M0007133

SANMOTION

AC SERVO SYSTEMS

Q

TYPE C

Positioning function type

Rotary motor

Instruction Manual

SANYO DENKI

E

ENGLISH

Preface

This product corresponds with the shipping regulations given in the Export Trade Control Ordinance (Table 1, item 16) and the Foreign Exchange Ordinance (Table 1, item 16). When these products are exported by customers, and when exported including the other freight or together with other freight, it is recommended to fulfill the requirements related to Security Export Control with the relevant authorities, including “Information Requirements” and “Objective Requirements”.

This manual outlines the functions, wiring, installation, operations, maintenance, specifications, etc. of the AC servo amplifier “Q” Series Type C. The “Q” Series Type C AC servo amplifier system is compatible with a wide variety of various applications requiring low, medium or high capacity, high efficiency, reduced footprint, and excellent cost performance.
This product was developed to offer a series of servo motors that are easy to use and offer excellent functionality in an AC servo motor. It fulfills various needs, such as the downsizing of the control panel, and offers compatability for a wide range of applications requiring a servo motor.

★Precautions related to this Instruction Manual

- In order to fully understand the functions of AC servo amplifier “Q” Series Type C, please read this instruction manual thoroughly before using it.
- After reading this manual thoroughly, please keep it handy for reference.
- Please contact the dealer or sales representative if there are defects such as nonconsecutive pages, missing pages or if the manual is lost or damaged.
- Carefully and completely follow the safety instructions outlined in this manual. Please note that safety is not guaranteed for usage methods other than those specified in this manual or usage methods intended for the original product.
- The contents of this manual may be modified without prior notice, as revisions or additions are made in the usage method of this product. Modifications are performed per the revisions of this manual.
- Permission is granted to reproduce or omit part of the attached figures (as abstracts) for use.
- Although the manufacturer has taken all possible measures to ensure the veracity of the contents of this manual, if you should notice any error or ommission, please notify the dealer or sales office of the finding.

★Terminology

Within this Instruction Manual:
“AC servo motor” is abbreviated as “servo motor” or “motor”;
“AC servo amplifier” is abbreviated as “servo amplifier” or “amplifier”;
“Wire-saving increment encoder” is abbreviated as “incre”, “wire-saving incre” or “INC-E”;
“Absolute encoder with incre” is abbreviated as “Abso with incre” or “ABS-E”;
“Wire-saving absolute encoder” is abbreviated as “Wire-saving ABS”;
“Absolute encoder with a request” is abbreviated as “Abso with a request”;
Moreover, both “wire-saving incremental encoder” and “absolute encoder” are abbreviated as “Encoder,” and for the optical encoder and entire resolver encoder the term “Sensor” is used generally.

★Related instructions manual

Refer to M0005351 for the usage instructions for the setup software.

Table of Contents

Safety Precautions

This document is a summary of the safety precautions regarding the use of the Q-series C-type amplifier.
Please read it carefully prior to use.

1. Safety Precautions

1.1 Introduction

The Q-series servo amplifiers and servo motors were designed for use with general industrial equipment. The following instructions should be followed:

- Read the User Manual carefully before any installation or assembly work, and to ensure proper use.
- Do not perform any retrofitting or modification of the product.
- Consult with your sales representative or a trained, professional technician regarding the installation and maintenance of these devices.
- Special consideration, such as redundant services or an emergency generator, is required when operating, maintaining and controlling devices in certain applications related to human safety or public functions. Contact your distributor or sales office if you intend to use these devices in applications such as:

  ① In medical instruments or systems used for life support;

  ② With control systems for trains or elevators, the failure of which could cause bodily injury;

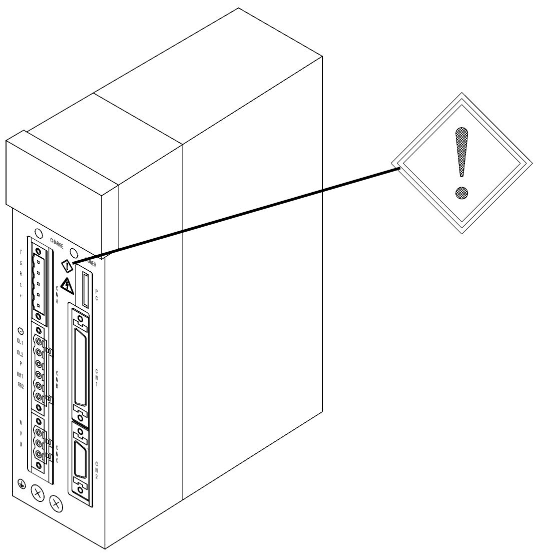
  ③ In computer systems of social or public importance;

  ④ In other equipment or systems related to human safety or public infrastructure.
- Additionally, please contact your distributor or sales office if the device is to be used in an environment where vibration is present, such as in-vehicle or transport applications.

Before installing, operating, performing maintenance or inspecting this device, read this entire manual carefully to ensure proper use. Use this device only after learning about its operation, safety information, and the precautions related to its use. After reading the User Manual, keep it in a location where it is always available to the user for easy reference.

1.2 Location of warning labels on the product

Warning labels are located at the center of the front panel of the servo amplifier.



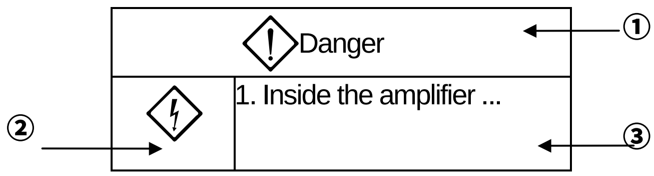
1. Safety Precautions

1.3 Interpretation of the warning labels

This documentation uses the following annotation.
Read "1.4 Safety precautions" after you understand the meanings of the warning labels.

1.3.1 Label description

Section 1.4 uses the following annotation.



① : Safety precaution level
② : Graphic symbol
③ : Details of the graphic symbol.

1.3.2 Precaution levels

There are four different precaution levels.

① Danger — **Denotes immediate hazards which WILL probably cause severe bodily injury or death as a result of incorrect operation.**

② Caution — **Denotes hazards which COULD cause bodily injury and product or property damage as a result of incorrect operation.**

In addition, even those hazards denoted by Caution could lead to a serious accident, so the instructions should be strictly followed.

③ Mandatory — **Indicates actions that must be carried out (mandatory actions).**

④ Prohibited — **Indicates actions that must not be allowed to occur prohibited actions).**

1.3.3 Graphic symbols

There are eight different graphic symbols.

Symbol Type	Sample symbols
Danger symbols	 Danger/Injury  Electric shock
Caution symbols	 Caution  Fire  Burn
Prohibition symbols	 Prohibited  Disassembly prohibited
Mandatory symbol	 Mandatory

1.4 Safety Precautions

Danger

<General>

1. **Do not use this device in explosive environment.**
   Injury or fire could otherwise result.

2. **Do not touch the inside of the amplifier.**
   Electric shock could otherwise result.

3. **Do not perform any wiring, maintenance or inspection when the device is hot-wired.**
   After switching the power off, wait at least 5 minutes before performing these tasks.
   Electric shock could otherwise result.

4. **Only technically qualified personnel should transport, install, wire, operate, or perform maintenance and inspection on this device.**
   Electric shock, injury or fire could otherwise result.

<Wiring>

5. **The protective ground terminal (⏚) should always be grounded.**
   The ground terminal of the motor should always be connected to the protective ground terminal (⏚) of the amplifier.
   Electric shock could otherwise result.

6. **Do not damage the cable, do not apply unreasonable stress to it, do not place heavy items on it, and do not insert it in between objects.**
   Electric shock could otherwise result.

7. **Wiring should be done based on the wiring diagram or the user manual.**
   Electric shock or fire could otherwise result.

Danger

<Operation>

8. Do not touch the rotating part of the motor during operation.
   Bodily injury could otherwise result.

9. Do not touch or get close to the terminal while the device is powered up.
   Electric shock could otherwise result.

10. Do not unplug the connector while the device is powered up.
    Electric shock could otherwise result.

1. Safety Precautions

Caution

<General>

1. Please read the User Manual carefully before installation, operation, maintenance or inspection, and perform these tasks according to the instructions.
   Electric shock, injury or fire could otherwise result.

2. Do not use the amplifier or the motor outside their specifications.
   Electric shock, injury or damage to the device could otherwise result.

3. Do not use a defective amplifier or motor.
   Injury or fire could otherwise result.

4. Use the amplifier and motor together in the specified combination.
   Fire or damage to the device could otherwise result.

5. Be careful of the high temperatures generated by the amplifier/motor and the peripherals.
   Burn could otherwise result.

<Package opening>

6. Open the box only after checking its top and bottom location.
   Bodily injury could otherwise result.

7. Verify that the products correspond to the order sheet/packing list.
   If the wrong product is installed, injury or damage could result.

8. Keep the motor’s sensor terminals away from static electricity.
   Damage to the device could otherwise result.

Caution

<Wiring>

9. Do not measure the insulation resistance and the pressure resistance. Damage to the device could otherwise result. Contact your dealer or our sales office if you wish to perform such testing.

10. Wiring should follow electric equipment technical standards and indoor wiring regulations.
An electrical short or fire could otherwise result.

11. Wiring connections must be secure. Motor interruption or bodily injury could otherwise result.

12. Keep static electricity and high voltage away from the sensor terminals of the motor.
Damage to the device could otherwise result.

<Installation>

13. Do not stand on the device or place heavy objects on top of it.
Bodily injury could otherwise result.

14. Do not obstruct the air intake and exhaust vents, and keep them free of debris and foreign matter.
Fire could otherwise result.

15. Make sure the mounting orientation is correct.
Damage to the device could otherwise result.

16. Consult the User Manual regarding the required distance between the amplifier, the control panel interior, and other devices.
Damage to the device could otherwise result.

17. Do not subject the device to excessive shock or vibration. Damage to the device could otherwise result.

18. Secure the device against falling, overturning, or shifting inadvertently during installation.
Use the hardware supplied with the motor (if applicable).

19. Do not expose the device to water, corrosive or flammable gases, or any flammable material.
Fire or damage to the device could otherwise result.

20. Install the device on a metal or other non-flammable support. Fire could otherwise result.

Caution

<Operation>

21. There is no safeguard on the motor. Use an over-voltage safeguard, short-circuit breaker, overheating safeguard, and emergency stop to ensure safe operation.
Injury or fire could otherwise result.

22. Do not touch the radiation fin of the amplifier, the regenerative resistor, or the motor while the device is powered up, or immediately after switching the power off, as these parts generate excessive heat.
Burn could otherwise result.

23. In the case of any irregular operation, stop the device immediately.
Electric shock, injury or fire could otherwise result.

24. Do not perform extensive adjustments to the device as they may result in unstable operation. Bodily injury could otherwise result.

25. Trial runs should be performed with the motor in a fixed position, separated from the mechanism. After verifying successful operation, install the motor on the mechanism. Bodily injury could otherwise result.

26. The securing brake is not to be used as a safety stop for the mechanism. Install a safety stop device on the mechanism. Bodily injury could otherwise result.

27. In the case of an alarm, first remove the cause of the alarm, and then verify safety. Next, reset the alarm and restart the device. Bodily injury could otherwise result.

28. Avoid getting close to the device, as a momentary power outage could cause it to suddenly restart (although it is designed to be safe even in the case of a sudden restart).
Bodily injury could otherwise result.

29. Verify that the power specifications are normal.
Damage to the device could otherwise result.

30. Standard specification servo amplifiers have a dynamic brake resistor. Do not rotate the motor continuously from the outside when the amplifier is not powered on, because the dynamic brake resistor will heat up, and can be dangerous.

Caution

<Maintenance>

31. Be careful during maintenance and inspection, as the body of the amplifier becomes hot. Burn could otherwise result.

32. It is recommended to replace the electrolytic capacitors in the amplifier after 5 years, if used at an average temperature of 40°C year round.
The expected life of the cooling fan motor is 10 years, if used at an average temperature of 40°C year round. Regular replacement is recommended.

33. Please contact your distributor or sales office if repairs are necessary.
Disassembly could render the device inoperative.

<Transportation>

34. Make sure the device does not fall, overturn, or move inadvertently during transportation.

35. Do not hold the device by the cables or the shaft while handling it.
Damage to the device or bodily injury could otherwise result.

<Disposal>

36. If the amplifier or the motor is no longer in use, it should be discarded as general industrial waste.

1. Safety Precautions

Prohibited

<Storage>

1. Do not store the device where it could be exposed to rain, water, toxic gases or other liquids. Damage to the device could otherwise result.

<Operation>

2. The built-in brake is intended to secure the motor; do not use it for regular control. Damage to the brake could otherwise result.

<Maintenance>

3. Do not overhaul the device.
   Fire or electric shock could otherwise result.

<General>

4. Do not remove the nameplate cover attached to the device.

1. Safety Precautions

Mandatory

<Storage>

1. Store the device where it is not exposed to direct sunlight, and within the specified temperature and humidity ranges {−20°C to+65°C, below 90% RH (non-condensing)}.

2. Please contact our office if the amplifier is to be stored for a period of 3 years or longer.
   The capacity of the electrolytic capacitors decreases during long-term storage, and could cause damage to the device.

<Operation>

3. Install an external emergency stop circuit that can stop the device and cut off the power instantaneously. Install an external protective circuit to the amplifier to cut off the power from the main circuit in the case of an alarm. Motor interruption, bodily injury, burnout, fire and secondary damages could otherwise result.

4. Operate within the specified temperature and humidity range {Amplifier: Temperature 0°C to 55°C, Humidity below 90% RH (non-condensing); Motor: Temperature 0°C to 40°C, Humidity below 90% RH (non-condensing)}.

<Transportation>

5. Follow the directions written on the outside box. Excess stacking could result in collapse.

6. The motor angling bolts are used for transporting the motor itself; do not use them for transporting the machinery, etc.

Prior to Use

2. Prior to Use

The instructions listed below should be followed when using the product. Incorrect use could result in accident or damage to the device.

2. 1 Package opening

The instructions below should be followed when opening the package and removing the product from the box.

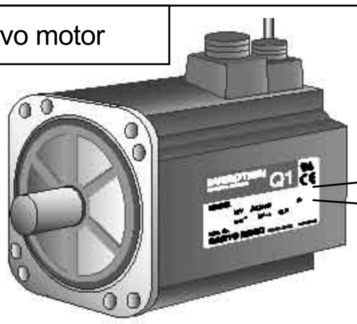
Be careful to not drop the product when removing it from the box.
Be especially careful with motors, as they can be very heavy.

2.2 Product verification

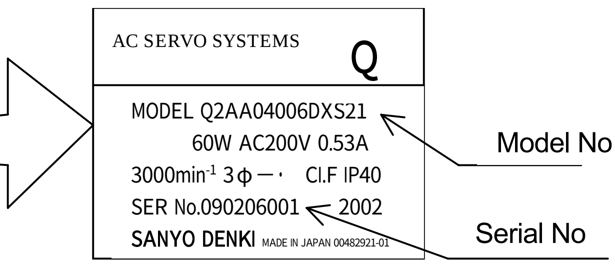
Verify the following when the product arrives. If you find any discrepancy, contact your distributor or sales office.

- **Verify that the model number of the servo motor or servo amplifier is the same as ordered. (The model number is located on the main name plate, following the word "MODEL".)**
- **Verify that there are no abnormalities, such as damages to the exterior of the device, or missing accessories.**
- **Verify that there are no loose screws on the servo motor or servo amplifier.**

Servo motor

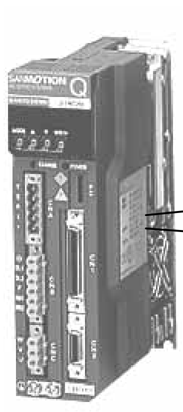


Servo motor main nameplate

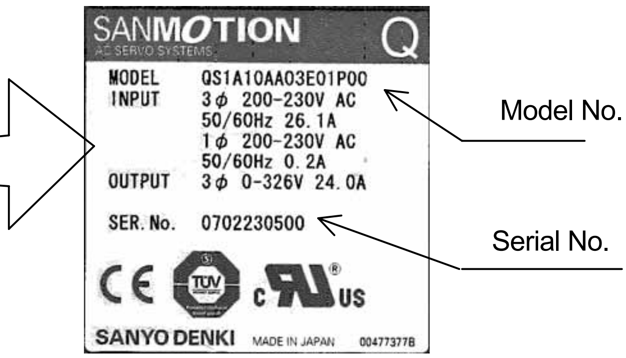


Interpretation of the serial number
Month (2 digits) + Year (2 digits) + Day (2 digits)+ Serial number (4 digits) + Revision ("A" is abbreviation)

Servo amplifier



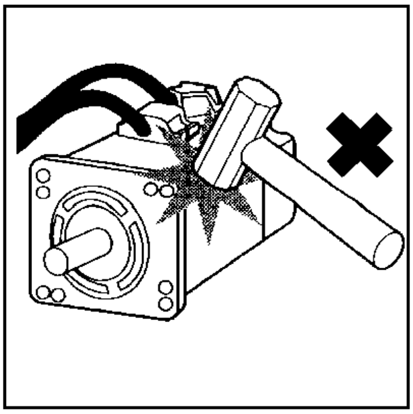
Servo amp main nameplate

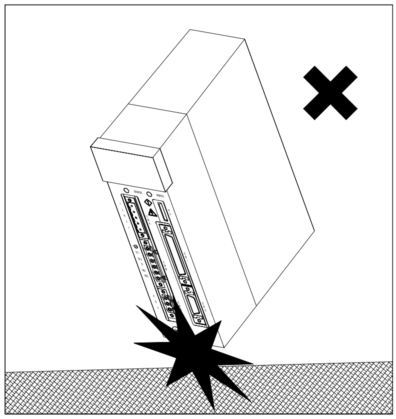


2.3 Precautions related to use

Use the product with the following precautions in mind:

- **Do no subject the servo motor or servo amplifier to shock during installation; damage to the device could otherwise result. Be especially careful when handling the servo motor as it has a sensor attached.**





Always use the specified range for electric power.

AC 200V input type:

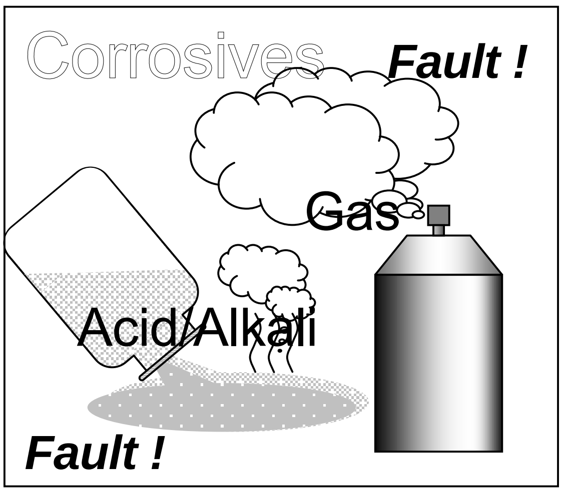
<u>AC200 - 230V (+10%, -15%) 50/60Hz</u>

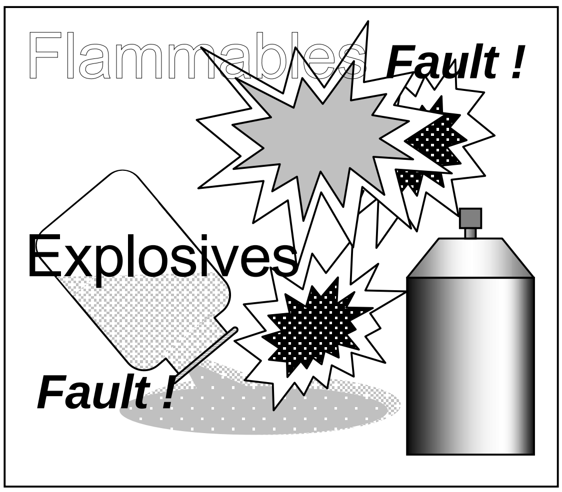
AC 100V input type:

<u>AC100 - 115V (+10%, -15%) 50/60Hz</u>

If the power does not meet these specifications, an accident could result.

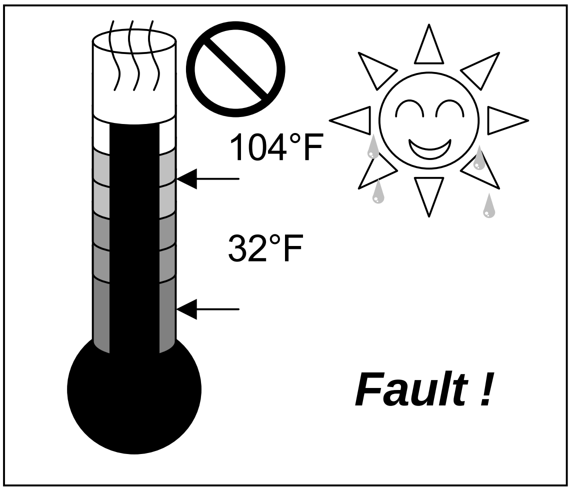
- **If there are surges on the power line, use a surge protector between the power source and the device, as a malfunction or accident could otherwise result.**
- **When doing maintenance or inspection, switch the power on or off only after verifying safety concerns, such as the status of the load device. If the power is switched ON/OFF with the load connected, accident or damage to the device could result.**
- **Never use this product in the proximity of corrosive (acid, alkali, etc.), flammable, explosive liquids or gases, as these could damage the device.**
- **Never use the product where flammable or explosive liquids or gases are present, as these can catch fire.**

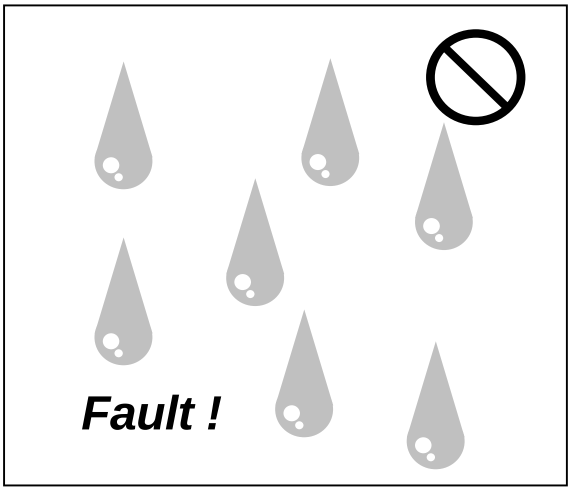




2. Prior to Use

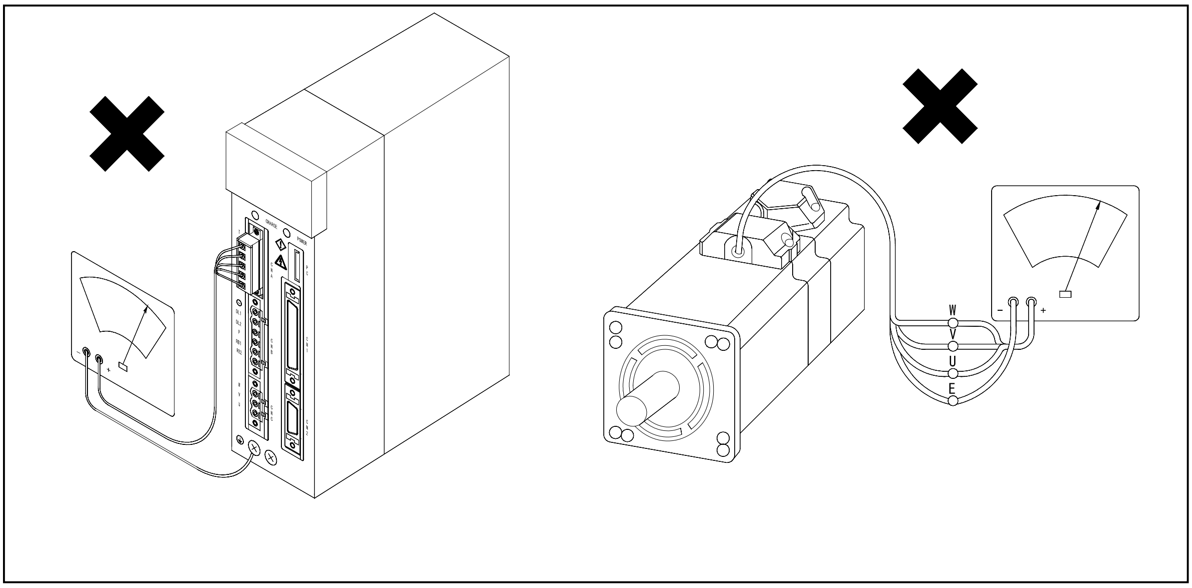
- **Use the device within the specified operating temperature of 0-40°C (sub-amp is 0-55°C) and relative humidity below 90%.**
- **Prevent water, cutting fluid or rain from contacting the servo motor or servo amplifier; a short circuit or electric shock could otherwise result.**





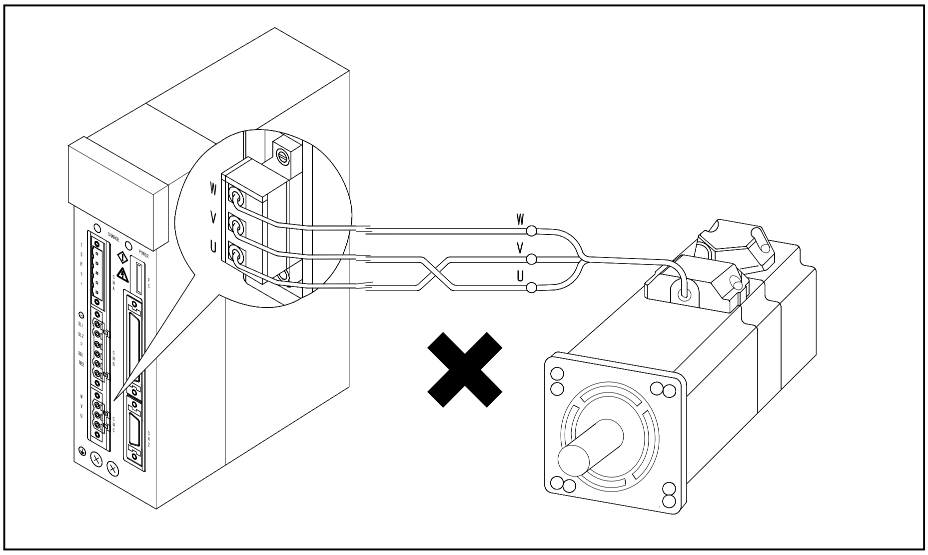
- **For safety, verify that the protective ground terminal connection (⏚) of the servo amplifier is at least D-type (Class 3 (Max 100Ω)). The ground terminal of the servo motor should always be connected to the protective ground terminal (⏚) of the servo amplifier.**

- **Never perform a withstand voltage test or a Megger-test on the servo motor or servo amplifier. This product uses capacitor grounding between the 0V and the main unit. If you wish to perform such testing, please contact the distributor or sales office.**



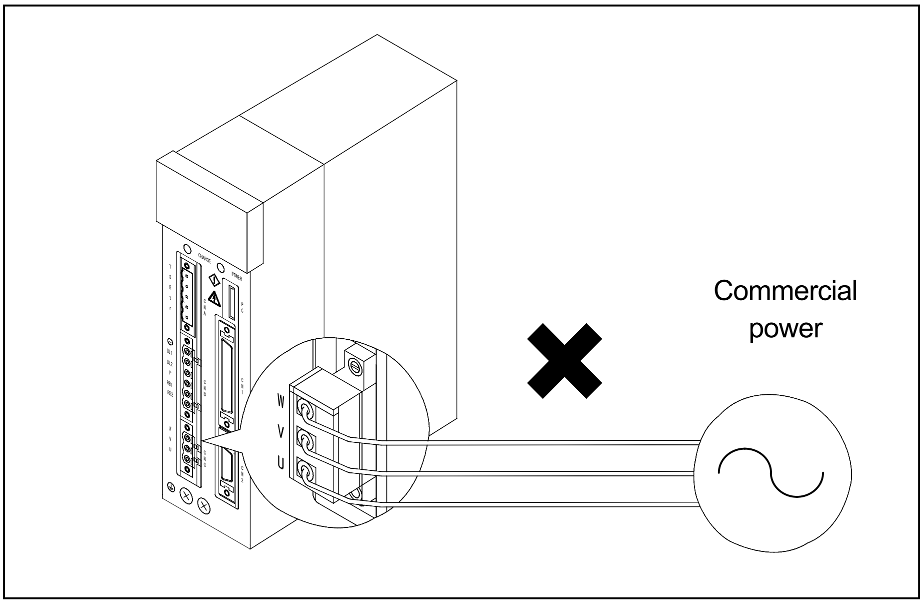
2. Prior to Use

- **Wiring should be performed after reading "4. Wiring" to ensure correct connections. Incorrect wiring could result in damage to the device, or fire.**
- **The servo motor is not an induction motor. Therefore, reversing the phases of the motor will not result in reverse rotation.**



- **Apply a surge protector to coils such as relays, electromagnetic contacts, induction motors and brake solenoids, etc.**

- **Connect power at the specified range to the R, S, and T terminals of the servo amplifier. If the power is out of the specified range, use a transformer. If commercial power is applied to the U, V, W terminals of the servo amplifier, it will cause damage to the device.**



2.4 Interpretation of the model number

2.4.1 Servo motor model number

Q ○ A A ○○ ○○○ △ □ ◇ ▽▽ ★ ☆

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫

① Series name Q-series

② Motor type 1:Low inertia 2: Medium inertia 3: High inertia

③ Voltage A: 200V; C: 400V; E: 100V

④ Motor form: A: Standard flange; C: Hollow shaft

⑤ Flange angle dimensions

04: 40 or 42mm; 05: 54mm; 06: 60mm; 07: 76mm; 08: 80mm or 86mm; 10: 100mm; 12: 120mm; 13: 130mm; 18: 180mm; 22: 220mm

⑥ Rated output ○○○＝○○○×10W however, ○○K is ○○×10^3 W

⑦ Maximum rotation speed

S: 1000 min^{-1} M: 1500 min^{-1} B: 2000 min^{-1}

R: 2500 min^{-1} H: 3000, 3500 min^{-1} D: 5000 min^{-1}

P: 4500 min^{-1}

⑧ Existence of a securing brake

X: No brake; B: 90 V brake; C: 24V brake

⑨ Detector type

S: Wire-saving incremental encoder

D: Incremental/absolute encoder (Manchester encoding) (PA035)

P: Wire-saving absolute encoder (start-stop synchronization) (PA035)

F: Wire-saving absolute sensor (resolver type, 2 provided) (RA062)

⑩ Specification identification

00: Standard product

⑪ Additional specification identification

E: CE mark supported; U: UL supported; M: CE mark + UL supported

⑫ Gear identification

A: 1/3

The design order is noted by alphabetical characters at the end of the Lot Number on the nameplate.

2.4.2 Servo amplifier model number

QS1 □ ○○ A C 0 XX △△ ▽ 00

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① Q-series servo amplifier

② Power input, power part description

Power input, power part details			Model numbers by amplifier capacity				
DB	Input voltage	Internal regenerative resistor	15A	30A	50A	100A	150A
○	AC200V	○	L	L	A	A	A
×	AC200V	○	M	M	B	B	B
○	AC100V	○	N	N	—	—	—
×	AC100V	○	P	P	—	—	—
○	AC200V	×	A	A	L	L	L
×	AC200V	×	B	B	M	M	M
○	AC100V	×	E	E	—	—	—
×	AC100V	×	F	F	—	—	—

③ Amplifier description

01: 15A; 03: 30A; 05: 50A; 10: 100A; 15: 150A; 30: 300A

④ Motor structure type A: rotary motor

⑤ Control unit hardware type

C: With positioning function

⑥ Motor combination marking

0: P motor combination; Q motor standard combination

Other than 0: Q motor special specification (decreased rated value, hollow motor, etc.)

⑦ Compatible motor (refer to the standard combinations in the next section.)

Sample: 41 Q2AA04006

⑧ Compatible sensor type (refer to the next section for more details.)

01: Wire-saving incremental encoder 2000P/R
02: Wire-saving incremental encoder 6000P/R
03: Absolute/incremental encoder 2048P/R 11-bit/single rotation, 13-bit/multiple rotation
06: Absolute sensor (ABS-RII) 13-bit/single rotation, 13-bit/multiple rotation
A3: Wire-saving absolute sensor (optical type) 17-bit/single rotation, 16-bit/multiple rotation, transmission rate: 2.5M
A8: Wire-saving absolute sensor (resolver type) 17-bit/single rotation, 14-bit/multiple rotation, transmission rate: 2.5M

⑨ Interface specification

S: Speed control type; T: Torque (thrust) control type; P: Position control type; X: Speed-torque (thrust) switch type
Y: Position-torque (thrust) switch type; U: Position-speed switch type; V: Internal speed control type (linear case is in brackets)

⑩ Individual specification

00: Standard product; A1: single phase specification (AC 200V) - however, only products with amplifier capacity of 15A – 50A.

•The design order is noted by alphabetical characters at the end of the Lot Number on the name plate.

2.5 Standard combinations

The following table shows the standard combinations of rotary motors and servo amplifiers according to the motor and amplifier model numbers. Incorrect combination of rotary motors and servo amplifiers will result in incorrect operation.

Table 2-1 Q-series rotary motor and servo amplifier combinations
(AC 200V input type)

Rotary motor		Servo amplifier	
Q1AA○○○○○○□◇▽▽		QS1A○○AC0XX△△▽00	
Series	Flange angle Rated output	Amplifier capacity	Motor type
Q1	04003D	01 (15A)	31
	04005D	01 (15A)	32
	04010D	01 (15A)	33
	06020D	01 (15A)	34
	06040D	03 (30A)	35
	07075D	03 (30A)	36
	10100D	05 (50A)	37
	10150D	05 (50A)	38
	10200D	10 (100A)	39
	10250D	10 (100A)	3A
	12100D	05 (50A)	3B
	12200D	10 (100A)	3C
	12300D	10 (100A)	3D
	13300D	10 (100A)	3E
	13400D	15 (150A)	3F
	13500D	15 (150A)	3G
	18450M	15 (150A)	3H

Q2AA○○○○○○□◇▽▽		QS1A○○AC0XX△△▽00	
Series	Flange angle Rated output	Amplifier capacity	Motor type
Q2	04006D	01 (15A)	41
	04010D	01 (15A)	42
	05005D	01 (15A)	43
	05010D	01 (15A)	44
	05020D	01 (15A)	45
	07020D	01 (15A)	46
	07030D	01 (15A)	47
	07040D	03 (30A)	48
	07050D	03 (30A)	49
	08050D	03 (30A)	4A
	08075D	05 (50A)	4B
	08100D	05 (50A)	4C
	10100H	05 (50A)	4D
	10150H	05 (50A)	4E
	13050H	03 (30A)	4F
	13100H	05 (50A)	4G
	13150H	05 (50A)	4H
	13200H	10 (100A)	4J
	18200H	10 (100A)	4K
	18350H	15 (150A)	4L
	18450H	15 (150A)	4M
	18550R	15 (150A)	4N
	22250H	10 (100A)	4P
	22350H	15 (150A)	4R
	22450R	15 (150A)	4S
	22550B	15 (150A)	4T
	22700S	15 (150A)	4U

Table 2-2 Q-series rotary motor and servo amplifier combinations
(AC 100V input type)

Servo motor		Servo amplifier	
Q1EA○○○○○○□◇▽▽		QS1A○○AC0XX△△▽00	
Series	Flange angle Rated output Max rotation speed	Amplifier capacity	Motor type
Q1	04003D	01 (15A)	3S
	04005D	01 (15A)	3T
	04010D	01 (15A)	3U
	06020D	03 (30A)	3V

Servo motor		Servo amplifier	
Q2EA○○○○○○□◇▽▽		QS1E○○AC0XX△△▽00	
Series	Flange angle Rated output Max rotation speed	Amplifier capacity	Motor type
Q2	04006D	01 (15A)	4V
	04010D	01 (15A)	4W
	05005D	01 (15A)	4X
	05010D	01 (15A)	4Y
	05020D	03 (30A)	4Z
	07020D	03 (30A)	71

2. Prior to Use

The following table shows the combinations of servo amplifiers and P-series servo motors (200V, 100V) according to the motor and amplifier model numbers. Incorrect combination of servo motors and servo amplifiers will result in incorrect operation.

Table 2-3 P-series rotary motor and Q-series servo amplifier combinations (AC 200V input type)

Servo motor		Servo amplifier	
P☆B○○○○○○□◇▽▽		QS1A○○AC0XX△△▽00	
Series	Flange angle Rated output Max rotation speed	Amplifier capacity	Motor type
P10	10030H	03 (30A)	11
	10075H	03 (30A)	12
	13050H	03 (30A)	13
	13100H	05 (50A)	14
	13150H	05 (50A)	15
	18200H	10 (100A)	16
	18350H	15 (150A)	17
	18450R	15 (150A)	18
	18550M	15 (150A)	19
	13050B	03 (30A)	1A
	13100B	03 (30A)	1B
	13150B	05 (50A)	1C
	18200B	05 (50A)	1D
	18350B	10 (100A)	1E
	18450B	10 (100A)	1F
P20	10100D	05 (50A)	21
	10150D	05 (50A)	22
	10200D	10 (100A)	23
	10250D	10 (100A)	24
	13300D	10 (100A)	25
	13400D	15 (150A)	26
	13500D	15 (150A)	27
	10100H	03 (30A)	28
	10150H	05 (50A)	29
	10200H	05 (50A)	2A
	10250H	10 (100A)	2B
	13300H	10 (100A)	2C
	13400H	10 (100A)	2D
	13500H	15 (150A)	2E
P30	04003D	01 (15A)	N1
	04005D	01 (15A)	N2
	04010D	01 (15A)	N3
	06020D	01 (15A)	N4
	06040D	03 (30A)	N5
	08075D	03 (30A)	N6

Servo motor		Servo amplifier	
P☆B○○○○○○□◇▽▽		QS1A○○AC0XX△△▽00	
Series	Flange angle Rated output Max rotation speed	Amplifier capacity	Motor type
P50	03003D	01 (15A)	M1
	04006D	01 (15A)	M2
	04010D	01 (15A)	M3
	05005D	01 (15A)	M4
	05010D	01 (15A)	M5
	05020D	01 (15A)	M6
	07020D	01 (15A)	M8
	07030D	01 (15A)	M9
	07040D	03 (30A)	MA
	08040D	03 (30A)	MB
	08050D	03 (30A)	MC
	08075D	05 (50A)	MD
	08100D	05 (50A)	ME
	08075H	03 (30A)	MF
	08100H	03 (30A)	MG
P60	13050H	03 (30A)	PA
	13100H	05 (50A)	P1
	13150H	05 (50A)	P2
	13200H	10 (100A)	P3
	15300H	15 (150A)	P4
	18200H	10 (100A)	P5
	18350H	15 (150A)	P6
	18450R	15 (150A)	P7
	18550R	15 (150A)	PR
	18750R	30 (300A)	PW
	22550M	15 (150A)	P8
	22700S	15 (150A)	P9
	2211KB	30 (300A)	PG
	2215KB	30 (300A)	PX
P80	15075H	03 (30A)	R2
	18120H	05 (50A)	R3
	22250H	10 (100A)	R4
	22350R	10 (100A)	R9
	22350H	15 (150A)	R5
	22450R	15 (150A)	R6

Table 2-4 P-series rotary motor and Q-series servo amplifier combinations (AC 100V input type)

Servo motor		Servo amplifier	
P☆B○○○○○○□◇▽▽		QS1A○○AC0XX△△▽00	
Series	Flange angle Rated output Max rotation speed	Amplifier capacity	Motor type
P30	04003P	01 (15A)	NA
	04005P	01 (15A)	NB
	04010P	01 (15A)	NC
	06020P	03 (30A)	ND

Servo motor		Servo amplifier	
P☆B○○○○○○□◇▽▽		QS1E○○AC0XX△△▽00	
Series	Flange angle Rated output Max rotation speed	Amplifier capacity	Motor type
P50	03003P	01 (15A)	MH
	04006P	01 (15A)	MJ
	04010P	01 (15A)	MK
	05005P	01 (15A)	ML
	05010P	01 (15A)	MM
	05020P	03 (30A)	MN
	07020P	03 (30A)	MR
	07030P	03 (30A)	MS

The following table shows the sensor types for rotary motors. Incorrect combination of sensors and servo amplifiers will result in incorrect operation. The shaded parts are optional.

Table 2-5 Sensor types for Q-series rotary motors

ID	Sensor							
	Type	Format	Transmission format	Trans. rate	Divisions per rotation	Multiple rotations	Abbreviation	Hard. ID.
01	Wire-saving incremental	Optical	———	–	2000P/R	–	INC-E	A
02	Wire-saving incremental	Optical	———	–	6000P/R	–	INC-E	A
03	Absolute/incremental	Optical	Full duplex Manchester	1M	Incr. part: 2048P/R Abs. part: 11-bit	13-bit	ABS-E	R
06	Absolute request	Resolver	Full duplex Manchester	1M	13-bit	13-bit	ABS-R	H
A3	Wire-saving absolute	Optical	Half duplex start-stop synchronization	2.5M	17-bit	16-bit	PA035C-2.5MH	A
A4	Wire-saving absolute	Optical	Half duplex start-stop synchronization	4M	17-bit	16-bit	PA035C-4MH	A
A7	Wire-saving absolute	Resolver	Half duplex start-stop synchronization	2.5M	15-bit	-8192 Rotation ~ +8192 Rotation	RA062C-2.5MH	A
A8	Wire-saving absolute	Resolver	Half duplex start-stop synchronization	2.5M	17-bit		RA062C-2.5MH	A
A9	Wire-saving absolute	Resolver	Half duplex start-stop synchronization	4M	15-bit		RA062C-4MH	A
AA	Wire-saving absolute	Resolver	Half duplex start-stop synchronization	4M	17-bit		RA062C-4MH	A
AB	Absolute request	Resolver	Full duplex Manchester	1M	15-bit	13-bit	RA062M-1MF	H
AC	Absolute request	Resolver	Full duplex Manchester	2M	15-bit	13-bit	RA062M-2MF	H
B1	Wire-saving incremental	Optical	———	–	131072 P/R	–	PP038	A
B2	Wire-saving incremental	Optical	———	–	10000 P/R	–	PP038	A

Servo System Configuration

3. Servo System Configuration

3.1 Block diagram

The block diagram is shown below.

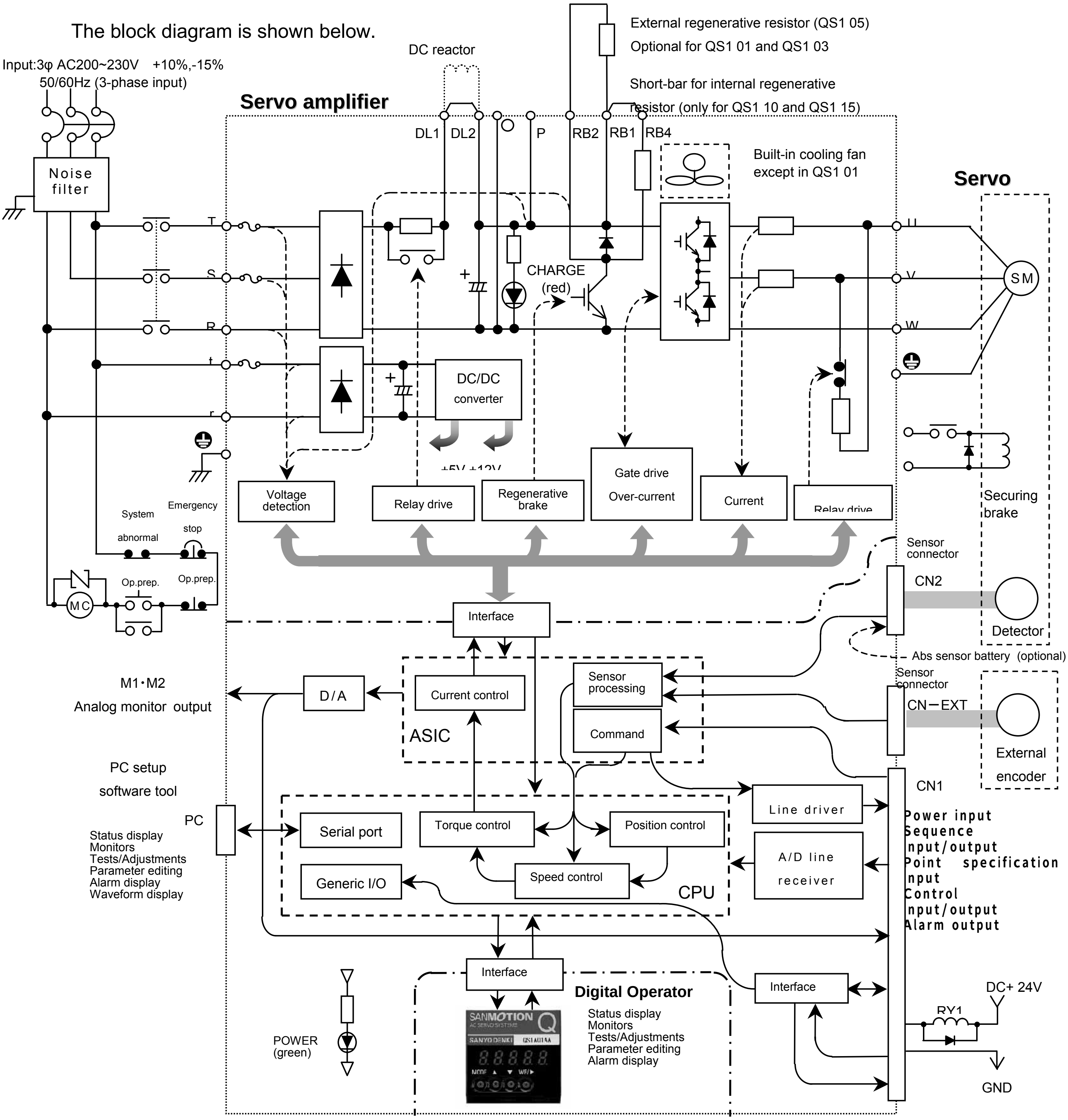


Fig. 3-1 Block diagram

3. Servo System Configuration

3.2 External wiring diagram

The following diagram shows the external wiring.

φ AC200~230V +10%,-15% 50/60Hz

1φ AC200～230V +10%,-15% 50/60Hz

1φ AC100～115V +130%,-15% 50/60Hz (Only QS1 01 and QS1 03 are supported.)

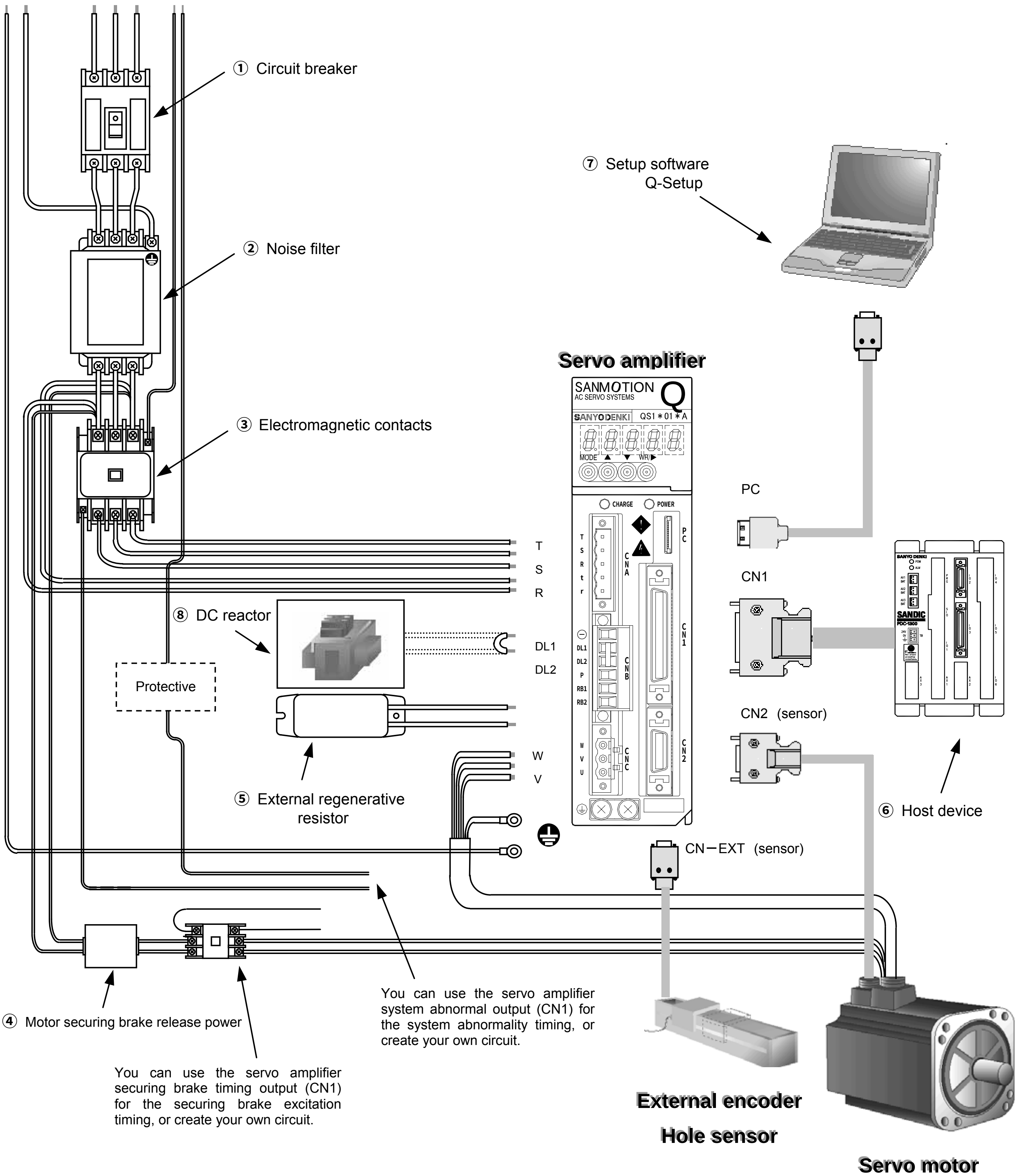


Fig. 3-2 External wiring diagram

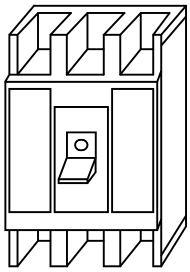
3. Servo System Configuration

3.2.1 Peripherals

Standard peripherals connected to the Q-series products are shown below.

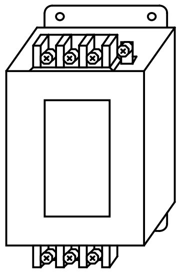
① Circuit breaker

Will cut off the power to protect the power line, in the case of an overload or significant leakage current.



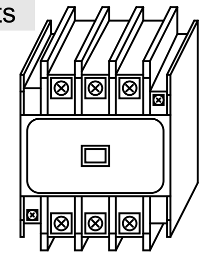
② Noise filter

Used to protect the power line from external noise and from the noise generated by the servo amplifier.



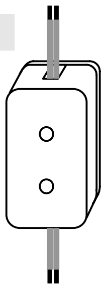
③ Electromagnetic contacts

Switch the main circuit power ON/OFF; require installation of a surge protector.
Install the protective circuit shown in 7-16 to the electromagnetic circuit.



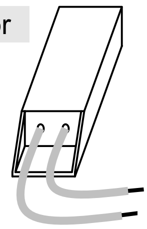
④ Motor securing brake release power

If the servo motor has a brake, this power is used to release the brake.



⑤ External regenerative resistor

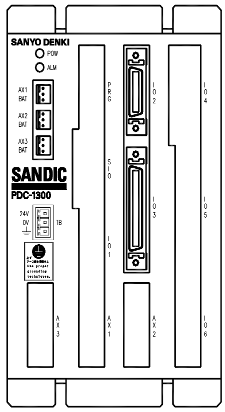
Connect an external regenerative resistor to the RB-1-RB-2 terminals of the CNB on the QS1 01, QS1 03 and QS1 05.
If the capacity of the internal regenerative resistor in the QS1 10 and QS1 15 is not sufficient, remove the RB1 – RB4 short-bar, and connect an external regenerative resistor between the RB1 and RB2



⑥ Host device

PCL or something can be connected as a host device.

If you connect your own host device, refer to the external wiring diagram as well as sections "4. Wiring", and "10. Specifications".



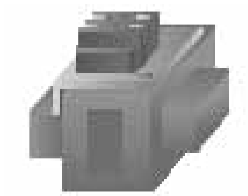
⑦ Setup software Q_Setup

Connect the PC using the RS-232C port to perform "Operation status monitoring", "Parameter modification, Batch save/load", "Tests, adjustments" and "Waveform display"

Setup software
Q-Setup

⑧ DC Reactor

A full capacity DC reactor can be connected to the Q-series servo amplifier to protect other devices from the effects of harmonics.
Connect it between the DL-1 and DL-2 terminals.



3.3 Servo amplifier part names

The servo amplifier part names are explained in two sections; one for QS1 01, QS1 03 and QS1 05, and the other for QS1 10 and QS1 15.

3.3.1 Part names for QS1 01, QS1 03 and QS1 05

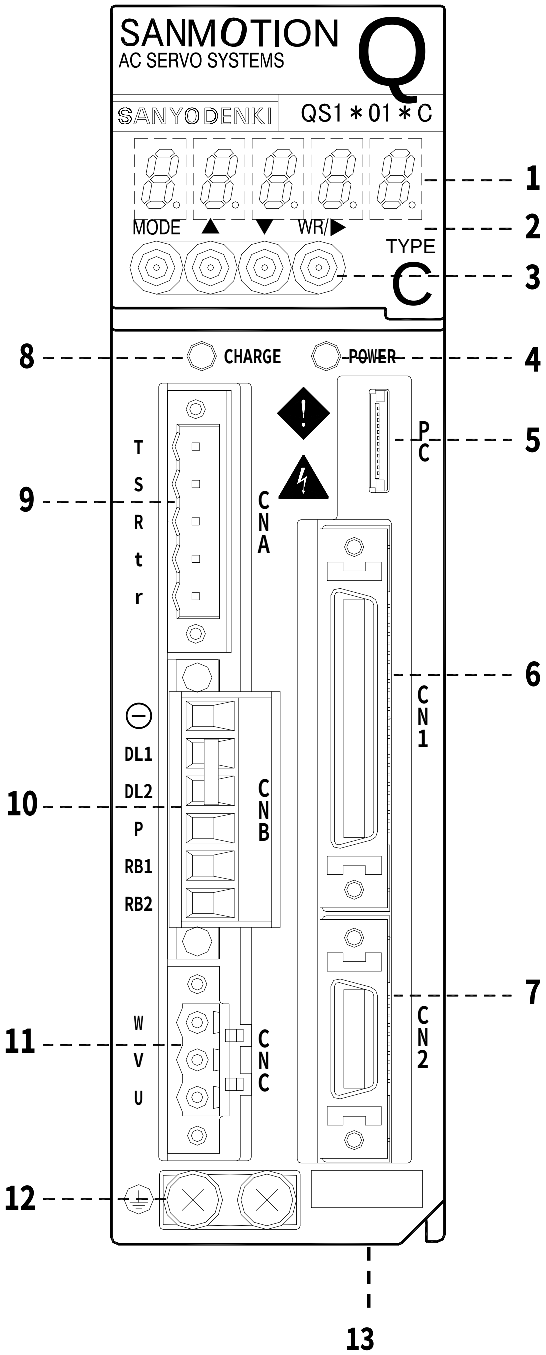


Fig. 3-3 Servo amplifier front view (QS1 01)

1. 5-digit 7-segment LED

LED display for the Digital Operator.

2. Digital Operator

Performs "Status display", "Monitoring", "Tests/Adjustments", "Parameter editing" and "Alarm display" on the servo amplifier.
Instructions for use → See Section 8.

3. Operating Key

Key to operate the Digital Operator.

4. Control power status LED (POWER, green)

Shows that the +5V control power is on.

5. Setup software (PC) connector

This connector is used to connect the setup software (Q-Setup) to use the "Status display", "Monitoring", "Tests/Adjustments", "Parameter editing", "Point data editing", "Alarm display", and "Action waveform display" functions.

6. Generic input/output connector (CN1)

Servo amplifier and host device input/output signal connector.
Wiring → See section 4.

7. Sensor signal connector (CN2)

Connect the sensor signal from the servo motor.
Wiring → See section 4.

8. Main circuit power charge LED (CHARGE – red)

Shows if the smoothing capacitor of the main circuit is charged.

9. Control power, main circuit power input connector (CNA)

Connect the control power to (r, t) and the main circuit power to (R, S, T). The input voltage specifications of the QS1 01 and QS1 03 are different. Unlike the PY2-series, connect from the top in the order of T, S, R, t, r. *Wiring → See section 4.*

10. External regenerative resistor, DC reactor connector (CNB)

Connect the external regenerative resistor to (RB1, RB2), and the DC reactor to (DL1, DL2). If the DC reactor is not used, always short the DL1-DL2 terminals. *Wiring → See section 4.*

11. Servo motor power connector (CNC)

Attach the power connector of the servo motor.
Unlike the PY2-series, connect from the top in the order of W, V, U. *Wiring → See section 4.*

12. Protective ground terminal (⏚))

Connect the protective ground. Use D-type (Class 3) grounding.

13. External encoder, hole sensor connector (CN-EXT)

Connect the external encoder for full-close control, and the hole-sensor for linear motor. A connection is necessary only if a full-close control or a linear motor is used.

3. Servo System Configuration

3.3.2 Part names for QS1 10, 15 and 30

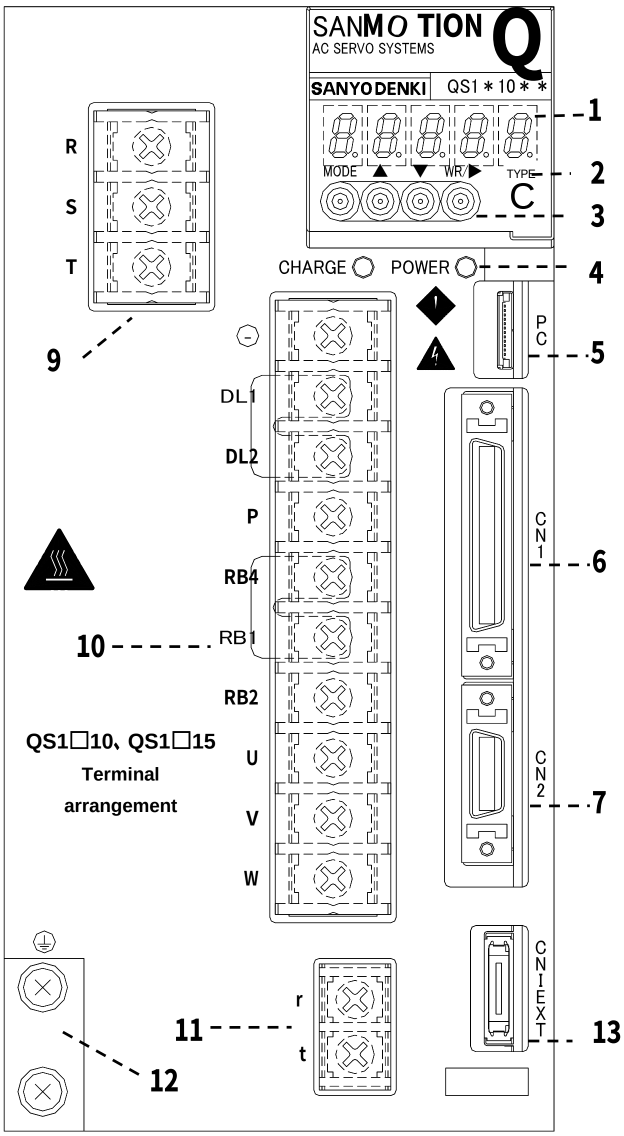


Fig. 3-4 Servo amplifier front view (QS1 10)

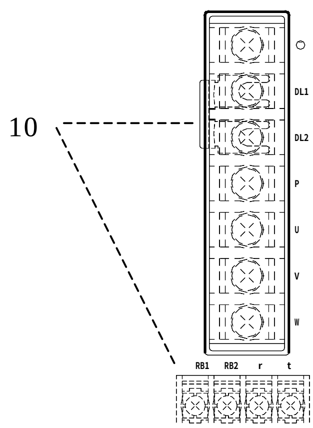


Fig. 3-5 QS1 30 Terminal arrangement

1. 5-digit 7-segment LED

LED display for the Digital Operator.

2. Digital Operator

Performs “Status display”, “Monitoring”, “Tests/Adjustments”, “Parameter editing” and “Alarm display” on the servo amplifier.
Instructions for use → See Section 8.

3. Operating Key

Key to operate the Digital Operator.

4. Control power status LED (POWER, green)

This shows that control power (r, t) is supplied and +5V control power is established.

5. Setup software (PC) connector

This connector is used to connect the setup software (Q-Setup) to use the “Status display”, “Monitoring”, “Tests/Adjustments”, “Parameter editing”, “Point data editing”, “Alarm display”, and “Action waveform display” functions.

6. Generic input/output connector (CN1)

Servo amplifier and host device input/output signal connector.
Wiring → See section 4.

7. Sensor signal connector (CN2)

Connect the sensor signal from the servo motor.
Wiring → See section 4.

8. Main circuit power charge LED (CHARGE – red)

Shows if the smoothing capacitor of the main circuit is charged.

9. Main circuit power input terminal

Connect the main circuit power to (R, S, T).
Wiring → See section 4.

10. Regenerative resistor, DC reactor, servo motor power connector

Connect the external regenerative resistor to (RB1, RB2), the DC reactor to (DL1, DL2), and the servo motor power line to (U, V, W).
If the internal regenerative resistor is used, short the RB1-RB4 terminals.
If the capacity of the internal regenerative resistor is insufficient, remove the short-bar from RB1-RB4, and connect an external regenerative resistor between RB1-RB2 terminals.
If the DC reactor is not used, always short the DL1-DL2 terminals. *Wiring → See section 4*.

11. Control power input terminal

Connect the control power to (r, t). *Wiring → See section 4*.

12. Protective ground terminal (⏚)

Connect the protective ground. Use D-type (Class 3) grounding.

13. External encoder, hole-sensor connector (CN-EXT)

Connect the external encoder for full-close control, and the hole-sensor for linear motor. A connection is necessary only if a full-close control or a linear motor is used.

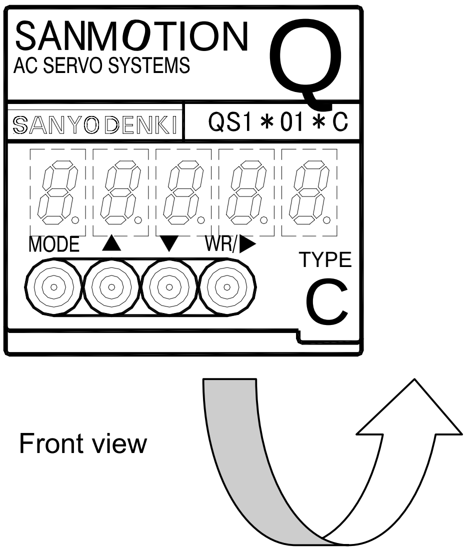
3. Servo system configuration

3.4 Battery space, analog monitor

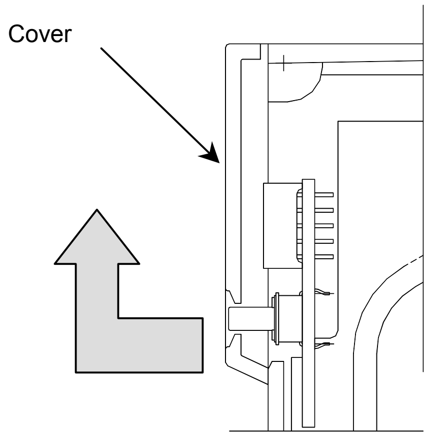
The cover of the Digital Operator can be opened and closed. A battery can be inserted into the space under the cover, and there is a connector for analog monitor output as well.

3.4.1 Battery space, analog monitor

Pull the bottom of the cover to open up the Digital Operator.



Front view



Side view (see-through)

① Battery space

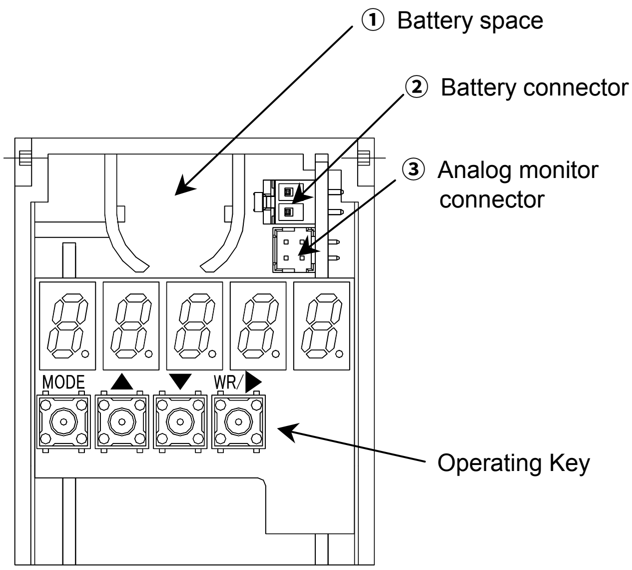
Insert the absolute encoder backup battery.

② Battery connector (2 pins)

Connect the inserted battery to the battery space.

③ Analog monitor connector (4 pins)

This connector outputs to the analog monitor output signal MON1, MON2 and the digital monitor output DMON



Front view with cover open

Wiring

4. Wiring

4.1 Electric wire sizes

- The following table shows the electric wire sizes used with the external connectors of the servo amplifier.
- The electric wire and the size should be selected based on the wiring distance, the environment and the current capacity.
- The information in Table 4-1 assumes an ambient temperature of 40°C, 3 lead coil wires, and rated current.

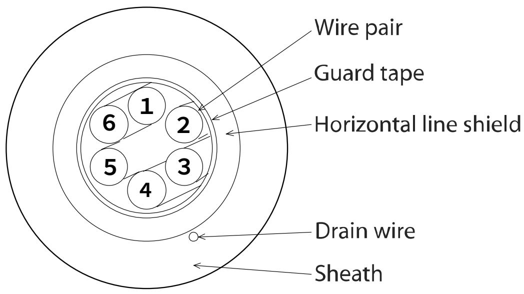
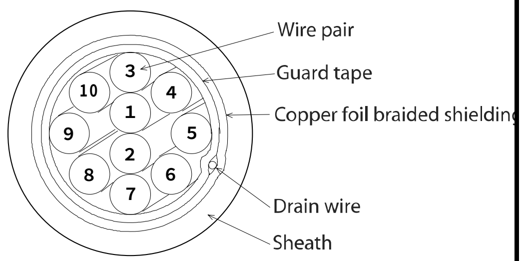
Table 4-1 Electric wire sizes

External connector name		Type / Connector marking	Electric wire size examples					
			QS1 01	QS1 03	QS1 05	QS1 10	QS1 15	QS1 30
Main circuit / Control circuit	Main circuit power input connector	CNA or connector block (R,S,T)	AWG16 equivalent	AWG14 equivalent	AWG12 equivalent	AWG10 equivalent	AWG8 equivalent	AWG6 equivalent
	Control power input connector	CNA or connector block (r, t)	AWG16 equivalent					
	Motor connector (power line)	CNC or connector block (U,V,W)	AWG16 equivalent	AWG14 equivalent	AWG12 equivalent	AWG10 equivalent	AWG8 equivalent	AWG6 equivalent
	Safeguard connector (⏚)	⏚	AWG14 equivalent					
	Regenerative resistor input connector	CNB or connector block (RB1, RB2)	AWG16 equivalent		AWG14 equivalent	AWG12 equivalent	AWG10 equivalent	AWG8 equivalent
Signal circuit	Input signal connector	CN1	At least AWG24 (some parts use single shielded twisted pair wires)					
	Sensor signal connector	CN2	Single shield twisted pair wire, at least AWG24					

1. If you bundle the wires or insert them into a wire-duct, consider the acceptable current reduction ratio.
2. If the ambient temperature is high, life expectancy of the wires will be shorter due to heat-related deterioration. In this case, use heat-resistant vinyl wires.
3. Depending on the capacity of the servo motor, the size of the electric wires connected to the main circuit power input connector and the motor connector can be smaller than indicated in the table above. (Use the appropriate size wires based on Section 10, Power Capacity.)
4. We offer an optional cable for the sensor signal connection. Refer to the model number when purchasing this.
5. The recommended pressure torque for the CNA~C is 0.5~0.6 Nm. Please tighten to this torque. If it is necessary to have an insulation distance between the main circuit wires and between the main circuit and the signal circuit wires, pole terminals with insulation sleeves should be used. (If the wire used is bigger than AWG12, these cannot be used.)
6. The recommended tightening torque for the jack-screws of the CN1, CN2 shell (connector cover: 103**-52A0-008) is 0.196±0.049 Nm (2.0±0.5 kgf cm). Please tighten to this torque. Using a stopper on the jack-screw prevents over-tightening. The product number is 3342-26 (with stopper). The recommended torque is 0.441±0.049 Nm (4.5±0.5 kgf cm).

4.2 Sensor cable specifications

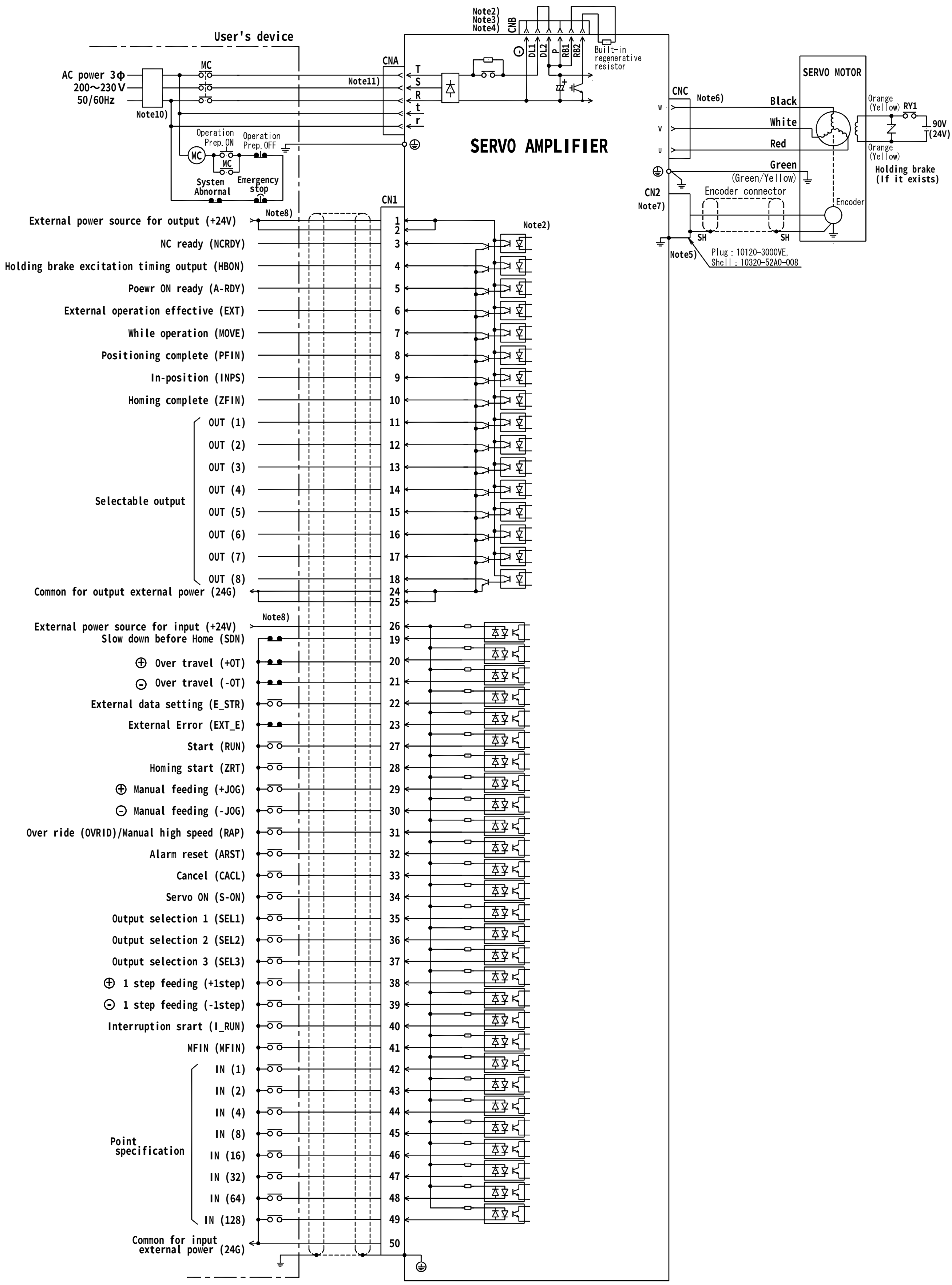
Table 4-2 Cable specifications

	Specifications	
	Wire-saving incremental encoder (INC-E: wiring length max. 20m)	Wire-saving incremental encoder (INC-E: wiring length 20m~30m)
Connection method	Soldering	Soldering
Manufacturer	Tonichi Cable, Ltd.	Tatsuta Electric Wire And Cable Co., Ltd.
Outline specification	6 pairs x 0.2mm^2 (tin-plated soft copper wire)	10 pairs x 0.2mm^2 (high tensile copper alloy wire)
Finished outline	8.0 mm MAX	10.0 mm MAX
Conductor resistance	91 Ω/km MAX	123 Ω/km MAX
Internal structure and lead colors	 1: red-black (twisted pair) 2: blue-brown (") 3: green-purple (“) 4: white-yellow (“) 5: sky-peach (“) 6: orange-grey (“)	 1: blue-white (twisted pair) 2: yellow-white (“) 3: green-white (“) 4: red-white (“) 5: purple-white (“) 6: blue-brown (") 7: yellow-brown (“) 8: green-brown (“) 9: red-brown (“) 10: purple-brown (")
Our standard specification	Model number: 00216167-01 Terminal unprocessed (no connector attached)	Model number: 6870010-01 Terminal unprocessed (no connector attached)

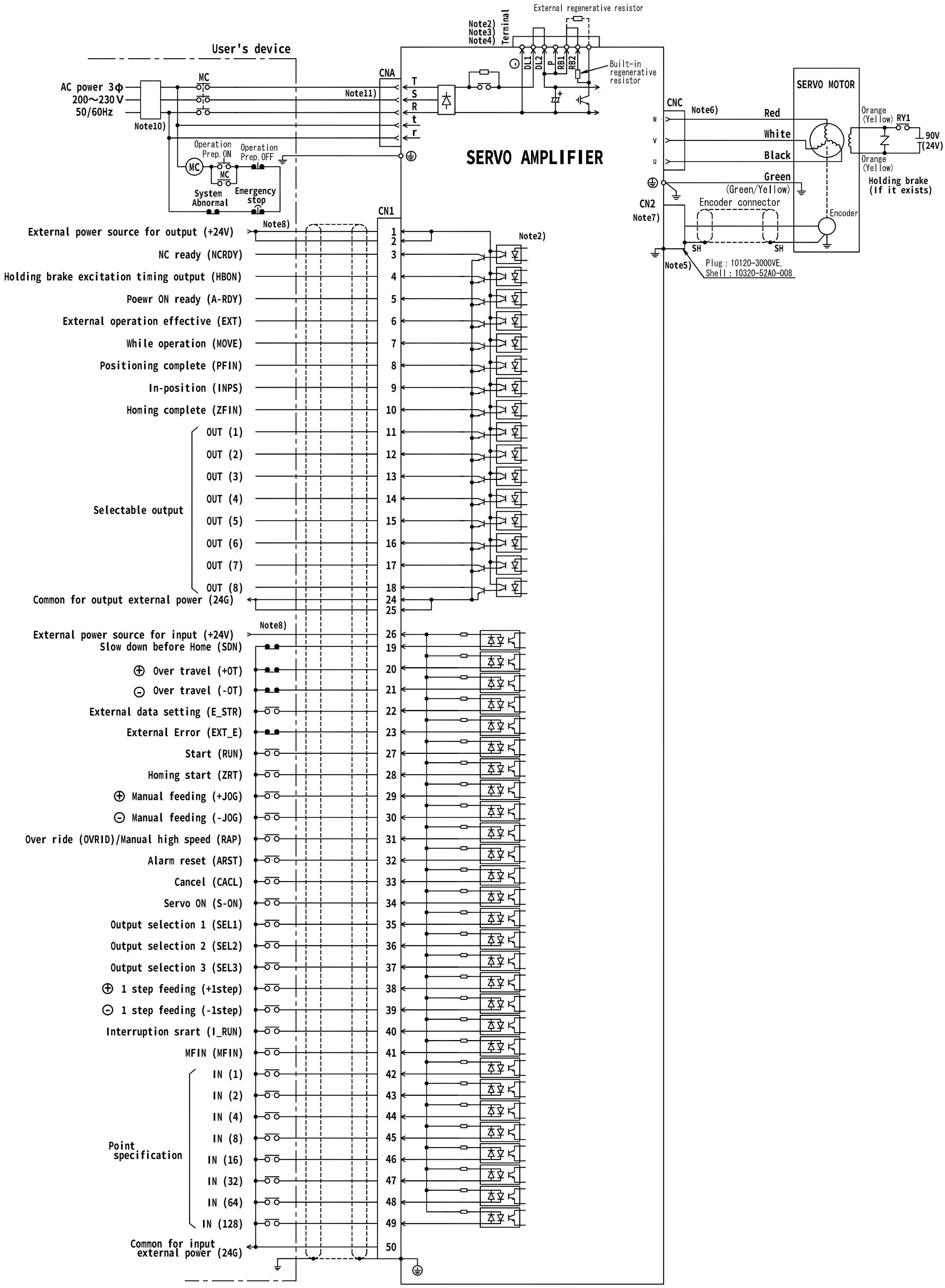
1. The following are the acceptable wiring distances between the servo amplifier and the motor (sensor) using the appropriate cables.
   - Wire-saving incremental encoder (INC-E): Maximum 20m when using cables with 6 pairs and max 91 Ω/km
   - Wire-saving incremental encoder (INC-E): Maximum 30m when using cables with 10 pairs and max 123 Ω/km
2. The wiring distance ***can be increased to 50 m*** by using a low-conductive resistance cable (thick wire size cable) or by increasing the number of wires.
   Please contact your distributor or sales office for further details.
3. Please specify the model number and the length when ordering cables.
4. Please contact your office if you want to use the cables for moving parts.

4.3 External wiring diagram

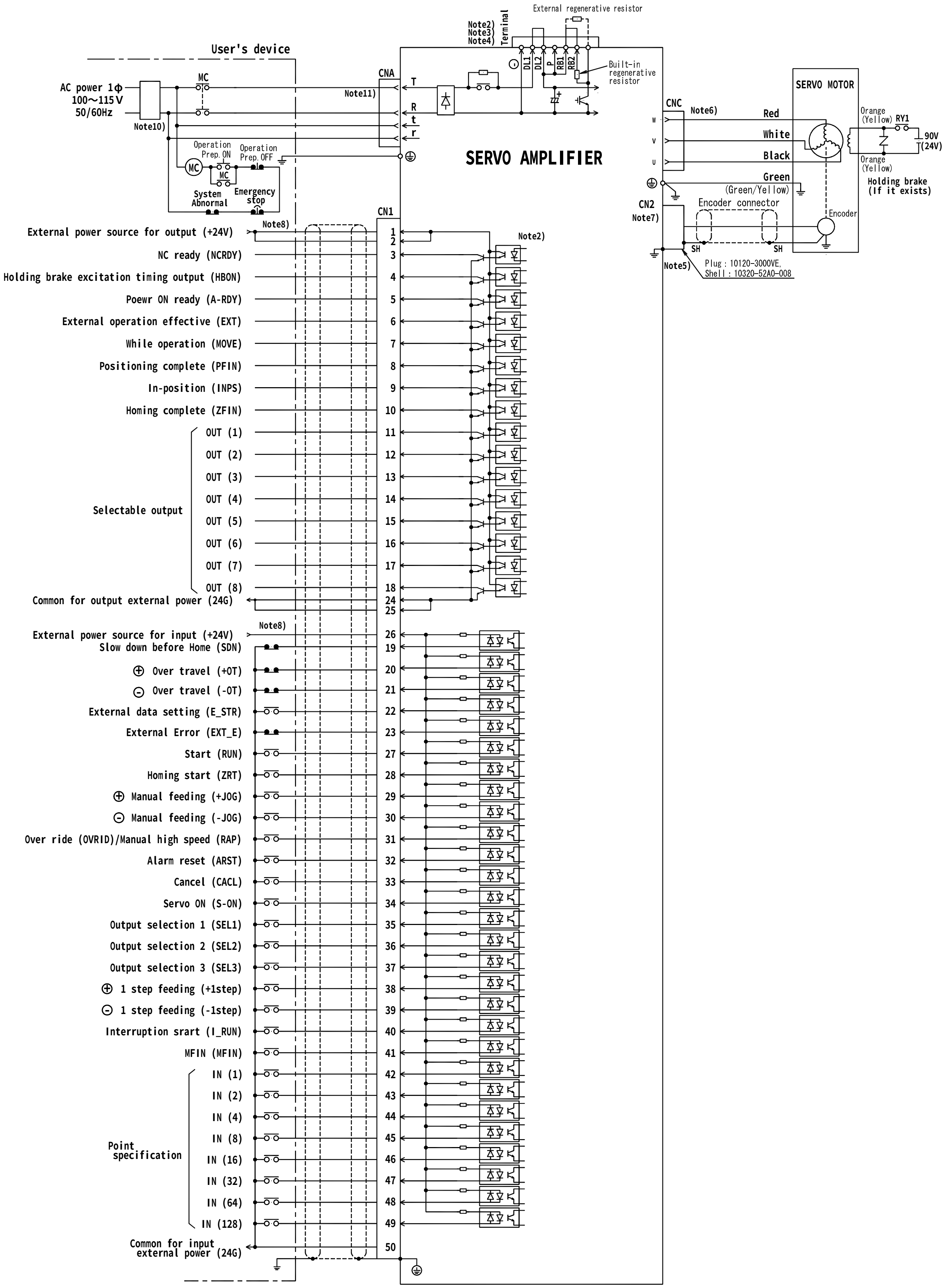
4.3.1 External wiring diagram (AC 200V input type 15A~50A)



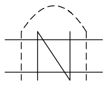
4.3.2 External wiring diagram (AC 200V input type 100A, 150A, 300A)



4.3.3 External wiring diagram (AC 100V input type)



External wiring diagram, Notes

Note 1)  Use a twisted pair cable with external shield.

Note 2) 15A - 50A : Connect the regenerative resistor in between “RB1-RB2” terminals.
If an external regenerative resistor is used, first disconnect the built-in regenerative resistor from RB1-RB2, and then connect the external regenerative resistor between the RB1 and RB2 terminals.

100A – 150A : If the built-in regenerative resistor is used, short the RB1-RB4 terminals.
If an external regenerative resistor is used, first disconnect the short bar from RB1-RB4, and then connect the external regenerative resistor between the RB1 and RB2 terminals.

Note 3) The DL1 and DL2 terminals are for connecting a DC reactor.

Note 4) The ⊖ terminal and the P terminal are for maintenance (high-voltage circuit).

Note 5) Refer to 00292539, regarding shielding.

Note 6) The motor-side connection depends on the motor specification. The red, white, black, green and orange makings are for use with lead type motor power line and brake line. Refer to the motor specification for canon plug type connections.

Note 7) Refer to the encoder connection diagram regarding the encoder connector wiring.

Note 8) Power should be supplied by the user.

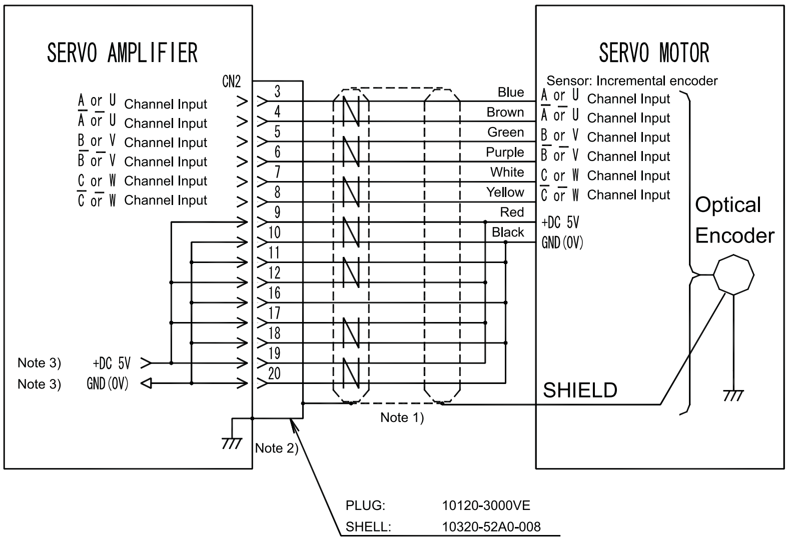
Note 9) R, S, T, r, s, ⊖, P, DL1, DL2, RB1, RB2, U, V and W are high-voltage circuit, all other lines are low-voltage. Ensure sufficient distance between the high- and low-voltage circuits.

Note 10) It is recommended to use a ground fault interrupter conforming to the UL, IEC, and EN standards.

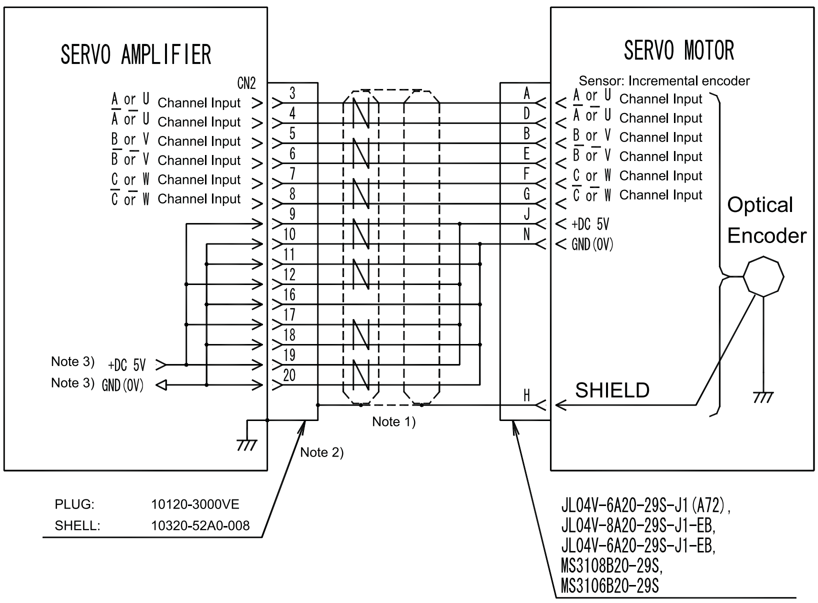
Note 11) Do not connect the S-phase on an amplifier used with single-phase power.

4.3.4 Sensor wiring diagram (INC-E wire-saving incremental encoder)

Incremental encoder (INC-E), lead wire type



Incremental encoder (INC-E), canon plug type



Note 1) Use a twisted pair cable with external shield.

Note 2) Refer to 4.6.2 CN1, CN2 shielding method.

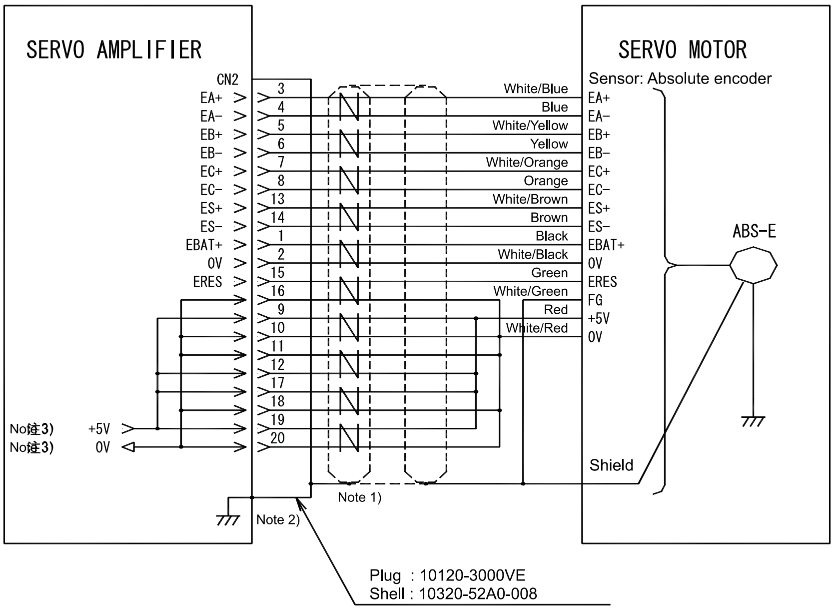
Note 3) The sensor power connection depends on the length of the sensor cable. Refer to the following table.

Sensor cable length	5m or less	10m or less	20m or less	30m or less
+DC 5V connection	Pin 19 connected (Pins 9, 12, 17 don't need to be connected)	Pins 17, 19 connected (Pins 9, 12 don't need to be connected)	Pins 12, 17, 19 connected (Pin 9 doesn't need to be connected)	Pins 9, 12, 17, 19 conne
GND (0V) connection	Pin 20 connected (Pins 10, 11, 16, 18 don't need to be connected)	Pins 18, 20 connected (Pins 10, 11, 16 don't need to be connected)	Pins 11, 18, 20 connected (Pins 10, 16 don't need to be connected)	Pins 10, 11, 16, 18, 20 connected

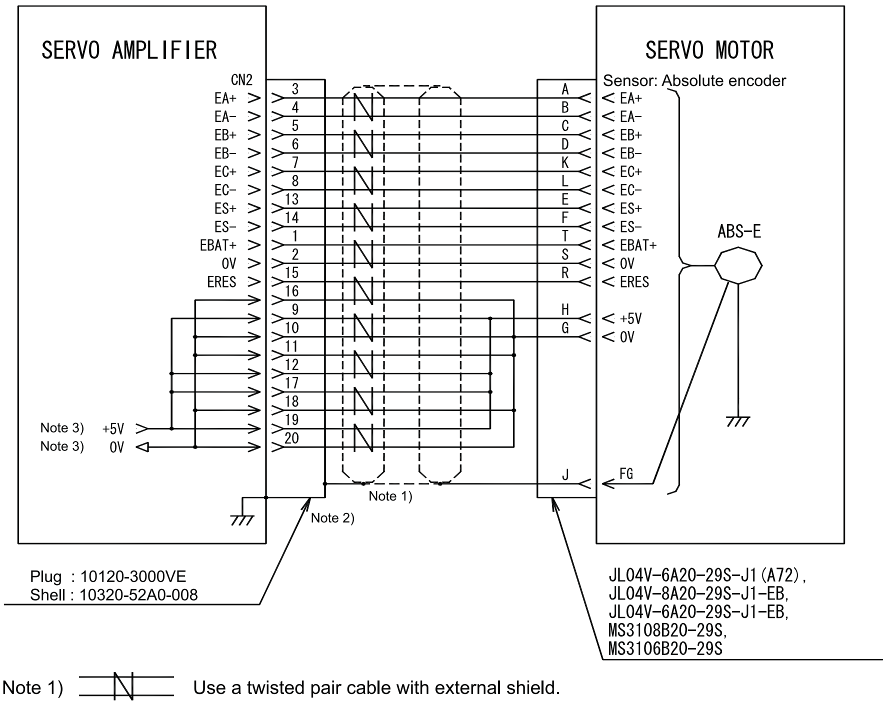
Fig. 4-4 Sensor wiring diagram (INC-E wire-saving incremental encoder)

4.3.5 Sensor wiring diagram (ABS-E absolute/incremental encoder)

Absolute encoder (ABS-E), lead wire type



Absolute encoder (ABS-E), canon plug type



Note 1) Use a twisted pair cable with external shield.

Note 2) Refer to 4.6.2 CN1, CN2 shielding method.

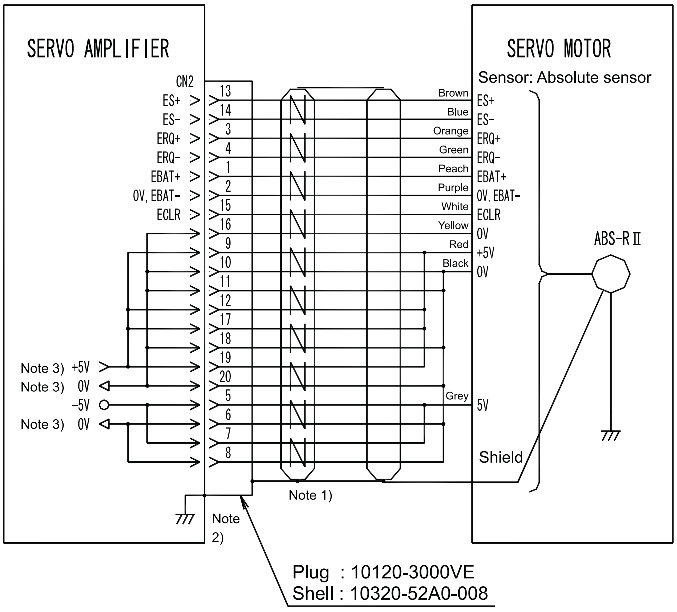
Note 3) The sensor power connection depends on the length of the sensor cable. Refer to the following table.

Sensor cable length	5m or less	10m or less	20m or less	30m or less
+5V connection	Pin 19 connected (Pins 9, 12, 17 don't need to be connected)	Pins 17, 19 connected (Pins 9, 12 don't need to be connected)	Pins 12, 17, 19 connected (Pin 9 doesn't need to be connected)	Pins 9, 12, 17, 19 connected
0V connection	Pins 16, 20 connected (Pins 10, 11, 18 don't need to be connected)	Pins 16, 18, 20 connected (Pins 10, 11 don't need to be connected)	Pins 11, 16, 18, 20 connected (Pin 10 doesn't need to be connected)	Pins 10, 11, 16, 18, 20 connected

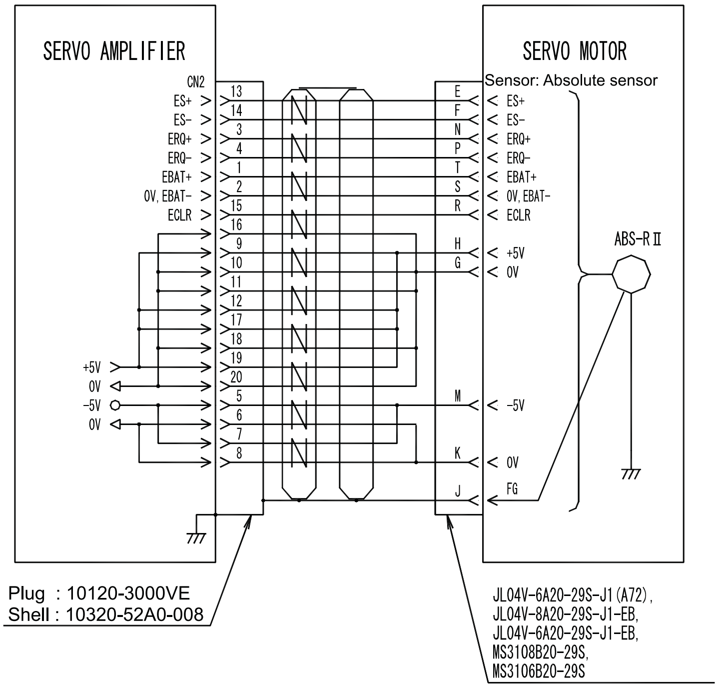
Fig. 4-5 Sensor wiring diagram (ABS-E absolute encoder)

4.3.6 Sensor wiring diagram (ABS-RII and RA062M absolute/request sensor)

Absolute/request sensor, lead wire type



Absolute/request sensor, canon plug type



Note 1) Use a twisted pair cable with external shield.

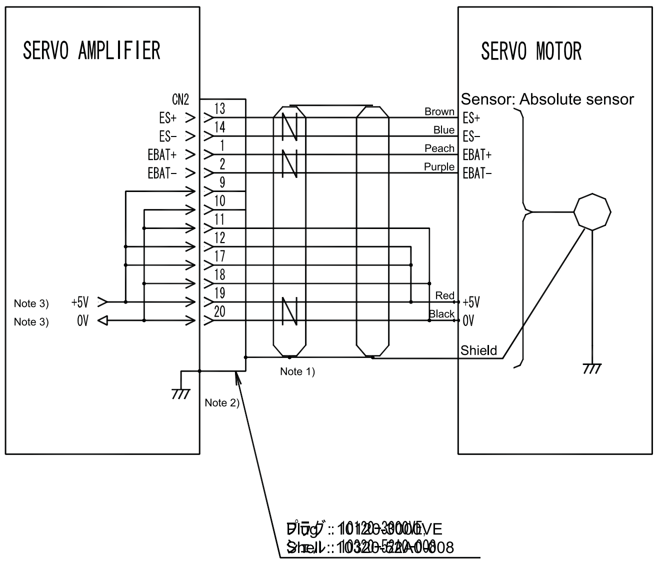
Note 2) Refer to 4.6.2 CN1, CN2 shielding method.

Note 3) +5V, 0V connections
If the sensor cable length is 5m or less, pins 11, 12, 17, 18 don't need to be connected.
If the sensor cable length is 5m~30m, all of these pins should be connected.

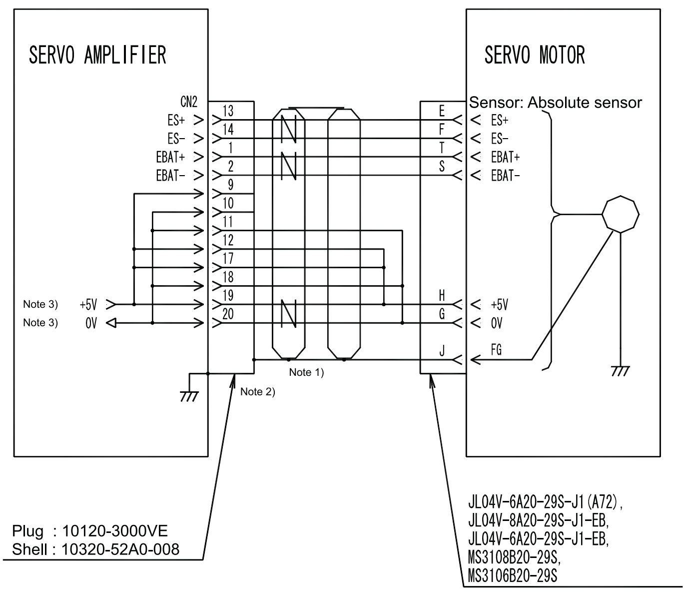
Fig. 4-6 Sensor wiring diagram (Absolute/request sensor)

4.3.7 Sensor wiring diagram (PA035C & RA062C wire-saving absolute sensors)

Wire saving absolute sensor, lead wire type



Wire saving absolute sensor, canon plug type



Note 1) Use a twisted pair cable with external shield.

Note 2) Refer to 4.6.2 CN1, CN2 shielding method.

Note 3) The sensor power connection depends on the length of the sensor cable. Refer to the table below.

Note 4) For the RA062C, there is no need to connect EBAT+ and EBAT-.

Sensor cable length	10m or less	25m or less	40m or less
+5V connection	Pin 19 connected (Pins 12, 17 don't need to be connected)	Pins 17, 19 connected (Pin 12 doesn't need to be connected)	Pins 12, 17, 19 connected
0V connection	Pin 20 connected (Pins 11, 18 don't need to be connected)	Pins 18, 20 connected (Pin 11 doesn't need to be connected)	Pins 11, 18, 20 connected

Fig. 4-7 Sensor wiring diagram (wire-saving absolute sensor)

4.4 Connector terminal layout, I/O signal diagram

4.4.1 CN1 interface connector

CN1 is the interface connector to the host controller, etc.
The connector on the amplifier side is a “10250-52A2JL” (made by Sumitomo 3M Ltd).

24	22	20	18	16	14	12	10	8	6	4	2
			Note 3	Note 5	Note 5		Note 1				Note 1
OUT-COM	T-COMP	SG	F-TLA	CONT8	CONT7	SG	$\overline{PS}$	$\overline{CO}$	$\overline{BO}$	$\overline{AO}$	BTN-1
Output seq. power common	Torque compensation input	Velocity cmd./ Torque cmd. common	Forward current limit	Generic input		Position signal output	Position signal output				Battery minus side

25	23	21	19	17	15	13	11	9	7	5	3	1
		Note 2	Note 3		Note 5	Note 5		Note 1				Note 1
OUT-COM	SG	V-REF/ T-REF	R-TLA	SG	CONT8	CONT7	ZOP	PS	CO	BO	AO	BTP-1
Output seq. power common	Torque compensation common	Velocity cmd./ Torque cmd. common	Reverse current limit	Current limit common	Generic input		Z-phase open collector output	Position Signal Output				Battery plus side

49	47	45	43	41	39	37	35	33	31	29	27
		Note 6	Note 6	Note 6	Note 6	Note 5	Note 5	Note 5			
OUT-PWR	SG	OUT7	OUT5	OUT3	OUT1	CONT1	CONT3	CONT5	SG	$\overline{R-PC}$	$\overline{F-PC}$
Output sequence power	Pulse command common	Generic Output				Generic Input			Monitor Common	Reverse Pulse Command	Forward Pulse Command

50	48	46	44	42	40	38	36	34	32	30	28	26
		Note 6	Note 6	Note 6	Note 6		Note 5	Note 5	Note 5	Note 4		
IN-COM	SG	OUT8	OUT6	OUT4	OUT2	SG	CONT2	CONT4	CONT6	MON1	R-PC	F-PC
Input sequence power	Pulse command option	Generic Output				Generic Input Common	Generic input			Monitor output	Reverse Pulse Command	Forward Pulse Command

Fig. 4-8 CN1 Connector terminal layout

Note 1. The battery connector and the position signal output PS connector can be used in connection with an absolute encoder (ABS-E) or an absolute sensor.
Note 2. Command input functions are different depending on the control mode.
Note 3. The current limit input formula can be selected.
Note 4. The signal to monitor and the output range can be selected.
Note 5. The generic input can be used to enable an internal function, and this function can be selected.
Note 6. Multiple signals for generic output can be selected.

> The picture above shows the connections on the connector side.
> There is no cable connector supplied with the servo amplifier. The user should source the connector or purchase it as optional equipment.

4.4.2 CN2 sensor connector

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

● Incremental encoder (INC-E) connector layout diagram

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

Fig. 4-9 CN2 connector (INC-E incremental encoder) layout diagram

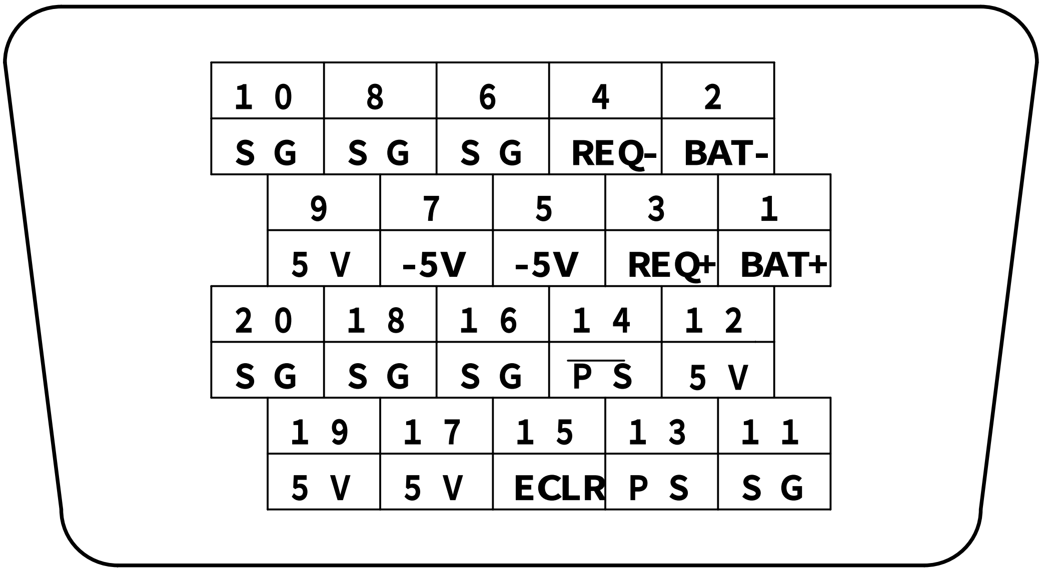
● Absolute/incremental encoder (ABS-E) connector layout diagram

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

Fig. 4-10 CN2 connector (ABS-E absolute/incremental encoder) layout diagram

4. Wiring

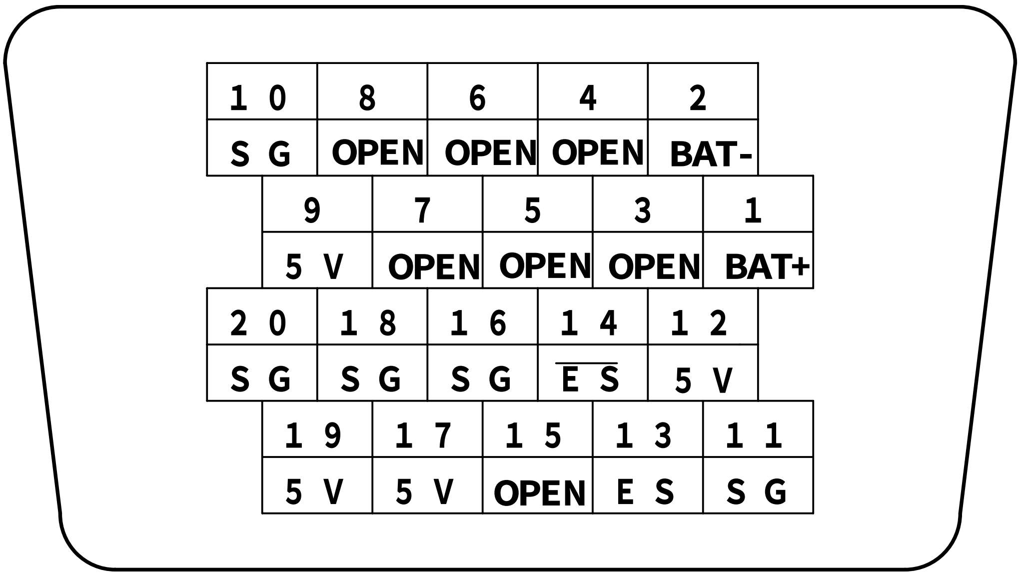
● Absolute request sensor (ABS-RII, RA062M) connector layout diagram



Note: It is not necessary to connect BAT+ and BAT- on the RA062M.

Fig. 4-11 CN2 connector (Absolute request sensor) layout diagram

● Wire saving absolute sensor（PA035C,RA062C）connector layout diagram



Note: It is not necessary to connect BAT+ and BAT- on the RA062C.

Fig. 4-12 CN2 connector (wire-saving absolute sensor) layout diagram

4.5 Wiring method

The servo amplifier is a control device processing signals under a few millivolts. Therefore, observe the following instructions when wiring:

1. Input/output signal line, sensor signal line
   Use the recommended cables or equivalent twisted pair and multi-core single shield twisted pair cables for the input/output signal line and the sensor signal line. Perform wiring with the following precautions in mind:
   - Wire using the shortest distance.
   - Separate the main circuit lines and the signal lines.
   - Do not wire the main circuit lines near the side of the amplifier.
   - If it is necessary to have an insulation distance between the main circuit wires and between the main circuit and the signal circuit wires, pole terminals with insulation sleeves should be used. (These cannot be used for AWG12.)
2. Grounding
   Abide by the following rules of grounding:
   - One-point grounding using 2.0mm^2 diameter wire.
   - Use D-type (Class 3) grounding (ground resistance max. 100Ω).
   - The frame (ground terminal, ground line) of the servo motor should always be connected to the protective ground terminal (⏚) of the servo amplifier.
   - The protective ground terminal (⏚) of the servo amplifier should always be connected to the PE (Protective Earth) terminal of the control panel. Always use single-point grounding.
3. Noise protection
   Follow the instructions below to prevent malfunctions due to noise.
   - The noise filter, servo amplifier, and the host controller should be separated by a short distance.
   - Apply a surge absorber circuit to coils such as relays, electromagnetic contacts, induction motors and brake solenoids, etc.
   - Do not pass the main circuit lines and the signal lines through the same wire conduit; do not overlap them in any way.
   - If there are large noise sources such as electric welding machines or electric discharge machines nearby, apply a noise filter for the power line and the input circuit.
   - Do not bundle the primary and secondary wiring of the noise filter together.
   - Do not use a long grounding line.
4. RF interference countermeasures
   The servo amplifier is an industrial machine; therefore it does not include RF interference countermeasures. If RF interference is a problem, insert a line filter to the power line input.
5. EMC conformity
   Refer to Section 12 regarding EMC conformity.

