	If not, replace the battery.
Tempera-ture	As needed	○		Temperature	Check ambient temperature and motor frame temperature.	Ambient temperature must be within the specification. Check the load condition operating pattern and conduct necessary correction.

1 Prior to cleaning, make sure that the air does not contain water or oil.
2 This check/replacement interval is when a water-proof or oil-proof function is required.
3 Users are requested to constantly monitor the battery voltage.
Be advised that that estimated life of our recommended battery (Toshiba lithium battery ER6V: 3.6V, 2000 mAh) is about 6 years.

8.5 Overhaul Parts

The parts listed in Table 8.4 will deteriorate with age. For maintenance, inspect periodically.

Table 8-3 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 104°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 PQ Servo System 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.
   - Servo Amplifiers except PQM1A015, PQM1A030 have built-in cooling fan motors.
     Be sure to maintain a 10-mm spaces in both sides and a 50-mm spaces in 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 104°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.

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9.1 Servo Amplifier

This section describes the specifications of Servo Amplifier in drawings and tables.

9.1.1 Common Specifications of Power Supply Unit

Table 9-1 Common Specifications

	Model No.		PQM0PA7R8	PQM0PA120	PQM0PA160	PQM0PA270	PQM0PA370	PQM0PC750
Basic specification	(*1) Input power	Main circuit	• 3-phase, 200 VAC to 230 VAC +10%, 15%, 50/60 Hz±3Hz.					• 3-phase, 400 VAC to 460VAC +10%, 15%, 50/60 Hz±3Hz.
		Control circuit	• Single-phase, 200 VAC to 230 VAC +10%, 15%, 50/60 Hz±3Hz.					
	Input power supply capacity (Main circuit) (*7)		13kVA	20kVA	27kVA	46kVA	64kVA	130kVA
	Input power supply capacity (Control circuit)		200VA (When five Servo Amplifiers are in operation.)					
	Rated output capacity (Main circuit)		7.8kW	12kW	16kW	27kW	37kW	75kW
	Regenerative resistor permissible resistance		6.5Ω. or more	5.0Ω. or more	3.3Ω. or more	2.5Ω. or more	1.3Ω. or more	2.4Ω. or more
	Environment	Operating ambient temperature (*2)	32 to 131°F					
		Storage temperature	–4 to +149°F					
		Operating / storage humidity	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		4.5	5.0	5.0	16	22.0	27.0
Built-in functions	Protection function		Main circuit overvoltage, Failed phase, Regeneration error, Power supply unit overheating, Control power supply error, External surface overheating (Detectable at the first Servo Amplifier)					
	LED Display		Alarm display at the first Servo Amplifier.					
	Regenerative processing		Circuit built in (External resistor)					

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Table 9-1 Common Specifications

		Model No. PQM1□○○△		A015	A030	A050	A100	A150	A300	B600	B900	D600	D800
Basic specification		Control function		Velocity, torque or position control (through switching of parameters).									
Basic specification		Control method		IGBT PWM control, sine wave drive.									
Basic specification		(*1) Input power	Main circuit	240 V to 358 VDC								480 V to 716 VDC	
Basic specification		(*1) Input power	Control circuit	240 V to 358 VDC									
Basic specification		Environment	Operating ambient temperature (*2)	32 to 131°F									
Basic specification		Environment	Storage temperature	–4 to + 149°F									
Basic specification		Environment	Operating/storage humidity	90% RH maximum (no condensation)									
Basic specification		Environment	Altitude	Up to 1,000 meters above sea level.									
Basic specification		Environment	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.									
Basic specification		Environment	Shock	2G									
Basic specification		Structure		Equipped with a built-in, tray-type power supply.									
Basic specification		Mass kg		3.0	3.0	4.5	5.5	5.5	11.3	27.0	47.0	51.0	51.0
Performance	For the velocity control specification	(*3) Velocity control range		1 : 3000									
Performance	For the velocity control specification	(*4) Velocity variations	Load variation (0 to 100%)	±0.1% maximum/maximum revolution speed									
Performance	For the velocity control specification	(*4) Velocity variations	Voltage variation (170V to 253V)	±0.1% maximum/maximum revolution speed									
Performance	For the velocity control specification	(*4) Velocity variations	Temperature variation (32°F to 131°F)	±0.5% maximum/maximum revolution speed									
Performance	For the velocity control specification	(*6) Frequency characteristics		400 Hz (JL=JM)									
Built-in functions		Protection function		Overcurrent, overload, excessive main circuit voltage, over-speed, sensor error, low main circuit voltage, velocity control error, excessive deviation, memory error, low battery, CPU error.									
Built-in functions		LED Display		Internal status and alarms.									
Built-in functions		Dynamic brake		Built-in						Circuit built-in (Resistor and electromagnetic contactor are optional.)			
Built-in functions		Applicable load inertia		Within the applicable inertia of the Servomotor combined.									
Built-in functions		(*5) Monitor output	Velocity monitor (VMO)	2.0 V±10% (at 1000 min^{-1})									
Built-in functions		(*5) Monitor output	Current monitor (IMO)	2.0 V±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 / output signals	Velocity / torque control specification	Velocity command	Input impedance	Approximately 10 kΩ.									
Input / output signals	Velocity / torque control specification	Torque command	Command voltage	±2.0 VDC (at 100% torque, forward motor rotation with positive command. maximum input voltage ±10 V)									
Input / output signals	Velocity / torque control specification	Torque command	Input impedance	Approximately 10 kΩ.									
Input / output signals	Velocity / torque control specification	Current limit input		±2.0 VDC±10% (at rated armature current)									
Input / output signals	Velocity / torque control specification	Sequence input signals		Servo on, alarm reset, forward rotation inhibit, reverse rotation inhibit, proportional control, current limit and encoder clear.									
Input / output signals	Velocity / torque control specification	Sequence output signals		Current limit status, low velocity, servo ready, holding brake timing and alarm code (4 bits).									
Input / output signals	Velocity / torque control specification	Position output signals (pulse dividing)		N/8192 (N=1 to 8191), 1/N (N=1 to 64) or 2/N (N=3 to 64).									
Input / output signals	Velocity / torque control specification	Absolute position output signal (serial output)		9600 bps start-stop synchronization or 1 Mbps/2 Mbps Manchester method (when an absolute encoder is used)									
Input / output signals	For the position control specification	Position command	Max. input pulse frequency	2M pulse/second (backward+forward pulse, code+pulse), 1M pulse/second (90° phase difference 2-phase pulse train command)									
Input / output signals	For the position control specification	Position command	Input pulse form	Forward + reverse command pulses or code + pulse train command, 90° phase difference 2-phase pulse train command.									
Input / output signals	For the position control specification	Position command	Electronic gear	N/D (N=1 to 32767, D=1 to 32767), where 1/32767≦N/D≦32767.									
Input / output signals	For the position control specification	Current limit input		±2.0 VDC±10% (at rated armature current)									
Input / output signals	For the position control specification	Sequence input signal		Servo on, alarm reset, forward rotation inhibit, reverse revolution inhibit, proportional control, current limit, and encoder clear.									
Input / output signals	For the position control specification	Sequence output signal		Current control status, zero deviation, servo ready, holding brake timing and alarm code (N= 3 to 64).									
Input / output signals	For the position control specification	Position output signal (pulse dividing)		N/8192 (N=1 to 8191), 1/N (N=1 to 64) or 2/N (N=3 to 64).									
Input / output signals	For the position control specification	Absolute position output (serial output)		9600 bps start-stop synchronization or 1Mbps/2Mbps Manchester method (when an absolute encoder is used)									

9. SPECIFICATIONS

*1: The supply voltage shall be within the specified range.
If the voltage exceeds the specified range, install a step-down transformer.

*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 the input power voltage is also defined and specified by the ratio of the change in revolution speeds to the maximum speed.

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

- Speed (N) <min^{-1}> : $N = 1000 \times \frac{\text{(Vm voltage)} \langle V \rangle}{2}$
  (When the standard Vm 2 mV/min^{-1} is selected for the monitor output.)

- Load torque (TL) <N•m> : $TL = TR \times \frac{\text{(Im voltage)} \langle V \rangle}{2}$
  (When the standard Im 2 V/IR is selected for the monitor output.)

*6: The value depends on how the monitor and amplifier are combined and the given load conditions.

*7: Use these values when selecting electromagnetic contactor or other parts. When selecting transformer, two-to-threefold capacity is required. In this case, consult us.

9.1.2 Acceleration and Decelerate Time

The acceleration time (t_a) and deceleration time (t_b) 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.

$$\text{Acceleration time : } t_a = (J_M + J_L) \bullet \frac{2\pi}{60} \bullet \frac{N_2 - N_1}{T_P - T_L} \text{ (sec)}$$

$$\text{Deceleration time : } t_b = (J_M + J_L) \bullet \frac{2\pi}{60} \bullet \frac{N_2 - N_1}{T_P + T_L} \text{ (sec)}$$

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	:	Instantaneous maximum stall torque (N•m)
T_L	:	Load torque (N•m)

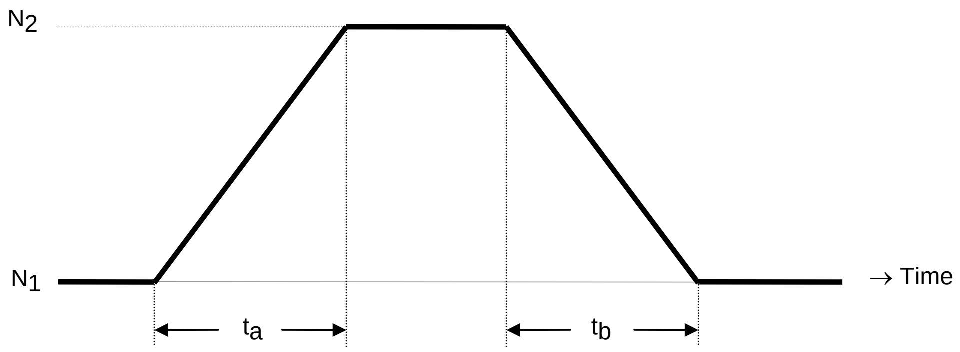


Fig. 9-1 Motor Revolution Speed Time Chart

For actually determining t_a and t_b, it is recommended that the above T_P be kept to approximately 0.8 × T_P , making allowance for load.

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 repetition frequency up to the maximum speeds exceeds $\frac{20}{m+1}$ times/min under "load inertia = motor inertia $\times$ 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

When the operating state is as in Fig. 9-2, use the motor at a frequency in which the effective motor armature current effective value is at the motor rated armature current (IR) or lower.
Supposing the operating cycle is t, the usable range is represented in the following expression.

$$t \geqq \frac{T_a{}^2 t_a + T_L{}^2 t_s + T_b{}^2 t_b}{T_{rms}{}^2} \text{ (s)}$$

T_a:Acceleration torque
T_b:Deceleration torque
T_L:Load torque
T_{rms}: Effective torque
T_r: Rated torque

When the cycle time (t) has already been determined, find T_a, T_p, t_a and t_b satisfying the above expression.

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

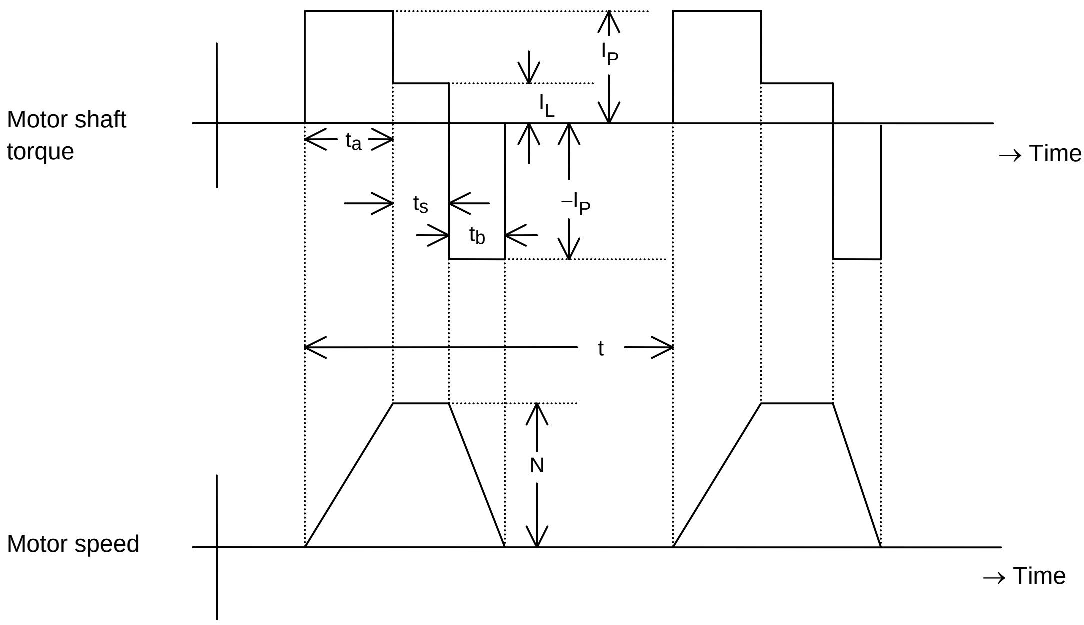


Fig. 9-2 Motor Shaft Torque and Speed Timing Chart

(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 repetition frequency can be obtained by the following expression.

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

T_R: Rated torque

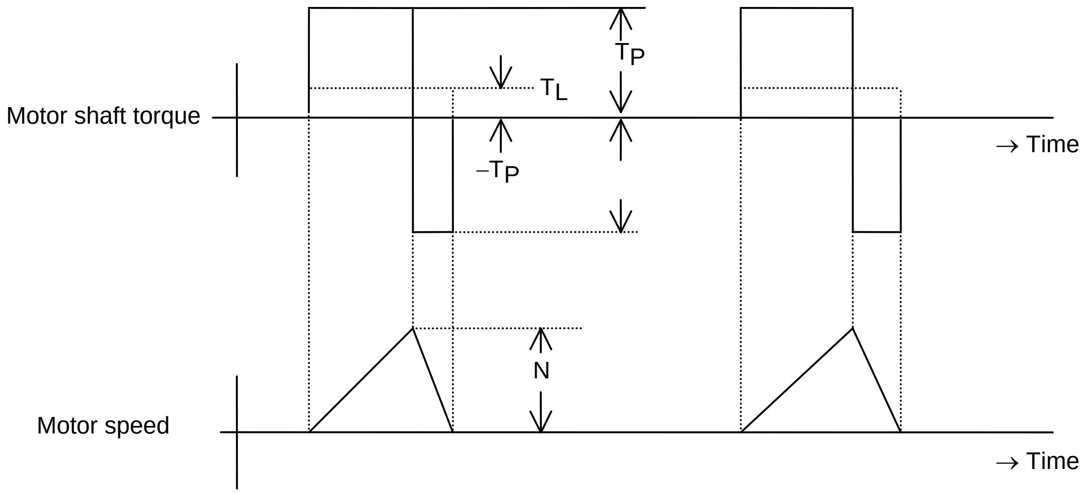


Fig. 9-3 Motor Shaft Torque and Speed Timing Chart

(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 repetition frequency can be obtained by the following expression.

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

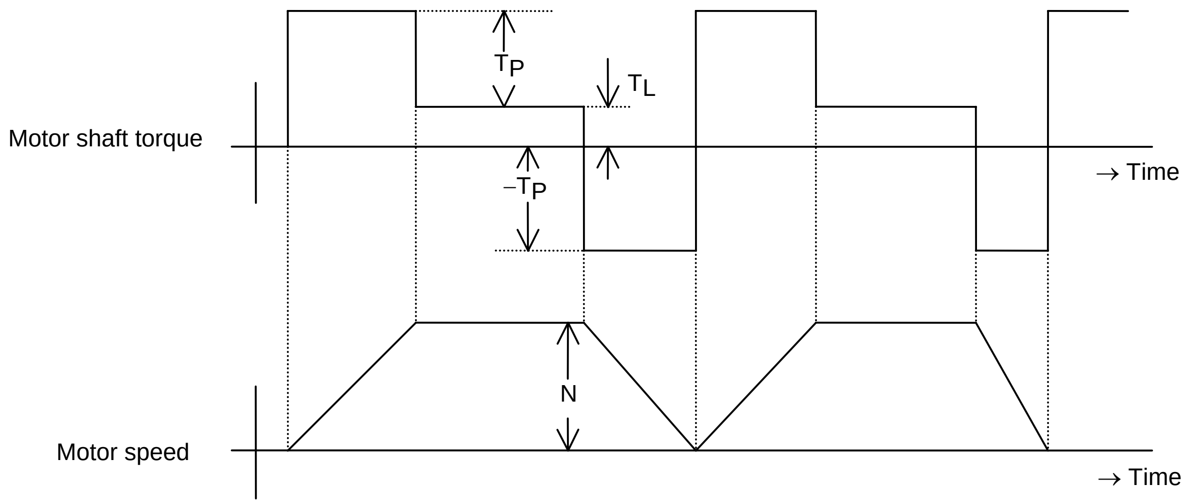


Fig. 9-4 Motor Shaft torque and Speed Timing Chart

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 the Servo Amplifier is used with a load inertia exceeding the allowable load inertia calculated in terms of the motor shaft, a main circuit power overvoltage detection or regenerative error function may be activated and may exceed the dynamic brake momentary capacity 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. SPECIFICATIONS

9.1.5 CN1 Input/Output Interface Circuit Configuration

Input circuit configuration

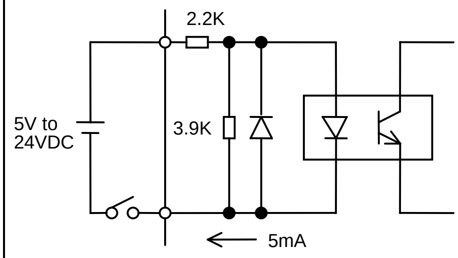
(1) Type 1 (photocoupler input)

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.



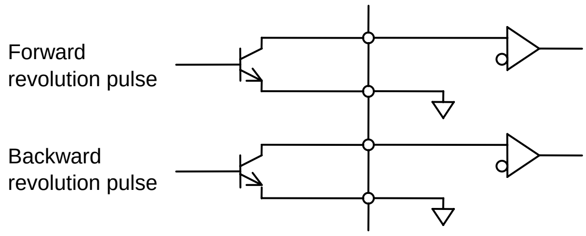
(2) Type 2 (line driver input)

This type of input circuit is like the one shown on the right.

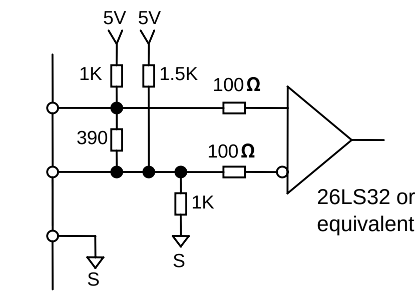
The applicable line receiver is equivalent to the 26LS32.

This type permits only command pulse input of the position control type.

This type can be connected to an open collector output.



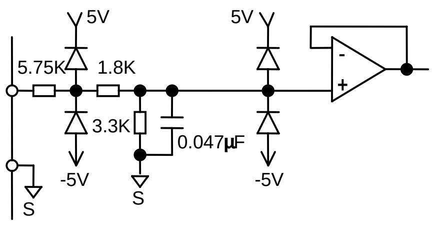
Connection example



(3) Type 3 (analog input 1)

This type of input circuit is like the one shown on the right.

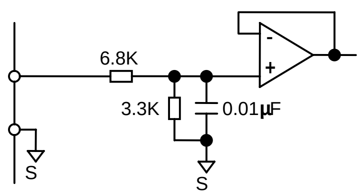
Type 3 permits only analog velocity and torque commands (torque compensation) as input signals.



(4) Type 4 (analog input 2)

This type of input circuit is like the one shown on the right.

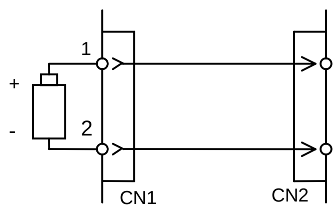
This type permits only current limit for both forward and backward revolution as input signals.



(5) Type 5 (through input)

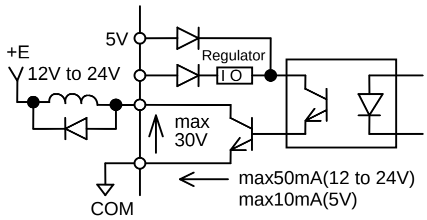
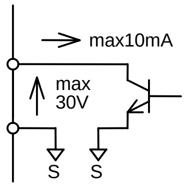
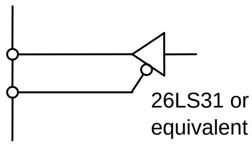
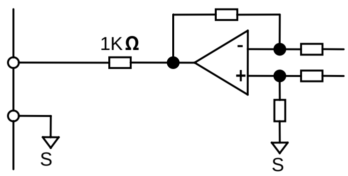
This type of input circuit is like the one shown on the right.

This type permits only battery power (for absolute encoder) as input signals.



9. SPECIFICATIONS

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 5 V and 12 V to 24 V 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.	

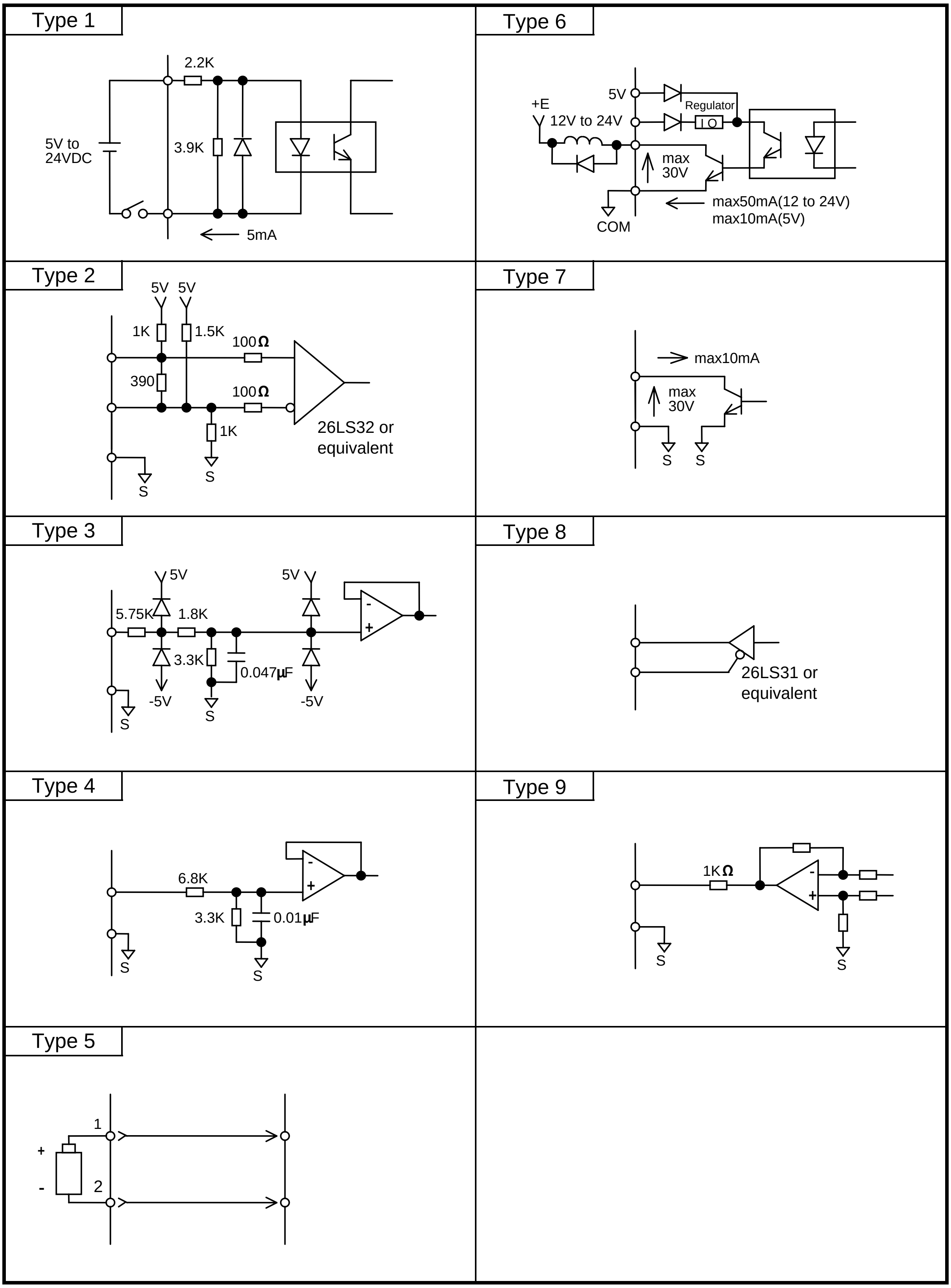


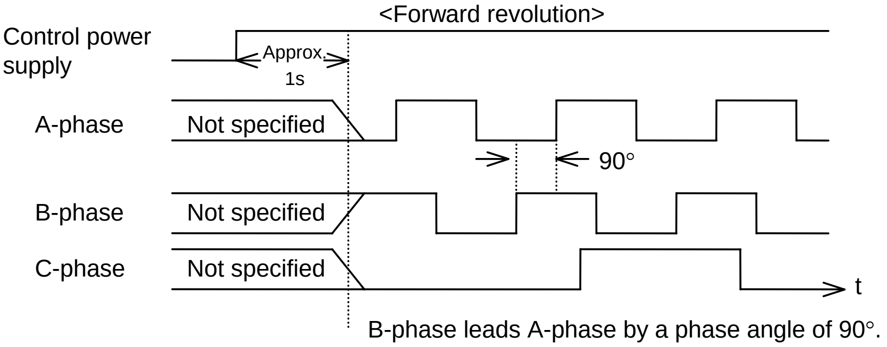
Fig. 9-5 CN1 Circuit Type

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 .



Not specified for about 1s after the control power is turned on.

9.1.6.2 Serial Output (Output Only When the ABS-E Absolute Encoder Is Used)

One of the two position signal outputs can be selected using the remote operator. When FUNC5 bit 7 on Page 6 in Mode 2 of the remote operator is set at 0, start-stop synchronization is selected.
When bit 6 is set at 1, Manchester coding synchronization is selected. For details, refer to Func5 in "7.2.3 Parameter List". The specifications are as follows:

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

Table 9-2 (1) Start-stop Synchronization Output (9600 bps) Specifications

Transmission system	Start-stop 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 9-2 (2) Manchester Coding Synchronization Output (1 Mbps) Specifications

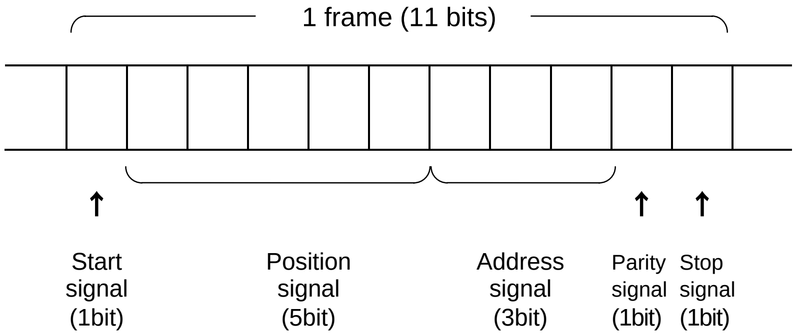
Transmission system	Manchester coding synchronization
Baud rate	1 Mbps
Number of transfer frames	2 frames (25 bits/frame)
Transfer format	See Fig. 9-7.
Transmission error check	(3 bits) CRC error check
Transfer time	66 μs (Typ.)
Transfer cycle	84 μs±2 μs(See Fig. 9-8 (2).)
Incremental direction	Increase 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 (9600 bps • 1 Mbps)

(2-1) Start-stop 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
•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

Fig. 9-6 Transfer Format of Start-stop Synchronization (9600 bps)

D0 to D10................ One-revolution absolute value
D11 to D23.............. Multi-revolution absolute value
BATE....................... Battery alarm
SOT......................... Absolute value range over
WAR........................ Battery warning

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

① Configuration in a frame

1 frame (25 bits)

Start signal	MODEM address signal	Position signal	Frame address signal	CRC signal	Stop signal
(3 bit)	(2 bit)	(15 bit)	(1 bit)	(3 bit)	(1 bit)

② Configuration in each frame

• Frame 1

Start signal (⚠ 1)

1	1	1

MODEM address signal

0	0

Position signal

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14

(LSB)

Frame address signal

0

CRC signal

0／1	0／1	0／1

Stop signal

0

• Frame 2

Position signal

D15	D16	D17	D18	D19	D20	D21	D22	D23	BATE	SOT	0	WAR	0	0

(MSB)

Frame address signal

1

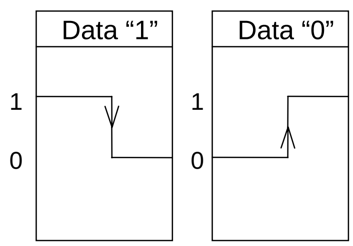
The start signal, MODEM signal, CRC signal and stop signal are the same as those in frame 1.

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 D0 to D10........... One-revolution absolute value
D11 to D23......... Multi-revolution absolute value
BATE.................. Battery alarm
SOT.................... Absolute value range over
WAR................... Battery warning



Manchester code

(3) Transfer cycle (9600 bps • 1 Mbps)

(3-1) Start-stop synchronization (9600 bps)

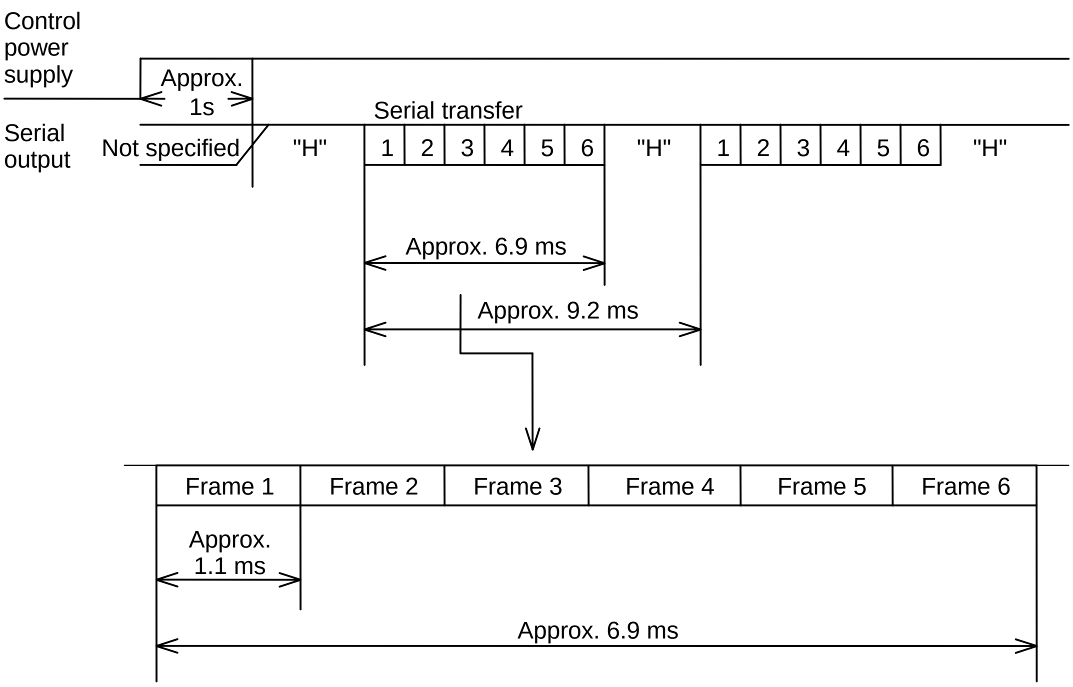


Fig. 9-8 (1) Transfer Cycle of Start-stop synchronization (9600 bps)

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

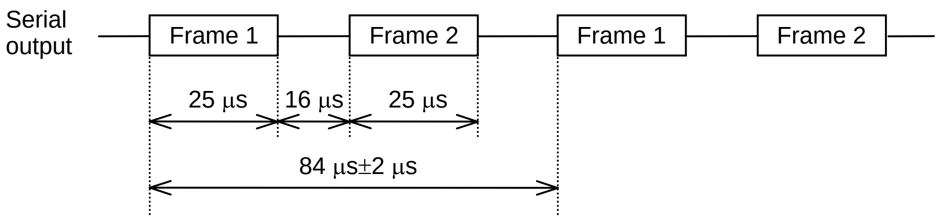


Fig. 9-8 (2) Transfer Cycle of Manchester Coding Synchronization (1 Mbps)

> ⚠ 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.

9.1.6.3 Serial Output (Output Only When the ABS-RII Absolute Sensor Is Used)

One of the two position signal outputs can be selected using the remote operator. When FUNC5 bit 7 on Page 6 in Mode 2 of the remote operator is set at 0, start-stop synchronization is selected.
When bit 6 is set at 1, Manchester coding synchronization is selected. For details, refer to Func5 in "7.2.3 Parameter List". The specifications are as follows:

(1) Serial output specifications

Table 9-3 (1) Start-stop Synchronization Output (9600 bps) Specifications

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

Table 9-3 (2) Manchester Coding Synchronization Output (1 Mbps) Specifications

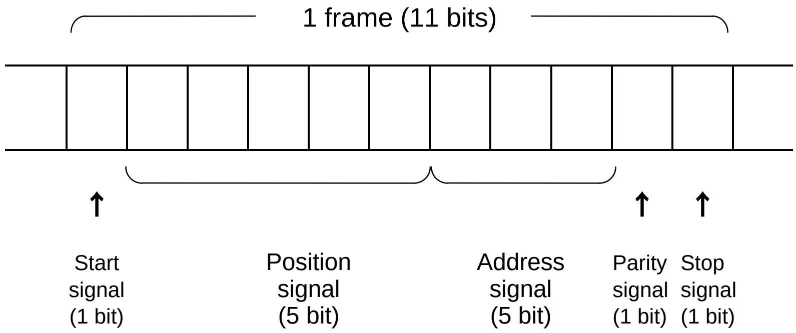
Transmission system	Manchester coding synchronization
Baud rate	1 Mbps
Number of transfer frames	2 frames (25 bits/frame)
Transfer format	See Fig. 9-10.
Transmission error check	(3 bits) CRC error check
Transfer time	66 μs (Typ.)
Transfer cycle	84 μs$\pm$2 μs(See Fig. 9-11 (2).)
Incremental direction	Increase at forward revolution ⚠

⚠ Forward revolution means counterclockwise rotation as viewed from the motor shaft.

(2) Transfer format

(2-1) Start-stop 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
・Frame 5	0	D20	D21	D22	D23	D24	0	0	1	0／1	1
・Frame 6	0	D25 (MSB)	0	0	AW0	AW1	1	0	1	0／1	1

Fig. 9-9 Start-stop Synchronization (9600 bps) Transfer Format

D0 to D12................ One-revolution absolute value

D13 to D25.............. Multi-revolution absolute value

(In the case of 8192FMT sensor)

	AW0	AW1
Battery alarm	0	1
Sensor error	Output low	
Normal	0	0

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

① Configuration in a frame

1 frame (25 bits)

Start signal (3 bit)	MODEM address signal (2 bit)	Position signal (15 bit)	Frame address signal (1 bit)	CRC signal (3 bit)	Stop signal (1 bit)

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

D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25 (MSB)	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. 9-10 Transfer Format of Manchester Coding Synchronization (1 Mbps)

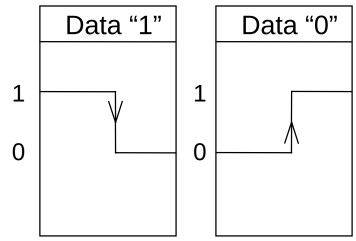
1 The first 2 bits of the start signal are output as a high (1) signal of the whole bit section. The remaining 23 bits are all Manchester coded.

2 D0 to D12........... One-revolution absolute value

D13 to D25......... Multi-revolution absolute value

(In the case of 8192FMT sensor)

	AW0	AW1
Battery alarm	0	1
Sensor error	Output low	
Normal	0	0



Manchester code

(3) Serial PS Transfer Cycle (Fig. 9-11)

(3-1) Start-stop synchronization (9600 bps)

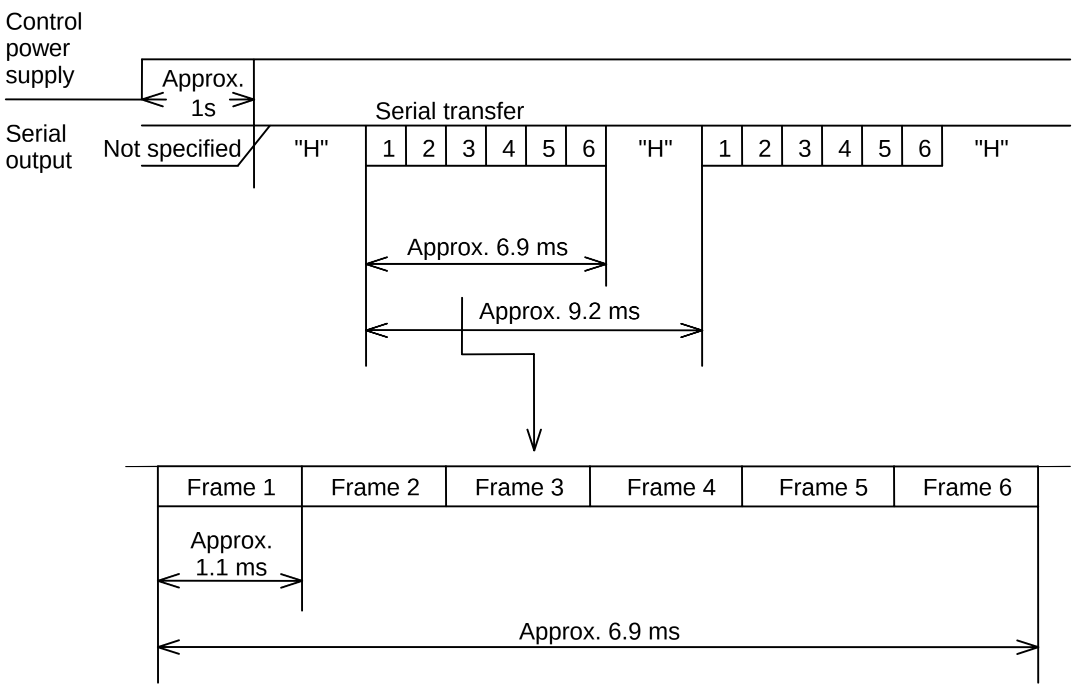


Fig. 9-11 (1) Transfer Cycle of Start-stop Synchronization (9600 bps)

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

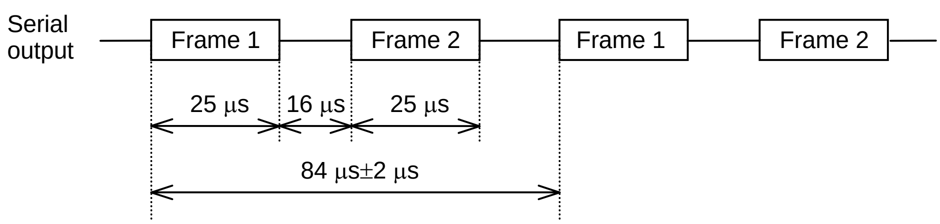


Fig. 9-11 (2) Transfer Cycle of Manchester Coding Synchronization (1 Mbps)

⚠ 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.

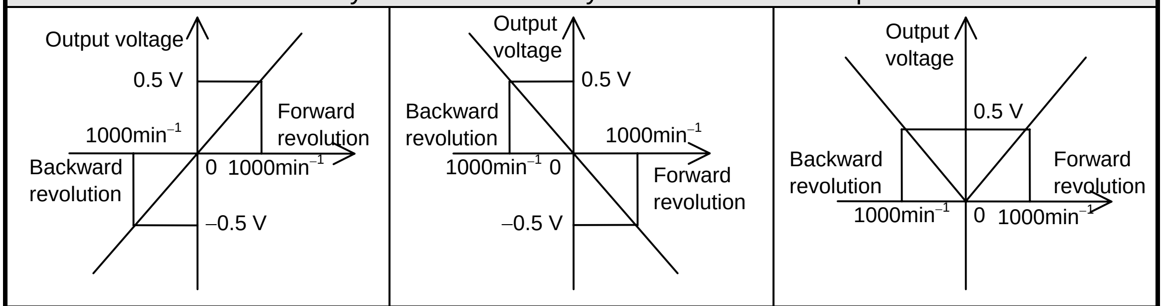
9.1.7 Monitor Output

- The contents of outputs from monitor 1 (MON1) and monitor 2 (MON2) can be selected by the remote operator.
- Monitor 1 and 2 outputs are convenient for selecting a check pin on the controller.
- Outputs can be changed on Page 3 in Mode 2 (Func2) or Page 0 or 1 in Mode 4 of the remote operator. See Pages 0 and 1 in Mode 4 in "7.2.3 Parameter List".

(1) Velocity, torque and position deviation monitor

Refer to Fig 9-12 (1) to (3).
The velocity command outputs internal data of the amplifier, which are different from the values generated by the VCMD monitor of the remote operator.
In the SOFF state, the monitor output value is zero.
When the control power is turned on or off, the monitor output is unfixed.

Velocity command / velocity feedback monitor output



The scale can be changed among 3 V/1000 min^{-1}, 1 V/1000 min^{-1}, and 2 V/1000 min^{-1}.

Fig. 9-12(1)

Current command / current feedback monitor output

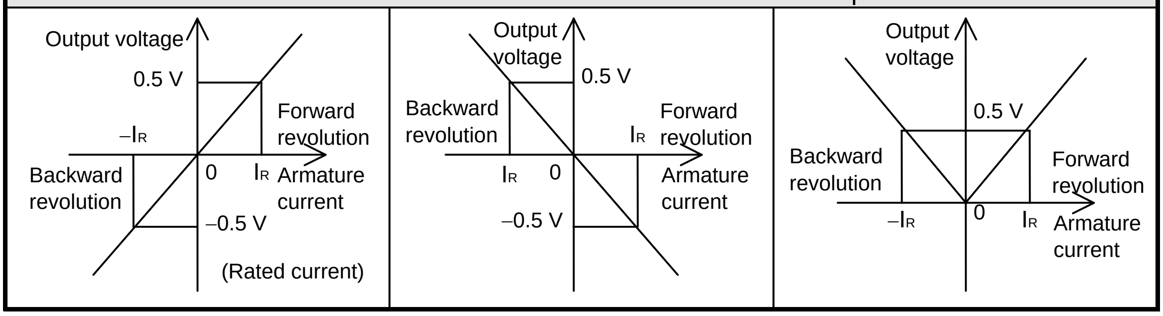
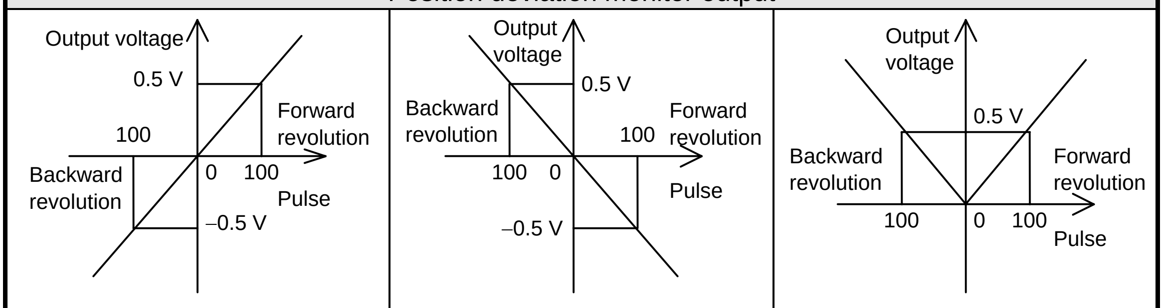


Fig. 9-12 (2)

Position deviation monitor output



The scale can be changed among 50 mV/pulse, 10 mV/pulse and 20 mV/pulse.

Fig. 9-12 (3)

(2) Typical monitor applications

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

Speed and current measurement
When connecting a measuring instrument to the velocity or current feedback monitor, use a both-swing type CD voltmeter and connect it as in Fig. 9-12 (4).
In this case, use a shielded wire and make the wiring as short as possible.

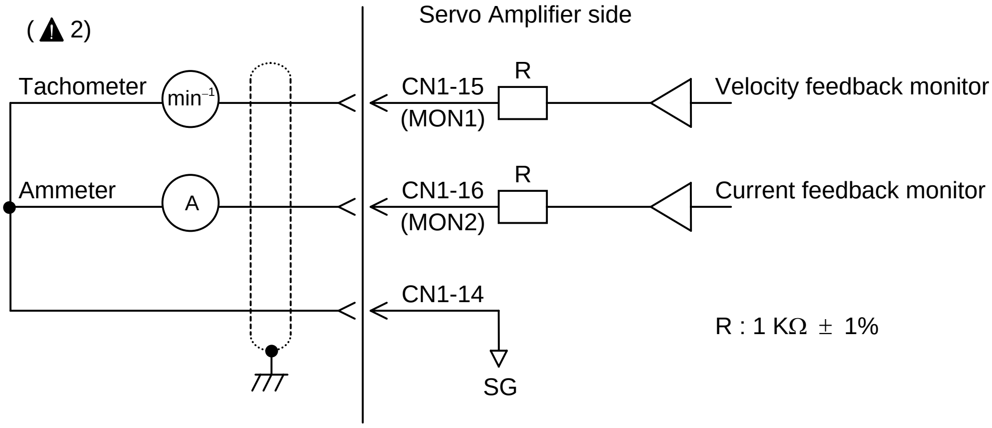


Fig. 9-12 (4) Typical Connection of Monitor and Measuring Instrument

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

1. When the above method is used for CN1-15 and CN1-16, change the contents carefully so as not to damage the measuring instrument.
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	"L"		Bit 6 = 0 Bit 5 = 0
		26 27		"L"	
	Code + forward revolution pulse	28 29			Bit 6 = 1 Bit 5 = 0
		26 27	"H"	"L"	
	"90°" phase difference two-phase pulse train ⚠ 1	28 29	90°	90°	Bit 6 = 0 Bit 5 = 1
		26 27			

Fig. 9-13 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 page 7-41 of this manual.

(2) Command pulse timing

Each command pulse timing is as follows .

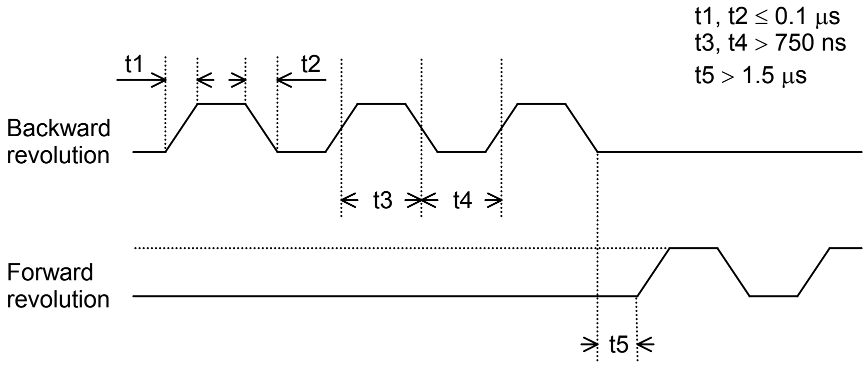
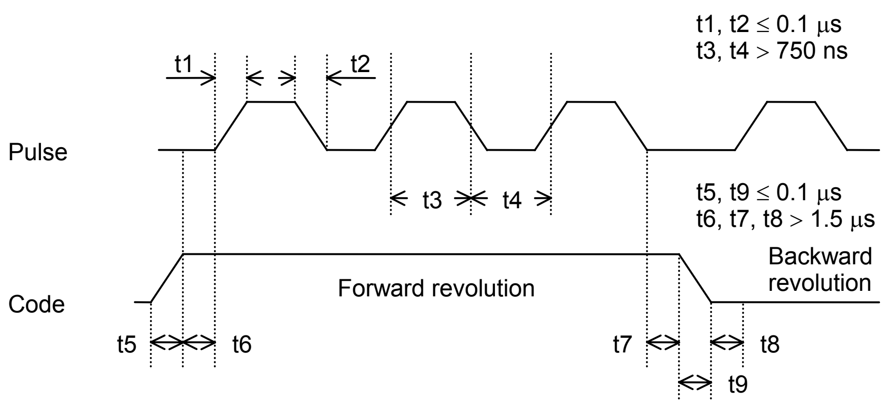
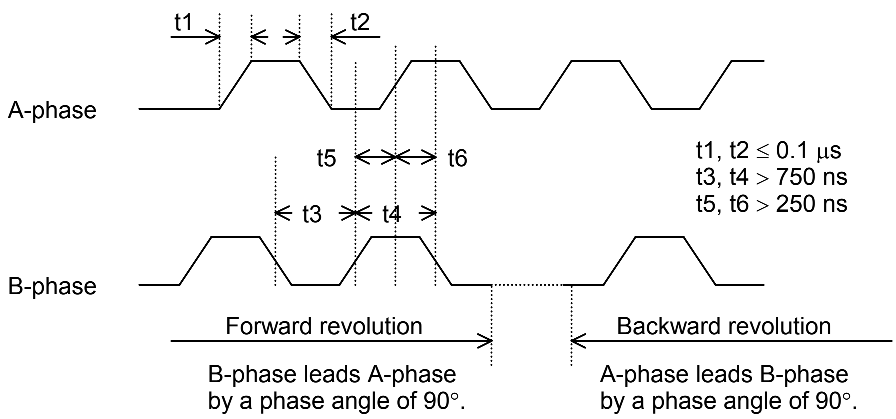
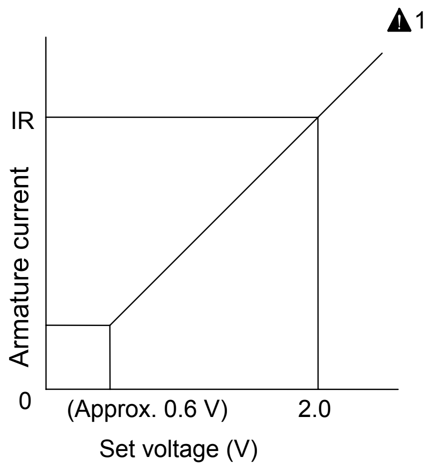
Command pulse	
Backward revolution pulse train + Forward revolution pulse train.	
Code + Pulse train	
90° phase difference two-phase pulse	

Fig. 9-14 Command Pulse Timing

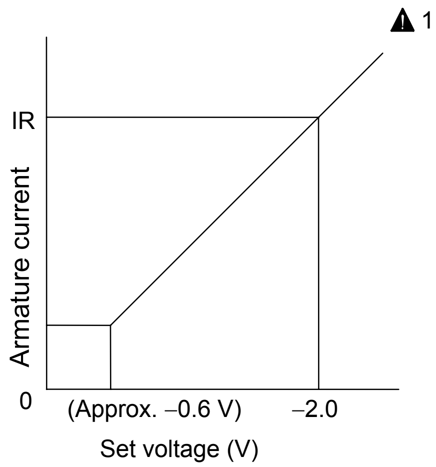
The above values apply only when screen mode 2-0 (PMOD) (digital filter DFC1 and 0 ="00", and bit 7 ="0") is selected.

(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 2 V/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 the Func1 parameter on page 7-46) is also possible.
Fig. 9-15 shows the relationship between the set voltage and the current limit value.



(a) Forward revolution current limit (PIL)



(b) Backward revolution current limit (NIL)
(when negative polarity is selected)

Fig. 9-15 Set Voltage and Current Limit Value

1. If a value exceeding the instantaneous maximum stall armature current (Ip) of the Servomotor is set, the system 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 the torque compensation input and motor generation torque, see Fig. 9-17 (the same as the torque command input of the torque command 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. 9-16 shows the circuit types of CN1 input/output signals and Tables 9-4 and 9-5 describe the general specifications.

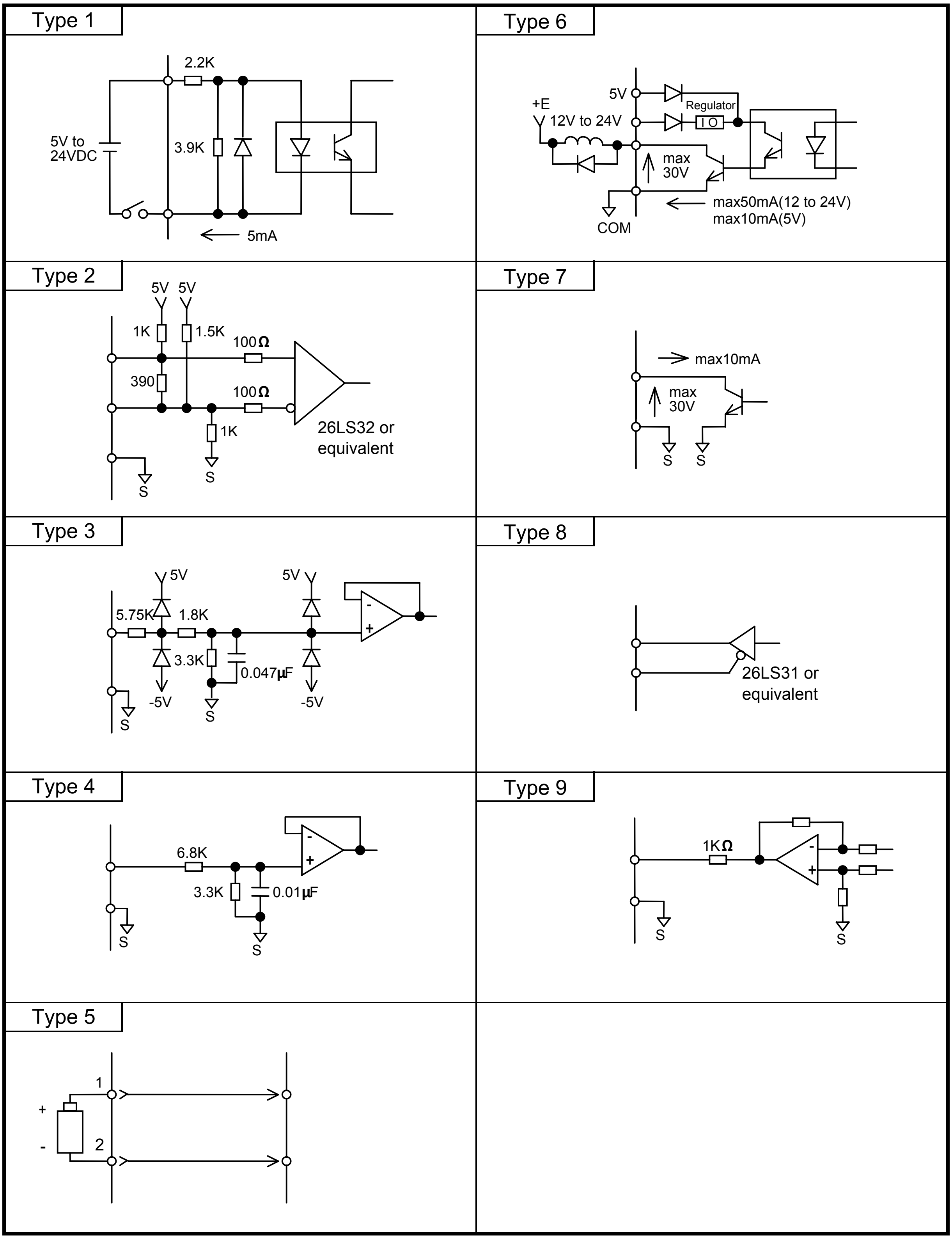


Fig. 9-16

Table 9-4 General Specifications of Position Control Type Input Signals (Incremental Encoder) 1/2

<table>
<tr><th>Signal name</th><th>Abbr.</th><th>Pin No.
* 1</th><th>Circuit type
* 2</th><th colspan="2">General specification</th></tr>
<tr><td>Forward revolution pulse train command</td><td>PPC
PPC</td><td>26
27</td><td>Type 2</td><td colspan="2">Pulse train for forward revolution</td></tr>
<tr><td>Backward revolution pulse train command</td><td>NPC
NPC</td><td>28
29</td><td>Type 2</td><td colspan="2">Pulse train for backward revolution</td></tr>
<tr><td>Torque compensation</td><td>TCOMP</td><td>22 (20)</td><td>Type 3</td><td colspan="2">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.</td></tr>
<tr><td>Servo ON</td><td>SON</td><td>37 (23)</td><td>Type 1</td><td colspan="2">Servo ON status is provided by closing the contact, and entering the pulse train waiting status.</td></tr>
<tr><td>Alarm reset</td><td>RST</td><td>30 (23)</td><td>Type 1</td><td colspan="2">With this signal input, alarm code or alarm bit outputs and an error display are reset.</td></tr>
<tr><td>Deviation clear</td><td>CLE</td><td>34 (50)</td><td>Type 1</td><td colspan="2">By inputting the contact close signal for 10 ms or more, the contents of the deviation counter can be cleared to zero.</td></tr>
<tr><td>Forward revolution overtravel
Backward revolution overtravel</td><td>PROT
NORT</td><td>32 (23)
33 (23)</td><td>Type 1</td><td colspan="2">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.)</td></tr>
<tr><td>Proportional control (standard)</td><td>PCON</td><td rowspan="3"></td><td rowspan="3">Type 1
[For 35 and 36 pins, one of the three functions can be selected by setting the remote operator.]</td><td colspan="2">With this signal input, the velocity loop becomes proportional control.</td></tr>
<tr><td>Command multiplier</td><td>PMUL</td><td colspan="2">With this signal input, command pulses are multiplied by the magnification ratio set on page 3 in Parameter set screen mode 1.</td></tr>
<tr><td>Command pulse inhibit</td><td>INH</td><td colspan="2">Inputting command pulses is inhibited.</td></tr>
<tr><td>Forward revolution current limit</td><td>PIL</td><td>18 (17)</td><td>Type 4</td><td>The current is limited to the rated current at +2 V (effective when ILM is input).</td><td rowspan="2">To enable the external current limit, Func1 bit 0 must be set at "1".</td></tr>
<tr><td>Backward revolution current limit</td><td>NIL</td><td>19 (17)</td><td>Type 4</td><td>Current is limited to the rated current at -2 V (effective when ILM is input).</td></tr>
<tr><td>Current limit permit</td><td>ILM</td><td>31 (23)</td><td>Type 1</td><td colspan="2">The current is limited by closing the contact. It is ineffective during JOG or overtravel (the limit method is based on Func1 parameter).</td></tr>
<tr><td>Input sequence power supply 1</td><td rowspan="2">5 to 24 VDC</td><td>23</td><td rowspan="2">——</td><td colspan="2">External power supply for CN1-30, 31, 32, 33, 36 and 37.</td></tr>
<tr><td>Input sequence power supply 2</td><td>50</td><td colspan="2">External power supply for CN1-34 and 35.</td></tr>
</table>

*1 The pin numbers in parentheses denote the ground or common side of each signal.

