Fuji Electric RYB401S3-VBC-Z3

Servo Amplifer

$1450.00

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Qty Available: 1

Used and in Excellent Condition

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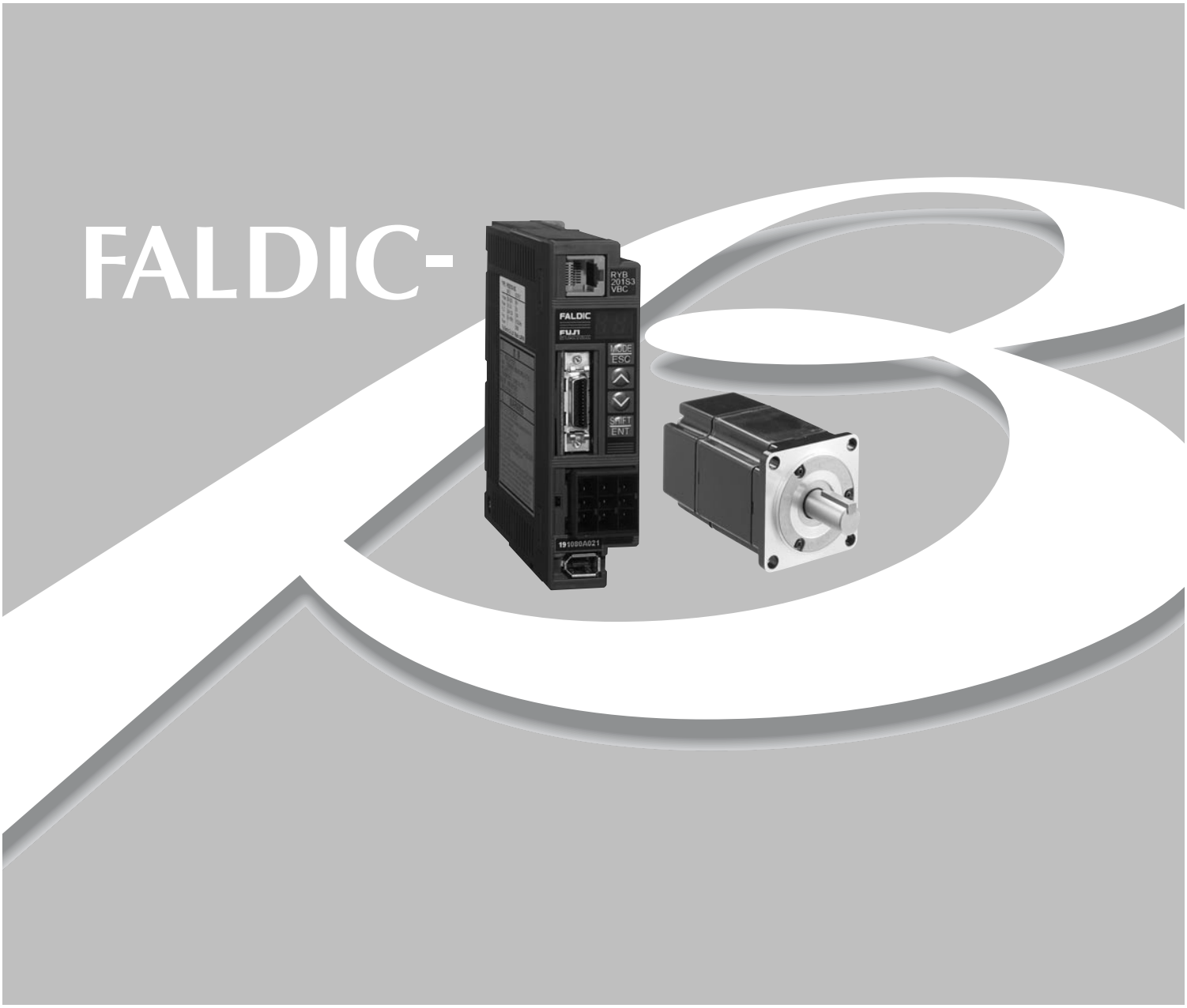
FUJI ELECTRIC

FUJI AC SERVO SYSTEM
FALDIC-β Series
USER'S MANUAL



MEH395

SAFETY INSTRUCTIONS

In all stages of the installation, operation, maintenance and check of this equipment, reference must be made to this manual and other related documents.
The correct understanding of the equipment, information about safety and other related instructions are essential for this system.
Cautionary indications DANGER and CAUTION are used in this manual to point out particular hazards and to highlight some unusual information which must be specially noted.

● DANGER

Cautionary indication	 DANGER
Description of cautionary indication	Indicates that death or severe personal injury will result if proper precautions are not taken.

● CAUTION

Cautionary indication	 CAUTION
Description of cautionary indication	Indicates that personal injury or property damage alone will result if proper precautions are not taken.

Alert symbols are used as necessary.

Alert symbol	Description
	Unspecified precaution
	Electrical shock hazard warning
	Do not disassemble

Alert symbol	Description
	Hot
	Ground

Warning label

The warning label in Fig. B is located at the arrow in Fig. A.

Fig. A

Fig. B


危 険

けが・感電のおそれあり
・通電中、及び電源遮断後5分間は本体に触れないで下さい。
・確実に接地を行うこと。
・取扱説明書を熟読の上、その指示に従って下さい。
高温注意（火傷のおそれあり）
・通電中は本体に触れないで下さい。

WARNING

RISK OF ELECTRIC SHOCK
·Don't touch the controller while applying power and at least 5min. after disconnecting power.
·Securely ground(earth) the controller.
·See manual for detail before use.
CAUTION HOT CONTROLLER(MAY CAUSE BURN)
·Don't touch the controller while applying power.
DESIGN NOTICE
·Where residual-current-operated protective device(RCD) is used for protection in case of direct or indirect contact, only RCD of type B is allowed on the supply side of this Electric equipment(EE). Otherwise another protective measure shall be applied such as separation of the EE from the environment by double or reinforced insulation or isolation of EE and supply system by a transformer.

Fig. B shows the following contents:

■ There is a risk of electric shock.
Do not touch the amplifier when a commercial power is applied and for at least five minutes after de-energization.

Be sure to ground (3rd class grounding) the terminal marked "⏚"

DANGER

- Prior to inspection, turn off power and wait for at least five minutes.
  Otherwise, there is a risk of electric shock.
- Do not touch the amplifier when the commercial power is supplied.
  Otherwise, there is a risk of electric shock.

CAUTION

- Do not disassemble the motor.
  Otherwise, the operation may be abnormal, thereby damaging the coupled machine.
- Do not hit the motor with hammer or any other instruments.
  The integrated (built-in) encoder may break, causing the motor to run at an excessive speed.
- Do not connect a commercial power supply directly to the motor. Otherwise, it may break.
- Supplying power other than 200 [V] to the amplifier may break it.
- Do not turn on and off the commercial power repeatedly.
  Otherwise, the amplifier rectifier may break.
- The motor must be firmly tightened to the mounting base or the driven machine.
  If rapid acceleration or deceleration is attempted without this firm tightening, the motor may become dislocated, causing injury.
- Withstand voltage and insulation test with megger must not be conducted.
  Otherwise the amplifier and encoder will break.

Descriptions given in this manual may be different from those of the product as a result of improvements of the product. Descriptions in this manual are subject to change without notice.
Values are indicated in SI units (third stage) in this manual. The units may be different from those indicated on the product (nameplate).
Illustration given in this manual may show the servo amplifier or servomotor of a specific capacity. Accordingly they may be different from the appearance of the product you have purchased.

Products introduced in this manual have not been designed or manufactured for such applications in a system or equipment that will affect human bodies or lives. Customers, who want to use the products introduced in this manual for special systems or devices such as for atomic-energy control, aerospace use, medical use, and traffic control, are requested to consult Fuji.
Customers are requested to prepare safety measures when they apply the products introduced in this manual to such systems or facilities that will affect human lives or cause severe damage to property if the products become faulty.

Introduction

This manual is the User's Manual for Fuji's FALDIC-β Series AC Servo System. The User's Manual comes in one volume and covers all handling procedures of the product.

The following document is included in the package of each device.

Device	Name of document	Document No.
Servo amplifier	User's Manual Fuji FALDIC-β Series AC Servo Amplifier (RYB□□□S□-VBC)	INR SI470714
Servomotor	User's Manual Fuji GY Series AC Servomotor	ING-YH347

The type designation of the product covered in this manual is shown below.

Device	Applicable type
Servo amplifier	RYB□□□S3-VBC
Servomotor	GYC□□□DC1-C*-**** GYS□□□DC1-C*-****
Gear head	GYN□□□SAG-G□□ GYN□□□CAG-G□□

* "□" in the type designation indicates a decimal point or number.
* "*" in the type designation indicates an alphabetic character or no mark.

For any uncertainties in the description of this manual or in the product itself, contact your dealer or Fuji's sales outlet shown at the end of the manual.

CONTENTS

FALDIC-β

1

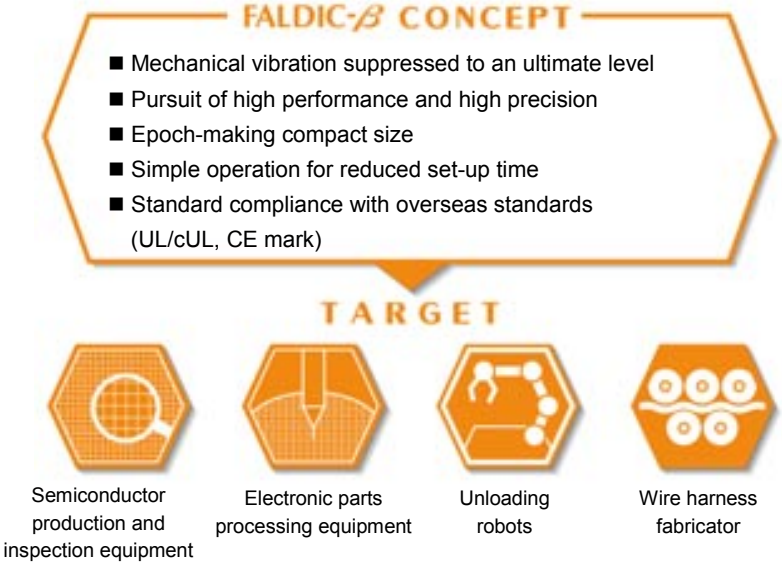
OUTLINE

1 Outline

1-1) Outline

Requirements for functions and performance are sophisticated

Fuji's original vibration control function and notch filter are adopted for substantial suppression of mechanical vibration and a positioning setting time shorter than 1 ms is achieved in FALDIC-β Series in the pursuit of high performance and high precision. The compact main body in which functions are integrated allows flexible installation. Requirements for functions and performance are sophisticated to meet various needs at higher levels. They are best for machines requiring short cycle time and high-speed positioning.



Best for machines requiring short cycle time and high-speed positioning

Advanced functions and performance of Fuji's AC servo system

Performance

FALDIC-β

- 50 to 750 W (rated speed: 3000 r/min)
- Slim or cubic motor
- 16-bit incremental encoder
- Exclusively used for pulse string input
- Simple operation
- New function: PC loader (option)

FALDIC-α

- 50 W to 5 kW (rated speed: 3000 r/min)
- Slim or cubic motor
- 16-bit absolute/incremental encoder
- Pulse string/analog input, DI/DO, SX bus, T-link, RS 485, and various interface
- Built-in positioning controller (L/R type)
- PC loader (option)

(Catalog No.: MH544)

ES Series

- 50 W to 3.7 kW (rated speed: 2000 r/min)
- Compatible with general-purpose motor
- 1000 P/R encoder
- Pulse string/analog input
- Special loader (option)

(Catalog No.: MH541)

* Contact us for FALDIC-α Series and ES Series.

Function

Application examples

- Semiconductor production and inspection equipment
- Electronic parts processing equipment
- Unloading robots
- Wire harness fabricator
- Packing machines
- Printing machines
- Conveyance
- Fibers
- Food processing
- Wood processing
- Injection molding
- Metal cutting and machine tools

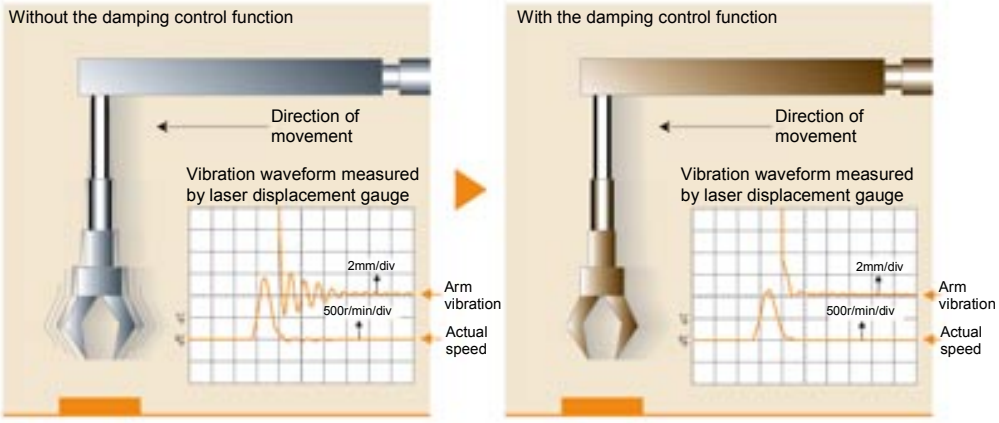
Feature. 1

Suppresses mechanical vibrations to the maximum extent.

■ **Equipped with a "Damping Control Function" which is an effective countermeasure for vibration of the tips of robot arms, etc.**

Fuji's original damping control function (Patent pending)

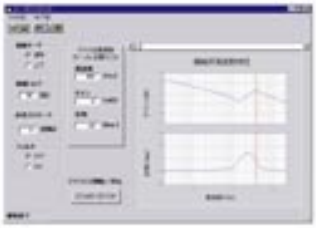
In high tact operation of mechanisms with low rigidity, such as the tips of robot arms, suppression of arm tip vibration is a major factor in shortening tact time. In the FALDIC-β series, Fuji's original "Damping Control Function" is standard equipment. It reduces vibration in machines with low rigidity and realizes high machine tact.



■ **Equipped with a notch filter and servo analysis function.**

Notch Filter

This function is for the purpose of reducing machine resonance. By setting the data on the resonance point, which differs in each machine, as a parameter in the servo amplifier, the machine resonance occurring in that point can be reduced.



Servo Analysis Function (Option)

In order to utilize the "Damping Control Function" and "Notch Filter," etc. effectively, it is necessary to analyze the "resonance frequencies" that are inherent in each machine. If the "Servo Analysis Function" offered in the optional personal computer loader is used, it can analyze the data for the machine system simply, eliminating the needs for complicated calculations and adjustments which are dependent on intuition.

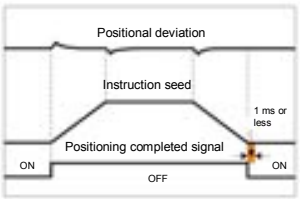
Feature. 2

Designed for high performance and high precision.

■ **Instruction following servo (positional deviation ≈ zero).**

Position time is 1 ms or less.

Through the newly developed feed forward control which compensates for servo delay, operation even during acceleration and deceleration can be done with positional deviation almost zero. A positioning completed signal can be output virtually simultaneously with the end of the instruction pulse (within 1 ms) .



■ **16-bit High Resolution Encoder**

A 65536 pulse/revolution serial encoder (exclusive INC) is standard equipment.

It can also be used for machines where high performance and highly accurate positioning is required.

Feature. 3

Servo amplifiers which are the smallest in the industry, and can be installed side by side without clearance.

200V type, 200W actual size

■ **Innovative compact body**

200V type, 200W: 35 (W) x 130 (H) x 130 (D)

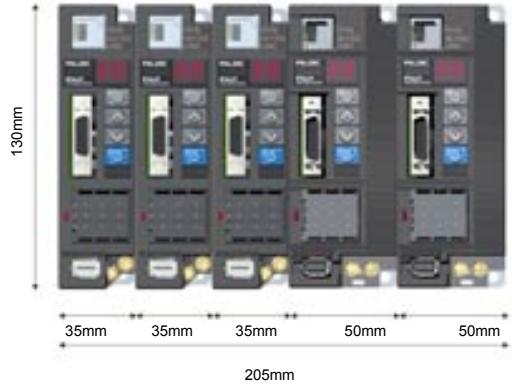
■ **Side by side installation supports miniaturization of the control panel.**

These units can be installed side by side horizontally, and through standardization of the height and depth dimensions, even if multiple units are used, they can be housed in an extremely compact cabinet, enabling miniaturization of control panels.

Capacity (W)	W (mm)	H (mm)	D (mm)
50	35	130	130
100	35	130	130
200	35	130	130
400	50	130	130
750	70	130	130

■ **Panel space is reduced by side by side installation.**

(Example: 200W x 3 axes + 400 W x 2 axes.



* The operating environment varies if the unit is installed close to another.

Feature. 4

Simple Operation and Short setup time

■ **Uses a new type auto tuning function.**

The previous auto tuning function has been further refined so that adjustments of even “heavy perpetual loads,” which are considered to be difficult in ordinary tuning, can be done easily.

■ **Setup parameters are designed to facility operability**

By setting only 7 different parameters in the basic settings, operation with the industry’s top level performance can be accomplished. In addition, by using the “personal computer loader” (option) for setting each type of system, setup can be accomplished in a short time.

Feature. 5

The standard configuration conforms to international standards. (UL/cUL, CE Marks)

The standard specifications of the FALDIC-β Series support the “UL/cUL” and “CE Mark,” so it can be used not only within Japan but anywhere overseas. This makes it a global servo with leading edge performance, dimensions and operability that can be utilized anywhere.

* Application filed for acquisition of UL/cUL, CE marking.

1-2) Items to be confirmed

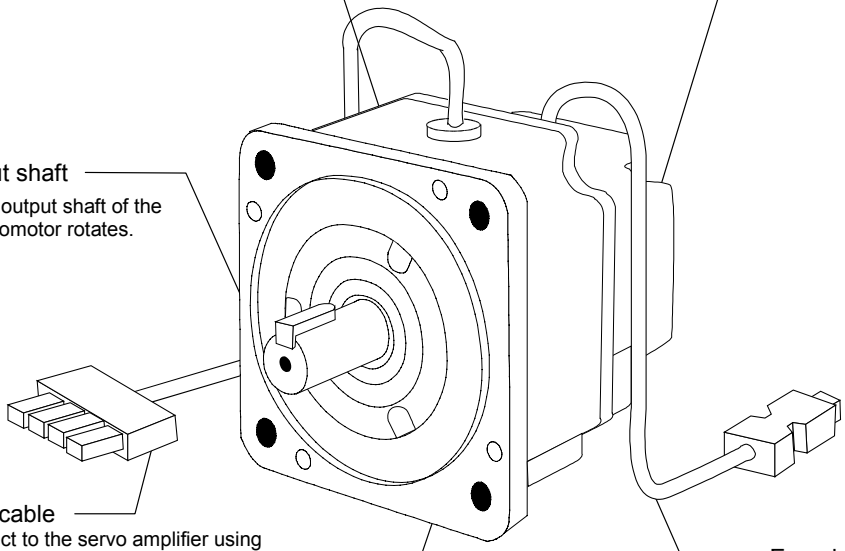
When the product (FALDIC-β Series) is delivered to you, unpack and check the following.

Items to be confirmed	Checking method	Check mark
Is the delivered FALDIC-β Series what you have ordered?	Check the "type" field in the motor and amplifier nameplates shown in the following pages.	
Is there any damage around the product?	Observe the appearance to check for broken parts.	
Check if the servomotor shaft rotates smoothly.	Turn by hand. If the shaft rotates smoothly, there is no problem. However, the shaft does not turn with servomotors equipped with a brake.	
Are any screws dislocated or loose?	Use a screwdriver to check screws.	

If any defects are found, contact your dealer or Fuji's sales outlet (shown on the back cover of this manual) immediately.

1-3) Servomotor

■ Appearance of product



Frame
The frame supports the output shaft of the servomotor. The frame is molded of resin.

Encoder
A 16-bit serial encoder is housed on the side of the servomotor opposite to the load.

Output shaft
The output shaft of the servomotor rotates.

Power cable
Connect to the servo amplifier using the optional cable or connector kit.

The wiring from the power cable up to the servo amplifier is called “power wiring.”

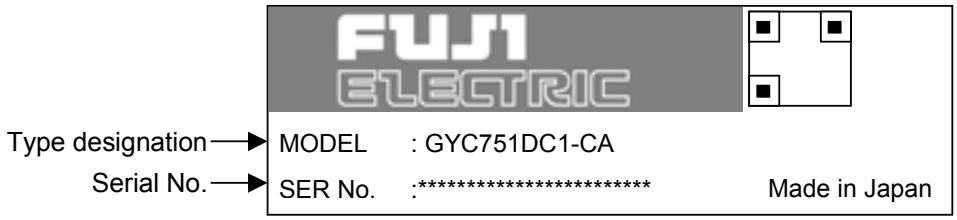
Encoder cable
Connect to CN2 of the servo amplifier using the optional cable or connector kit.

The wiring from the encoder cable up to the servo amplifier is called “encoder wiring.”

Flange
The servomotor is installed to the machine on this side.

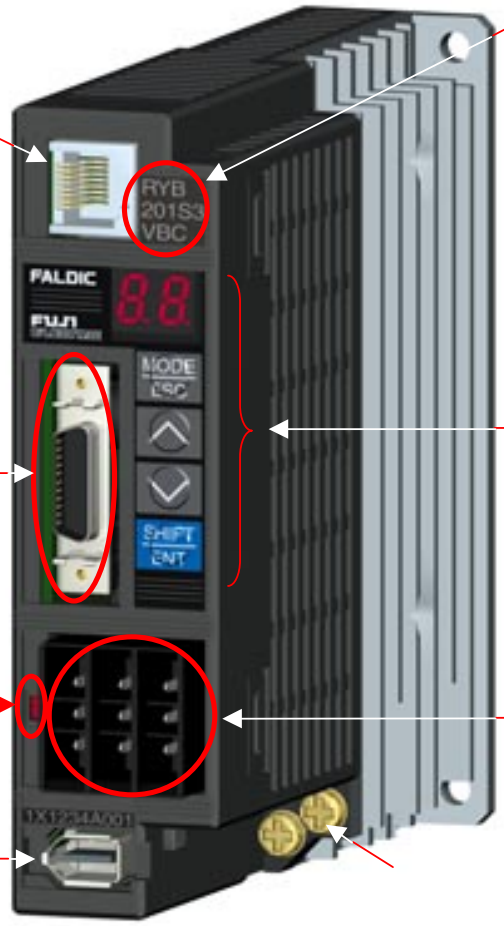
* The figure shows type GYC751DC1-C. The appearance varies according to the motor capacity.

■ How the nameplate looks

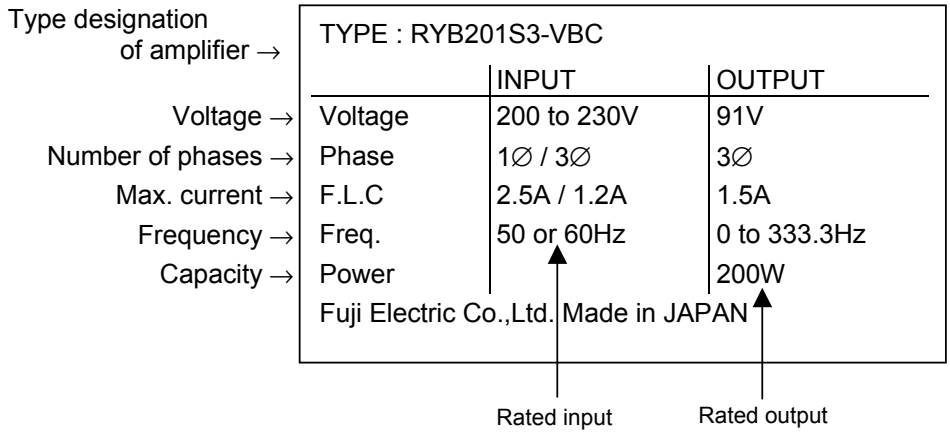


1-4) Servo amplifier

■ Appearance of product



■ How the nameplate looks



1-5) Type designation

<Servo amplifier>

RYB 201 S 3 — V B C 6

[Basic type designation]
RYB: Standard type

[Capacity]
201 : **20** X 10^1 = 200W
500 : **50** X 10^0 = 50W

[Series]
S: Standard

[Development generation]

[Major function]
V: Pulse string/speed control

[Host I/F]
B: DI/DO
(Exclusively used for pulse string)

[Encoder]
C: Standard
16-bit, exclusively used for incremental operation

[Voltage]
No indication: 3-phase 200V
6 : Single-phase 100V

<Servomotor>

GYS 201 D C 1 — C 6 B — B

[Basic type designation]
GYS : Slim
GYC : Cubic

[Capacity]
201 : **20** X 10^1 = 200W
500 : **50** X 10^0 = 50W

[Rated speed]
D : 3000 [r/min]

[Installation method]
C: Flange

[Development generation]

[Encoder]
H : 20-bit absolute/incremental
C : 16-bit, exclusively for incremental

[Voltage]
No indication : 3-phase 200V
6 : Single-phase 100V
8 : Common between single-phase 100V and 3-phase 200V

[Oil seal/shaft]
A : No oil seal with straight key
B : No oil seal without straight key

[Brake]
No indication : None
B : Installed

<Gear head>

GYN 201 S A G — G09

[Basic type designation]
GYN:Standard type

[Capacity]
201 : **20** X 10^1 = 200W
500 : **50** X 10^0 = 50W

[Motor type]
S : Slim
C : Cubic

[Development generation]

[Installation method]
G : Flange

[Gear ratio]
G09 : 1/9
G25 : 1/25

- MEMO -

FALDIC-β

2

INSTALLATION

2-1) Servomotor

2-2) Servo amplifier

2 INSTALLATION

2-1) Servomotor

(1) Storage temperature

Store the servomotor in the following environment when leaving it without energization.

Storage temperature : -20 to 60 °C

Storage humidity : 10 to 90% RH (no condensation allowed)

(2) Operating environment

Operate the servomotor in the following environment.

Operating temperature : -10 to 40 °C

Operating humidity : 10 to 90% RH (no condensation allowed)

*Use the gear head in the following operating environment.

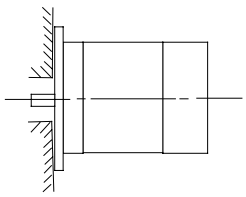
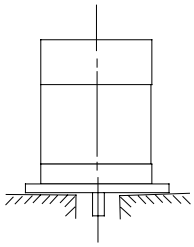
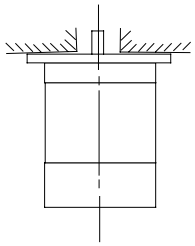
Operating temperature : 0 to 40 °C

Operating humidity : 10 to 90% RH (no condensation allowed)

(3) Mounting

The servomotor can be mounted horizontally, downward or upward. The same rule applies to the gear head and the servomotor equipped with a brake.

Flange-mounted

IM B5 (L51)	IM V1 (L52)	IM V3 (L53)
		

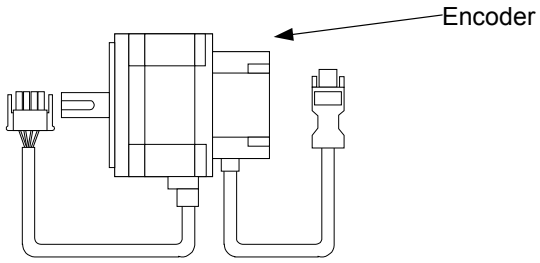
The symbol in the figure indicates the mounting method coded by JEM. Description in parentheses ( ) indicates the former JEM code.

(4) Handling

The servomotor is equipped with a built-in encoder. Do not hammer the output shaft of the servomotor because the encoder is a precision device.

Do not support the encoder to lift the servomotor during installation.

The encoder built in the servomotor has been aligned with the servomotor. If it is disassembled, the rated performance will not be obtained.

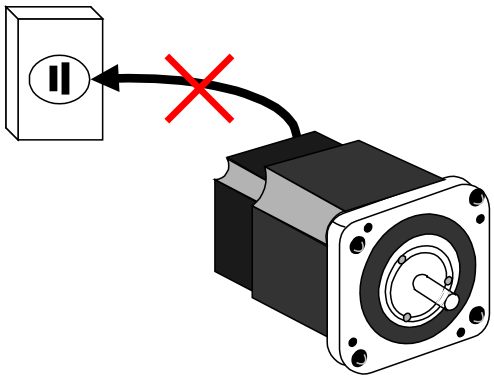


CAUTION	
	■ Do not disassemble the servomotor. If the servomotor is disassembled, the performance will deteriorate and the mechanical system may be broken. ■ Never give shocks to the servomotor by hitting with a hammer etc. Otherwise the encoder will be broken, causing the servomotor to run away.

(5) Power supply to servomotor

Do not connect commercial power supply to the servomotor. Otherwise the internal magnet will be de-energized to cause a failure of servomotor rotation.

For the connection method between the servomotor and servo amplifier, see chapter 3.



(6) Cable stress

Do not apply bending or tensile stress to the cable.

■ Precautions for applications with moving servomotor

- Design a system of an application with a moving servomotor so that the cables are free from forcible stress.
- Route the encoder cable and power cable in Cableveyor.
- Fix the encoder cable and power cable from the servomotor using cable clamps.
- Design the bending radius as large as possible.
- Do not allow bending stress or the weight of the cable itself to be exerted at cable connections.

(7) Protection against water and oil

Measures taken to the motor are useful for protection against moderate amount of splashes. However, the shaft is not water-proof or oil resistant, and so take appropriate measures on the machine side to avoid entry of water and oil into the servomotor.

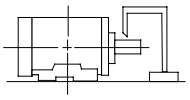
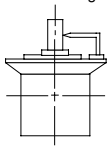
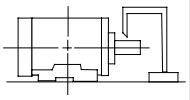
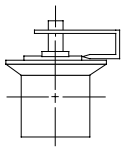
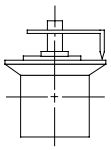
In environment with much water or oil drops or oil mist, install a cover or the like on the machine and connect lead wires and connector downward.

(8) Dimensional tolerances

The servomotor is assembled to the following accuracy.

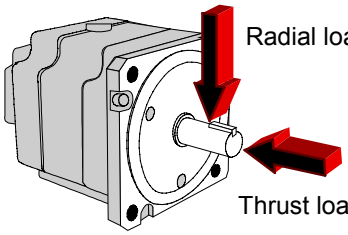
Unit: mm

Type of servomotor	Run-out at shaft end	Center deviation (Flange)	Perpendicularity of flange face (Flange)
GYC□□□DC1	≤ 0.02	≤ 0.06	≤ 0.08
GYS□□□DC1	≤ 0.02	≤ 0.06	≤ 0.08

Run-out at shaft end	Parallelism of shaft	Center deviation	Perpendicularity of flange face
 Leg mount  Flange mount			

(9) Load

The radial load and thrust load exerted on the shaft end of the servomotor are as follows.

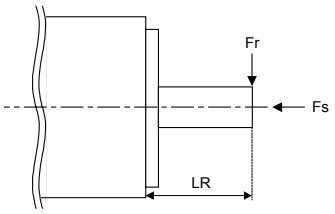


Radial load: Load exerted at right angles to motor shaft

Thrust load: Load exerted in parallel to motor shaft

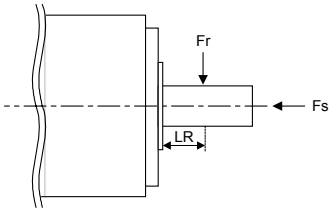
■ Servomotor

Type of servomotor		Allowable radial load Fr [N]	Allowable thrust load Fs [N]	LR [mm]
GYS	500DC1-C8B	127	19	25
	101DC1-CB	127	19	25
	201DC1-CA	264	58	30
	401DC1-CA	264	58	30
	751DC1-CA	676	147	40
GYC	101DC1-CA	107	19	25
	201DC1-CA	235	39	30
	401DC1-CA	235	39	30
	751DC1-CA	460	88	40



■ 1/9 gear head

Motor type	Type of gear head		Allowable radial load Fr [N]	Allowable thrust load Fs [N]	LR [mm]
Slim (GYS)	GYN	500SAG-G09	294	147	11
		101SAG-G09	294	147	11
		201SAG-G09	441	196	17
		401SAG-G09	589	245	17
		751SAG-G09	736	294	22.5
Cubic (GYC)	GYN	101CAG-G09	548.8	372.4	11
		201CAG-G09	1019	666.4	17
		401CAG-G09	1019	666.4	17
		751CAG-G09	1381.8	882	22.5



■ 1/25 gear head

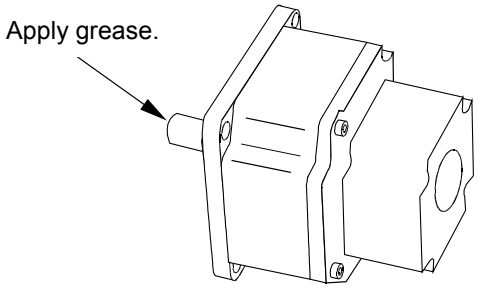
Motor type	Type of gear head		Allowable radial load Fr [N]	Allowable thrust load Fs [N]	LR [mm]
Slim (GYS)	GYN	500SAG-G25	441	147	11
		101SAG-G25	441	147	11
		201SAG-G25	687	196	17
		401SAG-G25	883	245	17
		751SAG-G25	1019	294	22.5
Cubic (GYC)	GYN	101CAG-G25	764.4	588	11
		201CAG-G25	1430	1058	17
		401CAG-G25	1430	1058	17
		751CAG-G25	1940	1372	22.5

■ Assembling the GYN gear head

Follow the procedure below to assemble the GYN gear head. The procedure is similar for the GRN gear head.

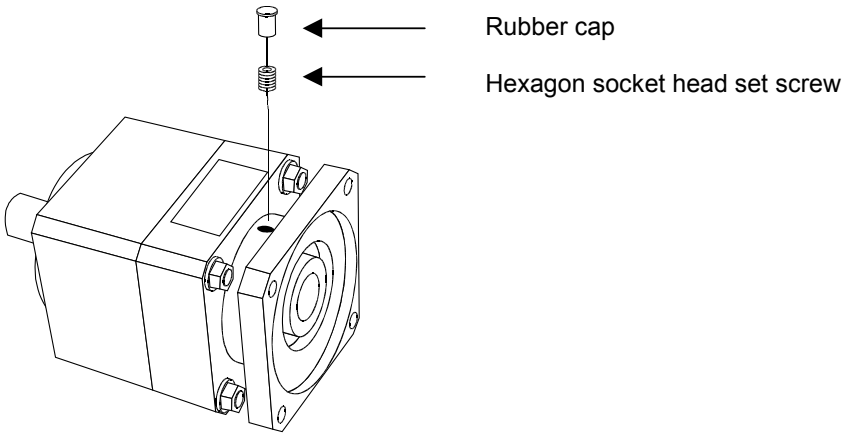
(1) Applying grease

Before assembling the GYC/GYS motor to the gear head, apply grease on the output shaft of the servomotor. (This is for prevention of seizure of the output shaft of the servomotor.)



(2) Preparation for assembly

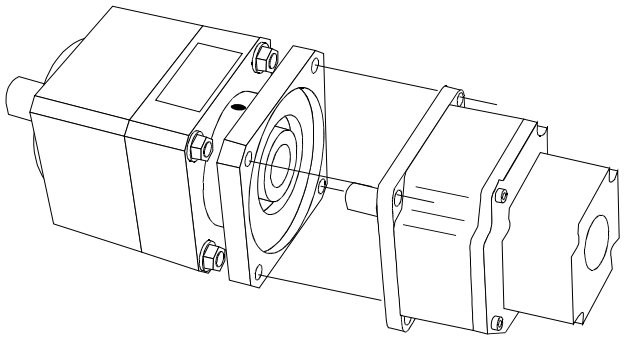
1) Remove the rubber cap in the depth of the flange face (of the gear head) installing the servomotor.



2) Align the position of the key in the input shaft of the gear head with the rubber cap hole.
Loosen the hexagon socket head cap screw in the rubber cap.
(The hexagon socket head cap screw is located at the input shaft of the gear head.)

(3) Assembling the motor

While aligning the input shaft of the gear head with the key, insert the output shaft of the servomotor. Tighten the screws of the gear head to fix the flange face of the motor to the flange face of the gear input shaft.



Screw size (For GYS)

Type of gear head	Size of accessory screw (quantity)	Tightening torque
GYN500SAG-G09, -G25	M4 x 12 (4 pcs.)	1.8 ± 0.21 [N· m]
GYN101SAG-G09, -G25		
GYN201SAG-G09, -G25		
GYN401SAG-G09, -G25		
GYN751SAG-G09, -G25	M5 x 12 (4 pcs.)	3.5 ± 0.42 [N· m]

Screw size (For GYC)

Type of gear head	Size of accessory screw (quantity)	Tightening torque
GYN101CAG-G09, -G25	M4 x 12 (4 pcs.)	1.8 ± 0.21 [N· m]
GYN201CAG-G09, -G25		
GYN401CAG-G09, -G25		
GYN751CAG-G09, -G25	M5 x 12 (4 pcs.)	3.5 ± 0.42 [N· m]

After fixing the screws, tighten the hexagon socket head cap screw.

Hexagon socket head cap screw

Type of gear head	Size of accessory screw	Tightening torque
GYN500SAG-G09, -G25	M4 x 4	1.8 ± 0.21 [N · m]
GYN101SAG-G09, -G25		
GYN201SAG-G09, -G25		
GYN401SAG-G09, -G25		
GYN751SAG-G09, -G25		
GYN101CAG-G09, -G25		
GYN201CAG-G09, -G25		
GYN401CAG-G09, -G25		
GYN751CAG-G09, -G25		

Plug the rubber cap in the original position as the last step.

2-2) Servo amplifier

(1) Storage temperature

Store the servo amplifier in the following environment when leaving it without energization.

Storage temperature : -20 to 85 °C

Storage humidity : 10 to 90% RH (no condensation allowed)

(2) Operating environment

Operate the servomotor in the following environment.

The servo amplifier is not drip-proof and dust resistant.

Operating temperature : -10 to 50 °C

Operating humidity : 10 to 90% RH (no condensation allowed)

(3) Mounting

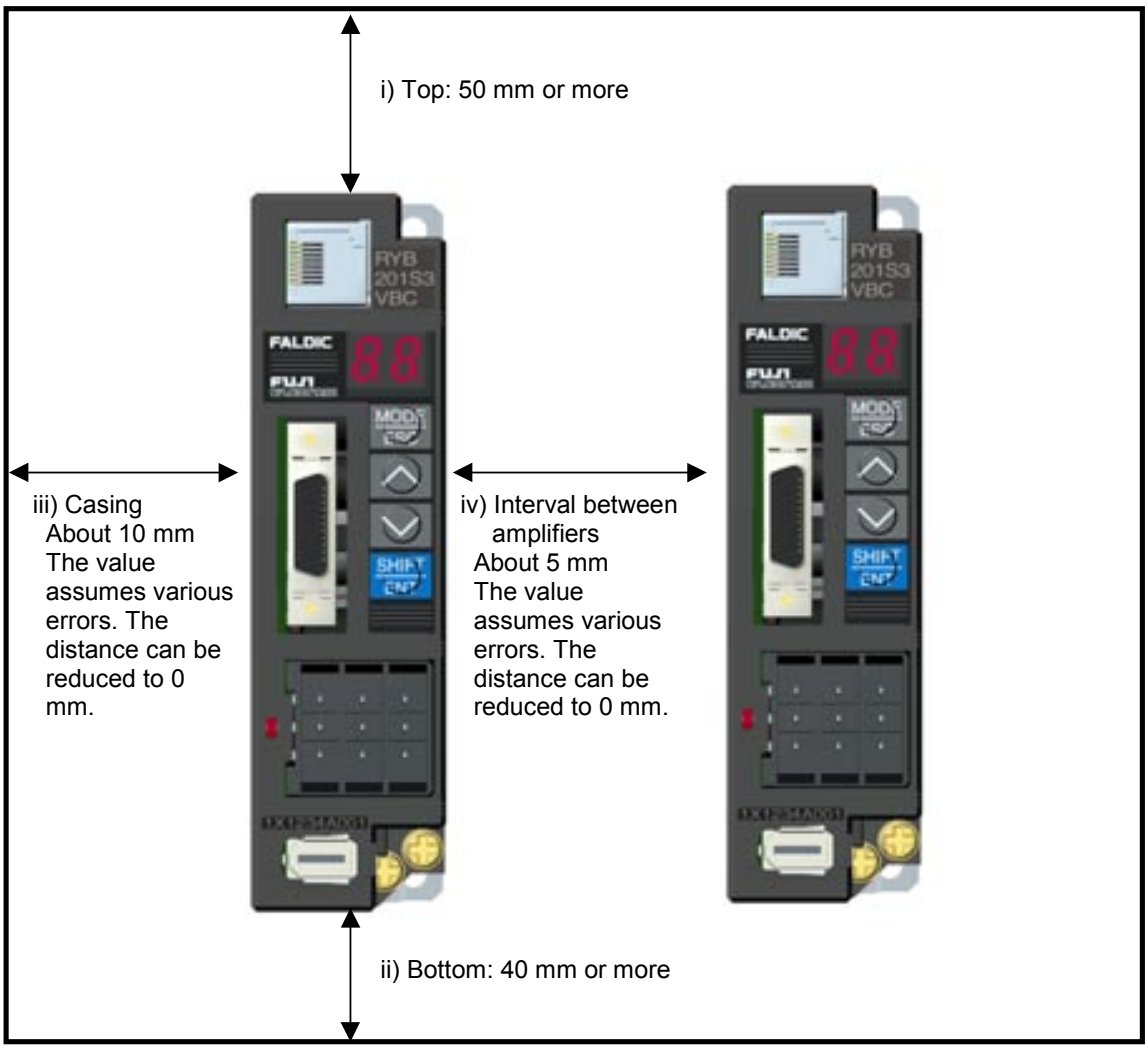
1) Mount the servo amplifier in the upright direction so that the “FALDIC” characters on the keypad panel of the servo amplifier look horizontally.

2) The servo amplifier has the part that generates heat during operation.

To mount multiple servo amplifiers in the same panel, observe the following precautions.

- Mount side by side in principle. The RYB servo amplifier can be mounted closely. Use the amplifiers at 80% ED rating* if they are installed in contact with each other. There is no limitation in the operation frequency when amplifiers are mounted at 5 mm or larger intervals.
- Reserve 40 mm or a larger distance at the bottom of the servo amplifier.
- 50 mm or a larger distance is necessary above the servo amplifier for heat radiation.

* Servo amplifiers can be operated at 100% ED at ambient temperatures below 45°C.

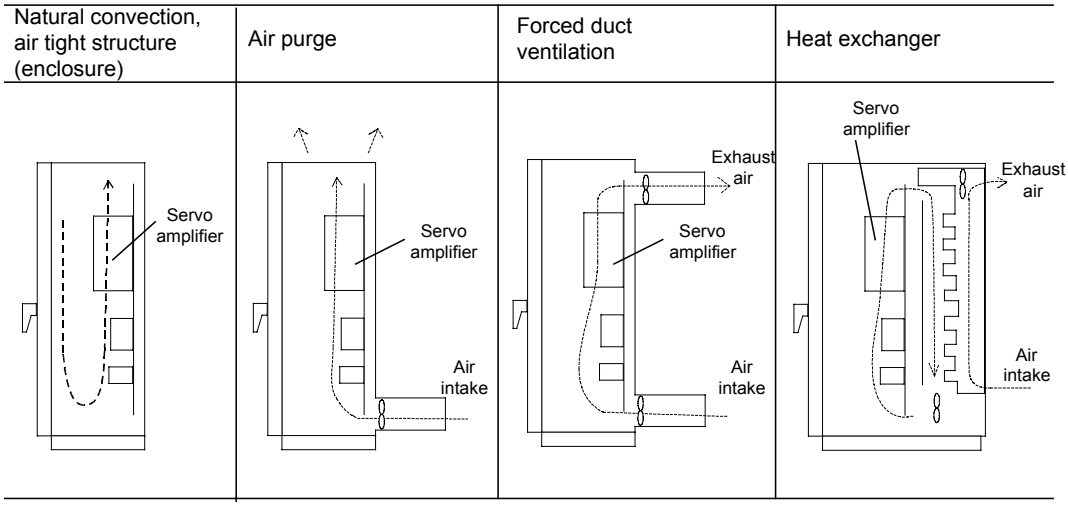


(4) Handling

The servo amplifier consists of electronic parts including microprocessors. Do not operate in the following environment.

- Location near oil, steam or corrosive gas
- Location with much dust

Mount the servo amplifier in an airtight panel equipped with a forced ventilation fan when using it at places with much dust.



- Location where strong electrostatic or magnetic field exists
- Accommodation in the same panel together with high voltage (3 kV, 6 kV) equipment
- Sharing of the same power supply with the equipment which generates large noise
- Under standing vibration
- In vacuum
- In explosive atmosphere

(5) Power supply to servo amplifier

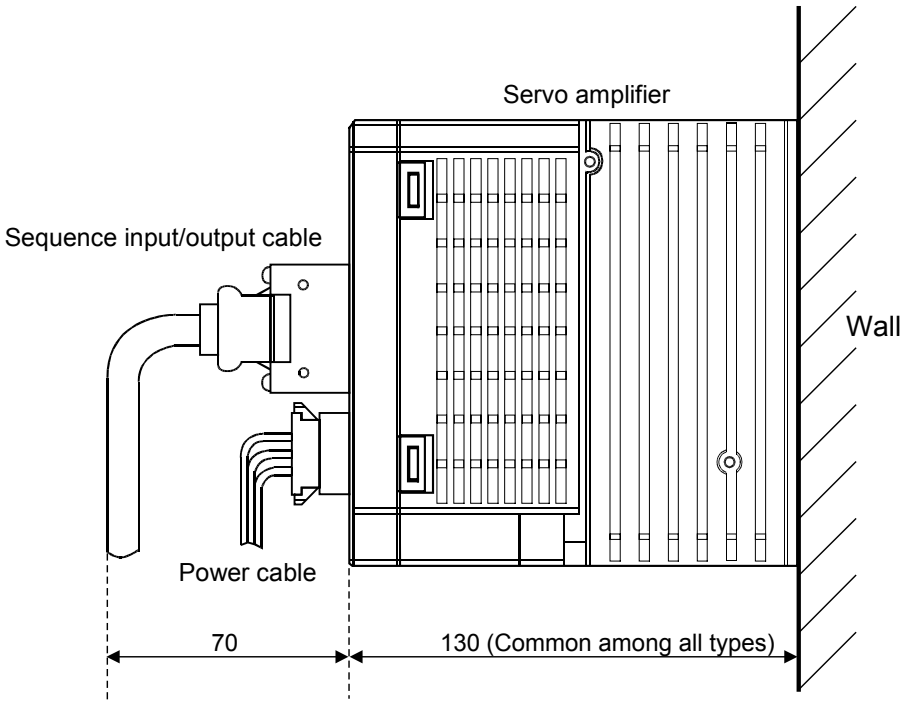
Supply electric power to the servo amplifier in the specification range.

- Single-phase 100 V: 100 to 115 [VAC] (fluctuation: -15 to +10%)
- Three-phase 200 V: 200 to 230 [VAC] (fluctuation: -15 to +10%)

* Single-phase power supply can be used for three-phase 200V servo amplifiers with 400W or smaller outputs.

(6) Depth of amplifier

Allow 70 mm or more distance for a servo amplifier connected with a sequence input/output cable.



-MEMO-

FALDIC-β

3

WIRING

3 WIRING

3-1) Configuration

The configuration of FALDIC-β Series is as follows.

(1) Servomotor (without brake)

FAB/ELB

FAB or ELB is installed in the primary circuit of the servo amplifier to avoid losses caused by shutdown or power-on or short-circuit current. The electromagnetic contactor may be installed between the circuit breaker and AC reactor.

AC reactor

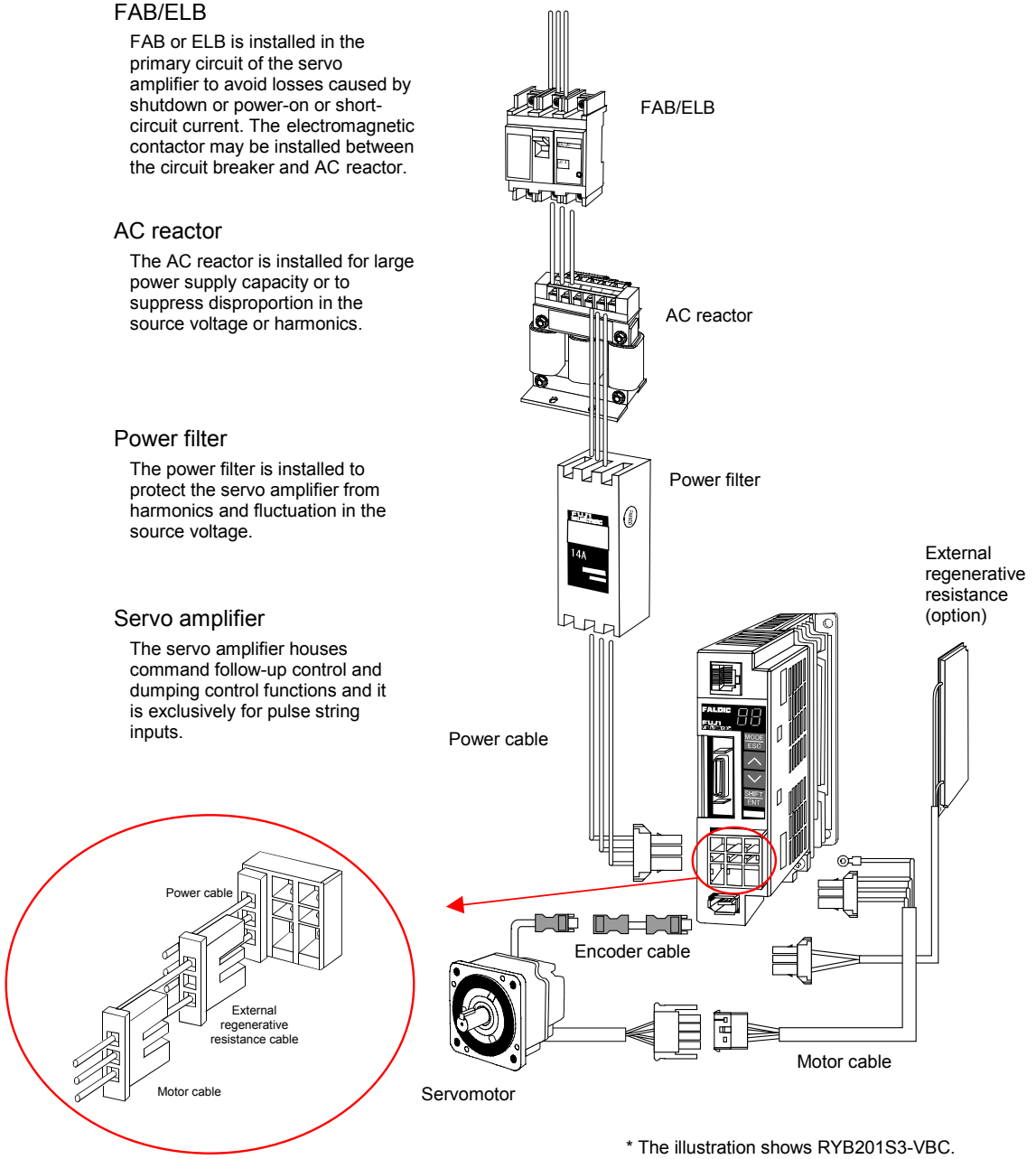
The AC reactor is installed for large power supply capacity or to suppress disproportion in the source voltage or harmonics.

Power filter

The power filter is installed to protect the servo amplifier from harmonics and fluctuation in the source voltage.

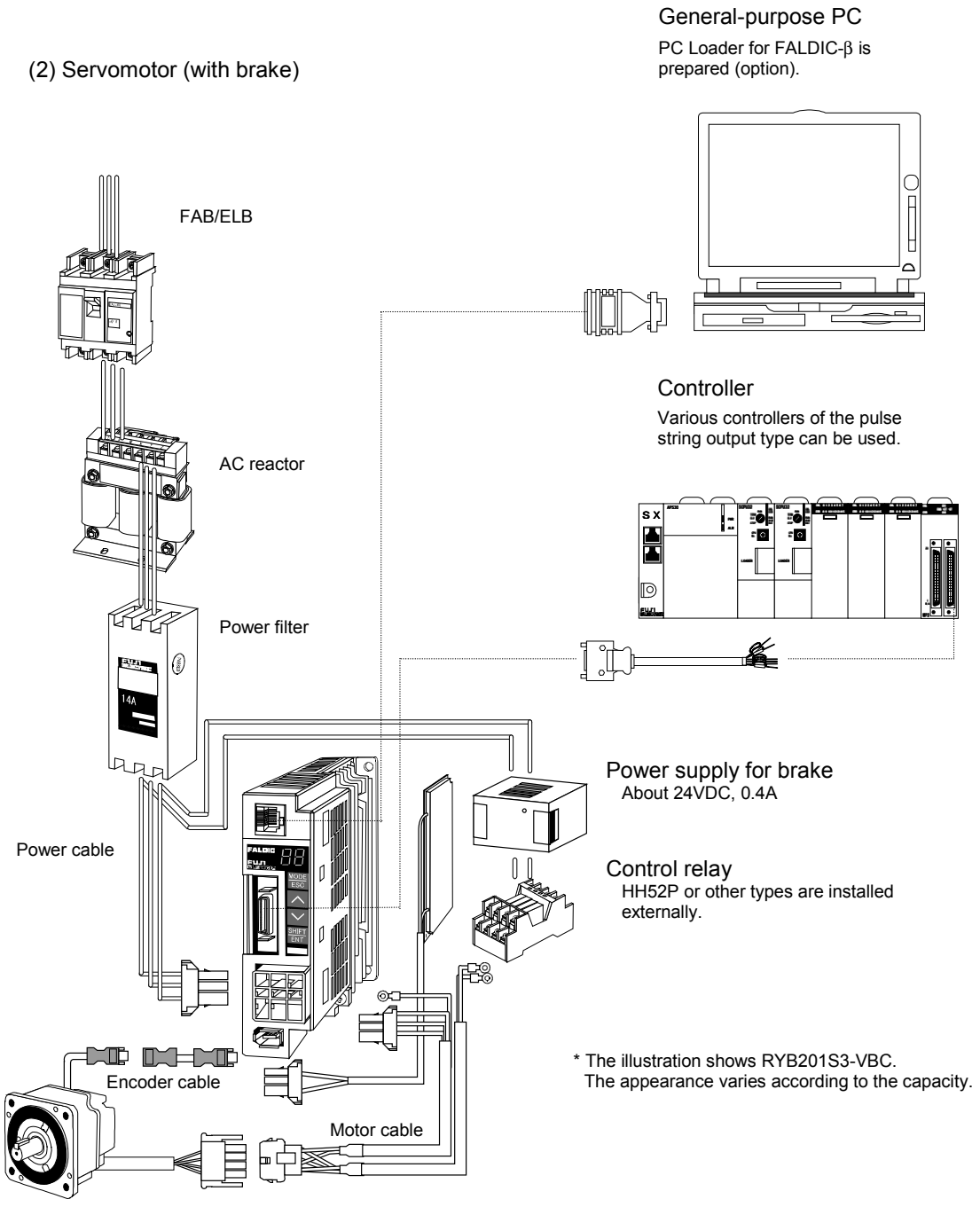
Servo amplifier

The servo amplifier houses command follow-up control and dumping control functions and it is exclusively for pulse string inputs.



* The illustration shows RYB201S3-VBC.
The appearance varies according to the capacity.

(2) Servomotor (with brake)



CAUTION

Do not use the same power supply for the brake (24VDC, 0.4A) and sequence input/output.

Prepare separate power supplies.

3-2) Servo amplifier

Supply commercial power shown in Chapter 11 to the amplifier.
Do not supply commercial power to the servomotor. If attempted, the motor will be broken.

(1) Commercial power supply

■ 3-phase 200V series

Supply 200V commercial power to the servo amplifier. Connect the power cables to the L1, L2 and L3 terminals.

Voltage: 200 / 200 to 230 V, -15 to +10%

Frequency: 50/60Hz

No. of phases: 3 (Single-phase 200V can be supplied to servo amplifiers with 400W or smaller capacities.)

Use a step-down transformer to supply power from the 400V system. If the voltage is supplied directly, the servo amplifier will be broken.

■ Single-phase 100V series

Supply 100V commercial power to the servo amplifier. Connect the power cables to the L1 and L2 terminals.

Voltage: 100 to 115V, -15 to +10%

Frequency: 50/60Hz

No. of phases: Single

Use a step-down transformer to supply power from the 200V system. If the voltage is supplied directly, the servo amplifier will be broken.

(2) Power supply capacity

The power supply capacity required for each servo amplifier is as follows. The same power supply capacity applies to the step-up or step-down transformer.

The specified power supply capacity is for the designated cable size and a wiring length of 20m. If the power supply capacity is 500 kVA or more, an AC reactor specified in section 10-6 should be provided. (Otherwise the contact of the electromagnetic contactor or the like may melt.)

Input power supply	Type of servo amplifier	Applicable motor example (slim type)	Power supply capacity
3-phase 200V series	RYB500S3-VBC	GYS500DC1-C8B	0.15kVA
	RYB101S3-VBC	GYS101DC1-CB	0.3kVA
	RYB201S3-VBC	GYS201DC1-CA	0.6kVA
	RYB401S3-VBC	GYS401DC1-CA	1.2kVA
	RYB751S3-VBC	GYS751DC1-CA	2.1kVA
Single-phase 100V series	RYB500S3-VBC6	GYS500DC1-C8B	0.15kVA
	RYB101S3-VBC6	GYS101DC1-C6B	0.6kVA
	RYB201S3-VBC6	GYS201DC1-C6B	1.2kVA

The RYB Series servo amplifier (3-phase 200V type 3.7 kW or less) is applicable to the harmonics suppression guideline for electric appliances and general-purpose equipment (enacted in 1994 and revised in September 1997) issued by the Ministry of International Trade and Industry of Japanese government. Regulation levels are determined by the Japan Electrical Manufacturers' Association according to this guideline.

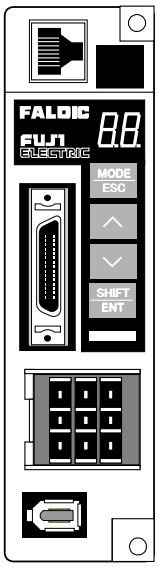
You must connect a reactor for harmonics suppression to the servo amplifier to comply with this guideline. Refer to "AC reactor" in the manual for the reactor.

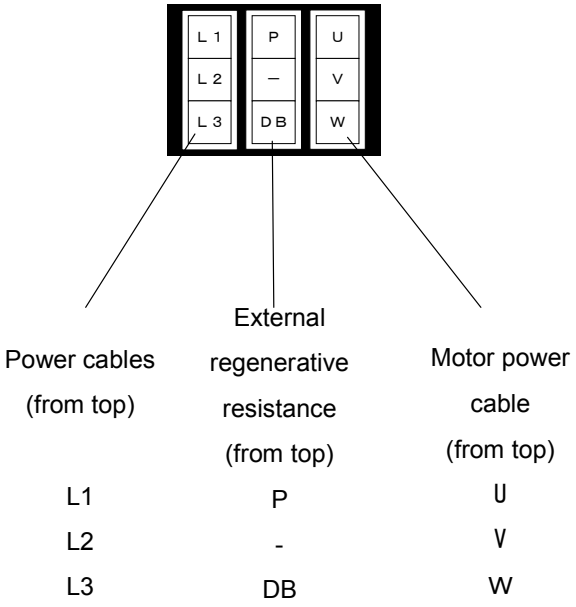
When you prepare the other reactor, consult us for its detailed specifications.

