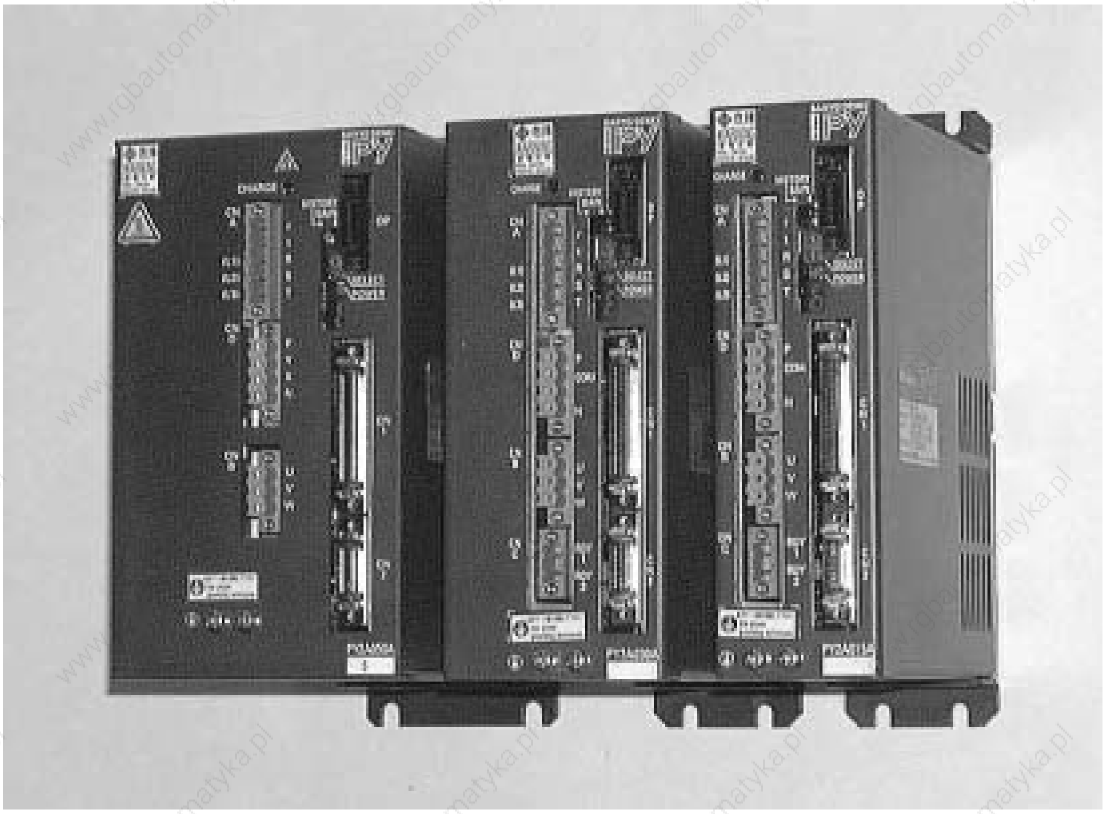
M0001584J

AC SERVO SYSTEM

BL Super P Series

PY PY2

PY2 Servo Amplifier Instruction Manual



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SANYO DENKI CO.,LTD

English

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 Economy, Trade & Industry is not required. For customs purposes, however, an explanation may be required. So, 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.

PREFACE

The "PY" series 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 "PY2" was developed as an upgraded version of this "PY" series to satisfy customer needs for further downsizing.

The "PY2" Servo Amplifier features the same performance as the "PY" series, on which it is based, with only the size reduced. The small and high performance "PY2" Servo Amplifier is useful for a large number of customers in applications requiring space saving.

This User's Manual explains the functions, wiring, installation, operation, maintenance and specifications of the "PY2" Servo Amplifies and our Servomotors.

To completely utilize all functions of the "PY2" series, 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.".

Also, "Wiring-saved incremental encoders" and "Request signal-unavailable absolute encoders" are sometimes abbreviated to "Encoders" and "Wiring-saved incremental encoders", "Request signal-unavailable absolute encoders" and "Request-available absolute sensors" to "Sensors".

International Standard Compliance

The “PY2” Servo Amplifier complies with the following International standards.

International standard	Standard No.
TÜV	EN50178
UL	UL508C
CUL	UL508C
Low Voltage Directive	EN50178
EMC Directive	EN55011

Working Environment

Since the working environment for the “PY2” Servo Amplifiers must be pollution level 2 or above (i.e. level 1 or 2) as specified in EN50178, be sure to use them in a pollution level 1 or 2 environment.

Power Supply

The “PY2” Servo Amplifiers must be used under the conditions specified in overvoltage category II, EN 50178. Use a reinforced insulation transformer conforming to the EN Standard for power supply input. For the interface, use a DC power supply whose input and output sections have reinforced-insulation.

CE Marking

At Sanyo Denki, we are executing tests on the “PY2” Servo Amplifier for compliance with the CE marking at qualifying institutions. The CE mark is required to be attached all end products sold in EU countries. Only products conforming to the safety standards are permitted to have them. Accordingly, customers are requested to perform the final conformity test on their machines or systems incorporating our amplifiers.

The CE Marking Conformity Standards

We execute conformity tests for the following standards on the “PY2” Servo Amplifier at qualifying institutions.

Classification of directive	Classification	Test	Test standard
Low Voltage Directive	—	—	EN50178
EMC Directive	Emission	Terminal interference voltage	EN55011
		Electromagnetic radiation interference	EN55011
	Immunity	Radiation field immunity	EN61000-4-3 / 1996 ENV50204 / 1995
		Conductivity immunity	EN61000-4-6 / 1996
		Electrostatic immunity	EN61000-4-2 EN61000-4-2 : A1 / 1998
		Electrostatic immunity	EN61000-4-2 EN61000-4-2 : A1 / 1998
		Burst immunity	EN61000-4-4 / 1995

File numbers

Low Voltage Directive, Declaration	:	File No. C0002827C
Low Voltage Directive, Certification	:	File No. B 01 05 21206 040 (Messrs. TÜV PRODUCT SERVICE)
EMC Directive, Declaration	:	File No. C0004056
EMC Directive, Certification	:	File No. E9 99 05 30982 005 (Messrs. TÜV PRODUCT SERVICE)

UL Marking

The “PY2” series products are qualified to have the UL (U.S. version) and cUL (Canada version) marks of the Underwriters Laboratories attached.

File Numbers

File No.: E179775 Power Conversion Equipment (CCN: NMMS, NMMS7)

Fuse

The “PY2” Servo Amplifiers are not equipped with fuses. Customers are requested to prepare a UL-approved fast-blown fuse and install it in the input section of the main circuit power supply.

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0. SAFETY PRECAUTIONS

SAFETY PRECAUTIONS

This chapter summarizes the precautions to ensure safe operation of the PY2 Servo Amplifier.

Be sure to read this chapter before operation.

0. SAFETY PRECAUTIONS

0.1 Introduction

The “PY2” Servo Amplifier is designed to be used for general industrial equipment. So, note the following precautions.

- To ensure proper operation, thoroughly read the Instruction Manual before installation, wiring and operation.
- Do not modify the product.
- For installation or maintenance, consult our dealer or authorized agency.
- When using the product for the following purposes, special measures, such as system multiplication or emergency power generator installation, should be taken regarding operation, maintenance and management of the product. In this case, consult us.
  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.

Be sure to read all parts of this manual before use (installation, operation, maintenance, inspection, etc.) to properly use the equipment and only start using it after completely understanding all aspects, safety information and precautions relating to the equipment.
Keep this manual handy after reading it.

0.2 "Warning Label" Location on Product

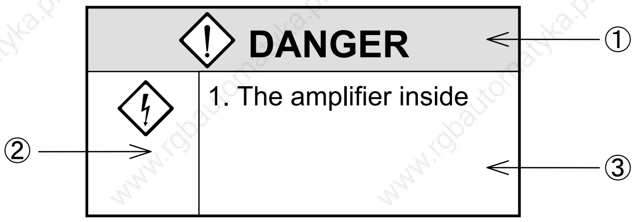
The warning label is on the front upper left of the Servo Amplifier.

0.3 Meaning of Warning Indication

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

0.3.1 Details of Indications

Section 0.4 describes as 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

0.4 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. Be sure to ground the PE (protective earth) terminal ⏚ of the amplifier.
   The grounding terminal of the motor must be connected to the PE (protective earth) terminal ⏚ of the amplifier. Otherwise, an electric shock may occur.
6. Don't damage cable, stress them abnormally, place heavy items on them nor get them caught between other parts or devices.
   Otherwise, an electric shock may occur.
7. Be sure to connect the power cable in accordance with the connection diagram or the User's Manual.
   Otherwise, you may be struck by electricity, or fire may occur.
8. Since no fuse is built into the main power supply input terminals (R, S and T) of the amplifier, be sure to insert a UL-approved circuit breaker or fast-blown fuse to the amplifier power supply input wiring to protect it and its peripherals.

DANGER	
	<Operation>
⚠	9. During operation, never touch the motor rotator, or you may be injured.
⚡	10. While the power is supplied, never approach nor touch terminals, or you may be struck by electricity.
⚡	11. While the power is supplied, never remove any terminal cover, or you may be struck by electricity.

0. SAFETY PRECAUTIONS

CAUTION

<General>

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

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

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

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

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

<Unpacking>

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

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

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

0. SAFETY PRECAUTIONS

CAUTION

<Wiring>

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

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

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

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

<Installation>

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

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

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

16. Decide the distances between the amplifier, the inside surface of the control panel and other equipment in accordance with the User's Manual.
Otherwise, troubles may occur.

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

18. During installation, take an extreme care not to drop nor overturn these units, or you may face serious dangers.
When raising the motor, use the lifting bolt if it is fitted.

19. Never install these units where they are exposed to splash of water, in corrosive or inflammable gas atmosphere or near combustibles.
Otherwise, fire may occur or they may get out of order.

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

⚠ CAUTION

<Operation>

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

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

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

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

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

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

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

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

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

⚠ CAUTION

<Maintenance>

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

31. The electrolytic capacitor inside the amplifier is recommended to be replaced with a new one every five years for preventive maintenance providing that the yearly ambient temperature is 40°C.
The expected life of the cooling fan motor is 10 years at the yearly ambient temperature of 40°C. Regular replacement is recommended.

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

<Transportation>

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

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

<Disposal>

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

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.

<General>

4. Do not remove the nameplate.

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, 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. When the alarm generates, assemble the safety circuit outside of the amplifier.
Running away, injury, burning, fire, and secondary damage may be caused.

5. Operate the system within the specified ranges of the temperature and humidity (see below).
Amplifier: Temperature = 0 to 55°C, Humidity = 90% RH or lower (no dew condensation)
Motor: Temperature = 0 to 40°C, Humidity = 90% RH or lower (no dew condensation)

<Transportation>

6. Overloaded products will collapse.
So, load them in accordance with the indication on the outer cases.

7. 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 will 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

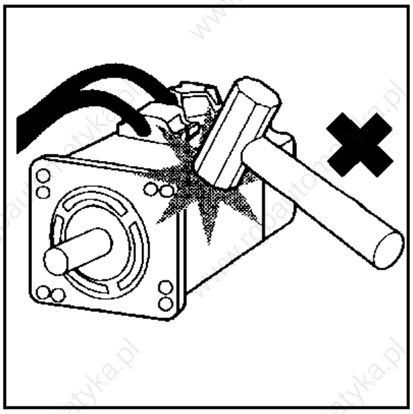
Check the following after receiving the product. Contact us if any abnormality is detected.

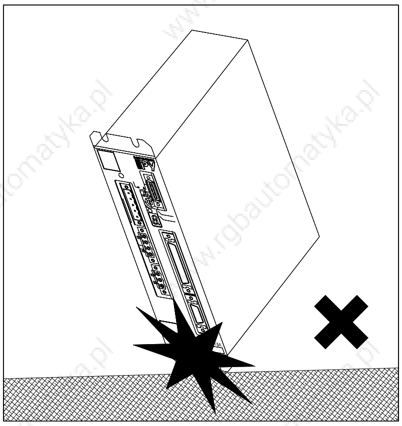
- Check if the model numbers of the Servomotor and the Servo Amplifier match those of the ordered ones (the numbers are described after "MODEL" on the main nameplate).
- Check the appearance of the Servomotor and the Servo Amplifier to confirm that they are free from any abnormality such as breakage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

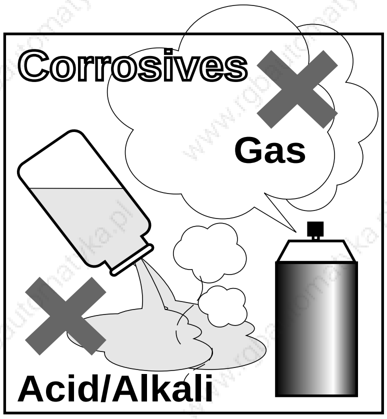


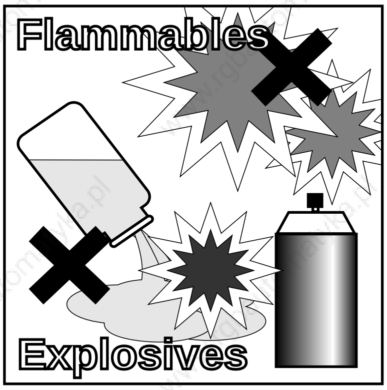


1. BEFORE OPERATION

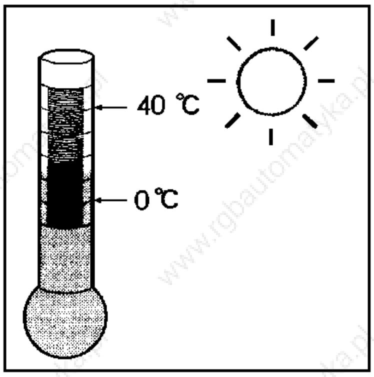
- Be sure to use a power supply within the specified range.
  200 VAC input type: PY2A…, PY2B…
  200 VAC to 230 VAC (+10%, −15%) 50/60 Hz
  100 VAC input type: PY2E…, PY2F…
  100 VAC to 115 VAC (+10%, −15%) 50/60 Hz
  If a power supply other than the above is used, an accident may result.

- 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.





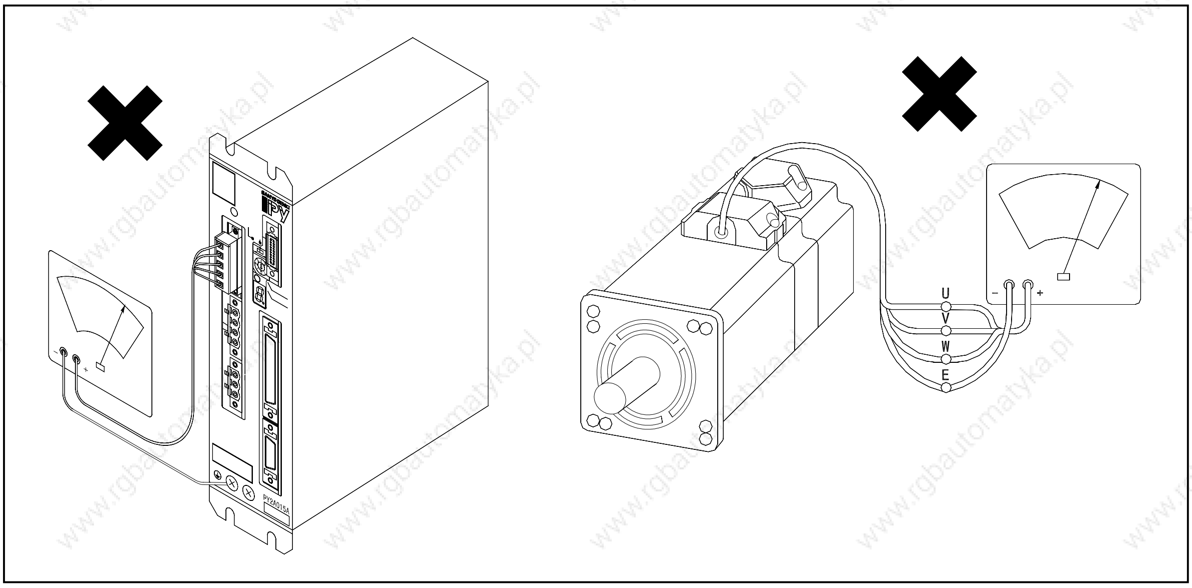
- Use this product within the ambient temperature range from 0°C to 40°C (0°C to 55°C for the Servo Amplifier) and below the relative humidity limit of 90%.
- The Servomotor and the Servo Amplifier should be kept away from water, cutting fluid or rainwater. Otherwise electric leakage or and electric shock may result.



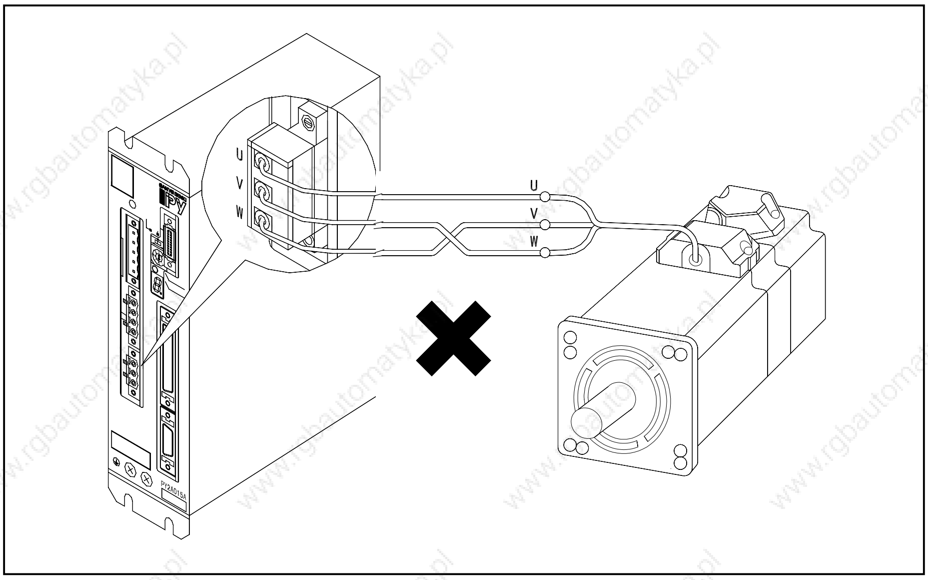
1. BEFORE OPERATION

- For 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 a megger test of the Servomotor or the Servo Amplifier.
  In this product, 0V and the main body is earthed by the capacitor.
  If such test is necessary, consult with us.



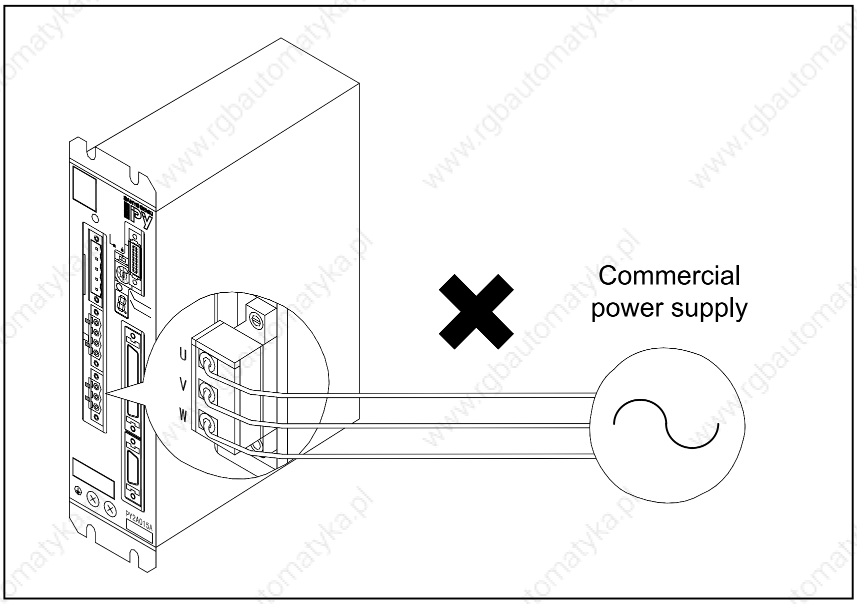
- Perform correct wiring by referring to the chapter "4. Wiring".
  Wrong wiring may cause Servomotor's or amplifier's breakage.
- Since the "P" series Servomotor is not an induction motor, the direction of revolution cannot be changed by swapping the phases.
  To change the direction, use the remote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



1.4 How to Read Model Numbers

1.4.1 Model Number of Servomotor

○○○ B ○○ ○○○ △ □ ◇ ▽▽

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

2. Indicates the BL motor

3. 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
   - 13…130 mm 15…150 mm 18…180 mm
   - 22…220 mm

4. Indicates rated output
   - ○○○ = ○○○ × 10 w

5. Maximum revolution speed
   - S…1000 min^{-1} M…1500 min^{-1} B…2000 min^{-1}
   - R…2500 min^{-1} H…3000 min^{-1} D…4500 min^{-1}
   - P…4500 min^{-1}

6. Equipping of holding brake
   - X…Not equipped. B…Equipped. (90V) C…Equipped. (24V)

7. Type of detector
   - S… Wiring-saved incremental encoder
   - J… Absolute encoder with the motor flange square of 60 mm or less; Request signal-unavailable type.
   - A… Absolute encoder with the motor flange square of 76 mm or more; Request signal-unavailable type.
   - N... ABS-RII; Super-capacitor-unavailable, request signal-available type.
   - V... ABS-RII; Super-capacitor-built-in, request signal-available type.

8. Specification identification
   - 00… Standard motor

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

1.4.2 Model Number of Servo Amplifier

PY2 □ ○○○ A 0 XX △ ▽ 00

1. Indicates a PY2 servo amplifier

2. Type of power unit
   A… For 200 VAC input, with dynamic brake
   B… For 200 VAC input, without dynamic brake
   E… For 100 VAC input, with dynamic brake
   F… For 100 VAC input, without dynamic brake

3. Amplifier capacity
   015… 15A 030… 30A 050...50A

4. Hardware type of control unit
   A... Wiring-saved incremental encoder (INC-E) or request signal-unavailable absolute encoder (ABS-E)
   H... Request signal-available absolute sensor (ABS-RII)
   P… Wiring-saved absolute sensor (ABS-E.S1)

5. Optional specifications of power supply input and power sections

Model code	Contents of specifications			Support by power section type and amplifier capacity *3				
	Built-in regenerative resistor *1	RDY output *2	Main circuit power supply type	PY2A015	PY2A030	PY2A050	PY2E015	PY2E030
0	×	○	3-phase	○	○	×	×	×
1	×	○	Single phase	○	○	×	○	○
2	×	×	3-phase	○	○	×	×	×
3	×	×	Single phase	○	○	×	○	○
4	○	○	3-phase	△ *4	○	○	×	×
5	○	○	Single phase	△ *4	○	○	△*4	○
6	○	×	3-phase	△ *4	○	○	×	×
7	○	×	Single phase	△ *4	○	○	△*4	○

*1: Built-in regenerative resistor: ○= with built-in regenerative resistor, ×= without built-in regenerative resistor
*2: RDY output: ○= with RDY output, ×= without RDY output
*3: Support by power section type and amplifier capacity ○= supportive, ×= not supportive
*4: For 15A regenerative resistor built-in type, configuration (dimension) of Amp. partially differs from standard.

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

7. Type of applicable sensor
   1... Wiring-saved incremental encoder (2000P/R)
   2... Wiring-saved incremental encoder (6000P/R)
   3... Request signal-unavailable absolute encoder (ABS-E, 2048P/R)
   6... Request signal-available absolute encoder (ABS-RII, 8192P/R)
   W…Wiring-saved absolute sensor (ABS-E.S1, 32768 dividing)

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

9. Discrete specification
   00… Standard product

- The design revision order is indicated by an alphabet at the end of Lot No. on the nameplate.
- In some Servo Amplifiers, the items 6 to 9 above are not specified. Servo Amplifiers having the following model numbers can be used after specifying the parameters such as motor, sensor and interface.
  PY2A015A2 PY2A030A2 PY2A050A6 PY2E015A3 PY2E030A3

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 "PY2" Servo Amplifier Standard Combination Table (200 VAC input type)

Servomotor		Servo Amplifier	
P☆B○○○○○○□◇▽▽		PY2A○○○A2 X X △▽00	
Series	Flange square Rated output Maximum speed	Amplifier capacity	Motor type
P10	10030H	030	11
	10075H	030	12
	13050H	030	13
	13100H	050	14
	13150H	050	15
	13050B	030	1A
	13100B	030	1B
	13150B	050	1C
	18200B	050	1D
P20	10100D	050	21
	10150D	050	22
	10100H	030	28
	10150H	050	29
	10200H	050	2A
P30	04003D	015	N1
	04005D	015	N2
	04010D	015	N3
	06020D	015	N4
	06040D	030	N5
	08075D	030	N6

Servomotor		Servo Amplifier	
P☆B○○○○○○□◇▽▽		PY2A○○○A2 X X △▽00	
Series	Flange square Rated output Maximum speed	Amplifier capacity	Motor type
P50	03003D	015	M1
	04006D	015	M2
	04010D	015	M3
	05005D	015	M4
	05010D	015	M5
	05020D	015	M6
	07020D	015	M8
	07030D	015	M9
	07040D	030	MA
	08040D	030	MB
	08050D	030	MC
	08075D	050	MD
	08100D	050	ME
	08075H	030	MF
	08100H	030	MG
P60	13050H	030	PA
	13100H	050	P1
	13150H	050	P2
P80	15075H	030	R2
	18120H	050	R3

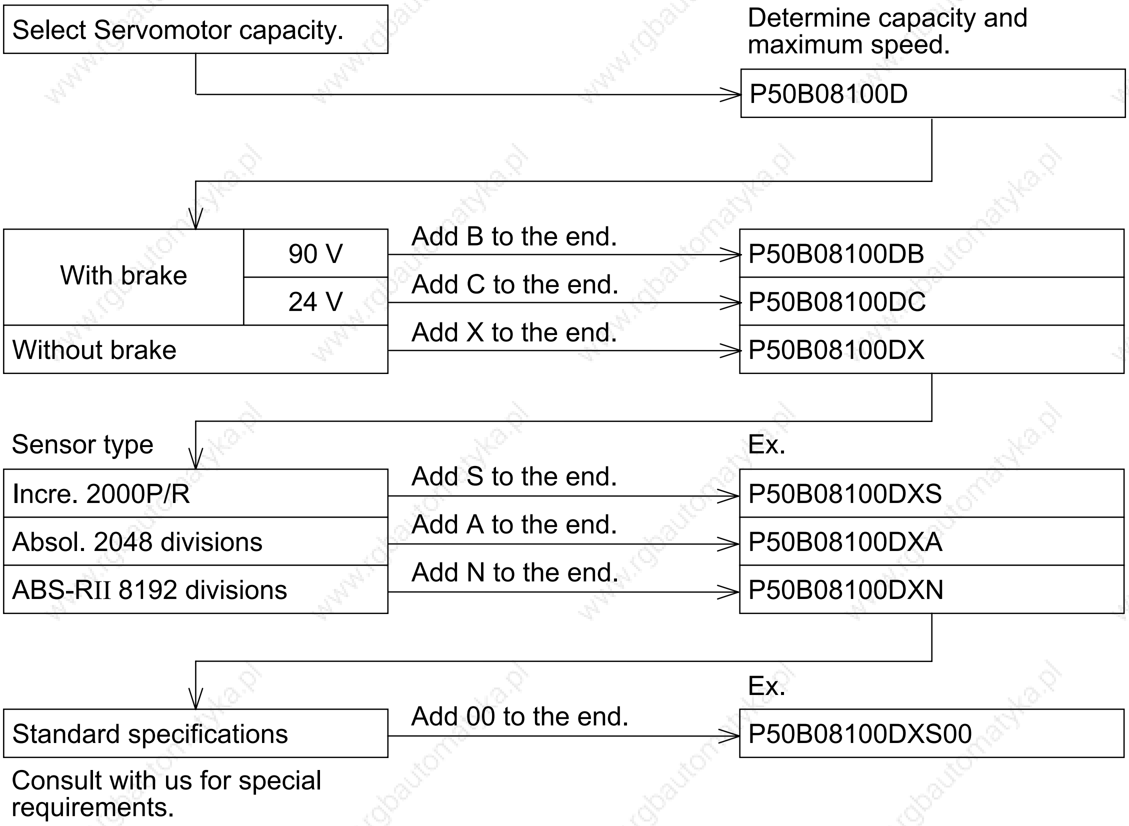
Table1-2 "PY2" Servo Amplifier Standard Combination Table (100 VAC input type)

Servomotor		Servo Amplifier	
P☆B○○○○○○□◇▽▽		PY2E○○○A3 X X △▽00	
Series	Flange square Rated output Maximum speed	Amplifier capacity	Motor type
P30	04003P	015	NA
	04005P	015	NB
	04010P	015	NC
	06020P	030	ND

Servomotor		Servo Amplifier	
P☆B○○○○○○□◇▽▽		PY2E○○○A3 X X △▽00	
Series	Flange square Rated output Maximum speed	Amplifier capacity	Motor type
P50	03003P	015	MH
	04006P	015	MJ
	04010P	015	MK
	05005P	015	ML
	05010P	015	MM
	05020P	030	MN
	07020P	030	MR
	07030P	030	MS

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 "PY2" Servo Amplifier Built-in Functions

This section describes the main built-in functions of the Servo Amplifier and additional functions specially for the PY2 series.
The functions marked **OP** require the remote operator (see Chapter 7).

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

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

- **Regenerative processing function**

  A regenerative processing circuit is built into the system, which enables regenerative processing simply by externally connecting a resistor to the amplifier.
  Since no regenerative resistor is built in except for 50 A type amplifier, one is required to be externally connected to the amplifier when regenerative processing is required.

- **Dynamic brake function**

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

- **Holding brake excitation timing output**

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

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

  If a vibration occurs when this function is incorporated in the system, the parameters "BEF" and "LPF" are set by the remote operator according to the vibration frequency, restraining the vibration. When offline, executing “auto notch filter tuning (Tune IBEF) at test mode can automatically set notch filter frequency (IBF1). For more adequate setting, measure the oscillation frequency with an oscilloscope on the current command monitor.

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

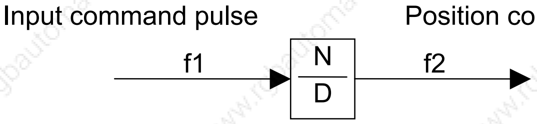
  The control power and the main circuit power are separated.
  When an alarm or an emergency stop occurs, the main circuit power alone can be cut off for safety, and the control power can remain activated.
  This enables the continuation of alarm output, making analysis and maintenance easy.

● Servo tuning support function OP

When the remote operator sets a mode, the load inertia is automatically estimated and a proper parameter is set. There are two different kind of tuning methods: one is “Offline auto tuning” executed at test mode when offline, and the other is “Online auto tuning” estimating appropriate gain and changing the gain at real time during operation.

● 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.

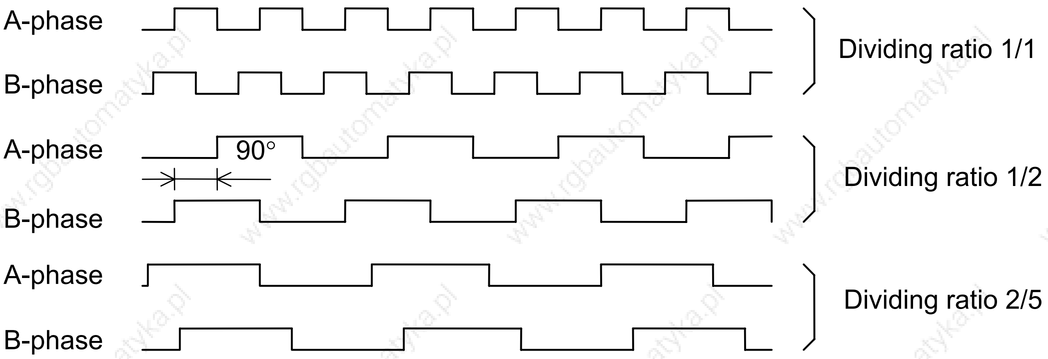


When N = 1 to 32767 and
D = 1 to 32767

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

● 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.
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.

- **Power supply type selection function (200 VAC input type) OP**

  Either a 3-phase, 200 VAC type or the single phase, 200 VAC type main power supply can be selected. After selecting either one, simply turn the control power supply on again, no other parameter settings are necessary. (Since some types of motors have different 3- or single-phase properties, refer to the combination specifications in Section 9.)

- **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.

- **Applicable to absolute sensor (ABS-R II) OP**

  Applicable to an absolute sensor (ABS-R II).

- **Applicable to Wiring-saved absolute sensor (ABS-E.S1) OP**

  Applicable to a wiring-saved absolute sensor (ABS-E.S1). Absolute sensor can be wiring-saved. In use to application not requiring holding multi-rotational part, wiring number can be less then that for wiring-saved incremental encoder (INC-E). In case of not requiring holding multi-rotational part, battery connection is not necessary (Need parameter setting to select functions).

⚠ Applicable Servo Amplifiers to absolute sensor (ABS-R II) and wiring-saved absolute sensor (ABS-E.S1) have different internal circuits from incremental (INC-E) and absolute (ABS-E) encoder-type amplifiers. Use product applicable to an absolute sensor.

2. FUNCTION, CHARACTERISTICS AND CONFIGURATION

Additional function specially for the PY and PY2 series (compared to PZ amplifiers)

In addition to the various control functions provided in the "PZ" series, the following functions have been added to the "PY" and "PY2" series

1. Control mode switching function OP

This function is for switching the control mode without power shutdown.

2. Internal velocity command function OP

The amplifier has three types of velocity commands, and this function is for switching the velocity command depending on the situation.

3. Function to correspond with the external encoder for full-close control OP

By providing an external incremental encoder process circuit in the amplifier, full-close control is enabled. (For full-close correspondence, consult us, as additional parts are required.)

4. Gain switching using a rotary switch OP

By using a rotary switch, gain setting is enabled without connecting to a remote operator.

5. Gain switching function OP

Two types of gain settings can be selected in the amplifier. Gain switching is enabled depending on the situation.

6. Upgrading of the personal computer interface functions OP

Following upgrading of the personal computer interface functions, graphic indication of the monitor data and execution of various test modes have been enabled as well as parameter setting and editing using a PC.
(See the instruction manual for the personal computer interface provided separately.)

> ⚠ Be sure to use the PY personal computer interface version 1.30 or later when combining the 100 VAC power input type (PY2E), single-phase power supply specification PY2 Servo Amplifier with a personal computer interface.
>
> (The amplifier may malfunction if combined with version 1.24, 1.23 or earlier.)

7. Input command auto offset function OP

The analog input command auto offset function is added, which facilitates offset adjustment in the velocity or torque control mode.

2.2 Characteristics of "PY2" Servo Amplifier

This section explains the characteristics of the "PY2" amplifiers.

- **The volume is about half that of conventional models**

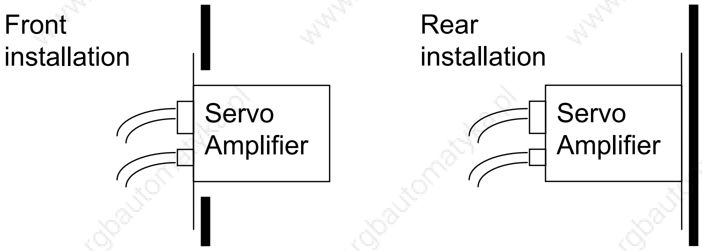
  About 40% to 65% smaller in terms of volume than the “PY”, ”PZ” and ”PE” series.
  PY2A015 (to 300 W) : About 45%
  PY2A030 (to 1 kW) : About 65%
  PY2A050 (to 2 kW) : About 45% (Note: "PY" is assumed to be 100%.)

- **Unified height and depth**

  The height of the amplifier applicable to 30 W to 2 kW motors is kept at to 168 mm (excluding the mounting fitting) and the depth at 135 mm.

- **Front or rear installation is selectable**

  Although only rear installation is usually available for a small Servo Amplifier, both front and rear installations can be selected for the "PY2" or "PY" type.
  (Rear installation is standard for the "PY2" on shipment.)



- **All amplifier I/O wirings are changed to the connector type**

  The terminals of the high-voltage parts, which used to be the terminal board type on our conventional "PY" and "PZ" series, are changed to the connector type. This improves operability when installing or maintaining the Servo Amplifier.

- **The leakage current has been reduced to about half that of conventional models**

  Measures to reduce leakage current are taken on the "PY2" amplifier, reducing it to about half that of our conventional "PY" or "PZ" series.
  When a 2 m cabtyre cable is used for the motor power line:
    - 15A, 30A 0.5 mA or less
    - 50A 1.5mA or less

- **Additional tuning function**

  In addition to “Offline auto tuning” function, “Online auto tuning” and “Auto notch filter tuning” functions are available.

2. FUNCTION, CHARACTERISTICS AND CONFIGURATION

- **Supports various types of power supplies**

  The “PY2” Servo Amplifier supports 200 VAC 3-phase, 200 VAC single-phase and 100 VAC single-phase types of power supplies.
  Switching between 200 VAC 3-phase and 200 VAC single-phase is possible by simply changing the parameters.
  (Switching between 100 VAC single-phase and 3-/single-phase is impossible since they have different hardware. A 100 VAC motor is also necessary.)

- **High response**

  Features higher response than our conventional "PZ" type ("PY" and "PY2" have the same level of response).

- **High reliability and long life**

  Ensures long operation without failure thanks to circuit technologies accumulated from extensive experience gained from our conventional models.

2. FUNCTION, CHARACTERISTICS AND CONFIGURATION

Differences Between PY2 Amplifier and Sanyo Denki's Conventional Models and Precautions

- **No fuse is built into the main power supply input section.**

On our conventional PY, PZ, PE and PU models, fuses are built into the main power supply input sections to save wiring and other reasons when a single axis is used. On the PY2 amplifier, however, no fuse is built in since use of multiple axes is assumed and downsizing is the main theme of its development.
(No fuse is built into the PV amplifier, one of our conventional models, as with the PY2.)
In order to protect the main power supply input section from overcurrent, connect a UL-approved circuit breaker and a fast-blown fuse to the amplifier input section before operation.

- **Fewer noise filters on the main and control power supply input sections**

The number of noise filters has been reduced on the PY2 amplifier than on our conventional PY, PZ, PE, PV and PU models. Noiseproofing, however, is the same as that on conventional models thanks to improved internal circuits.
Although noiseproofing does not differ, after Sanyo Denki's conventional amplifier in your system is replaced with the PY2 amplifier, power supply noise which had been absorbed by the noise filters inside the conventional amplifier may affect other peripherals. So, it is recommended that you attach noise filters to the power supply (200 VAC).

- **No regenerative resistor is built in. (The 50 A type amplifier normally has one built-in.)**

On our conventional PY, PZ, PE, PV and PU models, regenerative resistors are built in (the power absorbed differs depending on the model and the capacity).
On the "PY2A015*" and "PY2A030*" types, no regenerative resistor is built in.
(They incorporate regenerative processing circuits only.)
Externally connect regenerative resistors to systems requiring regenerative processing.
If no regenerative resistor is externally connected, it takes about five minutes to discharge the capacitor after the main circuit power is turned off. Before maintaining the amplifier, make sure that the "CHARGE" lamp on the front of the amplifier indicates that it has been discharged.

- **The dynamic braking methods differ.**

On the PY2 amplifier, the slowing-down revolution angle at the time of stopping by dynamic braking is twice that of the PY, PZ and PE models in the worst case.
(The angle is the same between the PV and PY2. No dynamic brake is built into the PU model.)

- **The forcible air cooling method is adopted for cooling power modules (for the 30 A and 50 A types only).**

On the "PY2A030*" and "PY2A050*" types, the forcible air cooling method is adopted to enable down sizing and long life. So, the Servo Amplifier does not stop functioning even after the cooling fan stops due to failure. To ensure long operation of the amplifier, check the motion of the fan during regular inspection.

- **Sensor cable wiring**

  While the maximum length of the sensor cable wiring is 50 m for our conventional PY, PZ, and PE models when a standard cable is used, the length is 30 m for the PY2 amplifier for sensor power supply reasons (the maximum length is 25 m for the absolute encoder (ABS-E) type).
  The permissible wiring distance can be extended to 50 m by using a cable with low conductor resistance (a thick cable) or by increasing the number of wires. Contact us for details.

- **External thermal input**

  While our conventional PY, PZ and PE models are equipped with input terminals capable of directly connecting contact outputs of external thermals, the PY2 amplifier is not.
  To connect an external thermal output to the amplifier, set the general-purpose input terminal to the external thermal signal input before operation.

- **AMP ready contact output**

  While our conventional PY, PZ and PE models are equipped with contact output terminals (AMP ready output terminals) for magnetic contactors which control the amplifier main power on/off switching, they are optional on the PY2 amplifier. For details, refer to "1.4 How to Read Model Numbers".
  When no AMP ready output is used, turn the main power on and off using an external safety circuit.

- **Analog monitor output**

  While analog monitor output is ± 10 V peak for our conventional PY, PZ and PE models, it is ± 3 V peak for the PY2 amplifier. The resolution of the PY2 is also lower than that of conventional models.
  Consult with us if high resolution is required for system evaluation or other purposes.

Table 2-1 Comparison of PY2/PY and Sanyo's Other Series (for Reference)

	PY2 amplifier	PY amplifier	PZ and PE amplifiers	PU amplifier	PR amplifier	RB amplifier	PV amplifier
Input power	100 VAC 200 VAC Single phase 3 phases	200 VAC Single phase 3 phases	200 VAC Single phase 3 phases	100 VAC 200 VAC Single phase	200 VAC Single phase	5 VDC, 38 V 5 VDC, 24 V 100 VAC, Single phase 200 VAC, Single phase	200 VAC Single phase
Features	● Multi function ● High response, high performance ● Small & compact ● Easy connection due to adopting connector method	● Multi function ● High response, high performance	● Multi function ● High response, high performance	● Small & compact ● Easy connection due to adopting connector method	● Data transmission servo (Direct input of velocity, acceleration and feed data. Easy operation using PC or CPU.) ● High cost performance ● Downsizing ● Easy system design	● Data transmission servo (Direct input of velocity, acceleration and feed data. Easy operation using PC or CPU.) ● High cost performance ● Downsizing ● Easy system design	● Small & compact ● Wide range of interface • Position, velocity and torque command • Serial command (RS-485) • Contact input operation command ● Easy connection due to adopting connector method
Motor combined	P1 series 0.3 to 2 kW P2 series 1 to 2 kW P3 series 30 to 750 W P5 series 30 to 1000 W P6 series 0.5 to 1.5 kW P8 series 0.75 to 1.2 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	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	Robust-syn motor Equivalent to 10 to 600 W	P3 series 30 to 750 W P5 series 30 to 1000 W
Sensor	Wiring-saved incremental ANS-R II ABS-E ABS-E.S1	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	Incremental (200P/R, 800P/R)	Wiring-saved incremental ABS-R II ABS-E
I/F	Pulse train input Analog input Serial input	Pulse train input Analog input Serial input	Pulse train input Analog input Serial input	Pulse train input or analog input	Centronics-based 8-bit parallel data input	Centronics-based 8-bit parallel data input	Serial command (RS-485), pulse train input or analog input
Built-in functions	● Regenerative processing circuit (without internal regenerative resistor) ● 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 ● 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 ● 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	● Built-in pattern generator ● Rush prevention ● Discharge circuit	● Regenerative processing ● Vibration restraining function ● Dynamic brake ● Rush prevention
Measures for overseas standards	TÜV recognition to be obtained UL recognition to be obtained	TÜV recognition obtained UL recognition obtained	TÜV recognition obtained (PE type only)		TÜV recognition obtained	TÜV recognition obtained	TÜV recognition obtained UL recognition obtained

2.3 Characteristics of Servomotor

- **Wide range of models (67 types in total)**

P1 series:	from 0.3 to 5.5 kW (15 types)	P2 series:	from 1 to 5 kW (14 types)
P3 series:	from 30 to 750 W (6 types)	P5 series:	from 30 W to 1000 W (15 types)
P6 series:	from 0.5 to 7 kW (11 types)	P8 series:	from 0.75 to 4.5 kW (6 types)

- **High-speed motor**

  Maximum speed of 2000 min^{-1} and 3000 min^{-1} for P1
  Maximum speed of 3000 min^{-1} and 4500 min^{-1} for P2
  Maximum speed of 4500 min^{-1} for P3 and P5
  Maximum speed of 3000 min^{-1} for P6 and P8
  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.

- **Compatible with various sensors**

  Compatible with the wiring-saved incremental encoder, the ABS-E absolute sensor (encoder) or the ABS-R II absolute sensor (the settings inside the amplifier differ depending on sensor types).

Table 2-2 Comparison of PY2 and PY Servomotor (for reference)

	P1 series (high rigidity)	P2 series (low inertia)	P3 series (low inertia)	P5 series (high rigidity)	P6 series (high rigidity)	P8 series (flat type)
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 (15 types)	1 to 5 kW (14 types)	30 to 750 W (6 types)	30 to 1000 W (15 types)	0.5 to 7 kW (11 types)	0.75 to 4.5 kW (6 types)
Sensor	● Incre. ● Absolute ABS-E	● Incre. ● Absolute ABS-E ABS-R II (R III)	● Incre. ● Absolute ABS-R II (R III)	● Incre. ● Absolute ABS-E ABS-R II (R III)	● Incre. ● Absolute ABS-E ABS-R II (R III)	● Incre. ● Absolute ABS-E ABS-R II (R III)
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

3. SERVO SYSTEM CONFIGURATION

SERVO SYSTEM CONFIGURATION

3. SERVO SYSTEM CONFIGURATION

3.1 Block Diagram

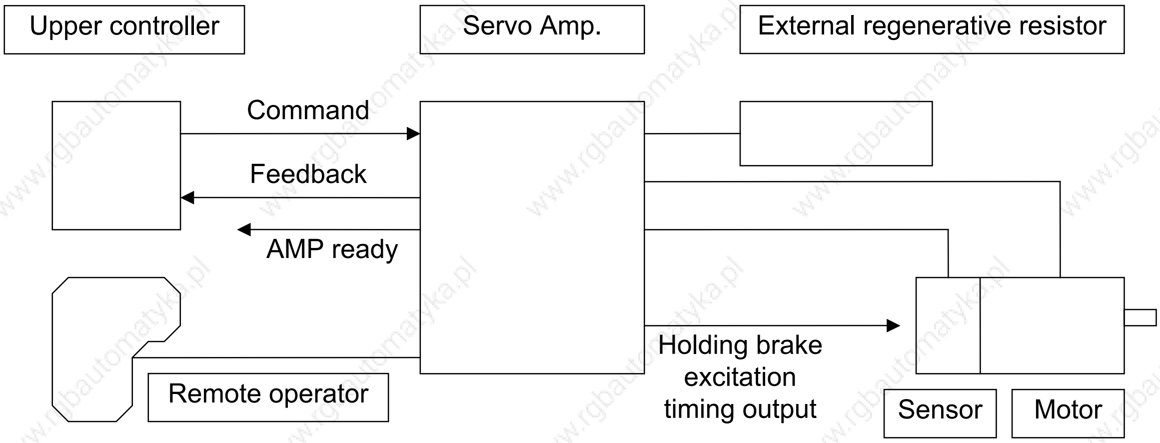
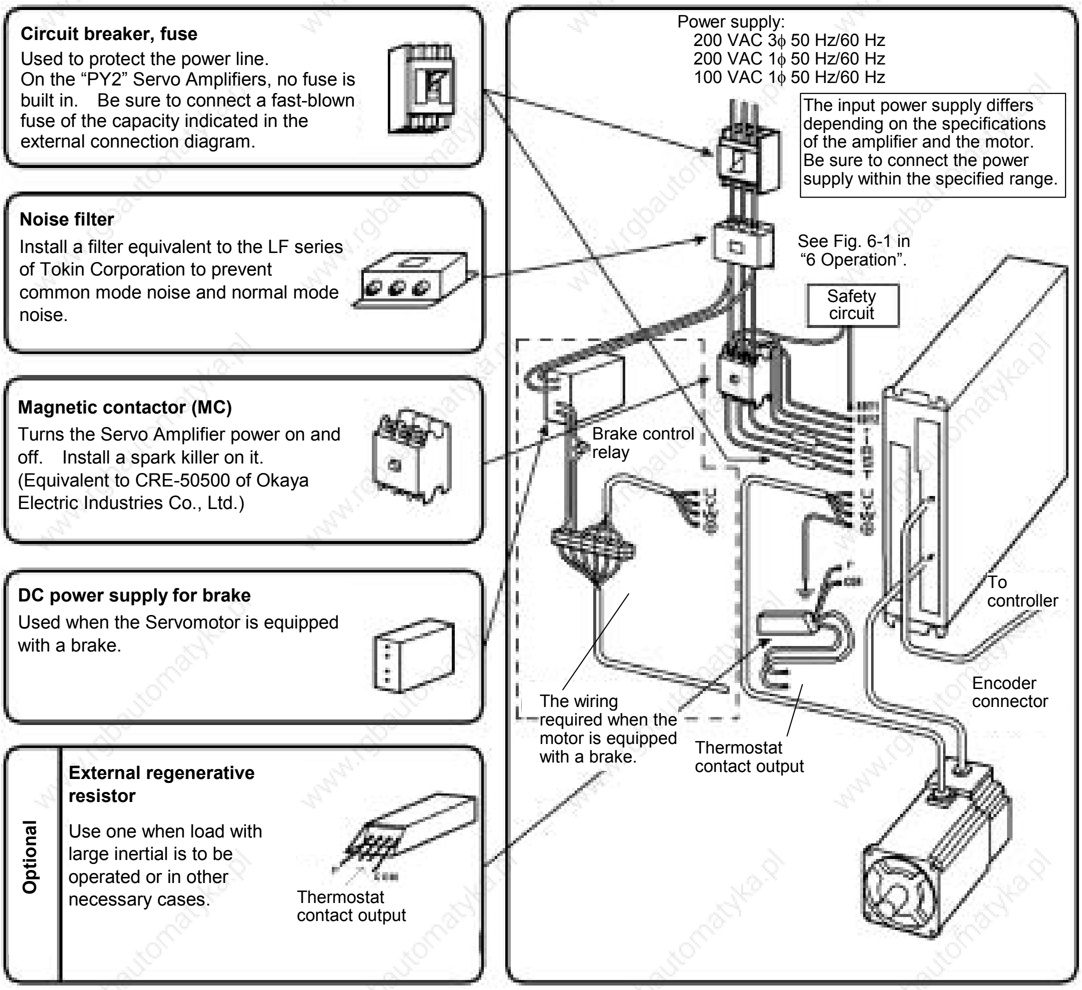


Fig. 3-1 System Configuration Schematic Diagram

3.2 External Mounting and Wiring Diagram


Circuit breaker, fuse
Used to protect the power line.
On the “PY2” Servo Amplifiers, no fuse is built in. Be sure to connect a fast-blown fuse of the capacity indicated in the external connection diagram.

Noise filter
Install a filter equivalent to the LF series of Tokin Corporation to prevent common mode noise and normal mode noise.

Magnetic contactor (MC)
Turns the Servo Amplifier power on and off. Install a spark killer on it. (Equivalent to CRE-50500 of Okaya Electric Industries Co., Ltd.)

DC power supply for brake
Used when the Servomotor is equipped with a brake.

Optional

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

Power supply:
200 VAC 3ϕ 50 Hz/60 Hz
200 VAC 1ϕ 50 Hz/60 Hz
100 VAC 1ϕ 50 Hz/60 Hz

The input power supply differs depending on the specifications of the amplifier and the motor. Be sure to connect the power supply within the specified range.

See Fig. 6-1 in “6 Operation”.

Fig. 3-2 External Mounting and Wiring Diagram

3.3 Names of Servo Amplifier Parts

3.3.1 PY2A015/030

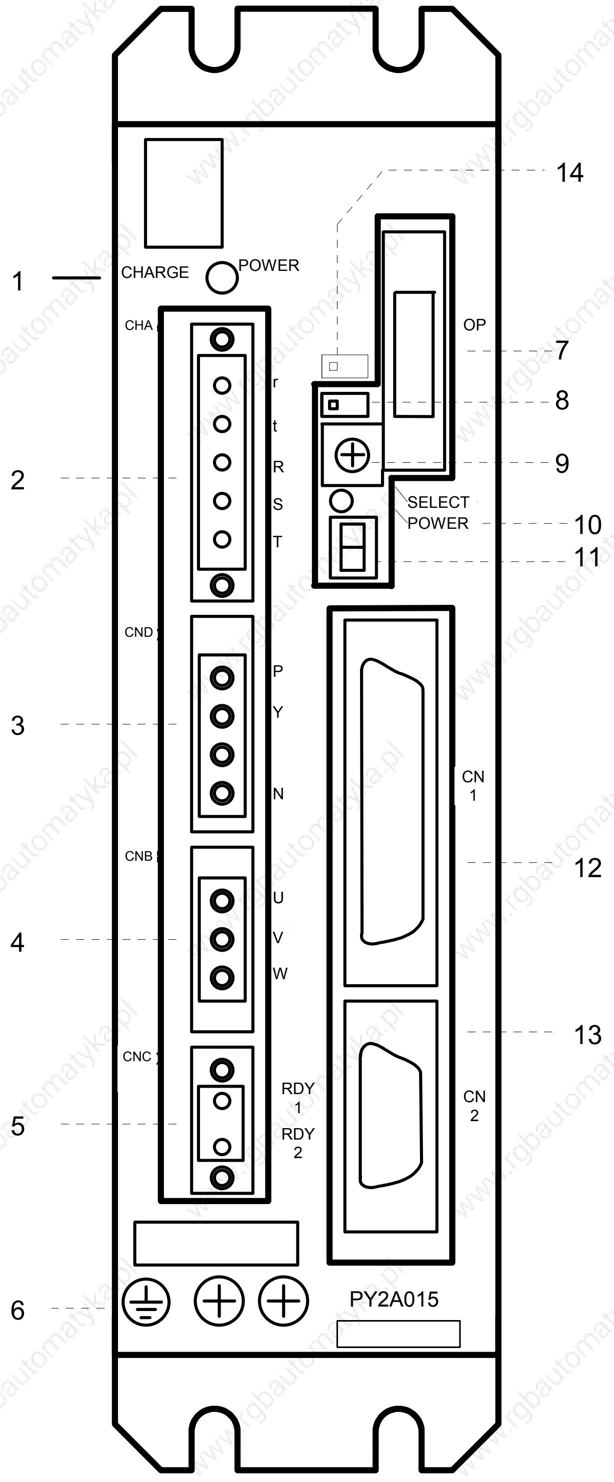


Fig. 3-3 Front View of Servo Amplifier

(PY2A015A0)

1 Main circuit power supply charge (CHARGE)
Indicates the charge of the smoothing capacitor of the main circuit power supply.

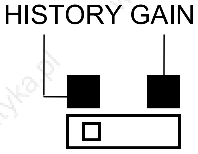
2 Control & main power supply inputs (CAN)
Connect the control power supply (AC 200 V, single phase) to the r and t terminals and the main power supply (AC 200 V, 3-phase) to the R, S and T terminals.

3 Regenerative resistor connector terminal (CND)
Connect a regenerative resistor between the P and Y (or COM) terminals.

4 Main circuit connector terminal (CNB)
Connect a motor power cable to it.

5 AMP ready output terminal (CNC) Optional
Outputs a-contact when the control power supply is set up and no alarm occurs (250 VAC, 2 A/30 VDC, 2 A).

6 Protective earth terminal (⏚)
Grounds an earth cable for class 3 earthing.



7 Remote operator connector

8 HISTORY/GAIN changeover switch
Sets the rotary switch to the alarm history or gain changeover function.

9 Rotary switch (SELECT)
Used to check the alarm history and change the gain.

10 5 V power supply set-up (POWER)
Comes on when the control power (r or t) is supplied.

11 7-segment LED
Indicates the status of the amplifier and the type of alarm issued.

12 Interface connector (CN1)
Connected to a host controller, etc.

13 Sensor signal connector (CN2)
Connected to the sensor signal line from the motor.

14 Maintenance mode switch
Used for maintenance by Sanyo operator. So, do not change the setting during general operation.
When the Servo Amplifier is used, be sure to set the switch to the left when viewed from the front of the amplifier. (It is hard to view from the front since hidden in the Servo Amplifier case.)

⚠

14 Maintenance mode switch

- Be sure to set this switch to the normal mode for operation (*set it to the left when viewed from the front of the amplifier*).
- Never change the setting of this switch. If it is set to the maintenance mode, the system malfunctions.

The 15 A and 30 A capacity amplifiers have different dimensions (width).

3.3.2 PY2E015/030

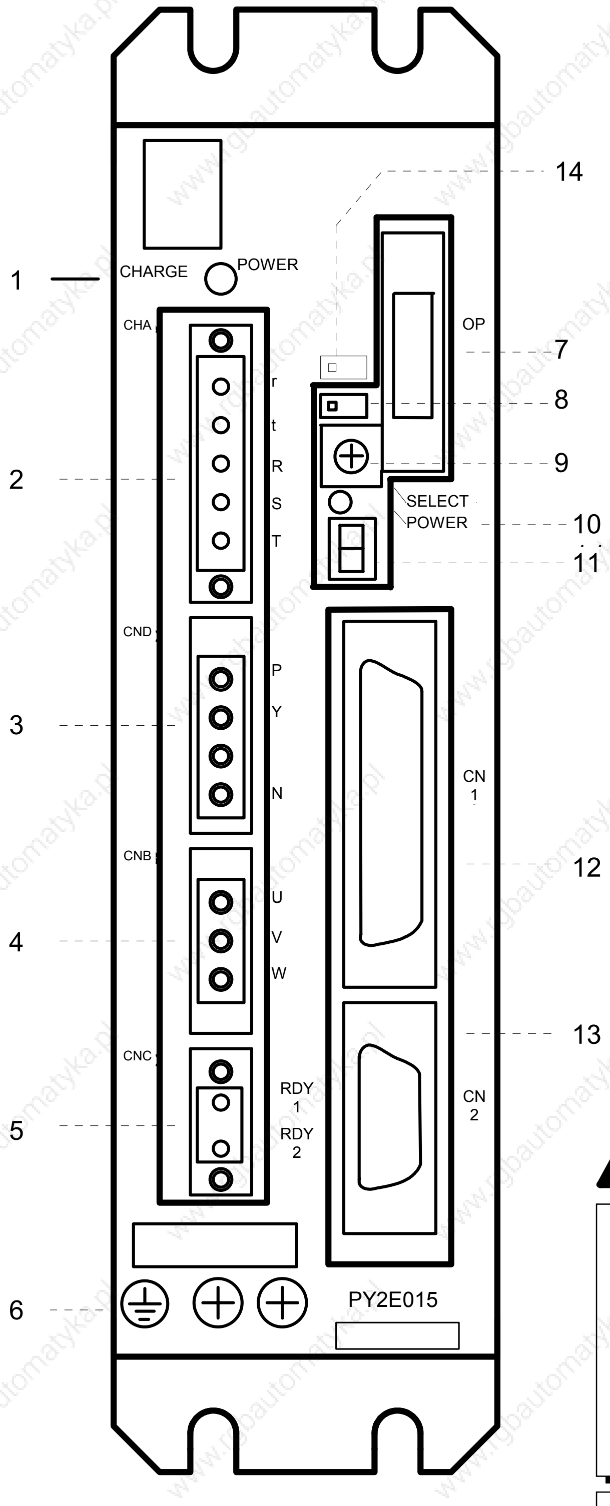


Fig. 3-4 Front View of Servo Amplifier

(PY2E015A1)

2 Control and main power supply (CNA)
Connect the control power supply (100 VAC, single-phase) to r and t, and the main power supply (100 VAC, single-phase) to R and T.

Same as 1 and 3 to 14, 200 VAC input type.
(Refer to 3.3.1 PY2A015/030.)

⚠

14 Maintenance mode switch

- Be sure to set this switch to the normal mode for operation (*set it to the left when viewed from the front of the amplifier*).
- Never change the setting of this switch. If it is set to the maintenance mode, the system will malfunction.

The 15 A and 30 A capacity amplifiers have different dimensions (width).

3.3.3 PY2A050

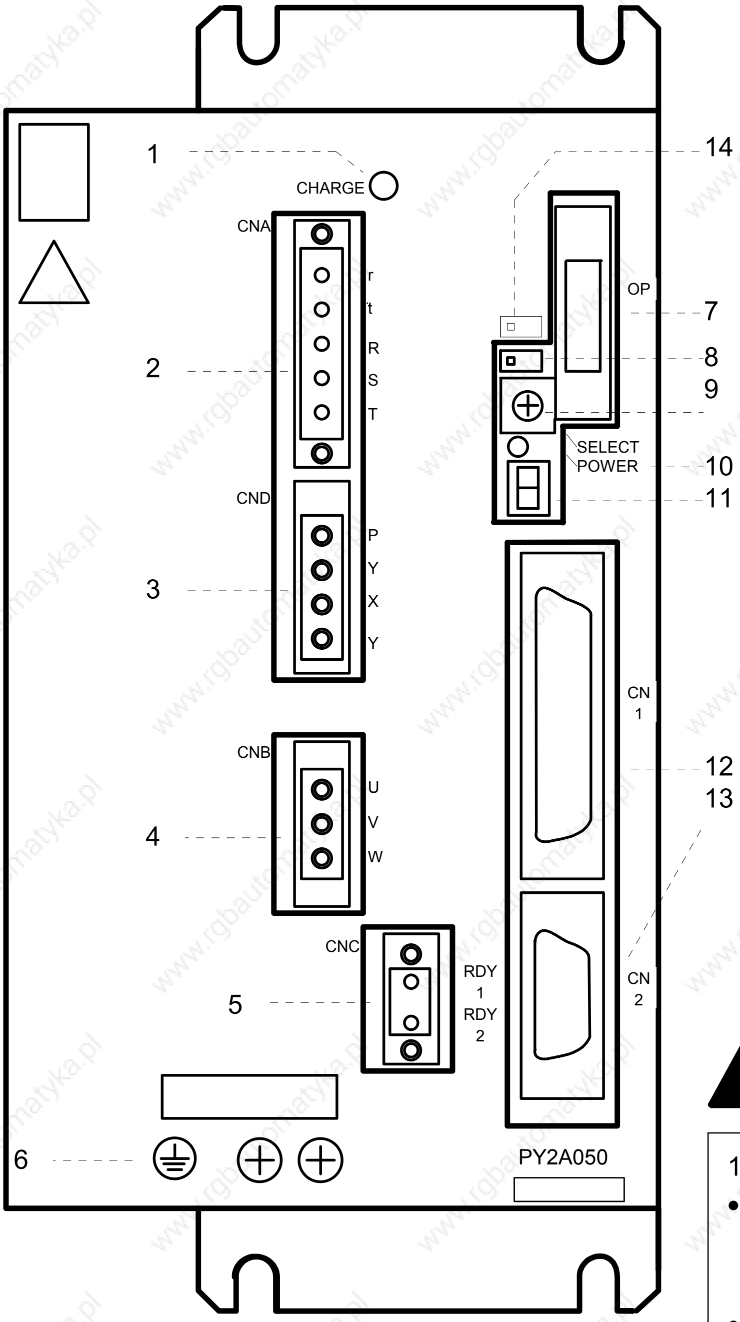


Fig. 3-5 Front View of Servo Amplifier

(PY2A050A4)

3 Regenerative resistor connecting terminal (CND)
When a built-in regenerative resistor is used, use it at the settings made on shipment (i.e. short-circuit the P and X terminals using a short-circuit bar).
When an external regenerative resistor is used, remove the short-circuit bar from across the P and X terminals and install a regenerative resistor between the P and Y terminals.

Same as 1, 2 and 4 to 14, PY2A015/030.
(Refer to 3.3.1 PY2A015/030.)

⚠

14 Maintenance mode switch

- Be sure to set this switch to the normal mode for operation *(set it to the left when viewed from the front of the amplifier.)*
- Never change the setting of this switch. If it is set to the maintenance mode, the system will malfunction.

3. SERVO SYSTEM CONFIGURATION

3.4 Optional Peripheral Equipment List

The following optional peripheral devices are available for the PY2 Servo Amplifiers.
Please order as necessary.

- **I/O connectors**

The table below lists I/O connector plugs and housings.
(Connectors of standard shapes are listed as optional equipment.)

Connector List for PY2A (200 VAC input type)

Application	Model No.	Set contents	Maker	Maker's model No.
Single item	AL-00385594	CN1 plug and housing	Sumitomo 3M	10150-3000VE
				10350-52A0-008
	AL-00385596	CN2 plug and housing	Sumitomo 3M	10120-3000VE
				10320-52A0-008
	AL-00329461-01	CNA plug	Phoenix Contact	MSTB2.5/5-STF-5.08
	AL-00329458-01	CNB plug	Phoenix Contact	IC2.5/3-STF-5.08
	AL-00329460-01	CNC plug	Phoenix Contact	MSTB2.5/2-STF-5.08
	AL-00329459-01	CND plug	Phoenix Contact	IC2.5/4-STF-5.08
Low-voltage circuit connector set	AL-00292309	CN1 or CN2 plug and housing	Sumitomo 3M	10150-3000VE
				10350-52A0-008
				10120-3000VE
				10320-52A0-008
High-voltage circuit connector set	AL-00377169	CNA, CNB or CND plug	Phoenix Contact	MSTB2.5/5-STF-5.08
				IC2.5/3-STF-5.08
				IC2.5/4-STF-5.08
PY2A015 and PY2A030 (without RDY output) set	AL-00382550	CN1 or CN2 plug and housing CNA, CNB or CND plug	Sumitomo 3M Phoenix Contact	10150-3000VE
				10350-52A0-008
				10120-3000VE
				10320-52A0-008
				MSTB2.5/5-STF-5.08
				IC2.5/3-STF-5.08
				IC2.5/4-STF-5.08
PY2A015 and PY2A030 (with RDY output) set	AL-00382550 AL-00329460-01	CN1 or CN2 plug and housing CNA, CNB, CNC or CND plug	Sumitomo 3M Phoenix Contact	
PY2A015 (built-in Regenerative resistor) PY2A030 (built-in Regenerative resistor) PY2A050(without RDY output) set	AL-00393603		Sumitomo 3M Phoenix Contact	10150-3000VE
				10350-52A0-008
				10120-3000VE
				10320-52A0-008
				MSTB2.5/5-STF-5.08
				IC2.5/3-STF-5.08
PY2A015 (built-in Regenerative resistor) PY2A030 (built-in Regenerative resistor) PY2A050 (with RDY output) set	AL-00393605	CN1 or CN2 plug and housing CNA, CNB or CNC plug	Sumitomo 3M Phoenix Contact	

3. SERVO SYSTEM CONFIGURATION

Connector List for PY2E (100 VAC input type)

Application	Model No.	Set contents	Maker	Maker's model No.
Single item	AL-00329461-02	CNA plug	Phoenix Contact	MSTB2.5/4-STF-5.08
PY2E015 and PY2E030 (without RDY output) set	AL-00397841	CN1 or CN2 plug and housing CNA, CNB or CND plug	Sumitomo 3M Phoenix Contact	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008 MSTB2.5/4-STF-5.08 IC2.5/3-STF-5.08 IC2.5/4-STF-5.08
PY2E015 and PY2E030 (with RDY output) set	AL-00397841 AL-00329460-01	CN1 or CN2 plug and housing CNA, CNB, CNC or CND plug	Sumitomo 3M Phoenix Contact	
PY2A015 (built-in Regenerative resistor) PY2A030 (built-in Regenerative resistor) (without RDY output) set	AL-00329461-02 AL-00329458-01 AL-00292309	CN1 or CN2 plug and housing CNA or CNB plug	Sumitomo 3M Phoenix Contact	
PY2A015 (built-in Regenerative resistor) PY2A030 (built-in Regenerative resistor) (with RDY output) set	AL-00329461-02 AL-00329458-01 AL-00329460-01 AL-00292309	CN1 or CN2 plug and housing CNA, CNB or CNC plug	Sumitomo 3M Phoenix Contact	

- Although a commercially available plug not listed in the above table may be used, it may not engage with the amplifier properly depending on its shape.
- Consult with us when using a plug or housing whose engagement with the amplifier is not confirmed.
- The power supply input connector CNA models differ depending on the input power supply voltage type (200 VAC or 100 VAC input).
- CND connector (IC2.5/4-STF-5.08) is normally attached to Servo Amplifier having an amplifier capacity of 50 A.
- CND connector (IC2.5/4-STF-5.08) is normally attached to 15A and 30A Servo Amplifier with built-in regenerative resistor.

- **Remote operator**

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

Model No.
RP-001

- **Personal computer interface**

The following parts are available for communication with PC.

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

The PC interface can be used only on Windows 95.

- **External regenerative resistor**

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

Model No.	Model No.
REGIST-080W 100B	REGIST-220W 20B
REGIST-080W 50B	REGIST-500W 20B
REGIST-120W 100B	REGIST-500W 14B
REGIST-120W 50B	REGIST-500W 10B
REGIST-220W 100B	REGIST-500W 7B
REGIST-220W 50B	

A type without a thermal (no "B" at the end of the model number) is also available.

- **Cable**

Only sensor cables are available. Terminals, however, are not treated.

Model No.	Remarks
6879019-1	For wiring-saved incremental encoder (20 m or shorter)
6870010-1	For wiring-saved incremental encoder (20 m or longer)
	For absolute encoder (ABS-E)
	Absolute sensor (ABS-R II)

- **Cannon connector**

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

Model No.	Remarks
MS06B24-11S-16	Straight plug for the P1, P2, P6 or P8 motor power line.
MS06B20-29S-12	Straight plug for the P1, P2, P6 or P8 motor sensor line.

- **Anti-noise parts**

The following anti-noise parts are available.

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

4. WIRING

WIRING

4. WIRING

4.1 Applicable Wire Sizes

- The table below shows typical sizes of external terminals and wires used for the Servo Amplifier.
- Select the wire to use and its size based on the wiring distance, operation environment and current capacity.
- Table 4-1 assumes that the rated current flows on three lead wiring harnesses at an ambient temperature of 104°F (40°C).

Table 4-1 Applicable Wire Sizes

External terminal name		Model Terminal code	Example of applicable wire size		
			PY2A015 PY2E015	PY2A030 PY2E030	PY2A050
	Main circuit power supply input terminal	CNA (R. S. T)	Equivalent to AWG16	Equivalent to AWG14	Equivalent to AWG12
	Control power supply input terminal	CNA (r. t)	Equivalent to AWG16		
	Motor connector terminal (power line)	CNB (U, V, W)	Equivalent to AWG16	Equivalent to AWG14	Equivalent to AWG12
	PE (protective earth) terminal (⏚)	⏚	Equivalent to AWG14		
	AMP ready output terminal (optional)	CNC (RDY1, RDY2)	Equivalent to AWG20		
	Regenerative resistor connection input terminal	CND (P, X, Y)	Equivalent to AWG16		Equivalent to AWG14
Signal circuit	I/O signal connector	CN1	AWG24 or greater (A twisted pair lump shielded wire is partly used.)		
	Sensor signal connector	CN2	AWG 24 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.

2 When the ambient temperature is high, the life will be shortened due to thermal degradation. In this case, use a heat-resistant vinyl cable.

3 The size of the wire to be connected to the main circuit power supply input terminal or motor connecting terminal can be smaller than listed in the above table, depending on the capacity of the Servomotor. (Use a wire of suitable size, referring to Power Supply Capacity in Section 9.)

4 We prepare an optional sensor signal line connector cable, which can be purchased by specifying the model number.

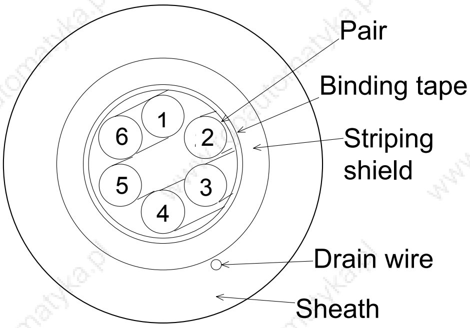
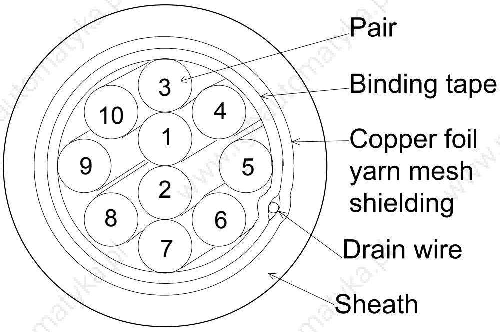
5 It is recommended to use an "insulation sleeve-equipped bar terminal" if a certain insulation distance is required to be secured between main circuit wires or between main and signal circuit wires.
(This terminal cannot be used when the wire used is AWG12 or greater.)

6 The recommended tightening torque of the jack screw (screw) in the shell (connector cover : 10320-52A0-008) is 0.196±0.049N･m(2.0±0.5kgf･cm).
We ask you to tighten with this torque.

7 The jack screw with a stopper can prevent over-tightening. The product no. (with a stopper) is 3342-26 and the recommended tightening torque is 0.441±0.049N･m (4.5±0.5kgf･cm).

4.2 Specifications of Sensor Cable

Table 4-2 Specifications of Cable

	Specifications	
	Wiring-saved incremental encoder (INC-E : wiring distance 20 m or less)	Wiring-saved incremental encoder (INC-E : wiring distance 20 m to 30 m) Absolute encoder (ABS-E, ABS-RII)
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 cables are used, the permissible distance between the Servo Amplifier and the motor (sensor) is as follows:
  - Wiring-saved incremental encoder (INC-E): 20 m max. when 6 pairs of cables of 91 Ω/km or less are used.
  - Wiring-saved incremental encoder (INC-E): 30 m max. when 10 pairs of cables of 123 Ω/km or less are used.
  - Absolute encoder (ABS-E): 25 m max. when 10 pairs of cables of 123 Ω/km or less are used.
  - Absolute sensor (ABS-R II): 30 m max. when 10 pairs of cables of 123 Ω/km or less are used.

2 The permissible wiring distance can be extended to 50 m by using a cable with low conductor resistance (a thick cable) or increasing the number of wires. Contact us for details.

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

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

4.3 External Wiring Diagram

4.3.1 External Wiring Diagram (200 VAC Input Type)

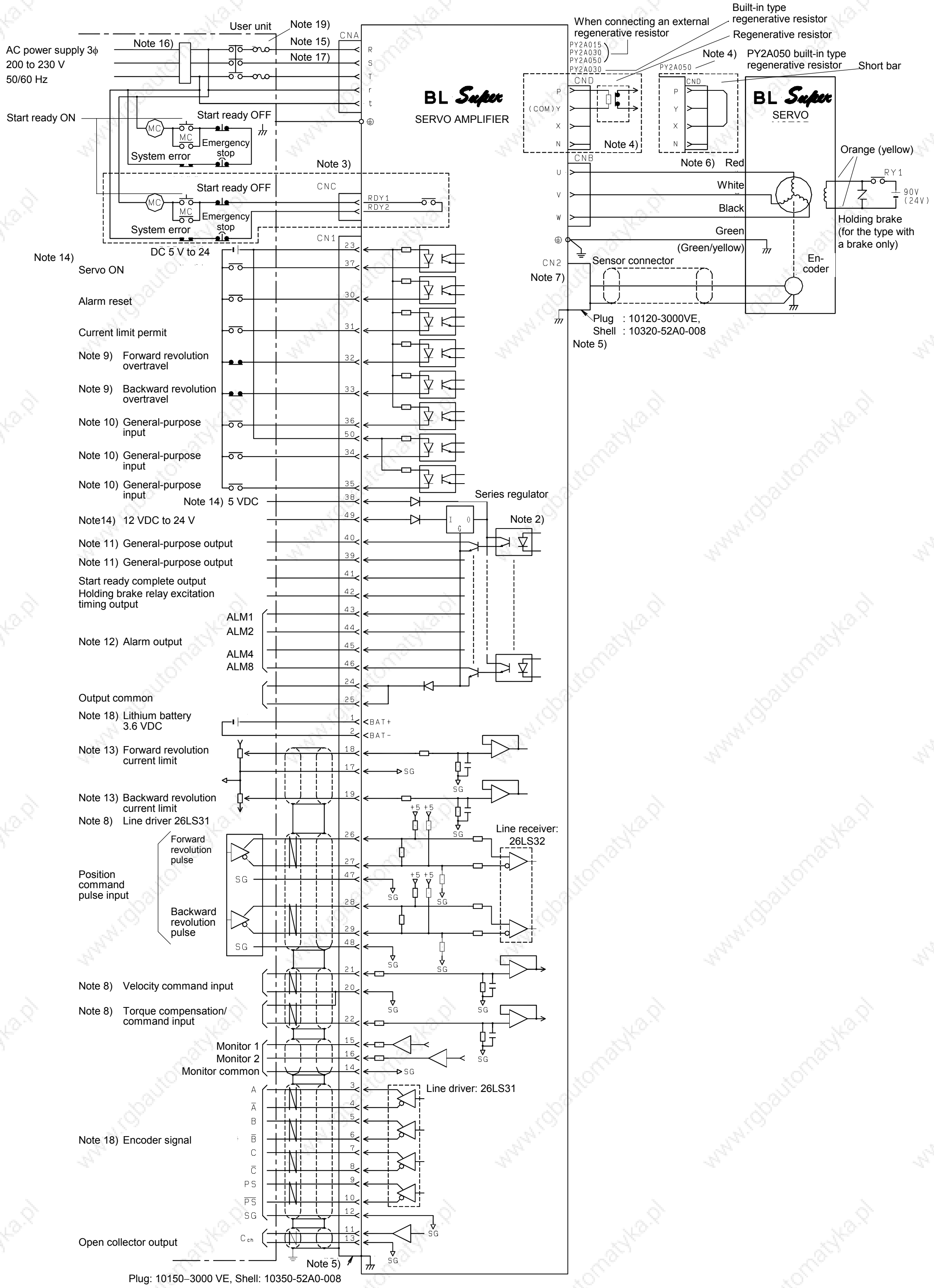
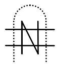
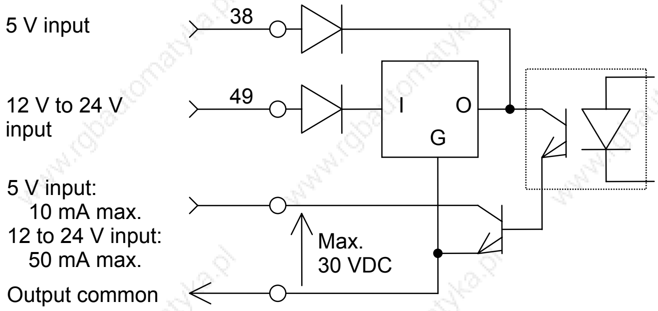


Fig. 4-1 (a) External Wiring Diagram (200 VAC Input Type)

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

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

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



Note 3) : RDY (RDY1 or 2 terminal) output is optional.
RDY (RDY1 or 2 terminal) is a contact output.
Contact rating: 250 VAC, 2 A
30 VDC, 2 A
Inductive load: COSϕ = 0.4, L/R = 7 mS

Note 4) :

Amp. capacity	CND terminal [*1]	Built-in type regenerative resistor	Use of built-in type regenerative resistor [*2]	Method of connecting external regenerative resistor [*3]
15, 30 A (Normal)	P, Y (or COM), N	None		Connect it between the P and Y (or COM) terminals.
30 A (Special)	P, Y, N	Equipped	Same as default connection. Connect it between the P and Y terminals.	Connect it between the P and Y terminals after removing the wiring connected between the P and Y terminals. [*4]
50 A (Normal)	P, Y, X, N	Equipped	Same as the default. Short-circuit the P and X terminals using a short-circuit bar.	Connect it between the P and X terminals after removing the short-circuit bar across P and X terminals.

*1 : The N terminal is for maintenance (high-voltage circuit). So, do not wire the N terminal.

*2 : The thermostat contact output of the built-in regenerative resistor is connected inside the amplifier.

*3 : A thermostat for the external regenerative resistor shall be built into the user device, or connected to the external overheat detection input to protect the resistor.

*4 : Be careful not to bring the removed wire into contact with the conductive parts.

Note 5) : Refer to 4.6.2 CN1 & CN2 Shielding Procedure.

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

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

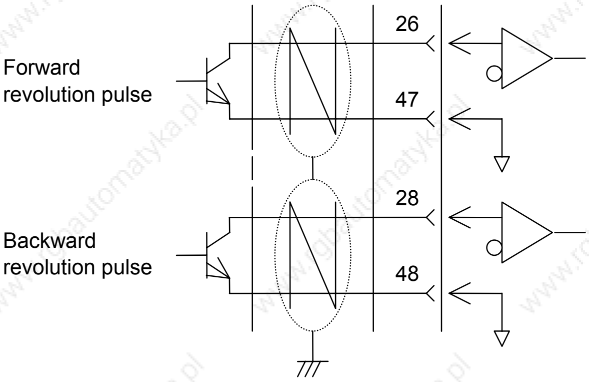
Note 8) : The functions of command input differ depending on control modes.

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 can be reversed.

Refer to the figure on the right when connecting the position command pulse input to the open collector output.



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

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

Control mode \ General-purpose input terminal		34 pin	35 pin	36 pin
Position control type		Deviation clear	(1)	(1)
Velocity control type		Internal velocity command, revolution direction input	(2)	(2)
Torque control type		–	(3)	(3)
Velocity/torque switch type	No switching	Internal velocity command, revolution direction input	Control mode switching input or (2).	Control mode switching input or (2).
	During switching	–	Control mode switching input or (3).	Control mode switching input or (3).
Position/torque switch type	No switching	Deviation clear	Control mode switching input or (1).	Control mode switching input or (1).
	During switching	–	Control mode switching input or (3).	Control mode switching input or (3).
Position/velocity switch type	No switching	Deviation clear	Control mode switching input or (1).	Control mode switching input or (1).
	During switching	Internal velocity command, revolution direction input	Control mode switching input or (2).	Control mode switching input or (2).

(1) : Functions can be selected among external overheating detection, proportional control, command multiplication and command pulse inhibit.
(2) : Functions can be selected among external overheating detection, proportional control, zero clamp and internal setting velocity select.
(3) : Available as the external overheating detection input function.

In addition to the above, it can also be set as the gain switch input.
One pin can be set to have several or no functions.
For details, refer to the operation manual.

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

Note 12) : Alarm output
Output alarm state using codes. It can also be output using bits by setting.

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

Note 14) : Your are required to prepare the power. Either of the inputs can be selected.

Note 15) : The R, S, T, r, t, RDY1, RDY2, P, Y (or COM), N, U, V and W terminals 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.

Note 16) : We recommend that a UL-approved earth leakage breaker be used that complies with IEC or EN standard.

Note 17) : Do not wire the S phase for a single-phase power amplifier.

Note 18) : The lithium battery connector terminals (1 and 2 pins) and encoder signals PS and $\overline{\text{PS}}$ (9 and 10 pins) are available when your encoder is the absolute type (ABS-E, ABS-RII or ABS-E.S1).

Note 19) : Be sure to install the following types of UL-approved fuses for the main circuit power supply input.

Amplifier capacity 15 A, 30 A	:	30 A fast-blown type
Amplifier capacity 50 A	:	50 A fast-blown type

Note 20) : Make sure to connect SG (signal ground) for difference input signal (line driver of position command/ line driver of dividing output), or wrong operation and breakage may occur.

Fig. 4-1 (b) External Wiring Diagram (200 VAC Input Type), Precautions

4.3.2 External Wiring Diagram (100 VAC Input Type)

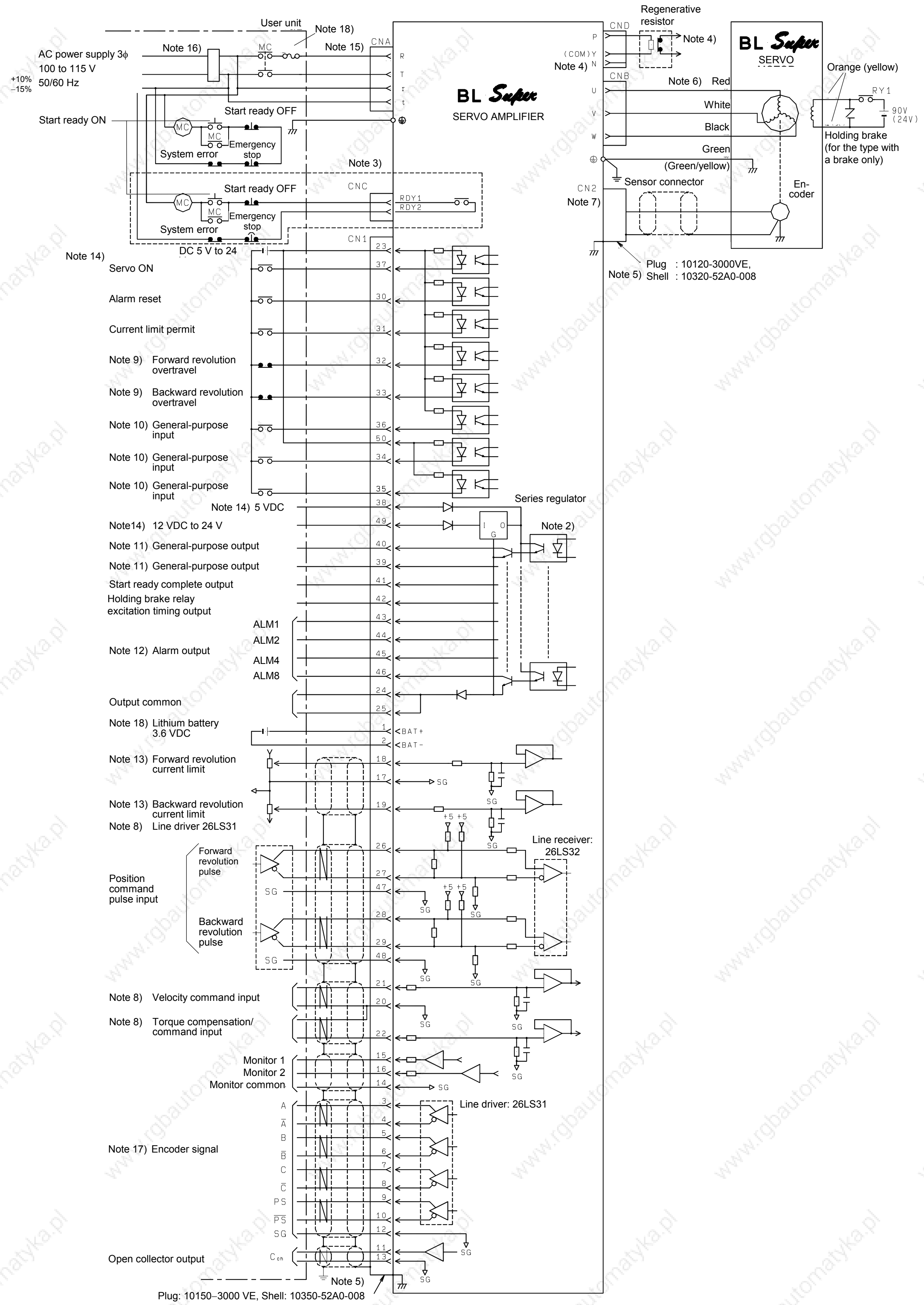
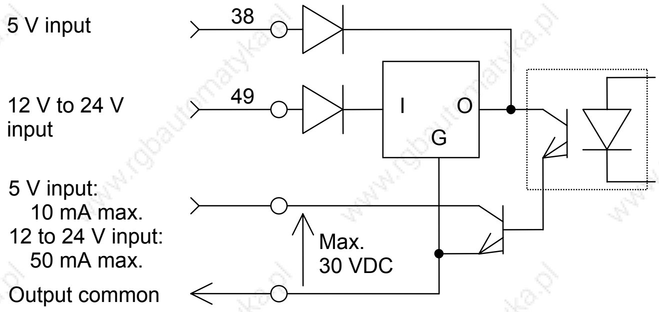


Fig. 4-2 (a) External Wiring Diagram (100 VAC Input Type)

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

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

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



Note 3) : RDY (RDY1 or 2 terminal) output is optional.

RDY (RDY1 or 2 terminal) is a contact output.

Contact rating: 250 VAC, 2 A
30 VDC, 2 A
Inductive load: COSϕ = 0.4, L/R = 7 mS

Note 4) :

Amp. capacity	CND terminal [*1]	Built-in type regenerative resistor	Use of built-in type regenerative resistor [*2]	Method of connecting external regenerative resistor [*3]
15, 30 A (Normal)	P, Y (or COM), N	None		Connect it between the P and Y (or COM) terminals.
30 A (Special)	P, Y, N	Equipped	Same as default connection. Connect it between the P and Y terminals in the same way as on shipment.	Connect it between the P and Y terminals after removing the wiring connected between the P and Y terminals. [*4]

[*1] : The N terminal is for maintenance (high-voltage circuit). So, do not wire the N terminal.

[*2] : The thermostat contact output of the built-in regenerative resistor is connected inside the amplifier.

[*3] : A thermostat for the external regenerative resistor shall be built into the user device, or connected to the external overheat detection input to protect the resistor.

[*4] : Be careful not to bring the removed wire into contact with the conductive parts.

Note 5) : Refer to 4.6.2 CN1 & CN2 Shielding Procedure.

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

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

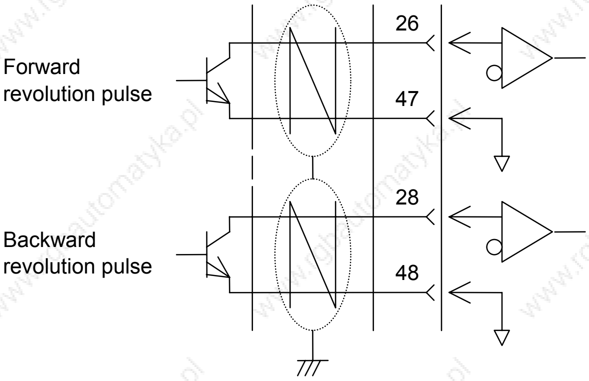
Note 8) : The functions of command input differ depending on control modes.

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

For the details of the control mode and Func1 setting, refer to the user's manual.

The polarity of command input can be reversed.

Refer to the figure on the right when connecting the position command pulse input to the open collector output.



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

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

General-purpose input terminal / Control mode		34 pin	35 pin	36 pin
Position control type		Deviation clear	(1)	(1)
Velocity control type		Internal velocity command, revolution direction input	(2)	(2)
Torque control type		–	(3)	(3)
Velocity/torque switch type	No switching	Internal velocity command, revolution direction input	Control mode switching input or (2).	Control mode switching input or (2).
	During switching	–	Control mode switching input or (3).	Control mode switching input or (3).
Position/torque switch type	No switching	Deviation clear	Control mode switching input or (1).	Control mode switching input or (1).
	During switching	–	Control mode switching input or (3).	Control mode switching input or (3).
Position/velocity switch type	No switching	Deviation clear	Control mode switching input or (1).	Control mode switching input or (1).
	During switching	Internal velocity command, revolution direction input	Control mode switching input or (2).	Control mode switching input or (2).

(1) : Functions can be selected among external overheating detection, proportional control, command multiplication and command pulse inhibit.
(2) : Functions can be selected among external overheating detection, proportional control, zero clamp and internal setting velocity select.
(3) : Available as the external overheating detection input function.

In addition to the above, it can also be set as the gain switch input.
One pin can be set to have several or no functions.
For details, refer to the operation manual.

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

Note 12) : Alarm output
Output alarm state using codes. It can also be output using bits by setting.

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

Note 14) : Your are required to prepare the power. Either of the inputs can be selected.

Note 15) : The R, S, T, r, t, RDY1, RDY2, P, Y (or COM), N, U, V and W terminals 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.

Note 16) : We recommend a UL-approved earth leakage breaker be used that complies with IEC or EN standard.

Note 17) : The lithium battery connector terminals (1 and 2 pins) and encoder signals PS and $\overline{\text{PS}}$ (9 and 10 pins) are available when your encoder is the absolute type (ABS-E, ABS-RII or ABS-E.S1).

