A Nidec Group Company

Sankyo

All for dreams

Instruction Manual

AC SERVO MOTOR and SERVO AMPLIFIER Series

S-FLAG

Thank you for your purchase of the S-FLAG products. This Instruction Manual includes precautions for the product use.

- Please study this manual first and use the product properly and safely.
- **Before using the product, be sure to carefully read the *Safety Instructions*.**
- After reading this manual, please keep it for future reference.
- Product specifications are subject to change without notice in the course of product improvement.

Revision History

Date of Publication	Version No.	Revised Contents
June 2013	1	Initial publication
March 2014	2	Addition: 50W and 100W motor specifications
December 2014	3	Addition: Internal position command mode, torque control mode, and tuning method

Preface

The documents listed below are intended as reference material to this Instruction Manual of the S-FLAG Series. Due to space and printing limitations, they are referenced from but not printed in the actual Manual.

Additional Manual 1 S-FLAG Series	Multi-axis Amplifiers
Additional Manual 2 S-FLAG Series	Absolute System
Additional Manual 3 S-FLAG Series	Communication Interface
Additional Manual 4 S-FLAG Series	Positioner Function
Additional Manual 5 S-FLAG Series	Special I/O Settings
Additional Manual 6 S-FLAG Series	How to Use DA24A** with Single-Phase AC200V

Contents

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1. Before you start

Table of Contents

Figure

Tables

1-1. Introduction

Improper use or handling of the product may not only hinder its optimal performance of the product, but also cause troubles and shorten the product life.
Read through this Instruction Manual carefully. Handle the product with care and use the product properly.

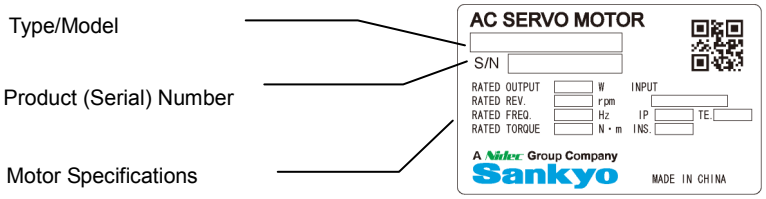
1-1-1 About This Instruction Manual

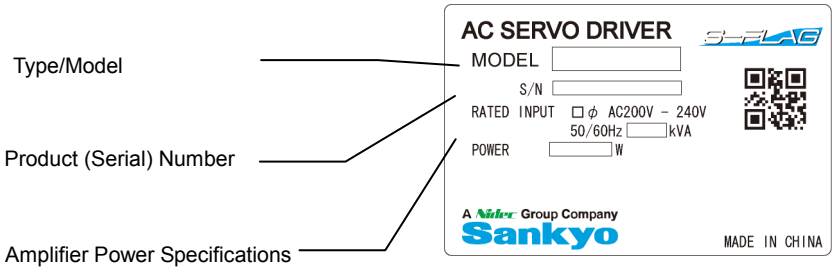
- This instruction manual was created to the best of our knowledge and ability. Should you have any questions, please do not hesitate to contact us at our agency office.
- The following precautions should be clearly mentioned in the instruction manual for your product which our S-FLAG product is integrated into.
  - Your product is hazardous because it is a high voltage device.
  - There is a danger of residual high-voltage in terminals and inside of your product even after power supply is shut off.
  - There are high temperature parts in your product.
  - Disassembling your product is not allowed.
- Be aware that new functions might be added in the future without notice in order to improve the product performance.
- When planning to obtain safety standard certifications for your product that our S-FLAG product is integrated into, please contact us in advance.
- The S-FLAG product requires to be used under proper conditions for its long term use. Please use the product in accordance with the instruction manual.
- We strive to keep the instruction manual up to date. As such, the contents are always subject to change. For the latest version of the instruction manual, please contact us.
- No reproduction in any form of this manual, in whole or in part, may be made without written authorization from NIDEC SANKYO CORPORATION.

1-1-2 Product Package Check

- Is the product you have received exactly what you ordered?
- Was the product delivered to you without suffering any transport damage?
- If you received a wrong product or discovered any transport damage in the delivered package, please contact the sales office that you made the purchase from.

1-1-3 Product Plate

MOTOR PLATE


AMPLIFIER PLATE


1-1-4 Danger Signs

CAUTION! HOT	
	Do not touch the product on which this sign is attached during operation or after a while, or you may get burned from the heat.

This sign can be found at the location as shown below.

Side of Motor

Side of Amplifier

1-1 INTRODUCTION

DANGER! ELECTRIC SHOCK	
	Do not touch the amplifier on which this sign is attached during operation or within 5 minutes after operation, or you may get injured.

This sign can be found at the location as shown below.

Side of Amplifier

DANGER or CAUTION	
	If the product with this sign attached is used in the wrong way during operation or after a while, injuries or machine damage may be caused. Be mindful of safety at all times in order to avoid injuries.

This sign can be found at the location as shown below.

Side of Amplifier

1-1 Introduction

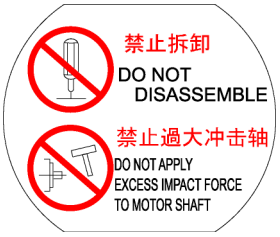
FG (Frame Ground, Protective Earth Ground) Symbol

Always practice protective grounding using FG terminals located where this symbol is found.

This symbol can be found at the location as shown below.

FG terminals on front-side of Amplifier

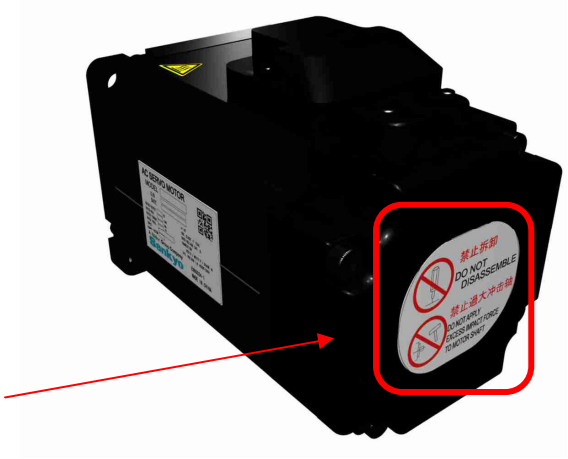
NO DISASSEMBLE & NO IMPACT FORCE



Do not remove the encoder cover, or do not disassemble.

Do not apply excessive impact force the motor or motor shaft.

This label is attached to the location as shown below.



Beating the encoder cover may cause product damage.

Motor/Encoder Cover

1-2. Safety Instructions

1-2-1 Safety Precautions

■ Signs below differentiate and explain severities of physical injury and/or product damage that may be caused when safety instructions are not followed and the product are used improperly.

DANGER	This sign is used to inform of hazardous conditions that can result in death or severer injury.
CAUTION	This sign is used to inform of hazardous conditions that can result in physical injury and/or damage to the product.

■ The following signs explain types of safety measures you must take.

	Indicates “prohibited” actions that must be avoided.
	Indicates “mandatory” actions that must be carried out.

DANGER

Type of safety measures	Description of Precaution	Possible harms in neglect of the instruction
Installation & Wiring		
	Never connect the motor directly to a commercial power supply.	Fire or product failure.
	Do not place any flammable items in the vicinity of a motor or amplifier.	Fire
	Be sure to protect the amplifier with a protective casing and allow the stipulated clearance specified in the instruction manual between the amplifier and the casing or any other product.	Electric shock, fire or product failure
	Install the product in a place with little dust and free from water or oil splash.	Electric shock, fire, product failure or damage
	Mount the motor and amplifier on metallic or other non-flammable members.	Fire
	Be sure to have any wiring work carried out by an electrical work expert.	Electric shock

	The FG terminal of the motor or amplifier must be always grounded.	Electric shock
	When conducting any wiring work, always turn OFF the circuit breaker on the upstream side first and then do the work accurately and methodically.	Electric shock, injury, product failure or damage
	Be sure to connect all cables correctly and isolate all energized sections using insulating material.	Electric shock, fire or product failure

Control & Operation		
	Never touch the inside of the amplifier.	Burn or electric shock
	The cables should not be damaged, stressed, loaded, or pinched.	Electric shock, product failure or damage
	Never touch the revolving part of the motor while it is operating.	Injury
	Do not use product at locations subject to water splashing, in a corrosive atmosphere, in an atmosphere of flammable gases, or near flammable materials.	Fire
	Do not use product at locations subject to severe vibrations or impact forces.	Electric shock, injury or fire
	Do not use product with a cable being immersed in oil or water.	Electric shock, product failure or damage
	Do not carry out any wiring work or touch the controls with a wet hand.	Electric shock, injury or fire
	In the case of a shaft end key-grooved motor, do not touch the key groove with an unprotected hand.	Injury
	Do not touch the heat sink of the motor or amplifier because it will be hot.	Burn or part damage
	Do not drive the motor by external power source.	Fire
Other Operating Precautions		
	Always confirm safety after the occurrence of an earthquake.	Electric shock, injury or fire
	To prevent any fire or personal injury during an earthquake, carry out installation work securely and properly.	Injury, electric shock, fire, product failure or damage
	Provide an external emergency stop circuit so that operation can be stopped and power supply shut down immediately upon the occurrence of an emergency.	Injury, electric shock, fire, product failure or damage
Maintenance & Inspection		
	The amplifier has parts with dangerously high voltage. Before doing any wiring or inspection work, allow more than 5 minutes after power off for complete discharge of internal voltage. Also never disassemble the amplifier.	Electric shock

⚠ CAUTION

Type of safety measures	Description of Precaution	Possible harms in neglect of the instruction
Installation & Wiring		
	Observe the specified combinations of a motor and an amplifier.	Fire or product failure
	Do not touch the terminals of a connector directly by hand.	Electric shock or product failure
	Be careful not to block a ventilation port and do not allow the ingress of foreign object.	Electric shock or fire
	When operating a test run, confirm the operation with the motor being fixed in place and isolated from the machinery first, then mount the motor on the machinery.	Injury
	Observe the specified mounting method and orientation.	Injury or product failure
	Carry out proper mounting that is commensurate with the main body mass and rated output of the product.	Injury or product failure
Control & Operation		
	Do not step on the product or place any heavy object on the product.	Electric shock, injury, product failure or damage
	Never carry out any extreme change in adjustments because operation will become unstable.	Product failure or damage
	Do not come close to the machine after the restoration of power after power outage. The machine may restart unexpectedly at any time. Take appropriate measures to ensure safety against an unexpected restart.	Injury
	Do not use the product at locations subject to direct sunlight.	Product failure
	Do not apply impact load.	Product failure
	Do not use the built-in brake of the motor for ordinary braking purposes because it is intended just for holding.	Injury or product failure
	Do not use any malfunctioning or damaged motor or amplifier.	Injury, electric shock, or fire
	Confirm that the power supply specifications are normal.	Product failure
	The holding brake is not a stopping device to secure the safety of the machine. The machine requires a separate stopping device to secure safety.	Injury
	Upon occurrence of an alarm, remove the cause and secure safety before resetting the alarm and restarting the machine.	Injury
	Connect the brake control relay and the emergency stop relay in series.	Injury or product failure
Transportation & Storage		
	Do not store the product at locations subject to water or moisture or where toxic gases or liquids are present.	Product failure
	Do not hold the cables or the motor shaft when transporting.	Injury or product failure
	Do not let the product drop or fall over during transportation or installation work.	Injury or product failure
	If the product was stored away for an extended period of time, please contact us at the location listed on this instruction manual.	Product failure
	Store the product in a place that meets the storage conditions specified in this instruction manual.	Product failure

Type of safety measures	Description of Precaution	Possible harms in neglect of the instruction
Other Operating Precautions		
	When disposing of batteries, insulate them with tape or other material and dispose of them according to the local laws and regulations.	
	When disposing of our product, treat them as industrial waste.	
Maintenance & Inspection		
	Overhauls must not be done by anyone but NIDEC SANKYO CORPORATION.	Product failure
	Do not turn the power supply ON and OFF too frequently.	Product failure
	Do not touch the heat sink of the motor, amplifier, regenerative resistor, etc., by hand while they are energized or for a while after power shutdown because they may be dangerously hot.	Burn or electric shock
	In case of amplifier failure, shut down both the control power and the main circuit power.	Fire
	When not using the product for an extended period of time, be sure to turn the power OFF.	Injury by device malfunction, etc.

Warranty

Warranty Period

- The warranty period of the product shall be 18 months after the date of manufacture at Sankyo. In the case of motors equipped with a brake, the times of shaft accelerations and decelerations shall not exceed the service life.

Details of Warranty

- Product failures that occur during the period of warranty under normal operating conditions in accordance with this instruction manual shall be repaired without cost to the customer. However, even within the period of warranty, repairs for the following cases of product failure shall be provided on a charged-for basis;
  1. A failure attributable to misuse, improper repair or modification
  2. A failure attributable to dropping of the product after purchase or to damage during transportation
  3. A failure attributable to use of the product in a manner in which it was not originally intended for
  4. A failure attributable to fire, earthquake, lightning, storm and flood damage, salt damage, abnormal voltage or any other natural disaster or accident
  5. A failure attributable to the ingress of water, oil, metallic fragments or any other foreign objects

- The warranty shall be limited to the delivered product itself and does not cover any loss or damage caused by failure of the delivered product.

1-2-2 Compliance with Safety Standards

■ Compliance with European EC Directive

Products to be sold in the EU internal market are subject to the EC Directives. Products put on the market must comply with the EU safety requirements and require the CE mark to prove their safety (See the figure below).

We perform the following “EC Directive Low Voltage” and “EC Directive EMC” conformity test on our products which are in compliance with the EC directive, so that the final products, machines, or devices of yours that our products are integrated into can easily obtain the CE Mark.

CE

Figure1-2-1 CE Mark

■ Low Voltage Directive

Because the input power voltage of our products is AC200V type, the products are subject to safety requirements for electrical product used with rated voltages of AC50V-1000Ⅴ and DC75V-1500V. Our products are in compliance with the low voltage directive by meeting the following installation requirements.

- Overvoltage Category II
- Class I equipment
- Pollution degree 2 (circuit components)

The following are applicable compliance standards.

Table 1-2-1 Product subject to Low-voltage directive

Product within the scope	Reference of Applicable Standard	Title of Standard
Motor	EN60034-1	Rotating electrical machines -- Part 1: Rating and performance
	EN60034-11	Rotating electrical machines -- Part 11: Thermal protection
Amplifier	EN61800-5-1	Adjustable speed electrical power drive systems -- Part 5-1: Safety requirements

■ EMC (Electromagnetic compatibility) Directive

Our motors and amplifiers are in compliance with the EMC directive by meeting the installation requirements described in this manual.

Wiring, grounding, and other conditions in which your machines utilize our product could be different from the conditions in which we perform the compliance test.

Therefore, your machine or device that our product(s) are applied to needs to be compliant with the EMC directive and requires EMC approval as a final machine or device.

The following are applicable compliance EMS and EMI standards.

■ EMS (Immunity) - EN61000-6-2:2005

Table 1-2-2 Generic Immunity Standards for Industrial Environments

Product within the scope	Reference of Applicable Standard	Title of Standard Testing and measurement techniques
Motor & Amplifier	IEC61000-4-2: 2008	Electrostatic discharge immunity test
	IEC61000-4-3: 2006+A1: 2007+A2: 2010	Radiated, radio-frequency, electromagnetic field immunity test
	IEC61000-4-4: 2004+A1: 2010	Electrical fast transient/burst immunity test
	IEC61000-4-5: 2005	Surge immunity test
	IEC61000-4-6: 2008	Immunity to conducted disturbances, induced by radio-frequency fields
	IEC61000-4-8: 1993+A1: 2010	Power frequency magnetic field immunity test
	IEC61000-4-11: 2004	Voltage dips, short interruptions and voltage variations immunity tests

■ **EMI（Emissions）- EN55011：2009 +A1:2010**

Table 1-2-3 Industrial, scientific and medical equipment - Radio frequency disturbance characteristics

Product within the scope	Reference of Applicable Standard	Title of Standard
Motor & Amplifier	EN55011: 2009 +A1: 2010 Group 1 *, Class A **	Noise terminal voltage
		Disturbance electric field strength

Note:

* **Group 1**: All equipment in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself

** **Class A**: All equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

■ Compliance with the UL standards

We ensure the compliance of our products by conducting the following UL standard tests.

Table 1-2-4 UL Standard

Product within the scope	Reference of Applicable Standard	Title of Standard
Motor	UL1004-1	Standard for Electrical Motors
	UL1004	Standard for Rotating Electrical Machines - General Requirements
Amplifier	UL508C	Standard for Power Conversion Equipment

(MEMO)

2. Product Specifications

2 Product Specifications

Contents

Figures

2 Product Specifications

Tables

2-1. Motor Specifications

2-1-1 How to Read the Motor Model Number

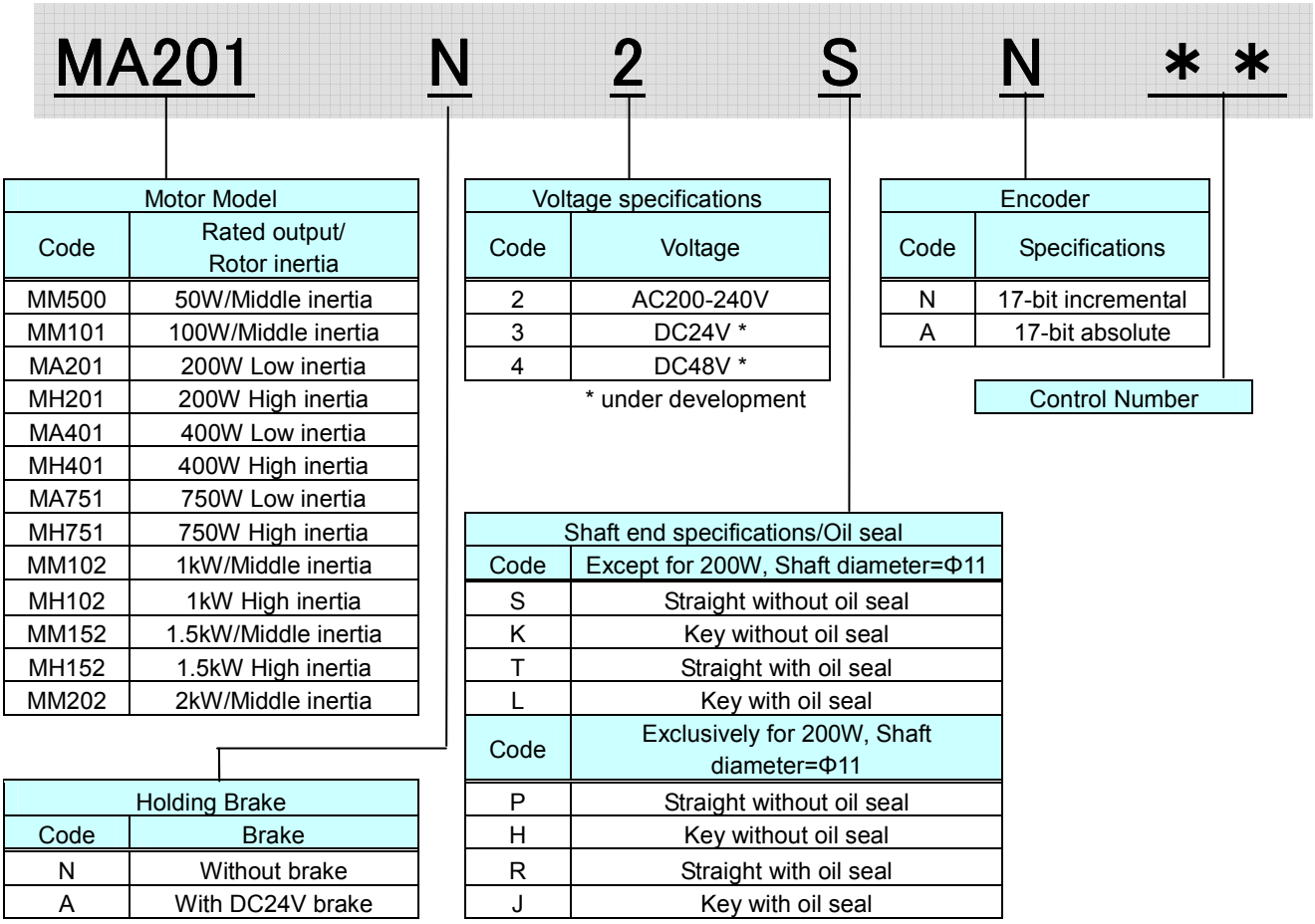


Figure 2-1-1 How to read the motor model number

2-1-2 Motor Mounting Screw Sizes

	For motor mounting, use the recommended screw size shown on the table below.	Otherwise, the product life may become shorter and the product performance may be compromised.

Table 2-1-1 Motor mounting screws

Motor mounting screws		
Type of Servo Motor	Mounting hole diameter	Recommended screw
MM500, MM101	2 - Φ4.5	M4 X 12 mm or longer
MA201, MH201	4 - Φ5.5	M5 X 12 mm or longer
MA401, MH401	4 - Φ5.5	M5 X 12 mm or longer
MA751, MH751	4 - Φ6.6	M6 X 14 mm or longer
MM102, MH102	4 - Φ9	M8 X 18 mm or longer
MM152, MH152	4 - Φ9	M8 X 18 mm or longer
MM202	4 - Φ9	M8 X 18 mm or longer

2-1-3 Oil Seal

	If there is any possibility of oil ingress into the motor through the output shaft due to a decelerator such as a gear being connected to the motor or due to other reasons, please order the type of a servomotor with oil seal.	Otherwise, the product life may become shorter or the product performance may be compromised.

2-1-4 Basic Specifications

Table 2-1-2 Motor Specifications（50W,100W）

Item			Unit	Specifications	
Voltage			V	AC200V - 240V	
Motor model （M□□□□□□□□**）			—	M500□2□□ Middle inertia	M101□2□□ Middle inertia
Fitting flange size			mm	□40	□40
Approximate mass		Without brake	kg	0.4	0.5
		With brake		0.6	0.8
Compatible amplifier name（DA□□□**）				2YZ	2Z1
Basic Specifications	Rated output		W	50	100
	Rated torque		N·m	0.16	0.32
	Instantaneous maximum torque		N·m	0.56	1.12
	Rated current		Arms	0.6	0.9
	Instantaneous maximum current		Arms	2.1	3.2
	Rated revolving speed		r/min	3000	
	Maximum revolving speed		r/min	6000	
	Torque constant		N·m/Arms	0.25	0.36
	Induced voltage constant per phase		mV/(r/min)	8.8	12.5
	Rated power rate	Without brake	kW/s	5.6	13.6
		With brake		4.7	12.3
	Mechanical time constant	Without brake	ms	2.60	1.69
		With brake		3.06	1.87
	Electrical time constant		ms	0.64	0.76
	Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.045	0.074
		With brake		0.053	0.082
	Allowable load	Radial	Refer to section 2-1-5 Allowable Load of Motor Output Shaft.		
		Thrust			
	Encoder		17bit Asynchronous Serial communication (half duplex)		
Brake Specifications	Usage		Holding brake, which		
	Power supply		—	SELV power supply: Use the one with reinforced insulation from hazardous voltage.	
	Rated voltage		V	DC24V±10 %	
	Rated current		A	0.25	
	Static friction torque		N·m	≥ 0.16	≥ 0.32
	Suction time		ms	≤ 35	
	Release time		ms	≤ 20	
	Release voltage		V	≥ DC1V	
Operating Environment Requirements	Time rating		Continuous		
	Ambient temperature for use		0℃-40℃		
	Ambient humidity for use		20-85%RH (no condensation)		
	Ambient temperature for storage		-20℃- 65℃, max tolerable temperature：80℃ for 72 hours		
	Ambient humidity for storage		20 - 85%RH (no condensation)		
	Atmosphere for use/storage		Indoors (not subject to direct sunlight), Free from corrosive gases, flammable gases, flammables, grinding fluid, oil mist, and dust		
	Thermal endurance class		Class B		
	Insulation resistance		≥ 5MΩ at 1,000VDC		
	Dielectric strength		1500 VAC for 1 minute		
	Operating altitude		≤1000m above sea level		
	Vibration class		V15 (JEC2121)		
	Vibration durability		49m/s^2 （5G）		
	Durability shock		98m/s^2 （10G）		
	Protective structure		IP65 (IP67 is also applicable)		
Precautions			The servomotors are: ·Class I products for which grounding is mandatory ·Overvoltage category II products ·Pollution degree 2 products		
			The “Rated torque” above is a value when the motor is mounted to a double-length L-shaped flange.		
			Brake cables have polarity. Refer to Table 3-3-2; connect the yellow lead (BRK+) to +24V and the blue lead (BRK-) to GND.		

2-1 Motor Specifications

Table 2-1-3 Motor Specifications（200W, 400W）

Item			Unit	Specifications			
Voltage			V	AC200V - 240V			
Motor model （M□□□□□□□□**）			—	A201□2□□ Low inertia	H201□2□□ High inertia	A401□2□□ Low inertia	H401□2□□ High inertia
Fitting flange size			mm	□60	□60	□60	□60
Approximate mass		Without brake	kg	0.9	1.0	1.3	1.5
		With brake		1.4	1.5	1.8	2.0
Compatible amplifier name(DA□□□**)				212		224	
Basic Specifications	Rated output		W	200		400	
	Rated torque		N·m	0.64		1.27	
	Instantaneous maximum torque		N·m	1.91		3.82	
	Rated current		Arms	1.7		2.7	
	Instantaneous maximum current		Arms	5.1		8.1	
	Rated revolving speed		r/min	3000			
	Maximum revolving speed		r/min	5000			
	Torque constant		N·m/Arms	0.417		0.498	
	Rated output		mV/(r/min)	14.5		17.4	
	Rated power rate	Without brake	kW/s	23.8	9.2	55.9	23.2
		With brake		19.3	8.6	50.7	21.9
	Mechanical time constant	Without brake	ms	1.13	2.91	0.70	1.69
		With brake		1.39	3.11	0.77	1.78
	Electrical time constant		ms	1.99		2.47	
	Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.17	0.44	0.29	0.70
		With brake		0.21	0.47	0.32	0.74
	Allowable load	Radial	Refer to section 2-1-5 Allowable Load of Motor Output Shaft.				
		Thrust					
	Encoder		17bit Asynchronous Serial communication (half duplex)				
Brake Specifications	Usage		Holding brake, which				
	Power supply		—	SELV power supply: Use the one with reinforced insulation from hazardous voltage.			
	Rated voltage		V	DC24V±10 %			
	Rated current		A	0.3			
	Static friction torque		N·m	≥ 1.27			
	Suction time		ms	≤ 50			
	Release time		ms	≤ 15			
	Release voltage		V	≥ DC1V			
Operating Environment Requirements	Time rating		Continuous				
	Ambient temperature for use		0℃-40℃				
	Ambient humidity for use		20-85%RH (no condensation)				
	Ambient temperature for storage		-20℃- 65℃, max tolerable temperature：80℃ for 72 hours				
	Ambient humidity for storage		20 - 85%RH (no condensation)				
	Atmosphere for use/storage		Indoors (not subject to direct sunlight), Free from corrosive gases, flammable gases, flammables, grinding fluid, oil mist, and dust				
	Thermal endurance class		Class B				
	Insulation resistance		≥ 5MΩ at 1,000VDC				
	Dielectric strength		1500 VAC for 1 minute				
	Operating altitude		≤1000m above sea level				
	Vibration class		V15 (JEC2121)				
	Vibration durability		49m/s^2 （5G）				
	Durability shock		98m/s^2 （10G）				
	Protective structure		IP65 (IP67 is possibly applicable)				
Precautions			The servomotors are: ·Class I products for which grounding is mandatory ·Overvoltage category II products ·Pollution degree 2 products				
			The “Rated torque” above is a value when the motor is mounted to a double-length L-shaped flange.				
			Brake cables have polarity. Refer to Table 3-3-2; connect the yellow lead (BRK+) to +24V and the blue lead (BRK-) to GND.				

2-1 Motor Specifications

Table 2-1-4 Motor Specifications（750W）

Item			Unit	Specifications	
Voltage			V	AC200V - 240V	
Motor model （M□□□□□□□□**）			—	A751□2□□ Low inertia	H751□2□□ High inertia
Fitting flange size			mm	□80	□80
Approximate mass		Without brake	kg	2.5	2.7
		With brake		3.3	3.5
Compatible amplifier name(DA□□□**)				238	
Basic Specifications	Rated output		W	750	
	Rated torque		N·m	2.39	
	Instantaneous maximum torque		N·m	7.1	
	Rated current		Arms	4.3	
	Instantaneous maximum current		Arms	12.9	
	Rated revolving speed		r/min	3000	
	Maximum revolving speed		r/min	4500	
	Torque constant		N·m/Arms	0.61	
	Rated output		mV/(r/min)	21.33	
	Rated power rate	Without brake	kW/s	61.9	35.2
		With brake		51.3	31.5
	Mechanical time constant	Without brake	ms	0.55	0.96
		With brake		0.66	1.08
	Electrical time constant		ms	4.3	4.3
	Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.92	1.62
		With brake		1.11	1.81
	Allowable load	Radial	Refer to section 2-1-5 Allowable Load of Motor Output Shaft.		
		Thrust			
	Encoder		17bit Asynchronous Serial communication (half duplex)		
Brake Specifications	Usage		Holding brake, which		
	Power supply		—	SELV power supply: Use the one with reinforced insulation from hazardous voltage.	
	Rated voltage		V	DC24V±10 %	
	Rated current		A	0.4	
	Static friction torque		N·m	≥ 2.39	
	Suction time		ms	≤70	
	Release time		ms	≤20	
	Release voltage		V	≥ DC1V	
Operating Environment Requirements	Time rating		Continuous		
	Ambient temperature for use		0℃-40℃		
	Ambient humidity for use		20-85%RH (no condensation)		
	Ambient temperature for storage		-20℃- 65℃, max tolerable temperature：80℃ for 72 hours		
	Ambient humidity for storage		20 - 85%RH (no condensation)		
	Atmosphere for use/storage		Indoors (not subject to direct sunlight), Free from corrosive gases, flammable gases, flammables, grinding fluid, oil mist, and dust		
	Thermal endurance class		Class B		
	Insulation resistance		≥ 5MΩ at 1,000VDC		
	Dielectric strength		1500 VAC for 1 minute		
	Operating altitude		≤1000m above sea level		
	Vibration class		V15 (JEC2121)		
	Vibration durability		49m/s^2 （5G）		
	Durability shock		98m/s^2 （10G）		
	Protective structure		IP65 (IP67 is also applicable)		
Precautions			The servomotors are: ·Class I products for which grounding is mandatory ·Overvoltage category II products ·Pollution degree 2 products		
			The “Rated torque” above is a value when the motor is mounted to a double-length L-shaped flange.		
			Brake cables have polarity. Refer to Table 3-3-2; connect the yellow lead (BRK+) to +24V and the blue lead (BRK-) to GND.		

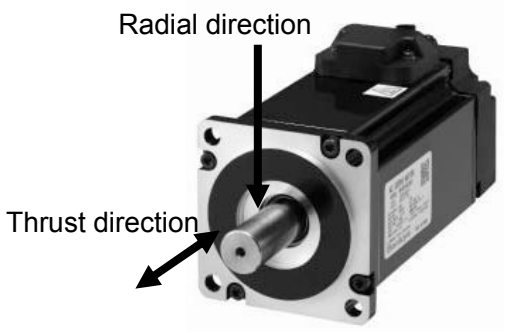
2-1 Motor Specifications

Table 2-1-5 Motor Specifications（1kW, 1.5kW, 2kW）

Item			Unit	Specifications				
Voltage			V	AC200V - 240V				
Motor model （M□□□□□□□□**）			—	M102□2□□ Middle inertia	H102□2□□ High inertia	M152□2□□ Middle inertia	H152□2□□ High inertia	M202□2□□ Middle inertia
Fitting flange size			mm	□130	□130	□130	□130	□130
Approximate mass		Without brake	kg	5.6	7.6	7.0	9.0	8.4
		With brake		7.0	9.0	8.4	10.4	9.8
Compatible amplifier name（DA□□□**）				24A		26B		28C
Basic Specifications	Rated output		W	1000		1500		2000
	Rated torque		N·m	4.77		7.16		9.55
	Instantaneous maximum torque		N·m	14.3		21.5		28.6
	Rated current		Arms	5.6		9.9		12.2
	Instantaneous maximum current		Arms	16.8		30		36.6
	Rated revolving speed		r/min	2000		2000		2000
	Maximum revolving speed		r/min	3000		3000		3000
	Torque constant		N·m/Arms	0.88		0.81		0.85
	Rated output		mV/(r/min)	30.9		28.4		29.6
	Rated power rate	Without brake	kW/s	50.0	9.2	76.9	13.8	104.9
		With brake		36.5	8.6	61.4	13.3	87.9
	Mechanical time constant	Without brake	ms	0.76	4.17	0.60	3.32	0.58
		With brake		1.05	4.43	0.75	3.46	0.69
	Electrical time constant		ms	10.1		12.2		8.2
	Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·㎡	4.56	24.9	6.67	37.12	8.70
		With brake		6.24	26.4	8.35	38.65	10.38
	Allowable load	Radial	Refer to section 2-1-5 Allowable Load of Motor Output Shaft.					
		Thrust						
	Encoder		17bit Asynchronous Serial communication (half duplex)					
Brake Specifications	Usage		Holding brake, which					
	Power supply		—	SELV power supply: Use the one with reinforced insulation from hazardous voltage.				
	Rated voltage		V	DC24V±10 %				
	Rated current		A	1.0				
	Static friction torque		N·m	≥ 9.55				
	Suction time		ms	≤120				
	Release time		ms	≤30				
	Release voltage		V	≥ DC1V				
Operating Environment Requirements	Time rating		Continuous					
	Ambient temperature for use		0℃-40℃					
	Ambient humidity for use		20-85%RH (no condensation)					
	Ambient temperature for storage		-20℃- 65℃, max tolerable temperature：80℃ for 72 hours					
	Ambient humidity for storage		20 - 85%RH (no condensation)					
	Atmosphere for use/storage		Indoors (not subject to direct sunlight), Free from corrosive gases, flammable gases, flammables, grinding fluid, oil mist, and dust					
	Thermal endurance class		Class F					
	Insulation resistance		≥ 5MΩ at 1,000VDC					
	Dielectric strength		1500 VAC for 1 minute					
	Operating altitude		≤1000m above sea level					
	Vibration class		V15 (JEC2121)					
	Vibration durability		49m/s2（5G）					
	Durability shock		98m/s2（10G）					
	Protective structure		IP65 (IP67 is also applicable)					
Precautions			The servomotors are: ·Class I products for which grounding is mandatory ·Overvoltage category II products ·Pollution degree 2 products					
			The “Rated torque” above is a value when the motor is mounted to a double-length L-shaped flange.					
			Brake cables have polarity. Refer to Table 3-3-2; connect the yellow lead (BRK+) to +24V and the blue lead (BRK-) to GND.					

2-1-5 Allowable Load of Motor Output Shaft

	Please use the motors within the range of allowable load to the motor output shaft.	Otherwise, the product life may become shorter or the product performance may be compromised.



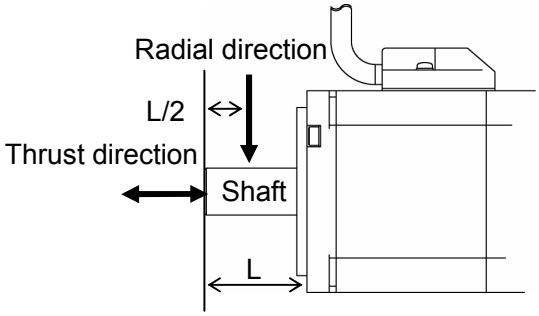


Table 2-1-6 Allowable load of motor output shaft

Allowable load	Unit	50W	100W	200W	400W	750W	1kW	1.5kW	2kW
Radial direction	N	68	68	245	245	392	490	490	490
Thrust direction	N	58	58	98	98	147	196	196	196

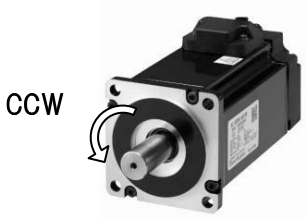
2-1-6 Encoder Specifications

Table 2-1-7 Encoder electrical specifications

Item	Specifications		Notes
Motor model	M□□□□□□□N**（17bit）	M□□□□□□□A**（17bit）	-
Power supply voltage	DC 4.5V - 5.5V		Power supply ripple ≤5%
External battery	-	DC 2.4 - 5.5V	
External capacitor	-	DC 2.4 - 5.5V	
Power supply current consumption	160mA (Typ.)		Not including rush current
External battery current consumption	-	10μA (Typ.)	This value is valid when: at room temperature, the motor not in motion, and battery voltage of 3.6 V.
Single turn resolution	Absolute 131,072 （17bit）		
Multi-turn count	-	65,536	
Maximum revolving speed	6,000 r/min		
Input/output type	Differential transform		
Count-up direction (※)	Positive direction（CCW）		

Table 2-1-8 Encoder communication specification

Item	Specifications	
Motor model	M□□□□□□□N**	M□□□□□□□A**
Transmission method	Asynchronous serial communication (half duplex)	
Communication speed	2.5Mbps	



(※) The “Count-up” direction is called “positive” when the shaft rotation viewed from the front-side of the flange is counterclockwise (CCW).

