M0005349F

SANMOTION

AC SERVO SYSTEMS

Q

TYPE S

Instruction Manual

SANYO DENKI

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 S. The “Q” Series Type S 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.

Please note that this instruction manual is applicable for the amplifier revision “D”or “E” (and refer to the details given in the following pages).

★Precautions related to this Instruction Manual

- In order to fully understand the functions of AC servo amplifier “Q” Series Type S, please read this instruction manual thoroughly before using it.
- After reading this manual thoroughly, please keep it handy for reference.
- Please contact the dealre 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.

Details of Software Modifications Related to Instruction Manual Revision

Each time the Instruction Manual is upgraded, the modifications are recorded. Since these modifications are functional additions to equipment already in use, modifications such as parameter modification, etc., are not required. Additionally, these additional functions are displayed as new functions in this Instruction Manual.

1.Target model number

Model name	Common specifications	Specifications	Revision
QS1□01AA QS1□03AA QS1□05AA	Input power : "200V" or "100V" Built-in regenerative resistance : "Yes" or "No" DB resistance : "Built-in" or "No"	Standard encoder Rotary servo system	"C" → "D"
QS1□10AA QS1□15AA		Standard encoder Rotary servo system	"B" → "C"
QS1□01LA QS1□03LA QS1□05LA		Standard encoder Linear servo system	"C" → "D"
QS1□10LA QS1□15LA		Standard encoder Linear servo system	"B" → "C"
QS1□01AH QS1□03AH QS1□05AH		Full-duplex communication encoder Rotary servo system	"C" → "D"
QS1□10AH QS1□15AH		Full-duplex comm. encoder Rotary servo system	"B" → "C"
QS1□01AH QS1□03AH QS1□05AH		Full-duplex comm. encoder Rotary servo system	"C" → "D"
QS1□10AH QS1□15AH		Full-duplex comm. encoder Rotary servo system	"B" → "C"
QS1□01AT QS1□03AT QS1□05AT		Full closed system Rotary servo system	"C" → "D"
QS1□10AT QS1□15AT		Full closed system Rotary servo system	"B" → "C"

2. Modification period

As per production in the last ten days of February 2003

3. Modification purpose

For the upgrade of the servo amplifier

4. Main Modification Contents

4.1. Modification of main name plate

4.2. Modification of servo amplifier software

1. Modification of software version
2. Addition of operation trace function
3. Addition of pulse sending JOG function
4. Extension of function related to brake operation start time
5. Extension of function related to deviation clear (position control)
6. Addition of analog monitor output signal
7. Addition of digital monitor output function
8. Addition of display function of load torque monitor (estimate)

4.3. Modification of instruction manual (M0005313)

4.4. Version upgradation of set-up software

5. Details of main modification contents

5.1. Modification of main name plate

Modification in material quality with air permeability. The material color changes to white with the modification of material quality.

5.2. Modifcation of Servo Amplifier Software

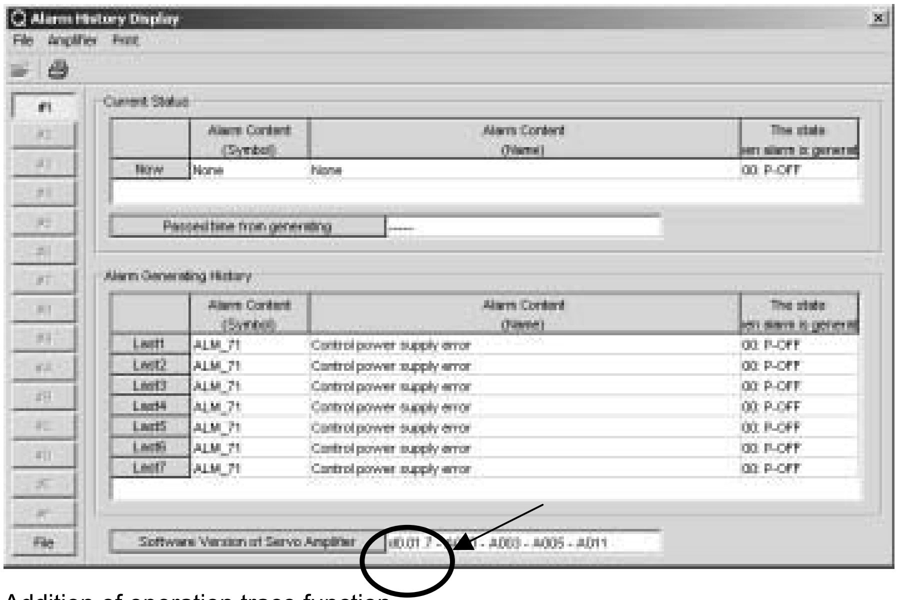
1. The software has been upgraded to version “P0.01.0” (from “P0.00.5”). Check the software version currently in use by the following methods:

- Check by using the digital operator

  In the Status Display Mode (mode immediately after turning control power), press the “MODE” key several times to display the “Alarm Trace Mode” (“ALn.00”). If the “▼” key is pressed twice, the software (CPU) version is displayed.

- Check by using the Q-SETUP set-up software

  When you are online, if “Monitor (<u>M</u>)” – “Alarm history display (<u>A</u>)…” is selected, the following screen is displayed. The portion indicated with an arrow is the software version.



Current Status

	Alarm Content (Symbol)	Alarm Content (Name)	The state en alarm is general
Now	None	None	00: P-OFF

Passed time from generating: ------

Alarm Generating History

	Alarm Content (Symbol)	Alarm Content (Name)	The state en alarm is general
Last1	ALM_71	Control power supply error	00: P-OFF
Last2	ALM_71	Control power supply error	00: P-OFF
Last3	ALM_71	Control power supply error	00: P-OFF
Last4	ALM_71	Control power supply error	00: P-OFF
Last5	ALM_71	Control power supply error	00: P-OFF
Last6	ALM_71	Control power supply error	00: P-OFF
Last7	ALM_71	Control power supply error	00: P-OFF

Software Version of Servo Amplifier: x0.01.7 - [illegible] - A003 - A005 - A011

2. Addition of operation trace function

This function can be used when combined with the Q-SETUP set-up software Version 0.3.1-0.01.4 onwards.

3. Addition of pulse sending JOG function

This function can be used when it is combined with Q-SETUP set-up software Version 0.3.1-0.01.4 onwards.

4. Extension of function related to brake operation start time

After a status change from servo ON to servo OFF, the brake (holding brake and dynamic brake) operation function is extended, so that the motor does not stop even if the prescribed time is elapsed.

Parameter setting value G1-19：BONBGN	P0.00.5	P0.01.0
0ms	Brake operation after 4ms is elapsed	Brake operatrion function becomes disabled after the prescribed time is elapsed.
1ms~4ms	Brake operation after 4ms is elapsed	Same condition as on the left
5ms~65535ms	Brake operation after the time set is elapsed (Internal processing of servo amplifier is performed in 4ms unit. Therefore, when BONBGN = 13ms, “brake operation after 16ms is elapsed”. 16ms which is the multiple of 4 exceeds the setting time of 13ms.)	Same condition as on the left

5. Extension of function related to deviation clear (position control)

Deviation clear input is extended in 2 types, level input and edge input.

Parameter setting G3-00：PA300		P0.00.5	P0.01.0
Upper	Name	Deviation clear selection	Deviation clear selection
	0H	Servo OFF/deviation clear: Deviation clear input/level detection	Same condition as on the left
	1H	Servo OFF/deviation clear: Deviation clear input/level detection	Servo OFF/deviation clear: Deviation clear input / edge detection
	2H	Servo OFF/deviation not cleared: Deviation clear input/level detection	Same condition as on the left
	3H	Servo OFF/deviation not cleared: Deviation clear input/level detection	Servo OFF/deviation not cleared: Deviation clear input / edge detection
Lower	Name	Position command pulse digital filter	Position command pulse digital filter
	0H	Minimum pulse width=834nsec	Same condition as on the left
	1H	Minimum pulse width=250nsec	Same condition as on the left
	2H	Minimum pulse width=500nsec	Same condition as on the left
	3H	Minimum pulse width＝1.8usec	Same condition as on the left
	4H	Minimum pulse width＝3.6usec	Same condition as on the left
	5H	Minimum pulse width＝7.2usec	Same condition as on the left
	6H	Minimum pulse width=125nsec	Same condition as on the left
	7H	Minimum pulse width=83.4nsec	Same condition as on the left

6. Addition of analog monitor output signal

   Signal that can be selected as analog monitor output is added.

Parameter setting G5-00：MON1 G5-01：MON2	P0.00.5	P0.01.0
00H	Torque monitor ［2V/TR］	Same condition as on the left
01H	Torque command monitor ［2V/TR］	Same condition as on the left
02H	Velocity monitor 2mV/min-1	Same condition as on the left
03H	Velocity monitor ［1mV/min-1］	Same condition as on the left
04H	Velocity monitor ［3mV/min-1］	Same condition as on the left
05H	Velocity command monitor 2mV/min-1	Same condition as on the left
0GH	Speed command monitor ［1mV/min-1］	Same condition as on the left
07H	Speed command monitor ［3mV/min-1］	Same condition as on the left
08H	Position deviation counter monitor ［50mV/Pulse］	Same condition as on the left
09H	Position deviation counter monitor ［20mV/Pulse］	Same condition as on the left
0AH	Position deviation counter monitor ［10mV/Pulse］	Same condition as on the left
0BH	――――――	Load torque monitor (estimate) 2V/TR
0CH	――――――	Position command pulse monitor (Position command pulse input frequency) ［10mV/kPulse/s］
0DH	――――――	U phase electrical angle ［8Vp-p］
0EH	――――――	Position deviation counter monitor ［5mV/Pulse］
0FH	――――――	Position deviation counter monitor ［1mV/Pulse］
10H	――――――	Position command pulse monitor (Position command pulse input frequency) ［2mV/kPulse/s］

7. Addition of digital monitor output function

   This adds a digital display for motor excitation status (HIGH/LOW), and also adds positioning completion, etc. The display signal can be selected from Group5 –Page 02.

8. Addition of load torque monitor (estimate) display function

   This function displays the estimated load torque in s numeric value and also outputs the analog voltage.

5.3. Modifications of Instruction Manual

M0005313D is modified to M0005313E.

1. Contents were modified to reflect software modifications for the servo amplifier.
2. Chapter 7 Sequence: Part of the explanation was modified
3. Chapter 12: Added EMC command approval/declaration number

5.4.Modifications of Q-SETUP Setup Software

The Q-SETUP Setup Software has been upgraded. Please refer to the text file appended to the setup software for the details on modifications to Version 0.3.1-01.4.

1. Addition of operation trace function
2. Addition of pulse sending JOG operation function
3. Modification/addition of general parameter
4. Addition of monitor display
5. Modification of system parameter

Details of Software Modifications Related to Instruction Manual Revision

Each time the Instruction Manual is upgraded, the modifications are recorded. Since these modifications are functional additions to equipment already in use, modifications such as parameter modification, etc., are not required. Additionally, these additional functions are displayed as new functions in this Instruction Manual.

1. Modification of Servo Amplifier

1-1 Target model number

Model name	Common specifications	Specifications	Revision
QS1□01AA QS1□03AA QS1□05AA	Input power： “200V” or “100V” Built-in regenerative resistance： “Yes” or “No” DB resistance： “Built-in” or “No”	Standard encoder Rotary servo system	“D” → “E”
QS1□10AA QS1□15AA		Standard encoder Rotary servo system	“C” → “D”
QS1□01LA QS1□03LA QS1□05LA		Standard encoder Linear servo system	“D” → “E”
QS1□10LA QS1□15LA		Standard encoder Linear servo system	“C” → “D”
QS1□01AH QS1□03AH QS1□05AH		Full-duplex communication encoder Rotary servo system	“D” → “E”
QS1□10AH QS1□15AH		Full-duplex communication encoder Rotary servo system	“C” → “D”
QS1□01AH QS1□03AH QS1□05AH		Full-duplex communication encoder Rotary servo system	“D” → “E”
QS1□10AH QS1□15AH		Full-duplex communication encoder Rotary servo system	“C” → “D”
QS1□01AT QS1□03AT QS1□05AT		Full closed system Rotary servo system	“D” → “E”
QS1□10AT QS1□15AT		Full closed system Rotary servo system	“C” → “D”

1-2. Modifications of servo amplifier software version

The servo amplifier software has been upgraded from version “P0.01.0” to “P0.01.2”.

Check the servo amplifier software version by the following methods.

(Additionally, you can check the revision of the amplifier by checkin the end SER. No. on the main name plate and the seal end of the front side as shown in the above table.)

① In the Status Display Mode (mode immediately after turning control power):

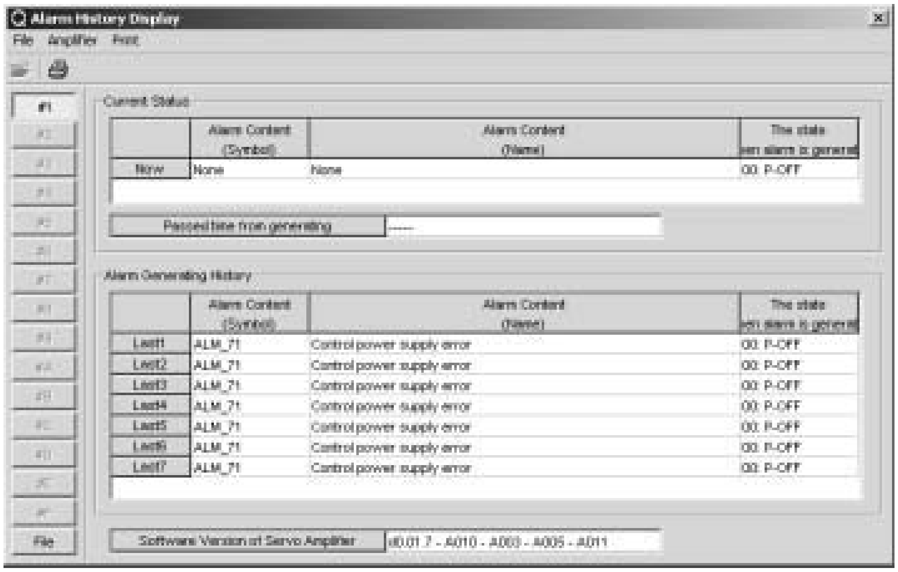
Press the “MODE” key several times to display the “Alarm Trace Mode” (“ALn.00”).

If the “▼” key is pressed twice, the software (CPU) version is displayed.

② Check by using the Q-SETUP set-up software:

When you are online, if “Monitor (M)” – “Alarm history display (A)…” is selected,

the following screen is displayed. The portion indicated with an arrow is the software version.



Current Status

	Alarm Content (Symbol)	Alarm Content (Name)	The state en alarm is general
Now	None	None	00: P-OFF

Passed time from generating ------

Alarm Generating History

	Alarm Content (Symbol)	Alarm Content (Name)	The state en alarm is general
Last1	ALM_71	Control power supply error	00: P-OFF
Last2	ALM_71	Control power supply error	00: P-OFF
Last3	ALM_71	Control power supply error	00: P-OFF
Last4	ALM_71	Control power supply error	00: P-OFF
Last5	ALM_71	Control power supply error	00: P-OFF
Last6	ALM_71	Control power supply error	00: P-OFF
Last7	ALM_71	Control power supply error	00: P-OFF

Software Version of Servo Amplifier d0.01 7 - A010 - A003 - A005 - A011

1-3. Added functions related to servo amplifier I/O

① PY compatible alarm output (4bit) is added to the General Purpose selection items

General parameter Group 9- Page 00 to 07：OUT1 to OUT8

50：Output PY compatible alarm code 1 (positive logic)
51：Output PY compatible alarm code 1 (negative logic)
52：Output PY compatible alarm code 2 (positive logic)
53：Output PY compatible alarm code 2 (negative logic)
54：Output PY compatible alarm code 4 (positive logic)
55：Output PY compatible alarm code 4 (negative logic)
56：Output PY compatible alarm code 8 (positive logic)
57：Output PY compatible alarm code 8 (negative logic)

② Operation setup completion 2 signal output is added to the General Purpose output selection items

Outputs are sent 100msec after turning ON the main circuit power supply (equivalent to the SRDY signal of PY amplifier)

General parameter Group 9- Page 00 to 07：OUT1 to OUT8

58：Output terminal is ON during operation setup completion
59：Output terminal is OFF during operation setup completion

③ Near range status is added to the General Purpose input selection

General parameter Group 7,8 Selection table

20：Function is enabled during near range status
21：Function is enabled when not in near range status

1-4. Addition of other functions of servo amplifier

① Addition of amplifier cumulative operation time display

Monitor screen Page 1C：OPE_TIME

② Addition of password settings

Password can be set from the digital operator in the front of the amplifier. After setting the password, parameters cannot be edited from digital operator or Q-setup software. Notify the dealer or sales representative in case you forget the password.

1-5. Addition of functions related to sensor

① Addition of alarm for wire-saving absolute sensor RA062C

Abnormal acceleration alarm (alarm code:B7), error in multi-rotation generation (Same as :A5), EEPROM data not set (same as : A6), error in resolver output (same as: A7) and resolver disconnection (same as : A8) are added.

② Addition of application of incremental encoder (7 pairs) with CS signal

This feature is also compatible to the BL865 motor made by SANYO DENKI. Add a connector (for receiving CS signal) of full close, etc., and new hardware for the servo amplifier. It is also necessary to set Page 2 of the system parameters to 01:_7Pairs_INC.

③ Addition of contents of encoder serial PS output

When using the absolute encoder, the format (baud rate is 9600 bps) for sending the absolute signal to upper level device and decimal number ASCI code is added to binary. The PA404 lower setting becomes decimal number ASCII code when it is 00, and binary is 01. Moreover, in the case of the incremental encoder, irrespective of the PA404 lower settings, present position monitor output is possible by start-stop synchronization (9600bps, binary).

④ CS offsset support is added to incremental encoder function selection of the linear servo system

System parameter Page 02：Incremental encoder function selection

89：Only signal / A,B,Z: CS normalized/software (Compulsory settings)

2. Modifications of Q-SETUP Setup Software

The Q-SETUP setup software has been upgraded from version 0.3.1-0.01.4 to version 0.4.7-0.03.0. Version 0.3.1-0.01.4, which is currently in use, is not compatible with the new software (version P0.01.2) for the servo amplifier. Download the new Q-SETUP setup software version 0.4.7-0.03.0 from Sanyo Denki's home page (www.sanyodenki.co.jp).

Further, in version 0.4.7-0.03.0, there are two types of installation possible, a complete or partial instalation. The difference between the two different installation types is the availability of a "System Analysis" function. More detail on the difference between complete and partial installation is given below.

Detail	Complete installation	Partial installation
Features	Selection of complete and partial is possible. System analysis function exists during complete installation.	Only partial installation is possible. System analysis function does not exist during partial installation.
File name	Setup_V047-0030-Complete.exe	Setup_V047-0030-Reduced.exe
File size	About 6.2MB	About 1.4MB
File size after installation	Complete：About 20MB Partial：About 5MB	Only partial：About 5MB

[Note] The relationship between the Q-SETUP setup software and servo amplifier is as follows.

List of compatible versions of Q series servo amplifier and Q-SETUP software

Software version of Q series servo amplifier	**Version of Q-SETUP software**
P0.00.2 (Amplifier revision: A)	**Version 0.1.7-0.00.8 Release 2 (Note 1)**
P0.00.5 (Amplifier revision) : QS1A01~05:BorC,QS1A10/15:B）	**Version 0.2.1-0.01.2 Version 0.3.1-0.01.4 (Note 2) Version 0.4.7-0.03.0 (Note 2,3)**
P0.01.0 (Amplifier revision) : QS1A01~05:D,QS1A10/15:C）	**Version 0.3.1-0.01.4 Version 0.4.7-0.03.0 (Note 3)**
P0.01.2 (Amplifier revision) : QS1A01~05:E,QS1A10/15:D）	**Version 0.4.7-0.03.0**

Note1.

With servo amplifier software version P0.00.2, the communication procedure between the servoamplifier and the PC differs from version P0.00.5 onwards. Therefore, it cannot be combined with a version other than version 0.1.7-0.00.8 Release 2.

Note 2.

For servo amplifier software version is P0.00.5, some functions like operation trace and pulse sending JOG may be partially disabled.

Note 3.

For servo amplifier software prior to version P0.01.0, some functions like operation trace and pulse sending JOG may be partially disabled.

2-1. Additional functions related to Q-SETUP setup software

① Addition of system analysis function NEW Amplifier Complete

It is possible to display the machine resonance antiresonance point on the PC by frequency analysis. Use the PC with an upgraded servo amplifier and the Q-SETUP setup software completely installed.

② Addition of operation trace scroll mode NEW Amplifier Partial Complete

It is possible to scroll the operation status (and its display) on the PC. It is recommended to set the sampling period to 50msec (minimum) and the CPU operation frequency of the PC above 800 MHz. Use the PC with an upgraded servo amplifier and partial or fully-installed Q-SETUP setup software.

③ Addition of motor parameter file Partial Complete

It is possible to modify the combined motor by using the “Motor parameter settings”. At this time, 38 types of P-series motor and 15 types of Q-series motor are planned for this addition.

3. Changes to Instruction Manual

The following Instruction Manual is revised according to the modifications of the amplifier software and Q-SETUP software. Refer to the Instruction Manual for more details about these modifications.

Servo Amplifier

	Before modification	After modification
Japanese version	M0005313E	M0005313F
English version	M0005349E	M0005349F

Q-SETUP setup software

	Before modification	After modification
Japanese version	M0005351B	M0005351C
English version	M0006024B	M0006024C

Note: Regarding the release period of the Instruction Manual

A Japanese version is released along with the product shipment; however, please note that the release of the English version will be slightly delayed.

4. Modification Period

Servo amplifier: As of August 2003

Q-SETUP setup software: Released September 1, 2003

5. Modification Purpose

The servo amplifier and its software, together with the Q-SETUP setup software, are revised to take advantage of functional improvements in these products.

Safety Precautions

This document is a summary of the safety precautions regarding the use of the Q-series S-type amplifier.

Please read it carefully prior to use.

1. Safety Precautions

1.1 Introduction

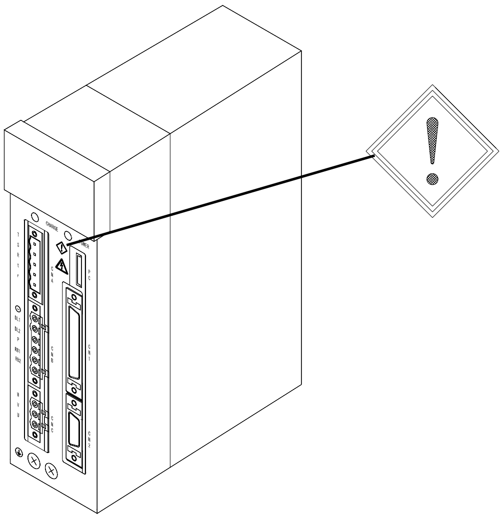
The Q-series servo amplifiers and servo motors were designed for use with general industrial equipment. The following instructions should be followed:

- 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.

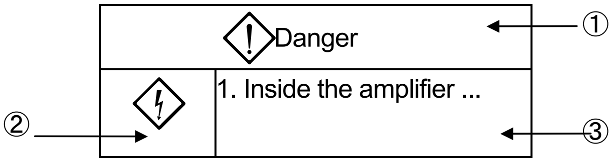


1.3 Interpretation of the warning labels

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.

1. Safety Precautions

⚠ 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℃ 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.

Table of Contents

Safety Precautions

This document is a summary of the safety precautions regarding the use of the Q-series S-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;

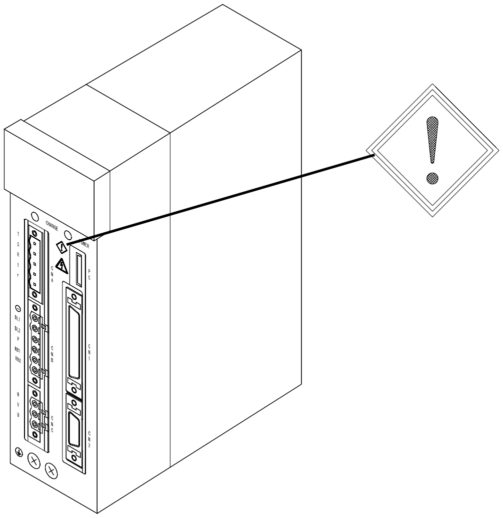
  ③ In computer systems of social or public importance;

  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.

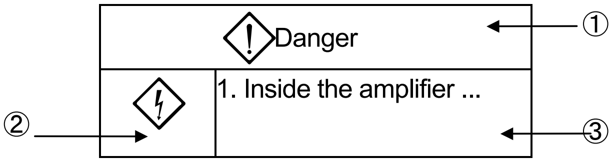


1.3 Interpretation of the warning labels

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.

1. Safety Precautions

⚠ 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℃ 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.

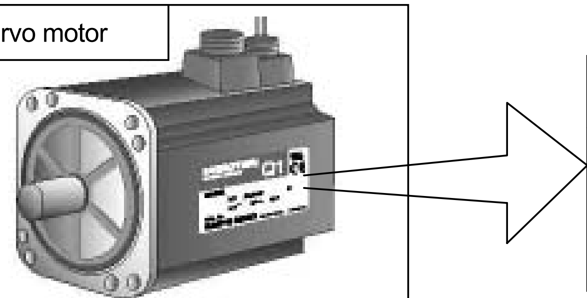
Be careful to not drop the product when removing it from the box.
Be especially careful with motors, as they can be very heavy.

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

AC SERVO SYSTEMS **Q**

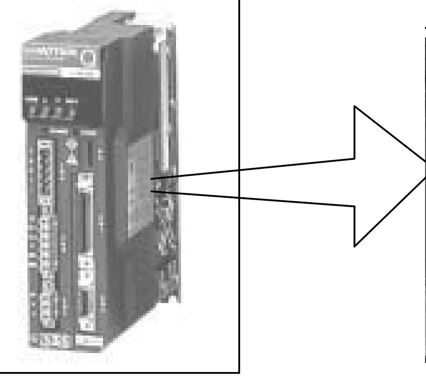
MODEL Q2AA04006DXS21
60W AC200V 0.53A
3000min^{-1} 3ϕ — · Cl.F IP40
SER No.090206001 2002
SANYO DENKI MADE IN JAPAN 00482921-01

Model No

Serial No

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

SANMOTION Q

MODEL QS1A10AA03E01P00
INPUT 3ϕ 200-230V AC
50/60Hz 26.1A
1ϕ 200-230V AC
50/60Hz 0.2A
OUTPUT 3ϕ 0-326V 24.0A

SER. No. 0702230500

SANYO DENKI MADE IN JAPAN

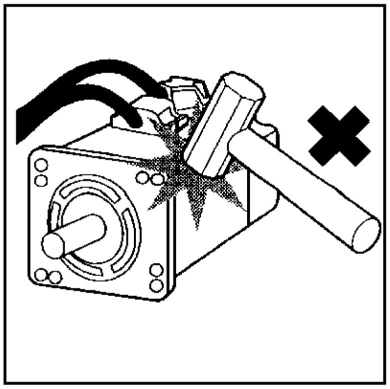
Model No.

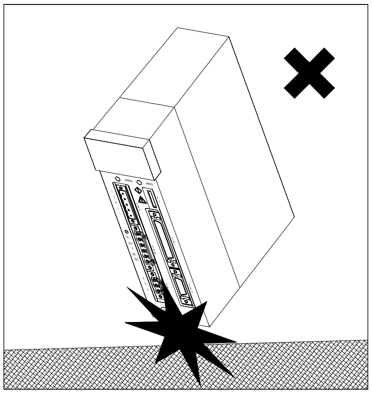
Serial No.

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:

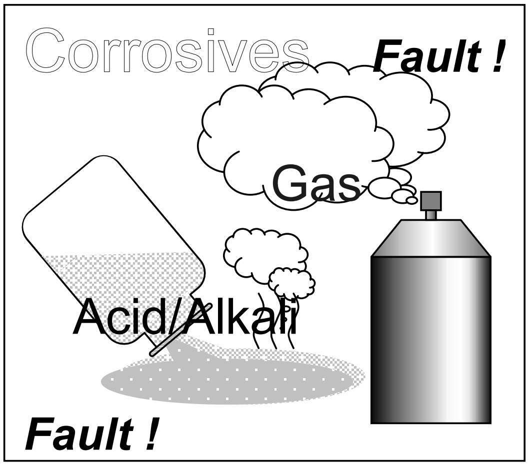
AC200 - 230V (+10%, -15%) 50/60Hz

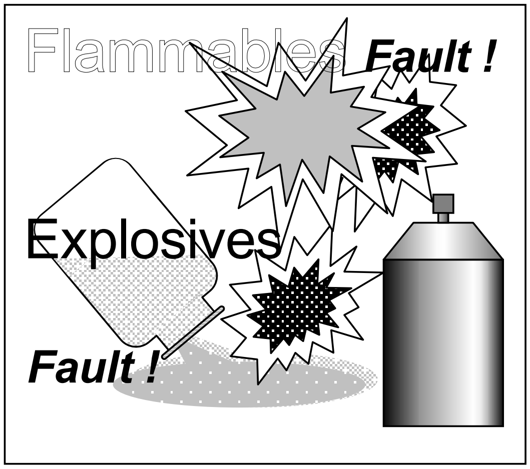
AC 100V input type:

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

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

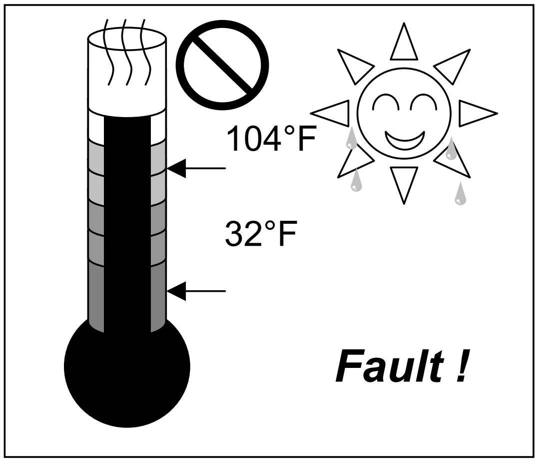
- **If there are surges on the power line, use a surge protector between the power source and the device, as a malfunction or accident could otherwise result.**
- **When doing maintenance or inspection, switch the power on or off only after verifying safety concerns, such as the status of the load device. 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.**

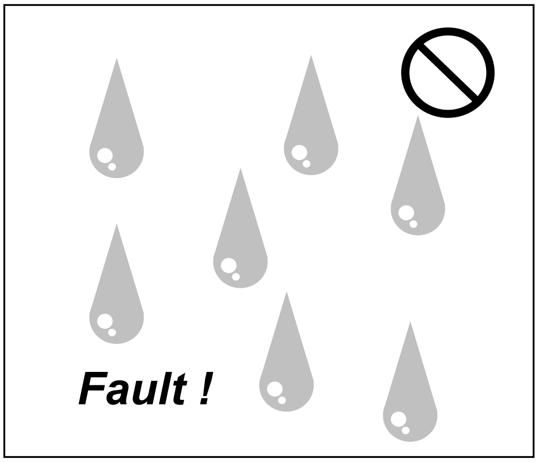




2. Prior to Use

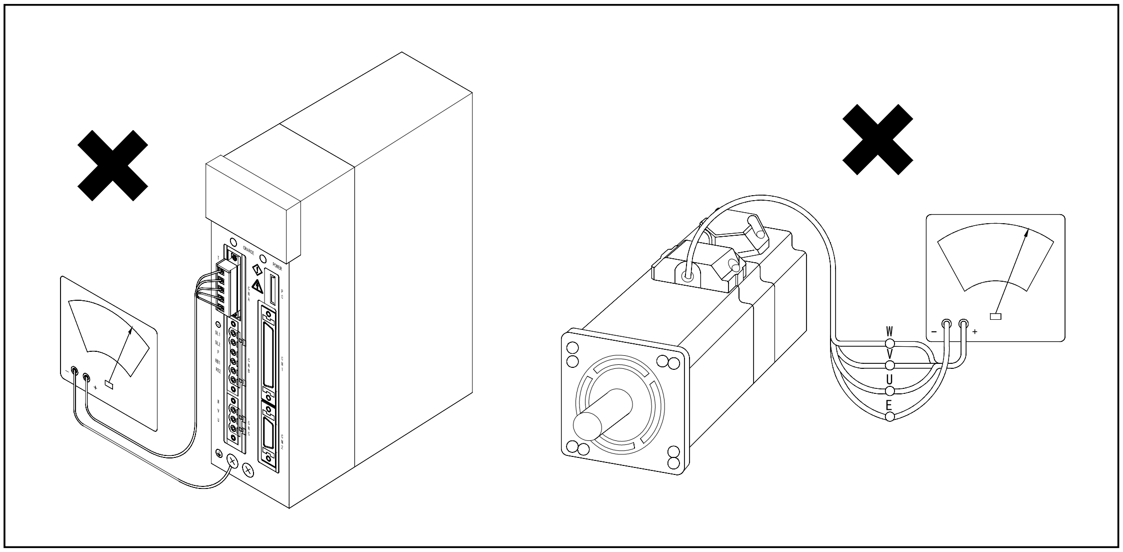
- Use the device within the specified operating temperature of 0-40°C (sub-amp is 0-55°C) and relative humidity below 90%.
- Prevent water, cutting fluid or rain from contacting the servo motor or servo amplifier; a short circuit or electric shock could otherwise result.



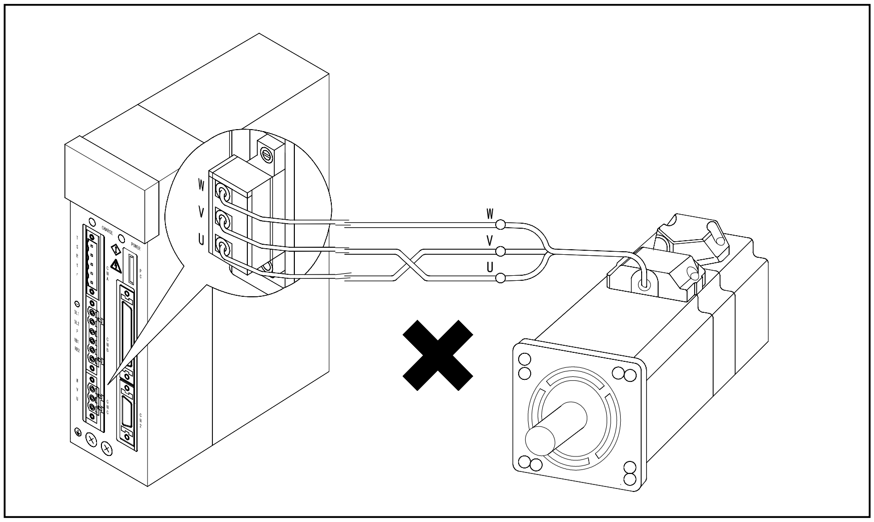


- For safety, verify that the protective ground terminal connection (⏚) of the servo amplifier is at least D-type (Class 3 (Max 100Ω)). The ground terminal of the servo motor should always be connected to the protective ground terminal (⏚) of the servo amplifier.

- 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.

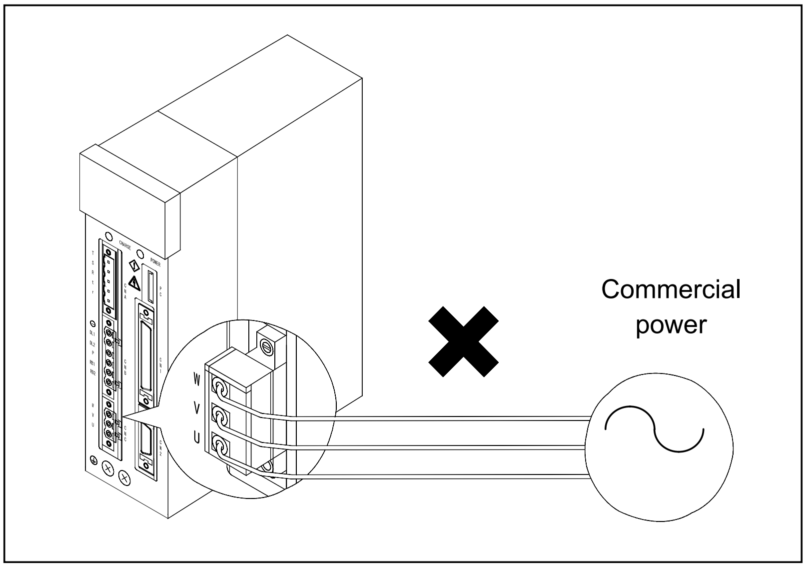


- **Wiring should be performed after reading “4. Wiring” to ensure correct connections. Incorrect wiring could result in damage to the device, or fire.**
- **The servo motor is not an induction motor. Therefore, reversing the phases of the motor will not result in reverse rotation.**



- **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　Ａ　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	15 A	30 A	50 A	100 A	150 A
○	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

A: Standard I/F such as a wire-saving incremental encoder or wire-saving absolute encoder
H: Absolute request sensor (ABS-RII, RA062M)
R: Absolute/incremental encoder (ABS-E)
T: Full close

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　Q2AA04006D

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. Prior to Use

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○○ＡＡ０ＸＸ△△▽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

Rotary motor		Servo amplifier	
Ｑ２ＡＡ○○○○○○□◇▽▽		ＱＳ１Ａ○○ＡＡ０ＸＸ△△▽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○○ＡＡ０ＸＸ△△▽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○○ＡＡ０ＸＸ△△▽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○○ＡＡ０ＸＸ△△▽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
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○○ＡＡ０ＸＸ△△▽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○○ＡＡ０ＸＸ△△▽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

2. Prior to Use

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.

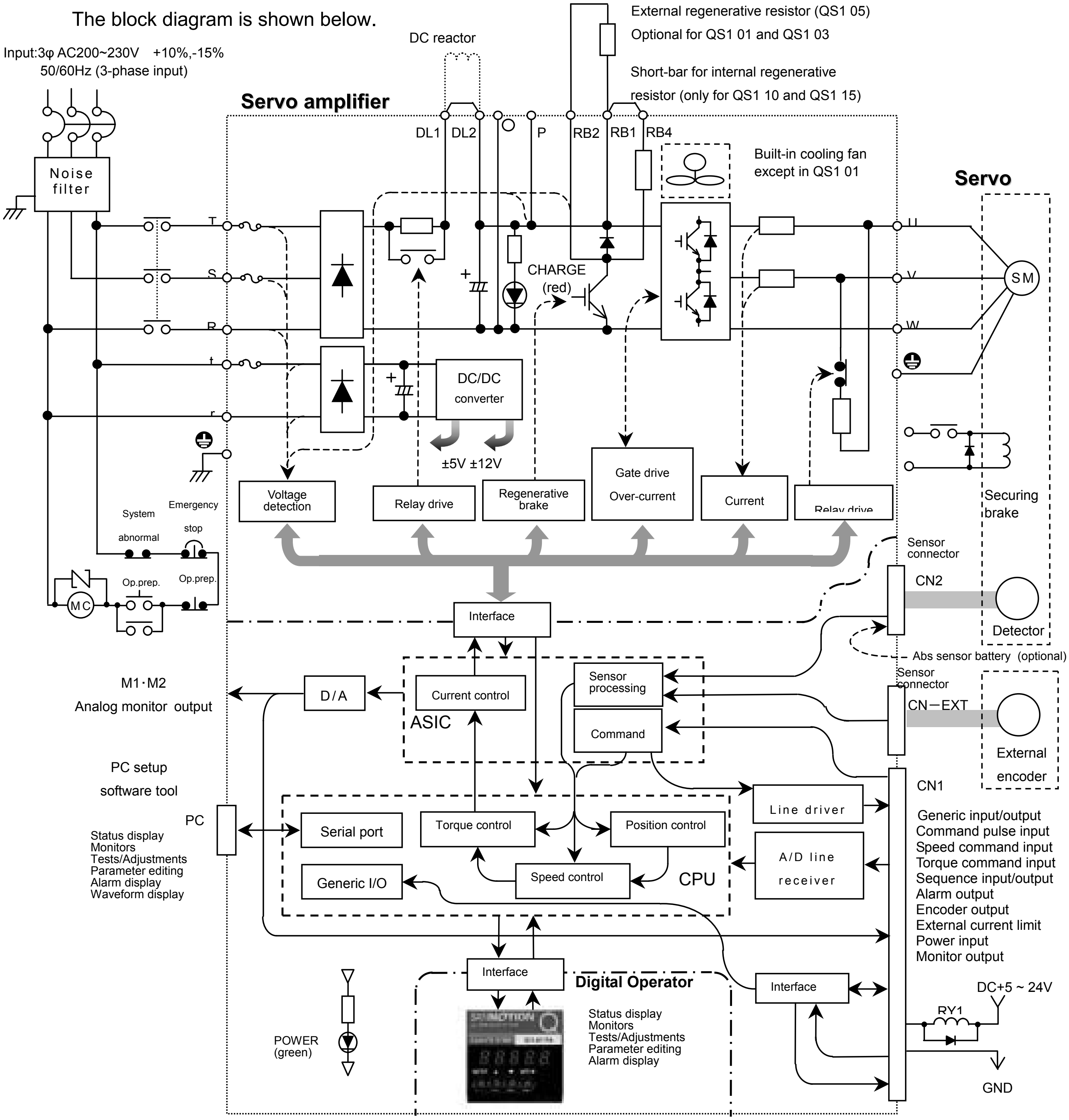
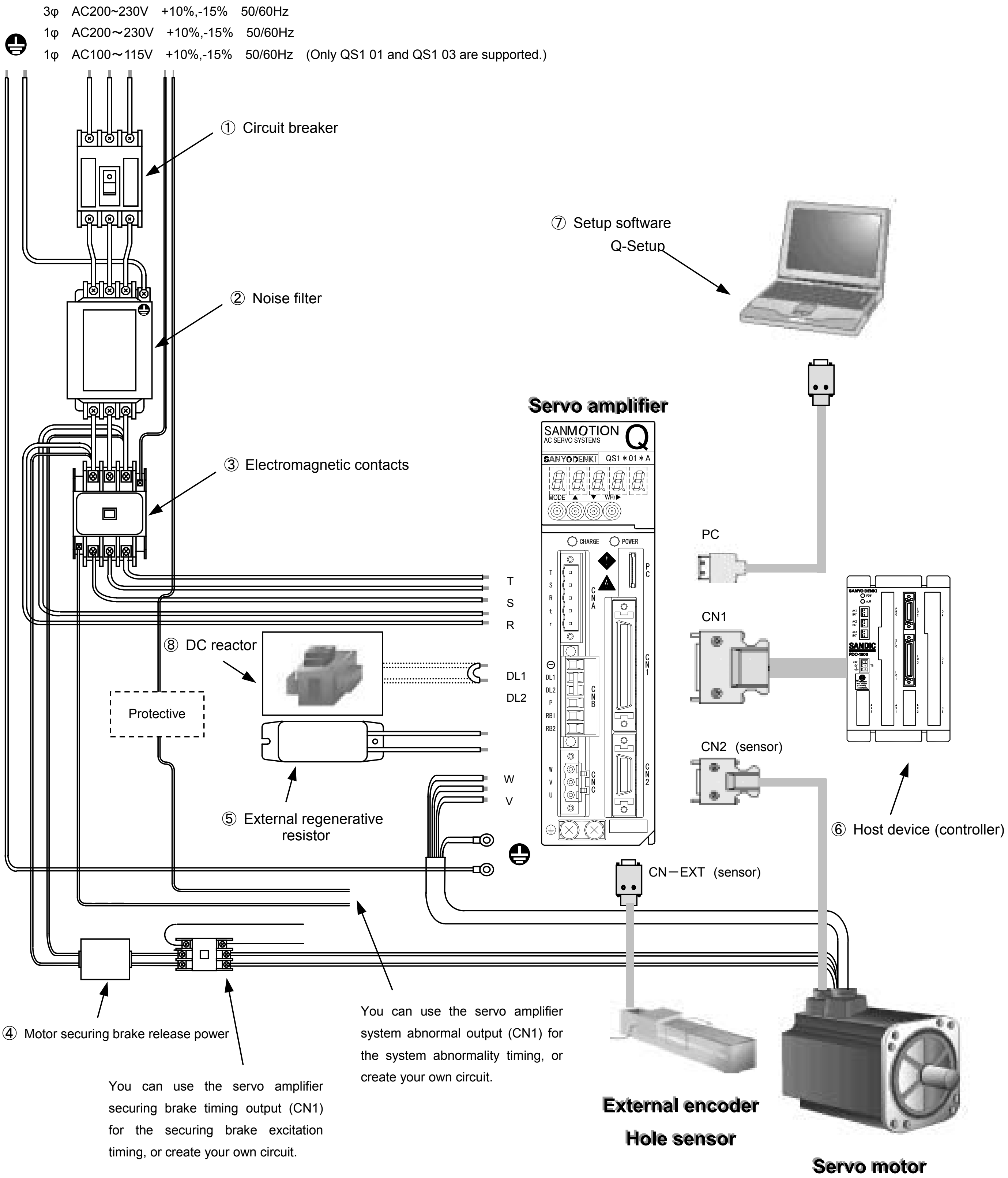


Fig. 3-1 Block diagram

3. Servo System Configuration

3.2 External wiring diagram

The following diagram shows the external wiring.



You can use the servo amplifier system abnormal output (CN1) for the system abnormality timing, or create your own circuit.

You can use the servo amplifier securing brake timing output (CN1) for the securing brake excitation timing, or create your own circuit.

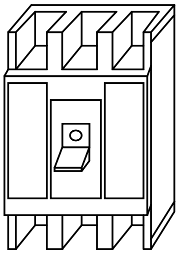
Fig. 3-2 External wiring diagram

3.2.1 Peripherals

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

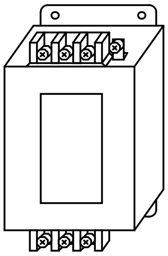
① Circuit breaker

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



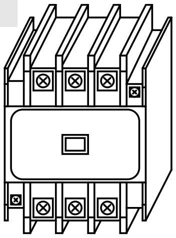
② Noise filter

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



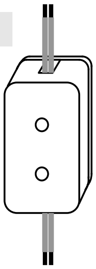
③ Electromagnetic contacts

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.



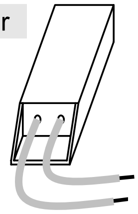
④ Motor securing brake release power

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



⑤ External regenerative resistor

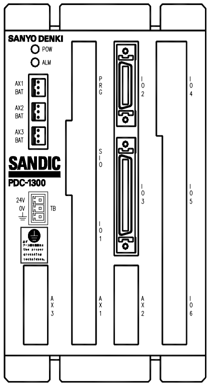
Connect an external regenerative resistor to the RB-1-RB-2 terminals of the CNB on the QS1 01, QS1 03 and QS1 05.
If the capacity of the internal regenerative resistor in the QS1 10 and QS1 15 is not sufficient, remove the RB1－RB4 short-bar, and connect an external regenerative resistor between the RB1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



⑥ Host device (controller)

Connects not only our host device but other manufacturer's devices

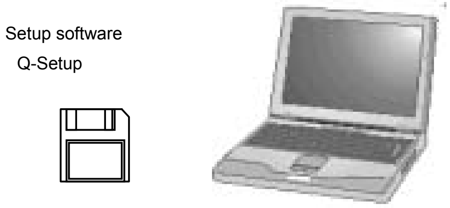
If you develop your own host device, refer to the external wiring diagram as well as sections "4. Wiring", and "10. Specifications".



Our digital controller (PDC-1300) etc.

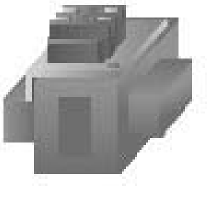
⑦ Setup software Q_Setup

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



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

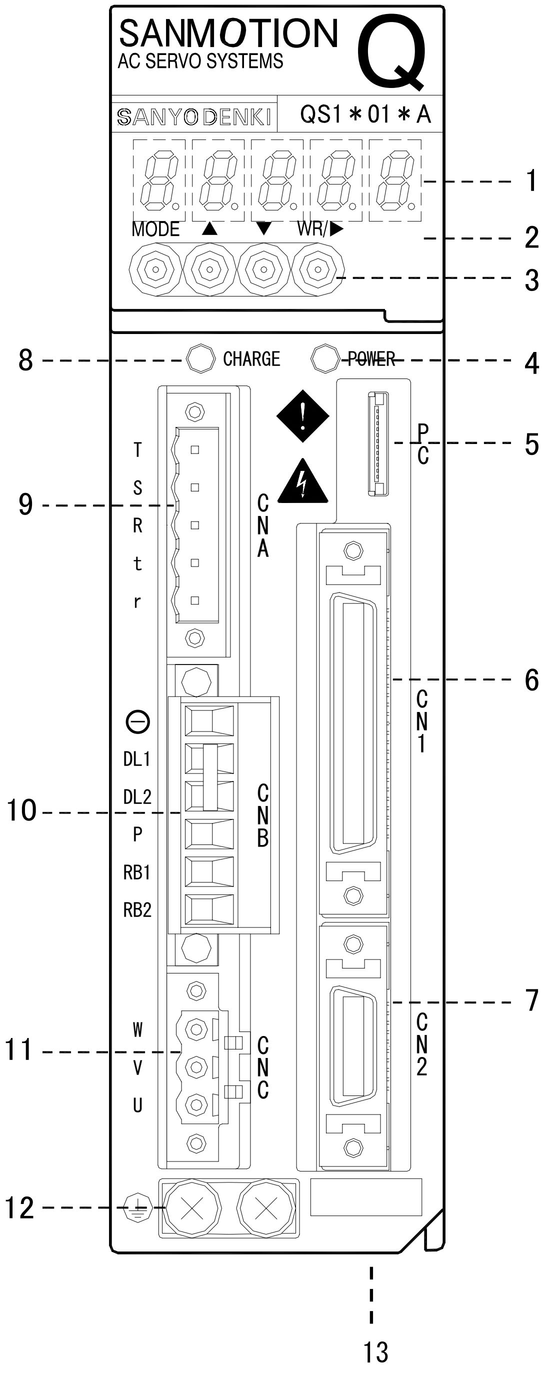


Fig. 3-3 Servo amplifier front view (QS1 01)

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” and “Alarm display” functions.

6. Generic input/output connector (CN1)

Servo amplifier and host device (controller) 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.

3.3.2 Part names for QS1 10 and QS1 15

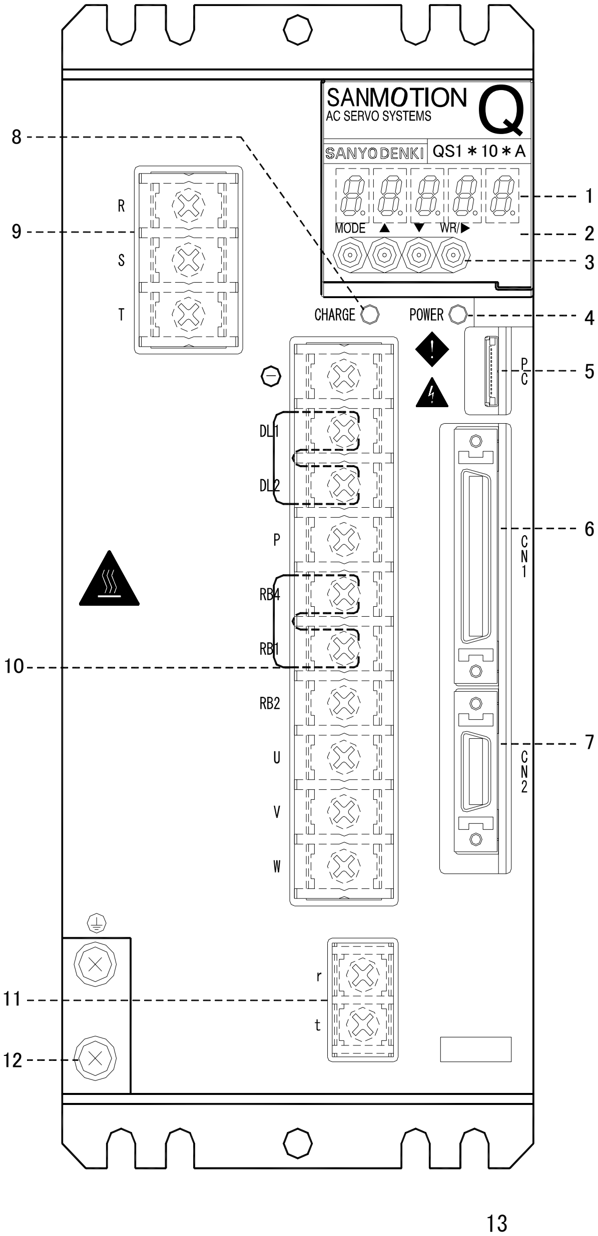


Fig. 3-4 Servo amplifier front view (QS1 10)

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" and "Alarm display" functions.

6. Generic input/output connector (CN1)

Servo amplifier and host device (controller) 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.

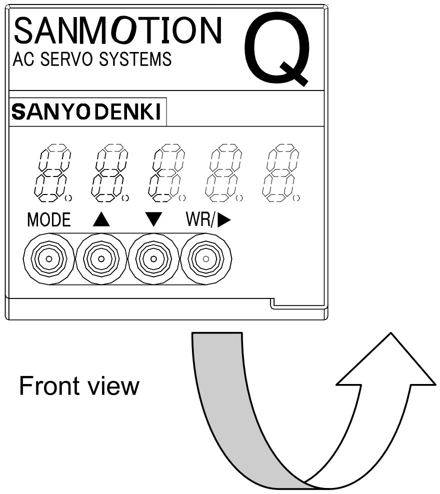
3. Servo System Configuration

3.4 Battery space, analog monitor

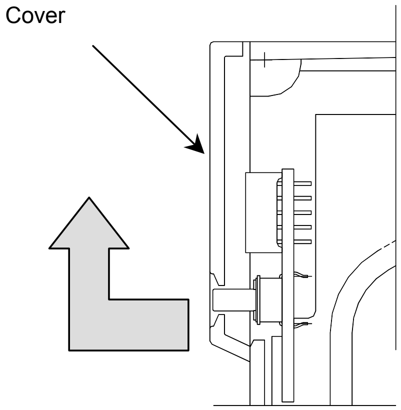
The cover of the Digital Operator can be opened and closed. A battery can be inserted into the space under the cover, and there is a connector for analog monitor output as well.

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

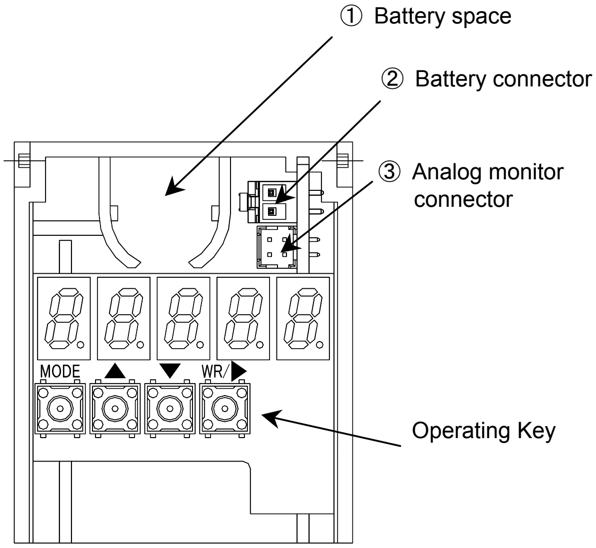
Insert the absolute encoder backup battery.

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 "New Function".



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

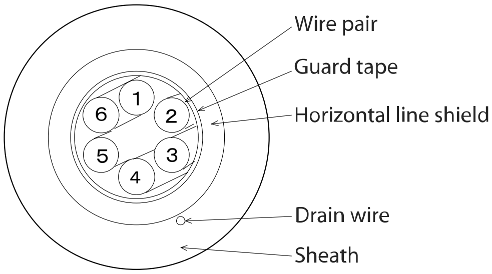
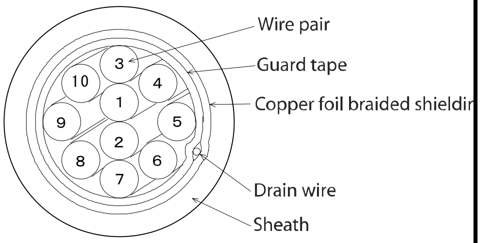
External connector name		Type Connector marking	Electric wire size examples					
			QS1 01	QS1 03	QS1 05	QS1 10	QS1 15	
Main circuit / Control circuit	Main circuit power input connector	CNA or connector block (R,S,T)	AWG16 equivalent	AWG14 equivalent	AWG12 equivalent	AWG10 equivalent	AWG8 equivalent	
	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	
	Safeguard connector (⏚)	⏚	AWG14 equivalent					
	Regenerative resistor input connector	CNB or connector block (RB1, RB2)	AWG16 equivalent		AWG14 equivalent	AWG12 equivalent	AWG10 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

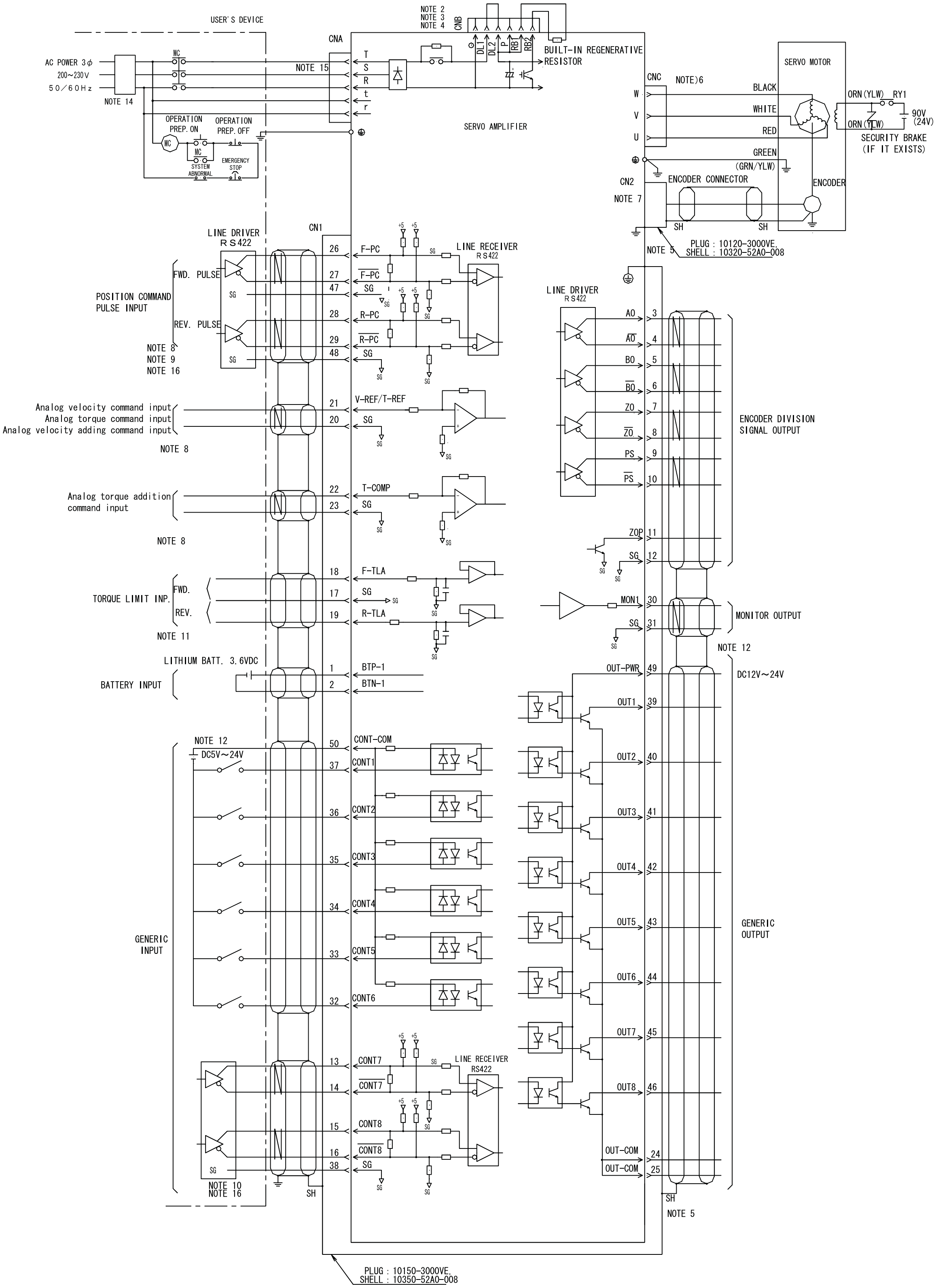
Table 4-2 Cable specifications

	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)

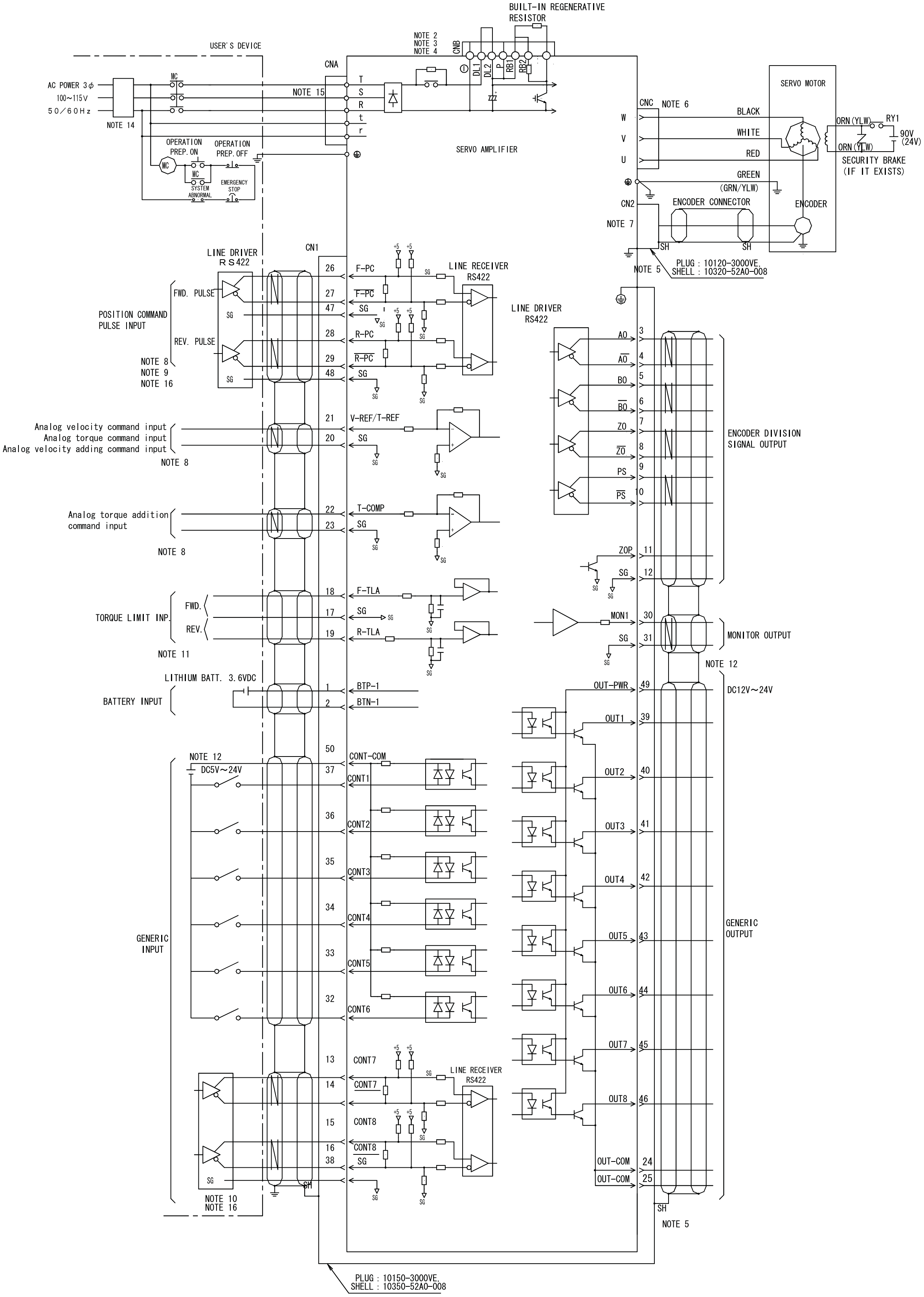
1. The following are the acceptable wiring distances between the servo amplifier and the motor (sensor) using the appropriate cables.
   - Wire-saving incremental encoder (INC-E): Maximum 20m when using cables with 6 pairs and max 91 Ω/km
   - Wire-saving incremental encoder (INC-E): Maximum 30m when 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

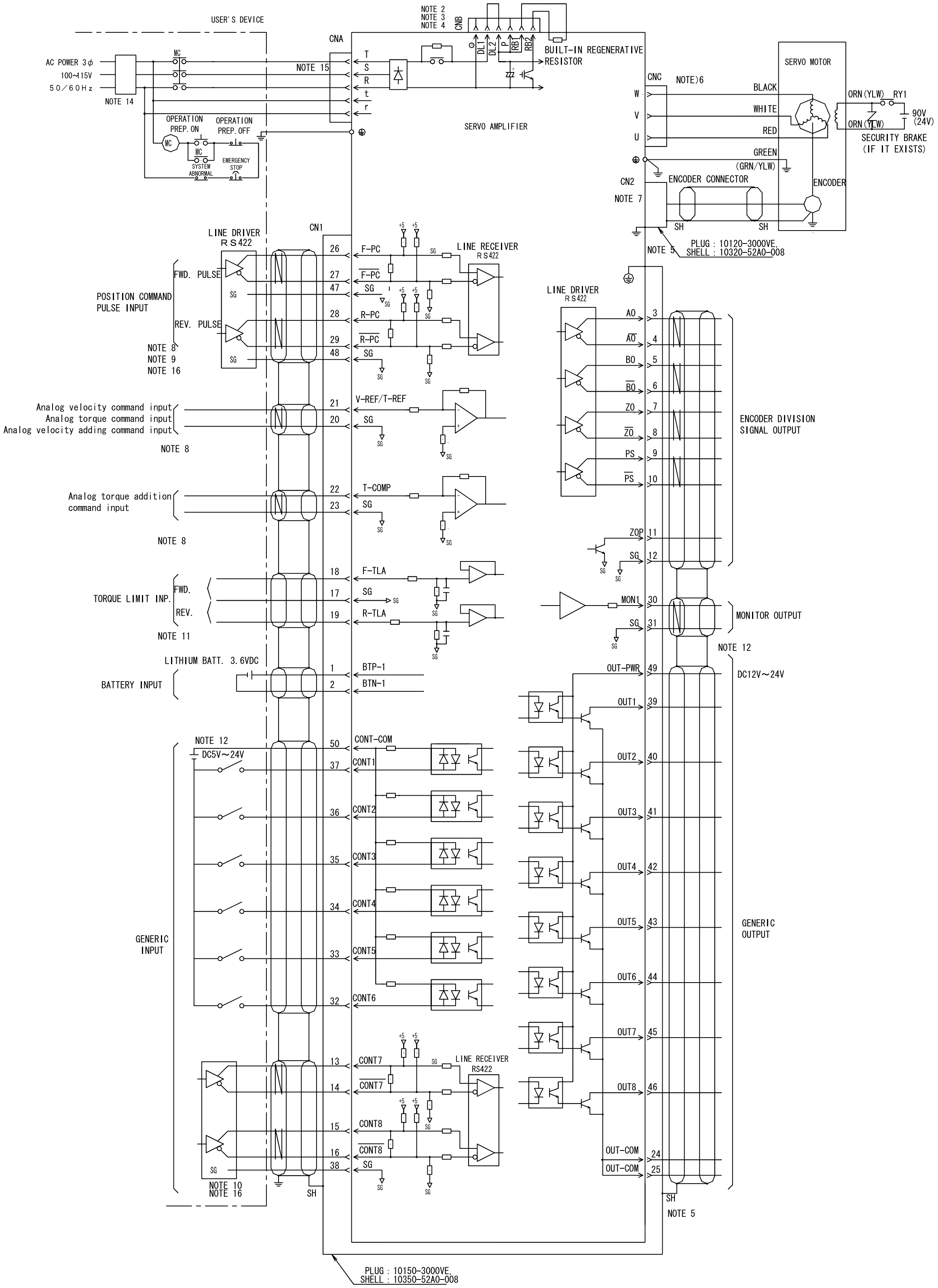
4.3.1 External wiring diagram (AC 200V input type 15A～50A)



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



4.3.3 External wiring diagram (AC 100V input type)



4. Wiring

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

Note 2) AC15~50A: 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.

AC100~150A: 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.
If a DC reactor is not used, short the DL1 and DL2 terminals using the short bar supplied.

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 markings are for use with lead type motor power line and brake line. Refer to the motor specifications for canon plug type connections.

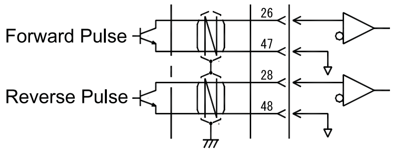
Note 7) Refer to the encoder connection diagram regarding the encoder connector wiring.

Note 8) The function of the command input depends on the control mode.

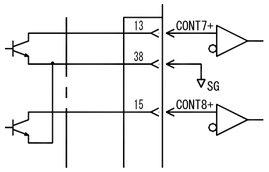
Command input connector Control mode		Position command pulse input	Velocity command/Torque command input	Torque compensation input
Position control mode		Position command pulse input	Depending on the parameter settings, it becomes velocity adding input	Depending on the parameter settings, it becomes torque compensation input
Velocity control mode		————	Velocity command input	Depending on the parameter settings, it becomes torque compensation input
Torque control mode		————	Torque command input	————
Velocity-Torque switching mode	No switching	————	Velocity command input	Depending on the parameter settings, it becomes torque compensation input
	During switching	————	Torque command input	————
Position-Torque switching mode	No switching	Position command pulse input	Depending on the parameter settings, it becomes velocity adding input	Depending on the parameter settings, it becomes torque compensation input
	During switching	————	Torque command input	————
Position-Velocity switching mode	No switching	Position command pulse input	Depending on the parameter settings, it becomes velocity adding input	Depending on the parameter settings, it becomes torque compensation input
	During switching	————	Velocity command input	Depending on the parameter settings, it becomes torque compensation input

The polarity of the command inputs can be reversed.

Note 9) To connect the command pulse input to an open collector output, refer to the following diagram:



Note 10) Generic input 7 and 8 are connected to a signal receiving circuit (line receiver).
These can be connected to an open collector output.



Note 11) Depending on the forward and reverse current limit input settings, the forward current limit can be used as a limit for both forward and reverse, or the reverse current limit can be controlled by a positive voltage. The internal setting value can also be used as a limit.

Note 12) Power should be supplied by the user.

Note 13) R, S, T, r, s, ⊖ , P, DL1, DL2, RB1, RB2, U, V, W are high-voltage circuits, all other lines are low-voltage. Ensure sufficient distance between the high- and low-voltage circuits.

Note 14) It is recommended to use a ground fault interrupter conforming to the UL, IEC and EN standards.

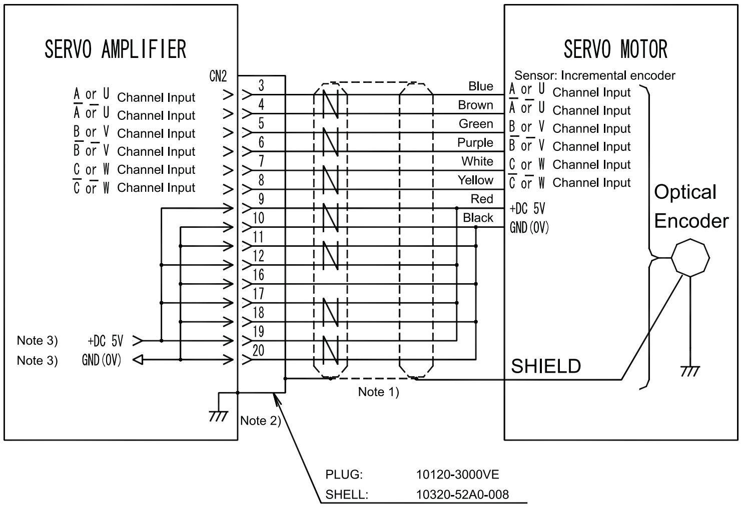
Note 15) Do not connect the S-phase on an amplifier used with single-phase power.

Note 16) For differential input signals, the SG line should always be connected in order to prevent abnormal operation and damage.

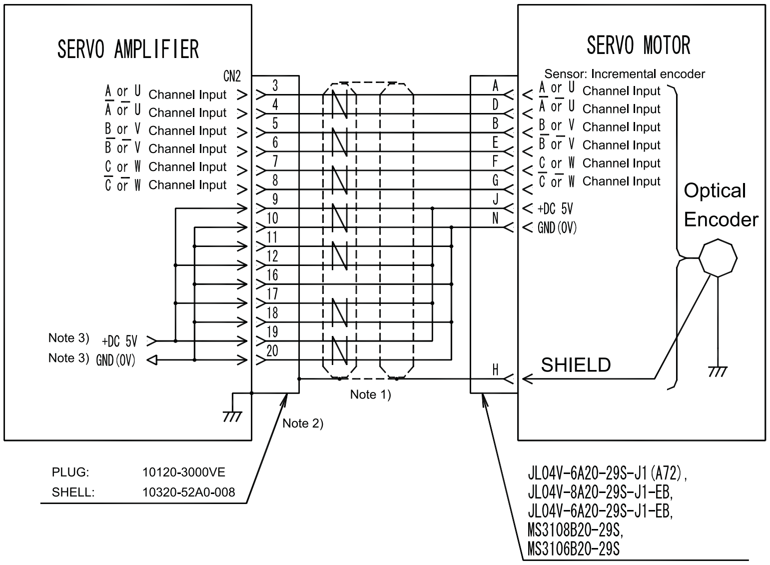
External wiring diagram, precautions

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.

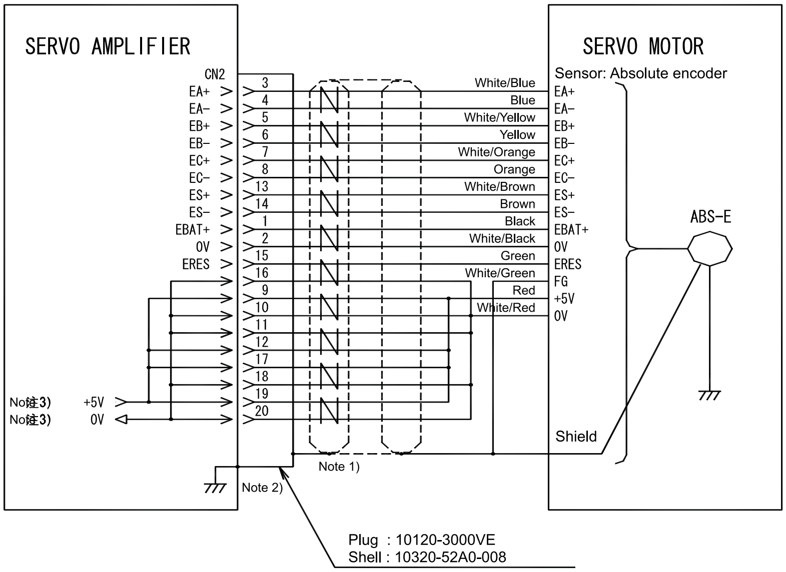
Note 3) The sensor power connection depends on the length of the sensor cable. Refer to the following table.