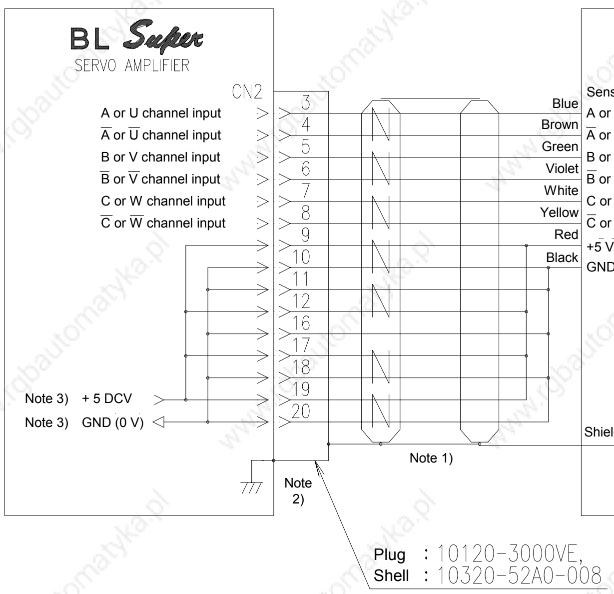
Note 18) : Be sure to install a UL-approved, 30 A fast-blown type fuse for the main circuit power supply input.

Note 19) : Make sure to connect SG (signal ground) for difference input signal (line driver of position command/ line driver of dividing output), or wrong operation and breakage may occur.

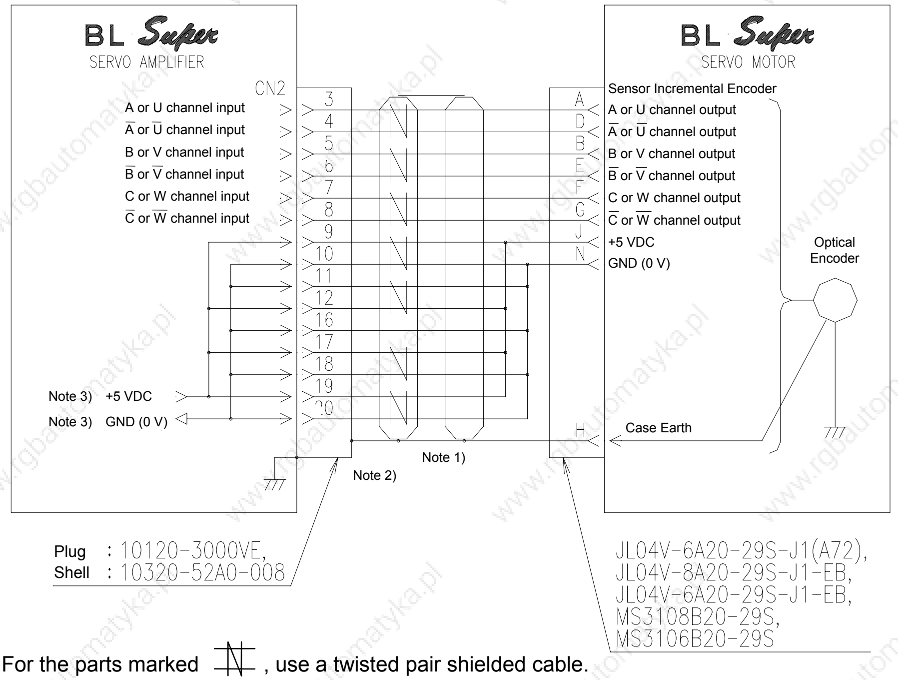
Fig. 4-2 (b) External Wiring Diagram (100 VAC Input Type), Precautions

4.3.3 Sensor Connection Diagram (INC-E Wiring-saved Incremental Encoder)

Incremental encoder (INC-E): Lead wire type



Incremental encoder (INC-E): Cannon plug type



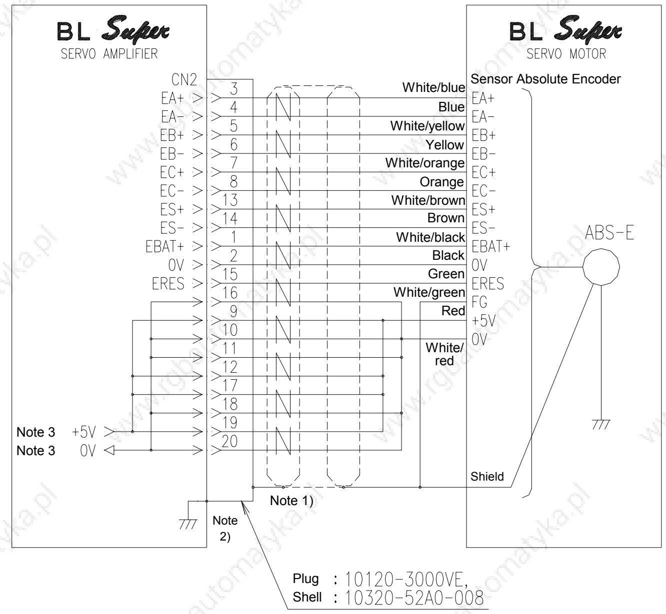
Notes:
1. For the parts marked $\not{\mathrm{N}}$, use a twisted pair shielded cable.
2. Refer to 4.6.2 CN1 & CN2 Shielding Procedure.
3. The sensor power connection differs depending on the cable length.
   Refer to the following table.

Sensor cable length	5 m or less	10 m or less	20 m or less	30 m or less
+5 VDC wiring	19-pin connection (9, 12 and 17 pins need not be connected)	17- and 19-pin connection (9 and 12 pins need not be connected)	12-, 17- and 19-pin connection (9 pin need not be connected)	9-, 12-, 17- and 19-pin connection
GND (0 V) wiring	20-pin connection (10, 11, 16 and 18 pins need not be connected)	18- and 20-pin connection (10, 11 and 16 pins need not be connected)	11-, 18- and 20-pin connection (10 and 16 pins need not be connected)	10-, 11-, 16-, 18- and 20-pin connection

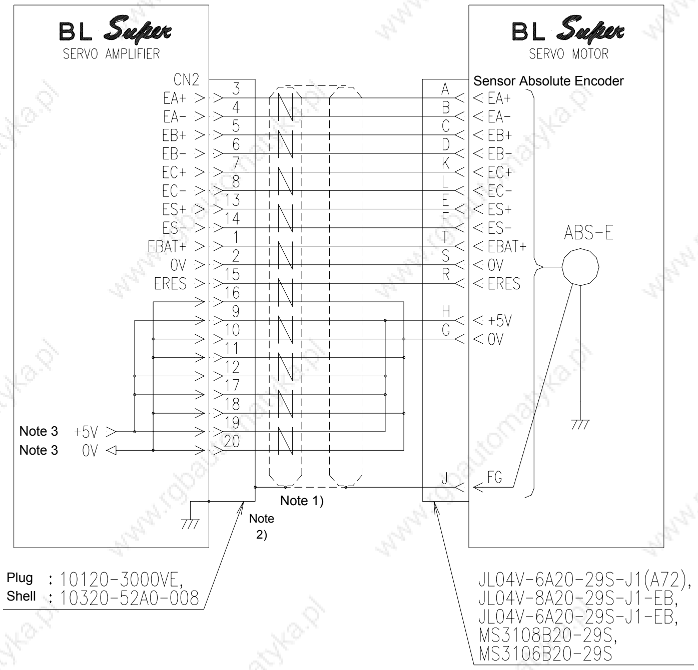
Fig. 4-3 Sensor Connection Diagram (INC-E Wiring-saved Incremental Encoder)

4.3.4 Sensor Connection Diagram (ABS-E Request Signal-unavailable Absolute Encoder)

Absolute encoder (ABS-E): Lead wire type



Absolute encoder (ABS-E): Cannon plug type



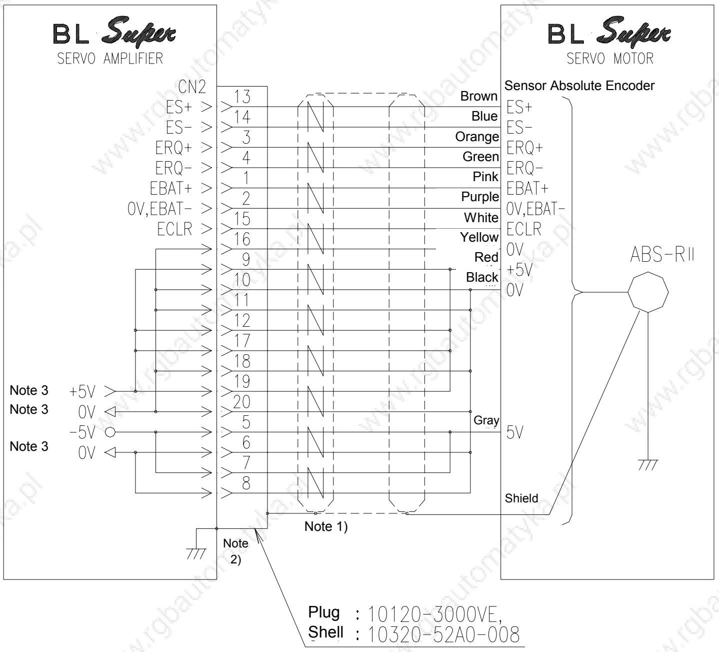
Notes:
1. For the parts marked ⊬, use a twisted pair shielded cable.
2. Refer to 4.6.2 CN1 & CN2 Shielding Procedure.
3. The sensor power connection differs depending on the cable length. Refer to the following table.

Sensor cable length	5 m or less	10 m or less	15 m or less	25 m or less
+5 V wiring	19-pin connection (9, 12 and 17 pins need not be connected)	17- and 19-pin connection (9 and 12 pins need not be connected)	12-, 17- and 19-pin connection (9 pin need not be connected)	9-, 12-, 17- and 19-pin connection
0 V wiring	16- and 20-pin connection (10, 11 and 18 pins need not be connected)	16-, 18- and 20-pin connection (10 and 11 pins need not be connected)	11-, 16-, 18- and 20-pin connection (10 pin need not be connected)	10-, 11-, 16-, 18- and 20-pin connection

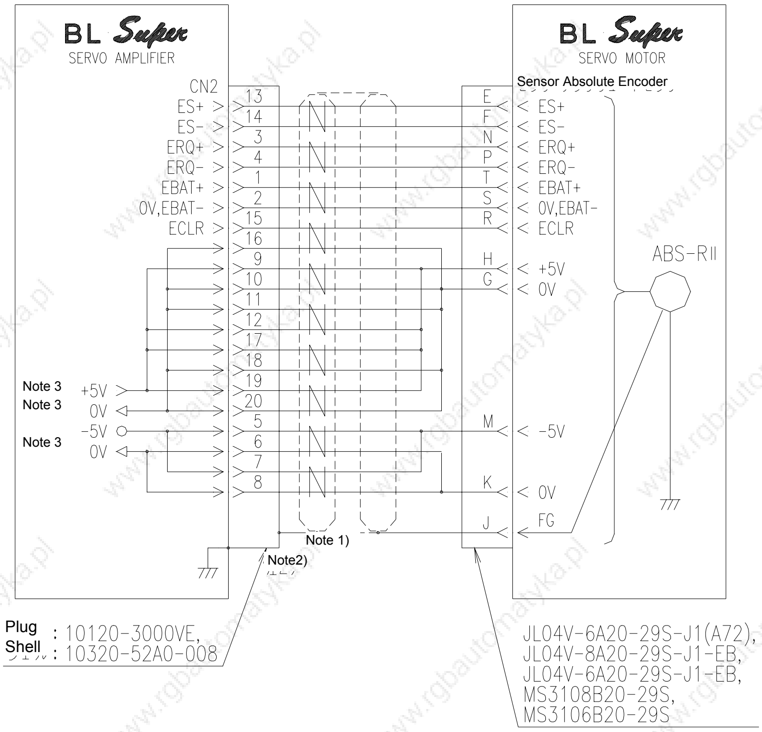
Fig. 4-4 Sensor Connection Diagram (ABS-E Absolute Encoder)

4.3.5 Sensor Connection Diagram (ABS-RII Request Signal-available Absolute Sensor)

Absolute sensor (ABS-RII): Lead wire type



Absolute sensor (ABS-RII): Cannon plug type

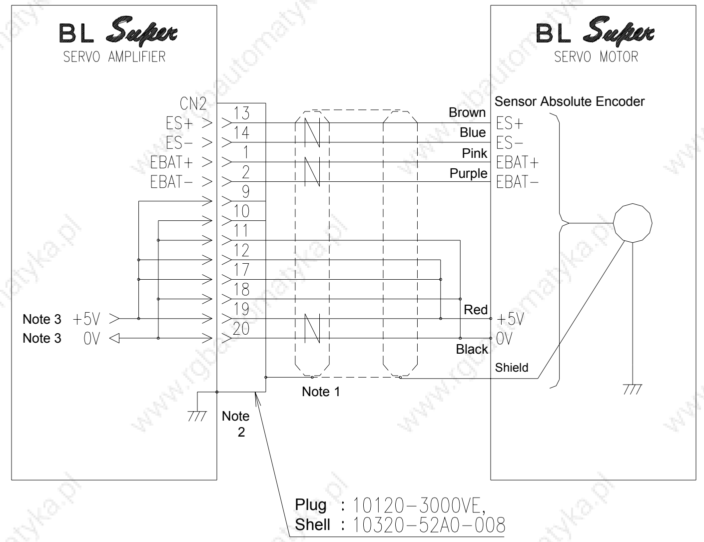


Notes:
1. For the parts marked $\not\perp$, use a twisted pair shielded cable.
2. Refer to 4.6.2 CN1 & CN2 Shielding Procedure.
3. When the sensor cable length is 5m or less, 11, 12, 17 and 18 pins need not be connected. When the length is between 5 m and 30 m, connect all pins.

Fig. 4-5 Sensor Connection Diagram (ABS-RII Absolute Sensor)

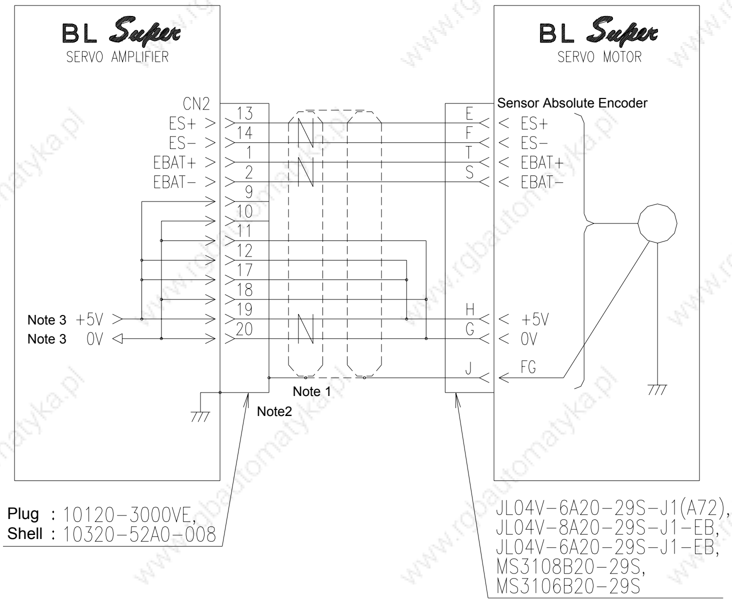
4.3.6 Sensor Connection Diagram (Wiring-saved Absolute Sensor)

Absolute sensor (E03B151302): Lead wire type



Plug : 10120−3000VE,
Shell : 10320−52A0−008

Absolute sensor (E03B151302): Cannon plug type



Plug : 10120−3000VE,
Shell : 10320−52A0−008

JL04V−6A20−29S−J1(A72),
JL04V−8A20−29S−J1−EB,
JL04V−6A20−29S−J1−EB,
MS3108B20−29S,
MS3106B20−29S

Notes:
1. For the parts marked N, use a twisted pair shielded cable.
2. Refer to 4.6.2 CN1 & CN2 Shielding Procedure.
3. The sensor power connection differs depending on the cable length. Refer to the following table.

Sensor cable length	10 m or less	25 m or less	40 m or less
+5 V wiring	19-pin connection (12 and 17 pins need not be connected)	17- and 19-pin connection (12 pin need not be connected)	12-, 17- and 19-pin connection
0 V wiring	20-pin connection (11 and 18 pins need not be connected)	18- and 20-pin connection (11 pin need not be connected)	11-, 18- and 20-pin connection

4. In case of application not using multi-rotational part, wiring of “EBAT+” and “EBAT-“ are not necessary.

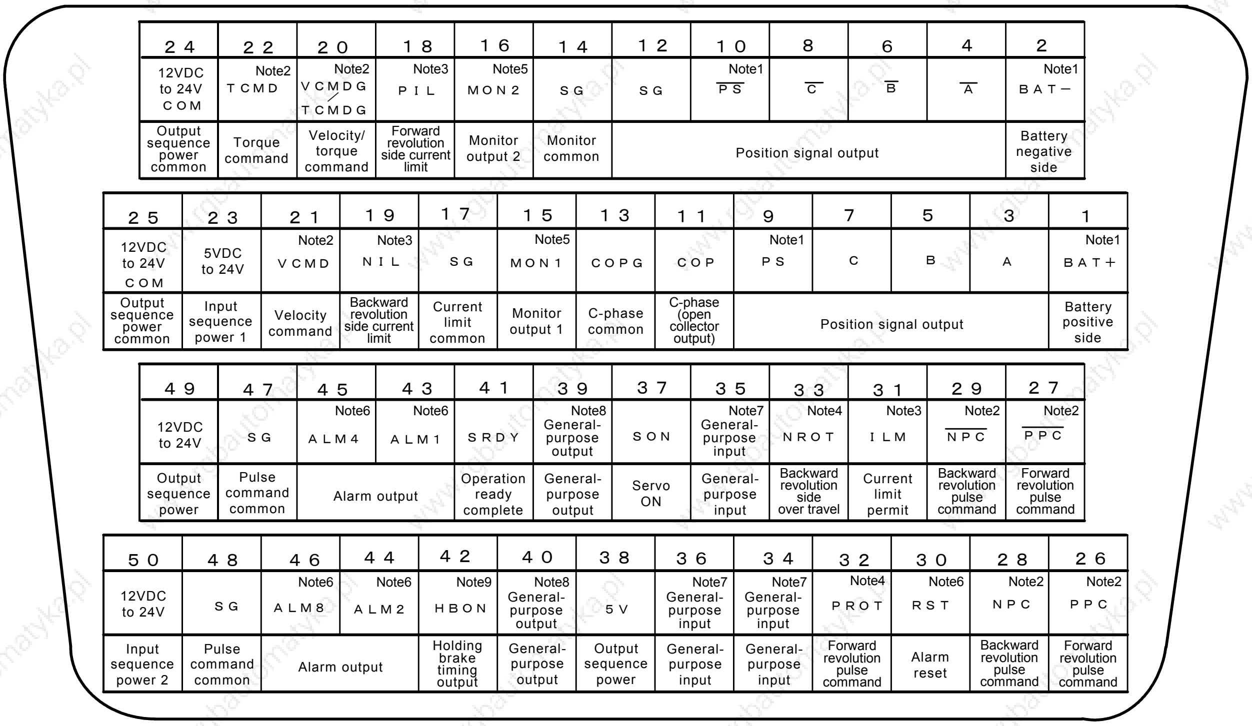
   However, set Func6, bit5 to “1”.

Fig. 4-6 Sensor Connection Diagram (Wiring-saved Absolute Encoder ABS-E.S1)

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 $\overline{\text{PS}}$	$\overline{\text{C}}$	$\overline{\text{B}}$	$\overline{\text{A}}$	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 $\overline{\text{NPC}}$	Note2 $\overline{\text{PPC}}$
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. 4-7 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.

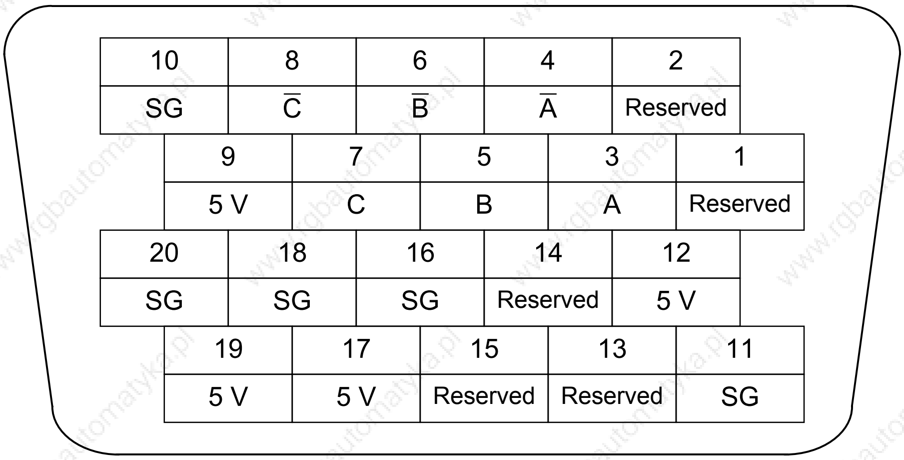
⚠ The above figure shows the arrangement when viewed from the wiring section of the connector. Connector at cable side is not attached to Servo Amplifier, and should be prepared by user.

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) or wiring-saved absolute sensor (ABS-E.S1).

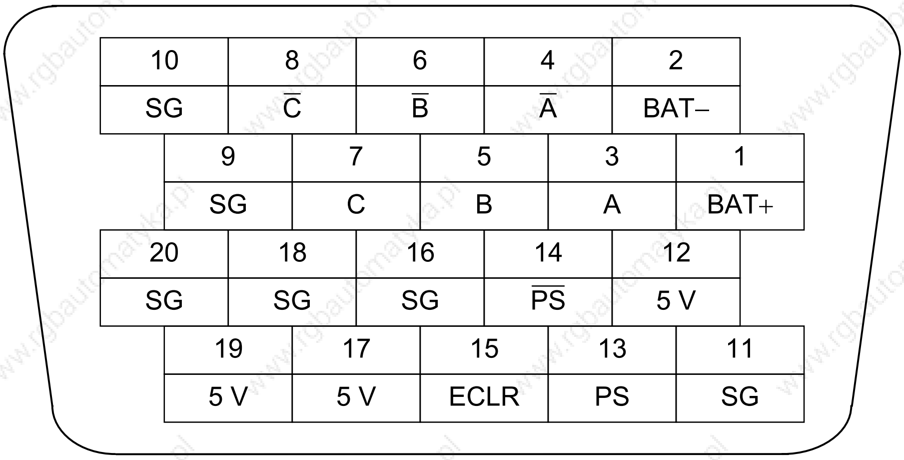
● **Incremental encoder (INC-E) terminal arrangement diagram**



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. 4-8 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. 4-9 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. 4-10 CN2 Connector (ABS-RII Request Signal-available Absolute Sensor) Terminal Arrangement Diagram

- **Wiring-saved absolute sensor (ABS-E.S1) terminal arrangement diagram**

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

Fig. 4-11 CN2 Connector (ABS-E.S1 Wiring-saved 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.

⚠

1 Input/output or sensor signal line

For the input/output or sensor signal line, use recommended cables or their equivalent (twisted wires or multi-conductor twisted lump shielded wires). Wire them by taking the following precautions into account.

- 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.
- We recommend to use an "insulation sleeve-equipped bar terminal" if a certain insulation distance is required to be secured between main circuit wires or between main and signal circuit wires.
  (This terminal cannot be used when AWG12 wire is used.)

2 Earth cable

- Earth the wire with the diameter of 2.0 mm^2 at one point.
- Perform class 3 earth (earth resistance value: 100 Ω max.).
- Be sure to connect the frame of the Servomotor (the grounding wire and the terminal) to the PE (protective earth) terminal (⏚) of the Servo Amplifier.
- Be sure to connect the PE (protective earth) terminal (⏚) for the Servo Amplifier to that for the control panel. Be sure to ground it at one point.

3 Measures against malfunction due to noise

Note the following to prevent malfunction due to noise.

- Arrange the noise filter, the Servo Amplifier, and the upper controller as near as possible.
- Be sure to install a surge absorbing circuit on the coils for the relay, the magnetic contactor, the induction motor and the brake solenoid.
- Don’t pass main circuit signal lines in the same duct or overlap them.
- When a large noise source such as an electric welding machine or an electric discharge machine exists nearby, insert a noise filter into the power supply and the input circuit.
- Don't bind the noise filter primary and secondary side wires together.
- Don't make the earth cable longer.

4 Measure against radio interference

Since the Servo Amplifier is an industrial equipment, no measure against radio interference has been taken to it. If the interference causes some problem, insert a line filter to the power line input.

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 earth

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 any adverse effect due to this current, be sure to connect the motor terminal (motor frame) to the PE (protective earth) terminal (⏚) of the Servo Amplifier.
Also, be sure to ground it directly.

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.

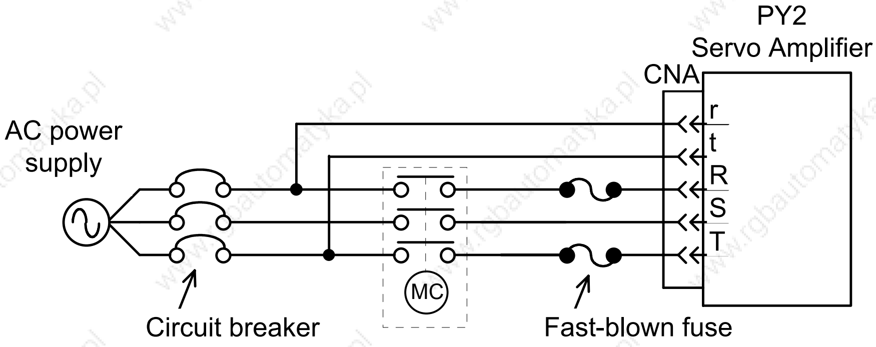
4 Miswiring

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

5 Protection against input overcurrent

Be sure to connect a UL-approved circuit breaker and a fast-blown fuse to the Servo Amplifier input to protect the power line. For the capacity of the fast-blown fuse, refer to the following.

Amplifier capacity 15 A, 30 A : 30 A fast-blown type
Amplifier capacity 50 A : 50 A fast-blown type



6 Leakage current

Even after the motor frame is grounded as specified, leakage current flows in the input power line. When selecting a leak detection-type breaker, make sure that no oversensitive operation is caused by high-frequency leakage current by referring to "Servo Amplifier/Servomotor Leakage Current" in the specifications.

7 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.

8 Lightning surge

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

4.6.1 Recommended Surge Protector

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

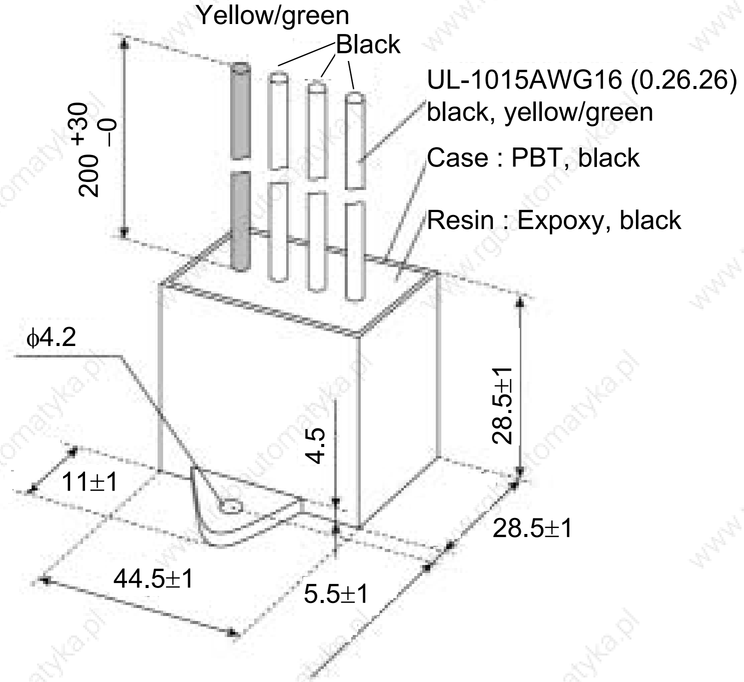
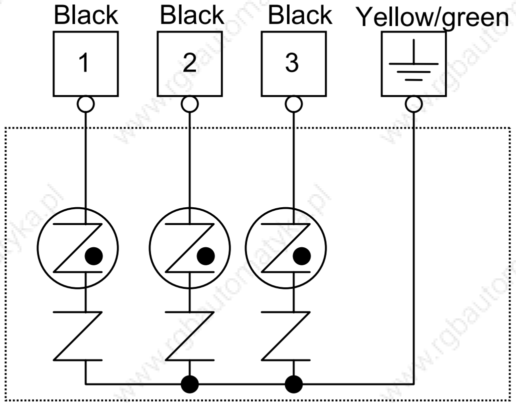
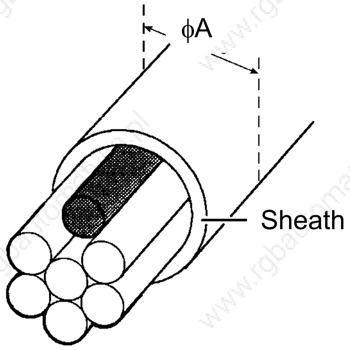
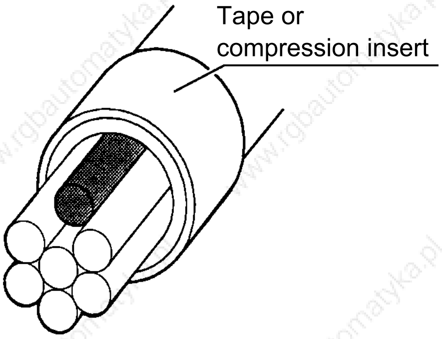
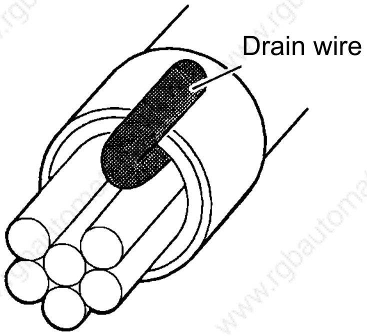
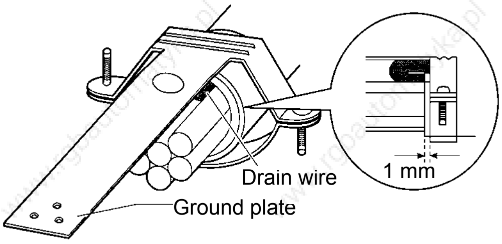
Item	Specification
Model No.	R.A.V-781BXZ-2A (Okaya Electric Industries Co., Ltd.)
External dimensions	
Maximum allowable circuit voltage	300 Vrms
Clamp voltage	783 V±10%
Surge-resistant current	2500 A (waveform) 8 × 20 μs
Surge-resistant voltage	20 kV (waveform) 1.2 × 50 μs
Connection diagram	
Weight	Approx. 100 g

Fig. 4-12 Recommended Surge Protector

4.6.2 CN1 & CN2 Shielding Procedure

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

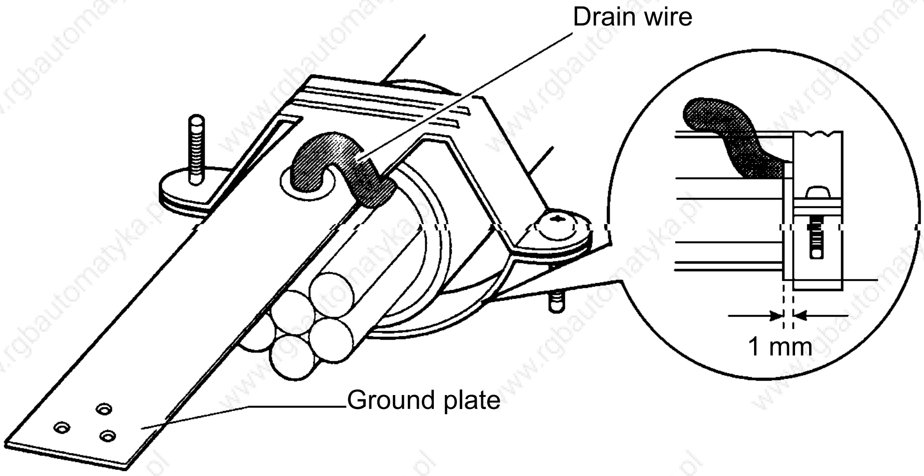
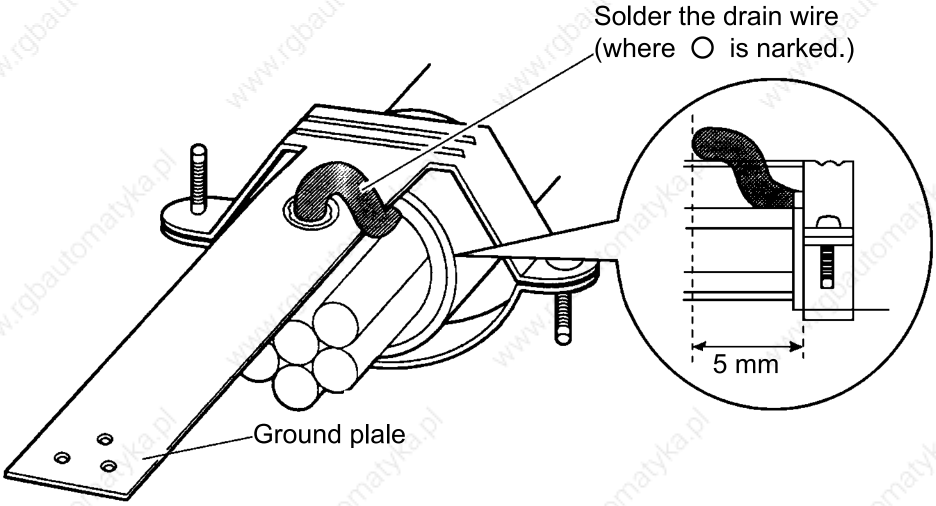
- **Clamp processing**

1		Remove the cable sheath.
2		Mount a tape or a compression insert. 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.

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	

- **Applicable CN2 ϕ A Size**

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

Table 4-3 Applicable CN2 ϕ A Size

Connector No.	Applicable ϕA 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.

4.6.3 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 (ϕA)	Maker name
10607-C058	ϕ4.0 to 5.0 mm	Sumitomo 3M Ltd.
10607-C068	ϕ5.0 to 6.0 mm	
10607-C078	ϕ6.0 to 7.0 mm	
10607-C088	ϕ7.0 to 8.0 mm	
10607-C098	ϕ8.0 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

5. INSTALLATION

INSTALLATION

5. INSTALLATION

5.1 Servo Amplifier Installation

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

5.1.1 Installation Place

Install the Servo Amplifier by referring to the following.

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

5.1.2 Installation Procedure

● **Direction and Position of Installation**

Install the Servo Amplifier vertically and fix the amplifier by tightening M5 screws onto the four mounting holes as in the figure below.

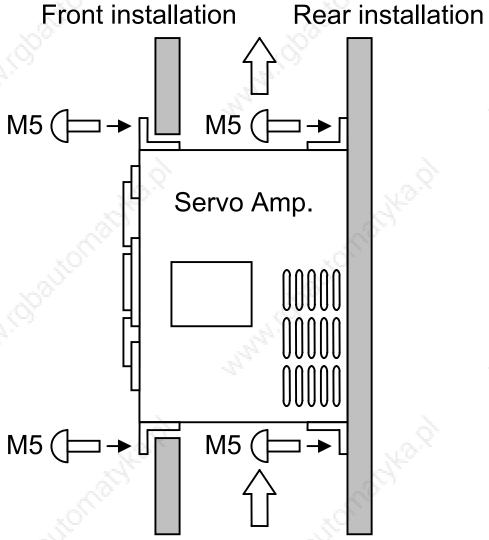


Fig. 5-1

● **Board arrangement conditions**

- Provide a space of 50 mm at minimum on both upper and lower sides of the Servo Amplifier so as not to prevent air from flowing out of the radiator or the amplifier. If heat remains on the upper part of the amplifier, install a fan to force air to flow.
- Provide a space of 10 mm at minimum on both sides of the amplifier so as not to prevent radiation from the heat sink on the side of the amplifier or air from flowing out of it.

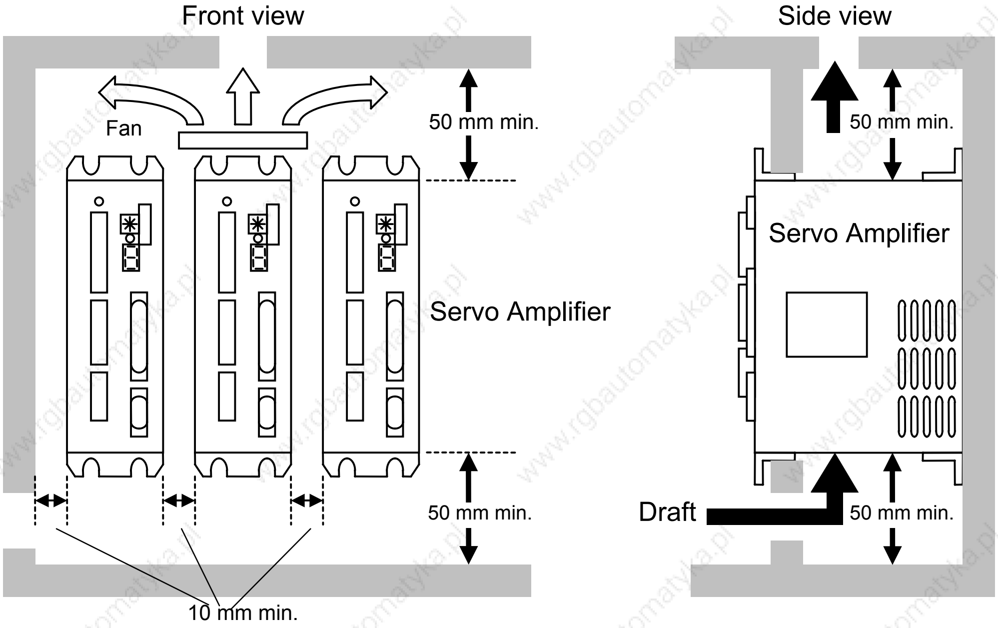


Fig. 5-2

5.2 Servomotor Installation

The Servomotor is designed to be installed indoors.
Note the following precautions on the position and method for installation.

5.2.1 Installation Place

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

- Ambient temperature : 0 to 40°C
- Storage temperature : – 20 to 65°C
- Ambient humidity : 20 to 90%
- Well-ventilated places without corrosive 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 or 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.

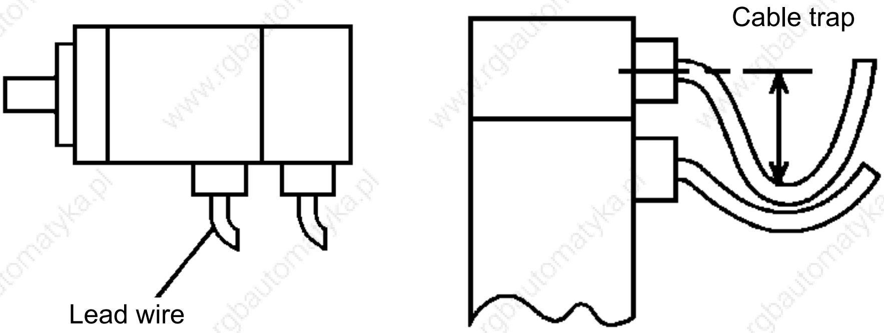


Fig. 5-4

● **Prevention against wetting**

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

The cannon plug type P1, P2 and P6 as well as the P8 series motor become equivalent to IP67 by using a waterproof connector or conduit on the other side of the cannon connector.
The P3 series motors and the P5 series motors with the flange size of 30 mm and 40 mm sqs. have waterproofing equivalent to IP40 and the P5 series motors with the flange size of 50 mm, 70 mm and 80 mm sqs. to IP55.

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

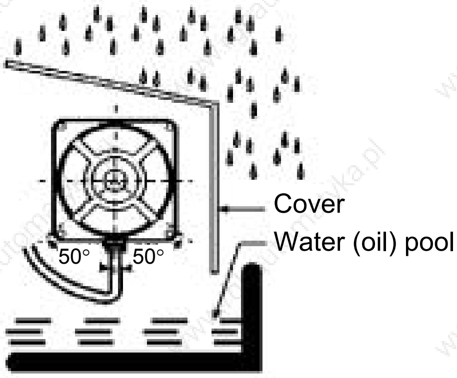


Fig. 5-5

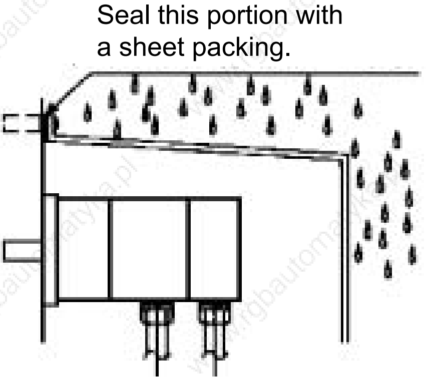


Fig. 5-6

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

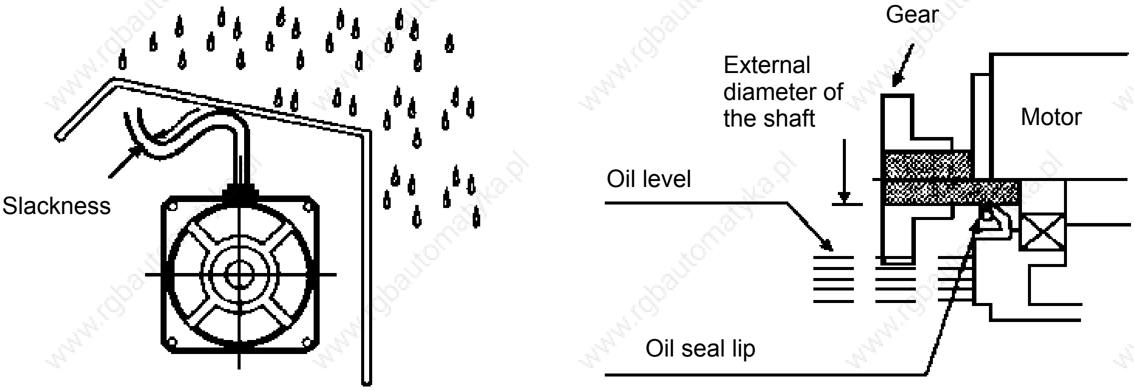
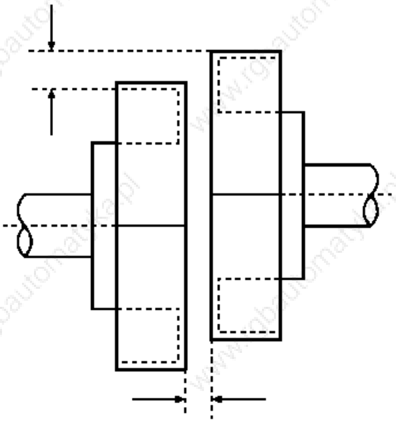


Fig. 5-7

● **Connection to the opposite machine**

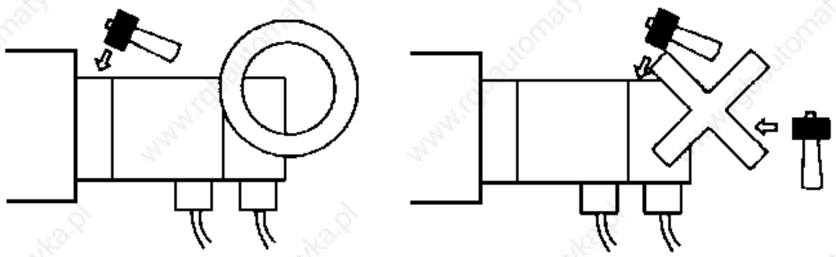
- Perform centering accurately between the motor shaft and the opposite machine as in Fig. 5-8. Note that when a rigid coupling is used, especially, a slight offset will lead to damage of the output shaft.



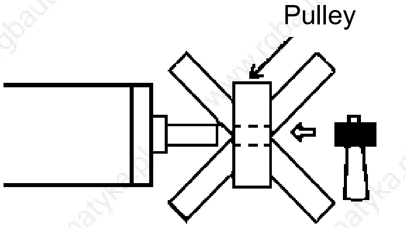
The difference between the maximum and minimum after measuring four points on the entire circumference is 3/100 mm or less (when rotated together with the coupling).

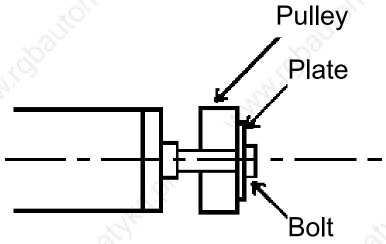
Fig. 5-8 Centering

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

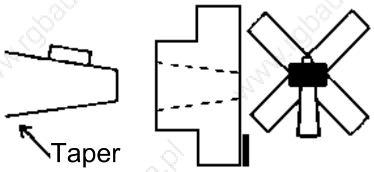


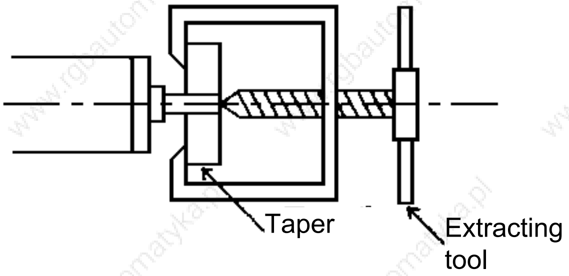
- When installing the motor to the machine, make a installing hole precisely so that the motor joint can be smoothly connected. Also, make the installing surface as flat as possible, or the shaft or the bearing may be damaged.
- When installing the gear, the pulley, the coupling, etc., avoid giving shocks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





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





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

● Allowable load of bearing

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

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

	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
P2	P20B10100	100	30	30	70	30	30
	P20B10150	100	30	30	70	30	30
	P20B10200	100	30	30	70	30	30
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
	B50B05020	25	20	15	15	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
P8	P80B15075	100	140	140	65	50	50
	P80B18120	150	140	140	95	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 (see the figure below).

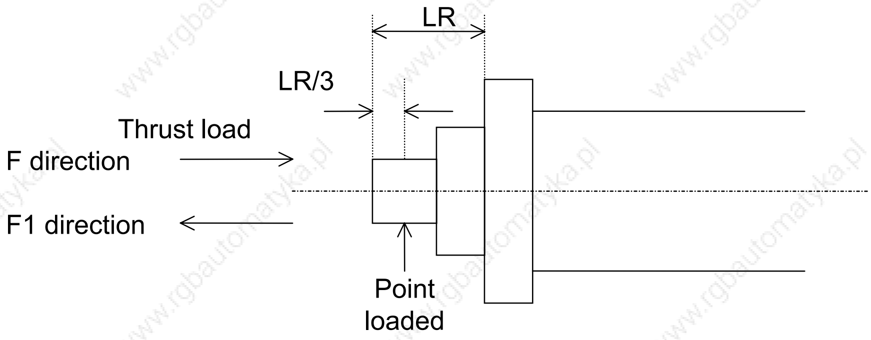


Fig. 5-9 Radially loaded position

5.3 Cable Installation

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

6. OPERATION

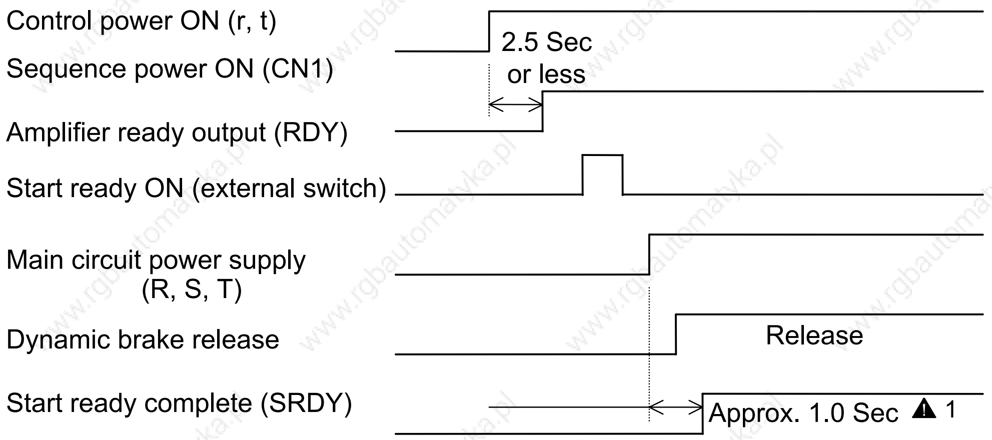
OPERATION

6. OPERATION

6.1 Operation Sequence

The frequency of power ON/OFF should be 10 times/H or less, and 50 times/day or less.

6.1.1 Power ON Sequence



1 The time period from main circuit power ON to SRDY is approx. 1 sec. However, in case of single phase power of Amplifier with 50A capacity, that will be approx. 1.5 sec.

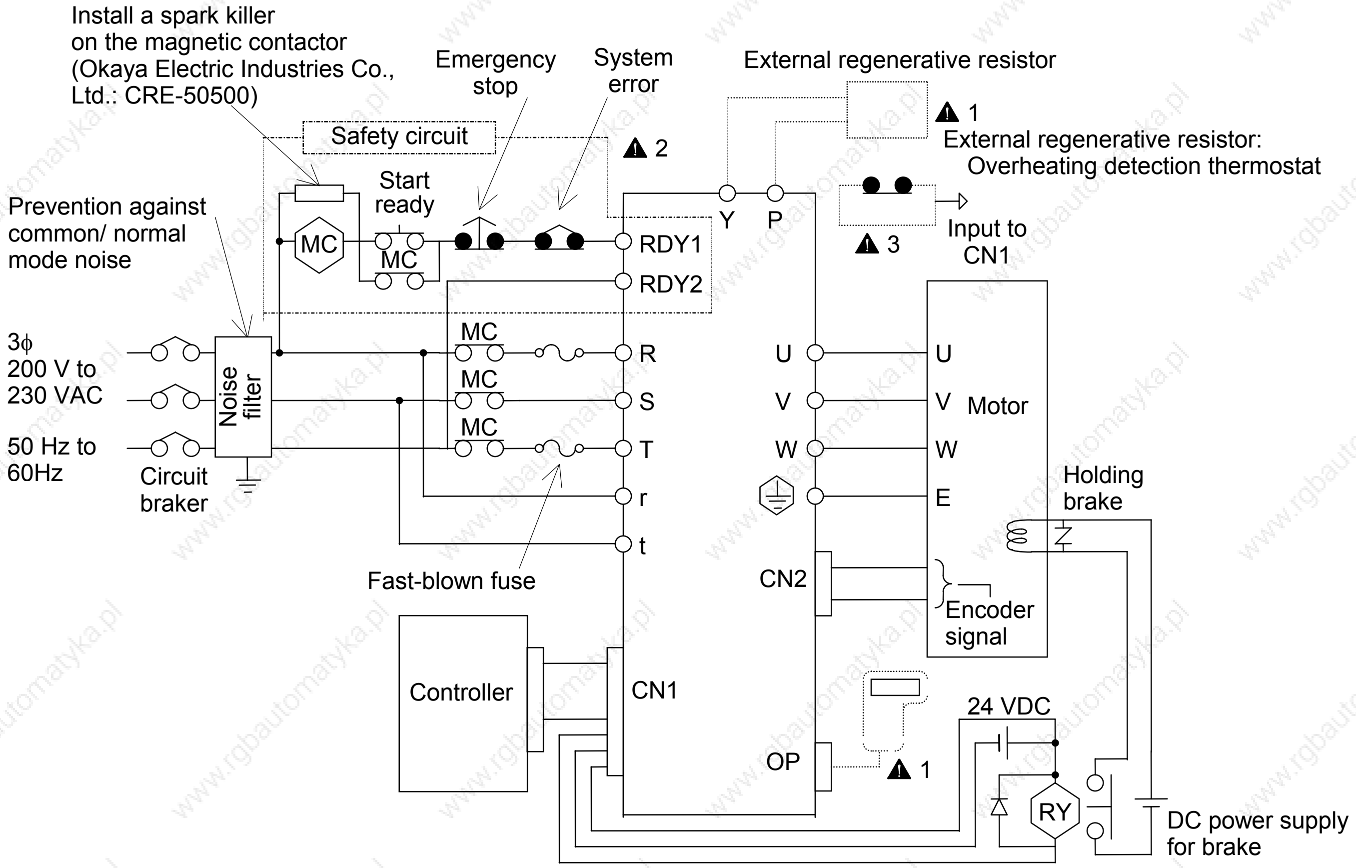
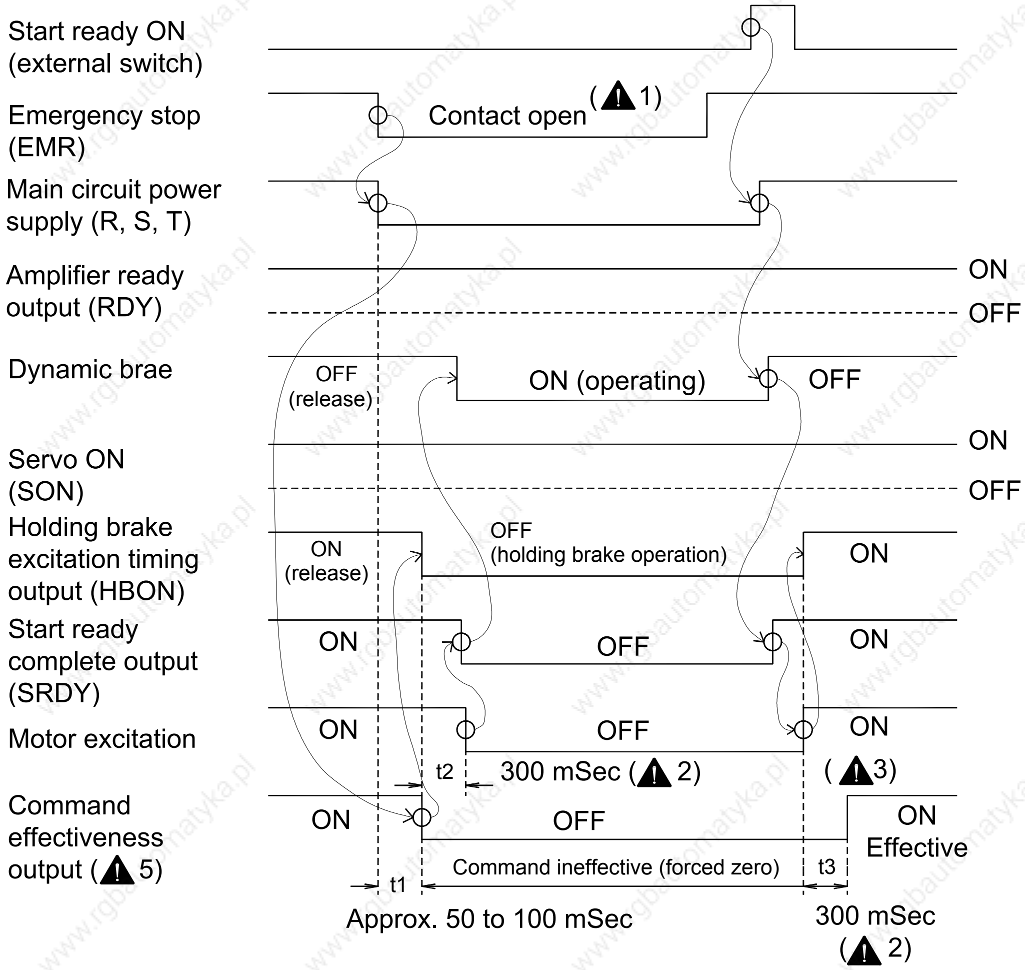


Fig. 6-1

1 The dotted line denotes an option.
2 RDY1 and RDY2 in the safety circuit are optional.
3 The thermostat output in the external regenerative resistor can be connected to general-purpose input CN1 of the amplifier.

6.1.2 Stop Sequence

6.1.2.1 Stop and recovery due to emergency stop input



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

2 • The holding brake timing (standard value 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) between t2 and t3.

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

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

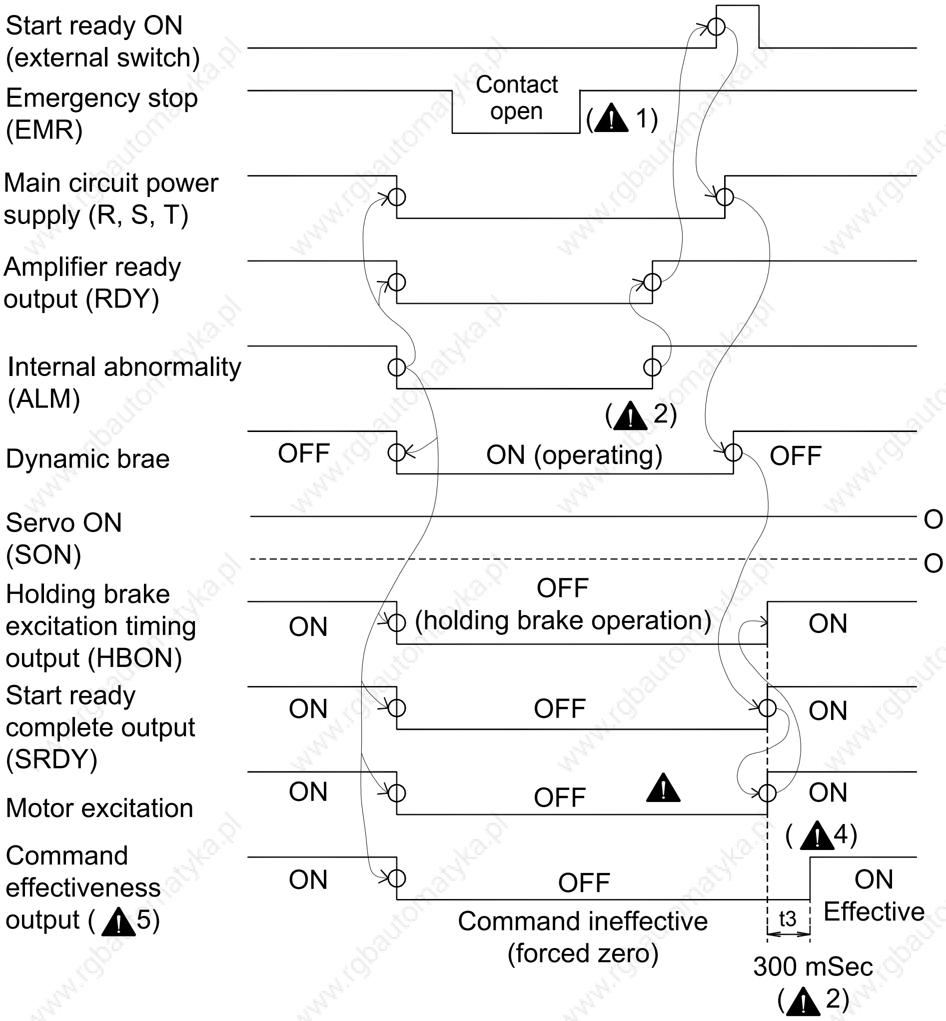
4 • If an emergency stop occurs in a heavy load status, MPE (Main circuit Power Error, alarm "9") may be activated.

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

6 • The time period from main circuit power ON to SRDY is approx. 1 sec. However, in case of single phase power of Amplifier with 50A capacity, that will be approx. 1.5 sec.

7 • When the alarm generates, assemble the safety circuit outside of the amplifier. Running away, injury, burning, fire, and secondary damage may be caused.

6.1.2.2 Stop and recovery due to an internal error



⚠

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

2 • As per the alarm reset sequence.

3 • The holding brake timing (standard value 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.

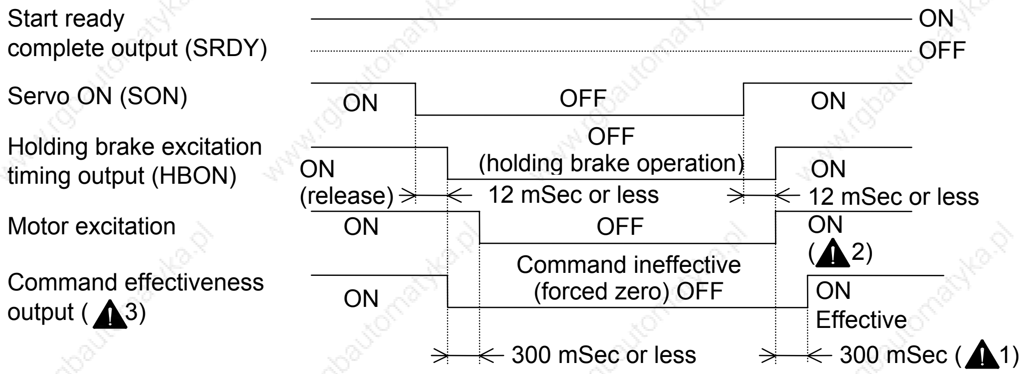
- It is possible to make commands effective immediately after SON by setting Func1 bit5 to "1" when setting parameters. However, the sequence current limit value is applied when switching from SON to SOFF and is not applied when switching from SOFF to SON.

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

6 • The time period from main circuit power ON to SRDY is approx. 1 sec. However, in case of single phase power of Amplifier with 50A capacity, that will be approx. 1.5 sec.

6.1.3 Servo OFF Sequence

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



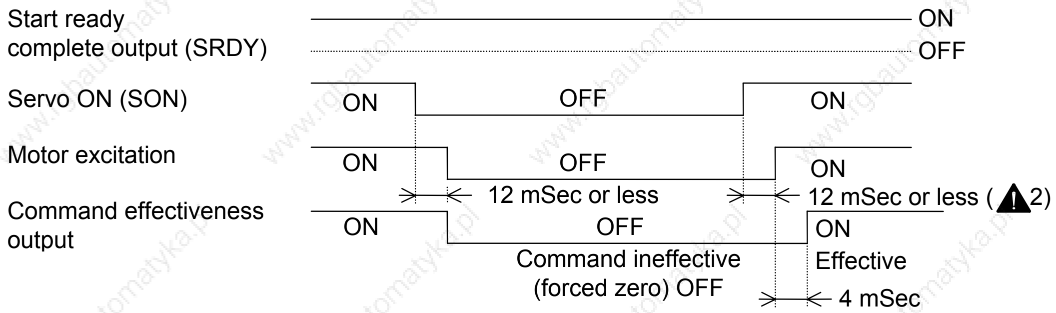
1 • The current is limited by the sequence current limit value (standard value 120%, which is changed in Parameter Mode 1 on Page 12) for 300 mSec.

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.

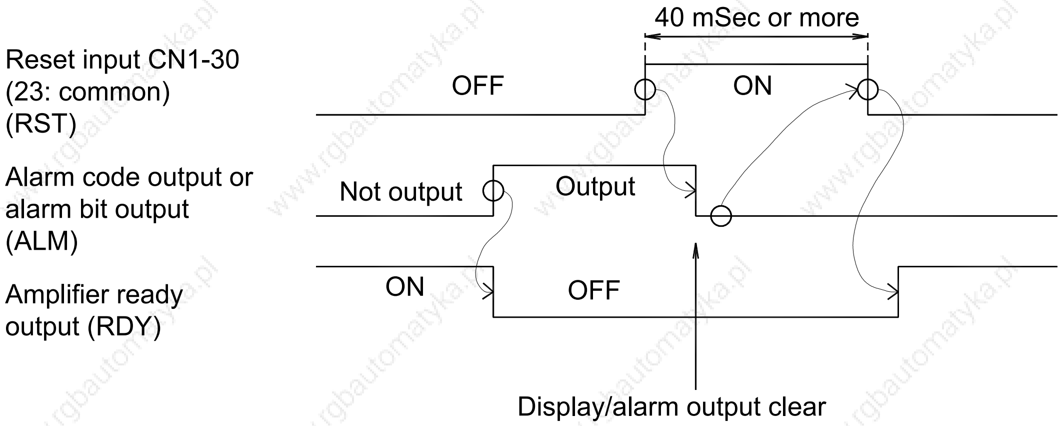
6.1.3.2 When holding brake timing THB is set at 0 msec (⚠1)



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.

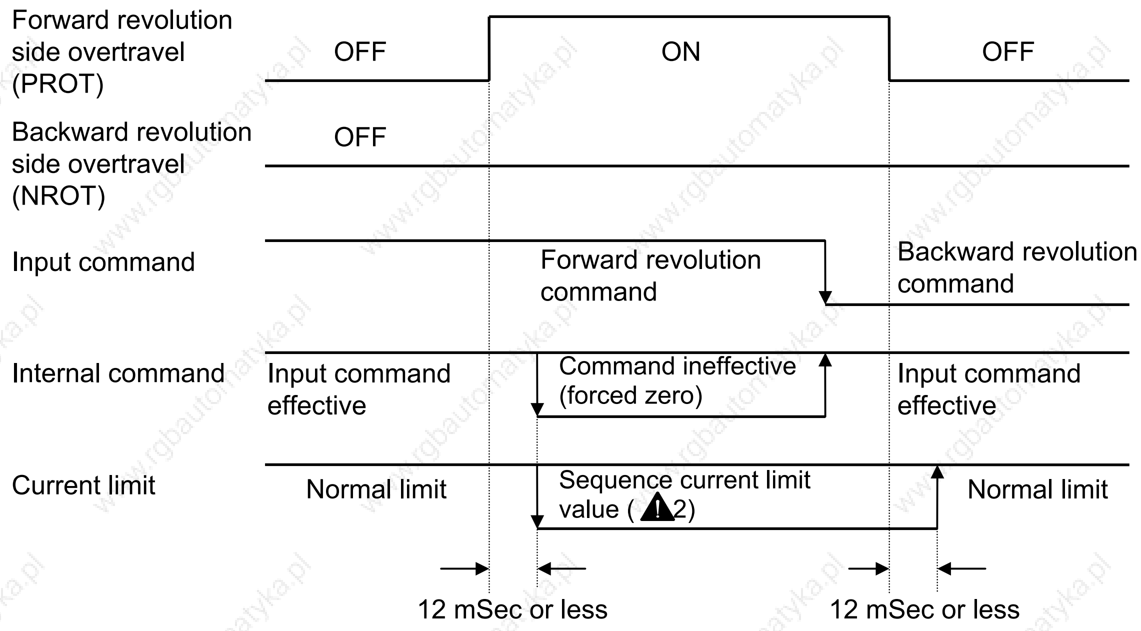
6.1.4 Alarm Reset Sequence

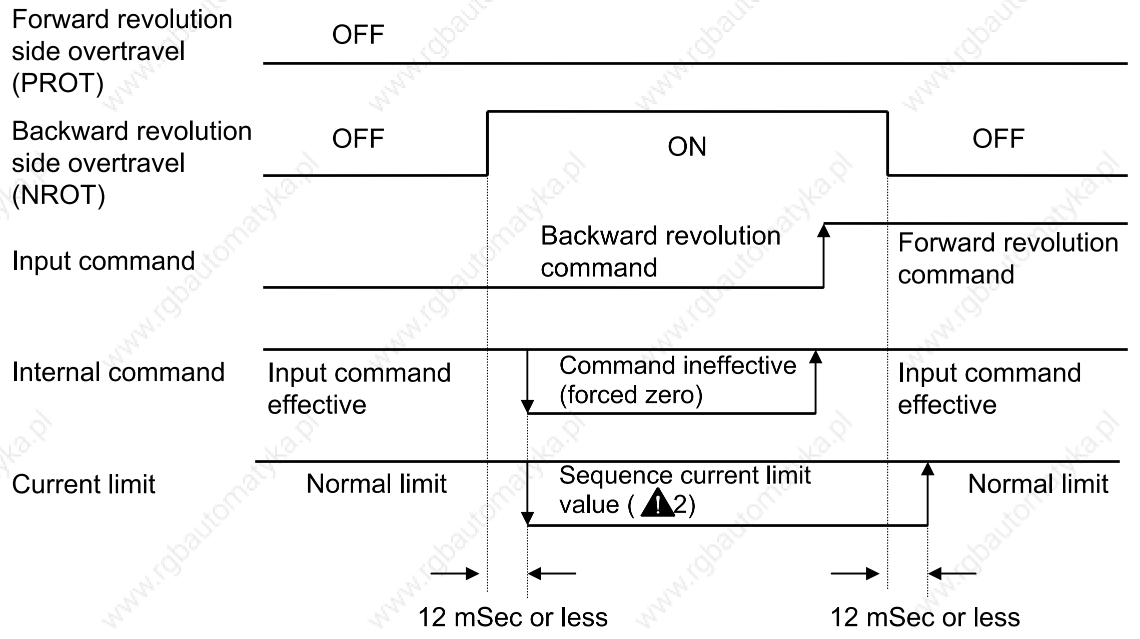


1. Regarding the upper controller, turn off "reset input" after checking that no alarm occurs by watching the alarm output.
2. When the alarm status continues in spite of "reset input", the alarm output is not cleared. It is necessary to set a time-out period of 40 mSec or more to return "reset input" 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.

When turning the control power on or off to reset an alarm, allow a sufficient control power off time. If the time is too short, another alarm may be issued.

6.1.5 Overtravel Sequence





⚠

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

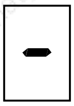
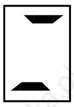
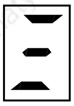
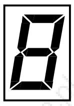
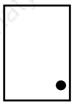
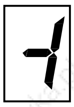
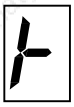
2 Sequence current limit value can be changed by SILM in the Parameter Mode 1 on Page 12.

6.2 Display

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

6.2.1 Status Display

Table 6-1 Status Display

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

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

6.2.2 Alarm Display

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

6.3 Be 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 terminals r and t of connector CNA of the Servo Amplifier (hereinafter referred to "amplifier").

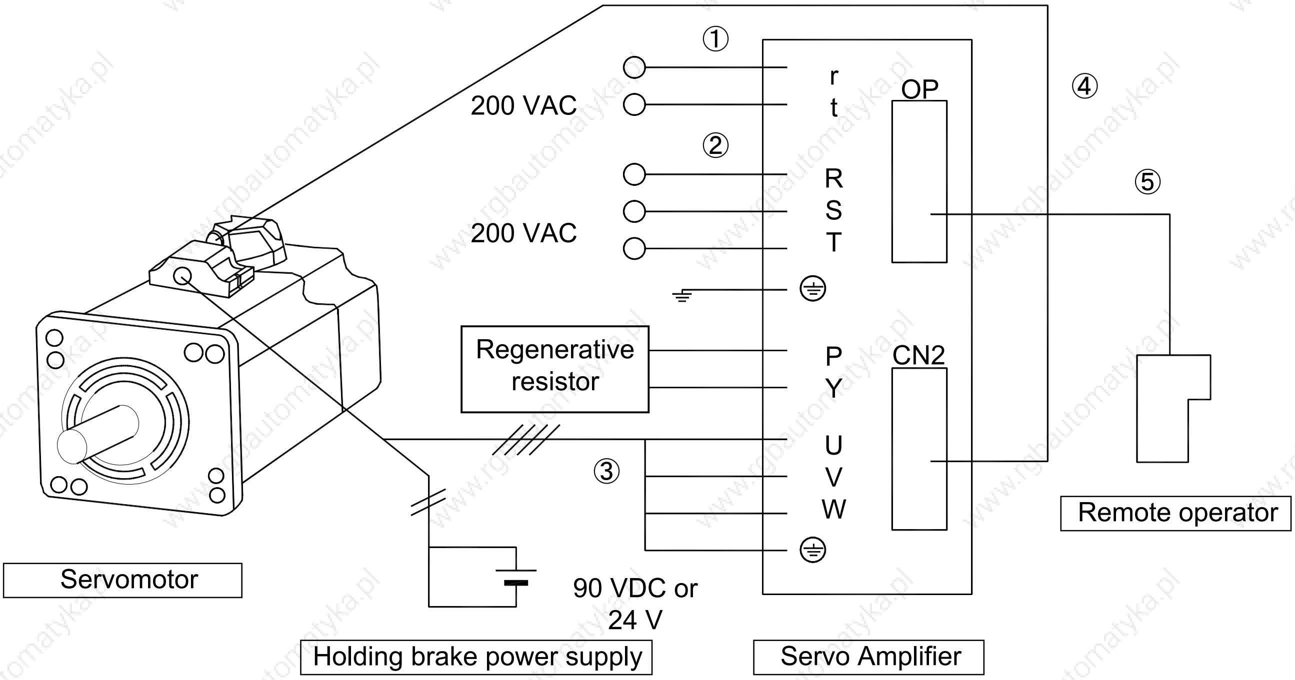
2 Wire 200 VAC to terminals R, S and T of amplifier connector CNA.
Ground the PE (protective earth ⏚) terminal of the amplifier.

3 Wire the motor power lines to the U, V and W terminals as well as to the PE (⏚) terminals of the amplifier connector CNB. (For amplifiers having 15 A or 30 A capacity, connect an external regenerative resistor between the P and Y (or COM) terminals of the connector CND.)

4 Wire the encoder cable to amplifier connector CN2.

5 Connect the remote operator to the amplifier connector OP.

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



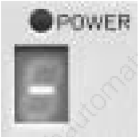
6.3.2 Jog Operation

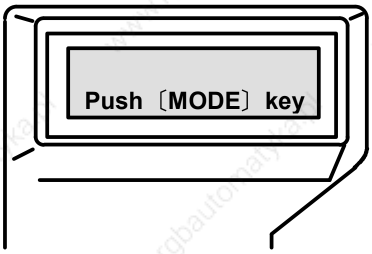
7 Turn ON the 200 VAC of r-t (① wires).

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

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

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




Push〔MODE〕key

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

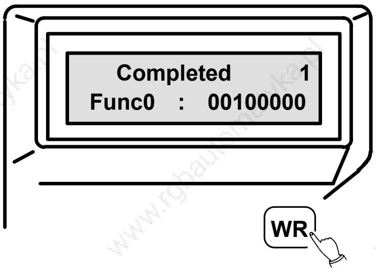
Repeat pushing ON MODE , 2 and △ or ▽ keys until the right screen appears.


∗Para. Set3 1
Func0 : 00000000

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


∗Para. Set3 1
Func0 : 00100000

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


Completed 1
Func0 : 00100000

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

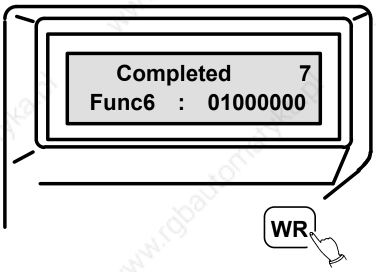
Push the ▽ key a few times until the right screen appears.


∗Para. Set3 7
Func6 : 00000000

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


∗Para. Set3 7
Func6 : 01000000

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

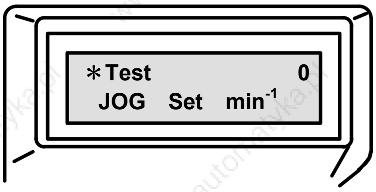

Completed 7
Func6 : 01000000

10 Turn on the 200 VAC (② wires) of R-S-T.

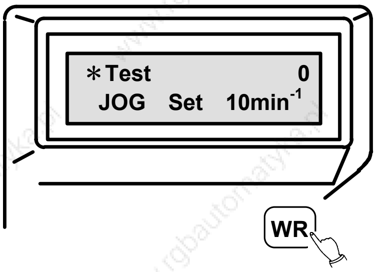
The 7-segment LED is light as shown in the right figure.

11 Start the JOG operation.

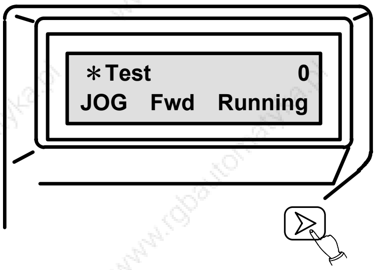
Push the ON MODE and 7 keys so that the right screen will appear.


＊Test 0
JOG Set min^{-1}

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

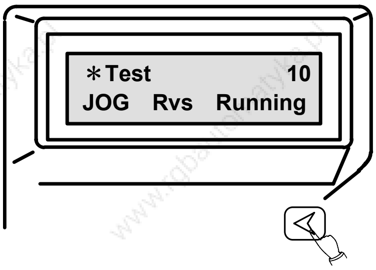

＊Test 0
JOG Set 10min^{-1}

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


＊Test 0
JOG Fwd Running

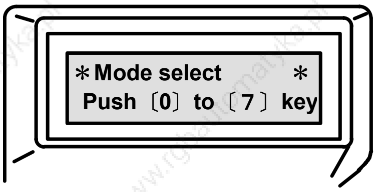
The remote operator keeps sounding "beep, beep" and the motor rotates counterclockwise (CCW) in 10 min^{-1} when viewed from its shaft side.

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


＊Test 10
JOG Rvs Running

12 Return to original mode.

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


＊Mode select ＊
Push 〔0〕 to 〔7〕 key

The d key in the 7-segment LED flickers.

By this, the JOG operation ends.

6.3.3 Resetting and Turning the Power Off

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

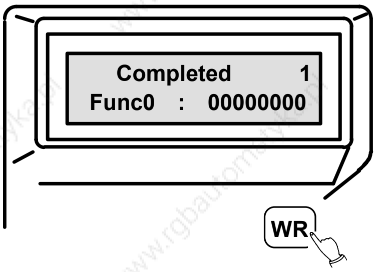
Repeat pushing the ON MODE , 2 and △ or ▽ keys until the right screen appears.


＊Para. Set3 1
Func0 : 00100000

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


＊Para. Set3 1
Func0 : 00000000

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


Completed 1
Func0 : 00000000

14 Turn off the 200 VAC of R-S-T.

15 Turn off the 200 VAC of r-t.

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

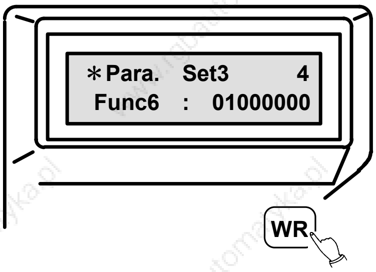
6.4 Encoder Clear Using Remote Operator (When Absolute Encoder is Used)

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

1 Make the test mode effective.

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

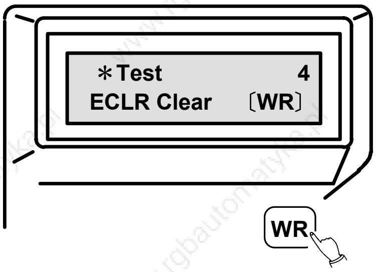
Press the WR key.



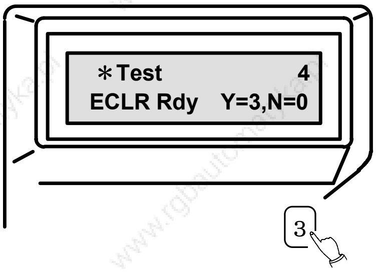
2 Perform ECLR.

Press the ON MODE key and the 7 key, then select ELCR on page 4.

Press the WR key, and press the 3 key down for 4 seconds or more.



Press the 0 key and the ON MODE key to terminate the test mode.



3 Turn on the power again.
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.

2 On the ABS-E absolute encoder, alarm "8" (sensor error) may be issued after the power is turned on for the first time after the amplifier or motor is wired. This is because the voltage to be supplied to the sensor is lowered due to charging to the capacitor in the encoder. The alarm can be reset by turning the control power on again.

In case of use without connecting retium battery in an application not using multiple rotational data for wiring-saved absolute sensor (ABS-E.S1), set Func6, bit5 to “1” before turning control power ON again. Thus, alarm “U” (battery alarm) shall not be detected when turning control power ON again.

7. EXPLANATION OF PARAMETERS

EXPLANATION OF PARAMETERS

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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.

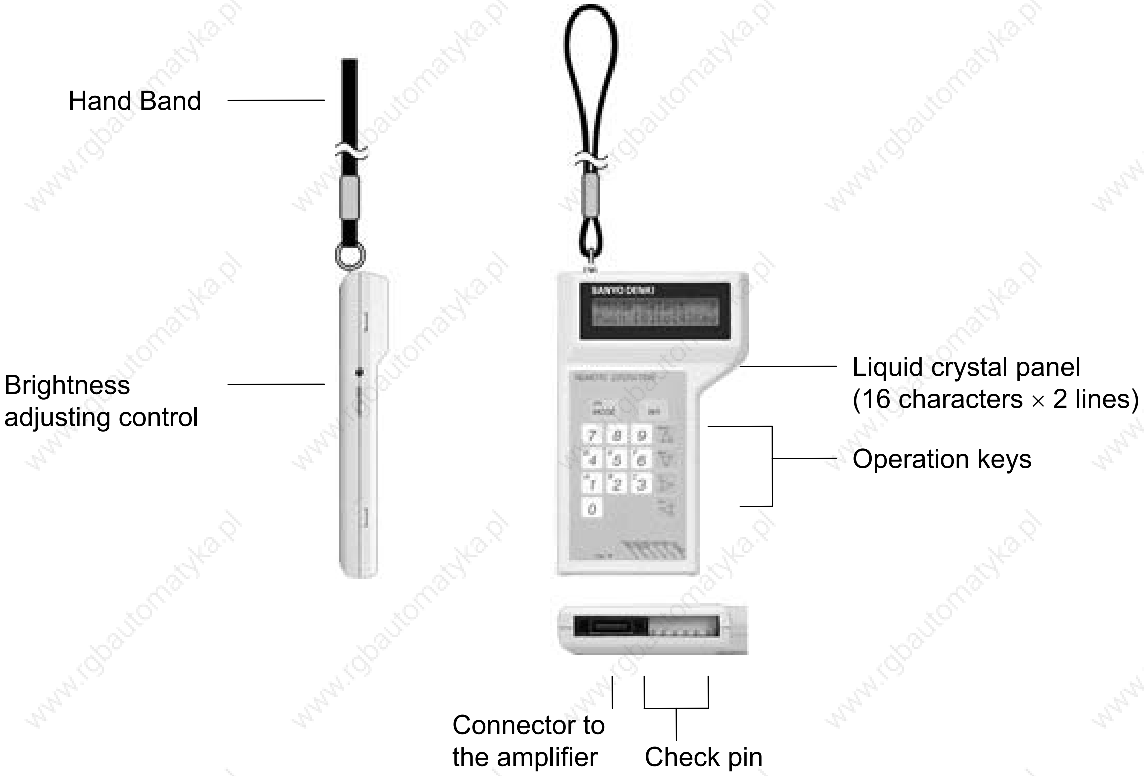


Fig. 7-1 Remote Operator

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 0°C to +50°C (32°F to 122°F)	During storage –20°C to +65°C (-4°F to 149°F)
Working atmosphere	Free from oil mist, corrosive gas and dust	

7.1.2 Function Table

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 • Current command low pass filter setting value • Built-in regenerative resistor absorbed power
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 • Offline automatic tuning • Automatic offset (velocity and torque commands) • Encoder clear • Automatic notch filter tuning
Setting mode	8	Allows user parameters to be entered directly from the key pad.
	9	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). (High when the alarm is on.)

7.1.3 Basic Operation Procedure

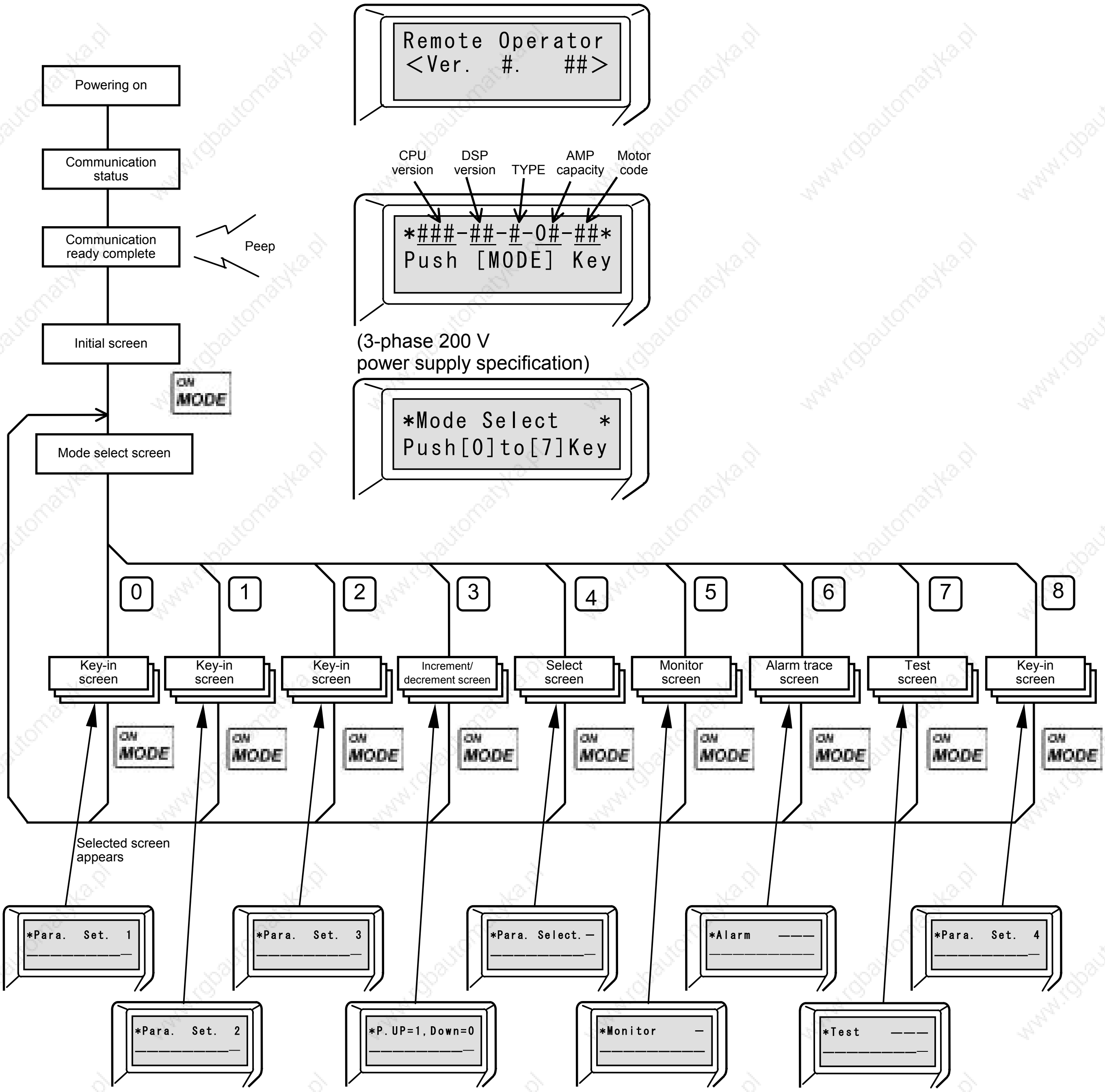


Fig. 7-2 Basic Operation of Remote Operator

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

To re-start, press the ON MODE key.

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

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

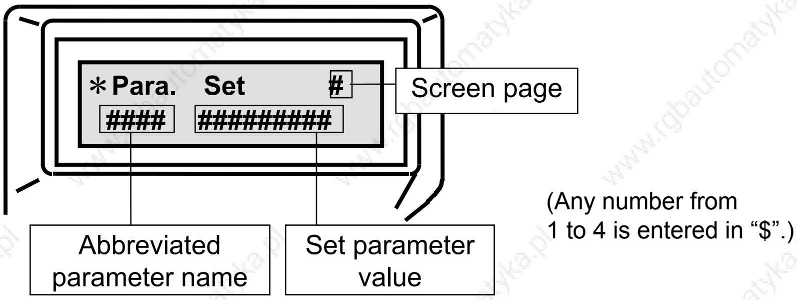


Fig. 7-3 Parameter Setting Mode Screen

Table 7-4 Parameters for Screen Mode 0

Page No.	Abbreviation	Name	Setting range	Unit
0	KpM	Monitors position loop gain	-	rad/S
1	KffM	Monitors feed forward gain	-	%
2	KvpM	Monitors velocity loop proportional gain	-	Hz
3	TviM	Monitors velocity loop integral time constant	-	mSec
4	FLPM	Monitors feed forward LPF	-	Hz
5	VLPM	Monitors velocity command LPF	-	Hz
6	ILPM	Monitors current command LPF	-	Hz
7	BFAM	Monitors current command BEFA	-	Hz
8	BFBM	Monitors current command BEFB	-	Hz
9	Tpcm	Position command LPF time constant	0 to 4000	mSec
10	Tvac	Velocity command acceleration time	0 to 9999	mSec
11	Tvde	Velocity command deceleration time	0 to 9999	mSec
12	KvpA	Velocity loop proportional gain addition value	0 to 255	Hz

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

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}

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

Page No.	Abbreviation	Name	Setting range	Unit
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 ⚠ 1,2	500 to 65535	P/R
17	EENP*	Full close encoder pulse number ⚠ 1,2,3	500 to 65535	P/R
18	OLWL	Over load warning level ⚠ 2	30 to 100	%

⚠ 1 Page 16(MENP) and 17(EENP) can be changed after setting Mode2, Func6, bit7 to “1”.

⚠ 2 Page 16(MENP), 17(EENP) and 18(OLWL) are enabled by turning control power ON again.

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

Table 7-6 Parameters for Screen Mode 2

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

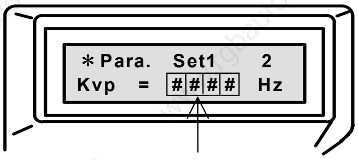
Table 7-7 Parameters for Screen Mode 8

Page No.	Abbreviation	Name	Setting range	Unit
0	-	-	-	-
1	-	-	-	-
2	-	-	-	-
3	Tn_F	Current command user setting value when automatic notch filter tuning	30 to (IP/IR) ×100	%
4	O_JL	Observer / load inertia proportion	0 to 3000	%

- **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:

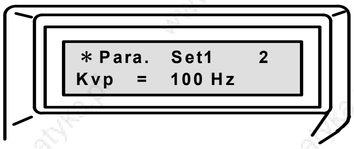
1 Select page 2 using by △ or ▽ key.



The cursor flashes.

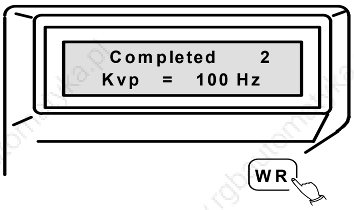
2 Move the cursor to the position corresponding to the desired number of input digits using ▷ or ◁ key.

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



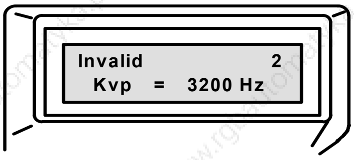
4 The set value is stored in the nonvolatile memory using key and the remote operator operates with the set value.

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

7.1.5 Parameter Increment/Decrement Mode (Screen Mode 3)

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

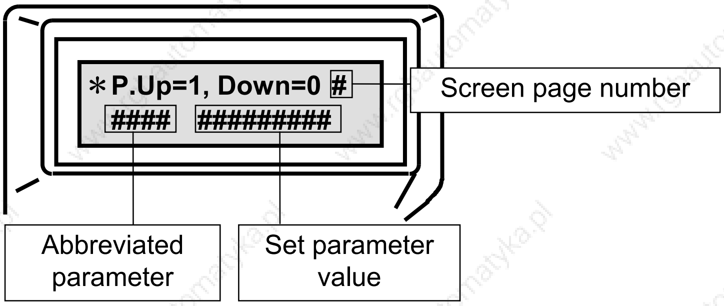


Fig. 7-4 Parameter Increment/Decrement Mode Screen

Table 7-8 Parameters for Screen Mode 3

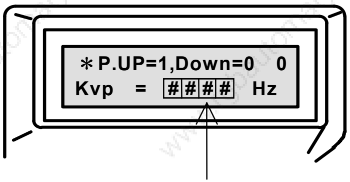
Page No.	Abbreviation	Name	Setting range	Unit
0	-	-	-	-
1	-	-	-	-
2	-	-	-	-
3	Vzero	Velocity command zero adjustment	±16383	
4	Tzero	Torque command zero adjustment	±16383	
5	Tn_Lv	Real time automatic tuning level	±5	

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,

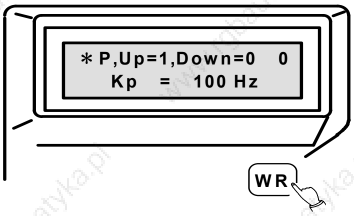
1 Select page 0 using by △ or ▽ key.



The cursor flashes.

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

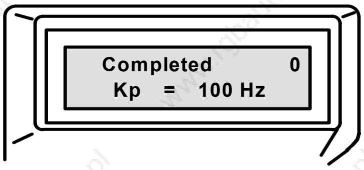
3 As needed, increase or decrease the number in each digit using the [1] or [0] key (the value you specify will be immediately reflected in the operation).