*2 For the circuit type, see Fig. 9-16.

Table 9-4 General Specifications of Position Control Type Input Signals (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	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).
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	49	——	External power supply for CN1-39, 40, 41, 42, 43, 44, 45 and 46.
	5 V	38		
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 of each signal.

*2 For the circuit type, see Fig. 9-16.

The output contents depend on the Func4 parameter setting.

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(6) General Specifications of CN1 Input/Output Signals (Absolute Encoder)

This section explains the general specifications of CN1 input/output signals of the position control type

Table 9-5 General Specifications of Position Control Type Input Signal (Absolute Encoder) 1/2

Signal name	Abbr.	Pin No. * 1	Circuit type * 2	General specification
Forward revolution pulse train command	PPC $\overline{PPC}$	26 27	Type 2	Pulse train for forward revolution.
Backward revolution pulse train command	NPC $\overline{NPC}$	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 NORT	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) 36 (23)	Type 1 [For 35 and 36 pins, one of the 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 signal and reset the alarm.
Proportional control (standard)	PCON			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 +2 V (effective when ILM is input). To enable the external current limit, Func1 bit0 must be set at "1".
Backward revolution current limit	NIL	19 (17)	Type 5	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 the Func1 parameter).
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 CN1-34 and 35.

*1 The pin numbers in parentheses denote the ground or common side of each signal.
*2 For the circuit type, see Fig. 9-16.

Table 9-5 General Specifications of Position Control Type Input Signal (ABS-E Absolute Encoder) 2/2

Signal name	Abbr.	Pin No. *1	Circuit type *2	General specification
Monitor 1	MON1	15 (14)	Type 9	2 V±10%/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, $\overline{A}$ 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	$\overline{PS}$ PS	9 10	Type 8	The absolute value signal is output in serial form (9600 bps or 1 M/2 Mbps) 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	49	——	External power supply for CN1-39, 40, 41, 42, 43, 44, 45, and 46.
	5 V	38		
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 bit7 must be set at 1.

*1 The pin numbers in parentheses denote the ground or common side of each signal.

*2 For the circuit type, see Fig. 9-16.

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. 9-17 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.

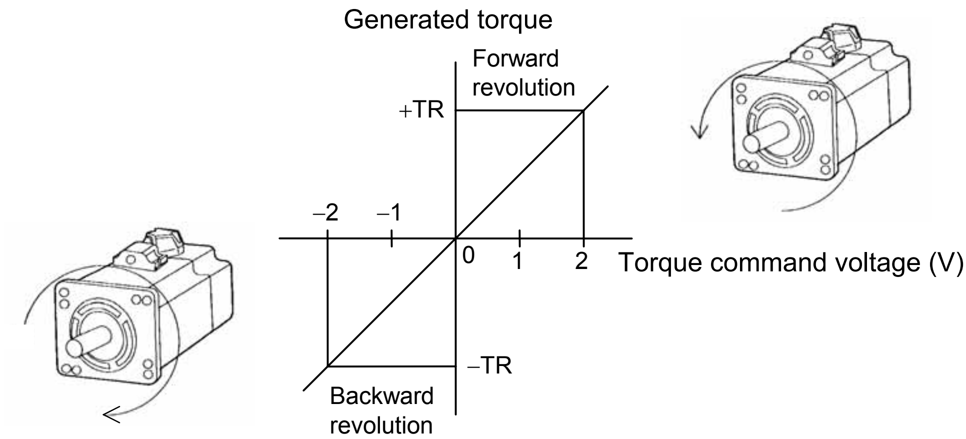


Fig. 9-17 Torque Command - Generated Torque

② Velocity command input

Fig. 9-18 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.

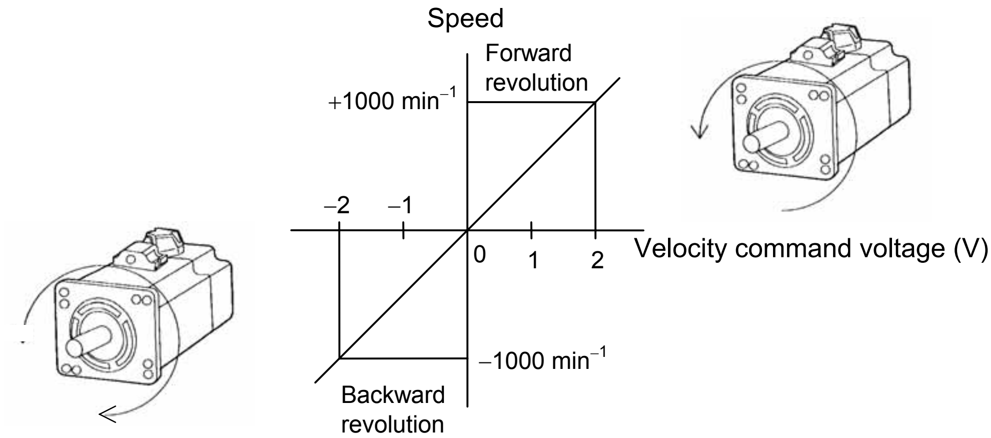
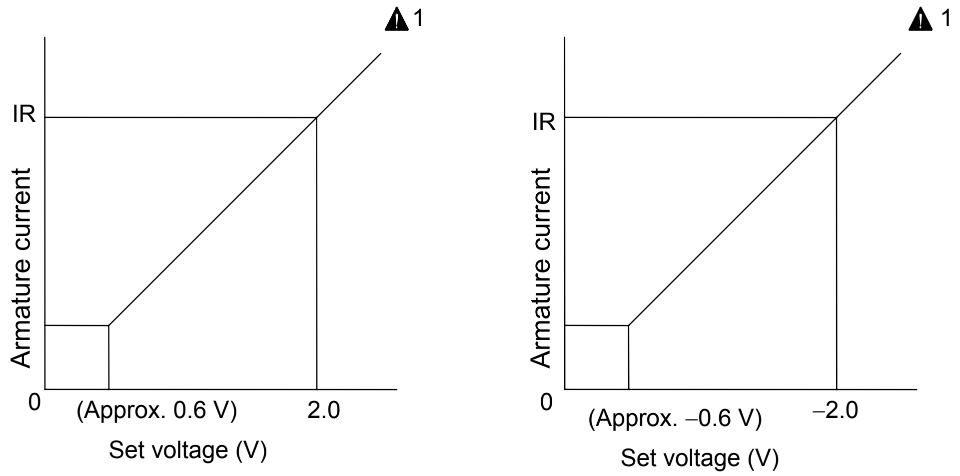


Fig. 9-18 Velocity Command - Speed Characteristics

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 2 V/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 Func1 in chapter 7).
Fig. 9-19 shows the relationship between the set voltage and the current limit value.



(a) Forward revolution current limit (PIL)

(b) Backward revolution current limit (NIL) (when negative polarity is selected)

Fig. 9-19 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. 9-17 (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. 9-20 shows the circuit types of CN1 input/output signals, and Tables 9-6 and 9-7 describe the general specifications.

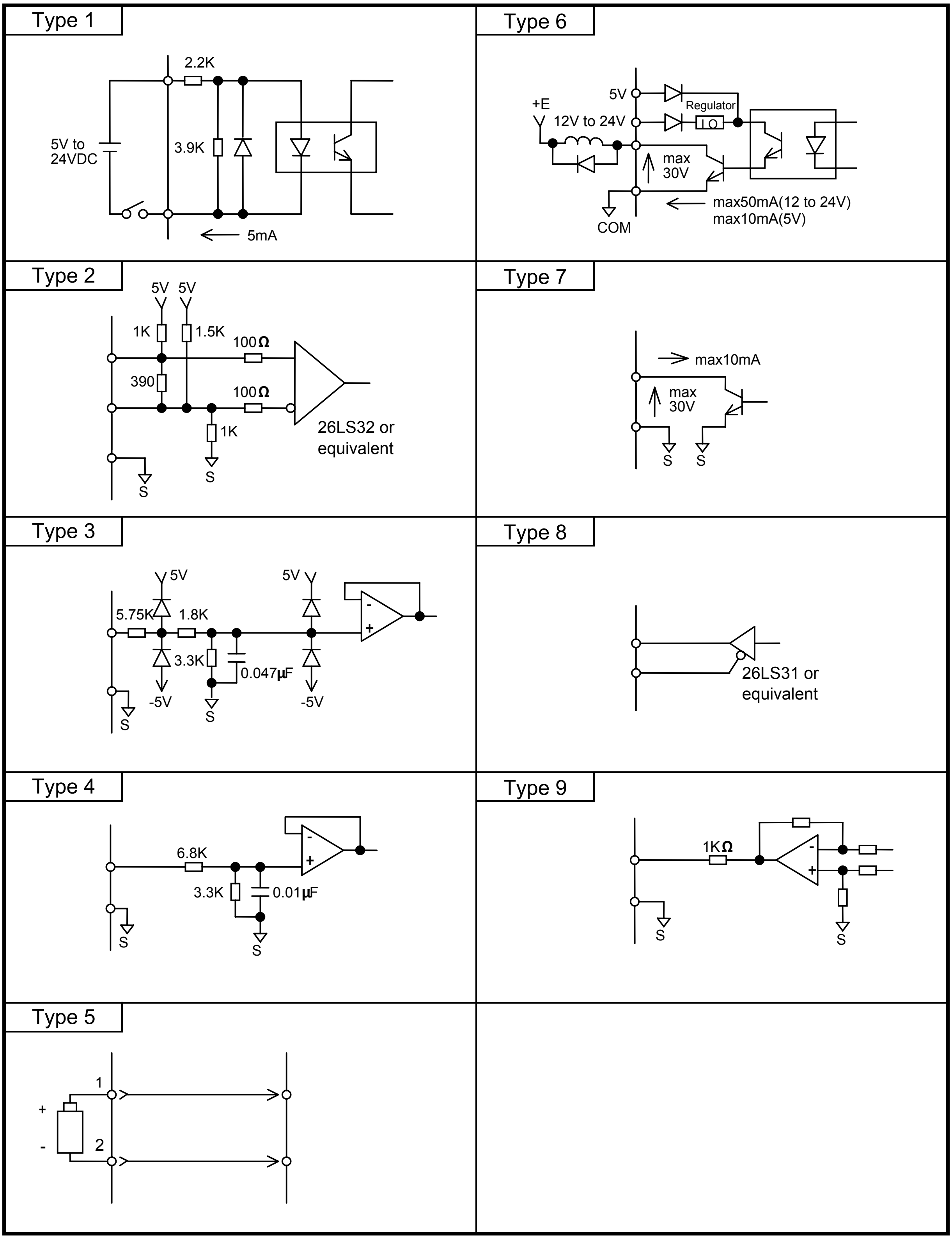


Fig. 9-20

Table 9-6 General Specifications of Velocity Control Type Input Signal (Wiring-saved Incremental Encoder) 1/2

<table>
<tr><th>Signal name</th><th>Abbr.</th><th>Pin No.
* 1</th><th>Circuit type
* 2</th><th colspan="2">General specification</th></tr>
<tr><td>Speed command</td><td>VCMD</td><td>21 (20)</td><td>Type 3</td><td colspan="2">With a ±2 V input, the velocity becomes 1000 min^{-1} in the standard setting (maximum input voltage ±10 V).</td></tr>
<tr><td>Torque compen-sation / Torque command</td><td>TCOMP / TCMD</td><td>22 (20)</td><td>Type 3</td><td colspan="2">With a ±2 V input, the velocity becomes the rated one (TR) and is limited to the instantaneous maximum stall torque.</td></tr>
<tr><td>Servo ON</td><td>SON</td><td>37 (23)</td><td>Type 1</td><td colspan="2">Servo ON status is provided by closing the contact and entering the velocity command input (VCMD) waiting status.</td></tr>
<tr><td>Alarm reset</td><td>RST</td><td>30 (23)</td><td>Type 1</td><td colspan="2">With this signal input, alarm code or alarm bit outputs and error display are reset.</td></tr>
<tr><td>Forward revolution current limit</td><td>PIL</td><td>18 (17)</td><td>Type 4</td><td>The current is limited to the rated current at +2 V (effective when ILM is input).</td><td rowspan="2">To enable the external current limit, Func1 bit10 must be set at "1".</td></tr>
<tr><td>Backward revolution current limit</td><td>NIL</td><td>19 (17)</td><td>Type 4</td><td>The current is limited to the rated current with -2 V (effective when ILM is input).</td></tr>
<tr><td>Current limit permit</td><td>ILM</td><td>31 (23)</td><td>Type 1</td><td colspan="2">The current is limited by closing the contact.
It is ineffective during JOG or overtravel (The limit method is based on the Func1 parameter).</td></tr>
<tr><td>Forward revolution overtravel
Backward revolution overtravel</td><td>PROT
NORT</td><td>32 (23)
33 (23)</td><td>Type 1</td><td colspan="2">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 an a-contact input by setting the remote operator.)</td></tr>
<tr><td>Proportional control (standard)</td><td>PCON</td><td rowspan="3">35 (50)
36 (23)</td><td rowspan="3">Type 1
One of the three functions can be selected by setting the remote operator.</td><td colspan="2">When the motor drifts during a long stop time due to command input zero, inputting this signal stops the motor by friction torque.</td></tr>
<tr><td>Zero clamp</td><td>ZCMD</td><td colspan="2">Inputting this signal makes the speed command 0 (zero).</td></tr>
<tr><td>Internally set velocity select</td><td>VCS2/
VCS1</td><td colspan="2">Combining CN1 - 35 and 36 input signals enables a desired internally set velocity to be selected.</td></tr>
<tr><td>Input sequence power supply 1</td><td>5 to 24 VDC</td><td>23</td><td>——</td><td colspan="2">External power supply for CN1-30, 31, 32, 33, 36 and 37.</td></tr>
<tr><td>Internal velocity command revolution direction</td><td>ROTS</td><td>34 (50)</td><td>Type 1</td><td colspan="2">This signal specifies the revolution direction when the internal velocity command is turned on.</td></tr>
</table>

*1 The pin numbers in parentheses denote the ground or common side of each signal.

*2 For the circuit type, see Fig. 9-20.

9. SPECIFICATIONS

Table 9-6 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	2 V±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	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 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, $\overline{A}$ 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).
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	49	——	External power supply for CN1-39, 40, 41, 42, 43, 44,45 and 46.
	5 V	38		

*1 The pin numbers in parentheses denote the ground or common side of each signal.
*2 For the circuit type, see Fig. 9-20.

The output contents depend on the Func4 parameter setting.

(5) General Specifications of CN1 Input/Output Signals (Absolute Encoder)

This section explains the general specification of CN1 input/output signals of the velocity control type.

Table 9-7 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 compensation / 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 +2 V (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 -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 the Func1 parameter).	
Forward revolution overtravel Backward revolution overtravel	PROT NORT	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) 36 (23)	Type 1 [One of the 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			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. 9-20.

Table 9-7 General Specifications of Velocity Control Type Input 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±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	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, $\overline{A}$ 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	$\overline{PS}$ PS	9 10	Type 8	The absolute value signal is output in serial form (9600 bps or 1 M/2 Mbps) 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 5 V	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. 9-20.

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.

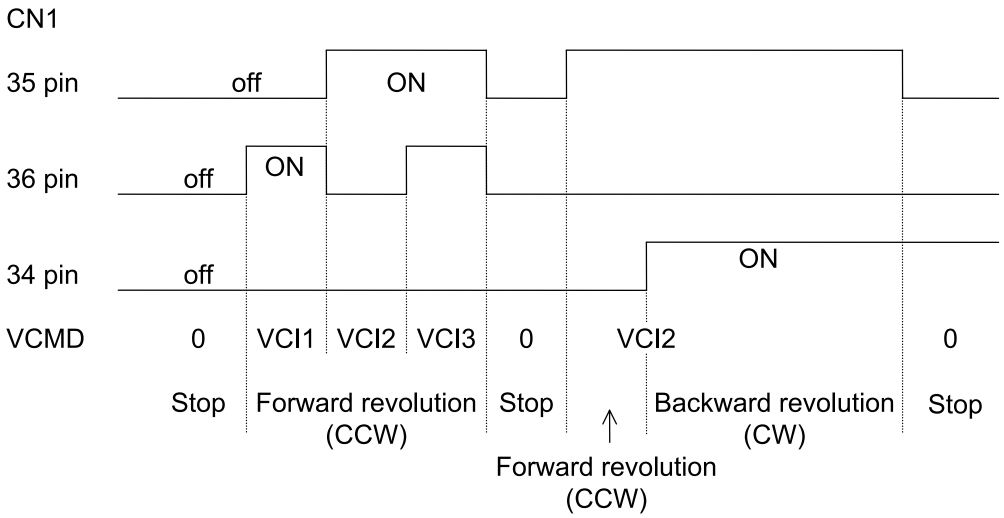
Switching pattern	OFF	ON
Velocity ↔ Torque	Velocity	Torque
Position ↔ Torque	Position	Torque
Position ↔ Velocity	Position	Velocity

9.1.10.2 Precautions

- Take utmost care in switching.
- As long as the test mode (JOG or Tune) is turned on, switching of the control mode is not available.
- When switching from velocity or position control to torque control takes place, the velocity will be limited according to the value set on the parameter (Mode 1 Page 6).
  (As the motor speed exceeds the predetermined maximum 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 condition) to prevent motor runaway.
  This function, however, is not capable of running the motor at a constant speed.
  If a relatively small value is specified as the maximum speed limit, and if the torque command value is large relative to the load inertia and load torque, the motor speed may exceed the before mentioned speed limit. Do not use the motor in this situation over a long time. When you don't turn on the speed limit, the maximum speed will be set at 32767 min^{-1}.
- Note that there is 12 msec maximum delay from changing the input signal to completion of control mode switching.
- As long as switching of the control mode is taking place (input signal is turned 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.

9.1.12 Power Supply Capacity

Table 9-8 shows the input power supply capacity under load at the rated output (200 VAC,400VAC).

Table 9-8 Power Supply Capacity

Amplifier model No.	Motor model No.	Main circuit power supply (KVA)	Amplifier model No.	Motor model No.	Main circuit power supply (KVA)
PQM1A015	P10B10030H	1.0	PQM1A100	P10B18200H	4.0
	P30B04003D	0.2		P10B18350B	5.8
	P30B04005D	0.2		P10B18450B	7.5
	P30B04010D	0.3		P20B10200D	4.0
	P30B06020D	0.5		P20B10250D	4.2
	P50B03003D	0.2		P20B13300D	5.0
	P50B04006D	0.3		P20B10250H	4.2
	P50B04010D	0.4		P20B13300H	5.0
	P50B05005D	0.3		P50B13400H	6.7
	P50B05010D	0.4		P60B13200H	5.0
	P50B05020D	0.8		P60B18200H	5.0
	P50B07020D	0.8		P80B22250H	5.9
PQM1A030	P10B10075H	1.9	PQM1A150	P10B18350H	5.8
	P10B13050H	1.3		P10B18450R	7.5
	P10B13050B	1.3		P10B18550M	9.2
	P10B13100B	2.5		P20B13400D	6.7
	P20B10100H	2.5		P20B13500D	8.3
	P30B06040D	1.0		P60B15300H	8.3
	P30B08075D	1.7		P60B18350H	6.9
	P50B07040D	1.3		P60B18450R	7.4
	P50B08040D	1.3		P60B18550R	8.4
	P50B08050D	1.5		P60B22550M	10.1
	P50B08075H	2.0		P60B22700S	12.2
	P50B08100H	2.2		P80B22350H	7.4
	P60B13050H	1.4	PQM1A300	P60B18750R	12.6
PQM1A050	P10B13100H	2.5		P60B2211KB	15.7
	P10B13150H	3.0		P60B2215KB	21.4
	P10B13150B	3.0	PQM1B600	P60B2220KB	28.0
	P20B18200B	4.0		P60B2820KM	28.0
	P20B10100D	2.5		P60B2825KM	35.0
	P20B10150D	3.0		P60B2830KM	42.4
	P20B10150H	3.0	PQM1B900	P60B2837KB	51.8
	P20B10200H	4.0	PQM1D600	P60B2845KE	63.0
	P50B08075D	2.0	PQM1D800	P60B3255KE	77.0
	P50B08100D	2.5		P60B3275KE	105.0
	P60B13100H	2.5			
	P60B13150H	3.9			

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 9-9 Rush Current

Power supply unit model name	Control circuit (maximum value within 1 mS after power on)	Main circuit (maximum value within 1200mS after power on)
PQM0PA7R8	40A (0-P)	18A (0-P)
PQM0PA120	40A (0-P)	18A (0-P)
PQM0PA160	40A (0-P)	18A (0-P)
PQM0PA270	40A (0-P)	72A (0-P)
PQM0PA370	40A (0-P)	72A (0-P)
PQM0PC750	40A (0-P)	144A (0-P)

9.1.13 Servo Amplifier / Servomotor Leakage Current

Since the Servo 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 9-10 Leakage Current

Motor model No.	Leakage current per motor
PQM1◇015	3 mA
PQM1◇030	
PQM1◇050	
PQM1◇100	
PQM1◇150	
PQM1◇300	4 mA
PQM1◇600	6 mA
PQM1◇900	10 mA
PQM◇600 (400V type)	10 mA
PQM◇800 (400V type)	10 mA

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 9-10 are those measured with an ordinary leak checker with filter 700 Hz).

9.1.14 Calorific Value

Radiator duct cooling system is employed in the power supply unit and Servo Amplifier, and so, it is easy to downsize and seal the board.
Table 9-11 shows the calorific values of the Amplifier under the rated load.

Table 9-11 Calorific Values of Servo Amplifiers (1/2)

Amplifier model No.	Total calorific values of Servo Amplifier & power supply unit (W)	Calorific values at the fixing site (W)	Calorific values at the duct cooling site (W)
P10B10030H	31	8	23
P30B04003D	15	4	11
P30B04005D	17	4	13
P30B04010D	19	5	14
P30B06020D	26	6	20
P50B03003D	15	4	11
P50B04006D	16	4	12
P50B04010D	18	4	14
P50B05005D	17	4	13
P50B05010D	19	5	14
P50B05020D	23	6	17
P50B07020D	27	7	20
P50B07030D	21	5	16
P10B10075H	51	13	38
P10B13050H	41	10	31
P10B13050B	34	18	26
P10B13100B	52	12	39
P20B10100H	46	11	35
P30B06040D	31	8	23
P30B08075D	16	4	12
P50B07040D	33	8	25
P50B08040D	35	9	26
P50B08050D	40	10	30
P50B08075H	42	10	32
P50B08100H	47	12	35
P60B13050H	44	11	33
P80B15075H	51	13	38
P10B13100H	95	24	71
P10B13150H	130	32	98
P10B13150B	90	22	68
P10B18200B	120	30	90
P20B10100D	80	20	60
P20B10150D	100	25	75
P20B10150H	85	21	64
P20B10200H	105	26	79
P50B08075D	70	17	53
P50B08100D	80	20	60
P60B13100H	90	22	68
P60B13150H	110	27	83
P80B18120H	120	30	90
P10B18200H	170	42	128
P10B18350B	195	49	146
P10B18450B	220	55	165
P20B10200D	165	59	124
P20B10250D	170	42	128
P20B13300D	175	44	131
P20B10250H	125	31	94
P20B13300H	165	41	124
P20B13400H	195	49	146
P60B13200H	160	40	120

Table 9-11 Calorific Values of Servo Amplifiers (2/2)

Amplifier model No.	Total calorific values of Servo Amplifier & power supply unit (W)	Calorific values at the fixing site (W)	Calorific values at the duct cooling site (W)
P60B18200H	150	37	113
P80B22250H	220	55	165
P80B22350R	200	50	150
P10B18350H	240	60	180
P10B18450R	280	70	210
P10B18550M	275	69	206
P20B13400D	20	60	180
P20B13500D	260	65	195
P20B13500H	245	61	184
P60B15300H	250	62	188
P60B18350H	260	65	195
P60B18450R	260	65	195
P60B18550R	335	84	251
P60B22550M	310	77	233
P60B22700S	350	87	263
P80B22350H	240	60	180
P80B22450R	260	65	195
P60B18750R	620	155	465
P60B2211KB	58-	145	435
P60B2215KB	750	187	563
P60B2220KB	885	265	720
P60B2820KM	780	234	546
P60B2825KM	840	252	588
P60B2830KM	960	288	672

1 Since the values in the table do not include the calorific values of an external regenerative resistor, change the addition term of the external regenerative resistor calorific value depending on the installation place.

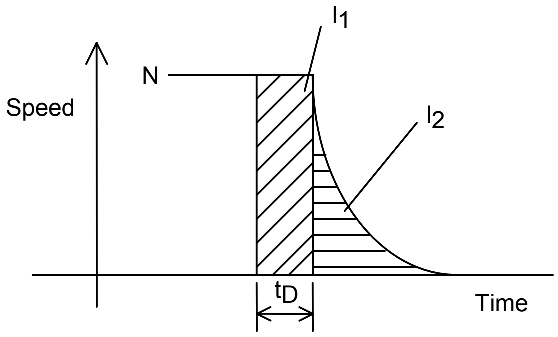
2 Regarding installation, strictly observe the installation procedure described in "5. Installation".

9. SPECIFICATIONS

9.1.15 Dynamic Brake

Dynamic brake is built-in in the Servo Amplifier for emergency stop, and is activated when alarm is detected.
The following shows the characteristics and allowable frequency of the dynamic brake.

(1) Slowing-down revolution angle by dynamic brake



N : Motor speed (min^{-1})
I_1 : Slowing-down revolution angle (rad) by AMP internal processing time t_D.
I_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. 9-21

[Standard expression] Supposing the load torque (T_L) is zero

$$I = I_1 + I_2$$

$$= \frac{2\pi N \cdot t_D}{60} + (J_m + J_L) \times (\alpha N + \beta N^3) \times 2$$

I : Overall slowing-down revolution angle (rad)
J_m : Motor inertia ($kg \cdot m^2$)
J_L : Load inertia (calculated in terms of motor shaft) ($kg \cdot m^2$)
$\alpha \cdot \beta$: Constant related to motor. See Table 9-14.

[Standard expression] Supposing the load torque $T_L = T_L$.

$$I_3 = \frac{1}{2} (J_m + J_L) \left(\frac{2\pi}{60} N \right)^2 \times \frac{1}{T_L}$$

$$I = I_1 + \frac{I_2 \cdot I_3}{I_2 + I_3}$$

T_L : Load Torque ($N \cdot m$)

Table 9-12 Dynamic brake operation delay time

Amplifier model No.	Delay time t_D (S)
PQM1A015	6.5×10^{-3}
PQM1A030	6.5×10^{-3}
PQM1A050	12.0×10^{-3}
PQM1A100	12.0×10^{-3}
PQM1A150	12.0×10^{-3}
PQM1A300	12.0×10^{-3}

(2) Instantaneous resistance of dynamic brake

When the load inertia (J_L) substantially exceeds the applicable load inertia, dynamic brake resistance may abnormally increase, and built-in thermal fuse may break, causing resetting impossible. Consult with us if such operating conditions are assumed.
The energy E_{RD} consumed by the dynamic brake operation at a single time is represented by the following expression. Make sure to keep E_{RD} below the value shown in the table 9-13.

$$E_{RD} = \frac{2.5}{R\phi + 2.5} \times \left\{ \frac{1}{2} (J_m + J_L) \times \left(\frac{2\pi}{60} N \right)^2 - I \cdot T_L \right\}$$

$R\phi$: Motor phase winding resistance (Ω)
J_m : Motor inertia ($kg \cdot m^2$)
J_L : Load inertia (calculated in terms of motor shaft) ($kg \cdot m^2$)
N : Motor speed at the feed speed V (min^{-1})
I : Overall slowing-down revolution angle (rad)
T_L : Load torque ($N \cdot m$)

Table 9-13

<table>
<tr><th>Amplifier model No.</th><th>E_{RD} (J)</th></tr>
<tr><td>PQM1A015</td><td>360</td></tr>
<tr><td>PQM1A030</td><td>360</td></tr>
<tr><td>PQM1A050</td><td rowspan="3">3700</td></tr>
<tr><td>PQM1A100</td></tr>
<tr><td>PQM1A150</td></tr>
<tr><td>PQM1A300</td><td>16900</td></tr>
</table>

(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.
>
> $$\frac{\text{6 minutes}}{(\text{Rated motor speed/ Maximum motor speed when operating})^2}$$

(4) Dynamic brake constant table

Table 9-14 Dynamic Brake Constant Table

Amplifier model No.	Motor model No.	α	β	J_M(kg-m^2)
PQM1A015	P10B10030H	4.5	3.52×10^{-7}	3.9×10^{-4}
	P30B04003D	122.6	67.4×10^{-7}	0.024×10^{-4}
	P30B04005D	70.73	41.7×10^{-7}	0.031×10^{-4}
	P30B04010D	26.38	13.8×10^{-7}	0.051×10^{-4}
	P30B06020D	12.99	20.1×10^{-7}	0.144×10^{-4}
	P50B03003D	183.9	10.2×10^{-7}	0.02×10^{-4}
	P50B04006D	47.18	8.94×10^{-7}	0.054×10^{-4}
	P50B04010D	28.81	5.64×10^{-7}	0.079×10^{-4}
	P50B05005D	63.39	25.5×10^{-7}	0.060×10^{-4}
	P50B05010D	24.32	10.0×10^{-7}	0.098×10^{-4}
	P50B05020D	10.25	4.42×10^{-7}	0.173×10^{-4}
	P50B07020D	13.48	7.08×10^{-7}	0.398×10^{-4}
	P50B07030D	7.59	5.06×10^{-7}	0.507×10^{-4}
PQM1A030	P10B10075H	1.7	0.88×10^{-7}	14×10^{-4}
	P10B13050H	2.37	1.93×10^{-7}	12×10^{-4}
	P10B13050B	1.67	2.78×10^{-7}	12×10^{-4}
	P10B13100B	0.75	1.24×10^{-7}	25×10^{-4}
	P20B10100H	1.66	4.19×10^{-7}	1.55×10^{-4}
	P30B06040D	4.42	7.95×10^{-7}	0.255×10^{-4}
	P30B08075D	2.98	4.40×10^{-7}	0.635×10^{-4}
	P50B07040D	5.79	2.42×10^{-7}	0.74×10^{-4}
	P50B08040D	6.49	3.45×10^{-7}	0.828×10^{-4}
	P50B08050D	4.91	1.69×10^{-7}	1.17×10^{-4}
	P50B08075H	2.41	1.04×10^{-7}	1.93×10^{-4}
	P50B08100H	1.51	0.73×10^{-7}	2.66×10^{-4}
	P60B13050H	2.39	5.64×10^{-7}	2.8×10^{-4}
	P80B15075H	1.55	4.06×10^{-7}	5.3×10^{-4}
PQM1A050	P10B13100H	1.69	0.55×10^{-7}	25×10^{-4}
	P10B13150H	1.45	1.89×10^{-7}	35×10^{-4}
	P10B13150B	0.59	0.73×10^{-7}	35×10^{-4}
	P10B18200B	0.54	0.58×10^{-7}	73×10^{-4}
	P20B10100D	3.34	2.16×10^{-7}	1.55×10^{-4}
	P20B10150D	2.19	1.26×10^{-7}	2.04×10^{-4}
	P20B10150H	1.44	1.59×10^{-7}	2.04×10^{-4}
	P20B10200H	1.28	1.11×10^{-7}	2.83×10^{-4}
	P50B08075D	4.61	0.59×10^{-7}	1.93×10^{-4}
	P50B08100D	2.99	0.36×10^{-7}	2.66×10^{-4}
	P60B13100H	1.56	1.43×10^{-7}	5.6×10^{-4}
	P60B13150H	1.07	0.72×10^{-7}	8.3×10^{-4}
	P80B18120H	1.62	2.48×10^{-7}	12.1×10^{-4}
PQM1A100	P10B18200H	1.28	1.11×10^{-7}	73×10^{-4}
	P10B18350B	0.55	0.12×10^{-7}	144×10^{-4}
	P10B18450B	0.32	0.09×10^{-7}	206×10^{-4}
	P20B10200D	4.17	0.35×10^{-7}	2.83×10^{-4}
	P20B10250D	2.85	0.32×10^{-7}	3.71×10^{-4}
	P20B13300D	2.01	0.30×10^{-7}	7.14×10^{-4}
	P20B10250H	1.41	0.58×10^{-7}	3.71×10^{-4}
	P20B13300H	1.30	0.44×10^{-7}	7.14×10^{-4}
	P20B13400H	1.09	0.25×10^{-7}	9.79×10^{-4}
	P60B13200H	1.70	0.26×10^{-7}	12.1×10^{-4}
	P60B18200H	1.48	0.41×10^{-7}	22.1×10^{-4}
	P80B22250H	1.83	0.45×10^{-7}	27.1×10^{-4}
	P80B22350R	0.76	0.27×10^{-7}	43.1×10^{-4}
PQM1A150	P10B18350H	0.95	0.07×10^{-7}	144×10^{-4}
	P10B18450R	0.60	0.05×10^{-7}	206×10^{-4}
	P10B18550M	0.25	0.04×10^{-7}	330×10^{-4}
	P20B13400D	2.09	0.13×10^{-7}	9.79×10^{-4}
	P20B13500D	1.52	0.08×10^{-7}	12.58×10^{-4}
	P20B13500H	1.12	0.13×10^{-7}	12.58×10^{-4}
	P60B15300H	1.74	0.12×10^{-7}	20.1×10^{-4}
	P60B18350H	1.42	0.13×10^{-7}	34.1×10^{-4}
	P60B18450R	0.74	0.12×10^{-7}	47.1×10^{-4}
	P60B18550R	0.57	0.05×10^{-7}	61.9×10^{-4}
	P60B22550M	0.43	0.12×10^{-7}	90.1×10^{-4}
	P60B22700S	0.15	0.06×10^{-7}	177.0×10^{-4}
	P80B22350H	1.28	0.17×10^{-7}	43.1×10^{-4}
	P80B22450R	0.71	0.16×10^{-7}	58.1×10^{-4}
PQM1A300	P60B18750R	0.95	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 Ω.

9.1.16 Regenerative Processing Capacity

This power supply unit has a built-in regenerative circuit. Therefore, the regenerative processing capacity is determined by allowable power of the external regenerative resistor. Make sure to keep PM<PR (allowable power of regenerative resistor), after calculating regenerative power PM.
The following shows how to calculate regenerative power PM.

(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

$$EM = EHb = \frac{1}{2} \times N \times 3 \cdot KE\phi \times \frac{Tb}{KT} \times tb - \left(\frac{Tb}{KT}\right)^2 \times 3 \cdot R\phi \times tb$$

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}]
Rϕ	:	Armature resistance	[Ω] (motor constant)
tb	:	Deceleration time	[s]
Tb	:	Torque at deceleration	[N•m] (Tb = Tc – TF)
Tc	:	Acceleration/deceleration torque	[N•m]
TF	:	Friction torque	[N•m]

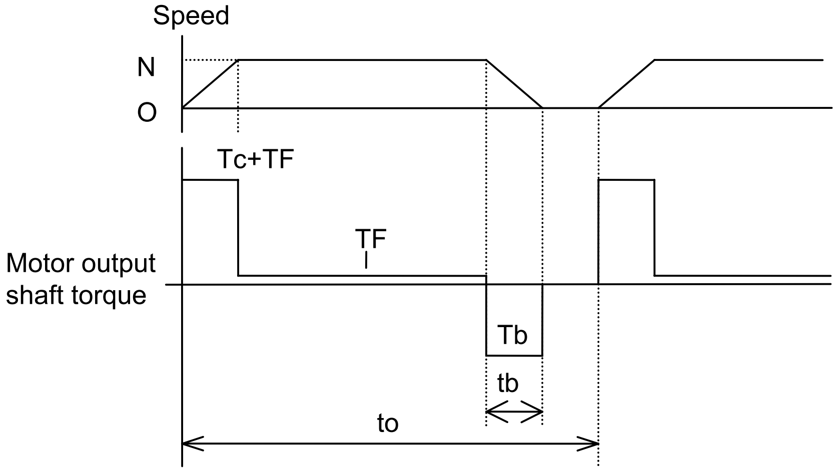


Fig. 9-22 (1)

② For vertical shaft driving (when a gravitational load is applied)

EM = EVUb + EVD + EVDb

$$= \frac{1}{2} \times N \times 3 \cdot KE\phi \times \frac{TUb}{KT} \times tUb - (\frac{TUb}{KT})^2 \times 3 \cdot R\phi \times tUb$$

$$+ N \times 3 \cdot KE\phi \times \frac{TD}{KT} \times tD - (\frac{TD}{KT})^2 \times 3 \cdot R\phi \times tD$$

$$+ \frac{1}{2} \times N \times 3 \cdot KE\phi \times \frac{TDb}{KT} \times tDb - (\frac{TDb}{KT})^2 \times 3 \cdot R\phi \times tDb$$

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 EVUb, EVD or EVDb becomes negative as a result of calculation, calculate EM after changing the value 0.

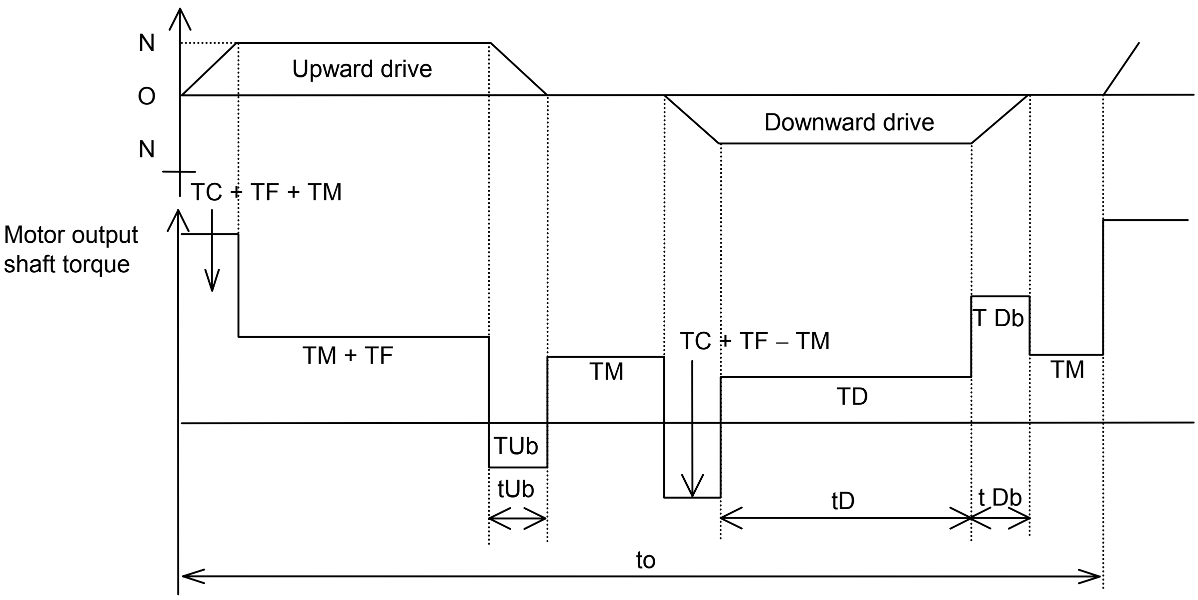


Fig. 9-22 (2)

Step 2 : Calculate the effective regenerative power

Based on the calculation of effective regenerative power, check the regenerative capacity of 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]

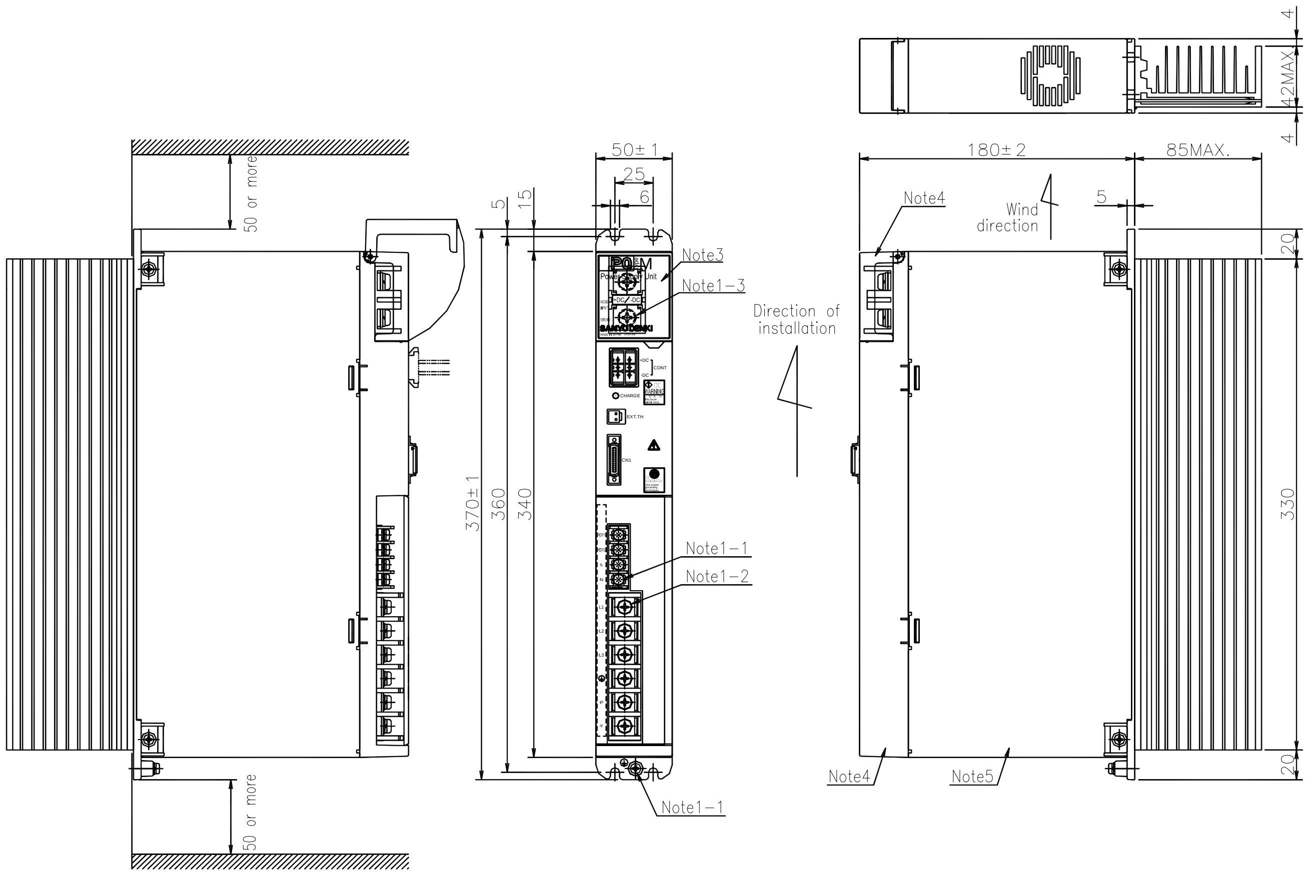
Refer to Table 9-15, External regenerative resistor combination table, for allowable effective power of external regenerative resistor.

9. SPECIFICATIONS

9.2 External Views

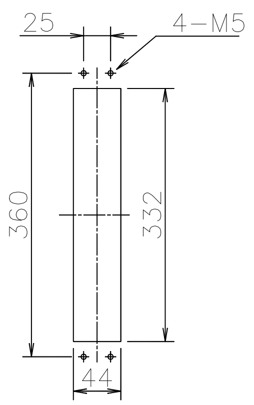
9.2.1 Power Supply Unit

PQM0PA7R8

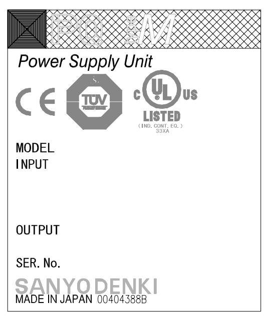


Note1-1 Terminal screw : M4
Tightening torque : 1.2 N・m
Note1-2 Terminal screw : M5
Tightening torque : 2.0 N・m
Note1-3 Terminal screw : M6
Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate

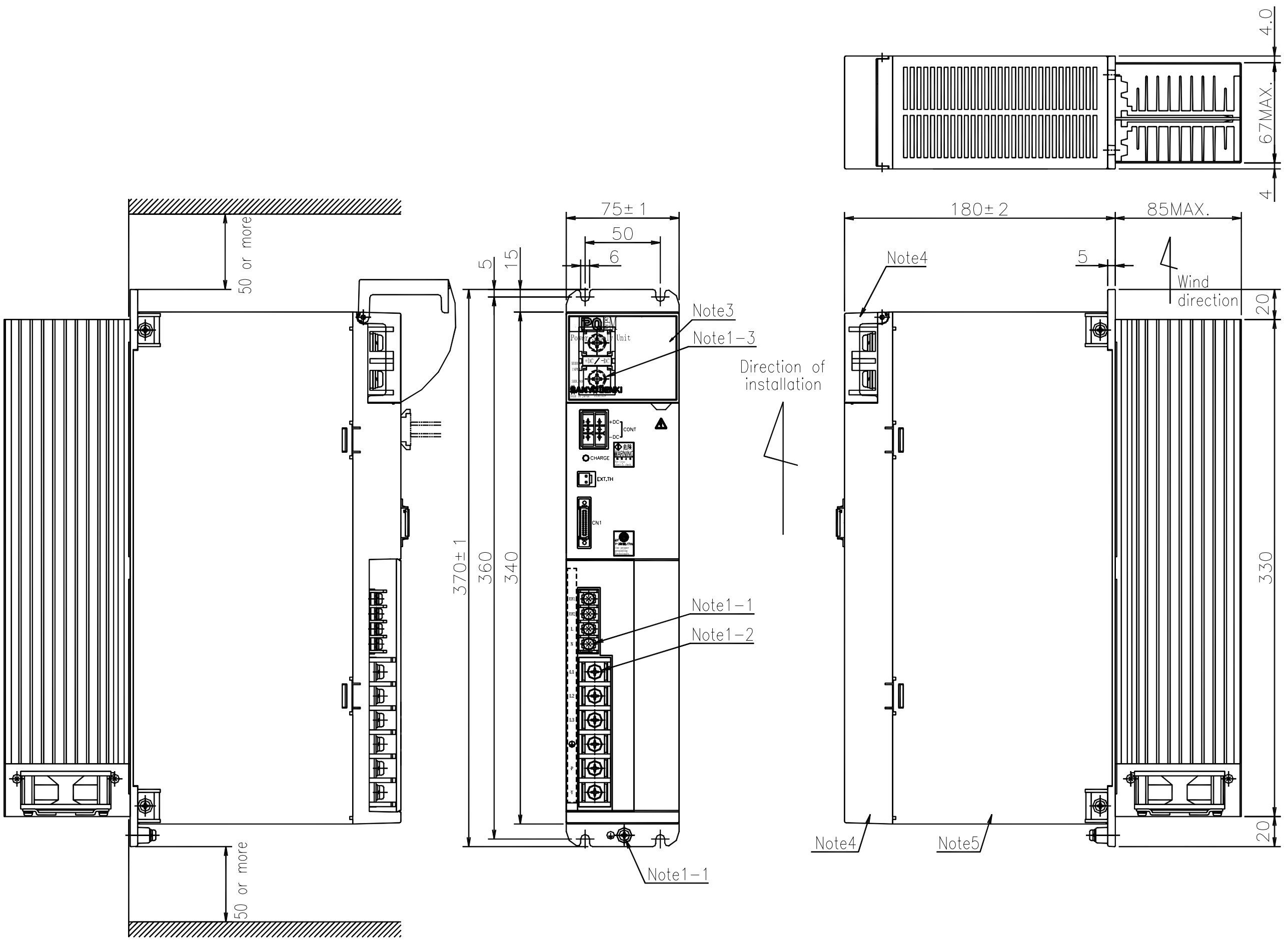


Note 4 Cover material : Resin

Note 5 Body material : SPCC / black chromated

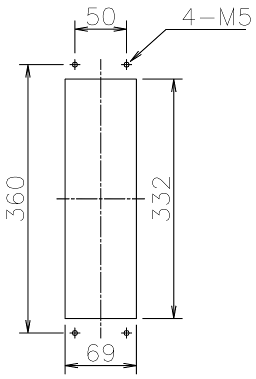
9. SPECIFICATIONS

PQM0PA120
PQM0PA160

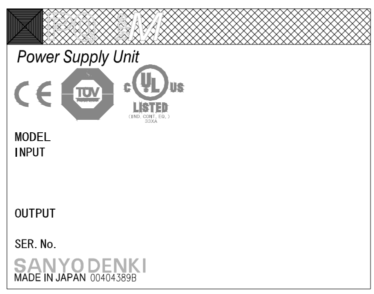


Note1-1 Terminal screw : M4
Tightening torque : 1.2 N･m
Note1-2 Terminal screw : M5
Tightening torque : 2.0 N･m
Note1-3 Terminal screw : M6
Tightening torque : 2.5 N･m

Note 2 Mounting panel working drawing



Note 3 Main nameplate

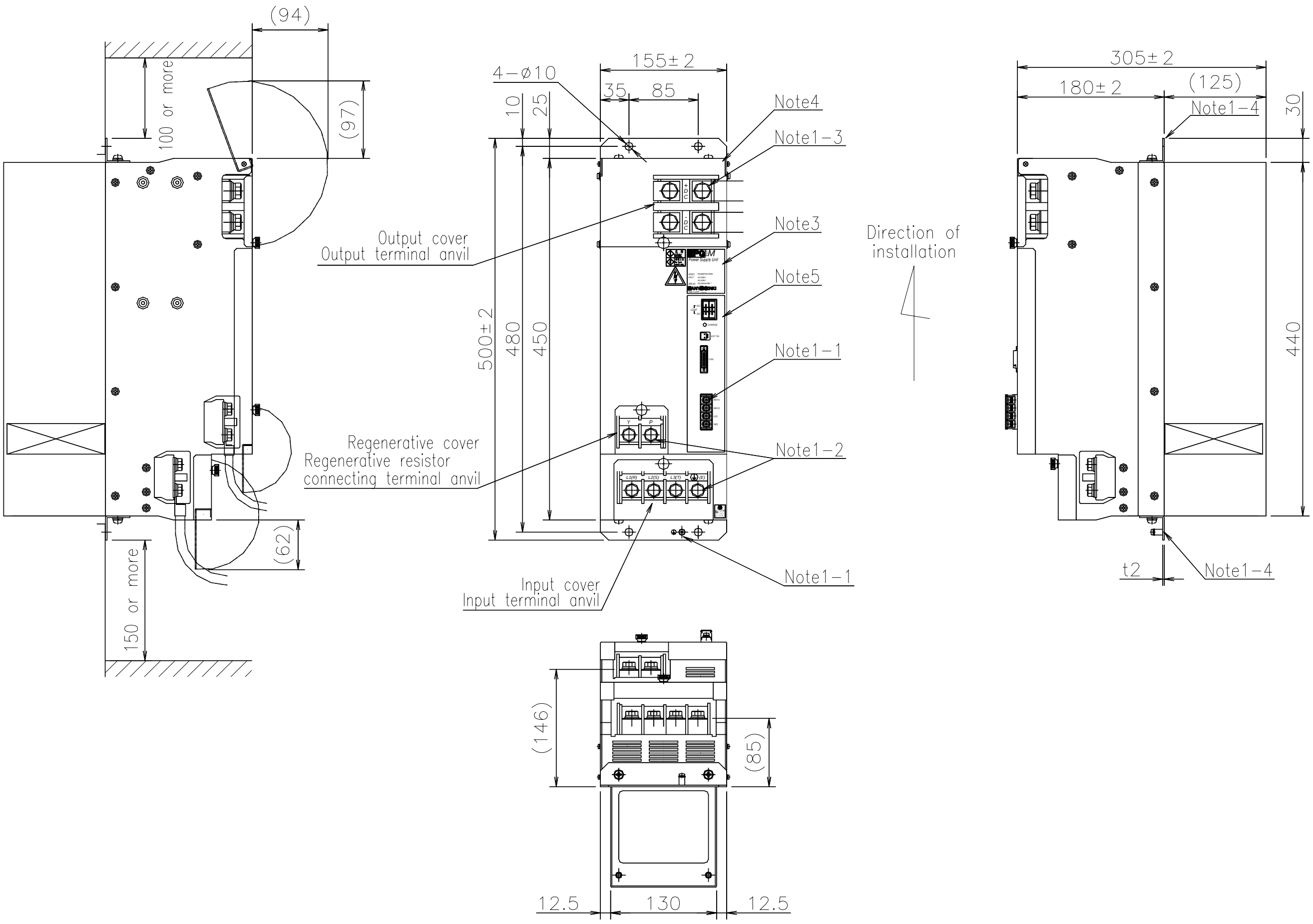


Note 4 Cover material : Resin

Note 5 Body material : SPCC / black chromated

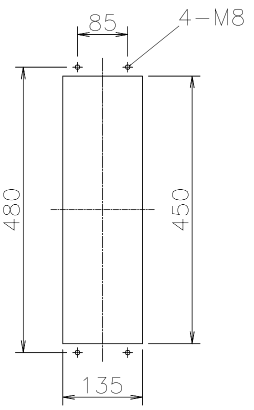
9. SPECIFICATIONS

PQM0PA270

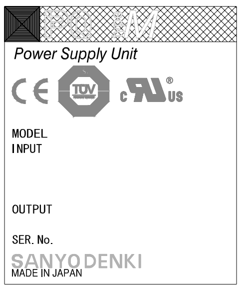


Note1-1　Terminal screw : M4
　　　　Tightening torque : 1.2 N･m
Note1-2　Terminal screw : M5
　　　　Tightening torque : 2.0 N･m
Note1-3　Terminal screw : M6
　　　　Tightening torque : 2.5 N･m
Note1-4　Screw for L-shaped mounting metal : M6
　　　　Tightening torque : 5 N･m