Table 2-1-9 Encoder environmental requirements

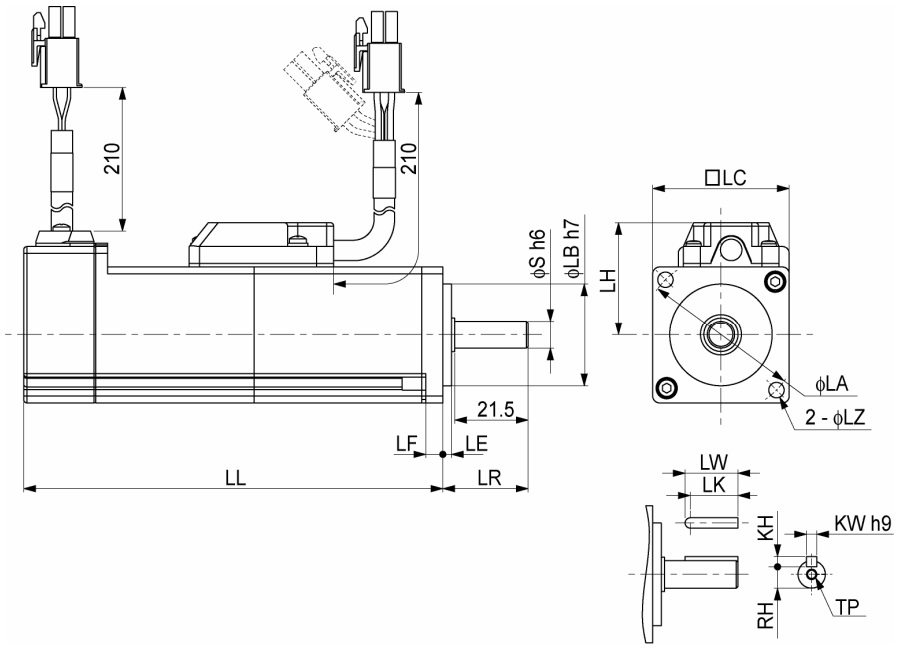
Item	Specifications
Ambient operating temperature	0 - 85℃
External disturbance magnetic field	±2mT (20G) or below

Note:

1. Using the motor with rotations of 180 degrees or less will reduce the encoder’s rotational accuracy.
2. For a motor equipped with a brake, follow the brake voltage and polarity specifications.
3. If the brake voltage is less than 12V or the polarity is reversed, the encoder’s rotational accuracy will be reduced.

2-1-7 External Dementions

- MM500□2□□** Middle inertia
- MM101□2□□** Middle inertia



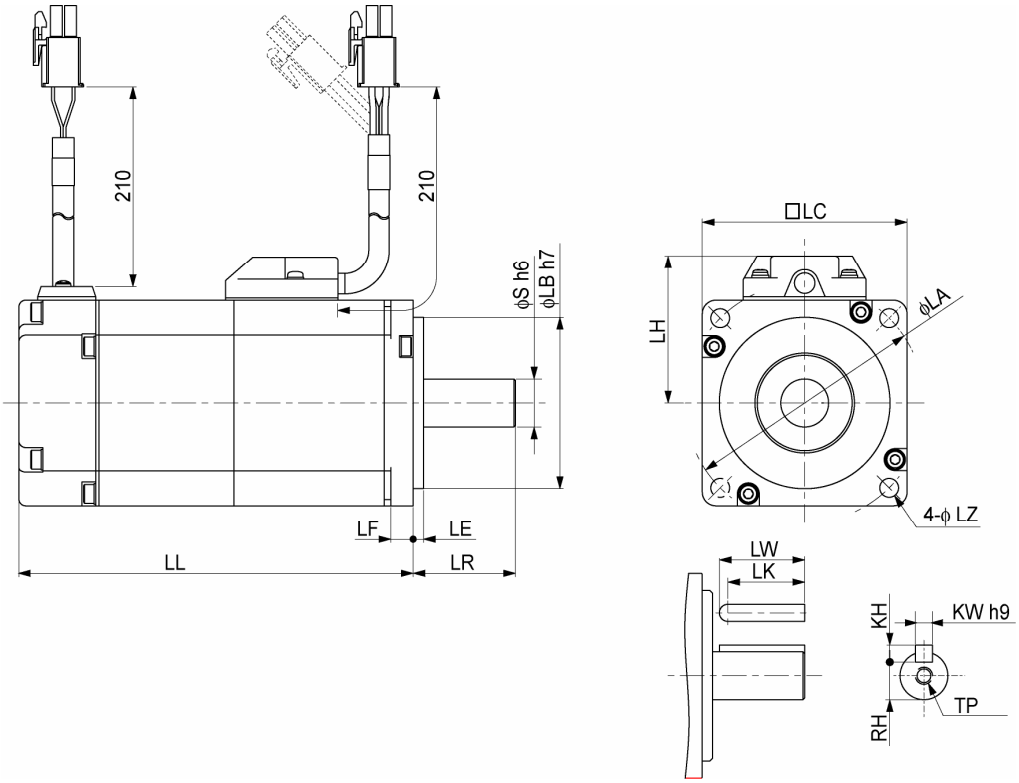
Voltage		AC200V - 240V			
Motor model number		50W		100W	
		Without oil seal	With oil seal	Without oil seal	With oil seal
		Middle inertia			
		MM500□2S□**	MM500□2T□**	MM101□2S□**	MM101□2T□**
		MM500□2K□**	MM500□2L□**	MM101□2K□**	MM101□2L□**
LC （Flange size）		□40			
LL	Without brake	66.4	72	82.4	88
	With brake	106.8	112.4	122.8	128.4
LR		25			
S		8			
LA		46			
LB		30			
LE		2.5			
LF		5			
LH		33			
LZ		4.5			
Dimensions with key	LW	15.5			
	LK	14			
	KW	3			
	KH	3			
	RH	6.2			
	TP	M3 Depth 6			

(The dimensional unit is mm.)

Note: The straight shaft products are not tapped ends.

2-1 Motor Specifications

- MA201□2Δ□** 200W Low inertia Shaft Φ11
- MH201□2Δ□** 200W High inertia Shaft Φ11
- MA201□2□□** 200W Low inertia Shaft Φ14
- MH201□2□□** 200W High inertia Shaft Φ14



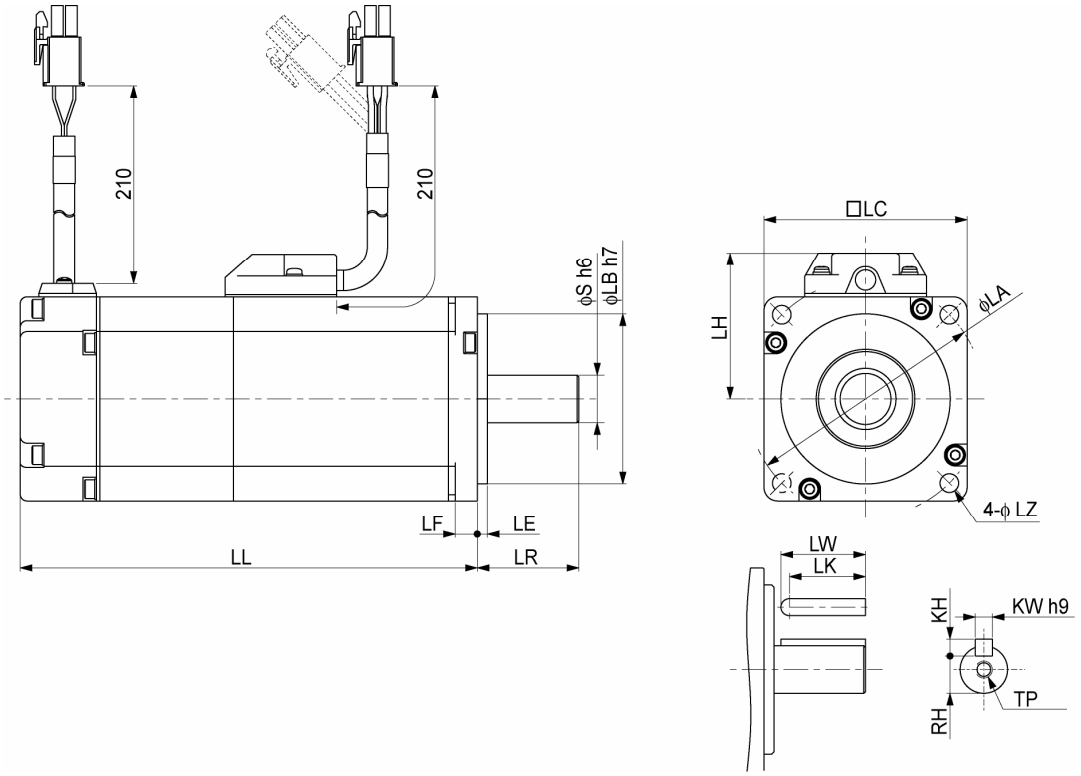
Voltage		AC200V - 240V			
Motor model number		200W			
		Low inertia	High inertia	Low inertia	High inertia
		MA201□2□□**	MH201□2□□**	MA201□2Δ□**	MH201□2Δ□**
Shaft diameter		Φ14		Φ11	
LC (FLANGE SIZE)		□60			
LL	Without brake	79	98.5	79	98.5
	With brake	115.5	135	115.5	135
LR		30			
S		14		11	
LA		70			
LB		50			
LE		3			
LF		6.5			
LH		43			
LZ		5.5			
Dimensions with key	LW	25		20	
	LK	22.5		18	
	KW	5		4	
	KH	5		4	
	RH	11		8.5	
	TP	M5 Depth 10		M4 Depth 8	

(The dimensional unit is mm.)

Note: The straight shaft products are not tapped ends.

2-1 Motor Specifications

- MA401□2□□** 400W Low inertia
- MH401□2□□** 400W High inertia



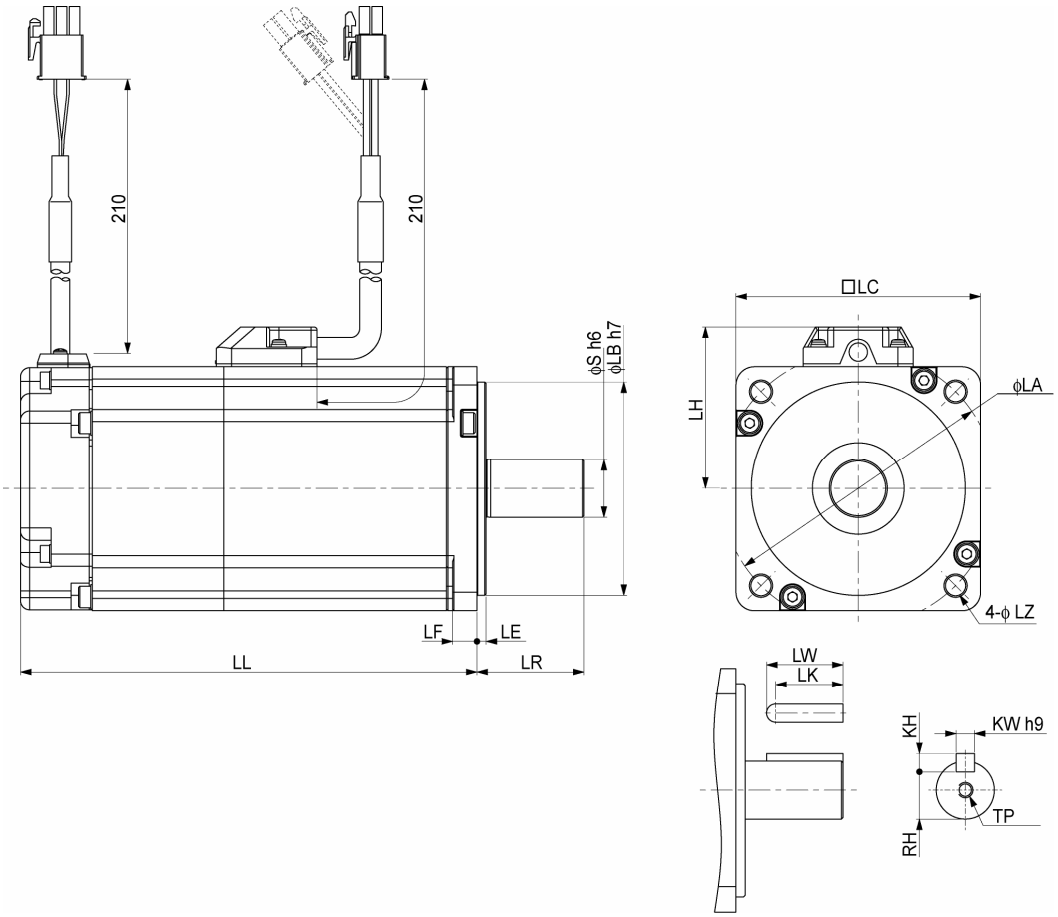
Voltage		AC200V - 240V	
Motor model number		400W	
		Low inertia	High inertia
		MA401□2□□**	MH401□2□□**
LC (FLANGE SIZE)		□60	
LL	Without brake	98.5	118
	With brake	135	154.5
LR		30	
S		14	
LA		70	
LB		50	
LE		3	
LF		6.5	
LH		43	
LZ		5.5	
Dimensions with key	LW	25	
	LK	22.5	
	KW	5	
	KH	5	
	RH	11	
	TP	M5 Depth 10	

(The dimensional unit is mm.)

Note: The straight shaft products are not tapped ends.

2-1 Motor Specifications

- MA751□2□□** 750W Low inertia
- MH751□2□□** 750W High inertia



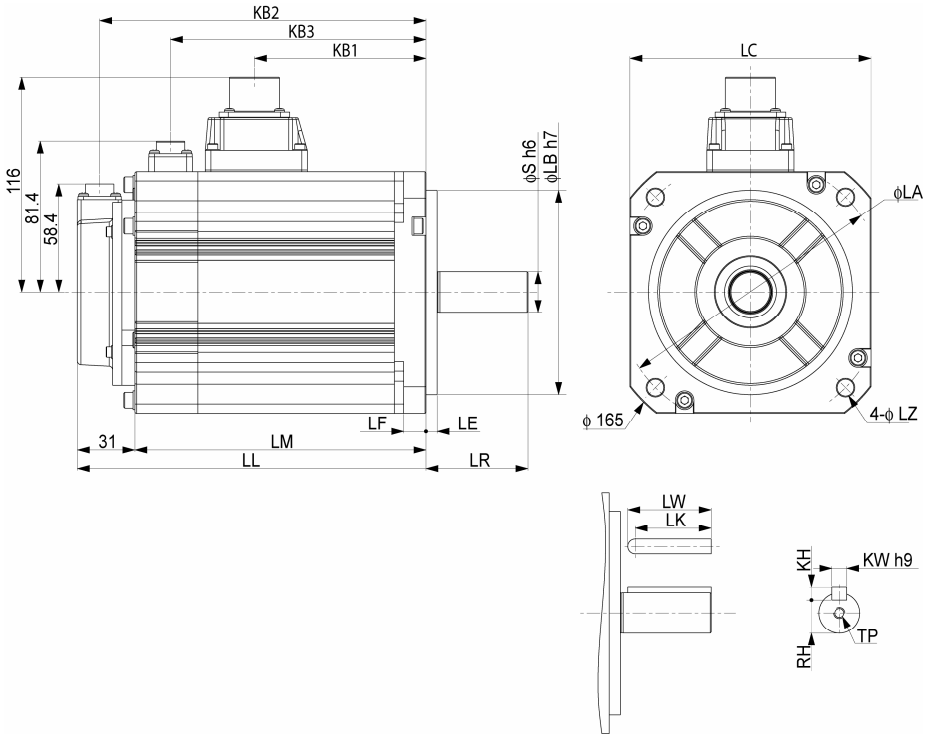
Voltage		AC200V - 240V	
Motor model number		750W	
		Low inertia	High inertia
		MA751□2□□**	MH751□2□□**
LC (FLANGE SIZE)		□80	
LL	Without brake	112.3	127.3
	With brake	149.3	164.3
LR		35	
S		19	
LA		90	
LB		70	
LE		3	
LF		8	
LH		53	
LZ		6.6	
Dimensions with key	LW	25	
	LK	22	
	KW	6	
	KH	6	
	RH	15.5	
	TP	M5 Depth 10	

(The dimensional unit is mm.)

Note: The straight shaft products are not tapped ends.

2-1 Motor Specifications

- MM102□2□□** MH102□2□□** 1kW Middle/High inertia
- MM152□2□□** MH152□2□□** 1.5kW Middle/High inertia
- MM202□2□□** 2kW Middle inertia



Voltage		AC200V - 240V				
Motor model number		1kW		1.5kW		2kW
		Middle inertia	High Inertia	Middle inertia	High Inertia	Middle inertia
		MM102 □2□□**	MH102 □2□□**	MM152 □2□□**	MH15 2□2□□**	MM202 □2□□**
LC (FLANGE SIZE)		□130				
LL	Without brake	128	163	145.5	180.5	163
	With brake	153	188	170.5	205.5	188
LM	Without brake	97	132	114.5	149.5	132
	With brake	122	157	139.5	174.5	157
LR		55	70	55	70	55
S		22				
LA		145				
LB		110				
LE		6				
LF		12				
LZ		9				
KB1		57.5	92.5	75	110	92.5
KB2	Without brake	116	151	133.5	168.5	151
	With brake	141	176	158.5	193.5	176
KB3	Without brake	-	-	-	-	-
	With brake	102.8	137.8	120.3	155.3	137.8
Dimensions with key	LW	45				
	LK	41				
	KW	8				
	KH	7				
	RH	18				
	TP	M6 Depth 20				

(The dimensional unit is mm.)

Note: The straight shaft products are not tapped ends.

2-1-8 N-T Characteristics

■ MM500□2□□**

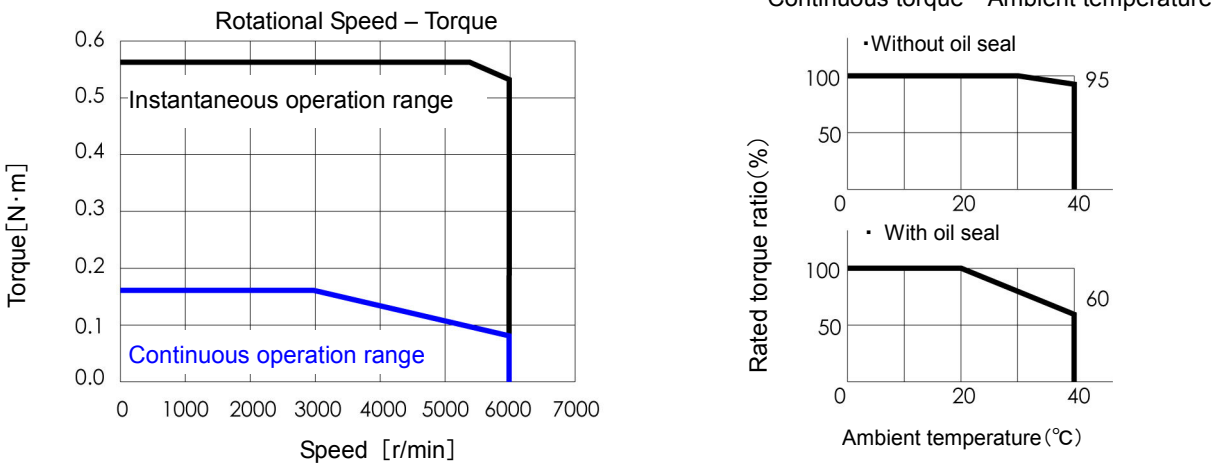


Figure 2-1-2 N-T Characteristics（50W）

■ MM101□2□□**

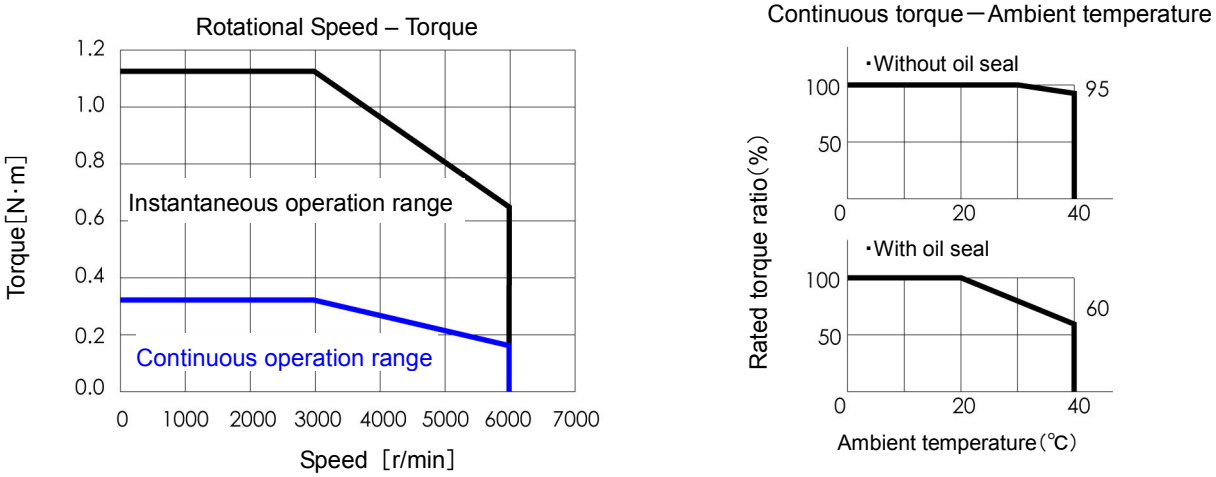


Figure 2-1-3 N-T Characteristics（100W）

■ MA201□2□□**, MH201□2□□**

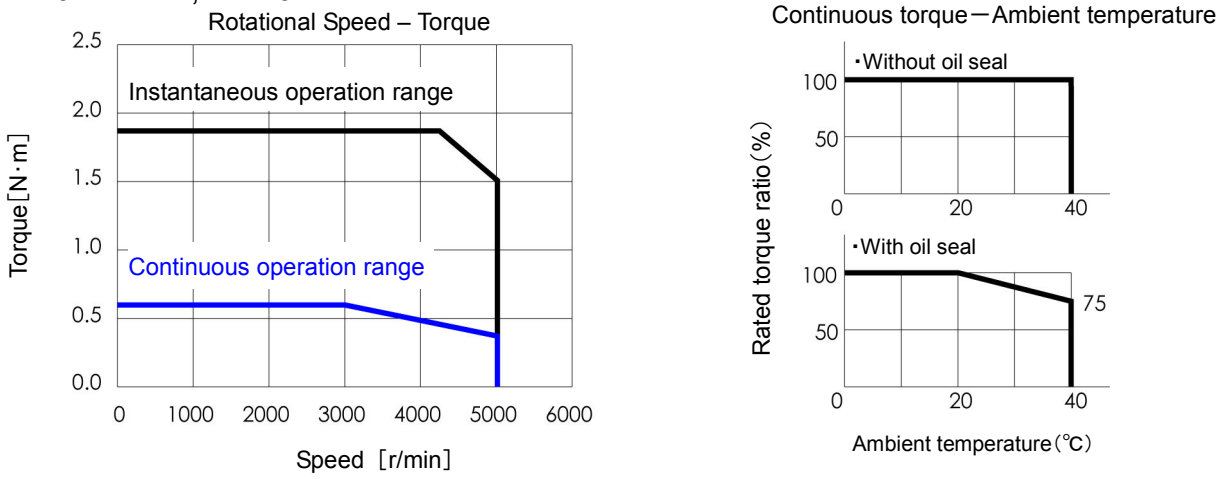


Figure 2-1-4 N-T Characteristics（200W）

■ MA401□2□□**, MH401□2□□**

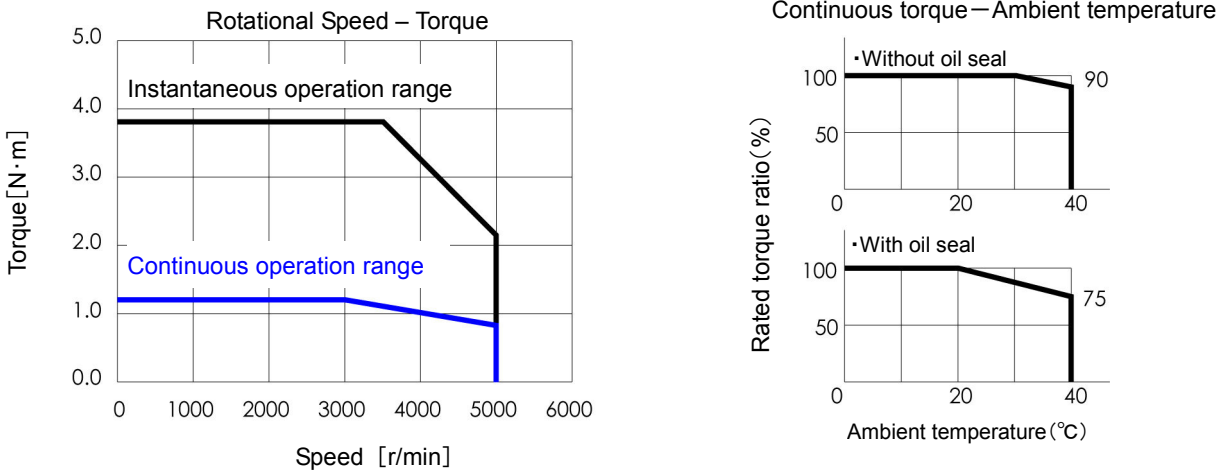


Figure 2-1-5 N-T Characteristics（400W）

■ MA751□2□□**, MH751□2□□**

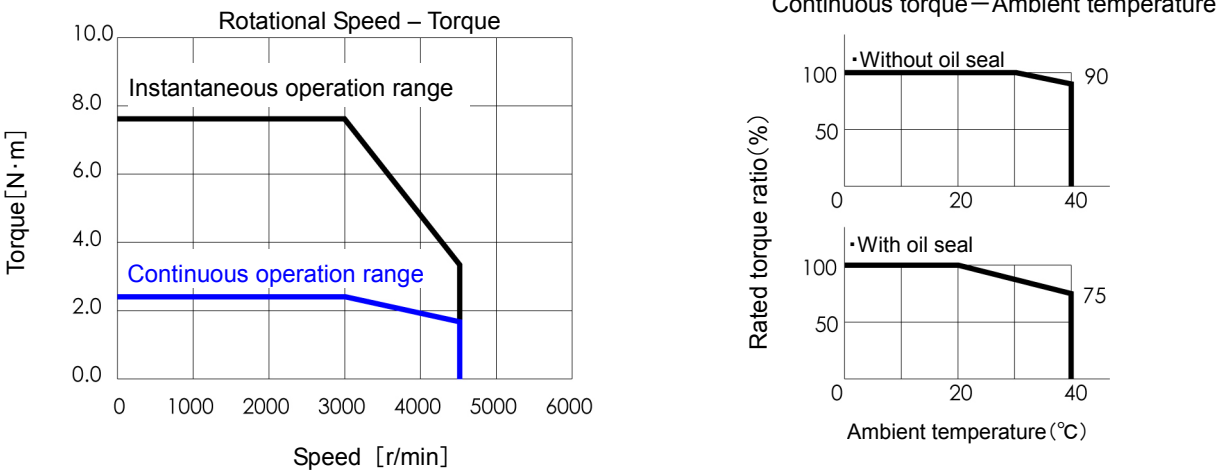
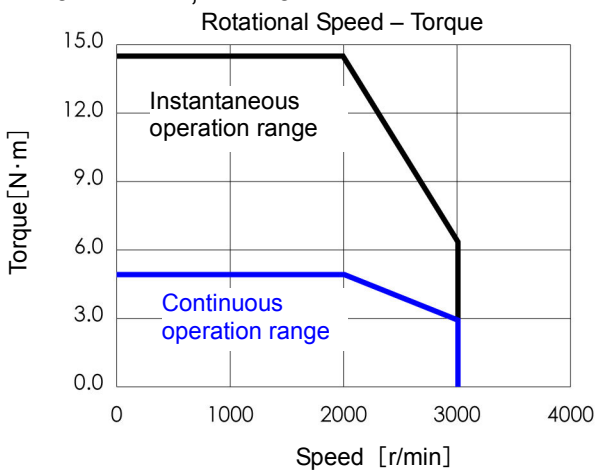


Figure 2-1-6 N-T Characteristics（750W）

■ MM102□2□□**, MH102□2□□**



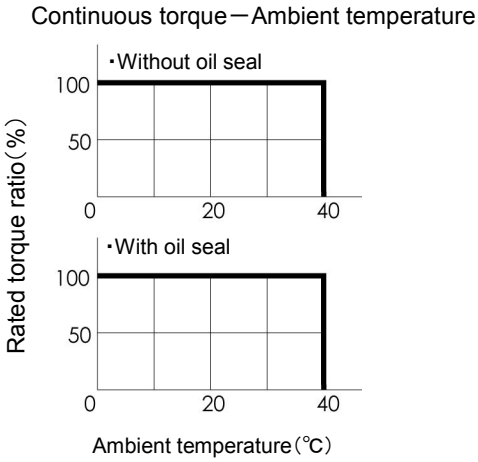
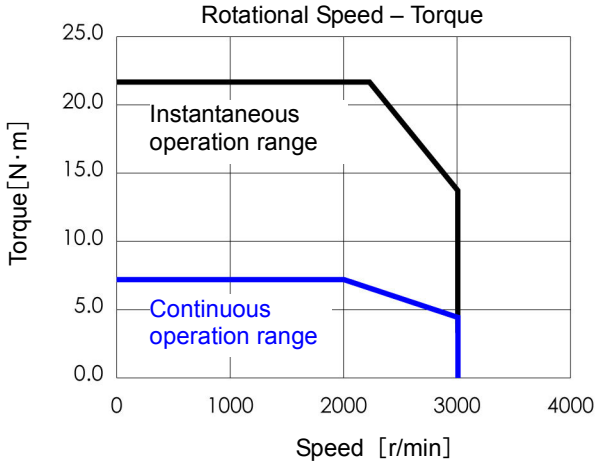


Figure 2-1-7 N-T Characteristics（1kW）

■ MM152□2□□**, MH152□2□□**



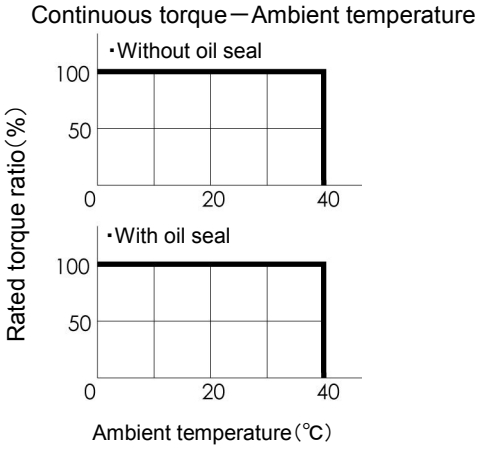
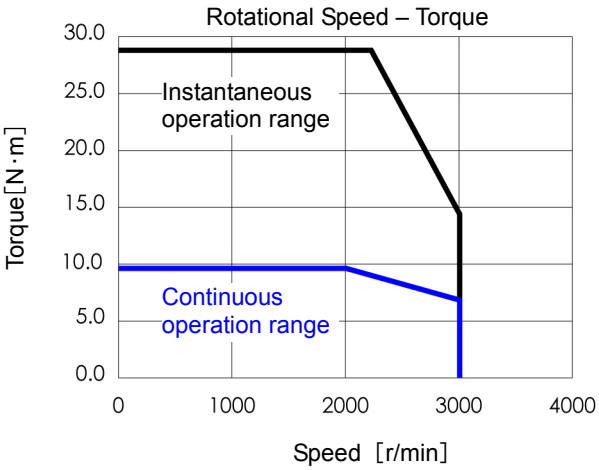


Figure 2-1-8 N-T Characteristics（1.5kW）

■ MM202□2□□**



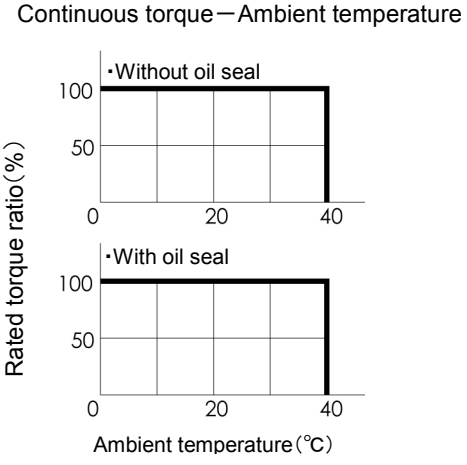


Figure 2-1-9 N-T Characteristics（2kW）

2-2. Amplifier Specifications

2-2-1 How to Read the Amplifier Model Number

Voltage Specifications	
Code	Voltage
2	AC200-240V

Compatible Motor		
Code	Motor model number	Output
YZ	M□500□2□□**	50W
Z1	M□101□2□□**	100W
12	M□201□□□□**	200W
24	M□401□□□□**	400W
38	M□751□□□□**	750W
4A	M□102□□□□**	1kW
6B	M□152□□□□**	1.5kW
8C	M□202□□□□**	2kW

Encoder Specifications	
Code	Specifications
0	17-bit (incremental only)
1	17-bit (both incremental and absolute)

Control Number

Figure 2-2-1 How to read the amplifier part number

2-2-2 Component Names and Functions

Amplifier mounting holes
- =<750W : Φ5.5, the recommended screw M5×1 (one location)
- >=1kW : Φ5.5, the recommended screw M5×2 (two locations)

With spring washer

Setting Panel
Used for parameter setting, tuning, and status display

UVW Motor power output connector
UVW output

B1/ B2 / L1 / L2 / (L3)
B1/B2: the regeneration resistor connection
L1/L2/(L3): the AC200V input connection

CHARGE Hazardous Voltage Display LED
This will be lit while there is residual hazardous voltage inside the amplifier.

CN3 PC Communication connecter
Used for Parameter Settings and Tuning in the dedicated software "S-TUNE"

CN1 User I/O connector
Control power input, Command input, Parallel I/O, ABZ output

CN2 Encoder connector
Connect the encoder.