4 Using the 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 , 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.

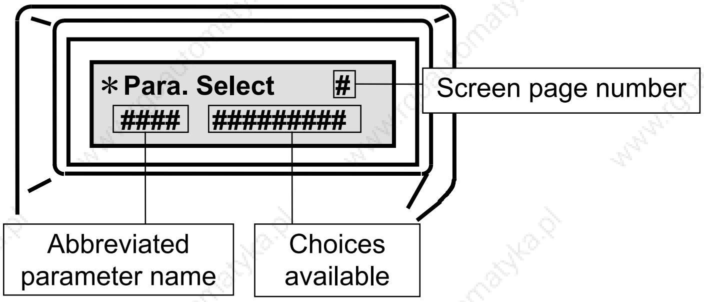


Fig. 7-5 Parameter Select Mode Screen

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	19
	1	M2	Monitor 2 output	19
	2	Func	Servo function select	4
System parameters	3	TYPE	Control mode	6
	4	ENKD	Encoder type	3
	5	ABSF	ABS sensor format	11
	6	MOT.	Motor type	X – 42676
	7	MOKD	Motor configuration	Rotary only
	8	PSKD	Power supply type	PY2B050: 1
	9	RGKD	Regenerative resistor type	2

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

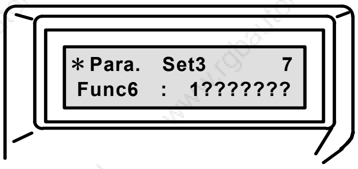
2 Note that modification of a system parameter is enabled only after the control power has been turned off.

Make sure to set the page9 regenerative resistor type (RGKD) to “Built-in regenerative resistor (Built-in R). With this setting, validity of overheat protection detecting process of build-in regenerative resistor will be judged. Overheat detection of build-in regenerative resistor will not be executed when “No regenerative resistor connection or external regenerative resistor (Note/Ext.R)” is selected. Therefore, built-in regenerative resistor may smoke or be burnt.

● Setting practice

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

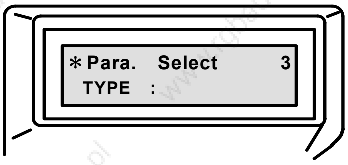
1 Set Func6 bit7 to “1” from Mode 2 Page 7.



＊Para. Set3 7
Func6 : 1???????

(?) appears before
the setting is down.

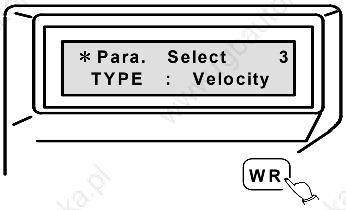
2 Select Mode 4.



＊Para. Select 3
TYPE :

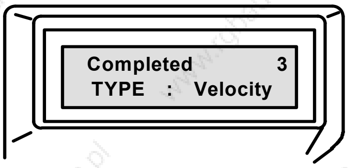
3 Using the △ or ▽ key, select page 3.

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



＊Para. Select 3
TYPE : Velocity

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



Completed 3
TYPE : Velocity

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 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.

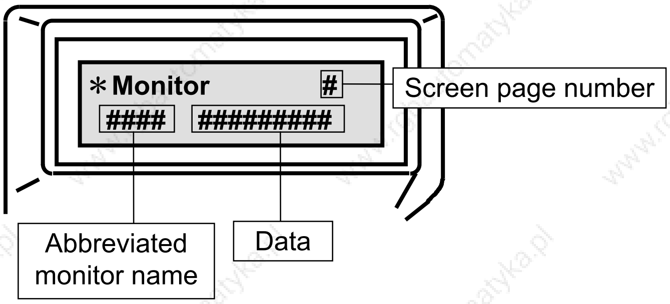


Fig. 7-6 Monitor Mode Screen

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

<table>
<tr><th>Page No.</th><th>Abbre-viation</th><th>Contents</th></tr>
<tr><td>0</td><td>STATUS</td><td>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>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>GAIN3</td><td>GAIN2</td><td>GAIN1/ General purpose 2</td><td>CLE</td><td>-</td><td>General purpose 1</td><td>SON</td></tr>
<tr><td>Pin No.</td><td>31</td><td>9</td><td>8</td><td>27</td><td>30</td><td>-</td><td>32</td><td>29</td></tr>
</table>
The output becomes active at "1". Bit 2 display is unstable.</td></tr>
<tr><td>2</td><td>OUTPUT</td><td>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></tr>
<tr><td></td><td>ALM+
ALM-</td><td>ACOD3</td><td>ACOD2</td><td>ACOD1+
ACOD1-</td><td>-</td><td>-</td><td>-</td><td>COIN1+
COIN1-</td></tr>
<tr><td>Pin No.</td><td>36,37</td><td>12</td><td>40</td><td>34,35</td><td></td><td></td><td></td><td>38,39</td></tr>
</table>
"1" indicates the active output status. Displays for Bit 3, 2, 1 are unstable.</td></tr>
<tr><td>3</td><td>VCMD</td><td>Indicates the velocity command. [min^{-1}] (⚠2)</td></tr>
<tr><td>4</td><td>VFBK</td><td>Indicates the velocity feedback. [min^{-1}]</td></tr>
<tr><td>5</td><td>ICMD</td><td>Indicates the current command. [I/IR × 100%]</td></tr>
<tr><td>6</td><td>IFBK</td><td>Indicates the current feedback. [I/IR × 100%]</td></tr>
<tr><td>7</td><td>Pos. E</td><td>Indicates the position deviation counter value. [pulse]</td></tr>
<tr><td>8</td><td>CSU</td><td>Indicates the U-phase electric angle. [deg]</td></tr>
</table>

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	-	-
14	-	-
15	-	-
16	-	-
17	RegP	Indicates the built-in regenerative resistor absorbed power. [W] (⚠ 3)

⚠

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.

3 It indicates the power when built-in regenerative resistor is selected at screen Mode4, page9 regenerative resistor type selection (RGKD) in Servo Amplifier with built-in regenerative resistor. It will not indicate in case of no regenerative resistor connection or external regenerative resistor.

<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.

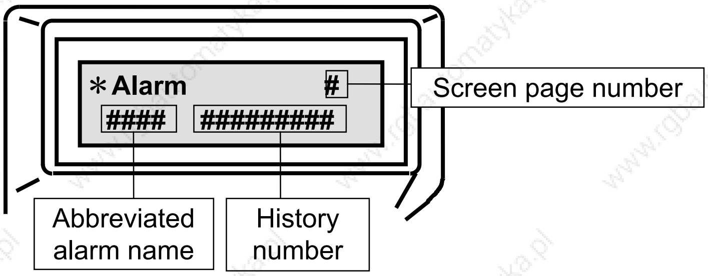


Fig. 7-7 Alarm Trace Mode Screen

Table 7-11 Screen Mode 6

Page No.	History No.	Abbre-viation	Name
0	Now		Current alarm
		None	No alarm
		OC	Power element error
		AOH	Amplifier overheating
		EXOH	External overheating
		OV	Overvoltage
		RGOH	Built-in regenerative resistor overheating
		PE	Control power supply voltage
		DE1	Sensor error
		DE2	Sensor error
		OL	Overload
		OS	Over-speed
		SE	Velocity control error
		OVF	Excessive deviation
		MPE	Main power error
		FP	Main power open-phase
		RGOL	Regenerative error
		DSPE	Servo processor error
		MEME	Memory error
		DE3	Sensor error
		DE4	Sensor error
		IFBE	Current FB 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

● **Tracing method**

The alarm history can be seen by using ⊼ or ⊻ key.

Press the 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].

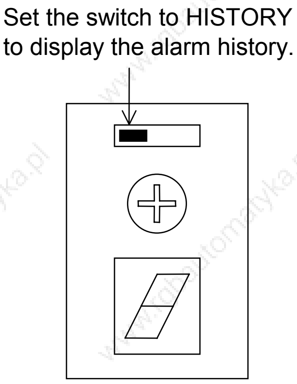


Fig. 7-8 Displaying the Alarm History

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.

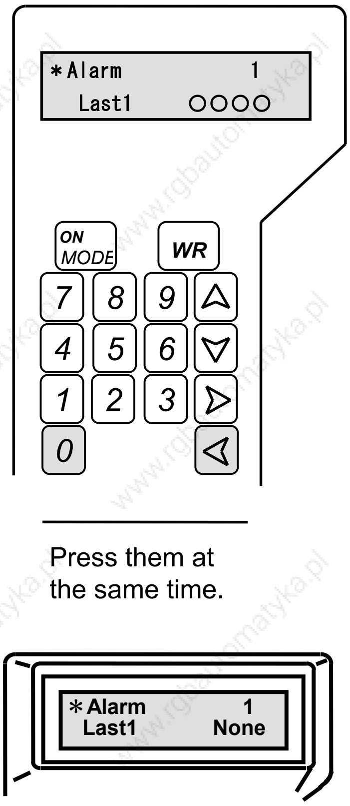
Table 7-12 Abbreviated Alarm Names

7-seg.	Abbre-viation	How to read
1	OC	Power element error
2	OL	Overload
3	AOH	Amplifier overheating
5	OV	Overvoltage
6	OS	Over-speed
7	PE	Control power supply error
8	DE	Sensor error
9	MPE	Main power error
A	FP	Main power open-phase

7-seg.	Abbre-viation	How to read
C	SE	Speed control error
d	OVF	Excessive deviation
E	EXOH	External overheating
F	DSPE	Servo processor failure
H	RGOH	Built-in regenerative resistor overheating
J	RGOL	Regenerative error
P	MEME	Memory error
U	AEE	Low battery
No light	CPUE	CPU error

○ Clearing all alarm histories

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



Press them at the same time.

Fig. 7-9 Alarm Clearing Method

7.1.9 Test Mode (Screen Mode 7)

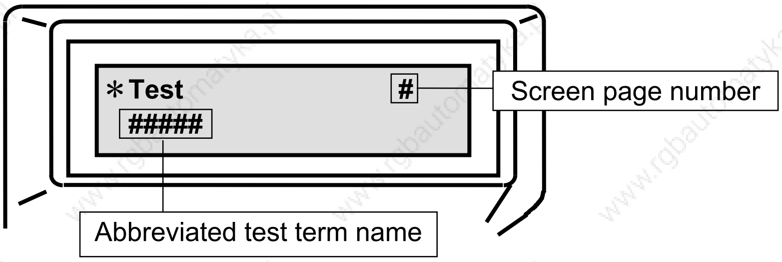


Fig. 7-10 Test Mode Screen

Table 7-13 Screen Mode 7

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

- **Before turning on the test mode**

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

- **When implementing JOG or Tune**

1. When the control mode can be switched (between velocity and torque, position and torque, and position and velocity), turn off the input signal for switching.
2. Set the command input to "0".
3. Turn off the Servo ON (SON) signal.
   In the test mode, turn the forced Servo ON using the remote operator to output the holding 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**

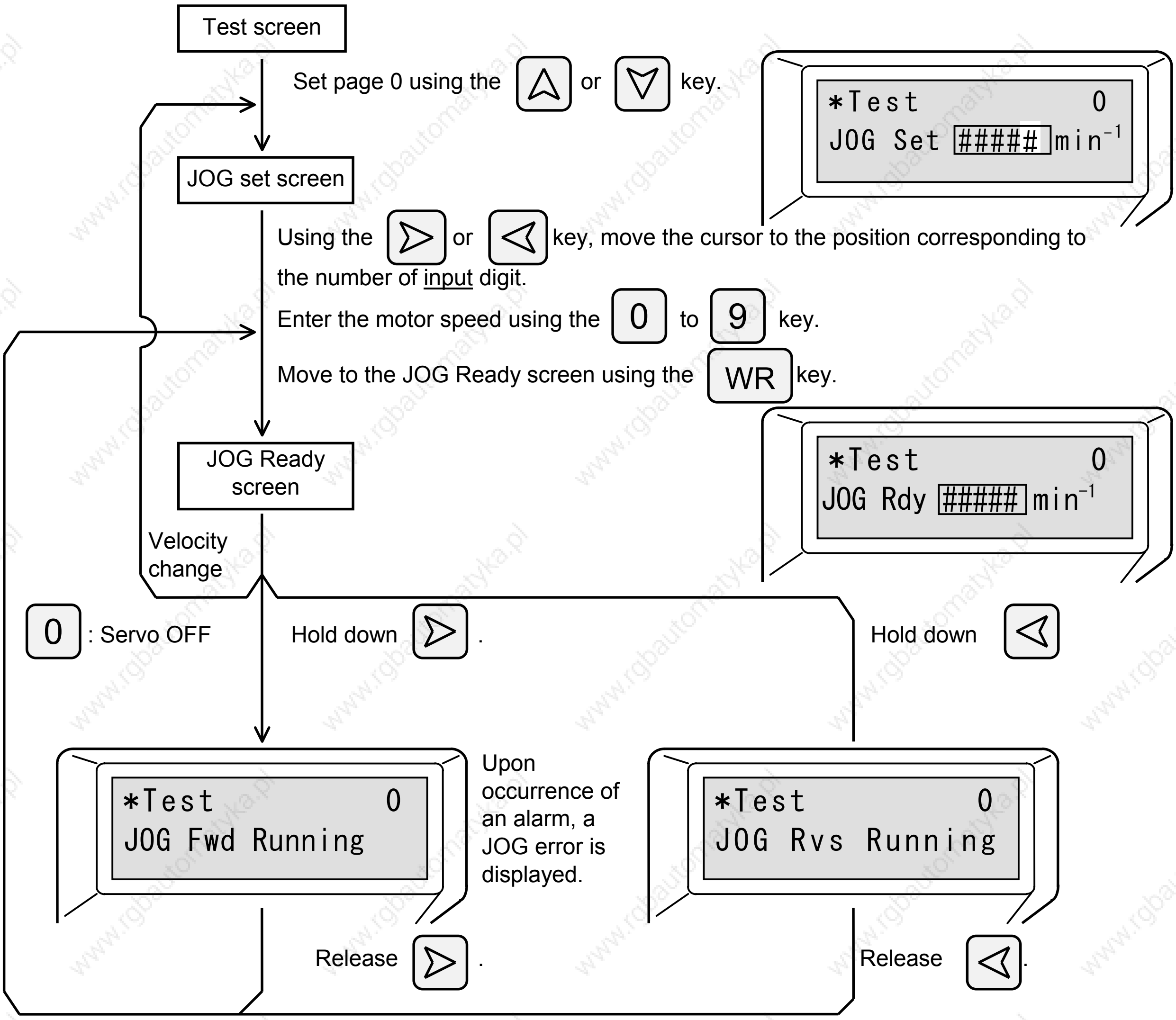
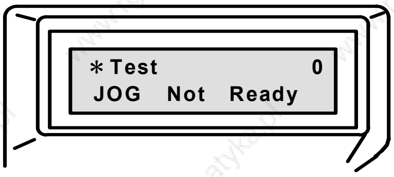


Fig. 7-11 JOG Operation Procedure

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:



∗Test 0
JOG Not Ready

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

7.1.9.2 Offline automatic tuning function

● Outline of offline automatic tuning function

The offline automatic 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 offline automatic 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 offline automatic tuning function or a tuning error may occur ("Tn_G 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 offline automatic tuning function is executed, the remote operator is dismounted from the Amplifier main body (remote operator POWER OFF).
- While offline automatic tuning function is executed, 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.
- Over travel status
- While command input is inhibited by holding brake timing or others.

● Offline automatic tuning operation

- For tuning rigidity to be tuned, select Low, Middle or High according to machine rigidity.
- When offline automatic 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 offline automatic 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 automatic 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.

● Setting together with Real time automatic tuning

In case of devise making real time automatic tuning valid during normal operation, it is required to set the gain in initial operation to low. Therefore, when executing offline automatic tuning in the device making real time automatic tuning valid, selecting low for machine rigidity is recommended.

(Refer to Chapter 11 for Tunings)

- **Offline automatic tuning procedure**

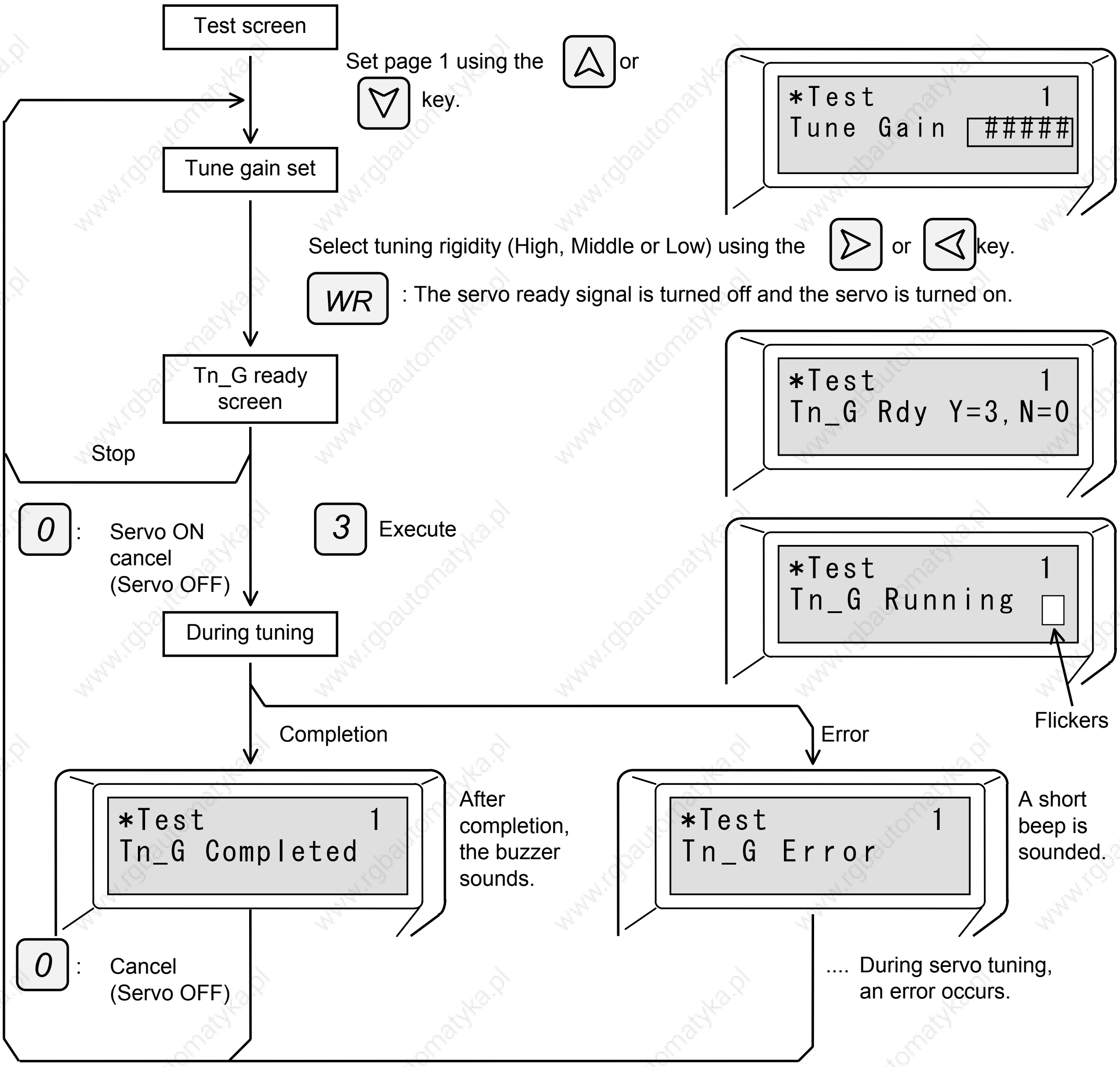
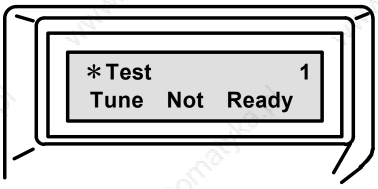


Fig. 7-12 Offline automatic Tuning Operation

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

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


∗Test 1
Tune Not Ready

The offline automatic tuning is enabled, the Tune Gain set screen appears.

7.1.9.3 Automatic notch filter tuning function

● Outline of Automatic notch filter tuning function (Tune IBEF)

The automatic notch filter tuning function operates the motor through the remote operator and estimates resonance point of current loop from its operating status, and proper parameters are automatically set as notch filter frequency. Current command BEF1 parameter (IBF1) is set using this function.

● Precautions on working and load conditions

When automatic notch filter 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 able to set by the automatic notch filter tuning function or a tuning error may occur ("Tn_F 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.
- While offline automatic tuning function is executed, the remote operator is dismounted from the Amplifier main body (remote operator POWER OFF).
- While offline automatic tuning function is executed, 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 under sine waveform current command peak.
- 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.
- Over travel status
- While command input is inhibited by holding brake timing or others.

● Automatic notch filter tuning operation (Tune IBEF)

- When automatic notch filter tuning is executed, forward/backward revolution is performed for about 1.5 seconds with a current command of 200 Hz to 1kHz 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.
- Current command peak value of sine waveform is equivalent to rated current (rated torque) at standard setting. User setting value (page3 of Mode3) can be also used as current command peak value. Execute tuning with appropriate current command according to load status.
- During automatic notch filter tuning, notch filter set by parameter (IBF1, IBF2) is invalid.
- When automatic notch filter tuning is ended normally, proper parameters are automatically set and the parameters are stored in the non-volatile memory.
- After execution of this automatic notch filter tuning function, a deviation of the position loop may be left. For this reason, make sure to clear the deviation before returning to normal operation.
- In this automatic notch filter tuning, a maximum resonance point is estimated and automatically set into the current command BEF1 (IBF1). When there are more than one resonance points, manually set the resonance point into current command BEF2 (IBF2).
- When notch filter is not necessary as a result of automatic notch filter tuning, current command BEF1 (IBF1) shall be set to 1000 Hz (filter invalid).

- **Automatic notch filter tuning (Tune IBEF) procedure**

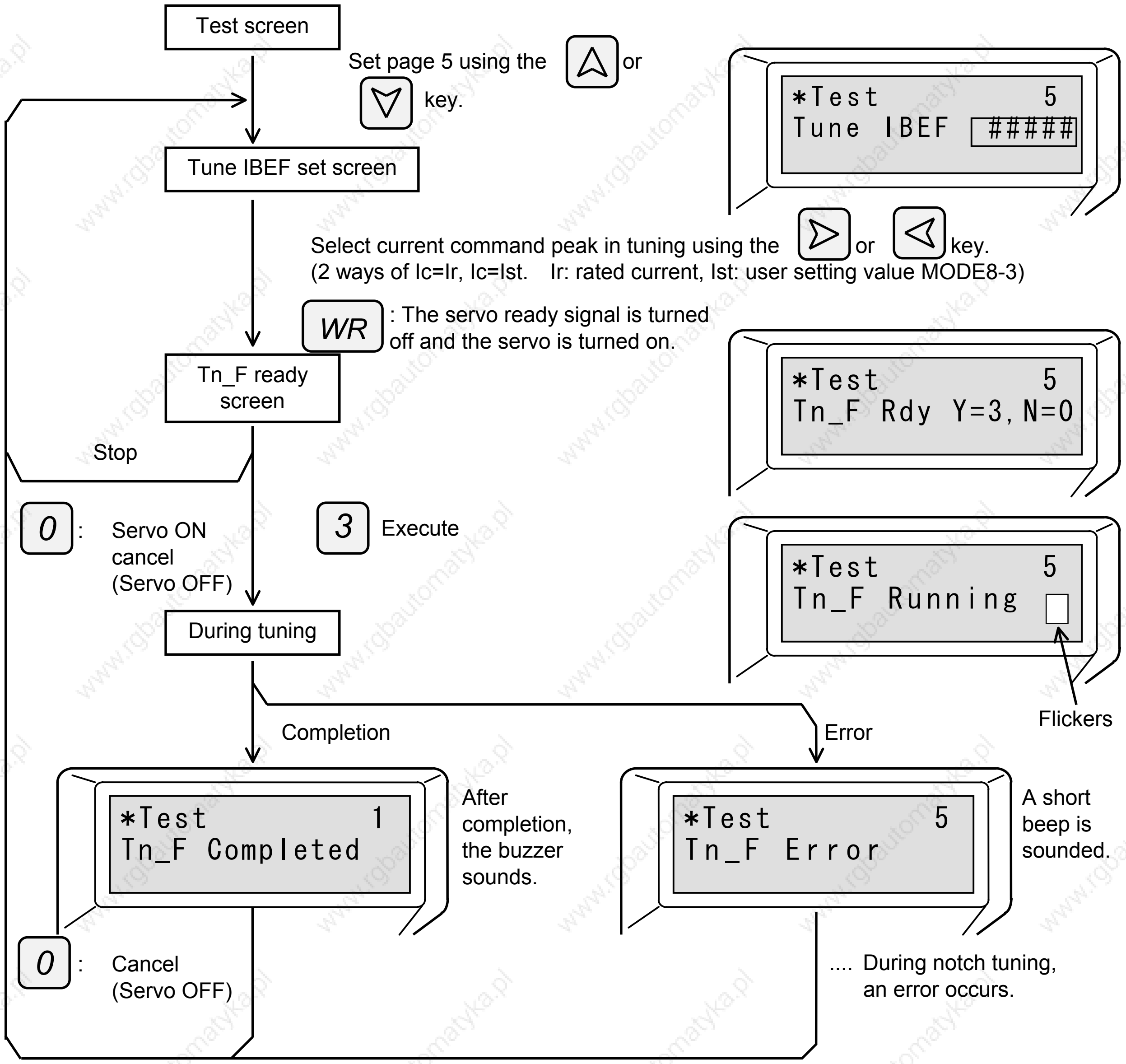
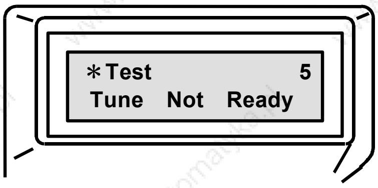


Fig. 7-13 Automatic Notch Filter Tuning Operation

After automatic notch filter tuning is completed, press the **0** key to return to the set screen from the ready screen, and then return to the initial screen using the MODE key.

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


*Test 5
Tune Not Ready

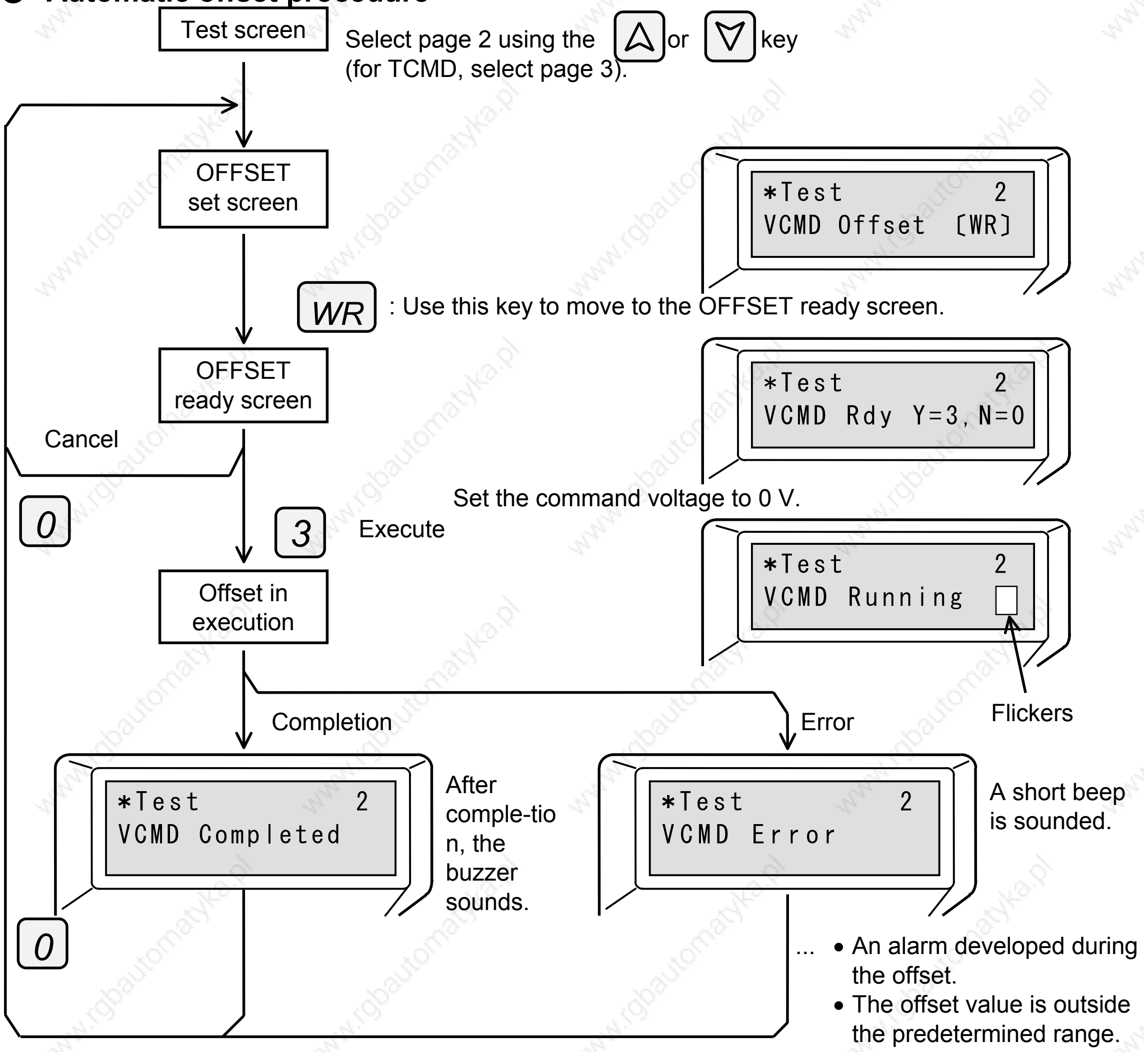
The automatic notch filter tuning is enabled, the Tune IBEF set screen appears.

7.1.9.4 Automatic offset function

- **Outline of automatic 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)

- **Automatic offset procedure**



```
*Test          2
VCMD Offset  [WR]
```

```
*Test          2
VCMD Rdy  Y=3, N=0
```

```
*Test          2
VCMD Running  □
```

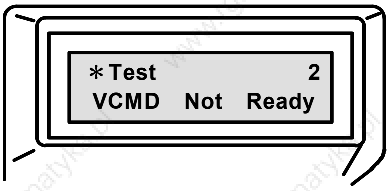
```
*Test          2
VCMD Completed
```

```
*Test          2
VCMD Error
```

Fig. 7-14 Automatic 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 bit6 = 0), the following message appears on the screen:



∗Test 2
VCMD Not Ready

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

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

- Screen No. 2 → 3.
- VCMD → TCMD.

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

7.1.9.5 Encoder clear function

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

- **Encoder clearing procedure**

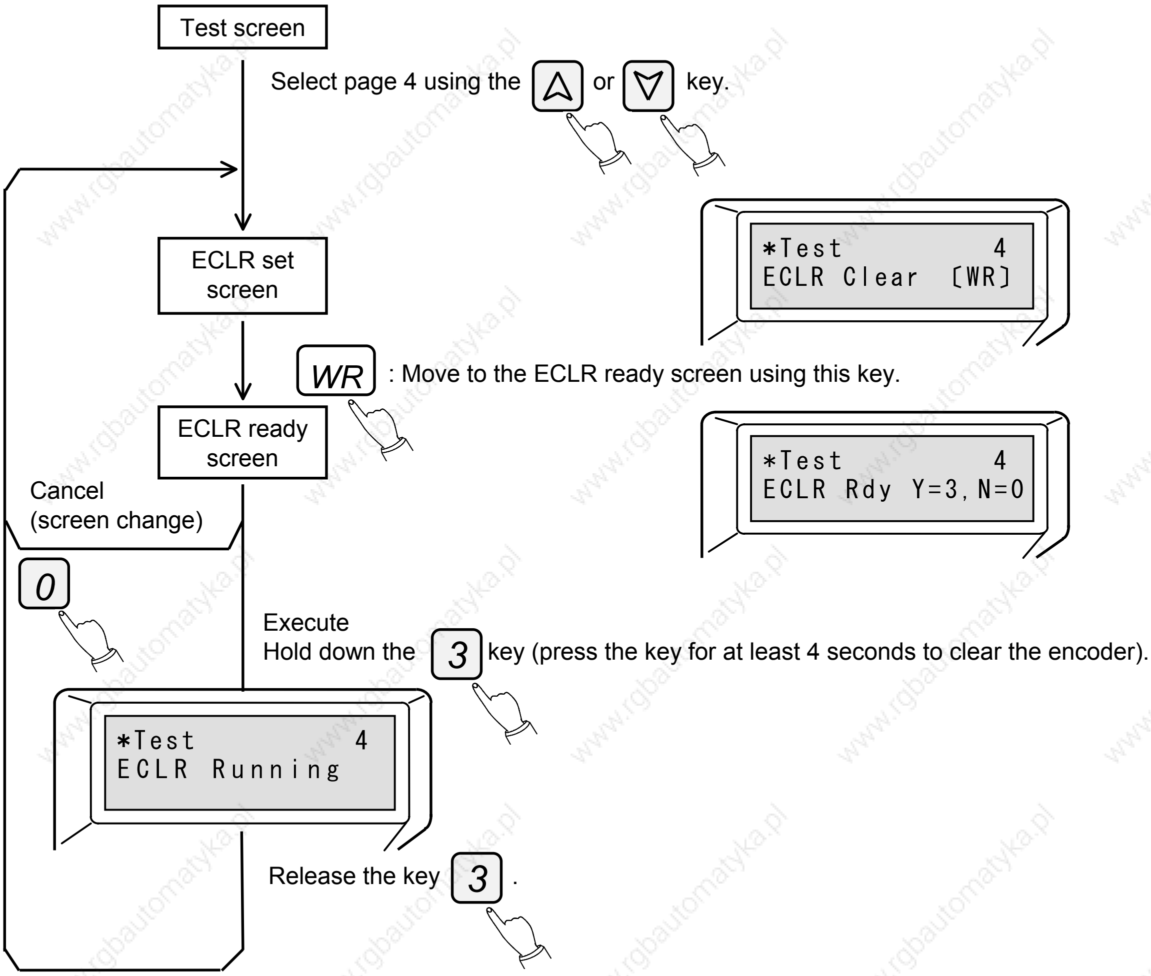
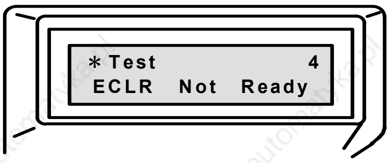


Fig. 7-15 Encoder Clear Operation Procedure

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

When the encoder clear is disabled (when Func6 bit6 = 0), the following message appears on the screen:



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

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

7. EXPLANATION OF PARAMETERS

7.2 Description of Parameters

7.2.1 Block Diagram of Position Control Type Parameters

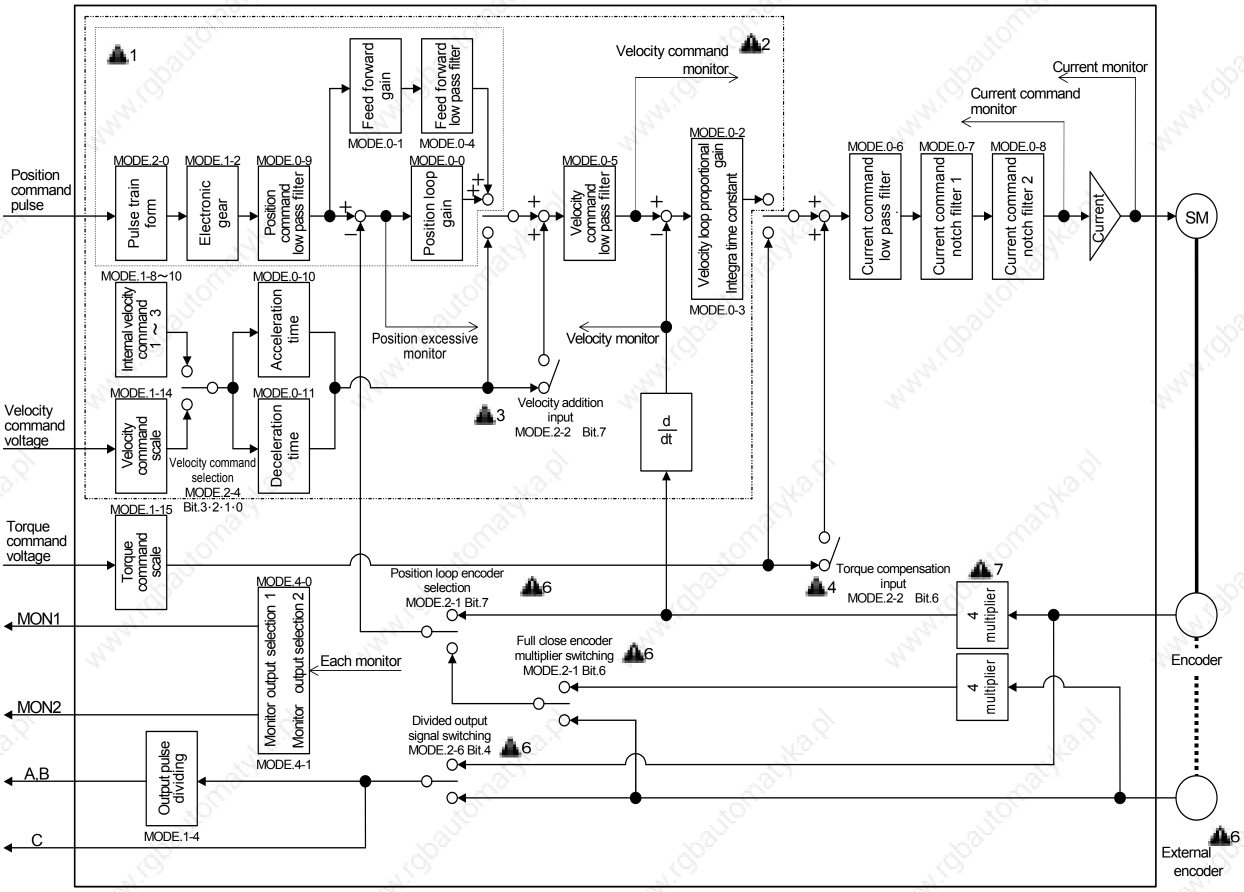


Fig. 7-15 Control System Block Diagram

1 Parts inside ⬚ do not function in the velocity/torque control mode.

2 Parts inside ⬚ 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.

6 An external encoder can be connected on a fully closed servo system only.
If your system is not fully closed, set bits7 and 6 of MODE.2-1 and bit4 of MODE.2-6 to zero.

7 The multiplication-by-4 function of the motor encoder applies only to INC-E and ABS-E . For ABS-RII, multiplication by 1 applies.

7.2.2 Parameter Summary Table

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
0	0	KpM	Position loop gain Monitor	45(30)	rad/S	-	
	1	KffM	Feed forward gain Monitor	0	%	-	
	2	KvpM	Velocity loop proportional gain Monitor	100(70)	Hz	-	
	3	TviM	Velocity loop integral time constant Monitor	15(20)	mSec	-	
	4	FLPM	Feed forward LPF Monitor	1000	Hz	-	
	5	VLPM	Velocity command LPF Monitor	1000	Hz	-	
	6	ILPM	Current command LPF Monitor	450	Hz	-	
	7	BFAM	Current command BEFA Monitor	1000	Hz	-	
	8	BFBM	Current command BEFB Monitor	1000	Hz	-	
	9	Tpcm	Position command LPF time constant Monitor	0	mSec	-	
	10	Tvac	Velocity command acceleration time	0	mSec	0 to 9999	
	11	Tvde	Velocity command deceleration time	0	mSec	0 to 9999	
	12	KvpA	Velocity loop proportional gain addition value	0	Hz	0 to 255	

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

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

* 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.

3 Cannot be changed without turning control power OFF once.

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

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

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
3	0				-	-	
	1				-	-	
	2				-	-	
	3	Vzero	Zero adjustment of velocity command	$$$$		±16383	
	4	Tzero	Zero adjustment of torque command	$$$$		±16383	
	5	Tn_Lv	Level of real time automatic tuning	0		±5	

Mode	Page	Abbre-viation	Name	Standard value	Unit	Setting range	Remarks
8	0						
	1						
	2						
	3	Tn_F	User setting value of current command when automatic notch filter tuning	100	%	30 to (⚠ 1)	
	4	O_JL	Observer・load inertia proportion	100	%	0 to 3000	

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

⚠ User setting value of torque command when automatic notch filter tuning cannot be over IP/IR × 100%.

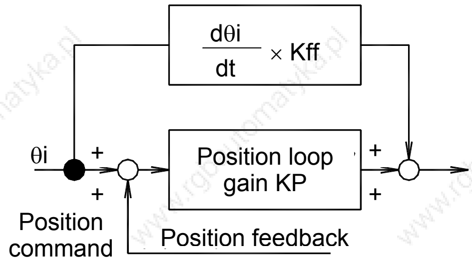
7. EXPLANATION OF PARAMETERS

Mode	Page	Abbre-viation	Name	Standard value	Setting range	Remarks
4	0	M1	Monitor 1 output	Vm0.5mV/min^{-1}	19 ranges	IR: Rated armature current
	1	M2	Monitor 2 output	Ic0.5 V/IR	19 ranges	
	2	Func	Servo function	Normal	4 ranges	
	3	TYPE	Control mode	$$$$	6 ranges	(⚠)
	4	ENKD	Encoder type	$$$$	3 ranges	(⚠)
	5	ABSF	ABS sensor format	$$$$	11 ranges	(⚠)
	6	MOT.	Motor type	$$$$	x - 42676	(⚠)
	7	MOKD	Motor configuration	Rotary	Rotary only	(⚠)
	8	PSKD	Power supply type	$$$$	PY2A: 1 range	(⚠)
	9	RGKD	Selection of regenerative resistor type	$$$$	2 ranges	(⚠)

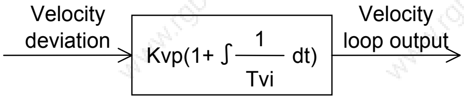
* The values denoted by $$$$ vary according to the specifications employed at the time of shipment.

⚠ 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.

7.2.3 Parameter List

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
9	0 to 7	Kp0 to Kp7	Position loop gain • Proportional gain of the position controller.	45 (30)	rad/s	1 to 1000	Position control
	8 to 15	Kff0 to Kff7	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
	16 to 23	Kvp0 to Kvp7	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

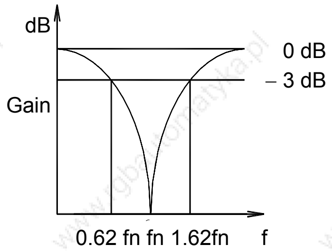
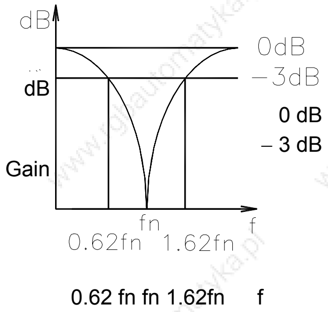
Values in parentheses are applicable to motors of other than P3 and P5 series.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
9	24 to 31	Tvi0 to Tvi7	Velocity loop integral time constant • Integral time constant of the velocity controller (proportional integral control). 	15 (20)	mSec	1 to 1000	Position and velocity control (⚠1)
	32 to 39	FLP0 to FLP7	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 (⚠2)
	40 to 47	VLP0 to VLP7	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 (⚠2)
	48 to 55	ILP0 to ILP7	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	(⚠2)

⚠

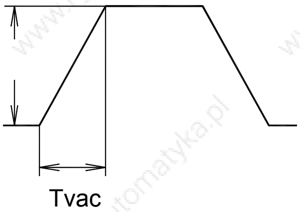
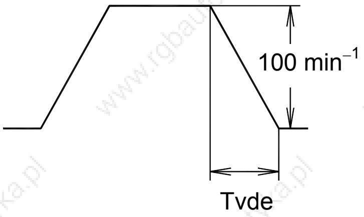
1 Selecting 1000 ms turns on the proportional control.
2 Selecting 1000 Hz disables the filter function.

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

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
9	56 to 63	BFA0 to BFA7	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 (⚠)
	64 to 71	BFB0 to BFB7	Current command BEF2 • For the current command in the velocity loop, this parameter sets the notch filter center frequency of the following characteristics. [Characteristics] 	1000	Hz	200 to 1000	In 10 Hz (⚠)

⚠ Selecting 1000 Hz disables the filter function.

7. EXPLANATION OF PARAMETERS

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

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

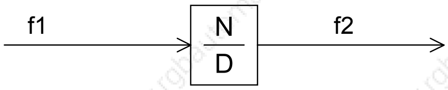
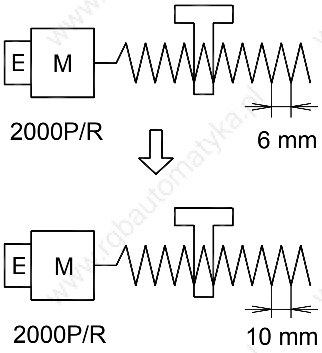
Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
0	12	KvpA	Velocity loop proportional gain addition value • This parameter is used for setting a weight per rotary switch 1. • The actual velocity loop proportional gain is: Kvp + (KvpA × RSW). When switching of the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

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

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	0	INP	In-position (positioning finish) signal width • This parameter selects the number of waiting pulses on the deviation counter that output the in-position signal. • The standard value is the encoder pulse irrespective of the electronic gear function or the command multiplier setting. <u>INC-E, ABS-E</u> Incremental pulse multiplied by 4 is standard. <u>ABS-RⅡ, ABS-E.S1</u> Sensor absolute value (PS) is standard. [Example] When the parameter is set at 64 with a 2000 pulse encoder, the positioning complete signal is output when the value falls in the following range toward the target position: 64 × 1/(2000 × 4) × 360° = 2.88°	64	pulse (+/–)	1 to 32767	Position control
	1	OVF	Excess deviation value • When the deviation counter exceeds the setting range, an OVF alarm occurs.	256	× 256 pulses	1 to 32767	Position control

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	2	EGER	Electronic gear ratio  N : 1 to 32767 $f2 = f1 \times N/D$ D : 1 to 32767 $1/32767 \leqq N/D \leqq 32767$ [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.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	3	PMUL	Command pulse multiplier • Set the parameter so that the position command pulse is multiplied by 1 to 63. • 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 automatic switching function is enabled: Proportional-plus-integral control when the speed is lower than the LTG setting. Proportional control when the speed is over the LEG setting.	50	min^{-1}	0 to 32767	

7. EXPLANATION OF PARAMETERS

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

7. EXPLANATION OF PARAMETERS

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

7. EXPLANATION OF PARAMETERS

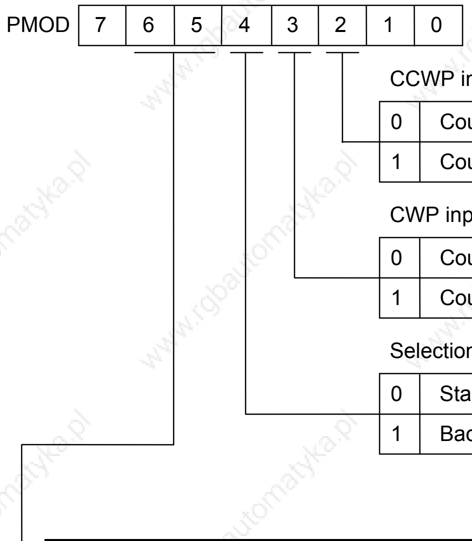
Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
1	12	SILM	Sequence current limit value • Sets a current limit value for holding brake sequencing, overtravel or JOG operation. • This setting is available within the range of IP/IR × 100.	120	%	30 to (IP/IR) × 100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

Mode	Page	Abbreviation	Name and description	Standard value	Unit	Setting range	Remarks
1	16	MENP	Motor encoder pulse number • Sets the number of pulses of the encoder used. • The following shows the number of encoder pulse in standard combination: Saved wiring incremental encoder --- 2000 P/R. Absolute encoder --- 2048 P/R.	$$$$	P/R	500 to 65535	(⚠1) (⚠2)
	17	EENP	Number of pulses of fully closed encoder • Sets the number of pulses of the encoder used in terms of the motor shaft. • This parameter is usable only on the servo system that supports the fully closed design.	$$$$	P/R	500 to 65535	(⚠ 1) (⚠ 2)
	18	OLWL	Over load warning level • This parameter is for warning output before getting into over load alarm status and motor stoppage (see 9.6 warning output for over load warning output function). • Possible setting level range is from 30 to 99% when over load alarm level is regarded as 100%. There will be no over load warning output in setting 100%.	100	%	30 to 100	(⚠ 2)

⚠

1 When changing your setting, set Func6 bit7 to "1" from Screen Mode 2 prior to the change.
2 Turn the control power off once before the change.

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



CCWP input polarity switching

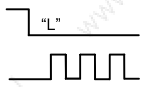
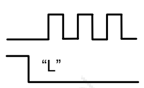
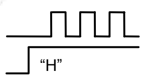
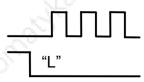
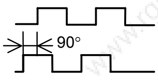
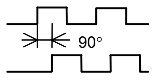
0	Counts at the rising edge.
1	Counts at the falling edge.

CWP input polarity switching

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

Selection of revolution direction ⚠3

0	Standard.
1	Backward revolution.

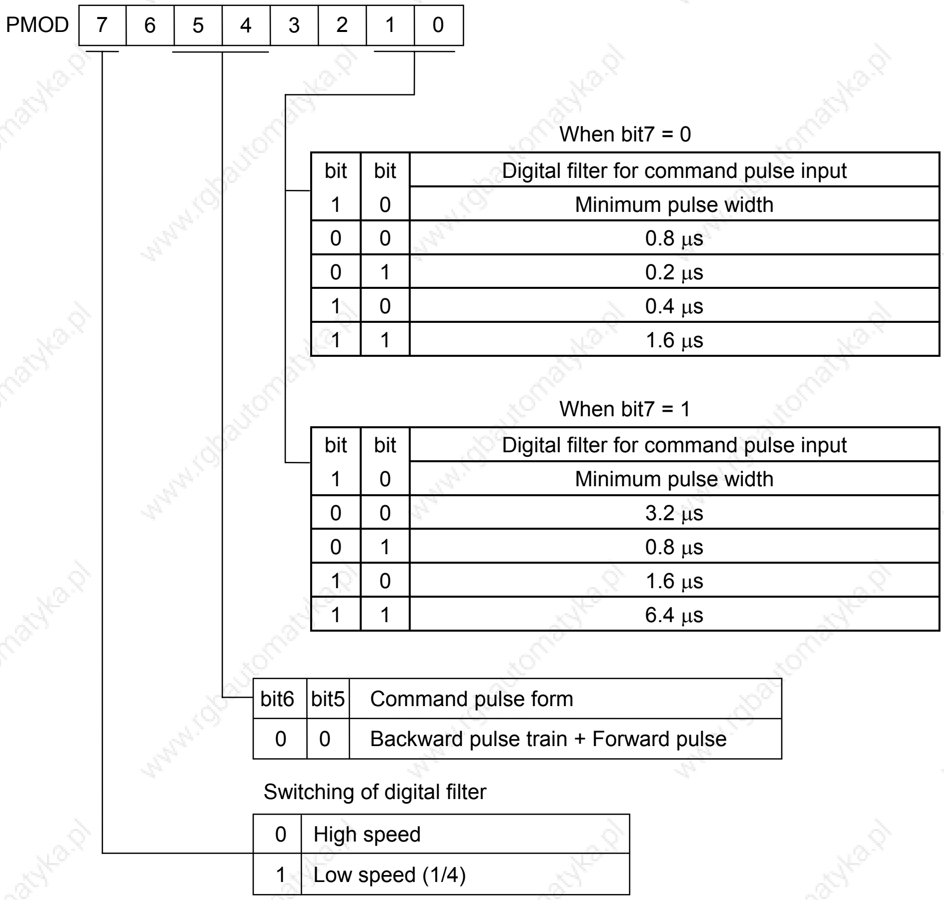
Bit 6	Bit 5	Command pulse form	Motor forward revolution command	Motor backward revolution command	CN1	
0	0	Forward revolution pulse train + backward revolution pulse train			28, 29 26, 27	When the revolution direction bit is set at “0”.
1	0	Code + pulse train			28, 29 26, 27	
0	1	90° phase difference two-phase pulse train.			28, 29 26, 27	
1	1	Prohibited				

1 For setting of bit7, 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	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Position command pulse train form 0 and 1 of bit7 specify setting of the digital filter used for the position command pulse train input. The following describes the digital filter setting corresponding to each input pulse form. ① Backward pulse train + Forward pulse train				



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

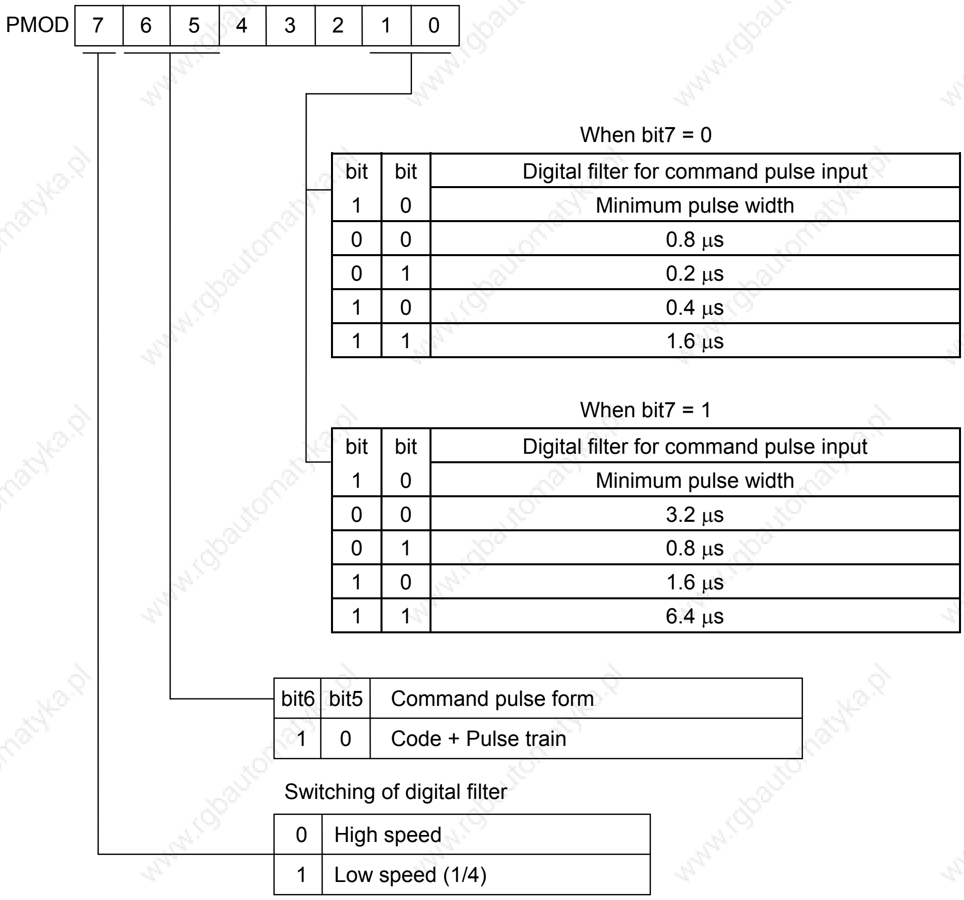
Switching of digital filter

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.

7. EXPLANATION OF PARAMETERS

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



When bit7 = 0

bit 1	bit 0	Digital filter for command pulse input Minimum pulse width
0	0	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	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	0	PMOD	Position command pulse train form ③ 90° phase difference two-phase pulse train				

PMOD	7	6	5	4	3	2	1	0

When bit7 = 0

bit 1	bit 0	Digital filter for command pulse input	
		Minimum pulse width	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	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

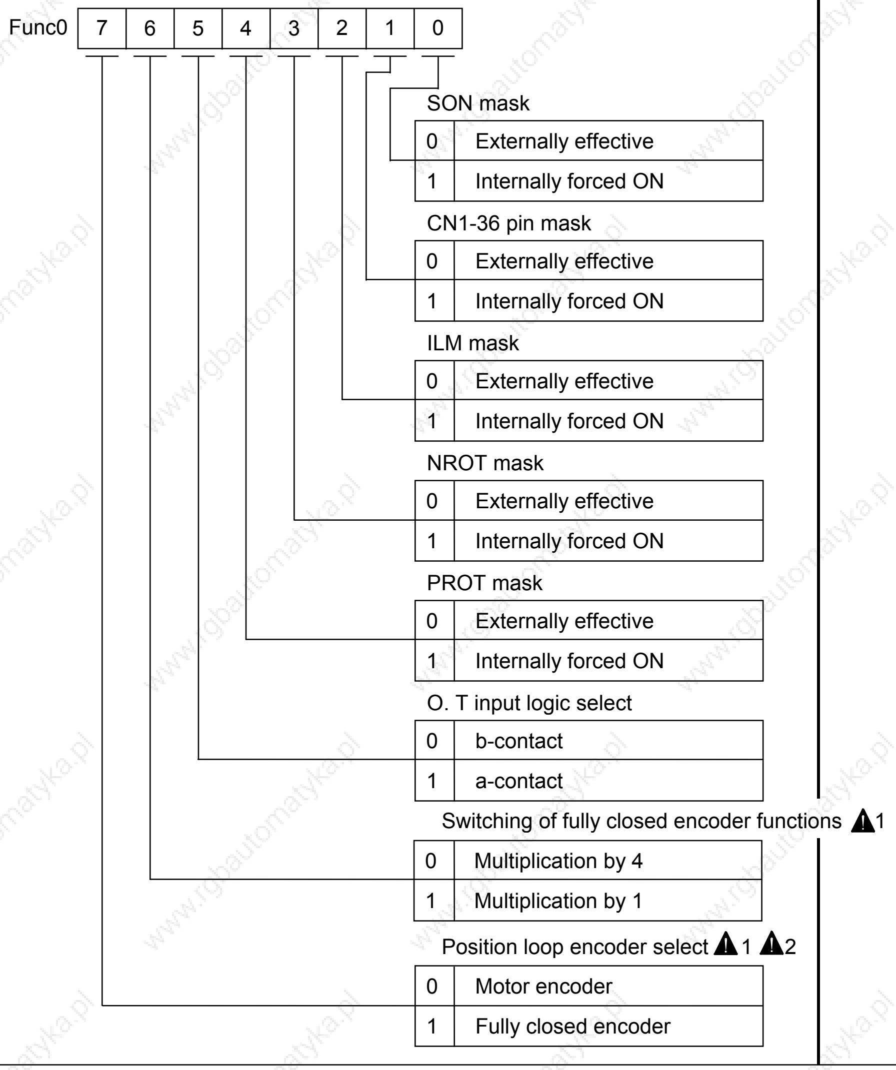
bit6	bit5	Command pulse form
0	1	90° phase difference two-phase pulse

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.

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



SON mask

0	Externally effective
1	Internally forced ON

CN1-36 pin mask

0	Externally effective
1	Internally forced ON

ILM mask

0	Externally effective
1	Internally forced ON

NROT mask

0	Externally effective
1	Internally forced ON

PROT mask

0	Externally effective
1	Internally forced ON

O. T input logic select

0	b-contact
1	a-contact

Switching of fully closed encoder functions ⚠1

0	Multiplication by 4
1	Multiplication by 1

Position loop encoder select ⚠1 ⚠2

0	Motor encoder
1	Fully closed encoder

⚠

1 This function is available only with a servo system that supports the fully closed design.

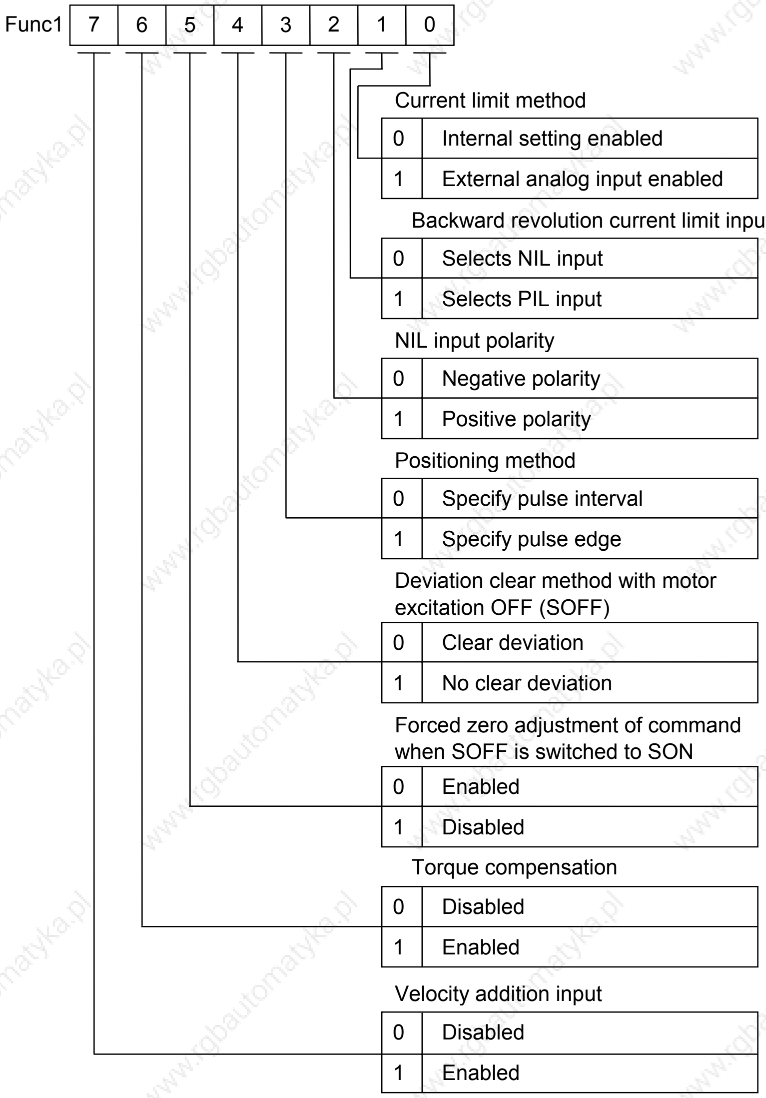
2 Selecting a fully closed encoder does not change the divided output. Thus, when you need a divided output for the fully closed encoder, set Func5 bit4 to "1".

3 When overtravel bits 3 and 4 are internally turned on, they become ineffective if the overtravel input logic is b-contact. And, they are always in overtravel status if the overtravel input logic is a-contact.

4 When changing the setting of bit 7 or 6, you must turn the control power off once prior

7. EXPLANATION OF PARAMETERS

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



Current limit method

0	Internal setting enabled
1	External analog input enabled

Backward revolution current limit input

0	Selects NIL input
1	Selects PIL input

NIL input polarity

0	Negative polarity
1	Positive polarity

Positioning method

0	Specify pulse interval
1	Specify pulse edge

Deviation clear method with motor excitation OFF (SOFF)

0	Clear deviation
1	No clear deviation

Forced zero adjustment of command when SOFF is switched to SON

0	Enabled
1	Disabled

Torque compensation

0	Disabled
1	Enabled

Velocity addition input

0	Disabled
1	Enabled

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

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

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

7. EXPLANATION OF PARAMETERS

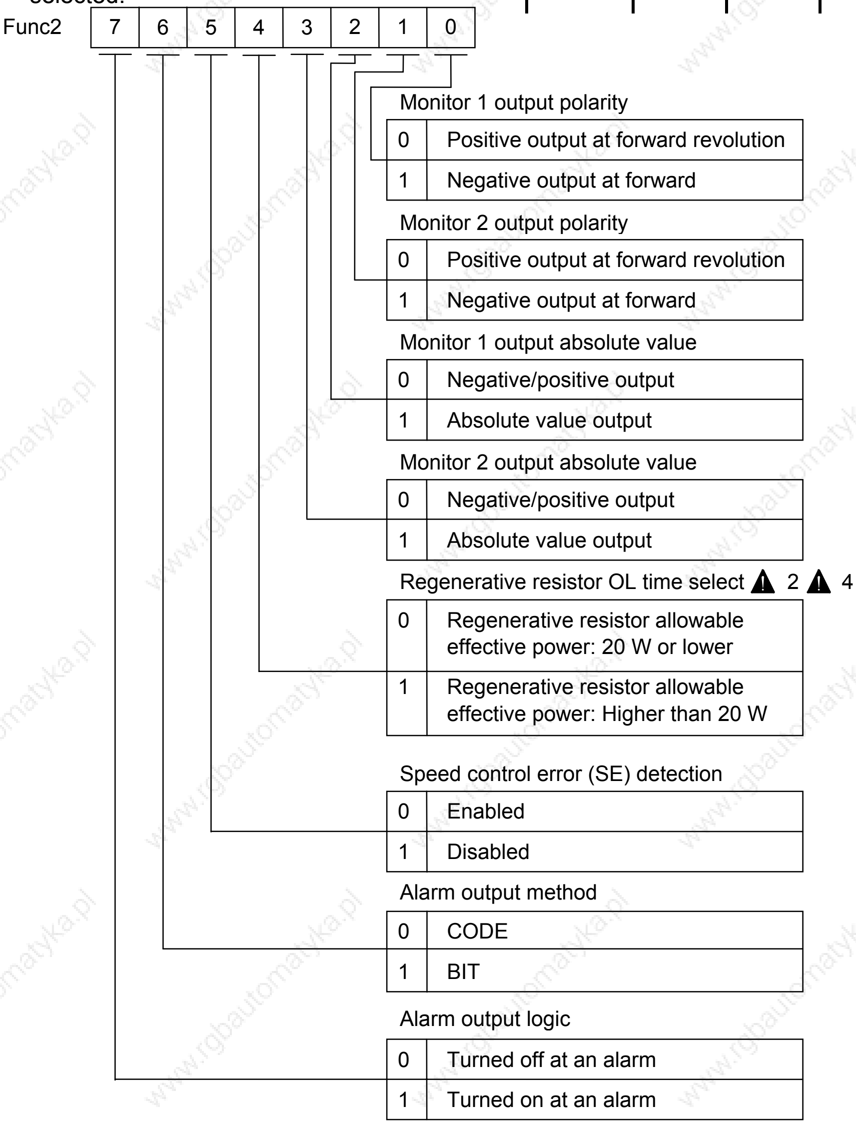
Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	2	Func1	Amplifier function select 1 • How to use different current limit approaches Bits 2 to 0 are parameters relevant to current limit. The following describes their setting and the corresponding current limit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

Func1

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

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

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



Monitor 1 output polarity

0	Positive output at forward revolution
1	Negative output at forward

Monitor 2 output polarity

0	Positive output at forward revolution
1	Negative output at forward

Monitor 1 output absolute value

0	Negative/positive output
1	Absolute value output

Monitor 2 output absolute value

0	Negative/positive output
1	Absolute value output

Regenerative resistor OL time select ⚠ 2 ⚠ 4

0	Regenerative resistor allowable effective power: 20 W or lower
1	Regenerative resistor allowable effective power: Higher than 20 W

Speed control error (SE) detection

0	Enabled
1	Disabled

Alarm output method

0	CODE
1	BIT

Alarm output logic

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

⚠

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

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

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

4 The 15 A and 30 A capacity amplifiers do not have built-in regenerative resistors.
- Bit 4 shall be set according to the permissible effective power of the external regenerative resistor used.

The 50 A capacity amplifiers have built-in regenerative resistor.
- When using a built-in regenerative resistor, set bit 4 at “0”.
- When using an external regenerative resistor, set bit 4 according to the permissible effective power of the resistor.

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

Func3	7	6	5	4	3	2	1	0

CN1-35 pin input select (⚠ 5,7)

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

CN1-36 pin input select (⚠ 5,7)

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

External overheating detection input select (⚠ 6)

bit 5	bit 4	
0	0	Disables external overheating detection
1	0	
0	1	Enables external overheating detection Enables CN1-35 pin
1	1	Enables external overheating detection Enables CN1-36 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)

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

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbre-viation	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. Note 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 5, 4, 1 or 0 is disabled except for the external overheating detection or 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 5, 4, 3 or 2 is disabled except for the external overheating detection or internal velocity setting function.

   When the control mode and gain switching are assigned to the same pin, both switching 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 switching.

   At the same time, control mode and gain switching are made valid (this, however, is only effective when the velocity control mode including the control mode switching mode is selected).

   When the external overheating detection is enabled, the control mode or gain switching function is not enabled even if the control mode or gain switching function is set to the same pin.

   When the external overheating detection is enabled, enabling the internal velocity setting function enables both functions at the same time. When the external overheating detection input is turned off, however, alarm "E" is issued.
5. When the same signal is selected for both the CN1-35 and 36 pins, pin 36 takes precedence over pin 35.
6. [External overheating detection input function]

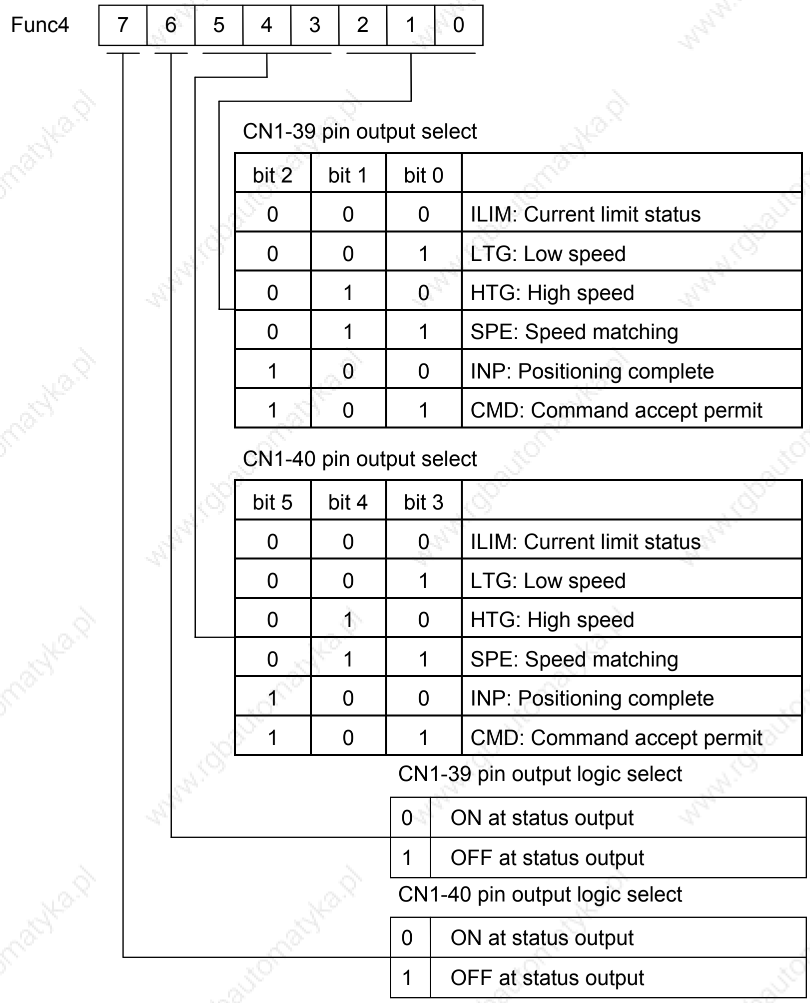
   Setting bit4 to 1 enables the external overheating detection function.

   The normal state refers to when the enabled input is turned on and the external overheating alarm is issued when the enabled input is turned off.

   When another signal is assigned to the same terminal as the external overheating input, functions other than the internal velocity setting function are disabled.
7. In case of torque control, inputting any selected function except for “ECLR” at bit3, 2, 1 or 0 will be invalid.

7. EXPLANATION OF PARAMETERS

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



CN1-39 pin output select

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

CN1-40 pin output select

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

CN1-39 pin output logic select

0	ON at status output
1	OFF at status output

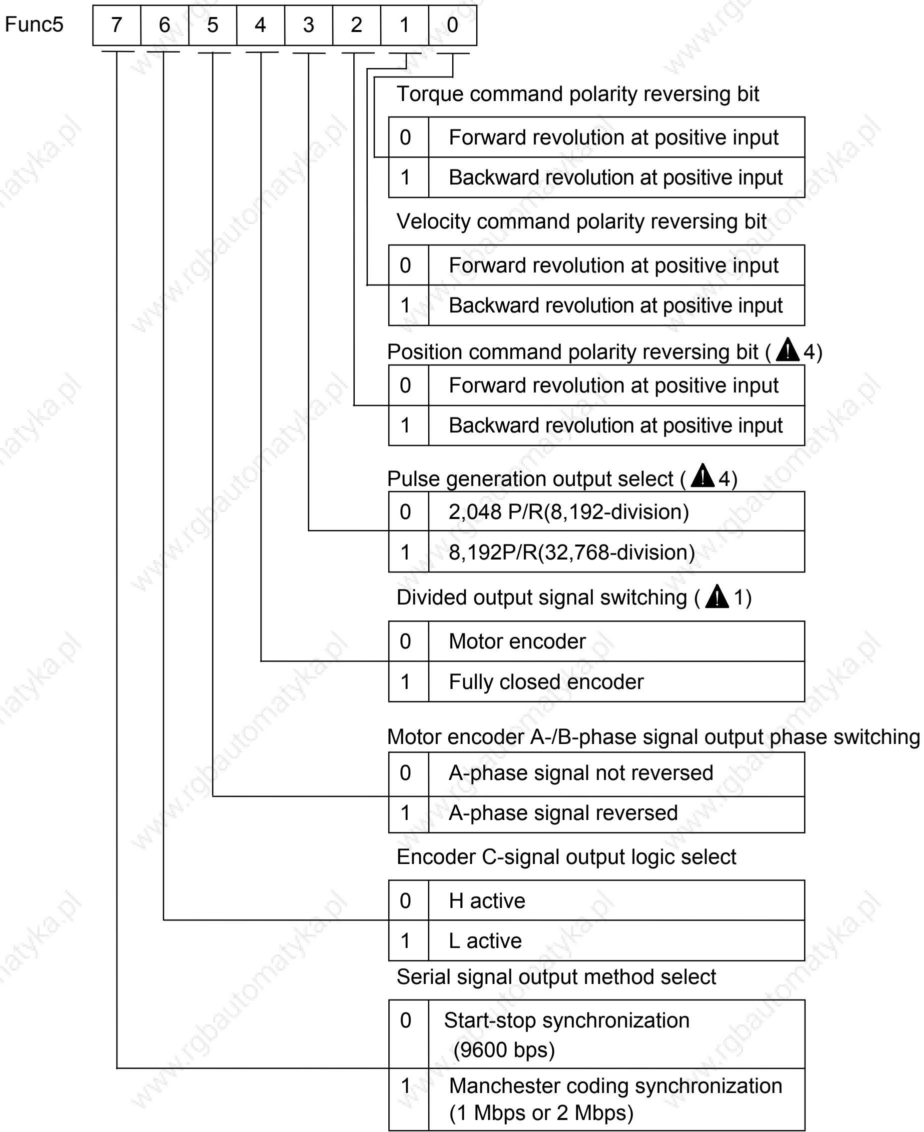
CN1-40 pin output logic select

0	ON at status output
1	OFF at status output

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

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

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



Torque command polarity reversing bit

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

Velocity command polarity reversing bit

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

Position command polarity reversing bit (⚠ 4)

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

Pulse generation output select (⚠ 4)

0	2,048 P/R(8,192-division)
1	8,192P/R(32,768-division)

Divided output signal switching (⚠ 1)

0	Motor encoder
1	Fully closed encoder

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

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

Encoder C-signal output logic select

0	H active
1	L active

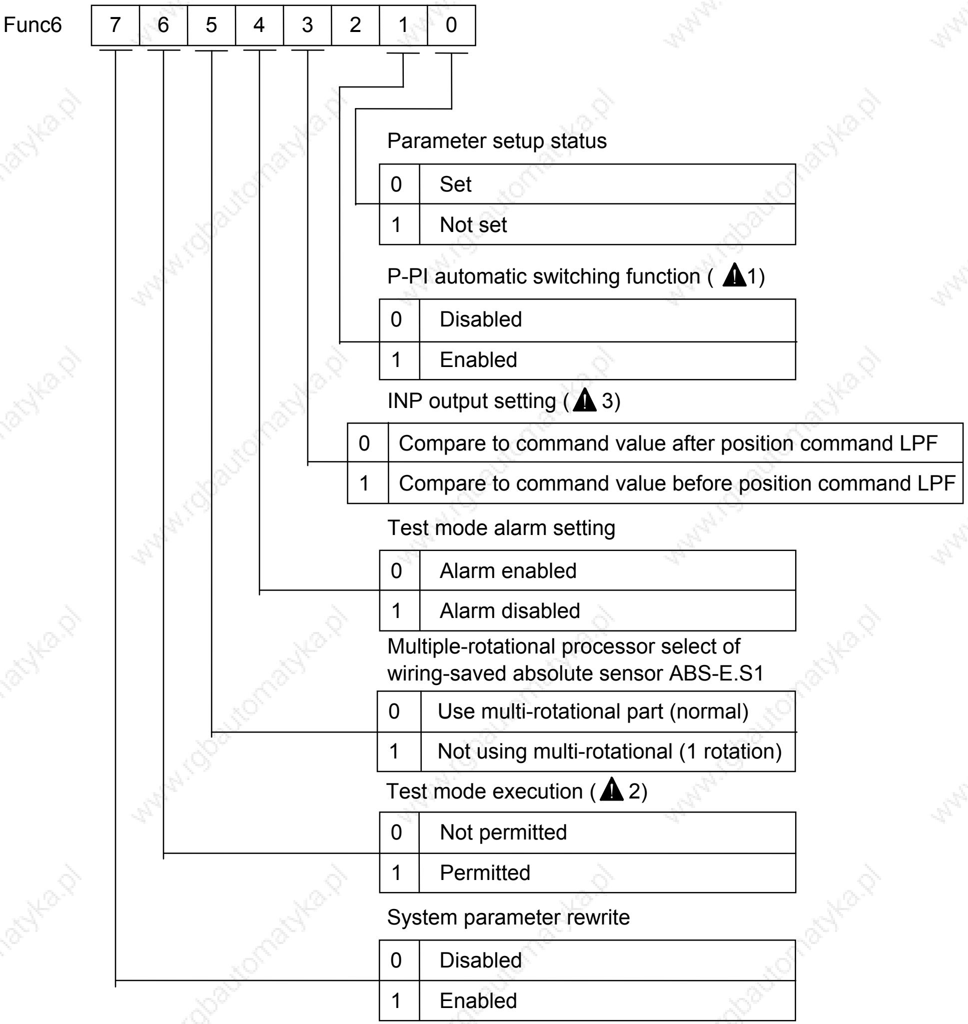
Serial signal output method select

0	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, 4 and 3, 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 or Wiring-saved absolute sensor ABS-E.S1 is used.
The number of incremental pulses to be output from CN1-3 to 8 pins can be selected.
5 Bit2 of Func5 and bit4 of PMOD function the same. When 1 is set to both bits, the system is rotated forward at positive input.

Mode	Page	Abbre-viation	Name and description	Standard value	Unit	Setting range	Remarks
2	7	Func6	Amplifier function select 6 • This parameter is used for changing the contents of parameters or permitting execution of the test mode.	0000-0000		0, 1	



Parameter setup status

0	Set
1	Not set

P-PI automatic switching function (⚠1)

0	Disabled
1	Enabled

INP output setting (⚠ 3)

0	Compare to command value after position command LPF
1	Compare to command value before position command LPF

Test mode alarm setting

0	Alarm enabled
1	Alarm disabled

Multiple-rotational processor select of wiring-saved absolute sensor ABS-E.S1

0	Use multi-rotational part (normal)
1	Not using multi-rotational (1 rotation)

Test mode execution (⚠ 2)

0	Not permitted
1	Permitted

System parameter rewrite

0	Disabled
1	Enabled

Note: Set bit2 to “0”.

* 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".

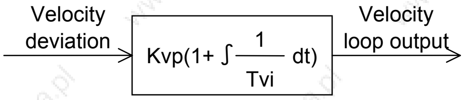
* If bit 0 is set at "1", alarm (memory error) will be indicated. After setting necessary parameter, set bit 0 to "0", then turn power on.

1 Automatic switch function between proportional and proportional-plus-integral controls is enabled by setting bit1 to “1”. When automatic switch function is enabled, control type is:
Proportional-plus-integral control when at or lower than set speed in LTG on page5 of Mode1.
Proportional control when speed is higher than set speed in LTG on page5 of Mode1.

2 When using wiring-saved absolute sensor ABS-E.S1, multiple-rotational data will be invalid by setting bit5 to “1” (1 rotational mode). When multiple-rotational data is not required application, battery connection is not necessary. Set bit5 to “0” except for using wiring-saved absolute sensor ABS-E.S1.

3 Cannot set bit5 and 3 without turning off the power once.

7. EXPLANATION OF PARAMETERS

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

⚠
When changing the value, store your setting in the non-volatile memory using either the WR, ON MODE, △ or ▽ key.

If turning off the control power without this key operation, the setting will not be stored.

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

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

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

<table>
<tr><th>Mode</th><th>Page</th><th>Abbre-viation</th><th>Name and description</th><th>Standard value</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>4</td><td>0</td><td>M1</td><td>Monitor output select 1
• The contents of monitor 1 output (CN1-15 pin) can be selected among the following 19 types.
<table>
<tr><th>Indication</th><th colspan="2">Contents</th></tr>
<tr><td>Im 2 V/IR</td><td>Current monitor</td><td>2 V/IR peak</td></tr>
<tr><td>Ic 2 V/IR</td><td>Current command</td><td>2 V/IR peak</td></tr>
<tr><td>Vm 2 mV/min^{-1}</td><td>Velocity monitor</td><td>2 mV/min^{-1}</td></tr>
<tr><td>Vm 1 mV/min^{-1}</td><td>Velocity monitor</td><td>1 mV/min^{-1}</td></tr>
<tr><td>Vm 3 mV/min^{-1}</td><td>Velocity monitor</td><td>3 mV/min^{-1}</td></tr>
<tr><td>Vc 2 mV/min^{-1}</td><td>Velocity command</td><td>2 mV/min^{-1}</td></tr>
<tr><td>Vc 1 mV/min^{-1}</td><td>Velocity command</td><td>1 mV/min^{-1}</td></tr>
<tr><td>Vc 3 mV/min^{-1}</td><td>Velocity command</td><td>3 mV/min^{-1}</td></tr>
<tr><td>Per 50 mV/P</td><td>Position deviation</td><td>50 mV/1 pulse</td></tr>
<tr><td>Per 20 mV/P</td><td>Position deviation</td><td>20 mV/1 pulse</td></tr>
<tr><td>Per 10 mV/P</td><td>Position deviation</td><td>10 mV/1 pulse</td></tr>
<tr><td>Rm 0.3 V/Full</td><td>Regenerative load factor</td><td>0.3 V/Full</td></tr>
<tr><td>Im 0.5 V/IR</td><td>Current monitor</td><td>0.5 V/IR peak</td></tr>
<tr><td>Ic 0.5 V/IR</td><td>Current command</td><td>0.5 V/IR peak</td></tr>
<tr><td>Vm 0.5 mV/min^{-1}</td><td>Velocity monitor</td><td>0.5 mV/min^{-1}</td></tr>
<tr><td>Vc 0.5 mV/min^{-1}</td><td>Velocity command</td><td>0.5 mV/min^{-1}</td></tr>
<tr><td>Per 5 mV/P</td><td>Position deviation</td><td>5 mV/1 pulse</td></tr>
<tr><td>Im 1V/IR</td><td>Current monitor</td><td>1V/IR peak</td></tr>
<tr><td>Ic 1V/IR</td><td>Current command</td><td>1V/IR peak</td></tr>
</table>
Where,
IR : Rated armature current.
Full : Allowable power of built-in regenerative resistor.</td><td>Vm0.5 mV/min^{-1}</td><td>19 types</td><td></td></tr>
<tr><td></td><td>1</td><td>M2</td><td>Monitor output select 2
• The monitor 2 output (CN1-16 pin) can be selected from the 19 types above (M1).</td><td>Ic0.5 V/IR</td><td>19 types</td><td></td></tr>
</table>

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

7. EXPLANATION OF PARAMETERS

<table>
<tr><th>Mode</th><th>Page</th><th>Abbre-viation</th><th>Name and description</th><th>Standard value</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>4</td><td>2</td><td>Func</td><td>Servo function select
• Selectable enabled/ disabled of gain switch and real time automatic tuning functions.
<table>
<tr><th>Indication</th><th>Contents</th></tr>
<tr><td>Normal</td><td>Gain switching disabled
Real time automatic tuning disabled</td></tr>
<tr><td>Gain_Sel.</td><td>Gain switching enabled
Real time automatic tuning disabled</td></tr>
<tr><td>Gain_Tun.</td><td>Gain switching disabled
Real time automatic tuning enabled</td></tr>
<tr><td>Gsel&Gtun</td><td>Gain switching enabled
Real time automatic tuning enabled</td></tr>
</table>
</td><td>Normal</td><td>4 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>

⚠ Changing Func allows switching the servo gain during operation.

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

1 Turn off the control power before change.
2 Change is effective only after Func6 bit7 is set at "1" from Screen Mode 2.
3 If the above operation (Func6 bit7 to "1") is ignored, the parameter change is invalid

<table>
<tr><th>Mode</th><th>Page</th><th>Abbre-viation</th><th>Name and description</th><th>Standard value</th><th>Setting range</th><th>Remarks</th></tr>
<tr><td>4</td><td>4</td><td>ENKD</td><td>Encoder type
• Selects the type of encoder used.
<table>
<tr><th>Indication</th><th>Contents</th></tr>
<tr><td>INC.E</td><td>Incremental encoder with reduced wiring</td></tr>
<tr><td>ABS.E(1M)</td><td>Absolute encoder (1 Mbps)</td></tr>
<tr><td>ABS.E(2M)</td><td>Absolute encoder (2 Mbps)</td></tr>
<tr><td>ABS.E S1.2</td><td>Wiring-saved absolute sensor</td></tr>
</table>
$$$$: The standard value varies according to the specifications employed at the time of shipment.</td><td>$$$$</td><td>4 types</td><td></td></tr>
<tr><td></td><td>5</td><td>ABSF</td><td>ABS sensor format
• A desired format can be selected from the following.
2048FMT
4096FMT
8192FMT
16384FMT
32768FMT
65536FMT
131072FMT
262144FMT
524288FMT
1048576FMT
2097152FMT</td><td>$$$$</td><td>11 formats</td><td></td></tr>
<tr><td></td><td>6</td><td>MOT.</td><td>Motor type
• Selects the motor used (in each series).
• Selectable motor types vary with the amplifier capacity.</td><td>$$$$</td><td>A motor from the P1, P2, P3, P5, P6 and P8 series.</td><td></td></tr>
<tr><td></td><td>7</td><td>MOKD</td><td>Motor configuration
• Cannot select except for rotary motor.</td><td>Rotary</td><td>Rotary only</td><td></td></tr>
</table>

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

1 Turn off the control power before change.
2 Change is effective only after Func6 bit7 is set at "1" from Screen Mode 2.
3 If the above operation (Func6 bit7 to "1") is ignored, the parameter change is invalid and,

Encoder type (ENKD) on page 4 may not be able to be displayed or set according to hardware type.

7. EXPLANATION OF PARAMETERS

Mode	Page	Abbre- viation	Name and description	Standard value	Setting range	Remarks
4	8	PSKD	Power supply type • Selects the type of power supply for the servo amplifier's main power supply circuit. • Selectable power supplies differ depending on the amplifier series. PY2A series (200 VAC input type) 200 VAC, 3ph (200 VAC, 3-phase) ↓ ↑ 200 VAC, 1ph (200 VAC, single-phase) PY2E series (100 VAC input type) Only 100 VAC, 1ph (100 VAC, single-phase) can be used, and changing to another power supply is impossible. • In the case of special motors (motor code: FF), the type of power supply cannot be selected. Motor codes are indicated on the initial screen. (Refer to 7.1.3 Basic Operating Procedure.)	$$$$	2 types 1 type	PY2Axxx PY2Exxx
	9	RGKD	Regenerative resistor type • Selecting regenerative resistor to use. • Selectable Motor differs according to Servo Amplifier capacity. None/ Ext.R : Regenerative resistor is not connected, or external regenerative resistor. Built-in R : Built-in regenerative resistor Refer to 9.5 Built-in Regenerative resistor (Built-in R) for detail of parameter setting on regenerative resistor.	$$$$	2 types	

When using regenerative resistor built-in the Servo Amplifier, make sure to set regenerative resistor type (RGKD) on page 9 to "built-in regenerative resistor (built-in R)". With this parameter setting, enable/ disable of built-in regenerative resistor overheat protection detection processor is judged. In case that "regenerative resistor is not connected or external regenerative resistor (None/ Ext.R)" is selected, overheat detection of built-in regenerative resistor will not be executed. Consequently, built-in regenerative resistor may be burn or smoke occurs.

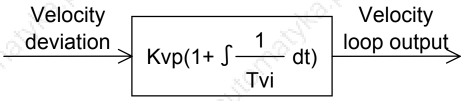
$$$$: The standard value varies according to the specifications employed at the time of shipping.

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

1. Turn off the control power before change.
2. Change is effective only after Func6 bit7 is 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.

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

7. EXPLANATION OF PARAMETERS

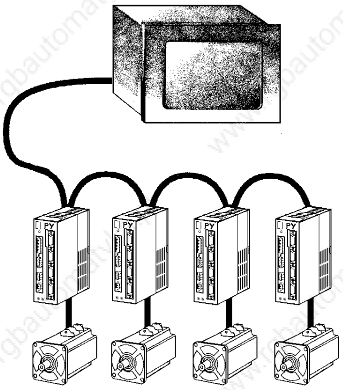
Mode	Page	Abbreviation	Name and description	Standard value	Setting range	Remarks	Mode
8	0	Kp2	Position loop gain 2 • Proportional gain of the position controller. • Enabled during gain switching.	45 (30)	rad/S	1 to 1000	Position control
	1	Kvp2	Velocity loop proportional gain 2 • Proportional gain of the velocity controller (proportional integral controller). Setting unit represents the value when the load inertial is 0. • Enabled during gain switching.	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).  • Enabled during gain switching.	15 (20)	mSec	1 to 1000	Position/ Velocity control (⚠)
	3	Tn_F	User setting value of current command when automatic notch filter tuning: • User setting value of current command when executing automatic notch filter tuning at test mode.　Selecting Ic=Ist on Tune IBEF setting screen enables automatic notch tuning execution at current command of user setting value (Tn_F).	100	%	30 to (IP/IR) ×100	
	4	O_JL	Observer・load inertia ratio • Parameter to estimate load torque used for real time automatic tuning processor. • Setting the value of　"load inertia / motor inertia　×100". Refer to chapter 11 for detail.	100	%	0 to 3000	

⚠

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.

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 the 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).

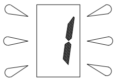
↓

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.

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 detector error	Possible	• Current detector error of Servo Amplifier was detected.