(3) Main circuit terminals

The power cable for the servo amplifier, external regenerative resistor (option) and servomotor power cable are connected at the main circuit terminals.

The main circuit terminals accept connectors. The connector is not included in the accessories of the servo amplifier. Purchase connector kits or wiring cables.

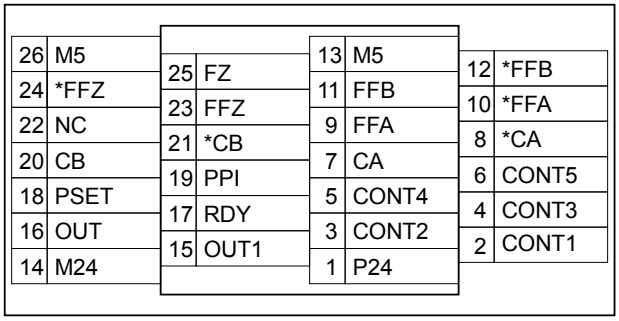




Terminal symbol	Pin No.	Name	Function and meaning
L1 L2 L3	1 2 3	Power cable	Supplies commercial power supply. Single-phase power cables can be connected to 400W or smaller capacities of 3-phase 200V type. There is no phase sequence. With single-phase 100V, connect the power cables to the L1 and L2 terminals.
P DB	1 3	External regenerative resistance (option)	Used to connect an external regenerative resistance. The external regenerative resistance is optional. Connect across the P and DB terminals. Leave pin 2 unconnected.
U V W	1 2 3	Motor power cable	Used to connect the power cable of the servomotor. The grounding (E) terminal of the servomotor is provided in the depth on the bottom of the servo amplifier. The specified phase sequence of the servomotor cannot be changed. Connect the identical cables of the servomotor.

(4) Sequence input/output terminal

Connect the signal cable of a host controller to connector 1 (CN1) of the servo amplifier.



Compatible connector on cable side

Soldered plug: 10126-3000V

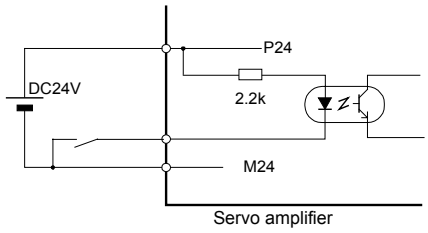
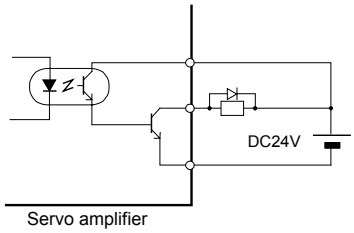
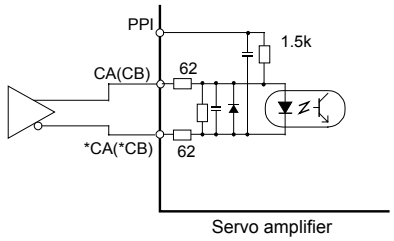
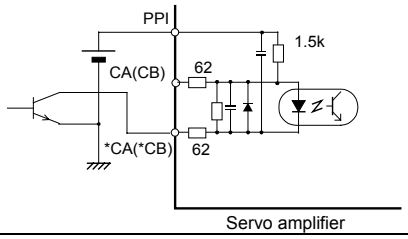
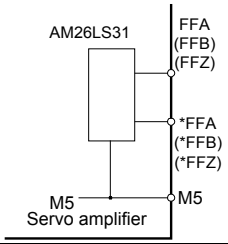
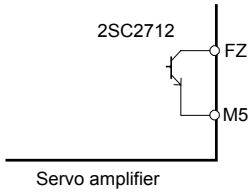
Shell kit : 10326-52A0-008

■ List of sequence functions

Terminal symbol	Pin No.	Name	Function and meaning
P24 M24	1 14	Power supply for sequence input/output	Power supply input for sequence input/output signals (+24VDC, 0.3A)
CONT1 CONT2 CONT3 CONT4 CONT5	2 3 4 5 6	Sequence input	Sequence input signals. The following signals are allocated by the factory settings. (+24VDC, 10 mA) CONT 1: Operation command (RUN) CONT 2: Reset (RST) CONT 3: (Not specified) CONT 4: (Not specified) CONT 5: (Not specified)
OUT1 OUT2 RDY PSET	15 16 17 18	Sequence output	Sequence output signals. The following signals are allocated by the factory settings. (Max. +30VDC / 50mA) OUT 1: Alarm detection, a-contact OUT 2: (Not specified) RDY: Active when ready to turn PSET: Active upon completion of positioning
PPI CA *CA CB *CB	19 7 8 20 21	Pulse string input	PPI: Power supply input for open collector (24 VDC +/-5%) - Differential input CA, *CA, CB, *CB (max. input frequency: 1 MHz) - Open collector input *CA, *CB (max. input frequency: 200 kHz) The pulse string form can be chosen from command pulse and sign, forward/reverse rotation pulse, and two signals having 90-degree phase difference.
FFA *FFA FFB *FFB FFZ *FFZ FZ M5	9 10 11 12 23 24 25 26 ,13	Frequency dividing output	Frequency dividing output terminals. Two signals having 90-degree phase difference in proportion to the rotation of the servomotor are output. (Differential output) The FZ terminal is an open-collector output. (Max. +30VDC, 50mA) M5: Reference potential
NC	22	No connection	Do not connect this terminal.

* Terminals having the same name (M5) are connected internally. They are not connected with terminal M24.

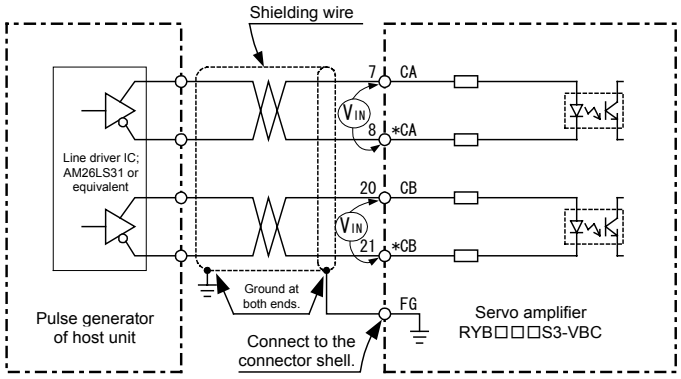
■ Interface circuit diagram

Signal name	Specification	Circuit
Sequence input	24VDC, 10mA (For each point)	
Sequence output	+30VDC, 50mA (Max.)	
Pulse string input (Differential output)	Differential input	
Pulse string input (Open collector)	24 VDC (12 VDC*)	
Pulse string output (Differential output)	Differential output	
Pulse string output (Open collector)	+30VDC, 50mA (Max.)	

* The pulse train input can be a 12 VDC input. In this case, the wiring method varies. Refer to the drawing in item (3) below.

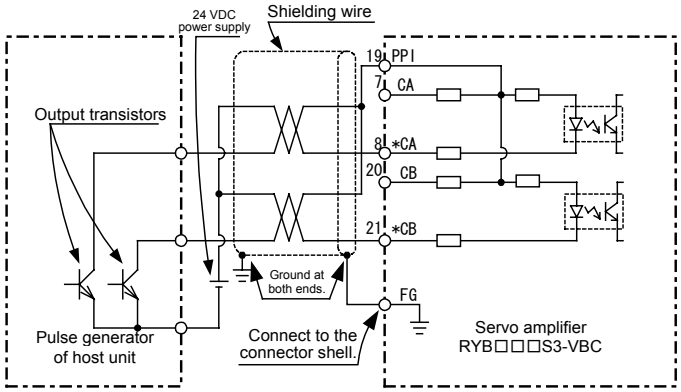
■ Examples of recommended wiring for command pulse

(1) Differential output devices



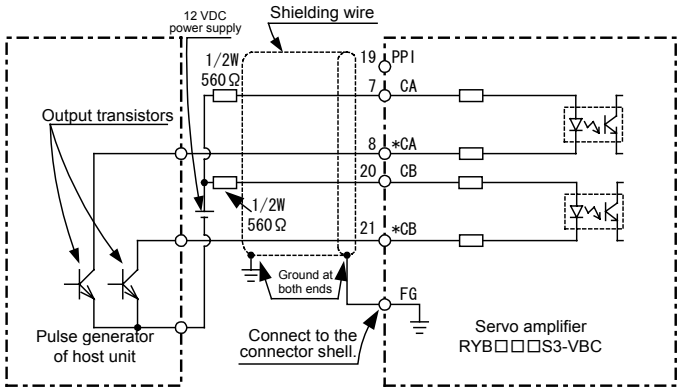
V_{IN}: The voltage amplitude between CA and *CA (between CB and *CB) must be between 2.8 and 3.7V. (The servo amplifier may not accept the input pulse in other than the specified range.)

(2) Open collector output devices (24 VDC input)



24 VDC power supply: Contain the source voltage within the 24 VDC +/-5% range.
This circuit consumes a maximum 40 mA current. Prepare a power supply having a sufficient margin.

(3) Open collector output devices (12 VDC input)



12 VDC power supply: Contain the source voltage within the 12 VDC +/-5% range.
This circuit consumes a maximum 40 mA current. Prepare a power supply having a sufficient margin.

3-3) Servomotor

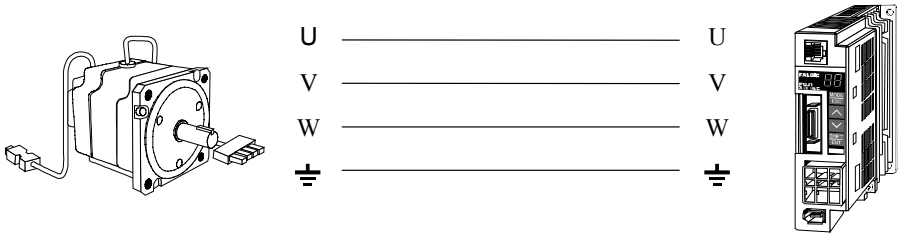
(1) Servomotor

Connect the power cable of the servomotor to the U, V and W terminals of the servo amplifier while identifying the symbols.

Do not supply commercial power directly to the servomotor. If attempted, the magnet inside the motor will be de-magnetized and the servomotor will not rotate.

⚠ CAUTION	Do not supply commercial power to the servomotor. If attempted, the internal magnet will be de-magnetized and the servomotor will not rotate.

The direction of rotation of the servomotor cannot be changed by changing the sequence of the servomotor terminals. Change the parameter 4 setting to achieve this.



The wiring length between the servo amplifier and servomotor should be within 50 m long.

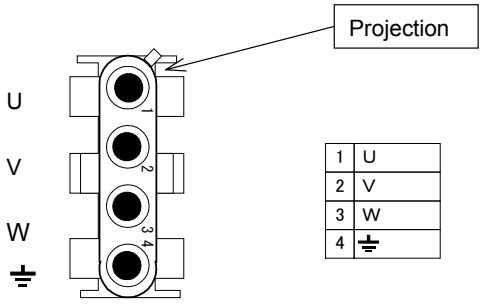
It is not permitted to perform ON/OFF of the wiring between the servo amplifier and servomotor using magnetic contactors. It is not permitted to turning ON/OFF multiple servomotors with a single servo amplifier.

Furthermore, it is not permitted to connect the following equipment along the wiring between the servo amplifier and servomotor:

Phase advancing capacitor, various reactors, noise filter, surge absorber

■ Connector for GYC/GYS type

Without brake



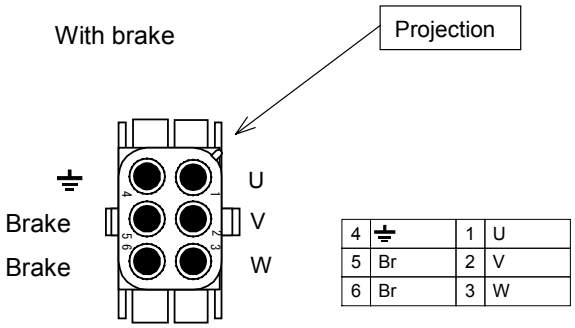
1	U
2	V
3	W
4	⏚

Motor power cable on motor side
(Viewed from contact inserting side)

1 cap housing
350780-1 type (Japan AMP)

4 contactors (socket)
350750-3 or
350689-3 type (Japan AMP)

With brake



4	⏚	1	U
5	Br	2	V
6	Br	3	W

Motor power cable on motor side
(Viewed from contact inserting side)

1 cap housing
350781-1 type (Japan AMP)

4 contactors (socket)
350750-3 or
350-689-3 type (Japan AMP)

CAUTION

Do not use the same power supply for the brake (24VDC, 0.4A) and sequence input/output.

Prepare separate power supplies.

3-4) Encoder

The servomotor is equipped with a 16-bit serial encoder (exclusively for incremental mode). Connect the encoder wiring to CN2 of the servo amplifier.

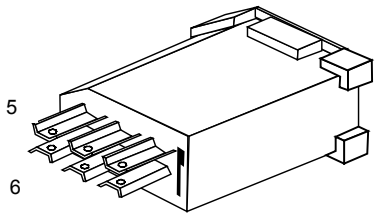
The wiring connector is not included in accessories.

An optional cable with connectors at both ends is prepared.

The maximum wiring length of the encoder is 50 m with limitations from the cable size.

■ Connector for GYC/GYS type

Wiring on servo amplifier side



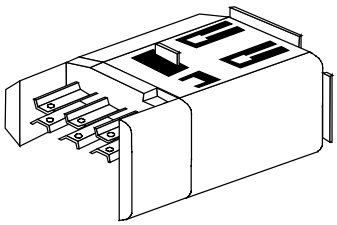
5	SIG+	3	-	1	P5
6	SIG-	4	-	2	M5

Encoder wiring
(Viewed from wiring side)

Housing	:54180-0611
Shell body clamp	:58299-0600
Shell body cover	:58300-0600
Mold cover	:54181-0615
Mold cover	:54182-0605
Cable clamp	:58303-0000
Clamp screw (M2 x 4)	:59832-0009

* All parts are made by Molex.

Wiring on servomotor side



6	SIG-	4	-	2	M5
5	SIG+	3	-	1	P5

Encoder wiring
(Viewed from wiring side)

Housing	:53988-0611
Shell body clamp	:58302-0600
Mold cover	:53989-0605
Mold cover	:53990-0650
Cable clamp	:58303-0000
Clamp screw (M2 x 4)	:53982-0009

* All parts are made by Molex.

- Wiring cable

Use the following cables if the optional encoder cable is not used.

■ Cross-link polyethylene insulated, vinyl sheath cable for robot travel (DAIDEN Co., Ltd.)
RMCV-SB (UL2464) AWG# 25/2P + AWG# 23/2C (twisted-pair cable)
(Cable length: within 10m)
Twisted 2P (pairs), 2C (core) composite cable of different cable sizes
Note: Use the core with larger sectional area for power supply.

■ Cross-link polyethylene insulated, vinyl sheath cable for robot travel (DAIDEN Co., Ltd.)
RMCV-SB (UL2464) AWG# 25/2P + AWG# 23/2C (twisted-pair cable)
(Cable length: within 50m)
Note: Use the core with larger sectional area for power supply.

- Connection

It is not allowed to extend the wiring distance by connecting two or more cables of short wiring length.

CAUTION

Do not extend the wiring distance by connecting two or more short cables.
Otherwise the servomotor will be stopped due to poor contact.

- Cable size

See the following table for conversion between AWG and mm sizes.

Gauge		Diameter		Sectional area	
A.W.G	mm.G	mil	mm	Circular mil	mm^2
	1.4	55.12	1.400	3038	1.539
16		50.82	1.291	2583	1.309
	1.2	47.24	1.200	2232	1.131
23		22.57	0.5773	509.4	0.2581
	.55	21.65	0.5500	468.7	0.2376
24		20.10	0.5106	404.0	0.2047
	.50	19.69	0.5000	387.7	0.1963
25		17.90	0.4547	320.4	0.1623
	.45	17.72	0.4500	314.0	0.1590

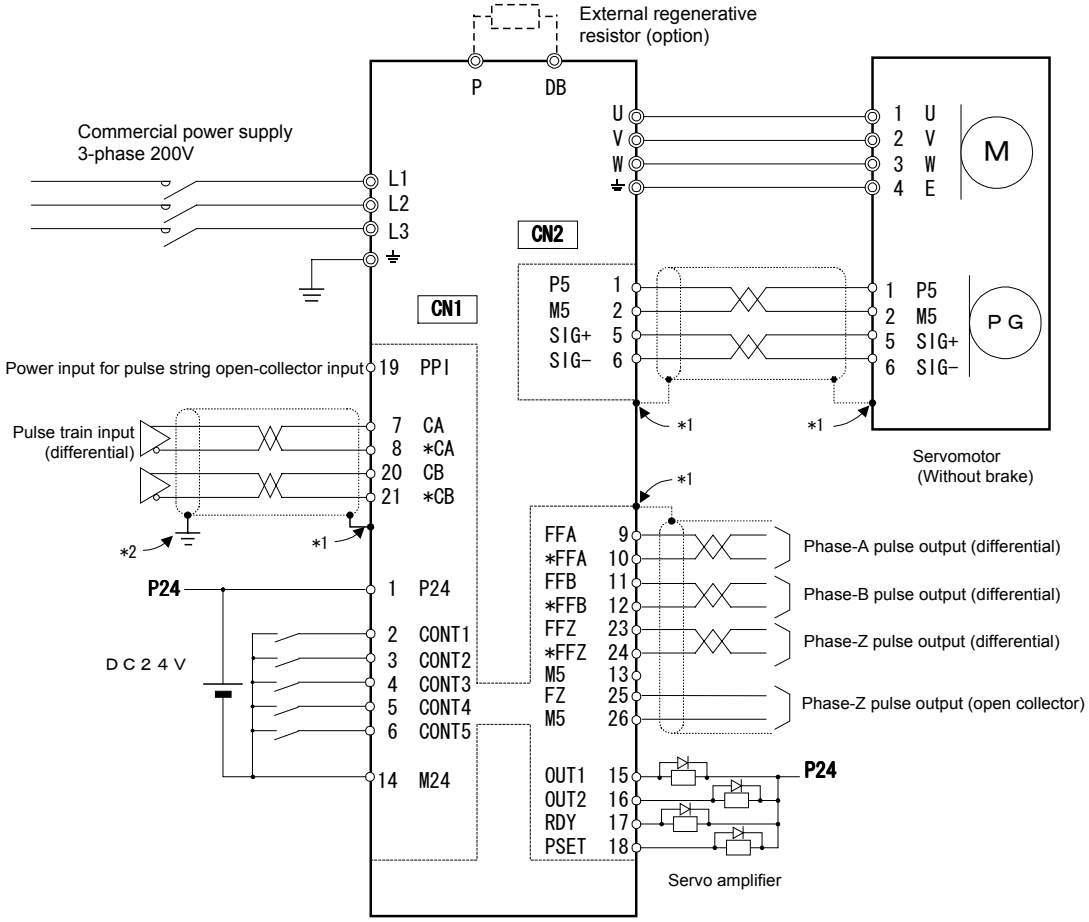
-MEMO-

3-5) Standard connection diagrams

Connection diagrams of the servo amplifier are shown here.

- 3-phase 200V (without brake)
- 3-phase 200V (with brake)
- Single-phase 100V (without brake)
- Single-phase 100V (with brake)

■ Three-phase 200 V (without brake)



*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) terminal on the pulse generator side.

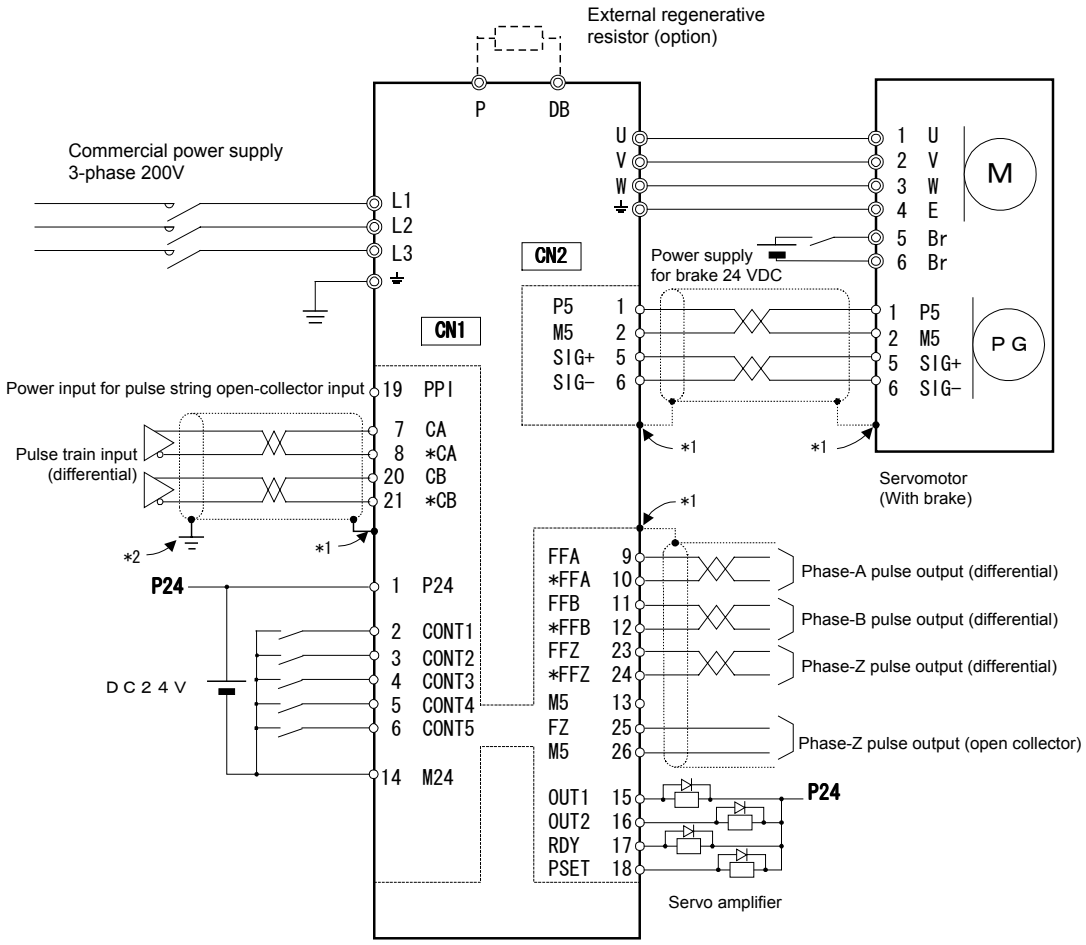
- The external regenerative resistor is not built in. The external regenerative resistor is prepared as optional equipment.
- For 500 kVA or larger power supply capacities, connect the power supply coordination reactor.
- Arbitrary signals can be allocated to CONT and OUT terminals.

The factory settings are as follows.

Terminal symbol	Factory setting
CONT 1	Operation command [RUN]
CONT 2	Reset [RST]
CONT 3	(Not specified)
CONT 4	(Not specified)
CONT 5	(Not specified)

Terminal symbol	Factory setting
OUT1	Alarm detection: a-contact
OUT 2	(Not specified)

■ Three-phase 200 V (with brake)



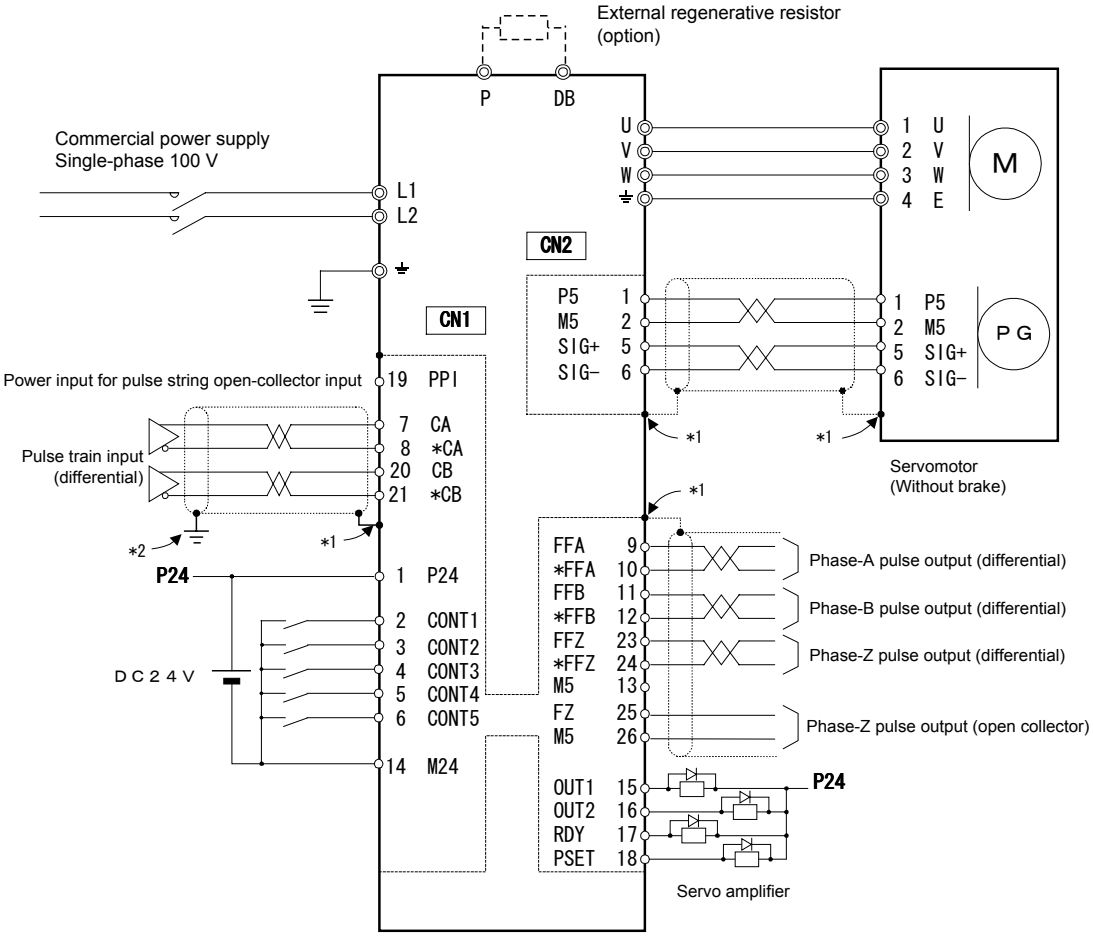
*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) terminal on the pulse generator side.

- The distance between the servomotor and servo amplifier can be extended up to 20 m when optional cable is used. The distance can be extended up to about 50 m if the cable size is increased.
  For the cable size of the encoder, refer to section 3-4 “Encoder.”

CAUTION

Do not use the same power supply for the brake (24VDC, 0.4A) and sequence input/output. Prepare separate power supplies.

■ Single-phase 100 V (without brake)



*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) terminal on the pulse generator side.

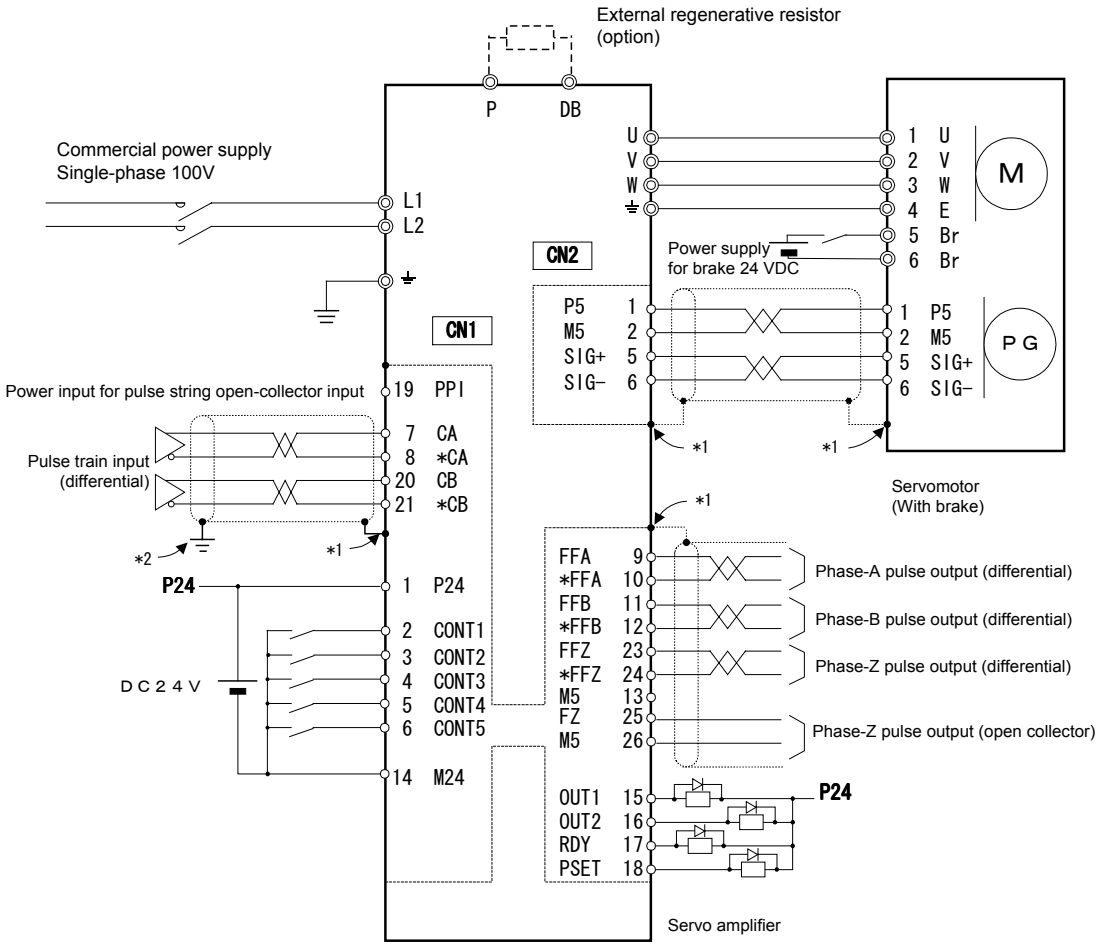
- The external regenerative resistor is not built in. The external regenerative resistor is prepared as optional equipment.
- For 500 kVA or larger power supply capacities, connect the power supply coordination reactor.
- Arbitrary signals can be allocated to CONT and OUT terminals.

The factory settings are as follows.

Terminal symbol	Factory setting
CONT 1	Operation command [RUN]
CONT 2	Reset [RST]
CONT 3	(Not specified)
CONT 4	(Not specified)
CONT 5	(Not specified)

Terminal symbol	Factory setting
OUT1	Alarm detection: a-contact
OUT 2	(Not specified)

■ Single-phase 100 V (with brake)



*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) terminal on the pulse generator side.

- The distance between the servomotor and servo amplifier can be extended up to 20 m when optional cable is used. The distance can be extended up to about 50 m if the cable size is increased.
  For the cable size of the encoder, refer to section 3-4 “Encoder.”

CAUTION

Do not use the same power supply for the brake (24VDC, 0.4A) and sequence input/output.
Prepare separate power supplies.

-MEMO-

3-6) Connection examples

Connection diagrams for combination examples of the servo amplifier with relevant devices are shown. For products not specified in this manual, be sure to refer to the operation manual or user's manual of the corresponding equipment. The connection diagrams shown in this chapter are for reference only.

- Programmable controller (NWOP40□-□)
- Positioning module (NP1F-MP2)
- Positioning module (NC1F-VP1)
- Positioning unit (AD75 type)
- Position control unit (NC113)

Controller side

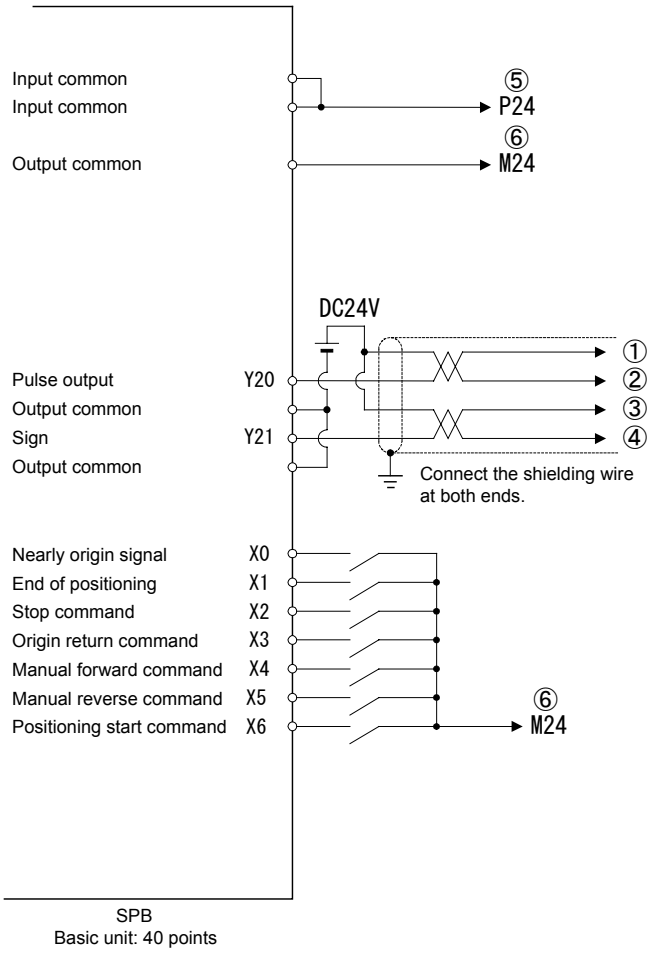
■ Programmable controller (NWOP40□-□)

For one-axis control of SPB (programmable controller) through pulse string outputs

Axis control can be made with the basic unit.

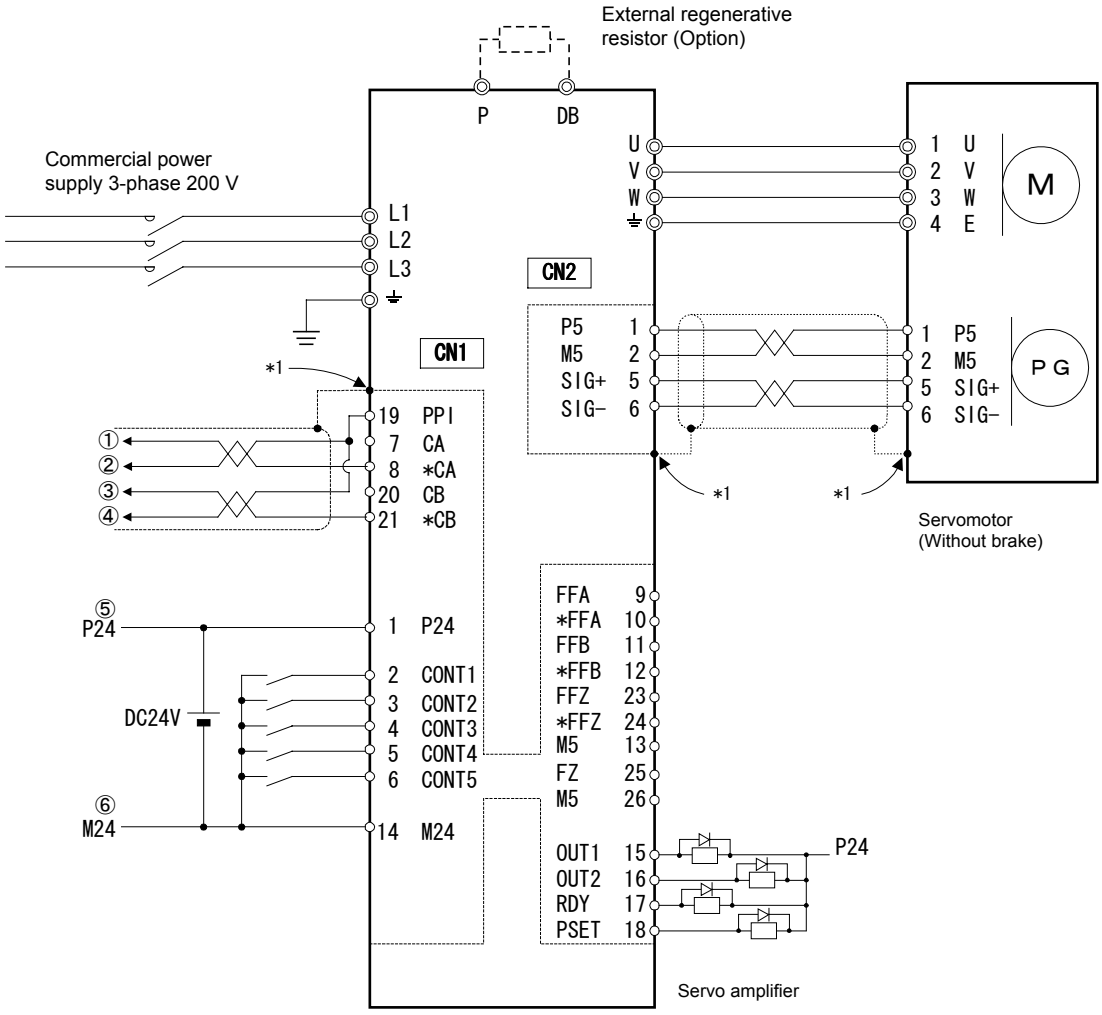
The form of the output pulse is command pulse and command sign.

For the programmable logic controller, refer to the operation manual or user's manual.



Servo side

■ Programmable controller (NWOP40□-□)



*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) terminal on the pulse generator side.

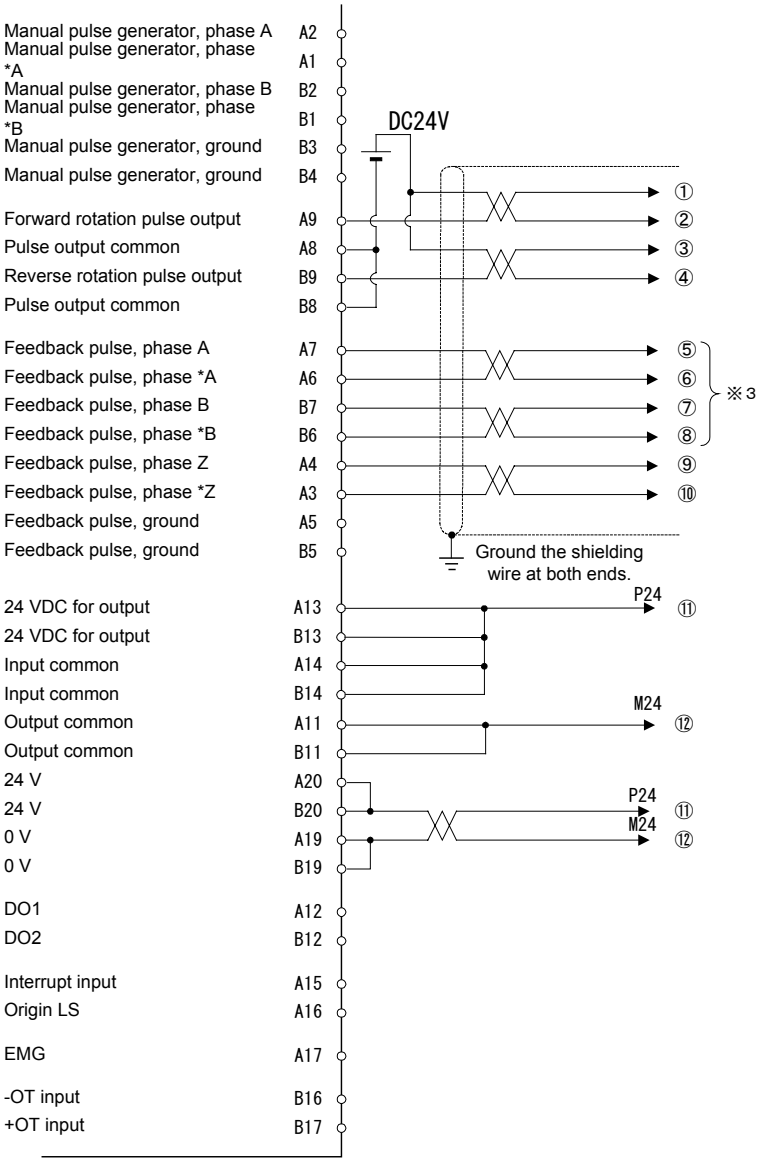
Controller side

■ Positioning module (NP1F-MP2)

Example of connection with MICREX-SX series pulse-string output two-axis positioning module.

The control type is semi-closed loop with 500kHz maximum input frequency.

For the programmable logic controller, refer to the operation manual or user's manual.

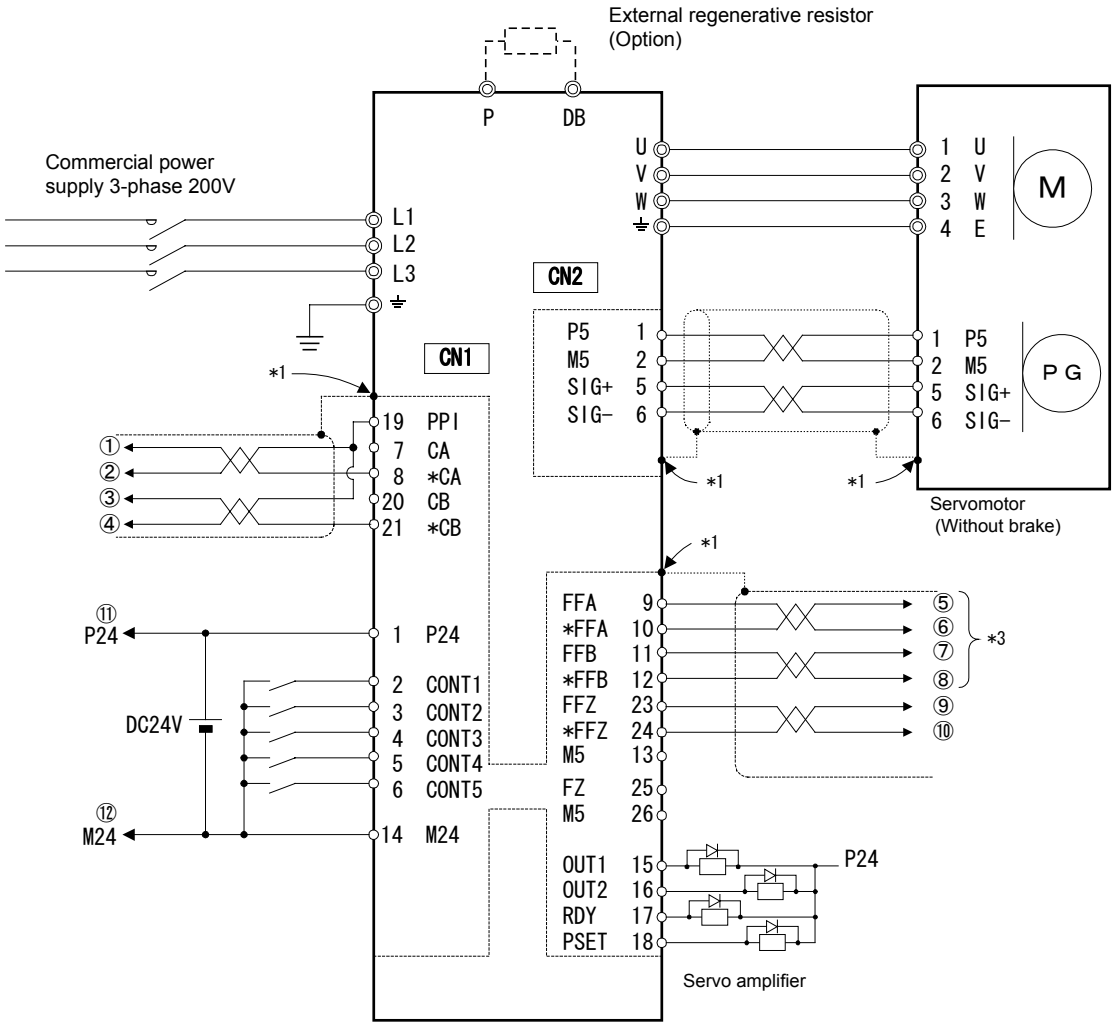


Pulse train output positioning module (2-axis specification)
[NP1F-MP2]

*3: Operation can be made even if these terminals are left open.

Servo side

■ Positioning module (NP1F-MP2)



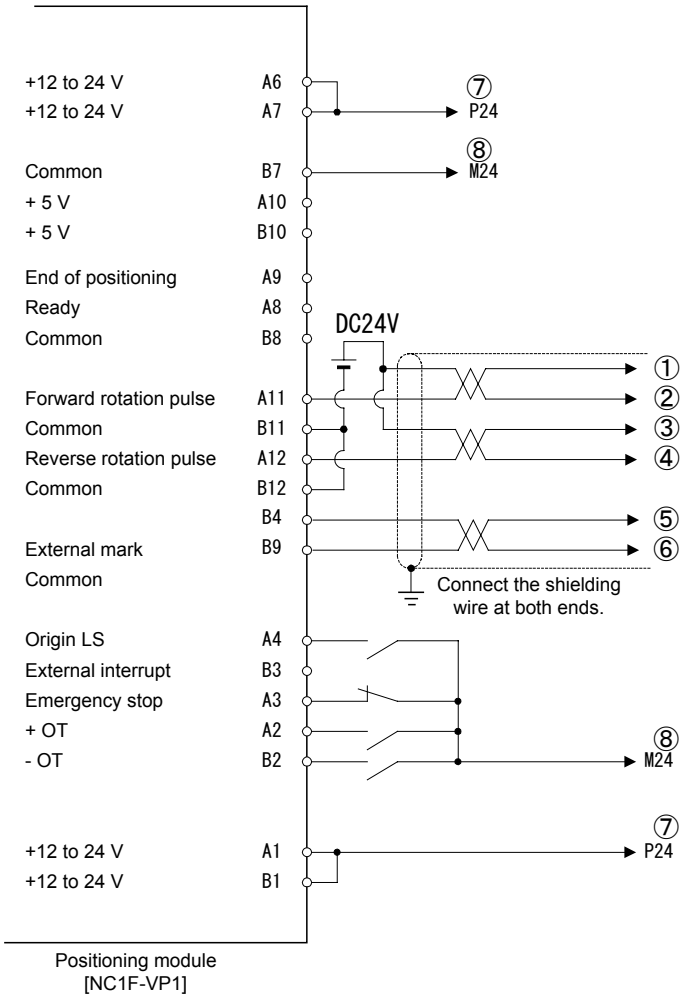
*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) termin
on the pulse generator side.
*3: Operation can be made even if these terminals are left open.

Controller side

■ Positioning module (NC1F-VP1)

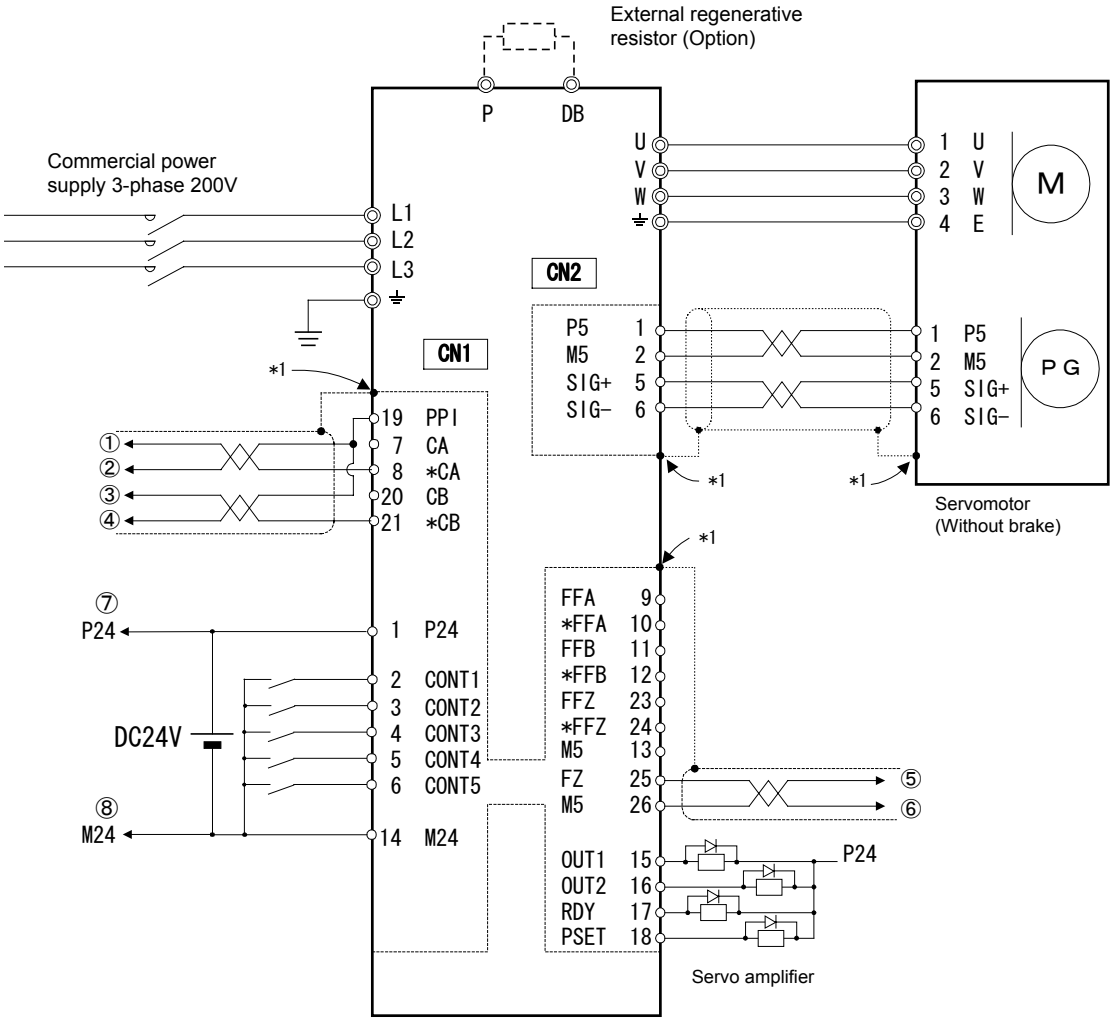
Example of connection with positioning module for MICREX-F series F70. Linear positioning can be executed.

- The pulse string of NC1F-VP1 is open collector output.
- The output form is forward rotation pulse and reverse rotation pulse in the factory setting.
- The automatic start signal does not become valid if the MON output is left active.
- MOFF in the same scanning cycle as activation of MON is not valid.



Servo side

■ Positioning module (NC1F-VP1)

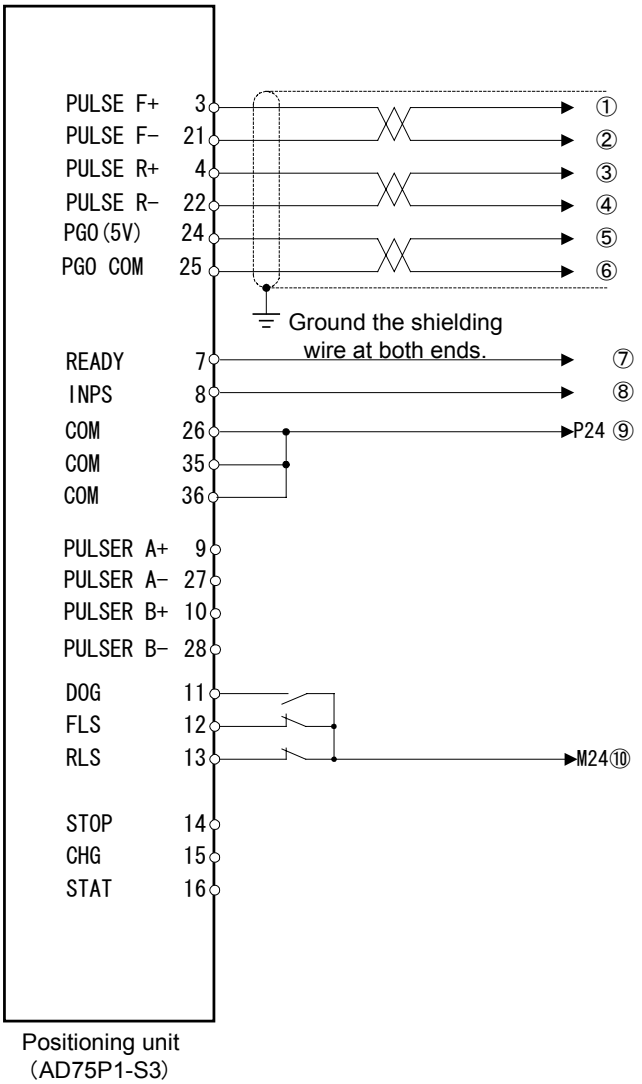


*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) termin on the pulse generator side.

Controller side

■ Positioning unit (AD75 type)

Example of connection with AD75 type positioning unit made by Mitsubishi Electric Co., Ltd.
Only connections between the AD75 positioning unit and servo amplifier are shown.
For the programmable logic controller, refer to the operation manual or user's manual of the equipment.
The connection diagram shown in this chapter is only for reference.



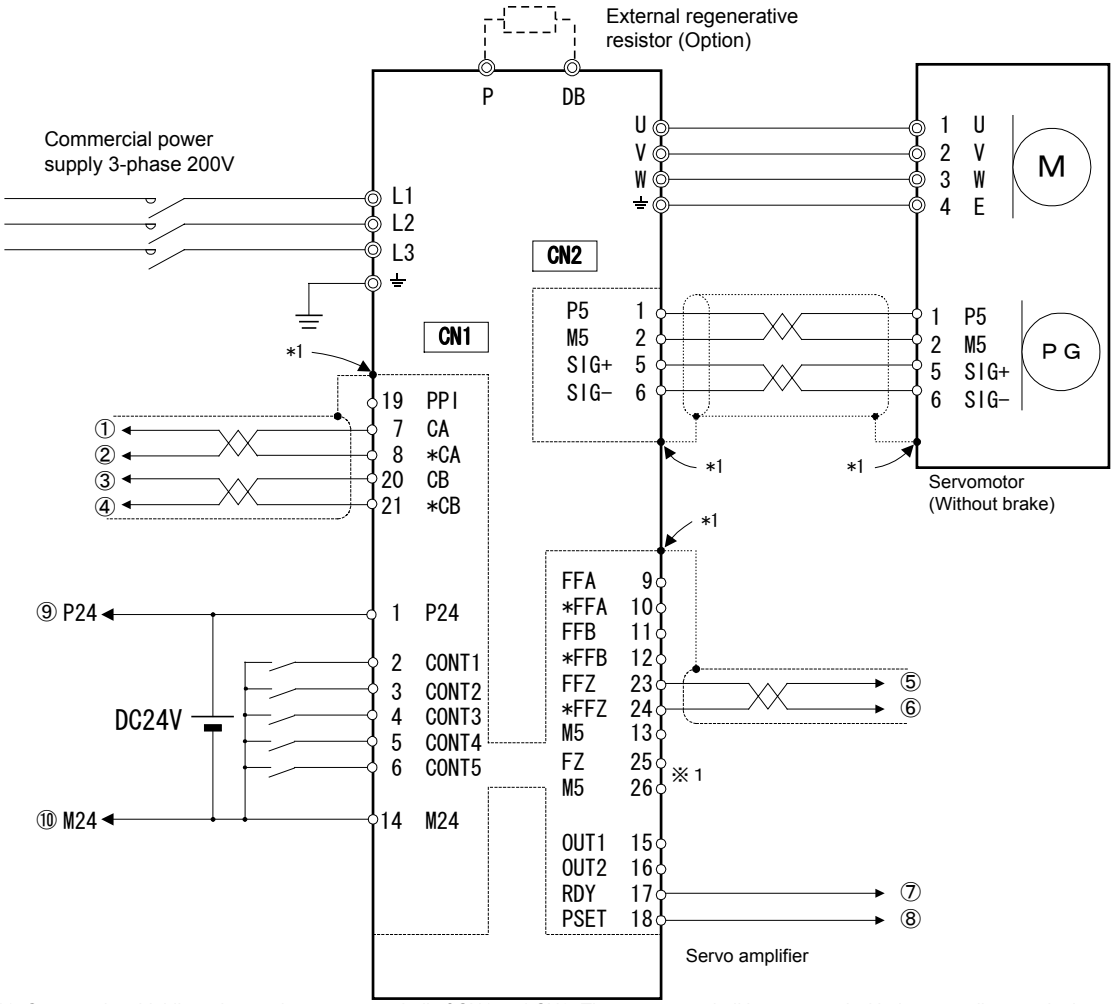
Servo side

■ Positioning unit (AD75 type)

<Setting example>

● AD75 positioning unit

The pulse output mode is used to output CW/CCW pulses.



*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) termin
on the pulse generator side.

Controller side

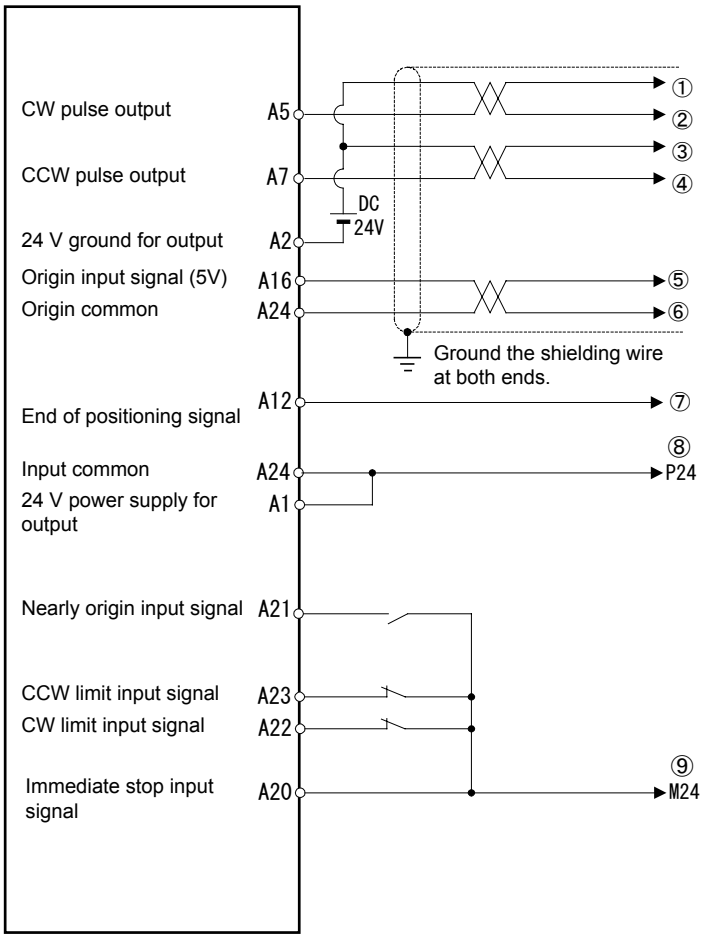
■ Position control unit (C200HW-NC113 type)

Example of connection with C200HW-NC113 position control unit made by Omron Corp.

Only connections between the C200HW-NC113 position control unit and servo amplifier are shown.

For the programmable logic controller, refer to the operation manual or user's manual of the equipment.

The connection diagram shown in this chapter is only for reference.