Amplifier mounting notch
φ5.5, the recommended screw M5 (one location),
Spring washer

FG (Protective earth) terminal
M4 screw of length 8,
With spring washer and shake proof washer

Figure 2-2-2 Amplifier - Parts and Functions

2-2-3 Basic Specifications

Table 2-2-1 Amplifier Specifications

Item			Specifications							
Model name(DA□□□**)			DA2YZ	DA2Z1	DA212	DA224	DA238	DA24A	DA26B	DA28C
Common Specifications	Compatible motor		M□500□2 □□**	M□101□2 □□**	M□201□2 □□**	M□401□2 □□**	M□751□2 □□**	M□102□2 □□**	M□152□2 □□**	M□202□2 □□**
	External dimensions	W (mm)	40				48	84		
		H (mm)	160							
		D (mm)	130							
	Weight (kg)		0.7				0.8	1.6		
	Input power	Main circuit power	Single-phase AC200 - 240V ±10% 50/60Hz					Three-phase AC200 - 240V ±10% 50/60Hz		
		Control power	DC24V ±10%							
		Current Consumption (Typ.)	170mA			210mA	260mA	350mA		
			This does not include rush current. See Note 1) below for control power supply requirements.							
	Control type		Three-phase PWM inverter sine-wave driven							
	Output specifications	Rated current (Arms)	0.6	0.9	1.7	2.7	4.3	5.6	9.9	12.2
		Output frequencies (Hz)	0 - 400		0 - 333		0 - 300	0 - 250		
	Encoder feedback		17 bit single-turn absolute (The product can function as a multi-turn absolute type when batteries are added.)							
	Control signal	Input	8-point (24 VDC system, photo-coupler input insulation) inputs whose functions are switched by the control mode							
		Output	8-point (24 VDC system, open-collector output insulation) outputs whose functions are switched by the control mode							
	Analog signal	Input	1-point (± 10 V) input whose functions can be switched by the control mode							
	Pulse signal	Input	RS-422 differential Open-collector							
		Output	A-/B-/Z-phase: RS-422 differential Only Z-phase through open-collector							
	Communication function		USB: communication with PC (used to connect to “S-TUNE”) RS-485: host remote control communication (multi-drop compatible)							
	Amplifier status display function		Normal/Error indicated by STATUS LED Power ON Normal：Green light, Power ON Fault：Red light, Power OFF：Dim							
	Regeneration function		A regenerative resistor may be installed externally - See Note 2)							
	Dynamic brake		None - See Note 3)							
	Control mode		Position control, Internal position control, Speed control, Internal speed control, or Torque control							

2-2 Amplifier Specifications

Item				Specifications
Functions				
	Position control mode	Control input		Servo ON, alarm reset, command input inhibit, deviation counter clear, 2-stage torque limit, CCW/CW run prohibited
		Control output		Alarm status, servo ready, position completion, brake release, servo status, output under torque control
		Pulse input	Maximum command pulse frequency	RS -422 differential: 4 Mpps Open-collector: 200 kpps
			Input pulse signal form	Pulse + Direction, A-/B-phase quadrature encoder pulse, CW + CCW pulse – See Note 4)
			Command pulse Division/ Multiplication	A/B; A : 1-65535, B : 1-65535, 1/1000 < A/B < 1000
			Smoothing Filter	FIR Filter
		Pulse output	Output pulse signal format	Encoder position pulse outputted in the following form: • A-/B-phase quadrature encoder pulse and Z-phase index pulse released in RS-422 differential format • Z-phase index pulse outputted through open-collector
Functions	Internal position control mode	Control input		Servo ON, alarm reset, deviation counter clear ,start, point selection 1, point selection 2, point selection 3, point selection 4, home position sensor input
		Control output		Alarm status, servo ready, brake release, servo status, output under torque control, motion completion, return to home position complete
		Operation mode		Point table, communication operation, manual pulse train input
		Pulse output	Output pulse signal format	Encoder position pulse outputted in the following form: • A-/B-phase quadrature encoder pulse and Z-phase index pulse outputted in RS-422 differential format • Z-phase index pulse outputted through open-collector
	Speed control mode	Control input		Servo ON, alarm reset, command input inhibit (zero speed clamping) 2-stage torque limit, CCW/CW run prohibited
		Control output		Alarm status, servo ready, brake release, servo status, output under torque control
		Analog input	Speed command input	Input voltage: -10 V to +10 V, Maximum speed is reached at ± 10 V.
			Smoothing filter	IIR Filter, FIR Filter
		Pulse output	Output pulse signal format	Encoder position pulse outputted in the following form: • A-/B-phase quadrature encoder pulse and Z-phase index pulse outputted in RS-422 differential format • Z-phase index pulse outputted through open-collector
	Internal speed control I mode	Control input		Servo ON, alarm reset, internal speed command – 1 & 2, 8-stage internal speed command, 2-stage torque limit
		Control output		Alarm status, servo ready, brake release, servo status, output under torque control
		Pulse Output	Output pulse signal format	Encoder position pulse outputted in the following form: • A-/B-phase quadrature encoder pulse and Z-phase index pulse outputted in RS-422 differential format • Z-phase index pulse outputted through open-collector
	Torque control mode	Control input		Servo ON, alarm reset, command input inhibit (zero torque command) 2-stage torque limit, CCW/CW run prohibited
		Control output		Alarm status, servo ready, brake release, servo status, output under torque control
		Analog input	Torque command input	Input voltage: -10 V to +10 V, Maximum torque is reached at ± 10 V.
		Pulse output	Output pulse signal format	Encoder position pulse outputted in the following form: • A-/B-phase quadrature encoder pulse and Z-phase index pulse outputted in RS-422 differential format • Z-phase index pulse outputted through open-collector

2-2 Amplifier Specifications

Item			Specifications
Functions	Common features	Speed observer	Available
		Damping control	Available
		Auto-tuning	Available
		Encoder output Division/Multiplication	Available
		Tuning & Function settings	Available through the S-FLAG setup software “S-TUNE”
		Protective functions: Hardware alarms	Overvoltage, low voltage, overcurrent , abnormal temperature, overload (see the section 2-2-5 Overload Detection Characteristics), encoder error
		Protective functions: Software alarms	Overspeed, position deviation too high, parameter errors
Environmental specifications		Ambient temperature: For operation	0℃ - 55℃ - See Note 5 and 6)
		Ambient temperature: For storage	-20℃ - 65℃
		Ambient humidity: For operation	20 - 85% RH or less (no condensation)
		Ambient humidity: For storage	20 - 85% RH or less (no condensation)
		Atmosphere for operation and storage	Indoors (not subject to direct sunlight); free from corrosive gases, flammable gases, oil mist, or dust
		Altitude	1,000m or less above sea level
		Vibration	5.8m/s^2 (0.6G) or less, 10 - 60Hz (no continuous operation allowed at frequency of resonance)
Dielectric strength			AC1,500V for one minute across the primary and FG
Note			The servo amplifiers are: ·Class I products for which grounding is mandatory ·Overvoltage category II products ·Pollution degree 2 products

Note 1) Follow the instructions below when selecting DC24V external power supply for control power:

1. Use a SELV (Safety Extra Low Voltage) power supply which is isolated from hazardous voltage with reinforced insulation. Practice overcurrent protection to prevent the amplifier from malfunctioning or use a power supply whose output capacity is 100W or less.
2. The current consumption listed in the table is for the cases of no I/O signals connected except for the Servo ON signal. Current consumption by all I/O signals in use will be added up.

Note 2) Use the setup panel to determine whether a regeneration resistor should be installed or not.

1. Select  in the state display mode.
2. Display  in the state of regeneration.
3. Observe if the display on the setup panel turns to  while the speed of the equipment is approaching to the actual operation speed from the low speed (approximately 20% of the maximum speed).
4. If the display becomes to show  , install a regeneration resistor, referring to “Table 2-2-2 Regeneration Resistors” below.
5. The regeneration resistance value shown on Table 2-2-2 doesn’t guarantee the optimal performance. If the generated heat temperature becomes too high, raise the resistance value or select a resistor whose allowable power is larger.

Table 2-2-2 Regeneration Resistors

Model name (DA□□□**)	DA2YZ	DA2Z1	DA212	DA224	DA238	DA24A	DA26B	DA28C
Compatible motor	M□500	M□101	M□201	M□401	M□751	M□102	M□152	M□202
Rated output	50W	100W	200W	400W	750W	1kW	1.5kW	2kW
Regeneration resistance value	40-50Ω					30Ω	30Ω	20Ω
Regeneration allowable power	20W					40W	40W	60W

Note 3） The amplifiers are equipped with a software-based dynamic braking function to stop the equipment. This dynamic braking function does not necessarily work in case of amplifier failure or shutoff of control power supply (e.g., power outage).

Note 4） Pulse train command input forms are described in the following table.

Table 2-2-3 Pulse train command input forms

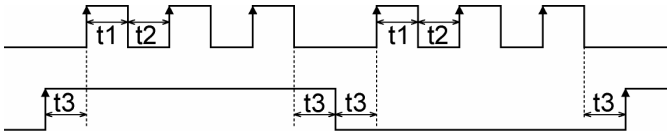
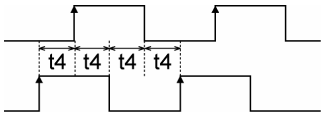
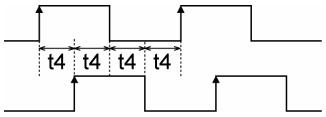
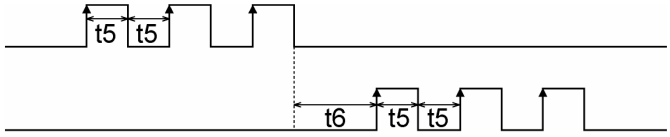
Parameter No.32.0 Pulse train command Input mode	Input signal form	Signal name	Minimal time interval needed(t1,t2,t3,t4,t5,t6)	
			Positive direction command	Negative direction command
0 (initial value)	Pulse & Direction Command pulse	Pulse CMD_PLS Direction CMD_DIR		
1	A-/B-phase quadrature encoder pulse	A-phase CMD_PLS B-phase CMD_DIR		
2	CCW pulse CW pulse	CCW CMD_PLS CW CMD_DIR		

Table 2-2-4 Maximum command pulse frequency and minimum time of Pulse Train Command Input signal

Input pulse signal	Maximum command pulse frequency	Minimum time [μs]					
		t1	t2	t3	t4	t5	t6
Differential	4Mpps	0.125	0.125	2.5	0.25	0.125	0.125
Open connector	200kpps	2.5	2.5	2.5	2.5	2.5	2.5

1. Time needed for rising or falling edge of the command pulse input signal should be 0.1μs or less.
2. The number of pulse is counted at the time of rising edge (i.e. from Low to High).
3. Set parameter No.33.0 “Pulse train command input filter selection” according to the input frequency.

Note 5） When mounting an amplifier, have it screwed through the mounting holes to a protection case and leave adequate space surrounding the amplifier in order to prevent the ambient temperature from rising. Follow the instructions described in the section “3-1-5 Mounting Orientation and Space”.

Note 6) Ambient temperature derating

Regarding the ambient temperature of a 2kW amplifier (Model Name: DA28C), take the following into consideration:

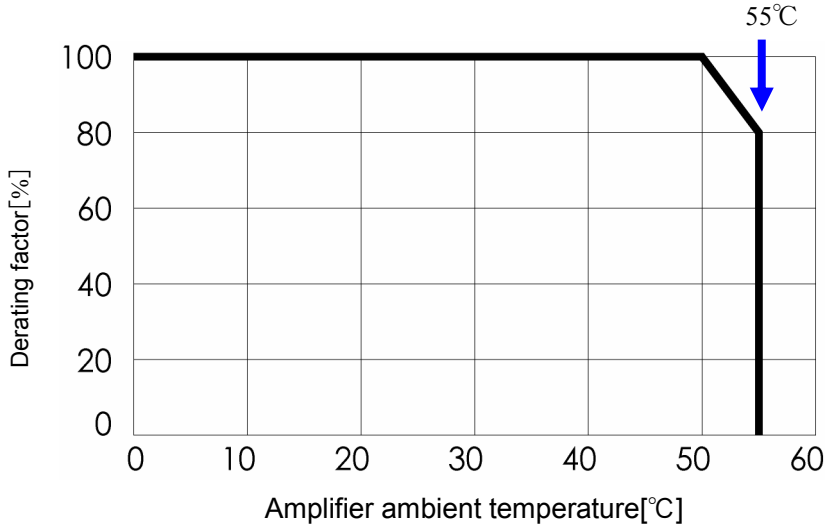
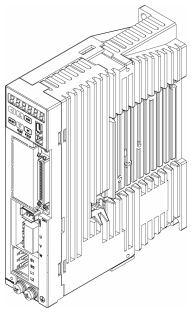
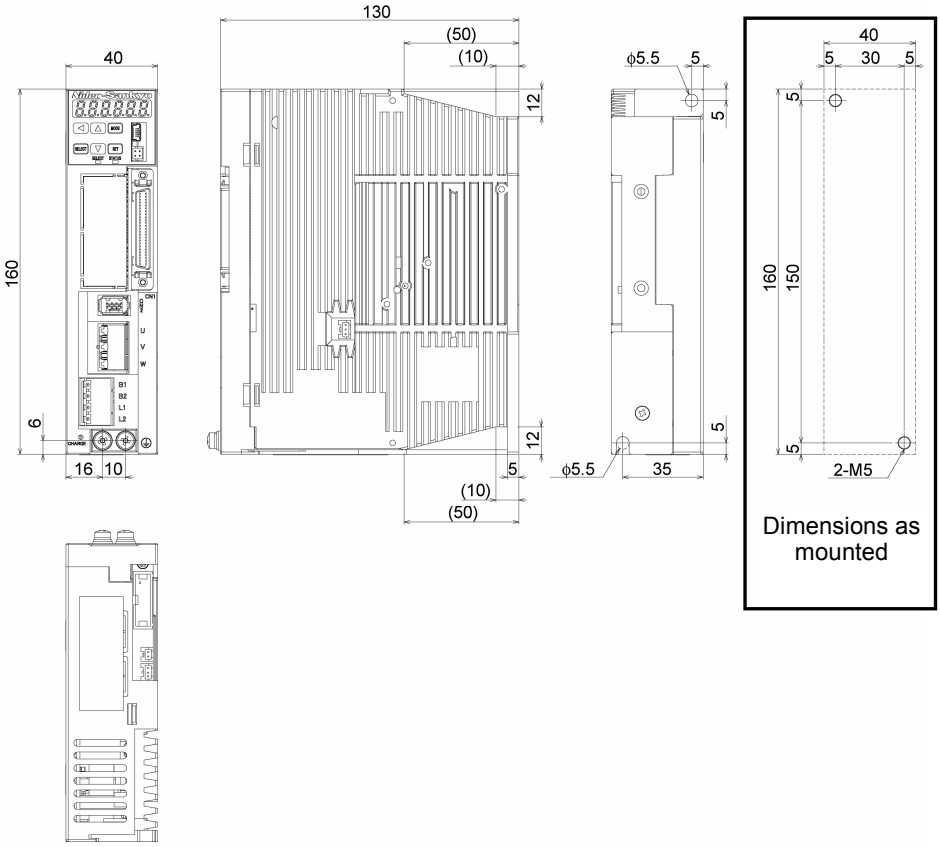


Figure 2-2-3 2kW Amplifier Derating

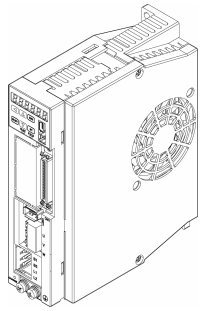
2-2-4 External Dementions

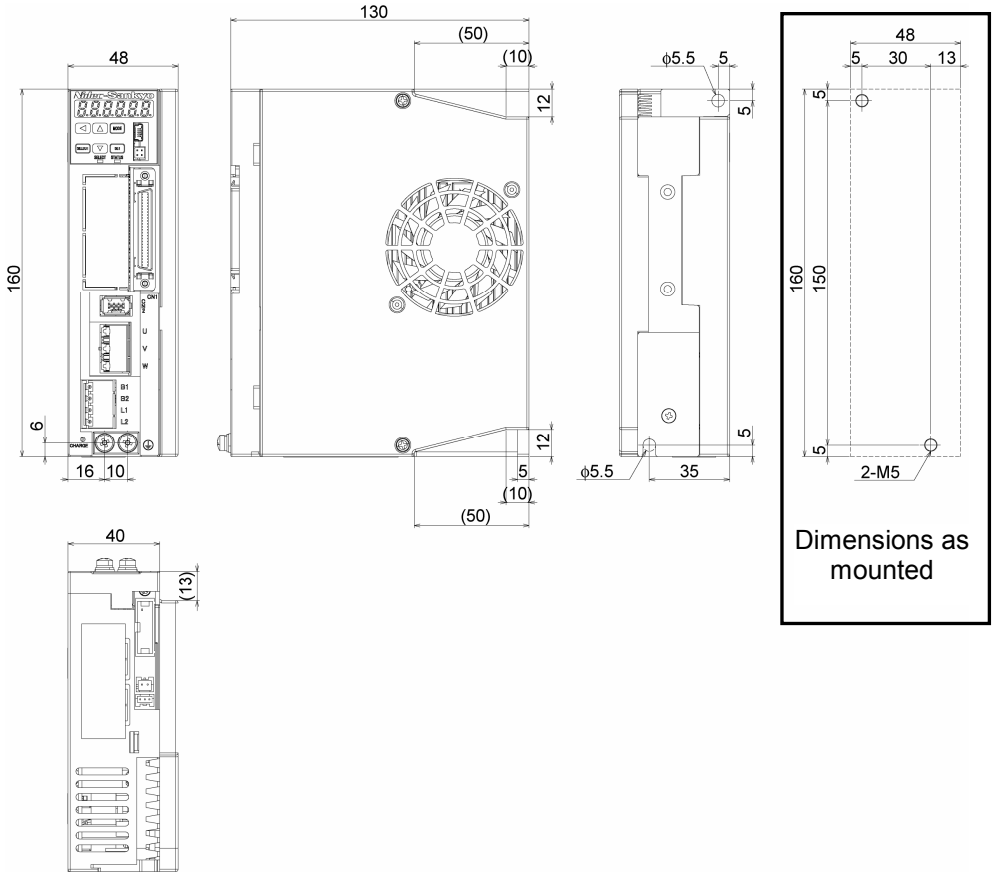
DA2YZ**
DA2Z1**
DA212**
DA224**



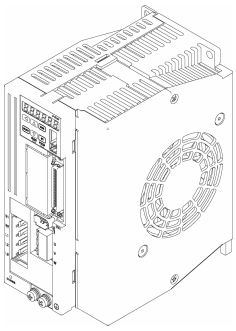


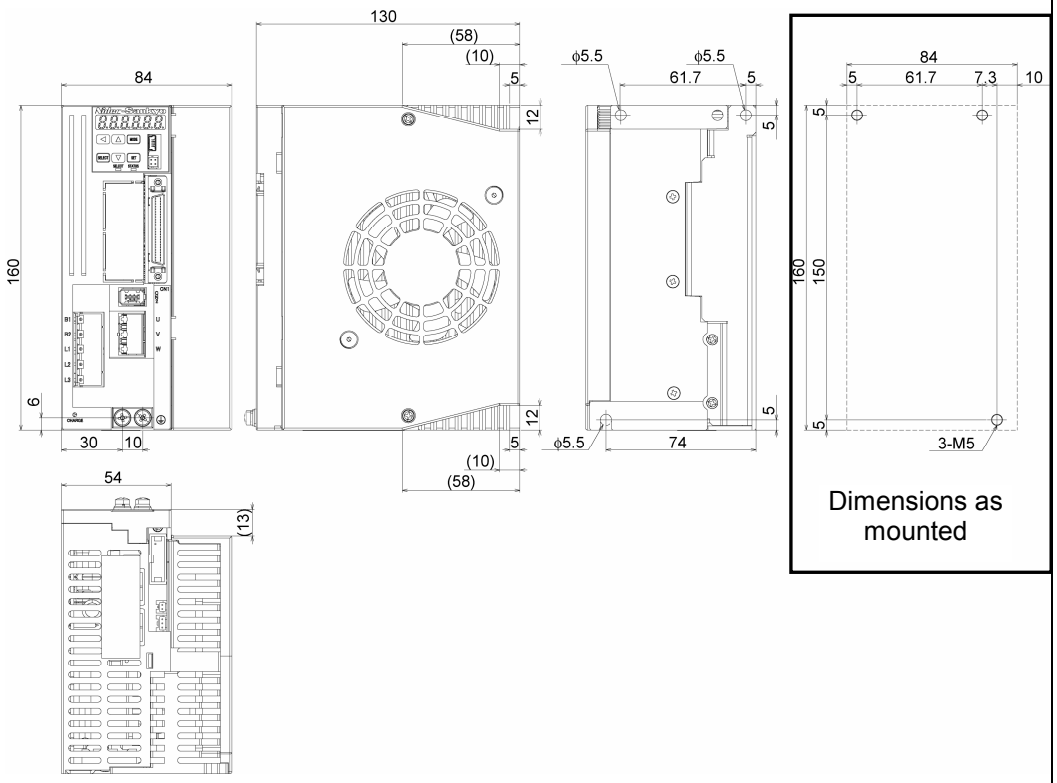
DA238**





DA24A**
DA26B**
DA28C**





(The dimensional unit is mm.)

2-2-5 Overload Detection Characteristics

This servo amplifier performs overload protection and outputs the overload alarm when the motor is operated above the overload detection characteristics curve shown below. The motor makes an emergency stop in that case.

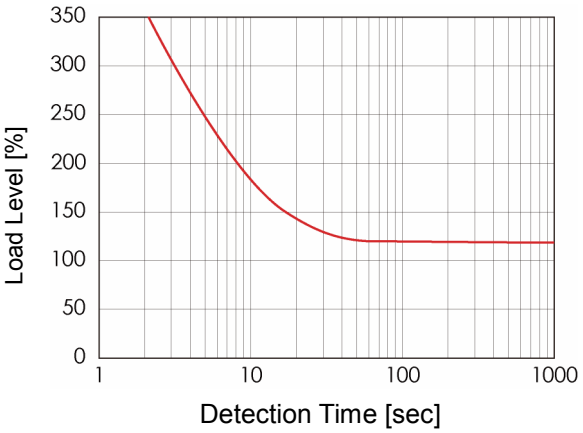


Figure 2-2-4 Overload detection characteristics (50W)

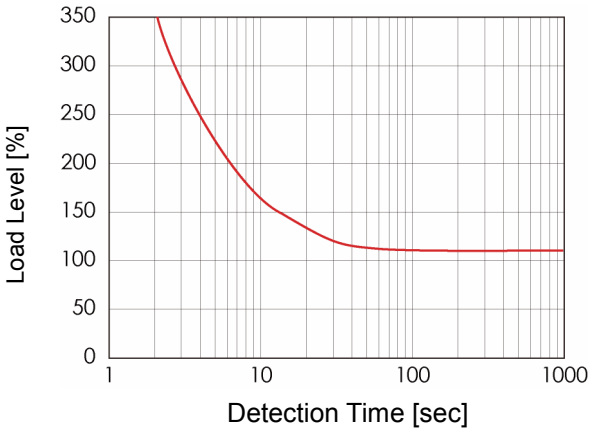


Figure 2-2-5 Overload detection characteristics (100W)

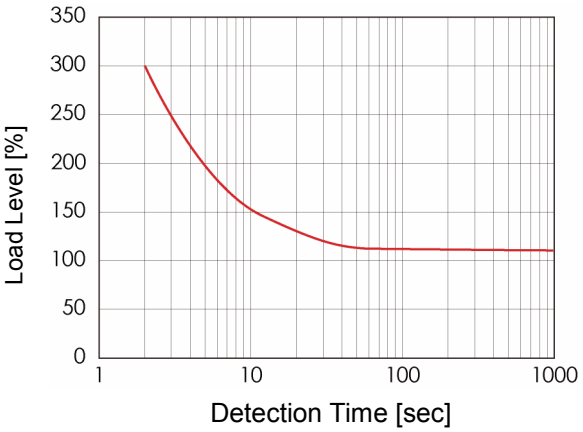


Figure 2-2-6 Overload detection characteristics (200W)

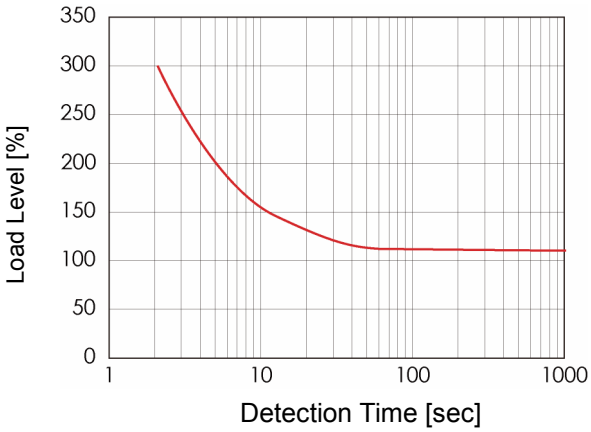


Figure 2-2-7 Overload detection characteristics (400W)

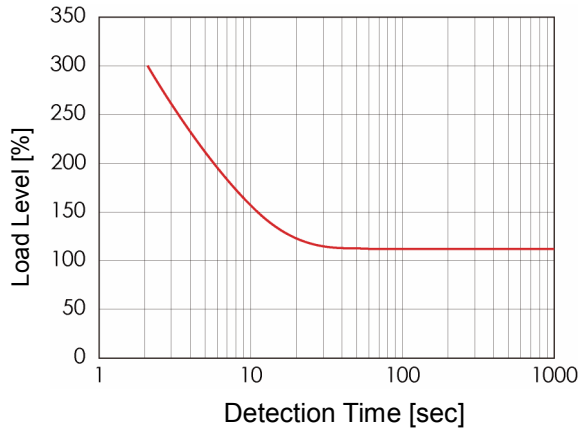


Figure 2-2-8 Overload detection characteristics (750W)

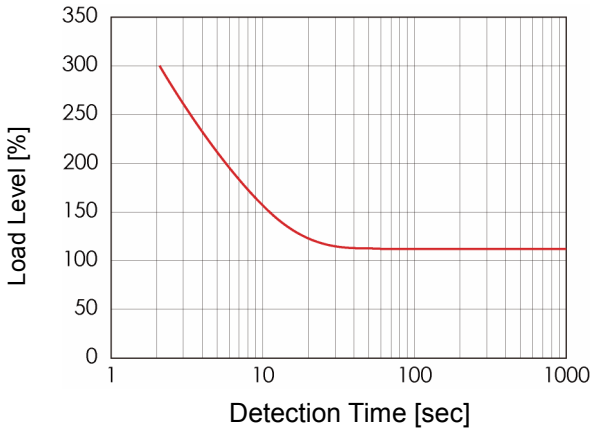


Figure 2-2-9 Overload detection characteristics (1kW)

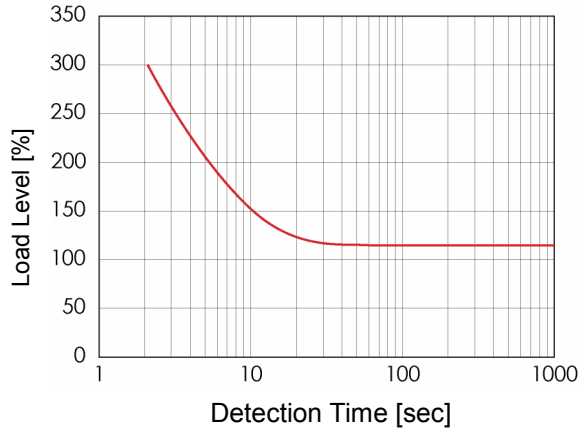


Figure 2-2-10 Overload detection characteristics (1.5kW)

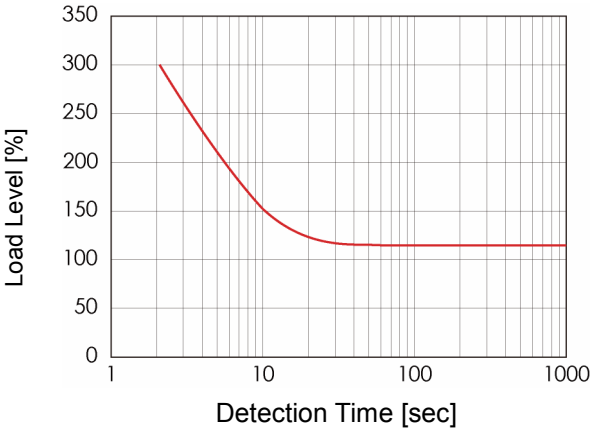


Figure 2-2-11 Overload detection characteristics (2kW)

(MEMO)

3. Installation and Connections

3 Installation and Connections

Contents

Figures

Tables

3-1. Installation

3-1-1 Installation Environment

	Please have the installation and operation environment meet the requirements described in the product specifications in Chapter 2. Should you use the product in different conditions from the installation and operation environment specifications, please contact us.	Otherwise, the service life of the motor and the amplifier may become shorter and the equipment performance may be compromised.

1. Install the product at a location free from direct sunlight.
2. Be sure to install amplifiers inside the control board.
3. Install the product at locations free from humidity and ingress of water or oil such as cutting oil or oil mist.
4. Never use the product in ambient air of explosive or flammable gases, chloride, acidic or alkaline corrosive ambience (e.g., sulfur dioxide, chlorine, ammonia and so on).
5. Do not use the product at locations subject to dust, iron dust, or chips.
6. Do not use the product near locations subject to high temperatures, continuous vibrations, or excessive shock.

3-1-2 Protection against Dust and Water

	The amplifier is not designed to protect against water.	Exposure to water will cause amplifier failure.

The motor construction except for shaft output and connector sections is IP 65 in compliance with IEC 34-5 (International Electrotechnical Commission) and JEM 1030 (Standard by The Japan Electrical Manufacturers' Association).

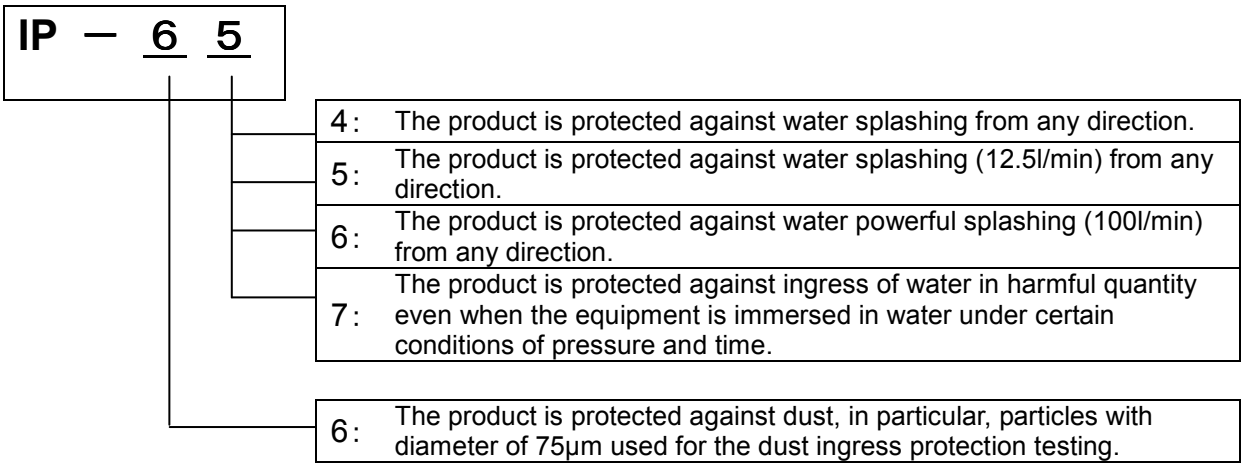


Figure 3-1-1 IP degrees of protection

3-1-3 Impact Load

	Shock resistance of the motor is 200m/s^2 (20G). During transportation, installation or removal of the equipment, do not apply strong impact load. In addition, do not carry it by the encoder, cable, or connector sections.	Otherwise, the motor may fail, or the product life may become shorter and the equipment performance may be compromised.
	When removing pulleys, or couplings etc. from the shaft, always use a pulley remover.	

3-1-4 Connecting to Machinery

	When mounting the motor, do not apply excessive stress to the encoder cable.	Otherwise, the encoder cable may snap.
	When connecting the motor to a load, use a coupling to absorb deviations from normal angles and directions so that the motor shaft load remains within the specified allowable load to the motor shaft.	Otherwise, the service life of the motor bearing may become shorter and the shaft may get damaged.
	Bending radii of the motor power cable and encoder cable must be R20mm or larger.	Otherwise, the motor power cable or the encoder cable may snap.

3-1-5 Mounting Orientaion and Space

	When installing the amplifier, leave adequate surrounding space for the heat inside the protection case and control console board to radiate and flow.	Otherwise, the ambient temperature may rise above the maximum ambient operating temperature and the service life of the amplifier may become shorter.

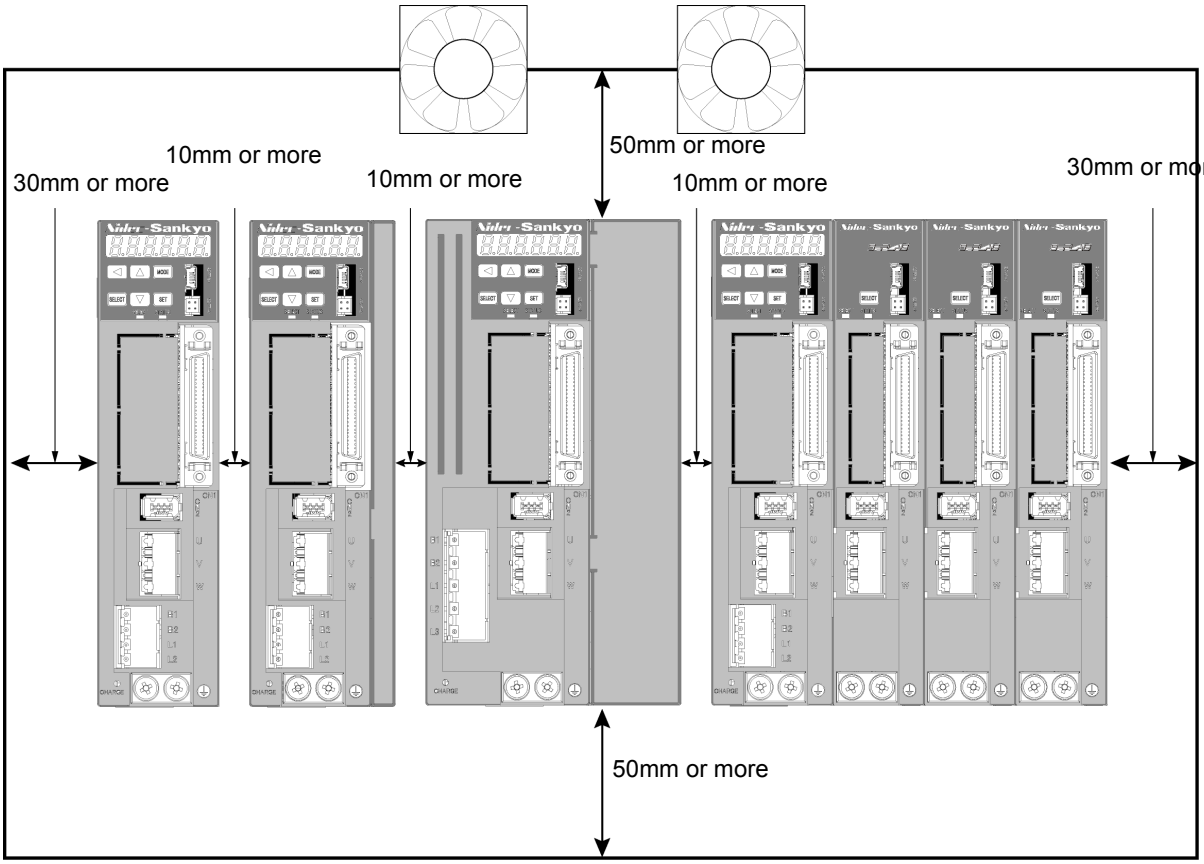


Figure 3-1-2 Spacing for Amplifier Mounting

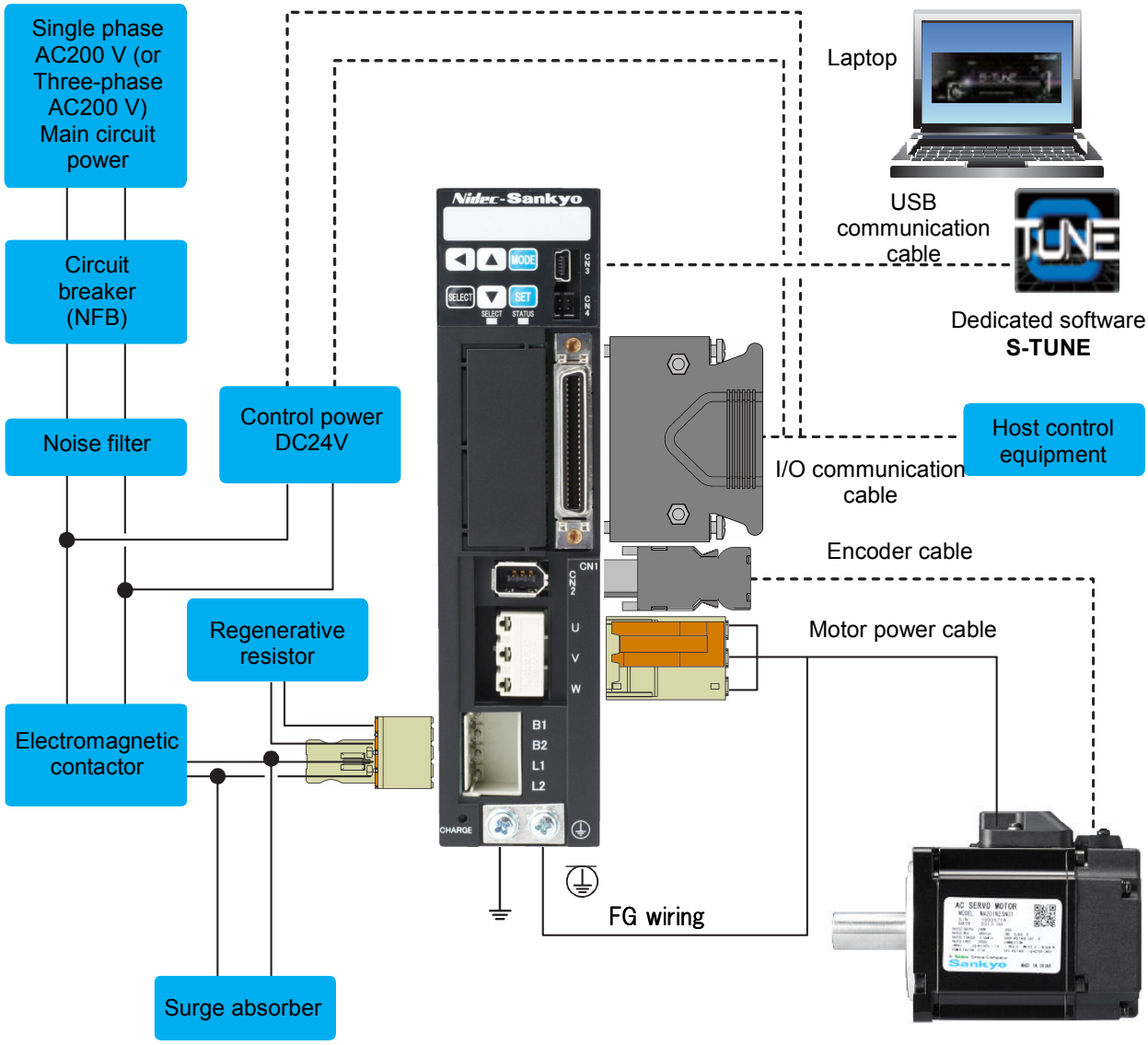
1. Install amplifiers vertically. For mounting, amplifiers with 750W or less will need M5 screws at two locations and those with 1kW or above will need M5 screws at three locations.
2. When mounting amplifiers to enclosure space (e.g., a protection case), use a cooling fan or an air conditioner so that the ambient temperature of each circuit board installed inside will not rise above 55°C.
3. The surface temperature of the heat sink could rise 30°C higher than the ambient temperature.
4. Wiring materials should be heat-resistant. Equipment and wires sensitive to heat should be installed with clearance from the amplifier.
5. The product life of the amplifiers is determined by the ambient temperature of the internal electrolytic capacitor. Electrolytic capacitors have a lifespan of approximately 5 to 6 years when used under the following conditions: the annual average temperature of 30°C, the load factor of 80%, and the average daily operation of 20 hours or less.