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

Operating state when alarm occurred

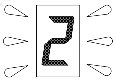
OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	△		○		△
When servo ON is inputted	○	○	○	△	
When motor is started or stopped	△	△	△	○	
After operating for a short period	△	△	△		○

Corrective Measures

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

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	○								
When servo ON is inputted	○	○							○
After position command input (when motor is not rotating)		○			○	○	○		○
After position command input (after operating for a short period)			○	○	○		△	○	

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	Faulty amplifier control board or power module	Replace servo amplifier.
2	Faulty servomotor sensor circuit	Replace servomotor.
3	Effective torque is exceeding rated torque	• Monitor torque generated by motor using the estimated effective torque (Trms) of MODE5/ page12 of remote operator to check if effective torque is exceeding rated torque. • Or, calculate effective torque of motor from the load and operating conditions → If effective torque is higher than rated torque, review operating or load conditions, or replace with larger capacity motor.
4	Incorrect combination of amplifier and motor.	• Check if motor code of Mode4/ page6 of remote 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

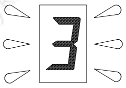
<Overload cause #3: Effective torque is exceeding rated torque>

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	AOH	Amplifier Overheat	Possible	• Overheat was detected in Amplifier. • Overheat was detected in regenerative resistor 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

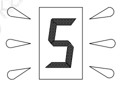
OPERATING STATE	POSSIBLE CAUSES				
	1	2	3	4	5
When control power supply is turned on	△		○	△	
During operation	△	○	○	○	
After emergency stoppage					○

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	Faulty internal circuit of Servo Amplifier	Replace amplifier.
2	Regenerative power is too large	• Review operational conditions • Use external regenerative resistor
3	Although regenerative power is within specification, ambient temperature of Servo Amplifier is too high.	Review cooling method so that temperature in control board not become over 131°F (55℃).
4	Although regenerative power is within specification, cooling fun in Servo Amplifier stops.	• Check if cooling fan in amplifier is rotating. Replace amplifier if fan is not operating.
5	Regenerative power when emergency stoppage was too large.	• Replace Amplifier • Review load condition

After 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
	0101	OV	Over voltage	Possible	DC voltage of main circuit of amplifier exceeded allowable voltage

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

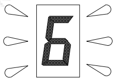
Operating state when alarm occurred

OPERATING STATE	POSSIBLE CAUSES					
	1	2	3	4	5	6
When control power supply is turned on	○					
When main circuit power supply is turned on	○	○				
When motor is started or stopped		△	○	○	○	○

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	Faulty amplifier control board	Replace servo amplifier.
2	Power voltage of main circuit is exceeding allowable voltage	Reduce voltage to within allowable range.
3	Load inertia is too high	Reduce load inertia to within allowable range.
4	Subject to not connecting regenerative resistor: • Operational pattern requires regenerative resistor.	• Review operational pattern and load inertia, change to operational pattern not requiring regenerative resistor. • Install external regenerative resistor
5	Subject to using built-in regenerative resistor: • Faulty wiring of connector CND, or • Regenerative circuit is faulty	• Wiring built-in regenerative resistor correctly: [15A/30A] Connect built-in regenerative resistor wires to P and Y terminals of connector CND. [50A] Short circuit between P- X terminals of connector CND. Replace Servo Amplifier if malfunction persists.
6	Subject to using external regenerative resistor: • Regenerative resistor is not connected • Regenerative resistor is broken • Regenerative circuit is faulty	Turn power OFF, check wiring and resistance value of regenerative resistor. Replace amplifier if malfunction persists.

Alarm Status

Segment LED Display	Alarm Code 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.

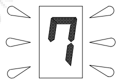
Operating state when alarm occurred

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

Corrective Measures

	CAUSES	CORRECTIVE MEASURES
1	Faulty amplifier control board	Replace servo amplifier.
2	Faulty servomotor sensor	Replace servomotor
3	Overshoot is too large during motor start.	Use the analog monitor of the remote 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.

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

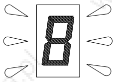
OPERATING STATE	POSSIBLE CAUSES		
	1	2	3
When control power supply is turned on	△	○	
During operation	△		○

Corrective Measures

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

8. MAINTENANCE

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.

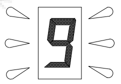
Operating state when alarm occurred

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

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Encoder wiring: • Incorrect wiring • Loose connector • Poor connector contact • Encoder cable is too long • Encoder cable is too thin	• Check and correct wiring. • Check if sensor power voltage of motor is over 4.75V. Correct if necessary.
2	Wrong sensor classification setting of amplifier	Correct setting.
3	Sensor classification setting differs from actual sensor.	Replace with servomotor attached with correct sensor.
4	Faulty amplifier control circuit	Replace servo amplifier.
5	Faulty servomotor sensor	Replace servomotor.
6	Parameter setting is for full close servo system.	Set parameters for semi-close system (Mode2-page0 Func0-bit7).

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 drop

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

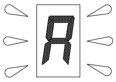
Operating state when alarm occurred

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

Corrective Measures

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

Alarm Status

Segment LED Display	Alarm Code 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.

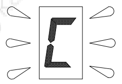
Operating state when alarm occurred

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

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty input contact on one of the R, S, T phases	Check and correct wiring.
2	Faulty amplifier internal circuit	Replace servo amplifier
3	Servo amplifier is not specified for single phase	• Confirm model number and delivery specification of servo amplifier. Replace with amplifier for single phase, if necessary. • Change parameter for single phase Amplifier (Mode4-page8 PSKD)

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					○
Upon servo ON input	○		○		
Upon command input	○	○	○		
When motor is started or stopped				○	

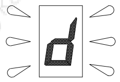
Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Incorrect wiring of U, V, W phases between amplifier and motor	Check and correct wiring.
2	Incorrect wiring of A, B phases between INC-E and ABS-E encoder connection	Check and correct wiring.
3	Motor is vibrating (oscillating)	Adjust servo parameter to stop vibration (oscillation).
4	Overshoot and/or undershoot is too large	Use the analog monitor of the remote 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.
4	Faulty servo amplifier control circuit	Replace servo amplifier.

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

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

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

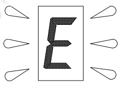
Operating State when alarm occurred

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

Corrective Measures

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

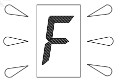
Operating state when alarm occurred

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

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Although the system is of not connecting external thermal, Amplifier sets to external overheat detection valid.	Change parameter setting to external overheat detection invalid (Mode2-Page4 Func3-bit4,5)
2	In case of system connecting external thermal, wiring is disconnected.	Check and correct wiring.
3	External thermal terminal (external regenerative resistor) operated.	• Review operational conditions. • Increase capacity of external regenerative resistor
4	Faulty servo amplifier control board	Replace servo amplifier

Alarm Status

Segment LED Display	Alarm Code 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.

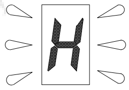
Operating state when alarm occurred

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

Corrective Measures

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

Alarm Status

Segment LED Display	Alarm Code ALM8,4,2,1	Abbreviation	Alarm Name	Alarm Clear	Contents
	0101	RGOH	Overheat of built-in regenerative resistor	Possible	Overheating detected in internal regenerative resistor module.

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

Operating state when alarm occurred

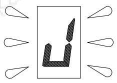
OPERATING STATE	POSSIBLE CAUSES			
	1	2	3	4
When control power supply is turned on	△		○	○
During operation	△	○	○	○

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty amplifier internal circuit	Replace servo amplifier
2	Regenerative power is too high	• Review operating conditions. • Use an external regenerative resistor module
3	Faulty parameter setting (page9 of mode8) regenerative resistor type (RGKD)	Check parameter setting: • In case regenerative resistor is not connected; regenerative resistor type (RGKD) = “None/Ext.R” • In case of using external regenerative resistor; regenerative resistor type (RGKD) = “None/Ext.R” • In case of using built-in regenerative resistor; regenerative resistor type (RGKD) = “Built-in R”
4	Faulty wiring of built-in regenerative resistor.	Wire according to Chapter 9 Regenerative Resistor. [Amplifier capacity of 15A/ 30A] Connect built-in regenerative resistor wire to P and Y terminals of CND connector. [Amplifier capacity of 50A] Short circuit between P-X terminals of CND connector. Replace Servo Amplifier if malfunction persists.

When using regenerative resistor built in Servo Amplifier, make sure to set page9 Regenerative Resistor type (RGKD) to “built-in regenerative resistor (Built-in R). With this setting, validity of overheat protection detection process of built-in regenerative resistor is judged. In case “no regenerative resistor connection or external regenerative resistor (None/ Ext.R) is selected, overheat detection of built-in regenerative resistor will not function. Therefore, built-in regenerative resistor may be burn or smoke occurs.

Alarm Status

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

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

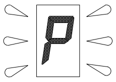
Operating state when alarm occurred

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

Corrective Measures

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

Alarm Status

Segment LED Display	Alarm Code 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.

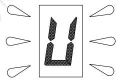
Operating state when alarm occurred

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

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	CPU is unable to read correct value from built-in non-volatile memory in amplifier.	Replace servo amplifier
2	Faulty amplifier control board	Replace servo amplifier
3	Bit0 of Func6 was changed to “1” from remote 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	○	○	○	△
During operation			○	△

Corrective Measures

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

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

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.

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	△	○		○
During operation	△	○	○	

Corrective Measures

	CAUSE	CORRECTIVE MEASURES
1	Faulty amplifier control circuit	Replace servo amplifier
2	Weak internal 5V power due to short-circuit of input/output wiring of signal line of amplifier	Disconnect all connectors and turn power supply on → If 7 segment LED blinks, check and repair short-circuit on signal line.
3	Faulty operation due to noise	• Check if earth cable of amplifier is correctly grounded. • Add ferrite core as noise measure.
4	In maintenance mode.	• Maintenance mode SW on the front of Amplifier (see Chapter 3 front view of Servo 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 8-2 (1/2) Troubleshooting (Non-Alarm)

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

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

No	Malfunction	Inspection	Causes and corrective measures
6	Excessive overshoot/undershoot during start/stop		• Servo tuning at "High" • Lower velocity loop gain • Increase integral time constant • Loosen acceleration / deceleration command pattern • Use position command low pass filter
7	Abnormal noise	(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 • Check if power supply voltage drops

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

Table 8-2-2 Alarm History Display

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

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

8.3 Switching of Velocity Loop Proportional Gain Using Rotary Switch

8.3.1 Overview

The PY or PY2 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 "Gain_sel".

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, A, B, C and D 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.
Temper-ature	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 8-4 Periodical Parts Inspection

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

1. Capacitor for main circuit smoothing
   - If the Servo Amplifiers have been stored for over 3 years, consult us.
     The capacity of the capacitor for main circuit smoothing is reduced depending on the motor output current and the frequency of on-off switching of the power supply during operation. This can cause the capacitor to malfunction.
   - If the capacitor is used under conditions in which the average temp. is 106°F（40°C), and the Servo Amplifier’s rated output current exceeds 50% on average, replace it with a new one every 5 years.
   - If the capacitor is used in an application requiring the frequency of on-off switching the power to exceed 30 times a day, consult us.

2. Cooling fan motor
   - The PY2 Servo Amplifier is designed to comply with pollution level 2 (IEC 664-1/2.5.1).
     Since it is not designed to be oil- or dust-proof, use the Servo Amplifier in a pollution level 2 or better (i.e. pollution level 1 or 2) environment.
   - The PY0A050, PY0A100 and PY0A150 Servo Amplifiers have built-in cooling fan motors.
     Be sure to maintain a 50-mm spaces upper and below amplifier.
     If the space is narrower, the static pressure of the cooling fun will be reduced and the parts will deteriorate, causing the motor to malfunction.
     When an abnormal noise is heard, or oil or dust adheres to the cooling fan, it must be replaced.
     The estimated life of the cooling fan is 5 years under a year-round average temp. of 106°F（40°C).

3. Lithium battery
   - The normal replacement interval of our recommended lithium battery is its estimated life.
     The life of the lithium battery will be reduced if the frequency of power supply on-off switching is high or if the motor remains unused for a long time.
     If the battery voltage is 3.6 V or less when inspected, replace with new one.

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

9. SPECIFICATIONS

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9.1 Servo Amplifier

9.1.1 Common Specifications

Table 9-1 Common Specifications

Model No.				PY2A015	PY2A030	PY2A050	PY2E015	PY2E030
Basic specification	Control function			Velocity, torque or position control (through switching of parameters).				
	Control method			IGBT PWM control, sine wave drive.				
	(*1) Input power	Main circuit		• 3-phase, 200 VAC to 230 VAC +10%, - 15%, 50/60 Hz±3Hz. • Single-phase, 200 VAC to 230 VAC +10%, - 15%, 50/60 Hz±3Hz.			• Single-phase, 100 VAC to 115 VAC +10%, - 15%, 50/60 Hz±3Hz.	
		Control circuit		• Single-phase, 200 VAC to 230 VAC +10%, - 15%, 50/60 Hz±3Hz.			• Single-phase, 100 VAC to 115 VAC +10%, - 15%, 50/60Hz±3Hz.	
	Environment	Operating ambient temperature (*2)		0 to 55°C				
		Storage temperature		–20 to +65°C				
		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			1.5	2.0	2.7	1.5	2.0
Performance	For the velocity control specification	(*3) Velocity control range		1 : 5000				
		(*4) Velocity variations	Load variation (0 to 100%)	±0.1% maximum/maximum revolution speed				
			Voltage variation (170V to 253V)	±0.1% maximum/maximum revolution speed				
			Temperature variation (0°C to 55°C)	±0.5% maximum/maximum revolution speed				
		(*6) Frequency characteristics		400 Hz (JL=JM)				
Built-in functions	Protection function			Overcurrent, overload, amplifier overheating, excessive main circuit power, over-speed, control power error, sensor error, low main circuit voltage, main circuit open-phase, velocity control error, excessive deviation, external overheating, servo processor error, regeneration error, memory error, battery error, CPU error.				
	LED display			Internal status and alarms.				
	Dynamic brake			Built-in				
	Regenerative processing			Circuit built in (resistor is optional)		Regenerative resistor built-in	Circuit built-in (resistor is optional)	
	Applicable load inertia			Within the applicable inertia of the Servomotor combined.				
	(*5) Monitor output	Velocity monitor (VMO)		0.5 V±20% (at 1000 min^{-1})				
		Current monitor (IMO)		0.5 V±20% (at 100%)				
Input / output signals	Velocity / torque control specification	Velocity command	Command voltage	±2.0 VDC (at 1000 min^{-1} command, forward motor revolution with positive command, maximum input voltage ±10 V).				
			Input impedance	Approximately 10 kΩ.				
		Torque command	Command voltage	±2.0 VDC (at 100% torque, forward motor rotation with positive command)				
			Input impedance	Approximately 10 kΩ.				
		Current limit input		±2.0 VDC±15% (at rated armature current)				
		Sequence input signals		Servo on, alarm reset, forward rotation inhibit, reverse rotation inhibit, proportional control, current limit velocity command zero, control mode switching, gain switching, external overheating, current limit and encoder clear.				
		Sequence output signals		Current limit status, low velocity, high velocity, velocity match, command receive enabled, servo ready, holding brake timing and alarm code (4 bits).				
		Position output signals (pulse dividing)		N/8192 (N=1 to 8191), 1/N (N=1 to 64) or 2/N (N=3 to 64).				
		Absolute position output signal (serial output)		9600 bps start-stop synchronization or 1 Mbps/2 Mbps Manchester method (when an absolute sensor is used)				
	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)				
			Input pulse form	Forward + reverse command pulses or code + pulse train command, 90° phase difference 2-phase pulse train command.				
			Electronic gear	N/D (N=1 to 32767, D=1 to 32767), where 1/32767≦N/D≦32767.				
		Current limit input		±2.0 VDC±15% (at rated armature current)				
		Sequence input signal		Servo on, alarm reset, forward rotation inhibit, reverse revolution inhibit, deviation clear , current limit, command multiplication, command pulse inhibit, control mode switching, gain switching, external overheating and encoder clear.				
		Sequence output signal		Current control status, low velocity, high velocity, positioning complete, command receive enabled, servo ready, holding brake timing and alarm code (4 bits).				
		Position output signal (pulse dividing)		N/8192 (N=1 to 8191), 1/N (N=1 to 64) or 2/N (N=3 to 64).				
		Absolute position output (serial output)		9600 bps start-stop synchronization or 1Mbps/2Mbps Manchester method (when an absolute sensor is used)				

*1: The supply voltage shall be within the specified range.

200 VAC power supply input type (PY2A)
  Specified voltage range: 170 to 253 VAC
  The supply voltage must not exceed 230 VAC+10% (253 V).
100 VAC power supply input type (PY2E)
  Specified voltage range: 85 to 127 VAC
  The supply voltage must not exceed 115 VAC+10% (127 V).
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) $\langle \mathrm{min}^{-1} \rangle$: $N = 1000 \times \dfrac{(\text{Vm voltage})\ \langle V \rangle}{0.5}$

  (When the standard Vm 0.5 mV/min^{-1} is selected for the monitor output.)

- Load torque (TL) $\langle N \cdot m \rangle$: $TL = TR \times \dfrac{(\text{Im voltage})\ \langle V \rangle}{0.5}$

  (When the standard Im 0.5 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.

9.1.2 Acceleration and Deceleration 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)

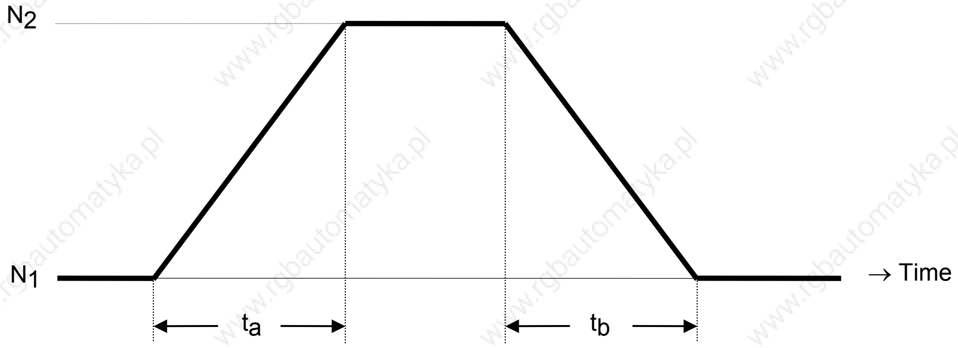


Fig. 9-1 Motor Revolution Speed Time Chart

For actually determining t_a and t_b, it is recommended that the above $T_P \leqq 0.8\ T_P$ be limited, making allowance for load.

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

9.1.3 Allowable Repetition Frequency

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

- **Allowable repetition frequency based on the Servo Amplifier**

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

- **Allowable repetition frequency based on the type of motor used**

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

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

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.

$$t \geqq \frac{I_P{}^2 (t_a + t_b) + I_L{}^2 t_S}{I_R{}^2} \quad [s]$$

I_P : Instantaneous maximum stall armature current
I_R : Rated armature current
I_L : Current equivalent to load torque

When the cycle time (t) has already been determined, find I_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.

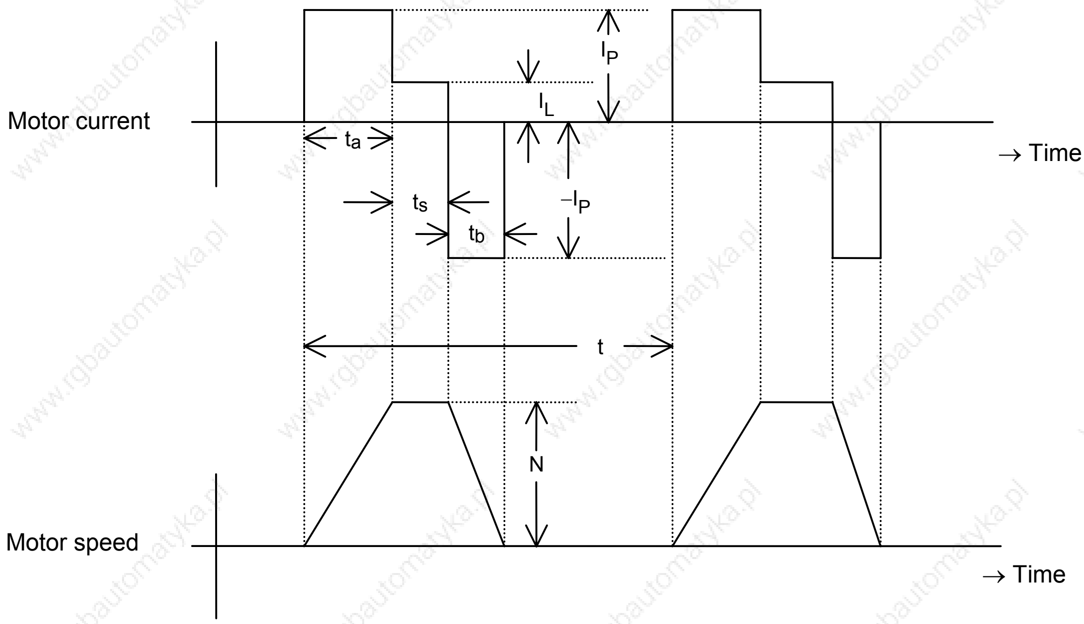


Fig. 9-2 Motor Current and Speed Timing Chart

(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

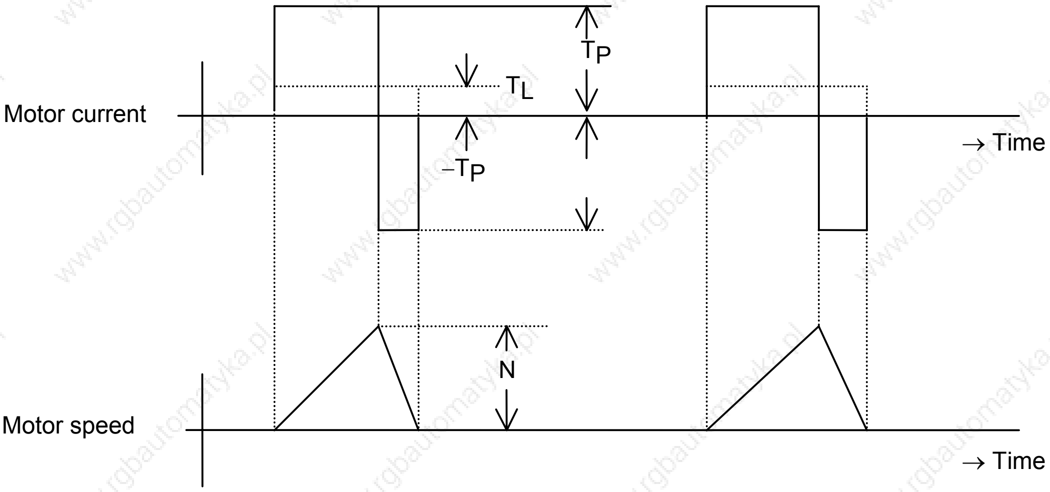


Fig. 9-3 Motor Current and Speed Timing Chart

(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.

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

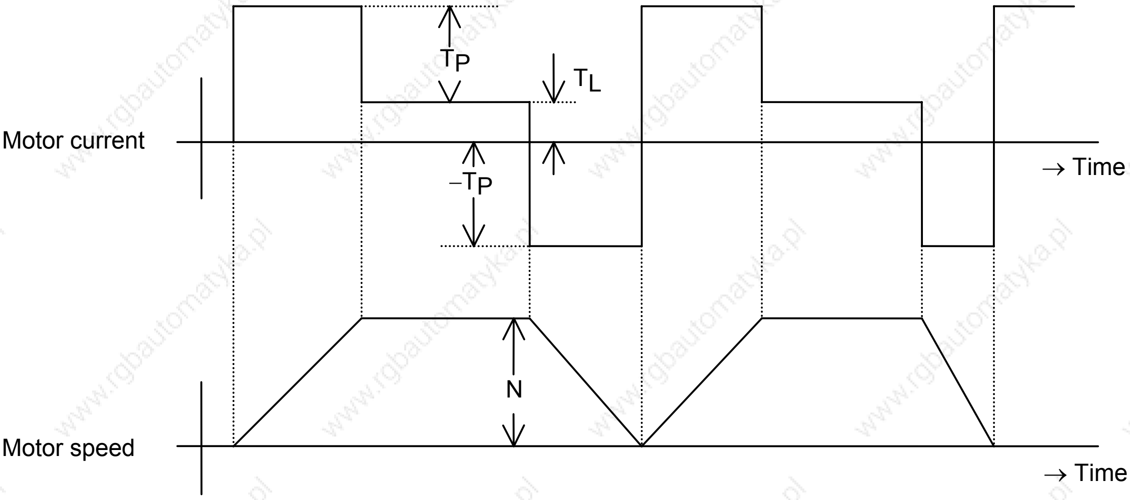


Fig. 9-4 Motor Current and Speed Timing Chart

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 at the time of deceleration.

In this case, the following measures must be taken.

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

For details, ask us for information.

9.1.5 CN1 Input/Output Interface Circuit Configuration

Input circuit configuration

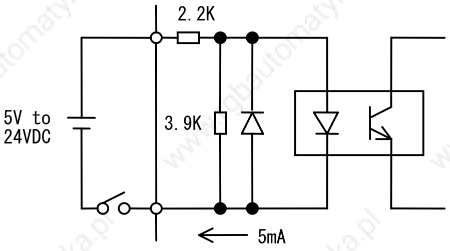
(1) Type 1 (photocoupler input)

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

The input signals of type 1 are Servo ON, alarm reset, forward revolution inhibit, backward revolution inhibit, current limit permit deviation clear, proportional control, command multiplier, command pulse inhibit (zero clamp) and encoder clear (for absolute encoder).

The applicable power supply is 5 V to 24 V. The user must prepare this power supply.

Required power specifications: 5 to 24 VDC±10%, 100 mA minimum.



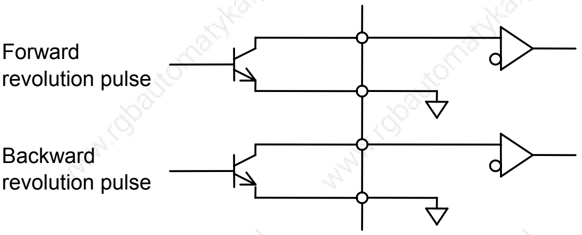
(2) Type 2 (line driver input)

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

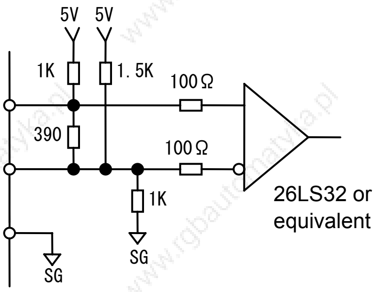
The applicable line receiver is equivalent to the 26LS32.

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

This type can be connected to an open collector output.



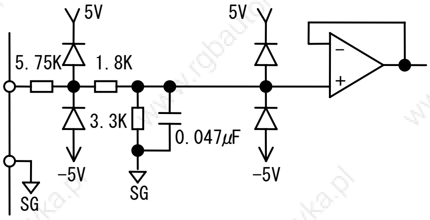
Connection example



(3) Type 3 (analog input 1)

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

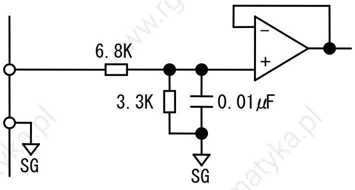
Type 3 permits only analog velocity and torque commands (torque compensation) as input signals.



(4) Type 4 (analog input 2)

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

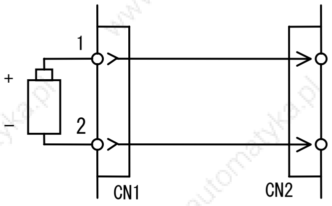
This type permits only current limit for both forward and backward revolution as input signals.



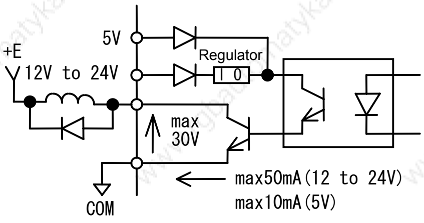
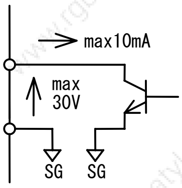
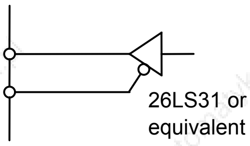
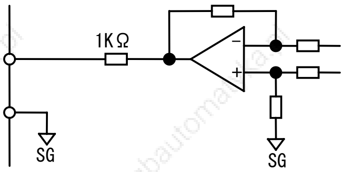
(5) Type 5 (through input)

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

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



Output circuit configuration

(1) Type 6 (open collector output 1) This type of output circuit is an isolated contactless circuit like the one shown on the right. The signals of type 6 are current limit status, low velocity (deviation zero), start ready complete, holding brake excitation timing signal and alarm code. One of the two power supplies of 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.	

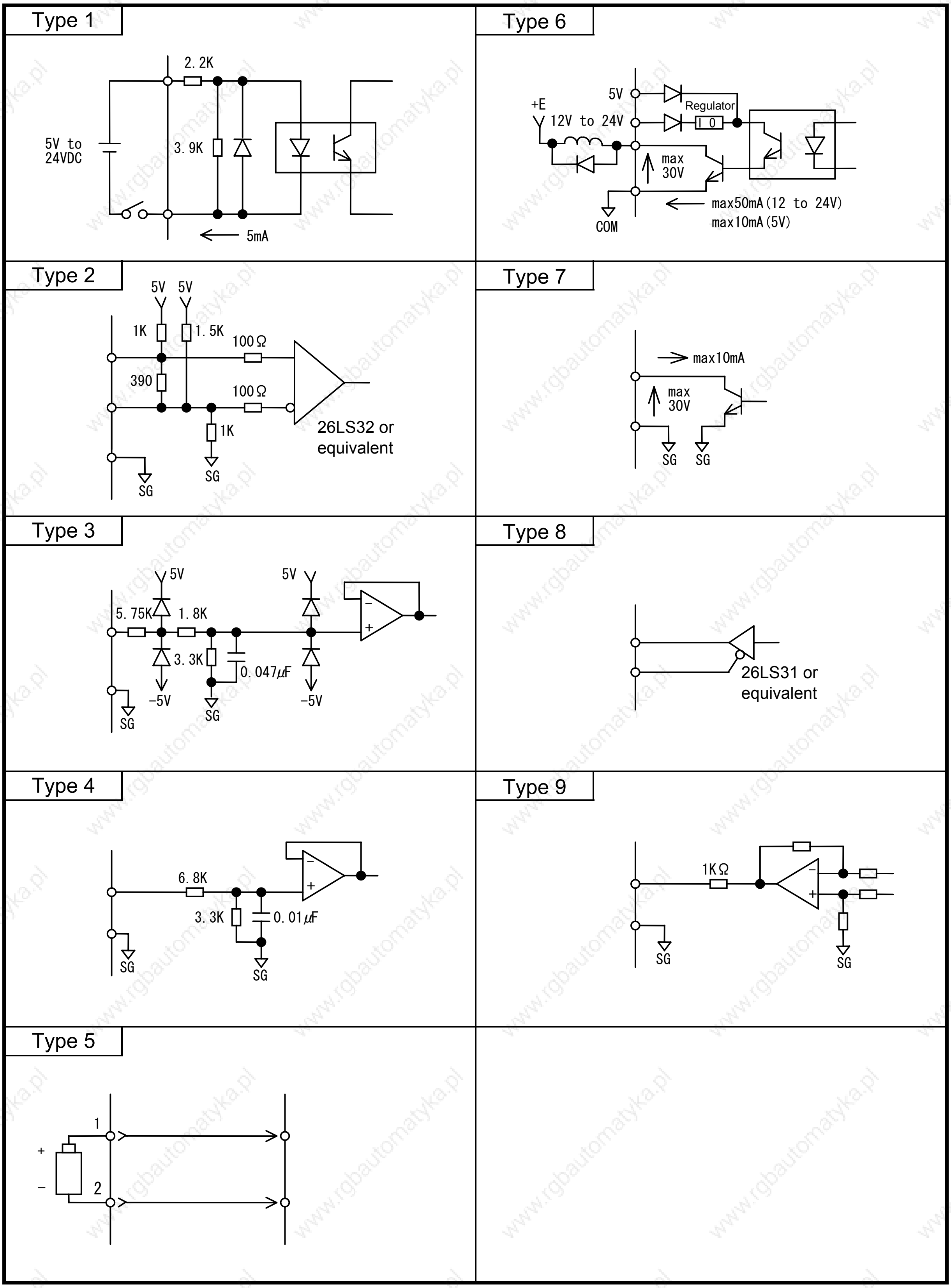


Fig. 9-5 CN1 Circuit Type

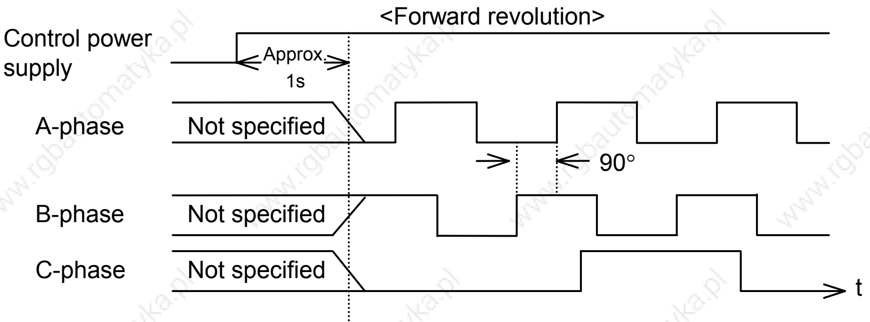
9.1.6 Position Signal Output

This section explains the position signal output specifications.

Chapter	Contents		Relevant Sensors
9.1.6.1	Pulse output	Fig. 9-6	Wiring-saved incremental encoder INC-E Request-signal unavailable absolute encoder ABS-E Request-signal available absolute sensor ABS-R Ⅱ Wiring-saved absolute sensor ABS-E.S1
9.1.6.2	Serial output (When absolute encoder ABS-E is used.)	Fig. 9-7-1 Fig. 9-7-2 Fig. 9-7-3	Request-signal unavailable absolute encoder ABS-E
9.1.6.3	Serial output (When absolute sensor ABS-R Ⅱ is used.)	Fig. 9-8-1 Fig. 9-8.2 Fig. 9-8-3	Request-signal available absolute sensor ABS-R Ⅱ
9.1.6.4	Serial output (When wiring-saved absolute sensor ABS-E.S1 is used.)	Fig. 9-9-1 Fig. 9-9-2 Fig. 9-9-3	Wiring-saved absolute sensor ABS-E.S1

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 .



B-phase leads A-phase by a phase angle of 90°.

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

9.1.6.2 Serial Output (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. 9-7-1
Transmission error check	(1 bit) even parity
Transfer time	6.9 ms (Typ.)
Transfer cycle	9.2 ms (See Fig. 9-7-3 (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. 9-7-2.
Transmission error check	(3 bits) CRC error check
Transfer time	66 μs (Typ.)
Transfer cycle	84 μs±2 μs(See Fig. 9-7-3 (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

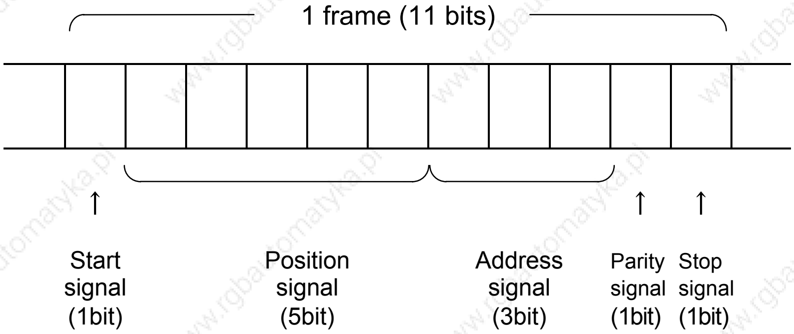


Fig. 9-7-1 (1) Frame Configuration of Start-stop Synchronization (9600 bps)(ABS-E)

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. 9-7-1 (2) Transfer Format of Start-stop Synchronization (9600 bps)(ABS-E)

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

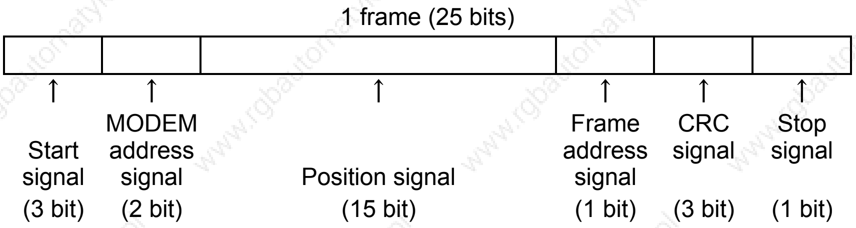
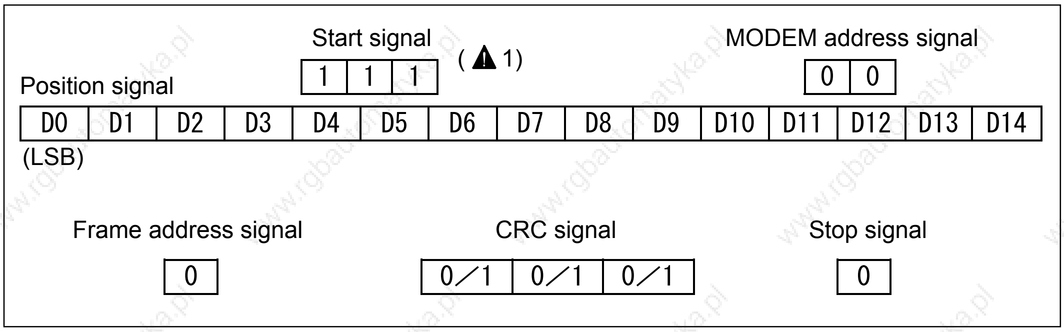


Fig. 9-7-2 (1) Frame Configuration of Manchester Coding Synchronization (1Mbps) (ABS-E)

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

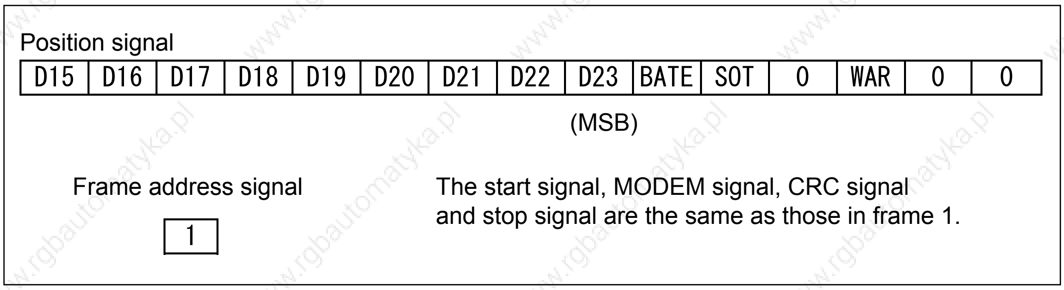
CRC signal

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

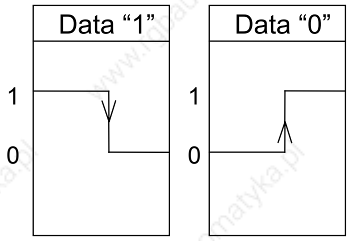
1

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

Fig. 9-7-2 (2) Transfer Format of Manchester Coding Synchronization (1 Mbps) (ABS-E)

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)

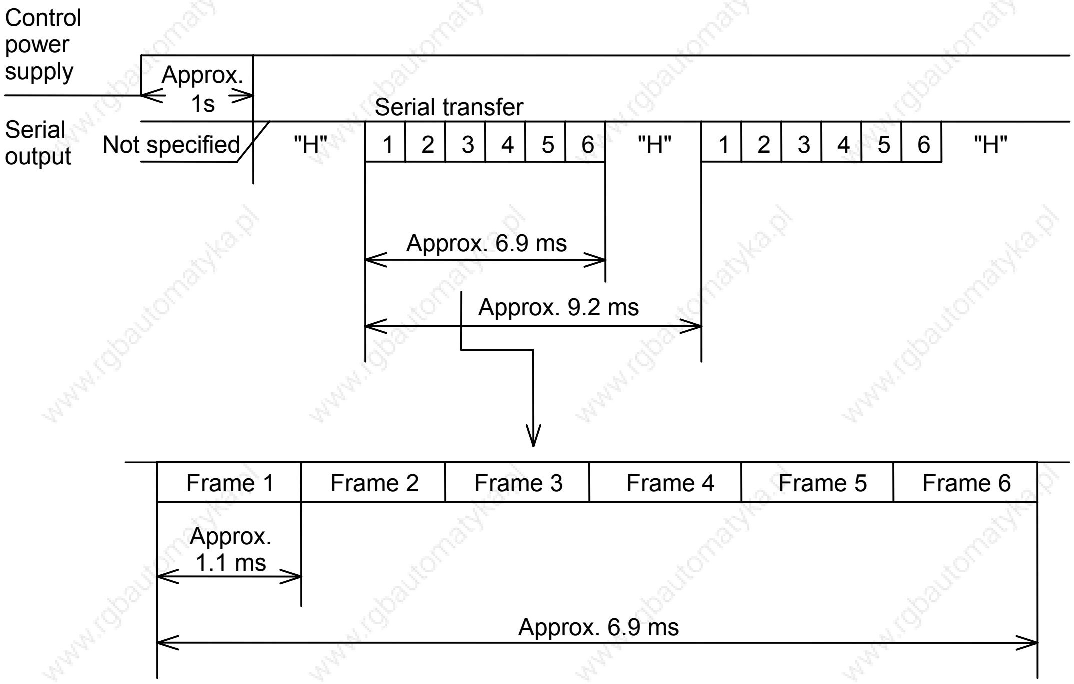


Fig. 9-7-3 (1) Transfer Cycle of Start-stop synchronization (9600 bps) (ABS-E)

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

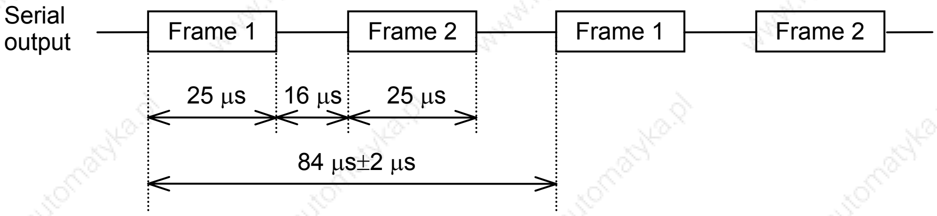


Fig. 9-7-3 (2) Transfer Cycle of Manchester Coding Synchronization (1 Mbps) (ABS-E)

⚠ 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 (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. 9-8-1.
Transmission error check	(1 bit) even parity
Transfer time	6.9 ms (Typ.)
Transfer cycle	9.2 ms (See Fig. 9-8-3 (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. 9-8-2.
Transmission error check	(3 bits) CRC error check
Transfer time	66 μs (Typ.)
Transfer cycle	84 μs±2 μs(See Fig. 9-8-3 (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

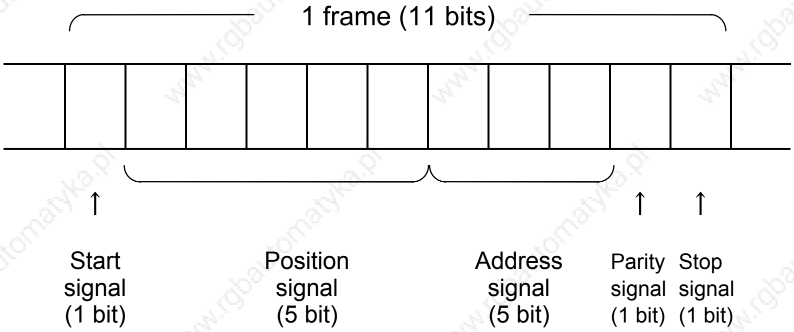


Fig. 9-8-1 (1) Frame Configuration of Start-stop Synchronization (9600bps) (ABS-RⅡ)

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. 9-8-1 (2) Start-stop Synchronization (9600 bps) Transfer Format (ABS-RⅡ)

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

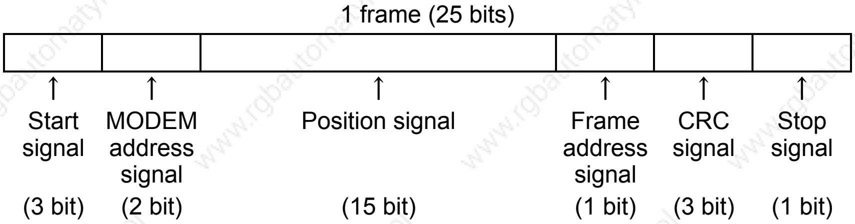
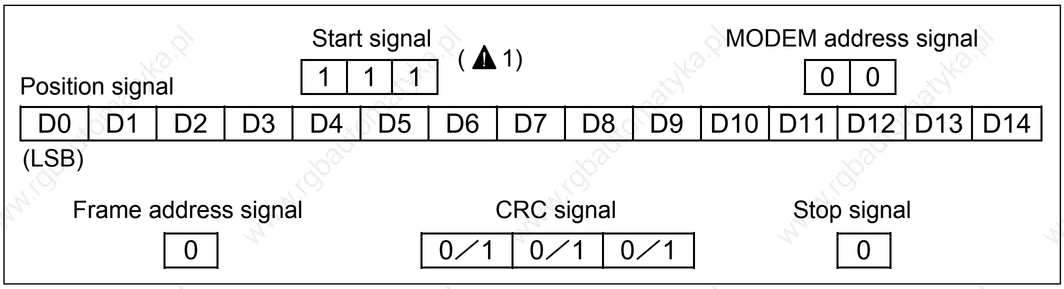


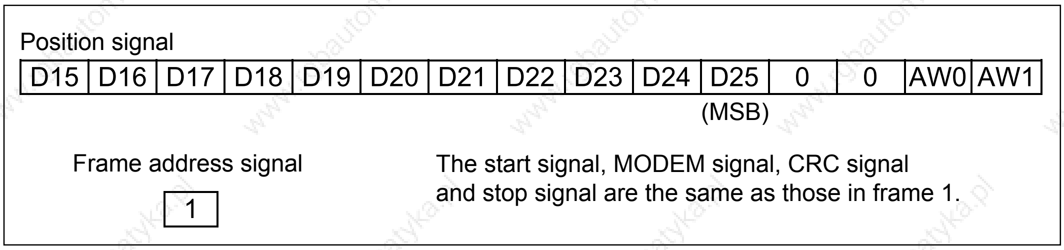
Fig. 9-8-2 (1) Frame Configuration of Manchester Coding Synchronization (1Mbps)(ABS-RⅡ)

② Configuration in each frame

- Frame 1



- Frame 2



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

Fig. 9-8-2 (2) Transfer Format of Manchester Coding Synchronization (1 bps) (ABS-RⅡ)

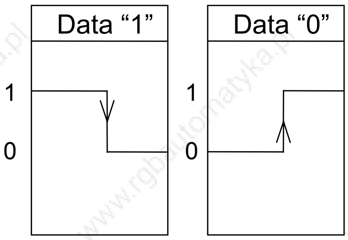
1 The first 2 bits of the start signal are output as a high (1) signal of the whole bit section. The remaining 23 bits are all Manchester coded.

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

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

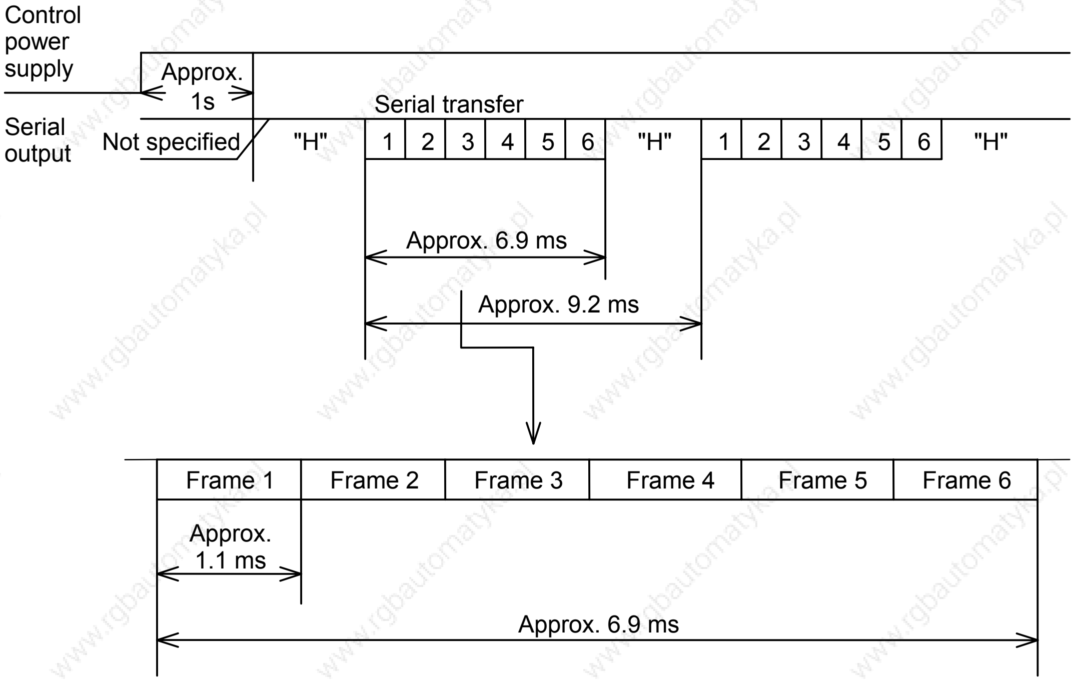


Fig. 9-8-3 (1) Transfer Cycle of Start-stop Synchronization (9600 bps) (ABS-RⅡ)

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

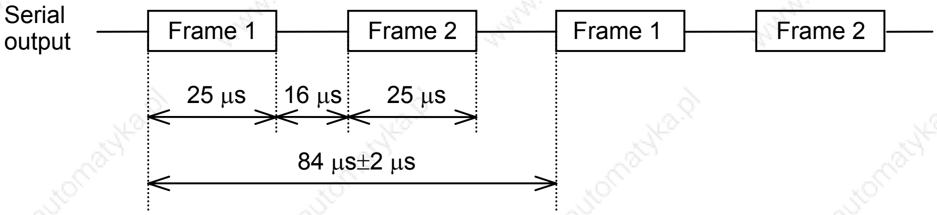


Fig. 9-8-3 (2) Transfer Cycle of Manchester Coding Synchronization (1 Mbps) (ABS-RⅡ)

⚠ 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.

9.1.6.4 Serial Output (When the ABS-E.S1 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 9-4 (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. 9-9-1.
Transmission error check	(1 bit) even parity
Transfer time	6.9 ms (Typ.)
Transfer cycle	9.2 ms (See Fig. 9-9-3 (1).)
Incremental direction	Increased at forward revolution ⚠

Table 9-4 (2) Manchester Coding Synchronization Output (1 Mbps) Specifications

Transmission system	Manchester coding synchronization
Baud rate	2 Mbps
Number of transfer frames	2 frames (25 bits/frame)
Transfer format	See Fig. 9-9-2.
Transmission error check	(3 bits) CRC error check
Transfer time	25 µs (Typ.)
Transfer cycle	42 µs±2 µs(See Fig. 9-9-3 (2).)
Incremental direction	Increase at forward revolution ⚠

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

⚠ Specifications for the ABS-E.S1 Wiring-saved Absolute Sensor are as follows:
One revolution: 32768 divisions (15 bits), Mutli-revolution: 65536 rotations (16 bits)
When combined with the PY2 Servo Amplifier, however, the product will be operated in the following specifications because of the limited communication specifications:
One revolution: 32768 divisions (15 bits), Multi-revolution: 8192 rotations (13 bits)

⚠ When the product is used in the application requiring no multi-revolution data under the setting of Func6 Bit5 = 1 (Mode2 Page7) without battery connected (when used in one-revolution mode);

- Even if one revolution mode is set, error or warning bit may be set at the data output from the serial position signal (CM1-9, 10 pins). This causes no problem in the operation of the Servo system. When one revolution mode is set, make the upper system exclude these bits.
- When one revolution mode is set, multi-revolution data may change suddenly. Do not use the multi-revolution data at the upper system.

(2) Transfer format

(2-1) Start-stop synchronization (9600 bps)

① Configuration in a frame

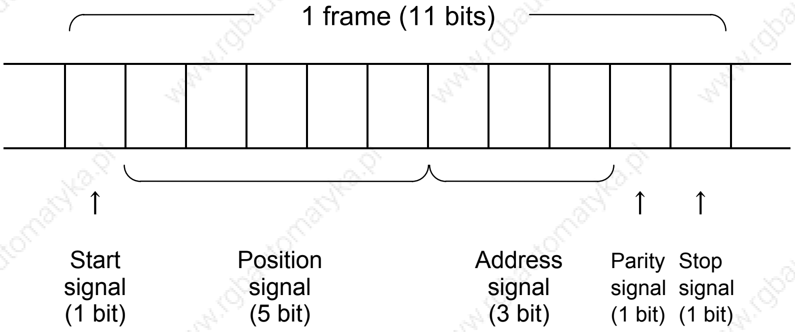


Fig. 9-9-1 (1) Start-stop Synchronization (9600bps) Frame Configuration (ABS-E.S1)

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)	D26	D27	AW0	AW1	1	0	1	0／1	1

Fig. 9-9-1 (2) Start-stop Synchronization (9600 bps) Transfer Format (ABS-E.S1)

D0 to D14 ....One-revolution absolute value(15bit)

D15 to D27 ....Multi-revolution absolute value(13bit)

(In the case of 8192FMT sensor)

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

(2-1) Manchester Coding Synchronization (2 bps)

① Configuration in a frame

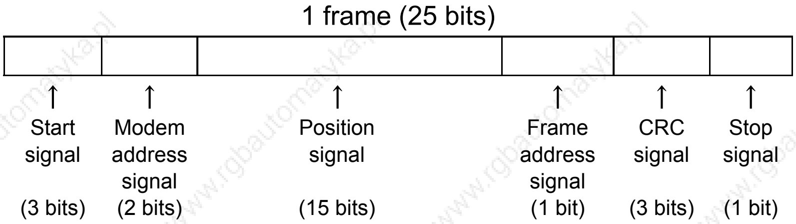


Fig. 9-9-2 (1) Manchester Coding Synchronization (2 Mbps) Frame Configuration (ABS-E.S1)

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	D24	D25	D26	D27	AW0	AW1
										(MSB)				

Frame address signal

1

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

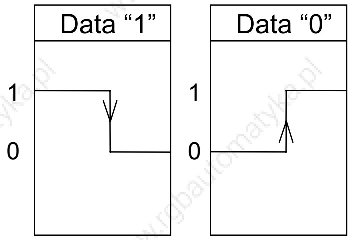
Fig. 9-9-2 (2) Manchester Coding Synchronization (2 Mbps) Transfer Format (ABS-E.S1)

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 D14 ....One-revolution absolute value

D15 to D27 ....Multi-revolution absolute value

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



Manchester code

(3) Serial PS Transfer Cycle

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

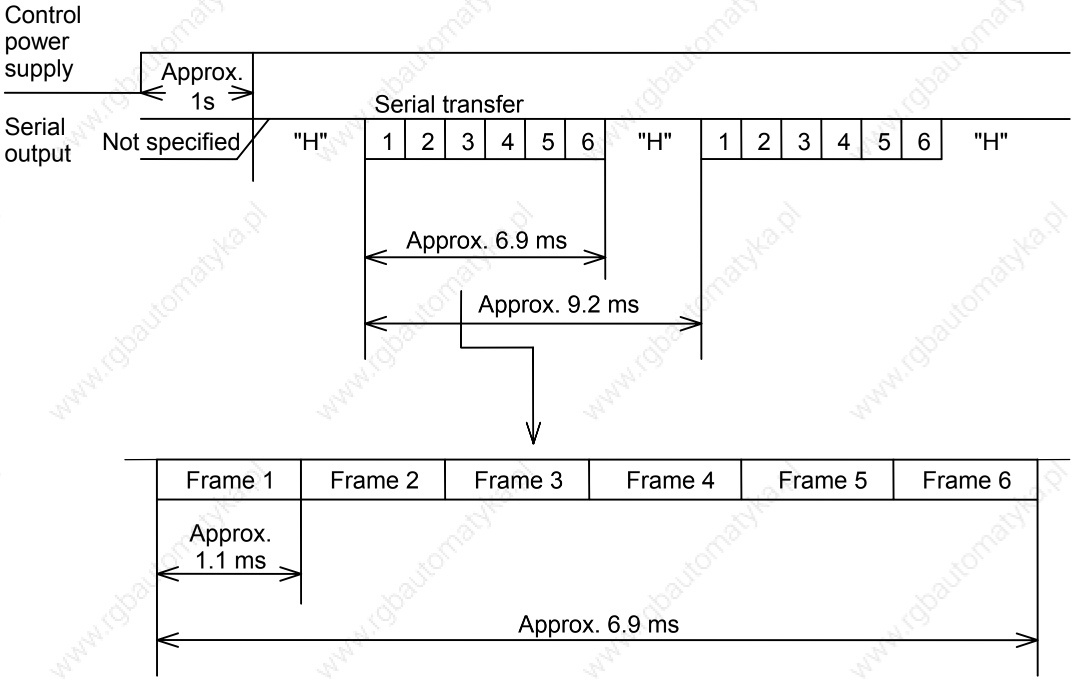


Fig. 9-9-3 (1) Transfer Cycle of Start-stop Synchronization (9600 bps) (ABS-E.S1)

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

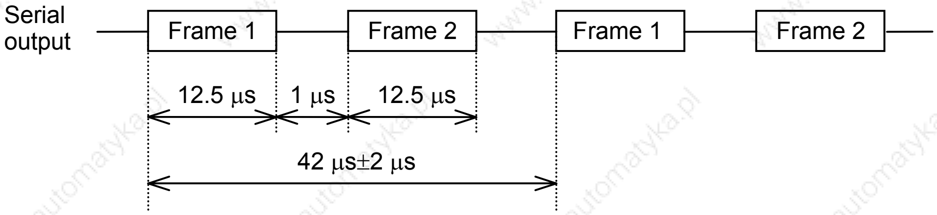


Fig. 9-9-3 (2) Transfer Cycle of Manchester Coding Synchronization (2 Mbps) (ABS-E.S1)

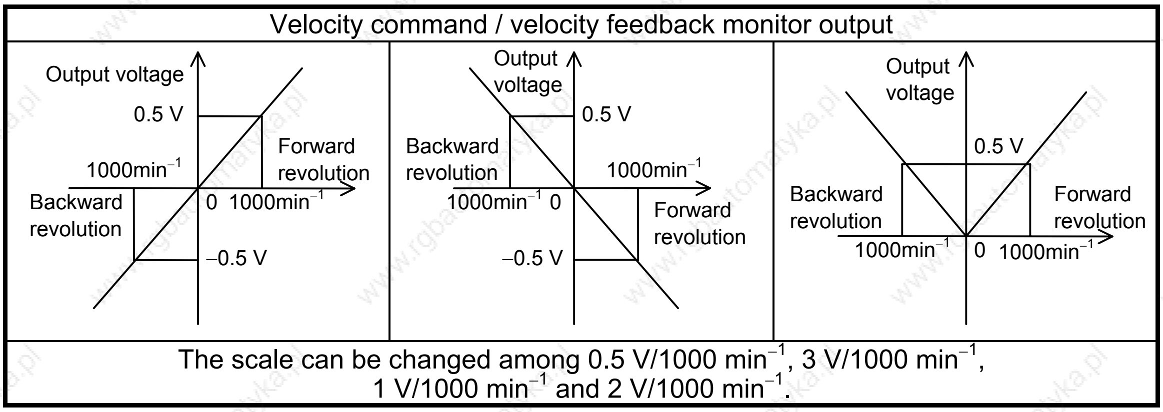
The serial output is not specified for about 1 sec after the power is turned on.
Communication does not always start with frame 1 in 1 sec.

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 1 and 2 in Mode 4 in "7.2.3 Parameter List".

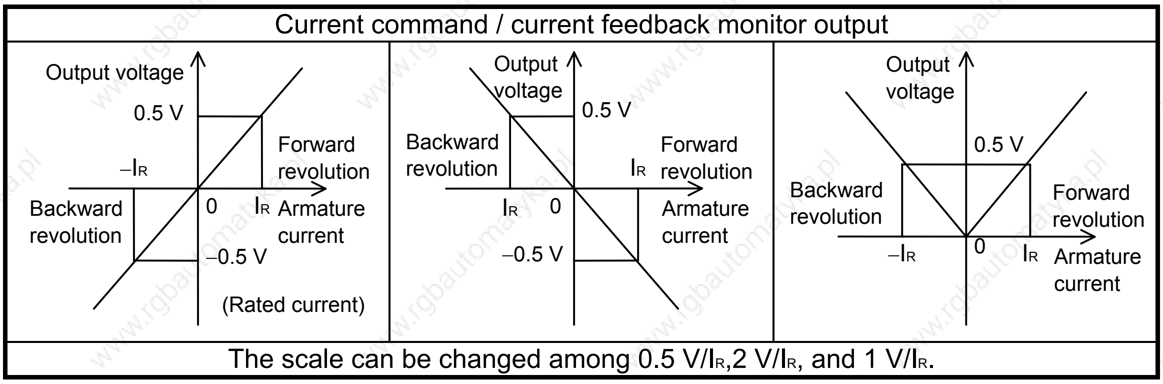
(1) Velocity, torque and position deviation monitor

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

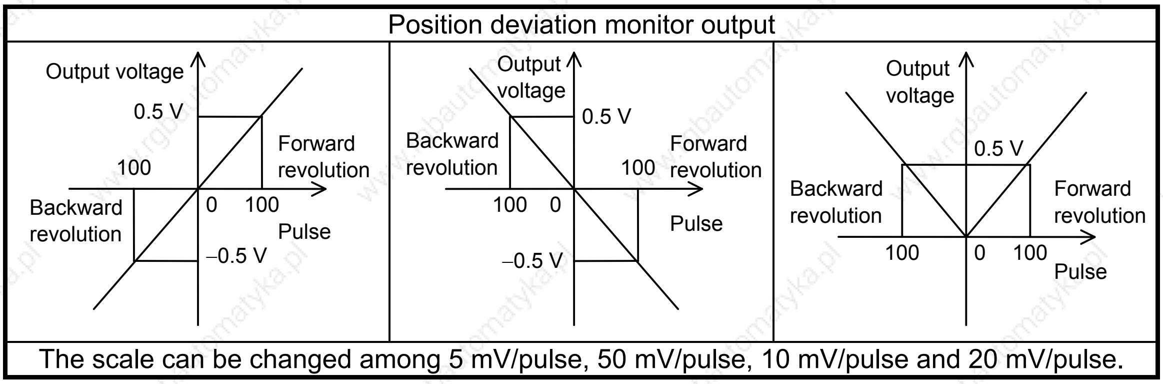
The scale can be changed among 0.5 V/1000 min^{-1}, 3 V/1000 min^{-1}, 1 V/1000 min^{-1} and 2 V/1000 min^{-1}.

Fig. 9-12 (1)


Current command / current feedback monitor output

The scale can be changed among 0.5 V/I_R,2 V/I_R, and 1 V/I_R.

Fig. 9-12 (2)


Position deviation monitor output

The scale can be changed among 5 mV/pulse, 50 mV/pulse, 10 mV/pulse and 20 mV/pulse.

Fig. 9-12 (3)

(2) Regenerative load factor monitor output

The regenerative load factor monitor output is convenient for checking the effective power of the regenerative resistor.
Regenerative load factor monitor signals are output as follows:

Effective power of regenerative resistor/Monitor reference power (W) = 0.3 V
(The monitor reference power is set at the value listed in Table 9-5.)

The output voltage is updated every second.

The effective power of the regenerative resistor is typically calculated as follows:

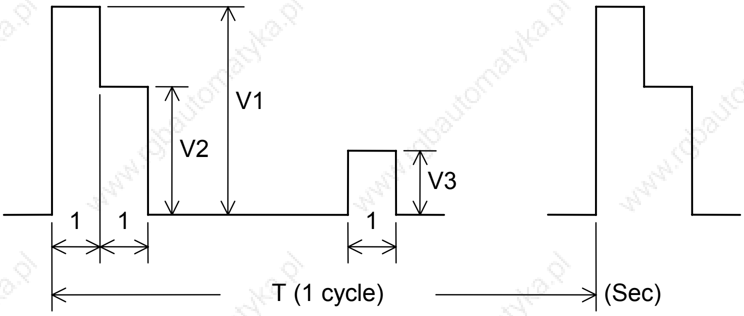


Fig. 9-12 (4)

When the power is measured as in the figure above, the following calculation is possible:

$$\text{Effective power of regenerative resistor (W)} = \frac{V1 + V2 + V3}{T \times 0.3} \times \text{Monitor reference power (W)}$$

The result is acceptable if it is within the allowable effective power of the regenerative resistor.

> 1 When T (1 cycle) is 1 second or shorter, measure the effective power by repeating cycles for more than 1 second.

The regenerative resistor load factor monitor assumes that the regenerative resistor values are as in the table below.

Table 9-5 Regenerative Resistor Value and Monitor Reference Power of Each Amplifier Capacity

Type of amplifier		PY2A015 PY2E015	PY2A030 PY2E030	PY2A050
Resistance value (Ω)		100 Ω	50 Ω	20 Ω
Monitor reference power	Func2 bit 4 = 0	5 W	5 W	20 W
	Func2 bit 4 = 1	10 W	10 W	40 W

∗ For the allowable effective power of an external regenerative resistor, refer to "Table 9-21 External Regenerative Resistor Combination Table".

∗ After switching, Func2 bit 4 is enabled by turning on the control power supply again.

> 2 Since the maximum output voltage of the analog monitor is 3 V, if the power consumption with a regenerative resistor in a second exceeds 10 times of the reference power, it will continue for the next 1 second.
> 3 The regenerative load factor monitor may cause errors of ±30%.
> 4 The monitor reference power changes depending on the regenerative resistor OL time select in Func2 bit 4.
> 5 When the built-in regenerative resistor is used, use the built-in regenerative resistor absorbing power monitor RegP (Mode5 Page17) of the remote operator.

(3) Typical monitor applications

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

Speed and current measurement
When connecting a measuring instrument to the velocity or current feedback monitor, use a both-swing type CD voltmeter and connect it as in Fig. 9-12 (5).
In this case, use a shielded wire and make the wiring as short as possible.

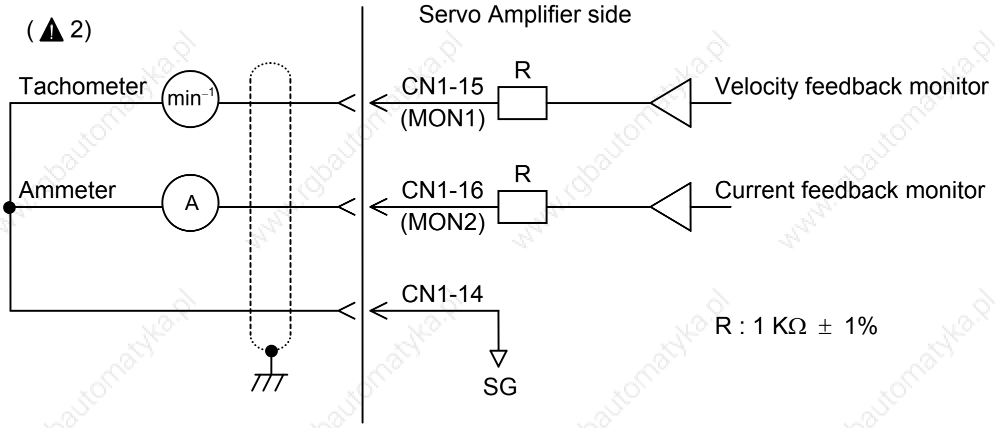


Fig. 9-12 (5) Typical Connection of Monitor and Measuring Instrument

- Current feedback monitor output (CN1 - 16)
  ±0.5 V±20%/rated armature current.
- Velocity feedback monitor output (CN1 - 15)
  ±0.5 V±20%/1000 min^{-1}.
- The maximum monitor output voltage is ±3 V.

⚠

1 When the contents of the monitor output are changed using the remote operator or PC interface, the contents of CN1-15 and CN1-16 are also changed.
So, When the above use is employed 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.

3 When the control power is turned on or off, the monitor output becomes unfixed, outputting about ±5.5 V.
When any measuring instrument is connected, be careful not to damage it.

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 .

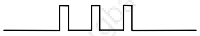
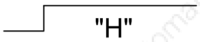
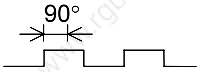
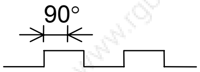
	Command pulse type	Input pin No. CN1-	For motor forward revolution command	For motor backward revolution command	PMOD in Mode 2 on Page 0 of remote operator ⚠ 2
When "0" is set in the revolution direction bit	Backward revolution pulse train + forward revolution pulse train	㉘ ㉙			Bit 6 = 0 Bit 5 = 0
		㉖ ㉗			
	Code + forward revolution pulse	㉘ ㉙			Bit 6 = 1 Bit 5 = 0
		㉖ ㉗			
	"90°" phase difference two-phase pulse train ⚠ 1	㉘ ㉙			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 basically set at 4.
2 For details, see page 7-43 of this manual.

(2) Command pulse timing

Each command pulse timing is as follows .

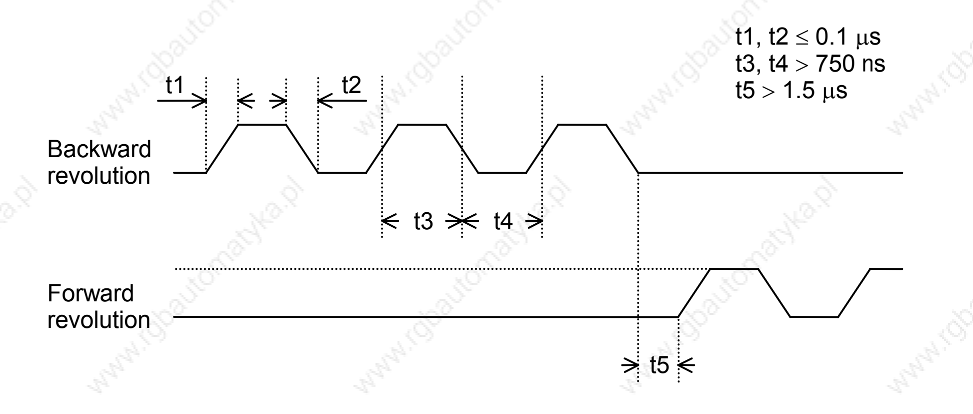
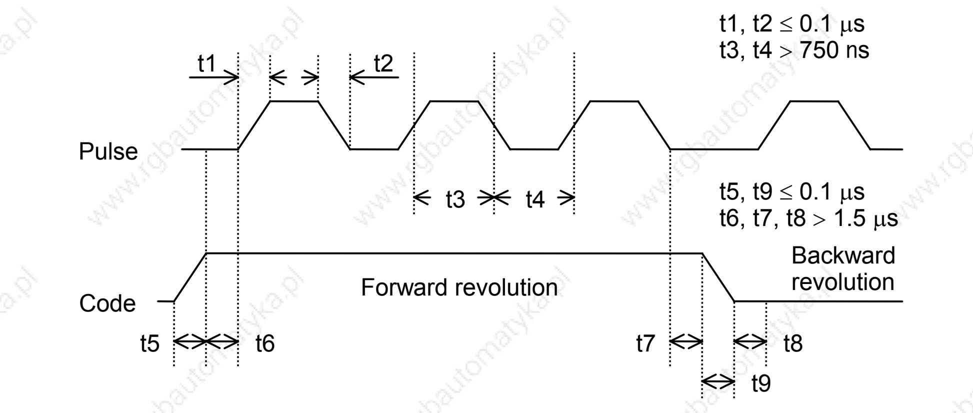
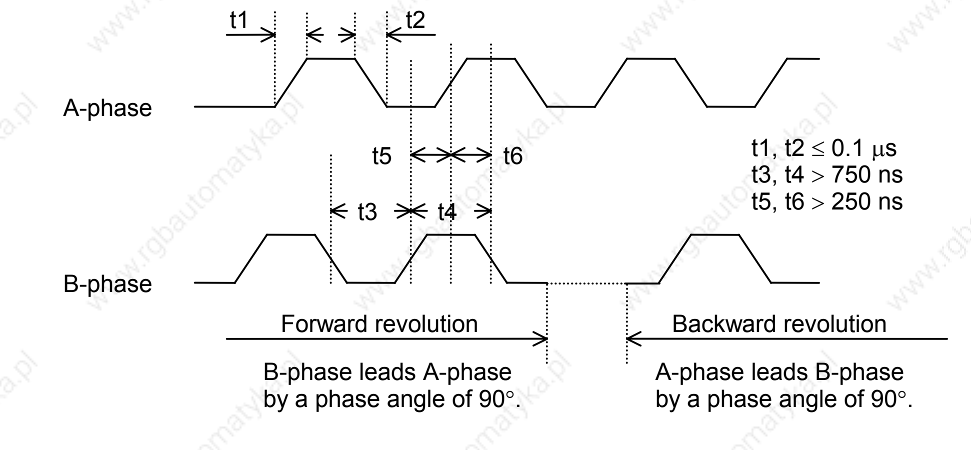
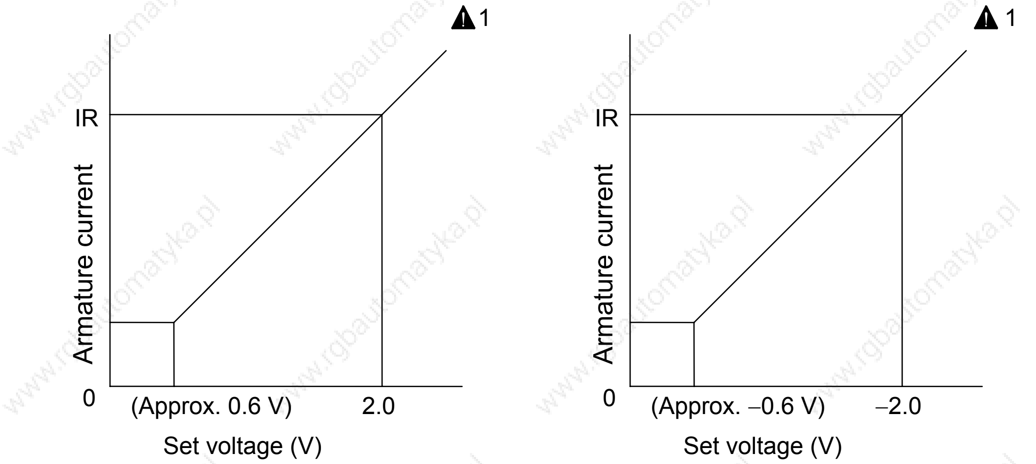
Command pulse	
Backward revolution pulse train + Forward revolution pulse train.	
Code + Pulse train	
90° phase difference two-phase pulse	

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 in Chapter 7) 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 9-6 and 9-7 describe the general specifications.

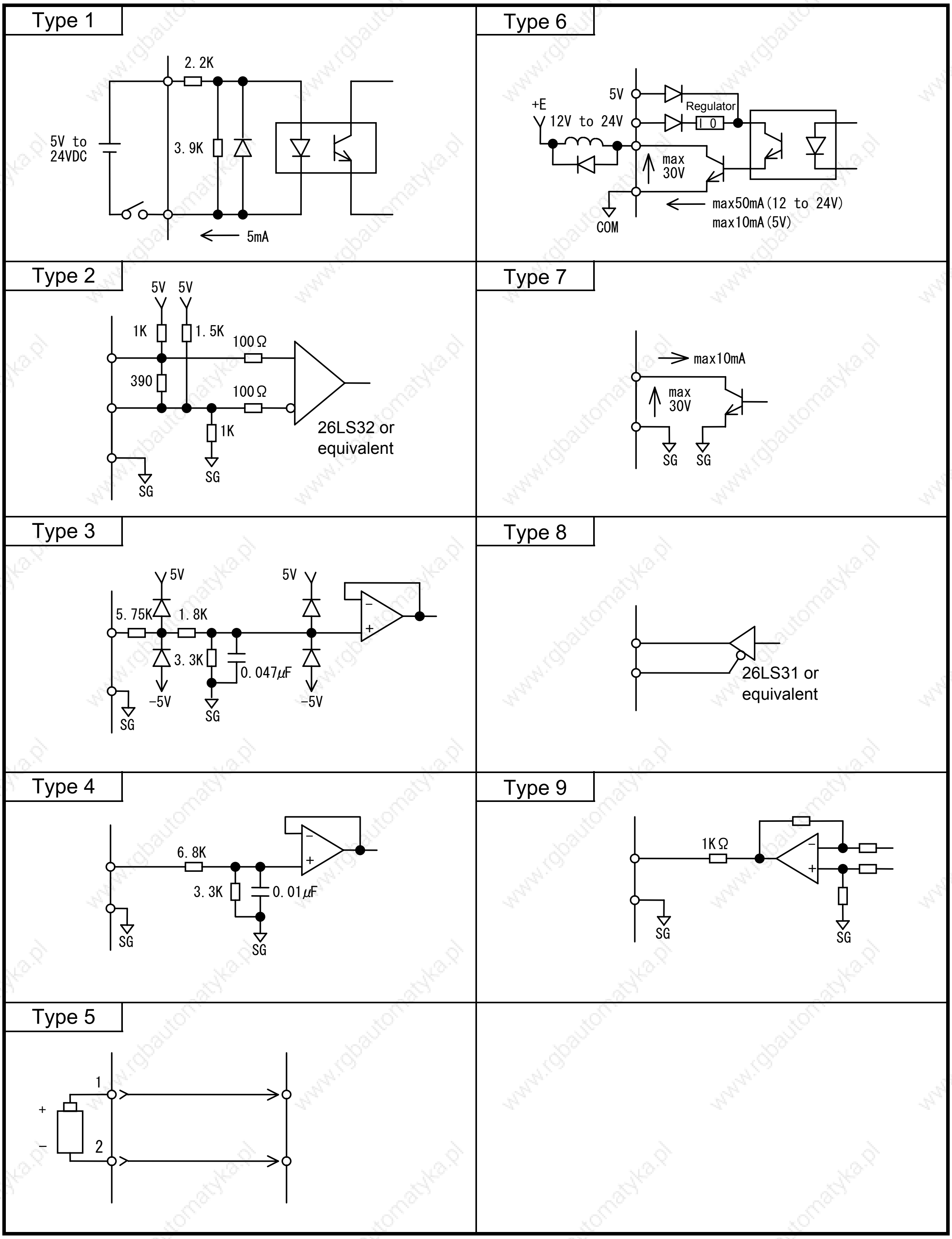


Fig. 9-16

Table 9-6 General Specifications of Position Control Type Input Signals (Incremental Encoder) 1/2

Signal name	Abbr.	Pin No. ∗1	Circuit type ∗2	General specification
Forward revolution pulse train command	$\underline{\text{PPC}}$ PPC	26 27	Type 2	Pulse train for forward revolution
Backward revolution pulse train command	$\underline{\text{NPC}}$ NPC	28 29	Type 2	Pulse train for backward revolution
Torque compensation	TCOMP	22 (20)	Type 3	The rated torque (TR) is obtained by inputting ±2V, but is limited by the maximum instantaneous stall torque. To enable torque compensation, Func1 bit 6 must be set at 1.
Servo ON	SON	37 (23)	Type 1	Servo ON status is provided by closing the contact, and entering the pulse train waiting status.
Alarm reset	RST	30 (23)	Type 1	With this signal input, alarm code or alarm bit outputs and an error display are reset.
Deviation clear	CLE	34 (50)	Type 1	By inputting the contact close signal for 2 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.)
External overheating detection	EOH	35 (50) 36 (23)	Type 1 For 35 and 36 pins, one of the four functions can be selected by setting the remote operator.	Normal operation while input is on. The external overheating alarm state is assumed when input is turned off.
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 3 in Parameter set screen mode 1.
Command pulse inhibit	INH			Inputting command pulses is inhibited.
Forward revolution current limit	PIL	18 (17)	Type 4	The current is limited to the rated current at +2 V (effective when ILM is input). To enable the external current limit, Func1 bit 0 must be set at "1".
Backward revolution current limit	NIL	19 (17)	Type 4	Current is limited to the rated current at -2 V (effective when ILM is input).
Current limit permit	ILM	31 (23)	Type 1	The current is limited by closing the contact. It is ineffective during JOG or overtravel (the limit method is based on Func1 parameter).
Input sequence power supply 1	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 9-6 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	0.5V±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	0.5V±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.
Positioning complete	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 5 V	49 38	—	External power supply for CN1-39, 40, 41, 42, 43, 44, 45 and 46.
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.

(6) General Specifications of CN1 Input/Output Signals (ABS-E Absolute Encoder, ABS-RⅡ Absolute Sensor and ABS-E.S1 Wiring-saved Absolute Sensor)

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

Table 9-7 General Specifications of Position Control Type Input Signal (ABS-E Absolute Encoder, ABS-RⅡ Absolute Sensor and ABS-E.S1 Wiring-saved Absolute Sensor) 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
$\overline{\text{PPC}}$</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
$\overline{\text{NPC}}$</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 +2 V, but is limited by the maximum instantaneous stall torque.
To enable torque compensation, Func1 bit6 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, 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 2 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>Encoder clear (standard)</td><td>ECLR</td><td rowspan="5">35 (50)
36 (23)</td><td rowspan="5">Type 1
[For 35 and 36 pins, one of the five functions can be selected by setting the remote operator.]</td><td colspan="2">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.</td></tr>
<tr><td>External overheating detection</td><td>EOH</td><td colspan="2">Normal operation while input is on.
The external overheating alarm state is assumed when input is turned off.</td></tr>
<tr><td>Proportional control (standard)</td><td>PCON</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 5 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 bit0 must be set at "1".</td></tr>
<tr><td>Backward revolution current limit</td><td>NIL</td><td>19 (17)</td><td>Type 5</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 the Func1 parameter).</td></tr>
<tr><td>Battery power</td><td>BAT+
BAT−</td><td>1
2</td><td>Type 10</td><td colspan="2">This signal connects a 3.6 VDC equivalent battery (ER6 2000 mAH from Toshiba Battery is recommended).</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 9-7 General Specifications of Position Control Type Input Signal (ABS-E Absolute Encoder, ABS-RII Absolute Sensor and ABS-E.S1 Wiring-saved Absolute Sensor) 2/2

Signal name	Abbr.	Pin No. ∗1	Circuit type ∗2	General specification
Monitor 1	MON1	15 (14)	Type 9	0.5 V±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	0.5 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.
Positioning complete	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 5 V	49 38	—	External power supply for CN1 - 39, 40, 41, 42, 43, 44, 45, and 46.
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.

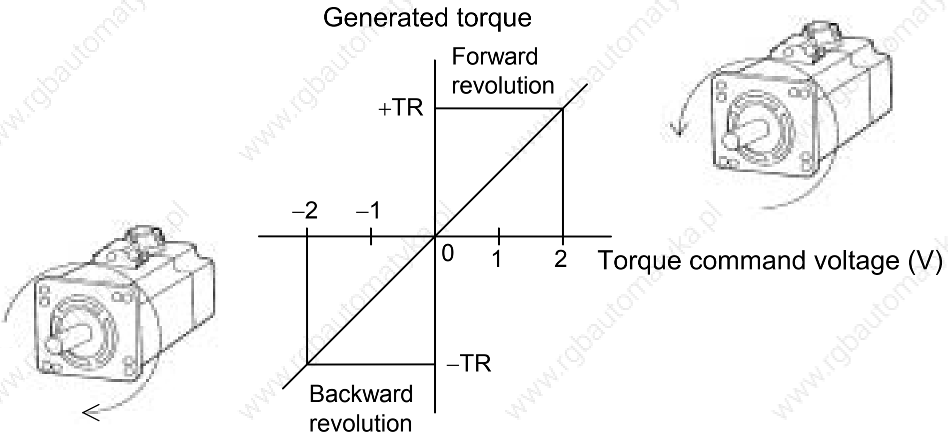


Fig. 9-17 Torque Command - Generated Torque

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.

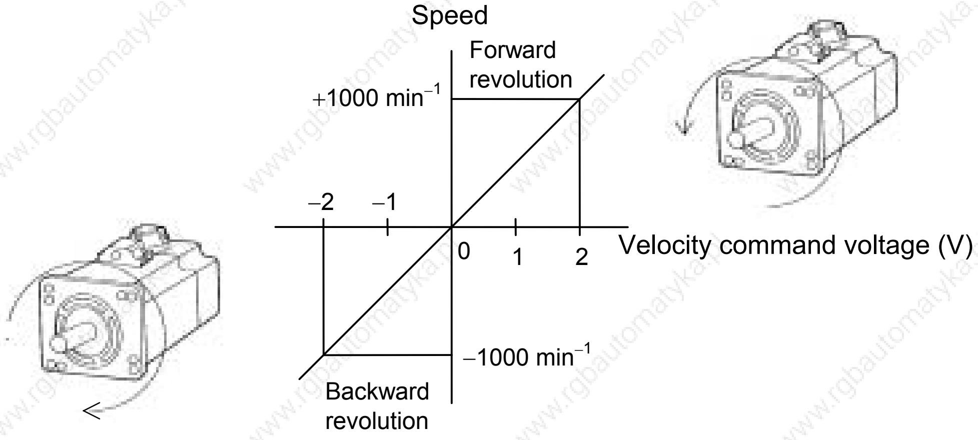
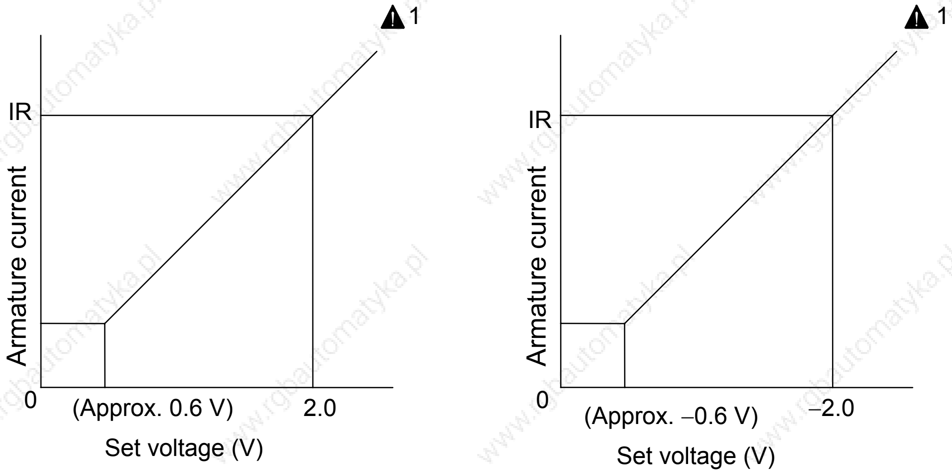


Fig. 9-18 Velocity Command - Speed Characteristics

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 9-8 and 9-9 describe the general specifications.

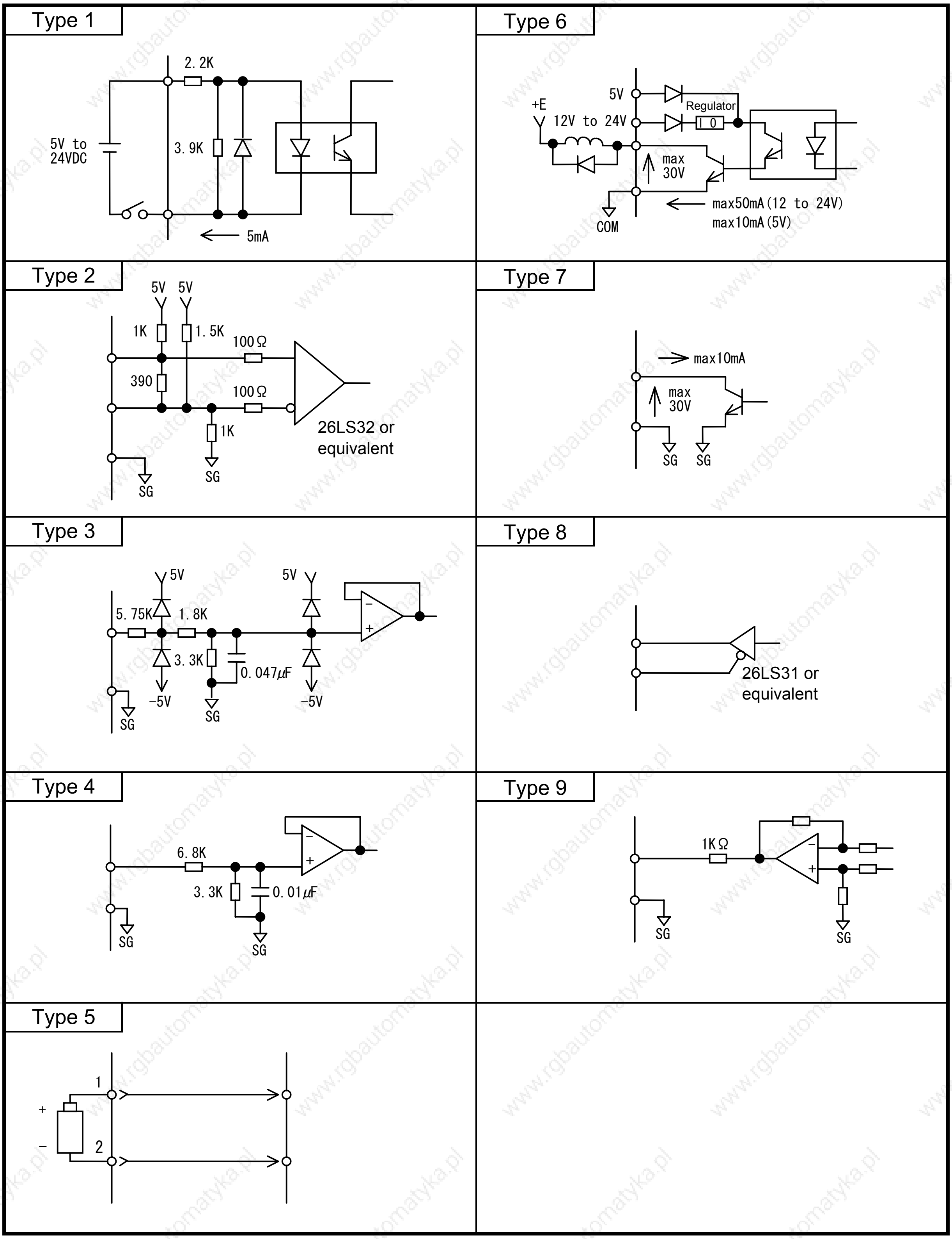


Fig. 9-20

Table 9-8 General Specifications of Velocity Control Type Input Signal (Wiring-saved Incremental Encoder) 1/2

Signal name	Abbr.	Pin No. ∗1	Circuit type ∗2	General specification
Speed command	VCMD	21 (20)	Type 3	With a ±2 V input, the velocity becomes 1000 min^{-1} in the standard setting (maximum input voltage ±10 V).
Torque compensation / Torque command	TCOMP / TCMD	22 (20)	Type 3	With a ±2 V input, the velocity becomes the rated one (TR) and is limited to the instantaneous maximum stall torque.
Servo ON	SON	37 (23)	Type 1	Servo ON status is provided by closing the contact and entering the velocity command input (VCMD) waiting status.
Alarm reset	RST	30 (23)	Type 1	With this signal input, alarm code or alarm bit outputs and error display are reset.
Forward revolution current limit	PIL	18 (17)	Type 4	The current is limited to the rated current at +2 V (effective when ILM is input). To enable the external current limit, Func1 bit10 must be set at "1".
Backward revolution current limit	NIL	19 (17)	Type 4	The current is limited to the rated current with -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 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.)
External overheating detection	EOH	35 (50) 36 (23)	Type 1 For 35 and 36 pins, one of the four functions can be selected by setting the remote operator.	Normal operation while input is on. The external overheating alarm state is assumed when input is turned off.
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. (Function disabled for torque control type)
Zero clamp	ZCMD			Inputting this signal makes the speed command 0 (zero). (Function disabled for torque control type)
Internally set velocity select	VCS2 / VCS1			Combining CN1 - 35 and 36 input signals enables a desired internally set velocity to be selected. (Function disabled for torque control type)
Input sequence power supply 1	5 to 24 VDC	23	—	External power supply for CN1 - 30, 31, 32, 33, 36 and 37.
Internal velocity command revolution direction	ROTS	34 (50)	Type 1	This signal specifies the revolution direction when the internal velocity command is turned on.

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

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

Table 9-8 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	0.5 V±20%/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	0.5 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 lower than 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.

(5) General Specifications of CN1 Input/Output Signals
(ABS-E Absolute Encoder, ABS-RⅡ Absolute Sensor and ABS-E.S1 Wiring-saved Absolute Sensor)

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

Table 9-9 General Specifications of Velocity Control Type Input Signal (ABS-E Absolute Encoder, ABS-RⅡ Absolute Sensor and ABS-E.S1 Wiring-saved Absolute Sensor) 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 [For 35 and 36 pins, one of the five 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.
External overheating detection	EOH			Normal operation while input is on. The external overheating alarm state is assumed when input is turned off.
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. (Function disabled for torque control type)
Zero clamp	ZCMD			Inputting this signal makes the speed command 0 (zero). (Function disabled for torque control type)
Internally set velocity select	VCS2 / VCS1			Combining CN1 - 35 and 36 input signals enables a desired internally set velocity to be selected. (Function disabled for torque control type)
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 9-9 General Specifications of Velocity Control Type Input Signal (ABS-E Absolute Encoder, ABS-RⅡ Absolute Sensor and ABS-E.S1 Absolute Sensor) 2/2

Signal name	Abbr.	Pin No. ∗1	Circuit type ∗2	General specification
Monitor 1	MON1	15 (14)	Type 9	0.5 V±20%/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	0.5 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 lower than 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.