4.6 Wiring precautions

Observe the following precautions when wiring:

1. Noise processing

   The main circuit of the servo amplifier uses the IPM for the PWM control. Incorrect grounding can cause switching noise, due to di/dt and dv/dt during IPM switching. Since the servo amplifier contains electric circuits such as a CPU, it is extremely important to prevent the penetration of external noise by wiring or other means.

   Correct wiring and grounding is required for noise protection. The servo amplifier power noise tolerance (normal, common noise) is 1500V, 1μsec, within 30 minutes. Do not perform noise testing longer than 30 minutes.

2. Motor frame grounding

   If the servo amplifier is grounded via the frame, then Cf x dv/dt current flows from the power part of the servo amplifier through the motor floating capacitance (Cf). In order to protect against this current, always connect the motor ground terminal (motor frame) to the protective ground terminal (⏚) of the servo amplifier. Connect the servo amplifier protective ground terminal (⏚) directly to ground.

3. Grounding of the wiring

   If the motor is wired to a metal conduit or metal box, the metal must be grounded. Use single-point grounding.

4. Faulty wiring

   Take care to ensure that all wiring is correct, as faulty wiring can cause damage to the device.

5. Leakage current

   A slight leakage current on the input power line will occur, even if the motor frame is grounded according to the instructions. If you use a leakage current detector-type breaker, refer to the "Servo amplifier motor leakage current" section of the specifications, and make sure it is not oversensitive to high frequency leakage current.

6. Power surge protection

   If there are surges on the power line, use the product only after connecting a surge protector between the power source and the device.

7. Lightning surge

   If there is a possibility that the servo amplifier is subject to lightning surges in excess of 2KV, insert a lightning surge protector to the control board input. The following products (below) are recommended for lightning surge protection at the servo amplifier input.

4.6.1 Suggested surge protector

You can directly request the following items from the manufacturer, or buy them as optional equipment through your dealer or sales office.

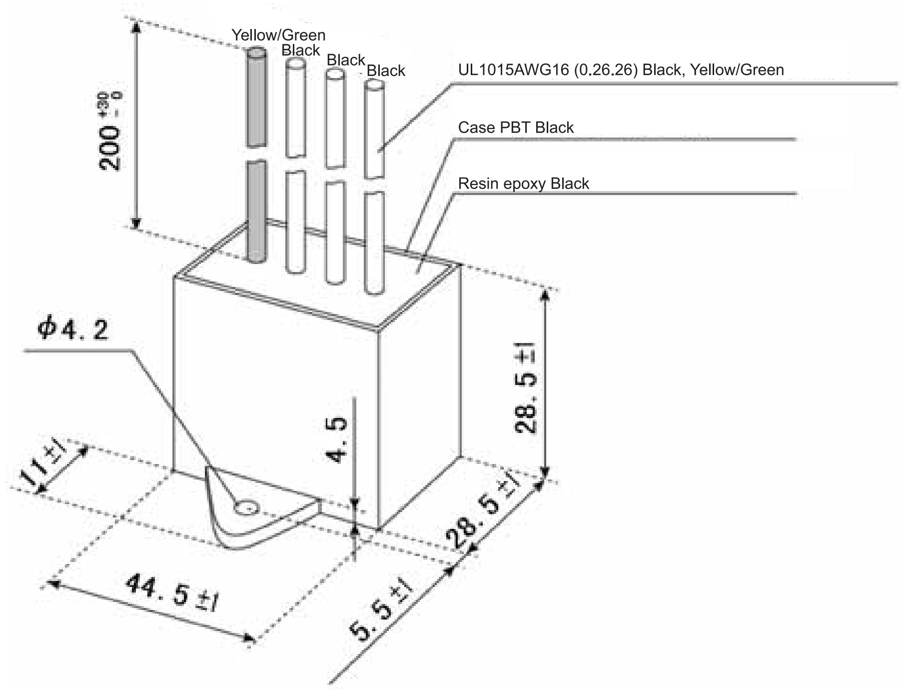
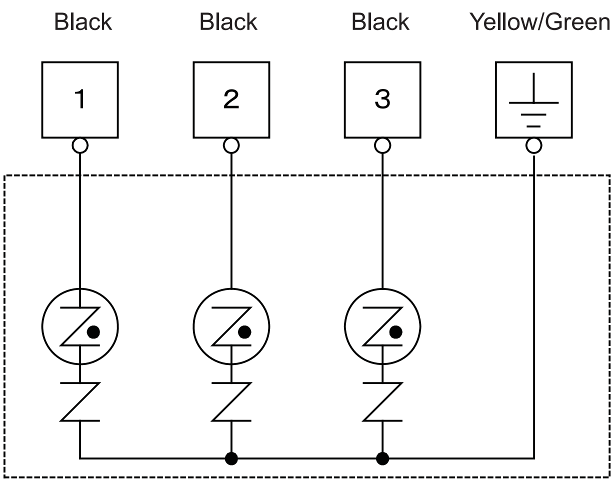
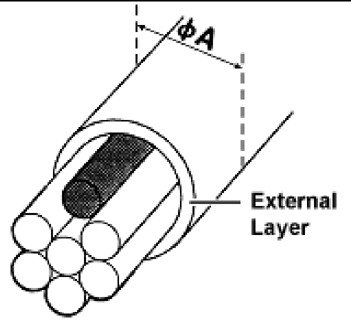
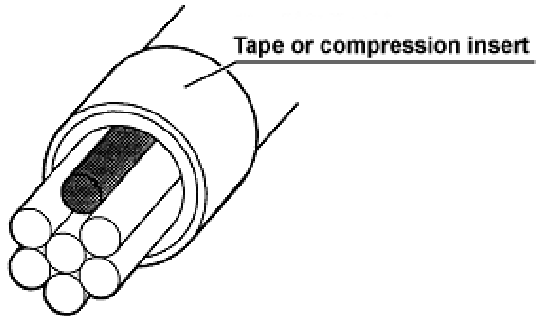
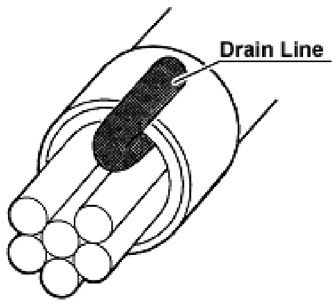
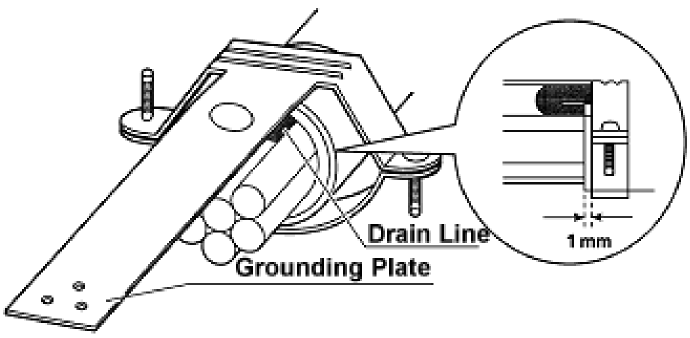
Item	Specifications
Product model number (Manufacturer)	RAV-781BXZ-2A Okaya Electric Industries Co., Ltd.
Dimensions	 Unit: mm
Maximum circuit voltage	300 Vrms
Clamp voltage	783V±10%
Surge withstand	2500 A (Waveform) 8 x 20 μs
Surge withstand	20 KV (Waveform) 1.2 x 50 μs
Wiring diagram	
Weight	Approx. 100 g

Fig. 4-13 Recommended surge protector

4.6.2 CN1, CN2 shielding method

The following diagram shows the shielding on the CN1 and CN2 connectors.
There are two shielding methods: by using a clamp, or by soldering.

● **Using a clamp**

1		Remove the external layer of the cable.
2		Attach a tape or a compression insert. The tape or compression insert must be on top of the external layer of the cable.
3		Fold back the drain line.
4		Tighten the cable clamp from the top of the drain line. Attach it about 1 mm from the tape or the compression insert.

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

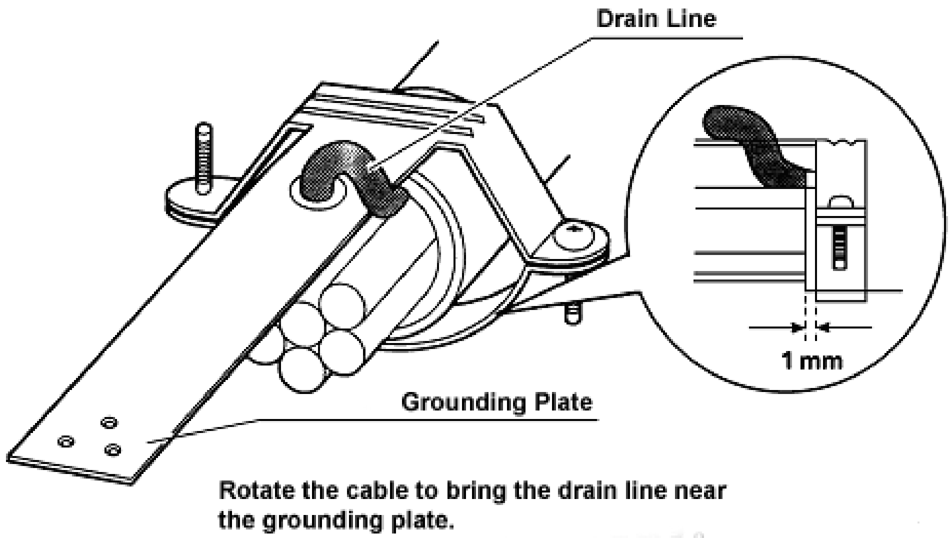
Fig. 4-14 CN1 and CN2 shielding (a)

4. Wiring

● **Soldering**

Item 2 is identical to using a clamp.

1



2

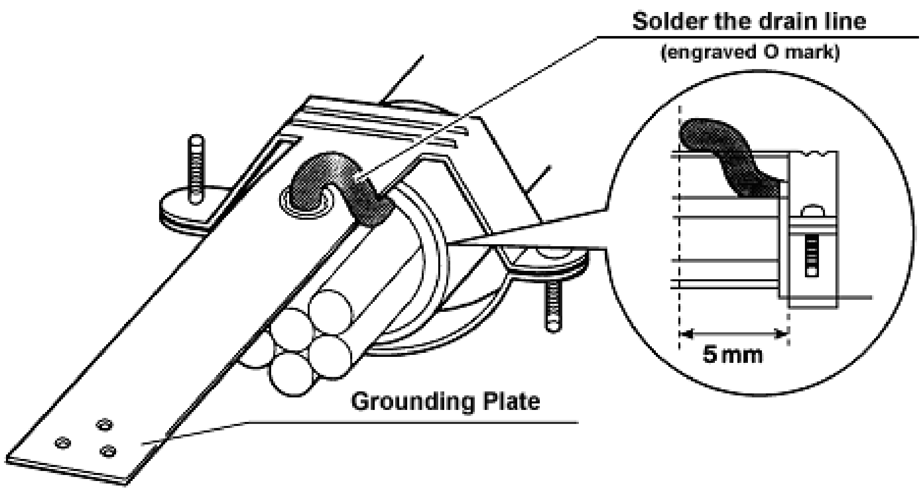


Fig. 4-15 CN1 and CN2 shielding (b)

● **CN2 proper ØA dimensions**

The following table shows the appropriate ØA dimensions for CN1 and CN2. If the dimensions are within the proper ØA dimensions, the compression insert is unnecessary.

Table 4-3 CN1 and CN2 proper ØA dimensions

Connector No.	Proper ØA dimensions	Connector model name	Manufacturer
CN1	15.0~16.5 mm	10150-3000VE 10350-52A0-008	Sumitomo 3M Ltd.
CN2	10.5~12.0 mm	10120-3000VE 10320-52A0-008	Sumitomo 3M Ltd.

4.6.3 CN2 compression insert application example

The following table lists the suggested compression inserts for the CN2.

Table 4-4 CN2 compression inserts

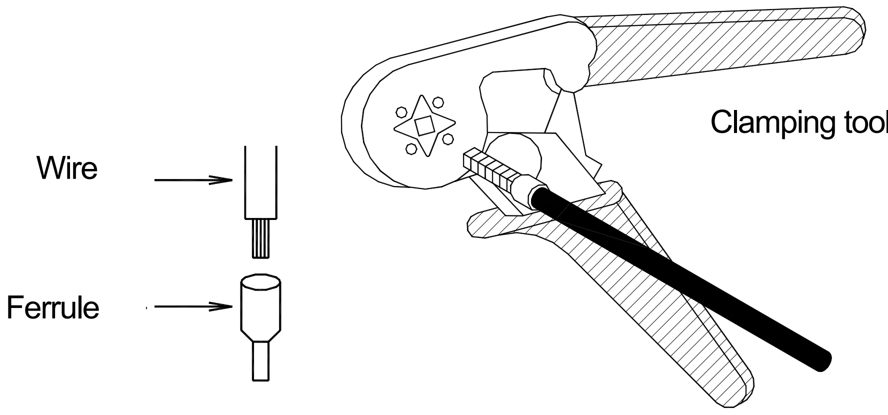
Compression insert product number	Appropriate cable outer diameter (ØA)	Manufacturer
10607-C058 10607-C068 10607-C078 10607-C088 10607-C098	Ø4.0~5.0 mm Ø5.0~6.0 mm Ø6.0~7.0 mm Ø7.0~8.0 mm Ø8.0~9.0 mm	Sumitomo 3M Ltd.

1. The above-listed inserts fit the CN2 connector.
2. Consult with the manufacturer directly or contact our office for purchasing information.
   The manufacturer's home page address is http://www.mmm.co.jp .

4.6.4 How to plug the wire of CNA～CNC

1. Put the electrical wire into the ferrule and clamp with a special tool.
2. Push the end of the ferrule all the way in the connector and cramp with a special slotted screw driver.
   In addition, recommended tightening torque is 0.5 to 0.6 Nm.

1



Recommended ferrules for wire sizes and model numbers of clamping tools are as follows (made by Phoenix Contact Co. Lit.)

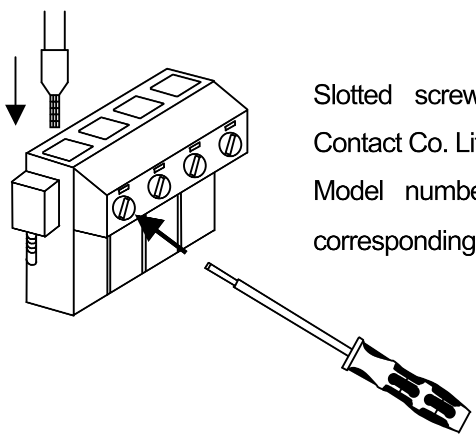
Recommended ferrule model numbers

mm^2	AWG	Model number		
		1Pcs/Pkt	1000Pcs/Pkt	Taping
0.75 mm^2	18	AI0.75-8GY	AI0.75-8GY-1000	AI0.75-8GY-B (1000Pcs/Pkt)
1.0 mm^2	18	AI1-8RD	AI1-8RD-1000	AI1-8RD-B (1000Pcs/Pkt)
1.5 mm^2	16	AI1.5-8BK	AI1.5-8BK-1000	AI1.5-8BK-B (1000Pcs/Pkt)
2.5 mm^2	14	AI2.5-8BU	AI2.5-8BU-1000	AI2.5-8BU-B (500Pcs/Pkt)

注） GY : Gray, RD : Red, BK : Black, BU : Blue

Clamping tool model numbers：CRIMPFOX UD 6-4 for 0.25mm^2～6mm^2、CRIMPFOX UD 10-4 for 0.75mm^2～10mm^2

2



Slotted screwdriver（made by Phoenix Contact Co. Lit.）

Model number：SZS0.6 × 3.5）or the corresponding item

4.7 Wiring method of full close control (Option)

Please take great care of the following description.

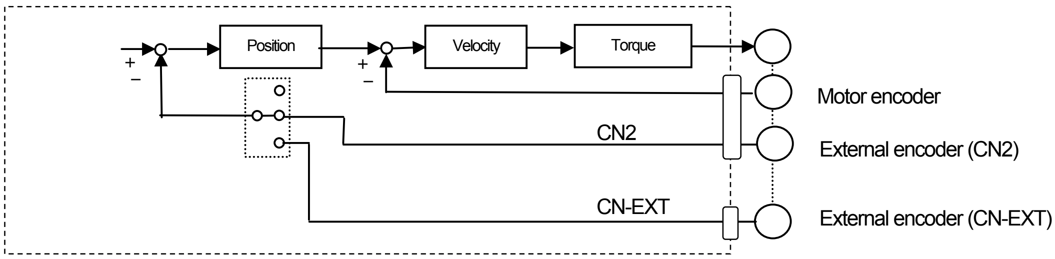
4.7.1 Full close control

Full close control makes it possible to obtain the position of the machinery correctly by getting the feedback signal of position loop from the external encoder and conduct positioning control of great precision.

Take a look at the diagram below.

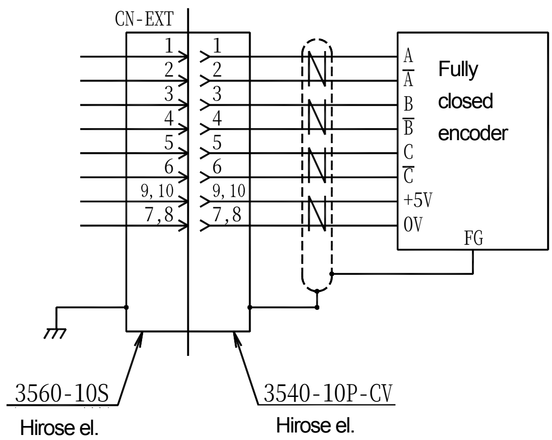
External encoder signal can be caught from CN2 only when the motor encoder is a wire-saving absolute sensor.

Full close control



4.7.2 Sensor connection diagram

Servo amplifier outside dimension of full close control is the same shape as the standard type. Connector CN-EXT is added to the lower part of the amplifier in the case of 15, 30, 50A and to the front part of it in the case of 100, 150, 300A. Moreover, connector CN-EXT is our model number : AL-Y0000845-01(option).



Use shield jacket cable at twisted pair wire.

Note 1) Maximum input frequency of external encoder signal into the amplifier 5MHz.

Note2) If +5V, 0V output from CN-EXT is connected to earthing or with short circuit or reversely, it does cause burnt damage to the amplifier. So connect with great care. External electric power is recommened to be used. Power specifications are +5V +10%, -0%, below 250mA.

Note 3) Please use 3540-10P-CV manufactured by Hirose Electric Works, Ltd. for connector CN-EXT. If you make a mistake in building up, it most likely leads to reverse connection.

Note 4) In the case of the standard setting (PA 401 lower setting: OH), wire so that the relation of A/B phases of external encoder signal is the same as 10-9 section like motor encoder.

4.7.3 Parameters

• Full close setting

System parameter page 09	Position loop control encoder selection

Selection	Explanation
01:_Ext-ENC(CN2)	Full close control／External encoder（CN2 input signal）
02:_Ext-ENC(CN-EXT)	Full close control／External encoder（CN－EXT input signal）

Full close is set at“02:_Ext-ENC(CN-EXT)”when it is shipped .

• External encoder resolution setting

System parameter page 0A	External encoder resolution

Pulse numbers converted to one rotary of motor axis is setup.

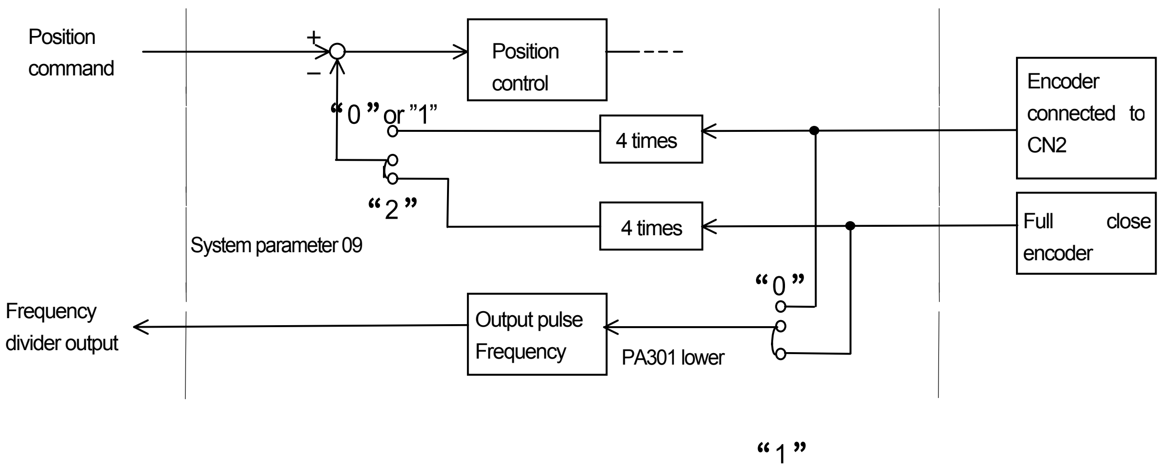
• Frequency divider setting

Encoder pulse frequency divider output can be selected from both motor encoder and external encoder.

Parameter group 3 page 01	Lower：Encoder pulse frequency divider output switchover

Selection		Explanation
0H	Motor encoder	Motor encoder signal connected to CN2 • External encoder signal
1H	Full close encoder	External encoder signal connected to CN-EXT

Full close control is set at“1”when it is shipped.　Frequency divider ratio is set at ENRAT of group 1, page06 like the standard.



4.7.4 Connector for connecting to CN-EXT sensor

Connector at the side of an amplifier is ”3560-10S”（manufactured by Hirose Electric Works Ltd. ）

2	4	6	8	10
A-	B-	C-	5G	+5V
1	3	5	7	9
A	B	C	5G	+5V

CN-EXT connector (external encoder) terminal diagram

Full close control used in CN2 is as follows.

10	8	6	4	2
SG	C-	B-	A-	BAT-
9	7	5	3	1
+5V	C+	B+	A+	BAT+
20	18	16	14	12
SG	SG	SG	ES-	+5V
19	17	15	13	11
+5V	+5V	−	ES+	SG

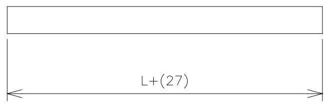
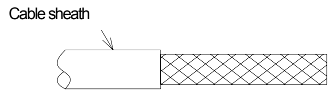
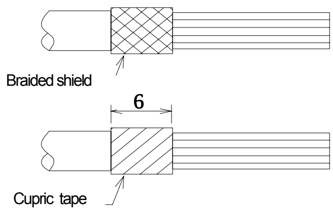
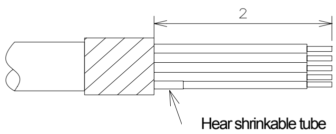
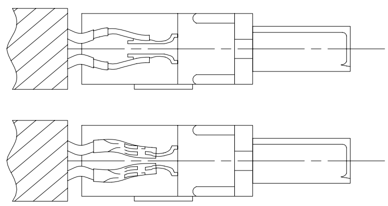
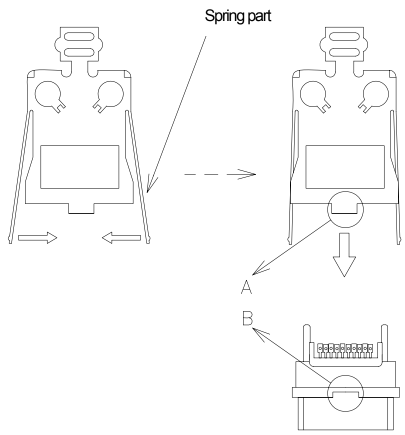
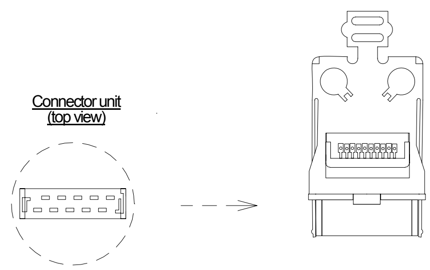
Note）Shaded region in the diagram is for motor encoder signal.

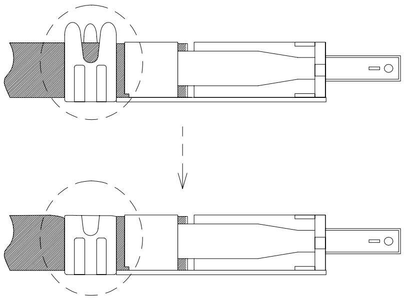
4.7.5 CN-EXT connection procedures

Connecting procedures for CN-EXT connector is shown in the figure.

Object product: 3540-10P-CV（manufactured by Hirose Electric Works Ltd.）

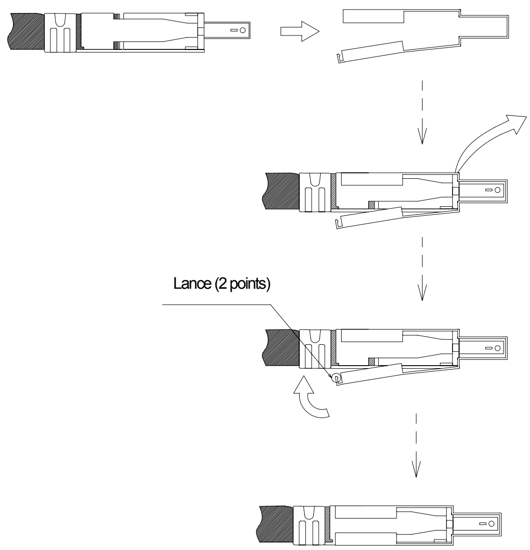
Connector body 1, Ground shell 1, Lock spring 1, Cover A 1, Cover B 1, Screw 2

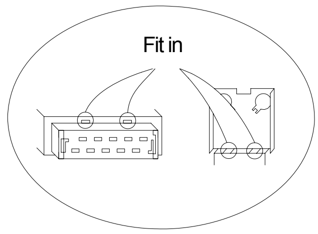
Connecting procedure	Works	
1. Cable cutting		Cut the specified cable into the predefined length (L+27). （Extra 27mm of harness is needed in the connector.）
2. Cable direction		Strip the cable sheath by 20mm.
3. Shield braiding		Fold back braided shield and cut it into 6mm. Stick cupric tape (width 6mm) on it outside the cable by 1.5 turns.
4. Signal wire coating peeling and heat shrinkable tube		Peel about 2mm of signal wire terminal coating and let heat shrinkable tube (about3mm) through the signal wire.
5. Solder connection		Connect to the connector unit terminal by soldering according to the prescribed wiring method. Move the heat shrinkable tube to the side of connector unit and make it shrink after soldering. Soldering conditions Recommended temperature：280～350℃、 Recommended time: below 4sec. Recommended trowel capacity：15～30W
6. Lock spring slot in		Push the spring part of a lock spring to the direction of the arrow into the hole of the connector unit. Make sure to attach convexity A to concavity B. 

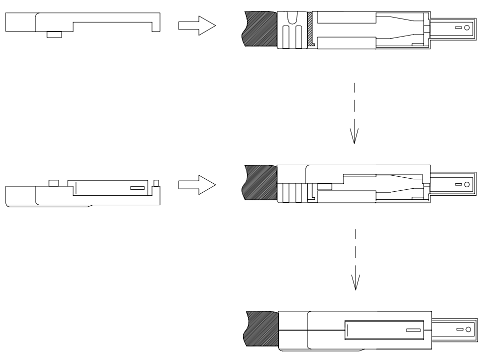
<table>
<tr><th>Connecting procedure</th><th>Works</th></tr>
<tr><td>7. Cable clamp</td><td>


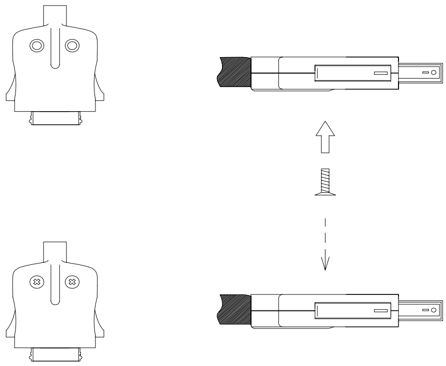
Fasten the cable clamp of lock spring with the specified harness tool. Make sure recommended cable clamp power is over 80.0N.

<table>
<tr><th>Product</th><th>Harness tool</th></tr>
<tr><td>3540-10P-CV</td><td>3530-10/CA-MP(01)</td></tr>
</table>

AWG28（7/0.127） UL20276
Cable external diameter5.0 C/H4.9±0.1
</td></tr>
<tr><td>8. Ground shell slot in</td><td>




Slot ground shell in connector unit. Make sure the hole of a connector unit is fit to the click of a ground shell like the magnified figure.
Make sure to see if the lance of a ground shell is surely slotted.
</td></tr>
<tr><td>9. Cover case slot</td><td>


Slot cover case into the connector. Make sure to see if the projection of a cover case is surely inserted into the hole of a ground shell.
Conform the shape of a projection and that of a hole.
</td></tr>
<tr><td>10. Screw on</td><td>


Screw on the connector.
Wear tapping screw with a driver at torque 0.14～0.18N・m
</td></tr>
</table>

Installation

5. Installation (Servo amplifier)

5.1 Servo amplifier installation

Please note the following points regarding the servo amplifier installation location and mounting method.

5.1 Installation location

Install the servo amplifier in compliance with the following precautions:

Issue	Precautions
Various precautions	● The device should be installed on non-flammable surfaces only. Installation on or near flammable materials can cause fire. ● Do not stand, put or drop heavy items on the servo amplifier. ● Operate the device within the specified environmental conditions. ● Make sure no screws or other conductive or flammable materials get inside the servo amplifier. ● Do not drop the device or subject it to excessive shock. ● Do not install or operate a damaged device, or one with damaged parts; return it for repair. ● Contact your distributor or sales office if the servo amplifier was stored or out of use for an extended period of time.
If enclosed in a cabinet	● The temperature inside the cabinet can exceed the external temperature depending on the power consumption of the device and the size of the cabinet. Consider the cabinet size, cooling, and placement, and make sure the temperature around the servo amplifier does not exceed 55°C. For longevity and reliability purposes it is recommended to keep the temperature below 40°C.
If there is a vibration source nearby	● Protect the servo amplifier from vibration by installing it on a base with a shock absorber.
If there is a heat generator nearby	● If the ambient temperature may increase due to convection or radiation, make sure the temperature near the servo amplifier does not exceed 55°C.
If corrosive gas is present	● Long-term use may cause contact failure on the connectors and connecting parts. Never use the device where it may be exposed to corrosive gas.
If explosive or combustible gas is present	● Never use the device where explosive or combustible gas is present. The device’s relays and contacts, regenerative resistors and other parts can arc (spark) and can cause fire or explosion.
If dust or oil mist is present	● The device cannot be used where dust or oil mist is present. If dust or oil mist accumulates on the device, it can cause insulation deterioration or leakage between the conductive parts, and damage the servo amplifier.
If a large noise source is present	● If inductive noise enters the input signals or the power circuit, it can cause a malfunction. If there is a possibility of noise, inspect the line wiring and take appropriate noise prevention measures. A noise filter should be installed to protect the servo amplifier.

5.1.2 Mounting method

● Mounting direction and location

① Mount the servo amplifier standing upright as shown in Fig. 5-1.

② Refer to Section 10 (Options) regarding the front and back panel mounting hardware (PY2 mounting compatible).

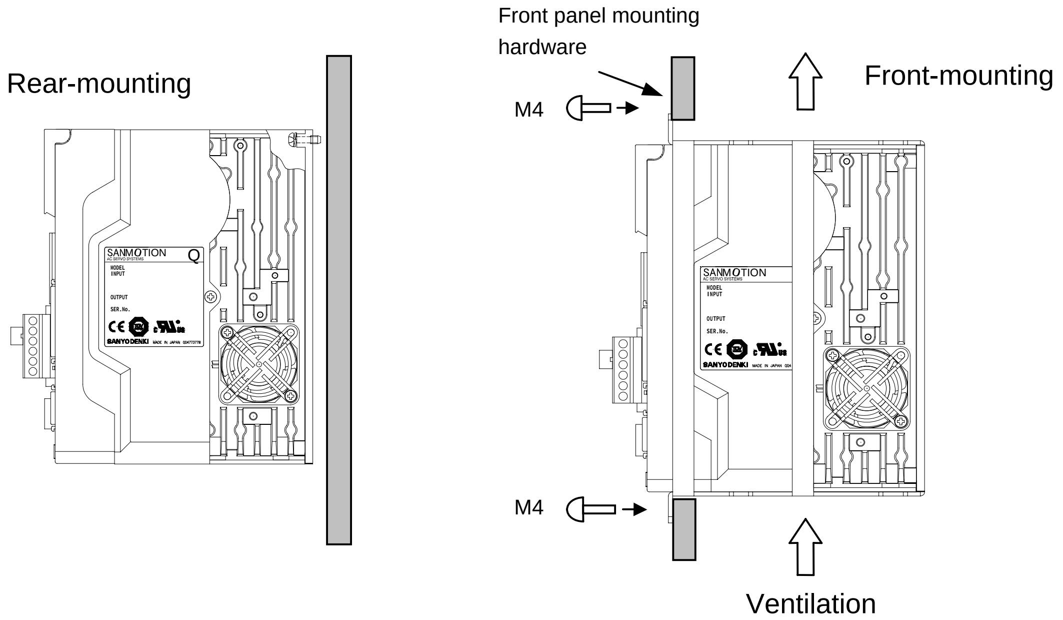


Fig. 5-1 Servo amplifier mounting

● Arrangement within the machine

① Leave at least 50 mm space above and below the servo amplifier to ensure unobstructed airflow from the inside of the servo amplifier and the radiator. If heat gets trapped above the servo amplifier, use a fan to create airflow.

② Leave at least 10 mm space on both sides of the servo amplifier to ensure unobstructed airflow from the heat-sinks on the side and from the inside of the servo amplifier.

③ If the Q-series servo amplifier is installed on its side, make sure that the ambient temperature does not exceed 50°C, and mount the back panel to a metal plate at least 2mm thick.

④ Both the QS1 03 and QS1 05 have a fan attached to the side panel; therefore it is recommended to mount it in the configuration shown in Fig. 5-2.

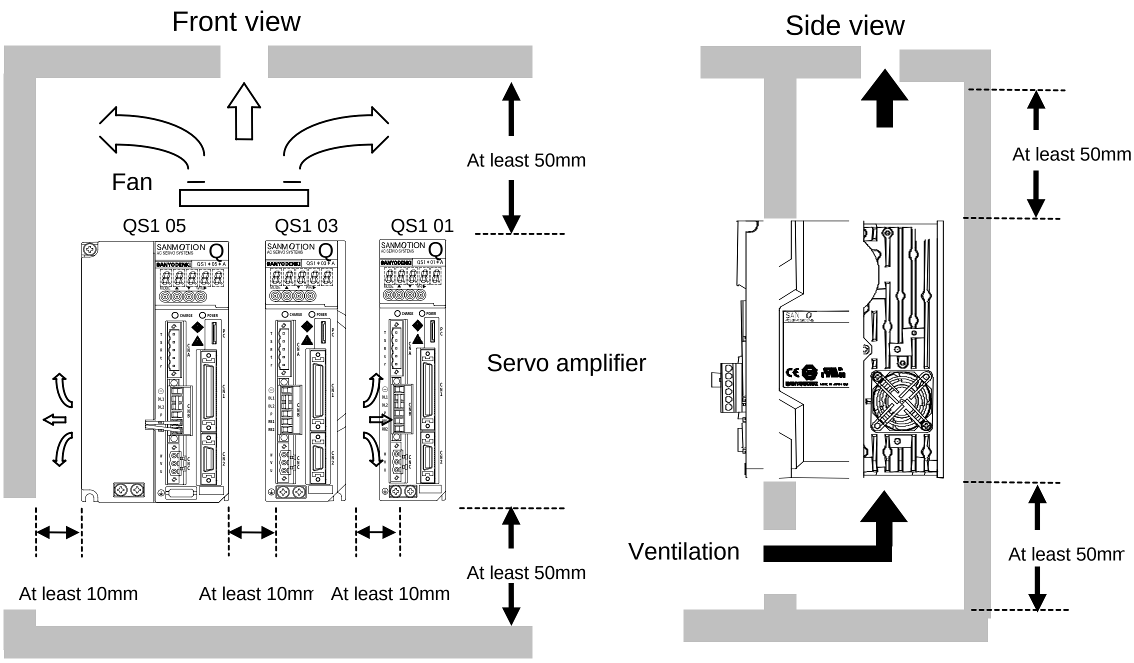


Fig 5-2 Arrangement within the machine

5.2 Servo motor installation

The servo motor is designed for indoor use.
Please note the following regarding the installation location and mounting method for the servo motor.

5.2.1 Installation location

Install the servo motor indoors, within the following environmental conditions:

① Ambient temperature: 0 to 40°C

② Storage temperature: -20 to 65°C

③ Ambient humidity: 20 to 90%

④ Good ventilation, no corrosive or explosive gases present.

⑤ No dust or dirt accumulation in the environment.

⑥ Easy access for inspection and cleaning.

⑦ Do not use the device in locations where the oil seal lip is continuously exposed to oil, or where the device is exposed to large quantities of water, oil drops, or cutting fluid. The motor is designed to withstand only small amounts of moisture spray.

5.2.2 Mounting method

Please note the following points regarding the installation location and mounting method:

① Mounting in several orientations - horizontal, or with the shaft on top or bottom- is acceptable.

② If the output shaft is used in reduction devices that use grease, oil, or other lubricants, or in mechanisms exposed to liquids, the motor should be installed in a perfectly horizontal or downward position. In some models, there is an oil-seal attached to the output shaft. If the shaft is facing upwards and the seal lip is continuously exposed to oil, oil can enter inside the motor and cause damage, as a result of wear and degradation of the oil seal. In such cases an oil-seal should be used on the load-side as well. Contact your distributor or sales office if the device is to be used in such conditions.

③ The motor connector and cable outlet should be installed facing downwards, as nearly vertical as possible.

④ In vertical installation, create a cable trap to prevent oily water from getting into the motor.

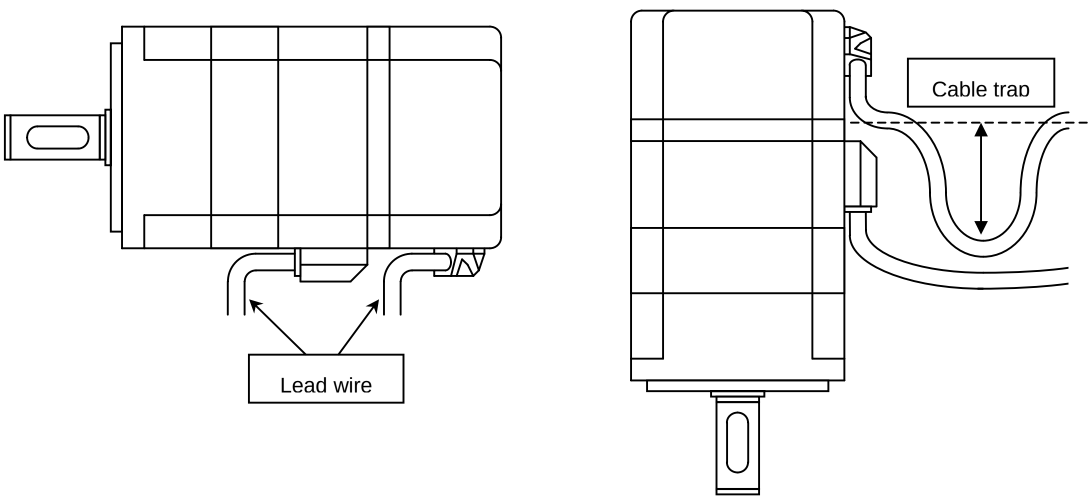


Fig. 5-3 Motor mounting direction

5.2.3 Waterproofing and dust proofing

① The protection inside the motor conforms to IEC standards (IEC34-5). However, such protection is suitable only for short-term use. For regular use, additional sealing measures are required. Be sure to handle the connector carefully, as damage to the exterior of the connector (painted surface) can reduce its waterproofing capability.

② The motor waterproofing is of IPX 7 class level, but still requires careful handling. If the motor is continuously wet, due to the respiratory effect of the motor, liquid may penetrate inside the motor.

③ Install a protective cover to prevent corrosion of the coating and the seal material, which can be caused by certain types of coolants (especially water soluble types).

④ Q1- and Q2-series motors with canon plugs are only IP67 rated if waterproof connectors and/or conduits are used on the matching canon connectors.

⑤ Q1-series motors (with all flange sizes) and Q2-series motors (with the 42mm flange size) are IP40 rated, but IP67 rated waterproofing is also available as an option. Q2-series motors with flange sizes of 54mm, 76mm and 86mm have IP67 rated waterproofing.

5.2.4 Protective cover installation

① Install a protective cover (as described below) for motors continuously subjected to liquids.

② Turn the connectors (lead outlets) downwards within the angle range shown in the picture below.

③ Install the cover on the side where the water or oil would drip.

④ Install the cover at an angle (for runoff), to prevent water or oil from collecting.

⑤ Make sure that the cable does not get soaked in water or oil.

⑥ Create a sag in the cable outside the cover, to make sure water or oil does not penetrate to the motor.

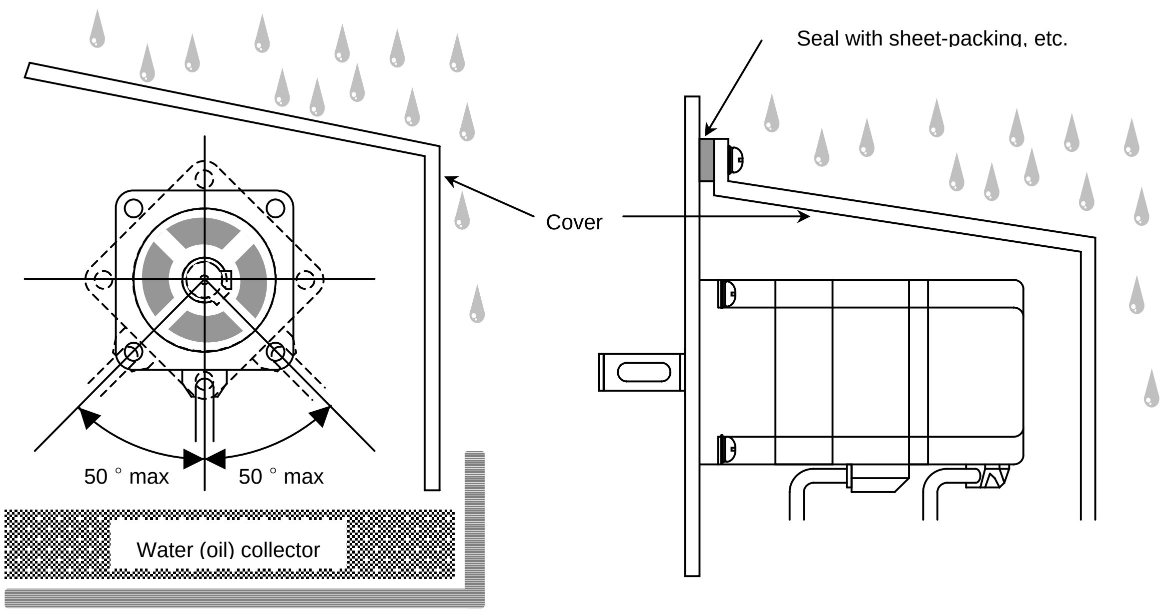


Fig. 5-4 Protective cover and motor installation angle

5. Installation (Servo motor)

⑦ If it is not possible to install the connectors (lead outlets) facing downwards, create a sag in the cable to prevent water or oil from entering the motor.

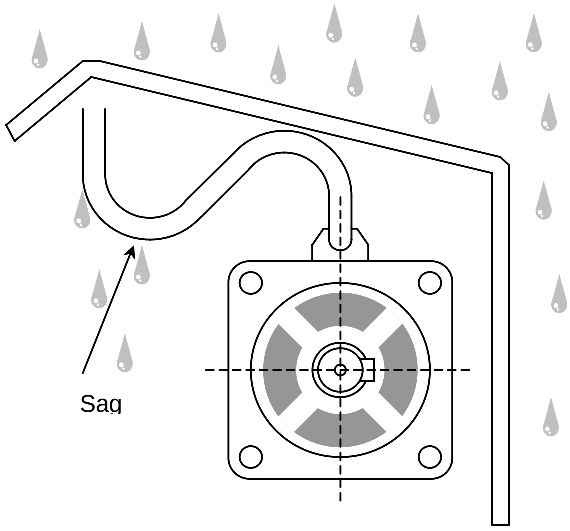


Fig. 5-5 Cable sag

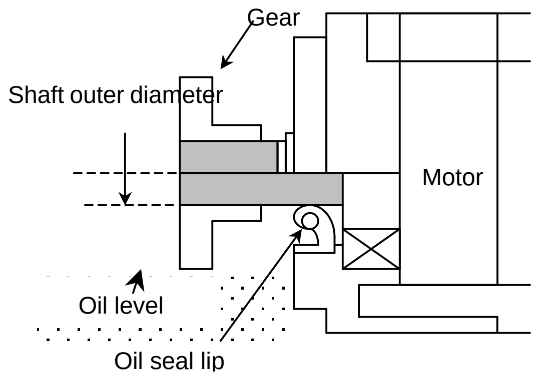


Fig. 5-6 Oil level

5.2.5 Gear installation

Install the gear based on Fig. 5-6 and the following precautions.

① The oil level of the gear box should be below the oil seal lip, for a slight spraying effect on the lip.

② Create a hole to prevent pressure build-up inside the gear box, as pressure can cause water or oil to penetrate the oil seal and enter inside the motor.

③ If the motor is used with the shaft facing upwards, an oil seal should be used on the opposite side of the mechanism as well. In addition, install a drain to expel the water or oil that may penetrate through this oil seal.

5.2.6 Integration with the target machinery

① Use Fig, 5-7 as a reference for correct centering of the motor shaft and the target machinery. Please note when using a rigid coupling that even a slight mistake in centering can damage the output shaft.

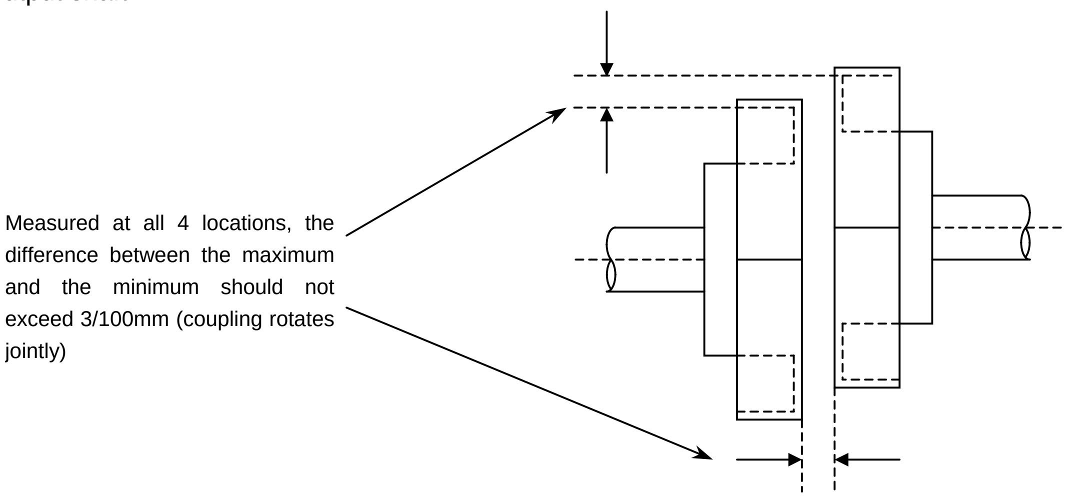
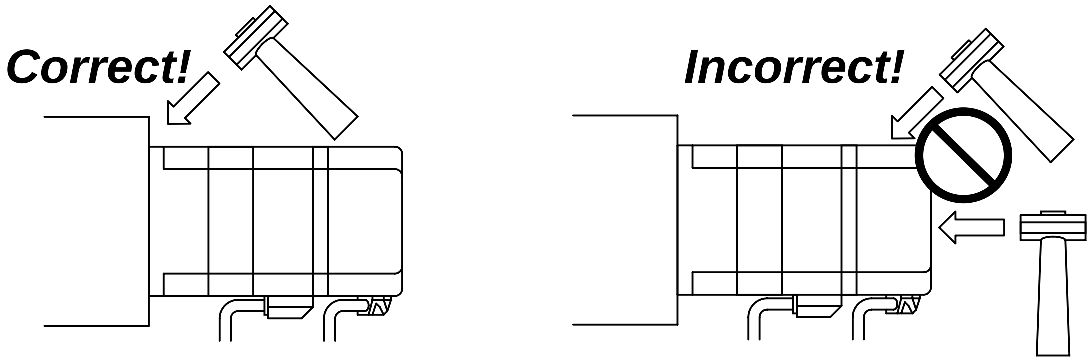


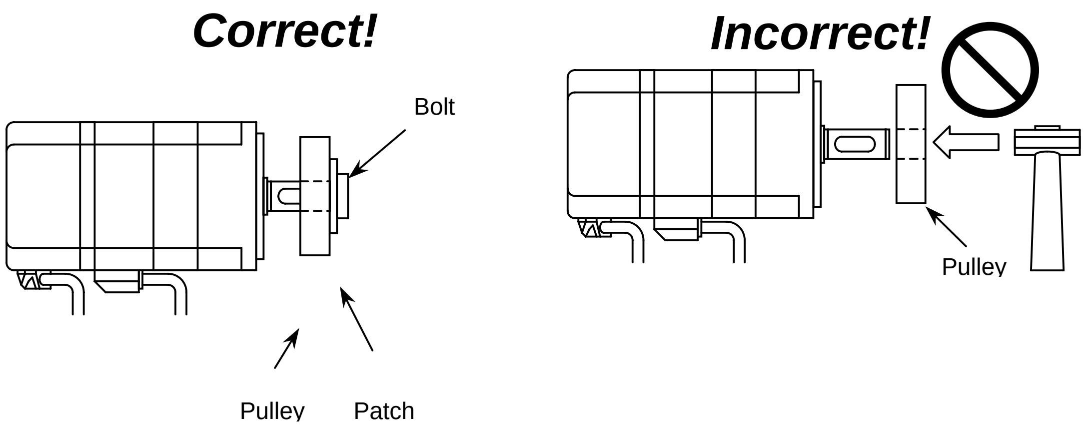
Fig. 5-7 Centering

② Do not subject the motor shaft to shock, as the precision encoder is directly connected to it. If it is absolutely necessary to hit the motor for position adjustment or other reasons, use a rubber or plastic hammer and hit the front flange area.



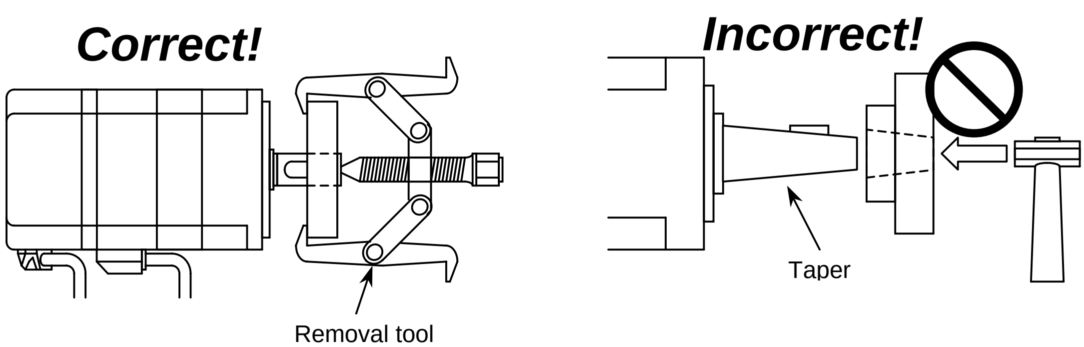
③ If mounting to a machine, create enough mounting holes for smooth coupling of the motor flange rabbet. The mounting surface should be flat, otherwise damage to the shaft or the load may occur.

④ Use the screw at the end of the shaft for installing parts such as the gear, pulley, or coupling, to avoid shock.



⑤ Tapered motor shafts transmit the torque via the tapered surface. Make sure the key fits without rattling. The tapered surface contact should be no less than 70%.

⑥ Use a special tool for removing the gear, pulley, etc.



⑦ If a belt-drive is used, verify that the gear reduction value of the belt tension does not exceed the tolerance values listed in Table 5.1.

5.2.7 Allowable bearing load

① Table 5-1 shows the allowable bearing load of the servo motors. Maximum thrust load and radial load values should not be exceeded.
The thrust load and radial load tolerance values assume individual application to the shaft.

Table 5-1 Q-series radial load and thrust load tolerances

	Model	Assembly			Operation		
		Radial load (N)s	Thrust load (N)		Radial load (N)	Thrust load (N)	
		F_R	F direction	F1 direction	F_R	F direction	F1 direction
Q1	Q1AA04003	98	78	78	49	29	29
	Q1AA04005	150	98	98	98	29	29
	Q1AA04010	150	98	98	98	29	29
	Q1AA06020	390	200	200	200	78	78
	Q1AA06040	390	200	200	250	98	98
	Q1AA07075	590	390	390	340	200	200
	Q1AA10100	980	290	290	690	200	200
	Q1AA10150	980	290	290	690	200	200
	Q1AA10200	980	290	290	690	200	200
	Q1AA10250	980	290	290	690	200	200
	Q1AA12100	980	290	290	690	290	290
	Q1AA12200	980	290	290	690	290	290
	Q1AA12300	980	290	290	690	290	290
	Q1AA13300	2000	390	390	980	390	390
	Q1AA13400	2000	390	390	1200	390	390
	Q1AA13500	2000	390	390	1200	390	390
	Q1AA18450	2300	1900	1900	1500	490	490
Q2	Q2AA04006	150	98	98	98	29	29
	Q2AA04010	150	98	98	98	29	29
	Q2AA05005	200	200	150	150	78	78
	Q2AA05010	200	200	150	150	78	78
	Q2AA05020	250	200	150	200	78	78
	Q2AA07020	250	490	200	200	98	98
	Q2AA07030	250	490	200	200	98	98
	Q2AA07040	250	490	200	250	98	98
	Q2AA07050	250	490	200	250	98	98
	Q2AA08050	590	780	290	340	200	200
	Q2AA08075	590	780	290	340	200	200
	Q2AA08100	590	780	290	340	200	200
	Q2AA10100	980	290	290	690	200	200
	Q2AA10150	980	290	290	690	200	200
	Q2AA13050	1700	1300	1300	490	290	290
	Q2AA13100	1700	1300	1300	690	290	290
	Q2AA13150	1700	1300	1300	690	290	290
	Q2AA13200	1700	1300	1300	690	290	290
	Q2AA18200	2300	1900	1900	1500	490	490
	Q2AA18350	2300	1900	1900	1500	490	490
	Q2AA18450	2300	1900	1900	1500	490	490
	Q2AA18550	3900	2000	2000	1800	590	590
	Q2AA22250	2300	1900	1900	930	490	490
	Q2AA22350	2300	1900	1900	1500	490	490
	Q2AA22450	2300	1900	1900	1500	490	490
	Q2AA22550	3900	2000	2000	1800	590	590
	Q2AA22700	3900	2000	2000	2500	1100	1100

・The radial load tolerance value is the maximum load that can be applied at the point measuring 1/3 of the distance from the tip of the output shaft.
(Refer to Fig. 5-8.)

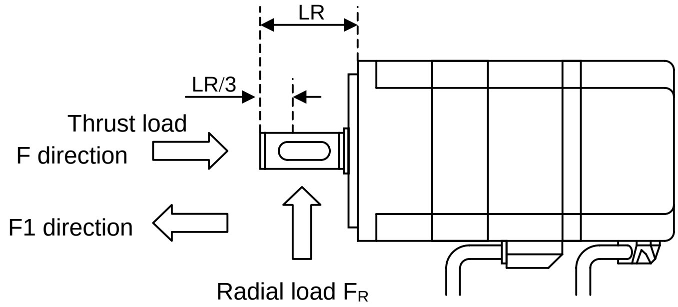


Fig. 5-8 Radial load position

5.2.8 Cable installation considerations

① Make sure that no stress is applied to the cable and that it is undamaged.

② If the servo motor is installed in a moving location, make sure that no excessive stress is applied to the cable, by allowing a large bending radius.

③ Avoid pulling the cable over sharp objects such as cutting scrap that can damage its exterior. Make sure the cable is not touching any machinery, and that it is out of the path of people and machines.

④ Prevent bending or additional weight stress on the cable connection by clamping the cable to the machinery.

⑤ In applications where the motor or the cable is moving using a cable bear, the bending radius should be based on the required cable-life and the type of cable used.

⑥ Install the cables of moving parts in a manner that permits easy regular replacement. Consult with your distributor or sales office for recommendations, if you use cables for moving parts.

Operation and Functions

This section explains parameter settings to enable test runs and various functions.

6. Operation and Functions

6.1 Parameter configuration

The servo amplifier has various parameters for setting functions, adjustments and characteristics. This section explains the required settings and the use of each function.　Refer to the Parameter Quick Reference List in 8.2 of Section 8.

6.1 Parameter configuration and tools

● There are three major types of parameters.

- 【Generic parameters】・【System parameters】・【Motor parameters】
- 【Generic parameters】are divided into 11 groups【Group 0~A】.

Type	Group	Description	Reset power to set?*
Generic parameters	Group0	Control-related parameter setting values	Not necessary
	Group1	Function-related parameter setting values	Not necessary
	Group2	Control-related parameter setting values	Not necessary
	Group3	Function setting parameters 1	Not necessary
	Group4	Function setting parameters 2	**Necessary**
	Group5	Motor output-related parameters	Not necessary
	Group6	Control-related parameters	Not necessary
	Group7	Function-enabling condition setting parameters 1	Not necessary
	Group8	Function-enabling condition setting parameters 2	Not necessary
	Group9	Generic output connector output condition setting parameter	Not necessary
Positioning parameters	GroupA	Positioning-related parameter setting values	**Partially necessary**
System parameters	------	Servo amplifier and servo motor specifications related parameters	**Necessary**
Motor parameters	------	Parameter to select the combined servo motor	**Necessary**

*Reset power to set?: Parameters marked “Necessary” require the unit to be powered off and on again for any changes to take effect.

● Parameters can be modified or edited using the “Q-setup Setup Software” and the “Digital Operator” on the front panel of the servo amplifier.

“Q-setup Setup Software”

“Digital Operator”

● Parameters can be saved and downloaded.

- Parameter settings can be saved into file format using the “Q-Setup Setup Software”.
- The saved parameters can be downloaded to another servo amplifier (of the QS1-series typeC).
- All three parameter types (generic, system and motor parameters) can be simultaneously downloaded, or you may select an individual parameter type (or several) for download.

For more information, refer to the “Q-Setup-Setup Software Instruction Manual M0005351* 3.18”.

● The “Q-Setup-Setup Software Instruction Manual【M0005351*】” is available on our website.
Visit **http://www.sanyodenki.co.jp/** to download the manual.

● A special cable is necessary for transmission / downloading; contact your dealer or sales office for information.

6.1.2 Parameter description table

System parameters

Page	Name	Description page
--	Amplifier capacity	6-7
--	Motor structure	6-7
--	Control power input voltage	6-7
--	Control power input type	6-7
--	Main circuit power input voltage	6-8
00	Main circuit power input type	6-8
01	Motor encoder type	6-8
02	Incremental encoder function selection	6-8
03	Incremental encoder resolution	6-8
04	Absolute encoder function selection	6-8
05	Absolute encoder resolution	6-8
06	Combined motor model number	6-7
08	Control mode	6-9
09	Position loop control/position loop encoder selection	6-9
0A	External encoder resolution	6-9
0B	Regenerative resistor selection	6-10

Generic parameters (Group0)

Page	Name	Description	Description page
00	KP1	Position loop proportional gain 1	6-23
01	TPI1	Position loop integral time constant 1	----
02	KVP1	Velocity loop proportional gain 1	6-23
03	TVI1	Velocity loop integral time constant 1	6-23
04	KP2	Position loop proportional gain 2	6-23
05	TPI2	Position loop integral time constant 2	----
06	KVP2	Velocity loop proportional gain 2	6-23
07	TVI2	Velocity loop integral time constant 2	6-23
08	JRAT1	Load inertia moment ratio 1	6-23
09	JRAT2	Load inertia moment ratio 2	6-23
0A	FFGN	Feed forward gain	6-23
0E	PCFIL	Position command filter	6-23
0F	FFFIL	Feed forward filter	6-23
10	VCFIL	Velocity command filter	6-23
11	TCNFILA	Torque command notch filter A	6-23
12	TCNFILB	Torque command notch filter B	6-23
13	TCFIL１	Torque command filter 1	6-23
14	TCFIL2	Torque command filter 2	6-23
1D	AFBK	Acceleration feedback gain	----
1E	AFBFIL	Acceleration feedback filter	----

Generic parameters (Group1)

Page	Name	Explanation	Description page
01	NEAR	Near range	6-35
07	LOWV	Low velocity setting	6-36
08	VA	Velocity attainment setting (High velocity setting)	6-36
09	VCMP	Velocity matching range	6-36
0F	SQTCLM	Sequence operation torque limit	6-27
10	BONDLY	Securing brake delay (securing delay of the securing brake)	6-28
11	BOFFDLY	Securing brake release delay (releasing delay of the securing brake)	6-28
17	TCOMP	Internal torque addition command	6-30
18	VCOMP	Internal velocity addition command	6-30
19	BONBGN	Brake operation start time	6-27
1A	ZV	Zero velocity range	----
1B	PFDDLY	Power failure detection delay	6-41
1C	OLWLV	Overload warning level	6-42
1D	OFWLV	Over-fluctuation warning level	6-42
20	INCEDAT	Incremental encoder figure abnormality setting value	----
22	ATNFIL	Auto-notch filter tuning torque command value	6-41

Generic parameters (Group2)

Page	Name	Description	Description page
00	OBLPF1	Observer output low-pass filter 1	----
01	OBLPF2	Observer output low-pass filter 2	----
02	OBG	Observer compensation gain	----
03	ANRES	Antiresonance frequency	----
07	RTLEVEL	Real-time auto-tuning responsiveness setting	----

Generic parameters (Group3)

Page	Name	Description	Description page
02	PA302	Reserved	----
		P-PI automatic switch function	6-39
03	PA303	Reserved	----
		Velocity feedback abnormality (ALM_C3) / velocity control abnormality (ALM_C2) detection	----
04	PA304	Overtravel operation	6-25
		Dynamic brake operation	6-26
05	PA305	Analog monitor output polarity	6-43
		Forced stop	6-26
06	PA306	Velocity addition command input	6-30
		Torque addition command input	6-30
07	PA307	Absolute encoder clear function selection	6-32
		In-position conclusion signal/position fluctuation monitor	6-35
08	PA308	External incremental encoder (CN-EXT) digital filter	6-31
		Motor incremental encoder (CN2) digital filter	6-31

Generic parameters (Group4)

Page	Name	Description	Description page
01	PA401	Reserved	----
		External encoder (CN-EXT) polarity	6-31
02	PA402	Setup software transmission baud rate	----
		Setup software transmission axis number	----
03	PA403	Reserved	----
		Positioning method	6-36
06	PA406	Position detection system	----
		Reserved	----

Generic parameters (Group5)

Page	Name	Description	Description page
00	MON1	Analog monitor output 1 selection	6-43
01	MON2	Analog monitor output 2 selection	6-43
02	DMON	Digital monitor output selection	6-44

Generic parameters (Group6)

Page	Name	Description	Description page
00	PA600	Observer function selection	----
01	PA601	Amplifier function selection 601	----
06	PA606	Amplifier function selection 606	----

Generic parameters (Group7)

Page	Name	Description	Description page
01	MS	Control mode switch function	6-9
02	PCON	Velocity loop proportional control switch function	6-38
03	GC	Gain switch function	6-38

Generic parameters (Group8)

Page	Name	Description	Description page
08	DISCHARGE	Forced discharge function	6-40
12	PPCON	Position loop proportional control switch function	6-41
14	TCOMPS	Torque addition function	6-30
15	VCOMPS	Velocity addition function	6-30

NC Parameter【Group A】

Page	Name	Description	Description page
00	S_vmx	System velocity limit	
01	T_vmx	PC action velocity limit	
02	S_+OT	Plus direction software limit	
03	S_-OT	Minus direction software limit	
04	Stp_P	Striking depth ※1	
05	S_inp	System imposition width ※1	
06	S_ovf	System overflow ※1	
07	T_ovf	Over flow at current limit ※1	
08	Bakls	Backlash	
09	SOTde	Software limit detection	
0A	M_dir	Motor movement direction ※1	
0B	Accel	Acceleration-deceleration constant	
0C	S_rat	S-acceleration-deceleration time	
0D	T_jog	PC movement Jog current limit	
0E	Z_typ	Zero return type	
0F	Z_dir	Zero return direction	
10	Z_hsp	Zero return high speed	
11	Z_lsp	Zero return low speed	
12	Z_add	Zero position coordinate	
13	Z_ofs	Zero offset value	
14	Z_inp	Zero imposition width ※1	
16	A_ofs	Absolute sensor effective stroke length ※2	
17	Zon1L	Domain（1）minus direction side	
18	Zon1H	Domain（1）plus direction side	
19	Zon2L	Domain（2）minus direction side	
1A	Zon2H	Domain（2）plus direction side	
1B	Zon3L	Domain（3）minus direction side	
1C	Zon3H	Domain（3）plus direction side	
1D	Zon4L	Domain（4）minus direction side	
1E	Zon4H	Domain（4）plus direction side	
1F	Zon5L	Domain（5）minus direction side	
20	Zon5H	Domain（5）plus direction side	
21	Zon6L	Domain（6）minus direction side	
22	Zon6H	Domain（6）plus direction side	
23	Zon7L	Domain（7）minus direction side	
24	Zon7H	Domain（7）plus direction side	
25	Zon8L	Domain（8）minus direction side	
26	Zon8H	Domain（8）plus direction side	

NC Parameter【Group A】

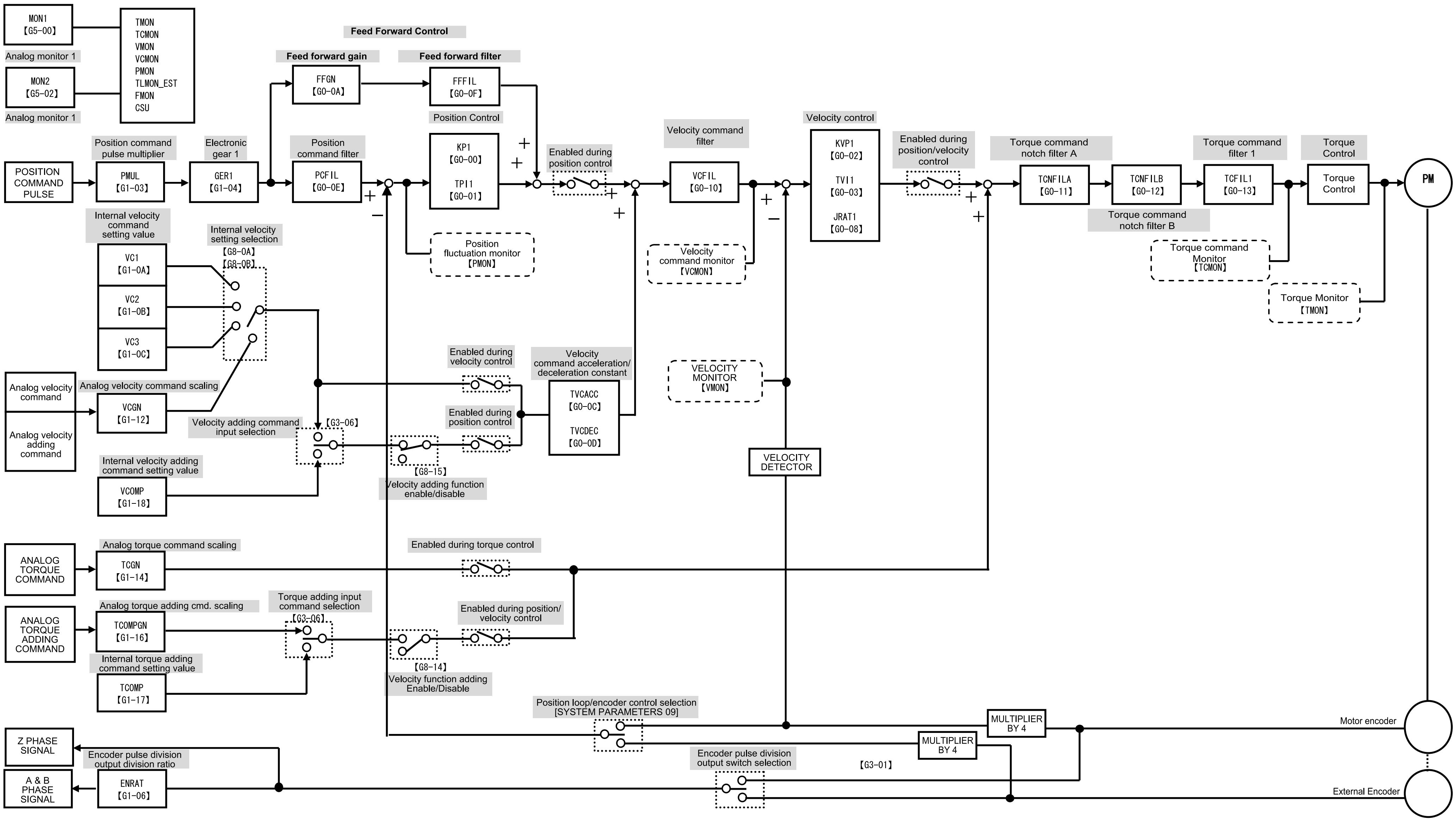
Page	Name	Description	Description page
27	H_jog	Manual high speed	
28	L_jog	Manual low speed	
29	H_stp	High speed 1step distance	
2A	L_stp	Low speed 1step distance	
2B	Ovrid0	Override 0	
2C	Ovrid1	Override 1	
2D	Ovrid2	Override 2	
2E	Ovrid3	Override 3	
2F	Ovrid4	Override 4	
30	Ovrid5	Override 5	
31	Ovrid6	Override 6	
32	Ovrid7	Override 7	
33	Ovrid8	Override 8	
34	Ovrid9	Override 9	
35	Ovrid10	Override 10	
36	Ovrid11	Override 11	
37	Ovrid12	Override 12	
38	Ovrid13	Override 13	
39	Ovrid14	Override 14	
3A	Ovrid15	Override 15	
3B	S_pls	System division number ※1	
3C	U_pls	User division number ※1	
3E	D_dpo	Velocity, position data decimal point ※1	
3F	Unit	Setup unit ※1	
4D	Sw1	Function switch 1	
4E	Sw2	Function switch 2	

※1： It is necessary to cycle the control power if the set values are changed.

※2： Be sure to perform homing if the setup of this parameter “A_ofs” is changed. Otherwise that will cause displacement.

6. Operation and Functions

6.1.3 Control mode block diagram



6. Operation and Functions

6.2 System and motor parameters

System parameters modify the specifications of the servo amplifier and the servo motor. Unless there is a problem with the factory settings, it is not recommended to modify these specifications. Incorrect settings may cause irregular operation and servo motor interruption. If modification is necessary, first save the factory settings using the “Q-Setup” setup software.

6.2.1 System parameter types

- System parameters are configured with the following parameters:

Page	Name	Setting range	Notes
--	Amplifier capacity	**Not modifiable**	Shows the servo amplifier capacity.
--	Motor structure	**Not modifiable**	Shows the structure of the combined motor.
--	Control power input voltage	**Not modifiable**	Shows the power voltage supplied to the control power.
--	Control power input type	**Not modifiable**	Shows the input type supplied to the control power.
--	Main circuit power input voltage	**Not modifiable**	Shows the power voltage supplied to the main circuit.
00	Main circuit power input type	2 types (1 type)	Shows the input type supplied to the main circuit.
01	Motor encoder type	2 types	Selects the motor encoder type.
02	Incremental encoder function selection	2 types	Selects the function details of the incremental encoder.
03	Incremental encoder resolution	500P/R ~ 65535P/R	Sets the resolution of the incremental encoder.
04	Absolute encoder function selection	8 types	Selects the function details of the absolute encoder.
05	Absolute encoder resolution	11 types	Sets the resolution of the absolute encoder.
06	Combined motor model number	**Not modifiable**	Shows the model of the combined motor.
08	Control mode	1 types	Selects the control mode.
09	Position loop control/position loop encoder selection	3 types	Selects position loop control or position loop encoder method.
0A	External encoder resolution	500P/R ~ 65535P/R	Sets the resolution of the external encoder connected to CN-EXT.
0B	Regenerative resistor selection	3 types	Selects the type of regenerative resistor connected.

∗ **Not modifiable**: Shows system information preset in the servo amplifier. These settings cannot be modified or edited.

∗ Turn off the power after modifying the settings, and then turn it back on. Parameters will not change otherwise.

6.2.2 Checking servo amplifier and servo motor specifications using parameters

- Verify that the servo amplifier specification settings match that of the servo motor used.

• Shows the capacity of the servo amplifier used.

Amplifier capacity	*****_Ampere**

• Verify it shows “Rotary”.

Motor structure	**Rotary Motor**

• Shows the power voltage of the control power (r,t) of the servo amplifier used.

Control power input voltage	*****V Class**

• Shows the input type supplied to the control power.

Control power input types	**AC Single_Phase**

• Shows the power voltage supplied to the main circuit.

Main circuit power input voltage	*****V_Class**

Not modifiable

• Shows the model of the combined motor.

Combined motor model number	************(code_code)**

* (code_code) is a manufacturer control number; verify the motor model only.

6. Operation and Functions

6.2.3 Servo amplifier and servo motor specification setting values

● The following parameters can be modified, but settings different from the specifications can result in irregular operation and servo motor interruption. Take care when modifying these settings. After modifying the parameters, turn the power off and back on again to enable the changes.

- The input type of the power supplied to the main circuit can be modified as shown in the table.

Page	Name	Setting range
00	Main circuit power input type	2 types (1 type)

Setting value	Explanation
00：_AC_3-phase	3-phase AC power is supplied to the main circuit
01：_AC_Single-phase	Single-phase AC power is supplied to the main circuit

* Modify this setting only if you are changing the main circuit power input specifications.

- The motor encoder type setting can be modified as shown in the table.

Page	Name	Setting range
01	Motor encoder type	2 types

Setting value	Explanation
00：_Incremental_ENC	Incremental encoder
01：_Absolute_ENC	Absolute encoder

* Always check the servo motor encoder (sensor) specifications before making any changes to the settings.

* The incremental encoder cannot be used for the following servo amplifier models:

QS1□□□A**C**△××△△▽∗∗・・・・・・Control hardware classification is "Absolute/request sensor"

QS1□□□A**C**△××△△▽∗∗・・・・・・Control hardware classification is "Absolute/incremental encoder"

- The detailed functions and the resolution of the incremental encoder can be selected as shown in the table.

Incremental encoder exclusive use

Page	Name	Setting range
02	Incremental encoder function selection	2 types

Setting value	Explanation
00：_Standard	Wire-saving incremental encoder [Standard 4-pairs]
01：_7 pairs_INC-E	Incremental encoder with CS signal [7 pairs]

Page	Name	Setting range
03	Incremental encoder resolution	500~65535P/R

* Always check the servo motor encoder (sensor) specifications before making any changes to the settings.

- The detailed functions and the resolution of the absolute encoder can be selected as shown in the table.

Absolute encoder exclusive use

Page	Name	Setting range
04	Absolute encoder function selection	8 types

Setting	Explanation
04：PA035C-2.5MH_Manu	PA035 start-stop synchronization, 2.5Mbps half-duplex transmission (manual setting)
05：PA035C-4MH_Manu	PA035 start-stop synchronization, 4.0Mbps half-duplex transmission (manual setting)
06：RA062C-2.5MH_Manu	PA035 start-stop synchronization, 2.5Mbps half-duplex transmission (manual setting)
07：RA062C-4MH_Manu	PA062 start-stop synchronization, 4.0Mbps half-duplex transmission (manual setting)
80：RA062M-1MF	RA062 Manchester 1Mbps full duplex transmission
81：RA062M-2MF	RA062 Manchester 2Mbps full duplex transmission
82：ABS-RⅡ-1MF	ABS-RII 1Mbps full-duplex transmission
83：ABS-RⅡ-2MF	ABS-RII 2Mbps full-duplex transmission
84：ABS-E	ABS-E 1Mbps (absolute encoder with incremental signal)

Page	Name	Setting range
05	Absolute encoder resolution	11 types

Setting	Explanation	Setting	Explanation
00：_2048	2048 divisions	07：_262144	262144 divisions
01：_4096	4096 divisions	08：_524288	524288 divisions
02：_8192	8192 divisions	09：_1048576	1048576 divisions
03：_16384	16384 divisions	0A：_2097152	2097152 divisions
04：_32768	32768 divisions		
05：_65536	65536 divisions		
06：_131072	131072 divisions		

* Always check the servo motor encoder (sensor) specifications before making any changes to the settings.

- The control mode can not be modified.

Page	Name	Setting range
08	Control mode	1 types

Setting	Explanation	Setting	Explanation
02：_Position	Position control		

6. Operation and Functions

• Position loop control/encoder selection

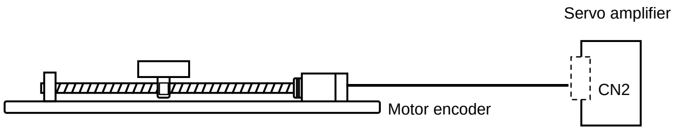
When the servo amplifier is used in position control mode, the type of the encoder input to the position loop can be selected (motor encoder/external encoder).

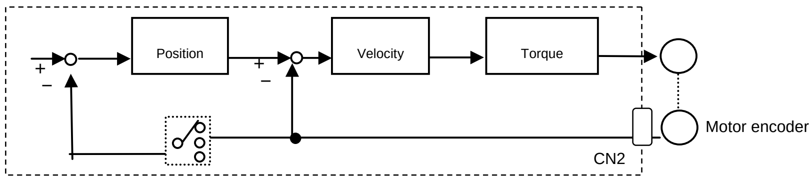
Page	Name	Setting range
09	Position loop control/encoder selection	3 types

Setting	Explanation
00：_Motor_encoder	Semi-close control/motor encoder
01：_Ext－ENC (CN2)	Full-close control/external encoder (CN2 input signal)
02：_Ext－ENC (CN-EXT)	Full-close control/external encoder (CN-EXT input signal)

• Semi-close control setting values are shown below.

Setting	Explanation
00：_Motor_encoder	Semi-close control/motor encoder





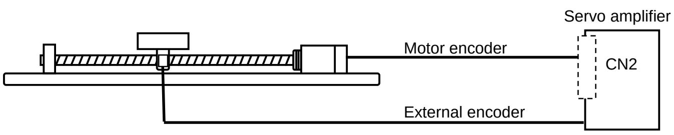
【Position loop control/encoder selection】

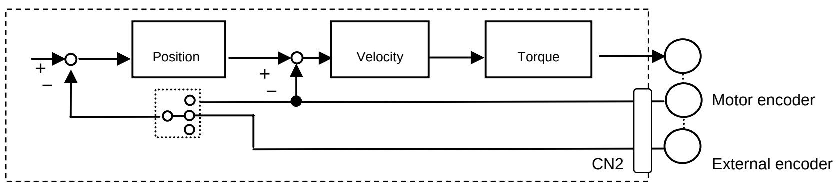
Servo motor encoders connectible to CN2	• Incremental encoder • Absolute encoder (sensor)

• Full-close control requires one of the following setting values.

Setting value: 01

Setting	Explanation
01：_Ext－ENC (CN2)	Full-close control/external encoder (CN2 input signal)



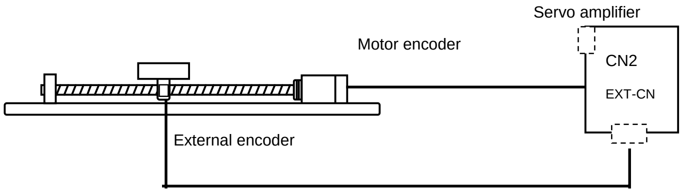


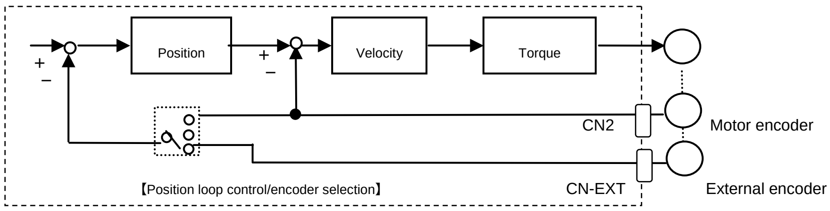
【Position loop control/encoder selection】

Servo motor encoders connectible to CN2	• Wire-saving absolute sensor

Setting value: 02

Setting	Explanation
02：_Ext－ENC (CN-EXT)	Full-close control/external encoder (CN-EXT input signal)





Servo motor encoders connectible to CN2	• Incremental encoder • Absolute encoder (sensor)

• The resolution of the external encoder can be set as shown in the table. External encoder exclusive use

Page	Name	Setting range
0A	External encoder resolution	500~65535P/R

* Always check the combined encoder specifications before making any changes to the settings.

* Set the number of pulses per one motor shaft rotation.

• The type of the regenerative resistor can be selected as shown in the table.

Page	Name	Setting range
0B	Regenerative resistor selection	3 types

Setting	Explanation
00：_Not_connect	Regenerative resistor not connected
01：_Built-in_R	Built-in regenerative resistor used
02：_External_R	External regenerative resistor used

* Make sure you set "00:_Not_connect" if there is no regenerative resistor connected.
Otherwise, when the power is turned on, it will cause an “AL 43: regeneration abnormal” error.

* If there is a regenerative resistor connected, do not use the "00:_Not _connect" setting.
Otherwise, damage to the regenerative circuit and the regenerative resistor could occur.

6.2.4 Motor parameters

● The motor parameters control the servo motor settings. Unless there is a problem with the factory settings, please do not modify them. If the settings do not match the combined servo motor, the servo motor could be interrupted or damaged. Always check the servo motor model number before making any modifications.

- The servo motor parameters can be modified using the “Q-Setup” setup software.
- Select the servo motor, and then execute the program. By doing so, all of the servo motor parameters can be downloaded and modified at once.
- After modifying the settings, turn the power off and back on again for the changes to take place.

For more information, refer to “Q-Setup-Setup Software Instruction Manual M0005351”.

6.2.5 Parameters for positioning

- Parameters for positioning(ＮＣ parameters)are a group of parameters that set up positioning system. If data input is not matched to the machinery, it makes different actions from intended ones. So be sure to make a confirmation.

Make the power off once and ON again after altering parameters “0A M_dir”, “3B S_pls”, “3C U_pls”, “3E D_dpo”, and “3F Unit”.

Refer to “Q-Setup-Setup Software Instruction Manual M000535”for details.

- Parameters that are setup at first

０４	「Ｓｔｐ＿Ｐ」	Striking depth
０５	「Ｓ＿ｉｎｐ」	System in-position width
０６	「Ｓ＿ｏｖｆ」	System overflow
０７	「Ｔ＿ｏｖｆ」	Current limit overflow
０Ａ	「Ｍ＿ｄｉｒ」	Operation direction
１４	「Ｚ＿ｉｎｐ」	Home-position in-position width
３Ｂ	「Ｓ＿ｐｌｓ」	Number of system divisions
３Ｃ	「Ｕ＿ｐｌｓ」	Number of user divisions
３Ｅ	「Ｄ＿ｄｐｏ」	Velocity, Position data decimal point
３Ｆ	「Ｕｎｉｔ」	Setting unit
•	「――――」	Encoder function
•	「――――」	Encoder resolving power
•	「――――」	Motor model number

Refer to ６.２.１ section （System parameter）

１）Encoder function, resolving power, and motor model number are determined when they are purchased(shipped setting values).

２）３Ｅ「Ｄ＿ｄｐｏ」：Velocity and decimal point for position data setting are designated.

「０」・・・without decimal points
「１」・・・one place of decimals
「２」・・・two places of decimals
「３」・・・three places of decimals
「４」・・・four places of decimals
「５」・・・five places of decimals

３）３Ｆ「Ｕｎｉｔ」：Setting unit

「０」・・・Pulse
「１」・・・**mm**

Significance
Cycle the power after setting parameters through 1) to 11) .

4）０Ａ「Ｍ＿ｄｉｒ」：Motor operation direction is adjusted.

「０」：Positive direction coordinate/Rotary motor is CCW turn seen from shaft side.

「１」：Positive direction coordinate/Rotary motor is CW turn seen from shaft side.

5）３Ｂ「Ｓ＿ｐｌｓ」：Division number per one turn of motor

「Ｓ＿ｐｌｓ」＝"Encoder resolving power"（during use of absolute sensor）

「Ｓ＿ｐｌｓ」＝"Encoder resolving power"×４（during use of incremental sensor）

（Detection multiplication）

＜Sensor resolving power example＞

① ＡＢＳ－Ｅ （2048 Ｐ／Ｒ）・・・「Ｓ＿ｐｌｓ」＝2048

② Incremental（2000 Ｐ／Ｒ）・・・「Ｓ＿ｐｌｓ」＝8000

6）３Ｃ「Ｕ＿ｐｌｓ」：Travel distance per turn of a motor seen from user.

Input setting unit of position data is determined at the above"Ｄ＿ｄｐｏ","Ｓ＿ｐｌｓ", and"Ｕ＿ｐｌｓ".（※５ of parameters list in ８．５．１０ ＧｒｏｕｐＡ）

Ex. 6-1) System that travels 5mm per turn of a motor at absolute sensor（ＡＢＳ－Ｅ：２０４８ division）.

Position data setting unit ０．００１mm

Ｄ＿ｄｐｏ＝３

Ｓ＿ｐｌｓ＝２０４８

Ｕ＿ｐｌｓ＝５．０００

If you want to set 7.354 mm as travel distance, setup "7.354".

Note 1) Since minimum unit possible for positioning is"Ｓ＿ｐｌｓ", there is no positioning division power in the case of"Ｕ＿ｐｌｓ"＞"Ｓ＿ｐｌｓ".

For example, ５．０００／２０４８＝０．００３, so positioning error is included in below ０．００３ mm. However, compare with values without decimal points of"Ｕ＿ｐｌｓ"in this check. ５．０００→５０００ in the example, so"Ｕ＿ｐｌｓ"＞"Ｓ＿ｐｌｓ".

Note 2) The maximum setting value of " Ｓ＿ｐｌｓ" is １３１０７２.

The maximum setting value of " Ｕ＿ｐｌｓ" is １３１０７２.

In case "Ｕｎｉｔ＝０１（mm）"

A : actual rotational of motor shaft (1/min)

B : user target velocity

C : feeding distance par one motor rotation from the user point of view (= U_pls) (mm)

The calculation would be done as follows.

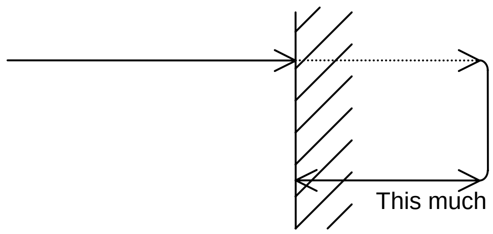
<u>B = A * (1/60) * C</u>

Note 3) Please turn off the control power source once, after changing the parameter "D_dpo", "Unit" and "M_dir".

From the above, ※４ in the parameters list of ８．５．１０ ＧｒｏｕｐＡ is determined.

7）０４「Ｓｔｐ＿Ｐ」：Striking depth（Pulse）

This is a virtual entry depth at striking operation.　It is a pulse that complete positioning even without reaching the goal position if the striking depth falls in with the difference between command position and present one at the striking operation during positioning feeding.



8）０５「Ｓ＿ｉｎｐ」：System in-position width（Pulse）

- Positioning is completed and in-position is output when the difference between command position and present position (deviation amount) is within **Ｓ＿ｉｎｐ** value(±).
- This value should usually be set with positioning error permissible value.

9）０６「Ｓ＿ｏｖｆ」：System overflow（Ｕ）

- Values considered as overmuch position deviation (alarm) and defective position loop (defective trailing) including operation are setup.
- Set values are determined in adjusted value and maximum velocity of position loop gain(Kp) and feed forward gain(KFF).

Ｓ＿ｏｖｆ＞VmaｘＸ（１００−Ｋｆｆ）／（１００×Ｋｐ）

１０）０７「Ｔ＿ｏｖｆ」：Overflow at current limit（Ｕ）

- During current limit, position deviation is apt to be bigger than usual operation and overmuch deviation alarm becomes sensitive.
- This is a parameter to avoid this state.
- Therefore usually it is **Ｔ＿ｏｖｆ＞Ｓ＿ｏｖｆ**.

１１）１４「Ｚ＿ｉｎｐ」：Zero imposition width（Pulse）

- This is imposition width for zero return operational completion.
- If the machinery rigidity is low and it is hard to do imposition when zero return has been completed, please make"**Ｚ＿ｉｎｐ**" larger.　However, precision of zero position gets worse.

Note）Setup for only incremental sensor is necessary.

6. Operation and functions

6.3 Test run

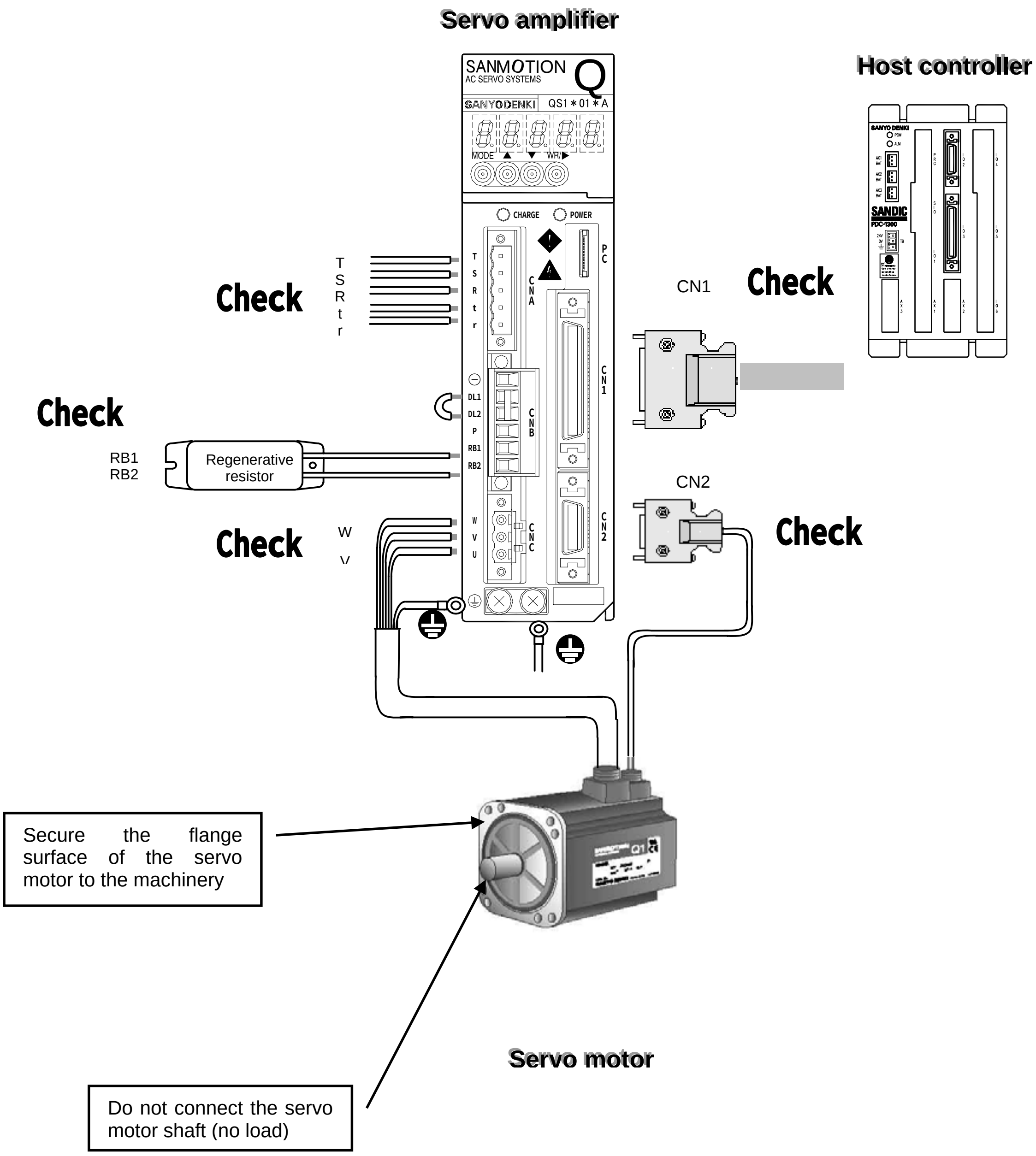
6.3.1 Servo motor standalone test run

Do not connect the servo motor shaft to any machinery!

Step 1:

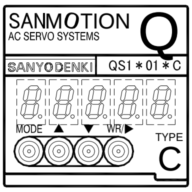
Check the wiring:

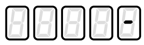
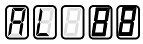
- Check the input power wiring
- Check the servo motor wiring
- Check the CN2 (motor encoder) wiring
- Check the CN1 (input/output signal) wiring
- Check the regenerative resistor wiring (if used)



Step 2. Control power ON

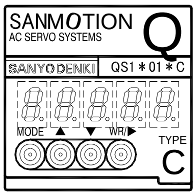
- Disconnect CN1 and turn ON the control power (r, t).
- Check the 7 segment LED display on the servo amplifier front panel.



	Control power (r, t) is ON, amplifier ready (RDY) shows ON status	**Go to Step 3**
	If an alarm is issued, the last 2 digits are the alarm code.	

Step 3. Main circuit power ON

- Turn the main power (R, S, T) ON.
- Check the 7 segment LED display on the servo amplifier front panel.

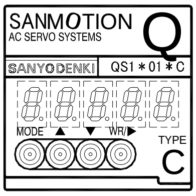


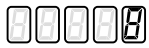
	Control power (R, S, T) is ON, operation preparation complete signal shows ON status	**Go to Step 4**
	If an alarm is issued, the last 2 digits are the alarm code.	

* Alarms can be generated by problems with the power wiring, encoder wiring, regenerative resistor wiring, power specification settings, encoder settings or regenerative resistor settings. Turn off the power, and follow the troubleshooting instructions in “Section 9, Maintenance”.

Step 4.　Input the servo on signal for a test excitation of the servo motor

- Check that the position command pulse, analog velocity and analog torque commands are not input.
- Input the servo on signal.
- Check the 7 segment LED display on the servo amplifier front panel.



	Servo is in “ON" status, and turns as if writing a number 8 shape.	**Go to Step 5**

Step 5.　Input the command and operate the servo motor

Position control・・・ Position command

Control mode	System parameter page ０８	Selects the control mode

For more information, refer to “8.4.1 System parameters”

1. Set and check parameter values for manual low speed.

Manual low speed	Parameter group Ａ page ２８	Velocity setup for manual low speed

For more information, refer to “6.2.5Parameters for positioning ”,”8.5.11 Parameters of Group A “.

2. Input (+) manual feeding or (-) manual feeding from the host device and operate it.

3. Check the position command pulse monitor, command position monitor, velocity monitor, position fluctuation monitor and the current position monitor using the monitor functions.

Check for the position command pulse input.

Position command pulse monitor	Monitor Page 0D:FMON	Frequency of position command pulse input is displayed.

• Check the command position.

Command position monitor	Monitor page 0B:CPMON	Command position is displayed.

• Check if the velocity by manual feeding is identical to the actual servo motor rotation velocity.

Velocity command monitor	Monitor page 06:VCMON	Velocity command value is displayed.
Velocity monitor	Monitor page 05:VMON	Rotation velocity of servo motor is displayed.

• Check if the position error value changes when the servo motor is accelerated or decelerated.
• Check if the servo motor stops when the manual feeding signal is OFF.

Position error monitor	Monitor page 09:PMON	Position error value is displayed.

Turn OFF the main circuit power and the control power, then turn them ON again. Send enough position command pulses for a single rotation of the servo motor. Confirm that the servo motor has rotated once, and that the current position monitor shows a corresponding travel distance.

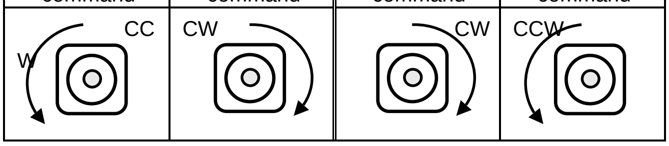
Current position monitor	Monitor Page 0A:APMON	Displays the current position (the origin is the position at the time of turning the control power on).

4. Check that the polarity of the position command pulse sent from the host device matches the servo motor rotation direction.
• With standard factory settings the servo motor rotates forward (counterclockwise) when the input command is positive (+) (forward pulse sequence), and reverse (clockwise) when the input command is negative (-) (reverse pulse sequence).

If necessary, modify the position command pulse polarity using the parameter value settings in the table below.

Operation direction	Parameter group A page 0A	Command input polarity

Standard command input polarity setting		Modified command input polarity	
+ input command	− input command	+ input command	− input command

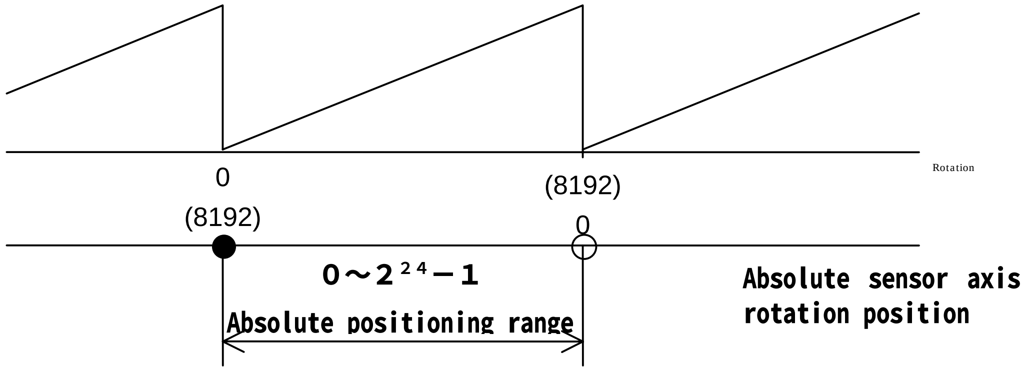


* If there is an alarm, or the servo motor is not moving, problems may exist with the power wiring, CN1 wiring, CN2 wiring, regenerative resistor wiring, or by differences between the host device and the servo amplifier specification parameters. Check the wiring and the parameters, and correct them if necessary.

6.3.2 Zero position of absolute sensor

a） Absolute sensor（ABS-E）

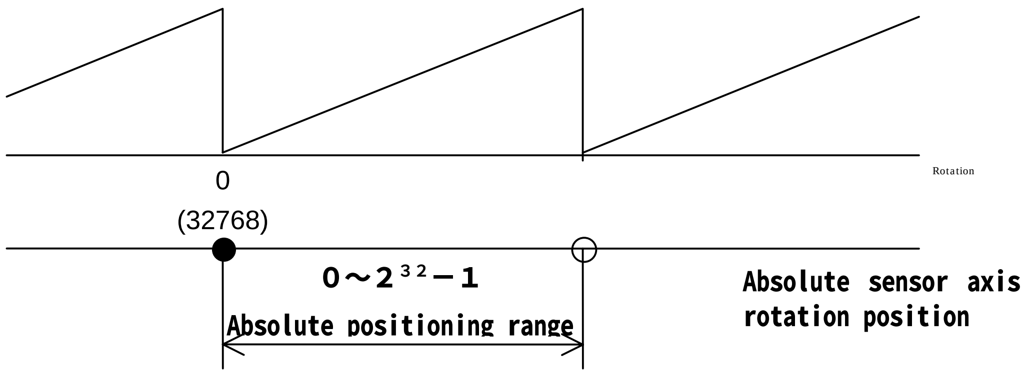
- Position output signal of ABS-E is 24bit and you can use in this range.
- Division number：2048 division／one rotation…11bit
- Multi rotation number：8192 turns…13bit　　　Total 24bit（Example）



In other words, 0～（$2^{24}-1$）…［0～16777215］is effective stroke.　You can determine the position in this range.

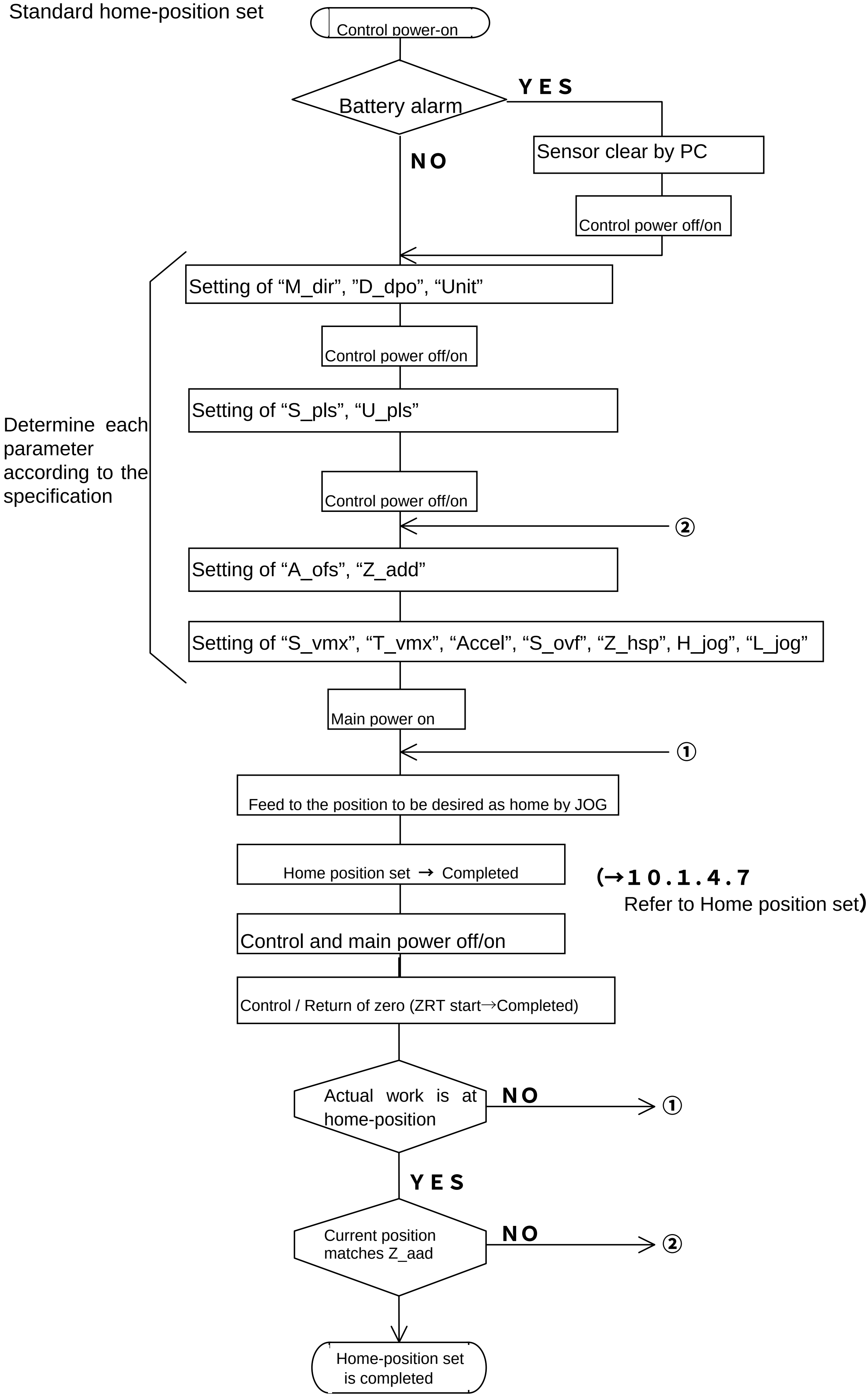
b） Absolute sensor（PA035）

- You can use 32bit range of sensor, though position output signal of PA035 is 33bit.
- Division number：131072 division／one rotation…17bit
- Multi rotation number：32768 turns…15bit　　　Total 32bit（Example）



In other words, 0～（$2^{32}-1$）…［0～4294967295］is effective stroke.　You can determine the position in this range.

c）Standard home-position set



d） Example of home determination

Ball screw drive：Direct-coupled **P＝10mm．l＝800mm**

Travel distance set unit：**0．01mm** Velocity unit **0．01mm／sec**

①**M_dir＝“0”**・・・・・・・・・・Increase direction of sensor and user coordinate is identical

D_dpo＝“2”（two places of decimals）・**0．01mm、0．01mm／sec**

Unit ＝“1”（mm）

Cycle control power after setting these.

②**S_pls＝2048（ABS−E）**・・From division number

U_pls＝10．00・・・・・・・・・Travel 10.00mm per rotation of motor is stipulated.

S_ovf＝50．00

Cycle control power after setting this.

③**S_vmx＝750．00（mm／sec）**・From **Nmax＝4500**$\mathbf{min^{-1}}$

T_vmx＝200．00（mm／sec）・・From **T_vmx＜S_vmx**

H_jog＝20．00（mm／sec）・・・Low speed for a while

L_jog＝1．00（mm／sec）・・・・Low speed for a while

Z_hsp＝20．00（mm／sec）・・・Low speed for a while

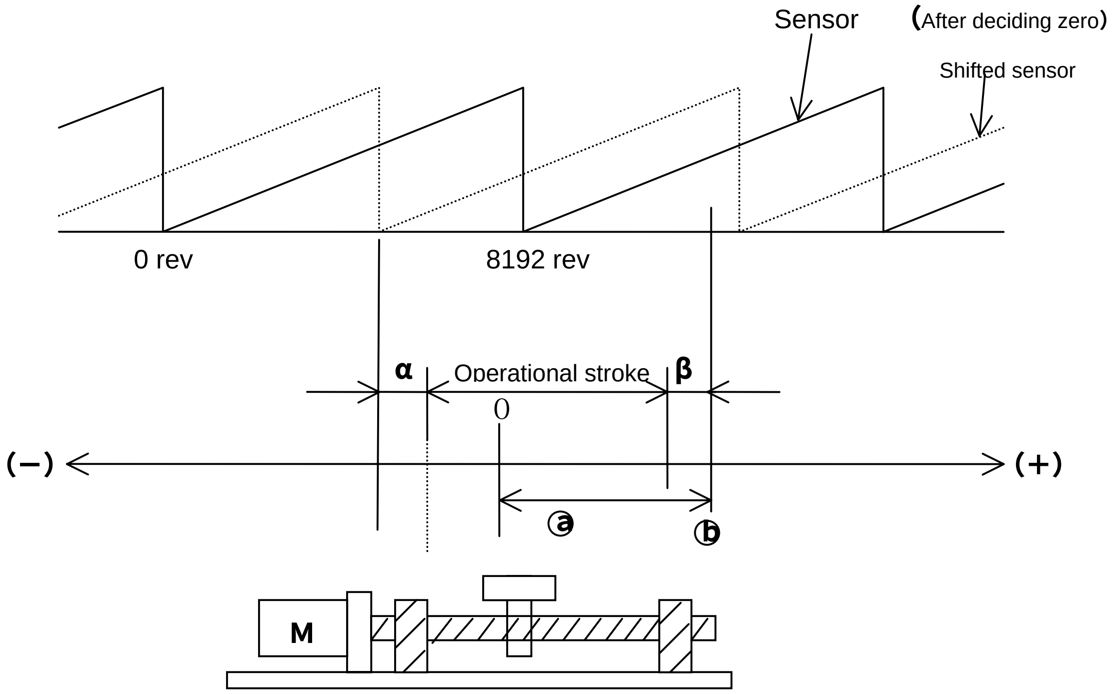
Accel＝250．00（mm／sec）・・Setting of running **0→4500**$\mathbf{min^{-1}}$ at 300m sec at rising.