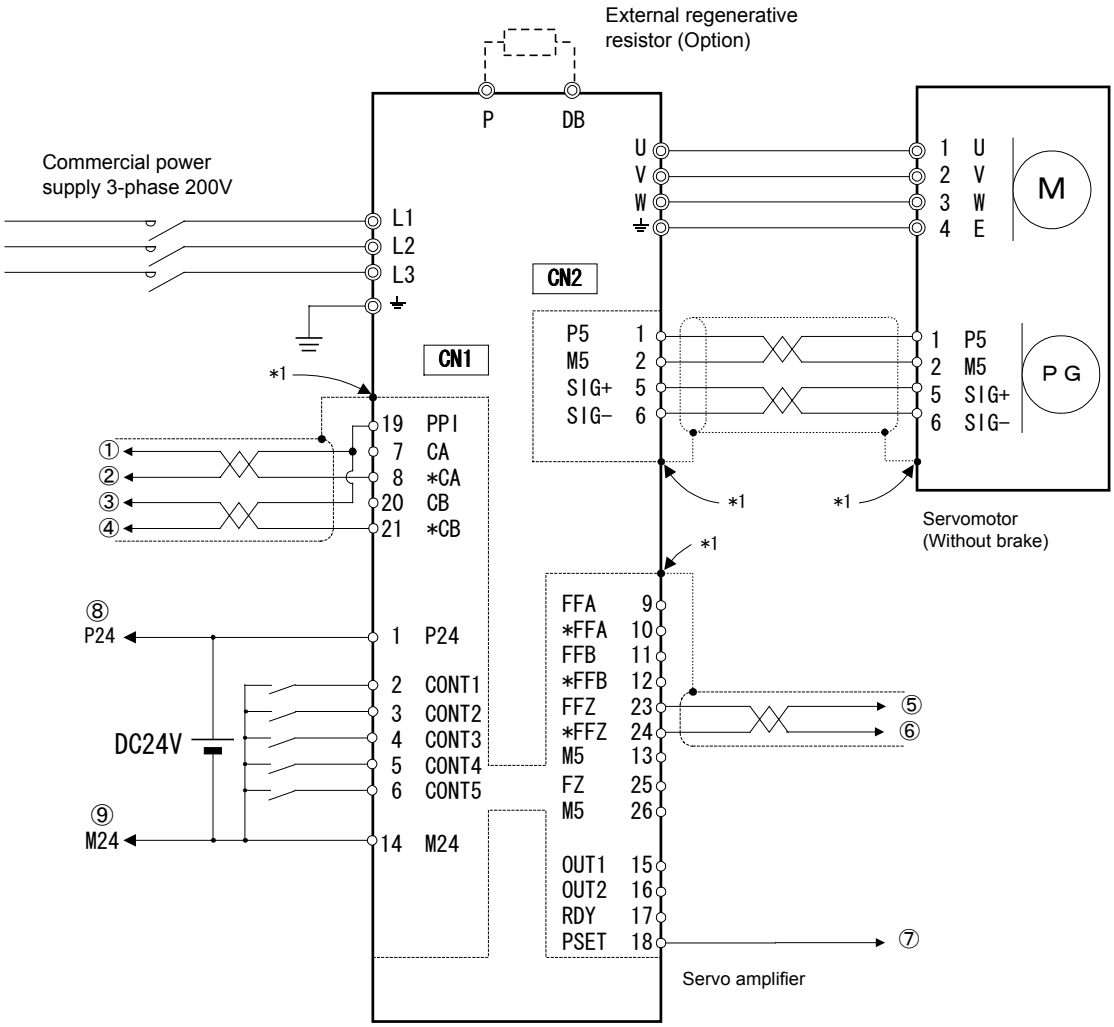
Servo side

■ Position control unit (C200HW-NC113 type)

<Setting example>

● C200HW-NC113 position control unit

The pulse output mode is used to output CW and CCW pulses.



*1: Connect the shielding wires to the connector shell of CN1 and CN2. The connector shell is connected with the grounding terminal.
*2: Ground the shielding wire at both ends. (Connect it to the connector shell on the amplifier side, and connect it to the FG (ground) termina on the pulse generator side.

-MEMO-

FALDIC-β

4

TEST OPERATION

4 TEST OPERATION

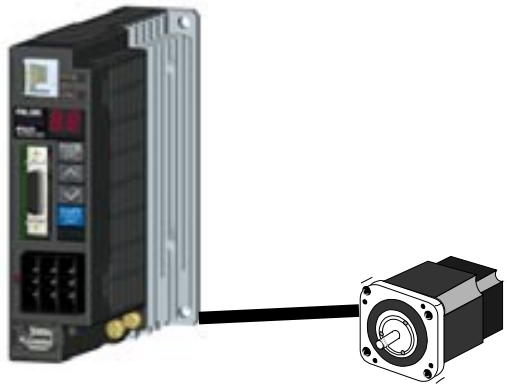
4-1) Test operation in two stages

Perform test operation in the following two stages.

■ First stage

Check wiring and product or parameters.

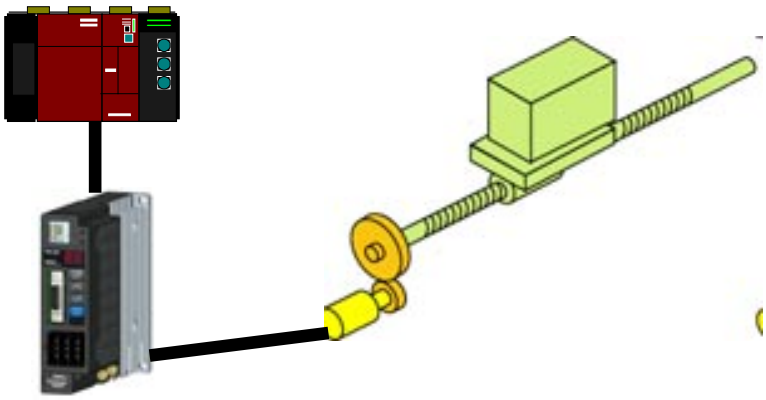
Use only the servomotor and servo amplifier without connection of the servomotor to the machine, and perform test operation.



■ Second stage

Check the parameters of the servo amplifier.

Mount the servo amplifier to the host controller and the machine to perform test operation.



4-2) First stage

Connect the servo amplifier and servomotor to perform test operation. Refer to Chapter 3 for the wiring method.

Do not connect the servomotor to the mechanical system when performing test operation.

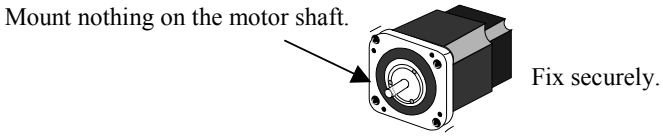
Check the following items in the first stage.

<Items to be checked>

1. Check the power supply wiring of the servo amplifier (L1, L2 and L3).
2. Check the servomotor power cables (U, V and W) and encoder cable.
3. Check if the servo amplifier and servomotor function correctly.
4. Check parameter #4 (switching direction of rotation).

■ Test operation procedure

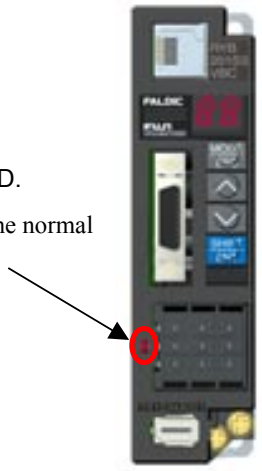
(1) Fix the servomotor so that it will not fall.



(2) Referring to Chapter 3, connect cables to the servo amplifier and the servomotor.

(3) Turn the power on.

Check the charge LED (i) and keypad panel indication (ii).



When correct	bF
When faulty	A value between 1 and 19 blinks. (Alarm detection)

* If an alarm is detected, turn the power off, check wiring, and refer to Chapter 9.

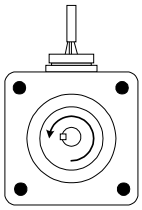
(4) Perform test operation at the keypad panel.

Use the keypad panel to turn the servomotor. Check that the servomotor turns in the correct direction.

Basic setting parameter #04

No.	Name	Setting range	Initial value	Change
04	Direction of rotation switch	0: Forward rotation (CCW) 1: Reverse rotation (CW)	0	Power

Forward rotation (CCW)

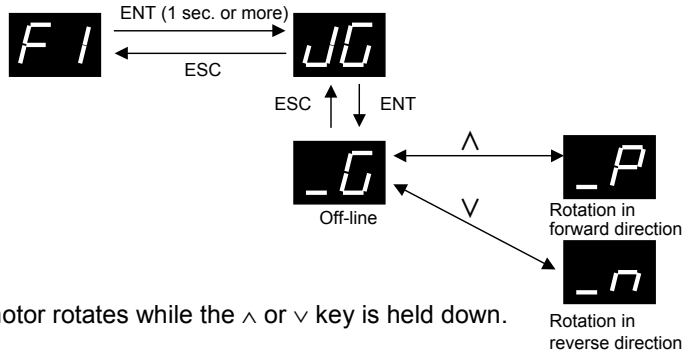


If no fault is found in the first stage, go to the second stage.

Test operation at keypad panel

Use the MODE key to start the test operation mode.

The servomotor rotates while the key on the keypad panel is held down. The servomotor rotates at the speed specified at parameter #29 with the acceleration and deceleration time specified at parameter #30.



* The servomotor rotates while the ∧ or ∨ key is held down.

System setting parameters #29 and #30

No.	Name	Setting range	Initial value	Change
29	Speed setting (for test operation)	1 to 5000 [r/min] (in 1 increments)	100	Always
30	Acceleration / deceleration time (for test operation)	0.000 to 9.999 sec. (in 0.001 increments)	0.100	Always

4-3) Second stage

Mount the servo amplifier to the host controller and mount the servomotor to the machine to perform test operation. The test operation should be conducted in the final operation state.

Check the following items in the second stage.

<Items to be checked>

1. Wiring between servo amplifier and host controller

2.Installation of servomotor to mechanical system

3.Check of parameters #1 through #4

No.	Name	Setting range	Initial value	Change
01	Command pulse correction α	1 to 32767 (in 1 increments)	8	Always
02	Command pulse correction β	1 to 32767 (in 1 increments)	1	Always
03	Pulse string input form	0: Command pulse and command sign 1: Forward or reverse rotation pulse 2: Two signals with 90-degree phase difference	1	Power
04	Direction of rotation switch	0: Forward rotation (CCW) 1: Reverse rotation (CW)	0	Power

■ Test operation procedure

(1) Referring to section 2-1 “Servomotor,” mount the servomotor to the machine securely. (Mount securely without play or deflection.)

(2) Adjust the host controller and servo amplifier. (Check parameters #1 through #4. Refer to section 5-3 “Basic settings.”)

(3) According to description in Chapter 6 “Adjustment of servo,” adjust the parameters of the servo amplifier.

If no fault is found in the second stage, the test operation is complete.

-MEMO-

FALDIC-β

5

PARAMETERS

5 PARAMETERS

5-1) Parameter configuration

Various parameters are used to set up the mechanical system and adjust the characteristics and accuracy of servo.

The parameters of FALDIC-β Series are divided into the four major groups (basic setting, system setting, control system setting and adjustment by manufacturer) shown in the table below.

Parameter configuration

Type	Parameter No.	Outline	Page
Basic settings	01 to 04	The pulse string input method and the direction of rotation are specified.	5- 6
	05 to 07	The tuning method is selected.	5-11
System settings	10 to 16	The sequence input/output signals are specified.	5-16
	17 and 18	The output pulse is specified.	5-32
	19 to 22	The positioning completion signal is specified.	5-34
	23 and 24	The torque limit and undervoltage alarm detection method are specified.	5-37
	25 and 26	These parameters are used for connection of optional items.	5-39
	27 and 28	The parameter write-protection mode and keypad panel display details are specified.	5-41
	29 and 30	Minutes of test operation are specified.	5-42
Control system settings	40 to 56	The servo gain and time constants of various filters are specified.	5-46
	57 to 60	The notch filter for suppressing resolution of the mechanical system is specified.	5-52
	61 to 64	These are parameters for dumping control.	5-53
For adjustments by manufacturer	80 to 83	For adjustment by manufacturer. Do not change.	5-54

The parameters are saved in the electrically erasable programmable read-only memory (EEPROM) and are not lost even when the power is turned off.

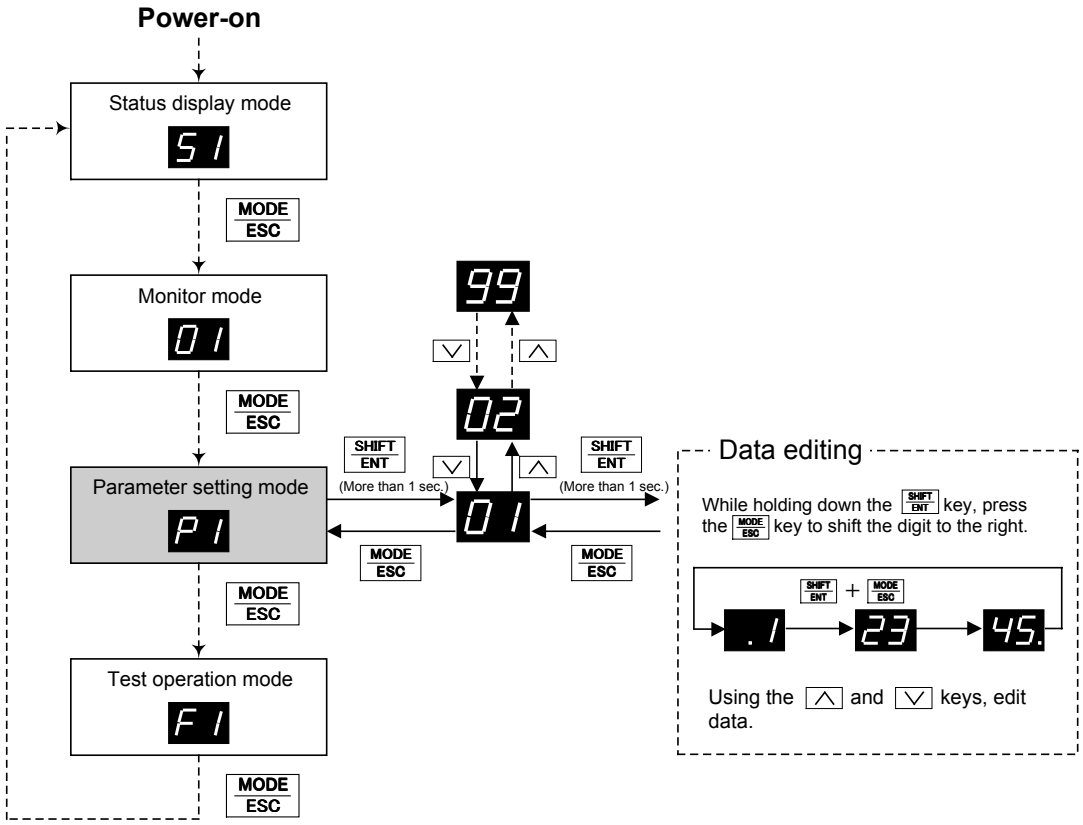
Parameters marked “Power” in the “Change” field in the parameter list become valid after the power supply is turned off and on again. (Check that the keypad panel (7-segment LED display) is unlit when the power is turned off.)

■ Parameter editing method

There are two parameter editing methods: through keypad panel operation and through PC loader operation.

(1) Parameter editing through keypad panel operation

Press the MODE ESC key to select the parameter editing mode and press the ∧ or ∨ key to select the desired parameter number.



(2) Parameter editing through PC loader

Use the optional PC loader to edit parameters.

5-2) List of parameters

■ List of parameters of FALDIC-β (1)

No.	Name	Setting range	Initial value	Change	Page
Basic settings					
01	Command pulse correction α	1 to 32767 (in 1 increments)	8	Always	5-6
02	Command pulse correction β	1 to 32767 (in 1 increments)	1	Always	5-6
03	Pulse string input form	0: Command pulse/command sign, 1: Forward/reverse rotation pulse, 2: Two signals with 90-degree phase difference	1	Power	5-8
04	Direction of rotation switch	0: Positive direction: Forward rotation (CCW), 1: Positive direction: Reverse rotation (CW)	0	Power	5-10
05	Tuning mode	0: Auto tuning, 1: Semi-auto tuning, 2: Manual tuning	0	Always	5-11
06	Load inertia ratio	0.0 to 100.0 times (in 0.1 increments)	5. 0	Always	5-12
07	Auto tuning gain	1 to 20 (in 1 increments)	10	Always	5-13
08 and 09	Not used	-	0	-	5-14
System settings					
10	CONT 1 signal allocation	0 to 10 (in 1 increments) 0: Not specified 1: Operation command [RUN] 2: Reset [RST] 3: + overtravel 4: - overtravel 5: Emergency stop [EMG] 6: P-action 7: Deviation clearance 8: External regenerative resistor overheat 9: Anti-resonance frequency selection 0 10: Anti-resonance frequency selection 1	1 [RUN]	Power	5-16
11	CONT 2 signal allocation		2 [RST]	Power	
12	CONT 3 signal allocation		0	Power	
13	CONT 4 signal allocation		0	Power	
14	CONT 5 signal allocation		0	Power	
15	OUT 1 signal allocation	0 to 5 (in 1 increments) 0: Not specified 1: Alarm detection: a-contact 2: Alarm detection: b-contact 3: Dynamic brake 4: Overtravel detection 5: Forced stop detection	1 (Alarm detect: a-contact)	Power	5-16
16	OUT 2 signal allocation		0	Power	
17	Output pulse count	16 to 16384 [pulse] (in 1 increments)	2048	Power	5-32
18	Phase-Z offset	0 to 65535 [pulse] (in 1 increments)	0	Power	5-33
19	Zero deviation width	1 to 10000 [pulse] (in 1 increments)	200	Always	5-34
20	Deviation limit width	10 to 65535 [x 100 pulse] (in 1 increments)	10000	Always	5-35
21	Zero speed width	10 to 5000 [r/min] (in 1 increments)	50	Always	5-36
22	Positioning end judgment time	0.000 to 1.000. sec. (in 0.001 increments)	0.000	Always	5-37
23	Max. current limit	0 to 300 % (in 1 increments)	300	Always	5-37
24	Undervoltage alarm detection	0: No detection, 1: Detection	1	Power	5-38
25	Regenerative resistor electronic thermal calculation	0: Invalid, 1: Valid (optional regenerative resistor (thin type))	0 *1	Power	5-39
26	Dynamic brake on overtravel detection valid/invalid	0: Invalid, 1: Valid	0	Power	5-40
27	Parameter write-protection	0: Write-enable, 1: Write-protected	0	Always	5-41
28	Keypad panel initial display	0 to 11 (in 1 increments)	0	Power	5-41
29	Speed setting (for test operation)	1 to 5000 [r/min] (in 1 increments)	100	Always	5-42
30	Acceleration / deceleration time (for test operation)	0.000 to 9.999 sec. (in 0.001 increments)	0.100	Always	5-42
31 to 39	Not used	-	0	-	5-43

*1. Set to “1” when thin external regenerative resistor is connected.

■ List of parameters of FALDIC-β (2)

No.	Name	Setting range	Initial value	Change	Page
Control system settings					
40	Position controller gain 1	1 to 1000 [rad/sec] (in 1 increments)	77*2	Always	5-46
41	Speed response 1	1 to 1000 [Hz] (in 1 increments)	57*2	Always	
42	Speed controller integration time 1	1.0 to 1000.0 [msec] (in 0.1 increments)	25.9*2	Always	
43	S-curve time constant	0.0 to 100.0 [msec] (in 0.1 increments)	2.0	Always	5-48
44	Feed forward gain	0.000 to 1.500 (in 0.001 increments)	0.000	Always	
45	Feed forward filter time constant	0.0 to 250.0 [msec] (in 0.1 increments)	12.9*2	Always	5-46
46	Torque filter time constant	0.00 to 20.00 [msec] (in 0.01 increments)	0.31*2	Always	
47	Speed setting filter	0.00 to 20.00 [msec] (in 0.01 increments)	0.00	Always	5-49
48	Gain switching factor	0: Position deviation (x 10), 1: Feedback speed, 2: Command speed	1	Always	5-50
49	Gain switching level	1 to 1000 (in 1 increments)	50	Always	
50	Gain switching time constant	0 to 100 [msec] (in 1 increments)	10	Always	
51	Position controller gain 2	30 to 200 % (in 1 increments)	100	Always	
52	Speed response 2	30 to 200 % (in 1 increments)	100	Always	
53	Speed controller integration time 2	30 to 200 % (in 1 increments)	100	Always	
54	Position gain added when setting	0 to 1000 [rad/sec] (in 1 increments)	0	Always	5-51
55	Addition limit when setting	0 to 200 [r/min] (in 1 increments)	0	Always	
56	Command follow-up control selection	0: None, 1: Command follow-up control, 2: Command follow-up control (with correction on stop)	0	Power	
57	Notch filter 1 frequency	10 to 200 [x 10Hz] (in 1 increments)	200	Always	5-52
58	Notch filter 1 damping amount	0 to 40 [dB] (in 1 increments)	0	Always	
59	Notch filter 2 frequency	10 to 200 [x 10Hz] (in 1 increments)	200	Always	
60	Notch filter 2 damping amount	0 to 40 [dB] (in 1 increments)	0	Always	
61	Anti-resonance frequency 0	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always	5-53
62	Anti-resonance frequency 1	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always	
63	Anti-resonance frequency 2	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always	
64	Anti-resonance frequency 3	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always	
65 to 79	Not used	-	0	-	5-53
For adjustments by manufacturer					
80	For adjustment by manufacturer 1	-	Adjusted value	-	5-54
81	For adjustment by manufacturer 2	-	Adjusted value	-	
82	For adjustment by manufacturer 3	-	Adjusted value	-	
83	For adjustment by manufacturer 4	-	Adjusted value	-	
84 to 99	Not used	-	0	-	5-54

*2. Indicates the value immediately after parameter initialization is executed. The value is automatically updated if “auto tuning” or “semi-auto tuning” is selected with basic setting parameter #5.

5-3) Basic settings

The basic setting parameters are described in the order of the parameter number.

P1 / 01 – 02

Basic setting parameter #01 and #02

No.	Name	Setting range	Initial value	Change
01	Command pulse correction α	1 to 32767 (in 1 increments)	8	Always
02	Command pulse correction β	1 to 32767 (in 1 increments)	1	Always

These parameters are used to convert the travel distance per each command pulse into a unit quantity that is used by the electronic gear.

Calculate in the following equation.

■ Calculation formula for command pulse correction α and β

$$\frac{\text{(Mechanical system travel distance per revolution of servomotor)}}{\text{(65536 pulses/rotation)}} \times \frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction } \beta\text{)}} = \text{(Unit quantity)*}$$

* "Unit quantity" is a value such as "1," "0.1," "0.01," and "0.001."

$$\frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction } \beta\text{)}} = \frac{\text{(65536 pulses/rotation)}}{\text{(Mechanical system travel distance per revolution of servomotor)}} \times \text{(Unit quantity)}$$

Reduce the fraction so that command pulse correction α and β become integers within 32767.

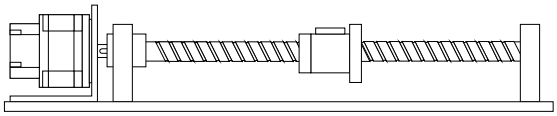
■ Setting from PC loader (option)

Use the "α and β setting from mechanical configuration" button in the parameter editing screen of the PC loader to automatically specify command pulse correction values α and β.

<α / β setting screen>

Data are automatically set by simply entering the machine specifications.
Because settings are given for each component of the machine, entry is simply.

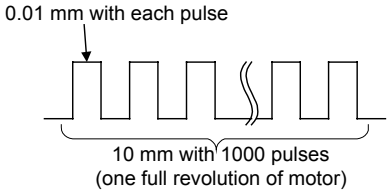
To couple 10-mm-lead screw to the output shaft of the servomotor with a setting unit of 1/100



$$\frac{\text{(Mechanical system travel distance per revolution of servomotor)}}{\text{(65536 pulses/rotation)}} \times \frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction } \beta\text{)}} = \text{(Unit quantity)}$$

$$\frac{10\text{ mm}}{\text{(65536 pulses/rotation)}} \times \frac{\text{(Command pulse correction } \alpha\text{)}}{\text{(Command pulse correction } \beta\text{)}} = 1/100$$

Hence command pulse correction α becomes "8192" and command pulse correction β becomes "125." With the above settings, the mechanical system travel distance per each pulse in the pulse string becomes 0.01 mm.



NOTE

The pi (π) included in the mechanical system travel distance per each revolution of the servomotor can be approximated with "355 / 113."

The number of output pulses has nothing to do with command pulse correction. According to the setting of system setting parameter #17, two signals with phase-B-advanced 90-degree phase difference are output when the motor shaft rotates in the forward direction.

P1 / 03

Basic setting parameter #03

No.	Name	Setting range	Initial value	Change
03	Pulse string input form	0: Command pulse / command sign, 1: Forward / reverse rotation pulse, 2: Two signals with 90-degree phase difference	1	Power

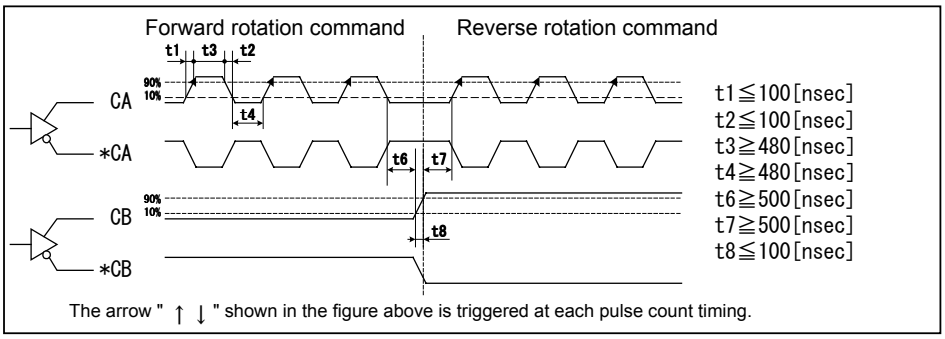
The form of the signal added to the pulse string input terminal can be selected.

The form of pulse strings added to the [CA], [*CA], [CB] and [*CB] pulse string input terminals of the servo amplifier can be specified. The maximum input frequency is 1.0MHz.

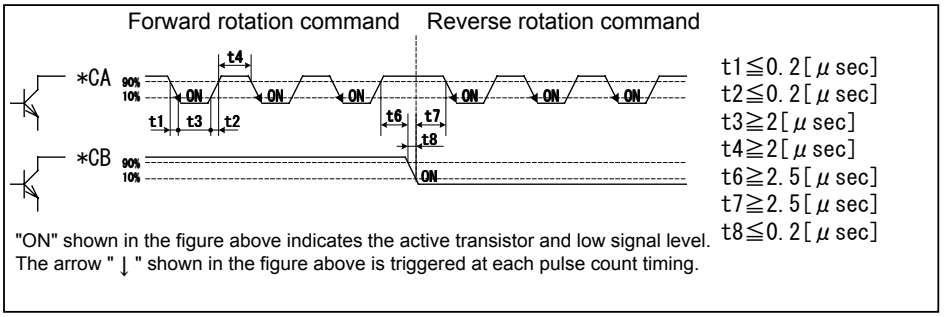
■ Command pulse/command sign (Setting of basic setting parameter 03: 0)

The rotation amount is indicated with the command pulse while the direction of rotation is indicated with the command sign.

- Differential input



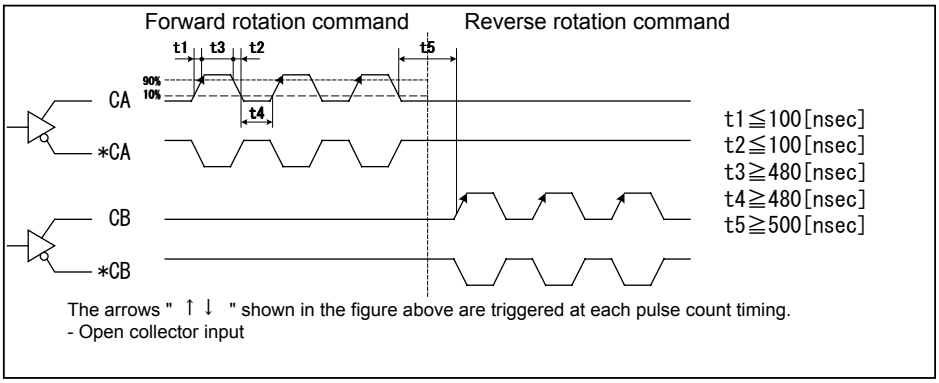
- Open collector input



■ Forward / reverse rotation pulse (Setting of basic setting parameter 03: 1)

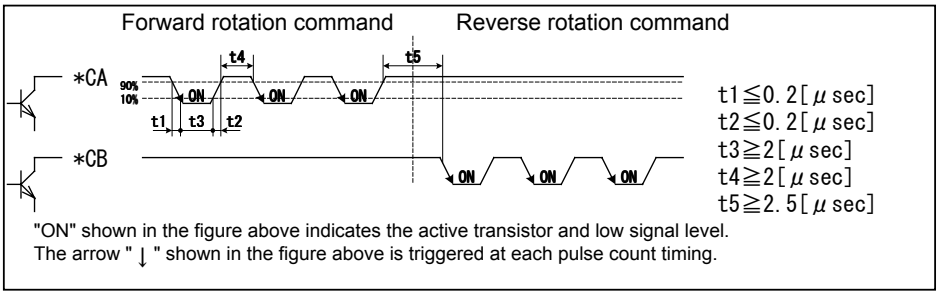
The forward rotation pulse indicates the rotation amount in the positive direction, while the reverse pulse indicates that in the reverse direction.

- Differential input



The arrows " ↑ ↓ " shown in the figure above are triggered at each pulse count timing.

- Open collector input

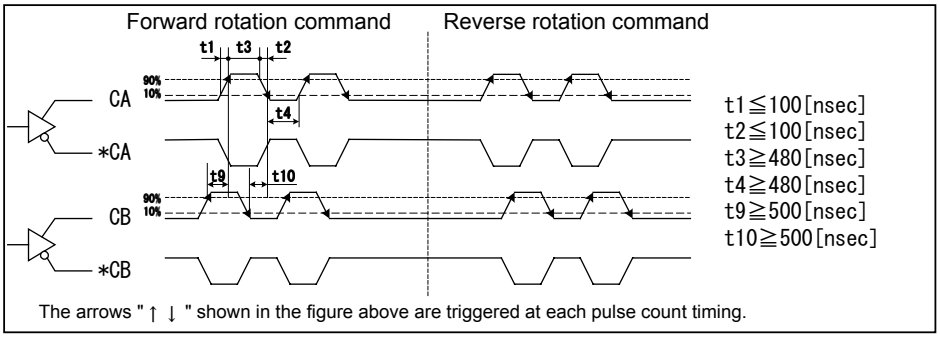


"ON" shown in the figure above indicates the active transistor and low signal level.
The arrow " ↓ " shown in the figure above is triggered at each pulse count timing.

■ Two signals with 90-degree phase difference (Setting of basic setting parameter 03: 2)

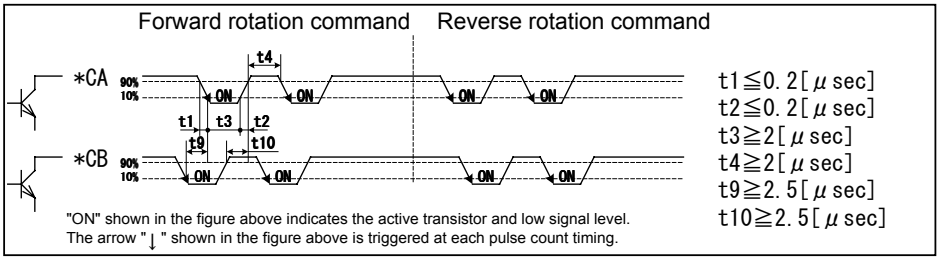
The phase-A and phase-B signals indicate the direction of rotation and rotation amount, respectively. Each edge in the phase-A or phase-B signal corresponds to one pulse.

- Differential input



The arrows " ↑ ↓ " shown in the figure above are triggered at each pulse count timing.

- Open collector input



"ON" shown in the figure above indicates the active transistor and low signal level.
The arrow " ↓ " shown in the figure above is triggered at each pulse count timing.

P1 / 04

Basic setting parameter #04

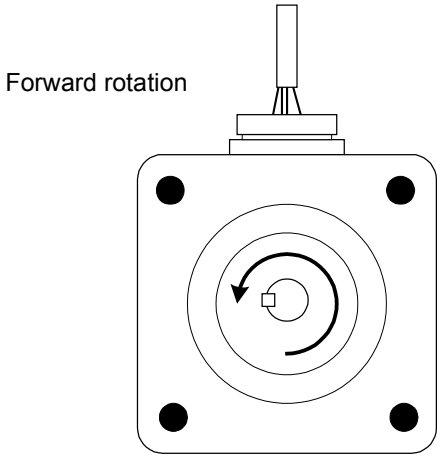
No.	Name	Setting range	Initial value	Change
04	Direction of rotation switch	0: Positive direction: Forward rotation (CCW), 1: Positive direction: Reverse rotation (CW)	0	Power

Use this parameter to keep consistency between the direction of rotation of the servomotor and mechanical travel direction.

The direction of rotation is positive when a forward rotation pulse or a pulse string of two signals with level H or phase-B-advanced 90-degree phase difference signals is input.

■ Forward/reverse rotation

The counterclockwise rotation when viewed from the output shaft of the servomotor is forward rotation. The clockwise rotation is reverse.



P1 / 05

Basic setting parameter #05

No.	Name	Setting range	Initial value	Change
05	Tuning mode	0: Auto tuning, 1: Semi-auto tuning, 2: Manual tuning	0	Always

Select the tuning method of the servo amplifier.

■ Auto tuning (Setting of basic setting parameter 05: 0)

This is the factory setting of the servo amplifier.

The inertia ratio of the machine is always assumed inside the amplifier in this mode to automatically set the optimum gain.

■ Semi-auto tuning (Setting of basic setting parameter 05: 1)

Use this mode when the inertia ratio of the machine cannot be assumed correctly inside the amplifier.

■ Manual tuning (Setting of basic setting parameter 05: 2)

Use this option when adjustment fails in the auto tuning and semi-auto tuning modes.

Parameters that must be set or those automatically adjusted in each tuning mode are as follows.

No.	Name	Tuning mode		
		0: Auto	1: Semi-auto	2: Manual
06	Load inertia ratio	-	○	○
07	Auto tuning gain	○	○	×
40	Position controller gain 1	-	-	○
41	Speed response 1	-	-	○
42	Speed controller integration time 1	-	-	○
45	Feed forward filter time constant	-	-	○
46	Torque filter time constant	-	-	○

*○: Parameter that must be set

- : Parameter that may not be set (The value is automatically calculated inside the amplifier and the result is reflected on the parameter.)

x : The parameter has no effect even if it is set.

Refer to Chapter 6 for detailed description of tuning.

P1 / 06

Basic setting parameter #06

No.	Name	Setting range	Initial value	Change
06	Load inertia ratio	0.0 to 100.0 times (in 0.1 increments)	5.0	Always

Specify the moment of inertia of the load (moment of inertia of load converted to motor shaft) exerted on the motor shaft in the mechanical system, in the ratio to the moment of inertia of the motor.

$$\text{Load inertial ratio} = \frac{\text{(Moment of inertia of load converted to motor shaft)}}{\text{(Moment of inertia of motor)}}$$

This parameter must be specified in some tuning modes (basic parameter 05).

No.	Name	Tuning mode		
		0: Auto	1: Semi-auto	2: Manual
06	Load inertia ratio	Automatically refreshed at every 10 minutes	○	○

○: Parameter that must be set

■ How to specify the load inertia ratio

There are the following two setting methods.

1) Setting the value monitored at the keypad panel

Use monitor mode 09 at the keypad panel to monitor.

Use the monitored value as a setting.

* If the value fluctuates, set the average value.

If fluctuation is considerable and the maximum-to-minimum ratio exceeds two, use the setting method described below.

2) Setting the calculated value

Calculate the load inertial moment and specify the result.

The calculation formula for obtaining the moment of inertia is described in appendix.

* Capacity selection software can be used for automatic calculation.

The capacity selection software can be downloaded free of charge from Fuji Electric's home page.

http://web1.fujielectric.co.jp/kiki-info/User/index.html

P1 / 07

Basic setting parameter #07

No.	Name	Setting range	Initial value	Change
07	Auto tuning gain	1 to 20 (in 1 increments)	10	Always

Specify the response of the servomotor used in the auto tuning or semi-auto tuning mode.

Specify a larger value to reduce the command follow-up time and positioning setting time, but too large a value cause the motor to vibrate.

* There is no need to set the parameter in the manual tuning mode.

■ Setting method

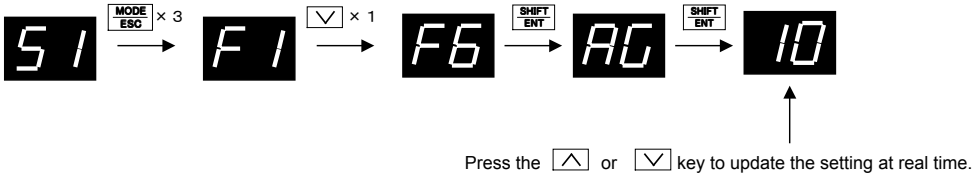
There are two setting methods

1) Setting parameter using PC loader and keypad panel (parameter setting mode)

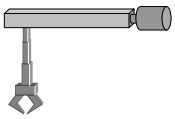
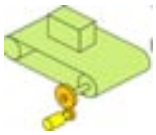
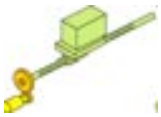
After the parameter is established, the setting content is updated.

2) Setting through auto tuning gain setting from keypad panel (in test operation mode)

The setting is updated at real time when the value is changed.



■ Approximate measure for setting

Configuration of machine	Auto tuning gain (approximate)
Large transfer machine	1 to 6
Arm robot 	5 to 10
Belt drive 	7 to 13
Ball screw mechanism 	10 to 15
Inserting, mounting or bonding machine	13 to 20

* If the gain cannot be increased up to the value specified as an approximate measure, there may be mechanical resonance. Use a notch filter to suppress mechanical resonance. → Refer to page 5-52.

P1 / 08 — 09

Basic setting parameter #08 and #09

No.	Name	Setting range	Initial value	Change
08 and 09	Not used	-	0	-

These parameters are not used.

-MEMO-

5-4) System settings

System setting parameters are described in the order of the parameter number.

P1 / 10 – 14

System setting parameters #10 through #14

No.	Name	Setting range	Initial value	Change
10	CONT 1 signal allocation	0 to 10 (in 1 increments) 0: Not specified 1: Operation command [RUN] 2: Reset [RST] 3: + overtravel 4: - overtravel 5: Emergency stop [EMG] 6: P-action 7: Deviation clearance 8: External regenerative resistor overheat 9: Anti-resonance frequency selection 0 10: Anti-resonance frequency selection 1	1 [RUN]	Power
11	CONT 2 signal allocation		2 [RST]	Power
12	CONT 3 signal allocation		0	Power
13	CONT 4 signal allocation		0	Power
14	CONT 5 signal allocation		0	Power

P1 / 15 – 16

System setting parameters #15 and #16

No.	Name	Setting range	Initial value	Change
15	OUT 1 signal allocation	0 to 5 (in 1 increments) 0: Not specified 1: Alarm detection: a-contact 2: Alarm detection: b-contact 3: Dynamic brake 4: Overtravel detection 5: Forced stop detection	1 Alarm detect: a-contact	Power
16	OUT 2 signal allocation		0	Power

The following functions can be assigned to sequence input/output terminals.

■ CONT signal allocation number

Setting	Name	Page
0	Not specified	-
1	Operation command [RUN]	5-18
2	Reset [RST]	5-19
3	+ overtravel [+OT]	5-20
4	- overtravel [-OT]	
5	Forced stop [EMG]	5-22
6	P-action	5-24
7	Deviation clearance	5-25
8	External regenerative resistor overheat	5-26
9	Anti-resonance frequency selection 0	5-27
10	Anti-resonance frequency selection 1	

■ OUT signal allocation number

Setting	Name	Page
0	Not specified	-
1	Alarm detection: a-contact	5-28
2	Alarm detection: b-contact	
3	Dynamic brake	5-29
4	Overtravel detection	5-20
5	Forced stop detection	5-22

■ Each sequence input/output signal can be monitored in the trace screen of the PC loader.

The ready [RDY] and positioning end [PSET] signals among sequence output signals are fixed at the OUT terminals.

Sequence input signal	CONT allocation	PC loader
Operation command [RUN]	O	O
Reset [RST]	O	O
+ overtravel [+OT]	O	O
- overtravel [-OT]	O	O
Forced stop [EMG]	O	O
P-action	O	O
Deviation clearance	O	O
External regenerative resistor overheat	O	O
Anti-resonance frequency selection 0	O	O
Anti-resonance frequency selection 1	O	O
Manual forward rotation [FWD]*	×	O (For test op.)
Manual reverse rotation [REV]*	×	O (For test op.)

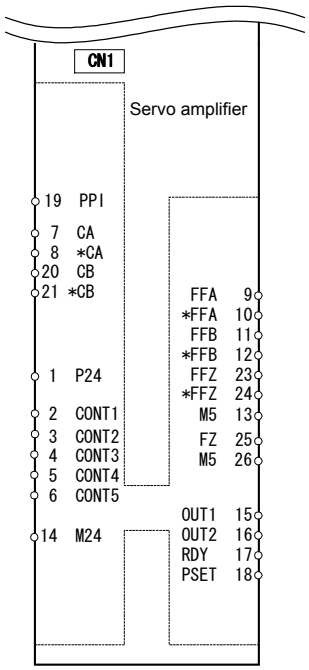
O: Terminal allocation and waveform trace are possible.

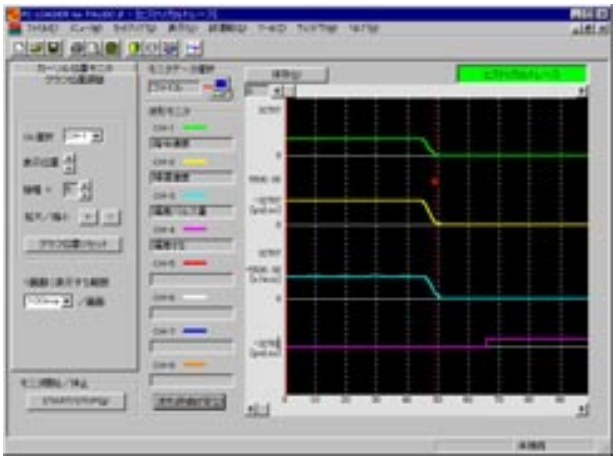
Sequence output signal	OUT allocation	PC loader
Alarm detection: a-contact	O	O
Alarm detection: b-contact	O	O
Dynamic brake	O	O
Overtravel detection	O	O
Forced stop detection	O	O
Ready [RDY]	x (Fixed)	O
Positioning end [PSET]	x (Fixed)	O
Zero deviation*	×	O
Zero speed*	×	O
Torque limit detection*	×	O
CPU ready*	×	O

* Only waveform at the PC loader can be traced.

Terminals cannot be allocated.

Terminal allocation of connector 1 (CN1) of servo amplifier and trace screen of PC loader





(1) Operation command [RUN]

This signal makes the servomotor ready to rotate.

Sequence input signal	Operation command [RUN].. Assigned to CONT 1 with factory setting

■ Function

The servomotor is ready to rotate while the operation command [RUN] signal remains active.

The servomotor does not rotate if motor power is supplied but the operation command signal is turned off.

If the signal is turned off during rotation, the servomotor decelerates at its maximum performance and, after the stopping point (with rotation speed being within the zero speed width specified at parameter #21), the servomotor coasts to stop.

There is no retaining torque after the servomotor is stopped.

When the operation command [RUN] remains inactive, all rotation commands are ignored.

The servomotor is ready to rotate when the operation command [RUN] is active without alarm detection with active + overtravel, - overtravel and forced stop [EMG] signals.

If the operation command [RUN] signal is active and other signals are turned off, the servomotor is stopped.

■ Parameter setting

To assign the operation command [RUN] signal to a sequence input terminal, specify the corresponding value (“1”) to the system setting parameter.

If the signal is not assigned to sequence input terminals, the signal is assumed to be active at any time.

■ Reference

For the forced stop signal, refer to page 5-22.

(2) Reset [RST]

Alarm detection of the servo amplifier is reset.

Sequence input signal	Reset [RST] ... Assigned to CONT 2 with factory setting

■ Function

The sequence input signal resets the alarm detected at the servo amplifier.

Alarm detection is reset upon the activating edge of the reset [RST] signal.

■ Alarms that can be reset

Indication	Description
01	Overcurrent 1
02	Overcurrent 2
03	Overspeed
04	Overvoltage
10	Regenerative transistor overheat
11	Encoder communication alarm
13	Overload
14	Undervoltage
15	Regenerative resistance overheat
16	Deviation limit
17	Amplifier overheat
18	Encoder overheat

■ Alarms that cannot be reset

Indication	Description
05	Encoder trouble
06	Control power alarm 1
07	Control power alarm 2
08	Memory alarm
09	Motor combination alarm
12	CONT duplication
19	Initial error

■ Parameter setting

To assign the reset [RST] signal to a sequence input terminal, specify the corresponding value (“2”) to the system setting parameter.

If this signal is not assigned to the sequence input terminals, the signal is assumed to be inactive at any time.

■ Reference

Alarm detection can be reset in any of the following methods.

1) Activating edge of reset [RST] sequence input signal
2) ENT key operation upon alarm reset [“F2”] in test operation mode
3) Simultaneous depression of ∧ and ∨ keys upon alarm detection [“52”] (for more than 1 second)
4) Simultaneous depression of ∧ and ∨ keys upon alarm history [“53”] (for more than 1 second)
5) Power off and on

The alarm history can be initialized through ENT key operation at alarm history initialization [“F3”] in the test operation mode.

(3) Overtravel and overtravel detection

Movement of the machine can be forcibly stopped upon a signal from a limit switch or the like.

Sequence input/output signal	Overtravel / overtravel detection

■ Function

+OT (3)/-OT (4)

These are input signals from limit switches for the prevention of overtravel (OT) at the end of the moving stroke of the machine.

When the input signal is turned off, the servomotor decelerates to stop at its maximum performance while ignoring the rotation command in the detected direction. Only pulse string inputs in the direction opposite to the detecting direction and manual feed (forward/reverse rotation command) in the test operation mode are executed. (b-contact)

When overtravel is detected, deviation is reset.

■ Parameter setting

To assign the +OT signal to a sequence input terminal, specify the corresponding value (“3”) to the system setting parameter. For -OT signal, specify “4.”

These signals are assumed to be active at any time if they are not assigned to the sequence input terminals.

To assign OT detection to a sequence output terminal, specify the corresponding value (“4”) to the system setting parameter.

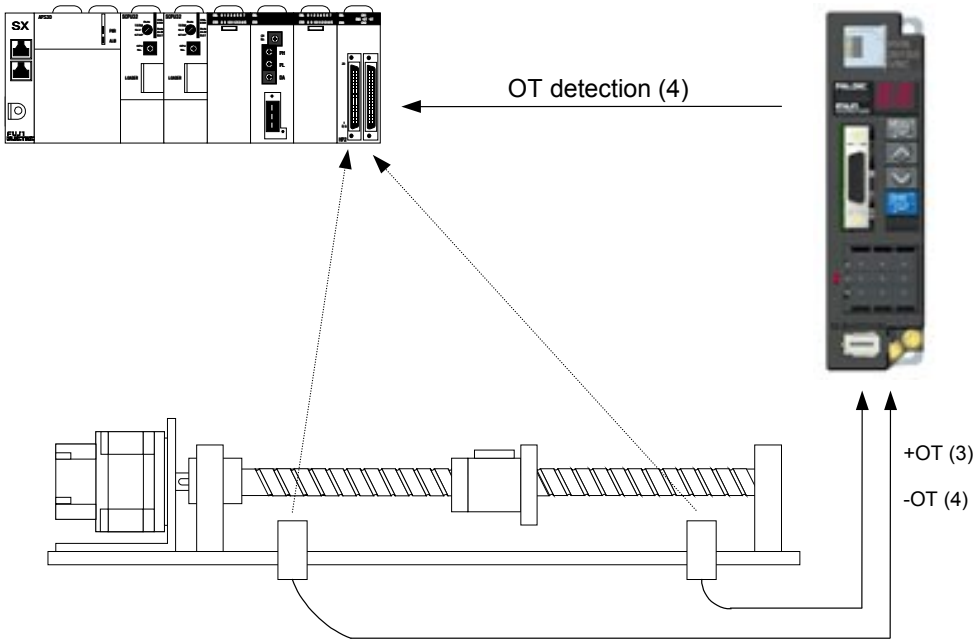
■ Reference

(1) Detecting direction

The +OT signal is detected while the servomotor rotates in the positive direction. The positive direction is the direction specified in basic setting parameter #4. The servomotor is not stopped even if the +OT signal is detected during rotation in the negative direction.

(2) OT detection (4)

This sequence output signal is turned on when +OT (3) or -OT (4) sequence input is turned off.



(4) Forced stop and forced stop detection

This signal supplied at the sequence input terminal stops the servomotor forcibly.

Sequence input/output signal	Forced stop/forced stop detection

■ Function

(1) Forced stop

The servomotor is forcibly stopped (with a b-contact) while the forced stop (5) signal is turned off. This signal is valid in all control states and it is executed at the highest priority. Because safety and detection speeds are generally important for forced stop (5), the signal is directly connected to the servo amplifier.

Usually a self-locking pushbutton switch (command switch) on the operation panel is connected.

When forced stop is detected, deviation is reset.

(2) Forced stop detection

When the forced stop (5) signal is turned off, the forced stop detection (5) signal is turned on to notify external devices of the event.

■ Parameter setting

To assign forced stop to a sequence input terminal, specify the corresponding value (“5”) to the system setting parameter.

If this signal is not assigned to the sequence input terminals, the signal is assumed to be active at any time.

Specify “5” for forced stop detection.

■ Reference

(1) Ready [RDY]

Assign the forced stop (5) signal to a sequence input terminal to turn on the ready [RDY] signal upon activation of the operation command [RUN] and forced stop signals, readying the output shaft of the servomotor to rotate.

(2) State of forced stop

If forced stop (5) is inactive and operation command [RUN] is active, the servomotor is stopped with the zero speed command state. The zero speed state is valid in all control forms.

Activate forced stop to ready the servomotor for operation.

Deactivate the operation command [RUN] signal to coast to stop.

(3) Rotation command

While the forced stop signal remains inactive, all rotation commands are ignored.

(5) P-action

Proportional band control is adopted as a control method of the servo amplifier.

Sequence input signal	P-action

■ Function

Activate this signal while the operation command [RUN] signal is active with the motor shaft being mechanically locked.

If P-action is activated during rotation of the servomotor, position control becomes unstable. Do not activate the signal while the servomotor rotates.

■ Parameter setting

To assign P-action to a sequence input terminal, specify the corresponding value (“6”) to the system setting parameter.

The signal is assumed to be inactive at any time if it is not assigned to the sequence input terminals.

NOTE

If the brake is handled with servo locked, an overload alarm (“13”) is detected.

This is because the servo performs PI control to generate a torque and restore the original position even upon small deviation. Therefore activate P-action without fail, using an external signal, when the brake is applied.

(6) Deviation clearance

Difference (deviation) between the command position and feedback position is reduced to zero.

Sequence input signal	Deviation clearance

■ Function

While this signal remains active, the difference between the command position and feedback position is reduced to zero. The feedback position is made the command position.

■ Parameter setting

To assign deviation clearance to a sequence input terminal, specify the corresponding value (“7”) to the system setting parameter.

■ Reference

While the deviation clearance signal is activated, all rotation commands are ignored.
If the deviation clearance signal is turned on during rotation of the servomotor, pulse command, manual forward rotation [FWD] of the test operation mode and other commands are ignored, to cause the servomotor to be stopped.

The feedback position does not change even if deviation clearance is executed.
Deviation accumulated at a stopper can be zeroed to avoid movement caused by the offsetting of deviation upon a released load.

(7) External regenerative resistor overheat

The electronic thermal relay signal of the optional external regenerative resistor is used to forcibly stop the servomotor.

Sequence input signal	External regenerative resistor overheat

■ Function

The servomotor is forcibly stopped (with a b-contact) while the external regenerative resistor overheat signal is inactive.

If this signal is deactivated during rotation, the servomotor decelerates by its maximum performance to stop (within the zero speed width (parameter #21)), and then it coasts to stop.

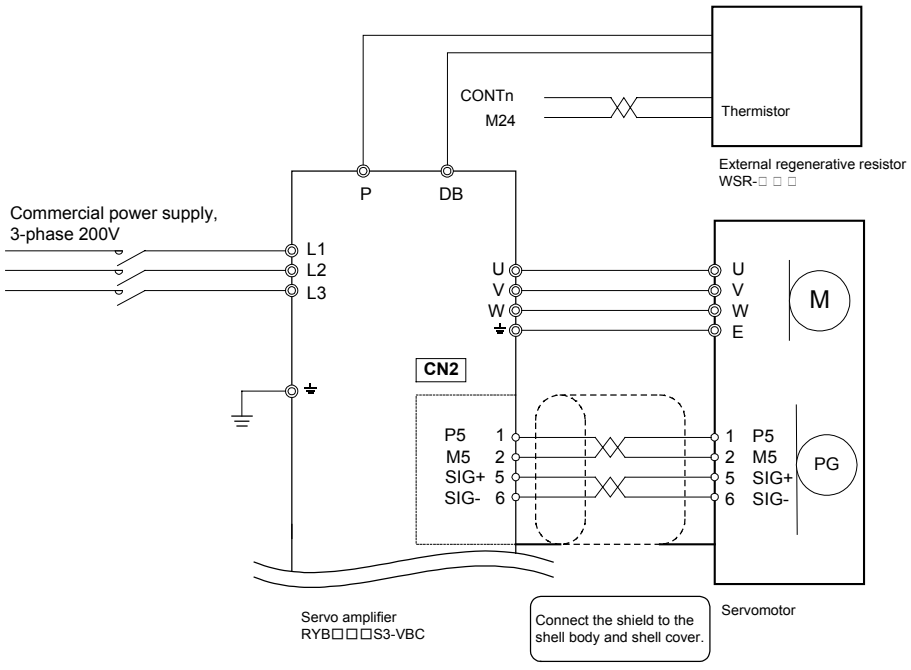
No holding torque generates after the servomotor is stopped.

■ Parameter setting

To assign external regenerative resistor overheat to a sequence input terminal, specify the corresponding value (“8”) to the system setting parameter.

The signal is assumed to be active at any time if it is not assigned to the sequence input terminals.

* Because the thin external regenerative resistance is not provided with thermistor output, be sure to assign “1” (valid) to parameter #25 (regenerative resistor electronic thermal calculation).



(8) Anti-resonance frequency selection 0/1

Set any of the four anti-resonance frequencies.

Sequence input signal	Anti-resonance frequency selection 0/1

■ Function

Select any of the four anti-resonance frequencies by setting two ON/OFF bits.

Anti-resonance frequency selection 1	Anti-resonance frequency selection 0	Anti-resonance frequency
OFF	OFF	Parameter #61*
OFF	ON	Parameter #62
ON	OFF	Parameter #63
ON	ON	Parameter #64

* The signal is assumed to be inactive at any time if it is not assigned to sequence input signals.
In this case, parameter #61 (anti-resonance frequency 0) becomes always valid.
To make anti-resonance frequencies invalid, set the anti-resonance frequency at 200.0Hz (factory shipment value).

■ Parameter setting

To assign anti-resonance frequency 0 or 1 to a sequence input terminal, specify the corresponding value (“9”) or (“10”) to the system setting parameter.

■ Reference

For details of the anti-resonance frequency, refer to Chapter 7.

(9) Alarm detection: a-contact (b-contact)

The servo amplifier detects the action (alarm) of protection function to activate (desactivate)* the signal.

Sequence output signal	Alarm detection: a-contact ... Assigned to OUT1 with shipment setting Alarm detection: b-contact

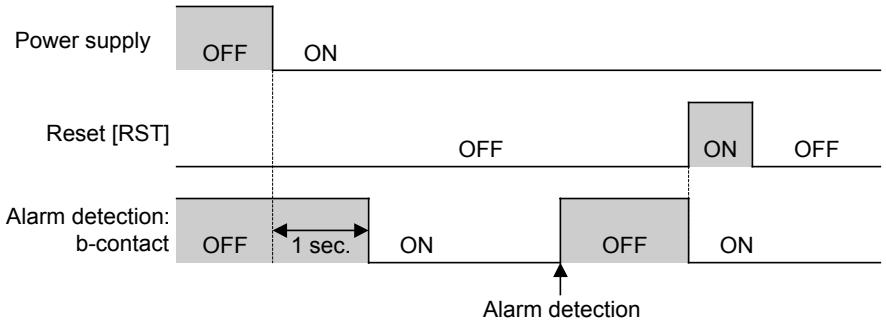
■ Function

The signal is activated (deactivated*) and is held at the servo amplifier when the servo amplifier detects an alarm. After the cause of the alarm is removed, the signal is deactivated (activated*) upon the activating edge of the reset signal [RST] so that operation is resumed.

The host controller recognizes the alarm detection signal to check for an alarm.

* Description in parentheses ( ) is for b-contact alarm detection.

<Precaution for usage of b-contact alarm detection>



Make sure that the signal is inactive for about one second after the power is turned on.

■ Parameter setting

To assign a- or b-contact alarm detection to the sequence output terminal, specify the corresponding value (“1” or “2”) to the system setting parameter.

(10) Dynamic brake

The signal is activated when the servo amplifier detects a major fault.

Sequence output signal	Dynamic brake

■ Function

The signal is activated when the servo amplifier detects a major fault with which the servomotor cannot be driven, and it is retained until an alarm reset signal is input.
When the dynamic brake is applied, three phases of the synchronous motor are short-circuited to generate power. After the output shaft of the servomotor is stopped, no braking force generates.

The output terminal of the dynamic brake is +30VDC, 50mA. Because the electromagnetic contact cannot be driven directly, use a general relay or solid-state contactor (SSC).

■ Parameter setting

To assign the dynamic brake to the sequence output terminal, specify the corresponding value ("3") to the system setting parameter.

■ Reference

- Major fault

With this type of failure, the servomotor cannot be driven.

<Action upon alarm>

Coasting to stop upon detection

Detection of major fault

Indication	Description
01	Overcurrent 1
02	Overcurrent 2
03	Overspeed
04	Overvoltage
05	Encoder trouble
06	Control power alarm 1
07	Control power alarm 2
08	Memory alarm
09	Motor combination alarm
10	Regenerative transistor overheat
11	Encoder communication alarm
12	CONT duplication
13	Overload

- Minor fault

This type of failure occurs in cases such as for protection against overheats.

<Action upon alarm>

The servomotor decelerates at the maximum performance and, after being stopped*, it coasts to stop.

Detection of minor fault

Indication	Description
14	Undervoltage
15	Regenerative resistor overheat
16	Deviation limit
17	Amplifier overheat
18	Encoder overheat
19	Initial error

* The rotation speed is reduced to within the zero speed width (parameter #21).

(11) Ready [RDY]

The signal is activated when the motor is ready to rotate.