Note 2　Mounting panel working drawing



Note 3　Main nameplate

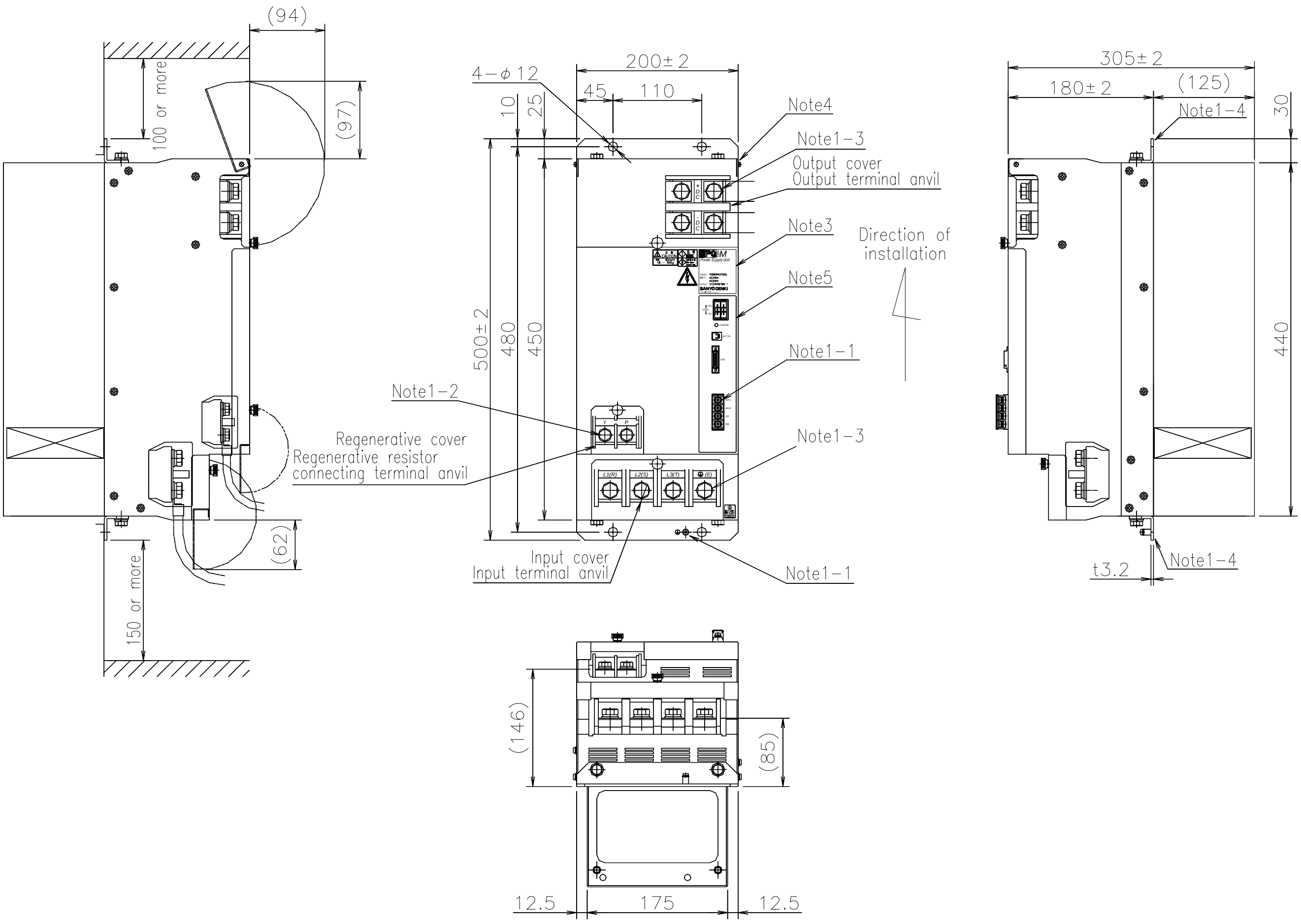


Note 4　Body material : SPCC / black chromated

Note 5　Front panel : Resin sheet

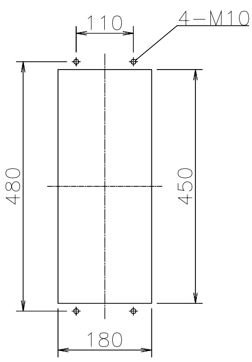
9. SPECIFICATIONS

PQM0PA370

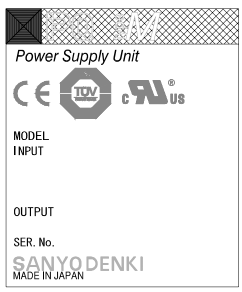


Note1-1 Terminal screw : M4
Tightening torque : 1.2 N・m
Note1-2 Terminal screw : M8
Tightening torque : 9.0 N・m
Note1-3 Terminal screw : M10
Tightening torque :15 N・m
Note1-4 Screw for L-shaped mounting metal : M8
Tightening torque : 12 N・m

Note 2 Mounting panel working drawing



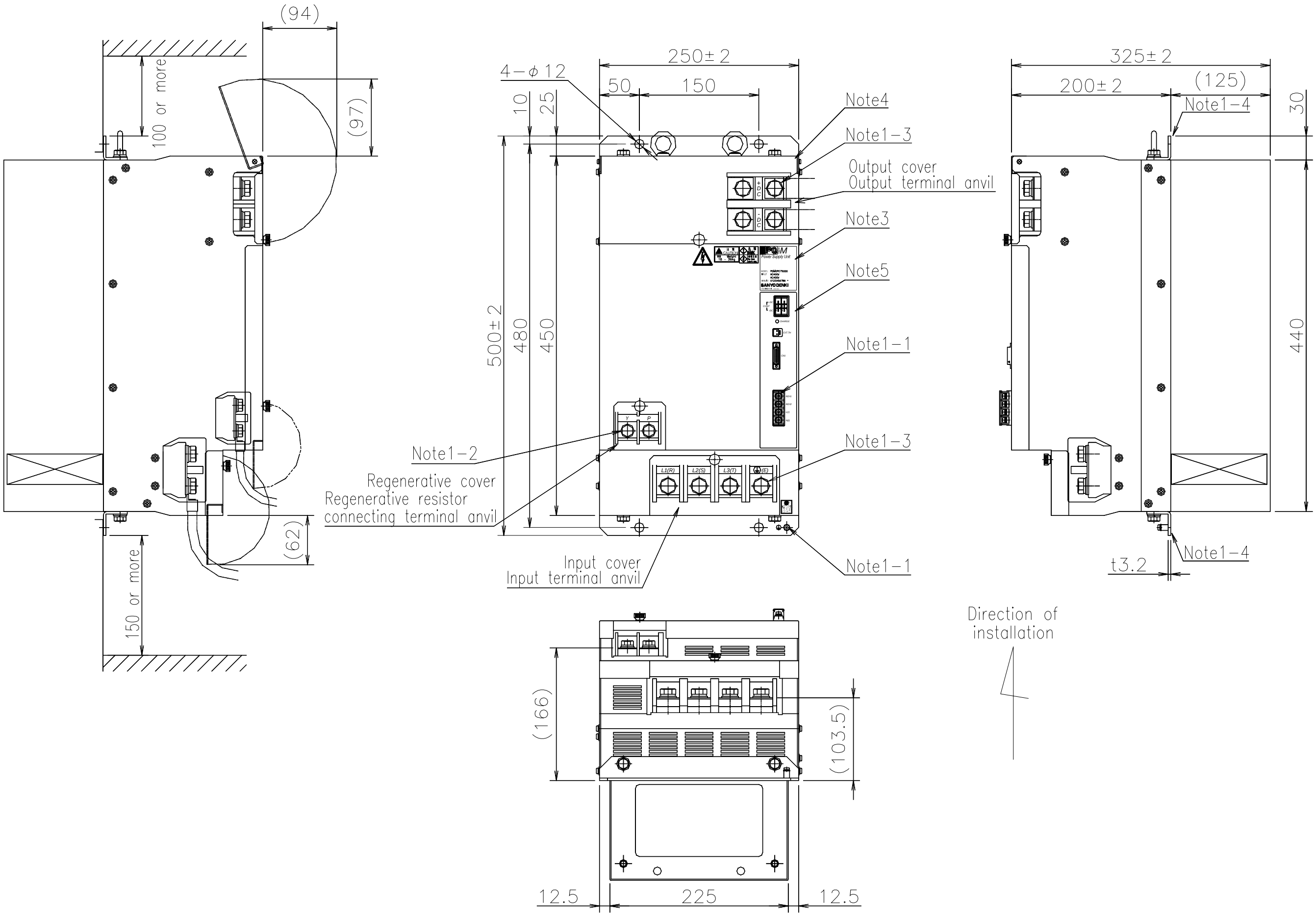
Note 3 Main nameplate



Note 4 Body material : SPCC / black chromated

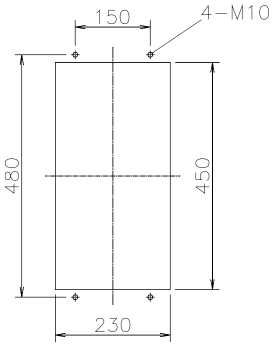
Note 5 Front panel : Resin sheet

PQM0PC750

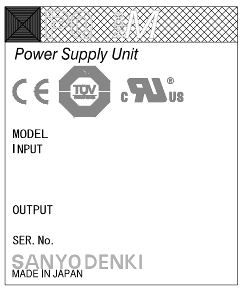


Note1-1　Terminal screw : M4
　　　　Tightening torque : 1.2 N･m
Note1-2　Terminal screw : M8
　　　　Tightening torque : 9.0 N･m
Note1-3　Terminal screw : M10
　　　　Tightening torque :15 N･m
Note1-4　Screw for L-shaped mounting metal : M8
　　　　Tightening torque : 12 N･m

Note 2　Mounting panel working drawing



Note 3　Main nameplate



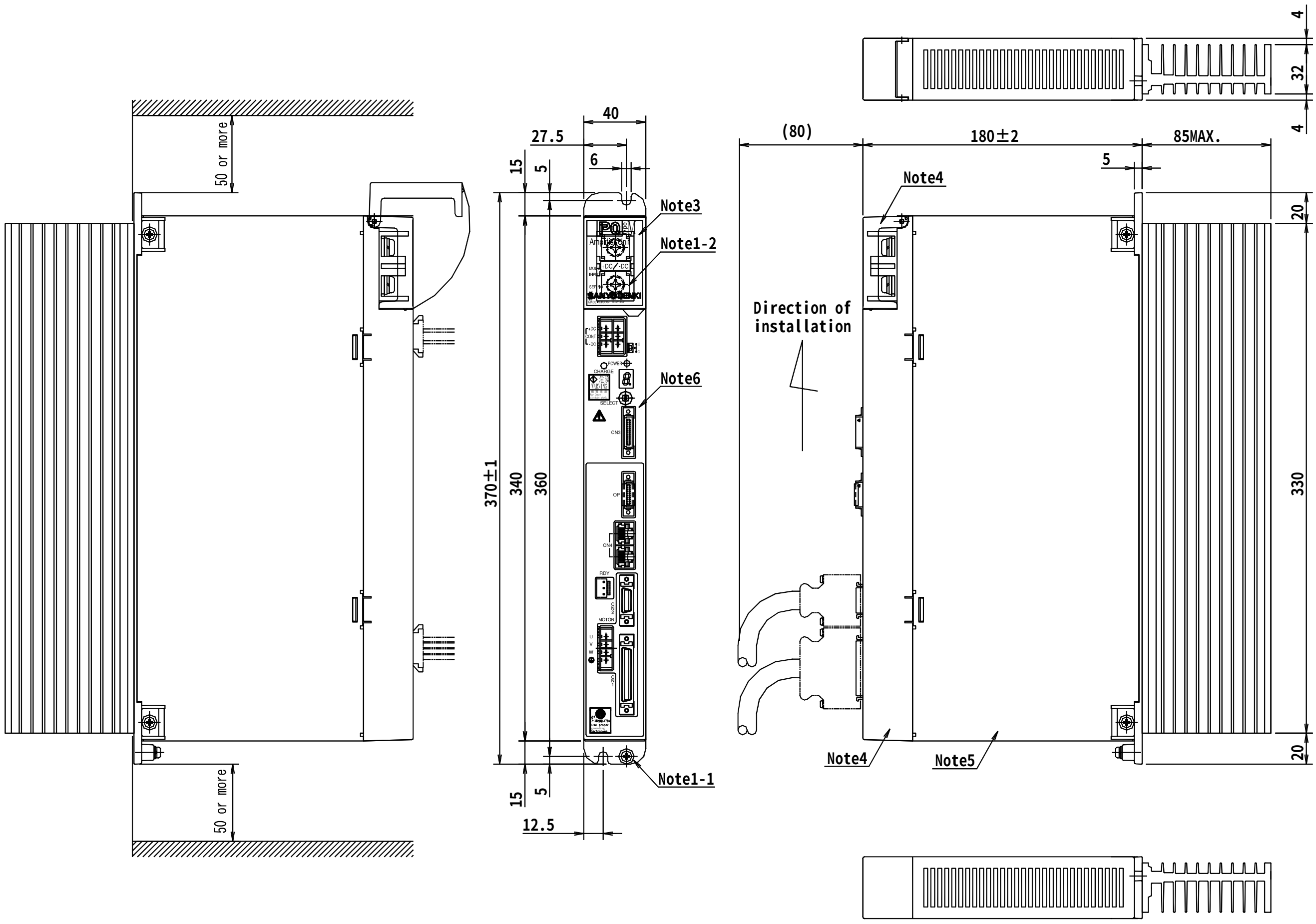
Note 4　Body material : SPCC / black chromated

Note 5　Front panel : Resin sheet

9. SPECIFICATIONS

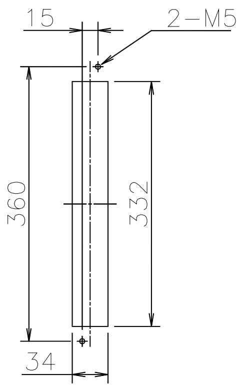
9. 2. 2 Servo Amplifier

PQM1A015
PQM1A030

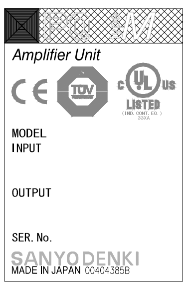


Note1-1 Terminal screw : M4
Tightening torque : 1.2 N・m
Note1-2 Terminal screw : M6
Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate



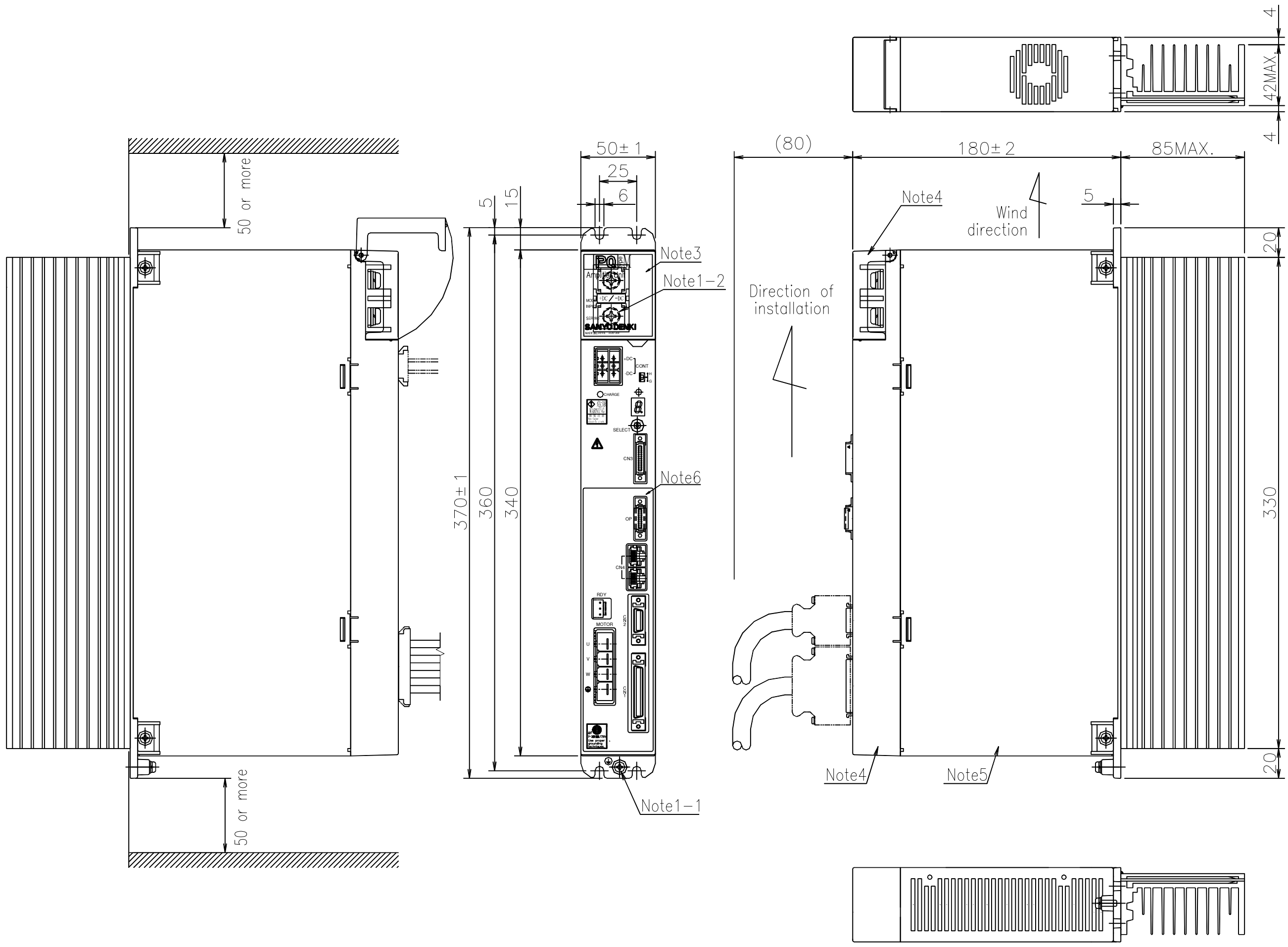
Note 4 Cover material : Resin

Note 5 Body material : SPCC / black chromated

Note 6 Front panel : Resin sheet

9. SPECIFICATIONS

PQM1A050A



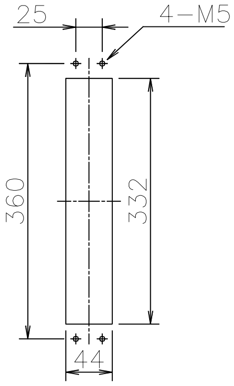
Note1-1 Terminal screw : M4

Tightening torque : 1.2 N・m

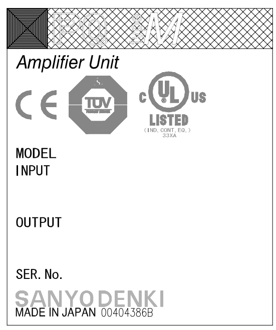
Note1-2 Terminal screw : M6

Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate



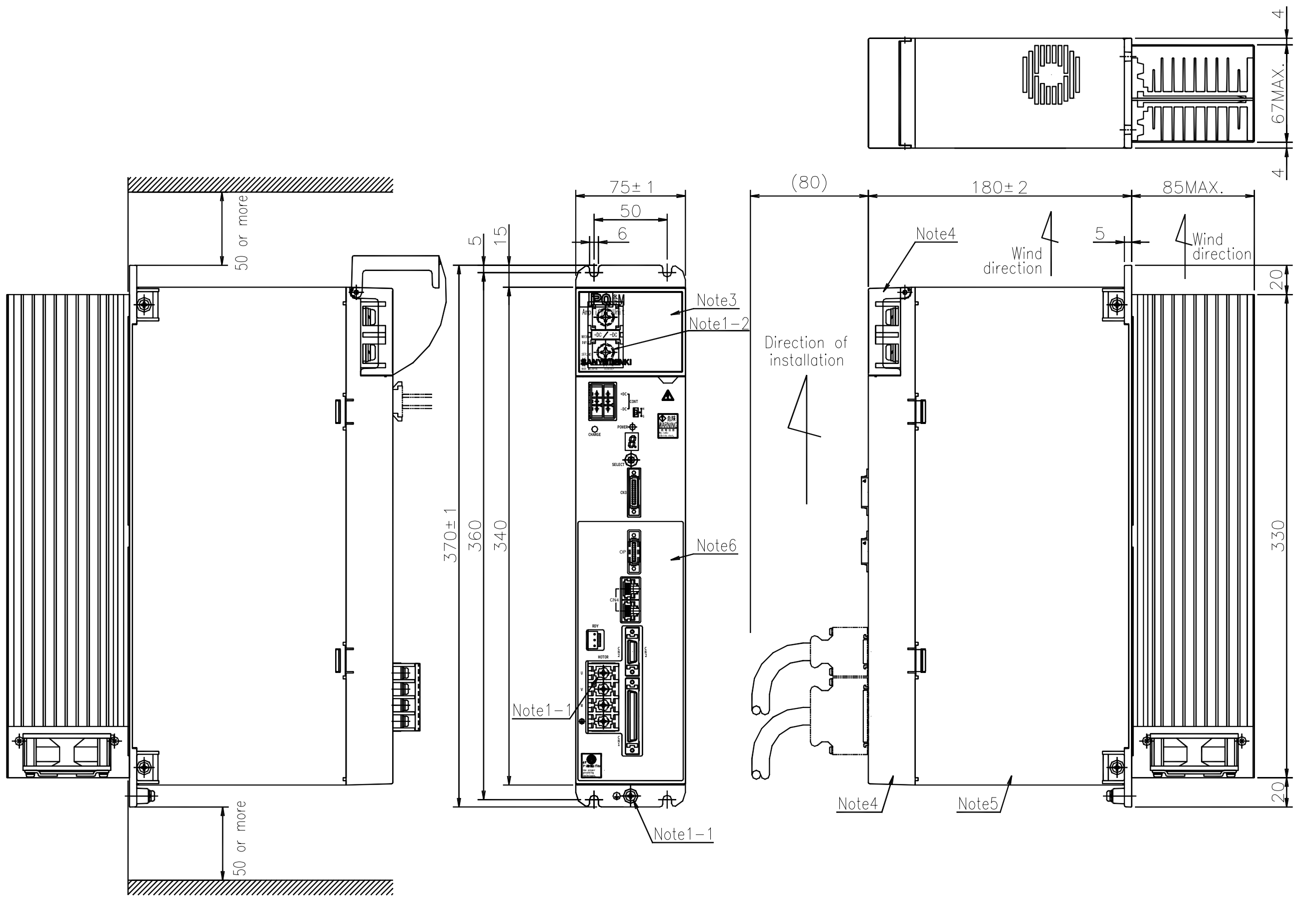
Note 4 Cover material : Resin

Note 5 Body material : SPCC / black chromated

Note 6 Front panel : Resin sheet

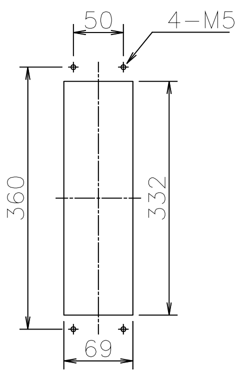
9. SPECIFICATIONS

PQM1A100A
PQM1A150 A

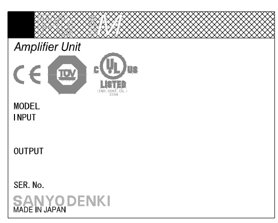


Note1-1 Terminal screw : M4
Tightening torque : 1.2 N・m
Note1-2 Terminal screw : M6
Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate



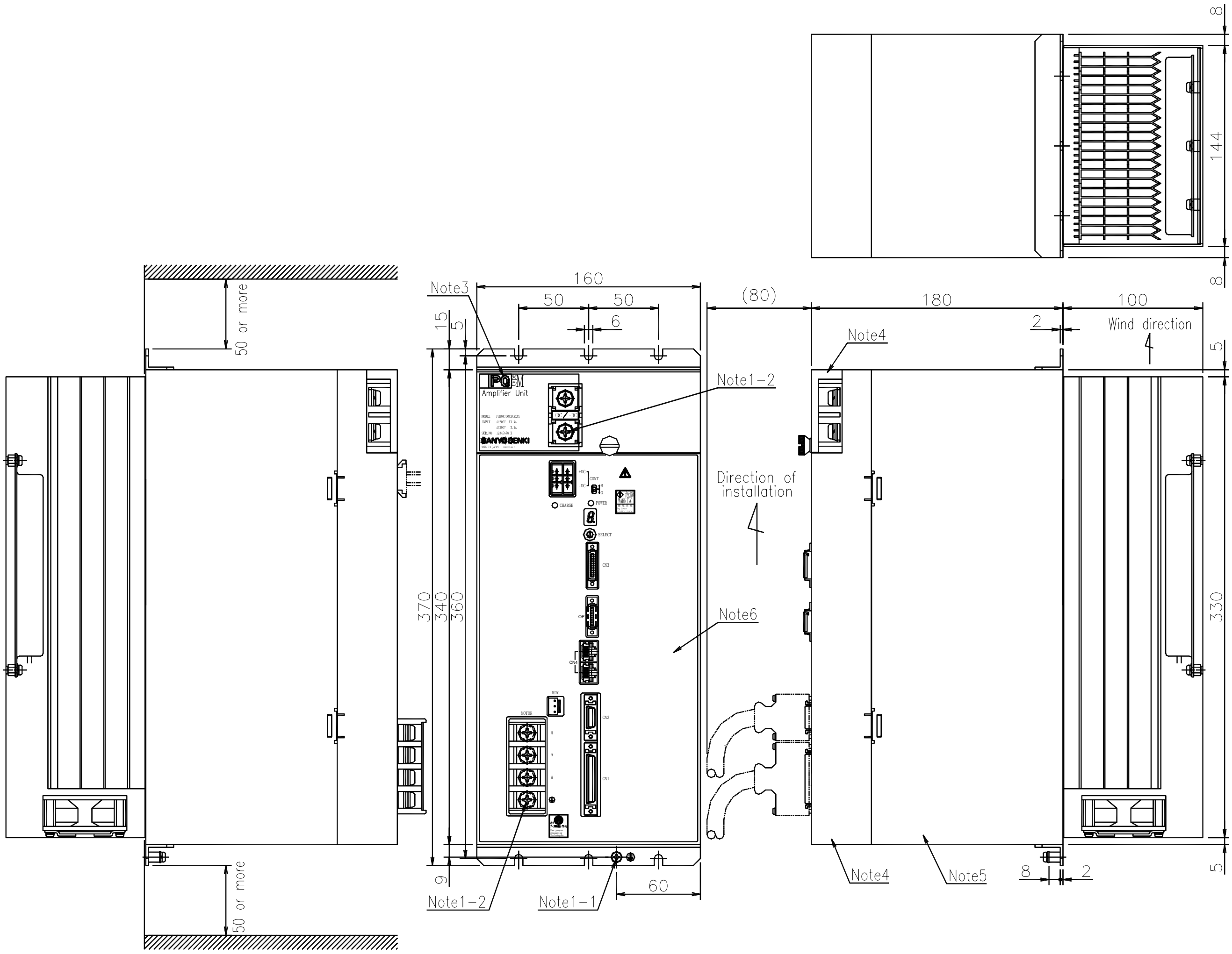
Note 4 Cover material : Resin

Note 5 Body material : SPCC / black chromated

Note 6 Front panel : Resin sheet

9. SPECIFICATIONS

PQM1A300A



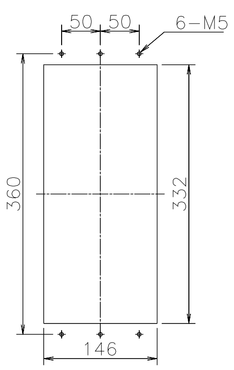
Note1-1 Terminal screw : M4

Tightening torque : 1.2 N・m

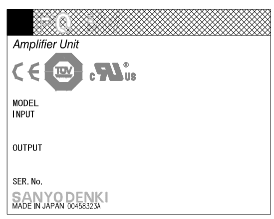
Note1-2 Terminal screw : M6

Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate

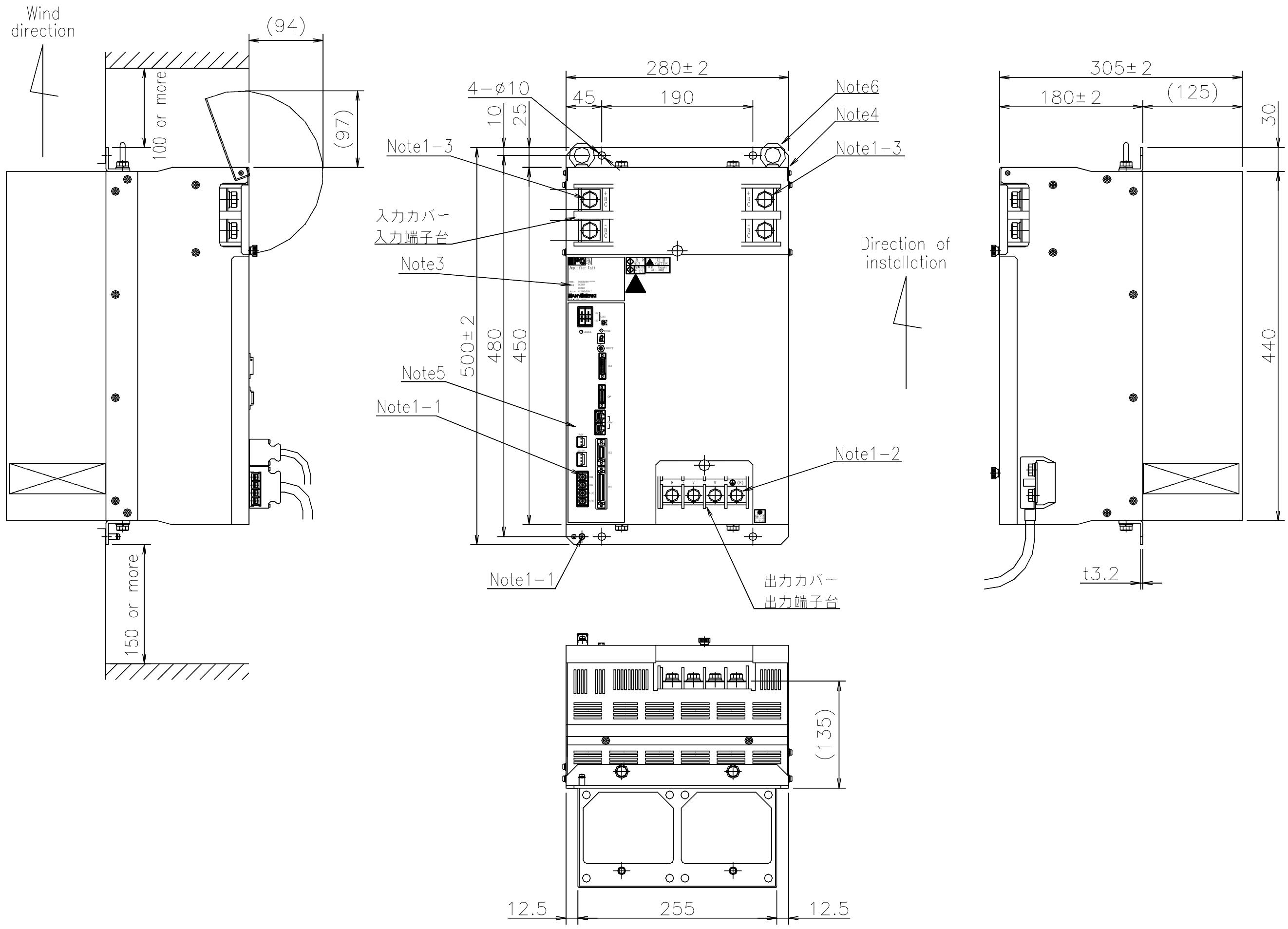


Note 4 Cover material: Resin

Note 5 Body material : SPCC / black chromated

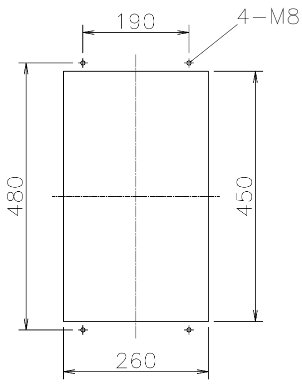
Note 6 Front panel : Resin sheet

PQM1B600A

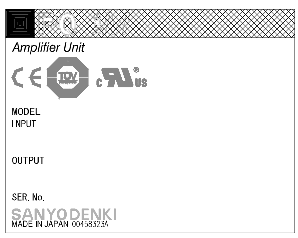


Note1-1 Terminal screw : M4
Tightening torque : 1.2 N・m
Note1-2 Terminal screw : M10
Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate

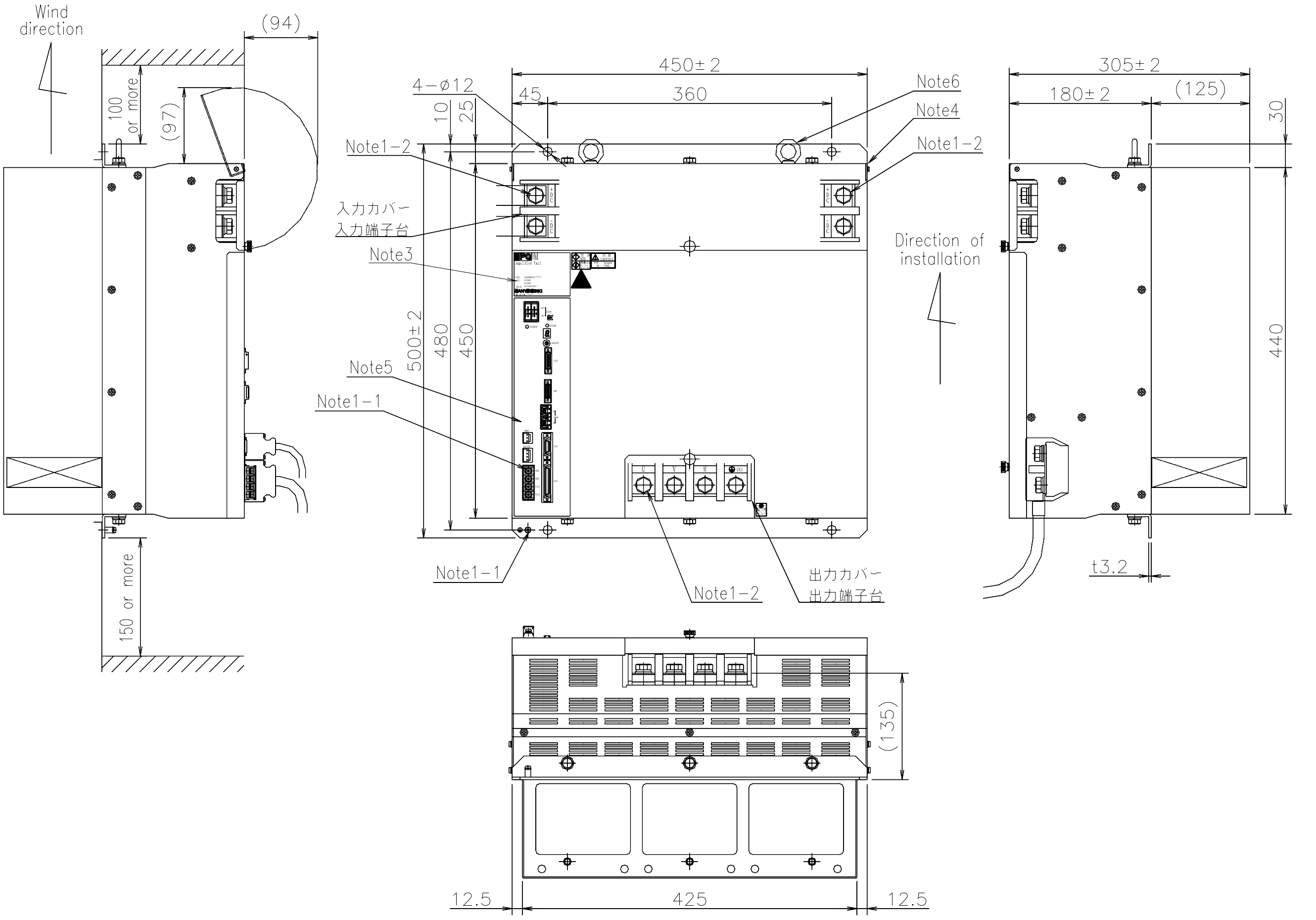


Note 4 Body material : SPCC / black chromated

Note 5 Front panel : Resin sheet

Note 6 Eye bolt : M8
Do not use this for other purpose than transportation use.

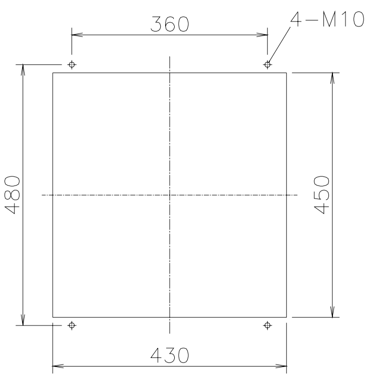
PQM1B900A



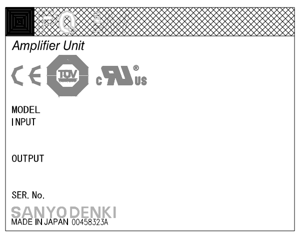
Note1-1 Terminal screw : M4
Tightening torque : 1.2 N・m

Note1-2 Terminal screw : M10
Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate



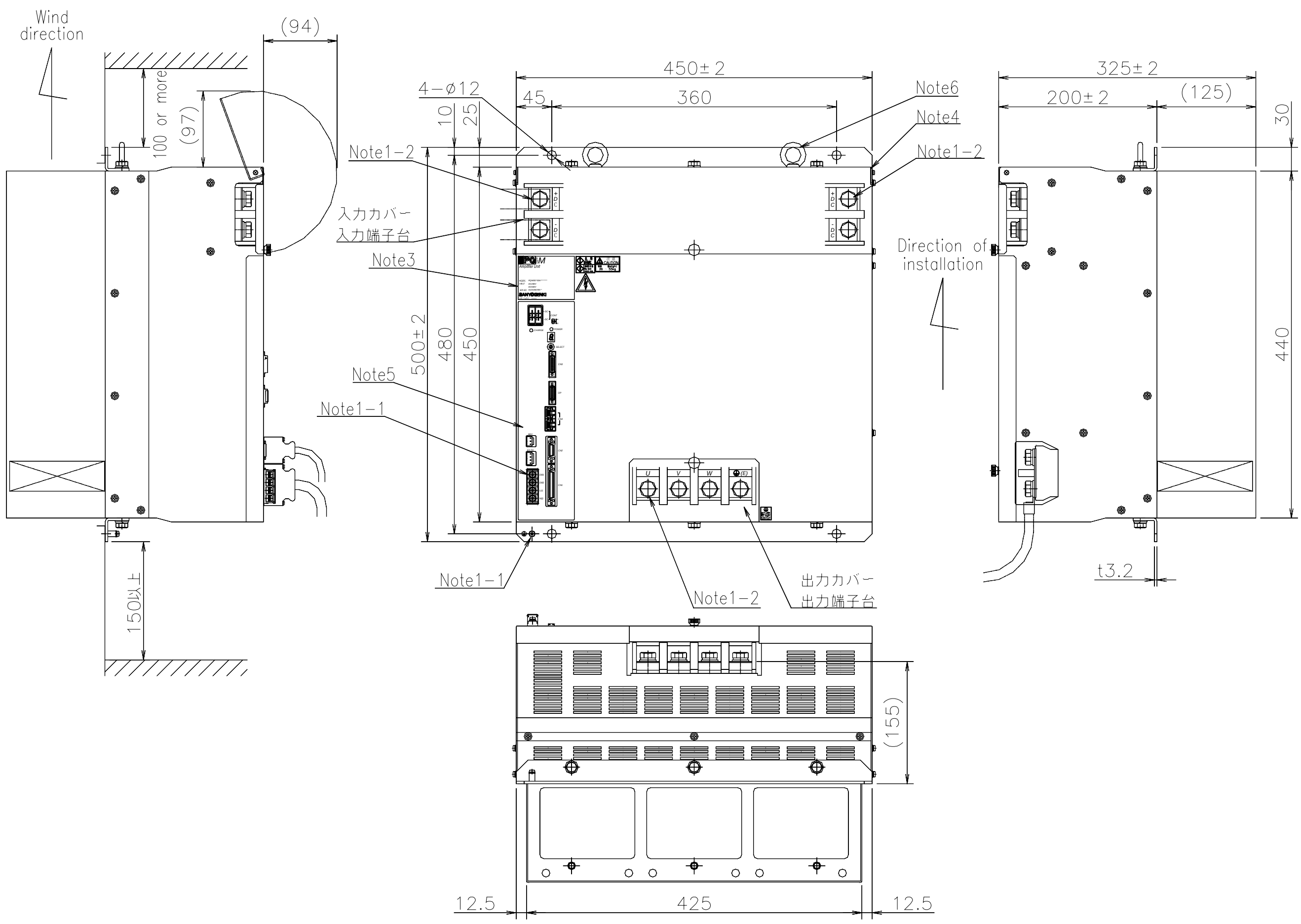
Note 4 Body material : SPCC / black chromated

Note 5 Front panel : Resin sheet

Note 6 Eye bolt: M8
Do not use this for other purpose than transportation use

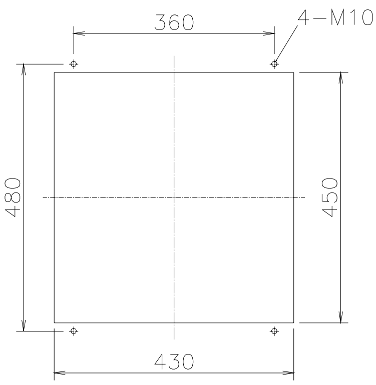
9. SPECIFICATIONS

PQM1D600A
PQM1D800A

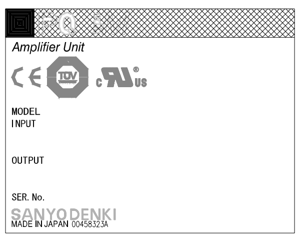


Note1-1 Terminal screw : M4
Tightening torque : 1.2 N・m
Note1-2 Terminal screw: M5
Tightening torque : 2.0 N・m
Note1-3 Terminal screw : M10
Tightening torque : 2.5 N・m

Note 2 Mounting panel working drawing



Note 3 Main nameplate



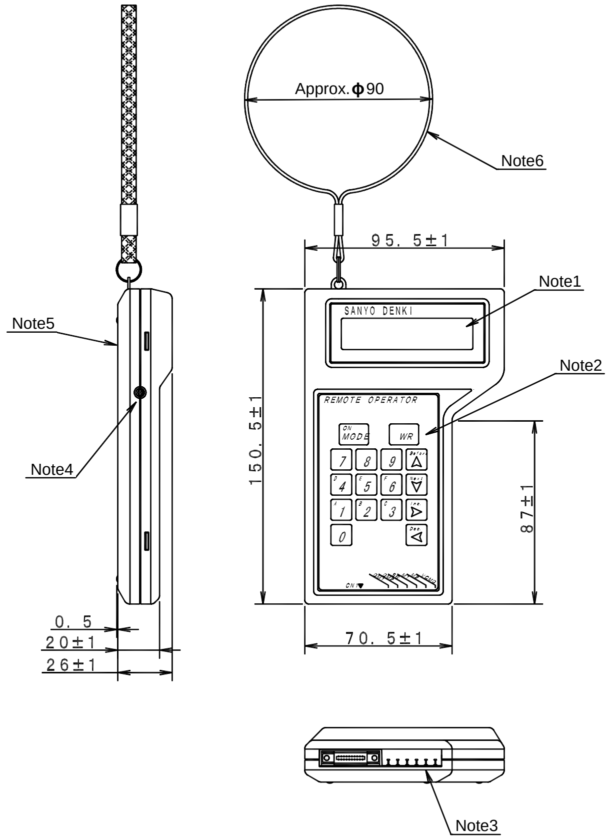
Note 4 Body material : SPCC / Black chromated

Note 5 Front panel : Resin sheet

Note 6 Eye bolt: M8
Do not use this for other purpose than
Transportation use.

9. SPECIFICATIONS

9.2.3 Remote Operator (Option)



Unit：mm

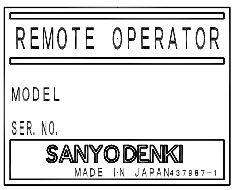
1 Liquid crystal display (two line display)

2 Key (16 keys, Control Element)

3 Check pins (DM1, DM2, SG, M1, M2 and VCMD from the left)

4 Volume knob (for adjusting liquid crystal brightness)

5 Main nameplate



6 Hand band

9.3 External Regenerative Resistor

9.3.1 How to Connect and Set External Regenerative Resistor (Optional)

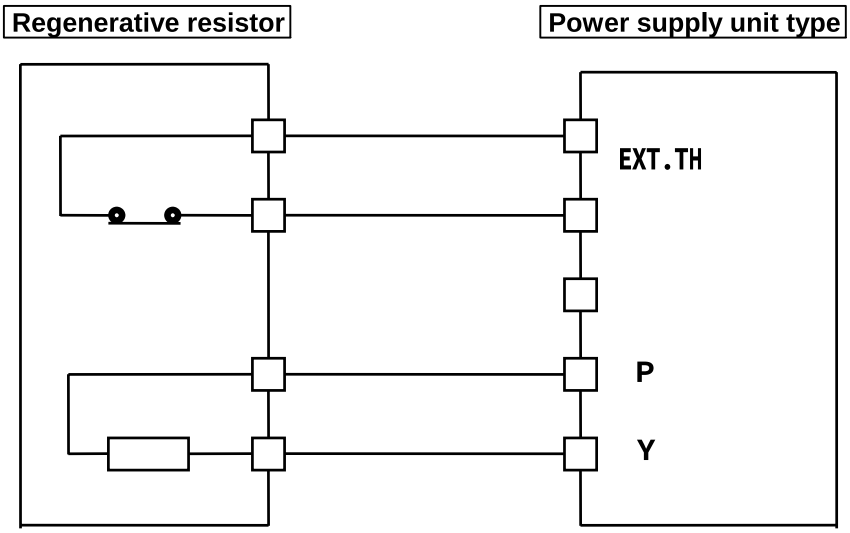


Fig. 9-23 Typical External Regenerative Resistor Connecting Diagram

Operational Precautions

1. Make sure to connect an external regenerative resistor between the P terminal and Y terminal.
2. When using an external regenerative resistor with a built-in thermostat, make sure to connect it to EXT.TH.
3. Make sure to use a twisted wire for wiring an external regenerative resistor and make wiring as short as possible (less than 5m).
4. Use a non-combustible cable or perform non-combustible processment (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.
5. Set FUNC 2 bit 4 of the remote operator to “1”

9.3.2 External Regenerative Resistor Combination Table

Referring to Table 9-15, determine the type, number of pieces and connecting method of the external regenerative resistor based on the effective regenerative power obtained by the operation pattern and the Servo Amplifier type.

Table 9-15 External Regenerative Resistor Combination Table

PM *1 / Power supply unit type	Up to 30 W	Up to 55 W	Up to 125 W	Up to 250 W	Up to 500 W	Up to 1000 W	Up to 2000 W	2000 W or above
PQM0PA7R8	Resistor C × 1pc. Connection (I)	Resistor F × 1pc. Connection (I)	Resistor I × 1pc. Connection (I)	Resistor K × 2pc. Connection (III)	Resistor I × 4pc. Connection (IV)	Resistor M ×4pcs. Connection (IV)	Inquire	
PQM0PA120	Resistor C × 1pc. Connection (I)	Resistor F × 1pc. Connection (I)	Resistor I × 1pc. Connection (I)	Resistor K × 2pc. Connection (III)	Resistor I × 4pc. Connection (IV)	Resistor M ×4pcs. Connection (IV)	Inquire	
PQM0PA160	Resistor B × 1pc. Connection (I)	Resistor E × 1pc. Connection (I)	Resistor H × 1pc. Connection (I)	Resistor J × 2pc. Connection (III)	Resistor H × 4pc. Connection (IV)	Resistor I × 8pcs. Connection (V)	Resistor M × pcs. Connection (V)	Inquire
PQM0PA270	Resistor B × 1pc. Connection (I)	Resistor E × 1pc. Connection (I)	Resistor H × 1pc. Connection (I)	Resistor H × 2pc. Connection (III)	Resistor H × 8pc. Connection (V)	Resistor H × 8pcs. Connection (V)	Resistor M × pcs. Connection (V)	Inquire
PQM0PA370	Resistor A × 1pc. Connection (I)	Resistor D × 1pc. Connection (I)	Resistor G × 1pc. Connection (I)	Resistor H × 2pc. Connection (III)	Resistor H × 8pc. Connection (V)	Inquire		
PQM0PC750	Resistor H × 8pc. Connection (V)						Resistor M × 8pc Connection (V)	Inquire

For external resistor A to M, refer to " Table 9-16 External Regenerative Resistors List".
For connecting methods (I) to (IV), refer to "Fig. 9-24 Detailed Connecting Methods of External Regenerative Resistors".
For “Inquire”, consult with us.
*PM : Effective regenerative power

9.3.3 External Regenerative Resistor List

Table 9-16 External Regenerative Resistor

Symbol	Types	Permissible effective power (PM)	Resistance value	Outside dimensions	Thermostat	Outline drawing
A	REGIST-120W1R5B	10W	1.5 Ω	W42,L182,D20	Available (N.C.Contact)	See Fig. 9-25.
B	REGIST-120W5B	10W	5 Ω	W42,L182,D20	Available (N.C.Contact)	See Fig. 9-25.
C	REGIST-120W7B	30W	7 Ω	W42,L182,D20	Available (N.C.Contact)	See Fig. 9-25.
D	REGIST-220W1R5B	30W	1.5 Ω	W60,L230,D20	Available (N.C.Contact)	See Fig. 9-26.
E	REGIST-220W5B	55W	5 Ω	W42,L182,D20	Available (N.C.Contact)	See Fig. 9-26.
F	REGIST-220W7B	55W	7 Ω	W60,L230,D20	Available (N.C.Contact)	See Fig. 9-26.
G	REGIST-500W1R5B	55W	1.5 Ω	W80,L250,D40	Available (N.C.Contact)	See Fig. 9-27.
H	REGIST-500W5B	125W	5 Ω	W80,L250,D40	Available (N.C.Contact)	See Fig. 9-27.
I	REGIST-500W7B	125W	7 Ω	W80,L250,D40	Available (N.C.Contact)	See Fig. 9-27.
J	REGIST-500W10B	125W	10Ω	W80,L250,D40	Available (N.C.Contact)	See Fig. 9-27.
K	REGIST-500W14B	125W	14Ω	W80,L250,D40	Available (N.C.Contact)	See Fig. 9-27.
L	REGIST-500W20B	125W	20Ω	W80,L250,D40	Available (N.C.Contact)	See Fig. 9-27.
M	REGIST-1000W6R7B	250W	6.7Ω	W140,L340,D57	Available (N.C.Contact)	See Fig. 9-28.

9.3.4 Detailed Connecting Methods of External Regenerative Resistors

The following figures describe detailed connecting methods of external regenerative resisters.