A_ofs＝2000．00（mm）・・・amount of **α＝2000．00mm**

（**β**：Spare＞**0**）

Z_add＝0．00（mm）・・・・・User coordinate at home-position set shall be 0.

Turn on the main power after setting this.



④Travel to the position that you want to make zero by JOG.

⑤Home position set→Completed…Sensor coordinate system will be dot-line part.

（→Refer to １０.１.４.７ Home position set）

⑥With that, zero determination operation is completed.

⑦Check （α＋Operational stroke＋β）＜８１９２ｒｅｖ（ABS-RⅡSensor）

You cannot use it if it exceeds sensor stroke.

（It operates in the next sensor zone and causes damage to the mechanism.）

Note

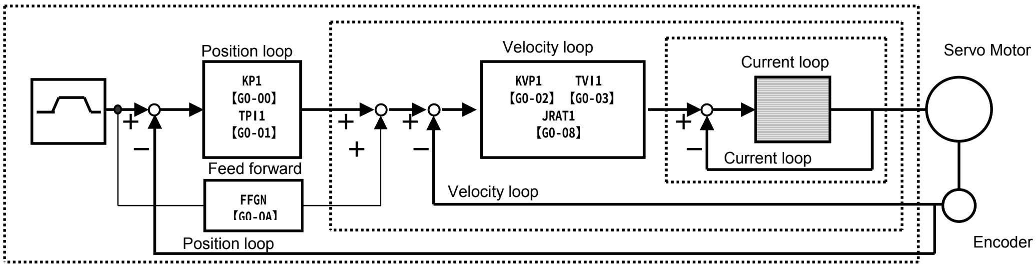
If you change Ｍ＿ｄｉｒ，Ｄ＿ｄｐｏ，Ｕｎｉｔ，Ｓ＿ｐｌｓ，Ｕ＿ｐｌｓ，Ａ＿ｏｆｓ，Ｚ＿ａｄｄ and when you change motor or release battery alarm, Please don’t fail to perform home position set.

6.4 Servo adjustment parameters

6.4.1 Servo system

This section explains the servo motor gain setting parameters. A detailed Control Block Diagram can be found in section 6.1.

- The servo system consists of three sub-systems: the position loop, the velocity loop and the current loop. High responsiveness is required for the internal loops. The relationship of these three systems is shown below. If this structure is compromised, it could result in instability, low responsiveness, vibration and oscillation.



The responsiveness of the current loop is ensured internally in the servo amplifier; there is no need for the user to make additional adjustments.

6.4.2 Servo adjustment parameters

Group	Page	Symbol	Name	
0	00	KP1 [1/S]	Position loop proportional gain 1	GAIN1
	01	TPI1 [ms]	Position loop integration time constant 1	
	02	KVP1 [Hz]	Velocity loop proportional gain 1	
	03	TVI1 [ms]	Velocity loop integration time constant	
	08	JRAT1 [%]	Load inertia moment ratio 1	
	13	TCFIL1 [Hz]	Torque command filter 1	
	04	KP2 [1/S]	Position loop proportional gain 2	GAIN2
	05	TPI2 [ms]	Position loop integration time constant 2	
	06	KVP2 [Hz]	Velocity loop proportional gain 2	
	07	TVI2 [ms]	Velocity loop integration time constant 2	
	09	JRAT2 [%]	Load inertia moment ratio 2	
	14	TCFIL2 [Hz]	Torque command filter 2	
	0A	FFGN [%]	Feed forward gain	---
	0E	PCFIL [ms]	Position command filter	
	10	VCFIL [Hz]	Velocity command filter	
	11	TCNFILA [Hz]	Torque command notch filter A	
	12	TCNFILB [Hz]	Torque command notch filter B	
	0F	FFFIL [Hz]	Feed forward filter	
	1D	AFBK [0.1%]	Acceleration feedback gain	
	1E	AFBFIL [Hz]	Acceleration feedback filter	

Two types of servo parameters can be set. GAIN1←→GAIN2 can be switched using the CONT* input. Refer to “8.5.8 Group7 Parameters” for more information.

6.4.3 Description of servo adjustment parameters

JRAT: Load inertia moment ratio setting. Set the value calculated by the following equation:

$$\text{JRAT1} = \frac{\text{Motor shaft conversion load inertia【JL】}}{\text{Servo motor inertia【JM】}} \times 100\%$$

KVP: Velocity loop proportional gain setting.
The higher this value is set, the higher the responsiveness will be. Set it to a value that does not cause vibration or oscillation in the mechanism of the device.
If the JRAT value is set accurately, the value set for the KVP will be the response zone of the velocity loop.

TVI: Velocity loop integration time constant setting.
Since the integration time constant is a delay attribute of the servo system, higher values for this parameter mean decreased responsiveness and an increase in settling time. Conversely, if the integration time constant is set too low, the servo system may become instable, and the mechanism could vibrate or oscillate. Set the integration time constant to a value that does not cause vibration or oscillation in the device mechanism. For stable operation of the servo system, set the TVI to a value less than 1/4 of the velocity loop response zone.

Set the minimum value that results in $TVI_{[ms]} = 1/(KVP_{[Hz]}/4 \cdot 2\pi)$.

KP: Position loop proportional gain setting.
By setting the position loop proportional gain to a higher value, the responsiveness increases and the settling time shortens. However, if the device mechanism has low rigidity, higher settings may result in vibration or oscillation. If you wish to set the position loop gain to a higher value, consider the rigidity of the device mechanism before raising the characteristic frequency. For stable operation of the servo system, set the KP(Hz) to a value less than 1/4 of the velocity loop response zone.

Set the maximum value that results in $KP_{[1/S]} = KVP_{[Hz]}/4 \cdot 2\pi$.

TCFIL: Torque command filter setting.
This value sets the cutoff frequency of the primary low-pass filter for the torque command inside the velocity loop. The filter eliminates resonance, vibration and irregular noise. The torque command filter is a delay attribute to the servo system; excessively high settings will lead to decreased responsiveness.

VCFIL: Velocity command filter setting.
This value sets the cutoff frequency of the primary low-pass filter for the velocity command inside the velocity loop. The filter eliminates vibration caused by the velocity command. This setting is effective when used in velocity control mode or position control mode with the full-close specification. The velocity command filter is a delay attribute to the servo system; excessively high settings will lead to decreased responsiveness.

PCFIL: Position command filter setting.
This value sets the cutoff frequency of the primary low-pass filter for the position command inside the position loop. The filter eliminates resonance, vibration and abnormal noise. The position command filter is a delay attribute to the servo system; excessively high settings will lead to decreased responsiveness.

FFGN: Feed forward gain setting.
This setting reduces position fluctuation and increases the position loop response time. This setting can speed up the settling time, but in devices where the position loop proportional gain is already set high, this setting may not be effective. Set it to a value that does not affect the in-position conclusion signal while using the velocity monitor, and also does not cause overshoot in the velocity monitor.

FFFIL: Feed forward filter setting.
This value sets the cutoff frequency of the primary low-pass filter for the feed forward.
Setting the feed forward filter may eliminate the breakup of the in-position conclusion signal and the overshoot on the velocity monitor.

TCNFILA/B: Torque command notch filter setting.
Setting the torque command notch filter to the resonance frequency of the device mechanism may eliminate resonance and irregular noise. Combining both TCNFILA and TCNFILB can create a two-stage notch filter.
TCNFILA can automatically be set by using “Auto notch filter tuning”.

6. Operation and Functions

6.5 Description of functions

This section explains the various functions of the servo amp. Some functions are common to all control modes, while some are unique to particular modes.

6.5.1 Functions related to machinery control

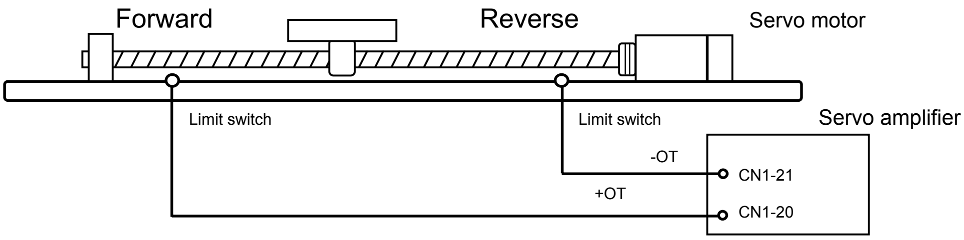
- **Servo motor operation selections for servo off and servo motor stop**
  - The options for the stop condition for servo off are: servo brake, dynamic brake, or free-run.
  - The options for the past-stop condition of the servo motor are: dynamic brake or free-run.

Parameter Group 3 Page 04 (lower byte)	Dynamic brake operation

PA304=	*0 H		*1 H		*2 H		*3 H		*4 H		*5 H	
	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop
Free-run	○	○	○			○				○		
Dynamic brake				○	○		○	○				○
Servo brake									○		○	

* For more information regarding these sequences, refer to “7.2.3 Brake function and sequence”.

- **Over travel function**
  - The over travel function uses a limit switch to prevent damage to the device. It stops the device when the movement range of the moving part is exceeded.



  - If the overtravel function is used, select the operating conditions of “Position command input, Servo motor stop operation and Servo ON signal” in the case of overtravel.

Parameter Group 3 Page 04	Upper byte: Overtravel operation

PA304	Selection value	Explanation
3∗H	If OT occurs: position command stop and servo brake ON. After the motor stops, servo OFF.	• If OT occurs, command input is disabled, the servo brake operates and the motor stops. • After the motor stops, the servo turns OFF.
4∗H	If OT occurs: position command stop and dynamic brake ON. After the motor stops, servo OFF.	• If OT occurs, command input is disabled, the dynamic brake operates and the motor stops. • After the motor stops, the servo turns OFF.

- Stop motor using servo brake" was selected for overtravel, then the torque for the servo brake operation can be set by using the sequence torque operation limit value.

Parameter Group 1 Page 0F	SQTCLM: Sequence torque operation limit	10~500%

If the value is set higher than the maximum output torque (T_P) of the servo motor, it will be limited by (T_P).

- **Emergency stop operation selection function**

- Options for the servo motor stop condition (for an emergency stop due to power interruption, etc. while the servo motor is in moving operation) are either servo brake or dynamic brake.

Parameter Group 3 Page 05	Lower byte: Emergency stop operation

PA305	Selection value	Explanation
0H	Servo brake	The motor will be stopped using the servo brake in case of an emergency stop.
1H	Dynamic brake	The motor will be stopped using the dynamic brake in case of an emergency stop.

For more information regarding this sequence, refer to "7.2.4 Emergency stop (power interception/emergency stop)".

- **Command input polarity inversion function**

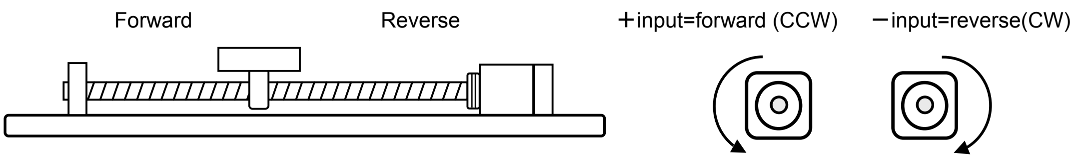
- The rotation direction of the servo motor can be reversed without modifying the input command wiring or the servo motor wiring.

Parameter Group A Page 0A	Motor movement direction

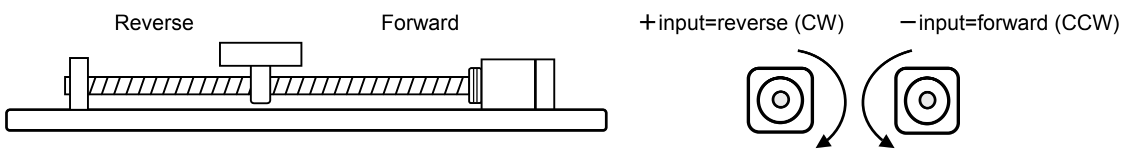
	Selection value
00H	Position command/+ input = forward (Coordinate plus direction)
01H	Position command/+ input = reverse （Coordinate minus direction）

Using the initial factory settings, the servo motor rotates in the forward (CCW) direction with a positive (+) input, and in the reverse (CW) direction with a negative (-) input.

Standard command input polarity setting



Modified command input polarity setting



- **Torque limit function in sequence operation**

  - During the sequence operation the output torque is limited. Limiting the output torque protects the device mechanism.
  - The torque limits during sequence operation support the following sequence operations:
    - JOG operation
    - Overtravel operation
    - Securing brake standby time
    - Servo brake operation

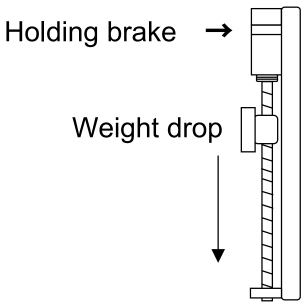
• Sequence operation torque limit value setting

Parameter Group 1 Page 0F	SQTCLM: Sequence torque operation limit	10~500%

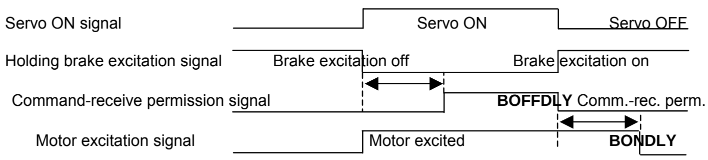
If this value is set higher than the maximum output torque (T_P) of the servo motor, it will be limited by (T_P).

6.5.2 Functions related to the motor holding brake

If the vertical shaft of the device is being controlled, a servo motor with a brake should be used. When the servo amplifier power and the servo motor excitation is off, the moving part of the device can fall, due to its own weight. The holding brake can be used to mechanically hold the moving part of the device. However, it cannot be used to control the device system.



• The timing for the OFF (BOFFDLY) and ON (BONDLY) operation of the securing brake can be set according to the device specifications. The setting increment is 4 msec. If the setting is 0 msec, the command is disabled (forced zero) for 4 msec after SON.



- If the motor does not stop within the timeframe set for the brake operation start (BONBGN) when the servo is turned OFF, the holding brake and the dynamic brake force the motor to stop. This function can be disabled by setting the value to “0” msec. The setting increment is 4 msec; therefore set the value to 4msec or higher.

Parameter Group 1 Page 19	BONBGN: Brake operation start time	0~65535ms

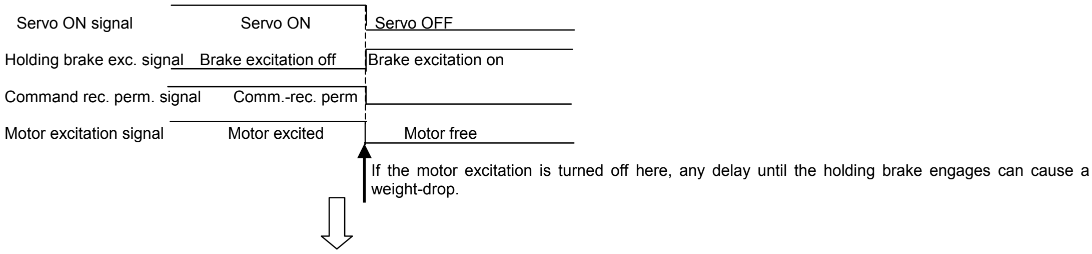
The term “motor does not stop” (above) means that the motor velocity does not fall below the zero velocity (ZV) range.

The stop sequence is different depending on the condition settings of the emergency stop operation. Refer to "Section 7, 7.2.5 Brake operation start time".

If the brake operation start time (BONBGN) passes, the servo motor will be forced to stop by both the dynamic brake and the holding brake, which can cause damage to the holding brake. Therefore, use this function only after considering the specifications and the sequence of the device.

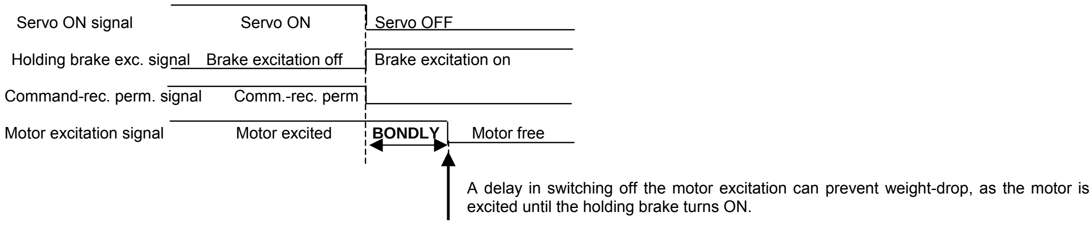
- **Holding brake operation delay function (BONDLY)**

This function is enabled during servo brake operation at servo OFF. It is disabled for dynamic brake and free-run.



• Set the delay time for the holding brake operation

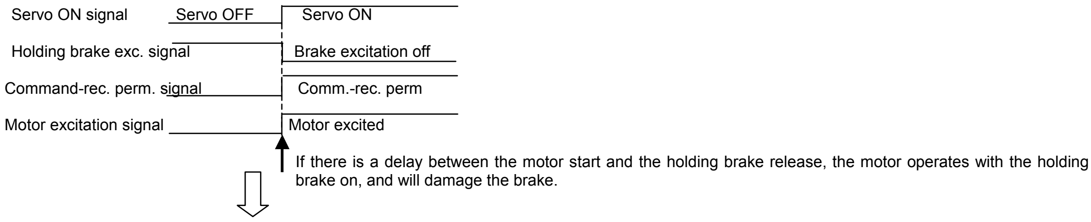
Parameter Group 1 Page 10	● BONDLY: Holding brake operation delay time	0~1000ms*



*The setting increment is 4 msec. If the setting is 0 msec, the command is disabled (forced zero) for 4 msec after SON.

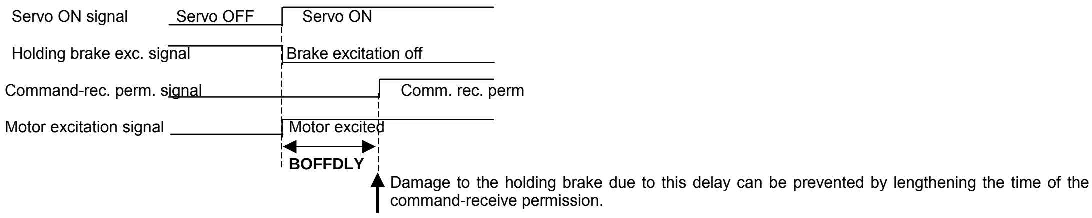
• The holding brake excitation signal can be output through the CN1-4pin.

- **Holding brake release delay function (BOFFDLY)**



• Set the delay time for the holding brake release

Parameter Group 1 Page 11	● BOFFDLY: Holding brake release delay time	0~1000ms*



*The setting increment is 4 msec. If the setting is 0 msec, the command is disabled (forced zero) for 4 msec after SON.

• The holding brake excitation signal can be output through the CN1-4pin.

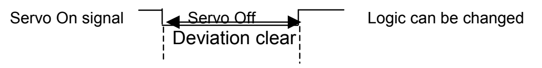
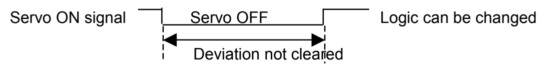
6.5.3 Input command functions

- **Position deviation clear function**

This function is used for clearing the position deviation counter in the servo amplifier from the host unit to zero.

- Make these settings after selecting the “position deviation clear” method.

Parameter Group 3 Page 00	Upper byte：Deviation Clear Selection

Selection		Explanation
0H	Servo OFF/Deviation is cleared	• Deviation is always cleared when servo is off. 
1H	Reserved	
2H	Servo OFF/Deviation is not cleared	• Deviation is not cleared when servo is off. • There is a possibility that the motor runs rapidly after servo On when the position deviation has been built up. 
3H	Reserved	

- **Velocity addition function**

The velocity addition function is the feed-forward function in the velocity control system. The internal velocity addition command is used when the velocity addition command value is a fixed value.

- Internal velocity addition function

Sets the internal velocity addition command value.

Parameter Group 1 Page 18	VCOMP: Internal velocity addition command	-32768~+32767 min^{-1}

Select the velocity addition command input method.

Parameter Group 3 Page 06	Upper byte: velocity addition command input

Selection		Explanation
0H	Velocity addition function invalid	
2H	Use internal velocity addition command	Use internal velocity addition command value when velocity addition function is valid.

Select the condition for enabling the velocity addition function and then input the setting.

Parameter Group 8 Page 15	VCOMPS: Velocity addition function

- **Torque addition function**

The torque addition function is the feed-forward function of the torque control system.
The internal torque addition command can be used when using the torque addition command value as a fixed value.

- Internal torque addition function

- Sets the internal torque addition command value.

Parameter Group 1 Page 17	TCOMP: Internal torque addition command	-500～+500 %

- Select the torque addition command input method.

Parameter Group 3 Page 06	Lower byte: Torque calculation command input

Selection		Explanation
0H	Torque addition function invalid	
2H	Use internal torque addition command	Use internal torque addition command value when torque addition function is valid.

- Select the condition for enabling the torque addition function and then input the setting.

Parameter Group 8 Page 14	TCOMPS: Torque addition function

6.5.4 Encoder functions

- **External encoder pulse polarity selection function**

You can select external encoder pulse (CN-EXT) polarity.

Parameter Group 4 Page 01	Lower byte: External encoder (CN-EXT) polarity

Selection			
0H	EX-Z/not reversed	EX-B/not reversed	EX-A/not reversed
1H	EX-Z/not reversed	EX-B/not reversed	EX-A/reversed
2H	EX-Z/not reversed	EX-B/reversed	EX-A/not reversed
3H	EX-Z/not reversed	EX-B/reversed	EX-A/reversed
4H	EX-Z/reversed	EX-B/not reversed	EX-A/not reversed
5H	EX-Z/reversed	EX-B/not reversed	EX-A/reversed
6H	EX-Z/reversed	EX-B/reversed	EX-A/not reversed
7H	EX-Z/reversed	EX-B/reversed	EX-A/reversed

＊ The polarity selection function is disabled when connected to CN2 as external encoder.
＊ After changing the settings, this function is enabled by restarting the control power supply.

- **Incremental encoder digital filter function**

You can set the digital filter value of the incremental pulse for the selected incremental encoder. When noise is superimposed on the incremental encoder, the pulse below the set value is removed as noise. Set this value by considering the frequency of pulses from the selected encoder and the maximum number of rotations of the servo motor. If the input value is greater than the encoder frequency during the peak rotation of the servo motor, the encoder pulse is removed and the servo motor will stop.

The motor encoder and external encoder can be set separately.

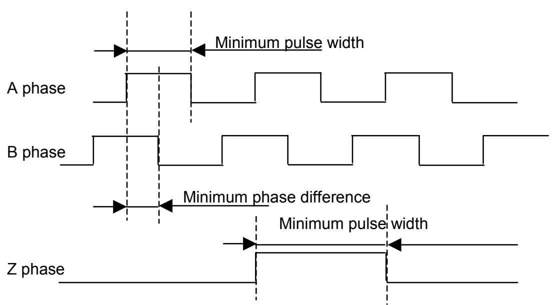
Selection of motor incremental encoder digital filter

Parameter Group 3 Page 08	Lower byte: Motor incremental encoder (CN2) digital filter

Selection of external incremental encoder digital filter

Parameter Group 3 Page 08	Upper byte: External incremental encoder (CN-EXT) digital filter

Selection	Explanation
0H	Minimum pulse width=110nsec (minimum phase difference=37.5nsec)
1H	Minimum pulse width=220nsec [standard setting value]
2H	Minimum pulse width=440nsec
3H	Minimum pulse width=880nsec
4H	Minimum pulse width=75nsec (minimum phase difference=37.5nsec)
5H	Minimum pulse width=150nsec
6H	Minimum pulse width=300nsec
7H	Minimum pulse width=600nsec



- **Absolute encoder clear function** Wire-saving absolute sensor

- When using a wire-saving absolute sensor, you can select the contents to be cleared.
  - Clear "Warning + multiple rotation data"
  - Clear only "Warning"

Parameter Group 3 Page 07	Upper byte: Select absolute encoder clear function

Selection	
0H	Clear encoder status (abnormal / warning) and multiple rotation data [standard setting]
1H	Clear only encoder status (abnormal / warning)

∗These conditions are applicable only to the wire-saving absolute encoder.

6.5.5 All functions 1

- **Functions signal**

These functions can be enabled together with other function conditions (zero velocity / positioning completion)。

- Functions

Group	Page	Symbol	Name
7	02	PCON	Velocity loop comparison control switchover function
	03	GC	Gain switchover function
8	08	DISCHARGE	Forced discharge function
	12	PPCON	Position loop comparison control switchover function
	14	TCOMPS	Torque addition function
	15	VCOMPS	Velocity addition function

Selection		Explanation
00H	Always_ Disable	Function is always disabled.
01H	Always_ Enable	Function is always enabled.
12H	LOWV_IN	Function is enabled during low velocity status (velocity below LOWV set value).
13H	LOWV_OUT	Function is enabled when not in low velocity status (velocity below LOWV set value).
14H	VA_IN	Function is enabled during velocity attainment status (velocity above VA set value).
15H	VA_OUT	Function is enabled when not in velocity attainment status (velocity above VA set value).
16H	VCMP_IN	Function is enabled during velocity matching status (velocity deviation below VCMP set value).
17H	VCMP_OUT	Function is enabled when not in velocity matching status (velocity deviation below VCMP set value).
18H	ZV_IN	Function is enabled during zero velocity status (velocity below ZV set value).
19H	ZV_OUT	Function is enabled when not in zero velocity status (velocity below ZV set value).
1AH	INP_IN	Function is enabled during positioning completion status (Position deviation is below INP set value)
1BH	INP_OUT	Function is enabled when not in positioning completion status (Position deviation is below INP set value)
1CH	TLC_IN	Function is enabled during torque limit operation status.
1DH	TLC_OUT	Function is enabled during torque limit operation status.
1EH	VLC_IN	Function is enabled during velocity limit operation status.
1FH	VLC_OUT	Function is enabled when not in velocity limit operation status.
20H	NEAR_IN	Function is enabled during near range status.
21H	NEAR_OUT	Function is enabled when not in near range status.

- **In-position output**

The in-position output signal is issued when servo motor feeding is completed (when it reaches the set deviation counter value).

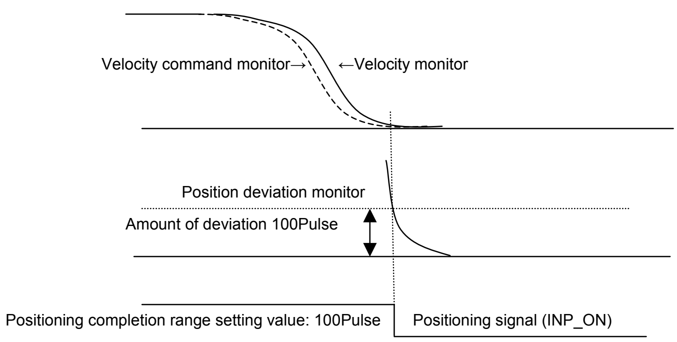
- Setting the in-position range

Parameter group A page 05	S_inp：System in-position width	1～65535　Pulse

Set the deviation counter value with positioning completion signals. The encoder pulse is evaluated, irrespective of the command pulse multiplication and electronic gear settings.

Incremental encoder:　4 times (4x) encoder pulse is evaluated.

Absolute encoder:　absolute value is evaluated.



- **Deviation counter overflow value**

Determines the overflow value of the deviation counter.

Parameter group A page 08	S_ovf：System overflow value	1～2147483647 (User unit)

- **NEAR signal (internal state)**

It is used together with the in-position signal and shows the near status of positioning completion

NEAR range settings

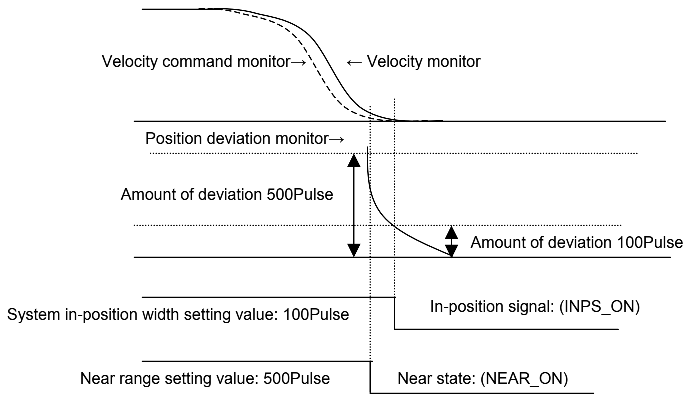
Parameter Group 1 Page 01	NEAR: near range	1~65535 Pulse

NEAR signal setting

- Determine the logical status of the NEAR signal from among the selection.

Selection		Explanation
1AH	NEAR_ON	State ON during near range status
1BH	NEAR_OFF	State OFF during near range status

By setting the value greater than the setting of in-position range, sequence state can be transferred to the anticipated state before the in-position state.

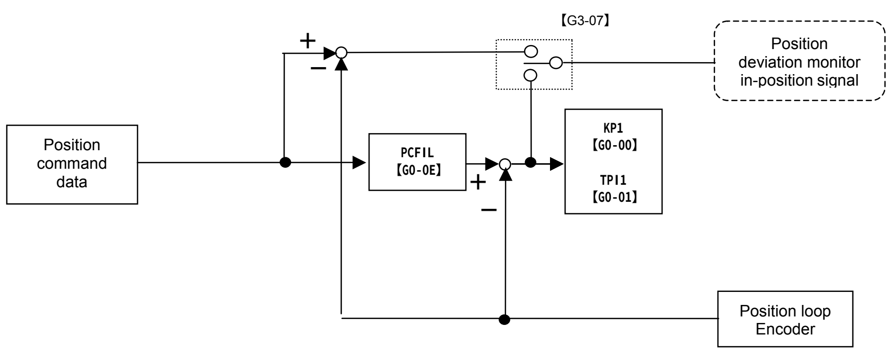


- **In-position signal / position deviation monitor detection function**

Position command used in the calculation of in-position signal and position deviation monitor output can be selected before/after passing through the position command filter.

Parameter Group 3 Page 07	Lower byte: In-position signal / position deviation monitor

Selection	
0H	Compare "Position command value after passing through position command filter" and "Feedback value".
1H	Compare "Position command value before passing through position command filter" and "Feedback value".



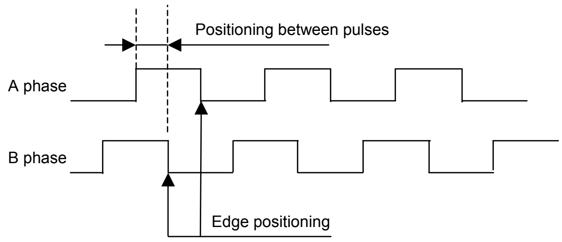
- **Positioning system**

Select the position at the time of positioning stop between encoder pulses from the edge.
The positioning system can also be selected.

Parameter Group 4 page 03	Lower byte: Positioning system

Selection	
0H	Specify positioning between pulses
1H	Specify edge positioning

After changing the setting, the function is enabled by cycling the control power supply.

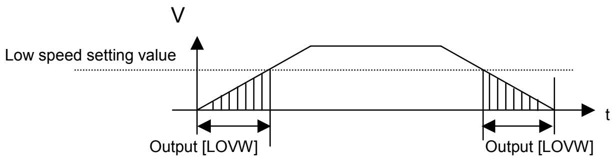


- **Low velocity setting / velocity attainment setting / velocity matching range**

These parameters affect settings for the velocity output range.
The status can be used as a valid condition for all functions.

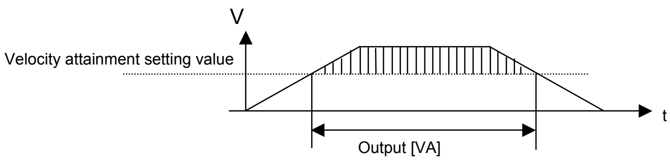
• Low velocity settings: Low velocity state is set if velocity goes below the set value.

Parameter Group 1 Page 07	LOWV: Low velocity setting	0~65535min^{-1}



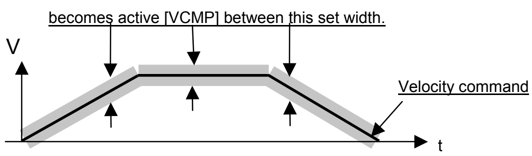
• Velocity attainment settings: Velocity attainment state is given if velocity exceeds the set value.

Parameter Group 1 Page 08	VA: Velocity attainment settings	0~65535min^{-1}



• Velocity matching range: Velocity matching range state is given if velocity deviation reaches the set range.

Parameter Group 1 Page 09	VCMP: Velocity matching range	0~65535min^{-1}

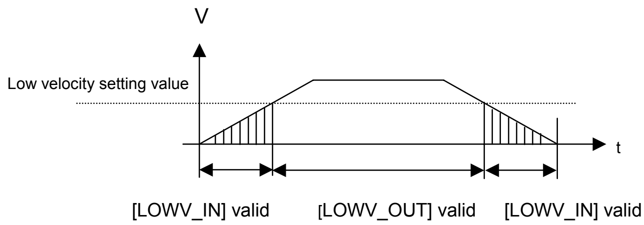


6. Operation and Functions

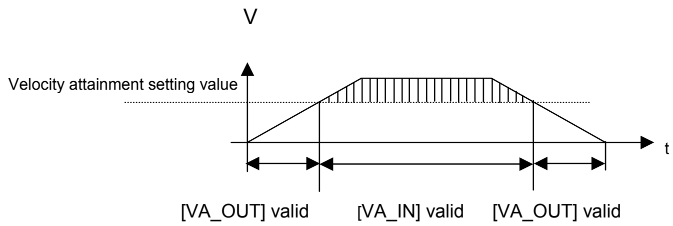
All functions can be enabled, when used in combination with "Group 7/Group 8" functions' valid conditions.
For example, by setting the gain switchover function of Group 7 Page 03 to 12H, gain is changed during low velocity status.

Selection		Explanation
12H	LOWV_IN	Function is enabled during low velocity status (velocity below LOWV set value).
13H	LOWV_OUT	Function is enabled when not in low velocity status (velocity below LOWV set value).
14H	VA_IN	Function is enabled during velocity attainment status (velocity above VA set value).
15H	VA_OUT	Function is enabled when not in velocity attainment status (velocity above VA set value).
1GH	VCMP_IN	Function is enabled during velocity matching status (velocity deviation below VCMP set value).
17H	VCMP_OUT	Function is enabled when not in velocity matching status (velocity deviation below VCMP set value).

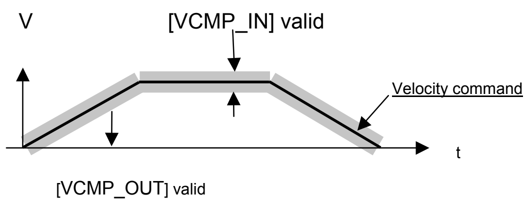
- Low velocity status [LOWV_IN]: Function is enabled during low velocity status (velocity below LOWV set value).
- Low velocity status [LOWV_OUT]: Function is enabled outside of low velocity status (velocity below LOWV set value).



- Velocity attainment status [VA_IN]: Function is enabled during velocity attainment status (velocity above VA set value).
- Velocity attainment status [VA_OUT]: Function is enabled outside of velocity attainment status (velocity above VA set value).



- Velocity matching status [VCMP_IN]: Function is enabled during velocity matching status (velocity deviation below VCMP set value).
- Velocity matching status [VCMP_OUT]: Function is enabled outside of velocity matching status (velocity deviation below VCMP set value).
-



- **Gain switchover function**

Two types of gain settings can be used alternatively. Switching between Gain 1 and Gain 2 (set by parameter Group 0) is done by enabling the gain change function (GC).

- Setting the gain on the general parameter page:

Group	Page	symbol	Name	
0	00	KP1 [1/S]	Position loop comparison gain 1	GAIN1
	01	TPI1 [ms]	Position loop reset time constant 1	
	02	KVP1 [Hz]	Velocity loop comparison gain 1	
	03	TVI1 [ms]	Velocity loop reset time constant 1	
	08	JRAT1 [%]	Load inertia moment comparison 1	
	13	TCFIL1 [Hz]	Torque command filter 1	
	04	KP2 [1/S]	Position loop comparison gain 2	GAIN2
	05	TPI2 [ms]	Position loop reset time constant 2	
	06	KVP2 [Hz]	Velocity loop comparison gain 2	
	07	TVI2 [ms]	Velocity loop reset time constant 2	
	09	JRAT2 [%]	Load inertia moment comparison 2	
	14	TCFIL2 [Hz]	Torque command filter 2	

- The conditions for enabling gain switching function are assigned. The value for GAIN 2 is enabled when the GC signal is valid.

Parameter Group 7 Page 03	GC: Gain change function

- **Velocity loop comparison control switchover function**

Velocity loop PI control / P control can be used alternatively. Control switching is activated by enabling the velocity loop proportional control switching function (PCON).

PI control (proportional / integral control): Velocity loop proportional gain (KVP) / Velocity loop integral action time (TVI)
P control (proportional control): Velocity loop proportional gain (KVP)

∗ When set to proportional control, servo gain is reduced and the servo system is made stable.
∗ When the velocity loop integral action time (TVI) is set to 1000.0ms, it is not necessary to use this function, since the integral action time in use is invalid (proportional control)

The conditions for enabling the velocity loop proportional control switching function are assigned. It is changed to the proportional control when the PCON state is valid.

Parameter Group 7 Page 02	PCON: Velocity loop proportional control switchover function

- **P-PI Auto change function**

  Velocity loop PI control / P control changes can be made automatically. This function can change to PI control when below a set value to LOWV, and to P control when above a set value to LOWV.

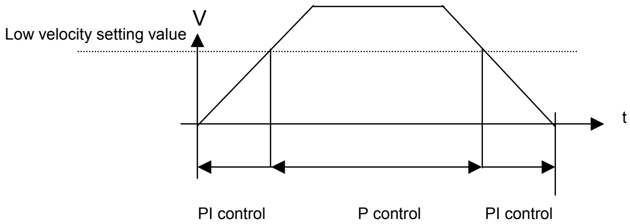
Set the conditions affected by low velocity settings.

Parameter Group 1 Page 07	LOWV: Low velocity settings	0~65535min^{-1}

Set P-PI auto switching.

Parameter Group 3 Page 02	Lower byte: P-PI Auto change function

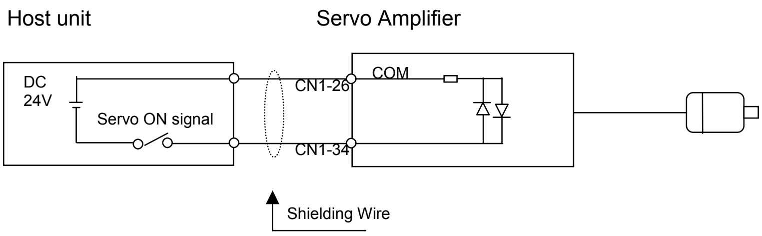
Selection	
0H	P-PI auto switching function / invalid
1H	P-PI auto switching function / valid



- **Servo ON function**

  This function enables the sending of a servo ON signal from the host unit. The servo motor can be set to “ready” status by enabling the servo ON function (SON).

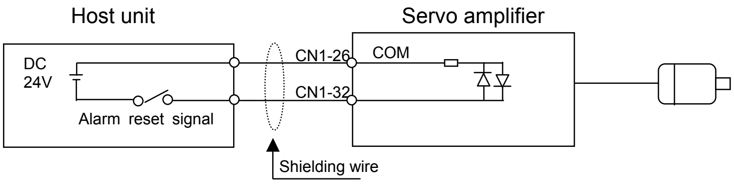
The servo motor is excited when the SON signal is enabled.

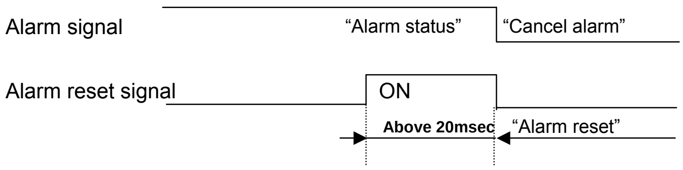


- **Alarm reset function**

This function enables the setting of an alarm reset signal from the host unit. An alarm is cleared by enabling alarm reset function (AL-RST).

The alarm is cleared if the AL-RST signal is valid.





∗ Note that there are some alarms which need to turning OFF the control power supply to clear the alarm state.

- **External trip input function**

This function can output a contact input (such as external thermal) as an alarm (AL55H) in the servo amplifier.

An alarm (AL55H) is given if the EXT-E signal (CN1-23) is valid (input circuit OFF)

- **Forced discharge function**

This function forcefully discharges voltage charged in the condenser for the main circuit power supply in the servo amplifier when power supply to the main circuit is cut. However, discharge is not possible when the main circuit power supply is ON.

The conditions for enabling forced discharge function are assigned. Forced discharge is possible when the DISCHARGE signal is valid.

Parameter Group 8 Page 08	DISCHARGE: Forced discharge function

- **Position loop comparison control switchover function**

Position loop PI control / P control can be used alternatively. Enable switching by activating the position loop comparison control switching function (PPCON).

PI control (comparison / integral control): Position loop comparison gain (KP) / reset time constant (TPI)

P control (Comparison control): Position loop comparison gain (KP)

Since the position loop reset time constant (TPI) is normally 1000.0 ms, the reset time constant becomes invalid.

Conditions for enabling the position loop comparison control switching function are assigned. A switch is made to comparison control when the PPCON signal is valid.

Parameter Group 8 Page 12	PPCON: Position loop comparison control switchover function

6.5.6 All functions 2

- **Power failure detection delay time function**

This function allows setting of a delay period, after power off of the control power supply, for detecting problems in the control power supply. Detection of unexpected power failures is diminished when this value is increased. However, even if this value is increased and problem detection is delayed, when the power supply to the internal logic circuit is exhausted, routine operations at the time of control power supply cut off / restart will continue.

Set the power failure detection delay time.

Parameter Group 1 Page 1B	PFDDLY: Power failure detection delay time	20~1000 ms

∗ When energy to the main circuit power supply is insufficient, problems like a reduction in main circuit power supply are also detected.
∗ The actual anomaly detection delay time compared to the selected value can vary between -12ms and +6ms.
∗ After selection, the setting value for this parameter is enabled by restarting the control power supply.

- **Auto notch filter tuning function**

Resonance and noise from the system can be suppressed by setting the torque command notch filter to the resonance frequency of the unit machine system. Auto settings are possible through auto notch filter tuning. This function can be operated from the “Digital operator” or the “Setup software Q-Setup”. The value set for auto notch filter tuning is automatically stored in torque command notch filter A.

Set the torque command value when selecting auto notch filter tuning execution.

Parameter Group 1 Page 22	ATNFIL: Torque command value of Auto notch filter tuning	10~300 %

Refer to “Chapter 8 8.1.3.3 Trial operation adjustment mode” in the “Q-Setup-Setup Software Instruction Manual M0005351” for details of operation methods.

- **Overload warning function**

This function will send a warning before reaching overload alarm status. Set the ratio corresponding to the overload alarm value to 100%. When set to 100%, the overload warning and overload alarm are given simultaneously.

Set the overload warning level.

Parameter Group 1 Page 1C	OLWLV: Overload warning level	20~100 %

Selection		Explanation
2CH	WNG-OLW_ON	Output turns ON during overload warning status
2DH	WNG-OLW_OFF	Output turns OFF during overload warning status

The overload detection process is assumed to be 75% of the rated load at the time of starting the control power supply (hot start). At this time, if the overload warning level is set below 75%, an overload warning is given after starting the control power supply.

- **Excessive deviation warning function**

This function gives a warning before reaching excessive deviation alarm status.

Set the deviation excessive warning value.

Parameter Group 1 Page 1D	OFWLV: Excessive deviation warning level	1~65535 x 256 pulse

Selection		Explanation
2AH	WNG-OFW_ON	Output turns ON during excessive deviation warning status
2BH	WNG-OFW_OFF	Output turns OFF during excessive deviation warning status

This setting is enabled after restarting the control power supply.

- **Regenerative overload, battery warning function**

2EH	WNG-ROLW_ON	Output turns ON during regenerative overload warning status
2FH	WNG-ROLW_OFF	Output turns OFF during regenerative overload warning status
30H	WNG-BAT_ON	Output turns ON during battery warning status
31H	WNG-BAT_OFF	Output turns OFF during battery warning status

6. Operation and Functions

6.6 Description of monitor output function

All signals from the servo amplifier can be displayed on the analog monitor (2 channels) and digital monitor (1 channel). The analog monitor (CH1) can also be displayed on CN1. CH1, CH2 and the digital monitor can be viewed simultaneously by connecting the optional monitor box and a dedicated cable to the connector for the analog monitor (located inside the access cover on the front surface of the servo amplifier).

6.6.1 Analog monitor

Analog monitor polarity settings

Parameter Group 3 Page 05	Upper: Analog monitor polarity

Selection		Explanation
0H	MON2: Forward, positive output MON1: Forward, positive output	MON2: Positive voltage output in forward rotation; output pos and neg voltage. MON1: Positive voltage output in forward rotation; output pos and neg voltage.
1H	MON2: Forward, positive output MON1: Forward, negative output	MON2: Positive voltage output in forward rotation; output pos and neg voltage. MON1: Negative voltage output in forward rotation; output pos and neg voltage.
2H	MON2: Forward, negative output MON1: Forward, positive output	MON2: Negative voltage output in forward rotation; output pos and neg voltage. MON1: Positive voltage output in forward rotation; output pos and neg voltage.
3H	MON2: Forward, negative output MON1: Forward, negative output	MON2: Negative voltage output in forward rotation; output pos and neg voltage. MON1: Negative voltage output in forward rotation; output pos and neg voltage.
4H	MON2: Forward, positive output MON1: Absolute value output	MON2: Positive voltage output in forward rotation; output pos and neg voltage. MON1: Positive voltage output together in forward and reverse rotation.
5H	MON2: Forward, negative output MON1: Absolute value output	MON2: Output minus voltage when forward Output positive and minus voltage. MON1: Positive voltage output together in forward and reverse rotation.
6H	MON2: Absolute value output MON1: Forward, positive output	MON2: Positive voltage output together in forward and reverse rotation. MON1: Output positive voltage when forward Output positive and minus voltage.
7H	MON2: Absolute value output MON1: Forward, negative output	MON2: Positive voltage output together in forward and reverse rotation. MON1: Negative voltage output in forward rotation; output pos and neg voltage.
8H	MON2: Absolute value output MON1: Absolute value output	MON2: Positive voltage output together in forward and reverse rotation. MON1: Positive voltage output together in forward and reverse rotation.

Analog monitor output settings

Parameter Group 5 Page 01	MON1: Select analog monitor output 1
Parameter Group 5 Page 02	MON2: Select analog monitor output 2

Selection		Explanation
00H	TMON_2V/TR	Torque monitor 2V/rated torque
01H	TCMON_2V/TR	Torque command monitor 2V/rated torque
02H	VMON_2mV/min-1	Speed monitor 2mV/min-1
03H	VMON_1mV/min-1	Speed monitor 1mV/min-1
04H	VMON_3mV/min-1	Speed monitor 3mV/min-1
05H	VCMON_2mV/min-1	Speed command monitor 2mV/min-1
06H	VCMON_1mV/min-1	Speed command monitor 1mV/min-1
07H	VCMON_3mV/min-1	Speed command monitor 3mV/min-1
08H	PMON_50mV/P	Position deviation counter monitor 50mV/Pulse
09H	PMON_20mV/P	Position deviation counter monitor 20mV/Pulse
0AH	PMON_10mV/P	Position deviation counter monitor 10mV/Pulse
0BH	TLMON_EST_2V/TR	Load torque monitor (estimated value) 2V/TR
0CH	FMON_10mV/kP/s	Position command pulse monitor (Position command pulse input frequency) 10mV/kPulse/sec
0DH	Sine-U	U phase electrical angle 8V p-p
0EH	PMON_5mV/P	Position deviation counter monitor 5mV/Pulse
0FH	PMON_1mV/P	Position deviation counter monitor 1mV/Pulse
10H	FMON_2mV/kP/s	Position command pulse monitor (Position command pulse input frequency) 2mV/kPulse/sec

6.6.2 Digital monitor

- Digital monitor output settings

Parameter Group 5 Page 02	DMON: Digital monitor output selection

value		Explanation	value		Explanation
00H	Always_OFF	Output is always OFF.	4AH	CHARGE_ON	turns ON during main circuit power source charging
01H	Always_ON	Output is always ON.	4BH	CHARGE_OFF	turns ON during main circuit power source charging
02H	S-RDY_ON	turns ON during completion of operation preparation	4CH	DB_OFF	turns OFF during dynamic brake operations.
03H	S-RDY_OFF	turns OFF during completion of operation preparation	4DH	DB_ON	turns ON during dynamic brake operations.
04H	P-ON_ON	turns ON when power is ON.	4AH	CHARGE_ON	turns ON during main circuit power source charging
05H	P-ON_OFF	turns OFF when power is ON.	4BH	CHARGE_OFF	turns ON during main circuit power source charging
06H	A-RDY_ON	turns ON when power is authorized ON.	58H	S-RDY2_ON	turns ON during completion of operation preparation
07H	A-RDY_OFF	turns OFF when power is authorized ON.	59H	S-RDY2_OFF	turns OFF during completion of operation preparation
08H	S-ON_ON	turns ON during motor excitation	60H	NCRDY_ON	turns ON when motor can be excited by S-ON input
09H	S-ON_OFF	turns OFF during motor excitation	61H	HBON_ON	turns ON while holding brake excitation signal is output
0AH	MBR-ON_ON	turns ON during maintenance brake excitation signal output.	62H	ERR_ON	turns OFF during error status
0BH	MBR-ON_OFF	turns OFF during maintenance brake excitation signal output.	63H	EXT_ON	turns OFF while external operation is enabled
0CH	TLC_ON	turns ON during torque limit operations.	64H	MOVE_ON	Output is ON while operational signal is input
0DH	TLC_OFF	turns OFF during torque limit operations.	65H	PFIN_ON	turns ON when positioning is finished
0EH	VLC_ON	turns ON during speed limit operations	66H	INPS_ON	turns ON in in-imposition state
0FH	VLC_OFF	turns OFF during speed limit operation	67H	ZFIN_ON	turns ON after homing is finished
10H	LOWV_ON	turns ON during low speed status	68H	OUT1_ON	Output is ON while output OUT (1) is ON
11H	LOWV_OFF	turns OFF during low speed operation	69H	OUT2_ON	Output is ON while output OUT (2) is ON
12H	VA_ON	turns ON during speed transport status	6AH	OUT3_ON	Output is ON while output OUT (3) is ON
13H	VA_OFF	turns OFF during speed transport status	6BH	OUT4_ON	Output is ON while output OUT (4) is ON
14H	VCMP_ON	turns ON during speed coincidence status	6CH	OUT5_ON	Output is ON while output OUT (5) is ON
15H	VCMP_OFF	turns OFF during speed coincidence status	6DH	OUT6_ON	Output is ON while output OUT (6) is ON
16H	ZV_ON	turns ON during zero speed status	6EH	OUT7_ON	Output is ON while output OUT (7) is ON
17H	ZV_OFF	turns OFF during zero speed status	6FH	OUT8_ON	Output is ON while output OUT (8) is ON
18H	INP_ON	turns ON during positioning completion status.	70H	EXT-E_ON	Output turns On when EXT-E input is ON
19H	INP_OFF	turns OFF during positioning completion status.	71H	RUN_ON	Output turns On when RUN input is ON
1AH	NEAR_ON	turns ON during near range status	72H	ZRT_ON	Output turns On when ZRT input is ON
1BH	NEAR_OFF	turns OFF during near range status	73H	+JOG_ON	Output turns On when +JOG input is ON
1CH	CMD-ACK_ON	turns ON during command receipt permission status	74H	-JOG_ON	Output turns On when -JOG input is ON
1DH	CMD-ACK_OFF	turns OFF during zero command receipt permission status	75H	RAP/OVRD_ON	Output turns On when RAP/OVRD input is ON
1EH	GC-ACK_ON	turns ON during gain switchover status	76H	ARST_ON	Output turns On when ARST input is ON
1FH	GC-ACK_OFF	turns OFF during gain switchover status	77H	CACL_ON	Output turns On when CACL input is ON
20H	PCON-ACK_ON	turns ON during speed loop comparison limit switchover status.	78H	S-ON_ON	Output turns On when S-ON input is ON
21H	PCON-ACK_OFF	turns OFF during speed loop comparison control switchover status.	79H	SEL1_ON	Output turns On when SEL1 input is ON
26H	F-OT_ON	turns ON during forward over travel status	7AH	SEL2_ON	Output turns On when SEL2 input is ON
27H	F-OT_OFF	turns OFF during forward over travel status	7BH	SEL3_ON	Output turns On when SEL3 input is ON
28H	R-OT_ON	turns ON during reverse over travel status	7CH	+1STEP_ON	Output turns On when +1STEP input is ON
29H	R-OT_OFF	turns OFF during reverse over travel status	7DH	-1STEP_ON	Output turns On when -1STEP input is ON
2AH	WNG-OFW_ON	turns ON during excessive deviation warning status	7EH	I_RUN_ON	Output turns On when I_RUN input is ON
2BH	WNG-OFW_OFF	turns OFF during excessive deviation warning status	7FH	MFIN_ON	Output turns On when MFIN input is ON
2CH	WNG-OLW_ON	turns ON during excessive load warning status	80H	RESERVE1_ON	(Reserved)
2DH	WNG-OLW_OFF	turns OFF during excessive load warning status	81H	RESERVE2_ON	(Reserved)
2EH	WNG-ROLW_ON	turns ON during regenerative excessive load warning status	82H	RESERVE3_ON	(Reserved)
2FH	WNG-ROLW_OFF	turns OFF during regenerative excessive load warning status	83H	RESERVE4_ON	(Reserved)
30H	WNG-BAT_ON	turns ON during battery warning status	84H	SDN_ON	Output turns On when SDN input is ON
31H	WNG-BAT_OFF	turns OFF during battery warning status	85H	+OT_ON	Output turns On when +OT input is ON
38H	ALM_ON	turns ON during alarm status	86H	-OT_ON	Output turns On when -OT input is ON
39H	ALM_OFF	turns OFF during alarm status	87H	E_STR_ON	Output turns On when E_STR input is ON

Refer to “Chapter 10- 10.1.7 Monitor output, 10.4 Options” for details on the monitor box and dedicated cable.

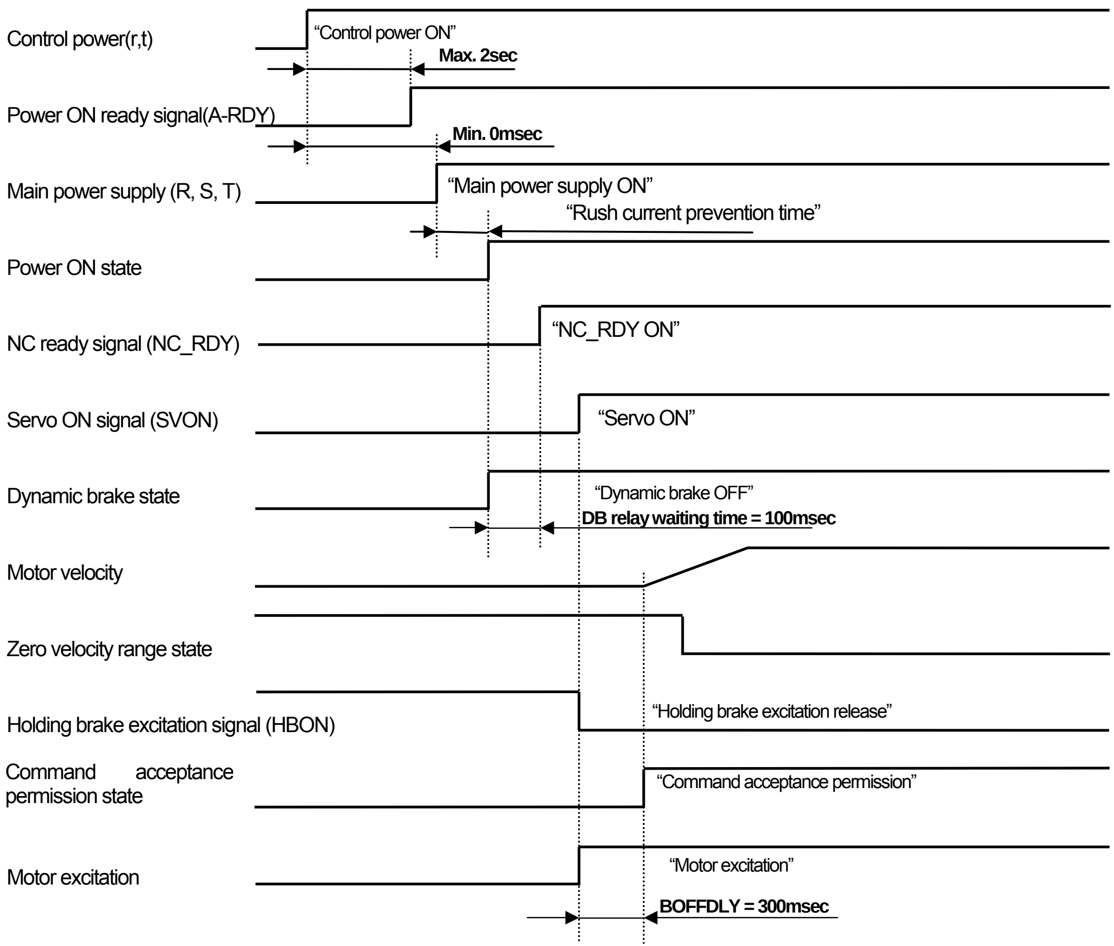
Operations

7. Operations

7.1 Operation sequence setup

Various sequences are managed by setting various parameters in the Q series servo amplifier. This section outlines the “Power ON / Servo ON” and “Servo OFF / Power OFF” sequences during standard parameter setup. The functions, setup, and sequences of various parameters are explained in “7.2 Sequence Functions”.

7.1.1 Power ON / Servo ON sequence

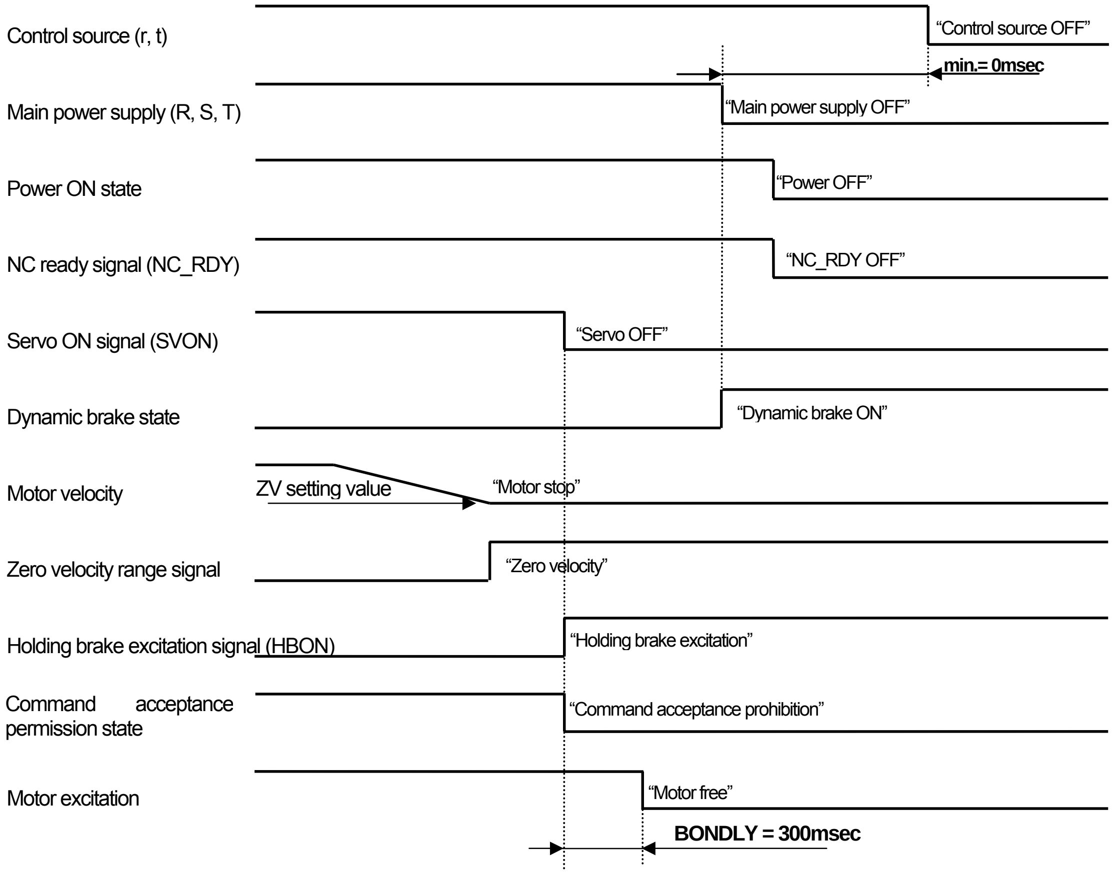


When the amplifier is in alarm, the NC ready signal is not given.

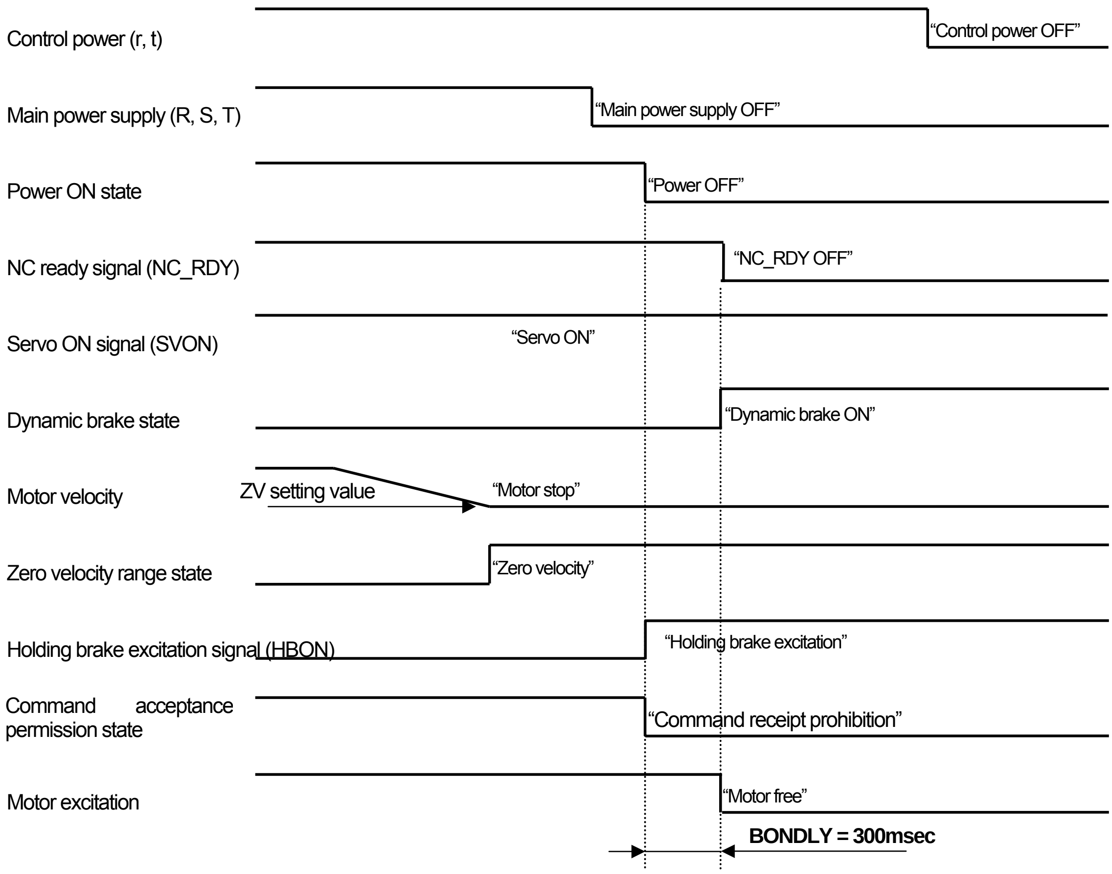
The rush current prevention time changes with the amplifier capacity. Refer to the following table.

Servo amplifier model number	Input power AC200V 3 phase	Input power AC200V 1 phase	Input power AC100V
QS1□01	900 msec	1800 msec	1800 msec
QS1□03	900 msec	1800 msec	1800 msec
QS1□05	900 msec	1800 msec	—
QS1□10	1400 msec	—	—
QS1□15	1400 msec	—	—
QS1□30	1900 msec	—	—

7.1.2 Servo OFF / Power OFF sequence



7.1.3 Sequence when power is turned OFF when servo is ON



7.2 Sequence-related functions

To locate detailed information on managing sequences by setting various parameters in the Q series servo amplifier, refer to the following table.

Function	Related parameters			Explanation	Sequence
	Q-Setup group	Q-Setup page	Digital operator		
Forced electric discharge function	8	08	PA808	7.2.1	–
Motor excitation time until holding brake operation setting	1	10	PA110	7.2.2	7.2.2
	1	11	PA111		
Operation for stopping the motor / brake selection after stopping the motor, during servo off signal input	3	04	PA304 (下位) PA11A	7.2.3	7.2.3.1 ~7.2.3.6
Brake selection setting during power-off / forced stopping of EMR input	3	05	PA305 (下位)	7.2.4	7.2.4.1 ~7.2.3.4
Brake operation start time setting	1	19	PA119	7.2.5	7.2.5.1 ~7.2.5.3

7.2.1 Forced electric discharge function

If the frequency of the power ON/OFF of the servo amplifier is less than 5 times/hour and less than 30 times/day, the forced electric discharge funtion will attempt to compensate.
To raise the frequency of the main power supply ON / OFF sequence, set the parameter so that the main power supply is OFF in such a way that the discharge process is not performed.

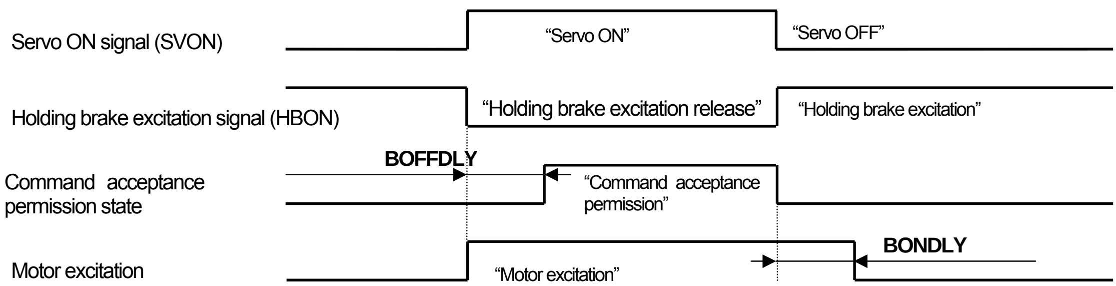
Forced electric discharge function: Parameter Group 8 Page 08 (**Refer to "Chapter 8", 8-51)**

The standard setting value is "01:_Always_Enable" (function always enabled). Modify to "00:Always_Disable" (function always disabled) to override the standard sertting.

> While the main power supply is OFF, repeated "ON / OFF" cycling of the main power supply by the discharge function at frequent intervals during operational status may cause burning of the amplifier and power input circumference circuit, and eventual failure.

7.2.2 Holding brake excitation function and sequence

When using a holding brake with the servo motor, it is possible to change the excitation time of the servo motor during the operation and release of the brake. Set this function with the following parameters:
Holding brake operation delay time (BONDLY): Parameter Group 1 Page 10 (**Refer to "Chapter 8", 8-34)**
Holding brake operation release delay time: Parameter Group 1 Page 11 (**Refer to "Chapter 8", 8-34)**
When the input value is 0msec, the command becomes invalid within 4msec after SON.



7.2.3 Brake function and sequence

This function is valid from the start of operation (Servo ON status), until a Servo OFF signal is received.

The method for stopping the servo motor (free run operation / dynamic brake operation / servo brake operation) is selected when specifying the Servo OFF signal. The servo motor status after stopping (motor free / dynamic brake status) is also determined in the same way. Select these combined conditions from the dynamic brake operation parameters listed below.

It is possible to set the conditions for stopping the motor (motor velocity) with the parameter zero velocity range (ZV). If the motor velocity is within the set range, it will be detected as zero velocity status.

Dynamic brake operation: Parameter Group 3 Page 04-lower (**Refer to "Chapter 8", 8-39)**
Zero speed range (ZV): Parameter Group 1 Page 1A (**Refer to "Chapter 8", 8-35)**

Selection	When servo is OFF	After stopping the motor	Sequence
0H	Free run operation	Motor free operation	7.2.3.1
1H	Free run operation	Dynamic brake operation	7.2.3.2
2H	Dynamic brake operation	Motor free operation	7.2.3.3
3H	Dynamic brake operation	Dynamic brake operation	7.2.3.4
4H	NC deceleration stop operation	Motor free operation	7.2.3.5
5H	NC deceleration stop operation	Dynamic brake operation	7.2.3.6

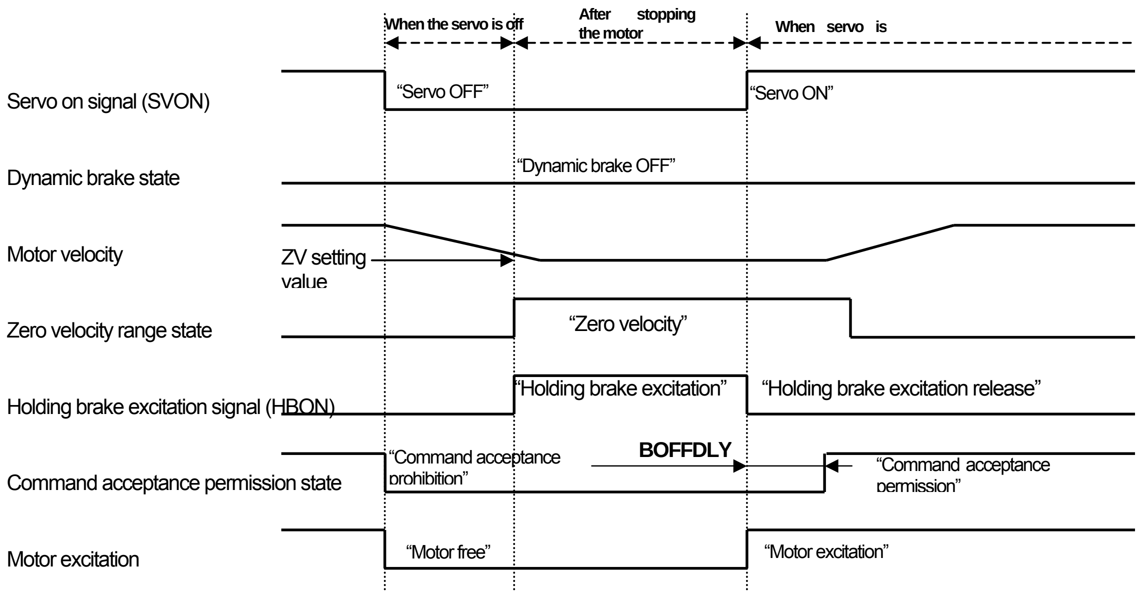
Free run operation
Motor status: current is not passed, not excited. Motor stops due to friction of the machine.

Dynamic brake operation
Motor status: short circuit in the electric circuit of servo motor; motor is stopped at once.

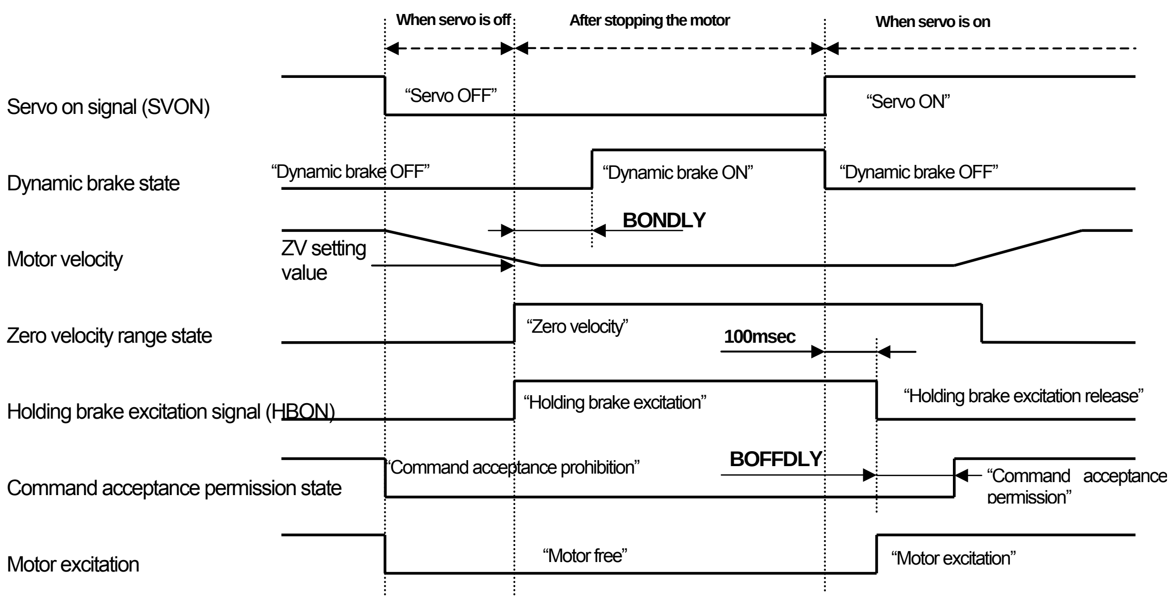
NC deceleration stop operation
Deceleration stop method using the programmed accel/decel parameter is used.

Motor free operation
Motor status: current is not passed, not excited. Motor stops due to machine friction.

7.2.3.1 When servo is OFF: Free run operation　After stopping the motor: Motor free operation



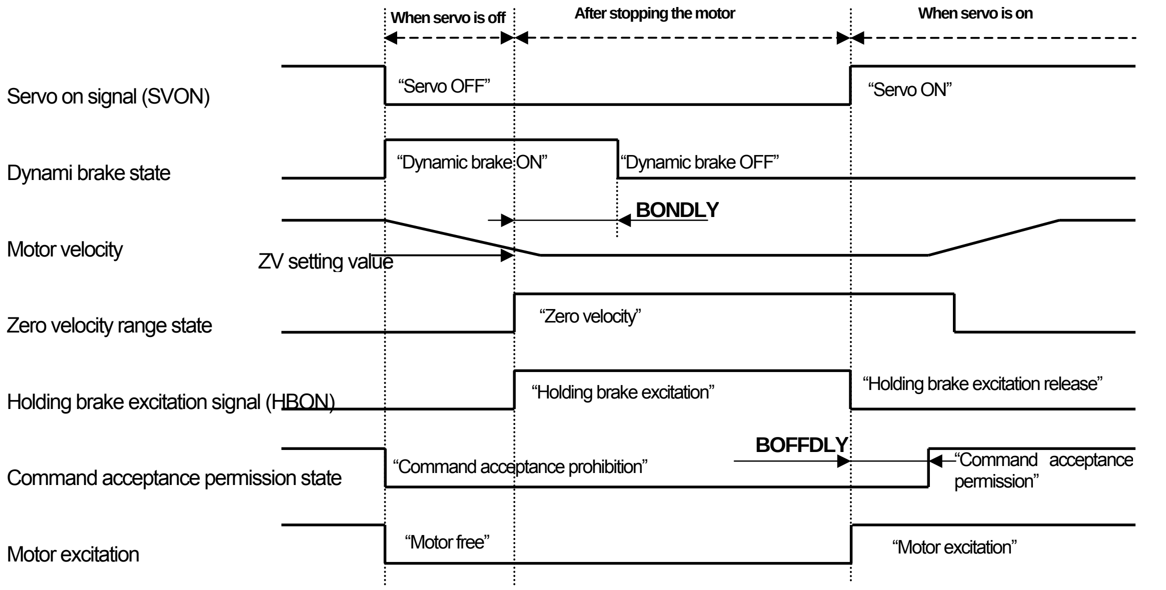
7.2.3.2 When servo is OFF: Free run operation　After motor stop: Dynamic brake operation



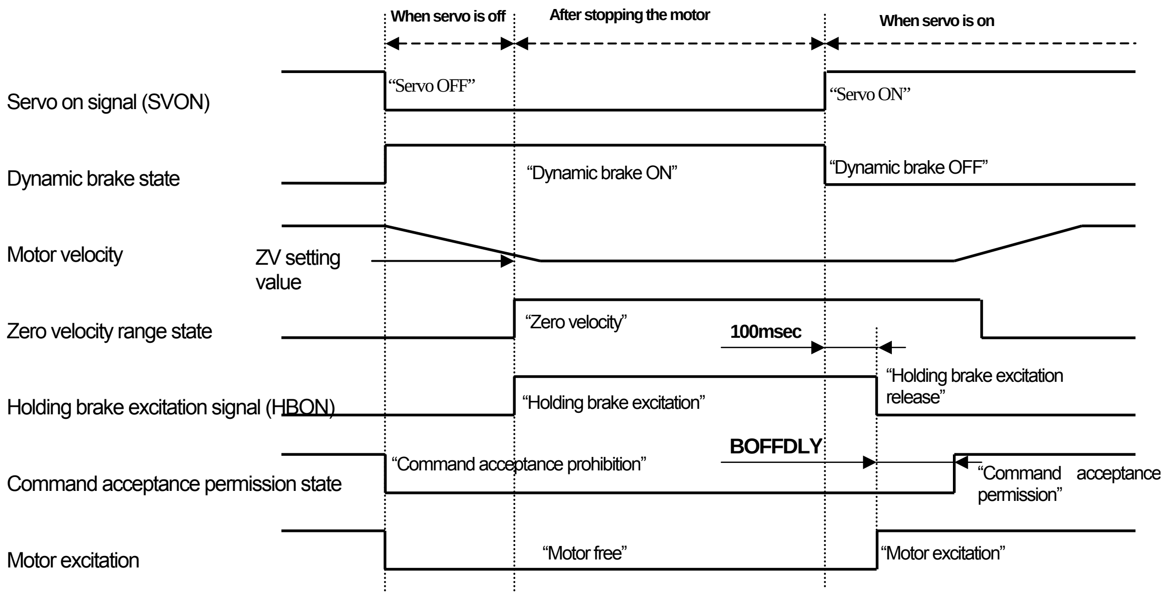
BONDLY: Parameter Group 1 Page 10　(**Refer to "Chapter 8", 8-34)**

BOFFDLY: Parameter Group 1 Page 11　(**Refer to "Chapter 8", 8-34)**

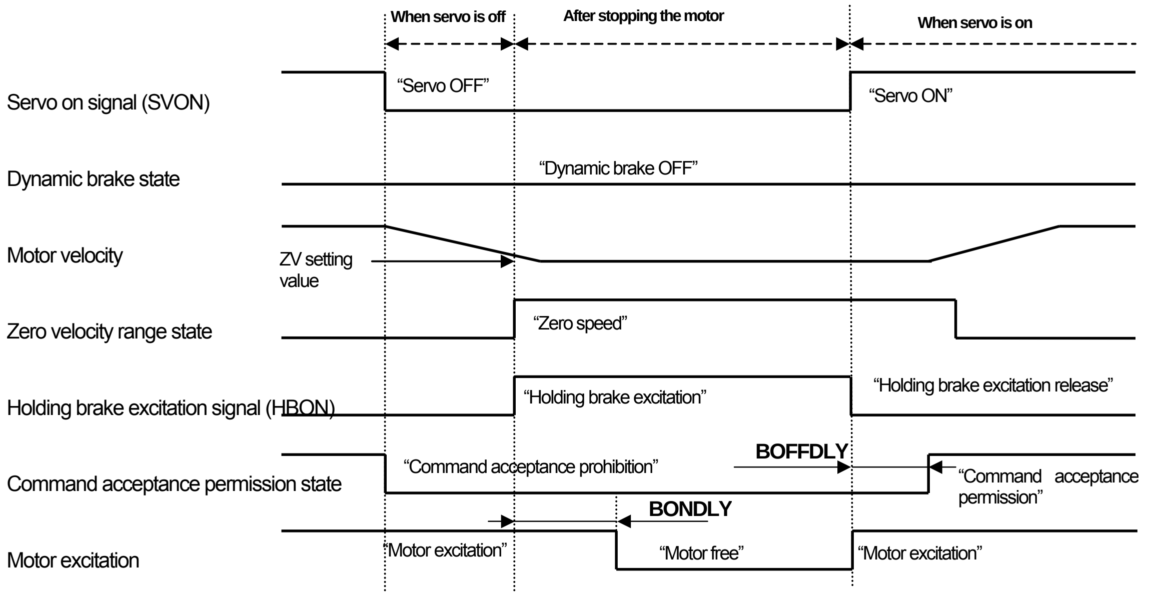
7.2.3.3 When servo is OFF: Dynamic brake operation After motor stop: Motor free operation



7.2.3.4 Servo OFF: Dynamic brake operation After motor stop: Dynamic brake operation

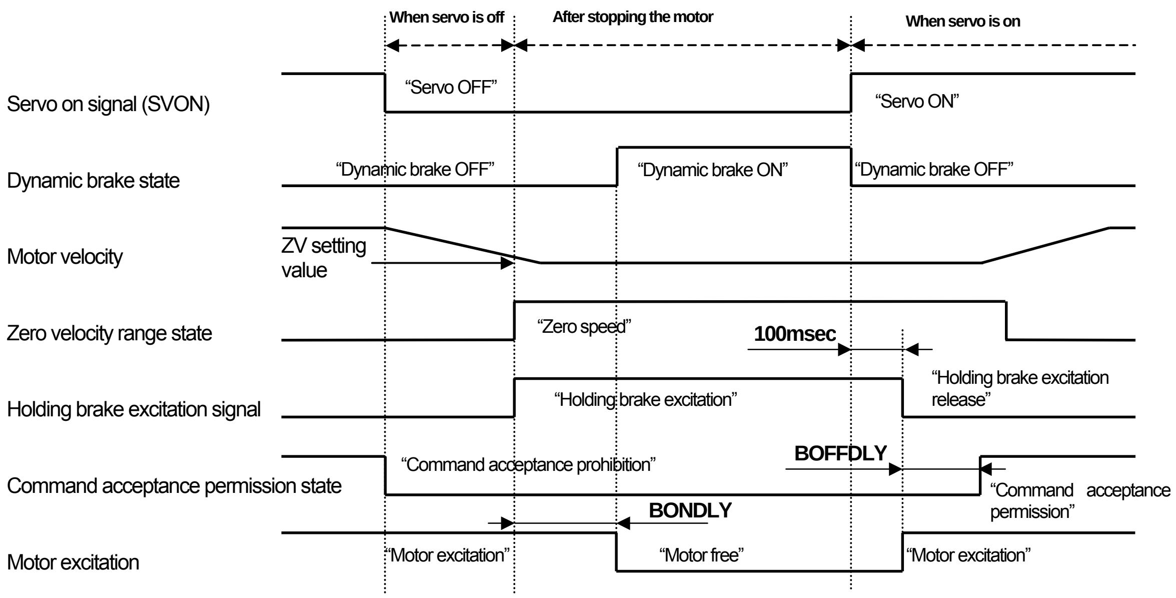


7.2.3.5 When servo is OFF: Servo brake operation After motor stop: Motor free operation



Note: A position deviation is not cleared when a servo ON signal is entered after switching the servo OFF, and during brake operation delay time (BONDLY).

7.2.3.6 When servo is OFF: Servo brake operation After motor stop: Dynamic brake operation



7.2.4 Forcible stop (Power OFF/ emergency stop) function and sequence

This function is valid from Servo ON status (operating) until the main circuit power supply is disconnected.

When the main circuit power is disconnected, the operation method for stopping the servo motor (servo brake stop or dynamic brake stop) is selected.
Make a selection from the following parameters:

Forced stop operation: Parameter Group 3 Page 05 Lower (**Refer to "Chapter 8" , 8-40)**

Selection	Forced stop operation		Sequence
0H	Servo brake	Main circuit power OFF	7.2.4.1
1H	Dynamic brake	Main circuit power OFF	7.2.4.2

When dynamic brake is selected and an alarm for a servo brake stop is detected, bring the servo motor to a stop with the dynamic brake. (Refer to 7.3 for more details)

Servo brake operation

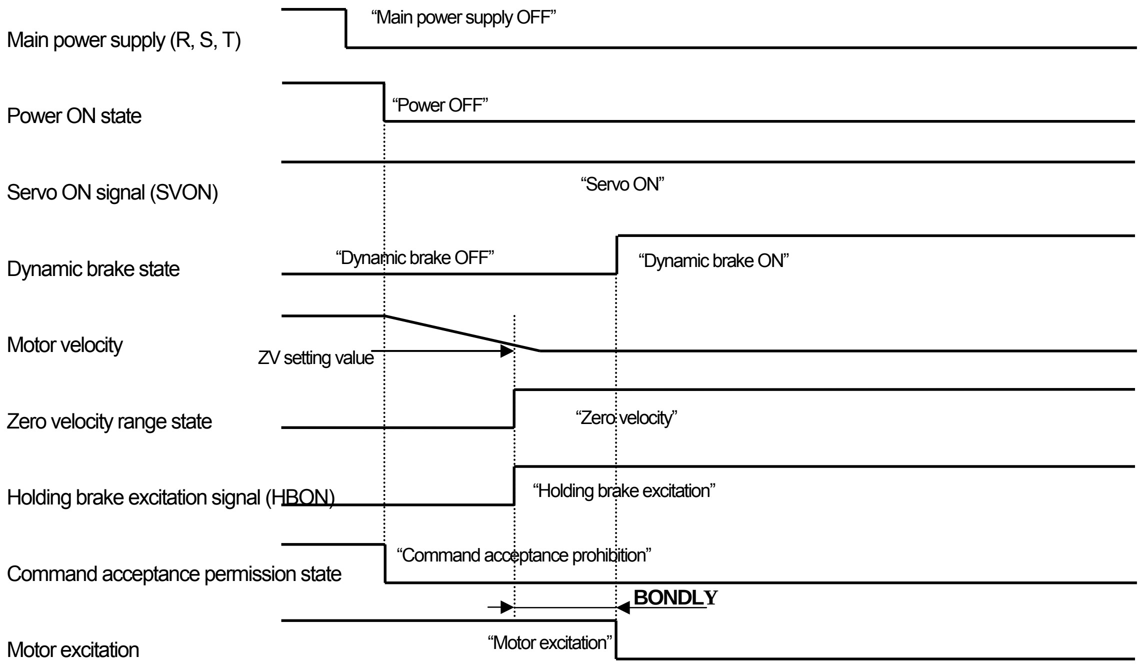
In this operation, the velocity command is forcibly set to "zero velocity", the output torque is controlled, and the motor is stopped. It is possible to change the limit value of output torque with the following parameters:

Torque limit value during sequence operation: Parameter Group 1 Page OF (**Refer to "Chapter 8", 8-34)**

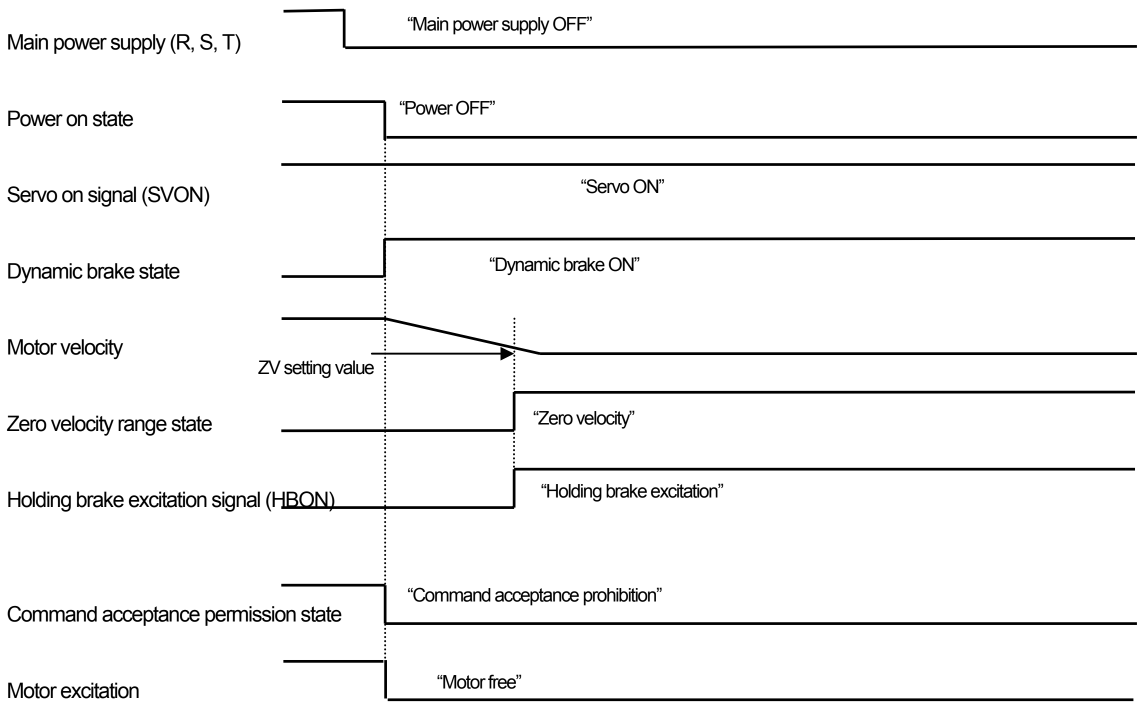
Dynamic brake operation

In this operation, make the electric circuit of the servo motor power short, then the motor is stopped immediately.

7.2.4.1 Forcible stop operation: Servo brake operation (When main circuit power is disconnected)



7.2.4.2 Forcible stop operation: Dynamic brake operation (When main circuit power is disconnected)



7.2.5 Brake operation start time (BONBGN)

This function is used to control the gravitational axis (vertical axis)

Brake operation start time: Parameter Group 1 Page 19 **(Refer to "Chapter 8", 8-35)**
Setting range : "0~65535" msec ("0" msec setting : function is invalid)

Zero velocity range (ZV) : Parameter Group 1 Page 1A **(Refer to "Chapter 8", 8-35)**
Setting range : "50~500" min^{-1}

If the motor does not stop within the set time of brake operation start time, from Servo ON status to Servo OFF status (where motor speed has not reached below the value of "Zero velocity range [ZV]"), stop the motor with both the holding brake and dynamic brake. In this situation, the motor is stopped with both holding brake and dynamic brake (7.2.5.1) regardless of the selected operation for motor stop during servo OFF signal input/setting of brake selection after stopping the motor. Only the holding brake operates when the servo is OFF and dynamic brake is ON (7.2.5.2).

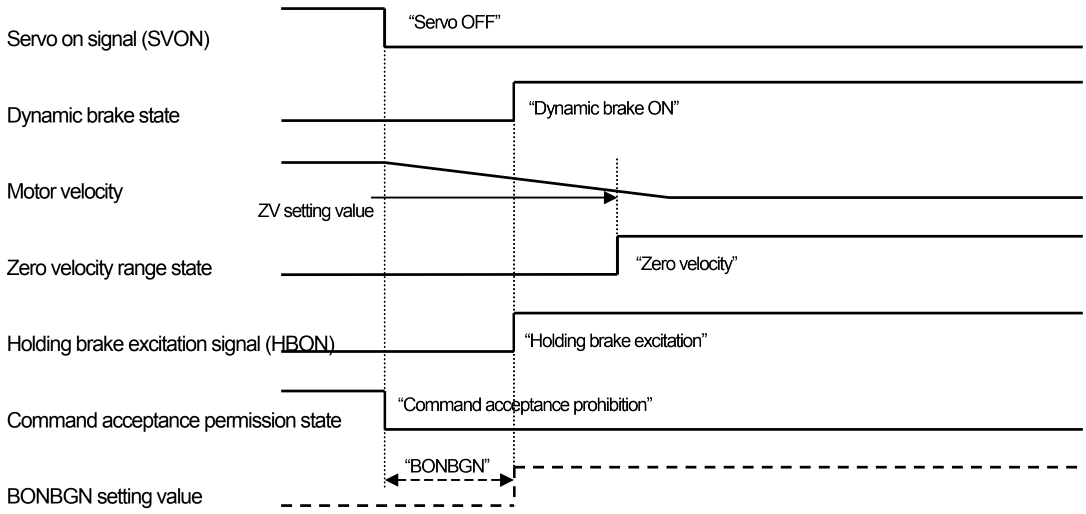
Input	Parameter Group 3 Page 04 Lower	Sequence
Servo OFF	0H / 1H : Free run operation when servo is off 4H / 5H : Servo brake operation when servo is off	7.2.5.1
	2H / 3H : Dynamic brake operation when servo is off	7.2.5.2

When the motor stops within the selected value of brake operation start time (when motor speed is below the setting value of "Zero velocity range (ZV) [PA11A]"), this setting will not function per the normal status. PA304 settings continue to be valid. Refer to sequence 7.2.3 for more details.

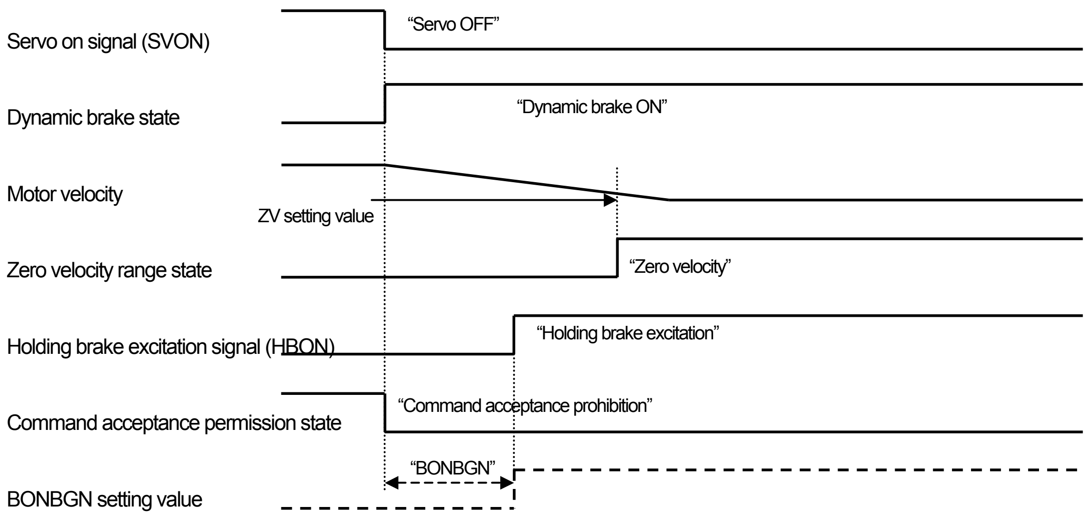
When the brake operation start time has been set, and power is interrupted to stop the motor during motor operations ("motor not stopped" status), this sequence changes per the conditions (servo brake operation / dynamic brake operation) of "Forced stop operation: Parameter Group 3 Page 05 Lower".

Input	Parameter Group 3 Page 05 lower	Sequence
Power OFF	Servo brake	7.2.5.3
	Dynamic brake	7.2.5.4

7.2.5.1 If the motor does not stop within brake operation start time, in case free run or NC deceleration operation is selected as servo off operations

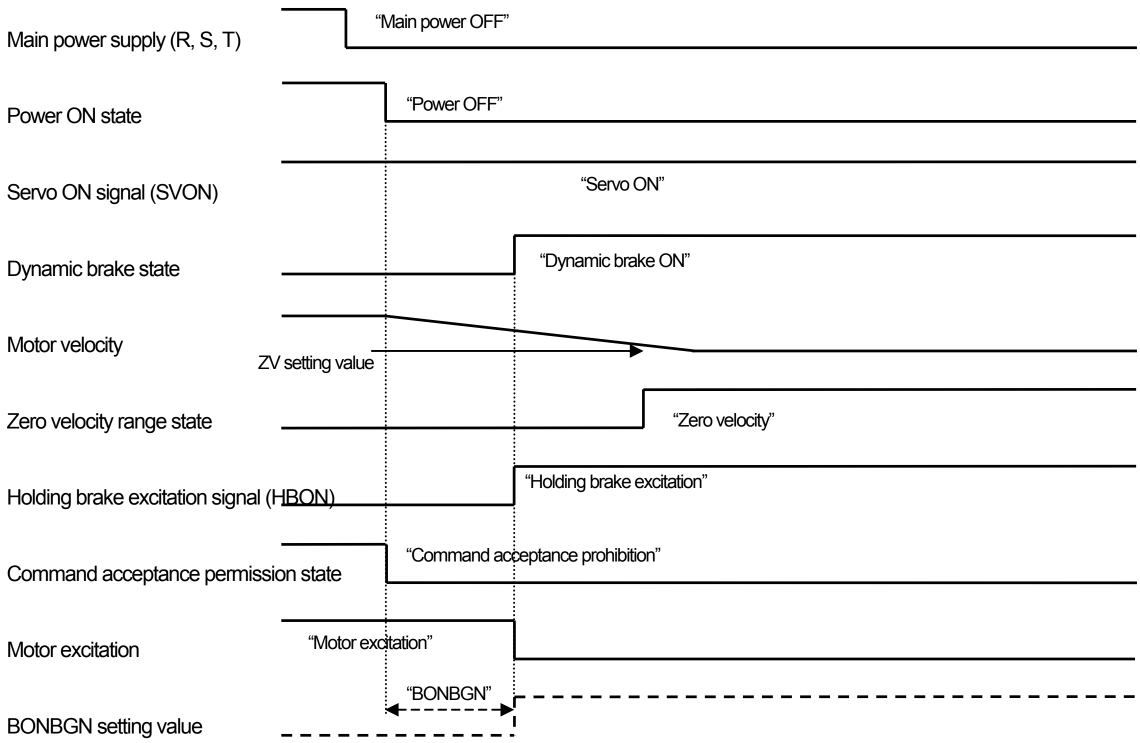


7.2.5.2 If the motor does not stop within brake operation start time, in case dynamic brake operation is selected as servo off operations

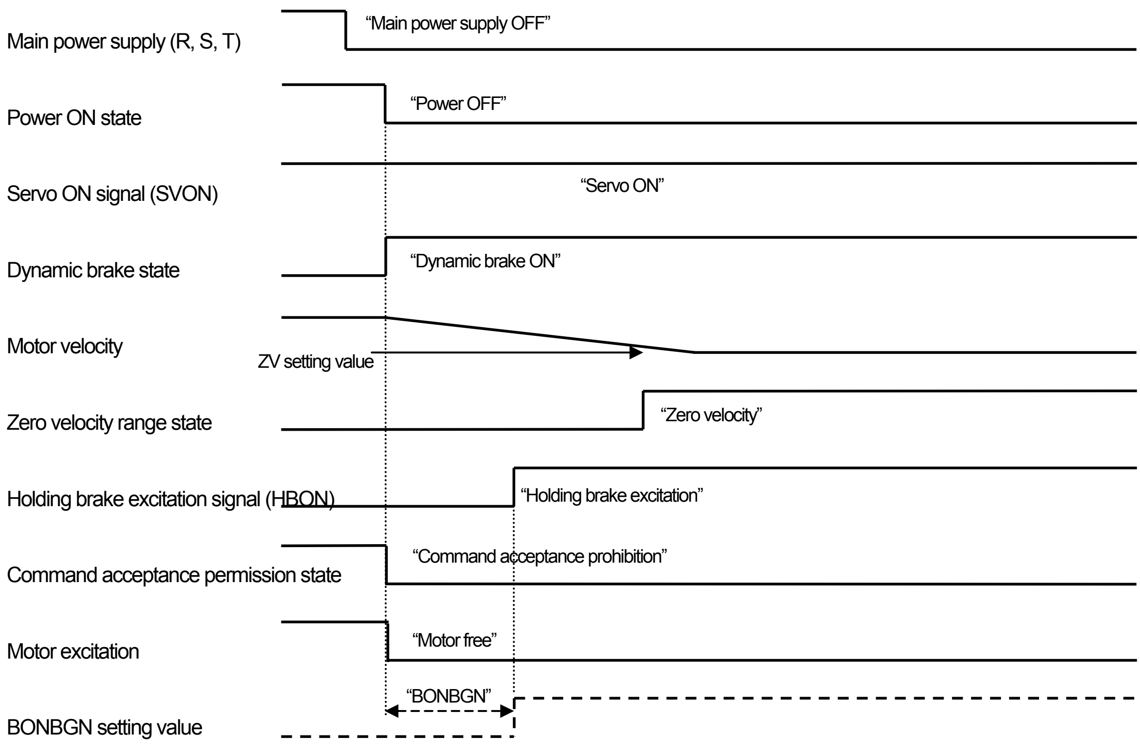


> ⚠ The holding brakes may be damaged if the motor was to be stopped by the holding brake after brake operation start time (BONBGN) is elapsed.

7.2.5.3 During powerOFF: When forced stop operation seletion is servo brake selection



7.2.5.4 During power OFF: When forced stop selection is dynamic brake selection



7.3 Alarm sequence

There are 2 different sequences for stop operation (DB, SB) available at the time of alarm detection. As the stop operation differs per the alarm type, confirm the selected stop operation in “Chapter 9, List of Operations at the Time of Alarm Detection”.

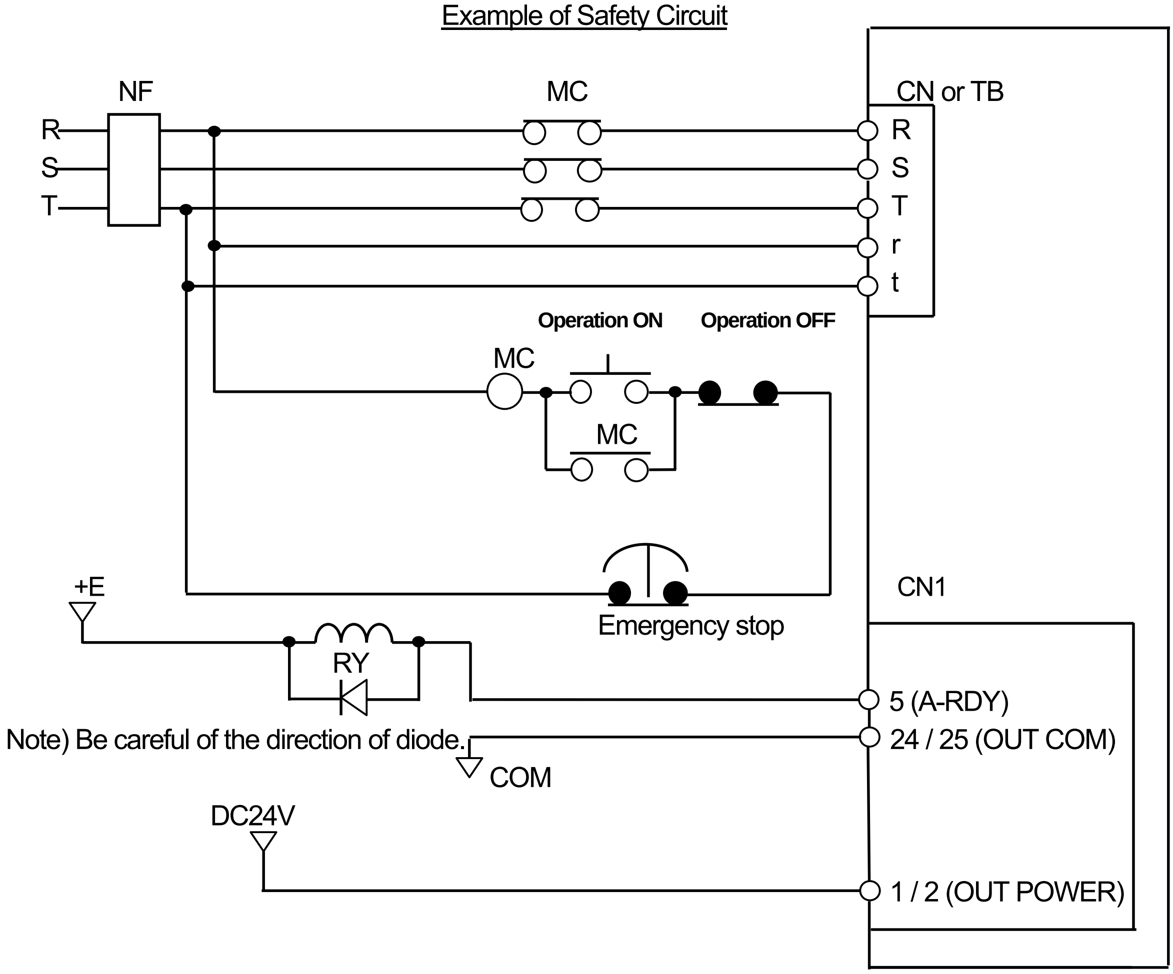
- DB Operation: Slows down and stops the servo motor with the dynamic brake upon alarm. (Sequence 7.3.1)
- SB Operation: Slows down and stops the servo motor with a sequence current limiting value. (Sequence 7.3.2)

When dynamic brake operation is selected as a forcible stop operation, alarm detection will initiate dynamic brake operations to slow down and stop the servo motor.

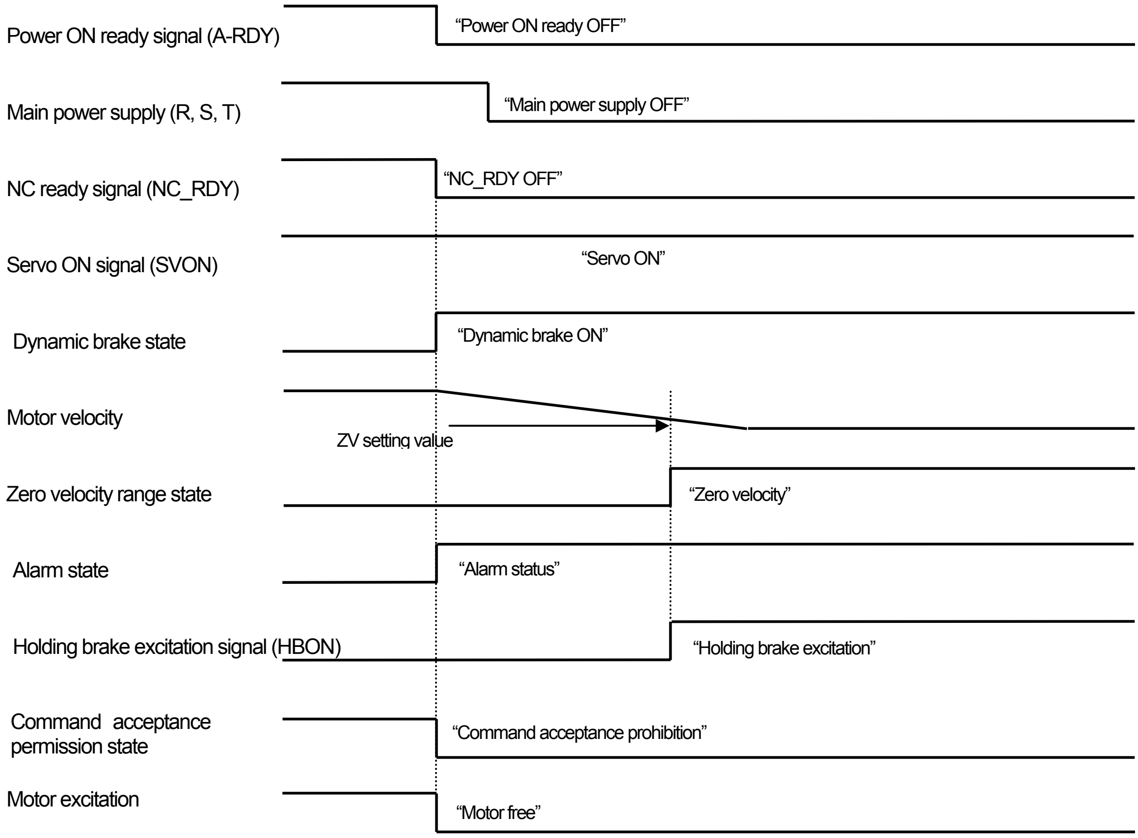
Related parameters Group 3 Page 05 …… Refer to “Chapter 8” 8-40

Install a safety circuit, as shown in the following figure, so that the main power supply can be cut off immediately when the alarm rings. The installation of the safety circuit is explained in the following pages. Check the alarm status on the unit’s front LED display and proceed according to “Chapter 9, In Case of Alarm”. Failure to follow the procedures outlined in “Chapter 9, In Case of Alarm” may lead to failure of the external amplifier and/or peripheral device, and fire.