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.

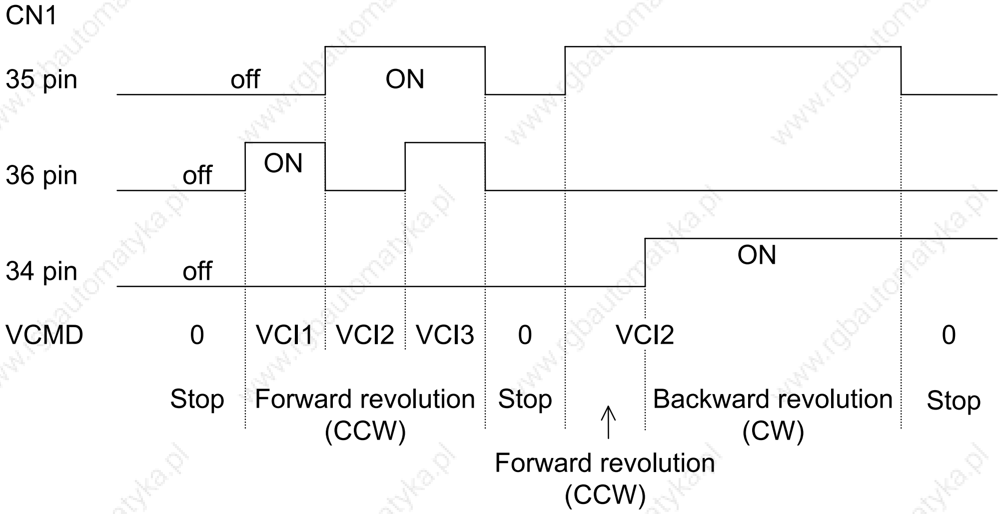
Switching pattern	OFF	ON
Velocity ↔ Torque	Velocity	Torque
Position ↔ Torque	Position	Torque
Position ↔ Velocity	Position	Velocity

9.1.10.2 Precautions

- Utmost care must be taken in the switching procedure.
- During the test mode (JOG or Tune) is on, switching of the control mode is not available.
- When the switching takes place from velocity or position control to torque control, the velocity will be limited in accordance with the set value of speed limit on the parameter (Mode 1 Page 6).
  (As the motor speed exceeds this set value, 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 (to no load or light load status) to prevent motor runaway.
  This function, however, is not capable of running the motor at a constant speed.
  If a relatively small value is set as the speed limit, and if the torque command value is large relative to the load inertia and load torque, the motor speed may exceed this set value. Do not keep using the motor in this situation over a long time period. When you don't turn on the speed limit, the speed limit value must be set at 32767 min^{-1}.
- Note that there is a maximum of 12 msec delay between changing the input signal and completion of control mode switching.
- During the switching of control mode (input signal is ON), the test mode (JOG or Tune) is not available. The screen will display the "Not Ready" message.

9.1.11 Internal Velocity Command

Combining external input signals (3 bits), this command is capable of selecting speed (parameter) and direction.



The CN1 35 and 36 pins are used for selecting the speed, and 34 pin is used for selecting the revolution direction.

Note 1: This function is enabled when parameter Func3 bits3, 2, 1 and 0 are all set at "1010" in the velocity control mode. In this case, the polarity reverse function of the external analog velocity command, the velocity command scale and the velocity command are all disabled.

Note 2: If there is a lag between input timing to the CN1 35 and 36 pins, another speed can be selected. Switching of the signal must take place simultaneously.

Note 3: Note that there is a 12 msec maximum delay from changing the input signal to completion of control mode switching.

9.1.12 Power Supply Capacity

Table 9-10 shows the input power supply capacity under load at the rated output.

Table 9-10 Power Supply Capacity (1/2)

Amplifier model No.	Motor model No.	Power supply capacity per unit	
		Main circuit power supply (KVA)	Control power supply (VA)
PY2A015 (When 200 VAC)	P10B10030H	1.0	40
	P30B04003D	0.2	
	P30B04005D	0.2	
	P30B04010D	0.3	
	P30B06020D	0.5	
	P50B03003D	0.2	
	P50B04006D	0.3	
	P50B04010D	0.4	
	P50B05005D	0.3	
	P50B05010D	0.4	
	P50B05020D	0.8	
	P50B07020D	0.8	
	P50B07030D	1.0	
PY2A030 (When 200 VAC)	P10B10075H	1.9	40
	P10B13050H	1.3	
	P10B13050B	1.3	
	P10B13100B	2.5	
	P20B10100H	2.5	
	P30B06040D	1.0	
	P30B08075D	1.7	
	P50B07040D	1.3	
	P50B08040D	1.3	
	P50B08050D	1.5	
	P50B08075H	2.0	
	P50B08100H	2.2	
	P60B13050H	1.4	
	P80B15075H	1.8	
PY2A050 (When 200 VAC)	P10B13100H	2.5	40
	P10B13150H	3.0	
	P10B13150B	3.0	
	P20B18200B	4.0	
	P20B10100D	2.5	
	P20B10150D	3.0	
	P20B10150H	3.0	
	P20B10200H	4.0	
	P50B08075D	2.0	
	P50B08100D	2.5	
	P60B13100H	2.5	
	P60B13150H	3.9	
	P80B18120H	3.1	

1 When using two or more motors, add the power supply capacity per unit of each motor.
2 When accelerating or decelerating the motor, two-to-fourfold momentary power may be required.

Table 9-10 Power Supply Capacity (1/2)

Amplifier model No.	Motor model No.	Power supply capacity per unit	
		Main circuit power supply (KVA)	Control power supply (VA)
PY2E015 (When 100 VAC)	P30B04003P	0.2	40
	P30B04005P	0.3	
	P30B04010P	0.5	
	P50B03003P	0.2	
	P50B04006P	0.3	
	P50B04010P	0.5	
	P50B05005P	0.3	
	P50B05010P	0.5	
PY2E030 (When 100 VAC)	P30B06020P	1.0	40
	P50B05020P	1.0	
	P50B07020P	1.0	
	P50B07030P	1.5	

1 When using two or more motors, add the power supply capacity per unit of each motor.
2 When accelerating the motor, two-to-fourfold momentary power may be required.

Table 9-11 Rush Current

Amplifier model name	Control circuit (maximum value within 1mS after power on) *3	Main circuit (maximum value within 600mS after power on)
PY2A015	40 A (0 - P) [*1]	23 A (0 - P) [*1]
PY2A030	40 A (0 - P) [*1]	23 A (0 - P) [*1]
PY2A050	40 A (0 - P) [*1]	23 A (0 - P) [*1]
PY2E015	20 A (0 - P) [*2]	17.2 A (0 - P) [*2]
PY2E030	20 A (0 - P) [*2]	17.2 A (0 - P) [*2]

1 The leakage current is maximum when 230 VAC is supplied.
2 The leakage current is the maximum when 115 VAC is supplied.
3 A thermistor is used for the leakage current prevention circuit of the control power supply.
If the temperature of the thermistor remains high such as when turning the power supply on immediately after turning it off, or when turning the power supply on and off repeatedly in a short period, a leakage current higher than that given in the above table may flow.

9.1.13 Servo Amplifier/Servomotor Leakage Current

Since the PY2 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 9-12 Leakage Current

Amplifier model No.	Motor model No.	Leakage current per motor
PY2A015 PY2A030 PY2E015 PY2E030	P10B□□□□□□□◇▽▽	0.5 mA
	P20B□□□□□□□◇▽▽	0.5 mA
	P30B□□□□□□□◇▽▽	0.5 mA
	P50B□□□□□□□◇▽▽	0.5 mA
	P60B□□□□□□□◇▽▽	0.5 mA
	P80B□□□□□□□◇▽▽	0.5 mA
PY2A050	P10B□□□□□□□◇▽▽	1.5 mA
	P20B□□□□□□□◇▽▽	1.5 mA
	P30B□□□□□□□◇▽▽	1.5 mA
	P50B□□□□□□□◇▽▽	1.5 mA
	P60B□□□□□□□◇▽▽	1.5 mA
	P80B□□□□□□□◇▽▽	1.5 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 9-12 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 9-12 are those measured with an ordinary leak checker with filter 700 Hz).

9.1.14 Calorific Value

Table 9-13 shows the calorific values of the PY2 Servo Amplifier under the rated load.

Table 9-13 Calorific Values of PY2 Servo Amplifiers (1/2)

Amplifier model No.	Motor model No.	Total calorific values of Servo Amplifier (W)
PY2A015	P30B04003D	15
	P30B04005D	16
	P30B04010D	19
	P30B06020D	26
	P50B03003D	15
	P50B04006D	16
	P50B04010D	18
	P50B05005D	17
	P50B05010D	19
	P50B05020D	22
	P50B07020D	26
	P50B07030D	27
PY2A030	P10B10030H	30
	P10B10075H	48
	P10B13050H	40
	P10B13050B	34
	P10B13100B	50
	P20B10100H	45
	P30B06040D	32
	P30B08075D	45
	P50B07040D	34
	P50B08040D	35
	P50B08050D	39
	P50B08075H	41
	P50B08100H	46
	P60B13050H	43
	P80B15075H	54
PY2A050	P10B13100H	78
	P10B13150H	103
	P10B13150B	75
	P10B18200B	97
	P20B10100D	68
	P20B10150D	82
	P20B10150H	70
	P20B10200H	88
	P50B08075D	59
	P50B08100D	67
	P60B13100H	74
	P60B13150H	89
	P80B18120H	94

1 Since the values in the table do not include the calorific values of an external regenerative resistor, they must be added as required.

2 When an external regenerative resistor is used, change the addition term of the external regenerative resistor calorific value depending on the installation place.

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

Table 9-13 Calorific Values of PY2 Servo Amplifiers (2/2)

Amplifier model No.	Motor model No.	Total calorific values of Servo Amplifier (W)
PY2E015	P30B04003P	19
	P30B04005P	22
	P30B04010P	27
	P50B03003P	19
	P50B04006P	21
	P50B04010P	25
	P50B05005P	23
	P50B05010P	26
PY2E030	P30B06020P	43
	P50B05020P	37
	P50B07020P	42
	P50B07030P	48

1. Since the values in the table do not include the calorific values of an external regenerative resistor, they must be added as required.
2. When an external regenerative resistor is used, change the addition term of the external regenerative resistor calorific value depending on the installation place.
3. Regarding installation, strictly observe the installation procedure described in "5. Installation".

9.1.15 Dynamic Brake

(1) Slowing-down revolution angle by dynamic brake

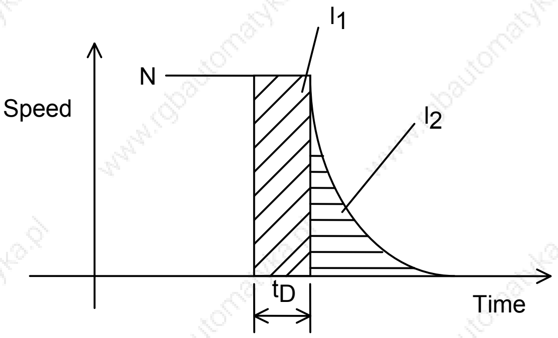


Fig. 9-21

N : Motor speed (min^{-1})
l_1 : Slowing-down revolution angle (rad) by AMP internal processing time t_D.
l_2 : Slowing-down revolution angle (rad) by dynamic brake operation.
t_D : Delay time (sec) from occurrence of a signal until the start of operation. (Based on AMP capacity. Refer to the following table.)

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

$$
\begin{aligned}
l &= l_1 + l_2 \\
&= \frac{2\pi N \cdot t_D}{60} + (J_m + J_L) \times (\alpha N + \beta N^3) \times 2
\end{aligned}
$$

l : Overall slowing-down revolution angle (rad)
J_m : Motor inertia ($kg \cdot m^2$)
J_L : Load inertia (calculated in terms of motor shaft) ($kg \cdot m^2$)
$\alpha \bullet \beta$: Constant related to motor. See Table 9-16.

Table 9-14

Amplifier model No.	Delay time t_D (S)
PY2A015 PY2E015	10×10^{-3}
PY2A030 PY2E030	10×10^{-3}
PY2A050	24×10^{-3}

⚠ The slowing-down revolution angle of the PY2 amplifier is twice that of our conventional PY, PZ or PE series in the worst case.

(2) Instantaneous resistance of dynamic brake

When the load inertia (J_L) substantially exceeds the applicable load inertia, dynamic brake resistance may abnormally increase, causing an overheating alarm or damage of the dynamic brake resistance. 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.

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

$R\phi$: Motor phase winding resistance (Ω)
J_m : Motor inertia ($kg \cdot m^2$)
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 ($N \cdot m$)

Be sure to keep E_{RD} below the value in the following table.

Table 9-15

Amplifier model No.	E_{RD} (J)
PY2A015 PY2E015	360
PY2A030 PY2E030	360
PY2A050	1330

When the energy consumed by dynamic brake resistance during one dynamic braking exceeds the specified value indicated in Table 9-15, the dynamic brake may be damaged. Consult us if such operating conditions are anticipated.
(The dynamic brake will not be damaged if the load is within the range of the applicable load inertia.)

(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 50 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 9-16 Dynamic Brake Constant Table (1/2)

Amplifier model No.	Motor model No.	α	β	J_M (Kg-m^2)
PY2A015	P30B04003D	114.00	60.5×10^{-7}	0.024×10^{-4}
	P30B04005D	66.00	37.3×10^{-7}	0.031×10^{-4}
	P30B04010D	25.00	12.2×10^{-7}	0.051×10^{-4}
	P30B06020D	12.70	17.2×10^{-7}	0.144×10^{-4}
	P50B03003D	170.00	9.20×10^{-7}	0.02×10^{-4}
	P50B04006D	43.90	8.00×10^{-7}	0.054×10^{-4}
	P50B04010D	27.00	5.01×10^{-7}	0.079×10^{-4}
	P50B05005D	59.20	22.8×10^{-7}	0.060×10^{-4}
	P50B05010D	23.00	9.29×10^{-7}	0.098×10^{-4}
	P50B05020D	9.78	3.86×10^{-7}	0.173×10^{-4}
	P50B07020D	13.00	6.14×10^{-7}	0.398×10^{-4}
	P50B07030D	7.27	4.41×10^{-7}	0.507×10^{-4}
PY2A030	P10B10030H	4.29	3.08×10^{-7}	3.9×10^{-4}
	P10B10075H	1.69	0.75×10^{-7}	14×10^{-4}
	P10B13050H	1.29	1.65×10^{-7}	12×10^{-4}
	P10B13050B	0.58	2.41×10^{-7}	12×10^{-4}
	P10B13100B	0.54	1.06×10^{-7}	25×10^{-4}
	P20B10100B	1.61	3.59×10^{-7}	1.55×10^{-4}
	P30B06040D	4.32	6.80×10^{-7}	0.255×10^{-4}
	P30B08075D	2.97	3.68×10^{-7}	0.635×10^{-4}
	P50B07040D	5.63	2.08×10^{-7}	0.74×10^{-4}
	P50B08040D	6.34	2.95×10^{-7}	0.828×10^{-4}
	P50B08050D	4.84	1.44×10^{-7}	1.17×10^{-4}
	P50B08075H	2.36	0.88×10^{-7}	1.93×10^{-4}
	P50B08100H	1.49	0.62×10^{-7}	2.66×10^{-4}
	P60B13050H	2.37	4.74×10^{-7}	2.8×10^{-4}
	P80B15075H	1.54	3.39×10^{-7}	5.3×10^{-4}
PY2A050	P10B13100H	1.69	0.46×10^{-7}	25×10^{-4}
	P10B13150H	1.29	0.27×10^{-7}	35×10^{-4}
	P10B13150B	0.58	0.61×10^{-7}	35×10^{-4}
	P10B18200B	0.54	0.48×10^{-7}	73×10^{-4}
	P20B10100D	3.33	1.81×10^{-7}	1.55×10^{-4}
	P20B10150D	2.19	1.05×10^{-7}	2.04×10^{-4}
	P20B10150H	1.44	1.59×10^{-7}	2.04×10^{-4}
	P20B10200H	1.28	0.93×10^{-7}	2.83×10^{-4}
	P50B08075D	4.61	0.49×10^{-7}	1.93×10^{-4}
	P50B08100D	2.99	0.30×10^{-7}	2.66×10^{-4}
	P60B13100H	1.57	1.19×10^{-7}	5.6×10^{-4}
	P60B13150H	1.08	0.60×10^{-7}	8.3×10^{-4}
	P80B18120H	1.63	2.06×10^{-7}	12.1×10^{-4}

The α and β values are obtained on the assumption that the resistance value of the power line is 0 Ω.

If the combination with the amplifier is not listed in the above table, a different constant applies. In this case, consult with us.

Table 9-16 Dynamic Brake Constant Table (2/2)

Amplifier model No.	Motor model No.	α	β	J_M (Kg-m^2)
PY2E015	P30B04003P	159.18	0.39×10^{-7}	0.024×10^{-4}
	P30B04005P	117.73	0.26×10^{-7}	0.031×10^{-4}
	P30B04010P	49.27	7.63×10^{-7}	0.051×10^{-4}
	P50B03003P	210.53	7.50×10^{-7}	0.02×10^{-4}
	P50B04006P	63.32	5.55×10^{-7}	0.054×10^{-4}
	P50B04010P	40.15	3.42×10^{-7}	0.079×10^{-4}
	P50B05005P	86.16	0.16×10^{-7}	0.060×10^{-4}
	P50B05010P	39.20	5.45×10^{-7}	0.098×10^{-4}
PY2E030	P30B06020P	39.68	5.45×10^{-7}	0.144×10^{-4}
	P50B05020P	22.20	1.67×10^{-7}	0.173×10^{-4}
	P50B07020P	30.48	2.57×10^{-7}	0.398×10^{-4}
	P50B07030P	24.25	1.29×10^{-7}	0.507×10^{-4}

The α and β values are obtained on the assumption that the resistance value of the power line is 0 Ω.

If the combination with the amplifier is not listed in the above table, a different constant applies. In this case, consult with us.

9.1.16 Regenerative Processing

Although the PY2 (15 A/30 A) has a built-in regenerative processing circuit, no regenerative resistor is provided. So, externally connect a regenerative resistor as necessary. It is recommended that one be externally connected when a 300 W or higher motor is to be driven.
Mount it between the P and Y (or COM) terminals of connector CND on the front of the amplifier.
The PY2 (50 A) has a built-in regenerative resistor. However, regenerative power that cannot be absorbed by the built-in resistor may occur depending on the load inertia or the operating pattern. In such cases, connect an external regenerative resistor.

⚠ If inertia is large and sudden starting or stopping is applied without a regenerative resistor, an overvoltage alarm ("5" displayed in the 7-segment LED, alarm code "05H") may be issued. In this case, externally connect a regenerative resistor (the Servo Amplifier will not break even if an overvoltage alarm is issued).

⚠ On the Servo Amplifier without an external regenerative resistor, the main circuit power smoothing electrolytic capacitor is not instantaneously discharged when the R, S or T terminal of the main circuit power is turned off. In this case, allow more than five minutes after the main circuit power is turned off and make sure that the red LED on the front of the amplifier, which indicates whether the main circuit power is charged or not, is turned off (discharged) before removing the amplifier.

Available external regenerative resistors are introduced in 9.5. Select according to your specifications by referring to the following method of calculating 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

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

EM	:	Regenerative energy at horizontal shaft driving	[J]
EHb	:	Regenerative energy at deceleration	[J]
KEϕ	:	Induced voltage constant	[Vrms/min^{-1}] (motor constant)
KT	:	Torque constant	[N･m/Arms] (motor constant)
N	:	Motor speed	[min^{-1}]
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]

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

$$
\begin{aligned}
EM &= EVUb + EVD + EVDb \\
&= \frac{1}{2} \times N \times 3 \cdot KE\phi \times \frac{TUb}{KT} \times tUb - \left(\frac{TUb}{KT}\right)^2 \times 3 \cdot R\phi \times tUb \\
&+ N \times 3 \cdot KE\phi \times \frac{TD}{KT} \times tD - \left(\frac{TD}{KT}\right)^2 \times 3 \cdot R\phi \times tD \\
&+ \frac{1}{2} \times N \times 3 \cdot KE\phi \times \frac{TDb}{KT} \times tDb - \left(\frac{TDb}{KT}\right)^2 \times 3 \cdot R\phi \times tDb
\end{aligned}
$$

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.

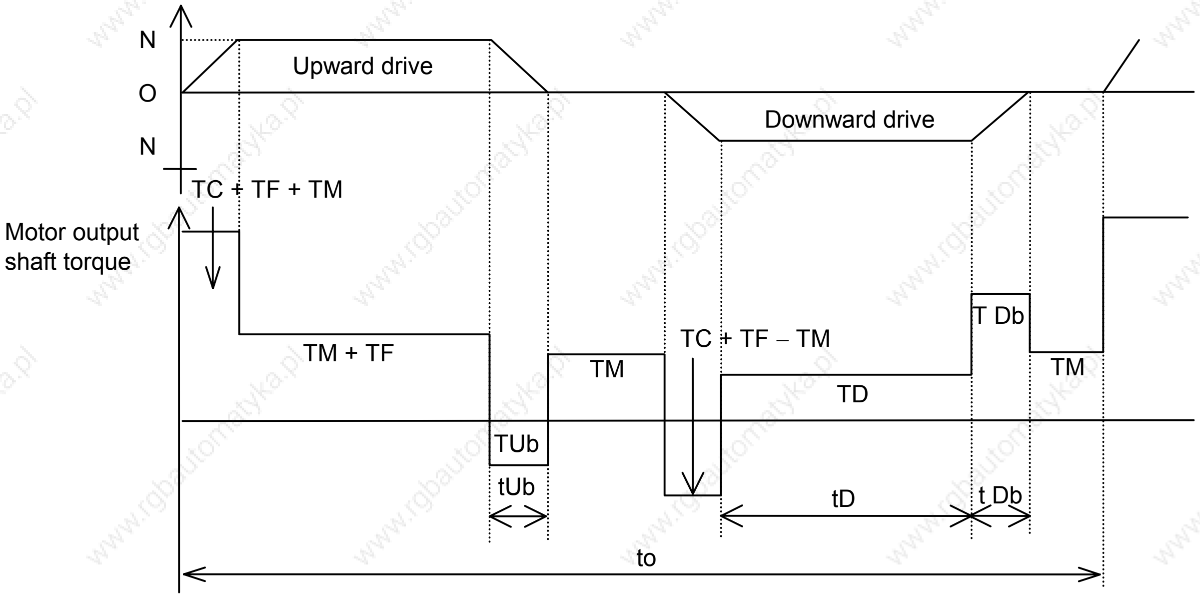


Fig. 9-22

Step 2 : Calculate the effective regenerative power
Based on the calculation obtained during regeneration, check the regenerative capacity of the regenerative resistor connected to the PY2 amplifier.

① For horizontal shaft driving

$$PM = \frac{EM}{t\,o}$$

PM	:	Effective regenerative power	[W]
EM	:	Regenerative energy at deceleration	[J]
t o	:	Cycle time	[s]

② For vertical shaft driving

$$PM = \frac{EM}{t\,o}$$

PM	:	Effective regenerative power	[W]
EM	:	Regenerative energy at upward driving, downward driving and decelerated downward driving	[J]
t o	:	Cycle time	[s]

(2) Selection of external regenerative resistor

Compare the regenerative effective power obtained in steps 1 and 2 in (1) with the values in "9.5 External Regenerative Resistor Combination Table" and select an appropriate resistor.

9.2 Servomotor

9.2.1 Common Specifications

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

Series	P1	P2	P3	P5	P6	P8
Time rating	Continuous					
Insulation class	Class F					
Dielectric strength	1500 VAC for 1 minute					
Insulation resistance	500 VDC and 10 MΩ minimum					
Protective system	Totally-enclosed and self-cooling type					
	IP67 ⚠		IP40	P50B03,04:IP40 Other than the above: IP55	IP67 ⚠	
Sealing	Provided		Not provided	P50B03,04: Not provided Other than the above: Provided	Provided	
Ambient temperature	0 to +40°C					
Storage temperature	– 20 to 65°C					
Ambient humidity	20% to 90% (no condensation)					
Vibration class	V10		V15			
Coating color	Munsell N1.5 equivalent (outside)					
Excitation system	Permanent magnet type					
Installation method	Flange type					

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

9.2.2 Revolution Direction Specifications

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

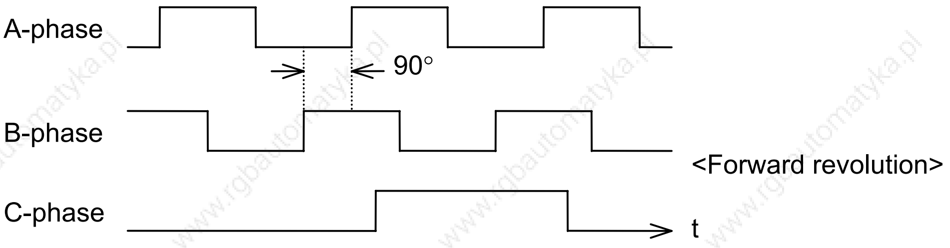
(1) Servomotor

The Servomotor rotates counterclockwise (forward revolution) when viewed from the load side after a command to increase a position command is input.

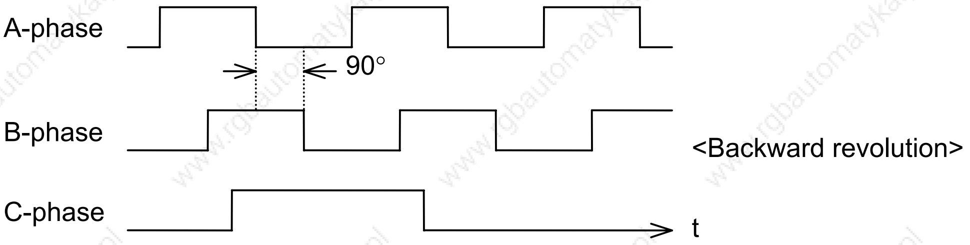
Fig. 9-23 Servomotor

(2) Encoder signal phase

Incremental encoder



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



B-phase lags A-phase by a phase angle of 90°

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

Fig. 9-24 Encoder Signal Phase

Absolute encoder

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

9.2.3 Motor Mechanical Specifications

(1) Vibration resistance

Install the Servomotor shaft horizontally as shown in Fig. 9-25 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.

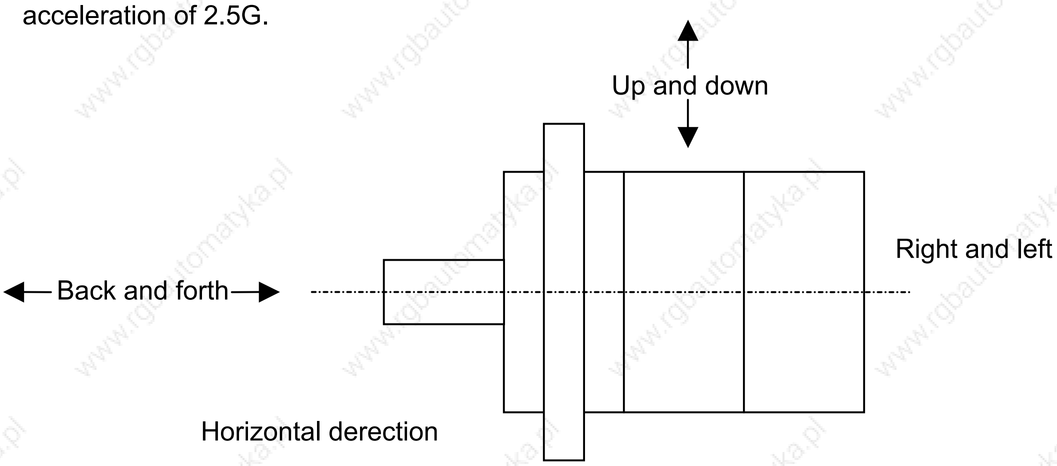


Fig. 9-25 Vibration Resistance Measurement

(2) Shock resistance

Install the motor shaft in the horizontal direction as shown in Fig. 9-26 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.

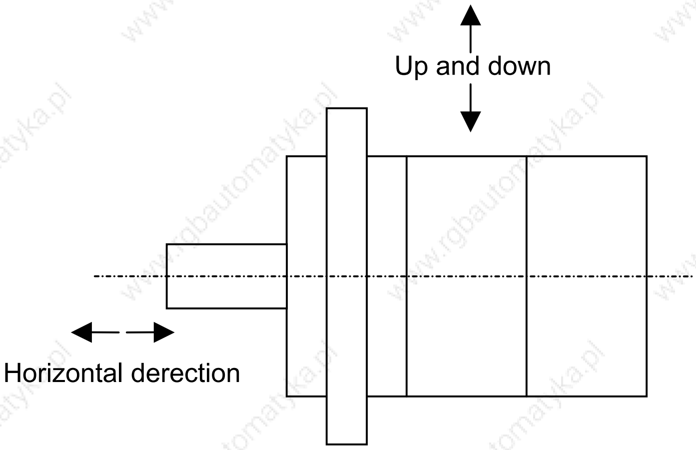
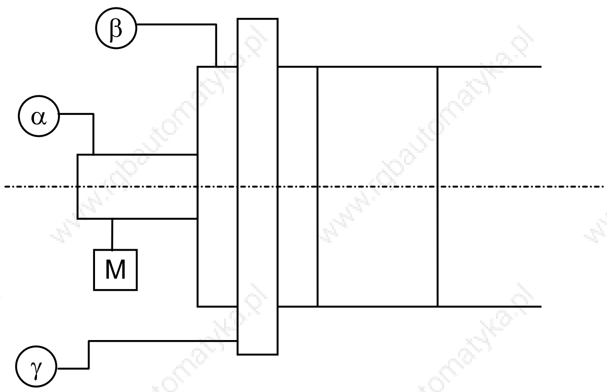


Fig. 9-26 Shock Measurement

(3) Working accuracy

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

Table 9-18

Item	Accuracy (T.I.R) ∗1		Reference diagram
Runout of output shaft end (α)	0.02		
Eccentricity of the external diameter of the flange on output shaft M (β)	P1	0.04	
	P2	0.08	
	P3	0.06	
	P5	0.06	
	P6	0.08	
	P8	0.08	
Perpendicularity of the flange face to output shaft M (γ)	P1	0.04	
	P2	0.08	
	P3	0.07	
	P5	0.07	
	P6	0.08	
	P8	0.08	

∗1: T.I.R (Total Indicator Reading)

(4) Vibration class

The vibration class of the Servomotor is V 15 or less at the maximum speed when measured as a single Servomotor unit as in Fig. 9-27.

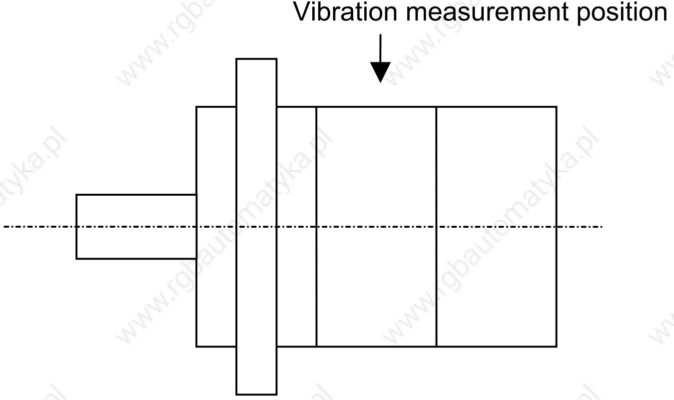


Fig. 9-27 Vibration Measurement

(5) Mechanical strength

The output strength of the Servomotor can endure the instantaneous torque of 300% of the maximum continuous torque.

(6) Oil seal

An S-shaped oil seal as in Table 9-19 is mounted to the output shaft of the Servomotor. 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○□◇▽▽ P10B18350○□◇▽▽ P10B18450○□◇▽▽	AE2965F1
P10B18550○□◇▽▽	AE3459A5
P20B10○○○○□◇▽▽	AC1306E0
P30B○○○○○○□◇▽▽ P50B03○○○○□◇▽▽ P50B04○○○○□◇▽▽	(None)
P50B05○○○○□◇▽▽	AC0382A0
P50B07○○○○□◇▽▽	AC0687A0
P50B08○○○○□◇▽▽	AC0875A0
P60B13○○○○□◇▽▽ P60B15○○○○□◇▽▽ P80B15○○○○□◇▽▽	AC1677E1
P60B18○○○○□◇▽▽	AC2368E1
P80B18○○○○□◇▽▽	AC2368E0

9.2.4 Holding Brake Specifications

An optional holding brake is available for each motor. Since this brake is used for holding, it cannot be used for braking except in an emergency. Turn brake excitation on and off using the holding brake timing signal output.

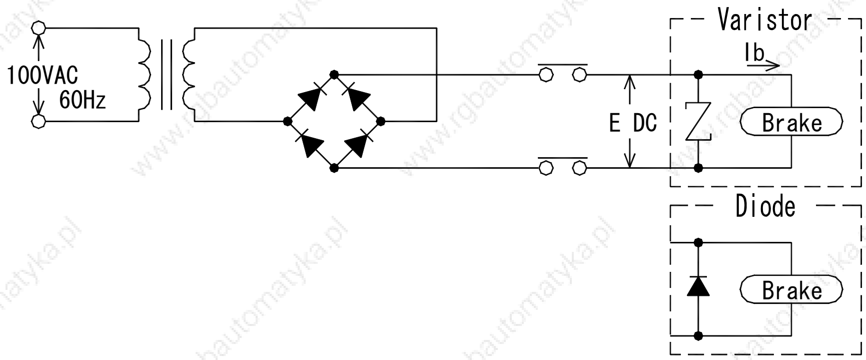
When the signal is used, forcibly set the command to 0 min^{-1} in the Servo Amplifier while the brake is released.

To externally control the holding brake, a response time as in Table 9-20 is required. When using a motor with a brake, determine the timing sequence taking this response delay time into account.

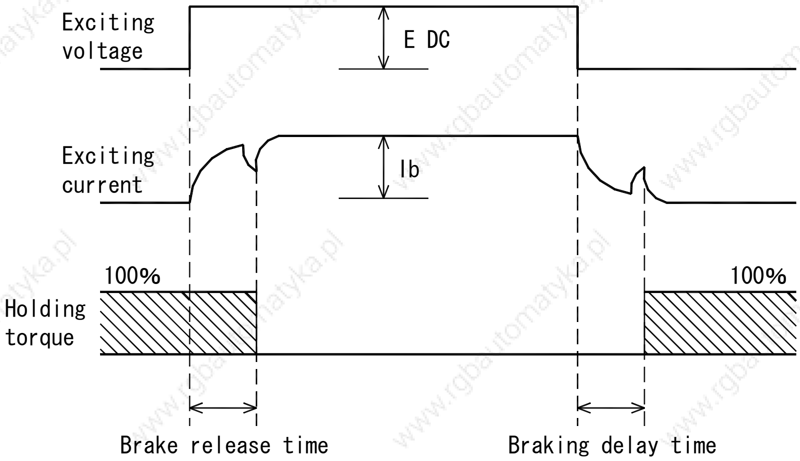
Table 9-20 Holding Brake Specifications

Model No.		Static friction torque	Brake release time	Braking delay time (msec)	
				Varister	Diode
P1	P10B10030	3.9	40	30	120
	P10B10075				
	P10B13050	8.8	100	30	140
	P10B13100				
	P10B13150				
	P10B18200	32.4	120	40	150
P2	P20B10100	3.92	40	30	120
	P20B10150	7.84	100	30	140
	P20B10200				
P3	P30B04003	0.098	25	15	100
	P30B04005	0.157			
	P30B04010	0.32			
	P30B06020	0.637	30	20	120
	P30B06040	1.274			
	P30B08075	2.38	40	20	200
P5	P50B03003	0.098	25	15	60
	P50B04006	0.191	25	15	100
	P50B04010	0.319			
	P50B05005	0.167	15	10	100
	P50B05010	0.353			
	P50B05020				
	P50B07020	0.69	25	15	100
	P50B07030	0.98			
	P50B07040				
	P50B08040	1.37	30	20	200
	P50B08050	1.96			
	P50B08075	2.94			
	P50B08100				
P6	P60B13050	3.5	40	30	120
	P60B13100	9.0	70	30	130
	P60B13150	9.0	100	30	140
	P60B13200	12.0			
	P60B18200				
	P60B18350	32.0	120	40	150
P8	P80B15075	9.0	70	30	130
	P80B18120				

1. The brake response time was measured in the following circuit.



2. The brake release and braking delay time refers to those in the Fig. below.



3. The brake release time is the same for both the varistor and the diode.

9.2.5.1 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.

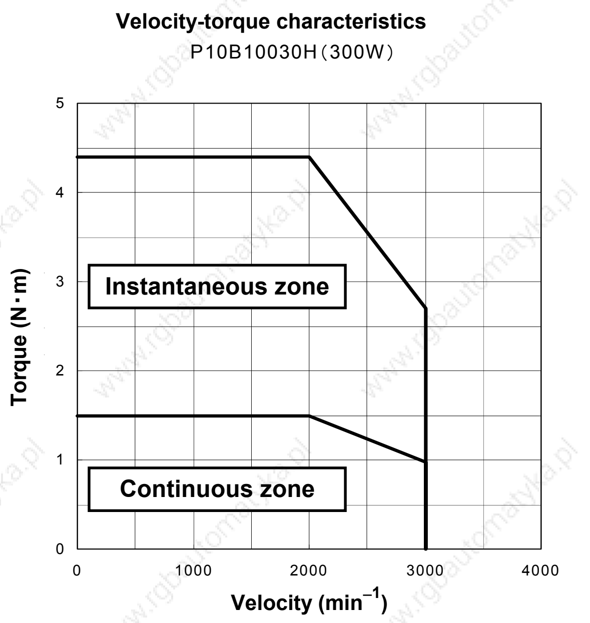
P10B10030H

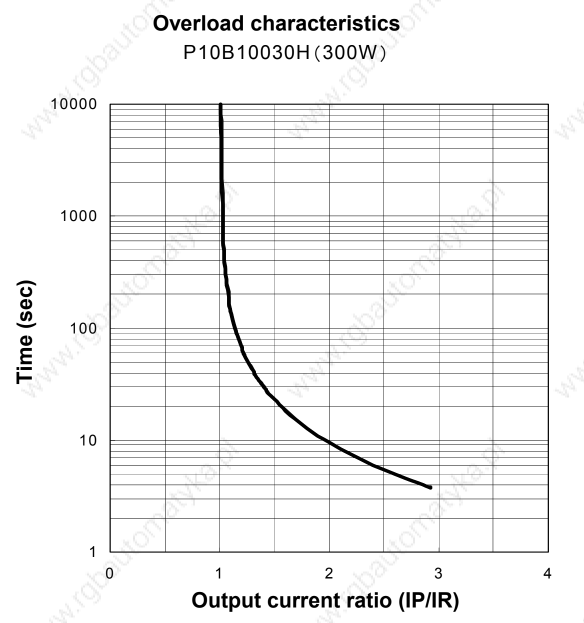
Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	300	W	300	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	1.5	N·m	15	kg·cm
∗ Continuous stall torque	T_S	1.5	N·m	15	kg·cm
∗ Instantaneous maximum stall torque	T_P	4.4	N·m	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·m^2(GD^2/4)	4.08	g·cm·s^2
Inertia (including ABS-E)	J_M	4.0×10^{-4}	kg·m^2(GD^2/4)	4.1	g·cm·s^2
Inertia (including ABS-RII)	J_M	3.98×10^{-4}	kg·m^2(GD^2/4)	4.08	g·cm·s^2
Applicable load inertia	J_L	$J_M \times 5$	kg·m^2(GD^2/4)	$J_M \times 5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	5.1	kg	5.1	kg
Weight (including ABS-E)	W_E	5.0	kg	5.0	kg
Weight (including ABS-RII)	W_E	5.2	kg	5.2	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	3.9 or more	N·m	40 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.76/0.23	A(DC)	0.76/0.23	A(DC)
Inertia	J_B	0.34×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.





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}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	14.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	14.1×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	14.1	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RII)	J_M	14.08×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	14.08	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	$J_M \times 4$	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	$J_M \times 4$	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	9.9	kg	9.9	kg
Weight (including ABS-E)	W_E	9.8	kg	9.8	kg
Weight (including ABS-RII)	W_E	10.0	kg	10.0	kg

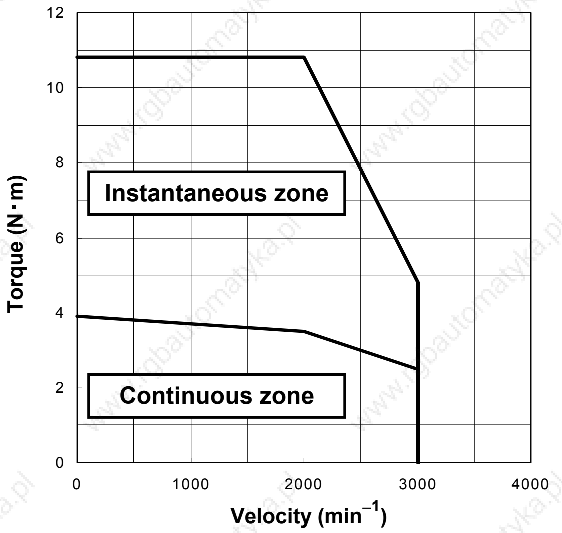
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.9 or more	N·m	40 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.76/0.23	A(DC)	0.76/0.23	A(DC)
Inertia	J_B	0.34×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	0.35	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	0.8	kg	0.8	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

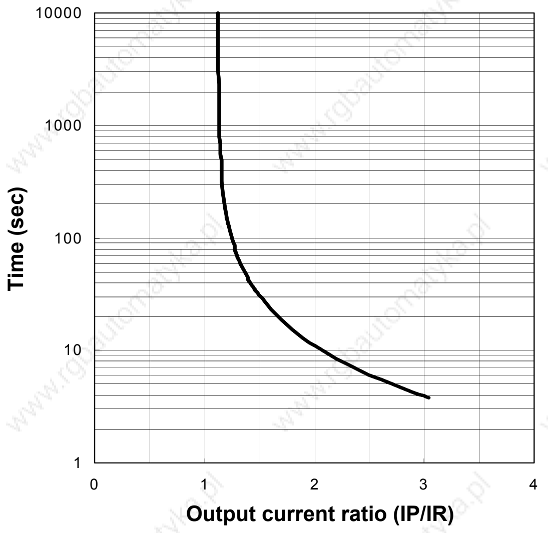
Velocity-torque characteristics

P10B10075H（750W）



Overload characteristics

P10B10075H（750W）



P10B13050H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	500	W	500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	2.4	N·m	24	kg·cm
∗ Continuous stall torque	T_S	2.9	N·m	30	kg·cm
∗ Instantaneous maximum stall torque	T_P	8.8	N·m	90	kg·cm
∗ Rated armature current	I_R	4.0	Arms	4.0	Arms
∗ Continuous stall armature current	I_S	4.6	Arms	4.6	Arms
∗ Instantaneous maximum stall armature current	I_P	15.1	Arms	15.1	Arms
Torque constant	K_T	0.72	N·m/Arms	7.3	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	25.1	$\mathrm{mV/min}^{-1}$	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}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	12	$\mathrm{g \cdot cm \cdot s^2}$
Inertia (including ABS-E)	J_M	12.1×10^{-4}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	12.1	$\mathrm{g \cdot cm \cdot s^2}$
Inertia (including ABS-RII)	J_M	12.08×10^{-4}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	12	$\mathrm{g \cdot cm \cdot s^2}$
Applicable load inertia	J_L	$J_M \times 5$	$\mathrm{kg \cdot m^2 (GD^2/4)}$	$J_M \times 5$	$\mathrm{g \cdot cm \cdot s^2}$
Weight (including wiring-saved INC)	W_E	7.6	kg	7.6	kg
Weight (including ABS-E)	W_E	7.5	kg	7.5	kg
Weight (including ABS-RII)	W_E	7.7	kg	8.7	kg

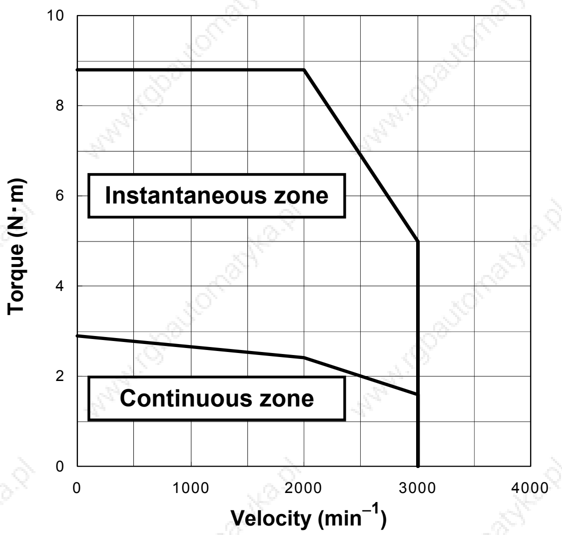
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	0.5	$\mathrm{g \cdot cm \cdot s^2}$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

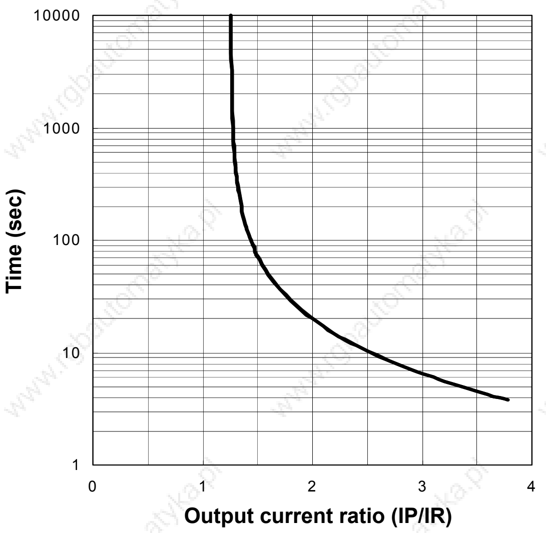
Velocity-torque characteristics

P10B13050H（500W）



Overload characteristics

P10B13050H（500W）



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-RII)	J_M	25.08×10^{-4}	$kg \cdot m^2(GD^2/4)$	25	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	$J_M \times 5$	$kg \cdot m^2(GD^2/4)$	$J_M \times 5$	$g \cdot cm \cdot s^2$
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-RII)	W_E	11.8	kg	11.8	kg

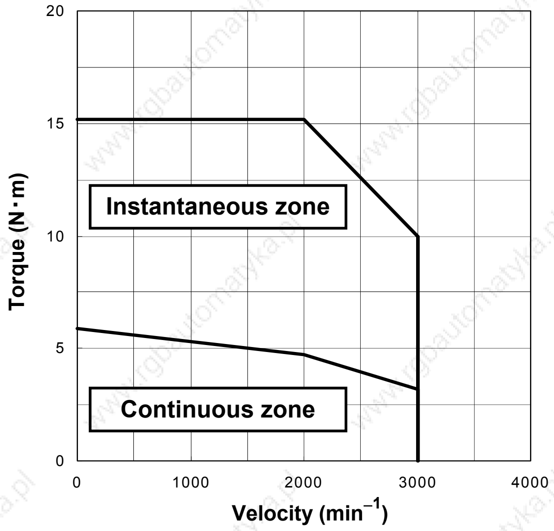
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	$kg \cdot m^2(GD^2/4)$	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. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

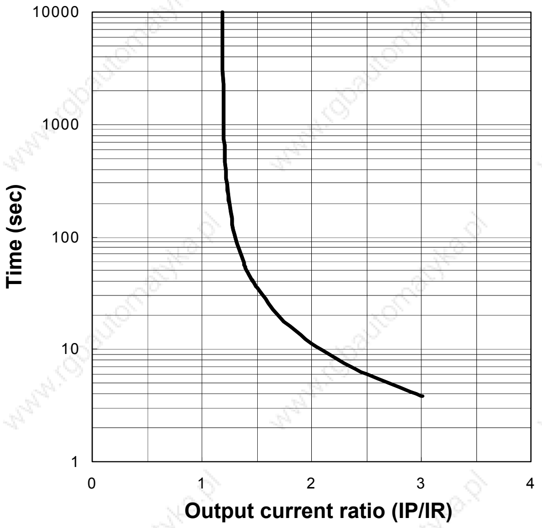
Velocity-torque characteristics

P10B13100H(1.0kW)



Overload characteristics

P10B13100H(1.0kW)



9. SPECIFICATIONS

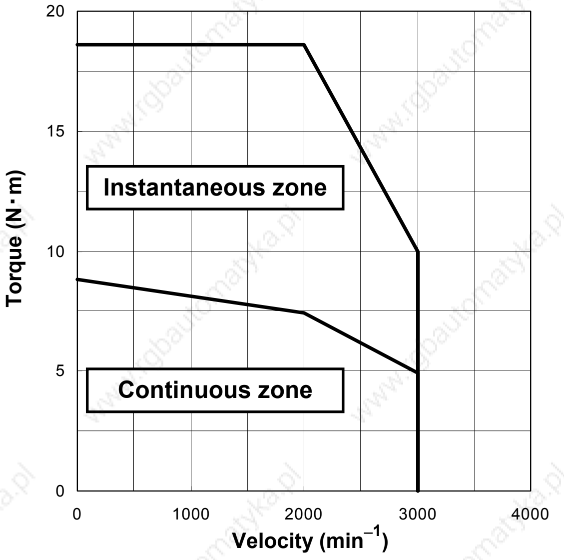
P10B13150H

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·m^2(GD^2/4)	36.08	g·cm·s^2
Inertia (including ABS-E)	J_M	35.1×10^{-4}	kg·m^2(GD^2/4)	36.1	g·cm·s^2
Inertia (including ABS-RII)	J_M	35.08×10^{-4}	kg·m^2(GD^2/4)	36.08	g·cm·s^2
Applicable load inertia	J_L	$J_M \times 5$	kg·m^2(GD^2/4)	$J_M \times 5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	16.1	kg	16.1	kg
Weight (including ABS-E)	W_E	16.0	kg	16.0	kg
Weight (including ABS-RII)	W_E	16.2	kg	16.2	kg

Holding Brake Data Sheet (Option)

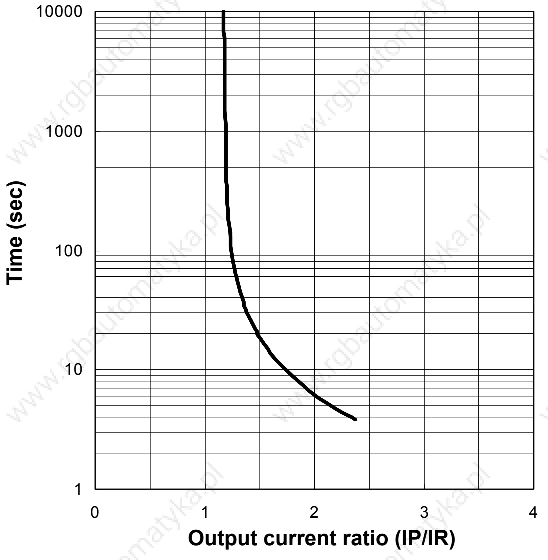
Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P10B13150H（1.5kW）



Overload characteristics

P10B13150H（1.5kW）

P10B13050B

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	500	W	500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	2000	min^{-1}	2000	rpm
* Rated torque	T_R	2.4	N·m	24	kg·cm
* Continuous stall torque	T_S	2.9	N·m	30	kg·cm
* Instantaneous maximum stall torque	T_P	8.8	N·m	90	kg·cm
* Rated armature current	I_R	2.9	Arms	2.9	Arms
* Continuous stall armature current	I_S	3.4	Arms	3.4	Arms
* Instantaneous maximum stall armature current	I_P	11.0	Arms	11.0	Arms
Torque constant	K_T	0.98	N·m/Arms	10.0	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	34.3	mV/min^{-1}	34.3	V/krpm
Phase armature resistance	R_ϕ	2.43	Ω	2.43	Ω
Electrical time constant	t_e	3.2	msec	3.2	msec
Mechanical time constant (not including sensor)	t_m	9.0	msec	9.0	msec
Inertia (including wiring-saved INC)	J_M	12.08×10^{-4}	kg·m^2(GD^2/4)	12.08	g·cm·s^2
Inertia (including ABS-E)	J_M	12.1×10^{-4}	kg·m^2(GD^2/4)	12.1	g·cm·s^2
Inertia (including ABS-RII)	J_M	12.08×10^{-4}	kg·m^2(GD^2/4)	12.08	g·cm·s^2
Applicable load inertia	J_L	$J_M \times 5$	kg·m^2(GD^2/4)	$J_M \times 5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	7.6	kg	7.6	kg
Weight (including ABS-E)	W_E	7.5	kg	7.5	kg
Weight (including ABS-RII)	W_E	7.7	kg	7.7	kg

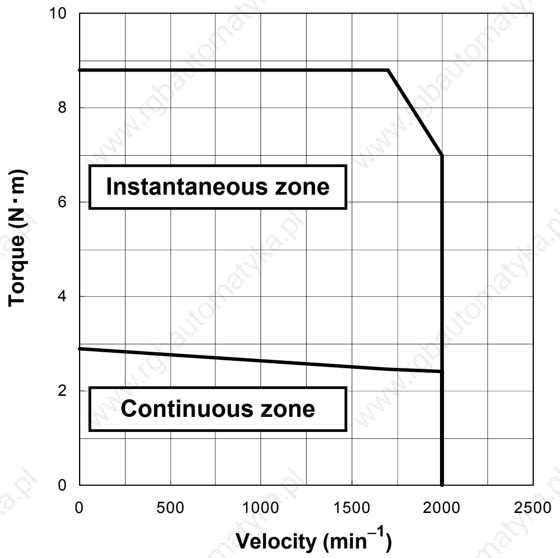
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 300 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

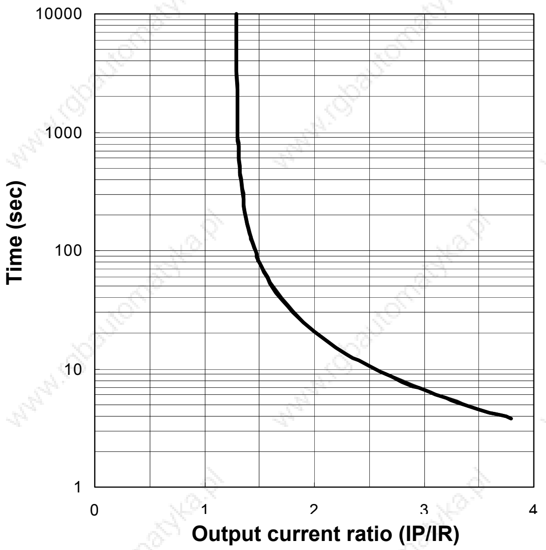
Velocity-torque characteristics

P10B13050B(500W)



Overload characteristics

P10B13050B(0.5kW)



9. SPECIFICATIONS

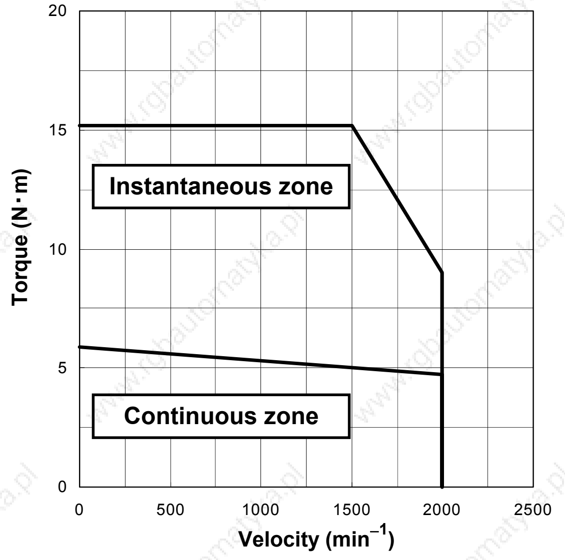
P10B13100B

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·m^2(GD^2/4)	25.08	g·cm·s^2
Inertia (including ABS-E)	J_M	25.1×10^{-4}	kg·m^2(GD^2/4)	25.1	g·cm·s^2
Inertia (including ABS-RII)	J_M	25.08×10^{-4}	kg·m^2(GD^2/4)	25.08	g·cm·s^2
Applicable load inertia	J_L	$J_M \times 5$	kg·m^2(GD^2/4)	$J_M \times 5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	11.7	kg	11.7	kg
Weight (including ABS-E)	W_E	11.6	kg	11.6	kg
Weight (including ABS-RII)	W_E	11.8	kg	11.8	kg

Holding Brake Data Sheet (Option)

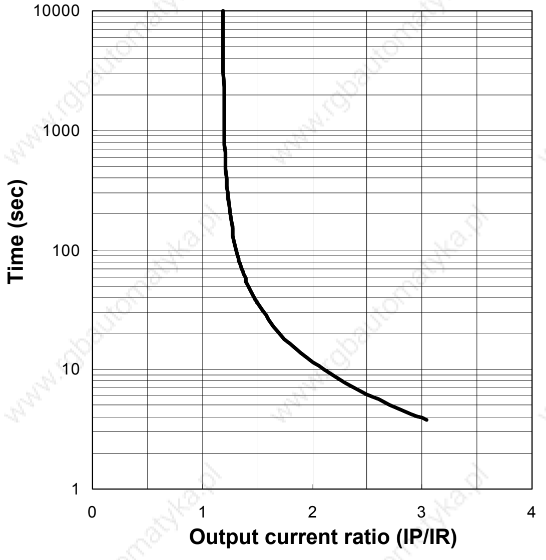
Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P10B13100B（1.0kW）



Overload characteristics

P10B13100B（1.0kW）

9. SPECIFICATIONS

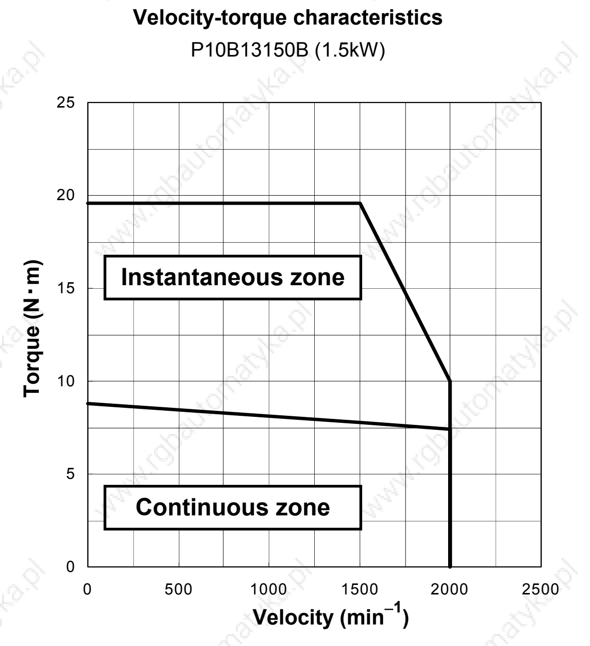
P10B13150B

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·m^2(GD^2/4)	36.08	g·cm·s^2
Inertia (including ABS-E)	J_M	35.1×10^{-4}	kg·m^2(GD^2/4)	36.1	g·cm·s^2
Inertia (including ABS-RII)	J_M	35.08×10^{-4}	kg·m^2(GD^2/4)	36.08	g·cm·s^2
Applicable load inertia	J_L	$J_M \times 5$	kg·m^2(GD^2/4)	$J_M \times 5$	g·cm·s^2
Weight (including wiring-saved INC)	W_E	16.1	kg	16.1	kg
Weight (including ABS-E)	W_E	16.1	kg	16.0	kg
Weight (including ABS-RII)	W_E	16.2	kg	16.2	kg

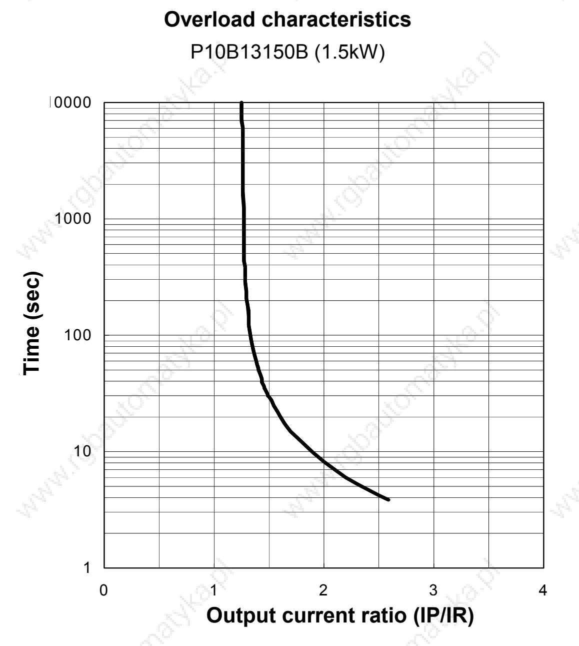
Holding Brake Data Sheet (Option)

Holding torque	T_B	8.8 or more	N·m	90 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.


Velocity-torque characteristics

P10B13150B (1.5kW)


Overload characteristics

P10B13150B (1.5kW)

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}	$kg·m^2(GD^2/4)$	74.08	$g·cm·s^2$
Inertia (including ABS-E)	J_M	73.1×10^{-4}	$kg·m^2(GD^2/4)$	74.1	$g·cm·s^2$
Inertia (including ABS-RII)	J_M	73.08×10^{-4}	$kg·m^2(GD^2/4)$	74.08	$g·cm·s^2$
Applicable load inertia	J_L	$J_M \times 5$	$kg·m^2(GD^2/4)$	$J_M \times 5$	$g·cm·s^2$
Weight (including wiring-saved INC)	W_E	23.1	kg	23.1	kg
Weight (including ABS-E)	W_E	23.0	kg	23.0	kg
Weight (including ABS-RII)	W_E	23.2	kg	23.2	kg

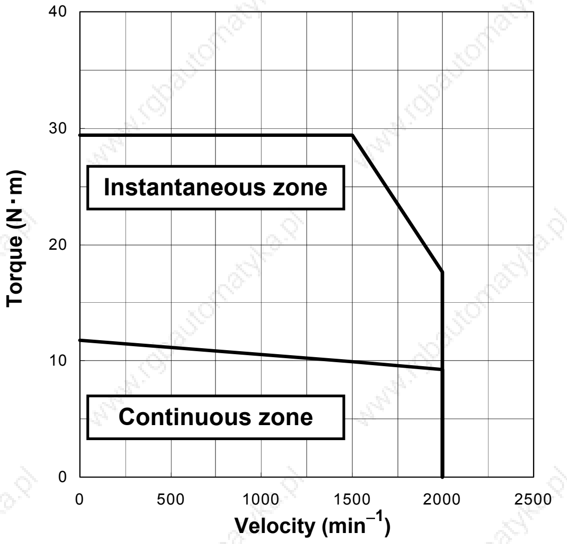
Holding Brake Data Sheet (Option)

Holding torque	T_B	32.4 or more	N·m	330 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	1.4/0.37	A(DC)	1.4/0.37	A(DC)
Inertia	J_B	3.4×10^{-4}	$kg·m^2(GD^2/4)$	3.5	$g·cm·s^2$
Weight	W	5.0	kg	5.0	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

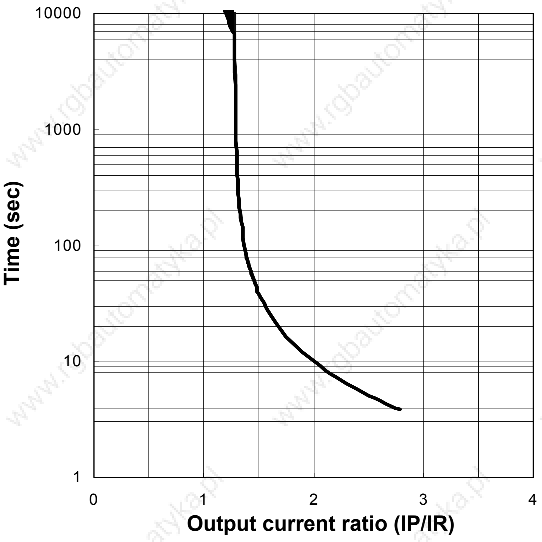
Velocity-torque characteristics

P10B18200B (2.0kW)



Overload characteristics

P10B13150B (1.5kW)



9.2.5.2 Motor Data Sheet P2

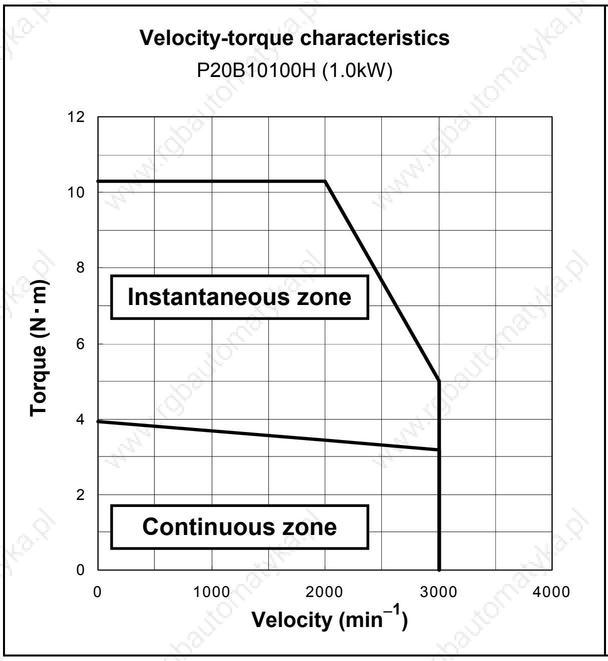
P20B10100H

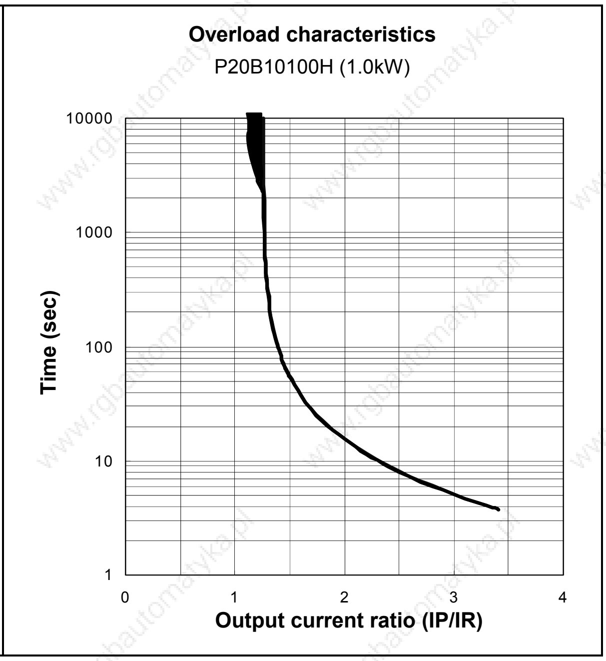
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	1000	W	1000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	3.19	N·m	32.5	kg·cm
* Continuous stall torque	T_S	3.92	N·m	40	kg·cm
* Instantaneous maximum stall torque	T_P	10.3	N·m	10.5	kg·cm
* Rated armature current	I_R	4.1	Arms	4.1	Arms
* Continuous stall armature current	I_S	4.7	Arms	4.7	Arms
* Instantaneous maximum stall armature current	I_P	14	Arms	14	Arms
Torque constant	K_T	0.89	N·m/Arms	9.1	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	31.2	$\mathrm{mV/min}^{-1}$	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}	$\mathrm{kg \cdot m^2(GD^2/4)}$	1.58	$\mathrm{g \cdot cm \cdot s^2}$
Inertia (including ABS-E)	J_M	1.57×10^{-4}	$\mathrm{kg \cdot m^2(GD^2/4)}$	1.6	$\mathrm{g \cdot cm \cdot s^2}$
Inertia (including ABS-RII)	J_M	1.55×10^{-4}	$\mathrm{kg \cdot m^2(GD^2/4)}$	1.58	$\mathrm{g \cdot cm \cdot s^2}$
Applicable load inertia	J_L	15.5×10^{-4}	$\mathrm{kg \cdot m^2(GD^2/4)}$	15.8	$\mathrm{g \cdot cm \cdot s^2}$
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}	$\mathrm{kg \cdot m^2(GD^2/4)}$	0.15	$\mathrm{g \cdot cm \cdot s^2}$
Weight	W	1.3	kg	1.3	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.





P20B10150H

	Name	Symbol	Data	Unit	Data	Unit
∗	Rated output	P_R	1500	W	1500	W
	Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
	Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗	Rated torque	T_R	4.79	N·m	48.8	kg·cm
∗	Continuous stall torque	T_S	4.90	N·m	50	kg·cm
∗	Instantaneous maximum stall torque	T_P	17.7	N·m	180	kg·cm
∗	Rated armature current	I_R	6.5	Arms	6.5	Arms
∗	Continuous stall armature current	I_S	6.3	Arms	6.3	Arms
∗	Instantaneous maximum stall armature current	I_P	25	Arms	25	Arms
	Torque constant	K_T	0.83	N·m/Arms	8.5	kg·cm/Arms
	Induced voltage constant	$K_{E\phi}$	29.0	mV/min^{-1}	29.0	V/krpm
	Phase armature resistance	R_ϕ	0.67	Ω	0.67	Ω
	Electrical time constant	t_e	13	msec	13	msec
	Mechanical time constant (not including sensor)	t_m	0.57	msec	0.57	msec
	Inertia (including wiring-saved INC)	J_M	2.04×10^{-4}	kg·m^2(GD^2/4)	2.08	g·cm·s^2
	Inertia (including ABS-E)	J_M	2.06×10^{-4}	kg·m^2(GD^2/4)	2.1	g·cm·s^2
	Inertia (including ABS-RII)	J_M	2.04×10^{-4}	kg·m^2(GD^2/4)	2.08	g·cm·s^2
	Applicable load inertia	J_L	20.4×10^{-4}	kg·m^2(GD^2/4)	20.8	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	6.5	kg	6.5	kg
	Weight (including ABS-E)	W_E	6.4	kg	6.4	kg
	Weight (including ABS-RII)	W_E	6.6	kg	6.6	kg

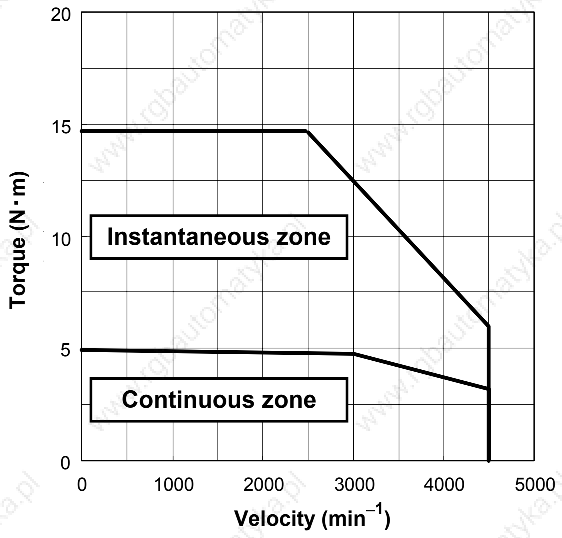
Holding Brake Data Sheet (Option)

Holding torque	T_B	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.83/0.22	A(DC)	0.83/0.22	A(DC)
Inertia	J_B	0.40×10^{-4}	kg·m^2(GD^2/4)	0.39	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

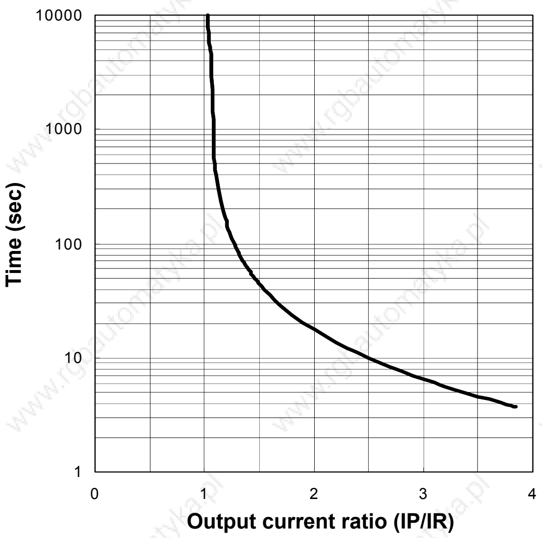
Velocity-torque characteristics

P20B10150H (1.5kW)



Overload characteristics

P20B10150H (1.5kW)



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·m^2(GD^2/4)	2.88	g·cm·s^2
Inertia (including ABS-E)	J_M	2.85×10^{-4}	kg·m^2(GD^2/4)	2.9	g·cm·s^2
Inertia (including ABS-RII)	J_M	2.83×10^{-4}	kg·m^2(GD^2/4)	2.88	g·cm·s^2
Applicable load inertia	J_L	28.3×10^{-4}	kg·m^2(GD^2/4)	28.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	8.7	kg	8.7	kg
Weight (including ABS-E)	W_E	8.6	kg	8.6	kg
Weight (including ABS-RII)	W_E	8.8	kg	8.8	kg

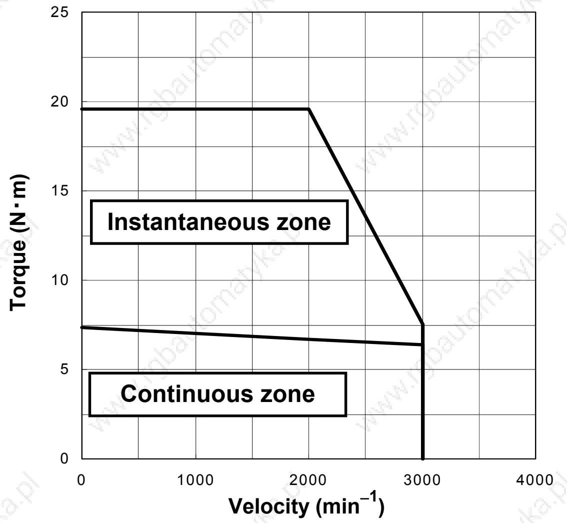
Holding Brake Data Sheet (Option)

Holding torque	T_B	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.83/0.22	A(DC)	0.83/0.22	A(DC)
Inertia	J_B	0.40×10^{-4}	kg·m^2(GD^2/4)	0.39	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 470 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

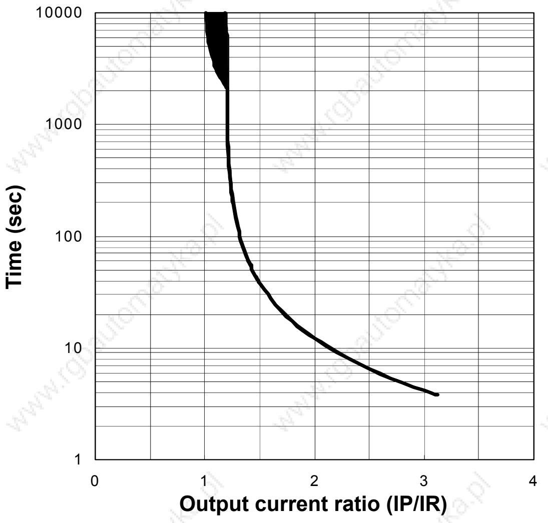
Velocity-torque characteristics

P20B10200H (2.0kW)



Overload characteristics

P20B10200H (2.0kW)



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}	$\text{kg·m}^2(\text{GD}^2/4)$	1.58	g·cm·s^2
Inertia (including ABS-E)	J_M	1.57×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	1.6	g·cm·s^2
Inertia (including ABS-RII)	J_M	1.55×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	1.58	g·cm·s^2
Applicable load inertia	J_L	15.5×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	15.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	5.4	kg	5.4	kg
Weight (including ABS-E)	W_E	5.3	kg	5.3	kg
Weight (including ABS-RII)	W_E	5.5	kg	5.5	kg

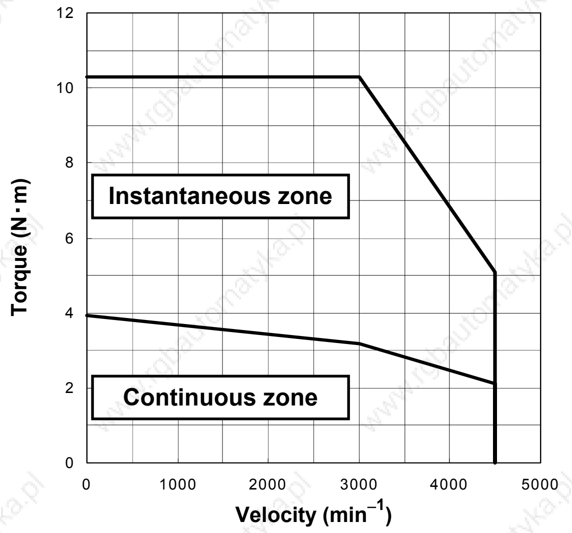
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.92 or more	N·m	40 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.60/0.16	A(DC)	0.60/0.16	A(DC)
Inertia	J_B	0.15×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	0.15	g·cm·s^2
Weight	W	1.3	kg	1.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

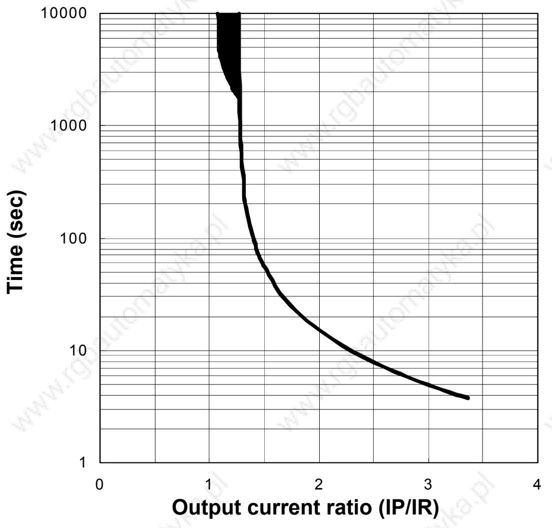
Velocity-torque characteristics

P20B10100D (1.0kW)



Overload characteristics

P20B10100D (1.0kW)



9. SPECIFICATIONS

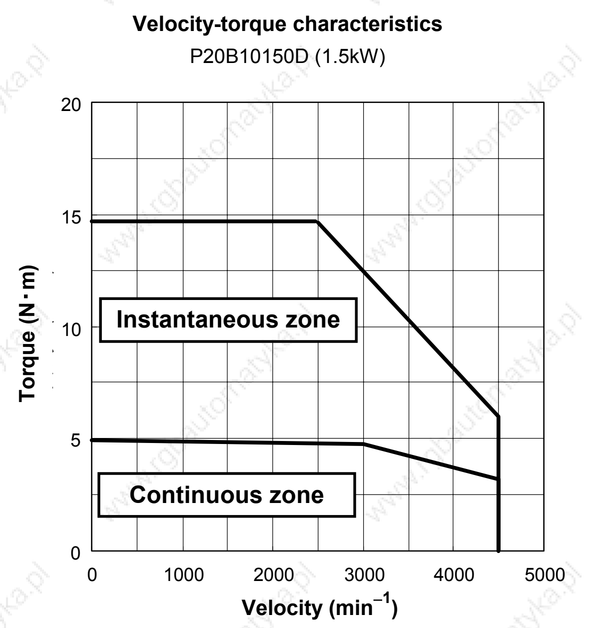
P20B10150D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	4.79	N·m	48.8	kg·cm
* Continuous stall torque	T_S	4.90	N·m	50	kg·cm
* Instantaneous maximum stall torque	T_P	14.7	N·m	150	kg·cm
* Rated armature current	I_R	8.4	Arms	8.4	Arms
* Continuous stall armature current	I_S	8.1	Arms	8.1	Arms
* Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.65	N·m/Arms	6.6	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	22.6	mV/min^{-1}	22.6	V/krpm
Phase armature resistance	R_ϕ	0.42	Ω	0.42	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	0.59	msec	0.59	msec
Inertia (including wiring-saved INC)	J_M	2.04×10^{-4}	kg·m^2(GD^2/4)	2.08	g·cm·s^2
Inertia (including ABS-E)	J_M	2.06×10^{-4}	kg·m^2(GD^2/4)	2.1	g·cm·s^2
Inertia (including ABS-RII)	J_M	2.04×10^{-4}	kg·m^2(GD^2/4)	2.08	g·cm·s^2
Applicable load inertia	J_L	20.4×10^{-4}	kg·m^2(GD^2/4)	20.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	6.5	kg	6.5	kg
Weight (including ABS-E)	W_E	6.4	kg	6.4	kg
Weight (including ABS-RII)	W_E	6.6	kg	6.6	kg

Holding Brake Data Sheet (Option)

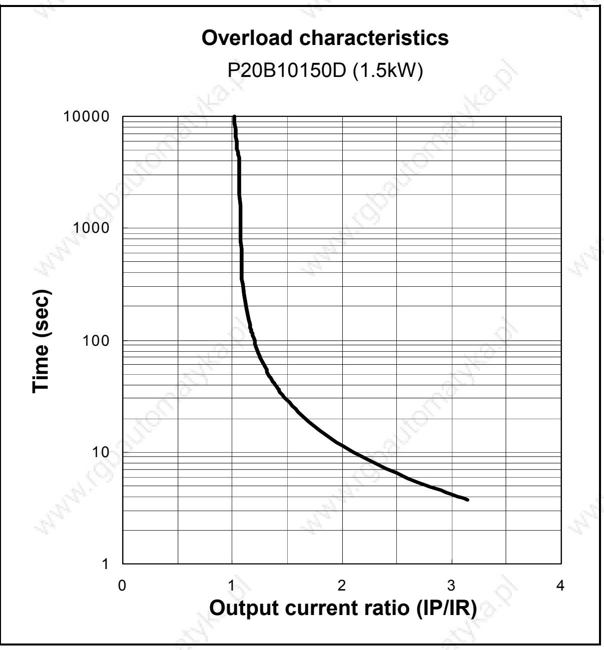
Holding torque	T_B	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.83/0.22	A(DC)	0.83/0.22	A(DC)
Inertia	J_B	0.40×10^{-4}	kg·m^2(GD^2/4)	0.39	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P20B10150D (1.5kW)



Overload characteristics

P20B10150D (1.5kW)

9.2.5.3 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·m^2(GD^2/4)	0.025	g·cm·s^2
Inertia (including ABS-E)	J_M	0.049×10^{-4}	kg·m^2(GD^2/4)	0.05	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.021×10^{-4}	kg·m^2(GD^2/4)	0.0223	g·cm·s^2
Applicable load inertia	J_L	0.24×10^{-4}	kg·m^2(GD^2/4)	0.25	g·cm·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-RII)	W_E	0.39	kg	0.39	kg

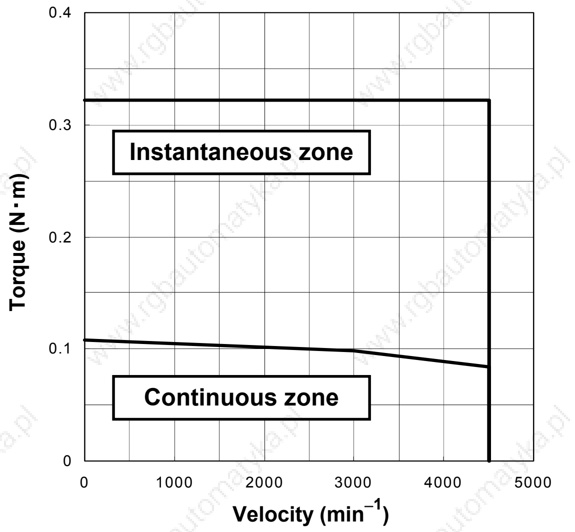
Holding Brake Data Sheet (Option)

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·m^2(GD^2/4)	0.008	g·cm·s^2
Weight	W	0.24	kg	0.24	kg

- The mark ∗ denotes the value after a temperature rise. The others are values a 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

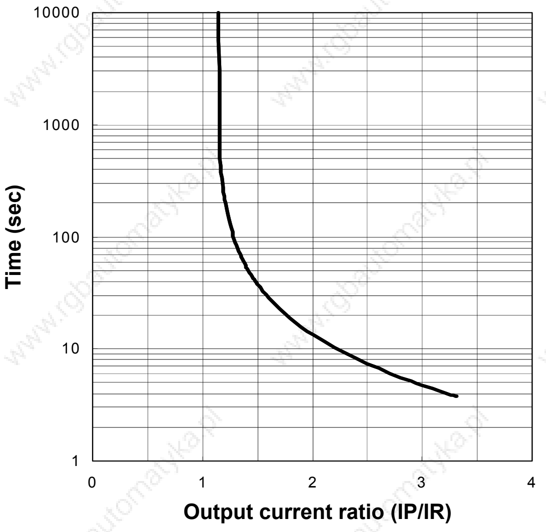
Velocity-torque characteristics

P30B04003D（30W）



Overload characteristics

P30B04003D（30W）



9. SPECIFICATIONS

P30B04005D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	50	W	50	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.157	N·m	1.6	kg·cm
* Continuous stall torque	T_S	0.167	N·m	1.7	kg·cm
* Instantaneous maximum stall torque	T_P	0.49	N·m	5.0	kg·cm
* Rated armature current	I_R	0.74	Arms	0.74	Arms
* Continuous stall armature current	I_S	0.75	Arms	0.75	Arms
* Instantaneous maximum stall armature current	I_P	2.4	Arms	2.4	Arms
Torque constant	K_T	0.235	N·m/Arms	2.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	8.2	mV/min^{-1}	8.2	V/krpm
Phase armature resistance	R_ϕ	9.1	Ω	9.1	Ω
Electrical time constant	t_e	1.2	msec	1.2	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	0.031×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	0.032	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	0.056×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	0.057	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RII)	J_M	0.028×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	0.029	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	0.31×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	0.32	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	0.35	kg	0.35	kg
Weight (including ABS-E)	W_E	0.68	kg	0.68	kg
Weight (including ABS-RII)	W_E	0.44	kg	0.44	kg

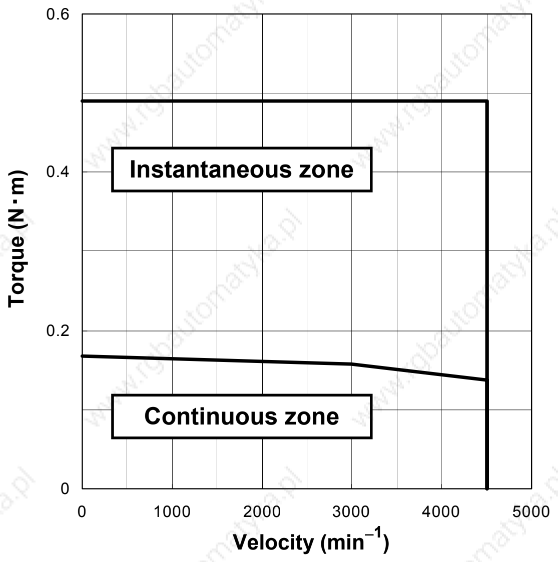
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.157 or more	N·m	1.6 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.26/0.07	A(DC)	0.26/0.07	A(DC)
Inertia	J_B	0.0078×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	0.008	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	0.24	kg	0.24	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

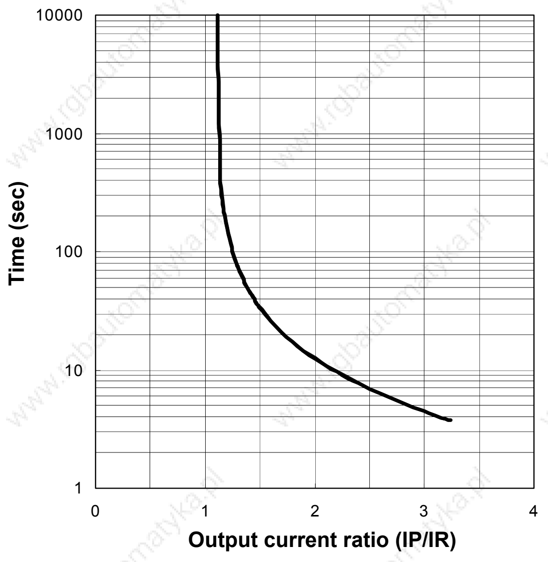
Velocity-torque characteristics

P30B04005D（50W）



Overload characteristics

P30B04005D（50W）



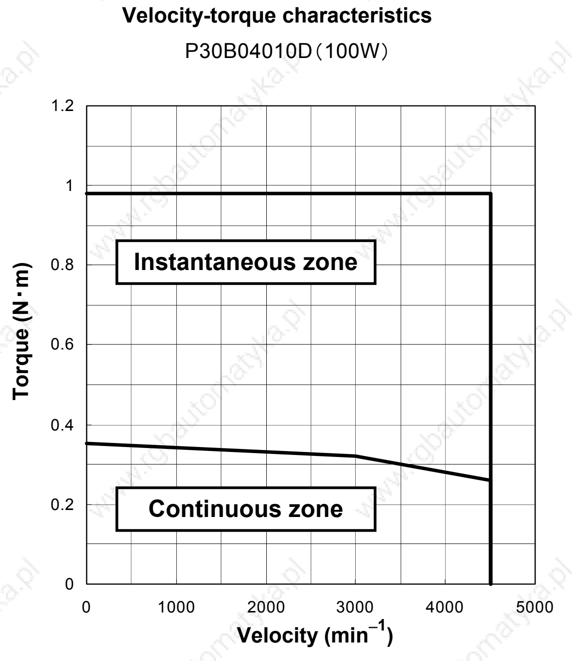
P30B04010D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.32	N·m	3.25	kg·cm
∗ Continuous stall torque	T_S	0.353	N·m	3.6	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.98	N·m	10	kg·cm
∗ Rated armature current	I_R	1.1	Arms	1.1	Arms
∗ Continuous stall armature current	I_S	1.3	Arms	1.3	Arms
∗ Instantaneous maximum stall armature current	I_P	4.1	Arms	4.1	Arms
Torque constant	K_T	0.292	N·m/Arms	2.98	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	10.2	mV/min^{-1}	10.2	V/krpm
Phase armature resistance	R_ϕ	4.3	Ω	4.3	Ω
Electrical time constant	t_e	1.4	msec	1.4	msec
Mechanical time constant (not including sensor)	t_m	0.7	msec	0.7	msec
Inertia (including wiring-saved INC)	J_M	0.051 × 10^{-4}	kg·m^2(GD^2/4)	0.052	g·cm·s^2
Inertia (including ABS-E)	J_M	0.076 × 10^{-4}	kg·m^2(GD^2/4)	0.077	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.048 × 10^{-4}	kg·m^2(GD^2/4)	0.049	g·cm·s^2
Applicable load inertia	J_L	0.51 × 10^{-4}	kg·m^2(GD^2/4)	0.52	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.5	kg	0.5	kg
Weight (including ABS-E)	W_E	0.83	kg	0.83	kg
Weight (including ABS-RII)	W_E	0.59	kg	0.59	kg

Holding Brake Data Sheet (Option)

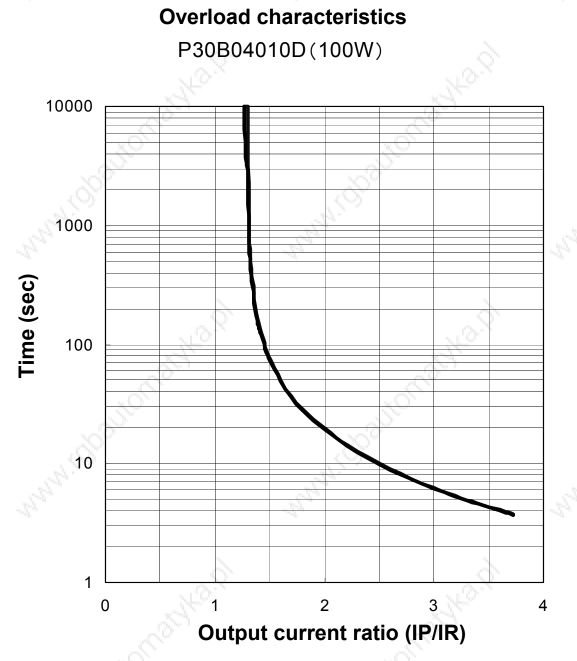
Holding torque	T_B	0.32 or more	N·m	3.25 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.26/0.07	A(DC)	0.26/0.07	A(DC)
Inertia	J_B	0.0078 × 10^{-4}	kg·m^2(GD^2/4)	0.008	g·cm·s^2
Weight	W	0.24	kg	0.24	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P30B04010D（100W）