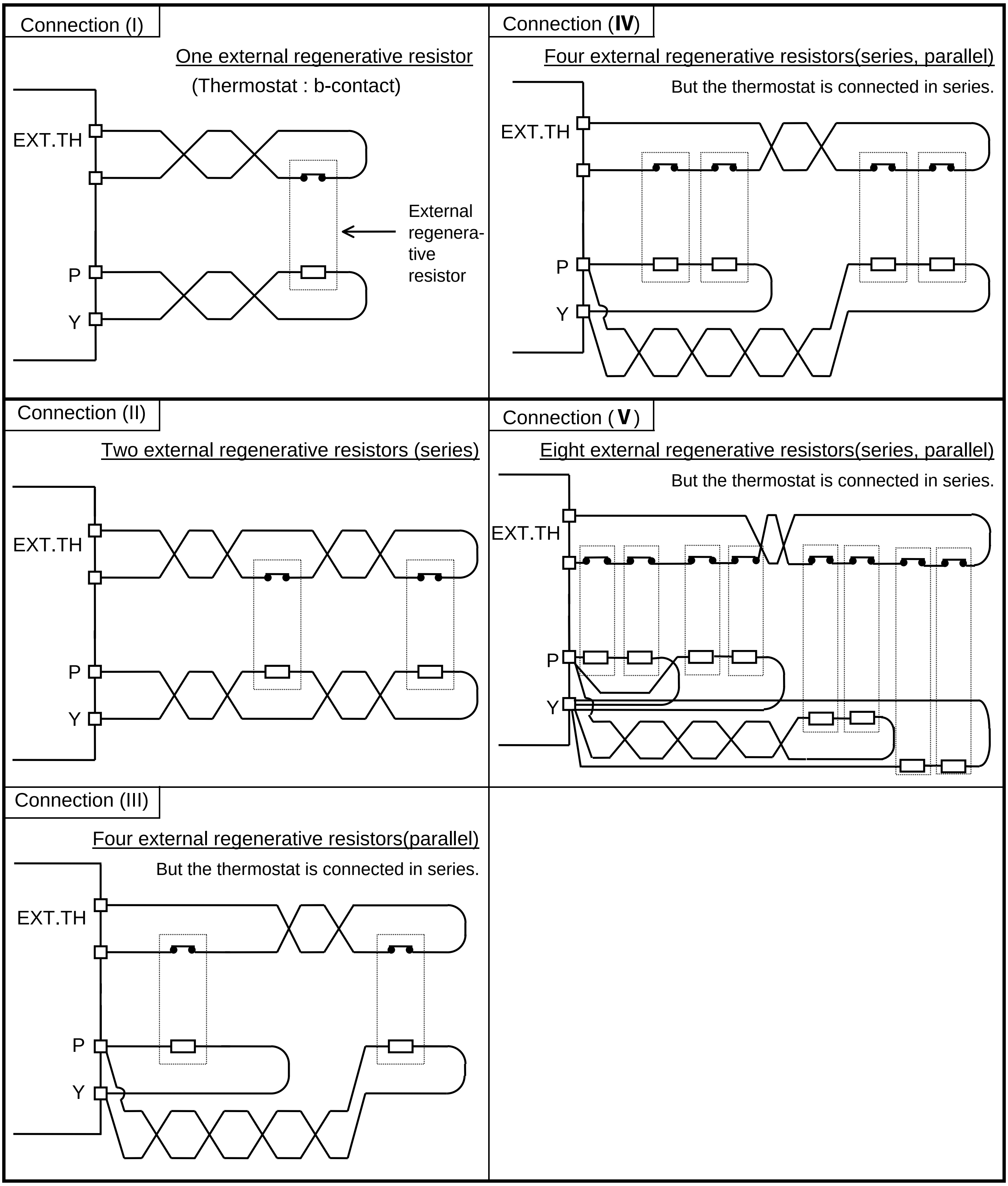
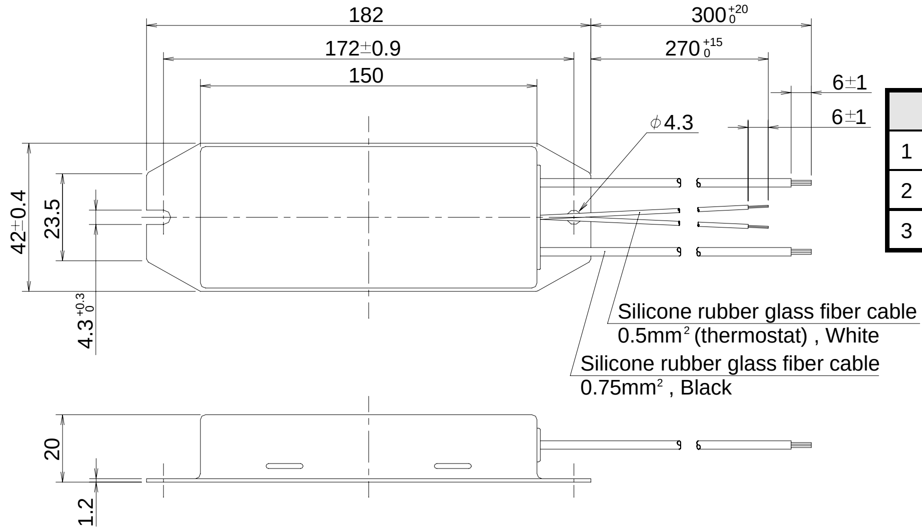


Fig. 9-24 Detailed Connecting Methods of External Regenerative Resistors"

9.3.5 Regenerative Resistor Outline Drawings (Optional)

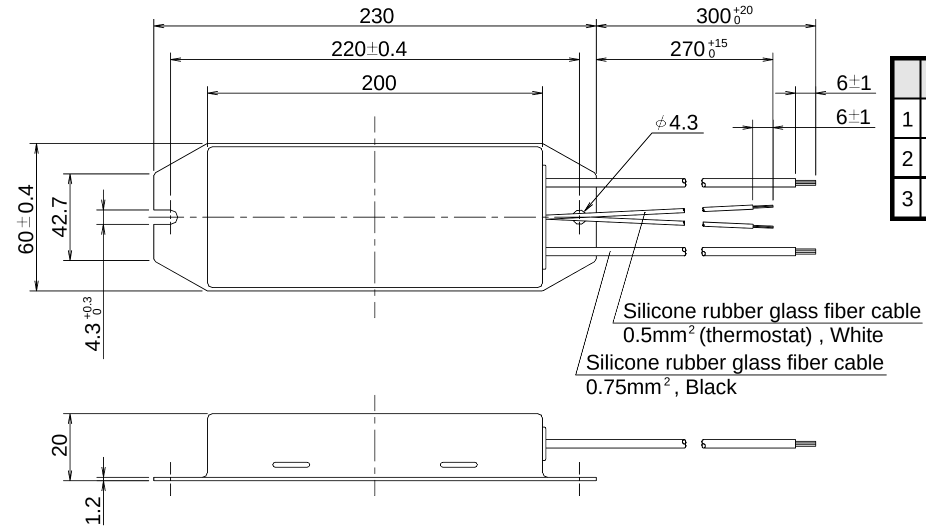
①



	Model No.	Thermostat
1	REGIST-120W1R5B	b-Contact
2	REGIST-120W5B	b-Contact
3	REGIST-120W7B	b-Contact

Fig. 9-25 Unit: mm

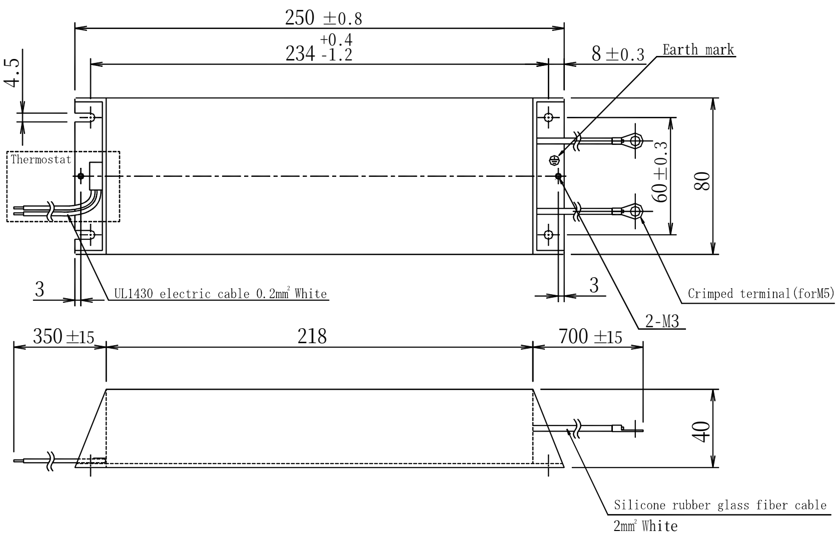
②



	Model No.	Thermostat
1	REGIST-220W1R5B	b-Contact
2	REGIST-220W5B	b-Contact
3	REGIST-220W7B	b-Contact

Fig. 9-26 Unit: mm

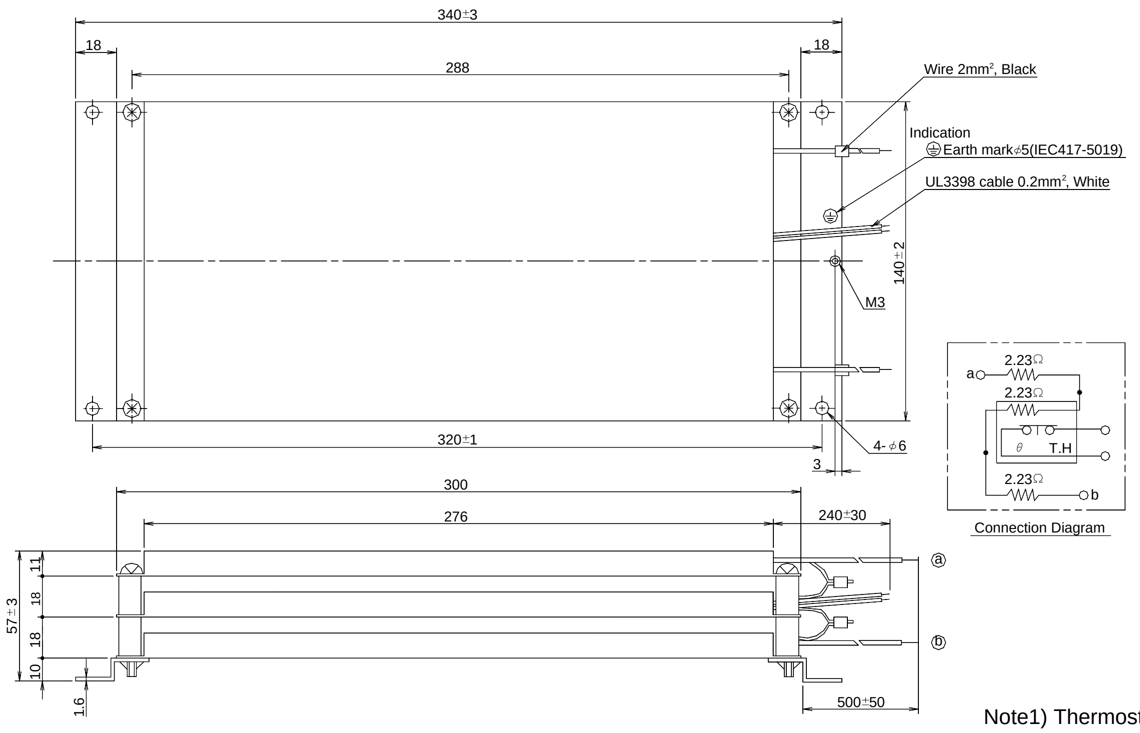
③



	Model No.	Thermostat
1	REGIST-500W1R5B	b-Contact
2	REGIST-500W1R5	None
3	REGIST-500W5B	b-Contact
4	REGIST-500W5	None
5	REGIST-500W7B	b-Contact
6	REGIST-500W7	None
7	REGIST-500W10B	b-Contact
8	REGIST-500W10	None
9	REGIST-500W14B	b-Contact
10	REGIST-500W14	None
11	REGIST-500W20B	b-Contact
12	REGIST-500W20	None

Fig. 9-27 Unit: mm

④



Note1) Thermostat Specification
- b contact
- Operation temperature

	Model No.	Thermostat
1	REGIST-1000W6R7B	b-Contact

Fig. 9-28 Unit: mm

9.4 Servomotor

This section describes the specifications of Servo Motor using graphics and tables.

9.4.1 Common Specifications

Table 9-17 Common Specifications of P1, P2, P3, P5, P6 and P8 Series Servomotors

<table>
<tr><th>Series</th><th>P1</th><th>P2</th><th>P3</th><th>P5</th><th>P6</th><th>P8</th></tr>
<tr><td>Time rating</td><td colspan="6">Continuous</td></tr>
<tr><td>Insulation class</td><td colspan="6">Class F</td></tr>
<tr><td>Dielectric strength</td><td colspan="6">1500 VAC for 1 minute</td></tr>
<tr><td>Insulation resistance</td><td colspan="6">500 VDC and 10 MΩ minimum</td></tr>
<tr><td rowspan="2">Protective system</td><td colspan="6">Totally-enclosed and self-cooling type</td></tr>
<tr><td colspan="2">IP67</td><td>IP40</td><td>P50B03,04:IP40
P50B05, 07, 08: IP55</td><td colspan="2">IP67</td></tr>
<tr><td>Sealing</td><td colspan="2">Provided</td><td>Not provided</td><td>P50B03,04: Not provided
P50B05: Provided</td><td colspan="2">Provided</td></tr>
<tr><td>Ambient temperature</td><td colspan="6">32 to +104°F</td></tr>
<tr><td>Storage temperature</td><td colspan="6">– 4 to 149°F</td></tr>
<tr><td>Ambient humidity</td><td colspan="6">20% to 90% (no condensation)</td></tr>
<tr><td>Vibration class</td><td colspan="2">V10</td><td colspan="4">V15</td></tr>
<tr><td>Coating color</td><td colspan="6">Munsell N1.5 equivalent (outside)</td></tr>
<tr><td>Excitation system</td><td colspan="6">Permanent magnet type</td></tr>
<tr><td>Installation method</td><td colspan="6">Flange type</td></tr>
</table>

Conforms to IP67 using a waterproof connector, conduit, shell, clamp, etc. for the other side.

9.4.2 Revolution Direction Specifications

This section explains the direction of revolution for the Servomotor and the encoder respectively.

(1) Servomotor

In the case of standard installation, the Servomotor rotates counterclockwise when viewed from the load side after a “plus” velocity command and a forward revolution pulse command are input.
Making the revolution direction reverse with the same command is possible by setting parameter.

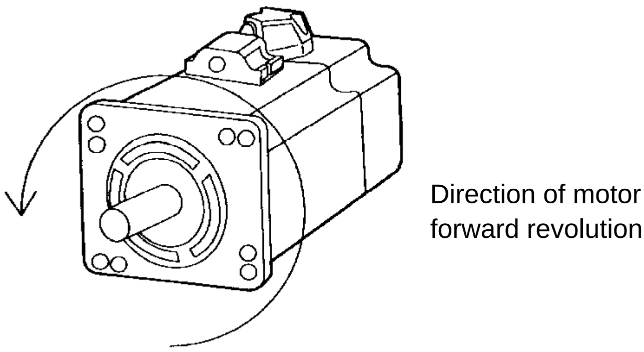
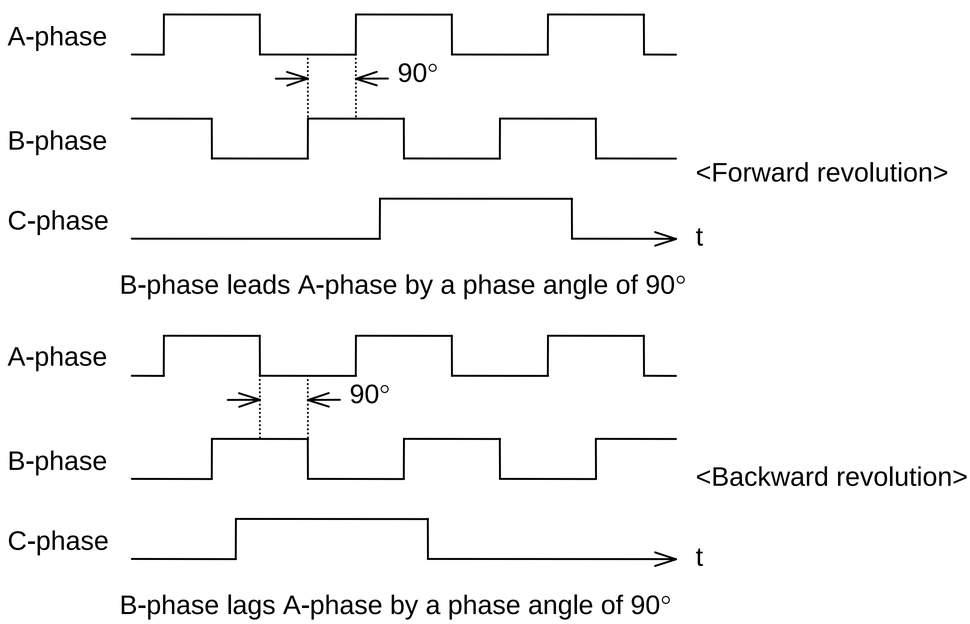


Fig. 9-29 Servomotor

(2) Encoder signal phase

Incremental encoder



When C-phase is high, both A- and B-phases cross the low level once every revolution.

Fig. 9-30 Encoder Signal Phase

Absolute encoder

Forward revolution ....Position data incremental output.
Backward revolution ....Position data decremental output.

9.4.3 Motor Mechanical Specifications

The followings describe the 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. 9-31 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.

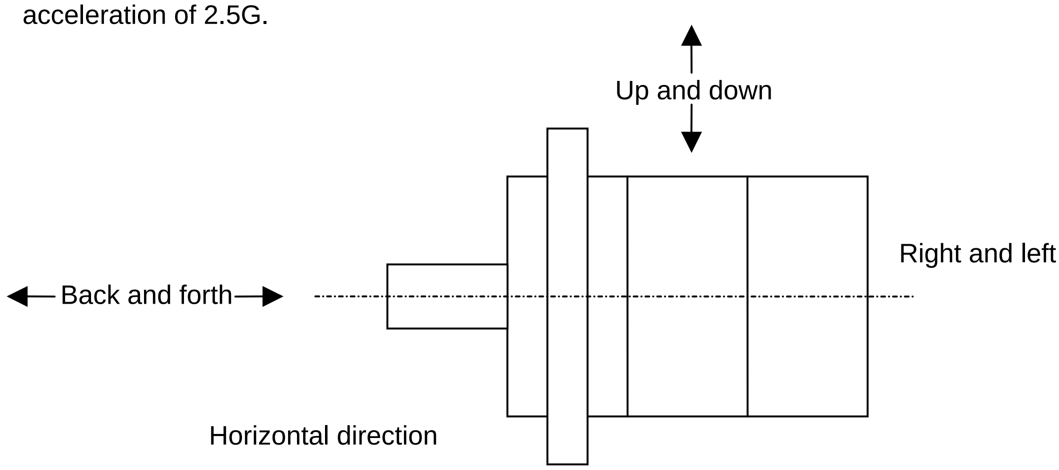


Fig. 9-31 Vibration Resistance Measurement

(2) Shock resistance

Install the motor shaft in the horizontal direction as shown in Fig. 9-32 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.

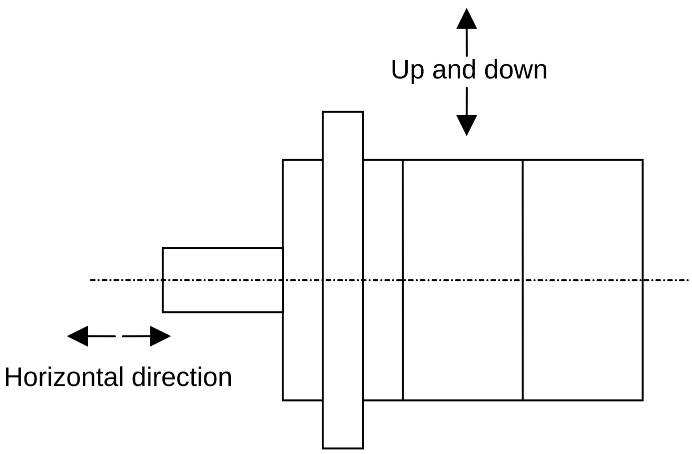
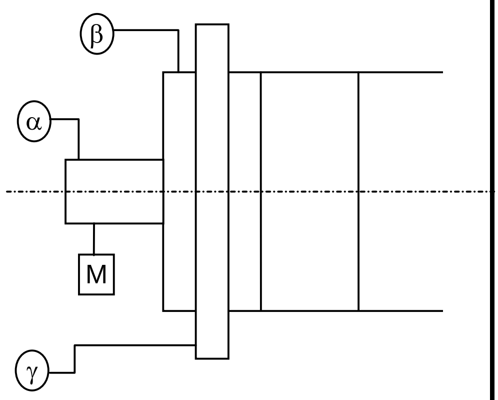


Fig. 9-32 Shock Measurement

(3) Working accuracy

Table 9-18 shows the accuracy of the Servomotor output shaft and installation.

Table 9-18

Item	P1	P108-18550	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

The vibration class of the Servomotor is V 15 or less at the maximum speed (10 V or less for P10, P20) when measured as a single Servomotor unit as in Fig. 9-33.

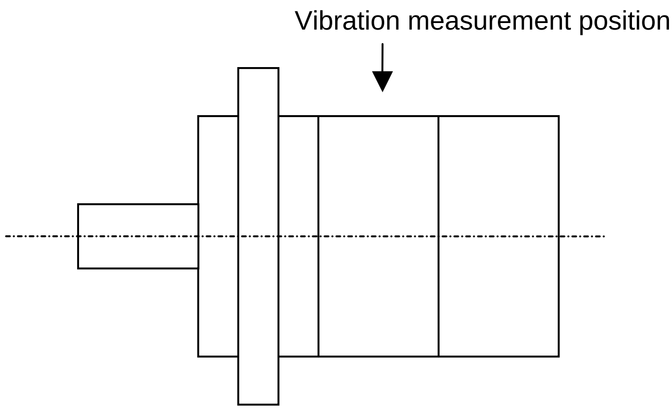


Fig. 9-33 Vibration Measurement

(5) Mechanical strength

The output strength of the Servomotor can endure the instantaneous maximum stall torque.

(6) Oil seal

An S-shaped oil seal as in Table 9-19 is mounted to the output shaft of the Servomotor.
Refer to this in maintenance works.
Use an oil seal made by NOK or equivalent.

Table 9-19 Oil Seals

Servomotor model	Oil seal model No. (S type)
P10B10○○○○□◇▽▽	AE1538E5
P10B13○○○○□◇▽▽	AE2230E0
P10B18200○□◇▽▽	AE2965F1
P10B18350○□◇▽▽	
P10B18450○□◇▽▽	
P10B18550○□◇▽▽	AE3459A5
P20B10○○○○□◇▽▽	AC1306E0
P20B13○○○○□◇▽▽	AC1893E0
P30B○○○○○○□◇▽▽	(None)
P50B03○○○○□◇▽▽	
P50B04○○○○□◇▽▽	
P50B05○○○○□◇▽▽	AC0382A0
P50B07○○○○□◇▽▽	AC0687A0
P50B08○○○○□◇▽▽	AC0875A0
P60B13○○○○□◇▽▽	AC1677E1
P60B15○○○○□◇▽▽	
P80B15○○○○□◇▽▽	
P60B18○○○○□◇▽▽	AC2368E1
P60B22○○○○□◇▽▽	AC3152E0
P60B28○○○○□◇▽▽	AC3618E0
P60B32○○○○□◇▽▽	AC3932A0
P80B18○○○○□◇▽▽	AC2368E0
P80B22○○○○□◇▽▽	

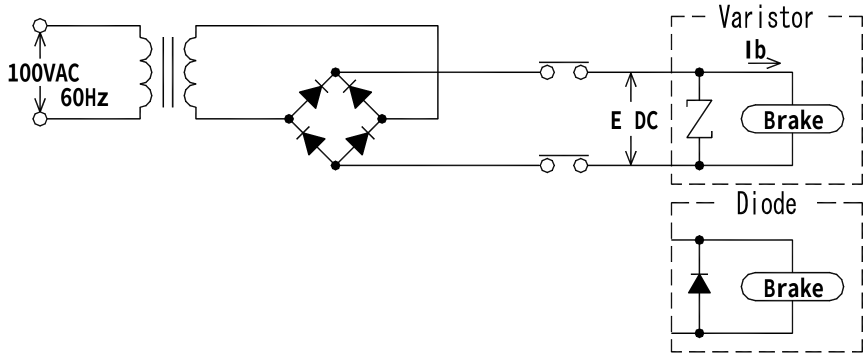
9.4.4 Holding Brake Specifications

An optional holding brake is available for each motor. Since this brake is for holding, do not use this for braking except in an emergency. Turn brake excitation on and off using the holding brake timing signal output.
When the signal is used, forcibly set the command to 0 min^{-1} in the Servo Amplifier while the brake is released. For velocity command input timing, see 6.1, Operation sequence.
To externally control the holding brake, a response time as in Table 9-23 is required. When using a motor with a brake, determine the timing sequence taking this response delay time into account.

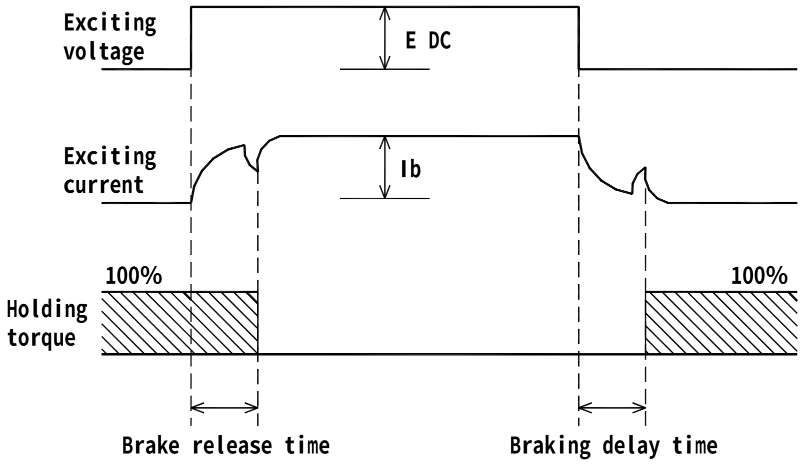
Table 9-20 Holding Brake Specifications

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				
	P20B10250	9.4	100	30	140
	P20B13300	11.4	100	30	140
	P20B13400	14.4	120	50	50
	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
P6	P60B15300	20	120	50	150
	P60B18200	12.0	100	3	140
	P60B18350	32.0	120	40	150
	P60B18450		150	40	250
	P60B18550	54.9	300	140	400
	P60B18750				
	P60B22550	90.0			
	P60B22700				
	P60B2211K	90.0	300	140	400
	P60B2215K				
	P60B2220K				
	P60B2820K				
	P60B2825K				
	P60B2830K				
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. SPECIFICATIONS

9. 4. 5. 1 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}	$kg\cdot m^2$ $(GD^2/4)$	4.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	4.0×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	4.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RⅡ)	J_M	3.98×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	4.08	$g\cdot cm\cdot s^2$
	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	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

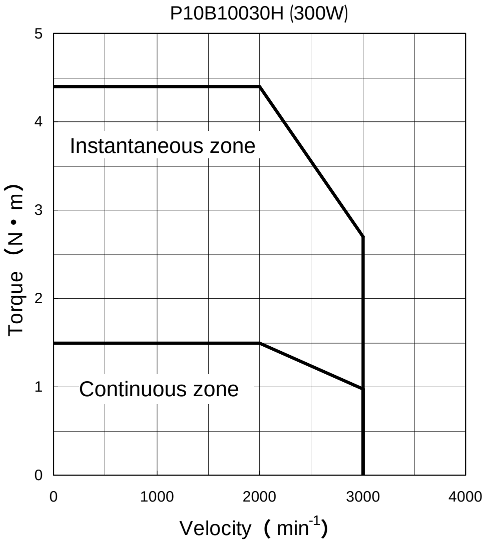
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

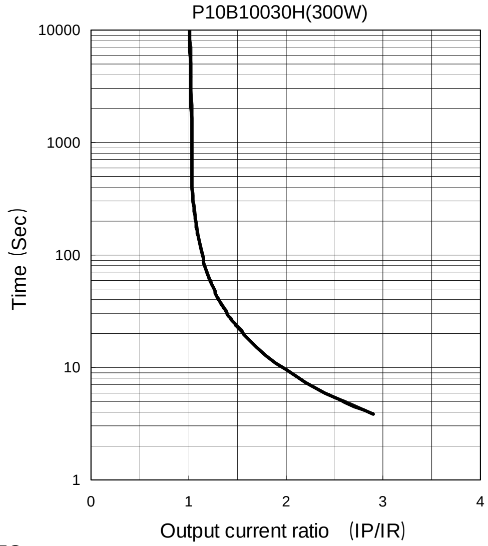
Velocity-torque characteristics

P10B10030H (300W)



Overload characteristics

P10B10030H(300W)



9. SPECIFICATIONS

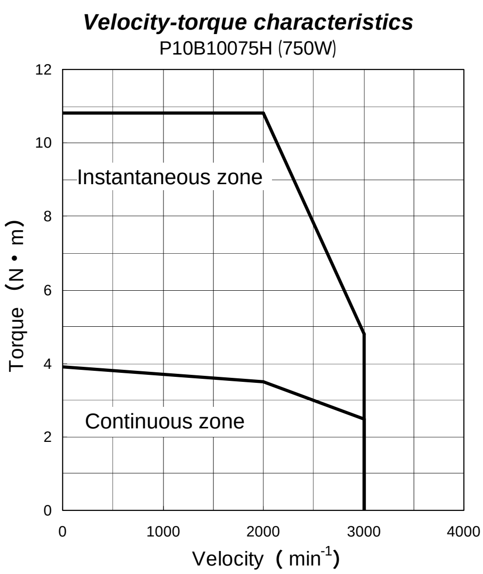
P10B10075H

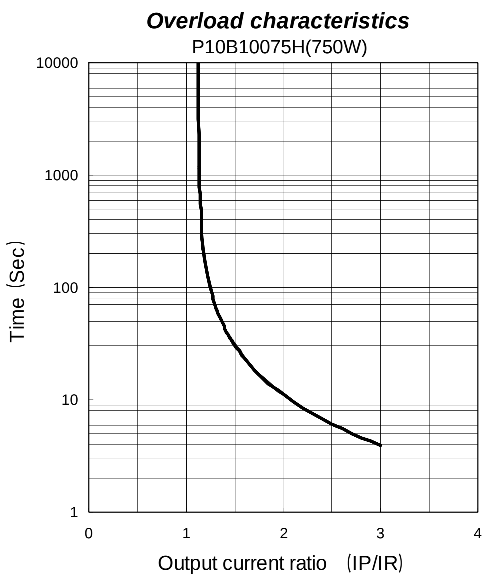
	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	P_R	750	W	750	W
	Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
	Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
*	Rated torque	T_R	3.5	N•m	36	kg·cm
*	Continuous stall torque	T_S	3.9	N•m	40	kg·cm
*	Instantaneous maximum stall torque	T_P	10.8	N•m	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}	$kg\cdot m^2$ ($GD^2/4$)	14.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	14.1×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	14.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	14.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	14.08	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	$J_M\times4$	$kg\cdot m^2$ ($GD^2/4$)	$J_M\times4$	$g\cdot cm\cdot s^2$
	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-R II)	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}	$kg\cdot m^2$ ($GD^2/4$)	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 t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

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-R II)	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-R II)	W_E	7.7	kg	8.7	kg

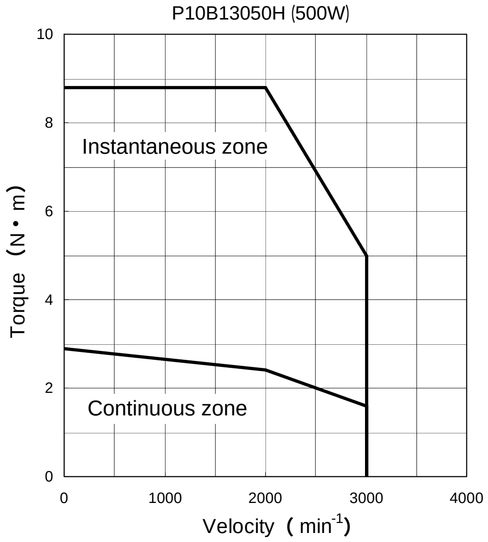
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

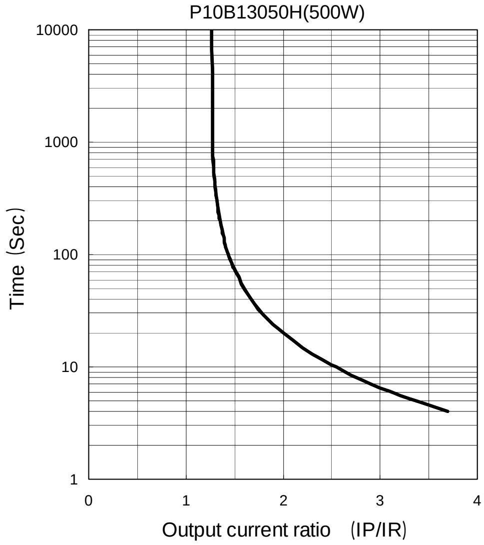
Velocity-torque characteristics

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}	$kg\cdot m^2$ $(GD^2/4)$	25	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	25.1×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	25.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	25.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$		$g\cdot cm\cdot s^2$
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	11.7	kg	11.7	kg
Weight (including ABS-E)	W_E	11.6	kg	11.6	kg
Weight (including ABS-R II)	W_E	11.8	kg	11.8	kg

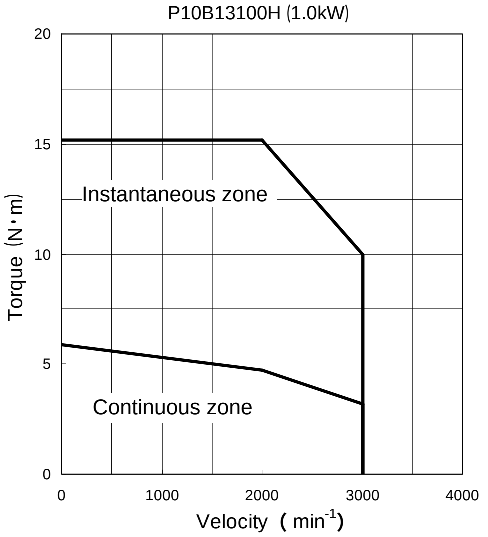
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

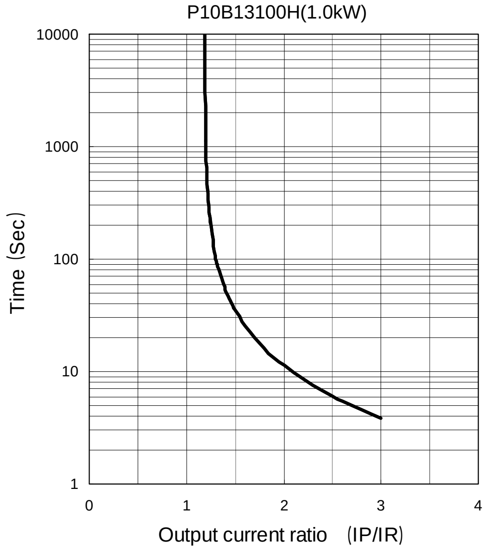
Velocity-torque characteristics

P10B13100H (1.0kW)



Overload characteristics

P10B13100H(1.0kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	36.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	35.1×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	36.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RⅡ)	J_M	35.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	36.08	$g\cdot cm\cdot s^2$
	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	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}	$kg\cdot m^2$ $(GD^2/4)$	0.5	$g\cdot cm\cdot s^2$
Weight	W	1.5	kg	1.5	kg

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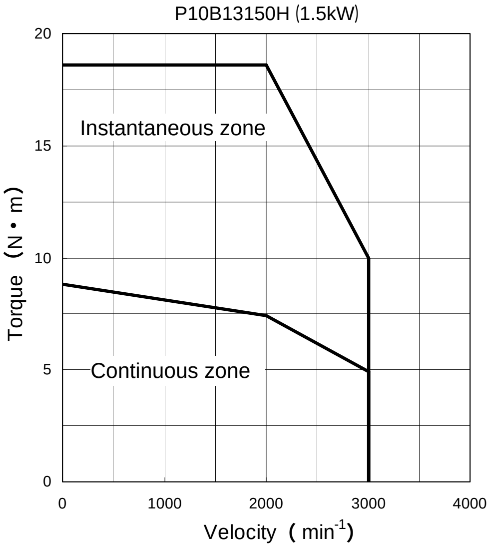
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

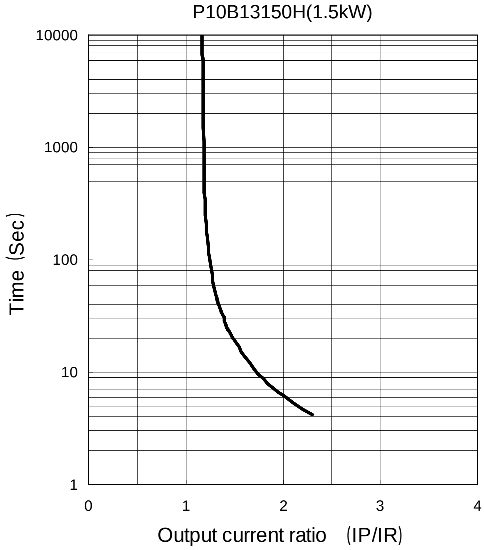
Velocity-torque characteristics

P10B13150H (1.5kW)



Overload characteristics

P10B13150H(1.5kW)



9. SPECIFICATIONS

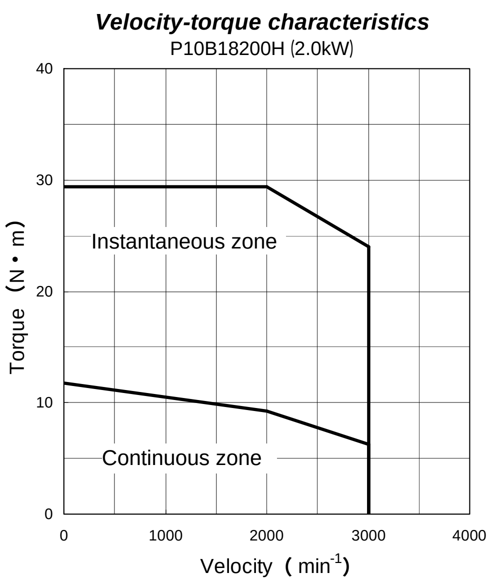
P10B18200H

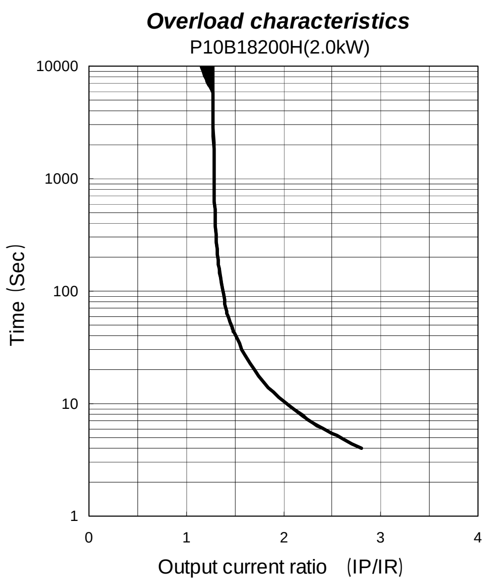
	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	PR	2000	W	2000	W
	Rated revolution speed	NR	2000	min^{-1}	2000	rpm
	Maximum revolution speed	Nmax	3000	min^{-1}	3000	rpm
*	Rated torque	TR	9.3	N•m	95	kg·cm
*	Continuous stall torque	TS	11.8	N•m	120	kg·cm
*	Instantaneous maximum stall torque	TP	29.4	N•m	300	kg·cm
*	Rated armature current	IR	16.9	Arms	16.9	Arms
*	Continuous stall armature current	IS	19.7	Arms	19.7	Arms
*	Instantaneous maximum stall armature current	IP	48.3	Arms	48.3	Arms
	Torque constant	KT	0.74	N·m/Arms	7.6	kg·cm/Arms
	Induced voltage constant	KE_ϕ	25.9	mV/min^{-1}	25.9	V/krpm
	Phase armature resistance	R_ϕ	0.16	Ω	0.16	Ω
	Electrical time constant	te	7.5	msec	7.5	msec
	Mechanical time constant (not including sensor)	tm	6.3	msec	6.3	msec
	Inertia (including wiring-saved INC)	JM	73.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	74.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	JM	73.1×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	74.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RII)	JM	73.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	74.08	$g\cdot cm\cdot s^2$
	Applicable load inertia	JL	JM×4	$kg\cdot m^2$ ($GD^2/4$)	JM×4	$g\cdot cm\cdot s^2$
	Weight (including wiring-saved INC)	WE	23.1	kg	23.1	kg
	Weight (including ABS-E)	WE	23.0	kg	23.0	kg
	Weight (including ABS-RII)	WE	23.2	kg	23.2	kg

Holding Brake Data Sheet (Option)

Holding torque	TB	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	VB	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	IB	1.4/0.37	A (DC)	1.4/0.37	A (DC)
Inertia	JB	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

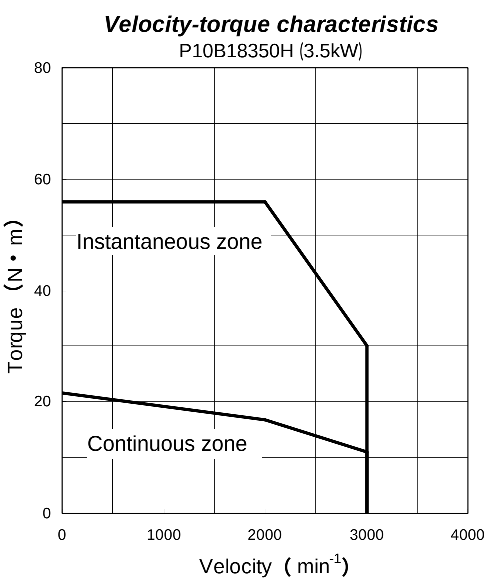
P10B18350H

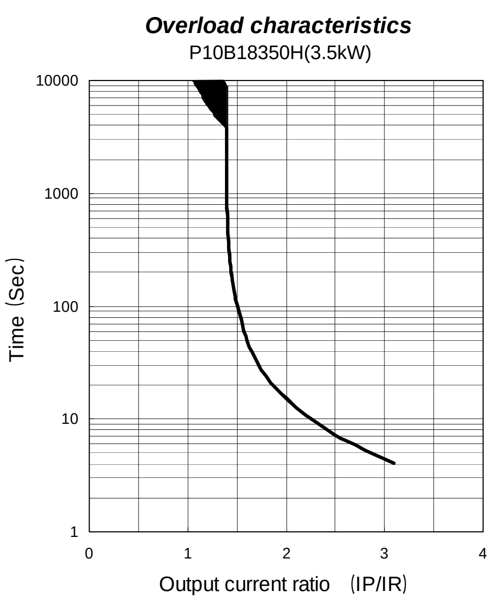
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	3500	W	3500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	16.7	N•m	170	kg·cm
* Continuous stall torque	T_S	21.6	N•m	220	kg·cm
* Instantaneous maximum stall torque	T_P	55.9	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

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

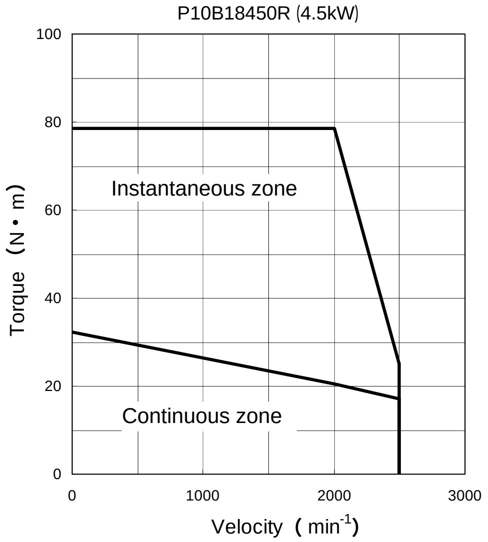
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

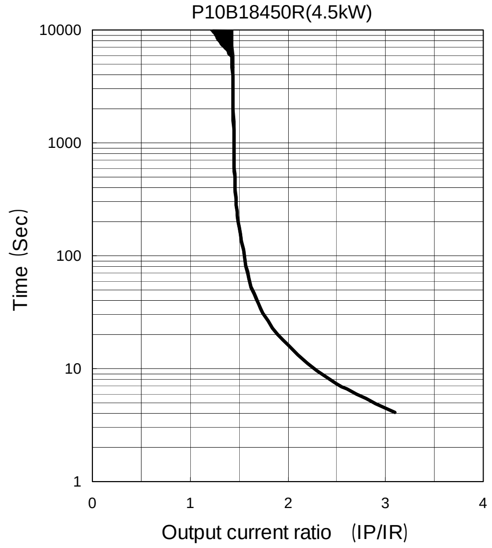
Velocity-torque characteristics

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}	$kg\cdot m^2$ ($GD^2/4$)	336.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	330.1×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	336.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RII)	J_M	330.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	336.08	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	$J_M\times3.3$	$kg\cdot m^2$ ($GD^2/4$)	$J_M\times3.3$	$g\cdot cm\cdot s^2$
	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

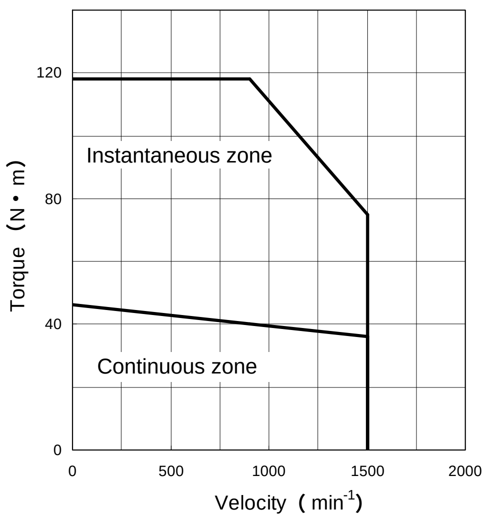
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	8.0	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

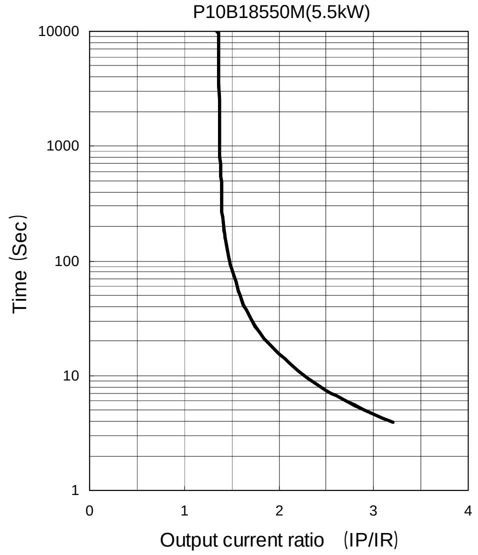
Velocity-torque characteristics

P10B18550M (5.5kW)



Overload characteristics

P10B18550M(5.5kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ ($GD^2/4$)	12.08	$g\cdot cm\cdot s^2$
	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}	$kg\cdot m^2$ ($GD^2/4$)	12.08	$g\cdot cm\cdot s^2$
	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	7.7	kg

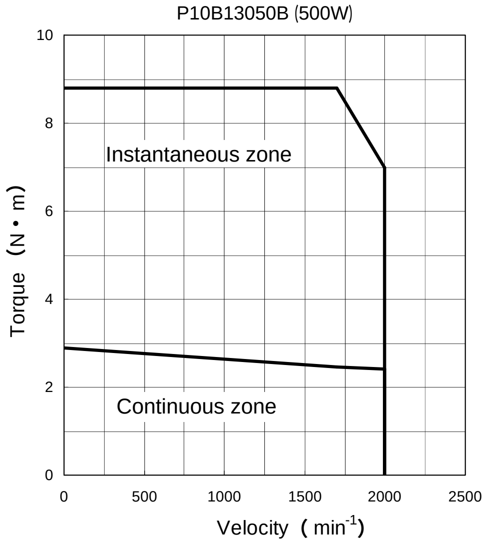
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	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 × 300 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

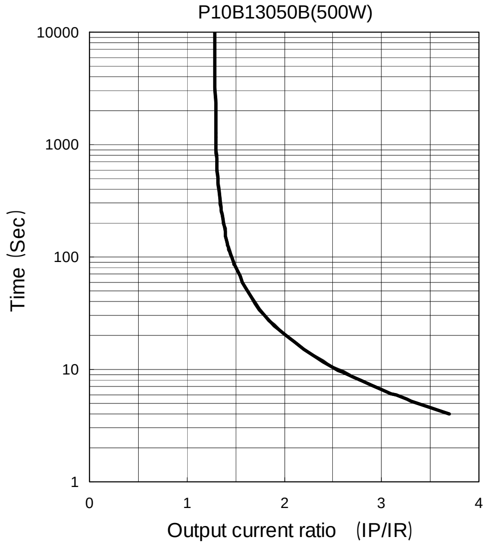
Velocity-torque characteristics

P10B13050B (500W)



Overload characteristics

P10B13050B(500W)



9. SPECIFICATIONS

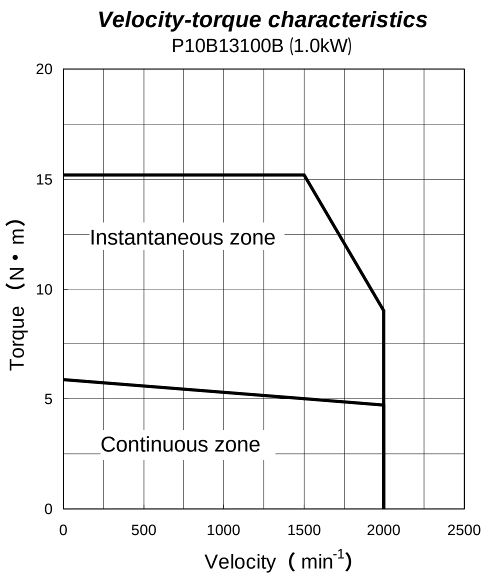
P10B13100B

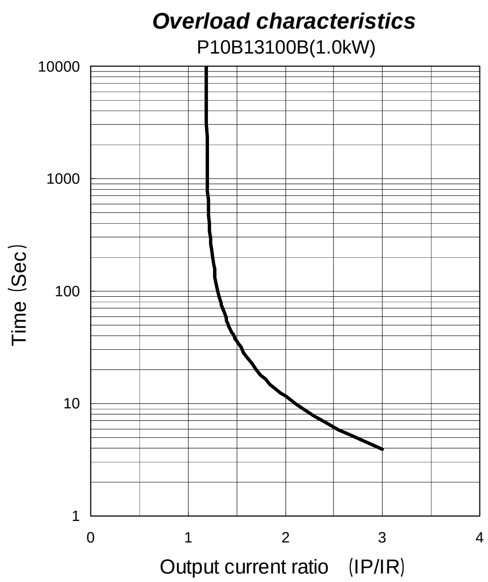
	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	P_R	1000	W	1000	W
	Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
	Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
*	Rated torque	T_R	4.7	N•m	48	kg·cm
*	Continuous stall torque	T_S	5.9	N•m	60	kg·cm
*	Instantaneous maximum stall torque	T_P	15.2	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}	$kg\cdot m^2$ ($GD^2/4$)	25.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	25.1×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	25.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	25.08×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	25.08	$g\cdot cm\cdot s^2$
	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	11.7	kg	11.7	kg
	Weight (including ABS-E)	W_E	11.6	kg	11.6	kg
	Weight (including ABS-R II)	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}	$kg\cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	36.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	35.1×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	36.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	35.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	36.08	$g\cdot cm\cdot s^2$
	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	16.1	kg	16.1	kg
	Weight (including ABS-E)	W_E	16.1	kg	16.0	kg
	Weight (including ABS-R II)	W_E	16.2	kg	16.2	kg

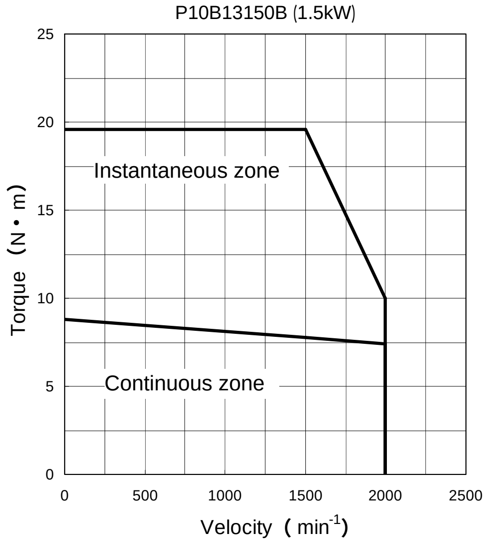
Holding Brake Data Sheet (Option)

Name	Symbol	Data	Unit	Data	Unit
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 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

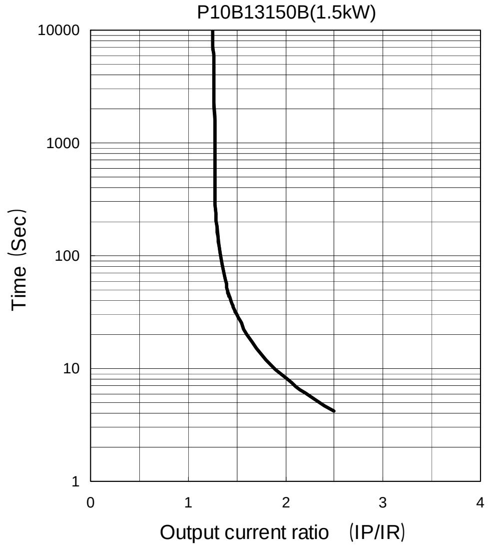
Velocity-torque characteristics

P10B13150B (1.5kW)



Overload characteristics

P10B13150B(1.5kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	74.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	73.1×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	74.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	73.08×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	74.08	$g\cdot cm\cdot s^2$
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	23.1	kg	23.1	kg
Weight (including ABS-E)	W_E	23.0	kg	23.0	kg
Weight (including ABS-R II)	W_E	23.2	kg	23.2	kg

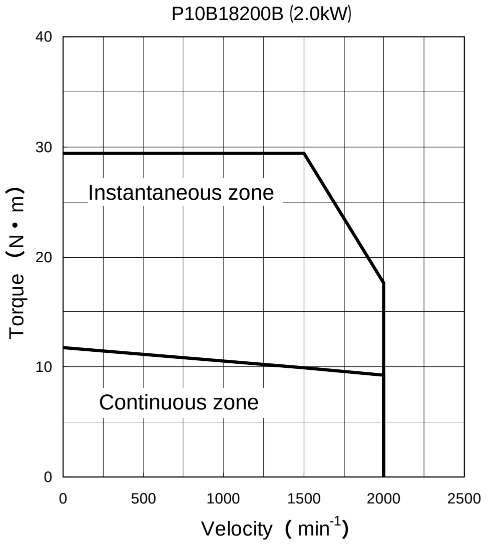
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

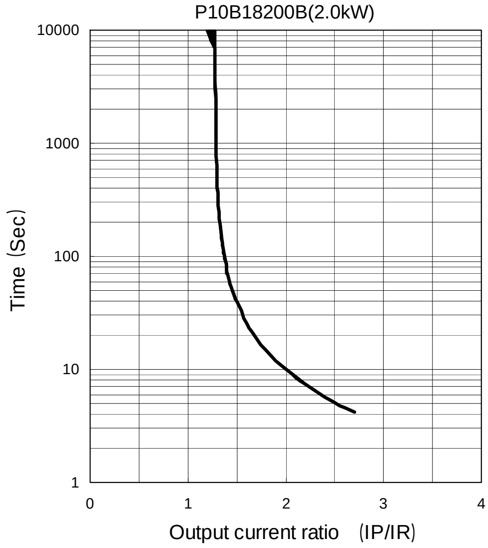
Velocity-torque characteristics

P10B18200B (2.0kW)



Overload characteristics

P10B18200B(2.0kW)



9. SPECIFICATIONS

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•m^2 (GD^2/4)	147.08	g·cm·s^2
Inertia (including ABS-E)	J_M	144.1×10^{-4}	kg•m^2 (GD^2/4)	147.1	g·cm·s^2
Inertia (including ABS-R II)	J_M	144.08×10^{-4}	kg•m^2 (GD^2/4)	147.08	g·cm·s^2
Applicable load inertia	J_L	J_M×4.7	kg•m^2 (GD^2/4)	J_M×4.7	g·cm·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-R II)	W_E	32.7	kg	32.7	kg

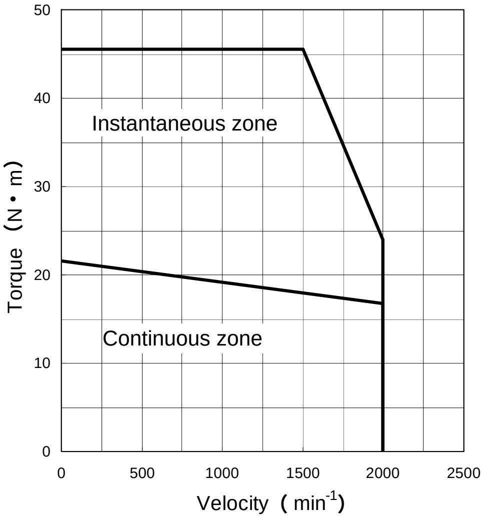
Holding Brake Data Sheet (Option)

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•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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

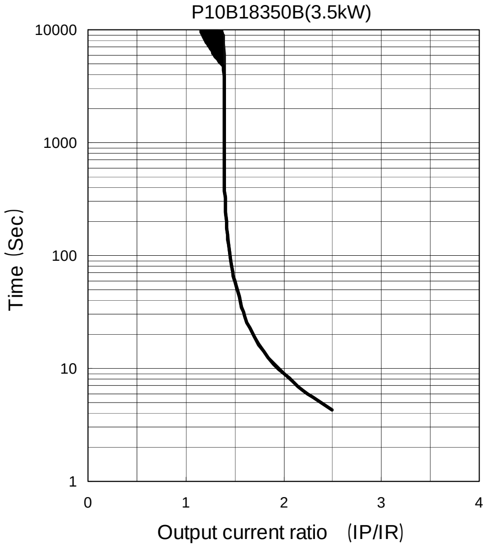
Velocity-torque characteristics

P10B18350B (3.5kW)



Overload characteristics

P10B18350B(3.5kW)



9. SPECIFICATIONS

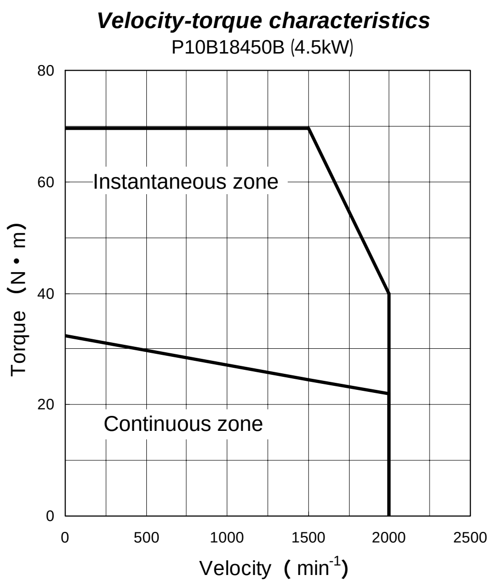
P10B18450B

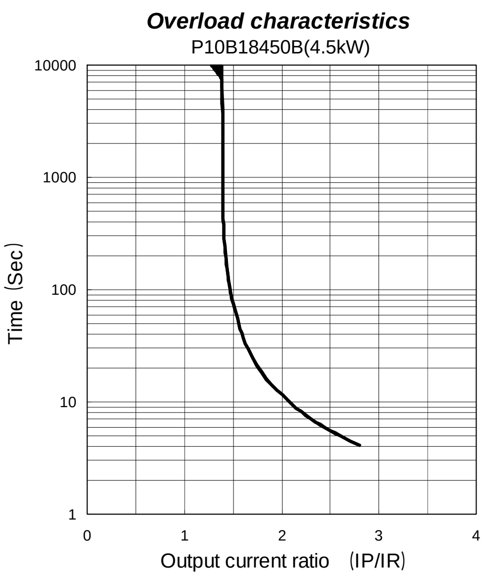
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	4500	W	4500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
* Rated torque	T_R	21.6	N•m	220	kg·cm
* Continuous stall torque	T_S	32.4	N•m	330	kg·cm
* Instantaneous maximum stall torque	T_P	69.6	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. 4. 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}	$kg\cdot m^2$ ($GD^2/4$)	1.58	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	1.57×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	1.6	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	1.55×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	1.58	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	15.5×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	15.8	$g\cdot cm\cdot s^2$
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-R II)	W_E	5.5	kg	5.5	kg

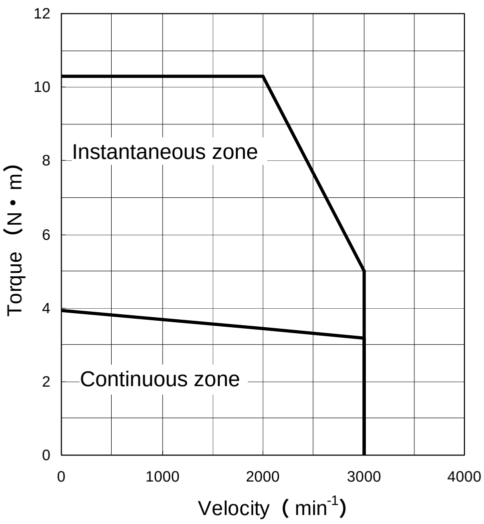
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	0.15	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