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)

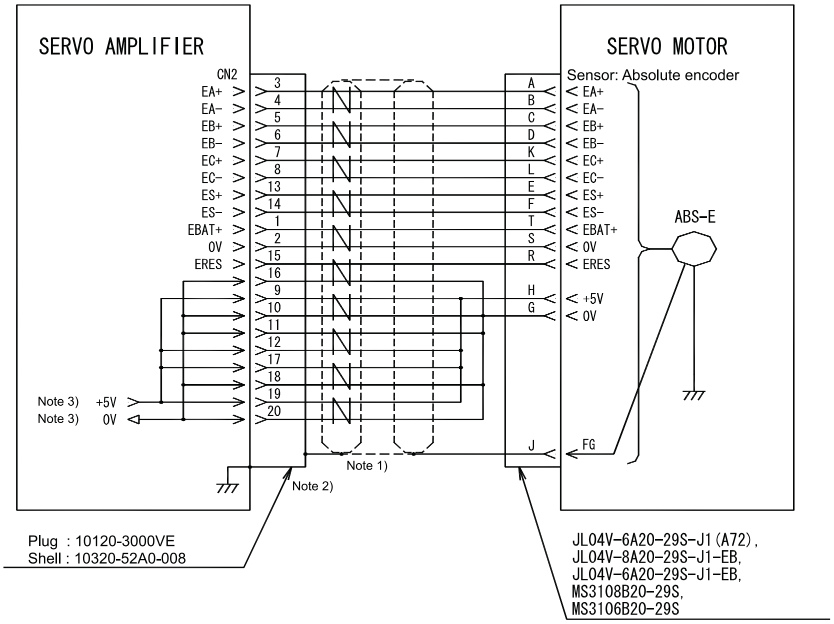
4.3.5 Sensor wiring diagram (ABS-E absolute/incremental encoder)

Absolute encoder (ABS-E), lead wire type



Plug : 10120-3000VE
Shell : 10320-52A0-008

Absolute encoder (ABS-E), canon plug type



Plug : 10120-3000VE
Shell : 10320-52A0-008

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

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

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

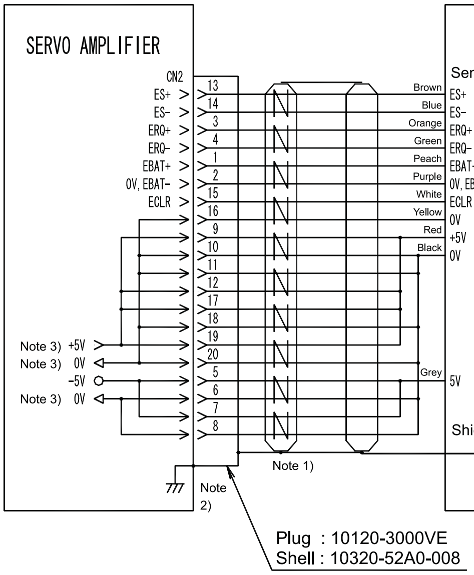
Note 3) The sensor power connection depends on the length of the sensor cable. Refer to the following table.

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

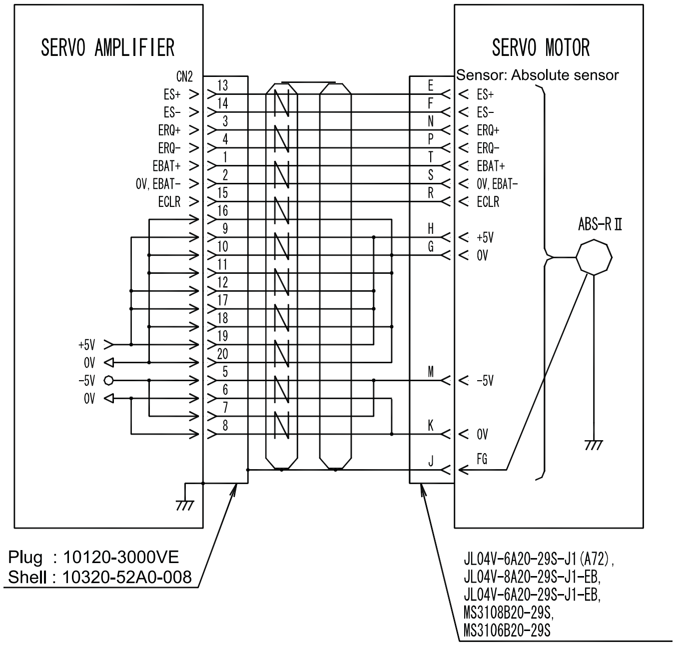
Fig. 4-5 Sensor wiring diagram (ABS-E absolute encoder)

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) ─┤N├─ Use a twisted pair cable with external shield.

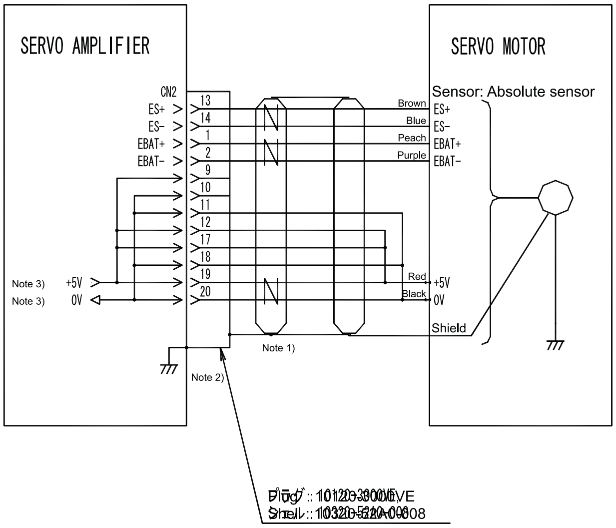
Note 2) Refer to 4.6.2 CN1, CN2 shielding method.

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.

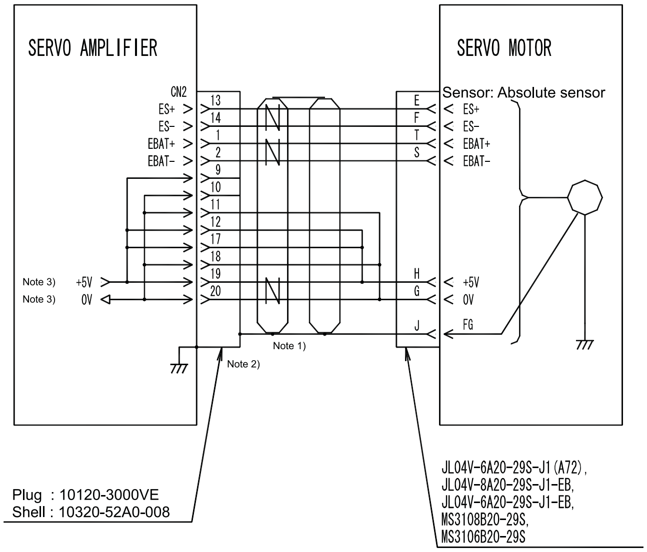
Fig. 4-6 Sensor wiring diagram (Absolute/request sensor)

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-.

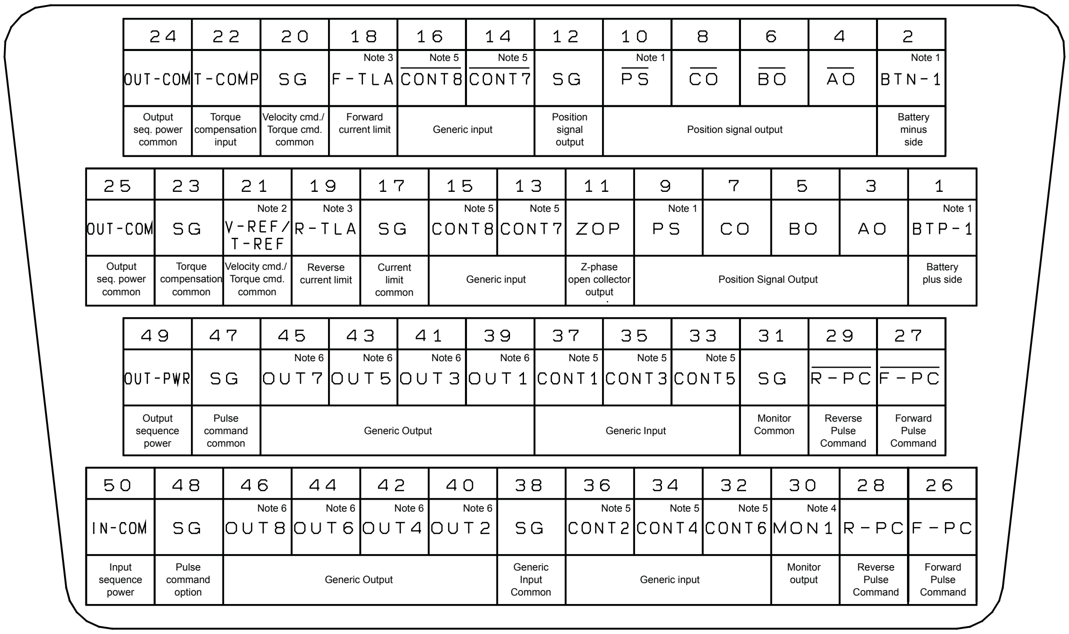
Sensor cable length	10m or less	25m or less	40m or less
+5V connection	Pin 19 connected (Pins 12, 17 don't need to be connected)	Pins 17, 19 connected (Pin 12 doesn't need to be connected)	Pins 12, 17, 19 connected
0V connection	Pin 20 connected (Pins 11, 18 don't need to be connected)	Pins 18, 20 connected (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	$\overline{\text{CONT8}}$	$\overline{\text{CONT7}}$	SG	$\overline{\text{PS}}$	$\overline{\text{CO}}$	$\overline{\text{BO}}$	$\overline{\text{AO}}$	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	$\overline{\text{R-PC}}$	$\overline{\text{F-PC}}$
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

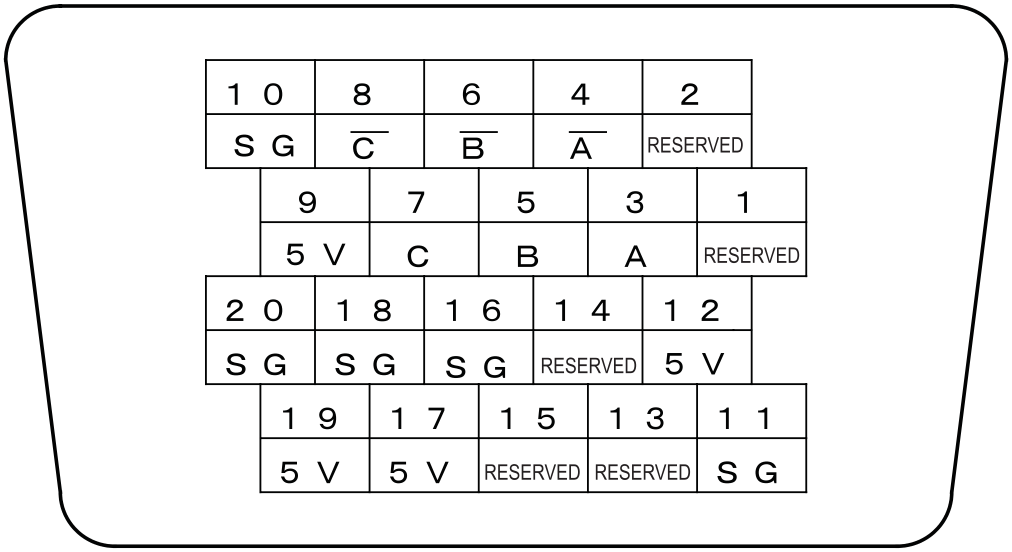
Note 1. The battery connector and the position signal output PS connector can be used in connection with an absolute encoder (ABS-E) or an absolute sensor.
Note 2. Command input functions are different depending on the control mode.
Note 3. The current limit input formula can be selected.
Note 4. The 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).

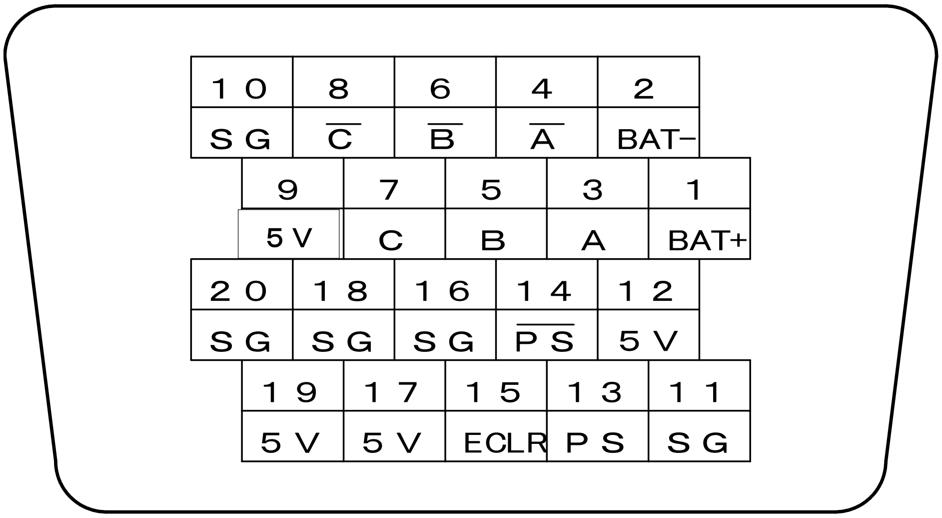
- Incremental encoder (INC-E) connector layout diagram



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

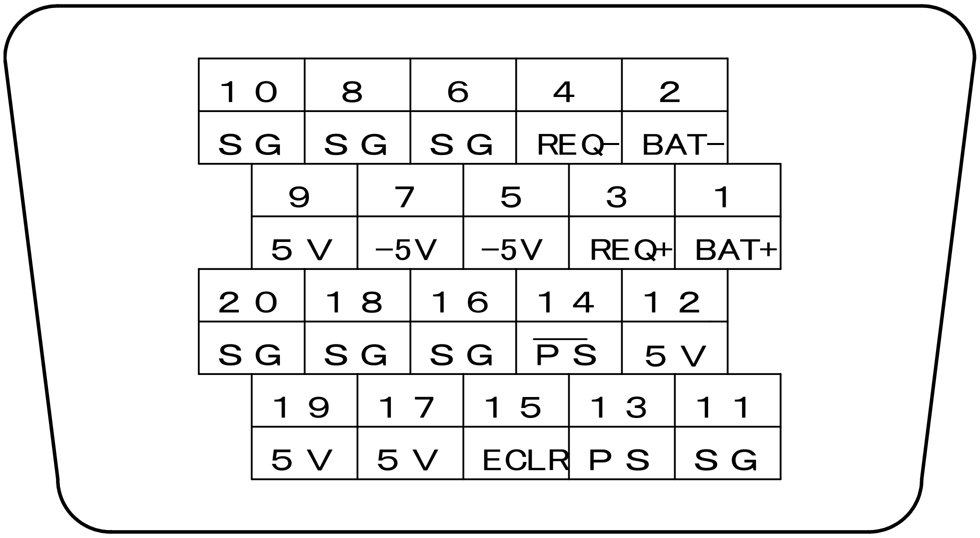
- Absolute/incremental encoder (ABS-E) connector layout diagram



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

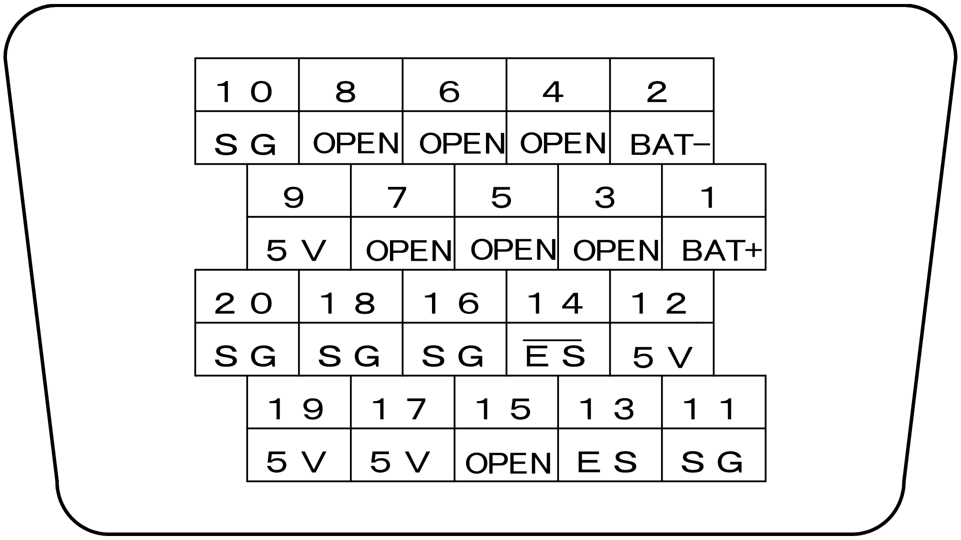
- Absolute request sensor (ABS-RII, RA062M) connector layout diagram



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.

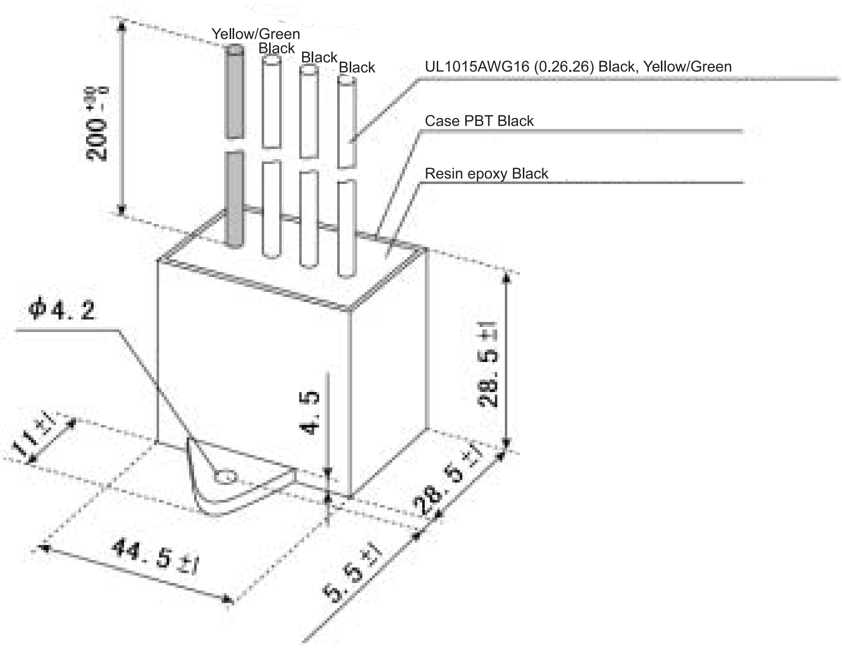
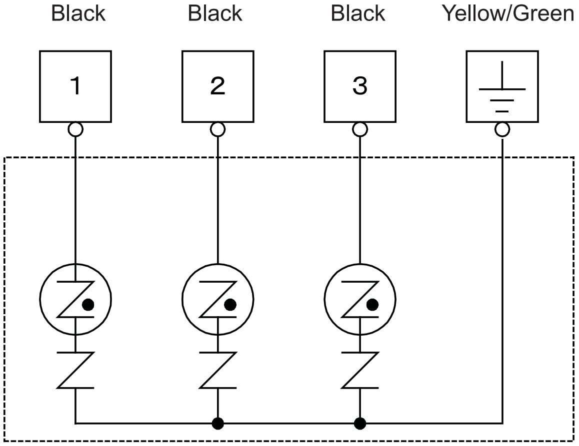
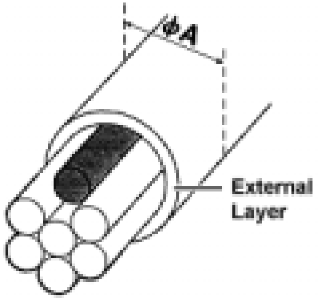
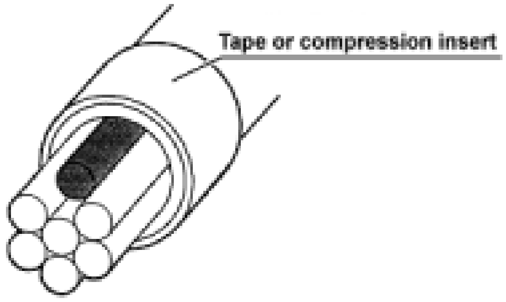
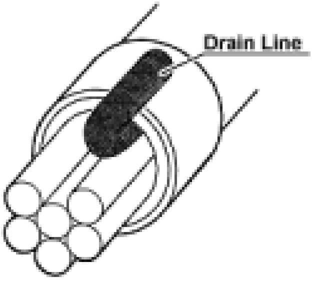
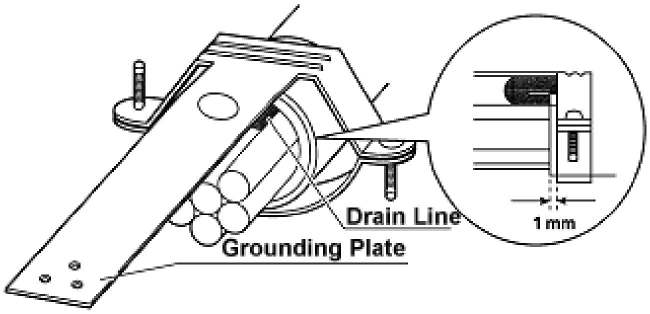
Item	Specifications
Product model number (Manufacturer)	R･A･V-781BXZ-2A Okaya Electric Industries Co., Ltd.
Dimensions	 Unit: mm
Maximum circuit voltage	300 Vrms
Clamp voltage	783V±10%
Surge withstand	2500 A (Waveform) 8 x 20 μs
Surge withstand	20 KV (Waveform) 1.2 x 50 μs
Wiring diagram	
Weight	Approx.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

- **Soldering**

Item 2 is identical to using a clamp.

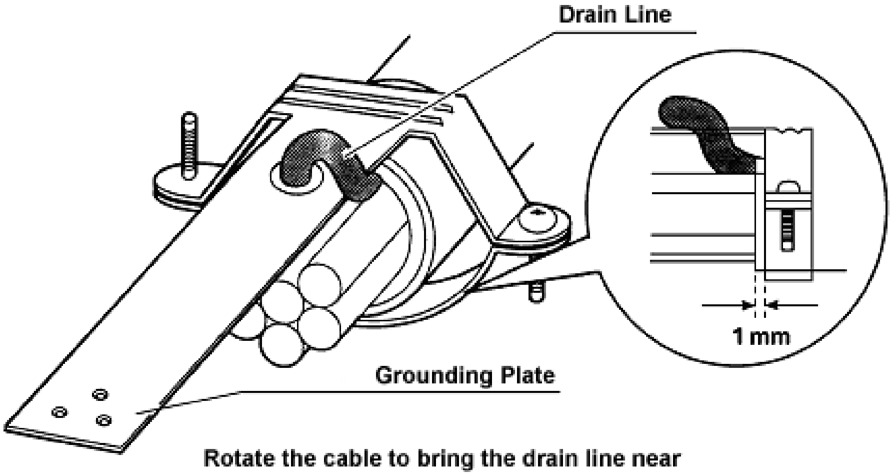
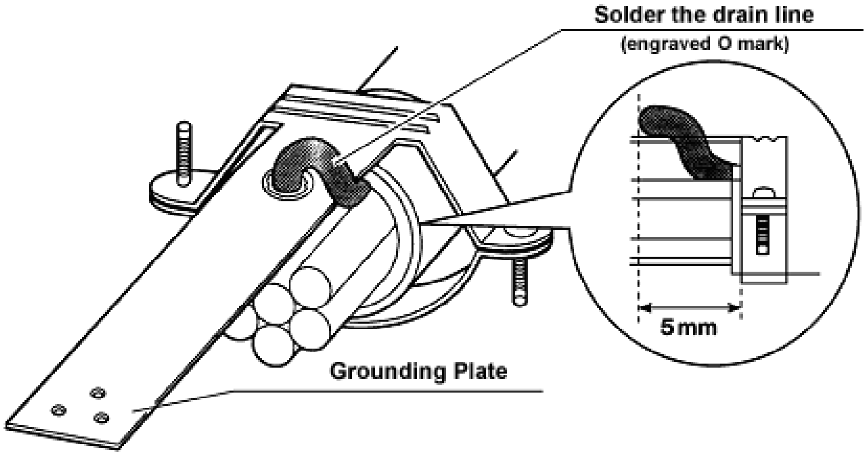
1	 Rotate the cable to bring the drain line near the grounding plate.
2	

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	Ø4.0～5.0 mm	Sumitomo 3M Ltd.
10607-C068	Ø5.0～6.0 mm	
10607-C078	Ø6.0～7.0 mm	
10607-C088	Ø7.0～8.0 mm	
10607-C098	Ø8.0～9.0 mm	

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 .

Installation

5. Installation (Servo amplifier)

5.1 Servo amplifier installation

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

5.1.1 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).

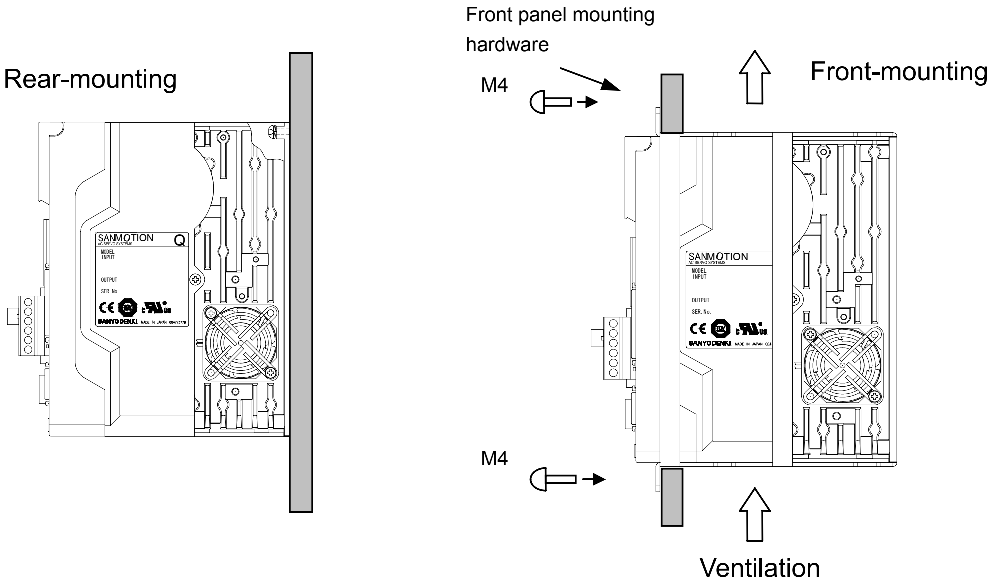


Fig. 5-1 Servo amplifier mounting

- Arrangement within the machine
  - ① Leave at least 10 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.

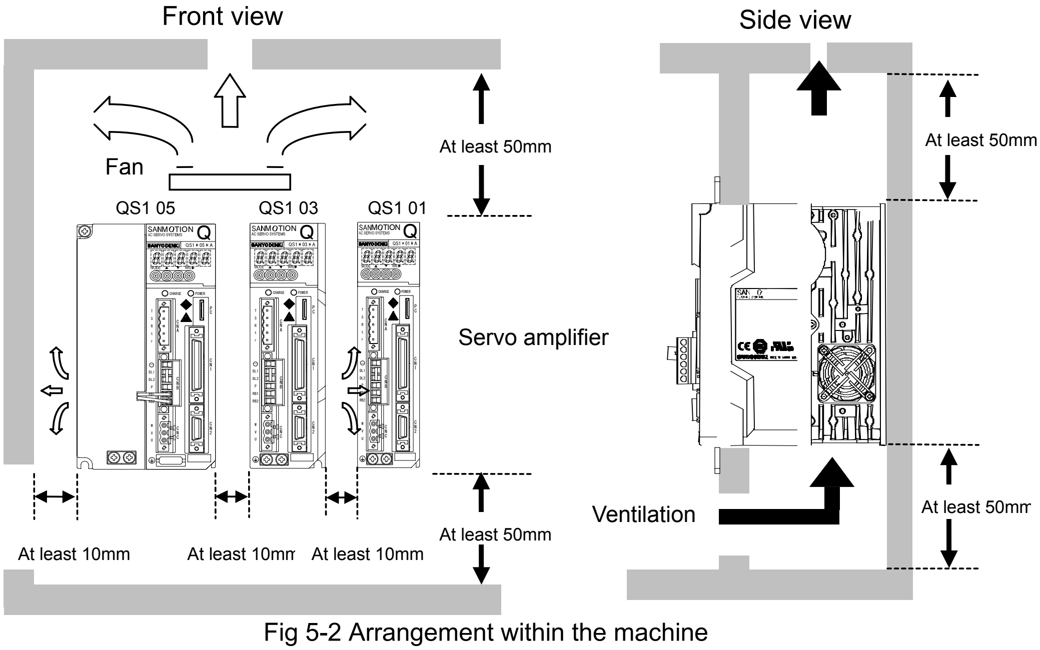


Fig 5-2 Arrangement within the machine

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.

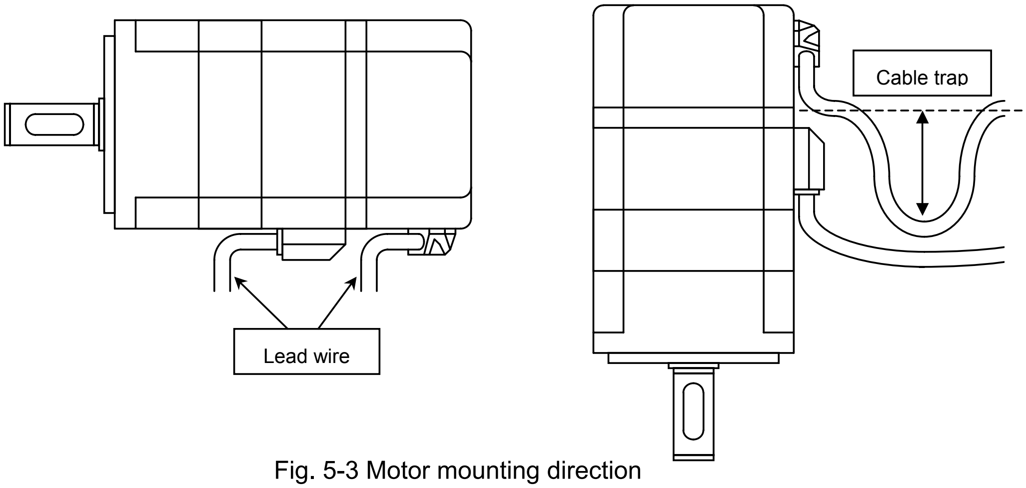


Fig. 5-3 Motor mounting direction

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.

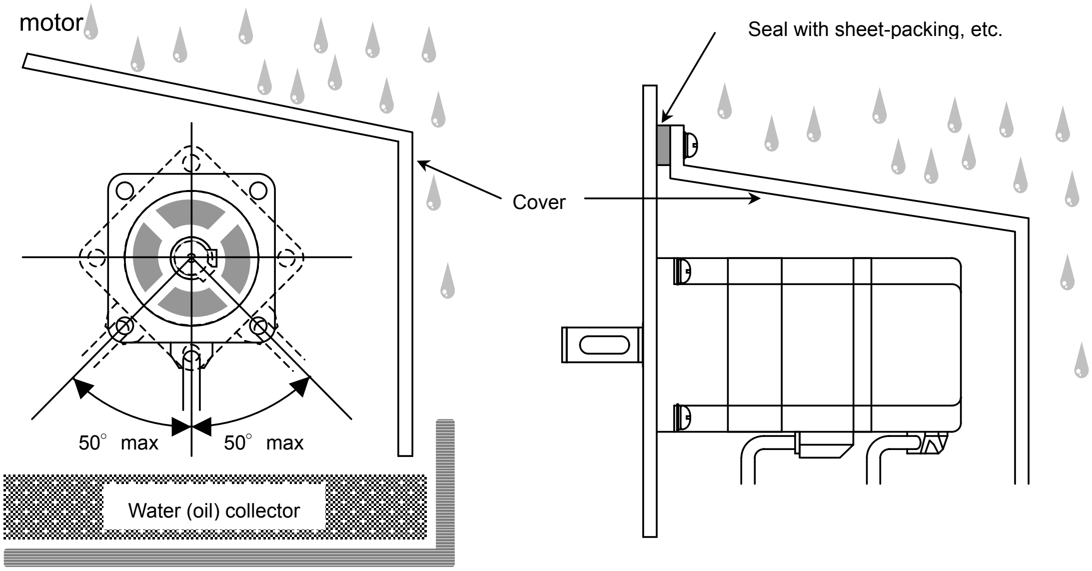


Fig. 5-4 Protective cover and motor installation angle

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.

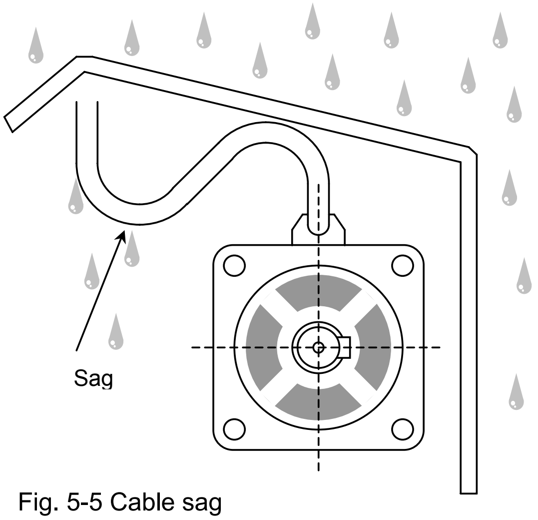


Fig. 5-5 Cable sag

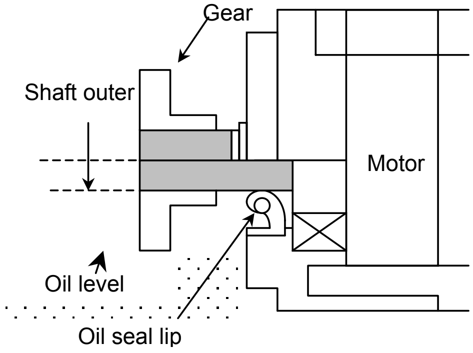


Fig. 5-6 Oil level

5.2.5 Gear installation

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

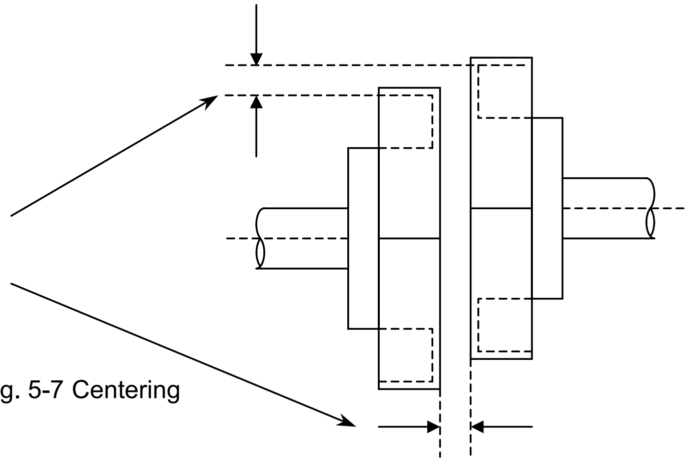
① The oil level of the gear box should be below the oil seal lip, for a slight spraying effect on the lip.

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

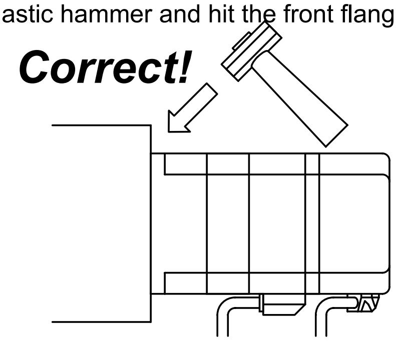
① Use Fig, 5-7 as a reference for correct centering of the motor shaft and the target machinery. Please note when using a rigid coupling that even a slight mistake in centering can damage the output shaft.

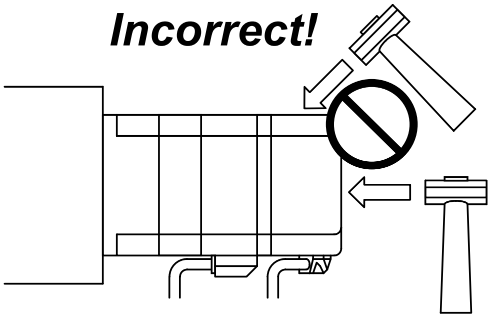


Measured at all 4 locations, the difference between the maximum and the minimum should not

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.

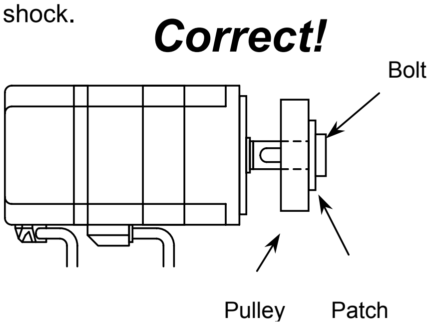


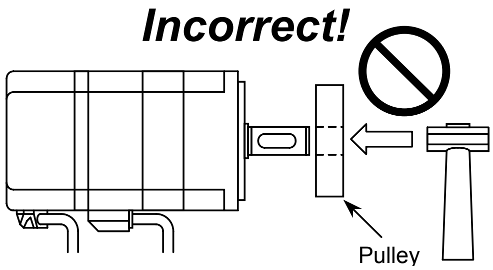


③ If mounting to a machine, create enough mounting holes for smooth coupling of the motor flange rabbet.

The mounting surface should be flat, otherwise damage to the shaft or the load may occur.

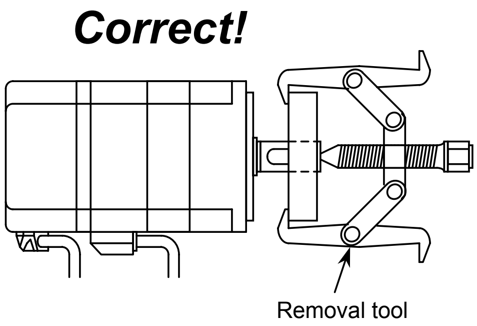
④ Use the screw at the end of the shaft for installing parts such as the gear, pulley, or coupling, to avoid shock.

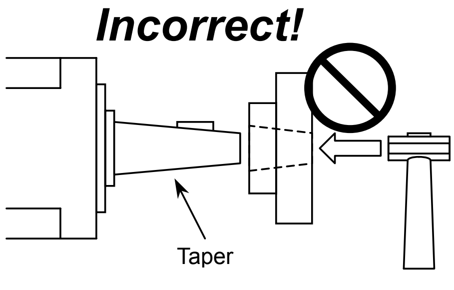




⑤ Tapered motor shafts transmit the torque via the tapered surface. Make sure the key fits without rattling. The tapered surface contact should be no less than 70%.

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 measuringed 1/3 of the distance from the tip of the output shaft.
(Refer to Fig. 5-8.)

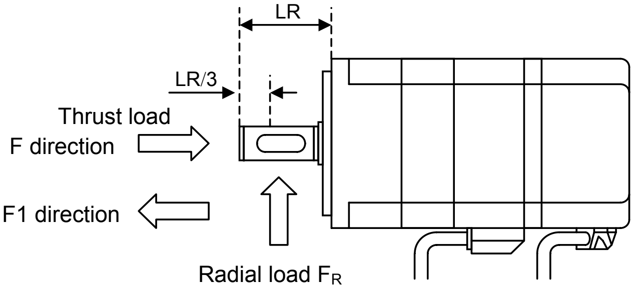


Fig. 5-8 Radial load position

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.

6. Operation and functions

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.

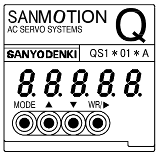
  ・【Generic parameters】・【System parameters】・【Motor parameters】
  ・【Generic parameters】are divided into 10 groups【Group 0~9】.

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
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).
  ・ 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 M0005351C 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	6-6
--	Motor structure	6-6
--	Control power input voltage	6-6
--	Control power input type	6-6
--	Main circuit power input voltage	6-6
00	Main circuit power input type	6-7
01	Motor encoder type	6-7
02	Incremental encoder function selection	6-7
03	Incremental encoder resolution	6-7
04	Absolute encoder function selection	6-7
05	Absolute encoder resolution	6-7
06	Combined motor model number	6-6
08	Control mode	6-8, 6-42
09	Position loop control/position loop encoder selection	6-8
0A	External encoder resolution	6-9
0B	Regenerative resistor selection	6-9

Generic parameters (Group0)

Page	Name	Description	Description page
00	KP1	Position loop proportional gain 1	6-16, 6-17
01	TPI1	Position loop integral time constant 1	----
02	KVP1	Velocity loop proportional gain 1	6-16, 6-17
03	TVI1	Velocity loop integral time constant 1	6-16, 6-17
04	KP2	Position loop proportional gain 2	6-16, 6-17
05	TPI2	Position loop integral time constant 2	----
06	KVP2	Velocity loop proportional gain 2	6-16, 6-17
07	TVI2	Velocity loop integral time constant 2	6-16, 6-17
08	JRAT1	Load inertia moment ratio 1	6-16, 6-17
09	JRAT2	Load inertia moment ratio 2	6-16, 6-17
0A	FFGN	Feed forward gain	6-16, 6-17
0C	TVCACC	Velocity command acceleration time constant	6-25
0D	TVCDEC	Velocity command deceleration time constant	6-25
0E	PCFIL	Position command filter	6-16, 6-17
0F	FFFIL	Feed forward filter	6-16, 6-17
10	VCFIL	Velocity command filter	6-16, 6-17
11	TCNFILA	Torque command notch filter A	6-16, 6-17
12	TCNFILB	Torque command notch filter B	6-16, 6-17
13	TCFIL 1	Torque command filter 1	6-16, 6-17
14	TCFIL2	Torque command filter 2	6-16, 6-17

Generic parameters (Group1)

Page	Name	Explanation	Description page
00	INP	In-position conclusion range	6-6, 6-38
01	NEAR	Near range	6-39
02	OFLV	Fluctuation counter overflow value	6-38
03	PMUL	Position command pulse multiplier	6-27
04	GER1	Electronic gear 1	6-28
05	GER2	Electronic gear 2	6-28
06	ENRAT	Encoder pulse division output division ratio	6-32
07	LOWV	Low velocity setting	6-40, 6-41, 6-43
08	VA	Velocity attainment setting (High velocity setting)	6-40, 6-41
09	VCMP	Velocity matching range	6-40, 6-41
0A	VC1	Internal velocity command 1	6-24, 25
0B	VC2	Internal velocity command 2	6-24, 25
0C	VC3	Internal velocity command 3	6-24, 25
0D	VCLM	Velocity limit command	6-26
0E	TCLM	Internal torque limit value	6-20
0F	SQTCLM	Sequence operation torque limit	6-19, 6-22
10	BONDLY	Securing brake delay (securing delay of the securing brake)	6-23
11	BOFFDLY	Securing brake release delay (releasing delay of the securing brake)	6-23
12	VCGN	Analog velocity command scaling	6-24, 25, 30
14	TCGN	Analog torque command scaling	6-26
16	TCOMPGN	Analog torque addition command scaling	6-31
17	TCOMP	Internal torque addition command	6-31
18	VCOMP	Internal velocity addition command	6-30
19	BONBGN	Brake operation start time	6-22
1A	ZV	Zero velocity range	----
1B	PFDDLY	Power failure detection delay	6-46
1C	OLWLV	Overload warning level	6-47
1D	OFWLV	Over-fluctuation warning level	6-47
20	INCEDAT	Incremental encoder figure abnormality setting value	----
21	JOGVC	JOG velocity command	6-46
22	ATNFIL	Auto-notch filter tuning torque command value	6-46

Generic parameters (Group2)

Page	Name	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	Page
00	PA300	Fluctuation clear selection	6-29
		Position command pulse digital filter	6-27
01	PA301	Encoder pulse division output polarity	6-33
		Encoder pulse division output switch	6-33
02	PA302	Command input polarity	6-19
		P-PI automatic switch function	6-43
03	PA303	Torque limit input	6-20, 6-21
		Velocity feedback abnormality (ALM_C3) / velocity control abnormality (ALM_C2) detection	----
04	PA304	Overtravel operation	6-18
		Dynamic brake operation	6-18
05	PA305	Analog monitor output polarity	6-48, 6-49
		Forced stop	6-19
06	PA306	Velocity addition command input	6-30
		Torque addition command input	6-31
07	PA307	Absolute encoder clear function selection	6-35
		In-position conclusion signal/position fluctuation monitor	6-39
08	PA308	External incremental encoder (CN-EXT) digital filter	6-34
		Motor incremental encoder (CN2) digital filter	6-34

Generic parameters (Group4)

Page	Name	Description	Page
00	PA400	Command pulse selection	6-27
		Command pulse input polarity	6-27
01	PA401	Reserved	----
		External encoder (CN-EXT) polarity	6-34
02	PA402	Setup software transmission baud rate	----
		Setup software connection shaft number	----
03	PA403	Reserved	----
		Positioning method	6-40
04	PA404	Reserved	----
		Encoder signal output (PS) format	6-35

Generic parameters (Group5)

Page	Name	Description	Page
00	MON1	Analog monitor output 1 selection	6-48, 6-49
01	MON2	Analog monitor output 2 selection	6-48, 6-49
02	DMON	Digital monitor output selection	6-48, 6-49

Generic parameters (Group6)

Page	Name	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	Page
00	CLR	Fluctuation clear function	6-29
01	MS	Control mode switch function	6-42
02	PCON	Velocity loop proportional control switch function	6-43
03	GC	Gain switch function	6-42, 6-43

Generic parameters (Group8)

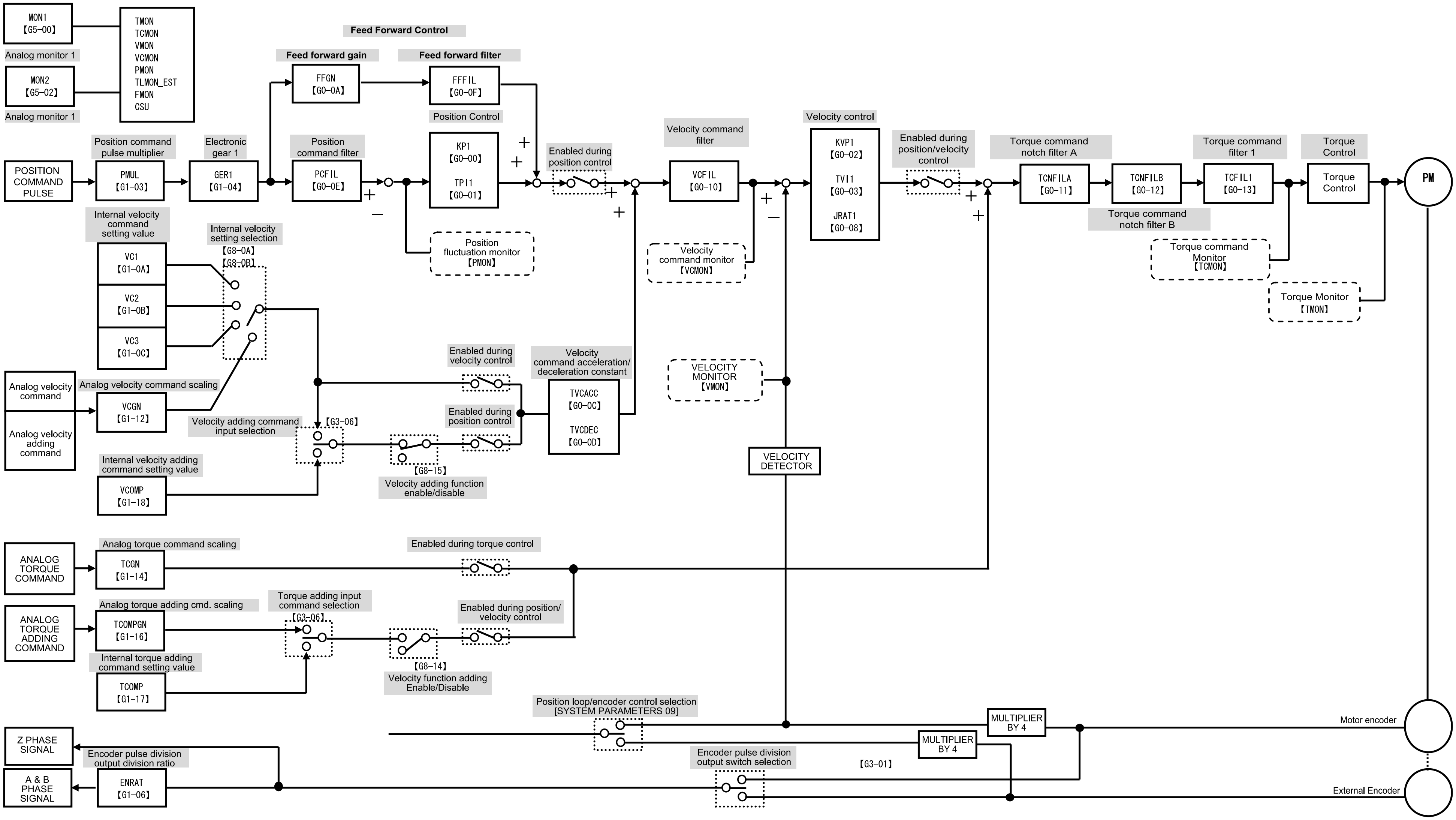
Page	Name	Description	Page
00	S-ON	Servo on function	6-44
01	AL-RST	Alarm reset function	6-44
02	TL	Torque limit function	6-20, 6-21
03	ECLR	Absolute encoder clear function	6-35
04	F-OT	Forward overtravel function	6-18
05	R-OT	Reverse overtravel function	6-18
06	INH/Z-STP	Position command pulse inhibit function/zero velocity stop function	6-45
07	EXT-E	External trip input function	6-45
08	DISCHARGE	Forced discharge function	6-45
09	EMR	Emergency stop function	6-45
0A	SP1	Internal velocity control selection input 1	6-24, 25
0B	SP2	Internal velocity control selection input 2	6-24, 25
0D	DIR	Internal velocity direction selection input	6-24, 25
0E	RUN	Internal velocity start signal input	6-24, 25
0F	RUN-F	Internal velocity forward start signal input	6-24, 25
10	RUN-R	Internal velocity reverse start signal input	6-24, 25
11	GERS	Electronic gear switch function	6-28
12	PPCON	Position loop proportional control switch function	6-45
14	TCOMPS	Torque addition function	6-31
15	VCOMPS	Velocity addition function	6-30

Generic parameters (Group9)

Page	Name	Description	Page
00	OUT1	Generic output 1	6-37
01	OUT2	Generic output 2	6-37
02	OUT3	Generic output 3	6-37
03	OUT4	Generic output 4	6-37
04	OUT5	Generic output 5	6-37
05	OUT6	Generic output 6	6-37
06	OUT7	Generic output 7	6-37
07	OUT8	Generic output 8	6-37

6. Operation and functions

6.1.3 Control mode block diagram



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	6 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**

・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.

6.2.3 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□□□AH△××△△▽∗∗・・・・・・Control hardware classification is "Absolute/request sensor"

QS1□□□AH△××△△▽∗∗・・・・・・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 be modified as shown in the table.

Page	Name	Setting range
08	Control mode	6 types

Setting	Explanation	Setting	Explanation
00：_Torque	Torque control	03：_Velo－Torq	Velocity-Torque control switch
01：_Velocity	Velocity control	04：_Posi－Torq	Position-Torque control switch
02：_Position	Position control	05：_Posi－Velo	Position-Velocity control switch

* Parameters are different for each mode. Refer to the "Control mode block diagram" when making modifications.

* When using dual mode control (Velo－Torq, Posi－Torq, Posi－Velo), switch enabling conditions are required. The Control mode switch function in【Generic parameters】Group7, Page 01 must be set as well.

- Position loop control/encoder selection

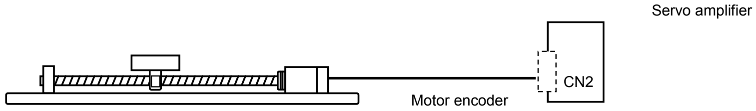
Position control mode

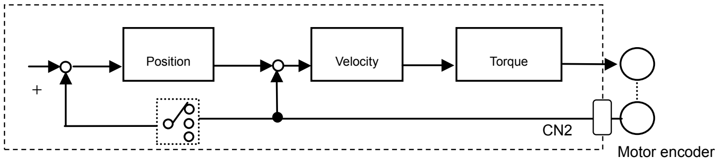
When the servo amplifier is used in position control mode, the type of the encoder input to the position loop can be selected (motor encoder/external encoder).

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





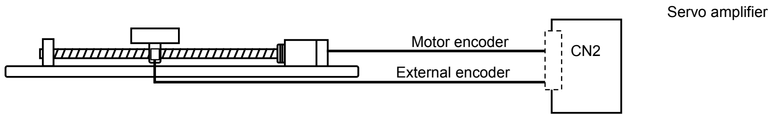
【Position loop control/encoder selection】

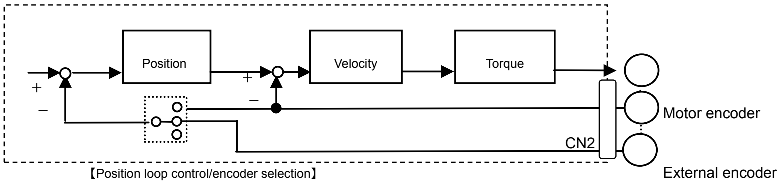
Servo motor encoders connectible to CN2	・ Incremental encoder ・Absolute encoder (sensor)

- 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)



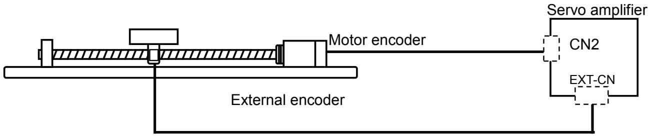


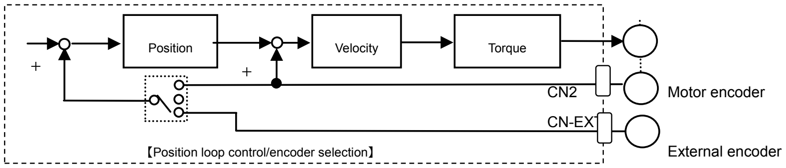
【Position loop control/encoder selection】

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 M0005351C".

6.3 Test run

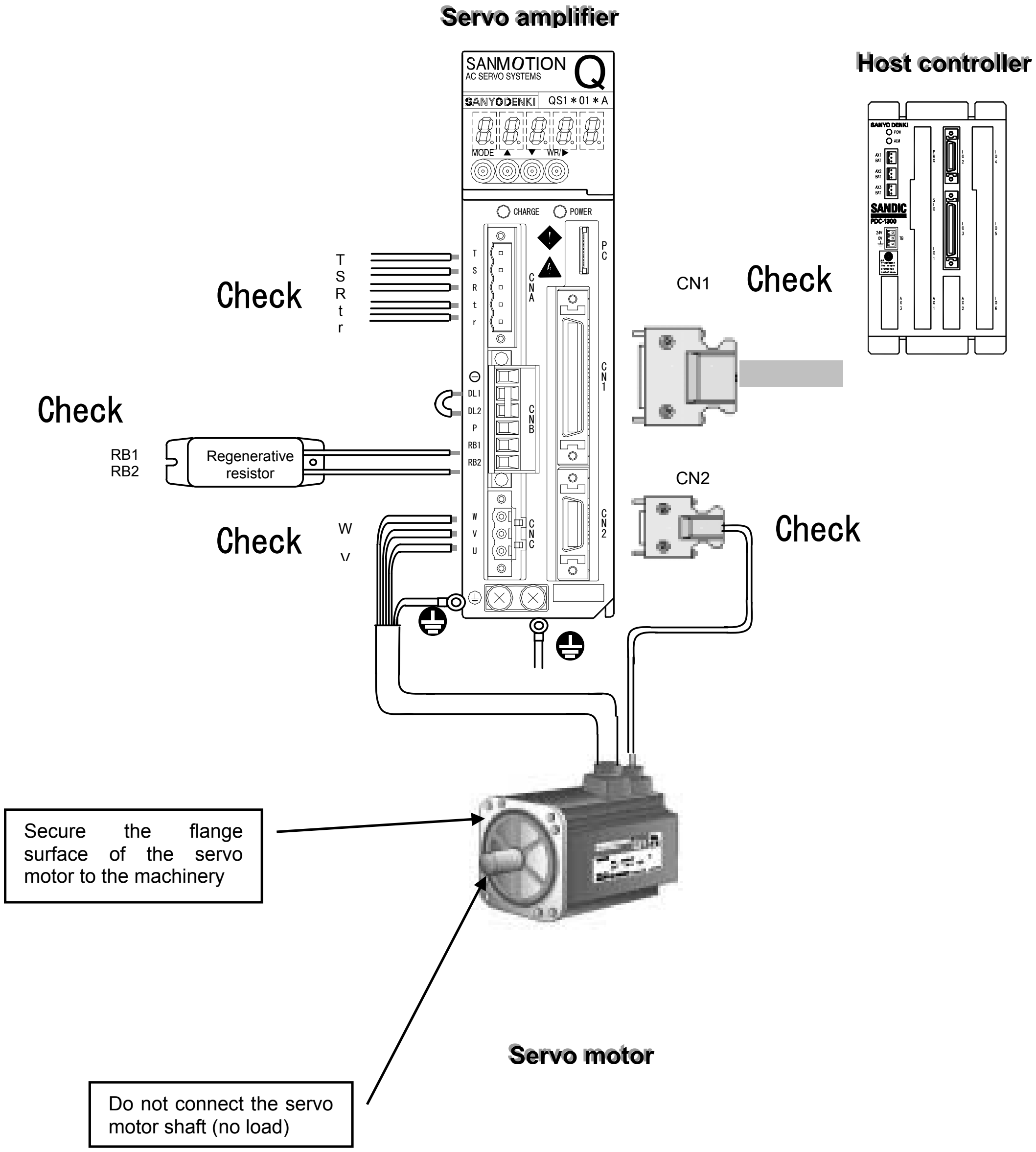
6.3.1 Servo motor standalone test run

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)

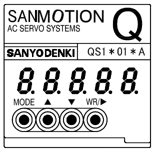


Secure the flange surface of the servo motor to the machinery

Do not connect the servo motor shaft (no load)

Step 2. Control power ON

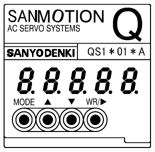
- Disconnect CN1 and turn ON the control power (r, t).
- Check the 7 segment LED display on the servo amplifier front panel.



	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.

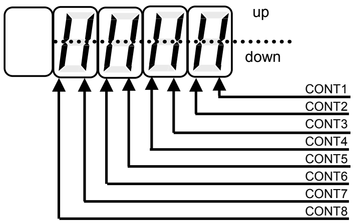


	Control power (R, S, T) is ON, operation preparation complete signal shows ON status	**Go to Step 4**
	If an alarm is issued, the last 2 digits are the alarm code.	

* 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”.

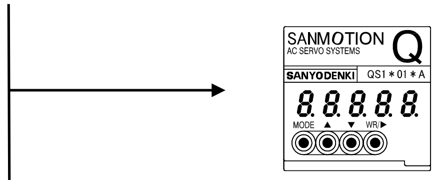
Step 4. Check the input signal

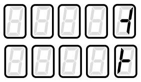
- Turn OFF the main circuit power (R, S, T) and the control power.
- Connect CN1, and then turn ON the control power (r, t).
- The input signals (CONT8~1) are allocated based on Group 7 and Group 8 of the Generic parameters. For more information regarding this allocation, refer to "8.5.8 Group 7 parameters" and "8.5.9 Group 8 parameters".
- Check the generic input signal using the Digital Operator or the monitor function of Q-Setup (monitor page 03). Turn ON and OFF the connected signals (CONT1~CONT8) and check the correct logic switching (up‹›down, 0‹›1) using the Digital Operator or the Q-Setup display.



Step 5. 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 6**
	Overtravel status forward side, reverse side overtravel status (Position control mode/velocity control mode)	

If overtravel is not used, change the following parameters.

Control mode	Parameter Group 8 Page 04, 05	Selects the condition that enables the overtravel function

For more information, refer to “8.5.9 Group 8 parameters”.

Step 6. Input the command and operate the servo motor

- The test run process is different for each control mode. Check the control mode used.
  Position control: Position command pulse; Velocity control: Analog velocity command; Torque control: Analog torque command

Control mode	System parameters Page 08	Selects the control mode

For more information, refer to “8.4.1 System parameters”.

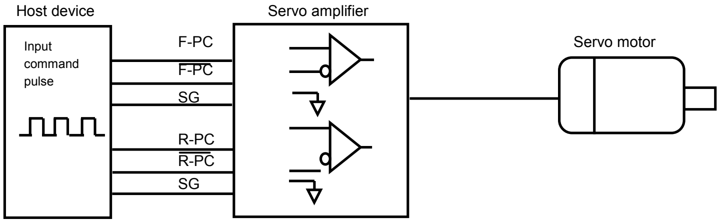
- **Operation in position control mode**

1. Match the position command pulse format to the host device output format.

Command pulse selection	Parameter Group 4 Page 00 (Host)	Selects the position command pulse format

For more information, refer to “8.5.5 Group4 parameters” and “10.1.5 Position command input”.

2. Input a low frequency position command pulse from the host device for low-velocity operation.



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 cmd. pulse monitor	Monitor Page 0D:FMON	Displays the frequency of the position command pulse input from the host device.

・Check the command position.

Command position monitor	Monitor Page 0B:CPMON	Displays the position input from the host device.

・Check that the velocity specified by the position command pulse from the host device matches the actual rotation velocity of the servo motor.

Velocity command monitor	Monitor Page 06:VCMON	Displays the velocity command value.
Velocity monitor	Monitor Page 05:VMON	Displays the rotation velocity of the servo motor.

・Check that the position fluctuation value changes when the servo motor accelerates or decelerates.

・Check that the servo motor stops when the position command pulse from the host device is switched off.

Position fluctuation monitor	Monitor Page 09:PMON	Displays the position fluctuation value.

・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.

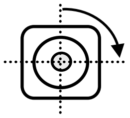
Current position monitor	Monitor Page 0A:APMON	Displays the current position (the origin is the position at the time of turning the control power on).

The factory setting for the electronic gear is 1/1. If necessary, modify the electronic gear settings by using the parameter values according to the table below. If you modify the electronic gear settings, the rotation speed and the travel distance will change.

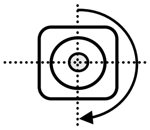
Electronic gear 1:GEAR1	Parameter Group1 Page 04	Sets the electronic gear for the position command pulse

Number of servo motor encoder pulses: 2000P/R, when the host command pulse travel distance is 2000P/R

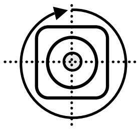
Electronic gear setting 1/1



Electronic gear setting 2/1



Electronic gear setting 4/1

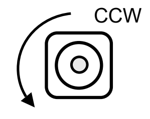
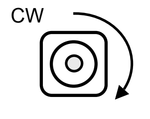
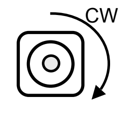
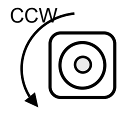


4. Check that the polarity of the position command pulse sent from the host device matches the servo motor rotation direction.

・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.

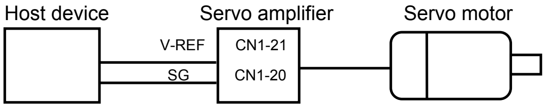
Position command pulse polarity	Parameter Group3 Page 02 (Host)	Sets the command input polarity

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.

・ Operation in velocity control mode

1. Input the analog velocity command from the host device and put the servo motor in motion at a low velocity.



2. Check the velocity command monitor and the velocity monitor using the monitor functions.

Analog velocity command/ Analog torque command voltage monitor	Monitor Page 0C:VC/TC-IN	Displays the analog command voltage from the host device

・Check that the analog velocity command is input.

Velocity command monitor	Monitor Page 06:VCMON	Displays the velocity command value.
Velocity monitor	Monitor Page 05:VMON	Displays the rotation velocity of the servo motor.

・Check that the velocity specified by the analog velocity command from the host device matches the actual rotation velocity of the servo motor.

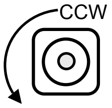
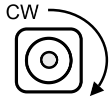
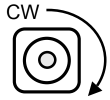
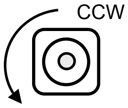
・Check that the servo motor stops when the analog velocity command is set to 0V.
Occasionally, the servo motor will slowly rotate even if the input analog velocity command voltage is 0V. If so, use the analog velocity command/torque command auto-offset function to correct the analog velocity command voltage.
For more information, refer to "8.1.3.3 Test run/Adjustments" in the "Q-Setup-Setup Software Instruction Manual M0005351C 3.18". The Q-Setup-Setup Software Instruction ManualM0005351C" is available on our website; please go to **http://www.sanyodenki.co.jp** to download the manual.

3. Check that the polarity of the analog velocity command sent from the host device matches the servo motor rotation direction.

・With factory settings, the servo motor rotates forward (CCW) when the input command is positive (+) (forward pulse sequence), and reverse (CW) when the input command is negative (-) (reverse pulse sequence).

If necessary, modify the analog velocity command polarity by using the parameter value settings in the table below.

Analog velocity command polarity	Parameter Group 3 Page 02 (Host)	Sets the command input polarity

Standard command input polarity setting		Modified command input polarity	
+ input command	- input command	+ input command	- input command
			

4. Check the scaling of the analog velocity command sent from the host device.

・The standard factory setting is 500min^{-1}/V. The servo motor rotation speed will be 500min^{-1} for each 1V of the analog velocity command voltage. If necessary, modify the analog velocity command scaling by using the parameter value settings in the table below.

Analog speed command scaling	Parameter Group 1 Page 12	Sets the analog velocity command scaling

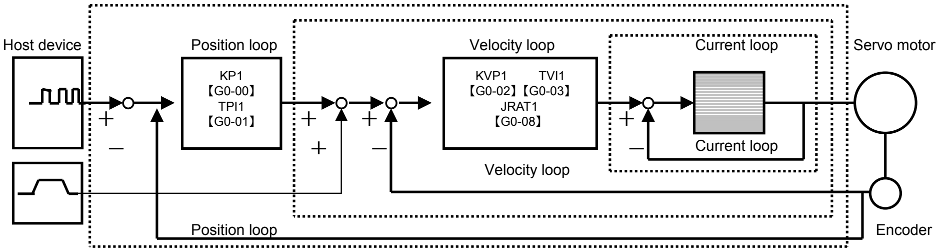
* If there is an alarm, or the servo motor is not moving, problems may exist with the power wiring, CN1 wiring, CN2 wiring, regenerative resistor wiring, or by differences between the host device and the servo amplifier specification parameters. Check the wiring and the parameters, and correct them if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

6.4 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 used for velocity control

Group	Page	Symbol	Name	
0	02	KVP1 [Hz]	Velocity loop proportional gain 1	GAIN1
	03	TVI1 [ms]	Velocity loop integration time constant 1	
	08	JRAT1 [%]	Load inertia moment ratio 1	
	13	TCFIL1 [Hz]	Torque command filter 1	
	06	KVP2 [Hz]	Velocity loop proportional gain 2	GAIN2
	07	TVI2 [ms]	Velocity loop integration time constant 2	
	09	JRAT2 [%]	Load inertia moment ratio 2	
	14	TCFIL2 [Hz]	Torque command filter 2	
	10	VCFIL [Hz]	Velocity command filter	---
	11	TCNFILA [Hz]	Torque command notch filter A	
	12	TCNFILB [Hz]	Torque command notch filter B	

∗ 2 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 GAIN adjustment parameters used for position control

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 1	
	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	

∗ 2 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.

6.4.4 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”.

6.5 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** Position control Velocity control
  - 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 (sub)	Dynamic brake operation

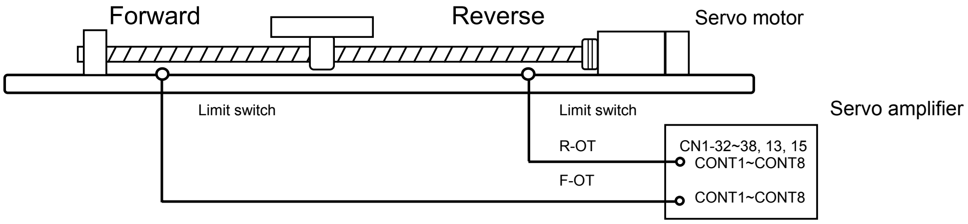
PA304=	*0 H		*1 H		*2 H		*3 H		*4 H		*5 H	
	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop	Servo OFF	Motor past-stop
Free-run	○	○	○			○				○		
Dynamic brake				○	○		○	○				○
Servo brake									○		○	

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

* Torque control always uses free-run stop, regardless of this setting.

- **Overtravel function** Position control mode
  - The overtravel 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. Allocate the overtravel input signal to CONT1~CONT8.

Parameter Group 8 Page 04	F-OT: Forward overtravel function
Parameter Group 8 Page 05	R-OT: Reverse overtravel function



- 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	Host: Overtravel operation

PA304	Selection value	Explanation
0*H	If OT occurs: position command stop and servo brake ON. After the motor stops, servo ON.	・If OT occurs, command input is disabled, the servo brake operates and the motor stops. ・After the motor stops, the servo turns ON. (At OT, command disabled = velocity limit command = 0)
1*H	If OT occurs: position command stop and dynamic brake ON. After the motor stops, servo ON.	・If OT occurs, command input is disabled, the dynamic brake operates and the motor stops. ・After the motor stops, the servo turns ON. (At OT, command disabled = velocity limit command = 0)
2*H	If OT occurs: position command stop and free-run brake ON. After the motor stops, servo ON.	・If OT occurs, command input is disabled, and the free-run operates. ・After the motor stops, the servo turns ON. (At OT, command disabled = velocity limit command = 0)
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.
5*H	If OT occurs: position command stop and free-run brake ON. After the motor stops, servo OFF.	・If OT occurs, command input is disabled, and the free-run operates. ・After the motor stops, the servo turns OFF.
6*H	If OT occurs: position command receive permission condition and velocity limit command =0.	・If OT occurs, OT occurrence velocity limit command becomes zero.

- If “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** Velocity control mode Position control mode

- 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	Sub: 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)”.
During torque control mode, the motor will be stopped using the dynamic brake regardless of this setting.

● **Command input polarity inversion function** Velocity control Position control Torque control

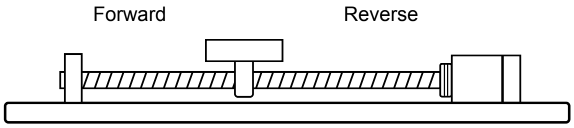
- The rotation direction of the servo motor can be reversed without modifying the input command wiring or the servo motor wiring.

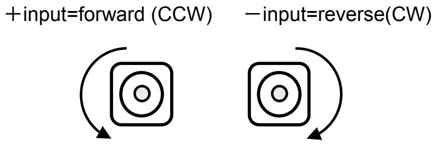
Parameter Group 3 Page 02	Host: Command input polarity

PA302	Selection value		
0＊H	Position command/+ input = forward:	Velocity command/+ input = forward:	Torque command/+ input = forward
1＊H	Position command/+ input = forward:	Velocity command/+ input = forward:	Torque command/+ input =reverse
2＊H	Position command/+ input = forward:	Velocity command/+ input = reverse:	Torque command/+ input = forward
3＊H	Position command/+ input = forward:	Velocity command/+ input = reverse:	Torque command/+ input =reverse
4＊H	Position command/+ input = reverse:	Velocity command/+ input = forward:	Torque command/+ input = forward
5＊H	Position command/+ input = reverse:	Velocity command/+ input = forward:	Torque command/+ input =reverse
6＊H	Position command/+ input = reverse:	Velocity command/+ input = reverse:	Torque command/+ input = forward
7＊H	Position command/+ input = reverse:	Velocity command/+ input = reverse:	Torque command/+ input =reverse

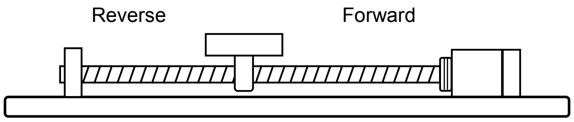
Using the initial factory settings, the servo motor rotates in the forward (CCW) direction with a positive (+) input, and in the reverse (CW) direction with a negative (-) input.

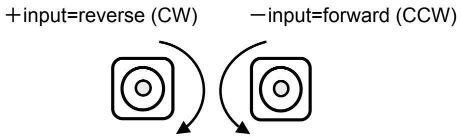
Standard command input polarity setting





Modified command input polarity setting





● Internal torque limit function

Velocity control　Position control　Torque control

There are two areas where selections for the torque limit function can be made: the internal torque limit and the external torque limit. The two selections have different settings, and affect the operation of the device in different ways.

- The internal torque limit (constant) can be used to limit the maximum torque and protect the device mechanism. Set these parameters according to the following table:

・Internal torque limit selection: Parameter Group 3 Page 03 = 0*H

Parameter Group 3 Page 03	Host: torque limit input

PA303	Selection value	Explanation
0＊H	Use the internal torque limit value (TCLM)	・Forward: limited by internal constant. ・Reverse: limited by internal constant.
1＊H	Use the external torque limit input: Forward/F-TLA, Reverse/R-TLA (- voltage input)	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the negative voltage input to R-TLA.
2＊H	Use the external torque limit input: Forward/F-TLA, Reverse/R-TLA (+ voltage input)	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the positive voltage input to R-TLA.
3＊H	Use the external torque limit input: Forward/F-TLA, Reverse/F-TLA	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the positive voltage input to F-TLA.

・Internal torque limit value setting

Parameter Group 1 Page 0E	TCLM: Internal torque limit value	10～500%

・Torque limit function enable

Parameter Group 8 Page 02	Torque limit function

Select the enabling condition of the torque limit permission function using the torque limit functions in Parameter Group 8, Page 02. When the condition is valid, the torque limit is enabled.

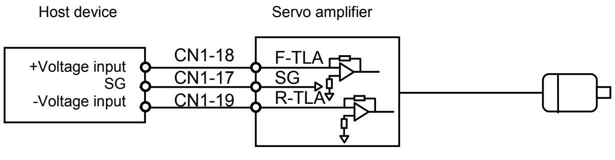
- If the value is set higher than the maximum output torque (T_P) of the servo motor, it will be limited by (T_P).
- Set this value after considering the acceleration time. Too low of a setting can result in insufficient acceleration torque and poor control.
- The internal torque limit should be set higher than the acceleration torque.
- The internal torque limit is identical for forward and reverse rotation. Separate torque limits cannot be set.

● External torque limit function

Velocity control　Position control　Torque control

With the external torque limit function, separate torque limits can be set for forward and reverse rotation. There is a designated input for external torque limit on the CN1 input signal.

Forward torque limit input (F-TLA): CN1-18 【Input voltage range: 0V～+10V】
Reverse torque limit input (R-TLA): CN1-19 【Input voltage range: -10V～+10V】
SG: CN1-17

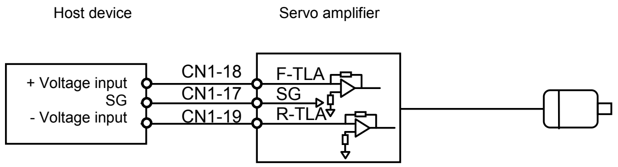


The input voltage specification and the input signal specification can be used in three ways. In Parameter Group 3 Page 03, select from the host torque limit.