Overload characteristics

P30B04010D（100W）

9. SPECIFICATIONS

P30B06020D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.637	N·m	6.5	kg·cm
* Continuous stall torque	T_S	0.686	N·m	7	kg·cm
* Instantaneous maximum stall torque	T_P	1.96	N·m	20	kg·cm
* Rated armature current	I_R	2.2	Arms	2.2	Arms
* Continuous stall armature current	I_S	2.3	Arms	2.3	Arms
* Instantaneous maximum stall armature current	I_P	7.5	Arms	7.5	Arms
Torque constant	K_T	0.316	N·m/Arms	3.22	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	11.0	mV/min^{-1}	11.0	V/krpm
Phase armature resistance	R_ϕ	1.5	Ω	1.5	Ω
Electrical time constant	t_e	3.8	msec	3.8	msec
Mechanical time constant (not including sensor)	t_m	0.63	msec	0.63	msec
Inertia (including wiring-saved INC)	J_M	0.144×10^{-4}	kg·m^2(GD^2/4)	0.147	g·cm·s^2
Inertia (including ABS-E)	J_M	0.169×10^{-4}	kg·m^2(GD^2/4)	0.172	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.141×10^{-4}	kg·m^2(GD^2/4)	0.144	g·cm·s^2
Applicable load inertia	J_L	1.44×10^{-4}	kg·m^2(GD^2/4)	1.47	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.15	kg	1.15	kg
Weight (including ABS-E)	W_E	1.37	kg	1.37	kg
Weight (including ABS-RII)	W_E	1.35	kg	1.35	kg

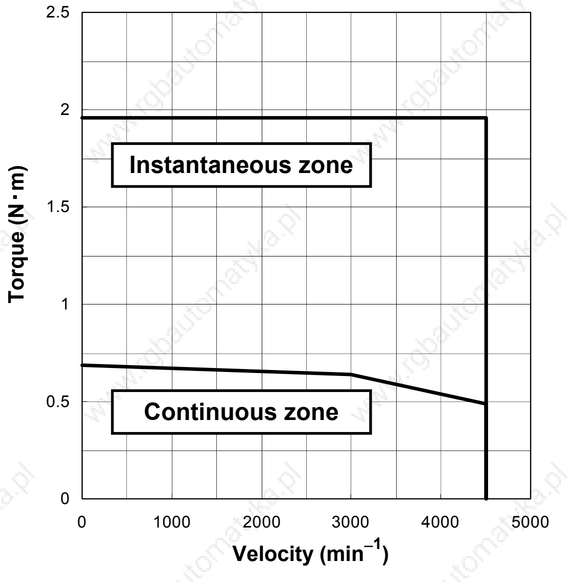
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.637 or more	N·m	6.5 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.31/0.07	A(DC)	0.31/0.07	A(DC)
Inertia	J_B	0.06×10^{-4}	kg·m^2(GD^2/4)	0.061	g·cm·s^2
Weight	W	0.44	kg	0.44	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

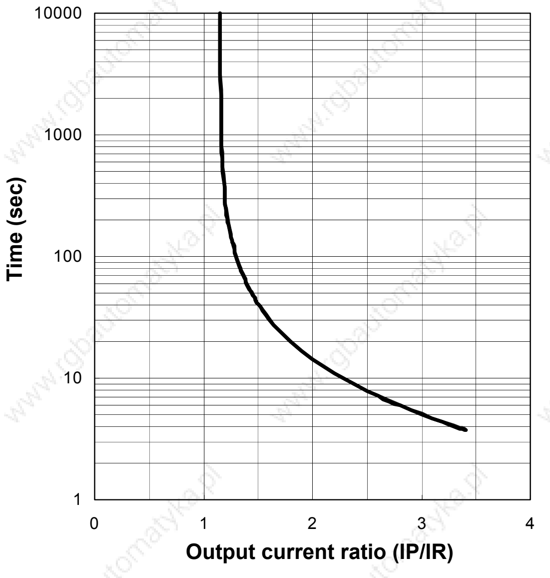
Velocity-torque characteristics

P30B06020D（200W）



Overload characteristics

P30B06020D（200W）



P30B06040D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	1.274	N·m	13	kg·cm
* Continuous stall torque	T_S	1.372	N·m	14	kg·cm
* Instantaneous maximum stall torque	T_P	3.82	N·m	39	kg·cm
* Rated armature current	I_R	2.7	Arms	2.7	Arms
* Continuous stall armature current	I_S	2.8	Arms	2.8	Arms
* Instantaneous maximum stall armature current	I_P	8.6	Arms	8.6	Arms
Torque constant	K_T	0.533	N·m/Arms	5.44	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	18.6	mV/min^{-1}	18.6	V/krpm
Phase armature resistance	R_ϕ	1.4	Ω	1.4	Ω
Electrical time constant	t_e	4.6	msec	4.6	msec
Mechanical time constant (not including sensor)	t_m	0.38	msec	0.38	msec
Inertia (including wiring-saved INC)	J_M	0.255×10^{-4}	kg·m^2(GD^2/4)	0.265	g·cm·s^2
Inertia (including ABS-E)	J_M	0.280×10^{-4}	kg·m^2(GD^2/4)	0.290	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.252×10^{-4}	kg·m^2(GD^2/4)	0.262	g·cm·s^2
Applicable load inertia	J_L	2.55×10^{-4}	kg·m^2(GD^2/4)	2.65	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.7	kg	1.7	kg
Weight (including ABS-E)	W_E	1.92	kg	1.92	kg
Weight (including ABS-RII)	W_E	1.90	kg	1.90	kg

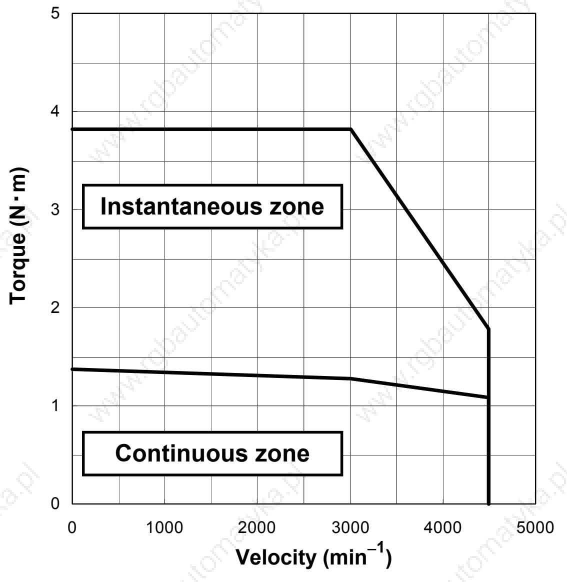
Holding Brake Data Sheet (Option)

Holding torque	T_B	1.274 or more	N·m	13 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.31/0.07	A(DC)	0.31/0.07	A(DC)
Inertia	J_B	0.06×10^{-4}	kg·m^2(GD^2/4)	0.061	g·cm·s^2
Weight	W	0.44	kg	0.44	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

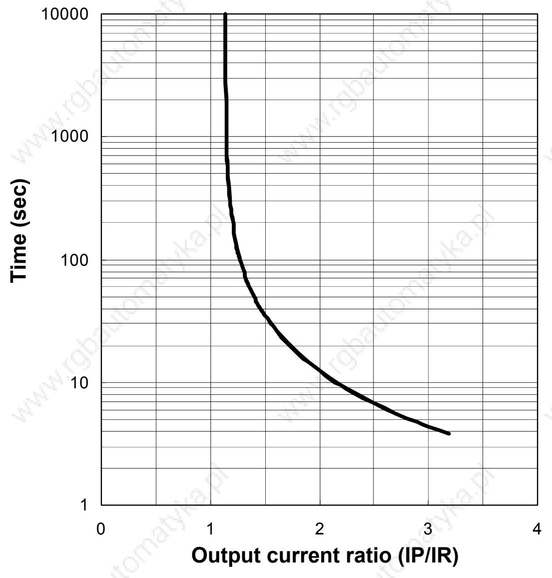
Velocity-torque characteristics

P30B06040D（400W）



Overload characteristics

P30B06040D（400W）



9. SPECIFICATIONS

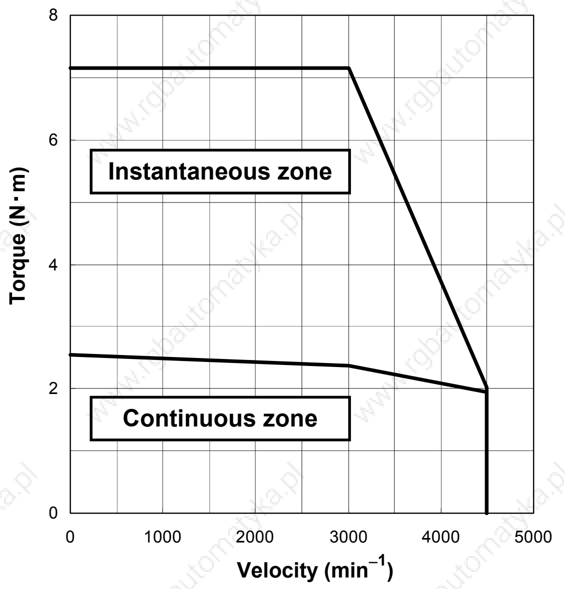
P30B08075D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	2.38	N·m	24.3	kg·cm
∗ Continuous stall torque	T_S	2.55	N·m	26	kg·cm
∗ Instantaneous maximum stall torque	T_P	7.15	N·m	73	kg·cm
∗ Rated armature current	I_R	4.6	Arms	4.6	Arms
∗ Continuous stall armature current	I_S	4.8	Arms	4.8	Arms
∗ Instantaneous maximum stall armature current	I_P	15.0	Arms	15.0	Arms
Torque constant	K_T	0.565	N·m/Arms	5.77	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	19.74	mV/min^{-1}	19.74	V/krpm
Phase armature resistance	R_ϕ	0.52	Ω	0.52	Ω
Electrical time constant	t_e	8.3	msec	8.3	msec
Mechanical time constant (not including sensor)	t_m	0.3	msec	0.3	msec
Inertia (including wiring-saved INC)	J_M	0.635×10^{-4}	kg·m^2(GD^2/4)	0.645	g·cm·s^2
Inertia (including ABS-E)	J_M	0.78×10^{-4}	kg·m^2(GD^2/4)	0.79	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.647×10^{-4}	kg·m^2(GD^2/4)	0.657	g·cm·s^2
Applicable load inertia	J_L	6.35×10^{-4}	kg·m^2(GD^2/4)	6.45	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.3	kg	3.3	kg
Weight (including ABS-E)	W_E	3.71	kg	3.71	kg
Weight (including ABS-RII)	W_E	3.49	kg	3.49	kg

Holding Brake Data Sheet (Option)

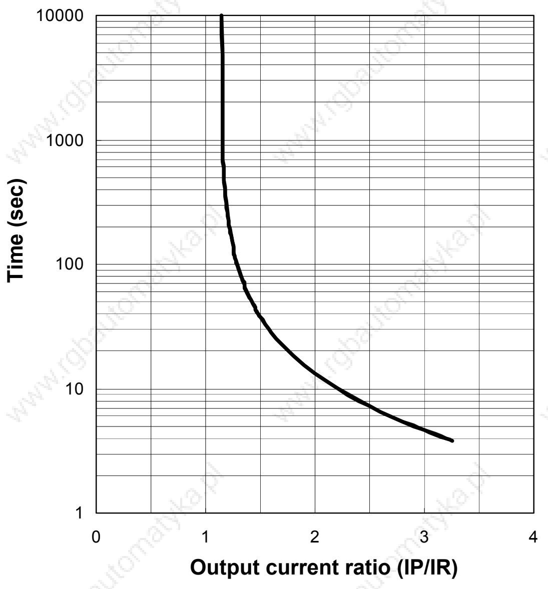
Holding torque	T_B	2.38 or more	N·m	24.3 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.37/0.08	A(DC)	0.37/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P30B08075D（750W）



Overload characteristics

P30B08075D（750W）

9.2.5.4 Motor Data Sheet P5

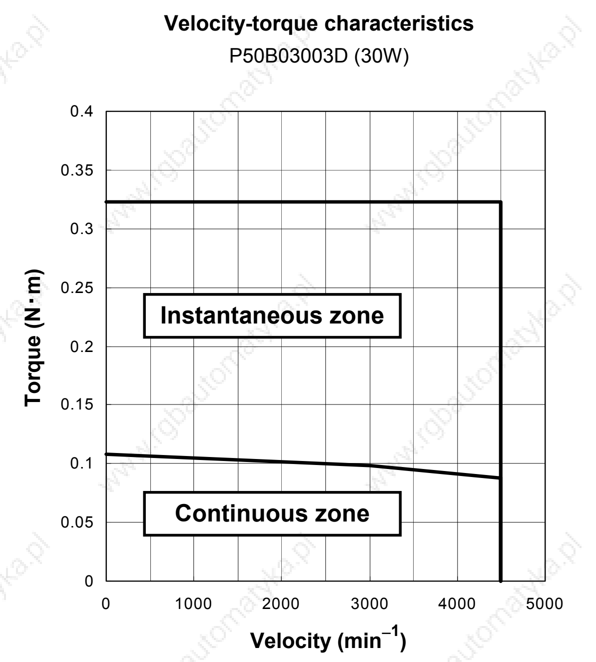
P50B03003D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	30	W	30	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.098	N·m	1	kg·cm
∗ Continuous stall torque	T_S	0.108	N·m	1.1	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.323	N·m	3.3	kg·cm
∗ Rated armature current	I_R	0.5	Arms	0.5	Arms
∗ Continuous stall armature current	I_S	0.53	Arms	0.53	Arms
∗ Instantaneous maximum stall armature current	I_P	1.8	Arms	1.8	Arms
Torque constant	K_T	0.206	N·m/Arms	2.11	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	7.2	mV/min^{-1}	7.2	V/krpm
Phase armature resistance	R_ϕ	20.5	Ω	20.5	Ω
Electrical time constant	t_e	0.7	msec	0.7	msec
Mechanical time constant (not including sensor)	t_m	2.1	msec	2.1	msec
Inertia (including wiring-saved INC)	J_M	0.0197×10^{-4}	$kg·m^2(GD^2/4)$	0.02	$g·cm·s^2$
Inertia (including ABS-E)	J_M		$kg·m^2(GD^2/4)$		$g·cm·s^2$
Inertia (including ABS-RII)	J_M	0.0167×10^{-4}	$kg·m^2(GD^2/4)$	0.0173	$g·cm·s^2$
Applicable load inertia	J_L	0.197×10^{-4}	$kg·m^2(GD^2/4)$	0.2	$g·cm·s^2$
Weight (including wiring-saved INC)	W_E	0.24	kg	0.24	kg
Weight (including ABS-E)	W_E		kg		kg
Weight (including ABS-RII)	W_E	0.31	kg	0.31	kg

Holding Brake Data Sheet (Option)

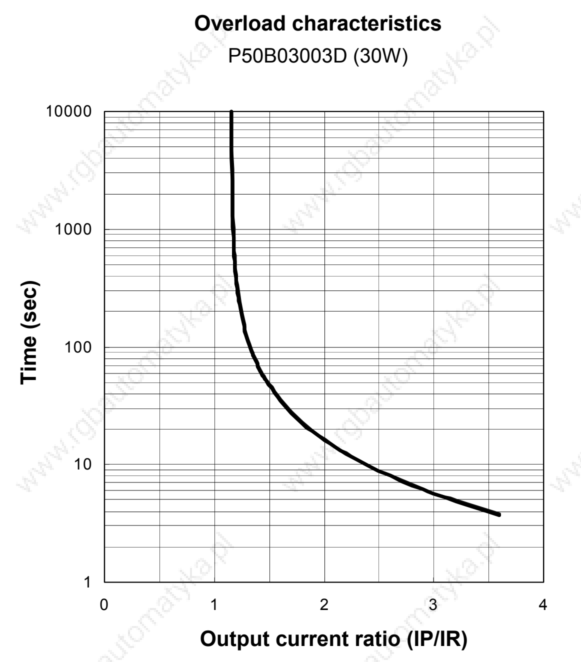
Holding torque	T_B	0.098 or more	N·m	1 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.25/0.07	A(DC)	0.25/0.07	A(DC)
Inertia	J_B	0.0021×10^{-4}	$kg·m^2(GD^2/4)$	0.0022	$g·cm·s^2$
Weight	W	0.15	kg	0.15	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P50B03003D (30W)



Overload characteristics

P50B03003D (30W)

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·m^2(GD^2/4)	0.055	g·cm·s^2
Inertia (including ABS-E)	J_M	0.054×10^{-4}	kg·m^2(GD^2/4)	0.08	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.051×10^{-4}	kg·m^2(GD^2/4)	0.0520	g·cm·s^2
Applicable load inertia	J_L	0.54×10^{-4}	kg·m^2(GD^2/4)	0.55	g·cm·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	0.52	kg	0.52	kg

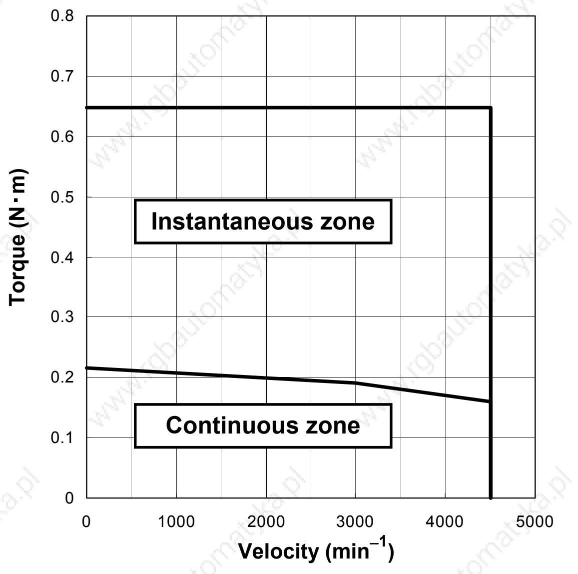
Holding Brake Data Sheet (Option)

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·m^2(GD^2/4)	0.008	g·cm·s^2
Weight	W	0.24	kg	0.24	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

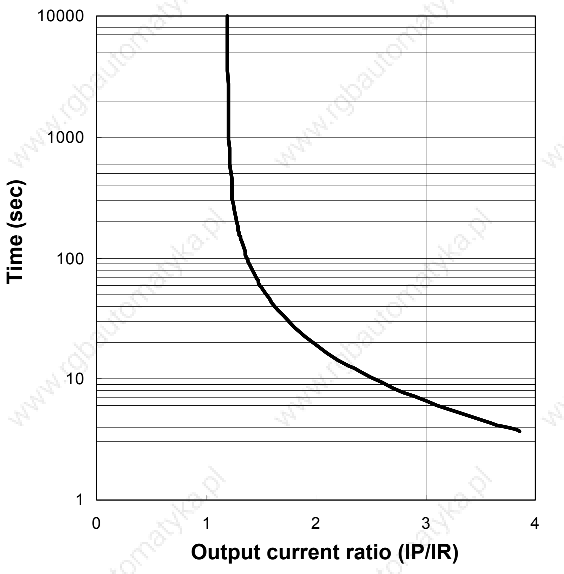
Velocity-torque characteristics

P50B04006D (60W)



Overload characteristics

P50B04006D (60W)



P50B04010D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.319	N·m	3.25	kg·cm
* Continuous stall torque	T_S	0.353	N·m	3.6	kg·cm
* Instantaneous maximum stall torque	T_P	0.98	N·m	10	kg·cm
* Rated armature current	I_R	1.0	Arms	1.0	Arms
* Continuous stall armature current	I_S	1.2	Arms	1.2	Arms
* Instantaneous maximum stall armature current	I_P	3.6	Arms	3.6	Arms
Torque constant	K_T	0.333	N·m/Arms	3.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	11.6	mV/min^{-1}	11.6	V/krpm
Phase armature resistance	R_ϕ	7.0	Ω	7.0	Ω
Electrical time constant	t_e	1.5	msec	1.5	msec
Mechanical time constant (not including sensor)	t_m	1.4	msec	1.4	msec
Inertia (including wiring-saved INC)	J_M	0.079×10^{-4}	kg·m^2(GD^2/4)	0.08	g·cm·s^2
Inertia (including ABS-E)	J_M	0.104×10^{-4}	kg·m^2(GD^2/4)	0.105	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.0760×10^{-4}	kg·m^2(GD^2/4)	0.077	g·cm·s^2
Applicable load inertia	J_L	0.79×10^{-4}	kg·m^2(GD^2/4)	0.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.59	kg	0.59	kg
Weight (including ABS-E)	W_E	0.89	kg	0.89	kg
Weight (including ABS-RII)	W_E	0.65	kg	0.65	kg

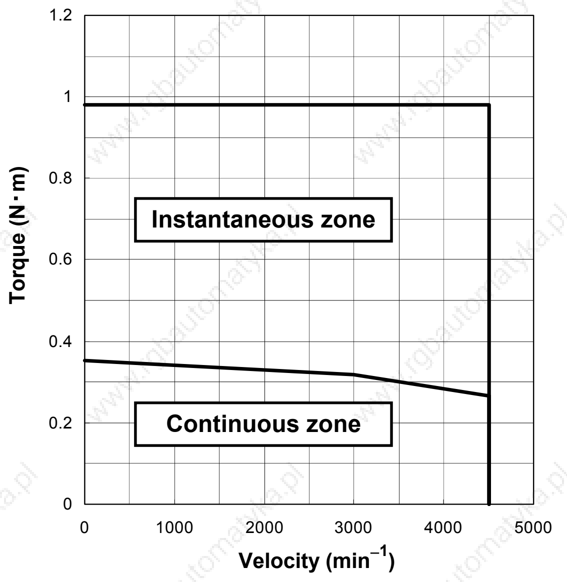
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.319 or more	N·m	3.25 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.26/0.07	A(DC)	0.26/0.07	A(DC)
Inertia	J_B	0.0078×10^{-4}	kg·m^2(GD^2/4)	0.008	g·cm·s^2
Weight	W	0.24	kg	0.24	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

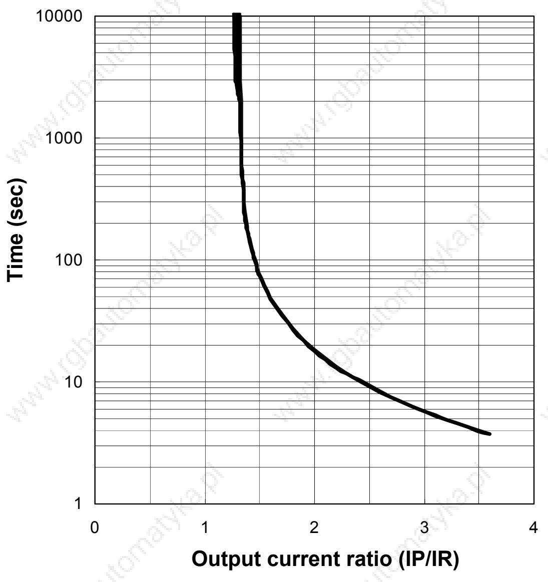
Velocity-torque characteristics

P50B04010D (100W)



Overload characteristics

P50B04010D（100W）



9. SPECIFICATIONS

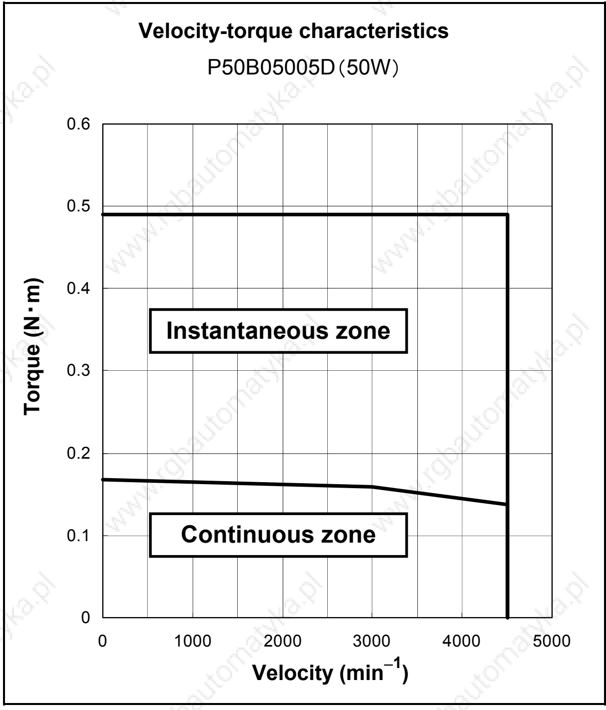
P50B05005D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	50	W	50	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.159	N·m	1.62	kg·cm
* Continuous stall torque	T_S	0.167	N·m	1.7	kg·cm
* Instantaneous maximum stall torque	T_P	0.49	N·m	5	kg·cm
* Rated armature current	I_R	0.85	Arms	0.85	Arms
* Continuous stall armature current	I_S	0.85	Arms	0.85	Arms
* Instantaneous maximum stall armature current	I_P	2.9	Arms	2.9	Arms
Torque constant	K_T	0.249	N·m/Arms	2.54	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	8.7	mV/min^{-1}	8.7	V/krpm
Phase armature resistance	R_ϕ	9.2	Ω	9.2	Ω
Electrical time constant	t_e	2.1	msec	2.1	msec
Mechanical time constant (not including sensor)	t_m	2.6	msec	2.6	msec
Inertia (including wiring-saved INC)	J_M	0.063×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.064	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.088×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.089	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	0.060×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.061	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	0.63×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.64	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	0.53	kg	0.53	kg
Weight (including ABS-E)	W_E	0.8	kg	0.8	kg
Weight (including ABS-RII)	W_E	0.61	kg	0.61	kg

Holding Brake Data Sheet (Option)

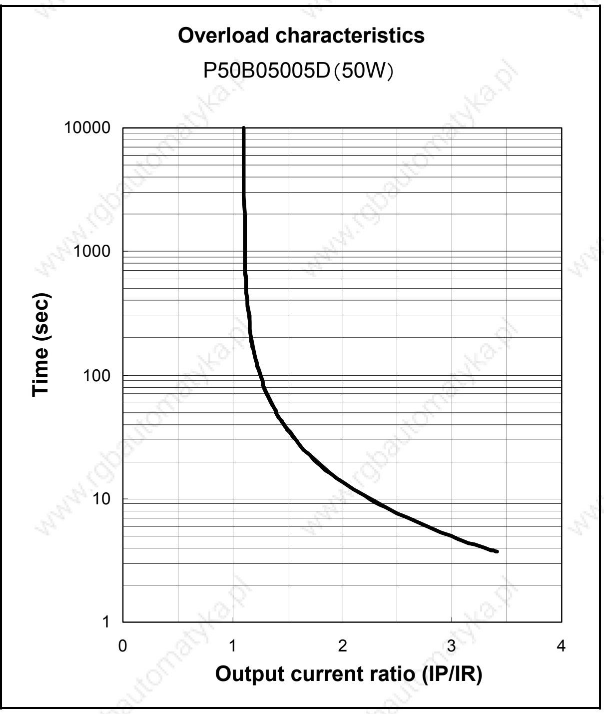
Holding torque	T_B	0.167 or more	N·m	1.7 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.40/0.11	A(DC)	0.40/0.11	A(DC)
Inertia	J_B	0.029×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.03	$g \cdot cm \cdot s^2$
Weight	W	0.3	kg	0.3	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P50B05005D（50W）



Overload characteristics

P50B05005D（50W）

P50B05010D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.319	N·m	3.25	kg·cm
∗ Continuous stall torque	T_S	0.353	N·m	3.6	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.98	N·m	10	kg·cm
∗ Rated armature current	I_R	1.1	Arms	1.1	Arms
∗ Continuous stall armature current	I_S	1.2	Arms	1.2	Arms
∗ Instantaneous maximum stall armature current	I_P	3.7	Arms	3.7	Arms
Torque constant	K_T	0.319	N·m/Arms	3.25	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	11.1	mV/min^{-1}	11.1	V/krpm
Phase armature resistance	R_ϕ	4.9	Ω	4.9	Ω
Electrical time constant	t_e	2.5	msec	2.5	msec
Mechanical time constant (not including sensor)	t_m	1.4	msec	1.4	msec
Inertia (including wiring-saved INC)	J_M	0.101×10^{-4}	kg·m^2(GD^2/4)	0.103	g·cm·s^2
Inertia (including ABS-E)	J_M	0.126×10^{-4}	kg·m^2(GD^2/4)	0.128	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.098×10^{-4}	kg·m^2(GD^2/4)	0.100	g·cm·s^2
Applicable load inertia	J_L	1.01×10^{-4}	kg·m^2(GD^2/4)	1.03	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.74	kg	0.74	kg
Weight (including ABS-E)	W_E	1.01	kg	1.01	kg
Weight (including ABS-RII)	W_E	0.82	kg	0.82	kg

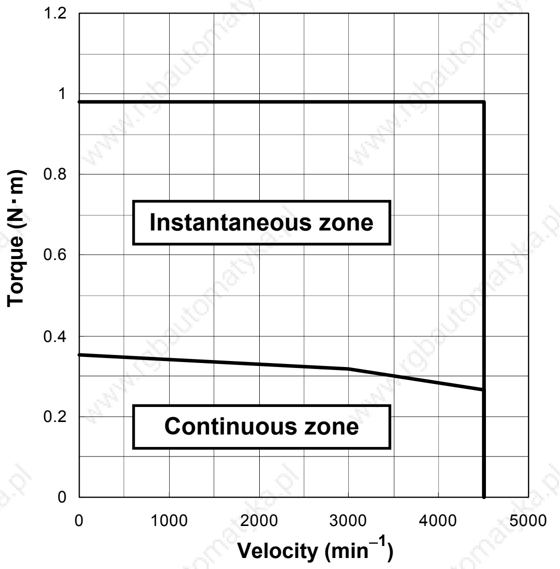
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.353 or more	N·m	3.6 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.40/0.11	A(DC)	0.40/0.11	A(DC)
Inertia	J_B	0.029×10^{-4}	kg·m^2(GD^2/4)	0.03	g·cm·s^2
Weight	W	0.3	kg	0.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

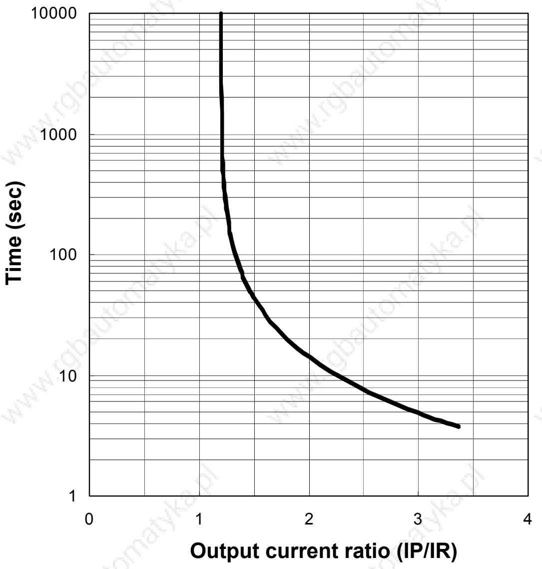
Velocity-torque characteristics

P50B05010D（100W）



Overload characteristics

P50B05010D（100W）



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·m^2(GD^2/4)	0.176	g·cm·s^2
Inertia (including ABS-E)	J_M	0.198×10^{-4}	kg·m^2(GD^2/4)	0.201	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.170×10^{-4}	kg·m^2(GD^2/4)	0.173	g·cm·s^2
Applicable load inertia	J_L	1.73×10^{-4}	kg·m^2(GD^2/4)	1.76	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.07	kg	1.07	kg
Weight (including ABS-E)	W_E	1.34	kg	1.34	kg
Weight (including ABS-RII)	W_E	1.20	kg	1.20	kg

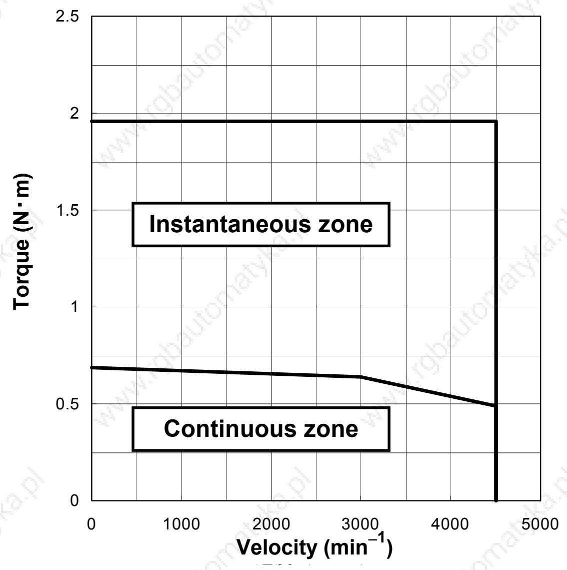
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.353 or more	N·m	3.6 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.40/0.11	A(DC)	0.40/0.11	A(DC)
Inertia	J_B	0.029×10^{-4}	kg·m^2(GD^2/4)	0.03	g·cm·s^2
Weight	W	0.3	kg	0.3	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

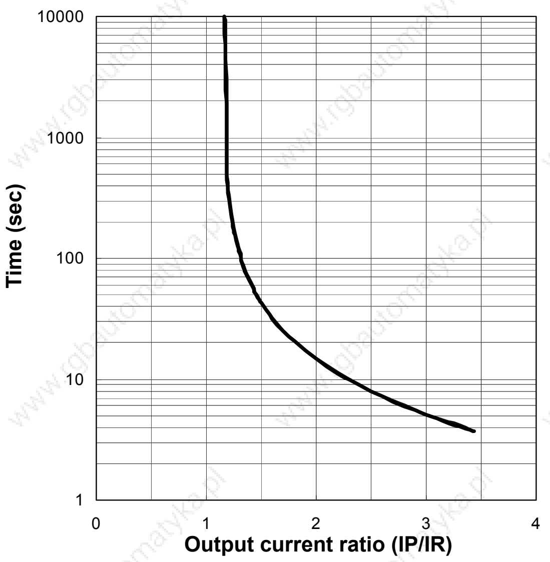
Velocity-torque characteristics

P50B05020D（200W）



Overload characteristics

P50B05020D（200W）



9. SPECIFICATIONS

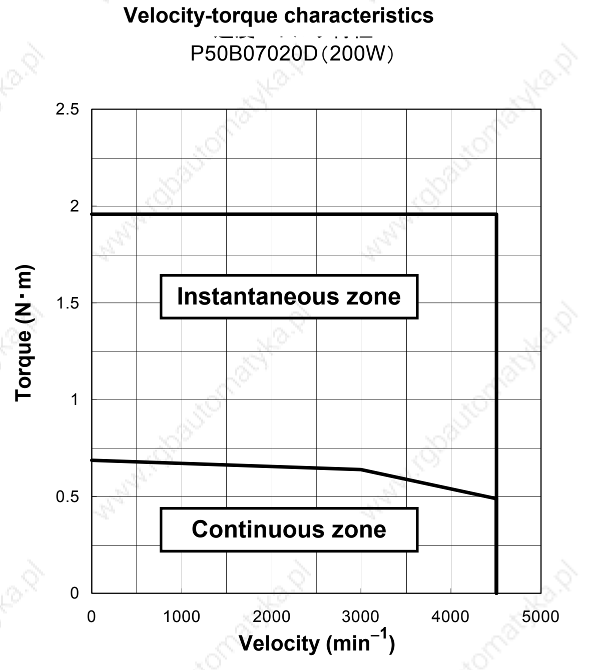
P50B07020D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.637	N·m	6.5	kg·cm
∗ Continuous stall torque	T_S	0.686	N·m	7	kg·cm
∗ Instantaneous maximum stall torque	T_P	1.96	N·m	20	kg·cm
∗ Rated armature current	I_R	2.2	Arms	2.2	Arms
∗ Continuous stall armature current	I_S	2.3	Arms	2.3	Arms
∗ Instantaneous maximum stall armature current	I_P	7.4	Arms	7.4	Arms
Torque constant	K_T	0.348	N·m/Arms	3.55	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	12.15	mV/min^{-1}	12.15	V/krpm
Phase armature resistance	R_ϕ	2.5	Ω	2.5	Ω
Electrical time constant	t_e	3.6	msec	3.6	msec
Mechanical time constant (not including sensor)	t_m	2.4	msec	2.4	msec
Inertia (including wiring-saved INC)	J_M	0.386×10^{-4}	kg·m^2(GD^2/4)	0.394	g·cm·s^2
Inertia (including ABS-E)	J_M	0.531×10^{-4}	kg·m^2(GD^2/4)	0.539	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.398×10^{-4}	kg·m^2(GD^2/4)	0.406	g·cm·s^2
Applicable load inertia	J_L	3.86×10^{-4}	kg·m^2(GD^2/4)	3.94	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.57	kg	1.57	kg
Weight (including ABS-E)	W_E	1.87	kg	1.87	kg
Weight (including ABS-RII)	W_E	1.60	kg	1.60	kg

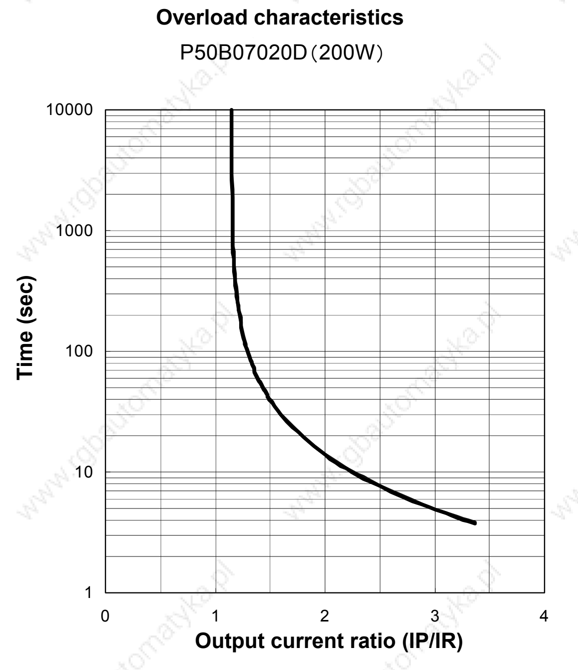
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.69 or more	N·m	7 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.30/0.08	A(DC)	0.30/0.08	A(DC)
Inertia	J_B	0.245×10^{-4}	kg·m^2(GD^2/4)	0.25	g·cm·s^2
Weight	W	0.57	kg	0.57	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.


Velocity-torque characteristics

P50B07020D（200W）


Overload characteristics

P50B07020D（200W）

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	$\mathrm{mV/min}^{-1}$	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}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	0.505	$\mathrm{g \cdot cm \cdot s^2}$
Inertia (including ABS-E)	J_M	0.64×10^{-4}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	0.65	$\mathrm{g \cdot cm \cdot s^2}$
Inertia (including ABS-RII)	J_M	0.507×10^{-4}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	0.517	$\mathrm{g \cdot cm \cdot s^2}$
Applicable load inertia	J_L	4.95×10^{-4}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	5.05	$\mathrm{g \cdot cm \cdot s^2}$
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-RII)	W_E	1.80	kg	1.80	kg

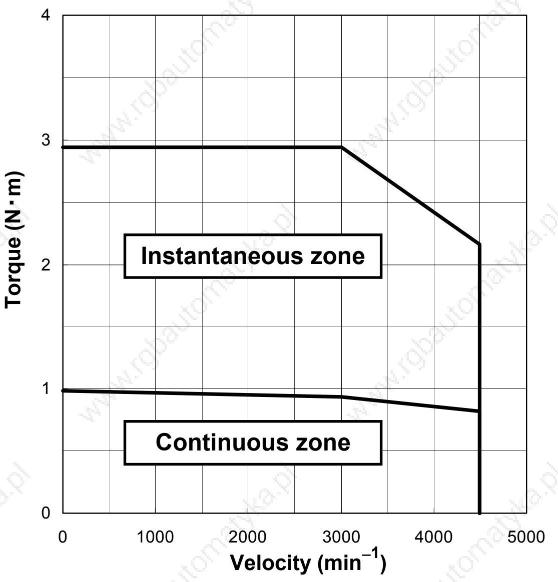
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.98 or more	N·m	10 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.30/0.08	A(DC)	0.30/0.08	A(DC)
Inertia	J_B	0.245×10^{-4}	$\mathrm{kg \cdot m^2 (GD^2/4)}$	0.25	$\mathrm{g \cdot cm \cdot s^2}$
Weight	W	0.57	kg	0.57	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

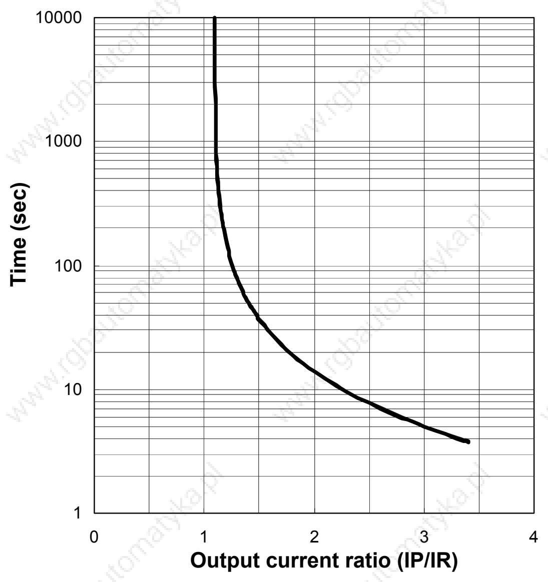
Velocity-torque characteristics

P50B07030D（300W）



Overload characteristics

P50B07030D（300W）



9. SPECIFICATIONS

P50B07040D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	1.274	N·m	13	kg·cm
∗ Continuous stall torque	T_S	1.372	N·m	14	kg·cm
∗ Instantaneous maximum stall torque	T_P	3.92	N·m	40	kg·cm
∗ Rated armature current	I_R	3.0	Arms	3.0	Arms
∗ Continuous stall armature current	I_S	3.1	Arms	3.1	Arms
∗ Instantaneous maximum stall armature current	I_P	10	Arms	10	Arms
Torque constant	K_T	0.481	N·m/Arms	4.91	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	16.8	mV/min^{-1}	16.8	V/krpm
Phase armature resistance	R_ϕ	1.65	Ω	1.65	Ω
Electrical time constant	t_e	4	msec	4	msec
Mechanical time constant (not including sensor)	t_m	1.6	msec	1.6	msec
Inertia (including wiring-saved INC)	J_M	0.74×10^{-4}	kg·m^2(GD^2/4)	0.755	g·cm·s^2
Inertia (including ABS-E)	J_M	0.885×10^{-4}	kg·m^2(GD^2/4)	0.9	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.752×10^{-4}	kg·m^2(GD^2/4)	0.767	g·cm·s^2
Applicable load inertia	J_L	7.4×10^{-4}	kg·m^2(GD^2/4)	7.55	g·cm·s^2
Weight (including wiring-saved INC)	W_E	2.1	kg	2.1	kg
Weight (including ABS-E)	W_E	2.4	kg	2.4	kg
Weight (including ABS-RII)	W_E	2.10	kg	2.10	kg

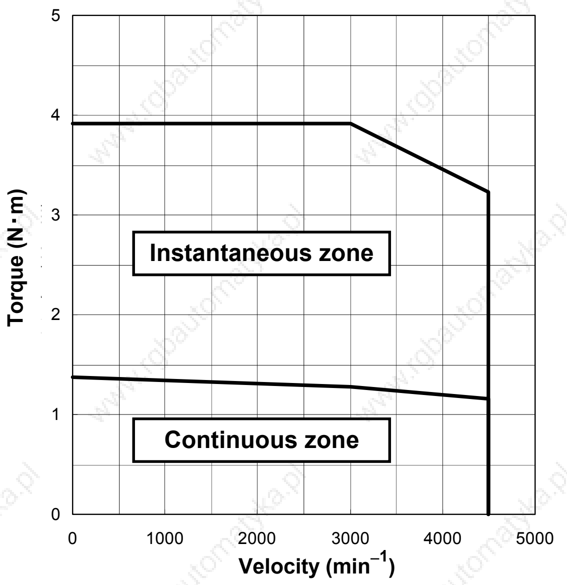
Holding Brake Data Sheet (Option)

Holding torque	T_B	0.98 or more	N·m	10 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.30/0.08	A(DC)	0.30/0.08	A(DC)
Inertia	J_B	0.245×10^{-4}	kg·m^2(GD^2/4)	0.25	g·cm·s^2
Weight	W	0.57	kg	0.57	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

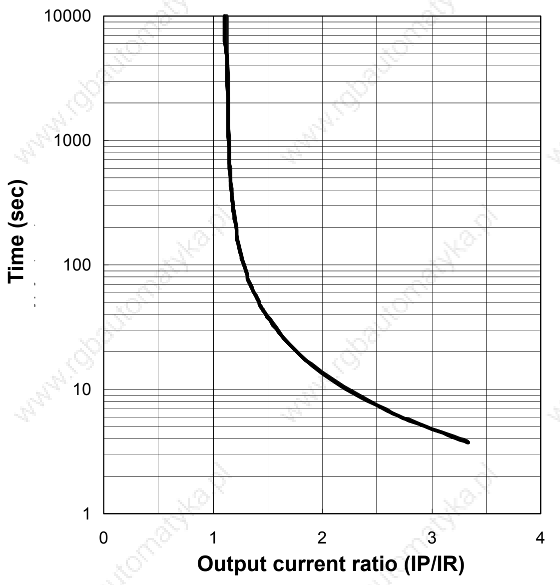
Velocity-torque characteristics

P50B07040D（400W）



Overload characteristics

P50B07040D（400W）



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}	$\text{kg·m}^2(\text{GD}^2/4)$	0.845	g·cm·s^2
Inertia (including ABS-E)	J_M	0.973×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	0.99	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.840×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	0.857	g·cm·s^2
Applicable load inertia	J_L	8.28×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	8.45	g·cm·s^2
Weight (including wiring-saved INC)	W_E	2.45	kg	2.45	kg
Weight (including ABS-E)	W_E	2.71	kg	2.71	kg
Weight (including ABS-RII)	W_E	2.45	kg	2.45	kg

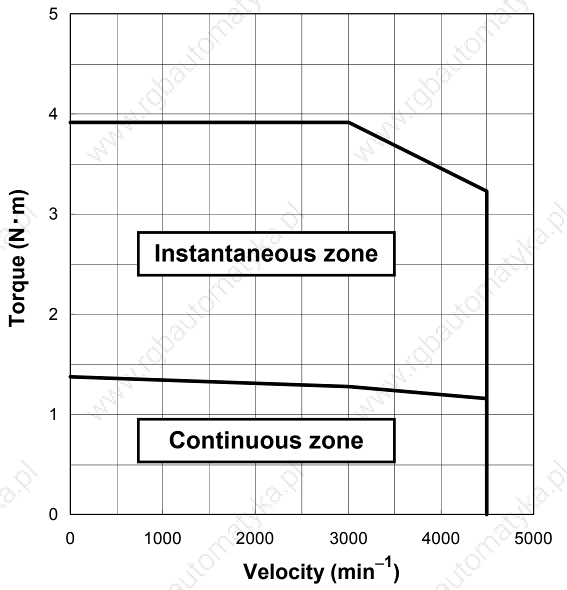
Holding Brake Data Sheet (Option)

Holding torque	T_B	1.37 or more	N·m	14 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.33/0.08	A(DC)	0.33/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	$\text{kg·m}^2(\text{GD}^2/4)$	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

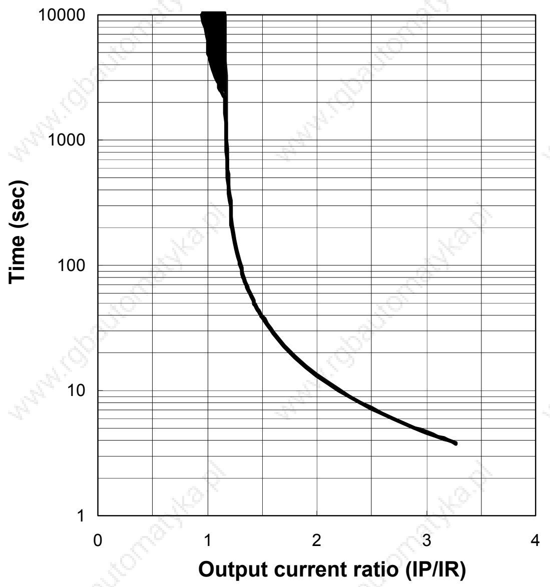
Velocity-torque characteristics

P50B08040D（400W）



Overload characteristics

P50B08040D（400W）



9. SPECIFICATIONS

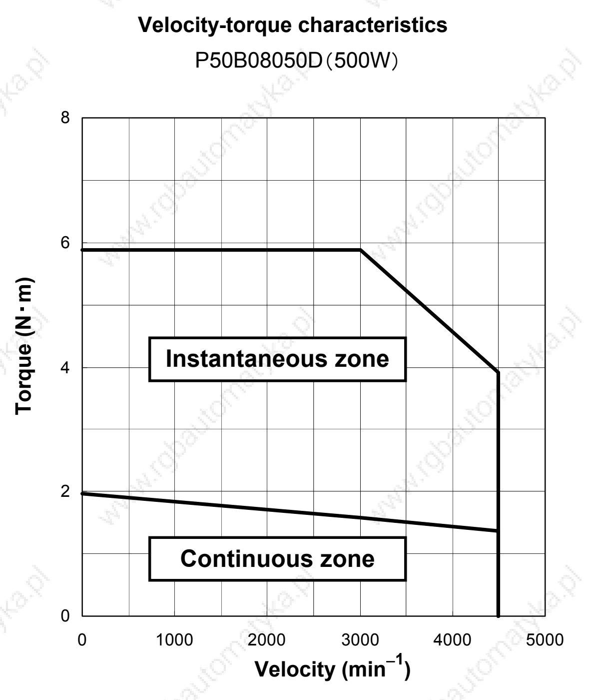
P50B08050D

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	500	W	500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	1.589	N·m	16.2	kg·cm
∗ Continuous stall torque	T_S	1.96	N·m	20	kg·cm
∗ Instantaneous maximum stall torque	T_P	5.88	N·m	60	kg·cm
∗ Rated armature current	I_R	3.9	Arms	3.9	Arms
∗ Continuous stall armature current	I_S	4.5	Arms	4.5	Arms
∗ Instantaneous maximum stall armature current	I_P	15	Arms	15	Arms
Torque constant	K_T	0.473	N·m/Arms	4.83	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	16.5	mV/min^{-1}	16.5	V/krpm
Phase armature resistance	R_ϕ	0.94	Ω	0.94	Ω
Electrical time constant	t_e	5.2	msec	5.2	msec
Mechanical time constant (not including sensor)	t_m	1.5	msec	1.5	msec
Inertia (including wiring-saved INC)	J_M	1.161×10^{-4}	kg·m^2(GD^2/4)	1.185	g·cm·s^2
Inertia (including ABS-E)	J_M	1.306×10^{-4}	kg·m^2(GD^2/4)	1.33	g·cm·s^2
Inertia (including ABS-RII)	J_M	1.173×10^{-4}	kg·m^2(GD^2/4)	1.197	g·cm·s^2
Applicable load inertia	J_L	11.6×10^{-4}	kg·m^2(GD^2/4)	11.9	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.0	kg	3.0	kg
Weight (including ABS-E)	W_E	3.26	kg	3.26	kg
Weight (including ABS-RII)	W_E	3.00	kg	3.00	kg

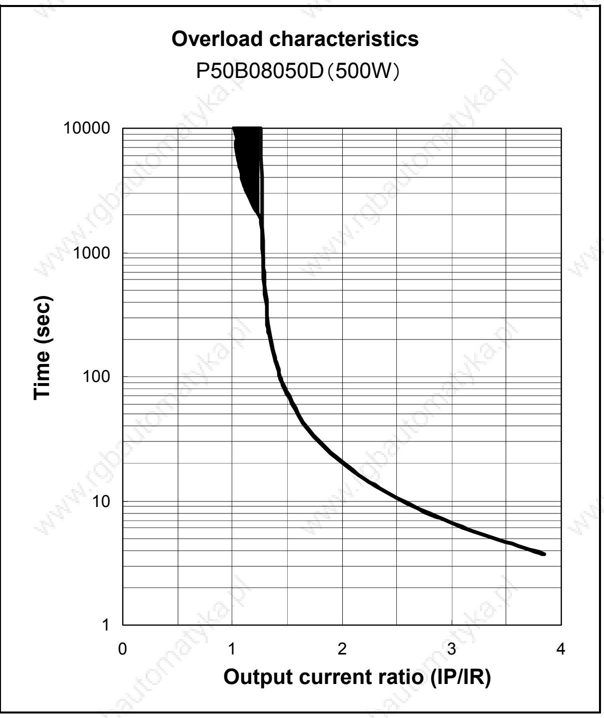
Holding Brake Data Sheet (Option)

Y	T_B	1.96 or more	N·m	20 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.33/0.08	A(DC)	0.33/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.


Velocity-torque characteristics

P50B08050D（500W）


Overload characteristics

P50B08050D（500W）

9. SPECIFICATIONS

P50B08075H

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	2.381	N·m	24.3	kg·cm
* Continuous stall torque	T_S	2.94	N·m	30	kg·cm
* Instantaneous maximum stall torque	T_P	8.82	N·m	90	kg·cm
* Rated armature current	I_R	3.9	Arms	3.9	Arms
* Continuous stall armature current	I_S	4.6	Arms	4.6	Arms
* Instantaneous maximum stall armature current	I_P	15.3	Arms	15.3	Arms
Torque constant	K_T	0.689	N·m/Arms	7.03	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	24.05	mV/min^{-1}	24.05	V/krpm
Phase armature resistance	R_ϕ	1.07	Ω	1.07	Ω
Electrical time constant	t_e	5.3	msec	5.3	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	1.926×10^{-4}	kg·m^2(GD^2/4)	1.965	g·cm·s^2
Inertia (including ABS-E)	J_M	2.071×10^{-4}	kg·m^2(GD^2/4)	2.11	g·cm·s^2
Inertia (including ABS-RII)	J_M	1.938×10^{-4}	kg·m^2(GD^2/4)	1.977	g·cm·s^2
Applicable load inertia	J_L	19.26×10^{-4}	kg·m^2(GD^2/4)	19.65	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.9	kg	3.9	kg
Weight (including ABS-E)	W_E	4.16	kg	4.16	kg
Weight (including ABS-RII)	W_E	3.90	kg	3.90	kg

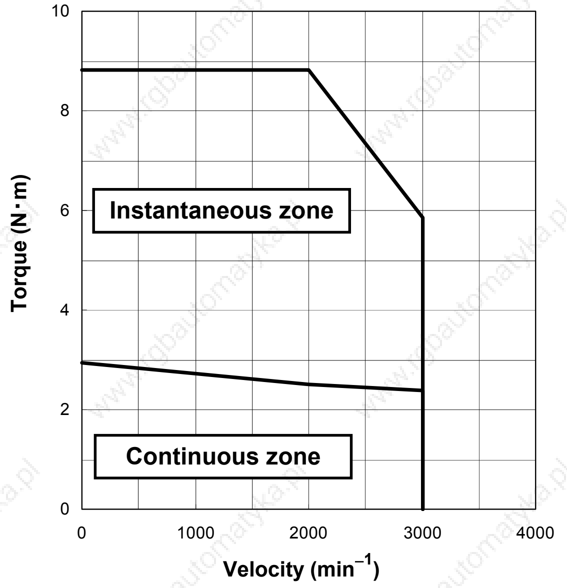
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94 or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.33/0.08	A(DC)	0.33/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

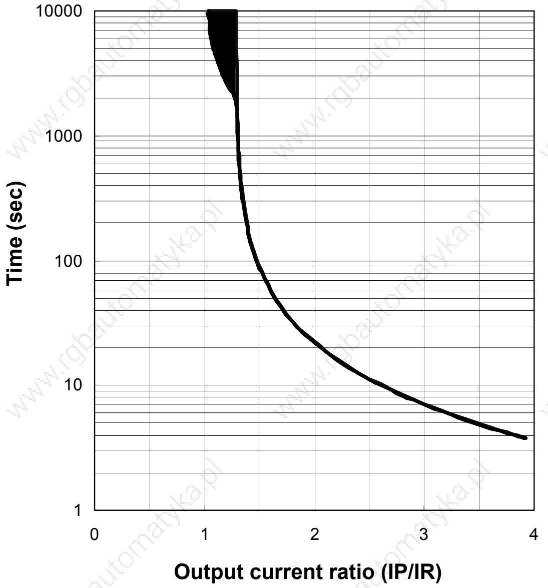
Velocity-torque characteristics

P50B08075H（750W）



Overload characteristics

P50B08075H（750W）



9. SPECIFICATIONS

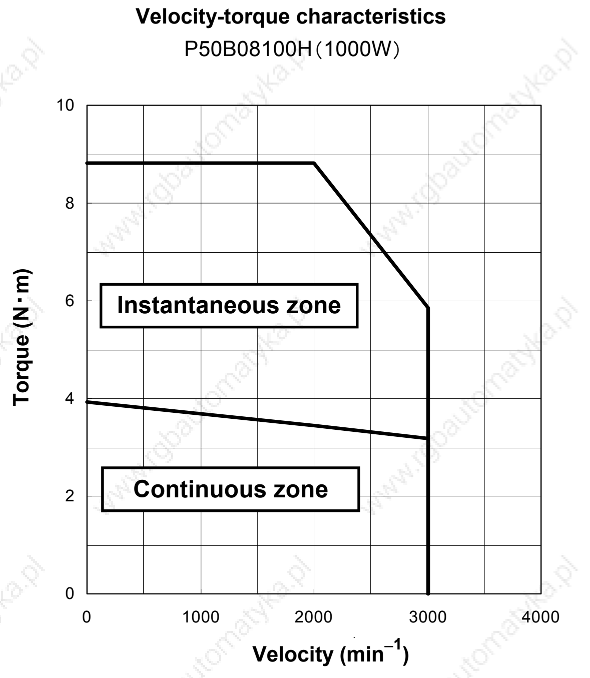
P50B08100H

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-RII)	J_M	2.663×10^{-4}	$kg \cdot m^2(GD^2/4)$	2.717	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	26.5×10^{-4}	$kg \cdot m^2(GD^2/4)$	27.1	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	5.05	kg	5.05	kg
Weight (including ABS-E)	W_E	5.31	kg	5.31	kg
Weight (including ABS-RII)	W_E	5.1	kg	5.1	kg

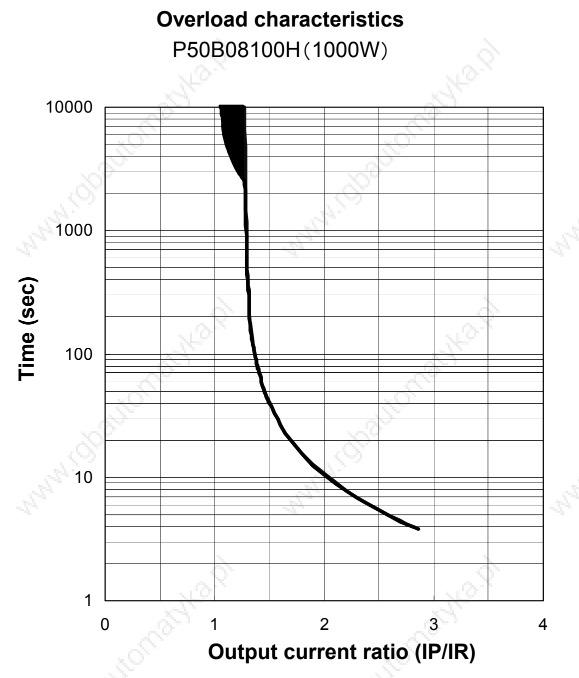
Holding Brake Data Sheet (Option)

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. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.


Velocity-torque characteristics

P50B08100H（1000W）


Overload characteristics

P50B08100H（1000W）

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·m^2(GD^2/4)	1.965	g·cm·s^2
Inertia (including ABS-E)	J_M	2.071×10^{-4}	kg·m^2(GD^2/4)	2.11	g·cm·s^2
Inertia (including ABS-RII)	J_M	1.938×10^{-4}	kg·m^2(GD^2/4)	1.977	g·cm·s^2
Applicable load inertia	J_L	19.26×10^{-4}	kg·m^2(GD^2/4)	19.65	g·cm·s^2
Weight (including wiring-saved INC)	W_E	3.9	kg	3.9	kg
Weight (including ABS-E)	W_E	4.16	kg	4.16	kg
Weight (including ABS-RII)	W_E	3.90	kg	3.90	kg

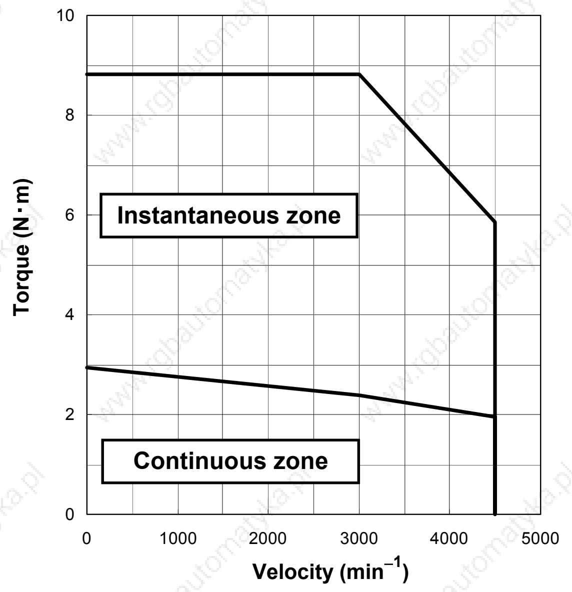
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94 or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.33/0.08	A(DC)	0.33/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

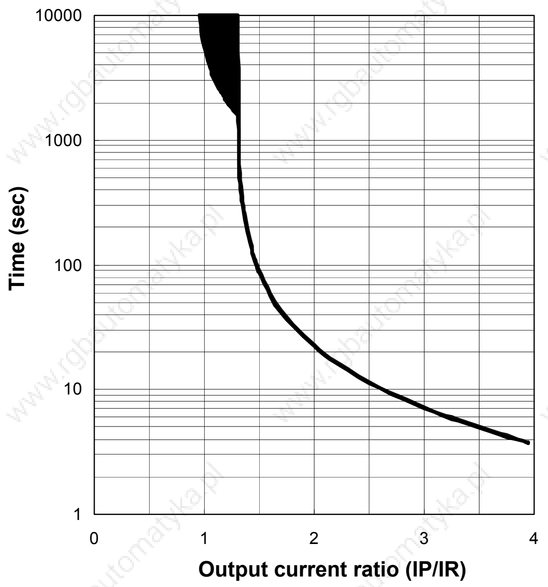
Velocity-torque characteristics

P50B08075D（750W）



Overload characteristics

P50B08075D（750W）



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·m^2(GD^2/4)	2.705	g·cm·s^2
Inertia (including ABS-E)	J_M	2.796×10^{-4}	kg·m^2(GD^2/4)	2.85	g·cm·s^2
Inertia (including ABS-RII)	J_M	2.663×10^{-4}	kg·m^2(GD^2/4)	2.717	g·cm·s^2
Applicable load inertia	J_L	26.5×10^{-4}	kg·m^2(GD^2/4)	27.1	g·cm·s^2
Weight (including wiring-saved INC)	W_E	5.05	kg	5.05	kg
Weight (including ABS-E)	W_E	5.31	kg	5.31	kg
Weight (including ABS-RII)	W_E	5.05	kg	5.05	kg

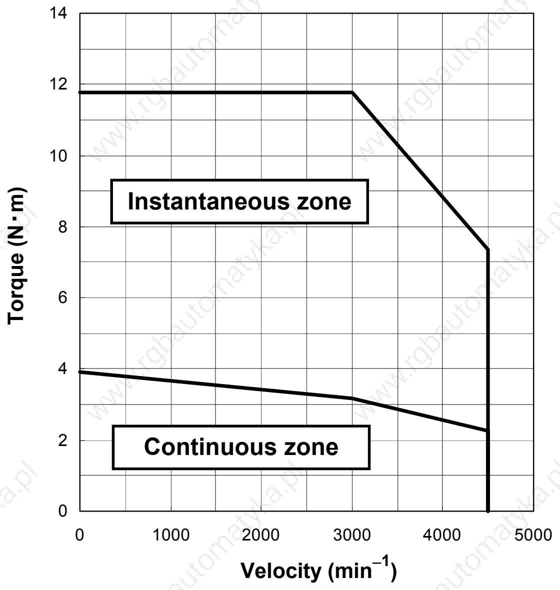
Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94 or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.33/0.08	A(DC)	0.33/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	kg·m^2(GD^2/4)	0.35	g·cm·s^2
Weight	W	0.8	kg	0.8	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

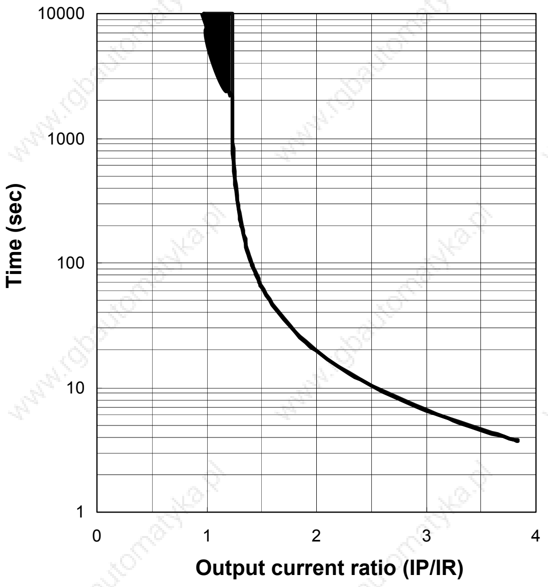
Velocity-torque characteristics

P50B08100D(1000W)



Overload characteristics

P50B08100D(1000W)



9.2.5.5 Motor Data Sheet P6

P60B13050H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	500	W	500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	2.5	N·m	25	kg·cm
∗ Continuous stall torque	T_S	3.0	N·m	31	kg·cm
∗ Instantaneous maximum stall torque	T_P	7.0	N·m	71	kg·cm
∗ Rated armature current	I_R	4.5	Arms	4.5	Arms
∗ Continuous stall armature current	I_S	5.2	Arms	5.2	Arms
∗ Instantaneous maximum stall armature current	I_P	15.0	Arms	15.0	Arms
Torque constant	K_T	0.65	N·m/Arms	6.6	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	22.5	mV/min^{-1}	22.5	V/krpm
Phase armature resistance	R_ϕ	0.64	Ω	0.64	Ω
Electrical time constant	t_e	9.1	msec	9.1	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	2.78×10^{-4}	kg·m^2(GD^2/4)	2.88	g·cm·s^2
Inertia (including ABS-E)	J_M	2.85×10^{-4}	kg·m^2(GD^2/4)	2.95	g·cm·s^2
Inertia (including ABS-RII)	J_M	2.78×10^{-4}	kg·m^2(GD^2/4)	2.88	g·cm·s^2
Applicable load inertia	J_L	27.8×10^{-4}	kg·m^2(GD^2/4)	28.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	4.7	kg	4.7	kg
Weight (including ABS-E)	W_E	4.7	kg	4.7	kg
Weight (including ABS-RII)	W_E	4.8	kg	4.8	kg

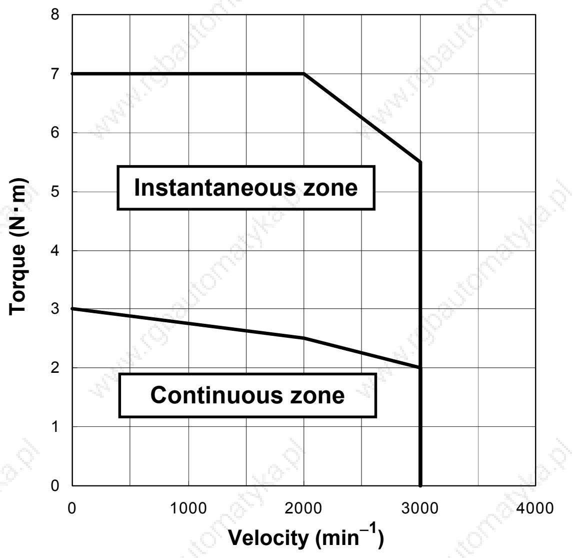
Holding Brake Data Sheet (Option)

Holding torque	T_B	3.5 or more	N·m	36 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.91/0.25	A(DC)	0.91/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.3	kg	1.3	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

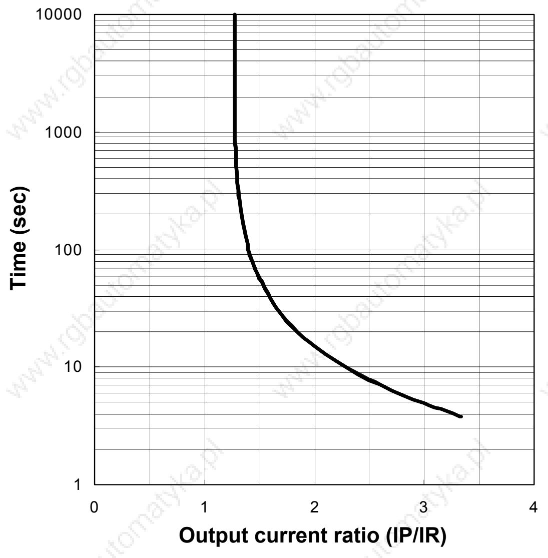
Velocity-torque characteristics

P60B13050H（500W）



Overload characteristics

P60B13050H（0.5kW）



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·m^2(GD^2/4)	5.68	g·cm·s^2
Inertia (including ABS-E)	J_M	5.65×10^{-4}	kg·m^2(GD^2/4)	5.75	g·cm·s^2
Inertia (including ABS-RII)	J_M	5.580×10^{-4}	kg·m^2(GD^2/4)	5.680	g·cm·s^2
Applicable load inertia	J_L	55.8×10^{-4}	kg·m^2(GD^2/4)	56.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	6.6	kg	6.6	kg
Weight (including ABS-E)	W_E	6.6	kg	6.6	kg
Weight (including ABS-RII)	W_E	6.7	kg	6.7	kg

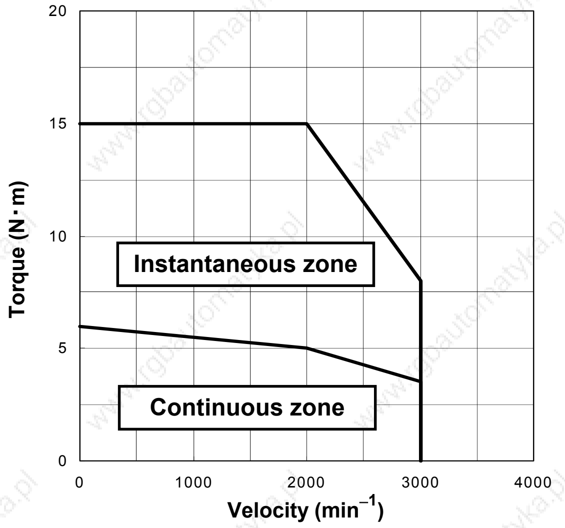
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.0 or more	N·m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

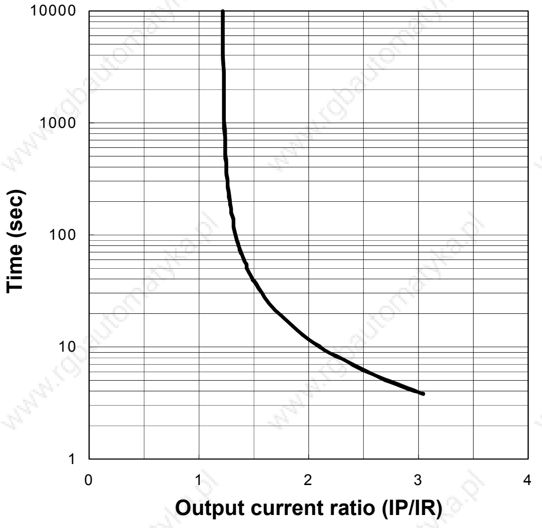
Velocity-torque characteristics

P60B13100H（1.0kW）



Overload characteristics

P60B13100H（1.0kW）



9. SPECIFICATIONS

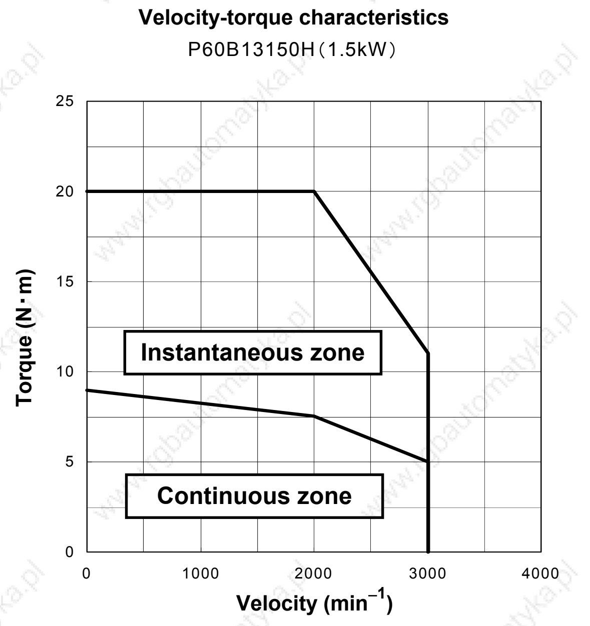
P60B13150H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	7.5	N·m	76	kg·cm
∗ Continuous stall torque	T_S	9.0	N·m	92	kg·cm
∗ Instantaneous maximum stall torque	T_P	20.0	N·m	204	kg·cm
∗ Rated armature current	I_R	9.4	Arms	9.4	Arms
∗ Continuous stall armature current	I_S	10.7	Arms	10.7	Arms
∗ Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.90	N·m/Arms	9.2	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	31.4	mV/min^{-1}	31.4	V/krpm
Phase armature resistance	R_{ϕ}	0.27	Ω	0.27	Ω
Electrical time constant	t_e	10	msec	10	msec
Mechanical time constant (not including sensor)	t_m	0.82	msec	0.82	msec
Inertia (including wiring-saved INC)	J_M	8.28×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	8.48	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-E)	J_M	8.35×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	8.55	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Inertia (including ABS-RII)	J_M	8.280×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	8.443	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Applicable load inertia	J_L	82.8×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	84.8	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight (including wiring-saved INC)	W_E	7.8	kg	7.8	kg
Weight (including ABS-E)	W_E	7.8	kg	7.8	kg
Weight (including ABS-RII)	W_E	8.9	kg	8.9	kg

Holding Brake Data Sheet (Option)

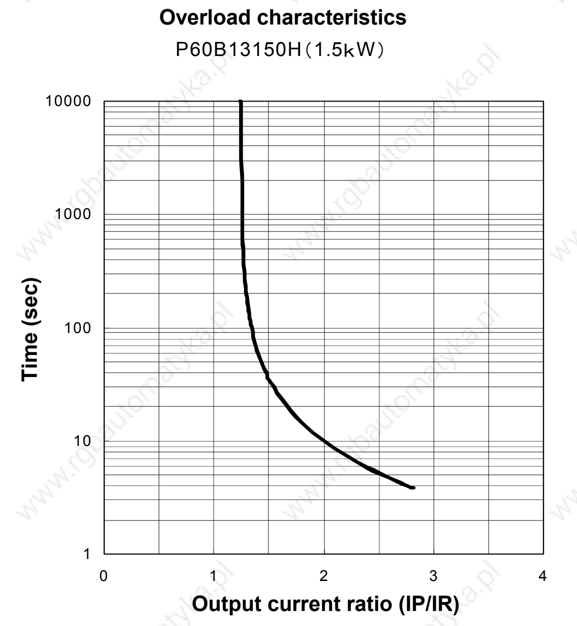
Holding torque	T_B	9.0 or more	N·m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	$\text{kg}\cdot\text{m}^2(\text{GD}^2/4)$	0.5	$\text{g}\cdot\text{cm}\cdot\text{s}^2$
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.



Velocity-torque characteristics

P60B13150H（1.5kW）



Overload characteristics

P60B13150H（1.5kW）

9.2.5.6 Motor Data Sheet P8

P80B15075H

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
∗ Rated torque	T_R	3.6	N·m	37	kg·cm
∗ Continuous stall torque	T_S	3.7	N·m	38	kg·cm
∗ Instantaneous maximum stall torque	T_P	9.0	N·m	92	kg·cm
∗ Rated armature current	I_R	5.2	Arms	5.2	Arms
∗ Continuous stall armature current	I_S	5.2	Arms	5.2	Arms
∗ Instantaneous maximum stall armature current	I_P	13.9	Arms	13.9	Arms
Torque constant	K_T	0.78	N·m/Arms	7.9	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	27.0	mV/min^{-1}	27.0	V/krpm
Phase armature resistance	R_ϕ	0.44	Ω	0.44	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	1.1	msec	1.1	msec
Inertia (including wiring-saved INC)	J_M	5.28×10^{-4}	kg·m^2(GD^2/4)	5.38	g·cm·s^2
Inertia (including ABS-E)	J_M	5.35×10^{-4}	kg·m^2(GD^2/4)	5.45	g·cm·s^2
Inertia (including ABS-RII)	J_M	5.280×10^{-4}	kg·m^2(GD^2/4)	5.383	g·cm·s^2
Applicable load inertia	J_L	52.8×10^{-4}	kg·m^2(GD^2/4)	53.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	6.2	kg	6.2	kg
Weight (including ABS-E)	W_E	6.2	kg	6.2	kg
Weight (including ABS-RII)	W_E	6.3	kg	6.3	kg

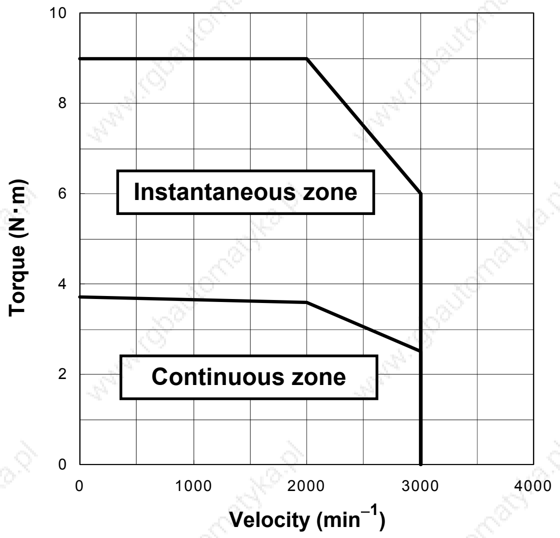
Holding Brake Data Sheet (Option)

Holding torque	T_B	9.0 or more	N・m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	kg·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

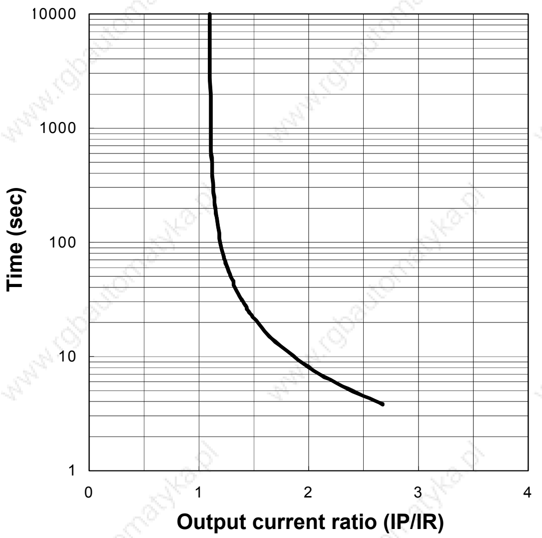
Velocity-torque characteristics

P80B15075H（750W）



Overload characteristics

P80B15075H（0.75kW）



9. SPECIFICATIONS

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·m^2(GD^2/4)	12.1	g·cm·s^2
	Inertia (including ABS-E)	J_M	12.2×10^{-4}	kg·m^2(GD^2/4)	12.2	g·cm·s^2
	Inertia (including ABS-RII)	J_M	12.10×10^{-4}	kg·m^2(GD^2/4)	12.34	g·cm·s^2
	Applicable load inertia	J_L	121×10^{-4}	kg·m^2(GD^2/4)	121	g·cm·s^2
	Weight (including wiring-saved INC)	W_E	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

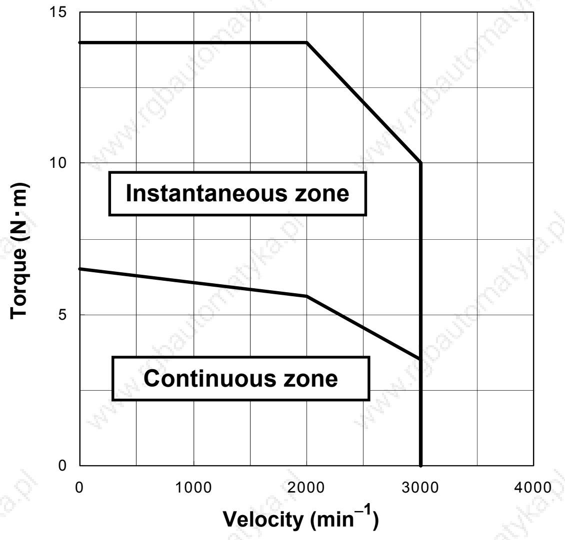
Holding Brake Data Sheet (Option)

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·m^2(GD^2/4)	0.5	g·cm·s^2
Weight	W	1.5	kg	1.5	kg

- The mark * denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50A capacity and 200V AC, 3-phase power supply voltage. When power supply voltage is below 200V AC, the instantaneous zone drops.

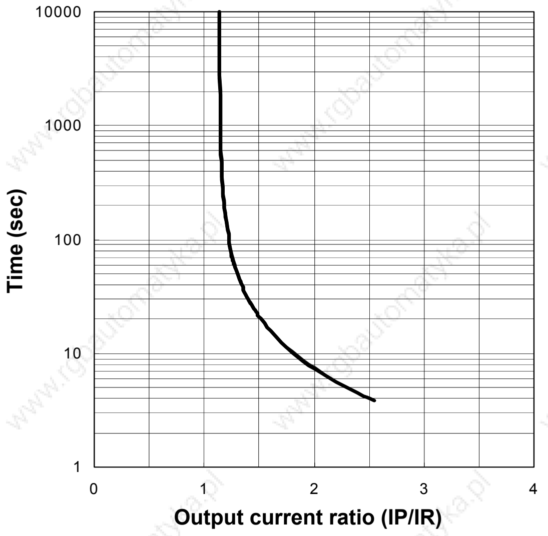
Velocity-torque characteristics

P80B18120H(1.2kW)



Overload characteristics

P80B18120H(1.2kW)



9.2.5.7 Motor Data Sheet P3 (100V Motor)

P30B04003P

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	1.0	Arms	1.0	Arms
∗ Continuous stall armature current	I_S	1.1	Arms	1.1	Arms
∗ Instantaneous maximum stall armature current	I_P	3.6	Arms	3.6	Arms
Torque constant	K_T	0.1	N·m/Arms	1.07	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	3.65	mV/min^{-1}	3.65	V/krpm
Phase armature resistance	R_ϕ	3.04	Ω	3.04	Ω
Electrical time constant	t_e	1.2	msec	1.2	msec
Mechanical time constant (not including sensor)	t_m	1.6	msec	1.6	msec
Inertia (including wiring-saved INC)	J_M	0.024×10^{-4}	kg·m^2(GD^2/4)	0.025	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.021×10^{-4}	kg·m^2(GD^2/4)	0.0223	g·cm·s^2
Applicable load inertia	J_L	0.24×10^{-4}	kg·m^2(GD^2/4)	0.25	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.3	kg	0.3	kg
Weight (including ABS-RII)	W_E	0.39	kg	0.39	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

P30B04005P

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	50	W	50	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.157	N·m	1.6	kg·cm
∗ Continuous stall torque	T_S	0.167	N·m	1.7	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.49	N·m	5.0	kg·cm
∗ Rated armature current	I_R	1.5	Arms	1.5	Arms
∗ Continuous stall armature current	I_S	1.6	Arms	1.6	Arms
∗ Instantaneous maximum stall armature current	I_P	5.1	Arms	5.1	Arms
Torque constant	K_T	0.113	N·m/Arms	1.15	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	3.93	mV/min^{-1}	3.93	V/krpm
Phase armature resistance	R_ϕ	2.25	Ω	2.25	Ω
Electrical time constant	t_e	1.3	msec	1.3	msec
Mechanical time constant (not including sensor)	t_m	1.4	msec	1.4	msec
Inertia (including wiring-saved INC)	J_M	0.031×10^{-4}	kg·m^2(GD^2/4)	0.032	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.028×10^{-4}	kg·m^2(GD^2/4)	0.0293	g·cm·s^2
Applicable load inertia	J_L	0.31×10^{-4}	kg·m^2(GD^2/4)	0.32	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.35	kg	0.35	kg
Weight (including ABS-RII)	W_E	0.44	kg	0.44	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

9. SPECIFICATIONS

P30B04010P

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.32	N·m	3.25	kg·cm
∗ Continuous stall torque	T_S	0.353	N·m	3.6	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.98	N·m	10	kg·cm
∗ Rated armature current	I_R	2.2	Arms	2.2	Arms
∗ Continuous stall armature current	I_S	2.4	Arms	2.4	Arms
∗ Instantaneous maximum stall armature current	I_P	7.4	Arms	7.4	Arms
Torque constant	K_T	0.162	N·m/Arms	1.65	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	5.63	mV/min^{-1}	5.63	V/krpm
Phase armature resistance	R_ϕ	1.58	Ω	1.58	Ω
Electrical time constant	t_e	1.3	msec	1.3	msec
Mechanical time constant (not including sensor)	t_m	0.8	msec	0.8	msec
Inertia (including wiring-saved INC)	J_M	0.051×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.052	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	0.048×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.0493	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	0.51×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.52	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	0.5	kg	0.5	kg
Weight (including ABS-RII)	W_E	0.59	kg	0.59	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

P30B06020P

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	7.0	kg·cm
∗ Instantaneous maximum stall torque	T_P	1.96	N·m	20	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	15.8	Arms	15.8	Arms
Torque constant	K_T	0.151	N·m/Arms	1.54	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	5.28	mV/min^{-1}	5.28	V/krpm
Phase armature resistance	R_ϕ	0.39	Ω	0.39	Ω
Electrical time constant	t_e	3.6	msec	3.6	msec
Mechanical time constant (not including sensor)	t_m	0.71	msec	0.71	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-RII)	J_M	0.141×10^{-4}	$kg \cdot m^2(GD^2/4)$	0.1443	$g \cdot cm \cdot s^2$
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-RII)	W_E	1.35	kg	1.35	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

9.2.5.8 Motor Data Sheet P5 (100V Motor)

P50B03003P

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	0.323	N·m	3.3	kg·cm
∗ Rated armature current	I_R	1.0	Arms	1.0	Arms
∗ Continuous stall armature current	I_S	1.1	Arms	1.1	Arms
∗ Instantaneous maximum stall armature current	I_P	3.6	Arms	3.6	Arms
Torque constant	K_T	0.108	N·m/Arms	1.1	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	3.79	mV/min^{-1}	3.79	V/krpm
Phase armature resistance	R_ϕ	5.4	Ω	5.4	Ω
Electrical time constant	t_e	0.7	msec	0.7	msec
Mechanical time constant (not including sensor)	t_m	2.0	msec	2.0	msec
Inertia (including wiring-saved INC)	J_M	0.0197×10^{-4}	kg·m^2(GD^2/4)	0.02	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.0167×10^{-4}	kg·m^2(GD^2/4)	0.0173	g·cm·s^2
Applicable load inertia	J_L	0.197×10^{-4}	kg·m^2(GD^2/4)	0.2	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.24	kg	0.24	kg
Weight (including ABS-RII)	W_E	0.31	kg	0.31	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

P50B04006P

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	1.3	Arms	1.3	Arms
∗ Continuous stall armature current	I_S	1.4	Arms	1.4	Arms
∗ Instantaneous maximum stall armature current	I_P	5.0	Arms	5.0	Arms
Torque constant	K_T	0.164	N·m/Arms	1.68	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	5.74	mV/min^{-1}	5.74	V/krpm
Phase armature resistance	R_ϕ	2.95	Ω	2.95	Ω
Electrical time constant	t_e	1.5	msec	1.5	msec
Mechanical time constant (not including sensor)	t_m	1.5	msec	1.5	msec
Inertia (including wiring-saved INC)	J_M	0.054×10^{-4}	kg·m^2(GD^2/4)	0.055	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.051×10^{-4}	kg·m^2(GD^2/4)	0.052	g·cm·s^2
Applicable load inertia	J_L	0.54×10^{-4}	kg·m^2(GD^2/4)	0.55	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.46	kg	0.46	kg
Weight (including ABS-RII)	W_E	0.52	kg	0.52	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

9. SPECIFICATIONS

P50B04010P

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	1.8	Arms	1.8	Arms
∗ Continuous stall armature current	I_S	2.1	Arms	2.1	Arms
∗ Instantaneous maximum stall armature current	I_P	6.0	Arms	6.0	Arms
Torque constant	K_T	0.195	N·m/Arms	1.99	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	6.8	mV/min^{-1}	6.8	V/krpm
Phase armature resistance	R_ϕ	2.35	Ω	2.35	Ω
Electrical time constant	t_e	1.6	msec	1.6	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	0.079×10^{-4}	kg·m^2(GD^2/4)	0.08	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.076×10^{-4}	kg·m^2(GD^2/4)	0.0773	g·cm·s^2
Applicable load inertia	J_L	0.79×10^{-4}	kg·m^2(GD^2/4)	0.8	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.59	kg	0.59	kg
Weight (including ABS-RII)	W_E	0.65	kg	0.65	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

P50B05005P

Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	50	W	50	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.159	N·m	1.62	kg·cm
∗ Continuous stall torque	T_S	0.167	N·m	1.7	kg·cm
∗ Instantaneous maximum stall torque	T_P	0.49	N·m	5.0	kg·cm
∗ Rated armature current	I_R	1.6	Arms	1.6	Arms
∗ Continuous stall armature current	I_S	1.6	Arms	1.6	Arms
∗ Instantaneous maximum stall armature current	I_P	5.0	Arms	5.0	Arms
Torque constant	K_T	0.136	N·m/Arms	1.39	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	4.76	mV/min^{-1}	4.76	V/krpm
Phase armature resistance	R_ϕ	2.6	Ω	2.6	Ω
Electrical time constant	t_e	2.2	msec	2.2	msec
Mechanical time constant (not including sensor)	t_m	2.4	msec	2.4	msec
Inertia (including wiring-saved INC)	J_M	0.063×10^{-4}	kg·m^2(GD^2/4)	0.064	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.060×10^{-4}	kg·m^2(GD^2/4)	0.0613	g·cm·s^2
Applicable load inertia	J_L	0.63×10^{-4}	kg·m^2(GD^2/4)	0.64	g·cm·s^2
Weight (including wiring-saved INC)	W_E	0.53	kg	0.53	kg
Weight (including ABS-RII)	W_E	0.61	kg	0.61	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

9. SPECIFICATIONS

P50B05010P

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	2.1	Arms	2.1	Arms
∗ Continuous stall armature current	I_S	2.2	Arms	2.2	Arms
∗ Instantaneous maximum stall armature current	I_P	6.7	Arms	6.7	Arms
Torque constant	K_T	0.176	N·m/Arms	1.8	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	6.25	mV/min^{-1}	6.25	V/krpm
Phase armature resistance	R_ϕ	1.5	Ω	1.5	Ω
Electrical time constant	t_e	2.6	msec	2.6	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-RII)	J_M	0.098×10^{-4}	$kg\cdot m^2(GD^2/4)$	0.1003	$g\cdot cm\cdot s^2$
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-RII)	W_E	0.82	kg	0.82	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

P50B05020P

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	7.0	kg·cm
∗ Instantaneous maximum stall torque	T_P	1.96	N·m	20	kg·cm
∗ Rated armature current	I_R	3.4	Arms	3.4	Arms
∗ Continuous stall armature current	I_S	3.5	Arms	3.5	Arms
∗ Instantaneous maximum stall armature current	I_P	11	Arms	11	Arms
Torque constant	K_T	0.218	N·m/Arms	2.223	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	7.6	mV/min^{-1}	7.6	V/krpm
Phase armature resistance	R_ϕ	0.85	Ω	0.85	Ω
Electrical time constant	t_e	2.8	msec	2.8	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-RII)	J_M	0.170×10^{-4}	$kg\cdot m^2(GD^2/4)$	0.1733	$g\cdot cm\cdot s^2$
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-RII)	W_E	1.15	kg	1.15	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

9. SPECIFICATIONS

P50B07020P

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	17.0	kg·cm
∗ Instantaneous maximum stall torque	T_P	1.96	N·m	20	kg·cm
∗ Rated armature current	I_R	4.3	Arms	4.3	Arms
∗ Continuous stall armature current	I_S	4.4	Arms	4.4	Arms
∗ Instantaneous maximum stall armature current	I_P	14.4	Arms	14.4	Arms
Torque constant	K_T	0.18	N·m/Arms	1.84	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	6.3	mV/min^{-1}	6.3	V/krpm
Phase armature resistance	R_ϕ	0.66	Ω	0.66	Ω
Electrical time constant	t_e	3.6	msec	3.6	msec
Mechanical time constant (not including sensor)	t_m	2.3	msec	2.3	msec
Inertia (including wiring-saved INC)	J_M	0.386×10^{-4}	kg·m^2(GD^2/4)	0.394	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.398×10^{-4}	kg·m^2(GD^2/4)	0.406	g·cm·s^2
Applicable load inertia	J_L	3.86×10^{-4}	kg·m^2(GD^2/4)	3.94	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.57	kg	1.57	kg
Weight (including ABS-RII)	W_E	1.61	kg	1.61	kg

- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. 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.