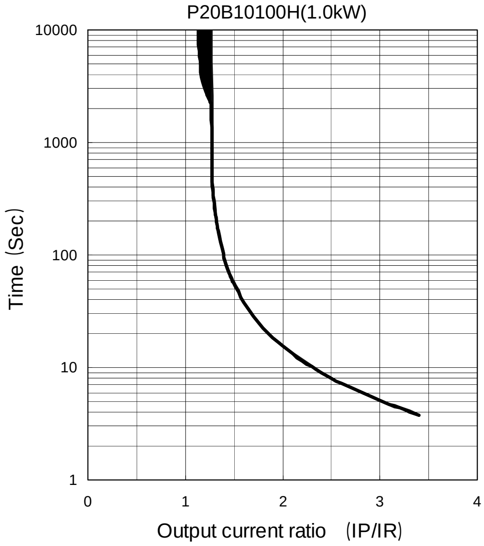
Velocity-torque characteristics

P20B10100H (1.0kW)



Overload characteristics

P20B10100H(1.0kW)



9. SPECIFICATIONS

P20B10150H

	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	PR	1500	W	1500	W
	Rated revolution speed	NR	3000	min^{-1}	3000	rpm
	Maximum revolution speed	Nmax	3000	min^{-1}	3000	rpm
*	Rated torque	TR	4.79	N•m	48.8	kg·cm
*	Continuous stall torque	TS	4.90	N•m	50	kg·cm
*	Instantaneous maximum stall torque	T_P	17.7	N•m	180	kg·cm
*	Rated armature current	IR	6.5	Arms	6.5	Arms
*	Continuous stall armature current	IS	6.3	Arms	6.3	Arms
*	Instantaneous maximum stall armature current	IP	25	Arms	25	Arms
	Torque constant	KT	0.83	N·m/Arms	8.5	kg·cm/Arms
	Induced voltage constant	KEϕ	29.0	mV/min^{-1}	29.0	V/krpm
	Phase armature resistance	Rϕ	0.67	Ω	0.67	Ω
	Electrical time constant	te	13	msec	13	msec
	Mechanical time constant (not including sensor)	tm	0.57	msec	0.57	msec
	Inertia (including wiring-saved INC)	JM	2.04×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	2.08	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	JM	2.06×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	2.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RⅡ)	JM	2.04×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	2.08	$g\cdot cm\cdot s^2$
	Applicable load inertia	JL	2.04×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	20.8	$g\cdot cm\cdot s^2$
	Weight (including wiring-saved INC)	WE	6.5	kg	6.5	kg
	Weight (including ABS-E)	WE	6.4	kg	6.4	kg
	Weight (including ABS-RⅡ)	WE	6.6	kg	6.6	kg

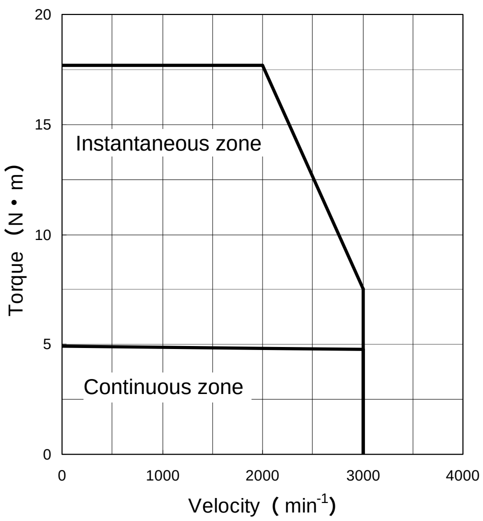
Holding Brake Data Sheet (Option)

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 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

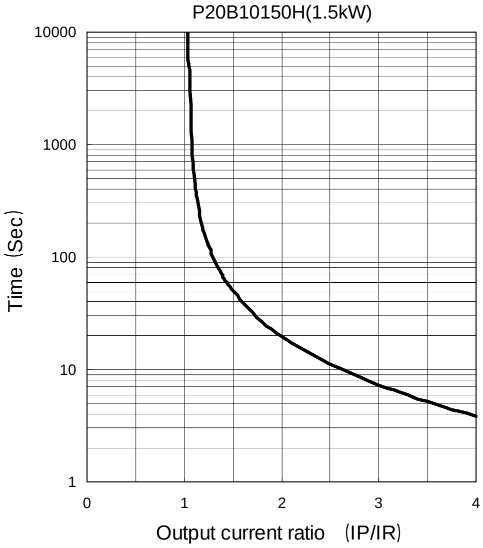
Velocity-torque characteristics

P20B10150H (1.5kW)



Overload characteristics

P20B10150H(1.5kW)



9. SPECIFICATIONS

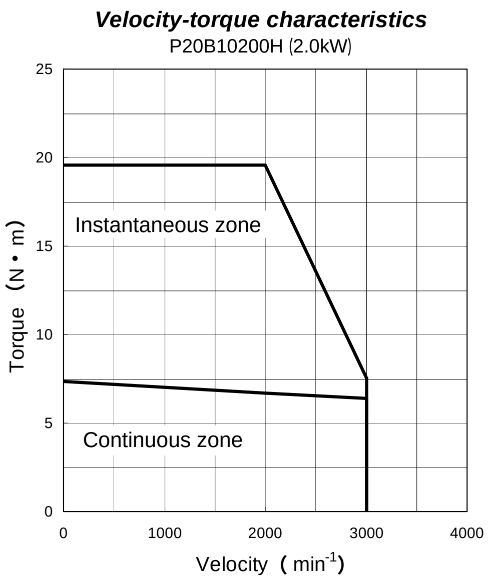
P20B10200H

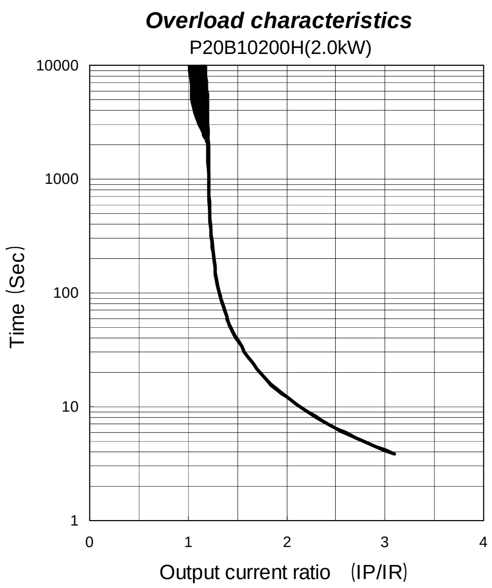
Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	2000	W	2000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	6.37	N•m	65	kg·cm
∗ Continuous stall torque	T_S	7.36	N•m	75	kg·cm
∗ Instantaneous maximum stall torque	T_P	19.6	N•m	200	kg·cm
∗ Rated armature current	I_R	8.5	Arms	8.5	Arms
∗ Continuous stall armature current	I_S	9.3	Arms	9.3	Arms
∗ Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.85	N·m/Arms	8.7	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	30.0	mV/min^{-1}	30.0	V/krpm
Phase armature resistance	R_ϕ	0.50	Ω	0.50	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	0.56	msec	0.56	msec
Inertia (including wiring-saved INC)	J_M	2.83×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.88	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	2.85×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.9	$g\cdot cm\cdot s^2$
Inertia (including ABS-RII)	J_M	2.83×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.88	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	28.3×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	28.8	$g\cdot cm\cdot s^2$
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}	$kg\cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, 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-R II)	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-R II)	W_E	9.5	kg	9.5	kg

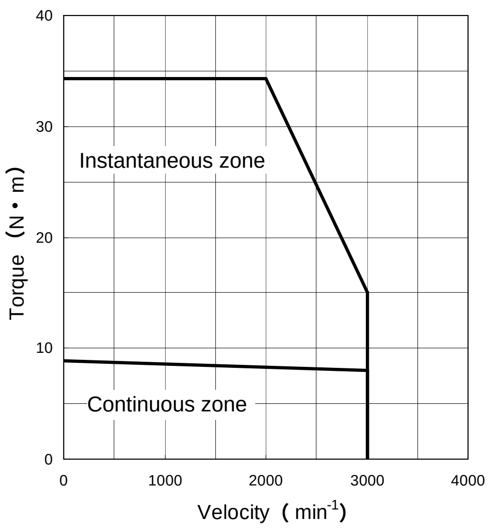
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

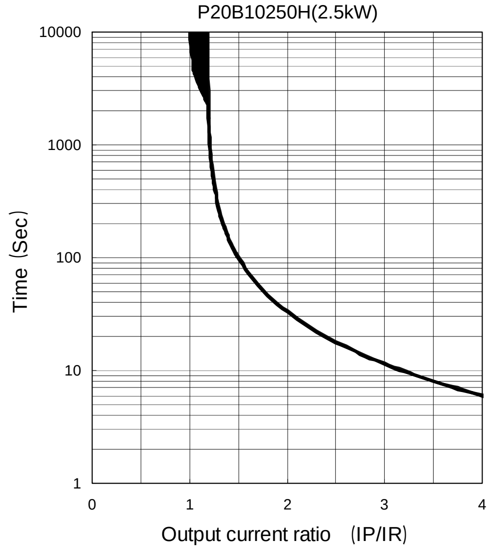
Velocity-torque characteristics

P20B10250H (2.5kW)



Overload characteristics

P20B10250H(2.5kW)



9. SPECIFICATIONS

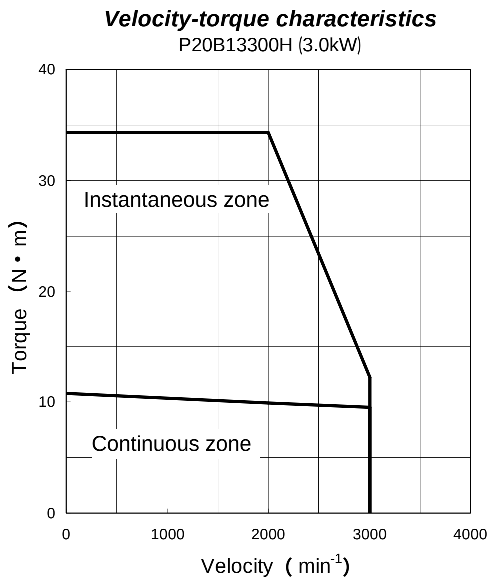
P20B13300H

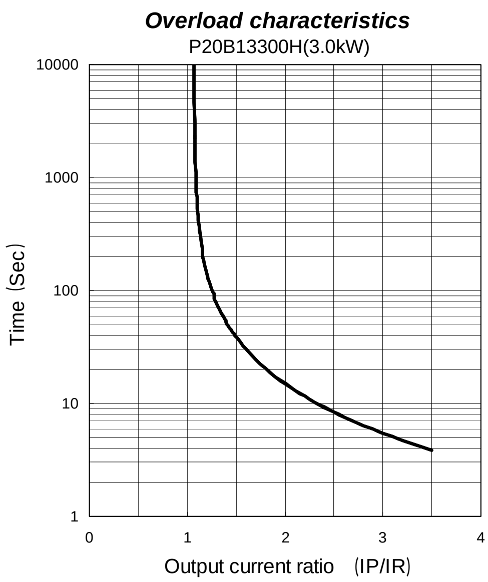
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	3000	W	3000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	9.51	N•m	97	kg·cm
* Continuous stall torque	T_S	10.8	N•m	110	kg·cm
* Instantaneous maximum stall torque	T_P	34.3	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}	$kg\cdot m^2$ ($GD^2/4$)	7.28	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	7.16×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	7.3	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	7.14×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	7.28	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	71.4×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	72.8	$g\cdot cm\cdot s^2$
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-R II)	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}	$kg\cdot m^2$ ($GD^2/4$)	0.49	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

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}	$kg{\cdot}m^2$ ($GD^2/4$)	9.98	$g{\cdot}cm{\cdot}s^2$
	Inertia (including ABS-E)	J_M	9.81×10^{-4}	$kg{\cdot}m^2$ ($GD^2/4$)	10.0	$g{\cdot}cm{\cdot}s^2$
	Inertia (including ABS-R II)	J_M	9.79×10^{-4}	$kg{\cdot}m^2$ ($GD^2/4$)	9.98	$g{\cdot}cm{\cdot}s^2$
	Applicable load inertia	J_L	97.9×10^{-4}	$kg{\cdot}m^2$ ($GD^2/4$)	99.8	$g{\cdot}cm{\cdot}s^2$
	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-R II)	W_E	14.5	kg	14.5	kg

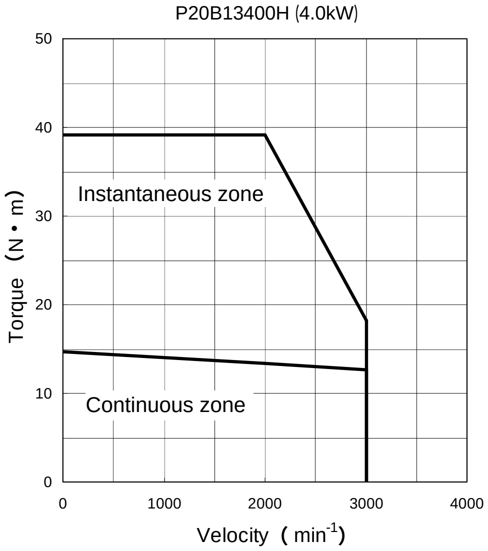
Holding Brake Data Sheet (Option)

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}	$kg{\cdot}m^2$ ($GD^2/4$)	0.56	$g{\cdot}cm{\cdot}s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

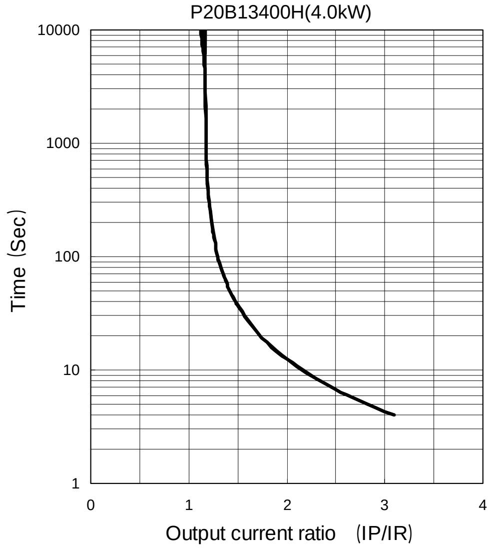
Velocity-torque characteristics

P20B13400H (4.0kW)



Overload characteristics

P20B13400H(4.0kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ ($GD^2/4$)	12.78	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	12.6×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	12.8	$g\cdot cm\cdot s^2$
Inertia (including ABS-RII)	J_M	12.58×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	12.78	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	125.8×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	127.8	$g\cdot cm\cdot s^2$
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

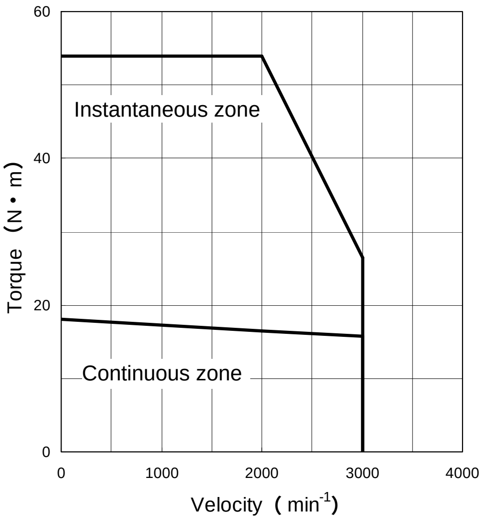
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	0.56	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

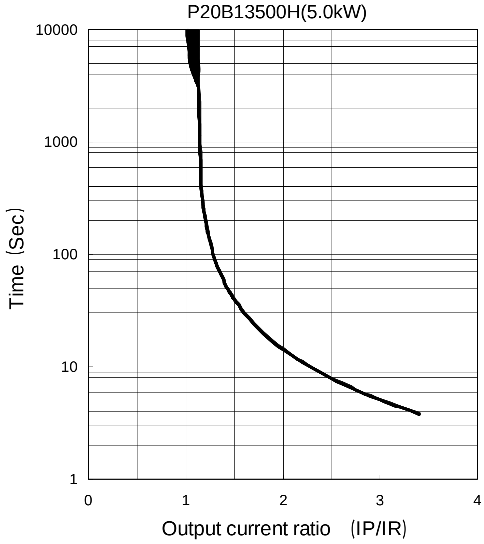
Velocity-torque characteristics

P20B13500H (5.0kW)



Overload characteristics

P20B13500H(5.0kW)



9. SPECIFICATIONS

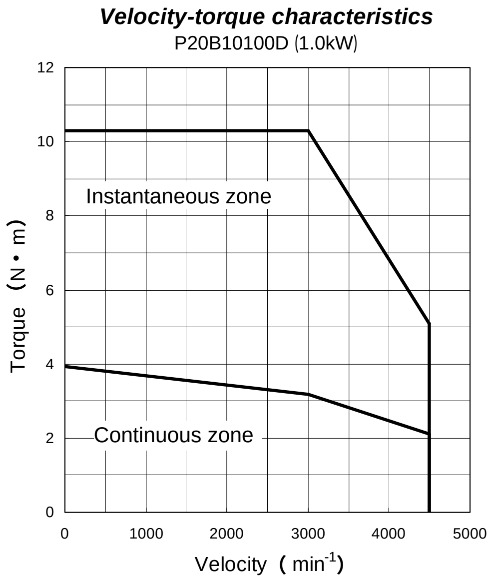
P20B10100D

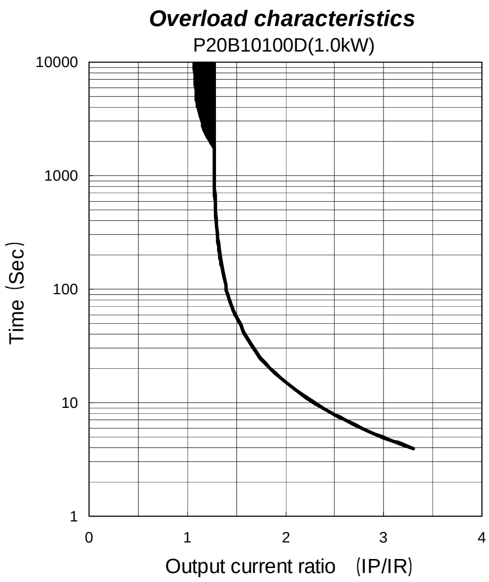
	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	P_R	1000	W	1000	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
*	Rated torque	T_R	3.19	N•m	32.5	kg·cm
*	Continuous stall torque	T_S	3.92	N•m	40	kg·cm
*	Instantaneous maximum stall torque	T_P	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}	$kg\cdot m^2$ $(GD^2/4)$	1.58	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	1.57×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	1.6	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RII)	J_M	1.55×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	1.58	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	15.5×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	15.8	$g\cdot cm\cdot s^2$
	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}	$kg\cdot m^2$ $(GD^2/4)$	0.15	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

P20B10150D

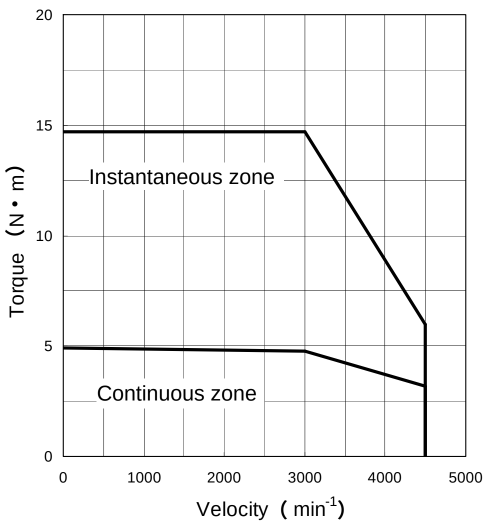
Name	Symbol	Data	Unit	Data	Unit
* Rated output	PR	1500	W	1500	W
Rated revolution speed	NR	3000	min^{-1}	3000	rpm
Maximum revolution speed	Nmax	4500	min^{-1}	4500	rpm
* Rated torque	TR	4.79	N•m	48.8	kg·cm
* Continuous stall torque	TS	4.90	N•m	50	kg·cm
* Instantaneous maximum stall torque	T_P	14.7	N•m	150	kg·cm
* Rated armature current	IR	8.4	Arms	8.4	Arms
* Continuous stall armature current	IS	8.1	Arms	8.1	Arms
* Instantaneous maximum stall armature current	IP	26.5	Arms	26.5	Arms
Torque constant	KT	0.65	N·m/Arms	6.6	kg·cm/Arms
Induced voltage constant	KEϕ	22.6	mV/min^{-1}	22.6	V/krpm
Phase armature resistance	Rϕ	0.42	Ω	0.42	Ω
Electrical time constant	te	13	msec	13	msec
Mechanical time constant (not including sensor)	tm	0.59	msec	0.59	msec
Inertia (including wiring-saved INC)	JM	2.04×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	JM	2.06×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	JM	2.04×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.08	$g\cdot cm\cdot s^2$
Applicable load inertia	JL	20.4×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	20.8	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	WE	6.5	kg	6.5	kg
Weight (including ABS-E)	WE	6.4	kg	6.4	kg
Weight (including ABS-R II)	WE	6.6	kg	6.6	kg

Holding Brake Data Sheet (Option)

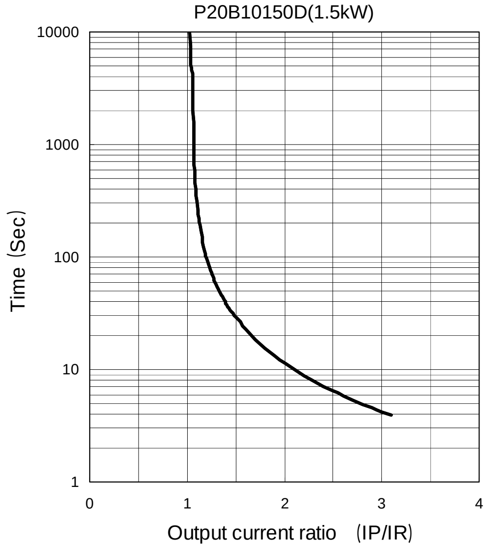
Holding torque	TB	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	VB	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	IB	0.83/0.22	A (DC)	0.83/0.22	A (DC)
Inertia	JB	0.40×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.39	$g\cdot cm\cdot s^2$
Weight	W	1.5	kg	1.5	kg

- 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 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

Velocity-torque characteristics
P20B10150D (1.5kW)



Overload characteristics
P20B10150D(1.5kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	2.88	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	2.85×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	2.9	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	2.83×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	2.88	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	28.3×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	28.8	$g\cdot cm\cdot s^2$
	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-R II)	W_E	8.8	kg	8.8	kg

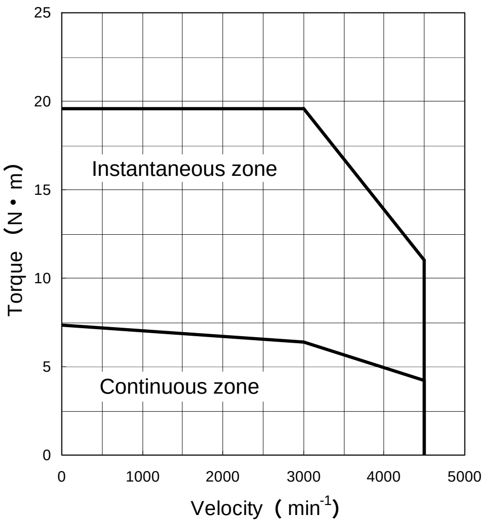
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

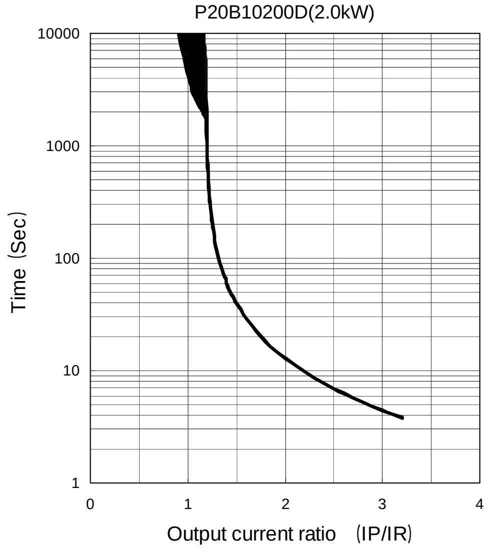
Velocity-torque characteristics

P20B10200D (2.0kW)



Overload characteristics

P20B10200D(2.0kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	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-R II)	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-R II)	W_E	9.5	kg	9.5	kg

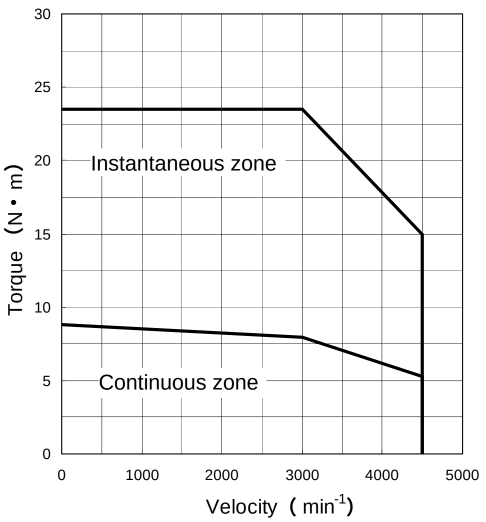
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

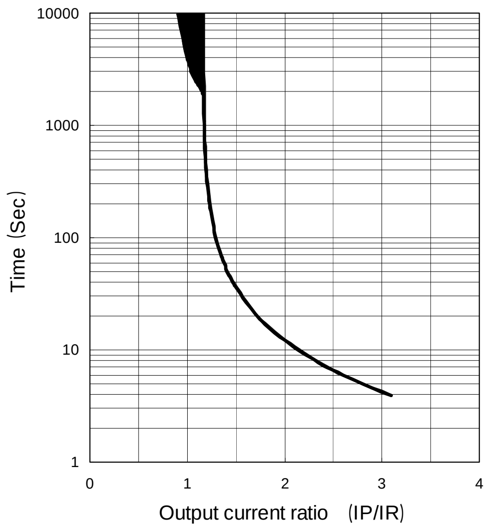
Velocity-torque characteristics

P20B10250D (2.5kW)



Overload characteristics

P20B10250D(2.5kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	7.28	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	7.16×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	7.3	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	7.14×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	7.28	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	71.4×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	72.8	$g\cdot cm\cdot s^2$
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-R II)	W_E	11.5	kg	11.5	kg

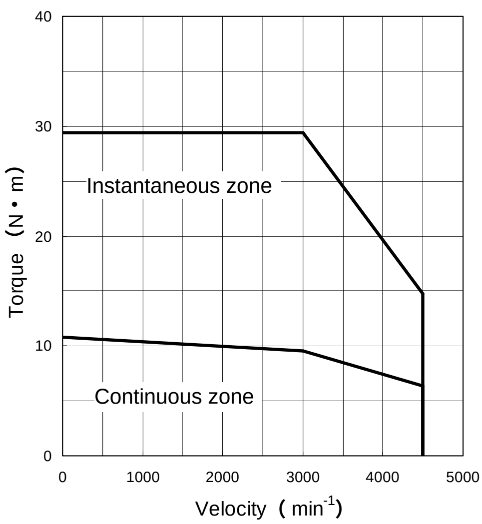
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	0.49	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

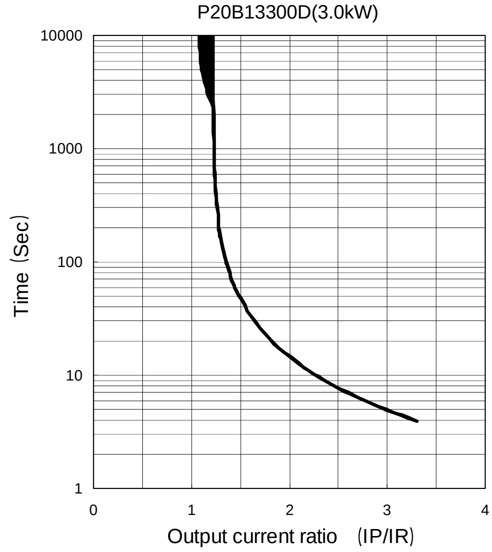
Velocity-torque characteristics

P20B13300D (3.0kW)



Overload characteristics

P20B13300D(3.0kW)



9. SPECIFICATIONS

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}	$kg{\cdot}m^2$ $(GD^2/4)$	9.98	$g{\cdot}cm{\cdot}s^2$
Inertia (including ABS-E)	J_M	9.81×10^{-4}	$kg{\cdot}m^2$ $(GD^2/4)$	10.0	$g{\cdot}cm{\cdot}s^2$
Inertia (including ABS-R II)	J_M	9.79×10^{-4}	$kg{\cdot}m^2$ $(GD^2/4)$	9.98	$g{\cdot}cm{\cdot}s^2$
Applicable load inertia	J_L	97.9×10^{-4}	$kg{\cdot}m^2$ $(GD^2/4)$	99.8	$g{\cdot}cm{\cdot}s^2$
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-R II)	W_E	14.5	kg	14.5	kg

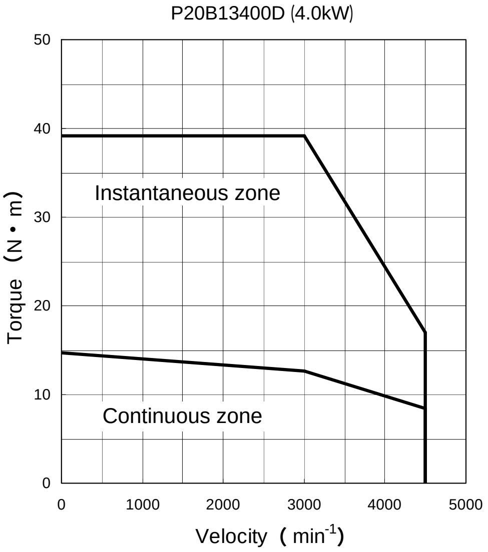
Holding Brake Data Sheet (Option)

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}	$kg{\cdot}m^2$ $(GD^2/4)$	0.56	$g{\cdot}cm{\cdot}s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

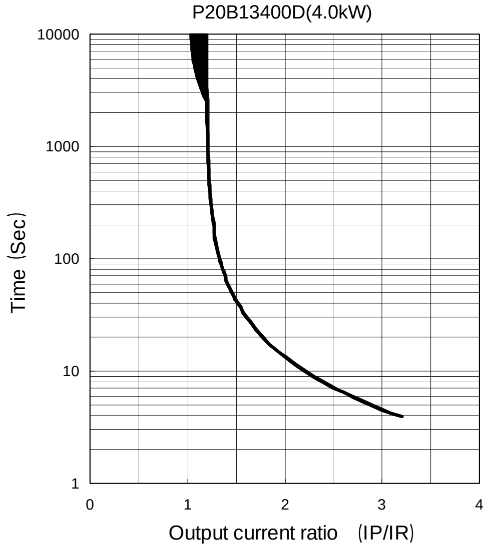
Velocity-torque characteristics

P20B13400D (4.0kW)



Overload characteristics

P20B13400D(4.0kW)



9. SPECIFICATIONS

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}	$kg \cdot m^2$ ($GD^2/4$)	12.78	$g \cdot cm \cdot s^2$
	Inertia (including ABS-E)	J_M	12.6×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	12.8	$g \cdot cm \cdot s^2$
	Inertia (including ABS-R II)	J_M	12.58×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	12.78	$g \cdot cm \cdot s^2$
	Applicable load inertia	J_L	125.8×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	127.8	$g \cdot cm \cdot s^2$
	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-R II)	W_E	17.4	kg	17.4	kg

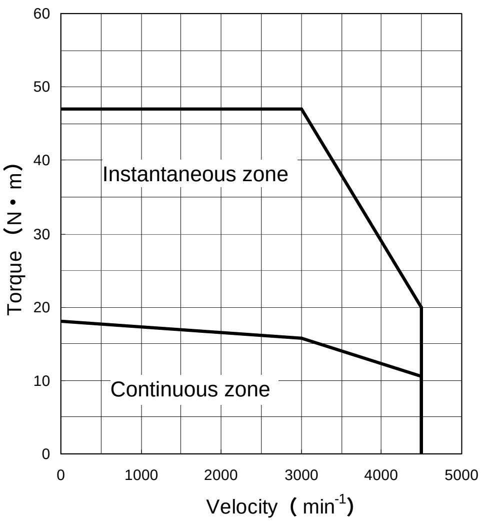
Holding Brake Data Sheet (Option)

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}	$kg \cdot m^2$ ($GD^2/4$)	0.56	$g \cdot cm \cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

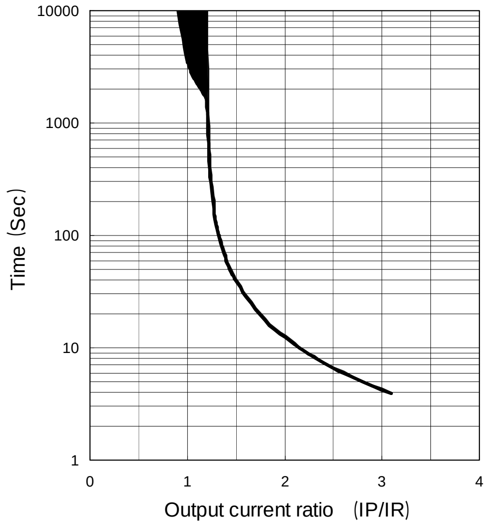
Velocity-torque characteristics

P20B13500D (5.0kW)



Overload characteristics

P20B13500D(5.0kW)



9. 4. 5. 3 Motor Data Sheet

P3

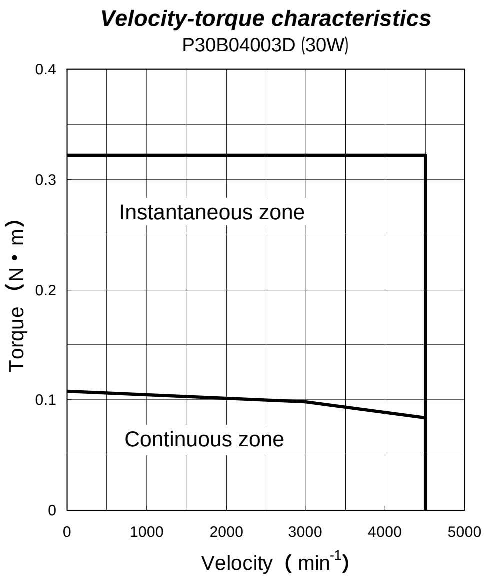
P30B04003D

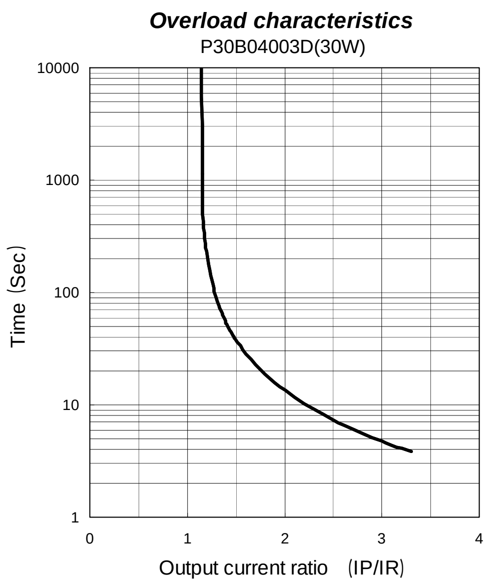
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	30	W	30	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.098	N•m	1.0	kg·cm
* Continuous stall torque	T_S	0.108	N•m	1.1	kg·cm
* Instantaneous maximum stall torque	T_P	0.322	N•m	3.3	kg·cm
* Rated armature current	I_R	0.54	Arms	0.54	Arms
* Continuous stall armature current	I_S	0.56	Arms	0.56	Arms
* Instantaneous maximum stall armature current	I_P	1.79	Arms	1.79	Arms
Torque constant	K_T	0.2	N·m/Arms	2.08	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	7.1	mV/min^{-1}	7.1	V/krpm
Phase armature resistance	R_ϕ	12.5	Ω	12.5	Ω
Electrical time constant	t_e	1.2	msec	1.2	msec
Mechanical time constant (not including sensor)	t_m	1.8	msec	1.8	msec
Inertia (including wiring-saved INC)	J_M	0.024×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.025	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	0.049×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.05	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	0.024×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.025	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	0.24×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.25	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	0.3	kg	0.3	kg
Weight (including ABS-E)	W_E	0.63	kg	0.63	kg
Weight (including ABS-R II)	W_E	0.63	kg	0.63	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	0.26/0.07	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

P30B04005D

	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	PR	50	W	50	W
	Rated revolution speed	NR	3000	min^{-1}	3000	rpm
	Maximum revolution speed	Nmax	4500	min^{-1}	4500	rpm
*	Rated torque	TR	0.157	N•m	1.6	kg·cm
*	Continuous stall torque	TS	0.167	N•m	1.7	kg·cm
*	Instantaneous maximum stall torque	TP	0.49	N•m	5.0	kg·cm
*	Rated armature current	IR	0.74	Arms	0.74	Arms
*	Continuous stall armature current	IS	0.75	Arms	0.75	Arms
*	Instantaneous maximum stall armature current	IP	2.4	Arms	2.4	Arms
	Torque constant	KT	0.235	N·m/Arms	2.4	kg·cm/Arms
	Induced voltage constant	KEϕ	8.2	mV/min^{-1}	8.2	V/krpm
	Phase armature resistance	Rϕ	9.1	Ω	9.1	Ω
	Electrical time constant	te	1.2	msec	1.2	msec
	Mechanical time constant (not including sensor)	tm	1.3	msec	1.3	msec
	Inertia (including wiring-saved INC)	JM	0.031×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.032	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	JM	0.056×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.057	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	JM	0.028×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.029	$g\cdot cm\cdot s^2$
	Applicable load inertia	JL	0.31×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.32	$g\cdot cm\cdot s^2$
	Weight (including wiring-saved INC)	WE	0.35	kg	0.35	kg
	Weight (including ABS-E)	WE	0.68	kg	0.68	kg
	Weight (including ABS-R II)	WE	0.44	kg	0.44	kg

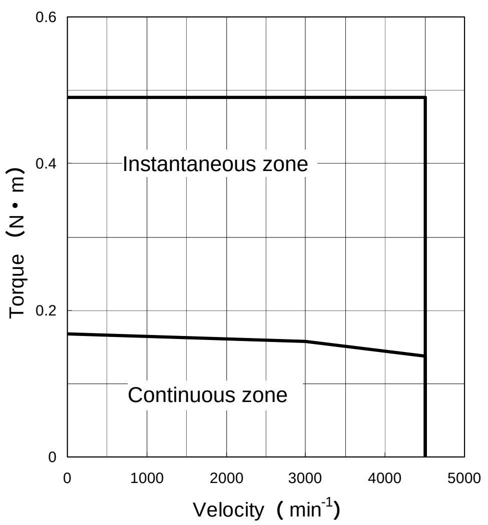
Holding Brake Data Sheet (Option)

Holding torque	TB	0.157 or more	N·m	1.6 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}	$kg\cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

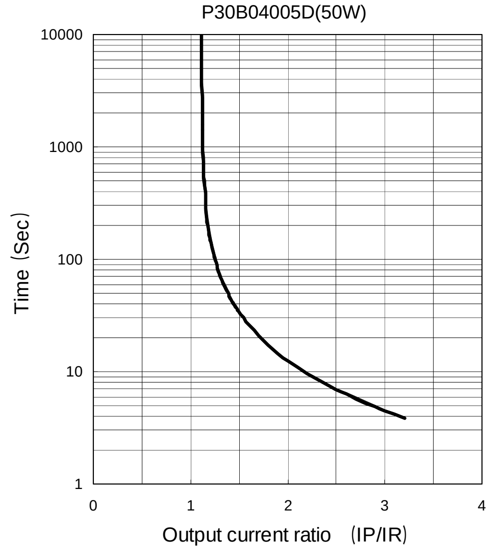
Velocity-torque characteristics

P30B04005D (50W)



Overload characteristics

P30B04005D(50W)



9. SPECIFICATIONS

P30B04010D

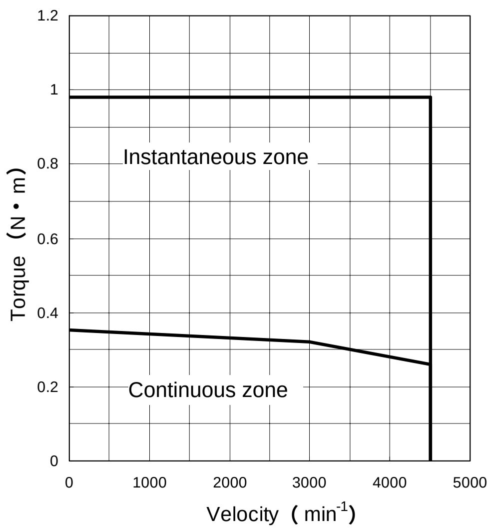
Name	Symbol	Data	Unit	Data	Unit
* Rated output	PR	100	W	100	W
Rated revolution speed	NR	3000	min^{-1}	3000	rpm
Maximum revolution speed	Nmax	4500	min^{-1}	4500	rpm
* Rated torque	TR	0.32	N•m	3.25	kg·cm
* Continuous stall torque	TS	0.353	N•m	3.6	kg·cm
* Instantaneous maximum stall torque	T_P	0.98	N•m	10	kg·cm
* Rated armature current	IR	1.1	Arms	1.1	Arms
* Continuous stall armature current	IS	1.3	Arms	1.3	Arms
* Instantaneous maximum stall armature current	IP	4.1	Arms	4.1	Arms
Torque constant	KT	0.292	N·m/Arms	2.98	kg·cm/Arms
Induced voltage constant	KEϕ	10.2	mV/min^{-1}	10.2	V/krpm
Phase armature resistance	Rϕ	4.3	Ω	4.3	Ω
Electrical time constant	te	1.4	msec	1.4	msec
Mechanical time constant (not including sensor)	tm	0.7	msec	0.7	msec
Inertia (including wiring-saved INC)	JM	0.051×10^{-4}	$kg\cdot m^2$ (GD^2/4)	0.052	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	JM	0.076×10^{-4}	$kg\cdot m^2$ (GD^2/4)	0.077	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	JM	0.048×10^{-4}	$kg\cdot m^2$ (GD^2/4)	0.049	$g\cdot cm\cdot s^2$
Applicable load inertia	JL	0.51×10^{-4}	$kg\cdot m^2$ (GD^2/4)	0.52	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	WE	0.5	kg	0.5	kg
Weight (including ABS-E)	WE	0.83	kg	0.83	kg
Weight (including ABS-R II)	WE	0.59	kg	0.59	kg

Holding Brake Data Sheet (Option)

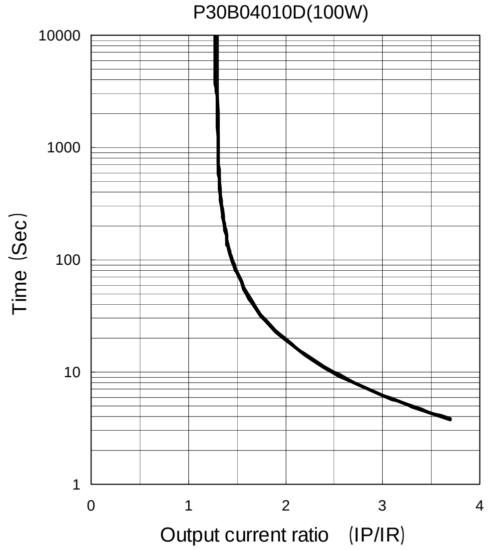
Holding torque	TB	0.32 or more	N·m	3.25 or more	kg·cm
Exciting voltage	VB	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	IB	0.26/0.07	A (DC)	0.26/0.07	A (DC)
Inertia	JB	0.0078×10^{-4}	$kg\cdot m^2$ (GD^2/4)	0.008	$g\cdot cm\cdot s^2$
Weight	W	0.24	kg	0.24	kg

- 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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

Velocity-torque characteristics
P30B04010D (100W)



Overload characteristics
P30B04010D(100W)



9. SPECIFICATIONS

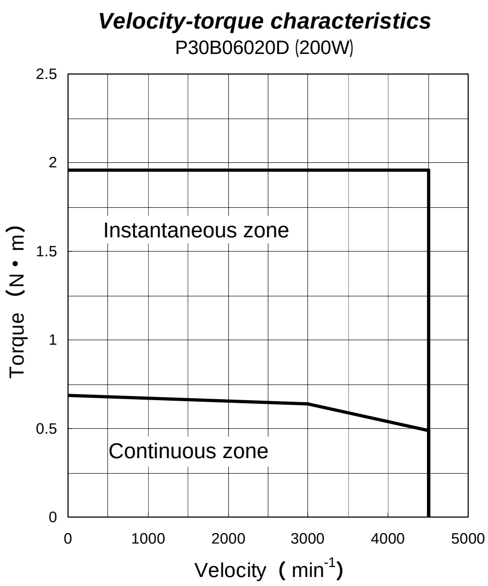
P30B06020D

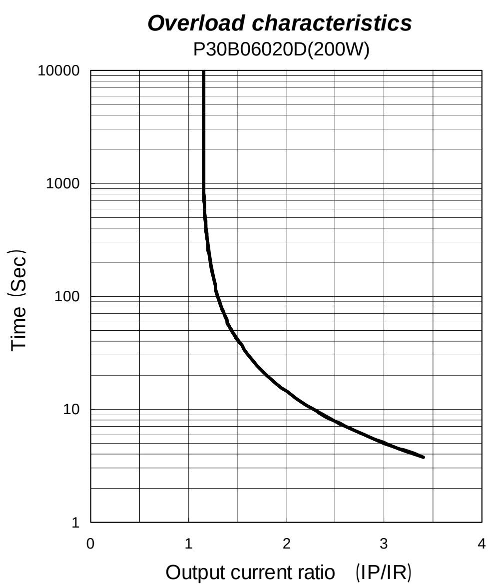
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.637	N•m	6.5	kg·cm
* Continuous stall torque	T_S	0.686	N•m	7	kg·cm
* Instantaneous maximum stall torque	T_P	1.96	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}	$kg\cdot m^2$ ($GD^2/4$)	0.147	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	0.169×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.172	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	0.141×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.144	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	1.44×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	1.47	$g\cdot cm\cdot s^2$
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-R II)	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}	$kg\cdot m^2$ ($GD^2/4$)	0.061	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

P30B06040D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	PR	400	W	400	W
Rated revolution speed	NR	3000	min^{-1}	3000	rpm
Maximum revolution speed	Nmax	4500	min^{-1}	4500	rpm
∗ Rated torque	TR	1.274	N•m	13	kg·cm
∗ Continuous stall torque	TS	1.372	N•m	14	kg·cm
∗ Instantaneous maximum stall torque	T_P	3.82	N•m	39	kg·cm
∗ Rated armature current	IR	2.7	Arms	2.7	Arms
∗ Continuous stall armature current	IS	2.8	Arms	2.8	Arms
∗ Instantaneous maximum stall armature current	IP	8.6	Arms	8.6	Arms
Torque constant	KT	0.533	N·m/Arms	5.44	kg·cm/Arms
Induced voltage constant	KEφ	18.6	mV/min^{-1}	18.6	V/krpm
Phase armature resistance	Rφ	1.4	Ω	1.4	Ω
Electrical time constant	te	4.6	msec	4.6	msec
Mechanical time constant (not including sensor)	tm	0.38	msec	0.38	msec
Inertia (including wiring-saved INC)	JM	0.255×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.265	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	JM	0.280×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.290	$g\cdot cm\cdot s^2$
Inertia (including ABS-RII)	JM	0.252×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.262	$g\cdot cm\cdot s^2$
Applicable load inertia	JL	2.55×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.65	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	WE	1.7	kg	1.7	kg
Weight (including ABS-E)	WE	1.92	kg	1.92	kg
Weight (including ABS-RII)	WE	1.90	kg	1.90	kg

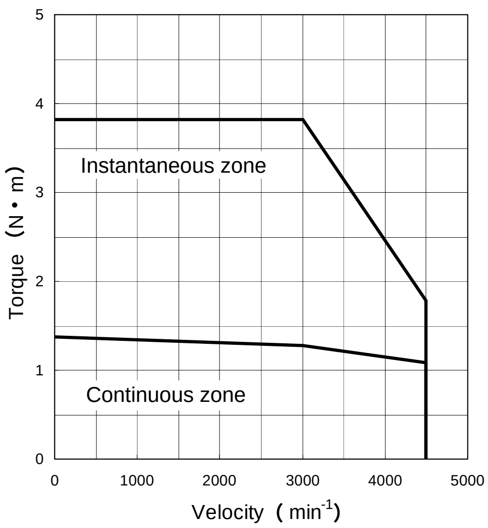
Holding Brake Data Sheet (Option)

Holding torque	TB	1.274 or more	N·m	13 or more	kg·cm
Exciting voltage	VB	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	IB	0.31/0.07	A (DC)	0.31/0.07	A (DC)
Inertia	JB	0.06×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.061	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

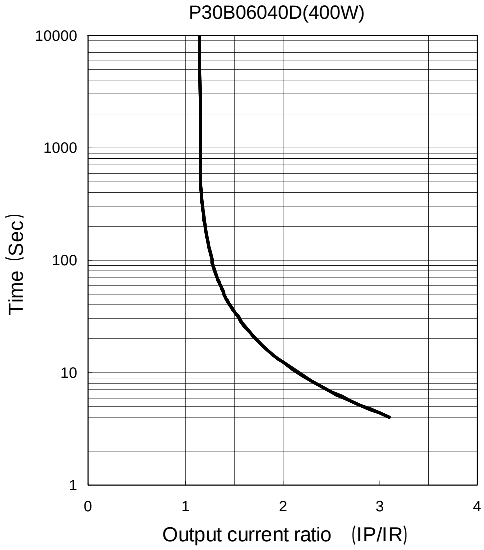
Velocity-torque characteristics

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}	$kg \cdot m^2$ ($GD^2/4$)	0.645	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.78×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	0.79	$g \cdot cm \cdot s^2$
Inertia (including ABS-R II)	J_M	0.647×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	0.657	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	6.35×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	6.45	$g \cdot cm \cdot s^2$
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-R II)	W_E	3.49	kg	3.49	kg

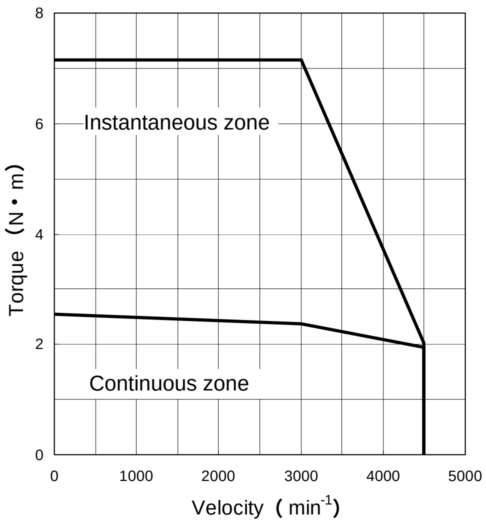
Holding Brake Data Sheet (Option)

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}	$kg \cdot m^2$ ($GD^2/4$)	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 t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

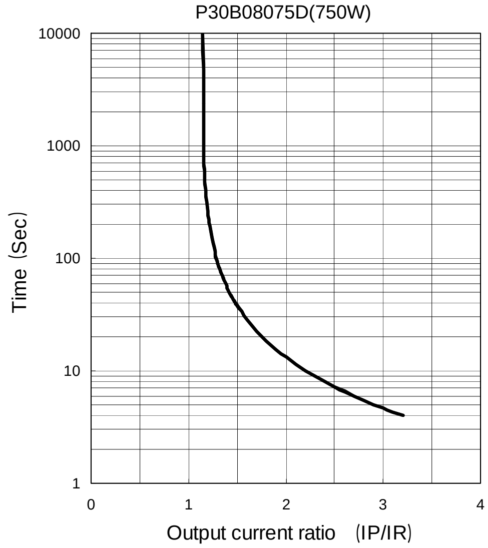
Velocity-torque characteristics

P30B08075D (750W)



Overload characteristics

P30B08075D(750W)



9. 4. 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}	$kg\cdot m^2$ ($GD^2/4$)	0.02	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M		$kg\cdot m^2$ ($GD^2/4$)		$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	0.0167×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.0173	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	0.197×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.2	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	0.24	kg	0.24	kg
Weight (including ABS-E)	W_E		kg		kg
Weight (including ABS-R II)	W_E	0.31	kg	0.31	kg

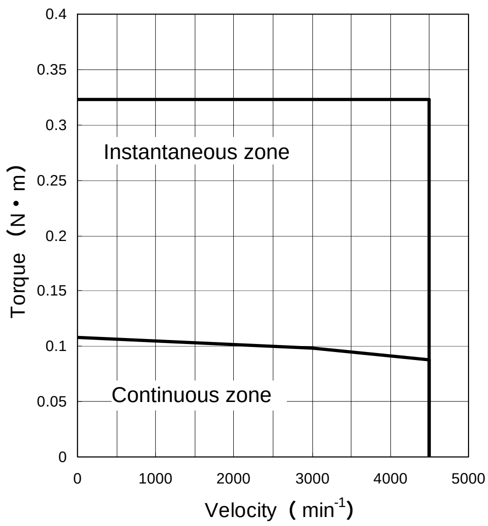
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	0.0022	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

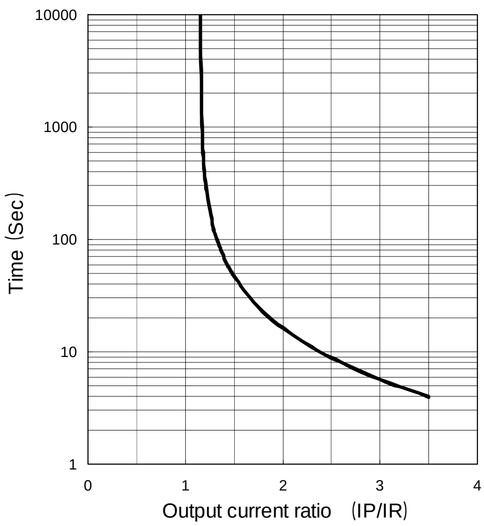
Velocity-torque characteristics

P50B03003D (30W)



Overload characteristics

P50B03003D(30W)



9. SPECIFICATIONS

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

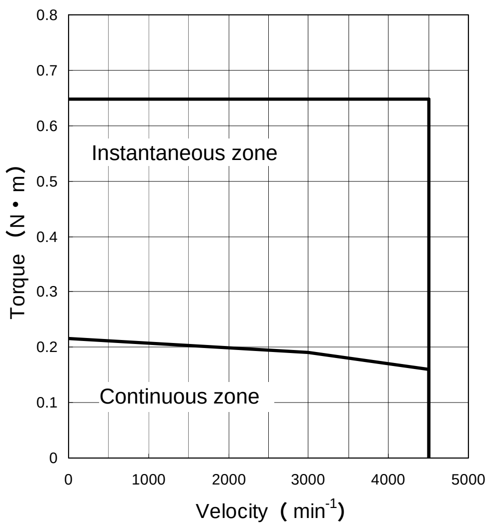
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

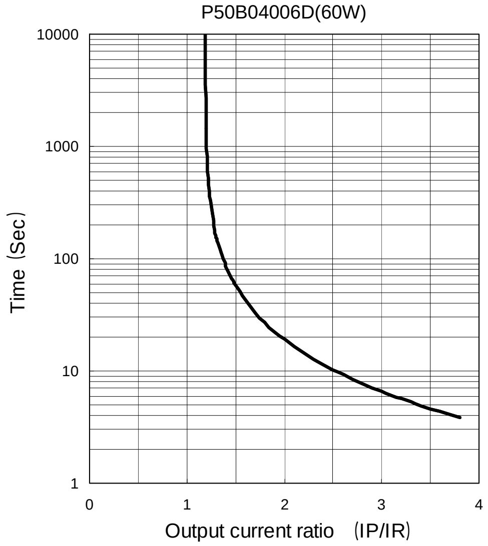
Velocity-torque characteristics

P50B04006D (60W)



Overload characteristics

P50B04006D(60W)