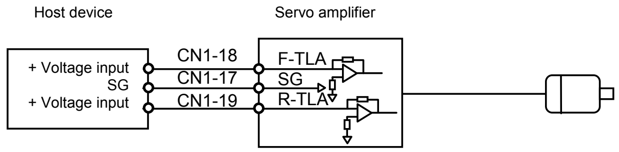
・External torque limit selection: Parameter Group 3 Page 03 = 1*H, 2*H, 3*H

Parameter Group 3 Page 03	Host: torque limit input

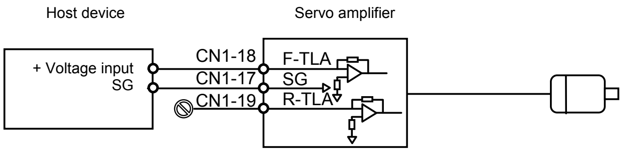
PA303	Selection value	Explanation
1*H	Use the external torque limit input: Forward/F-TLA, Reverse/R-TLA (- voltage input)	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the negative voltage input to R-TLA.



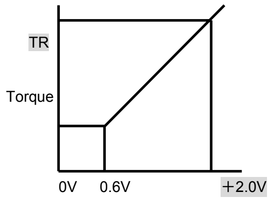
PA303	Selection value	Explanation
2*H	Use the external torque limit input: Forward/F-TLA, Reverse/R-TLA (+ voltage input)	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the positive voltage input to R-TLA.



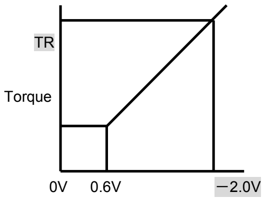
PA303	Selection value	Explanation
3*H	Use the external torque limit input: Forward/F-TLA, Reverse/F-TLA	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the positive voltage input to F-TLA.



Connect the voltage corresponding to the torque limit to the external torque input pin. The relationship between the input voltage and the limitable torque is the rated torque (TR) = 2V for the type of servo motor used.



【Voltage setting】



【Voltage setting】

・Torque limit function enable

Parameter Group 8 Page 02	Torque limit function

Select the enabling condition of the torque limit permission function using the torque limit functions in Parameter Group 8, Page 02. If the selected condition is valid, the torque limit is enabled.

● **Torque limit function in sequence operation** Velocity control Position control Torque control

- 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

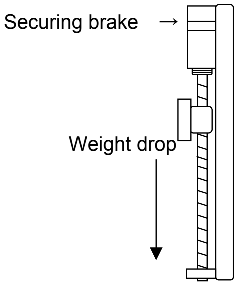
・Sequence operation torque limit value setting

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

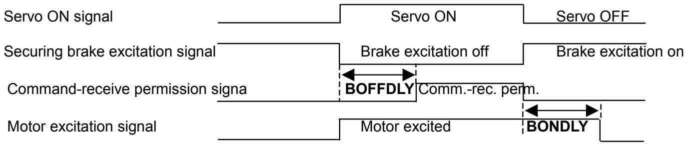
If this value is set higher than the maximum output torque (T_P) of the servo motor, it will be limited by (T_P).

6.5.2 Functions related to the motor securing 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 securing brake can be used to mechanically secure 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 securing 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

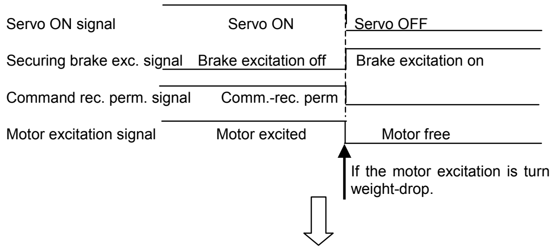
The term “motor does not stop” (above) means that the motor velocity does not fall below the zero velocity (ZV) range.

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 securing brake, which can cause damage to the securing brake. Therefore, use this function only after considering the specifications and the sequence of the device.

● Securing brake operation delay function (BONDLY) Velocity control mode Position control mode

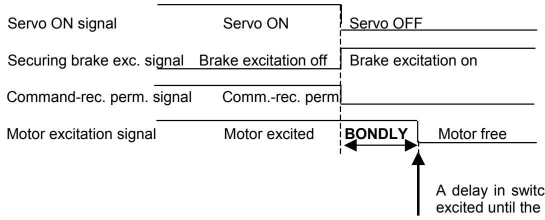
This function is enabled during servo brake operation at servo OFF. It is disabled for dynamic brake and free-run.



If the motor excitation is turned off here, any delay until the securing brake engages can cause a weight-drop.

・Set the delay time for the securing brake operation

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



A delay in switching off the motor excitation can prevent weight-drop, as the motor is excited until the securing brake turns ON.

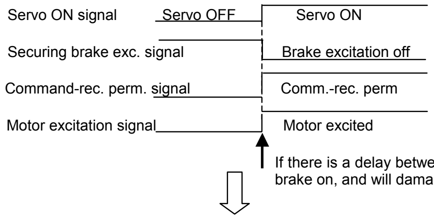
*The setting increment is 4 msec. If the setting is 0 msec, the command is disabled (forced zero) for 4 msec after SON.

・The securing brake excitation signal can be output through the generic outputs (OUT1～OUT8).

Parameter Group 9 Page 0*	OUT*: Generic output *

Selection value		Explanation
0AH	MBR-ON_ON	During securing brake excitation signal output, the output turns ON.
0BH	MBR-ON_OFF	During securing brake excitation signal output, the output turns OFF.

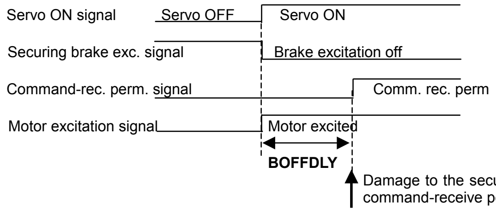
● Securing brake release delay function (BOFFDLY) Velocity control Position control Torque control



If there is a delay between the motor start and the securing brake release, the motor operates with the securing brake on, and will damage the brake.

・Set the delay time for the securing brake release

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



Damage to the securing brake due to this delay can be prevented by lengthening the time of the command-receive permission.

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

・The securing brake excitation signal can be output through the generic outputs (OUT1～OUT8).

Parameter Group 9 Page 0*	OUT: Generic output*

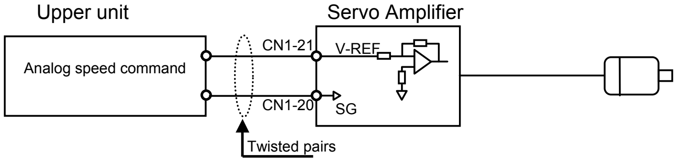
Selection value		Explanation
0AH	MBR-ON_ON	During securing brake excitation signal output, the output turns ON.
0BH	MBR-ON_OFF	During securing brake excitation signal output, the output turns OFF.

6.5.3 Input command functions

Analog speed command Speed control mode

- The analog speed command is the input command used for speed control, via the CN1 analog speed command input.

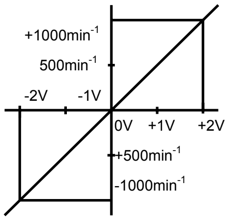
Analog speed command input (V-REF): CN1-21 [Input voltage range -10V～+10V]
Analog speed command input SG: CN1-20



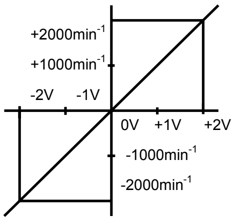
- Control the speed of the servo motor in proportion to the analog speed command voltage. The scaling setting of the analog speed command can be changed via parameter settings. Set the analog speed command scaling in accordance with the upper unit.

Parameter Group 1 Page 12	VCGN: Analog speed command scaling	0～4000min^{-1}/V

[Analog speed scaling setting value=500min^{-1}/V]



[Analog speed scaling setting value=1000min^{-1}/V]



* Refer to page 6-19 for the reverse function of command input polarity.

Internal speed command Speed control mode

- The speed of the servo motor can be controlled using the internal speed command. Three types of internal speed command settings are possible.
- Set the internal speed command and rotation direction with general input CONT1～CONT8 conditions.

1. Set the internal speed command value.

Parameter Group 1 Page 0A	VC1: internal speed command 1	0～32767min^{-1}/V
Parameter Group 1 Page 0B	VC2: internal speed command 2	0～32767min^{-1}/V
Parameter Group 1 Page 0C	VC3: internal speed command 3	0～32767min^{-1}/V

2. Select the conditions for enabling the internal speed command. The internal speed command requires the selection of valid conditions.

Parameter Group 8 Page 0A	SP1: internal speed setting selection input 1
Parameter Group 8 Page 0B	SP2: internal speed setting selection input 2

SP1: internal speed setting selection input 1	Valid	→	VC1: internal speed command 1
SP2: internal speed setting selection input 2	Valid	→	VC2: internal speed command 2
SP1: internal speed setting selection input 1 SP2: internal speed setting selection input 2	Valid	→	VC3: internal speed command 3
SP1: internal speed setting selection input 1 SP2: internal speed setting selection input 2	Invalid	→	Analog speed command

3. Begin operation with the internal speed command and select the conditions for rotation direction.

Parameter Group 8 Page 0D	DIR: internal speed operation direction selection input.
Parameter Group 8 Page 0E	RUN: internal speed operation start signal input

Parameter Group 8 Page 0F	RUN-F: internal speed forward start signal input
Parameter Group 8 Page 10	RUN-R: internal speed reverse start signal input

4. If the above conditions are valid, run the servo motor with the selection combinations listed below.

RUN: internal speed operation start signal input	Valid	Servo motor moves forward
DIR: internal speed operation direction selection input.	Invalid	
RUN: internal speed operation start signal input	Valid	Servo motor in reverse
DIR: internal speed operation direction selection input.	Valid	

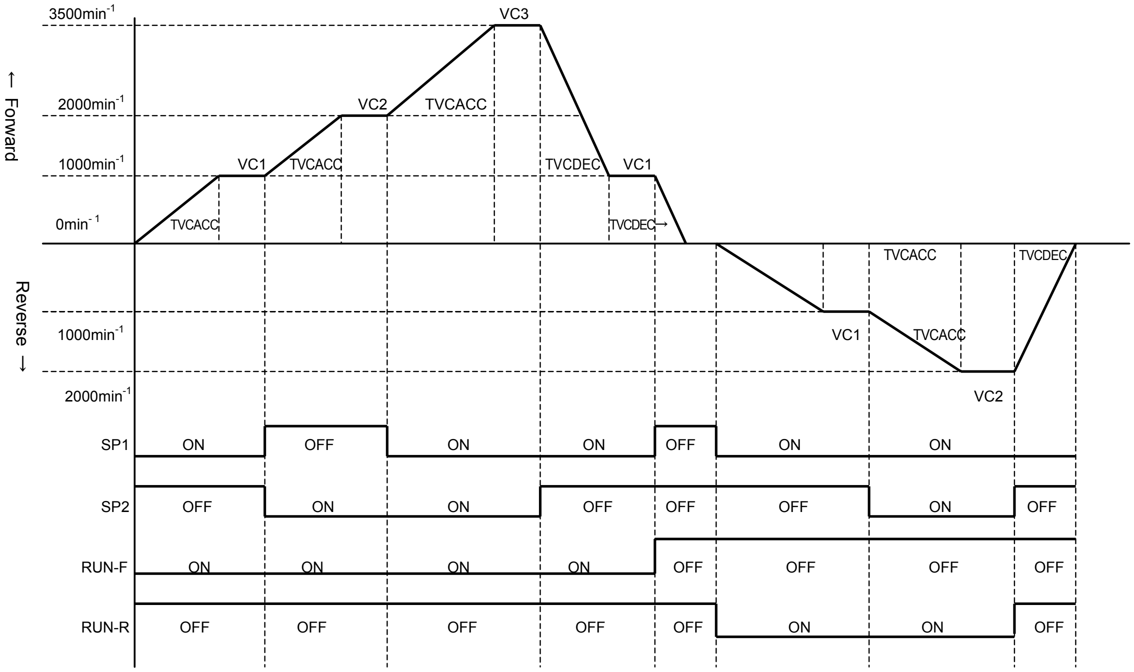
RUN-F: Valid internal speed forward start signal input	Valid	Servo motor moves forward
RUN-R: Valid internal speed reverse start signal input	Valid	Servo motor in reverse

Example of internal speed command operation setting / operation pattern

VC1: internal speed command 1	$1000min^{-1}$
VC2: internal speed command 2	$2000min^{-1}$
VC3: internal speed command 3	$3500min^{-1}$

SP1: internal speed setting selection input 1	Valid general input CONT3 ON function
SP2: internal speed setting selection input 2	Valid general input CONT4 ON function

RUN-F: internal speed forward start signal input	Valid general input CONT5 ON function
RUN-R: internal speed reverse start signal input	Valid general input CONT5 OFF function

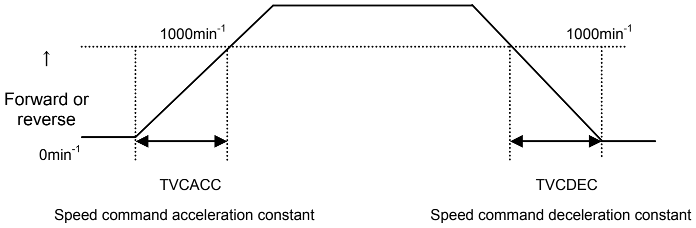


● Speed command adjustment constant

Speed control mode

- The step input speed command can be changed to a constant adjustment speed command using the speed command adjustment constant.
- Set the time increment within "$0min^{-1}$ → $\pm 1000min^{-1}$", "$\pm 1000min^{-1}$ → $0min^{-1}$" based on the number of servo motor axial rotations.

Parameter Group 0 Page 0C	TVCACC: Speed command adjustment constant.	0～16000 ms
Parameter Group 0 Page 0D	TVCDEC: Speed command adjustment constant	0～16000 ms

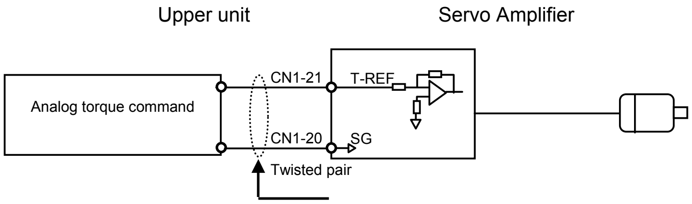


The analog speed command and internal speed command can be used together.

Analog torque command Torque control mode

- The analog torque command is the input command used for torque control. Connect to CN1 analog torque command input.

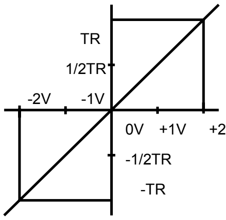
Analog torque command input (V-REF): CN1-21 [Input voltage range -10V~+10V]
Analog torque command input SG: CN1-20



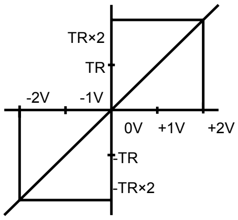
- The torque of the servo motor is controlled in proportion to the analog torque command voltage value. Analog torque command scaling settings can be changed by modifying the parameters. Set the analog torque command scaling in accordance with the upper unit.

Parameter Group 1 Page 14	TCGN: Analog torque command scaling	0～500　%/V

[Analog speed scaling setting value=50%/V]



[Analog speed scaling setting value=100%/V]



*　Refer to page 6-19 for reverse function of command input polarity.

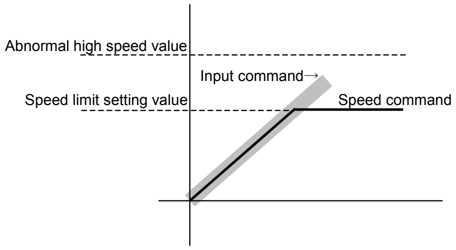
Analog speed command / torque command auto offset function Speed control mode
Torque control mode

- The servo motor may rotate with low speed even when the analog command voltage is entered as 0V. If so, change the analog command voltage with the analog speed command / torque command auto offset function. Refer to “8.1.3.3 Trial Operation / adjustment” and “Q-Setup-Setup Software Instruction Manual M0005351C3.18” for details.

Speed limit command Speed control mode
Position control mode

- An upper limit value can be locked in with the speed limit command.
- This value cannot be set to exceed the speed capabilities of the adjoining motor.

Parameter Group 1 Page 0D	VCLM: Speed limit command	1～65535　min^{-1}



Location command pulse

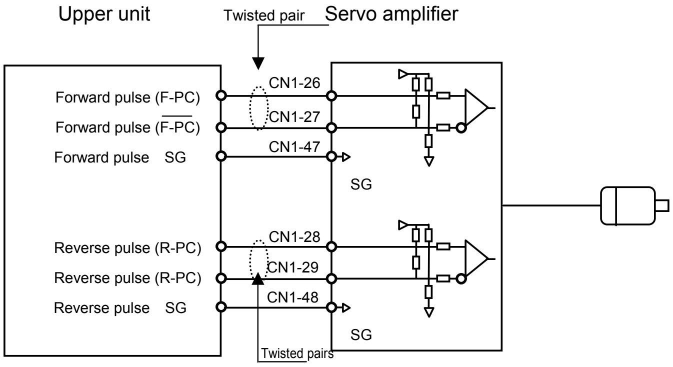
Position control mode

- The location command pulse input command is the input command used for location control. Connect to CN1 location command pulse input.

Forward	Reverse
Forward pulse (F-PC): CN1-26	Reverse pulse (R-PC): CN1-28
Forward pulse ($\overline{\text{F-PC}}$): CN1-27	Reverse pulse ($\overline{\text{R-PC}}$): CN1-29
Forward pulse SG: CN1-47	Reverse pulse SG: CN1-48

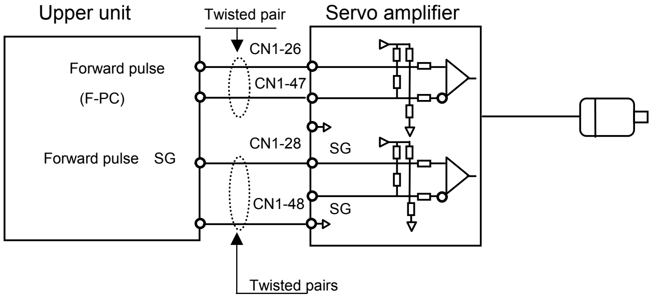
- There are 2 output types for the upper unit, the "Line driver output" and the "Open collector output".

Using line driver output:



* Always connect SG.
* Line Receiver: RS 422

Using open collector output



- 3 types of location command pulse can be selected; make this selection per the specifications of the upper unit.

Parameter Group 4 page 00	Upper: Command pulse selection

PA400	Selection
0*H	Forward pulse +reverse pulse
1*H	90°phase difference=phase pulse string
2*H	Code + pulse string

∗ Refer to "10.1.5 Location command input" for details.

10.1.5.1	Upper unit output type
10.1.5.2	Selection of location command pulse type
10.1.5.3	Command pulse timing
10.1.5.4	Location command pulse digital filter setting

* Refer to page 6-19 for reverse function of command input polarity.

Command pulse multiplication

Position control mode

- Use this function to multiply the location command pulse in multiples of 1~63. The input value always becomes valid when using location control type.

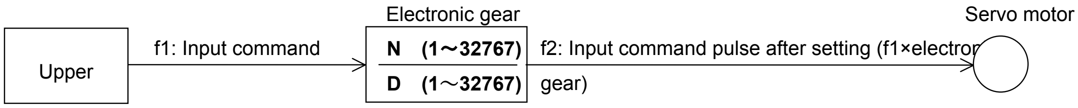
Parameter Group 1 page 03	PMUL: Command pulse multiplication	1～63

Electronic gear

Position control mode

- This function allows a distance setting on the servo motor in reference to the location command pulse from the device.

Parameter Group 1 page 04	GER1: Electronic gear 1	1/32767～32767/1
Parameter Group 1 Page 05	GER2: Electronic gear 2	1/32767～32767/1



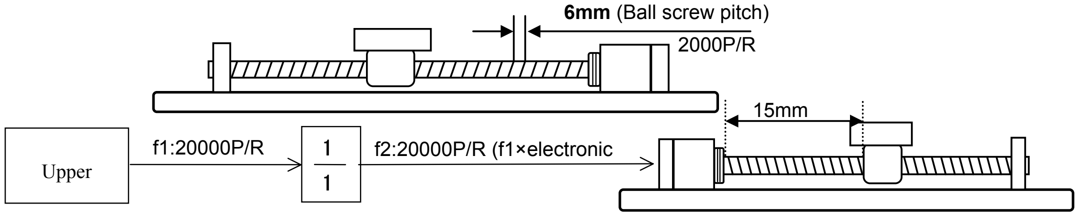
Electronic gear setting range: $$\frac{1}{32767} \leqq \frac{N}{D} \leqq \frac{32767}{1}$$

Changing the electronic gear setting by 1/2 increment is done with the following parameters:

Parameter Group 8 Page 11	GERS: Electron gear change function

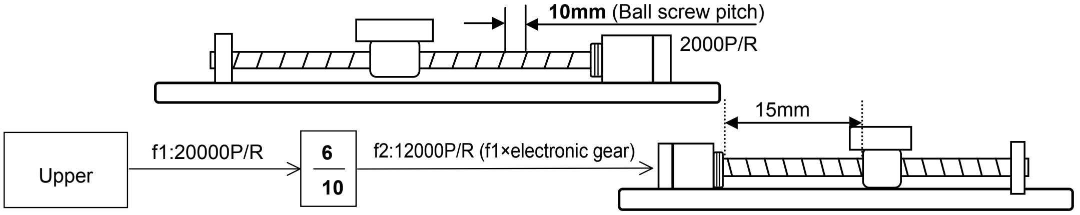
[Ex.:] When the sensor pulses 2000P/R with a ball screw pitch of 6mm, the work distance will shift 15mm.

- Servo motor 1 rotation=8000P/R (sensor pulse 2000P/Rx4 times)
- To make the work distance 15mm (since the ball screw pitch is 6mm), the rotations of servo motor are 15mm/6mm=2.5 rotations
- The pulse transmission at that time is 8000P/Rx2.5=20000 pulses
- When the electronic gear setting is set to 1/1, pulse transmission to the upper unit is 20000 pulses.



When the ball screw pitch is changed to 10mm

- To make the work distance 15mm (with a ball screw pitch of 10mm), the rotations of the servo motor will be 15mm/10mm=1.5 rotations
- The pulse transmission is then 8000P/Rx1.5=12,000 pulses
- If the electronic gear is set to 6/10, the pulse transmission of f2 can be changed to 12,000 pulses, without changing the pulse transmission of the upper unit.



Thus, simply by setting the electronic gear alone, additional settings to other functions become unnecessary.

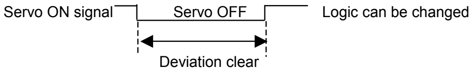
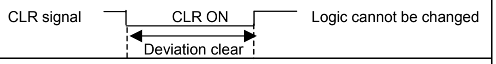
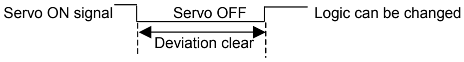
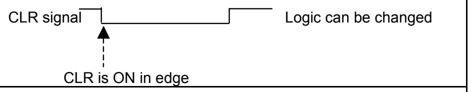
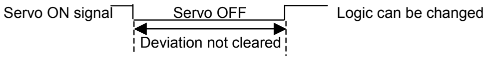
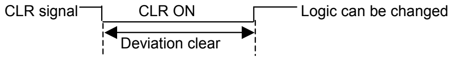
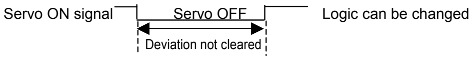
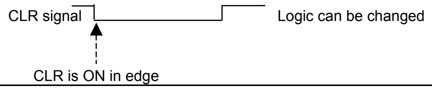
Location deviation clear function

Location control type

This function is used for changing the location deviation counter in the servo amplifier from the upper unit to zero.

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

Parameter Group 3 page 00	Upper: Deviation clear selection

Selection		Explanation
0H	Servo OFF/deviation clear: Deviation clear input/level detection	Deviation is always cleared when servo is off.  Deviation is always cleared when deviation clear input is ON. 
1H	Servo OFF/deviation clear: Deviation clear input / edge detection	Deviation is always cleared when servo is off.  Deviation is cleared in the edge when deviation clear input becomes OFF/ON. 
2H	Servo OFF/deviation not cleared: Deviation clear input/level detection	Deviation is not cleared when servo is OFF. The motor may start suddenly after servo is turned ON with location deviation detected.  Deviation is always cleared when deviation clear input is ON. 
3H	Servo OFF/deviation not cleared: Deviation clear input / edge detection	Deviation is not cleared when servo is OFF. The motor may start suddenly after servo is turned ON with location deviation detected.  Deviation is cleared in the edge when deviation clear input becomes OFF/ON. 

Select the conditions for enabling deviation clear.

Parameter Group 7 page 00	CLR: Deviation clear function

Speed addition function Location control type

The speed addition function is the fast-forward function in the speed control system. The speed addition command input function has 2 settings: the internal speed addition command and the analog speed addition command. The internal speed addition command is used when the speed addition command value is a fixed value. The analog speed addition command is used when setting the speed addition command input value from the upper unit.

- Internal speed addition function

Sets the internal speed addition command value.

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

Select the speed addition command input method.

Parameter Group 3 Page 06	Upper: Speed addition command input

Selection		Explanation
0H	Speed addition function invalid	
1H	Use analog speed addition command	Use analog speed addition command value when speed addition function is valid.
2H	Use internal speed addition command	Use internal speed addition command value when speed addition function is valid.

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

Parameter Group 8 Page 15	VCOMPS: Speed addition function

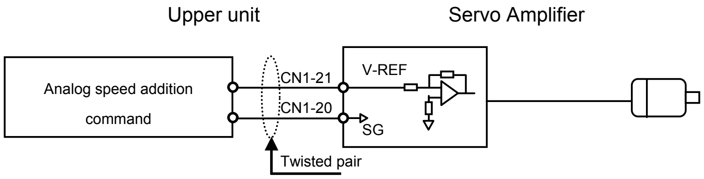
- Analog speed addition function

Sets the analog speed addition command scaling (for use together with analog speed command scaling).

Parameter Group 1 Page 12	VCGN: Analog speed command scaling	0～4000 min^{-1}/V

- The input used in the analog speed addition command is the same as the analog speed command / analog torque command input.

Analog speed addition command input: CN1-21 [Input voltage range -10V~+10V]
Analog speed addition command input SG: CN1-20



Select the speed command input method.

Parameter Group 3 Page 06	Upper: Speed addition command input

Selection		Explanation
0H	Speed addition function invalid	
1H	Use analog speed addition command	Use analog speed addition command value when speed addition function is valid.
2H	Use internal speed addition command	Use internal speed addition command value when speed addition function is valid.

Select the conditions for enabling the speed addition function.

Parameter Group 8 Page 15	VCOMPS: Speed addition function

Torque addition function Speed control mode Position control mode

The torque addition function is the fast-forward function of the torque control system. There are 2 types of settings for the torque addition command input function: the internal torque addition command and the analog torque addition command. The internal torque addition command can be used when using the torque addition command value as a fixed value. The analog torque addition command can be used when setting the torque addition command input value from the upper unit.

- 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: Torque calculation command input

Selection		Explanation
0H	Torque addition function invalid	
1H	Use analog torque addition command	Use analog torque addition command value when torque addition function is valid.
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

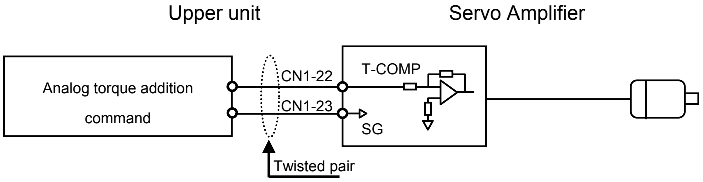
- Analog torque addition function

Sets the analog torque addition command scaling.

Parameter Group 1 Page 16	TCOMPGN: Analog speed command scaling	0～500 %

- The input used in the analog torque addition command provides the signal analog torque addition command input of CN1.

Analog torque addition command input: CN1-22 [Input voltage range -10V~+10V]
Analog torque addition command input SG: CN1-23



Select the torque addition command input method.

Parameter Group 3 Page 06	Lower: Torque calculation command input

Selection		Explanation
0H	Torque addition function invalid	
1H	Use analog torque addition command	Use analog torque addition command value when torque addition function is valid.
2H	Use internal torque addition command	Use internal torque addition command value when torque addition function is valid.

Select the conditions for enabling the torque addition function.

Parameter Group 8 Page 14	TCOMPS: Torque addition function

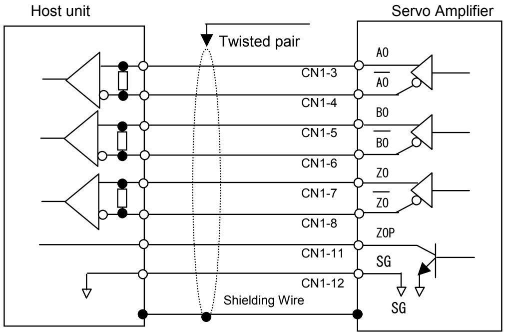
6.5.4 Encoder Functions

Encoder Pulse Divider Output

Incremental Output

The encoder signals (Phase A / Phase B) used in the host unit can be output according to a ratio formula. When using in the host unit's position loop control, input the result (obtained after dividing the number of encoder pulses) as an integer. However, when using this function to monitor the host unit, input a ratio that is as close as possible to the setup value.

The output of Z phase is not divided. Output is sin O/C (CN1-11).



Line driver specifications:RS422

Always connect shielding wire to CN1-12 (SG).

Setting the division ratio for the Encoder Pulse Frequency Divider Output.

Parameter Group 1 Page 06	ENRAT: Ratio of the Encoder Pulse Frequency Divider Output	1/1～1/8192

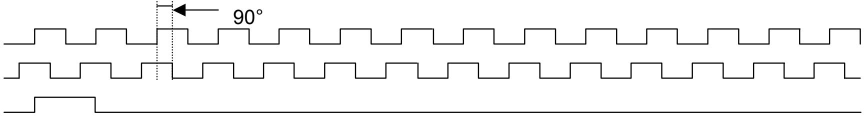
When entering the pulse ratio, adhere to the conditions as described below:

Frequency division= $\frac{1}{\alpha}$ α=1～64, 8192 $\frac{1}{1}$ $\frac{1}{2}$ $\frac{1}{3}$ ～ $\frac{1}{64}$ 、 $\frac{1}{8192}$

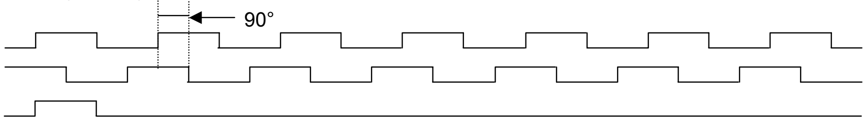
Frequency division= $\frac{2}{\alpha}$ α=3～64, 8192 $\frac{2}{3}$ $\frac{2}{4}$ $\frac{2}{5}$ ～ $\frac{2}{64}$ 、 $\frac{2}{8192}$

Frequency division= $\frac{\beta}{8192}$ β=1～8191 $\frac{1}{8192}$ $\frac{2}{8192}$ $\frac{3}{8192}$ ～ 、 $\frac{8191}{8192}$

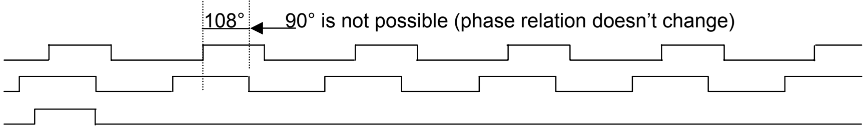
Frequency division1/1 (forward)



Frequency division1/2 (forward)



Frequency division 2/5 (forward)



* Destabilizes 1 sec after controlled power is supplied.

Encoder Pulse Divider Output Changeover selection function

Incremental Output

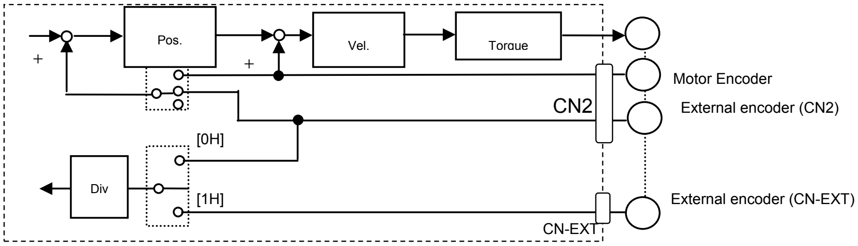
The Encoder Pulse Divider Output can be selected from 2 types, the Motor Encoder and the External Encoder.

Parameter Group 3 Page 01	Low: Encoder Pulse Output Changeover

Selection		Explanation
0H	Motor Encoder	The motor encoder signal / External encoder signal connected to CN2
1H	Full Close Encoder	The External Encoder Signal connected to CN-EXT

- When in semi-close control mode, select 0H:Motor Encoder.
- When using an absolute sensor without an incremental absolute encoder, send the incremental pulse of 8192P/R to the dividing circuit.
- When using the pulse of the external encoder in the upper unit in full-close control mode, the settings change via the connector connecting the external encoder.

When the external encoder is connected to CN-2 Select OH: motor encoder
When the external encoder is connected to CN-EXT, select 1H: Full-close encoder



[change in encoder frequency output]

Encoder Pulse Divider Output polarity selection function

Incremental Output

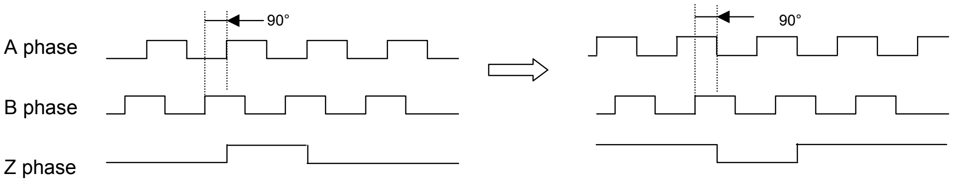
The polarity of the encoder pulse frequency output can be selected.

Parameter Group 3 Page 01	Upper: Encoder pulse frequency output polarity

Selection		Explanation
0H	A phase signal / not reversed Z phase signal logic / High active	A phase signal cannot be reversed. Z phase signal is given as High active.
1H	A phase signal / reversed Z phase signal logic / High active	A phase signal can be reversed.
2H	A phase signal / not reversed Z phase signal logic / Low active	Z phase signal is given as Low active.
3H	A phase signal / reversed Z phase signal logic / Low active	

Setting 0H (Frequency division ratio 1/1: with forward rotation)
Using the incremental encoder

Setting 3H (Frequency division ratio 1/1: with forward rotation)
Using the incremental encoder



External encoder pulse polarity selection function

External encoder

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

Parameter Group 4 Page 01	Lower: 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

Incremental encoder

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.

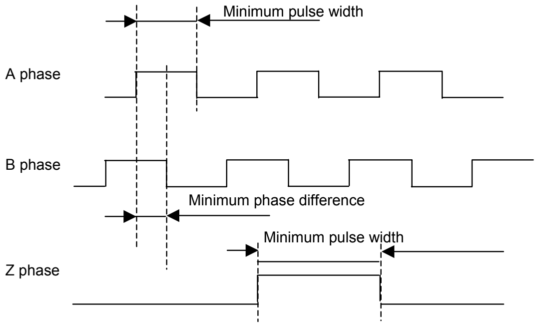
Selection of motor incremental encoder digital filter

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

Selection of external incremental encoder digital filter

Parameter Group 3 Page 08	Upper: 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

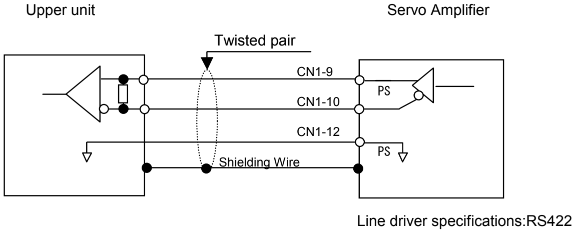


Encoder signal output format function

When using an absolute encoder, the location data can be displayed serially from the servo amplifier.

The types of signal output formats are “Binary code output”, “Decimal ASCII code output” and “Encoder direct output”.

Therefore, select this format in compliance with the specifications of the upper unit.



Always connect shielding wire to CN1-12 (SG).

Selection of encoder signal output (PS) format

Parameter group 4 page 04	Lower: Encoder signal output (PS) format

Selection	
0H	Binary code output
1H	Decimal ASCII code output
2H	Encoder signal direct output

- ∗ When using the incremental encoder (serial), the current monitor value is displayed in binary code irrespective of the set value.
- ∗ After changing the settings, this function is enabled by restarting the control power supply.
- ∗ Refer to “Chapter 10 Specifications 10.1.3 Location signal output” for location signal output specifications and format details.
- ∗ When encoder signal direct output is selected, the serial signal sent from the encoder to the servo amplifier is displayed as is. As such, information other than location data is displayed per the absolute sensor used.

Absolute encoder clear function

Absolute encoder Wire-saving absolute sensor

Select the conditions for enabling absolute encoder clear.

Parameter group 8 page 03	ECLR: Absolute encoder clear function

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

Parameter Group 3 Page 07	Upper: 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**

This feature has the capability to import upper unit signals through the servo amplifier general input signals (CONT1~CONT8).
To enable general input signals, first set the conditions for enabling the functions.
There is no fixed method for allocating the functions. They are allocated randomly to the general inputs (CONT1~CONT8), and the logic can also be set simultaneously.
These functions can be enabled together with other function conditions (zero speed / positioning completion), separate from the general input signal (CNT1~CNT8).

Functions

Group	Page	symbol	Name
7	00	CLR	Deviation clear function
	01	MS	Control mode switching function
	02	PCON	Speed loop comparison control switchover function
	03	GC	Gain switchover function
8	00	S-ON	Servo ON function
	01	AL-RST	Alarm reset function
	02	TL	Torque limit function
	03	ECLR	Absolute encoder clear function
	04	F-OT	Forward rotation over travel function
	05	R-OT	Reverse rotation over travel function
	06	INH/Z-STP	Position command pulse prohibition function / speed zero stop function
	07	EXT-E	External trip input function
	08	DISCHARGE	Forced discharge function
	09	EMR	Emergency stop function
	0A	SP1	Internal speed setting selection input 1
	0B	SP2	Internal speed setting selection input 2
	0D	DIR	Internal speed operation direction selection input.
	0E	RUN	Operation start signal input of internal speed
	0F	RUN-F	Forward rotation start signal input of internal speed
	10	RUN-R	Reverse rotation start signal input of internal speed
	11	GERS	Electronic gear switchover function
	12	PPCON	Position loop comparison control switchover function
	14	TCOMPS	Torque addition function
	15	VCOMPS	Speed addition function

Selection		Explanation
00H	Always_ Disable	Function is always disabled.
01H	Always_ Enable	Function is always enabled.
02H	CONT1_ON	Function is enabled when general input CONT1 is turned ON.
03H	CONT1_OFF	Function is enabled when general input CONT1 is turned OFF.
04H	CONT2_ON	Function is enabled when general input CONT2 is turned ON.
05H	CONT2_OFF	Function is enabled when general input CONT2 is turned OFF
0GH	CONT3_ON	Function is enabled when general input CONT3 is turned ON.
07H	CONT3_OFF	Function is enabled when general input CONT3 is turned OFF.
08H	CONT4_ON	Function is enabled when general input CONT4 is turned ON.
09H	CONT4_OFF	Function is enabled when general input CONT4 is turned OFF.
0AH	CONT5_ON	Function is enabled when general input CONT5 is turned ON.
0BH	CONT5_OFF	Function is enabled when general input CONT5 is turned OFF.
0CH	CONT6_ON	Function is enabled when general input CONT6 is turned ON.
0DH	CONT6_OFF	Function is enabled when general input CONT6 is turned OFF.
0EH	CONT7_ON	Function is enabled when general input CONT7 is turned ON.
0FH	CONT7_OFF	Function is enabled when general input CONT7 is turned OFF.
10H	CONT8_ON	Function is enabled when general input CONT8 is turned ON.
11H	CONT8_OFF	Function is enabled when general input CONT8 is turned OFF.
12H	LOWV_IN	Function is enabled during low speed status (speed below LOWV set value).
13H	LOWV_OUT	Function is enabled when not in low speed status (speed below LOWV set value).
14H	VA_IN	Function is enabled during speed transport status (speed above VA set value).
15H	VA_OUT	Function is enabled when not in speed transport status (speed above VA set value).
1GH	VCMP_IN	Function is enabled during speed coincidence status (speed deviation below VCMP set value).
17H	VCMP_OUT	Function is enabled when not in speed coincidence status (speed deviation below VCMP set value).
18H	ZV_IN	Function is enabled during zero speed status (speed below ZV set value).
19H	ZV_OUT	Function is enabled when not in zero speed status (speed 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 speed limit operation status.
1FH	VLC_OUT	Function is enabled when not in speed limit operation status.
20H	NEAR_IN	Function is enabled during near range status.
21H	NEAR_OU	Function is enabled when not in near range status.

6. Operations / Functions

The signals to the upper unit can be output from the servo amplifier general output signal (OUT1~OUT8).
The general output signals (OUT1~OUT8) of Group 9 are randomly allocated, and the logic can also be set simultaneously.

Signals are output with the selected conditions:

Group	Page	symbol	Name and contents
9	00	OUT1	Selects output signals of general output 1 / general output OUT1
	01	OUT2	Selects output signals of general output 2 / general output OUT2
	02	OUT3	Selects output signals of general output 3 / general output OUT3.
	03	OUT4	Selects output signals of general output 4 / general output OUT4
	04	OUT5	Selects output signals of general output 5 / general output OUT5.
	05	OUT6	Selects output signals of general output 6 / general output OUT6
	06	OUT7	Selects output signals of general output 7 / general output OUT7.
	07	OUT8	Selects output signals of general output 8 / general output OUT8

Selection		Explanation			
00H	Always_OFF	Output is always OFF.	36H	ALM7_ON	Output alarm code bit 7 (positive logic)
01H	Always_ON	Output is always ON.	37H	ALM7_OFF	Output alarm code bit 7 (negative logic)
02H	S-RDY_ON	Output turns ON during completion of operation preparation	38H	ALM_ON	Output turns ON during alarm status
03H	S-RDY_OFF	Output turns OFF during completion of operation preparation	39H	ALM_OFF	Output turns OFF during alarm status
04H	P-ON_ON	Output turns ON when power is ON.	3AH	CONT1_ON	Output turns ON when general input CONT1 is ON
05H	P-ON_OFF	Output turns OFF when power is ON.	3BH	CONT1_OFF	Output turns OFF when general input CONT1 is ON
0GH	A-RDY_ON	Output turns ON when power is authorized ON.	3CH	CONT2_ON	Output turns ON when general input CONT2 is ON
07H	A-RDY_OFF	Output turns OFF when power is authorized ON.	3DH	CONT2_OFF	Output turns OFF when general input CONT2 is ON
08H	S-ON_ON	Output turns ON during motor excitation	3EH	CONT3_ON	Output turns ON when general input CONT3 is ON
09H	S-ON_OFF	Output turns OFF during motor excitation	3FH	CONT3_OFF	Output turns OFF when general input CONT3 is ON
0AH	MBR-ON_ON	Output turns ON during maintenance brake excitation signal output.	4OH	CONT4_ON	Output turns ON when general input CONT4 is ON
0BH	MBR-ON_OFF	Output turns OFF during maintenance brake excitation signal output.	41H	CONT4_OFF	Output turns OFF when general input CONT4 is ON
0CH	TLC_ON	Output turns ON during torque limit operations.	42H	CONT5_ON	Output turns ON when general input CONT5 is ON
0DH	TLC_OFF	Output turns OFF during torque limit operations.	43H	CONT5_OFF	Output turns OFF when general input CONT5 is ON
0EH	VLC_ON	Output turns ON during speed limit operations	44H	CONT6_ON	Output turns ON when general input CONT6 is ON
0FH	VLC_OFF	Output turns OFF during speed limit operation	45H	CONT6_OFF	Output turns OFF when general input CONT6 is ON
10H	LOWV_ON	Output turns ON during low speed status	46H	CONT7_ON	Output turns ON when general input CONT7 is ON
11H	LOWV_OFF	Output turns OFF during low speed operation	47H	CONT7_OFF	Output turns OFF when general input CONT7 is ON
12H	VA_ON	Output turns ON during speed transport status	48H	CONT8_ON	Output turns ON when general input CONT8 is ON
13H	VA_OFF	Output turns OFF during speed transport status	49H	CONT8_OFF	Output turns OFF when general input CONT8 is ON
14H	VCMP_ON	Output turns ON during speed coincidence status	4AH	CHARGE_ON	Output turns ON during main circuit power source (smoothing condenser) charging
15H	VCMP_OFF	Output turns OFF during speed coincidence status	4BH	CHARGE_OFF	Output turns OFF during main circuit power source (smoothing condenser) charging
1GH	ZV_ON	Output turns ON during zero speed status	4CH	DB_OFF	Output turns OFF during dynamic brake operations.
17H	ZV_OFF	Output turns OFF during zero speed status	4DH	DB_ON	Output turns ON during dynamic brake operations.
18H	INP_ON	Power turns ON during positioning completion status.	4EH	-----	reserved
19H	INP_OFF	Power turns OFF during positioning completion status.	4FH	-----	reserved
1AH	NEAR_ON	Output turns ON during near range status	50H	PYALM1_ON	PY compatibility alarm code 1 is output (positive logic)
1BH	NEAR_OFF	Output turns OFF during near range status	51H	PYALM1_OFF	PY compatibility alarm code 1 is output (negative logic)
1CH	CMD-ACK_ON	Output turns ON during command receipt permission status	52H	PYALM2_ON	PY compatibility alarm code 2 is output (positive logic)
1DH	CMD-ACK_OFF	Output turns OFF during zero command receipt permission status	53H	PYALM2_OFF	PY compatibility alarm code 2 is output (negative logic)
1EH	GC-ACK_ON	Output turns ON during gain switchover status	54H	PYALM4_ON	PY compatibility alarm code 4 is output (positive logic)
1FH	GC-ACK_OFF	Output turns OFF during gain switchover status	55H	PYALM4_OFF	PY compatibility alarm code 4 is output (negative logic)
20H	PCON-ACK_ON	Output turns ON during speed loop comparison limit switchover status.	56H	PYALM8_ON	PY compatibility alarm code 8 is output (positive logic)
21H	PCON-ACK_OFF	Output turns OFF during speed loop comparison control switch status.	57H	PYALM8_OFF	PY compatibility alarm code 8 is output (negative logic)
22H	GERS-ACK_ON	Output turns ON during electronic gear switchover status	58H	S-RDY2_ON	Output terminal turns ON during completion
23H	GERS-ACK_OFF	Output turns OFF during electronic gear switchover status	59H	S-RDY2_OFF	Output terminal turns OFF during completion
24H	MS-ACK_ON	Output turns ON during control mode switchover status			
25H	MS-ACK_OFF	Output turns OFF during control mode switchover status			
26H	F-OT_ON	Output turns ON during forward over travel status			
27H	F-OT_OFF	Output turns OFF during forward over travel status			
28H	R-OT_ON	Output turns ON during reverse over travel status			
29H	R-OT_OFF	Output turns OFF during reverse over travel status			
2AH	WNG-OFW_ON	Output turns ON during excessive deviation warning status			
2BH	WNG-OFW_OFF	Output turns OFF during excessive deviation warning status			
2CH	WNG-OLW_ON	Output turns ON during excessive load warning status			
2DH	WNG-OLW_OFF	Output turns OFF during excessive load warning status			
2EH	WNG-ROLW_ON	Output turns ON during regenerative excessive load warning status			
2FH	WNG-ROLW_OFF	Output turns OFF during regenerative excessive load warning status			
30H	WNG-BAT_ON	Output turns ON during battery warning status			
31H	WNG-BAT_OFF	Output turns OFF during battery warning status			
32H	ALM5_ON	Output alarm code bit 5 (positive logic)			
33H	ALM5_OFF	Output alarm code bit 5 (negative logic)			
34H	ALM6_ON	Output alarm code bit 6 (positive logic)			
35H	ALM6_OFF	Output alarm code bit 6 (negative logic)			

- **Positioning completion signal output** Position control mode

The positioning completion signal is output from the selected output terminal when servo motor movement is completed (reaches the set deviation counter value) during location control mode.

Setting the positioning completion range

Parameter Group 1 Page 00	INP: Positioning completion range	1～65535 Pulse

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

Incremental encoder: 4 times (4x) encoder pulses is standard.

Absolute encoder: absolute value is standard.

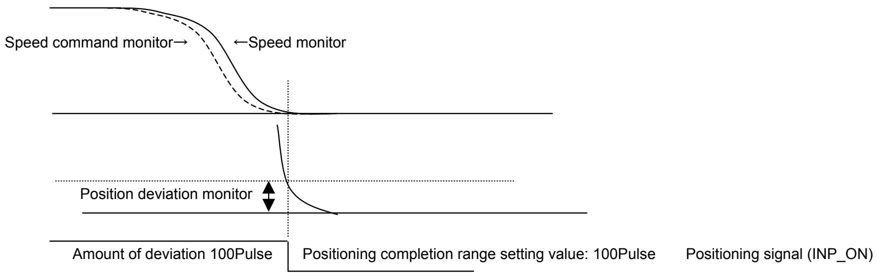
- Setting the positioning completion signal

Parameter Group 9 Page 0∗	OUT*: general output∗

Determine the logical status of the positioning completion signal output, and to which output terminal to assign the positioning completion signal output.

Selection		Explanation
18H	INP_ON	Output turns ON during positioning completion status.
19H	INP_OFF	Output turns OFF during positioning completion status.

Group	Page	symbol	Name and contents	Setting range	CN1
9	00	OUT1	Selects output signals of general output 1 / general output OUT1.	00h～59h	39Pin
	01	OUT2	Selects output signals of general output 2 / general output OUT2.	00h～59h	40Pin
	02	OUT3	Selects output signals of general output 3 / general output OUT3.	00h～59h	41Pin
	03	OUT4	Selects output signals of general output 4 / general output OUT4.	00h～59h	42Pin
	04	OUT5	Selects output signals of general output 5 / general output OUT5.	00h～59h	43Pin
	05	OUT6	Selects output signals of general output 6 / general output OUT6.	00h～59h	44Pin
	06	OUT7	Selects output signals of general output 7 / general output OUT7.	00h～59h	45Pin
	07	OUT8	Selects output signals of general output 8 / general output OUT8.	00h～59h	46Pin



- **Deviation counter overflow value** Position control mode

Determines the overflow value of the deviation counter.

Parameter Group 1 Page 02	OFLV: Deviation counter overflow value	1～65535 x 256 pulse

● NEAR signal output

Position control mode

Outputs signal indicating proximity to position completion.

NEAR range settings

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

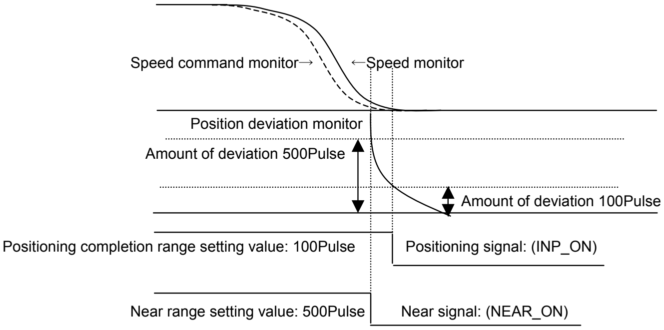
NEAR signal output settings

Parameter Group 9 Page 0＊	OUT*: general output＊

Determine the logical status of the NEAR signal output, and to which output terminal to assign the positioning completion signal output. The assignment of the output terminal is the same location as the positioning completion signals (above).

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

If set to a value greater than the positioning completion range settings, the upper unit receives the NEAR signal before receiving the positioning completion signal (INP), and transition to the positioning completion operations is enabled.



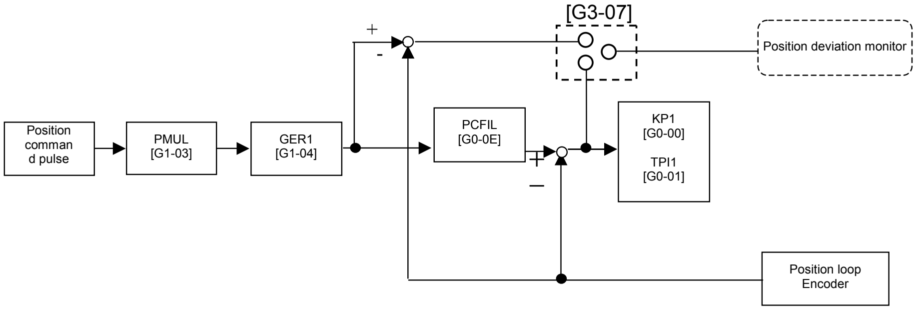
● Positioning completion signal/positioning deviation monitor detection function

Position control mode

- When using location control, the positioning completion signal and position command used in position deviation monitor output can be selected after passing through the position command filter.

Parameter Group 3 Page 07	Lower: Positioning completion 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

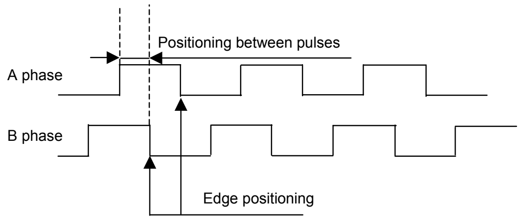
Position control mode

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: Positioning system

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

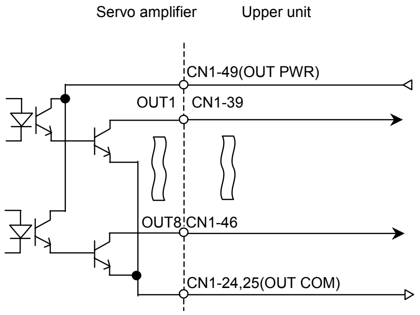
After changing the setting, the function is enabled by restarting the control power supply.



● Low speed setting / speed transport setting / speed coincidence range

Position control mode Speed control mode Torque control mode

This parameter affects settings for the speed output range. The signal can be output from general output (OUT1~OUT8) and used as a valid condition for all functions. However, the speed coincidence range is invalid in torque control mode.



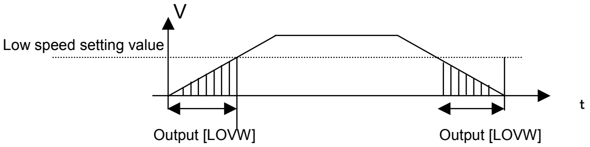
To direct signals to the upper unit, make assignments to the signals in parameter Group 9. Use the general output terminal (OUT1~OUT8) of the connected CN1.

Group	Page	Symbol	Name
9	00～07	OUT1～OUT8	General output 1～General output 8

Selection		Explanation
10H	LOWV_ON	Output turns ON during low speed status
11H	LOWV_OFF	Output turns OFF during low speed operation
12H	VA_ON	Output turns ON during speed transport status
13H	VA_OFF	Output turns OFF during speed transport status
14H	VCMP_ON	Output turns ON during speed coincidence status
15H	VCMP_OFF	Output turns OFF during speed coincidence status

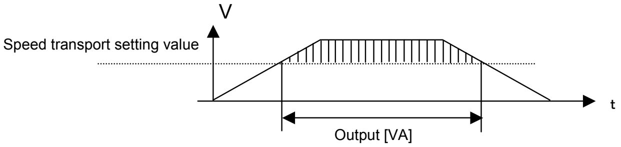
Low speed settings: Low speed signal is sent if speed goes below the set value.

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



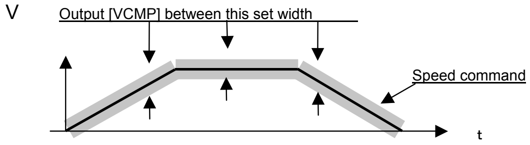
Speed transport settings: Speed transport signal is given if speed exceeds the set value.

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



Speed coincidence range: Speed coincidence range signal is given if speed deviation reaches the set range.

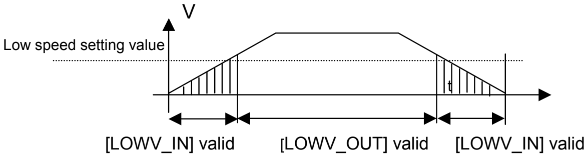
Parameter Group 1 Page 09	VCMP: Speed coincidence range	0～65535min^{-1}



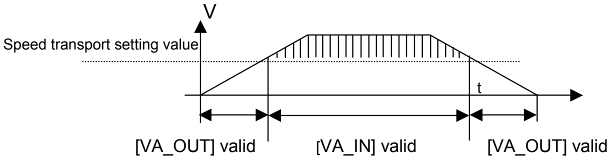
All functions can be enabled without sending output signals to the upper unit, when used in combination with "Group 7/Group 8" functions' valid conditions (input signals). For example, by setting the gain switchover function of Group 7 Page 03 to 12H, gain is changed during low speed status.

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

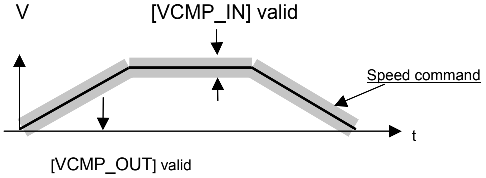
- Low speed status [LOWV_IN]: Function is enabled during low speed status (speed below LOWV set value).
- Low speed status [LOWV_OUT]: Function is enabled outside of low speed status (speed below LOWV set value).



- Speed transport status [VA_IN]: Function is enabled during speed transport status (speed above VA set value).
- Speed transport status [VA_OUT]: Function is enabled outside of speed transport status (speed above VA set value).



- Speed coincidence status [VCMP_IN]: Function is enabled during speed coincidence status (speed deviation below VCMP set value).
- Speed coincidence status [VCMP_OUT]: Function is enabled outside of speed coincidence status (speed deviation below VCMP set value).



- **Control mode switching function** Position control mode Speed control mode Torque control mode

Two types of control modes can be used alternately. Switching is enabled on the control mode switching function (MS) after selecting the matching control type via the system parameters.

- Select the control mode from system parameter Page 08

Page	Name	Setting range
08	Control mode	6 ways

Setting	Explanation
03:_Velo-Torq	Speed control – Torque control switchover
04:_Posi-Torq	Position control – Torque control switchover
05:_Posi-Velo	Position control – Speed control switchover

After changing the settings, the function is enabled by restarting the control power supply.

The conditions for enabling control mode switching function are assigned. The control mode is changed when the MS signal is valid.

Parameter Group 7 Page 01	MS: Control mode switching function

- **Gain switchover function** Position control mode Speed control mode Torque control mode

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]	Speed loop comparison gain 1	
	03	TVI1 [ms]	Speed 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]	Speed loop comparison gain 2	
	07	TVI2 [ms]	Speed 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

- **Speed loop comparison control switchover function** Position control mode Speed control mode

Speed loop PI control / P control can be used alternatively. Activate switching by enabling the speed loop comparison control switching function (PCON).

PI control (comparison / integral control): Speed loop comparison gain (KVP) / Speed loop reset time constant (TVI)
P control (Comparison control): Speed loop comparison gain (KVP)

＊ When set to comparison control, servo gain is reduced and the servo system is made stable.
＊ When the speed loop reset time constant (TVI) is set to 1000.0ms, it is not necessary to use this function, since the reset time constant in use is invalid (Comparison control)

The conditions for enabling the speed loop comparison control switching function are assigned. Change the comparison control when the PCON signal is valid.

Parameter Group 7 Page 02	PCON: Speed loop comparison control switchover function

- **P-PI Auto change function** Position control mode Speed control mode

Speed loop PI control / P control changes can be made automatically. Similar to the low speed settings (LOWV) conditions, this function can change to PI control when below a set value and to P control when above a set value.

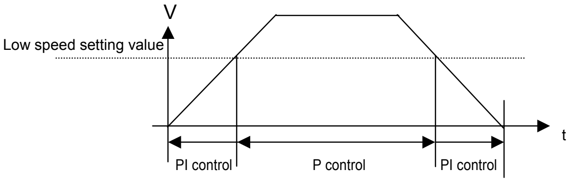
Set the conditions affected by low speed settings.

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

Set P-PI auto switching.

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

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



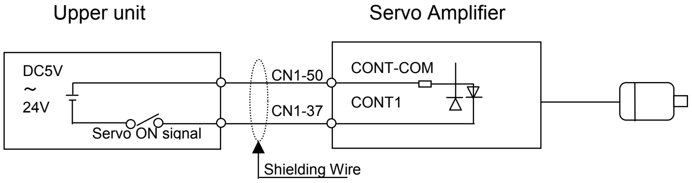
- **Servo ON function** Position control mode Speed control mode Torque control mode

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

The conditions for enabling the Servo ON function are assigned. The servo motor is set to “ready” status when the SON signal is enabled.

Parameter Group 8 Page 00	SON: Servo ON function

The following circuit is created when valid conditions are assigned to CONT1.The logic can also be modified by the allocation of valid conditions.



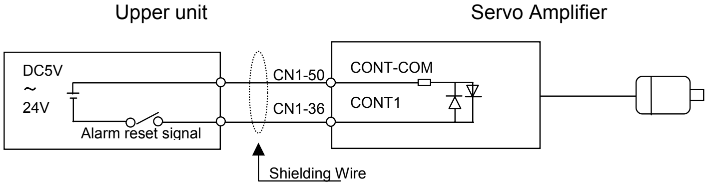
- **Alarm reset function** Position control mode Speed control mode Torque control mode

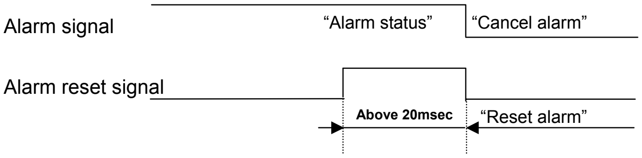
This function enables the sending of an alarm reset signal from the upper unit. An alarm is cleared by enabling alarm reset function (AL-RST).

The conditions for enabling alarm reset function are assigned. The alarm is cleared if the AL-RST signal is valid.

Parameter Group 8 Page 01	AL-RST: Alarm reset function

The following circuit is created when valid conditions are assigned to CONT2. The logic can also be modified by the allocation of valid conditions.





Note that any alarm not cleared by simply turning OFF the control power supply cannot be cleared with the alarm reset signal.

- **Position command pulse inhibition / zero speed stop function** Position control mode Speed control mode

The position command pulse inhibition function (INHIBIT function) can be used in position control mode, and the zero speed stop function can be used in speed control mode. If enabled during servo motor operations, these functions lead to input command inhibition and servo motor stops in servo motor excitation status. Even if a position command pulse is entered in position control mode, the input pulse is not counted in the servo amplifier.

The conditions for enabling position command pulse inhibition / zero speed stop function are assigned, and function when the INH/Z-STP signal is enabled.

Parameter Group 8 Page 06	INH/Z-STP: Position command pulse inhibition / zero speed stop function

- **External trip input function** Position control mode Speed control mode Torque control mode

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

The conditions for enabling the external trip function are assigned. An alarm (AL55H) is given if the EXT-E signal is valid.

Parameter Group 8 Page 07	EXT-E: External trip function

- **Forced discharge function** Position control mode Speed control mode Torque control mode

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

- **Emergency Stop Function (EMR function)** Position control mode Speed control mode Torque control mode

This function enables an emergency stop of the servo motor after receiving an emergency stop signal in the servo amplifier.

The conditions for enabling the unit emergency stop signal are assigned. The unit emergency stop function is executed when the EMR signal is valid.

Parameter Group 8 Page 09	EMR: Emergency stop function

- **Position loop comparison control switchover function** Position control mode

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** Position control mode Speed control. mode Torque control mode

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.

- **JOG operation function** Position control mode Speed control mode Torque control mode

Intended for use when checking machine operations or performing a fine adjustment, this function allows the servo motor to operate without the upper unit. There are 2 different modes in JOG operation: speed JOG and pulse transmission JOG. Select the proper mode relative to the operation of the unit

Speed JOG operation
Can be operated from the “Digital operator” or “Setup software Q-Setup”.

Set the speed command value when selecting speed JOG operation execution.

Parameter Group 1 Page 21	JOGVC: JOG velocity command value	10～300 %

Pulse transmission JOG operation
Can be operated from the “Setup software Q-Setup”.
Refer to “Chapter 8 8.1.3.3 Trial operation adjustment mode” in the “Q-Setup-Setup Software Instruction Manual M0005351C” for details on operation methods.

- **Auto notch filter tuning function** Position control mode Speed control mode Torque control mode

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 M0005351C” for details of operation methods.

- **Overload warning function** Position control mode Speed control mode Torque control mode

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 %

・ For sending the signals to the upper unit, assign the signals in parameter Group 9. Output from general output terminal (OUT1～OUT8) of the connected CN1.

Group	Page	symbol	Name
9	00～07	OUT1～OUT8	General output 1～General output 8

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** Position control mode Speed control mode Torque control mode

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

For sending the signals to the upper unit, assign the signals in parameter Group 9. Output from general output number (OUT1～OUT8) of the connected CNss1.

Group	Page	symbol	Name
9	00～07	OUT1～OUT8	General output 1～General output 8

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** Position control mode Speed control mode Torque control mode

・ For sending the signals to the upper unit, assign the signals in parameter Group 9. Output from general output terminal (OUT1～OUT8) of the connected CN1.

Group	Page	symbol	Name
9	00～07	OUT1～OUT8	General output 1～General output 8

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

6.6 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 00	MON1: Select analog monitor output 1
Parameter Group 5 Page 01	MON2: Select analog monitor output 2

Selection		Explanation
0H	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
0GH	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/ｓ
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/ｓ

6.6.2 Digital monitor

Digital monitor output settings

Parameter Group 5 Page 02	DMON: Digital monitor output selection

Selection		Explanation			
0H	Always_OFF	Output is always OFF.	36H	ALM7_ON	Output alarm code bit 7 (positive logic)
01H	Always_ON	Output is always ON.	37H	ALM7_OFF	Output alarm code bit 7 (negative logic)
02H	S-ON	Output turns ON during completion of operation preparation	38H	ALM_ON	Output turns ON during alarm status
03H	S-RDY_OFF	Output turns OFF during completion of operation preparation	39H	ALM_OFF	Output turns OFF during alarm status
04H	P-ON_ON	Output turns ON when power is ON.	3AH	CONT1_ON	Output turns ON when general input CONT1 is ON
05H	P-ON_OFF	Output turns OFF when power is ON.	3BH	CONT1_OFF	Output turns OFF when general input CONT1 is ON
0GH	A-RDY_ON	Output turns ON when power is authorized ON.	3CH	CONT2_ON	Output turns ON when general input CONT2 is ON
07H	A-RDY_OFF	Output turns OFF when power is authorized ON.	3DH	CONT2_OFF	Output turns OFF when general input CONT2 is ON
08H	S-ON_ON	Output turns ON during motor excitation	3EH	CONT3_ON	Output turns ON when general input CONT3 is ON
09H	S-ON_OFF	Output turns OFF during motor excitation	3FH	CONT3_OFF	Output turns OFF when general input CONT3 is ON
0AH	MBR-ON_ON	Output turns ON during maintenance brake excitation signal output.	4OH	CONT4_ON	Output turns ON when general input CONT4 is ON
0BH	MBR-ON_OFF	Output turns OFF during maintenance brake excitation signal output.	41H	CONT4_OFF	Output turns OFF when general input CONT4 is ON
0CH	TLC_ON	Output turns ON during torque limit operations.	42H	CONT5_ON	Output turns ON when general input CONT5 is ON
0DH	TLC_OFF	Output turns OFF during torque limit operations.	43H	CONT5_OFF	Output turns OFF when general input CONT5 is ON
0EH	VLC_ON	Output turns ON during speed limit operations	44H	CONT6_ON	Output turns ON when general input CONT6 is ON
0FH	VLC_OFF	Output turns OFF during speed limit operation	45H	CONT6_OFF	Output turns OFF when general input CONT6 is ON
10H	LOWV_ON	Output turns ON during low speed status	46H	CONT7_ON	Output turns ON when general input CONT7 is ON
11H	LOWV_OFF	Output turns OFF during low speed operation	47H	CONT7_OFF	Output turns OFF when general input CONT7 is ON
12H	VA_ON	Output turns ON during speed transport status	48H	CONT8_ON	Output turns ON when general input CONT8 is ON
13H	VA_OFF	Output turns OFF during speed transport status	49H	CONT8_OFF	Output turns OFF when general input CONT8 is ON
14H	VCMP_ON	Output turns ON during speed coincidence status	4AH	CHARGE_ON	Output turns ON during main circuit power source (smoothing condenser) charging
15H	VCMP_OFF	Output turns OFF during speed coincidence status	4BH	CHARGE_OFF	Output turns ON during main circuit power source (smoothing condenser) charging
1GH	ZV_ON	Output turns ON during zero speed status	4CH	DB_OFF	Output turns OFF during dynamic brake operations.
17H	ZV_OFF	Output turns OFF during zero speed status	4DH	DB_ON	Output turns ON during dynamic brake operations.
18H	INP_ON	Power turns ON during positioning completion status.	4EH	-----	reserved
19H	INP_OFF	Power turns OFF during positioning completion status.	4FH	-----	reserved
1AH	NEAR_ON	Output turns ON during near range status	50H	PYALM1_ON	PY compatibility alarm code 1 is output (positive logic)
1BH	NEAR_OFF	Output turns OFF during near range status	51H	PYALM1_OFF	PY compatibility alarm code 1 is output (negative logic)
1CH	CMD-ACK_ON	Output turns ON during command receipt permission status	52H	PYALM2_ON	PY compatibility alarm code 2 is output (positive logic)
1DH	CMD-ACK_OFF	Output turns OFF during zero command receipt permission status	53H	PYALM2_OFF	PY compatibility alarm code 2 is output (negative logic)
1EH	GC-ACK_ON	Output turns ON during gain switchover status	54H	PYALM4_ON	PY compatibility alarm code 4 is output (positive logic)
1FH	GC-ACK_OFF	Output turns OFF during gain switchover status	55H	PYALM4_OFF	PY compatibility alarm code 4 is output (negative logic)
20H	PCON-ACK_ON	Output turns ON during speed loop comparison limit switchover status.	56H	PYALM8_ON	PY compatibility alarm code 8 is output (positive logic)
21H	PCON-ACK_OFF	Output turns OFF during speed loop comparison control switchover status.	57H	PYALM8_OFF	PY compatibility alarm code 8 is output (negative logic)
22H	GERS-ACK_ON	Output turns ON during electronic gear switchover status	58H	S-RDY2_ON	Output terminal turns ON during completion of operation preparation
23H	GERS-ACK_OFF	Output turns OFF during electronic gear switchover status	59H	S-RDY2_OFF	Output terminal turns OFF during completion of operation preparation
24H	MS-ACK_ON	Output turns ON during control mode switchover status			
25H	MS-ACK_OFF	Output turns OFF during control mode switchover status			
26H	F-OT_ON	Output turns ON during forward over travel status			
27H	F-OT_OFF	Output turns OFF during forward over travel status			
28H	R-OT_ON	Output turns ON during reverse over travel status			
29H	R-OT_OFF	Output turns OFF during reverse over travel status			
2AH	WNG-OFW_ON	Output turns ON during excessive deviation warning status			
2BH	WNG-OFW_OFF	Output turns OFF during excessive deviation warning status			
2CH	WNG-OLW_ON	Output turns ON during excessive load warning status			
2DH	WNG-OLW_OFF	Output turns OFF during excessive load warning status			
2EH	WNG-ROLW_ON	Output turns ON during regenerative excessive load warning status			
2FH	WNG-ROLW_OFF	Output turns OFF during regenerative excessive load warning status			
30H	WNG-BAT_ON	Output turns ON during battery warning status			
31H	WNG-BAT_OFF	Output turns OFF during battery warning status			
32H	ALM5_ON	Output alarm code bit 5 (positive logic)			
33H	ALM5_OFF	Output alarm code bit 5 (negative logic)			
34H	ALM6_ON	Output alarm code bit 6 (positive logic)			
35H	ALM6_OFF	Output alarm code bit 6 (negative logic)			

Refer to “Chapter 10- 10.1.4 Monitor output, 10.4 Options” for details on the monitor box and dedicated cable.

7. Operations

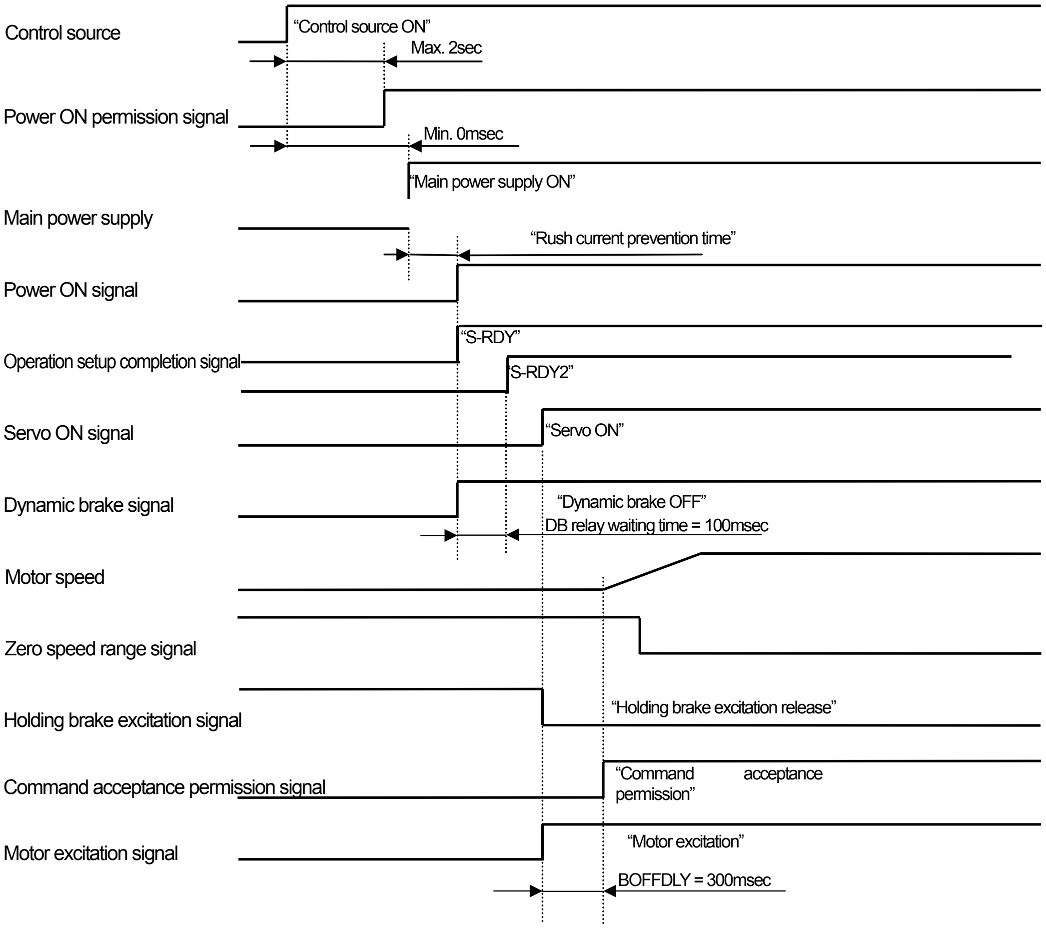
Operations

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

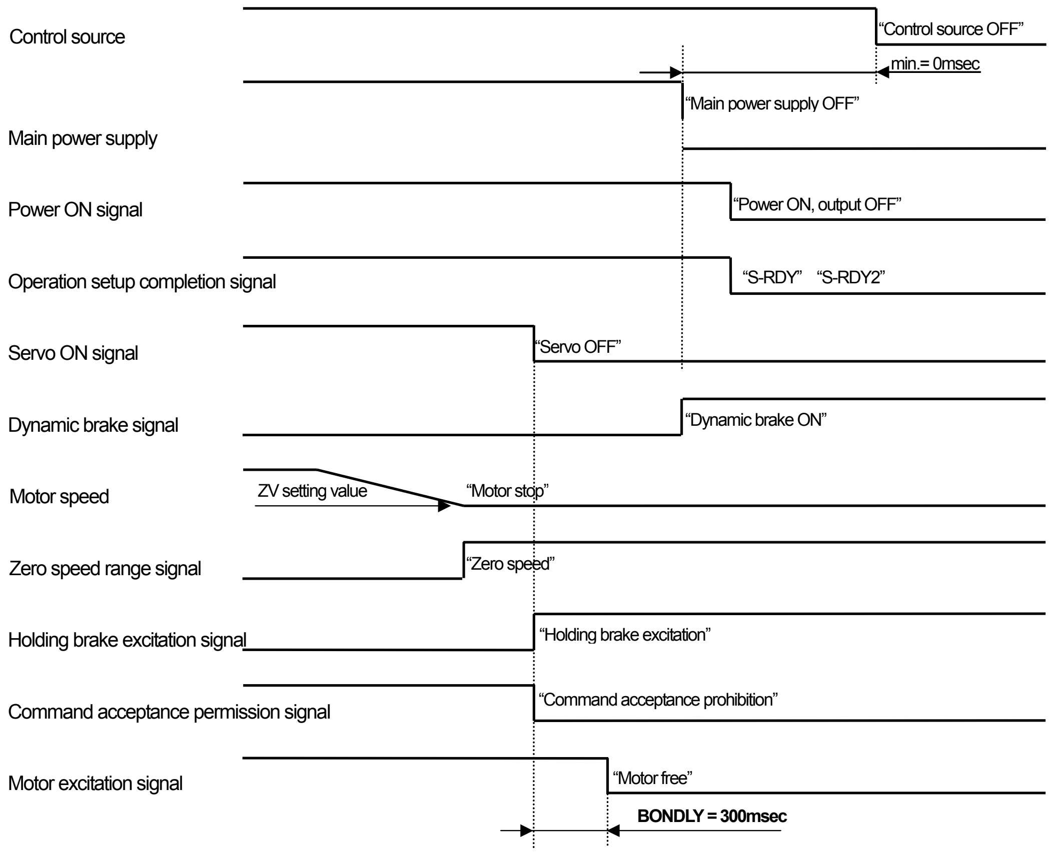


When the amplifier is in alarm status or when an emergency stop (EMR) occurs, the operation setup completion signal is not given.