P50B07030P

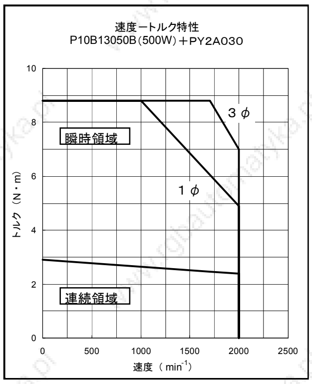
Name	Symbol	Data	Unit	Data	Unit
∗ Rated output	P_R	300	W	300	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
∗ Rated torque	T_R	0.931	N·m	9.5	kg·cm
∗ Continuous stall torque	T_S	0.98	N·m	10	kg·cm
∗ Instantaneous maximum stall torque	T_P	2.94	N·m	30	kg·cm
∗ Rated armature current	I_R	5.3	Arms	5.3	Arms
∗ Continuous stall armature current	I_S	5.4	Arms	5.4	Arms
∗ Instantaneous maximum stall armature current	I_P	18.2	Arms	18.2	Arms
Torque constant	K_T	0.197	N·m/Arms	2.01	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	6.87	mV/min^{-1}	6.87	V/krpm
Phase armature resistance	R_ϕ	0.49	Ω	0.49	Ω
Electrical time constant	t_e	3.7	msec	3.7	msec
Mechanical time constant (not including sensor)	t_m	1.8	msec	1.8	msec
Inertia (including wiring-saved INC)	J_M	0.495×10^{-4}	kg·m^2(GD^2/4)	0.505	g·cm·s^2
Inertia (including ABS-RII)	J_M	0.507×10^{-4}	kg·m^2(GD^2/4)	0.517	g·cm·s^2
Applicable load inertia	J_L	4.95×10^{-4}	kg·m^2(GD^2/4)	5.05	g·cm·s^2
Weight (including wiring-saved INC)	W_E	1.71	kg	1.71	kg
Weight (including ABS-RII)	W_E	1.75	kg	1.75	kg

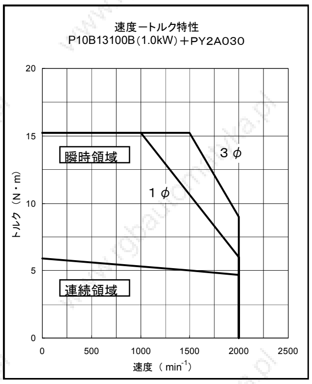
- The mark ∗ denotes the value after a temperature rise. The others are values at 68°F. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 305 mm square aluminum plate installed.

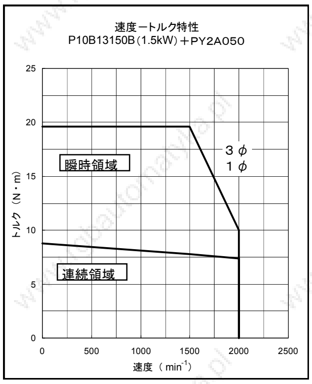
9.3 Combination Specifications

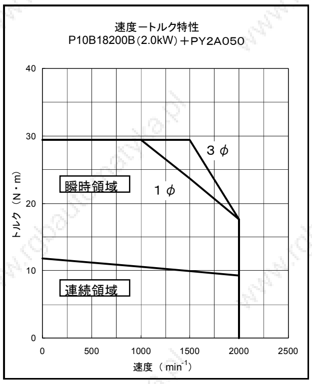
The velocity and torque characteristics differ depending on the amplifier capacity and power supply of the amplifier. The velocity and torque characteristics when combining Servomotors and PY2 type Servo Amplifiers normally are indicated below.

9.3.1 P1 Series (B Coil) + PY2

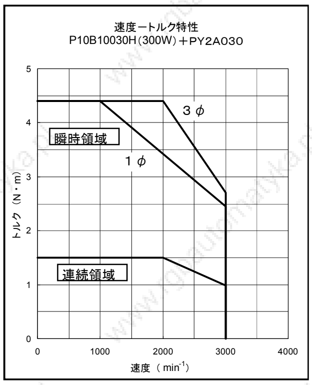

速度－トルク特性
P10B13050B(500W)＋PY2A030

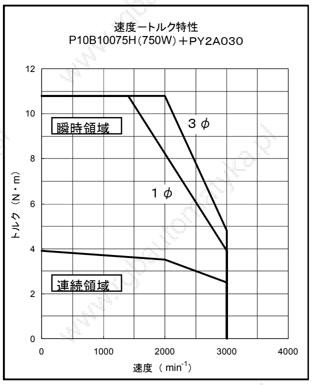

速度－トルク特性
P10B13100B(1.0kW)＋PY2A030

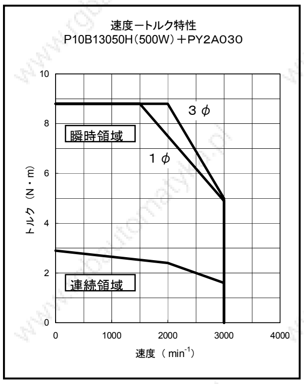

速度－トルク特性
P10B13150B(1.5kW)＋PY2A050

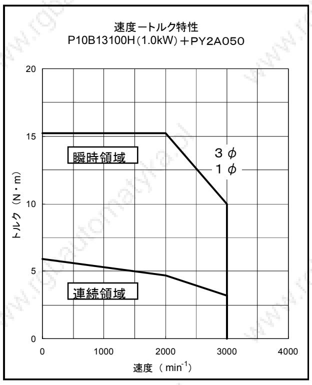

速度－トルク特性
P10B18200B(2.0kW)＋PY2A050

9.3.2 P1 Series (H Coil) + PY2

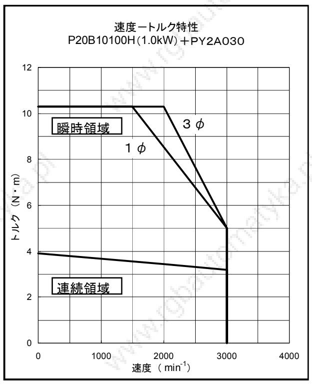

速度－トルク特性
P10B10030H(300W)＋PY2A030

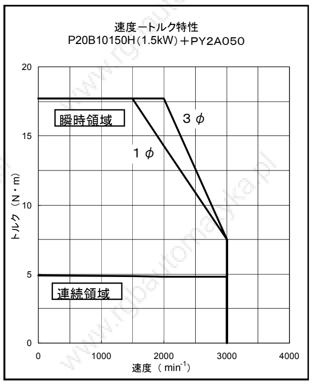

速度－トルク特性
P10B10075H(750W)＋PY2A030

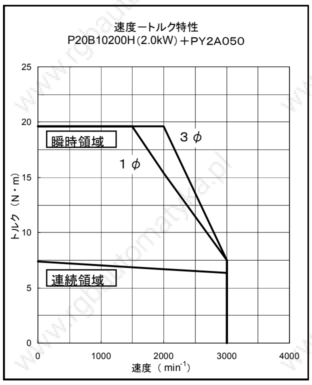

速度－トルク特性
P10B13050H(500W)＋PY2A030

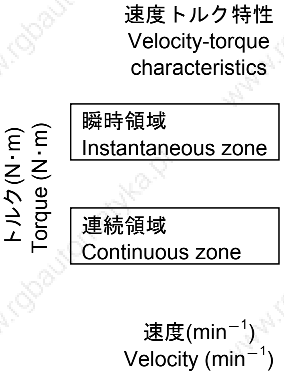

速度－トルク特性
P10B13100H(1.0kW)＋PY2A050

9.3.3 P2 Series (H Coil) + PY2


速度－トルク特性
P20B10100H(1.0kW)＋PY2A030

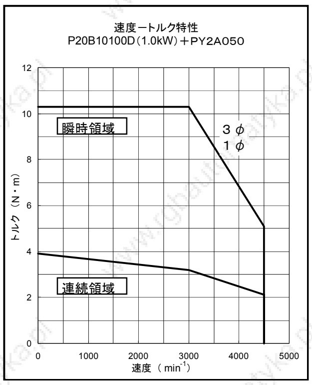

速度－トルク特性
P20B10150H(1.5kW)＋PY2A050

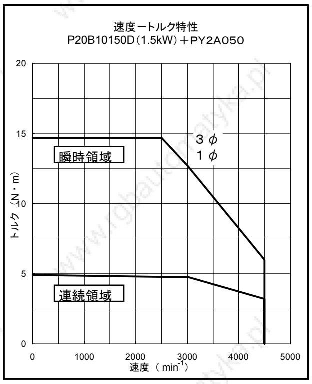

速度－トルク特性
P20B10200H(2.0kW)＋PY2A050

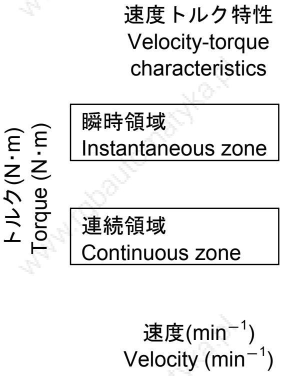


3 φ: Indicates the characteristics when 3-phase, 200 VAC is supplied to the Servo Amplifiers.
1 φ: Indicates the characteristics when single-phase, 200 VAC is supplied to the Servo Amplifiers.

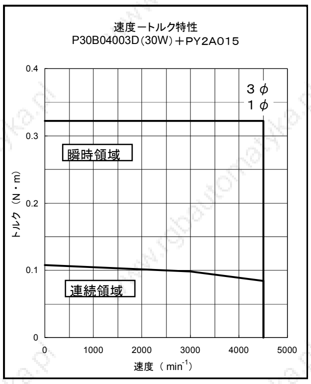
9.3.4 P2 Series (D Coil) + PY2

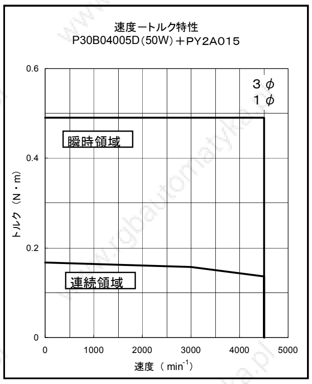

速度ートルク特性
P20B10100D（1.0kW）＋PY2A050

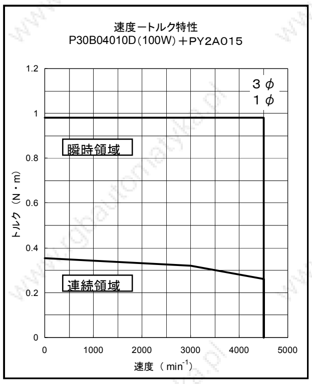

速度ートルク特性
P20B10150D（1.5kW）＋PY2A050

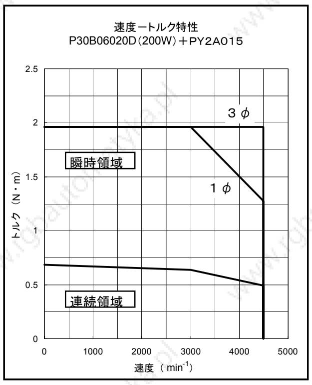


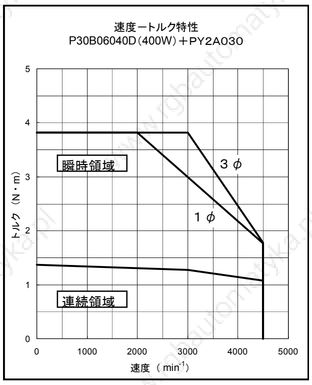
9.3.5 P3 Series (D Coil) + PY2

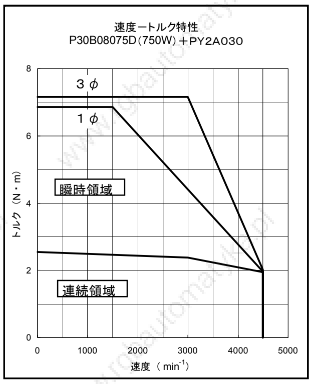

速度ートルク特性
P30B04003D（30W）＋PY2A015


速度ートルク特性
P30B04005D（50W）＋PY2A015

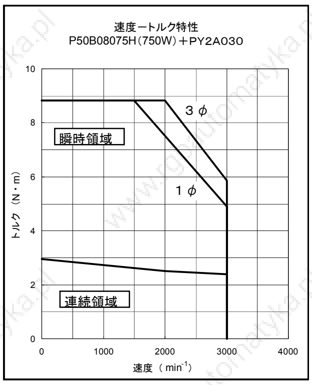

速度ートルク特性
P30B04010D（100W）＋PY2A015

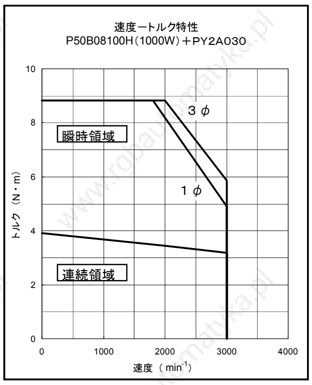

速度ートルク特性
P30B06020D（200W）＋PY2A015


速度ートルク特性
P30B06040D（400W）＋PY2A030


速度ートルク特性
P30B08075D（750W）＋PY2A030

9.3.6 P5 Series (H Coil) + PY2

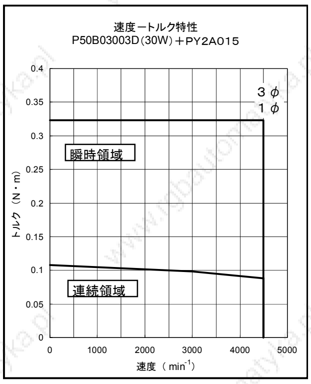

速度ートルク特性
P50B08075H（750W）＋PY2A030

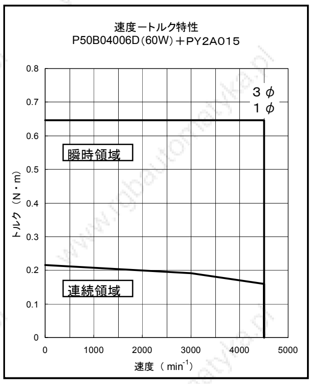

速度ートルク特性
P50B08100H（1000W）＋PY2A030

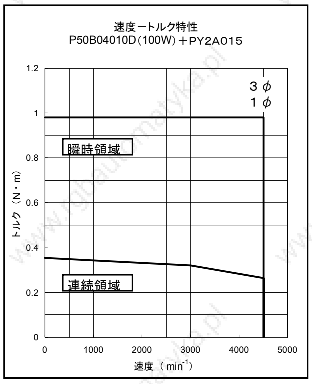
3 φ: Indicates the characteristics when 3-phase, 200 VAC is supplied to the Servo Amplifiers.

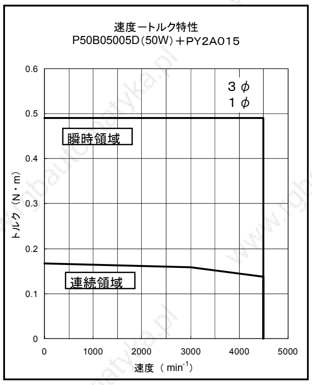
1 φ: Indicates the characteristics when single-phase, 200 VAC is supplied to the Servo Amplifiers.

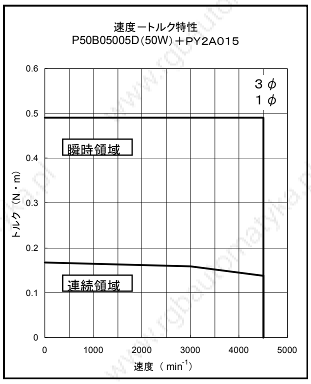
9.3.7 P5 Series (D Coil) + PY2

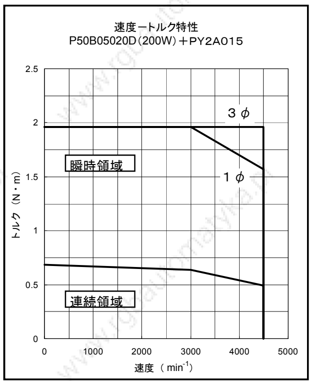

速度ートルク特性
P50B03003D(30W)+PY2A015

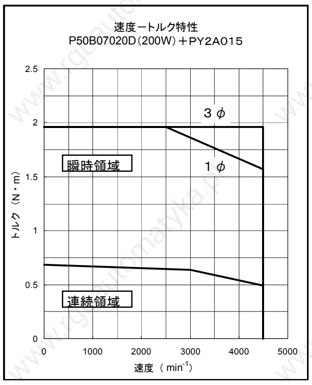

速度ートルク特性
P50B04006D(60W)+PY2A015

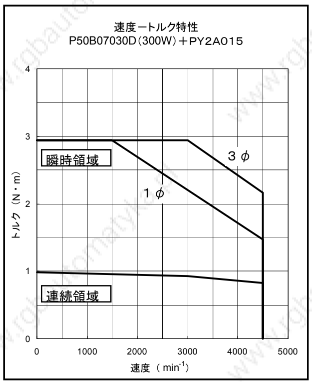

速度ートルク特性
P50B04010D(100W)+PY2A015

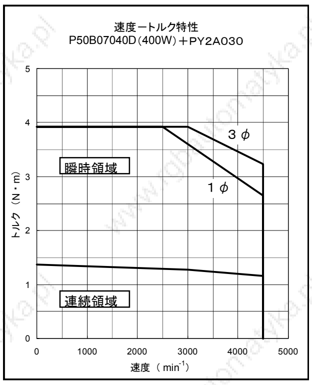

速度ートルク特性
P50B05005D(50W)+PY2A015

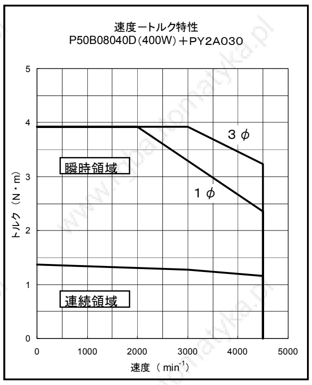

速度ートルク特性
P50B05005D(50W)+PY2A015

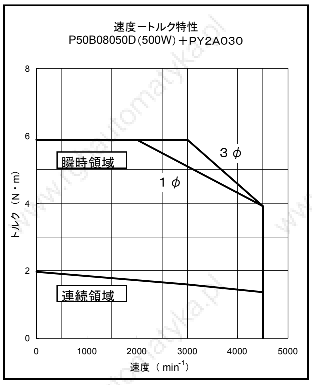

速度ートルク特性
P50B05020D(200W)+PY2A015

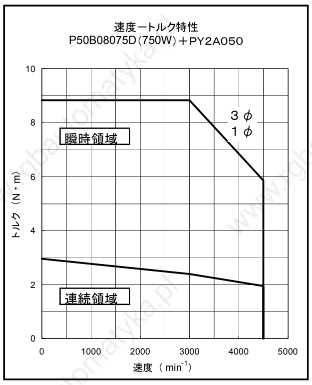

速度ートルク特性
P50B07020D(200W)+PY2A015

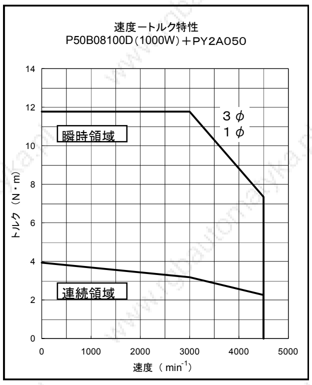

速度ートルク特性
P50B07030D(300W)+PY2A015

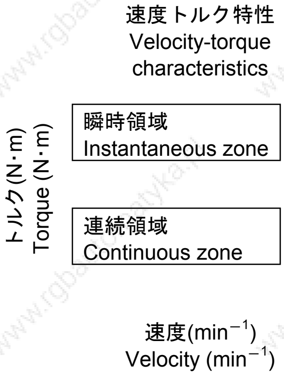

速度ートルク特性
P50B07040D(400W)+PY2A030


速度ートルク特性
P50B08040D(400W)+PY2A030


速度ートルク特性
P50B08050D(500W)+PY2A030

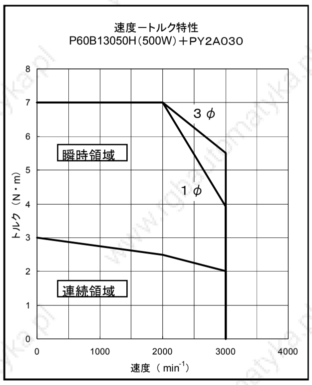

速度ートルク特性
P50B08075D(750W)+PY2A050

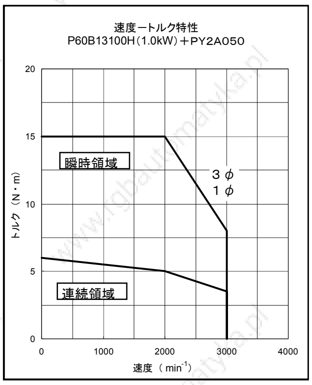

速度ートルク特性
P50B08100D(1000W)+PY2A050

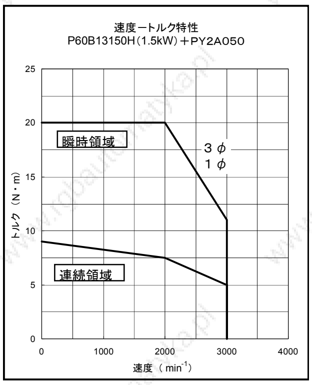

速度トルク特性
Velocity-torque characteristics

3 φ: Indicates the characteristics when 3-phase, 200 VAC is supplied to the Servo Amplifiers.
1 φ: Indicates the characteristics when single-phase, 200 VAC is supplied to the Servo Amplifiers.

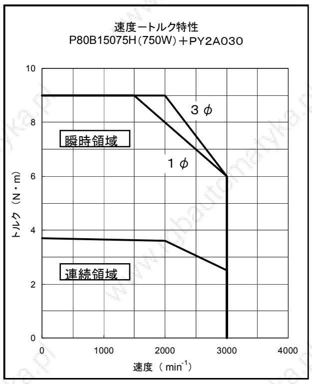
9.3.8 P6 Series (H Coil) + PY2

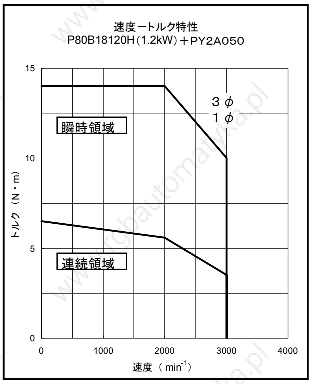


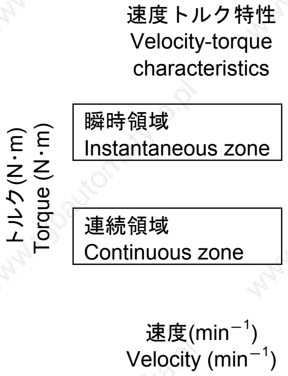




9.3.9 P8 Series (H Coil) + PY2

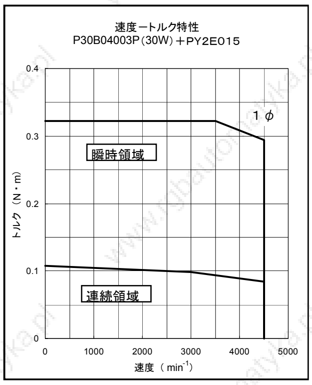


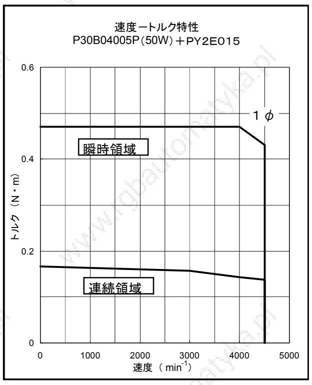


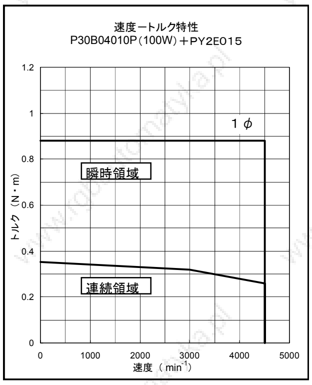


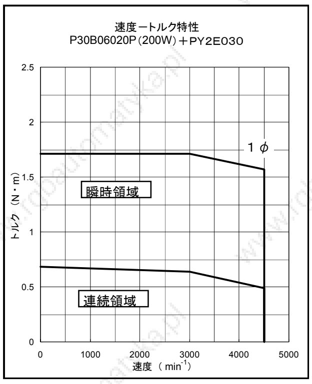
3φ: Indicates the characteristics when 3-phase, 200 VAC is supplied to the Servo Amplifiers.
1φ: Indicates the characteristics when single-phase, 200 VAC is supplied to the Servo Amplifiers.

9.3.10 P3 Series (P Coil) + PY2

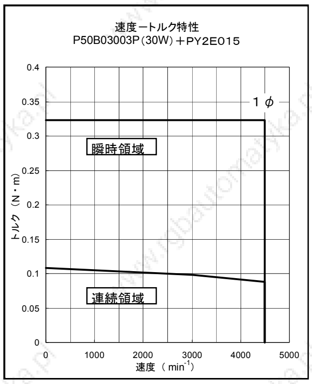


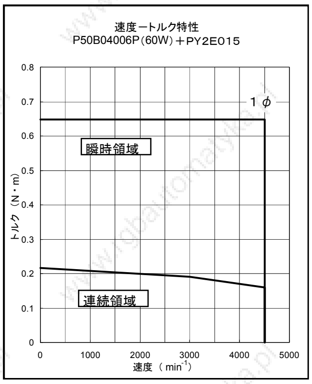


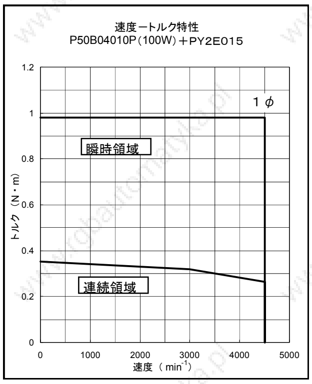


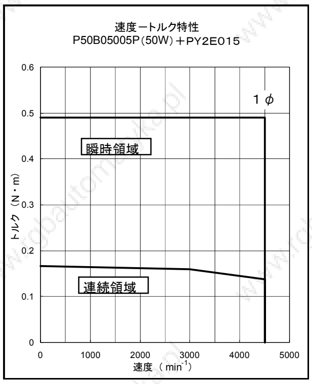


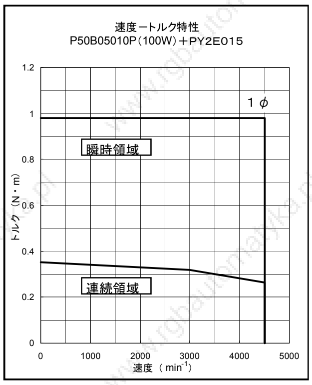
9.3.11 P5 Series (P Coil) + PY2

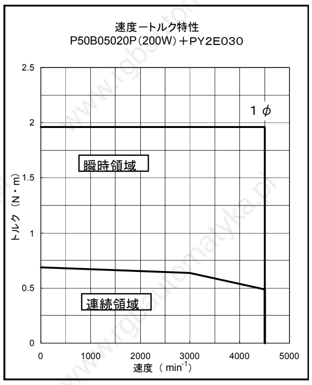


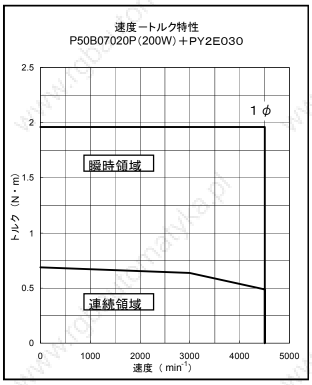


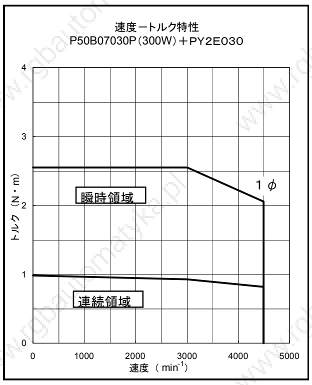




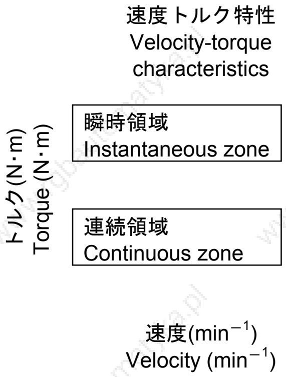








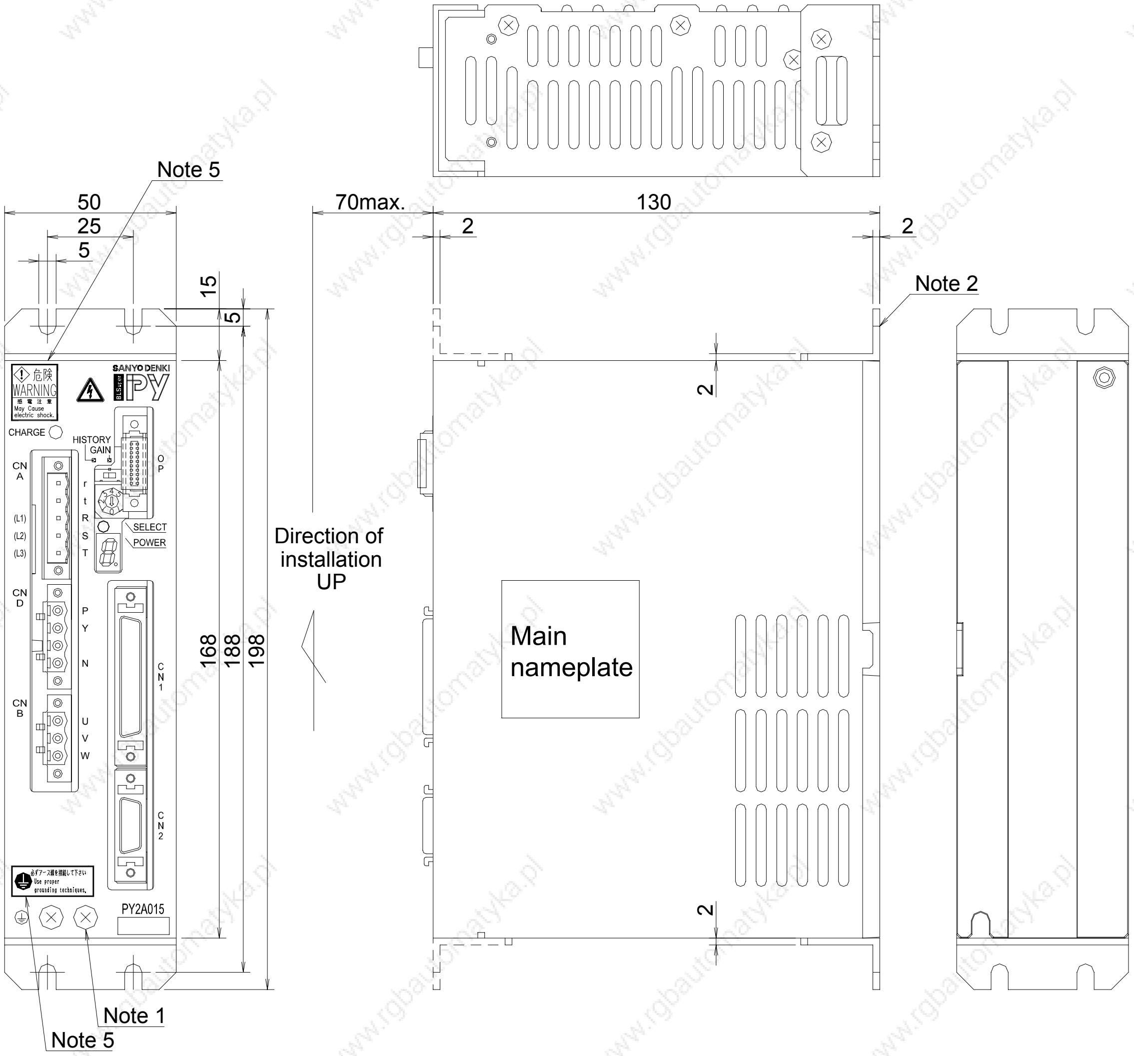
The above graphs indicate the characteristics when single-phase, 100 VAC is supplied to the Servo Amplifiers.



9.4 External Views

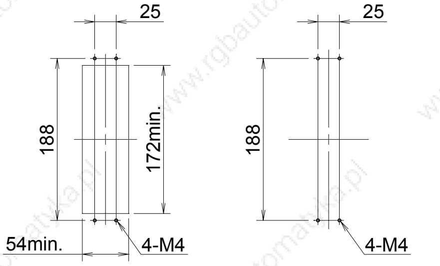
9.4.1 Servo Amplifier

Servo Amplifier model numbers: PY2A015A2 • PY2A015A3
PY2A015H2 • PY2A015H3
PY2A015P2 • PY2A015P3

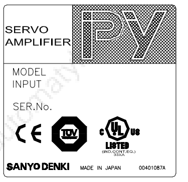


Notes : 1. Earth terminal screw : M4
Tightening torque : 1.18N・m

2. Mounting panel warking drawing
(front-mountable)


Front-side mounting
Rear-side mounting

3. Main nameplate



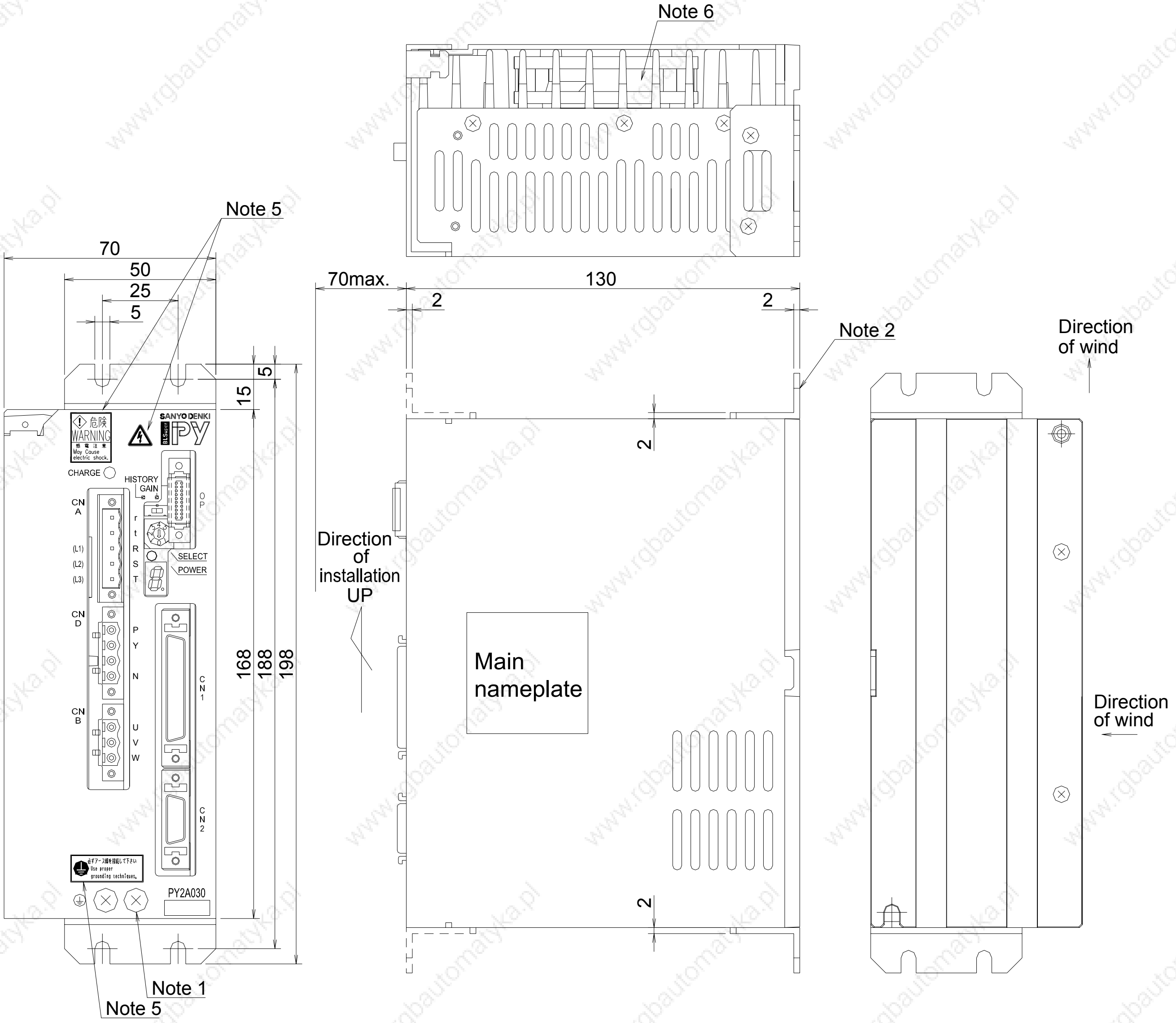
The design of the main nameplate may change when the device meets other standards.

4. Body material : SPCC / green chromated

5. Warning label

9. SPECIFICATIONS

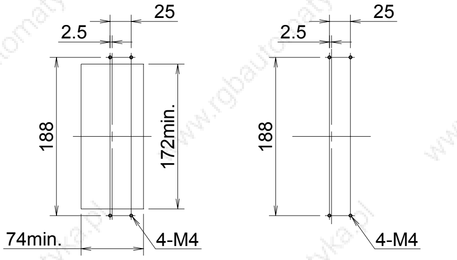
Servo Amplifier model numbers: PY2A030A2 • PY2A030A3
PY2A030H2 • PY2A030H3
PY2A030P2 • PY2A030P3



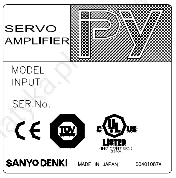
Notes : 1. Earth terminal screw : M4
Tightening torque : 1.18N・m

2. Mounting panel warking drawing (front-mountable)

Front-side mounting Rear-side mounting



3. Main nameplate



The design of the main nameplate may change when the device meets other standards.

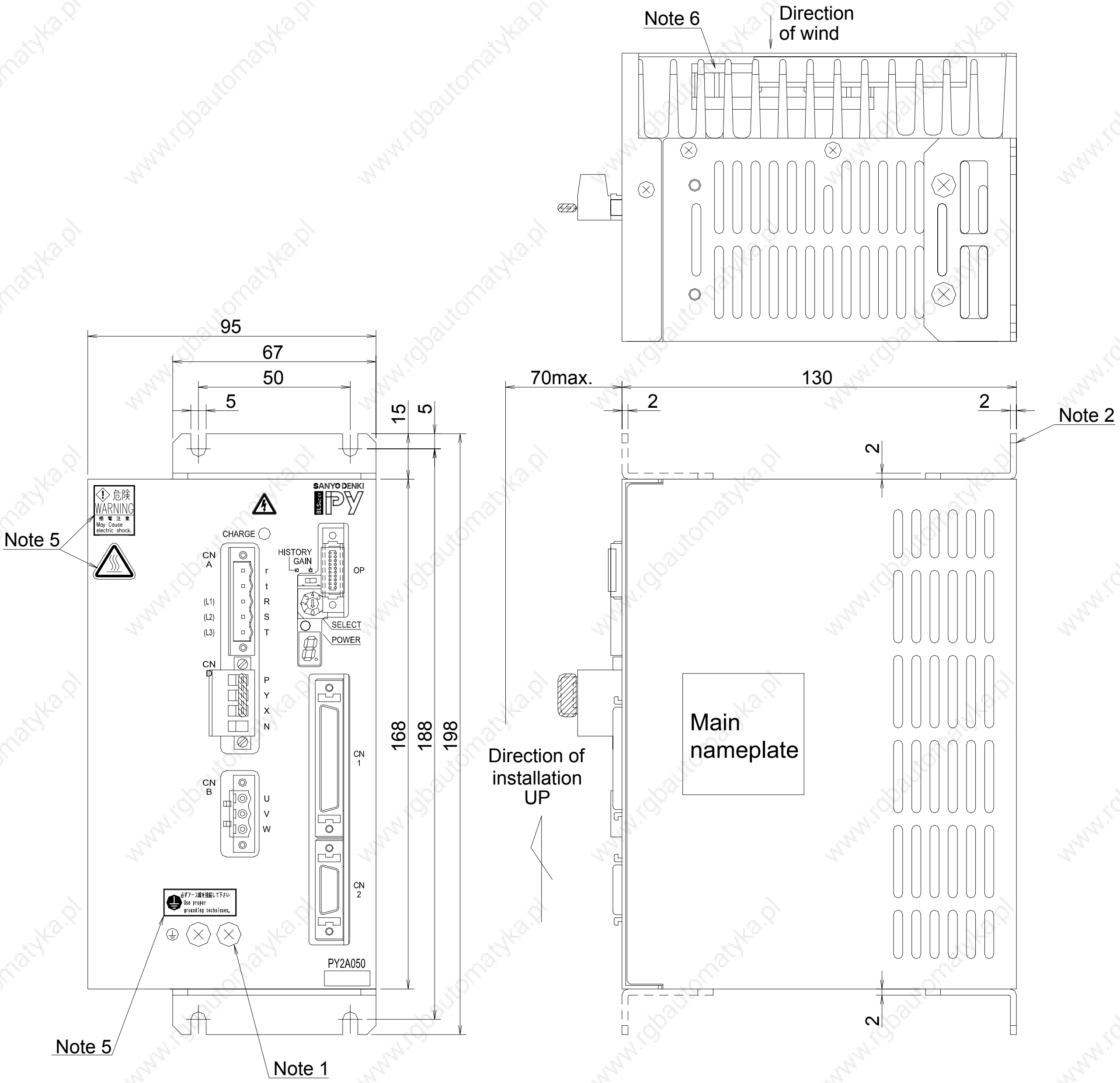
4. Body material : SPCC / green chromated

5. Warning label

6. Fan motor

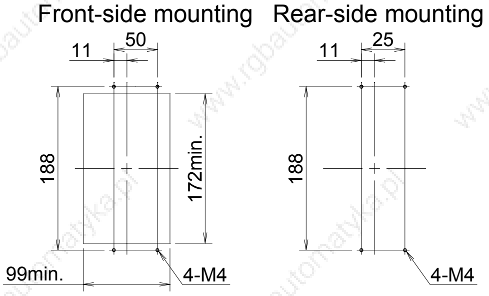
9. SPECIFICATIONS

Servo Amplifier model numbers: PY2A050A6 • PY2A050A7
PY2A050H6 • PY2A050H7, PY2A050P6 • PY2A050P7

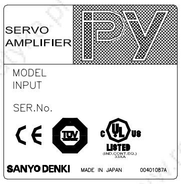


Notes : 1. Earth terminal screw : M4
Tightening torque : 1.18N・m

2. Mounting panel warking drawing
(front-mountable)



3. Main nameplate



The design of the main nameplate may change when the device meets other standards.

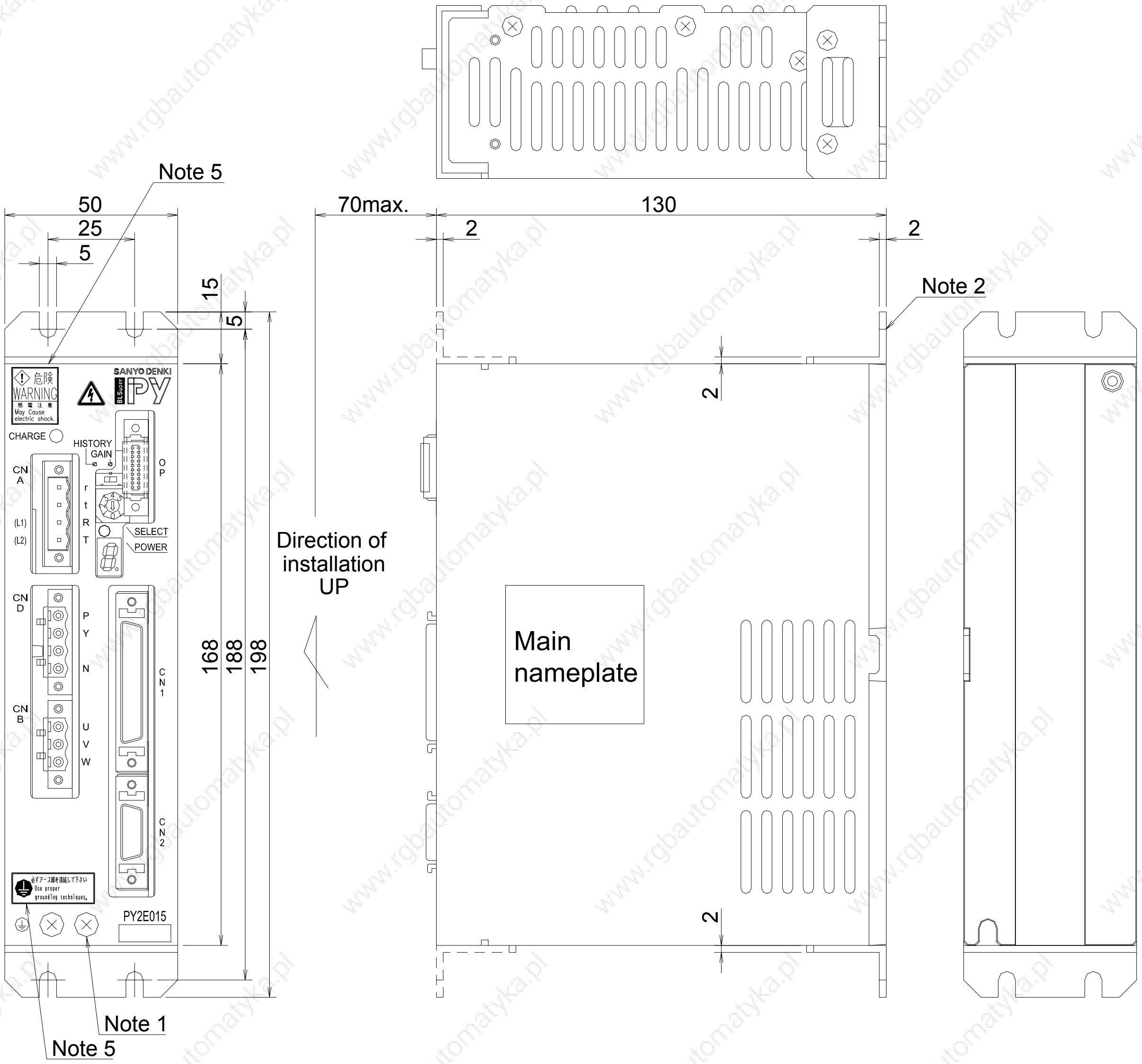
4. Body material : SPCC / green chromated

5. Warning label

6. Fan motor

9. SPECIFICATIONS

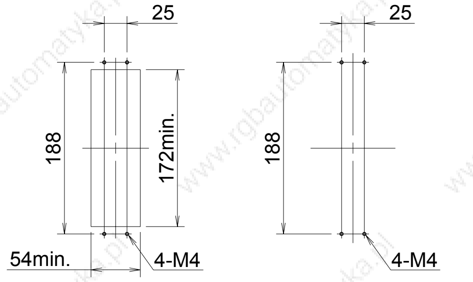
Servo Amplifier model numbers: PY2E015A3 • PY2E015H3 • PY2E015P3



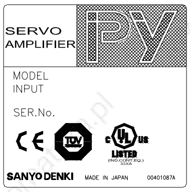
Notes : 1. Earth terminal screw : M4
Tightening torque : 1.18N・m

2. Mounting panel warking drawing (front-mountable)

Front-side mounting Rear-side mounting



3. Main nameplate



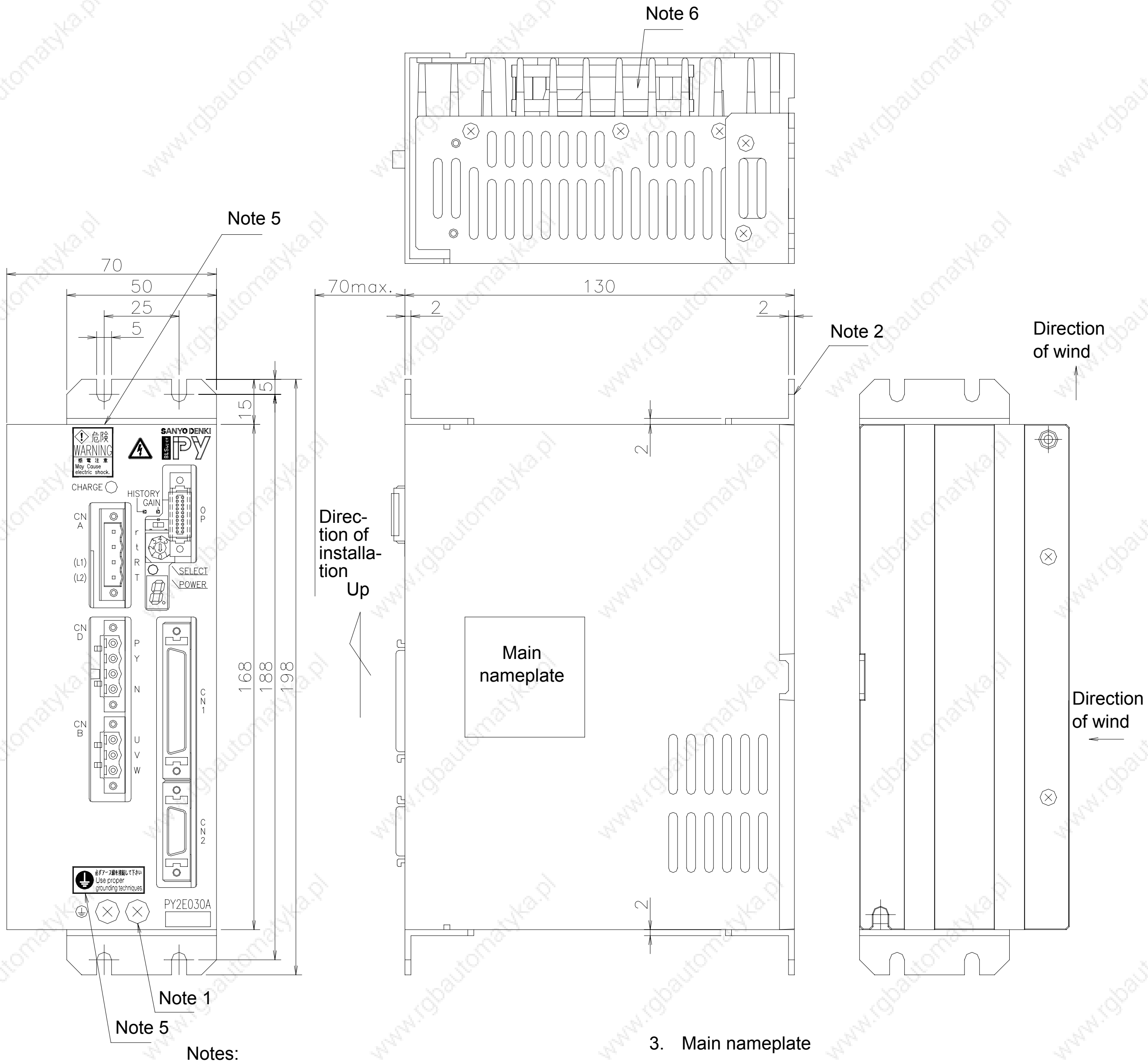
The design of the main nameplate may change when the device meets other standards.

4. Body material : SPCC / green chromated

5. Warning label

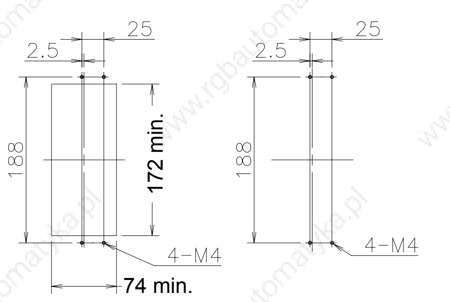
9. SPECIFICATIONS

Servo Amplifier model numbers: PY2E030A3 • PY2E030H3 • PY2E03P3

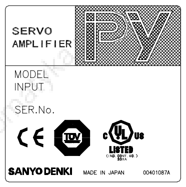


Notes:

1. Earth terminal screw: M4
   Tightening torque: 1.18 N･m
2. Mounting panel working drawing (front-mountable)


Front-side mounting Rear-side mounting

3. Main nameplate



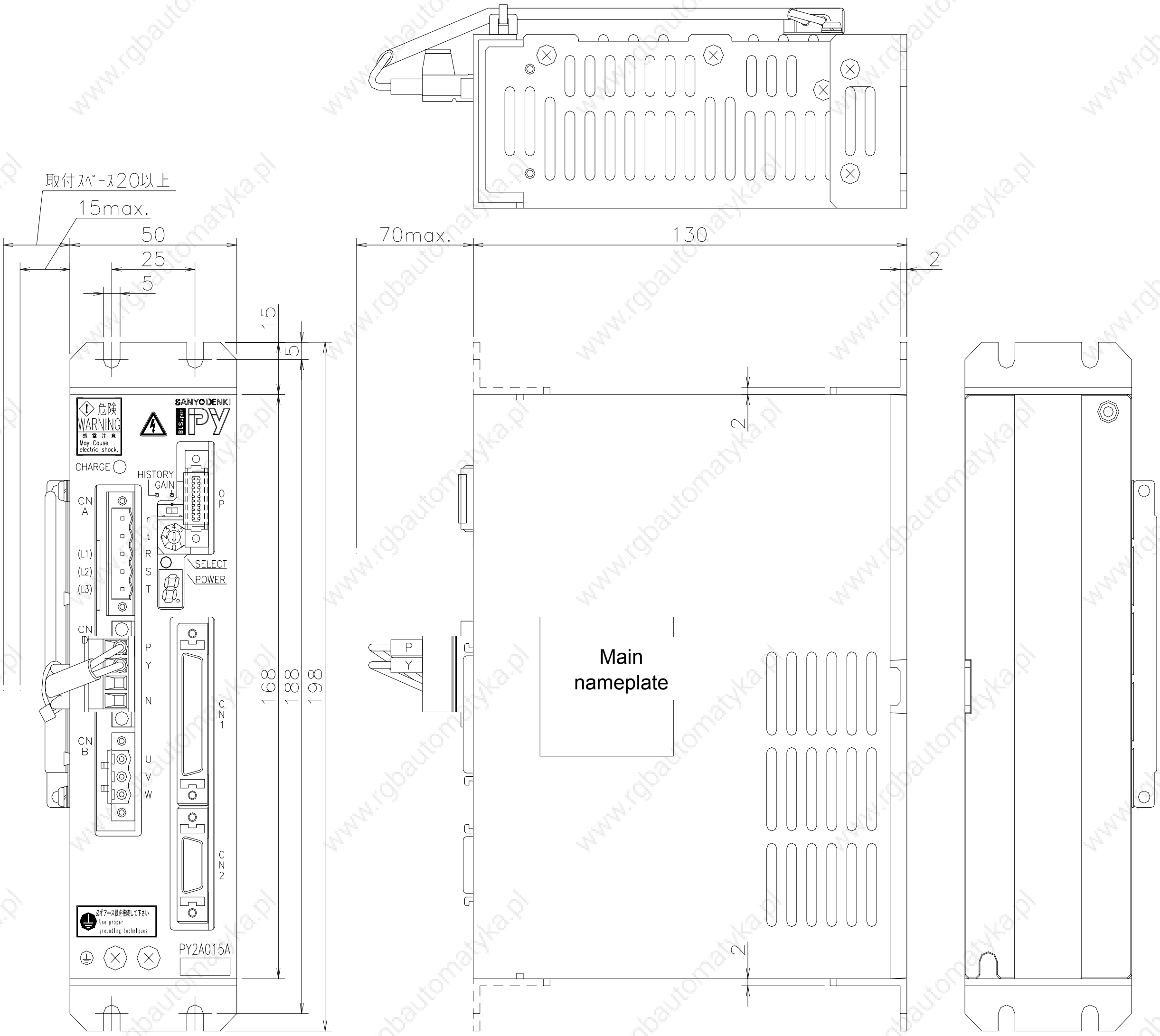
(The design of the main nameplate may change when the device meets other standards.)

4. Body material: SPCC/green chromated
5. Warning label

6. Fan motor

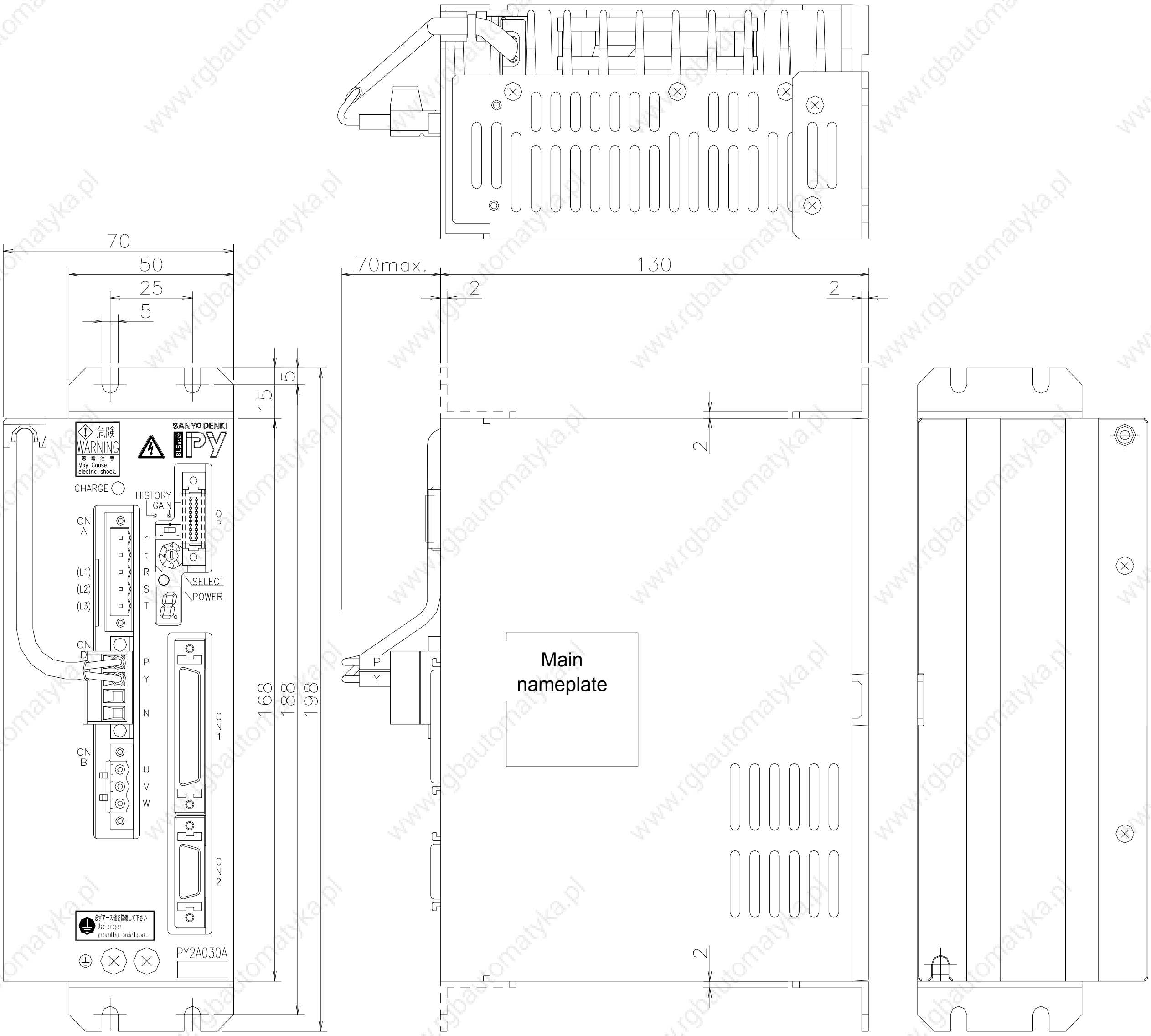
9. SPECIFICATIONS

Servo Amplifier model numbers: PY2A015A6 • PY2A015A7
PY2A015H6 • PY2A015H7
PY2A015P6 • PY2A015P7



9. SPECIFICATIONS

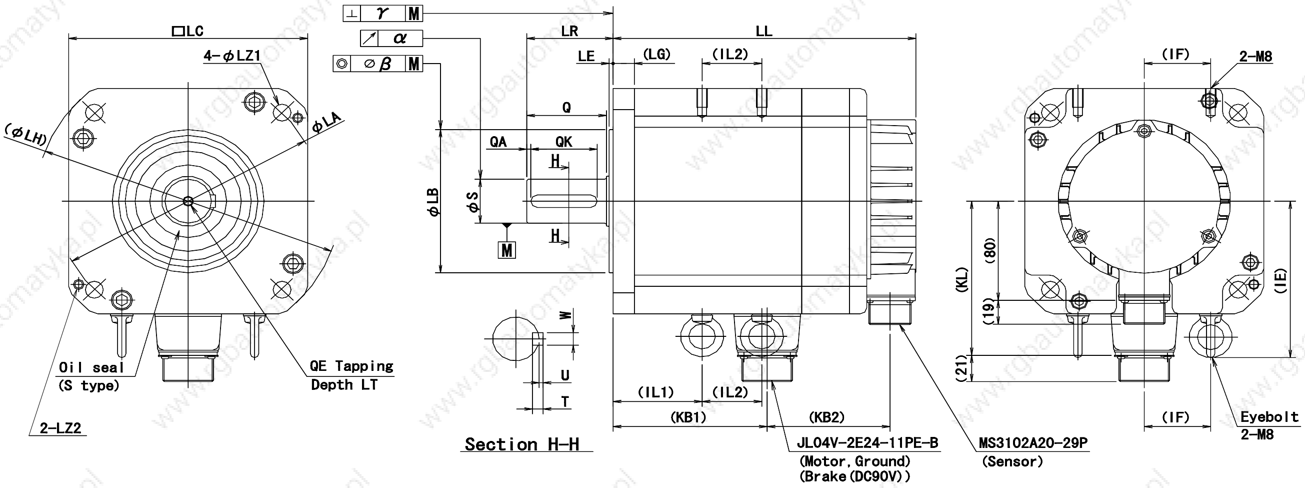
Servo Amplifier model numbers: PY2A030A6 • PY2A030A7
PY2A030H6 • PY2A030H7
PY2A030P6 • PY2A030P7



9.4.2 Servomotor

Servomotor model No.: P1 motor

Incremental encoder (INC-E)
Absolute sensor (ABS-RII)



Unit: mm

	Incremental·ABS-RII				Connector (motor)										
	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△□◇	182	53	225	96	18-10P	76	19	20-15P	76	19	10	115	0 95-0.035	3	130
P10B10075△□◇	272		315												
P10B13050△□◇	176	56	216	97	18-10P	91	19	20-15P	91	19	12	145	0 110-0.035	6	165
P10B13100△□◇	221		261												
P10B13150△□◇	272		312												
P10B18200△□◇	230	52	278	100	22-22P	118	19	24-11P	118	21	16	20	0 114.3-0.035	3	230
P10B18350△□◇	280		328												
P10B18450△□◇	350		398		24-10P										
P10B18550△□◇	501		565	116			21				19				

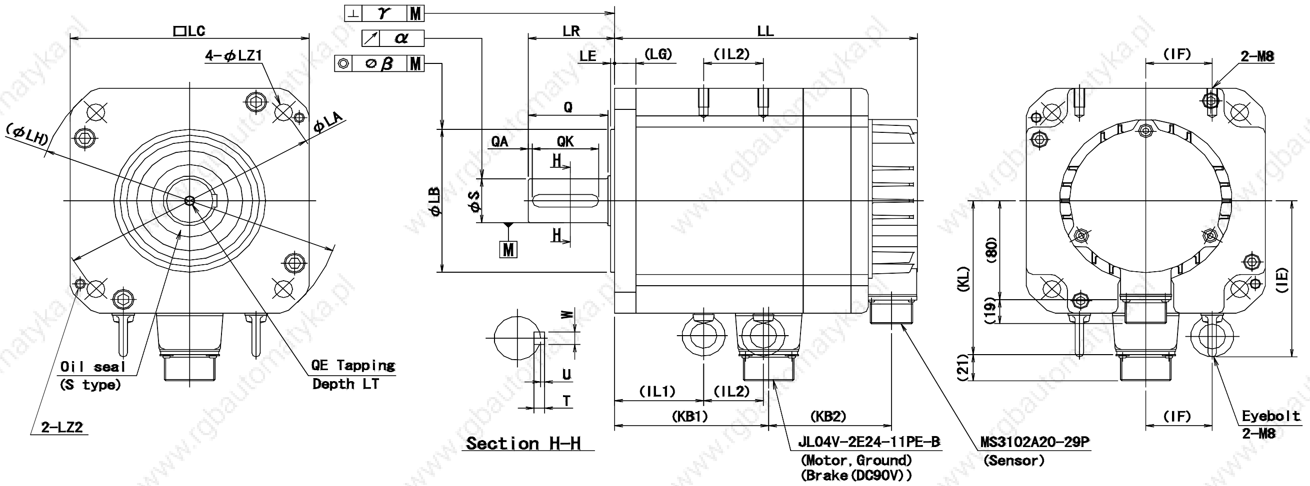
				Shaft												
				Standard (61BM compatible type)			High rigidity type									
MODEL	LC	LZ1	LZ2	LR	S	Q	LR	S	Q	KB1	KL3	α	β	γ	IL1	IL2
P10B10030△□◇	100	9	–	35	0 16-0.011	30	45	0 22-0.013	40	108	64	0.02	0.04	0.04	–	–
P10B10075△□◇								0 25-0.013		198						
P10B13050△□◇	130	9	M6	58	0 19-0.013	52	58	0 25-0.013	40	100	80	0.02	0.04	0.04	–	–
P10B13100△□◇										145						
P10B13150△□◇					0 21-0.013	40		0 35-0.016		196						
P10B18200△□◇	180	13.5	M8	79	0.01 35.0	76	79	0 48-0.016	76	158	80	0.02	0.04	0.04	27	113
P10B18350△□◇										208						163
P10B18450△□◇										278						233
P10B18550△□◇				110	0 42-0.016	110	110	0 63-0.019	110	429		0.04	0.04	0.04	30	381

> Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

9. SPECIFICATIONS

Servomotor model No.: P1 motor

Absolute encoder (ABS-E type)



⚠ Unit: mm

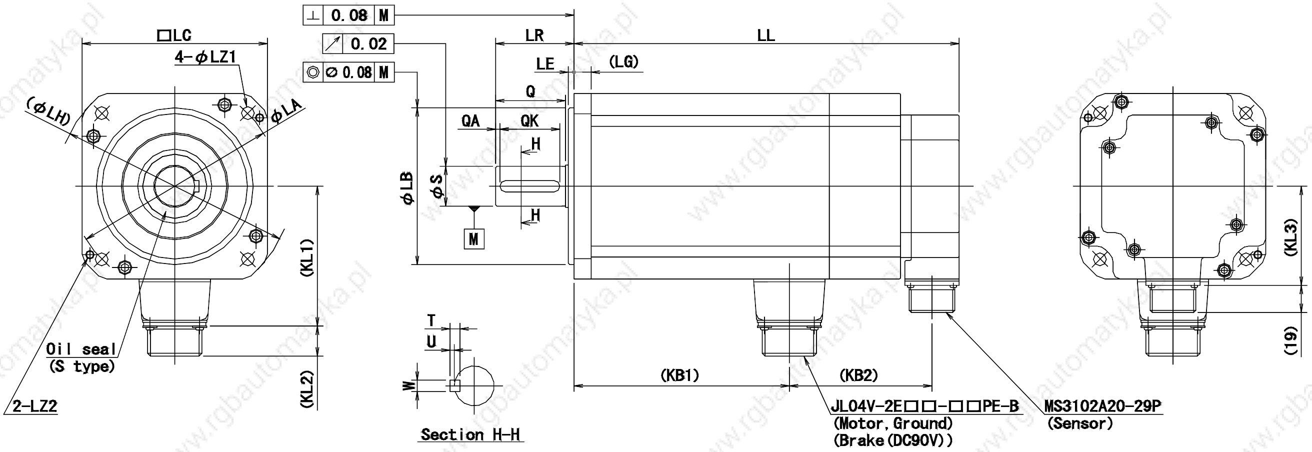
	ABS - E				Connector										
	W/O brake		With brake		Motor earth			B (Type with B only)							
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH
P10B10030△□◇	234	73	277	116	18-10P	76	19	20-15P	76	19	10	115	0 95-0.035	3	130
P10B10075△□◇	324		367												
P10B13050△□◇	214	61	253	100	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.

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											

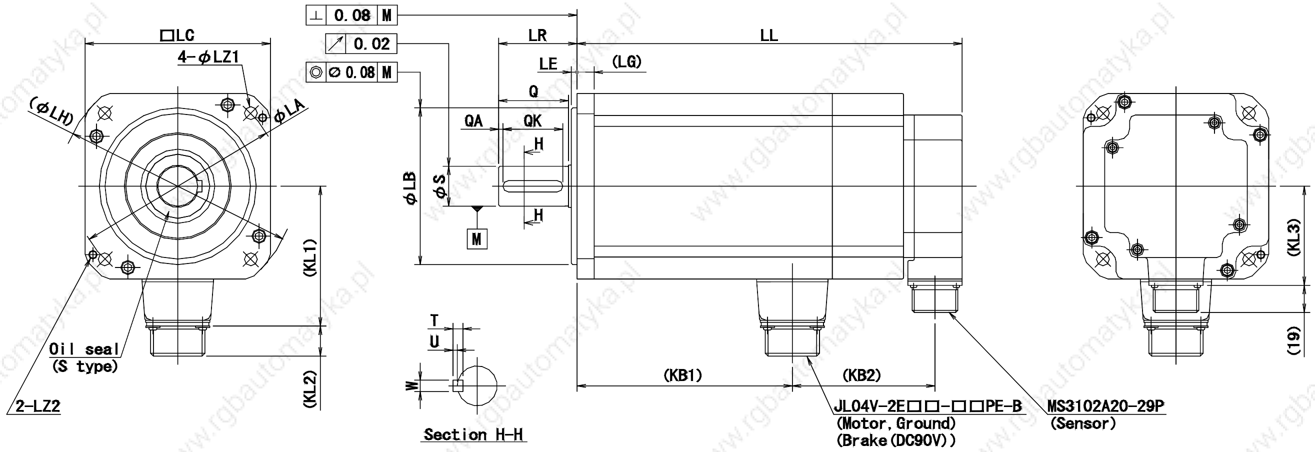
MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	KL3
P20B10100△□◇	–	45	0 22-0.013	40	3	32	0 6-0.030	6	2.5	80	70
P20B10150△□◇										105	
P20B10200△□◇										130	
P20B10250△□◇										155	
P20B13300△□◇	M6	55	28-0.013	50	3	42	0 8-0.036	7	3	117	
P20B13400△□◇										151	
P20B13500△□◇										190	

⚠ 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

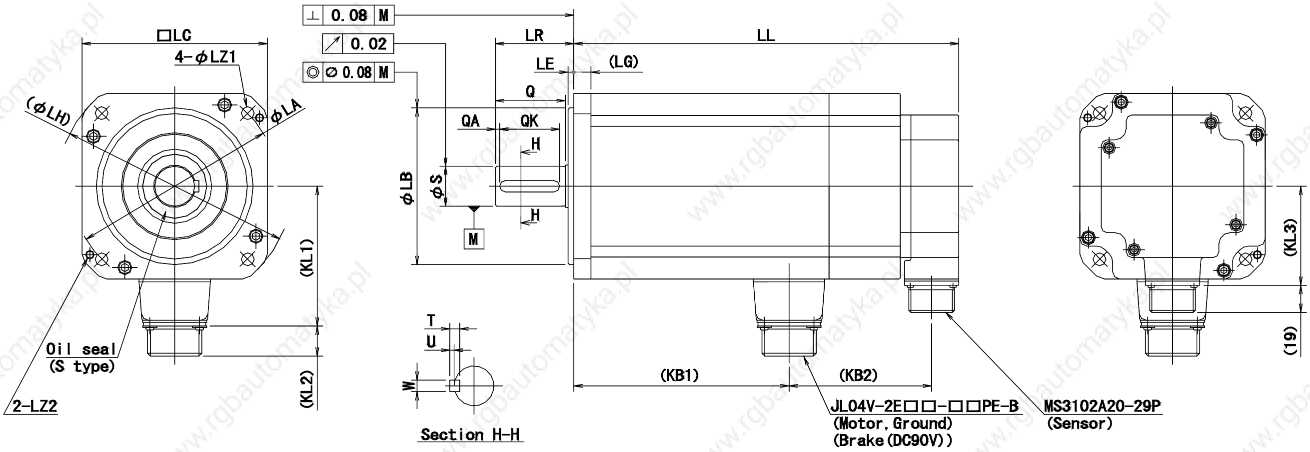
	W/O brake		With brake		Connector									
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH	LC	LZ1
P20B10100△□◇	187	88	231	132	20-15P	76	19	10	115	0 95-0.035	3	130	100	9
P20B10150△□◇	212		256											
P20B10200△□◇	237		281											
P20B10250△□◇	262		306											
P20B13300△□◇	234	98	276	140	24-11P	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.

Servomotor model No.: P2 motor

Absolute sensor (ABS-RII type)



Unit: mm

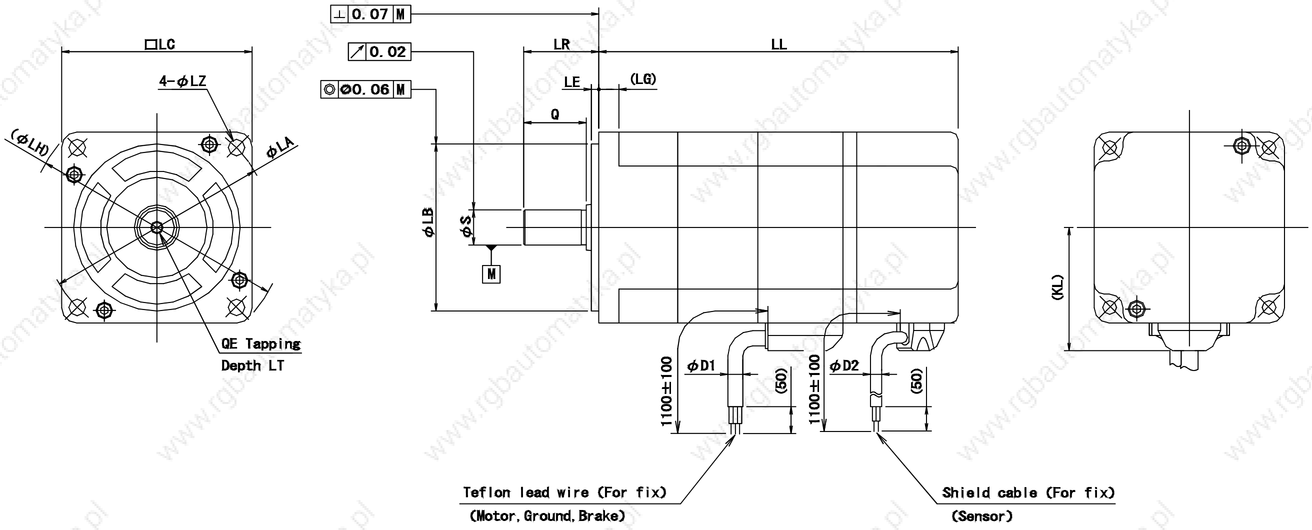
	W/O brake		With brake		Connector									
MODEL	LL	KB2	LL	KB2	MS3102A	KL1	KL2	LG	LA	LB	LE	LH	LC	LZ1
P20B10100△□◇	177	78	221	122	20-15P	76	19	10	115	0 95-0.035	3	130	100	9
P20B10150△□◇	202		246											
P20B10200△□◇	227		271											
P20B10250△□◇	252		296											
P20B13300△□◇	224	88	266	130	24-11P	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.

Servomotor model No.: P3 motor

Incremental encoder (INC-E type)
Absolute sensor (ABS-RII type)



Incremental encoder (INC-E type)

Unit: mm

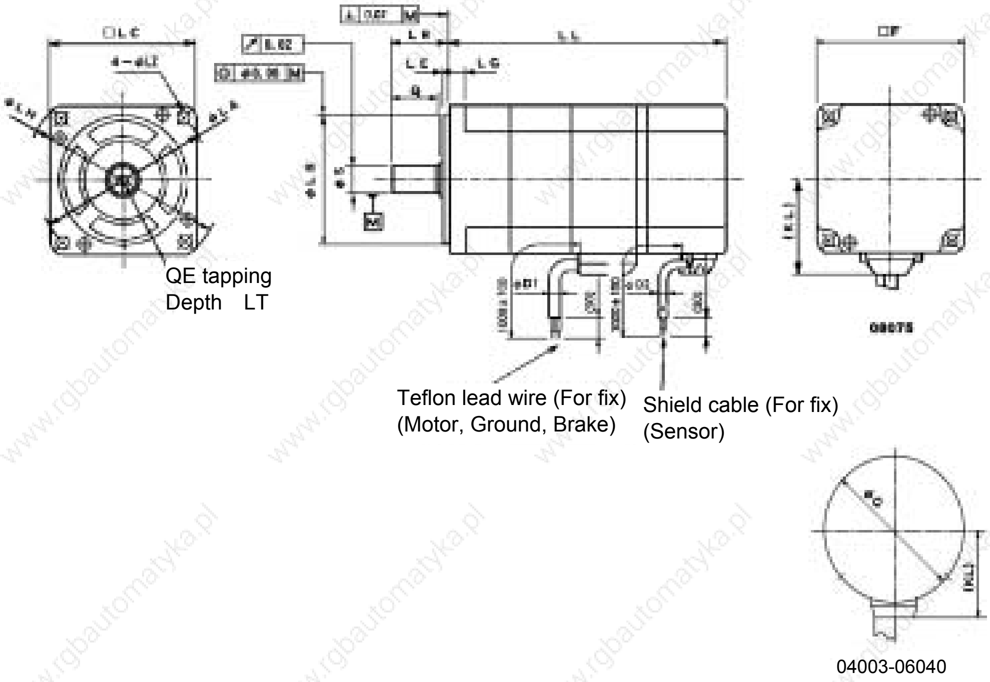
	W/O brake	With brake															
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2
P30B04003△□◇	64	102.5	5	30	46	0 30-0.021	2.5	54	40	4.5	25	0 6-0.008	—	—	—	6	4.7
P30B04005△□◇	70	108.5										0 8-0.009		—	—		
P30B04010△□◇	88	126.5															
P30B06020△□◇	95.5	133.5	6	41	70	0 50-0.025	3	81	60	5.5	30	0 14-0.011		M5	12	6.7	
P30B06040△□◇	123.5	161.5															
P30B08075△□◇	140	180.5	8	52	90	0 70-0.030	3	107	80	6.6	40	0 16-0.011	35				

Absolute sensor (ABS-RII type)

	W/O brake	With brake															
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2
P30B04003△□◇	70	108.5	5	30	46	0 30-0.021	2.5	54	40	4.5	25	0 6-0.008	—	—	—	6	5.1
P30B04005△□◇	76	114.5										0 8-0.009					
P30B04010△□◇	94	132.5															
P30B06020△□◇	101	149.5	6	41	70	0 50-0.025	3	81	60	5.5	30	0 14-0.011		M5	12	6.7	
P30B06040△□◇	129	167															
P30B08075△□◇	140	180.5	8	52	90	0 70-0.030	3	107	80	6.6	40	0 16-0.011	35				

Servomotor model No.: P3 motor

Absolute encoder (ABS-E type)



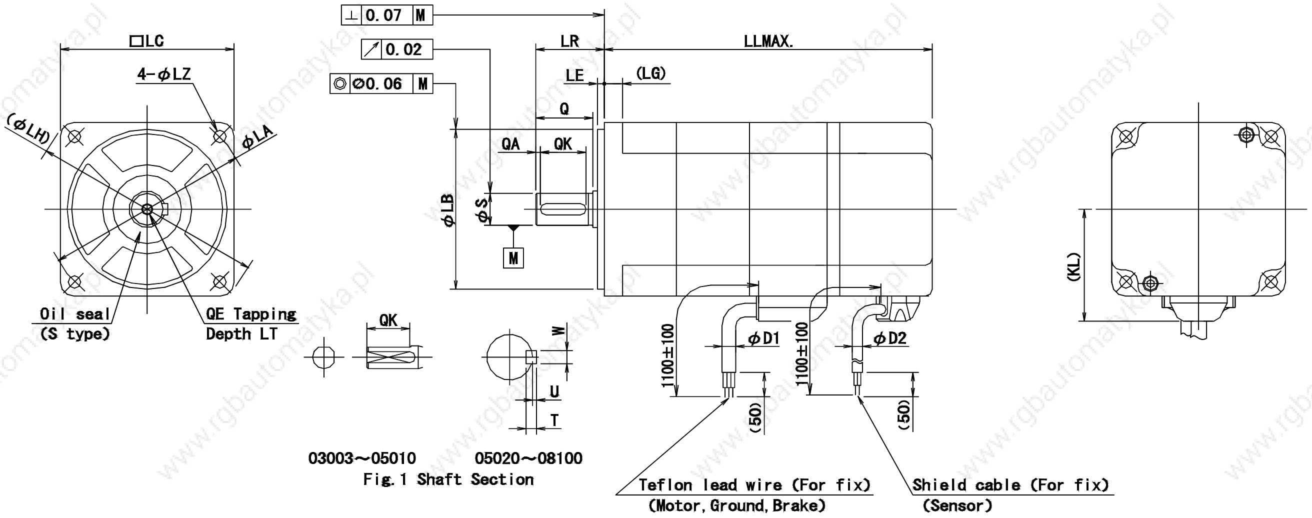
Unit: mm

	W/O brake	With brake																	
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	F	G	S	Q	QE	LT	D1	D2
P30B04003△□◇	101.5	140	5	38	46	0 30-0.021	2.5	54	40	4.5	25	—	60	0 6-0.008	—	—	—	6	7.1
P30B04005△□◇	107.5	146												0 8-0.009		—	—		
P30B04010△□◇	125	163.5																	
P30B06020△□◇	134	172	6	41	70	0 50-0.025	3	81	60	5.5	30	—	90	0 14-0.011		M5	12	6.7	
P30B06040△□◇	162	200																	
P30B08075△□◇	177	217.5	8	52	90	0 70-0.030	3	107	80	6.6	40	80	—	0 16-0.011	35				8

9. SPECIFICATIONS

Servomotor model No.: P5 motor

Incremental encoder (INC-E type)

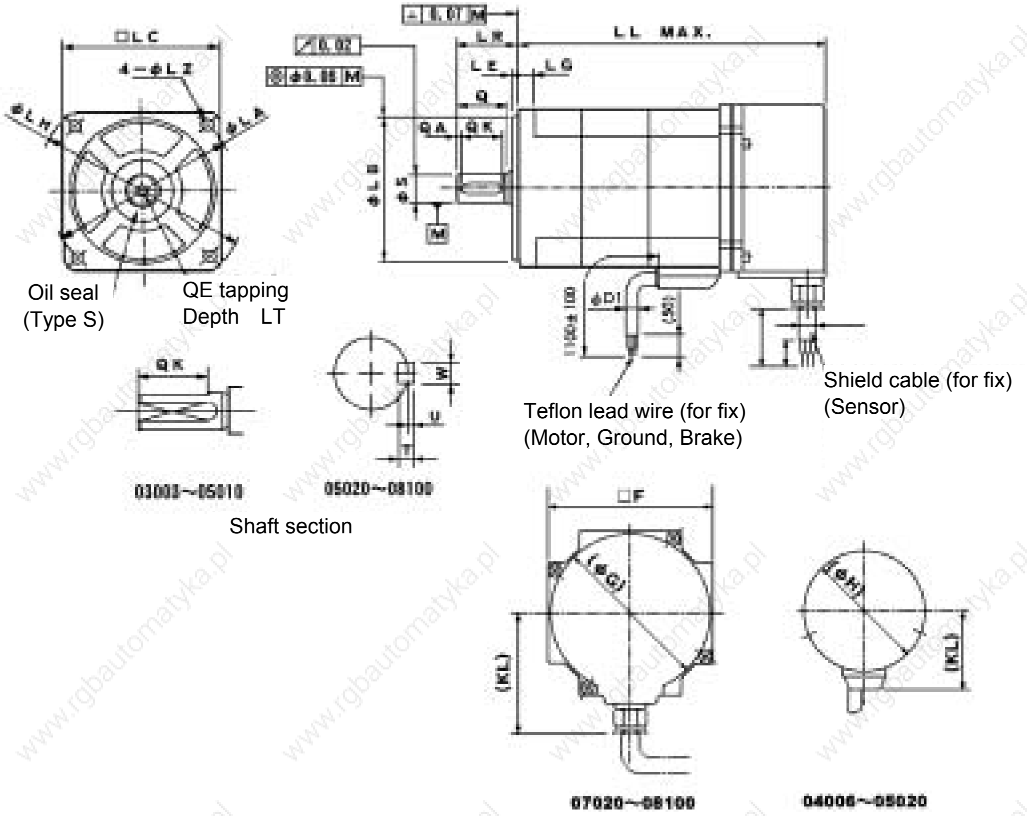


D2＝4.7 mm
Unit: mm

	W/O brake	With brake																			D1			
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	W/O brake & DC 90V brake	DC 24V 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																						

Servomotor model No.: P5 motor

Absolute encoder (ABS-E type)



Unit: mm

	W/O brake	With brake																								
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	F	G	H	S	Q	QA	QK	W	T	U	QE	LT	D1	D2	Oil seal
P50B04006△□◇	114	146	5	38	48	0 34-0.025	2	57	42	3.5	24	—	—	60	0 7-0.009	20	—	15	Slotted, 2 places 6.5±0.2			—	—	6	7.1	Not fitted
P50B04010△□◇	127	159																								
P50B05005△□◇	111	139	5	38	60	0 50-0.025	2.5	71.5	54	4.5	24	—	—	60	0 8-0.009	20	—	15	Slotted, 2 places 7.5±0.2			M3	8	6.7		Fitted
P50B05010△□◇	121	149																								
P50B05020△□◇	140	169									30				0 11-0.011	25	2	20	4	4	1.5	M4	10			
P50B07020△□◇	136	164	5	67	90	0 70-0.030	3	102.5	76	5.5	30	82	78	—	0 14-0.011	25	2	20	5	5	2	M5	12		8	
P50B07030△□◇	142	170																								
P50B07040△□◇	152	180																								
P50B08040△□◇	152	192	5	67	100	0 80-0.030	3	115	86	6.6	35	82	78	—	0 16-0.011	30	2	20	5	5	2	M5	12			
P50B08050△□◇	162	202																								
P50B08075△□◇	185	225																								
P50B08100△□◇	208	248																								

9. SPECIFICATIONS

Servomotor model No.: P5 motor

Absolute sensor (ABS-RII type)

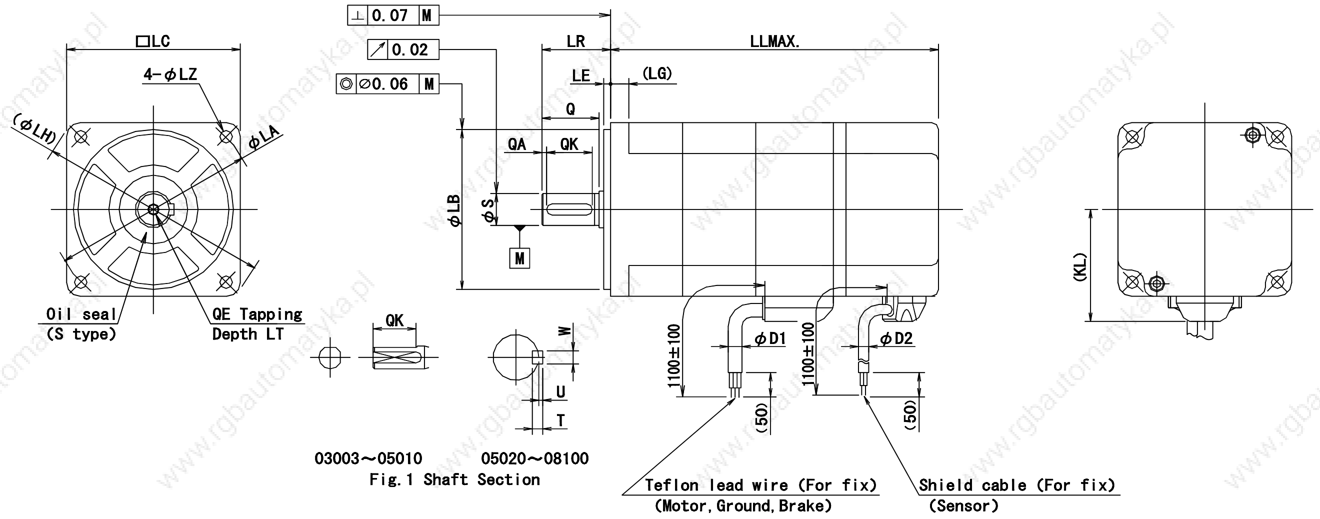


Fig. 1 Shaft Section

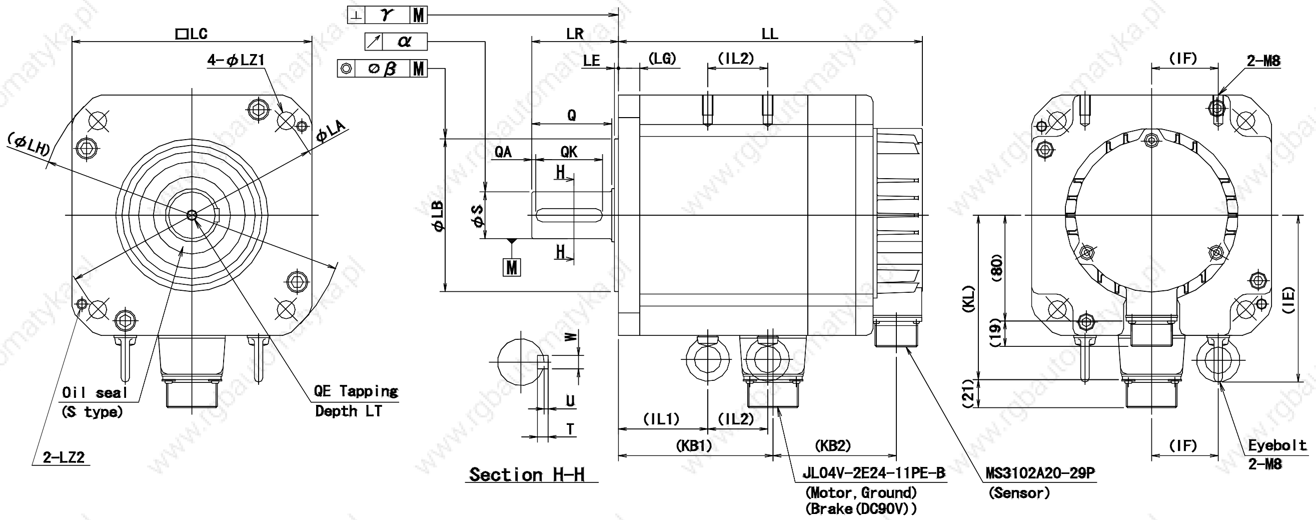
D2＝4.7 mm
Unit: mm

MODEL	W/O brake	With brake																			D1			
	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	W/O brake & DC 90V brake	DC 24V brake	D2	Oil seal
P50B03003△□◇	73	103.5	4.5	27.5	40	0 30-0.021	2	47	35	3.5	15	0 5-0.008	—	—	11	Slotted, 2 places 4.5±0.2			—	—	6	7	4.7	Not fitted
P50B04006△□◇	86	118	5	31	48	0 34-0.025	2	57	42	3.5	24	0 7-0.009	20	—	15	Slotted, 2 places 6.5±0.2			—	—				
P50B04010△□◇	99	131																						
P50B05005△□◇	82	111	5	38	60	0 50-0.025	2.5	71.5	54	4.5	24	0 8-0.009	20	—	15	Slotted, 2 places 7.5±0.2			M3	8	6.7	7.5		Fitted
P50B05010△□◇	92	121																						
P50B05020△□◇	111	140									30	0 11-0.011	25	2	20	4	4	1.5	M4	10				
P50B07020△□◇	97	124	8	50	90	0 70-0.030	3	102.5	76	5.5	30	0 14-0.011	25	2	20	5	5	2	M5	12				
P50B07030△□◇	103	130																						
P50B07040△□◇	113	140																						
P50B08040△□◇	116	156	8	55	100	0 80-0.030	3	115	86	6.6	35	0 16-0.011	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-RII type)



Unit: mm

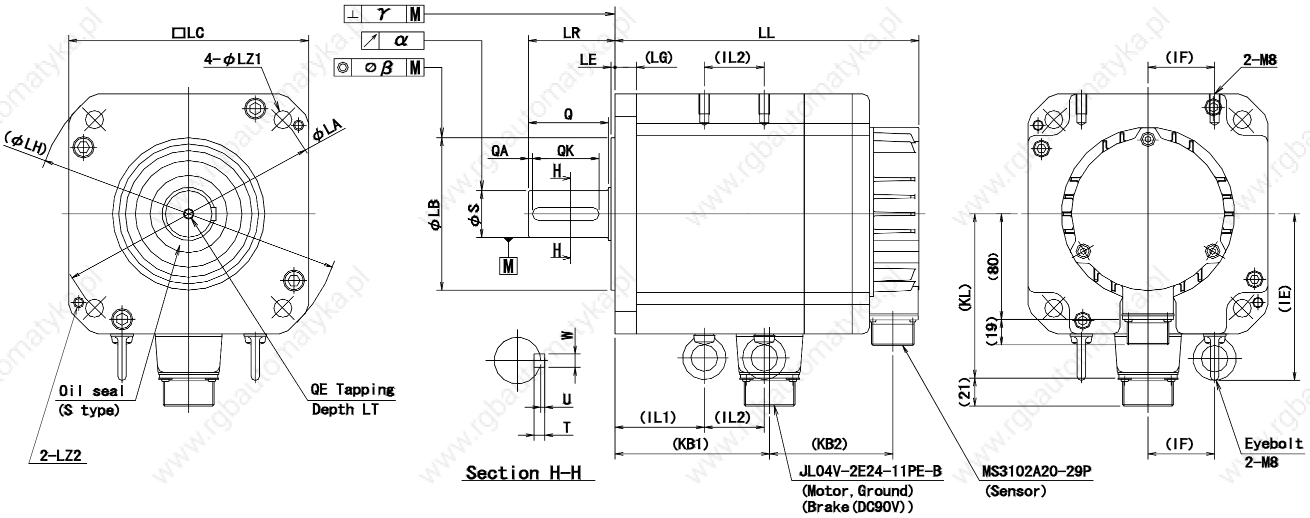
⚠ Since the connector must be waterproof when engaged, use a waterproof connector for the plug on the receiving side when IP67 is applied.