3-1-6 Other Precautions

1. The motor shaft has anti-rust oil applied at the time of shipment. Please wipe the oil completely before installing the motor.
2. Never dismantle the encoder or disassemble the motor body.
3. Have the control voltage (DC 24V and GND) and the host control device share the same power supply.
4. Be sure to turn off the circuit breaker for the main power supply in advance before performing maintenance work.
5. Be careful with the residual voltage in the amplifier for approximately 30 seconds after shutting off the main power supply.
6. Never attempt to replace a fuse.
7. The amplifier with 750 W or above has a cooling fan attached on the right side. Do not touch or block the vent of the amplifier.

3-2. Wiring

3-2-1 Wiring and Connections



Solid line: High voltage cable
Dotted line：Non-hazardous cable

Figure 3-2-1 System configuration diagram

Danger		
	Be careful with wiring and handling of high voltage materials.	Otherwise, electric shock, fire, equipment failure or damage may be caused.

3-2 Wiring

Important points

Be sure to connect FG for the AC200V input (main circuit) power supply.
Have the DC24 V power supply and the AC200V input (main circuit) power supply share the same AC200V main power supply.
Do not place a switch between the DC24 V power supply and the amplifier. When planning to place a switch, be sure to place it on the AC200V cable which inputs to the DC24 V power supply.
For the high voltage cables shown on Figure 3-2-1, use copper wires with a rated withstand voltage of 600 V or higher.
If the length of the I/O host communication cable between the host control equipment and the amplifier connector CN1 becomes 50cm or longer, use a shielded twisted-pair cable so that the length will not exceed 2m.
Work out with wiring so that the encoder cable length will not exceed 20m.

Table 3-2-1 Wiring Connections with Peripheral Equipment

Item	Description
Peripheral equipment configuration	To comply with the EC Directive, select appropriate equipment that are in compliance with applicable standards and install them in accordance with “3-2-1 General Wiring Diagram” in this chapter.
Installation environment	Install the amplifier in the environment of Pollution Degree 2 or 1 defined by IEC60664-1.
Power supply 1: AC200 – 240 V (main circuit)	Please use the product in the power supply environment of Over-Voltage Category II defined by IEC60664-1.
Power supply 2: DC24 V; Amplifier control power; I/O power; Motor brake release power	Use a DC24 V external power supply whose specifications meet the SELV requirement, that is, Safety Extra Low Voltage (i.e. non-hazardous voltage, or reinforced insulation from any hazardous voltage) power.
Wires/Cables	For the motor motive power cable, AC200V input cable, and FG cable: Select wire materials with a dielectric strength of 1) AWG18/600 V or equivalent for the motors of 750W or less 2) AWG14/600 V or equivalent for the motors of 1 kW or over. For the encoder cable: Select an AWG 22-24 shielded twisted pairs cable with a dielectric strength of 30 V or equivalent, and keep its length within 20m. For the user I/O cable: Select an AWG 26 shielded twisted pairs cable with a dielectric strength of 300 V or equivalent and keep its length within 2m. When planning to use cables longer than specified above, please contact us.
Circuit breaker	In order to protect the power supply line, the circuit breaker shuts the circuit down upon occurrence of over-current. In accordance with “3-2-1 General Wiring Diagram” in this chapter, be sure to use an IEC standard and UL-certified circuit breaker between the power supply and the noise filter. To ensure compliance with EMC, use our recommended circuit breaker which has a function of electrical leakage detection. For our recommended circuit breakers, refer to “3-2-2 Recommended Peripheral Devices” in this chapter.
Noise filter	Prevents any ingress of external noise from the power supply line. To ensure compliance with EMC, use our recommended noise filter. Refer to “3-2-2 Recommended Peripheral Devices” in this chapter.
Electromagnetic contactor	Turns the main power supply ON and OFF. Use a surge absorber at the primary side of the AC200V input power supply.
Surge absorber	To ensure compliance with EMC, connect our recommended surge absorber to the primary side of AC200V input power supply. Refer to “3-2-2 Recommended Peripheral Devices” in this chapter.
Signal line noise filter/ferrite core	To ensure compliance with EMC, use our recommended signal line noise filter/ferrite core. Refer to “3-2-2 Recommended Peripheral Devices” in this chapter.

Item	Description
Regenerative resistor	The product is not equipped with a regenerative resistor. In cases where the smoothing capacitor inside the servo amplifier is not capable of fully absorbing regenerative power, an externally mounted regenerative resistor is required. As a guideline, check the state of regeneration on the settings panel, and use a regenerative resistor if the regenerative voltage warning is ON. For the regenerative resistor specifications, refer to Note 2) under section 2-2-3 “Basic Specifications” in Chapter 2. Use a built-in thermostat type resistor to form an overheating prevention circuit.
Grounding	Since the S-FLAG products are Class I equipment, protective grounding is mandatory. Properly ground our products using protective grounding terminals through EMC-compatible casings and the control panel. The location of protective grounding terminals are located where the FG symbol shown below is attached. 

3-2-2 Recommended Peripheral Devices

Table 3-2-2 Recommended Peripheral Devices

Device	Manufacturer	Model Number	Note
Circuit breaker	Fuji Electric Co Ltd	EW32AAG-2P020B	Used for single phase 200V; 20A; leakage current of 30mA Equivalent products are acceptable.
Noise filter	OKAYA Electric Industries Co Ltd	For 1Φ: SUPF－EX**-ER-6 For 3Φ: 3SUPF－BE**-ER-6-*	Select an appropriate product according to your system configuration, considering current capacity, and etc.
Magnetic contactor	Omron Corporation	SK06G-E10	Equivalent products are acceptable.
Surge absorber	OKAYA Electric Industries Co Ltd	LV275DI-Q4 （1Φ) LV275DI-U4 （3Φ）	EMC-compliant
Signal line noise filter/ferrite core	Seiwa Electric （Misumi）	E04SR401938 （ATCK-1130）	EMC-compliant

Note: The peripheral devices recommended here are sold separately.

3-3. Connectors and Pin Assignments

3-3-1 Motor Connectors and Pin Assignments (750W or less)

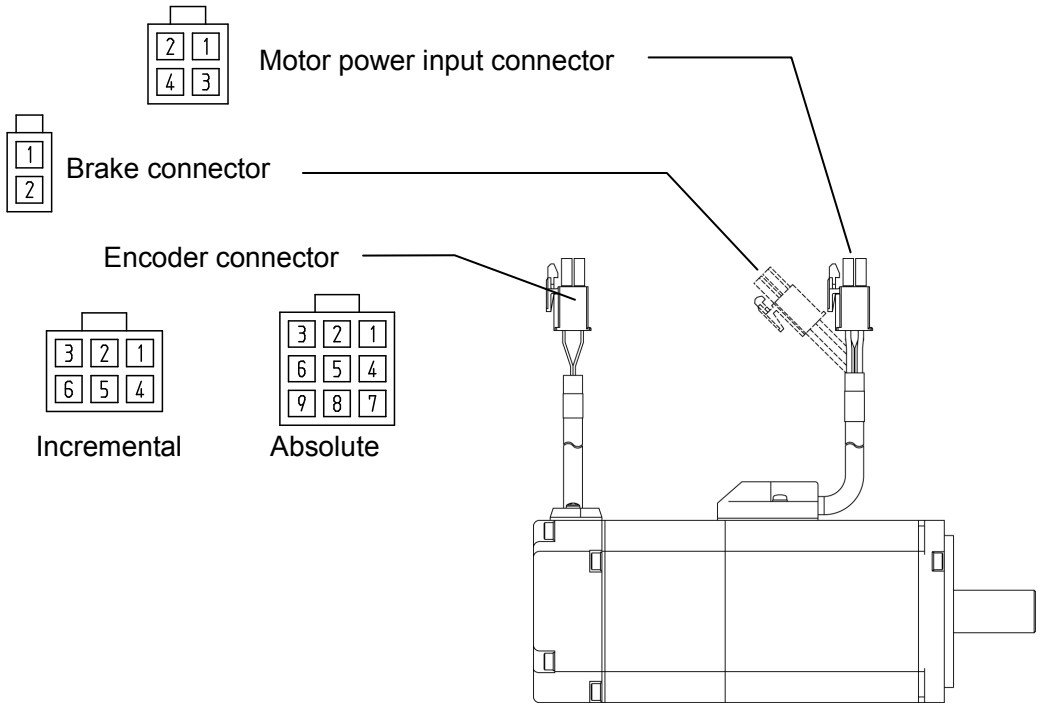


Figure 3-3-1 Motor connectors (750W or less)

Table 3-3-1 Motor connector model
(750W or less)

Name	Connector model		Manufacturer
Motor power input	Housing	172167-1	Tyco Electronics Japan
	Contact	170364-1	
Brake	Housing	172165-1	Tyco Electronics Japan
	Contact	170363-1	
Encoder（Incremental）	Housing	172168-1	Tyco Electronics Japan
	Contact	170363-1	
Encoder (Absolute)	Housing	172169-1	Tyco Electronics Japan
	Contact	170363-1	

3-3 Connectors and Pin Assignments

Table 3-3-2 Motor connector pin assignments
(750W or less)

Name	Pin No.	Signal name	Description
Motor power input	1	U	Motor power U-phase
	2	V	Motor power V-phase
	3	W	Motor power W-phase
	4	FG	Motor frame ground
Brake [1)]	1	BRK＋	Brake power supply DC24V
	2	BRK－	Brake power supply ground
Encoder（Incremental）	1	-	NC
	2	+D	Serial communication data +Data
	3	-D	Serial communication data -Data
	4	VCC	Encoder power supply 5V output
	5	GND	Signal ground
	6	SHIELD	Shield
Encoder (Absolute)	1	BAT	External battery [2)]
	2	CAP	External capacitor [2)]
	3	SHIELD	Shield
	4	+D	Serial communication data +Data
	5	-D	Serial communication data -Data
	6	IC	Internal connect [3)]
	7	VCC	Encoder power supply 5V output
	8	GND	Signal ground
	9	IC	Internal connect [3)]

1) For a motor equipped with a brake
2) For the external capacitor and battery, use GND as the reference point of potential.
3) Since the internal connect (IC) is internally connected to the circuit board, do not connect anything to that.

Table 3-3-3 Cable-Side Connectors and Wire Materials
(750W or less)

Name	Compatible connector model	Manufacturer	Wire material
Motor power input	Housing 172159-1 Contact 170366-1	Tyco Electronics Japan	AWG18
Brake [1)]	Housing 172157-1 Contact 170366-1	Tyco Electronics Japan	AWG22
Encoder （Incremental）	Housing 172160-1 Contact 170365-1	Tyco Electronics Japan	Power supply：AWG22 Signal：AWG24
Encoder (Absolute)	Housing 172161-1 Contact 170365-1	Tyco Electronics Japan	Power supply：AWG22 Signal：AWG24

1) For a motor equipped with a brake

3-3-2 Motor Connectors and Pin Assignments（1kW or above）

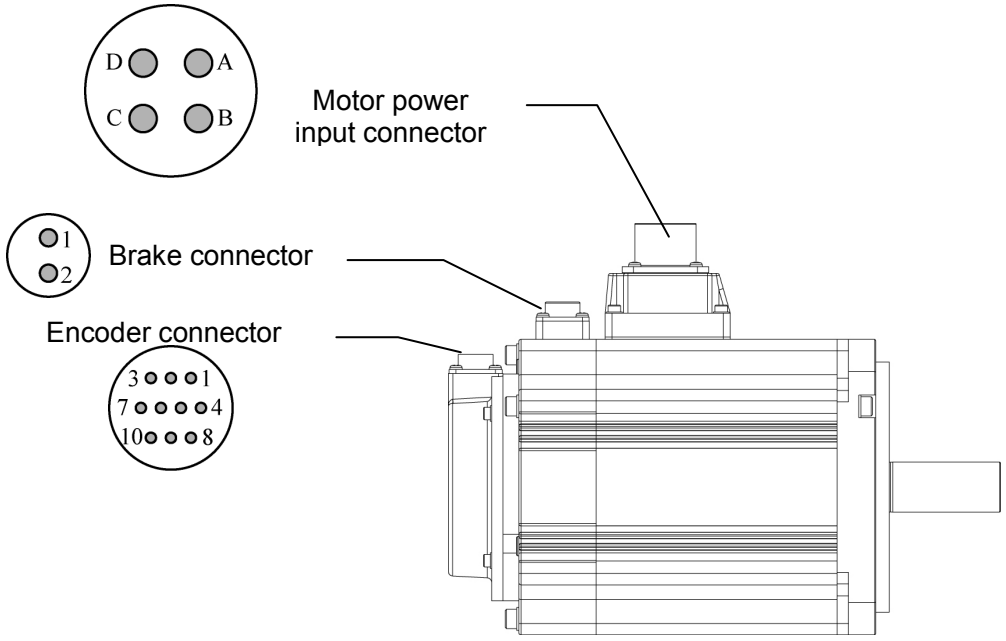


Figure 3-3-2 Motor connectors (1kW or above)

Table 3-3-4 Motor connector model
(1kW or above)

Name	Model	Manufacturer
Motor power input	JL04V-2E18-10PE-B-R	Japan Aviation Electronics
Brake	CM10-R2P-D (D7)	DDK
Encoder（Incremental）	CM10-R10P-D (D7)	DDK
Encoder (Absolute)	CM10-R10P-D (D7)	DDK

Table 3-3-5 Motor connector pin assignments
(1kW or above)

Name	Pin No.	Signal name	Description
Motor power input	A	U	Motor power U-phase
	B	V	Motor power V-phase
	C	W	Motor power W-phase
	D	FG	Motor frame ground
Brake [1]	1	BRK+	Brake power supply DC24V
	2	BRK-	Brake power supply GND
Encoder（Incremental）	1	VCC	Encoder power supply 5V output
	2	GND	Signal ground
	3	-	NC
	4	-	NC
	5	+D	Serial communication data +Data
	6	-D	Serial communication data -Data
	7	-	NC
	8	-	NC
	9	-	NC
	10	SHIELD	Shield
Encoder (Absolute)	1	VCC	Encoder power supply 5V output
	2	GND	Signal ground
	3	CAP	External capacitor [2]
	4	BAT	External battery [2]
	5	+D	Serial communication data +Data
	6	-D	Serial communication data -Data
	7	IC	Internal connect [3]
	8	IC	Internal connect [3]
	9	GND	Signal ground
	10	SHIELD	Shield

1) For a motor equipped with a brake
2) For the external capacitor and battery, use GND as the reference point of potential.
3) Since the internal connect (IC) is internally connected to the circuit board, do not connect anything to that.

Table 3-3-6 Cable-Side Connectors and Wire Materials
（Motor of 1kW or above）

Name	Compatible connector model	Manufacturer	Wire material
Motor power input	JL04V-6A18-10SE-EB-R (Straight) JL04V-8A18-10SE-EB-R (Right angle)	Japan Aviation Electronics	AWG14
Brake [1]	CM10-SP2S-□-D [2] (Straight) CM10-AP2S-□-D [2] (Right angle)	DDK	AWG18
Encoder（Incremental） & Encoder(Absolute)	CM10-SP10S-□-D [2] (Straight) CM10-AP10S-□-D [2] (Right angle)	DDK	power supply：AWG22 Signal：AWG24

1) For a motor equipped with a brake
2) □ Indicateds S, M or L.

3-3-3 Amplifier Connectors and Pin Assignments

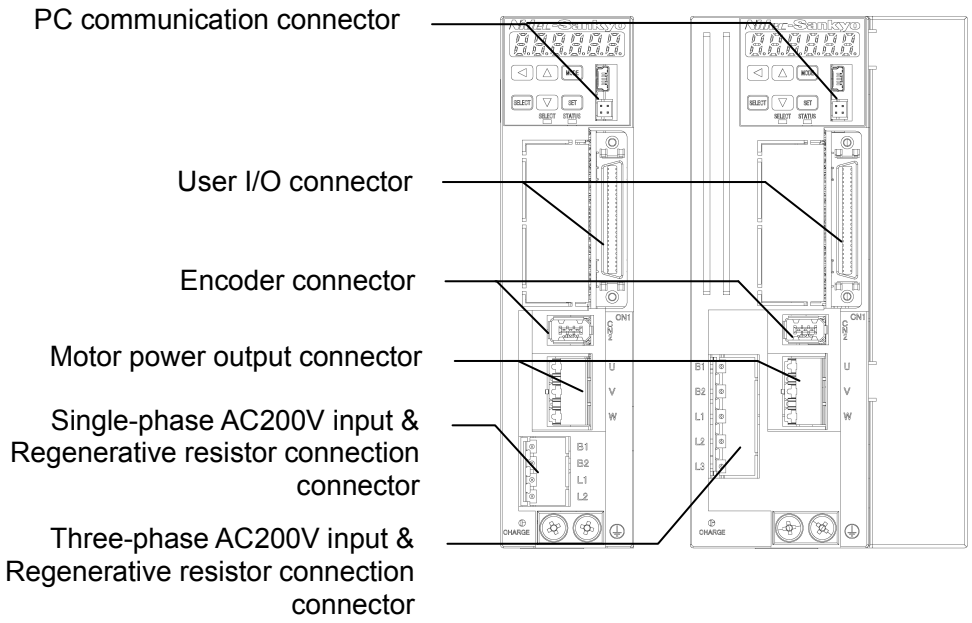


Figure 3-3-3 Amplifier connectors (front view)

Table 3-3-7 Amplifier connector model

Name	Model	Manufacturer
Regenerative resistor connection Single-phase AC200 V input（750W or less）	2092-1424	WAGO Japan
Regenerative resistor connection Three-phase AC200 V input（1kW or above）	2092-3425	WAGO Japan
Motor power output	2092-3323	WAGO Japan
Encoder	3E106-2230KV	3M
PC communication	UX60SC-MB-5ST	Hirose Electric
User I/O	10250-59A3 MB	3M

Table 3-3-8 Amplifier connector pin assignments
(750W or less)

Name	Code	Pin No.	Signal	Description
Regenerative resistor connection	B1/B2/ L1/L2	1	VP	P-side regenerative resistor connection
		2	Regen-out	N-side regenerative resistor connection
Single-phase AC200V input		3	Primary -Power 1	L1
		4	Primary -Power 2	L2
Motor power output	U/V/W	1	U	Motor power U-phase output
		2	V	Motor power V-phase output
		3	W	Motor power W-phase output
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Encoder power supply GND
		3	NC	Reserved
		4	NC	Reserved
		5	+D	Encoder signal data
		6	-D	Encoder signal/data
		-	FG	SHIELD wired to the connector casing
PC communication	CN3	1	VBUS	USB power supply(5V)
		2	D-	USB data -
		3	D+	USB data +
		4	NC	-
		5	GND	USB power ground(GND)
User I/O	Refer to Table 3-3-11			

Table 3-3-9 Amplifier connector pin assignments
(1kW or above)

Name	Code	Pin No.	Signal	Description
Regenerative resistor connection	B1/B2/ L1/L2/L3	1	VP	P-side regenerative resistor connection
		2	Regen-out	N-side regenerative resistor connection
Three-phase AC200V input		3	Primary -Power 1	L1; L1 when using 1.5kW or less with single-phase power
		4	Primary -Power 2	L2; Do not connect when using with single-phase power
		5	Primary -Power 3	L3; L2 when using with single-phase power
Motor power output	U/V/W	1	U	Motor power U-phase output
		2	V	Motor power V-phase output
		3	W	Motor power W-phase output
Encoder	CN2	1	VCC	Encoder power supply +5V
		2	GND	Encoder power supply GND
		3	NC	Reserved
		4	NC	Reserved
		5	+D	Encoder signal data
		6	-D	Encoder signal /data
		-	FG	SHIELD wired to the connector casing
PC communication	CN3	1	VBUS	USB power supply (5V)
		2	D-	USB data-
		3	D+	USB data+
		4	NC	-
		5	GND	USB power supply(GND)
User I/O	Refer to Table 3-3-11			

Table 3-3-10 Cable-side connectors and wire materials

Name	Code	Compatible connector model	Manufacturer	Note	Wire material
Single-phase AC200V input & Regenerative resistor connection	B1/B2/ L1/L2	2092-1104/002-000	WAGO Japan	Included	AWG18
Three-phase AC200V input & Regenerative resistor connection	B1/B2/ L1/L2/L3	2092-3105/002-000	WAGO Japan	Included	AWG14
Motor power output	U/V/W	2092-3523/002-000	WAGO Japan	Included	(*)
Encoder	CN2	Connector 3E206-0100KV Cover 3E306-3200-008	3M		Power supply AWG22 Signal AWG24
PC communication	CN3	USB mini B	any		
User I/O	CN1	Plug 10150-3000-PE Cover 10350	3M		AWG26

(*) Use AWG18 for 750W or less, AWG14 for 1kW or above.

The following listed above are included in the amplifier product package:

- ✓ Single-phase AC200V input & Regenerative resistor connection connector (or Three-phase AC200V input & Regenerative resistor connection connector)
- ✓ Motor power output connector

The other connectors are sold separately.

3-4. RS-485 Communication

3-4-1 Wiring

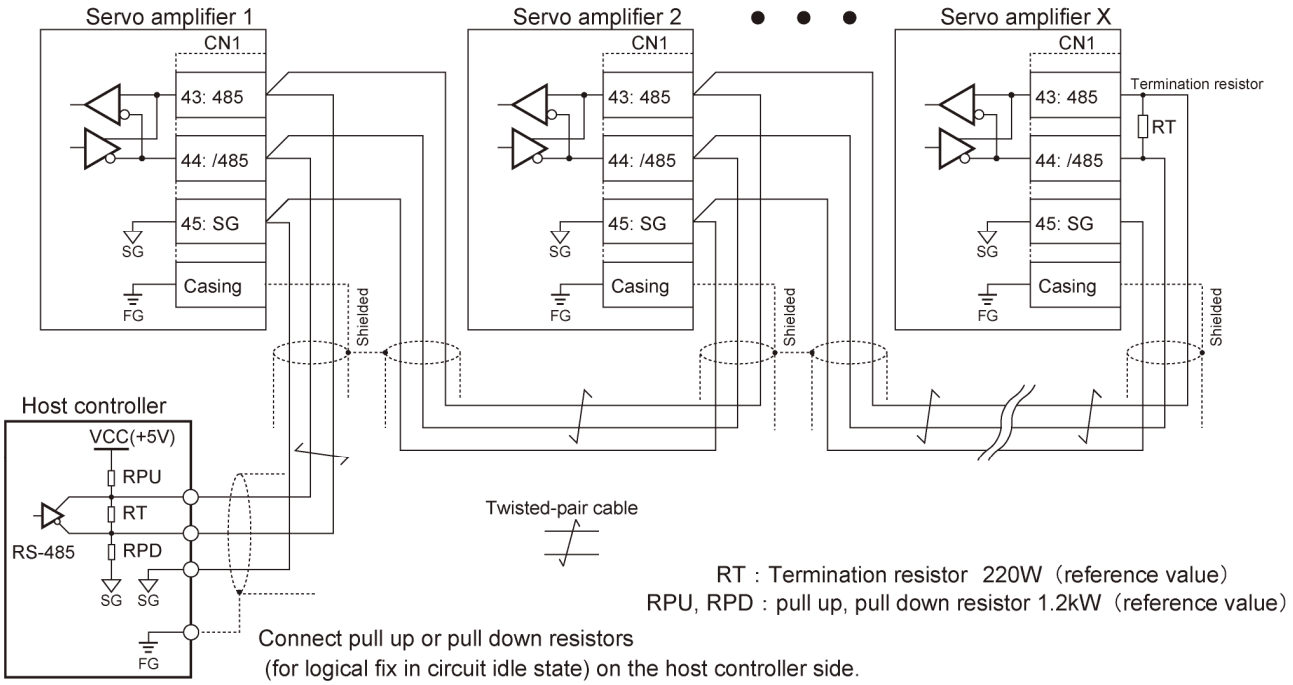
This section describes the wiring between amplifiers to use RS-485 communication. For the settings and communication method, refer to the reference material called “Communication Interface”.
RS-485 communication makes it possible for the host controller connected with one amplifier to do 1) change parameters of multiple amplifiers, and 2) measure waveforms of a status display, such as position deviation, rotational speed, and so on.

Table 3-4-1 RS-485 Communication Specification

Communication Specification	
Electrical specification	RS-485
Communication system	Asynchronous serial communication (half duplex)
Communication speed	57.6 kbps
Data bit	8 bit
Parity bit	none
Stop bit	1 bit
Error detection	CRC16-CCITT
Data transfer	8 bit binary code
Communication data length	35 byte or less
Address setting	32 max

3-4 RS-485 Communication

The following diagram shows wiring between amplifiers . Connect data connectors to the CN1 pin 43 and 44, and the signal ground to the CN1 pin 45.



If your connector wiring becomes complex, use signal distribution terminal blocks.
(See below for a wring example).

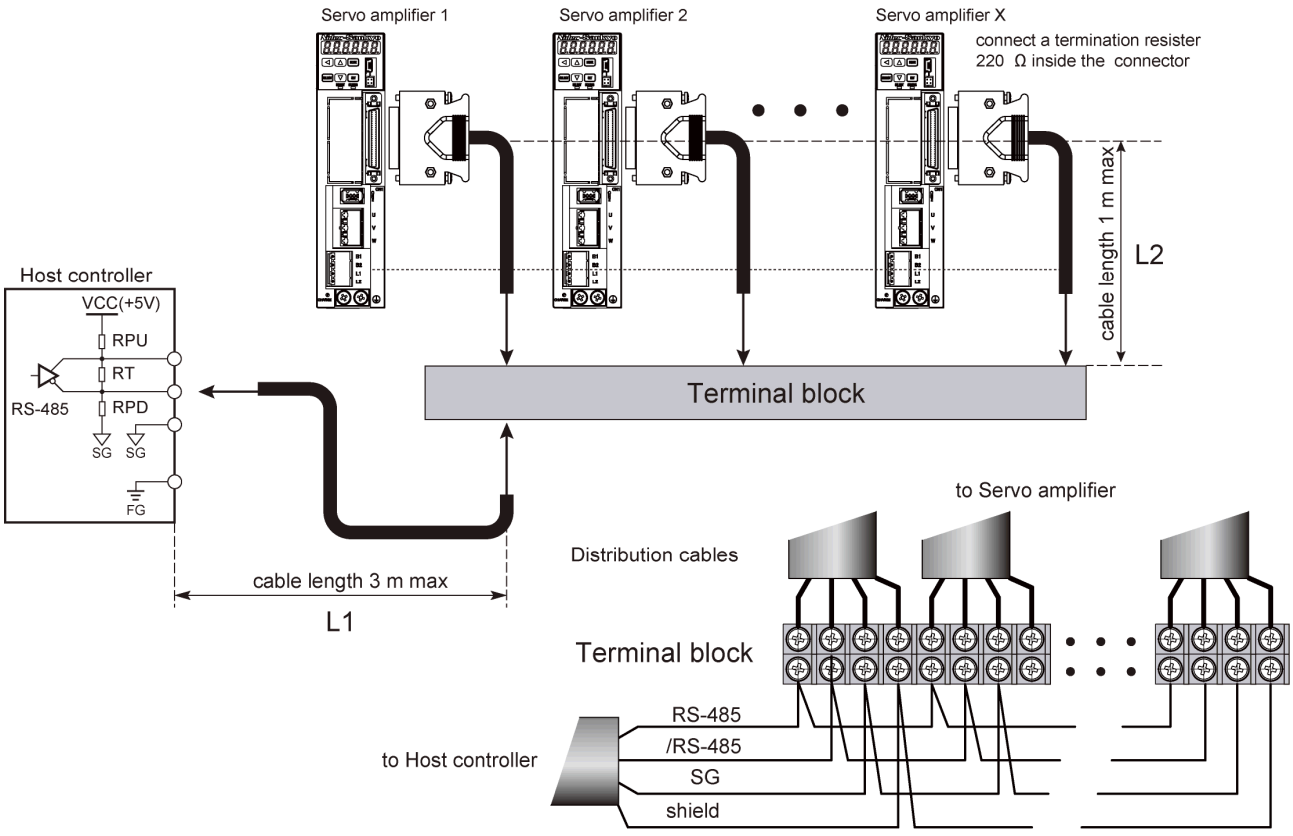


Figure 3-4-1 Example of Multi-drop Connections

Table 3-4-2 User I/O Connector (CN1) Pin Assignments

Name	Code	Pin No.	Signal Name	Description
User I/O	CN1	43	485	485 of RS-485 communication data
		44	/485	/485 of RS-485 communication data
		45	SG	Signal ground

■ Notes on Wiring

Table 3-4-3 RS-485 Communication Wiring Notes

Item	Note
L1	3m max Keep the length of the connector between the host controller and the amplifier connector CN1 3 meters max.
L2	1m max Keep the length of connectors between each servo amplifier and the terminal block 1 meter max.
Termination resistor	Termination resistor: 220Ω, 0.25W Connect a terminating resistor between the pin 43 and 44 of the end amplifier's connector CN1 and the host controller. Pull up or pull down resistors: 1.2kΩ, 0.25W Connect pull up or pull down resistors (for logical fix in circuit idle state) on the host controller side.

(MEMO)

4. Setup Panel

Contents

FIGURES

TABLES

4-1. Introduction

The following operations are allowed on the Setup Panel.

- Status Display（Status Display Mode）
- Alarm Status Display（Alarm Status Display Mode）
- Parameter Setting（Parameter Setting Mode）
- Auto Tuning（Auto Tuning Mode）
- Parameter Saving（Parameter Saving Mode）
- Auxiliary Functions（JOG Function Mode, Parameter Clear Mode, Encoder Clear Mode）

	Do not press more than one button simultaneously on the Setup Panel.	Otherwise, DISPLAY LED will be inaccurate.

4-2. Parts and Functions of Setup Panel

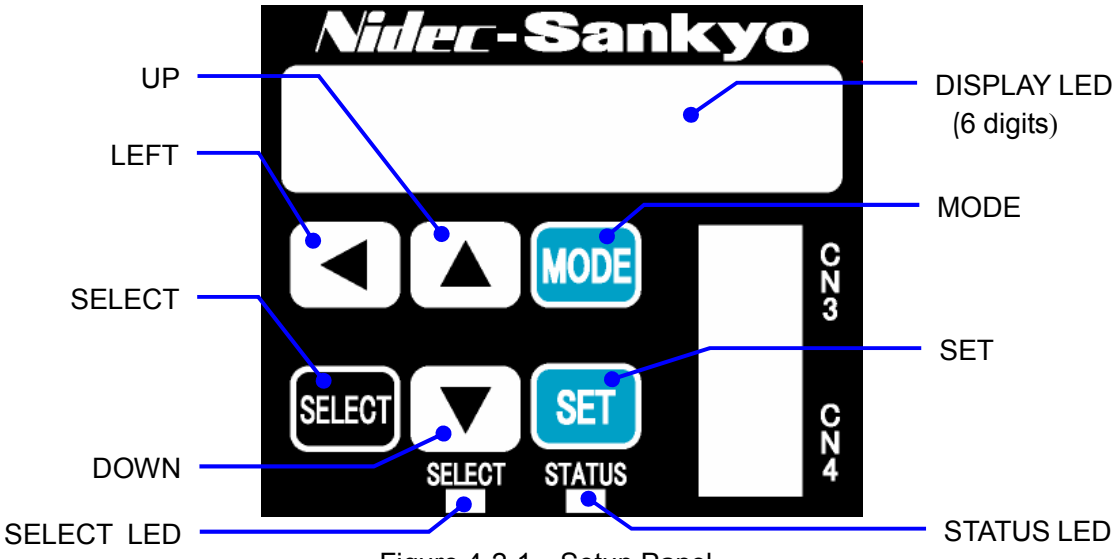


Figure 4-2-1 Setup Panel

4-2 Parts and Functions of Setup Panel

Table 4-2-1 Parts and Functions of Setup Panel

Setup Panel Menu	Name	Function
	MODE button	Change operation modes and parameters.
	SET button	Select items and set values.
	UP button	Increase the numeric value of the selected digit at the blinking position.
	DOWN button	Decrease the numeric value of the selected digit at the blinking position.
	LEFT button	Move the blinking position (digit to select) to the left.
	STATUS LED	When Power ON, Green light: Normal status Red light: Alarm status When Power Off, No light: Normal status
	SELECT button	In a multi-axis system; Select a sub-amplifier whose information to be displayed on the main amplifier's Setup Panel.
	SELECT LED	In a multi-axis system; Display information of a sub-amplifier, which is currently lit, on the main amplifier's Setup Panel.

4-3. Selecting an Operation Mode

This section explains the steps to switch operation modes on the Setup Panel.

When the control power of the amplifier turns on, 『S-FLAG』 is displayed on the Setup Panel. Use the MODE button MODE to select an operation mode. Pressing the MODE button MODE once displays Speed Feedback (motor rotation speed in r/min). Pressing the MODE button MODE again displays 『dP_St』 (Status Display Mode). Pressing the MODE button MODE repeatedly displays Alarm Status Display Mode, Parameter Setting Mode, Auto Tuning Mode, Parameter Saving Mode, and Auxiliary Function Mode in this order. Go back to Status Display mode by pressing the MODE button MODE one more time. Press the SET button SET to enter the operation mode of your selection.