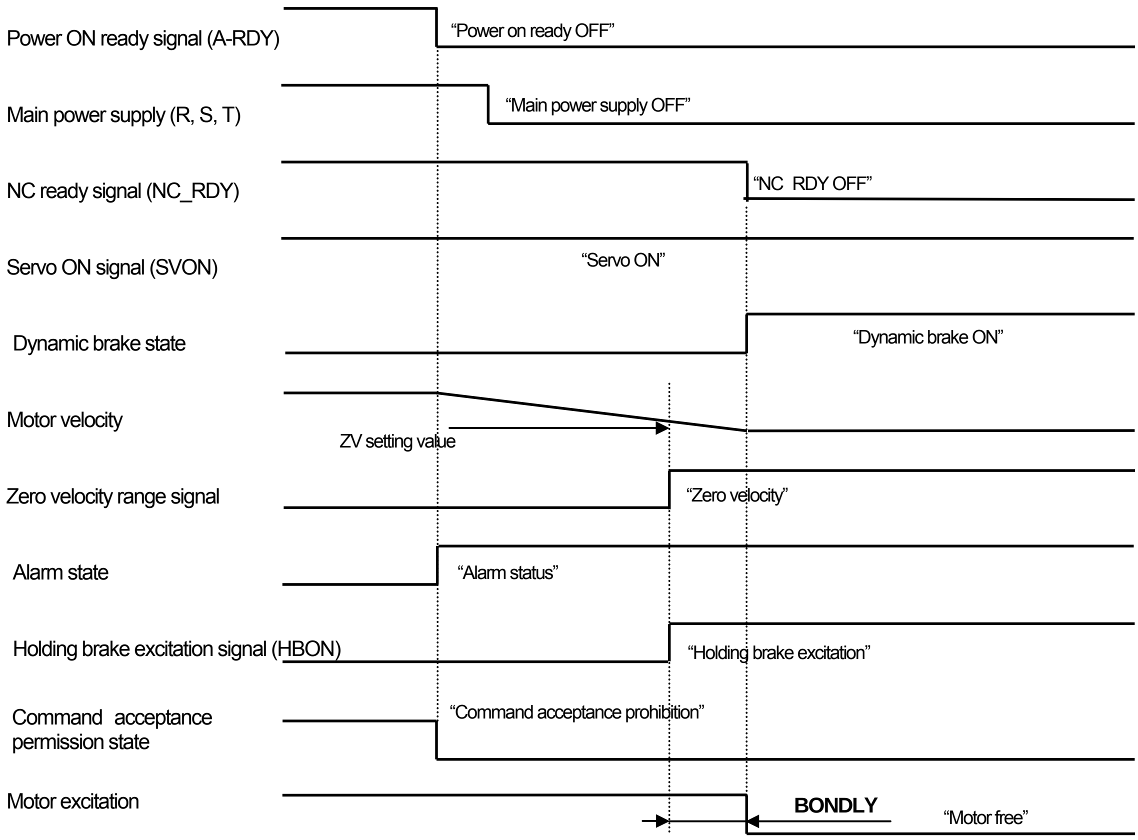
Example of Safety Circuit



7.3.1 Sequence during dynamic brake

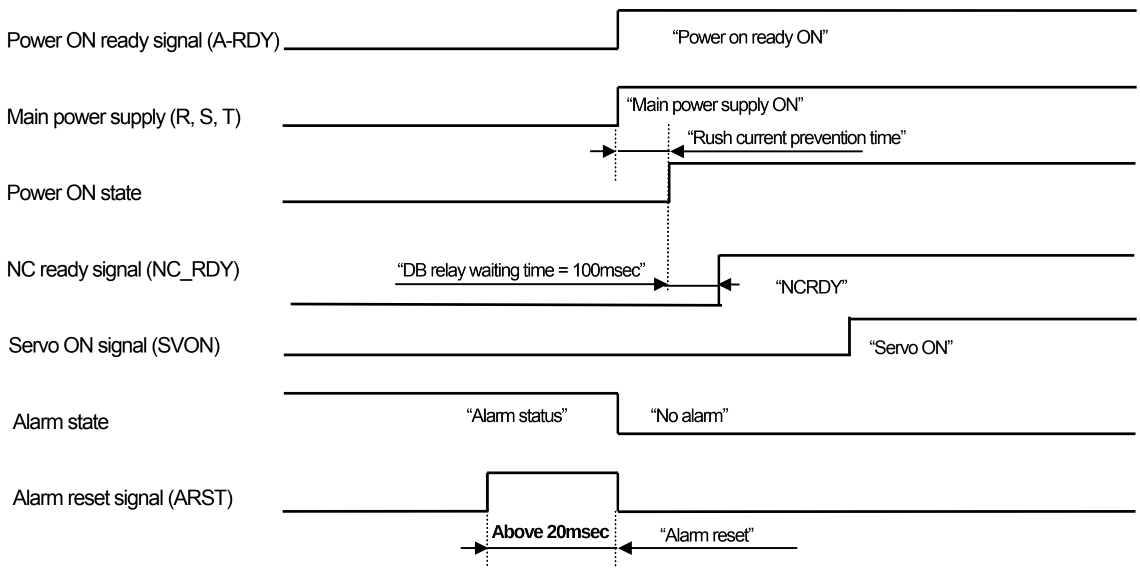


7.3.2 Sequence during servo brake

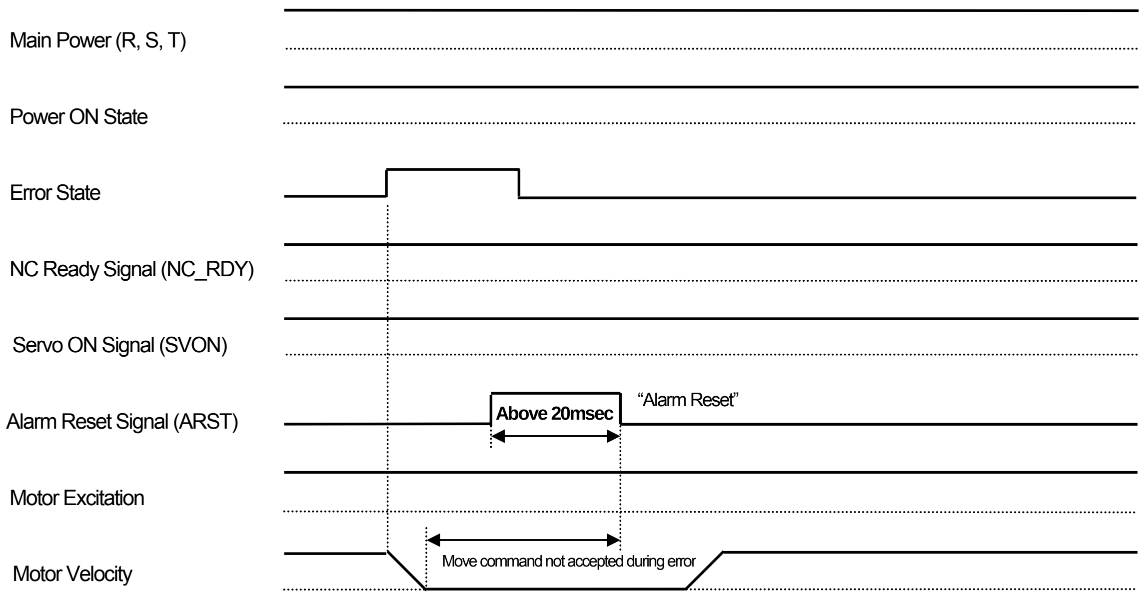


7.3.3 Alarm reset sequence

The procedure to reset an alarm by the alarm reset signal input will follow the sequence described in the figure below. The alarm cannot be reset unless the power is switched ON, following a power OFF based on the conditions of the alarm. For more detailed explanation, see "Chapter 9, Alarm Clear in Alarm List".



7.4 Error Sequence

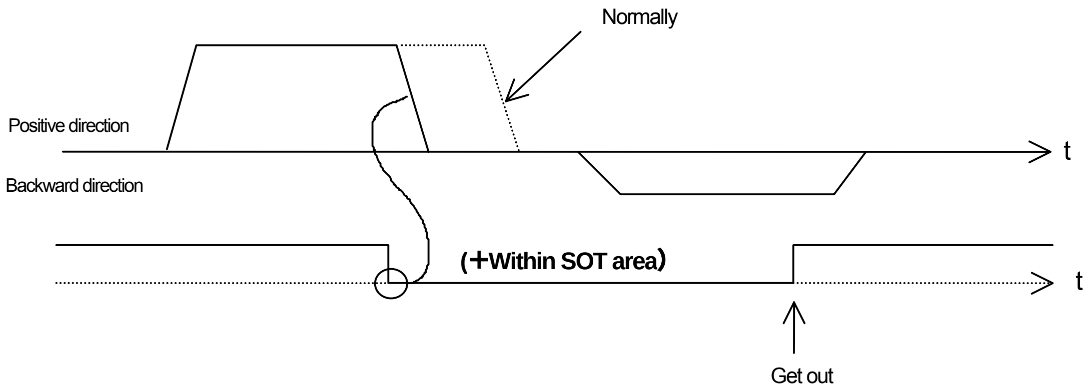


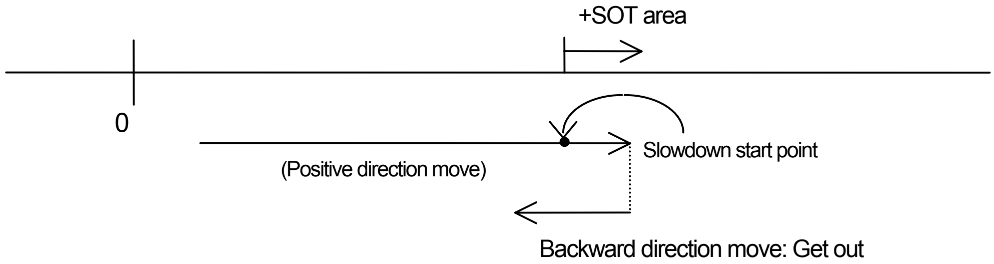
(Note 1) • Motor excitation is sustained, but move order is not accepted until it is reset in the state of error. However software limit is excepted. (Refer to 7.5.)

(Note 2) • Error code can be output from the selectable output. (output selection settings→Refer to 10.1.2.)

→9.3 Take measures by troubleshooting when errors happen.

7.5 Software limit sequence





Positive direction move command is not accepted within SOT area (Backward direction move command within -SOT area). Meanwhile the move toward escape direction is conducted by Manual feed (JOG).

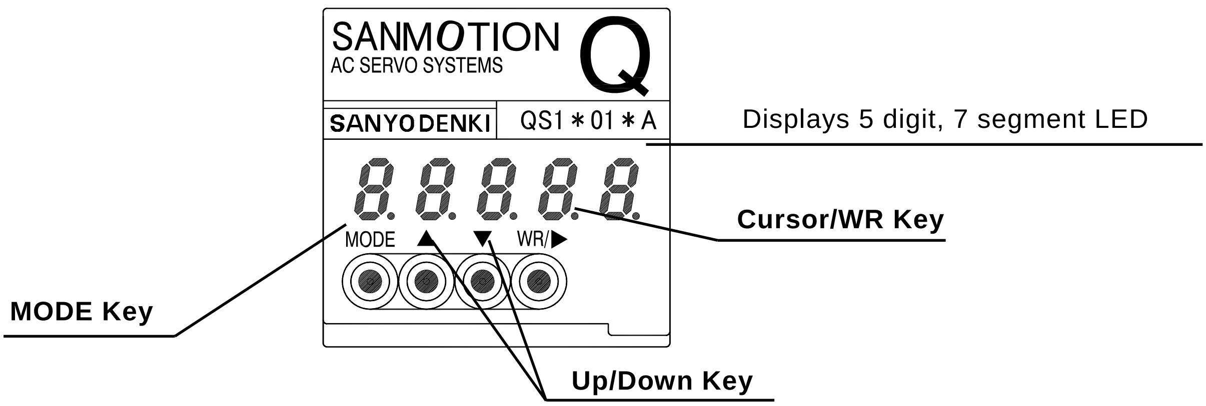
Description of Parameters

8. Description of Parameters

8.1 Digital Operator

This section outlines the basic operations of the digital operator. In the Q Series, it is possible to change the parameters, monitor the speed/electric current, trace alarms and the various test operations, and adjust the servo amplifier with the built-in digital operator.

8.1.1 Digital Operator name



8.1.2 Table of Functions

Table 8-1 Functions of Input keys

Input keys	Display	Input time	Function
WR Key	**WR**	More than 1second	To input selections and write edited data.
Cursor Key	▶	Less than 1 second	Changes the cursor position. Moves to the next digit after pressing this key.
Down Key	▼	Less than 1 second	Changes the numeric value according to the cursor position after pressing this key.
Up Key	▲	Less than 1 second	Changes the numeric value while scrolling with the key pressed for more than 1 second.
MODE Key	**MODE**	Less than 1 second	Changes the MODE after pressing this key.

Table 8-2 Digital operator

Mode	Display	Function	Pages	Operation page
Status Display mode	-	Displays the servo amplifier status.	8-3	8-3
Monitor mode	ob	Displays the screen of each monitor.	8-16	8-4
Test operation, Adjustment mode	Ad	Enables test operations(JOG operation, etc.) and adjustment of servo amplifier.	8-7	8-7
Basic mode	bA	Sets 16 basic types of user parameters.	8-11	8-11
Alarm Trace mode	AL	Displays the current and past 7 alarm events, as well as the CPU version.	8-12	8-12
Parameter Editing mode	PA	Sets user parameters **[Group0~Group8]**	8-17	8-13
System Parameter Editing mode	ru	Sets system parameters.	8-17	8-14

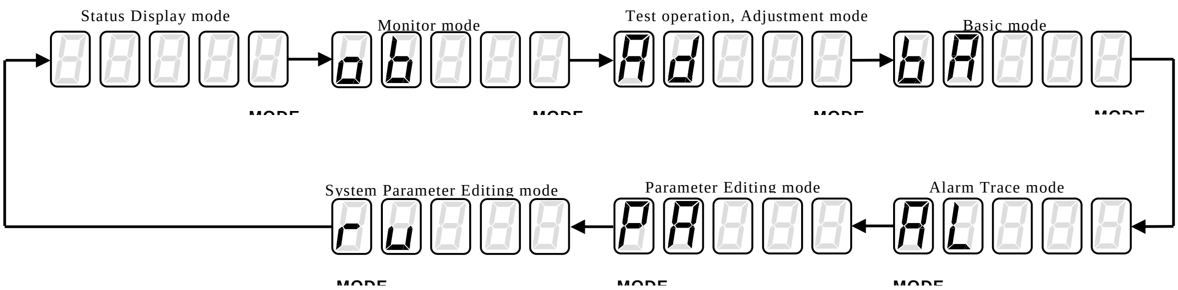
Note: Confirm the page details of each mode in the List of Parameters.

Note 2: Display range differs slightly from Q-Setup setup software.

8. Description of Parameters

8.1.3 Operations

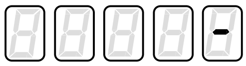
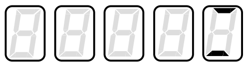
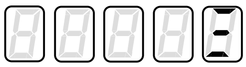
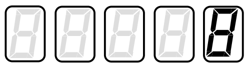
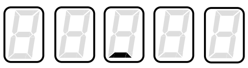
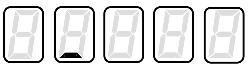
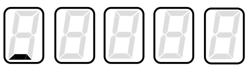
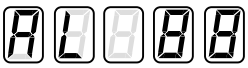
The mode changes in the following order by pressing the **MODE Key** as shown in the figure below**.**



Note) In the Q-Setup setup software, the Test operation mode and Adjustment mode are in ‘Running’ status, and the functions of the digital operator (Basic mode, Parameter Editing mode, System Parameter Editing mode, Test Operation and Adjustment mode, Alarm Trace All Clear of Alarm Trace mode) are disabled.

8.1.3.1 Status Display mode

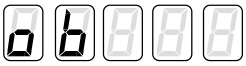
In the Status Display mode, various conditions are displayed according to the status of servo amplifier as shown in the following table.

Marking		Status description
7 segment LED		Control power supply (r,t) is established and amplifier (RDY) is ON.
7 segment LED		Main power supply (R,S,T) is ON or is established, but Operation Preparation Completion signal is OFF.
7 segment LED		Main power supply (R,S,T) is established and Operation Preparation Completion signal is ON.
7 segment LED		Servo is ON. Rotates after drawing the character “8”
7 segment LED		Overload warning status
7 segment LED		Regenerative overload warning status
7segment LED		Battery warning status
7 segment LED		Displays the “AL Alarm Code” while issuing the alarm.

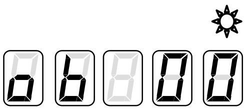
Refer to the “Maintenance” alarm for alarm contents. In some cases Overload, Regenerative overload, or Battery warning status may be displayed separately, or with the alarm display.

8.1.3.2 Monitor mode

1. Display Monitor mode **ob** by pressing **MODE Key**.



2. The display changes as shown below **[**Page Selection Display screen**]**



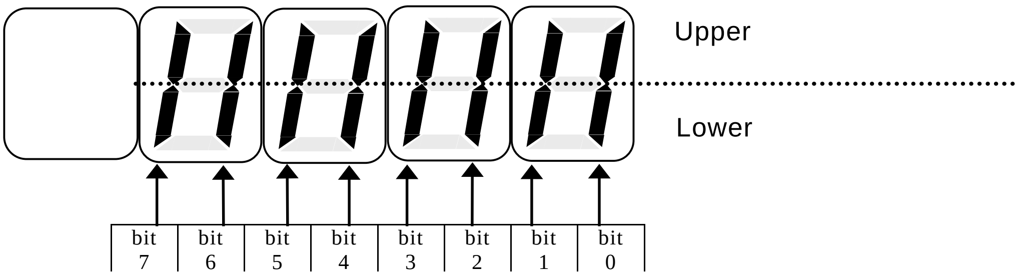
3. Display the page to be monitored by pressing the **Up/Down Keys.** The numeric value increases with the **Up Key** and decreases with the **Down Key**.
4. Press and hold the **WR key** for more than 1 second. The previously selected data is displayed.
5. Pressing the **Mode Key** will return to the Page Selection Display Screen.
6. Move to a different mode by pressing the **MODE Key** again.

Display data

Bit data display :The data in the chart below is displayed in bit units

Page	Symbol	Name	Unit	Display range
01	WARNING1	Warning Status 1	--	-----
02	WARNING1	Warning Status 2	--	-----
03	CONT8-1	General Input CONT8-1 monitor	--	-----
04	OUT8-1	General Output OUT8-1 monitor	--	-----
1A	INC-E_MON	Incremental signal monitor	--	-----

The layout of the monitor display for bit data is as shown below.



	Warning Status 1	**Warning Status 2**	**INC-E_MON**
Upper	Warning	Warning	Upper
Lower	No warning	No warning	Lower
bit7	Excessive deviation Warning	(Not decided)	(Not decided)
bit6	(Not decided)	'Low battery' warning	Z phase signal (CN-EXT)
bit5	Speed limit operation Running	(Not decided)	B phase signal (CN-EXT)
bit4	Torque limit opration Running	(Not decided)	Aphase signal (CN-EXT)
bit3	Re-generative overload Warning	(Not decided)	(Not decided)
bit2	Overload Warning	(Not decided)	Z phase signal (CN2)
bit1	(Not decided)	(Not decided)	B phase signal (CN2)
bit0	Internal amp temperature Warning	Main circuit power supply Charging	A phase signal (CN2)

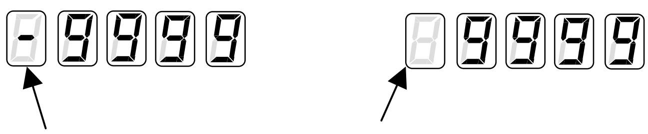
8. Description of Parameters

Decimal data display: The data on the page given below is displayed in decimal numbers.

However, when displaying values of more than ±10000000, it is displayed in hexadecimal numbers.

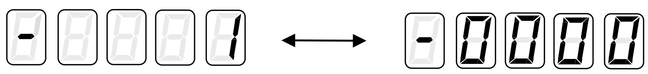
Page	Symbol	Name	Unit	Display range
05	VMON	Speed monitor	min-1	-32767 ~ +32766
06	VCMON	Speed command monitor	min-1	-32767 ~ +32766
07	TMON	Torque monitor	%	-499 ~ +499
08	TCMON	Torque command monitor	%	-499 ~ +499
09	PMON	Position variation monitor	Pulse	-99999999 ~ +99999999
0D	FMON	Position cmd pulse monitor (Position cmd pulse input freq.)	kHz	-6000 ~ +6000
0E	CSU	U-phase electrical angle	deg	0 ~ 359
11	RegP	Rate of regereation resistance operation	%	0 ~ 100
12	TRMS	Effective torque monitor	%	0 ~ 499
13	TRMS_EST	Effective torque monitor (Estimated value)	%	0 ~ 499
14	JRAT_MON	Control loop parameter__Load inertia moment ratio monitor	%	0 ~ 15000
15	KP_MON	Control loop parameter__Position loop ratio gain monitor	s-1	1 ~ 3000
16	TPI_MON	Control loop parameter__Constant monitor at the time of position loop integration	ms	0.5 ~ 1000.0
17	KVP_MON	Control loop parameter__Speed loop ratio gain monitor	Hz	1 ~ 2000
18	TVI_MON	Control loop parameter__Constant monitor at the time of speed loop integration	ms	0.5 ~ 1000.0
19	TCFIL_MON	Control loop parameter__Torque command filter monitor	Hz	1 ~ 2000
1C	OPE_TIM	Amplifier operation time	×2 hour	-----

Data display within **10000** **[**-9999~+9999**]**



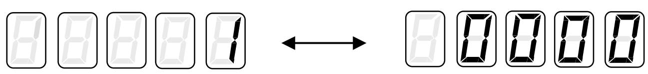
The fifth digit is a symbol display.The blank space represents the symbol “+”.

Data display above **10000**



Screen 2 Screen 1

▲ Key ▼ Key



Screen 2 Screen 1

▲ Key ▼ Key

Screen 1 and Screen 2 can be interchanged by using the **Up/Down Keys.** Screen 2 and Screen 1 are displayed on pressing the **Up Key** and **Down Key** respectively. The screens cannot be changed if displaying data within ±10000. The data beyond ±10000000 is displayed by using a hexadecimal display.

8. Description of Parameters

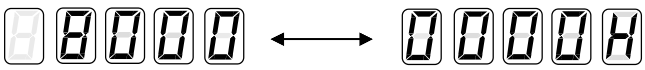
Hexadecimal data display: The data on the following pages (of values above ±10000000) is displayed in hexadecimal.

Page	Symbol	Name	Unit	Display range
0A	APMON	Current position monitor	Pulse	8000 0000H~ FFFF FFFFH
0B	CPMON	Command position monitor	Pulse	8000 0000H~ FFFF FFFFH
0F	PS-H	Absolute encoder PS data (Higher rank)	x2^32 P	0000 ~ FFFF
10	PS-L	Absolute encoder PS data (Lower rank)	Pulse	0000 ~ FFFF

Data display **within 1 word.** [8000H ~ 7FFFH]

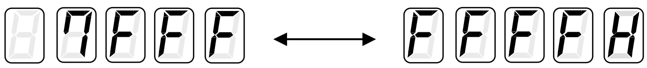
Hex data is displayed after displaying an “H” as the first digit.

Data display **above 1 word.** [8000 0000H ~ 7FFF FFFFH]



Screen 2 Screen1

▲ Key ▼ Key



Screen 2 Screen 1

▲ Key ▼ Key

※ Screen1 and Screen2 can be interchanged with the **Up/Down Keys.**
Screen 2 is displayed by pressing the **Up Key** and Screen 1 is displayed by pressing the **Down Key**. When the data is less than 10000H, it is not possible to interchange the screens.

8.1.3.3 Trial operations, Adjustment mode

Trial operations, tuning, alarm reset, and encoder clear of the servo amplifier can be performed through trial operations and the adjustment mode.

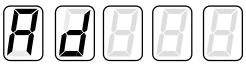
Page	Name
02	Alarm reset
03	Encoder clear
04	Fixed excitation
06	Auto Notch filter tuning

Note: Operations using the digital operator are interrupted during execution of test mode with the Q-SETUPset up software. Resume operations with the digital operator after exiting from the test mode in the Q-SETUP set up software.

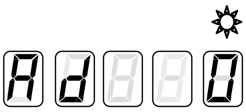
Note 2: If the main power supply is not turned ON (only control power supply is established), execution of auto notch filter tuning is not possible. Begin these after turning ON the main power supply.

"Execution not allowed" display:

1. Display the Trial Operations and Adjustment Mode **Ad** after pressing the **MODE Key**.

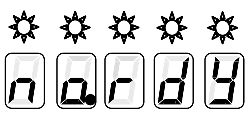


2. Change the display as follows [in the Page Selection Display screen]:



3. Display the page to be edited by pressing the **Up/Down Keys**. The numeric value increases with the **Up Key** and decreases with the **Down Key**.
4. Press and hold the **WR Key** for more than 1 second. The Start screen of each page is displayed.
   Return to the Page Selection Display Screen by pressing the **MODE Keys.** Pressing the **MODE Key** to shift to the next mode.

5. The display is changed as follows [Non executable screen]:

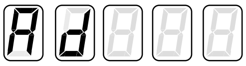


6. Return to the Page Selection Display Screen by pressing the **MODE Key.** Press the **MODE Key** once more to shift to the next mode.

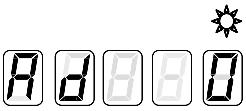
8. Description of Parameters

[Operation method for trial operations and adjustment mode]

1. Display the Trial Operations and Adjustment Mode **Ad** by pressing the **MODE Key.**

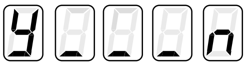


2. The display changes as shown below [Page Selection Display Screen]:

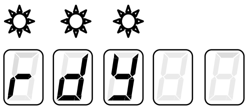


3. Display the page to be edited by pressing the **Up/Down Key**. The numeric value increases with the **Up Key** and decreases with the **Down Key**.
4. Press and hold the **WR Key** for more than 1 second. The Start screen of each page is displayed. Return to the Page Selection Display Screen by pressing the **MODE Key.** Press the **MODE Key** once more to shift to the next mode.

5. The display is changed as follows [Execution confirmation screen]:



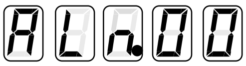
6. Press the **Up Key** to execute [yes], or the **Down Key** to reject [no]. After input of the selection, the display will return to the Page Select Display Screen.



7. Press and hold the **WR Key** for more than 1 sec to begin execution. The Execution Screen will differ according to the functions on each page.

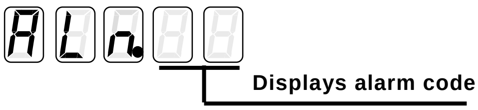
Page	Name
02	**Alarm reset**

Alarm reset end



Display shows that "There is currently no alarm."

Alarm reset error

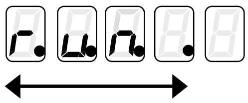


The cause of the alarm is not eliminated. Refer to the "Maintenance" alarm, and after the cause of the alarm is eliminated, reset the alarm again.

8. Return to **rdy (above step 6)** status by pressing the **MODE Key**.

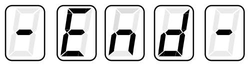
Page	Name
03	**Encoder clear**

Executing encoder clear

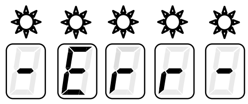


Move dots to the right or left within 4sec

Encoder clear end



Encoder clear error

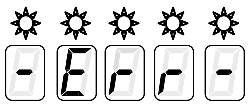


8. Return to **rdy** status by pressing the **MODE Key**.

Page	Name
04	**Fixed excitation (Linear motor)**

In the case of the linear motor only. In the case of the rotary motor, an error is displayed even if you try to execute it.

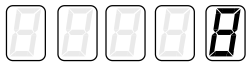
Fixed excitation error



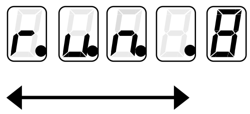
8. Return to **rdy** status by pressing the **MODE Key**.

Page	Name
06	**Auto Notch filter tuning**

Displays a number 8 in servo ON status.

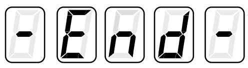


8. Start Auto Notch tuning by pressing the **Up** Key

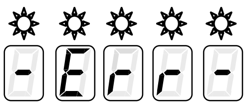


Dot moves to right & left

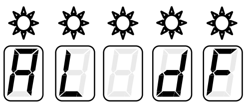
Auto Notch tuning end



Auto Notch tuning error

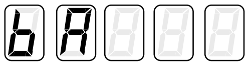


9. If the **MODE** Key is pressed, an alarm rings and the Auto Notch tuning is completed.

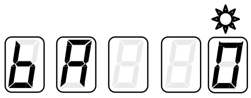


8.1.3.4 Basic Mode

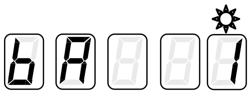
1. Display basic mode bA by pressing the **MODE Key**.



2. The display changes as shown below. **[**Page Selection Display screen**]**

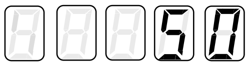


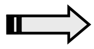
3. Display the page to be edited by pressing the **Up/Down Key**. The numeric value increases with the **Up Key** and decreases with the **Down Key**.



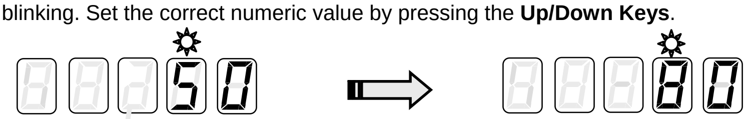
[Page 1: Speed loop ratio gain 1**]**

4. Press and hold the **WR key** for more than 1 second. The previously selected data is displayed.
   Pressing the **Mode Key** will return to the Page Selection Display screen [3]. When in test mode with the Q-SETUP set up software, the unit will display the Page Selection Display screen [3].

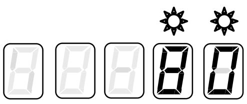


[Old value: 50Hz**]**  **[**New value: 80Hz**]**

5. To edit numeric values, quickly press the **Cursor Key** (within 1 second), and the numeric value furthest left on the display will begin to blink. To move to the next digit, once again quickly press the **Cursor Key** (same as before) so that the next digit begins blinking. Set the correct numeric value by pressing the **Up/Down Keys**.



6. Press and hold the **WR Key** for more than 1 second. The display will blink 3 times to confirm that the setting is complete.



[New value: 80Hz**]**

[If a value exceedng the allowable range is entered, the display will not blink 3 times for confirmation, and the previous value (before editing) is displayed. Return to step 5 above to continue.]

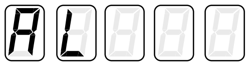
7. Return to step 1 by pressing the **MODE Key.** (Pressing the **MODE Key** will shift the mode.)

The 16 basic parameters of the servo amplifier can be set in Basic Mode.
The selected contents are the same as the contents set in parameter mode.

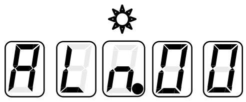
Page	Abbreviated name	Name	Standard setting value	Setting range	Units
00	KP1	Position loop gain 1	30	1~3000	1/S
01	KVP1	Speed loop ratio gain 1	50	1~2000	Hz
02	TVI1	Speed loop integration constant 1	20.0	0.5~1000.0	ms
03	KP2	Position loop gain 2	30	1~3000	1/S
04	KVP2	Speed loop ratio gain 2	50	1~2000	Hz
05	TVI2	Speed loop integration constant 2	20.0	0.5~1000.0	ms
06	PCFIL	Position command filter	0.0	0.0~2000.0	ms
07	FFFIL	Speed feed forward filter	2000	1~2000	Hz
08	VCFIL	Speed command filter	2000	1~2000	Hz
09	TCNFILA	Torque command notch filter A	2000	100~2000	Hz
0A	TCNFILB	Torque command notch filter B	2000	100~2000	Hz
0B	TCFIL1	Torque command filter 1	600	1~2000	Hz
0C	TCFIL2	Torque command filter 2	600	1~2000	Hz

8.1.3.5 Alarm Trace Mode

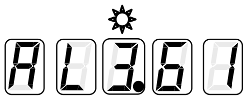
1. Display the alarm trace mode “AL” by pressing the **MODE Key**.



2. The display will change as shown below. **[**Page Selection Display screen**]**



3. Display the selected page by pressing the **Up/Down Keys**. Increase the numeric value with the **Up Key**, and decrease it with the **Down Key**. The alarm code is displayed with 2 digits to the right.



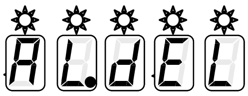
Alarm before 3 times: **[**Alarm code 61**]**

4. Returns to step 3 **[**Page Selection Display screen**]** by pressing the **MODE Key.** Pressing the **MODE Key** will shift to the next mode.The alarm trace mode displays the previous 7 alarms, the CPU version, and permits an alarm trace delete for the servo amplifier.

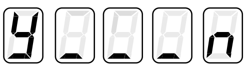
Selection page	Abbreviated name	Selection page	Abbreviated name
N	Present alarm	5	Alarm before 5 times
1	Alarm before 1 time	6	Alarm before 6 times
2	Alarm before 2 times	7	Alarm before 7 times
3	Alarm before 3 times		CPU version
4	Alarm before 4 times		Alarm trace delete

8.1.3.5.1 Alarm trace delete method

1. Display AL.dEL, and press snd hold the **WR Key** for more than 1 second.

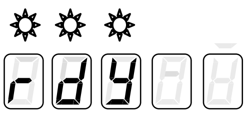


2. The display is changed as follows: [Execution confirmation screen]

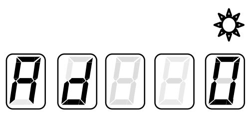


3. Press the **Up Key** to execute [yes], otherwise press the **Down Key** [no].

If **Up Key [**yes**]**: is pressed:

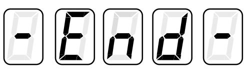


If **Down Key [**no**]** is pressed (returns to page selection screen):

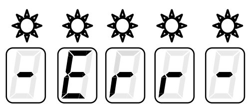


4. Press and hold the **WR Key** for more than 1 second to begin execution. After completion, the screen is changed as follows:

Alarm trace delete completion



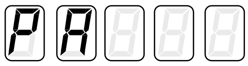
Alarm trace delete error



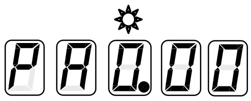
5. Return to the Page Selection Display screen by pressing the **MODE key**.

8.1.3.6 Parameter editing mode

1. Enter the parameter editing mode PA by pressing the **MODE key**.

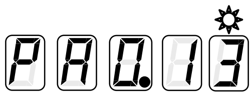


2. The display changes as shown below. **[**Page Selection Display screen**]**



3. Display the page to be edited by pressing the **Up/Down Keys.** Increase the numeric value with the **Up Key**, and decrease it with the **Down Key.**

.

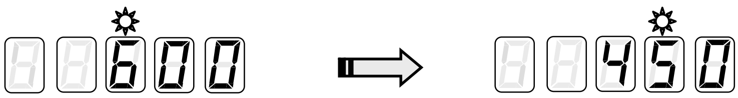


[Group 0 Page 13: Torque command filter 1**]**

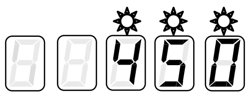
4. Press and hold the **WR key** for more than 1 second to display the previously selected value.
   Return to step 2 [Page Selection Display screen] by pressing the **Mode Key**. The unit will returns to the Page Selection Display screen when in test mode with the Q-SETUP set up software.

[Old value: 600Hz**]** ⇒ **[**New value: 450Hz**]**

5. To edit numeric values, quickly press the **Cursor Key** (within 1 second), and the numeric value furthest left on the display will begin to blink. To move to the next digit, once again quickly press the **Cursor Key** (same as before) so that the next digit begins blinking. Set the correct numeric value by pressing the **Up/Down Keys**.



6. Press and hold the **WR Key** for more than 1 second. The display will blink 3 times to confirm that the setting is complete.

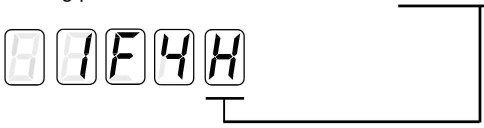


[New value: 450Hz**]**

[If a value exceedng the allowable range is entered, the display will not blink 3 times for confirmation, and the previous value (before editing) is displayed. Return to step 5 above to continue.]

7. Return to the Page Selection Display screen by pressing the **MODE key**.

∗ The following parameters are set in hexadecimal. “H” is displayed in the first (furthest right) digit.

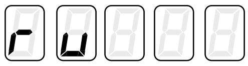


Group page 1.17: Internal torque addition command

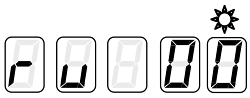
Group page 1.18: Internal speed addition command

8.1.3.7 System parameter editing mode

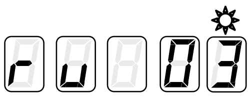
1. Display the system parameter editing mode “ru” by pressing the **MODE Key**.



2. The display changes as shown below. **[**Page Selection Display screen**]**

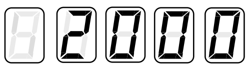


3. Display the page to be edited by pressing the **Up/Down Keys.** Increase the numeric value with the **Up Key**, and decrease it with the **Down Key.**



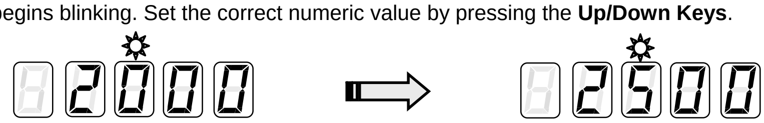
[Page 3: Incremental resolution**]**

4. Press and hold the **WR Key** for more than 1 second. The previously selected data is displayed.
   Return to the Page Selection Display screen by pressing **MODE Key**. When in test mode with the Q-SETUP set up software, the unit will display the Page Selection Display screen.

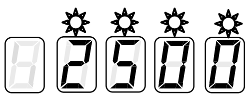


[Old value: 2000P/R**]** ⇨ **[**New value: 2500P/R**]**

5. To edit numeric values, quickly press the **Cursor Key** (within 1 second), and the numeric value furthest left on the display will begin to blink. To move to the next digit, once again quickly press the **Cursor Key** (in the same manner as before) so that the next digit begins blinking. Set the correct numeric value by pressing the **Up/Down Keys**.



6. Press and hold the **WR Key** for more than 1 second. The display will blink 3 times to confirm that selection is complete.



[New value: 2500P/R**]**

[If a value exceedng the allowable range is entered, the display will not blink 3 times for confirmation, and the previous value (before editing) is displayed. Return to step 5 above to continue.]

7. Return to the Page Selection Display screen by pressing the **MODE key**.

8. Description of Parameters

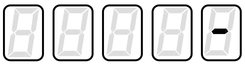
8.1.3.8 Password function

The password function allows selection of a password, and protection against unauthorized parameter changes (lock function). When setting the password, be sure to make a note of it for future reference, as it is impossible to release the lock function without the password.

The password function is enabled or disabled by turning OFF the control power and then once again switching it ON.

The permitted values for a password is a combination of 4 digits from 0~9 and A~F; **"0000"** is invalid.

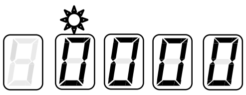
1. Press the **MODE Key** to enter the status display mode. (This is the display status during control power input)



2. Press the **Up Key**. If the message "-**PAS**-" is blinking, this indicates that a password has not yet been set. A password has been set only when -**PAS**- is not blinking.

Password not set　　　　Password set

3. Press and hold **WR Key** for more than 1 second; an "0000" message is displayed.

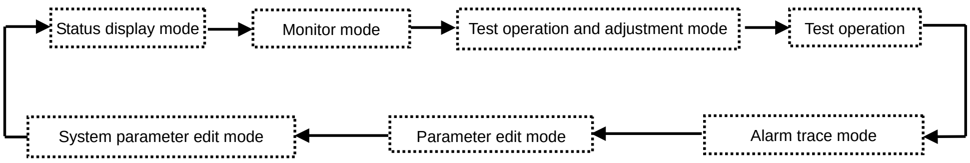


Enter the desired password by using the **Up/Down Key/Cursor Keys**. To delete it enter the previous password.

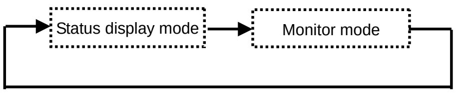
5. Press and hold the **WR Key** for more than 1 second. When a password is set, the display will blink 3 times for confirmation. To confirm deletion of a previous password, an **"0000"** message will blink 3 times. (When deleting, if the entered password does not match, the display will blinkwith an **"-Err-"** message. Confirm the password and re-enter it again.)

6. Turn OFF the control power supply once and switch it ON again to enable setting of the password and release.

If a password has not been set, whenever **MODE Key** is pressed, the display shifts to the selected mode.



When the password is set, pressing the **MODE Key** will only shift the status display mode and monitor mode.



∗ Note that setting / release of a password can only be performed by the digital operator.

∗ If a password has been set, it is not possible make parameter changes via the "Q-Setup Software".

If the parameter is changed by the "Q-SetupSoftware", the "Communication establishment' will be disconnected. Therefore, make a note of the password and remember it.

8.2 Simplified Parameter Chart

Table 8-2. Monitor

Monitor	Page	Symbol	Name	Unit	Display Range	Remarks
	00	STATUS	Servo Amplifier Status	--	-----	
	01	WARNING1	Warning Status 1	--	0000-0000 ～ 1111-1111	
	02	WARNING2	Warning Status 2	--	0000-0000 ～ 1111-1111	
	05	VMON	Velocity Monitor	min-1	-32767 ～ +32766	
	06	VCMON	Velocity Command Monitor	min-1	-32767 ～ +32766	
	07	TMON	Torque Monitor	%	-499 ～ +499	
	08	TCMON	Torque Command Monitor	%	-499 ～ +499	
	09	PMON	Position Deviation Monitor	Pulse	-2147483647～+2147483646	
	0A	APMON	Actual Position Monitor	Pulse	-2147483648～+2147483647	Note2
	0B	CPMON	Command Position Monitor	Pulse	-2147483648～+2147483647	Note3
	0D	FMON	Position Command Pulse Monitor (Position Command Pulse Input Frequency)	k Pulse/s	-6000 ～ +6000	
	0E	CSU	U-Phase Electrical Angle Monitor	deg	0 ～ 359	
	0F	PS-H	Absolute Encoder PS Data (Upper)	x2^32 P	0000-0000 ～ FFFF-FFFF	
	10	PS-L	Absolute Encoder PS Data (Lower)	Pulse	0000-0000 ～ FFFF-FFFF	
	11	RegP	Regenerative Resistance Run Rate	%	0.00 ～ 99.99	
	12	TRMS	Effective Torque Monitor	%	0 ～ 499	
	13	TRMS_EST	Effective Torque Monitor (Estimate)	%	0 ～ 499	
	14	JRAT_MON	Control Loop Parameter__Moment of inertia ratio of the Load Monitor	%	0 ～ 15000	
	15	KP_MON	Control Loop Parameter__Position Loop Proportional Gain	s-1	1 ～ 3000	
	16	TPI_MON	Control Loop Parameter__Position Loop Integral Time Constant Monitor	ms	0.5 ～ 1000.0	
	17	KVP_MON	Control Loop Parameter__Speed Loop Proportional Gain Monitor	Hz	1 ～ 2000	
	18	TVI_MON	Control Loop Parameter__Speed Loop Integral Time Constant Monitor	ms	0.5 ～ 1000.0	
	19	TCFIL_MON	Control Loop Parameter__Torque Command Filter Monitor	Hz	1 ～ 2000	
	1A	INC-E_MON	Incremental Encoder Signal Monitor	--	0000-0000 ～ 1111-1111	
	1B	TLMON_EST	Load Troque Monitor (Estimate)	%	-499 ～ +499	
	1C	OPE_TIM	Amplifier operating time	×2 hour	-----	
	20	POINTNO	Execution Point Number	--	0 ～ 254	
	21	AD_REAL	Actual Position (User Coordinate)	--	-2147483647～+2147483646	Note4
	22	AD_MACH	Command Position (User Coordinate)	--	-2147483647～+2147483646	Note4
	23	PAERR	Position Deviation (User Coordinate)	--	-2147483647～+2147483646	Note4
	24	S_OUT	Specific Output Monitor	--	0000-0000 ～ 1111-1111	
	25	G_OUT	General-purpose Output Monitor	--	0000-0000 ～ 1111-1111	
	26	IN_G1	Input (Group 1) Monitor	--	0000-0000 ～ 1111-1111	
	27	IN_G2	Input (Group 2) Monitor	--	0000-0000 ～ 1111-1111	
	28	IN_G3	Input (Group 3) Monitor	--	0000-0000 ～ 1111-1111	
	29	IN_POINT	Input (Point Number) Monitor	--	0000-0000 ～ 1111-1111	
	2A	ZONE_OUT	Zone Output Monitor	--	0000-0000 ～ 1111-1111	
	2B	M_OUT	M Output Monitor	--	0000-0000 ～ 1111-1111	
	2C	TEST_MON	Test Monitor	--	0000-0000 ～ 1111-1111	Note5
	2D	PF_CODE	Interior Status	--	00 ～ FF	Note5

Note 1: "No display" or "0" may be displayed in Control Mode and servo amplifier status.

Note 2: The Actual Position Monitor is a free run counter, which records the original position when control power is turned ON.

Note 3: The Command Position Monitor is a free run counter, which records the original position when control power is turned ON. However, any command pulse received during command acceptance inhibition is not counted. Therefore, after positioning, the Command Position Monitor and the Actual Position Monitor may not match..

Note4: Actual monitor values are shown in the user's coordinate system and provided with decimal points by setting at D_ dpo. The display range is described with number of significant figures. In reality, display range is within the area provided with decimal points at suitable position.

Note5: Those are our monitors for confirmation.

8. Description of Parameters

Table 8-3. System parameters

System Parameter	Page	Name	Setting Range	Remarks
	–	Amplifier Capacity	——	Indicates the capacity of servo amplifier. (Note 1)
	–	Motor Structure	——	Indicates the structure of the combined motor. (Note 1)
	–	Control Power Input Voltage	——	Indicates the voltage supplied to the control power. (Note 1)
	–	Control Power Input Type	——	Indicates power input type supplied to the control power. (Note 1)
	–	Main Circuit Power Input Voltage	——	Indicates voltage supplied to the main circuit power supply. (Note 1)
	00	Main Circuit Power Input Type	2 ways (1way)	Selects the type of power input supplied to the main circuit power supply.
	01	Motor Encoder Type	2 ways	Selects type of motor encoder.
	02	Incremental Encoder Function Selection	2 ways	Selects the detailed function of incremental encoder.
	03	Incremental Encoder Resolution	500P/R ~ 65535P/R	Sets the resolution of incremental encoder.
	04	Absolute Encoder Function Selection	8 ways	Selects the detailed function of absolute encoder.
	05	Absolute Encoder Resolution	11 ways	Sets the resolution of absolute encoder.
	06	Combined Motor Model Number	——	Indicates combined motor model number. (Note 2)
	08	Control mode	6 ways	Selects the control mode.
	09	Position Loop control / Position Loop Encoder Selection	3 ways	Selects the position loop control method and position loop encoder.
	0A	External Encoder Resolution	500P/R ~ 65535P/R	Sets the resolution of external encoder to be connected to the connector ON-EXIT.
	0B	Regemeratove Resistance Selection	3 ways	Selects the regenerative resistance to be connected.

Note 1: Values selected for Amplifier Capacity, Motor Structure, Control Power Input Voltage, Control Power Input Type, and Main Circuit Power Input Voltage cannot be changed.

Note 2: The Combined Motor Model Number can be changed by using the motor parameter settings; system parameter settings cannot be edited.

Note 3: The setting changes for system parameters and motor parameters are enabled by turning ON the control power again, after editing the parameters.

Table 8-4. General Parameter Group 0 [Control Parameter Settings]

Group Note2	Page Note2	Parameter Level	Symbol	Name	Standard Value	Unit	Setting Range	Remarks
0	00	Basic	KP1	Position Loop Proportional Gain 1	30	1/s	1~3000	
	01	Advanced	TPI1	Position loop Integral Time Constant 1	1000.0	Msec	0.5~1000.0	
	02	Basic	KVP1	Speed Loop Proportional Gain 1	50	Hz	1~2000	
	03	Basic	TVI1	Speed Loop Integral Time Constant 1	20.0	Msec	0.5~1000.0	
	04	Basic	KP2	Position Loop Proportional Gain 2	30	1/s	1~3000	
	05	Advanced	TPI2	Position Loop Integral Time Constant 2	1000.0	Msec	0.5~1000.0	
	06	Basic	KVP2	Speed Loop Proportional Gain 2	50	Hz	1~2000	
	07	Basic	TVI2	Speed Loop Integral Time Constant 2	20.0	Msec	0.5~1000.0	
	08	Basic	JRAT1	Moment of Inertia Load Ratio 1	100	%	0~15000	
	09	Basic	JRAT2	Moment of Inertia Load Ratio 2	100	%	0~15000	
	0A	Basic	FFGN	Feed-Forward Gain	0	%	0~100	
	0E	Standard	PCFIL	Position Command Filter	0.0	Msec	0.0~2000.0	
	0F	Standard	FFFIL	Feed-Forward Filter	2000	Hz	1~2000	
	10	Standard	VCFIL	Velocity Command Filter	2000	Hz	1~2000	
	11	Standard	TCNFILA	Torque Command Notch Filter A	2000	Hz	100~2000	Note 1
	12	Standard	TCNFILB	Torque Command Notch Filter B	2000	Hz	100~2000	Note 1
	13	Standard	TCFIL1	Torque Command Filter 1	600	Hz	1~2000	
	14	Standard	TCFIL2	Torque Command Filter 2	600	Hz	1~2000	
	1D	Advanced	AFBK	Acceleration Speed Feedback Gain	0	0.1%	-1000~1000	
	1E	Advanced	AFBFIL	Acceleration Speed Feedback Filter	1500	Hz	1~2000	

Note 1: TCNFILA、TCNFILB can be set to 1Hz per unit. In the servo amplifier, this parameter can be set to 10 Hz per unit. Even though the setting is changed to 1Hz per unit, operation is unchanged.

Note 2: PA Group Page (PA0. 00) is displayed in the digital operator.

8. Description of Parameters

Table 8-5 General Parameter Group 1 [Miscellaneous Settings Values]

Group Note 6	Page Note 6	Parameter Level	Symbol	Name	Standard Setting Value	Unit	Setting Range	Remarks
1	01	Basic	NEAR	Near Range	500	Pulse	1～65535	
	07	Basic	LOWV	Low Velocity Setting	50	min-1	0～65535	
	08	Basic	VA	Velocity Attainment Setting (High velocity setting)	1000	min-1	0～65535	
	09	Basic	VCMP	Velocity Matching Range	50	min-1	0～65535	
	0F	Basic	SQTCLM	Sequence Operating Time Torque Limit Value	120	%	10～500	Note 1
	10	Basic	BONDLY	Holding Brake Operation Delay Time (Holding Brake Holding Delay Time)	300	ms	0～1000	Note 4
	11	Basic	BOFFDLY	Holding brake operation cancel release delay time (holding brake release delay time)	300	ms	0～1000	Note 4
	17	Standard	TCOMP	Internal Torque Addition Command	0	%	-500～500	
	18	Standard	VCOMP	Internal Velocity Addition Command	0	min-1	-32768～32767	
	19	Standard	BONBGN	Brake Operation Starting Time	0	ms	0～65535	Note 3
	1A	Standard	ZV	Zero Velocity Range	50	min-1	50～500	
	1B	Advanced	PFDDLY	Power Failure Detection Delay Time	32	ms	20～1000	Note 2
	1C	Standard	OLWLV	Overload Warning Level	90	%	20～100	Note 2
	1D	Standard	OFWLV	Excessive Deviation Warning Level	65535	x256 pulse	1～65535	
	20	Advanced	INCEDAT	Incremental Encoder Calculation Error Setting Value	128	Pulse	4～65535	
	22	Standard	ATNFIL	Torque Command Value of Auto Notch Filter Tuning	50	%	10～300	Note 1

Note 1: If settings exceed TP/TR✳100%, the output torque is regulated by TP.

Note 2: Settings are enabled by restoring the control power.

Note 3: Function can be disabled by setting the unit to O msec. The setting unit is 4 msec; setting must be more than 4msec to use this function.

Note 4: The setting unit is 4 msec. When the input value is 0 msec, this command is disabled (mandatory zero) for 4 msec after SON.

Note 5: PA Group Page (PA1. 00) is displayed in the digital operator.

Table 8-6. General Parameter Group 2 [Observer Parameter Settings]

Group Note1	Page Note1	Parameter Level	Symbol	Name	Standard Setting Value	Unit	Setting Range	Remarks
2	00	Advanced	OBLPF1	Observer Output Low-pass Filter 1	200	Hz	1～2000	
	01	Advanced	OBLPF2	Observer Output Low-pass Filter 2	16	Hz	1～2000	
	02	Advanced	OBG	Observer Compensation Gain	0	%	0～1000	
	03	Advanced	ANRES	Anti-Resonance Frequency	40	Hz	10～200	
	07	Advanced	RTLEVEL	Real Time Auto Tuning Response Setting	0		0～10	

Note 1: PA Group Page (PA2. 00) is displayed in the digital operator

Table 8-7 General Parameter Group 3 [Amplifier Function Settings (1)]

Group Note1	Page Note1	Parameter Level	Symbol	Name			Standard setting value	Remarks
				Parameter name	Upper	Lower		
3	00	Basic	PA300	Amplifier Function Selection 300	Deviation clear selection	Position command pulse digital filter	00h	
	02	Basic	PA302	Amplifier Function Selection 302	Command input polarity	P-P Automatic switchover function	00h	
	03	Basic	PA303	Amplifier Function Selection 303	Torque limit input	Detect speed feedback error (ALM-C3) / Detect speed limit error (ALM-C2)	01h	
	04	Basic	PA304	Amplifier Function Selection 304	Over travel operation	Dynamic brake operation	04h	
	05	Basic	PA305	Amplifier Function Selection 305	Analog monitor output polarity	Forced stop operation	00h	
	06	Standard	PA306	Amplifier Function Selection 306	Speed addition command input	Torque addition command input	00h	
	07	Advanced	PA307	Amplifier Function Selection 307	Absolute encoder clear function selection	Positioning completion signal / Position deviation monitor	00h	
	08	Advanced	PA308	Amplifier Function Selection 308	External incremental encoder (CN-EXT) digital filter	Monitor incremental encoder (CN2) digital filter	11h	

Note 1: PA Group Page (PA3..00) is displayed in the digital operator

Table 8-8. General Parameter Group 4 [Amplifier Function Settings (2)]

Group Note2	Page Note2	Parameter Level	Symbol	Name			Standard setting value	Remarks
				Parameter name	Upper	Lower		
4	01	Basic	PA401	Amplifier Function Selection401	Reservation	External encoder (CN-EXT) polarity	00h	Note 1
	02	Basic	PA402	Amplifier Function Selection 402	Setup software communication baud rate	Setup software communication axis signal	51h	Note 1
	03	Basic	PA403	Amplifier Function Selection 403	Reservation	Positioning method	00h	Note 1
	06	Basic	PA406	Amplifier Function Selection 406	Position detection system selection	Reservation	00h	Note 1

Note 1: Setting is changed by tuning ON the control power again.

Note 2: PA Group Page (PA4. 00) is displayed in the digital operator

Table 8-9 General Parameter Group 5 [Monitor Output Selection]

Group Note 1	Page Note 1	Parameter Level	Symbol	Name	Standard Setting Value	Setting range	Remarks
5	00	Basic	MON1	Analog monitor output 1 selection	02:VMON_2mV/min-1	00h~10h	
	01	Basic	MON2	Analog monitor output 2 selection	01:TCMON_2V/TR	00h~10h	
	02	Basic	DMON	Digital monitor output selection	00:Always_OFF	00h~4Dh	

Note 1: PA Group Page (PA5. 00) is displayed in digital operator.

Table 8-10 Group 6 Observer Function Parameter Settings

Group Note 1	Page Note 1	Parameter Level	Symbol	Name	Standard Setting Value	Setting Range	Remarks
6	00	Advanced	PA600	Observer function selection	00: OFF	00h~02h	
	01	Advanced	PA601	Amplifier Function Selection 601	Upper 0: Reservation Lower 0: Real time auto tuning function disabled		
	06	Advanced	PA606	Amplifier Function Selection 606	Upper 0: Reservation Lower 1: Secondary Low-pass filter		

Note 1: PA Group Page (PA6. 00) is displayed in the digital operator

Table 8-11 General Parameter Group 7 [Assigning valid conditions to miscellaneous functions (1)]

Group Note 1	Page Note 1	Parameter Level	Symbol	Name	Standard Setting Value	Setting Range	Remarks
7	01	Basic	MS	Control Mode Switchover Function	00:_Always_ Disable	00h	
	02	Basic	PCON	Speed Loop Proportional Control Switchover Function	00:_Always_ Disable	00h～1Fh	02-11
	03	Basic	GC	Gain Switchover Function	00:_Always_ Disable	00h～1Fh	02-11

Note 1: PA Group Page (PA7. 00) is displayed in the digital operator

Table 8-12 General Parameter Group 8 [Assigning valid conditions to miscellaneous functions (2)]

Group Note 1	Page Note 1	Parameter Level	Symbol	Name	Standard Setting Value	Setting Range	Remarks
8	08	Advanced	DISCHARGE	Forced Discharge Function	01:_Always_ Enable	00h～1Fh	
	12	Advanced	PPCON	Position Loop Proportion Control Switchover Function	01:_Always_ Enable	00h～1Fh	
	14	Standard	TCOMPS	Torque Addition Function	00:_Always_ Disable	00h～1Fh	
	15	Standard	VCOMPS	Velocity Addition Function	00:_Always_ Disable	00h～1Fh	

Note 1: PA Group Page (PA8.00) is displayed in the digital operator

8. Description of Parameters

Table8-13 NC Parameter Group**A** [Setting of Positioning (**1**／**2**)]

Group Note1	Page Note1	Parameter Level	Symbol	Name	Standard Setting Value	Setting Range	Remarks	
A	00	Basic	S_vmx	System velocity limit		※4	1～2147483647	
	01	Basic	T_vmx	Velocity limit of PC operation		※4	1～2147483647	
	02	Basic	S_+OT	Positive direction software limit		※5	-2147483647 ～2147483647	
	03	Basic	S_-OT	Negative direction software limit		※5	-2147483647 ～2147483647	
	04	Basic	Stp_P	Striking depth ※1		Pulse	1～28672	
	05	Basic	S_inp	System in-position width ※1		Pulse	1～65535	
	06	Basic	S_ovf	System overflow ※1		※5	1～2147483647	
	07	Basic	T_ovf	Current limit overflow ※1		※5	1～2147483647	
	08	Basic	Bakls	Backlash		※5	0～65535	
	09	Basic	SOTde	Software limit detection		－	0,1	
	0A	Basic	M_dir	Operation direction ※1		－	0,1	
	0B	Basic	Accel	Acceleration/deceleration constant		※3	1～65535	
	0C	Basic	S_rat	S-acceleration/decelaration time		msec	0～32767	
	0D	Basic	T_jog	Jog current limit of PC operation		%	0～510	
	0E	Basic	Z_typ	Home-position return type		－	0,1	
	0F	Basic	Z_dir	Home-position return direction		－	0,1	
	10	Basic	Z_hsp	Home-position return high speed		※4	1～2147483647	
	11	Basic	Z_lsp	Home-position return low speed		※4	1～2147483647	
	12	Basic	Z_add	Home-position coordinate		※5	-2147483647 ～2147483647	
	13	Basic	Z_ofs	Home-position offset value		※5	-2147483647 ～2147483647	
	14	Basic	Z_inp	Home-position in-position width ※1		Pulse	1～65535	
	16	Basic	A_ofs	Effective stroke lengthb of absolute sensor ※2		※5	-2147483647 ～2147483647	
	17	Basic	Zon1L	Zone (1) Negative direction side		※5	-2147483647 ～2147483647	
	18	Basic	Zon1H	Zone (1) Positive direction side		※5	-2147483647 ～2147483647	
	19	Basic	Zon2L	Zone (2) Negative direction side		※5	-2147483647 ～2147483647	
	1A	Basic	Zon2H	Zone (2) Positive direction side		※5	-2147483647 ～2147483647	
	1B	Basic	Zon3L	Zone (3) Negative direction side		※5	-2147483647 ～2147483647	
	1C	Basic	Zon3H	Zone (3) Positive direction side		※5	-2147483647 ～2147483647	
	1D	Basic	Zon4L	Zone (4) Negative direction side		※5	-2147483647 ～2147483647	
	1E	Basic	Zon4H	Zone (4) Positive direction side		※5	-2147483647 ～2147483647	
	1F	Basic	Zon5L	Zone (5) Negative direction side		※5	-2147483647 ～2147483647	
	20	Basic	Zon5H	Zone (5) Positive direction side		※5	-2147483647 ～2147483647	
	21	Basic	Zon6L	Zone (6) Negative direction side		※5	-2147483647 ～2147483647	
	22	Basic	Zon6H	Zone (6) Positive direction side		※5	-2147483647 ～2147483647	
	23	Basic	Zon7L	Zone (7) Negative direction side		※5	-2147483647 ～2147483647	
	24	Basic	Zon7H	Zone (7) Positive direction side		※5	-2147483647 ～2147483647	
	25	Basic	Zon8L	Zone (8) Negative direction side		※5	-2147483647 ～2147483647	
	26	Basic	Zon8H	Zone (8) Positive direction side		※5	-2147483647 ～2147483647	

8. Description of Parameters

Table8-13 NC Parameter GroupA [Setting of Positioning (2／2)]

Group	Page	Parameter Level	Symbol	Name	Standard Setting Value	Unit	Setting Range	Remarks
A	27	Basic	H_jog	Manual high speed		※4	1～2147483647	
	28	Basic	L_jog	Manual low speed		※4	1～2147483647	
	29	Basic	H_stp	High speed 1step travel distance		※5	1～2147483647	
	2A	Basic	L_stp	Low speed 1step travel distance		※5	1～2147483647	
	2B	Basic	Ovrid0	Override 0		%	1～255	
	2C	Basic	Ovrid1	Override 1		%	1～255	
	2D	Basic	Ovrid2	Override 2		%	1～255	
	2E	Basic	Ovrid3	Override 3		%	1～255	
	2F	Basic	Ovrid4	Override 4		%	1～255	
	30	Basic	Ovrid5	Override 5		%	1～255	
	31	Basic	Ovrid6	Override 6		%	1～255	
	32	Basic	Ovrid7	Override 7		%	1～255	
	33	Basic	Ovrid8	Override 8		%	1～255	
	34	Basic	Ovrid9	Override 9		%	1～255	
	35	Basic	Ovrid10	Override 10		%	1～255	
	36	Basic	Ovrid11	Override 11		%	1～255	
	37	Basic	Ovrid12	Override 12		%	1～255	
	38	Basic	Ovrid13	Override 13		%	1～255	
	39	Basic	Ovrid14	Override 14		%	1～255	
	3A	Basic	Ovrid15	Override 15		%	1～255	
	3B	Basic	S_pls	Number of system divisions ※1		(Pulse)	1～131072	
	3C	Basic	U_pls	Number of user division ※1		(mm)	1～131072	
	3E	Basic	D_dpo	Velocity, Position data decimal point ※1		–	0～5	
	3F	Basic	Unit	Setting unit ※1		–	0,1	
	4D	Basic	Sw1	Fenction switch1		–	0000～0083	
	4E	Basic	Sw2	Function switch 2		–	0000～00E7	

※1：If setting values are changed, it is necessary to restore the control power.

※2：If the setup of this parameter “A_ofs” is changed, please be sure to perform .
Otherwise it causes displacement.

※3，4，5：The units regarding velocity or position are not specified in this instruction manual because they are determined by user’s setting system parameter (S__pls，U__pls，D__dpo，Unit).
Units that are given from here on will be indicated as follows.
Things about velocity･････“U_v”、 Things about position･････“U”
Refer to 6.2.5 Positioning parameter.regarding unit decision.

8. Description of Parameters

8.3 Monitor List

8.3.1 Monitor

Monitor	Page	Symbol	Name and description	Unit	Setting Range	Remarks
	00	STATUS	Servo amplifier status ・Main circuit power supply status. Power ON/ Power OFF ・Operation preparation status. Servo Ready OFF/ Servo Ready ・Servo ON status: Servo ON Displays the status of servo amplifier, as mentioned above. Moreover, also displays the existence of any alarm conditions.	----	----	
	01	WARNING1	Warning status 1 Displays warning status: "1" During warning "0" No warning Bit 7: During excessive deviation warning Bit 6: (Indefinite) Bit 5: During velocity limit operation Bit 4: During torque limit operation Bit 3: During regenerative overload warning Bit 2: During overload warning Bit 1: (Indefinite) Bit 0: During warning for amplifier internal temperature	----	0000-0000 ~ 1111-1111	
	02	WARNING2	Warning status 2 Displays warning status: "1" During warning "0" No warning Bit 7: (Indefinite) Bit 6: Low Voltage Warning for absolute encoder backup battery Bit 5: (Indefinite) Bit 4: (Indefinite) Bit 3: (Indefinite) Bit 2: (Indefinite) Bit 1: (Indefinite) Bit 0: During charging of main circuit power supply	----	0000-0000 ~ 1111-1111	

Monitor	Page	Symbol	Name and description	Unit	Setting Range	Remarks
	05	VMON	Velocity monitor Displays number of motor rotations.	min-1	-32767 ~ +32766	
	06	VCMON	Velocity command monitor Displays velocity command value. Always displays “0”, when servo is OFF, in torque control mode.	min-1	-32767 ~ +32766	
	07	TMON	Torque monitor Displays output torque of motor.	%	-499 ~ +499	
	08	TCMON	Torque command monitor Displays torque command value. Always displays “0” , when Servo is OFF.	%	-499 ~ +499	
	09	PMON	Position deviation monitor Displays position deviation value. Always displays “0”, for speed control mode and torque control mode.	Pulse	-2147483647 ~ +2147483646	
	0A	APMON	Current position monitor Displays the current position, relative to the position at the start of control power input . This counter is free run, so when the current position exceeds the display range, it becomes the maximum value of the reverse polarity.	Pulse	-2147483648 ~ +2147483647	
	0B	CPMON	Command position monitor Displays the command position relative to the position while turning ‘ON’ the control power as original point. This counter is free run, so when current position exceeds the display range, it becomes the maximum value of the reverse polarity. It does not count the command pulse of command acceptance inhibition. The counter is also cleared during speed control mode and torque control mode. Therefore, after positioning completion status this value may not match with the current position monitor.	Pulse	-2147483648 ~ +2147483647	
	0D	FMON	Position command pulse monitor (Position command pulse input frequency) Displays entered command pulse frequency.	k Pulse/s	-6000 ~ +6000	
	0E	CSU	U-phase electrical angle monitor Always displays U-phase electrical angle, excluding encoder errors.	deg	0 ~ 359	
	0F	PS-H	Absolute encoder PS data (Upper) Displays position data PS of absolute encoder. Always displays “0” in the system, which uses an incremental encoder.	x2^32 P	0000-0000 ~ FFFF-FFFF	
	10	PS-L	Absolute encoder PS data (Lower) Displays position data PS of absolute encoder. Always displays “0” in the system, which uses an incremental encoder.	Pulse	0000-0000 ~ FFFF-FFFF	

Monitor	Page	Symbol	Name and description	Unit	Setting Range	Remarks
	11	RegP	Regenerative resitance run rate Displays run rate of regenerative resistance.	%	0.00 ~ 99.99	
	12	TRMS	Effective torque monitor Displays effective torque.This value is an accurate numerical value, but may take several hours to stabilize based on the operation pattern	%	0 ~ 499	
	13	TRMS_EST	Effective torque monitor (Estimate) Displays an estimate of effective torque. Effective torque is estimated over a short time period, so it is useful for quickly confirming torque when the same operation pattern is repeated in a comparatively short time.	%	0 ~ 499	
	14	JRAT_MON	Control loop parameter_Moment of inertia load ratio monitor Displays the parameter value used in calculating the control loop. Parameters can be confirmed while using the gain switchover function and real time auto tuning function.	%	0 ~ 15000	
	15	KP_MON	Control loop parameter_position loop proportional gain monitor Displays the parameter value used in calculating the control loop. Parameters can be confirmed while using the gain switchover function and real time auto tuning function.	s-1	1 ~ 3000	
	16	TPI_MON	Control loop parameter_ position loop integral time constant monitor Displays the parameter value used in calculating the control loop. Parameters can be confirmed while using the gain switchover function.	Msec	0.5 ~ 1000.0	
	17	KVP_MON	Control loop parameter_ speed loop proportional gain monitor Displays the parameter value used in calculating the control loop. Parameters can be confirmed while using the gain switchover function and real time auto tuning function.	Hz	1 ~ 2000	
	18	TVI_MON	Control loop parameter_ speed loop integral time constant monitor Displays the parameter value used in calculating the control loop. Parameters can be confirmed while using the gain switchover function and real time auto tuning function.	Msec	0.5 ~ 1000.0	
	19	TCFIL_MON	Control loop parameter_torque command filter monitor Displays the parameter value used in calculating the control loop. Parameters can be confirmed while using the gain switchover function and real time auto tuning function.	Hz	1 ~ 2000	
	1A	INC-E_MON	Incremental encoder signal monitor Displays the signal of the incremental encoder, which is connected to both CN2 and CN-EXT. Bit 7: Indefinite Bit 6: Z phase signal (CN-EXT) Bit 5: B phase signal (CN-EXT) Bit 4: A phase signal (CN-EXT) Bit 3: Indefinite Bit 2: Z phase signal (CN2) Bit 1: B phase signal (CN2) Bit 0: A phase signal (CN2)	----	0000-0000 ~ 1111-1111	
	1B	TLMON_EST	Load torque monitor (Estimate) Displays an estimate of load torque.	%	-499 ~ +499	
	1C	OPE_TIM	Amplifier operating time Monitored during power ON phase (supplying the control power). Amplifier operating time = current value × 2 hours	×2 hour	----	

Monitor	Page	Symbol	Name and description	Unit	Setting Range	Remarks
	20	POINTNO	Execution point number It indicates the point numbers during or after execution.	–	0 ～ 255	
	21	AD_REAL	Actual location (User coordinate) It indicates actual location in the user's coordinate system in the form of values without decimal points.	–	-2147483647 ～ +2147483646	
	22	AD_MACH	Command position (User coordinate) It indicates command position in the user's coordinate system in the form of values without decimal points.	–	-2147483647 ～ +2147483646	
	23	PAERR	Position deviation (User coordinate) It indicates position deviation in the user's coordinate system in the form of values without decimal points.	–	-2147483647 ～ +2147483646	
	24	S_OUT	Special output monitor Bit7：ZFIN Bit6：INPS Bit5：PFIN Bit4：MOVE Bit3：EXT Bit2：A-RDY Bit1：HBON Bit0：NCRDY	–	0000-0000 ～ 1111-1111	
	25	G_OUT	Generalized output monitor Bit7：OUT(8) Bit6：OUT(7) Bit5：OUT(6) Bit4：OUT(5) Bit3：OUT(4) Bit2：OUT(3) Bit1：OUT(2) Bit0：OUT(1)	–	0000-0000 ～ 1111-1111	
	26	IN_G1	Input (Group 1) monitor Bit7：CACL Bit6：ARST Bit5：RAP/OVRID Bit4：-JOG Bit3：+JOG Bit2：ZRT Bit1：RUN Bit0：EXT-E	–	0000-0000 ～ 1111-1111	
	27	IN_G2	Input (Group 2) monitor Bit7：MFIN Bit6：I_RUN Bit5：-1STEP Bit4：+1STEP Bit3：SEL3 Bit2：SEL2 Bit1：SEL1 Bit0：S-ON	–	0000-0000 ～ 1111-1111	
	28	IN_G3	Input (Group 3) monitor Bit7：E_STR Bit6：-OT Bit5：+OT Bit4：SDN Bit3：spare Bit2：spare Bit1：spare Bit0：spare	–	0000-0000 ～ 1111-1111	
	29	IN_POINT	Input (Point number) monitor Bit7：IN(128) Bit6：IN(64) Bit5：IN(32) Bit4：IN(16) Bit3：IN(8) Bit2：IN(4) Bit1：IN(2) Bit0：IN(1)	–	0000-0000 ～ 1111-1111	
	2A	ZONE_OUT	Zone output monitor Bit7：ZONE8 Bit6：ZONE7 Bit5：ZONE6 Bit4：ZONE5 Bit3：ZONE4 Bit2：ZONE3 Bit1：ZONE2 Bit0：ZONE1	–	0000-0000 ～ 1111-1111	
	2B	M_OUT	M output monitor Bit7：MSTR Bit6：spare Bit5：spare Bit4：spare Bit3：M(8) Bit2：M(4) Bit1：M(2) Bit0：M(1)	–	0000-0000 ～ 1111-1111	
	2C	TEST_MON	Test monitor （For our confirmation ）	–	0000-0000 ～ 1111-1111	
	2D	PF_CODE	Internal state	–	00 ～ FF	

8. Description of Parameters

8.4 System parameters/ Motor parameters List

8.4.1 System Parameters

<table>
<tr><th>System Parameter</th><th>Page</th><th>Name and Description</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td rowspan="9"></td><td>–</td><td>Amplifier capacity
Indicates the capacity of the servo amplifier; this is a fixed setting.</td><td>——</td><td></td></tr>
<tr><td>–</td><td>Motor structure
Indicates combined motor structure; this is a fixed setting.</td><td>——</td><td></td></tr>
<tr><td>–</td><td>Control power input voltage(s)
Indicates voltage supplied to the control power; this is a fixed setting.</td><td>——</td><td></td></tr>
<tr><td>–</td><td>Type of control power input
Indicates input type of power supplied to control power; this is a fixed setting.</td><td>——</td><td></td></tr>
<tr><td>–</td><td>Main circuit power supply input voltage
Indicates voltage supplied to main circuit power supply; this is a fixed setting.</td><td>——</td><td></td></tr>
<tr><td>00</td><td>Type of main circuit power input
Selects the input mode for power supplied to the main circuit power supply.<table><tr><th>Setting value</th><th>Explanation</th></tr><tr><td>00:AC_3-phase</td><td>Supplies 3-phase AC power to main circuit power supply</td></tr><tr><td>01:_AC_Single-phase</td><td>Supplies single phase AC power to main circuit power supply</td></tr></table></td><td>2 values (200V input type)
1 value (100V input type)</td><td></td></tr>
<tr><td>01</td><td>Motor encoder type
Selects motor encoder type.<table><tr><th>Setting value</th><th>Explanation</th></tr><tr><td>00:_Inclemental_ENC</td><td>Incremental encoder</td></tr><tr><td>01:_Absolute_ENC</td><td>Absolute encoder</td></tr></table></td><td>2 values</td><td></td></tr>
<tr><td>02</td><td>Incremental encoder function selection
Selects detailed functionality of the incremental encoder.This setting value is valid only when the motor encoder mode is set to “incremental encoder”.<table><tr><th>Setting value</th><th>Explanation</th></tr><tr><td>00:_Standard</td><td>Wire-saving incremental encoder
[Standard (4 pairs)]</td></tr><tr><td>01:_ pairs_INC-E</td><td>Incremental encoder with CS signal (7 pairs)</td></tr></table></td><td>1 value</td><td></td></tr>
<tr><td>03</td><td>Incremental encoder resolution
Unit = Pulse/Rev
Sets resolution of incremental encoder and number of pulses for each rotation of motor shaft.This setting value is valid only when motor encoder mode is set to “incremental encoder”.</td><td>500P/R ~ 65535P/R</td><td></td></tr>
</table>

Note: Changes in system parameter settings are enabled after turning ‘ON’ the control power again.

<table>
<tr><th>System Parameter</th><th>Page</th><th>Name and Description</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td></td><td>04</td><td>Absolute encoder function selection
Selects the detailed functionality of the absolute encoder.This setting value is valid only when motor encoder mode is set to “Absolute encoder”.
<table>
<tr><th>Setting</th><th>Explanation</th></tr>
<tr><td>04：PA035C-2.5MH_Manu</td><td>PA035 asynchronous 2.5Mbps
Half-duplex communication (Manual Setting)</td></tr>
<tr><td>05：PA035C-4MH_Manu</td><td>PA035 asynchronous 4.0Mbps
Half-duplex communication (Manual Setting)</td></tr>
<tr><td>06：RA062C-2.5MH_Manu</td><td>RA062 asynchronous 2.5Mbps
Half-duplex communication (Manual Setting)</td></tr>
<tr><td>07：RA062C-4MH_Manu</td><td>RA062 asynchronous 4.0Mbps
Half-duplex communication (Manual Setting)</td></tr>
<tr><td>80：RA062M-1MF</td><td>RA062 Manchester 1Mbps
Full-duplex communication</td></tr>
<tr><td>81：RA062M-2MF</td><td>RA062 Manchester 2Mbps
Full-duplex communication</td></tr>
<tr><td>82：ABS-R□-1MF</td><td>ABS-RII 1Mbps
Full-duplex communication</td></tr>
<tr><td>83：ABS-R□-2MF</td><td>ABS-RII 2Mbps
Full-duplex communication</td></tr>
<tr><td>84：ABS-E</td><td>ABS-E 1Mbps (Absolute encoder with incremental signal)</td></tr>
</table>
</td><td>Setting ranges differs per the type of hardware.</td><td></td></tr>
<tr><td></td><td>05</td><td>Absolute encoder resolution
Sets resolution of absolute encoder.
This setting value is valid only when motor encoder mode is set to “Absolute encoder”.
<table>
<tr><th>Setting</th><th>Explanation</th></tr>
<tr><td>00:_2048 divisions</td><td>2048 divisions</td></tr>
<tr><td>01:_4096 divisions</td><td>4096 divisions</td></tr>
<tr><td>02:_8192 divisions</td><td>8192 divisions</td></tr>
<tr><td>03:_16384 divisions</td><td>16384 divisions</td></tr>
<tr><td>04:_32768 divisions</td><td>32768 divisions</td></tr>
<tr><td>05:_65536 divisions</td><td>65536 divisions</td></tr>
<tr><td>06:_131972 divisions</td><td>131072 divisions</td></tr>
<tr><td>07:_262144 divisions</td><td>262144 divisions</td></tr>
<tr><td>08:_524288 divisions</td><td>524288 divisions</td></tr>
<tr><td>09:_1048576 divisions</td><td>1048576 divisions</td></tr>
<tr><td>0A:_2097152 divisions</td><td>2097152 divisions</td></tr>
</table>
</td><td>11 values</td><td></td></tr>
<tr><td></td><td>06</td><td>Combined motor model number
Indicates model number of the combined motor.
Change the motor parameter settings to change the combined motor.</td><td>-----</td><td></td></tr>
</table>

Note: Changes in system parameter settings are valid after turning ‘ON’ the control power again.

<table>
<tr><th>System Parameter</th><th>Page</th><th>Name and Description</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td></td><td>08</td><td>Control mode
Selects control mode.
<table>
<tr><th>Setting</th><th>Explanation</th></tr>
<tr><td>02:_Position</td><td>Type of position control</td></tr>
</table></td><td>1 values</td><td></td></tr>
<tr><td></td><td>09</td><td>Position loop control / encoder selection
Selects position loop control method and position loop encoder.
<table>
<tr><th>Setting</th><th>Explanation</th></tr>
<tr><td>00:_Motor_encoder</td><td>Semi-close control / Motor Encoder</td></tr>
<tr><td>01:_Ext-ENC (CN2)</td><td>Full-close control / Ext. encoder (CN2 input signal)</td></tr>
<tr><td>02:_Ext-ENC (CN-EXT)</td><td>Full-close control /
External encoder (CN-EXT input signal)</td></tr>
</table></td><td>3 values</td><td></td></tr>
<tr><td></td><td>0A</td><td>External encoder resolution
Unit=Pulse/Rev
Sets the resolution of the external encoder under full closed control.
Sets the number of converted pulses for each rotation of the motor shaft.</td><td>500P/R ~ 65535P/R</td><td></td></tr>
<tr><td></td><td>0B</td><td>Regenerative resistance selection
Selects the type of regenerative resistance to be connected.
<table>
<tr><th>Setting</th><th>Explanation</th></tr>
<tr><td>00:_Not_connect</td><td>Regenerative resistance is not connected.</td></tr>
<tr><td>01:_Built-in_R</td><td>Built-in regenerative resistance is used.</td></tr>
<tr><td>02:_External_R</td><td>External regenerative resistance is used.</td></tr>
</table></td><td>3 values</td><td></td></tr>
</table>

Note: Changes in system parameter settings are valid after turning 'ON' the control power again.

8.4.2 Motor Parameters

Motor Parameter	Page	Name and Description	Setting Range	Remarks
	–	Motor parameter (MOT01~MOT53) Motors combined with the servo amplifier are specified by data from 53 parameters (106 bytes). To change the combined motors, it is necessary to change all 53 parameters. The motor parameters can be overwritten completely, by writing the mp0 file in the servo amplifier, using the motor parameter settings of the setup software.	mp0 File	

Note: Changes in motor parameter settings are valid after turning 'ON' the control power again..

8. Description of Parameters

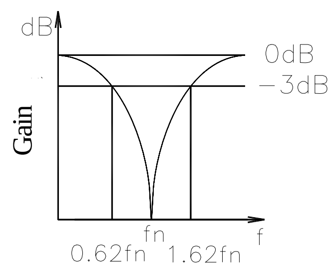
8.5 General Parameters List

8.5.1 Parameters of Group 0

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
0	00	KP1	Basic	Position loop proportional gain 1 · Proportional gain of position controller.	30	1/s	1~ 3000	
	01	TPI1	Advanced	Position loop integral time constant 1 · Integral time constant of position controller. · This setting is valid when the switchover function of position loop proportional control is invalid. · Integral items are invalid (proportional control) when setting value is1000.0ms.	1000.0	msec	0.5~ 1000.0	
	02	KVP1	Basic	Velocity loop proportional gain 1 · Proportional gain of velocity controller. · When load inertia is the value is set in JRAT1, it is the response of KVP1 setting value.	50	Hz	1~ 2000	
	03	TVI1	Basic	Velocity loop integral time constant 1 · Integral time constant of velocity controller. · Integral items are invalid (proportional control) when this value is1000.0ms.	20.0	msec	0.5~ 1000.0	
	04	KP2	Basic	Position loop proportional gain 2 · Proportional gain of position controller. ·KP2 is valid during gain switchover.	30	1/s	1~ 3000	
	05	TPI2	Advanced	Position loop integral time constant 2 · Integral time constant of position controller. · This setting is valid when the switchover function of position loop proportional control is invalid. · Integral items are invalid (proportional control) when this value is1000.0ms. ·TPI2 is valid during gain switchover.	1000.0	msec	0.5~ 1000.0	
	06	KVP2	Basic	Velocity loop proportional gain 2 ·Proportional gain of velocity controller. ·When the value is set in JRAT2 for load inertia, it is the response of KVP2 setting value. ·KVP2 is valid during gain switchover.	50	Hz	1~ 2000	
	07	TVI1	Basic	Velocity loop integral time constant 2 ·Integral time constant of velocity controller. · Integral items are invalid (proportional control) when setting value is1000.0ms. ·TVI2 is valid during gain switchover.	20.0	msec	0.5~ 1000.0	

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
0	08	JRAT1	Basic	Moment of inertia ratio of the load 1 · Moment of inertia of the load device is set for the moment of inertia of the motor. Setting value=JL/JM*100% JL: Moment of inertia of the load JM: Moment of inertia of the motor	100	%	0~ 15000	
	09	JRAT2	Basic	Moment of inertia ratio of the load 2 · The moment of inertia ratio of the load device is set for the moment of inertia of the motor. Setting value=JL/JM*100% JL: Moment of inertia of the load JM: Moment of inertia of the motor · JRAT2 is valid during switchover of the gain.	100	%	0~ 15000	
	0A	FFGN	Basic	Feed-forward gain · Feed-forward compensation gain at the time of position control.	0	%	0~100	

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
0	0E	PCFIL	Standard	Position command filter · Parameter for inserting a primary Low-pass filter for the position command pulse · Filter settings are a fixed value; filter is invalid when the settiing is 0.0ms.	0	ms	0.0~ 2000.0	
	0F	FFFIL	Standard	Feed-forward filter · Parameter for inserting a primary Low-pass filter for the feed-forward command. · The cut-off frequency is a fixed value; this filter is invalid when its setting value is 2000Hz.	2000	Hz	1~ 2000	
	10	VCFIL	Standard	Velocity command filter · Parameter for inserting a primary low-pass filter for the velocity command. · The cut-off frequency is a fixed value; this filter is invalid when its setting value is 2000Hz.	2000	Hz	1~ 2000	
	11	TCNFILA	Standard	Torque command notch filter A · Parameter for setting a notch filter (with the characteristics shown in the following figure) for torque command. · The main frequency is a fixed value, set to 10Hz unit in the servo amplifier. Operation will not change, even if set to 1HzUnit. · This filter is invalid when its setting value is 2000Hz. · It can be considered as 2-stage notch filter, by combining it with TCNFILB. · After auto notch filter tunning is implemented for a test run, the tuning result is saved in TCNFILA. (Results automatically change after tuning.) [Characteristics] 	2000	Hz	100~ 2000	
	12	TCNFILB	Standard	Torque command notch filter B · Parameter for setting notch filter for torque command. Characteristics of the notch filter are similar to TCNFILA. · The main frequency is a fixed value, set to 10Hz unit in the servo amplifier. Operation will not change, even if it is set to 1HzUnit. · This filter is invalid when the setting value is 2000Hz.	2000	Hz	100~ 2000	

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
0	13	TCFIL1	Standard	Torque command filter 1 · Parameter for inserting low-pass filter for torque command. · The cut-off frequency is a fixed value.	600	Hz	1~ 2000	
	14	TCFIL2	Standard	Torque command filter 2 · Parameter for inserting low-pass filter for torque command. · The cut-off frequency is a fixed value. · TCFIL2 is valid during gain switchover.	600	Hz	1~ 2000	
	1D	AFBK	Advanced	Acceleration feedback gain · The compensation function for assigning stability to the speed loop. · The torque command is compensated by adding this gain to the detected acceleration. · Setting unit is 0.1%. Enter "206" for setting "+20.6%" and "-314" for setting "-31.4%.	0	0.1%	-1000~ 1000	
	1E	AFBFIL	Advanced	Acceleration speed feedback filter · Parameter for inserting primary low-pass filter for acceleration speed feedback compensation. · The cut-off frequency is a fixed value. · This filter is invalid when its setting value is 2000Hz.	1500	Hz	1~ 2000	

8.5.2 Parameters of Group1

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
1	01	NEAR	Basic	Near range • Parameter for setting the range to output the 'Positioning Completion'near signal. • The deviation counter value is set while displaying the 'Positioning Completion' near signal. • Encoder pulse is the standard, irrespective of electronic gear function and command multiplication function.	500	Pulse	1～ 65535	
	07	LOWV	Basic	Low velocity setting • Parameter for setting the low velocity output range. •Low velocity is output when the velocity is below the selected value.	50	min-1	0～ 65535	
	08	VA	Basic	Velocity attainment setting • Parameter for setting the value that outputs velocity attainment. • Velocity attainment is output when the velocity exceeds the selected value. • If the motor velocity is less than the selected value during torque control operations, and when the control change function is enabled, the torque command is always set to 0. (Fixed speed cannot be controlled.) Avoid continuous usage in this manner.	1000	min-1	0～ 65535	
	09	VCMP	Basic	'Velocity matching' range • Parameter for 'Velocity matching' output range settings. • 'Velocity matching' is output when the velocity deviation (difference between velocity command and the actual velocity) is within the range of the selected value.	50	min-1	0～ 65535	

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
1	0F	SQTCLM	Basic	Sequence operation torque limit value • Parameter for setting output torque during sequence operations. • The torque limit value is set by comparing it with the rated output torque. (100%= Rated torque) • Output torque is restricted during sequence operations like JOG operations, tuning operations, waiting period for holding brake operation, and OT status. • The output torque is restricted by TP if a value exceeding the 'peak output torqueTP' is selected. (In TP there are variations of ±20%)	120	%	10～ 500	
	10	BONDLY	Basic	Holding brake operation delay time (Holding brake holding delay time) • The holding brake operation delay time is set when switching from servo ON status to servo OFF status. • Motor excitation is continued by the 'setting time zero command' while switching from servo ON status to servo OFF status.	300	ms	0～ 1000	
	11	BOFFDLY	Basic	Holding brake operation cancel release delay time (Holding brake release delay time) • The holding brake operation cancel release delay time is set while switching from servo ON status to servo OFF status. • Motor excitation is continued by the 'setting time zero command' while switching from servo ON status to servo OFF status.	300	ms	0～ 1000	
	17	TCOMP	Standard	Internal torque addition command • Parameter for when the torque addition command is used (with a fixed value) while using the torque addition function.	0	%	-500～ +500	
	18	VCOMP	Standard	Internal velocity additional command • Parameter for when the velocity addition command is used (with a fixed value) while using the velocity addition function.	0	min-1	-32768 ～ +32767	

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
1	19	BONBGN	Standard	Brake operation start time • Parameter for setting motor free operation time, dynamic brake operation time, and servo brake operation time. • Both the holding brake and dynamic brake are used if setting time lapses after switchover from servo ON status to servo OFF status. If the motor has not stopped even after turning the servo OFF by the gravitational axis etc., then motor is controlled by the holding brake and dyanmic brake. The motor will not operate in the system if motor speed is set below zero under 'Setting time'. • If the setting time is 0 msec, the brake operation start time becomes invalid (BONBGN=infinity).	0	msec	0~ 65535	For 0msec = "infinity", is compatible after Amplifier Software Revision "P0.01.0" .
	1A	ZV	Standard	Zero velocity range • Setting value for detecting zero velocity status (motor stop). • If motor velocity is less than this value, it is considered to have zero velocity status.	50	min-1	50~ 65535	
	1B	PFDDLY	Advanced	Power failure detection delay time • The delay time is dtermined from power OFF of control power until the error is detected in the control power. • Instantaneous stop detection is slowed by an increase in the selected value. (Only error detection is delayed by increasing this value .If the power supply for the internal logic circuit is cut, the same operations as when restarting the control power are performed. If there is a shortage of energy to the main circuit, different errors, such as a low power supply to the main circuit, are detected.) • The actual error detection delay time varies between -12ms and +6ms. • The selected value is enabled after turning ON the control power again.	32	msec	20~ 1000	
	1C	OLWLV	Standard	Overload warning level • Adjusts the display of a warning before the overload alarm rings. • The available range is 20%~99% when the overload alarm level is 100%. If the selected value is 100%, the overload warning is displayed at the same time as the overload alarm. The overload detection process is assumed to be 75% of rated load while supplying control power (hot start). If the overload warning level is set below 75%, it may be displayed in 'supply control power' status. • This setting is enabled after turning ON the control power again.	90	%	20~ 100	
	1D	OFWLV	Standard	Excessive deviation warning level • Parameter for warning prior to the 'position excessive deviation' alarm .	65535	x256 pulse	1~ 65535	

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
1	20	INCEDAT	Advanced	Abnormal setting value while calculating incremental encoder • Parameter for detecting errors in calculating incremental encoder. • Calculation error alarm rings when accumulated errors exceed the selected value after turning the control power 'ON'. •Incremental pulses should be selected as a multiple of 4 (standard value). Note that a pulse number less than a multiple of 4 is monitored for calculation error detection, by rounding the fraction.	128	Pulse	4~ 65535	
	22	ATNFIL	Standard	Torque command value of auto notch filter tuning • Parameters for the torque command value during the tuning auto notch filter "test run and adjustment" • A value of 100% is considered apprpriate for the rated torque command.	50	%	10~300	

8. Description of Parameters

8.5.3 Parameters of Group 2

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
2	00	OBLPF1	Advanced	Observer output low-pass filter 1 • Primary low-pass filter is set for observer output as default • Cutoff frequency is a fixed value	200	Hz	1~ 2000	
	01	OBLPF2	Advanced	Observer output low-pass filter 2 • Primary low-pass filter is set to output the estimated load torque monitor from the observer. • Cut ff frequency is a fixed value • Filter is invalid if selected value is 2000Hz • Valid when damping control is performed as an absorber function.	16	Hz	1~ 2000	
	02	OBG	Advanced	Observer compensation gain • Observer compensation gain for torque command • When settings for the observer compensation function are valid, it is adjustments are made in proportion to the selected value.	0	%	0~1000	
	03	ANRES	Advanced	Anti resonance frequency • Anti resonance frequency is selected for damping control.	40	Hz	1~200	
	07	RTLEVEL	Advanced	Real time auto tuning response setting • Sets the response conditions of the control loop parameter, relative to real time auto tuning. • Response increases with an increase in the selected value. Should be set relative to the specifications of the device.	0		0~10	

8.5.4 Parameters of Group 3

<table>
<tr><th>Group</th><th>Page</th><th>Symbol</th><th>Parameter Level</th><th>Name and Description</th><th>Standard Setting Value</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td rowspan="6">3</td><td rowspan="3">00</td><td rowspan="3">PA300</td><td rowspan="3">Basic</td><td>Amplifier Function Selection 300</td><td>00</td><td></td><td></td></tr>
<tr><td>・Upper: Deviation clear selection
Select a method for clearing a position deviation from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Servo OFF/deviation clear:
Deviation clear input/level detection</td><td>Deviation is always cleared when servo is OFF.
Deviation is always cleared when deviation clear input is ON.</td></tr>
<tr><td>1H</td><td>Servo OFF/deviation clear:
Deviation clear input / edge detection</td><td>・Deviation is cleared on the edge where deviation clear input is changes from OFF→ON</td></tr>
<tr><td>2H</td><td>Servo OFF/deviation not cleared:
Deviation clear input/level detection</td><td>Deviation is not cleared when servo is OFF.
(After servo is ON, motor may suddenly start moving.)</td></tr>
<tr><td>3H</td><td>Servo OFF/deviation not cleared:
Deviation clear input / edge detection</td><td>Deviation is not cleared when servo is OFF.
(After servo is ON, motor may suddenly start moving)</td></tr>
</table></td><td>0∗</td><td></td><td></td></tr>
<tr><td>Lower: Reservation</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">02</td><td rowspan="3">PA302</td><td rowspan="3">Basic</td><td>Amplifier Function Selection 302</td><td>∗0</td><td></td><td></td></tr>
<tr><td>Upper: Reservation</td><td></td><td></td><td></td></tr>
<tr><td>・ Lower: P-PI auto switchover
・ Select P-PI auto-switchover function from the following contents.
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>P-PI auto-switchover function/ Disabled</td><td></td></tr>
<tr><td>1H</td><td>P-PI auto-switchover function/ Enabled</td><td></td></tr>
</table></td><td>∗0</td><td>∗0～
∗1</td><td></td></tr>
</table>

<table>
<tr><th>Group</th><th>Page</th><th>Symbol</th><th>Parameter Level</th><th>Name and Description</th><th>Standard Setting Value</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td>3</td><td>03</td><td>PA303</td><td>Basic</td><td>Amplifier Function Selection303</td><td>∗1</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Upper: Reservation</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Lower: Speed feedback error (ALM_C3) detection / Speed control error (ALM_C2) detection
Select the speed feedback error (ALM_C3) detection function and speed control error (ALM_C2) detection function from the following:
(Speed control errors may be wrongly detected during an operation that causes an overshoot of the motor. In such cases use the “Disabled” setting
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>ALM_C3 detection function enabled:
ALM_C2 detection function enabled</td><td>Speed feedback error is detected
Speed limit error is detected</td></tr>
<tr><td>1H</td><td>ALM_C3 detection function enabled:
ALM_C2 detection function disabled</td><td>Speed feedback error is detected
Speed limit error is not detected</td></tr>
<tr><td>2H</td><td>ALM_C3 detection function disabled:
ALM_C2 detection function enabled</td><td>Speed feedback error is not detected
Speed limit error is detected</td></tr>
<tr><td>3H</td><td>ALM_C3 detection function disabled:
ALM_C2 detection function disabled</td><td>Speed feedback error is not detected
Speed limit error is not detected</td></tr>
</table></td><td>∗1</td><td>∗0～
∗3</td><td></td></tr>
<tr><td></td><td>04</td><td>PA304</td><td>Basic</td><td>Amplifier Function Selection304</td><td>44</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Upper: Over travel operation
In the case of over travel, select operations from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>3H</td><td>Position command inhibition & servo brake operations when OT occurs.
Servo is OFF after motor is stopped.</td><td>・When OT occurs, command input is disabled and motor is stopped by the servo brake operations.
・Servo is OFF after motor is stopped</td></tr>
<tr><td>4H</td><td>Position command inhibition & dynamic brake operations when OT occurs.
Servo is OFF after motor is stopped.</td><td>・When OT occurs, command input is disabled and motor is stopped by the dynamic brake operations.
・Servo is OFF after motor is stopped</td></tr>
</table></td><td>4∗</td><td>3∗～
4∗</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Lower: Dynamic brake operation
Dynamic brake operations, when servo is switched to Servo OFF, are selected from the following contents:
(When main circuit power supply is cut, dynamic brake is operated irrespective of these settings.)
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Free run operations when servo is OFF.
Motor free operation after motor is stopped.</td><td></td></tr>
<tr><td>1H</td><td>Free run operations when servo is OFF.
Dynamic brake operations after motor is stopped.</td><td></td></tr>
<tr><td>2H</td><td>Dynamic brake operations when servo is OFF.
Motor free operation after motor is stopped.</td><td></td></tr>
<tr><td>3H</td><td>Dynamic brake operations when servo is OFF.
Dynamic brake operation after motor is stopped.</td><td></td></tr>
<tr><td>4H</td><td>Servo brake operations when servo is OFF.
Motor free operation after motor is stopped.</td><td></td></tr>
<tr><td>5H</td><td>Servo brake operations when servo is OFF.
Dynamic brake opreation after motor is stopped.</td><td></td></tr>
</table></td><td>∗4</td><td>∗0～
∗5</td><td></td></tr>
</table>

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
3	05	PA305	Basic	Amplifier Function Selection305	00		
				・Upper: Analog monitor output polarity Output polarity of analog monitor outputs MON1and MON2 are selected from the following contents.	0*	0*~ 8*	

Selection		Explanation
0H	MON2：Display positive for forward rotations MON1：Display positive for forward rotations	・MON2：Positive voltage is displayed for forward rotations. Positive / Negative voltage is displayed. ・MON1：Positive voltage is displayed for forward rotations. Positive / Negative voltage is displayed..
1H	MON2：Display positive for forward rotations MON1：Display negative for forward rotations	・MON2：Positive voltage is displayed for forward rotations.. Positive / Negative voltage is displayed. ・MON1：Negative voltage is displayed for forward rotations. Positive / Negative voltage is displayed.
2H	MON2：Display negative for forward rotations MON1：Display positive for forward rotations	・MON2：Negative voltage is displayed for forward rotations. Positive / Negative voltage is displayed. ・MON1：Plus voltage is displayed for forward rotations.. Positive / Negative voltage is displayed.
3H	MON2：Display negative for forward rotations MON1：Display negative for forward rotations	・MON2：Negative voltage is displayed for forward rotations. Positive / Negative voltage is displayed. ・MON1：Minus voltage is displayed for forward rotations.. Positive / Negative voltage is displayed.
4H	MON2：Display positive for forward rotations MON1：Displays absolute value	・MON2：Positive voltage is displayed for forward rotations. Positive / Negative voltage is displayed. ・MON1：Positive voltage is displayed for both forward and reverse rotations.
5H	MON2：Display negative for forward rotations MON1：Displays absolute value	・MON2：Negative voltage is displayed for forward rotations. Positive / Negative voltage is displayed. ・MON1：Positive voltage is displayed for both forward and reverse rotations.
6H	MON2：Displays absolute value MON1：Display positive for forward rotations	・MON2：Positive voltage is displayed for both forward and reverse rotations. ・MON1：Positive voltage is displayed for forward rotations. Positive / Negative voltage is displayed.
7H	MON2：Displays absolute value MON1：Display negative for forward rotations	・MON2：Positive voltage is displayed for both forward and reverse rotations. ・MON1：Negative voltage is displayed for forward rotations.. Positive / Negative voltage is displayed.
8H	MON2：Displays absolute value MON1：Display absolute value	・MON2：Positive voltage is displayed for both forward and reverse rotations. ・MON1：Positive voltage is displayed for both forward and reverse rotations.

Name and Description	Standard Setting Value	Setting Range	Remarks
・Lower: Forced stop operation Forced stop operations (EMR) are selected from the following contents.	*0	*0~*1	

Selection		Explanation
0H	Servo brake	When EMR is input, motor is stopped by servo brake operations.
1H	Dynamic brake	When EMR is input, motor is stopped by dynamic brake operations.

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
3	06	PA306	Basic	Amplifier Function Selection 306	00		
				・Upper : Speed addition command input Select speed addition command input from the following:	0*	0*~ 2*	
				・Lower: Torque addition command input Select torque addition command input from the following:	*0	*0~*2	

Upper: Speed addition command input

Selection		Explanation
0H	Speed addition function disabled	
1H	Use analog speed addition command	Use analog speed addition command value when speed addition function is enabled.
2H	Use internal speed addition command	Use internal speed addition command value when speed addition function is enabled.

Lower: Torque addition command input

Selection		Explanation
0H	Torque addition function disabled	
1H	Use analog torque addition command	When torque addition function is enabled, analog torque addition command value is used
2H	Use internal torque addition command	When torque addition function is enabled, internal torque addition command value is used.

<table>
<tr><th>Group</th><th>Page</th><th>Symbol</th><th>Parameter Level</th><th>Name and Description</th><th>Standard Setting</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td>3</td><td>07</td><td>PA307</td><td>Basic</td><td>Amplifier Function Selection 307</td><td>00</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Upper: Absolute encoder clear function selection
This function is used for clearing the absolute encoder warning, which does not clear automatically.
(Enabled only while using the wire-saving absolute encoder.)
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Clear encoder status (abnormal / warning) and multiple rotations data [standard setting]</td><td></td></tr>
<tr><td>1H</td><td>Clear only the encoder status (abnormal / warning)</td><td></td></tr>
</table></td><td>0*</td><td>0*~
1*</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Lower: Positioning completion signal / position deviation monitor
Positioning completion signal (INP) and position deviation monitor are selected from the following contents:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Compare “Feedback value” with “Position command value after passing through the position command filter”.</td><td></td></tr>
<tr><td>1H</td><td>Compare “Feedback value” with “Position command value before passing through the position command filter”</td><td></td></tr>
</table></td><td>*0</td><td>*0~*1</td><td></td></tr>
<tr><td></td><td>08</td><td>PA308</td><td>Basic</td><td>Amplifier Function Selection 308</td><td>11</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Upper: External incremntal encoder (CN-EXT) digital filter
Choose settings for digital display of the external incremental encoder, which is connected to connector CN-EXT, from the following contents:
<table>
<tr><th colspan="2">Selection</th><th>Notes</th></tr>
<tr><td>0H</td><td>Minimum pulse width = 110nsec (Minimum phase difference =37.5nsec)</td><td></td></tr>
<tr><td>1H</td><td>Minimum pulse width= 220nsec [Standard setting value]</td><td></td></tr>
<tr><td>2H</td><td>Minimum pulse width= 440nsec</td><td></td></tr>
<tr><td>3H</td><td>Minimum pulse width= 880nsec</td><td></td></tr>
<tr><td>4H</td><td>Minimum pulse width= 75nsec (Minimum phase difference=37.5nsec)</td><td></td></tr>
<tr><td>5H</td><td>Minimum pulse width= 150nsec</td><td></td></tr>
<tr><td>6H</td><td>Minimum pulse width= 300nsec</td><td></td></tr>
<tr><td>7H</td><td>Minimum pulse width= 600nsec</td><td></td></tr>
</table></td><td>1*</td><td>0*~
7*</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Lower: Motor incremental encoder (CN2) digital filter
Choose settings for the digital filter of the motor incremental encoder, which is connected to connector CN2, from the following contents:
<table>
<tr><th colspan="2">Selection</th><th>Notes</th></tr>
<tr><td>0H</td><td>Minimum pulse width= 110nsec (Minimum phase difference= 37.5nsec)</td><td></td></tr>
<tr><td>1H</td><td>Minimum pulse width= 220nsec [Standard setting value]</td><td></td></tr>
<tr><td>2H</td><td>Minimum pulse width= 440nsec</td><td></td></tr>
<tr><td>3H</td><td>Minimum pulse width= 880nsec</td><td></td></tr>
<tr><td>4H</td><td>Minimum pulse width= 75nsec (Minimum phase difference= 37.5nsec)</td><td></td></tr>
<tr><td>5H</td><td>Minimum pulse width= 150nsec</td><td></td></tr>
<tr><td>6H</td><td>Minimum pulse width= 300nsec</td><td></td></tr>
<tr><td>7H</td><td>Minimum pulse width= 600nsec</td><td></td></tr>
</table></td><td>*1</td><td>*0~*7</td><td></td></tr>
</table>

8.5.5 Parameters of Group 4

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
4	01	PA401	Basic	Amplifier Function Selection 401	00		
				▪ Upper : Reservation Do not change the setting value. Selection / Explanation 0H: reserved The setting is enabled after turning ON the control power again..	0*	0*~ 0*	
				▪ Lower : External encoder (CN – EXT) polarity Select the signal polarity of the external encoder (connected to CN - EXT) from the following: Selection / Explanation 0H: EX-Z / Do not reverse, EX-B/ Do not reve rse, EX-A/ Do not reverse 1H: EX-Z/ Do not reverse, EX-B/ Do not reverse, EX-A/ Reverse 2H: EX-Z/ Do not reverse, EX-B/ Reverse, EX-A/ Do not reverse 3H: EX-Z/ Do not reverse, EX-B/ Reverse, EX-A/ Reverse 4H: EX-Z/ Reverse, EX-B/ Do not reverse, EX-A/ Do not reverse 5H: EX-Z/ Reverse, EX-B/ Do not reverse, EX-A/ Reverse 6H: EX-Z/ Reverse, EX-B/ Reverse, EX-A/ Do not reverse 7H: EX-Z/ Reverse, EX-B/ Reverse, EX-A/ Reverse The setting is enabled after turning ON the control power again..	*0	*0~*7	

Nested selection tables within the description cells:

Selection		Explanation
0H	reserved	

Selection		Explanation
0H	EX-Z / Do not reverse EX-B/ Do not reve rse EX-A/ Do not reverse	
1H	EX-Z/ Do not reverse EX-B/ Do not reverse EX-A/ Reverse	
2H	EX-Z/ Do not reverse EX-B/ Reverse EX-A/ Do not reverse	
3H	EX-Z/ Do not reverse EX-B/ Reverse EX-A/ Reverse	
4H	EX-Z/ Reverse EX-B/ Do not reverse EX-A/ Do not reverse	
5H	EX-Z/ Reverse EX-B/ Do not reverse EX-A/ Reverse	
6H	EX-Z/ Reverse EX-B/ Reverse EX-A/ Do not reverse	
7H	EX-Z/ Reverse EX-B/ Reverse EX-A/ Reverse	

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
4	02	PA402	Basic	Amplifier Function Selection 402	51		
				▪ Upper :Setup software communication baud rate. Selct the baud rate for communicating with the PC, from the following:	5*	0*~ 5*	

Selection		Explanation
0H	1200 bps	
1H	2400 bps	
2H	4800 bps	
3H	9600 bps	
4H	19200 bps	
5H	38400 bps	

The setting is enabled after turning ON the control power again.

· Lower : Setup software communication axis number. Select the axis number for communicating with the PC from the following:	*1	*1~*F

Selection		Explanation
1H	#1	
2H	#2	
3H	#3	
4H	#4	
5H	#5	
6H	#6	
7H	#7	
8H	#8	
9H	#9	
AH	#A	
BH	#B	
CH	#C	
DH	#D	
EH	#E	
FH	#F	

The setting is enabled after turning ON the control power again..