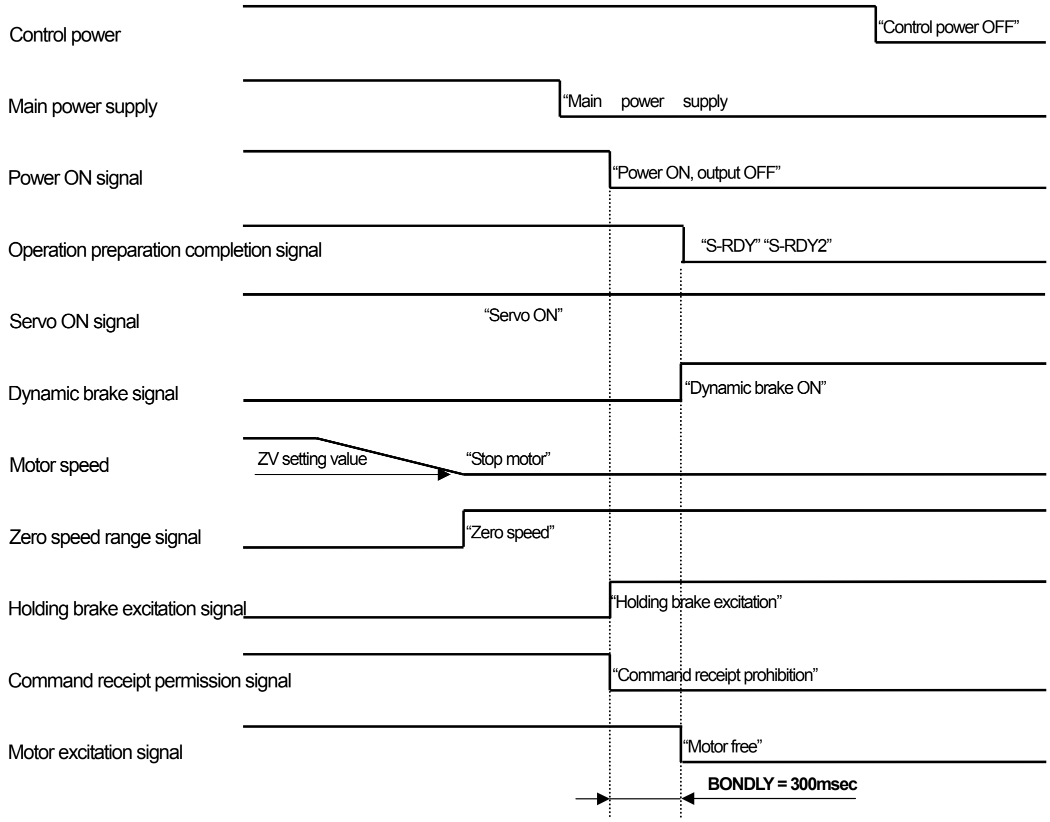
The rush current prevention time changes with the amplifier capacity. Refer to the following table.

Servo amplifier model number	Input power	Rush prevention time	Input power	Rush prevention time
QS1□01	AC200V 3 phase	900 msec	AC200V Single phase	1800 msec
QS1□03	AC200V 3 phase	900 msec	AC200V Single phase	1800 msec
QS1□05	AC200V 3 phase	900 msec	AC200V Single phase	1800 msec
QS1□10	AC200V 3 phase	900 msec	AC200V Single phase	1800 msec
QS1□15	AC200V 3 phase	900 msec	AC200V Single phase	1800 msec
QS1□01	AC100V	1800 msec		
QS1□03	AC100V	1800 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(Lower) 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(Lower)	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", 8-56)**

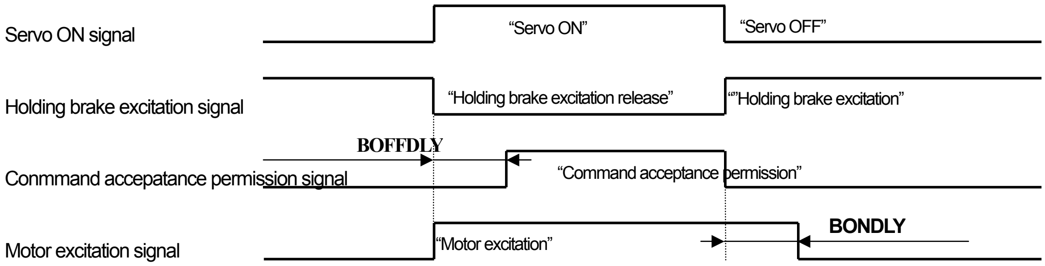
The standard setting value is "01:_Always_Enable" (function always enabled). Modify to "00:Always_Disable" (function always disabled) to override the standard sertting.

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", 8-35)**
Holding brake operation release delay time: Parameter Group 1 Page 11 (**Refer to "Chapter 8", 8-35)**
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 speed) with the parameter zero speed range (ZV). If the motor speed is within the set range, it will be detected as zero speed status.

Dynamic brake operation: Parameter Group 3 Page 04-lower (**Refer to "Chapter 8", 8-44)**
Zero speed range (ZV): Parameter Group 1 Page 1A (**Refer to "Chapter 8", 8-37)**

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	Servo brake operation	Motor free operation	7.2.3.5
5H	Servo brake operation	Dynamic brake operation	7.2.3.6

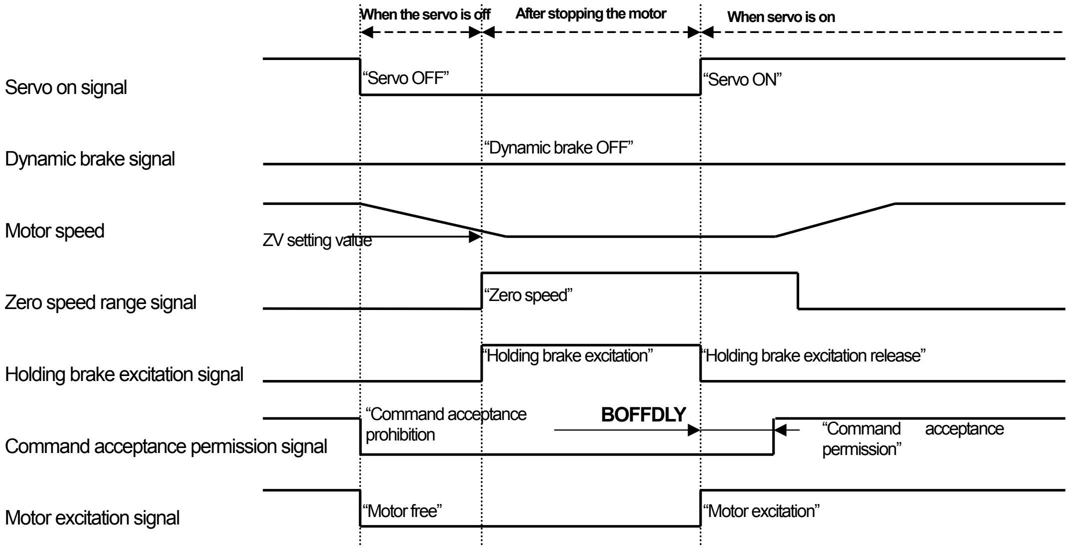
Free run operation
Motor status: current is not passed, not excited. Motor stops due to friction of the machine.

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

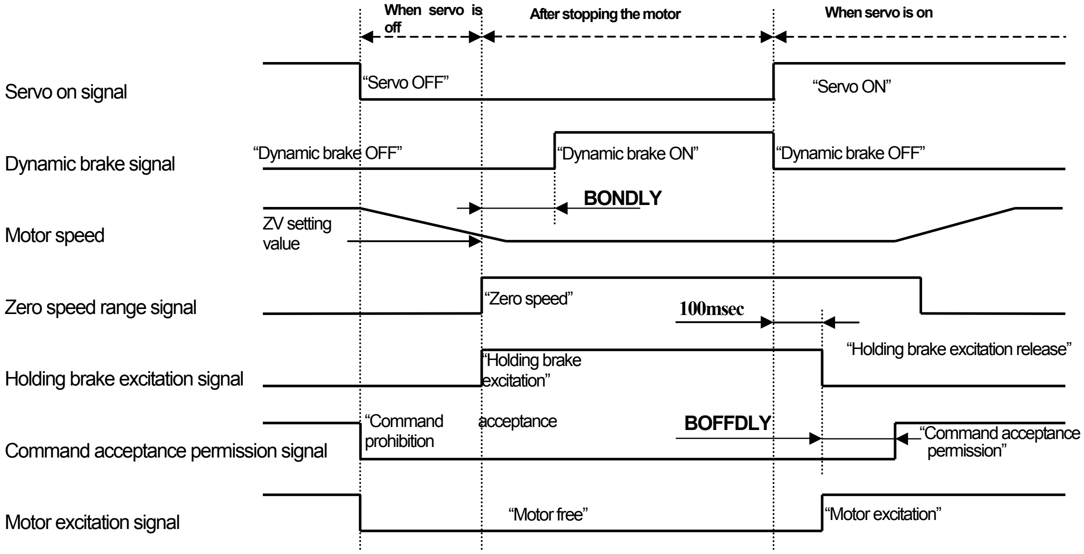
Servo brake operation
Motor status: speed command is forcibly set to "zero speed"; output torque is controlled and stopped. Possible to change the limit value of output torque with the following parameters:
Torque limit value during sequence operation: Parameter Group 1 Page OF (**Refer to "Chapter 8", 8-35)**

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

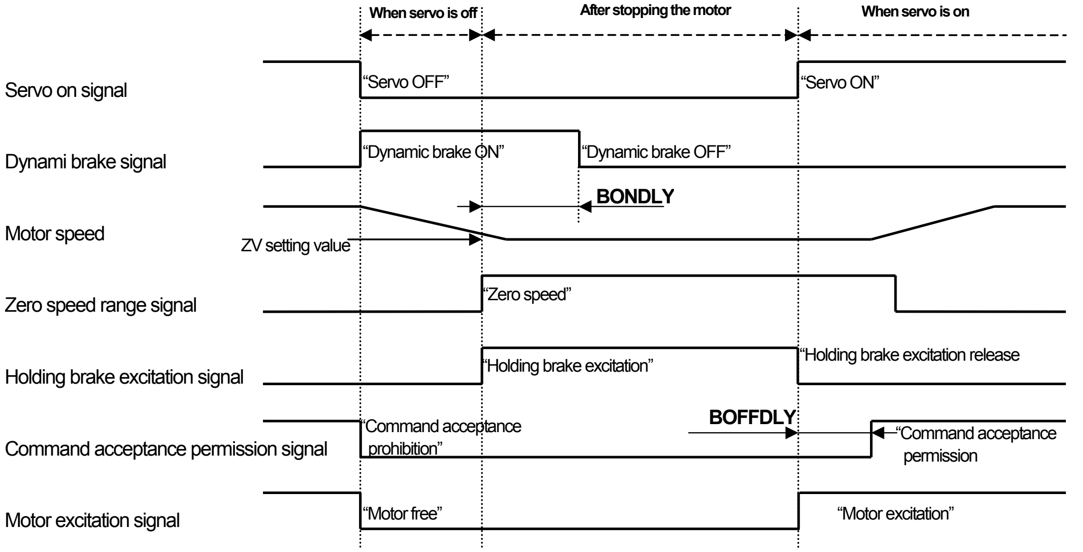


7.2.3.2 Servo OFF: Free run operation   After motor stop: Dynamic brake operation

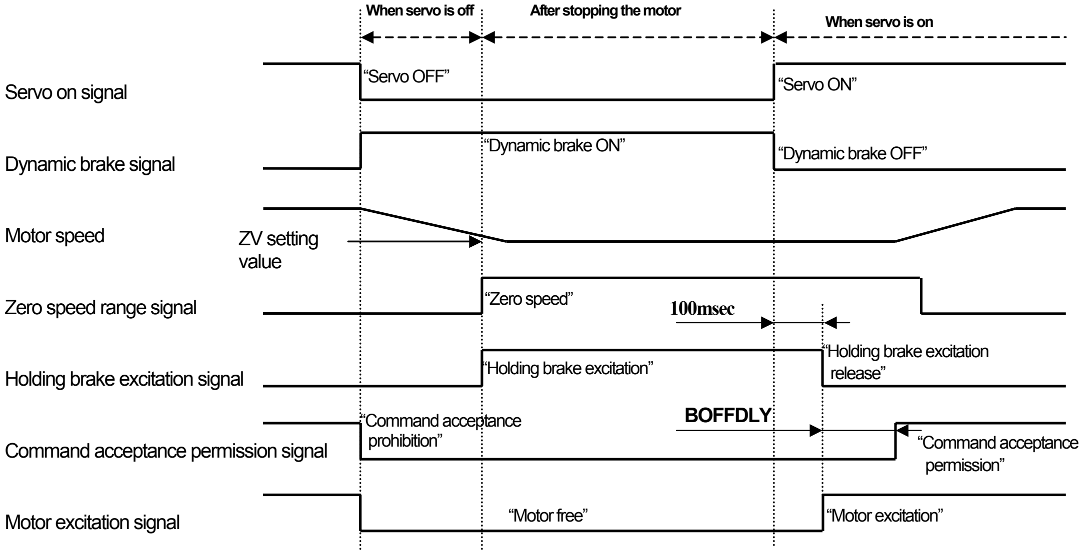


BONDLY: Parameter Group 1 Page 10 (**Refer to "Chapter 8", 8-35)**
BOFFDLY: Parameter Group 1 Page 11 (**Refer to "Chapter 8", 8-35)**

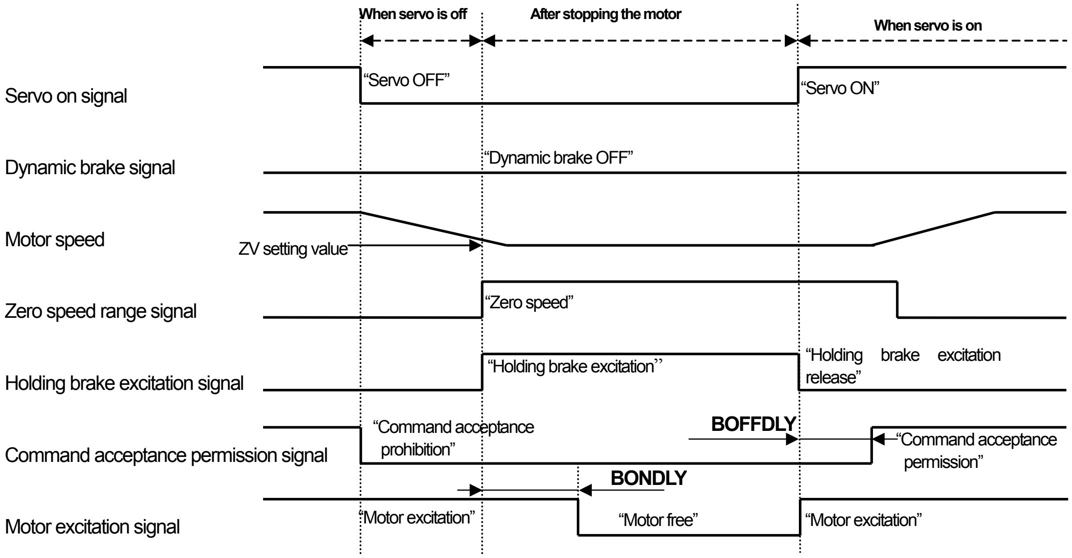
7.2.3.3 Servo OFF: Dynamic brake operation After motor stop: Motor free operation



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

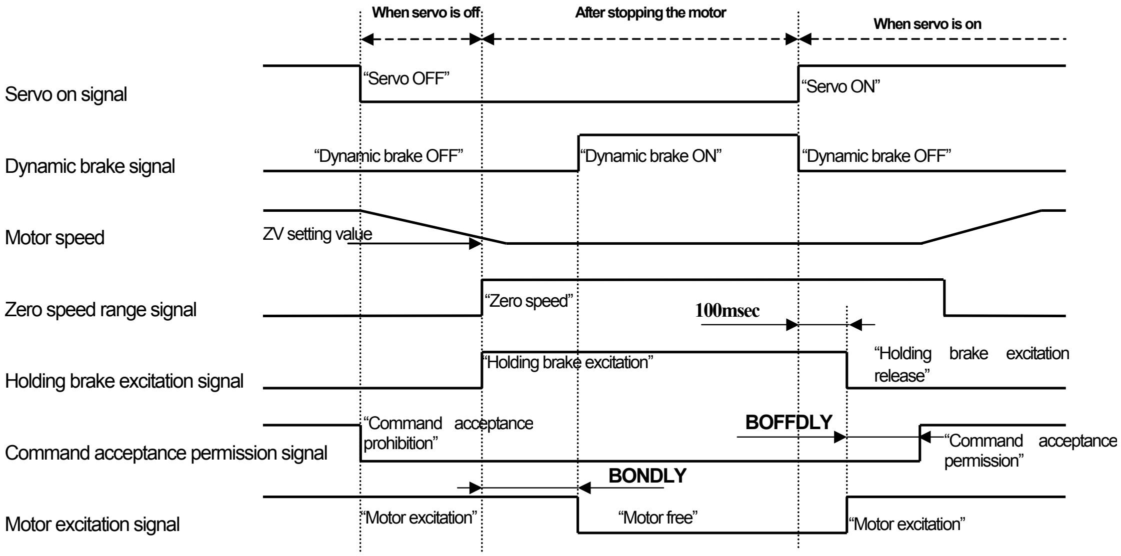


7.2.3.5 Servo OFF: Servo brake operation After motor stop: Motor free operation



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 Servo 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 and an emergency stop (EMR) signal is received.

When the main circuit power is disconnected or when an emergency stop (EMR) signal is received, 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" , 8-45)**

Selection	Forced stop operation		Sequence
0H	Servo brake	Main circuit power OFF	7.2.4.1
		Emergency stop (EMR)	7.2.4.2
1H	Dynamic brake	Main circuit power OFF	7.2.4.3
		Emergency stop (EMR)	7.2.4.4

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

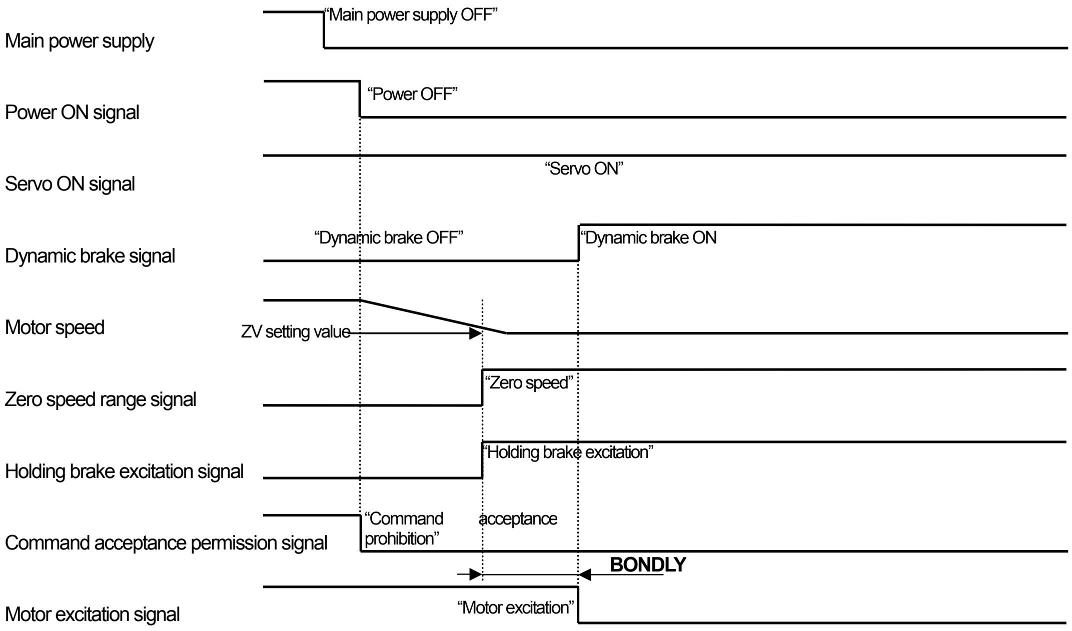
In this operation, the speed command is forcibly set to "zero speed", the output torque is controlled, and the motor is stopped. It is possible to change the limit value of output torque with the following parameters:

Torque limit value during sequence operation: Parameter Group 1 Page OF (**Refer to "Chapter 8", 8-35)**

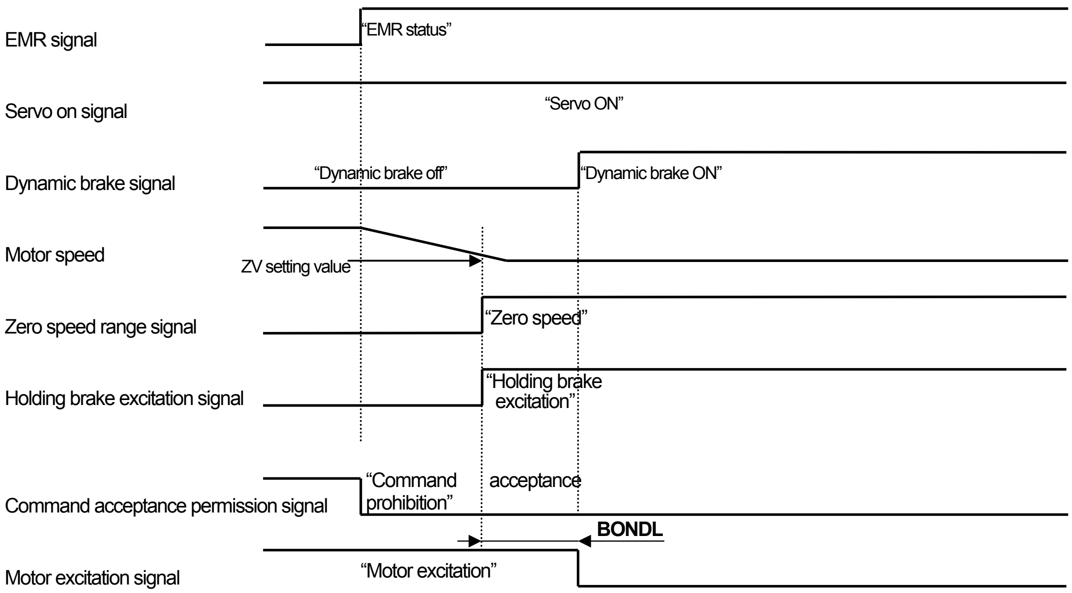
Dynamic brake operation

In this operation, there is a short in the electric circuit of the servo motor and the motor is stopped at once.

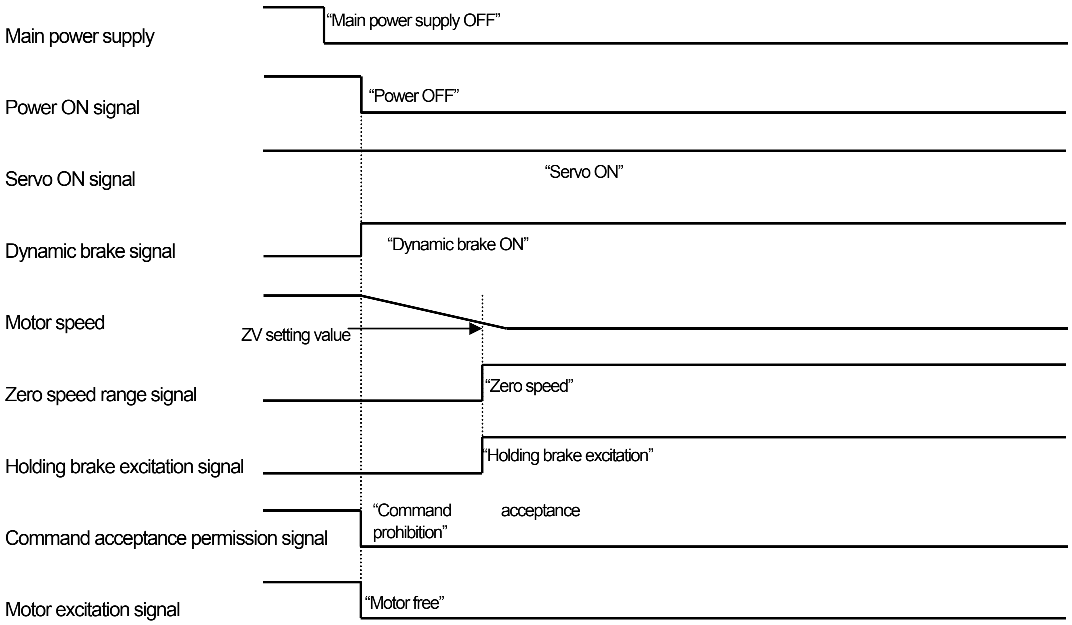
7.2.4.1 Forcible stop operation: Servo brake operation (When main circuit power is disconnected)



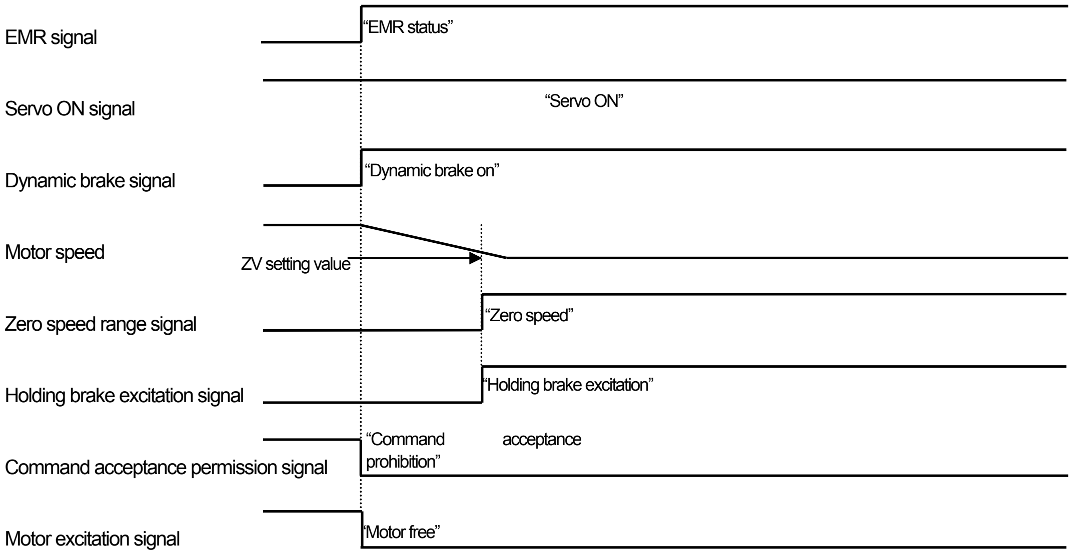
7.2.4.2 Forcible stop operation: Servo brake operation (Emergency stop/EMR)



7.2.4.3 Forcible stop operation: Dynamic brake operation (when main circuit power is disconnected)



7.2.4.4 Forced stop operation: Dynamic brake operation (Emergency stop/EMR)



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", 8-37)**
Setting range : "0～65535" msec ("0" msec function is invalid)

Zero velocity range (ZV) : Parameter Group 1 Page 1A **(Refer to "Chapter 8", 8-37)**
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).

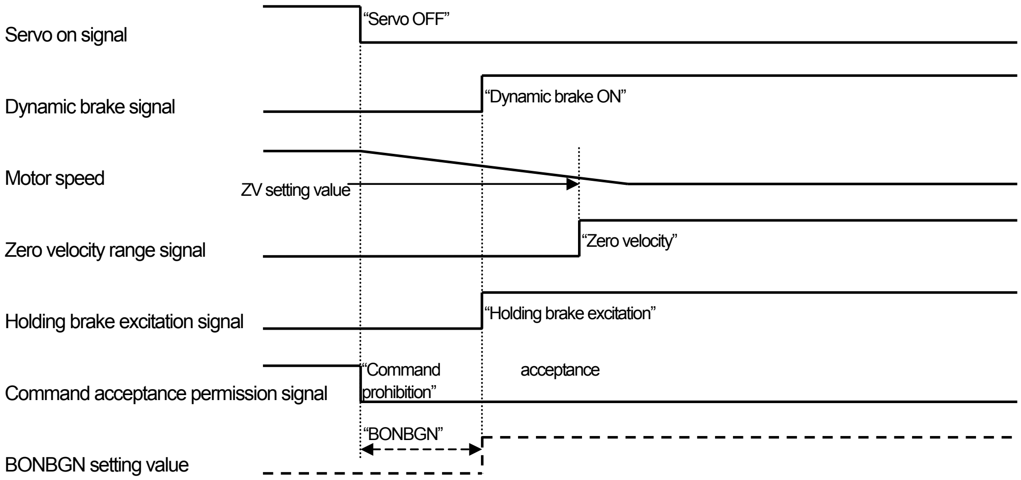
Input	Parameter Group 3 Page 04 Lower	Sequence
Servo OFF	0H / 1H : Free run operation when servo is off 4H / 5H : Servo brake operation when servo is off	7.2.5.1
	2H / 3H : Dynamic brake operation when servo is off	7.2.5.2

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.

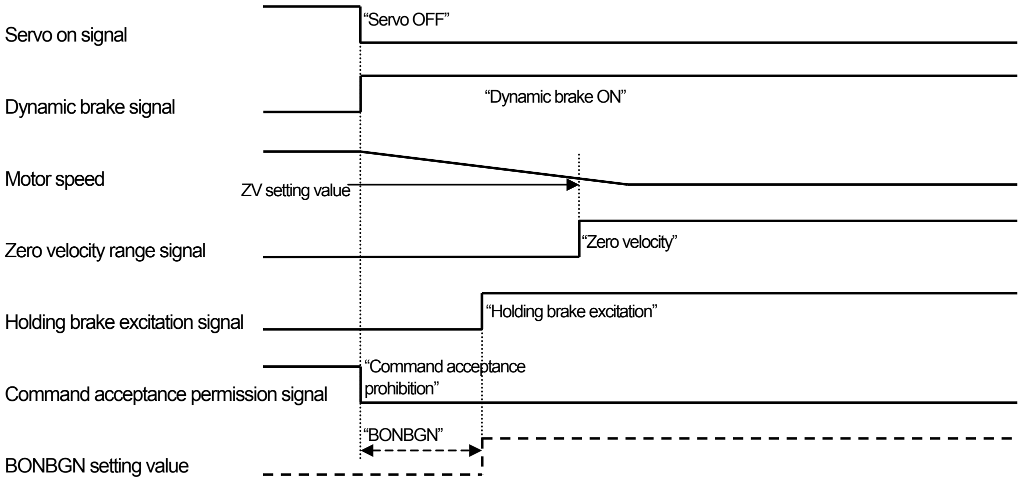
When the brake operation start time has been set, and power is interrupted to stop the motor during motor operations ("motor not stopped" status), this sequence changes per the conditions (servo brake operation / dynamic brake operation) of "Forced stop operation: Parameter Group 3 Page 05 Lower".

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 free run or servo brake operations are selected, when servo is off and motor does not stop within brake operation start time

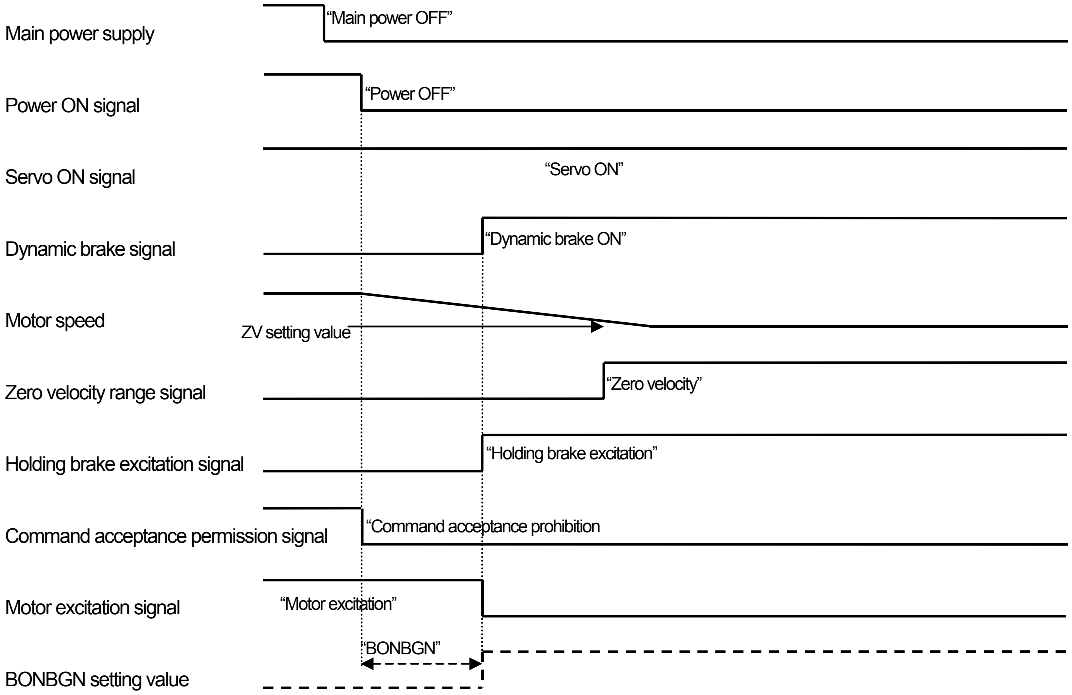


7.2.5.2 If dynamic brake operations are selected, when servo is off and motor does not stop within brake operation start time

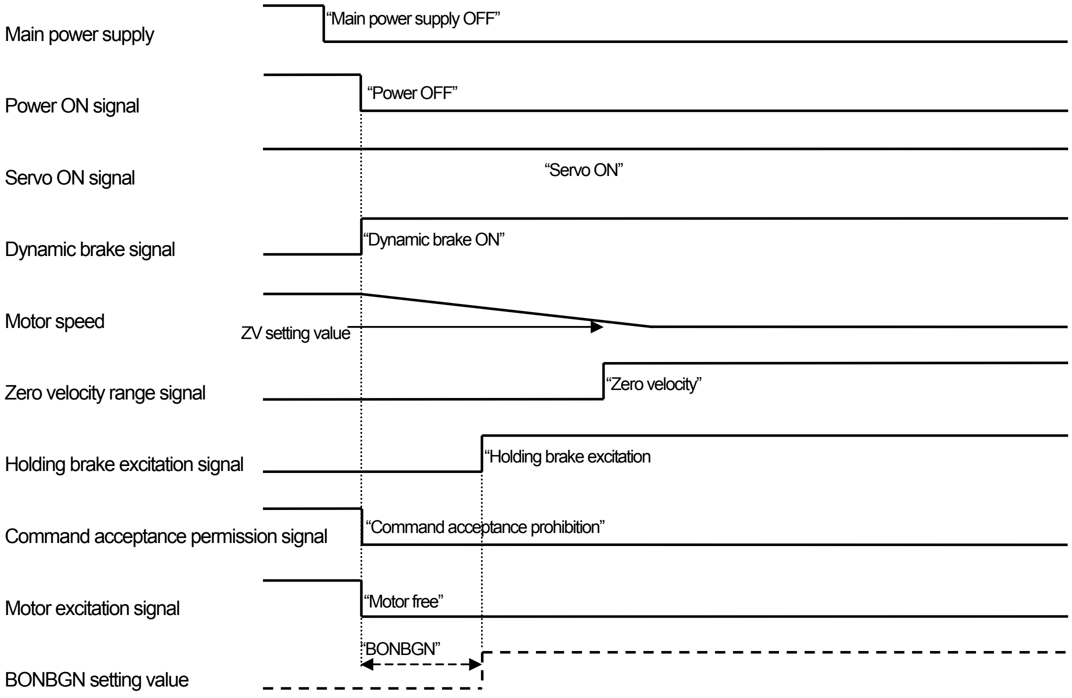


⚠ The holding brakes may be damaged if the brake operation start time (BONBGN) is extended, as the holding brakes are continuously applied.

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



7.2.6 Output signal function

It is possible to output various output signals from the general purpose output (OUT1~OUT8) by setting its parameters.

Parameter Group 9 **(Refer to "Chapter 8", 8-58)**

Sequence signal name	Parameter group 9		
Power ON permission signal	06H	A-RDY_ON	Output is ON when power-on is allowed
	07H	A-RDY_OFF	Output is OFF when power-on is allowed
Power ON signal	04H	P-ON_ON	Output is ON when power is "on"
	05H	P-ON_OFF	Output is OFF when power is "on"
Operation setup completion signal	02H	S-RDY_ON	Output is ON when operation setup is completed
	03H	S-RDY_OFF	Output is OFF when operation setup is completed
Motor excitation signal	08H	S-ON_ON	Output is ON when motor is excited
	09H	S-ON_OFF	Output is OFF when motor is excited
Zero velocity range signal	16H	ZV_ON	Output is ON during zero velocity status
	17H	ZV_OFF	Output is OFF during zero velocity status
Holding brake excitation signal	0AH	MBR-ON_ON	Output is ON during holding brake excitation signal output
	0BH	MBR-ON_OFF	Output is OFF during holding brake excitation signal output
Command acceptance permission signal	1CH	CMD-ACK_ON	Output is ON during command acceptance permission status
	1DH	CMD-ACK_OFF	Output is OFF during command acceptance permission status
Dynamic brake signal	4CH	DB_OFF	Output is OFF during dynamic brake operation
	4DH	DB_ON	Output is ON during dynamic brake operation
Operation preparation completion signal	58H	S-RDY2_ON	Output is IN when operation preparation is completed
	59H	S-RDY2_OFF	Output is OFF when operation preparation is completed

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".

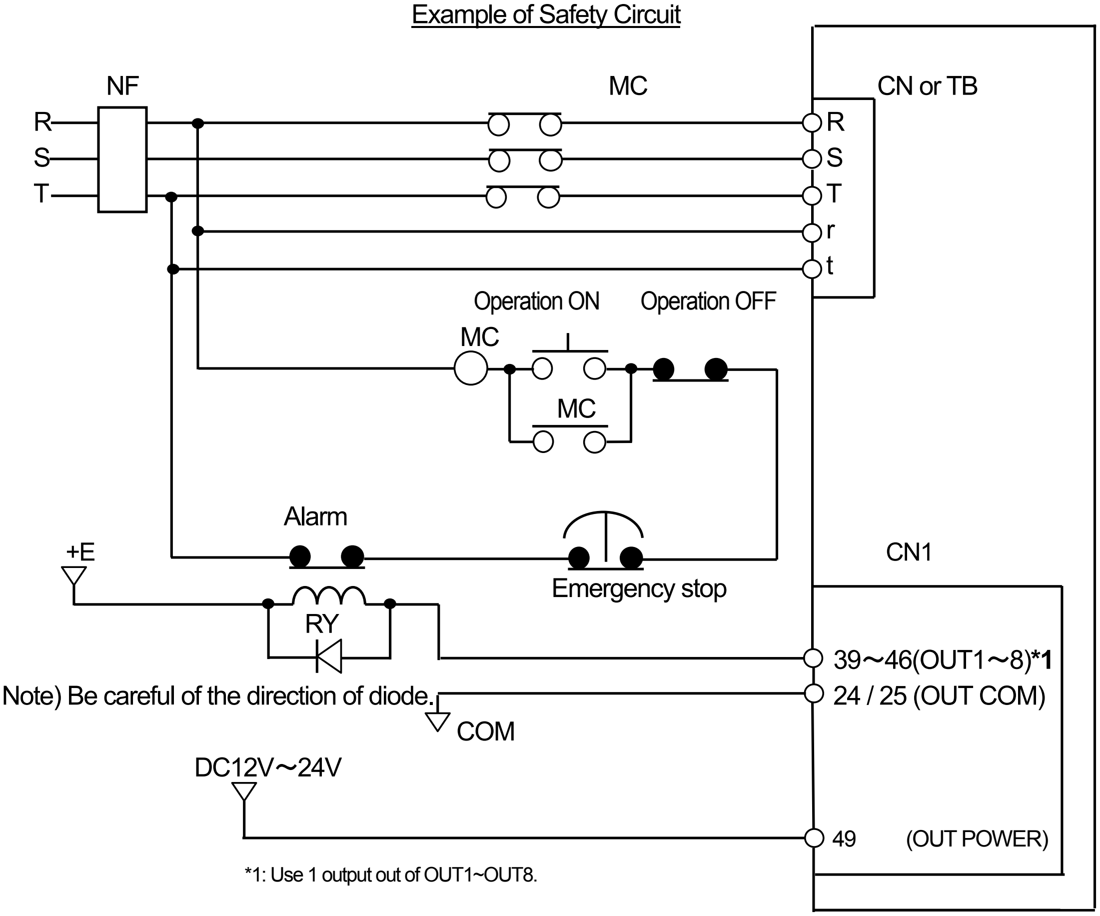
- DB Operation: Slows down and stops the servo motor with the dynamic brake upon alarm. (Sequence 7.3.1)
- SB Operation: Slows down and stops the servo motor with a sequence current limiting value. (Sequence 7.3.2)

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" 8-45

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

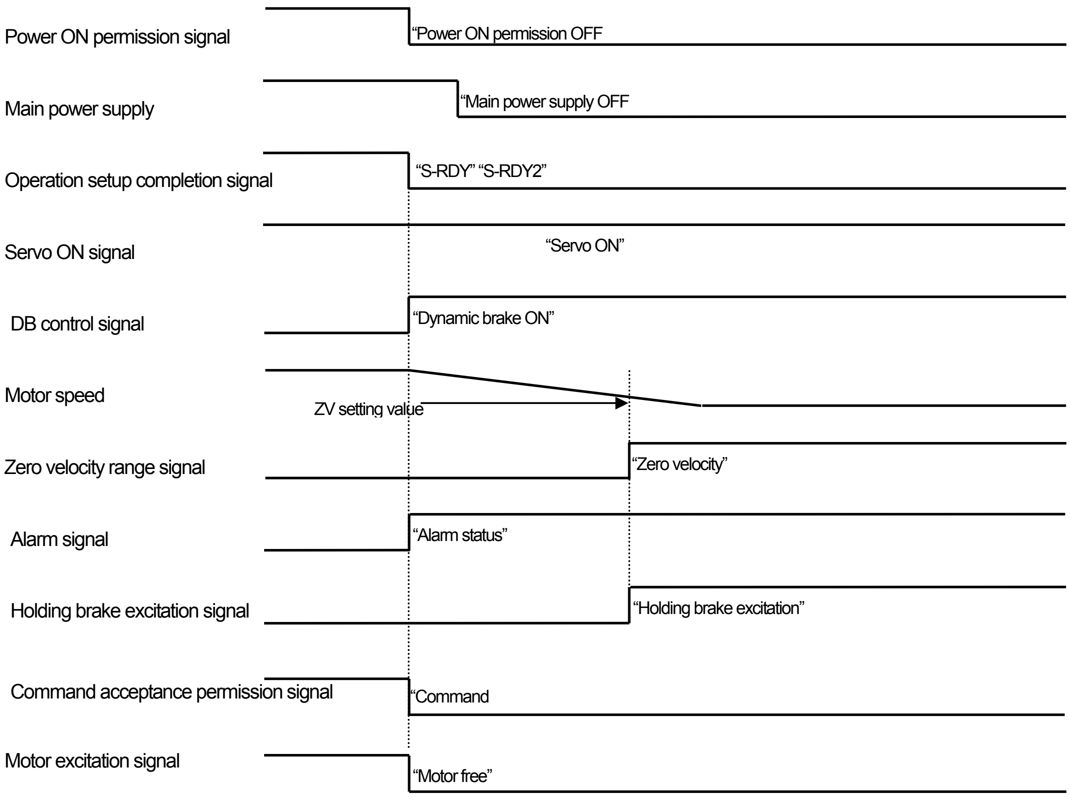


*1: Use 1 output out of OUT1~OUT8.

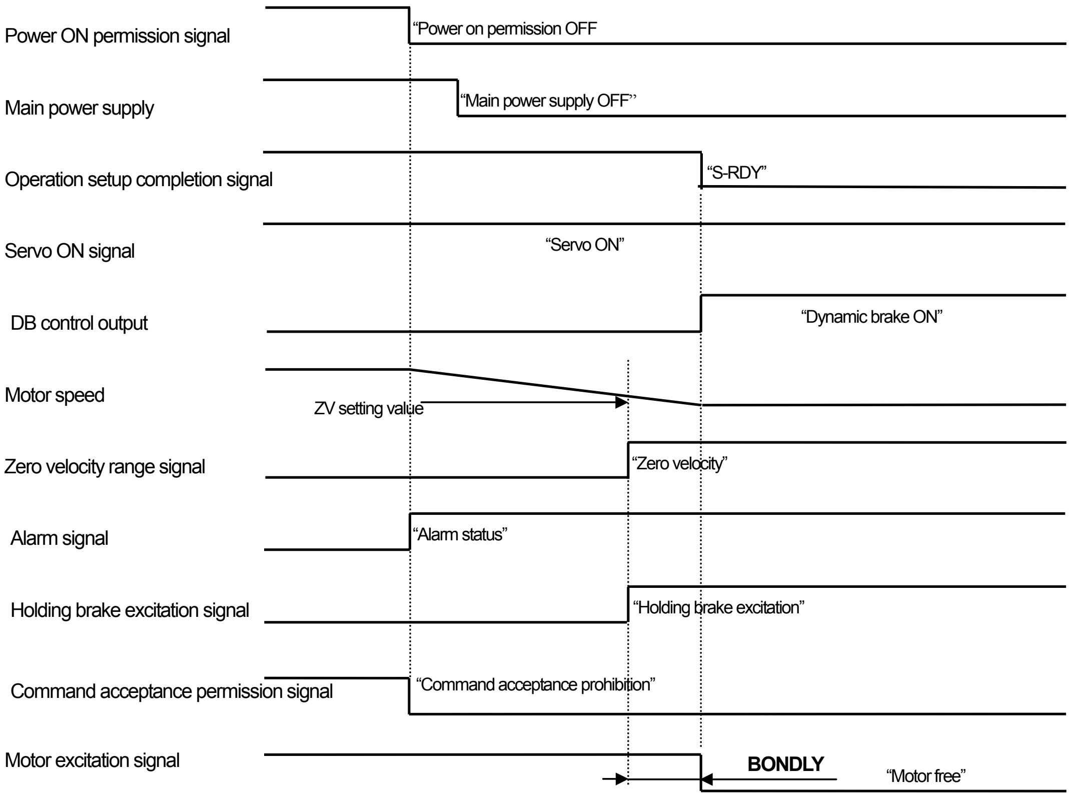
Set the value of the general purpose output (OUT1∼OUT8) used by parameter Group 9 to 38H (output ON during alarm status) or 39H (output OFF during alarm status). The above drawing shoes the general purpose output value set to 39H (output OFF during alarm status).

Related parameter: Parameter Group 9 (Refer to "Chapter 8", 8-58)

7.3.1 Sequence during dynamic brake

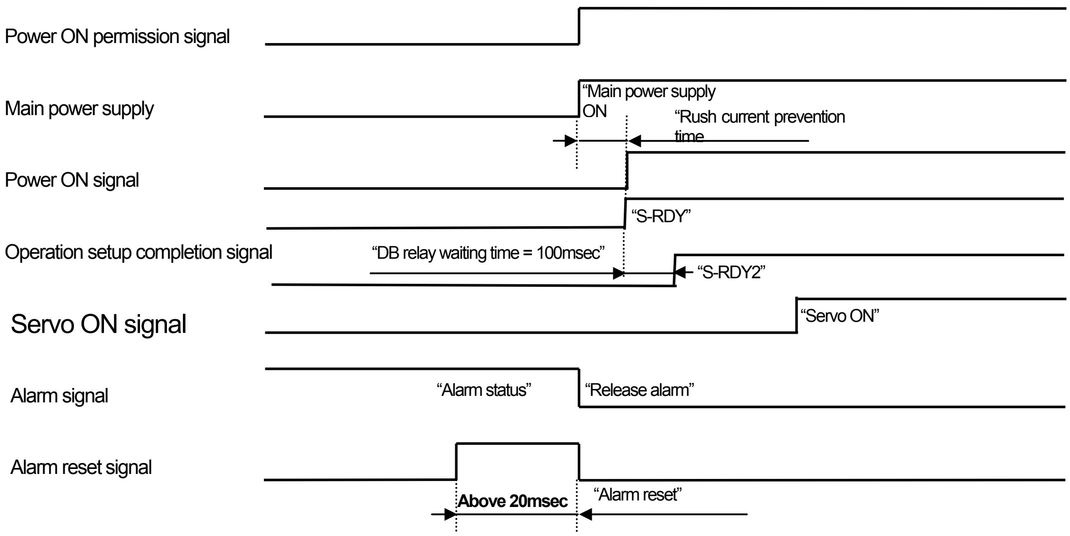


7.3.2 Sequence during servo brake



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”.



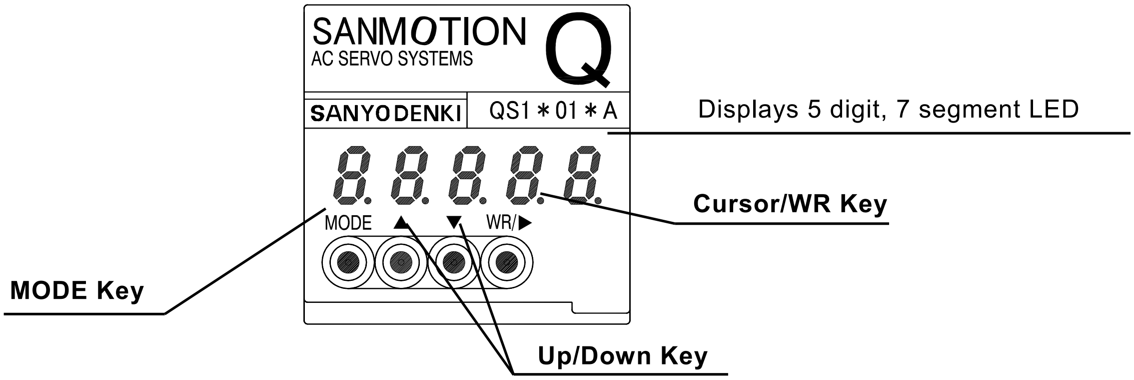
Description of Parameters

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. Changes the numeric value while scrolling with the key pressed for more than 1 second.
Up Key	▲	Less than 1 second	
MODE Key	**MODE**	Less than 1 second	Changes the MODE after pressing this key.

Table 8-2 Digital operator

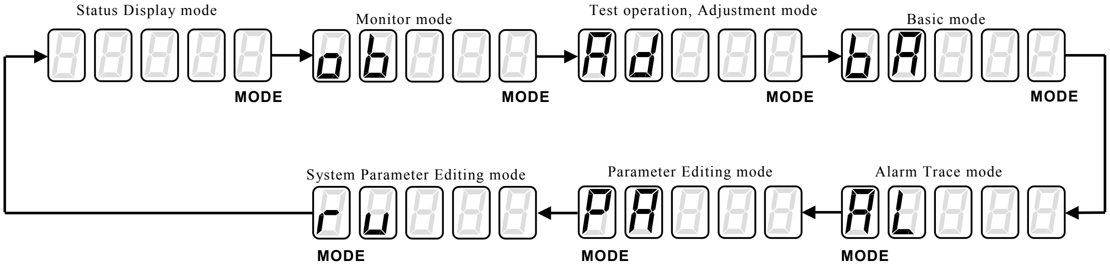
Mode	Display	Function	Pages	Operation page
Status Display mode	-	Displays the servo amplifier status.	8-3	8-3
Monitor mode	ob	Displays the screen of each monitor.	8-22	8-4
Test operation, Adjustment mode	Ad	Enables test operations(JOG operation, etc.) and adjustment of servo amplifier.	8-7	8-7
Basic mode	bA	Sets 16 basic types of user parameters.	8-12	8-12
Alarm Trace mode	AL	Displays the current and past 7 alarm events, as well as the CPU version.	8-13	8-13
Parameter Editing mode	PA	Sets user parameters **[Group0~Group9]**	8-28	8-14
System Parameter Editing mode	ru	Sets system parameters.	8-25	8-16

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

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

8.1.3 Operations

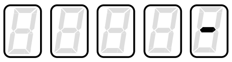
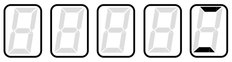
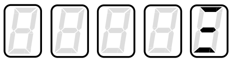
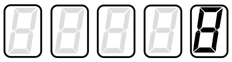
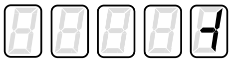
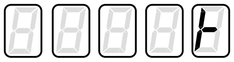
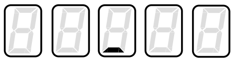
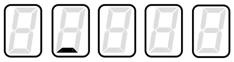
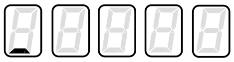
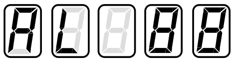
The mode changes in the following order by pressing the **MODE Key** as shown in the figure below**.**



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

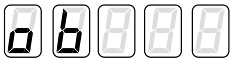
In the Status Display mode, various conditions are displayed according to the status of servo amplifier as shown in the following table.

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		Normal rotation is in ‘Over-Travel’ status in position and speed control type.
7 segment LED		Reverse rotation is in ‘Over-Travel’ status in position and speed control type.
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.

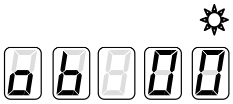
Refer to the “Maintenance” alarm for alarm contents. In some cases Overload, Regenerative overload, or Battery warning status may be displayed separately, or with the alarm display.

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**]**



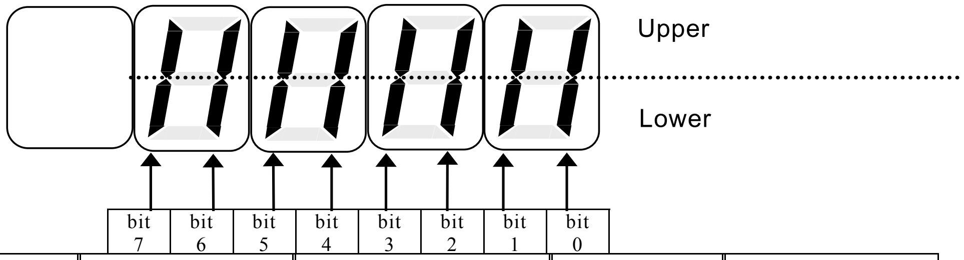
3. Display the page to be monitored by pressing the **Up/Down Keys.** The numeric value increases with the **Up Key** and decreases with the **Down Key**.
4. Press and hold the **WR key** for more than 1 second. The previously selected data is displayed.
5. Pressing the **Mode Key** will return to the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



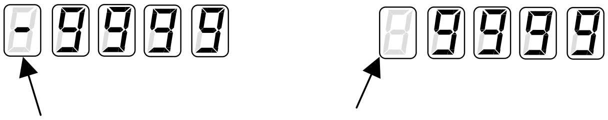
	Warning Status 1	**Warning Status 2**	**General Input**		**General Output OUT1～8**	**INC-E_MON**
			CONT1～6	**CONT7,8**		
Upper	Warning	Warning	Input photocoupler ON	Negative logic signal Input	Output transistor ON	Upper
Lower	No warning	No warning	Input photocouplerOFF	Positive logic signal Input	Output transistor OFF	Lower
bit7	Excessive variation Warning	(Not decided)	CONT8		OUT8	(Not decided)
bit6	（Not decided）	‘Low battery’ warning	CONT7		OUT7	Z phase signal （CN-EXT）
bit5	Speed limit operation Running	（Not decided）	CONT6		OUT6	B phase signal （CN-EXT）
bit4	Torque limit opration Running	（Not decided）	CONT5		OUT5	Aphase signal （CN-EXT）
bit3	Re-generative overload Warning	Reverse operation is in ‘Over-travel’ status	CONT4		OUT4	（Not decided）
bit2	Overload Warning	Normal operation is in’Over-travel’ status	CONT3		OUT3	Z phase signal （CN2）
bit1	（Not decided）	（Not decided）	CONT2		OUT2	B phase signal （CN2）
bit0	Internal amp temperature Warning	Main circuit power supply Charging	CONT1		OUT1	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.

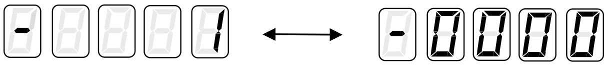
Page	Symbol	Name	Unit	Display range
05	VMON	Speed monitor	min-1	-32767 ～ +32766
06	VCMON	Speed command monitor	min-1	-32767 ～ +32766
07	TMON	Torque monitor	%	-499 ～ +499
08	TCMON	Torque command monitor	%	-499 ～ +499
09	PMON	Position variation monitor	Pulse	-99999999 ～ +99999999
0C	VC/TC-IN	Analog speed cmd/Analog torque command input voltage	mV	-12000 ～ +12000
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**]**



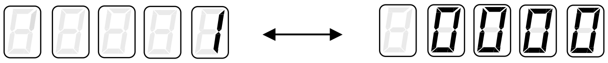
The fifth digit is a symbol display.The blank space represents the symbol “+”.

Data display above **10000**



Screen 2 Screen 1

▲ Key ▼ Key



Screen 2 Screen 1

▲ Key ▼ Key

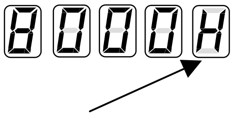
Screen 1 and Screen 2 can be interchanged by using the **Up/Down Keys.** Screen 2 and Screen 1 are displayed on pressing the **Up Key** and **Down Key** respectively. The screens cannot be changed if displaying data within ±10000. The data beyond ±10000000 is displayed by using a hexadecimal display.

8. Description of parameters

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

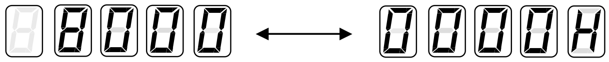
Page	Symbol	Name	Unit	Display range
0A	APMON	Current position monitor	Pulse	8000 0000H～ FFFF FFFFH
0B	CPMON	Command position monitor	Pulse	8000 0000H～ FFFF FFFFH
0F	PS-H	Absolute encoder PS data（Higher rank）	x2^32 P	0000 ～ FFFF
10	PS-L	Absolute encoder PS data（Lower rank）	Pulse	0000 ～ FFFF

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



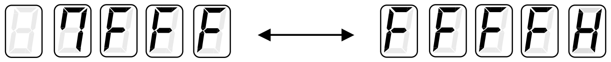
Hex data is displayed after displaying an “H” as the first digit.

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.

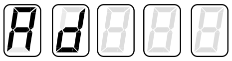
Page	Name
00	Analog speed command / torque command auto offset adjustment
01	Analog torque addition command auto offset adjustment
02	Alarm reset
03	Encoder clear
04	Fixed excitation
05	Speed JOG operation
06	Auto Notch filter tuning

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.

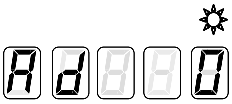
Note 2: If the main power supply is not turned ON (only control power supply is established), execution of JOG operation or auto notch filter tuning is not possible. Begin these after turning ON the main power supply.

"Execution not allowed" display:

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

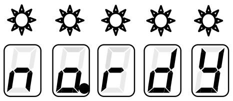


2. Change the display as follows [in the Page Selection Display screen]:



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]:

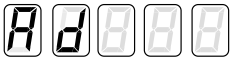


6. Return to the Page Selection Display Screen by pressing the **MODE Key.** Press the **MODE Key** once more to shift to the next mode.

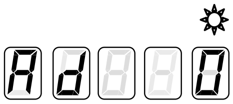
8. Description of parameters

[Operation method for trial operations and adjustment mode]

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

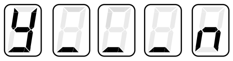


2. The display changes as shown below [Page Selection Display Screen]:

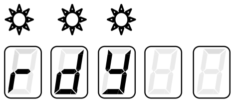


3. Display the page to be edited by pressing the **Up/Down Key**. The numeric value increases with the **Up Key** and decreases with the **Down Key**.
4. Press and hold the **WR Key** for more than 1 second. The Start screen of each page is displayed. Return to the Page Selection Display Screen by pressing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



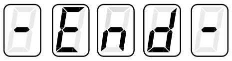
6. Press the **Up Key** to execute [yes], or the **Down Key** to reject [no]. After input of the selection, the display will return to the Page Select Display Screen.



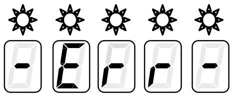
7. Press and hold the **WR Key** for more than 1 sec to begin execution. The Execution Screen will differ according to the functions on each page.

Page	Name
00	**Analog speed command /Torque command auto offset adjustment**
01	**Analog torque addition command auto offset adjustment**

Auto offset end



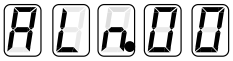
Auto offset error



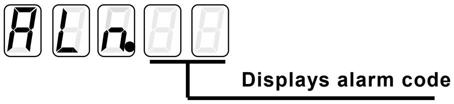
8. Return to **rdy** status by pressing the **MODE Key**.

Page	Name
02	**Alarm reset**

Alarm reset end



Alarm reset error



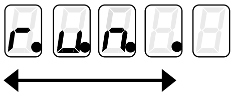
Display shows that "There is currently no alarm." *

*(However, the ause of the alarm is not eliminated. Check the "Maintain" alarm, and after the cause of the alarm is eliminated, reset the alarm.)

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

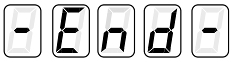
Page	Name
03	**Encoder clear**

Executing encoder clear

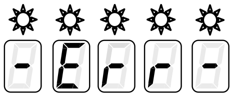


Move dots to the right or left within 4sec

Encoder clear end



Encoder clear error

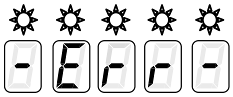


8. Return to **rdy** status by pressing the **MODE Key**.

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

The servo motor can be used in the case of the linear motor. In the case of the rotary motor, an error is displayed even after completing fixed excitation.

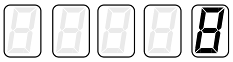
Fixed excitation error



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

Page	Name
05	Speed Jog operation

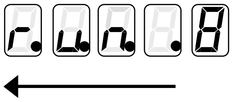
Displays a number 8 in servo ON status.The display will show “overtravel” when this condition occurs.



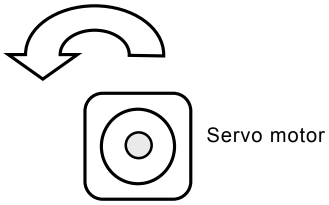
8. The servo motor rotates in a **CCW** direction by pressing the **Up** key, and rotates in a **CW** direction by pressing the **Down** key. The servo motor rotates while the key is pressed, and stops when the key is released.

Up Key (**CCW** direction)

Rotation direction (CCW)

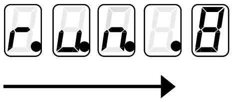


Dot moves from right to left

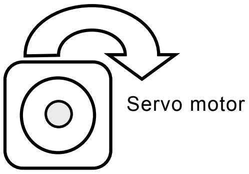


Down Key (**CW** direction)

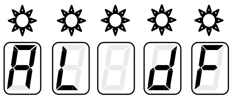
Rotation direction (CW)



Dot moves from left to right



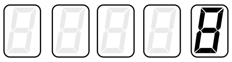
9. If the **MODE** Key is pressed, an alarm rings and the Speed Jog operation is completed.



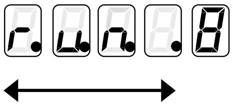
8. Description of parameters

Page	Name
06	**Auto Notch filter tuning**

Displays a number 8 in servo ON status.

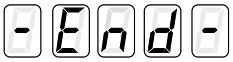


8. Start Auto Notch tuning by pressing the **Up** Key

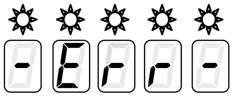


Dot moves to right & left

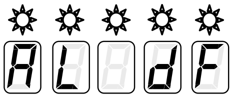
Auto Notch tuning end



Auto Notch tuning error

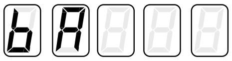


9. If the **MODE** Key is pressed, an alarm rings and the Auto Notch tuning is completed.

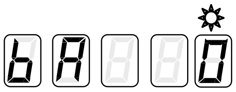


8.1.3.4 Basic Mode

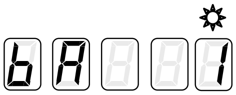
1. Display basic mode bA by pressing the **MODE Key**.



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

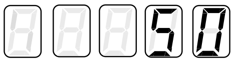


3. Display the page to be edited by pressing the **Up/Down Key**. The numeric value increases with the **Up Key** and decreases with the **Down Key**.



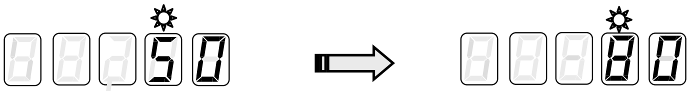
[Page 1: Speed loop ratio gain 1]

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].

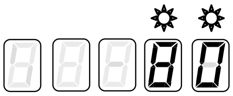


[Old value: 50Hz] → [New value: 80Hz]

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.]

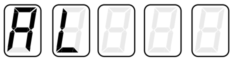
7. Return to step 1 by pressing the **MODE Key.** (Pressing the **MODE Key** will shift the mode.)

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.

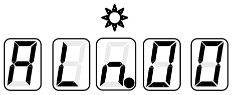
Page	Abbreviated name	Name	Standard setting value	Setting range	Units
00	KP1	Position loop gain 1	30	1～3000	1/S
01	KVP1	Speed loop ratio gain 1	50	1～2000	Hz
02	TVI1	Speed loop integration constant 1	20.0	0.5～1000.0	ms
03	KP2	Position loop gain 2	30	1～3000	1/S
04	KVP2	Speed loop ratio gain 2	50	1～2000	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
0D	INP	Positioning completion range	100	1～65535	Pulse
0E	OVF	Deviation counter overflow	500	1～65535	x256 pulse
0F	PMUL	Positioning command pulse multiplication	1	1～63	-

8.1.3.5 Alarm Trace Mode

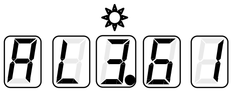
1. Display the alarm trace mode "AL" by pressing the **MODE Key**.



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.



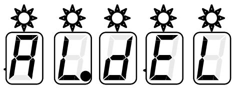
Alarm before 3 times: [Alarm code 61]

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.

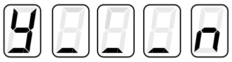
Selection page	Abbreviated name	Selection page	Abbreviated name
N	Present alarm	5	Alarm before 5 times
1	Alarm before 1 time	6	Alarm before 6 times
2	Alarm before 2 times	7	Alarm before 7 times
3	Alarm before 3 times		CPU version
4	Alarm before 4 times		Alarm trace delete

8.1.3.5.1 Alarm trace delete method

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

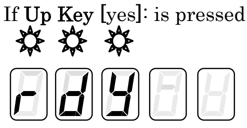


2. The display is changed as follows: [Execution confirmation screen]

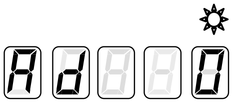


3. Press the **Up Key** to execute [yes], otherwise press the **Down Key** [no].

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

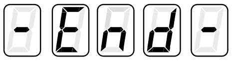


If **Down Key** [no] is pressed (returns to page selection screen):

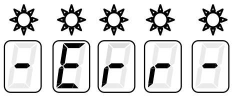


4. Press and hold the **WR Key** for more than 1 second to begin execution. After completion, the screen is changed as follows:

Alarm trace delete completion



Alarm trace delete error

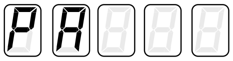


5. Return to the Page Selection Display screen by pressing the **MODE key**.

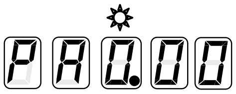
8.1.3.6 Parameter editing mode

8.1.3.6.1 [General parameter]

1. Enter the parameter editing mode PA by pressing the **MODE key**.

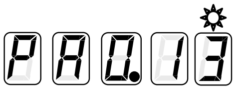


2. The display changes as shown below. [Page Selection Display screen]



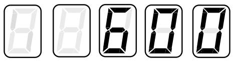
3. Display the page to be edited by pressing the **Up/Down Keys.** Increase the numeric value with the **Up Key**, and decrease it with the **Down Key.**

.



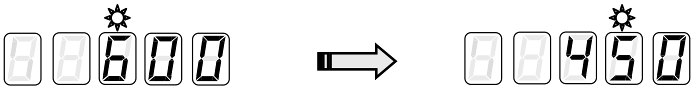
[Group 0 Page 13: Torque command filter 1]

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.

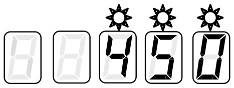


[Old value: 600Hz] ⇒ [New value: 450Hz]

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 1.13: Analog speed command/torque command offset
Group page 1.15: Analog torque command addition command offset
Group page 1.17: Internal torque addition command
Group page 1.18: Internal speed addition command

8.1.3.6.2 [General parameter/special settings]

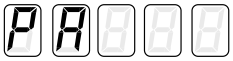
The following 3 parameters affect the numerator / denominator settings.

Group page 1.04: **Electronic gear 1**

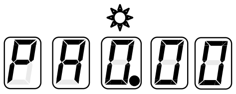
Group page 1.05: **Electronic gear 2**

Group page 1.06: **Ratio of encoder pulse circumference output**

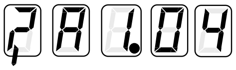
1. Enter the parameter editing mode “PA” by pressing the **MODE Key.**



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

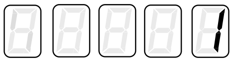


3. Display the page to be edited by pressing the **Up/Down Keys.** Increase the numeric value with the **Up Key**, and decrease it with the **Down Key.**



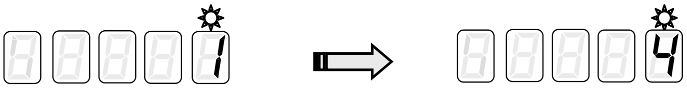
[Group 1 Page 04: Electronic gear 1]

4. Press and hold the **WR key** for more than 1 second. The previously selected numerator data is displayed. Return to the Page Selection Display screen by pressing the **MODE key**.

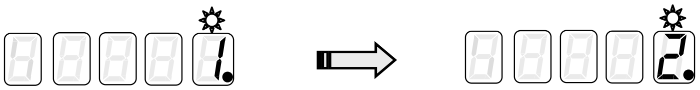


[Old value: 1/1] → [New value: 4/2]

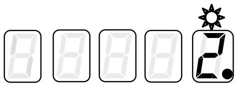
5. To edit numeric values, quickly press the **Cursor Key** (within 1 second), and the numeric value furthest left on the display will begin to blink. To move to the next digit (if applicable), once again quickly press the **Cursor Key** (in the same manner as before) so that the next digit begins blinking.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



6. Press and hold the **WR Key** for more than 1 second. The selected denominator data is displayed. When reading denominator data, note that the dot indicates the lower number in the value (i.e., for a value of 4/2, the dot will be next to the 2).



7. Press and hold the **WR Key** for more than 1 second; the display will blinks 3 times to confirm that data setting is complete.

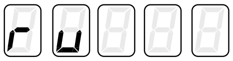


[If a value exceedng the allowable range is entered, the display will not blink 3 times for confirmation, and the previous value (before editing) is displayed. Return to step 5 above to continue.]

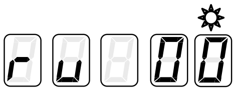
8. Return to the Page Selection Display screen by pressing the **MODE key**.

8.1.3.7 System parameter editing mode

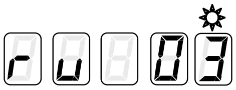
1. Display the system parameter editing mode “ru” by pressing the **MODE Key**.



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

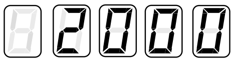


3. Display the page to be edited by pressing the **Up/Down Keys.** Increase the numeric value with the **Up Key**, and decrease it with the **Down Key.**



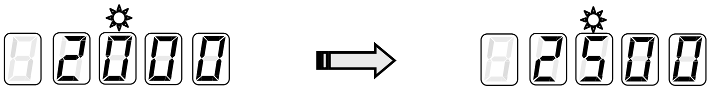
[Page 3: Incremental resolution]

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.

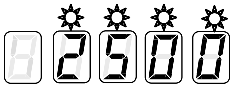


[Old value: 2000P/R] → [New value: 2500P/R]

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]

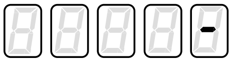
[If a value exceedng the allowable range is entered, the display will not blink 3 times for confirmation, and the previous value (before editing) is displayed. Return to step 5 above to continue.]

7. Return to the Page Selection Display screen by pressing the **MODE key**.

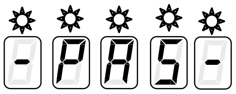
8.1.3.8 Password function

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.

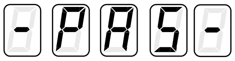
1. Press the **MODE Key** to enter the status display mode. (This is the display status during control power input)



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

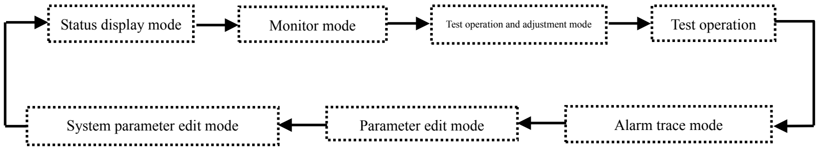
3. Press and hold **WR Key** for more than 1 second; an "0000" message is displayed.