4-3 Selecting an Operation Mode

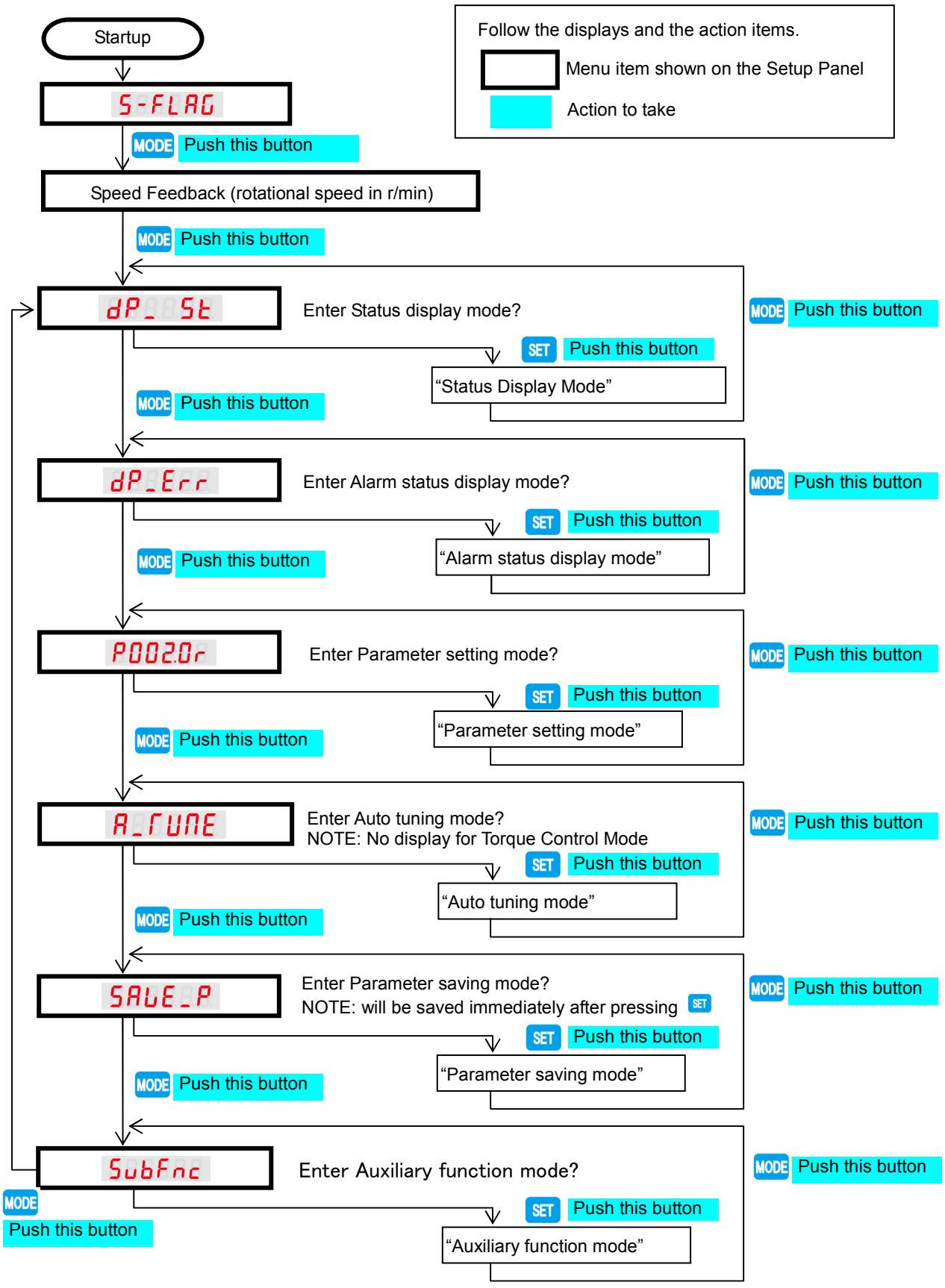


Figure 4-3-1 Operation Flowchart for Operation Mode Selection on Setup Panel

4-4. Status Display Mode

4-4-1 Status Display Mode

This section explains the operation flow for Status Display Mode.

At the initial display S-FLAG, press the MODE button MODE twice to show dP_St and enter Status Display Mode. In this mode, you can check the status display, the product model code and the product serial number. Press the SET button SET to display a status code on the right of St_. To find what each code means, see Table 4-4-1 “List of Status Codes”. Press the UP or DOWN button to change the code to display. To see the value of the displayed status code, press the SET button SET. By pressing the UP or DOWN button further, the product model code and the product serial number will be displayed next to the status code as shown below:

Model code: Pt_[AAA]

Serial No.: PS_[AAA]

Where: [AAA] displays Mot (motor), drv (amplifier), or Enc (encoder).

4-4 Status Display Mode

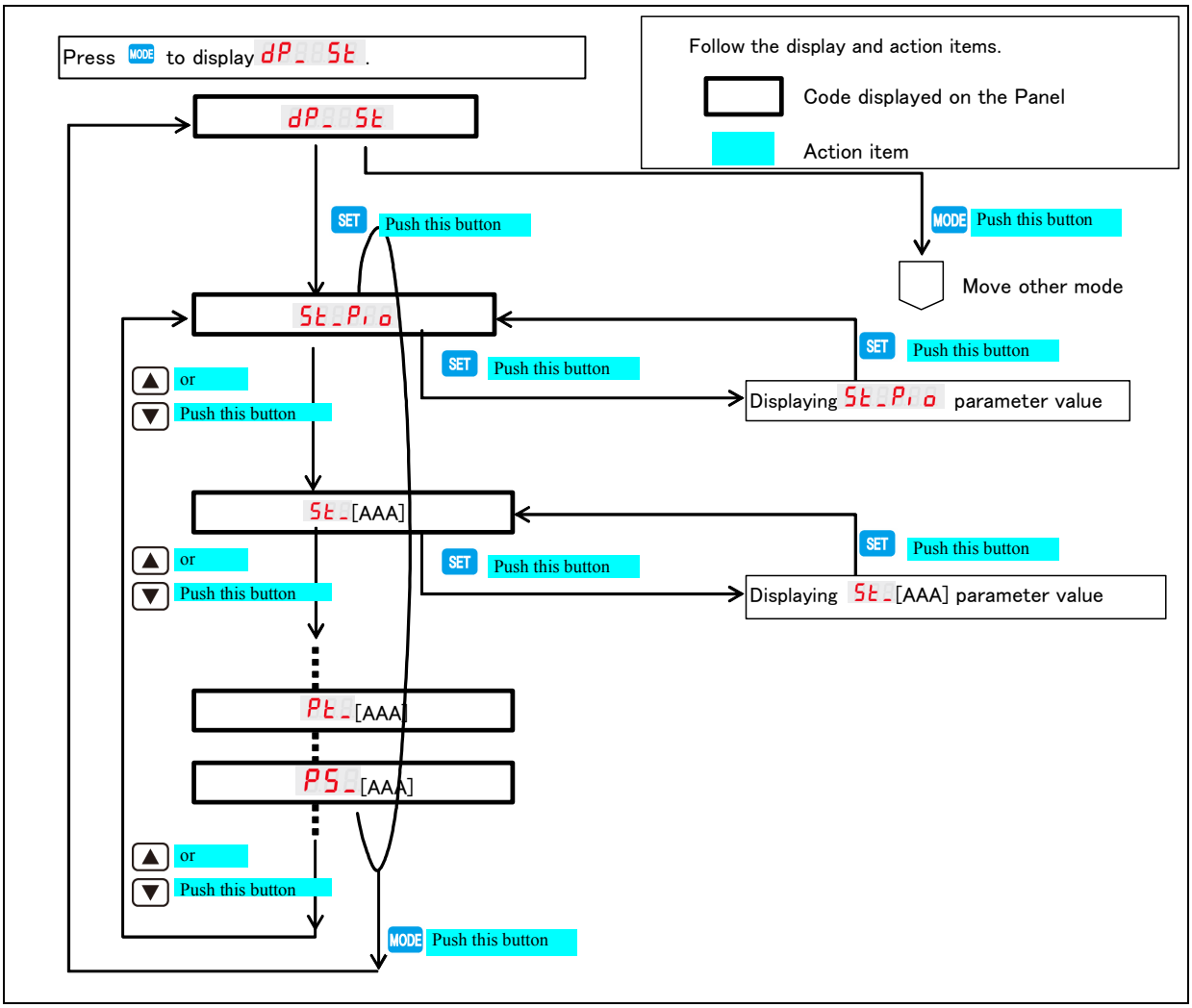


Figure 4-4-1 Operation Flowchart for Status Display Mode on Setup Panel

4-4 Status Display Mode

Table 4-4-1 Display Menu on DISPLAY LED

Code	Status Description
St_Pio	Parallel I/O status Displays the Parallel I/O status assigned by parallel I/O. See “4-4-3 Parallel I/O status” for details.
St_tMP	Control component temperature [℃] Shows the temperature of the amplifier control component.
St_PCP	Pulse train command input (Position) [pulse] Displays the number of pulse output from the host controller.
St_PCS	Pulse train command input (Speed) Indicates a differential value of the train command input (Position) in [pulse/160μs] for 750 W or less and [pulse/200μs] for 1kW or more.
St_ASC	Analog command input (command value) [r/min] Indicates a value to input as the speed command value after applying Gain and Filtering to the analog speed command from the host controller.
St_PPS	Positioning status 0 indicates “operating Position” and 1 indicates “Positioning complete”.
St_PCA	ABS position command value [pulse] Indicates a value of the position command in the command pulse unit.
St_PFA	ABS position feedback value Indicates the motor position (in the command pulse unit) returned from the encoder.
St_PdC	Command position deviation Indicates the difference (in the command pulse unit) of the position command value and position feedback value.
St_PCo	Position command value [pulse] This is a command value input to the position loop after applying Division Multiplication and Filtering to Pulse train input (Position) and Internal Position Command. This will be displayed in encoder pulse unit.
St_PFb	Position feedback value [pulse] Indicates a motor angular position detected by encoder.
St_Pdv	Position deviation [pulse] Indicates the difference between a position control value and a position feedback value.
St_SCo	Speed command input value [r/min] Indicates a speed command value input to the amplifier position control and the amplifier speed control.
St_SFb	Speed feedback value [r/min] Indicates the motor rotational speed detected by the encoder.
St_Sdv	Speed deviation [r/min] Indicates the difference between a speed command value and a speed feedback value.

4-4 Status Display Mode

Code	Status Description
	Torque command value This value is1000 indicating 100% of rated torque, and 3000 indicating 300% of rated torque.
	Load [digit] A value of approximately 1000 is acceptable (i.e. load factor is 100%). However, a value of around 1440 or more for longer than a specified time will cause “Overload Error”.
	Encoder Rotor mechanical angle (one rotation) [pulse] means rotor’s absolute angle per rotation data output from the encoder.
	Encoder Rotor mechanical angle (integrated value)[pulse] In the case of absolute encoder, this code indicates absolute data and means multiple rotation integrated angle data output from the encoder.
	Regeneration State Displays the Regeneration State. See the section 4-4-4 Regeneration State” for details.
	Main circuit voltage [0.1V] Displays the main circuit voltage (the value is just a reference). NOTE: this is displayed only for the amplifier model「DA2□□2*」
	Amplifier model code Displays the amplifier model code.
	Motor model code Displays the motor model code.
	Encoder model code Displays the encoder model code.
	Amplifier serial number Displays the amplifier serial number.
	Motor serial number Displays the motor serial number.
	Encoder serial number Displays the encoder serial number.

4-4-2 Display of More than 5 Digits on DISPLAY LED

Some numeric parameters can have more than 5 digits. The following illustrates how those numbers are displayed. Here are two examples: a positive number 123456789 and a negative number -123456789.

（1） Display 1: displaying the last 5 digits（LAST）

Positive number

Negative number

（2） Display 2: displaying the first 5 digits (CENTER）

Positive number

Negative number

（3） Display 3: displaying a positive or negative sign（FIRST）

Plus sign (+) for a positive

Minus sign (-) for a negative

Figure 4-4-2 Example of Number Display on DISPLAY LED

DISPLAY LED shows the last digits first and the blinking position moves to the left with the LEFT button ◄. While the 5th digit from the right is blinking, press the LEFT button ◄ again to go to the next display (Display 2). After a positive negative sign is displayed (Display 3), pressing the LEFT button ◄ again to go back to the last 5 digit display (Display 1). DISPLAY LED shows the last 5 digits, the preceding 5 digits, the positive negative sign, in this order, repeatedly.

The most left position indicates which Display you are in, Display 1, 2 or 3. That is, "_" indicates Display 1, "—" indicates Display 2, and "¯" indicates Display 3. For a negative number, the most left character comes with a dot at its right bottom. Note that for less than 6 digits, Display 2 is irrelevant.

4-4-3 Parallel I/O Status

The input (8-point) and output (8-point) signal status of User I/O Connector (CN1) control signal is displayed as Parallel I/O.

Display St_Pio on the Setup Panel first and press the SET button SET next.

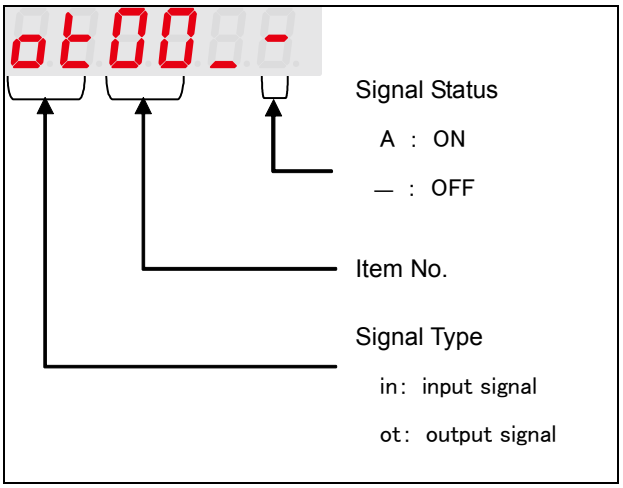


Figure 4-4-3 Check Parallel I/O Status

■ Parallel I/O Status Display

For details of the User I/O Connector (CN1) signal, refer to the section 6.7 “User I/O (CN1) connector pin assignments”. Note that O6 indicates “encoder Z-phase output”, but the status display is fixed at 0.

Table 4-4-2 Parallel I/O Status Display

Display (Signal Type Item No.)	Signal Name	Display (Signal Type Item No.)	Signal Name
ot00	O1	in00	I1
ot01	O2	in01	I2
ot02	O3	in02	I3
ot03	O4	in03	I4
ot04	O5	in04	I5
ot05	O6	in05	I6
ot06	O7	in06	I7
ot07	O8	in07	I8

■ Operation Flow for Parallel I/O Status Display

Pressing the UP or DOWN button changes the display number. Press the LEFT button to display the output signal ot00_- while an input signal is displayed. Similarly, press the LEFT button to display the input signal in00_- while an output signal is displayed.

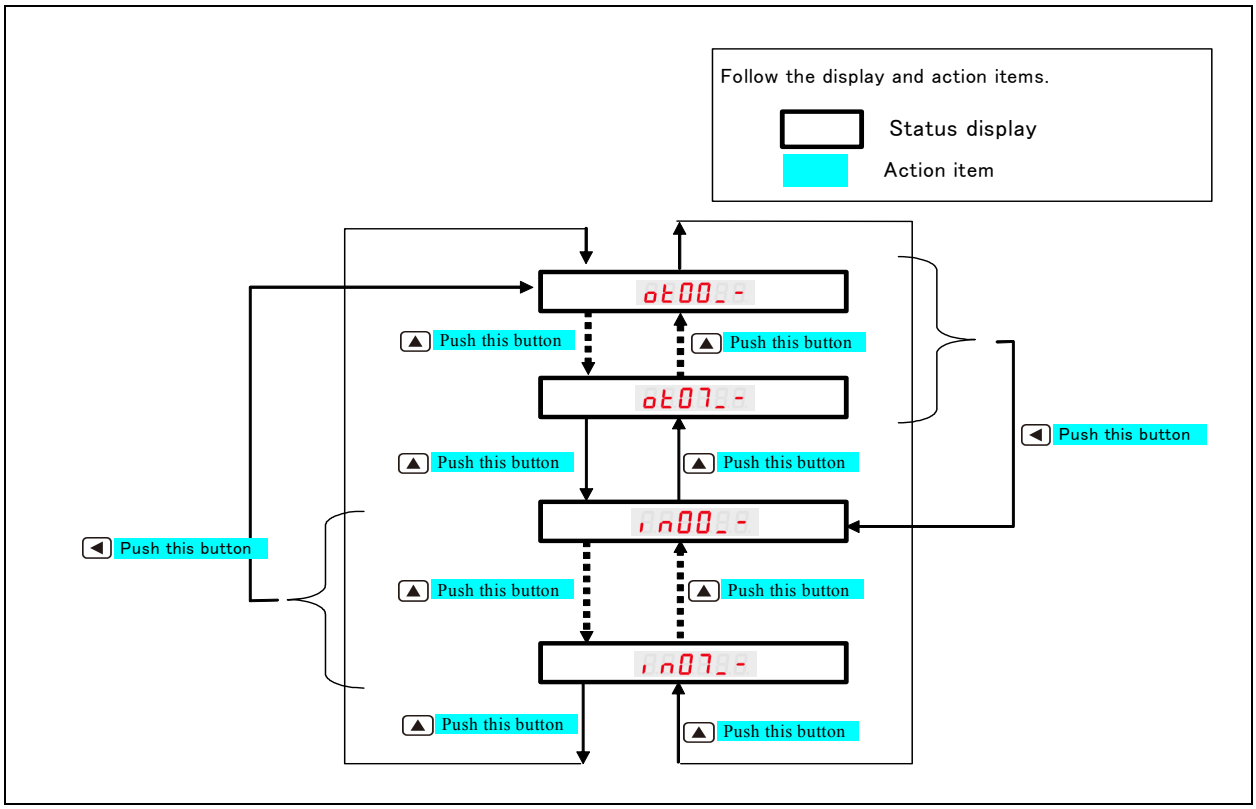


Figure 4-4-4 Operation Flowchart for Parallel I/O Status Display

4-4-4 Regeneration State

The Regeneration State shows a voltage status of the amplifier main circuit DC and the amplifier operation status of the regeneration power processing circuit. At the initial display of S-FLAG, press the SET button SET.

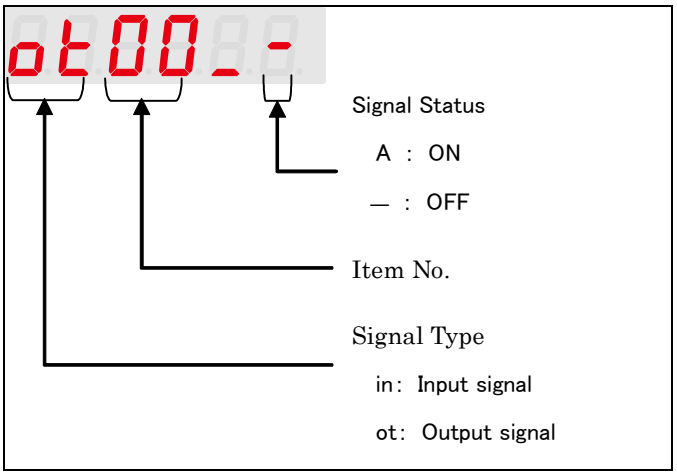


Figure 4-4-5 Check Regeneration State

■ Regeneration State Display Items

Table 4-4-3 Regeneration State Display Items

Display	Name	Content
ot00	Regeneration control output	Displays the amplifier operation status of the generation power process circuit. This signal's turning ON indicates that regeneration power is being processed by the regeneration resistor.
ot01	Reserved	『-』 fixed
:	:	:
ot07	Reserved	『-』 fixed
in00	Regeneration voltage warning	This signal turns ON when the main circuit DC voltage reaches the regeneration voltage warning value. In that case, it is possible that the regeneration process circuit of the amplifier starts operating, hence, you are recommend to connect a regeneration resistor to the amplifier. This signal turns ON when the voltage is lower than the regeneration voltage threshold.
In01	Regeneration voltage threshold	This signal turns ON when the main circuit DC voltage reaches the regeneration voltage threshold. In that case, the regeneration process circuit of the amplifier starts operating. You need to connect a regenerating resistor to the amplifier. Not doing so will cause a power supply error.
in02	Reserved	『-』 fixed
:	:	:
in07	Reserved	『-』 fixed

4-4 Status Display Mode

■ Operation Flow for Regeneration State Display

Pressing the UP or DOWN button changes the display number. Press the LEFT button to display the output signal ot00_- while an input signal is displayed. Similarly, press the LEFT button to display the input signal in00_- while an output signal is displayed.

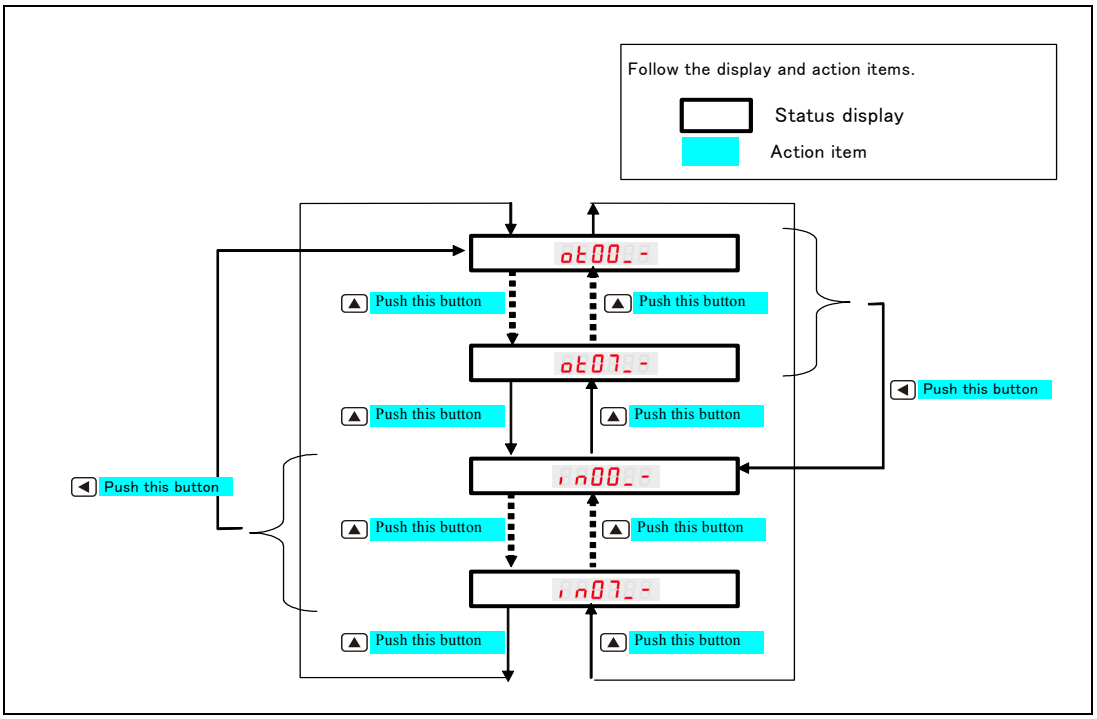


Figure 4-4-6 Operation Flowchart for Regeneration State Display

■ How to determine whether you should connect a regeneration resistor

Display in00_- as described above. When the regeneration display changes from in00_- to in00_A while operating the device, you need a regeneration resistor.

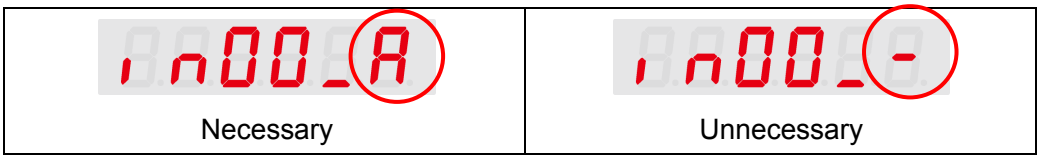


Figure 4-4-7 Indicator of If Regeneration Resistor is Needed

Caution		
	When operating the device, start with a slow motion (around 20% of the max speed) and gradually raise it to the actual operation speed. Watch out for the display change from in00_- to in00_A during regeneration.	Otherwise, device failures or damages may be caused.

4-5. Alarm Status Display Mode

Figure 4-5-1 shows the operation flow for Alarm Status Display Mode.

At the initial display S-FLAG, press the MODE button MODE three times to show dP_Err and enter the alarm status display mode. Press the SET button SET to display the amplifier alarm status. When no alarm is occurring, Err.-- will be displayed. If there is an ongoing alarm item, "Err. **" (where ** is the alarm number) will be displayed. See Table 4-5-1 List of Alarms.

In case of multiple ongoing alarms, pressing the UP or DOWN button changes the alarm number to display.

■ Automatic Display on the Setup Panel upon Alarms

When an alarm occurs, DISPLAY LED automatically shows "Err. **" except for the following modes:

1) Parameter Setting Mode
2) Auto Tuning Mode
3) Parameter Saving Mode
4) Auxiliary Function Mode

If you are in one of those four modes, switching to another mode by pressing the MODE button makes a display change to "Err. **".

■ Alarm Display for Multi-axis Amplifiers

In the case of a sub-amplifier alarm in multi-axis amplifiers, only STATUS LED STATUS will be blinking red and "Err.**" will not be displayed. To display the sub-amplifier alarm on the main-amplifier's Setup Panel, press the SELECT button SELECT on the Setup Panel of the sub-amplifier causing the alarm. For troubleshooting and resetting alarms, see §7.2 Alarms and Solutions.

4-5 Alarm Status Display Mode

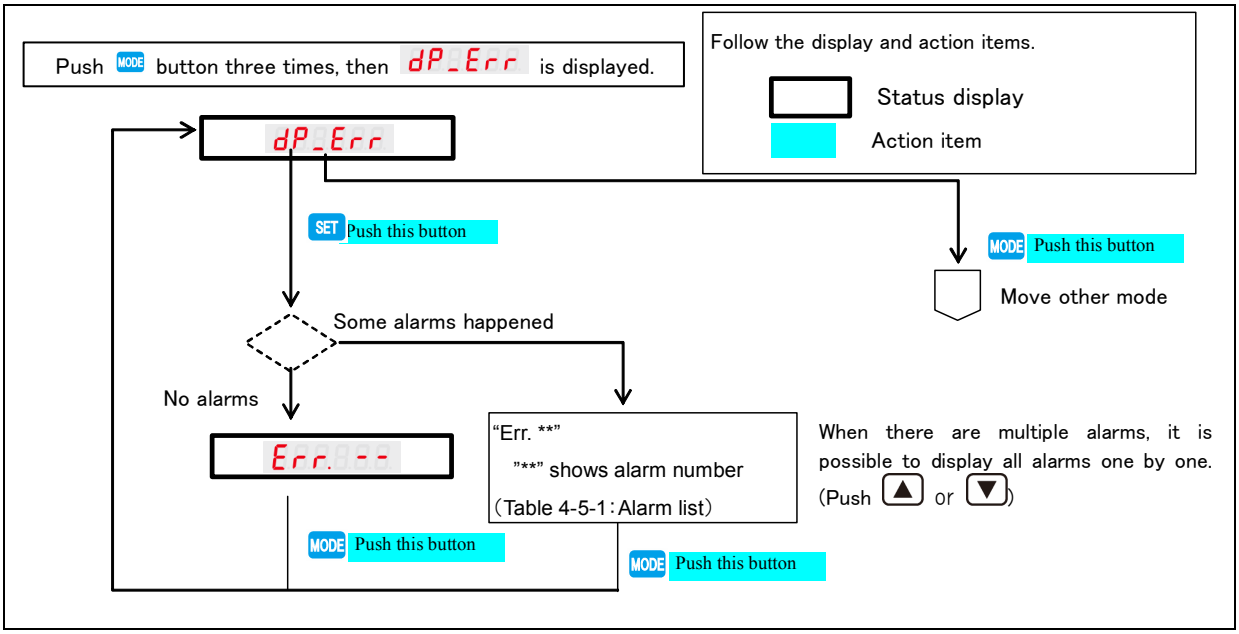


Figure 4-5-1 Alarm Status Display Operation Flowchart

Table 4-5-1 List of Alarms

Alarm No.	Alarm Name	Alarm No.	Alarm Name
00	System Error	16	Encoder communication Error 1 (Error in received data)
01	EEP data error	17	Encoder communication Error 2 (No response)
02	Product code error	18	Encoder error
04	Overspeed error	19	Encoder communication Error 3 (no communication in both ways)
05	Speed deviation error	20	Multi-rotation data error
06	Position deviation error	21	Encoder voltage drop
07	Overload error	22	Voltage drop in the control power supply
08	Command overspeed error	23	Base circuit disconnection
09	Encoder pulse output frequency error	24	Overcurrent error
10	Positioning command overflow/home position return failure	25	Inverter error 1
11	Encoder multi-rotation counter overflow	26	Inverter error 2 (SERVO ON timeout)
12	Overheat error	27	Current sensor error
14	Overvoltage error	29	Voltage drop in the 5V control power supply
15	Power supply error		

4-6. Parameter Setting Mode

Figure 4-6-2 is the operation flowchart for the Parameter Setting Mode.

At the initial display S-FLAG, press the MODE button MODE 4 times to enter the Parameter Setting Mode and the display will change to P[AAA].[B][r].

■ Description of 『P[AAA].[B][r]』

- [AAA].[B] indicates a parameter number. Press the UP ▲ or DOWN ▼ button to select a parameter number to set. Press the SET SET button to display the parameter setting. Refer to §8.4 Parameter List in Chapter 8 for descriptions of parameter numbers.
- [r] in the end is either "blank" or "r" as shown in Figure 4-6-1. If "r" is displayed, it's necessary to reboot the amplifier after saving the parameter. Refer to §4-8 "Parameter Saving Mode" in this chapter.

	
Need to reboot the amplifier	No need to reboot the amplifier

Figure 4-6-1 Indicator of If Rebooting Amplifier is Needed

■ Process of the parameter setting change

① The Setup Panel displays the parameter value with the last digit blinking, and waits for a parameter value input. You can change the digit that is currently blinking. For the parameter setting which can be outside the range of [-99999, +99999] (only for No. 87.0 "Position deviation error Detection value"), DISPLAY LED will show 5 digits at a time as described in §4-4-2 "Six or More Digits Display on DISPLAY LED".

② Use the LEFT button ◀ to select a digit that you want to make a change, and use the UP or DOWN button ▲ or ▼ to change the value.

③ Press the SET button SET to set the parameter at the amplifier. DISPLAY LED stops blinking at this point. If there is no further change to be made for the parameter value, press the MODE button MODE.

④ In the parameter saving mode, save the changed parameter to EEPROM in the amplifier. If you shut down the amplifier without saving the parameter, the setting change won't be into effect.

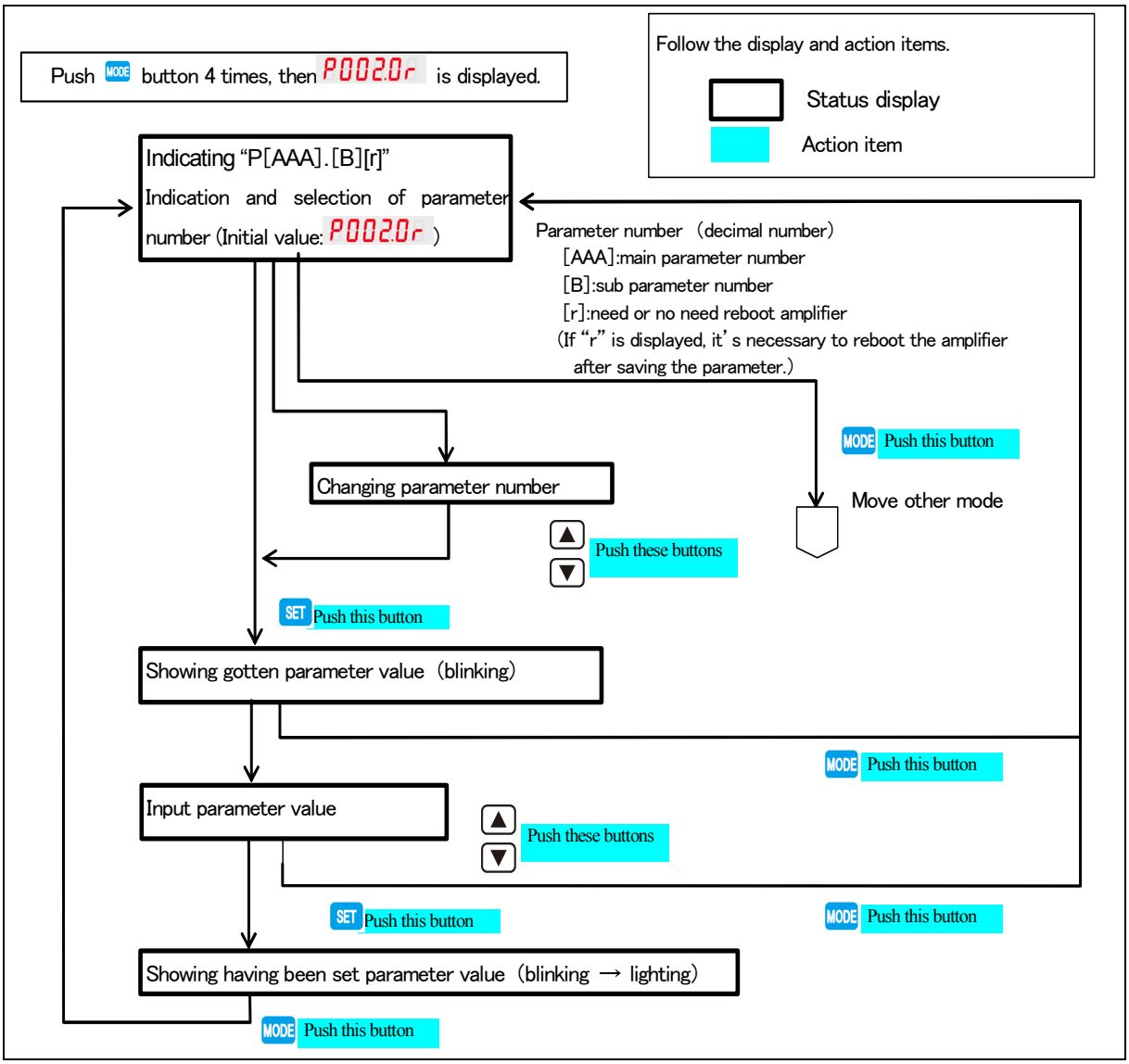


Figure 4-6-2 Operation Flowchart for Parameter Setting on Setup Panel

4-7. Auto Tuning Mode

At the initial display of S-FLAG, press the MODE button MODE five times to show A_TUNE on DISPLAY LED and press the SET button to enter the Auto Tuning Mode.

■ Parameters for Auto Tuning Mode

- In the auto tuning mode, only the parameters needed for “Simple Tuning” and “Fine Tuning” will be displayed.
- Perform Tuning as illustrated in the flowchart in Figure 4-7-1.
- The parameters that can be set in the position control or speed control are shown in Table 4-7-1. In the auto tuning mode, the parameter display on the Setup Panel can be changed from a parameter name to a corresponding parameter number by pressing the LEFT button◀.