Sequence output signal	Ready [RDY]

■ Function

The signal is activated when the following conditions are satisfied:

1) Active operation command [RUN] (1) signal

2) Active forced stop [EMG] (5) signal*

3) Inactive alarm detection: a-contact (1) signal (Or active alarm detection: b-contact (2) signal)

4) Active external regenerative resistor overheat (8) signal*

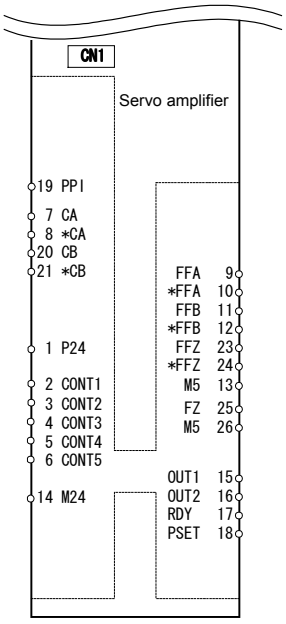
5) Source voltage above 150V

* Conditions 2) and 4) are ignored if the corresponding signal is not assigned to the CONT terminals.

The host controller recognizes the ready [RDY] signal to check if the servomotor is ready to rotate.

■ Parameter setting

The ready [RDY] signal is fixed at the sequence output terminal [RDY].



(12) Positioning end [PSET]

Use the signal to check that the positioning action has been completed.

Sequence output signal	Positioning end [PSET]

■ Function

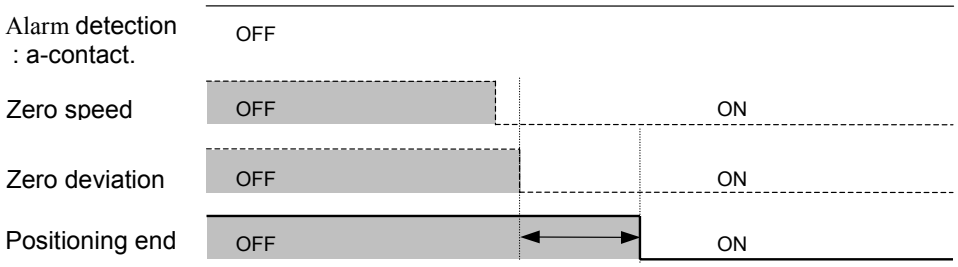
The signal is active when the following conditions are satisfied.

1) There is no alarm.

2) The rotation speed is within the zero speed width specified at parameter #21.

3) The deviation amount is within zero deviation width specified at parameter #19.

4) The above conditions remain arranged for the positioning end judgment time specified at parameter #22.



Positioning end judgment time (System setting parameter #22)

■ Parameter setting

The positioning end [PSET] signal is fixed at the sequence output terminal [PSET].

P1 / 17

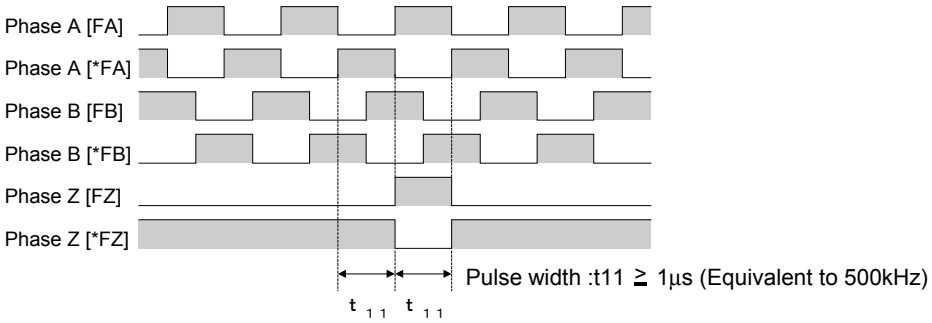
System setting parameter #17

No.	Name	Setting range	Initial value	Change
17	Output pulse count	16 to 16384 [pulse] (in 1 increments)	2048	Power

Specify the number of pulses output per each revolution of the servomotor.

The output form is two signals having 90-degree phase difference.
A phase-B advance signal is output during forward rotation of the output shaft of the servomotor. The setting does not depend on the direction of rotation setting (system setting parameter #4).
Two 90-degree phase difference signals are issued with reference to the power-on level.

The number of pulses output from the frequency dividing output terminals ([FA], [*FA], [FB], [*FB] and [*FZ] terminals) of the servo amplifier can be specified.



The phase-A and phase-B signals are 50% duty.
A single pulse of the phase-Z signal is output in each revolution. The output width depends on the number of output pulses.
The phase-A and phase-Z signals are synchronized with each other.
Use about 500kHz output frequency. There is no limit in the output frequency of the servo amplifier.
There is no relationship between the position of the output shaft of the servomotor and the phase-Z signal.

Supplement

Number of output pulses during rotation at 5000 [r/min] with an output pulse count setting of 3000

$$\frac{3000\ [\text{pulse/rev}]}{60} \times 5000\ [\text{r/min}] = 250000\ [\text{Hz}]$$

The number of output pulses exceeds 1.3 [MHz] with maximum 16384 [pulses/rev] and 5000 [r/min].

P1 / 18

System setting parameter #18

No.	Name	Setting range	Initial value	Change
18	Phase-Z offset	0 to 65535[pulse] (in 1 increments)	0	Power

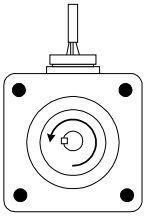
Specify the parameter to change the output position of the phase-Z signal.

There is a counterclockwise delay in the output position of the phase-Z signal by the number of pulses specified in system setting parameter #18.

This parameter has no relations with the direction of rotation switch (parameter #4).

$$\frac{\text{(Phase-Z offset [pulses])}}{\text{65536 pulses/rev}} = \text{Z [rev]}$$

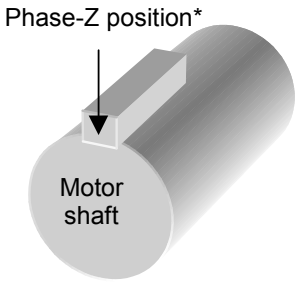
Counterclockwise



There is a counterclockwise delay in the output position of the phase-Z signal by Z revolutions.

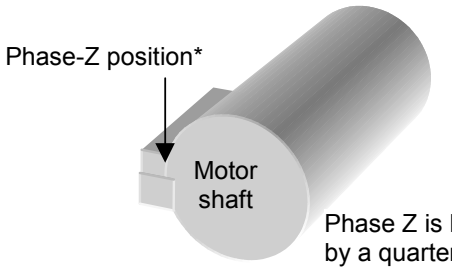
■ Output position of phase-Z signal

- When the phase-Z offset is “0”



- When phase-Z offset is “16384”

$$\frac{\text{16384 pulses}}{\text{65536 pulses/rev}} = \frac{1}{4}\ \text{[rev]}$$



Phase Z is late by a quarter revolution in the counterclockwise direction.

*The position of the key is not phase Z. The position of the key is assumed to be phase Z for explanation.

■ Reference

Adjustment of the phase-Z position can be made in the test operation mode of the keypad panel so that the current position becomes the position where the phase-Z signal is issued. → Refer to page 8-17.

Precaution for detection of phase-Z signal for origin returning action

To use this parameter, reserve at least one full revolution of the motor shaft from the origin return limit switch (origin LS) for origin returning action.
If the origin returning action starts within one revolution, the motor may turn one more revolution when origin return is completed.

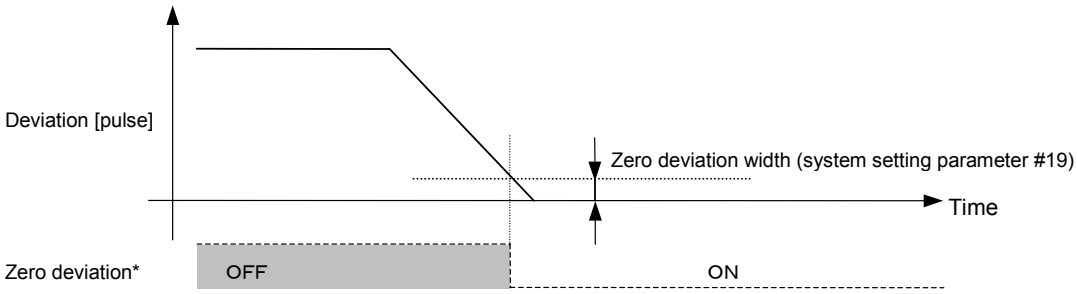
P1 / 19

System setting parameter #19

No.	Name	Setting range	Initial value	Change
19	Zero deviation width	1 to 10000 [pulse] (in 1 increments)	200	Always

Specify the width of the zone where the zero deviation signal is activated* in the number of encoder pulses.

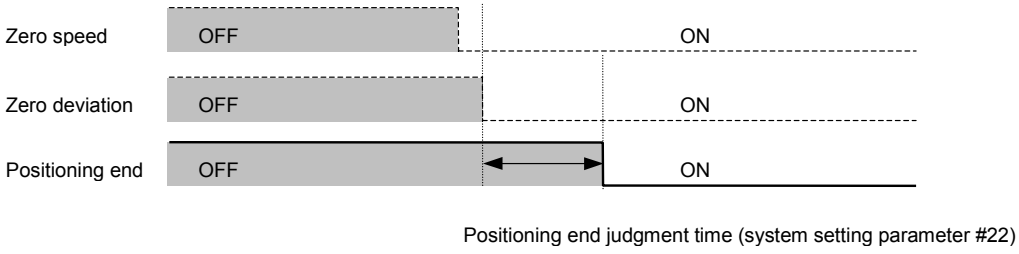
The unit is equivalent to the number of encoder feedback pulses (not command pulses).



* For internal processes of servo amplifier. Cannot be assigned to OUT terminals.

The zero deviation signal can be checked in the trace screen of the PC loader (option).

If both the zero deviation signal (system setting parameter #19) and zero speed signal (system setting parameter #21) remain active in the positioning end judgment time specified in system setting parameter #22, the positioning end signal is activated.



P1 / 20

System setting parameter #20

No.	Name	Setting range	Initial value	Change
20	Deviation limit width	10 to 65535 [× 100 pulse] (in 1 increments)	10000	Always

Specify the number of pulses for detecting the deviation limit (for alarm detection) in the number of encoder feedback pulses (not command pulses).

The initial setting is “10000,” so that deviation is detected at 1000000 pulses.

With the initial setting, deviation is detected if the difference between the command position and feedback position is equivalent to about 15.2 revolutions of the servomotor shaft.

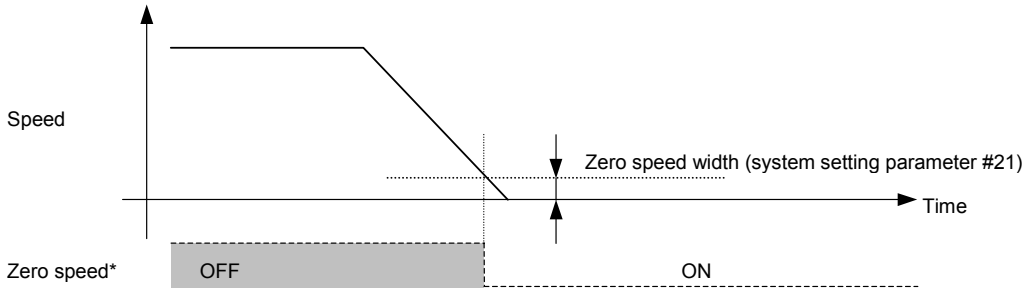
The deviation limit width is provided for alarm detection.

P1 / 21

System setting parameter #21

No.	Name	Setting range	Initial value	Change
21	Zero speed width	10 to 5000 [r/min] (in 1 increments)	50	Always

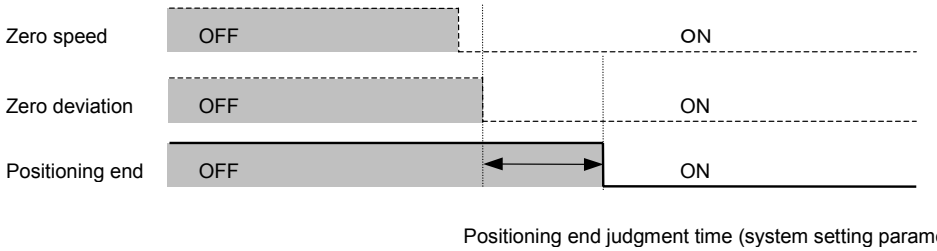
Use the parameter to judge if the servomotor is stopped. Specify the width where the zero speed signal is activated*.



* For internal processes of servo amplifier. Cannot be assigned to OUT terminals.

The zero speed signal can be checked in the trace screen of the PC loader (option).

If the zero deviation signal (system setting parameter #19) and zero speed signal (system setting parameter #21) remain active in the positioning completion judgment time specified in system setting parameter #22, the positioning end signal is activated.



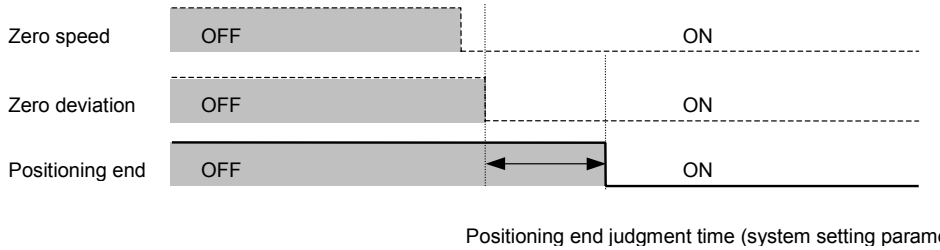
P1 / 22

System setting parameter #22

No.	Name	Setting range	Initial value	Change
22	Positioning end judgment time	0.000 to 1.000 sec. (in 0.001 increments)	0.000	Always

Specify the time for judgment of the end of positioning.

If the zero deviation signal (system setting parameter #19) and zero speed signal (system setting parameter #21) remain active in the positioning end judgment time (system setting parameter #22), the positioning end signal is activated.



P1 / 23

System setting parameter #23

No.	Name	Setting range	Initial value	Change
23	Max. current limit	0 to 300 % (in 1 increments)	300	Always

Specify the output torque limit of the servomotor.

This setting is always valid.

P1 / 24

System setting parameter #24

No.	Name	Setting range	Initial value	Change
24	Undervoltage alarm detection	0: No detection, 1: Detection	1	Power

Specify whether or not alarm detection is made upon detection of undervoltage in the power supply under active operation command [RUN].

System setting parameter #24

Setting range	Alarm	Deceleration action	Stopping action	When power is restored
0: No detection	Not detected	Deceleration at max. performance	Coast to stop	Action in the state prior to detection of undervoltage
1: Detection	Detected	Deceleration at max. performance	Coast to stop	Alarm stop (coast to stop)

Supplement If a voltage drop (undervoltage) caused by momentary power failure or the like is detected, the servomotor decelerates at the maximum performance of the servo amplifier. Because the servomotor functions as a generator during deceleration, the power may be regenerated to exceed the undervoltage level. If this happens, the servomotor starts to decelerate upon an undervoltage, the undervoltage alarm is removed, and the servomotor accelerates again.

- Major fault

With this type of failure, the servomotor cannot be driven.

<Action upon alarm>

Coasting to stop upon detection

Detection of major fault

Indication	Description
01	Overcurrent 1
02	Overcurrent 2
03	Overspeed
04	Overvoltage
05	Encoder trouble
06	Control power alarm 1
07	Control power alarm 2
08	Memory alarm
09	Motor combination alarm
10	Regenerative transistor overheat
11	Encoder communication alarm
12	CONT duplication
13	Overload

- Minor fault

This type of failure occurs in cases such as for protection against overheats.

<Action upon alarm>

The servomotor decelerates at the maximum performance and, after being stopped*, it coasts to stop.

Detection of minor fault

Indication	Description
14	Undervoltage
15	Regenerative resistor overheat
16	Deviation limit
17	Amplifier overheat
18	Encoder overheat
19	Initial error

* The rotation speed is reduced to within the zero speed width (parameter #21).

P1 / 25

System setting parameter #25

No.	Name	Setting range	Initial value	Change
25	Regenerative resistor electronic thermal calculation	0: Invalid, 1: Valid (optional regenerative resistor (thin type))	0	Power

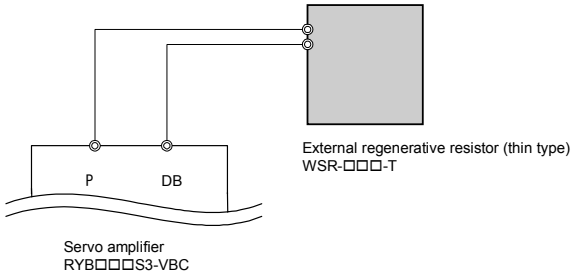
Specify the parameter when connecting the optional external regenerative resistor (thin type) (WSR-□□□-T).

System setting parameter #25

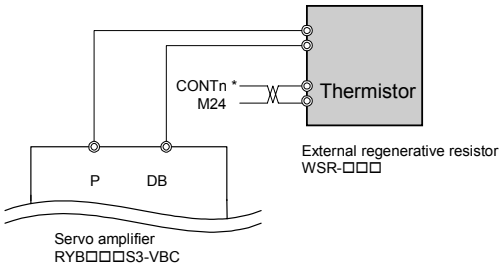
Regenerative resistor	Setting
None	0: Invalid
External regenerative resistor (thin type)	1: Valid (optional regenerative resistor (thin type))
External regenerative resistor	0: Invalid

■ Connection of optional external regenerative resistor (thin type) WSR-□□□-T)

The external regenerative resistor (thin type) must be protected with the electronic thermal relay inside the servo amplifier because it is provided with no thermistor.



■ Connection with optional external regenerative resistor (WSR-□□□)



* Assign external regenerative resistor overheat (8) to the CONT input terminal.

P1 / 26

System setting parameter #26

No.	Name	Setting range	Initial value	Change
26	Dynamic brake on overtravel detection valid/invalid	0: Invalid, 1: Valid	0	Power

Specify the parameter for models equipped with the optional dynamic brake unit (will be sold later).

P1 / 27

System setting parameter #27

No.	Name	Setting range	Initial value	Change
27	Parameter write-protection	0: Write-enable, 1: Write-protected	0	Always

Parameter editing is prohibited.

Even if write-protection is selected with system setting parameter #27, system setting parameter #27 can be edited.

P1 / 28

System setting parameter #28

No.	Name	Setting range	Initial value	Change
28	Keypad panel initial display	0 to 11 (in 1 increments)	0	Power

Specify the initial display of the keypad panel immediately after the power is supplied.

System setting parameter #28

Setting	Description	Display
0	State display mode	51
1	Current alarm	52
2	Alarm history	53

Setting	Description	Display
3	Feedback speed	01
4	Effective torque	02
5	Peak torque	03
6	Pulse string frequency	04
7	Input signals	05
8	Output signals	06
9	OL thermal value	07
10	Regenerative resistor thermal value	08
11	Load inertia ratio	09

For details of each item, refer to Chapter 8.

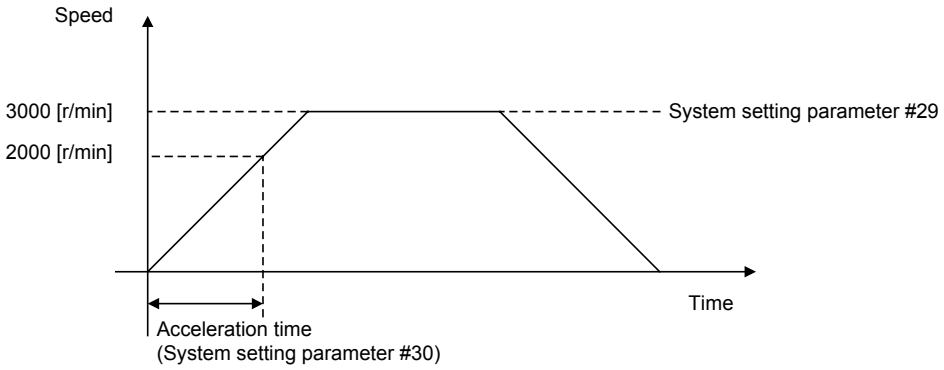
P1 / 29 – 30

System setting parameters #29 and #30

No.	Name	Setting range	Initial value	Change
29	Speed setting (for test operation)	1 to 5000 [r/min] (in 1 increments)	100	Always
30	Acceleration / deceleration time (for test operation)	0.000 to 9.999 sec. (in 0.001 increments)	0.100	Always

Specify the test operation speed and acceleration and deceleration time.

Specify the acceleration/deceleration in the time for reaching 2000 [r/min].



* Use the test operation mode of the keypad panel or PC loader to start test operation.

Refer to page 8-15.

■ Acceleration/deceleration time setting examples

1) To accelerate to 5000 [r/min] in 0.1 second

$$\text{Acceleration time} = \frac{(2000\ [\text{r/min}] \times (\text{Target acceleration time}))}{(\text{System setting parameter \#29})}$$

$$\text{Acceleration time} = \frac{(2000\ [\text{r/min}] \times 0.1\ \text{sec.})}{5000\ [\text{r/min}]} = 0.04\ \text{sec.}$$

2) To accelerate to 100 [r/min] in 0.05 sec.

$$\text{Acceleration time} = \frac{(2000\ [\text{r/min}] \times (\text{Target acceleration time}))}{(\text{System setting parameter \#29})}$$

$$\text{Acceleration time} = \frac{(2000\ [\text{r/min}] \times 0.05\ \text{sec.})}{100\ [\text{r/min}]} = 1\ \text{sec.}$$

P1 / 31 — 39

System setting parameters #31 through #39

No.	Name	Setting range	Initial value	Change
31 to 39	Not used	-	0	-

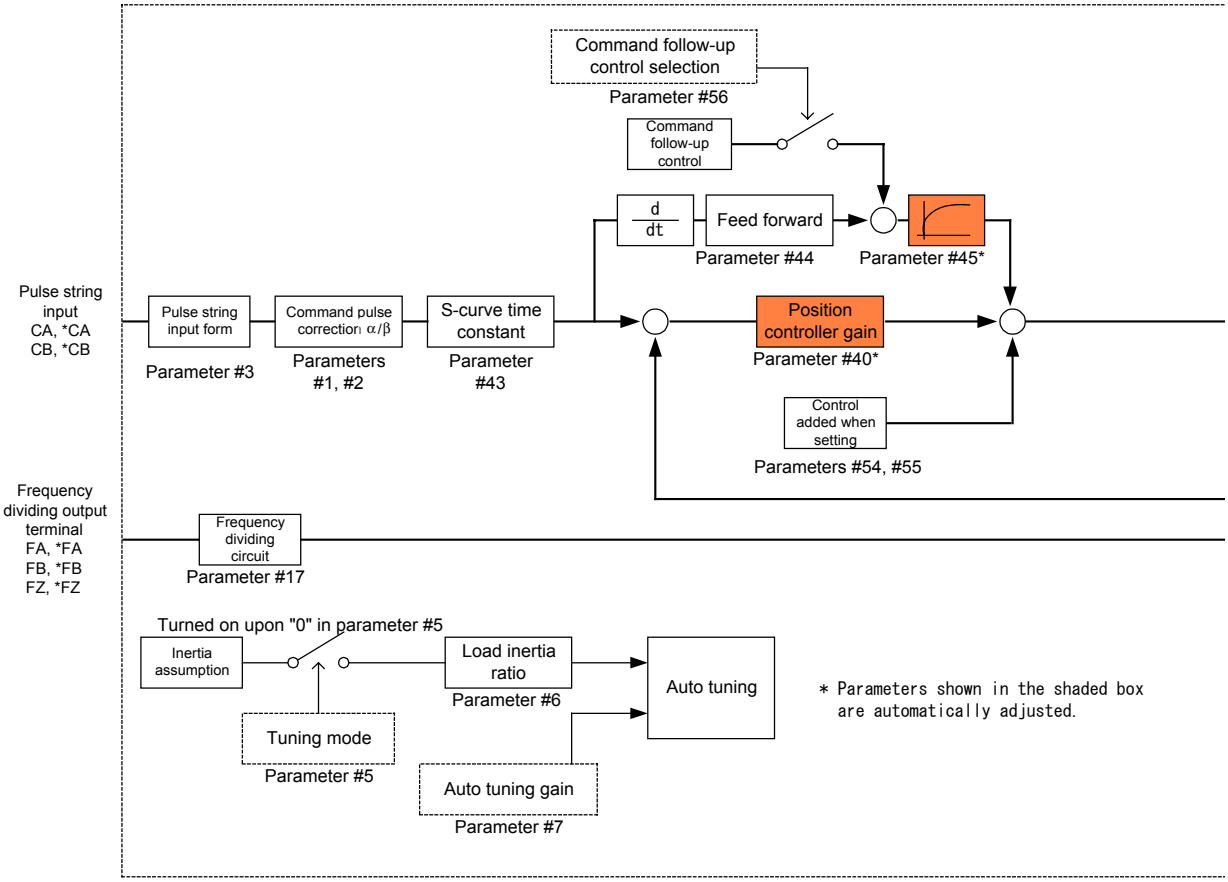
These parameters are not used.

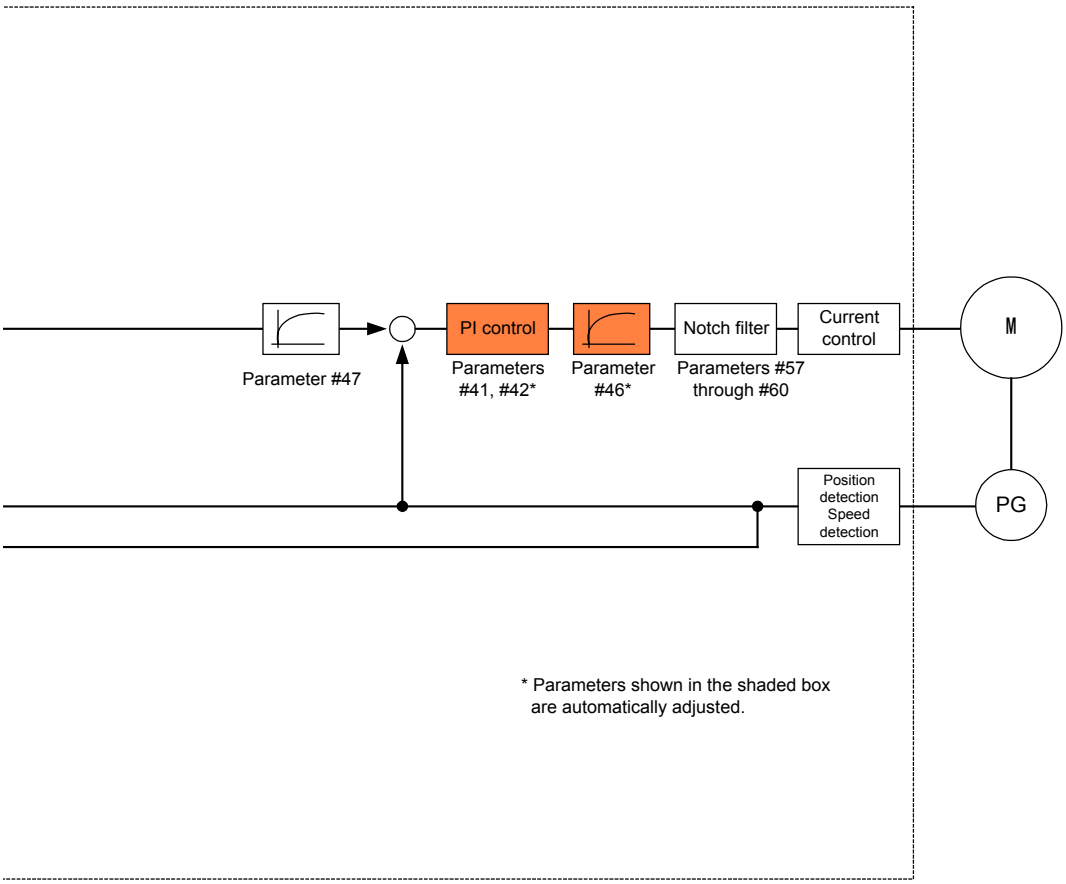
5-5) Control system settings

Control system setting parameters are described in the order of the parameter number.

■ Control block diagram

The control block diagram of FALDIC-β Series is shown.





P1 / 40 – 42

Control system setting parameters #40 through #42

No.	Name	Setting range	Initial value	Change
40	Position controller gain 1	1 to 1000 [rad/sec] (in 1 increments)	77	Always
41	Speed response 1	1 to 1000 [Hz] (in 1 increments)	57	Always
42	Speed controller integration time 1	1.0 to 1000.0 [msec] (in 0.1 increments)	25.9	Always

P1 / 45 – 46

Control system setting parameters #45 and #46

No.	Name	Setting range	Initial value	Change
45	Feed forward filter time constant	0.0 to 250.0 [msec] (in 0.1 increments)	12.9	Always
46	Torque filter time constant	0.00 to 20.00 [msec] (in 0.01 increments)	0.31	Always

These parameters are automatically updated when “auto tuning” or “semi-auto tuning” is selected at basic setting parameter #5.

Specify them when “manual tuning” is selected.

No.	Name	Tuning mode		
		0: Auto	1: Semi-auto	2: Manual
06	Load inertia ratio	-	○	○
07	Auto tuning gain	○	○	×
40	Position controller gain	-	-	○
41	Speed response	-	-	○
42	Speed controller integration time 1	-	-	○
45	Feed forward filter time constant	-	-	○
46	Torque filter time constant	-	-	○

*○ : Parameter which must be set

\- : Parameter which may not be set (The value is automatically calculated inside the amplifier and the result is reflected on the parameter.)

× : The parameter has no effect even if it is set.

■ Position controller gain 1 (Control system setting parameter 40)

This parameter determines the response of the position control loop. A larger setting improves the response to the position command, while too large a setting is likely to generate overshoot.

■ Speed response 1 (Control system setting parameter 41)

This parameter determines the response of the speed control loop. A larger setting improves the response of the servomotor, while too large a setting may cause the mechanical system to vibrate.

■ Speed controller integration time 1 (Control system setting parameter 42)

This parameter determines the response of the speed control loop. A smaller setting improves the response of the servomotor, while too small a setting may cause the mechanical system to vibrate.

■ Feed forward filter time constant (Control system setting parameter 45)

This parameter filters feed forward action of the position control loop.

A smaller setting improves the response while it may cause torque shock.

■ Torque filter time constant (Control system setting parameter 46)

This parameter filters the torque command.

A larger setting suppresses resonance of the machine while stability in the control may be undermined.

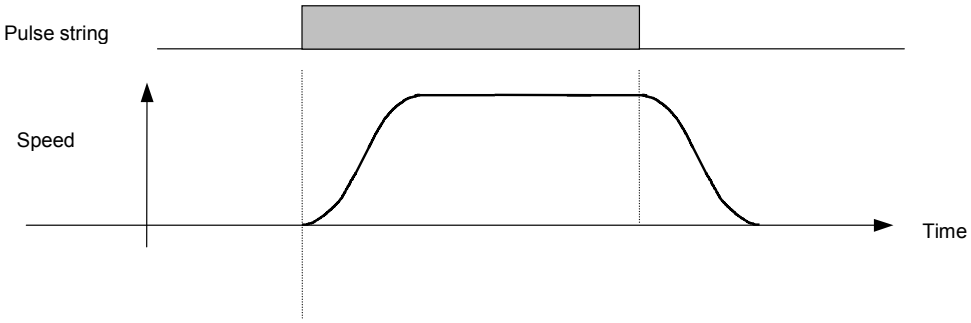
P1 / 43

Control system setting parameter #43

No.	Name	Setting range	Initial value	Change
43	S-curve time constant	0.0 to 100.0 [msec] (in 0.1 increments)	0.0	Always

The servomotor can be accelerated or decelerated moderately in the S-curve pattern.

If the pulse string input is given at a constant frequency, the servomotor accelerates or decelerates at the time constant of the set time.
The servomotor rotates by the number of input pulse strings.
Smooth acceleration and deceleration are obtained even if the host controller does not allow linear acceleration.



* Specify the parameter without fail if the dumping control function (parameters #61 through #64) are used.
  → Refer to section 7-1 “Vibration control.”

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Control system setting parameter #44

No.	Name	Setting range	Initial value	Change
44	Feed forward gain	0.000 to 1.500 (in 0.001 increments)	0.000	Always

This parameter functions if parameter #60 (command follow-up control selection) is set at “0 (none).”
Specify the parameter in a poorly rigid machine or a mechanical system having a large load inertia ratio, to increase the response.
Specify a value between 0.100 and 0.500 to obtain a preferable result. A larger setting reduces deviation (difference between position command and feedback position), resulting in a better response.

To perform synchronous operation between two axes, set “1.000.”

P1 / 47

Control system setting parameter #47

No.	Name	Setting range	Initial value	Change
47	Speed setting filter	0.00 to 20.00 [msec] (in 0.01 increments)	0.00	Always

Specify the parameter to filter the speed command.

* No change is necessary in principle.

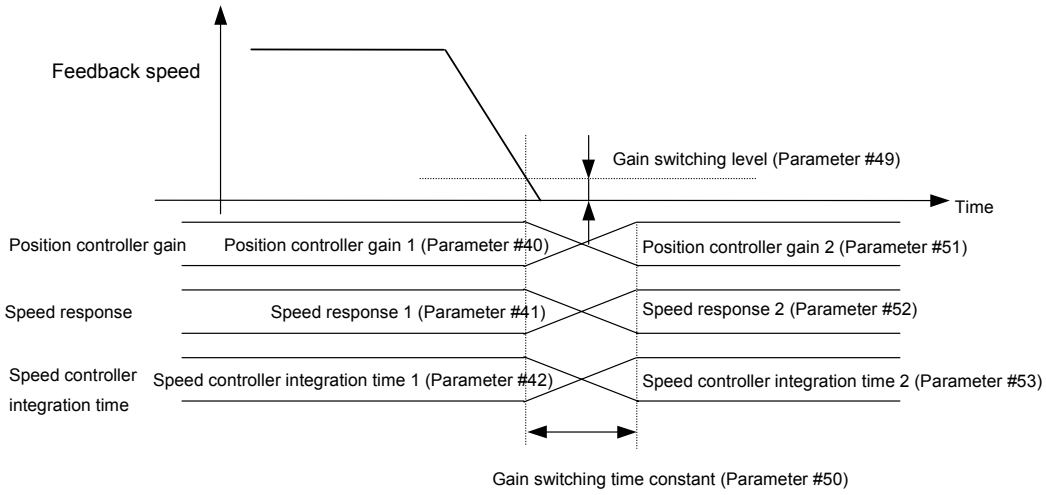
P1 / 48 – 53

Control system setting parameters #48 through #53

No.	Name	Setting range	Initial value	Change
48	Gain switching factor	0: Position deviation (x 10), 1: Feedback speed, 2: Command speed	1	Always
49	Gain switching level	1 to 1000 (in 1 increments)	50	Always
50	Gain switching time constant	0 to 100 [msec] (in 1 increments)	10	Always
51	Position controller gain 2	30 to 200 % (in 1 increments)	100	Always
52	Speed response 2	30 to 200 % (in 1 increments)	100	Always
53	Speed controller integration time 2	30 to 200 % (in 1 increments)	100	Always

The gain at the time of stopping is switched from the first gain (parameters #40 to #42) to the second gain (parameters #51 to #53).

Gain switching reduces the noise and vibration at the time of stopping.



The settings of the second gain (parameters #51 to #53) are given in the ratio (%) to the first gain.

Example: When speed response 1 (parameter #41) is 100Hz

"100%" of speed response 2 (parameter #52) means 100Hz.

"80%" of speed response 2 (parameter #52) means 80Hz.

* The same rule applies to position controller gain 2 (parameter #51) and speed controller gain 2 (parameter #53).

P1 / 54 – 55

Control system setting parameters #54 and #55

No.	Name	Setting range	Initial value	Change
54	Position gain added when setting	0 to 1000 [rad/sec] (in 1 increments)	0	Always
55	Addition limit when setting	0 to 200 [r/min] (in 1 increments)	0	Always

Increase the position gain at the time of stopping to reduce the setting time or to enhance the rigidity.

Do not use in regular cases.

→ Refer to section 7-3 “Position gain and limit added when setting.”

P1 / 56

Control system setting parameter #56

No.	Name	Setting range	Initial value	Change
56	Command follow-up control selection	0: None, 1: Command follow-up control, 2: Command follow-up control (with correction on stop)	0	Power

Use the parameter to select the command follow-up control mode where the mechanical system follows the command without delay to the pulse command.

→ Refer to section 7-2 “Command follow-up control.”

P1 / 57 – 60

Control system setting parameters #57 through #60

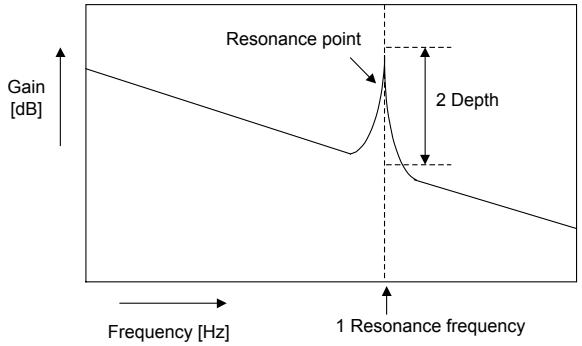
No.	Name	Setting range	Initial value	Change
57	Notch filter 1 frequency	10 to 200 [x 100 Hz] (in 1 increments)	200	Always
58	Notch filter 1 damping amount	0 to 40 [dB] (in 1 increments)	0	Always
59	Notch filter 2 frequency	10 to 200 [x 10Hz] (in 1 increments)	200	Always
60	Notch filter 2 damping amount	0 to 40 [dB] (in 1 increments)	0	Always

Specify to suppress resonance of the mechanical system.

Resonance can be suppressed at up to two points.

■ Notch filter setting method

i) Use the servo analysis function of the PC loader (option) to determine the resonance point of the machine.

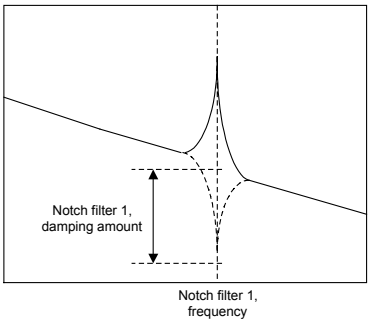


ii) Specify the resonance frequency and damping amount of the resonance point of the machine in parameters.

1 Resonance frequency → Parameter #57 (Notch filter 1 frequency)

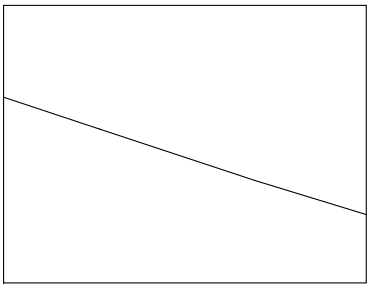
2 Depth → Parameter #58 (Notch filter 1 damping amount)*

* Too deep a damping amount may undermine stability of the control. Avoid setting too large a value.



The notch filter functions at the resonance point as shown in the figure above.

Use the servo analysis function again.



The resonance point is eliminated due to the notch filter.

P1 / 61 – 64

Control system setting parameters #61 through #64

No.	Name	Setting range	Initial value	Change
61	Anti-resonance frequency 0	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
62	Anti-resonance frequency 1	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
63	Anti-resonance frequency 2	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
64	Anti-resonance frequency 3	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always

Use these parameters to specify anti-resonance frequencies and suppress vibration of the workpiece (dumping control).

The dumping control function becomes invalid with 200.0Hz (factory setting).

→ Refer to section 7-1 “Vibration control.”

P1 / 65 – 79

Control system setting parameters #65 through #79

No.	Name	Setting range	Initial value	Change
65 to 79	Not used	-	0	-

These parameters are not used.

5-6) For adjustments by manufacturer

These parameters are for adjustments by the manufacturer. Do not change them.

Parameters #80 through #83 for adjustment by manufacturer

No.	Name	Setting range	Initial value	Change
80	For adjustment by manufacturer 1	-	Adjusted value	-
81	For adjustment by manufacturer 2	-	Adjusted value	-
82	For adjustment by manufacturer 3	-	Adjusted value	-
83	For adjustment by manufacturer 4	-	Adjusted value	-

These are parameters for adjustment by the manufacturer. Do not change them.

Parameters #84 through #99 for adjustment by manufacturer

No.	Name	Setting range	Initial value	Change
84 to 99	Not used	-	0	-

These parameters are not used.

FALDIC-β

ADJUSTMENT OF SERVO

6 ADJUSTMENT OF SERVO

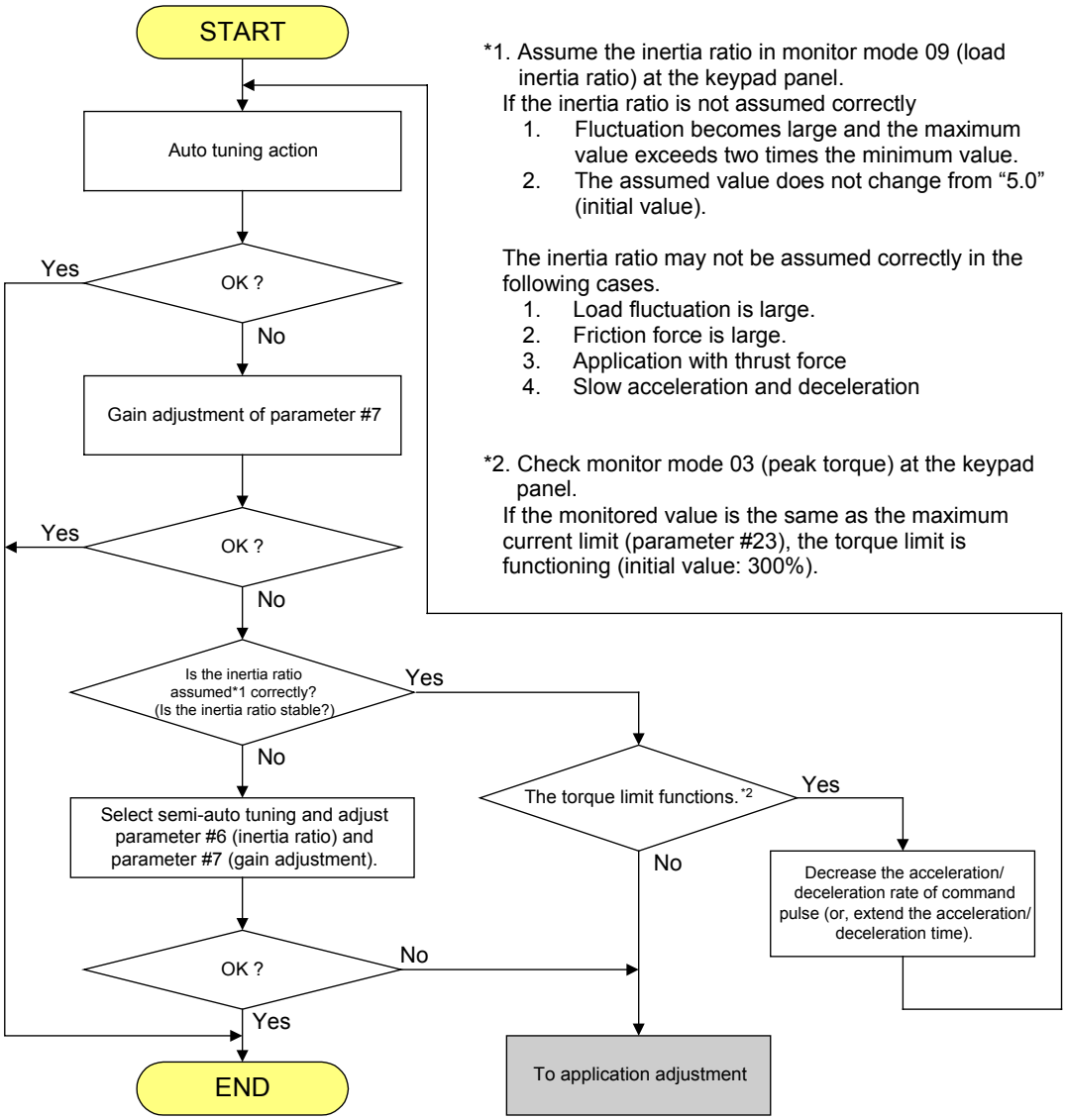
6-1) Basic adjustment

The servomotor must be tuned so that it reliably obeys commands sent from the host controller.

The tuning method of FALDIC-β Series includes three types: auto tuning, semi-auto tuning and manual tuning (parameter #5).

Be sure to operate the servomotor in the auto tuning mode (factory setting) for the first time when operating it.

The factory setting of FALDIC-β Series is auto tuning.



*1. Assume the inertia ratio in monitor mode 09 (load inertia ratio) at the keypad panel.
If the inertia ratio is not assumed correctly
1. Fluctuation becomes large and the maximum value exceeds two times the minimum value.
2. The assumed value does not change from “5.0” (initial value).

The inertia ratio may not be assumed correctly in the following cases.
1. Load fluctuation is large.
2. Friction force is large.
3. Application with thrust force
4. Slow acceleration and deceleration

*2. Check monitor mode 03 (peak torque) at the keypad panel.
If the monitored value is the same as the maximum current limit (parameter #23), the torque limit is functioning (initial value: 300%).

■ Parameters automatically adjusted in the auto or semi-auto tuning mode

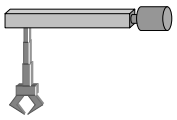
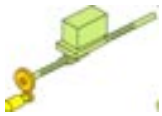
No.	Name	Tuning mode	
		0: Auto	1: Semi-auto
06	Load inertia ratio	- (Updated every 10 minutes)	O
07	Auto tuning gain	O	O
40	Position controller gain	- (Always updated)	- (Fixed)
41	Speed response	- (Always updated)	- (Fixed)
42	Speed controller integration time 1	- (Always updated)	- (Fixed)
45	Feed forward filter time constant	- (Always updated)	- (Fixed)
46	Torque filter time constant	- (Always updated)	- (Fixed)

O : Item specified manually.
- : Item specified automatically.

- Parameters automatically updated in the auto tuning mode are updated at real time.
- In the semi-auto tuning mode, automatically updated parameters are fixed once they are set*.

  * Parameters are automatically set when parameter #6 (load inertia ratio) or parameter #7 (auto tuning gain) is changed.

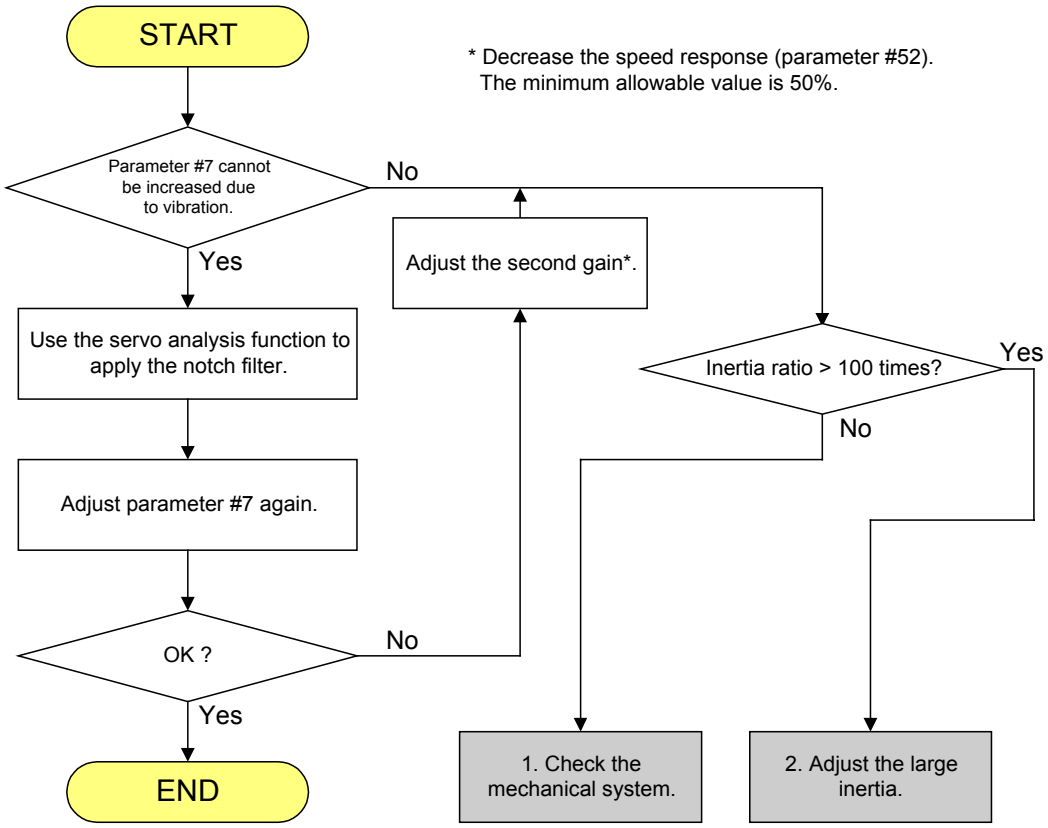
■ Approximate measure for auto tuning gain (parameter #7) setting

Mechanical configuration	Auto tuning gain (Approximate measure)
Large transportation machine	1 to 6
Arm robot 	5 to 10
Belt drive 	7 to 13
Ball screw mechanism 	10 to 15
Inserting, mounting or bonding machine	13 to 20

A larger auto tuning gain reduces the response time while vibration is likely to be generated.

6-2) Application adjustment

Use this adjustment method when adjustment is not satisfactory after the procedure described in section 6-1 “Basic adjustment” or if the servomotor vibrates and the auto tuning gain (parameter #7) cannot be increased sufficiently.



1. Check the mechanical system.

Check the mechanical system for the following problems.

i) Large backlash

ii) Deflection of belt

2. Adjust the large inertia.

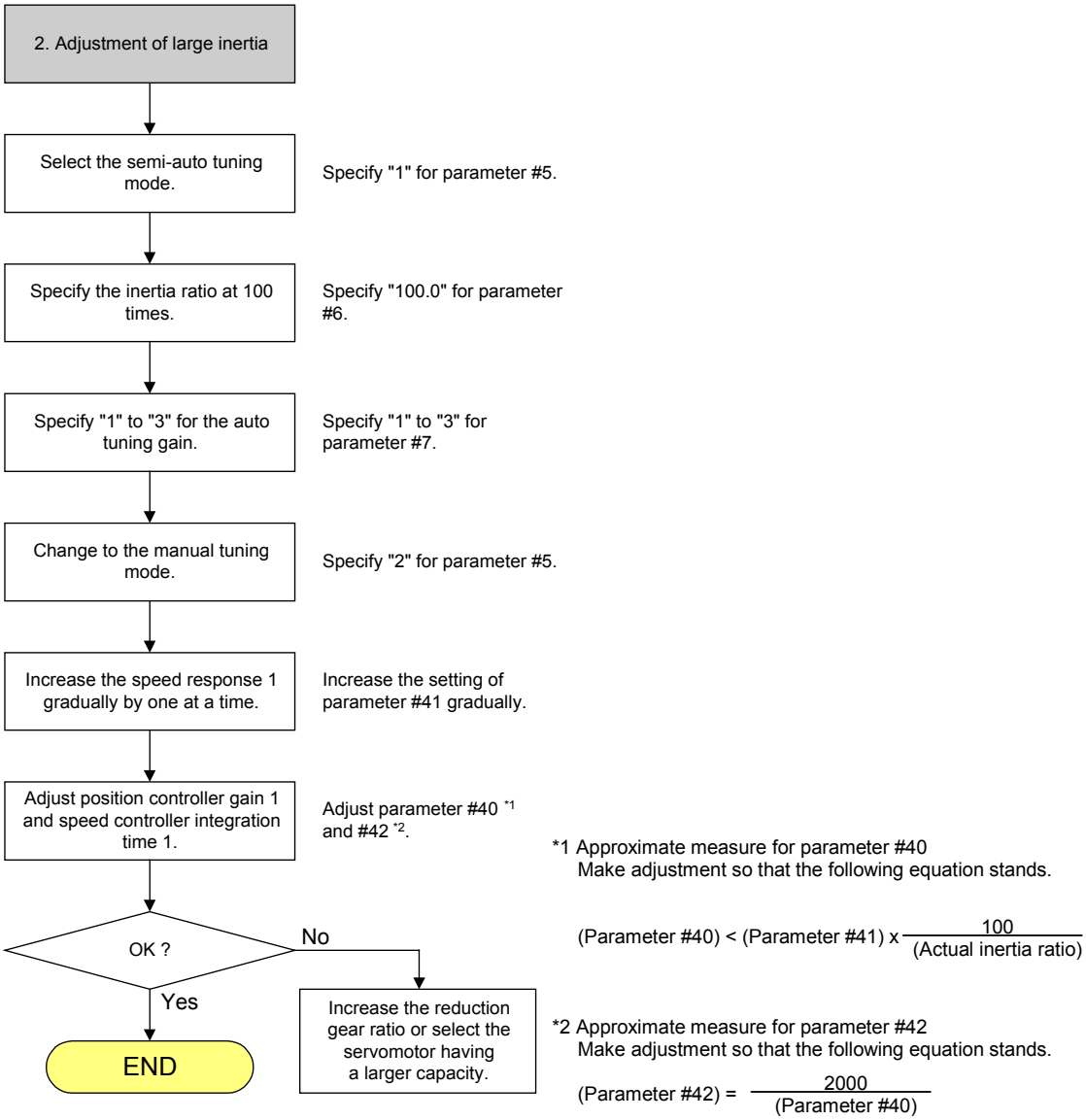
Note: The inertia ratio must be no larger than 100 times in principle.

■ How to check if the load inertia ratio exceeds 100 times

i) Use capacity selection software to automatically calculate the load inertia.

ii) Use monitor mode 09 (load inertia ratio) at the keypad panel to assume.

(The displayed value is up to 99 times. If “80” or a larger value is displayed, the ratio may be larger than 100 times.)



*1 Approximate measure for parameter #40
Make adjustment so that the following equation stands.

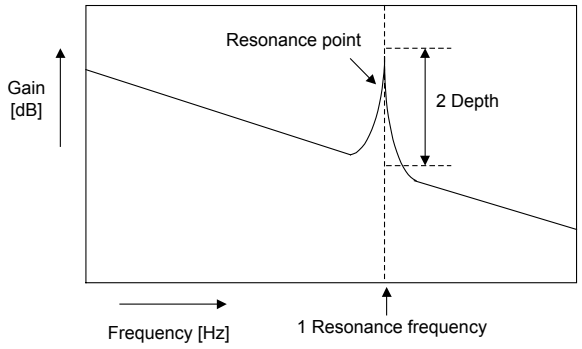
$$(\text{Parameter \#40}) < (\text{Parameter \#41}) \times \frac{100}{(\text{Actual inertia ratio})}$$

*2 Approximate measure for parameter #42
Make adjustment so that the following equation stands.

$$(\text{Parameter \#42}) = \frac{2000}{(\text{Parameter \#40})}$$

■ How to set the notch filter (parameters #57 through #60)

i) Use the servo analysis function of the optional PC loader to locate the resonance point of the machine.

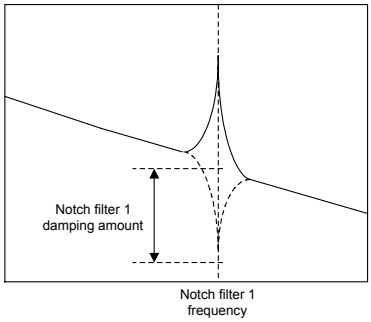


ii) Set the resonance frequency and damping amount at the resonance point of the machine in parameters.

1 Resonance frequency → Parameter #57 (Notch filter 1 frequency)

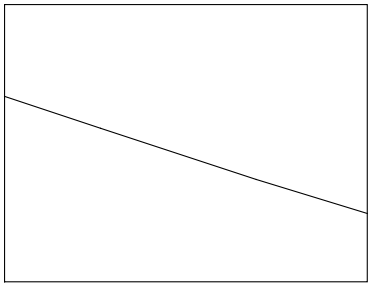
2 Depth → Parameter #58 (Notch filter 1 damping amount)*

* If the damping amount is too large, stability of the control system may be undermined. Avoid specifying too large a value.



The notch filter is applied at the resonance point as shown in the figure above.

Activate the servo analysis function again.

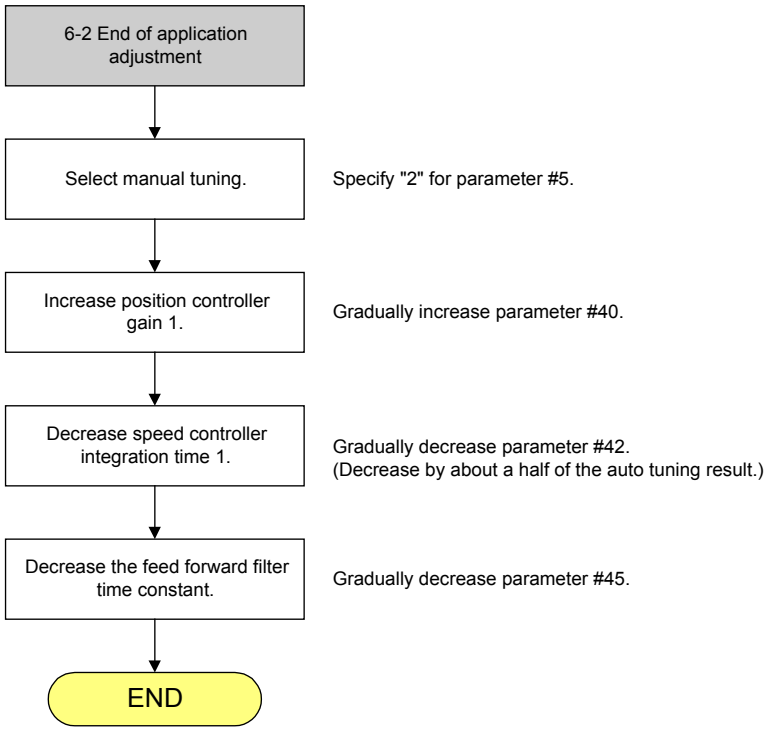


The notch filter functions to offset the resonance point.

6-3) Adjustment requiring high speed response

Use this method to obtain quicker response than that obtained after adjustment specified in section 6-2 “Application adjustment.” (However, do not use the method described here if “adjustment of large inertia” has been made.)

While measuring the operation time and output timing of the positioning end signal by using historical trace of the PC loader, make adjustment as follows.



Note 1: Adjust the gain so as not to generate mechanical vibration or torque fluctuation.

Note 2: If mechanical rigidity is poor, gradually increase the S-curve filter (parameter #43) to suppress vibration.

-MEMO-

FALDIC-β

7

SPECIAL ADJUSTMENT

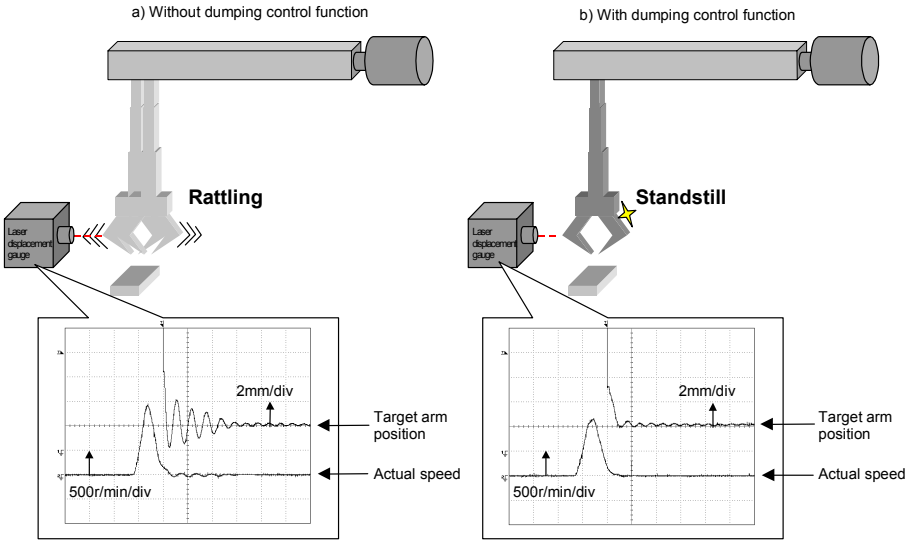
7 SPECIAL ADJUSTMENT

7-1) Vibration control

7-1-1) What is dumping control?