Enter the desired password by using the **Up/Down Key/Cursor Keys**. To delete it enter the previous password.

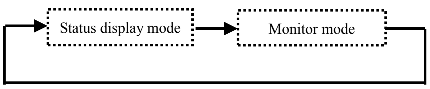
5. Press and hold the **WR Key** for more than 1 second. When a password is set, the display will blink 3 times for confirmation.
To confirm deletion of a previous password, an **"0000"** message will blink 3 times. (When deleting, if the entered password does not match, the display will blinkwith an **"-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	WARNING1	Warning Status 2	–	0000-0000 ～ 1111-1111	
	03	CONT8-1	General Input CONT 8 ~ 1 Monitor	–	0000-0000 ～ 1111-1111	
	04	OUT8-1	General OutputOUT 8 ~ 1 Monitor	–	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	Note 2
	0B	CPMON	Command Position Monitor	Pulse	-2147483648 ～ +2147483647	Note 3
	0C	VC/TC-IN	Analog Velocity Command / Analog Torque Command Input Voltage	MV	-12000 ～ +12000	
	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	Msec	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	Msec	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	----	“New Function 2”

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..

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 connecto 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	
	0C	Basic	TVCACC	Velocity Command Acceleration Constant	0	Msec	0～16000	
	0D	Basic	TVCDEC	Velocity Command Deceleration Constant	0	Msec	0～16000	
	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. Explanation of Parameters

Table 8-5 General Parameter Group 1 [Miscellaneous Settings Values]

Group Note6	Page Note6	Parameter Level	Symbol	Name	Standard Setting Value	Unit	Setting Range	Remarks
1	00	Basic	INP	Positioning Completion Range	100	Pulse	1～65535	
	01	Basic	NEAR	Near Range	500	Pulse	1～65535	
	02	Basic	OFLV	Deviation Counter Overflow Value	1500	x256 pulse	1～65535	
	03	Basic	PMUL	Position Command Pulse Multiplication	1	–	1～63	
	04	Basic	GER1	Electronic Gear 1	1/1	–	1/32767～32767/1	
	05	Advanced	GER2	Electronic Gear 2	1/1	–	1/32767～32767/1	
	06	Basic	ENRAT	Division Rate of Encoder Pulse Division Output	1/1	–	1/8192～1/1	Note 1
	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	
	0A	Basic	VC1	Internal Velocity Command 1	100	min-1	0～32767	
	0B	Basic	VC2	Internal Velocity Command 2	200	min-1	0～32767	
	0C	Basic	VC3	Internal Velocity Command 3	300	min-1	0～32767	
	0D	Standard	VCLM	Velocity Limit Command	65535	min-1	1～65535	Note 2
	0E	Basic	TCLM	Internal Torque Limit Value	100	%	10～500	Note 3
	0F	Basic	SQTCLM	Sequence Operating Time Torque Limit Value	120	%	10～500	Note 3
	10	Basic	BONDLY	Holding Brake Operation Delay Time (Holding Brake Holding Delay Time)	300	Msec	0～1000	Note 7
	11	Basic	BOFFDLY	Holding brake operation cancel release delay time (holding brake release delay time)	300	Msec	0～1000	Note 7
	12	Standard	VCGN	Analog Velocity Command Scaling	500	min-1/V	0～4000	
	14	Standard	TCGN	Analog Torque Command Scaling	50	%/V	0～500	
	16	Standard	TCOMPGN	Analog Torque Addition Command Scaling	50	%/V	0～500	
	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	Msec	0～65535	Note 5
	1A	Standard	ZV	Zero Velocity Range	50	min-1	50～500	
	1B	Advanced	PFDDLY	Power Failure Detection Delay Time	32	Msec	20～1000	Note 4
	1C	Standard	OLWLV	Overload Warning Level	90	%	20～100	Note 4
	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	
	21	Standard	JOGVC	JOG Velocity Command	50	min-1	0～32767	
	22	Standard	ATNFIL	Torque Command Value of Auto Notch Filter Tuning	50	%	10～300	Note 3

Note 1: Set within the following conditions (setting is not possible outside these conditions):

- When Numerator =1 , Denominator = 1~64, 8192 ［1/1 ～ 1/64 and 1/8192］
- When Numerator = 2, Denominator = 3~64, 8192［2/3 ～ 2/64 and 2/8192］
- When Numerator = 8192, Denominator = 1 ~ 8191 ［1/8192 ～ 8191/8192］

Note 2: If settings exceed the maximum rotations of the motor, rotation speed is regulated automatically per the motor’s characteristics. (Overspeed error settings cannot be changed)

Note 3: If settings exceed TP/TR✳100%, the output torque is regulated by TP.

Note 4: Settings are enabled by restoring the control power.

Note 5: 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. (“New Function”)

Note 6: PA Group Page (PA1. 00) is displayed in the digital operator.

Note 7: The setting unit is 4 msec. When the input value is 0 msec, this command is disabled (mandatory zero) for 4 msec after SON.

Table 8-6. General Parameter Group 2 [Observer Parameter Settings]

Group	Page	Parameter	Symbol	Name	Standard	Unit	Setting Range	Remark
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 Note 1	Page Note 1	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	
	01	Basic	PA301	Amplifier Function Selection 301	Encoder pulse division output polarity	Encoder pulse division output change	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	00	Basic	PA400	Amplifier Function Selection 400	Command pulse selection	Command pulse input polarity	00h	Note 1
	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
	04	Standard	PA404	Amplifier Function Selection 404	Reservation	Encoder signal output (PS) format	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	00	Basic	CLR	Deviation Clear Function	08:_CONT4_ON	00h～1Fh	
	01	Basic	MS	Control Mode Switchover Function	00:_Always_ Disable	00h～1Fh	
	02	Basic	POON	Speed Loop Proportional Control Switchover Function	04:_CONT2_ON	00h～1Fh	
	03	Basic	GC	Gain Switchover Function	00:_Always_ Disable	00h～1Fh	

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	00	Basic	S-ON	Servo ON Function	02:_CONT1_ON	00h～1Fh	
	01	Basic	AL-RST	Alarm Reset Function	10:_CONT8_ON	00h～1Fh	
	02	Basic	TL	Torque Limit Function	0E:_CONT7_ON	00h～1Fh	
	03	Basic	ECLR	Absolute Encoder Clear Function	06:_CONT3_ON	00h～1Fh	
	04	Basic	F-OT	Forward Over Travel Function	0D:_CONT6_OFF	00h～1Fh	
	05	Basic	R-OT	Reverse Over Travel Function	0B:_CONT5_OFF	00h～1Fh	
	06	Basic	INH/Z-STP	Position Command Inhibition Pulse Function / Zero Velocity Stop Function	00:_Always_ Disable	00h～1Fh	
	07	Basic	EXT-E	External Trip Input Function	00:_Always_ Disable	00h～1Fh	
	08	Advanced	DISCHARGE	Forced Discharge Function	01:_Always_ Enable	00h～1Fh	
	09	Basic	EMR	Emergency Stop Function	00:_Always_ Disable	00h～1Fh	
	0A	Basic	SP1	Input Internal Velocity Setting Selection 1	00:_Always_ Disable	00h～1Fh	
	0B	Basic	SP2	Input Internal Velocity Setting Selection 2	00:_Always_ Disable	00h～1Fh	
	0D	Basic	DIR	Input Operation Method Selection for Internal Velocity	00:_Always_ Disable	00h～1Fh	
	0E	Basic	RUN	Input Operation Starting signal for Internal Velocity	00:_Always_ Disable	00h～1Fh	
	0F	Basic	RUN-F	Input Forward Rotations Starting Signal for Internal Velocity	00:_Always_ Disable	00h～1Fh	
	10	Basic	RUN-R	Input Reverse Rotations Starting Signal for Internal Velocity	00:_Always_ Disable	00h～1Fh	
	11	Advanced	GERS	Electronic Gear Switchover Function	00:_Always_ Disable	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

Table 8-13 General Parameter Group 9 [Output Conditions for the General Output Terminal]

Group Note 1	Page Note 1	Parameter Level	Symbol	Name	Standard Setting Value	Setting Range	Remarks
9	00	Basic	OUT1	General Output 1	18:_INP_ON	00h～4Dh	
	01	Basic	OUT2	General Output 2	0C:_TLC_ON	00h～4Dh	
	02	Basic	OUT3	General Output 3	02:_S-RDY_ON	00h～4Dh	
	03	Basic	OUT4	General Output 4	0A:_MBR_ON	00h～4Dh	
	04	Basic	OUT5	General Output 5	33:_ALM5_OFF	00h～4Dh	
	05	Basic	OUT6	General Output 6	35:_ALM6_OFF	00h～4Dh	
	06	Basic	OUT7	General Output 7	37:_ALM7_OFF	00h～4Dh	
	07	Basic	OUT8	General Output 8	39:_ALM_OFF	00h～4Dh	

Note 1: PA Group Page (PA 9. 00) is displayed in the digital operator.

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 speed 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: During reverse overtravel Bit 2: During forward overtravel Bit 1:　(Indefinite) Bit 0: During charging of main circuit power supply	——	0000-0000 ～ 1111-1111	
	03	CONT8-1	General input CONT8~1 monitor Displays the status of the general input terminal. "1" Input photo coupler ON (CONT1～6), during negative logic signal input (CONT7,8) "0" Input photo coupler OFF (CONT1～6), during positive logic signal input (CONT7,8) Bit 7:　CONT 8 Bit 6:　CONT 7 Bit 5:　CONT 6 Bit 4:　CONT 5 Bit 3:　CONT 4 Bit 2:　CONT 3 Bit 1:　CONT 2 Bit 0:　CONT 1	——	0000-0000 ～ 1111-1111	

Monitor	Page	Symbol	Name and description	Unit	Setting Range	Remarks
	04	OUT8-1	General output OUT8~1 monitor Displays status of general output terminal. "1" Output transistor ON "0" Output transistor OFF Bit 7: OUT 8 Bit 6: OUT 7 Bit 5: OUT 6 Bit 4: OUT 5 Bit 3: OUT 4 Bit 2: OUT 3 Bit 1: OUT 2 Bit 0: OUT 1	-----	0000-0000 ～ 1111-1111	
	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	
	0C	VC/TC-IN	Analog velocity command / analog torque command input voltage Displays enered command voltage.	mV	-12000 ～ +12000	
	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. "New function"	%	-499 ～ +499	
	1C	OPE_TIM	Amplifier operating time "New function 2" Monitored during power ON phase (supplying the control power). Amplifier operating time = current value × 2 hours	×2 hour	----	

8.4 System 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></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>–</td><td>Motor structure
Indicates combined motor structure; this is a fixed setting.</td><td>——</td><td></td></tr>
<tr><td></td><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>–</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>–</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></td><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></td><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></td><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
“New Function”</td><td></td></tr>
<tr><td></td><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.

8. Explanation of 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></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-RⅡ-1MF</td><td>ABS-RII 1Mbps
Full-duplex communication</td></tr>
<tr><td>83 : ABS-RⅡ-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>00:_Torque</td><td>Type of torque control format</td></tr>
<tr><td>01:_Velocity</td><td>Type of velocity control</td></tr>
<tr><td>02:_Position</td><td>Type of position control</td></tr>
<tr><td>03:_Velo-Torq</td><td>Velocity control – Type of torque control switchover</td></tr>
<tr><td>04:_Posi-Torq</td><td>Position control – Type of torque control switchover</td></tr>
<tr><td>05:_Posi-Velo</td><td>Position control – Type of velocity control switchover</td></tr>
</table></td><td>6 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..

8.5 General Parameters List

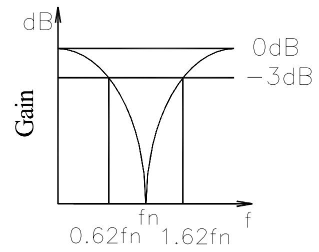
8.5.1 Parameters of Group 0

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. Explanation of Parameters

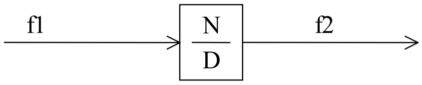
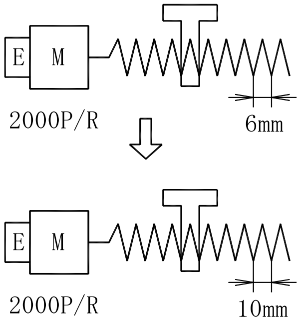
Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
0	08	JRAT1	Basic	Moment of inertia ratio of the load 1 · Moment of inertia of the load device is set for the moment of inertia of the motor. Setting value=JL/JM*100% JL: Moment of inertia of the load 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	
	0C	TVCACC	Basic	Velocity command acceleration constant · Parameter that restricts the acceleration speed of the commands for 'analog velocity command input', 'analog velocity additional input' and 'internal velocity command'. Acceleration: Command by 0min-1 (0min-1 → Forward rotation, 0min-1 → Reverse rotation) · Acceleration time is set as 1000min-1.	0	Msec	0～ 16000	
	0D	TVCDEC	Basic	Velocity command deceleration constant · Parameter that restricts the deceleration speed of the commands for 'analog velocity command input', 'analog velocity additional input' and 'internal velocity command'. Deceleration: Command by 0min-1 (Forward rotation → 0min-1, Reverse rotation →0min-1) · Deceleration time is set as 1000min-1.	0	Msec	0～ 16000	

8. Explanation of Parameters

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. · When 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	

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	00	INP	Basic	Positioning Completion Range • Parameter for setting the range to output the positioning completion signal. • The deviation counter value is set while displaying the positioning completion signal. • Encoder pulse is the standard, irrespective of electronic gear and command multiplication functions. Incremental encoder → Standard is 4 times the number of encoder pulses. Absolute encoder → The standard is an absolute value.	100	Pulse	1～65535	
	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	
	02	OFLV	Basic	Deviation counter overflow value • Parameter for setting the value to output the 'position exessive deviation alarm'. • Encoder pulse is the standard, irrespective of electronic gear function and command multiplication function..	1500	x256 pulse	1～65535	
	03	PMUL	Basic	Command pulse multiplication • Parameter for setting command pulse as 'x1 ～ 63'. • Multiplication value of 1～63 is set. • Normally, this multiplication value is considered as valid.	1	–	1～63	
	04	GER1	Basic	Electronic gear 1 • Electronic gear setTING for position command pulse.  N : 1 to 32767 f2 = f1×N/D D : 1 to 32767 1/32767≦N/D≦32767 [Example]  When ball screw pitch is changed, it is necessary to set electronic gear to (4/1) (6/10) = 24/10; additional settings are not required.	1/1	–	1/32767 ～ 32767/1	

8. Explanation of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
1	05	GER2	Advanced	Electronic gear 2 • Setting contents are similar to electronic gear 1. • Valid during electronic gear switchover.	1/1	–	1/32767 ～ 32767/1	
	06	ENRAT	Basic	Division ratio of encoder pulse division output • Parameter for setting encoder pulse division output. • Division ratio is fixed. (Setting of amplifier function selection is possible for signal polarity) • Following are the conditions for setting the division ratio: When Numerator = 1, Denominator = 1～64,8192 ［1/1 ～ 1/64 and 1/8192］ When Numerator = 2, Denominator = 3～64,8192 ［2/3 ～ 2/64 and 2/8192］ When Denominator=8192, Numerator=1～8191 ［1/8192 ～ 8191/8192］	1/1	–	1/1～ 1/8192	
	07	LOWV	Basic	Low speed 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 speed 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	
	0A	VC1	Basic	Internal velocity command 1 • Parameter for setting the velocity command for internal velocity operations.	100	min-1	0～ 65535	
	0B	VC2	Basic	Internal velocity command 2 • Parameter for setting the velocity command for internal velocity operations.	200	min-1	0～ 65535	
	0C	VC3	Basic	Internal velocity command 3 • Parameter for setting the velocity command for internal velocity operations.	300	min-1	0～ 65535	

8. Explanation of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
1	0D	VCLM	Standard	Velocity limit command • Parameter for restricting the velocity command. • The maximum value of velocity command is a fixed value. • Velocity command is restricted during position control operation and speed control opertion. • When the selected value exceeds the overspeed limit, velocity limit command settings are invalid.	65535	min-1	1～ 65535	
	0E	TCLM	Basic	Internal torque restriction value • Parameter for restricting the output torque. Output torque is restrictedwhen the torque control function is valid and internal torque control is selected. • Torque limit value is determined by comparing it with the rated output torque. (100%= Rated torque) • Output torque is restricted when the internal torque limit value is valid and the torque limit input is valid . • Output torque is restricted by TP if a value exceeding the peak output torqueTP is selected. (In TP there are variations of ±20%)	100	%	10～ 500	
	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	

8. Explanation of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Unit	Setting Range	Remarks
1	12	VCGN	Standard	Analog velocity command scaling • Parameter for setting the scaling of the analog velocity command.	500	min-1/V	0～4000	
	14	TCGN	Standard	Analog torque command scaling • Parameter for setting the scaling of the analog torque command.	50	%/V	0～500	
	16	TCOMPGN	Standard	Analog torque addition command scaling • Parameter for adjusting the scaling of the analog torque addition command input.	50	%/V	0～500	
	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	

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). "New function"	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 speed 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	

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	
	21	JOGVC	Standard	JOG velocity command • The velocity command value (initial value) is set while performing JOG operations, such as the "test run and adjustment".	50	min-1	0～ 32767	
	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	

8.5.3 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>3</td><td>00</td><td>PA300</td><td>Basic</td><td>Amplifier Function Selection 300</td><td>00</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><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
“New function”</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
“New function”</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>0*～
3*</td><td>"Edge detection" is compatible after Amplifier Software Revision [P0.01.0]..</td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Lower: Position command pulse digital filter
Select settings for the digital filter of the position command pulse from the following:
Comply with the position command specifications for the timing when switching the command direction and 90 degrees phase difference two-phase pulse string command.
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Minimum pulse width = 834nsec</td><td></td></tr>
<tr><td>1H</td><td>Minimum pulse width =250nsec</td><td></td></tr>
<tr><td>2H</td><td>Minimum pulse width =500nsec</td><td></td></tr>
<tr><td>3H</td><td>Minimum pulse width =1.8μsec</td><td></td></tr>
<tr><td>4H</td><td>Minimum pulse width =3.6μsec</td><td></td></tr>
<tr><td>5H</td><td>Minimum pulse width =7.2μsec</td><td></td></tr>
<tr><td>6H</td><td>Minimum pulse width =125nsec</td><td></td></tr>
<tr><td>7H</td><td>Minimum pulse width =83.4nsec</td><td></td></tr>
</table>
</td><td>*0</td><td>*0～*7</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>01</td><td>PA301</td><td>Basic</td><td>Amplifier Function Selection 301</td><td>00</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Upper: Encoder pulse division output polarity
Select the polarity of th eencoder pulse output division from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>A phase signal/ Not reversed:
Z phase signal logic/ High active</td><td>・A phase signal is not reversed.
・Z phase signal is displayed by High active</td></tr>
<tr><td>1H</td><td>A phase signal/ Reversed :
Z phase signal logic/ High active</td><td>・A phase signal is reversed and then displayed.</td></tr>
<tr><td>2H</td><td>A phase signal/ Not reversed:
Z phase signal logic/ Low active</td><td>・Z phase signal is displayed by Low active.</td></tr>
<tr><td>3H</td><td>A phase signal/ Reversed:
Z phase signal logic/ Low active</td><td></td></tr>
</table></td><td>0*</td><td>0*～
3*</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Lower: Encoder pulse division output transfer
Select the signal for encoder pulse division output from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Motor Encoder</td><td></td></tr>
<tr><td>1H</td><td>Full Close Encoder</td><td></td></tr>
</table>
Note:
When the external encoder (CN2) is used in full-close control,
the external encoder pulse is output even if “OH: motor encoder” is selcted.
If “1H: Full close encoder” is selected, division output becomes irregular.</td><td>*0</td><td>*0～*1</td><td></td></tr>
</table>

8. Explanation 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>3</td><td>02</td><td>PA302</td><td>Basic</td><td>Amplifier Function Selection 302</td><td>00</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Upper: Command input polarity
Select command polarity from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Forward rotation with ‘Position command / + Input’:
Forward rotation with ‘Velocity command / + Input’:
Forward rotation with ‘Torque command / + Input’</td><td></td></tr>
<tr><td>1H</td><td>Forward rotation with ‘Position command / + Input’:
Forward rotation with ‘Velocity command / + Input’:
Reverse rotation with ‘Torque command / + Input’</td><td></td></tr>
<tr><td>2H</td><td>Forward rotation with ‘Position command / + Input’:
Reverse rotation with ‘Velocity command / + Input’:
Forward rotation with ‘Torque command / + Input’:</td><td></td></tr>
<tr><td>3H</td><td>Forward rotation with ‘Position command / + Input’:
Reverse rotation with ‘Velocity command / + Input’:
Reverse rotation with ‘Torque command / + Input’:</td><td></td></tr>
<tr><td>4H</td><td>Position command/+ reverse rotation by input:
Forward rotation with ‘Velocity command / + Input’:
Forward rotation with ‘Torque command / + Input’:</td><td></td></tr>
<tr><td>5H</td><td>Position command/+ reverse rotation by input:
Forward rotation with ‘Velocity command / + Input’:
Reverse rotation with ‘Torque command / + Input’:</td><td></td></tr>
<tr><td>6H</td><td>Position command/+ reversel rotation by input:
Reverse rotation with ‘Velocity command / + Input’:
Forward rotation with ‘Torque command / + Input’:</td><td></td></tr>
<tr><td>7H</td><td>Position command/+ reversel rotation by input:
Reverse rotation with ‘Velocity command / + Input’:
Reverse rotation with ‘Torque command / + Input’:</td><td></td></tr>
</table>
</td><td>0*</td><td>0*～
7*</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><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>01</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Upper: Torque limit input
Select torque command limit (input) method from the following:
Limit values when torque command limit function is enabled
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Use internal torque limit value (TCLM)</td><td>・Forward rotation:
Restricted by an internal setting value
・Reverse rotation:
Restricted by an internal setting value</td></tr>
<tr><td>1H</td><td>Use external torque limit input:
Forward rotation/ F-TLA
Reverse rotation/ R-TLA (-Voltage input)</td><td>・Forward rotation:
Restricted by positive voltage value, which is input in F-TLA
・Reverse rotation:
Restricted by negative voltage value, which is input in R-TLA</td></tr>
<tr><td>2H</td><td>Use external torque limit input :
Forward rotations/ F-TLA、
Reverse rotation/ (+ voltage input)</td><td>・Forward rotation:
Restricted by positive voltage value, which is input in F-TLA
・Reverse rotation:
Restricted by positive voltage which, is input in R-TLA</td></tr>
<tr><td>3H</td><td>Use external torque limit input:
Forward rotation/ F-TLA
Reverse rotation/ F-TLA</td><td>・Forward rotation:
Restricted by positive voltage value, which is input in F-TLA
・Reverse rotation:
Restricted by positive voltage value, which is input in F-TLA</td></tr>
</table>
</td><td>0*</td><td>0*～
3*</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>
</table>

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
3	04	PA304	Basic	Amplifier Function Selection304	04		
				・Upper: Over travel operation In the case of over travel, select operations from the following:	0*	0*～ 6*	

Selection		Explanation
0H	Position command inhibition & servo brake operations when OT occurs. Servo is ON after motor is stopped.	・When OT occurs, command input is disabled and motor is stopped by servo brake operations. ・Servo is ON after motor is stopped (Command of OT occurrence is 'Disabled= Speed limit command= 0')
1H	Position command inhibition & dynamic brake operations when OT occurs Servo is ON after motor is stopped.	・When OT occurs, command input is disabled and motor is stopped by the dynamic brake operations. ・Servo is ON after motor is stopped (Command of OT occurrence is 'Disabled= Speed limit command= 0)
2H	Position command inhibition & free run operations when OT occurs. Servo is ON after motor is stopped.	・When OT occurs, command input is disabled and free run is started. ・Servo is ON after motor is stopped (Command of OT occurrence is 'Disabled= Speed limit command= 0)
3H	Position command inhibition & servo brake operations when OT occurs. Servo is OFF after motor is stopped.	・When OT occurs, command input is disabled and motor is stopped by the servo brake operations. ・Servo is OFF after motor is stopped
4H	Position command inhibition & dynamic brake operations when OT occurs. Servo is OFF after motor is stopped.	・When OT occurs, command input is disabled and motor is stopped by the dynamic brake operations. ・Servo is OFF after motor is stopped
5H	Position command inhibition & free run operations when OT occurs. Servo is OFF after motor is stopped.	・When OT occurs, command input is disabled and free run is started. ・Servo is OFF after motor is stopped.
6H	When OT occurs, position command acceptance permission status & speed limit command = 0	・When OT occurs, speed limit command is set to 'Zero'.

Name and Description	Standard Setting Value	Setting Range	Remarks
・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.)	*4	*0～*5	

Selection		Explanation
0H	Free run operations when servo is OFF. Motor free operation after motor is stopped.	
1H	Free run operations when servo is OFF. Dynamic brake operations after motor is stopped.	
2H	Dynamic brake operations when servo is OFF. Motor free operation after motor is stopped.	
3H	Dynamic brake operations when servo is OFF. Dynamic brake operation after motor is stopped.	
4H	Servo brake operations when servo is OFF. Motor free operation after motor is stopped.	
5H	Servo brake operations when servo is OFF. Dynamic brake opreation after motor is stopped.	

8. Explanation of Parameters

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*	
				・Lower: Forced stop operation Forced stop operations (EMR) are selected from the following contents.	*0	*0～*1	

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.

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.

<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>06</td><td>PA306</td><td>Basic</td><td>Amplifier Function Selection 306</td><td>00</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Upper : Speed addition command input
Select speed addition command input from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Speed addition function disabled</td><td></td></tr>
<tr><td>1H</td><td>Use analog speed addition command</td><td>Use analog speed addition command value when speed addition function is enabled.</td></tr>
<tr><td>2H</td><td>Use internal speed addition command</td><td>Use internal speed addition command value when speed addition function is enabled.</td></tr>
</table></td><td>0*</td><td>0*～2*</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>・Lower: Torque addition command input
Select torque addition command input from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Torque addition function disabled</td><td></td></tr>
<tr><td>1H</td><td>Use analog torque addition command</td><td>When torque addition function is enabled, analog torque addition command value is used</td></tr>
<tr><td>2H</td><td>Use internal torque addition command</td><td>When torque addition function is enabled, internal torque addition command value is used.</td></tr>
</table></td><td>*0</td><td>*0～*2</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</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

<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="3">4</td><td rowspan="3">00</td><td rowspan="3">PA400</td><td rowspan="3">Basic</td><td>Amplifer function selection 400.</td><td>00</td><td></td><td></td></tr>
<tr><td>・Upper : Command.Pulse Selection
Select the form of position command pulse from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Clockwise pulse + anticlockwise pulse</td><td></td></tr>
<tr><td>1H</td><td>90°phase difference=phase pulse string</td><td></td></tr>
<tr><td>2H</td><td>Code + pulse string</td><td></td></tr>
</table>
The setting is enabled after turning ON the control power again.</td><td>0*</td><td>0*～
2*</td><td></td></tr>
<tr><td>・Lower : Pulse command input polarity.
Select the polarity of the position command pulse count from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>F-PC: Count in leading edge /
R-PC: Count in leading edge.</td><td></td></tr>
<tr><td>1H</td><td>F-PC : Count in trailing edge /
R-PC : Count in leading edge</td><td></td></tr>
<tr><td>2H</td><td>F-PC : Count in leading edge /
R-PC : Count in trailing edge</td><td></td></tr>
<tr><td>3H</td><td>F-PC : Count in trailing edge /
R-PC : Count in trailing edge</td><td></td></tr>
</table>
The setting is enabled after turning ON the control power again..</td><td>*0</td><td>*0～*3</td><td></td></tr>
</table>

8. Explanation 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="3">4</td><td rowspan="3">01</td><td rowspan="3">PA401</td><td rowspan="3">Basic</td><td>Amplifier Function Selection 401</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 : External encoder (CN – EXT) polarity

Select the signal polarity of the external encoder (connected to CN - EXT) from the following:

<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>EX-Z / Do not reverse
EX-B/ Do not reverse
EX-A/ Do not reverse</td><td></td></tr>
<tr><td>1H</td><td>EX-Z/ Do not reverse
EX-B/ Do not reverse
EX-A/ Reverse</td><td></td></tr>
<tr><td>2H</td><td>EX-Z/ Do not reverse
EX-B/ Reverse
EX-A/ Do not reverse</td><td></td></tr>
<tr><td>3H</td><td>EX-Z/ Do not reverse
EX-B/ Reverse
EX-A/ Reverse</td><td></td></tr>
<tr><td>4H</td><td>EX-Z/ Reverse
EX-B/ Do not reverse
EX-A/ Do not reverse</td><td></td></tr>
<tr><td>5H</td><td>EX-Z/ Reverse
EX-B/ Do not reverse
EX-A/ Reverse</td><td></td></tr>
<tr><td>6H</td><td>EX-Z/ Reverse
EX-B/ Reverse
EX-A/ Do not reverse</td><td></td></tr>
<tr><td>7H</td><td>EX-Z/ Reverse
EX-B/ Reverse
EX-A/ Reverse</td><td></td></tr>
</table>

The setting is enabled after turning ON the control power again..

</td><td>*0</td><td>*0～*7</td><td></td></tr>
</table>

8. Explanation 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>4</td><td>02</td><td>PA402</td><td>Basic</td><td>Amplifier Function Selection 402</td><td>51</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>

▪ Upper :Setup software communication baud rate.

Selct the baud rate for communicating with the PC, from the following:

<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>1200 bps</td><td></td></tr>
<tr><td>1H</td><td>2400 bps</td><td></td></tr>
<tr><td>2H</td><td>4800 bps</td><td></td></tr>
<tr><td>3H</td><td>9600 bps</td><td></td></tr>
<tr><td>4H</td><td>19200 bps</td><td></td></tr>
<tr><td>5H</td><td>38400 bps</td><td></td></tr>
</table>

The setting is enabled after turning ON the control power again.

</td><td>5*</td><td>0*～
5*</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>

▪ ower : Setup software communication axis number.

Select the axis number for communicating with the PC from the following:

<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>1H</td><td>#1</td><td></td></tr>
<tr><td>2H</td><td>#2</td><td></td></tr>
<tr><td>3H</td><td>#3</td><td></td></tr>
<tr><td>4H</td><td>#4</td><td></td></tr>
<tr><td>5H</td><td>#5</td><td></td></tr>
<tr><td>6H</td><td>#6</td><td></td></tr>
<tr><td>7H</td><td>#7</td><td></td></tr>
<tr><td>8H</td><td>#8</td><td></td></tr>
<tr><td>9H</td><td>#9</td><td></td></tr>
<tr><td>AH</td><td>#A</td><td></td></tr>
<tr><td>BH</td><td>#B</td><td></td></tr>
<tr><td>CH</td><td>#C</td><td></td></tr>
<tr><td>DH</td><td>#D</td><td></td></tr>
<tr><td>EH</td><td>#E</td><td></td></tr>
<tr><td>FH</td><td>#F</td><td></td></tr>
</table>

The setting is enabled after turning ON the control power again..

</td><td>*1</td><td>*1～*F</td><td></td></tr>
</table>

8. Explanation 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">04</td><td rowspan="3">PA404</td><td rowspan="3">Standard</td><td>Amplifier function selection 404</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 : Encoder signal output (PS) format
Selct the signal format of the (PS) encoder signal display from the following:
<table>
<tr><th colspan="2">Selection</th><th>Explanation</th></tr>
<tr><td>0H</td><td>Binary code output</td><td></td></tr>
<tr><td>1H</td><td>Decimal ASCII output code.</td><td>"New Function 2"</td></tr>
<tr><td>2H</td><td>Encoder signal direct output</td><td></td></tr>
</table>
The setting is enabled after turning ON the control power again..</td><td>*0</td><td>*0～*2</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	"OB" ～ "10" are compatible from version "P0.01.0" or higher versions of Servo Amplifier software.

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 "New function"
0DH	Sine-U	U Phase Electrical Angle 8Vp-p "New function"
0EH	PMON_5mV/P	Position Deviation Counter Monitor 5mV / Pulse "New function"
0FH	PMON_1mV/P	Position Deviation Counter Monitor 1mV / Pulse "New function"
10H	FMON_2mV/kP/s	Position Command Pulse Monitor (Position Command Pulse Input Frequency) 2mV/kPulse/s "New function"

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	"OB" ～ "10" are compatible from version "P0.01.0" or higher versions of Servo Amplifier software.
	02	DMON	Basic	Digital monitor output selection ・Select the signal to be displayed in digital monitor output. The range of available values and contents are similar to Group 9. Refer to parameter page of 8.5.10 Group 9. "New function"	00H: Always_OFF	00h～4Dh	"OB" ～ "10" are compatible from version "P0.01.0" or higher versions of Servo Amplifier software.

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>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>
</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></td><td>01</td><td>PA601</td><td>Advanced</td><td>Amplifire function selection 601</td><td>00</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><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></td><td></td><td></td><td></td><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></td><td>01</td><td>PA606</td><td>Advanced</td><td>Amplifire function selection 606.</td><td>01</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><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></td><td></td><td></td><td></td><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. Explanation of Parameters

8.5.8 Parameters of Group 7

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
				Parmeters of Group 7. ・Select the conditions (Input signal) 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	CONT1_ON	When general input CONT 1is ON, function is enabled.
03H	CONT1_OFF	When general input CONT 1is OFF, function is enabled.
04H	CONT2_ON	When general input CONT 2 is ON, function is enabled
05H	CONT2_OFF	When general input CONT 2 is OFF, function is enabled.
06H	CONT3_ON	When general input CONT 3 is ON, function is enabled
07H	CONT3_OFF	When general input CONT 3 is OFF, function is enabled.
08H	CONT4_ON	When general input CONT 4 is ON, function is enabled
09H	CONT4_OFF	When general input CONT 4 is OFF, function is enabled.
0AH	CONT5_ON	When general input CONT 5 is ON, function is enabled
0BH	CONT5_OFF	When general input CONT 5 is OFF, function is enabled.
0CH	CONT6_ON	When general input CONT 6 is ON, function is enabled
0DH	CONT6_OFF	When general input CONT 6 is OFF, function is enabled.
0EH	CONT7_ON	When general input CONT 7 is ON, function is enabled
0FH	CONT7_OFF	When general input CONT 7 is OFF, function is enabled.
10H	CONT8_ON	When general input CONT 8 is ON, function is enabled
11H	CONT8_OFF	When general input CONT 8 is OFF, function is enabled.
12H	LOWV_IN	Function enabled during low velocity status (Velocity is less than LOWV setting value).
13H	LOWV_OUT	Function enabled outside of low velocity status (Velocity is less than LOWV setting
14H	VA_IN	Function enabled during velocity attainment status (Velocity is less than VA setting
15H	VA_OUT	Function enabled outside of velocity attainment status (Velocity is less than VA setting
16H	VCMP_IN	Function enabled during velocity matching status (Velocity deviation is less than VCMP
17H	VCMP_OUT	Function enabled outside of velocity matching status (Velocity deviation is less than
18H	ZV_IN	Function enabled during zero velocity status (Velocity is less than ZV setting value).
19H	ZV_OUT	Function enabled outside of zero velocity status (Velocity is less than ZV setting value).
1AH	INP_IN	Function enabled during 'Positioning completion' status (Position deviation is less than
1BH	INP_OUT	Function enabled outside of 'Positioning completion' status (Position deviation is less
1CH	TLC_IN	Function enabled during torque limit operation status.
1DH	TLC_OUT	Function enabled outside of torque limit operation status.
1EH	VLC_IN	Function enabled during velocity limit operation status.
1FH	VLC_OUT	Function enabled outside of velocity limit operation status.
20H	NEAR_IN	Function enabled during near range status.
21H	NEAR_OUT	Function enabled outside of near range status.

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
7	00	CLR	Basic	Deviation clear function ・Select the condition to enable the deviation clear function.	08:_CONT4_ON	00h～1Fh 32 ways	
	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～1Fh 32 ways	
	02	PCON	Basic	Velocity loop proportional control switchover function. ・The condition, which enables velocity loop proportional control switchover function, is selected. ('Enable' ="Proportional Control")	04: _CONT2_ON	00h～1Fh 32 ways	
	03	GC	Basic	Gain switchover function. ・The condition, which enables gain switchover function is selected. ('Enable' = KP2, TPI2, KVP2, TVI2, JRAT2, TCFIL2)	00:_Always_ Enable	00h～1Fh 32 ways	

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 (Input signal) 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	This function is always disabled.
01H	Always_ Enable	This function is always enabled.
02H	CONT1_ON	Function enabled when general input CONT1is ON,.
03H	CONT1_OFF	Function enabled when general input CONT1is OFF.
04H	CONT2_ON	Function enabled when general input CONT2 is ON.
05H	CONT2_OFF	Function enabled when general input CONT2 is OFF.
06H	CONT3_ON	Function enabled when general input CONT3 is ON.
07H	CONT3_OFF	Function enabled when general input CONT3 is OFF.
08H	CONT4_ON	Function enabled when general input CONT4 is ON.
09H	CONT4_OFF	Function enabled when general input CONT4 is OFF.
0AH	CONT5_ON	Function enabled when general input CONT5 is ON.
0BH	CONT5_OFF	Function enabled when general input CONT5 is OFF.
0CH	CONT6_ON	Function enabled when general input CONT6 is ON.
0DH	CONT6_OFF	Function enabled when general input CONT6 is OFF.
0EH	CONT7_ON	Function enabled when general input CONT7 is ON.
0FH	CONT7_OFF	Function enabled when general input CONT7 is OFF.
10H	CONT8_ON	Function enabled when general input CONT8 is ON.
11H	CONT8_OFF	Function enabled when general input CONT8 is OFF.
12H	LOWV_IN	Function enabled when there is low velocity status (Velocity is less than LOWV
13H	LOWV_OUT	Function enabled when there is no low velocity status (Velocity is less than LOWV
14H	VA_IN	Function enabled when there is Velocity attainment status (Velocity is less than VA
15H	VA_OUT	Function enabled when there is no Velocity attainment status (Velocity is less than
16H	VCMP_IN	Function enabled when there is velocity matching status (Velocity deviation is less
17H	VCMP_OUT	Function enabled when there is no velocity matching status (Velocity deviation is
18H	ZV_IN	Function enabled when there is zero velocity status (Velocity is less than ZV setting
19H	ZV_OUT	Function enabled when there is no zero velocity status (Velocity is less than ZV
1AH	INP_IN	Function enabled when there is ‘Positioning completion’ status (Position deviation is
1BH	INP_OUT	Function enabled when there is no ‘Positioning completion’ status (Position
1CH	TLC_IN	Function enabled when there is torque limit operation status.
1DH	TLC_OUT	Function enabled when there is no torque limit operation status.
1EH	VLC_IN	Function enabled when there is velocity limit operation status,.
1FH	VLC_OUT	Function enabled when there is no velocity limit operation status.
20H	NEAR_IN	Function enabled when there is near range status. ”New Function 2”
21H	NEAR_OUT	Function enabled when there is no near range status. “New Function 2”

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
8	00	S-ON	Basic	Servo ON Function ・Select the condition to enable Servo ON function.	02:_CONT1_ON	00h～1Fh	
	01	AL-RST	Basic	Alarm Reset Function ・Select the condition to enable the alarm reset function.	10:_CONT8_ON	00h～1Fh	
	02	TL	Basic	Torque limit function ・Select the condition to enable the torque limit permission function.	0E:_CONT7_ON	00h～1Fh	
	03	ECLR	Basic	Absolute encoder clear function ・Select the conditions to enable the absolute encoder clear function.	06:_CONT3_ON	00h～1Fh	

8. Explanation of Parameters

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
8	04	F-OT	Basic	Forward over travel function ▪ Select the condition to enable the forward over travel function.	0D:_CONT6_OFF	00h～1Fh	
	05	R-OT	Basic	Reverse over travel function. ▪ Select the condition to enable the reverse over travel function.	0B:_CONT5_OFF	00h～1Fh	
	06	INH/ Z-STP	Basic	Position command pulse inhibition function / Zero velocity stop function. ▪ Select the condition to enable the position command pulse inhibition function. (At the time of position control) ▪ Select the condition to enable the zero Velocity Command stop function.(At the time of speed control)	00:_Always_ Disable	00h～1Fh	
	07	EXT-E	Basic	External trip input function. ▪ Select the condition to enable the external trip input function.	00:_Always_ Disable	00h～1Fh	
	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～1Fh	
	09	EMR	Basic	Emergency stop function. ▪ Select the condition to enable the emergency stop function.	00:_Always_ Disable	00h～1Fh	
	0A	SP1	Basic	Input internal velocity setting selection 1 ▪ Select the input for the internal velocity command setting value selection 1.	00:_Always_ Disable	00h～1Fh	
	0B	SP2	Basic	Input internal velocity setting selection 2. ▪ Select the input for the internal velocity setting selection 2.	00:_Always_ Disable	00h～1Fh	
	0D	DIR	Basic	Input operation direction selection input for internal velocity ▪ Select the input of operation direction selection for internal speed.	00:_Always_ Disable	00h～1Fh	
	0E	RUN	Basic	Input operation starting signal for internal velocity ▪ Select the input of the operation starting signal for internal velocity.	00:_Always_ Disable	00h～1Fh	
	0F	RUN-F	Basic	Input forward rotation starting signal for internal velocity ▪Select the input of the forward rotation starting signal for internal velocity	00: _Always_ Disable	00h～1Fh	
	10	RUN-R	Basic	Input reverse rotation starting signal for internal velocity ▪Select the input of the reverse rotation starting signal for internal velocity.	00: _Always_ Disable	00h～1Fh	
	11	GERS	Basic	Electronic gear switchover function ▪ Select the condition to enable the electronic gear switchover function.	00: _Always_ Disable	00h～1Fh	
	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～1Fh	
	14	TCOMPS	Standard	Torque addition function ▪ Select the condition to enable the torque addition function.	00:_Always_ Disable	00h～1Fh	
	15	VCOMPS	Standard	Velocity Addition Function ▪ Select the condition to enable the velocity addition function.	00:_Always_ Disable	00h～1Fh	

8.5.10 Parameters of Group 9

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
9				Parameters of Group 9 ・Select the signal to be output from the general output terminal. ・Selection contents are as given in the following table. They are common for all parameters of Group 9.			

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.
22H	GERS-ACK_ON	The output is ON, during electronic gear switchover status.
23H	GERS-ACK_OFF	The output is OFF, during electronic gear switchover status.
24H	MS-ACK_ON	The output is ON, during control mode switchover status.
25H	MS-ACK_OFF	The output is OFF, during control mode 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.
32H	ALM5_ON	Output alarm code Bit 5（Positive logic）
33H	ALM5_OFF	Output alarm code Bit 5（Negative logic）
34H	ALM6_ON	Output alarm code Bit 6（Positive logic）
35H	ALM6_OFF	Output alarm code Bit 6（Negative logic）
36H	ALM7_ON	Output alarm code Bit 7（Positive logic）
37H	ALM7_OFF	Output alarm code Bit 7（Negative logic）
38H	ALM_ON	The output is ON, during alarm status.
39H	ALM_OFF	The output is OFF, during alarm status.

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
9				Description of available contents for paramters of Group 9 (continued)			

Selection		Explanation
3AH	CONT1_ON	When general CONT 1 is ON, the output is ON
3BH	CONT1_OFF	When general CONT 1 is ON, the output is OFF
3CH	CONT2_ON	When general CONT 2 is ON, the output is ON
3DH	CONT2_OFF	When general CONT 2 is ON, the output is OFF
3EH	CONT3_ON	When general CONT 3 is ON, the output is ON
3FH	CONT3_OFF	When general CONT 3 is ON, the output is OFF
40H	CONT4_ON	When general CONT 4 is ON, the output is ON
41H	CONT4_OFF	When general CONT 4 is ON, the output is OFF
42H	CONT5_ON	When general CONT 5 is ON, the output is ON
43H	CONT5_OFF	When general CONT 5 is ON, the output is OFF
44H	CONT6_ON	When general CONT 6 is ON, the output is ON
45H	CONT6_OFF	When general CONT 6 is ON, the output is OFF
46H	CONT7_ON	When general CONT 7 is ON, the output is ON
47H	CONT7_OFF	When general CONT 7 is ON, the output is OFF
48H	CONT8_ON	When general CONT 8 is ON, the output is ON
49H	CONT8_OFF	When general CONT 8 is ON, the output is OFF
4AH	CHARGE_ON	The output is ON, during charging of the main circuit power supply (Smoothing condenser).
4BH	CHARGE_OFF	The output is OFF, during charging of the main circuit power supply (Smoothing condenser).
4CH	DB_OFF	The output is OFF, during dynamic brake operations.
4DH	DB_ON	The output is ON, during tdynamic brake operations.
4EH	──	Reserved
4FH	──	Reserved
50H	PYALM1_ON	PY compatible alarm code 1 is output（Positive logic） “New function 2”
51H	PYALM1_OFF	PY compatible alarm code 1 is output（Negative logic） “New function 2”
52H	PYALM2_ON	PY compatible alarm code 2 is output（Positive logic） “New function 2”
53H	PYALM2_OFF	PY compatible alarm code 2 is output（Negative logic） “New function 2”
54H	PYALM4_ON	PY compatible alarm code 4 is output（Positive logic） “New function 2”
55H	PYALM4_OFF	PY compatible alarm code 4 is output（Negative logic） “New function 2”
56H	PYALM8_ON	PY compatible alarm code 8 is output（Positive logic） “New function 2”
57H	PYALM8_OFF	PY compatible alarm code 8 is output（Negative logic） “New function 2”
58H	S-RDY2_ON	The output terminal is ON, during “operation ready” status “New function 2”
59H	S-RDY2_OFF	The output terminal is OFF, during “operation ready” status. “New function 2”

Group	Page	Symbol	Parameter Level	Name and Description	Standard Setting Value	Setting Range	Remarks
9	00	OUT1	Basic	General output 1 ・Select output signal of general output OUT 1.	18:_INP_ON	00h～4Dh	
	01	OUT2	Basic	General output 2 ・Select output signal of general output OUT 2.	0C:_TLC_ON	00h～4Dh	
	02	OUT3	Basic	General output 3 ・Select output signal of general output OUT 3.	02:_S-RDY_ON	00h～4Dh	
	03	OUT4	Basic	General output 4 ・Select output signal of general output OUT 4.	0A:_MBR_ON	00h～4Dh	
	04	OUT5	Basic	General output 5 ・Select output signal of general output OUT 5.	33:_ALM5_OFF	00h～4Dh	
	05	OUT6	Basic	General output 6 ・Select output signal of general output OUT 6.	35:_ALM6_OFF	00h～4Dh	
	06	OUT7	Basic	General output 7 ・Select output signal of general output OUT 7.	37:_ALM7_OFF	00h～4Dh	
	07	OUT8	Basic	General output 8 ・Select output signal of general output OUT 8.	39:_ALM_OFF	00h～4Dh	

9. Maintenance

Maintenance

9. Maintenance

9.1 During an Alarm Occurrence

When an alarm is issued, the 7-segment LED blinks and the alarm code is displayed.

It is possible to output the higher 3 bits of the Alarm code (bits 7, 6, 5) and the PY amplifier compatible alarm code 4 bits (ALM 8, 4, 2, 1) from CN 1 as a general output.

Related parameter: Parameter Group 9 [PA900 ～ PA907] (Refer to Chapter 8, 8.5.10 for more detail)

When the alarm rings, check the contents per the Alarm List (Section 9.1.1), remove the cause per the Corrective Actions List (Section 9.1.2), and resume operations after safety is confirmed.

9.1.1 Alarm Reset

There are 4 different methods for resetting the alarm.

① Clear the alarm via an alarm resetting signal (AL-RST) of the general purpose input (CONT1 ~ CONT7) from C N 1.

Related parameter : Parameter Group 8 [PA801] (Refer to Chapter 8, 8.5.9)
Standard set value: CONT8_ON (When the general purpose input CONT8 is turned ON, the function is enabled.)

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 Group 3 [PA305] (Refer to Chapter 8, 8.5.4)

- Detection Operations: “－” 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

	Alarm code								Alarm title	Alarm contents	Detection Operations	Alarm Clear
	Display	3 bits output			PY compatible code							
		Bit7	Bit6	Bit5	ALM 8	ALM 4	ALM 2	ALM 1				
Abnormality related to drive	21H	0	0	1	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	0	1	Electric current abnormality 0	・ Abnormality of electric current detection value	DB	○
	23H				0	0	0	1	Electric current abnormality 1	・ Abnormality of Electric current detection circuit	DB	○
	24H				0	0	0	1	Electric current abnormality 2	・ Abnormality in communication with Electric current detection circuit	DB	○
Abnormality related to load	41H	0	1	0	0	0	1	0	Electrical overload 1	・ Excessive effective torque	SB	○
	43H				0	1	0	1	Regeneration Abnormality	・ Regeneration load ratio exorbitance	DB	○
	51H				0	0	1	1	Amplifier Overheating	・ Overheating detection of amplifier ambient temperature	SB	○
	53H				0	0	1	1	DB resistor Overheating	・ Overheating detection of DB resistor	SB	○
	54H				0	1	0	1	Internal overheating	・ Overheating detection of Internal regeneration resistor	DB	○
	55H				0	0	1	1	External overheating	・ Overheating detection of External regeneration resistor	DB	○

9. Maintenance

Table 9-1　Alarm list table

	Alarm code								Alarm name	Alarm contents	Operations while detecting	Alarm clear
	Display	3 bits output			PY compatible code							
		Bit7	Bit6	Bit5	ALM 8	ALM 4	ALM 2	ALM 1				
Abnormality in power source	61H	0	1	1	0	1	0	1	Excess voltage	• DC Excess voltage of main circuit	DB	○
	62H				1	0	0	1	Main circuit under voltage Note 1) Note 2)	• DC Main circuit low voltage	DB	○
	63H				1	0	1	0	Main power supply line drop Note 2)	• 1 phase of the 3 phase main circuit power supply disconnected	SB	○
	71H				0	1	1	1	Control power supply under voltage Note 1) Note 4)	• Control power supply low voltage	DB	○ (Note 3)
	72H				0	1	1	1	＋12 V power supply voltage	• Under voltage of + 12 V	SB	○
Abnormality related to encoder wiring	81H	1	0	0	1	0	0	0	Encoder A phase/ B Phase pulse signal abnormality 1	• Incremental encoder (A, B, Z) signal line break • Power supply break	DB	× (Note 6)
	82H				1	0	0	0	Breaking of absolute signal wire	• Absolute Encoder (PS) signal line break	DB	○
	83H				1	0	0	0	External Encoder A phase/ B phase signal Abnormality	• Breaking of full close Encoder (A, B) signal line	DB	○
	84 H				1	0	0	0	Abnormality in communication between encoder and amplifier	• Encoder serial signal time out	DB	○ (Note 7)
	85H				1	0	0	0	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	CS break	• CS signal line break	DB	×
	91H				1	0	0	0	Encoder command Abnormality	• Mismatch of transmission command and reception command	DB	○
	92H				1	0	0	0	Encoder FORM error	• Start, Stop bit Abnormality • Insufficient data length	DB	○
	93H				1	0	0	0	Encoder SYNC Abnormality	• Data cannot be received during the prescribed time after the command is sent.	DB	○
	94H				1	0	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.

9. Maintenance

Table 9-1 Alarm List

	Alarm code								Alarm title	Alarm contents	Operations while detecting	Alarm Clear
	Display	3 bits output			PY compatible code							
		Bit7	Bit6	Bit5	ALM 8	ALM 4	ALM 2	ALM 1				
Abnormality in encoder main body	A1H	1	0	1	1	0	0	0	Encoder Abnormality 1	• Breakdown of Encoder internal device	DB	○
	A2H				1	0	0	0	Absolute Encoder Battery Abnormality	• Battery low voltage	DB	○
	A3H				1	0	0	0	Encoder Overheating	• Motor built-in Encoder Overheating	DB	○
	A5H				1	0	0	0	Encoder Abnormality 3	• Error generation of multi-rotation data • Abnormality in operations of temperature sensor	DB	×
	A6H				1	0	0	0	Encoder Abnormality 4	• Encoder internal EEPROM data is not set • Overflow of multi-rotation data	DB	○
	A7H				1	0	0	0	Encoder Abnormality 5	• Resolver Abnormality • Light receiving abnormality in encoder	DB	×
	A8H				1	0	0	0	Encoder Abnormality 6	•Resolver disconnection • Light receiving abnormality in encoder	DB	×
	B2H				1	0	0	0	Encoder Abnormality 2	• Position data incorrect	DB	○
	B3H				1	0	0	0	Absolute Encoder rotations counter Abnormality	• Detection of incorrect multiple rotations coefficient	DB	○
	B4H				1	0	0	0	Absolute Encoder 1 rotation counter abnormality	• Detection of incorrect 1 rotation coefficient	DB	○
	B5H				1	0	0	0	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	0	0	Internal memory error of encoder	• Access error of Encoder internal EEPROM	DB	×
	B7H				1	0	0	0	Acceleration error	• Exceeds the permitted speed for motor rotation	DB	○
Control system abnormality	C1H	1	1	0	0	1	1	0	Over speed	• Motor rotation speed is 120 % more than the highest speed limit	DB	○
	C2H				1	1	0	0	Speed control Abnormality	• Power command and Acceleration codes are mismatched	DB	○
	C3H				1	1	0	0	Speed feedback Abnormality	• Motor power disconnection (Note 2)	DB	○
	D1H				1	1	0	1	Excessive position deviation	• Position error exceeds setup value	DB	○
	D2H				1	1	0	1	Position command pulse frequency Abnormality 1	• Frequency of entered position command pulse is excessive	SB	○
	D3H				1	1	0	1	Position command pulse frequency Abnormality 2	• Overflow of position command low-pass filter	SB	○
	DFH				1	1	0	1	Test mode end (Note 1)	• Detection in 'Test mode end' status	DB	○
Control system/Memory system abnormality	E1H	1	1	1	1	1	1	1	EEPROM Abnormality	• Abnormality of amplifier with built-in EEPROM	DB	×
	E2H				1	1	1	1	EEPROM check sum Abnormality	• Error in check sum of EEPROM (entire area)	-	×
	E3H				1	1	1	1	Internal RAM Abnormality	• Access error in CPU built in RAM	-	×
	E4H				1	1	1	1	Process abnormality in CPU ～ ASIC	•Access abnormality in CPU ~ ASIC	—	×
	E5H				1	1	1	1	Parameter error 1	•Detection when non-corresponding or undefined amplifier, motor, encoder code are specified.	-	×
	E6H				1	1	1	1	Parameter error 2	• Error in combining motor, encoder, and/or amplifier code set from system parameter	-	×
	F1H				1	1	1	1	Task process Abnormality	• Error in interruption process of CPU	DB	×
	F2H				1	1	1	1	Initial timeout	•Detection when initial process does not end within initial process time	-	×

Note 1: Alarm that rings 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
External input system	Forward over travel	• While entering forward over travel
	Reverse over travel	• While entering reverse over travel
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 the alarm rings, take measures and perform the process depending on the corrective actions for all alarm displays as given below.

1. An "○ "mark represents the cause number under "Status when the alarm rings' in the charts below

2. Take corrective action for items where the "○" mark is used.

3. If the problem is not resolved, next take corrective action for items where the "△" 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)

Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	△		○	△
Issued at servo input.	○	○	○	
Issued while starting and stopping the motor.	△	△	△	
Issued after extended operating time.	△	△	△	○

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°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 55℃.

Alarm code 22H (Electric current abnormality 0)

Status during alarm	Cause	
	1	2
Issued when the control power is turned ON.	○	△
Issued after the power is turned ON.	△	○

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)

Status during alarm	Cause	
	1	2
Issued when the control power is turned ON.	○	
Issued during operation.	△	○

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 41H (Overload 1)

Status during alarm	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)

Status during alarm	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)

Status during alarm	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.	△		○	△	
Issued during operation.	△	○	○	○	
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℃.
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 53H (DB Overheating)

Status during alarm	Cause	
	1	2
Issued when power supply is turned ON.	○	
Issued during operation.	△	○

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)

Status during alarm	Cause		
	1	2	3
Issued when power supply control is turned ON.	△		○
Issued during operation.	△	○	○

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

Status during alarm	Cause	
	1	2
Issued when power supply control is turned ON.	○	△

Corrective actions

Cause		Investigation and corrective actions
1	• Validity condition for external trip function is set to 'Valid'.	• When not in use, set 00: _Always _Disable for Group8, PA807.
2	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.

Relevant parameter: Parameter Group 8 [PA807] (Refer to Chapter 8, 8.5.9)

Standard set value : Always Disable (The function is always disabled.)

- When external regenerative resistor is not connected

Status during alarm	Cause		
	1	2	3
Issued when power supply control is turned ON.	○		△
Issued after operation.		○	△

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)

Status during alarm	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.		△	○	○

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)

Status during alarm	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.				○	△
Issued after power supply of main circuit is turned ON.	○	○			
Issued during operation, alarm resetting is possible.		△	○		
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)

Status during alarm	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.	△		
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)

Status during alarm	Cause		
	1	2	3
Issued at the time of power on.	△	○	
Issued during operation.	△		○

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)

Status during alarm	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)

Status during alarm	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)

Status during alarm	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.	○	○	○	○	△

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.

Status during alarm	Cause		
	1	2	3
Issued when control power supply is turned ON.	△	○	○

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.

Status during alarm	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)

Status during alarm	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.

Status during alarm	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℃.
3	• Motor is overheated.	• Confirm the cooling procedure of the servo motor.

Alarm code A5H (Encoder abnormality 3) “New Features 2”

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Status during alarm	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)

"New Features 2"

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Status when alarm rings.	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)

"New Features 2"

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Status during alarm	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 (RA062M) of the Manchester system.

Status during alarm	Cause	
	1	2
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.
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.

Status during alarm	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.

Status during alarm	Cause		
	1	2	3
Issued when power supply is turned ON.	○		△
Issued while stopping the motor.	○	○	
Issued while rotating the motor.	△	○	○

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)

"New function 2"

When abnormalities are detected in the internal part of the absolute position detector for the asynchronous system.

Status during alarm	Cause		
	1	2	3
Issued while stopping the motor.	○	○	
Issued while rotating the motor.	△	○	○

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)

Status during alarm	Cause			
	1	2	3	4
Issued when control power supply is turned ON.	○	△		
Issued if command is entered after Servo ON	△	○		
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)

Status during alarm	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)

Status during alarm	Cause		
	1	2	3
Issued when command is entered.	○	△	○

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).

Alarm code D1H (Excessive position deviation)

Status during alarm	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.	○	△	○	○	○		○	△	○		△	
Issued during starting or stopping at high speed.	○	○					○	○	○		△	○
Issued during the operations by lengthy command.		○					○	△			△	

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)

Status during alarm	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)

Status during alarm	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)

Status during alarm	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 in the controller).

Alarm code E1H (EEPROM abnormality)

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	○	△
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)

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	△	○

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)

Status during alarm	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)

Status during alarm	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)

Status during alarm	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 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	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 Corrective Actions for Problems During Operation

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. Enter deviation clear to check if process is continued.	· Stop the input of deviation clear (CN1-34 pin).
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.	-	· Set the servo tuning to “High”. · 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.

9.4 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.

9.5 Parts 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 replacement years	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 and QS1□010 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.

10. Specifications

Specifications

10. Specifications

10.1 Servo Amplifier

10.1.1 General specifications

General specifications

<table>
<tr><td rowspan="13">Basic specifications</td><td colspan="3">Model number QS1☐</td><td>015◇□□</td><td>030◇□□</td><td>050◇□□</td><td>100◇□□</td><td>150◇□□</td><td>300◇□□</td></tr>
<tr><td colspan="3">Control function</td><td colspan="6">Speed control, torque control, or position control (Parameter change)</td></tr>
<tr><td colspan="3">Control system</td><td colspan="6">IGBT PWM control Sinusoidal drive</td></tr>
<tr><td colspan="2" rowspan="2">*1Input power</td><td>Main circuit</td><td colspan="6">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</td></tr>
<tr><td>Controlling circuit</td><td colspan="6">Single phase AC200~230V+10, -15%, 50/60Hz±3Hz
Single phase AC100~115V+10, -15%, 50/60Hz ±3Hz*3</td></tr>
<tr><td rowspan="6">Environment</td><td colspan="2">Ambient temperature*4</td><td colspan="6">0～55^0 C</td></tr>
<tr><td colspan="2">Storage temperature</td><td colspan="6">-20～+65^0 C</td></tr>
<tr><td colspan="2">Operating / storage humidity</td><td colspan="6">Below 90%RH (no condensation）</td></tr>
<tr><td colspan="2">Elevation</td><td colspan="6">200 m below the sea level</td></tr>
<tr><td colspan="2">Vibration</td><td colspan="6">0.5G Frequency range 10～55HZ Test for 2H in each direction X.Y.Z</td></tr>
<tr><td colspan="2">Shock</td><td colspan="6">5G</td></tr>
<tr><td colspan="3">Structure</td><td colspan="6">Built-in tray type power supply</td></tr>
<tr><td colspan="3">Mass Kg</td><td>1.2</td><td>1.6</td><td>2.2</td><td>5.1</td><td>7.2</td><td></td></tr>
<tr><td rowspan="2">Perfor mance</td><td rowspan="2">In case of speed control specification</td><td colspan="2">Speed control range*5</td><td colspan="6">1:5000</td></tr>
<tr><td colspan="2">Frequency characteristics*7</td><td colspan="6">600Hz (JL=JM)</td></tr>
<tr><td rowspan="7">Built-in functions</td><td colspan="3">Protection functions</td><td colspan="6">Over current, Current detection error, Overload, Regeneration error, Amplifier overheating, External overheating, Over voltage, Main circuit low voltage, Main circuit open-phase, Control power supply error, Sensor error, Over speed, Speed control error, Speed feedback error, Excessive position error, Position command pulse error, CPU error, Built-in memory error, Battery error, Parameter error</td></tr>
<tr><td colspan="3">LED display</td><td colspan="6">Status display, Monitor display, Alarm display, Parameter settings, Adjustment mode</td></tr>
<tr><td colspan="3">Dynamic brake</td><td colspan="6">Built-in</td></tr>
<tr><td colspan="3">Regeneration process</td><td colspan="6">Built-in</td></tr>
<tr><td colspan="3">Applied load inertia</td><td colspan="6">Within the applied load inertia of combined servo motor</td></tr>
<tr><td rowspan="2">Monitor output *6</td><td colspan="2">Speed monitor (VMO)</td><td colspan="6">2.0V±10% (at 1000min^{-1})</td></tr>
<tr><td colspan="2">Current monitor (IMO)</td><td colspan="6">2.0V±10% (at 100%)</td></tr>
<tr><td rowspan="15">Input / Output signal</td><td rowspan="8">For speed/torque control specification</td><td rowspan="2">Speed command</td><td>Command voltage</td><td colspan="6">DC±2.0V (at 1000min^{-1} command, Foward motor rotation with positive command, maximum input voltage ±10V)</td></tr>
<tr><td>Input impedance</td><td colspan="6">Approx. 10k Ω</td></tr>
<tr><td rowspan="2">Torque command</td><td>Command voltage</td><td colspan="6">DC±2.0V (at 100% torque, Forward motor rotation with positive command)</td></tr>
<tr><td>Input impedance</td><td colspan="6">Approx. 10k Ω</td></tr>
<tr><td colspan="2">Current input limit</td><td colspan="6">DC±2.0V ±15% (at rated armature current)</td></tr>
<tr><td colspan="2">Sequence input signal</td><td colspan="6">Servo on, Alarm reset, Torque limit, Encoder clear, Forward rotation inhibition, Reverse rotation inhibition, Command inhibition, External trip, Forced discharge, Emergency stop, Change of control mode, Proportional control, Gain switch, Internal speed setting</td></tr>
<tr><td colspan="2">Sequence output signal</td><td colspan="6">Servo ready, Power ON, Servo ON, Holding brake timing, Within torque limit, Within speed limit, Low speed, velocity attainment, Matching speed, Zero speed, Command acceptable, Status of gain switch, Speed loop proportional control status, Control mode switchover status, Forward OT, Reverse OT, Warning, Alarm code (3Bit)</td></tr>
<tr><td colspan="2">Position output signal (Pulse division)</td><td colspan="6">N/8192 (N=1~8191), 1/N (N=1~64) or 2/N (N=3~64)</td></tr>
<tr><td rowspan="7">For position control specification</td><td rowspan="3">Position command</td><td>Maximum input pulse frequency</td><td colspan="6">5M pulse/second (Reverse rotation Forward rotation pulse, symbol + Pulse), 1.25M pulse/second (90° phase difference Two phase pulse)</td></tr>
<tr><td>Input pulse type</td><td colspan="6">Forward rotaion+Reverse rotation command pulse or symbol+Pulse string command or 90°phase difference Two phase sequence command</td></tr>
<tr><td>Electronic gear</td><td colspan="6">N/D (N=1~32767, D=1~32767) however, 1/32767 ≦N/D≦ 32767</td></tr>
<tr><td colspan="2">Current input limit</td><td colspan="6">DC±2.0V ±15% (at Rated armature current)</td></tr>
<tr><td colspan="2">Sequence input signal</td><td colspan="6">Servo ON, Warning reset, Torque limit, Clear encoder, Forward rotation inhibition, Reverse rotation inhibition, Command inhibition, External trip, Forced discharge, Emergency stop, Deviation Clear, Change of control mode, Proportional control, Gain switch, Change of electronic gear, Position loop proportional control</td></tr>
<tr><td colspan="2">Sequence output signal</td><td colspan="6">Servo ready, Power ON, Servo ON, Holding brake timing, Within torque limit, Within speed limit, Low speed, velocity attainment, Matching speed, Zero speed, Position fixed, Near range, Command acceptable, Status of gain switch, Speed loop proportional control status, Changed status of electronic gear, Changed control mode status, Forward OT, Reverse OT, Warning, Alarm code (3 bit)</td></tr>
<tr><td colspan="2">Position output signal (Pulse division)</td><td colspan="6">N/8192 (N=1～8191), 1/N (N=1～64) or 2/N (N=3～64)</td></tr>
</table>

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 the box, be sure that internal temperature does not exceed this range.

*5 Minimum rotational speed of the speed control range is determined as equivalent to the amplifier not stopping for a load with maximum continuous torque.

*6 Method 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)

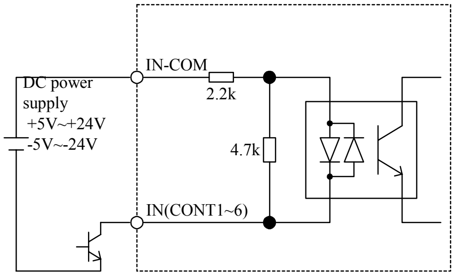
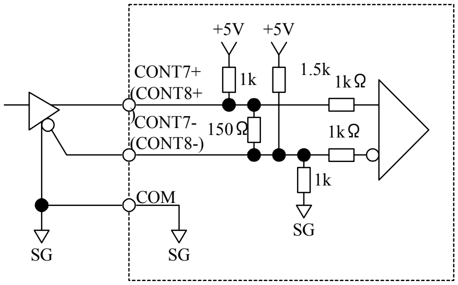
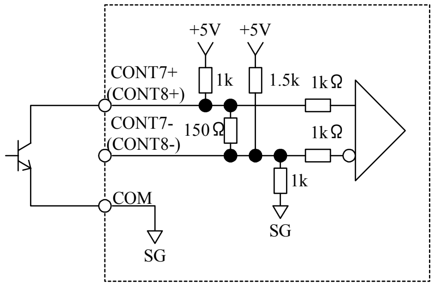
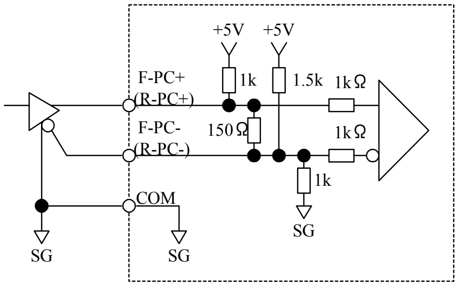
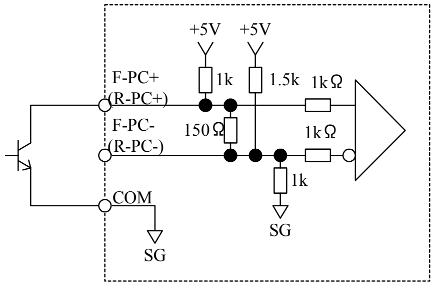
· Load torque (TL): TL=TR (N / m) × $\frac{\text{(Im Voltage)} \quad \text{(V)}}{2}$ (N /m)

(When monitor output setting is standard Im 2V/IR)

*7 The value differs depending on the combination of monitor and amplifier, sensor to be used, load condition, etc.

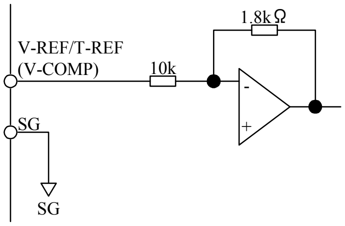
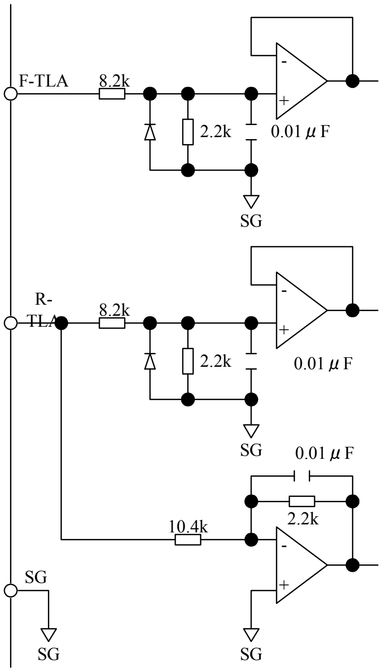
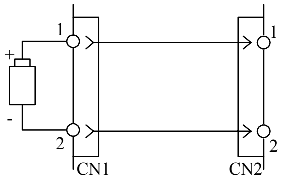
10.1.2 CN 1 General input / output interface

Structure of input circuit

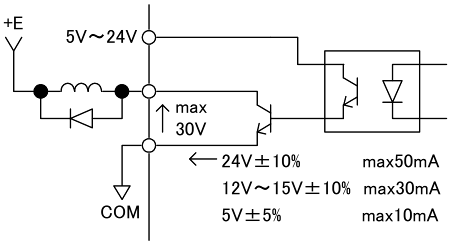
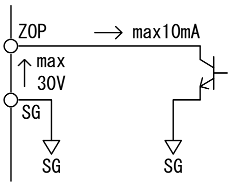
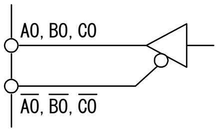
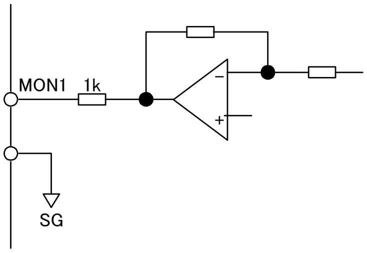
Type 1: General (two way / insulating) input (Photo coupler input) This type of input circuit is a non-contact circuit as shown in the figure on the right. The power supply range is within 5V ～ 24V. External power usage: DC5V~24V±10%, >100mA	
Type 2: General (high speed / non-insulating) input (Line driver input) This type of input circuit is shown in the figure on the right, and can be connected to an open collector output. Line receiver: RS 422	 
Type 3: Position command pulse input (Line driver input) This type of input circuit is shown in the figure on the right, and can be connected to an open collector output. Line receiver: RS 422 When connected to an open collector circuit, the maximum pulse frequency will be 150kHz.	 

10. Specifications

Structure of input circuit

Type 4: Analog input 1 Shown in the figure on the right, this input circuit only permits analogue speed and torque commands (speed compensation) as input signals.	
Type 5: Analog input 2 Shown in the figure on the right, this input circuit only permits forward rotation/reverse rotation current limit as input signals. Input voltage range Forward rotation (F-TLA): 0V～10V Reverse rotation (R-TLA): -10V～10V	
Type 6: Through input Shown in the figure on the right, this input circuit only permits battery power (absolute encoder specification) as an input signal.	

Structure of output circuit

Type 7: Open collector output 1 This type of output circuit is a non-contact circuit as shown in the figure on the right. External power supply specification: DC5V±10% or DC12V～24V±10%, Above 20mA	
Type 8: Open collector output 2 Shown in the figure on the right, its output signal is a Z-phase encoder signal.	
Type 9: Line driver output Shown in the figure on the right, its output signals are encoder signal phase A, phase B, phase Z, and absolute serial signals. Line driver: RS 422.	
Type 10: Analog output Shown in the figure on the right, its output is a Monitor 1 output signal.	

Specifications of CN1 input/output signal

Signal name	Code	Pin number *1	Circuit type *2	Outline of the specifications	
Forward rotation pulse string command	F-PC $\overline{\text{F-PC}}$	26 27 (47)	Type 3	Pulse string to be rotated in forward direction	
Reverse rotation pulse string command	R-PC $\overline{\text{R-PC}}$	28 29 (48)	Type 3	Pulse string to be rotated in reverse direction	
Speed command Torque command	V-REF T-REF	21 (20)	Type 4	In speed command: 1000min^{-1} with input of ±2V. In torque command: Rated torque (TR) with input of ±2V. (Standard setting) (Maximum input voltage±10V)	
Torque compensation	T-COMP	22 (23)	Type 4	Rated torque (TR) with input of ±2V. Restricted in instantaneous maximum stall torque. To enable the torque compensation function, set “1” or “2” in amplifier function selection 303.	
Forward rotation torque limit	F-TLA	18 (17)	Type 5	Rated torque with +2V. (Valid in allowed torque limit)	Refer to Chapter 8 for valid external current limit settings.
Reverse rotation torque limit	R-TLA	19 (17)	Type 5	Rated torque with -2V. (Valid in allowed torque limit)	
Battery power	BTP-1 BTN-1	1 2	Type 6	Requires a DC3.6V battery. (ER3V 1000mAH of Toshiba Battery Co. Ltd. is recommended)	
Monitor 1	MON1	30 (31)	Type 10	2V±20% / 1000min^{-1} (Speed monitor) Load: below 2mA, Output resistance 1k Ω Normal voltage during forward rotation	
Encoder signal	AO, $\overline{\text{AO}}$ BO, $\overline{\text{BO}}$ ZO, $\overline{\text{ZO}}$	3, 4 5, 6 7, 8	Type 9	Outputs encoder pulse via line driver after dividing. Signal is received by the line receiver. (RS 422)	
Absolute value signal	PS $\overline{\text{PS}}$	9 10	Type 9	Outputs the absolute value signal in serial form by the line driver. Receive by line receiver. (RS 422)	
Encoder C Channel signal	ZOP	11 (12)	Type 8	Output by the open collector; logic can be reversed by setting changes. (See Chapter 8)	

Specifications of CN1 input/output signal

Signal name	Code	Pin number *1	Circuit type *2	Outline of specifications
General input 1	CONT 6～1	32～37	Type 1	This is an input terminal to be used as a condition to enable the following internal functions: One input terminal enables multiple functions. Refer to Chapter 8 for how to select the internal function and input terminal. ・ Deviation clear (CLR) ・ Proportional control change (PCON) ・ Servo ON (S-ON) ・ Alarm reset (A-RST) ・ Allowed torque limit (TL) ・ Encoder clear (ECLR) ・ Forward over travel (F-OT) ・ Reverse rotation over travel (R-OT) Note: The functions above are set as standard parameters.
General input 2	CONT7 $\overline{\text{CONT7}}$ CONT8 $\overline{\text{CONT8}}$	13 14 15 16 (38)	Type 2	
Input sequence power supply	CONT-COM	50	-	External power supply for CN1-32～36.
General output	OUT 1～8	39～46 (24,25)	Type 7	Necessary items can be selected from each type of status output below, and can be output. Multiple outputs can be sent from a single output terminal. Refer to Chapter 8 for the selection method of status output. ・ Completing operation preparation (S-RDY) ・ Output signal during holding brake excitation (MBR-ON) ・ Torque limit (TLC) ・ Positioning completion status (INP) ・ Alarm code bit 5 (ALM5) ・ Alarm code bit 6 (ALM6) ・ Alarm code bit 7 (ALM7) ・ Alarm status (ALM) Note: The functions mentioned above are set as standard parameters.
Output sequence power supply	OUT-PWR	49	-	External power supply for CN1-39～46.