9. SPECIFICATIONS

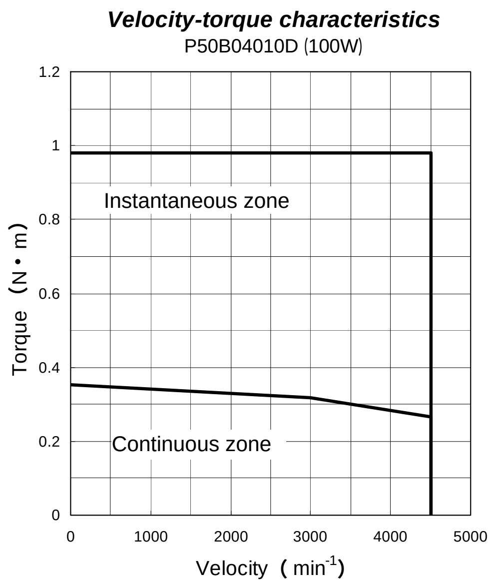
P50B04010D

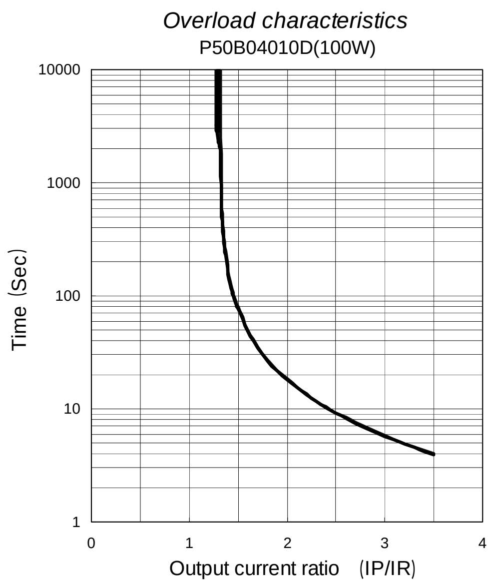
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.319	N•m	3.25	kg·cm
* Continuous stall torque	T_S	0.353	N•m	3.6	kg·cm
* Instantaneous maximum stall torque	T_P	0.98	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}	$kg\cdot m^2$ $(GD^2/4)$	0.08	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	0.104×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.105	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	0.0760×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.077	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	0.79×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.8	$g\cdot cm\cdot s^2$
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-R II)	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}	$kg\cdot m^2$ $(GD^2/4)$	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

P50B05005D

	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	PR	50	W	50	W
	Rated revolution speed	NR	3000	min^{-1}	3000	rpm
	Maximum revolution speed	Nmax	4500	min^{-1}	4500	rpm
*	Rated torque	TR	0.159	N•m	1.62	kg·cm
*	Continuous stall torque	TS	0.167	N•m	1.7	kg·cm
*	Instantaneous maximum stall torque	TP	0.49	N•m	5	kg·cm
*	Rated armature current	IR	0.85	Arms	0.85	Arms
*	Continuous stall armature current	IS	0.85	Arms	0.85	Arms
*	Instantaneous maximum stall armature current	IP	2.9	Arms	2.9	Arms
	Torque constant	KT	0.249	N·m/Arms	2.54	kg·cm/Arms
	Induced voltage constant	KEϕ	8.7	mV/min^{-1}	8.7	V/krpm
	Phase armature resistance	Rϕ	9.2	Ω	9.2	Ω
	Electrical time constant	te	2.1	msec	2.1	msec
	Mechanical time constant (not including sensor)	tm	2.6	msec	2.6	msec
	Inertia (including wiring-saved INC)	JM	0.063×10^{-4}	$kg{\cdot}m^2$ ($GD^2/4$)	0.064	$g{\cdot}cm{\cdot}s^2$
	Inertia (including ABS-E)	JM	0.088×10^{-4}	$kg{\cdot}m^2$ ($GD^2/4$)	0.089	$g{\cdot}cm{\cdot}s^2$
	Inertia (including ABS-RII)	JM	0.060×10^{-4}	$kg{\cdot}m^2$ ($GD^2/4$)	0.061	$g{\cdot}cm{\cdot}s^2$
	Applicable load inertia	JL	0.63×10^{-4}	$kg{\cdot}m^2$ ($GD^2/4$)	0.64	$g{\cdot}cm{\cdot}s^2$
	Weight (including wiring-saved INC)	WE	0.53	kg	0.53	kg
	Weight (including ABS-E)	WE	0.8	kg	0.8	kg
	Weight (including ABS-RII)	WE	0.61	kg	0.61	kg

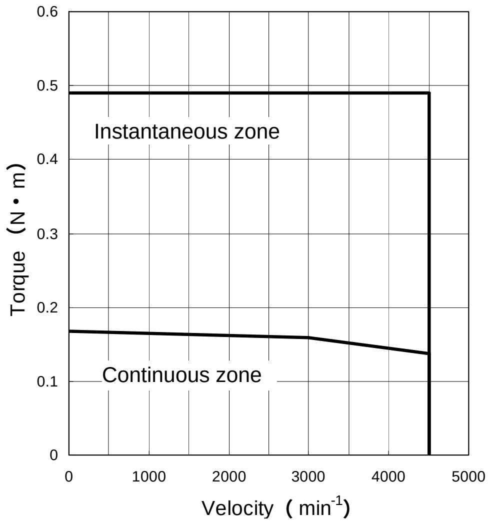
Holding Brake Data Sheet (Option)

Name	Symbol	Data	Unit	Data	Unit
Holding torque	TB	0.167 or more	N·m	1.7 or more	kg·cm
Exciting voltage	VB	24/90	V (DC)±10%	24/90	V (DC)±10%
Exciting current	IB	0.40/0.11	A (DC)	0.40/0.11	A (DC)
Inertia	JB	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

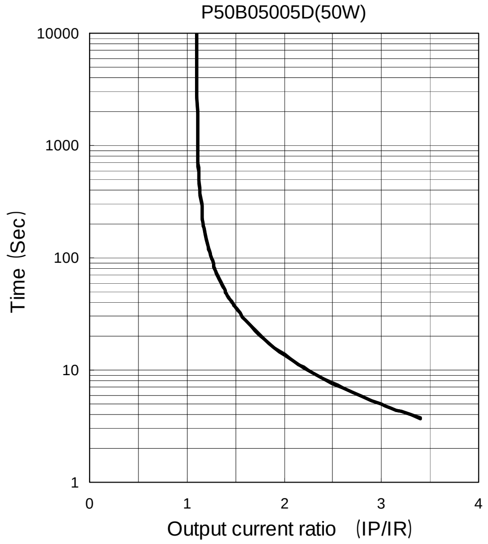
Velocity-torque characteristics

P50B05005D (50W)



Overload characteristics

P50B05005D(50W)



9. SPECIFICATIONS

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-R II)	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-R II)	W_E	0.82	kg	0.82	kg

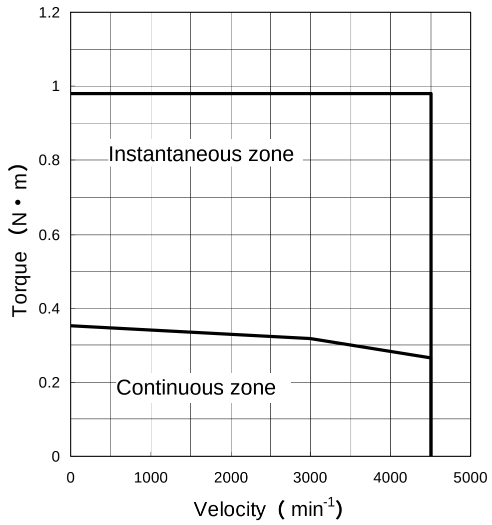
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

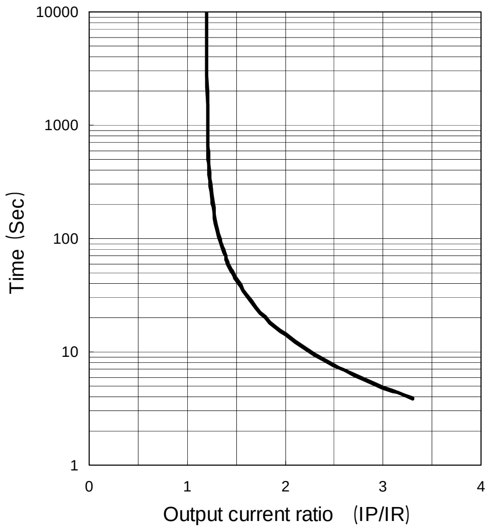
Velocity-torque characteristics

P50B05010D (100W)



Overload characteristics

P50B05010D(100W)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	0.176	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	0.198×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.201	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	0.170×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.173	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	1.73×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	1.76	$g\cdot cm\cdot s^2$
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

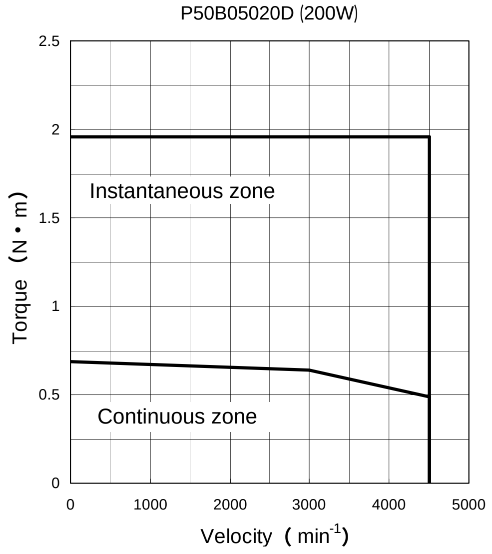
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

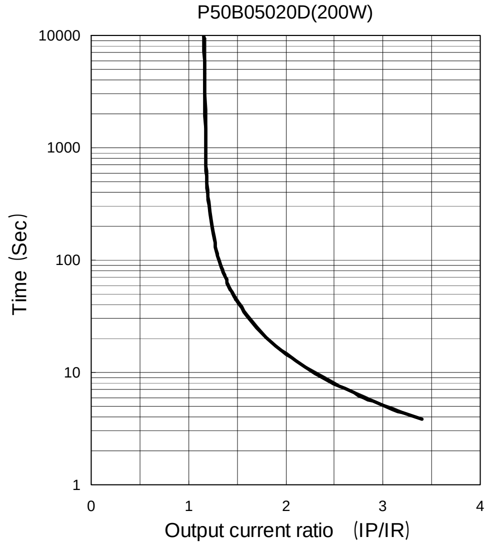
Velocity-torque characteristics

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}	$kg\cdot m^2$ ($GD^2/4$)	0.394	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	0.531×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.539	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	0.398×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.406	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	3.86×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	3.94	$g\cdot cm\cdot s^2$
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-R II)	W_E	1.60	kg	1.60	kg

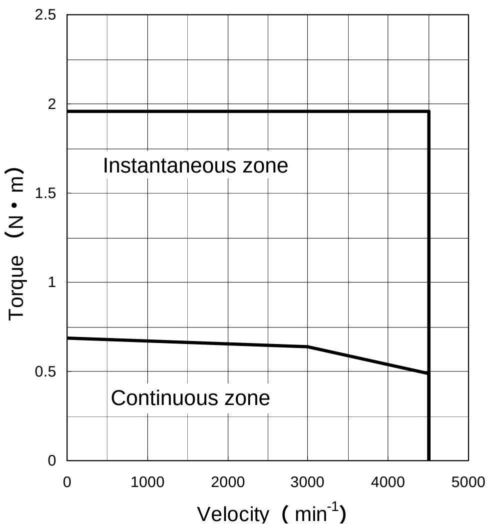
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	0.25	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

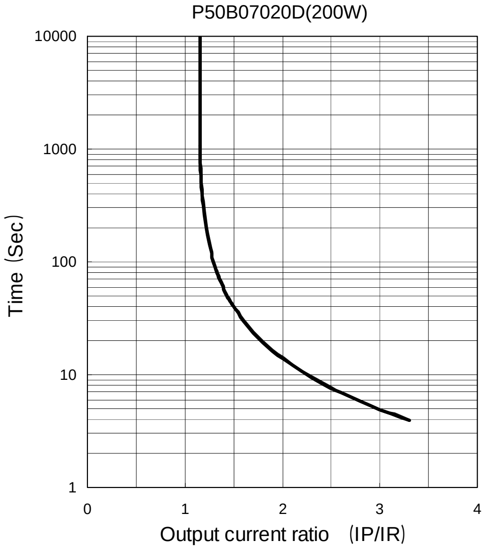
Velocity-torque characteristics

P50B07020D (200W)



Overload characteristics

P50B07020D(200W)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ ($GD^2/4$)	0.505	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	0.64×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.65	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	0.507×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	0.517	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	4.95×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	5.05	$g\cdot cm\cdot s^2$
	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-R II)	W_E	1.80	kg	1.80	kg

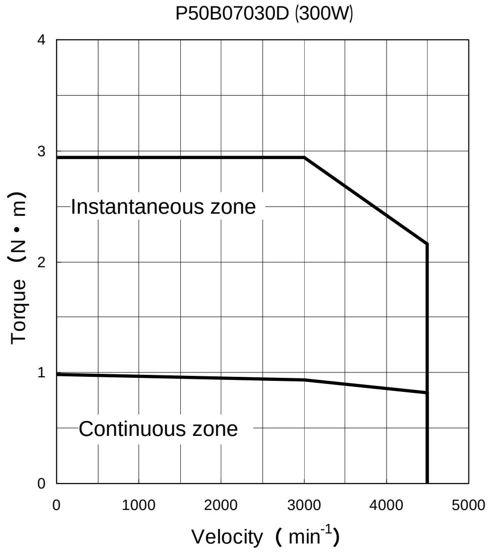
Holding Brake Data Sheet (Option)

Name	Symbol	Data	Unit	Data	Unit
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}	$kg\cdot m^2$ ($GD^2/4$)	0.25	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

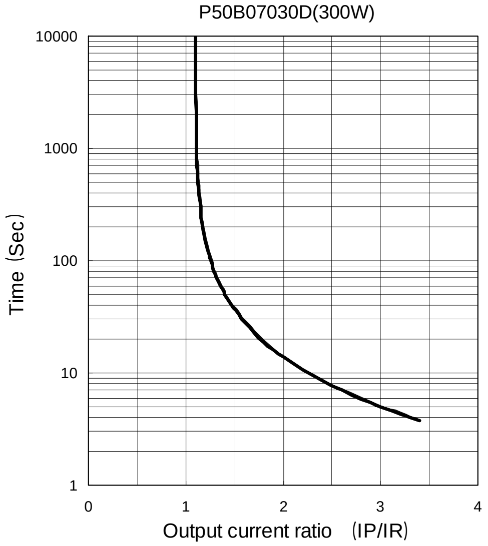
Velocity-torque characteristics

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}	$kg\cdot m^2$ $(GD^2/4)$	0.755	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	0.885×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.9	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	0.752×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	0.767	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	7.4×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	7.55	$g\cdot cm\cdot s^2$
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-R II)	W_E	2.10	kg	2.10	kg

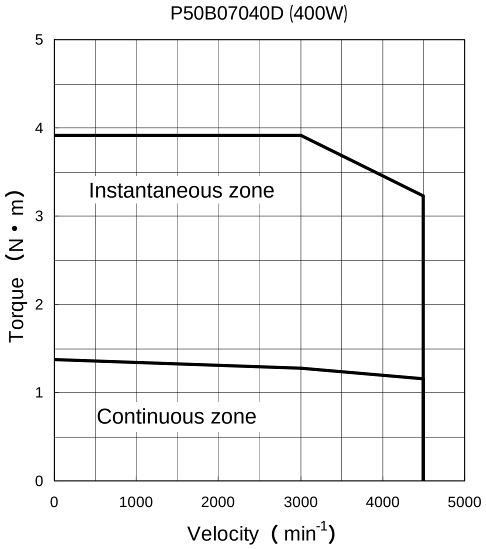
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	0.25	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

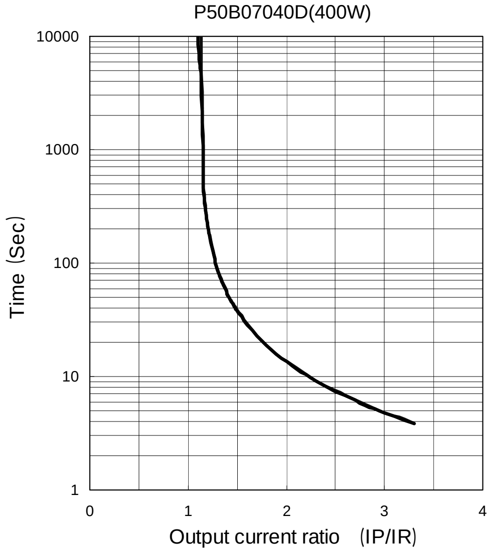
Velocity-torque characteristics

P50B07040D (400W)



Overload characteristics

P50B07040D(400W)



9. SPECIFICATIONS

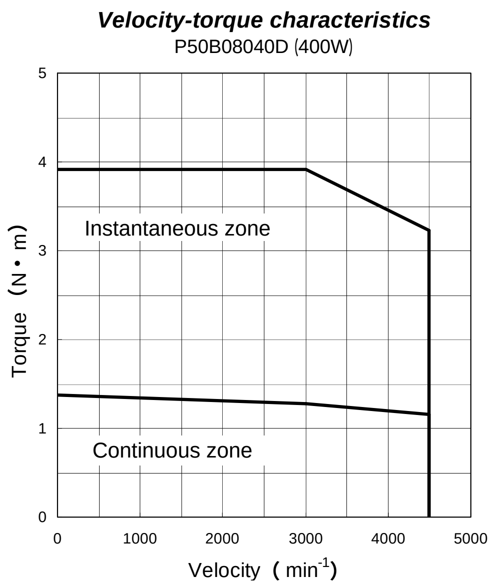
P50B08040D

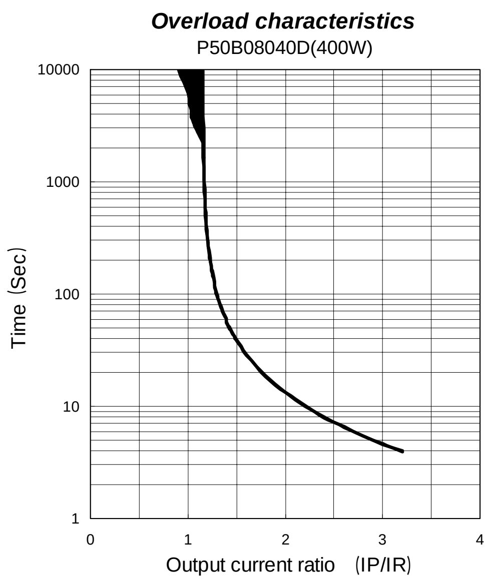
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	1.274	N•m	13	kg·cm
* Continuous stall torque	T_S	1.372	N•m	14	kg·cm
* Instantaneous maximum stall torque	T_P	3.92	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}	$kg \cdot m^2$ $(GD^2/4)$	0.845	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.973×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	0.99	$g \cdot cm \cdot s^2$
Inertia (including ABS-R II)	J_M	0.840×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	0.857	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	8.28×10^{-4}	$kg \cdot m^2$ $(GD^2/4)$	8.45	$g \cdot cm \cdot s^2$
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-R II)	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}	$kg \cdot m^2$ $(GD^2/4)$	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





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}	$kg\cdot m^2$ ($GD^2/4$)	1.185	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	1.306×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	1.33	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	1.173×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	1.197	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	11.6×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	11.9	$g\cdot cm\cdot s^2$
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-R II)	W_E	3.00	kg	3.00	kg

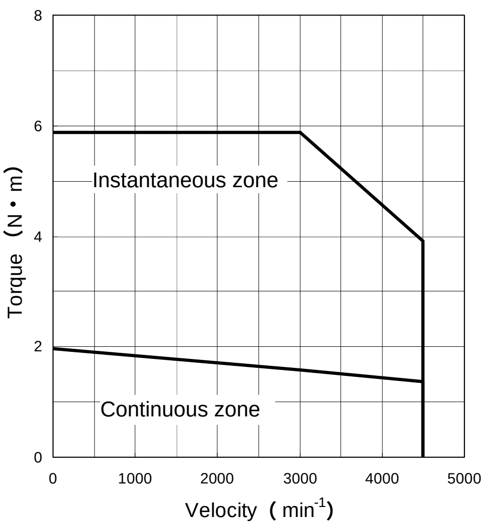
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

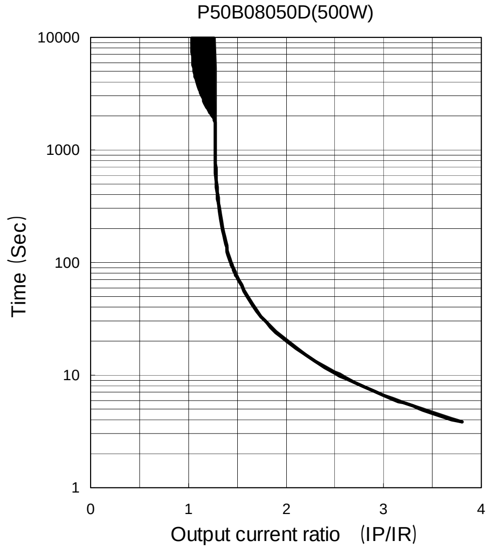
Velocity-torque characteristics

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}	$kg\cdot m^2$ ($GD^2/4$)	1.965	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	2.071×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.11	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	1.938×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	1.977	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	19.26×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	19.65	$g\cdot cm\cdot s^2$
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-R II)	W_E	3.90	kg	3.90	kg

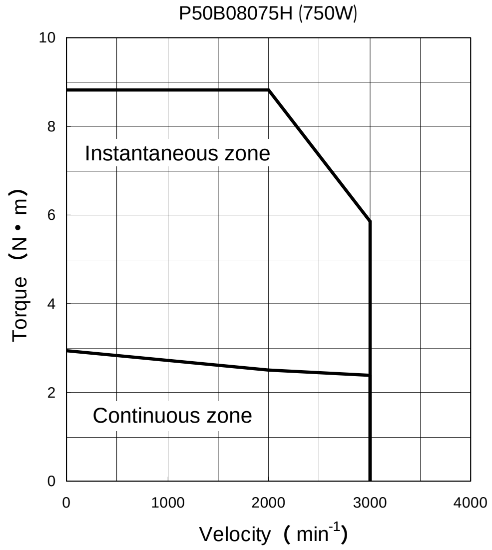
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

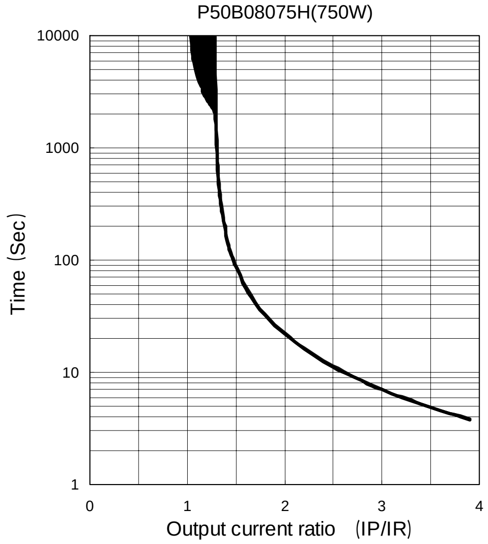
Velocity-torque characteristics

P50B08075H (750W)



Overload characteristics

P50B08075H(750W)



9. SPECIFICATIONS

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}	$kg \cdot m^2$ ($GD^2/4$)	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-R II)	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-R II)	W_E	5.1	kg	5.1	kg

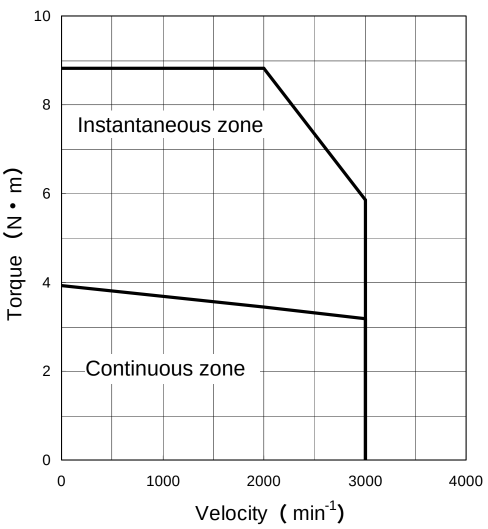
Holding Brake Data Sheet (Option)

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}	$kg \cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

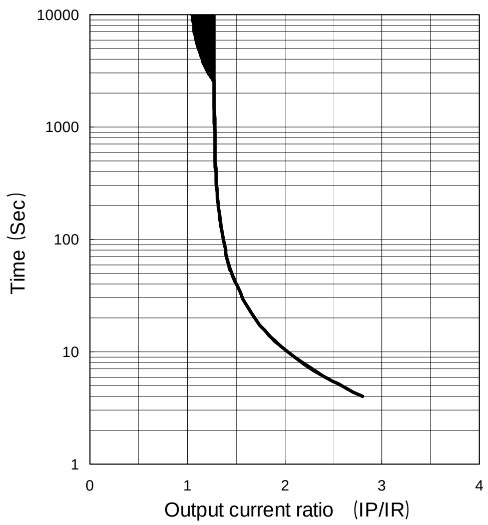
Velocity-torque characteristics

P50B08100H (1.0kW)



Overload characteristics

P50B08100H(1.0kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ (GD^2/4)	1.965	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	2.071×10^{-4}	$kg\cdot m^2$ (GD^2/4)	2.11	$g\cdot cm\cdot s^2$
	Inertia (including ABS-RII)	J_M	1.938×10^{-4}	$kg\cdot m^2$ (GD^2/4)	1.977	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	19.26×10^{-4}	$kg\cdot m^2$ (GD^2/4)	19.65	$g\cdot cm\cdot s^2$
	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

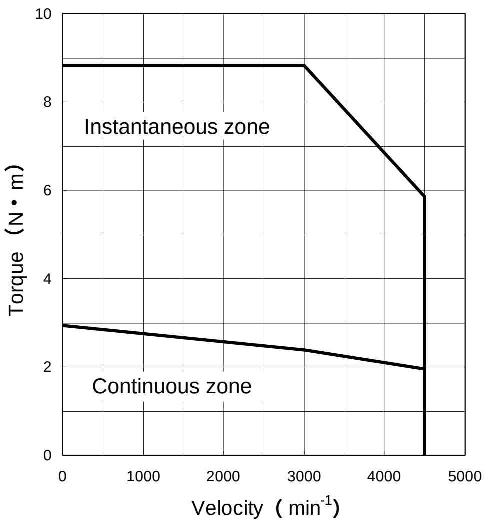
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ (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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

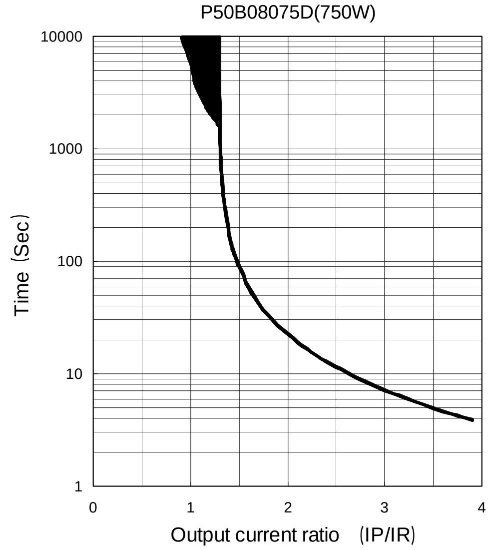
Velocity-torque characteristics

P50B08075D (750W)



Overload characteristics

P50B08075D(750W)



9. SPECIFICATIONS

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-R II)	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-R II)	W_E	5.05	kg	5.05	kg

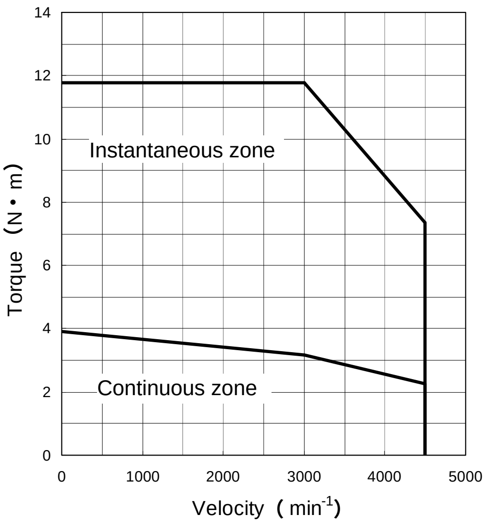
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

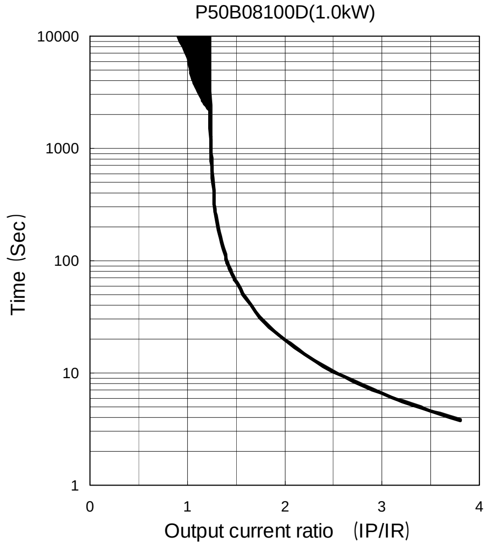
Velocity-torque characteristics

P50B08100D (1.0kW)



Overload characteristics

P50B08100D(1.0kW)



9. 4. 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}	$kg\cdot m^2$ ($GD^2/4$)	2.88	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	2.85×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.95	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	2.78×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2.88	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	27.8×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	28.8	$g\cdot cm\cdot s^2$
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-R II)	W_E	4.8	kg	4.8	kg

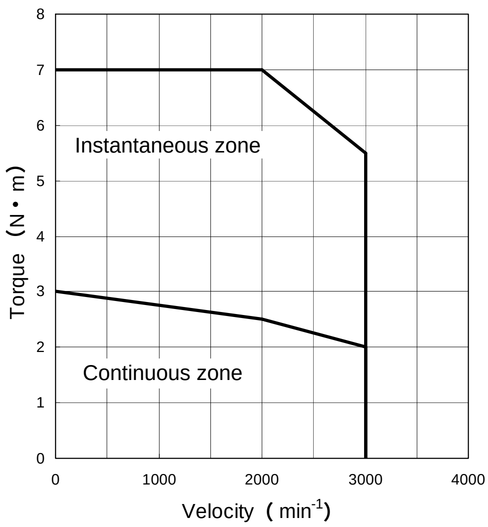
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	0.5	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

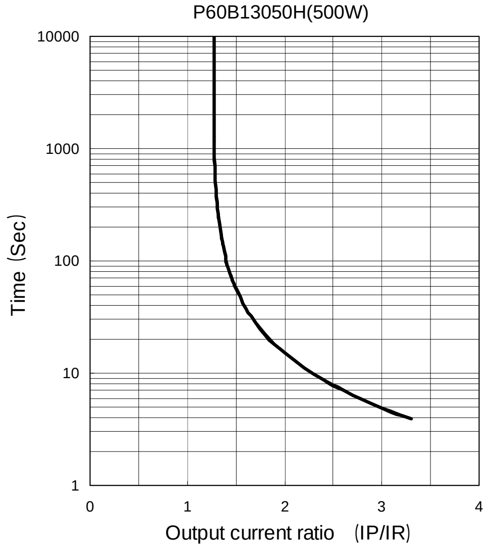
Velocity-torque characteristics

P60B13050H (500W)



Overload characteristics

P60B13050H(500W)



9. SPECIFICATIONS

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-R II)	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-R II)	W_E	6.7	kg	6.7	kg

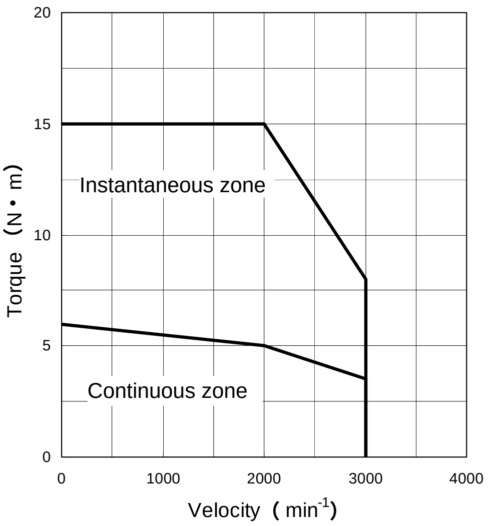
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

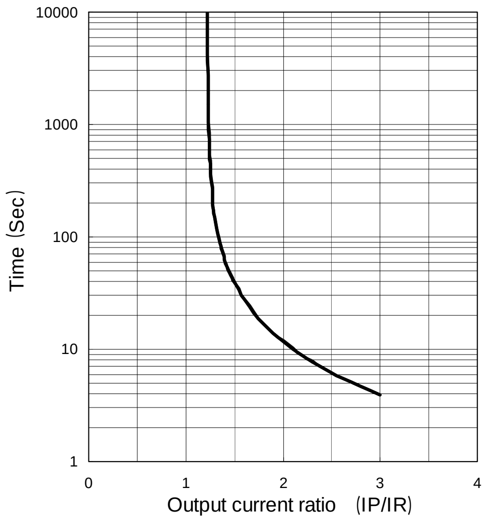
Velocity-torque characteristics

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}	$kg\cdot m^2$ ($GD^2/4$)	8.48	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	8.35×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	8.55	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	8.280×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	8.443	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	82.8×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	84.8	$g\cdot cm\cdot s^2$
	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-R II)	W_E	8.9	kg	8.9	kg

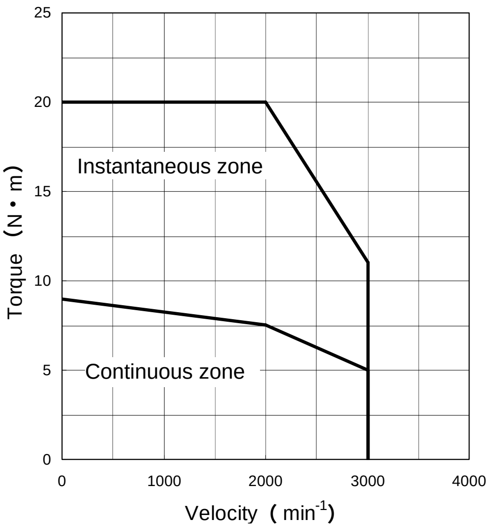
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

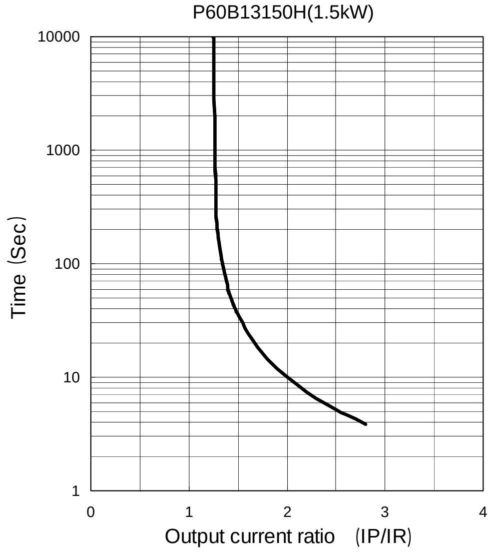
Velocity-torque characteristics

P60B13150H (1.5kW)



Overload characteristics

P60B13150H(1.5kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	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-R II)	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	9.8	kg	9.8	kg
Weight (including ABS-E)	W_E	9.8	kg	9.8	kg
Weight (including ABS-R II)	W_E	9.9	kg	9.9	kg

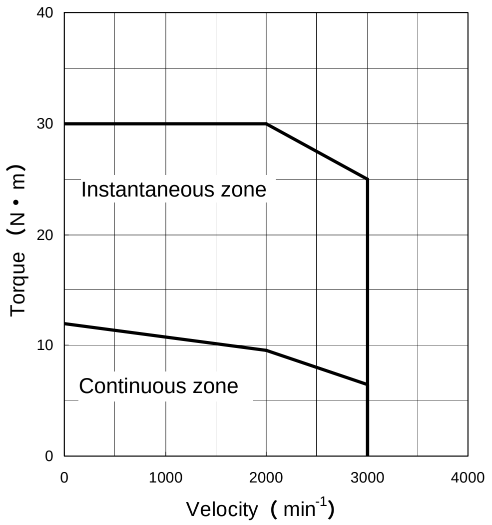
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	0.5	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

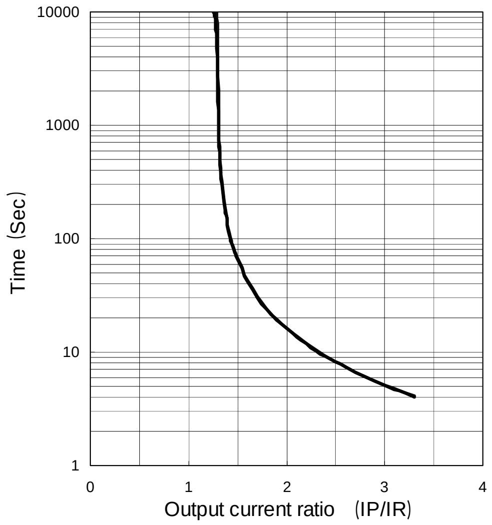
Velocity-torque characteristics

P60B13200H (2.0kW)



Overload characteristics

P60B13200H(2.0kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ ($GD^2/4$)	21.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	20.2×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	21.2	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	20.10×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	20.50	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	201×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	211	$g\cdot cm\cdot s^2$
	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-R II)	W_E	14.5	kg	14.5	kg

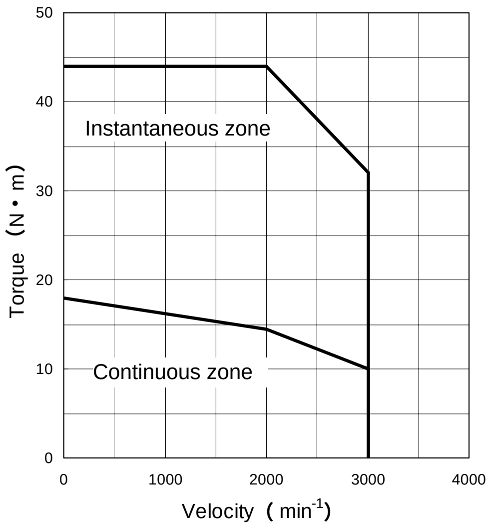
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	0.68	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

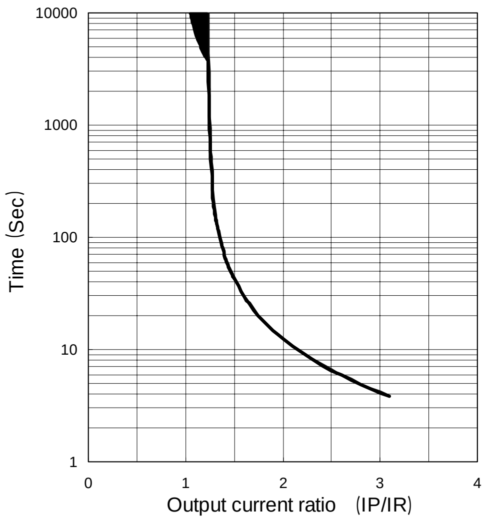
Velocity-torque characteristics

P60B15300H (3.0kW)



Overload characteristics

P60B15300H(3.0kW)



9. SPECIFICATIONS

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

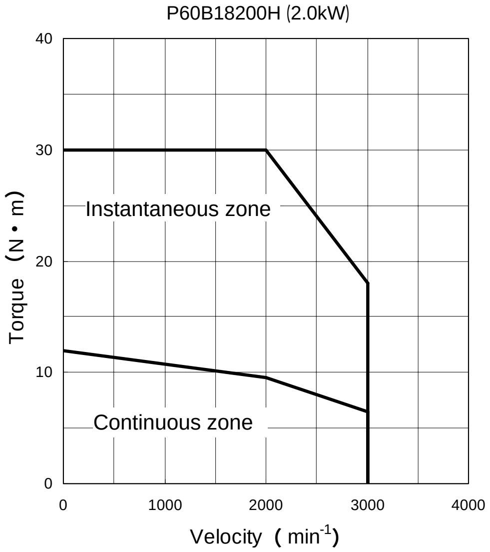
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

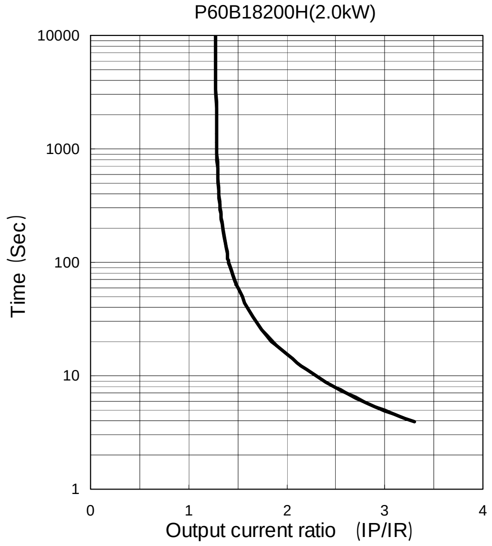
Velocity-torque characteristics

P60B18200H (2.0kW)



Overload characteristics

P60B18200H(2.0kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	35.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	34.2×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	35.2	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	34.10×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	34.88	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	341×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	351	$g\cdot cm\cdot s^2$
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-R II)	W_E	17.8	kg	17.8	kg

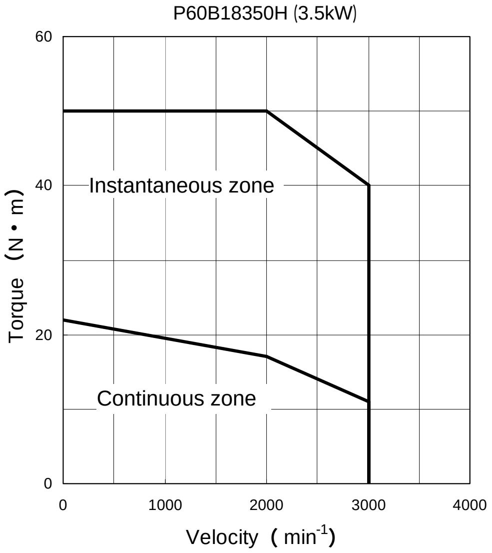
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

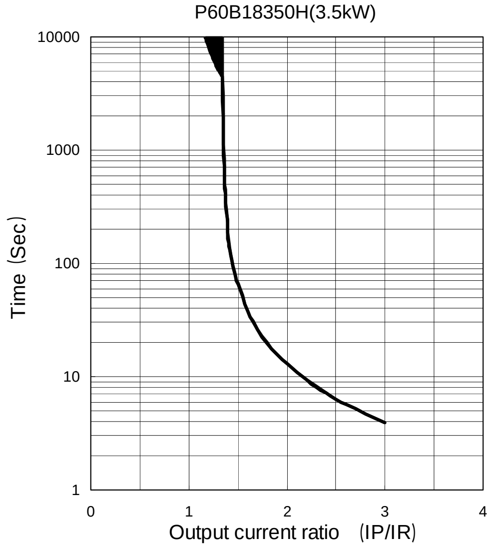
Velocity-torque characteristics

P60B18350H (3.5kW)



Overload characteristics

P60B18350H(3.5kW)



9. SPECIFICATIONS

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

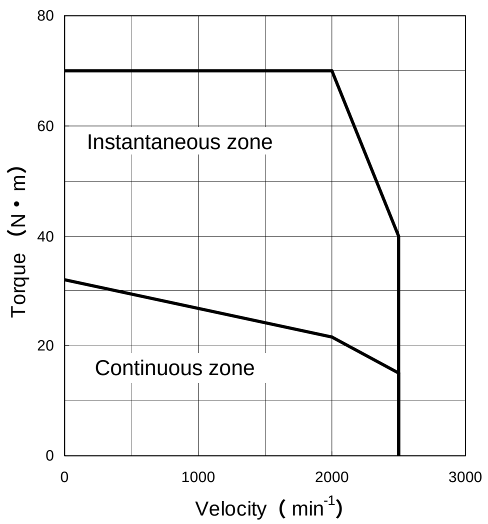
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

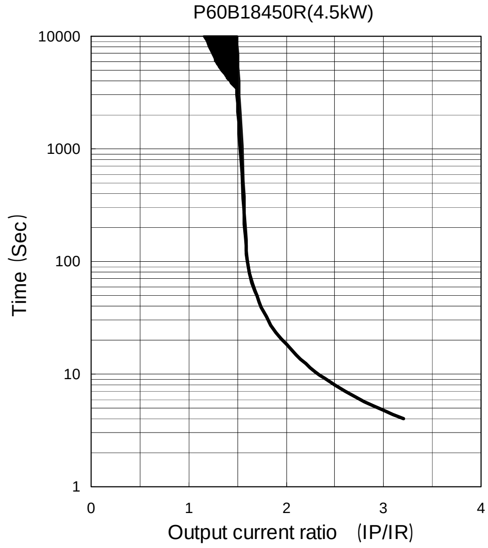
Velocity-torque characteristics

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}	$kg\cdot m^2$ ($GD^2/4$)	63.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	61.9×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	63.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	61.9×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	63.1	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	619×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	631	$g\cdot cm\cdot s^2$
	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-R II)	W_E	31.8	kg	31.8	kg

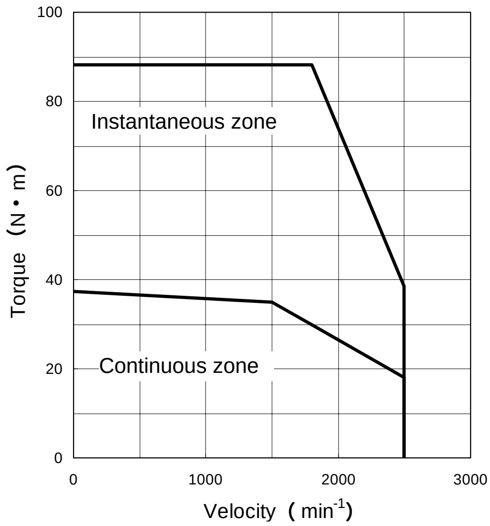
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	4.59	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

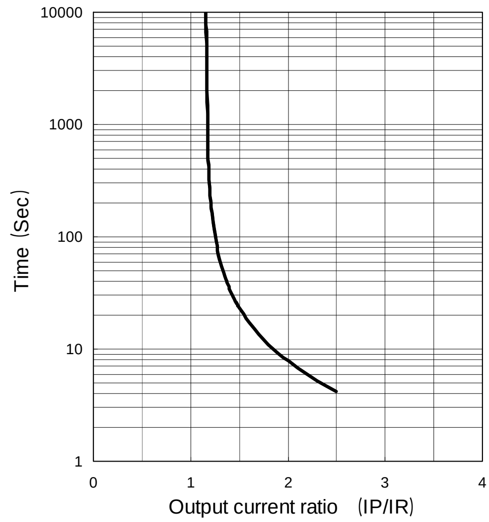
Velocity-torque characteristics

P60B18550R (5.5kW)



Overload characteristics

P60B18550R(5.5kW)



9. SPECIFICATIONS

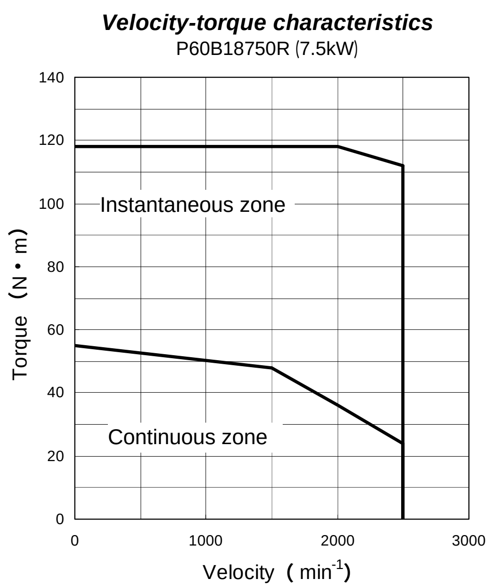
P60B18750R

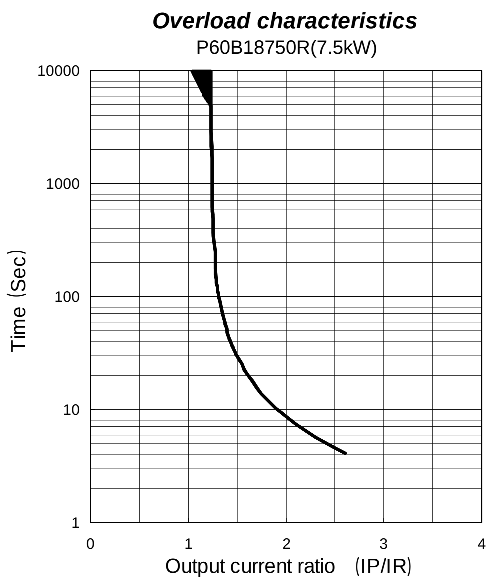
	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	P_R	7500	W	7500	W
	Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
	Maximum revolution speed	N_{max}	2500	min^{-1}	2500	rpm
*	Rated torque	T_R	48	N•m	490	kg·cm
*	Continuous stall torque	T_S	54.9	N•m	560	kg·cm
*	Instantaneous maximum stall torque	T_P	118	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-R II)	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-R II)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

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-R II)	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-R II)	W_E	34.9	kg	34.9	kg

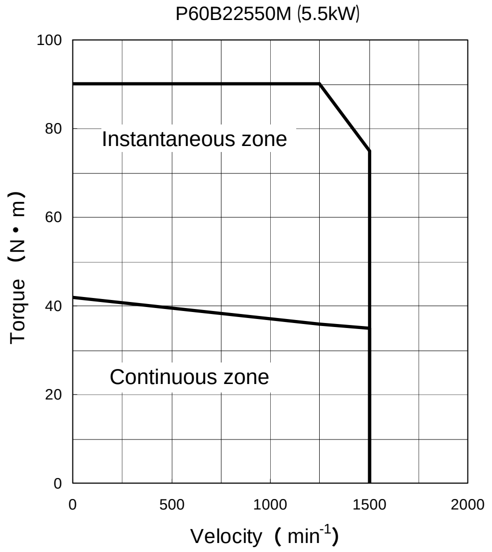
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

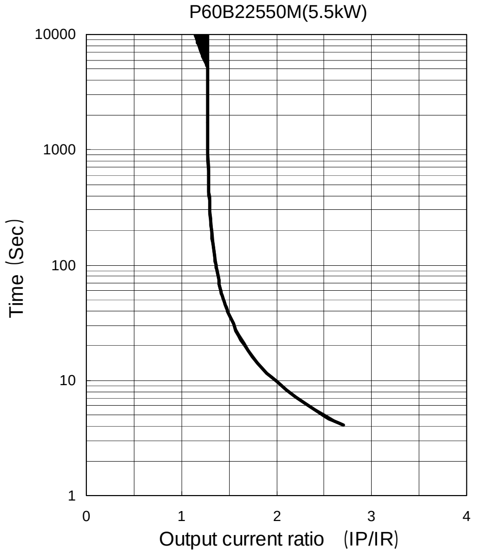
Velocity-torque characteristics

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}	$kg\cdot m^2$ $(GD^2/4)$	180	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	177×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	180	$g\cdot cm\cdot s^2$
Inertia (including ABS-RII)	J_M	177.0×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	180.0	$g\cdot cm\cdot s^2$
Inertia (including ABS-RIII)	J_M	177.0×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	180.0	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	1770×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	1800	$g\cdot cm\cdot s^2$
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

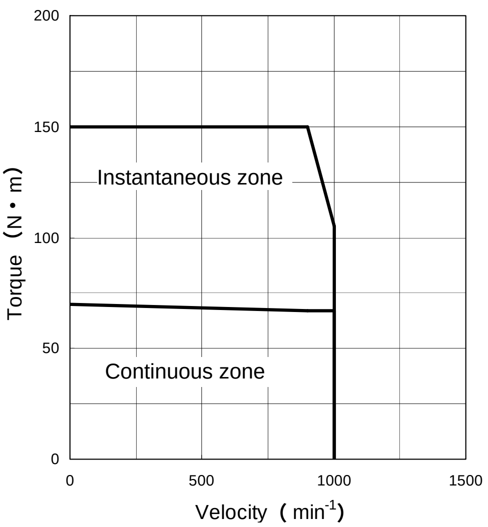
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

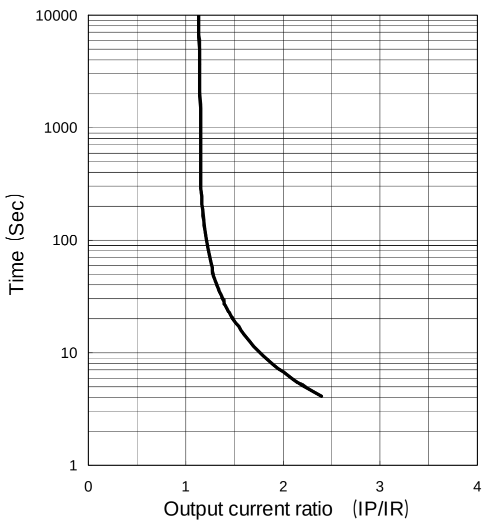
Velocity-torque characteristics

P60B22700S (7.0kW)



Overload characteristics

P60B22700S(7.0kW)



9. SPECIFICATIONS

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

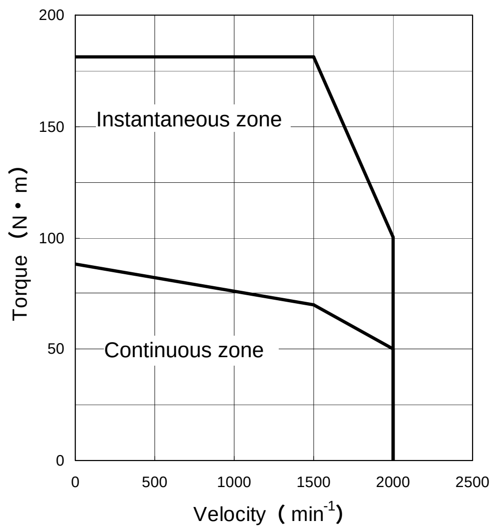
Holding Brake Data Sheet (Option)

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 t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

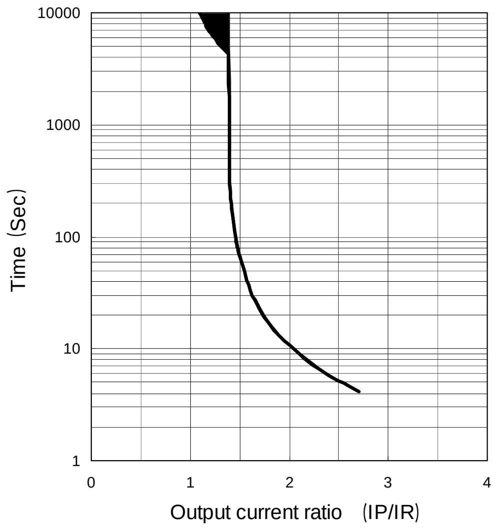
Velocity-torque characteristics

P60B2211KB (11kW)



Overload characteristics

P60B2211KB(11kW)



9. SPECIFICATIONS

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}	$kg\cdot m^2$ $(GD^2/4)$	253	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	248×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	253	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	248×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	253	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	2480×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	2530	$g\cdot cm\cdot s^2$
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-R II)	W_E	73.7	kg	73.7	kg

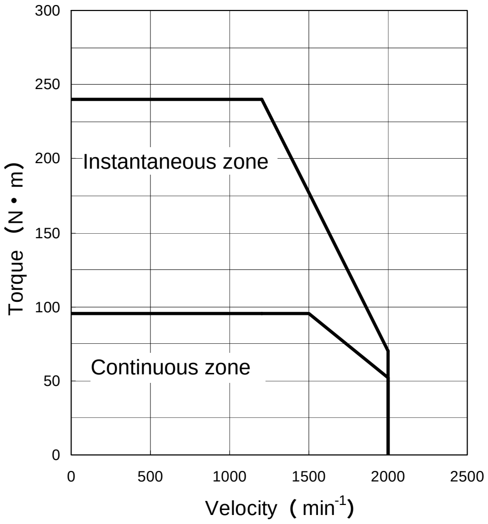
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	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 t20 × 540 mm square aluminum plate installed.
- The velocity-torque characteristics show values for the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

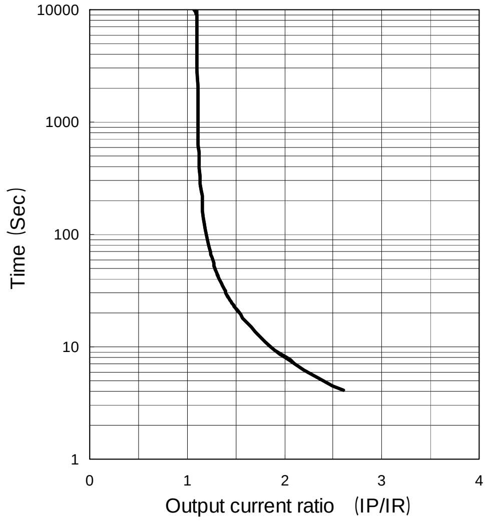
Velocity-torque characteristics

P60B2215KB (15kW)