(1) Purpose of dumping control

In a structure such as the robot arm and transfer machine where the structure has a spring characteristic, vibration occurs at the end of the workpiece during abrupt acceleration or deceleration of the motor. Vibration control aims at suppression of vibration of the workpiece and a quick positioning action in such a system.

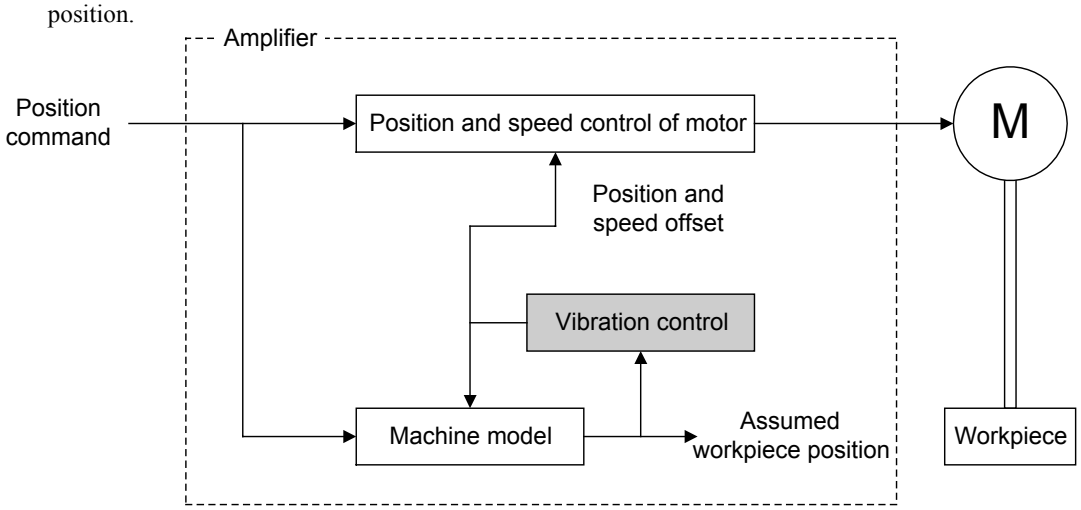


With dumping control, vibration is suppressed not only at the end of the machine but in the entire machine.

- Without dumping control ... The maximum torque generates during acceleration and deceleration of the motor, so that the entire machine vibrates due to the shocks during acceleration and deceleration.
- With dumping control ... Because the torque is controlled during acceleration or deceleration of the motor, shocks during acceleration and deceleration become moderate and vibration of the entire machine is suppressed even with those machines having relatively poor rigidity.

(2) Principle of dumping control

The amplifier incorporates a machine mode land controls dumping so that the vibration at the assumed workpiece position of the model is eliminated. The controlled variable thus obtained is added to the position and speed of the motor as an offset to suppress vibration at the actual workpiece position.



(3) Mechanical system where dumping control functions effectively

Applicable machine characteristics

- Vibration occurs at the end of the arm due to shocks during travel and stop of robot arm or the like.
- The machine itself vibrates due to the shock caused by movement or stopping of a part of the machine.
- Vibration frequency is between 5 and 50Hz.

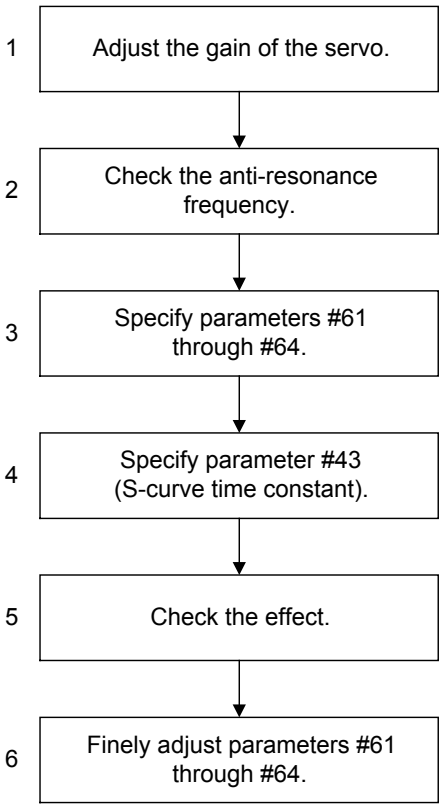
Inapplicable machine characteristics

- Vibration generates continuously without relations to movement or stopping.
- Vibration synchronized to the rotation of the motor or machine generates.
- The vibration frequency is smaller than 5Hz or larger than 50Hz.
- The moving time is within the vibration period.
- There is backlash in mechanical connections located up to the vibrating mechanism.

7-1-2) Parameter setting method

(1) Setting at the keypad panel

■ Adjustment flow chart



1 Adjust the gain of the servo.

To assure smooth stopping action of the servomotor through removal of overshoot and undershoot while ignoring vibration of the end of the machine, adjust the gain of the servo according to the adjustment procedure described in Chapter 6.

CAUTION

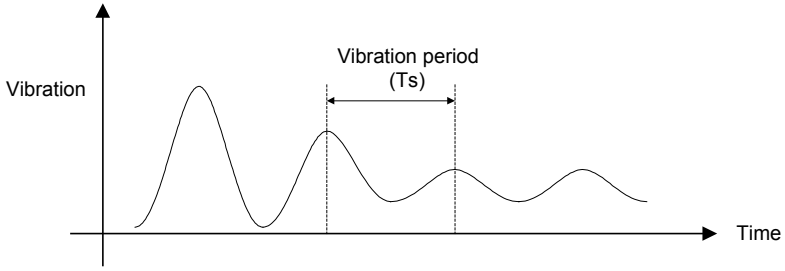
If parameters related to the gain are adjusted after specifying the anti-resonance frequency, the anti-resonance frequency must be specified again.
Be sure that the gain must be adjusted first.

2 Check the anti-resonance frequency.

There are two checking methods.

If vibration frequency can be measured using a laser displacement gauge or the like, follow checking method i). In other cases, follow checking method ii).

i) Measure vibration of the end of the arm directly using a laser displacement gauge or the like.



$$\text{Anti-resonance frequency} = \frac{1}{Ts} \text{ [Hz]}$$

ii) While reducing the settings of parameters #61 through #64 gradually from 200.0Hz (maximum value), visually check vibration to find the best value.

3 Setting parameters #61 through #64

Specify the anti-resonance frequency obtained in step 2, to any of parameters #61 through #64*.

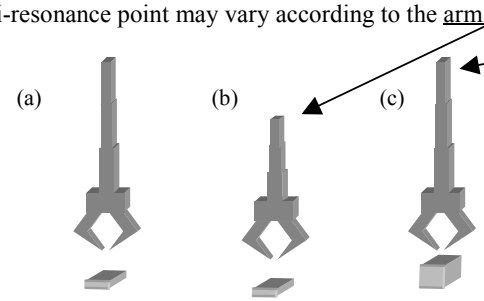
Control system setting parameters #61 through #64

No.	Name	Setting range	Initial value	Change
61	Anti-resonance frequency 0	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
62	Anti-resonance frequency 1	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
63	Anti-resonance frequency 2	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
64	Anti-resonance frequency 3	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always

* Up to four points can be specified.

Up to four points can be specified through combination of anti-resonance frequency selection 0 and anti-resonance frequency selection 1 of the CONT input signal.

The anti-resonance point may vary according to the arm length and the weight of the load.



The anti-resonance frequency may vary according to conditions a, b and c.

In this case, assign this function to the CONT input signal among parameters 10 through 14 and switch the anti-resonance frequency setting.

Anti-resonance frequency selection 1	Anti-resonance frequency selection 0	Anti-resonance frequency
OFF	OFF	Parameter #61*
OFF	ON	Parameter #62
ON	OFF	Parameter #63
ON	ON	Parameter #64

* These signals are assumed to be inactive at any time if they are not assigned to the sequence input signals.
In this case, parameter #61 (anti-resonance frequency 0) is always valid.
To make anti-resonance frequency invalid, set the anti-resonance frequency at 200.0Hz.

Change the setting during stoppage because otherwise shocks may generate.

4 Specify parameter #43 (S-curve time constant).

To achieve the effect of dumping control, specify parameter #43 (S-curve time constant).

The approximate measure of the setting is as follows.

Control system setting parameter #43

No.	Name	Setting range	Initial value	Change
43	S-curve time constant	0.0 to 100.0 [msec] (in 0.1 increments)	0.0	Always

Parameters #61 through #64 (Anti-resonance frequency)	Parameter #43 (S-curve time constant) (Approximate measure)
< 10 Hz	10 msec
10 Hz to 20 Hz	5 msec
> 20 Hz	2 or 3 msec

5 Check the effect.

There are three checking methods.

i) Check the vibration of the end of the arm using a laser displacement gauge or a similar measuring instrument.

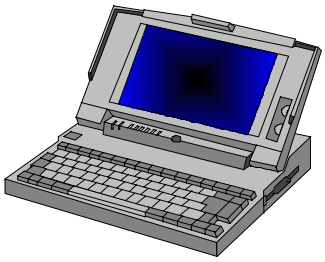
ii) Take the high-speed motion picture of the end of the arm to check for vibration.

iii) Visually check.

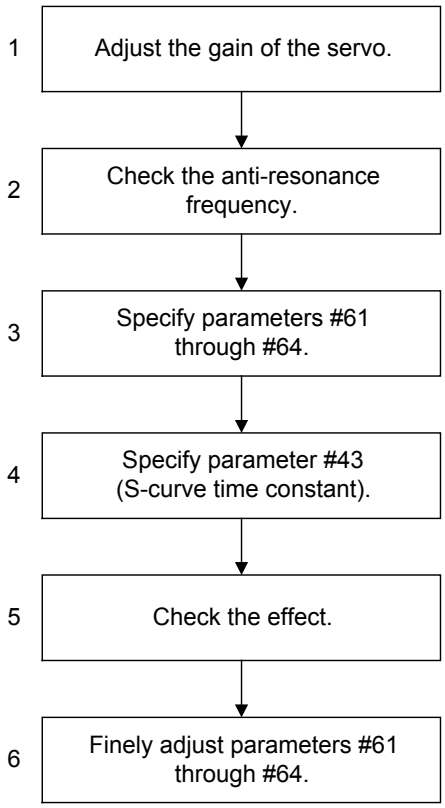
6 Finely adjust parameters #61 through #64.

While checking the effect of dumping control, finely adjust the setting (approximate measure: in 0.1 or 0.2 increments).

(2) Setting at the PC loader



■ Adjustment flow chart



1 Adjust the gain of the servo.

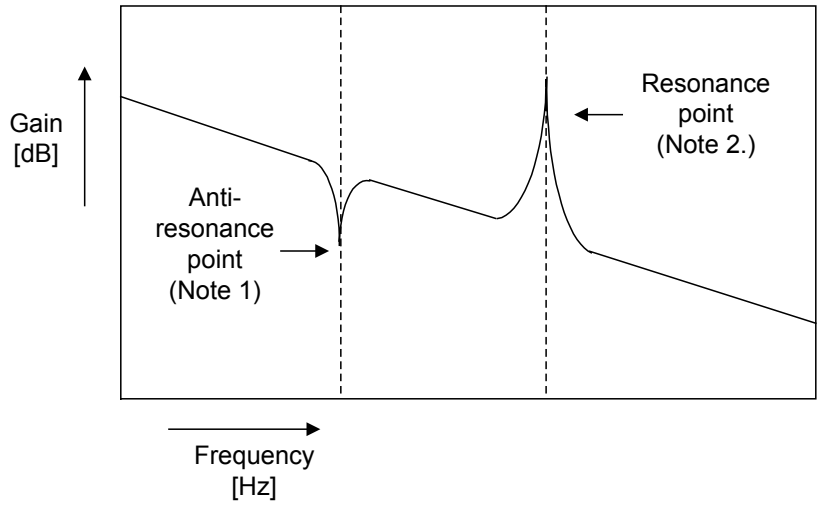
To assure smooth stopping action of the servomotor through removal of overshoot and undershoot while ignoring vibration of the end of the machine, adjust the gain of the servo according to the adjustment procedure described in Chapter 6.

CAUTION

If parameters related to the gain are adjusted after specifying the anti-resonance frequency, the anti-resonance frequency must be specified again.
Be sure that the gain must be adjusted first.

2 Check the anti-resonance frequency.

Use the servo analysis function to check the anti-resonance point.



Note 1 : The servo analysis function may fail to detect the anti-resonance point in the following machine configuration.

1 Machines with much friction

2 Reduction gear, ball screw mechanism and other machines having relatively large mechanical losses

Note 2 : Use the notch filter for the resonance point. Refer to page 5-52.

Resonance point and anti-resonance point

There are resonance point and anti-resonance point for the vibration of the machine.

The “resonance point” and “anti-resonance point” are machine characteristics viewed from the motor.

“Resonance point” ... The end of the arm does not vibrate but the motor vibrates at the frequency.

“Anti-resonance point” ... The motor shaft does not vibrate but the end of the arm vibrates at the frequency.

Generally speaking the anti-resonance frequency is smaller than the resonance frequency.

3 Setting parameters #61 through #64

Specify the anti-resonance frequency obtained in step 2, to any of parameters #61 through #64*.

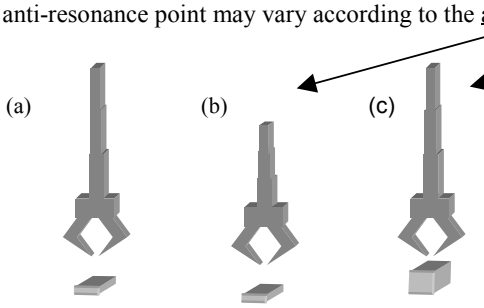
Control system setting parameters #61 through #64

No.	Name	Setting range	Initial value	Change
61	Anti-resonance frequency 0	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
62	Anti-resonance frequency 1	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
63	Anti-resonance frequency 2	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always
64	Anti-resonance frequency 3	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	Always

* Up to four points can be specified.

Up to four points can be specified through combination of anti-resonance frequency selection 0 and anti-resonance frequency selection 1 of the CONT input signal.

The anti-resonance point may vary according to the arm length and the weight of the load.



The anti-resonance frequency may vary according to conditions a, b and c.

In this case, assign this function to the CONT input signal among parameters 10 through 14 and switch the anti-resonance frequency setting.

Anti-resonance frequency selection 1	Anti-resonance frequency selection 0	Anti-resonance frequency
OFF	OFF	Parameter #61*
OFF	ON	Parameter #62
ON	OFF	Parameter #63
ON	ON	Parameter #64

* These signals are assumed to be inactive at any time if they are not assigned to the sequence input signals.
In this case, parameter #61 (anti-resonance frequency 0) is always valid.
To make anti-resonance frequency invalid, set the anti-resonance frequency at 200.0Hz.

Change the setting during stoppage because otherwise shocks may generate.

4 Specify parameter #43 (S-curve time constant).

To achieve the effect of dumping control, specify parameter #43 (S-curve time constant).

The approximate measure of the setting is as follows.

Control system setting parameter #43

No.	Name	Setting range	Initial value	Change
43	S-curve time constant	0.0 to 100.0 [msec] (in 0.1 increments)	0.0	Always

Parameters #61 through #64 (Anti-resonance frequency)	Parameter #43 (S-curve time constant) (Approximate measure)
< 10 Hz	10 msec
10 Hz to 20 Hz	5 msec
> 20 Hz	2 or 3 msec

4 Check the effect.

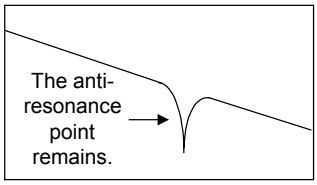
There are three checking methods.

i) Check the vibration of the end of the arm using a laser displacement gauge or a similar measuring instrument.

ii) Take the high-speed motion picture of the end of the arm to check for vibration.

iii) Visually check.

CAUTION



The anti-resonance frequency is not reflected on the servo analysis function even if one is set.

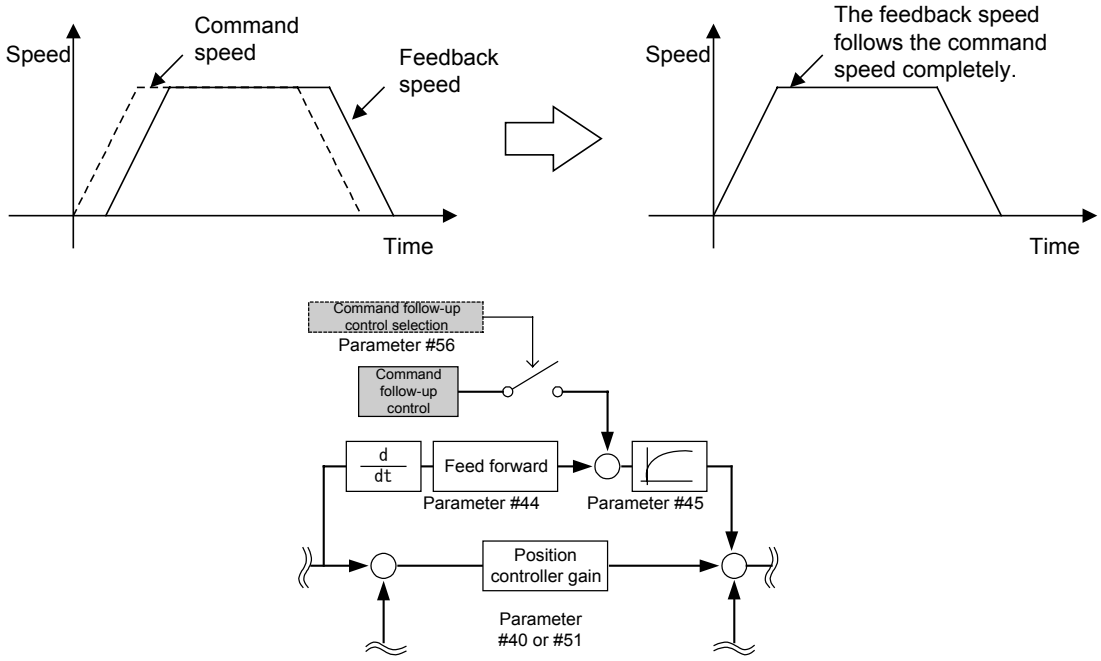
5 Finely adjust parameters #61 through #64.

While checking the effect of dumping control, finely adjust the setting (approximate measure: in 0.1 or 0.2 increments).

7-2) Command follow-up control

7-2-1) What is command follow-up control?

In the command follow-up control mode, movement follows the command pulse string completely with almost zero position deviation.



■ Mechanical system realizing command follow-up control

Use “command follow-up control” for the mechanical system satisfying all the following conditions.

1. Highly rigid machine
2. Pulse commands sent from the host controller are linear or in an S-curve to assure smooth acceleration and deceleration.
3. The pulse frequency updating period of the host controller is within several milliseconds.

If command follow-up control is used for a system not satisfying all of the above conditions, mechanical vibration may generate.

7-2-2) Parameter setting method

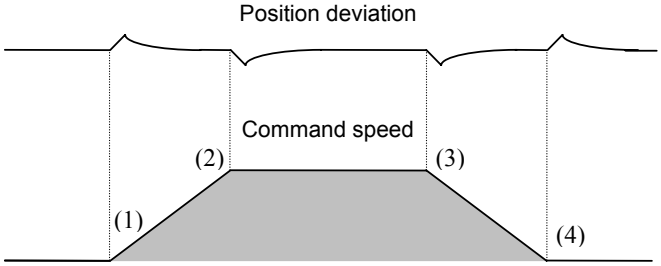
P1 / 56

Control system setting parameter #56

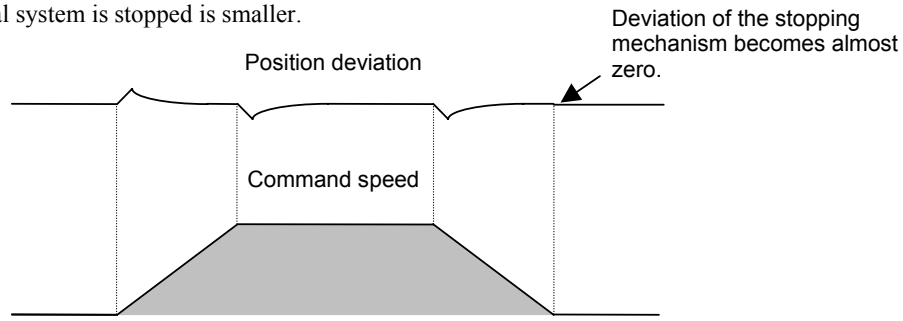
No.	Name	Setting range	Initial value	Change
56	Command follow-up control selection	0: None, 1: Command follow-up control, 2: Command follow-up control (with correction on stop)	0	Power

The command follow-up control includes two variations: with no correction on stop (setting: 1) and with correction on stop (setting: 2).

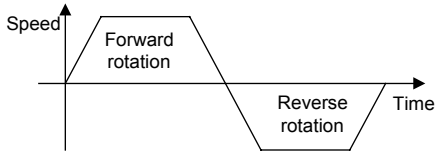
Position deviation generates in both methods when the acceleration changes (at (1), (2), (3), and (4)).



In case "with correction on stop (setting: 2)," position deviation caused by the acceleration change when the mechanical system is stopped is smaller.



Select "no correction on stop (setting: 1)" for operation patterns where changes from forward to reverse rotation continue.



* In the command follow-up control mode, specify "10" or a larger value for the auto tuning gain (parameter #7).

7-3) Position gain and limit added when setting

An increased position gain of the stopping mechanism is effective for a shorter setting time and improved rigidity.

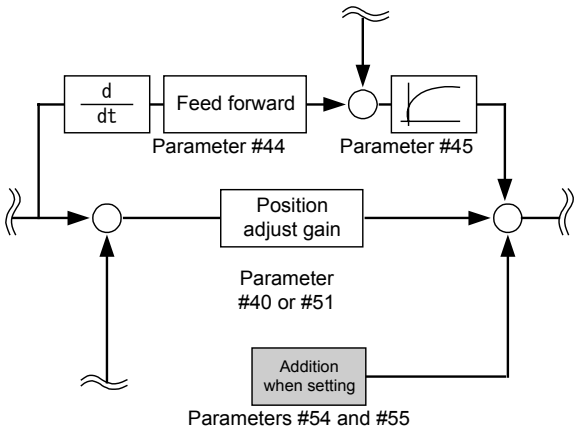
Parameters are #54 and #55.

P1 / 54 – 55

Control system setting parameters #54 and #55

No.	Name	Setting range	Initial value	Change
54	Position gain added when setting	0 to 1000 [rad/esc] (in 1 increments)	0	Always
55	Addition limit when setting	0 to 200 [r/min] (in 1 increments)	0	Always

The specified position gain (parameter #54) is added to the position controller gain (parameter #40 or #51) at speeds lower than the addition limit (parameter #55).



■ Approximate measure of setting

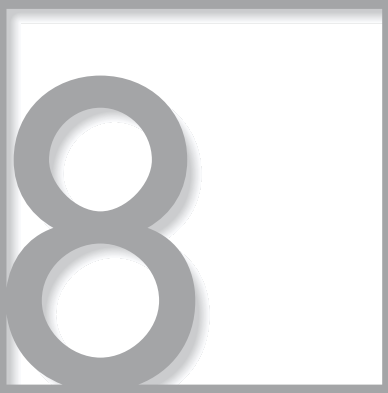
- Position gain added when setting (Parameter #54)

  0.5 times position controller gain 1 (Parameter #40)

- Addition limit when setting (Parameter #55)

  50 [r/min]

FALDIC-β



KEYPAD PANEL

8 KEYPAD PANEL

8-1) Display

The servo amplifier is provided with a keypad panel.
It has a display section of two 7-segment LED digits and four operation keys.
Figures and letters are displayed on the display section.
(See the left figure.)

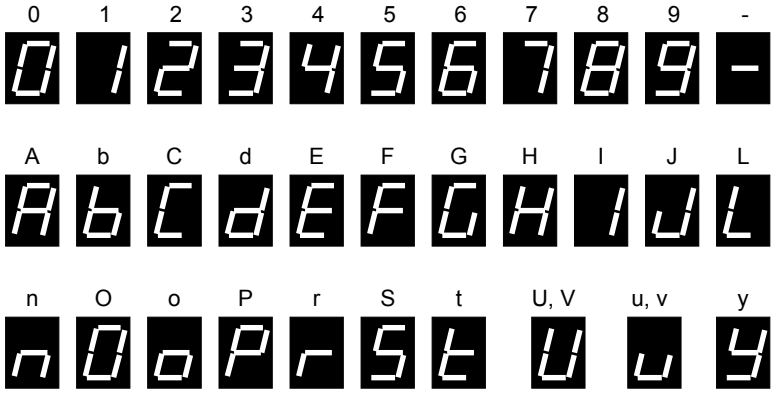
Supplement The keypad panel cannot be removed.

(1) Mode

The keypad panel operation can be classified into four modes:

State display mode ····· Indicates the servo amplifier status.
Monitor mode ····· Monitors the servomotor speed and the input/output signal status.
Parameter edit mode ····· Edits the parameter setting.
Test running mode ····· Operates the servomotor with the keypad operation.

List of 7-segment indications



(2) Operation key

MODE / ESC — Changes the mode (MODE). Cancels the selected mode (ESC).

SHIFT / ENT — Shifts to the less significant digit (SHIFT). Stores the mode and figure (ENT). Press more than 1 sec to store the data.

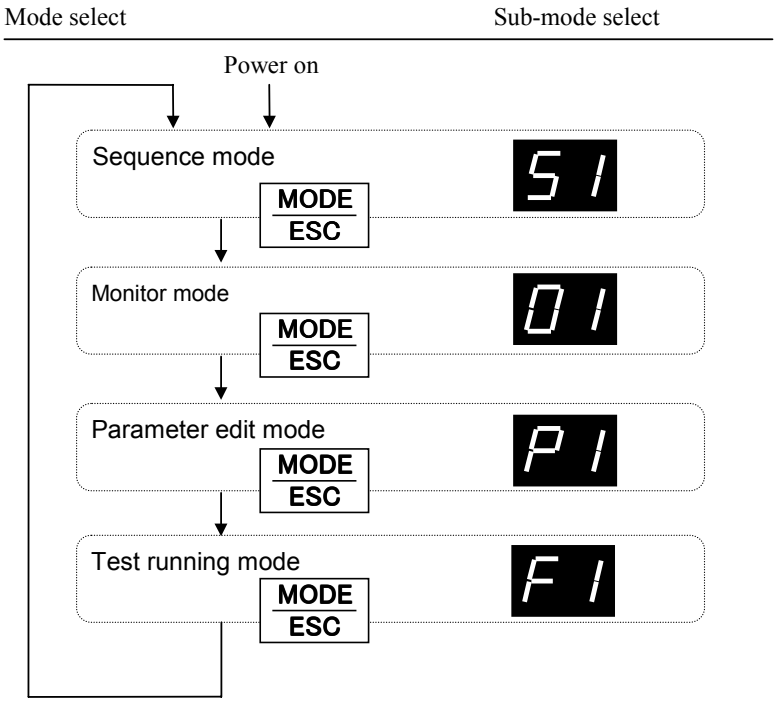
∨ — Selects the sub-mode. Decreases the figure (-1).

∧ — Selects the sub-mode. Increases the figure (+1).

Pressing the SHIFT / ENT key while pressing the MODE / ESC key shifts to the less significant digit.

(3) Mode select

Each mode can be selected by the [MODE] key.



8-2) Function list

Mode	Sub-mode	Sub-mode indication
State display mode	1. Action mode	
	2. Alarm detection	
	3. Alarm history	
Monitor mode	1. Feedback speed	
	2. Average torque	
	3. Peak torque	
	4. Pulse string input frequency	
	5. Input signal	
	6. Output signal	
	7. OL thermal value	
	8. Regenerative resistor thermal value	
	9. Load inertia ratio	
Parameter setting mode	1. Parameter	
Test running mode	1. Manual operation	
	2. Alarm reset	
	3. Alarm history initialization	
	4. Parameter initialization	
	5. Phase-Z position adjustment	
	6. Auto tuning gain setting	

8-3) State display mode

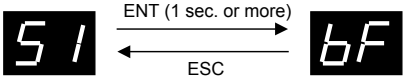
In the state display mode, the servo amplifier's current status and the alarm detection history can be displayed.

Press the "MODE" key to display [S1] and then press the "ENT" key for more than 1 sec.

Mode	Sub-mode	Sub-mode indication
State display mode	1. Operation mode	S1
	2. Alarm detection	S2
	3. Alarm history	S3

(1) Operation mode

Indicates the operation status of the servo amplifier.



Indication	Sequence
bF	In base-off condition. The servomotor does not have driving force and is coasting to stop.
PL	The servomotor can rotate and pulse string inputs are valid.
JG	The servomotor can rotate and is operated in the manual operation mode (test running).
Pt	The amplifier has detected an overtravel signal in positive direction and stops.
nt	The amplifier has detected an overtravel signal in negative direction and stops.
nO	The amplifier has received a forced stop signal and stops with the speed zero.

Reference

When power is supplied to the servo amplifier, the operation mode of the state display mode is displayed (with factory shipment setting).

The type of indication at power on can be changed by system parameter 28 setting.

System setting parameter #28

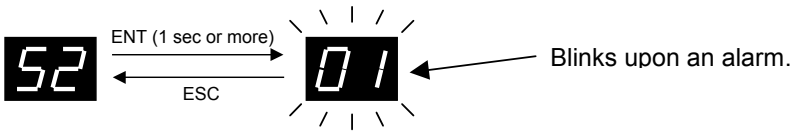
Setting	Display content	Display
0	State display mode	S1
1	Current alarm	S2
2	Alarm history	S3

Setting	Display content	Display
3	Feedback speed	01
4	Actual torque	02
5	Peak torque	03
6	Pulse string frequency	04
7	Input signal	05
8	Output signal	06
9	OL thermal value	07
10	DB thermal value	08
11	Load inertia ratio	09

(2) Alarm detection

The contents of current alarm can be displayed with codes.

When an alarm is detected, the following indication will appear automatically.



- Major fault

With this type of failure, the servomotor cannot be driven.

<Action upon alarm>

Coasting to stop upon detection

- Minor fault

This type of failure occurs in cases such as for protection against overheats.

<Action upon alarm>

The servomotor decelerates at the maximum performance and, after being stopped*, it coasts to stop

Detection of major fault

Indication	Description
01	Overcurrent 1
02	Overcurrent 2
03	Overspeed
04	Overvoltage
05	Encoder trouble
06	Control power alarm 1
07	Control power alarm 2
08	Memory alarm
09	Motor combination alarm
10	Regenerative transistor overheat
11	Encoder communication alarm
12	CONT duplication
13	Overload

Detection of minor fault

Indication	Description
14	Undervoltage
15	Regenerative resistor overheat
16	Deviation limit
17	Amplifier overheat
18	Encoder overheat
19	Initial error

Reference

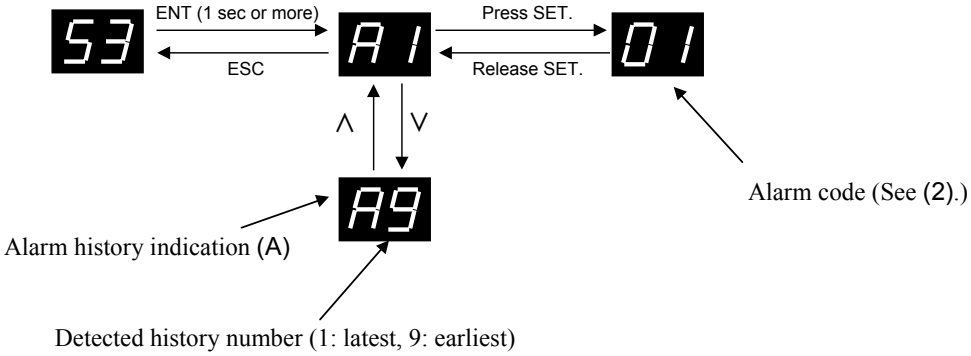
The alarm codes are indicated automatically.

The reset of alarm detection can be carried out in the test operation mode.

Press the ∧ and ∨ keys simultaneously for one second or more while alarm detection is indicated to reset the alarm detection.

(3) Alarm history

The latest nine times of alarm detection history can be indicated. The indication can be scrolled by the ∧ and ∨ keys.



Supplement

The alarm history can be deleted in the test operation mode [F3].

8-4) Monitor mode

In the monitor mode, the speed, torque and other states of the servomotor can be displayed.

Press the MODE key to display [01] and press the ENT key (for 1 sec or more) to display the content.

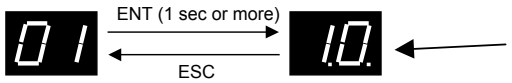
Mode	Sub-mode	Sub-mode indication
Monitor mode	1. Feedback speed	01
	2. Average torque	02
	3. Peak torque	03
	4. Pulse string input frequency	04
	5. Input signal	05
	6. Output signal	06
	7. OL thermal value	07
	8. Regenerative resistor thermal value	08
	9. Load inertia ratio	09

CAUTION

Only two figures are displayed in the monitor mode. The SHIFT key does not shift the place.
Therefore the value may not indicate the actual motion.
To monitor detail data, use the PC loader.

(1) Feedback speed

The servomotor's current speed. Even if the servomotor is driven by the load (mechanical system), the correct speed will be indicated. The indication is in 100 [r/min]* increments.



The speed is between -1000 and -1099 [r/min].
The lit decimal points indicate the negative sign.

* Speeds smaller than 100 [r/min] are rounded off.

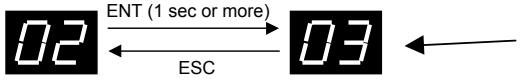
Example: The speed between 0 and 99 [r/min] is indicated 00 .
The speed between 3000 and 3099 [r/min] is indicated 30 .

Reverse rotation (clockwise rotation when viewed from the motor shaft) is indicated with two lit decimal points.

Example: -3000 [r/min]: 3.0. .

(2) Actual torque

Current servomotor's load ratio. The actual torque is displayed in the ratio (%) to the rated torque. The indication is in × 10 [%]* increments. The negative sign is not added.



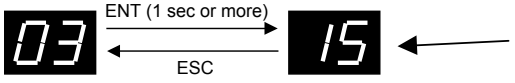
The actual torque is between 30 and 39 [%].

* Values smaller than 10 [%] are rounded off.

Example: 0 to 9 [%]: 00 .
30 to 39 [%]: 03 .

(3) Peak torque

Current servomotor's load ratio. Peak value is displayed at two-second intervals, assuming the rated torque as 100%. The indication is in 10 [%]* increments. The negative sign is not added.



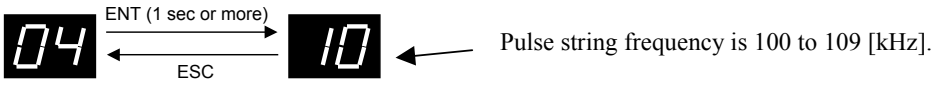
The peak torque is between 150 and 159 [%].

* Values smaller than 10 [%] are rounded off.

Example: 0 to 9 [%]: 00 .
30 to 39 [%]: 03 .

(4) Pulse string frequency

The pulse string frequency added to the pulse string input terminal is displayed. The indication is in × 10 [kHz]* increments. The negative sign is not added.



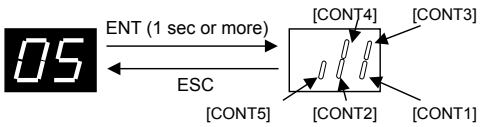
* Values smaller than 10 [kHz] are rounded off.

Example: 0 to 9 [kHz] or 1 [MHz] or over: 00 is indicated.

300 to 309 [kHz]: 30 is indicated.

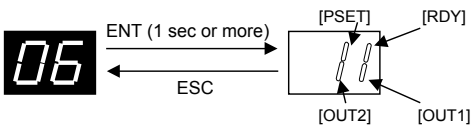
(5) Input signal

The ON/OFF state of the sequence input signal supplied to the servo amplifier is displayed. When the input signal is active, the corresponding LED is lit.



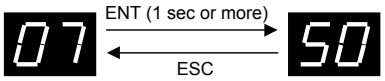
(6) Output signal

The ON/OFF state of the sequence output signal supplied to the servo amplifier is displayed. When the output signal is active, the corresponding LED is lit.



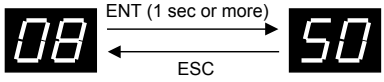
(7) OL thermal value

The load ratio is indicated, assuming the overload alarm level as 100. When the value reaches “100,” the overload alarm is issued. The indication is in [%]. 99 is indicated for values larger than 99 [%].



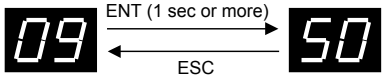
(8) Regenerative resistance thermal value

The regenerative load ratio is indicated, assuming the regenerative resistance overheat alarm level as 100. When the value reaches 100, a regenerative resistance overheat alarm is issued. The indication is in [%]. 99 is indicated for values larger than 99 [%].



(9) Load inertia ratio

The load inertia ratio recognized by the servo amplifier is indicated. The indication is in [times]. 99 is indicated for values larger than 99 [%].



8-5) Parameter setting mode

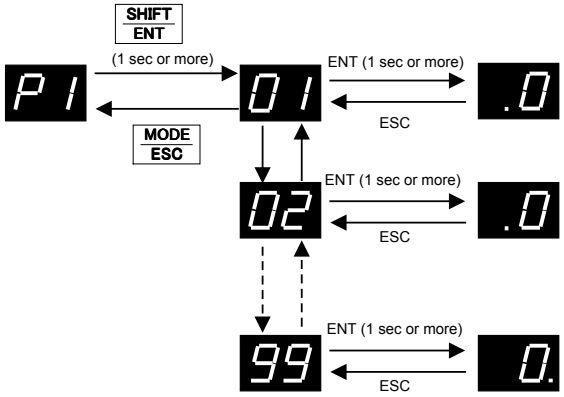
In the parameter setting mode, parameters can be edited.

Press the MODE key to display P 1 , and press the ENT key for 1 second or more to select the desired parameter.

After selecting the target parameter, press the ∧ or ∨ key to select the parameter number to be edited first. Press the ENT key to edit the parameter setting.

(1) Parameter

The parameter includes two types: those for which the change is reflected on the servo amplifier and servomotor immediately, and those for which the change is reflected after the power is turned off and on again.



(2) Indication and editing

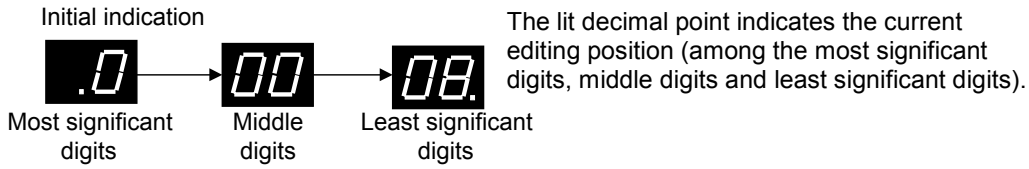
The indication and editing methods for parameter are as follows.

- Value indication

The most significant digits that can be edited are indicated first.

Example: Parameter #1 (Setting range: 1 to 32767, Initial value: 8)

Because the number of digits that can be edited is five (32767), 0 is indicated first.

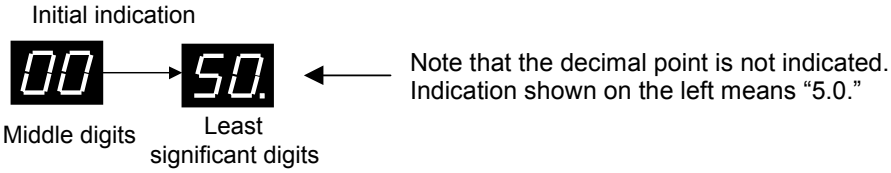


To clarify the number of digits of the value, zero is not indicated at places that cannot be edited.

To move among the digits, press the MODE key while holding down the SHIFT key.

* Example of indication of data that includes decimal point in the editing range

Parameter #6 (load inertia ratio) (Setting range: 0.0 to 100.0, Initial value: 5.0)

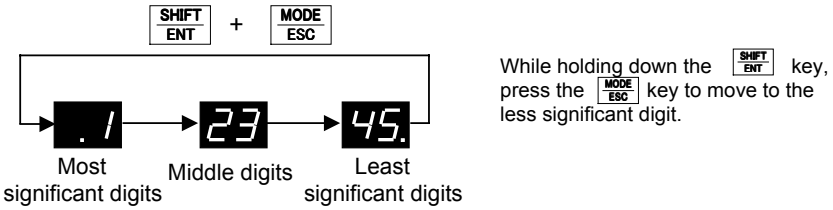


- Editing a value

After reading a parameter, units digit blinks at about one second intervals, prompting you to change that part.

Press the ∧ or ∨ key changes the value.

To move to another digit, press the MODE key while holding down the SHIFT key.



- Storing the value

Press and hold the ENT key for 1 sec or more to store the value. All digits blink three times simultaneously. The stored value remains as it is. (The stored value blinks at about 0.5 second intervals.)

- Value beyond the specified range

Values can be entered within the range from minimum to maximum specified for each parameter.

Values beyond the specified range cannot be entered.

- Editing example

Let us change the setting of parameter #2 (command pulse correction β) to “10.”

Keying	Indication	Remarks
		The action mode in the state display mode is displayed.
MODE ESC		Returns to mode selection.
MODE ESC Twice		Press the MODE key to select the parameter edit mode.
SHIFT ENT 1 sec or more		Hold down the ENT key for at least 1 second to designate the parameter number.
∧		Parameter #2 is read.
SHIFT ENT		Press the ENT key to read the setting of parameter #2. (The most significant digit of "00001" (initial value) is displayed.)
SHIFT ENT MODE ESC		While holding down the SHIFT key, press the MODE key three times to blink the tens digit.
∧		Change the value to "1."
SHIFT ENT MODE ESC		While holding down the SHIFT key, press the MODE key to blink the units digit.
∨		Change the value to "0."
SHIFT ENT 1 sec or more		Hold down the ENT key for at least 1 second to store the new value.
		The stored value remains as it is. Press the ESC key to select another parameter number.

8-6) Test running mode

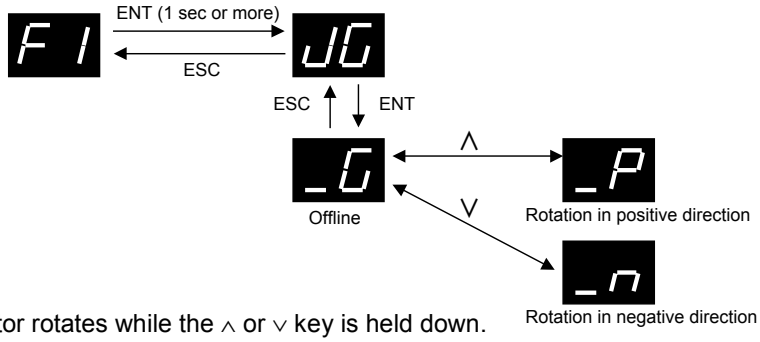
In the test running mode, keying on the keypad panel can rotate the servomotor or reset various settings of the servo amplifier.

Press the MODE key to display [F1] and hold down the ENT key for at least 1 second to execute test running.

Mode	Sub-mode	Sub-mode indication	Relevant parameters
Test running mode	1. Manual operation	F1	Parameters #29 and #30
	2. Alarm reset	F2	-
	3. Alarm history initialization	F3	-
	4. Parameter initialization	F4	Parameter #27
	5. Phase-Z position adjustment	F5	Parameter #18
	6. Auto tuning gain setting	F6	Parameter #7

(1) Manual operation

The servomotor rotates while a key on the keypad panel is pressed. The servomotor speed is as per the setting of parameter #29 and the acceleration/deceleration time is as per the setting of parameter #30.



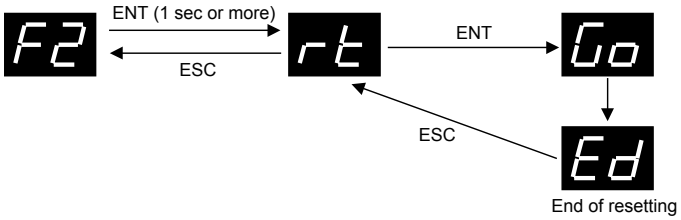
* The servomotor rotates while the ∧ or ∨ key is held down.

System setting parameters #29 and #30

No.	Name	Setting range	Initial value	Change
29	Speed setting (for test operation)	1 to 5000 [r/min] (in 1 increments)	100	Always
30	Acceleration / deceleration time (for test operation)	0.000 to 9.999 sec. (in 0.001 increments)	0.100	Always

(2) Alarm reset

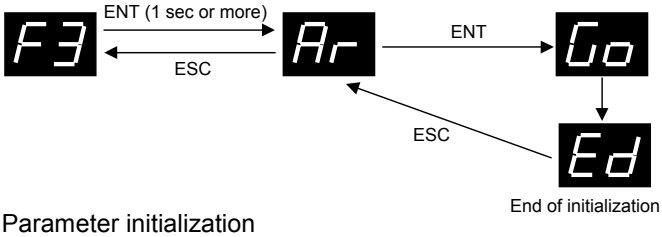
Resets the alarm detected by the servo amplifier.



(3) Alarm history initialization

Deletes the alarm detection log recorded in the servo amplifier. The alarm detection history (alarm history) can be monitored in state display mode [S3].

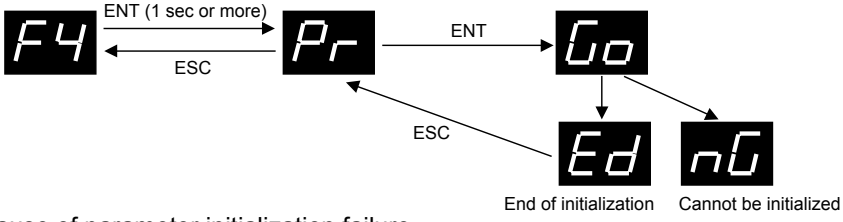
* The alarm history is retained even when the power is turned off.



(4) Parameter initialization

Initializes the parameters.

* After initializing, turn the power off then on again.



Cause of parameter initialization failure

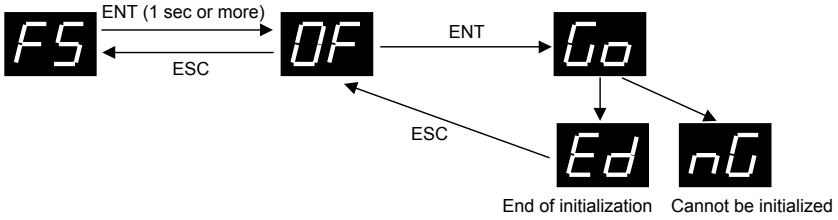
1. Write-protection selected at parameter #27 (write-protection of parameters)
   --> Change parameter #27 (write-protection of parameters) to “0” (write-enable).
2. Active operation command [RUN]
   -->Turn off the operation command [RUN].

System setting parameter #27

No.	Name	Setting range	Initial value	Change
27	Parameter write-protection	0: Write-enable, 1: Write-protection	0	Always

(5) Phase-Z position adjustment

Defines the current position as the phase-Z position. The current position and the distance to phase Z are automatically stored in parameter #18 (phase-Z offset).



Caution of phase-Z position adjustment failure

1. Write-protection selected at parameter #27 (write-protection of parameters)
   --> Change parameter #27 (write-protection of parameters) to “0” (write-enable).
2. Encoder origin (phase-Z) establishment failure (immediately after power-on)
   --> Turn the motor shaft at least twice to establish the phase-Z origin.

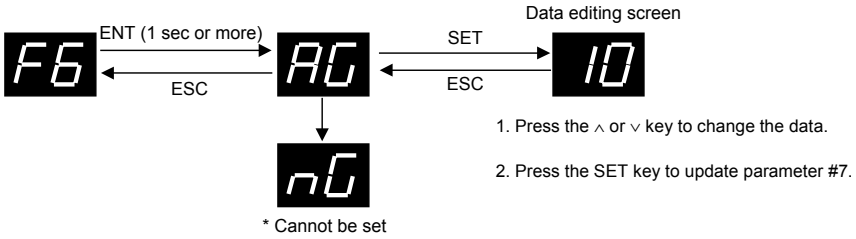
System setting parameter #18

No.	Name	Setting range	Initial value	Change
18	Phase-Z offset	0 to 65535 [pulse] (in 1 increments)	0	Power

(6) Auto tuning gain setting

Parameter #7 (auto tuning gain) is refreshed at real time.

Unlike the other parameters, an increase or decrease is reflected on the data immediately (parameter #7 is not updated. However, parameter #7 is updated when the SET key is pressed in the data editing screen).



Cause of auto-tuning gain setting failure

- Write-protection selected at parameter #27 (write-protection of parameters)
  --> Change parameter #27 (write-protection of parameters) to “0” (write-enable).

Basic setting parameter #07

No.	Name	Setting range	Initial value	Change
07	Auto tuning gain	1 to 20 (in 1 increments)	10	Always

-MEMO-

FALDIC-β

9

INSPECTION AND MAINTENANCE

9 INSPECTION AND MAINTENANCE

9-1) Inspection

The servo amplifier (RYB type) consists of electronic parts and requires no routine inspection.
The servomotor is of a synchronous type (brushless) and has no part that requires routine maintenance.
Though both the servo amplifier and servomotor are maintenance-free, perform periodic inspection to avoid possible accidents and keep reliability of the equipment.

DANGER

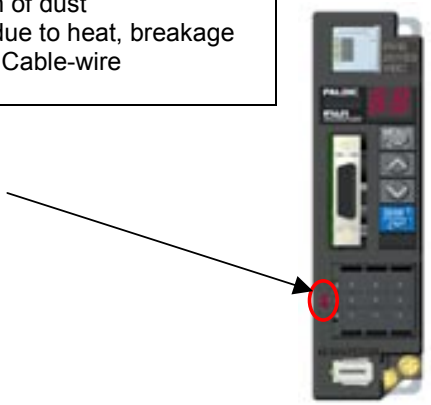
- Prior to inspection, turn off power and wait for at least five minutes. Otherwise, there is a risk of electric shock.
- Do not touch the servo amplifier when the commercial power is supplied. If attempted, there is a risk of electric shock.

Inspection items are as follows.

Inspection item

Device	Description
Servomotor	Misalignment of mechanical coupling Direct exposure to water, steam or oil Abnormal vibration
Servo amplifier	Loose screws of terminal block and fastening parts Excessive accumulation of dust Foreign odor, damage due to heat, breakage or external deformation Cable-wire discontinuation

Before checking electrical wirings, turn off the power and wait for 5 minutes and then check that the [CHARGE] LED is off on the keypad panel.



CAUTION

- Do not perform megger test on the PC-board or terminal block of servo amplifier. If attempted, the servo amplifier and the encoder housed in the servomotor may be broken.

9-2) Memory back-up

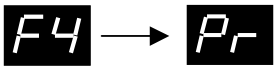
(1) Memory back-up

An electrically erasable programmable read-only memory (EEPROM) is used for retaining the parameters and alarm detection history after turning off power supply.

Each area can be initialized by turning off the servo amplifier operation command [RUN] (while motor is de-energized).

1 Initialization of parameter

To initialize, select the initialization [F4] of parameter in the test running mode and press the ENT key.



* After the initialization, be sure to turn on power again.

The initialization is not allowed if rewrite is inhibited by parameter #27.

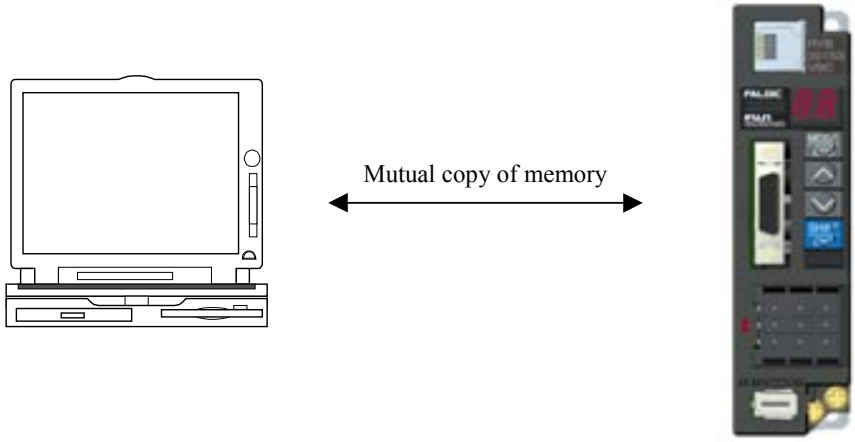
The initialization is impossible while the motor is energized with the [RUN] signal on.

2 Initialization of alarm detection history

The alarm detection history is held at all times. It can be initialized by the initialization [F3] of history in the test running mode of the keypad panel.

(2) Copying the memory

Use of the PC loader can copy the setting contents of servo amplifier to the loader or, reverse, the loader contents can be transferred to the servo amplifier.



9 INSPECTION AND MAINTENANCE

9-3) Fault display

The fault diagnosis is explained in three sections below.

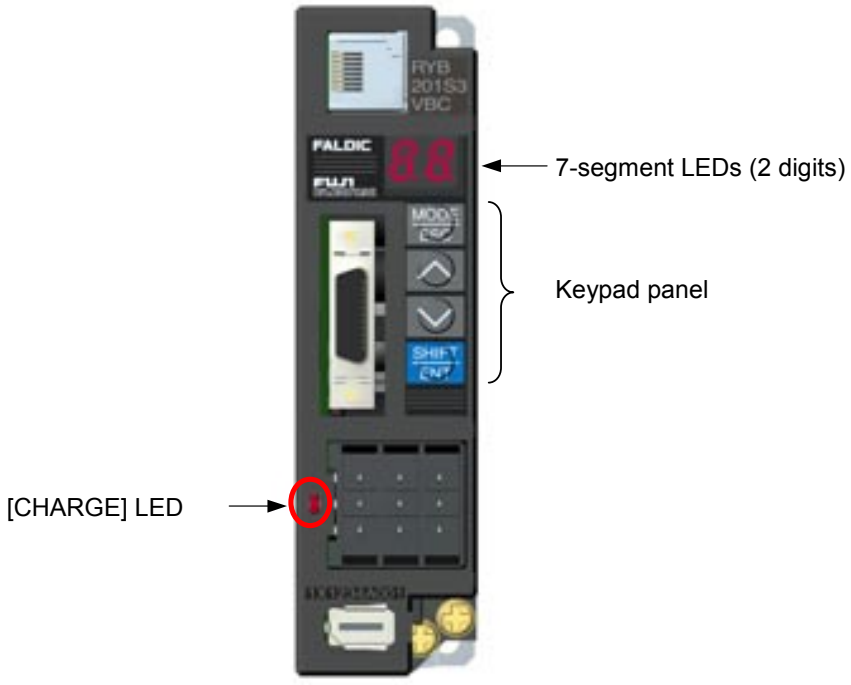
(1) Initial status

(2) When error (failure) is not displayed

(3) Faults with alarm indication and remedy

(1) Initial status

After turning on commercial power for the servo amplifier, either of 7-segment LEDs on the keypad panel lights up. The [CHARGE] LED lights on the keypad panel.



If turning on power displays nothing, contact us.

(2) When error (failure) is not displayed

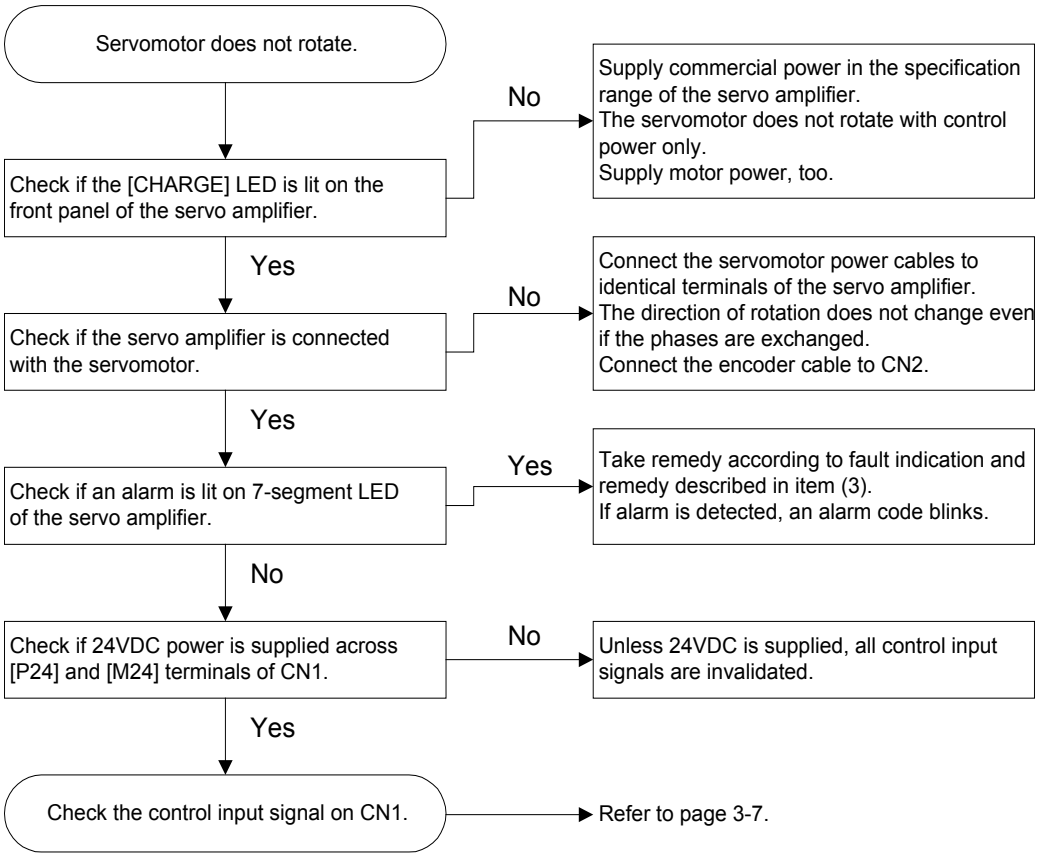
This type of failure is described by classification into the following three types:

1 Servomotor does not rotate.
2 Servomotor hunting
3 Positioning accuracy is poor.

If correct operation is not obtained after troubleshooting, contact us.

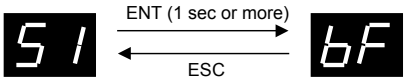
If an alarm is indicated at the keypad panel of the servo amplifier, refer to item (3).

1 Servomotor does not rotate.



<Action mode check>

Check the state of the servo amplifier.



Indication	Sequence
bF	Base off. Servomotor has no drive force. Coasting.
PL	The servomotor is ready to rotate. Pulse string input is effective.
JG	The servomotor is ready to rotate by manual operation (test running).
Pt	Stopped under detection of positive overtravel signal.
nt	Stopped under detection of negative overtravel signal.
n0	Stopped at zero speed upon forced stop signal input.