8. Description of Parameters

<table>
<tr><th>Group</th><th>Page</th><th>Symbol</th><th>Parameter Level</th><th>Name and Description</th><th>Standard Setting Value</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td rowspan="6">4</td><td rowspan="3">03</td><td rowspan="3">PA403</td><td rowspan="3">Basic</td><td>Amplifier function selection 403</td><td>00</td><td></td><td></td></tr>
<tr><td>(Upper : Reservation
Do not change the setting value.
<table><tr><th colspan="2">Selection</th><th>Explanation</th></tr><tr><td>0H</td><td>reserved</td><td></td></tr></table>The setting is enabled after turning ON the control power again..</td><td>0*</td><td>0*~
0*</td><td></td></tr>
<tr><td>・Lower : Positioning method.
Select the positioning method from the following:
<table><tr><th colspan="2">Selection</th><th>Explanation</th></tr><tr><td>0H</td><td>Positioning impulses specification</td><td></td></tr><tr><td>1H</td><td>Edge positioning specification</td><td></td></tr></table>The setting is enabled after turning ON the control power again..</td><td>*0</td><td>*0~
*0</td><td></td></tr>
<tr><td rowspan="3">06</td><td rowspan="3">PA406</td><td rowspan="3">Basic</td><td>Amplifier function selection 406</td><td>00</td><td></td><td></td></tr>
<tr><td>・Upper: Position detection system selection
Select position detection system from the following
<table><tr><th colspan="2">Selection</th><th>Explanation</th></tr><tr><td>0H</td><td>Absolute system</td><td></td></tr><tr><td>1H</td><td>Incremental system</td><td></td></tr></table></td><td>0∗</td><td>0∗~
1∗</td><td></td></tr>
<tr><td>・Lower: Reservation</td><td>∗0</td><td>∗0</td><td></td></tr>
</table>

8.5.6 Parameters of Group 5

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
5	00	MON1	Basic	Analog monitor output 1 selection ・Select the signal to be displayed in analog monitor output 1.	02H: VMON_2mV/min-1	00H～ 10H	

Selection		Explanation
00H	TMON_2V/TR	Torque Monitor 2V / Rating torque
01H	TCMON_2V/TR	Torque Command Monitor 2V / Rating torque
02H	VMON_2mV/min-1	Velocity Monitor 2mV/min-1
03H	VMON_1mV/min-1	Velocity Monitor 1mV / min-1
04H	VMON_3mV/min-1	Velocity Monitor 3mV / min-1
05H	VCMON_2mV/min-1	Velocity Command Monitor 2mV / min-1
06H	VCMON_1mV/min-1	Velocity Command Monitor 1mV / min-1
07H	VCMON_3mV/min-1	Velocity Command Monitor 3mV / min-1
08H	PMON_50mV/P	Position Deviation Counter Monitor 50mV / Pulse
09H	PMON_20mV/P	Position Deviation Counter Monitor 20mV / Pulse
0AH	PMON_10mV/P	Position Deviation Counter Monitor 10mV / Pulse
0BH	TLMON_EST_2V/TR	Load torque Monitor(Estimated value) 2V / TR
0CH	FMON_10mV/kP/s	Position Command Pulse Monitor (Position Command Pulse Input Frequency) 10mV/kPulse/s
0DH	Sine-U	U Phase Electrical Angle 8Vp-p
0EH	PMON_5mV/P	Position Deviation Counter Monitor 5mV / Pulse
0FH	PMON_1mV/P	Position Deviation Counter Monitor 1mV / Pulse
10H	FMON_2mV/kP/s	Position Command Pulse Monitor (Position Command Pulse Input Frequency) 2mV/kPulse/s”

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
	01	MON2	Basic	Analog monitor output 2 selection ・Select the signal to be displayed in analog monitor output 2. ・The selection range is similar to MON1 (above).	01H: TCMON_2mV/TR	00H～ 10H	

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
5	02	DMON	Basic	Digital monitor output selection ・Select the signal to be displayed in digital monitor output. Selections and their explanations are as follows.	00H: Always_OFF	00h～87h	

Selection		Explanation
00H	Always_OFF	Output is always OFF.
01H	Always_ON	Output is always ON.
02H	S-RDY_ON	The output is ON, during “operation ready” status.
03H	S-RDY_OFF	The output is OFF, during “operation ready” status.
04H	P-ON_ON	The output is ON, during power ON.
05H	P-ON_OFF	The output is OFF, during power ON.
06H	A-RDY_ON	The output is ON, during power ON allocation.
07H	A-RDY_OFF	The output is OFF, during power ON allocation.
08H	S-ON_ON	The output is ON, during motor excitation.
09H	S-ON_OFF	The output is OFF, during motor excitation.
0AH	MBR-ON_ON	The output is ON, during output of holding brake excitation signal.
0BH	MBR-ON_OFF	The output is OFF, during output of holding brake excitation signal.
0CH	TLC_ON	The output is ON, during torque limit operation.
0DH	TLC_OFF	The output is OFF, during torque limit operation
0EH	VLC_ON	The output is ON, during velocity limit operation.
0FH	VLC_OFF	The output is OFF, during velocity limit operation.
10H	LOWV_ON	The output is ON, during low velocity status.
11H	LOWV_OFF	The output is OFF, during low velocity stauts.
12H	VA_ON	The output is ON, during velocity attainment status.
13H	VA_OFF	The output is OFF, during velocity attainment status.
14H	VCMP_ON	The output is ON, during velocity matching status.
15H	VCMP_OFF	The output is OFF, during velocity matching status.
16H	ZV_ON	The output is ON, during zero velocity status.
17H	ZV_OFF	The output is OFF, during zero velocity status.
18H	INP_ON	The output is ON, during ‘Positioning completion’ status.
19H	INP_OFF	The output is OFF, during ‘Positioning completion’ status.
1AH	NEAR_ON	The output is ON, during near range status.
1BH	NEAR_OFF	The output is OFF, during near range status
1CH	CMD-ACK_ON	The output is ON, d uring command acceptance permission status.
1DH	CMD-ACK_OFF	The output is OFF, during command acceptance permission status.
1EH	GC-ACK_ON	The output is ON during gain switchover status.
1FH	GC-ACK_OFF	The output is OFF, during gain switchover status.
20H	PCON-ACK_ON	The output is ON, during speed loop proportional control switchover status.
21H	PCON-ACK_OFF	The output is OFF, during speed loop proportional control switchover status.
26H	F-OT_ON	The output is ON, during forward over travel.
27H	F-OT_OFF	The output is OFF, during forward over travel.
28H	R-OT_ON	The output is ON, during reverse over travel status.
29H	R-OT_OFF	The output is OFF, during reverse over travel status.
2AH	WNG-OFW_ON	The output is ON, during excessive deviation warning status.
2BH	WNG-OFW_OFF	The output is OFF, during excessive deviation warning status.
2CH	WNG-OLW_ON	The output is ON, during overload warning status.
2DH	WNG-OLW_OFF	The output is OFF, during overload warning status.
2EH	WNG-ROLW_ON	The output is ON, during regenerative overload warning status.
2FH	WNG-ROLW_OFF	The output is OFF, during regenerative overload warning status.
30H	WNG-BAT_ON	The output is ON, during battery warning status.
31H	WNG-BAT_OFF	The output is OFF, during battery warning status.
38H	ALM_ON	The output is ON, during alarm status.
39H	ALM_OFF	The output is OFF, during alarm status.
4AH	CHARGE_ON	The output is ON, during maincircuit power (smoothing capacitor) charge.
4BH	CHARGE_OFF	The output is OFF, during maincircuit power (smoothing capacitor). charge.
4CH	DB_OFF	The output is OFF, during dynamic brake operation.
4DH	DB_ON	The output is OFF, during dynamic brake operation.

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
5	02	DMON	Basic	Digital monitor output selection ・Select the signal to be displayed in digital monitor output. Selections and their explanations are as follows.	00H: Always_OFF	00h～ 87h	

Selection		Explanation
58H	S-RDY2_ON	The output terminal is ON, during "operation ready" status
59H	S-RDY2_OFF	The output terminal is OFF, during "operation ready" status.
60H	NCRDY_ON	The output is ON when the motor can be excited by S-ON input.
61H	HBON_ON	The output is ON when the holding brake excitation signal is emitted.
62H	A-RDY_ON	The output is ON during A-RDY state.
63H	EXT_ON	The output is ON when the input through external operation is effective.
64H	MOVE_ON	The output is ON during operation signal input.
65H	PFIN_ON	The output is ON when the operation signal is ON after positioning has been completed.
66H	INPS_ON	The output is ON within permissible deviation (within imposition).
67H	ZFIN_ON	The output is ON without alarm after zero return has been completed.
68H	OUT1_ON	The output is ON when the output OUT (1) is ON.
69H	OUT2_ON	The output is ON when the output OUT (2) is ON.
6AH	OUT3_ON	The output is ON when the output OUT (3) is ON.
6BH	OUT4_ON	The output is ON when the output OUT (4) is ON.
6CH	OUT5_ON	The output is ON when the output OUT (5) is ON.
6DH	OUT6_ON	The output is ON when the output OUT (6) is ON.
6EH	OUT7_ON	The output is ON when the output OUT (7) is ON.
6FH	OUT8_ON	The output is ON when the output OUT (8) is ON.
70H	EXT-E_ON	The output is ON when EXT-E input is ON.
71H	RUN_ON	The output is ON when RUN input is ON.
72H	ZRT_ON	The output is ON when ZRT input is ON.
73H	+JOG_ON	The output is ON when +JOG input is ON.
74H	-JOG_ON	The output is ON when -JOG input is ON.
75H	RAP/OVRD_ON	The output is ON when RAP/OVRD input is ON.
76H	ARST_ON	The output is ON when ARST input is ON.
77H	CACL_ON	The output is ON when CACL input is ON.
78H	S-ON_ON	The output is ON when S-ON input is ON.
79H	SEL1_ON	The output is ON when SEL1 input is ON.
7AH	SEL2_ON	The output is ON when SEL2 input is ON.
7BH	SEL3_ON	The output is ON when SEL3 input is ON.
7CH	+1STEP_ON	The output is ON when +1STEP input is ON.
7DH	-1STEP_ON	The output is ON when –1STEP input is ON.
7EH	I_RUN_ON	The output is ON when 1 RUN input is ON.
7FH	MFIN_ON	The output is ON when MFIN input is ON.
80H	RESERVE1_ON	(Reservatiion)
81H	RESERVE2_ON	(Reservatiion)
82H	RESERVE3_ON	(Reservatiion)
83H	RESERVE4_ON	(Reservatiion)
84H	SDN_ON	The output is ON when SDN input is ON.
85H	+OT_ON	The output is ON when +OT input is ON.
86H	-OT_ON	The output is ON when -OT input is ON.
87H	E_STR_ON	The output is ON when E_STR input is ON.

8.5.7 Parameters of Group 6

<table>
<tr><th>Group</th><th>Page</th><th>Symbol</th><th>Parameter Level</th><th>Name and Description</th><th>Standard Setting Value</th><th>Setting Range</th><th>Remarks</th></tr>
<tr><td rowspan="7">6</td><td>00</td><td>PA600</td><td>Advanced</td><td>Observer function selection
(Parameter for selecting observer function)
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>00H</td><td>OFF</td><td>Observer function disabled</td></tr>
<tr><td>01H</td><td>ON / Func1</td><td>‘Observer function enabled’ / ‘distrubance /suppression compensation’</td></tr>
<tr><td>02H</td><td>ON / Func2</td><td>Observer function enabled / damping control</td></tr>
</table></td><td>00: _ OFF</td><td>00H～ 02H</td><td></td></tr>
<tr><td rowspan="3">01</td><td rowspan="3">PA601</td><td rowspan="3">Advanced</td><td>Amplifire function selection 601</td><td>00</td><td></td><td></td></tr>
<tr><td>Upper : Reservation
Do not change the setting value.
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Reserved</td><td></td></tr>
</table></td><td>0?</td><td>0?～0?</td><td></td></tr>
<tr><td>Lower : Real time auto tuning function.
The real time auto tuning function is selected from the following contents.
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Real time auto tuning function disabled</td><td></td></tr>
<tr><td>1H</td><td>Real time auto tuning function enabled</td><td></td></tr>
<tr><td>2H</td><td>Real time auto tuning function enabled
(Including KP tuning)</td><td></td></tr>
</table></td><td>?0</td><td>?0～?2</td><td></td></tr>
<tr><td rowspan="3">06</td><td rowspan="3">PA606</td><td rowspan="3">Advanced</td><td>Amplifire function selection 606.</td><td>01</td><td></td><td></td></tr>
<tr><td>Upper : Reservation
Do not change the setting value.
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Reserved</td><td></td></tr>
</table></td><td>0∗</td><td>0∗</td><td></td></tr>
<tr><td>Lower : Torque command filter degree.
Select the degree of (TCFIL1/ TCFIL2) torque command filter.
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Primary Low-pass filter</td><td></td></tr>
<tr><td>1H</td><td>Secondary Low-pass filter</td><td></td></tr>
<tr><td>2H</td><td>Tertiary Low-pass filter</td><td></td></tr>
</table></td><td>∗1</td><td>∗0～ ∗2</td><td></td></tr>
</table>

8.5.8 Parameters of Group 7

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
7				Parmeters of Group 7. · Select the conditions to enable/disable various functions. · Selection contents are as given in the following table. It is common for all parameters of Group 7.			

Selection		Explanation
00H	Always_ Disable	This function is always disabled.
01H	Always_ Enable	This function is always enabled.
02H	LOWV_IN	When general input CONT 1is ON, function is enabled.
03H	LOWV_OUT	When general input CONT 1is OFF, function is enabled.
04H	VA_IN	When general input CONT 2 is ON, function is enabled
05H	VA_OUT	When general input CONT 2 is OFF, function is enabled.
06H	VCMP_IN	When general input CONT 3 is ON, function is enabled
07H	VCMP_OUT	When general input CONT 3 is OFF, function is enabled.
08H	ZV_IN	When general input CONT 4 is ON, function is enabled
09H	ZV_OUT	When general input CONT 4 is OFF, function is enabled.
0AH	INP_IN	When general input CONT 5 is ON, function is enabled
0BH	INP_OUT	When general input CONT 5 is OFF, function is enabled.
0CH	TLC_IN	When general input CONT 6 is ON, function is enabled
0DH	TLC_OUT	When general input CONT 6 is OFF, function is enabled.
0EH	VLC_IN	When general input CONT 7 is ON, function is enabled
0FH	VLC_OUT	When general input CONT 7 is OFF, function is enabled.
10H	NEAR_IN	When general input CONT 8 is ON, function is enabled
11H	NEAR_OUT	When general input CONT 8 is OFF, function is enabled.

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
7	01	MS	Basic	Control mode switchover function · Select the condition to enable control mode switchover function. ('Enable' = "Torque" for "Position torque control", "Torque" for "Velocity toque control" and "Velocity" for "Speed torque control".)	00:_Always_ Disable	00h	
	02	PCON	Basic	Velocity loop proportional control switchover function. · The condition, which enables velocity loop proportional control switchover function, is selected. ('Enable' ="Proportional Control")	00:_Always_ Disable	00h～11h 18ways	
	03	GC	Basic	Gain switchover function. · The condition, which enables gain switchover function is selected. ('Enable' = KP2, TPI2, KVP2, TVI2, JRAT2, TCFIL2)	00:_Always_ Disable	00h～11h 18ways	

8.5.9 Parameters of Group 8

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
8				Parameters of Group 8. ・Select the condition to enable various functions ・Selection contents are given in the following table, and common to all parameters of Group 8.			

Selection		Explanation
00H	Always_ Disable	The function is always disabled.
01H	Always_ Enable	The function is always enabled.
02H	LOWV_IN	Function enabled when there is low velocity status (Velocity is less than LOWV setting value).
03H	LOWV_OUT	Function enabled when there is no low velocity status (Velocity is less than LOWV setting value).
04H	VA_IN	Function enabled when there is Velocity attainment status (Velocity is more than VA setting value).
05H	VA_OUT	Function enabled when there is no Velocity attainment status (Velocity is more than VA setting value).
06H	VCMP_IN	Function enabled when there is velocity matching status (Velocity deviation is less than VCMP setting value).
07H	VCMP_OUT	Function enabled when there is no velocity matching status (Velocity deviation is less than VCMPsetting value).
08H	ZV_IN	Function enabled when there is zero velocity status (Velocity is less than ZV setting value).
09H	ZV_OUT	Function enabled when there is no zero velocity status (Velocity is less than ZV setting value).
0AH	INP_IN	Function enabled when there is 'Positioning completion' status (Position deviation is less than INP setting value).
0BH	INP_OUT	Function enabled when there is no 'Positioning completion' status (Position deviation is less than INP setting value).
0CH	TLC_IN	Function enabled when there is torque limit operation status.
0DH	TLC_OUT	Function enabled when there is no torque limit operation status.
0EH	VLC_IN	Function enabled when there is velocity limit operation status,.
0FH	VLC_OUT	Function enabled when there is no velocity limit operation status.
10H	NEAR_IN	Function enabled when there is near range status.
11H	NEAR_OUT	Function enabled when there is no near range status.

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
8	08	DISCHARGE	Advanced	Forced discharge function. ・Select the condition to enable the forced discharge function. (When main circuit power supply is ON, then it can not be discharged.)	01:_Always_ Enable	00h～11h	
	12	PPCON	Advanced	Position loop proportional control switchover function ・Select the condition to enable the position loop proportional control switchover function.	01:_Always_ Enable	00h～11h	
	14	TCOMPS	Standard	Torque addition function ・Select the condition to enable the torque addition function.	00:_Always_ Disable	00h～11h	
	15	VCOMPS	Standard	Velocity Addition Function ・Select the condition to enable the velocity addition function.	00:_Always_ Disable	00h～11h	

8. Description of Parameters

8.5.10 Parameters of Group A

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range
A	00	S_vmx	Basic	System velocity limit ・If the velocity exceeds this value through external operation, the velocity is limited at this setting.		※4	1～2147483647
	01	T_vmx	Basic	Velocity limit of PC operation ・If the velocity exceeds this value through PC operation, the velocity is limited at this setting velocity. In case of S_vmx＜T_vmx, the velocity is limited at S_vmx.		※4	1～2147483647
	02	S_+OT	Basic	Positive direction software limit ・If the actual coordinate exceeds this valu,e, the software limit gets errors.		※5	-2147483648～ 2147483647
	03	S_-OT	Basic	Negative direction software limit ・If the actual coordinate gets lower than this valu,e, the software limit gets errors.		※5	-2147483648～ 2147483647
	04	Stp_P	Basic	Striking depth ※1 ・The amount of soaking pulse is set up upon striking.		Pulse	1～28672
	05	S_inp	Basic	System in-position width ※1 ・If the deviation value is within the set imposition, imposition is output.		Pulse	1～65535
	06	S_ovf	Basic	System overflow ※1 ・Excessive deviation value is setup at overflow.		※5	1～2147483647
	07	T_ovf	Basic	Current limit overflow ※1 ・Excessive deviation value is setup at overflow during current limit.		※5	1～2147483647
	08	Bakls	Basic	Backlash ・The amount of backlash of the machine can be setup		※5	0～65535
	09	SOTde	Basic	Software limit detection ・Whether the software limit isdisabled or enabled is setup. "0"…Software limit is disabled "1"…Software limit is enabled		－	0,1
	0A	M_dir	Basic	Operation direction ※1 ・The operation direction of the motor is setup. "0"…CCW: in case of rotary in the direction of positive coordinate "1"…CW: in case of rotary in the direction of positive coordinate		－	0,1
	0B	Accel	Basic	Acceleration/deceleration constant ・Acceleration at external operation/PC operation mode is setup.		※3	1～65535
	0C	S_rat	Basic	S-acceleration/deceleration time ・S-shape time during an s-acceleration is setup.		msec	0～32767
	0D	T_jog	Basic	Jog current limit of PC operation ・The current limit value is setup when the current is limited through the Jog operation of PC movement.		%	0～510
	0E	Z_typ	Basic	Home-position return type ・The direction of Home-position return is setup. "0"－C phase signal search "1"－SDN OFF search (unnecessssary at the absolute sensor)		－	0,1
	0F	Z_dir	Basic	Home-position return direction ・The direction of Home-position return is setup. "0"－High speed / Positive direction Low speed/ Negative direction "1"－High speed/ Negative direction Low speed/ Positive direction (unnecessssary at the absolute sensor)		－	0,1

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range
A	10	Z_hsp	Basic	Home-position return high speed ･High speed setup upon Home-position return (when using incremental encoder) Velocity setup upon Home-position return (when using the absolute sensor)		※4	1～2147483647
	11	Z_lsp	Basic	Home-position return low speed ･Low speed setup upon Home-position return (Unnecessary when using the absolute sensor)		※4	1～2147483647
	12	Z_add	Basic	Home-position coordinate ･This value will be Home-position of the user's coordinate when 'home-position set' is executed. (When using incremental encoder) This value will be Home-position of the user's coordinate when Home-position returns. (When using the absolute sensor)		※5	-2147483648～2147483647
	13	Z_ofs	Basic	Home-position offset value ･In Home-position return, this value is used as an offset between the vase signal (C-phase or SDN signal) position and the user base position. (When using incremental encoder)		※5	-2147483648～2147483647
	14	Z_inp	Basic	Home-position in-position width ※1 ･Reducing this value improves the home-position return precision. (Only incremental encoder)		Pulse	1～65535
	16	A_ofs	Basic	Effective stroke length of absolute sensor ※2 ･Sets the valid stroke length from the home-position in the absolute sensor.		※5	-2147483648～2147483647
	17	Zon1L	Basic	Zone (1) Negative direction side ･Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	18	Zon1H	Basic	Zone (1) Positive direction side ･Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	19	Zon2L	Basic	Zone (2) Negative direction side ･Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	1A	Zon2H	Basic	Zone (2) Positive direction side ･Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	1B	Zon3L	Basic	Zone (3) Negative direction side ･Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	1C	Zon3H	Basic	Zone (3) Positive direction side ･Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	1D	Zon4L	Basic	Zone (4) Negative direction side ･Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	1E	Zon4H	Basic	Zone (4) Positive direction side ･Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	1F	Zon5L	Basic	Zone (5) Negative direction side ･Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	20	Zon5H	Basic	Zone (5) Positive direction side ･Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～2147483647
	21	Zon6L	Basic	Zone (6) Negative direction side ･Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～2147483647

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range
A	22	Zon6H	Basic	Zone (6) Positive direction side ・Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～ 2147483647
	23	Zon7L	Basic	Zone (7) Negative direction side ・Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～ 2147483647
	24	Zon7H	Basic	Zone (7) Positive direction side ・Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～ 2147483647
	25	Zon8L	Basic	Zone (8) Negative direction side ・Sets the valid negative direstion coordinates for the zone signal.		※5	-2147483648～ 2147483647
	26	Zon8H	Basic	Zone (8) Positive direction side ・Sets the valid positive direstion coordinates for the zone signal.		※5	-2147483648～ 2147483647
	27	H_jog	Basic	Manual high speed ・High speed setting of in manual feed and 1step feed. High speed or low speed can be switched by entering RAP.		※4	1～2147483647
	28	L_jog	Basic	Manual low speed ・Low speed setting of in manual feed and 1step feed. High speed or low speed can be switched by entering RAP.		※4	1～2147483647
	29	H_stp	Basic	High speed 1step travel distance ・Sets the travel distance in case of +/-1step input. High speed travel distance / low speed travel distance can be switched by entering RAP.		※5	1～2147483647
	2A	L_stp	Basic	Low speed 1step travel distance ・Sets the travel distance in case of +/-1step input. High speed travel distance / low speed travel distance can be switched by entering RAP.		※5	1～2147483647
	2B	Ovrid0	Basic	Oveerride 0 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	2C	Ovrid1	Basic	Oveerride 1 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	2D	Ovrid2	Basic	Oveerride 2 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	2E	Ovrid3	Basic	Oveerride 3 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	2F	Ovrid4	Basic	Oveerride 4 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	30	Ovrid5	Basic	Oveerride 5 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	31	Ovrid6	Basic	Oveerride 6 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	32	Ovrid7	Basic	Oveerride 7 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	33	Ovrid8	Basic	Oveerride 8 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	34	Ovrid9	Basic	Oveerride 9 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	35	Ovrid10	Basic	Oveerride 10 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	36	Ovrid11	Basic	Oveerride 11 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	37	Ovrid12	Basic	Oveerride 12 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255

8. Description of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range
A	38	Ovrid13	Basic	Oveerride 13 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	39	Ovrid14	Basic	Oveerride 14 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	3A	Ovrid15	Basic	Oveerride 15 ・This setting ratio is multiplied by travel velocity through this override input		%	1～255
	3B	S_pls	Basic	Number of system divisions ※1 ・Number of divisions for 1 motor rotation.		(Pulse)	1～131072
	3C	U_pls	Basic	Number of user divisions ※1 ・Travel distance per one motor rotation from the user point of view.		(mm)	1～131072
	3E	D_dpo	Basic	Velocity, Position data decimal point ※1 ・Setup of decimal point position for indication "0"···No decimal point "1"···One place of decimals "2"···Two places of decimals "3"···Three places of decimals "4"···Four places of decimals "5"···Five places of decimals		–	0～5
	3F	Unit	Basic	Setting unit ※1 ・Setting of the unit "0"······pulse、 "1"······ mm		–	0,1
	4D	Sw1	Basic	Function switch1		–	0000～0083
	4E	Sw2	Basic	Function switch2		–	0000～00E7

※1：If the set values are changed, restoration of the control power will be necessary.

※2：If the set values are changed, Please be sure to perform zero set. Otherwise it will cause displacement.

※ 3，4，5：Units are not specified in this instruction manual because user are supposed to setup the parametrs（S_pls，U_pls，D_dpo，Unit）.

※ Velocity system is displayed as "U_v" and position system "U" in the explanation from here on.
Refer to 6.2.5 Parameters for positioning function regarding unit setting.

8. Description of Parameters

8.5.10.1 Explanation of Parameters of GroupA

1) 00 S__vmx: System velocity limit (Uu)

The operational velocity data is limited within this value even if it is set larger by external manipulation.

2) 01 T__vmx: Velocity limit of PC operation (Uu)

The velocity is limited by this value like S__vmx when you manipulate through PC. However, it is limited with the set value of S__vmx in the case of S__vmx＜T__vmx.

3) 02 S__＋OT: Positive direction software limit (U)

- Software limit is always enabled in the case of an absolute sensor and enabled after zero return in the case of an incremental sensor.
- If the current position exceeds this set value, it decelerates and stops and forward transit is forbidden. (Software limit error will be output.)
- Break-out should be conducted by manual (JOG) to the opposite direction (negative direction). Error will be released by inputting alarmreset signal where it comes in the limit (operational range).

Note) SOTde=If you select"1", it won't work.

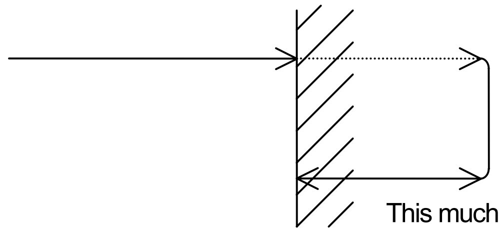
4) 03 S__－OT: Negative direction software limit (U)

- When the current position falls below this set value, backward transition is forbidden.
- Break-out should be conducted by manual (JOG) to the opposite direction (positive direction). Error will be released by inputting alarmreset signal where it comes in the limit (operational range).

Note) SOTde=If you select"1", it won't work.

5) 04 Stp__P: Striking depth

This is a virtual entry depth at striking operation. It is a pulse that complete positioning even without reaching the goal position if the striking depth falls in with the difference between command position and present one at the striking operation during positioning feeding.



6) 05 S__inp: System in-position width (Pulse)

- Positioning is completed and in-position is output when the difference between command position and present position (deviation amount) is within S__inp value(±).
- This value should usually be set with positioning error permissible value.

7) 06 S__ovf :System overflow (U)

- Values considered as overmuch position deviation (alarm) and defective position loop (defective trailing) including operation are setup.
- Set values are determined in adjusted value and maximum velocity of position loop gain(Kp) and feed forward gain(KFF).

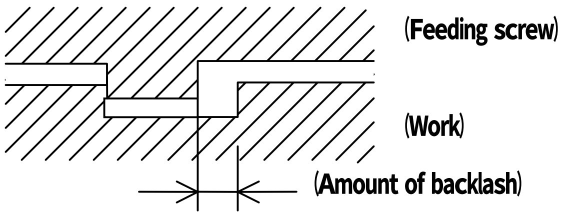
$$S\_ovf > Vmax X\ (100-Kff) / (100 \times Kp)$$

8) 07 T__ovf :Overflow at current limit (U)

- During current limit, position deviation is apt to be bigger than usual operation and overmuch deviation alarm becomes sensitive.
- This is a parameter to avoid this state.
- Therefore usually it is T__ovf>S__ovf.

9) 08 Bakls :Backlash (U)

- Amount of backlash of a machine is set.
- Amount of backlash is carried out being added to travel data every time travel direction changes.
- Perform zero return operation when you use backlash correction or after you alter setting.
- Correction starts when the direction reverses to the direction of zero return operational completion.

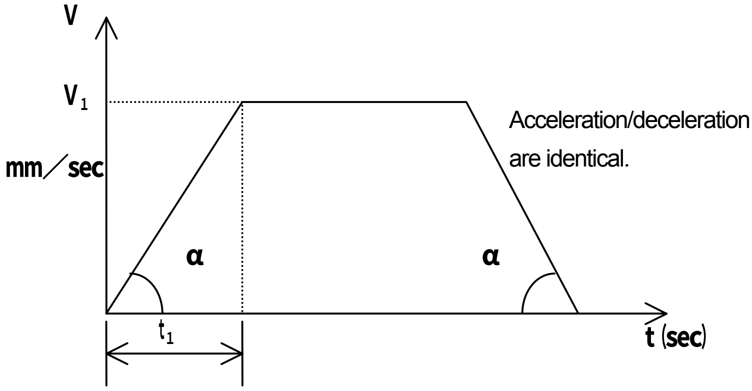


10) 09 SOTde:Software limit detection (—)

- Validity / invalidity of software limit is setup.
  - "0"···Software limit is invalid.
  - "1"···Software limit is valid.

11) 0B Accel: Acceleration/deceleration constant (—)

This is used in all the transitions of manual, 1step, home-position return, point transition.



$$\mathrm{Accel} = \frac{V_1 \times 10^{(D\_dpo)}}{t_1 \times 10^3}$$ However V_1 = (mm/s)

When rising at 0.2sec until the velocity of 0→375 (mm/sec)

V_1=375 (mm/sec) ⋯ (N=4500min^{-1})

t_1=0.2 (sec), D__dpo=2, U__pls=5.00 (mm)

$$\mathrm{Accel} = \frac{375 \times 10^2}{0.2 \times 10^3} = 187.5 \rightarrow 188$$

In addition, when rising at 0.2sec until the velocity of 0→22.5 (mm/sec)

In the case of V_1=22.5 (m/min)

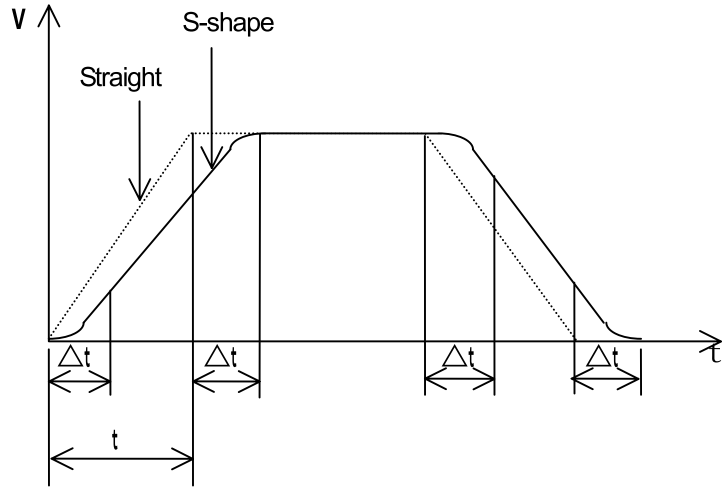
$$\mathrm{Accel} = \frac{V_1 \times 10^{(D\_dpo)}}{60 \times t_1}$$

$$= \frac{22.5 \times 10^2}{60 \times 0.2} = 187.5 \rightarrow 188$$

Note) When acceleration constant is too high, overshood or undershoot (vibration) is prone to happen.

12) OC S__rat: S-acceleration/deceleration time (msec)

- The curb section (△t) of s-shape in the acceleration and decelaration is set with time.
- Linear acceleration/deceleration when set value is below 4 (msec)
  (Set "0" during the straight line.)
- If acceleration time is short enough and the curb section of s-shape is too long, it can not reach acceleration constant (Accel).



- Rising (downward) time at S-shape is about △t longer (curb section of S-shape) than at straight line.
- The straight line at S-shape is acceleration constant (Accel).

13) OD T—jog: Jog current limit of PC operation

This is current limit set value when limiting current at Jog running of PC operation.

<Explanation of PC operation/Jog operation>

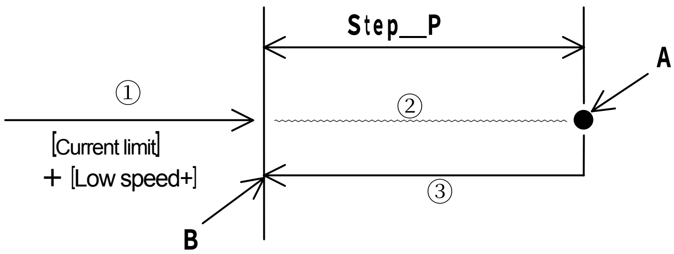
Jog operation by PC is carried out at "test operation" or "Jog operation execution".

Follow the directions below when you specially want to teach striking stop.

①Strike after Jog-moving at [current limit] + [low speed+] or [low speed−].

②Move the ideal value after striking making only pulses set by parameter "Step__P" as soaking pulses.

③When ideal value moves "Step__P", deviation will be cleared and ideal value is completed at position B.



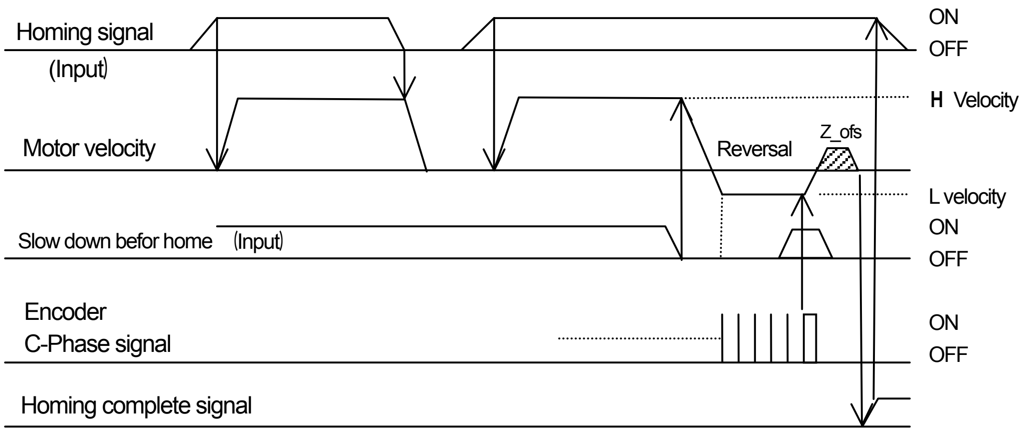
④If you register teaching, position A is automatically registered and you can teach striking stop.
(In advance, set other data for striking stop.)

14) OE Z__typ: Home-position return type (—)

When you use incremental encoder, home-position return operation brings electrical coordinate into line with actual machine operation. Setup home-position return type with parameter Z__typ, direction of home-position return with Z__dir, feeding velocity upon home-position return with Z__hsp, Z__lst.
The approach for home-position return has type0 and type1 as below.

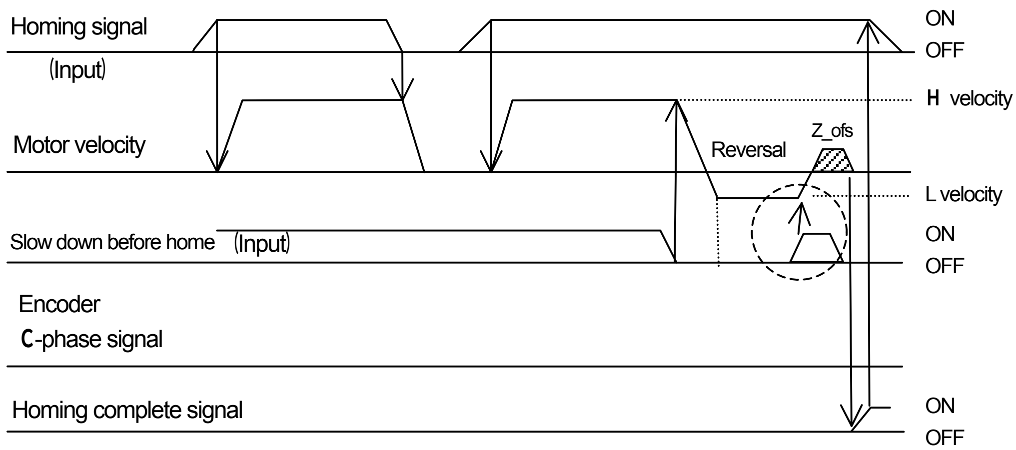
a) Home-position return type 0 (Set value: 0)

That travels toward home-position at H velocity (Z__hsp) on homing signal ON and decelerates and stops on slow-down signal (SDN) OFF. When the slow-down signal (SDN) is ON again by running back, that stops at home position which is added by home-position offset value (Z-add) with the first encoder C-phase signal ON as a benchmark.
The coordinate of home position is set to be the one which is registered in home position coordinate (Z-add).



b) Home-position return type 1(Setting value: 1)

That moves like type O from H velocity to reverseal operation, and stops at the home position that is added by home-position offset value (Z__ofs) with the slow-down signal (SDN) ON again as a benchmark.



Note: 1 Homing signal is accepted only when other operational signals (RUN , Jog, 1 STEP) are all OFF.

8. Description of Parameters

15) 0F Z__dir:Home-position return direction (—)

＊2 ・Seting 「0」…Forward rotation at high speed Backward rotation at low speed

・Setting 「1」…Backward rotation at high speed Forward rotation at low speed

16) 10 Z__hsp:Home-position return high speed (Uυ)

・With incremental sensor

Velocity at which it moves to the direction set by (Z__dir) without SDN input signal from homing start.

・With absolute sensor

Velocity of home positioning

17) 11 Z__lsp:Home-position return low speed (Uυ)

＊2 ・At homing operation, it slows down from (Z__hsp) by slow-down signal and later reverses and get away from the slow-down signal. Reverse velocity at that time.

18) 12 Z__add:Home-position coordinate (U)

＊3 ・With incremental sensor

The coordinate set here becomes user coordinate value when home-position return is completed.

・With absolute sensor

The value set here becomes user coordinate value at home-position set.

～Significant～ ・Home-position return or Home-position set is necessary when this value is changed.

19) 13 Z__ofs:Home-position offset value (U)

・When home-position return, it moves at this value as home reference signal (C-phase or SDN signal) position and correction amount of user reference position.
(When using incremental encoder)

20) 16 A__ofs:Effective stroke length of absolute sensor (U)

＊1 ・Unnecessary with incremental sensor

・Setup effective stroke length at absolute sensor as absolute value. Set this value adding margin (±α) to mechanical effective stroke. (If it exceeds this effective stroke length, normal positioning is impossible because it exceeds the region of absolute sensor.)

～Significant ～ Please be sure to set home if you change this value. If you resore control power without home-position set, it causes displacement of position.

＊ 1 Those are parameters needed only when sensor is absolute sensor.

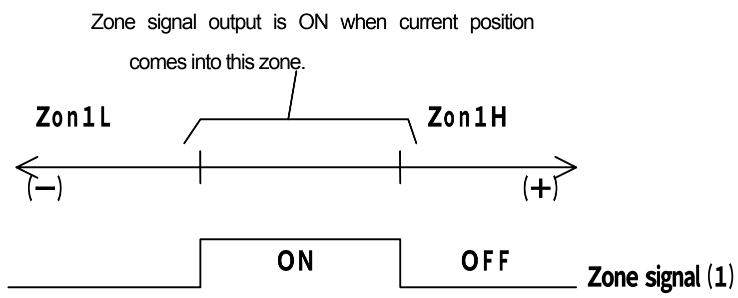
＊ 2 Those are parameters needed only when sensor is incremental sensor.
Check the position of zero when zero returns if you change thses system parameters.

＊ 3 Those are parameters needed by both absolute and incremental sensor.

8. Description of Parameters

21) **17** **Zon1L**:Zone signal (**1**) Negative direction side (**U**)
22) **18** **Zon1H**:Zone signal (**1**) Positive direction side (**U**)

- Set the zone that outputs zone signal (1) with **Zon1L** and **Zon1H**. Note) Zon1L＜Zon1H
- It is necessary to select zone signal output for general-purpose output.
  (Reference: Output selectionsignal)



- It is not output if the time when it is within the zone is too short. (t≧40msec)
- Zone signal is enabled after zero return completion with incremental sensor and always enabled with absolute sensor.

23) **19** **Zon2L**:Zone signal (**2**) Negative direction side (**U**)
24) **1**A **Zon2H**:Zone signal (**2**) Positive direction side (**U**)
25) **1**B **Zon3L**:Zone signal (**3**) Negative direction side (**U**)
26) **1**C **Zon3H**:Zone signal (**3**) Positive direction side (**U**)
27) **1**D **Zon4L**:Zone signal (**4**) Negative direction side (**U**)
28) **1**E **Zon4H**:Zone signal (**4**) Positive direction side (**U**)
29) **1**F **Zon5L**:Zone signal (**5**) Negative direction side (**U**)
30) **20** **Zon5H**:Zone signal (**5**) Positive direction side (**U**)
31) **21** **Zon6L**:Zone signal (**6**) Negative direction side (**U**)
32) **22** **Zon6H**:Zone signal (**6**) Positive direction side (**U**)
33) **23** **Zon7L**:Zone signal (**7**) Negative direction side (**U**)
34) **24** **Zon7H**:Zone signal (**7**) Positive direction side (**U**)
35) **25** **Zon8L**:Zone signal (**8**) Negative direction side (**U**)
36) **26** **Zon8H**:Zone signal (**8**) Positive direction side (**U**)

37) **27** **H__jog**:Manual high speed (**Uu**)

- Velocity when it moves at high speed when rapid signal (RAP) is input during manual (JOG) operation or 1 step feeding operation

38) **28** **L__jog**:Manual low speed (**Uu**)

- Velocity when rapid signal (RAP) is not input during manual (JOG) operation or 1 step feeding operation

39) **29** **H__stp**:High speed 1step travel distance (**U**)

- 1 step travel distance when it travels at high speed when rapid signal is input

40) **2A** **L__stp**:Low speed 1 step travel distance (**U**)

- 1 step travel distance when rapid signal (**RAP**) is not input

41) 2B Ovrid0：Override 0 (%)

・It operates at the velocity multiplied by this rate with the set value as 100% to velocity set value of point data.

Example) If Ovrid0＝10% to the velocity set 10mm／sec, execution speed will be 1mm/sec.

・The time when override O is enabled is when " Home-position return, point movement" when OVRID input is OFF.

Note) It is disabled for manual (JOG) operation.

42) 2C Ovrid1：Override 1 (%)

・The time override 1 is enabled when "Home-position return, point movement" when OVRID input is ON.

43) 2D Ovrid2：Override 2 (%)

・Set Sw2 bit6＝1 in order to enable override 2～15.

Note) Usable point numbers are limited to 1～31 because some point number specified input is allocated for override number specified input if setting Sw2 bit6＝1.

＜Input allocation＞

Item	Sw2 bit6＝0	Sw2 bit6＝1
CN1-31	RAP/OVRID	RAP/OVRID(1)
CN1-47	IN(32) ： Point number	OVRID(2)
CN1-48	IN(64) ： Point number	OVRID(4)
CN1-49	IN(128)： Point number	OVRID(8)
Effective point number	0～253	0～31
Effective override number	0, 1	0～15

Select override number specification in combinations of the above four inputs.

The total of "a" will be override number at input OVRID (a) that is ON. ("a"＝1.2.4.8)

Only CN1-47"OVRID(2)" is ON in the above four inputs if you specify override .

CN1-47"OVRID(2)」 and CN1-49「OVRID(8)" are ON and the other two inputs are OFF in the above four inputs if you specify override 10.

44) 2E Ovrid3：Override 3 (%)

45) 2F Ovrid4：Override4 (%)

46) 30 Ovrid5：Override5 (%)

47) 31 Ovrid6：Override6 (%)

48) 32 Ovrid7：Override7 (%)

49) 33 Ovrid8：Override8 (%)

50) 34 Ovrid9：Override9 (%)

51) 35 Ovrid10：Override10 (%)

52) 36 Ovrid11：Override11 (%)

53) 37 Ovrid12：Override12 (%)

54) 38 Ovrid13：Override13 (%)

55) 39 Ovrid14：Override14 (%)

56) 3A Ovrid15：Override15 (%)

57) 4D Sw1: Function switch 1

・Set values are given in hexadecimal.

	15	14	13	12	11	10	9	8
Upper	0	0	0	0	0	0	0	0

Bit number

	7	6	5	4	3	2	1	0
Lower	E/D	0	0	0	0	0	I/P	D/E

External data setting (bit 0)

0: No external data setting
1: Permitted external data setting

Coordinate at external data set teaching (bit 1)

0: Ideal position coordinate
1: Current position coordinate

Deviation clear at striking stop (bit 7)

0: Clear deviation
1: Don't clear deviation

Note) Secure all that don't have an explanation about bit to 0.

<Setting method> It will be in four-digit hexadecimal because bit numbers are displayed in hxidecimals per 4 bit unit.

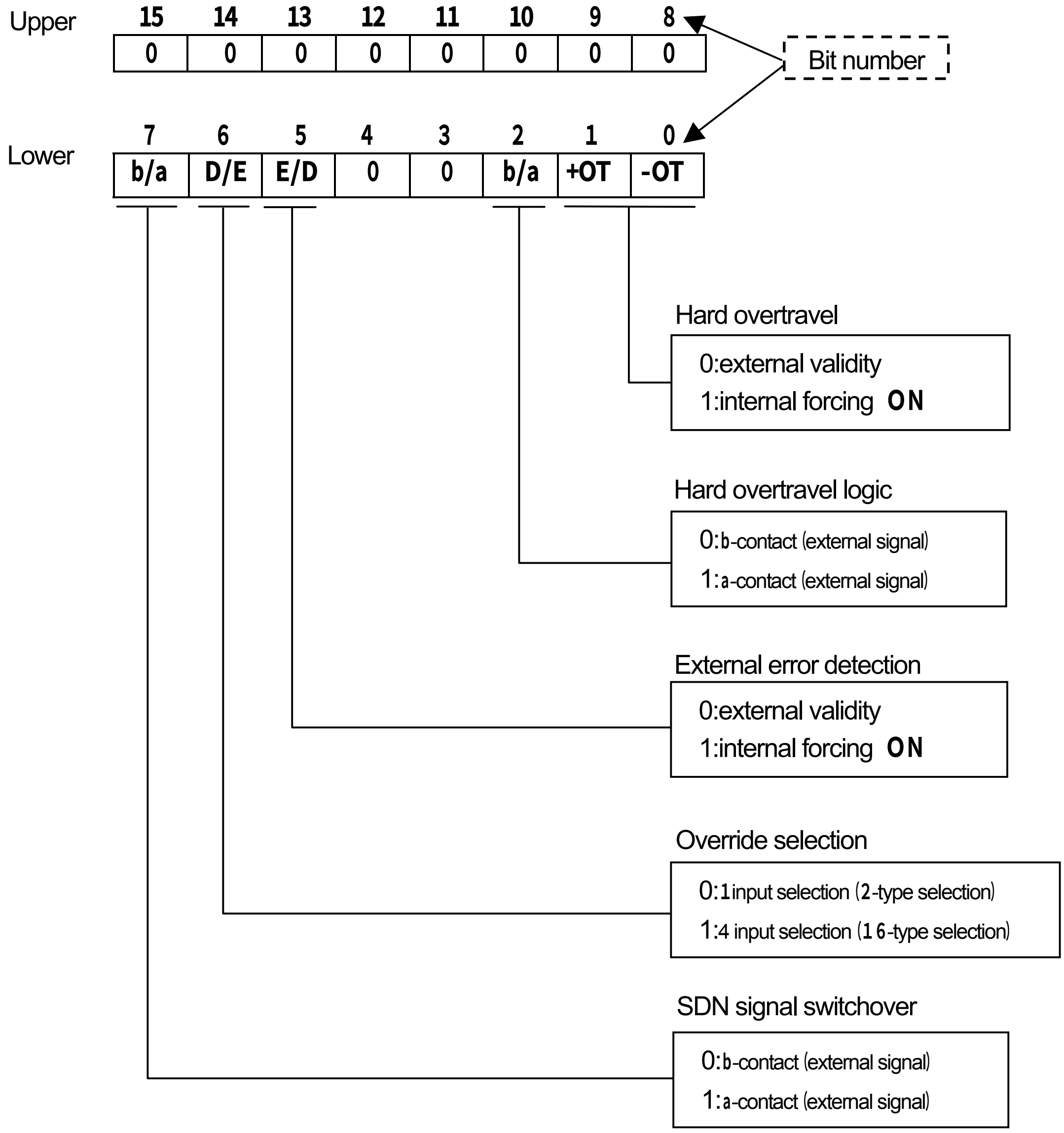
(Each of 10～15 is displayed A, B, C, D, E, F)

Bit weight for 1st digit bit 3=8 bit 2=4 bit 1=2 bit 0=1
Bit weight for 2nd digit bit 7=8 bit 6=4 bit 5=2 bit 4=1
Bit weight for 3rd digit bit 11=8 bit 10=4 bit 9=2 bit 8=1
Bit weight for 4th digit bit 15=8 bit 14=4 bit 13=2 bit 12=1

Setting example) ・No deviation clearance at striking stop・・・・・・・・・・・・・・・・bit7=1
・Coordinate at external data set teaching is current position coordinate・・・bit1=1
・External data setting shall be effective. (Permissible) ・・・・・・・・・・・・・・・・・・・bit0=1
Setting value shall be 0083 [H] in the above case.

58) 4E **Sw2**: Function switch 2

- It is used as function selection, logic reversal, and soft jumper.
- Setting values are given in hexadecimal. (Refer to parameters "**Sw1**")



Note) Secure evertying that doesn't have exlanations about bit to 0.

Setting example
- **SDN** signal shall be a-contact input.························bit7=1
- External error shall not be detected. (Internal forcing shall be ON) ···········bit5=1
- Hard overtravel shall be a-contact input.············bit2=1

setting value is **00A4 [H]** in the above case.

9. Maintenance

Maintenance

9. Maintenance

9.1 Alarm Event Procedures

When an alarm is issued, the 7-segment LED blinks and the alarm code is displayed.
It is possible to output alarm codes from CN 1 as a selectable output.
When an alarm is issued, verify its contents using the Alarm List (Section 9.1.1), eliminate the cause in accordance with the Corrective Actions List (Section 9.1.2), and verify safety before resuming operations.

9.1.1 Alarm Reset

There are 4 ways to reset an alarm.

① Clear the alarm via an alarm resetting signal (ARST) from C N 1.
② Clear the alarm by resetting it via the Q-SETUP setup software.
③ Clear the alarm by resetting it from the servo amplifier front panel and the digital operator.
Related parameter: Trial operation/ Adjustment mode [AD 2] (Refer to Chapter 8, 8.1.3.3)
④ Clear the alarm by cutting off the control power and turning ON the power again. Always confirm that the main circuit power supply is turned off, and then reactivate.

9.1.2 Alarm/ Warning List

・ Detection Operations: After alarm, “DB” will slow down and stop the servo motor.

・ Detection Operations: “SB” shows down and stops the servo motor as per the sequence current limitation value.

・ After selecting the dynamic brake in forced stop operation selection, the servo motor will slow down and stop by dynamic brake operations irrespective of operations during detecting. (However, while detecting alarm 53H [DB resistor super heating)], the servo motor will stops via servo brake operation.)

Related parameter: Parameter G r o u p 3 [PA305] (Refer to Chapter 8, 8.5.4)

・ Detection Operations: “ー” is an alarm detected only in the initial process after turning ON the control power.

・ Alarm clear: Alarms represented by an “X” signify that unless the control power supply is disconnected and reconnected, alarm clearing is not possible.

Table 9-1-1 Alarm List

	Display	Alarm Code								Alarm Title	Alarm Description	Operation when detected	Alarm Clear
		OUT 8	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1				
Drive system error	21H	0	0	1	0	0	0	0	1	Power device Abnormality (Over current)	・ Over current of drive module ・ Abnormality in drive power source ・ Overheating of drive module	DB	○
	22H	0	0	1	0	0	0	1	0	Electric current abnormality 0	・ Abnormality of electric current detection value	DB	○
	23H	0	0	1	0	0	0	1	1	Electric current abnormality 1	・ Abnormality of Electric current detection circuit	DB	○
	24H	0	0	1	0	0	1	0	0	Electric current abnormality 2	・ Abnormality in communication with Electric current detection circuit	DB	○
External input	31H	0	0	1	1	0	0	0	1	Forward over travel	・ Entering forward over travel	DB	○
	32H	0	0	1	1	0	0	1	0	Reverse over travel	・ Entering reverse over travel	DB	○
Load system error	41H	0	1	0	0	0	0	0	1	Electrical overload 1	・ Excessive effective torque	SB	○
	43H	0	1	0	0	0	0	1	1	Regeneration Abnormality	・ Regeneration load ratio exorbitance	DB	○
	51H	0	1	0	1	0	0	0	1	Amplifier Overheating	・ Overheating detection of amplifier ambient temperature	SB	○
	52H	0	1	0	1	0	0	1	0	In-rush prevention resistor overheating	・ Overheating detection of in-rush prevention resistor	SB	○
	53H	0	1	0	1	0	0	1	1	DB resistor Overheating	・ Overheating detection of DB resistor	SB	○
	54H	0	1	0	1	0	1	0	0	Internal overheating	・ Overheating detection of Internal regeneration resistor	DB	○
	55H	0	1	0	1	0	1	0	1	External overheating	・ Overheating detection of External regeneration resistor	DB	○

Table 9-1 Alarm List

	Display	Alarm code OUT 8	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1	Alarm name	Alarm description	Operation when detected	Alarm clear
Power system error	61H	0	1	1	0	0	0	0	1	Excess voltage	· DC Excess voltage of main circuit	DB	○
	62H	0	1	1	0	0	0	1	0	Main circuit under voltage Note 1) Note 2)	· DC Main circuit low voltage	DB	○
	63H	0	1	1	0	0	0	1	1	Main power supply line drop Note 2)	· 1 phase of the 3 phase main circuit power supply disconnected	SB	○
	71H	0	1	1	1	0	0	0	1	Control power supply under voltage Note 1) Note 4)	· Control power supply low voltage	DB	○Note3)
	72H	0	1	1	1	0	0	1	0	＋12 V power supply voltage	· Under voltage of + 12 V	SB	○
Encoder wiring system error	81H	1	0	0	0	0	0	0	1	Encoder A phase/ B Phase pulse signal abnormality 1	· Incremental encoder (A, B, Z) signal line break · Power supply break	DB	×Note6)
	82H	1	0	0	0	0	0	1	0	Breaking of absolute signal wire	· Absolute Encoder (PS) signal line break	DB	○
	83H	1	0	0	0	0	0	1	1	External Encoder A phase/ B phase signal Abnormality	· Breaking of full close Encoder (A, B) signal line	DB	○
	84H	1	0	0	0	0	1	0	0	Abnormality in communication between encoder and amplifier	· Encoder serial signal time out	DB	○Note7)
	85H	1	0	0	0	0	1	0	1	Encoder initial process Abnormality	· Failed to read CS data of incremental encoder · Abnormality in initial process of absolute encoder · Cable break	–	×
	87H	1	0	0	0	0	1	1	1	CS break	· CS signal line break	DB	×
	91H	1	0	0	1	0	0	0	1	Encoder command Abnormality	· Mismatch of transmission command and reception command	DB	○
	92H	1	0	0	1	0	0	1	0	Encoder FORM error	· Start, Stop bit Abnormality · Insufficient data length	DB	○
	93H	1	0	0	1	0	0	1	1	Encoder SYNC Abnormality	· Data cannot be received during the prescribed time after the command is sent.	DB	○
	94H	1	0	0	1	0	1	0	0	Encoder CRC Abnormality	· CRC generated from the received data and sent CRC does not match	DB	○

Note 1: Normal operations are possible until an instantaneous break of AC power at 1.5 cycles.

Note 2: Detection of control source abnormality or servo ready OFF is performed during an instantaneous break of 1.5 ~ 2 cycle.
PFDDLY (Group 1, page 1B) setup value is exceeding, therefore, detection of control power and servo ready off can be delayed.

Note 3: Low main circuit voltage or a line drop can be detected by a rise / drop in the main power supply, characterized by a gradual increase in voltage or a disconnection in the power supply.

Note 4: When the control panel voltage drops below +5V due to instantaneous disconnection of the controlled power supply, the alarm cannot be cleared without reduction in the voltage even after being fully restored to +5V or detection of a fault in the controlled supply.

Note 5: When an instantaneous break in the control power source is prolonged, the detected control source abnormality will not remain in the alarm history, after cutting off power and recharging,. (If an instantaneous break exceeds 1 sec., it is considered as a power source cutoff.)

Note 6: When full-close control/external encoder (CN2 input signal, see System Parameter Page 09) is selected, the alarm can be reset.

Note 7: When the absolute encoder with incremental signal is used, alarm resetting is prohibited.

Note 8: When the alarms for forward over travel, reverse over travel and external overheating are issued simultaneously, the forward over travel alarm will be displayed.

Table 9-1 Alarm List

	Display	OUT 8	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1	Alarm Name	Alarm description	Operation when detected	Alarm clear
Encoder main body error	A1H	1	0	1	0	0	0	0	1	Encoder Abnormality 1	· Breakdown of Encoder internal device	DB	○
	A2H	1	0	1	0	0	0	1	0	Absolute Encoder Battery Abnormality	· Battery low voltage	DB	○
	A3H	1	0	1	0	0	0	1	1	Encoder Overheating	· Motor built-in Encoder Overheating	DB	○
	A5H	1	0	1	0	0	1	0	1	Encoder Abnormality 3	· Error generation of multi-rotation data · Abnormality in operations of temperature sensor	DB	×
	A6H	1	0	1	0	0	1	1	0	Encoder Abnormality 4	· Encoder internal EEPROM data is not set · Overflow of multi-rotation data	DB	○
	A7H	1	0	1	0	0	1	1	1	Encoder Abnormality 5	· Resolver Abnormality · Light receiving abnormality in encoder	DB	×
	A8H	1	0	1	0	1	0	0	0	Encoder Abnormality 6	· Resolver disconnection · Light receiving abnormality in encoder	DB	×
	B2H	1	0	1	1	0	0	1	0	Encoder Abnormality 2	· Position data incorrect	DB	○
	B3H	1	0	1	1	0	0	1	1	Absolute Encoder rotations counter Abnormality	· Detection of incorrect multiple rotations coefficient	DB	○
	B4H	1	0	1	1	0	1	0	0	Absolute Encoder 1 rotation counter abnormality	· Detection of incorrect 1 rotation coefficient	DB	○
	B5H	1	0	1	1	0	1	0	1	Exceeds the permitted speed while turning ON the absolute Encoder power	· Exceeds the permitted speed of motor rotation speed when the power is turned ON	DB	○
	B6H	1	0	1	1	0	1	1	0	Internal memory error of encoder	· Access error of Encoder internal EEPROM	DB	×
	B7H	1	0	1	1	0	1	1	1	Acceleration error	· Exceeds the permitted speed for motor rotation	DB	○
Control system error	C1H	1	1	0	0	0	0	0	1	Over speed	· Motor rotation speed is 120 % more than the highest speed limit	DB	○
	C2H	1	1	0	0	0	0	1	0	Speed control Abnormality	· Power command and Acceleration codes are mismatched	DB	○
	C3H	1	1	0	0	0	0	1	1	Speed feedback Abnormality	· Motor power disconnection (Note 2)	DB	○
	D1H	1	1	0	1	0	0	0	1	Excessive position deviation	· Position error exceeds setup value	DB	○
	D2H	1	1	0	1	0	0	1	0	Position command pulse frequency Abnormality 1	· Frequency of entered position command pulse is excessive	SB	○
	D3H	1	1	0	1	0	0	1	1	Position command pulse frequency Abnormality 2	· Overflow of position command low-pass filter	SB	○
	DFH	1	1	0	1	1	1	1	1	Test mode end (Note 1)	· Detection in 'Test mode end' status	DB	○
Control system/Memory system error	E1H	1	1	1	0	0	0	0	1	EEPROM Abnormality	· Abnormality of amplifier with built-in EEPROM	DB	×
	E2H	1	1	1	0	0	0	1	0	EEPROM check sum Abnormality	· Error in check sum of EEPROM (entire area)	−	×
	E3H	1	1	1	0	0	0	1	1	Internal RAM Abnormality	· Access error in CPU built in RAM	−	×
	E4H	1	1	1	0	0	1	0	0	Process abnormality in CPU ~ ASIC	· Access abnormality in CPU ~ ASIC	−	×
	E5H	1	1	1	0	0	1	0	1	Parameter error 1	· Detection when non-corresponding or undefined amplifier, motor, encoder code are specified.	−	×
	E6H	1	1	1	0	0	1	1	0	Parameter error 2	· Error in combining motor, encoder, and/or amplifier code set from system parameter	−	×
	EFH	1	1	1	0	1	1	1	1	Check sum error of point data	· Check sum error in point data entire area	−	×
	F1H	1	1	1	1	0	0	0	1	Task process Abnormality	· Error in interruption process of CPU	DB	×
	F2H	1	1	1	1	0	0	1	0	Initial timeout	· Detection when initial process does not end within initial process time	−	×

Note 1: Alarm that occurs in 'Test mode end' status is not recorded in the alarm history.
Note 2: When there is a rapid motor slow down simultaneous with servo ON, there is a possibility that a break in the motor's power line cannot be detected.

Table 9-2 Warning List

	Warning Title	Warning Contents
Load system	Overload Warning	• When the effective torque exceeds the set torque
	Regenerated Overload Warning	• In case of overload of regenerative resistance
	Amplifier Overheating Warning	• Ambient temperature of the amplifier is out of range of the set temperature
Power supply system	Main circuit is charging	• Voltage of main circuit is above DC 105 V
Encoder system	Absolute encoder battery warning	• Battery voltage is below 3.0 V
Control system	Restricting torque command	• While restricting the torque command by torque restriction value
	Restricting speed command	• While restricting the speed command by speed value.
	Excessive position deviation	• When position deviation warning setup value is outside the proscribed limits

Note: Refer to Section 8-4 for the Warning Displays.

- Normal operations are possible even while detecting a warning. However, there is a possibility that the alarm may ring, while operations continued as is. Review the operating conditions prior to the ringing of the alarm.
- The warning is not latched at the time of detection. After completion of the warning status, it is automatically cancelled.
- There is a possibility that an overload warning will be detected when controlled power is supplied if the overload warning level setting value (Group 1, Page 1C) is set below 75%, as a rated load of 75% (hot start) has been assumed for the overload detection process when controlled power is supplied.

9.2 Trouble Shooting When the Alarm Rings

When an alarm rings, take corrective actions according to the guidelines noted for each alarm display in the following pages.

1. The possible cause number is marked with a "○ " mark in the table titled "Conditions when an alarm is issued."

↓

2. Take corrective actions for the alarm items marked with "○".

↓

3. If the problem is not resolved, next take corrective actions for items where the "Δ" mark is used.

↓

4. If the problem persists, contact your dealer or sales office.

⚠

While investigating the cause of the problem, confirm the safety of the surrounding environment, including the servo amplifier, motor, and manufacturing system. Failure to ensure safety could lead to dangerous conditions.
During troubleshooting, first understand the conditions at the time of the alarm occurrence, in order to focus on the areas relative to the malfunction and shorten the time needed for troubleshooting.
When replacing the servo motor and amplifier, confirm that the harmful condition has been eliminated, in order to avoid repeat damage to the system.
If the problem is not resolved after referring to this explanation, contact your dealer or sales office for assistance. Please refer to the back cover of this document for contact information.

Alarm code 21H (Power Device Abnormality / Over current)

Conditions when an alarm is issued.	Cause			
	1	2	3	4
Issued when control power is turned ON.	Δ		○	Δ
Issued at servo input.	○	○	○	
Issued while starting and stopping the motor.	Δ	Δ	Δ	
Issued after extended operating time.	Δ	Δ	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	· U/V/W-phase of amplifier is short circuited due to the wiring in amplifier and motor. Also, U/V/W-phases are grounded in the earth.	· Check the wiring between the amplifier and motor, and confirm that there is no error. If some error is detected, modify or change the wiring.
2	·Short circuit or fault in U/V/W phases on servo motor side.	· Replace the servo motor.
3	· Defect in control print panel · Defect in power device	· Replace the servo amplifier.
4	· Overheat is detected in Power device (IPM).	· Confirm that the cooling fan motor for the servo amplifier is working. If it is not working, replace the servo amplifier. · Confirm that the temperature of the control panel (ambient temperature of the servo amplifier) does not exceed 55^{o}C. If in excess of 55°C, check the installation method of the servo amplifier, and confirm that the cooling temperature of the control panel is set to below 55osC.

Alarm code 22H (Electric current abnormality 0)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when the control power is turned ON.	○	Δ
Issued after the power is turned ON.	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	·Defect in control print panel · Defect in power device	· Replace the servo amp.
2	· Servo amplifier and motor are not combined properly	· Confirm that the proper codes (per the specified Motor Codes) have been used for the servo motor; if not, replace the servo motor.

Alarm code 23H (Current detection abnormality 1)
Alarm code 24H (Current detection abnormality 2)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when the control power is turned ON.	○	
Issued during operation.	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of servo amplifier.	· Replace the servo amplifier.
2	· Malfunction due to noise	· Confirm proper grounding of the amplifier. · Add ferrite core or similar countermeasures against noise.

Alarm code 31H (Forward over travel)
Alarm code 32H (Reverser over travel)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when the control power is turned ON.	○	
Issued during operation.	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	· Power defect for external input signal (DC+24V). · Incorrect external wiring. · Incorrect signal logic for over travel. · Defect in internal circuit of servo amplifier.	·Use a power of (DC24V±10%) for external input signal. · Check the external wiring. Repair it if there are any errors. · Correct the over travel signal logic. · Replace the servo amplifier.
2	· While entering over travel. · Malfunction due to noise	· Move to effective operation area.(Get out of over travel status.) · Confirm proper grounding of the amplifier. · Add ferrite core or similar countermeasures against noise.

Alarm code 41H (Overload 1)

Conditions when an alarm is issued.	Cause								
	1	2	3	4	5	6	7	8	9
Issued when power supply control is turned ON.	○								
Issued at input of servo ON.	○	○							○
After command input, issued without rotating the motor.		○			○	○	○		○
After command input, brief motor rotation			○	○	○		△	○	

Corrective actions

Cause		Investigation and corrective actions
1	·Defect in servo amplifier control panel or power element peripheral	·Replace the servo amplifier.
2	·Defect in encoder circuit of servomotor	·Replace the servo motor.
3	·Effective torque exceeds the rated torque.	·Monitor the motor-generated torque in the effective torque estimated value (Trms), and confirm that the effective torque exceeds the rated torque. ·(Or,) calculate the effective torque of the motor from its loading and operating conditions. → If the effective torque is excessive, check the operating or loading, or replace the capacity of the large motor.
4	·Defect in motor-amplifier combination	·Check if the motor in use matches with the recommended type, and replace if it is improper.
5	·Holding brake of servo motor does not release.	·Check that the wiring and voltage of the holding brake are acceptable; if not, repair. → If the above are OK, replace the servomotor.
6	·Wiring of U/V/W –phase between servo amplifier and motor do not match.	· Check the wiring conditions and restore if improper.
7	·One or all connections of U/V/W -phase wiring of servo amplifier / motor is disconnected	· Check the wiring conditions and restore if improper.
8	·Machines collided.	·Check the operating conditions and limit switch.
9	·Encoder pulse number setting does not match with the motor.	·Match the encoder pulse number with the motor.

During the alarm caused by conditions in #3 (above), if OFF→ON of power supply control is repeated, there is a risk of burning out the servo motor. Restart operation only after the cause of #3 is removed, and after sufficient cooling time (more than 30 minutes) after turning the power supply OFF.

Alarm code 43H (Regeneration abnormality)

Conditions when an alarm is issued.	Cause 1	2	3	4	5	6	7	8
Issued when power supply control is turned ON.							○	
Issued when power supply of main circuit is turned ON.						○	○	○
Issued during operation.	○	○	○	○	○		△	

Corrective actions

Cause		Investigation and corrective actions
1	• Exceeded permitted value of regenerating power in built-in regenerative resistance specifications. • Excessive load inertia, or tact time is short.	• Check the load inertia and operating pattern. • Use an external regeneration resistor. • Set the load inertia within the specified range. • Increase the deceleration time. • Increase the tact time.
2	• Regenerative resistance wiring conflicts with built-in regenerative resistance specifications.	• Check wiring and replace if incorrect.
3	• Regenerative resistance wiring conflicts with external regeneration resistor specifications.	• Check wiring and replace if incorrect.
4	• Regeneration resistor is disconnected.	• For built-in regeneration resistor specifications, replace the servo amplifier. • For external regeneration resistor specifications, replace the regeneration resistor.
5	• Resistance value of external regeneration resistor is excessive.	• Replace the current resistance value with a value matching the specifications.
6	• Input power supply voltage exceeds the specified range.	• Check the input power supply voltage level.
7	• Defect in control circuit of servo amplifier.	• Replace the servo amplifier.
8	• When external regenerative resistance is selected for system parameter Page OE and external regenerative resistance is not installed.	• Install the external regenerative resistance. • Set to “Do not connect regenerative resistance“.

If regeneration resistance (either internal or external) is not actually connected, a regeneration abnormality is detected. Since a regeneration abnormality is not detected when regeneration resistance is connected but not selected in the setup, there is a danger that the amplifier or circuit will burn out or incur damage.

Alarm code 51H (Amplifier temperature abnormality)

Conditions when an alarm is issued.	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.	Δ		○	Δ	
Issued during operation.	Δ	○	○	○	
Issued after emergency stop.					○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in internal circuit of servo amplifier.	• Replace the servo amplifier.
2	•Regenerating power exceeded.	• Check the operating conditions. • Use external regeneration resistor.
3	•Regenerating power is within the specified range but ambient temperature of servo amplifier is out of specified range.	• Confirm that the cooling method maintains the temperature of control panel between 0 ~ 55^0.
4	• Regenerating power is within the specified range but built-in cooling fan of servo amplifier is stopped.	• For an amplifier equipped with a fan motor, check that the fan motor is running; if not, replace the servo amplifier.
5	• Regeneration energy during emergency stop exceeded.	• Change the servo amp. • Check the loading condition.

Abnormalities are detected in the internal temperature of the amplifier regardless of its ambient temperature. When an amplifier ambient temperature warning is issued, please be sure to check the cooling method of the control panel.

Alarm code 52H (In-rush prevention resistor overheating) ※ QS1*30 (Applied to 300A only)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when the control power is turned ON.	○	
Issued during operation.	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	· Main power turn ON/OFF repetition is excessively frequent.	·Use the amplifier within the allowable repetition range of main power turn ON/OFF, referring to 7.2.1.
2	· Defect in internal circuit of servo amplifier	· Replace the servo amplifier.

Alarm code 53H (DB Overheating)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when power supply is turned ON.	○	
Issued during operation.	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in internal circuit of servo amplifier.	• Replace the servo amplifier.
2	• DB operation frequency exceeded.	• Refer to section 9.1.8 to ensure that the dynamic brake frequency does not exceed its limit.

Alarm code 54H (Internal overheating)

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when power supply control is turned ON.	Δ		○
Issued during operation.	Δ	○	○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in internal circuit of servo amplifier.	• Replace the servo amplifier.
2	• Regenerating power excessive.	• Check the built-in regenerative resistance absorption power. • Check the operating conditions, so that regenerating power is within permitted absorption power. • Use an external regeneration resistor.
3	• Improper wiring of built-in regeneration resistor.	• Confirm improper condition and repair if necessary.

Set "Built-in regenerative resistance" for the regenerative resistance type when using the built-in regeneration resistor of servo amplifier. The overheat protection of the built-in regenerative resistance is monitored per this setting. When "No connected regenerative resistance or external regenerative resistance" is selected, overheating of built-in regenerative resistance is not detected. Therefore, a danger exists that built-in regenerative resistance will burn out or be damaged.

No thermostat is attached to the regeneration resistor embedded in 15A and 30A amplifiers. Abnormalities are detected after being estimated from the regeneration load ratio.

Alarm code 55H (External abnormality)

- When external regenerative resistor and output terminal of upper device are not connected

Conditions when an alarm is issued.	Cause	
	1	2
Issued when power supply control is turned ON.	○	Δ

Corrective actions

Cause		Investigation and corrective actions
1	• Validity condition for external trip function is set to 'Valid'.	• When not in use, set "1" at Group A Sw2 bit2.
2	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.

Relevant parameter: Parameter Group 8 [Sw2] (Refer to Chapter 8, 8.5.11)
Standard set value ：Always Disable (The function is always disabled.)

- When external regenerative resistor is not connected

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when power supply control is turned ON.	○		Δ
Issued after operation.		○	Δ

Corrective actions

Cause		Investigation and corrective actions
1	• Improper wiring of external regenerative resistance.	• Check wiring and replace if necessary.
2	• External regeneration resistor is operating.	• Check the operating conditions. • Increase the capacity of the external regeneration resistor.
3	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.

- When output terminal of upper level device is connected:
  Eliminate the alarm trigger of the upper level device.

Alarm code 61H (Over voltage)

Conditions when an alarm is issued.	Cause			
	1	2	3	4
Issued when power supply control is turned ON.	○			
Issued when power supply of main circuit is turned ON.	○	○		
Issued at the time of motor start/stop.		Δ	○	○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.
2	• The power supply voltage of main circuit exceeds the rated value.	• Reduce the power supply voltage to within the specified range.
3	• Excessive load inertia.	• Reduce the load inertia to within the specified range.
4	• Improper wiring of CND connector. • Built-in regeneration circuit is not functioning.	• Properly install the regenerative resistance wiring. Connect the regenerative resistance wiring to the P and Y terminals of the CND connector. • While using the external regenerative resistance, check the wiring and resistance value. • Replace the servo amplifier if any abnormality occurs.

Alarm code 62H (Main circuit under voltage)

Conditions when an alarm is issued.	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.				○	Δ
Issued after power supply of main circuit is turned ON.	○	○			
Issued during operation, alarm resetting is possible.		Δ	○		
Issued during operation, alarm resetting is not possible.		○			

Corrective actions

Cause		Investigation and corrective actions
1	• Power supply voltage is below the specified range.	• Check the power supply and set it within the specified range.
2	• Rectifier of main circuit is broken.	• Replace the servo amplifier.
3	• Input voltage is reduced and/or blinking.	• Check the power supply and confirm that there is no blinking or low voltage.
4	• Low voltage outside of the specified range is supplied to the main circuit (R/S/T).	• Check the main circuit voltage. Confirm that there is no external power supply to R/S/T when the main circuit is OFF.
5	• Defect in internal circuit of the servo amplifier.	• Replace the servo amplifier.

Alarm code 63H (Main power supply line -drop)

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when power supply control is turned ON.		○	
Issued when power supply of main circuit is turned ON.	○		○
Issued during motor operations.	Δ		
Alarm issued during single-phase power input selection.			○

Corrective actions

Cause		Investigation and corrective actions
1	• One out of 3 phases (R/S/T) is not inserted.	• Check the wiring and repair if necessary.
2	• Defect in internal circuit of Servo amplifier.	• Replace the servo amplifier.
3	• Servo amplifier is not specified for single phase.	• Check the model number and delivery specifications of the servo amplifier and replace it with a servo amplifier for single-phase power supply. • Edit the parameters and use a single-phase specification amplifier.

Alarm code 71H (Under voltage of control power supply)

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued at the time of power on.	Δ	○	
Issued during operation.	Δ		○

Corrective actions

Cause		Investigation and corrective actions
1	•Defect in internal circuit of the servo amplifier.	•Replace the servo amplifier.
2	•Power supply voltage is within the specified range.	•Confirm that the power supply is set within the specified range.
3	•Input voltage is fluctuating or stopped.	•Confirm that the power supply is neither stopped nor reduced.

Alarm code 72H (±12 V Power supply abnormality)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when power supply control is turned ON.	∆	○

Corrective actions

Cause		Investigation and corrective actions
1	•Defect in internal circuit of the servo amplifier.	•Replace the servo amplifier.
2	•Defect in external circuit	• Restart the power supply after removing the connector; if alarm is not issued, check the external circuit. • Restart the power supply after replacing the motor; if alarm is not issued, there is defect in the encoder's internal circuit.

Alarm code 81H (Pulse signal abnormality 1 of A phase/B phase)
Alarm code 82H (Disconnection of absolute signal)
Alarm code 83H (External encoder A phase/ B phase signal abnormality)
Alarm code 84H (Error in communication between encoder and amplifier)
Alarm code 87H (CS disconnection)

Conditions when an alarm is issued.	Cause					
	1	2	3	4	5	6
Issued when power supply control is turned ON.	○	○	○	○	○	○
Issued after servo is turned ON.				○	○	
Issued during operation.	∆			○	○	

Corrective actions

Cause		Investigation and corrective actions
1	For encoder wiring: •Improper wiring •Connector is removed •Loose connection •Encoder cable is too long •Encoder cable is too thin	• Check wiring and repair any abnormality. • Confirm that the encoder power supply voltage of the motor is above 4.75 V; increase it if below 4.75 V.
2	• Wrong amplifier encoder type is selected.	•Select the correct encoder type.
3	•Motor encoder that does not match with amplifier encoder type is attached.	•Replace with servo motor equipped with proper encoder.
4	•Defect in servo amplifier control circuit	•Replace the servo amplifier.
5	•Defect in servo motor encoder	• Replace the servo motor.
6	•Parameter set to 'Full-close/Servo system'.	• Edit the parameter and set to 'Semi-close/System setup'.

Alarm code 85H (Abnormality in initial process of encoder)

Conditions when an alarm is issued.	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.	○	○	○	○	Δ

Corrective actions

Cause		Investigation and corrective actions
1	For encoder wiring: •Improper wiring •Connector is removed •Loose connection •Encoder cable is too long •Encoder cable is too thin	• Check wiring and repair any abnormality. • Confirm that the encoder power supply voltage of the motor is above 4.75 V; increase it if below 4.75 V.
2	• Wrong amplifier encoder type is selected.	•Select the correct encoder type.
3	• Defect in servo amplifier control circuit	•Replace the servo amplifier.
4	•Defect in servo motor encoder	•Replace the servo motor.
5	•Initial position data could not be set, as the number of rotations of the motor is more than 300 min^{-1} during power supply.	•Restart the power supply after motor is stopped. (Only when PA 035C sensor is used.)

Alarm code 91H (Encoder command abnormality)
Alarm code 92H (Encoder FORM error)
Alarm code 93H (Encoder SYNC Abnormality)
Alarm code 94H (Encoder CRC Abnormality)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when control power supply is turned ON.	Δ	○	○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in encoder	• Replace the servo motor.
2	• Malfunction due to noise	• Confirm proper grounding of the amplifier. • Check the shielding of the encoder cable. • Add ferrite core or similar countermeasures against noise.
3	• Abnormality in encoder wiring.	• Check wiring between the encoder and amplifier.

Alarm code A1H (Encoder Abnormality 1)

When abnormalities are detected in the internal part of the absolute position detector (RA062M) for the asynchronous system.

Conditions when an alarm is issued.	Cause
	1
Issued when power supply is turned ON.	○
Issued during operation.	○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in internal circuit of encoder	• Turn ON the power supply again; if not restored, replace the motor.

Alarm code A2H (Abnormality in absolute encoder battery)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when control power is turned ON.	○	○
Issued during operation.		○

Corrective actions

Cause		Investigation and corrective actions
1	• Loose connection of battery cable.	• Confirm the battery connection in the front ON/OFF switch of the amplifier.
2	• Low battery voltage	• Check the battery voltage.

Alarm code A3H (Encoder overheating)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when control power supply is turned ON.	∆	○	
Issued while stopping the motor.	∆	○	
Issued during motor operations.		○	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of encoder	· Turn ON the power supply again; if not restored, replace the motor.
2	· Motor is not generating heat, but encoder ambient temperature is high.	· Confirm that the cooling method keeps the encoder ambient temperature below 80^0C.
3	· Motor is overheated.	· Confirm the cooling procedure of the servo motor.

Alarm code A5H (Encoder abnormality 3)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when power supply is turned ON.	∆	○	○
Issued during motor operations.	∆	○	

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of encoder	· Turn ON the power supply again; if not restored, replace the motor.
2	· Malfunction due to noise	· Confirm proper grounding of the amplifier. · Check the shielding of the encoder cable. · Add ferrite core or similar countermeasures against noise.
3	· Number of rotations exceeds the permitted number of rotations.	· Turn ON the power supply again, when motor is stopped.

Alarm code A6H（Encoder abnormality 4)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when power supply is turned ON.	○	○	
Issued during motor operations.		○	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of encoder	· Turn ON the power supply again; if not restored, replace the motor.
2	· Malfunction due to noise	· Confirm proper grounding of the amplifier. · Check the shielding of the encoder cable. · Add ferrite core or similar countermeasures against noise.
3	· Multi-rotation counter overflows.	· Correct the operation pattern, and avoid the continuous operation in a fixed direction.

Alarm code A7H (Encoder abnormality 5)
Alarm code A8H (Encoder abnormality 6)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause	
	1	2
Issued when power supply is turned ON.	○	○
Issued during motor operations.	∆	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of encoder	· Turn ON the power supply again; if not restored, replace the motor.
2	· Malfunction due to noise	· Confirm proper grounding of the amplifier. · Check the shielding of the encoder cable. · Add ferrite core or similar countermeasures against noise.

Alarm Code B2H (Encoder abnormalities 2)

When abnormality is detected in the internal part of the absolute position detector (RAO62M) of the Manchester system.

Conditions when an alarm is issued.	Cause	
	1	2
Issued during operation.	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in internal circuit of encoder	• Turn ON the power supply again; if not restored, replace the motor.
2	• Malfunction due to noise	• Confirm proper grounding of the amplifier. • Check the shielding of the encoder cable. • Add ferrite core or similar countermeasures against noise.

Alarm code B3H (Absolute encoder rotations counter abnormality)
Alarm code B4H (Absolute encoder 1 rotation counter abnormality)
Alarm code B6H (Encoder memory error)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause
	1
Issued when control power supply is turned ON.	○

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in internal circuit of encoder	• Turn ON the power supply again; if not restored, replace the motor.
2	• Malfunction due to noise	• Confirm proper grounding of the amplifier. • Check the shielding of the encoder cable. • Add ferrite core or similar countermeasures against noise.

Alarm code B5H (Over speed and multiple rotations generation abnormality)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when power supply is turned ON.	○		Δ
Issued while stopping the motor.	○	○	
Issued while rotating the motor.	Δ	○	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of encoder	· Turn ON the power supply again; if not restored, replace the motor.
2	· Malfunction due to noise	· Confirm proper grounding of the amplifier. · Check the shielding of the encoder cable. · Add ferrite core or similar countermeasures against noise.
3	· Number of motor rotations exceeds the permitted speed.	· Check the operation pattern and reduce the maximum number of rotations.

Alarm code B7H (Acceleration abnormality)

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued while stopping the motor.	○	○	
Issued while rotating the motor.	Δ	○	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of encoder	· Turn ON the power supply again; if not restored, replace the motor.
2	· Malfunction due to noise	· Confirm proper grounding of the amplifier. · Check the shielding of the encoder cable. · Add ferrite core or similar countermeasures against noise.
3	· The acceleration of motor rotation exceeds the permitted acceleration	· Check the operation pattern, and extend the acceleration and declaration time.

Alarm code C1H (Over speed)

Conditions when an alarm is issued.	Cause			
	1	2	3	4
Issued when control power supply is turned ON.	○	Δ		
Issued if command is entered after Servo ON	Δ	○		
Issued when the motor is started.			○	○
Issued other than operating and starting the motor		○	○	

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in control panel of servo amplifier.	· Replace the servo amplifier.
2	· Defect in the encoder of servo motor	· Replace the servo motor.
3	· Excessive overshoot while starting.	· Monitor speed with the analog monitor. →Adjust the servo parameters if overshoot is excessive. → Simplify the acceleration and declaration command pattern. → Reduce the load inertia.
4	· Wiring of U/V/W -phase between servo amplifier and motor do not match.	· Check the wiring and repair any irregularities.

Alarm code C2H (Speed control abnormality)

Conditions when an alarm is issued.	Cause				
	1	2	3	4	5
Issued when control power supply is turned ON.					○
Issued while due to input of Servo ON	○		○		
Issued if command is entered.	○	○	○		
Issued while starting and stopping the motor.				○	

Corrective actions

Cause		Investigation and corrective actions
1	· Wiring of U/V/W -phase between servo amplifier and motor do not match.	· Check the wiring and repair any irregularities.
2	· The wiring of A, B phase of INC-E and ABS-EI encoder connection is incorrect.	· Check the wiring and repair any irregularities.
3	· The motor is vibrating (oscillating).	· Adjust the servo parameters so that servo motor will not vibrate (oscillate).
4	· Excessive overshoot and undershoot.	· Monitor speed with the analog monitor. · Adjust the servo parameters to reduce overshoot and undershoot. · Increase acceleration and declaration command time. Mask the alarm.
5	· Abnormality in servo amplifier control circuit	· Replace the servo amplifier.

For the speed control error alarm, an alarm may occur while starting and stopping when load inertia is excessive. For this reason, in the gravitational axis applications, "Do not detect" is selected as the standard setting. Contact your distributor or sales office if detection is necessary.

Alarm code C3H (Speed feedback abnormality)

Conditions when an alarm is issued.	Cause		
	1	2	3
Issued when command is entered.	○	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	· Motor is not rotating.	· Confirm that the power line is properly connected. · Replace the servo motor.
2	· Defect in internal circuit of servo amplifier.	· Replace the servo amplifier.
3	· The motor is vibrating (oscillating).	· Adjust the servo parameter so that servo motor will not vibrate (oscillate).

9. Maintenance

Alarm code D1H (Excessive position deviation)

Conditions when an alarm is issued.	Cause											
	1	2	3	4	5	6	7	8	9	10	11	12
Issued when control power supply is turned ON.										○		
Issued when servo ON is stopped.						○					○	
Issued immediately after entering the command.	○	Δ	○	○	○		○	Δ	○		Δ	
Issued during starting or stopping at high speed.	○	○					○	○	○		Δ	○
Issued during the operations by lengthy command.		○					○	Δ			Δ	

Corrective actions

Cause		Investigation and corrective actions
1	· Position command frequency is high or acceleration and declaration time is short.	· Correct the position command of the controller
2	· Excessive initial load or low motor capacity.	· Correct the load condition or increase the motor capacity
3	· Holding brake is not released.	· Check the wiring and repair any abnormalities. If specified voltage is applied, replace the servo motor.
4	· Motor is mechanically locked or machine is colliding.	· Check the machinery system.
5	· One or all phases of U/V/W -phase of the servo amplifier and motor has disconnected.	· Check and repair the wiring connections.
6	· Motor is being rotated by an external force (Gravity, etc.) during stopping (positioning completion).	· Check the load, and/or increase the motor capacity.
7	· Valid current limit command is entered by the controller, and the current limit setting is reduced. · Number of encoder pulses does not match with the motor.	· Increase the current limit value or disable the current limit. · Match the number of motor encoder pulses.
8	· Settings of servo parameters (Position loop gain, etc.) are not appropriate.	· Check the servo parameter settings (Raise the position loop gain, etc.)
9	· Excessive deviation setting value is reduced.	· Set a greater value for excessive deviation.
10	· Defect in control panel of servo amplifier.	· Replace the servo amplifier.
11	· Servo motor encoder is defective.	· Replace the servo motor.
12	· Power supply voltage is low.	· Check the power supply voltage.

Alarm code D2H (Position pulse frequency abnormality 1)

Conditions when an alarm is issued.	Cause
	1
Issued after entering position command pulse.	○

Corrective actions

Cause		Investigation and corrective actions
1	· Command for the digital filter setting of the command pulse input is entered	· Decrease the frequency of the command pulse. · Increase the frequency of the digital filter.

Alarm code D3H (Abnormal position pulse frequency 2)

Conditions when an alarm is issued.	Cause	
	1	2
Issued after entering position command pulse.	○	○

Corrective actions

Cause		Investigation and corrective actions
1	· Frequency of command pulse input is excessive.	· Reduce the frequency of command pulse input.
2	· Setting value of electronic gear is excessive.	· Decrease the electronic gear setting value.

Alarm code DFH (Test mode end)

Conditions when an alarm is issued.	Cause
	1
Occurred after execution of test mode.	○

Corrective actions

Cause		Investigation and corrective actions
1	· Normal operation.	· Clear the alarm and restore operation. (After completion of test mode, to confirm any deviation).

Alarm code E1H (EEPROM abnormality)

Conditions when an alarm is issued.	Cause 1	Cause 2
Issued when control power supply is turned ON.	○	Δ
Issued during display key operation or computer interface operation.		○

Corrective actions

Cause		Investigation and corrective actions
1	· Correct value not read by CPU by nonvolatile memory of built-in servo amplifier.	· Replace the servo amplifier.
2	· Defect in the servo amplifier control panel	· Replace the servo amplifier.

Alarm code E2H (Abnormality in the internal data of EEPROM)

Conditions when an alarm is issued.	Cause 1	Cause 2
Issued when control power supply is turned ON.	Δ	○

Corrective actions

Cause		Investigation and corrective actions
1	· Correct value not read by CPU by nonvolatile memory of built-in servo amplifier	· Replace the servo amplifier.
2	· Failed to write into the nonvolatile memory during last power supply cutoff.	· Change the optional parameters, turn ON the power supply again, and confirm that alarm has cleared. → If alarm is not cleared, replace the servo amplifier.

Alarm code E3H (Internal RAM abnormality)
Alarm code E4H (Abnormality in process between CPU and ASIC)

Conditions when an alarm is issued.	Cause
	1
Issued when control power supply is turned ON.	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in the servo amplifier control panel	· Replace the servo amplifier.

Alarm code E5H (Parameter error 1)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when control power supply is turned ON.	○	○
Issued after changing any of system parameters.	○	

Corrective actions

Cause		Investigation and corrective actions
1	· Selected value is outside the specified range for a system parameter.	· Confirm the model number of the servo amplifier. · Confirm selected values of system parameters and modify if necessary. →Turn ON the power again and confirm that alarm is cleared.
2	· Defect in servo amplifier	· Replace the servo amplifier.

Alarm code E6H (Parameter error 2)

Conditions when an alarm is issued.	Cause	
	1	2
Issued when control power supply is turned ON.	○	○
Issued after changing any of system parameters.	○	

Corrective actions

Cause		Investigation and corrective actions
1	· Selected values of system parameters and actual hardware do not match · Improper assembly of system parameter settings.	· Confirm the model number of servo amplifier. · Confirm selected values of system parameters and correct if necessary. →Turn ON the power again and confirm that alarm is cleared.
2	· Defect in servo amplifier	· Replace the servo amplifier.

Alarm code EFH (Point data check sum error)

Conditions when an alarm is issued.	Cause 1	Cause 2
Issued when the control power is turned ON.	△	○

Corrective actions

Cause		Investigation and corrective actions
1	·Values were not correctly read into CPU from non-volatile memory built-in the servo amplifier.	·Replace the servo amplifier.
2	·Failed to write the non-volatile memory when setting the point data.	·Change any point data then turn on the power again, and confirm that no alarm is issued. → If an alarm is issued, replace the servo amplifier.

Alarm code F1H (Abnormality in task process)

Status during alarm	Cause 1
Issued while operating.	○

Corrective actions

Cause		Investigation and corrective actions
1	· Abnormality in control circuit of servo amplifier	· Replace the servo amplifier

Alarm code F2H (Initial time out)

Status during alarm	Cause 1	Cause 2
Issued when control power supply is turned ON.	○	○

Corrective actions

Cause		Investigation and corrective actions
1	· Defect in internal circuit of servo amplifier	· Replace the servo amplifier.
2	· Malfunction due to noise	· Confirm proper grounding of the amplifier. · Add ferrite core or similar countermeasures against noise.

9.3 Error Event Troubleshooting

When an error occurred, take corrective measures according to the guidelines noted for each error display as shown below.

Error code								Alarm name (Symbol)	Condition of operation	Cause	Countermeasures, Treatment
OUT 8	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1				
0	0	0	1	0	1	1	0	+Soft limit (OT_FRD)	Always	・Feed position over the positive soft limit setting.	・ Move within soft limit by Jog operation. ・ Change the parameter setting for soft limit.
0	0	0	1	0	1	1	1	⊖ Soft limit (OT_RVS)	Always	・Feed position over the negative soft limit setting.	
0	0	0	1	1	0	0	0	Defective point data (POINT_ DATA)	When point is about to move or while moving.	・When point moving, the point is not registered. ・When consecutive point moving, the points on the middle are not registered.	・ Input an alarm reset to release the error. ・ Register the point.
0	0	0	1	1	0	1	1	Home-position return operation error (ZRT)	During execution of home-position return operation	・Deceleration time at zero-return operation is excessively short.	・Widen the deceleration signal area to ensure decreasing time (move)..

9. Maintenance

9.4 Troubleshooting using History

There are two trace modes; alarm history and status history.
Up to 7 for alarm history and up to 64 for status history can be traced.
However, note that, when the control power is OFF, status history is updated only until the last 8.
See the example below.

	History No.	Status	
New	Last01	WAIT_ON	・・・Move completed.
	Last02	Move_point:007	・・・Move to P007
	Last03	Move_point:006	・・・Move to P006
	Last04	Move_point:005	・・・Move to P005
	Last05	WAIT_ON	・・・Move completed.
	Last06	STEP_ON	・・・Move by 1 STEP
	Last07	WAIT_ON	・・・Move completed.
	Last08	JOG_ON	・・・Move by JOG.(At JOG operation, when move is
	Last09	CANCEL_ON	stopped, cancellation always remains in history.)
	Last10	WAIT_ON	・・・Cancellation completed.
	Last11	CANCEL_ON	・・・Move is cancelled during move to P004
	Last12	Move_point:004	・・・Consecutive move to P004
	Last13	Move_point:003	・・・Move to P003
	Last14	ALM_None	・・・・・・Resetting
	Last15	ALM:55	・・After completion, external overheating alarm is issued.
	Last16	WAIT_ON	・・・Move completed.
	Last17	Move_point:002	・・・Move to P002
	Last18	WAIT_ON	・・・Move completed.
	Last19	Move_point:001	・・Move to P001
	Last20	WAIT_ON	・・・Servo ON
Old	Last21	SV_OFF	・・・Control power, main power ON.

As shown above, statuses before and after the alarm can be traced in history, which is very useful in the investigation of alarm causes.

See the alarm history in the case of above example.

History No.	Status	
Last01	ALM:55	・・・・・・Alarm EXT is issued.
・	・	
・	・	
・	・	
Last07	ALM:43	・・・・・・Alarm OL1 is issued.

Since only 64 can be traced in status history, it is recommended to check the history as soon as an alarm is issued.

9.5 Operational Problem Troubleshooting

Causes, investigation and corrective actions, when problems occurred and alarm is not displayed, are shown in the following table. If problem is not resolved even after taking the corrective actions, contact our company.

> Conducting investigations or corrective actions without turning the power OFF is dangerous, and could lead to injury.

Table 9-3 Corrective Actions for problems during operation

No	Problems	Investigation	Assumed causes and corrective actions
1	"≡" does not blink in 7-segment LED even if main power is ON.	1. Check the voltage at the power input terminal.	• If voltage is low, check the power supply. • If there is no voltage, check that wires and screws are fastened properly.
		2. Check if red "CHARGE" LED is blinking.	• Internal power circuit of servo amplifier is defective. → Replace the servo amplifier.
2	7-segment LED displays a rotating character "8" (Servo ON status), but motor does not rotate.	1. Check if command is entered.	• Reenter the previous command.
		2. Check if servo is locked.	• Fasten the connecting screws, as power line of motor is not connected.
		3. Check if current limit is entered.	• As current limit enters, motor cannot generate more torque than the load torque, so the motor does not rotate.
		4. Check that unnecessary control signal is not kept input.	• Turn OFF all the control signals which have been input simultaneously, and then turn ON only the necessary signal again.
		5. Over ride input is ON, and over ride set value is excessively small.	• Turn OFF the over ride input, or increase the set value.
		6. Check that CN1 (external operation) is effective.	• Shift the PC move screen to monitoring screen.
3	Rotations of servo motor are unstable and less than the specified command.	1. Check if proportional control is entered.	• Stop the input of proportional control.
		2. Check if current limit is entered.	• Stop the input of current limit.
4	Servo motor rotates only once, and stops.	1. Check motor power line.	• The motor power line is not connected.
		2. Check if the encoder resolution settings are correct.	• Change the settings and turn ON the power again.

Table 9-3 Corrective Actions for problems during operation

No	Problems	Investigation	Assumed causes and corrective actions
5	Motor is accelerated.	1. Check the motor power line.	• Phase order of motor power line does not match.
		2. Check the wiring of encoder cable.	• Wiring of A phase and B phase of the encoder is incorrect.
6	Motor is vibrating with frequency above 200 Hz.	-	• Reduce the loop gain speed. • Set the torque command low-pass filter and torque command notch filter.
7	Excessive over shoot/ under shoot during starting / stopping.	-	• Reduce the loop gain speed. • Increase the integral time constant. • Simplify the acceleration and declaration command. • Use position command low-pass filter.
8	Abnormal sound occurs	1. Check that there is no defect in mechanical installation.	• Observe by operating one motor. • Pay attention while coupling and confirm that there is no unbalance.
		2. Check whether abnormal sound is random or periodic while operating at low speed.	• Confirm that the twisted pair and shield processing of encoder signal line are correct. • Confirm that the wiring for encoder line and power line are installed in the same port. • Confirm that the power supply voltage is sufficient.

9.6 Maintenance

For maintenance purposes, a daily inspection is typically sufficient. A summary and schedule of Inspection items are shown in the following table.

1. As there is a possibility of damage during a megger test of the servo amplifier, a cable check (depending on the test) is recommended.
2. Do not dismantle the servo amplifier and servo motor by removing the cover of servo motor detector.

Table 9-4 Inspection summary

Inspection location	Testing conditions			Inspection Items	Inspection Methods	Solution if abnormal
	Time	During operation	While stopping			
Servo motor	Daily	○		Vibration	Check for excessive vibration.	Contact dealer/sales office.
	Daily	○		Sound	Check if there is no abnormal sound as compared to normal sound.	
	Periodic		○	Cleanliness	Check for dirt and dust.	Clean with cloth or air. → (1)
	Yearly		○	Measure value of insulation resistance	Contact the dealer or sales office.	
	5000 hours → (2)		○	Replacement of oil seal		
Servo amplifier	Periodic		○	Cleaning	Check for dust accumulated in the accessories.	Clean with air. → (1)
	Yearly		○	Loose screws	Check for loose connections	Fasten the screws properly.
Battery	Regularly → (3)		○	Battery voltage	Confirm that battery voltage is more than DC3.6V.	Replace the battery.
Temperature	On demand	○		Measure temperature	Ambient temperature Motor frame temperature	Set the ambient temperature within the limit. Check the load condition pattern.

1. While cleaning with air, confirm that there is no oil content and/or moisture in the air.
2. This inspection and replacement period is when water- or oil-proof functions are required.
3. The life expectancy of the battery is approximately 2 years, when its power is OFF throughout the year. For replacement, a lithium battery (ER3V: 3.6V, 1000mAh) manufactured by Toshiba Corp. is recommended.

9.7 Parts Replacement and Overhaul

Parts indicated in Table 9-5 may deteriorated over time. Perform periodic inspection for preventive maintenance.

Table 9-5 Periodic inspection of parts

No.	Part name		Number of average eplacement year	Corrective measures / usage conditions
1	Condenser for smoothing main circuit		5 Years	Replacement with new part is necessary. Load ratio ：Less than 50% of rated output current of amplifier Usage condition: Average temp. 40^0C year-round
2	Cooling Fan motor		5 Years	Replacement with new part is necessary. Usage condition: Average temp. 40^0C year-round
3	Lithium battery for absolute sensor	ER3V	3 Years	Replacement with new part is necessary.
4	Electrolysis condenser (other than condenser for smoothing main circuit)		5 Years	Replacement with new part is necessary. Usage condition: Average temp. 40^0C year-round Annual usage period is 4800 hours
5	Fuse		10 Years	Replacement with new part is necessary.

1. Condenser for smoothing the main circuit
   - If the servo amplifier is in use for more than 3 years, contact the dealer or sales office. The capacity of the condenser for smoothing the main circuit is reduces due to the frequency of motor output current and power ON/ OFF during usage, and it may cause damage.
   - When the condenser is used with an average 40^0C through out the year, and exceeds more than 50% of the rated output current of servo amplifier, it is necessary to replace the condenser with a new part every 5 years.
2. Cooling Fan motor
   - The Q-Series Amplifier is set corresponding to the degree of pollution specified in EN50178 or IEC 664-1. As it is not dust proof or oil proof, use it in an environment above Pollution Degree 2 (i.e., Pollution Degree 1,2).
   - Q-Series servo amplifiers models QS1□03, QS1□05, QS1□010, QS1□15, and QS1□30 have a built-in cooling fan; therefore be sure to maintain a space of 50mm on the upper and lower side of the amplifier for airflow.
   Installation in a narrow space may cause damage due to a reduction in the static pressure of the cooling fan and/or degradation of electronic parts. Replacement is necessary if abnormal noise occurs, or oil or dust is observed on the parts. Also, at an average temperature of 40°C year-round, the life expectancy is 5 years.
3. Lithium battery
   - The standard replacement period recommended by our company is the life expectancy of lithium battery based on normal usage conditions. However, if there is high frequency of turning the power ON/OFF, or the motor is not used for a long period, then the life of lithium battery is reduced. If the battery power is less than 3.6 V during inspection, replace it with new one.

The parameters of an overhauled servo amplifier are shipped as is.
Be sure to confirm the parameters before use.

Specifications

10. Specifications

10.1 Servo Amplifier

10.1.1 General specifications

General specifications

	Model No. QS1□		01◇C	03◇C	05◇C	10◇C	15◇C	30◇C
Basic specifications	Control function		Position control					
	Control method		ＩＧＢＴ ＰＷＭ control Sinusoidal drive					
	*1 Input power	Main circuit	Three phase ＡＣ２００～２３０Ｖ＋１０，－１５％ ，５０／６０Ｈｚ±３Ｈｚ Single phase ＡＣ２００～２３０Ｖ＋１０，－１５％ ，５０／６０Ｈｚ±３Ｈｚ*2 Single phase ＡＣ１００～１１５Ｖ＋１０，－１５％ ，５０／６０Ｈｚ±３Ｈｚ*3					
		Control circuit	Single phase ＡＣ２００～２３０Ｖ＋１０，－１５％ ，５０／６０Ｈｚ±３Ｈｚ Single phase ＡＣ１００～１１５Ｖ＋１０，－１５％ ，５０／６０Ｈｚ±３Ｈｚ*3					
		Interface	ＤＣ＋２４Ｖ±１０％					
	Environment	Ambient temperature*4	０～５５℃					
		Storage temperature	－２０～＋６５℃					
		Operation/storage humidity	Below ９０％ＲＨ（No condensation）					
		Elevation	２０００ｍ or lower in altitude					
		Vibration	０．５Ｇ Frequency range １０～５５Ｈｚ Tested for 2hrs in each direction Ｘ．Ｙ．Ｚ.					
		Shock	５Ｇ					
	Structure		Built-in tray type power supply					
	Mass ｋｇ		１．２５	１．５	２．２	５．５	６．８	１０．０
Built-in function	Protection function		Over current, Current detection error, Overload, Regeneration error, Amplifieroverheating, External overheating, Over voltage, Main circuit short voltage, Main power failed phase, Control power error, Sensor error, Over speed, Speed control error, Speed feed back error, Excessive position deviation, Position command pulse error, CPU error, Internal memory error, Battery error, Parameter error.					
	ＬＥＤ display		Statue display, monitor display, alarm display, parameter configuration, adjustment mode.					
	Dynamic brake		Built-in					
	Regeneration process		Built-in					
	Applicable load inertia		Within the applied load inertia of combined servo motor					
	Monitor output *5	Speed monitor（ＶＭＯ）	２．０Ｖ±１０％ (at 1000min⁻¹)					
		Current monitor（ＩＭＯ）	２．０Ｖ±１０％ (at 100%)					
Positioning function	Control axix number		One axis					
	Registered point number		Maximum of 254 points（P000～P253）can be set.					
	Maximum command量		-2,147,483,648～+2,147,483,647					
	Command unit		mm or pulse.					
	Feed Speed		2,147,483.647mm/sec（0.001mm/when pulse is selected.）					
	Acceleration/deceleration		Automatic acceleration/deceleration（Straight / S line switching）					
	Point data configuration		Values are input by PC, or configured by teaching.					
	Move point number setting		Pararrel 8 bits (Binary code)					
	Current limit		０～５１０％（Rated value is 100%）However, below peak stall current.					
	Software limit		Available					
	Move mode		Home-position return, manual（ＪＯＧ、１Ｓｔｅｐ）, point designating move					
	Zone signal		Maximum ８ zones					
Input/output	Sequence input signal		Servo ON, alarm reset, start, zero-return, manual, over-ride/manual high speed, cancellation, deceleration before zero-return, external abnormality, over travel, external data configuration, one step feeding, interruption start, output selection, MFIN, point designating input.					
	Sequence output signal		NC ready, holding brake timing, power on ready, external operation effective, while operation, positioning complete, in-position output, home-position return complete, selectable output (8 bits).					

10. Specifications

∗1 *Source Voltage should be within the specified range.*

AC200V Power input type

Specified power supply range AC170V~AC253V

Never raise the power supply above AC230V+10% (253V)

AC100V Power input type

Specified power supply range AC85V~AC127V

Never raise the power supply above AC115V+10% (127V)

Install a step-down transformer if power supply exceeds the specified power supply.

∗2 AC200V single-phase input type corresponds only to 15A~50A product.

∗3 AC100V single-phase input type corresponds only to 15A and 30A products.

∗4 *When stored in a box, be sure that internal temperature does not exceed this range.*

∗5 How to calculate the rotational speed (N) and Load torque (TL) for each monitor (Example):

· Rotational speed (N) :N= 1000 × $\frac{\text{(Vm Voltage)}\quad\text{(V)}}{2}$ (min-1)

(When monitor output setting is standard Vm 2mV/min-1)

· Load torque (TL): TL=TR (N / m) × $\frac{\text{(Im Voltage)}\quad\text{(V)}}{2}$ (N /m)

(When monitor output setting is standard Im 2V/IR)

∗6 The value differs depending on the combination of monitor and amplifier, sensor to be used, load condition, etc.

10.1.2　CN 1 General input / output interface

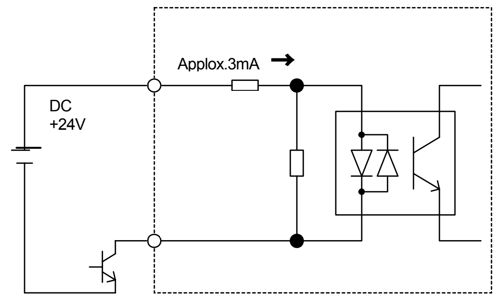
Structure of input circuit

Type 1：General input（2 way, insulated）

(Photo coupler input)

This type of input circuit is a no-contact structure as shown in the right.

External power supply：DC＋24V±10%、100mA or above.

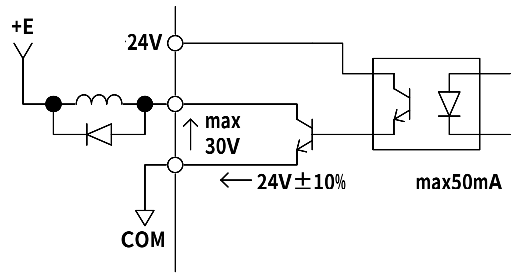


Structure of output circuit

Type 7：Open collector output

This type of output circuit is an insulated no-contact structure as shown in the right.

External power supply：DC＋24V±10%、80mA or above.



Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Outline of the specifications
Slowdown before Home	SDN	19	I	1)When incremental sensor is used, this is effective during home-position return operation. 2)Ignored when absolute sensor is used.	b contact input(Sw2：standard setting) 1) During home-position return operation with an incremental sensor used, Open (OFF) makes the amplifier decelerate (Home-position return low speed). 2) During low speed movement returning to home, home-position return is completed by Open (OFF) → Close(ON). How to return to zero; • Completed while Open (OFF) → Close (ON) of SDN. • Completed when seaching encoder C phase output signal after Open (OFF) →Close (ON) of SDN. These can be selected by a parameter for home-position return type (Z_typ）.
⊕Over travel	+OT	20	I	Always acceptable.	b contact input(Sw2:standard setting) Forward move is prohibited by inputting Open (OFF) and stops suddenly. After sudden stop, servo is OFF.
⊖ Over travel	-OT	21	I	Always acceptable.	b contact input(Sw2:standard setting) Reverse move is prohibited by inputting Open (OFF) and stops suddenly. After sudden stop, servo is OFF.
External data setting	E_S TR	22	I		a contact input This is a registration signal when external data setting is effective.
External error	EXT-E	23	I		b contact input(Sw2:standardsetting) When inputting Open (OFF), alarm is issued.
External powersourse for input	+24V	26	(I)		Power sourse for input circuit; DC24V±10%. To be supplied from external direct current power.

10. Specifications

Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Outline of the specifications
Start	RUN	27	I	1) Not acceptable when other input signals (ZRT, +JOG/-JOG, +1STEP / -1STEP, CACL) are ON. 2) Both MOVE and PFIN outputs must be OFF for points to newly move. (Not acceptable during movement) 3) Acceptable only at servo "ON" status (8-segment LED displays a rotating character of 8) and at external operation (operated from CN1).	a contact input A signal to start point move operations. 1) Starts at the edge of Open(OFF) → Close(ON). 2) Moves to specified point by point inptut ON at start reception. 3) When start signal is turned OFF during operation, it decelerates and stops momentarily. When start signal is turned ON again, continues point move. 4) Start signal is for positioning complete. (Keep ON status until PFIN turns ON.) Note) Point move in this chapter includes continuous point move.
Homing start	ZRT	28	I	1) Not acceptable when other input signals (RUN, +JOG/-JOG, 1STEP / -1STEP, CACL) are ON. 2) Both MOVE and PFIN outputs must be OFF for points to newly move.(Not acceptable during movement.) 3) Acceptable only at servo "ON" status (8-segment LED displays a rotating character of 8) and at external operation (operated from CN1).	a contact input Start signal for home-position start. • When an incremental sensor is used. 1) Starts return-to-zero operation at the edge of Open(OFF) → Close(ON) 2) Homing start signal must be kept ON until homing operation is complete (PFIN signal turns ON). 3) At homing operation, if homing start signal is turned OFF while high speed movement, it decelerates and stops into a temporary stop status (feed hold). And when homing start signal is turned ON again, resumes the homing operation. When in the low move mode, even if homing start signal is turned OFF, temporary stop status may not occur. • When an absolute sensor is used. 1) Starts homing operation at the edge of Open(OFF) → Close(ON). 2) At homing operation, returns to origin-set coordinate.

Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for Input (Restrictions)	Outline of the specifications
⊕Manual feeding	+JOG	29	I	1) Not acceptable when other input signals (RUN, ZRT, +1STEP / -1STEP) are ON. 2) Do not turn ON both +JOG and -JOG signals at the same time. 3) Not acceptable when alarms or others are occuring.	a contact input A signal to move forward at external operation manual drive. 1) Starts moving at the edge of Open(OFF) → Close(ON), moves while ON and decelerates / stops at OFF. 2) When RAP signal is OFF, the speed set by parameter manual low speed (L_jog) is the feeding speed, and when ON, the speed set by parameter manual high speed (H_jog) is the feeding speed. 3) During JOG feeding, outputs of MOVE and PFIN remain OFF.
⊖Manual feeding	-JOG	30	I	1) Not acceptable when other input signals (RUN, ZRT, +1STEP / -1STEP) are ON. 2) Do not turn ON both +JOG and -JOG signals at the same time. 3) Not acceptable when alarms or others are ringing.	a contact input A signal to move backward at external operation manual drive. 1) Starts moving at the edge of Open (OFF) → Close(ON), moves while ON and decelerates / stops at OFF. 2) When RAP signal is OFF, the speed set by parameter manual low speed(L_jog) is the feeding speed, and when ON, the speed set by parameter manual high speed (H_jog) is the feeding speed. 3) During JOG feeding, outputs of MOVE and PFIN remain OFF.
Over ride / Manual high speed	RAP / OVRID	31	I	1) Manual high speed: Effective at manual feeding and 1 step feeding by external operation (operated from CN1). 2) Over ride: Acceptable at point move and return-to-zero.	a contact input (Sw1: standard setting) 1) Switches high / low speed at manual drive. Switches the amount and speed of 1step feeding. 2) Moves by each multiple rate speed set by parameter(Ovrid).

10. Specifications

Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Outline of the specifications
Alarm reset	ARST	32	I	1) Effective at the time alarm / error. 2) Effective only at external operation mode.	a contact input A signal to release alarms/errors at alarm/error status. 1) Reset the arlams/errors after their causes have been eliminated. 2) Some alarms may not be released by this signal depending on the contents.
Cancel	CACL	33	I	Effective only at move by RUN, ZRT, +1step / -1step.	a contact input A signal to cancel the point move, home position return, 1 step feeding, and make other move possible. 1) During point move, home-position return and 1step feeding, turns into CACL positioning status by CACL_ON. 2) When point move, return-to-zero and 1 step feeding signals are turned OFF during CACL positioning status, and when CACL signal is turned OFF, operations are aborted (invalid) and other moves are possible.
Servo ON	S-ON	34	I	Effective at times other than move operation mode by PC and alarms.	a contact input A signal to turn ON the motor excitation. 1) When servo ON signal is turned OFF, servo motor excitation becomes OFF into free status. 2) Motor axis cannot be driven during servo OFF. Servo OFF must be while the motor axis is fixed. 3) When servo ON signal is turned OFF, holding brake excitation timing output (HBON) turns OFF.

10. Specifications

Specifications of CN1 input/output signals

<table>
<tr><th>Signal name</th><th>Code</th><th>Pin number</th><th>I/O</th><th>Conditions for input (Restrictions)</th><th>Outline of the specifications</th></tr>
<tr><td>Output selection 1</td><td>SEL1</td><td>35</td><td>I</td><td rowspan="3">Always acceptable.</td><td rowspan="3">a contact input
Signals to select meanings (contetns) of 8 bit signal of generic outputs (1) to (8). See the combinations below.
<table>
<tr><td>SEL1</td><td>SEL2</td><td>SEL3</td><td>Contents</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>Zone signal</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>Alarm/error code*</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>Execution point number</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>M output</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>Warning</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>Secondary control signal</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>Reserved</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td>Output selection 2</td><td>SEL2</td><td>36</td><td>I</td></tr>
<tr><td>Output selection 3</td><td>SEL3</td><td>37</td><td>I</td></tr>
<tr><td>+1 step feeding</td><td>+1step</td><td>38</td><td>I</td><td>1) Not acceptable when other input signals (RUN, ZRT, +JOG/-JOG, CACL) are ON.
2) Do not input both +1step and -1step signals at the same time.</td><td>a contact input
A signal to move forward at external operation fixed amount feeding.
1) Starts moving at the edge of Open(OFF) → Close(ON), and moves by the amount set by parameter.
2) When RAP signal is OFF, moves by the amount of “L_stp” at manual low speed.
When RAP signal is ON, moves by the amount of “H_stp” at manual high speed.
3) During 1step feeding, MOVE and PFIN signals remain OFF.</td></tr>
<tr><td>-1 step feeding</td><td>-1step</td><td>39</td><td>I</td><td>1) Not acceptable when other input signals (RUN, ZRT, +JOG/-JOG, CACL) are ON.
2) Do not input both +1step and -1step signals at the same time.</td><td>a contact input
A signal to move backward at external operation fixed pulse feeding.
1) Starts moving at the edge of Open(OFF) → Close(ON), and moves by the amount set by parameter.
2) When RAP signal is OFF, moves by the amount of “L_stp” at manual low speed.
When RAP signal is ON, moves by the amount of “H_stp” at manual high speed.
3) During 1step feeding, MOVE and PFIN signals remain OFF.</td></tr>
</table>

10. Specifications

Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for input （Restrictions）	Outline of the specifications
Interruption start	IRUN	40	I	1) Effective at external operation mode. 2) Can operate only while point move.	a contact input A signal to move to interruption point during point move. 1) Duiring point move, moves to interruption point set in the point data which is being executed at the edge of interruption start Open (OFF) → Close(ON) 2) Interruption move during interruption move is impossible.
MFIN	MFIN	41	I	Effective at both PC operation and external operation.	a contact input A signal to shake hands with M output (MSTR). Turn the MFIN input Open (OFF) → Close(ON) with the M output signal (MSTR) ON to make a handshake with M output. When M output type (M_typ) is “1”, use this MFIN input for handshake to be performed. If moved by changing speed, even when M output type is “1”, handshake is not performed.
Point specification	IN(1)	42	I	Point number specification input must have been established at start time.	a contact input (Sw1: standard setting) A signal to specify the target point number at start signal input (RUN). 1) Speicfy the number by binary code. 2) Numbers to be specified are from 0 to 253.
	IN(2)	43	I		
	IN(4)	44	I		
	IN(8)	45	I		
	IN(16)	46	I		
	IN(32)	47	I		
	IN(64)	48	I		
	IN(128)	49	I		
Common for input external power	24G	50	(I)		A DC24V signal ground for input circuit.

Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for input （Restrictions）	Outline of the specifications
External power source for output	+24V	1 2	(I)		Power source for driving output circuit. DC24V±10%. Supply from external DC power.
NC ready	NCRDY	3	**O**	1) (TR_ON) approx. 0.5 sec after power ON. 2) (TR_OFF) when main power is OFF and at alarms.	1) TR_ON when control power and main power are established, with no alarms, and position loop is formed. 2) During TR_ON, operations of point positioning move, home-position return, manual feeding and 1 step feeding are possible. NC ready is also TR_ON when servo ON input signal is Open (OFF).
Holding brake excitation timing output	HBON	4	**O**	(TR_ON) while motor is exciting.	Outputs the holding brake excitation (release) timing. At TR_ON, holding brake is excited (released).
Power ON ready	A-RDY	5	**O**	(TR_ON) within 2 sec after control power ON.	TR_ON when amplifier becomes the state that can be turned ON the main power supply, after control power is established.
External operation effective	EXT	6	**O**	1) TR_On when external operation is effective. 2) TR_OFF at PC operation.	1) TR_ON when external operation input signal can be used. 2) TR_OFF when operated by PC (in the PC mode). Do not oeprate externally this time.

Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Outlin of the specifications
While operation	MOVE	7	**O**	1) TR_OFF when power turns ON. 2) TR_OFF at alarms. 3) TR_ON during point move (from the time of move completed until turning OFF the start signal (RUN)). 4) TR_ON during home-position return (until turning OFF the homing signal (ZRT)). 5) TR_ON during 1 step feeding (from the time of move completed until turning OFF ±1STEP signal). 6) TR_OFF during manual feeding.	1) TR_ON when receiving start input (RUN) at the time of point positioning move. When move has been complete, TR_ON is maintained until start signal is turned OFF. The same for home-position return and 1 step feeding; When move has been complete, TR_ON is maintained until homing signal or ±1STEP signal is turned OFF. 2) When signals of MOVE and PFIN are TR_ON, operation input singnals (start, homing, manual feeding and 1 step feeding) are not accepted.
Positioning complete	PFIN	8	**O**	1) TR_OFF when power turns ON. 2) TR_OFF at alarms. 3) TR_ON from the time of move completed until turning OFF the start signal (RUN) at point move. 4) TR_ON from the time of move completed until turning OFF the homing signal (ZRT) at home-position return operation. 5) TR_ON from the time of move completed until turning OFF ±1STEP signal at 1 step feeding operation. 6) TR_OFF at manual feeding.	1) TR_ON when positioning is complete at point positioning move. When positioning is complete, TR_ON is maintained until start signla is turned OFF. 2) TR_ON when home-position return is complete at homing operation. When home-position return is complete, TR_ON is maintained until homing signal is turned OFF. 3) TR_ON when move is complete at 1 step feeding. When move is complete, TR_ON is maintained until ±1STEP signal is turned OFF. 4) When signals of PFIN and MOVE are TR_ON, input signals for other operations are not accepted.
In-position	INPS	9	**O**	1) TR_ON if within the in-position width when power turns ON. 2) TR_OFF generally during move. TR_ON when moving at low speed within the in-position width. 3) TR_OFF during alarms.	1) TR_ON when current position is an ideal position within ± in-position width. 2) TR_OFF once if moved outside the in-position width by an external means while stopping in the status of in-position output ON. TR_ON again when entering inside the in-position width by correcvie actions. 3) In-position width is set by system in-position width parameter.

10. Specifications

Specifications of CN1 input/output signals

Signal name	Code	Pin number	I/O	Conditions for input （Restrictions）	Outline of the specifications
Homing complete (When incremental sensor is used.)	ZFIN	10	O	When incremental sensor is used. 1) TR_OFF is maintained when power turns ON and at alarms. 2) TR_ON when home-position return is complete.	When incremental sensor is used. 1) After power turned ON or alarms were released, this is TR_ON when home-position return operation, which matches the machine coordinate and unit coordinate, is complete. After that TR_ON is maintained until another alarm or power shut off. 2) When power turns ON again or alarm is released, TR_OFF is maintained unless home-position return operation is performed again.
Warning output (When absolute sensor is used.)	WARN			When ABS sensor is used. TR_ON in the status of battery warning.	When ABS-E sensor is used. This warning output is TR_ON when the voltage of absolute sensor battery lowers and warning is output from the sensor.
Selectable output	OUT(1)	11	O		Outputs the contents set by intput signals of SEL1, SEL2 and SEL3 (alarms, zone signals, etc.). This has mening at TR_ON.
	OUT(2)	12	O		
	OUT(3)	13	O		
	OUT(4)	14	O		
	OUT(5)	15	O		
	OUT(6)	16	O		
	OUT(7)	17	O		
	OUT(8)	18	O		
Common for output external power	24G	24 25	(I)		A common for driving output circuit, DC24V signal ground and (-) common for output TR.

Contents of generic outputs OUT(1)～(8)

	Contents	Selection signal (Input)			Notes
		SEL1 (CN1-35)	SEL2 (CN1-36)	SEL3 (CN1-37)	
a	Zone signal	×	×	×	Switching is always effective. However, due to delay in contents switching, instability lasts for 50msec after switching.
b	Codes for errors, alarms	ON	×	×	
c	Execution point number	×	ON	×	
d	M output	ON	ON	×	
e	Warning	×	×	ON	
f	Secondary control signal	ON	×	ON	
―	(Reserved)	×	ON	ON	
―	(Reserved)	ON	ON	ON	

Thet mark (×)in the above table means OFF.

a) Zone signals
(SEL1～3:OFF)

Current position	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)
zon1L ～zon1H	―	―	―	―	―	―	―	ON
zon2L ～zon2H	―	―	―	―	―	―	ON	―
zon3L ～zon3H	―	―	―	―	―	ON	―	―
zon4L ～zon4H	―	―	―	―	ON	―	―	―
zon5L ～zon5H	―	―	―	ON	―	―	―	―
zon6L ～zon6H	―	―	ON	―	―	―	―	―
zon7L ～zon7H	―	ON	―	―	―	―	―	―
zon8L ～zon8H	ON	―	―	―	―	―	―	―

Note that the mark “―“ can mean either ON or OFF.
For example, if the setting is the same for all zones, Out (8) to (1) are all ON (inside the zones), and are all OFF (outside the zones).
Zone setting (Zon1L～Zon8H) is by parameters.

b) Codes for errors and alarms

(SEL1:ON)

※Errors → Rrefer to 9.3 Troublehsooting the errors.

※Alarms → Refer to 9.2 Troubleshooting the alarms.

Contents	OUT (8)	OUT (7)	OUT (6)	OUT (5)	OUT (4)	OUT (3)	OUT (2)	OUT (1)	Code display
(Normal)	×	×	×	×	×	×	×	×	00
⊕Sofware limit error	×	×	×	ON	×	ON	ON	×	16
⊖ Sofware limit error	×	×	×	ON	×	ON	ON	ON	17
Defective point data error	×	×	×	ON	ON	×	×	×	18
Homing operation error	×	×	×	ON	ON	×	ON	ON	1B
Power element error	×	×	ON	×	×	×	×	ON	21
Current detection error 0	×	×	ON	×	×	×	ON	×	22
Current detection error 1	×	×	ON	×	×	×	ON	ON	23
Current detection erro 2	×	×	ON	×	×	ON	×	×	24
Forward over travel	×	×	ON	ON	×	×	×	ON	31
Reverse over travel	×	×	ON	ON	×	×	ON	×	32
Overload 1	×	ON	×	×	×	×	×	ON	41
Regeneration error	×	ON	×	×	×	×	ON	ON	43
Amplifier overheating	×	ON	×	ON	×	×	×	ON	51
DB resistor overheating	×	ON	×	ON	×	×	ON	ON	53
Internal overheating	×	ON	×	ON	×	ON	×	×	54
External overheating	×	ON	×	ON	×	ON	×	ON	55
Over voltage	×	ON	ON	×	×	×	×	ON	61
Main circuit short voltage	×	ON	ON	×	×	×	ON	×	62
Main power failed phase	×	ON	ON	×	×	×	ON	ON	63
Control power short voltage	×	ON	ON	ON	×	×	×	ON	71
+12V power decrease	×	ON	ON	ON	×	×	ON	×	72
Encoer phases A/B pulse signal error 1	ON	×	×	×	×	×	×	ON	81
Absolute signal disconnection	ON	×	×	×	×	×	ON	×	82
External encoder phases A/B signal error	ON	×	×	×	×	×	ON	ON	83
Communication error between encoder and amplifier	ON	×	×	×	×	ON	×	×	84
Encoder initialization error	ON	×	×	×	×	ON	×	ON	85
CS disconnection	ON	×	×	×	×	ON	ON	ON	87
Encoder command error	ON	×	×	ON	×	×	×	ON	91
Encoder FORM error	ON	×	×	ON	×	×	ON	×	92
Encoder SYNC error	ON	×	×	ON	×	×	ON	ON	93
Encoder CRC error	ON	×	×	ON	×	ON	×	×	94

【Alarm codes- Continued】

Contents	OUT (8)	OUT (7)	OUT (6)	OUT (5)	OUT (4)	OUT (3)	OUT (2)	OUT (1)	Code display
Encoder error 1	ON	×	ON	×	×	×	×	ON	A 1
Absolute encoder battery error	ON	×	ON	×	×	×	ON	×	A 2
Encoder overheating	ON	×	ON	×	×	×	ON	ON	A 3
Encoder error 3	ON	×	ON	×	×	ON	×	ON	A 5
Encoder error 4	ON	×	ON	×	×	ON	ON	×	A 6
Encoder error 5	ON	×	ON	×	×	ON	ON	ON	A 7
Encoder error 6	ON	×	ON	×	ON	×	×	×	A 8
Encoder error 2	ON	×	ON	ON	×	×	ON	×	B 2
Absolute encoder rotations counter error	ON	×	ON	ON	×	×	ON	ON	B 3
Absolute encoder one rotation counter error	ON	×	ON	ON	×	ON	×	×	B 4
Absolute encoder permissible speed is exceeded when power turns ON	ON	×	ON	ON	×	ON	×	ON	B 5
Encoder internal memoryerror	ON	×	ON	ON	×	ON	ON	×	B 6
Acceleration error	ON	×	ON	ON	×	ON	ON	ON	B 7
Over speed	ON	ON	×	×	×	×	×	ON	C 1
Speed control error	ON	ON	×	×	×	×	ON	×	C 2
Speed feedback error	ON	ON	×	×	×	×	ON	ON	C 3
Excessive position deviation	ON	ON	×	ON	×	×	×	ON	D 1
Position command pulsefrequency error 1	ON	ON	×	ON	×	×	ON	×	D 2
Position command pulsefrequency error 2	ON	ON	×	ON	×	×	ON	ON	D 3
Test mode end	ON	ON	×	ON	ON	ON	ON	ON	D F
EEPROM error	ON	ON	ON	×	×	×	×	ON	E 1
EEPROM check sum error	ON	ON	ON	×	×	×	ON	×	E 2
Internal RAM error	ON	ON	ON	×	×	×	ON	ON	E 3
Processing error between CPU to ASIC	ON	ON	ON	×	×	ON	×	×	E 4
Parameter error 1	ON	ON	ON	×	×	ON	×	ON	E 5
Parameter error 2	ON	ON	ON	×	×	ON	ON	×	E 6
Point data check sum error	ON	ON	ON	×	ON	ON	ON	ON	E F
Task processing error	ON	ON	ON	ON	×	×	×	ON	F 1
Initial time out	ON	ON	ON	ON	×	×	ON	×	F 2

• The mark "×" means OFF.

c) Executed point number (SEL2:ON)

The point number currently being executed is output by Binary code.

For example, when a single move by P001 is moved, “001” is output as a Binary code.

When continuous moves by P002 to 006 are moved, currently executed points are output as Binary codes in “002”→“003”→“004”→“005”→“006”. These outputs are maintained until the next execution point is output or power shut off.

d) M output (SEL1, 2:ON)

	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)
Contents	Mstr	Not used	Not used	Not used	Mout (M code output)			

This is output by M code set by point data and by M output type.

(For details, refer to 10.1.3 M output.)

e) Warning output (SEL3:ON)

• For battery warnings, see the generic ouotputs (1)～(8) as follows:

※For warning contents, refer to 9.1.2 Warning list.

Condition	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)	notes
Normal	×	×	×	×	×	×	×	×	
Amplifier internal temperature warning	×	×	×	×	×	×	×	**ON**	
Main circuit power charging	×	×	×	×	×	×	**ON**	×	
Overload warning	×	×	×	×	×	**ON**	×	×	
Regeneration overload warning	×	×	×	×	**ON**	×	×	×	
Torque limit in operation	×	×	×	**ON**	×	×	×	×	
Speed limit in operation	×	×	**ON**	×	×	×	×	×	
Battery low voltage warning	×	**ON**	×	×	×	×	×	×	
Excessive deviation warning	**ON**	×	×	×	×	×	×	×	

The mark “×” in the above table means OFF.

Output condition here may be OFF for approx. 1 sec after power turns ON, therefore, check the condition after the rise (ON status) of NC ready or in-position output.

f) Secondary control signal (SEL1, 3:ON)

	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)
Contents	Not used	Not used	Not used	Not used	Not used	Not used	Err Error	ALM Alarm

ALM: Turns ON in case of Alarm occurrence

Err: Turns ON in case of Error occurrence (+/- software limit, defective point data, homing operation error)

10. Specifications

10.1.3 Description of Point Data

- Roles and functions of point data are described here.

Point number	Speed	Position	Move mode								Acceleration	S-shape acceleration/deceleration time	Current limit	M output			IP/JP	Dwell time	Repetition count
			Mode 1		Mode 2		Mode 3	ABS/INC	Striking W/Wo	Speed change stop/				Type	Delay	Code			
	*	*									*	ms	%		*			ms	
0	100.0	0.0	0	1	0	0	0	0	0	0	250	10	350	0	0.0	0	0	0	0000
1	214748364.7	-214748364.7	0	0	0	0	0	0	1	0	65535	32767	510	2	214748364.7	15	1	32767	0000
≀																			
253	10.0	50.0	0	1	0	0	0	1	0	0	200	0	150	0	0.0	0	253	100	0000

10.1.3.1 Point number

- Setting range：0～253
- Speicify this point number to perform settings and operations.
- Use 8 bit external input for external specification by binary code.

10.1.3.2 Speed(Uv)

- Setting range：0～2147483647 ・・・（Without decimal points）
  0～214748364.7 ・・・（One place for decimals）
- Set this below motor maximum rotation speed.

10.1.3.3 Position data(U)

- Setting range：-2147483648 ～+2147483647 ・・・（without decimal points）
  -214748364.8 ～+214748364.7・・・（One place for decimals）
  However, this must be within effective stroke.
- Whether this data is treated as an incremental amount (incremental command) or as a coordinate (absolute command) is determined by operation patterns.

10.1.3.4 Acceleration(Uv/ms)

- Setting range：0～65535
- Acceleration and deceleration are the same.

10.1.3.5 S-shaped acceleration/deceleration time(ms)

- Setting range：0～32767
- Acceleration and deceleration are the same.（Refer to 8.5.10 Description of Parameters.）

10.1.3.6 Current limit(%)

- Setting range：0～510(%)・・・At every 1(%)
- To set this to "0"does not mean 0(%) but without current limt.（For rotation tyep motors, current limit is treated the same as torque limit.）
  In other words, operation is possible up until motor peak torque.
  Set this to "0" for usual positioning.
- In general, set this current limit only when striking stop operation is performed.
  Setting this current limit will cause endless overflowing or operations.
- Larger current than the maximum current determined by motors will be limited by instantaneous maximum current.

10.1.3.7 Move mode

• See the move modes as follows:

a) Mode 1

00: Point data is not set　　01: Positioning operation effective
10: Reserved　　11: Reserved

b) Mode 2

00: Final move　　01: Continuous move
10: Reserved　　11: Reserved

c) Mode 3

Set this to “０”.

d) ABS / INC

０：Position data is absolute command.
１：Position data is incremental command.

e) Striking：Without／With

０：Normal move(Without striking)
１：Move by “striking stop“

f) Speed change：Stop／Continuous

０：Stop and change speed operation
１：Continuous speed change operation

a) Mode 1

Whether the point data is valid or invalid (not set) is set at “Mode 1”.
When ”Mode 1”is “01”, execution is possible with valid data.
When “Mode 1” is “00”, “10” and “11”, execution is impossible with invalid data.（There will be an“error 18” for defective point data.）

＜Combination examples of operation patterns＞

Data valid	W/Wo continue	Command position data	W/Wo striking	Operation pattern
Mode １	Mode ２	ＡＢＳ／ＩＮＣ	Striking	Speed change
Valid 「０１」	Comoplete 「００」 Continue 「０１」	Absolute command 「０」	Normal move (without striking) 「０」	Stop and change speed 「０」
		Incremental command 「１」		Stop and change speed 「０」
		Absolute command 「０」		Continuous speed change 「１」
		Incremental command 「１」		Continuous speed change 「１」
		Absolute command 「０」	Move with striking 「１」	Stop and change speed 「０」
		Incremental command 「１」		Stop and change speed 「０」
		Absolute command 「０」		Continuous speed change 「１」
		Incremental command 「１」		Continuous speed change 「１」

◎Make sure to set a move point of “Mode 2” with a compleltion code “00”　at the end of move pattern.

b) Mode 2 and f) speed change (operation)

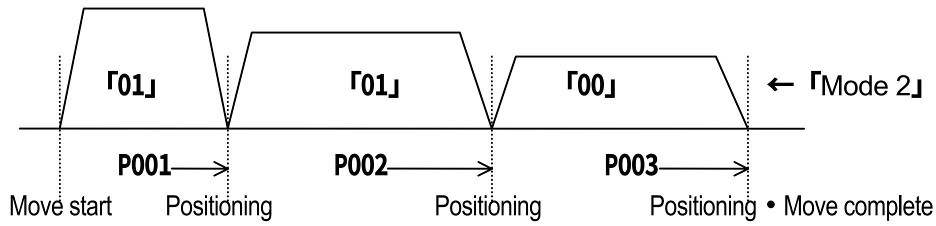
Operation pattern is according to “Mode 2” (With/Without continue of point execution).
When “Mode 2” is “00”, the move is complete.
When “Mode 2” is “01”, the move continues.
When “Mode 2”is “10” and “11”, there will be “error 18” at execution.

0: Stop and change speed

After moving by a certain points, decelerates and stops, and makes positioning to the next point. When “Mode 2”is “01”, the move continues, and when “Mode 2” is “00”, the move is complete at the point.

Example)

※The last point of move pattern must have “Mode 2” with ”00” in the end.



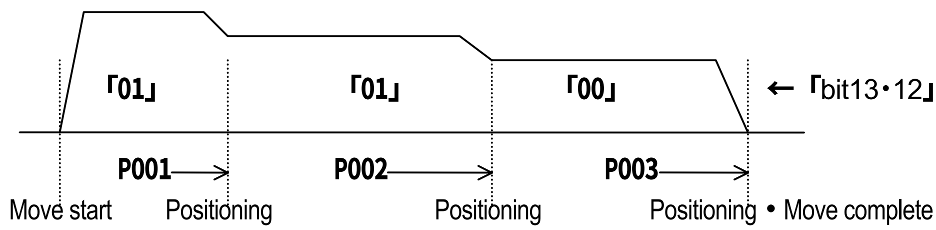
Move starts at P001, then to P001 → P002 → P003 (tempoprarily stops at each point). Since “Mode 2” at P003 is “00”, positioning and move is complete here.

Thus, when “Mode 2” is set to “01” in the point setting, the move continues to the next point (the point with 1 added to the currently moving point) up until “00”of “Mode 2”appears.

1: Continuous speed change operation

Set at a certain point, the move does not stop at the next point, but accelerates or decelerates according to the set speed and then moves. When “Mode 2” is “01”, the move continues and when “Mode 2” is “00”, the move is complete at the point, which is the same as‘stop and change speed operation’.

Example)



Move starts at P001, then to P001 → P002 → P003 with continuous speed change, and the move is complete at P003.

The point where the speed change is complete point where is a set position as the moving point.

＜Notes for continuous speed change operation＞

Continuous speed change does not occur in the following cases:

① The direction of move changes in the position data setting. （e.g. forward→reverse）
② Continuous speed change point is more than 8.
③ Point operation to be executed is stop and change speed opration.
④ The next point operation is stop and change speed operation.
⑤ “Mode 2” includes “00” (feeding complete).
⑥ Striking stop operation is being set.
⑦ Dwell time is being set(to other than 0).

On the other hand, the following functions are restricted when continuous speed change is used:

⑧ S-shaped acceleration/deceleration; At all the point numbers where continuous speed change is set, the move is a straight acceleration/deceleration even if parameters for S-shaped acceleration/deceleration are set.
⑨ Handshaking of M output; At the point where continuous speed change is orerated, M output handshaking is not executed even if it is set.
However, in the cases from ① to ⑦ shown above where continuous speed change does not actually occur in spite of the setting, M output handshaking is executed.
Customers are requested, generally, not to set M output handshaking under continuous speed change operation configuration.

c) Mode 3

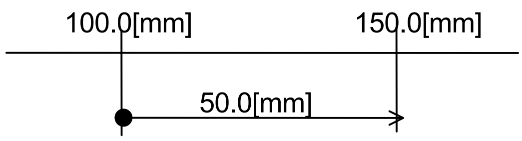
• Set “0” here, as this is a reserved zone.

d) ABS / INC

This determines as what kind of command the value set by position data will be treated.

0: Absolute command: Position data is treated as absolute coordinate system (user coordinate system).

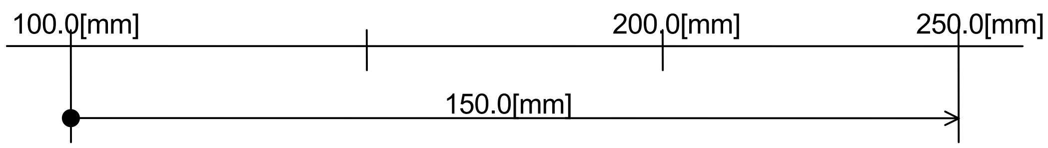
Example）When positioning by absolute command at the position data of 150.0［mm］, assuming that the current position is 100.0 ［mm］；



Thus, moves forward by 50.0 ［mm］ and gets positioned at 150.0 ［mm］ .
Therefore, the move amount varies depending on the current position.

1: Incremental command: Position data is treated as amount of feeding（user coordinatesystem）.

Example） When positioning by incremental command at the position data of 150.0 ［mm］ , assuming that the current position is 100.0 ［mm］ ;



Thus, moves forward by 150.0 ［mm］ and gets positioned at 250.0 ［mm］ .
Therefore, the position varies depending on the current position.

e) Striking：Without／With

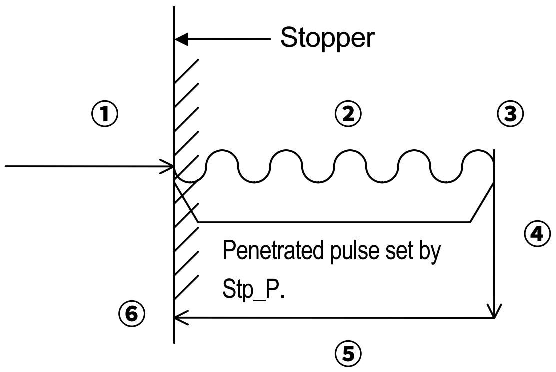
Sets with / without striking stop in the point move.

0: Normal move(without striking) setting

1: Striking stop setting

◎Striking stop

When striking stop is set, see the actual operation of striking stop as follows:



① Positioning move toward the stopper

② Strikes against the stopper, the current value stops, the ideal value keeps moving, and deviation accumulates.

③ Stops moving when penetrated pulse（deviation）≧ Stp_P（parameter）. (Evern if not reaching positioning point.)

④ During dwell time, pushing operation with penetrated pulse (deviation).

⑤ After dwell time, penetrated pulse is cleared.

⑥ Positioning complete or next move.

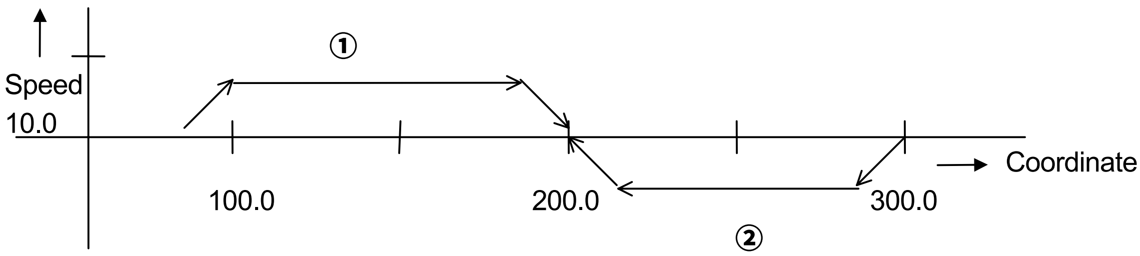
～Notes～

- When striking stop is used, set the current limit (torque limit) as well as this setting. Striking operation without current limit may cause overloading.
- In the normal positioning, make sure to set “the current limit ＝0”.
- When Stp_P（parameter）is small, or when deviation is large during move due to high speed/acceleration（deviation ≧Stp_P）, striking stop may occur accidentally during move. Make sure to keep the speed low.

10.1.3.8 Move example1 (Action)

a) Absolute command single move

Point number	Speed	Position	Move Mode: Mode 1		Mode 2		Mode 3	ABS/INC	Striking WoW	Speed	Acceleration	S-shaped acceleration/deceleration time	Current limit	M output: Type	Delay	Code	IP/JP	Dwell time	Repetition count
	*	*									*	ms	%		*			ms	
1	10.0	200.0	0	1	0	0	0	0	0	0	250	0	0	0	0.0	0	0	0	0000

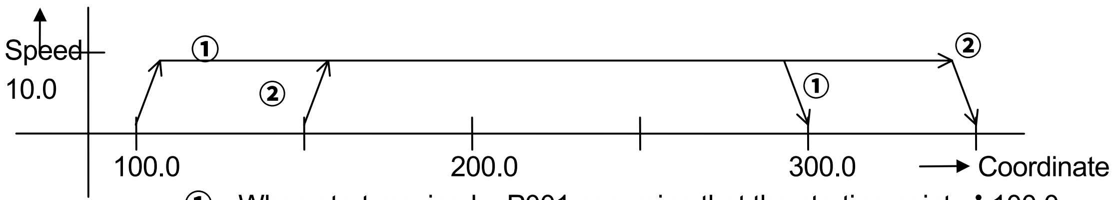


① When start moving by P001assuming that the strating point : 90.0

② When start moving by Poo91 assuing that the starting point : 290.0

b) Incremental command singla move

Point number	Speed	Position	Move Mode: Mode 1		Mode 2		Mode 3	ABS/INC	Striking WoW	Speed	Acceleration	S-shaped acceleration/deceleration time	Current limit	M output: Type	Delay	Code	IP/JP	Dwell time	Repetition count
	*	*									*	ms	%		*			ms	
1	10.0	200.0	0	1	0	0	0	1	0	0	250	0	0	0	0.0	0	0	0	0000

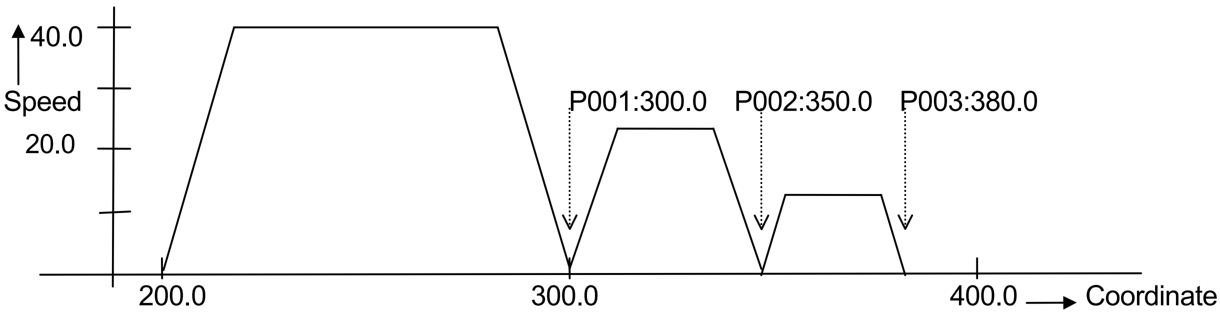


① When start moving by P001 assuming that the starting point : 100.0

② When start moving by P001 assuming that the starting point : 150.0

c) Incremental command stop-and-change-speed

Point number	Speed	Position	Move Mode: Mode 1		Mode 2		Mode 3	ABS/INC	Striking WoW	Speed	Acceleration	S-shaped acceleration/deceleration time	Current limit	M output: Type	Delay	Code	IP/JP	Dwell time	Repetition count
	*	*									*	ms	%		*			ms	
1	40.0	100.0	0	1	0	1	0	1	0	0	250	0	0	0	0.0	0	0	0	0000
2	20.0	50.0	0	1	0	1	0	1	0	0	250	0	0	0	0.0	0	0	0	0000
3	10.0	30.0	0	1	0	0	0	1	0	0	250	0	0	0	0.0	0	0	0	0000



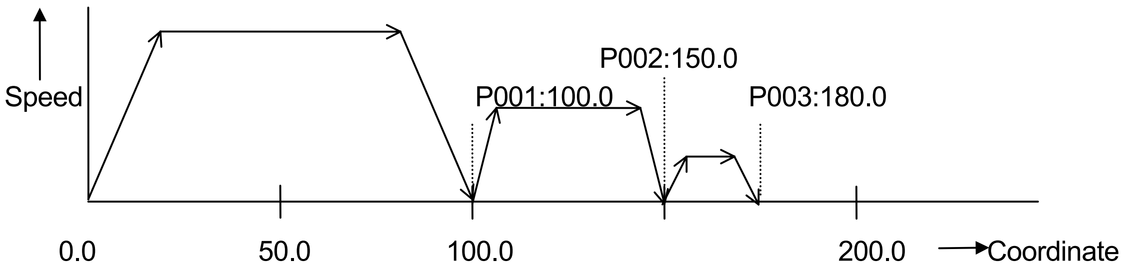
① When start moving by P001 assuming that the starting point : 200.0

※Even if the starting point is changed, move does not change.

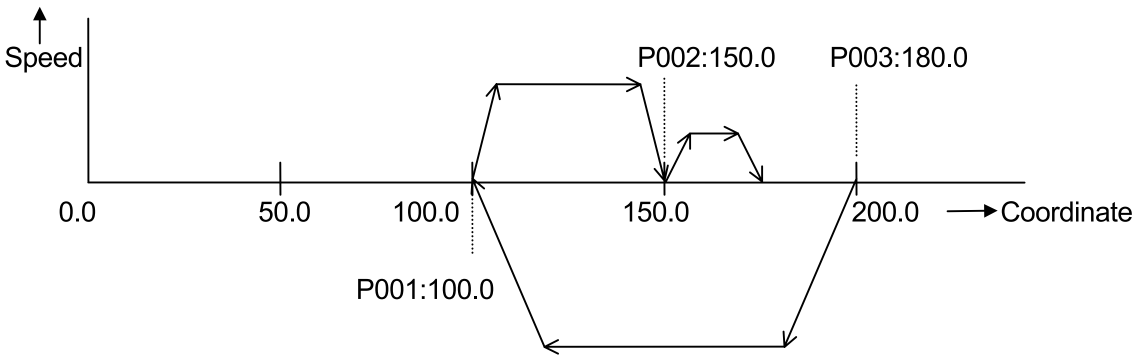
d) Absolute command stop-and-change-speed

Point number	Speed	Position	Move Mode: Mode 1		Mode 2		Mode 3	ABS/INC	StrikingWoW	Speed	Acceleration	S-shaped acceleration/deceleration time	Current limit	M output: Type	Delay	Code	IP/JP	Dwell time	Repetition count
	*	*									*	ms	%		*			ms	
1	40.0	100.0	0	1	0	1	0	0	0	0	250	0	0	0	0.0	0	0	0	0000
2	20.0	150.0	0	1	0	1	0	0	0	0	250	0	0	0	0.0	0	0	0	0000
3	10.0	180.0	0	1	0	0	0	0	0	0	250	0	0	0	0.0	0	0	0	0000

① When start moving by P001 assuming that the starting point : 0.0

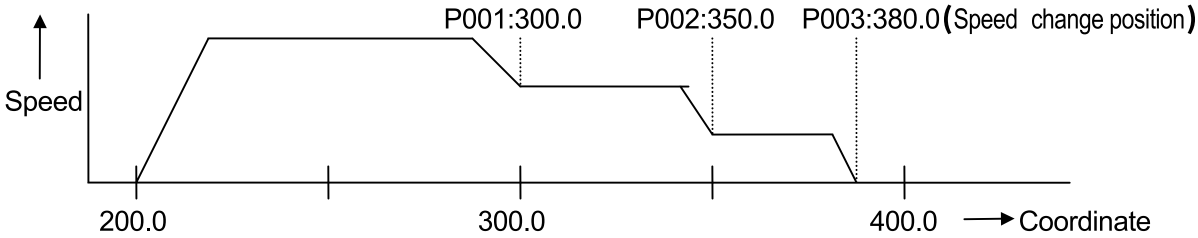


② With the same setting, moves P002→P003 reversely after moving by P001 assuming that the starting point : 200



e) Incremental command continuous speed change

Point number	Speed	Position	Move Mode: Mode 1		Mode 2		Mode 3	ABS/INC	StrikingWoW	Speed	Acceleration	S-shaped acceleration/deceleration time	Current limit	M output: Type	Delay	Code	IP/JP	Dwell time	Repetition count
	*	*									*	ms	%		*			ms	
1	40.0	100.0	0	1	0	1	0	1	0	1	250	0	0	0	0.0	0	0	0	0000
2	20.0	50.0	0	1	0	1	0	1	0	1	250	0	0	0	0.0	0	0	0	0000
3	10.0	30.0	0	1	0	0	0	1	0	1	250	0	0	0	0.0	0	0	0	0000



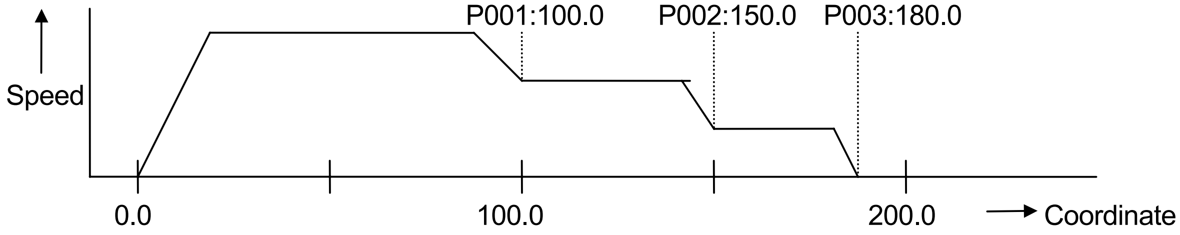
① Startmoving by P001 assuming that the startin point : 200.0

Speed change point of P001 and P002 is a registered position, however, it changes a little due to CPU sampling delay, motor speed or acceleration/deceleration setting. When accuracy for speed change point is desired, use a stop-and-change-speed operation.

f) Absolute command continuous speed change

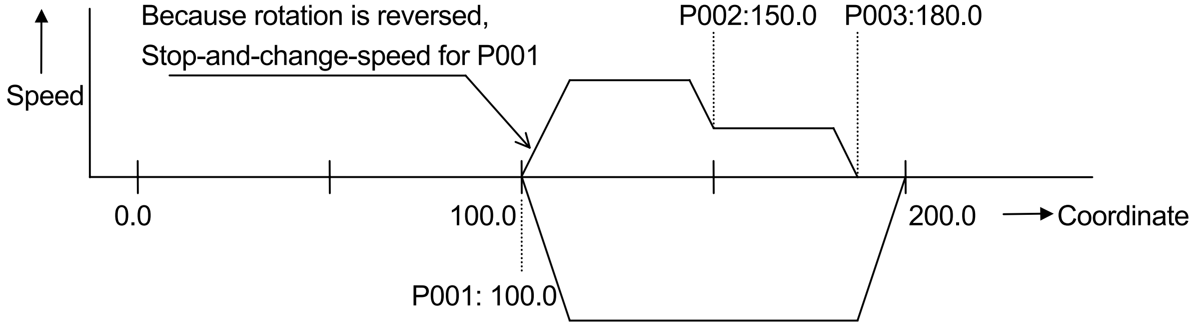
Point number	Speed	Position	Move Mode								Acceleration	S-shaped acceleration/deceleration time	Current limit	M output			IP/JP	Dwell time	Repetition count
			Mode 1		Mode 2		Mode 3	ABS/INC	Striking WoW	Speed				Type	Delay	Code			
	*	*									*	ms	%		*			ms	
1	40.0	100.0	0	1	0	1	0	0	0	1	250	0	0	0	0.0	0	0	0	0000
2	20.0	150.0	0	1	0	1	0	0	0	1	250	0	0	0	0.0	0	0	0	0000
3	10.0	180.0	0	1	0	0	0	0	0	1	250	0	0	0	0.0	0	0	0	0000

① Start moving by P001 assuming that the starting point : 0.0



② Startmoving by P001assuming that the starting point : 200.0

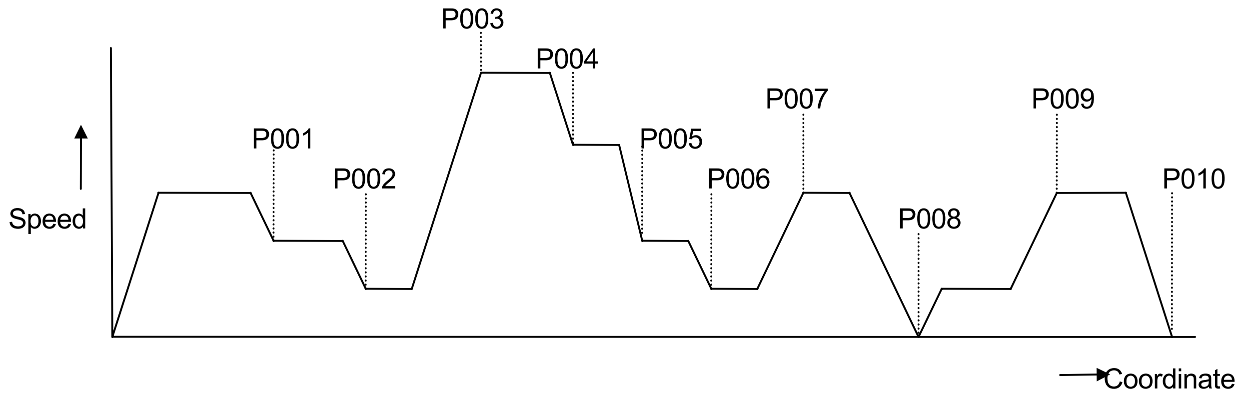
Stop-and-change-speed operation up to P001: 100.0, continuous speed changeP002→P003.



g) Continuous speed change for more than 8 points

① When operation is by "continuous speed change" for P001～P010

※Continuous speed change for P001～P007, stop-and-change-speed for P008, and again continuous speed change for P009 →P010.



10.1.3.9 Starting point 「Ip／Jp」 at interruption start

When an interruption start is input during move, the point set here will be started as an interruption start. In other words, when an interruption start is input, the move being executed is aborted and start moving by the point number "Ip／Jp" which is set at the point data.

However, during interruption start, another interruption start cannot be input.

10.1.3.10 Dwell time(msec)

Dwelltime function is that when the move is complete and current position is in-position, wait for the time set here and then perform positioning complete or the next move.

◎ Example)　In the case of 1 point move:　After the point move is complete, wait for dwell time and positioning complete is output. And in the middle of continous move, wait for the dwell time and then to the next move.

◎ As a special treatment, when "Striking stop" is performed with the dwell time being set, pushing control is performed for the penetrated pulse of the dwell time, and after that deviation is cleared.

◎ If the dwell time oter than 0 is set in the continuous speed change mode, the point is for stop-and-change-speed, not for continuous speed change.

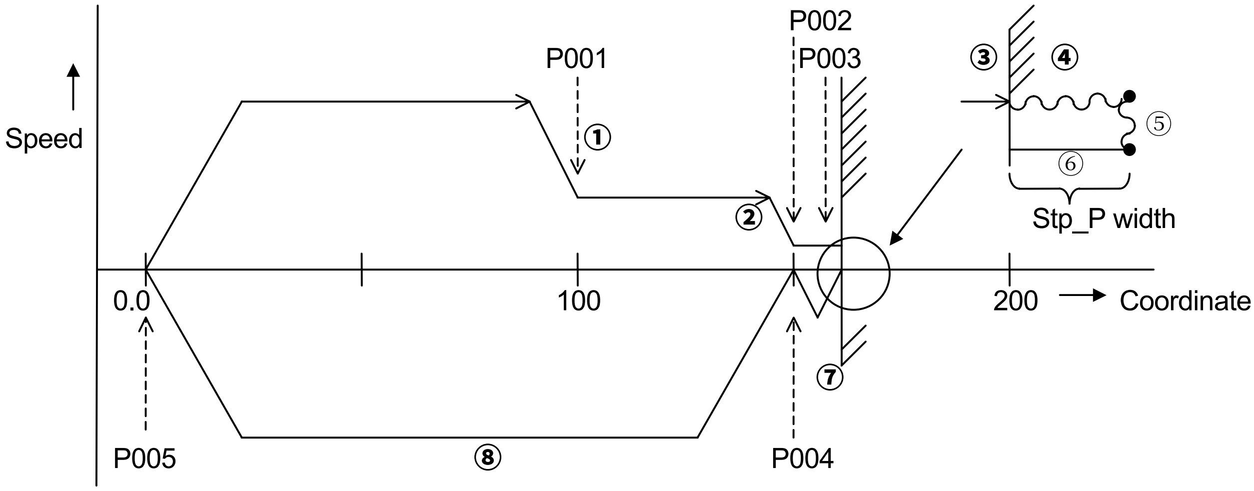
10.1.3.11 Number of repetitions

- Set this to “0000” (fixed) as this is a reserved area.

10.1.3.12 Move example 2 (Striking • Interruption Move)

The moves below are applications of Striking stop and interruption Move.

Point number	Speed	Position	Move Mode								Acceleration	S-shaped acceleration/deceleration time	Current limit	M output			IP/JP	Dwell time	Repetition count
			Mode 1		Mode 2		Mode 3	ABS/INC	StrikingWoW	Speed				Type	Delay	Code			
	*	*									*	ms	%		*			ms	
1	40.0	100.0	0	1	0	1	0	0	0	1	250	0	0	0	0.0	0	11	0	0000
2	20.0	150.0	0	1	0	1	0	0	0	1	250	0	0	0	0.0	0	11	0	0000
3	5.0	180.0	0	1	0	1	0	0	1	1	250	0	40	0	0.0	0	10	10000	0000
4	5.0	-5.0	0	1	0	1	0	1	0	0	250	0	40	0	0.0	0	10	0	0000
5	40.0	0.0	0	1	0	0	0	0	0	0	250	0	0	0	0.0	0	11	0	0000
≀																			
10	5.0	-5.0	0	1	0	1	0	1	0	0	250	0	40	0	0.0	0	0	0	0000
11	40.0	0.0	0	1	0	0	0	0	0	0	250	0	0	0	0.0	0	0	0	0000



① From Starting position：0.0, start by P001 and change speed, then to P002.
② Move by P002, change speed, then to P003.
③ During move by P003, strike the stopper and current position is stopped (with 40% current limt hereafter).
④ With the command value being output as is, idial position is allowed to enter and deviation pulse of Stp_P (penetrated pulse) accumulates, then the move is cancelled.
⑤ During the dwell time(10.0 msec), pushing operation for the penetrated pulse.
⑥ After the dwell time, deviation pulse is cleared.
⑦ Return “5.0” by P004 with an incremental command. (with 40% current limit so far.)
⑧ Return to the starting position by P005 high speed move.

This is the end of a series of operations. However, you can return to the starting position during move by interruption start.

When an interruption is started during move by P001, P002 andP005, return to the starting position with high speed by P011.
When an interruption is started during move by P003 andP004, continuous move is performed from P010 → P011, with current limit first and then return with high speed.

10.1.3.13 Moutput

a) Code
b) Type
c) Delay

Functions of M output are determined by the 3 parameters above.
See the descriptions of each parameter.

a) Code

Sets the data for M output. M output is 4 bits from “00～15”.

b) Type

Sets the function of M output as follows:

0: Without M output operations. No change from the previous M output.
1: When the move is complete with handshaking mode, MSTR signal is output and wait until MFIN signal is input. When MFIN signal is input, the next move is performed.
2: Only M output, without handshaking.

c) Delay

Sets the timing for outputting in M output as follows:

0: M output along with the start of the point move.
Negative value: M output when the point move is complete.
Positive value: M output after the move value set here (incremental value).
However, if this is larger than the value of point move, M output after the move is complete.

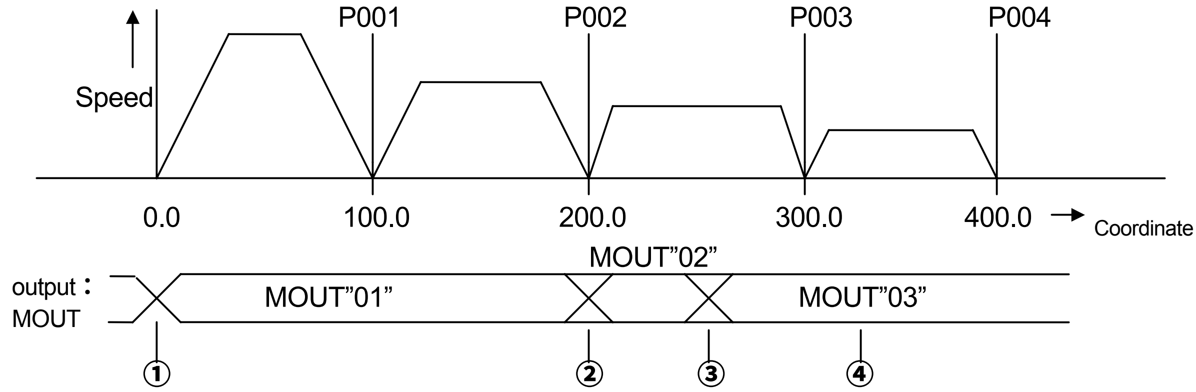
Notes a) M output must be selected at general output selection. (SEL1 and SEL2 are ON, and SEL3 is OFF.)
b) When M output type is “1”, M output is output at the M output timing. However, M output becomes “0” once after handshaking is complete.
c) When operation pattern is continuous speed change, do not use M output type “1”, Handshaking type.
d) M output is not output at the final point move.
When the move is complete with 1 point move, there is no M output. Therefore, set a dummy point (the same position) for output setting.

10. Specifications

10.1.3.14 Move example 3 (Moutput function)

a) In the case of M outputType→“ 2 ”

Point number	Speed	Position	Move Mode									Acceleration	S-shaped acceleration/deceleration time	Current limit	M output			P/JP	Dwell time	Repetition count
			Mode 1		Mode 2		Mode 3	ABS/INC	Stacking WoW	Speed					Type	Delay	Code			
	*	*										*	ms	%		*			ms	
1	40.0	100.0	0	1	0	1	0	0	0	0		250	0	0	2	0.0	1	0	0	0000
2	30.0	200.0	0	1	0	1	0	0	0	0		250	0	0	2	- 0.1	2	0	0	0000
3	20.0	300.0	0	1	0	1	0	0	0	0		250	0	0	2	50.0	3	0	0	0000
4	10.0	400.0	0	1	0	0	0	0	0	0		250	0	0	0	0.0	0	0	0	0000



1 Since M output timing for P001 is “ 0 ”, M output along with start.

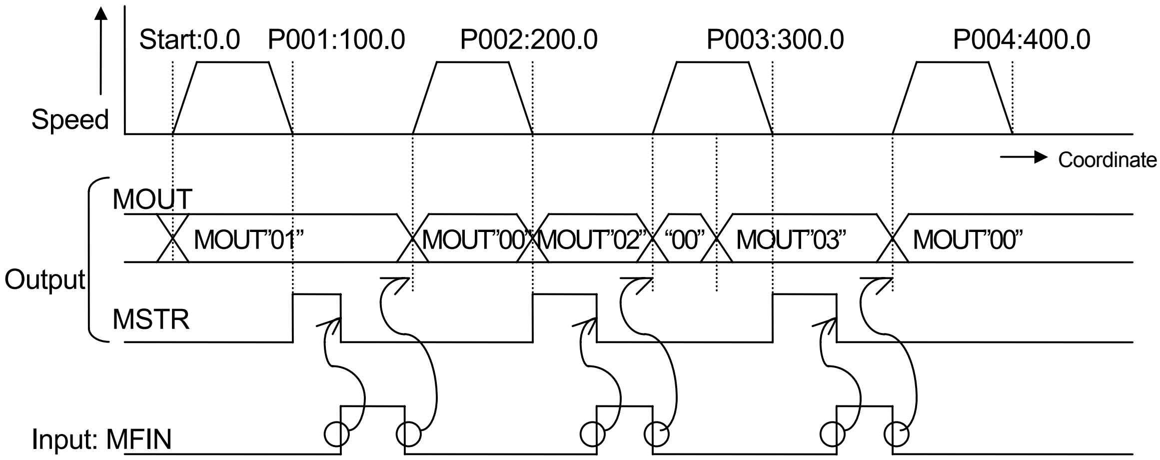
2 Since M output timing for P002 is “ -0.1(negative) ”, M output along with positioning complete.

3 Since M output timing for P003 is “ 50.0 ”, M output in “50” incremental feeding after move by P003.

4 When M outputType is “ 0 ”, no change in M output.

b) In the case of M outputType→ “ 1 ”

Point number	Speed	Position	Move Mode								Acceleration	S-shaped acceleration/deceleration time	Current limit	M output			P/JP	Dwell time	Repetition count
			Mode 1		Mode 2		Mode 3	ABS/INC	Sticking WoW	Speed				Type	Delay	Code			
	*	*									*	ms	%		*			ms	
1	20.0	100.0	0	1	0	1	0	0	0	0	250	0	0	1	0.0	1	0	0	0000
2	20.0	200.0	0	1	0	1	0	0	0	0	250	0	0	1	- 0.1	2	0	0	0000
3	20.0	300.0	0	1	0	1	0	0	0	0	250	0	0	1	50.0	3	0	0	0000
4	20.0	400.0	0	1	0	0	0	0	0	0	250	0	0	0	0.0	0	0	0	0000



In the case of M outputType: “ 1 ”, handshaking is performed using input/output of MSTR and MFIN. For example, in case of P001, M output timing is “0”, therefore, M output is output along with the start. When the move by P001 is complete, MSTR outputs ON and waits.
When input MFIN turns “ OFF→ON ”, M output outputs “ 00 ” and enters the next move, and then M output is executeed according to the next move setting.

10.1.4 Operations by external input

- See the descriptions of operations by external input. This is mainly operated by outputs such as sequencer.

10.1.4.1 Point specification move 1

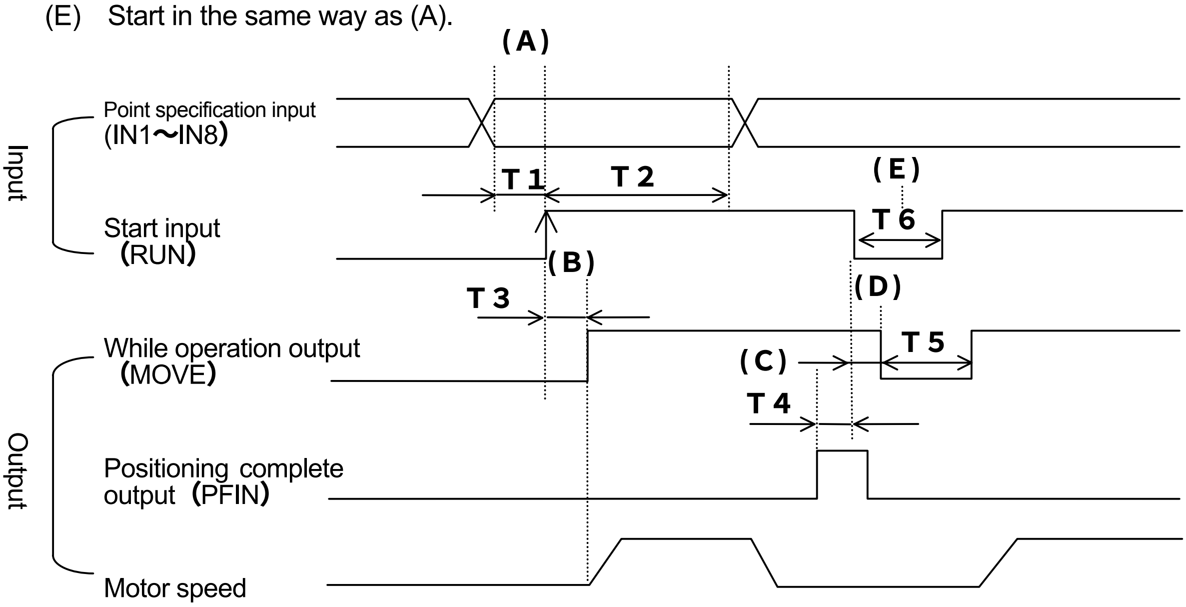
(A) Input a point number at the external point specification input (IN1～8), and after data set up, the start input (RUN) turns OFF→ON.

(B) MOVE (while operation output) becomes ON , and the move starts. （Start input remains ON.）

(C) After the move completes and the positioning complete output (PFIN) turns ON, turn OFF the start input (RUN).

(D) Start input (RUN) turns OFF, therefore, MOVE (while operation output) and PFIN (positioning complete output) turn OFF.

(E) Start in the same way as (A).



T１≧0ms	(data set up time)
T２≧４0ms	(Data hold time)
T３，T５≧２0ms	(Start acceptance delay time)
T４≧0ms	(Start signal holding time)
T６≧４0ms	(Start signal OFF time)

10.1.4.2 Point specification move 2

This section describes the feeding stop and move cancellation.

(A) Input a point number at the external point specification input (IN1～8), and after data set up, the start input (RUN) turns OFF→ON. MOVE (while operation output) turns ON and the move starts.

(B) Turning OFF the start input (RUN) during operation decelerates the motor. (This status is called feeding stop.)

(C) Turning on the start input (RUN) again in the feeding stop status resumes the point move set at (A) and positioning is performed (continues).

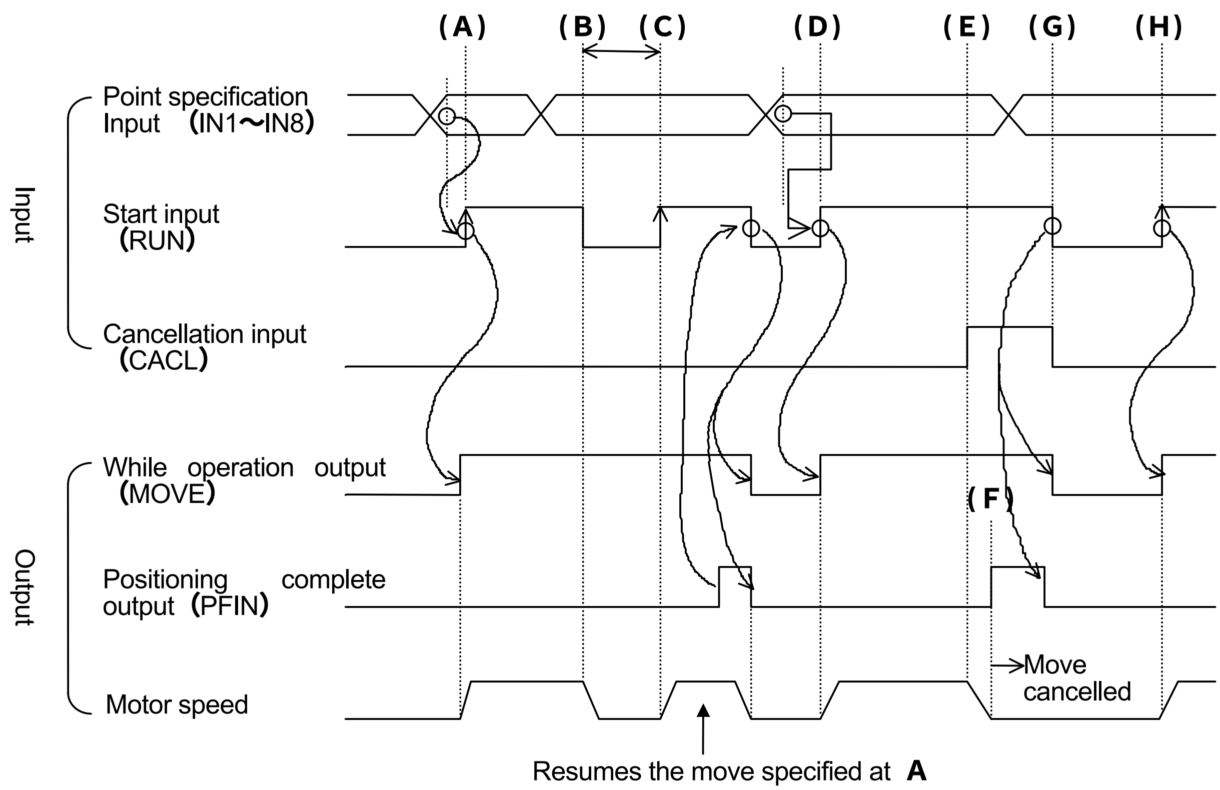
(D) Start in the same way as (A).

(E) Turn ON the cancellation input (CACL) during move, move cancellation mode makes the motor decelerate.

(F) When the move cancellation is complete with the motor decelerating and stopping, positioning complete output (PFIN) turns ON, which means the completion of cancellation.

(G) When positioning complete output (PFIN) turns ON, turn OFF the start input (RUN).
If MOVE (during operation input) and PFIN (positioning complete) are OFF, cancellation is complete.

(H) Then, input a desired point number at the point specification input to start.



10.1.4.3 Point specification move 3

This section describes interruption, which is very useful for forced return operation.

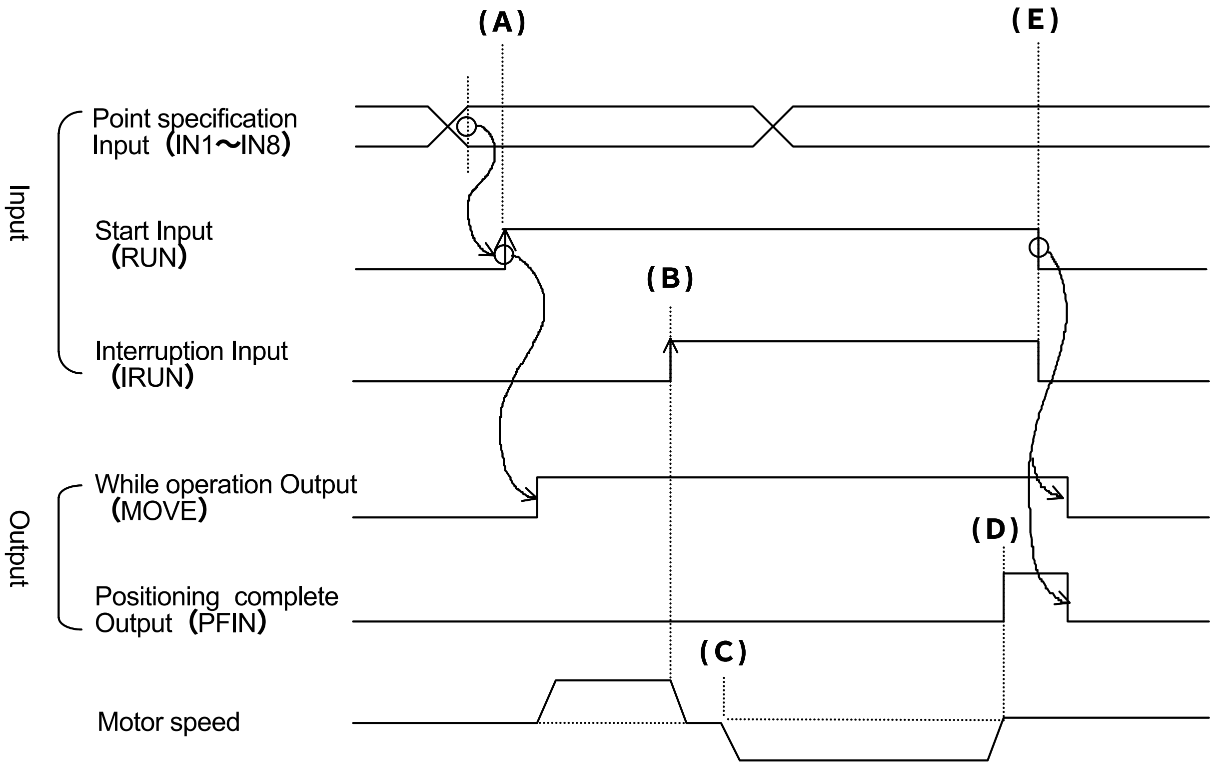
(A) Input a point number at the external point specification input (IN1～8), and after data set up, the start input (RUN) turns OFF→ON. MOVE (while operation output) turns ON and the move starts.

(B) When an interruption start input (IRUN) is turned ON during operation, interruption mode makes the motor decelerate and stop.

(C) After the motor stops, interruption point (IP) will be read from the data of specified point and the move starts to the interruption point.
※ The interruption point (IP) must have been specified beforehand at the point data.

(D) Upon the completion of interruption point move, positioning complete output (PFIN) turns ON.

(E) When positioning complete output (PFIN) turns ON, turn OFF the start input (RUN) and interruption start input (IRUN), and the interruption is complete.



10.1.4.4 Home-position return

1) For incremental sensor

(A) Turning homing input (ZRT) OFF→ON makes the home-position return operation start.

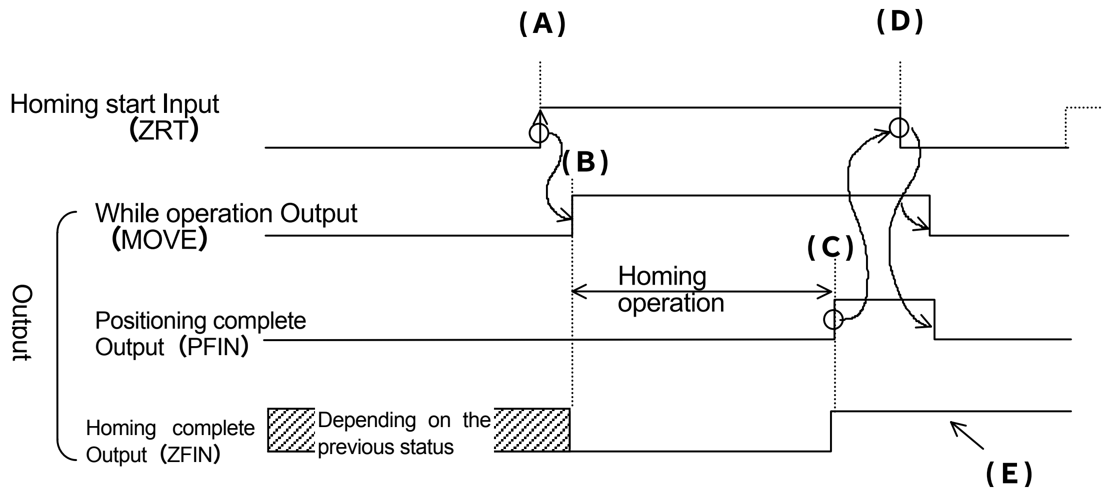
(B) When home-position return operation starts, while operation output (MOVE) turns ON.

(C) Upon completion of the home-position return, positioning complete output (PFIN) and homing complete output (ZFIN) turn ON.

(D) When homing input (ZRT) turns OFF, while operation output (MOVE) and positioning complete output (PFIN) turn OFF.

(E) Homing output (ZFIN) remains ON, however, it is OFF in the following cases:
(In other words, home-position return operation is necessary for the following cases.)
- When homing is started again.
- When alarms are issued.
- When the main power source turns OFF. (The same for turning it ON again.)
- When control power turns OFF. (The same for turning it ON again.)

Note) Do not apply cancellation, feed hold and servo OFF during homing from low speed feeding until operation complete (the point(D)).



2) For absolute sensor

When an absolute sensor is used, Home-position return operation is not necessary. Therefore homing related outputs are different form when an incremental sensor is used.

	When incremental sensor is used.	When absolute sensor is used.
CN1 – pin 28	Homing Input (ZRT)	Home-return Input (ZRT)
CN1 –pin 28	Homing complete Output(ZFIN)	Low battery warning Output (WARN)

And functions are;

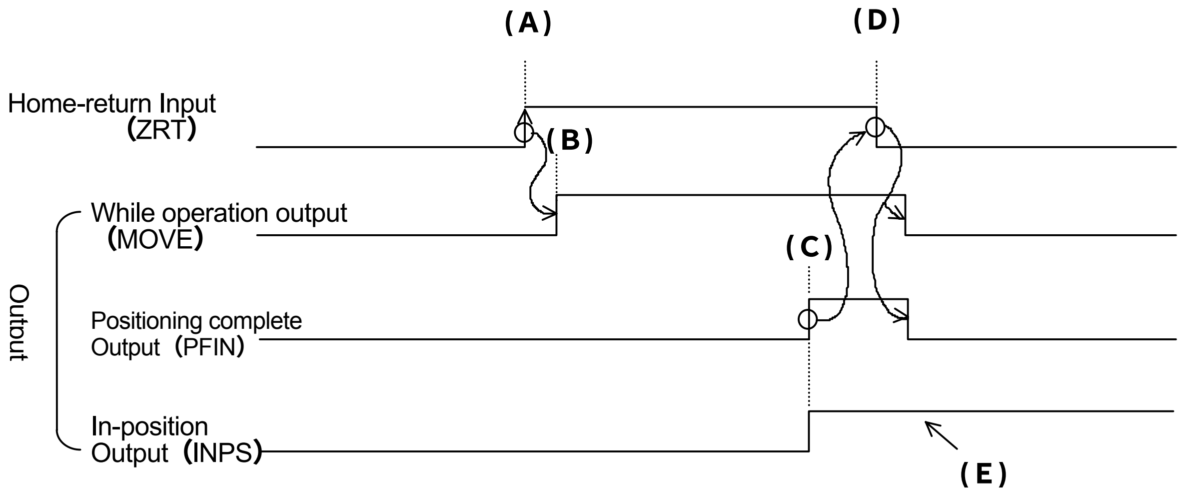
(A) Turning the home-return Input（ZRT）OFF→ON starts the home-return operation.
Home-return operation makes the move to the position (coordinate) whose origin has been set.

(B) While operation output （MOVE）turns ON, which is the same as usual point move.

(C) Positioning complete (PFIN) and in-position output (INPS) turn ON when the positioning is complete to the pre-set coordinate.

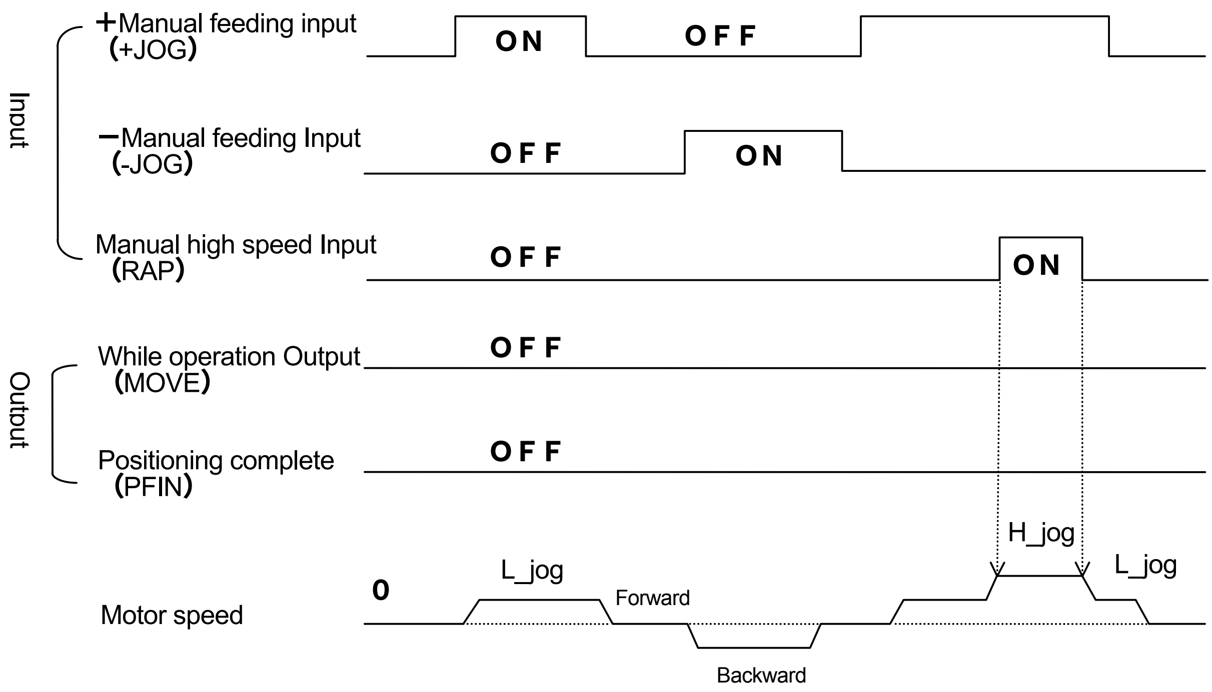
(D) Turn OFF the home-return (ZRT), and while operation output（MOVE） and positioning complete output（PFIN）turn OFF.

(E) In-position output（INPS）remains ON. However, it turns OFF when the position deviation becomes larger than in-position width in the next move, because conditions for this output are that current position coordinate should match the one with its origin set and also be within in-position.



10.1.4.5 JOG feeding（Manual feeding）

1) For incremental sensor
- While forward manual feeding（+JOG）Input is ON, the move is toward positive direction of the coordinate at the speed of（L_jog）set by a parameter.
- While backward manual feeding（-JOG）Input is ON, the move is toward negative direction of the coordinate.
- When manual high speed （RAP）is input during +JOG（or -JOG）is being input, the move is at the speed of parameter （H_jog）.



10.1.4.6 1 step feeding

Turning OFF→ON the ＋1 step (+1step) or the －1 step (-1step) makes the move by a certain pulse numbers set by a parameter.

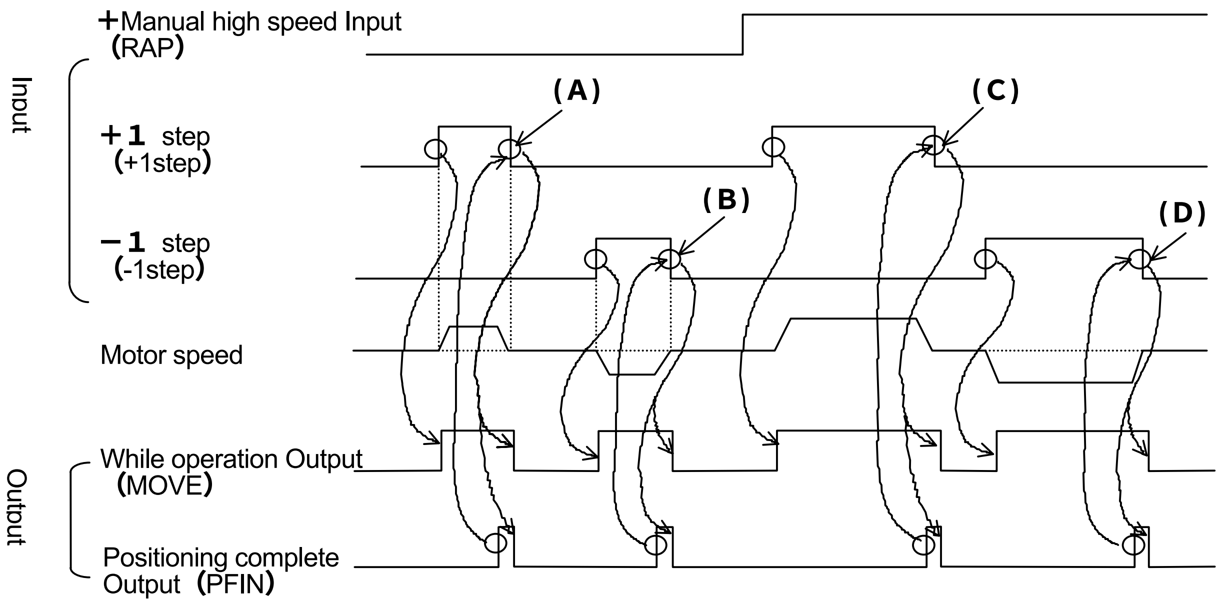
(A) Turning OFF→ON the ＋1 step input (+1step) while manual high speed input (RAP) if OFF makes the move toward positive direction by the "L_stp" set amount at the"L_jog"set speed.

(B) In the same way, turning OFF→ON the －1 step (-1step) makes the move toward negative direction.

(C) Turning OFF→ON the ＋1 step input (+1step) while manual high speed input (RAP) if ON makes the move toward positive direction by the "H_stp" set amount at the"H_jog"set speed.

(D) In the same way, turning OFF→ON the －1 step (-1step) makes the move toward negative direction.

- Keep the 1 step input ON during move . If it is OFF during move, the motor decelerates and stops into feed hold status. And when the input is turned ON again, the move continues.
- Cancellation input (CACL) is also effective.

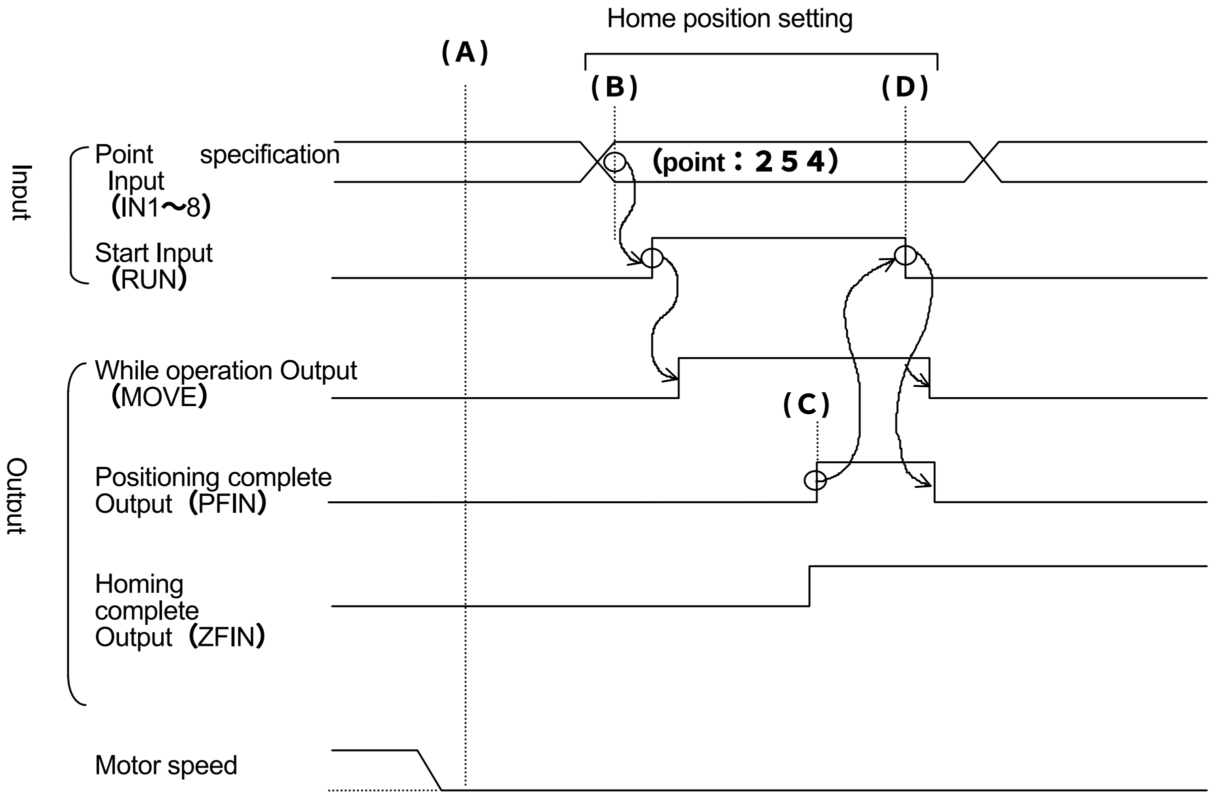


10.1.4.7 Home position setting（Origin setting）

Home position setting is the way to set the current position as an origin, and used for both incremental and absolute sensor.

Move to the position where you want to set as an origin by JOG feeding or others, specify the point at "254" (home position setting), and the current position is set as an origin without any move.

(A) Move to where you want to set as an origin by JOG feeding or others.
(B) Set "254" at the point specification input, and after the data set up, turn the start input（RUN） OFF→ON.
(C) When origin setting is complete, the positioning complete output（PFIN）and homing complete（ZFIN） turn ON.
(D) Turning OFF the start input makes the during operation output（MOVE） and positioning complete output（PFIN）OFF, and home position setting is complete.



※ Do not apply cancellation or servo OFF during home position setting.

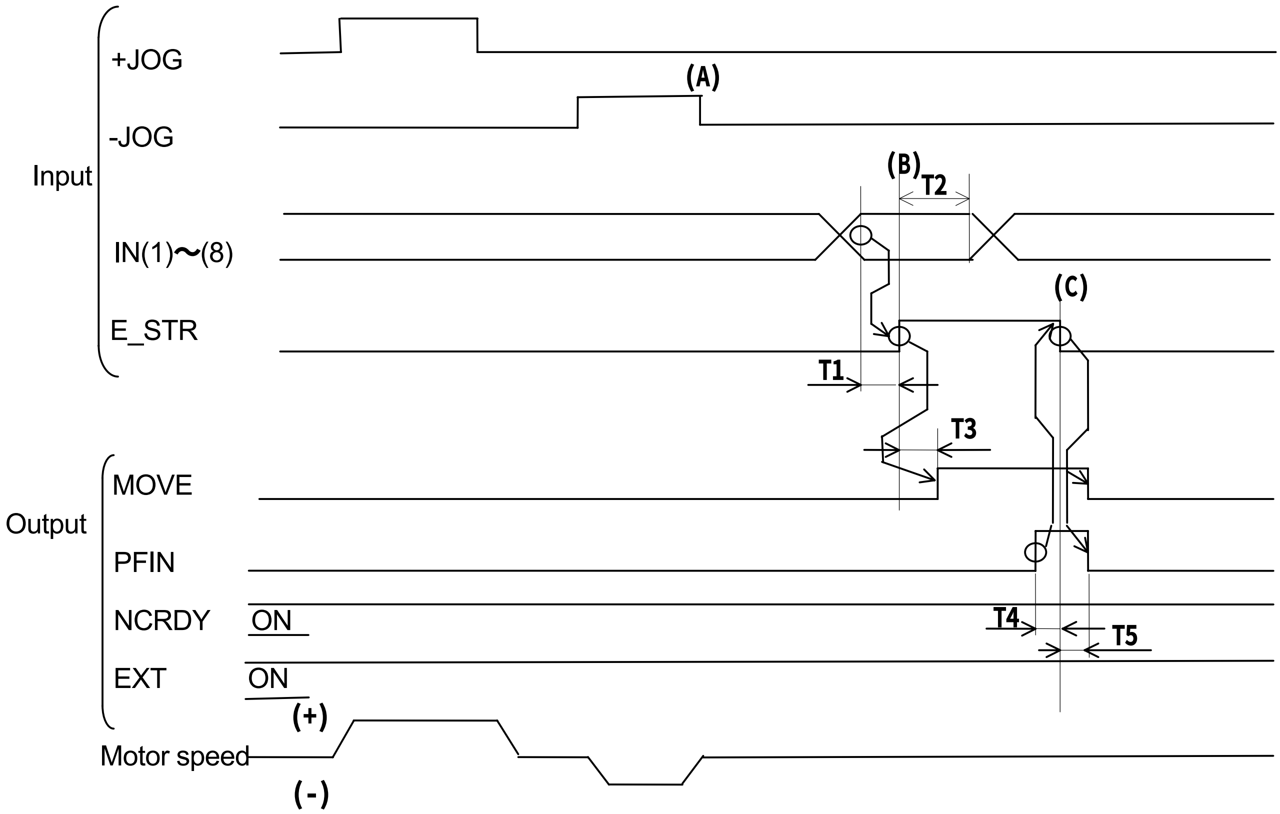
10.1.5 External data setting

• External point teaching setting is possible as external data setting.

10.1.5.1 Function of external teaching data setting

External data setting permission：Set “1” at parameter GroupA［Sw1］ bit0.
Specify the point number and turn ON the external input signal E_STR（CN1-pin 22）, and the current position where the motor is stopped (ideal position) will be registered (teaching) as a coordinate of the specified point number. (Data to be registered include speed 「L_jog」, positioning effective, final move, absolute command, without striking, stop operation of stop-and-change-speed.)

External data setting can be registered for execution in the external operation input mode, unless it is during move or alarm.



Ｔ１≧　０msec（Data／Command set up time）
Ｔ２≧４０msec（Data／Command hold time）
Ｔ３，Ｔ５≧２０msec（Start acceptance delay time）
Ｔ４≧　０msec（Start holding time）

（A）Move the motor where teaching is desired using JOG or others in the external operation mode.
（B）Specify the point number for teaching and turn OFF→ON the E_STR input signal.
（C）When the PFIN output signal turns ON, turn OFF the E_STR input signal.
Then PFIN and MOVE output signals turn ON→OFF.（External teaching data setting is complete.）

Note）The teaching data here will be treated as a temporary data in the amplifier.
When the power source is turned ON again, the position data is the one set at PC.
To save the point data in the amplifier, read it at PC before turning OFF the amplifier power and write.

10.1.6 Procedure prior to operation

a) From unpacking to operation

1. Unpacking

↓

- Check the model number.
- Check the appearance.

2. Wiring and installation

↓

- Perform wiring as instructed in Chapter 5, Wiring.
- Install as instructed in Chapter 6, Installation.
- Check the wiring.

3. Control power turn ON and system parameter setting

↓

- Set「M_dir」「F_dpo」「D_dpo」「Unit」, and turn ON the power again.
- Set「S_pls」「U_pls」「S_ovf」and turn ON the power again.
- Set other parameters.

4. Main power turn ON.（Origin determined.）

↓

- Origin setting （ABS system） （→Refer to 6.3.2.）
- Perform Return-to-zero（INC system）.

5. Point data setting

↓

- Register the point data at PC (using Q-Setup)

6. Test run

↓

- Move the point by sequencer to PC and confirm the point move as specified.

7. Regular run

↓

- Regular run by sequencer.

8. Stop

- Main power shut off.
- Control power shut off.

b) Regular run

1. Control power turn ON
    - Confirm that no alarm is output.

2. Main power turn ON
    - Confirm that servo is ON.

3. Return-to-zero （only for incremental system）
    - Not necessary for absolute system.

4. Regular run
    - Operation by sequencer.

5. Stop
    - Main power shut off.
    - Control power shut off.

10.1.7 Monitor output

- The command/ feedback/ General output signal can be monitored in Analog Monitor Output 1 (MON1), Analog Monitor output 2 (MON2), or Digital Monitor Output (DMON). It is possible to change the analog monitor output polarity/ output contents as via the parameter selection settings. Refer to “Chapter 8, Description of Parameters” for the output selection contents.

10.1.7.1 Parameters related to Analog Monitor Output 1(MON1) and Output 2 (MON2)

Analog monitor output polarity: Parameter Group 3 [PA305] (**Refer to “Chapter 8”, 8-5-4)**

Analog monitor output contents: Parameter Group 5 [PA500 PA501] (**Refer “Chapter 8”, 8-5-6)**

10.1.7.2 Parameter related to Digital monitor output (DMON)

Digital monitor output contents: Parameter Group 5 [PA502] (**Refer “Chapter 8”, 8-5-6)**

10.1.7.3 Monitor output terminal

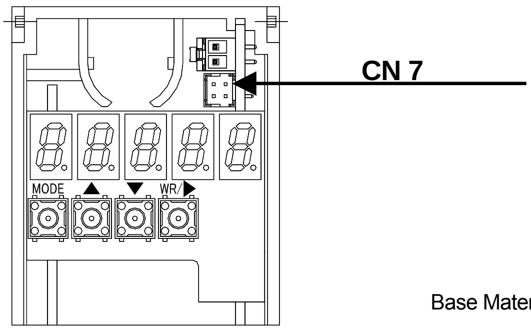
	CN 7
Analog monitor output 1 (MON1)	CN 7-1
Analog monitor output 2 (MON2)	CN 7-2
Digital monitor output (DMON)	CN 7-4
GND	CN 7-3

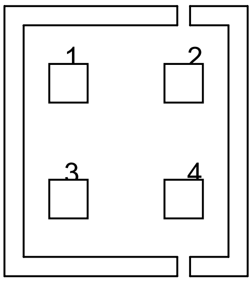
The monitor output value from CN1 is only monitor output 1. Use CN 7 when using monitor output 2.

Keep the lead cable and box with a check terminal as an option when using monitor output 1, 2 from CN7.

10.1.7.4 Installation position of CN 7 and output pin number

CN7 is stored inside the cover on the upper front of the servo amplifier.
Open the servo amplifier front cover by pulling up.





Base Material connector model number: LY20-4P-DLT1-P1 (JAE)

Receiving side housing model number: LY10-DC4 (JAE)

Receiving side contact model number: LY10-C1-1-10000（JAE）

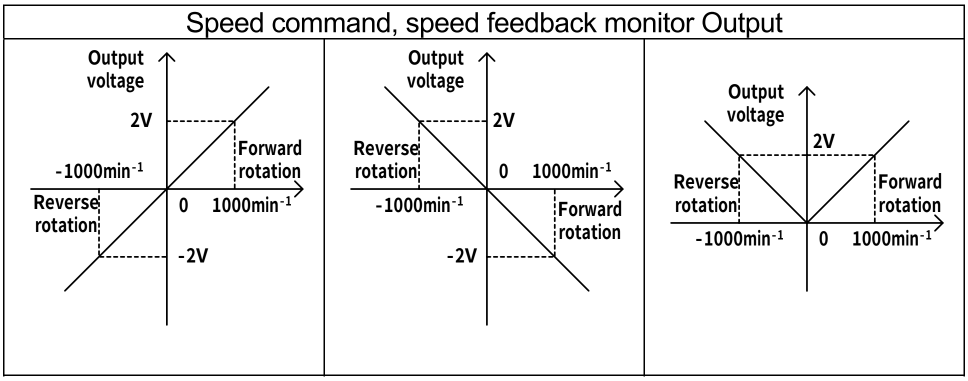
(1) Speed, Torque and Deviation Monitoring

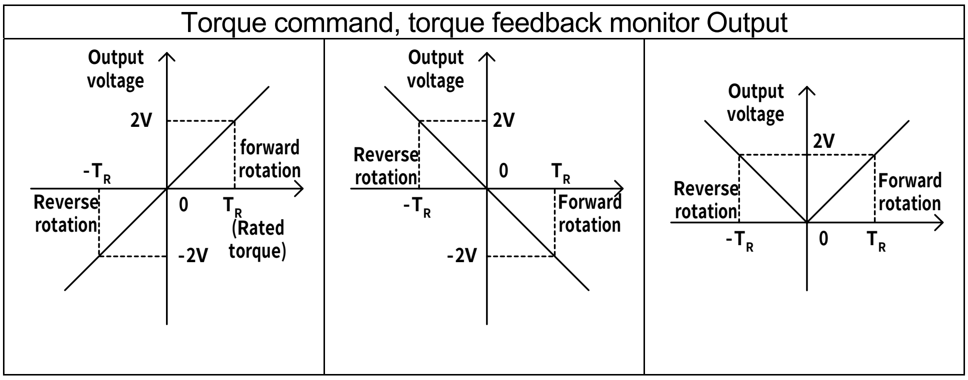
Refer to the following figure.

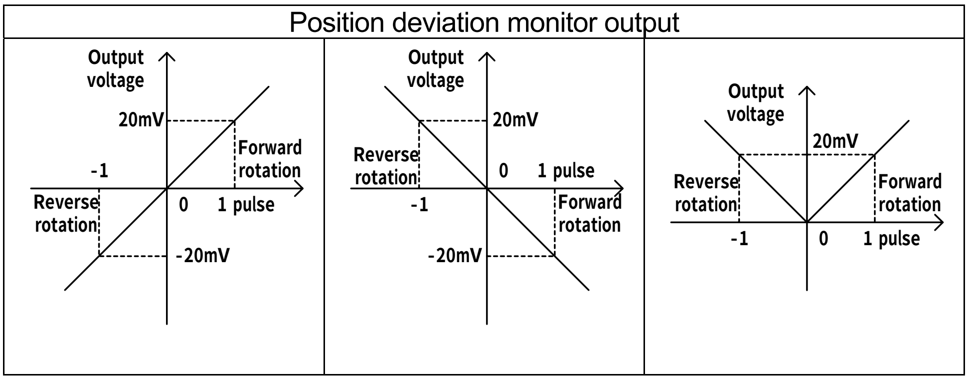
The speed command outputs data from the internal amplifier.

The monitor output value is 0 in SOFF status.

When the power supply control is turned on / cutoff, monitor output becomes irregular.







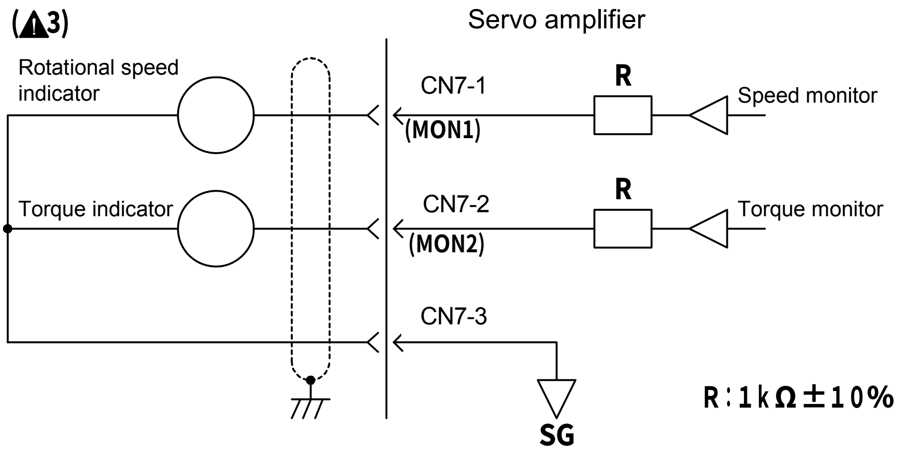
(2) Example of monitor application

The following is an application example of the speed and torque monitor.

Rotation speed measurement and torque measurement:

When a meter is connected to the speed feedback monitor and torque feedback monitor, use a direct current voltmeter with both directions as shown below.

Use shielded lines for wiring, making it as short as possible.



Example of monitor connection

- **Torque monitor output (CN7－2)**
  ±2．0V±20%／Rated torque

- **Speed monitor output (CN7－1)**
  ±2．0V±20%／1000min^{-1}

- **Maximum output voltage for monitor output is ±8V.**

1. The leading cable and a box with a check terminal which are used for monitor output 1, 2 from CN7 are optionally available. Contact your dealer or sales representative for information.
2. When the contents of the monitor output are changed from the Q-SETUP set-up software and the digital operator, the contents of CN7-1 and CN7-2 are changed as well. When used as shown above, take precautions against any damage of the device.
3. For measuring the speed and torque monitor, use a DC voltmeter of 10kΩ or more(bi-direction type).
4. When the power supply control is turned ON or disconnected, the monitor output becomes unstable and may output ±12～15V. While the device is connected, take care to prevent any damage.

10. Specifications

10.1.8 Power Capacity

The table below shows the input power capacity and recommended wiring tools for the rated output under load.

Input oltag	Amplifier volume QS1∗□□ A	Motor model number	Rated output(W	Main circuit power (KVA) During rating	Power supply control (VA)	Circuit breaker	Noise filter (EMC corresponding)	Electromagnetic contactor	Main circuit electric wire diameter	Power supply control line diameter
AC 200V	01	Q1AA04003D	30	0.2	30	NF30 shape 10A Manufactured by Mitsubishi Ltd.	RF3010 -DLC Manufactured by RASUMI	S-N10 Manufactured by Mitsubishi Ltd.	AWG16 or 1.25mm²	AGW16 Or 1.25mm²
		Q1AA04005D	50	0.2						
		Q1AA04010D	100	0.3						
		Q1AA06020D	200	0.5						
		Q2AA04006D	60	0.3						
		Q2AA04010D	100	0.4						
		Q2AA05005D	50	0.3						
		Q2AA05010D	100	0.4						
		Q2AA05020D	200	0.8						
		Q2AA07020D	200	0.8						
		Q2AA07030D	300	1.0						
	03	Q1AA06040D	400	1.0		NF30 Shape 10A			AWG14 or 2mm²	
		Q1AA07075d	750	1.7						
		Q2AA07040D	400	1.3						
		Q2AA07050D	500	1.5						
		Q2AA08050D	500	1.5						
		Q2AA13050H	500	1.4						
	05	Q1AA10100D	1000	2.5		NF30 Shape 15A			AWG12 or 3.5mm²	
		Q1AA10150D	1500	3.0						
		Q1AA12100D	1000	2.5						
		Q2AA08075D	750	2.0						
		Q2AA08100D	1000	2.5						
		Q2AA10100H	1000	2.5						
		Q2AA10150H	1500	3.0						
		Q2AA13100D	1000	2.5						
		Q2AA13150D	1500	3.0						
	10	Q1AA10200D	2000	4.0		NF50 Shape 30A	RF3020 -DLC	S-N18	AWG10 or 5.5mm²	
		Q1AA10250D	2500	4.2						
		Q1AA12200D	2000	4.0						
		Q1AA12300D	3000	5.0						
		Q1AA13300D	3000	5.0						
		Q2AA13200H	2000	5.0						
		Q2AA18200H	2000	5.0						
		Q2AA22250H	2500	5.9						
	15	Q1AA13400D	4000	6.7		NF50 Shape 50A	RF3030 -DLC 3SUP-HK30 -ER-6B Manufactured by Okaya Ltd.	S-N35	AWG8 or 8mm²	
		Q1AA13500D	5000	8.3						
		Q1AA18450M	4500	7.4						
		Q2AA18350H	3500	6.9						
		Q2AA18450H	4500	7.4						
		Q2AA18550F	5500	8.4						
		Q2AA22350H	3500	7.4						
		Q2AA22450F	4500	8.4						
		Q2AA22550B	5500	10.1						
		Q2AA22700S	7000	12.2		NF100 Shape 75A	3SUP-HK50 -ER-6B FS5559-35-33	S-N50		
	30	Q1AA18750H	7500			NF100 Shape 100A	RF3070-DLC Manufactured by RASUMI	S-N65	AWG6 or 14mm²	
		Q2AA18550H	5500							
		Q2AA18750L	7500							
		Q2AA2211KV	11000							
		Q2AA2215KV	15000							
AC 100V	01	Q1EA04003D	30	0.2		NF30 Shape 10A	RF3010-DLC Manufactured by RASUMI	S-N10	AWG16 or 1.25mm²	
		Q1EA04005D	50	0.3						
		Q1EA04010D	100	0.5						
		Q2EA04006D	60	0.3						
		Q2EA04010D	100	0.5						
		Q2EA05005D	50	0.3						
		Q2EA05010D	100	0.5						
	03	Q1EA06020D	200	0.5					AWG14 or 2mm²	

Incoming current values:

Incoming current

Input voltage	Amplifier model number	Control circuit (Maximum value between 1ms after input)*3	Main circuit（Maximum value between 1.2seconds after input）
AC 200V	QS1A015	40A (O−P)	18A (O−P) *1
	QS1A030	40A (O−P)	18A (O−P) *1
	QS1A050	40A (O−P)	18A (O−P) *1
	QS1A100	40A (O−P)	18A (O−P) *1
	QS1A150	40A (O−P)	18A (O−P) *1
	QS1A300	40A (O−P)	18A (O−P) *1
AC 100V	QS1E015	20A (O−P)	9A (O−P) *2
	QS1E030	20A (O−P)	9A (O−P) *2

1 The incoming current is at its maximum when AC230V is supplied.

2 The incoming current is at its maximum when AC115V is supplied.

3 Use the thermistor as the incoming current prevention circuit for the power supply control. When the power is turned ON again after disconnection, a power supply ON.disconnection is repeated over a short time, or the ambient temperature and thermistor temperature is high, an incoming current exceeding the values listed above may occur.

10.1.9 Leakage current of servo amplifier and motor

Since the “Q series” servo amplifier drives the motor by PWM control of the IPM, a high-frequency electric current leakage can flow through the floating capacity of the motor winding, power cable or amplifier. This may cause a malfunction in the short circuit breaker and the protective relay installed in the power supply electric circuit. Therefore, use the inverter as an electricity leakage breaker, as it provides a countermeasure against improper operation.

Leakage current

Motor model number	Amplifier model number	Leakage current per motor
Q1AA□□□□□□◇▽▽ Q2AA□□□□□□◇▽▽	QS1□01, 03	0.5mA
	QS1□05	1.5mA
	QS1□10, 15	3.0mA
	QS1□30	5.0mA

1) When using 2 or more motors, the electric current leakage each motor is compounded.

2) The above values are based on using the recommended tough**, rubber-sheathed 2m cable** as a power line.

3) The system must be grounded (Type D, 3rd type) so that a dangerous voltage condition (on the main part of the machine, i.e., operation panel, etc.) does not occur during an emergency leakage.

4) The value of leaked current is measured by an ordinary leak checker (700Hz Filter).

10.1.10 Calorific value

The calorific value under the rated load is shown below.

List of calorific value

Input voltage	Amplifier capacity	Motor model number	Total calorific value of servo amplifier (W)
AC 200V	QS1□01A	Q1AA04003D	11
		Q1AA04005D	15
		Q1AA04010D	18
		Q1AA06020D	24
		Q2AA04006D	12
		Q2AA04010D	19
		Q2AA05005D	16
		Q2AA05010D	19
		Q2AA05020D	26
		Q2AA07020D	32
		Q2AA07030D	32
	QS1□03A	Q1AA06040D	44
		Q1AA07075D	66
		Q2AA07040D	45
		Q2AA07050D	62
		Q2AA08050D	55
		Q2AA13050H	65
	QS1□05A	Q1AA10100D	47
		Q1AA10150D	61
		Q1AA12100D	47
		Q2AA08075D	43
		Q2AA08100D	45
		Q2AA10100H	50
		Q2AA10150H	62
		Q2AA13100D	58
		Q2AA13150D	63
	QS1□10A	Q1AA10200D	111
		Q1AA10250D	116
		Q1AA12200D	101
		Q1AA12300D	123
		Q1AA13300D	125
		Q2AA13200H	93
		Q2AA18200H	101
		Q2AA22250H	137
	QS1□15A	Q1AA13400D	146
		Q1AA13500D	169
		Q1AA18450M	160
		Q2AA18350H	138
		Q2AA18450H	154
		Q2AA18550R	201
		Q2AA22350H	137
		Q2AA22450R	150
		Q2AA22550B	191
		Q2AA22700S	222
	QS1□30A	Q1AA18750H	428
		Q2AA18550H	361
		Q2AA18750L	413
		Q2AA2211KV	496
		Q2AA2215KV	566

Input voltage	Amplifier capacity	Motor model number	Total calorific value of servo amplifier (W)
AC 100V	QS1□01A	Q1EA04003D	16
		Q1EA04005D	22
		Q1EA04010D	27
		Q2EA04006D	21
		Q2EA04010D	26
		Q2EA05005D	22
		Q2EA05010D	31
	QS1□03A	Q1EA06020D	51
		Q2EA05020D	43
		Q2EA07020D	49

1 Because the heat generated at the built-in regeneration resistance is not included in the values given in this table, it must be added when necessary.