4-7 Auto Tuning Mode

Table 4-7-1 Parameter Display in Auto Tuning Mode

Position Control		
Display Order	Name	Parameter Code/No. on the Setup Panel
1	Inertia condition	P_GGLP / P113.1
2	Control gain set	P_GSEr / P113.0
3	Inertia ratio	P_inEr / P102.0
4	Setting of auto tuning mode	P_ESTd / P110.0
5	Selection for use of real-time auto tuning	P_rUEn / P110.1
6	Control level	P_CLEv / P114.0
7	Integral gain	P_inTE / P119.0
8	Gain FF compensation 1	P_GFF1 / P117.0
9	Gain FF compensation 2	P_GFF2 / P118.0
10	Damping ratio	P_dAMP / P103.0
Speed Control		
Display Order	Name	Parameter Code/No. on the Setup Panel
1	Control gain set	P_GSEr / P129.0
2	Inertia ratio	P_inEr / P102.0
3	Setting of auto tuning mode	P_ESTd / P110.0
4	Selection for use of real-time auto tuning	P_rUEn / P110.1
5	Control level	P_CLEv / P130.0
6	Integral gain	P_inTE / P133.0
7	Gain FF compensation 1	P_GFFS / P132.0
8	Damping ratio	P_dAMP / P103.0

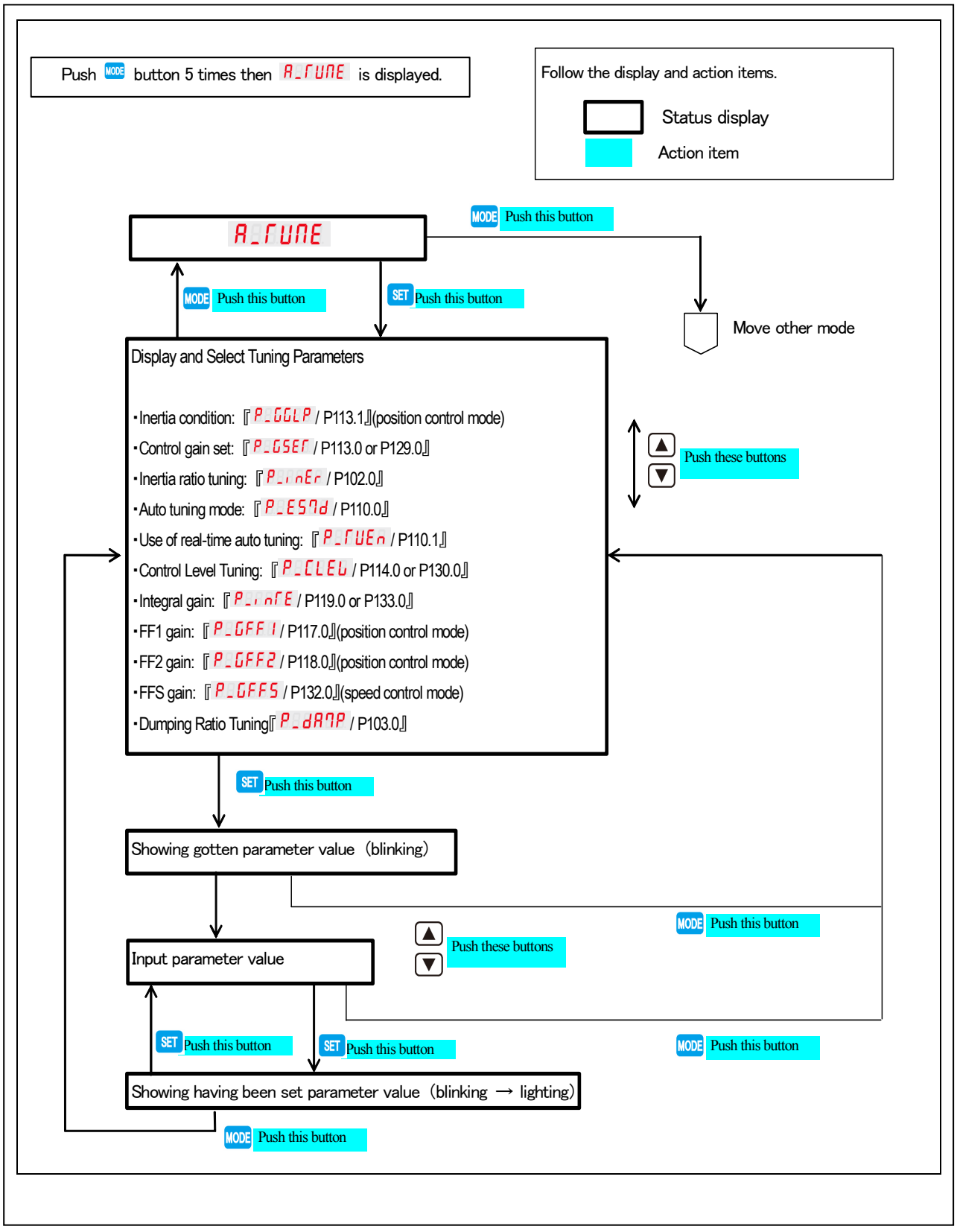


Figure 4-7-1 Auto Tuning Operation Flowchart

4-8. Parameter Saving Mode

At the initial display of S-FLAG, press the MODE button MODE six times to show SAVE_P on DISPLAY LED and press the SET button to enter the Parameter Saving Mode.
In the Parameter Saving Mode, the parameters set in the Parameter Setting Mode and Auto Tuning Mode will be saved to EEPROM. Note that if you only set parameters in the Parameter Setting Mode or Auto Tuning Mode (without saving), the parameter values will not be saved in EEPROM. As such, the parameter values you just set will be lost when the control power shuts down, and the parameters will be back to the default values.

See the operation flow for the Parameter Saving Mode below.

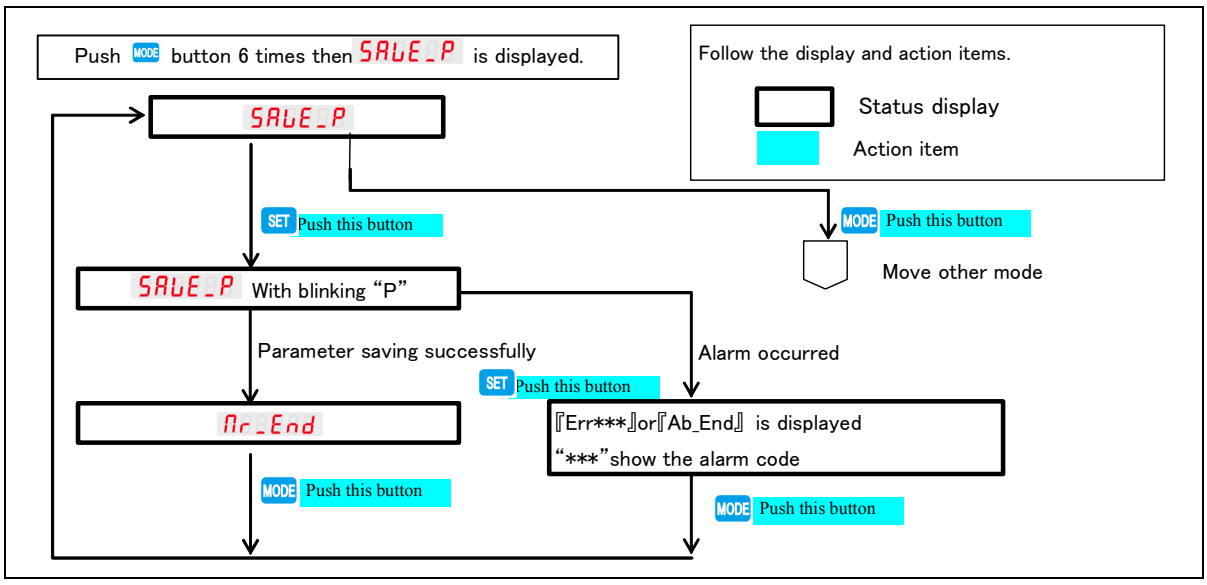


Figure 4-8-1 Operation Flowchart for Parameter Saving Mode on Setup Panel

In the Parameter Setting Mode, reboot the control power AFTER completing the operation above if you changed parameters for which control power (DC24V) reboot is needed. After the reboot, the new parameter settings will be effective.

4-9. Auxiliary Function Mode

At the initial display of S-FLAG, press the MODE button MODE seven times to show SubFnc on DISPLAY LED and press the SET button to enter the Auxiliary Function Mode.

Follow the operation flow shown in Figure 4-9-1.

For each function in the auxiliary Function Mode, see sections for procedure for each function in the Auxiliary Function Mode.

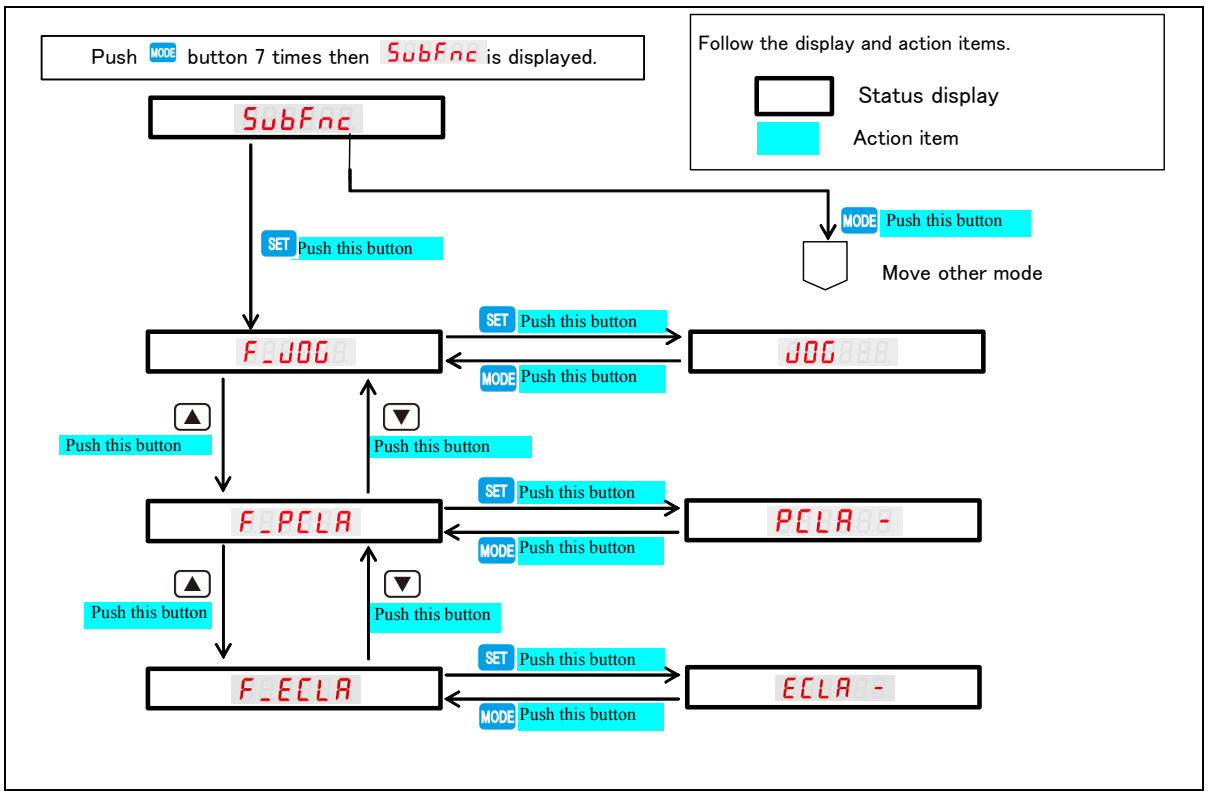


Figure 4-9-1 Operation Flowchart for Auxiliary Function Mode on Setup Panel

4-9 Auxiliary Function Mode

4-9-1 JOG Function

JOG function is used to perform a test run without any command input from the host controller. If tuning is your purpose, perform a test run. For test runs, refer to Chapter 9 “【Test Run】Tab” in the S-TUNE Instruction Manual.

Required conditions to use JOG function.

- The JOG function can be used in the Pulse train command mode of the Position control mode and the Speed control mode. Gain control corresponding to each control mode will be performed. The JOG function cannot be used in the internal position command mode of the Position control mode (positioner function and test run) and the Torque control mode.
- When using the JOG function in the Speed control mode/Internal speed command, the following I/O input will be invalid: VCRUN1, VCRUN2, VCSEL1, VCSEL2, and VCSEL3.
- The JOG function requires control power DC24V and the Servo ON signal input from the I/O connector.

Operation Flow

1. Follow Fig.4-9-1 “Operation Flowchart for Auxiliary Function Mode” and display F_JOG
2. Set the following three related parameters on the Setup Panel or in S-TUNE. For details of each parameter, refer to § 8.4 Parameter List.

Table 4-9-1 JOG Function Related Parameters

No.	Parameter
385.0	JOG operation acceleration time
386.0	JOG operation deceleration time (See Note 1)
387.0	JOG operation target speed

3. Press the SET button SET to display JOG
4. Have the Servo OFF status using the Parallel I/O.
5. Hold down the LEFT button ◀ to display SRV.OFF. The alarm Error occurs if operated at Servo ON. In that case, press the MODE button MODE to bring back the F_JOG display and repeat from step 3.
6. Have the Servo ON status with the Parallel I/O. SRV.ON will be displayed at this point.
7. The motor will rotate in the CCW direction with the UP button▲, and the CW direction with DOWN button▼. The motor will be rotating while you are holding down the UP or DOWN button and the motor will stop when you release the button. See Note 2).

8. To finish the JOG operation, have the Servo OFF status with Parallel I/O and display SAL.OFF. At this point, press the MODE button and change the display to F_JOG. Now you are back to regular operation condition from the JOG operation condition. If you keep the Servo ON status, you cannot switch to regular operation condition and an alarm Error occurs.

Note 1: If your parameter setting of “Deceleration time for the JOG operation” is a large number, it takes longer for the motor to completely stop after the UP▲ or DOWN▼ button is released.

Note 2: Pressing the UP▲ button and the DOWN▼ button simultaneously will make the motor stop. If the motor moves in an unexpected manner, stop the motor by shutting off the main circuit power supply or turning Servo OFF.

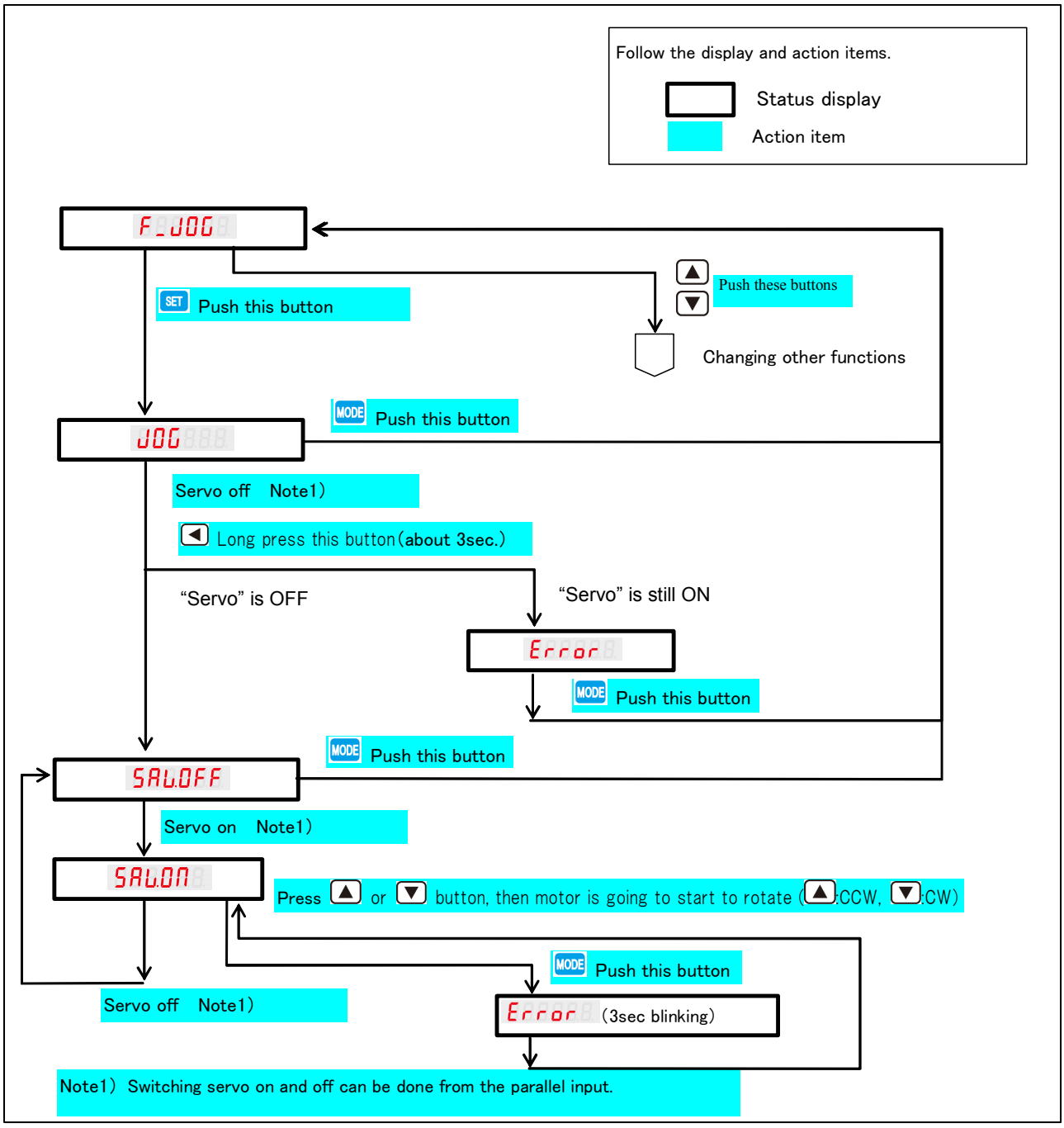


Figure 4-9-2 Operation Flowchart for JOG Function on Setup Panel

4-9-2 Parameter Clear Function

The Parameter Clear Function is used to reset the parameter settings and have the factory settings. After performing a parameter clear operation, rebooting will take the parameter settings back to factory settings.
Perform a Parameter Clear operation with the Servo OFF status. If operated with the Servo ON status, an alarm Error will occur.

Operation Flow

1. Follow Fig.4-9-1 Operation Flowchart of Auxiliary Function Mode and display F_PCLA.
2. Press the SET button SET to display PCLA -
3. Hold down the LEFT button. The display will change from PCLA - to ------ which will start blinking first, and will display FinSh next.
4. Reboot the control power to complete the Parameter Clear operation.

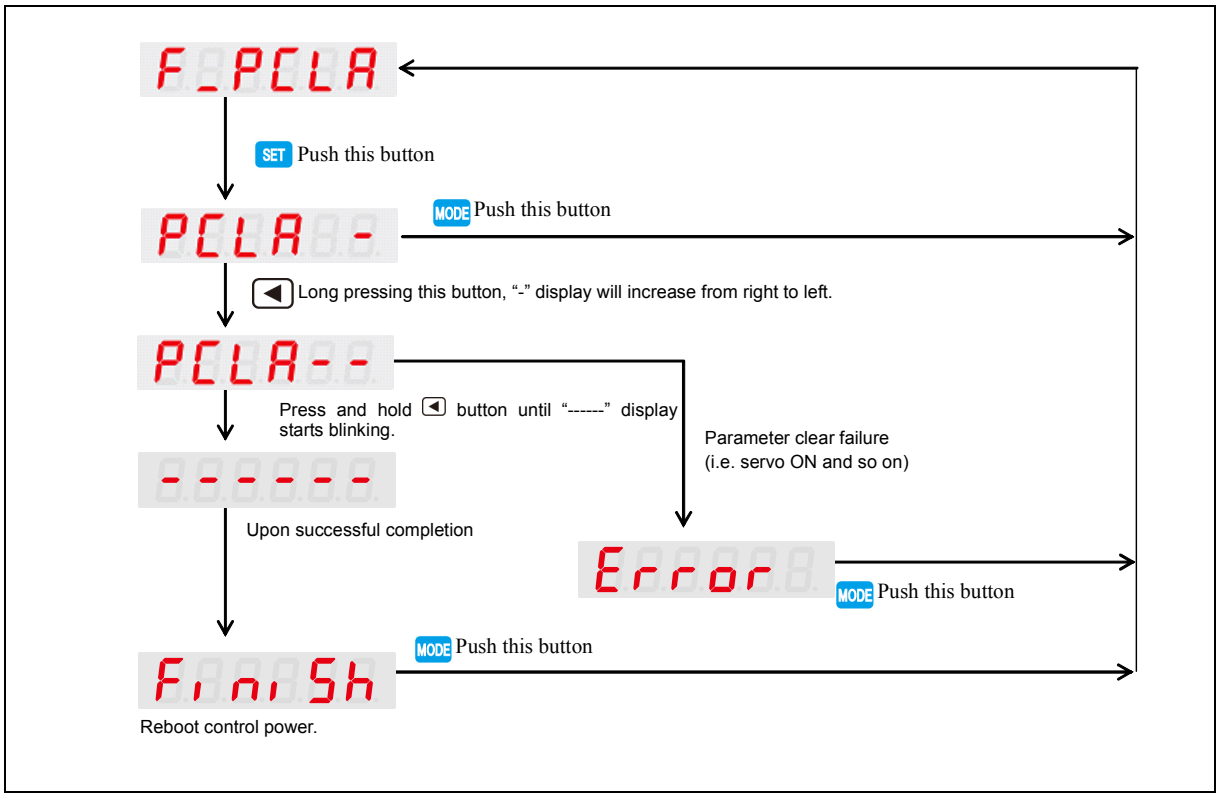


Figure 4-9-3 Operation Flowchart for Parameter Clear Function on Setup Panel

4-9-3 Encoder Clear Function

Refer to Chapter 5 “Initialization of Absolute Encoder” in a separate document “Reference 2 S-FLAG Series Absolute System”.

（MEMO）

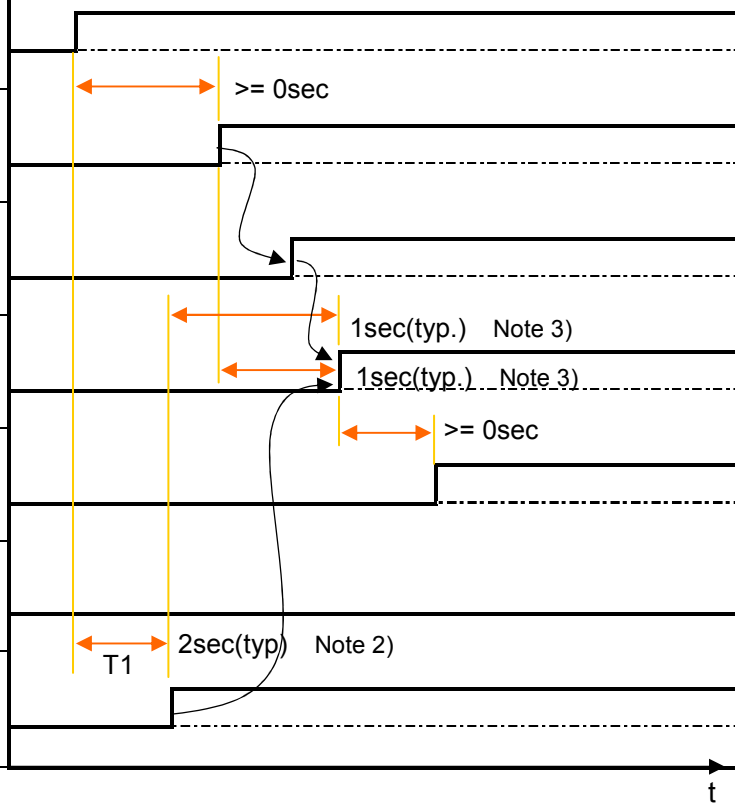
5. Timing Chart

5 Timing Chart

Contents

5-1. Turning the Power ON

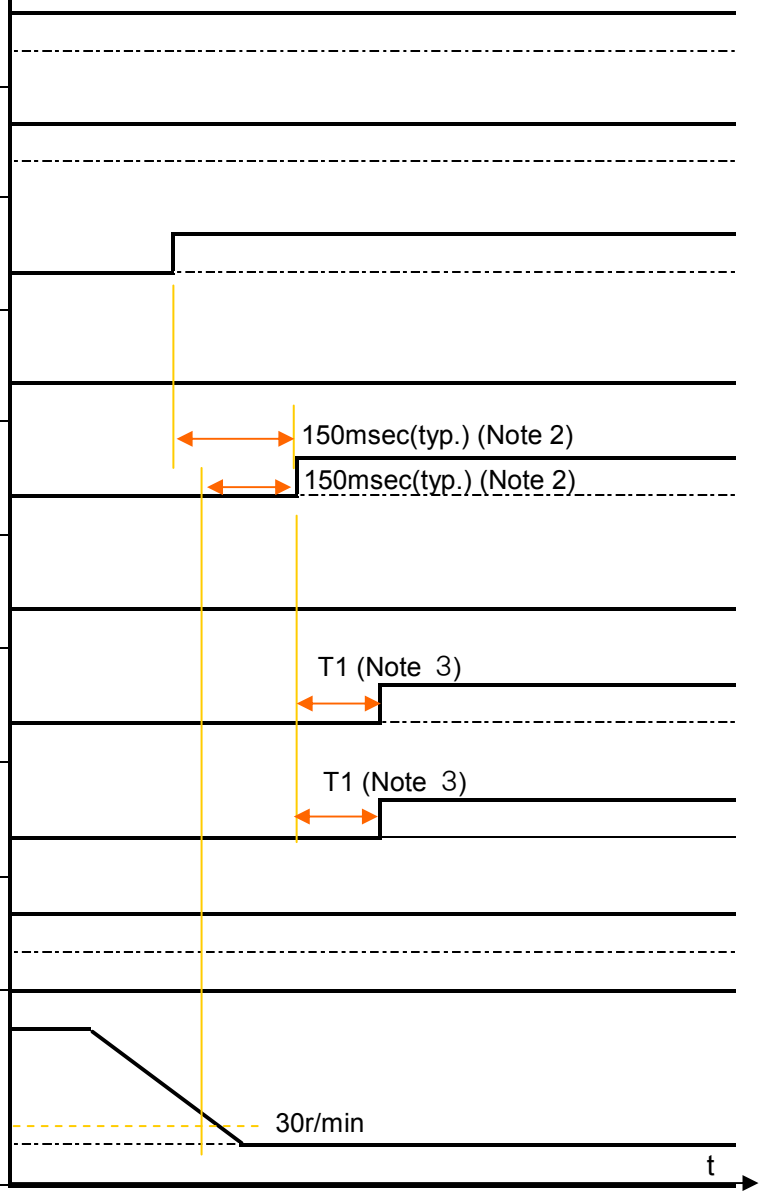
Signal Description	Signal Name	I/O Input Output Status		
Control Power (DC24V)		Input	ON OFF	- - -
Main Circuit AC Power	L1 L2 L3	Input	ON OFF	- -
Power Ready	PRDY	(Internal)	ON OFF	- -
Servo Ready	SRDY	Output	ON OFF	C O
Servo On	SVON	Input	ON OFF	C O
Internal Error Status		(Internal)	ERROR OK	- -
Alarm Status	ALM	Output	ON OFF	C O



Note:
1. "C" in I/O Status indicates that the contact of an input circuit or output circuit is closed, while "O" indicates open.
2. After Parameter Clear, T1 will take about 5 seconds due to parameters being initialized.
3. S-RDY turns ON when the following conditions are all met: Internal Error Status is OK, Main Circuit Power is ON, and PRDY is ON.

5-2. Servo OFF ⇒ ON

Signal Description	Signal Name	I/O Input Output Status		
Main Circuit AC Power	L1 L2 L3	Input	ON OFF	– –
Servo Ready	SRDY	Output	ON OFF	C O
Servo On	SVON	Input	ON OFF	C O
Internal Error Status	–	(Internal)	ERROR OK	– –
Motor Excitation Status	–	(Internal)	ON OFF	– –
Deceleration Stop Status	–	(Internal)	ON OFF	– –
Servo Status	SERVO	Output	ON OFF	C O
Brake Release	MBRK	Output	ON OFF	C O
Alarm Status	ALM	Output	ON OFF	C O
Motor Rotation Speed	–	–	–	–



Note:

1. "C" in I/O Status indicates that the contact of an input circuit or output circuit is closed, while "O" indicates open.
2. SERVO will not turn ON until the motor rotational speed reaches 30 rpm or below.
3. T1 value depends on the setting of Delay time for mechanical brake release (Parameter No. 238.0). (Initial Value: 4 msec, Variable in 0- 500 msec)

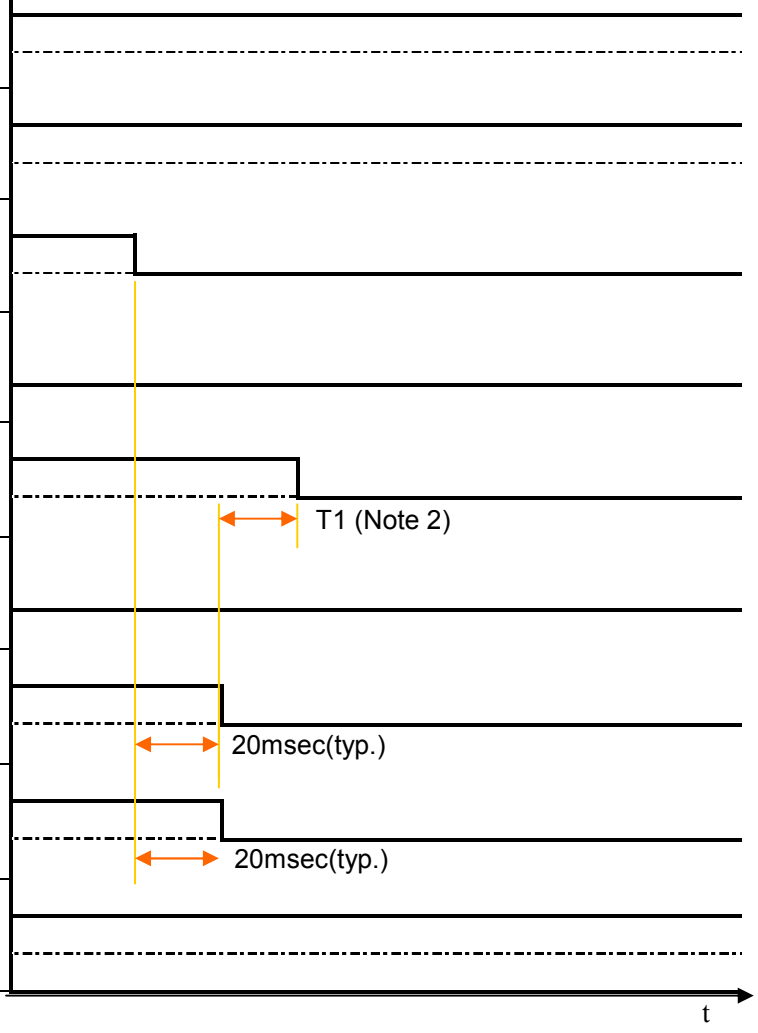
5-3. SERVO ON ⇒ OFF (Motor is idle)

This section is for cases when A) & B) are met simultaneously:

A) Cancelation reason for Deceleration Stop at Servo OFF is # of rotations or operating time upon cancelation (i.e. Parameter No.224.1 = 1: default)

B) Motor rotational speed is not above the number of rotations to cancel Deceleration Stop. (i.e. Parameter No. 227.0 =< 50r/pm, where 50r/pm is default)

Signal Description	Signal Name	I/O Input Output Status		
Main Circuit AC Power	L1 L2 L3	Input	ON OFF	- -
Servo Ready	SRDY	Output	ON OFF	C O
Servo On	SVON	Input	ON OFF	C O
Internal Error Status	-	(Internal)	ERROR OK	– –
Motor Excitation Status	-	(Internal)	ON OFF	– –
Deceleration Stop Status	-	(Internal)	ON OFF	– –
Servo Status	SERVO	Output	ON OFF	C O
Brake Release	MBRK	Output	ON OFF	C O
Alarm Status	ALM	Output	ON OFF	C O



Note:

1. “C” in I/O Status indicates that the contact of an input circuit or output circuit is closed, while “O” indicates open.
2. T1 depends on the setting of Delay time for Servo OFF (Parameter No.237.0: default of 0msec, variable in 0 - 500msec).

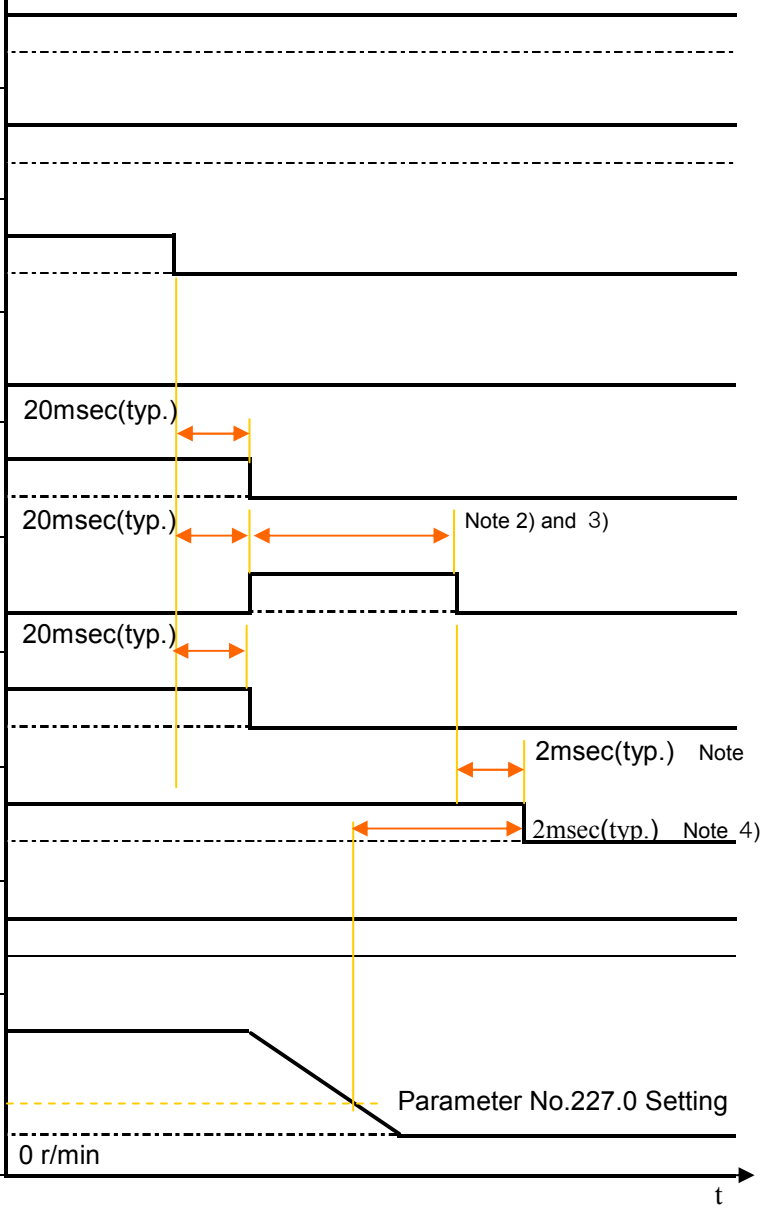
5-4. Servo ON ⇒ OFF（Motor in motion）

This section is for cases when A) & B) are met simultaneously:

A) Cancelation reason for Deceleration Stop at Servo OFF is # of rotations or operating time upon cancelation (i.e. Parameter No.224.1 = 1: default)

B) Motor rotational speed is not above the number of rotations to cancel Deceleration Stop. (i.e. Parameter No. 227.0 =< 50r/pm, where 50r/pm is default)

Signal Description	Signal Name	I/O Input Output Status		
Main Circuit AC Power	L1 L2 L3	入力	ON OFF	– –
Servo Ready	SRDY	出力	ON OFF	C O
Servo On	SVON	入力	ON OFF	C O
Internal Error Status	-	（内部）	ERROR OK	– –
Motor Excitation Status	-	（内部）	ON OFF	– –
Deceleration Stop Status	-	（内部）	ON OFF	– –
Servo Status	SERVO	出力	ON OFF	C O
Brake Release	MBRK	出力	ON OFF	C O
Alarm Status	ALM	出力	ON OFF	C O
Motor Rotational Speed	-	–	–	–

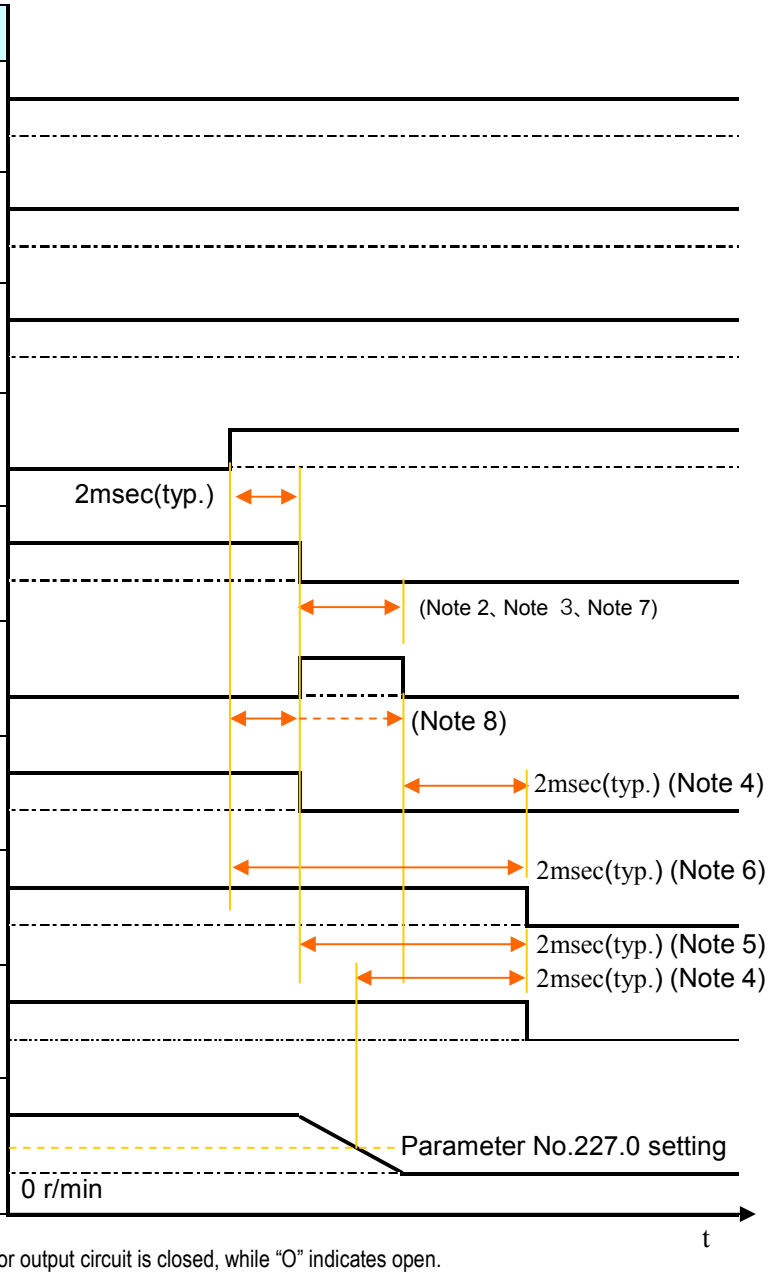


Note:

1. “C” in I/O Status indicates that the contact of an input circuit or output circuit is closed, while “O” indicates open.
2. At Servo OFF, the motor decelerates with the method specified by “Deceleration stop at Servo OFF: method selection (Parameter No.224.0)”.
3. Deceleration Stop by Short brake ends when the required settings of deceleration stop related parameters, No.224.1, 226.0, and 227.0, are met at Servo OFF.
   Timing of MBRK turning OFF is whichever comes first between the following two: 1. Deceleration Stop ends at Servo OFF, or 2. Deceleration stop: the number of rotation for stop cancelation（Parameter No.227.0）falls to the specified setting or below. When no brake is selected with Deceleration stop at Servo OFF: method selection (Parameter No.224.0), MBRK turns OFF at the moment Motor Excitation Status turns OFF.