2 Servomotor hunting

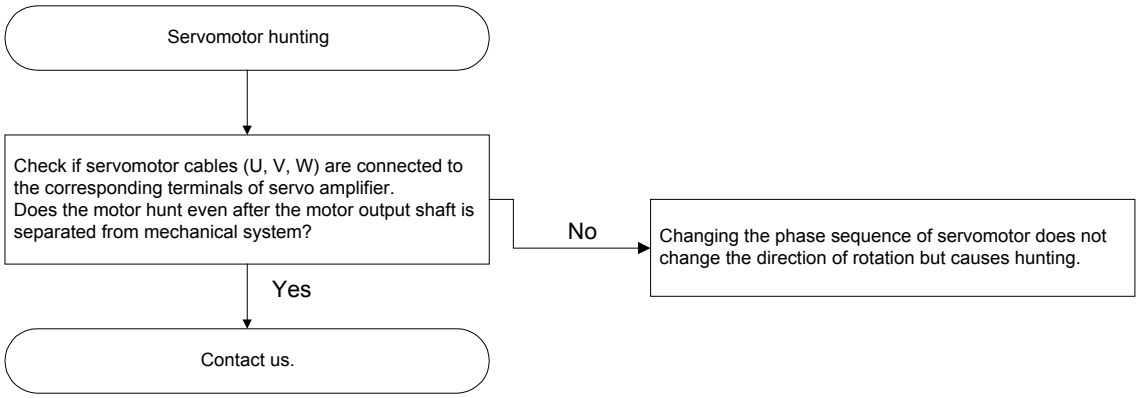
(Servomotor shaft alternates forward and reverse rotation repeatedly at a short interval.)

The servo amplifier incorporates a real-time tuning function that checks the mechanical system at all times.

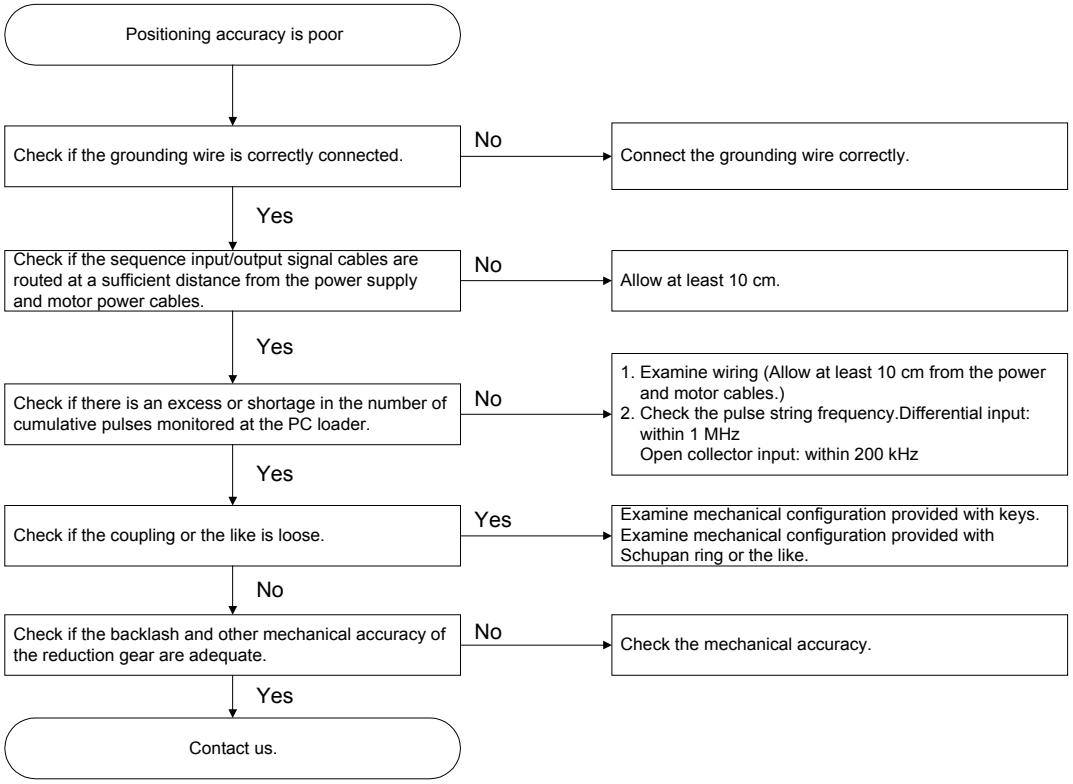
For the servo amplifier, the real-time tuning function is made active by factory setting.

The real-time tuning function is valid for almost all mechanical configurations with some exceptions.

If it does not work, notify us of the mechanical configuration where the servomotor drives.



3 Poor positioning accuracy



(3) Faults with alarm indication and remedy

If an alarm is detected, the detected alarm code blinks on the keypad panel of the servo amplifier. If multiple alarms are detected simultaneously, the alarm code with a higher priority blinks. See the table below for the priority order. The priority is given according to the order of alarm code.

- Major fault

With this type of failure, the servomotor cannot be driven.

<Action upon alarm>

Coasting to stop upon detection

- Minor fault

This type of failure occurs in cases such as for protection against overheats.

<Action upon alarm>

The servomotor decelerates at the maximum performance and, after being stopped*, it coasts to stop.

Major fault

Indication	Description	Page
01	Overcurrent 1	9-10
02	Overcurrent 2	9-10
03	Overspeed	9-11
04	Overvoltage	9-11
05	Encoder trouble	9-12
06	Control power alarm 1	9-12
07	Control power alarm 2	9-12
08	Memory alarm	9-13
09	Motor combination alarm	9-13
10	Regenerative transistor overheat	9-14
11	Encoder communication alarm	9-14
12	CONT duplication	9-14
13	Overload	9-15

Minor fault

Indication	Description	Page
14	Undervoltage	9-16
15	Regenerative resistor overheat	9-16
16	Deviation limit	9-17
17	Amplifier overheat	9-17
18	Encoder overheat	9-18
19	Initial error	9-18

Supplement

An alarm is automatically displayed if detected.

The alarm can be reset at a displayed state using the control input signal (reset).(The reset signal does not remove all alarms. --> Refer to page 5-19 for details.)

Alarm detection can be reset in the test running mode [F2] also.

9 INSPECTION AND MAINTENANCE

1. Overcurrent 1

[Indication on 7-segment LED]

[Description of trouble]
The output current of the transistor in the main circuit exceeds the rating, possibly causing breakage.

2. Overcurrent 2

[Indication on 7-segment LED]

[Description of trouble]
The output current of the servo amplifier exceeds the maximum rating, possibly causing breakage.

[Cause and remedy] (Common between overcurrent 1 and 2)

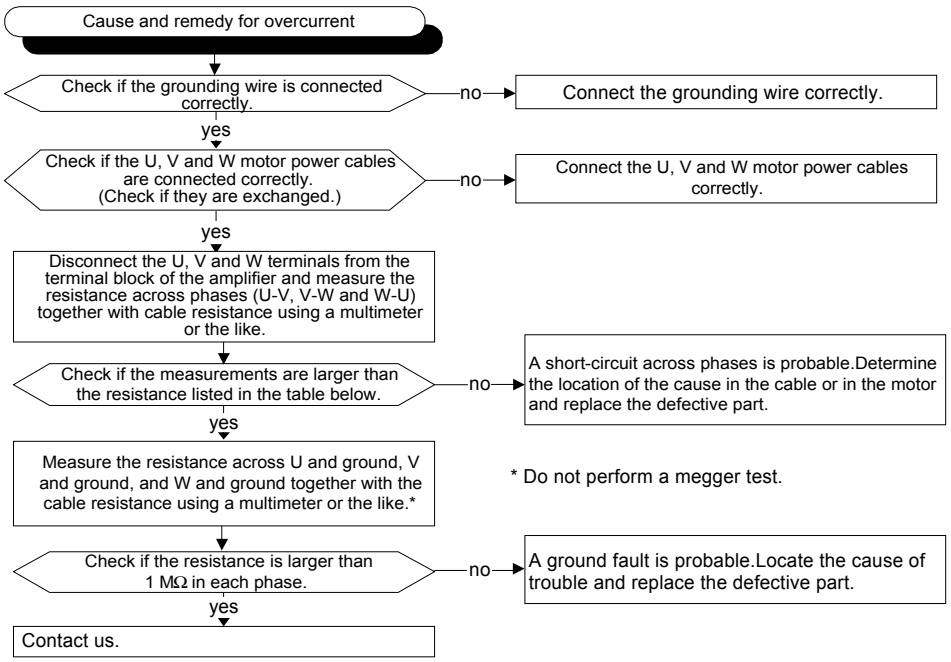


Table 1. [Resistance across phases of servomotor]

<200V specification>

Motor type	Resistance across wires (Ω) *1
GYS500DC1-C8	9.4
GYS101DC1-C	15.5
GYS201DC1-C	4.6
GYS401DC1-C	2.2
GYS751DC1-C	0.72

Motor type	Resistance across wires (Ω) *1
GYC101DC1-C	7.2
GYC201DC1-C	4.1
GYC401DC1-C	1.8
GYC751DC1-C	0.68

<100V specification>

Motor type	Resistance across wires (Ω) *1
GYS500DC1-C8	9.4
GYS101DC1-C6	5.0
GYS201DC1-C6	1.3

*1. Typical value at 20 °C. Not guaranteed.

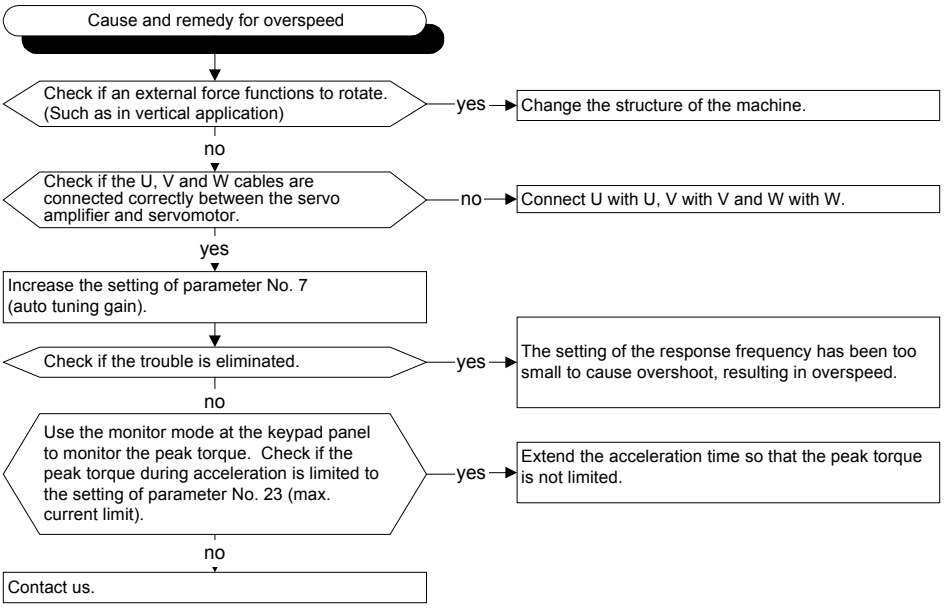
3. Overspeed

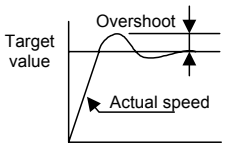
[Indication on 7-segment LED]

[Description of trouble]

The speed of the servomotor exceeds the rating, possibly causing breakage.

[Cause and remedy]





4. Overvoltage

[Indication on 7-segment LED]

[Description of trouble]

The DC voltage inside the servo amplifier exceeds the rating, possibly causing breakage.

[Cause and remedy]

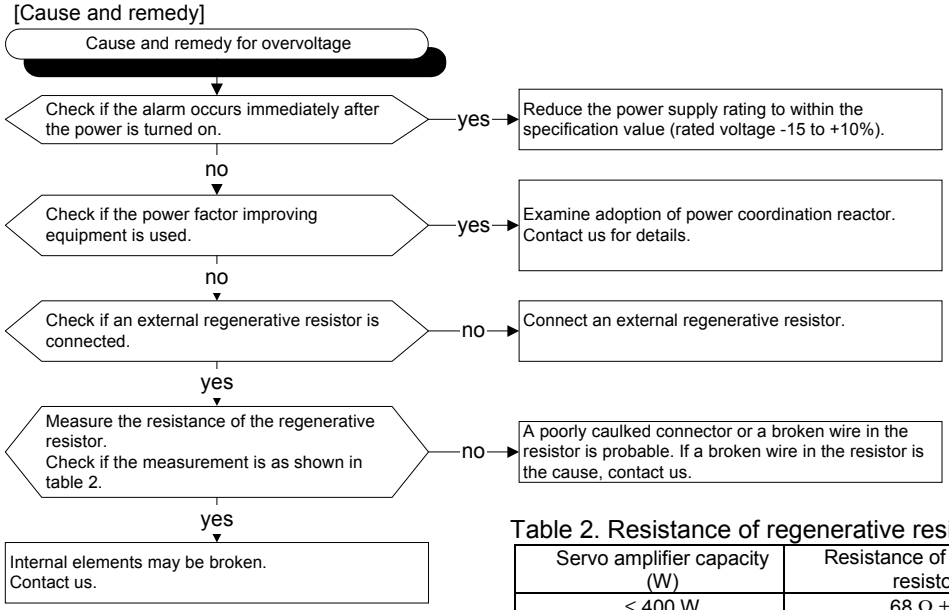


Table 2. Resistance of regenerative resistor

Servo amplifier capacity (W)	Resistance of regenerative resistor (Ω)
≤ 400 W	68 Ω ±10 %
750 W	40 to 15 Ω ±10 %

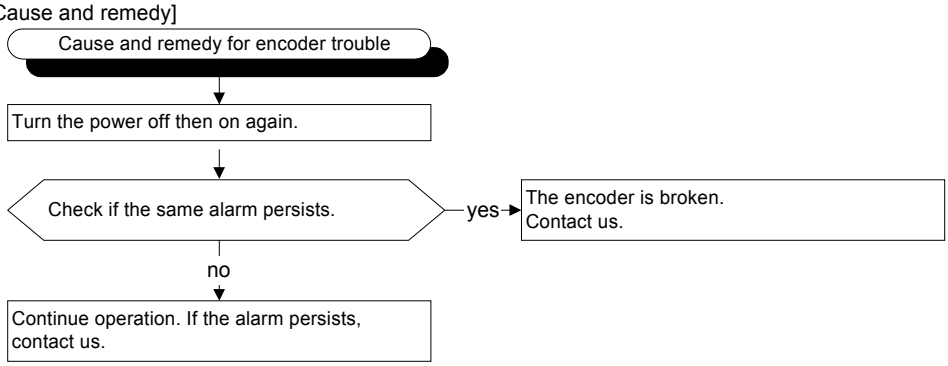
5. Encoder trouble

[Indication on 7-segment LED] 

[Description of trouble]

There is trouble in the encoder and it may be broken.

[Cause and remedy]



6. Control power alarm 1

[Indication on 7-segment LED]

[Description of trouble]

The internal control power of the servo amplifier is faulty.
The servo amplifier may be broken.

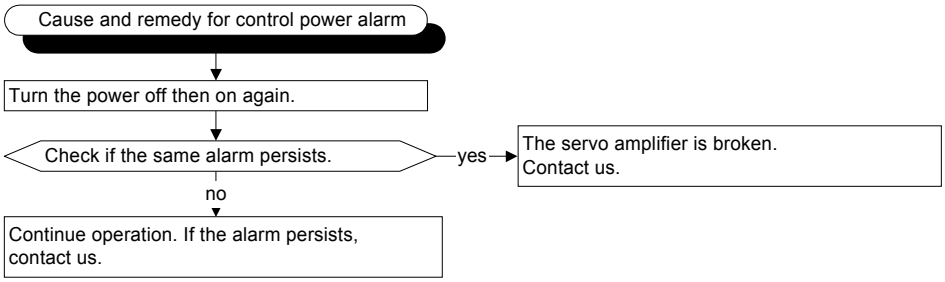
7. Control power alarm 2

[Indication on 7-segment LED]

[Description of trouble]

The control circuit is faulty and may be broken.

[Cause and remedy] (Common to control power alarms 1 and 2)



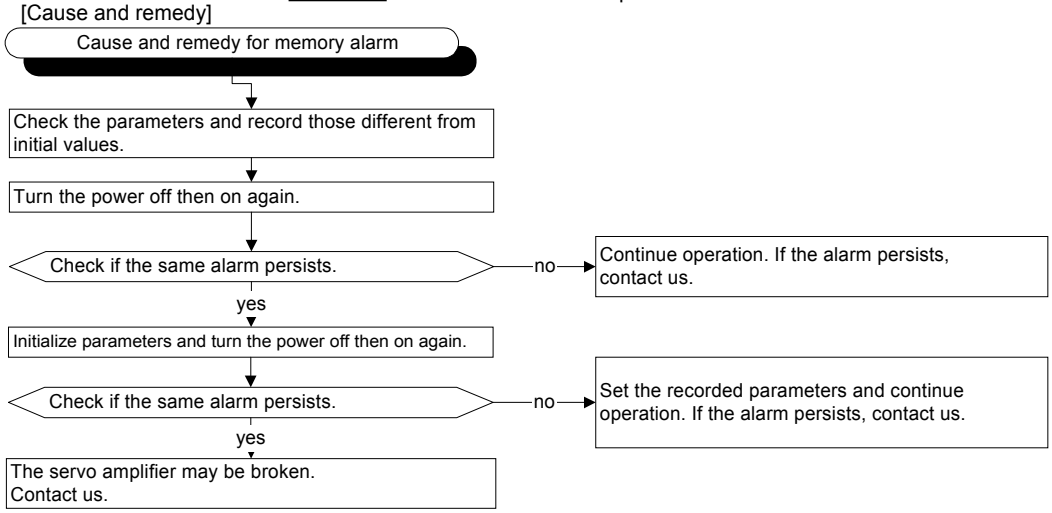
8. Memory alarm

[Indication on 7-segment LED]

[Description of trouble]

The parameter data stored in the EEPROM inside the servo amplifier is broken.

[Cause and remedy]



9. Motor combination alarm

[Indication on 7-segment LED]

[Description of trouble]

Combination between the servo amplifier and the servomotor is incorrect.

[Cause and remedy]

Use the servo amplifier and servomotor in the following combinations.
If this alarm is developed even though the combination is one of those listed below, contact us.

Servo amplifier type	Allowable servomotor type	
	Cubic type	Slim type
RYB500S3-VBC	-	GYS500DC1-C8
RYB101S3-VBC	GYC101DC1-C	GYS101DC1-C
RYB201S3-VBC	GYC201DC1-C	GYS201DC1-C
RYB401S3-VBC	GYC401DC1-C	GYS401DC1-C
RYB751S3-VBC	GYC751DC1-C	GYS751DC1-C
RYB500S3-VBC6	-	GYS500DC1-C8
RYB101S3-VBC6	-	GYS101DC1-C6
RYB201S3-VBC6	-	GYS201DC1-C6

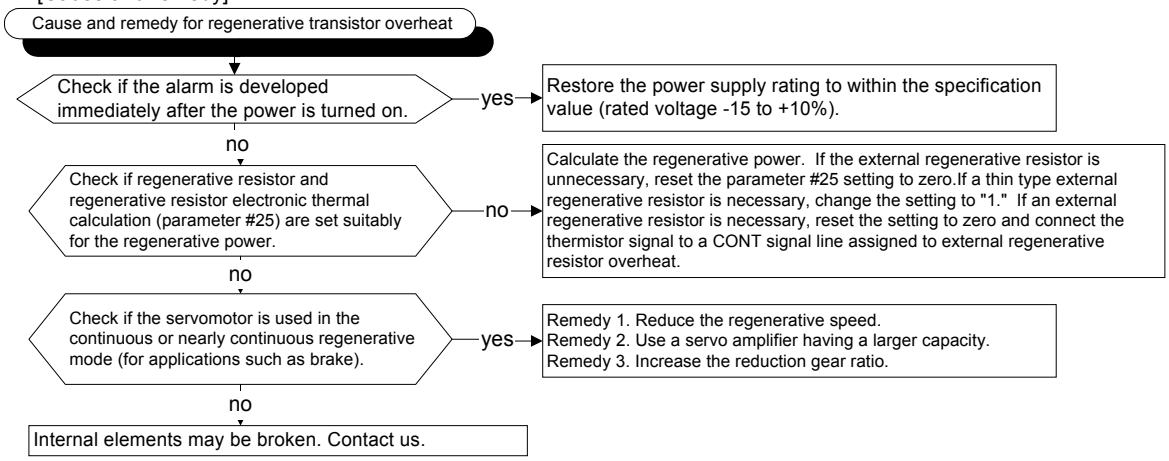
10. Regenerative transistor overheat

[Indication on 7-segment LED] 

[Description of trouble]

The regenerative transistor inside the servo amplifier is overloaded, causing overheat.

[Cause and remedy]



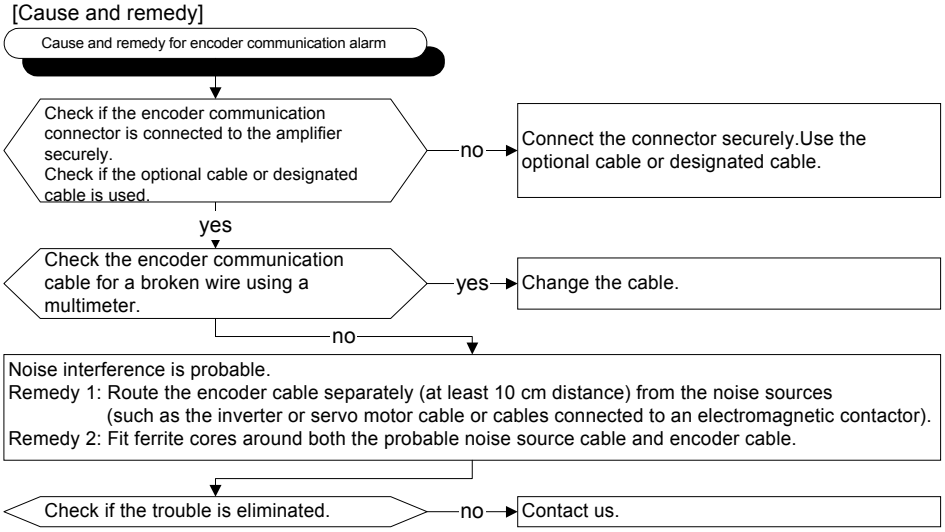
11. Encoder communication alarm

[Indication on 7-segment LED] 

[Description of trouble]

The communication link with the encoder is faulty.

[Cause and remedy]



12. CONT duplication

[Indication on 7-segment LED] 

[Description of trouble]

There is duplication in sequence input signal allocation.

[Cause and remedy]

There is duplication in allocation of the sequence input signal (CONT signal).
Check the settings of parameters #10 through #14 and eliminate duplication.
However, duplication is allowed for forcible stop (5).

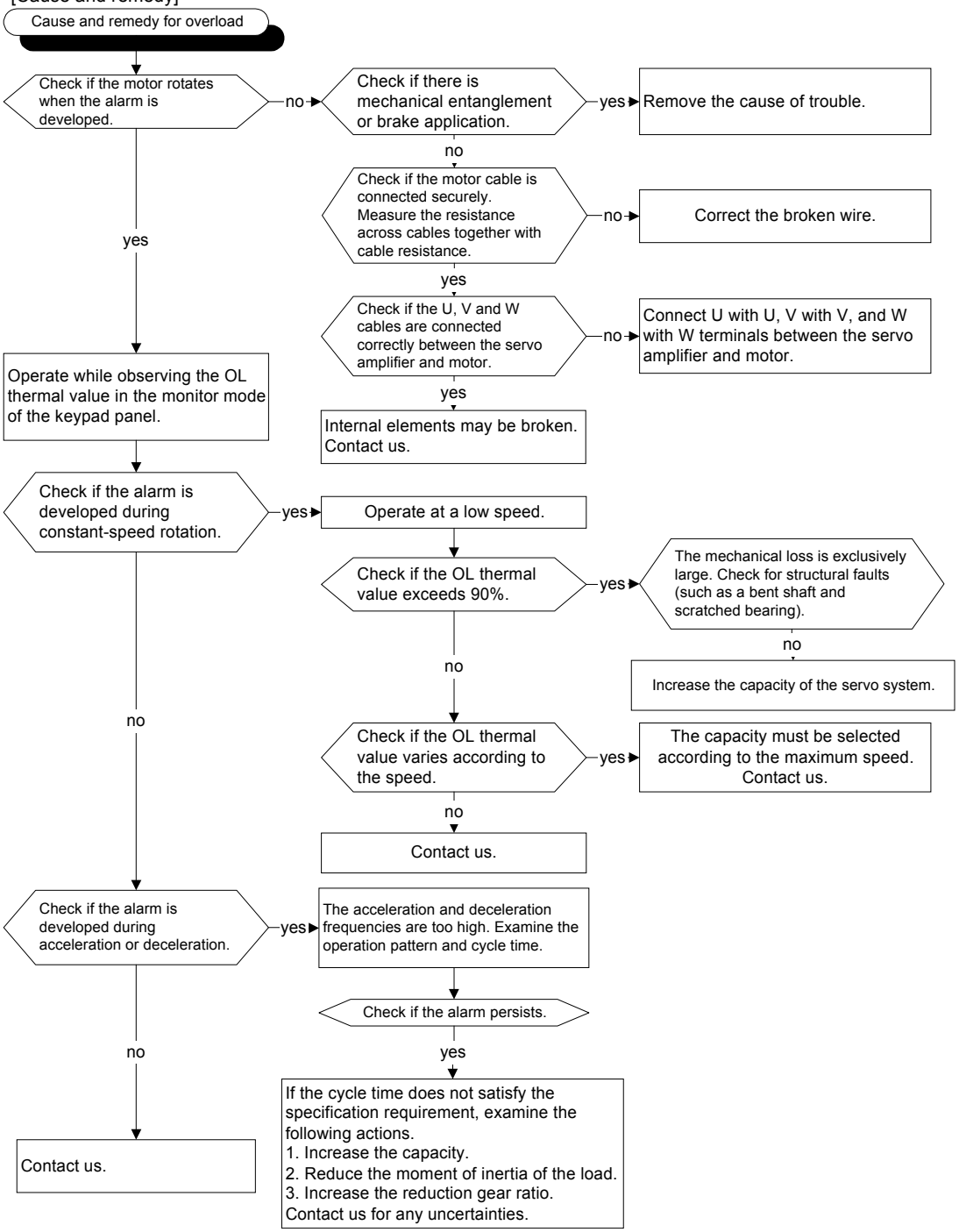
13. Overload

[Indication on 7-segment LED]

[Description of trouble]

The effective value of the output torque (command value) of the servo amplifier exceeds the allowable limit of the combined motor.

[Cause and remedy]



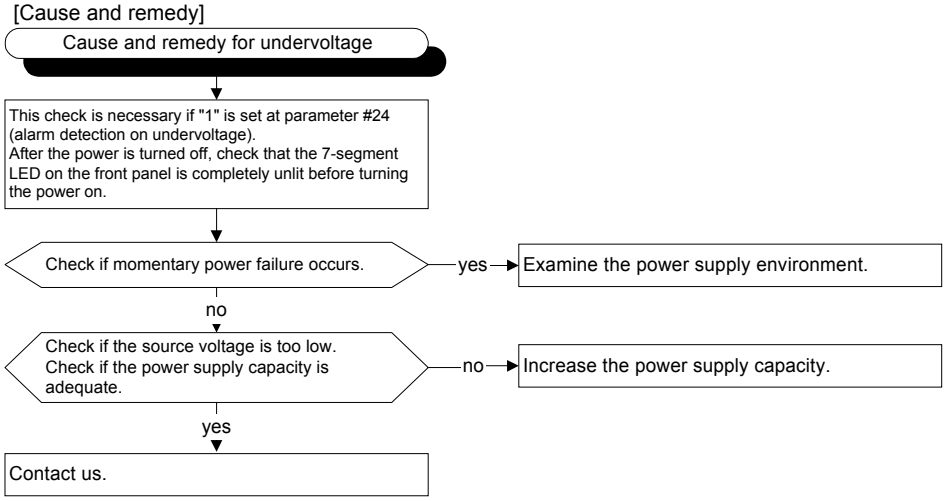
14. Undervoltage

[Indication on 7-segment LED] 

[Description of trouble]

The DC voltage inside the servo amplifier is reduced below the rating.

[Cause and remedy]



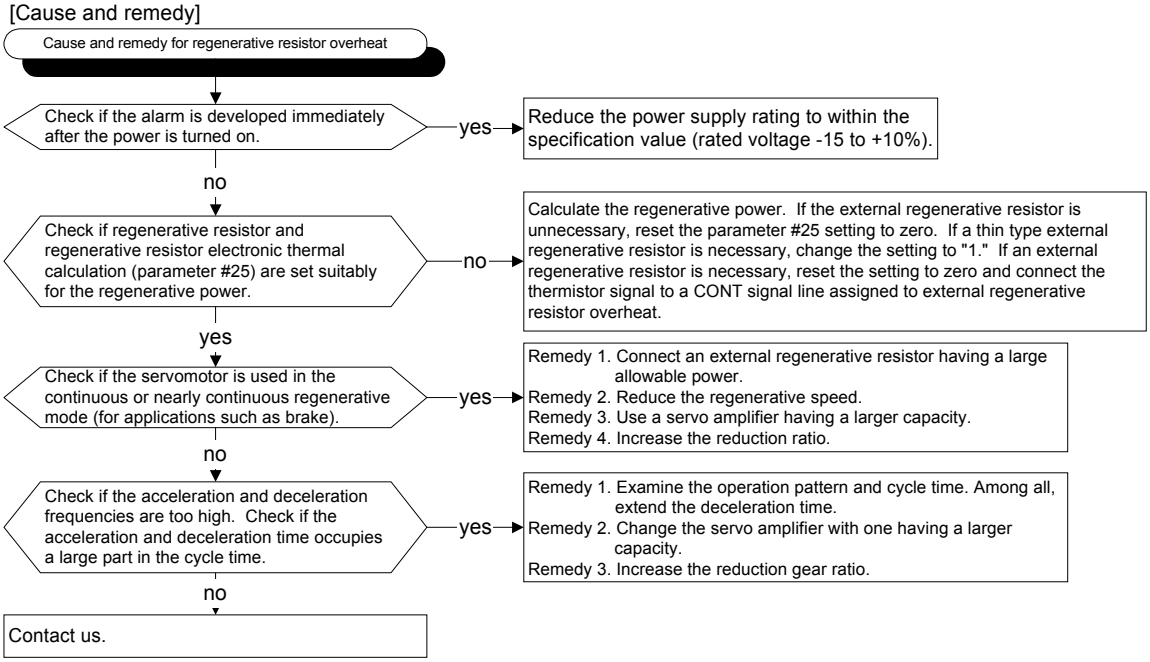
15. Regenerative resistor overheat

[Indication on 7-segment LED] 

[Description of trouble]

The heat generating from the regenerative resistor of the servo amplifier exceeds the allowable limit.

[Cause and remedy]



Supplement The percentage of the regenerative resistor heat to the overheat detection level can be monitored in the monitor mode of the keypad panel.

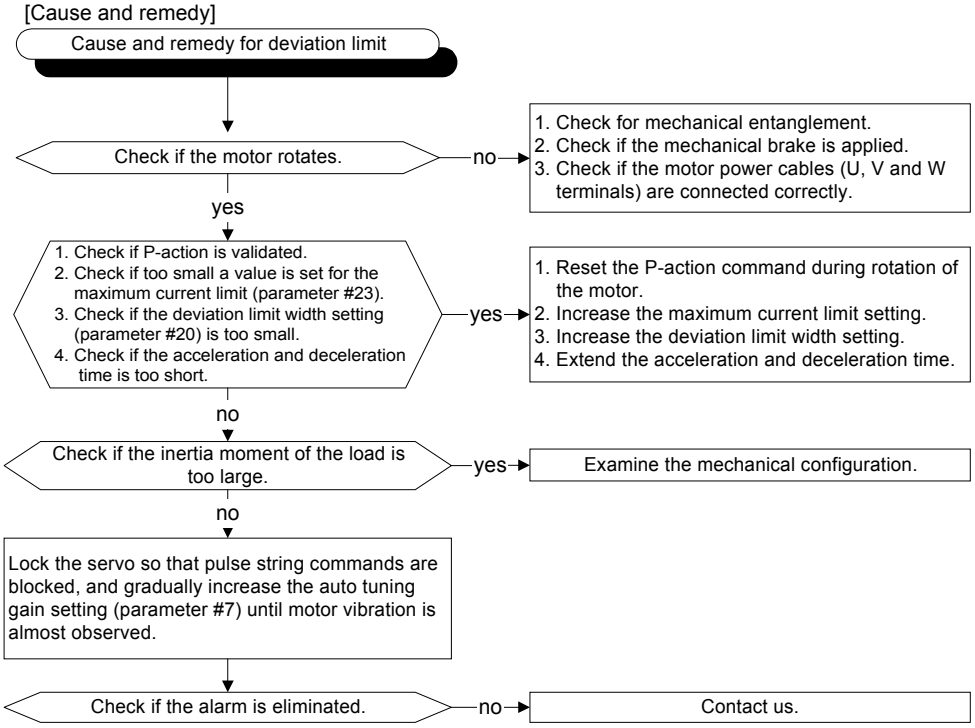
16. Deviation limit

[Indication on 7-segment LED] 

[Description of trouble]

The position deviation exceeds the deviation limit width specified at parameter #20.

[Cause and remedy]



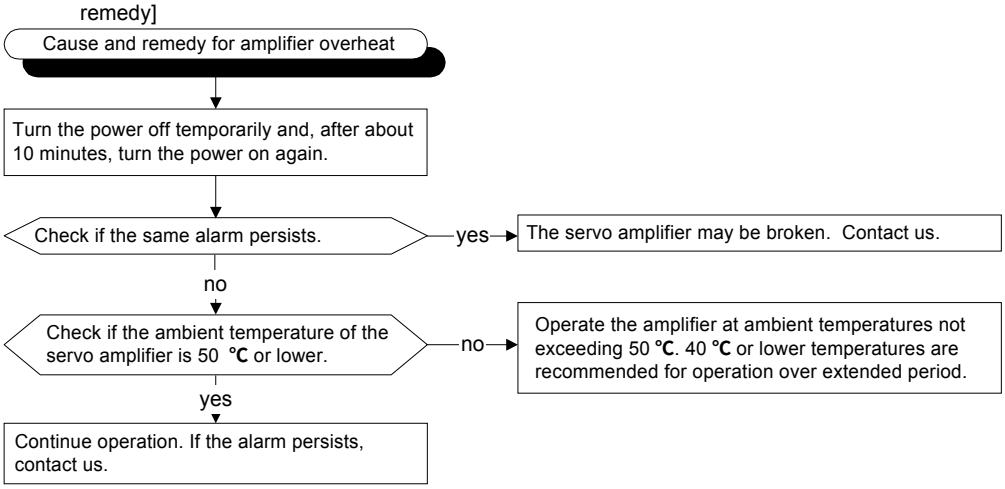
17. Amplifier overheat

[Indication on 7-segment LED] 

[Description of trouble]

The temperature of the heat sink of the servo amplifier exceeds the rating (about 1 00 **℃**).

[Cause and remedy]

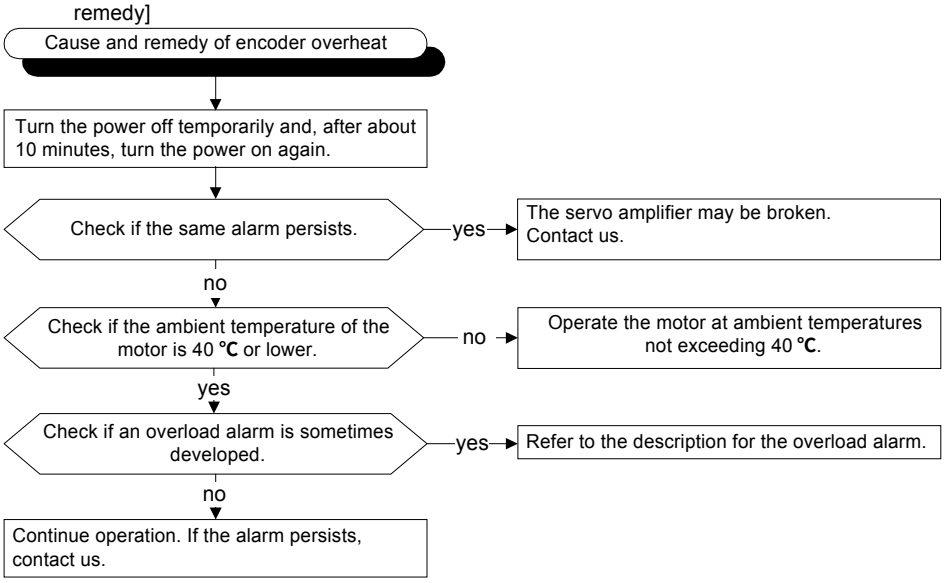


18. Encoder overheat

[Indication on 7-segment LED] 

[Description of trouble]
The temperature of the encoder mounted on the servomotor exceeds the rating.

[Cause and remedy]

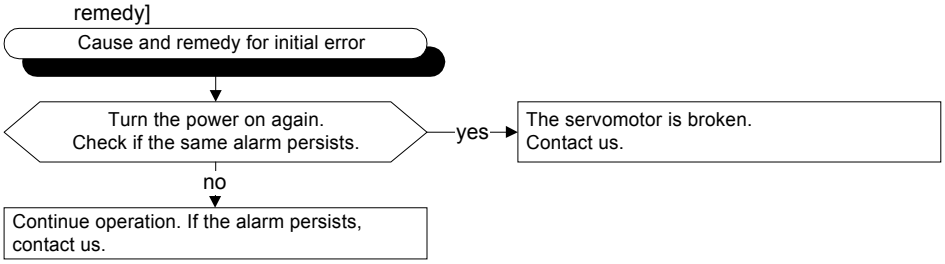


19. Initial error

[Indication on 7-segment LED] 

[Description of trouble]
The initial process of the encoder exceeds the predetermined time.

[Cause and remedy]



Items to specify when faulty

If an alarm appears, remedy it by referring to Chapter 9.
If the alarm is ignored and reset without knowledge about the cause of the alarm to continue operation, damage will be caused to the servo amplifier and servomotor.

When contacting us, specify the following items.

(1) Data on rating plate

Type of servo amplifier and servomotor

→ Example. RYB201S3-VBC

(2) Device configuration

Connected external resistor

→ Example. External regenerative resistor (type: WSR-401)

(3) Outline of mechanical equipment system driven by motor

→ Example. Ball-screw feed, vertical drive, reduction speed ratio 1/2

(4) Description of fault

a) Running duration (years). Was the motor operated normally even once?

b) Frequency of alarm occurrence, conditions

→ Example. When a certain device operates, the motor stops.

c) Alarm display contents

d) Is the alarm reproducible?

e) When does the alarm occur, during acceleration, during rotation at a constant speed, or during deceleration?

f) Is there any difference between forward rotation and reverse rotation?

g) Does the alarm occur under particular conditions?

→ Example. When [RUN] signal has been turned on.

→ Example. When a table has advanced to a particular position.

h) If you have the machine or the servo amplifier with the same specifications, does the alarm occur even after the amplifier or the machine is replaced?

9-4) Maintenance and discharge

(1) Operating conditions

Refer to Chapter 2.

1 Power-on

The servo amplifier can be left turned on.

DANGER
■ Do not touch the servo amplifier or wiring when the commercial power is supplied. If attempted, there is a risk of electric shock.

2 Specifications

The GYC and GYS type servomotors are continuous rating.

3 Power supply

Do not repeatedly turn on and off the power supply to start and stop the servomotor.

If attempted, the parts inside the servo amplifier will be broken.

4 Radio noise

No countermeasure is taken to the servo amplifier and servomotor against radio noise generation.

Therefore, following devices may receive noises.

- AM radios near the servo amplifier or servomotor
- Wired broadcast, etc. near the wiring
- Measuring instruments or household appliances

Refer to Chapter 10 for countermeasures against noise and installation methods.

(2) Expected service life

The servo amplifier and servomotor are susceptible to aging under regular operating conditions.

1 Servomotor

The motor bearings at the output shaft of the servomotor should be replaced, when required. If the bearings produce unusual noise, contact us.

The motor incorporates (built-in) encoder. Therefore, inquire us for bearing replacement.

2 Brake built in servomotor

The expected service life of the brake is approximately 20,000 operations at rated torque. However, no service life is set for the application as a holding means of the servomotor shaft.

There is no manual release lever for the servomotor brake.

3 Large capacity capacitor built in servo amplifier

The servo amplifier incorporates large capacity capacitors. Contact us when replacement with new one is required.

(3) Discharge

1 Servomotor

The servomotor is made from almost iron. It can be discharged as a general industrial waste.

2 Servo amplifier

The servo amplifier contains various electronic parts.

If you have difficulties for discharging, contact us.

-MEMO-

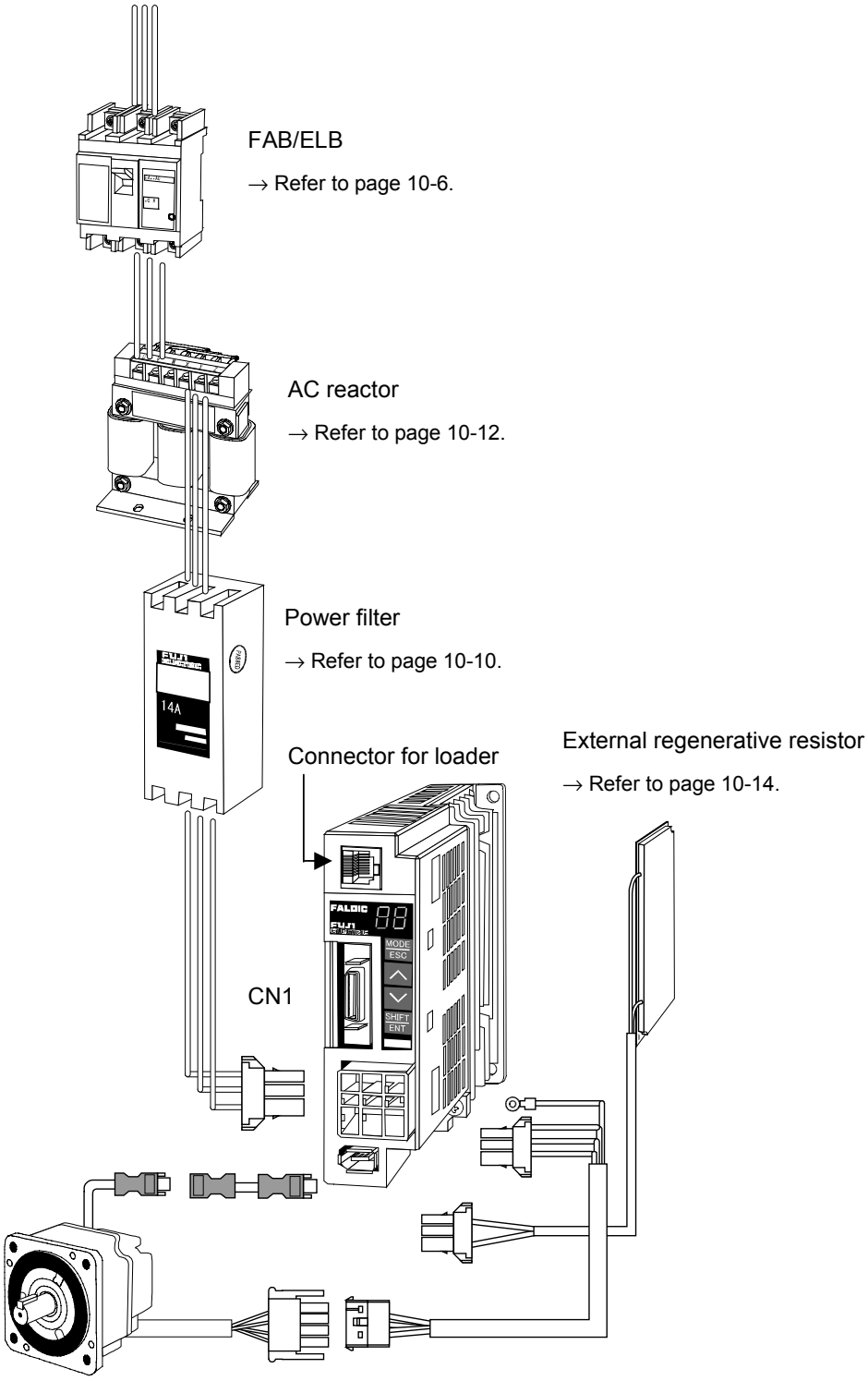
FALDIC-β

10

PERIPHERAL DEVICE

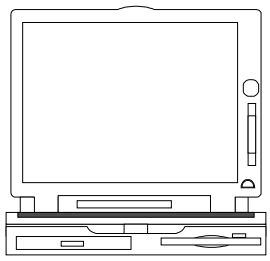
10 PERIPHERAL DEVICE

■ Configuration of system with peripheral devices

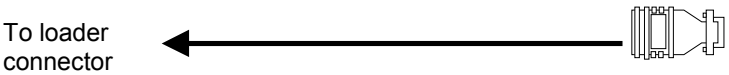


General-purpose PC

PC loader (option) for FALDIC-β is prepared.

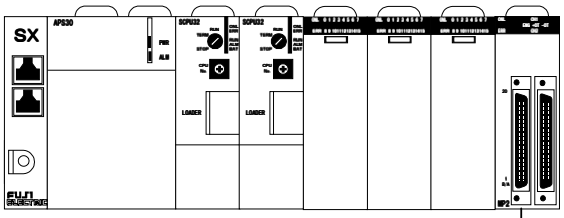


To loader connector

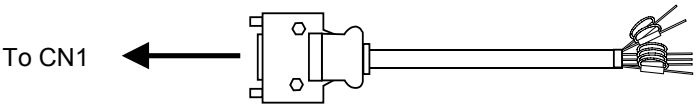


Controller

Various controllers of a pulse string output type can be connected.



To CN1



Optional cables

Cables for connecting devices.
Connector kit is prepared, too.

No wiring connector comes with the servo amplifier or servomotor. Order optional cables and connector kits separately. The connectors are described in section 10-8 “Option.”

* This is a schematic diagram for connections. The relative size of each device (external dimensions) is not correct.

10 PERIPHERAL DEVICE

10-1) Cable size

The electric circuits inside the control panel can be divided into the main circuit and control circuit. Cables used for general circuits except for those of encoder wiring of the servomotor are as follows.

■ 600V class, poly-vinyl insulated cable (JIS C 3307: IV)

Used for main circuit. The cable cannot be twisted.

■ Poly-vinyl insulated cable for electric appliances (JIS C 3316: KIV)

Can be used for all circuits; superior in flexibility.

■ 600V class, cross-link polyethylene insulated cable (JCS 360 (standard of the Japanese Electric Wire & Cable Maker's Association): FSCL)

Used for main circuit. The cable size is smaller than the 600V-class poly-vinyl cable and superior in flexibility.

Example: Furukawa Electric's Baudrex

■ Twisted shielded cable for electronic devices and electric appliances

Used for control circuit. Cables are prone to radio noise and inductive noise even in the panel and therefore shielded cables should be used.

Example: Furukawa Electric's Beemex S Shielded Cable XEBV or XEWV

The encoder cable for the servomotor is a composite 2C (cable) 4P (pair) shielded cable housing cables of different sizes.

■ Cross-link polyethylene poly-vinyl insulated cable for robot travel (twisted pair type) (Daito Co., Ltd.)

RMCV-SV	AWG#25 / 4P + AWG#23 / 2C	(within 10m)
	AWG#25 / 4P + AWG#17 / 2C	(within 50m)

(1) Commercial power supply and motor power cables

Use the following cables for commercial power supply and motor power cables.

The cables should be 600V class poly-vinyl insulated cable.

Unit: mm^2

Input power supply	Servo amplifier type	Capacity [W]	Motor power supply	Brake
3-phase 200V series	RYB500S3-□□□	50	0.75	0.75
	RYB101S3-□□□	100		
	RYB201S3-□□□	200		
	RYB401S3-□□□	400		
	RYB751S3-□□□	750		
Single-phase 100V series	RYB500S3-□□□6	50		
	RYB101S3-□□□6	100		
	RYB201S3-□□□6	200		

(2) Sequence input/output (CN1)

Digital input/output signals of max. 24VDC, 50mA current flow in the cables.

Cable size (CN1): AWG 26
26-core shielded cable

* Optional cable and connector kit are prepared (refer to section 10-8 “Option”).

(3) Encoder cable (CN2)

4-M bps serial communication is made through the cable. Use the following designated cable or optional cable (refer to section 10-8 “Option”).

Servo amplifier type	Cable size (CN2)
All models in RYB type	Cross-link polyethylene insulated, poly-vinyl sheath cable for robot travel (twisted pair cable) RMCV-SV type made by Daito Co., Ltd. AWG #25 / 4P + AWG #23 / 2C (within 10m) AWG #23 / 4P + AWG #17 / 2C (within 50m) Maker : DAIDEN

* Optional cable and connector kit are prepared (refer to section 10-8 “Option”).

10 PERIPHERAL DEVICE

10-2) FAB/ELB (molded case circuit breaker and earth leakage breaker)

FAB (molded case circuit breaker) or ELB (earth leakage breaker) is installed in the primary circuit of the power supply of the servo amplifier for turning power supply on/off and promptly cutting off a fault current such as short-circuit current.

The type for a single servo amplifier is described here.

The protective functions against overcurrent in the output circuit are built in the servo amplifier.

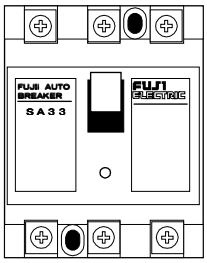
Type of molded case circuit breaker

Input power supply	Servo amplifier type	Capacity [W]	MCCB
3-phase 200V series	RYB500S3-□□□	50	SA33B/3
	RYB101S3-□□□	100	
	RYB201S3-□□□	200	SA33B/5
	RYB401S3-□□□	400	SA33B/10
	RYB751S3-□□□	750	SA53B/15
Single-phase 100V series	RYB500S3-□□□6	50	SA33B/3
	RYB101S3-□□□6	100	
	RYB201S3-□□□6	200	SA33B/5

Type of earth leakage breaker

Input power supply	Servo amplifier type	Capacity [W]	ELCB
3-phase 200V series	RYB500S3-□□□	50	EG33B/3
	RYB101S3-□□□	100	
	RYB201S3-□□□	200	EG33B/5
	RYB401S3-□□□	400	EG33B/10
	RYB751S3-□□□	750	EG53B/15
Single-phase 100V series	RYB500S3-□□□6	50	EG33B/3
	RYB101S3-□□□6	100	
	RYB201S3-□□□6	200	EG33B/5

<Appearance>



10-3) Electromagnetic contactor

Connect the electromagnetic contactor to isolate the servo amplifier by means of an external signal or to turn it on or off from a remote operation panel.

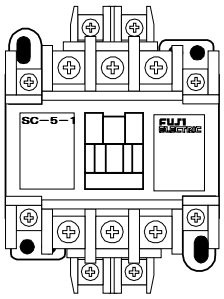
The types specified below turn on or off the primary circuit of a single servo amplifier of 500kVA or smaller power supply capacity and 20m or more wiring lengths with the designated cable size.

For power supply capacities exceeding 500kVA, connect an AC reactor.

Type of electromagnetic contactor

Input power supply	Servo amplifier type	Capacity [W]	MC
3-phase 200V series	RYB500S3-□□□	50	SC-5-1(19A)
	RYB101S3-□□□	100	
	RYB201S3-□□□	200	
	RYB401S3-□□□	400	
	RYB751S3-□□□	750	
Single-phase 100V series	RYB500S3-□□□6	50	
	RYB101S3-□□□6	100	
	RYB201S3-□□□6	200	

<Appearance>

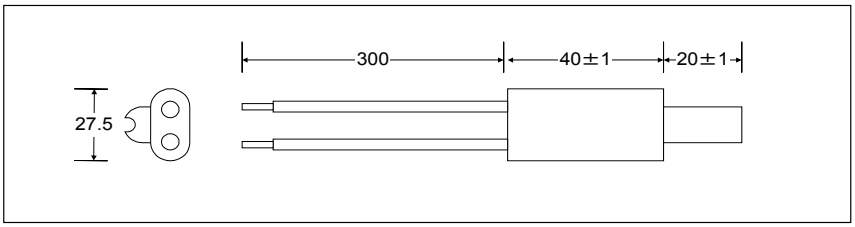


10-4) Surge absorber (surge suppressor, surge killer)

Shown below are recommended surge suppressors (for 250 [V] or less) to be installed on peripheral devices (magnetic contactor, solenoid value, electromagnetic brake, etc.) of the servo amplifier.
DC equipment should be equipped with a diode for surge voltage suppression.

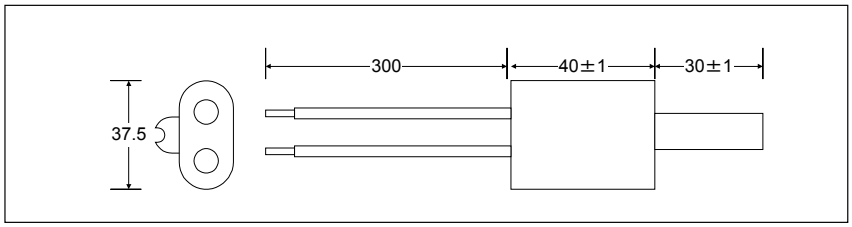
For control relay, etc.

Type: S1-B-0 (made by Okaya Sangyo)

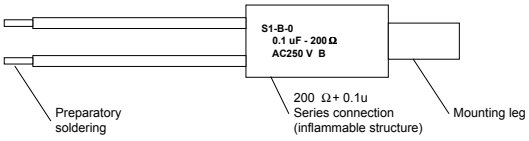


For electromagnetic contactor

Type: S2-A-0 (made by Okaya Sangyo)



* A non-inductive capacitor and non-inductive resistance are connected in series and sealed in epoxy resin.
  S1-B-0:200 Ω (1/2 W) + 0.1 µF
  S2-A-0:500 Ω (1/2 W) + 0.2 µF



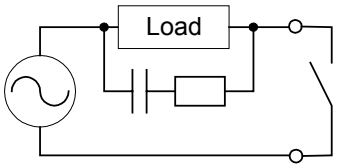
The purpose of the surge killer is suppression of surge voltage.

When an inductive load such as clutch and solenoid valve is turned off, several hundreds or thousands of volts of counter-electromotive force generates. The surge suppressor suppresses these surge voltages.

- Protection in AC circuit

  C-R circuit

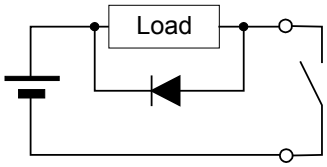
  (Can be used for DC circuit.)



- Protection in DC circuit

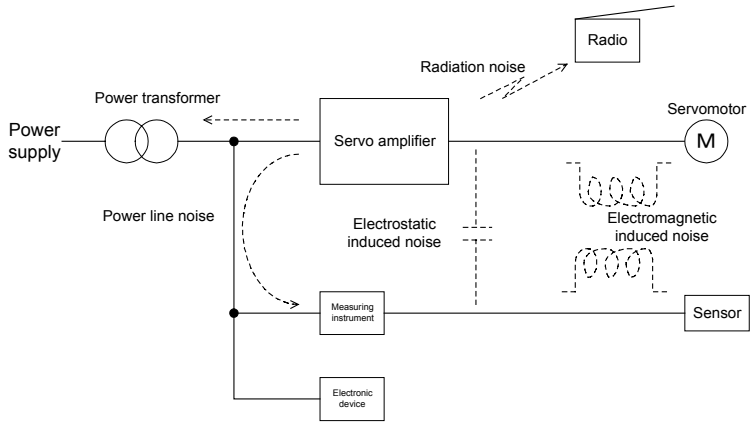
  Diode

  (Be careful of orientation of the diode.)



10-5) Power filter

In the servo amplifier, the pulse width modulation circuit performs high frequency switching similarly to general-purpose inverters. This causes power line noise, radiation noise from the amplifier and noise from the motor power cable, and these noises may have an adverse influence over external equipment. To prevent such an influence, the following methods are available.



(1) House the servo amplifier in a steel container (control cabinet) and ground the container. Avoid installation in a place close to the PC or measuring instruments.

(2) If the amplifier affects the equipment of which power is shared with the amplifier, incorporate the power filter in the primary circuit of the servo amplifier.
If the amplifier affects the equipment which gets its drive from different power source, install the transformer for radio noise prevention (TRAFY).

(3) Use a metal conduit to house the cable extended from the servo amplifier to the servomotor, and ground the conduit (grounding at several points is possible).

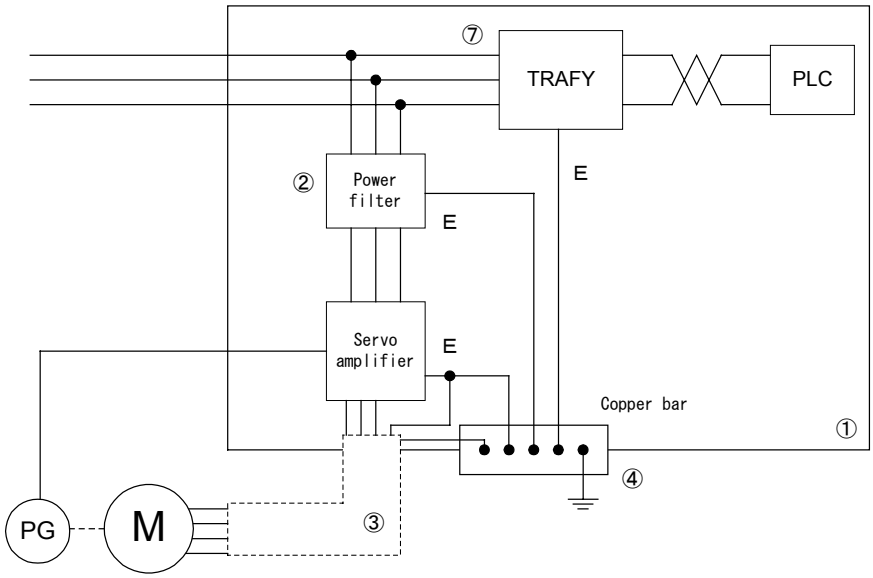
(4) Use a thick cable for grounding and make the cable as short as possible. Connect the grounding cable from the individual equipment directly to a copper bar (do not ground via any equipment).

(5) Avoid mutual connection of the following signals.

Grounding terminal and frame (enclosure)	×	0V of +24VDC power supply for sequence input/output	×	0V of power supply for speed command or 0V of encoder power supply

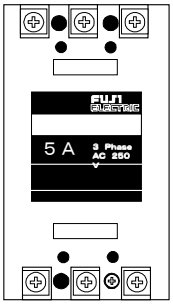
(6) Avoid binding together the main circuit and control circuit or laying them in parallel.
Main circuit : Commercial power supply, motor power cable between servo amplifier and servomotor
Control circuit : Analog voltage cable, +24VDC or +15VDC level signal cables, encoder cables of servomotor

(7) Connect a transformer for radio noise prevention (TRAFY) to separate 100V power system devices (PLC, general-purpose PC, etc.) from the 200V power system.



Input power supply	Servo amplifier type	Capacity [W]	FHF
3-phase 200V series	RYB500S3-□□□	50	FHF-TA/5/250
	RYB101S3-□□□	100	
	RYB201S3-□□□	200	
	RYB401S3-□□□	400	FHF-TA/10/250
	RYB751S3-□□□	750	FHF-TA/20/250
Single-phase 100V series	RYB500S3-□□□6	50	FHF-TA/5/250
	RYB101S3-□□□6	100	
	RYB201S3-□□□6	200	

<Appearance>



The power filter suppresses high-frequency voltage fluctuation caused by the servo amplifier on the commercial power supply.
The filter functions both in the primary and secondary circuits, so that it protects the servo amplifier against high-frequency voltage fluctuation in the primary power supply.