10.1.3 Position of signal output

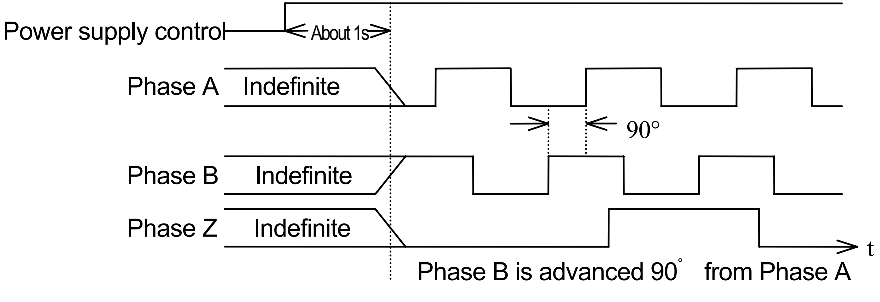
Details of signal output position specifications

Chapter	Contents	Related sensor
10.1.3.1	Pulse output	Wire-saving increment encoder (INC-E) Absolute encoder with increment (ABS-E) Absolute sensor with request signal (ABS-R II, RA062M) Wire-saving absolute sensor (PA035C, RA062C)
10.1.3.2	Serial output (Using absolute encoder ABS-E)	Absolute encoder with increment (ABS-E)
10.1.3.3	Serial output (Using absolute sensor ABS-R II, RA062M)	Absolute sensor with request signal (ABS-R II, RA062M)
10.1.3.4	Serial output (Using wire-saving absolute sensor PA035C, RA062C)	Wire-saving absolute sensor (PA035C, RA062C)

10.1.3.1 Pulse output

Outputs 90° phase difference two phase pulse (Phase A, Phase B) and Original pulse (Phase Z) from CN 1-3～8

(Forward rotation)



Phase B is advanced 90° from Phase A

- After turning ON the system, the power supply is not fixed for about 1 sec.
- Absolute encoder pulse (Increment) output is delayed for about 250 μs after power ON.
  One pulse is output for every change (once per rotation) of multiple rotations for Phase Z.
  (Does not determine the position relation of Phase Z and Phase A & B. A single pulse width is output based on the leading or trailing edge of Phase A or Phase B)
- When the division ratio is set other than 1/1, Phase A and Phase B are divided, but Phase Z is output by the original pulse width. In this case, no position relation of Phase Z and Phase A & Phase B is determined.

10.1.3.2 Serial output (While using absolute encoder ABS-E with increment)

Output of the position signal can be selected from 3 transmission methods. When the parameter group 4, page 4 (PA 404) is "＊0H", output is Asynchronous. For "＊1H", output is in ASCII code output in decimals, and synchronous Manchester encoding (Encoder signal direct output) when set to "＊2H". Refer to page 8-51 for more detailed setting information. The specifications are shown below.

(1) Serial output specifications

Synchronous method output (9600 bps) specifications

Transmission method	Asynchronous
Baud rate	9600 bps
Transfer frame	Frame 8 (11 bit/ frame)
Transfer format	Refer to table 10- 1 (2)
Transmission error check	(1 bit) equivalent to even number
Transfer time	9.2 ms (Type.)
Transfer period	Approx. 11 ms (Refer to Figure 10 -4 (1))
Increase method	Increase during forward rotation⚠

Output specifications for ASCII code in decimals

Transmission method	Asynchronous
Baud rate	9600 bps
Transfer frame	16 frame (10 bit/ frame)
Transfer format	Refer to Figure 10 -2 (2)
Transmission error check	(1 bit) equivalent to even number
Transfer time	16.7 ms (Type.)
Transfer period	Approx. 40 ms (Refer to (Figure 10- 4 (2))
Increase method	Increase during forward rotation ⚠

Synchronous Manchester encoding method output (1 Mbps) specifications

Transmission method	Synchronous Manchester encoding
Baud rate	1 Mbps
Transfer frame	2 frame (25 bit/ frame)
Transfer format	Refer to Figure 10-3 (2)
Transmission error check	(3 bit) CRC error check
Transfer time	66 μs (Type)
Transfer period	84 μs ± 2μs (Refer to Figure 10-4 (3))
Increase method	Increase during forward rotation⚠

⚠

Forward rotation means counterclockwise rotation, as seen from the motor shaft.

If the absolute value is increased to the maximum, the minimum value becomes 0.

(2) Transfer format

(2-1) Asynchronous (9600bps)

① Structure of Frame 1

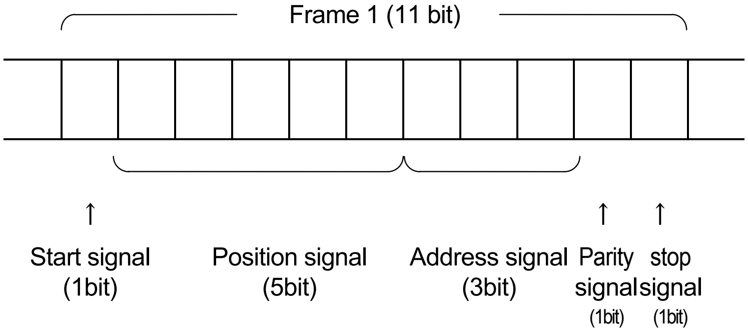


Figure 10- 1 (1) Frame structure of Asynchronous (9600bps)

② Structure of each frame

	Start signal	Position signal					Address signal			Parity signal	Stop signal
• 1st frame	0	D0 (LSB)	D1	D2	D3	D4	0	0	0	0/1	1
• 2nd frame	0	D5	D6	D7	D8	D9	1	0	0	0/1	1
• 3rd frame	0	D10	D11	D12	D13	D14	0	1	0	0/1	1
•4th frame	0	D15	D16	D17	D18	D19	1	1	0	0/1	1
•5th frame	0	D20	D21	D22	D23 (MSB)	BATE	0	0	1	0/1	1
•6thframe	0	SOT	0	WAR	0	0	1	0	1	0/1	1
•7th frame	0	0	0	0	0	0	0	1	1	0/1	1
• 8th frame	0	0	0	0	0	0	1	1	1	0/1	1

Figure 10 – 1 (2) Transfer format of asynchronous (9600bps)

D0～D10	. . .	Absolute value of 1 rotation
D11～D23	. . .	Absolute value of multiple rotations
BATE	. . .	Abnormal battery
SOT	. . .	Absolute value outside range
WAR	. . .	Battery warning

(2-2) ASCII code output in decimals (9600bps)

“New function 2”

①Structure of Frame 1

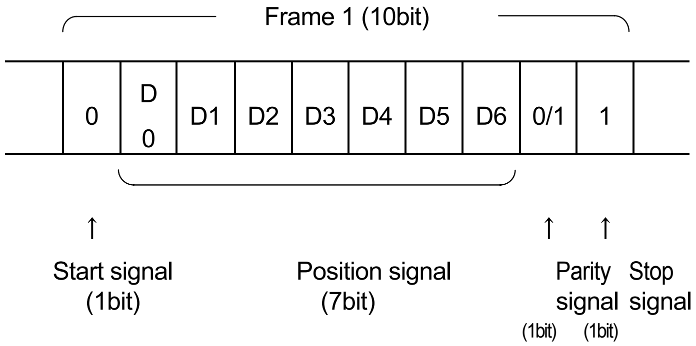


Table 10-2 (1)Frame structure of output for ASCII code in decimals

② Structure of each frame

Frame number	Transmission character	Data contents
1	“P” (ASCII code 50H)	Indicates that transmission data is position data
2	“+”(ASCII code 2BH)	Symbol of multiple rotations data
3	“0”(ASCII code 30H)	Multiple rotations data (5 digits)
4	Highest rank	
5	00000〜8191	
6		
7	Lowest rank	
8	“,”(ASCII code 2CH)	End characters
9	“0”(ASCII code 30H)	Absolute value data in 1 rotation (7digits)
10	“0”(ASCII code 30H)	
11	“0”(ASCII code 30H)	
12	Highest rank	
13	0000~2047	
14		
15	Lowest rank	
16	“CR”(ASCII code 0DH)	Carriage return

Figure 10 -2 (2) Transfer format of output for ASCII code in decimals

(2-3) Synchronous Manchester encoding (1Mbps)

① Structure of Frame 1

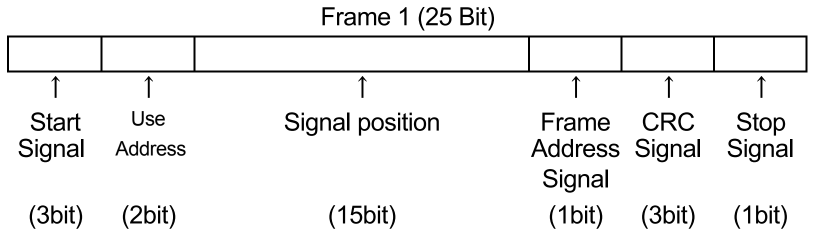
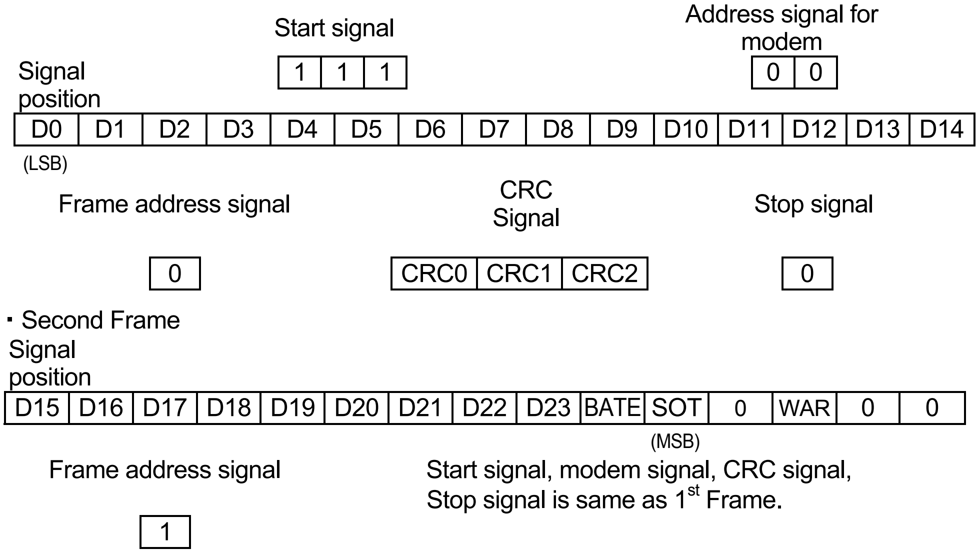


Figure 10-3 (1) Frame structure of synchronous Manchester encoding (1Mbps)

① Structure of each frame

- First Frame



1	1	1

0	0

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

CRC0	CRC1	CRC2

- Second Frame

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

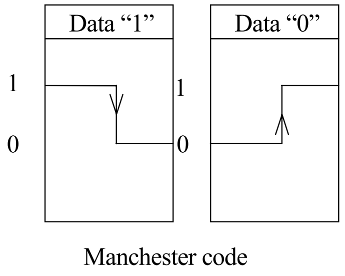
Start signal, modem signal, CRC signal, Stop signal is same as 1st Frame.

Figure 10-3 (2) Transfer format of synchronous Manchester encoding (1Mbps)

1 The first 2bits of the start signal are output as a signal of the total bit section H (1).
The remaining 23 bits following these are all Manchester encoded.

2 D0～D10 … Absolute value of 1 rotation
D11～D23 … Absolute value of multiple rotations
BATE … Abnormal Battery
SOT … Absolute value outside range
WAR … Battery warning

3 Generator Polynomial of CRC signal is P (X)=X^3+X+1.



(3)Transfer period

(3-1) Asynchronous (9600bps)

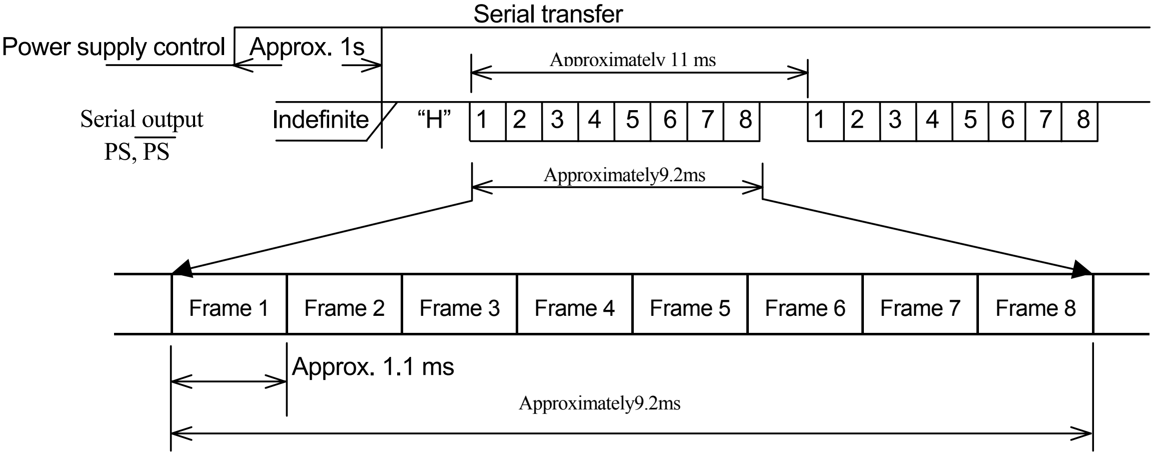


Figure 10-4(1) Transfer period of (9600bps) asynchronous.

(3-2) ASCII code output in decimals

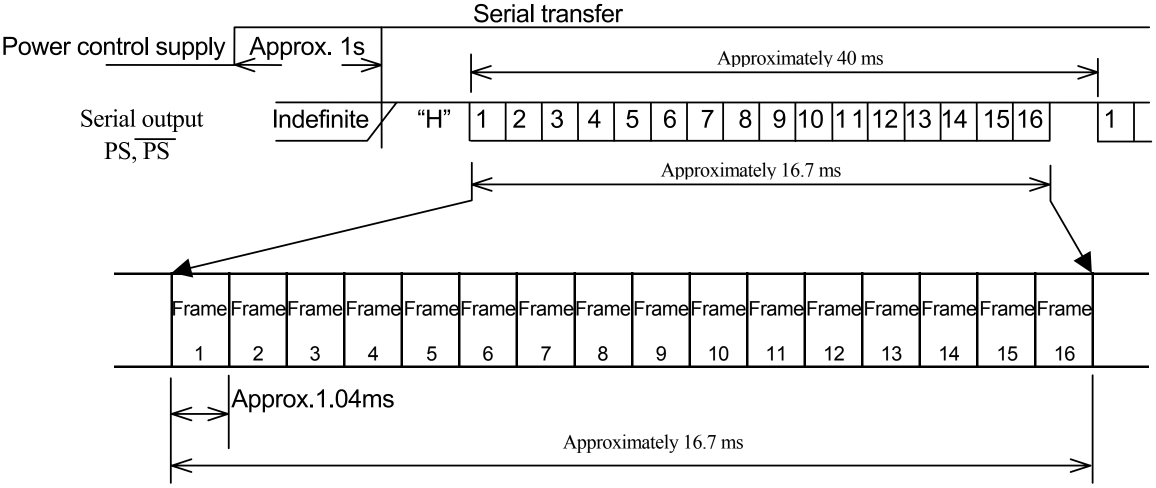


Figure 10-4(2) Transfer period of output for ASCII code in decimals

(3-3) Synchronous Manchester encoder (1Mbps)

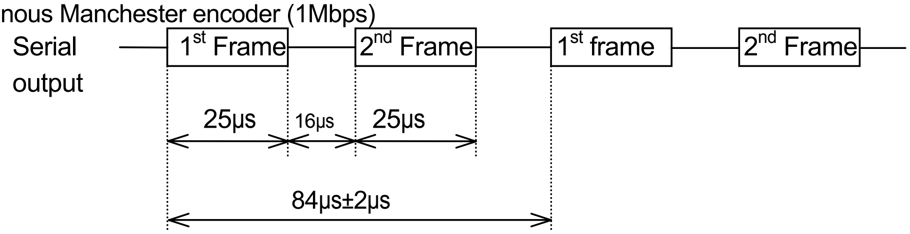


Figure 10-4(3) Transfer period of synchronous Manchester encoder (1Mbps)

* Power supply control is not fixed for 1s after booting.

Communication may not necessarily start from Frame 1 after 1s delay.

10.1.3.3 Serial output (When using Absolute sensor ABS-R II and RA062M)

Output of the position signal can be selected from 3 transmission methods. When the parameter group 4, page 4 (PA 404) is "＊0H", output is Asynchronous. For "＊1H", output is in ASCII code output in decimals, and synchronous Manchester encoding (Encoder signal direct output) when set to "＊2H". Refer to page 8-51 for more detailed setting information. The specifications are shown below.

(1）Serial output specifications

Asynchronous method output (9600 bps) specifications

Transmission method	Asynchronous
Baud rate	9600 bps
Transfer frame number	Frame 8 (11Bit / Frame)
Transfer format	Refer to Figure 10-5 (2)
Transmission error check	(1Bit) Even number parity
Transfer time	9.2 ms (Type.)
Transfer period	Approx.11 ms (Refer to Figure 10-8(1))
Increasing direction	Increase during forward rotation ⚠

Output specifications for ASCII code in decimals

Transmission method	Asynchronous
Baud rate	9600 bps
Transfer frame	16 Frame (10 bit / Frame)
Transfer format	Refer to Figure 10-6 (2)
Transmission error check	(1bit) Even number parity
Transfer time	16.7ms (Type.)
Transfer period	Approx. 40 ms (Refer to Figure 10-8(2))
Increasing method	Increase during forward rotation ⚠

Output specification Manchester encoder synchronous (1Mbps) method.

Transmission method	Manchester encoder synchronous
Baud rate	1 Mbps
Number of Transferred frames	Frame 2 (25bit / Frame): ABS-R II Frame 2(27 bit/ Frame: RA062M
Transfer format	Refer to Figure 10-7 (2)
Transmission error check	(3bit) CRC error check
Transfer time	66μs (Type.)
Transfer period	84μs±2μs (Refer to Figure 10-8(3))
Increasing direction	Increase during forward rotation ⚠

⚠ *Forward rotation means anticlockwise rotation, as seen from motor shaft axis.

<Information about RA062>

RA062 performs signal processing with custom ACIS of 4 gear-connected resolvers and detects the necessary position data in servo system (single / multiple rotation number of times) at the absolute position.

1) Detection feature of battery-less rotations: Without using the battery (external or internal), the number of rotations are held mechanically by the resolver when the power supply is OFF.
2) Environment-proof: The resolver (electromagnetic guidance sensor) is constructed from silicone steel plate and coil, making it strong and highly reliable as compared to optical sensors.
3) Wiring and user -friendly high-speed serial output: Synchronous Manchester encoding transmission and CRC error check
4) Self –diagnosis function: Outputs the alarm by detecting resolver disconnection, irregular temperature, and position data defects.
5) Small size, lightweight, and low power consumption
6) Environmental impact: Does not use a battery or aluminum electrolytic condenser containing harmful materials.

(2) Transfer format

(2-1) Asynchronous (9600bps)

① Structure of Frame 1

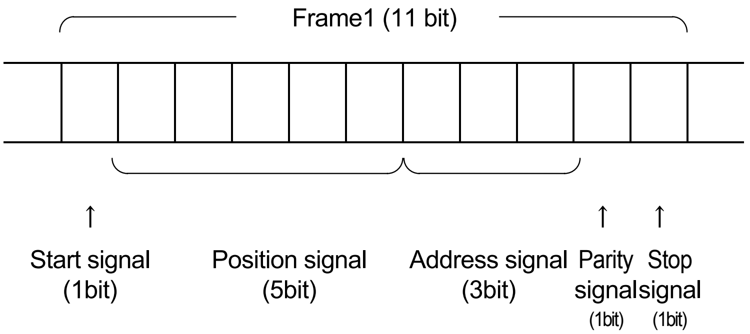


Figure 10 -5 (1) Frame structure of Asynchronous (9600bps)

② Structure of each frame

	Start signal	Position signal					Address signal			Parity signal	Stop signal
· Frame 1	0	D0 (LSB)	D1	D2	D3	D4	0	0	0	0/1	1
· Frame 2	0	D5	D6	D7	D8	D9	1	0	0	0/1	1
· Frame 3	0	D10	D11	D12	D13	D14	0	1	0	0/1	1
· Frame 4	0	D15	D16	D17	D18	D19	1	1	0	0/1	1
· Frame 5	0	D20	D21	D22	D23	D24	0	0	1	0/1	1
· Frame 6	0	D25 (MSB)	0/D26	0/D27 (MSB)	AW0	AW1	1	0	1	0/1	1
· Frame 7	0	0	0	0	0	0	0	1	1	0/1	1
· Frame 8	0	0	0	0	0	0	1	1	1	0/1	1

Figure 10 -5 (2) Transfer format of Asynchronous (9600bps)

For ABS-R II	D0 ~D12	…	Absolute value of 1 rotation (In case of 8192FMT))
	D13~D25	…	Absolute value of multiple rotations
For RA 062M	D0 ~D14	…	Absolute value of 1 rotation
	D15~D27	…	Absolute value of multiple rotations

AW0	AW1	ABS-R II	RA 062 M
0	0	Normal	Normal
0	1	Battery alarm	Sensor break down
1	1		Defective position data
Output LOW		Abnormal Sensor	Abnormal sensor

(2-2) ASCII code output in decimals (9600bps) “New function 2”

① Structure of Frame 1

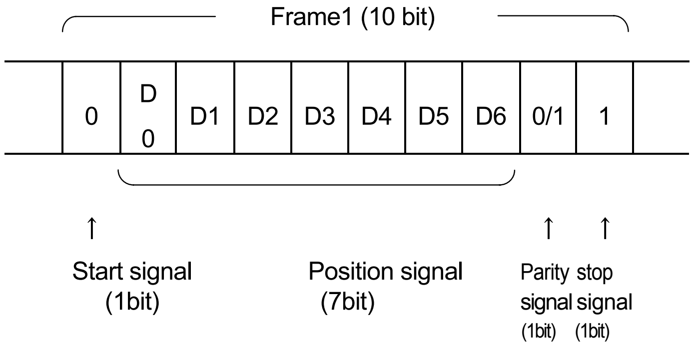


Figure 10 -6 (1) Frame structure of output for ASCII code in decimals

② Structure of each frame

Frame number	Transmission character	Data contents
1	“P” (ASCII code 50H)	Indicates that transmission data is a position data
2	“+” (ASCII code 2BH)	Code of multiple rotations
3	“0” (ASCII code 30H)	Multiple rotations data (5 digits)
4	Highest rank	
5	0000〜8191	
6		
7	Lowest rank	
8	“,” (ASCII code 2CH)	End character
9	“0” (ASCII code 30H)	Absolute value data in 1 rotation (7 digits)
10	“0” (ASCII code 30H)	
11	Highest rank	
12	0000〜8191	
13	Or	
14	00000〜32767	
15	Lowest rank	
16	“CR” (ASCII code 0DH)	Carriage return

Figure 10 -6 (2) Transfer format of Asynchronous (9600bps)

For ABS R II	1 rotation data (In case of 8192FMT)	: 0000〜8191
	Multiple rotations data	: 0000〜8191
For RA 062 M	1 rotation data	: 0000〜32767
	Multiple rotations data	: 0000〜8191

(2-3) Synchronous Manchester encoding (1Mbps)

① Structure of Frame 1

Frame 1 (25 bit/ 27 bit)

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

Figure 10 -7 (1) Frame structure of Synchronous Manchester encoding (1Mbps)

② Structure of each frame

- First frame

Start signal

1	1	1

Address signal for modem

0	0

Position signal

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

Frame address signal

0

CRC signal

CRC0	CRC1	CRC2

Stop signal

0

- Second frame

Position signal

D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	0/D26	0/D27	AW0	AW1
										(MSB)				

Frame address signal

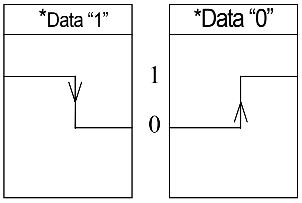
1

Start signal, modem signal, CRC signal
Stop signal is same as 1st frame

Figure 10 – 7(2) Transfer format of Synchronous Manchester encoding (1Mbps)

1) The first two bits of start signal are output as signal of the whole bit section H (1)

All the remaining 23 bits after this are Manchester encoded



Manchester code

2) ABS-RII D0 ～D12 … 1 rotation absolute value

D13～D25 … Multi rotation absolute value

RA062M D0 ～D14 … 1 rotation absolute value

D15～D27 … Multi rotation absolute value

AW0	AW1	ABS-R II	RA 062 M
0	0	Normal	Normal
0	1	Battery alarm	Sensor breakdown
1	1		Defective pos. data
LOW output-		Abnormal sensor	Abnormal sensor

3) Generator polynomial of CRC signal is P (X)= X^3+ X+ 1.

(3) Transfer period

(3-1) Asynchronous (9600bps)

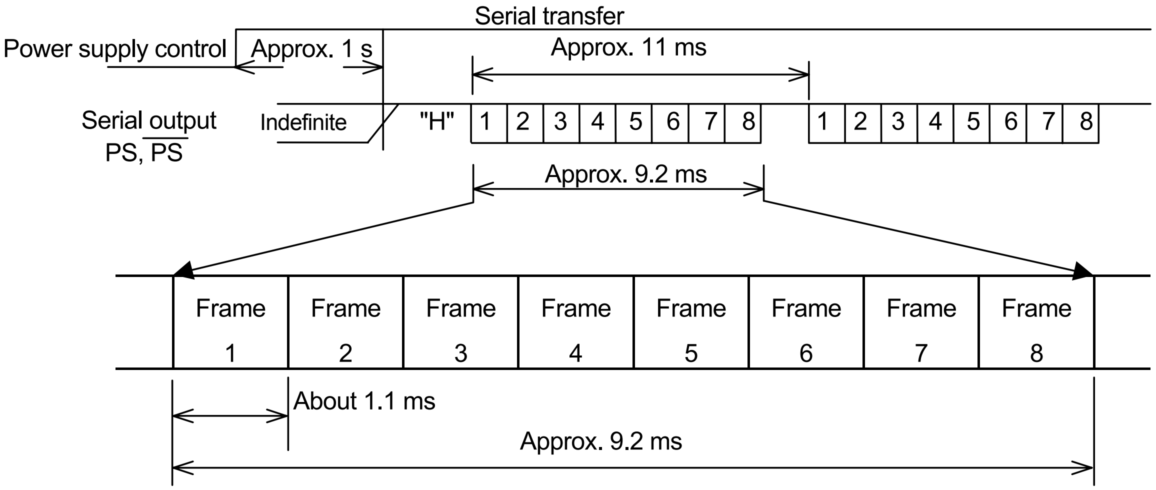


Figure 10 -8 (1) Transfer period of Asynchronous (9600bps)

(3 -2) output for ASCII code in decimals

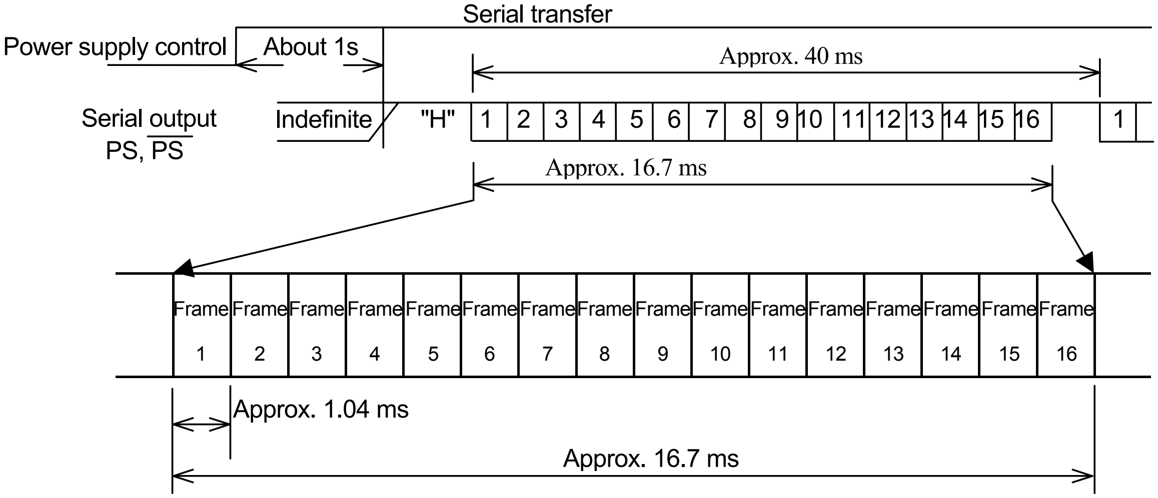


Figure 10 -8 (2) Transfer period of output for ASCII code in decimals

(3-3) Synchronous Manchester encoding (1Mbps)

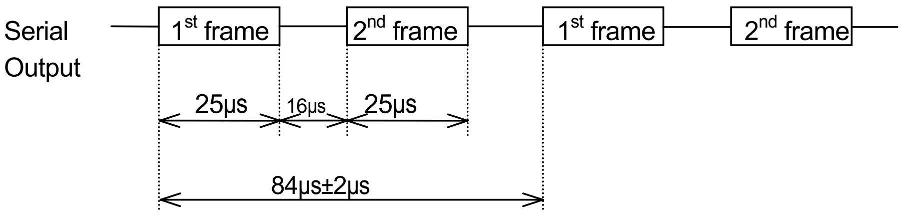


Figure 10 -8 (3) Transfer period of Synchronous Manchester encoding (1Mbps)

Power supply control is not fixed for 1s after booting.

Communication may not necessarily start from first frame after 1s.

(4) Absolute sensor RA 062M Handling precautions

・Number of rotations

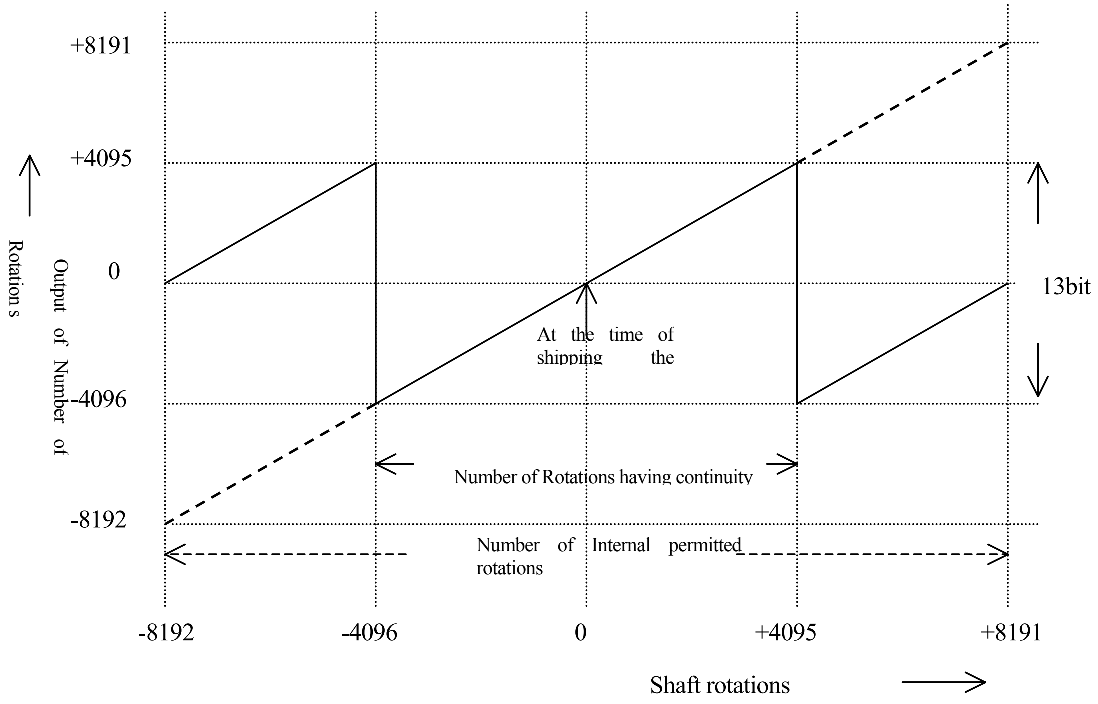
-4096 to +4095 rotations are continuously counted, by centering on 0 and increasing the count by 1 rotation during an operation. –8192 to +8191 rotations are maintained by centering on 0 with the mutual position relation of gear-combined resolver, when the power supply is OFF. When the number of permitted rotations (-8192 to +8191 rotations, centered on 0) exceeds this value, regardless of whether the power supply is ON or OFF, the number of rotations becomes unfixed when power supply is turned ON again.

Number of Rotations during operations (With focus on 0)	Permitted rotations (With a focus on 0)
-4096 to +4095 [Rotations] (13bit)	-8192 to +8191[Rotations]

Note: Position of 0 rotation becomes the multiple rotations data clear position

・Number of permitted rotations

The number of permitted rotations of the sensor will become –8192 to +8191rotations, regardless of whether the power supply is ON or OFF (Refer to Figure 10-15). If the sensor rotations exceed this value, the number of rotations will become unstable (a “slippage” in the number of rotations) when power supply is turned on again, and the continuity of the number of rotations will be lost before the power supply is turned OFF. In other words, the number of rotations just before the power supply is switched OFF and just after the power supply is switched ON again will differ. Moreover, no alarm will be output, in this case. Take care to ensure that rotations do not exceed the permitted range (-8192 to +8191 rotations). The number of rotations is set in the permitted range (0 rotation ±1) at the time of shipping the product. When conducting test operations before installing a customer’s device, perform a multi-return and meet 0 after determining the central point of rotation operation.



Rotation quantity and number of rotations for Shaft

・External magnetic field

Do not fix a magnet stand inside the sensor cover, or expose it to a strong magnetic field(20m T). Doing so will cause irregular operation of the resolver, and is the main cause of defective position data.

10.1.3.4 Serial output (While using wired-saving absolute sensor PA035C and RA062C)

Output of the position signal can be selected from 3 transmission methods. When the parameter group 4, page 4 (PA 404) is "∗0H", output is Asynchronous. For "∗1H", output is in ASCII code output in decimals, and synchronous Manchester encoding (Encoder signal direct output) when set to "∗2H". Refer to page 8-51 for more detailed setting information. The specifications are shown below.

(1) Serial output specifications

Asynchronous method output (9600 bps) specifications

Transmission method	Asynchronous
Baud rate	9600 bps
Number of frames transferred	8 Frames (11 bit/frame)
Transfer format	Refer to Figure 10-9(2)
Transmission error check	(1 bit) even number parity
Transfer time	9.2 ms (type.)
Transfer period	Approx. 11ms (Refer to figure 10-12(1))
Increase direction	Increase during forward rotation ⚠

Output specifications for ASCII code in decimals

Transmission method	Asynchronous
Baud rate	9600 bps
Transfer frame	16 frames (10 bit/frame)
Transfer format	Refer to figure 10-10(2)
Transmission error check	(1 bit) even number parity
Transfer time	16.7 ms (Type.)
Transfer period	Approx. 40ms (Refer to figure 10-12(2))
Increase method	Increase during forward rotation ⚠

Encoder signal direct output specifications

Transmission method	Asynchronous
Baud rate	2.5MHz, 4MHz
Number of frames transferred	3 or 4 frames (18 bit/frame)
Transfer format	Refer to figure 10-11(2), (3)
Transmission error check	(8 bit) CRC error check
Transfer time	21.6 μs or 28.8 μs (Type.): 2.5 MHz 13.5μs or 18μs (Type.): 4MHz
Transfer period	125μs (Refer to figure 10-12(3))
Increase direction	Increase during forward rotation ⚠

⚠ Forward rotation means anti clockwise rotation, as seen from the motor shaft.

(2) Transfer format

(2-1) Asynchronous（9600 bps）

① Structure of Frame 1

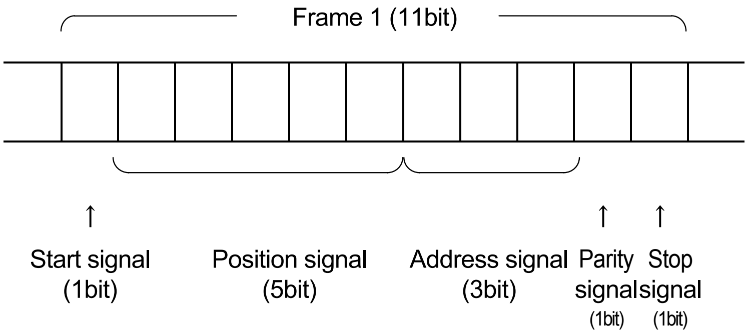


Figure 10-9 (1) Frame structure of asynchronous (9600 bps)

② Structure of each frame

	Start signal	Position signal					Address signal			Parity signal	Stop signal
· Frame 1	0	D0 (LSB)	D1	D2	D3	D4	0	0	0	0/1	1
· Frame 2	0	D5	D6	D7	D8	D9	1	0	0	0/1	1
· Frame 3	0	D10	D11	D12	D13	D14	0	1	0	0/1	1
· Frame 4	0	D15	D16	D17	D18	D19	1	1	0	0/1	1
· Frame 5	0	D20	D21	D22	D23	D24	0	0	1	0/1	1
· Frame 6	0	D25	D26	D27	D28	D29	1	0	1	0/1	1
· Frame 7	0	D30 (MSB)	0/D31	0/D32 (MSB)	0	0	1	1	1	0/1	1
· Frame 8	0	0	0	0	0	0	1	1	1	0/1	1

Figure 10-9(2) Transfer format of asynchronous (9600 bps)

· For PA035C	D0 ～D16	… Absolute value of 1 rotation
	D17～D32	…Absolute value of multiple rotations
· For RA062C	D0 ～D16	…Absolute value of 1 rotation
	D17～D30	…Absolute value of multiple rotations

(2-2) Output for ASCII code in decimals (9600 bps) “New function 2”

①Structure of frame 1

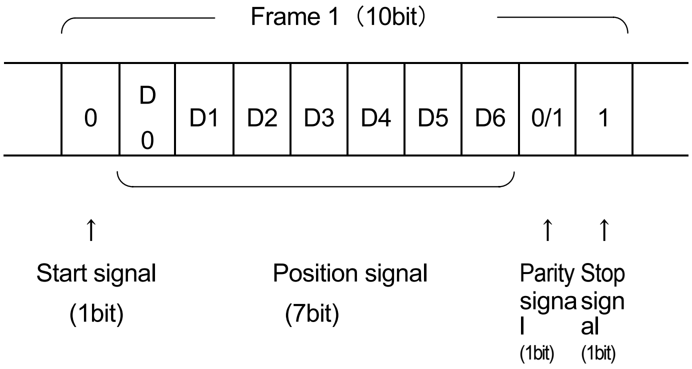


Figure 10-10 (1) Frame structure of Output for ASCII code in decimals

②Structure of each frame

Frame No.	Transmission character	Data contents
1	“P”（ASCII code　50H）	Shows that transmission data is position data.
2	“+”（ASCII code　2BH）	Code for data with multiple rotations
3	“0”（ASCII code　30H）	Multiple rotations Data (5digits)
4	Highest rank	
5	0000~8191	
6		
7	Lowest rank	
8	“,”（ASCII code 2CH）	Delimiter
9	“0”（ASCII code　30H）	Absolute data value in 1 rotation (7 digits)
10	Highest rank	
11		
12	000000～131071	
13		
14		
15	Lowest rank	
16	“CR”（ASCII code　0DH）	Carriage return

Figure 10-10(2) Transfer format of Output for ASCII code in decimals

· For PA035C	1 rotation data: 000000～131071
	Multiple rotations data: 00000～65535
· For RA062C	1 rotation data: 000000～131072
	Multiple rotations data: 00000～16383

(2-3) Encoder direct output

①Frame structure

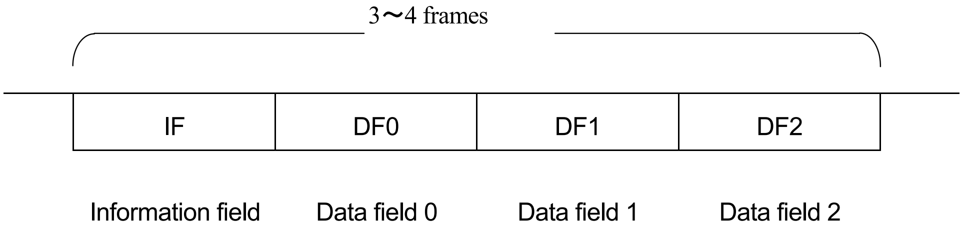


Figure 10-11(1) Frame structure of encoder direct output

②Frame structure

Information field (IF)

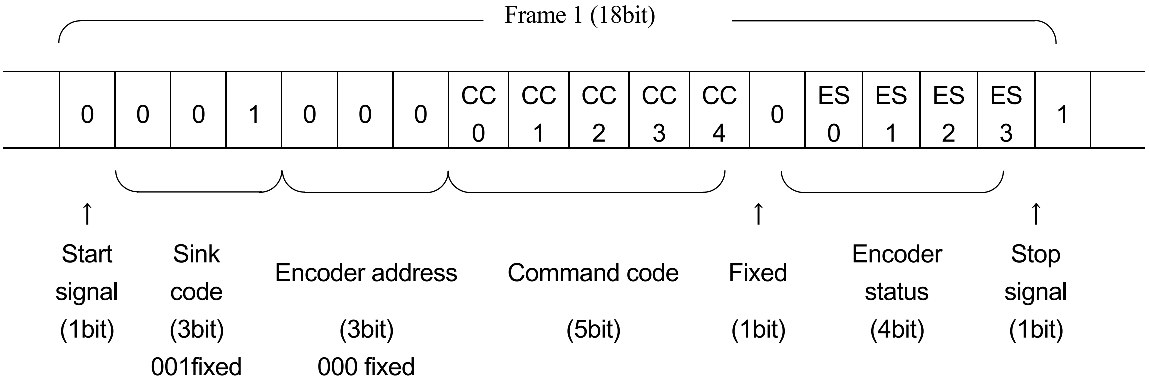


Figure 10-11(2) Format of information field

Command code CC [4:0]

CC [4:0]	Command contents
00000	Absolute full data request
00011	Encoder status request
01000	Status clear request
01010	Status+data clear request with multiple rotations

Encoder status ES [3:0]

ES [3:0]	Status contents	
ES0	PA035C	Accessing sensor, accessing memory in the sensor
	RA062C	Memory operation in the sensor
ES1	PA035C	Battery warning
	RA062C	“0” fixed
ES2	PA035C	Sensor overheat, abnormal memory, overspeed
	RA062C	Sensor overheat, abnormal memory, overspeed, abnormal encoder
ES3	PA035C	Battery alarm, single / multiple rotations counter error
	RA062C	Multiple rotations counter error

Data field (DF0~DF2)

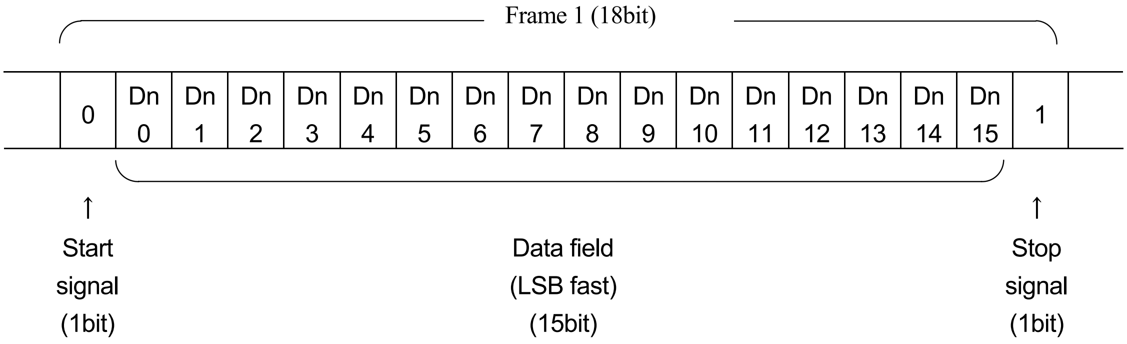


Figure 10-11(3) Format of data field

Compatibility table of command and data

Command CC[4:0]	Data			Frame length
	DF0 D0[0:15]	DF1 D1[0:15]	DF2 D2[0:15]	
00000	D0[0:15]=ABS[0:15]	D1[0:15]=ABS[16:31]	D2[0:7]=ABS[32:39] D2[8:15]=CRC[0:7]	4 frames
00011	D0[0:15]=ALM[0:15]	D1[0:7]="00000000" D2[8:15]=CRC[0:7]	—	3 frames
01000				
01010				

CRC [0:7] CRC generator polynomial P(X) =$X^8+X^4+X^3+X^2+1$
Applicable range is other than start bit and stop bit of each frame

ALM [0:15] Alarm contents differ per the sensor type.
Check sensor specifications for details.

(3) Transfer period

(3-1) Asynchronous（9600 bps）

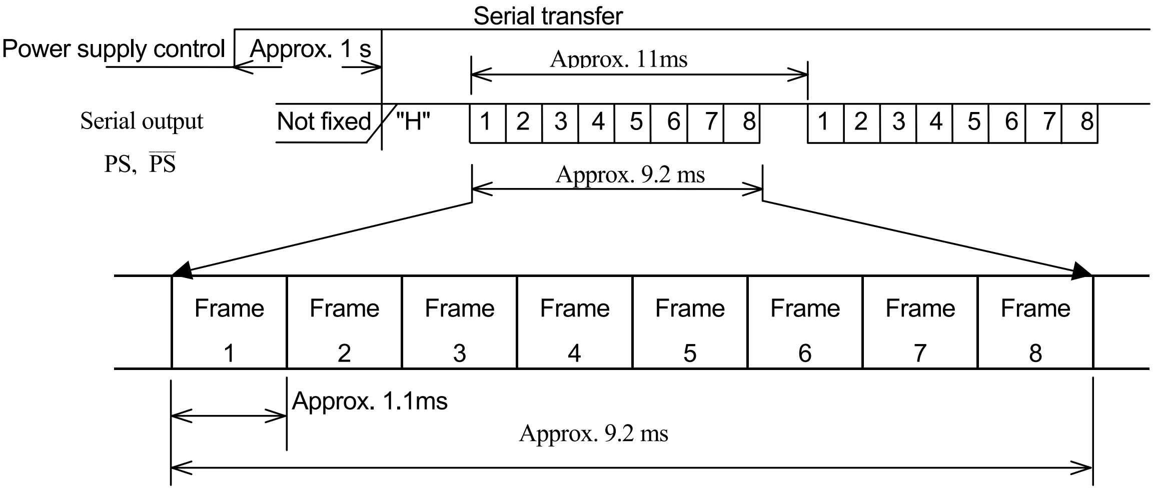


Figure 10-12 (1) Transfer period of asynchronous (9600 bps)

(3-2) Output for ASCII code in decimals

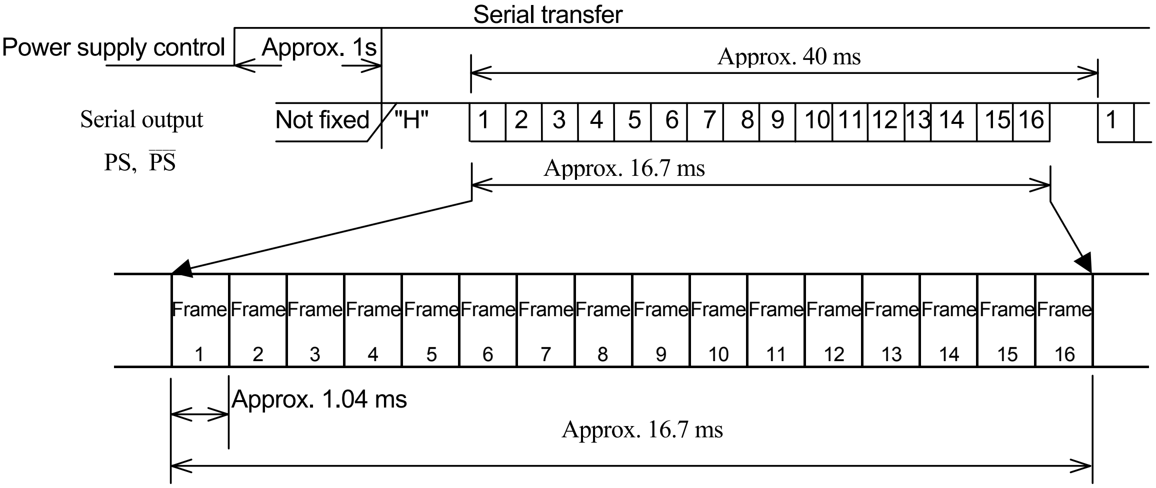


Figure 10-12 (2) Transfer period of output for ASCII code in decimals

(3-3) Encoder direct output (2.5MHz or 4MHz)

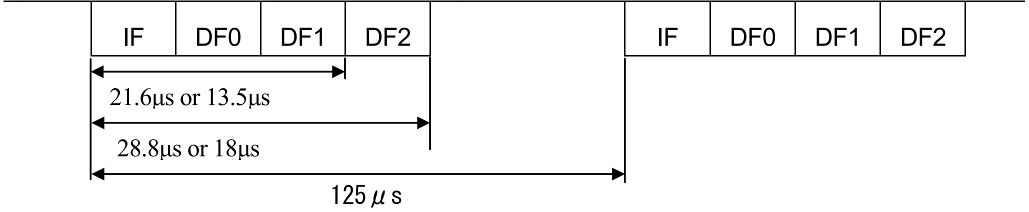


Figure 10-12 (3) Transfer period of encoder direct output

Power supply control is not fixed for 1s after booting.

Communication may not necessarily start from first frame after 1s.

10.1.3.4 Serial output (While using incremental encoder)

When using the incremental encoder, the actual position monitor value is output, irrespective of the selected value in Parameter Group 4, Page 4 (PA 404). The specifications are shown below.

(1) Serial output specifications

Asynchronous method output (9600bps) specifications

Transmission method	Asynchronous
Baud rate	9600 bps
Number of transferred frames	8 frames (11bit/frame)
Transfer format	Refer to Figure 10-13(2)
Transmission error check	(1bit) Even number parity
Transfer time	9.2ms(Type.)
Transfer period	Approx. 11ms (Refer Figure10-14)
Increasing direction	Increase during forward rotation ⚠

⚠ Forward rotation means anticlockwise rotation, as seen from motor shaft axis.

2）Transfer format

（2-1）Asynchronous(9600bps)

①Structure of Frame 1

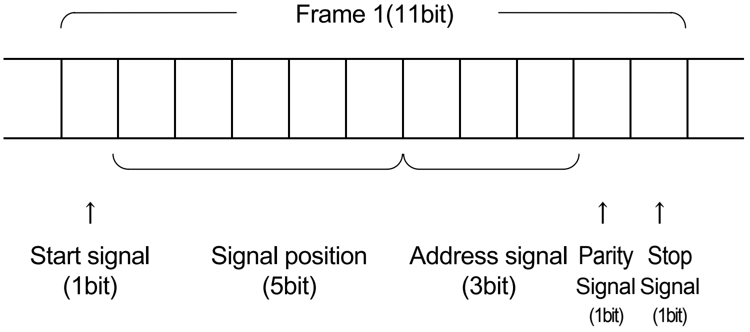


Fig.10-13（1） Frame structure of Asynchronous (9600bps)

②Structure of each frame

	Start Signal	Signal position					Address Signal			Parity Signal	Stop Signal
･Frame 1	0	D0 (LSB)	D1	D2	D3	D4	0	0	0	0／1	1
･Frame 2	0	D5	D6	D7	D8	D9	1	0	0	0／1	1
･Frame 3	0	D10	D11	D12	D13	D14	0	1	0	0／1	1
･Frame 4	0	D15	D16	D17	D18	D19	1	1	0	0／1	1
･Frame 5	0	D20	D21	D22	D23	D24	0	0	1	0／1	1
･Frame 6	0	D25	D26	D27	D28	D29	1	0	1	0／1	1
･Frame 7	0	D30	D31 (MSB)	0	0	0	1	1	1	0／1	1
･Frame 8	0	0	0	0	0	0	1	1	1	0／1	1

Fig.10-13 (2) Transfer format of Asynchronous (9600bps).

（3）Transfer period

（3-1）Asynchronous (9600bps)

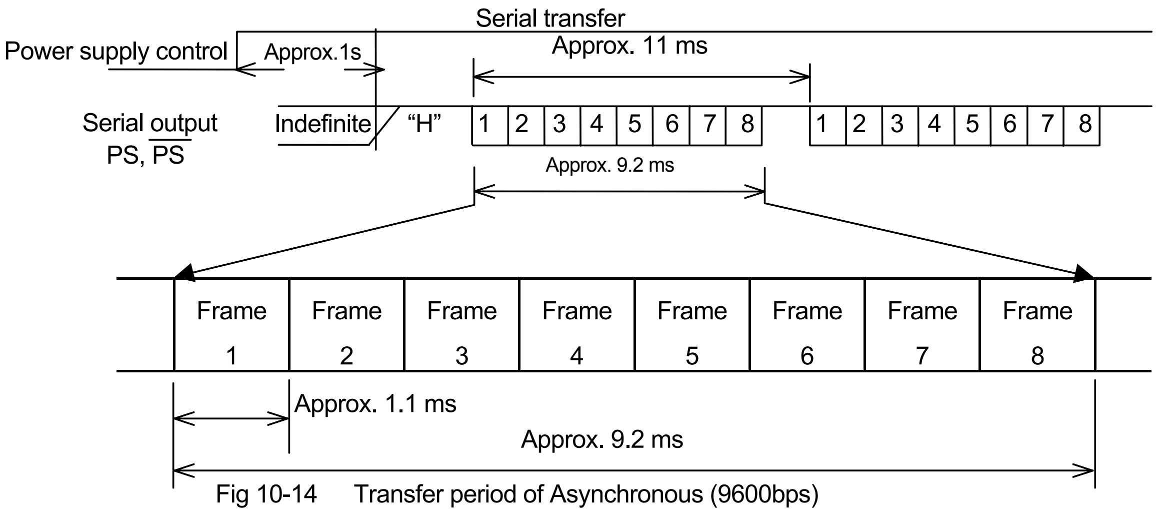


Fig 10-14 Transfer period of Asynchronous (9600bps)

10.1.4 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, Explanation of Parameters” for the output selection contents.

10.1.4.1 Parameters related to Analog Monitor Output 1(MON1) and Output 2 (MON2)

Analog monitor output polarity: Parameter Group 3 [PA305] (**Refer to “Chapter 8”, 8-44)**

Analog monitor output contents: Parameter Group 5 [PA500 PA501] (**Refer “Chapter 8”, 8-51)**

10.1.4.2 Parameter related to Digital monitor output (DMON)

Digital monitor output contents: Parameter Group 5 [PA502] (**Refer “Chapter 8”, 8-51)**

10.1.4.3 Monitor output terminal

	Connector CN1 for General input/output	CN 7
Analog monitor output 1 (MON1）	CN 1-30	CN 7-1
Analog monitor output 2 (MON2）	Disabled	CN 7-2
Digital monitor output (DMON)	Disabled	CN 7-4
GND	CN 1-31	CN 7-3

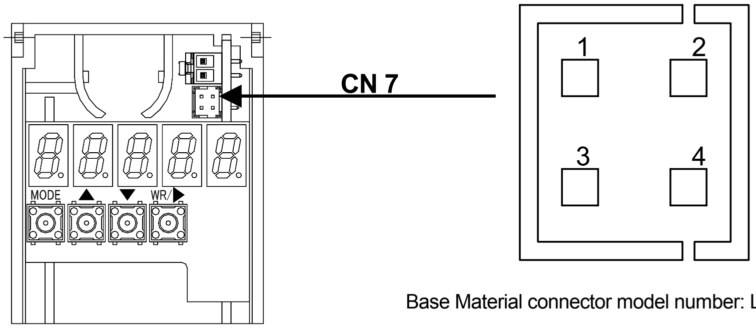
The monitor output value from CN1 is only monitor output 1. Use CN 7 when using monitor output 2.

Keep the lead cable and box with a check terminal as an option when using monitor output 1, 2 from CN7.

10.1.4.4 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）

10. Specifications

(1) Speed, Torque and Deviation Monitoring

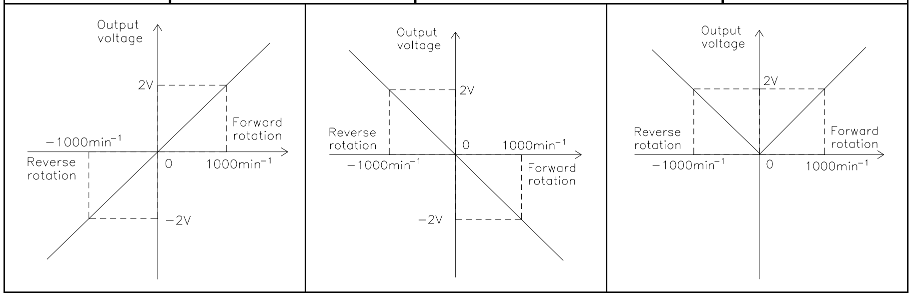
Refer to the following figure.

The speed command outputs data from the internal amplifier.

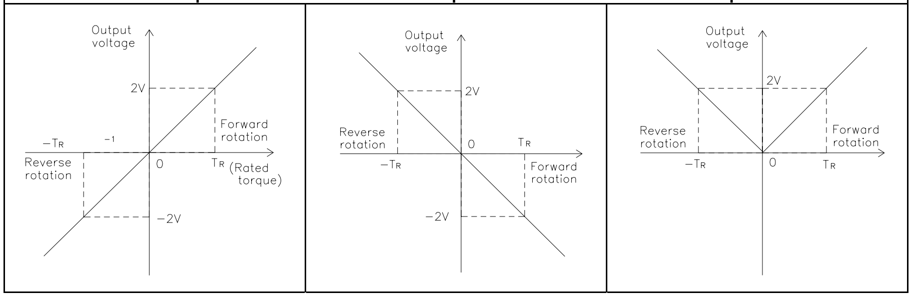
The monitor output value is 0 in SOFF status.

When the power supply control is turned on / cutoff, monitor output becomes irregular.

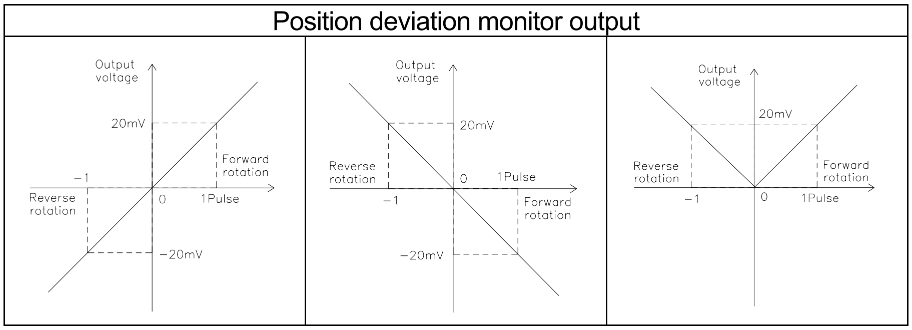
Speed command and speed feed back monitor output.



Torque command and Torque feedback monitor output



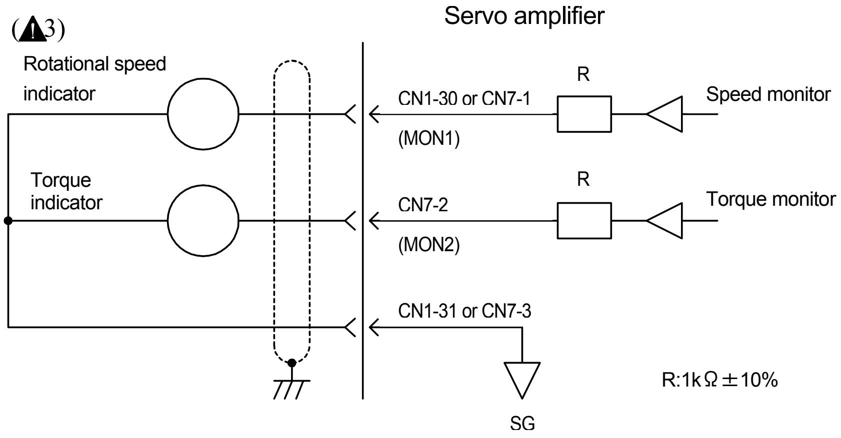
Position deviation monitor output



(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 feed back monitor, use both deflection types with a direct current voltmeter, and connect as shown in the following figure.
Use shielded line for wiring, and make wiring as small as possible.



Example monitor connection

- Torque monitor output (CN7-2)
  ±2.0 V ±20% / Rated Torque

- Speed monitor output (CN7-1)
  ±2.0 V ±20% / 1000min^{-1}

- Maximum output voltage value for monitor output is ±8 V.

⚠

1 Monitor output from CN1 is strictly monitor output 1.
Use CN7 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, and 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 CN1-30, CN7-1, and CN7-2 are also changed. When usage methods such as those described above are used, exercise caution to avoid against damaging the device.

3 For measuring the speed and torque monitor, DC voltmeter of 10kΩ or more (Bi-direction type).

4 When the power supply control is turned ON or disconnected, the monitor becomes unstable outputs to the extent of ±12～15V. While the device is connected, take sufficient care to protect against damage.

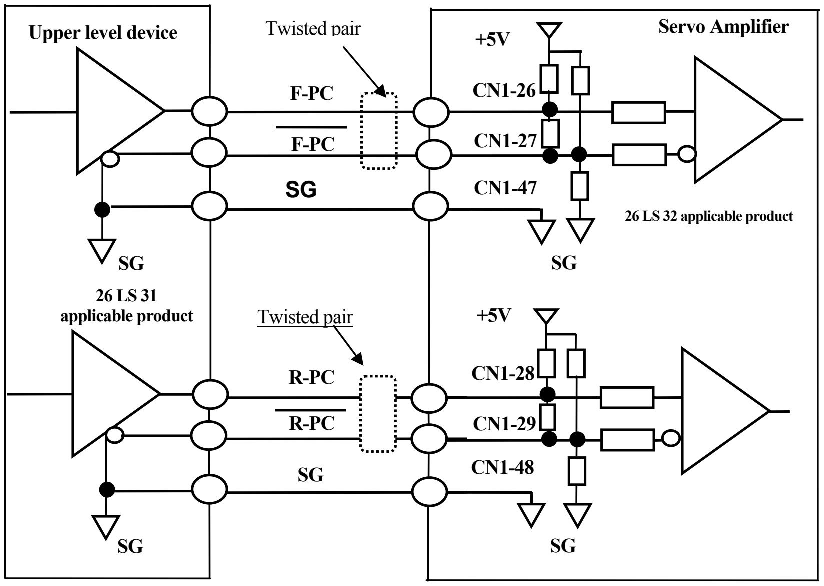
10.1.5 Position command input

Position command pulse input signal during position control is explained.

10.1.5.1 Upper level device output type

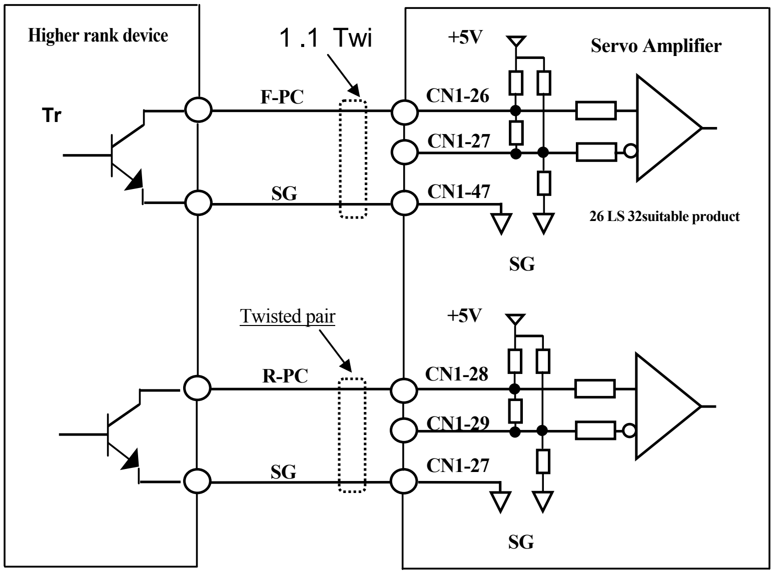
The upper level device output type can be either “Line driver output” or “Open collector output”.

When upper level device is line driver output type



Note: Always wire SG.

When upper level device is open collector output type



Tr=ON	“L” level
Tr=OFF	“H” level

10.1.5.2 Selection of position command pulse type and related parameters

Position command pulse can be selected from 3 types.

Command pulse selection: Parameter Group 4 [PA400] Upper level (**Refer to "Chapter 8", 8-47)**

OH: Forward rotation pulse string + reverse rotation pulse string

1H: 90^0 two-phase difference pulse string

2H: Code + Pulse string

Polarity of Position command pulse count can be selected from 4 types.

Command pulse selection: Parameter Group 4[PA400] lower rank (**Refer to "Chapter 8", 8-47)**

OH: F-PC: Count by leading edge / R-PC: Count by leading edge

1H: F-PC: Count by trailing edge / R-PC: Count by leading edge

2H: F-PC: Count by leading edge / R-PC: Count by trailing edge

3H: F-PC: Count by trailing edge / R-PC: Count by trailing edge

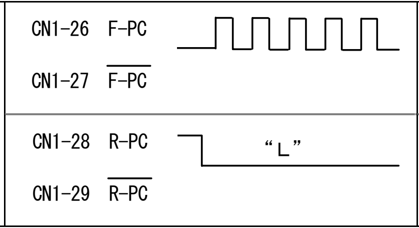
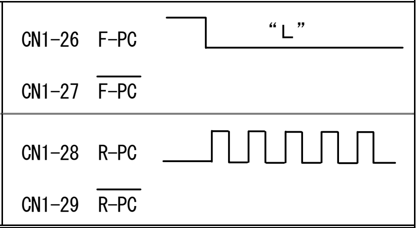
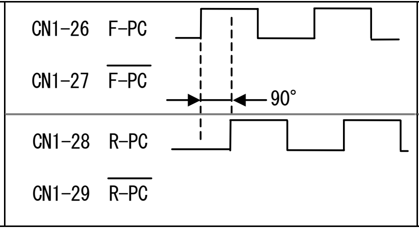
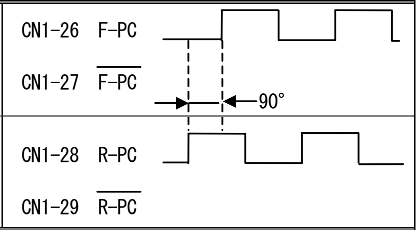
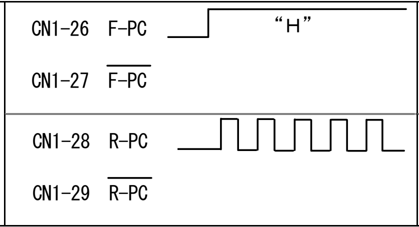
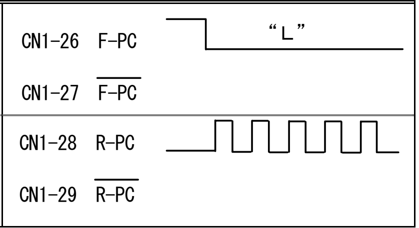
Polarity of Position command input can be selected from 2 types.

Command input polarity: Parameter Group3 [PA302] Upper level (**Refer to "Chapter 8", 8-41)**

OH/1H/2H/3H: Forward rotation by position command /+ input

4H/5H/6H/7H: Reverse rotation by position command/ + input

Command pulse type Command input polarity: forward rotation by position command/+input

PA400 Upper level	Command pulse type	Motor forward rotation command	Motor reverse rotation command
0	Forward rotation pulse string + Reverse rotation pulse string		
1	90^0 two-phase difference pulse string		
2	Code + Pulse string		

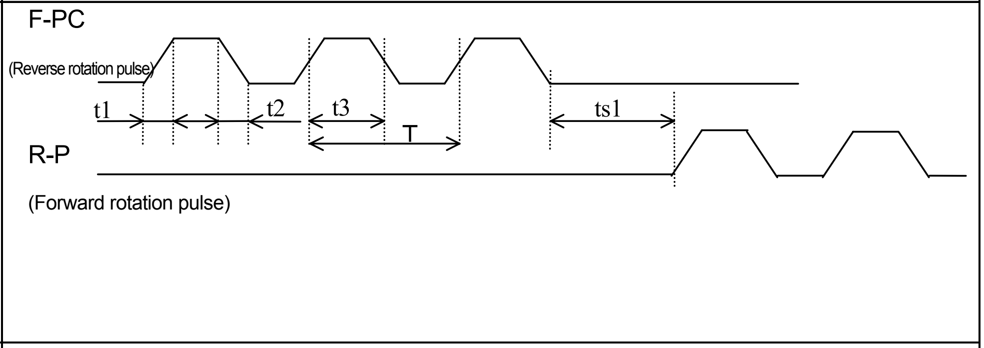
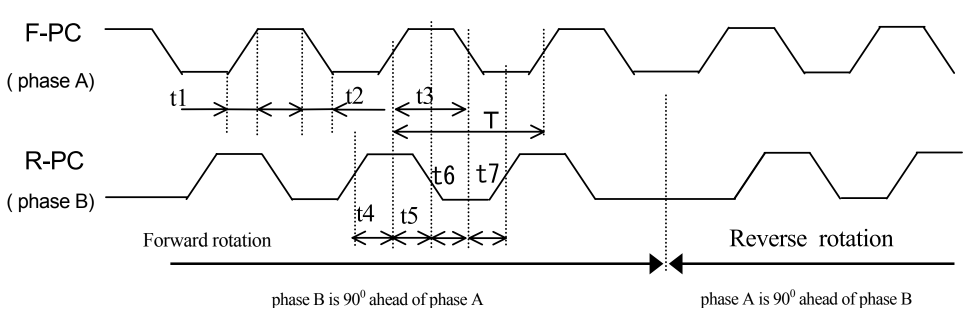
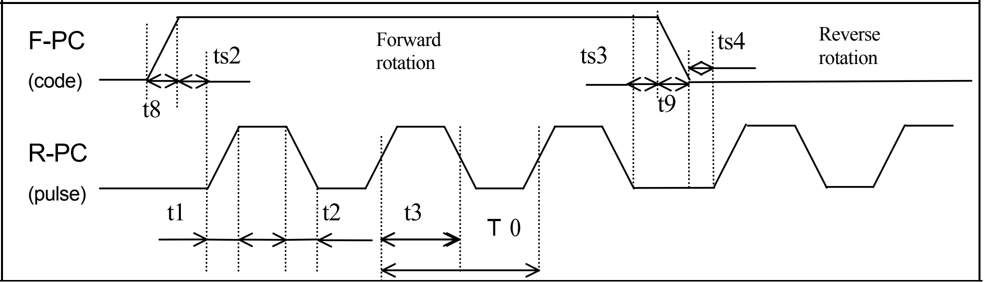
1) The base should be in multiples of 4 when 90^0 two-phase difference pulse string is entered.

2) Setting is enabled after turning the power supply control ON again.

10.1.5.3 Timing of command pulse

The timing of each command pulse is shown in the following figure.

Timing of command pulse

Command pulse	
Forward rotation pulse string + Reverse rotation pulse string	
90^0 two phase difference pulse	
Sign + pulse string	

	Forward rotation pulse + Reverse rotation pulse	90^0 two phase difference pulse	Code + pulse string
t1/t8	≦0.1 μs	≦0.1 μs	≦0.1 μs
t2/t9	≦0.1 μs	≦0.1 μs	≦0.1 μs
ts1/ts2 ts/ts4	>T	>T	>T
t4/t5/t6/t7	——	>250ns	——
(t3/T)x100	50%	50%	50%

The values shown above are valid when the Group3 PA300 position command pulse digital filter is set to “OH”. Refer to the next page for the position command pulse digital filter setting options.

10.1.5.4 Position command pulse digital filter setting

Position command pulse digital filter: Parameter Group 3 [PA300] Upper level

(**Refer to "Chapter 8", 8-39)**

If the minimum pulse width time is less than the selected value of the digital filter for position command input maximum frequency, the alarm "AL D2" will be issued. Select a value for the digital filter that is less than the minimum pulse width time for position command input maximum frequency. Select and set the digital filter setting for the position command pulse from the following contents, based on the command pulse mode of the device in use.

Forward rotation pulse string + Reverse rotation pulse string

PA300 lower rank	Minimum pulse width [t]	Position command input maximum frequency [f]
0H	t > 834 nsec	f < 599 Kpps
1H	t > 250 nsec	f < 2.0 Mpps
2H	t > 500 nsec	f < 1.0 Mpps
3H	t > 1.8 μsec	f < 277 Kpps
4H	t > 3.6 μsec	f < 138 Kpps
5H	t > 7.2 μsec	f< 69 Kpps
6H	t > 125 nsec	f< 4 Mpps
7H	t > 83.4 nsec	f < 5.9 Mpps

90^0 two phase difference pulse

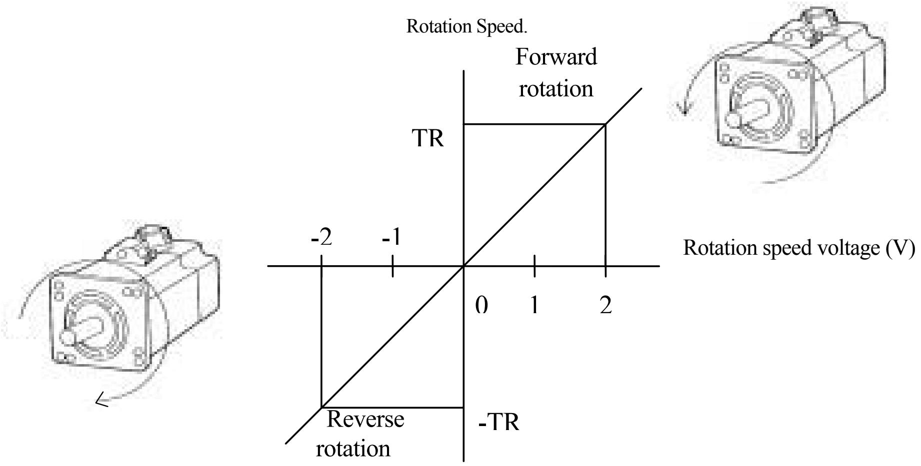
PA300 lower rank	Phase A /B Minimum edge interval [t]	Position command input maximum frequency [f]
0H	t > 834 nsec	f < 599 Kpps
1H	t > 250 nsec	f < 2.0 Mpps
2H	t > 500 nsec	f < 1.0 Mpps
3H	t > 1.8 μsec	f < 277 Kpps
4H	t > 3.6 μsec	f < 138 Kpps
5H	t > 7.2 μsec	f < 69 Kpps
6H	t > 164 nsec	f < 1.5 Mpps
7H	t > 164 nsec	f < 1.5 Mpps

Code + pulse string

PA300 lower rank	Minimum pulse width [t]	Position command input maximum frequency [f]
0H	t > 834 nsec	f < 599 Kpps
1H	t > 250 nsec	f < 2.0 Mpps
2H	t > 500 nsec	f < 1.0 Mpps
3H	t > 1.8 μsec	f < 277 Kpps
4H	t > 3.6 μsec	f < 138 Kpps
5H	t > 7.2 μsec	f < 69 Kpps
6H	t > 125 nsec	f < 4 Mpps
7H	t > 83.4 nsec	f < 5.9 Mpps

10.1.6 Velocity command input

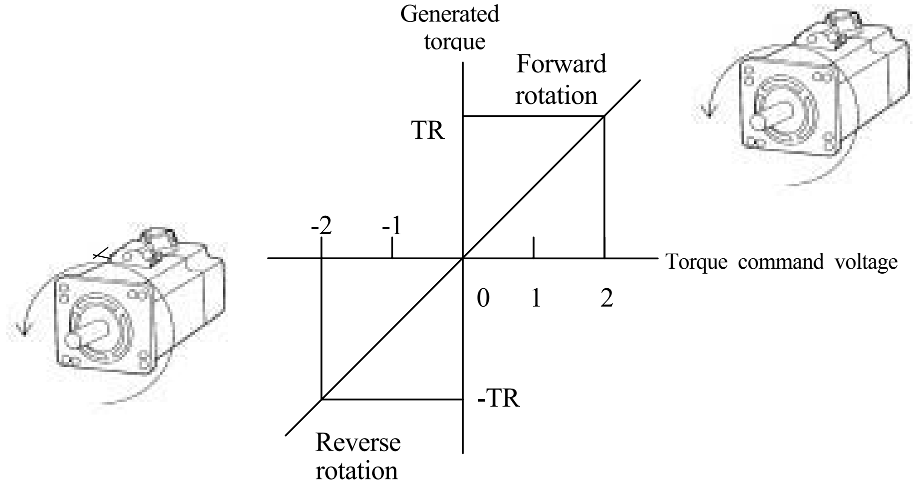
Velocity command and motor rotation speed characteristics are shown in the following figure. "Velocity command voltage" is the voltage to be input from Velocity command input terminals CN1-21 and 20. "Motor forward rotation (+)" is anticlockwise rotation, as seen from load side. The polarity can be changed by the Group 3 amplifier function Selection 302 parameter setting.