5-5. Alarm ON

Signal Description	Signal Name	I/O Input Output Status		
Main Circuit AC Power	L1 L2 L3	Input	ON OFF	– –
Servo Ready	SRDY	Output	ON OFF	C O
Servo On	SVON	Input	ON OFF	C O
Internal Error Status	-	(Internal)	ERROR OK	– –
Motor Excitation Status	-	(Internal)	ON OFF	– –
Deceleration Stop Status	-	(Internal)	ON OFF	– –
Servo Status	SERVO	Output	ON OFF	C O
Brake Release	MBRK	Output	ON OFF	C O
Alarm Status	ALM	Output	ON OFF	C O
Motor Rotational Speed	-	–	–	–



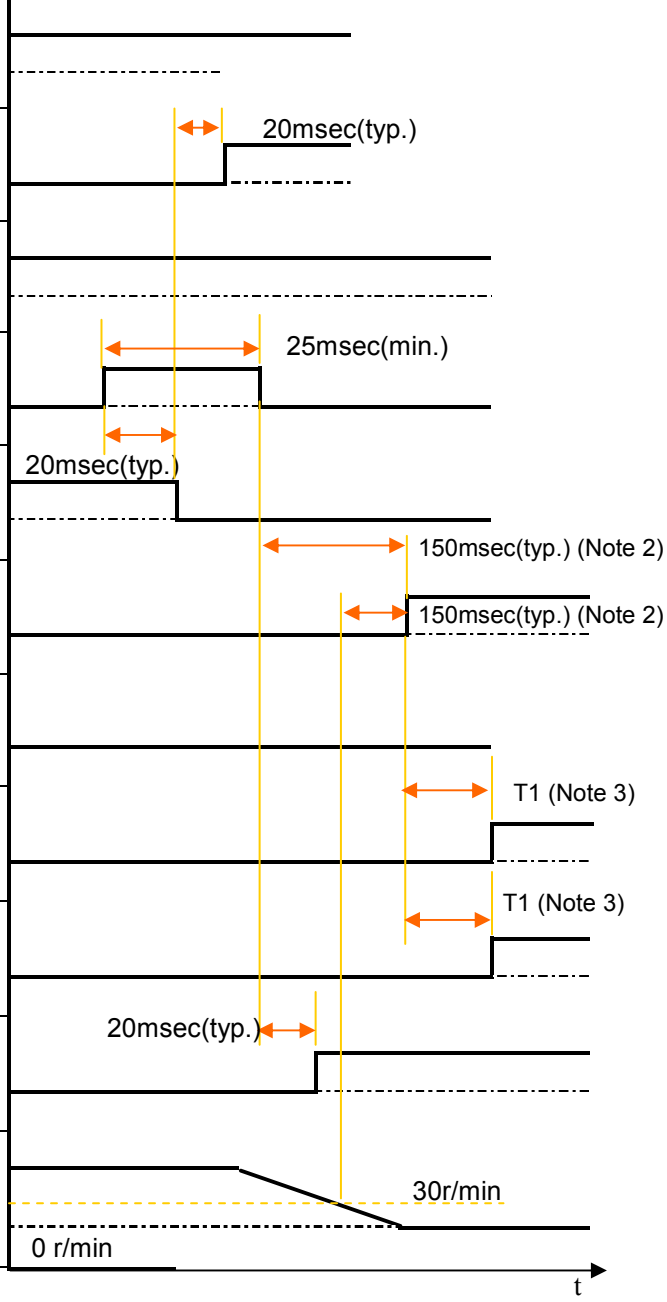
Note:

1. "C" in I/O Status indicates that the contact of an input circuit or output circuit is closed, while "O" indicates open.
2. At Servo OFF, the motor will stop per "Deceleration stop at Servo OFF: method selection (Parameter No.224.0)" as follows.
   a) Prompt stop or Short brake: the motor decelerates and stops with Short brake. b) No brake: free-run stop
3. Deceleration Stop ends when the required settings of deceleration stop related parameters, No.224.1, 226.0, and 227.0, are satisfied at Servo OFF.
4. Timing of MBRK turning OFF is whichever comes first between the following two except for the case of Note 6) Alarm:
   a) Deceleration Stop ends at Servo OFF or
   b) Deceleration stop: the number of rotation for stop cancelation (Parameter No.227.0) falls to the specified setting or below.
5. When Parameter No.224.0= no brake, MBRK turns OFF at the moment when Motor Excitation Status turns OFF.
6. In case of the following alarms, MBRK turns OFF right after Internal Error Status turns ERROR.
   a) Encoder related error, b) Control Power voltage drop error, c) Errors related to the invertor output part
7. Deceleration Stop behaves as follows depending on the error type:
   a) Encoder related errors: Deceleration stop turns OFF per Deceleration stop operating time (Parameter No. 226.0) because detecting Motor Rotation Speed is impossible.
   b) Control Power voltage drop error:
   - Free-run stop when Parameter No.224.2 "Use of a deceleration stop in case of control power supply voltage drop" is disabled. i.e. Parameter No.224.2 = 1(default is 0:Enable)
   - Otherwise, Deceleration stop turns OFF per Parameter NO.228.0 Deceleration stop time at Control power voltage drop. However, will be free-run because CPU will stop immediately and its actual operation time will be short.

   c) Errors related to Invertor output part (Invertor error 1, overvoltage error, overcurrent error, or base circuit shutoff): Free-run stop
8. In case of the following alarms, the Servo status will be extended until Deceleration Stop turns OFF:
   a) Encoder related error b) Control power voltage drop error

5-6. Alarm Reset (SVON = ON)

Signal Description	Signal Name	I/O Input Output Status		
Main Circuit AC Power	L1 L2 L3	Input	ON OFF	– –
Servo Ready	SRDY	Output	ON OFF	C O
Servo On	SVON	Input	ON OFF	C O
Reset	RESET	Input	ON OFF	C O
Internal Error Status	-	(Internal)	ERROR OK	– –
Motor Excitation Status	-	(Internal)	ON OFF	– –
Deceleration Stop Status	-	(Internal)	ON OFF	– –
Servo Status	SERVO	Output	ON OFF	C O
Brake Release	MBRK	Output	ON OFF	C O
Alarm Status	ALM	Output	ON OFF	C O
Motor Rotational Speed	–	–	–	–

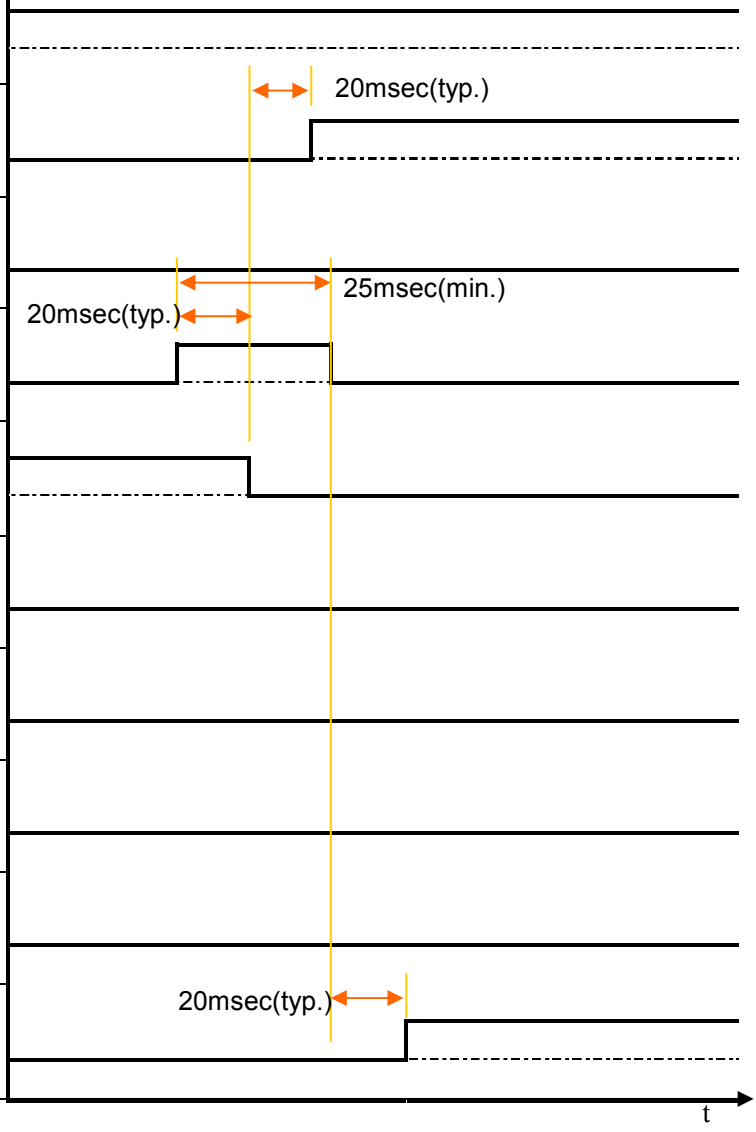


Note:

1. "C" in I/O Status indicates that the contact of an input circuit or output circuit is closed, while "O" indicates open.
2. Servo doesn't turn ON until Motor Rotational Speed falls to 30 r/pm or below.
3. T1 value depends on the setting of Delay time for mechanical brake release (Parameter No. 238.0). (Initial Value: 4 msec, Variable in 0- 500 msec)

5-7. Alarm Reset (SVON = OFF)

Signal Description	Signal Name	I/O Input Output Status		
Main Circuit AC Power	L1 L2 L3	Input	ON OFF	– –
Servo Ready	SRDY	Output	ON OFF	C O
Servo On	SVON	Input	ON OFF	C O
Reset	RESET	Input	ON OFF	C O
Internal Error Status	-	(Internal)	ERROR OK	– –
Motor Excitation Status	-	(Internal)	ON OFF	– –
Deceleration Stop Status	-	(Internal)	ON OFF	– –
Servo Status	SERVO	Output	ON OFF	C O
Brake Release	MBRK	Output	ON OFF	C O
Alarm Status	ALM	Output	ON OFF	C O



Note:

1. “C” in I/O Status indicates that the contact of an input circuit or output circuit is closed, while “O” indicates open

5 Timing Chart

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6. Operations

6 Operations

Contents

6 Operations

Figures

Tables

6 Operations

6-1. Introduction

6-1-1 Overview

This product can operate the motor in five operation modes each of which is a combination of a control mode and a command. This chapter describes how to operate the motor in each operation mode.

■ Position Control Mode (Pulse train command input)

(1) Wiring User I/O Connector (CN1)

In Position Control Mode, the following three signal inputs are possible.

- Differential input
- 24 V open collector input
- 5 V open collector input

(2) Setting Basic Setup parameters

(3) Test Run

■ Speed Control mode (Analog speed command input)

(1) Wiring User I/O Connector (CN1)

(2) Setting Basic Setup Parameters

(3) Test Run

■ Speed Control mode (Internal speed command)

(1) Wiring User I/O Connector (CN1)

(2) Setting Basic Setup Parameters

(3) Test Run

■ Torque Control mode (Analog torque command input)

(1) Wiring User I/O Connector (CN1)

(2) Setting Basic Setup Parameters

(3) Test Run

■ Position Control Mode (Internal position command)

6-1-2 Precautions

	Before wiring to the amplifier or motor, make sure to disconnect all the power supplies.	Failure to observe the precaution will result in electric shock or fire, product failure, or could damage the product.
	Wiring work has to be done by a certified operator.	Failure to observe the precaution will result in electric shock or fire, product failure, or could damage the product.
	Before turning on the power for the amplifier or motor, confirm that all wiring work was done properly.	Failure to observe the precaution will result in electric shock or fire, product failure, or could damage the product.

6-1-3 Common Parameters


Point

In all operation modes, the following common parameters have to set. Set the parameters based on actual use of yours. For details, refer to Chapter 8「8-4 Parameter List」.

Table 6-1-1 List of Common Parameters

Parameter No.	Outline
2.0	Parameters used to select a control mode and a command mode
3.0	
4.0	Parameters related to RS-485 and Absolute encoder
8.0	
11.0	
257.0	
67.0	Parameters related Driving input restriction
67.1	
67.2	
67.3	
144.0	Parameters related to Torque limit
144.1	
147.0	
148.0	
151.0	Parameters related to Safety stop
224.0	
224.1	
224.2	
226.0	
227.0	
228.0	
237.0	
272.1	Parameters related to Encoder pulse output
276.0	
278.0	

6-1-4 Setting Basic Setup Parameters

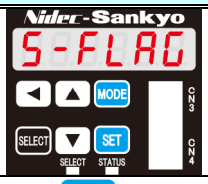
For each operation mode, setting the corresponding Basic Setup Parameters and Operational Parameters is necessary.

The following describes how to change the parameter settings using “Setup Panel” or “S-TUNE” step by step.

■ Using the Setup Panel

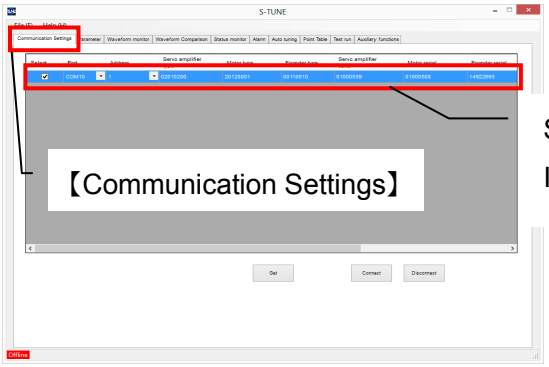
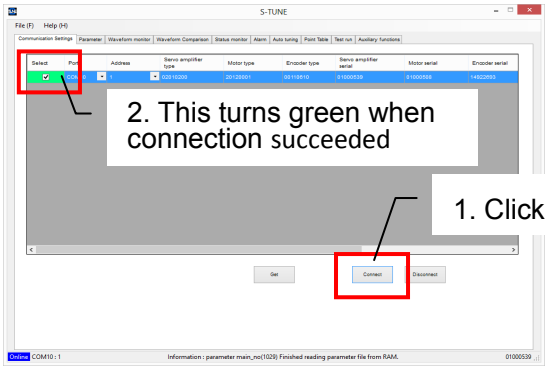
1. Turn on the control power (DC24V) for the amplifier.
2. Follow the steps described below to set the Basic Setup Parameters.

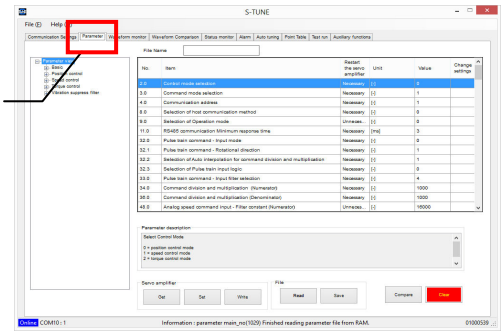
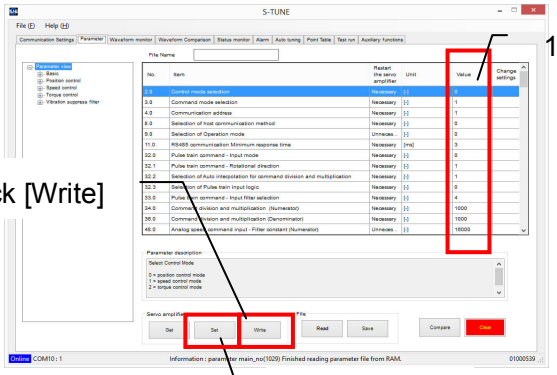
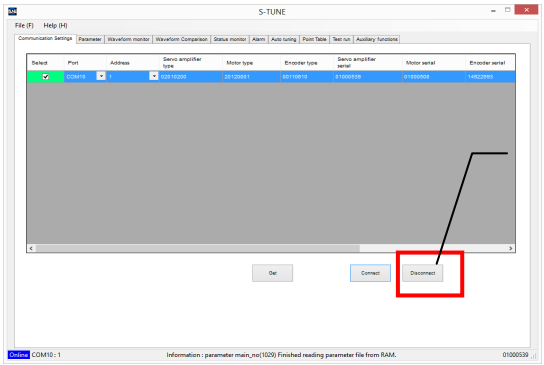
Table 6-1-2 Changing Basic Setup Parameter Settings with Setup Panel

Display and Operation	Description
	Display the initial startup.
Press MODE 4 times.	Change operation modes of the Setup Pane.
P002.0r	Switched to the Parameter mode where you can change Parameter No. Parameter No.2.0. is shown here .
Press SET once.	Display the Parameter No.2.0 setting.
r00000	Displaying the Parameter No.2.0 setting. The digit you can make a change to is blinking.
Press ▲ or ▼	Select a Parameter value.
r00001	Check the Parameter setting. This example is “Speed Control Mode”.
Press SET once	Write the Parameter setting to the amplifier RAM. At this point, blinking will turn solid.
Press MODE once	Return to the Parameter No. display.
P002.0r	Returned to the display where you can switch to another Parameter No.(Parameter No.2.0 is displayed here.)
Press ▲	Change the Parameter No.
P003.0r	Displaying Parameter No.3.0
Press SET once	Display the Parameter No.3.0 setting.
As illustrated above, you can select all related parameters with ▲ or ▼. When finished setting all the parameters, proceed to the next step.	
Press MODE three times	Change the Setup Panel mode.
SAVE_P	Switched to Parameter Saving Mode.
Press SET once	Save the parameters to the amplifier EEPROM. While the parameter settings are being saved,『P』will be blinking in the『SAVE_P』display.
nr_End	Finished.
-	Turn off the control power (DC24V) to the amplifier Off and On again. Until the amplifier is rebooted, the setting changes will not come into effect.

■ Using S-TUNE

Table 6-1-3 Changing Basic Setup Parameter settings with S-TUNE

Step	Display and Operation
1	Turn on the control power(DC24V) for the amplifier
2	 Connect the CN3 (PC communication connector) on the amplifier to your PC with a USB cable and start S-TUNE.
3	 Amplifier Information appears on the【Communication Settings】tab.
4	 Click the [Connect] button to start communicating with the amplifier.

Step	Display and Operation
5	【Parameter 】  Select the【Parameter 】tab. If you make a change in the [Value] column, “*” (asterisk) will appear in the [Change settings] column.
6	 Click the [Set] button to store the changed parameter settings to RAM. (“*” in the [Change settings] column will disappear.) Click the [Write] button to save the parameters to the amplifier EEPROM.
7	 Click the【Communication Settings】tab and click the [Disconnect】button to finish communicating with the amplifier.
8	Turn the amplifier control power (DC24V) Off and On again. Until the amplifier is rebooted, the setting changes will not come into effect.

(MEMO)

6-2. Position Control Mode (Pulse train command input)

6-2-1 Wiring User I/O Connector (CN1) (Differential input)

Table 6-2-1 User I/O Connector Pin Assignments (Pulse train position command input Differential input)

Name	Ref.	Pin No.	Signal name	Description
User I/O ·24V Power input ·Parallel I/O ·Pulse train command input ·ABZ output	CN1	1	24V	Amplifier control power supply 24 V input
		2	G24V	Amplifier control power supply GND
		3	COM+	I/O power supply 24 V input
		4	SVON	Servo ON
		5	RESET	Alarm reset
		6	HOLD	Command input inhibit
		7	PCLR	Deviation counter clear
		8	—	Reserved
		9	CCWL	CCW run inhibited
		10	CWL	CW run inhibited
		11	TLSEL1	Torque limit
		12	COM-	I/O power supply GND
		13	MBRK	Brake release
		14	SERVO	Servo status output
		15	POSIN	Positioning complete output
		16	—	Reserved
		17	T-LIMIT	Output during Torque control
		18	OCZ	Encoder Z-phase output(Open collector)
		19	SRDY+	Servo ready +
		20	SRDY-	Servo ready -
		21	ALM+	Alarm status +
		22	ALM-	Alarm status -
		23	NC1	Reserved (Do not connect)
		24	—	Reserved
		25	—	Reserved
		26	CMD_PLS	Pulse command Pulse, Quadrature encoder pulse A-phase, CCW
		27	/CMD_PLS	Pulse command /Pulse, Quadrature encoder pulse /A-phase, /CCW
		28	—	Reserved
		29	—	Reserved
		30	CMD_DIR	Pulse command Direction, Quadrature encoder pulse A-phase, CW
		31	/CMD_DIR	Pulse command /Direction, Quadrature encoder pulse /A-phase, /CW
		32	—	Reserved
		33	—	Reserved
		34	—	Reserved
		35	—	Reserved
		36	OUT_A	Encoder A-phase
		37	/OUT_A	Encoder /A-phase
		38	OUT_B	Encoder B-phase
		39	/OUT_B	Encoder/B-phase
		40	OUT_Z	Encoder Z-phase
		41	/OUT_Z	Encoder /Z-phase
		42	SG	Signal ground
		43	485	485 of RS-485 communication
		44	/485	/485 of RS-485 communication
		45	SG	Signal ground
		46	NC2	Reserved (Do not connect)
		47	—	Reserved
		48	—	Reserved
		49	—	Reserved
		50	—	Reserved

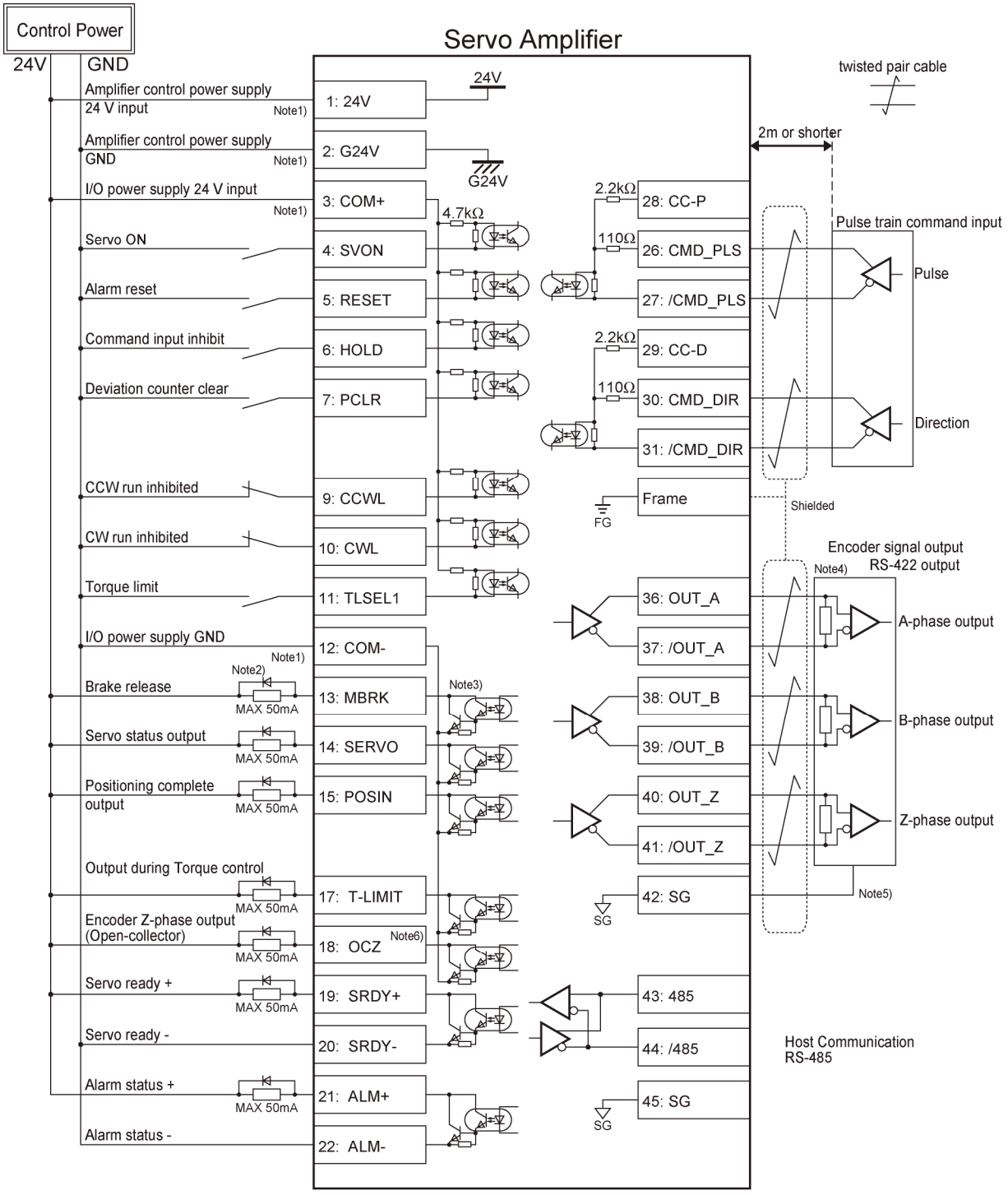


Figure 6-2-1 User I/O connector Wiring Example
(Pulse train position command input Differential input)

Note 1) Have only one power supply for both the control power (24V, G24V) and I/O power (COM+, COM-).
Note 2) When driving a load containing inductance component such as relay, connect a protection circuit (diode).
Note 3) The output circuit structure is open connector and Darlington connection transistor output and connects to relay or photocoupler. Note that when Transistor ON, connector-emitter voltage V_{CE}(SAT) is approximately 1V, which does not satisfy V_{IL} of regular TTL IC. Hence, the output circuit structure must not be connected directly.
Note 4) As shown in the wiring diagram, make sure to connect an end termination resistor.
Note 5) Connect to the line driver signal ground of the host controller which outputs amplifier encoder output. Connecting the signal ground to the amplifier control power GND might result in malfunction.
Note 6) When Z-phase pulse width is too narrow to be measured by the host controller accurately, decrease the paired-pulse ratio with “Encoder pulse output Division and multiplication” (No. No.276.0 and No.278.0) or reduce the number of rotations to make the pulse width wider. [Pulse width] = 1/(the number of rotations)/(the paired-pulse ratio x 2^{17}).

6-2-2 Wiring User I/O Connector (CN1)(24 V open collector input)

Table 6-2-2 User I/O Connector Pin assignments (Pulse train command input 24V open collector input)

Name	Ref.	Pin No.	Signal name	Description
User I/O ·24V Power input ·Parallel I/O ·Pulse train command input ·ABZ output	CN1	1	24V	Amplifier control power supply 24 V input
		2	G24V	Amplifier control power supply GND
		3	COM+	I/O power supply 24 V input
		4	SVON	Servo ON
		5	RESET	Alarm reset
		6	HOLD	Command input inhibit
		7	PCLR	Deviation counter clear
		8	—	Reserved
		9	CCWL	CCW run inhibited
		10	CWL	CW run inhibited
		11	TLSEL1	Torque limit
		12	COM-	I/O power supply GND
		13	MBRK	Brake release
		14	SERVO	Servo status output
		15	POSIN	Positioning complete output
		16	—	Reserved
		17	T-LIMIT	Output during Torque control
		18	OCZ	Encoder Z-phase output(Open collector)
		19	SRDY+	Servo ready +
		20	SRDY-	Servo ready -
		21	ALM+	Alarm status +
		22	ALM-	Alarm status -
		23	NC1	Reserved (Do not connect)
		24	—	Reserved
		25	—	Reserved
		26	CMD_PLS	Reserved
		27	/CMD_PLS	Pulse command /Pulse, Quadrature encoder pulse /A-phase, /CCW
		28	CC-P	24 V of /CMD_PLS
		29	CC-D	24 V of /CMD_DIR
		30	CMD_DIR	Reserved
		31	/CMD_DIR	Pulse command /Direction, Quadrature encoder pulse /A-phase, /CW
		32	—	Reserved
		33	—	Reserved
		34	—	Reserved
		35	—	Reserved
		36	OUT_A	Encoder A-phase
		37	/OUT_A	Encoder /A-phase
		38	OUT_B	Encoder B-phase
		39	/OUT_B	Encoder/B A-phase
		40	OUT_Z	Encoder Z-phase
		41	/OUT_Z	Encoder /Z-phase
		42	SG	Signal ground
		43	485	485 of RS-485 communication
		44	/485	/485 of RS-485 communication
		45	SG	Signal ground
		46	NC2	Reserved (Do not connect)
		47	—	Reserved
		48	—	Reserved
		49	—	Reserved
		50	—	Reserved

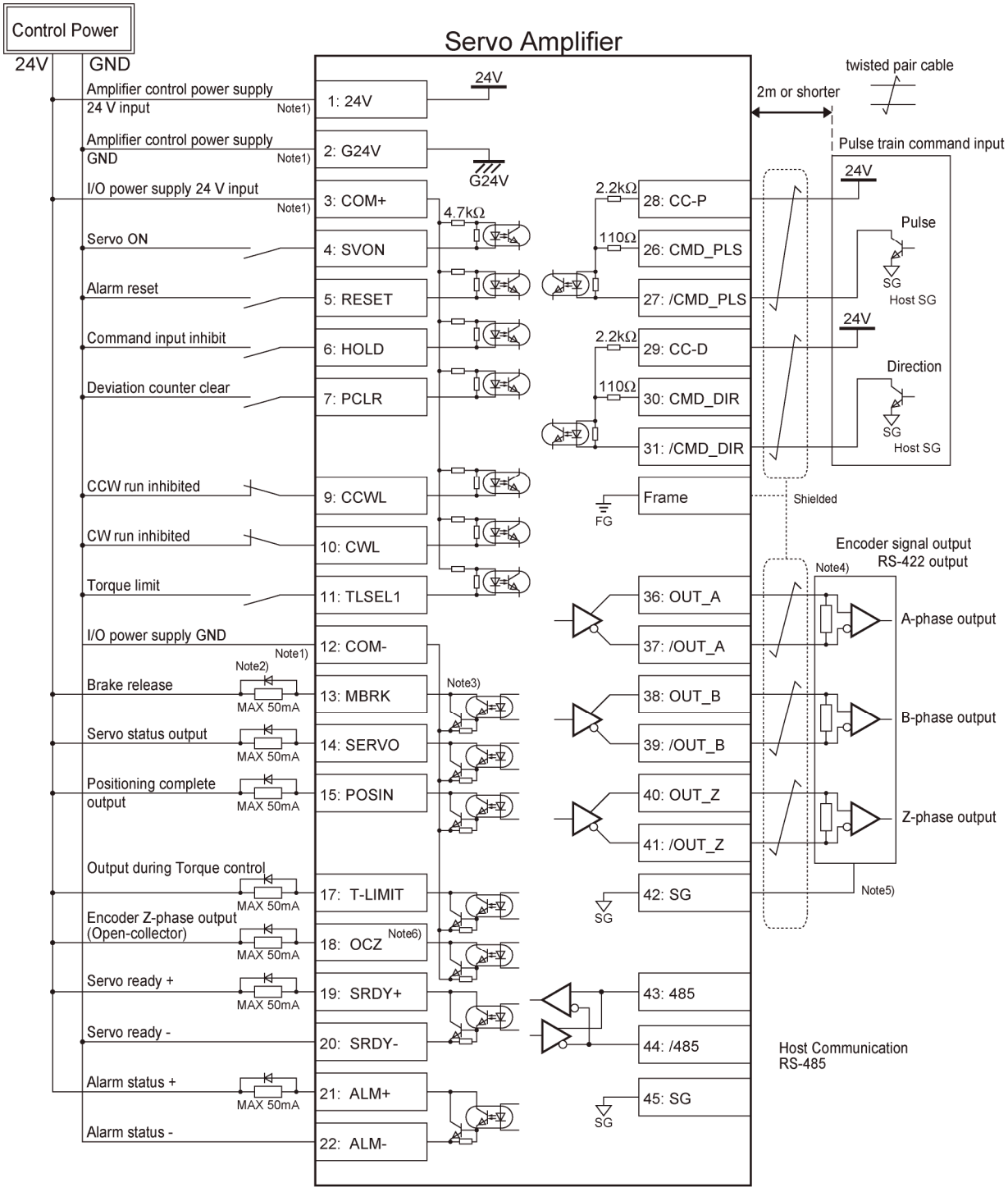


Figure 6-2-2 User I/O connector Wiring Example
(Pulse train position command input 24V Open collector input)

Note 1) Have only one power supply for both the control power (24V, G24V) and I/O power (COM+, COM-).
Note 2) When driving a load containing inductance component such as relay, connect a protection circuit (diode).
Note 3) The output circuit structure is open connector and Darlington connection transistor output and connects to relay or photocoupler. Note that when Transistor ON, connector-emitter voltage V_{CE}(SAT) is approximately 1V, which does not satisfy V_{IL} of regular TTL IC. Hence, the output circuit structure must not be connected directly.
Note 4) As shown in the wiring diagram, make sure to connect an end termination resistor.
Note 5) Connect to the line driver signal ground of the host controller which outputs amplifier encoder output. Connecting the signal ground to the amplifier control power GND might result in malfunction.
Note 6) When Z-phase pulse width is too narrow to be measured by the host controller accurately, decrease the paired-pulse ratio with “Encoder pulse output Division and multiplication” (No. No.276.0 and No.278.0) or reduce the number of rotations to make the pulse width wider. [Pulse width] = 1/(the number of rotations)/(the paired-pulse ratio x 2^{17}).