10-6) AC reactor

Connect the AC reactor in the primary circuit of the servo amplifier in the following cases.

(1) Large power supply capacity

When the power supply capacity exceeds 500kVA, the input current of the servo amplifier becomes large at the time of power on, and there is a possibility where the rectifying diodes of the amplifier are damaged.

(Cable length of 20m with specified cable diameter size)

(2) Imbalance in power supply voltage

The current gathers in the phase of a higher voltage if there is imbalance among source voltage phases. Connect an AC reactor if the power supply voltage imbalance rate is 3% or higher.

$$\text{(Imbalance rate of power supply voltage [\%])} = \frac{\text{((Max. voltage [V]) - (Min. voltage [V]))}}{\text{(3-phase average voltage [V])}} \times 100$$

Connect the AC reactor to average the input current among phases. It also functions as a guard against power failure in the source voltage line.

(3) Suppression of harmonics

Higher harmonics current is generated because the servo amplifier is of a capacitor input type. The AC reactor suppresses voltage distortion in the power supply system to prevent troubles from occurring in the devices connected to the same power supply system.

An imbalance in the source voltage increases harmonics.

Connect the AC reactor in the primary circuit of the servo amplifier. A smaller rated current capacity type generates heat, while the effect is small with a larger rated current capacity type.

Input power supply	Servo amplifier type	Capacity [W]	AC reactor	Reactance
3-phase 200V series [with 3-phase power supply]	RYB500S3-□□□	50	ACR2-0.4A	2.92mH
	RYB101S3-□□□	100		
	RYB201S3-□□□	200		
	RYB401S3-□□□	400	ACR2-0.75A	1.57mH
	RYB751S3-□□□	750	ACR2-1.5A	0.939mH
3-phase 200V series [with single-phase power supply]	RYB500S3-□□□	50	ACR2-0.4A	2.92mH
	RYB101S3-□□□	100		
	RYB201S3-□□□	200	ACR2-0.75A	1.57mH
	RYB401S3-□□□	400	ACR2-1.5A	0.939mH
Single-phase 100V series	RYB500S3-□□□6	50	ACR2-0.4A	2.92mH
	RYB101S3-□□□6	100		
	RYB201S3-□□□6	200	ACR2-0.75A	1.57mH

■ Guideline for harmonics suppression

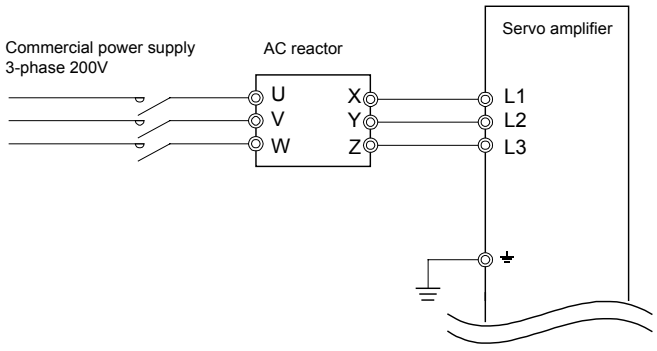
The servo amplifier is applicable to the guideline for suppression of harmonics.
3-phase 200V power supply types with 4.0kW or smaller outputs are applicable to the following guideline.

"Guideline for suppression of harmonics for household electric appliances and general-purpose equipment" (September 1997) issued by Ministry of International Trade and Industry of Japan

3-phase 200V power supply types with outputs exceeding 4.0kW are applicable to the following guideline.

"Guideline for suppression of harmonics for consumers contracting high voltage or special high voltage power" (September 1994) issued by Ministry of International Trade and Industry of Japan

Connect to the servo amplifier an AC reactor or DC reactor specified in this manual.
If the applicable reactor is connected, the regulation values set forth in the guideline for harmonics suppression can be satisfied.



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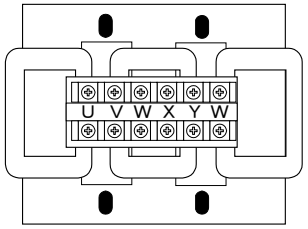


The AC reactor aims at suppression of harmonics and protection of servo amplifier against imbalance in the voltage and power failure in the power supply line.

10-7) External regenerative resistor (external braking resistor)

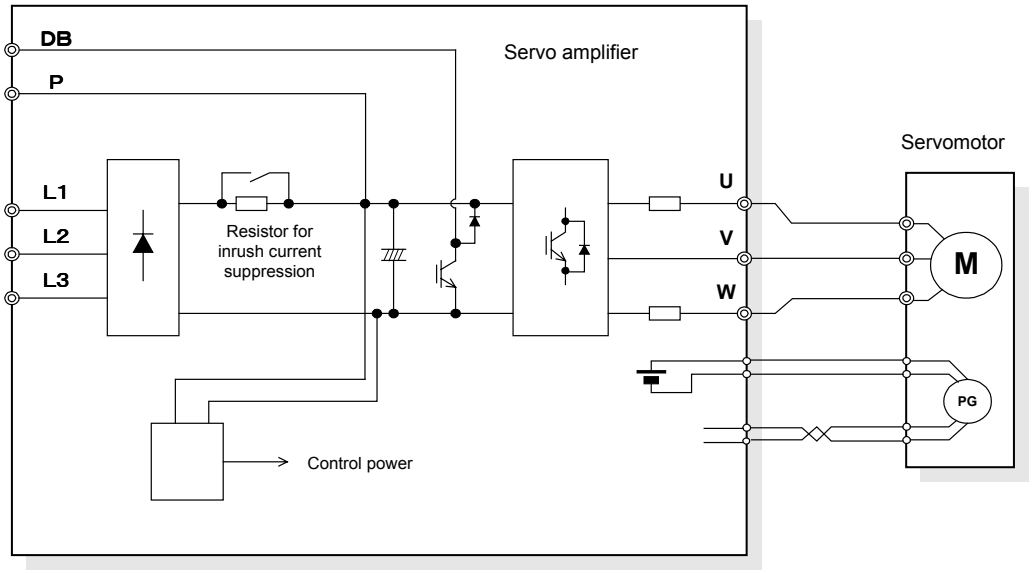
The regenerative resistor consumes the power generated at the servomotor.
Though the servo amplifier houses a built-in regenerative resistor, an external regenerative resistor should be installed if load variation is that of an elevation (hoisting) load or for higher frequency operation.

Input power supply	Servo amplifier type	Capacity [W]	External regenerative resistor
3-phase 200V series	RYB500S3-□□□	50	WSR-401 (resistance 68 Ω, 17W (continuous)) (WSR-401-T (resistance 68 Ω, 12W (continuous))
	RYB101S3-□□□	100	
	RYB201S3-□□□	200	
	RYB401S3-□□□	400	
	RYB751S3-□□□	750	Contact us separately. (WSR-751-T (resistance 33 Ω, 12W (continuous))
Single-phase 100V series	RYB500S3-□□□6	50	Contact us separately. (WSR-751-T (resistance 33 Ω, 12W (continuous))
	RYB101S3-□□□6	100	
	RYB201S3-□□□6	200	

* When the regenerative resistor is installed to the side of RYB75153-VBC, the resistance is 25W (continuous).

Description in parentheses { } indicates the thin type external regenerative resistor.

<Block diagram of main circuit>



To use an external regenerative resistor, connection and parameter setting are necessary.

System setting parameter #25

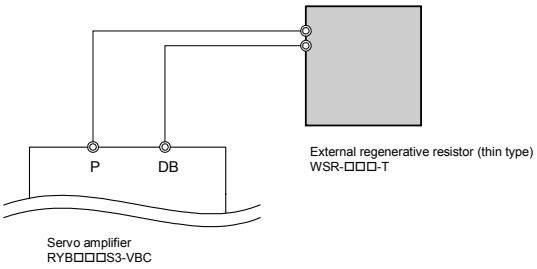
No.	Name	Setting range	Initial value	Change
25	Regenerative resistor electronic thermal calculation	0: Invalid, 1: Valid (optional regenerative resistor (thin type))	0	Power

System setting parameter #25

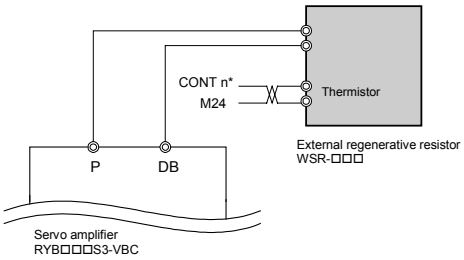
Regenerative resistor	Setting
None	0: Invalid
External regenerative resistor (thin type)	1: Valid (optional thin type regenerative resistor)
External regenerative resistor	0: Invalid

■ Connection of optional thin type external regenerative resistor (WSR-□□□-T)

Because the thin type external regenerative resistor is provided with no thermistor, use the electronic thermal relay inside the servo amplifier to protect.



■ Connection of optional external regenerative resistor (WSR-□□□)



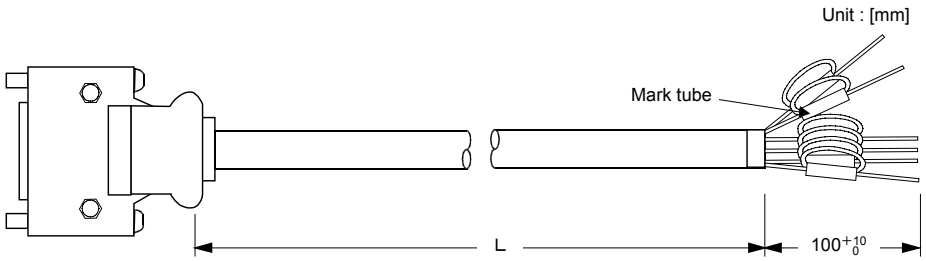
* Assign external regenerative resistor overheat (“8”) to the CONT input terminal.

10-8) Option

Series : Optional cable for sequence input/output

Type : WSC-D26P03

Applicable to : All models (for CN1)



■ Connector

Connector 1

Plug	10126-3000V
Shell	10326-52A0-008

Made by Sumitomo 3M

■ Wire color

Connector 1	1	2	3	4	5	6	7	8	9	10	11	12	13	15	14	16	17	18	19	20	21	22	23	24	25	26
Mark tube	1	2	3	4	5	6	7	8	9	10	11	12	13	15	14	16	17	18	19	20	21	22	23	24	25	26
Wire color Color	Orange		Gray		White		Yellow		Pink		Orange		Gray		White		Yellow		Pink		Orange		Gray		White	
Mark	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black	Red	Black
	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3

■ Length

Type	L [m]
WSC-D26P03	3.0 +0.3 0

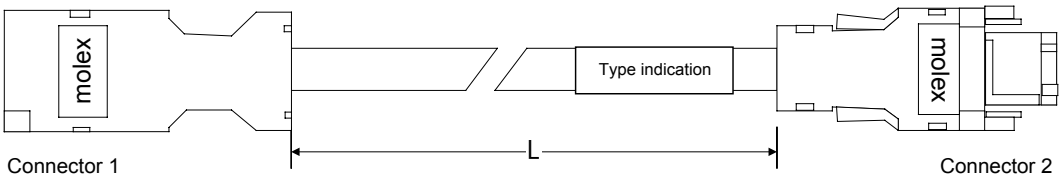
* For cables longer than 3m, contact us.

* The manufacturer of the connector is subject to change without notice.

Series : Optional cable for encoder wiring

Type : WSC-P06P05 to WSC-P06P20

Applicable to : All models



■ Connector

Connector 1

Housing main body	53988-0611
Socket shell cover	58300-0600
Socket mold cover	53989-0605
Socket mold cover	53990-0605
Cable clamp	58303-0000
Clamp screw	59832-0009

Made by Nihon Molex

Connector 2 (for 5m and 10m)

Housing main body	51145-0601
Crimp terminal	50639-8091
Plug shell cover	58098-0600
Plug shell body	58099-0600
Cable clamp	54017-0615
Clamp screw	54018-0605

Connector 2 (for 20m)

Plug housing main body	54180-0611
Plug shell cover	58299-0600
Plug shell body	58300-0600
Plug mold cover	54181-0615
Plug mold cover	54182-0605
Cable clamp	58303-0000
Clamp screw	59832-0009

Made by Nihon Molex

■ Wire color

Connector 1		1	2	3	4	5	6
Connector 2		1	2	3	4	5	6
Wire color	(1)	Red	Black	Orange	Orange / White	Sky blue	Sky blue / White
	(2)	White	Black	Yellow	Brown	Red	Blue

The wire color is either (1) or (2).

■ Length

Type	L [m]
WSC-P06P05	$5.0^{+0.5}_{0}$
WSC-P06P10	$10.0^{+1.0}_{0}$
WSC-P06P20	$20.0^{+2.0}_{0}$

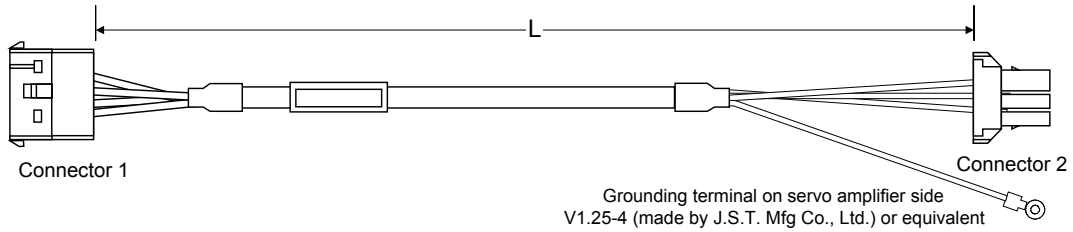
* The connector 1 and connector 2 types are different from those of the connector kit.
* The manufacturer of the connector is subject to change without notice.
* For cable lengths other than 5, 10 or 20m, contact us.

⚠ CAUTION	Do not extend the wiring distance by connecting two or more encoder wiring cables. A voltage drop by contact resistance of connector may stop the operation abruptly.

Series : Optional servomotor power cable for servomotors without brake

Type : WSC-M04P05-B to WSC-M04P20-B

Applicable to : Power cable for servomotors without brake



■ Connector

Connector 1

Cap housing	350780-1
Contact	350570-1

Made by Nihon AMP

Connector 2

Cap housing	2-178128-3
Contact	1-175218-5

Made by Nihon AMP

■ Wire color

Connector 1	1	2	3	4
Mark	U	V	W	E
Wire color	Red	White	Black	Green / Yellow

Connector 2	1	2	3	Round terminal
Mark	U	V	W	E
Wire color	Red	White	Black	Green / Yellow

■ Length

Type	L [m]
WSC-M04P05	5.0 +0.5 0
WSC-M04P10	10.0 +1.0 0
WSC-M04P20	20.0 +2.0 0

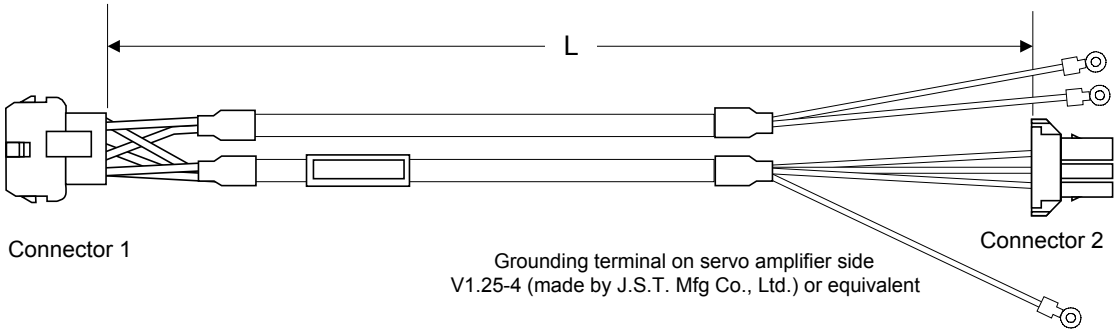
* The manufacturer of the connector is subject to change without notice.

* For cable lengths other than 5, 10 or 20m, contact us.

Series : Optional servomotor power cable for servomotors with brake

Type : WSC-M06P05-B to WSC-M06P20-B

Applicable to : Power cable for servomotors with brake



■ Connector

Connector 1

Cap housing	350781-1
Contact	350570-3

Made by Nihon AMP

Connector 2

Cap housing	2-178128-3
Contact	1-175218-5

Made by Nihon AMP

■ Wire color

Connector 1	1	2	3	4	5	6
Mark	U	V	W	E		
Wire color	Red	White	Black	Green / Yellow	Red	Black

Connector 2	1	2	3	Round terminal		
Mark	U	V	W	E		
Wire color	Red	White	Black	Green / Yellow	Red	Black

■ Length

Type	L [m]
WSC-M06P05	5.0 $^{+0.5}_{0}$
WSC-M06P10	10.0 $^{+1.0}_{0}$
WSC-M06P20	20.0 $^{+2.0}_{0}$

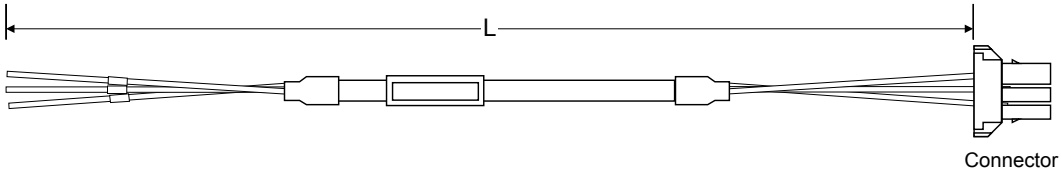
* For cable lengths other than 5, 10 or 20m, contact us.

* The manufacturer of the connector is subject to change without notice.

Series : Power cable

Type : WSC-S03P03-B

Applicable to : All models



■ Connector

Connector

Cap housing	1-178128-3
Contact	1-175218-5

Made by Nihon AMP

■ Wire color

Connector 1	1	2	3
Mark	L1	L2	L3
Wire color	Red	White	Black

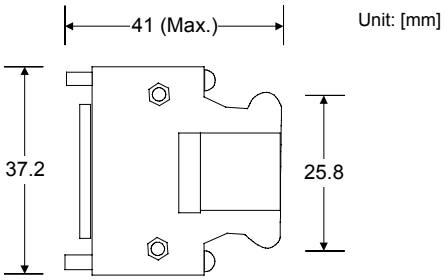
■ Length

Type	L [m]
WSC-S03P03-B	3.0 $^{+0.3}_{0}$

Series : Connector kit for sequence input/output

Type : WSK-D26P

Applicable to : All models



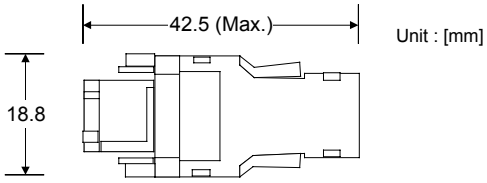
Soldering plug	10126-3000VE
Shell kit	10326-52A0-008

Made by Sumitomo 3M

Series : Connector kit for encoder

Type : WSK-P06P-M

Applicable to : All models



Housing main body	54180-0611
Shell cover	58299-0600
Shell cover	58300-0600
Mold cover	54181-0615
Mold cover	54182-0605
Cable clamp	58303-0000
Clamp screw	59832-0009

Made by Nihon Molex

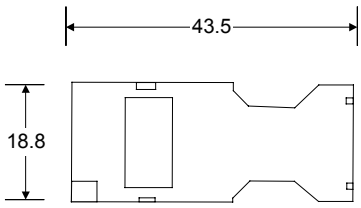
* The type of the connector kit is different from that of the optional cable.

* The manufacturer of the connector is subject to change without notice.

Series : Connector kit for encoder

Type : WSK-P06P-F

Applicable to : All models



Unit : [mm]

Housing main body	53988-0611
Shell body clamp side	58302-0600
Mold cover without latch	53989-0605
Mold cover	53990-0605
Cable clamp	58303-0000
Clamp screw	59832-0009

Made by Nihon Molex

* The type of the connector is different from that of the optional cable.
* The manufacturer of the connector is subject to change without notice.

Series : Connector kit for servomotor power cable (on amplifier side)

Type : WSK-M03P-B

Applicable to : All models

Series : Connector kit for power cable (on amplifier side)

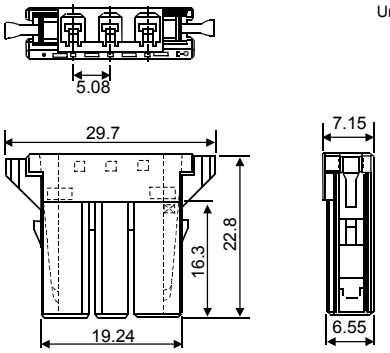
Type : WSK-S03P-B

Applicable to : All models

Series : Connector kit for external regenerative resistor (on amplifier side)

Type : WSK-R03P-B

Applicable to : All models



Unit : [mm]

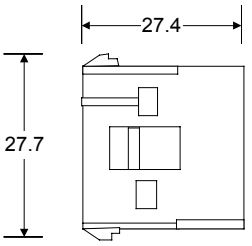
Connector kit for servomotor power cable WSK-M03P-B	Housing	2-178128-3
	Contact	1-175218-5
Connector kit for power cable WSK-S03P-B	Housing	1-178128-3
	Contact	1-175218-5
Connector kit for external regenerative resistor WSK-R03P-B	Housing	1-178128-3
	Contact	1-175218-5
	Keying plug	175855-1

Made by Nihon AMP

Series : Connector kit for servomotor power cable

Type : WSK-M04P

Applicable to : Power cable for servomotors without brake）



Unit : [mm]

Cap	350780-1
Shell body clamp side	350570-1 or 350689-3

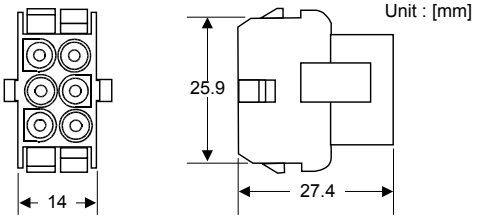
* The manufacturer of the connector is subject to change without notice.

Made by Nihon AMP

Series : Connector kit for servomotor power cable

Type : WSK-M06P

Applicable to : Power cable for servomotors with brake



Unit : [mm]

Cap housing	350781-1
Socket	350570-1

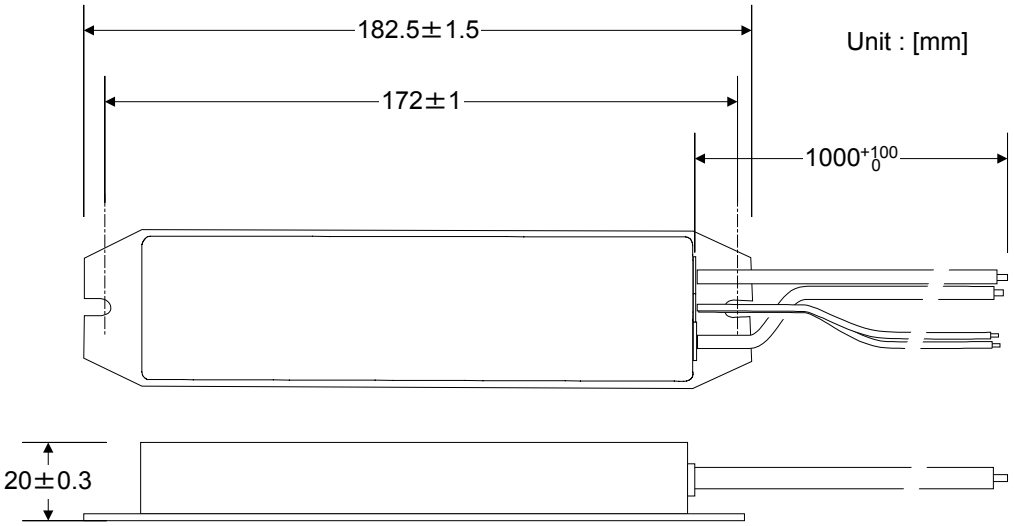
* The manufacturer of the connector is subject to change without notice.

Made by Nihon AMP

Series : External regenerative resistor (external braking resistor)

Type : WSR-401

Applicable to : 400 W and below



* Thickness of mounting plate is 1.2 mm.

Item		Specification
Type		WSR-401
Resistor	Resistance	68 [Ω]
	Allowable power	17 [W] (Continuous)
Thermistor	Operating temperature	Open at 135 ± 5 °C
	Withstand voltage	1.5 kVAC for 1 minute
	Contact capacity	30 VDC, 0.1 A

The distance between the servo amplifier and external regenerative resistor must be within 10m.

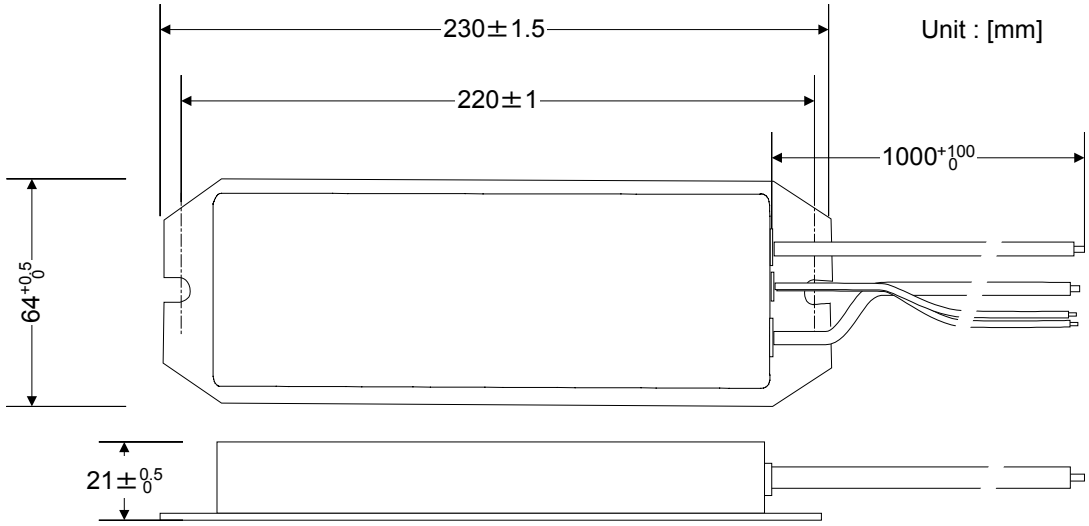
Do not place flammable objects near the external regenerative resistor because it generates heat.

For connection of the external regenerative resistor, refer to section 10-7 “External regenerative resistor.”

Series : External regenerative resistor (external braking resistor)

Type : WSR-751

Applicable to : 750 W



* Thickness of the mounting plate is 1.5 mm.

Item		Specification
Type		WSR-751
Resistor	Resistance	15 [Ω]
	Allowable power	25 [W] (Continuous)
Thermistor	Operating temperature	Open at 135 ± 5 °C
	Withstand voltage	2.5 kVAC for 1 minute
	Contact capacity	30 VDC, 0.1 A

The distance between the servo amplifier and external regenerative resistor must be within 10m.

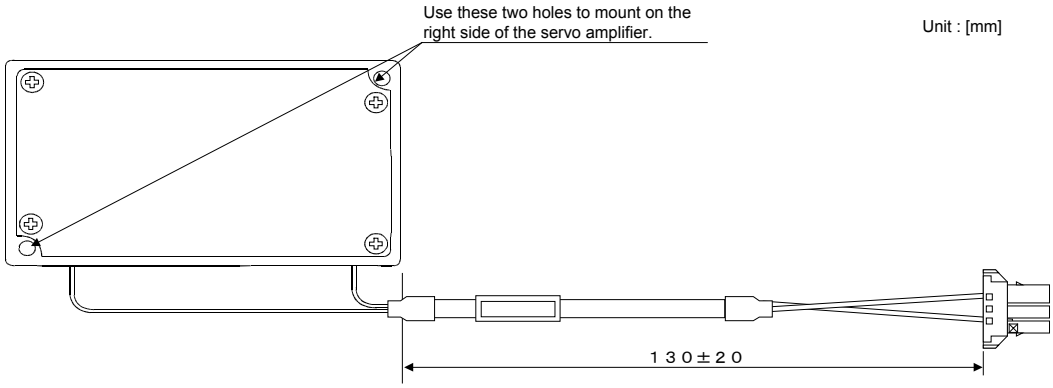
Do not place flammable objects near the external regenerative resistor because it generates heat.

For connection of the external regenerative resistor, refer to section 10-7 “External regenerative resistor.”

Series : External regenerative resistor (external braking resistor)

Type : WSR-401-T,WSR-751-T

Applicable to : 400 W or below (WSR-401-T), 750W (WSR-751-T)



Item		Specification	
Type		WSR-401-T	WSR-751-T
Resistor	Resistance	68 [Ω]	33 [Ω]
	Allowable power	12 [W] (Continuous)	12 [W] (Continuous)

FALDIC-β

11

SPECIFICATIONS

11 SPECIFICATIONS

11-1) List of servomotor specifications

(1) Slim type servomotor (50 to 750W)

200V series

■ Standard motor

Motor type GYS -		500DC1-C8B *1	101DC1-CB *1	201DC1-CA	401DC1-CA	751DC1-CA
Series		3-phase 200V				
Rated output	[W]	50	100	200	400	750
Rated torque	[N·m]	0.159	0.318	0.637	1.27	2.39
Rated speed	[r/min]	3000				
Max. speed	[r/min]	5000				
Max. torque	[N·m]	0.478	0.955	1.91	3.82	7.17
Moment of inertia	[kg/m^2]	0.0192×10^{-4}	0.0371×10^{-4}	0.135×10^{-4}	0.246×10^{-4}	0.853×10^{-4}
Rated current	[A]	0.85	0.85	1.5	2.7	4.8
Max. current	[A]	2.55	2.55	4.5	8.1	14.4
Insulation class		Class B				
Rating		Continuous rating				
Protective ventilation		Totally enclosed, self-cooling (IP 55) (except for shaft sealing and connectors)				
Terminal (Motor)		Cable 0.3 m (with connector)				
Terminal (Detector)		Cable 0.3 m (with connector)				
Overheat protection		None (Detection with servo amplifier)				
Mounting method		Flange IMB5 (L51) , IMV1 (L52) , IMV3 (L53)				
Shaft extension (*1)		Cylindrical shaft, without key		Cylindrical shaft, with key		
Paint color		N1.5				
Detector		16-bit serial encoder				
Vibration		V5 or below				
Install location and altitude		For indoors, 1000 [m] and below of site altitude				
Ambient temperatures and humidity		-10 to +40 °C, humidity: 90 % RH max. (free from condensation)				
Acceleration vibration, acceptable		49 m/s^2 (5 G)				
Mass	[kg]	0.45	0.55	1.2	1.8	3.4

■ Motor with brake (*3)

Motor type GYS - -		500DC1-C8B-B *1	101DC1-CB-B *1	201DC1-CA-B	401DC1-CA-B	751DC1-CA-B
Rated output	[W]	50	100	200	400	750
Rated torque	[N·m]	0.159	0.318	0.637	1.27	2.39
Static friction torque	[N·m]	0.3	0.3	1.27	1.27	2.45
Rated voltage		DC 24 V ± 10 %				
Attraction time	[ms]	35	35	40	40	60
Release time	[ms]	10	10	20	20	25
Power consumption (at 20 °C)	[W]	6.1	6.1	7.3	7.3	8.5
Mass	[kg]	0.62	0.72	1.7	2.3	4.2

■ Gear head (gear ratio 1/9)

Gear head type GYN -		500SAG-G09	101SAG-G09	201SAG-G09	401SAG-G09	751SAG-G09
Actual speed reduction ratio		1/9				
Rated speed of output shaft	[r/min]	333.3				
Max. speed of output shaft	[r/min]	555.5				
Rated torque of output shaft	[N·m]	1.23	2.45	4.9	9.8	18.1
Instantaneous max. torque of output shaft	[N·m]	3.68	7.36	14.7	29.4	54.3
Direction of rotation of output shaft (*4)		CCW				
Backlash		Within 40 min.		Within 30 min.		
Lubrication		Long-life grease (Sumiplex MP No. 2)				
Mass	[kg]	0.7	0.7	2.1	2.1	3.8

■ Gear head (gear ratio 1/25)

Gear head type GYN -		500SAG-G25	101SAG-G25	201SAG-G25	401SAG-G25	751SAG-G25
Actual speed reduction ratio		1/25				
Rated speed of output shaft	[r/min]	120				
Max. speed of output shaft	[r/min]	200				
Rated torque of output shaft	[N·m]	3.19	6.38	12.7	25.5	48
Instantaneous max. torque of output shaft	[N·m]	9.56	19.1	38.2	76.4	144
Direction of rotation of output shaft (*4)		CCW				
Backlash		Within 40 min.		Within 30 min.		
Lubrication		Long-life grease (Sumiplex MP No. 2)				
Mass	[kg]	0.7	0.7	2.1	2.1	3.8

(*1) The standard specification for 50W and 100W motors is “without key.” For combination with a gear head, order one with key.
(*2) The 50W motor is common to single-phase 100V and 3-phase 200V.
(*3) The brake is for retaining purpose.
(*4) Direction of rotation of gear output shaft is CCW (counter-clockwise) when the gear head input shaft rotates forward.

200V series

(2) Cubic type servomotor (100 to 750W)

■ Standard motor

Motor type GYS -	101DC1-CA	201DC1-CA	401DC1-CA	751DC1-CA
Series	3-phase 200V			
Rated output [W]	100	200	400	750
Rated torque [N·m]	0.318	0.637	1.27	2.39
Rated speed [r/min]	3000			
Max. speed [r/min]	5000			
Max. torque [N·m]	0.955	1.91	3.82	7.17
Moment of inertia [kg/m^2]	0.0577×10^{-4}	0.213×10^{-4}	0.408×10^{-4}	1.21×10^{-4}
Rated current [A]	1.0	1.5	2.6	4.8
Max. current [A]	3.0	4.5	7.8	14.4
Insulation class	Class B			
Rating	Continuous rating			
Protective ventilation	Totally enclosed, self-cooling (IP 55) (except for shaft sealing and connectors)			
Terminal (Motor)	Cable 0.3 m (with connector)			
Terminal (Detector)	Cable 0.3 m (with connector)			
Overheat protection	None (Detection with servo amplifier)			
Mounting method	Flange IMB5 (L51) , IMV1 (L52) , IMV3 (L53)			
Shaft extension	Cylindrical shaft, with key			
Paint color	N1.5			
Detector	16-bit serial encoder			
Vibration	V5 or below			
Install location and altitude	For indoors, 1000 [m] and below of site altitude			
Ambient temperatures and humidity	-10 to +40 °C, humidity: 90 % RH max. (free from condensation)			
Acceleration vibration, acceptable	49 m/s^2 (5 G)			
Mass [kg]	0.75	1.3	1.9	3.5

■ Motor with brake (*1)

Motor type GYC -	101DC1-CA-B	201DC1-CA-B	401DC1-CA-B	751DC1-CA-B
Rated output [W]	100	200	400	750
Rated torque [N·m]	0.318	0.637	1.27	2.39
Static friction torque [N·m]	0.318	1.27	1.27	2.39
Rated voltage	DC 24 V ± 10 %			
Attraction time [ms]	60	80	80	50
Release time [ms]	40	40	40	80
Power consumption (at 20 °C) [W]	6.5	9.0	9.0	8.5
Mass [kg]	1.0	1.9	2.6	4.3

■ Gear head (gear ratio 1/9)

Gear head type GYN -	101CAG-G09	201CAG-G09	401CAG-G09	751CAG-G09
Actual speed reduction ratio	1/9			
Rated speed of output shaft [r/min]	333.3			
Max. speed of output shaft [r/min]	555.5			
Rated torque of output shaft [N·m]	2.45	4.9	9.8	18.1
Instantaneous max. torque of output shaft [N·m]	7.35	14.7	29.4	54.4
Direction of rotation of output shaft (*2)	CCW			
Backlash	Within 40 min.	Within 30 min.		
Lubrication	Long-life grease (Sumiplex MP No. 2)			
Mass [kg]	0.72	2.1	2.1	3.8

■ Gear head (gear ratio 1/25)

Gear head type GYN -	101CAG-G25	201CAG-G25	401CAG-G25	751CAG-G25
Actual speed reduction ratio	1/25			
Rated speed of output shaft [r/min]	120			
Max. speed of output shaft [r/min]	200			
Rated torque of output shaft [N·m]	6.37	12.7	25.5	48
Instantaneous max. torque of output shaft [N·m]	19.1	38.2	76.4	144
Direction of rotation of output shaft (*2)	CCW			
Backlash	Within 40 min.	Within 30 min.		
Lubrication	Long-life grease (Sumiplex MP No. 2)			
Mass [kg]	0.72	2.1	2.1	3.8

(*1) The brake is for retaining purpose.
(*2) Direction of rotation of gear output shaft is CCW (counter-clockwise) when the gear head input shaft rotates forward.

11 SPECIFICATIONS

(3) Slim type servomotor (50 to 200W)

100V series

■ Standard motor

Motor type GYS -		500DC1-C8B *1	101DC1-C6B *1	201DC1-C6B *1
Series		Single-phase 100V		
Rated output	[W]	50	100	200
Rated torque	[N·m]	0.159	0.318	0.637
Rated speed	[r/min]	3000		
Max. speed	[r/min]	5000		
Max. torque	[N·m]	0.478	0.955	1.91
Moment of inertia	[kg/m^2]	0.0192×10^{-4}	0.0371×10^{-4}	0.135×10^{-4}
Rated current	[A]	0.85	1.5	2.7
Max. current	[A]	2.55	4.5	8.1
Insulation class		Class B		
Rating		Continuous rating		
Protective ventilation		Totally enclosed, self-cooling (IP 55)		
Terminal (Motor)		Cable 0.3 m (with connector)		
Terminal (Detector)		Cable 0.3 m (with connector)		
Overheat protection		None (Detection with servo amplifier)		
Mounting method		Flange IMB5 (L51) , IMV1 (L52) , IMV3 (L53)		
Shaft extension (*1)		Cylindrical shaft ,without key / Cylindrical shaft, with key		
Paint color		N1.5		
Detector		16-bit serial encoder		
Vibration		V5 or below		
Install location and altitude		For indoors, 1000 [m] and below of site altitude		
Ambient temperatures and humidity		-10 to +40 °C, humidity: 90 % RH max. (free from condensation)		
Acceleration vibration, acceptable		49 m/s^2 (5G)		
Mass	[kg]	0.45	0.55	1.2

■ Motor with brake (*3)

Motor type GYS - -		500DC1-C8B-B *1	101DC1-C6B-B *1	201DC1-C6B-B *1
Rated output	[W]	50	100	200
Rated torque	[N·m]	0.159	0.318	0.637
Static friction torque	[N·m]	0.3	0.3	1.27
Rated voltage		DC 24 V ± 10 %		
Attraction time	[ms]	35	35	40
Release time	[ms]	10	10	20
Power consumption (at 20 °C)	[W]	6.1	6.1	7.3
Mass	[kg]	0.62	0.72	1.7

■ Gear head (gear ratio 1/9)

Gear head type GYN -		500SAG-G09	101SAG-G09	201SAG-G09
Actual speed reduction ratio		1/9		
Rated speed of output shaft	[r/min]	333.3		
Max. speed of output shaft	[r/min]	555.5		
Rated torque of output shaft	[N·m]	1.23	2.45	4.9
Instantaneous max. torque of output shaft	[N·m]	3.68	7.36	14.7
Direction of rotation of output shaft (*4)		CCW		
Backlash		Within 40 min.		Within 30 min.
Lubrication		Long-life grease (Sumiplex MP No. 2)		
Mass	[kg]	0.7	0.7	2.1

■ Gear head (gear ratio 1/25)

Gear head type GYN -		500SAG-G25	101SAG-G25	201SAG-G25
Actual speed reduction ratio		1/25		
Rated speed of output shaft	[r/min]	120		
Max. speed of output shaft	[r/min]	200		
Rated torque of output shaft	[N·m]	3.19	6.38	12.7
Instantaneous max. torque of output shaft	[N·m]	9.56	19.1	38.2
Direction of rotation of output shaft (*4)		CCW		
Backlash		Within 40 min.		Within 30 min.
Lubrication		Long-life grease (Sumiplex MP No. 2)		
Mass	[kg]	0.7	0.7	2.1

(*1) The standard specification for 50W, 100W and 200W motors is “without key.” For combination with a gear head, order one with key.
(*2) The 50W motor is common between single-phase 100V and 3-phase 200V.
(*3) The brake is for retaining purpose.
(*4) Direction of rotation of gear output shaft is CCW (counter-clockwise) when the gear head input shaft rotates forward.

We can meet requirements for a geared servomotor equipped with planetary reduction gear of 3 minutes or shorter lost motion (backlash).

The reduction gear is made by Harmonic Drive Systems Co., Ltd.

Contact us for the specification, delivery term, price and other features of the item.

[Speed reduction ratio: 5]

Type of HPG	Motor capacity [W]	Item	Fuji Electric	
			GYS	GYC
14	50	M size [mm]	45	-
		Shape symbol	ABD	
		Inertia of reduction gear (10^{-4} kg · m^2)	0.0811	
		Ratio of inertia of reduction gear to that of motor	4.2	
	100	M size [mm]	45	45
		Shape symbol	ABJ	ACJ
		Inertia of reduction gear (10^{-4} kg · m^2)	0.0806	0.0800
		Ratio of inertia of reduction gear to that of motor	2.2	1.5
20	200	M size [mm]	52	59
		Shape symbol	GCJ	HDJ
		Inertia of reduction gear (10^{-4} kg · m^2)	0.6529	0.6529
		Ratio of inertia of reduction gear to that of motor	4.6	3.0
	400	M size [mm]	52	59
		Shape symbol	GHJ	HBJ
		Inertia of reduction gear (10^{-4} kg · m^2)	0.6529	0.6529
		Ratio of inertia of reduction gear to that of motor	2.6	1.6
	750	M size [mm]	59	59
		Shape symbol	HBM	HDM
		Inertia of reduction gear (10^{-4} kg · m^2)	0.6475	0.6475
		Ratio of inertia of reduction gear to that of motor	0.6	0.6

These are examples of reduction ratio 5. Contact us for details.

11-2) List of servo amplifier specifications

200V series

(1) Basic specifications (3-phase 200V)

Amplifier type		RYB500S3 -VBC	RYS101S3 -VBC	RYS201S3 -VBC	RYS401S3 -VBC	RYS751S3 -VBC
Capacity [W]		50	100	200	400	750
Input	Phase	3-phase (or single phase with 400W or below)				
	Voltage	AC 200 to 230 V –15 % to +10 %				
	Frequency	50 / 60Hz				
Output	Control method	Totally digital sinusoidal PWM current control				
	Overload capability	300 % for 3 sec.				
	Braking method	Regenerative braking to DC link circuit, optional external regenerative resistor				
	Carrier frequency	10 kHz				
Encoder		Exclusively incremental 16-bit serial encoder (resolution of each revolution: 16 bits = 65536)				
Functions and performance	Control performance	Position control through pulse string input				
	Max. pulse frequency	Input: 1.0 MHz (differential), 200 kHz (open collector), output: 500 kHz (differential)				
	Position control resolution	2^{16} (= 65536) in each revolution				
	Frequency response	600 Hz (Moment of load inertia after conversion into motor shaft extension (JL) = moment of inertia of motor rotor (JM))				
Moment of load inertia		Within 100 times of moment of inertia of motor rotor				
Protective functions (alarms)		Overcurrent (01, 02), overspeed (03), overvoltage (04), encoder trouble (05), control power alarm (06, 07), memory alarm (08), combination alarm (09), regenerative transistor overheat (10), encoder communication alarm (11), CONT duplication (12), overload (13), undervoltage (14), regenerative resistor overheat (15), deviation limit (16), amplifier overheat (17), encoder overheat (18), initial error (19)				
Operating environment	Installation site	For indoors, 1000m or below of site altitude, under clean atmosphere, no explosive hazardous gas and vapor is existing. In the case of compliance with the European standard: Pollution degree = 2, overvoltage category = II				
	Ambient temperature and humidity	-10 to +50 °C, 10 to 90 % RH (free from condensation)				
	Vibration / shock	4.9 m/s^2 (0.5 G) , 19.6 m/s^2 (2 G)				
Others		UL / cUL (compliance with UL508c), European standards (compliance with EN 50178) (being applied for)				
Mass [kg]		0.6			0.7	1.0

* Install an AC reactor for 500kVA or larger power supply capacities.
* Contact us for close installation requirements.

100V series

(2) Basic specifications (Single-phase 100V)

Amplifier type		RYB500S3 -VBC6	RYS101S3 -VBC6	RYS201S3 -VBC6
Capacity [W]		50	100	200
Input	Phase	Single-phase		
	Voltage	AC 100 to 115 V –15 % to +10 %		
	Frequency	50 / 60Hz		
Output	Control method	Totally digital sinusoidal PWM current control		
	Overload capability	300 % for 3 sec.		
	Braking method	Regenerative braking to DC link circuit, optional external regenerative resistor		
	Carrier frequency	10 kHz		
Encoder		Exclusively incremental 16-bit serial encoder (resolution of each revolution: 16 bits = 65536)		
Functions and performance	Control performance	Position control through pulse string input		
	Max. pulse frequency	Input: 1.0 MHz (differential), 200 kHz (open collector), output: 500 kHz (differential)		
	Position control resolution	2^{16} (= 65536) in each revolution		
	Frequency response	600 Hz (Moment of load inertia after conversion into motor shaft extension (JL) = moment of inertia of motor rotor (JM))		
Moment of load inertia		Within 100 times of moment of inertia of motor rotor		
Protective functions (alarms)		Overcurrent (01, 02), overspeed (03), overvoltage (04), encoder trouble (05), control power alarm (06, 07), memory alarm (08), combination alarm (09), regenerative transistor overheat (10), encoder communication alarm (11), CONT duplication (12), overload (13), undervoltage (14), regenerative resistor overheat (15), deviation limit (16), amplifier overheat (17), encoder overheat (18), initial error (19)		
Operating environment	Installation site	For indoors, 1000m or below of site altitude, under clean atmosphere, no explosive hazardous gas and vapor is existing. In the case of compliance with the European standard: Pollution degree = 2, overvoltage category = II		
	Ambient temperature and humidity	-10 to +50 °C, 10 to 90 % RH (free from condensation)		
	Vibration / shock	4.9 m/s^2 (0.5 G) , 19.6 m/s^2 (2 G)		
Others		UL / cUL (compliance with UL508c), European standards (compliance with EN 50178) (being applied for)		
Mass [kg]		0.6		0.7

* Install an AC reactor for 500kVA or larger power supply capacities.
* Contact us for close installation requirements.

(3) Interface specifications (Common between 3-phase 200V and single-phase 100V)

Terminal name	Symbol	Specification
Pulse string input	CA, *CA CB, *CB	Max. input frequency: 1.0 MHz (differential), 200 kHz (open collector)
		(1) Command pulse / command sign, (2) Forward rotation pulse / reverse rotation pulse, (3) Two signals with 90-degree phase difference
	PPI	Pull-up power input with open collector input (12 to 24 VDC)
Dividing output	FFA, *FFA FFB, *FFB	Max. output frequency: 500 kHz (differential)
		Two signals with 90-degree phase difference
		16 to 16384 [pulses/rev] (in 1 increments)
	FFZ, *FFZ	Differential output [1 pulse/rev]
	FZ, M5	Open collector output [1 pulse/rev]
Power supply input for sequence signals	P24, M24	+24 VDC, 300 mA (Supplied externally)
Sequence input signal	COUNT 1 to COUNT 5	+24 VDC, 10 mA (1 point) source input, terminal assigned to sequence input signal
Sequence output signal	OUT 1 to OUT 2	+30 VDC, 50 mA (max.) sink output, terminal assigned to sequence output signal

11-3) Speed-torque characteristics

Shown below are the torque characteristics with each servomotor and servo amplifier combination.

In the characteristics diagram, the axis of abscissas indicates the speed and the axis of ordinates indicates the motor output torque, and the servo motor can be continuously operated within the “continuous operation area” at rated speed or lower.

The rated torque cannot be output continuously above the rated speed.

The servomotor uses the “acceleration/deceleration area” for acceleration/deceleration. Toques above the rating cannot be output continuously. If torques above the rating is output continuously, the servomotor trips due to an overload.

The overload detecting time (guidepost) is as follows.

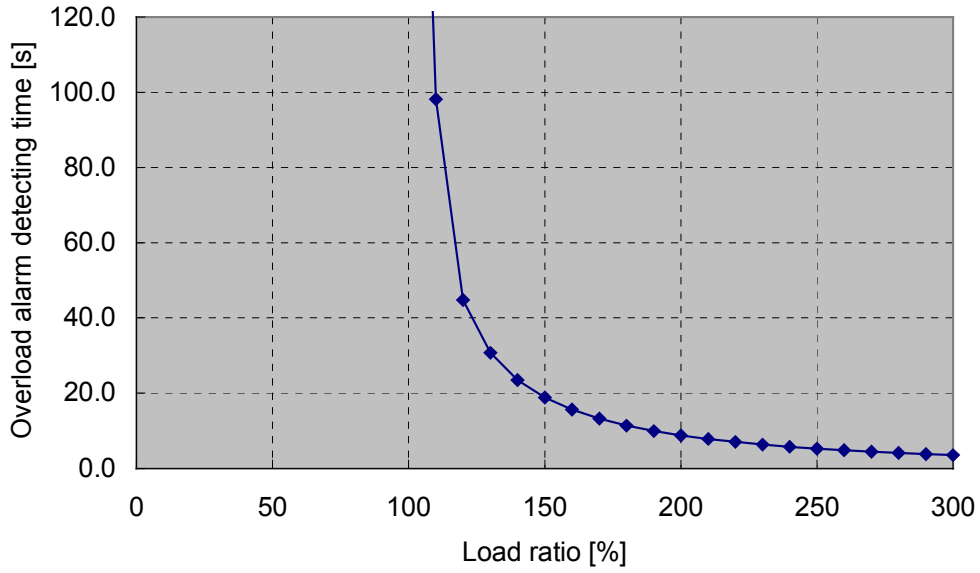
Overload detecting time

Continuous output torque	Overload detecting time
100 % (rated torque)	(Continuous)
200 % (rated torque)	About 35 sec
300 % (rated torque)	About 18 sec
400 % (rated torque)	About 9 sec
500 % (rated torque)	About 3 sec

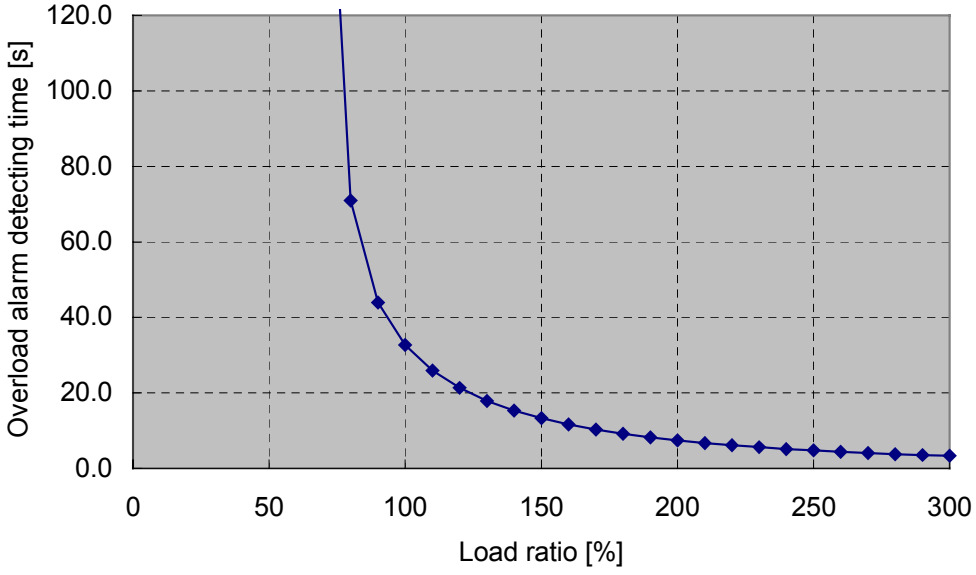
* The output torque is indicated in percentage to the rated torque (at rated speed or lower).

■ Overload alarm [13] detecting time

1) Overload alarm detecting time for operation at 3000 r/min



2) Overload alarm detecting time for operation at 5000 r/min

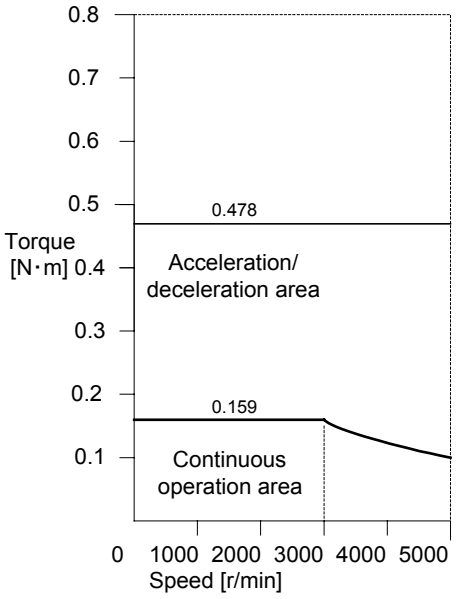


11 SPECIFICATIONS

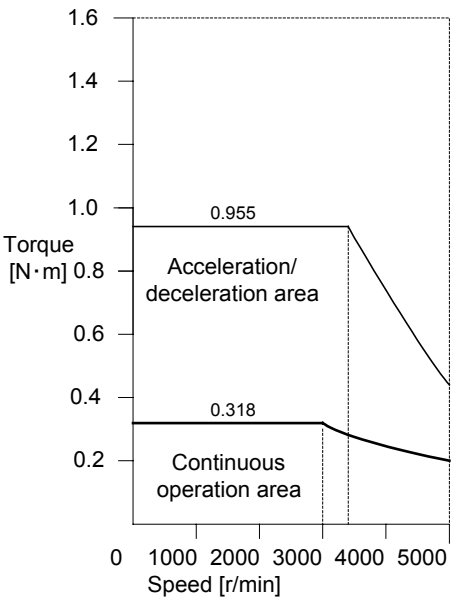
200V series

■ GYS type (slim type / 200V series)

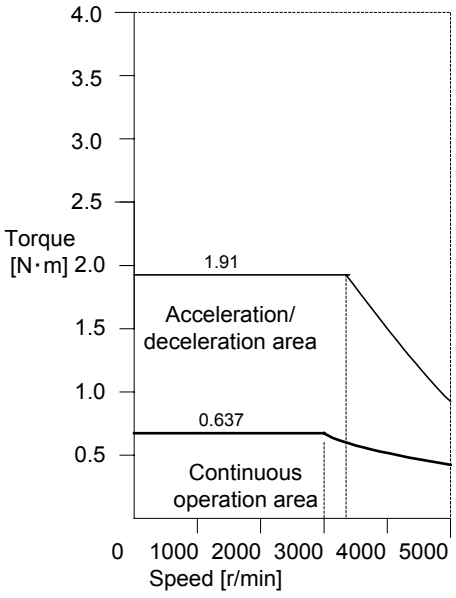
- GYS500DC1-C8B*1 (50 W)



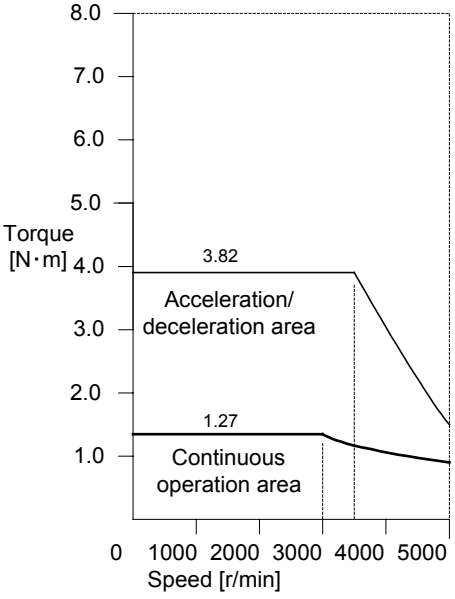
- GYS101DC1-CB (100 W)



- GYS201DC1-CA (200 W)



- GYS401DC1-CA (400 W)

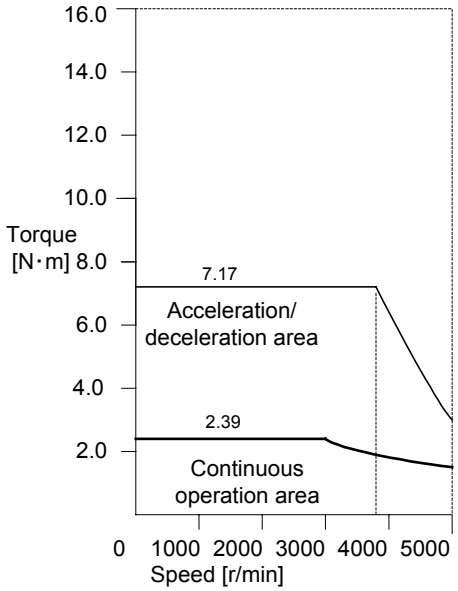


*1. GYS500DC1-C8B can be powered by 100V or 200V.