2 When an external regeneration resistance is used, modify the addition of calorific value of the external regeneration resistance depending on where it is installed.

3 Make sure to carefully follow the installation method outlined in Chapter 5 Installation.

10.2 Servo Motor

10.2.1 General Specifications

General specifications of servo motor

Series Name	Q1	Q2
Time Rating	Continuous	
Insulation Classification	Type F	
Dielectric Strength Voltage	AC 1500V 1 minute	
Insulation Resistance	DC 500 V, More than 10M Ω	
Protection method	Fully closed, Auto cooling	
	IP 67 ⚠ (However, Q1□A04,06 and 07 is IP40)	IP 67 (However, Q2□A04 is IP40)
Sealing	Sealed (except Q1□A04,06,07)	Sealed (except Q2□A04)
Ambient Temperature	0 ~ + 40^{0}C	
Storage Temperature	-20 ~ + 65^{0}C`	
Ambient Humidity	20 ~ 90% (without condensation)	
Vibration Classification	V 15	
Coating Color	Munsell N 1.5 equivalent	
Excitation Method	Permanent-magnet type	
Installation Method	Flange mounting	

Conforms to IP67 by using a waterproof connector, conduit, shell, clamp, etc.

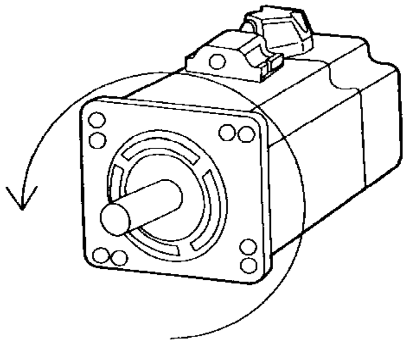
10.Specifications

10.2.2 Rotation Direction Specifications

The rotation characteristics for the servo motor and encoder are explained in this section.

(1) Servo Motor

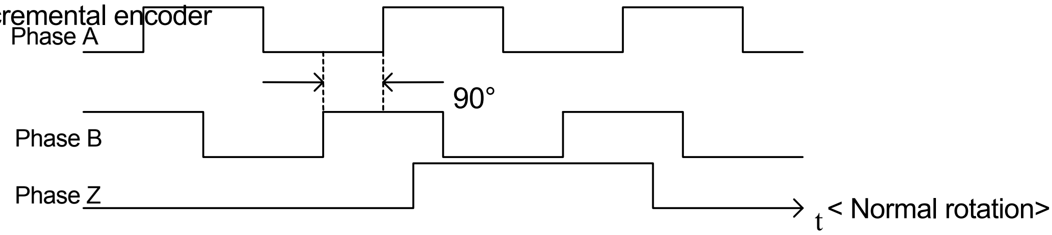
When a command to increase the position command is entered, the servo motor rotates in a counterclockwise direction from the load side (Normal rotation).



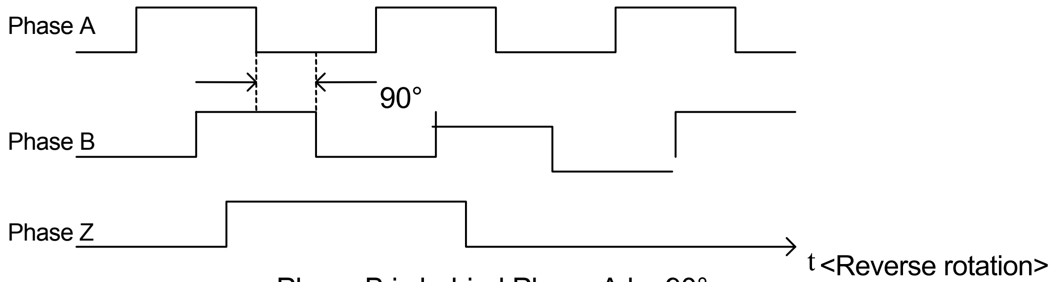
Rotation direction during normal motor operation

(2) Encoder Signal Phases

Incremental encoder



Phase B is ahead of Phase A by 90°.



Phase B is behind Phase A by 90°.

> When the Z-Phase is high, both A- and B- Phases cross the low level, once every revolution.

Absolute encoder

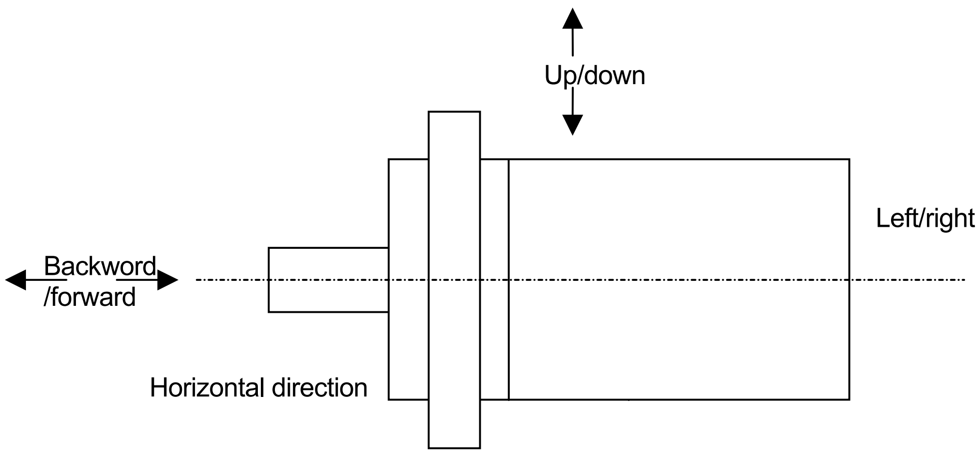
Normal (forward) rotation: Position data incremental output

Reverse rotation: Position data decreased output

10.2.3 Mechanical Specifications of the Motor

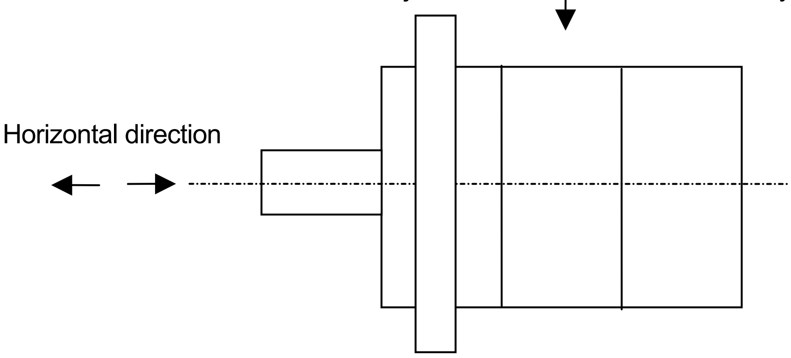
(1) Vibration Resistance

Install the servo motor in a horizontal direction (as shown in the following figure), so that when vibration is applied in any 3 directions (up/down, back/forward, left/right) it can withstand the vibration acceleration up to 24.5m/s^2.



(2) Shock Resistance

Install the shaft of the servo motor in a horizontal direction (as shown in the following figure). It should withstand shock acceleration up to 98 m/s^2 (when shocks are applied in an Up/down direction) for 2 rotations. However, since a precision detector is fixed to the counter-load side of the motor, any shock applied to the shaft may cause damage the detector; therefore, do not subject the shaft to shock under any circumstances.

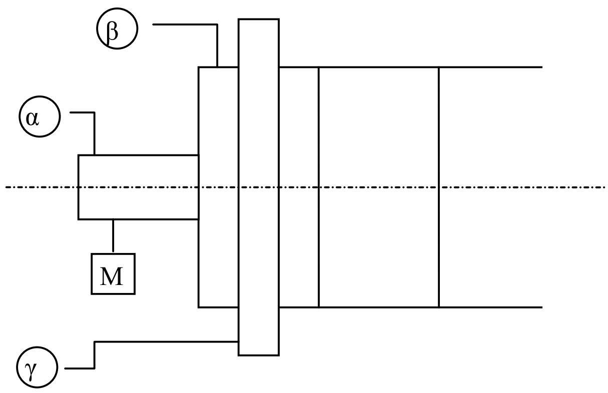


Shock measurement

10.Specifications

(3) Working Accuracy

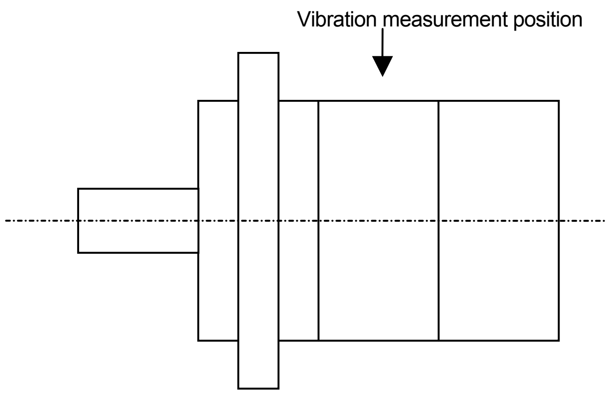
The following table shows the accuracy of the servo motor output shaft and precision (Total Indicator Reading) of the parts surrounding the shaft.

Items	T. I. R. *1	Reference Figure
Vibrations of output shaft terminal α	0.02	
Eccentricity of the external diameter of the flange on output shaft M (β)	0.06 (Below 86)	
	0.08 (Above 100)	
Perpendicularity of the lange face to output shaft M (γ)	0.07 (Below 86)	
	0.08 (Above 100)	

* 1 T.I.R. (Total Indicator Reading)

(4) Vibration Classification

The vibration classification of the servo motor is V15 or less, at the maximum rotation speed for a single servo motor unit, and is measured in the manner pictured below.



Vibration measurement

(5) Mechanical Strength

The output strength of the servo motor can withstand instantaneous maximum torque.

(6) Oil seal

A Type S oil seal (as described in the following table) is fixed to the output shaft of the servo motor. This oil seal is produced by NOK Corporation; please contact your dealer or sales representative for replacement of the oil seal.

Servo Motor Model	Oil Seal type（Type S）
Q1AA04○○○□	None
Q1AA06○○○□	None
Q1AA07○○○□	None
Q1AA10○○○□	AC1306E0
Q1AA12○○○□	AC1677E1
Q1AA13○○○□	AC1677E1
Q1AA18450□	AC2368E0
Q1AA18750□	AC2651A8
Q2AA04○○○□	None
Q2AA05○○○□	AC0382A0
Q2AA07○○○□	AC0687A0
Q2AA08○○○□	AC0875A0
Q2AA10○○○□	AC1306E0
Q2AA13○○○□	AC1677E1
Q2AA18○○○□	AC2368E0
Q2AA18550□	AC2651A8
Q2AA18750□	
Q2AA22○○○□	AC2368E0
Q2AA22550□	AC3152E0
Q2AA22700□	
Q2AA2211K□	
Q2AA2215K□	

10.2.4 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 for an emergency. Turn brake excitation ON or OFF by using the holding brake timing signal output. When using this signal, set the command for brake release time to $0min^{-1}$ for the servo amplifier.

To externally control the holding brake, a response time (as shown in the following table) is required. When using a motor with a brake, determine a time sequence that takes this delay time into account.

Holding Brake specifications

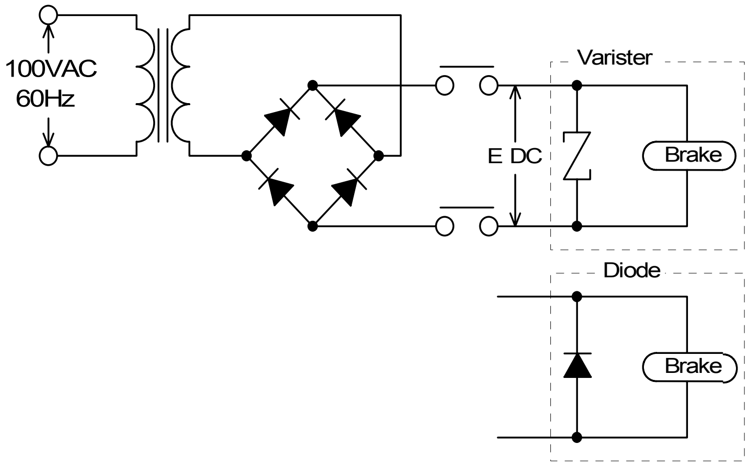
Model		Static friction torque N.m	Release time msec	Braking delay time msec	
				Varistor	Diode
Q1	Q1AA04003D	0.098	25	15	100
	Q1AA04005D	0.157			
	Q1AA04010D	0.320			
	Q1AA06020D	0.637	30	20	120
	Q1AA06040D	1.274			
	Q1AA07075D	2.38	40	20	200
	Q1AA10100D	3.92	40	30	120
	Q1AA10150D	7.84	100	30	140
	Q1AA10200**D**	7.84			
	Q1AA10250**D**	9.80	100	30	140
	Q1AA12100D	3.92	100	30	140
	Q1AA12200D	7.84	100	30	140
	Q1AA12300D	11.8	100	30	140
	Q1AA13400D	19.6	120	50	150
	Q1AA13500D	19.6			
	Q1AA18450M	32.0	150	40	250
	Q1AA18750H	54.9	300	140	400
Q2	Q2AA04006D	0.191	25	15	100
	Q2AA04010D	0.319			
	Q2AA05005D	0.167	15	10	100
	Q2AA05010D	0.353			
	Q2AA05020D	0.353			
	Q2AA07020D	0.69	25	15	100
	Q2AA07030D	0.98			
	Q2AA07040D	0.98			
	Q2AA07050D	1.96	30	20	200
	Q2AA08050D	1.96	30	20	200
	Q2AA08075D	2.94			
	Q2AA08100D	2.94			
	Q2AA10100H	3.92	40	30	120
	Q2AA10150H	7.84	100	30	140
	Q2AA13050H	3.50	40	30	120

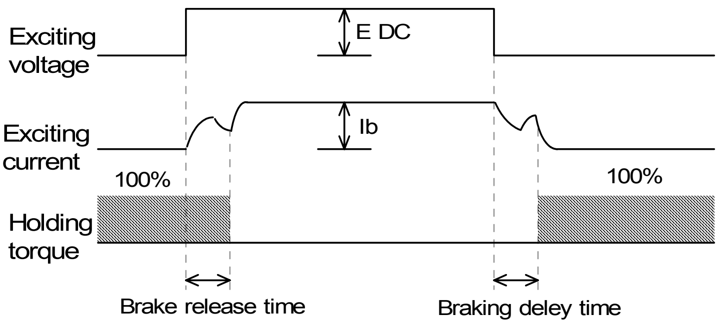
	Q2AA13100H	9.0	70	30	130
	Q2AA13150 H	9.0	100	30	140
	Q2AA13200 H	12.0			
	Q2AA18200 H	12.0	100	30	140
	Q2AA18350 H	32.0	120	40	150
	Q2AA18450 H	32.0	150	40	250
	Q2AA18550R	54.9	300	140	400
	Q2AA18550H				
	Q2AA18750L				
	Q2AA22250 H	32.0	300	140	400
	Q2AA22350 H	32.0	300	140	400
	Q2AA22450 H	32.0	300	140	400
	Q2AA22550B	90.0	300	140	400
	Q2AA22700S	90.0	300	140	400
	Q2AA2211KV				
	Q2AA2215KV				

100V Specifications

Model		Static friction torque N.m	Release time msec	Braking delay time msec	
				Varistor	Diode
Q1	Q1EA04003D	0.098	25	15	100
	Q1EA04005 D	0.157			
	Q1EA04010 D	0.32			
	Q1EA06020 D	0.637	30	20	120
Q2	Q2EA04006 D	0.191	25	15	100
	Q2EA04010 D	0.319			
	Q2EA05005 D	0.167	15	10	100
	Q2EA05010 D	0.353			
	Q2EA05020 D	0.353			
	Q2EA07020 D	0.69	25	15	100

Brake operating time is measured in the following circuit.





Note: The brake release time and braking delay time refer to those mentioned in the above tables.
The brake release time is the same for both the varistor and diode.

10.2.5 Motor Data Sheet

- This section displays motor data sheet (characteristics).
- By combining the servo motor and servo amplifier in the table, values for AC200V, 3 phases when the amplifier power supply is 200V, and for AC100V, single phase when the power supply is100V, are shown respectively.
- The radiation constant for installing the motor on an aluminium plate are shown as (Thickness) × (The length of one side of square).
- The "*" mark and speed-torque characteristics indicate the value after the rise to maximum temperature. Other values are at 20^0C, and are all typical values.
- There are 4 ～ 6 digits or alphabetical characters for servo motor models with a * mark.
- There are 10 digits or alphabetical characters for servo motor models with a * mark.

Specifications for 200V

Servo Motor model Q1AA			04003D	04005D	04010D	06020D	06040D	07075D	10100D
Servo Amplifier model QS1□			01*	01*	01*	01*	03*	03*	05*
*Rated output	P_R	kW	0.03	0.05	0.1	0.2	0.4	0.75	1
*Rated speed	N_R	min^{-1}	3000	3000	3000	3000	3000	3000	3000
*Maximum speed	N_{max}	min^{-1}	5000	5000	5000	5000	5000	5000	5000
*Rated torque	T_R	N・m	0.098	0.159	0.318	0.637	1.27	2.38	3.19
*Continuous stall torque	T_S	N・m	0.108	0.159	0.318	0.637	1.27	2.38	3.92
*Peak torque	T_P	N・m	0.322	0.477	0.955	1.91	3.82	7.16	10.5
*Rated current	I_R	Arms	0.49	0.80	1	1.5	2.9	4.3	6.9
*Continuous stall current	I_S	Arms	0.53	0.80	1	1.5	2.9	4.3	8.0
*Peak current	I_P	Arms	2.2	2.9	3.6	5.8	10.5	15	26.5
Torque constant	K_T	N・m/Arms	0.220	0.228	0.360	0.493	0.510	0.613	0.553
Voltage constant for each phase	$K_{E\Phi}$	m V/min^{-1}	7.68	7.95	12.6	17.2	17.8	21.4	19.3
Phase resistance	R_Φ	Ω	15	8.72	7.6	2.53	1.28	0.633	0.267
*Rated power rate	Q_R	kW/s	9.60	18.9	43.4	28.8	65.3	89.1	97.8
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	0.01	0.0134	0.0233	0.141	0.247	0.636	1.04
Aluminium plate		mm	t6×250	t6×250	t6×250	t12×250	t12×250	t12×250	t20×400

10 Specifications

Specifications for 200V

Servo Motor model Q1AA			10150D	10200D	10250D	12100D	12200D	12300D	13300D
Servo Amplifier model QS1☐			05*	10*	10*	05*	10*	10*	10*
*Rated output	P_R	kW	1.5	2	2.5	1	2	3	3
*Rated speed	N_R	min^{-1}	3000	3000	3000	3000	3000	3000	3000
*Maximum speed	N_{max}	min^{-1}	4500	5000	5000	5000	5000	5000	4500
*Rated torque	T_R	N・m	4.79	6.37	7.97	3.19	6.37	9.55	9.51
*Continuous stall torque	T_S	N・m	4.9	7.36	8.82	3.92	7.36	11	10.8
*Peak torque	T_P	N・m	14.7	19.6	24.4	11	21	31	28.4
*Rated current	I_R	Arms	8.2	15.9	16.6	6.2	14.3	16.2	16.1
*Continuous stall current	I_S	Arms	8.2	18	17.2	7.5	16.2	17.3	16.5
*Peak current	I_P	Arms	26.5	55	55	24.5	53	55	55
Torque constant	K_T	N・m/Arms	0.705	0.470	0.587	0.578	0.534	0.728	0.693
Voltage constant for each phase	$K_{E\phi}$	mV/min^{-1}	24.6	16.4	20.5	20.2	18.6	25.4	24.2
Phase resistance	R_ϕ	Ω	0.272	0.0860	0.104	0.190	0.0699	0.0793	0.0867
*Rated power rate	Q_R	kW/s	143	189	240	45.2	92.9	143	184
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	1.61	2.15	2.65	2.25	4.37	6.4	4.92
Aluminium plate		mm	t20×400	t20×470	t20×470	t20×400	t20×470	t20×470	t20×470

Specifications for 200V

Servo Motor model Q1AA			13400D	13500D	18450M	18750H			
Servo Amplifier model QS1☐			15*	15*	15*	30*			
*Rated output	P_R	kW	4	5	4.5	7.5			
*Rated rotation speed	N_R	min^{-1}	3000	3000	1500	1500			
*Maximum rotation speed	N_{max}	min^{-1}	4500	4500	1500	3000			
*Rated torque	T_R	N・m	12.7	15.7	28.5	48			
*Continuous stall torque	T_S	N・m	14.7	18.1	31.6	55			
*Peak torque	T_P	N・m	39.2	47.6	105	125			
*Rated current	I_R	Arms	23.4	25.8	24.8	55			
*Continuous stall current	I_S	Arms	26.4	27.5	24.8	60			
*Peak current	I_P	Arms	83	83	83	155			
Torque constant	K_T	N・m/Arms	0.612	0.724	1.37	0.91			
Voltage constant for each phase	$K_{E\phi}$	mV/min^{-1}	21.4	25.3	47.7	31.7			
Phase resistance	R_ϕ	Ω	0.0478	0.0461	0.0838	0.021			
*Rated power rate	Q_R	kW/s	251	291	295	443			
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	6.43	8.47	27.5	52			
Aluminium plate		mm	t20×470	t20×540	t20×540	t20×540			

10 Specifications

Specifications for 100V

Servo Motor model Q1EA			04003D	04005D	04010D	06020D			
Servo Amplifier model QS1☐			01*	01*	01*	03*			
*Rated output	P_R	kW	0.03	0.05	0.1	0.2			
*Rated speed	N_R	min^{-1}	3000	3000	3000	3000			
*Maximum speed	N_{max}	min^{-1}	5000	5000	5000	5000			
*Rated torque	T_R	N・m	0.098	0.159	0.318	0.637			
*Continuous stall torque	T_S	N・m	0.108	0.159	0.318	0.637			
*Peak torque	T_P	N・m	0.322	0.477	0.955	1.91			
*Rated current	I_R	Arms	0.9	1.92	2.2	4.5			
*Continuous stall current	I_S	Arms	0.95	1.92	2.2	4.5			
*Peak current	I_P	Arms	4	7	7.9	15.5			
Torque constant	K_T	N・m/Arms	0.115	0.0956	0.176	0.161			
Voltage constant for each phase	$K_{E\Phi}$	mV/min^{-1}	4.03	3.34	6.13	5.63			
Phase resistance	R_Φ	Ω	4.28	1.36	2.21	0.327			
*Rated power rate	Q_R	kW/s	9.60	18.9	43.4	28.8			
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	0.01	0.0134	0.0233	0.141			
Aluminium plate		mm	t6×305	t6×305	t6×305	t6×305			

Specifications for 200V

Servo Motor model Q2AA			04006D	04010D	05005D	05010D	05020D	07020D	07030D
Servo Amplifier model QS1☐			01*	01*	01*	01*	01*	01*	01*
*Rated output	P_R	kW	0.06	0.1	0.05	0.1	0.2	0.2	0.3
*Rated speed	N_R	min^{-1}	3000	3000	3000	3000	3000	3000	3000
*Maximum speed	N_{max}	min^{-1}	5000	5000	5000	5000	5000	5000	5000
*Rated torque	T_R	N・m	0.191	0.318	0.159	0.318	0.637	0.637	0.955
*Continuous stall torque	T_S	N・m	0.216	0.353	0.167	0.353	0.686	0.686	0.98
*Peak torque	T_P	N・m	0.65	1	0.518	1.06	2.05	2.1	3.4
*Rated current	I_R	Arms	0.67	1.1	0.86	1.1	1.6	2.1	2.1
*Continuous stall current	I_S	Arms	0.67	1.2	0.88	1.2	1.7	2.2	2.5
*Peak current	I_P	Arms	2.7	3.6	3.3	4.3	5.9	7.5	7.9
Torque constant	K_T	N・m/Arms	0.314	0.325	0.208	0.326	0.435	0.34	0.519
Voltage constant for each phase	$K_{E\Phi}$	mV/min^{-1}	10.97	11.34	7.26	11.4	15.18	11.8	18.1
Phase resistance	R_Φ	Ω	11.3	6.77	4.72	4.05	3.24	1.18	2.22
*Rated power rate	Q_R	kW/s	6.4	11.8	3.8	7.8	16.2	10.7	20.3
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	0.057	0.086	0.067	0.13	0.25	0.380	0.45
Aluminium plate		mm	t6×250	t6×250	t6×250	t6×305	t6×305	t6×305	t6×305

10 Specifications

Specifications for 200V

Servo Motor model Q2AA			07040D	07050D	08050D	08075D	08100D	10100H	10150H
Servo Amplifier model QS1☐			03*	03*	03*	05*	05*	05*	05*
*Rated output	P_R	kW	0.4	0.5	0.5	0.75	1	1	1.5
*Rated speed	N_R	min^{-1}	3000	3000	3000	3000	3000	2000	2000
*Maximum speed	N_{max}	min^{-1}	5000	5000	5000	5000	5000	3500	3000
*Rated torque	T_R	N・m	1.273	1.59	1.592	2.387	3.18	5	7.2
*Continuous stall torque	T_S	N・m	1.372	1.85	1.958	2.941	3.92	6	8
*Peak torque	T_P	N・m	4.1	5.2	6.56	9	12.5	16.6	20.5
*Rated current	I_R	Arms	3.0	4.3	3.7	5.9	6	6.8	8.6
*Continuous stall current	I_S	Arms	3.1	5.0	4.3	7	6.9	8.1	9.4
*Peak current	I_P	Arms	12	15	15	23.7	25	24.5	25.5
Torque constant	K_T	N・m/Arms	0.482	0.441	0.519	0.441	0.587	0.814	0.937
Voltage constant for each phase	$K_{E\Phi}$	mV/min^{-1}	16.8	15.4	18.1	15.4	20.5	28.4	32.7
Phase resistance	R_Φ	Ω	1.26	0.8	0.800	0.358	0.410	0.477	0.34
*Rated power rate	Q_R	kW/s	21.6	29.7	19.5	27.5	37.0	46.0	64.9
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	0.75	0.85	1.3	2.07	2.73	5.44	7.99
Aluminium plate		mm	t6×305	t6×305	t6×305	t6×305	t20×305	t20×400	t20×400

Specifications for 200V

Servo Motor model Q2AA			13050H	13100H	13150H	13200H	18200H	18350H	18450H
Servo Amplifier model QS1☐			03*	05*	05*	10*	10*	15*	15*
*Rated output	P_R	kW	0.5	1.0	1.5	2	2	3.5	4.5
*Rated rotation speed	N_R	min^{-1}	2000	2000	2000	2000	2000	2000	2000
*Maximum rotation speed	N_{max}	min^{-1}	3500	3000	3500	3500	3500	3500	3000
*Rated torque	T_R	N・m	2.5	5	7.52	9.55	9.55	16.7	21.5
*Continuous stall torque	T_S	N・m	3	6	9	12	12	21.1	27.0
*Peak torque	T_P	N・m	7.1	15	20.3	30.5	31	55	70
*Rated current	I_R	Arms	4.6	7	8.7	13.1	14.6	22.6	23.8
*Continuous stall current	I_S	Arms	5.2	8.3	10.2	16.3	18.1	28	29
*Peak current	I_P	Arms	15	23.7	26.5	48	55	80	81
Torque constant	K_T	N・m/Arms	0.607	0.803	0.981	0.822	0.809	0.840	1.04
Voltage constant for each phase	$K_{E\Phi}$	mV/min^{-1}	21.2	28.0	34.2	28.7	28.3	29.3	36.4
Phase resistance	R_Φ	Ω	0.636	0.373	0.235	0.154	0.101	0.045	0.0517
*Rated power rate	Q_R	kW/s	22.3	46.3	71.2	77.5	46.8	73.7	84.0
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	2.8	5.4	7.94	11.76	19.5	37.89	54.99
Aluminium plate		mm	t20×305	t20×400	t20×400	t20×470	t20×470	t20×470	t20×470

10 Specifications

Specifications for 200V

Servo Motor model Q2AA			18550R	22250H	22350H	22450R	22550B	22700S	
Servo Amplifier model QS1☐			15*	10*	15*	15*	15*	15*	
*Rated output	P_R	kW	5.5	2.5	3.5	4.5	5.5	7	
*Rated rotation speed	N_R	min^{-1}	1500	2000	2000	2000	1500	1000	
*Maximum rotation speed	N_{max}	min^{-1}	2500	3500	3000	2500	2000	1000	
*Rated torque	T_R	N・m	35	12	17	21.5	35	67	
*Continuous stall torque	T_S	N・m	37.3	13.5	22	32	42	70	
*Peak torque	T_P	N・m	88	30	50	70	90	150	
*Rated current	I_R	Arms	32.2	19.6	23.3	23	30	34	
*Continuous stall current	I_S	Arms	33.7	21.8	29.8	33	35.1	34	
*Peak current	I_P	Arms	83	55	78	83	79.7	83	
Torque constant	K_T	N・m/Arms ±10%	1.24	0.685	0.814	1.06	1.32	2.13	
Voltage constant for each phase	$K_{E\phi}$	mV/min^{-1} ±10%	43.2	23.9	28.4	37.1	46.0	74.5	
Phase resistance	R_ϕ	Ω	0.039	0.0735	0.0559	0.0497	0.0464	0.057	
*Rated power rate	Q_R	kW/s	178	44.7	61.1	68.5	128.5	275.4	
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	69	32.2	47.33	67.45	95.3	163	
Aluminium plate		mm	t20×540	t20×470	t20×470	t20×470	t20×540	t20×540	

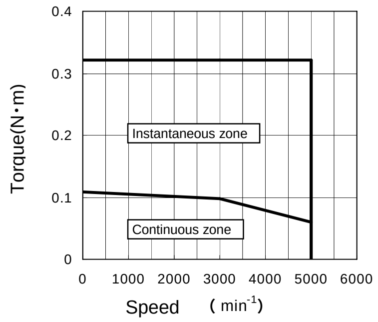
Specifications for 100V

Servo Motor model Q2EA			04006D	04010D	05005D	05010D	05020D	07020D	
Servo Amplifier model QS1☐			01*	01*	01*	01*	03*	03*	
*Rated output	P_R	kW	0.06	0.1	0.05	0.1	0.2	0.2	
*Rated rotation speed	N_R	min^{-1}	3000	3000	3000	3000	3000	3000	
*Maximum rotation speed	N_{max}	min^{-1}	5000	5000	5000	5000	5000	5000	
*Rated torque	T_R	N・m	0.191	0.318	0.159	0.318	0.637	0.637	
*Continuous stall torque	T_S	N・m	0.216	0.353	0.167	0.353	0.686	0.686	
*Peak torque	T_P	N・m	0.65	1	0.518	1.03	2.1	2.1	
*Rated current	I_R	Arms	1.9	2.0	1.5	2.1	3.9	4.4	
*Continuous stall current	I_S	Arms	1.9	2.2	1.5	2.3	4.1	4.6	
*Peak current	I_P	Arms	7.9	7	5.6	7.9	15.5	15.5	
Torque constant	K_T	N・m/Arms	0.117	0.188	0.121	0.169	0.184	0.162	
Voltage constant for each phase	$K_{E\phi}$	mV/min^{-1}	4.09	6.55	4.23	5.9	6.41	5.67	
Phase resistance	R_ϕ	Ω	1.57	2.00	1.84	1.22	0.595	0.504	
*Rated power rate	Q_R	kW/s	6.40	11.8	3.8	7.8	16.2	10.6	
Inertia (Including Wiring INC)	J_M	kg・m^2(GD^2/4) ×10-4	0.057	0.086	0.067	0.13	0.25	0.382	
Aluminium plate		mm	t6×305	t6×305	t6×305	t6×305	t6×305	t6×305	

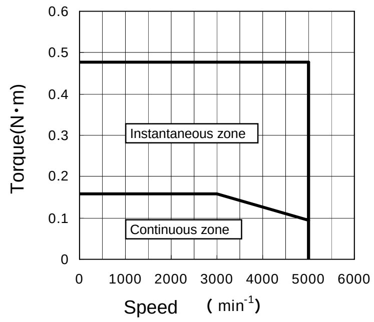
10 Specifications

Q1AA Motor speed-torque characteristics indicate the values in combination with an amplifier 3 phase when amplifier power supply is AC200V. Instant domain decreases when amplifier power supply is below 200V.

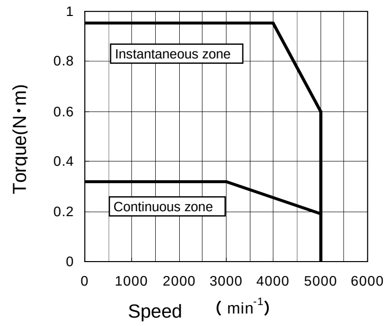
Speed – torque characteristics
Q1AA04003D (30W)



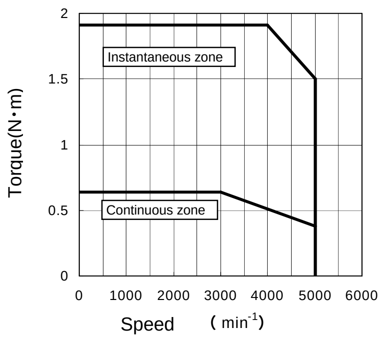
Speed – torque characteristics
Q1AA04005D (50W)



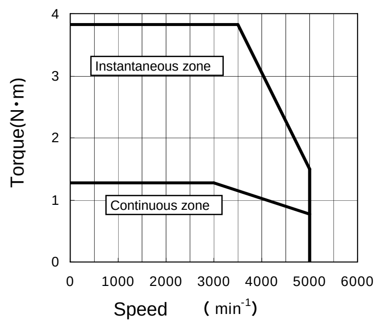
Speed – torque characteristics
Q1AA04010D (100W)



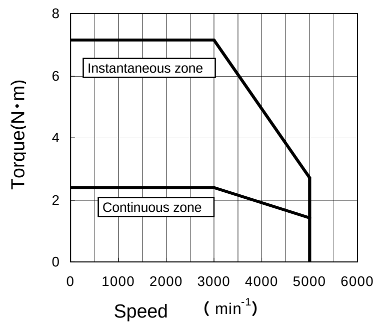
Speed – torque characteristics
Q1AA06020D (200W)



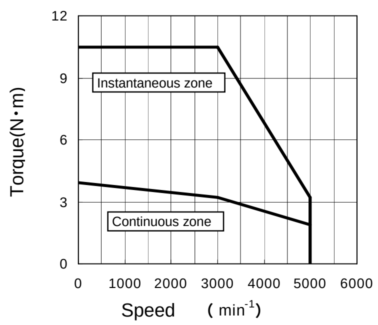
Speed– torque characteristics
Q1AA06040D (400W)



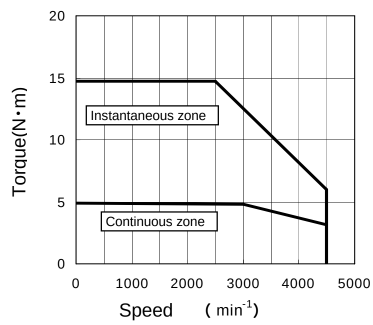
Speed– torque characteristics
Q1AA07075D (750W)



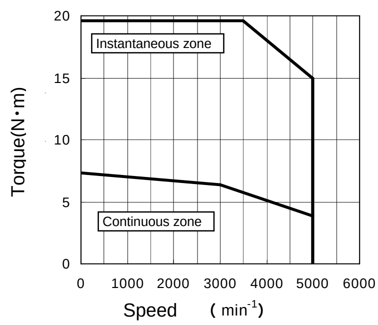
Speed – torque characteristics
Q1AA10100D (1kW)



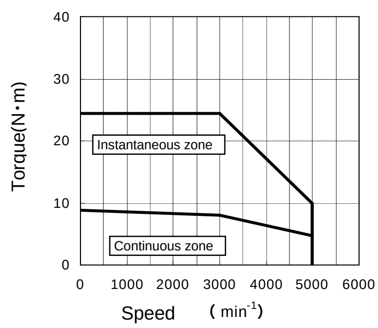
Speed – torque characteristics
Q1AA10150D (1.5kW)



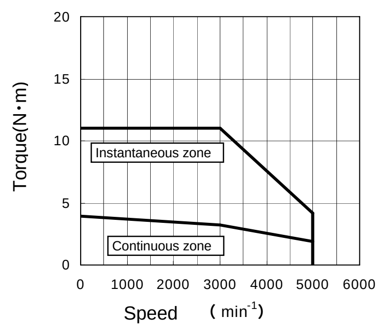
Speed – torque characteristics
Q1AA10200D (2kW)



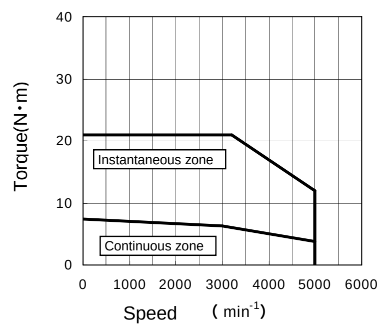
Speed – torque characteristics
Q1AA10250D (2.5kW)



Speed – torque characteristics
Q1AA12100D (1kW)



Speed – torque characteristics
Q1AA12200D (2kW)

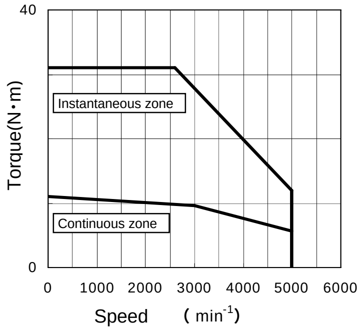


10 Specifications

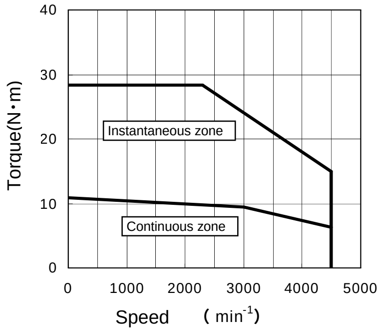
Q1AA Motor speed-torque characteristics indicate the values in combination with operation amplifier for 3 phase when amplifier power supply is AC200V. Instant domain decreases when amplifier power supply is below 200V.

Q1EA Motor speed-torque characteristics indicate the values in combination with operation amplifier for single phase when amplifier power supply is AC100V. Instant domain decreases when amplifier power supply is below 100V.

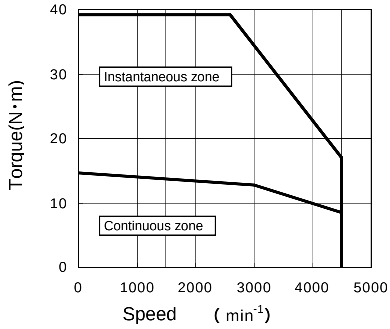
Speed – torque characteristics
Q1AA12300D (3kW)



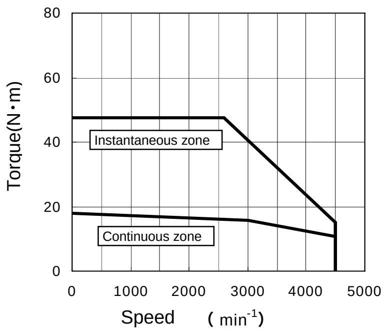
Speed – torque characteristics
Q1AA13300D (3kW)



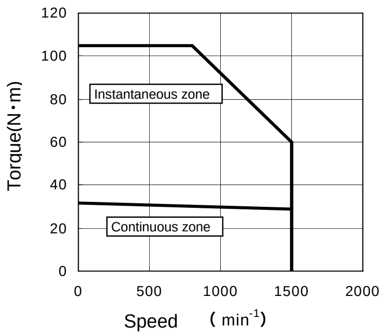
Speed – torque characteristics
Q1AA13400D (4kW)



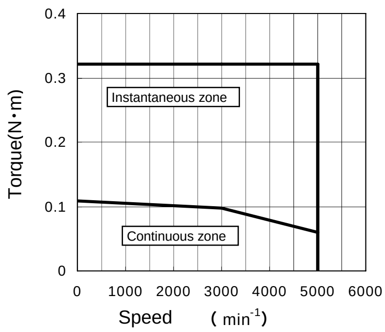
Speed – torque characteristics
Q1AA13500D (5kW)



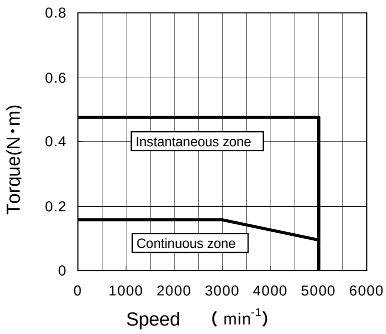
Speed – torque characteristics
Q1AA18450M (4.5kW)



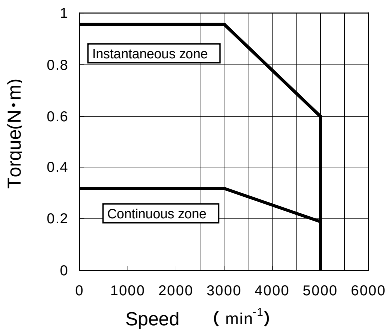
Speed – torque characteristics
Q1EA04003D (30W)



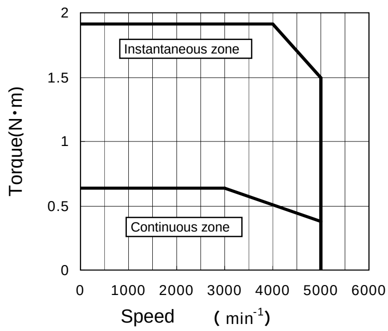
Speed – torque characteristics
Q1EA04005D (50W)



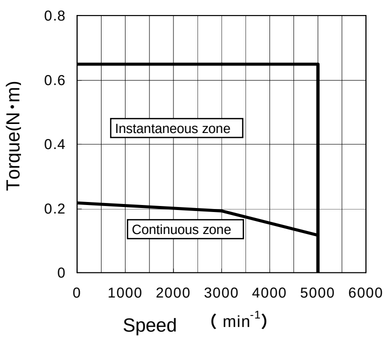
Speed – torque characteristics
Q1EA04010D (100W)



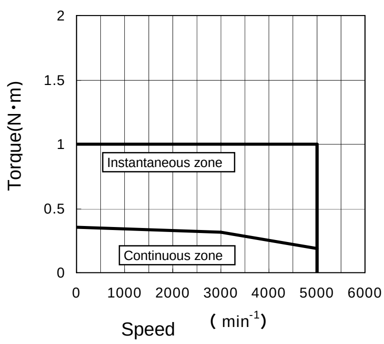
Speed – torque characteristics
Q1EA06020D (200W)



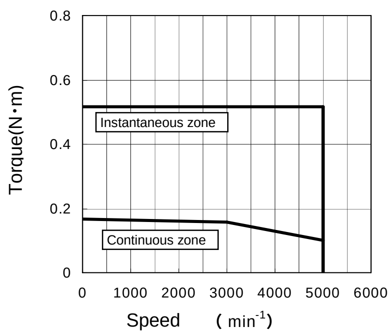
Speed – torque characteristics
Q2AA04006D (60W)



Speed – torque characteristics
Q2AA04010D (100W)



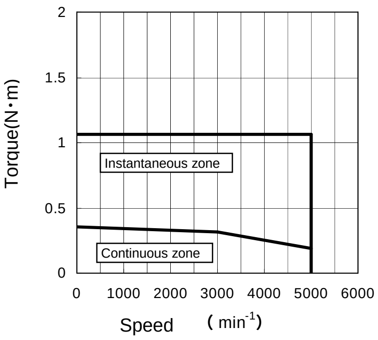
Speed – torque characteristics
Q2AA05005D (50W)



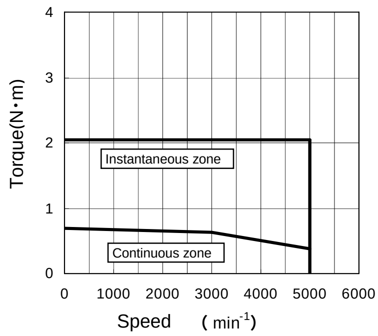
10 Specifications

Q2AA Motor speed-torque characteristics indicate the values in combination with operation amplifier for 3 phase when amplifier power supply is AC 200V. Instant domain decreases when amplifier power supply is below 200V.

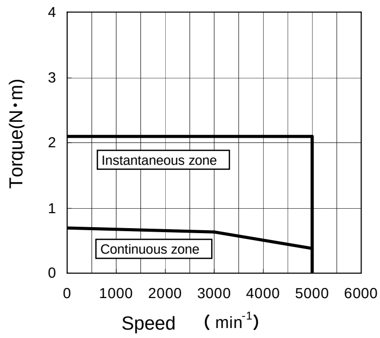
Speed – torque characteristics
Q2AA05010D (100W)



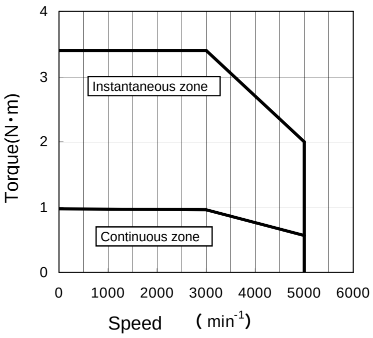
Speed – torque characteristics
Q2AA05020D (200W)



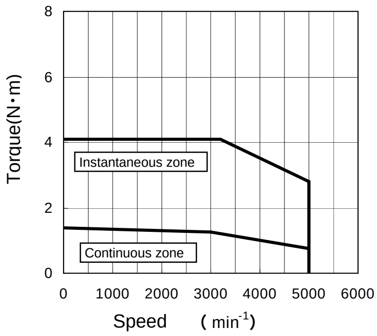
Speed – torque characteristics
Q2AA07020D (200W)



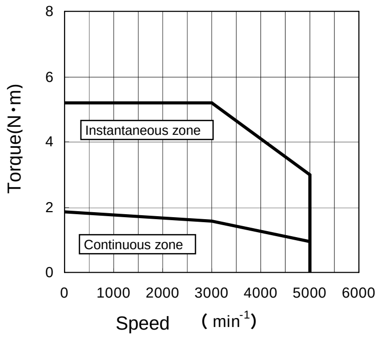
Speed – torque characteristics
Q2AA07030D (300W)



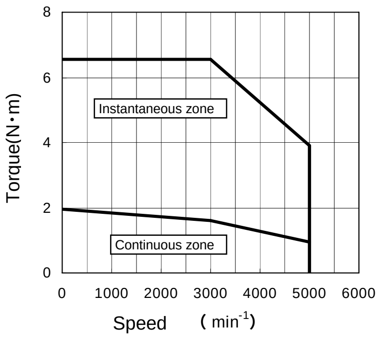
Speed – torque characteristics
Q2AA07040D (400W)



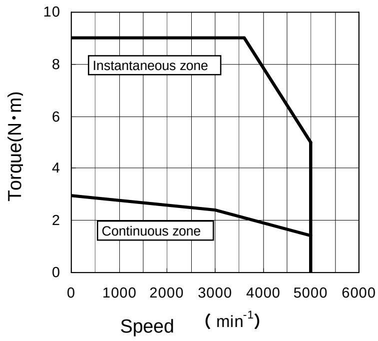
Speed – torque characteristics
Q2AA07050D (500W)



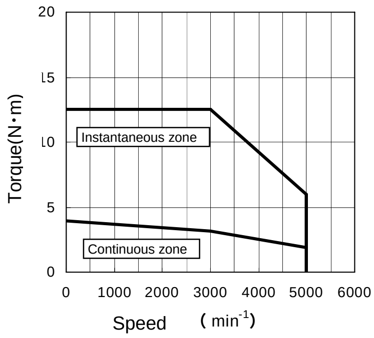
Speed – torque characteristics
Q2AA08050D (500W)



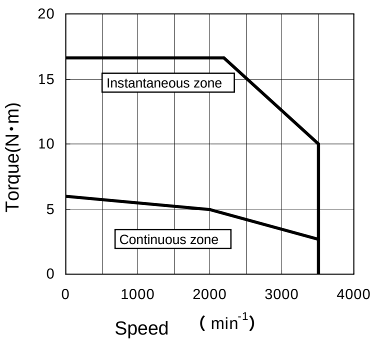
Speed – torque characteristics
Q2AA08075D (750W)



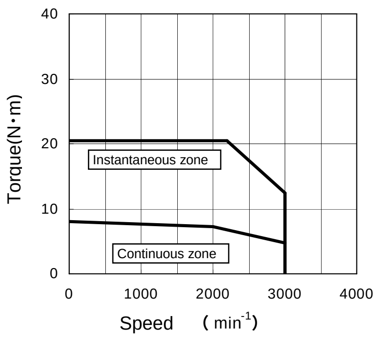
Speed – torque characteristics
Q2AA08100D (1kW)



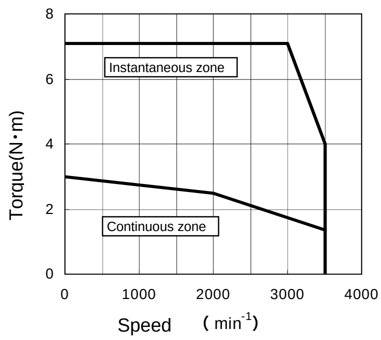
Speed – torque characteristics
Q2AA10100H (1kW)



Speed – torque characteristics
Q2AA10150H (1.5kW)



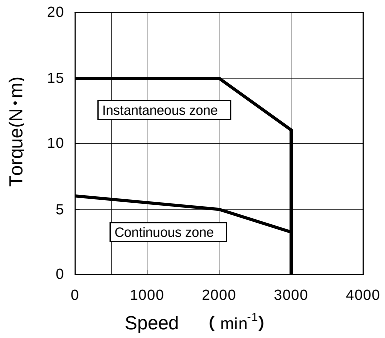
Speed – torque characteristics
Q2AA13050H (500W)



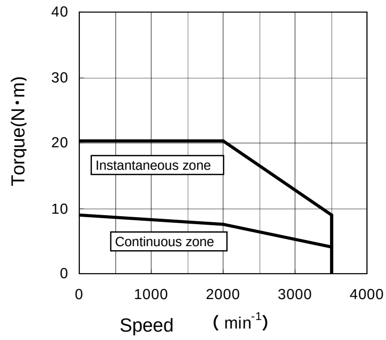
10 Specifications

Q2AA Motor speed-torque characteristics indicate the values in combination with an amplifier, with a power supply of AC 200V, 3 phases. When amplifier power supply is below 200V, the instantaneous zone decreases.

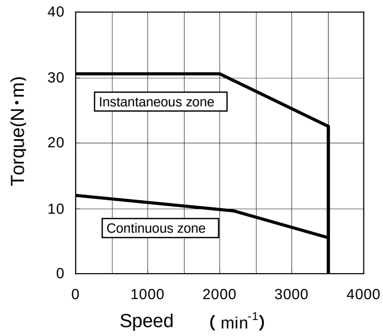
Speed – torque characteristics
Q2AA13100H (1kW)



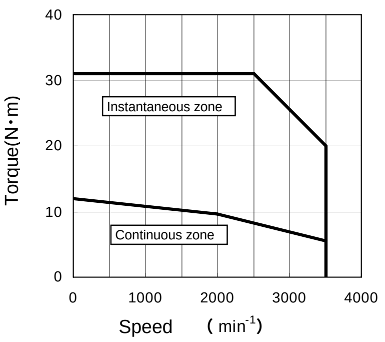
Speed – torque characteristics
Q2AA13150H (1.5kW)



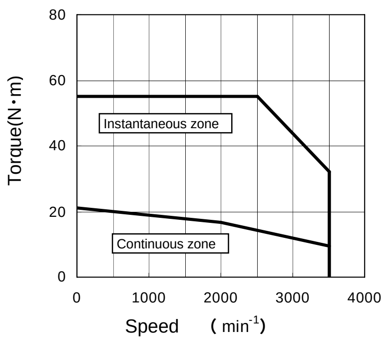
Speed – torque characteristics
Q2AA13200H (2kW)



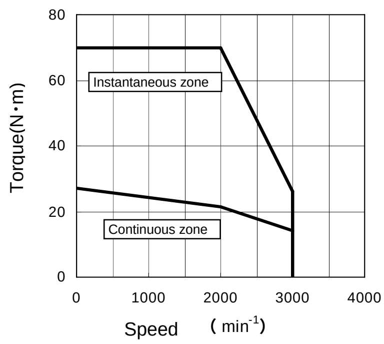
Speed – torque characteristics
Q2AA18200H (2kW)



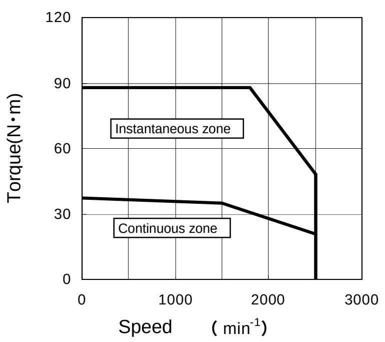
Speed – torque characteristics
Q2AA18350H (3.5kW)



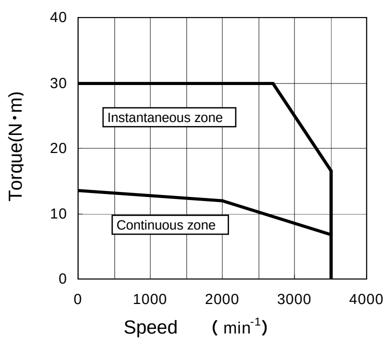
Speed – torque characteristics
Q2AA18450H (4.5kW)



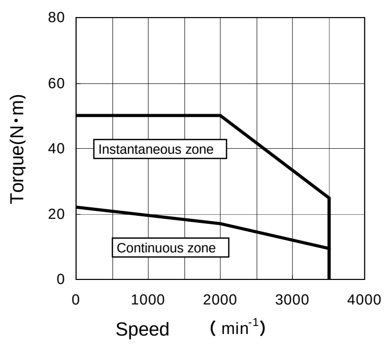
Speed – torque characteristics
Q2AA18550R (5.5kW)



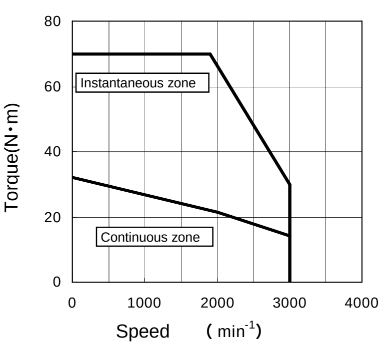
Speed – torque characteristics
Q2AA22250H (2.5kW)



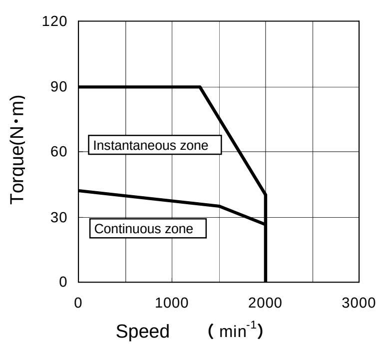
Speed – torque characteristics
Q2AA22350H (3.5kW)



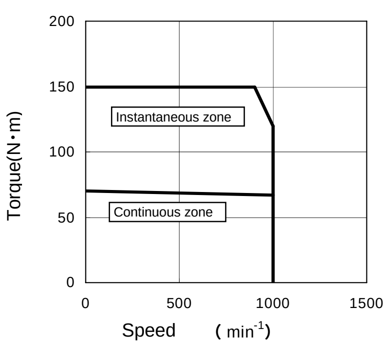
Speed – torque characteristics
Q2AA22450H (4.5kW)



Speed – torque characteristics
Q2AA22550B (5.5kW)



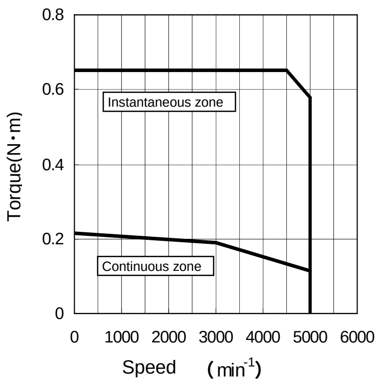
Speed – torque characteristics
Q2AA22700S (7kW)



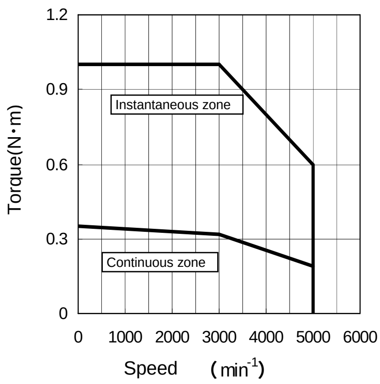
10 Specifications

The Q2EA motor speed-torque characteristics indicate the values in combination with an amplifier, when the amplifier power supply is AC100V, single phase. When amplifier power supply is below 100V, the instantaneous zone decreases.

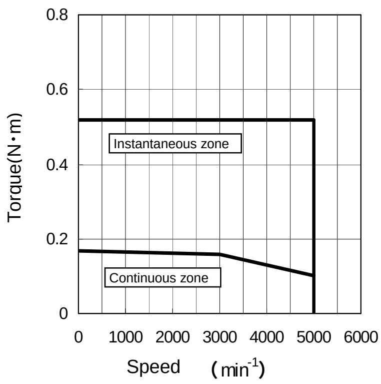
Speed – torque characteristics
Q2EA04006D (60W)



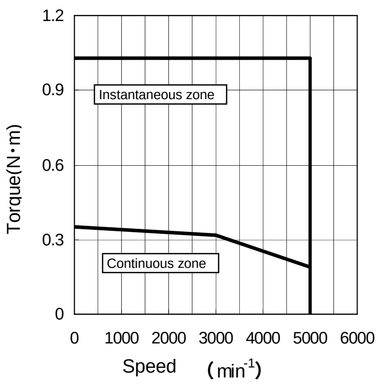
Speed – torque characteristics
Q2EA04010D (100W)



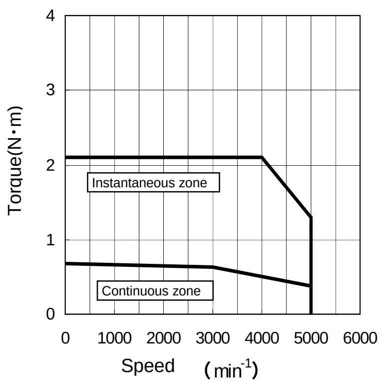
Speed – torque characteristics
Q2EA05005D (50W)



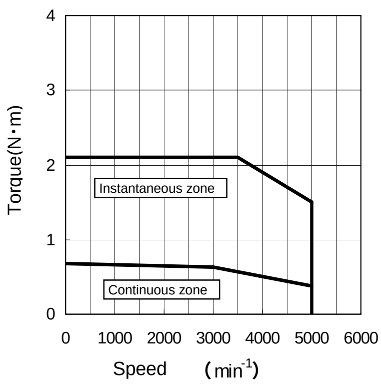
Speed – torque characteristics
Q2EA05010D (100W)



Speed – torque characteristics
Q2EA05020D (200W)



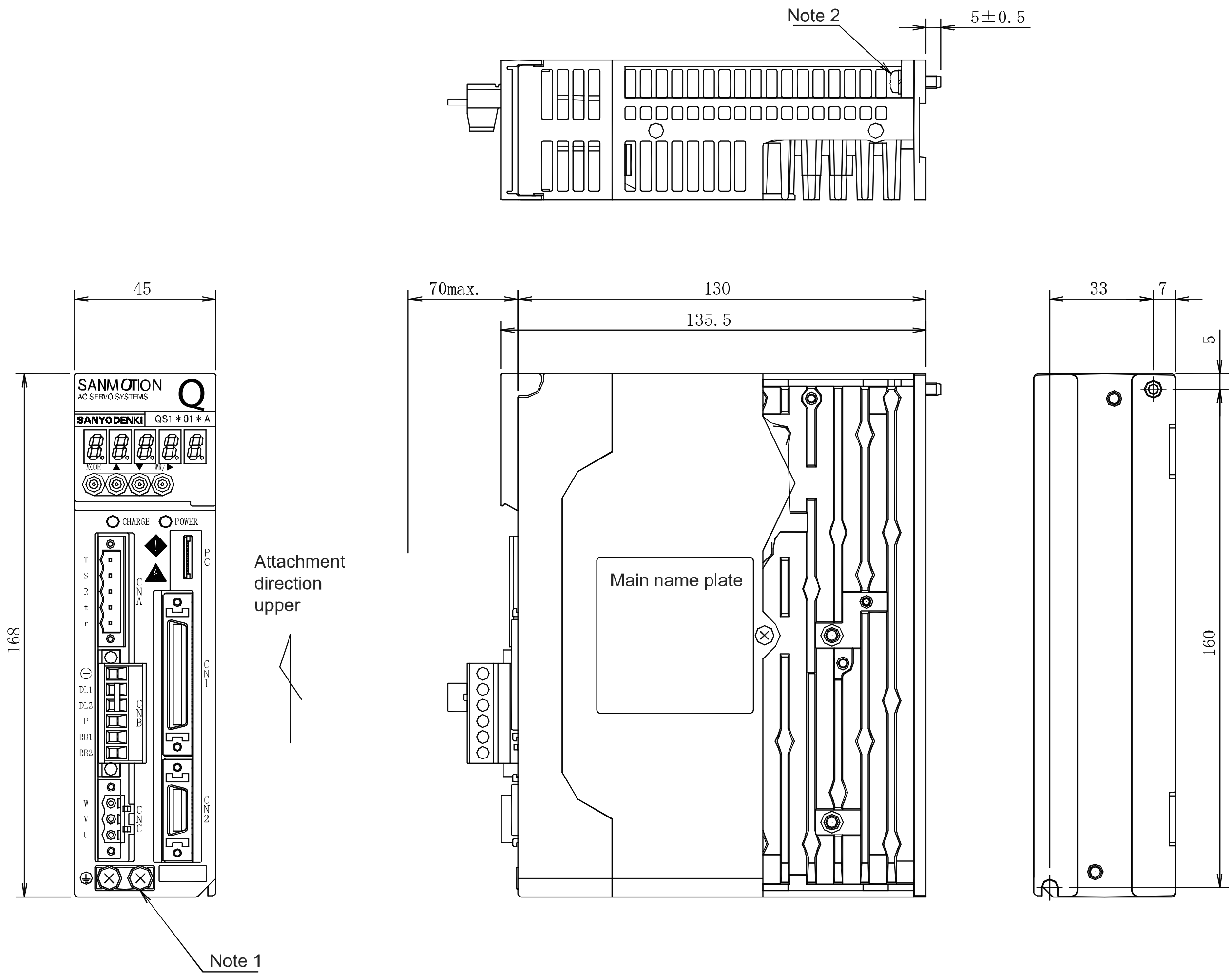
Speed – torque characteristics
Q2EA07020D (200W)



10.3 External appearance diagram

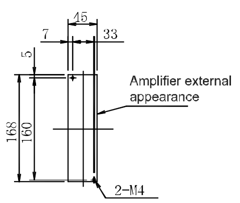
10.3.1 External appearance diagram of servo amplifier

Servo amplifier: QS1A01



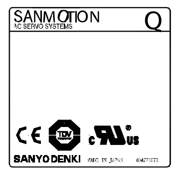
Note 1 Earthing terminal screw M4
Control torque 1.18N.m

Note 2 Attachment panel processing diagram



Upper part is fixed by the special screw attached.

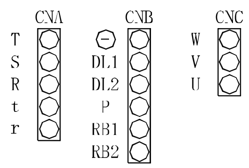
Note 3 Main name plate



Main name plate may change the design as per the standard acquisition

Note 4 Main Case Resin

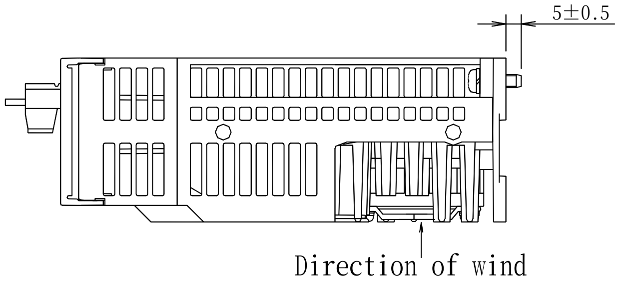
Terminal symbol arrangement (from top)

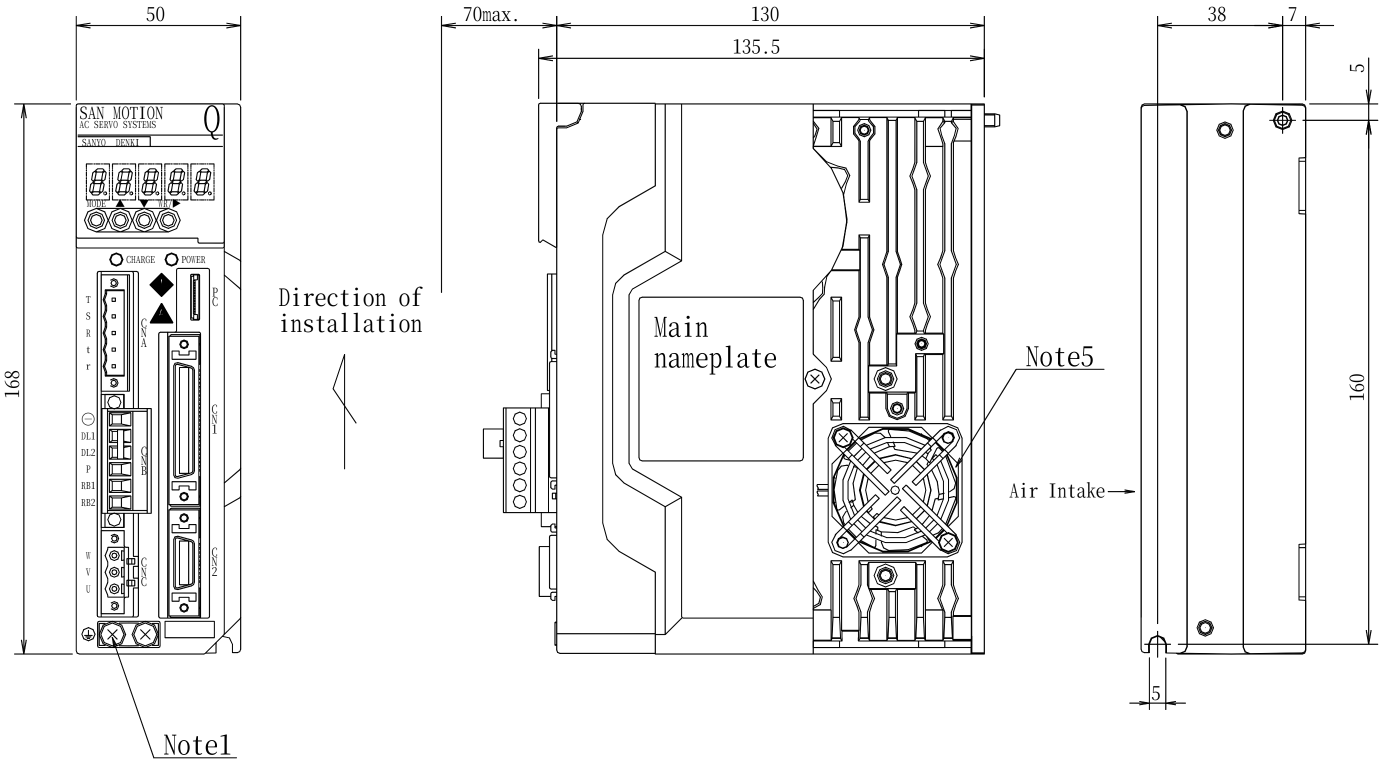


Weight: 1.25kg

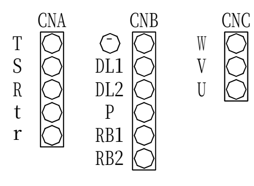
10 Specifications

Servo amplifier: QS1A03



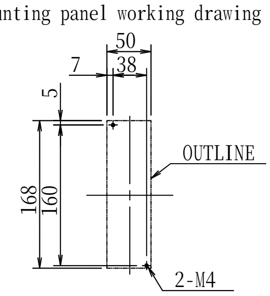


Terminal Layout



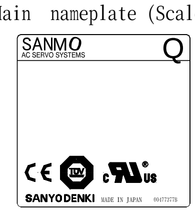
Note1: Earth Terminal screw M4
Tightening torque 1.18N.m

Note2: Mounting panel working drawing



Use the enclosed and specified screws for settling.

Note3: Main nameplate (Scale 1/1)



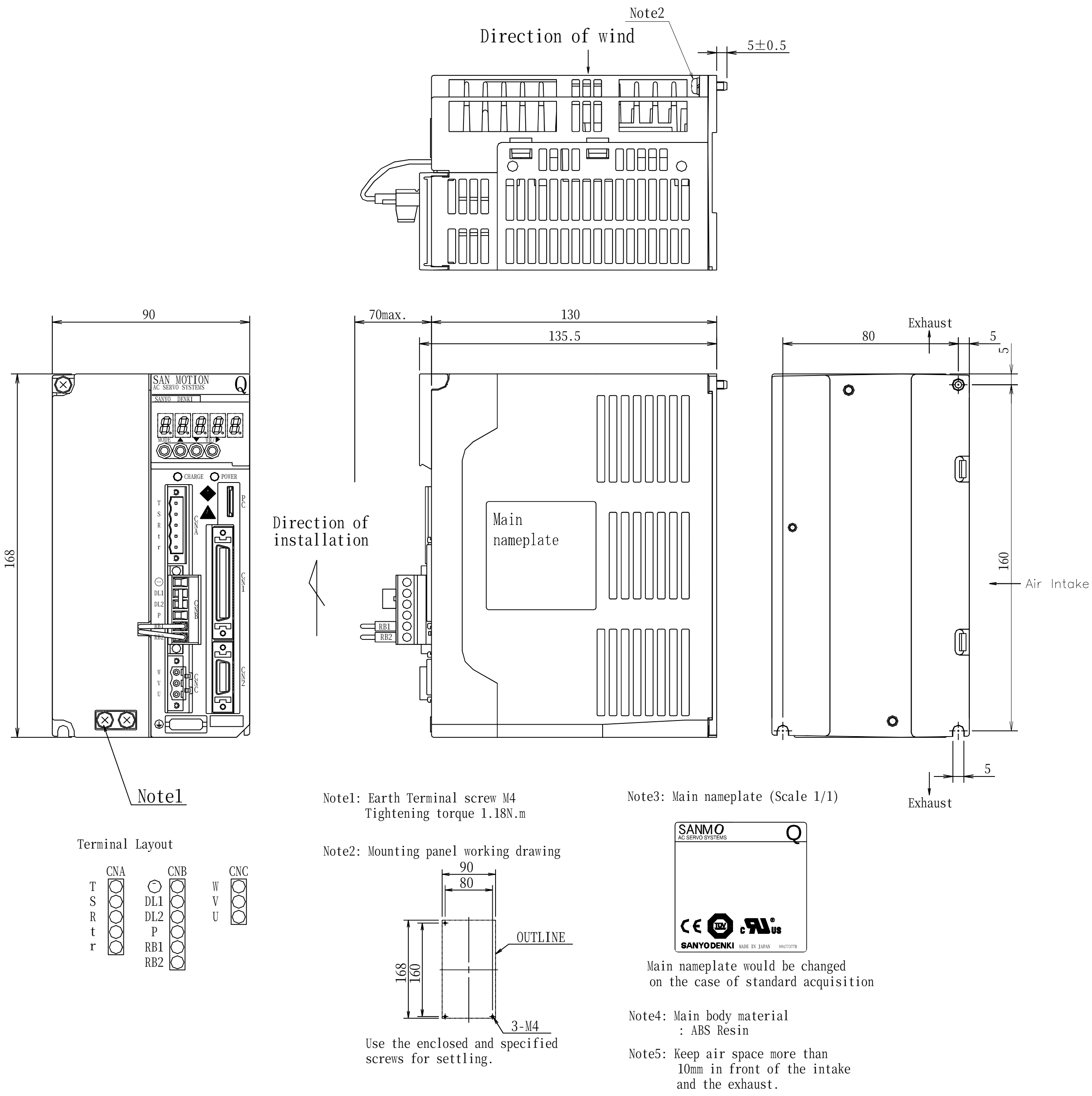
Main nameplate would be changed on the case of standard acquisition

Note4: Main body material
: ABS Resin

Note5: Keep air space more than 10mm in front of the intake and the exhaust.

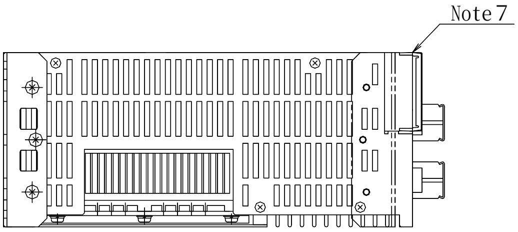
Weight : 1.3 kg

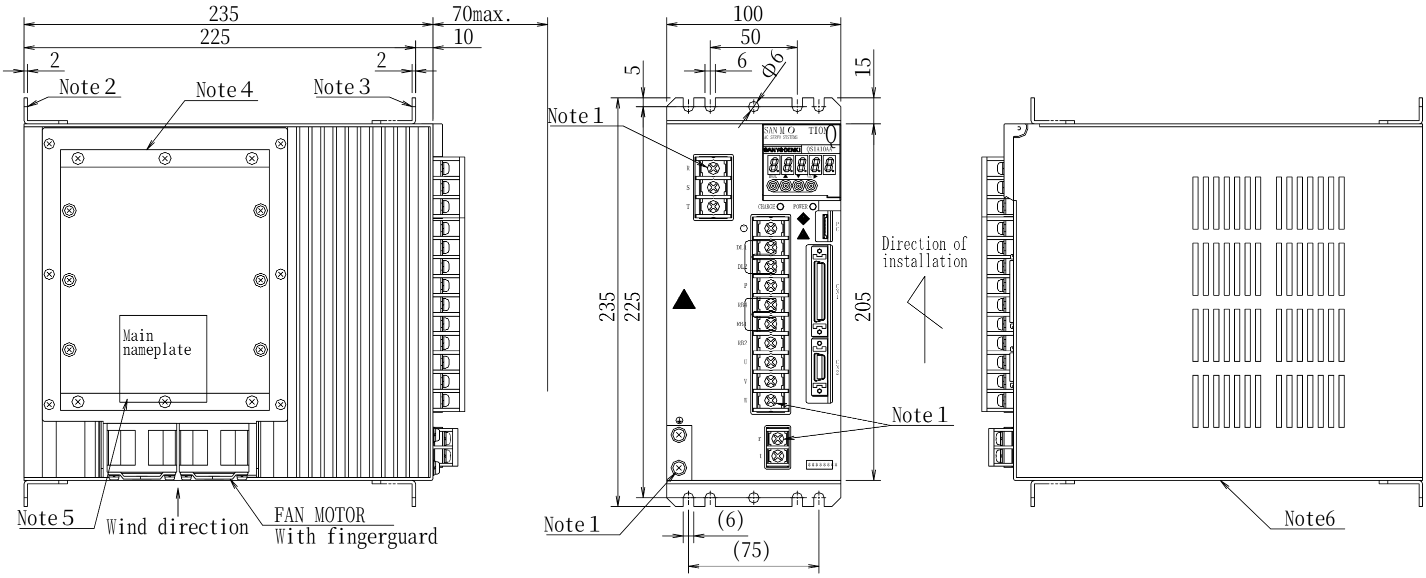
Servo amplifier: QS1A05

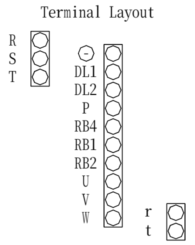


Weight : 2.2 kg

Servo amplifier: QS1A10

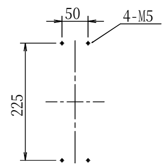




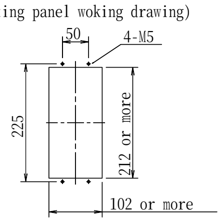


Note1, Terminal screw M4
Tightening torque 1.18N・m

Note2, Mounting panel working drawing
(in case of rear-side-mounting)

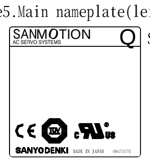


Note3, Mountable on the front side
(Mounting panel woking drawing)



Note4. Regenerative resistance

Note5.Main nameplate(left side)



Scale 1/1

Main nameplate would be changed
on the case of standard acquisition

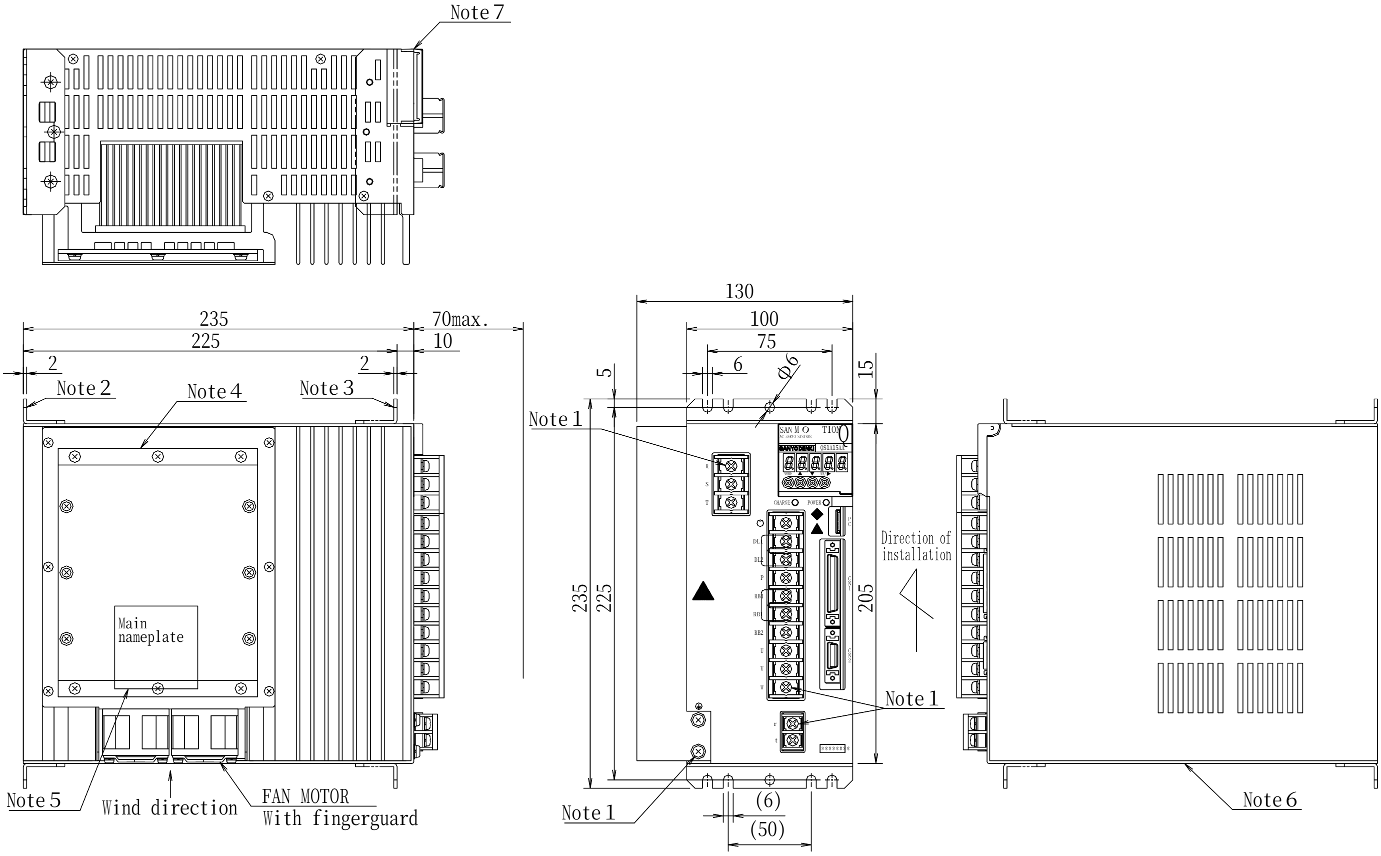
Note6. Main body material : SECC/coating

Note7. Caver material : ABS Resin

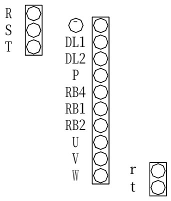
Weight : 5.5 kg

10 Specifications

Servo amplifier: QS1A15

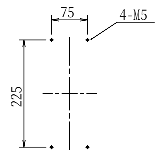


Terminal Layout

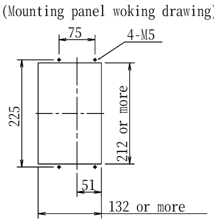


Note1, Terminal screw M4
Tightening torque 1.18N・m

Note2, Mounting panel working drawing
(in case of rear-side-mounting)

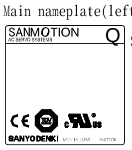


Note3, Mountable on the front side
(Mounting panel woking drawing)



Note4, Regenerative resistance

Note5, Main nameplate(left side)



Scale 1/1

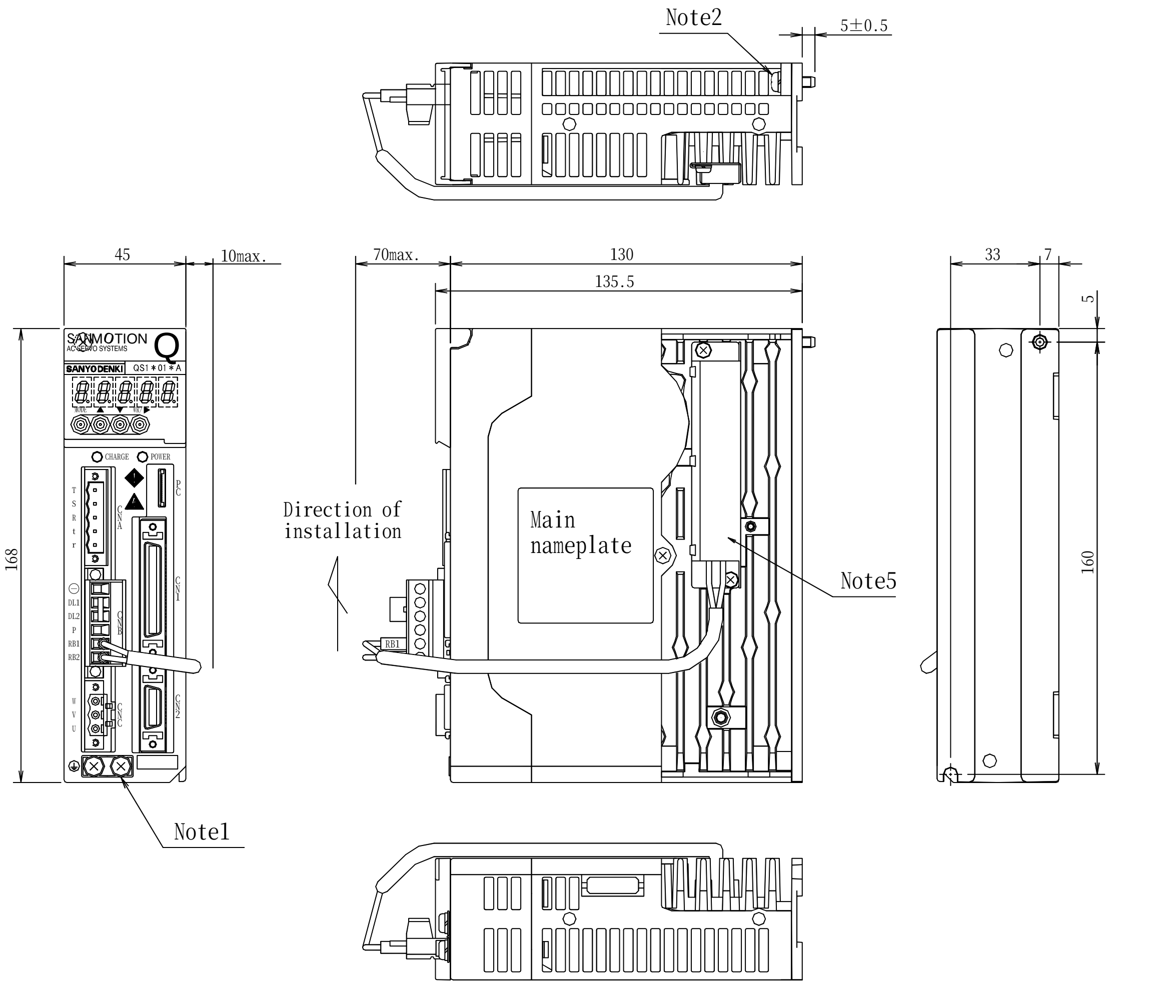
Main nameplate would be changed
on the case of standard acquisition

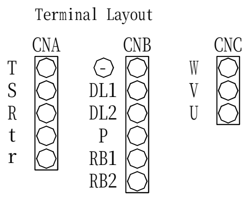
Note6, Main body material : SECC/coating

Note7, Caver material : ABS Resin

Weight : 6.8 kg

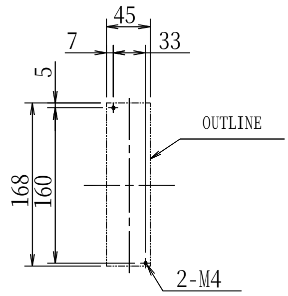
Servo amplifier: QS1L01





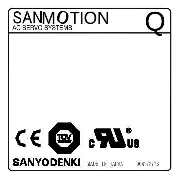
Note1: Earth Terminal screw M4
Tightening torque 1.18N.m

Note2: Mounting panel working drawing



Use the enclosed and specified screws for settling.

Note3: Main nameplate (Scale 1/1)



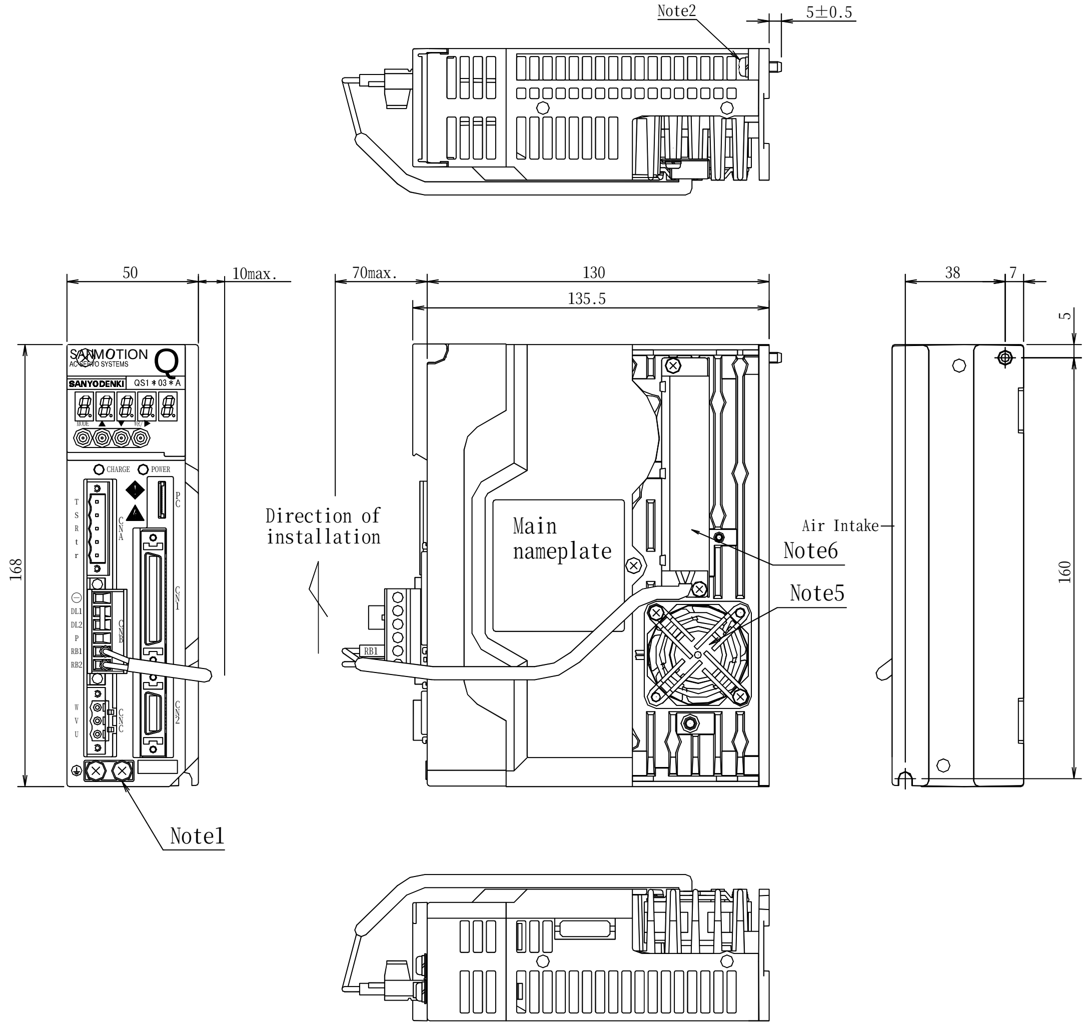
Main nameplate would be changed on the case of standard acquisition

Note4: Main body material
: ABS Resin

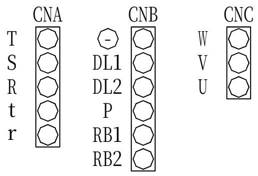
Note5: Regenerative resistor

Weight : 1.25 kg

Servo amplifier: QS1L03

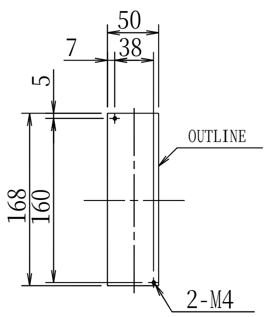


Terminal Layout



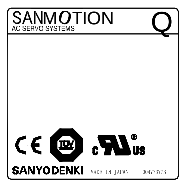
Note1: Earth Terminal screw M4
Tightening torque 1.18N.m

Note2: Mounting panel working drawing



Use the enclosed and specified screws for settling.

Note3: Main nameplate (Scale 1/1)



Main nameplate would be changed on the case of standard acquisition

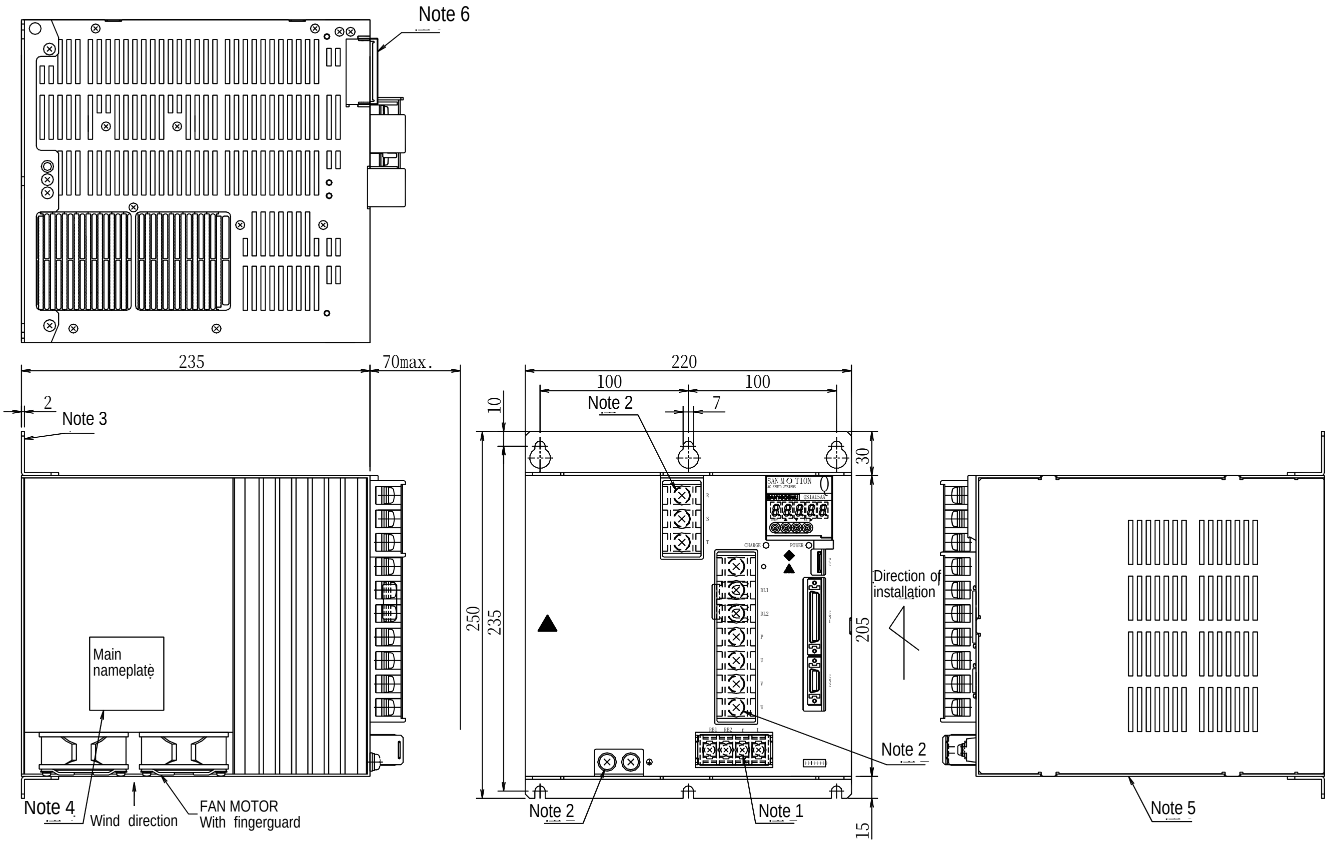
Note4: Main body material
: ABS Resin

Note5: Regenerative resistor

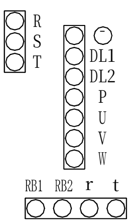
Weight : 1.3 kg

10. Specifications

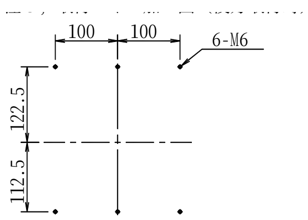
Servo amplifier：QS1A30



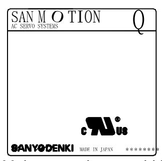
Terminal Layout



Note 1, Terminal screw M4
Tightening torque 1.37Nm
Note 2, Terminal screw M6
Tightening torque 3.73Nm
Note3, Mounting panel working drawing
(in case of rear-side-mounting)



Note 4, Main nameplate(left side)
Scale 1/1



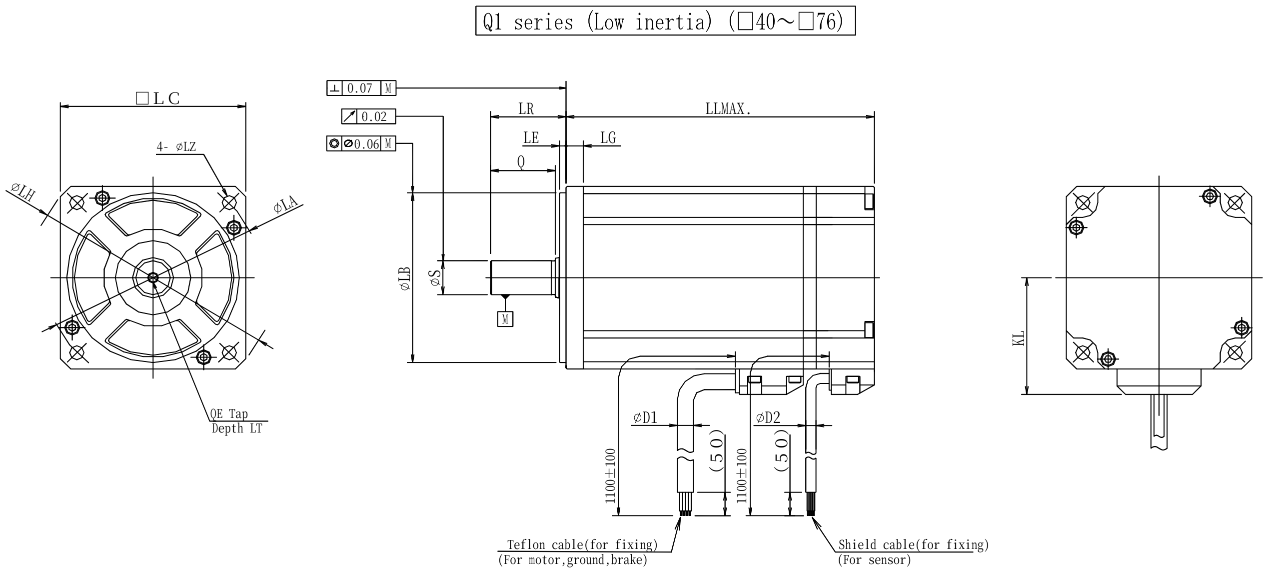
Main nameplate would be changed
On the case of standard acquisition

Note 5, Main body material: SECC/coating
Note 6, Caver material: ABS Resin

Weight: 10 Kg

10.3.2 External appearance diagram of Servo motor

Servo motor external appearance diagram

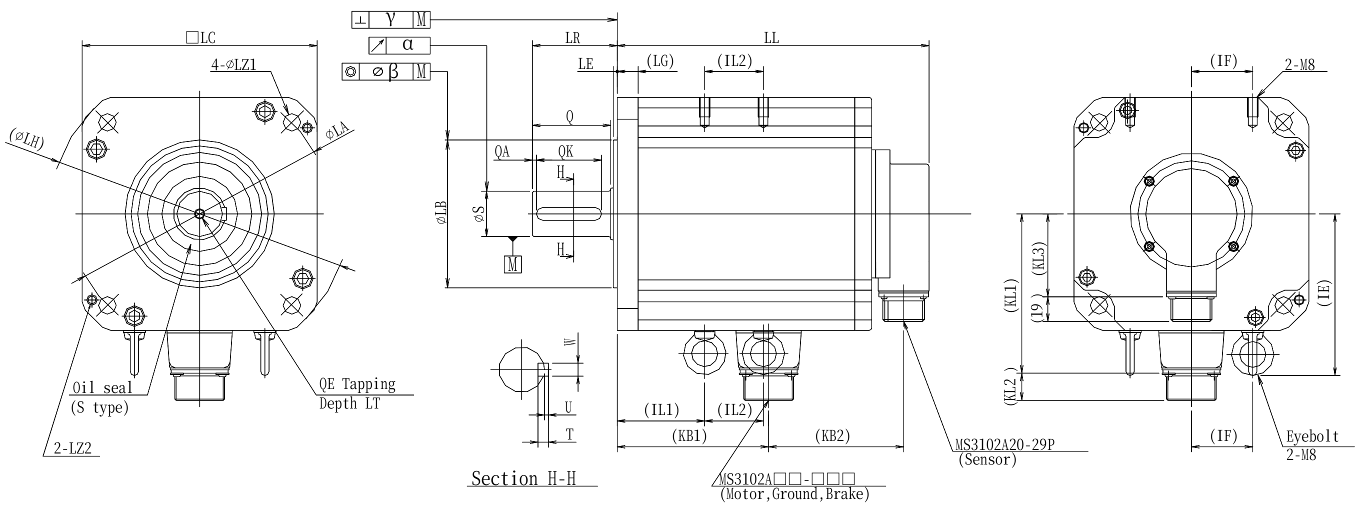


MODEL	LL (Incremental, Without B)	LL (Incremental, With B)	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2 (Incre-mental)	Oil seal
Q1AA04003△□◇	76	118.5										0 6-0.008		–	–			
Q1AA04005△□◇	83	125.5	5	30	46	0 30-0.021	2.5	54	40	4.5	25	0 8-0.009	–	–	–	7	4.7	
Q1AA04010△□◇	102	144.5																Option
Q1AA06020△□◇	113	142	6	41	70	0 50-0.025	3	81	60	5.5	30	0 14-0.011						
Q1AA06040△□◇	142	171												M5	12	7.5		
Q1AA07075△□◇	156	179.5	8	50	90	0 70-0.030	3	100	76	5.5	40	0 16-0.011	35					

Servo motor external appearance diagram

Q1 Series

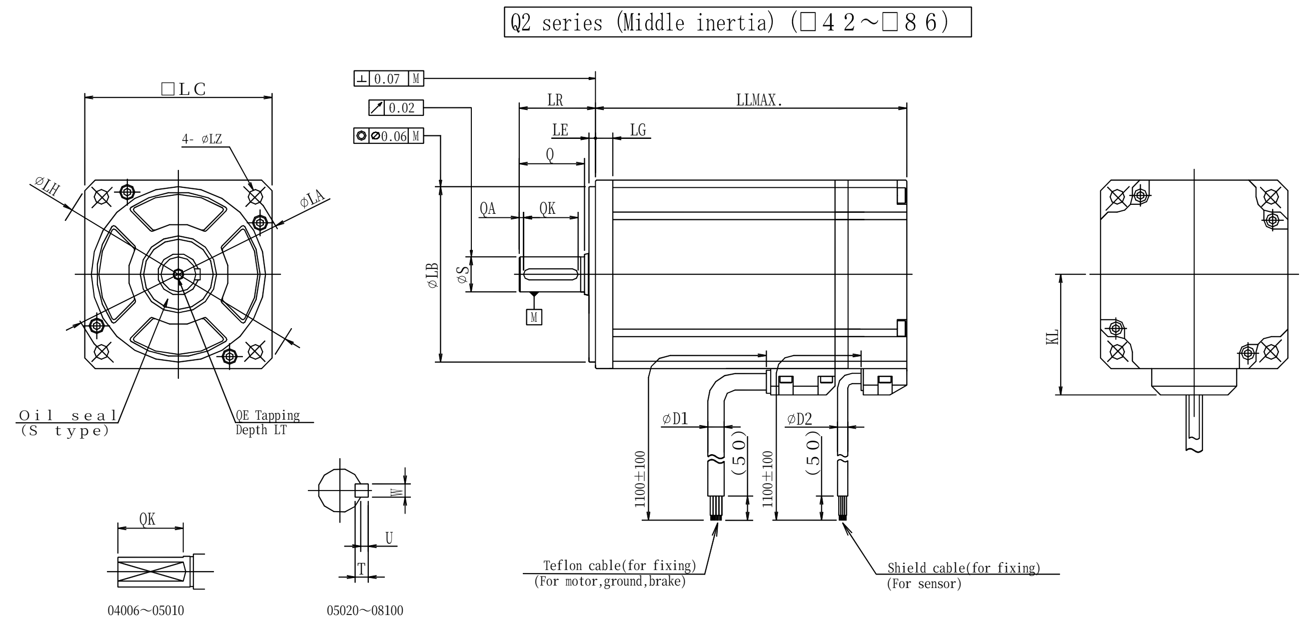
Q1 series (Low inertia) (□100～□180)



	Incremental w/ Brake		Incremental w/o Brake		Connector										
MODEL	LL	KB2	LL	KB2	MS3102A (Applicable products)	LG	KL1	KL2	KL3	LA	LB	LE	LH	LC	LZ1
Q1AA10100△□◇	184	80	221	117	20-15P	10	78	19	63	115	$95^{0}_{-0.035}$	3	130	100	9
Q1AA10150△□◇	209		246												
Q1AA10200△□◇	234		271												
Q1AA10250△□◇	259		296												
Q1AA12100△□◇	168	71	204	108	24-11P	12	93	21	67	135/145	$110^{0}_{-0.035}$	3	162	120	9
Q1AA12200△□◇	205		241												
Q1AA12300△□◇	242		278												
Q1AA13300△□◇	205	67	249	102	24-11P	12	98	21	80	145	$110^{0}_{-0.035}$	4	165	130	9
Q1AA13400△□◇	232		281	117											
Q1AA13500△□◇	269		318												
Q1AA18450△□◇	288	68	322	103	24-11P	16	123	21	80	200	$114.3^{0}_{-0.035}$	3	230	180	13.5

MODEL	LZ2	LR	S	Q	QA	QK	W	T	U	KB1	α	β	γ	QE	LT	IE	IF	IL1	IL2
Q1AA10100△□◇	–	45	$22^{0}_{-0.013}$	40	3	32	$6^{0}_{-0.030}$	6	2.5	84	0.02	0.08	0.08	M6	20	—	—	—	—
Q1AA10150△□◇										109									
Q1AA10200△□◇										134									
Q1AA10250△□◇										159									
Q1AA12100△□◇	–	45	$22^{0}_{-0.013}$	40	3	32	$6^{0}_{-0.030}$	6	2.5	76	0.02	0.08	0.08	M6	20	—	—	—	—
Q1AA12200△□◇										113									
Q1AA12300△□◇			$28^{0}_{-0.013}$	50	3	42	$8^{0}_{-0.036}$	7	3	150				M8	25				
Q1AA13300△□◇	M6	55	$28^{0}_{-0.013}$	50	3	42	8-0.036	7	3	117	0.02	0.08	0.08	M8	25	—	—	—	—
Q1AA13400△□◇										144									
Q1AA13500△□◇										181									
Q1AA18450△□◇	M8	65	$35^{0}_{-0.016}$	60	3	50	$10^{0}_{-0.036}$	8	3	200	0.02	0.08	0.08	M8	25	124	50	93	50

Servo motor external appearance diagram

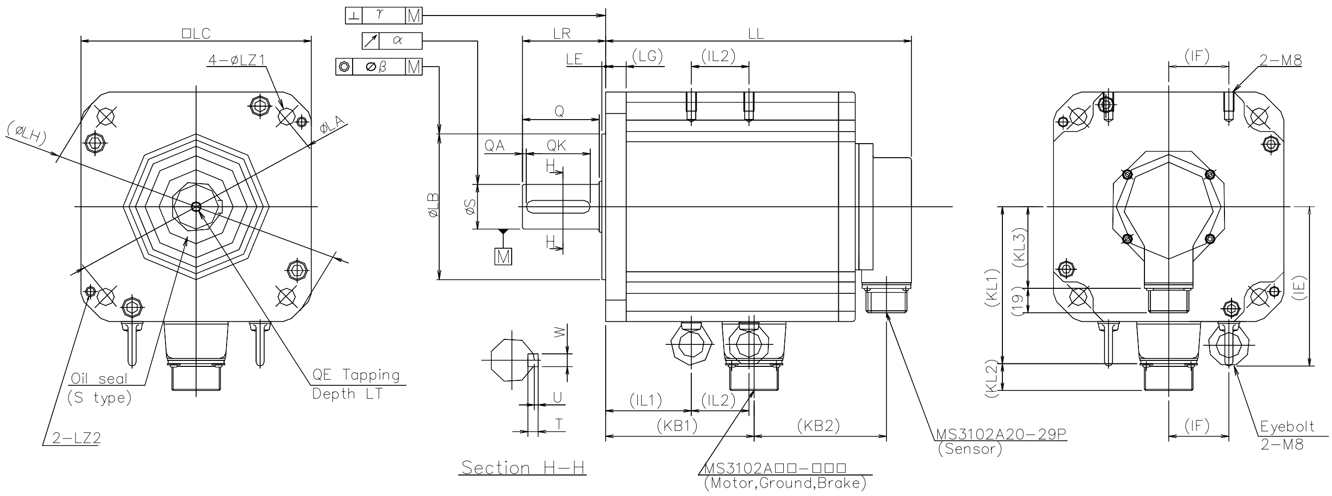


MODEL	LL (Incremental w/ B)	LL (Incremental w/o B)	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	D1	D2 (Incremental)	Oil Seal
Q2AA04006△□◇	82	114	5	31	48	$34^{0}_{-0.025}$	2	57	42	3.5	24	$7^{0}_{-0.009}$	20	–	15	2 Suriwari 6.5±0.2			–	–	7	4.7	Optýon
Q2AA04010△□◇	96	128																					
Q2AA05005△□◇	81	110	5	38	60	$50^{0}_{-0.025}$	2.5	71.5	54	4.5	24	$8^{0}_{-0.009}$	20	–	15	2 Suriwari 7.5±0.2			M3	8	7.5		Attached
Q2AA05010△□◇	89	117																					
Q2AA05020△□◇	105	133									30	$11^{0}_{-0.011}$	25	2	20	4	4	1.5	M4	10			
Q2AA07020△□◇	98	123	8	50	90	$70^{0}_{-0.030}$	3	100	76	5.5	30	$14^{0}_{-0.011}$	25	2	20	5	5	2	M5	12			
Q2AA07030△□◇	105	130																					
Q2AA07040△□◇	112	137																					
Q2AA07050△□◇	120	145																					
Q2AA08050△□◇	130	166	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			
Q2AA08075△□◇	147	183																					
Q2AA08100△□◇	166	201																					

Servo motor external appearance diagram

Q2 Series

Q2 series (Low inertia) (□100~□220)



	Incremental								Connector							
	w/o Brake				w/ Brake											
MODEL	LL	KB1	KB2	IL2	LL	KB1	KB2	IL2	MS3102A (Applicable Products)	LG	KL1	KL2	KL3	LA	LB	LE
Q2AA10100△□◇	196	98	77	−	231	98	113	−	20−15P	10	78	19	67	115	$95^{0}_{-0.035}$	3
Q2AA10150△□◇	226	128			261	128										
Q2AA13050△□◇	135	47	67	—	171	47	103	—	24−11P	12	98	21	78	145	$110^{0}_{-0.035}$	4
Q2AA13100△□◇	152	64			188	64										
Q2AA13150△□◇	169	81			205	81										
Q2AA13200△□◇	186	98			227	99	107									
Q2AA18200△□◇	171	83	68	—	207	83	104	—	24−11P	16	123	21	78	200	$114.3^{0}_{-0.035}$	3
Q2AA18350△□◇	203	115		20	238	115		20								
Q2AA18450△□◇	218	130		35	254	130		35								
Q2AA18550△□◇	282	189	72	50	325	189	115	50		19						
Q2AA22250△□◇	167	64	82	10	195	64	93	10	24−11P	16	141	21	78	235	$200^{0}_{-0.046}$	4
Q2AA22350△□◇	180	77		20	208	77		20								
Q2AA22450△□◇	198	95		40	226	95		40								
Q2AA22550△□◇	251	149		90	309	149	140	50		19						
Q2AA22700△□◇	310	207		110	368	207		110								

MODEL	LH	LC	LZ1	LZ2	LR	S	Q	QA	QK	W	T	U	α	β	γ	QE	LT	IE	IF	IL1
Q2AA10100△□◇	130	100	9	−	45	$22^{0}_{-0.013}$	40	3	32	$6^{0}_{-0.030}$	6	2.5	0.02	0.08	0.08	M6	20	—	—	—
Q2AA10150△□◇																				
Q2AA13050△□◇	165	130	9	M6	55	$22^{0}_{-0.013}$	50	3	42	$6^{0}_{-0.030}$	6	2.5	0.02	0.08	0.08	M6	20	—	—	—
Q2AA13100△□◇																				
Q2AA13150△□◇																				
Q2AA13200△□◇						$28^{0}_{-0.013}$				$8^{0}_{-0.036}$	7	3				M8	25			
Q2AA18200△□◇	230	180	13.5	M8	65	$35^{0}_{-0.016}$	60	3	50	$10^{0}_{-0.036}$	8	3	0.02	0.08	0.08	M8	25	124	50	—
Q2AA18350△□◇																				61
Q2AA18450△□◇																				
Q2AA18550△□◇				M10	79	$42^{0}_{-0.016}$	75		67	$12^{0}_{-0.043}$						M10	25			85
Q2AA22250△□◇	270	220	13.5		65	$35^{0}_{-0.016}$	60	3	50	$10^{0}_{-0.036}$	8	3	0.02	0.08	0.08	M8	25	142	54	50
Q2AA22350△□◇																				
Q2AA22450△□◇																				
Q2AA22550△□◇					79	$55^{0}_{-0.019}$	75	3	67	$16^{0}_{-0.043}$	10	4			0.10	M10	25			
Q2AA22700△□◇																				

10.4 Option

The following optional peripheral equipment is available for the Q series servo amplifier.