Overload characteristics

P60B2215KB(15kW)



9. SPECIFICATIONS

P60B2220KB

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	20000	W	20000	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	127.5	N•m	1300	kg·cm
* Continuous stall torque	T_S	127.5	N•m	1300	kg·cm
* Instantaneous maximum stall torque	T_P	280.5	N•m	2860	kg·cm
* Rated armature current	I_R	105	Arms	105	Arms
* Continuous stall armature current	I_S	98	Arms	98	Arms
* Instantaneous maximum stall armature current	I_P	255	Arms	255	Arms
Torque constant	K_T	1.38	N·m/Arms	14.1	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	48.1	mV/min^{-1}	48/1	V/krpm
Phase armature resistance	R_ϕ	0.012	Ω	0.012	Ω
Electrical time constant	t_e	33	msec	33	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}	$kg\cdot m^2$ ($GD^2/4$)	253	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	248×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	253	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	248×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	253	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	2480×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	2530	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	81	kg	73.7	kg
Weight (including ABS-E)	W_E	81	kg	73.7	kg
Weight (including ABS-R II)	W_E	81	kg	73.7	kg

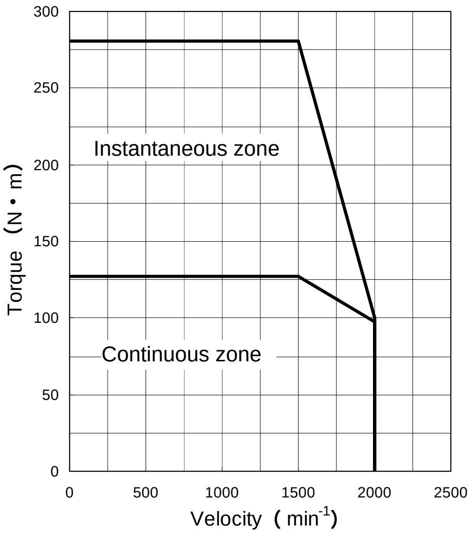
Holding Brake Data Sheet (Option)

Holding torque	T_B	166	N·m	1693	kg·cm
Exciting voltage	V_B	24	V (DC)±10%	24	V (DC)±10%
Exciting current	I_B	1.5	A (DC)	1.7	A (DC)
Inertia	J_B	12×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	12	$g\cdot cm\cdot s^2$
Weight	W	10	kg	10	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

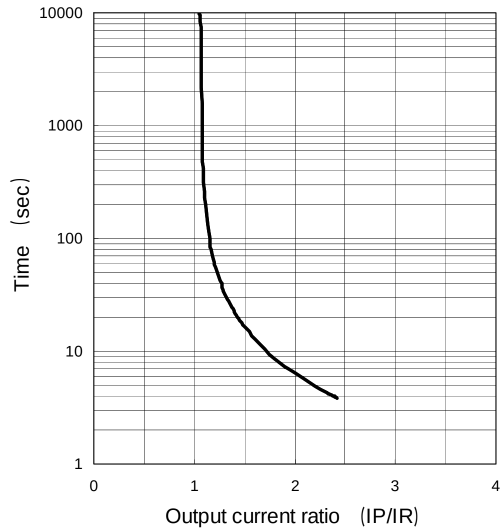
Velocity-torque characteristics

P60B2220KB (20kW)



Overload characteristics

P60B2220KB (20kW)



9. SPECIFICATIONS

P60B2820KM

	Name	Symbol	Data	Unit	Data	Unit
*	Rated output	P_R	20000	W	20000	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	127.5	N•m	1300	kg·cm
*	Continuous stall torque	T_S	127.5	N•m	1300	kg·cm
*	Instantaneous maximum stall torque	T_P	313.8	N•m	3200	kg·cm
*	Rated armature current	I_R	98	Arms	98	Arms
*	Continuous stall armature current	I_S	87	Arms	87	Arms
*	Instantaneous maximum stall armature current	I_P	253	Arms	253	Arms
	Torque constant	K_T	1.5	N·m/Arms	15.3	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	52.1	mV/min^{-1}	52.1	V/krpm
	Phase armature resistance	R_ϕ	0.014	Ω	0.014	Ω
	Electrical time constant	t_e	34	msec	34	msec
	Mechanical time constant (not including sensor)	t_m	0.71	msec	0.71	msec
	Inertia (including wiring-saved INC)	J_M	380×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	387	$g \cdot cm \cdot s^2$
	Inertia (including ABS-E)	J_M	380×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	387	$g \cdot cm \cdot s^2$
	Inertia (including ABS-R II)	J_M	380×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	387	$g \cdot cm \cdot s^2$
	Applicable load inertia	J_L	3800×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	3870	$g \cdot cm \cdot s^2$
	Weight (including wiring-saved INC)	W_E	93	kg	93	kg
	Weight (including ABS-E)	W_E	93	kg	93	kg
	Weight (including ABS-R II)	W_E	93	kg	93	kg

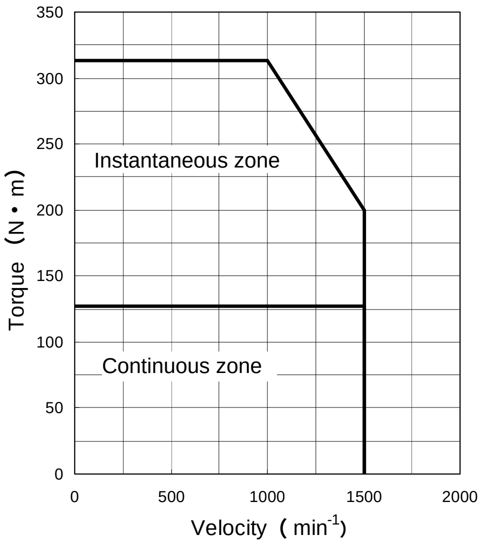
Holding Brake Data Sheet (Option)

Name	Symbol	Data	Unit	Data	Unit
Holding torque	T_B	191.2	N·m	1950	kg·cm
Exciting voltage	V_B	24	V (DC)±10%	24	V (DC)±10%
Exciting current	I_B	2.6	A (DC)	2.6	A (DC)
Inertia	J_B	11.8×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	11.8	$g \cdot cm \cdot s^2$
Weight	W	18.2	kg	18.2	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

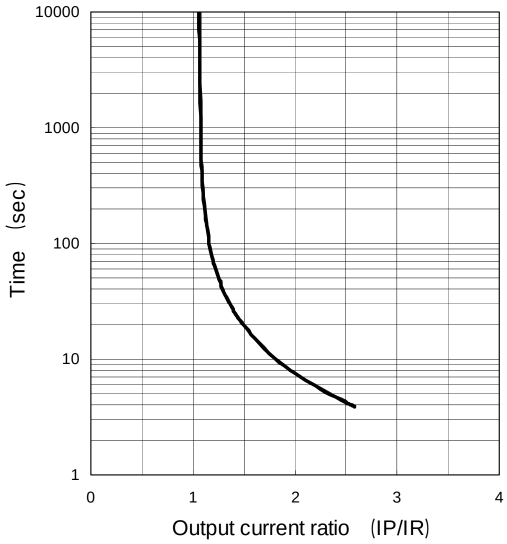
Velocity-torque characteristics

P60B2820KM (20kW)



Overload characteristics

P60B2820KM (20kW)



9. SPECIFICATIONS

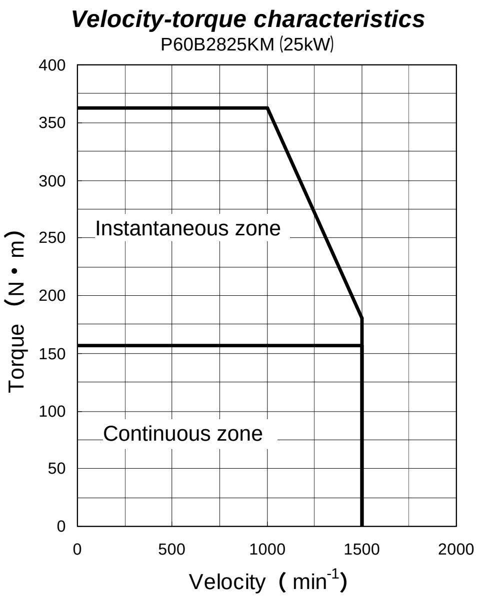
P60B2825KM

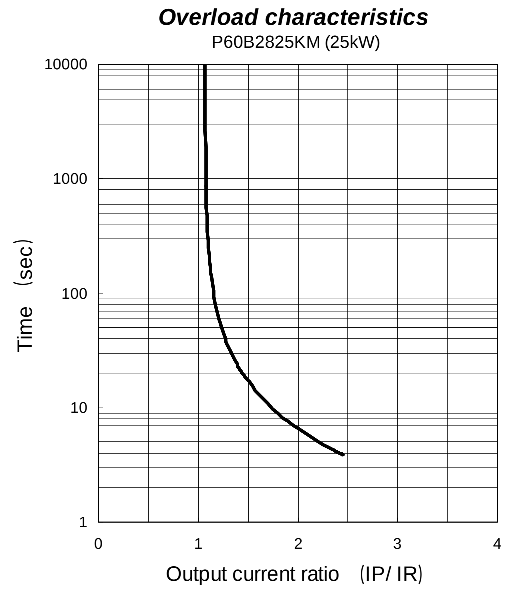
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	25000	W	25000	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	1500	min^{-1}	1500	rpm
* Rated torque	T_R	156.9	N•m	1600	kg·cm
* Continuous stall torque	T_S	156.9	N•m	1600	kg·cm
* Instantaneous maximum stall torque	T_P	362.9	N•m	3700	kg·cm
* Rated armature current	I_R	108	Arms	108	Arms
* Continuous stall armature current	I_S	98	Arms	98	Arms
* Instantaneous maximum stall armature current	I_P	251	Arms	251	Arms
Torque constant	K_T	1.74	N·m/Arms	17.7	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	60.7	mV/min^{-1}	60.7	V/krpm
Phase armature resistance	R_ϕ	0.015	Ω	0.015	Ω
Electrical time constant	t_e	36	msec	36	msec
Mechanical time constant (not including sensor)	t_m	0.63	msec	0.63	msec
Inertia (including wiring-saved INC)	J_M	424×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	424	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	424×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	424	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	424×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	424	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	4240×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	4240	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	98	kg	98	kg
Weight (including ABS-E)	W_E	98	kg	98	kg
Weight (including ABS-R II)	W_E	98	kg	98	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	191.2	N·m	1950	kg·cm
Exciting voltage	V_B	24	V (DC)±10%	24	V (DC)±10%
Exciting current	I_B	2.6	A (DC)	2.6	A (DC)
Inertia	J_B	11.8×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	11.8	$g\cdot cm\cdot s^2$
Weight	W	18.2	kg	18.2	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.





9. SPECIFICATIONS

P60B2830KM

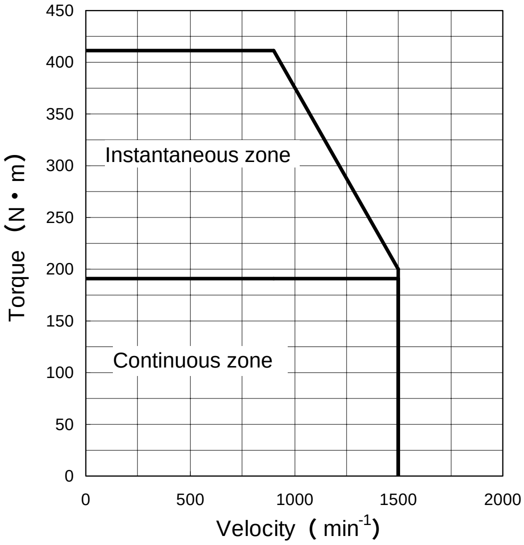
Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	30000	W	30000	W
Rated revolution speed	N_R	1500	min^{-1}	1500	rpm
Maximum revolution speed	N_{max}	1500	min^{-1}	1500	rpm
∗ Rated torque	T_R	191.2	N•m	1950	kg·cm
∗ Continuous stall torque	T_S	191.2	N•m	1950	kg·cm
∗ Instantaneous maximum stall torque	T_P	411.9	N•m	4200	kg·cm
∗ Rated armature current	I_R	118	Arms	118	Arms
∗ Continuous stall armature current	I_S	110	Arms	110	Arms
∗ Instantaneous maximum stall armature current	I_P	260	Arms	260	Arms
Torque constant	K_T	1.88	N·m/Arms	19.2	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	65.7	mV/min^{-1}	65.7	V/krpm
Phase armature resistance	R_ϕ	0.014	Ω	0.014	Ω
Rated power rate	Q_R	821	KW/S	821	KW/S
Electrical time constant	t_e	38	msec	38	msec
Mechanical time constant (not including sensor)	t_m	0.53	msec	0.53	msec
Inertia (including wiring-saved INC)	J_M	445×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	445	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	445×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	445	$g\cdot cm\cdot s^2$
Inertia (including ABS-RⅡ)	J_M	445×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	445	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	4450×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	4450	$g\cdot cm\cdot s^2$
Weight (including wiring-saved INC)	W_E	107	kg	107	kg
Weight (including ABS-E)	W_E	107	kg	107	kg
Weight (including ABS-RⅡ)	W_E	107	kg	107	kg

Holding Brake Data Sheet (Option)

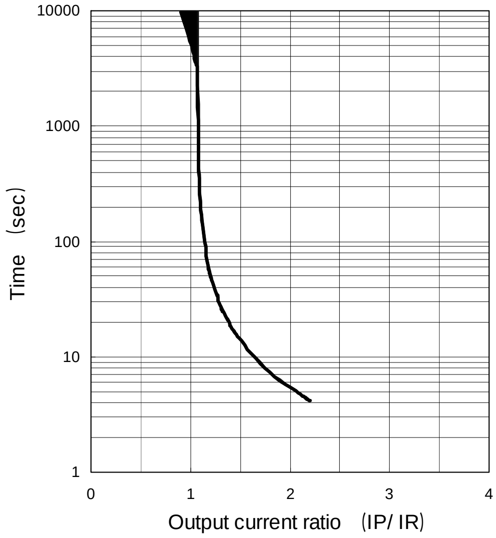
Holding torque	T_B	191.2	N·m	1950	kg·cm
Exciting voltage	V_B	24	V (DC)±10%	24	V (DC)±10%
Exciting current	I_B	2.6	A (DC)	2.6	A (DC)
Inertia	J_B	11.8×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	11.8	$g\cdot cm\cdot s^2$
Weight	W	18.2	kg	18.2	kg

- 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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

Velocity-torque characteristics
P60B2830KM (30kW)



Overload characteristics
P60B2830KM (30kW)



9. 4. 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}	$kg\cdot m^2$ ($GD^2/4$)	5.38	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	5.35×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	5.45	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	5.280×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	5.383	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	52.8×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	53.8	$g\cdot cm\cdot s^2$
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-R II)	W_E	6.3	kg	6.3	kg

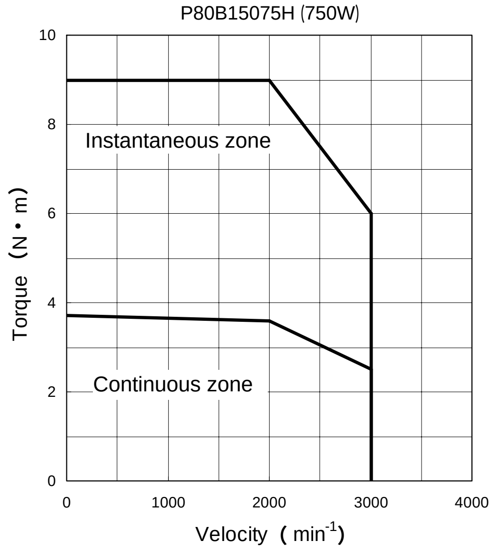
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

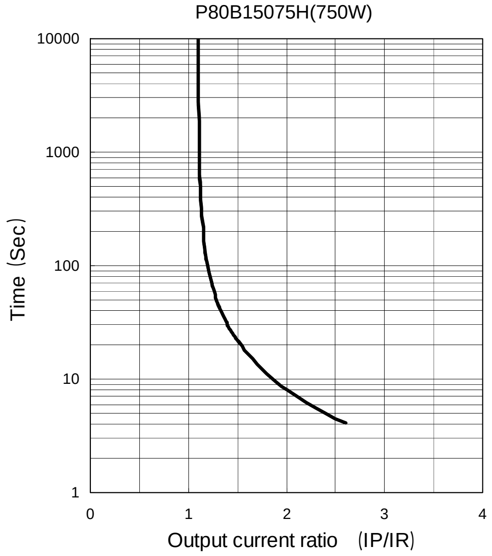
Velocity-torque characteristics

P80B15075H (750W)



Overload characteristics

P80B15075H(750W)



9. SPECIFICATION

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

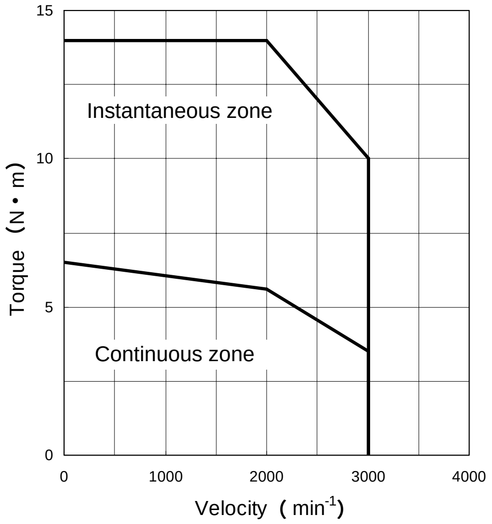
Holding Brake Data Sheet (Option)

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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

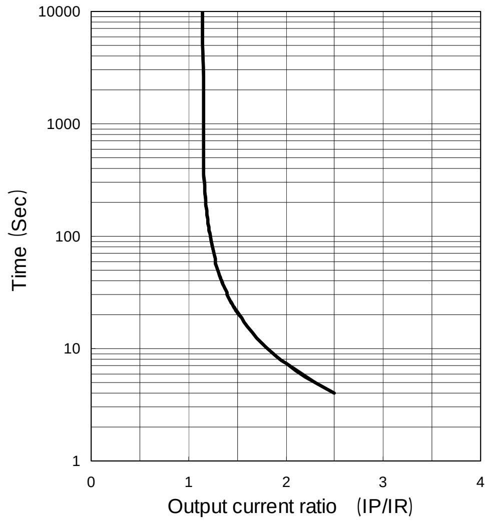
Velocity-torque characteristics

P80B18120H (1.2kW)



Overload characteristics

P80B18120H(1.2kW)



9. SPECIFICATION

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}	$kg \cdot m^2$ ($GD^2/4$)	28.1	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	27.2×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	28.2	$g \cdot cm \cdot s^2$
Inertia (including ABS-R II)	J_M	27.10×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	27.63	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	271×10^{-4}	$kg \cdot m^2$ ($GD^2/4$)	281	$g \cdot cm \cdot s^2$
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-R II)	W_E	15.6	kg	15.6	kg

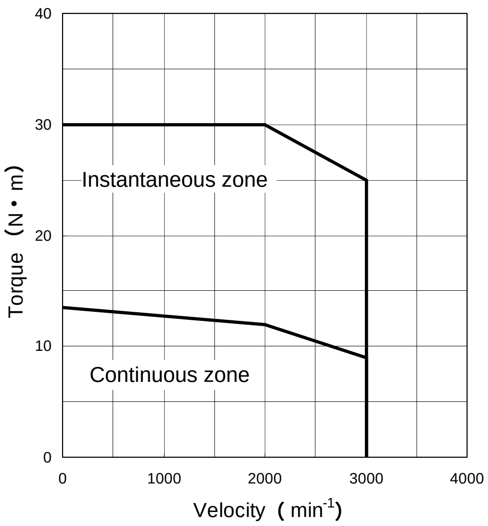
Holding Brake Data Sheet (Option)

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}	$kg \cdot m^2$ ($GD^2/4$)	10.1	$g \cdot cm \cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

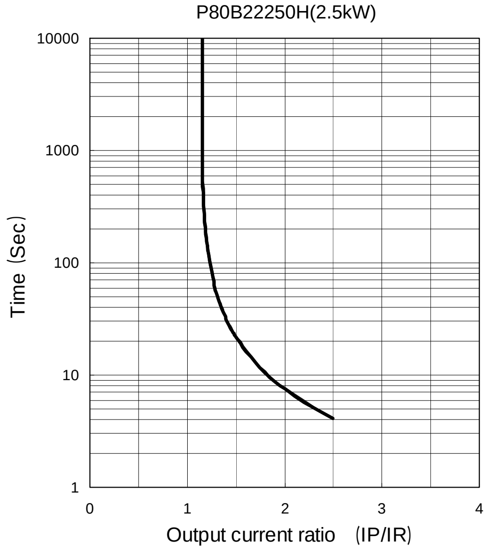
Velocity-torque characteristics

P80B22250H (2.5kW)



Overload characteristics

P80B22250H(2.5kW)



9. SPECIFICATION

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}	$kg\cdot m^2$ ($GD^2/4$)	44.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	43.2×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	44.2	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	43.10×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	43.94	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	431×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	441	$g\cdot cm\cdot s^2$
	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-R II)	W_E	18.6	kg	18.6	kg

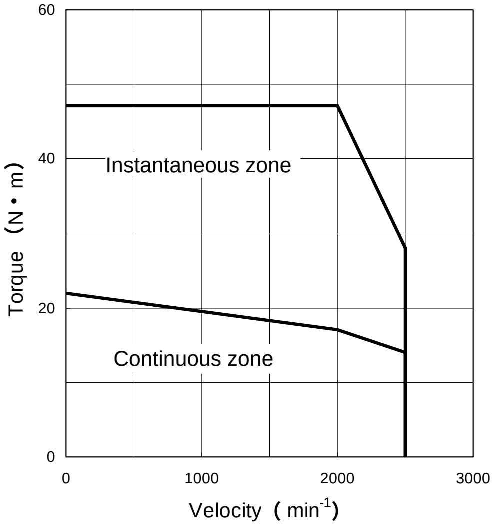
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	10.1	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

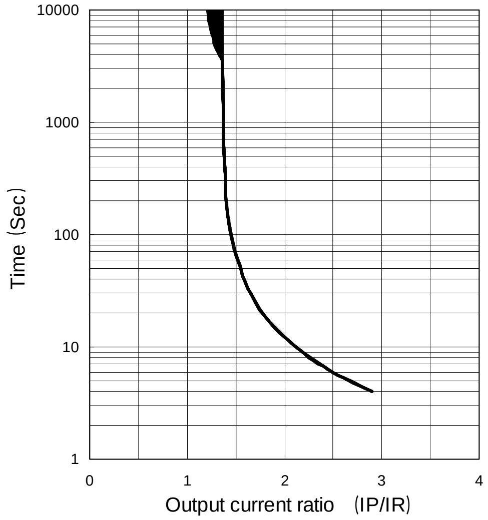
Velocity-torque characteristics

P80B22350R (3.5kW)



Overload characteristics

P80B22350R(3.5kW)



9. SPECIFICATION

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}	$kg\cdot m^2$ $(GD^2/4)$	44.1	$g\cdot cm\cdot s^2$
	Inertia (including ABS-E)	J_M	43.2×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	44.2	$g\cdot cm\cdot s^2$
	Inertia (including ABS-R II)	J_M	43.10×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	43.94	$g\cdot cm\cdot s^2$
	Applicable load inertia	J_L	431×10^{-4}	$kg\cdot m^2$ $(GD^2/4)$	441	$g\cdot cm\cdot s^2$
	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-R II)	W_E	18.6	kg	18.6	kg

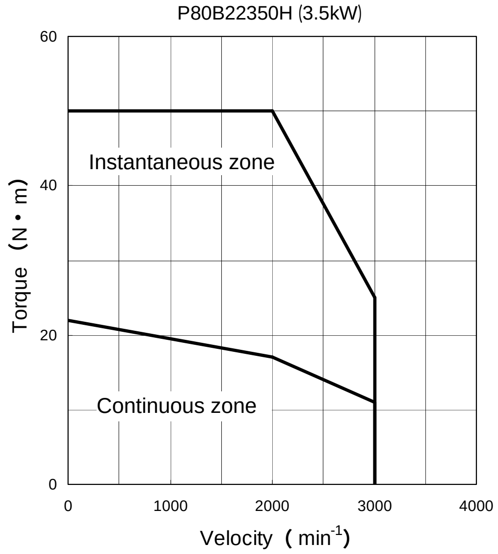
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ $(GD^2/4)$	10.1	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

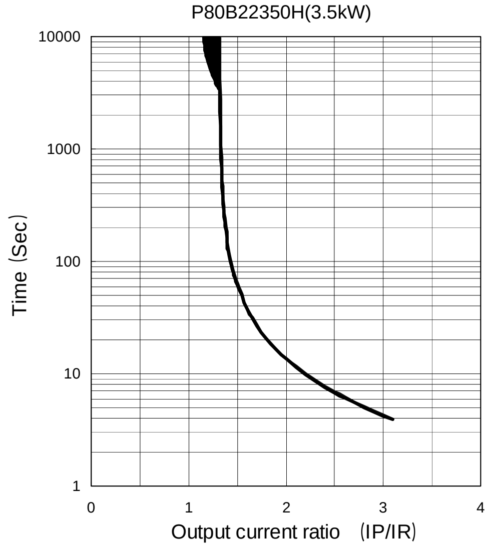
Velocity-torque characteristics

P80B22350H (3.5kW)



Overload characteristics

P80B22350H(3.5kW)



9. SPECIFICATION

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}	$kg\cdot m^2$ ($GD^2/4$)	59.1	$g\cdot cm\cdot s^2$
Inertia (including ABS-E)	J_M	58.2×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	59.2	$g\cdot cm\cdot s^2$
Inertia (including ABS-R II)	J_M	58.10×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	59.24	$g\cdot cm\cdot s^2$
Applicable load inertia	J_L	581×10^{-4}	$kg\cdot m^2$ ($GD^2/4$)	591	$g\cdot cm\cdot s^2$
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-R II)	W_E	22.1	kg	22.1	kg

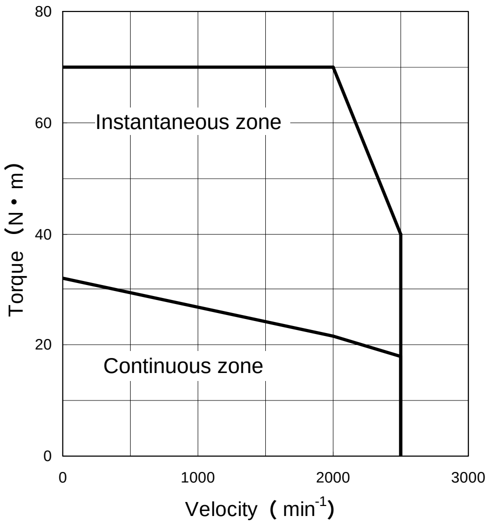
Holding Brake Data Sheet (Option)

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}	$kg\cdot m^2$ ($GD^2/4$)	10.1	$g\cdot cm\cdot s^2$
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 the case where the AMP power supply voltage is 200V AC. When power supply voltage is below 200V AC, instantaneous zone drops.

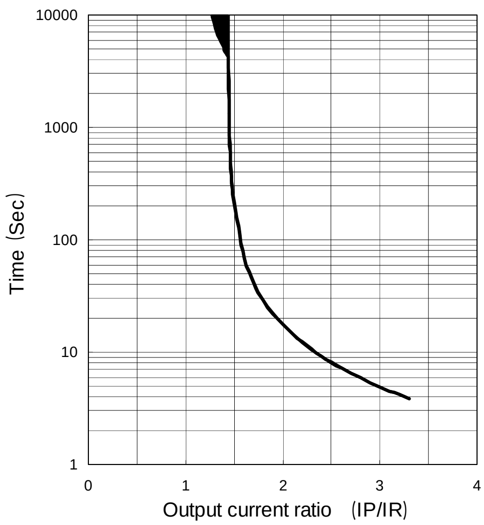
Velocity-torque characteristics

P80B22450R (4.5kW)



Overload characteristics

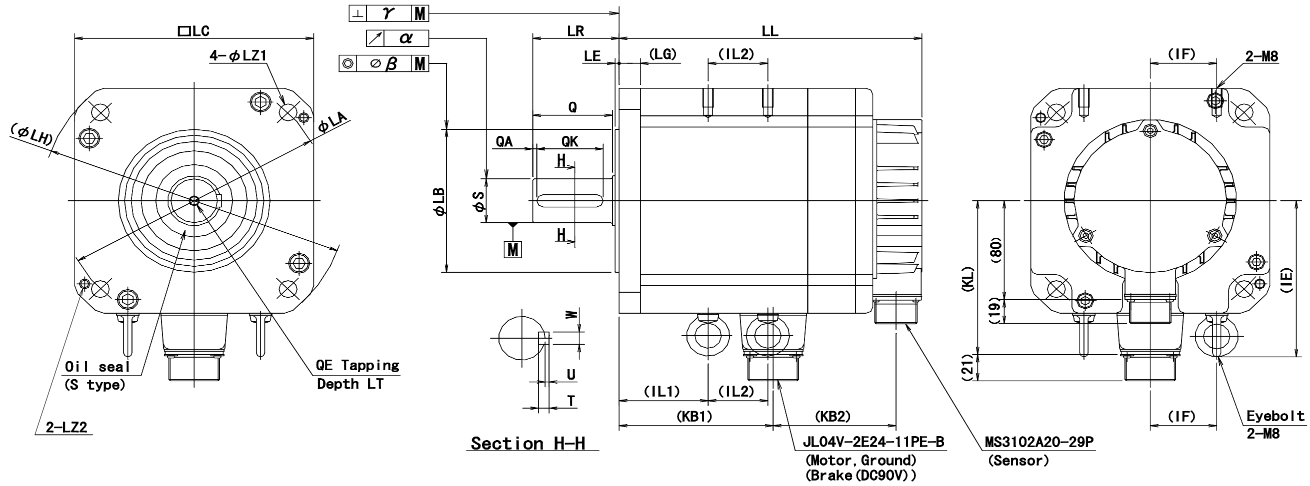
P80B22450R(4.5kW)



9.4.6 Servomotor External Views

Servomotor model No.: P1 motor

Incremental encoder (INC-E)
Absolute sensor (ABS-RⅡ)



Unit: mm

	Incremental・ABS-RⅡ・ABS-RⅢ W/O brake		With brake		Connector (motor) Motor earth			Connector (motor) B (Type 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	$95^{\ 0}_{-0.035}$	3	130
P10B10075△□◇	272		315												
P10B13050△□◇	176	56	216	97	18-10P	91	19	20-15P	91	19	12	145	$110^{\ 0}_{-0.035}$	6	165
P10B13100△□◇	221		261												
P10B13150△□◇	272		312												
P10B18200△□◇	230	52	278	100	22-22P	118	19	24-11P	118	21	16	20	$114.3^{\ 0}_{-0.035}$	3	230
P10B18350△□◇	280		328												
P10B18450△□◇	350		398		24-10P										
P10B18550△□◇	501		565	116			21				19				

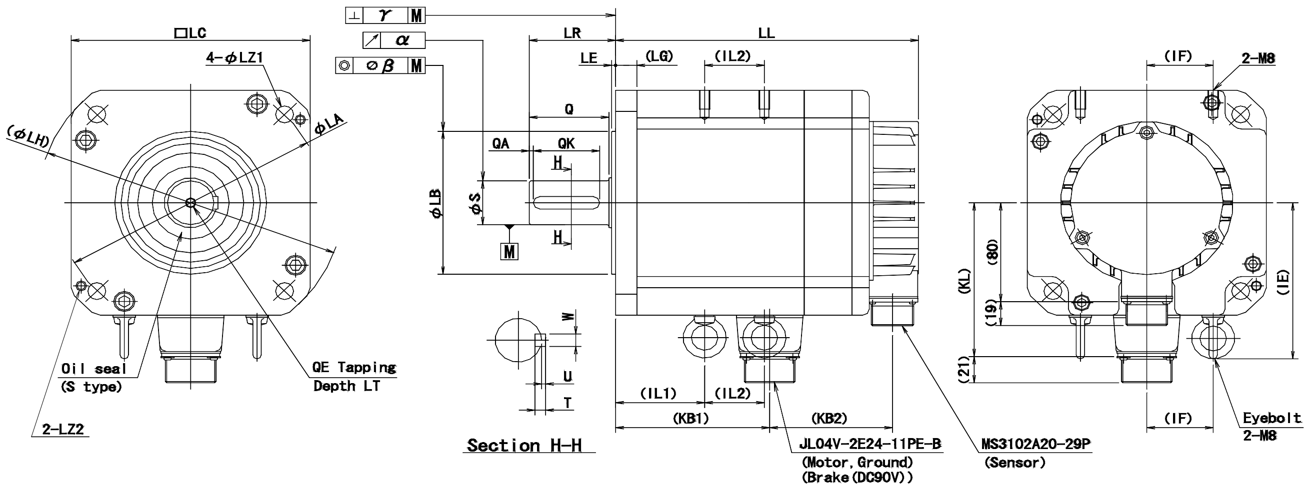
				Shaft Standard (61BM compatible type)			Shaft High rigidity type									
MODEL	LC	LZ1	LZ2	LR	S	Q	LR	S	Q	KB1	KL3	α	β	γ	IL1	IL2
P10B10030△□◇	100	9	–	35	$16^{\ 0}_{-0.011}$	30	45	$22^{\ 0}_{-0.013}$	40	108	64	0.02	0.04	0.04	–	–
P10B10075△□◇								$25^{\ 0}_{-0.013}$		198						
P10B13050△□◇	130	9	M6	58	$19^{\ 0}_{-0.013}$	52	58	$25^{\ 0}_{-0.013}$	40	100	80	0.02	0.04	0.04	–	–
P10B13100△□◇										145						
P10B13150△□◇					$21^{\ 0}_{-0.013}$	40		$35^{\ 0}_{-0.016}$		196						
P10B18200△□◇	180	13.5	M8	79	$35.0^{0.01}$	76	79	$48^{\ 0}_{-0.016}$	76	158	80	0.02	0.04	0.04	27	113
P10B18350△□◇										208						163
P10B18450△□◇										278						233
P10B18550△□◇				110	$42^{\ 0}_{-0.016}$	110	110	$63^{\ 0}_{-0.019}$	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.
A cooling fan is installed in the P10B18550H Motor. Since its external view is different from above, consult us when necessary.

9. SPECIFICATIONS

Servomotor model No.: P1 motor

Absolute encoder (ABS-E type)



Unit: mm

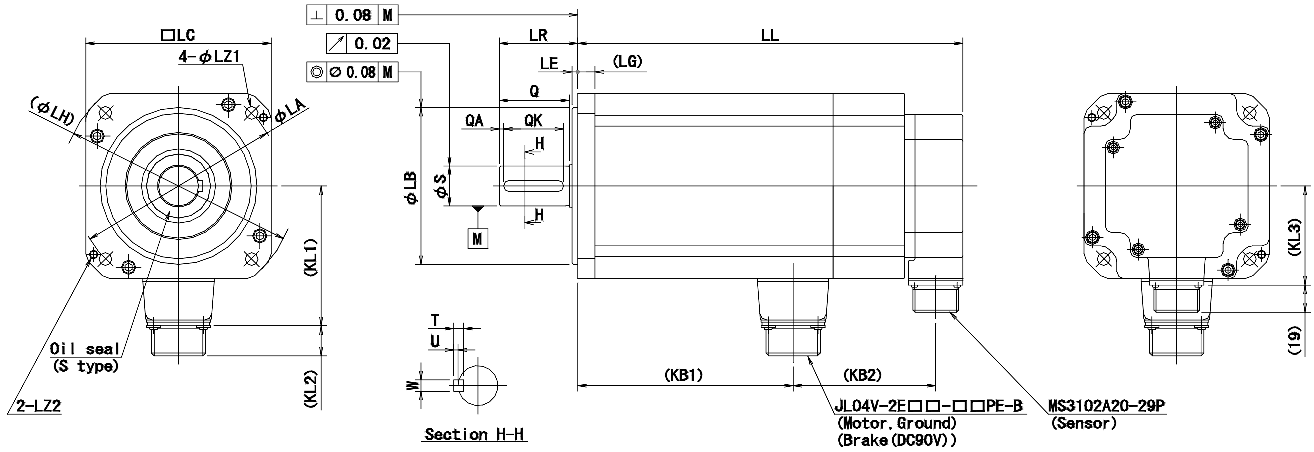
	ABS - E				Connector										
	W/O brake		With brake		Motor earth			B (Type with B only)							
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH
P10B10030△□◇	234	73	277	116	18-10P	76	19	20-15P	76	19	10	115	0 95-0.035	3	130
P10B10075△□◇	324		367												
P10B13050△□◇	214	61	253	100	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 type)			High rigidity type									
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.
A cooling fan is installed in the P10B18550H Motor. Since its external view is different from above, consult us when necessary.

Servomotor model No.: P2 motor

Incremental encoder (INC-E type)



Unit: mm

	W/O brake		With brake		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											

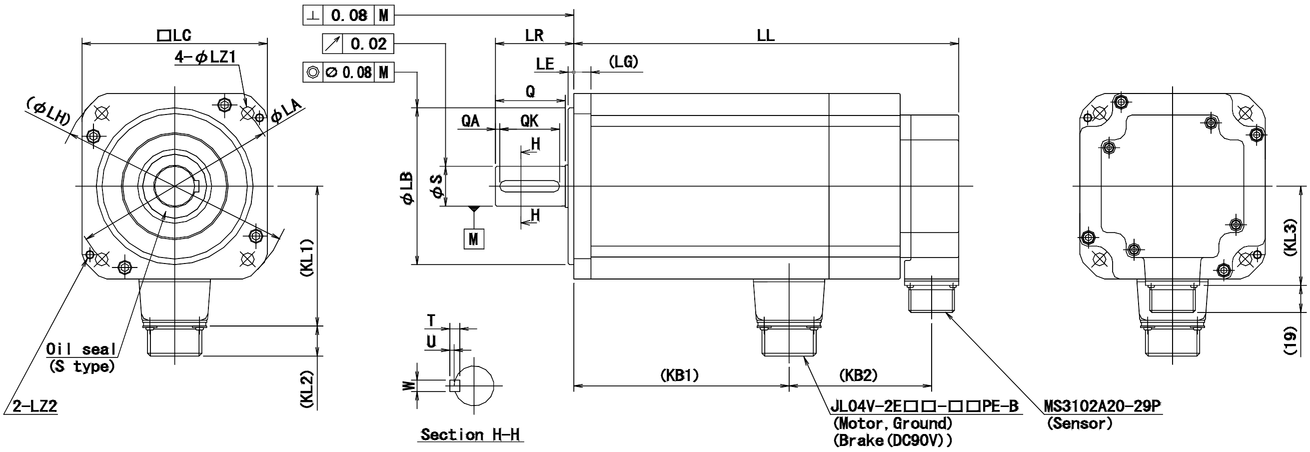
MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	KL3
P20B10100△□◇	–	45	0 22-0.013	40	3	32	0 6-0.030	6	2.5	80	70
P20B10150△□◇										105	
P20B10200△□◇										130	
P20B10250△□◇										155	
P20B13300△□◇	M6	55	28-0.013	50	3	42	0 8-0.036	7	3	117	
P20B13400△□◇										151	
P20B13500△□◇										190	

Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

9. SPECIFICATIONS

Servomotor model No.: P2 motor

Absolute sensor (ABS-E type)



Unit: mm

	W/O brake		With brake		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											

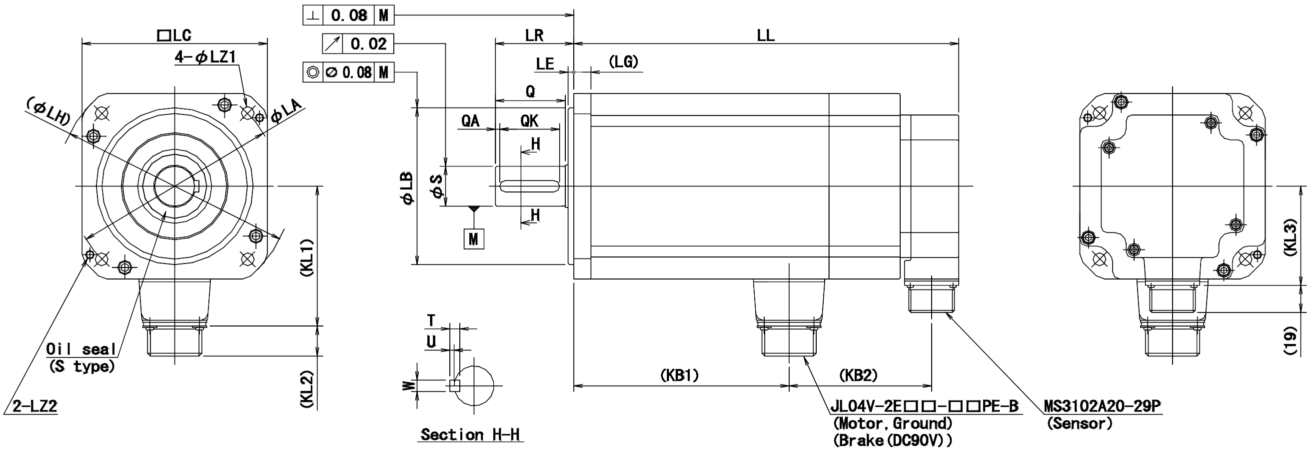
MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	KL3
P20B10100△□◇	–	45	0 22-0.013	40	3	32	0 6-0.030	6	2.5	80	80
P20B10150△□◇										105	
P20B10200△□◇										130	
P20B10250△□◇										155	
P20B13300△□◇	M6	55	28-0.013	50	3	42	0 8-0.036	7	3	117	
P20B13400△□◇										151	
P20B13500△□◇										190	

Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

9. SPECIFICATIONS

Servomotor model No.: P2 motor

Absolute sensor (ABS-R II type)



Unit: mm

	W/O brake		With brake		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											

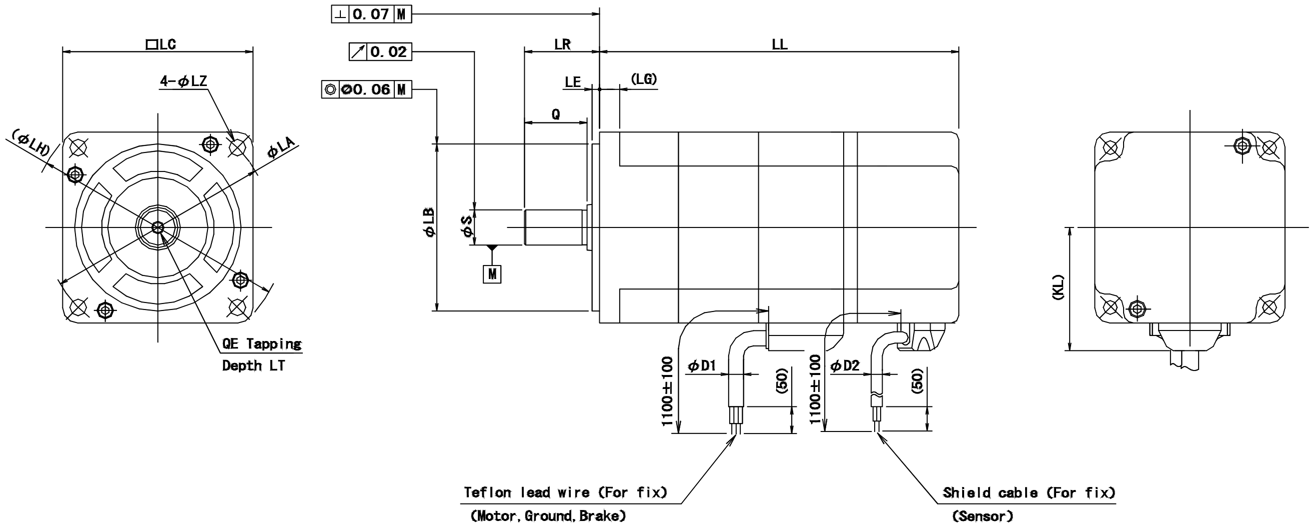
MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	KL3
P20B10100△□◇	–	45	0 22-0.013	40	3	32	0 6-0.030	6	2.5	80	80
P20B10150△□◇										105	
P20B10200△□◇										130	
P20B10250△□◇										155	
P20B13300△□◇	M6	55	28-0.013	50	3	42	0 8-0.036	7	3	117	
P20B13400△□◇										151	
P20B13500△□◇										190	

Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

9. SPECIFICATIONS

Servomotor model No.: P3 motor

Incremental encoder (INC-E type)
Absolute sensor (ABS-R Ⅱ type)



Incremental encoder (INC-E type)

Unit: mm

<table>
<tr><th></th><th>W/O brake</th><th>With brake</th><th colspan="15"></th></tr>
<tr><th>MODEL</th><th>LL</th><th>LL</th><th>LG</th><th>KL</th><th>LA</th><th>LB</th><th>LE</th><th>LH</th><th>LC</th><th>LZ</th><th>LR</th><th>S</th><th>Q</th><th>QE</th><th>LT</th><th>D1</th><th>D2</th></tr>
<tr><td>P30B04003△□◇</td><td>64</td><td>102.5</td><td rowspan="3">5</td><td rowspan="3">30</td><td rowspan="3">46</td><td rowspan="3">$30^{0}_{-0.021}$</td><td rowspan="3">2.5</td><td rowspan="3">54</td><td rowspan="3">40</td><td rowspan="3">4.5</td><td rowspan="3">25</td><td>$6^{0}_{-0.008}$</td><td rowspan="5">–</td><td>–</td><td>–</td><td rowspan="3">6</td><td rowspan="6">4.7</td></tr>
<tr><td>P30B04005△□◇</td><td>70</td><td>108.5</td><td rowspan="2">$8^{0}_{-0.009}$</td><td rowspan="2">–</td><td rowspan="2">–</td></tr>
<tr><td>P30B04010△□◇</td><td>88</td><td>126.5</td></tr>
<tr><td>P30B06020△□◇</td><td>95.5</td><td>133.5</td><td rowspan="2">6</td><td rowspan="2">41</td><td rowspan="2">70</td><td rowspan="2">$50^{0}_{-0.025}$</td><td rowspan="2">3</td><td rowspan="2">81</td><td rowspan="2">60</td><td rowspan="2">5.5</td><td rowspan="2">30</td><td rowspan="2">$14^{0}_{-0.011}$</td><td rowspan="3">M5</td><td rowspan="3">12</td><td rowspan="3">6.7</td></tr>
<tr><td>P30B06040△□◇</td><td>123.5</td><td>161.5</td></tr>
<tr><td>P30B08075△□◇</td><td>140</td><td>180.5</td><td>8</td><td>52</td><td>90</td><td>$70^{0}_{-0.030}$</td><td>3</td><td>107</td><td>80</td><td>6.6</td><td>40</td><td>$16^{0}_{-0.011}$</td><td>35</td></tr>
</table>

Absolute sensor (ABS-R Ⅱ type)

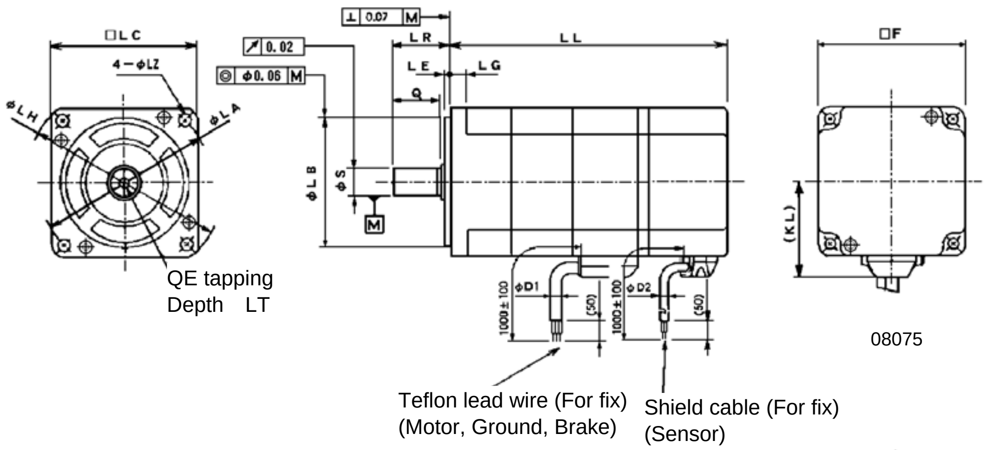
Absolute sensor (ABS-R Ⅲ type)

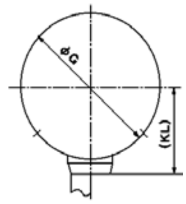
<table>
<tr><th></th><th>W/O brake</th><th>With brake</th><th colspan="15"></th></tr>
<tr><th>MODEL</th><th>LL</th><th>LL</th><th>LG</th><th>KL</th><th>LA</th><th>LB</th><th>LE</th><th>LH</th><th>LC</th><th>LZ</th><th>LR</th><th>S</th><th>Q</th><th>QE</th><th>LT</th><th>D1</th><th>D2</th></tr>
<tr><td>P30B04003△□◇</td><td>70</td><td>108.5</td><td rowspan="3">5</td><td rowspan="3">30</td><td rowspan="3">46</td><td rowspan="3">$30^{0}_{-0.021}$</td><td rowspan="3">2.5</td><td rowspan="3">54</td><td rowspan="3">40</td><td rowspan="3">4.5</td><td rowspan="3">25</td><td>$6^{0}_{-0.008}$</td><td rowspan="5">–</td><td rowspan="3">–</td><td rowspan="3">–</td><td rowspan="3">6</td><td rowspan="6">5.1</td></tr>
<tr><td>P30B04005△□◇</td><td>76</td><td>114.5</td><td rowspan="2">$8^{0}_{-0.009}$</td></tr>
<tr><td>P30B04010△□◇</td><td>94</td><td>132.5</td></tr>
<tr><td>P30B06020△□◇</td><td>101</td><td>149.5</td><td rowspan="2">6</td><td rowspan="2">41</td><td rowspan="2">70</td><td rowspan="2">$50^{0}_{-0.025}$</td><td rowspan="2">3</td><td rowspan="2">81</td><td rowspan="2">60</td><td rowspan="2">5.5</td><td rowspan="2">30</td><td rowspan="2">$14^{0}_{-0.011}$</td><td rowspan="3">M5</td><td rowspan="3">12</td><td rowspan="3">6.7</td></tr>
<tr><td>P30B06040△□◇</td><td>129</td><td>167</td></tr>
<tr><td>P30B08075△□◇</td><td>140</td><td>180.5</td><td>8</td><td>52</td><td>90</td><td>$70^{0}_{-0.030}$</td><td>3</td><td>107</td><td>80</td><td>6.6</td><td>40</td><td>$16^{0}_{-0.011}$</td><td>35</td></tr>
</table>

9. SPECIFICATIONS

Servomotor model No.: P3 motor

Absolute encoder (ABS-E type)





04003～06040

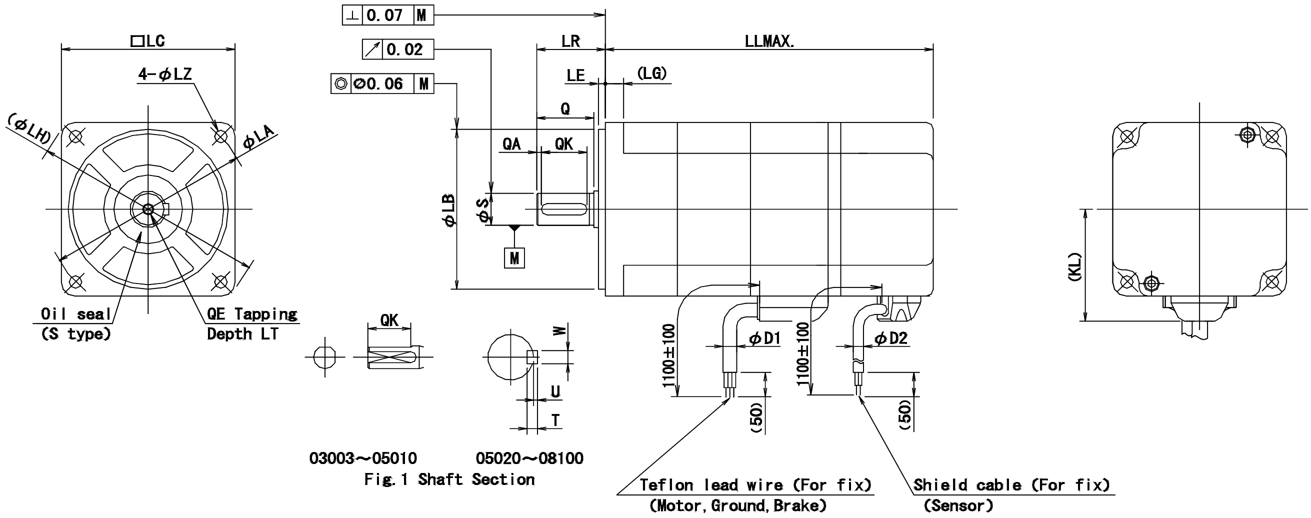
Unit: mm

MODEL	W/O brake LL	With brake 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

9. SPECIFICATIONS

Servomotor model No.: P5 motor

Incremental encoder (INC-E type)



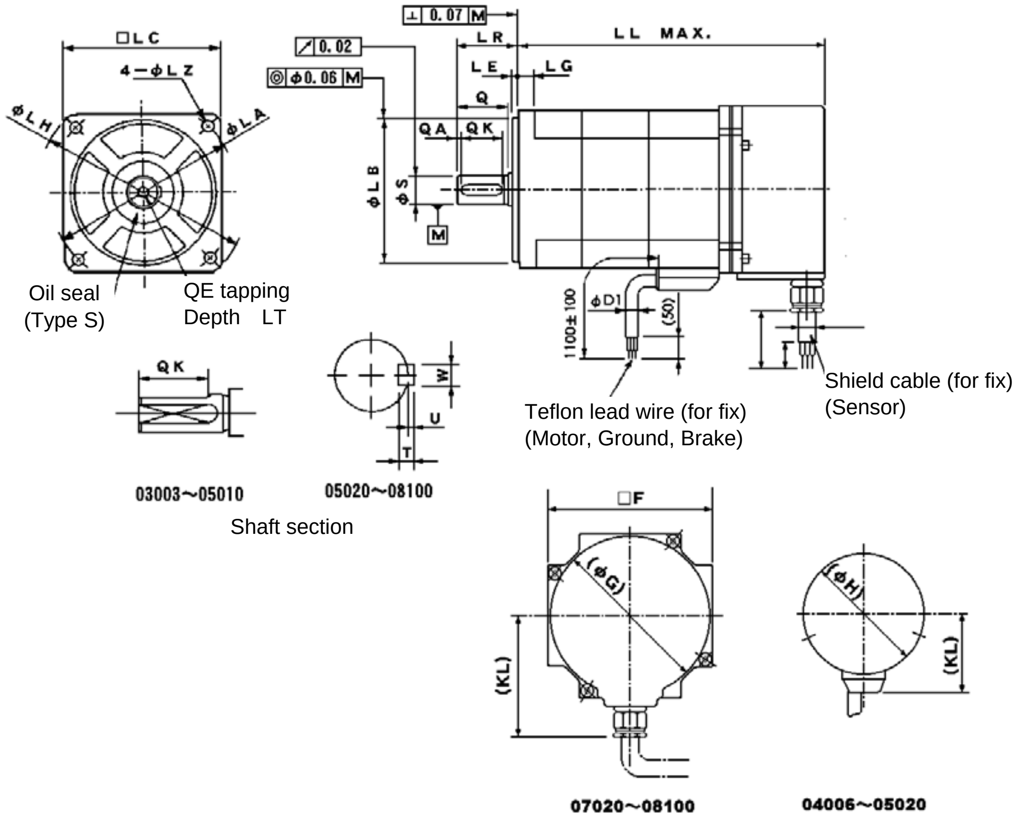
D2＝4.7 mm
Unit: mm

MODEL	LL (W/O brake)	LL (With brake)	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	D1 W/O brake & 90VDC brake	D1 24VDC brake	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																						

9. SPECIFICATIONS

Servomotor model No.: P5 motor

Absolute encoder (ABS-E type)