Velocity command-Characteristics of Rotation speed

10.1.7 Torque command input

The characteristics of torque command and motor generated torque are shown in the following figure. "Torque command voltage" is the voltage to be input from the torque command input terminal CN1-21 and 20. "Motor normal torque (+)" is the torque generated in an anticlockwise direction as seen from the load side. The polarity can be changed by the Group 3 amplifier function selection 302 parameter setting.



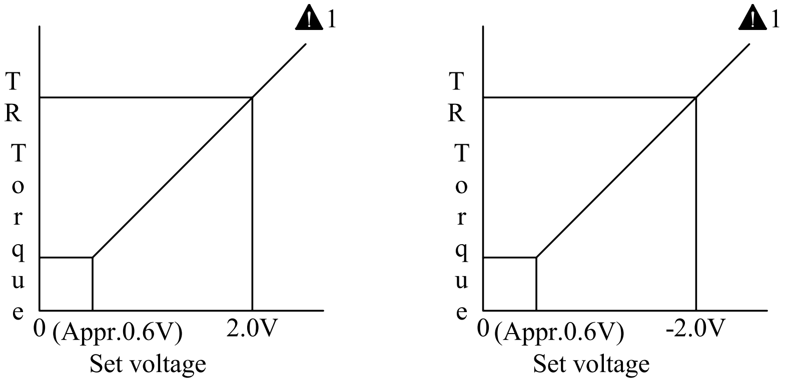
Torque command — Generated torque

When the velocity command voltage is less than +mV, the motor lock current may pulsate. If this becomes problematic, decrease the current pulsation by increasing the velocity command scale (VCGN).

10.1.8 External torque restricted input

It is possible to externally restrict the forward rotation drive torque and reverse rotation drive torque independently. Thetorque limit scale is 2V/ rated torque (TR) in applicable motors. While using the external torque limit, select the input method in amplifier function setting 303. (Refer to 'Chapter 8, Explanation of Parameters' for details.)

The relationship between the voltage value and the torque limit value is shown in the following figure.



(a)Forward rotation torque limit (F-TLA)

(b)Reverse rotation torque limit (R-TLA) (When polarity is set to minus)

Set voltage and torque limit value.

1 When settings exceeding the instantaneous maximum stall torque (Tp) of the servo motor are entered, they are saturated in Tp.

2 To lock the motor by means of a bump stop through applying an external torque limit, the torque limit value must be below the rated torque.

10.1.9 Torque compensation input.

For torque compensation input and motor generated torque characteristics, refer to the figure above (the same as torque command input for torque control type).

To input the torque compensation voltage, use torque compensation input terminals CN1-22 and 23.

This input is effective in speeding up acceleration time or for quadrant switching.

10.1.10 Power capacity

The following table shows input power capacity and recommended wiring tools for the rated output under load.

Power Capacity and Wiring Tool Examples

Input voltage	Amplifier volume	Motor model number	Rated output(W	Main circuit power supply (KVA) During rating	Power supply control (VA)	Circuit breaker	Noise filter (EMC Corresponding time)	electromagnetism contactor	Main circuit Electric wire diameter	Power supply control Line diameter
AC 200V	QS1A01	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 1.25mm^2	AGW16 Or 1.25mm^2
		Q1AA04005 D	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						
	QS1A03	Q1AA06040D	400	1.0	30	NF30 Shape 10A			AWG14 or 2mm^2	
		Q1AA07075D	750	1.7						
		Q2AA07040D	400	1.3						
		Q2AA07050D	500	1.5						
		Q2AA08050D	500	1.5						
		Q2AA13050H	500	1.4						
	QS1A05	Q1AA10100D	1k	2.5	30	NF30 Shape 15A			AWG12 or 3.5mm^2	
		Q1AA10150D	1.5k	3.0						
		Q1AA12100D	1k	2.5						
		Q2AA08075D	750	2.0						
		Q2AA08100D	1k	2.5						
		Q2AA10100H	1k	2.5						
		Q2AA10150H	1.5k	3.0						
		Q2AA13100D	1k	2.5						
		Q2AA13150D	1.5k	3.0						
	QS1A10	Q1AA10200D	2k	4.0	30	NF50 Shape 30A	RF3020 -DLC	S-N18	AWG10 or 5.5mm^2	
		Q1AA10250D	2.5k	4.2						
		Q1AA12200D	2k	4.0						
		Q1AA12300D	3k	5.0						
		Q1AA13300D	3k	5.0						
		Q2AA13200H	2k	5.0						
		Q2AA18200H	2k	5.0						
		Q2AA22250H	2.5k	5.9						
	QS1A15	Q1AA13400D	4k	6.7	30	NF50 Shape 50A	RF3030 -DLC 3SUP-HK30 -ER-6B Manufactured by Okaya Ltd.	S-N35	AWG8 or 8mm^2	
		Q1AA13500D	5k	8.3						
		Q1AA18450M	4.5k	7.4						
		Q2AA18350H	3.5k	6.9						
		Q 2AA18450H	4.5k	7.4						
		Q 2AA18550R	5.5k	8.4						
		Q 2AA22350H	3.5k	7.4						
		Q 2AA22450R	4.5k	8.4						
		Q 2AA22550 B	5.5k	10.1						
		Q 2AA22700S	7k	12.2		NF100 Shape 75A	3SUP-HK50 -ER-6B FS5559-35-33	S-N50		
AC 100V	QS1E01	Q1EA04003D	30	0.2	30	NF30 Shape 10A Manufactured by Mitsubishi Ltd.	RF3010 -DLC Manufactured by RASUMI	S-N10 Manufactured by Mitsubishi Ltd.	AWG16 or 1.25mm^2	
		Q1EA04005D	50	0.3						
		Q1EA04010D	100	0.5						
		Q2EA04006D	60	0.3						
		Q2EA04010D	100	0.5						
		Q2EA05005D	50	0.3						
		Q2EA05010D	100	0.5						
	QS1E03	Q1EA06020D	200	0.5	30				AWG14or 2mm^2	

Incoming current values:

Incoming current

Input voltage	Amplifier model name	Control circuit (Maximum value between 1ms after input)*3	Main circuit (Maximum value between 1.2 seconds after input)
AC 200V	QS1A015	40A (0-P)	18A (0-P)*1
	QS1A030	40A (0-P)	18A (0-P)*1
	QS1A050	40A (0-P)	18A (0-P)*1
	QS1A100	40A (0-P)	18A (0-P)*1
	QS1A150	40A (0-P)	18A (0-P)*1
	QS1A300	40A (0-P)	18A (0-P)*1
AC 100V	QS1 E015	20A (0-P)	9A (0-P)*2
	QS1 E030	20A (0-P)	9A (0-P)*2

1) The incoming current value is at its maximum when AC230V is supplied.

2) The incoming current value is at its maximum when AC115V is supplied.

3) Use a 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.

10.1.11 Servo amplifier motor current leakage

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.

Electric current leakage

Motor model number	Amplifier model number	Electric current leakage per motor
Q 1 AA □□□□□□◇▽▽ Q2 AA □□□□□□◇▽▽	QS 1 (01, 03)	0.5mA
	QS 1 (05)	1.5 mA
	QS 1 (10, 15)	3 mA

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 2mm 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).

10.1.12 Calorific value

The calorific value under the rated load is shown in the following table.

Calorific value list table

nput voltage	Amplifier capacity	Motor model number	Total calorific value of Servo amplifier (W)
AC 200 V	QS 1 A 01	Q1AA 04003D	11
		Q1AA 04005D	15
		Q1AA 04010D	18
		Q1AA06020D	24
		Q2AA04006D	12
		Q2AA04010D	19
		Q2AA05005D	16
		Q2AA05010D	19
		Q2AA05020D	26
		Q2AA07020D	32
		Q2AA07030D	32
	QS 1 A 03	Q1AA06040D	44
		Q1AA07075D	66
		Q2AA07040D	45
		Q2AA07050D	62
		Q2AA08050D	55
		Q2AA13050H	65
	QS 1 A 05	Q1AA10100D	47
		Q1AA10150D	61
		Q1AA12100D	47
		Q2AA08075D	43
		Q2AA08100D	45
		Q2AA10100H	50
		Q2AA10150H	62
		Q2AA13100D	58
		Q2AA13150D	63
	QS 1 A 10	Q1AA10200D	111
		Q1AA10250D	116
		Q1AA12200D	101
		Q1AA12300D	123
		Q1AA13300D	125
		Q2AA13200H	93
		Q2AA18200H	101
		Q2AA22250H	137
	QS 1 A 15	Q1AA13400D	146
		Q1AA13500D	169
		Q1AA18450M	160
		Q2AA18350H	138
		Q2AA18450H	154
		Q2AA18550R	201
		Q2AA22350H	137
		Q2AA22450R	150
		Q2AA22550B	191
		Q2AA22700S	222
AC 200 V	QS 1 E 01	Q1E04003D	16
		Q1EA04005D	22
		Q1EA04010D	27
		Q2EA04006D	21
		Q2EA04010D	26
		Q2EA05005D	22
		Q2EA05010D	31
	QS 1 E 03	Q1EA06020D	51
		Q2EA05020D	43
		Q2EA07020D	49

1) Because heat generation of the built-in regeneration resistance is not included in the values given in this table, it may be necessary to add it (if needed).
2) If using external regeneration resistance, modify the added of calorific value of external regeneration resistance based on the place where it is installed.
3) Be sure to carefully follow the installation method outlined in “Section 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℃	
Storage Temperature	-20 ～ + 65℃	
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	

⚠

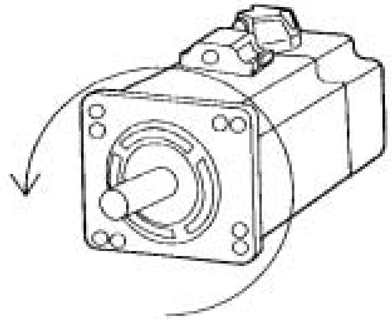
Conforms to IP67 by using a waterproof connector, conduit, shell, clamp, etc.

10.2.2 Rotation Direction Specifications

The rotation characteristics for the servo motor and encoder are explained in this section.

(1) Servo Motor

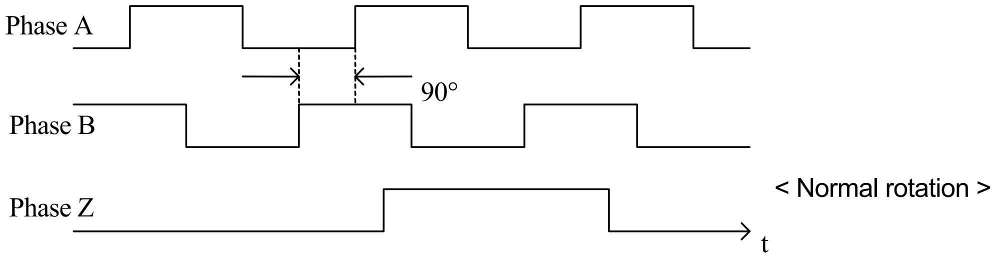
When a command to increase the position command is entered, the servo motor rotates in a counterclockwise direction from the load side (Normal rotation).



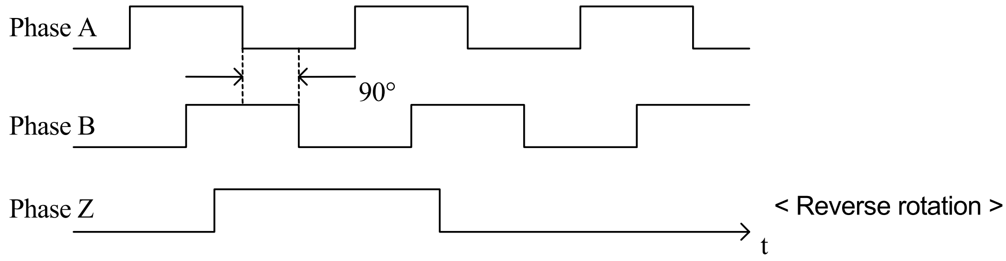
Rotation direction during normal motor operation

(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

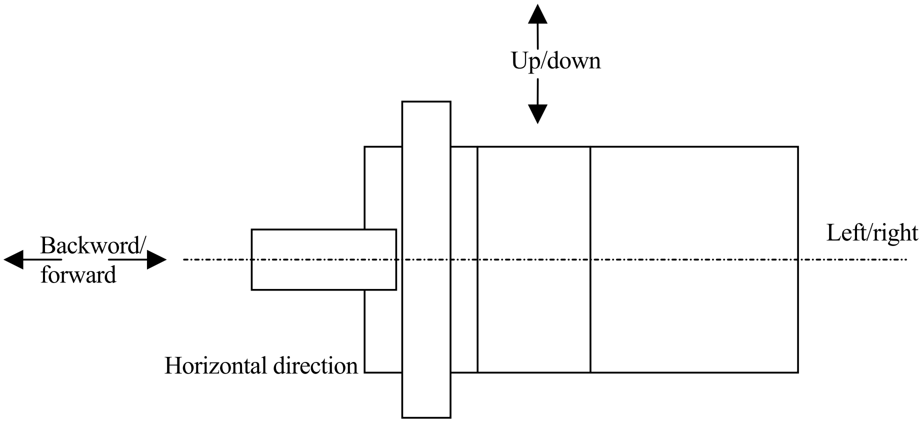
Normal (forward) rotation: Position data incremental output

Reverse rotation: Position data decreased output

10.2.3 Mechanical Specifications of the Motor

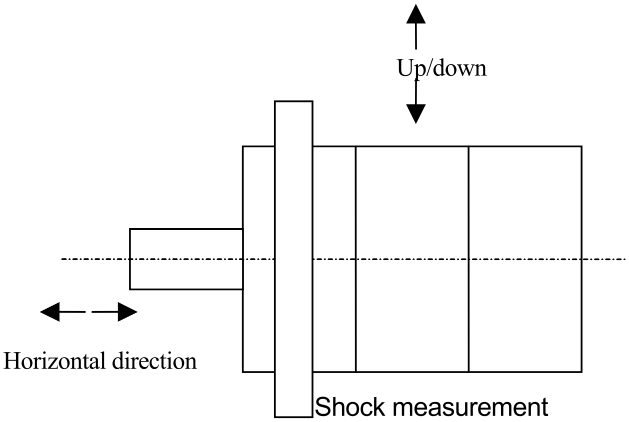
(1) Vibration Resistance

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.



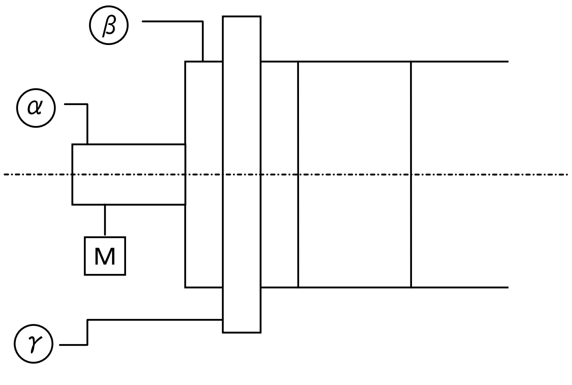
(2) Shock Resistance

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.



(3) Working Accuracy

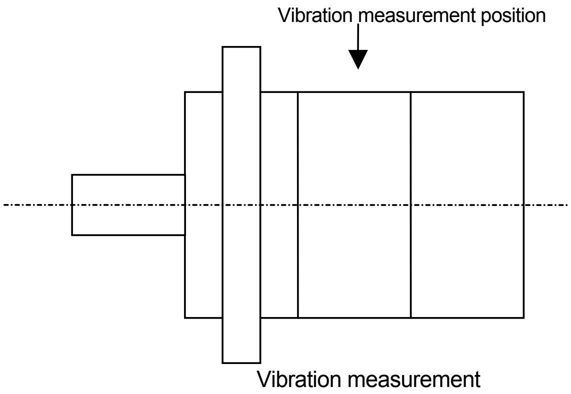
The following table shows the accuracy of the servo motor output shaft and precision (Total Indicator Reading) of the parts surrounding the shaft.

Items	* 1 T.I.R.	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.



(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
Q1AA18○○○☐	AC2368E0
Q2AA04○○○☐	None
Q2AA05○○○☐	AC0382A0
Q2AA07○○○☐	AC0687A0
Q2AA08○○○☐	AC0875A0
Q2AA10○○○☐	AC1306E0
Q2AA13○○○☐	AC1677E1
Q2AA18○○○☐	AC2368E0
Q2AA18550☐	AC2651A8
Q2AA22○○○☐	AC2368E0
Q2AA22550, 700☐	AC3152E0

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

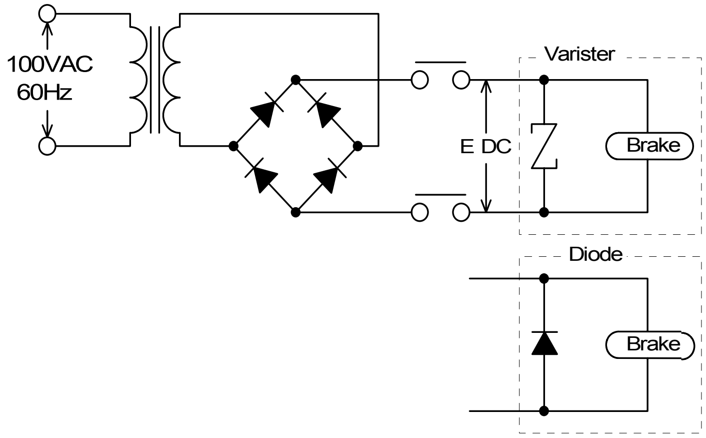
Model		Static friction torque N.m	Release time msec	Braking delay time msec	
				Varistor	Diode
Q1	Q1AA04003D	0.098	25	15	100
	Q1AA04005D	0.157			
	Q1AA04010D	0.320			
	Q1AA06020D	0.637	30	20	120
	Q1AA06040D	1.274			
	Q1AA07075D	2.38	40	20	200
	Q1AA10100D	3.92	40	30	120
	Q1AA10150D	7.84	100	30	140
	Q1AA10200D	7.84			
	Q1AA10250D	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
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

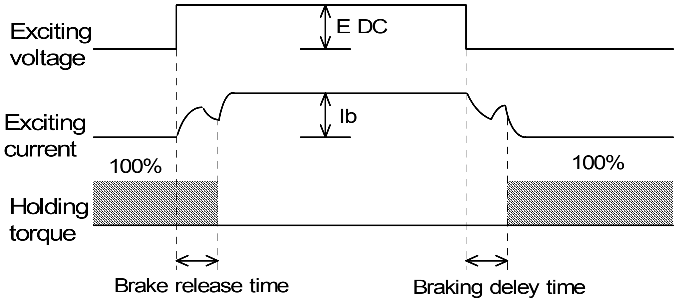
	Q2AA13150 H	9.0	100	30	140
	Q2AA13200 H	12.0			
	Q2AA18200 H	12.0	100	30	140
	Q2AA18350 H	32.0	120	40	150
	Q2AA18450 H	32.0	150	40	250
	Q2AA18550R	54.9	300	140	400
	Q2AA22250 H	32.0			
	Q2AA22350 H	32.0			
	Q2AA22450 H	32.0			
	Q2AA22550B	90.0			
	Q2AA22700S	90.0			

100 V Specifications

Model		Static friction torque N.m	Release time msec	Braking delay time msec	
				Varistor	Diode
Q1	Q1EA04003D	0.098	25	15	100
	Q1EA04005D	0.157			
	Q1EA04010D	0.32			
	Q1EA06020D	0.637	30	20	120
Q2	Q2EA04006D	0.191	25	15	100
	Q2EA04010D	0.319			
	Q2EA05005D	0.167	15	10	100
	Q2EA05010D	0.353			
	Q2EA05020D	0.353			
	Q2EA07020D	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	$K_{E\phi}$	mV/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				
Servo Amplifier model QS1☐			15*	15*	15*				
*Rated output	P_R	kW	4	5	4.5				
*Rated rotation speed	N_R	min^{-1}	3000	3000	1500				
*Maximum rotation speed	N_{max}	min^{-1}	4500	4500	1500				
*Rated torque	T_R	N·m	12.7	15.7	28.5				
*Continuous stall torque	T_S	N·m	14.7	18.1	31.6				
*Peak torque	T_P	N·m	39.2	47.6	105				
*Rated current	I_R	Arms	23.4	25.8	24.8				
*Continuous stall current	I_S	Arms	26.4	27.5	24.8				
*Peak current	I_P	Arms	83	83	83				
Torque constant	K_T	N·m/Arms	0.612	0.724	1.37				
Voltage constant for each phase	$K_{E\phi}$	mV/min^{-1}	21.4	25.3	47.7				
Phase resistance	R_ϕ	Ω	0.0478	0.0461	0.0838				
*Rated power rate	Q_R	kW/s	251	291	295				
Inertia (Including Wiring INC)	J_M	kg·m^2(GD^2/4) ×10-4	6.43	8.47	27.5				
Aluminium plate		mm	t20×470	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 constan 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

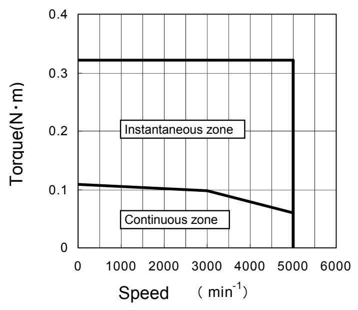
Servo Motor model Q2EA			04006D	04010D	05005D	05010D	05020D	07020D	
Servo Amplifier model QS1☐			01*	01*	01*	01*	03*	03*	
*Rated output	P_R	kW	0.06	0.1	0.05	0.1	0.2	0.2	
*Rated rotation speed	N_R	min^{-1}	3000	3000	3000	3000	3000	3000	
*Maximum rotation speed	N_{max}	min^{-1}	5000	5000	5000	5000	5000	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.

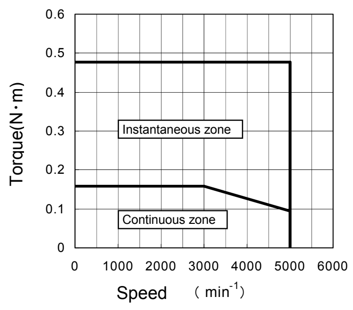
Speed – torque characteristics

Q1AA04003D（30W）



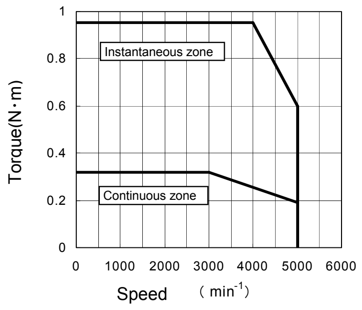
Speed – torque characteristics

Q1AA04005D（50W）



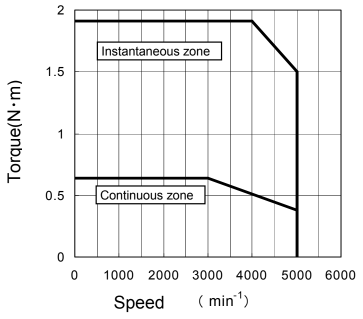
Speed – torque characteristics

Q1AA04010D（100W）



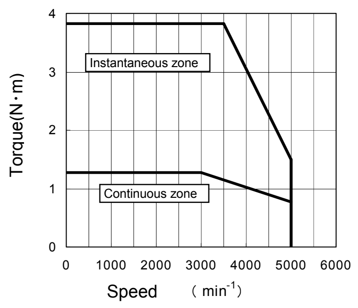
Speed – torque characteristics

Q1AA06020D（200W）



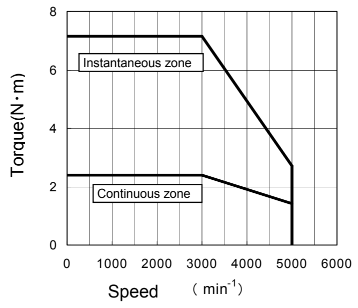
Speed– torque characteristics

Q1AA06040D（400W）



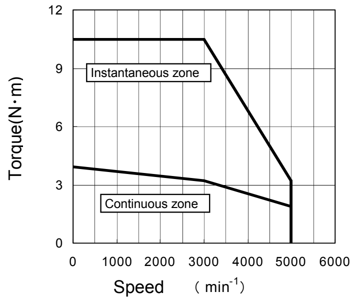
Speed– torque characteristics

Q1AA07075D（750W）



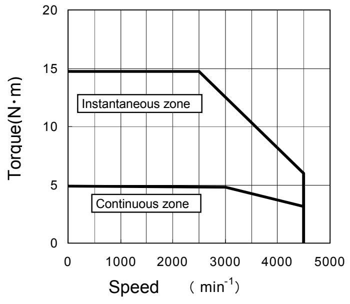
Speed – torque characteristics

Q1AA10100D（1kW）



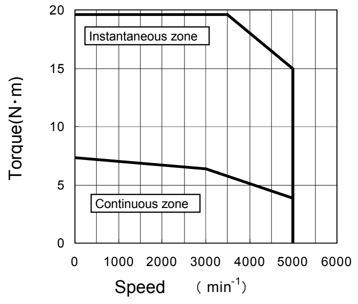
Speed – torque characteristics

Q1AA10150D（1.5kW）



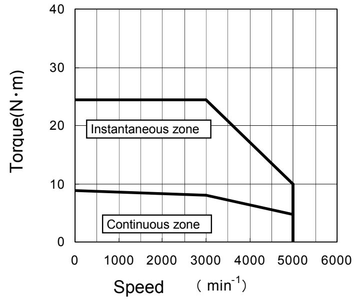
Speed – torque characteristics

Q1AA10200D（2kW）



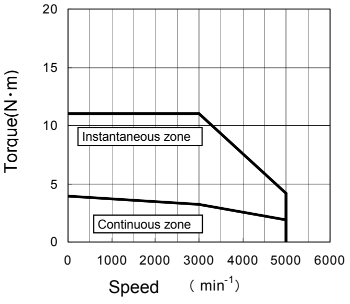
Speed – torque characteristics

Q1AA10250D（2.5kW）



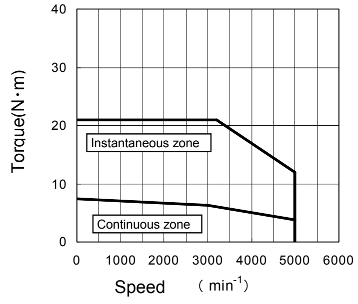
Speed – torque characteristics

Q1AA12100D（1kW）



Speed – torque characteristics

Q1AA12200D（2kW）

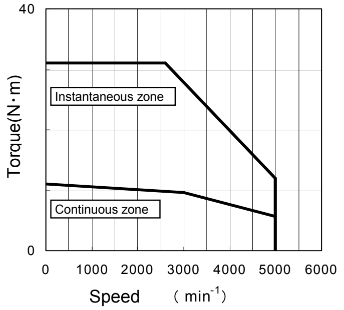


10 Specifications

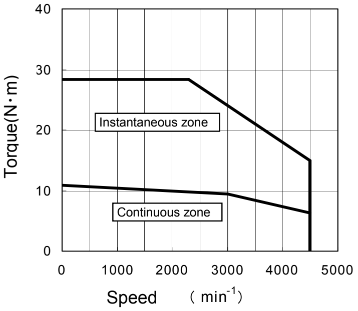
Q1AA Motor speed-torque characteristics indicate the values in combination with operation amplifier for 3 phase when amplifier power supply is AC200V. Instant domain decreases when amplifier power supply is below 200V.

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.

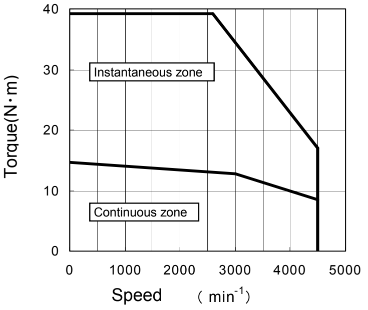
Speed – torque characteristics
Q1AA12300D（3kW）



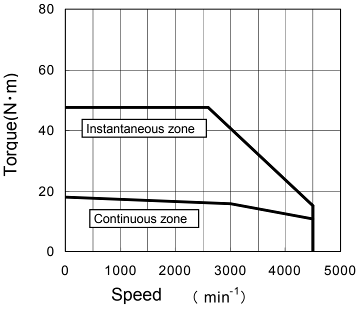
Speed – torque characteristics
Q1AA13300D（3kW）



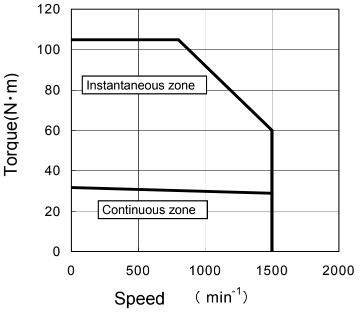
Speed – torque characteristics
Q1AA13400D（4kW）



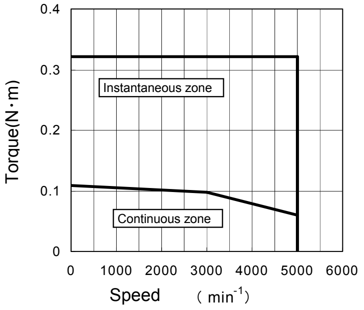
Speed – torque characteristics
Q1AA13500D（5kW）



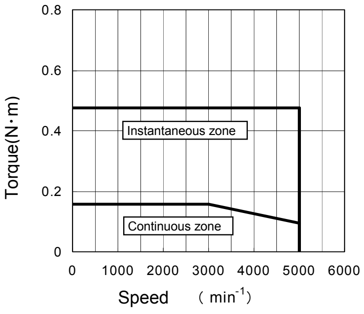
Speed – torque characteristics
Q1AA18450M（4.5kW）



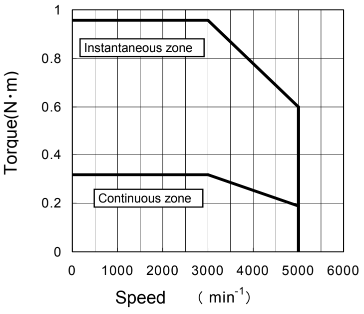
Speed – torque characteristics
Q1EA04003D（30W）



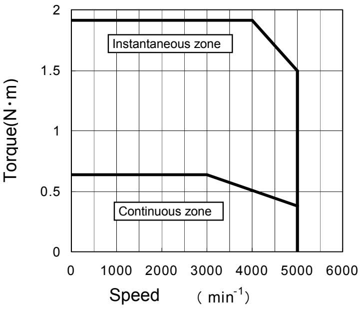
Speed – torque characteristics
Q1EA04005D（50W）



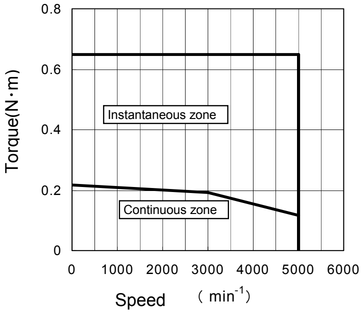
Speed – torque characteristics
Q1EA04010D（100W）



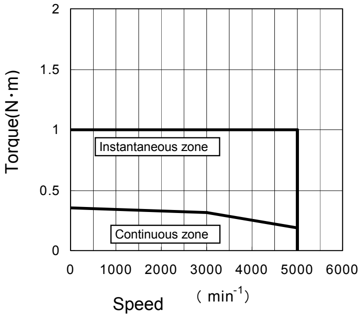
Speed – torque characteristics
Q1EA06020D（200W）



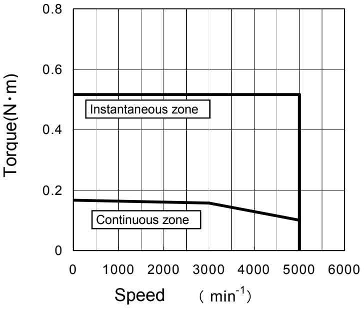
Speed – torque characteristics
Q2AA04006D（60W）



Speed – torque characteristics
Q2AA04010D（100W）



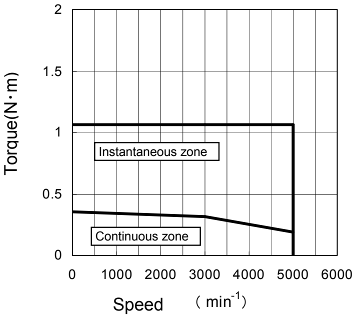
Speed – torque characteristics
Q2AA05005D（50W）



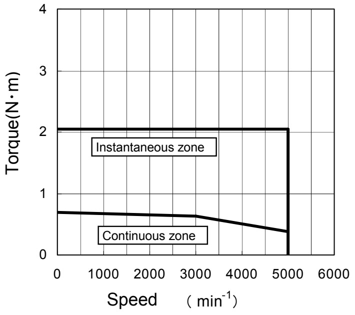
10 Specifications

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.

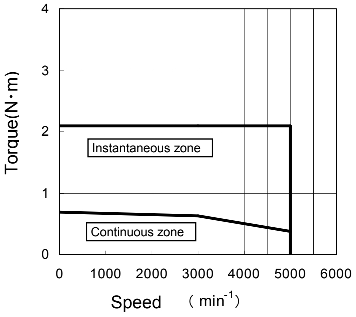
Speed – torque characteristics
Q2AA05010D（100W）



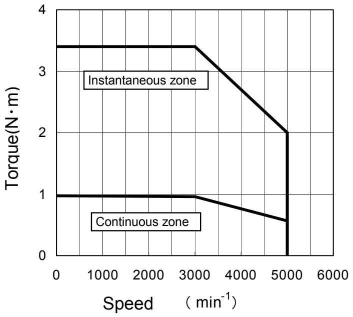
Speed – torque characteristics
Q2AA05020D（200W）



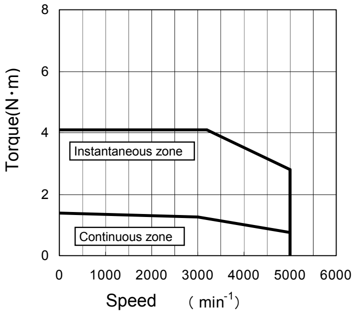
Speed – torque characteristics
Q2AA07020D（200W）



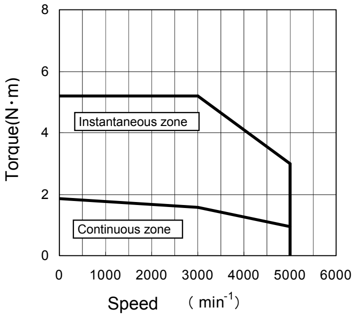
Speed – torque characteristics
Q2AA07030D（300W）



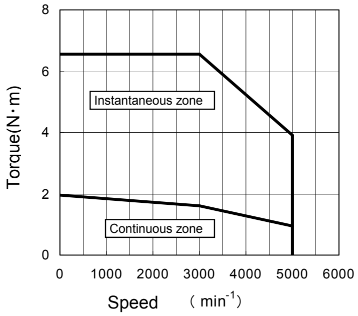
Speed – torque characteristics
Q2AA07040D（400W）



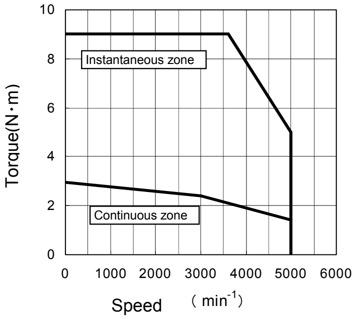
Speed – torque characteristics
Q2AA07050D（500W）



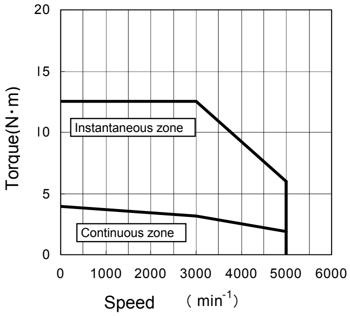
Speed – torque characteristics
Q2AA08050D（500W）



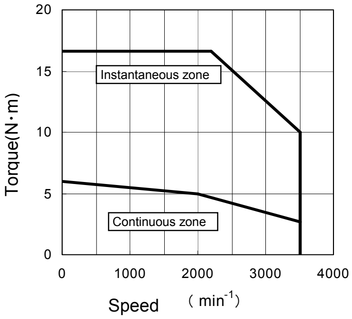
Speed – torque characteristics
Q2AA08075D（750W）



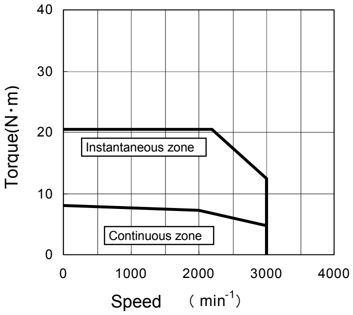
Speed – torque characteristics
Q2AA08100D（1kW）



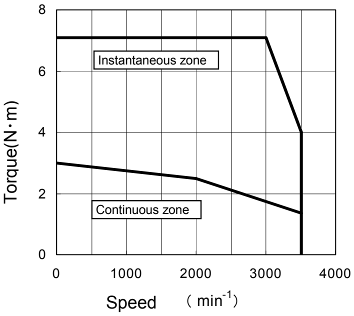
Speed – torque characteristics
Q2AA10100H（1kW）



Speed – torque characteristics
Q2AA10150H（1.5kW）



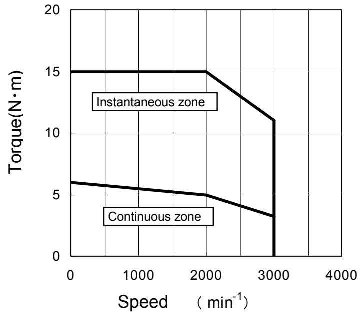
Speed – torque characteristics
Q2AA13050H（500W）



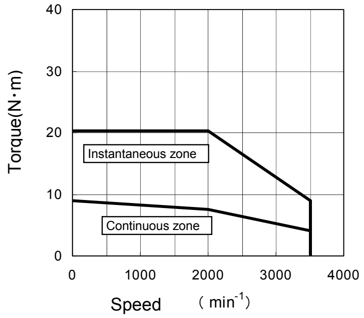
10 Specifications

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.

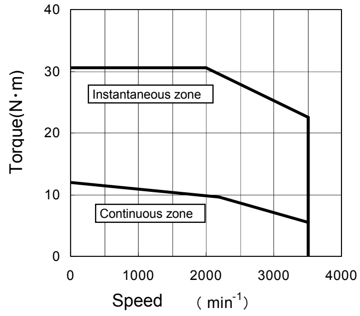
Speed – torque characteristics
Q2AA13100H（1kW）



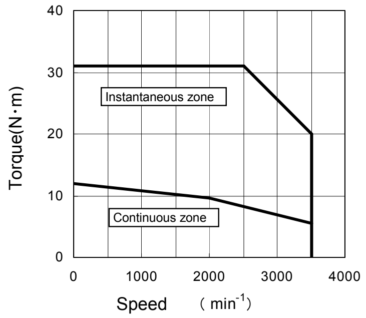
Speed – torque characteristics
Q2AA13150H（1.5kW）



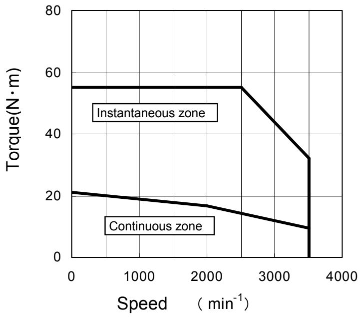
Speed – torque characteristics
Q2AA13200H（2kW）



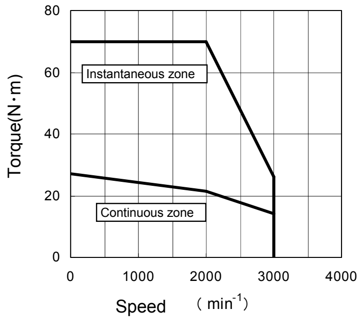
Speed – torque characteristics
Q2AA18200H（2kW）



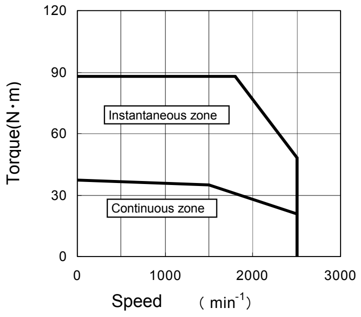
Speed – torque characteristics
Q2AA18350H（3.5kW）



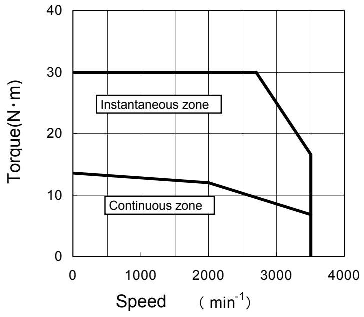
Speed – torque characteristics
Q2AA18450H（4.5kW）



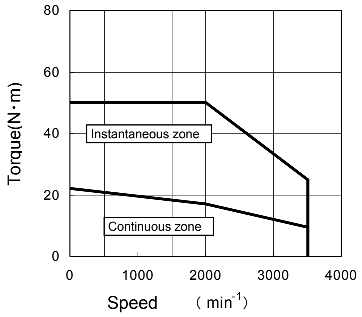
Speed – torque characteristics
Q2AA18550R（5.5kW）



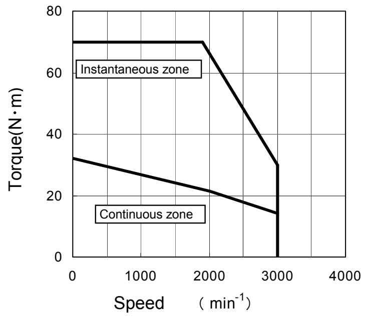
Speed – torque characteristics
Q2AA22250H（2.5kW）



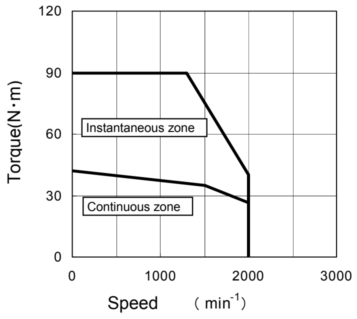
Speed – torque characteristics
Q2AA22350H（3.5kW）



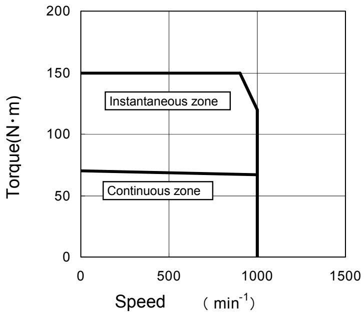
Speed – torque characteristics
Q2AA22450H（4.5kW）



Speed – torque characteristics
Q2AA22550B（5.5kW）



Speed – torque characteristics
Q2AA22700S（7kW）

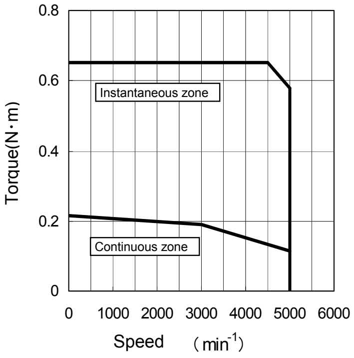


10 Specifications

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.

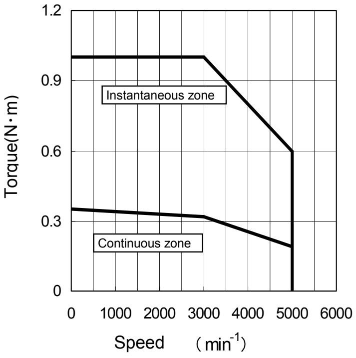
Speed – torque characteristics

Q2EA04006D (60W)



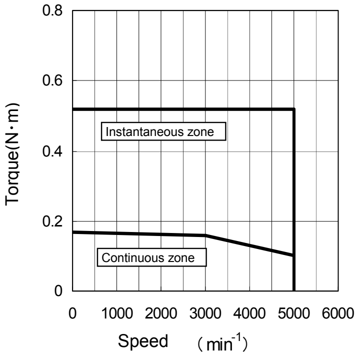
Speed – torque characteristics

Q2EA04010D (100W)



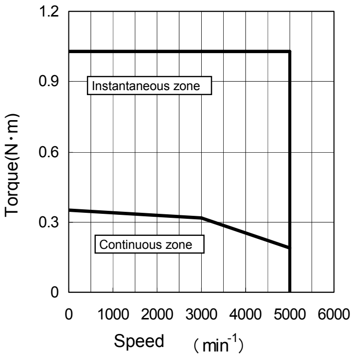
Speed – torque characteristics

Q2EA05005D (50W)



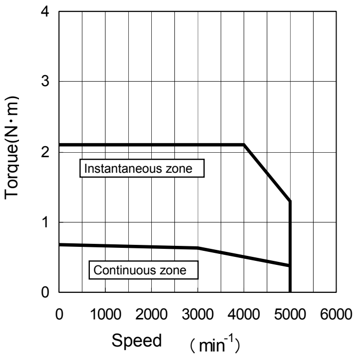
Speed – torque characteristics

Q2EA05010D (100W)



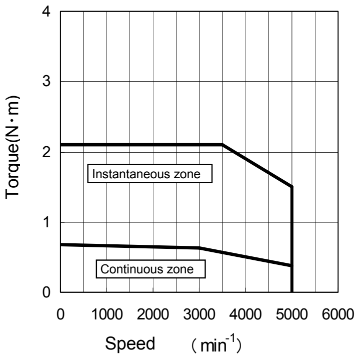
Speed – torque characteristics

Q2EA05020D (200W)



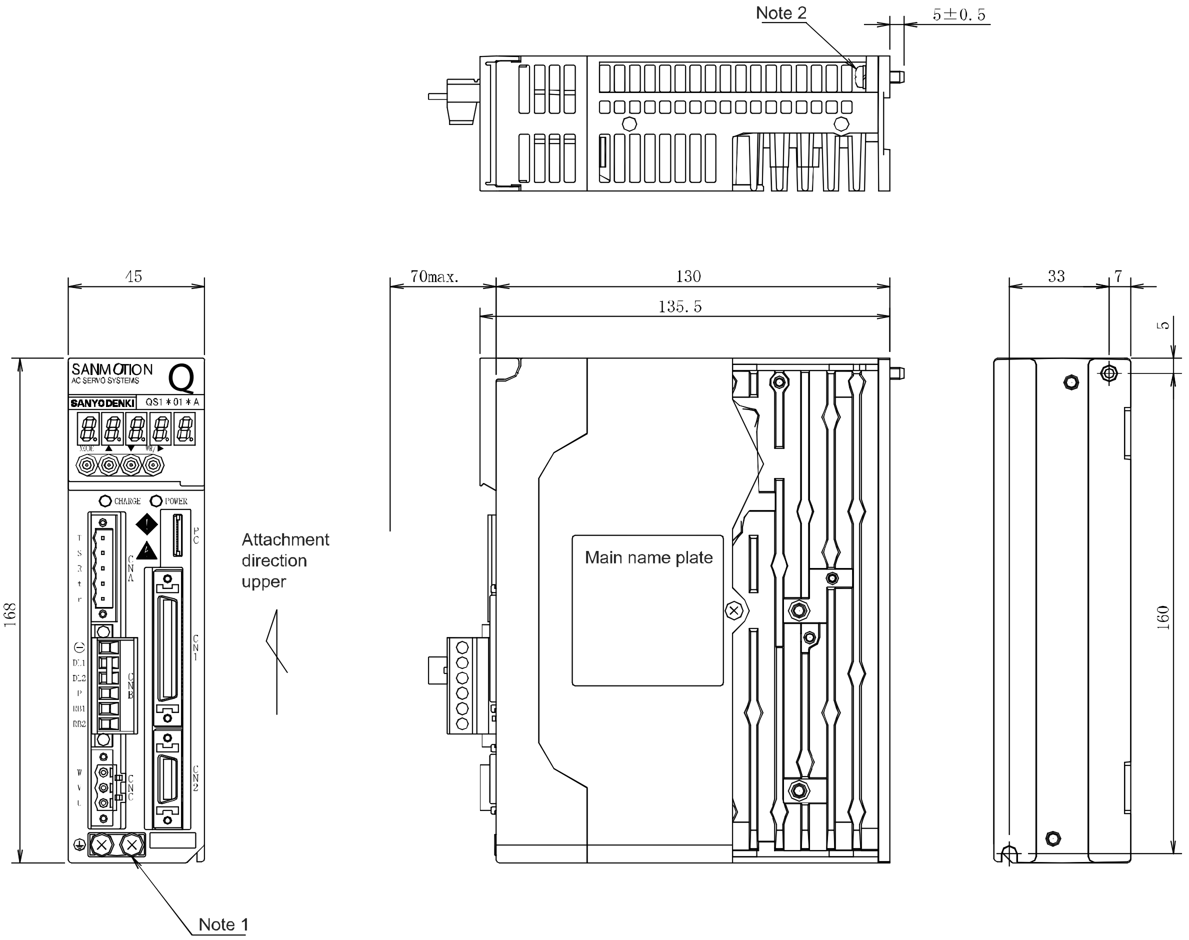
Speed – torque characteristics

Q2EA07020D (200W)

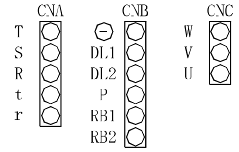


10.3.1 External appearance diagram of servo amplifier

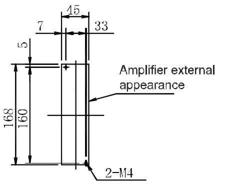
Servo amplifier: QS1A01



Terminal symbol arrangement (from top)

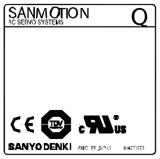


Note 1 Earthing terminal screw M4
Control torque 1.18N.m
Note 2 Attachment panel
processing diagram



Upper part is fixed by the special screw attached.

Note 3 Main name plate

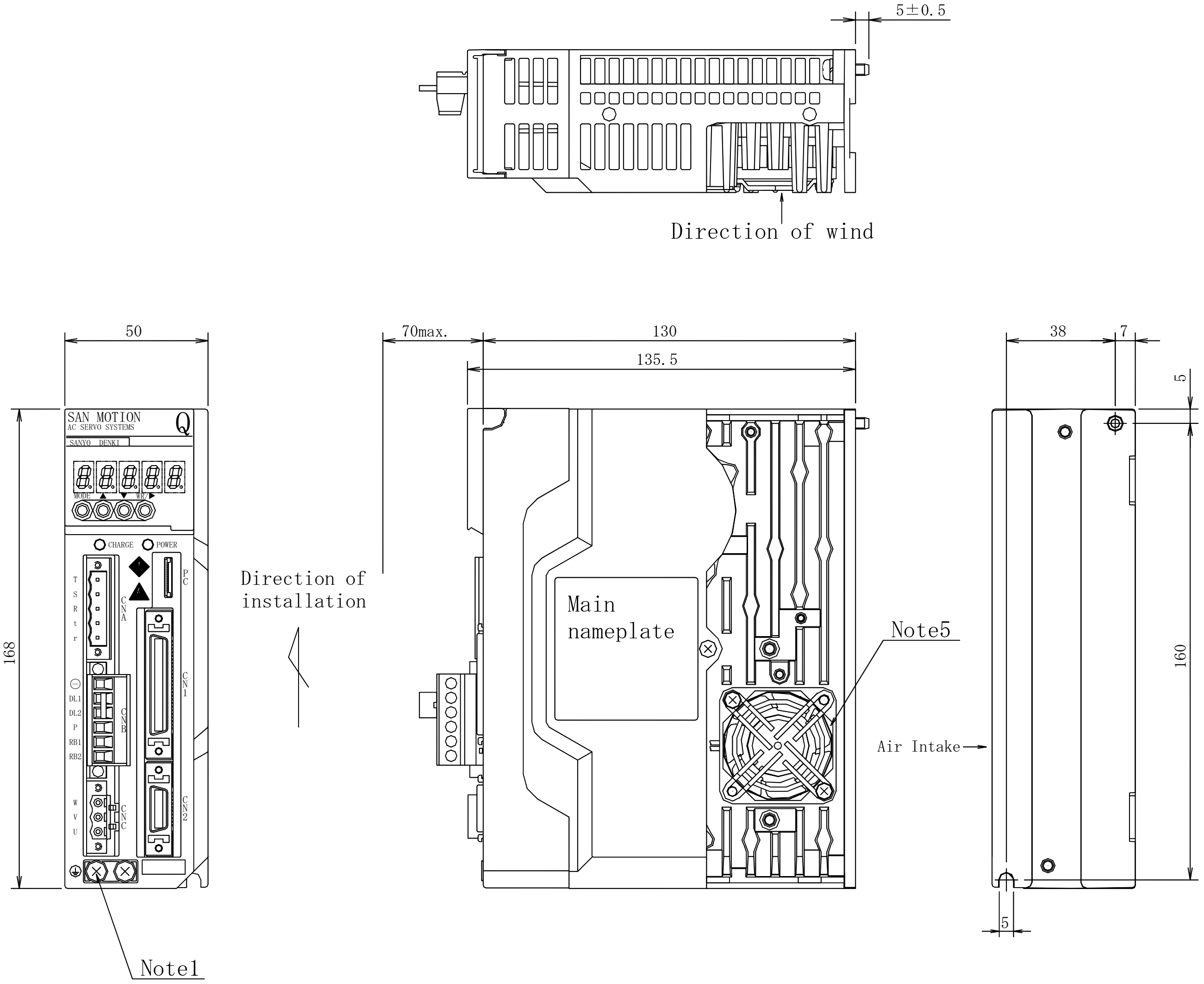


Main name plate may change the design as per the standard acquisition

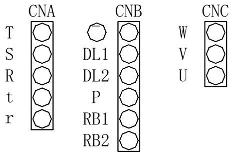
Note 4 Main Case Resin

Weight: 1.25kg

Servo amplifier: QS1A03

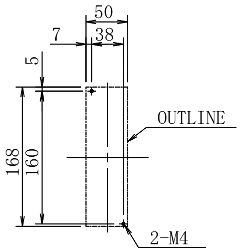


Terminal Layout



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)

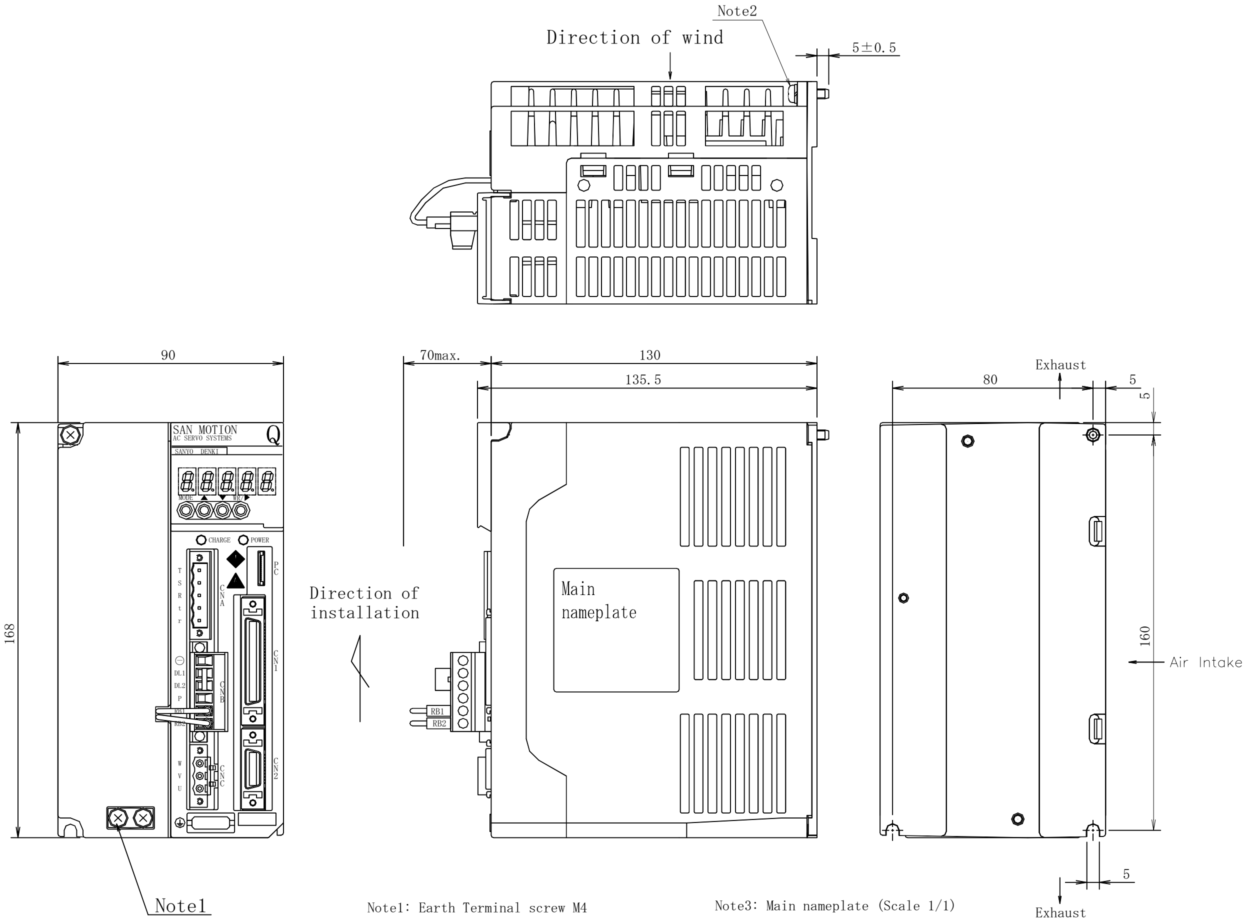
Main nameplate would be changed on the case of standard acquisition

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

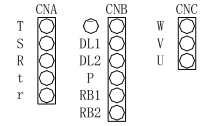
Servo amplifier: QS1A05



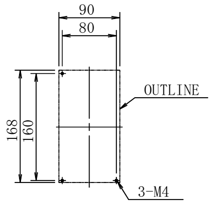
Note1: Earth Terminal screw M4
Tightening torque 1.18N.m

Note3: Main nameplate (Scale 1/1)

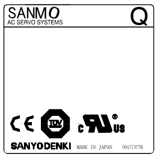
Terminal Layout



Note2: Mounting panel working drawing



Use the enclosed and specified screws for settling.



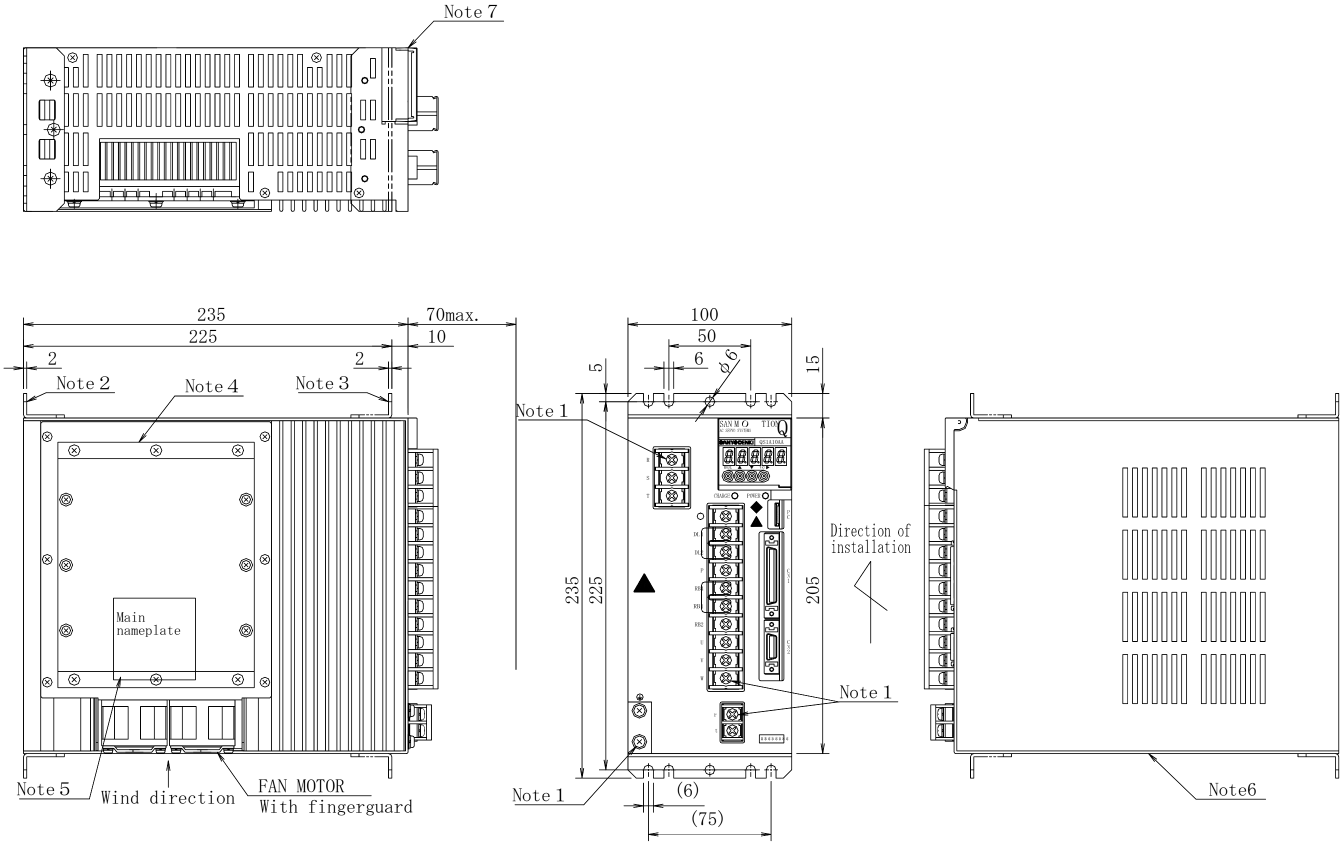
Main nameplate would be changed on the case of standard acquisition

Note4: Main body material
: ABS Resin

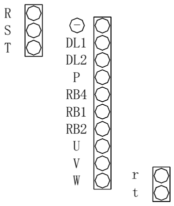
Note5: Keep air space more than
10mm in front of the intake
and the exhaust.

Weight : 2.2 kg

Servo amplifier: QS1A10

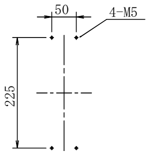


Terminal Layout

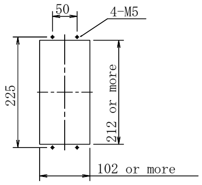


Note1, Terminal screw M4
Tightening torque 1.18N・m

Note2, Mounting panel working drawing
(in case of rear-side-mounting)

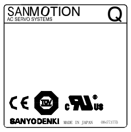


Note3, Mountable on the front side
(Mounting panel woking drawing)



Note4. Regenerative resistance

Note5.Main nameplate(left side)



Scale 1/1

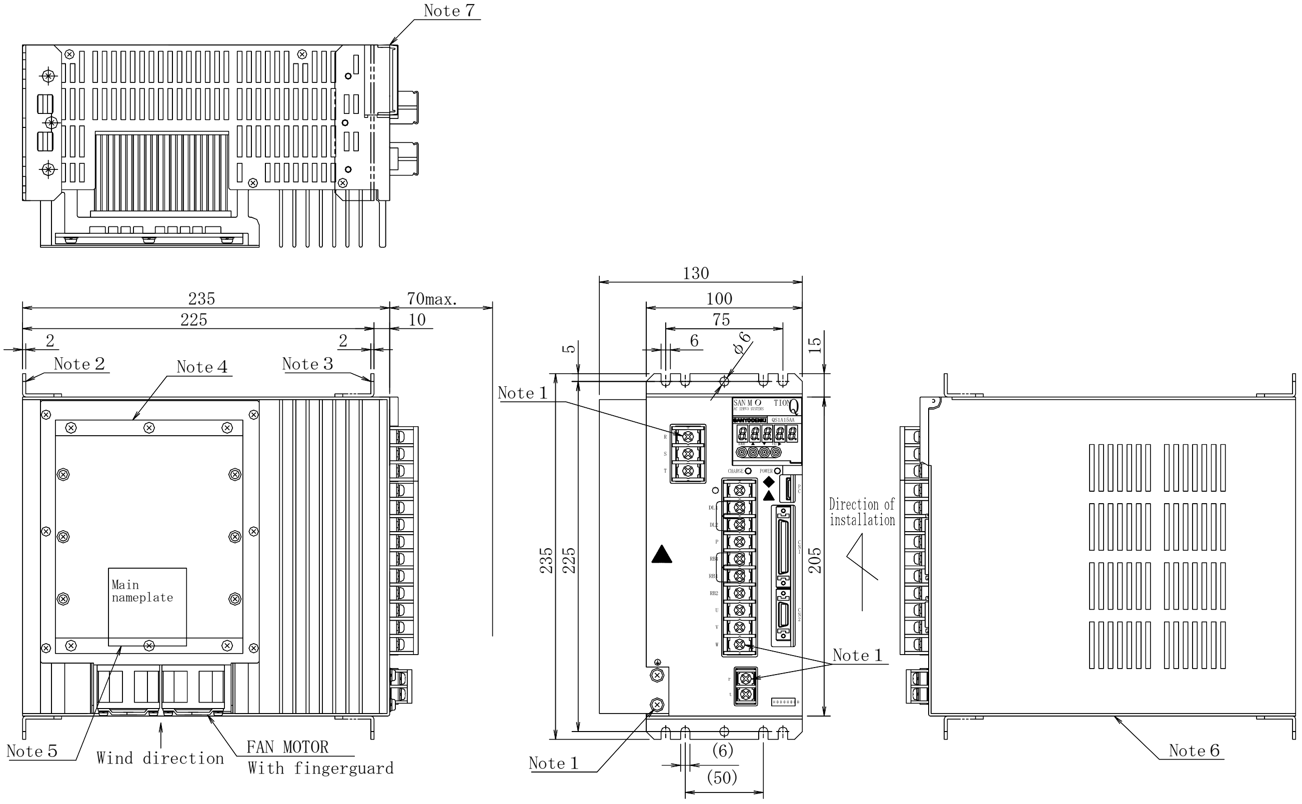
Main nameplate would be changed
on the case of standard acquisition

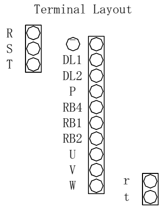
Note6. Main body material : SECC/coating

Note7. Caver material : ABS Resin

Weight : 5.5 kg

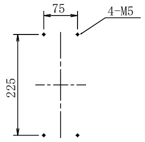
Servo amplifier: QS1A15



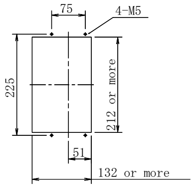


Note1, Terminal screw M4
Tightening torque 1.18N・m

Note2, Mounting panel working drawing
(in case of rear-side-mounting)

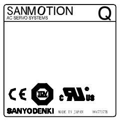


Note3, Mountable on the front side
(Mounting panel woking drawing)



Note4, Regenerative resistance

Note5, Main nameplate(left side)



Scale 1/1

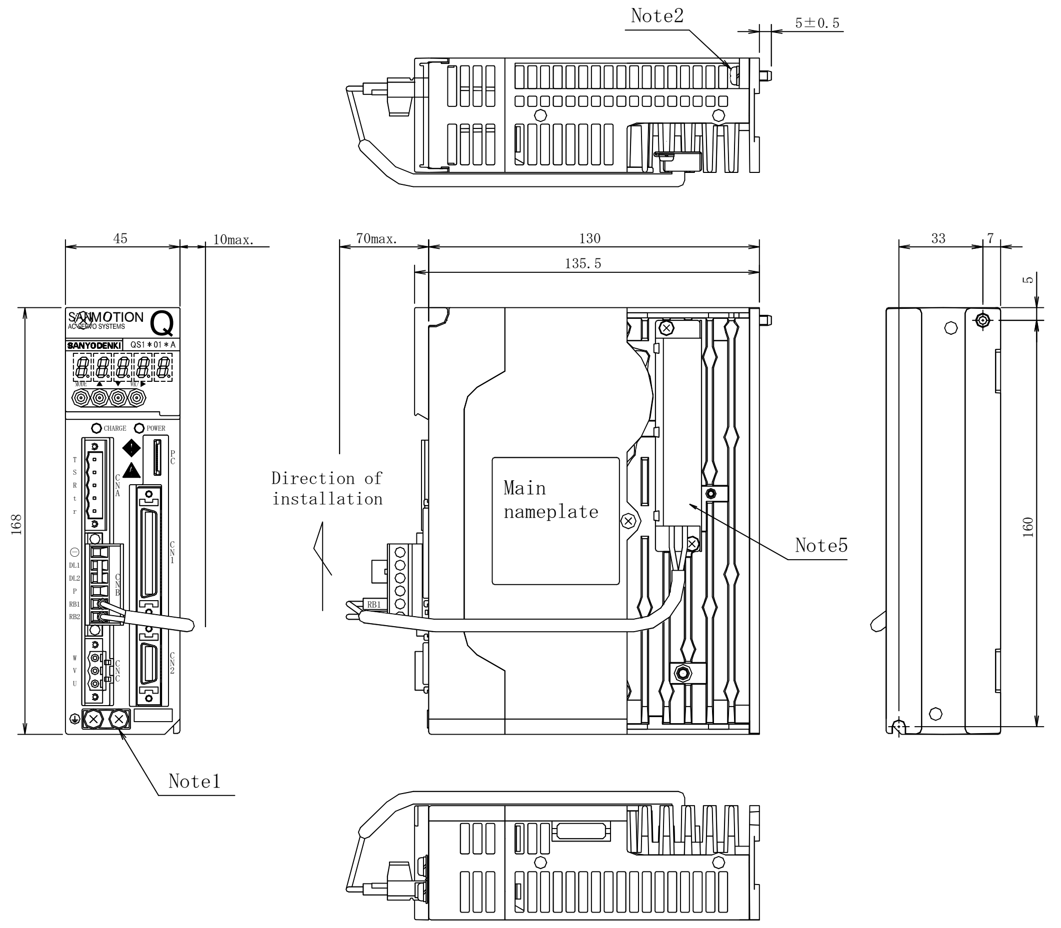
Main nameplate would be changed
on the case of standard acquisition

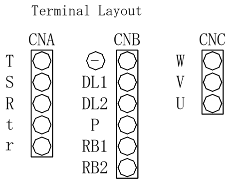
Note6, Main body material : SECC/coating

Note7, Caver material : ABS Resin

Weight : 6.8 kg

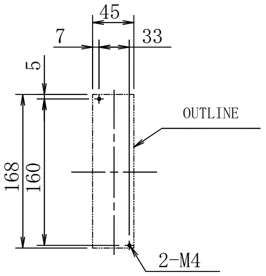
Servo amplifier: QS1L01





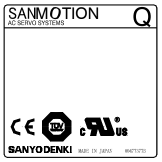
Note1: Earth Terminal screw M4
Tightening torque 1.18N.m

Note2: Mounting panel working drawing



Use the enclosed and specified screws for settling.