- Input/Output connector
  Plug and housing for the input/output connector
  (Standard sizes are listed for this optional equipment)

Connector list for QS1A, L, M, B (AC200V Input type)

Application	Model number	Contents	Manufacturer	Manufacturer's model number
Single connector	AL-00385594	CN1 Plug and housing	Sumitomo 3M Ltd.	10150-3000VE 10350-52A0-008
	AL-00385596	CN2 Plug and housing	Sumitomo 3M Ltd.	10120-3000VE 10320-52A0-008
	AL-00329461-01	CNA plug	Phoenix Contact Co. Ltd.	MSTB2.5/5-STF-5.08
	AL-Y0000988-01	CNB plug	Phoenix Contact Co. Ltd.	IC2.5/6-STF-5.08
	AL-00329458-01	CNC plug	Phoenix Contact Co. Ltd.	IC2.5/3-STF-5.08
	AL-Y0000845-01	CNEXT plug (only full close type)	Hirose Electric Co. Ltd	3540-10P-CV
Low voltage circuit Connector set	AL-00292309	CN1,CN2 plug and housing	Sumitomo 3M Ltd.	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008
High voltage circuit Connector set	AL-00484570	CNA,CNB,CNC plug	Phoenix Contact Co. Ltd.	MSTB2.5/5-STF-5.08 IC2.5/6-STF-5.08 IC2.5/3-STF-5.08
Amplifier capacity **QS1□01～QS1□05 Standard set**	AL-00393603	CN1,CN2 plug and housing CNA,CNC plug	Sumitomo 3M Ltd. Phoenix Contact Co. Ltd.	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008 MSTB2.5/5-STF-5.08 IC2.5/3-STF-5.08
Amplifier capacity **QS1□10,QS1□15 Standard set**	AL-00292309	CN1,CN2 plug and housing	Sumitomo 3M Ltd.	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008
Amplifier capacity **QS1□01～QS1□05 Full close type Connector set**	AL-00492485	CN1,CN2 plug and housing CNA,CNC,CNEXT Plug	Sumitomo 3M Ltd. Phoenix Contact Co. Ltd.) Hirose Electric Co. Ltd	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008 MSTB2.5/5-STF-5.08 IC2.5/3-STF-5.08 3540-10P-CV
Amplifier capacity **QS1□10,QS1□15 Full close type Connector set**	AL-00493622	CN1,CN2 plug and housing CNEXT plug	Sumitomo 3M Ltd. Hirose Electric Co. Ltd	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008 3540-10P-CV

Connector list for QS1E, F, N, P (AC100V Input type)

Application	Model number	Contents	Manufacturer	Manufacturer's model number
Single item	AL-00329461-02	CNA plug	Phoenix Contact Co. Ltd.	MSTB2.5/4-STF-5.08
Amplifier capacity **QS1☐01〜QS1☐03** **Standard set**	AL-00492384	CN1,CN2 Plug and housing CNA,CNC plug	Sumitomo 3M Ltd. Phoenix Contact Co. Ltd.	10150-3000VE
				10350-52A0-008
				10120-3000VE
				10320-52A0-008
				MSTB2.5/4-STF-5.08
				IC2.5/3-STF-5.08

- Metal mounting fittings

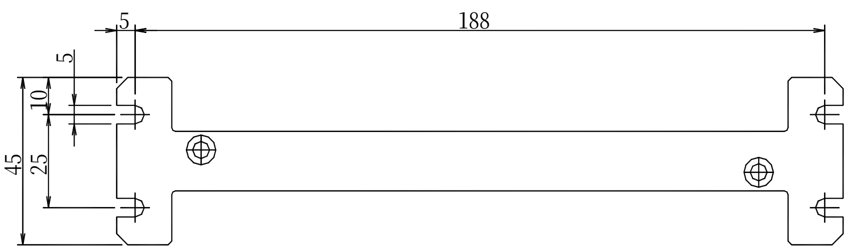
For servo amplifiers with amplifier capacity from 15A to 50A, interchangeable metal fittings are used.

Fittings list for QS 1☐01〜05

Servo amplifier model number	Mounting Position	Model	Contents
QS1☐01, QS1☐03	Back	AL-00483540-01	Fitting metals: 1 Tightning screw: 2
QS1☐01	Front	AL-00483541-01	Fitting metals: 1 Tightning screw: 6
QS1☐03	Front	AL-00483542-01	Fitting metals: 1 Tightning screw: 6
QS1☐05	Back	AL-00483543-01	Fitting metals: 1 Tightning screw: 2
	Front	AL-00483544-01	Fitting metals: 1 Tightning screw: 6

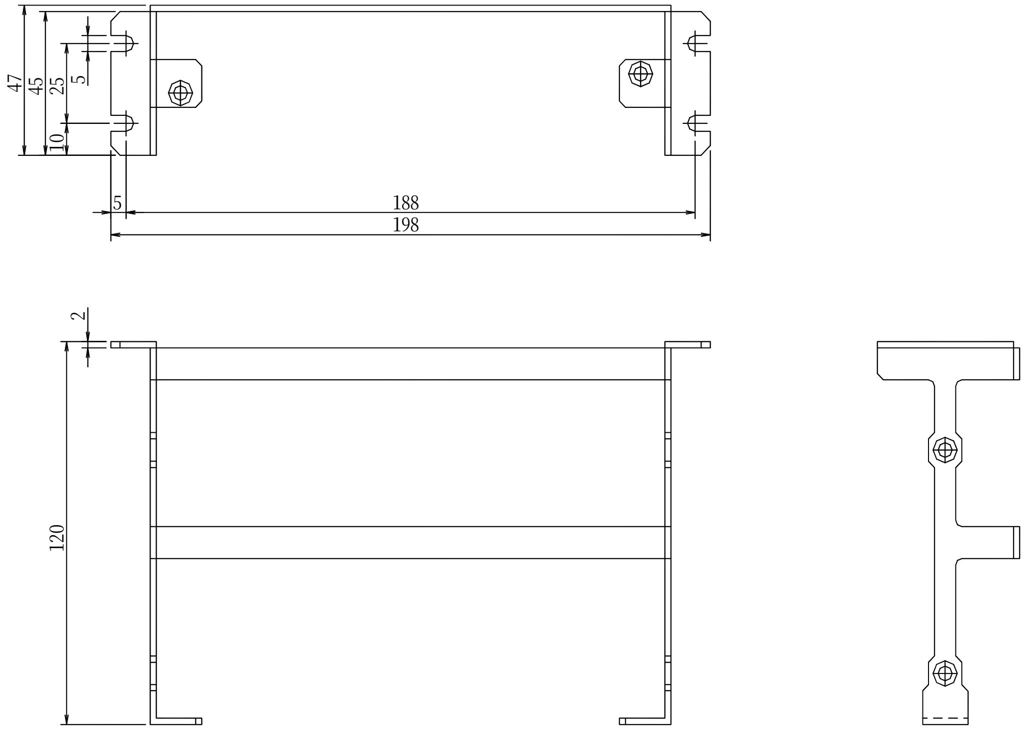
Model number AL-00483540-01 QS1☐01, QS1☐03 Common back surface Metal Fitting

Material SPCC, Surface processing Green chromate plating Thickness 2mm



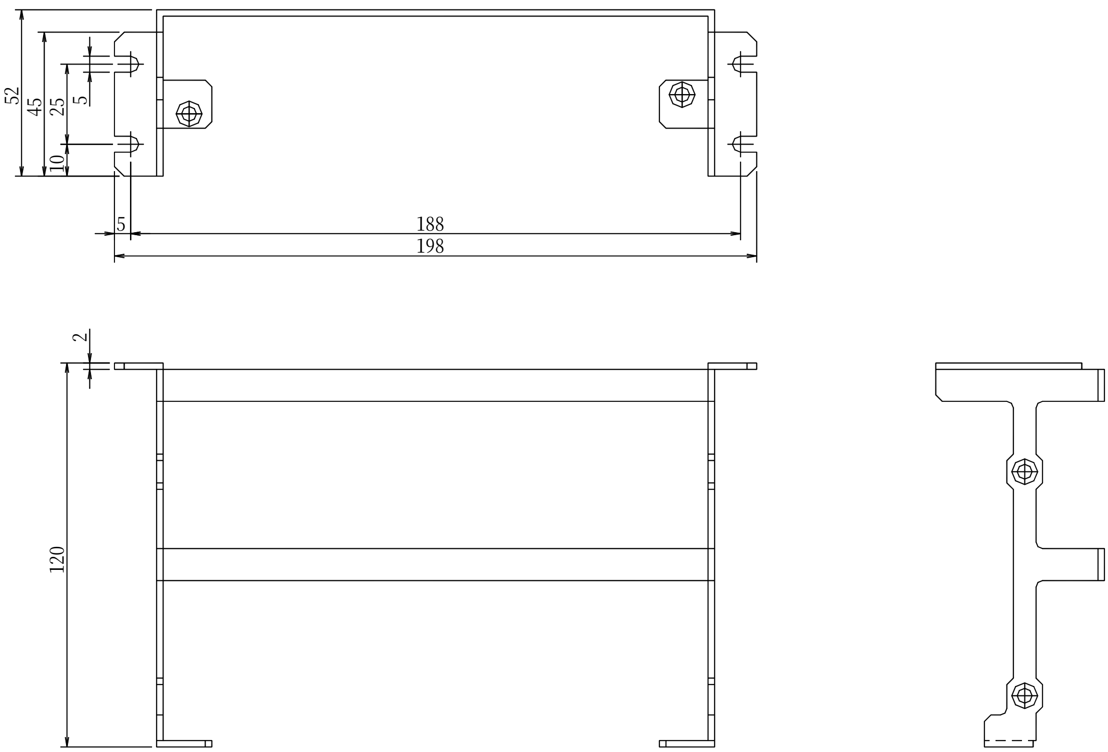
Model number AL-00483541-01　QS1☐01 Front surface　Metal Fitting

Material SPCC, Surface processing　Green chromate plating　Thickness 2mm



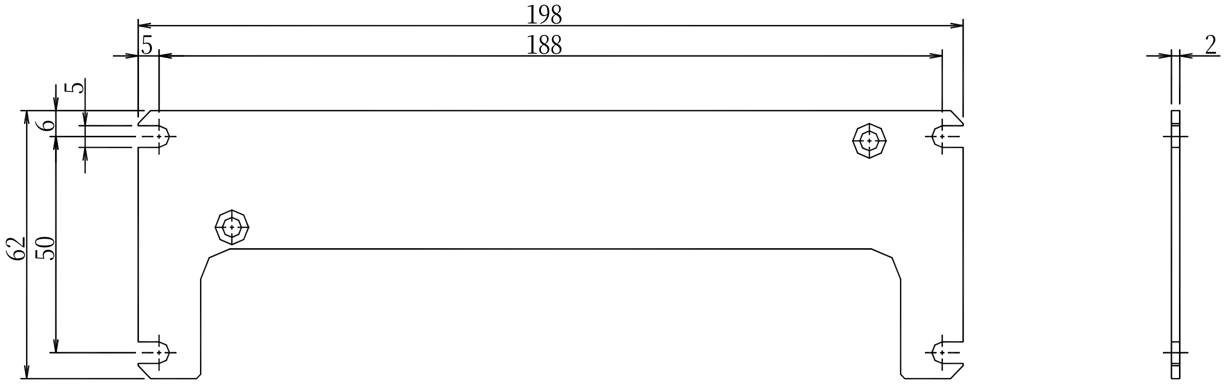
Model number AL-00483542-01　QS1☐03 Front surface　Metal fitting

Material SPCC, Surface processing　Green chromate plating　Thickness 2mm



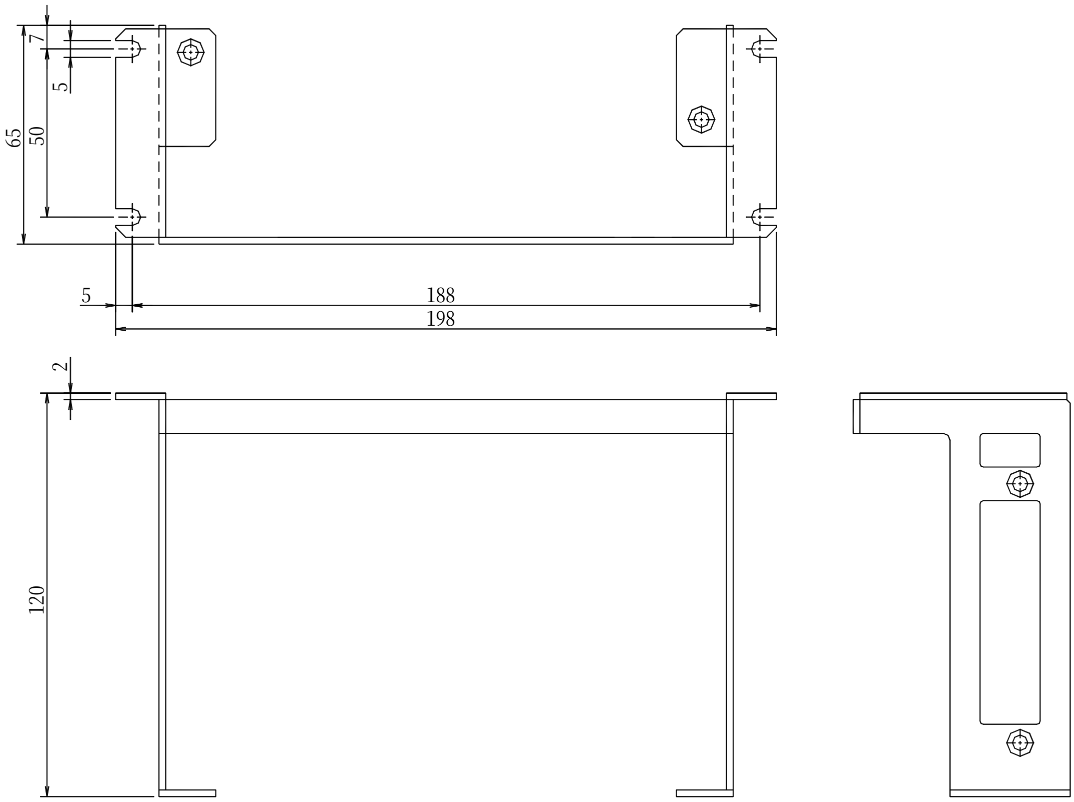
Model number AL-00483543-01　QS1□05 Back surface Metal fitting

Material SPCC　Surcafe processing　Green chromate plating　Thickness 2mm



Model number AL-00483544-01　QS1□05　Front surface　Metal fitting

SPCC　Surface processing　Green chromate plating　Thickness 2mm



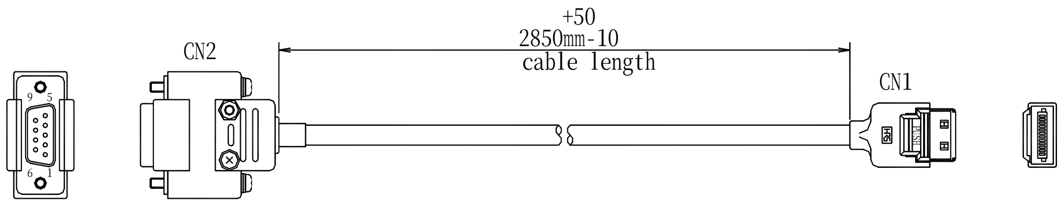
10. Specifications

●Setup software Q setup

Provided for communication with a personal computer.

Model number	Remarks
AL-00490833-01	Special purpose cable
——	Communication program (Can be downloaded from our home page.)

Model number AL-00490833-01   Special purpose cable



Refer to Q-SETUP Setup Software Instructions Manual for the wiring diagram.

● Q-SETUP Setup Software

Refer to the Q-SETUP setup Software and its Instruction Manual for details.

(1) When connected to a PC, parameter selections and position / speed / torque can be monitored and displayed in a graphical format. This software can easily be operated in a Windows operating environment.

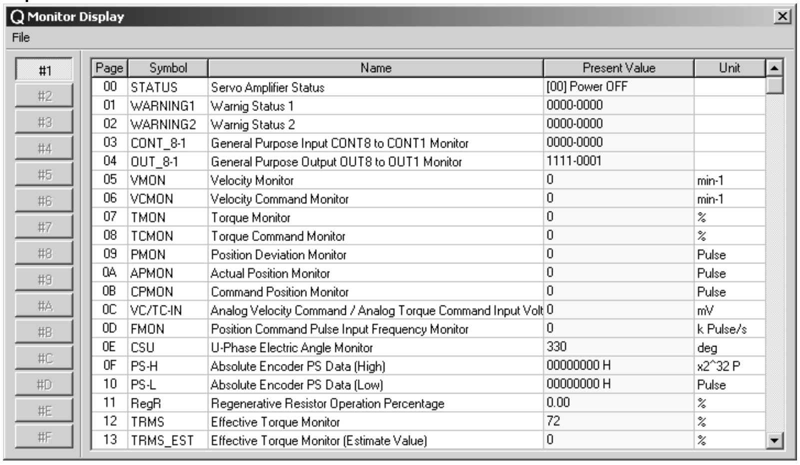
■ Operating environment

Item	Condition
PC	PC: IBM PC/AT compatible machine (NEC PC-98x1 series may not operate properly) CPU: Minimum Pentium133MHz (When scroll mode of drive trace function is used, CPU operating frequency greater than 350MHz or 800MHz is recommended) RAM: Minimum 32MB (64MB or above is recommended) HDD: Complete installation: Minimum 30MB free space; for incomplete installation, a minimum of 5MB is required Display resolution: Minimum of 800×600 resolution
OS	Windows®95, Windows®98, Windows®Me, WindowsNT®, Windows®2000, Windows®XP Home Edition/Professional
PC connected cable	AL-00490833-01

10. Specifications

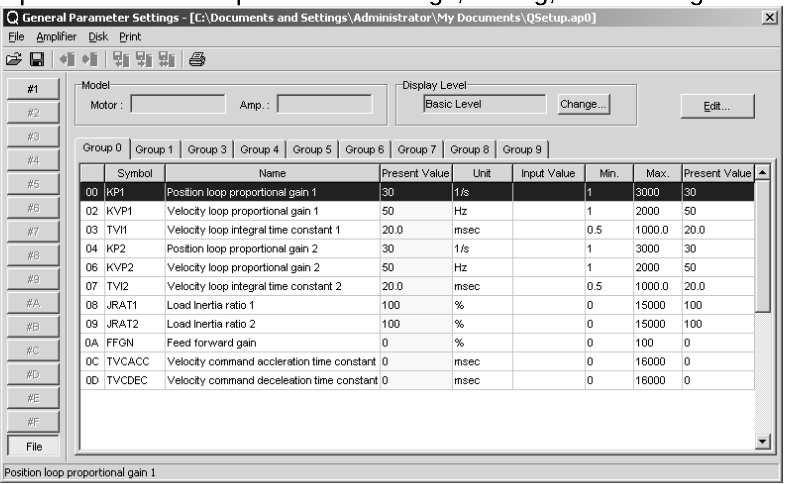
■ Monitor function

Operation information and terminal status can be monitored from here.



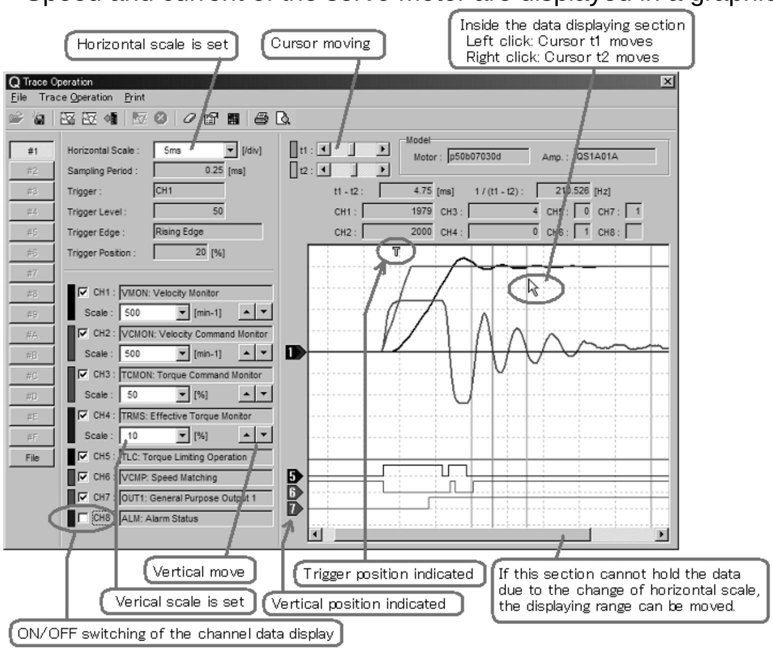
■Parameter settings

Operations such as parameter settings, saving, and reading tasks can be performed from a PC.



■ Drive trace function

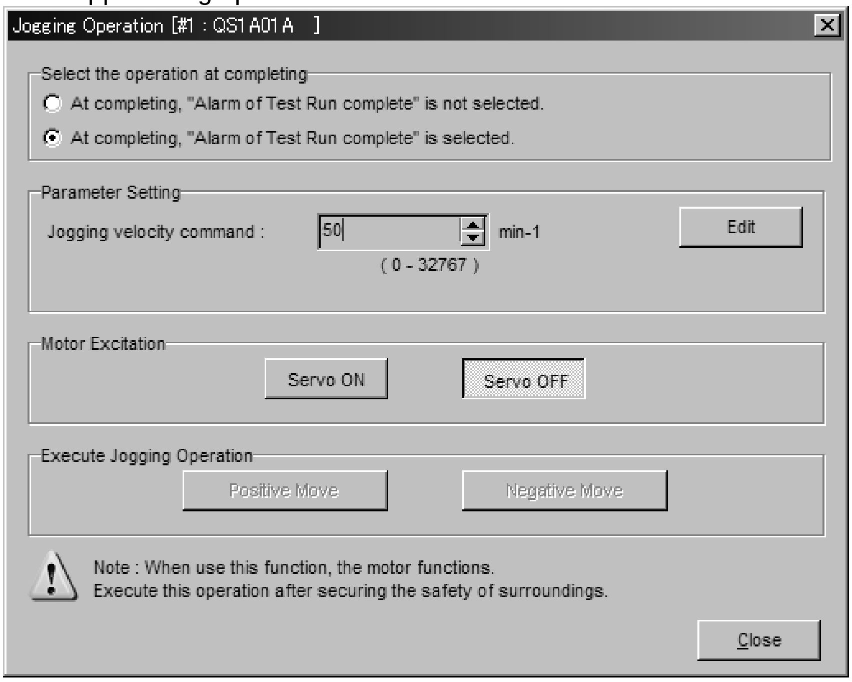
Speed and current of the servo motor are displayed in a graphical format.



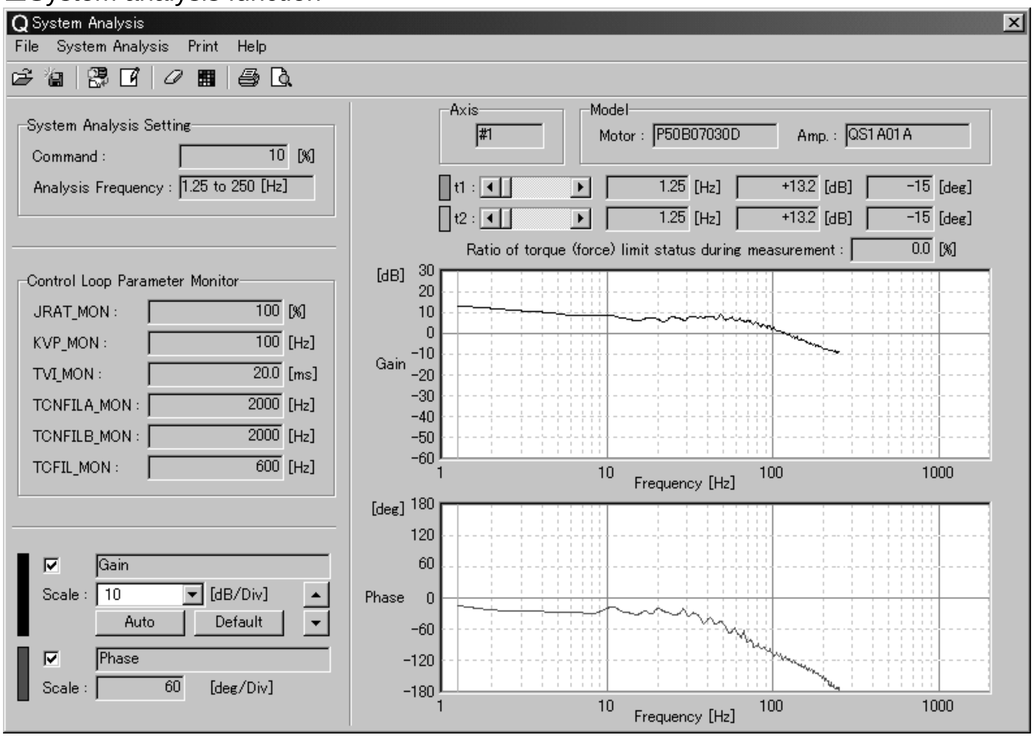
10. Specifications

■Test operations

It supports Jog operation function.



■System analysis function



●Monitor box

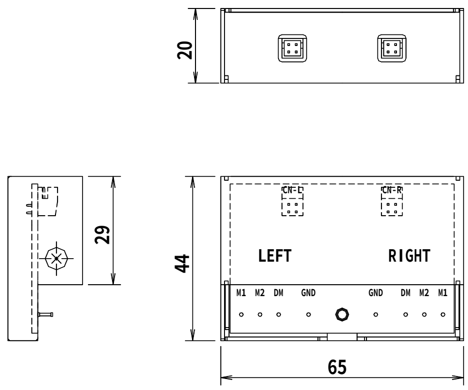
For analog monitor and digital monitor output.

Model number	Remarks
Q-MON-1	Monitor box + Special purpose cables (2)
AL-00496726-01	Special purpose cables (2)

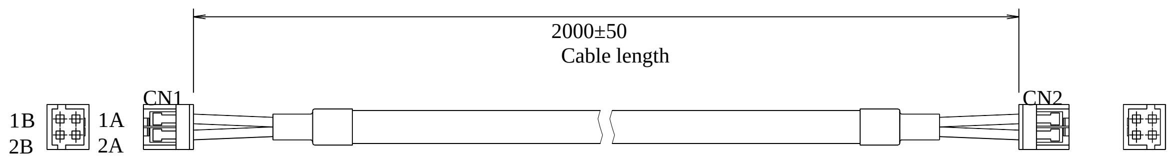
Model number Q-MON-1 (main unit)

The following two (2) special purpose cables are attached to the monitor box.

10. Specifications



Model number AL-00496726-01 Special purpose cable



Terminal name	Function	Terminal name	Function
1A	Analog monitor 1	2A	GND
1B	Analog monitor 2	2B	Digtal monitor

CN1, CN2 connector

	Manufacturer mdel number	Manufacturer
Connetcor	LY10-DC4	Japan Aviation Electronics Industry Ltd.
Contact	LY10-C1-1-10000	Japan Aviation Electronics Industry Ltd.

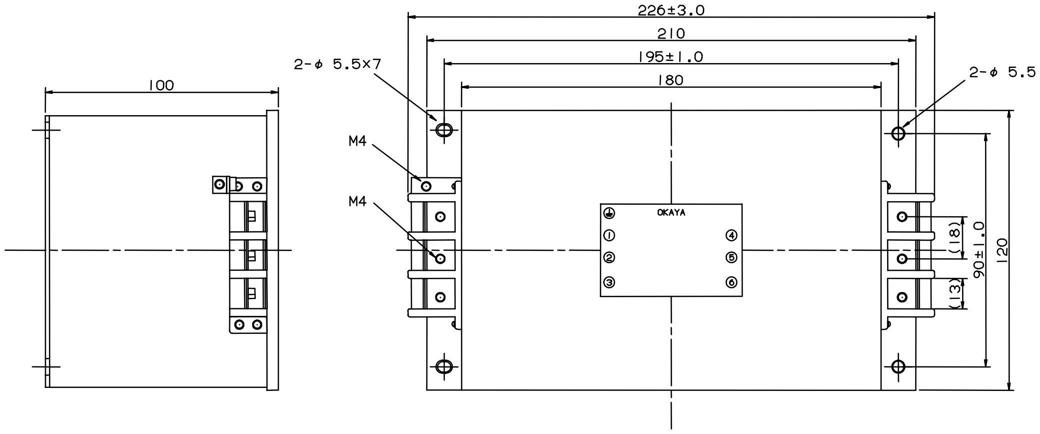
● EMC countermeasures kit

For EMC countermeasures. Refer to Chapter 12 for details.

Model number	Remarks
AL-00508115	Noise filter: 3SUP-HK30-ER-6B
	Toroidal core:251-211

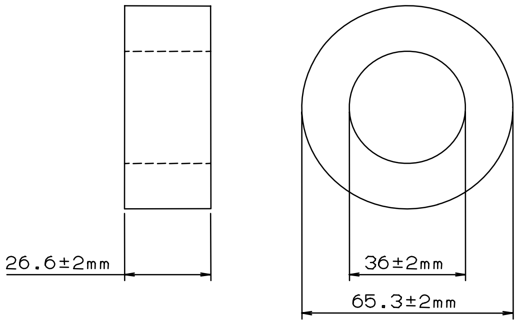
Model number: 3SUP-HK30-ER-6B

Unit: mm
General intersection: ±1.5mm



Mass:2.5kg

Model number: 251-211



About selection

11. About selection

11. 1 Time of Acceleration and Deceleration

The motor's acceleration time (t_a) and deceleration time (t_b) when under a constant load is calculated by following method.
These expressions are for the rated speed values, but exclude the viscous torque and friction torque of the motor.

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

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

t_a: Acceleration time (S)
t_b: Deceleration time (S)
J_M: Motor inertia (kg/m^2)
J_L: Load inertia (kg/m^2)
N_1,N_2: Rotational speed of motor (min^{-1})

T_P: Instantaneous maximum stall torque (N/m)
T_L: Load torque (N/m)

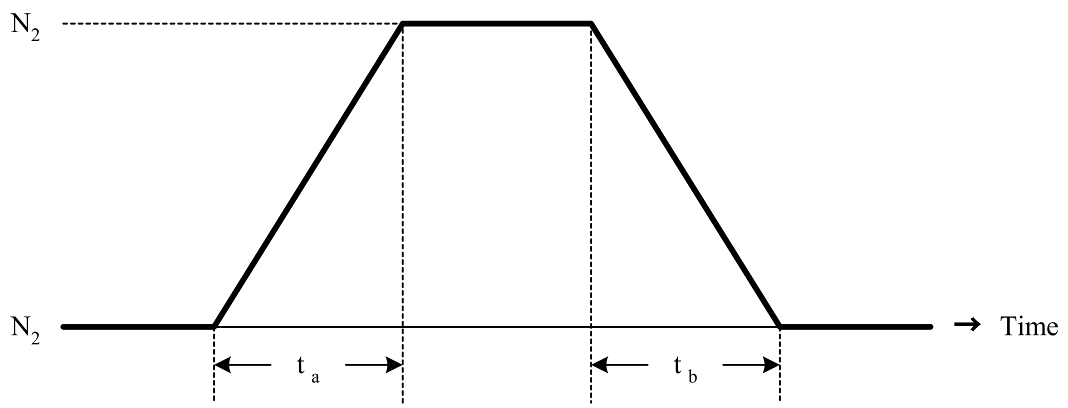


Figure 11-1 Time chart of motor rotation speed

> When determining t_a and t_b, it is recommended to do so by calculating the load margin and decreasing the instantaneous maximum instant stall torque value (TP) to 80%.

11. About selection

11.2 Permitted repetitions

There are separate limitations on repetitive operations for both the servo motor and servo amplifier, and the conditions of both must be fulfilled simultaneously.

- **Permitted repetitions for the servo amplifier**

  When START / STOP sequences are repeated frequently, confirm in advance that they are within the allowed range. Allowed repetitions differ depending on the type, capacity, load inertia, adjustable-speed current value and motor rotation speed of the motor in use. If the load inertia = motor inertia × m times, and when the permitted START / STOP repetitions (up until the maximum rotation speed) exceed $\frac{20}{m+1}$ times/min, contact your dealer or sales office for assistance, as precise calculation of effective torque and regenerating power is critical.

- **Permitted repetitions for the motor**

  Permitted START / STOP repetitions differ according to the motor’s usage conditions, such as the load condition and time of operation. As the conditions vary and as such cannot be specified uniformly, an example is given to aid in explanation.

11. About selection

(1) <u>When continuous-speed status and motor stop status is repeated</u>

In operating conditions such as those shown in Figure 11-2 below are considered, the effective value of the armature current of the motor is at a frequency below the rated armature current of the motor. If the operating cycle is considered as 't', the usable range can be determined as follows:

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

I_p: Instantaneous maximum stall armature current
I_r: Rated armature current
I_l: Current corresponding to load torque

When cycle time (t) is predetermined, I_p, t_a, t_b appropriate in the above formula are required.

When actually determining the system drive mode, it is recommended to calculate the load margin and suppress it to Trms ≤ 0.7TR

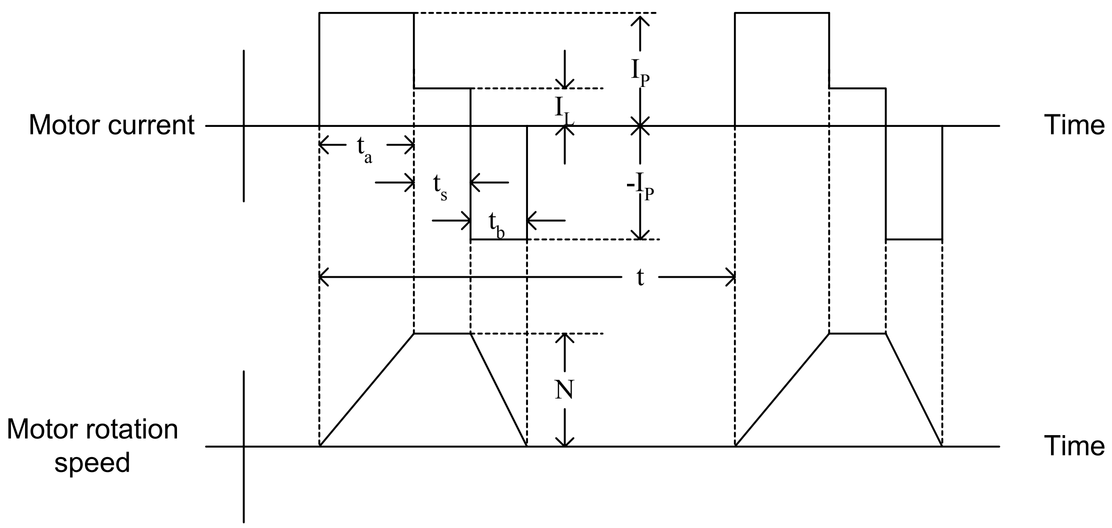


Figure 11-2 Time chart of motor current and rotation speed

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

For the operating status shown in figure 11-3, the value of permitted repetitions n (times/min) is displayed by following equation.

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

T_R: Rated torque

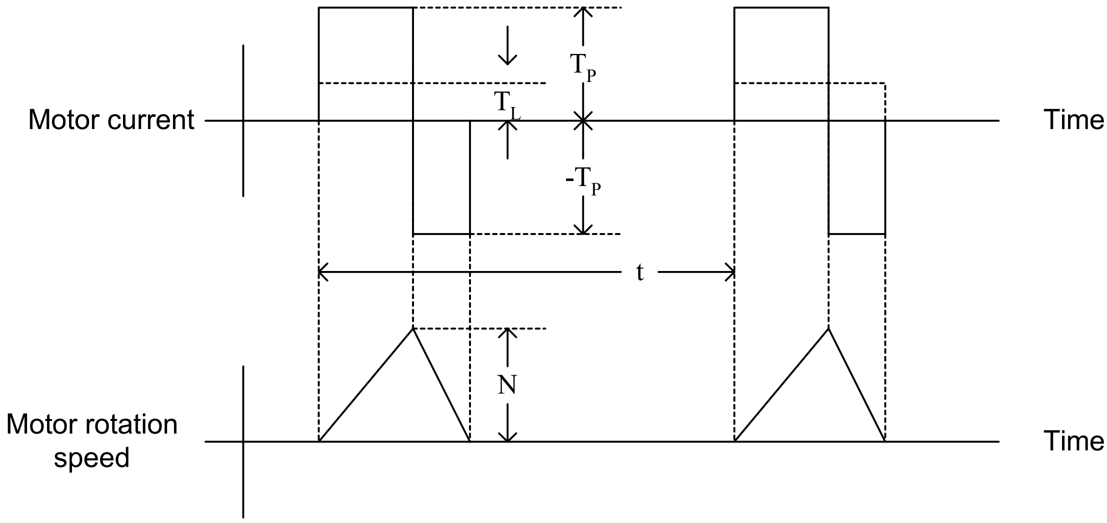


Figure 11-3 Time chart of motor current and rotation speed

(3) When the motor repeats acceleration, constant speed operation, and deceleration status

For the operating status shown in figure 11-4, the value of permitted repetitions 'n' (times/min) is displayed by following equation.

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

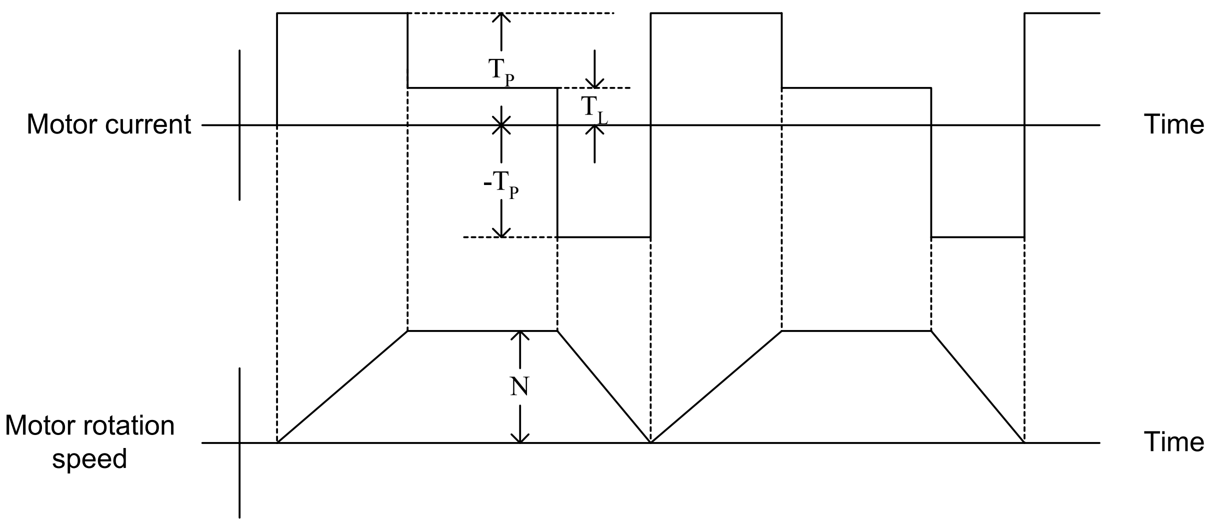


Figure 11-4 Time chart of motor current and rotation speed

11.3 Loading Precautions

(1)Negative load

The servo amplifier cannot perform negative load operations for more than several seconds, as that causes the motor to rotate continuously.

[Examples] :

-Downward motor drive (when there is no counter weight.)

-When usinglike a generator, such as the wind-out spindle of a winder.

When applying the amplifier to a negative load, contact your dealer or sales representative.

(2) Load Inertia (J_L)

When the servo amplifier is used with a load inertia exceeding the allowable load intertia calculated in terms of the motor shaft, a main circuit power overvoltage detection or regenerative error function may be issued at the time of deceleration.

In this case, the following measures must be take n:

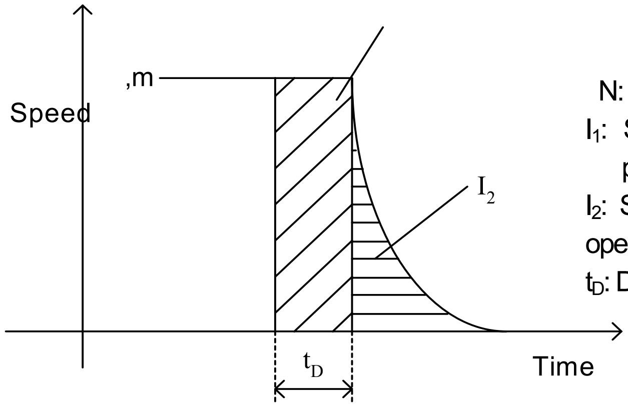
① Reduce the torque limit
② Extend the acceleration and deceleration time (Slow down)
③ Reduce the maximum motor speed
④ Install an external regenerative resistor (optional)

For more details, please consult with your dealer or sales representative.

11. About selection

11.4 Dynamic brake

(1) Slowing down the revolution angle by the dynamic brake



N: Motor speed (min $^{-1}$)

I_1: Slow-down revolution angle (rad) by amplifier internal process time t_D.

I_2: Slow-down revolution angle (rad) by on dynamic brake operation

t_D: Delay time from signal display to operation start (s)
(Depending on amplifier capacity; Refer to following)

Figure 11-5

[Standard formula] When load torque (T_L) is considered as zero.

$$I = I_1 + I_2$$

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

I: Integrated slow-down rotation angle (rad)
J_m: Motor inertia (kg/m^2)
J_L: Load inertia (Motor axis conversion) (kg/m^2)
α/β: Motor constant → refer to table 11-8

Table 11-8

Amplifier model name	Delay time t_D (S)
QS1A01	10×10^{-3}
QS1A03	10×10^{-3}
QS1A05	10×10^{-3}
QS1A10	24×10^{-3}
QS1A15	24×10^{-3}
QS1A30	42×10^{-3}

(2) Instantaneous tolerance of dynamic brake

If the load inertia (J_L) substantially exceeds the applicable load inertia, abnormal heat can be generated due to dynamic brake resistance. Take precautions against situations such as an overheat alarm or the failure of dynamic break resistance, and consult your dealer or sales representative if such a situation occurs.

The energy (E_{RD}) consumed by dynamic brake resistance in 1 dynamic brake operation is as follows:

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

Rφ: Motor phase winding resistance (Ω)
J_M: Motor inertia (kg./m^2)
J_L: Load inertia (Motor shaft conversion) (kg/m^2)
N: Number of motor rotations (min^{-1}) in feed rate V
I: Integrated slow-down rotating angle (rad)
TL : Load torque (N/m)

Use E_{RD} such that it will not exceed the values given in the following table.

Table 11-9

Amplifier model name	E_{RD} (J)
QS1A01	360
QS1A03	360
QS1A05	1800
QS1A10	2450
QS1A15	2450
QS1A30	9384

Dynamic brake resistance may fail if the energy consumed by dynamic brake resistance during dynamic brake operation exceeds the energy shown in table 11-9. Consult the dealer or sales representative if such a situation is anticipated.
(Brake failure will not occur if the load is within the range of the appropriate load inertia.)

(3) Allowable frequency of dynamic brake

The allowable frequency (main circuit power ON/OFF) of the dynamic brake is less than 10 rotations per hour and 50 rotations per day under the conditions of maximum speed and applicable load inertia.

In basic terms, operation of the dynamic brake in six minute intervals between two operations is permissable at maximum speed, but if the brake is to be operated with greater frequency, the motor speed must be reduced.

Use the following ratio to determine allowable frequency:

$$\frac{6 \text{ min}}{(\text{Number of rated rotations/ maximum number of rotations for usage})^2}$$

(4) Dynamic brake constant table.

Table11-10 Dynamic brake constant table (for AC200V)

Amplifier capacity	Motor model number	α	β	J_M(kg-m^2)
QS1A01	Q1AA04003**D**	204	92.0×10^{-7}	0.01×10^{-4}
	Q1AA04005**D**	130	34.3×10^{-7}	0.0134×10^{-4}
	Q1AA04010**D**	53	35.0×10^{-7}	0.0233×10^{-4}
	Q1AA06020D	87.8	25.6×10^{-7}	0.057×10^{-4}
	Q2AA04006D	87.8	25.6×10^{-7}	0.057×10^{-4}
	Q2AA04010D	55.2	8.4×10^{-7}	0.086×10^{-4}
	Q2AA05005D	132	10.7×10^{-7}	0.067×10^{-4}
	Q2AA05010D	45.2	7.93×10^{-7}	0.13×10^{-4}
	Q2AA05020D	19.0	46.9×10^{-7}	0.25×10^{-4}
	Q2AA07020D	25.9	11.7×10^{-7}	0.382×10^{-4}
	Q2AA07030D	11.0	13.9×10^{-7}	0.45×10^{-4}
QS1A03	Q1AA06040D	9.13	13.1×10^{-7}	0.247×10^{-4}
	Q1AA07050D	5.24	7.75×10^{-7}	0.636×10^{-4}
	Q2AA07040D	10.2	7.08×10^{-7}	0.75×10^{-4}
	Q2AA07050D	10.6	3.84×10^{-7}	0.85×10^{-4}
	Q2AA08050D	7.71	4.51×10^{-7}	1.30×10^{-4}
	Q2AA13050H	5.34	6.99×10^{-7}	2.80×10^{-4}
QS1A05	Q1AA10100D	6.50	6.89×10^{-7}	1.04×10^{-4}
	Q1AA10150D	3.95	3.60×10^{-7}	1.61×10^{-4}
	Q2AA08075D	9.23	1.71×10^{-7}	2.07×10^{-4}
	Q2AA08100D	5.30	1.62×10^{-7}	2.73×10^{-4}
	Q2AA10100H	2.78	1.50×10^{-7}	5.44×10^{-4}
	Q2AA10150H	2.03	0.92×10^{-7}	7.99×10^{-4}
	Q2AA13100H	2.81	3.35×10^{-7}	5.40×10^{-4}
	Q2AA13150H	1.79	2.33×10^{-7}	7.94×10^{-4}
QS1A10	Q1AA10200D	4.19	0.47×10^{-7}	2.15×10^{-4}
	Q1AA10250D	2.70	0.46×10^{-7}	2.65×10^{-4}
	Q1AA12200D	2.85	0.33×10^{-7}	4.37×10^{-4}
	Q1AA12300D	1.53	0.27×10^{-7}	6.40×10^{-4}
	Q1AA13300D	1.78	0.53×10^{-7}	4.92×10^{-4}
	Q2AA13200H	1.23	0.48×10^{-7}	11.76×10^{-4}
	Q2AA18200H	1.49	0.36×10^{-7}	19.95×10^{-4}
	Q2AA22250H	1.83	0.24×10^{-7}	32.20×10^{-4}
QS1A15	Q1AA13400D	2.13	0.25×10^{-7}	6.43×10^{-4}
	Q1AA13500D	1.52	0.20×10^{-7}	8.47×10^{-4}
	Q1AA18450**M**	0.43	0.35×10^{-7}	27.5×10^{-4}
	Q2AA18350H	1.14	0.09×10^{-7}	37.89×10^{-4}
	Q2AA18450H	0.74	0.09×10^{-7}	54.95×10^{-4}
	Q2AA18550**R**	0.52	0.05×10^{-7}	72.65×10^{-4}
	Q2AA22350H	1.13	0.17×10^{-7}	47.33×10^{-4}
	Q2AA22450**R**	0.76	0.12×10^{-7}	67.45×10^{-4}
	Q2AA22550B	0.46	0.11×10^{-7}	95.3×10^{-4}
	Q2AA22700**S**	0.18	0.10×10^{-7}	163×10^{-4}

The values for α and β are based on an assumed resistance value of the power line of 0Ω.
If the combination with an amplifier is different than those shown above, consult your dealer or sales office.

Amplifier capacity	Motor model number	α	β	J_M(kg-m^2)
QS1A30	Q1AA18750H	0.96	4.77×10^{-9}	52×10^{-4}
	Q2AA18550H	1.15	2.29×10^{-9}	73×10^{-4}
	Q2AA18750L	0.725	2.30×10^{-9}	95×10^{-4}
	Q2AA2211KV	0.475	2.47×10^{-9}	186×10^{-4}
	Q2AA2215KV	0.335	1.96×10^{-9}	255×10^{-4}

Table 11-11 Dynamic brake constant table (in case of AC100V)

Amplifier capacity	Motor model number	α	β	J^M(kg-m^2)
QS1E01	Q1EA04003D	276	68.1×10^{-7}	0.01×10^{-4}
	Q1EA04005D	205	39.7×10^{-7}	0.0134×10^{-4}
	Q1EA04010D	82.3	26.1×10^{-7}	0.0233×10^{-4}
	Q2EA04006D	129	7.40×10^{-7}	0.057×10^{-4}
	Q2EA04010D	72.5	4.91×10^{-7}	0.086×10^{-4}
	Q2EA05005D	212	3.48×10^{-7}	0.067×10^{-4}
	Q2EA05010D	71.6	2.55×10^{-7}	0.13×10^{-4}
QS1E03	Q1EA06020D	56.3	9.57×10^{-7}	0.141×10^{-4}
	Q2EA05020D	46.4	0.99×10^{-7}	0.25×10^{-4}
	Q2EA07020D	57.0	5.22×10^{-7}	0.382×10^{-4}

The values for α and β are based on an assumed resistance value of the power line of 0Ω.
If the combination with an amplifier is different than those shown above, consult your dealer or sales office.

11.5 Regeneration process

This servo amplifier has a built-in regenerative resistor. Therefore, as the regeneration capacity of the amplifier depends on the allowable power of the built-in regenerative resistor, calculate the regeneration power **PM**, and be sure to confirm that **PM<PR1** (allowable power of the amplifier's built-in regeneration resistor) is fulfilled. When regeneration power **PM** exceeds the allowable range of power **PR1** of the amplifier's built-in regeneration resistor, connect an optional external regeneration resistor for increasing regeneration capacity. In this case, calculate regeneration resistance **PM** and confirm that **PM<PRO** (the maximum allowable power for the external regeneration resistor) is fulfilled.

When regeneration power **PM** exceeds the maximum permitted power (**PRO**) of the external regeneration resistor, reconsider the acceleration constant, load inertia, etc.

The calculation method and measurement method of regeneration power **PM,** and the selection method and parameter setting of appropriate regeneration resistance, are explained in this section.

(1) Calculation method of regeneration power PM

Step 1. Calculate the regeneration energy.

An example of the calculation of regeneration energy (**EM**) is shown below.

(1) For operations along a horizontal axis

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

EM: Regeneration energy during operations along horizontal axis ……[J]
EHB: Regeneration energy during deceleration ……[J]
KEφ: Induced voltage constant ……[Vrms/min^{-1}] (Motor constant)
KT: Torque constant ……[N/m/Arms] (Motor constant)
N: Motor rotation speed ……[min^{-1}]
Rφ: Armature resistance ……[Ω] (Motor constant)
tb: Deceleration time ……[s]
Tb: Torque during deceleration ……[N/**m**] (Tb= Tc - TF)
Tc: Adjustable speed torque ……[N/m]
TF: Friction torque ……[N/m]

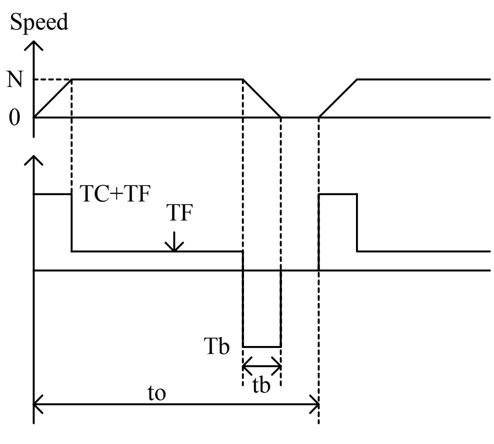


Figure 11-6

② **In case of operations along vertical axis (with a gravitational load)**

$$E_M = E_{VUb} + E_{VD} + E_{VDb}$$

$$= \frac{1}{2} N \times 3 \cdot K_E\phi \times \frac{T_{Ub}}{K_T} \times t_{Ub} - \left(\frac{T_{Ub}}{K_T}\right)^2 \times 3 \cdot R\phi \times t_{Ub}$$

$$+ N \times 3 \cdot K_E\phi \times \frac{T_D}{K_T} \times t_D - \left(\frac{T_D}{K_T}\right)^2 \times 3 \cdot R\phi \times t_D$$

$$+ \frac{1}{2} N \times 3 \cdot K_E\phi \times \frac{T_{Db}}{K_T} \times t_{Db} - \left(\frac{T_{Db}}{K_T}\right)^2 \times 3 \cdot R\phi \times t_{Db}$$

EM: Regeneration energy during operations along vertical axis ……[J]
EVUb: Regeneration energy during increased deceleration ……[J]
EVD: Regeneration energy during descending run ……[J]
EVDb: Regeneration energy during decreased deceleration ……[J]
TUb: Torque during increased deceleration ……[N/m]
tUb: Increased deceleration time ……[s]
TD: Torque during descending run ……[N/m] (TD=TM – TF)
tD: Descending run time ……[s]
TDb: Torque during decreased deceleration ……[N/m] (TDb=TC – TF+TM)
tDb: Decreased deceleration time ……[s]
TM: Gravitational load torque ……[N/m]

> When the calculation result of either of **EVUb**, **EVD**, or **EVDb** is negative, calculate **EM** by considering the value of those variabkes as 0.

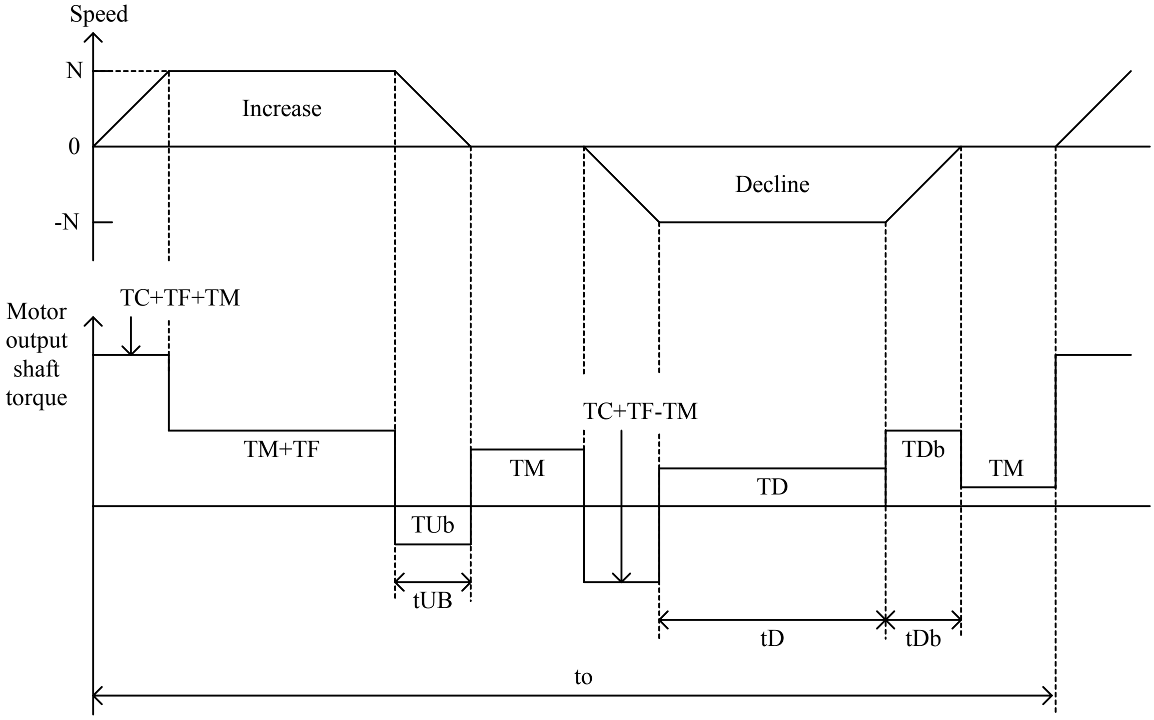


Figure 11-7

Step 2. Calculate the effective regeneration power.

Confirm the regeneration capacity of regeneration resistance connected to amplifier from the calculation result during regeneration.

① **For operations along horizontal axis**

$$PM=\frac{EM}{to}$$

PM: Effective regeneration power [W]
EM: Regeneration energy during deceleration [J]
to: Cycle time [s]

② **For operations along vertical axis**

$$PM=\frac{EM}{to}$$

PM: Effective regeneration power [W]
EM: Regeneration energy during increased deceleration/ descending / decreased deceleration [J]
to: Cycle time [s]

(2) Confirmation method of regeneration power PM in actual operation

Regeneration power **PM** can be easily confirmed in the digital operator or by Q-SETUP setup software.

Digital operator ······· Monitor mode Page 11 / Regeneration circuit operating rate

Setup software ······· Monitor display 11 / RegP / Regeneration circuit operating rate

The monitor value of the regeneration circuit operating rate shows the operating rate of regeneration circuit. The display range is 0.01%~99.99%.

The actual regeneration power **PM** can be calculated from this monitor value by following equation.

$$\text{Regeneration power PM (W)} = \frac{400(\mathrm{V})\times 400(\mathrm{V})}{\text{Regeneration resistance}} \times \frac{\text{regeneration circuit operating rate (\%)}}{100\ (\%)}$$

※This equation is used when the input supply voltage of the servo amplifier is 200V.
If input supply voltage is 100V, calculate **PM** after replacing "400(V)×400(V)" with "200(V)×200(V)".

※Refer to the following table for the regeneration resistance value of built-in regeneration resitance.

Calculation example: When RegP monitor value=0.12% by using QS1AL01AA∗, built-in regeneration resistance

(Input supply voltage 200V, Built-in regeneration resistance 100 Ω)

$$\frac{400(\mathrm{V})\times 400(\mathrm{V})}{100(\Omega)} \times \frac{0.12(\%)}{100(\%)} = \mathbf{1.92}\ (\mathrm{W})$$

Built-in regeneration resistance value

Amplifier model number	Input supply voltage	Built-in regeneration resistance value	Remarks
QS1LM01 QS1M01	200V type	100 Ω	Amplifier capacity 15 A, Built-in regeneration resistance
QS1L03 QS1M03		50 Ω	Amplifier capacity 30 A, Built-in regeneration resistance
QS1A05 QS1B05		17 Ω	Amplifier capacity 50 A, Built-in regeneration resistance
QS1A10 QS1A10		10 Ω	Amplifier capacity 100 A, Built-in regeneration resistance
QS1A15		6 Ω	Amplifier capacity 150 A, Built-in regeneration resistance
QS1N01 QS1P01	100V type	100 Ω	Amplifier capacity 15A, Built-in regeneration resistance
QS1N03 QS1P03		50 Ω	Amplifier capacity 30 A, Built-in regeneration resistance

The regeneration power calculated from this monitor value continues to be the target until the end of operations. Regeneration power changes per the voltage fluctuation of the input power supply, and changes in servo amplifier and loading device.
Select regeneration resistance by calculating regeneration power **PM** from the operation pattern, as per **(1) Calculation method of regeneration power PM.**

(3) External Regenerative Resistor Combination Table

In in Table 11-12 below, determine the type, number of, and connection method of the external regenerating resistor based on the model of servo amplifier and the effective regenerating power (**PM**) of the operation pattern.

Table 11-12 External Regenerative Resistor Combination Table

<table>
<tr><th>PM *1 / Amplifier Type name</th><th>Up to 2W</th><th>Up to 5W</th><th>Up to 10W</th><th>Up to 20W</th><th>Up to 30W</th><th>Up to 55W</th><th>Up to 60W</th><th>Up to 90W</th><th>Up to 110W</th><th>Up to 120W</th><th>Up to 125W</th><th>Up to 220W</th><th>Up to 250W</th><th>Up to 500W</th><th>Up to 1000W</th></tr>
<tr><td>QS1A01</td><td>Built in
Conn. (I)</td><td colspan="2">Resistor A×1
Connection (III)</td><td colspan="2">Resistor C×1
Connection(III)</td><td>Resistor E×1
Conn.(III)</td><td>Resistor D×2
Conn.(IV)</td><td colspan="2">Resistor F×2
Connection (IV)</td><td colspan="3">Resistor E×4
Connection (VI)</td><td colspan="3">Contact</td></tr>
<tr><td>QS1A03</td><td colspan="2">*2 Built in
Connection (I)</td><td>Resistor B×1
Conn. (III)</td><td colspan="2">Resistor D×1
Connection (III)</td><td>Resistor F×1
Conn.(III)</td><td>Resistor C×2
Conn.(V)</td><td colspan="2">Resistor E×2
Connection (V)</td><td colspan="3">Resistor F×4
Connection (VI)</td><td colspan="3">Contact</td></tr>
<tr><td>QS1A05</td><td colspan="4">*2 Built in
Connection (I)</td><td colspan="2">Resistor G×1
Connection (III)</td><td colspan="5">Resistor H×1 I×
Connection (III)</td><td colspan="2">Resistor 2
Connection (IV)</td><td>Resistor H×4
Connection (VI)</td><td>Contact</td></tr>
<tr><td>QS1A10</td><td colspan="8">*2 Built in
Connection (II)</td><td colspan="3">Resistor I×1
Connection (III)</td><td colspan="2">Resistor H×2
Connection (V)</td><td>Resistor I×4
Connection (VI)</td><td>Contact</td></tr>
<tr><td>QS1A15</td><td colspan="10">*2 Built in
Connection (II) 0</td><td>Resistor J×1
Connection (III)</td><td colspan="2">Resistor K×2
Connection (IV)</td><td>Resistor J×4
Connection (VI)</td><td>Contact</td></tr>
</table>

Refer to Table11-13 (External Regenerative Resistor List Table) for External Resistor A to I.
For connection method (I) to (VI), refer to Table 11-9 (Details of Regenerative Resistor Connection Method).
Additionally, consult your dselare or sales office with any questions.

* 1: PM is the effective regenerative power.
* 2: The built-in regenerative resistance differs based on the amplifier model.
Select the amplifier model based on the usage conditions described in Chapter 2, “Servo Amplifier Model Number”.

Table 11-13 External Regenerative Resistor List Table

Symbol	Model name	Permissible power PM	Resistance value	External dimension	Thermostat	External table
A	REGIST-080W100B	10W	100Ω	W44,L132,D20	Yes (b contact point)	See Table11-10
B	REGIST-080W50B	10W	50Ω	W44,L132,D20	Yes (b contact point)	See Table11-10
C	REGIST-120W100B	30W	100Ω	W42,L182,D20	Yes (b contact point)	See Table11-11
D	REGIST-120W50B	30W	50Ω	W42,L182,D20	Yes (b contact point)	See Table11-11
E	REGIST-220W100B	55W	100Ω	W60,L230,D20	Yes (b contact point)	See Table11-12
F	REGIST-220W50B	55W	50Ω	W60,L230,D20	Yes (b contact point)	See Table11-12
G	REGIST-220W20B	55W	20Ω	W60,L230,D20	Yes (b contact point)	See Table11-12
H	REGIST-500W20B	125W	20Ω	W80,L250,D40	Yes (b contact point)	See Table11-13
I	REGIST-500W10B	125W	10Ω	W80,L250,D40	Yes (b contact point)	See Table11-13
J	REGIST-500W7B	125W	7Ω	W80,L250,D40	Yes (b contact point)	See Table11-13
K	REGIST-500W14B	125W	14Ω	W80,L250,D40	Yes (b contact point)	See Table11-13

(4) Conenection and setting methods of the external regenerative resistor

Use the external regenerative resistor for regenerative power calculated in "[1] Calculation method for regenerative power **PM**"). The usage method is explained below.

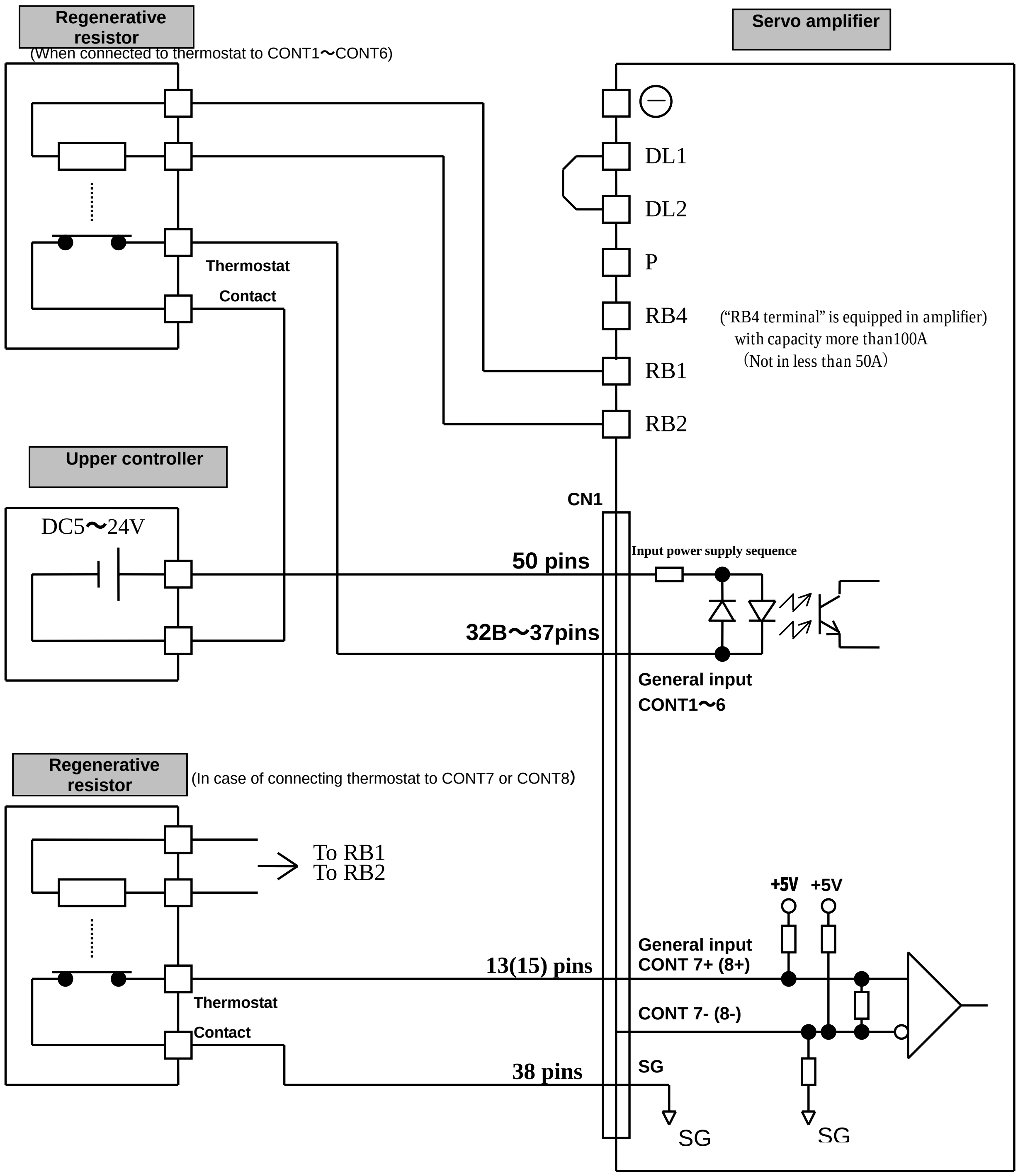


Figure 11-8 Typical external regenerative resistor connection diagram

11. About selection

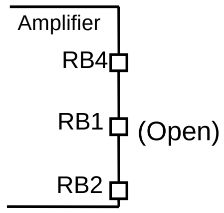
Usage Precautions

1. Regenerative resistance terminals differs according to amplifier capacity.
   - For amplifier capacity of 15A / 30A / 50A:
     Connect the external regenerative resistor between terminals RB1 nd RB2.
     (When connecting external regenerative resistance to an amplifier with built-in regenerative resistance, first removing the built-in regenerative resistance wiring in the RB1 and RB2 terminals, connect the external regenerative resistance. Moreover, take care that removed wiring should not touch current carrying part)
   - For amplifier capacity of 100A/ 150A:
     Remove the short bar between the RB1 and RB4 terminals, then connect the external
     regenerative resistor between the RB1 and RB2 terminals.
2. When using an external regenerative resistor with a built-in thermostat, connect the amplifier as shown in Figure 11-8, or maintain resistance by inserting the thermostat contact point output in the upper controller.
   Parameter setting example: When thermostat is connected to CONT 6,
   EXT-E of Group 8, Page 07 is ODH: CONT 6_Off;
   When CONT 6 is OFF, the external trip function becomes effective.
   Therefore, when the external regenerative resistance thermostat is tripped by
   heat generation, the external trip function is executed and an alarm (ALM_55) issued.
3. Make sure to change the regenerative resistance selection pattern, to a pattern suitable to the connected regenerative resistance type.
4. Be sure to keep wiring as short as possible (less than 5ml) and used twisted wire when wiring the external regenerative resistor.
5. Use nonflammable electric wire or perform non-combustible processing (silicon tube, etc.) for connecting cable and wired, and install wiring so as to not come in contact with the built-in unit .
6. The maximum electric current for the amplifier general input CONT7 + CONT 8 + input is 5 mA. Based on the material quality of the thermostat contact point, an alarm may not be detected without operating at 5mA.

(5) Regenerative Resistor Connection Method

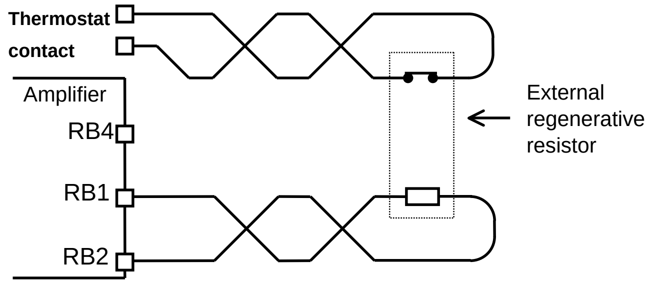
The connection method of the external regenerative resistor is shown in the following figure.

Without connection — **Regenerative process not required**



Connection (III) — **SIngle external regenerative resistor**

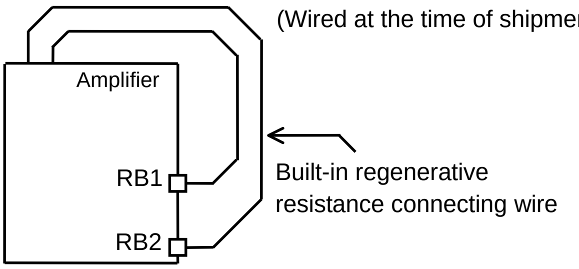
(Thermostat: contact point b)



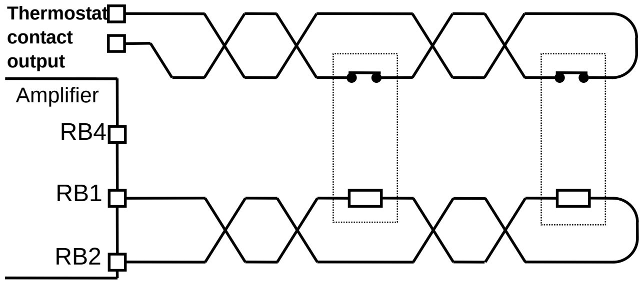
Regenerative resistance (Built-in Connection [I])

Amplifier capacity 15A/30A/50A Regenerative resistance built-in type

(Wired at the time of shipment)



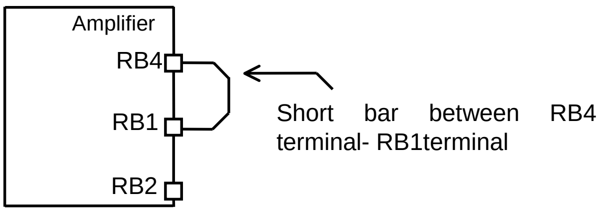
Connection (IV) — **2 external regenerative resistors (Serial)**



Regenerative resistance (Built-in Connection [II])

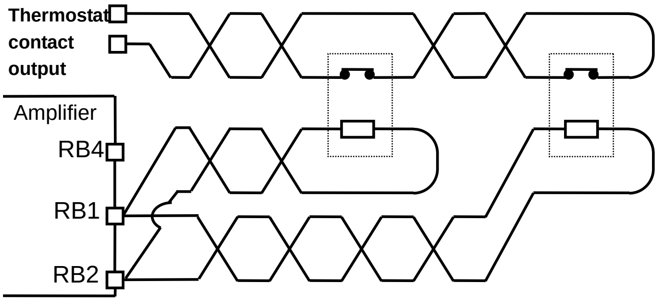
Amplifier capacity 100A/150A Built-in regenerative resistance

(Wired at the time of shipment)



Connection (V) — **2 external regenerative resistors (Parallel)**

Connect thermostat serially



Amplifiers with different capacities require different terminals

Amplifier capacity 15A/30A/50A:
Regenerative resistance connecting terminals are “RB1” and “RB2”. (Not “RB4” terminal)

Amplifier capacity 100A/150A:
Regenerative resistance connecting terminals are “RB1”, ”RB2” and “RB4”.
Connect the external regenerative resistor only after installing the short bar between “RB4” and “RB1”.

Connection (VI) — **4 external regenerative resistors (Serial/parallel)**

But connect Thermo start serially

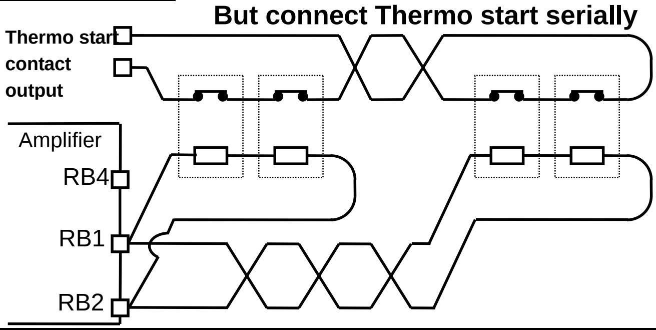


Figure 11-9 Details of method of connecting regenerative resistor

⚠ **Always change the parameters for the regenerative resistance selection while changing the regenerative resistance connection.**

(6) Regenerative Resistance Parameter Setting

With the Q series servo amplifier, the regenerative resistance protection function is specified by parameter selections. Appropriate protection for regenerative resistance is applied by setting parameters according to the type of regenerative resistance to be connected. Set the appropriate parameters by following the instructions given below.

The protection functions are divided into three main types:

①Protection for a short-time, high load factor (using built-in or external regenerative resistance): An error is detected when the power absorption of regenerative resistance is extremely high over a short time period (100msec to 10 seconds). A ‘Regenerative Error’ alarm (“ALM_43”) is issued when this error is detected.

②Protection when allowable power absorption is exceeded for long time (using built-in regenerative resistance): An error is detected when the power absorption of the built-in regenerative resistance exceeds the allowable power absorption over a long time period (from a few seconds to a few minutes). An ’Internal Overheat’ alarm (“ALM_54”) is issued when this error is detected.

③ Protection during thermostat operation of the external regenerative resistor: An error is detected when the external trip function is started. An ‘External error / external trip’ alarm (“ALM_55”) is issued when this error is detected. The two parameters requiring settings are given below.

① Regenerative resistance selection System parameter/Page 0B
(Set at the time of shipment) Regenerative resistance built-in type: 01:_Built-in_R
Regenerative resistance external type: 02:_External_R

②External trip input function General parameter/Group 8- Page 07 EXT-E
(Set at the time of shipment) 00:_Always_Disable

Relationship between parameter settings and protection functions

Regenerative resistance in use		Parameter setting		Protection function operation			Remarks
Resistor	Thermostat	Regenerative resistance selection	External trip input function EXT-E	Regenerative error ALM_43	Internal overheat ALM_54	External error / external trip ALM_55	
Regenerative resistor is not connected	-	00:_Not_Connect	- *1	Protection function Invalid	Protection function Invalid	- *1	
Built-in regenerative resistor is used	-	01:_Built-in_R	- *1	Protection function Valid	Protection function Valid	- *1	
External regenerative resistor is used	-	02:_External_R	- *1	Protection function Valid	Protection function Invalid	- *1	In this setting, “ALM_43” may be falsely detected by main circuit power ON when external regenerative resistance is not connected
External regenerative resistor is used	Resistance thermostat is connected to the amplifier	02:_External_R	Set in Input terminal/Input polarity to be connected.	Protection function Valid	Protection function Invalid	Protection function Valid	

* 1 External error “ALM_55” detection function can be used in cases other than connecting the external regenerative resistance thermostat.
Detection functions can be selected and used irrespective of the regenerative resistance selection.

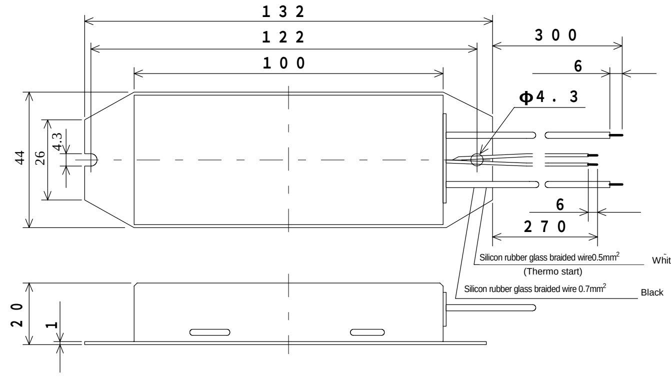
Make appropriate settings to regenerative resistance (System parameter/Page0B) when using built-in regenerative resistance.
If These parameter settings are incorrect, normally detected errors related to built-in regenerative resistance may not be detected, possible causing the burning/fuming of regenerative resistance.

The built-in regenerative resistance may generate heat even if the overheat alarm is notissued. Do not touch the servo amplifier for 30 minutes after power is disconnected in the case of a power failure, as there is a risk of burn.

Incorrect parameter settings may cause irregular operation of the protection functions. Upon an alarm, confirm its cause and adjust the settings appropriately.

(7) External appearance diagram of the external regenerative resistor

Unit: mm



	Model number	Thermostat
1	REGIST-080W100B	contact point b
2	REGIST-080W50B	contact point b

Figure 11-10

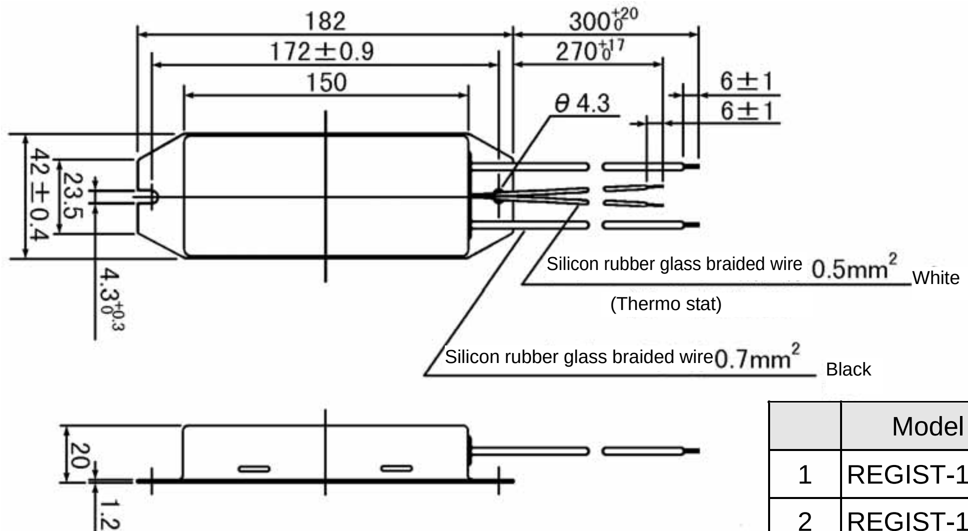


Figure 11-11

	Model number	Thermostat
1	REGIST-120W100B	contact point b
2	REGIST-120W50B	contact point b

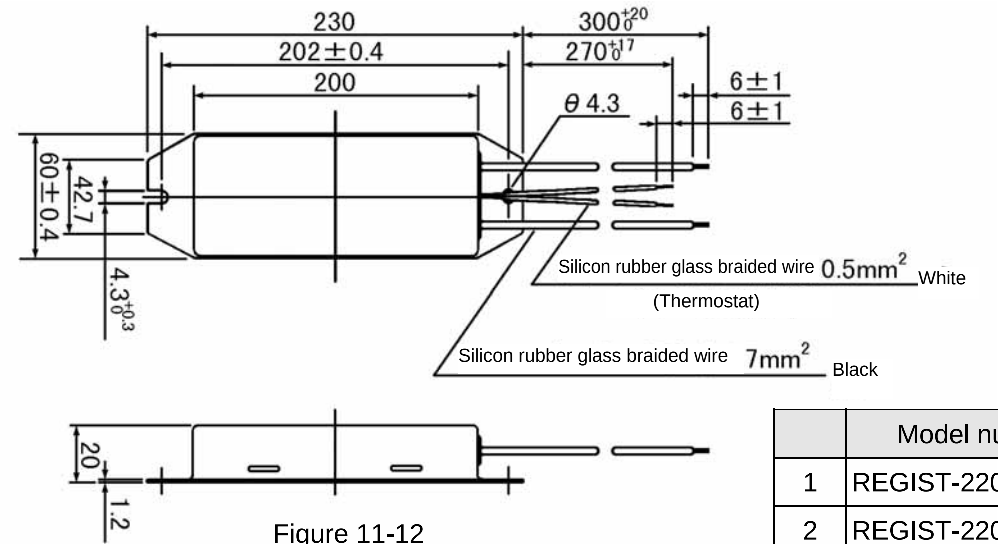


Figure 11-12

	Model number	Thermo stat
1	REGIST-220W50B	contact point b
2	REGIST-220W20B	contact point b
3	REGIST-220W100B	contact point b

Unit:mm

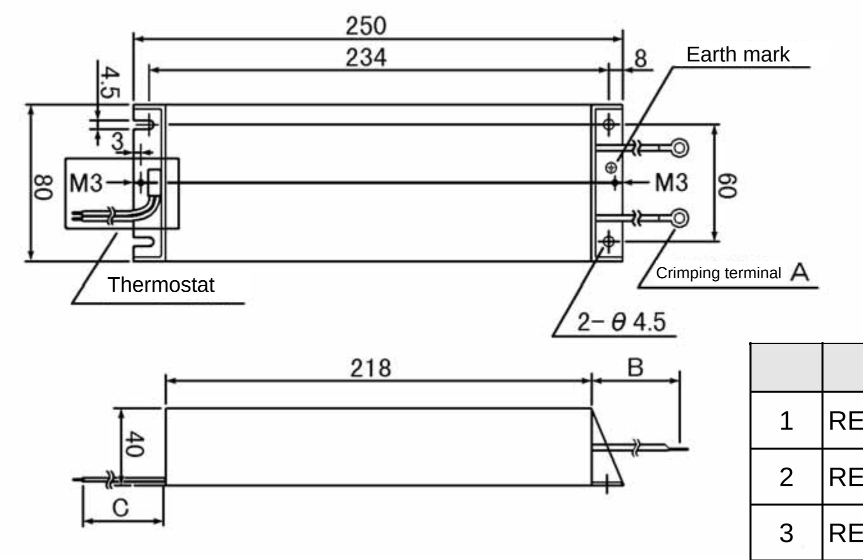


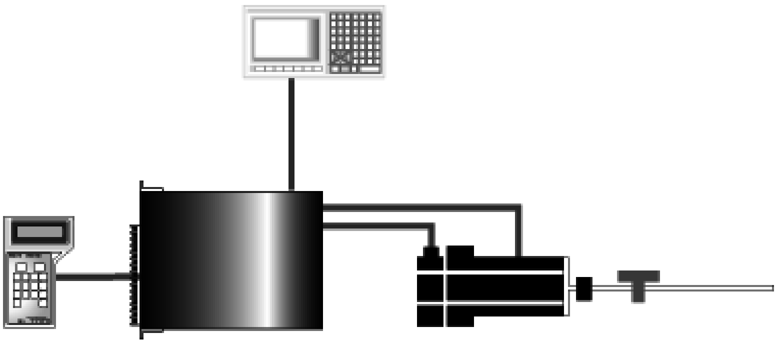
Figure 11-13

	Model number	Thermostat
1	REGIST-500W20B	b contact point
2	REGIST-500W20	None
3	REGIST-500W10B	b contact point
4	REGIST-500W10	None
5	REGIST-500W7B	b contact point
6	REGIST-500W7	None
7	REGIST-500W14B	b contact point
8	REGIST-500W14	None

Crimping terminal A=M5
B=700mm±15
C=350mm±15

11. About selection

International Standards



12. International Standards

12.1 International Standards Conformity

12.1.1 Outline of International Standards Conformity

North America

UL (Underwriters Laboratories, Inc.)

UL is a non-profit test organization, established by the US cooperative for Fire Insurance companies in 1894. In many states and municipalities throughout the United States, UL approval is mandated as a necessity by the local laws and ordinances. While UL approval is necessary for nearly all electrical products and appliances, generally it is also necessary to have UL approval for the built-in parts that these products use as well. The UL approval method is divided into “LISTING” and “RECOGNITION” classifications; LISTING displays the “UL” mark (shown in the upper left of this page) in some location on the final product, while RECOGNITION displays the “UR” mark (shown at the lower left for) the built-in parts used in the assembly of the equipment.

UL has conformed its standards with those of its Canadian counterpart CSA, and adheres to a mutual certification system recognized in both countries. In 1992, UL received recognition as a CO (Canada Safety Certification Organization member) and TO (Testing Organization member) by the SCC (Standards Council of Canada). Since that time, UL has been authorised to perform safety tests and issue recognition of Canadian standards conformity. Marks showing conformity to Canadian standards are shown at right:

Europe

TÜV (TÜV Product Service Japan, Ltd.)

Industrial products used in EU (European Union) member countries must display a “CE” mark, as required by the EC Directives (for machinery, EMC, and low voltage). Products which display the CE mark must meet every item of the EC Directives. The TÜVrecognition mark (shown at left) is based on the EN standards, making it easy to obtain CE marking.

12.1.2 International Standards Conformity of the QS1 Servo System

For the QS1 servo amplifier, the following international standards may be displayed:

Mark	International standards	Standard number	Certification Organization
	UL standard	UL508C	UL (Underwriters Laboratories, Inc.)
	CSA standard	UL508C	
	EN standard	EN50178 EN61000-6-2	TÜV (TÜV Product Service Japan, Ltd.)

12. International Standards

For the P series servo motor, the following international standards may be displayed:

Display	International standards	Standard number	Certification Organization
	UL standard	UL1004 UL1446	UL (Underwriters Laboratories, Inc.)
	EN standards	IEC-34-1 IEC34-5 IEC34-9	TÜV (TÜV Product Service Japan, Ltd.)

Standard servo motor products are classified by model number. See Chapter 2, from pages 2-6, for assistance on reading model numbers. For products conforming to international standards, some specifications may differ from the standard product due to prerequisites necessary for obtaining approval. Contact the manufacturer for more details.

12. 2 Cautions for International Standards Conformity

12.2.1 Common precautions for UL / TÜV standards conformity

① QS1 combination of servo amplifier and servo motor

1. For the combination of servo amplifiers and motors, see page 2-8 of Chapter 2, under “Standard Combinations of Q Series Servo Amplifiers”

② QS1 Usage environment of servo amplifier

1. Make sure to install the QS1 series amplifier in the control panel in an environment where the pollution level specified in EN50178 and IEC664 is lower than 2.
   Additionally, the control panel installation configuration (under IP54) must exclude exposure to water, oil, carbon, dust, etc.

③ Power source

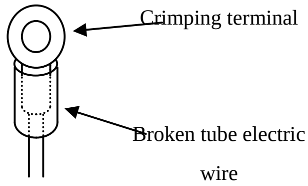
1. The QS1 series servo amplifiers must be used under the conditions specified in overvoltage category II, EN50178. Use a reinforced insulation transformer conforming to IEC or EN standards for power supply input.
2. For the interface, use a DC power supply with reinforced insulation input and outputs.

④ Grounding

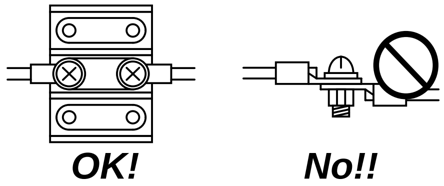
1. Always ground the protective earth terminals of the servo amplifier to the power supply earth. (⏚)
2. When connecting grounding wire to the protective earth terminal, always connect one wire in one terminal; never connect jointly with multiple wires or terminals.
3. When connecting the leakage stopper, make sure to connect the protective earth terminal to the power supply earth. (⏚)

⑤ Wiring

1. Connect earthing wire by using a crimping terminal with insulated tube, so that the connected wire will not touch the neighboring terminals.



2. For wire relays, use a fixed terminal block to connect wires; never connect wires directly.



⑥ Peripheral device

1. Connect an EMC filter to the input power supply of the unit.
2. Use an EN/ IEC-standard compatible no-fuse circuit breaker and electromagnetic contactor.

12.3 UL / cUL / TÜV Standards Conformity

12.3.1 UL / cUL Conformity and File Numbers

Servo amplifiers of the QS1 servo system are approved by UL (Underwriters Laboratories, Inc.) to display the UL RECOGNITION mark (for the US)and cUL (for Canada). Additionally, the servo motor is approved by UL to display the UL RECOGNITION mark for its built-in parts.

If proof of certification of UL and Canadian standards is required for a customer's QS1 servo system , please inform your dealer or sales representative by using the following file number:

Classification	File Number.	Category	Certification Organization
UL / cUL (Servo amplifier)	E179775	Power Conversion Equipment (CCN: NMMS, NMMS7)	UL (Underwriters Laboratories, Inc.)
UL (Servo motor)	To be fetched	Motors-Component	

Information is also available at the UL homepage: http://www.ul.com/database/.

12.3.2 TÜV Conformity and File Numbers

The QS1 servo system is qualified to display the TÜV mark by TÜV Product Service Japan, Ltd (TÜV Product Service Japan, Ltd), in order to simplify the process of displaying TÜV and CE markings on customers' instruments or devices .

Our company has performed the requisite low voltage and EMC self-declarations in accordance with EC directives, pursuant to the certificates issued by TÜV.

If proof of certification or declaration of the QS1 servo system is required for conformity purposes, please inform your dealer or sales representative by using the following file number. However, note that file numbers may change due to specification additions or similar reasons.

Command classification	Type	File Number	Certification organization
Low voltage command (Servo amplifier)	Declaration	C0005269	-
	Attested certificate	B 02 07 30982 019	TÜV Product Service Japan, Ltd
EMC command (Servo amplifier / servo motor)	Declaration	C0005055	-
	Attested certificate	B9 02 12 30982 022	TÜV Product Service Japan, Ltd
Low voltage command (Servo motor)	Declaration	To be fetched	-
	Attested certificate	To be fetched	TÜV Product Service Japan, Ltd

12.4 European EC command conformity

12.4.1 Outline of EC Directives

The European EC Directives were issued for the purpose of smooth circulation of products whose safety has been guaranteed by unifying the regulations of all the affiliated countries. It fulfills all basic safety conditions of the Machine, EMC, and Low-voltage Directives for products sold in EU-affiliated countries, and fulfills the conditions necessary for displaying CE markings. CE markings incorporates the QS1 series amplifier and targets the end products intended for in EU-affiliated countries.

12.4.2 Compliance with EC Directives

Our company has performed the requisite low voltage and EMC testing in accordance with EC Directives related to CE marking through a separate, third-party certifying authority.
However, for the EMC Directives, tests are performed by general installation and countermeasure methods, in our company as machines and configurations differ depending on customers' needs.

12. International Standards

The QS1 servo amplifier has been authorized to display CE marking (as shown at left) based on the recognition certificate issued by a separate, third-party certifying authority.

Accordingly, customers are instructed to perform the final conformity tests for all instruments and devices in use.

12.4.3 CE Marking Conformity Standards

The following conformity tests listed belowhave been performed for the QS1 servo system.

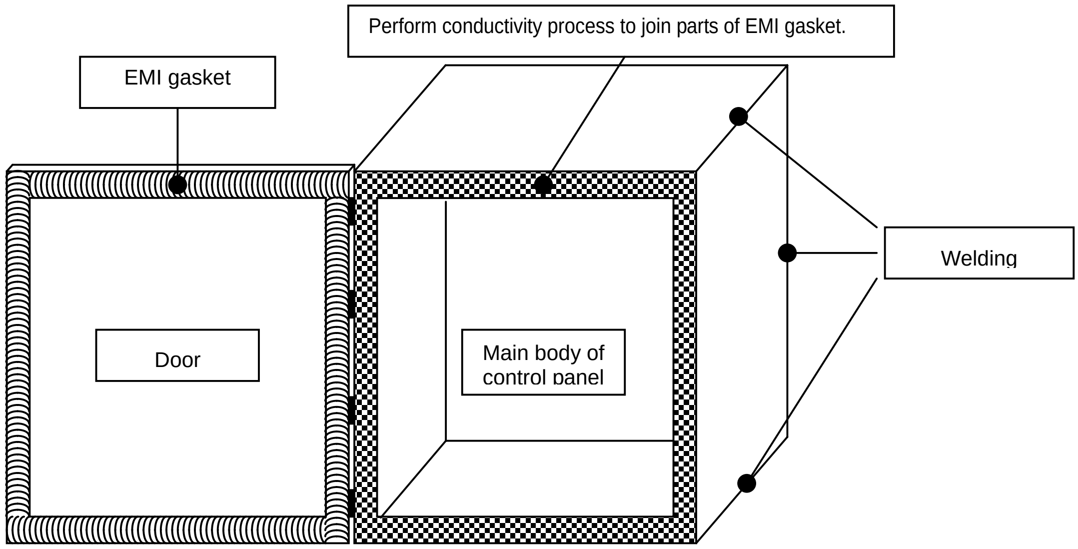
Directive classification	Classification	Test	Test standard
Low voltage Directive (Servo amplifier)	-	-	EN50178: 1997
EMC Directive (Servo amplifier / servo motor)	Emission	Conducted emission	EN55011: A1/1999
		Radiated emission	EN55011: A1/1999
	Immunity test	Electrostatic discharge immunity	EN61000-4-2: A2/2001
		Radiated electromagnetic field immunity	EN61000-4-3: A2/2001
		Electrical first transient / burst immunity	EN61000-4-4: A2/2001
		Conducted disturbance immunity	EN61000-4-6: A12001
		Surge immunity	EN61000-4-5: A12001
		Voltage Dips & Interruptions immunity	EN61000-4-11: A12001
Low voltage Directive (Servo motor)	-	Rotating electrical machines- Part1: Rating and performance	IEC-34-1
		Rotating electrical machines- Part5:Classification of degrees of protection provided by enclosures of rotating electrical machines(IP code)	IEC34-5
		Rotating electrical machines- Part 9:: Noise limits	IEC34-9

12.4.4 Cautions for EMC Directive Conformity

Use the following guidelines below for the QS1 servo system in order to conform the customer's equipment and devices to the EMC Directives.

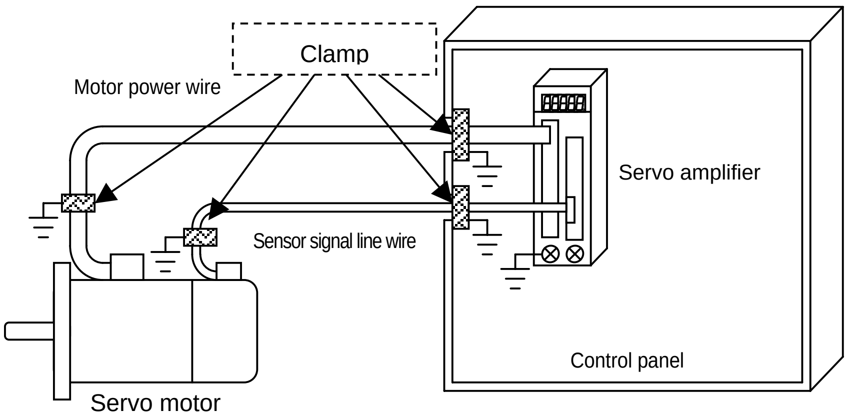
(1) Structure of control panel

1. A metallic material must be used for the door and main body of control panel.
2. The joints of the top and side panels must be masked and welded.
3. Parts joined with screws must be welded to prevent noise from leaking out from joints.
4. When joining parts with screws or spot welding, the welding space must be within 10cm.
5. Use an EMI gasket so that there is zero clearance between the door and control panel.
6. Install EMI gasket uniformly to the contact points between door and main body of control panel.
7. Perform conductivity processing on the EMI gasket, door and main body of control panel to confirm their conductivty.

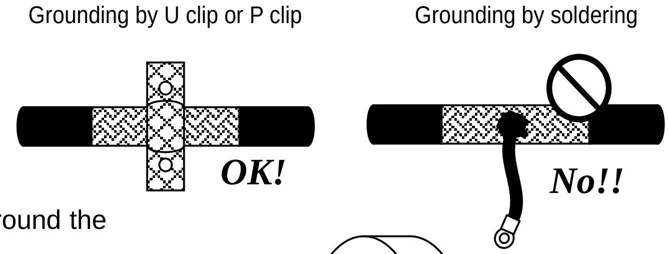


② Installation and wiring of peripheral equipment inside the control panel

1. Ground the noise filter frame to the control panel.
2. Ground the servo amplifier chassis provided by the customer.
3. Use shield cables for the motor power line and sensor cable.
4. Ground the shield of motor power wire and sensor cable to the control panel with the clamp.
5. Ground and clamp the shield of motor power line and sensor cable to the frame of the servo amplifier.



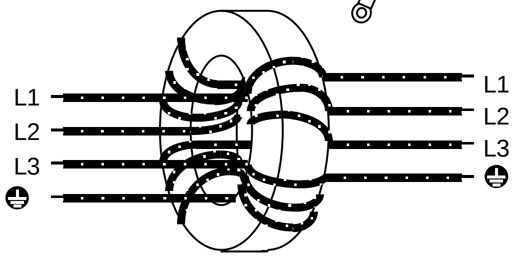
6. Use a conducting metal P clip or U clip to ground and clamp the shield wire, and fix it directly with metal screws. Do not ground by soldering electric wire to the shield wire.



7.Wrap the zero-phase reactor four times around the primary side of the noise filter.

8. Wire the servo amplifier at a short distance from the secondary side of noise filter.

9. Wire the primary side and secondary side of the noise filter separately.



③ Method of installing Servo amplifier

Refer the following figures for three phase and single phase installation.

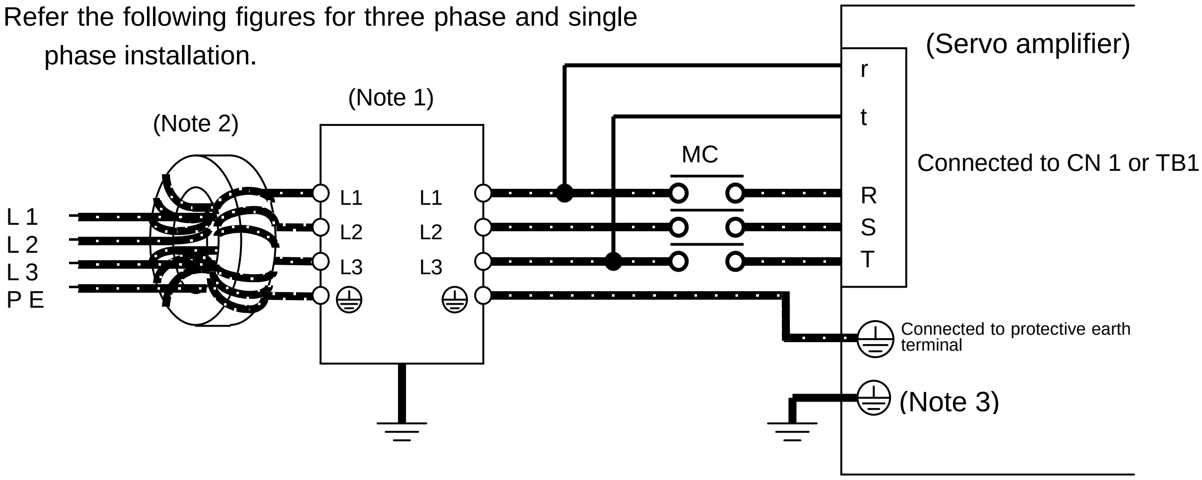


Figure 12-1 Three phase installation

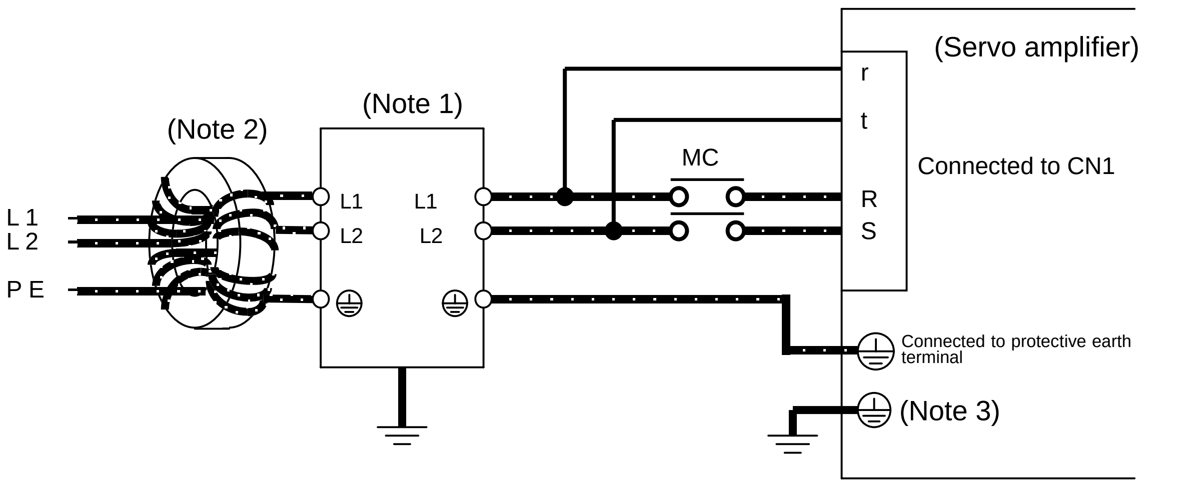


Figure12-2 Single phase installation

④ Recommended EMC countermeasures and their installation

(The Notes above correspond to the following figures)

(Note 1)

Noise filter

Model Number	Specifications	Manufacturer
3SUP-HK30-ER-6B	Rated voltage: Line-Line 500 V Rated current: 30 A	Okaya Electric Industries Co. Ltd.
3SUP-HK50-ER-6B	Rated voltage: Line-Line 500 V Rated current: 50 A	Okaya Electric Industries Co. Ltd.
RF3020-DLC	Rated voltage: Line-Line 440 to 550 V Rated current: 20 A	RASMI ELECTRONICS LTD.
RF3030-DLC	Rated voltage: Line-Line 440 to 550 V Rated current: 30 A	RASMI ELECTRONICS LTD.
RF1010-DLC	Rated voltage: Line-Neutral 250 V Rated current: 10 A	RASMI ELECTRONICS LTD.
FS5559-35-33	Rated voltage: Line-Line 480 V Rated current: 35 A	SCHAFFNER

∗ Always ground the frame of the noise filter.

∗ If possible, install wiring by separating the primary and secondary wiring of the noise filter.

∗ Keep wiring from the noise filter to servo amplifier as short as possible.

∗ Connect the servo amplifier to the secondary side of noise filter.

(Note 2) Power cable wirirng

Toroidal core

Model Number	External diameter	Internal diameter	Manufacturer
251-211	65 mm	36 mm	SCHAFFNER

∗ Wind the power cable four turns around toroidal core.

(Note 3) Grounding of amplifier and chassis

∗ Always ground the chassis of the servo amplifier.

Home page addresses (as of October 2002) of each manufacturer are given below for your reference.

Okaya Electric Industries Co. Ltd.: http://www.okayaelec.co.jp/

RASMI ELECTRONICS LTD. : http://www.rasmi.com/

SCHAFFNER : http://www.schaffner.com/

(5) EMC test execution

EMC testing of equipment and devices in which the QS1 servo system is incorporated should meet the emission and immunity (electromagnetic compatibility) standards for the usage environment / and operating conditions.

It is necessary to follow the instructions mentioned above and execute a final conformity check test after review.

Release
Revision A Nov.2005

Precautions For Adoption

⚠Cautions

The possibility of moderate or minor injury
and the occurrence of physical damage are assumed
when the precautions at right column are not observed.
Depending on the situation,
this may cause serious consequences.
Be sure to follow all listed precautions.

⚠Cautions

- Be sure to read the instruction manual before using this product.
- Take sufficient safety measures and contact us before applying this product to medical equipment that may involve human lives.
- Contact us before adapting this product for use with equipment that could cause serious social or public effects.
- The use of this product in high motion environments where vibration is present, such as in vehicles or shipping vessels, is prohibited.
- Do not convert or modify any equipment components.

* Please contact our Business Division for questions and consultations regarding the above.

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