	Incremental· ABS-RII						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	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														

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

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.

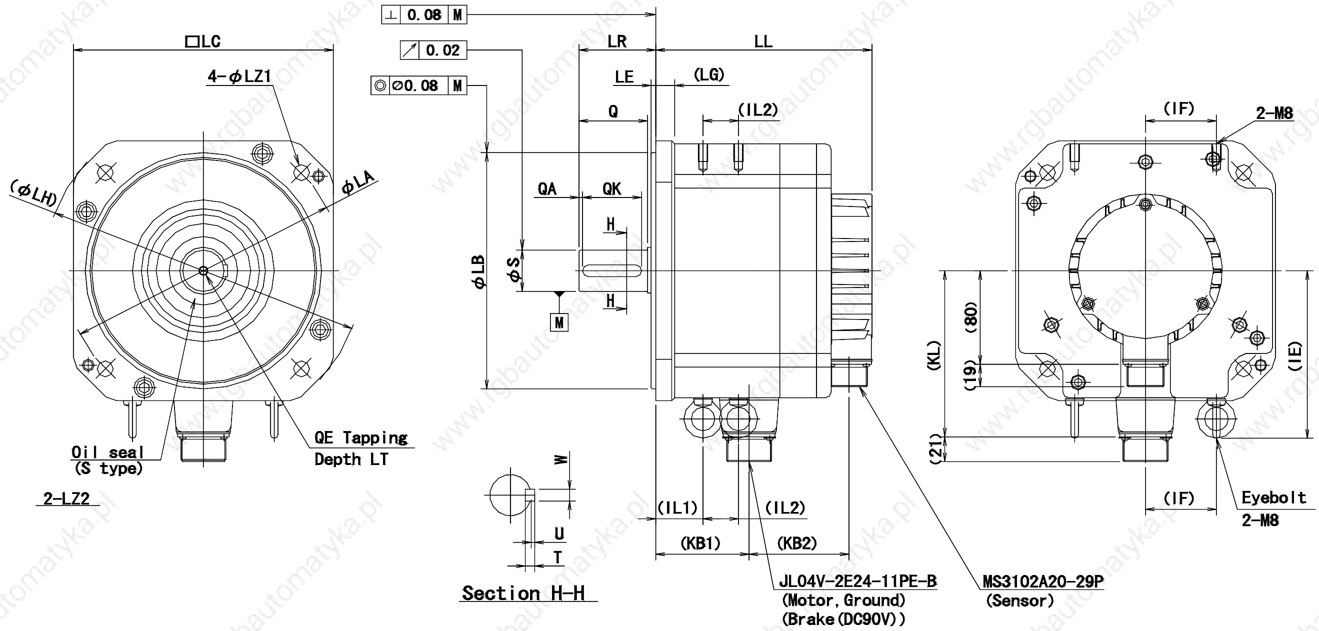
	ABS - E						Connector								
	W/O brake		With brake				Motor earth	B (Type with B only)							
MODEL	LL	KB2	LL	KB2	KB3	KB4	MS3102A	MS3102A	KL1	KL2	KL3	LG	LA	LB	LE
P60B13050△□◇	123	66	153	96	—	—	12 - 11P		98	21	—	12	145	0 110-0.035	4
P60B13100△□◇	143	67	176	100	—	—									
P60B13150△□◇	162		195												
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												

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

9. SPECIFICATIONS

Servomotor model No.: P8 motor

Incremental encoder (INC-E type)
Absolute sensor (ABS-RII type)



Unit: mm

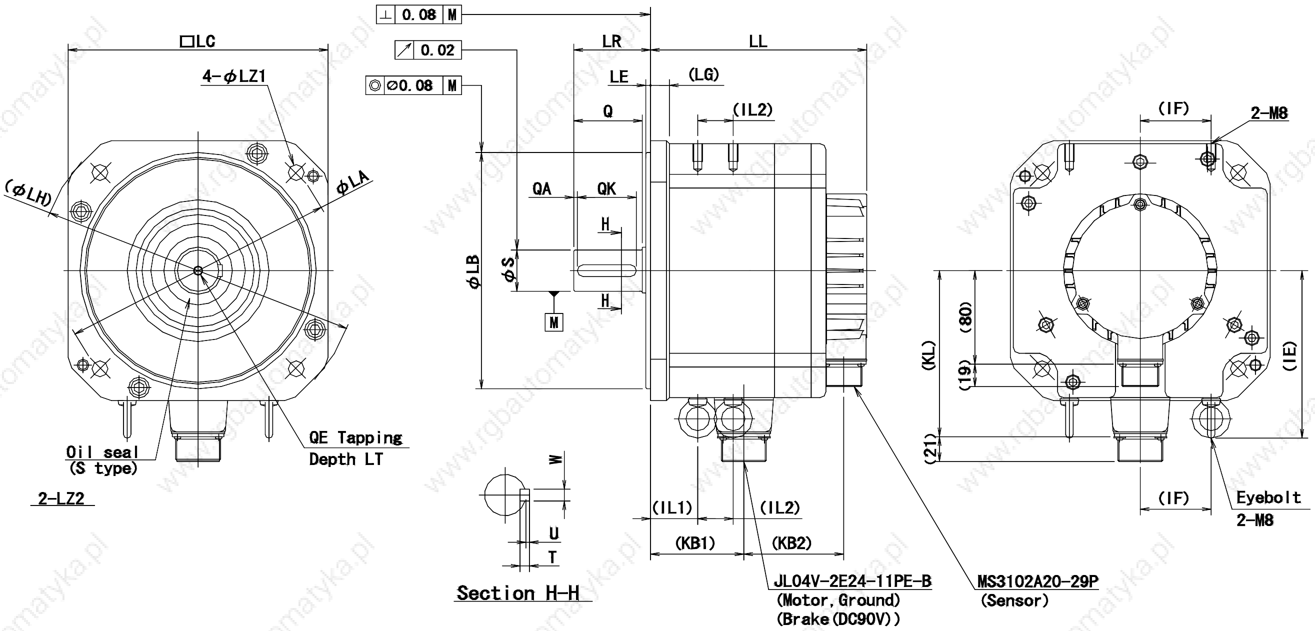
	W/O brake	With brake												
MODEL	LL	KB2	LL	KB2	LG	KL	LA	LB	LE	LH	LC	LZ1	LZ2	LR
P80B15075△□◇	116	56	150	90	12	106	165	0 130-0.040	4	190	150	11	M6	55
P80B18120△□◇	119	55	152	88	12	123	200	0 114.3-0.035	3	230	180	13.5	M8	55
P80B22250△□◇	122	52	154	84	16	141	235	0 200-0.046	4	270	220	13.5	M10	65
P80B22350△□◇	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)



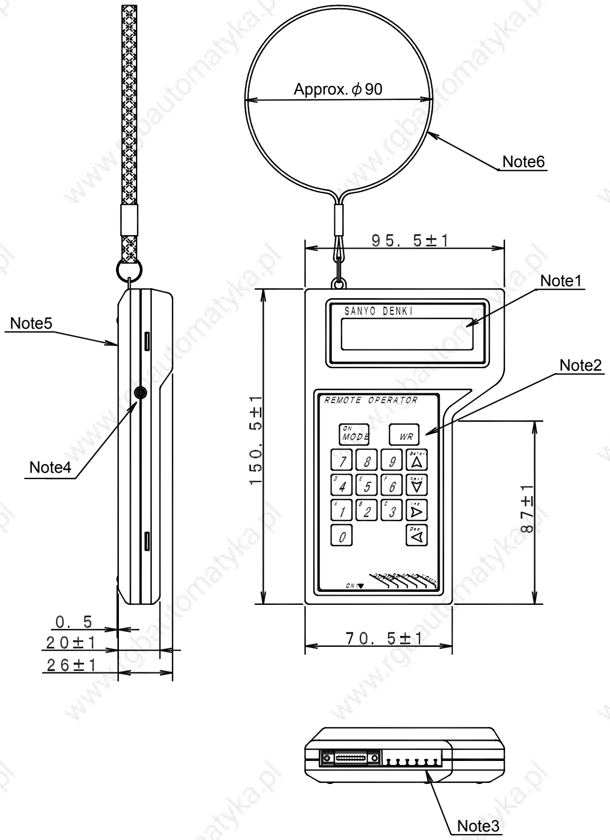
Unit: mm

	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	0 130-0.040	4	190	150	11	M6	55
P80B18120△□◇	129	65	152	88	12	123	200	0 114.3-0.035	3	230	180	13.5	M8	55
P80B22250△□◇	132	62	154	84	16	141	235	0 200-0.046	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△□◇	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.

9.4.3 Remote Operator (Option)



Unit : mm

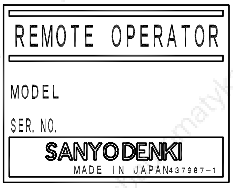
1 Liquid crystal display (Two line display)

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

9.5 Regenerative Resistor

9.5.1 Built-in Regenerative Resistor

Some PY2 Servo Amplifiers have built-in regenerative resistors. When the regenerative power is lower than the permissible absorbing power of the built-in regenerative resistor, the system configuration can be simplified by using a regenerative resistor built-in Servo Amplifier (Amplifier of 50A has built-in regenerative resistor as standard).

Amplifier Model No.	Permissible Absorbing Power	Resistance
PY2A015 PY2E015	2W	100Ω
PY2A030 OY2E030	5W	50Ω
PY2A050	20W	20Ω

Table 9-21 Permissible Absorbing Power of Built-in Regenerative Resistor

1) Wiring for built-in regenerative resistor
   Wiring has been done for the built-in regenerative resistor at time of shipping. However, in the case you wish to remove it to use an external regenerative resistor instead, or to re-connect the built-in regenerative resistor after removing it once, make sure to wire correctly observing 9.5.6 Connection of Regenerative Resistor.
2) Setting parameters
   Abnormal overheating of the built-in regenerative resistor is detected through software (Overheat protection) at the PY2 Servo Amplifier. Therefore, correct parameter settings are required when using a built-in regenerative resistor (Parameters for regenerative resistor have been set at time of shipping for the built-in regenerative resistor).

9.5.2 Parameter Settings for Regenerative Resistor

Table 9-22 Parameters for Regenerative Resistor

Status of regenerative resistor(How to process the regenerative power)	Regenerative resistor type Abbreviation: RGKD, Mode4-Page9	Regenerative resistor OL time select Abbreviation: Func2 bit4, Mode2-Page3
Regenerative resistor not connected	None/Ext.R	Func2 bit4 = “0”
External regenerative resistor connected (External regenerative resistor with 20W or less permissible absorbing power is used.)	None/Ext.R	Func2 bit4 = “0”
External regenerative resistor connected (External regenerative resistor with larger than 20W permissible absorbing power is used.)	None/Ext.R	Func2 bit4 = “1”
Built-in regenerative resistor used	Built-in R	Func2 bit4 = “0”

When reconnecting or changing the regenerative resistor, observe the table 9-22, Parameter for Regenerative Resistor, to ensure correct settings of parameters.

1) Regenerative Resistor Type (RGKD)
When absorbing power of the built-in regenerative resistor exceeds the permissible absorbing power over a long time period (ten seconds to several minutes), abnormal overheating is detected. (Alarm “H” ･ RGOH)

- When the built-in regenerative resistor is selected (RGKD = “Built-in R”), its absorbing power can be monitored by remote operator (Monitor for built-in regenerative resistor absorbing power: RegP ･ Mode5-Page17). When the monitor value exceeds the permissible absorbing power, overheating alarm may be issued. In this case, take appropriate countermeasures, such as reviewing operation patterns or using an external regenerative resistor.
- When the main circuit power is turned off, the electrolysis capacitor energy inside the Servo Amplifier is discharged through regenerative resistor. Therefore, in case of frequent repetition of the main circuit power turn ON and OFF, an alarm may be issued (Main circuit power ON/OFF frequency must be within 10 times/hour and 50 times/day).
- When the control power is turned on, the built-in regenerative resistor absorbing power monitor is set at Hot Start to protect the built-in regenerative resistor. Therefore, the monitor value will not become “0.0 W” until some time after the control power is turned on.

2) Regenerative Resistor OL Time Select (Func2 bit4)
When the regenerative resistor absorbing power (built-in/external regenerative resistor) is extremely large, an error will be detected in a short period of time (in hundred msec. to 99 seconds), outputting regeneration error (alarm “J” ･ RGOL).

When using a built-in regenerative resistor, correctly set the parameter as follows:
Regenerative resistor type (RGKD): Mode4-Page9
Regenerative resistor OL time select Func2 bit4: Mode2-Page4

Incorrect settings may hamper proper error detection and cause burnt or damage of regenerative resistor.

Built-in regenerative resistor may be heated to high temperature, even when no overheat alarm is issued. Take care not to touch the Servo Amplifier while power is being supplied or soon after the power turn off (within 30 minutes), otherwise you may be burnt.

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

Select an external regenerative resistor according to the regenerative power calculated in "9.1.16 Regenerative Processing". The following explains how to use the resistor.

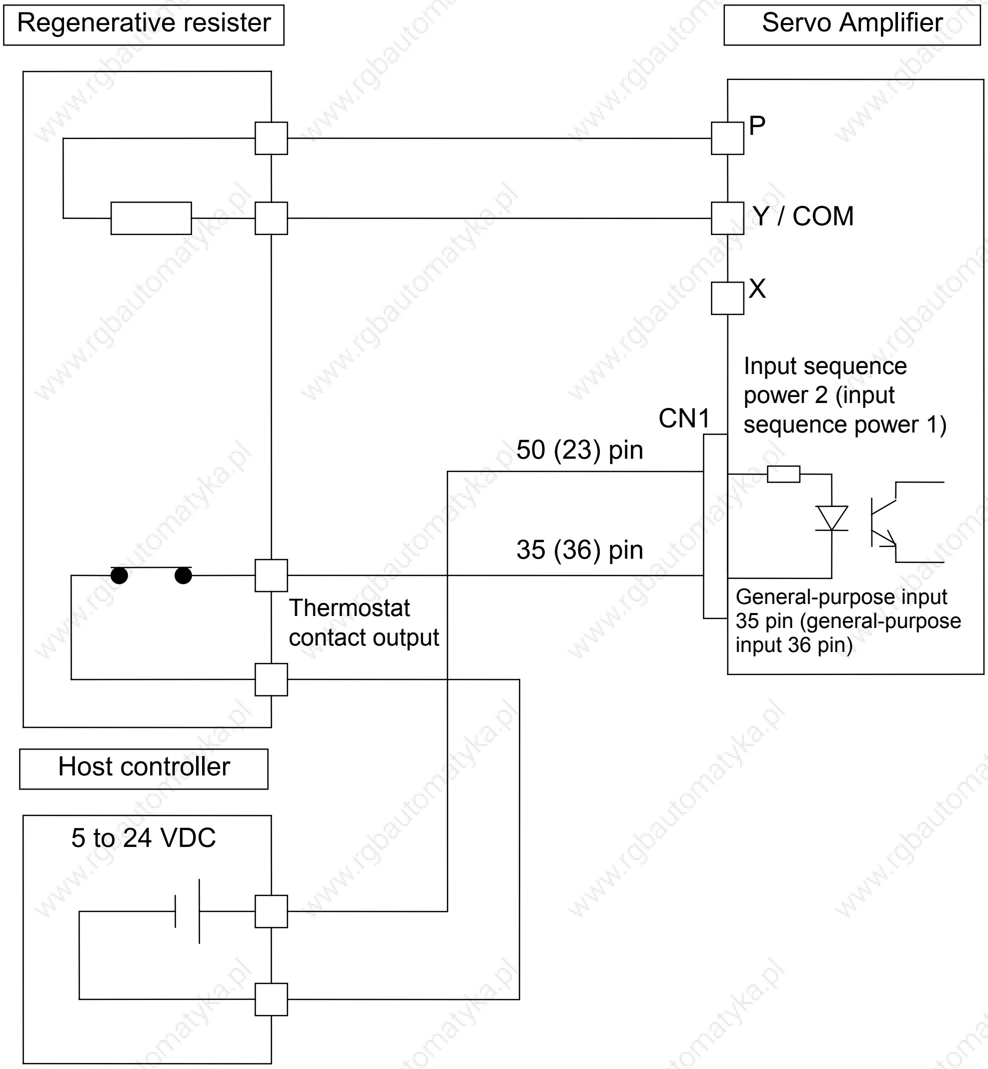


Fig. 9-28 Typical External Regenerative Resistor Connecting Diagram

Set the general-purpose input to the external overheating detection input function (bits 4 and 5 of the Func3 parameter).
When connecting a thermostat contact output to the amplifier, use a B-contact type thermostat.

For amplifiers having a capacity of 50 A, be sure to remove the short-circuit bar across the P and X terminals before installing an external regenerative resistor.

Operational precautions

1 For the details of how to connect an external regenerative resistor, refer to "Fig. 9-29 Detailed Connecting Methods of External Regenerative Resistors".

2. Some terminals to be connected differ depending on the amplifier capacity.
   - Amplifier capacity of 15A to 30 A
     Connect an external regenerative resistor between the P and Y (or COM) terminals.
   - Amplifier capacity of 50 A
     Connect an external regenerative resistor between the P and Y terminals after removing the short-circuit bar across the P and Y terminals.

3 For an external regenerative resistor with a thermostat installed, protect the resistor by connecting it to the amplifier as in Fig. 9-28 or connecting the thermostat contact output to the host controller.

4 Be sure to use a twisted wire for wiring an external regenerative resistor and make wiring as short as possible (less than 5 m).

5 Use a non-combustible cable or perform non-combustible treatment (silicon tube, etc.) for a connecting cable and wire an external regenerative resistor so as not to come in contact with the built-in one.

6 Set Func2 bit 4 using the remote operator according to the allowable effective power of the external regenerative resistor.
When allowable effective power of regenerative resistor = 20 W or lower:
Func2 bit 4 = 0 (default setting)
When allowable effective power of regenerative resistor = Higher than 20 W:
Func2 bit4 = 1

9.5.4 External Regenerative Resistor Combination Table

Referring to Table 9-23, 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 9-23 External Regenerative Resistor Combination Table

PM *1 Amplifier type	Up to 2 W	Up to 5 W	Up to 10 W	Up to 20 W	Up to 30 W	Up to 55 W	Up to 60 W	Up to 110 W	Up to 125 W	Up to 220 W	Up to 250 W	Up to 500 W	Up to 1000 W
PY2A015 PY2E015	*2 Resistor A × 1pc.	Resistor A × 1pc.		Resistor C × 1pc.		Resistor E × 1pc.	Resistor D × 2pcs.	Resistor F × 2pcs.	Resistor E × 4pcs.		Inquire		
	Connection (I)	Connection (I)		Connection (I)		Connection (I)	Connection (II)	Connection (II)	Connection (IV)				
PY2A030 PY2E030	*2 Resistor B × 1pc.		Resistor B × 1pc.	Resistor D × 1pc.		Resistor F × 1pc.	Resistor C × 2pcs.	Resistor E × 2pcs.	Resistor F × 4pcs.		Inquire		
	Connection (I)		Connection (I)	Connection (I)		Connection (I)	Connection (III)	Connection (III)	Connection (IV)				
PY2A050					Resistor G × 1pc.		Resistor H × 1pc.			Resistor I × 2pcs.		Resistor H × 4pcs.	Inquire
	Incorporated				Connection (I)		Connection (I)			Connection (II)		Connection (IV)	

For external resistor A to I, refer to " Table 9-24 External Regenerative Resistors List".
For connecting methods (I) to (IV), refer to "Fig. 9-29 Detailed Connecting Methods of External Regenerative Resistors".
For "Inquire", consult with us.
*1 PM : Effective regenerative power
*2 A built-in type regenerative resistor can be designated as optional for amplifiers having a capacity of 15A and 30 A. Refer to Chapter 1, Model Number of Servo Amplifier.

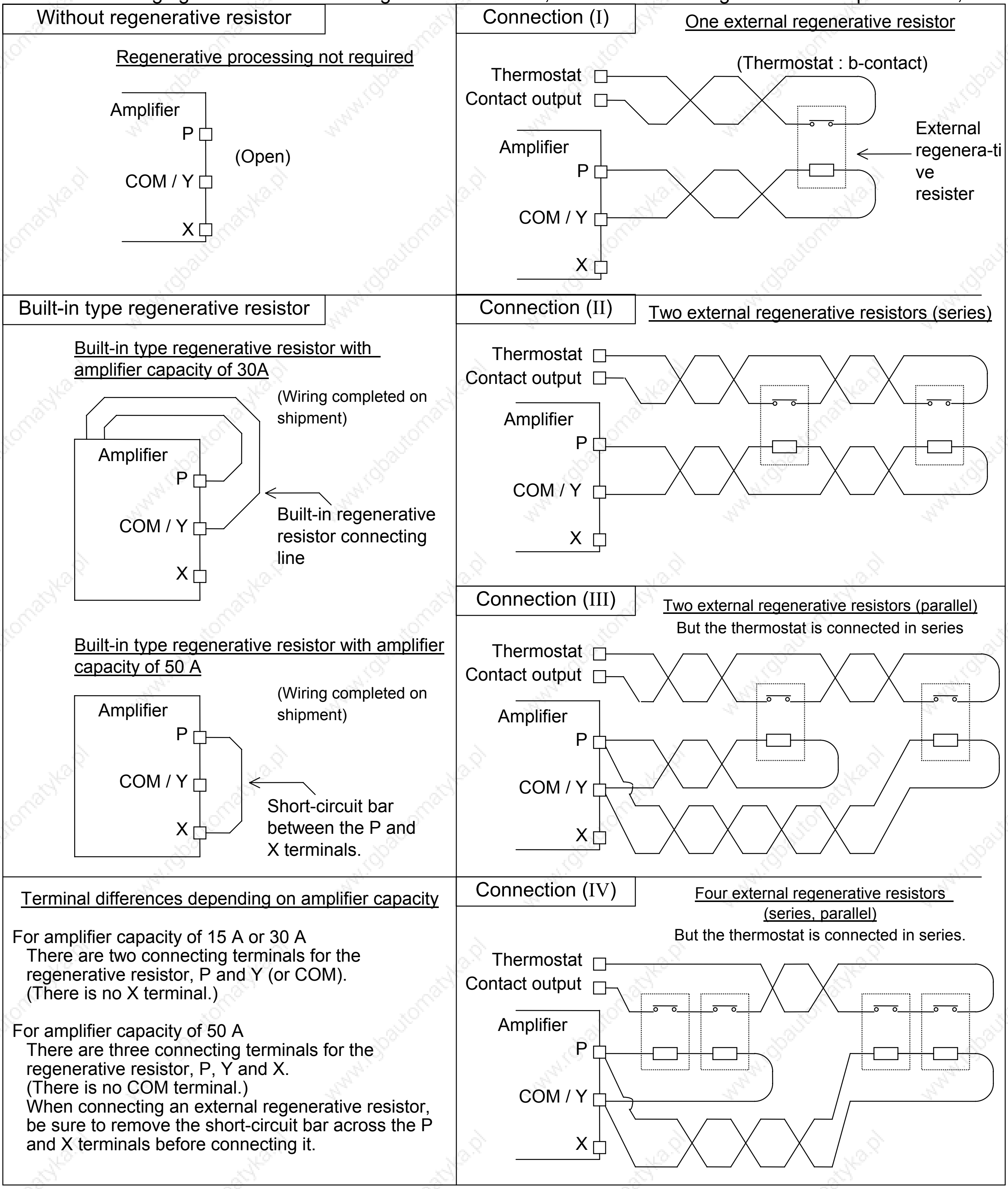
9.5.5 External Regenerative Resistor List

Table 9-24 External Regenerative Resistor

Symbol	Types	Permissible effective power (PM)	Resistance value	Outside dimensions	Thermostat	Outline drawing
A	REGIST-080W100B	10W	100 Ω	W44,L132,D20	Available (NC-contact)	See Fig. 9-30.
B	REGIST-080W50B	10W	50 Ω	W44,L132,D20	Available (NC-contact)	See Fig. 9-30.
C	REGIST-120W100B	30W	100 Ω	W42,L182,D20	Available (NC-contact)	See Fig. 9-31.
D	REGIST-120W50B	30W	50 Ω	W42,L182,D20	Available (NC-contact)	See Fig. 9-31.
E	REGIST-220W100B	55W	100 Ω	W60,L230,D20	Available (NC-contact)	See Fig. 9-32.
F	REGIST-220W50B	55W	50 Ω	W60,L230,D20	Available (NC-contact)	See Fig. 9-32.
G	REGIST-220W20B	55W	20 Ω	W60,L230,D20	Available (NC-contact)	See Fig. 9-32.
H	REGIST-500W20B	125W	20 Ω	W60,L230,D20	Available (NC-contact)	See Fig. 9-33.
I	REGIST-500W10B	125W	10 Ω	W60,L230,D20	Available (b-contact)	See Fig. 9-33.

9.5.6 Detailed Connecting Methods of External Regenerative Resistors

The following figures describe detailed connecting methods of external regenerative resistors.
When changing connections of the regenerative resistor, make sure to change the relevant parameters, too.



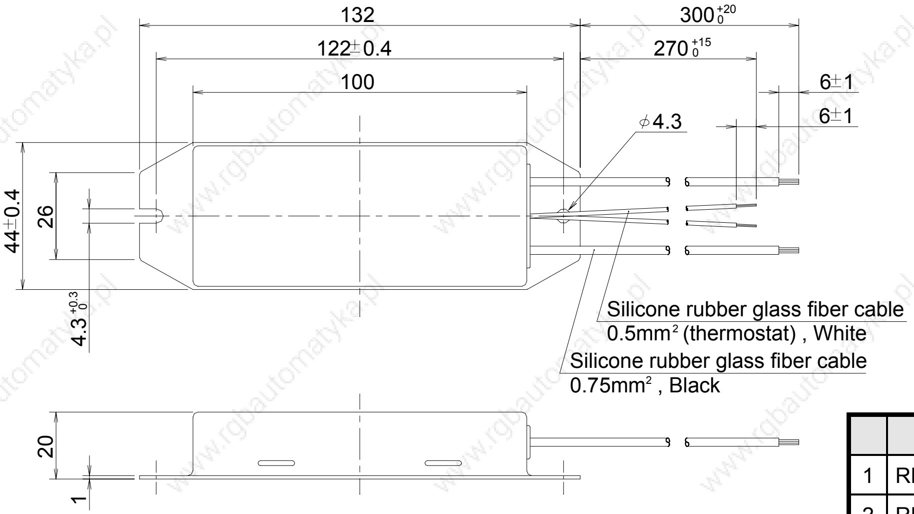
Terminal differences depending on amplifier capacity

For amplifier capacity of 15 A or 30 A
There are two connecting terminals for the regenerative resistor, P and Y (or COM).
(There is no X terminal.)

For amplifier capacity of 50 A
There are three connecting terminals for the regenerative resistor, P, Y and X.
(There is no COM terminal.)
When connecting an external regenerative resistor, be sure to remove the short-circuit bar across the P and X terminals before connecting it.

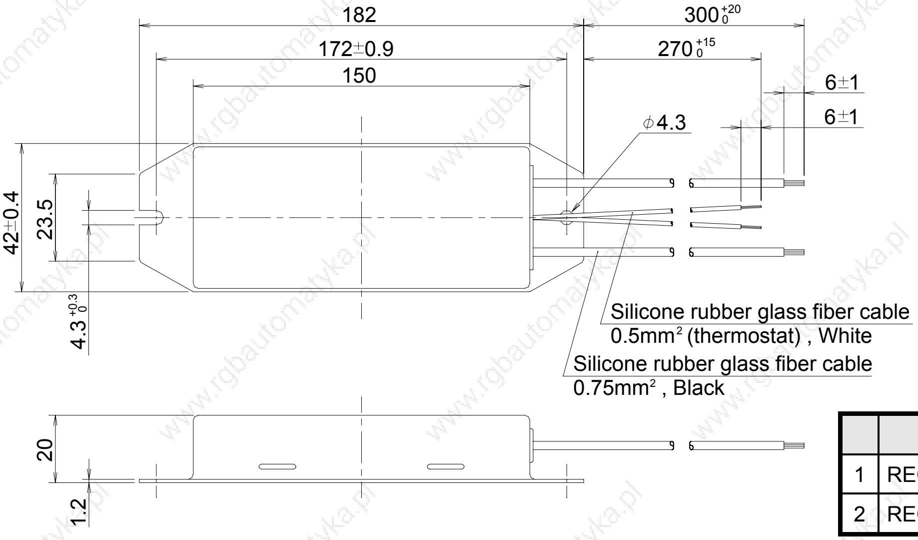
Fig. 9-29 Detailed Connecting Methods of External Regenerative Resistors"

9.5.7 External Regenerative Resistor Outline Drawings



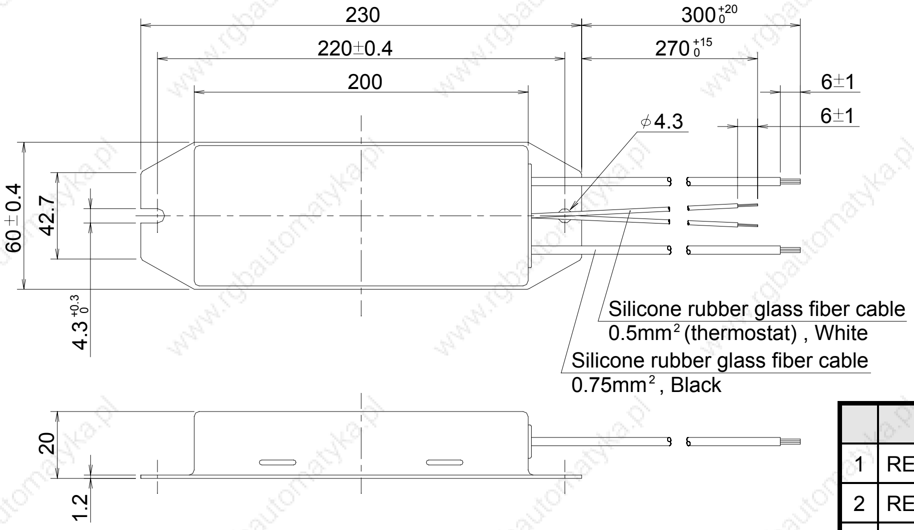
	Model No.	Thermostat
1	REGIST-80W100B	NC-contact
2	REGIST-80W50B	NC-contact

Fig. 9-30



	Model No.	Thermostat
1	REGIST-120W100B	NC-contact
2	REGIST-120W50B	NC-contact

Fig. 9-31



	Model No.	Thermostat
1	REGIST-220W50B	NC-contact
2	REGIST-220W20B	NC-contact
3	REGIST-220W100B	NC-contact

Fig. 9-32

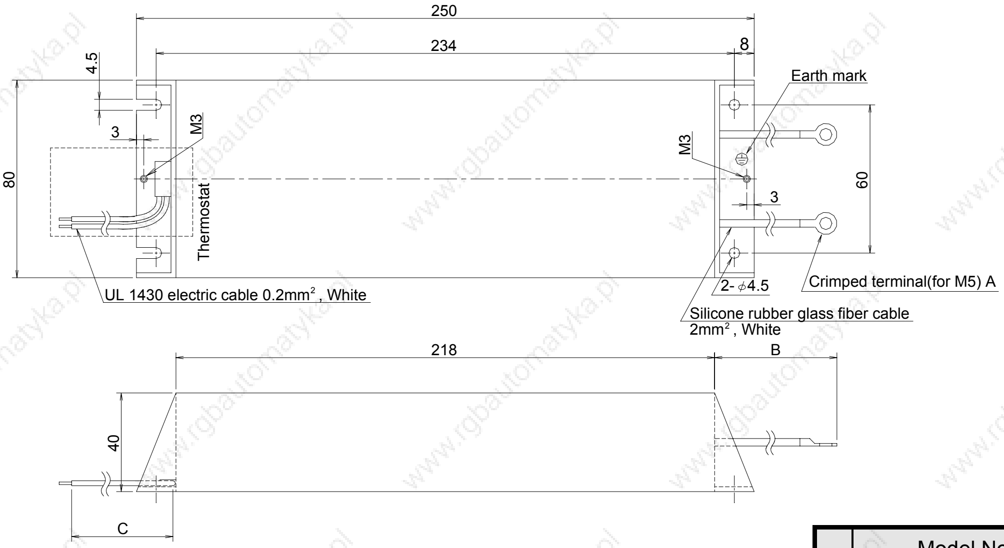


Fig. 9-33

	Model No.	Thermostat
1	REGIST-500W20B	NC-contact
2	REGIST-500W20	None
3	REGIST-500W10B	NC-contact
4	REGIST-500W10	None

Crinp style terminal A=M５
B=700mm±15
C=350mm±15

9.6 Warning Output

9.6.1 Overtravel Warning

For position control and velocity control types (including control mode switching type at the time of position control or velocity control), this function controls motor revolution in accordance with the external signal status.
Motor operation is controlled separately for forward revolution and backward revolution by overtravel signal.

1. Setting and connection
   1) Set Func0-bit5,4,3 of Mode2-Page1 for overtravel warning
      Bit5 : Select polarity of overtravel signal
      Bit4 : Forcible setting of forward revolution overtravel signal
      Bit3 : Forcible setting of backward revolution overtravel signal
      In case of forcible setting (bit4, 3 = “1”) at bit 4, 3, the signal always becomes ON regardless of the CN1-32, 33 pins input status. By combining with bit5, polarity select, the status of “forward/backward revolution overtravel ineffective” or “always forward/backward revolution overtravel” is possible.
   2) Connect the forward overtravel signal to CN1-32 pin and the backward overtravel signal to CN1-33 pin.

2. Operation when overtravel warning is issued
   - Refer to chapter 6, Overtravel Sequence, for the motor operation.
   - Displays for 7-segment LED are for forward revolution overtravel, and for backward revolution overtravel. No alarm is output.

3. Precautions
   1) Overtravel warning is only effective during SON status. Even if the overtravel signal is input while in SOFF, the status or display will not change.
   2) Operation of command ineffective (forced zero) differs between the position and velocity control types.
      - For the position control type, command pulses are inhibited at the revolution side where overtravel signal is input.
      - For the velocity control type, the velocity command becomes zero (VCMD = 0) at the revolution side where overtravel signal is input. These settings are validated when the acceleration/deceleration time (Tvac, Tvde) or low pas filter parameter (VLPF) is set.
   3) For the torque control type (including control mode switching type at the time of torque control), overtravel is ineffective, therefore overtravel signal input does not control the motor operation.
   4) At test mode JOG operation, overtravel input is validated. Operation at the revolution side where overtravel signal is input is controlled.
   5) When the signal input is canceled, overtravel warning will automatically recover.

9.6.2 Battery Warning

This warning is issued when the battery power for keeping sensor data is lowered on the absolute encoder (ABS-E) and absolute sensor (ABS-RII). A dot in the 7-segment LED will be lighted when the warning is issued.

When the sensor data is lost due to low voltage of the battery, battery alarm "U" will be displayed. In this case, replace the battery or execute encoder clear procedure (either from CN-1 or remote operator).

(Refer to 6.4, Encoder Clear Using Remote Operator for encoder clear procedure using remote operator.)

Battery warning is automatically canceled if the battery voltage becomes normal (The battery alarm is not canceled unless the encoder clear or alarm clear procedure is executed).

9.6.3 Overload Warning

Prior to the overload alarm output, overload warning is issued.

1. Setting
   1) Set Mode1-Page18 overload warning level (OLWL).
   2) Available setting is ranged from 30% to 99%, when the overload alarm level is set at 100%.
   3) When the overload warning level is set at 100%, the overload warning output will be invalidated.
   4) Parameter setting being input by remote operator or PC interface for overload warning level will be validated by turning off the Servo Amplifier control power once.

2. Overload warning output
   1) When overload warning is effective (e.g. OLWL = 80%)

Table 9-25-1 Output when overload warning is effective (e.g. OLWL = 80%)

(Alarm output sequence = CODE *¹)

Estimated motor temperature increase	7-segment LED display	CN-1 pin number for alarm output				Abbreviation	Alarm/Warning Name
		46 (ALM8)	45 (ALM4)	44 (ALM2)	43 (ALM1)		
Up to 80% of overload alarm level	--	0	0	0	0	--	No alarm No warning
80% or above up to 100% of overload alarm level	*³	0	1	0	0	OLW	Overload warning
100% or above of overload alarm level		0	0	1	0	OL	Overload alarm

Note 1. Set alarm output sequence at Func2 Bit6 of Mode2-Page3.
When Func2 Bit6 = "0", CODE is displayed, and when Func2 Bit6 = "1" , BIT is displayed.

Note 2. "0" and "1" in the alarm output are:
"0" = Output is short-circuit, "1" = Output is open, when Mode2 Page3 Func2 Bit7 = "0"
"0" = Output is open, "1" = Output is short-circuit, when Mode2 Page3 Func2 Bit7 = "1".

Note 3. 7-segment LED displays a flashing "4".

Table 9-25-2 Output when overload warning is effective (e.g. OLWL = 80%) (Alarm output sequence = BIT *1)

Estimated motor temperature	7-segment LED display	CN-1 pin number for alarm output				Abbreviation	Alarm/Warning Name
		46 (ALM8)	45 (ALM4)	44 (ALM2)	43 (ALM1)		
Up to 80% of overload alarm level	--	0	0	0	0	--	No alarm No warning
80% or above up to 100% of overload alarm level	*3	0	0	1	0	OLW	Overload warning
100% or above of overload alarm level		1	1	1	1	OL	Overload alarm

Note 1. Set alarm output sequence at Func2 Bit6 of Mode2-Page3.
When Func2 Bit6 = “0”, CODE is displayed, and when Func2 Bit6 = “1” , BIT is displayed.

Note 2. “0” and “1” in the alarm output are:
“0” = Output is short-circuit, “1” = Output is open, when Mode2 Page3 Func2 Bit7 = “0”
“0” = Output is open, “1” = Output is short-circuit, when Mode2 Page3 Func2 Bit7 = “1”.

Note 3. 7-segment LED displays a flashing “4”.

2) When overload warning is ineffective (e.g. OLWL = 100%)

Table 9-26-1 Output when overload warning is ineffective (e.g. OLWL = 100%) (Alarm output sequence = CODE *1)

Estimated motor temperature	7-segment LED display	CN-1 pin number for alarm output				Abbreviation	Alarm/Warning Name
		46 (ALM8)	45 (ALM4)	44 (ALM2)	43 (ALM1)		
Up to 80% of overload alarm level	--	0	0	0	0	--	No alarm No warning
80% or above up to 100% of overload alarm level							
100% or above of overload alarm level		0	0	1	0	OL	Overload alarm

Note 1. Set alarm output sequence at Func2 Bit6 of Mode2-Page3.
When Func2 Bit6 = “0”, CODE is displayed, and when Func2 Bit6 = “1”, BIT is displayed.

Note 2. “0” and “1” in the alarm output are:
“0” = Output is short-circuit, “1” = Output is open, when Mode2 Page3 Func2 Bit7 = “0”
“0” = Output is open, “1” = Output is short-circuit, when Mode2 Page3 Func2 Bit7 = “1”.

Table 9-26-2 Output when overload warning is ineffective (e.g. OLWL = 100%)
(Alarm output sequence =BIT *²)

Estimated motor temperature	7-segment LED display	CN-1 pin number for alarm output				Abbreviation	Alarm/Warning Name
		46 (ALM8)	45 (ALM4)	44 (ALM2)	43 (ALM1)		
Up to 80% of overload alarm level	--	0	0	0	0	--	No alarm No warning
80% or above up to 100% of overload alarm level							
100% or above of overload alarm level		1	1	1	1	OL	Overload alarm

Note 1. Set alarm output sequence at Func2 Bit6 of Mode2-Page3.
When Func2 Bit6 = “0”, CODE is displayed, and when Func2 Bit6 = “1”, BIT is displayed.

Note 2. “0” and “1” in the alarm output are:
“0” = Output is short-circuit, “1” = Output is open, when Mode2 Page3 Func2 Bit7 = “0”
“0” = Output is open, “1” = Output is short-circuit, when Mode2 Page3 Func2 Bit7 = “1”.

3. Precautions

1) This function only outputs warning, and does not execute sequence process such as Servo OFF in the alarm output or dynamic brake stop. In case of overload warning output, prevent overload alarm by reviewing the system operation cycle etc.
2) Warning output recovers automatically when the estimated motor temperature becomes lower than the set value for warning output (Overload alarm is not canceled without alarm reset procedure). Even in SOFF status, warning is output if the estimated motor temperature is higher than the set value.
3) When this function is validated, estimated motor temperature becomes Cold Start (Estimated motor temperature is 0% of the overload alarm level when the control power is turned on). Do not restart the system immediately after the power turn ON and OFF due to overload alarm, since the motor may not be cool enough. Otherwise, it may lead to burnt or damage of the motor or an accident. Secure enough time before restarting the system.
4) When overload warning and overtravel warning occur simultaneously, overtravel warning is prioritized in the 7-segment LED display.

10. INTERNATIONAL STANDARDS

INTERNATIONAL STANDARDS

10. INTERNATIONAL STANDARDS

10.1 International Standard Compliance

The "PY2" Servo Amplifier complies with the following international standards.

International standard	Standard No.
TÜV	EN50178
UL	UL508C
CUL	UL508C
Low Voltage Directive	EN50178
EMC Directive	EN55011

10.1.1 Working Environment

Since the working environment for the "PY2" Servo Amplifiers must be pollution level 2 or above (i.e. level 1 or 2) as specified in EN50178, make sure to use them in a pollution level 1 or 2 environment.

10.1.2 Power Supply

The "PY2" Servo Amplifiers must be used under the conditions specified in overvoltage category II, EN 50178. Use a reinforced insulation transformer conforming to the EN Standard for power supply input.

For the interface, use a DC power supply whose input and output sections have reinforced-insulation.

10.2 CE Marking

At Sanyo Denki, we are executing tests on the "PY2" Servo Amplifier for compliance with the CE marking at qualifying institutions. The CE mark is required to be attached all end products sold in EU countries. Only products conforming to the safety standards are permitted to have them. Accordingly, customers are requested to perform the final conformity test on their machines or systems incorporating our amplifiers.

10.2.1 The CE Marking Conformity Standards

We execute conformity tests for the following standards on the "PY2" Servo Amplifier at qualifying institutions.

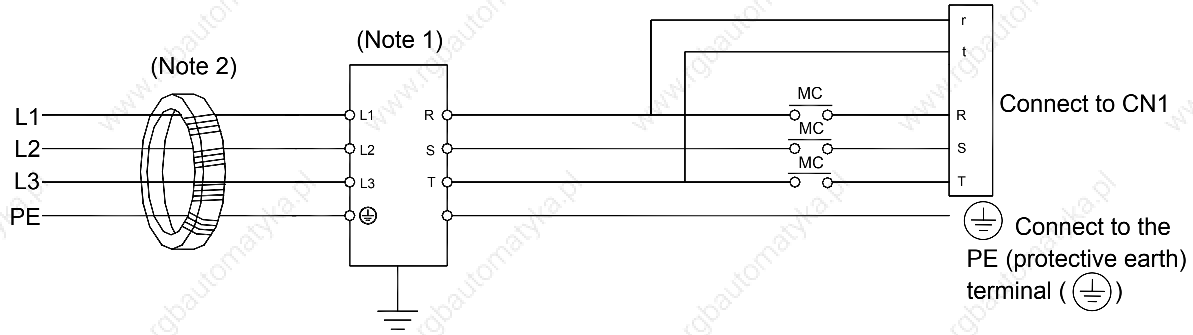
Classification of directive	Classification	Test	Test standard
Low Voltage Directive	–	–	EN50178
EMC Directive	Emission	Terminal interference voltage	EN55011
		Electromagnetic radiation interference	EN55011
	Immunity	Radiation field immunity	EN61000-4-3/1996 ENV50204/1995
		Conductivity immunity	EN61000-4-6/1996
		Electrostatic immunity	EN61000-4-2 EN61000-4-2: A1/1998
		Electrostatic immunity	EN61000-4-2 EN61000-4-2: A1/1998
		Burst immunity	EN61000-4-4/1995

File numbers

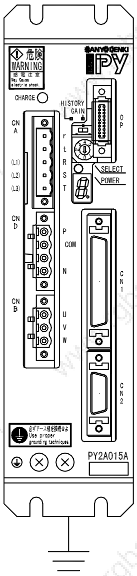
Low Voltage Directive,	Declaration	:	File No. C0002827C
Low Voltage Directive,	Certification	:	File No. B 01 05 21206 040 (Messrs. TÜV PRODUCT SERVICE)
EMC Directive,	Declaration	:	File No. C0004056
EMC Directive,	Certification	:	File No. E9 99 05 30982 005 (Messrs. TÜV PRODUCT SERVICE)

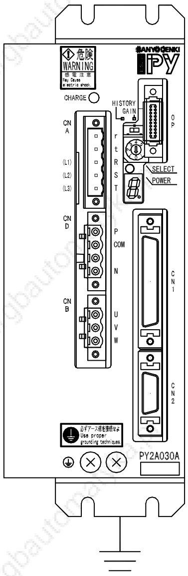
10.2.2 How to Install the EMC

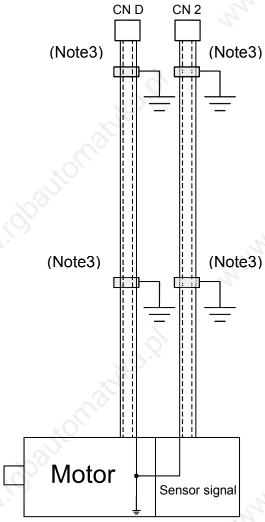
PY2A



(Note 1) Noise filter
(Note 2) Zero-phase reactor
(Note 3) Cable clamp

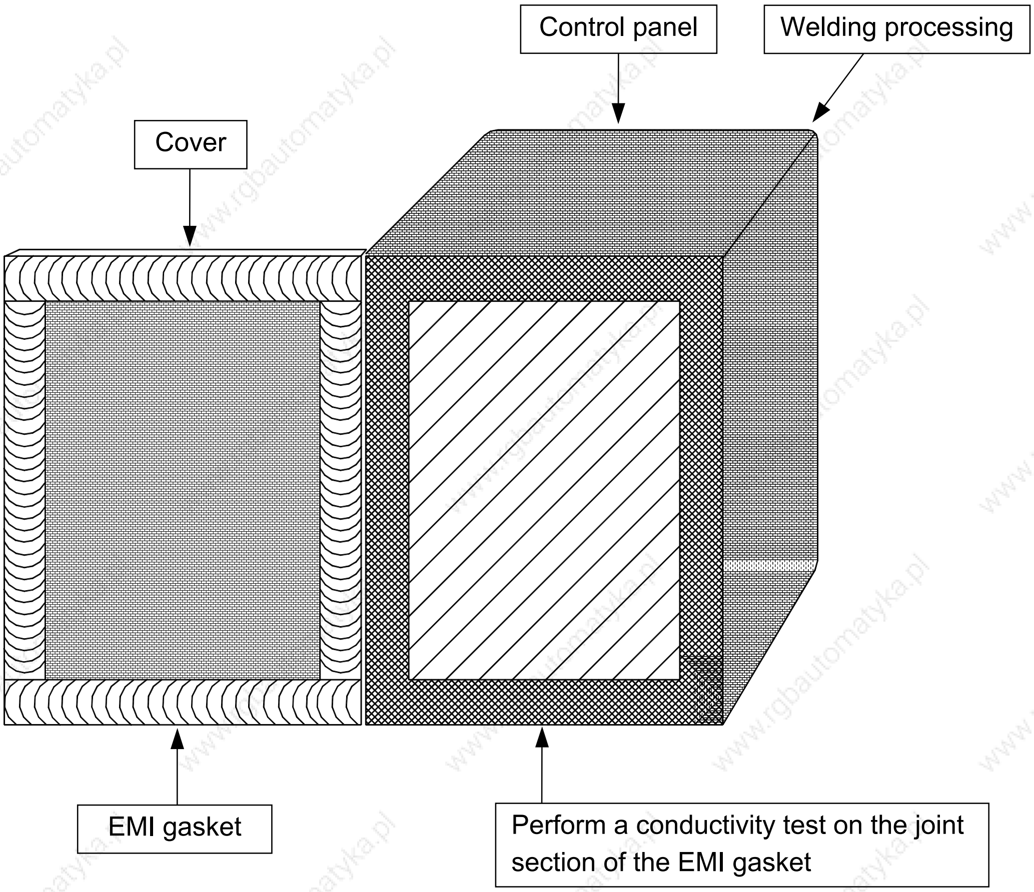






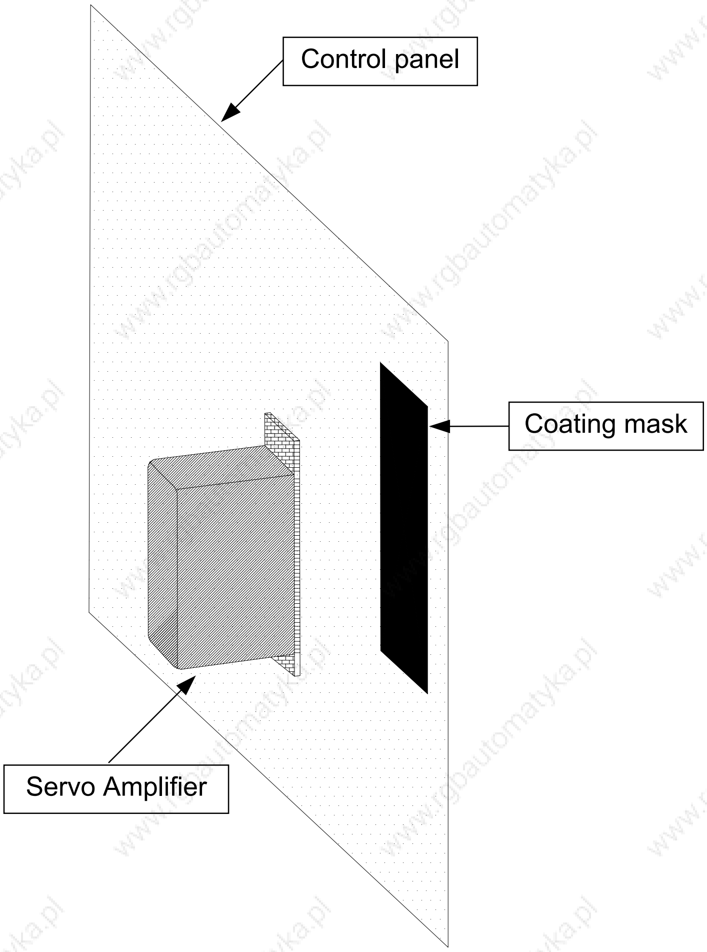
10.2.3 Structure of the Control Panel

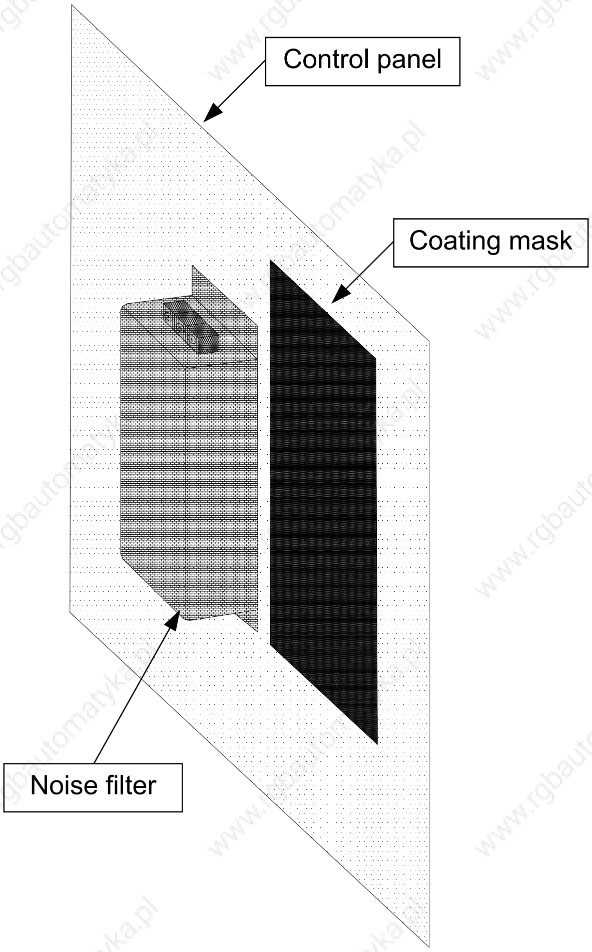
1. A metallic material is used for the control panel and its cover.
2. The joint of the roof and the side board shall be masked and welded.
3. The joint fixed with screws shall be welded to prevent noise from leaking from the gap in the joint.
4. In case of fixing with screws or spot welding, the welding space shall be within 10 cm.
5. Use an EMI gasket to prevent clearance between the cover and the control panel.
6. The EMI gasket shall be installed uniformly on the joint section of the cover and the control panel.
7. Perform a conductivity test on the EMI gasket, the cover and the control panel to make sure that they are conductive.



10.2.4 Installation Inside the Control Panel

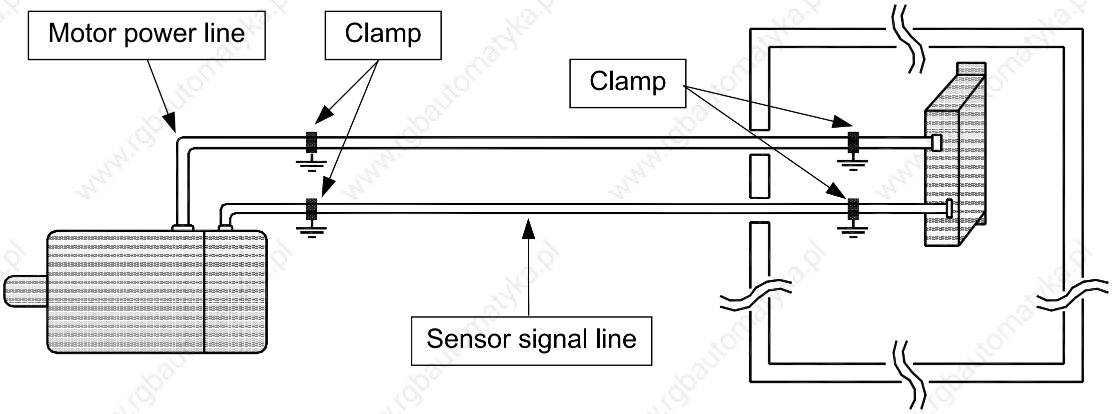
1. Install the noise filter frame on the control panel.
2. Apply a coating mask on the control panel where the noise filter is installed.
3. The Servo Amplifier box must be grounded.
4. Perform coating mask on the control panel where the Servo Amplifier is installed.





10.2.5 Wiring

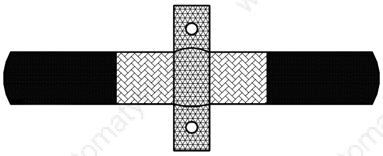
1. The motor power line shall be clamped on both the control panel and Servomotor sides.
2. The sensor signal line shall be clamped on both the control panel and the Servomotor sides.
3. Perform wiring of the motor power and sensor signal lines separately.



4. Install the clamp with a metal screw directly using a metal conductive P or U clip.
5. Do not clamp by soldering the power line to the shield.

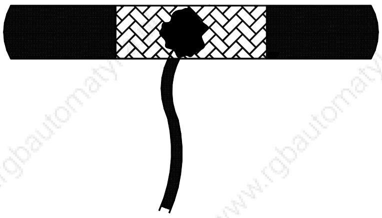
○

U or P clip

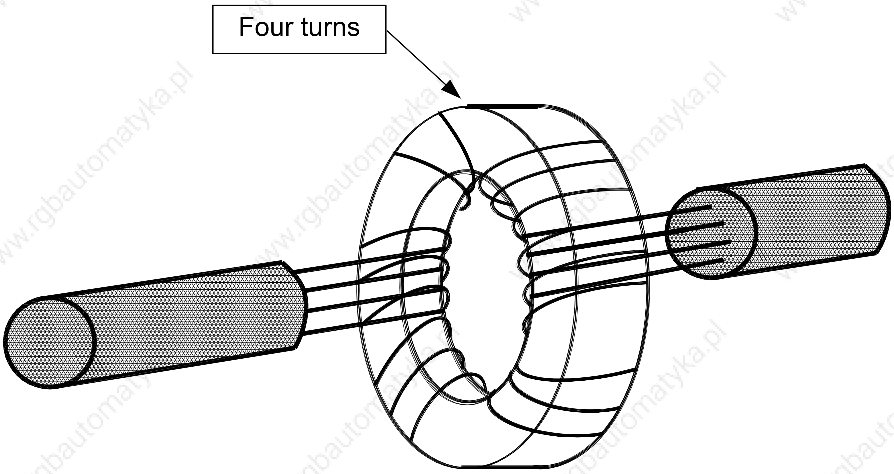


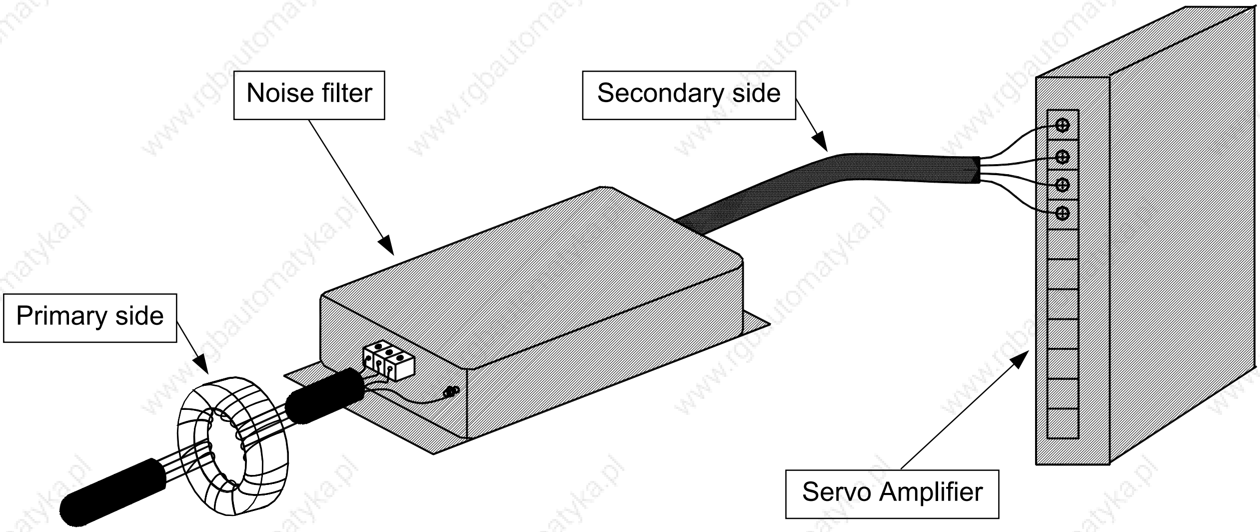
×

Soldering



6. Wind the zero-phase reactor four turns around the primary side of the noise filter.
7. Perform wiring from the secondary side of the noise filter to the Servo Amplifier, keeping it as short as possible.
8. The wiring for the primary and secondary sides of the noise filter must keep a certain distance apart.





10.2.6 Parts for EMC Countermeasures

We recommend the following parts for EMC countermeasures.

Noise filter

Model	Maker	Specifications
RF3020-DLC	RASMI ELECTRONICS LTD.	Rated voltage: Line-Line 440 - 550V Rated current: 20 A
3SUP-HK30-ER-6B	Okaya Electric Industry Co., Ltd.	Rated voltage: Line-Line 550V Rated current: 30 A

Zero-phase reactor

Model	Maker	Specifications
RZR-6020N	Okaya Electric Industry Co., Ltd.	1 kHz - 100 kHz 6.9 to 16.1 μH 500 kHz ≧2 μH (Measurement condition: through 1 turn)

Parts set for EMC countermeasures

Set name	Maker	Set contents	
		Model	Quantity
3SUP-HK30B60N	Okaya Electric Industry Co., Ltd.	3SUP-HK30-ER-6B	1 piece
		RZR-6020N	1 piece

10.3 UL Marking

The "PY2" series products are qualified to have the UL (U.S. version) and cUL (Canada version) marks of the Underwriters Laboratories attached.

10.3.1 File Numbers

File No.: E179775 Power Conversion Equipment (CCN: NMMS, NMMS7)

> In case you need certification of the Servo Amplifiers for your machines or systems when obtaining UL standards, let our sales representative know the above file number so that it can be obtained.

10.3.2 Fuse

The "PY2" Servo Amplifiers are not equipped with fuses. Customers are requested to prepare a UL-approved fast-blown fuse and install it in the input section of the main circuit power supply.

Recommended fuses

Amplifier capacity 15 A to 30 A	:	CR2LS-30/UL (Fuji Electric)
Amplifier capacity 50 A	:	CR2LS-50/UL (Fuji Electric)

11. SPECIAL SERVO FUNCTION

SPECIAL SERVO FUNCTION

11. SPECIAL SERVO FUNCTION

11.1 Outline of Servo Function

"PY2" Servo Amplifier has variety of servo and tuning functions.

11.1.1 Tuning /Parameter Connection

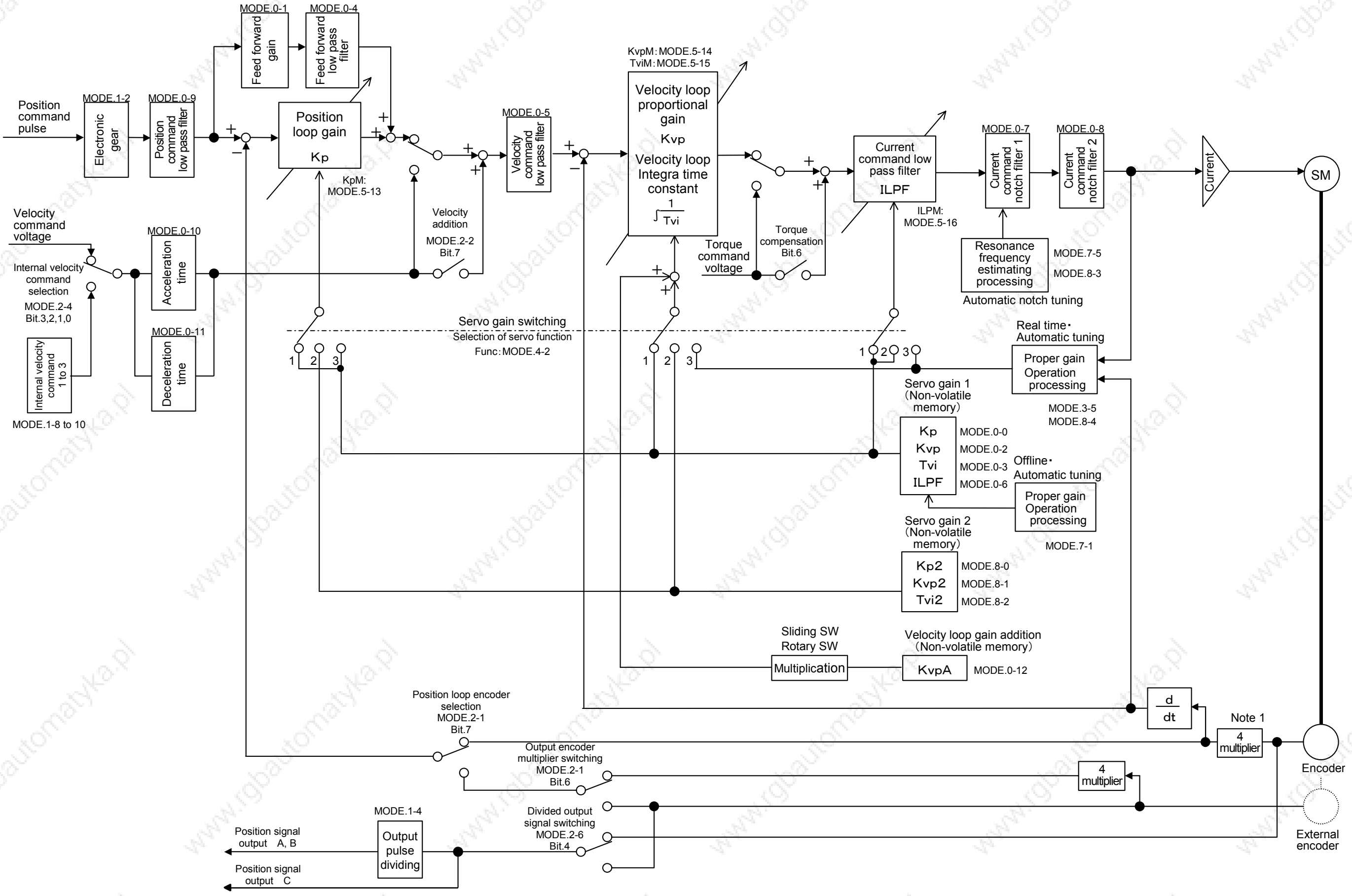
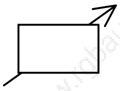


Fig. 11-1 Tuning/ Parameter Connection

Note 1: Multiplication by 4 function is effective when encoder is INC-E or ABS-E. For ABS-RⅡ, 1 multiplication will be fixed.

Note 2: Servo system complying with full close is required in order to connect external encoder. Consult with us. If servo system does not complying with full close, set bit7,6 of Mode 2-1 and bit4 of Mode2-6 to "0".

Note 3: Each low pass filter and notch filter becomes invalid when set at 1000Hz.

Note 4: Servo parameter of  changes according to set status. Current status of valid set value can be monitored by remote operator and monitor mode of PC interface (Mode 5 page 13,14,15,16)

11.2 Control Mode Switch

"PY2" Servo Amplifier has “Control Mode Switch” function that can switch control mode to the most suitable one according to application requirements during operation.

11.2.1 Parameter Setting

(1) Control Mode (TYPE: Mode 4, Page 3)

TYPE Setting	Control Type	Remarks	
		During switch signal OFF	During switch signal ON
Torque	Torque control	–	–
Velocity	Velocity control	–	–
Position	Position control	–	–
Velo ⟷ Torq	Velocity ⟷ Torque switch	Velocity control	Torque control
Posi ⟷ Torq	Position ⟷ Torque switch	Position control	Torque control
Posi ⟷ Velo	Position ⟷ Velocity switch	Position control	Velocity control

Control mode (TYPE: Mode4 page3) is system parameter and set bit7 of Func6 to “1” before changes. It becomes effective after turning ON the control power again.

(2) Selecting control mode switch input signal

Setting	Procedure
Func3 Bit7 = “0”	Input control mode switch signal by CN1-36 pin
Func3 Bit7 = “1”	Input control mode switch signal by CN1-35 pin

11.2.2 Control Mode Switch Procedure

When specified signal changes at bit7 of Func3, control mode will be switched within 12msec.
Then the contents of general use input signal (the contents set at bit3, 2, 1, 0 of Func3) will be also changed according to the control mode.

(1) Switching of Position control→Torque control, and Velocity control→Torque control

In Torque control when enabling control mode switch, the speed will be limited by high speed set value (HTG: page6 of Mode1) to prevent the motor from rotating out of order (torque command will be “0” by force when motor speed exceeds the high speed set value (HTG), it automatically recovers when the speed becomes below the high speed set value.)

The velocity control is set as error detection level when sudden load change (to no load/ small load) in torque control. However, it cannot control at fixed speed. There is a case that motor rotates over set value in the status that the set HTG is low and inputted torque command is large in comparing with load inertia and load torque. Do not allow this status to continue in use. Set HTG to 32767min^{-1} unless executing speed velocity control.

(2) Switching of Position control→Velocity control

When switching to velocity control mode, velocity command value changes inconsecutively. Therefore, if control mode is switched during motor operation, the operation may become unstable after switch. Be careful to switch modes during operation. Having velocity command LPF (VLPF: page5 of Mode0) effective (not at 1000Hz) will reduce the inconsecutiveness of velocity command value.

(3) Switching of Velocity control→Position control, and Torque control→Position control

Position deviation is cleared during control mode switching (when velocity control and torque control). Therefore, system restarts counting position command pulse after switched to position control. After tuning OFF the switch signal, input command pulse after switched to position control mode.

11.3 Gain Switch

The "PY2" series have “Gain switch“ function that can switch servo gain (Kp/ Kvp/ Tvi) during operation. Servo gain can be changed by inputting switch signal into Servo Amplifier according to variations of device rigidity, load and inertia.

11.3.1 Parameter setting

(1) Servo function select (Func: Mode4 page2)

Func setting	Servo function
Normal	Standard type
Gain_sel.	Gain switch type
Gain_Tun.	Real time automatic tuning type
Gsel&Gtun	Gain switch & real time automatic tuning type

Gain switch function will be valid when selecting “Gain_Sel.” or “Gsel&Gtun”

(2) Gain switch input signal select (Func3 bit6: Mode2 page4)

Setting	Procedure
Func3 bit6 = “0”	Input gain switch signal to CN-36pin.
Func3 bit6 = “1”	Input gain switch signal to CN-35pin.

11.3.2 Operation when gain switch is valid

Depending upon the external signal (CN1-36pin or 35pin) status “Servo gain switch (3 SWs)” in the middle of figure 11-1 varies. Servo gain will vary within two seconds after external signal change.
After executing offline automatic tuning, estimated proper gain will be set into gain1 (Kp ; Mode0 page0/ Kvp ; Mode0 page2/ Tvi ; Mode0 page3/ ILPF ; Mode0 page6) regardless of gain switching status.

(1) In case of Func = “Gain_Sel.”

When gain switch input is OFF, “Servo gain switch (3 SWs)” in the middle of figure 11-1 will be at the position of “1”. The following parameters will be valid:

Position loop gain : Kp Mode0 – page0
Velocity loop proportional gain : Kvp Mode0 – page2
Velocity loop integral time constant : Tvi Mode0 – page3
Current command LPF : ILPF Mode0 – page6

When gain switch input is ON, “Servo gain switch (3 SWs)” in the middle of figure 11-1 will be at the position of “2”. The following parameters will be valid:

Position loop gain : Kp2 Mode8 – page0
Velocity loop proportional gain : Kvp2 Mode8 – page1
Velocity loop integral time constant : Tvi2 Mode8 – page2
Current command LPF : ILPF Mode0 – page6

(2) In case of Func = “Gsel&Gtun”

When gain switch input is OFF, “Servo gain switch (3 SWs)” in the middle of figure 11-1 will be at the position of “3” (real time automatic tuning is valid in this status). The following parameters will be valid:

Position loop gain : Kp Mode0 – page0
Velocity loop proportional gain : Kvp Value of real time automatic tuning result
Velocity loop integral time constant : Tvi Value of real time automatic tuning result
Current command LPF : ILPF Value of real time automatic tuning result

When gain switch input is ON, “Servo gain switch (3 SWs)” in the middle of figure 11-1 will be at the position of “2”. The following parameters will be valid:

Position loop gain : Kp2 Mode8 – page0
Velocity loop proportional gain : Kvp2 Mode8 – page1
Velocity loop integral time constant : Tvi2 Mode8 – page2
Current command LPF : ILPF Mode0 – page6

11.4 Real Time Automatic Tuning

The "PY2" Servo Amplifier has “real time automatic tuning“ function that estimates proper gain by driving motor operation and changes servo gain in real time. With large device of inertia variation, Motor can be operated at proper gain all the time.

11.4.1 Parameter setting

(1) Servo function select (Func: Mode4 page2)

Func setting	Servo function
Normal	Standard type
Gain_sel.	Gain switch type
Gain_Tun.	Real time automatic tuning type
Gsel&Gtun	Gain switch & real time automatic tuning type

Real time automatic function will be valid when selecting “Gain_Tun.” or “Gsel&Gtun”

(2) Real time automatic tuning level (Tn_Lv: Mode3 page5)
Setting level when executing tuning according to the device rigidity.

Tn_Lv setting	Procedure	
	Device rigidity	
+5	High rigidity	Equivalent to “High” of offline automatic tuning
+4		
↓	↓	
+1		
0	Middle rigidity	Equivalent to “Middle” of offline automatic tuning
-1		
↓	↓	
-4		
-5	Low rigidity	Equivalent to “Low” of offline automatic tuning

(3) Observer/ load inertia ratio (O_JL: Mode8 page4)
The parameters to estimate load torque required when finding proper gain by real time automatic tuning.

Set O_JL[%] = load inertia JL / Motor inertia JM × 100

Normally, load inertia JL should be an average within variation range of load inertia (or most used value). If appropriate tuning cannot be done within “+5 to -5” range of real time automatic tuning level setting (Tn_Lv), High/ Low rigidity setting can be feasible by adjusting observer/ load inertia ratio.

- In case of making estimated gain larger though Tn_Lv = +5 is set
  → Set the observer/ load inertia ratio (O_JL) to the maximum inertia value in the variation range of device inertia.
  → Set the observer/ load inertia ratio (O_JL) over the maximum inertia value in the variation range of device inertia.
- In case of making estimated gain smaller though Tn_Lv = -5 is set
  → Set the observer/ load inertia ratio (O_JL) to the minimum inertia value in the variation range of device inertia.
  → Set the observer/ load inertia ratio (O_JL) smaller than the minimum inertia value in the variation range of device inertia

- When changing observer/ load inertia ratio (O_JL) during operation, estimating load torque will be stopped momentary. Therefore, the operation may be momentary unstable after change.
- When widely changing observer/ load inertia ration (O_JL) at once, estimated servo gain will increase outstandingly and may turn into oscillation status. Change gradually with monitoring operating status.
- Change parameters related to real time automatic tuning, only after securing the safety around devices.

11.4.2 Operation when real time automatic tuning is valid

"Servo gain switch (3SWs)" in the middle of figure 11-1 will be at the position of "3". Then proper gain will be estimated according to the Servo Amplifier and Motor operational status, and servo gain will be changed at real time. Changing servo gains are three kinds of velocity loop proportional gain, and velocity loop integral time constant and current command LPF.

Servo gain when real time automatic tuning is valid is as follows:

Position loop gain : Kp Mode0 – page0
Velocity loop proportional gain : Kvp Value of real time automatic tuning result
Velocity loop integral time constant : Tvi Value of real time automatic tuning result
Current command LPF : ILPF Value of real time automatic tuning result

The proper gain estimated by real time automatic tuning is used on RAM in the Servo Amplifier and is not memorized in non-volatilize memory. Proper gain is estimated during Motor operation (over certain value of acceleration/ declaration.) When no change on Motor speed, or servo OFF, the last (past) estimated result will be invalid. However, the parameters memorized in non-volatile memory will be valid in the following cases:

(1) In case of Func = "Gsel&Gtun"

When gain switch input is OFF, "Servo gain switch (3 SWs)" in the middle of figure 11-1 will be at the position of "3". The following parameters will be valid:

Position loop gain : Kp Mode0 – page0
Velocity loop proportional gain : Kvp Value of real time automatic tuning result
Velocity loop integral time constant : Tvi Value of real time automatic tuning result
Current command LPF : ILPF Value of real time automatic tuning result

When gain switch input is ON, "Servo gain switch (3 SWs)" in the middle of figure 11-1 will be at the position of "2". The following parameters will be valid:

Position loop gain : Kp2 Mode8 – page0
Velocity loop proportional gain : Kvp2 Mode8 – page1
Velocity loop integral time constant : Tvi2 Mode8 – page2
Current command LPF : ILPF Mode0 – page6

Even if gain switch input is ON status (during gain switching), proper gain estimation process would be executed. Therefore, at the point of turning OFF the gain switch input, the latest proper gain estimation result will be valid.

(2) When turning ON the Control power

In case of parameter setting which enables real time automatic tuning, "Servo gain switch (3 SWs)" in the middle of figure 11-1 will be at the position of "3". However, proper gain cannot be estimated when turning ON the control power. And then the servo gain memorized in the non-volatile memory will be valid instead

Position loop gain : Kp Mode0 – page0
Velocity loop proportional gain : Kvp Mode0 – page2
Velocity loop integral time constant : Tvi Mode0 – page3
Current command LPF : ILPF Mode0 – page6

With Motor operation after servo ON, proper gain estimation will be started. After completing proper gain estimation, servo gain will be changed.

(3) When alarm occurs

In case of parameter setting which enables real time automatic tuning, “Servo gain switch (3 SWs)” in the middle of figure 11-1 will be at the position of “3”. However, estimated gain cannot be judged whether it is proper or not when alarm occurs. Therefore the servo gain memorized in the non-volatile memory will be valid instead.

Position loop gain : Kp Mode0 – page0
Velocity loop proportional gain : Kvp Mode0 – page2
Velocity loop integral time constant : Tvi Mode0 – page3
Current command LPF : ILPF Mode0 – page6

With resuming Motor operation after alarm status is cleared, proper gain estimation will be started. After completing proper gain estimation, servo gain will be changed.

(4) When executing test mode

In case of parameter setting which enabling real time automatic tuning, “Servo gain switch (3 SWs)” in the middle of figure 11-1 will be at the position of “3”. However, the servo gain memorized in the non-volatile memory will be valid when executing test mode (JOG operation, offline automatic tuning and automatic notch tuning).

Position loop gain : Kp Mode0 – page0
Velocity loop proportional gain : Kvp Mode0 – page2
Velocity loop integral time constant : Tvi Mode0 – page3
Current command LPF : ILPF Mode0 – page6

With resuming normal Motor operation after test mode, proper gain estimation will be started. After completing proper gain estimation, servo gain will be changed.

11.4.3 Ofline automatic tuning and parameter setting of non-volatile memory

In real time automatic tuning, servo gain is estimated all the time by motor operation and changed in real time. For this reason, even if the parameter that memorized in non-volatile memory (Kvp: Mode0-page2, Tvi: Mode0-page3 and ILPF: Mode0-page6) is set in order to enable high response, it becomes hardly effective. It is quite enough if velocity loop proportional gain (Kvp: Mode0-page2), velocity loop integral time constant (Tvi: Mode0-page3) and current command LPF (ILPF: Mode0-page6), that would operate stably against the set value of position loop gain (Kp: Mode0-page0), are set soon after turning on the control power.

It is recommended to set the non-volatile memory (Kvp: Mode0-page2, Tvi: Mode0-page3 and ILPF: Mode0-page6) to low in order for enabling real time automatic tuning setting.

Also, when setting non-volatile memory parameters by offline automatic tuning, low gain setting is appropriate with the same reason above. It is recommended to select “low” of tuning mode and execute offline automatic tuning. However, position loop gain will not be changed in real time automatic tuning. Set according to the required response.

Servo gain estimation may no be executed appropriatetly due to “sudden load fluctuation”, “large backlash”, “slow Motor acceleration/ deceleration” or so on.
In this case, do not use real time automatic tuning function.

11.5 Additional Function of Velocity loop Proportional Gain

Velocity loop proportional gain can be easily changed by setting rotary and sliding switches on Servo Amplifier front. With using this function together with real time automatic tuning, the estimated proper gain Kvp with additional value can be used.

11.5.1 Parameter setting

(1) Velocity loop proportional gain additional value (KvpA: Mode0 page12)
This parameter setting sets additional value of velocity loop proportional gain per 1 position of rotary SW.

11.5.2 Switch setting

(1) History / Gain switch (sliding switch on Servo Amplifier front)
This switch sets valid/ invalid of velocity loop proportional gain additional function.

When this SW is at “History”, velocity loop proportional additional function is invalid.
Depending upon rotary SW position, alarm history will be shown on the 7-segment LED.

When this SW is at “Gain”, velocity loop proportional gain additional function is valid.
Depending upon rotary SW position, velocity loop proportional gain will be added.

(2) Select switch (rotary SW on Servo Amplifier front)
When History / Gain switch is set at “Gain”, the multiplication result of “Rotary SW position × velocity loop proportional gain additional value (kvpA) will be added on the velocity loop proportional gain.

⚠

- Note that electric shock or breakage may occur when changing SW setting during operation (during power ON). Operate in safety as “changing SW setting after power OFF and CHARGE LED is turned off” or “changing SW setting with using isolated tool” etc,.
- When returning back the sliding SW setting to “History”, velocity loop proportional gain additional function will be invalid.

11.6 P-PI Control Automatic Switch

The function that automatically switches between velocity loop proportional control and proportional integrate control according to the Motor speed is available. This function can shorten positioning time in position control.

11.6.1 Parameter setting

(1) P-PI automatic switch function (Func6 bit1: Mode2 page7)

Setting	Contents
Func6 bit = “0”	P-PI control automatic switch function is invalid
Func6 bit = “1”	P-PI control automatic switch function is valid

(2) Low speed setting (LTG: Mode1 page5)

In case that P-PI control automatic switching is valid:

- When Motor speed is low speed setting value (LTG) or lower, turning into the velocity loop proportional integrate control.
- When Motor speed is over low speed setting value (LTG), turning into the velocity loop proportional control.

There is an effect that positioning time will be shorter when setting the lower LTG. However, in case that there is a slight speed fluctuation even at Motor stoppage due to backlash or so on, too low LTG may result in counter effect. Normally set between 10 to 200rpm. Also, the low speed setting value (LTG) should differ enough from the fixed Motor speed. The speed will be unstable if switching P-PI control when fixed speed rotation.

11.6.2 The operation when P-PI control automatic switch function is valid

Velocity loop integrate process will be changed based upon the Motor speed.

(1) When Motor accelerates and beyond the low speed setting value, the current command (torque command) generated by velocity loop integrate formula will be “0”. Operation of proportional control is the same as that when velocity loop integrate time constant is invalid (1000Hz setting).

(2) When Motor decelerates to or below low speed setting value, velocity loop integrate time constant will be valid.

(3) When Motor rotates at fixed speed over low speed setting value in position control, position deviation will be wider (if position command pulse frequency is the same, there is no motor speed difference by proportional control and proportional integrate control).

(4) When inputting the command over the low speed setting value in velocity control, Motor rotates at the speed with deviation against the command.

11.6.3 Notificaiton

In the position control, there is an effect that positioning time will be shortened. Depending upon device structure however, P-PI control switching will result in counter effects. Sufficient evaluation is required for the devices of which belt driver has low rigidity, etc.

When the motor speed exceeds LTG by vibration or disturbance during motor stoppage, P control is activated. Since the integral is cleared, motor output torque becomes smaller. Superficially, the operation looks as if the holding torque became smaller. When there is vibration or disturbance, adjust LTG.

In the P-PI control switching, general-use input (CN1-35pin, 36pin) can be also used. Validate general-use input PCON at Func3 bit3, 2, 1 and 0 (Mode2 page4). For general-use input PCON, P-PI control will switch within 12msec. after input signal change.

11.7 Full Close Function

In this function, set external encoder for position control. As the hardware for this function is different from that for standard PY2 amplifier, need to decide whether or not to require this function before purchase.

11.7.1 Outline of full close function (optional)

(1) Full close specification (for reference)

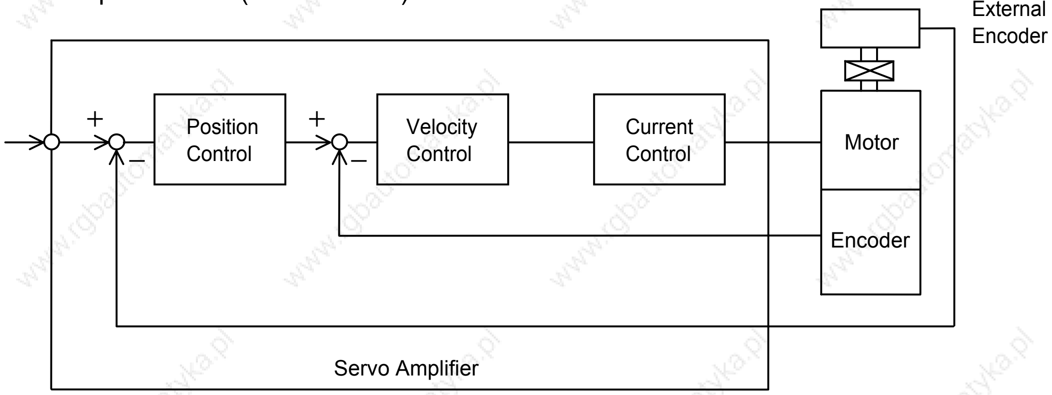


Fig. 11-2 Block Diagram of Full Close

(2) Standard PY2 (for reference)

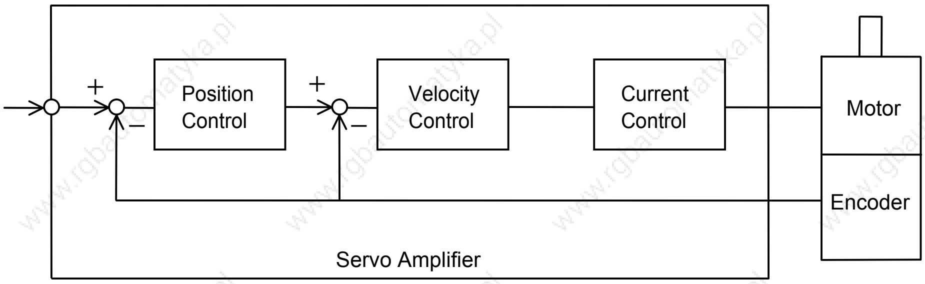


Fig. 11-3 Standard Block Diagram

In the full close function, device position is correctly obtained by getting feedback signal of position loop from external encoder, resulting in high accuracy control in positioning (control real position of device).

11.7.2 Hardware of full close function (optional)

(1) Configuration
Amplifiers of 15A, 30A and 50A are wider by 20mm.

(2) Additional connector

Connector CN3 will be added for connection with full close encoder. The wiring is as follows. Full close encoder, connector (HDEB-9P) and power supply should be prepared by customer.

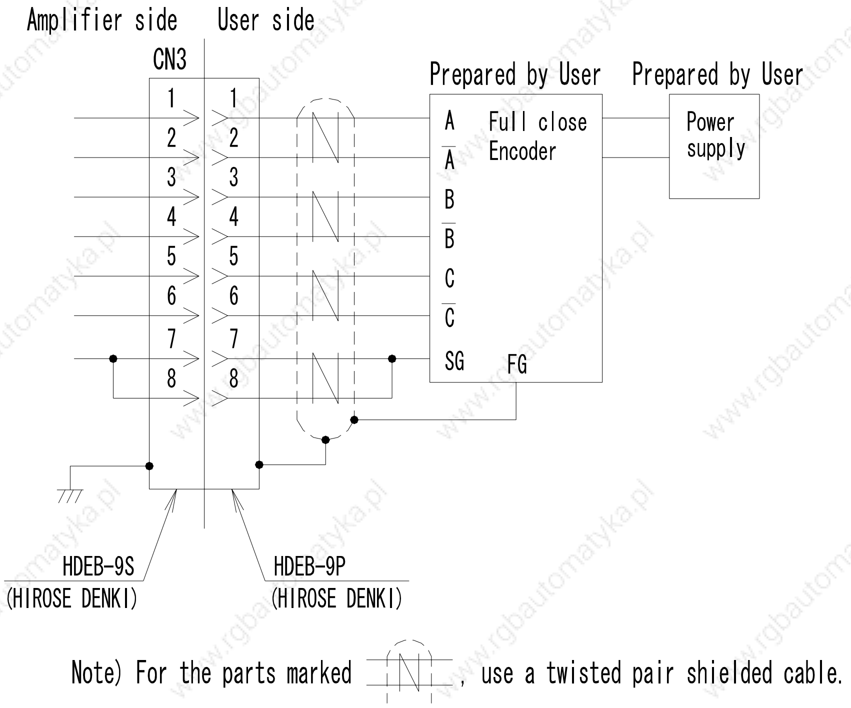


Fig. 11-4 Full Close Additional Wiring Diagram

(3) Maximum input frequency

The maximum input frequency from full close encoder output to Amplifier is 2MHz (the frequency before multiplied by 4).

11.7.3 Parameter setting of full close function (optional)

(1) Position loop encoder select (Func0 bit7: Mode2 page1)

Setting	Contents
Func0 bit7 = “0”	Use Motor encoder for position loop process
Func0 bit7 = “1”	Use full close encoder for position loop process

Normally use without changing this parameter setting, as it is already set according to the hardware specification at ex-factory.

(2) Setting of multiplication function (Func0 bit6: Mode2 page1)

Setting	Contents
Func0 bit6 = “0”	Use with multiplying full close encoder by 4.
Func0 bit6 = “1”	Use with multiplying full close encoder by 1.

(3) Setting of dividing function (Func5 bit4: Mode2 page6)

Setting	Contents
Func0 bit4 = “0”	Divide Motor encoder signal by CN1 position signal output (CN1-3 to 8, 11pin) and output.
Func0 bit4 = “1”	Divide full close encoder signal by CN1 position signal output (CN1-3 to 8, 11pin) and output.

Output pulse dividing ratio can be set by ENCR (Mode1 page4). Output pulse dividing ratio (ENCR) uses the same parameter for Motor encoder and full close encoder.

SANMOTION
P series　PY2
Instruction Manual

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