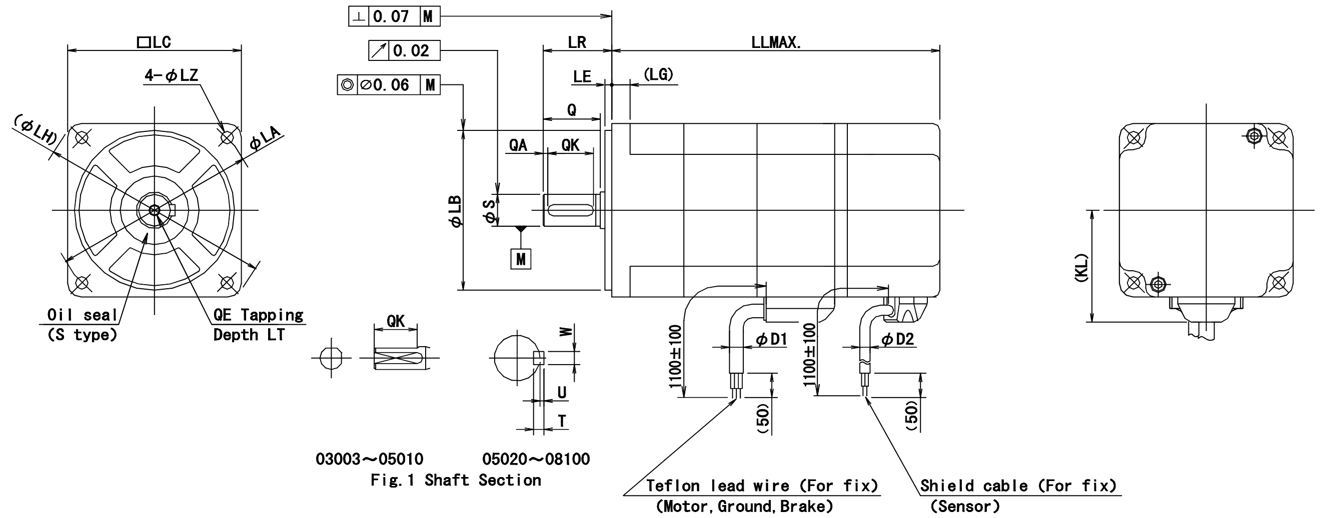


Unit: mm

MODEL	LL (W/O brake)	LL (With brake)	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	$34^{0}_{-0.025}$	2	57	42	3.5	24	—	—	60	$7^{0}_{-0.009}$	20	—	15	Slotted, 2 places 6.5±0.2			—	—	6	7.1	Not fitted
P50B04010△□◇	127	159																								
P50B05005△□◇	111	139	5	38	60	$50^{0}_{-0.025}$	2.5	71.5	54	4.5	24	—	—	60	$8^{0}_{-0.009}$	20	—	15	Slotted, 2 places 7.5±0.2			M3	8	6.7		Fitted
P50B05010△□◇	121	149																								
P50B05020△□◇	140	169									30				$11^{0}_{-0.011}$	25	2	20	4	4	1.5	M4	10			
P50B07020△□◇	136	164	5	67	90	$70^{0}_{-0.030}$	3	102.5	76	5.5	30	82	78	—	$14^{0}_{-0.011}$	25	2	20	5	5	2	M5	12		8	
P50B07030△□◇	142	170																								
P50B07040△□◇	152	180																								
P50B08040△□◇	152	192	5	67	100	$80^{0}_{-0.030}$	3	115	86	6.6	35	82	78	—	$16^{0}_{-0.011}$	30	2	20	5	5	2	M5	12			
P50B08050△□◇	162	202																								
P50B08075△□◇	185	225																								
P50B08100△□◇	208	248																								

Servomotor model No.: P5 motor

Absolute sensor (ABS-R II type)



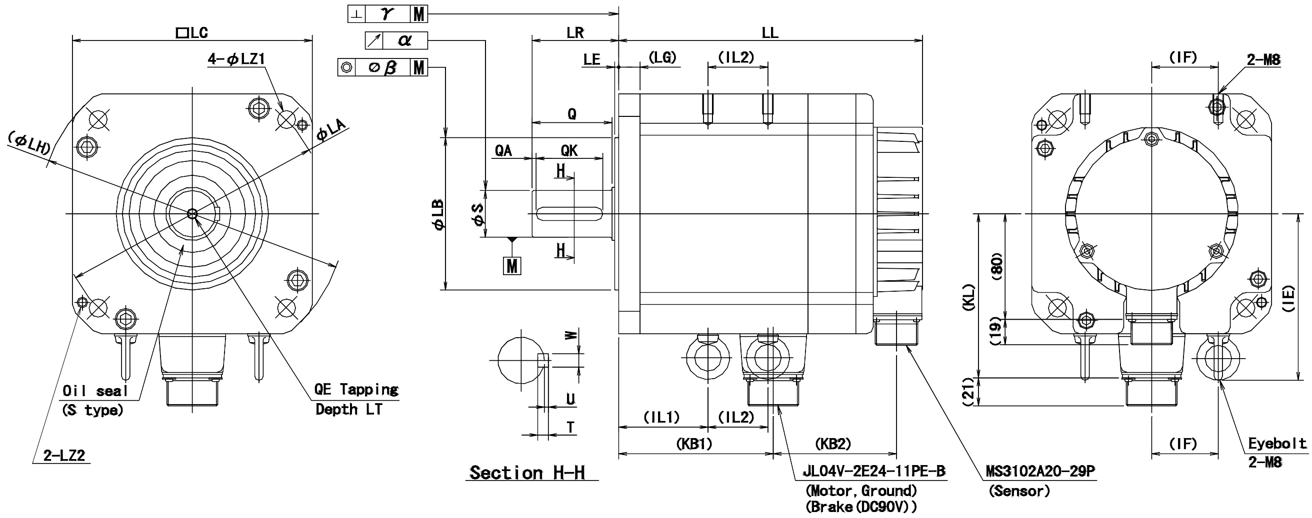
D2＝4.7 mm
Unit: mm

MODEL	LL (W/O brake)	LL (With brake)	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	D1: W/O brake & 90VDC brake	D1: 24VDC brake	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																						

9. SPECIFICATIONS

Servomotor model No.: P6 motor

Incremental encoder (INC-E type)
Absolute sensor (ABS-R II type)



Unit: mm

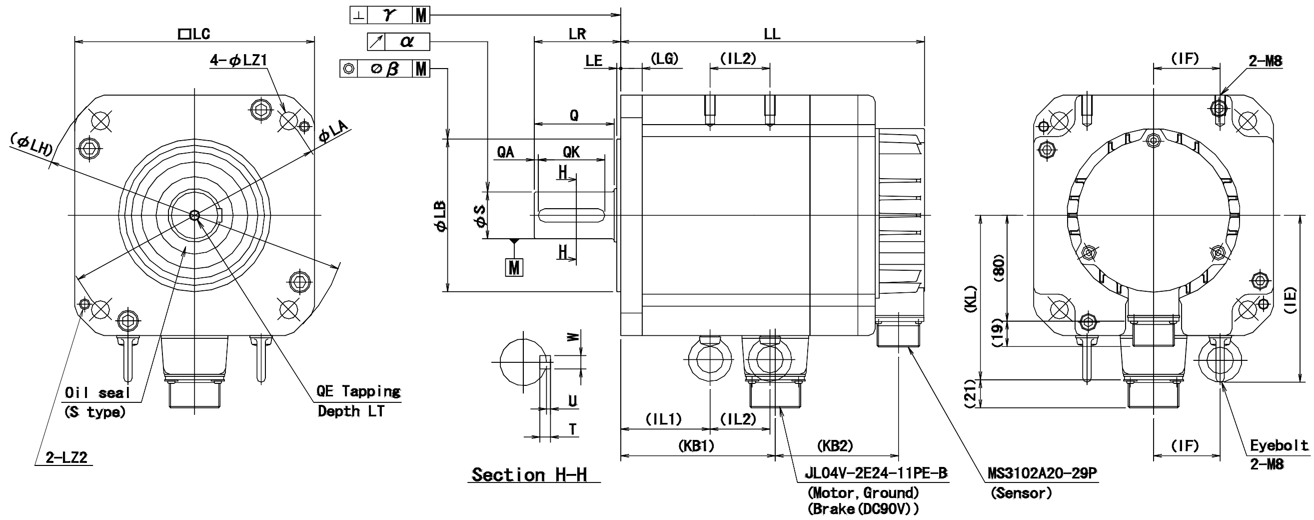
Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

	Incremental・ABS-R II・ABS RIII W/O brake		Incremental・ABS-R II・ABS RIII With brake				Connector Motor earth	Connector B (Type 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	$110^{0}_{-0.035}$	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	$130^{0}_{-0.040}$	4	190	150
P60B18200△□◇	144	56	179	91	—	—	24-11P		123	21	—	16	200	$114.3^{0}_{-0.035}$	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	$114.3^{0}_{-0.035}$	3	230	180
P60B22550△□◇	209	60	256	107	—	—	24-11P		141	21	—	19	235	$200^{0}_{-0.046}$	4	270	220
P60B22700△□◇	285		332														
P60B2211K△□◇	362	87	409	134	59	75	32-17P	10SL-4P	162	22	132	19	235	$200^{0}_{-0.046}$	4	270	220
P60B2215K△□◇	405		452														

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	$22^{0}_{-0.013}$	50	3	42	$6^{0}_{-0.030}$	6	2.5	37	0.02	0.08	0.08	M6	20	—	—	—	—
P60B13100△□◇											56									
P60B13150△□◇											75									
P60B13200△□◇				$28^{0}_{-0.013}$				$8^{0}_{-0.036}$	7	3	94				M8	25				
P60B15300△□◇	11	M6	55	$22^{0}_{-0.013}$	50	3	42	$8^{0}_{-0.036}$	7	3	106	0.02	0.08	0.08	M8	25	—	—	—	—
P60B18200△□◇	13.5	M8	65	$35^{0}_{-0.016}$	60	3	50	$10^{0}_{-0.036}$	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	$42^{0}_{-0.016}$	75	3	67	$12^{0}_{-0.043}$	8	3	175	0.02	0.08	0.08	M10	25	124	50	60	70
P60B22550△□◇	13.5	M10	79	$55^{0}_{-0.019}$	75	3	67	$19^{0}_{-0.043}$	10	4	129	0.03	0.08	0.10	M10	25	142	60	53	40
P50B22700△□◇											205								69	100
P50B2211K△□◇	13.5	M10	79	$55^{0}_{-0.019}$	75	3	67	$19^{0}_{-0.043}$	10	4	256	0.03	0.08	0.10	M10	25	142	60	69	130
P50B2215K△□◇											299								69	170

Servomotor model No.: P6 motor

Absolute encoder (ABS-E type)



Unit: mm

⚠ Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

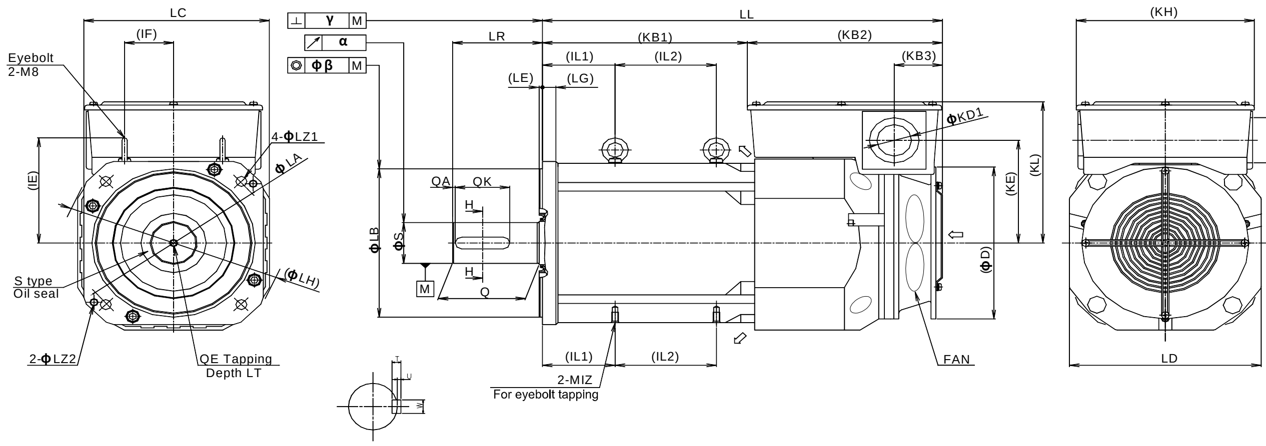
	ABS - E						Connector								
	W/O brake		With brake				Motor earth	B (Type with B only)							
MODEL	LL	KB2	LL	KB2	KB3	KB4	MS3102A	MS3102A	KL1	KL2	KL3	LG	LA	LB	LE
P60B13050△□◇	123	66	153	96	–	–	12 - 11P		98	21	–	12	145	0 110-0.035	4
P60B13100△□◇	143	67	176	100	–	–									
P60B13150△□◇	162		195												
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
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												

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

9. SPECIFICATIONS

Servomotor model No.: P6 motor

Incremental Encoder (INC-E type)
Absolute Sensor (ABS-RⅡ type)
Absolute Sensor (ABS-E type)



Unit: mm

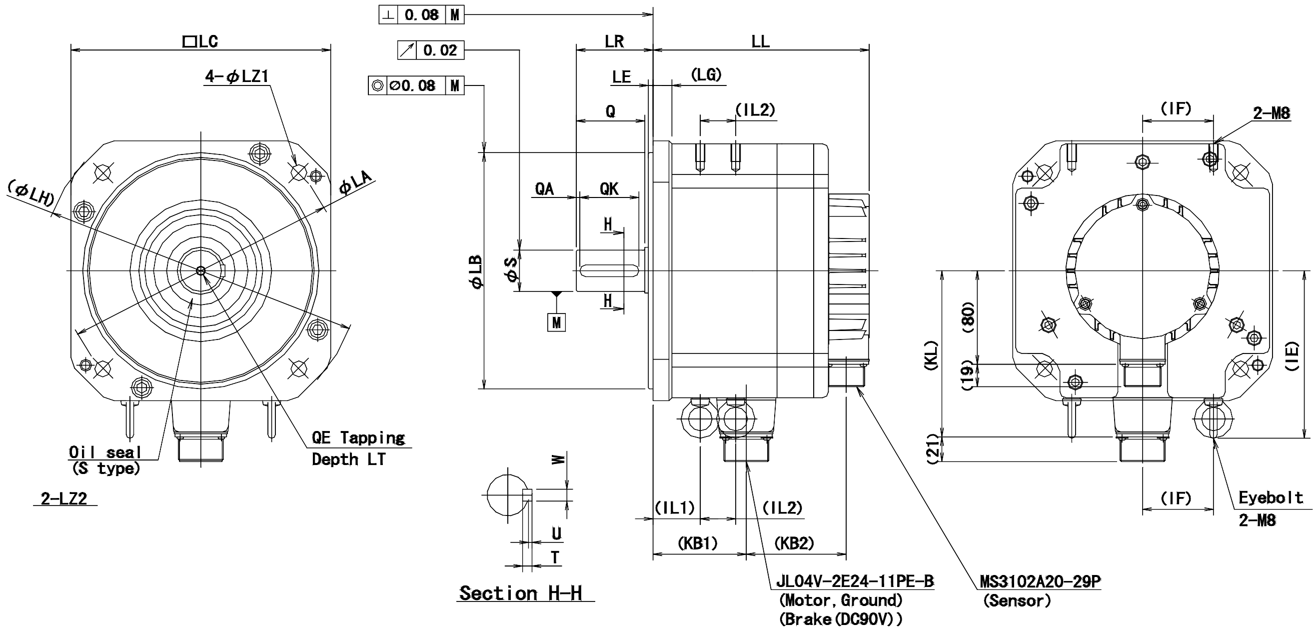
<table>
<tr><td></td><td colspan="4">Incremental·ABS-RⅡ</td><td colspan="16"></td></tr>
<tr><td></td><td colspan="2">W/O brake</td><td colspan="2">With brake</td><td colspan="16"></td></tr>
<tr><td>MODEL</td><td>LL</td><td>KB2</td><td>LL</td><td>KB2</td><td>KL</td><td>KH</td><td>LG</td><td>LA</td><td>LB</td><td>LE</td><td>LH</td><td>LC</td><td>LZ1</td><td>LZ2</td><td>LR</td><td>S</td><td>Q</td><td>QA</td><td>QK</td><td>W</td></tr>
<tr><td>P60B2220K△□◇</td><td>490</td><td rowspan="4">238</td><td>605</td><td rowspan="4">238</td><td>191</td><td rowspan="4">218</td><td>19</td><td>235</td><td>$200^{0}_{-0.046}$</td><td>4</td><td>270</td><td>220</td><td>13.5</td><td>M10</td><td rowspan="4">110</td><td rowspan="4">$55^{0}_{-0.019}$</td><td>106</td><td rowspan="4">3</td><td rowspan="4">67</td><td rowspan="4">$16^{0}_{-0.043}$</td></tr>
<tr><td>P60B2820K△□◇</td><td>429</td><td>529</td><td rowspan="3">215</td><td rowspan="3">20</td><td rowspan="3">300</td><td rowspan="3">$250^{0}_{-0.052}$</td><td rowspan="3">5</td><td rowspan="3">345</td><td rowspan="3">275</td><td rowspan="3">18.5</td><td rowspan="3">M12</td><td rowspan="3">105</td></tr>
<tr><td>P60B2825K△□◇</td><td>454</td><td>554</td></tr>
<tr><td>P60B2830K△□◇</td><td>479</td><td>579</td></tr>
</table>

<table>
<tr><td>MODEL</td><td>T</td><td>U</td><td>KB1</td><td>KB3</td><td>KD1</td><td>KD2</td><td>KE</td><td>α</td><td>β</td><td>γ</td><td>QE</td><td>LT</td><td>IE</td><td>IF</td><td>IL1</td><td>IL2</td><td>IZ</td><td>LD</td><td>D</td></tr>
<tr><td>P60B2220K△□◇</td><td rowspan="4">10</td><td rowspan="4">4</td><td>251</td><td rowspan="4">58</td><td rowspan="4">42.5</td><td rowspan="4">61</td><td>139</td><td>0.03</td><td>0.08</td><td rowspan="4">0.1</td><td rowspan="4">M10</td><td rowspan="4">25</td><td>142</td><td>60</td><td>89</td><td>124</td><td>8</td><td>235</td><td>205</td></tr>
<tr><td>P60B2820K△□◇</td><td>190</td><td rowspan="3">163</td><td rowspan="3">0.04</td><td rowspan="3">0.1</td><td rowspan="3">117</td><td rowspan="3">124</td><td>70</td><td rowspan="3">50</td><td rowspan="3">10</td><td rowspan="3">280</td><td rowspan="3"></td></tr>
<tr><td>P60B2825K△□◇</td><td>215</td><td>95</td></tr>
<tr><td>P60B2830K△□◇</td><td>240</td><td>120</td></tr>
</table>

9. SPECIFICATIONS

Servomotor model No.: P8 motor

Incremental encoder (INC-E type)
Absolute sensor (ABS-R II type)



Unit: mm

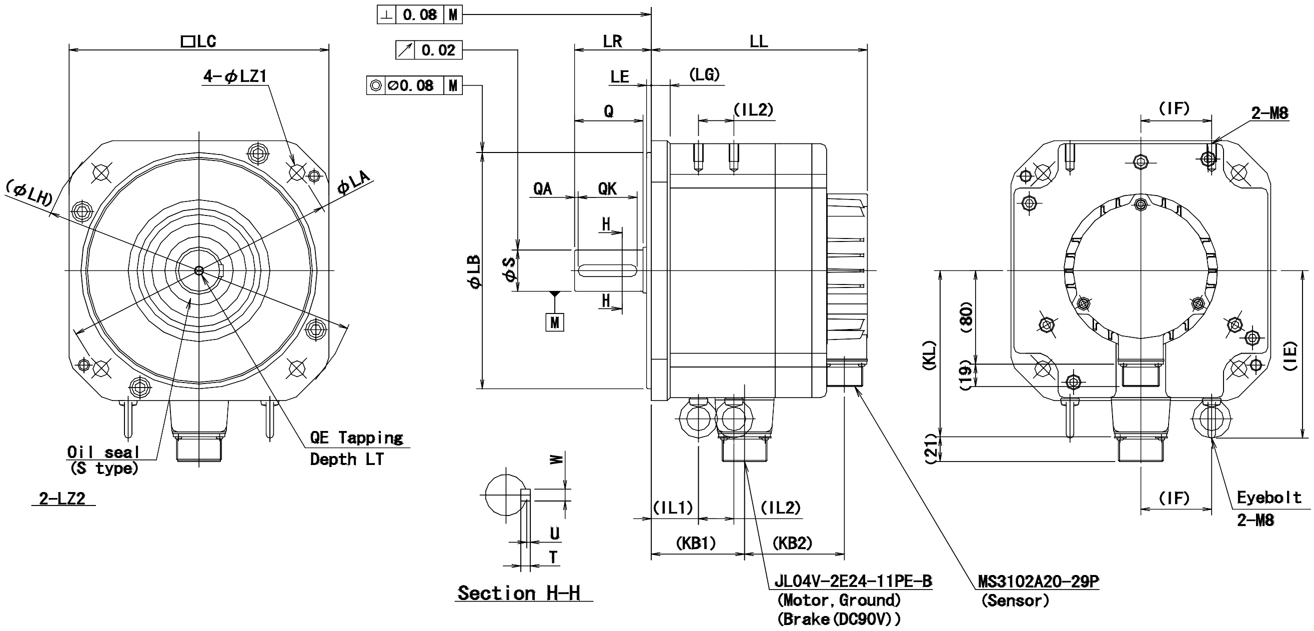
	W/O brake		With brake											
MODEL	LL	KB2	LL	KB2	LG	KL	LA	LB	LE	LH	LC	LZ1	LZ2	LR
P80B15075△□◇	116	56	150	90	12	106	165	0 130-0.040	4	190	150	11	M6	55
P80B18120△□◇	119	55	152	88	12	123	200	0 114.3-0.035	3	230	180	13.5	M8	55
P80B22250△□◇	122	52	154	84	16	141	235	0 200-0.046	4	270	220	13.5	M10	65
P80B22350△□◇	136		168											
P80B22450△□◇	151		183											

MODEL	S	Q	QA	QK	**W**	T	U	KB1	QE	LT	IE	IF	IL1	IL2
P80B15075△□◇	0 22-0.013	50	3	42	0 6-0.030	6	2.5	40	M6	20	–	–	–	–
P80B18120△□◇	0 28-0.036	50	3	42	0 8-0.036	7	3	44	M8	25	–	–	–	–
P80B22250△□◇	0 35-0.016	60	3	50	0 10-0.036	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.

Servomotor model No.: P8 motor

Absolute encoder (ABS-E type)



Unit: mm

	W/O brake		With brake											
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											

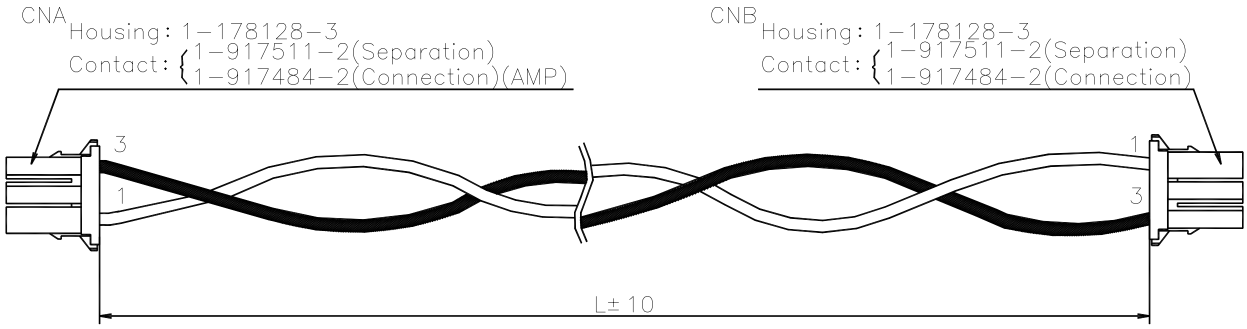
MODEL	S	Q	QA	QK	W	T	U	KB1	QE	LT	IE	IF	IL1	IL2
P80B15075△□◇	$22^{\ 0}_{-0.013}$	50	3	42	$6^{\ 0}_{-0.030}$	6	2.5	40	M6	20	–	–	–	–
P80B18120△□◇	$28^{\ 0}_{-0.036}$	50	3	42	$8^{\ 0}_{-0.036}$	7	3	44	M8	25	–	–	–	–
P80B22250△□◇	$35^{\ 0}_{-0.016}$	60	3	50	$10^{\ 0}_{-0.036}$	8	3	50	M8	25	142	60	41	–
P80B22350△□◇								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.

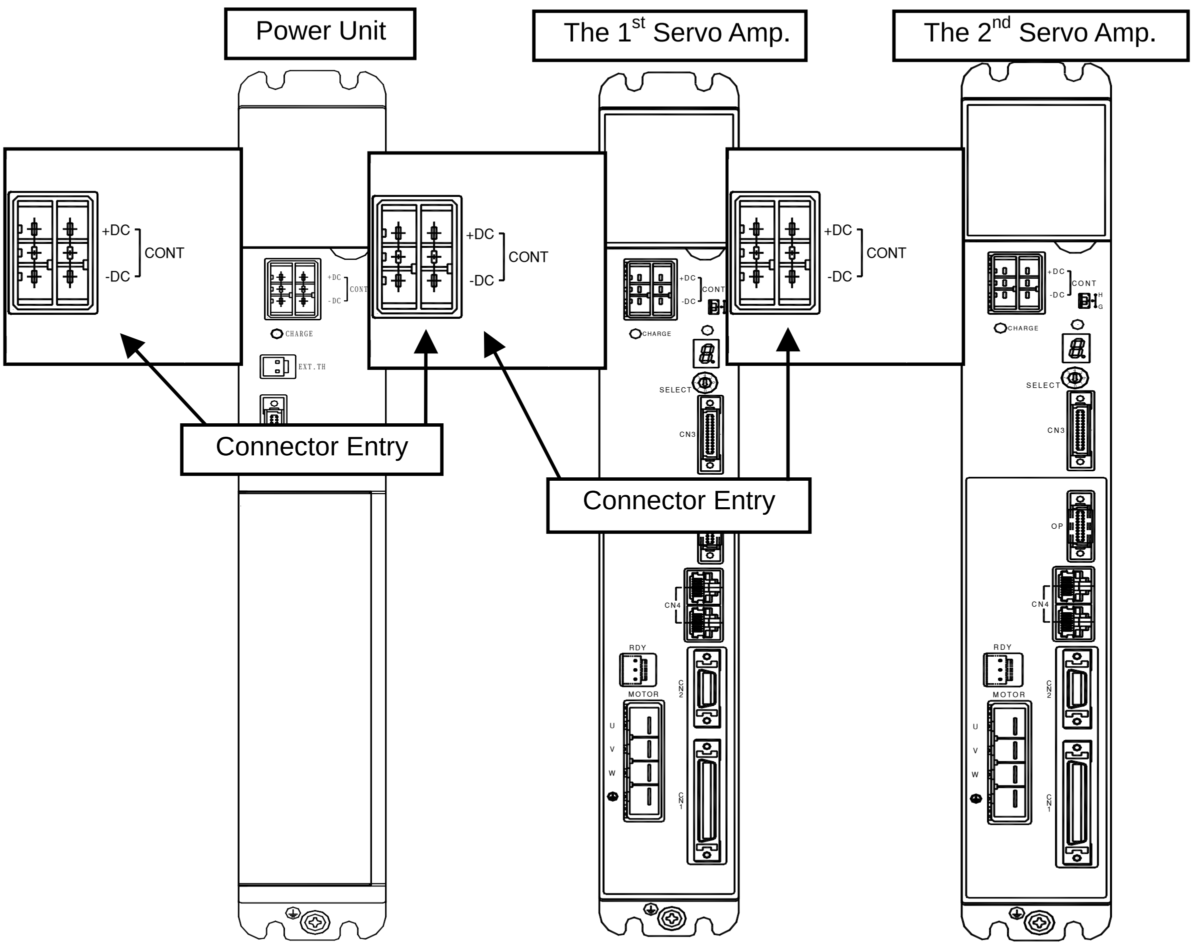
9.5 Option Cable

9.5.1 External Views

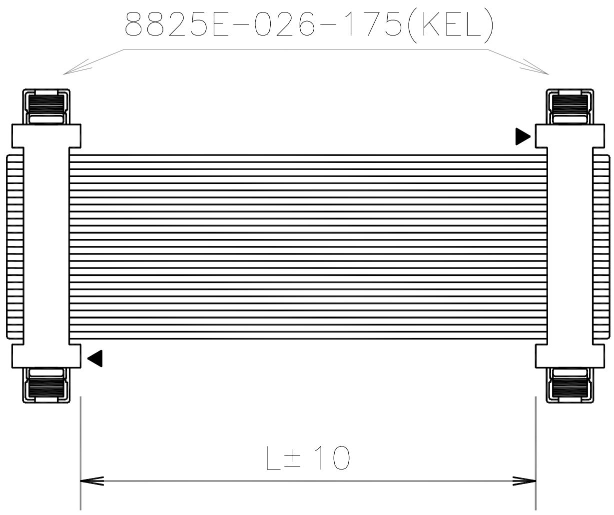
AL-00397732-□□ for DC CONT



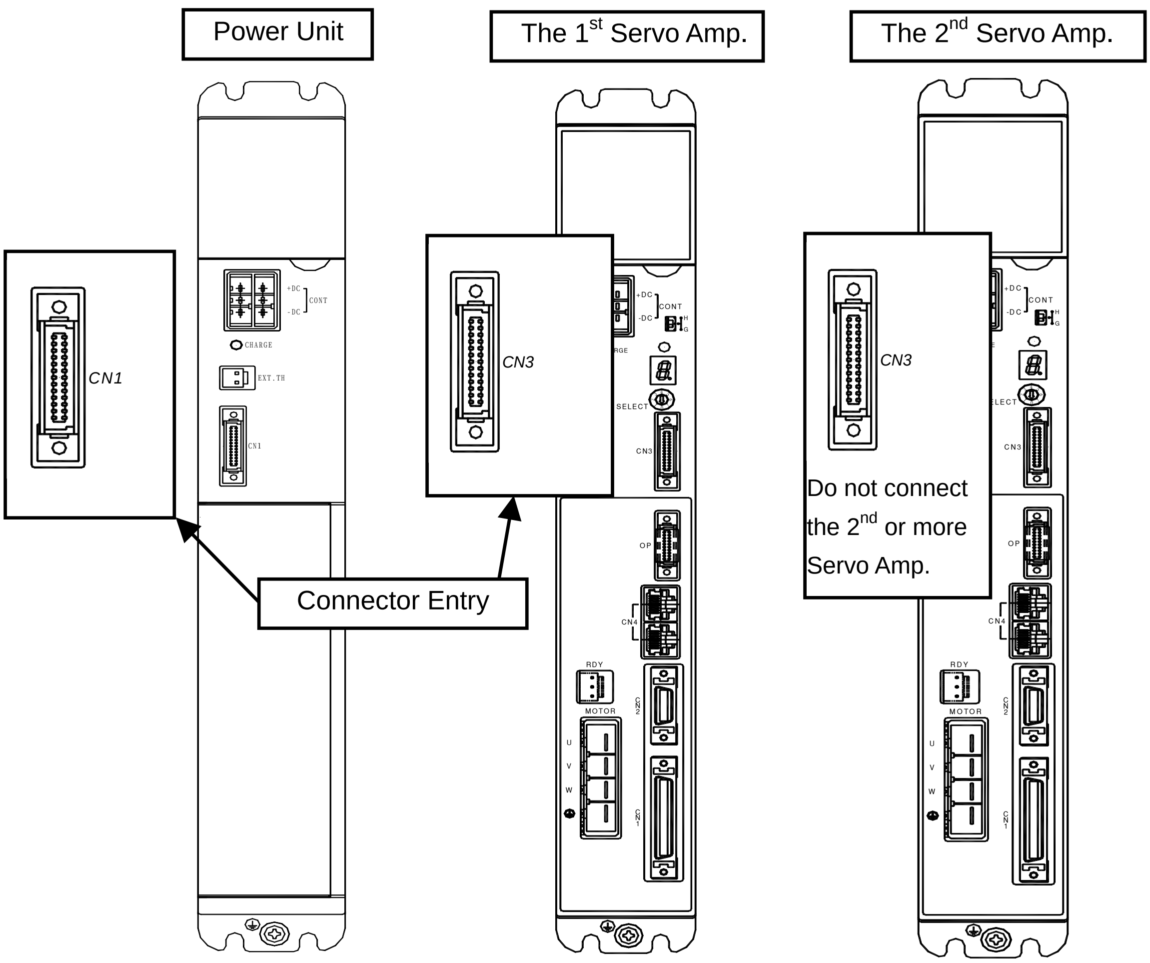
Model No.	L
AL-00397732-01	150mm
AL-00397732-02	200mm
AL-00397732-03	250mm



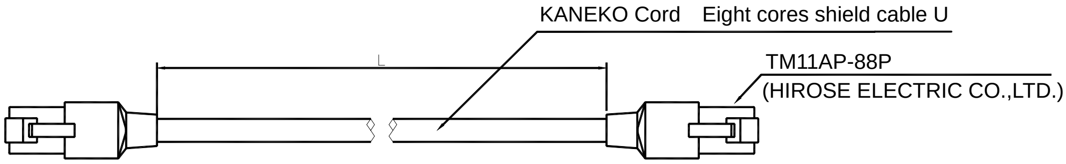
AL-00397730-□□　Between PS and AMP



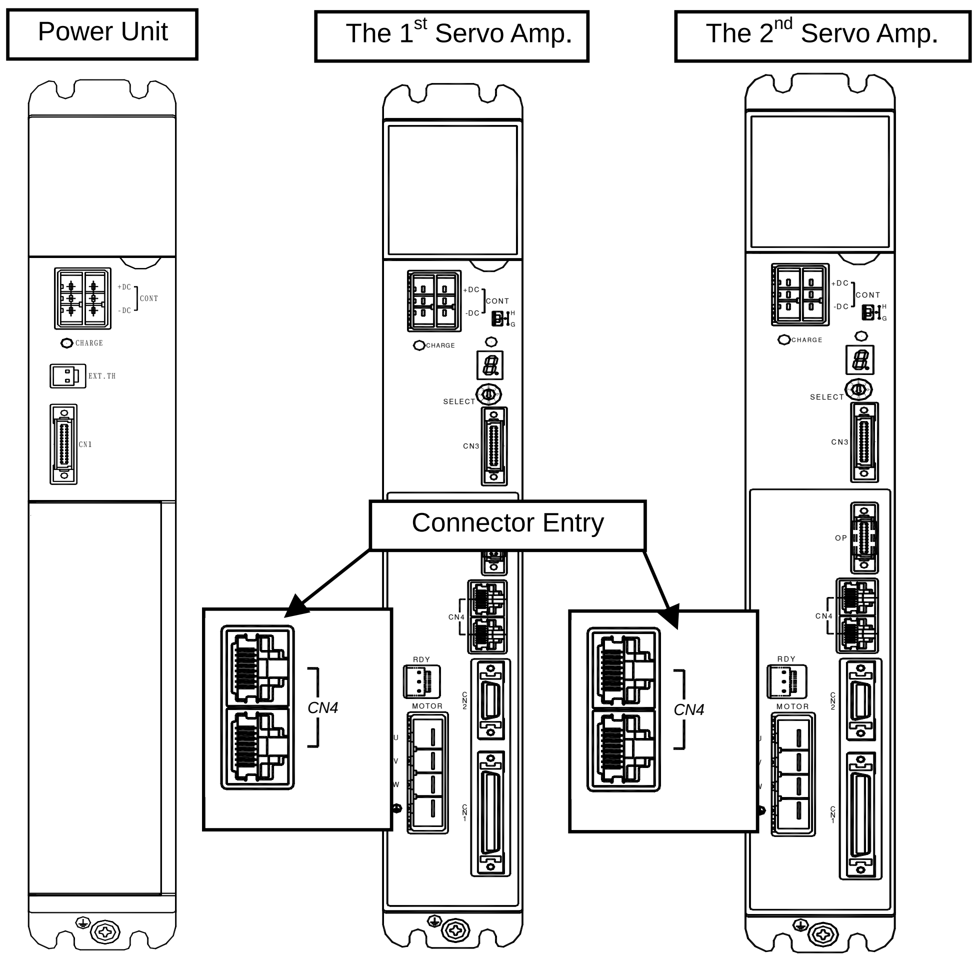
Model No.	L
AL-00397730-01	200mm
AL-00397730-02	250mm
AL-00397730-03	300mm
AL-00397730-04	350mm



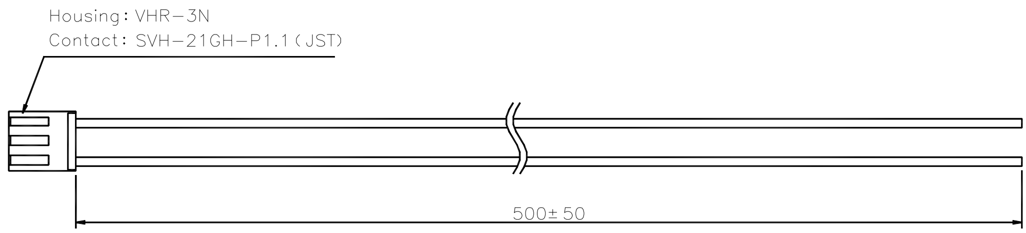
AL-00443493-□□　Between AMP and AMP



Model No.	L
AL-00443493-01	200mm±9
AL-00443493-02	400mm±15
AL-00443493-03	600mm±18

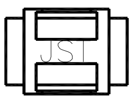


AL-00427658-01　for RDY



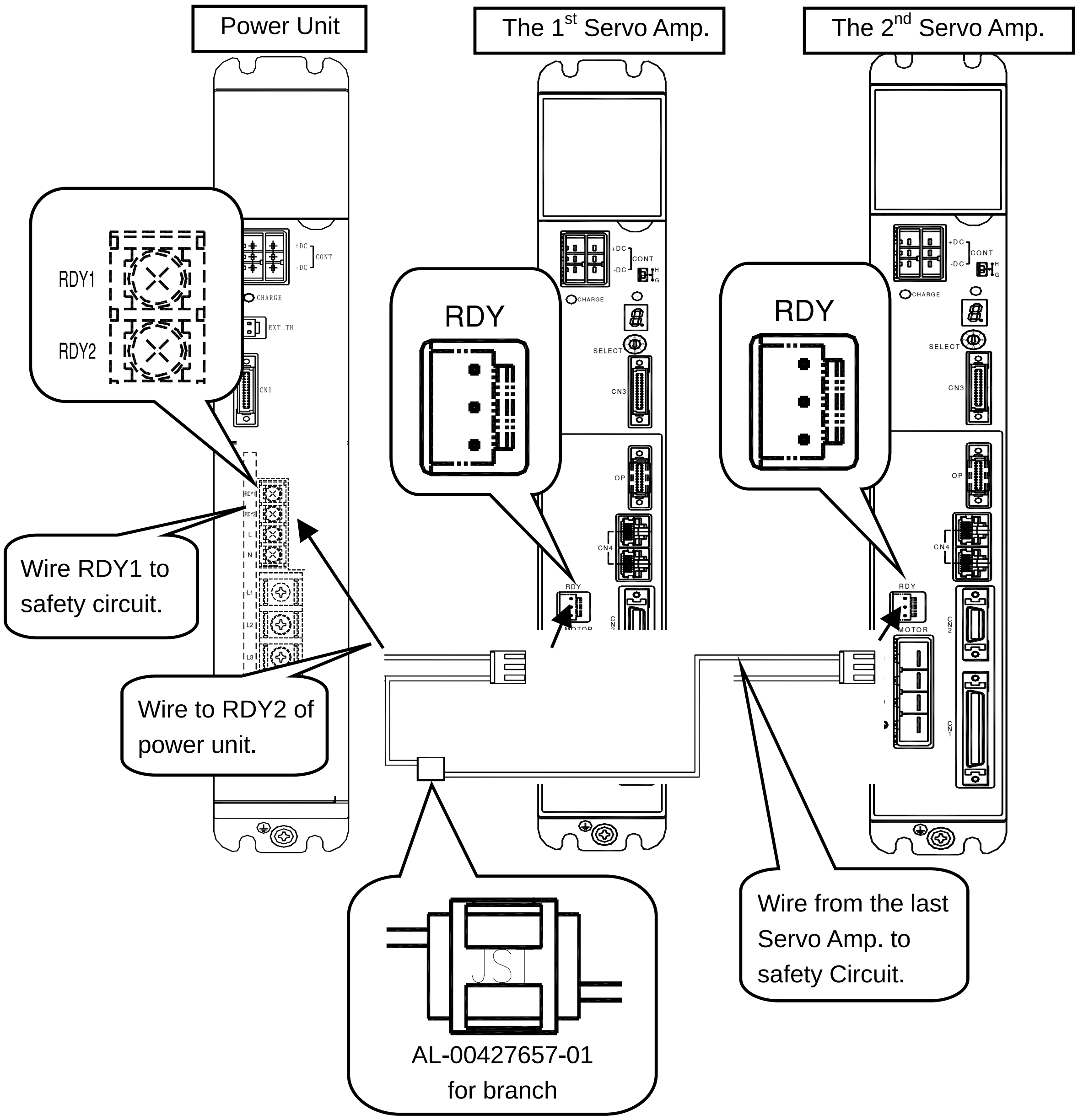
Model No.	L
AL-00427658-01	500mm

AL-00427657-01　for RDY branch

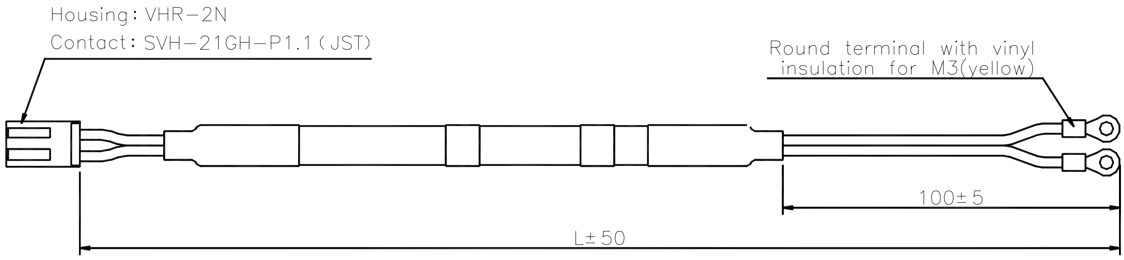


Model No.	L
AL-00427657-01	-

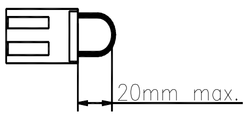
CL-2218T　(Made in Japan Soldeless Terminal Mfg. Co., Ltd.)



AL-00397733-□□ for EXT. TH (PQMOPA)

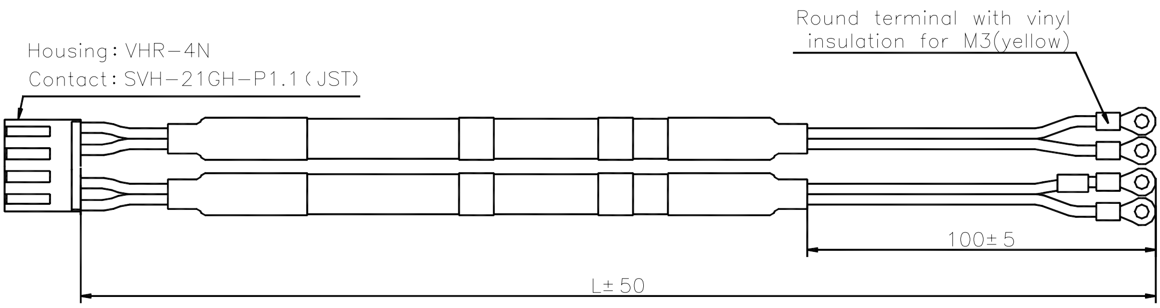


Model No.	L
AL-00397733-02	1500mm
AL-00397733-03	3000mm
AL-00397733-04	5000mm

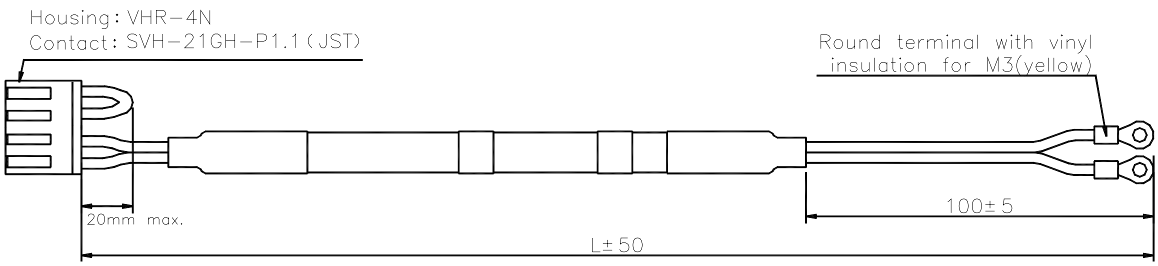


Model No.	L
AL-00397733-01	-

AL-00453107-□□ for EXT-TH (4 pins) (More than PQM1□600A,800A,900A)

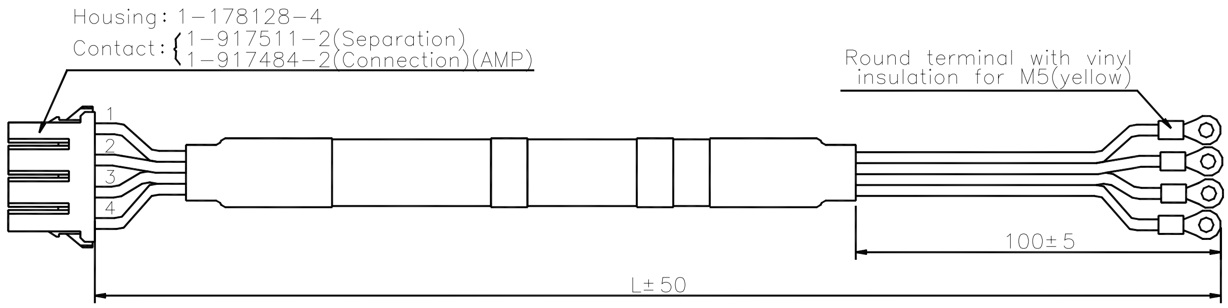


Model No.	L
AL-00453107-01	1500mm
AL-00453107-02	3000mm
AL-00453107-03	5000mm



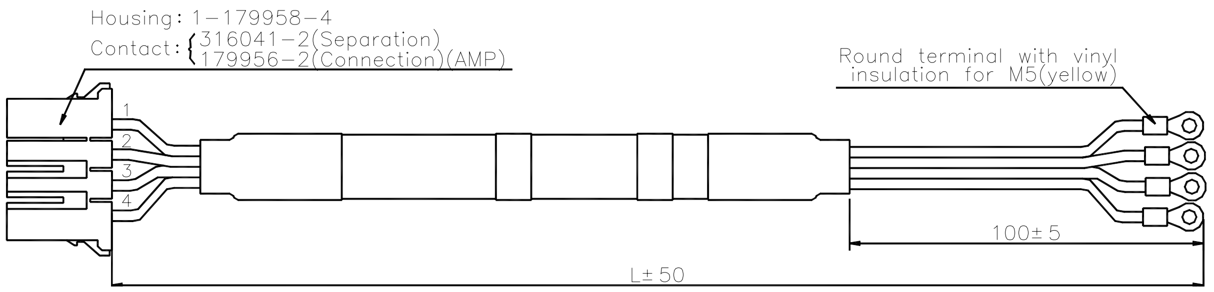
Model No.	L
AL-00453107-04	1500mm
AL-00453107-05	3000mm
AL-00453107-06	5000mm

AL-00397729-□□ for MOT (For PQM1□030A)



Model No.	L
AL-00397729-01	1500mm
AL-00397729-02	3000mm
AL-00397729-03	5000mm

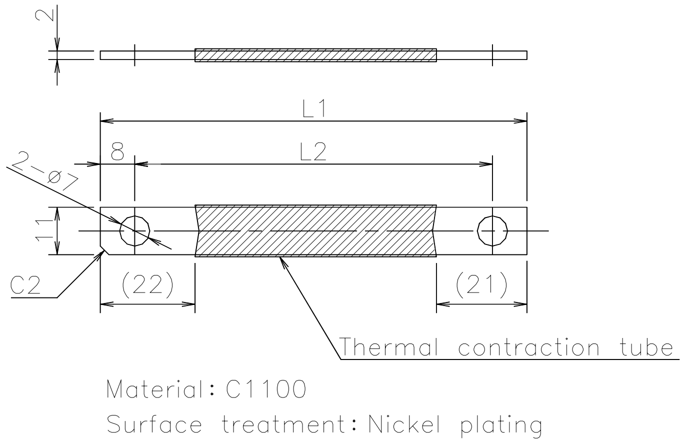
AL-00397734-□□ for MOT (For PQM1□050A)



Model No.	L
AL-00397734-01	1500mm
AL-00397734-02	3000mm
AL-00397734-03	5000mm

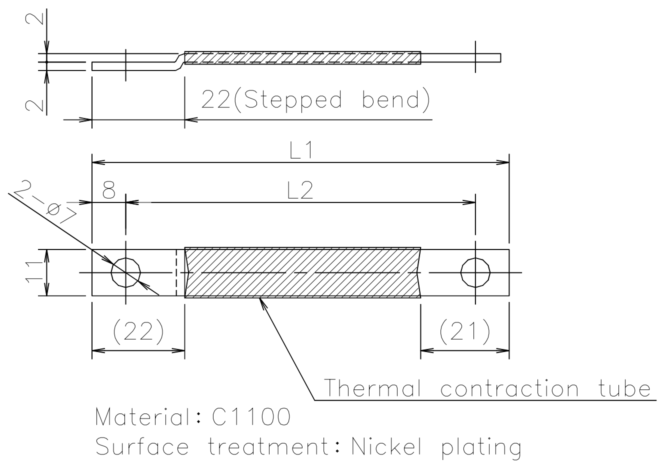
9. SPECIFICATIONS

AL-00385689-□□ Copper bar



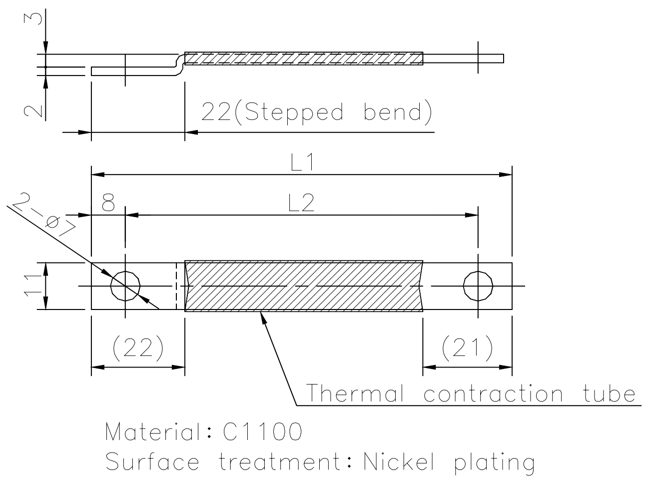
Model No.	L1 mm	L2 mm
AL-00385689-01	71	55
AL-00385689-02	96	80
AL-00385689-03	114	98
AL-00385689-04	139	123

AL-00385690-□□ Copper bar



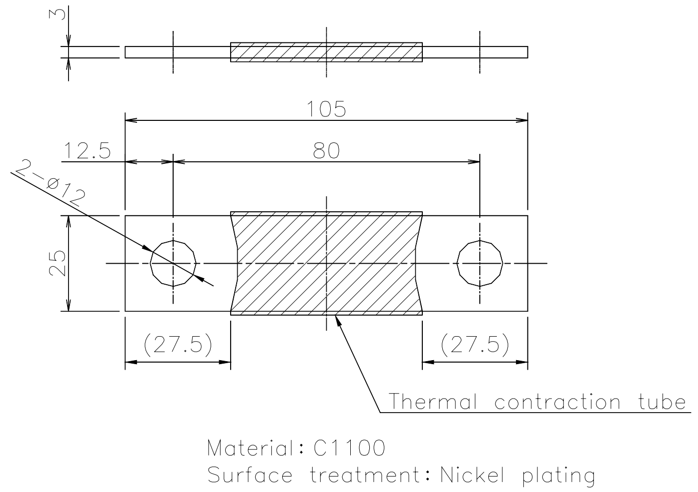
Model No.	L1 mm	L2 mm
AL-00385690-01	61	45
AL-00385690-02	71	55
AL-00385690-03	96	80
AL-00385690-04	138	122
AL-00385690-05	104	88
AL-00385690-06	114	98
AL-00385690-07	139	123
AL-00385690-08	181	165

AL-00409923-□□ Copper bar

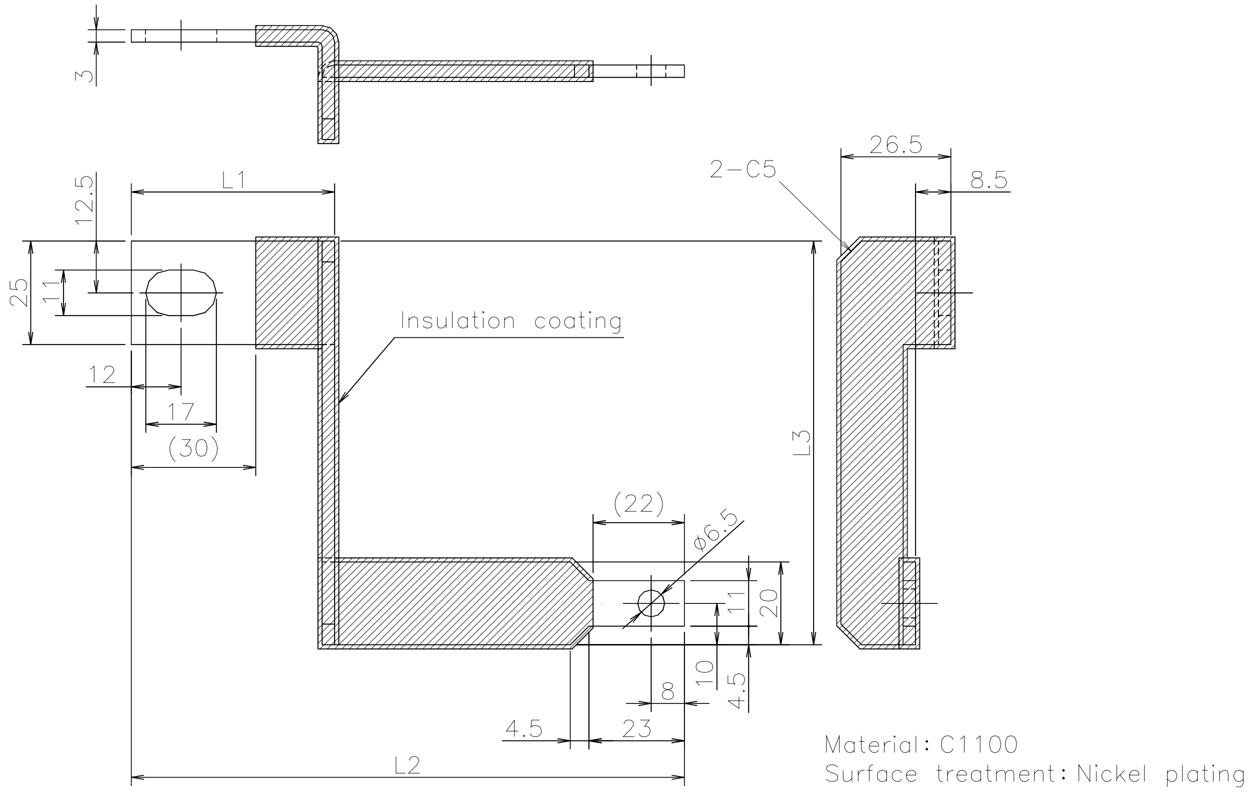


Model No.	L1 mm	L2 mm
AL-00409923-01	61	45
AL-00409923-02	71	55
AL-00409923-03	96	80
AL-00409923-04	138	122
AL-00409923-05	104	88
AL-00409923-06	114	98
AL-00409923-07	139	123
AL-00409923-08	181	165

AL-00423522-□□ Copper bar



AL-00426136-□□ Copper bar



Model No.		L1	L2	L3
AL-00426136-01	+DC	58	90.4	112.5
	-DC	49	90.4	97.5
AL-00426136-02	+DC	58	133.3	112.5
	-DC	49	133.3	97.5

M0005165B

BL Super
PQM series
Instruction Manual

Release:Jan , 2002

URL **http://www.sanyodenki.co.jp**

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