200V series

■ GYS type (slim type / 200V series)

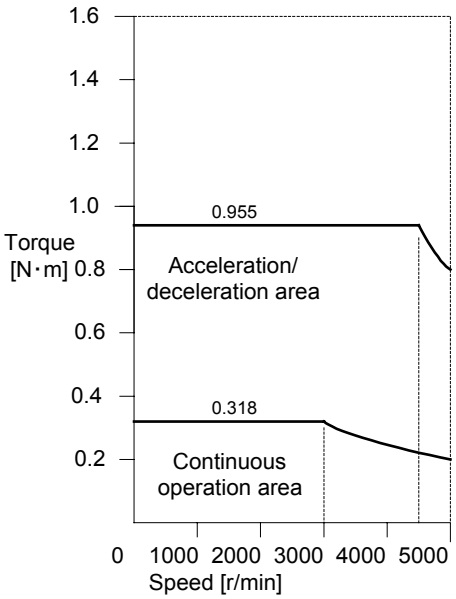
-GYS751DC1-CA (750 W)



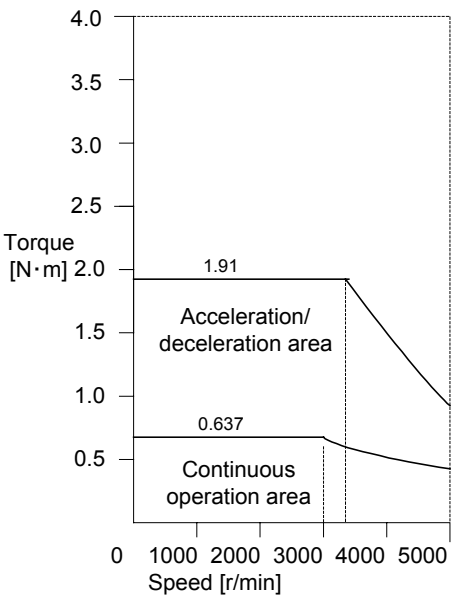
200V series

■ GYC type (cubic type / 200V series)

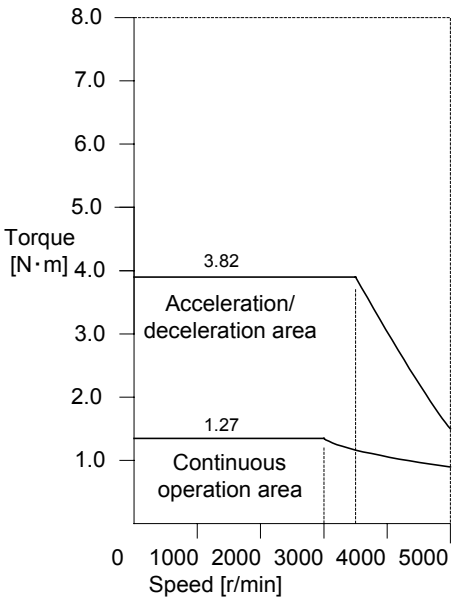
-GYC101DC1-CA (100 W)



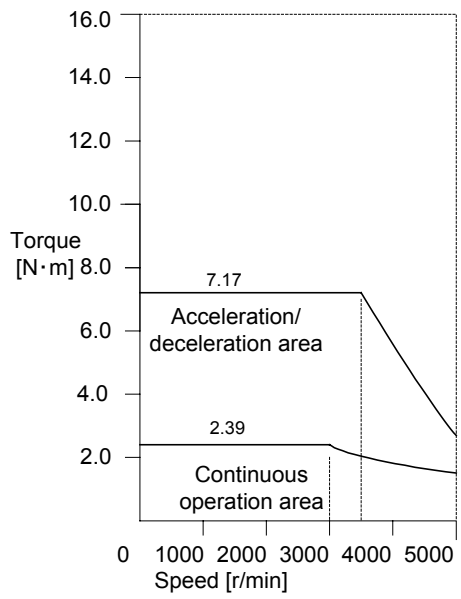
-GYC201DC1-CA (200 W)



-GYC401DC1-CA (400 W)



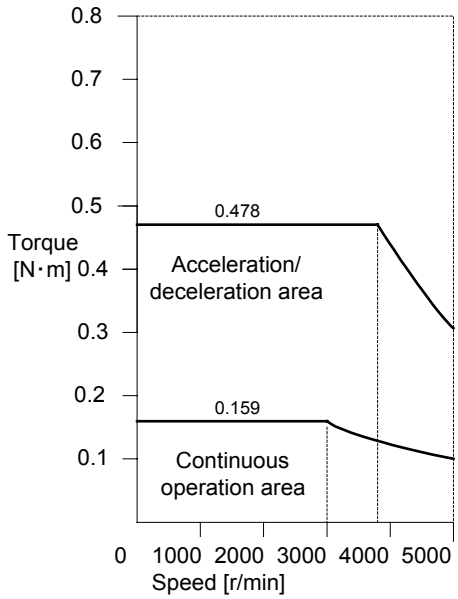
-GYC751DC1-CA (750 W)



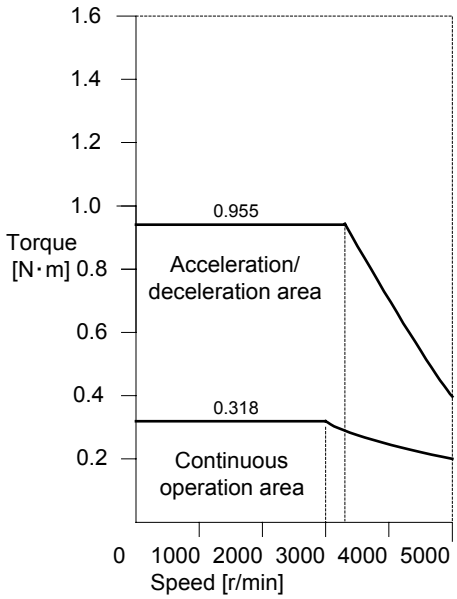
100V series

■ GYS type (slim type / 100V series)

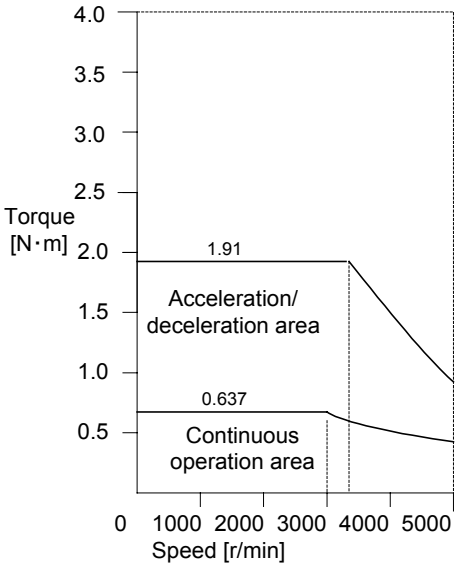
-GYS500DC1-C8B *1 (50 W)



-GYS101DC1-C6B (100 W)



-GYS201DC1-C6B (200 W)



*1. GYS500DC1-C8B can be powered by 100V or 200V.

-MEMO-

11-4) Dimensional drawing

Dimensions are in millimeters [mm].

The dimensions are subject to change without notice. Before placing an order, request us for final drawings.

1 Shaft extension

The standard output shaft of the servomotor is cylindrical with key.

Servomotor with brake and gear head are similar.

However, the standard output shaft of only the servomotors listed in the table below are cylindrical without key.

Cylindrical without key (standard)

Series	Servomotor type	Motor capacity
Single-phase 100V	GYS500DC1-C8B	50W
	GYS101DC1-C6B	100W
	GYS201DC1-C6B	200W
3-phase 200V	GYS500DC1-C8B	50W
	GYS101DC1-CB	100W

Contact us for different shaft extension shapes.

2 Mounting

The standard mounting type of the servomotor is flange.

The servomotor with brake and gear head are similar.

3 Wiring

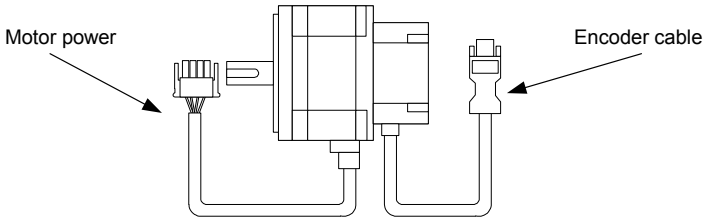
- Motor power cable (Servomotor)

The GYC and GYS servomotors are equipped with 0.3 m cable extension (with connectors).

No wiring connectors come with the servomotor.

Optional cable and connector kit equipped with connectors at both ends are prepared.

■ Example of appearance of servomotor



- Encoder cable

The GYC and GYS servomotors are equipped with 0.3m cable extension (with connectors).

No wiring connectors come with the servomotor.

Optional cable and connector kit equipped with connectors at both ends are prepared.

11 SPECIFICATIONS

■ Series : GYS series motor, standard type

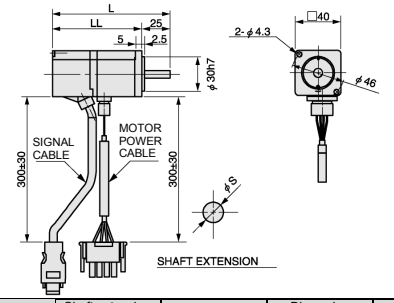
- 50W / 100W

*For combination with gear head, order one equipped with key.

(100V series)
•GYS500DC1-C8B
•GYS101DC1-C6B

(200V series)
•GYS500DC1-C8B
•GYS101DC1-CB

(Unit : mm)



Type	Shaft extension shape	Overall length	Dimension (flange)	Mass
	φS	L	LL	[kg]
GYS500DC1-C8B*	6h6	103	78	0.45
GYS101DC1-CB	8h6	121	96	0.55
GYS101DC1-C6B	8h6	121	96	0.55

* Common with 100V series.

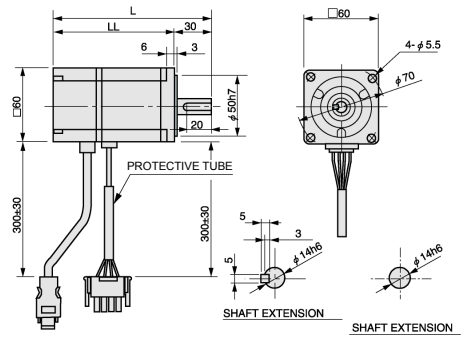
- 200W / 400W

* For combination with gear head, order one equipped with key. (100V series)

(100V series)
•GYS201DC1-C6B

(200V series)
•GYS201DC1-CA
•GYS401DC1-CA

(Unit : mm)

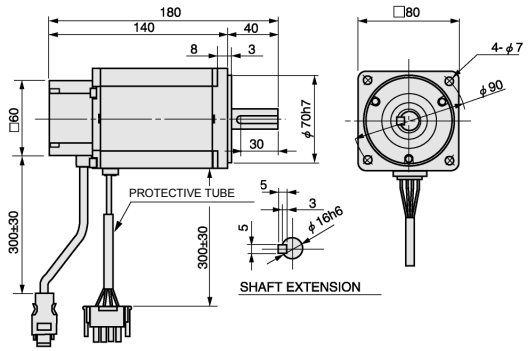


Type	Overall length	Dimension (flange)	Mass
	L	LL	[kg]
GYS201DC1-CA	126.5	96.5	1.2
GYS401DC1-CA	154.5	124.5	1.8
GYS201DC1-C6B	126.5	96.5	1.2

- 750W

•GYS751DC1-CA

(Unit : mm)



Mass : 3.4 [kg]

■ Series : GYS series motor with brake

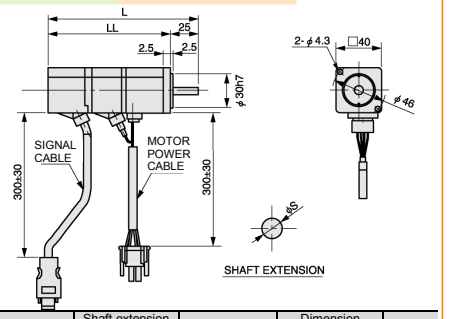
- 50W / 100W

*For combination with gear head, order one equipped with key.

(100V series)
•GYS500DC1-C8B-B
•GYS101DC1-C6B-B

(200V series)
•GYS500DC1-C8B-B
•GYS101DC1-CB-B

(Unit : mm)



Type	Shaft extension shape φS	Overall length L	Dimension (flange) LL	Mass [kg]
GYS500DC1-C8B-B*	6h6	140	115	0.62
GYS101DC1-CB-B	8h6	158	133	0.72
GYS101DC1-C6B-B	8h6	158	133	0.72

* Common with 100V series.

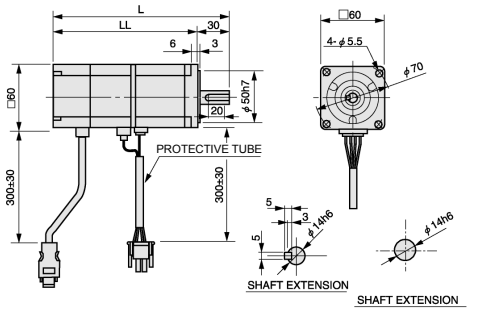
- 200W / 400W

* For combination with gear head, order one equipped with key. (100V series)

(100V series)
•GYS201DC1-C6B-B

(200V series)
•GYS201DC1-CA-B
•GYS401DC1-CA-B

(Unit : mm)

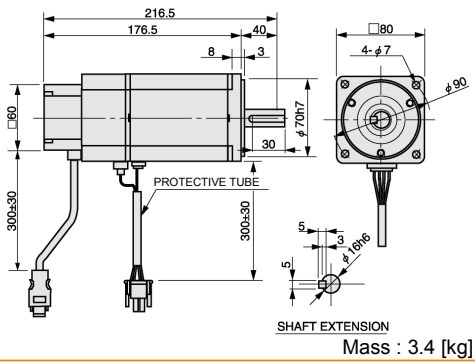


Type	Overall length L	Dimension (flange) LL	Mass [kg]
GYS201DC1-CA-B	165	135	1.7
GYS401DC1-CA-B	193	163	2.3
GYS201DC1-C6B-B	165	135	1.7

- 750W

•GYS751DC1-CA-B

(Unit : mm)



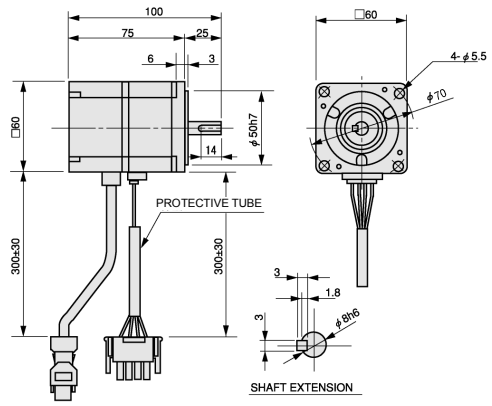
Mass : 3.4 [kg]

11 SPECIFICATIONS

■ Series : GYC series motor, standard type

- 100W

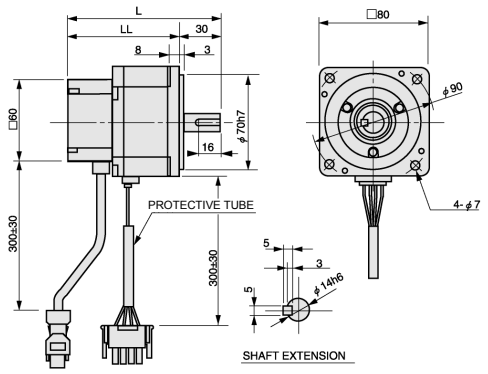
•GYC101DC1-CA (Unit : mm)



Mass : 0.75 [kg]

- 200W / 400W

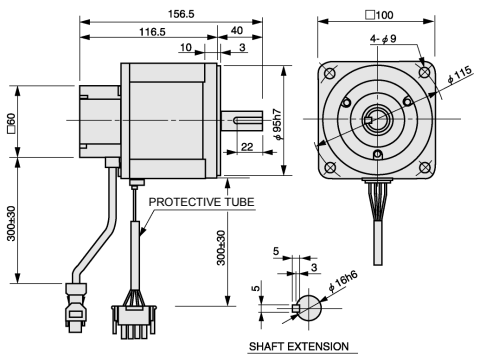
•GYC201DC1-CA •GYC401DC1-CA (Unit : mm)



Type	Overall length L	Dimension (flange) LL	Mass [kg]
GYC201DC1-CA	112	82	1.3
GYC401DC1-CA	127	97	1.9

- 750W

•GYC751DC1-CA (Unit : mm)

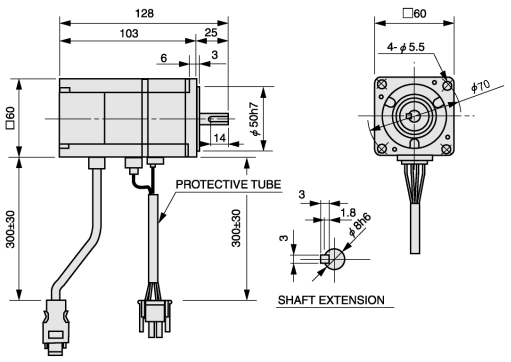


Mass : 3.5 [kg]

■ Series : GYC series motor with brake

- 100W

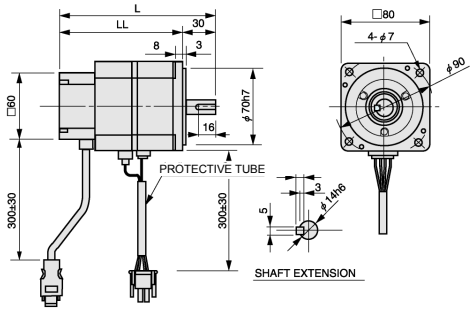
•GYC101DC1-CA-B (Unit : mm)



Mass : 1.0 [kg]

- 200W / 400W

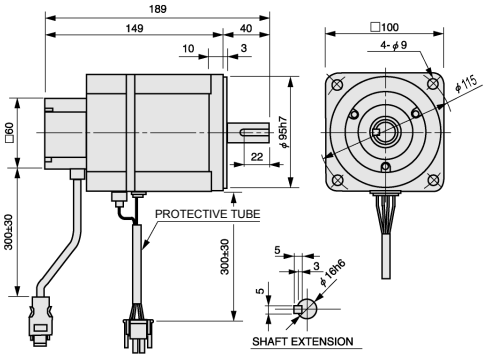
•GYC201DC1-CA-B •GYC401DC1-CA-B (Unit : mm)



Type	Overall length L	Dimension (flange) LL	Mass [kg]
GYC201DC1-CA-B	143.5	113.5	1.9
GYC401DC1-CA-B	158.5	128.5	2.6

- 750W

•GYC751DC1-CA-B (Unit : mm)



Mass : 4.3 [kg]

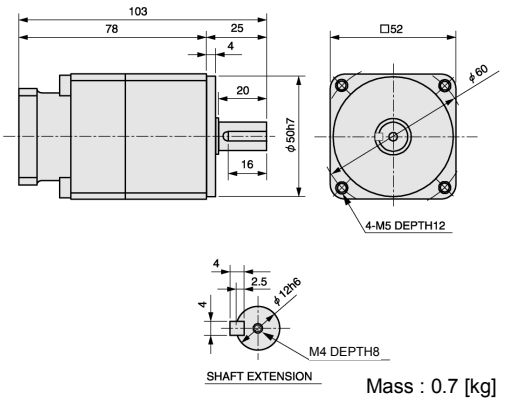
11 SPECIFICATIONS

■ Series : Gear head (1/9, 1/25) for GYS series motor

- 50W / 100W

•GYN500SAG-G09 •GYN500SAG-G25
•GYN101SAG-G09 •GYN101SAG-G25

(Unit : mm)

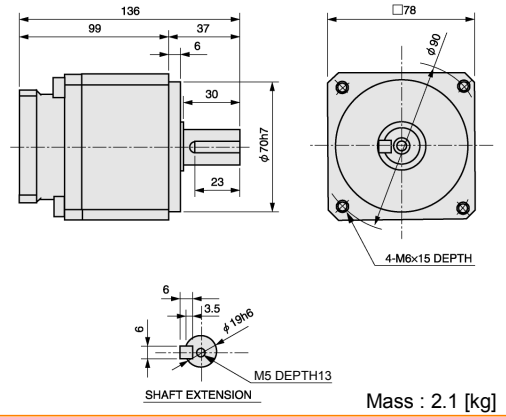


Mass : 0.7 [kg]

- 200W / 400W

•GYN201SAG-G09 • GYN201SAG-G25
•GYN401SAG-G09 • GYN401SAG-G25

(Unit : mm)

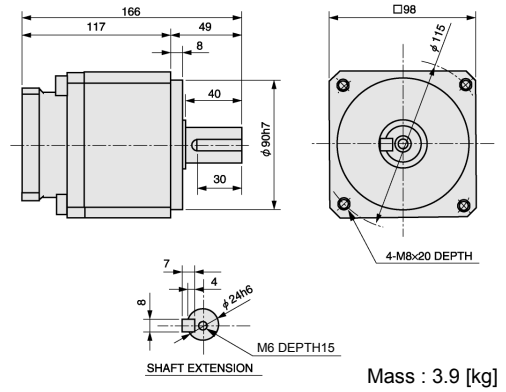


Mass : 2.1 [kg]

- 750W

•GYN751SAG-G09 •GYN751SAG-G25

(Unit : mm)

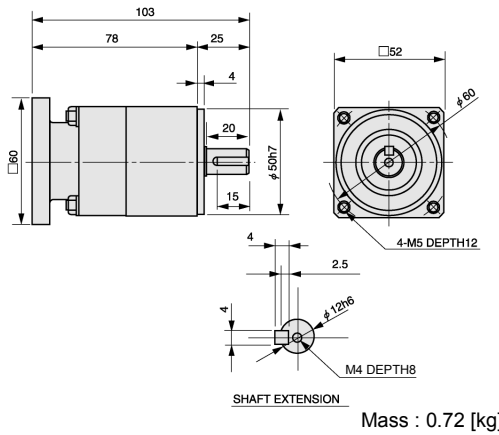


Mass : 3.9 [kg]

■ Series : Gear head (1/9, 1/25) for GYC series motor

- 100W

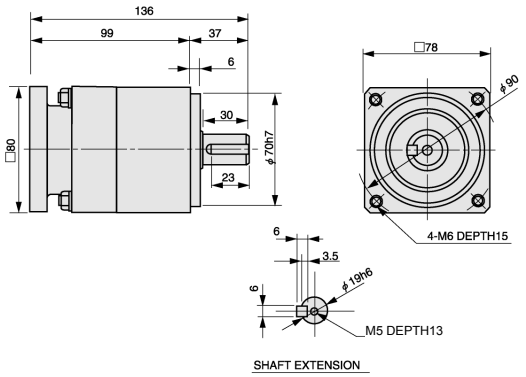
•GYN101CAG-G09 •GYN101CAG-G25 (Unit : mm)



Mass : 0.72 [kg]

- 200W / 400W

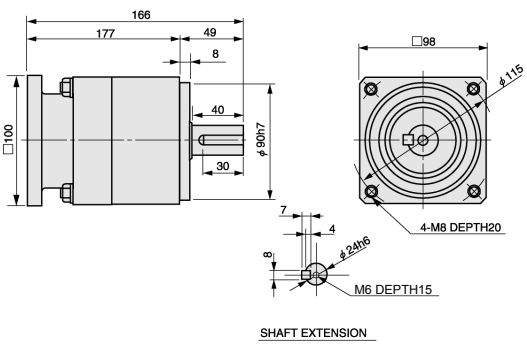
•GYN201CAG-G09 •GYN201CAG-G25
•GYN401CAG-G09 •GYN401CAG-G25 (Unit : mm)



Mass : 2.1 [kg]

- 750W

•GYN751CAG-G09 •GYN751CAG-G25 (Unit : mm)

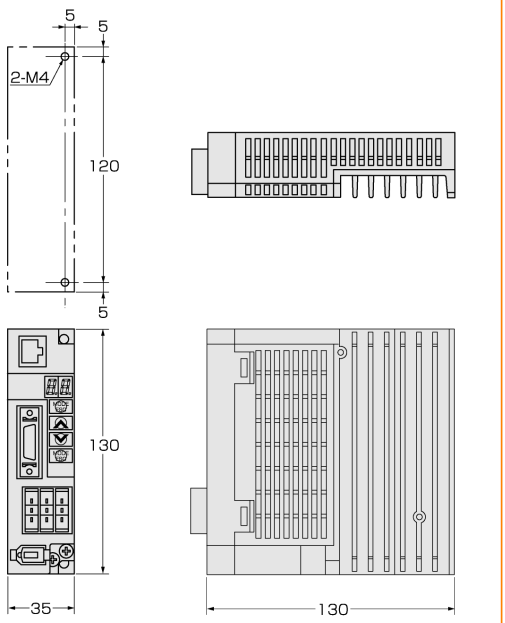


Mass : 3.8 [kg]

■ Servo amplifier

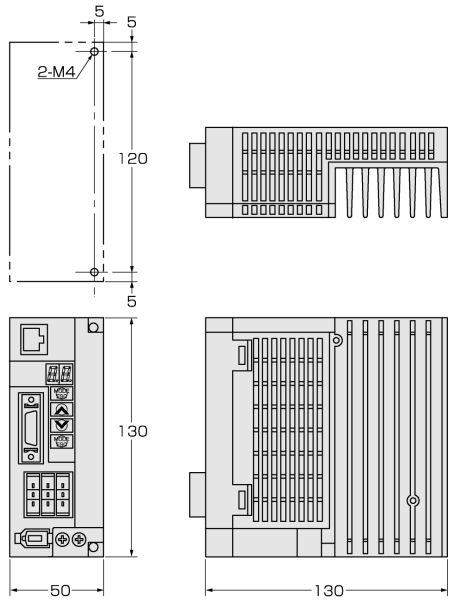
200V series	50W～200W
100V series	50W、100W

(Unit : mm)



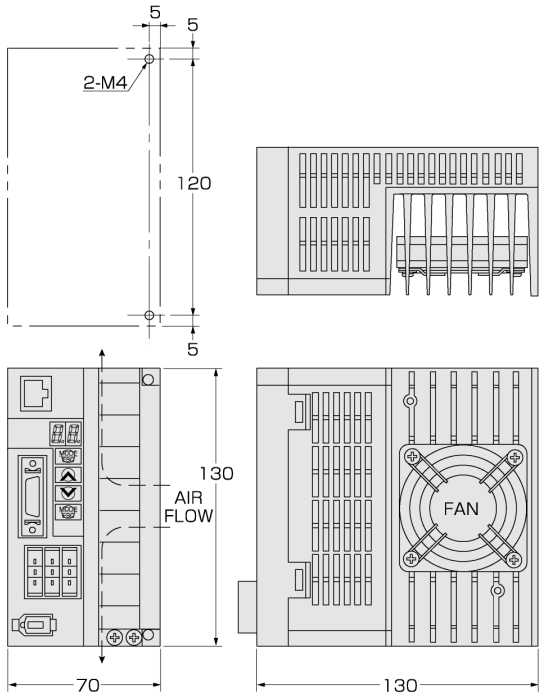
200V series	400W
100V series	200W

(Unit : mm)



200V series	750W

(Unit : mm)



FALDIC-β

APPENDIXES

■ Inertia moment calculation

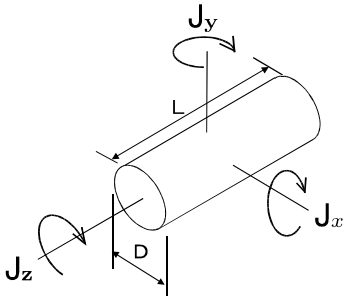
■ Load torque

■ Timing chart

APPENDIXES

■ Calculation of moment of inertia

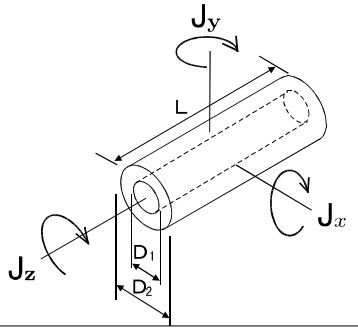
- Shape



$$J_z = \frac{W}{8}\left(\frac{D}{10^3}\right)^2 = \frac{\pi\rho}{32}\left(\frac{L}{10^3}\right)\left(\frac{D}{10^3}\right)^4$$

$$J_x = J_y = \frac{W}{16}\left(\frac{D}{10^3}\right)^2 + \frac{W}{12}\left(\frac{L}{10^3}\right)^2$$

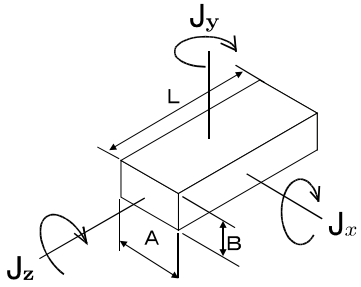
$$W = \frac{\pi\rho}{4}\left(\frac{L}{10^3}\right)\left(\frac{D}{10^3}\right)^2$$



$$J_z = \frac{W}{8}\left(\left(\frac{D_2}{10^3}\right)^2 + \left(\frac{D_1}{10^3}\right)^2\right) = \frac{\pi\rho}{32}\left(\frac{L}{10^3}\right)\left(\left(\frac{D_2}{10^3}\right)^4 - \left(\frac{D_1}{10^3}\right)^4\right)$$

$$J_x = J_y = \frac{W}{16}\left(\left(\frac{D_2}{10^3}\right)^2 + \left(\frac{D_1}{10^3}\right)^2\right) + \frac{W}{12}\left(\frac{L}{10^3}\right)^2$$

$$W = \frac{\pi\rho}{4}\left(\frac{L}{10^3}\right)\left(\left(\frac{D_2}{10^3}\right)^2 - \left(\frac{D_1}{10^3}\right)^2\right)$$

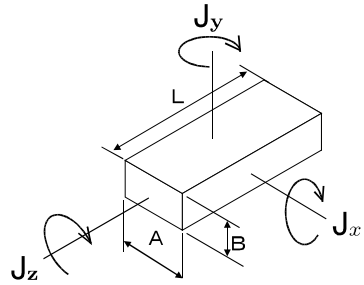


$$J_z = \frac{W}{16}\left(\left(\frac{A}{10^3}\right)^2 + \left(\frac{B}{10^3}\right)^2\right)$$

$$J_x = \frac{W}{16}\left(\frac{B}{10^3}\right)^2 + \frac{W}{12}\left(\frac{L}{10^3}\right)^2$$

$$J_y = \frac{W}{16}\left(\frac{A}{10^3}\right)^2 + \frac{W}{12}\left(\frac{L}{10^3}\right)^2$$

$$W = \frac{\pi\rho}{4}\left(\frac{A}{10^3}\right)\left(\frac{B}{10^3}\right)\left(\frac{L}{10^3}\right)$$

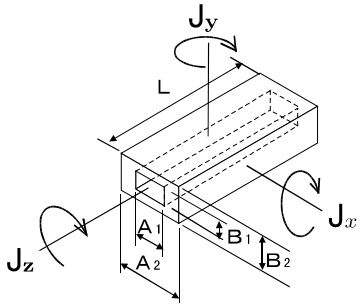


$$J_x = \frac{W}{12}\left(\left(\frac{B}{10^3}\right)^2 + \left(\frac{L}{10^3}\right)^2\right)$$

$$J_y = \frac{W}{12}\left(\left(\frac{L}{10^3}\right)^2 + \left(\frac{A}{10^3}\right)^2\right)$$

$$J_z = \frac{W}{12}\left(\left(\frac{A}{10^3}\right)^2 + \left(\frac{B}{10^3}\right)^2\right)$$

$$W = \rho\left(\frac{A}{10^3}\right)\left(\frac{B}{10^3}\right)\left(\frac{L}{10^3}\right)$$



$$J_x = \frac{W_2}{12}\left(\left(\frac{B_2}{10^3}\right)^2 + \left(\frac{L}{10^3}\right)^2\right) - \frac{W_1}{12}\left(\left(\frac{B_1}{10^3}\right)^2 + \left(\frac{L}{10^3}\right)^2\right)$$

$$J_y = \frac{W_2}{12}\left(\left(\frac{A_2}{10^3}\right)^2 + \left(\frac{L}{10^3}\right)^2\right) - \frac{W_1}{12}\left(\left(\frac{A_1}{10^3}\right)^2 + \left(\frac{L}{10^3}\right)^2\right)$$

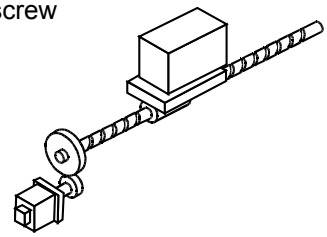
$$J_z = \frac{W_2}{12}\left(\left(\frac{A_2}{10^3}\right)^2 + \left(\frac{B_2}{10^3}\right)^2\right) - \frac{W_1}{12}\left(\left(\frac{A_1}{10^3}\right)^2 + \left(\frac{B_1}{10^3}\right)^2\right)$$

$$W = \rho\left(\left(\frac{A_2}{10^3}\right)\left(\frac{B_2}{10^3}\right) - \left(\frac{A_1}{10^3}\right)\left(\frac{B_1}{10^3}\right)\right)\left(\frac{L}{10^3}\right)$$

$$W_2 = \rho\left(\frac{A_2}{10^3}\right)\left(\frac{B_2}{10^3}\right)\left(\frac{L}{10^3}\right) \qquad W_1 = \rho\left(\frac{A_1}{10^3}\right)\left(\frac{B_1}{10^3}\right)\left(\frac{L}{10^3}\right)$$

- Conversion

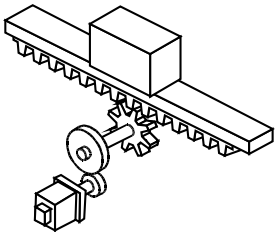
Ball-screw



$$J_1 = W\left(\frac{1}{2\pi} \times \frac{BP}{10^3}\right)^2 \times GL^2$$

W : Mass of movable part [kg]
BP : Lead of thread [mm]
GL : Reduction ratio (no unit)

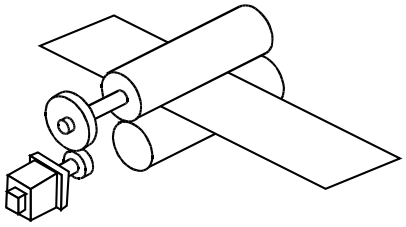
Rack and pinion, conveyor, chain drive



$$J_1 = W\left(\frac{1}{2\pi} \times \frac{BP}{10^3}\right)^2 \times GL^2$$

W : Total mass of moving parts [kg]
D : Diameter of pinion [mm]
: Diameter of sprocket [mm]
GL : Reduction ratio (no unit)

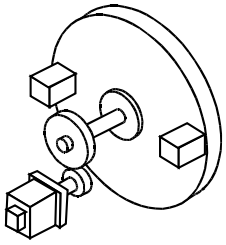
Feed roll



$$J_3 = \frac{W}{4}\left(\frac{D}{10^3}\right)^2 \times GL^2$$

W : Total mass of moving parts [kg]
D : Diameter of roll [mm]
GL : Reduction ratio (no unit)

Rotor, table drive



The moment of inertia can be obtained as a sum of each shape.Moment of inertia of an object placed at a distance from rotating shaft (J_4)

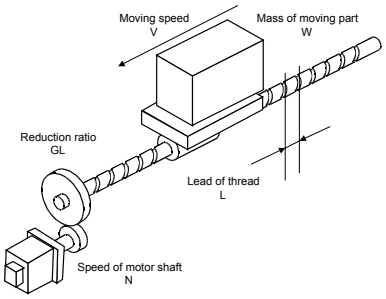
$$J_4 = \left(J + W\left(\frac{L}{10^3}\right)^2\right) \times GL^2$$

J : Moment of inertia around CG of body
W : Mass of body [kg]
L : Distance between body and rotating shaft [mm]
GL : Reduction ratio (no unit)

APPENDIXES

■ Load torque (T_L)

Ball-screw



$$T_L = \frac{(\mu W + F) \times 9.81}{2\pi\eta} \left(\frac{BP}{10^3}\right) \times GL$$

μ	:	Coefficient of friction
BP	:	Lead of thread [mm]
W, W_1	:	Mass of moving part [kg]
W_2	:	Mass of counter-weight [kg]
GL	:	Reduction ratio (no unit)
F	:	Thrust force [kg]

- When lifting vertically

$$T_L = \frac{((\mu + 1) W_1 - W_2) \times 9.81}{2\pi\eta} \left(\frac{BP}{10^3}\right) \times GL$$

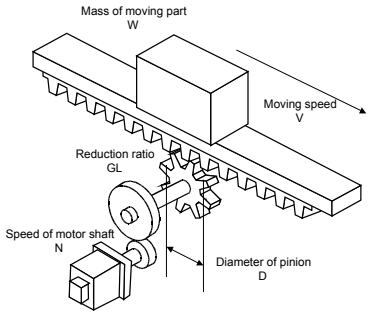
- When lowering vertically

$$T_L = \frac{((\mu - 1) W_1 - W_2) \times 9.81}{2\pi\eta} \left(\frac{BP}{10^3}\right) \times GL$$

- When stopping vertically

$$T_L = \frac{(W_1 - W_2) \times 9.81}{2\pi\eta} \left(\frac{BP}{10^3}\right) \times GL$$

Conveyor, rack and pinion



$$T_L = \frac{(\mu W + F) \times 9.81}{\eta} \left(\frac{D}{2} \times \frac{1}{10^3}\right) \times GL$$

μ	:	Coefficient of friction
D	:	Diameter [mm]
W, W_1	:	Mass of moving part [kg]
W_2	:	Mass of counter-weight [kg]
GL	:	Reduction ratio (no unit)

- When lifting vertically

$$T_L = \frac{((\mu + 1) W_1 - W_2) \times 9.81}{\eta} \left(\frac{D}{2} \times \frac{1}{10^3}\right) \times GL$$

- When lowering vertically

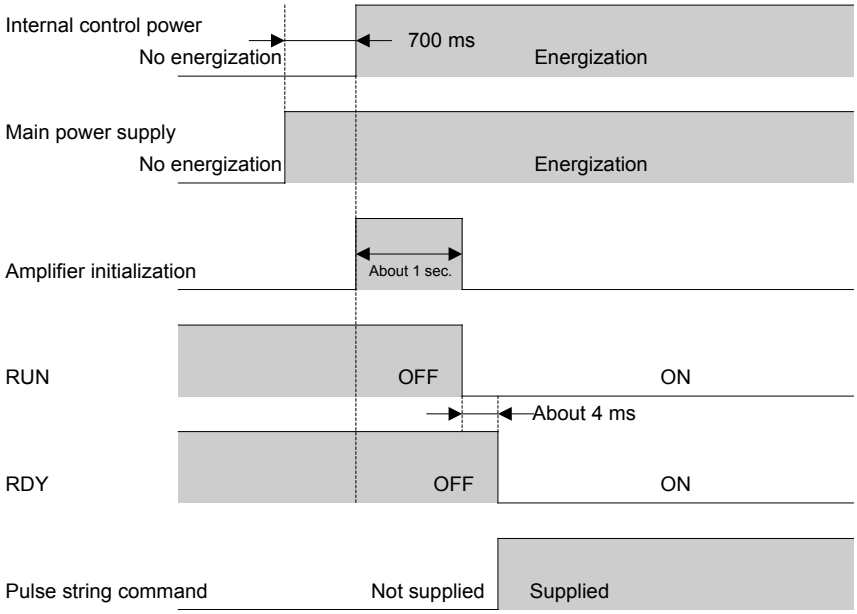
$$T_L = \frac{((\mu - 1) W_1 - W_2) \times 9.81}{\eta} \left(\frac{D}{2} \times \frac{1}{10^3}\right) \times GL$$

- When stopping vertically

$$T_L = \frac{(W_1 - W_2) \times 9.81}{\eta} \left(\frac{D}{2} \times \frac{1}{10^3}\right) \times GL$$

■ Timing chart

Power-on timing chart



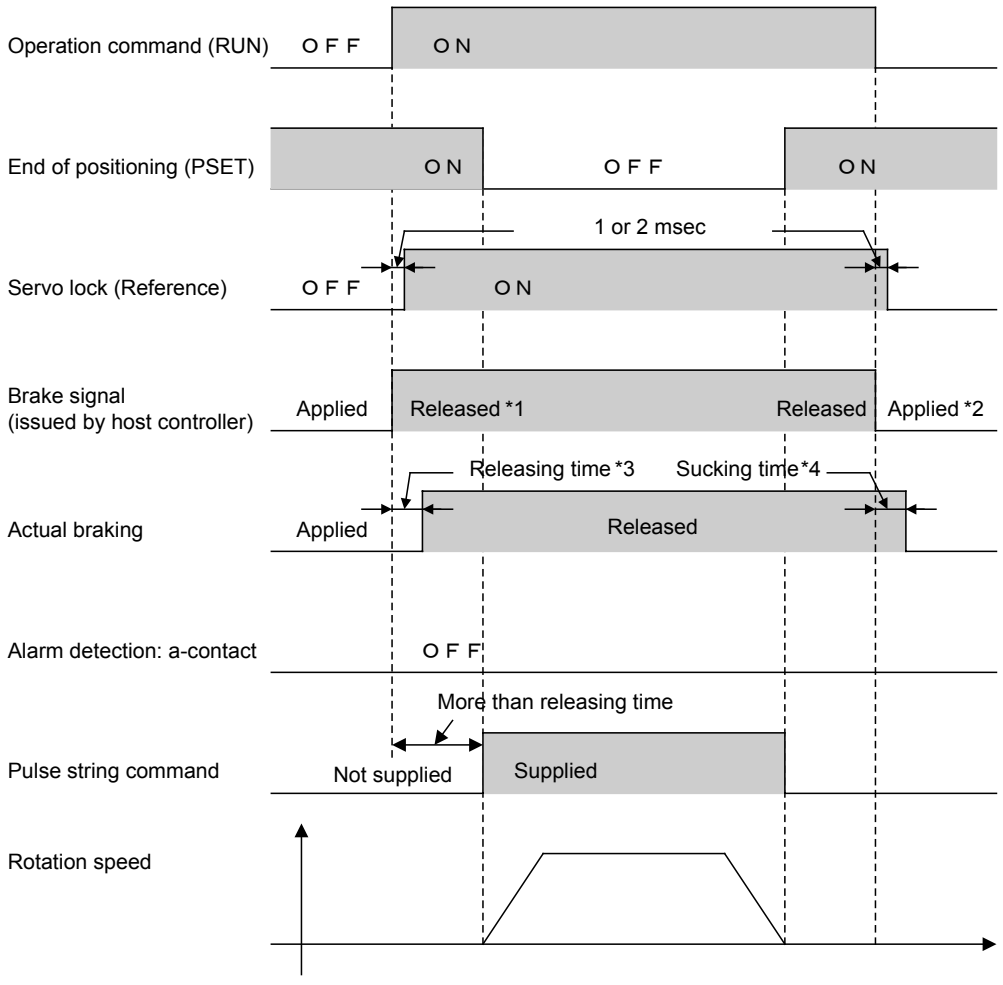
* Avoid turning on and off repeatedly.
  Wait at least one minute before turning the power on again after turning it off.

2) Timing chart of brake

Issue an excitation or release signal of the brake from the host controller directly.
The servo amplifier does not have a function (brake timing output) to apply or release the brake automatically.

(1) For horizontal or vertical application with a small load (self-weight)

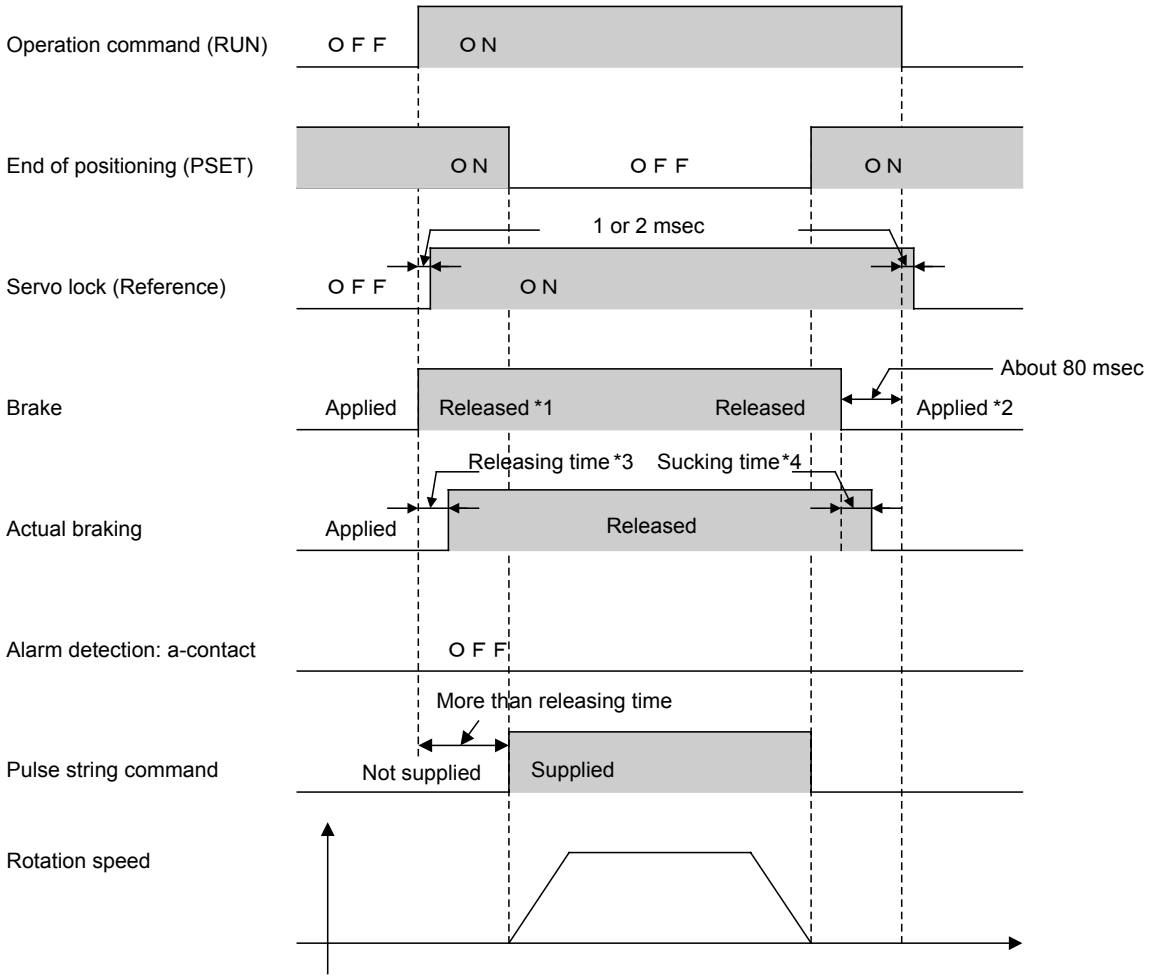
Apply the brake when the servomotor is stopped (with an end-of-positioning signal turned on).



*1: When the active brake is released, it takes the releasing time until the brake is released.
*2: When the released brake is applied, it takes the sucking time until the brake is applied.
*3: The releasing time is specified in the specification list of the brake-incorporated motor.
*4: The sucking time is specified in the specification list of the brake-incorporated motor.

(2) For vertical application with a large load (self-weight)

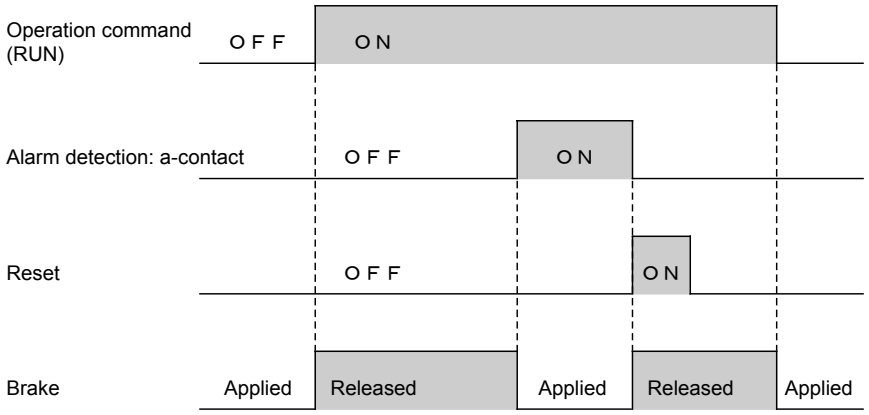
Build a program at the host controller to apply the brake before the operation command (RUN) is turned off (about 80 ms).
Apply the brake after the servo motor is stopped (with the end-of-positioning signal turned on).



*1: When the active brake is released, it takes the releasing time until the brake is released.
*2: When the released brake is applied, it takes the sucking time until the brake is applied.
*3: The releasing time is specified in the specification list of the brake-incorporated motor.
*4: The sucking time is specified in the specification list of the brake-incorporated motor.

(3) Timing chart of alarm detection

When an alarm is detected, the motor coasts to stop.
Therefore apply the brake as soon as an alarm is detected.
Build the program so that the brake is released when alarm detection is canceled.
The brake is for retention purpose. Because application of the brake during rotation reduces the life, avoid repetitive application.



Reference

- Major fault

With this type of fault, the servomotor cannot be driven.

<Action upon alarm>

Coasting to stop upon detection

Detection of major fault

Indication	Description
01	Overcurrent 1
02	Overcurrent 2
03	Overspeed
04	Overvoltage
05	Encoder trouble
06	Control power alarm 1
07	Control power alarm 2
08	Memory alarm
09	Motor combination alarm
10	Regenerative transistor overheat
11	Encoder communication alarm
12	CONT duplication
13	Overload

- Minor fault

This type of fault occurs in cases such as for protection against overheat.

<Action upon alarm>

The servomotor decelerates at the maximum performance and, after being stopped*, it coasts to stop.

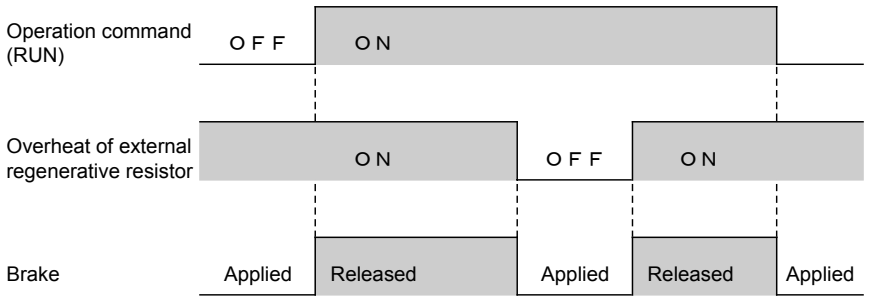
Detection of minor fault

Indication	Description
14	Undervoltage
15	Regenerative resistor overheat
16	Deviation limit
17	Amplifier overheat
18	Encoder overheat
19	Initial error

* The rotation speed is reduced to within the zero speed width (parameter #21).

(4) Timing chart upon overheat of external regenerative resistor

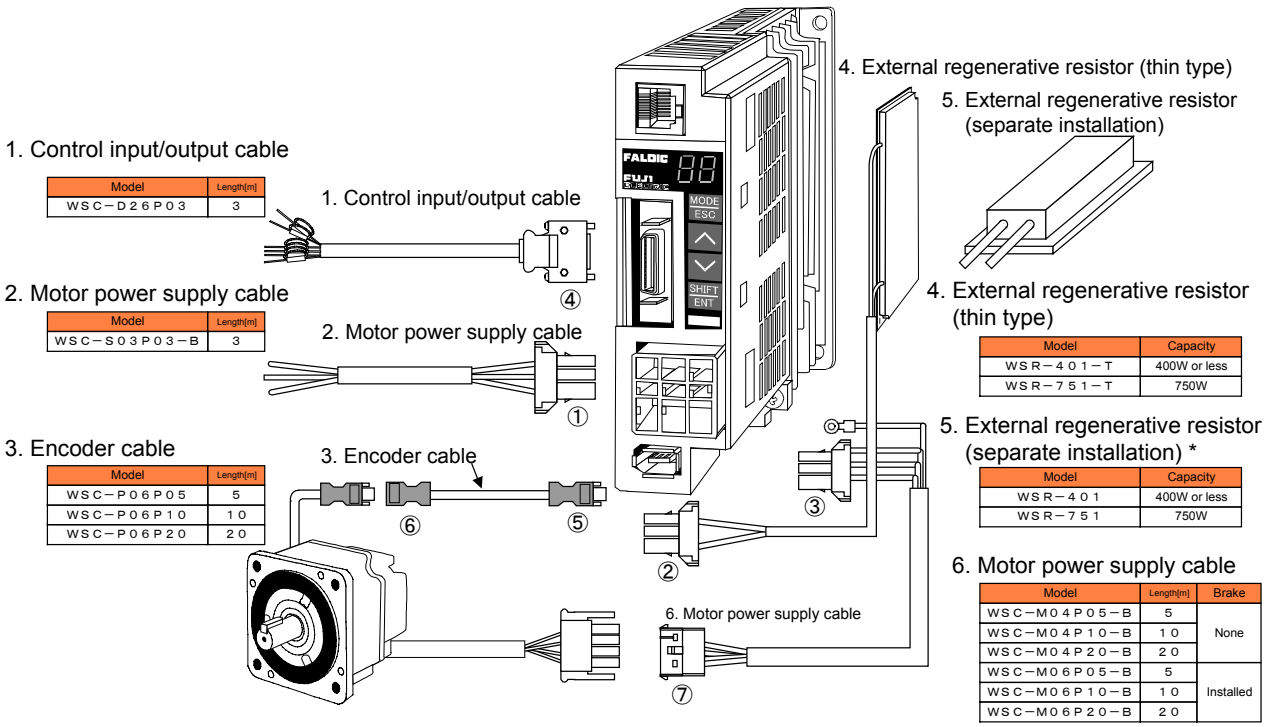
Upon overheat of the external regenerative resistor, the motor decelerates at the maximum performance and, after being stopped, it coasts to stop.
Therefore apply the brake when overheat of the external regenerative resistor is detected.
Build the program so that the brake is released when overheat is removed from the external regenerative resistor.
The brake is for retention purpose. Because application of the brake during rotation reduces the life, avoid repetitive application.



APPENDIXES

■ Option list

1) Various cables (Cable with connectors)



4. External regenerative resistor (thin type)

Model	Capacity
WSR−401−T	400W or less
WSR−751−T	750W

5. External regenerative resistor (separate installation) *

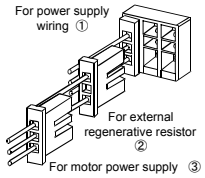
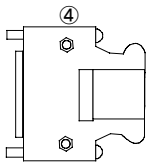
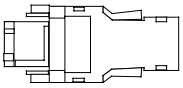
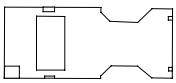
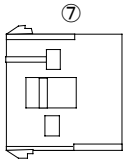
Model	Capacity
WSR−401	400W or less
WSR−751	750W

6. Motor power supply cable

Model	Length[m]	Brake
WSC−M04P05−B	5	None
WSC−M04P10−B	10	
WSC−M04P20−B	20	
WSC−M06P05−B	5	Installed
WSC−M06P10−B	10	
WSC−M06P20−B	20	

* The external regenerative resistor (separate installation type) is not equipped with the connector for connection with the amplifier. The external regenerative resistor connector (WSK-R03P-B) is necessary.

2) Various connectors (For cables prepared by customer)

Series	Main circuit connector	Control input/output wiring connector	Encoder wiring connector (amplifier side)	Encoder wiring connector (on motor side)	Motor power supply wiring connector
Appearance		 ④	 ⑤	 ⑥	 ⑦
Model	For power supply wiring WSK−S03P−B For external regenerative resistor WSK−R03P−B For motor power supply WSK−M03P−B	WSK−D26P	WSK−P06P−M	WSK−P06P−F	Without brake WSK−M04P With brake WSK−M06P
Cable size (common for all models)	For power supply wiring 0.75mm² * For external regenerative resistor 0.75mm² * For motor power supply 0.75mm² *	AWG26 26-element batch shielded cable	Cross-linked polyethylene cable with vinyl sheath for robot travel (twisted pair type) RMCV−SV AWG#25/4P+AWG#23/2C (10 m or less) AWG#23/4P+AWG#17/2C (50 m or less) Made by Daiden Co., Ltd.		For motor power supply 0.75mm² * For brake 0.75mm² *

*: The cable is based on the 600V cable with vinyl sheath.

■ Parameter list

Use these pages for reminder of parameter settings.

■ FALDIC-β parameter list (1)

No.	Name	Setting range	Initial value	Setting
Basic setting				
01	Command pulse correction α	1 to 32767 (in 1 increments)	8	
02	Command pulse correction β	1 to 32767 (in 1 increments)	1	
03	Pulse train input form	0: Command pulse/command sign, 1: Forward/reverse rotation pulse, 2: Two signals with 90-degree phase difference	1	
04	Direction of rotation switch	0: Positive direction: Forward rotation (CCW), 1: Positive direction: Reverse rotation (CW)	0	
05	Tuning mode	0: Auto tuning, 1: Semi-auto tuning, 2: Manual tuning	0	
06	Load inertia ratio	0.0 to 100.0 times (in 0.1 increments)	5.0	
07	Auto tuning gain	1 to 20 (in 1 increments)	10	
08 and 09	Not used	-	0	
System setting				
10	CONT 1 signal allocation	0 to 10 (in 1 increments) 0: Not specified 1: Operation command [RUN] 2: Reset [RST] 3: + overtravel 4: - overtravel 5: Emergency stop [EMG] 6: P-action 7: Deviation clearance 8: External regenerative resistor overload 9: Anti-resonance frequency selection 0 10: Anti-resonance frequency selection 1	1 [RUN]	
11	CONT 2 signal allocation		2 [RST]	
12	CONT 3 signal allocation		0	
13	CONT 4 signal allocation		0	
14	CONT 5 signal allocation		0	
15	OUT 1 signal allocation	0 to 5 (in 1 increments) 0: Not specified 1: Alarm detection: a-contact 2: Alarm detection: b-contact 3: Dynamic brake 4: Overtravel detection 5: Forced stop detection	1 (Alarm detect: a-contact)	
16	OUT 2 signal allocation		0	
17	Output pulse count	16 to 16384 [pulse] (in 1 increments)	2048	
18	Phase-Z offset	0 to 65535 [pulse] (in 1 increments)	0	
19	Zero deviation width	1 to 10000 [pulse] (in 1 increments)	200	
20	Deviation limit width	10 to 65535 [x 100 pulse] (in 1 increments)	10000	
21	Zero speed width	10 to 5000 [r/min] (in 1 increments)	50	
22	Positioning end judgment time	0.000 to 1.000 sec. (in 0.001 increments)	0.000	
23	Max. current limit	0 to 300 % (in 1 increments)	300	
24	Undervoltage alarm detection	0: No detection, 1: Detection	1	
25	Regenerative resistor electronic thermal calculation	0: Invalid, 1: Valid (optional regenerative resistor (thin type))	0 *1	
26	Dynamic brake on overtravel detection valid/invalid	0: Invalid, 1: Valid	0	
27	Parameter write-protection	0: Write-enable, 1: Write-protected	0	
28	Keypad panel initial display	0 to 11 (in 1 increments)	0	
29	Speed setting (for test operation)	1 to 5000 [r/min] (in 1 increments)	100	
30	Acceleration / deceleration time (for test operation)	0.000 to 9.999 sec. (in 0.001 increments)	0.100	
31 to 39	Not used	-	0	

■ FALDIC-β parameter list (2)

No.	Name	Setting range	Initial value	Setting
Control system setting				
40	Position adjustor gain 1	1 to 1000 [red/sec] (in 1 increments)	77 *2	
41	Speed response 1	1 to 1000 [Hz] (in 1 increments)	57 *2	
42	Speed adjustor integration time 1	1.0 to 1000.0 [msec] (in 0.1 increments)	25.9 *2	
43	S-curve time constant	0.0 to 100.0 [msec] (in 0.1 increments)	2.0	
44	Feed forward gain	0.000 to 1.500 (in 0.001 increments)	0.000	
45	Feed forward filter time constant	0.0 to 250.0 [msec] (in 0.1 increments)	12.9 *2	
46	Torque filter time constant	0.00 to 20.00 [msec] (in 0.01 increments)	0.31 *2	
47	Speed setting filter	0.00 to 20.00 [msec] (in 0.01 increments)	0.00	
48	Gain switching factor	0: Position deviation (x 10), 1: Feedback speed, 2: Command speed	1	
49	Gain switching level	1 to 1000 (in 1 increments)	50	
50	Gain switching time constant	0 to 100 [msec] (in 1 increments)	10	
51	Position adjustor gain 2	30 to 200 % (in 1 increments)	100	
52	Speed response 2	30 to 200 % (in 1 increments)	100	
53	Speed adjustor integration time 2	30 to 200 % (in 1 increments)	100	
54	Position gain added when setting	0 to 100 [red/sec] (in 1 increments)	0	
55	Addition limit when setting	0 to 200 [r/min] (in 1 increments)	0	
56	Command follow-up control selection	0: None, 1: Command follow-up control, 2: Command follow-up control (with correction on stop)	0	
57	Notch filter 1 frequency	10 to 200 [x 10Hz] (in 1 increments)	200	
58	Notch filter 1 damping amount	0 to 40 [dB] (in 1 increments)	0	
59	Notch filter 2 frequency	10 to 200 [x 10 Hz] (in 1 increments)	200	
60	Notch filter 2 damping amount	0 to 40 [dB] (in 1 increments)	0	
61	Anti-resonance frequency 0	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	
62	Anti-resonance frequency 1	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	
63	Anti-resonance frequency 2	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	
64	Anti-resonance frequency 3	5.0 to 200.0 [Hz] (in 0.1 increments)	200.0	
65 to 79	Not used	-	0	
For adjustment by manufacturer				
80	For adjustment by manufacturer 1	-	Adjusted value	
81	For adjustment by manufacturer 2	-	Adjusted value	
82	For adjustment by manufacturer 3	-	Adjusted value	
83	For adjustment by manufacturer 4	-	Adjusted value	
84 to 99	Not used	-	0	

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Fuji Electric Co., Ltd.

ED & C · Drive Systems Company

Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome
Shinagawa-ku, Tokyo 141-0032, Japan
Phone: +81-3-5435-7139 Fax: +81-3-5435-7460

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