Note3: Main nameplate (Scale 1/1)



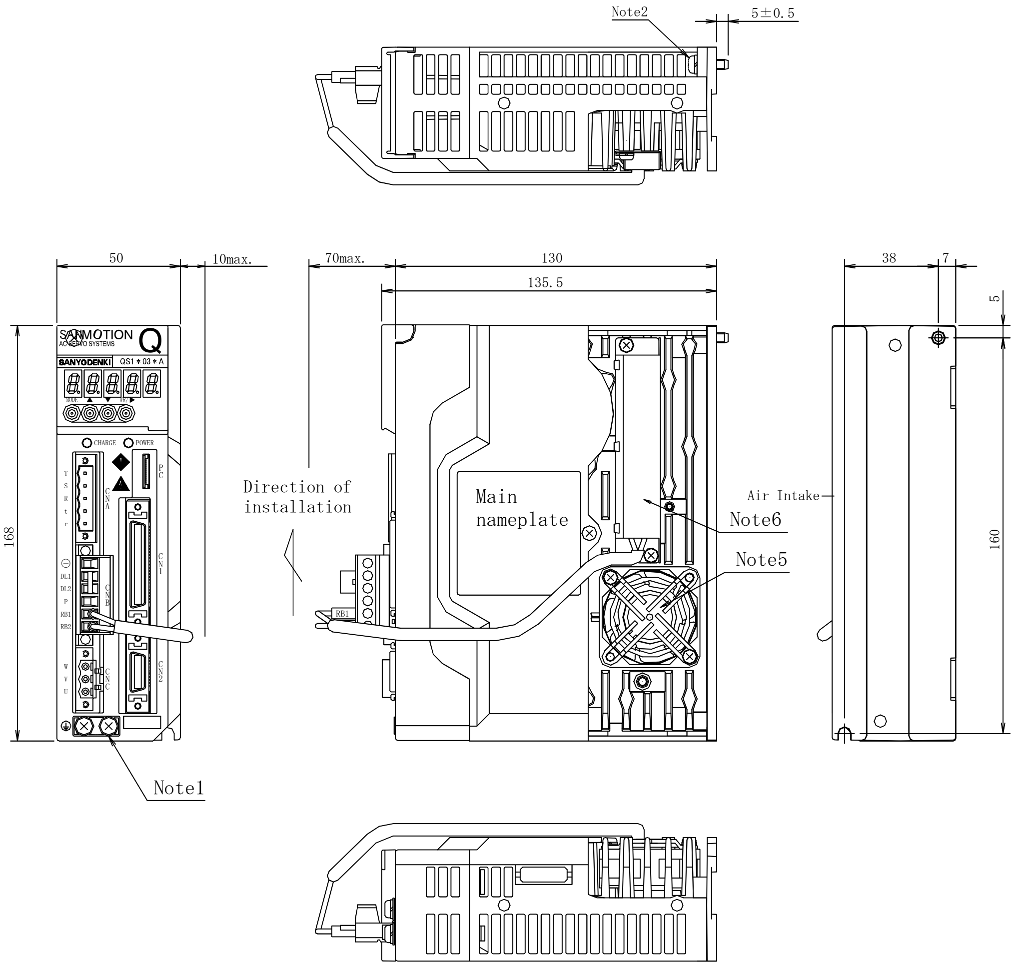
Main nameplate would be changed on the case of standard acquisition

Note4: Main body material
: ABS Resin

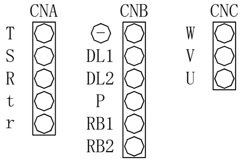
Note5: Regenerative resistor

Weight : 1.25 kg

Servo amplifier: QS1L03

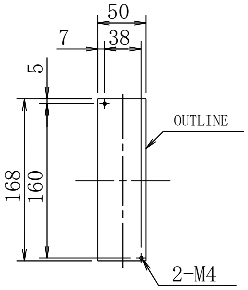


Terminal Layout



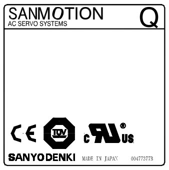
Note1: Earth Terminal screw M4
Tightening torque 1.18N.m

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

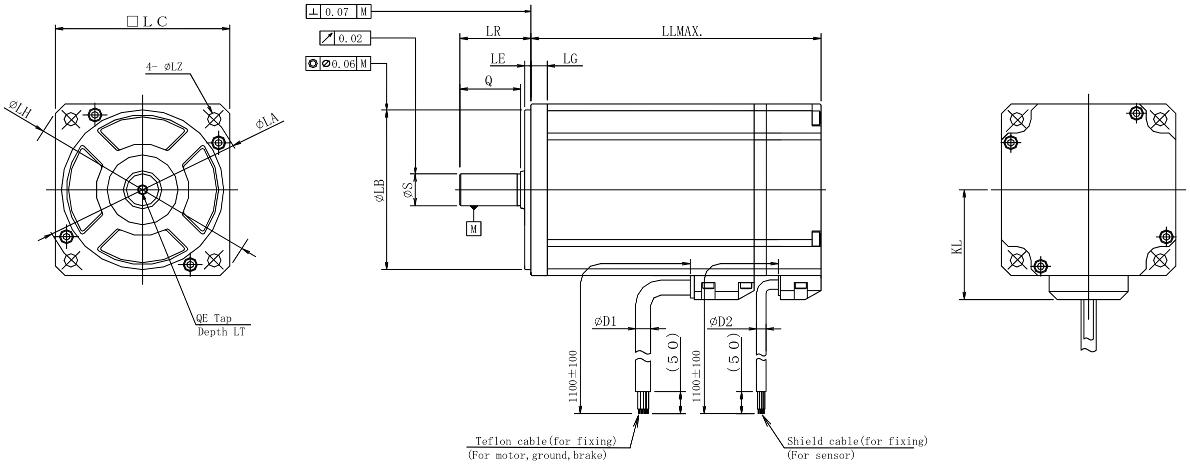
Note5: Regenerative resistor

Weight : 1.3 kg

10.3.2 External appearance diagram of Servo motor

Servo motor external appearance diagram

Q1 series (Low inertia) (□40～□76)

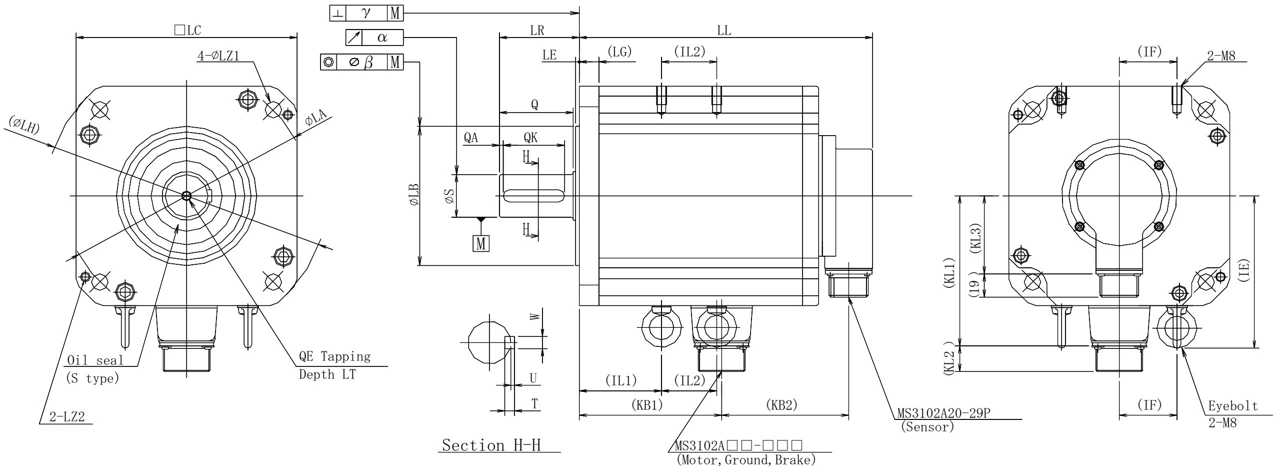


	Incremental																	
	Without B	With B															Incre-mental	
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QE	LT	D1	D2	Oil seal
Q1AA04003△□◇	76	118.5	5	30	46	0 30-0.021	2.5	54	40	4.5	25	0 6-0.008	–	–	–	7	4.7	Option
Q1AA04005△□◇	83	125.5										0 8-0.009		–	–			
Q1AA04010△□◇	102	144.5																
Q1AA06020△□◇	113	142	6	41	70	0 50-0.025	3	81	60	5.5	30	0 14-0.011		M5	12	7.5		
Q1AA06040△□◇	142	171																
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)

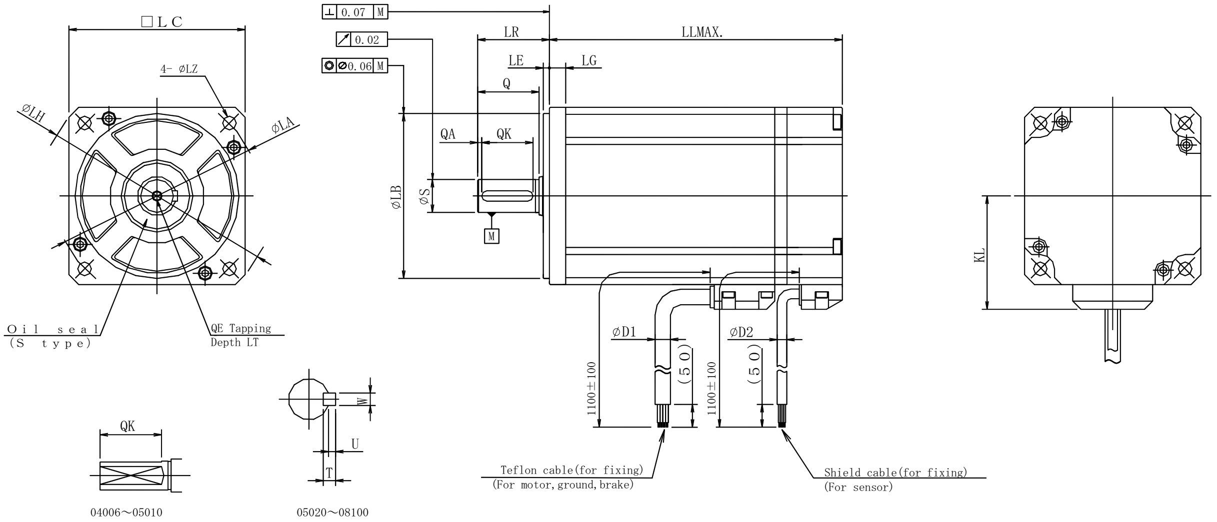


	Incremental				Connector										
	w/ Brake		w/o Brake												
MODEL	LL	KB2	LL	KB2	MS3102A (Applicable products)	LG	KL1	KL2	KL3	LA	LB	LE	LH	LC	LZ1
Q1AA10100△□◇	184	80	221	117	20-15P	10	78	19	63	115	$95^{0}_{-0.035}$	3	130	100	9
Q1AA10150△□◇	209		246												
Q1AA10200△□◇	234		271												
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

Q2 series (Middle inertia) (□42～□86)

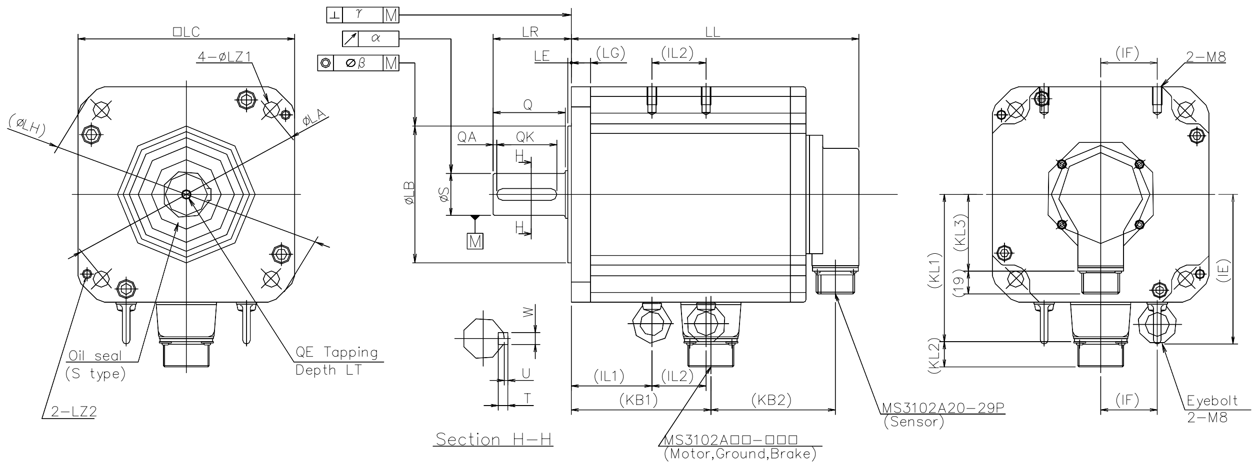


	Incremental																					Incre-mental	
	w/ B	w/o B																					
MODEL	LL	LL	LG	KL	LA	LB	LE	LH	LC	LZ	LR	S	Q	QA	QK	W	T	U	QE	LT	D1	D2	Oil Seal
Q2AA04006△□◇	82	114	5	31	48	0 34-0.025	2	57	42	3.5	24	0 7-0.009	20	–	15	2 Suriwari 6.5±0.2			–	–	7	4.7	Optýon
Q2AA04010△□◇	96	128																					
Q2AA05005△□◇	81	110	5	38	60	0 50-0.025	2.5	71.5	54	4.5	24	0 8-0.009	20	–	15	2 Suriwari 7.5±0.2			M3	8	7.5		Attached
Q2AA05010△□◇	89	117																					
Q2AA05020△□◇	105	133									30	0 11-0.011	25	2	20	4	4	1.5	M4	10			
Q2AA07020△□◇	98	123	8	50	90	0 70-0.030	3	100	76	5.5	30	0 14-0.011	25	2	20	5	5	2	M5	12			
Q2AA07030△□◇	105	130																					
Q2AA07040△□◇	112	137																					
Q2AA07050△□◇	120	145																					
Q2AA08050△□◇	130	166	8	55	100	0 80-0.030	3	115	86	6.6	35	0 16-0.011	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

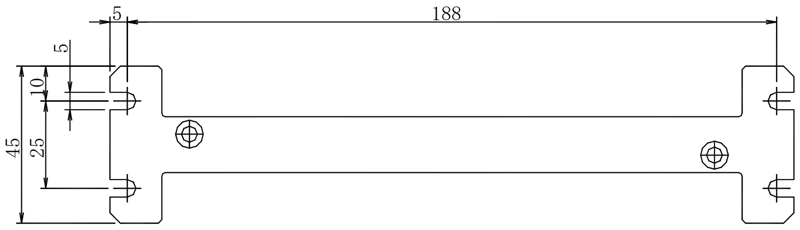
For servo amplifiers with amplifier capacity from 15A to 50A, interchangeable metal fittings are used.

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

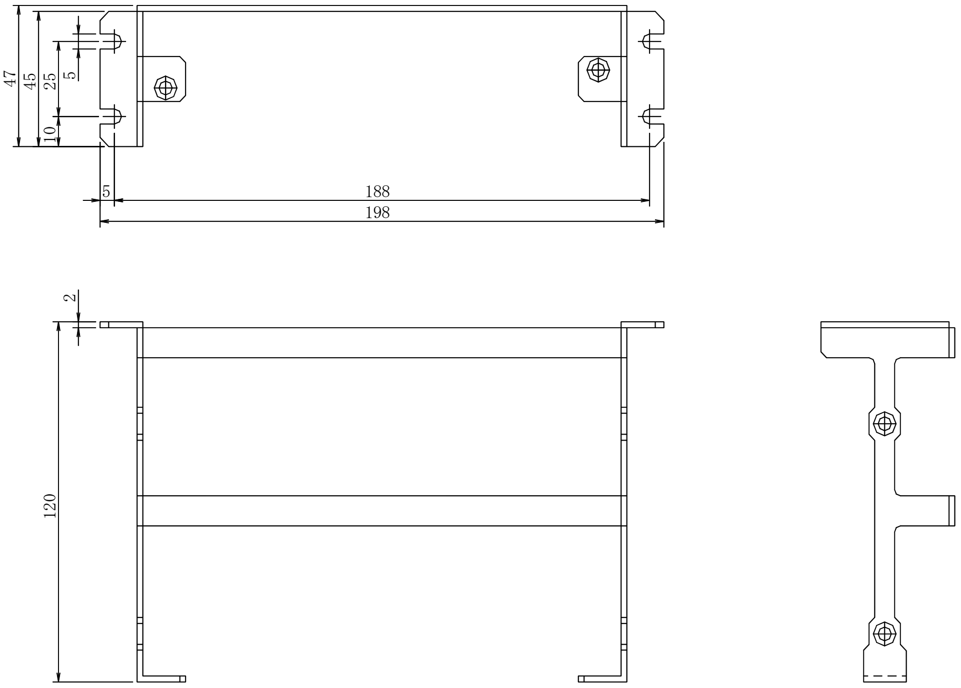
Model number AL-00483540-01 QS1□01, QS1□03 Common back surface Metal Fitting

Material SPCC, Surface processing Green chromate plating Thickness 2mm



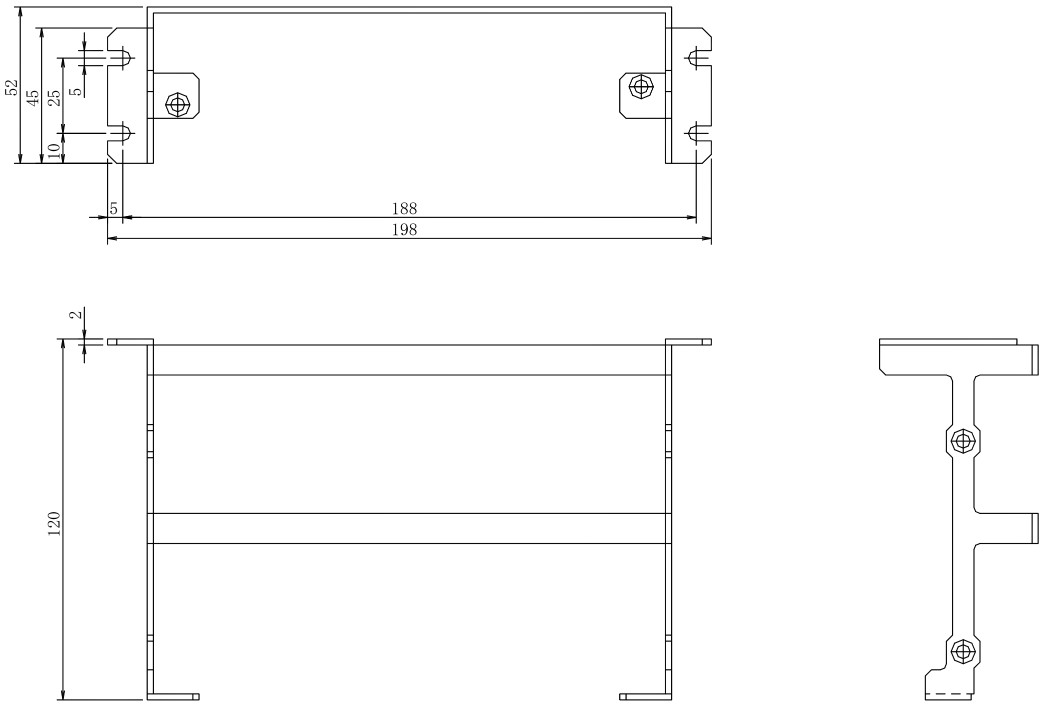
Model number AL-00483541-01 QS1☐01 Front surface Metal Fitting

Material SPCC, Surface processing Green chromate plating Thickness 2mm



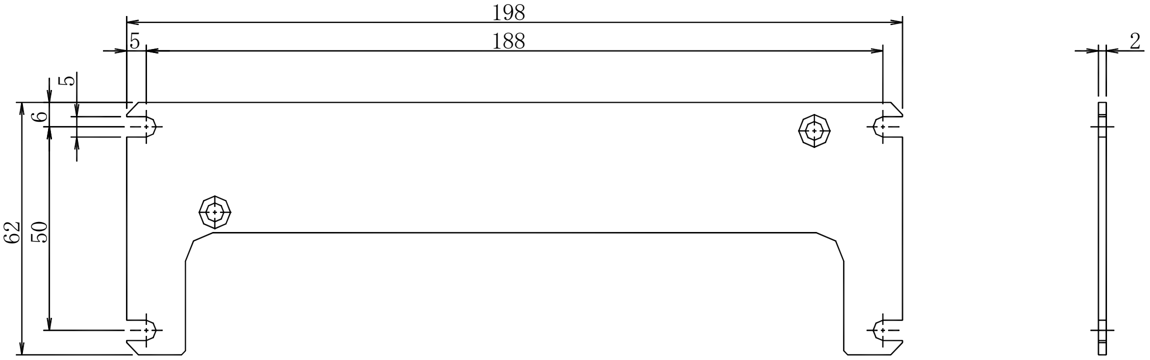
Model number AL-00483542-01 QS1☐03 Front surface Metal fitting

Material SPCC, Surface processing Green chromate plating Thickness 2mm



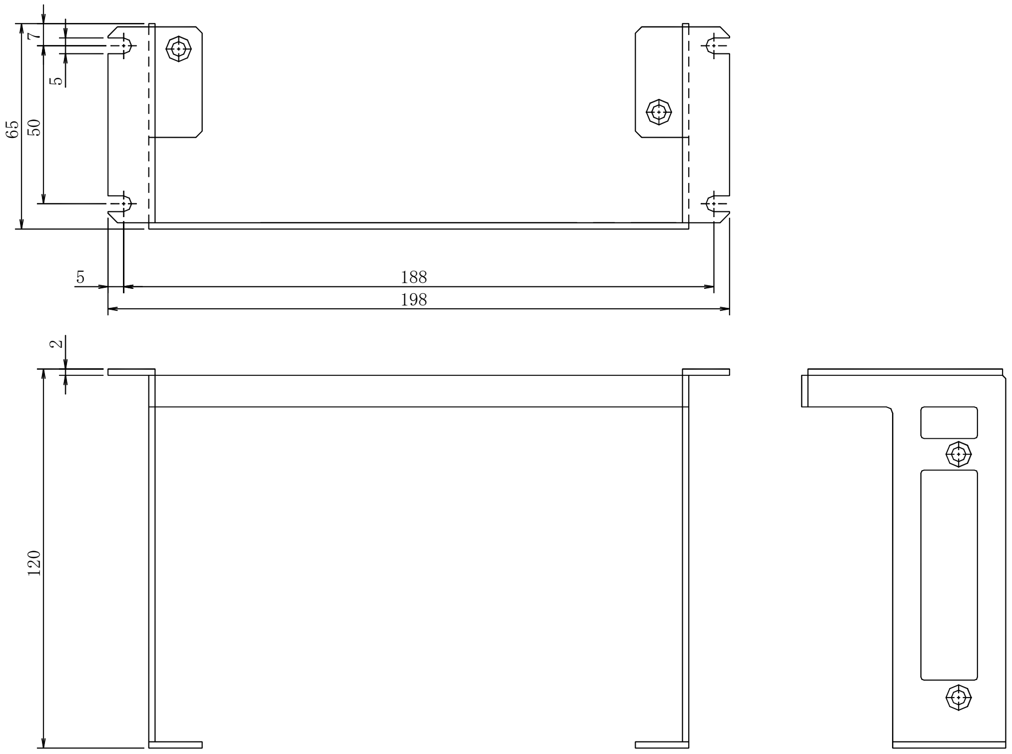
Model number AL-00483543-01 QS1☐05 Back surface Metal fitting

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

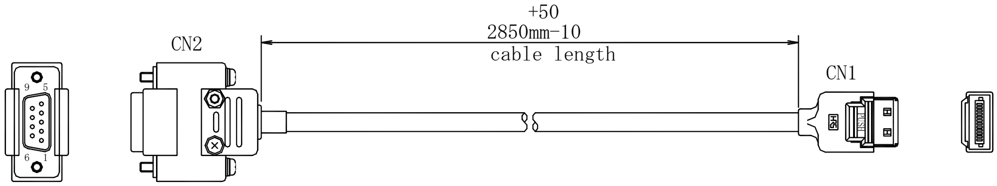


●Setup software Q setup

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.

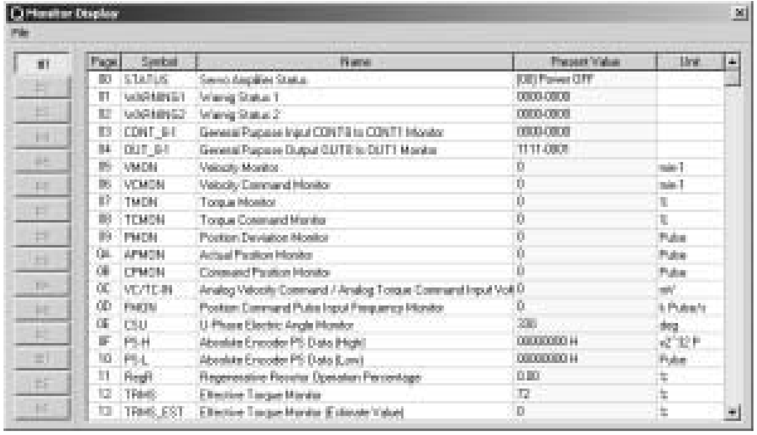
(1) When connected to a PC, parameter selections and position / speed / torque can be monitored and displayed in a graphical format. This software can easily be operated in a Windows operating environment.

■ 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

■ Monitor function

Operation information and terminal status can be monitored from here.

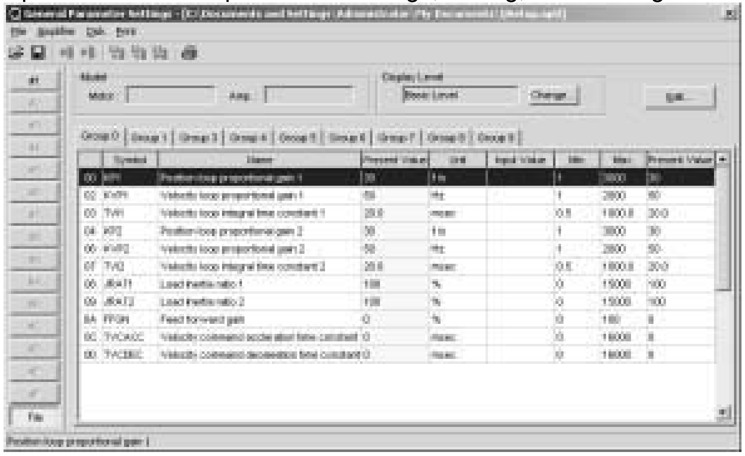


Monitor Display

Page	Symbol	Name	Present Value	Unit
00	STATUS	Servo Amplifier Status	[00] Power OFF	
01	WARNING1	Warning Status 1	0000-0000	
02	WARNING2	Warning Status 2	0000-0000	
03	CONT_8-1	General Purpose Input CONT8 to CONT1 Monitor	0000-0000	
04	OUT_8-1	General Purpose Output OUT8 to OUT1 Monitor	1111-0001	
05	VMON	Velocity Monitor	0	min-1
06	VCMON	Velocity Command Monitor	0	min-1
07	TMON	Torque Monitor	0	%
08	TCMON	Torque Command Monitor	0	%
09	PMON	Position Deviation Monitor	0	Pulse
0A	APMON	Actual Position Monitor	0	Pulse
0B	CPMON	Command Position Monitor	0	Pulse
0C	VC/TC-IN	Analog Velocity Command / Analog Torque Command Input Volt	0	mV
0D	PMON	Position Command Pulse Input Frequency Monitor	0	k Pulse/s
0E	CSU	U-Phase Electric Angle Monitor	330	deg
0F	PS-H	Absolute Encoder PS Data (High)	00000000 H	x2^32 P
10	PS-L	Absolute Encoder PS Data (Low)	00000000 H	Pulse
11	RegR	Regenerative Resistor Operation Percentage	0.00	%
12	TRMS	Effective Torque Monitor	72	%
13	TRMS_EST	Effective Torque Monitor (Estimate Value)	0	%

■Parameter settings

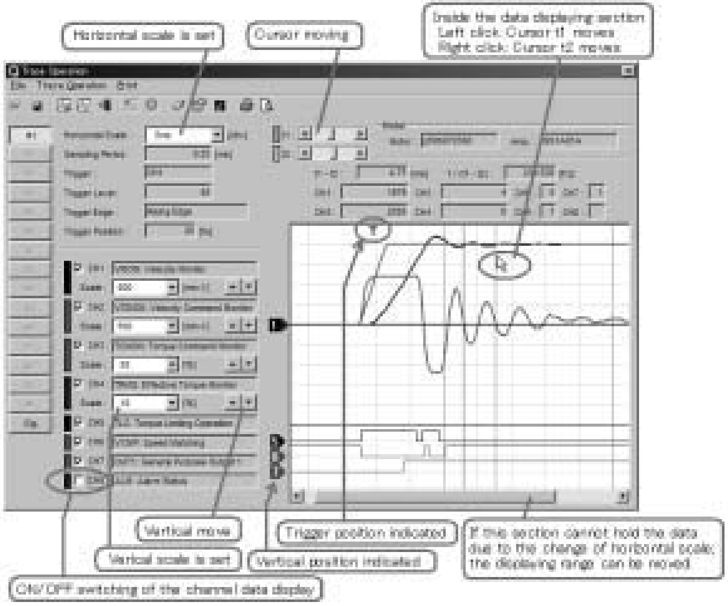
Operations such as parameter settings, saving, and reading tasks can be performed from a PC.



	Symbol	Name	Present Value	Unit	Input Value	Min	Max	Present Value
00	KP1	Position loop proportional gain 1	30	1/s		1	3000	30
02	KVP1	Velocity loop proportional gain 1	50	Hz		1	2000	50
03	TVI1	Velocity loop integral time constant 1	20.0	msec		0.5	1000.0	20.0
04	KP2	Position loop proportional gain 2	30	1/s		1	3000	30
06	KVP2	Velocity loop proportional gain 2	50	Hz		1	2000	50
07	TVI2	Velocity loop integral time constant 2	20.0	msec		0.5	1000.0	20.0
08	JRAT1	Load inertia ratio 1	100	%		0	15000	100
09	JRAT2	Load inertia ratio 2	100	%		0	15000	100
0A	FFGN	Feed forward gain	0	%		0	100	0
0C	TVCACC	Velocity command acceleration time constant	0	msec		0	16000	0
0D	TVCDEC	Velocity command deceleration time constant	0	msec		0	16000	0

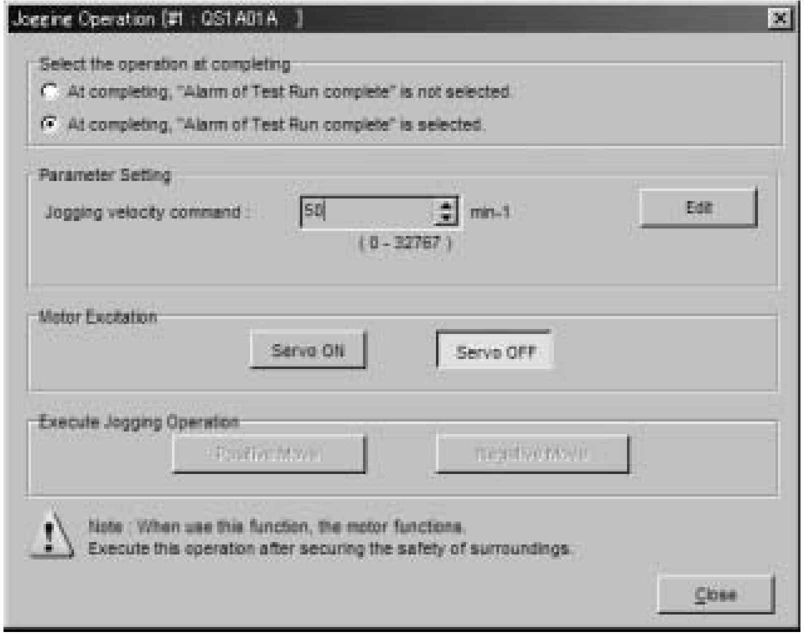
■ Drive trace function

Speed and current of the servo motor are displayed in a graphical format.



■Test operations

It supports Jog operation function.



Select the operation at completing

○ At completing, "Alarm of Test Run complete" is not selected.

● At completing, "Alarm of Test Run complete" is selected.

Parameter Setting

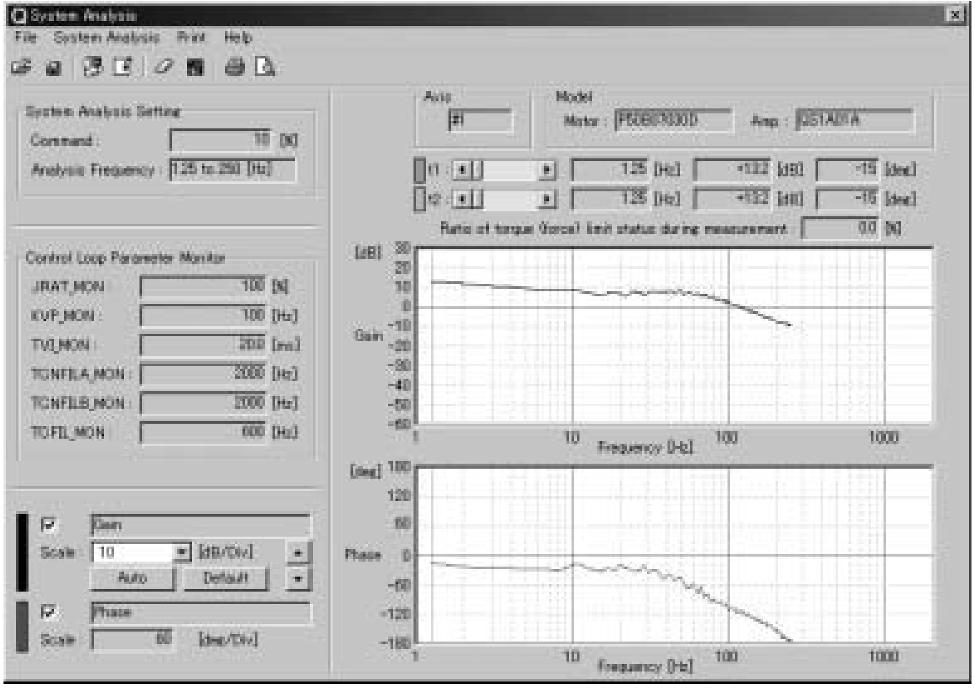
Jogging velocity command : 50 min-1 (0 - 32767)

Motor Excitation

Execute Jogging Operation

Note : When use this function, the motor functions.
Execute this operation after securing the safety of surroundings.

■System analysis function



System Analysis Setting

Command : 10 [%]

Analysis Frequency : 1.25 to 250 [Hz]

Axis : #1

Model Motor : P50B07030D Amp : QS1A01A

f1 : 1.25 [Hz] +13.2 [dB] -1.5 [deg]

f2 : 1.25 [Hz] +13.2 [dB] -1.5 [deg]

Ratio of torque (force) limit status during measurement 0.0 [%]

Control Loop Parameter Monitor

JRAT_MON : 100 [%]

KVP_MON : 100 [Hz]

TVI_MON : 20.0 [ms]

TCNFILA_MON : 2000 [Hz]

TCNFILB_MON : 2000 [Hz]

TCFIL_MON : 600 [Hz]

☑ Gain Scale : 10 [dB/Div]

☑ Phase Scale : 60 [deg/Div]

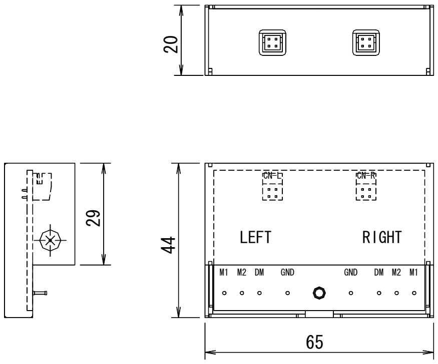
●Monitor box

For analog monitor and digital monitor output.

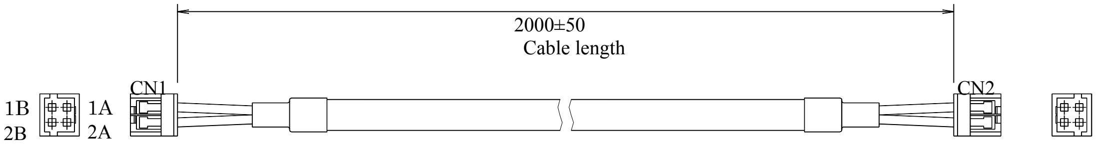
Model number	Remarks
Q-MON-1	Monitor box + Special purpose cables (2)
AL-00496726-01	Special purpose cables (2)

Model number Q-MON-1 (main unit)

The following two (2) special purpose cables are attached to the monitor box.



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.

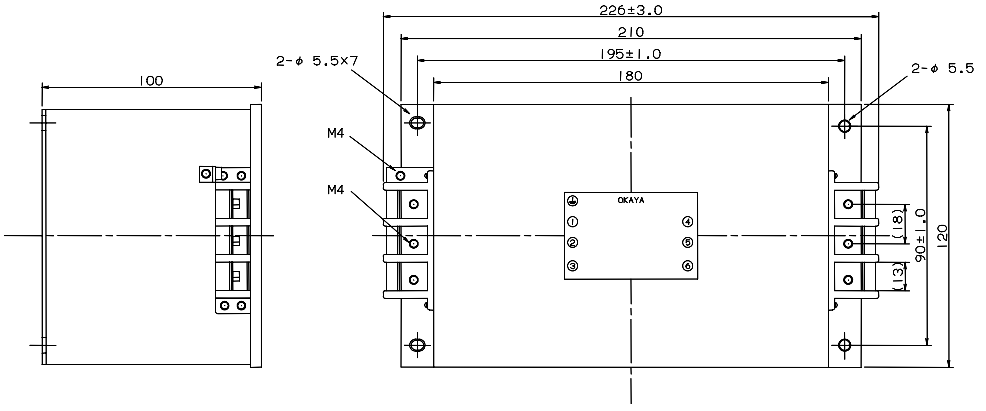
- EMC countermeasures kit

For EMC countermeasures. Refer to Chapter 12 for details.

Model number	Remarks
AL-00508115	Noise filter: 3SUP-HK30-ER-6B
	Toroidal core:251-211

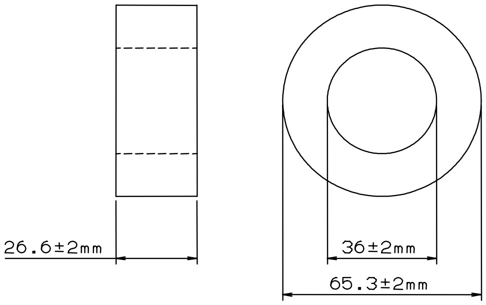
Model number: 3SUP-HK30-ER-6B

Unit: mm
General intersection: ±1.5mm



Mass:2.5kg

Model number: 251-211



11. Selection Details

Selection Details

11. Selection Details

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 ($kg \cdot m^2$)
J_L: Load inertia ($kg \cdot m^2$)
N_1,N_2: Rotational speed of motor (min^{-1})

T_P: Instantaneous maximum stall torque ($N \cdot m$)
T_L: Load torque ($N \cdot m$)

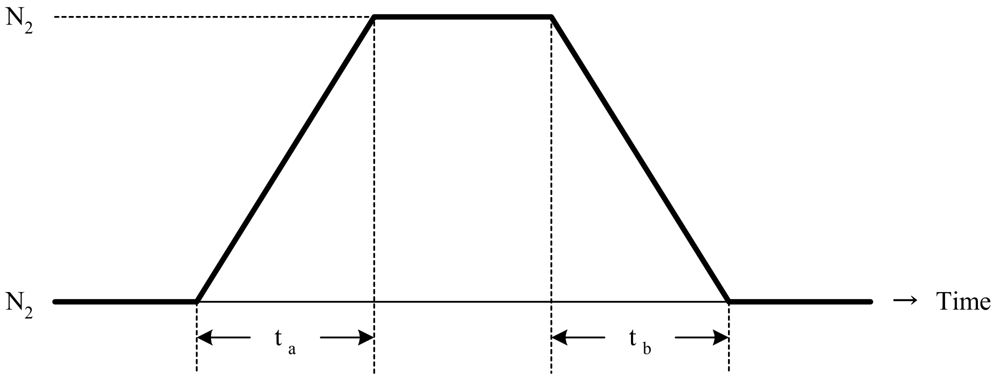


Figure 11-1 Time chart of motor rotation speed

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%.

11.2 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. Selection Details

(1) When continuous-speed status and motor stop status is repeated

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

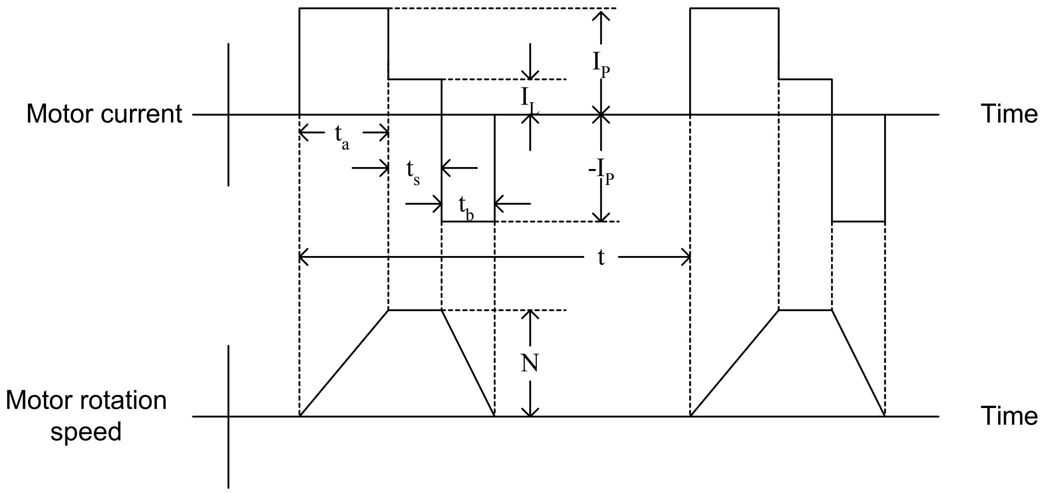


Figure 11-2 Time chart of motor current and rotation speed

(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.

$$n=2.86\times10^2\times\frac{1}{N(J_M+J_L)}\times\frac{T_P{}^2-T_L{}^2}{T_P{}^3}\times T_R{}^2\quad\text{[times/min]}$$

T_R: Rated torque

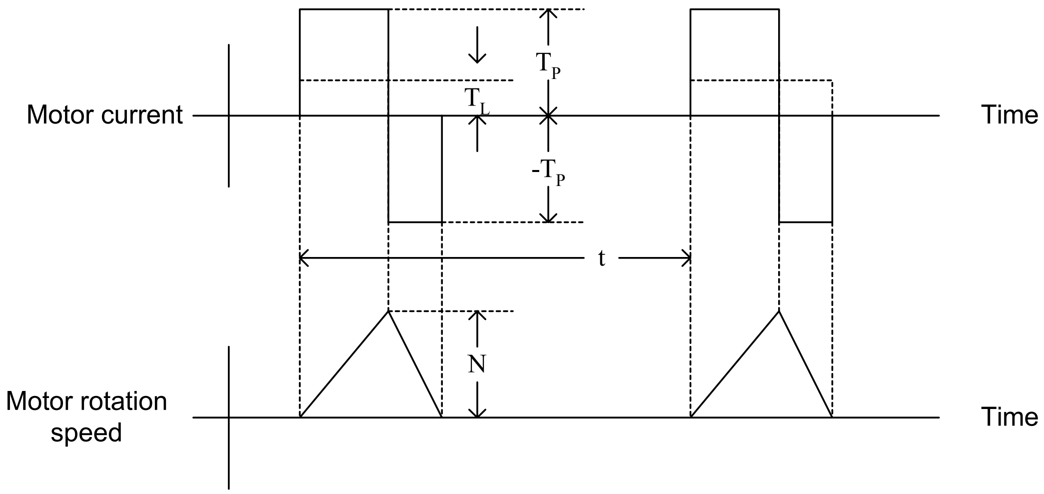


Figure 11-3 Time chart of motor current and rotation speed

(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.

$$n=2.86\times10^2\times\frac{1}{N(J_M+J_L)}\times\frac{T_R{}^2-T_L{}^2}{T_{PP}}\quad\text{[times/min]}$$

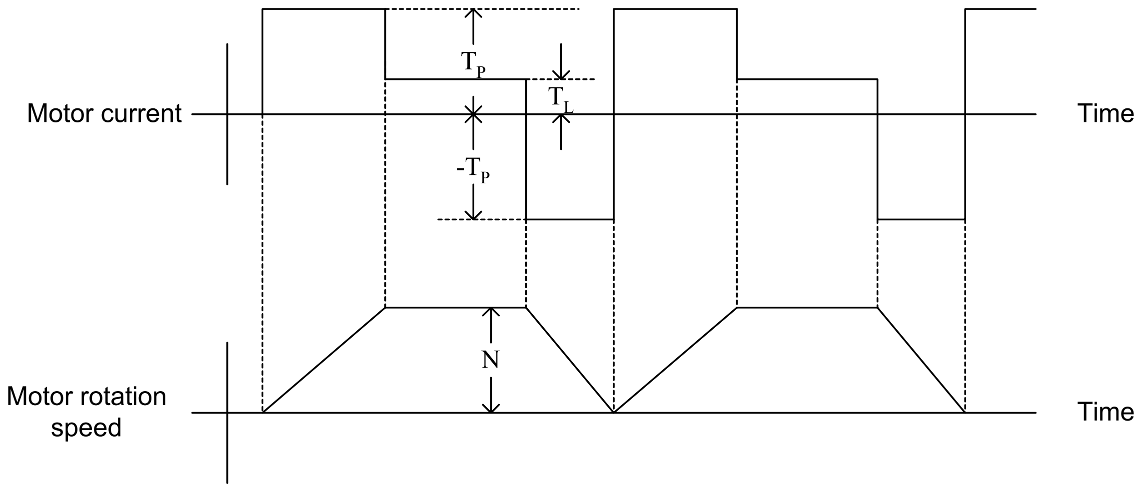


Figure 11-4 Time chart of motor current and rotation speed

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.

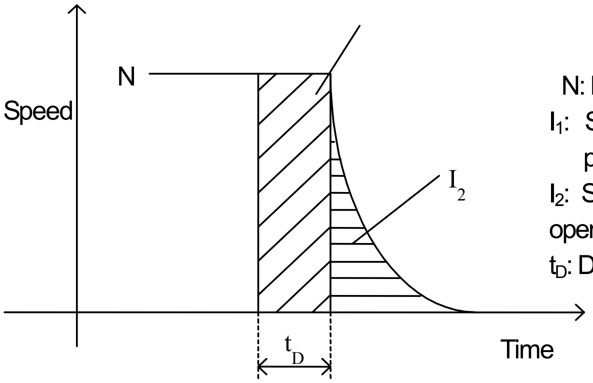
In this case, the following measures must be take n:

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.

11.4 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 ($\text{kg}\cdot\text{m}^2$)
J_L: Load inertia (Motor axis conversion) ($\text{kg}\cdot\text{m}^2$)
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	

(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:

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

$R\phi$: 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	

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:

$$\frac{6\ \text{min}}{(\text{Number of rated rotations/ maximum number of rotations for usage})^2}$$

11. Selection Details

(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}
	Q1AA18450M	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 0 Ω.
If the combination with an amplifier is different than those shown above, consult your dealer or sales office.

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

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

EM: 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]

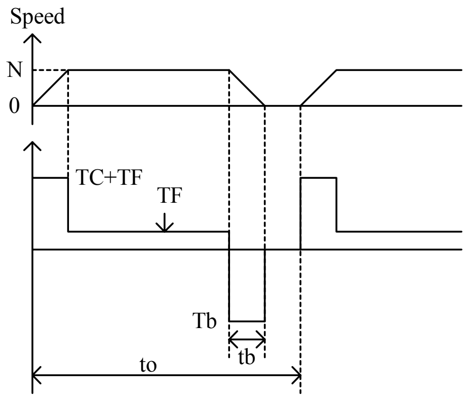


Figure 11-6

② In case of operations along vertical axis (with a gravitational load)

$$EM = EVUb + EVD + EVDb$$

$$\begin{aligned} &= \frac{1}{2} N \times 3 \cdot KE\phi \times \frac{TUb}{KT} \times tUb - \left(\frac{TUb}{KT}\right)^2 \times 3 \cdot R\phi \times tUb \\ &+ N \times 3 \cdot KE\phi \times \frac{TD}{KT} \times tD - \left(\frac{TD}{KT}\right)^2 \times 3 \cdot R\phi \times tD \\ &+ \frac{1}{2} N \times 3 \cdot KE\phi \times \frac{TDb}{KT} \times tDb - \left(\frac{TDb}{KT}\right)^2 \times 3 \cdot R\phi \times tDb \end{aligned}$$

EM: 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.

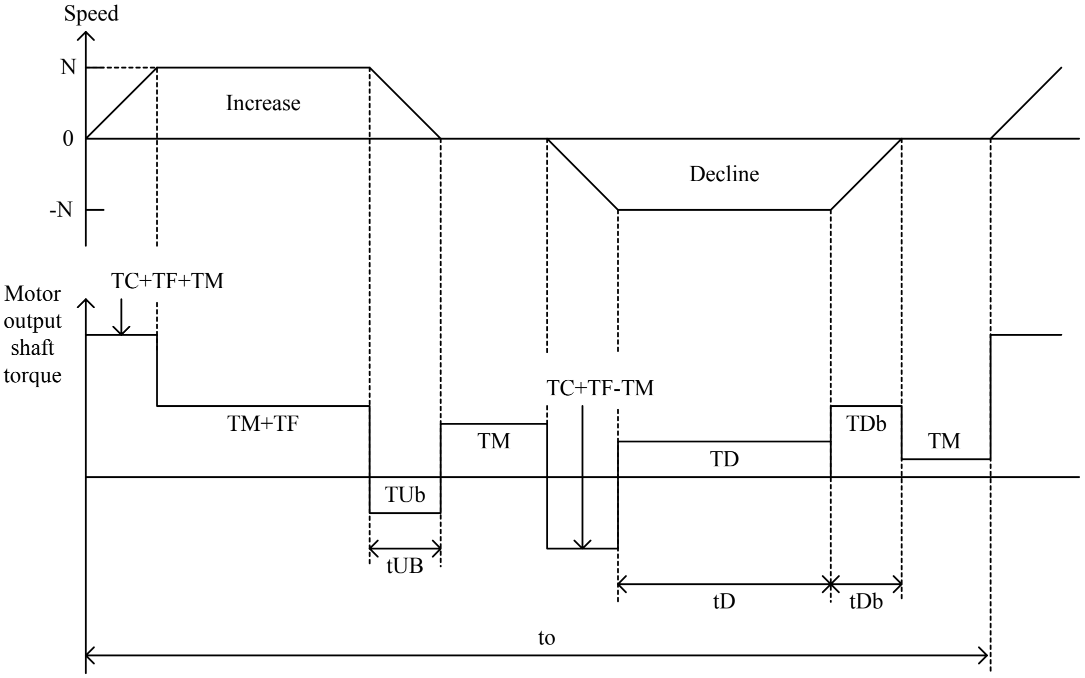


Figure 11-7

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)

$$\frac{400(\mathrm{V})\times 400(\mathrm{V})}{100(\Omega)} \times \frac{0.12(\%)}{100(\%)} = 1.92\ (\mathrm{W})$$

Built-in regeneration resistance value

Amplifier model number	Input supply voltage	Built-in regeneration resistance value	Remarks
QS1LM01 QS1M01	200V type	100Ω	Amplifier capacity 15 A, Built-in regeneration resistance
QS1L03 QS1M03		50Ω	Amplifier capacity 30 A, Built-in regeneration resistance
QS1A05 QS1B05		17Ω	Amplifier capacity 50 A, Built-in regeneration resistance
QS1A10 QS1A10		10Ω	Amplifier capacity 100 A, Built-in regeneration resistance
QS1A15		6Ω	Amplifier capacity 150 A, Built-in regeneration resistance
QS1N01 QS1P01	100V type	100Ω	Amplifier capacity 15A, Built-in regeneration resistance
QS1N03 QS1P03		50Ω	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

PM *1 / Amplifier Type name	**Up to 2W**	**Up to 5W**	**Up to 10W**	**Up to 20W**	**Up to 30W**	**Up to 55W**	**Up to 60W**	**Up to 90W**	**Up to 110W**	**Up to 120W**	**Up to 125W**	**Up to 220W**	**Up to 250W**	**Up to 500W**	**Up to 1000W**
QS1A01	Built in Conn. (I)	Resistor A×1 Connection (III)		Resistor C×1 Connection(III)		Resistor E×1 Conn.(III)	Resistor D×2 Conn.(IV)	Resistor F×2 Connection (IV)		Resistor E×4 Connection (VI)			Contact		
QS1A03	*2 Built in Connection (I)		Resistor B×1 Conn. (III)	Resistor D×1 Connection (III)		Resistor F×1 Conn.(III)	Resistor C×2 Conn.(V)	Resistor E×2 Connection (V)		Resistor F×4 Connection (VI)			Contact		
QS1A05	*2 Built in Connection (I)				Resistor G×1 Connection (III)		Resistor H×1 I× Connection (III)					Resistor 2 Connection (IV)		Resistor H×4 Connection (VI)	Contact
QS1A10	*2 Built in Connection (II)								Resistor I×1 Connection (III)			Resistor H×2 Connection (V)		Resistor I×4 Connection (VI)	Contact
QS1A15	*2 Built in Connection (II) 0										Resistor J×1 Connection (III)	Resistor K×2 Connection (IV)		Resistor J×4 Connection (VI)	Contact

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.

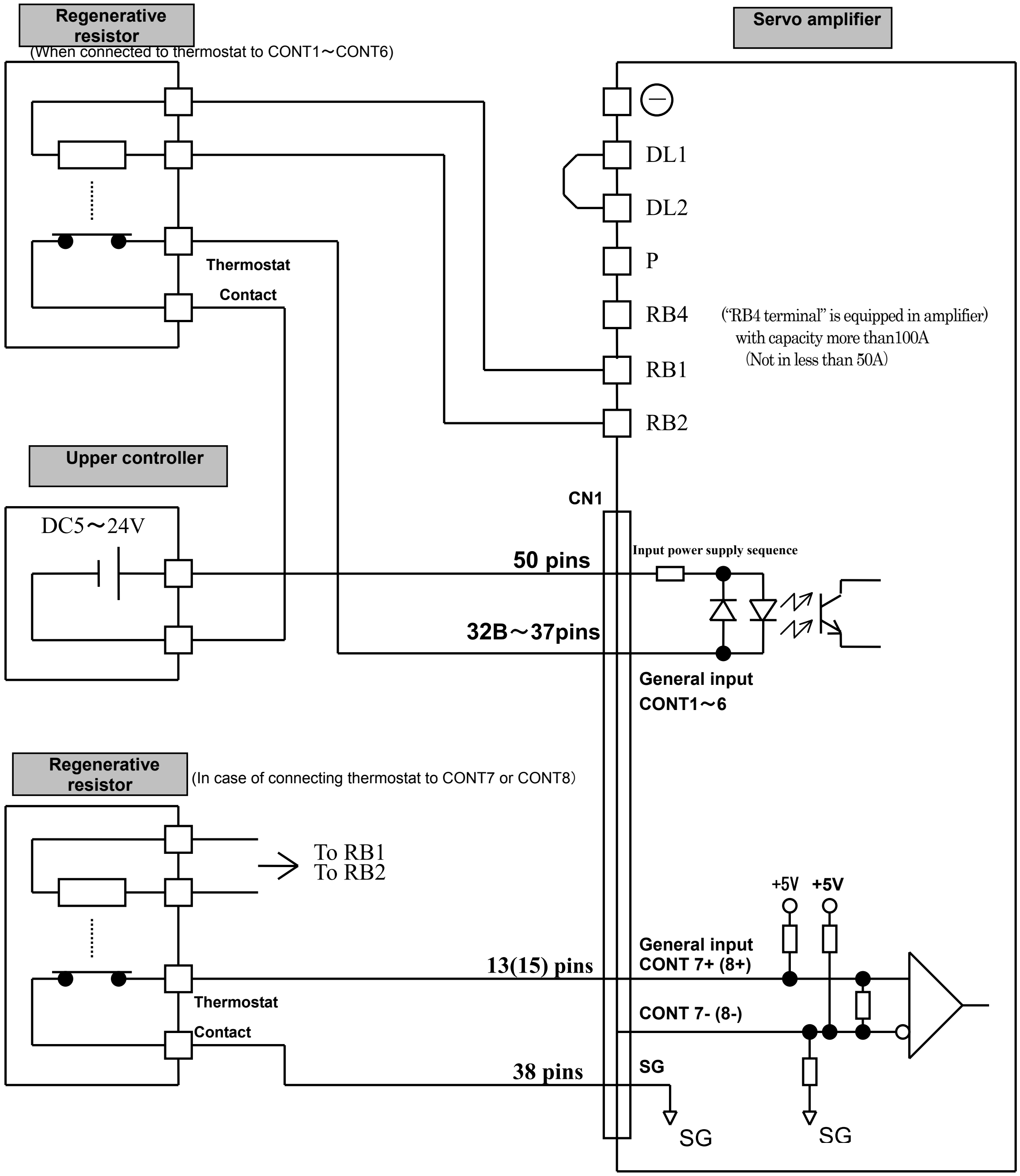


Figure 11-8 Typical external regenerative resistor connection diagram

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.

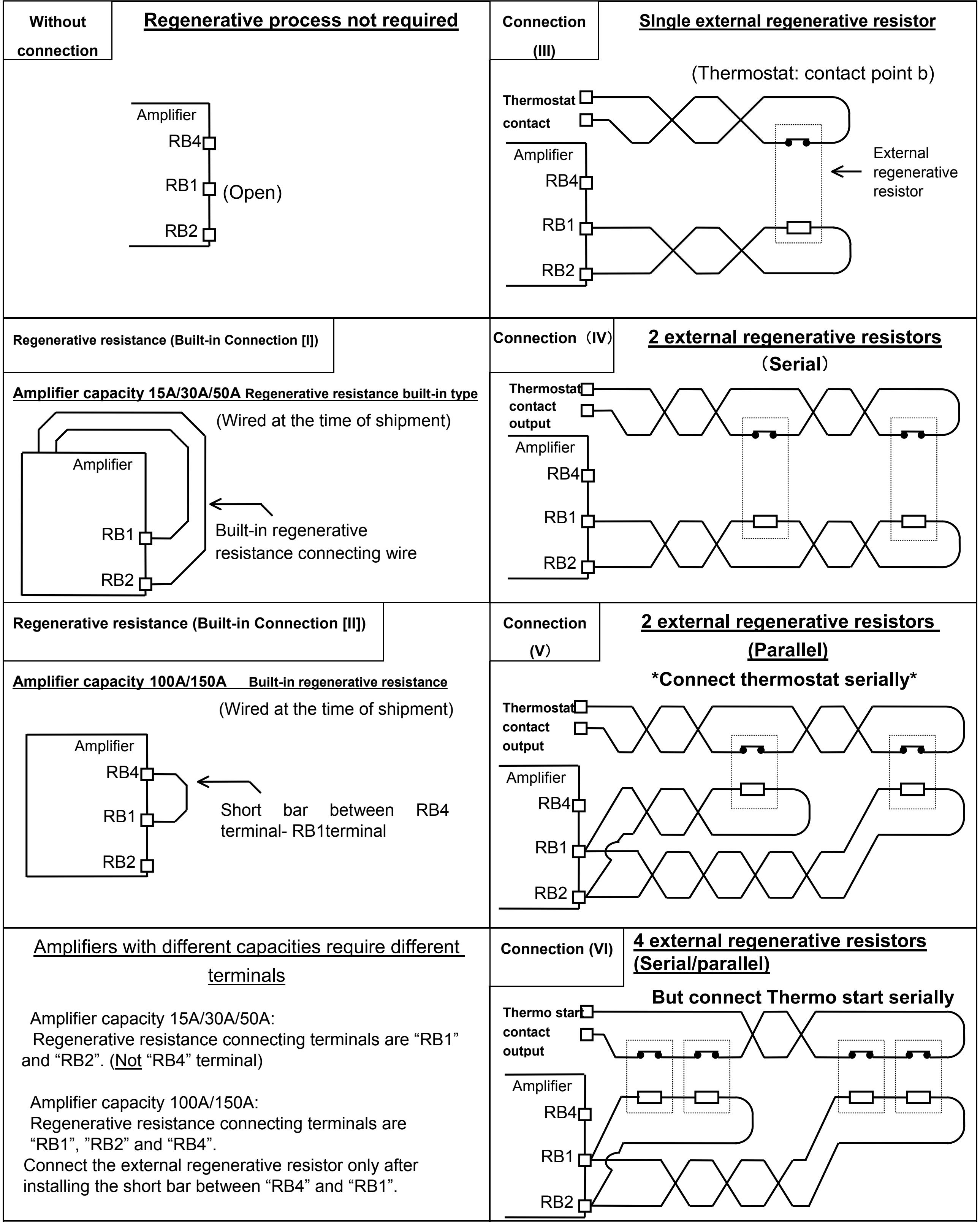
     (When connecting external regenerative resistance to an amplifier with built-in regenerative resistance, first removing the built-in regenerative resistance wiring in the RB1 and RB2 terminals, connect the external regenerative resistance. Moreover, take care that removed wiring should not touch current 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

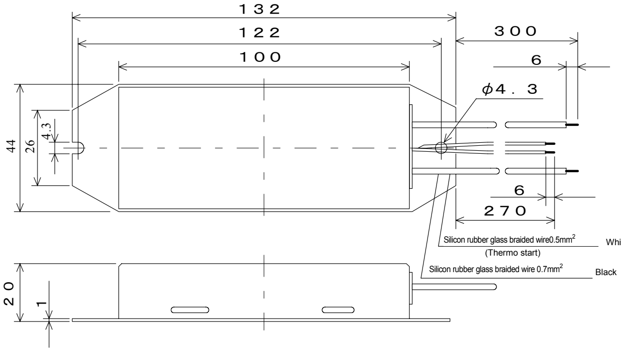


Figure 11-10

	Model number	Thermostat
1	REGIST-080W100B	contact point b
2	REGIST-080W50B	contact point b

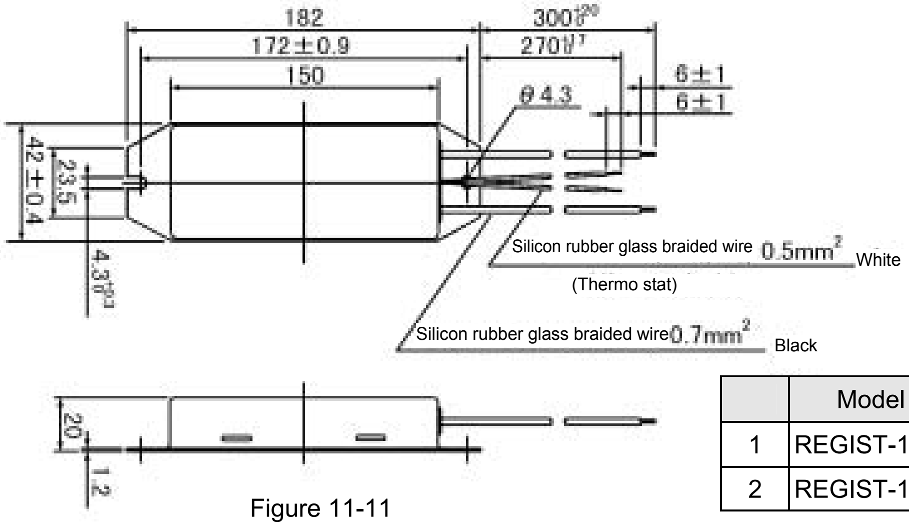


Figure 11-11

	Model number	Thermostat
1	REGIST-120W100B	contact point b
2	REGIST-120W50B	contact point b

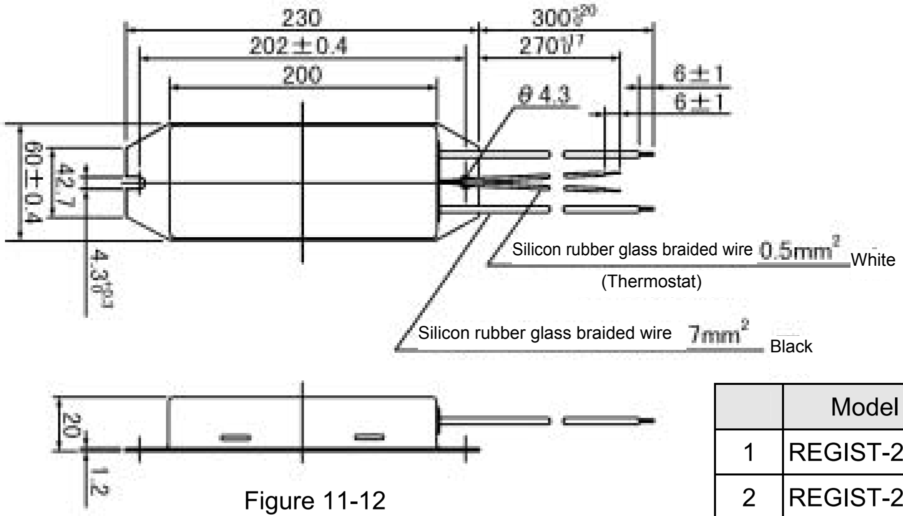


Figure 11-12

	Model number	Thermo stat
1	REGIST-220W50B	contact point b
2	REGIST-220W20B	contact point b
3	REGIST-220W100B	contact point b

Unit:mm

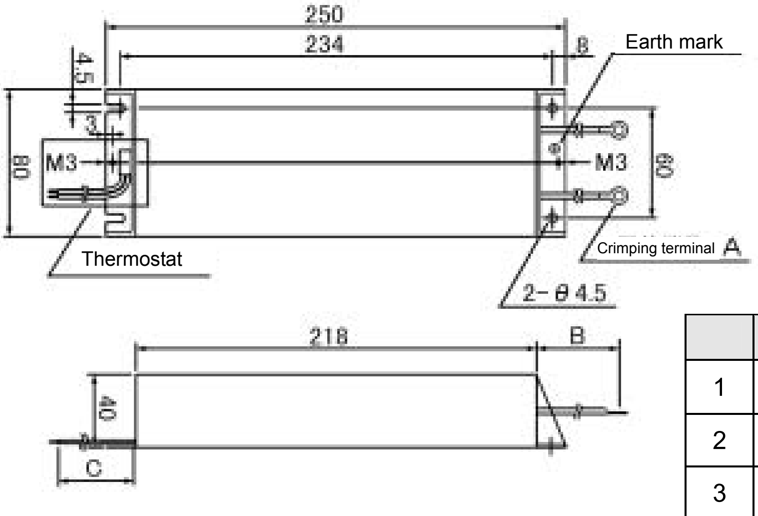
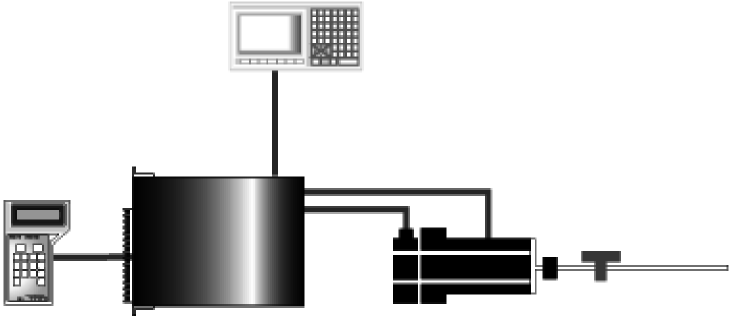


Figure 11-13

	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

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
ЯU®	UL standard	UL1004 UL1446	UL (Underwriters Laboratories, Inc.)
S TÜV PRODUCT SERVICE	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

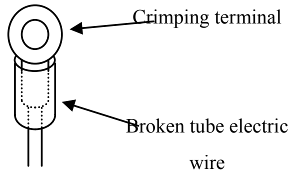
1. The QS1 series servo amplifiers must be used under the conditions specified in overvoltage category II, EN50178. Use a reinforced insulation transformer conforming to IEC or EN standards for power supply input.
2. For the interface, use a DC power supply with reinforced insulation input and outputs.

④ Grounding

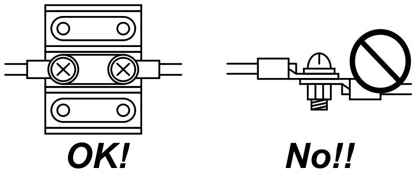
1. Always ground the protective earth terminals of the servo amplifier to the power supply earth. (⏚)
2. When connecting grounding wire to the protective earth terminal, always connect one wire in one terminal; never connect jointly with multiple wires or terminals.
3. When connecting the leakage stopper, 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.

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.

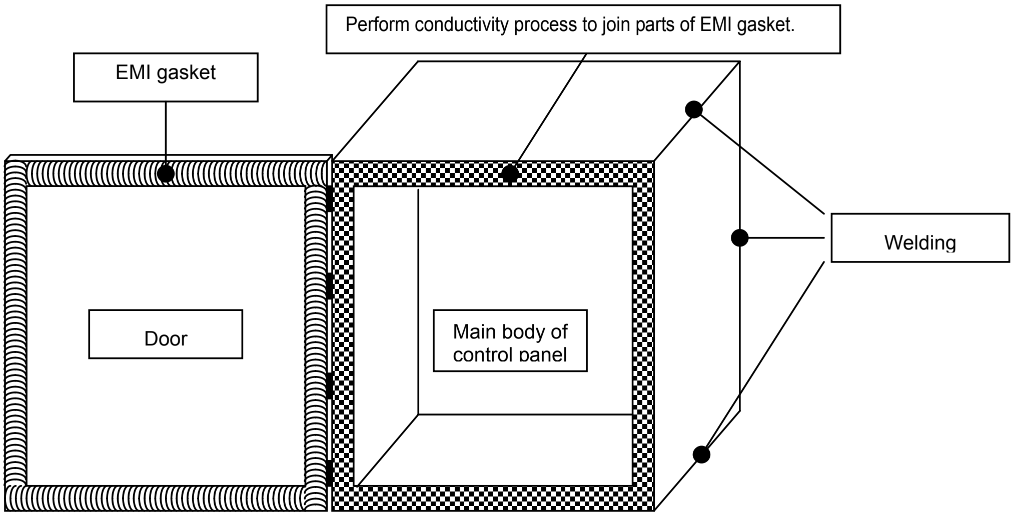
Directive classification	Classification	Test	Test standard
Low voltage Directive (Servo amplifier)	-	-	EN50178: 1997
EMC Directive (Servo amplifier / servo motor)	Emission	Conducted emission	EN55011: A1/1999
		Radiated emission	EN55011: A1/1999
	Immunity test	Electrostatic discharge immunity	EN61000-4-2: 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.

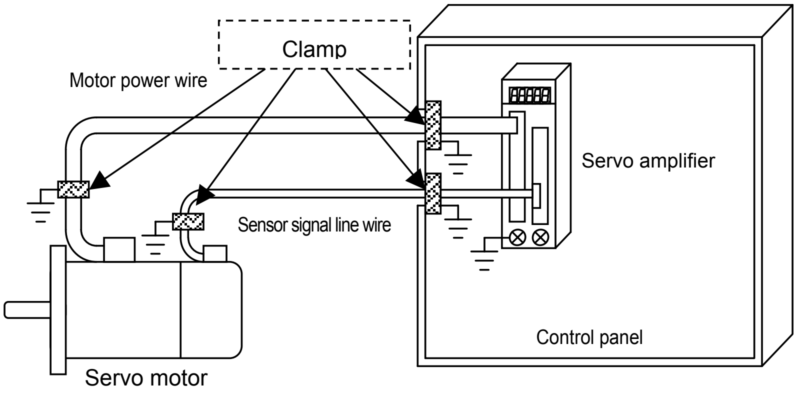
(1) Structure of control panel

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.

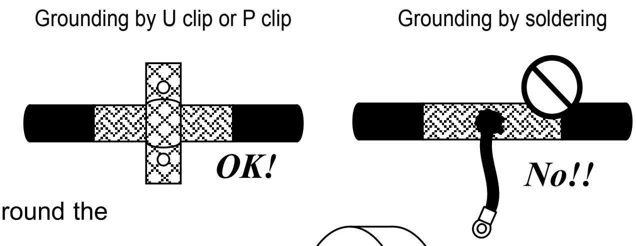


② Installation and wiring of peripheral equipment inside the control panel

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.



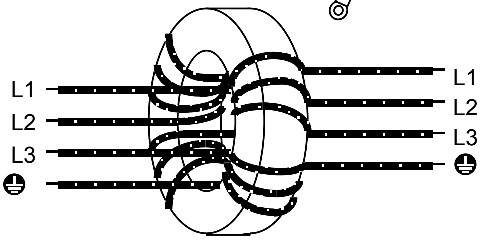
6. Use a conducting metal P clip or U clip to ground and clamp the shield wire, and fix it directly with metal screws. Do not ground by soldering electric wire to the shield wire.



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.

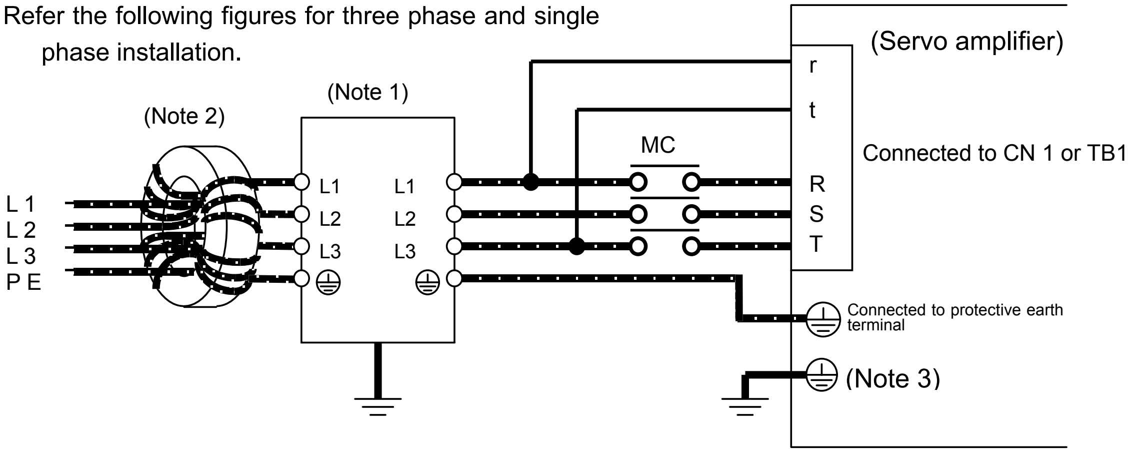


Figure 12-1 Three phase installation

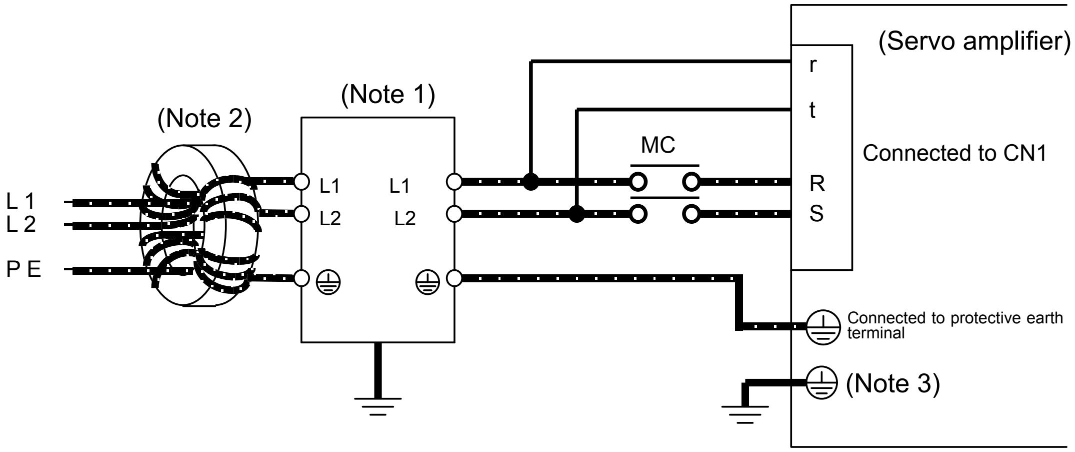


Figure12-2 Single phase installation

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 Feb. 2003
Revision E June 2003
Revision F June 2004

Home page http://www.sanyodenki.com

SANYO DENKI CO.,LTD.
1-15-1, Kita-otsuka Toshima-ku Tokyo 170-8451, JAPAN Phone +81 3 3917 2223 (North America area) Fax +81 3 3917 4521
Phone +81 3 3917 5157 (Europe area)
Phone +81 3 3917 2814 (Asia area)

TAIWAN BRANCH
Room 401, 4F, No.96, Chung Shan N, Rd., Sec.2, Taipei 104, Taiwan, R.O.C. Phone +886 2 2511 3938 Fax +886 2 2511 3975

HONG KONG BRANCH
1109, 11F New East Ocean Centre, 9 Science Museum Road, TST East, Kowloon, Hong Kong Phone:+852 2312 6250 Fax +852 2312 6220

SHANGHAI BRANCH
Room 2116, Bldg B, FAR EAST INTERNATIONAL PLAZA, No.317 Xianxia Rd., Shanghai 200051, China Phone +86 21 6235 1107 Fax +86 21 6278 8289

SANYO DENKI *AMERICA,INC.*
468 Amapola Avenue Torrance, California 90501 U.S.A Phone +1 310 783 5400 Fax +1 310 212 6545

SANYO DENKI *EUROPE SA.*
P.A. PARIS NORD II 48 Allee des Erables-VILLEPINTE BP.50286 F-95958 ROISSY CDG CEDEX France Phone:+33 1 48 63 26 61 Fax +33 1 48 63 24 16