6-2-3 Wiring User I/O Connector (CN1)(5 V open collector input)

Table 6-2-3 User I/O Connector Pin assignments (Pulse train command input 5V open collector input)

Name	Ref.	Pin No.	Signal name	Description
User I/O ·24V Power input ·Parallel I/O ·Pulse train command input ·ABZ output	CN1	1	24V	Amplifier control power supply 24 V input
		2	G24V	Amplifier control power supply GND
		3	COM+	I/O power supply 24 V input
		4	SVON	Servo ON
		5	RESET	Alarm reset
		6	HOLD	Command input inhibit
		7	PCLR	Deviation counter clear
		8	—	Reserved
		9	CCWL	CCW run inhibited
		10	CWL	CW run inhibited
		11	TLSEL1	Torque limit
		12	COM-	I/O power supply GND
		13	MBRK	Brake release
		14	SERVO	Servo status output
		15	POSIN	Positioning complete output
		16	—	Reserved
		17	T-LIMIT	Output during Torque control
		18	OCZ	Encoder Z-phase output(Open collector)
		19	SRDY+	Servo ready +
		20	SRDY-	Servo ready -
		21	ALM+	Alarm status +
		22	ALM-	Alarm status -
		23	NC1	Reserved (Do not connect)
		24	—	Reserved
		25	—	Reserved
		26	CMD_PLS	Pulse command 5 V power supply input of /CMD_ PLS
		27	/CMD_PLS	Pulse command /Pulse, Quadrature encoder pulse /A-phase, /CCW
		28	—	Reserved
		29	—	Reserved
		30	CMD_DIR	Pulse command 5 V power supply input of /CMD_ DIR
		31	/CMD_DIR	Pulse command /Direction, Quadrature encoder pulse /A-phase, /CW
		32	—	Reserved
		33	—	Reserved
		34	—	Reserved
		35	—	Reserved
		36	OUT_A	Encoder A-phase
		37	/OUT_A	Encoder /A-phase
		38	OUT_B	Encoder B-phase
		39	/OUT_B	Encoder/B A-phase
		40	OUT_Z	Encoder Z-phase
		41	/OUT_Z	Encoder /Z-phase
		42	SG	Signal ground
		43	485	485 of RS-485 communication
		44	/485	/485 of RS-485 communication
		45	SG	Signal ground
		46	NC2	Reserved (Do not connect)
		47	—	Reserved
		48	—	Reserved
		49	—	Reserved
		50	—	Reserved

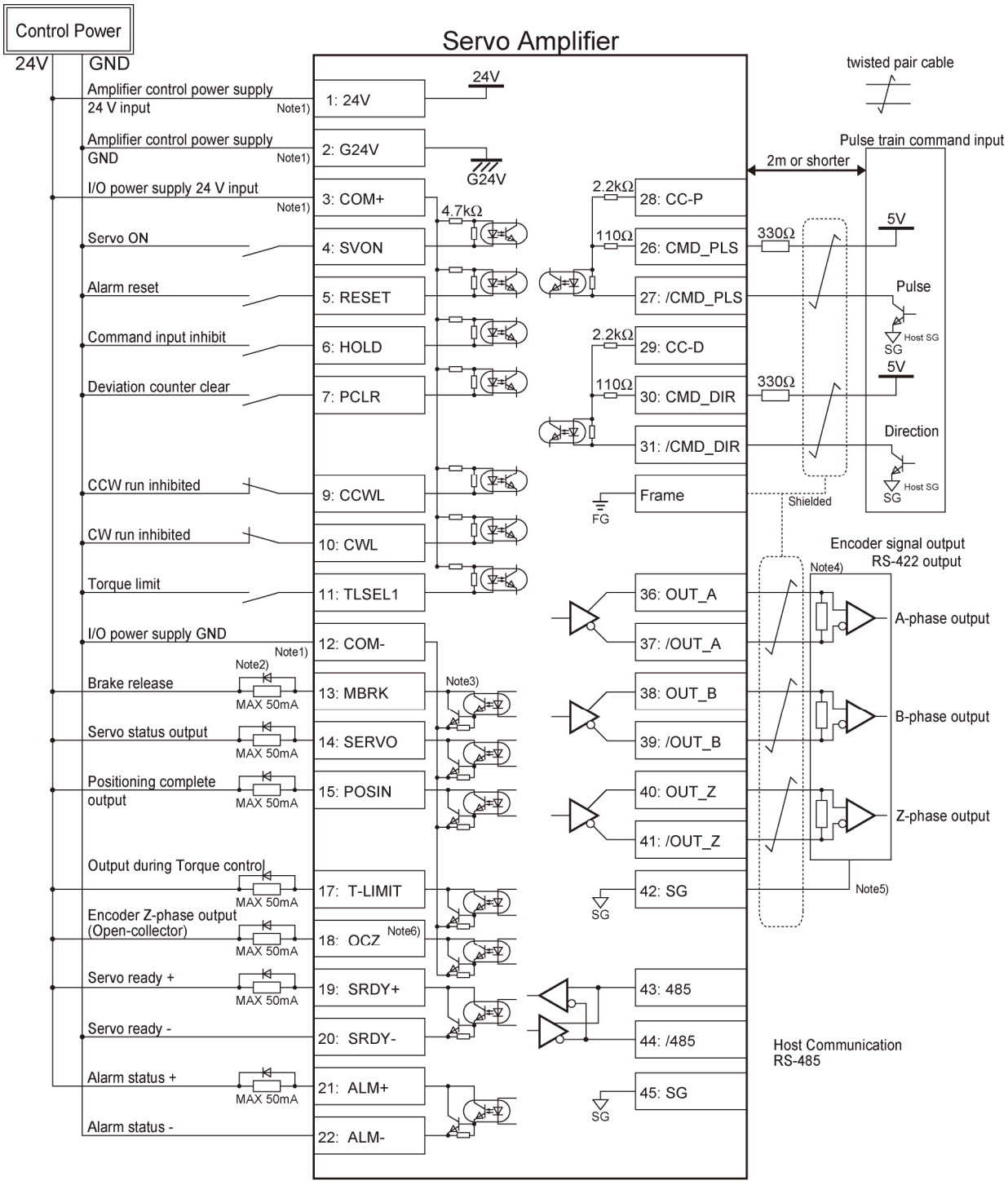


Figure 6-2-3 User I/O connector Wiring Example
(Pulse train position command input 5V Open collector input)

Note 1) Have only one power supply for both the control power (24V, G24V) and I/O power (COM+, COM-).
Note 2) When driving a load containing inductance component such as relay, connect a protection circuit (diode).
Note 3) The output circuit structure is open connector and Darlington connection transistor output and connects to relay or photocoupler. Note that when Transistor ON, connector-emitter voltage VCE(SAT) is approximately 1V, which does not satisfy VIL of regular TTL IC. Hence, the output circuit structure must not be connected directly.
Note 4) As shown in the wiring diagram, make sure to connect an end termination resistor.
Note 5) Connect to the line driver signal ground of the host controller which outputs amplifier encoder output. Connecting the signal ground to the amplifier control power GND might result in malfunction.
Note 6) When Z-phase pulse width is too narrow to be measured by the host controller accurately, decrease the paired-pulse ratio with “Encoder pulse output Division and multiplication” (No. No.276.0 and No.278.0) or reduce the number of rotations to make the pulse width wider. [Pulse width] = 1/(the number of rotations)/(the paired-pulse ratio x 2^{17}).

6-2-4 PLC Wiring Example 1 (Differential Output)

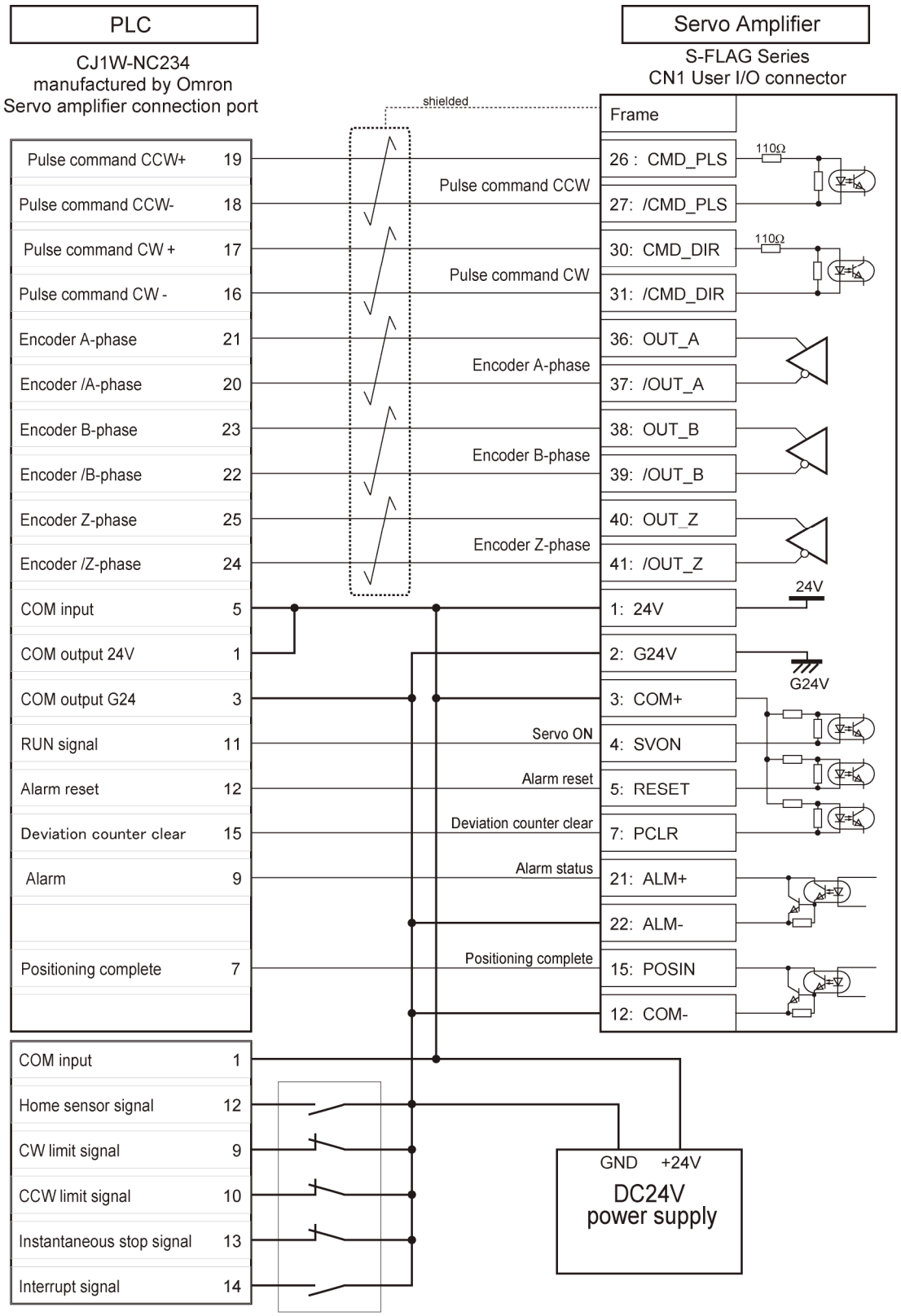


Figure 6-2-4 PLC Wiring Example1
(with CJ1W-NC234 by Omron; Differential Output)

6-2-5 PLC Wiring Example 2 (open collector output)

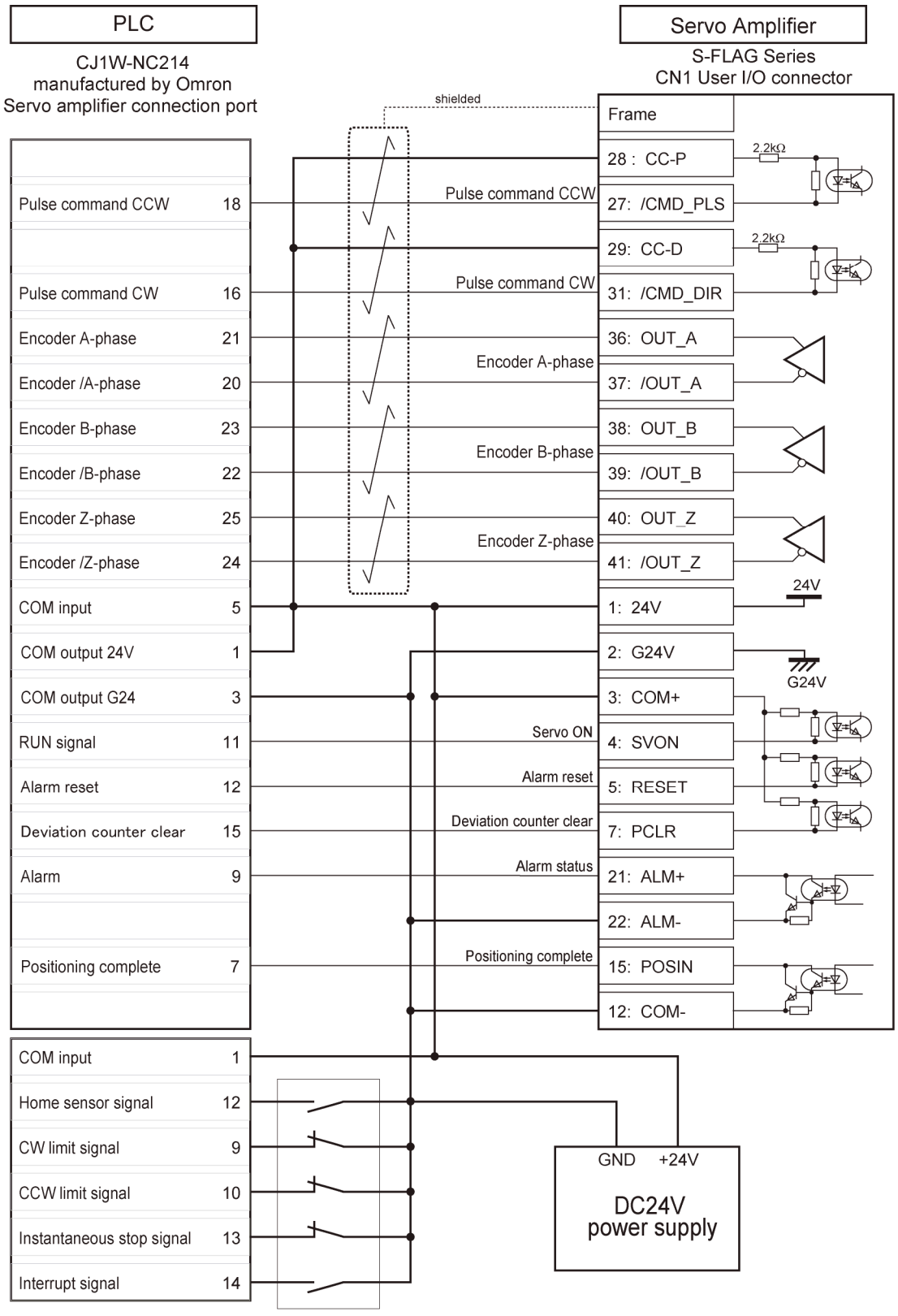


Figure 6-2-5 PLC Wiring Example 2
(with CJ1W-NC214 by Omron; Open Collector Output)

6-2-6 PLC Wiring Example 3 (open collector output)

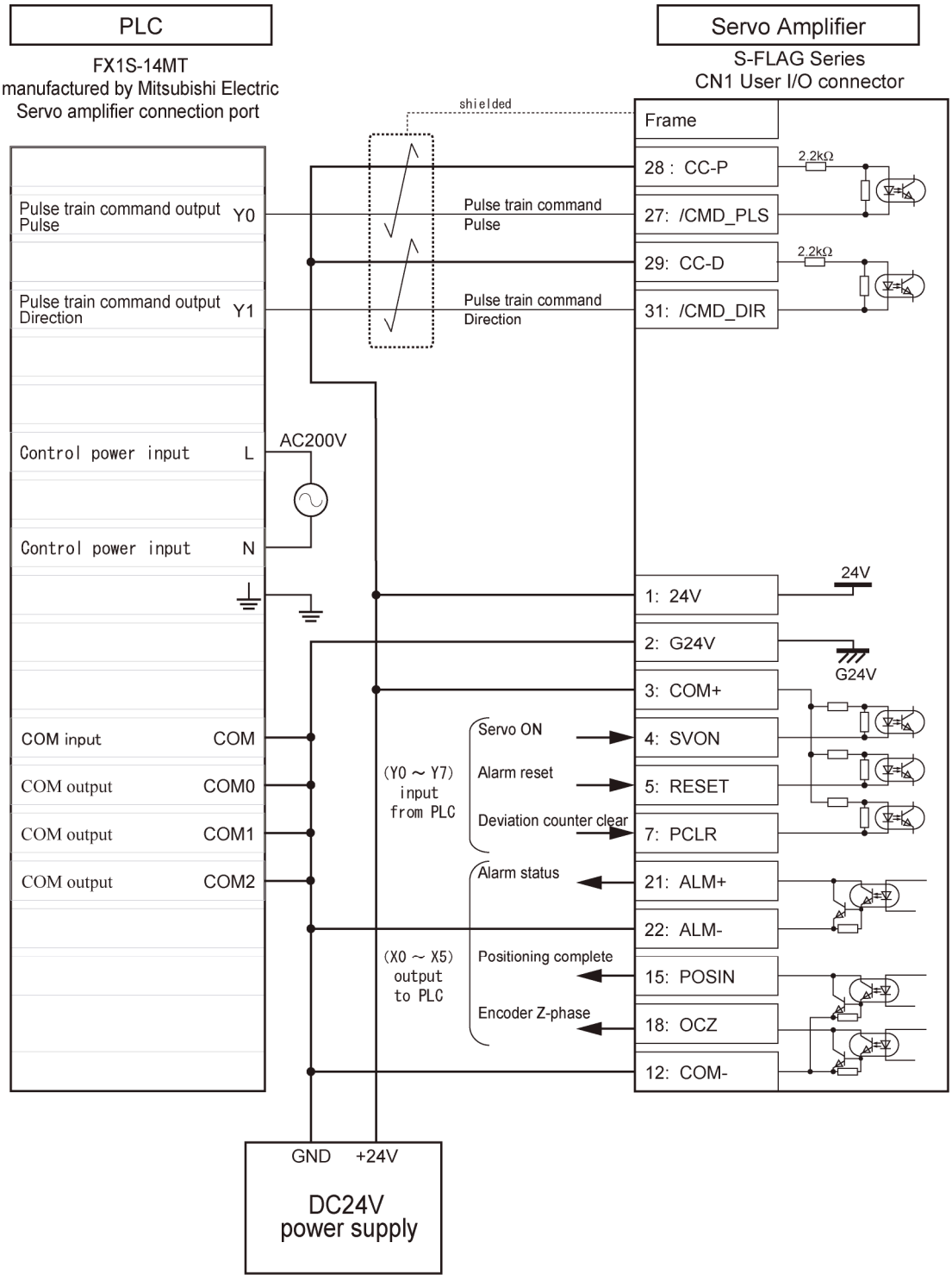


Figure 6-2-6 PLC Wiring Example 3
(with FX1S-14MT by Mitsubishi Electronic; Open Collector Output)

6-2-7 Setting Basic Setup Parameters

This section describes settings of Basic Setup Parameters. The factory setting is “Pulse train Position Command Input”.

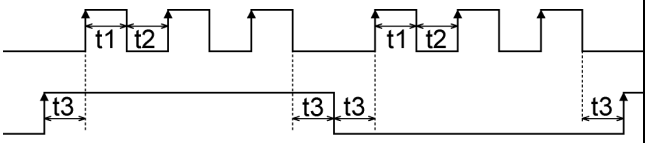
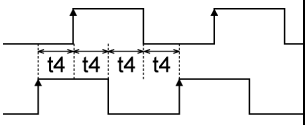
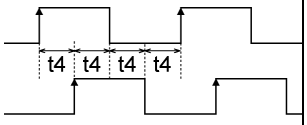
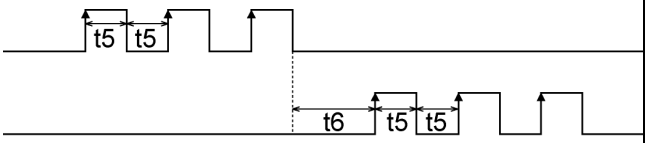
To use the amplifier in Pulse Train Position Command Input, you need to set the following corresponding parameters.

Table 6-2-4 Parameter Settings for Control Mode change

Parameter No.	Parameter	Required setting
2.0	Control mode selection	Select “0”
3.0	Command mode selection	Select “1”
32.0	Pulse command - Input mode	Select an input mode of Pulse train command input. (Note 1) 0 : Pulse/Direction 1 : QEP 2 : CCW/CW
34.0	Command paired-pulse ratio (Numerator)	Select “32,768”. (Note 2)
36.0	Command paired-pulse ratio (Denominator)	Set at “pulse count of the host controller output divided by 4” (Note 2)

Note 1) Pulse Train Command Input Form List is shown below. See more details in Chapter 2 Table 2-2-4 “Maximum command pulse frequency and minimum time of Pulse Train Command Input signal”

Table 6-2-5 Pulse Train Command Input Form List

Parameter No.32.0 Pulse train command Input mode	Input Signal Form	Signal Name	Minimal necessary time interval (t1,t2,t3,t4,t5,t6)	
			Positive direction command	Negative direction command
0 (default)	Pulse/Direction command pulse	Pulse CMD_PLS Direction CMD_DIR		
1	AB quadrature encoder pulse	A-Phase CMD_PLS B-Phase CMD_DIR		
2	CCW pulse CW pulse	CCW CMD_PLS CW CMD_DIR		

Note 2) Set this parameter when the pulse count per rotation of the host controller is inconsistent with the counter part of the amplifier (131,072). For details, refer to Section 8-4 Parameter List in Chapter 8.

6-2 Position Control Mode (Pulse train command input)

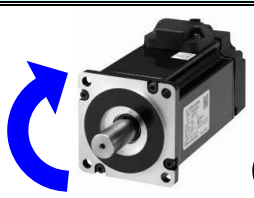
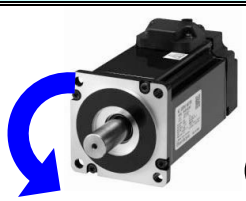
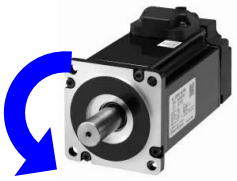
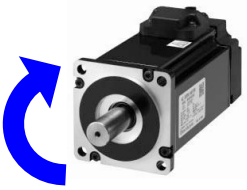
Also set the following parameters based on actual use of yours.

For details, refer to Section 8-4 Parameter List in Chapter 8.

Table 6-2-6 Operational parameters for Pulse train position command input

Parameter No.	Parameter	Description
32.1	Pulse train command - Rotational direction	Refer to Table 6-2-7.
32.3	Selection of Pulse train input logic	Select logic for pulse train input.
33.0	Pulse train command - Input filter selection	Used to reduce malfunction caused by noise in input command pulse.
64.0	Positioning completion determination method	Specify conditions for Positioning completion.
68.0	Positioning completion range	
69.0	Positioning completion speed	
70.0	Positioning completion Pulse train command input (speed)	
71.0	Positioning completion Detection delay time	
66.0	Position command smoothing filter 1 selection	Set a vibration suppression filter. Used in case of high acceleration deceleration speed command or device resonance caused during Positioning.
66.1	Position command smoothing filter 2 selection	
80.0	Position command smoothing filter 1 Moving average counter	
81.0	Position command smoothing filter 2 Moving average counter	

Table 6-2-7 Parameter No.32.1 setting and Motor rotational direction (Pulse train command)

Value of Parameter No.32.1	Command Pulse from Host Controller	
	Positive direction command	Negative direction command
0	 CW	 CCW
1 【default】	 CCW	 CW

Setting Basic Setup Parameters and Operational Parameters can be done using Setup Panel or S-TUNE.

Refer to the following for details

- Setup Panel: Table 6-1-2 Changing Basic Setup Parameter Settings (with Setup Panel)
- S-TUNE: Table 6-1-3 Changing Basic Setup Parameter Settings (with S-TUNE)

6-2-8 Test Run

■ Precautions for Test Run

	Before turning on the power for the amplifier or motor, confirm that all the wiring work was done properly.	Failure to observe this precaution will result in electric shock, fire, product failure, product damage.
	Set the Basic Setup parameters properly before conducting a test run.	Improper settings for Basic Setup Parameters could result in no motor motion, unstable motion, or uncontrollable motion, unexpected motion, which could cause injury or accident.
	Conduct a test run with the motor alone first with all the machinery disconnected.	Failure to observe this precaution could result in unstable motor motion, uncontrollable motion or other unexpected motions, which could cause injury or accident.
	For a motor with a brake, make sure to release the brake before starting the motor.	Failure to observe the precaution will result in the brake or motor troubles.

■ Test Run

Table 6-2-8 Test Run Procedure
(Pulse train command input)

Step	Operation
1	Make sure that all the wiring work has been done properly.
2	Turn on the control power (DC24V) for the amplifier.
3	Turn on the primary circuit power (AC200V) for the amplifier.
4	For Servo ON, connect the SVON pin of CN1 connector to COM-.
5	Input the position command pulse from the host controller in low frequency, and run the motor at a low speed (around100r/min). Make sure that the rotational direction of the motor and the direction setting are consistent.
6	After making sure of safety of actual motor motions, increase the Position command Pulse frequency gradually and check the motor motions. Confirm that the number of rotations has reached the target speed.

6-3. Speed Control Mode (Analog speed command input)

6-3-1 Wiring User I/O Connector (CN1)

Table 6-3-1 User I/O Connector Pin assignments (Analog speed command input)

Name	Ref.	Pin No.	Signal name	Description
User I/O ·24V Power input ·Parallel I/O ·Pulse train command input ·Analog input ·ABZ output	CN1	1	24V	Amplifier control power supply 24 V input
		2	G24V	Amplifier control power supply GND
		3	COM+	I/O power supply 24 V input
		4	SVON	Servo ON
		5	RESET	Alarm reset
		6	HOLD	Command input inhibit
		7	—	Reserved
		8	—	Reserved
		9	CCWL	CCW run inhibited
		10	CWL	CW run inhibited
		11	TLSEL1	Torque limit
		12	COM-	I/O power supply GND
		13	MBRK	Brake release
		14	SERVO	Servo status output
		15	—	Reserved
		16	—	Reserved
		17	T-LIMIT	Output during Torque control
		18	OCZ	Encoder Z-phase output(Open collector)
		19	SRDY+	Servo ready +
		20	SRDY-	Servo ready -
		21	ALM+	Alarm status +
		22	ALM-	Alarm status -
		23	NC1	Reserved (Do not connect)
		24	—	Reserved
		25	—	Reserved
		26	—	Reserved
		27	—	Reserved
		28	—	Reserved
		29	—	Reserved
		30	—	Reserved
		31	—	Reserved
		32	A_SPEED	Analog speed command input
		33	A_GND	Analog speed command GND
		34	—	Reserved
		35	—	Reserved
		36	OUT_A	Encoder A-phase
		37	/OUT_A	Encoder /A-phase
		38	OUT_B	Encoder B-phase
		39	/OUT_B	Encoder/B A-phase
		40	OUT_Z	Encoder Z-phase
		41	/OUT_Z	Encoder /Z-phase
		42	SG	Signal ground
		43	485	485 of RS-485 communication
		44	/485	/485 of RS-485 communication
		45	SG	Signal ground
		46	NC2	Reserved (Do not connect)
		47	—	Reserved
		48	—	Reserved
		49	—	Reserved
		50	—	Reserved

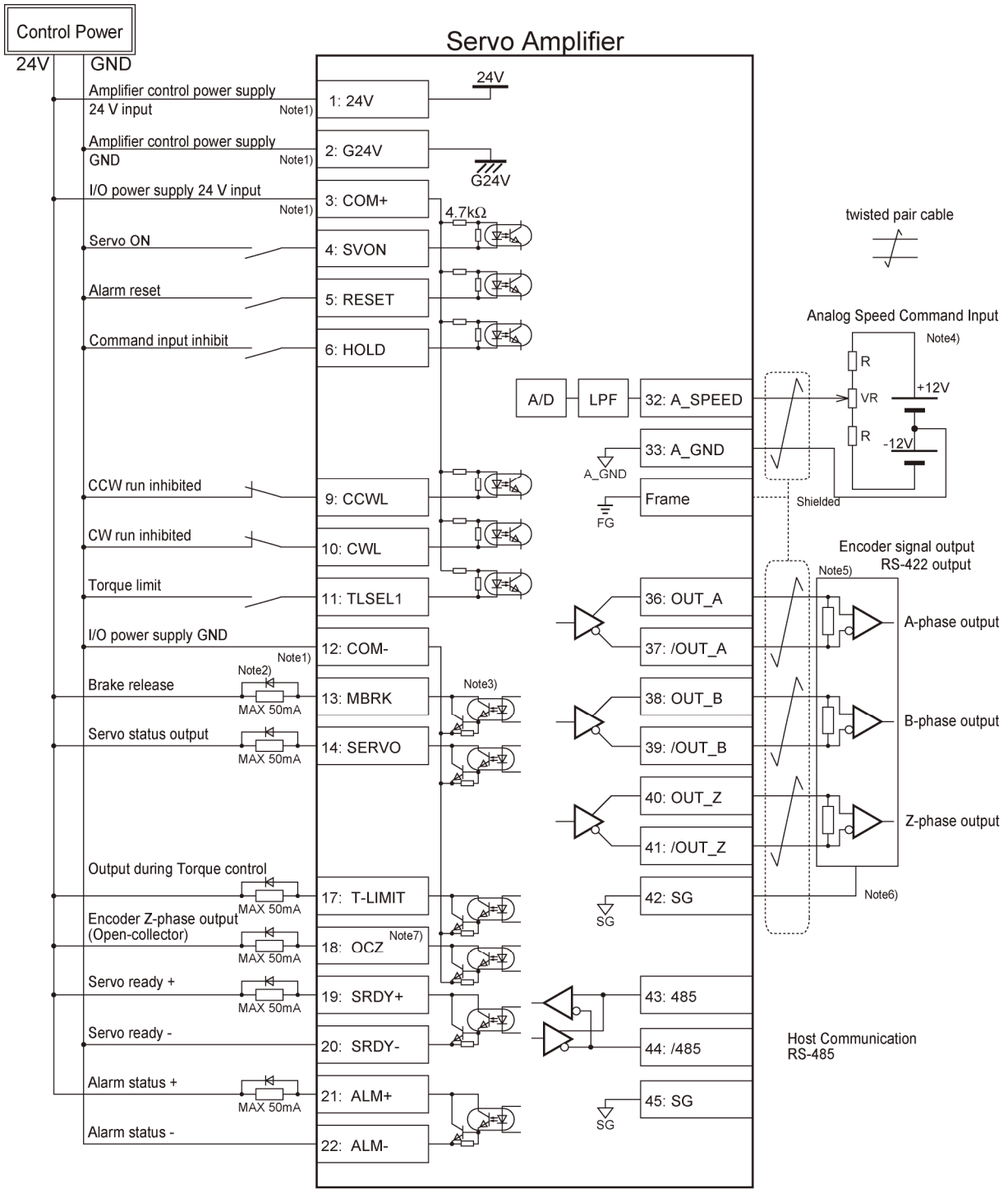


Figure 6-3-1 Wiring User I/O connector
(Analog Speed Command Input)

Note 1) Have only one power supply for both the control power (24V, G24V) and I/O power (COM+, COM-).
Note 2) When driving a load containing inductance component such as relay, connect a protection circuit (diode).
Note 3) The output circuit structure is open connector and Darlington connection transistor output and connects to relay or photocoupler. Note that when Transistor ON, connector-emitter voltage VCE(SAT) is approximately 1V, which does not satisfy VIL of regular TTL IC. Hence, the output circuit structure must not be connected directly.
Note 4) When structuring the command circuit with a variable resistor (VR) and a resistor (R), VR should be 2kΩ 1/4W or more and R should be 100Ω～200Ω 1/4W or more, in order to have a command input voltage range of -10V to +10V. When the host analog speed command circuit is isolated from the 24V control power, connect A_GND to the host SG, not to the control power GND. When not isolated, connect A_GND to the control power GND.
Note 5) As shown in the wiring diagram, make sure to connect an end termination resistor.
Note 6) Connect to the line driver signal ground of the host controller which outputs amplifier encoder output. Connecting the signal ground to the amplifier control power GND might result in malfunction.
Note 7) when Z-phase pulse width is too narrow to be measured by the host controller accurately, decrease the paired-pulse ratio with “Encoder pulse output Division and multiplication” (No. No.276.0 and No.278.0) or reduce the number of rotations to make the pulse width wider. [Pulse width] = 1／(the number of rotations)／(the paired-pulse ratio x 2^{17}).

6-3-2 Setting Basic Setup Parameters

This section describes Basic Setup Parameters corresponding to Speed control mode.

To use Analog Speed Command Input, make sure to set the following two parameters first.

Table 6-3-2 Parameter settings required for Analog Speed Command Input Control Mode

Parameter No.	Parameter	Required Setting
2.0	Control mode selection	Select “1”
3.0	Command mode selection	Select “2”

Choose and set some of the following Parameters No.48. - No.78.0, based on your operational needs. For details, refer to Chapter 8「8-4 Parameter List」.

Table 6-3-3 Parameters related to Analog Speed Command Input

Parameter No.	Parameter	Description
48.0	Analog speed command - Input filter constant (Numerator)	Use these two parameters for filtering noise elements in the input command voltage. Use these along with Parameter No.62.1.
49.0	Analog speed command - Input Filter constant (Denominator)	
50.0	Analog speed command - Input Gain (Numerator)	Use these two parameters to set a rotational count at the maximum command input voltage (±10V). (Note 1)
51.0	Analog speed command input - Input Gain (Denominator)	
52.0	Analog speed command - CCW speed limit override value (Numerator)	Set Rotational Speed Limit during CCW rotation. (Note 2)
53.0	Analog speed command - CCW speed limit override value (Denominator)	
54.0	Analog speed command - CW speed limit override value (Numerator)	Set Rotational Speed Limit during CW rotation. (Note 2)
55.0	Analog speed command - CW speed limit override value (Denominator)	
60.0	Analog speed command - Fixed offset value	Adjust Offset so that Speed becomes 0[r/min] when Command input is 0V. Parameter No.62.2 needs to be used with this parameter.
62.0	Analog speed command - Rotational direction	Refer to Table 6-3-6
62.1	Analog speed command - Input filter	Use this parameter along with Parameter No.48.0 and No.49.0.
62.2	Analog speed command - Offset tuning method	Use this parameter along with Parameter No.60.0.
77.0	Speed command smoothing filter selection	Use this parameter along with Parameter No.78.0.
78.0	Moving average time for Speed command smoothing filter	This parameter is used to reduce fluctuation of the motor speed. Use it along with Parameter No.77.0.

Note 1) Set Parameter No.51.0 (denominator) = Maximum Rotational Speed of the motor, and Parameter No.50.0 (numerator) = Target Maximum Rotational Speed of the motor.
The following example shows the parameter settings for a motor with max rotational speed of 5,000 [r/min] and for max rotational speed of 3,000 [r/min] at max command input voltage (±10V) .

Table 6-3-4 Example settings for Analog Speed Command - Input Gain

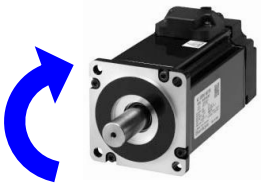
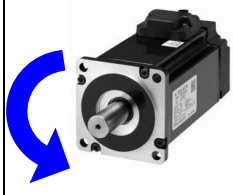
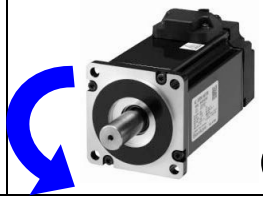
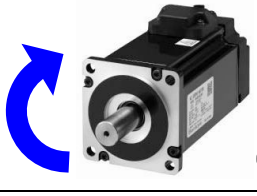
Parameter No.	Parameter	Setting
50.0	Analog speed command Input Gain (Numerator)	“3,000”
51.0	Analog speed command input Input Gain (Denominator)	“5,000”

Note 2) Set Parameter No.53.0 (denominator) and No.55.0 (denominator) = Maximum Rotational Speed of the motor and Parameter No.52.0 (numerator) and No.54.0 (numerator) = Target Rotational Speed Limit respectively.
The following example shows the parameter settings for a motor with max rotational speed of 5,000 [r/min] and for max rotational speed limit of 3,000 [r/min].

Table 6-3-5 Example settings for Analog Speed Command - Limit Override

Rotation Direction	Parameter No.	Parameter	Setting
CCW	52.0	Analog speed command - CCW speed limit override value (Numerator)	"3,000"
	53.0	Analog speed command - CCW speed limit override value (Denominator)	"5,000"
CW	54.0	Analog speed command - CW speed limit override value (Numerator)	"3,000"
	55.0	Analog speed command - CW speed limit override value (Denominator)	"5,000"

Table 6-3-6 Parameter No.62.0 setting and Motor rotation directions (Analog Speed Command Input)

Parameter No.62.0 setting	Input Analog Command voltage	
	Positive voltage	Negative voltage
0		
1 【default】		

Use the Setup Panel or S-TUNE for setup of Basic Setup Parameters and Operational Parameters.

For Setup Panel, see Table 6-1-2 Changing Basic Setup Parameter Settings (with Setup Panel).
For S-TUNE, see Table 6-1-3 Changing Basic Setup Parameter Settings (with S-TUNE).

6-3-3 Test Run

■ Precautions for Test Run

	Before turning on the power for the amplifier or motor, confirm that all the wiring work was done properly.	Failure to observe this precaution will result in electric shock, fire, product failure, or product damage.
	Set the Basic Setup parameters properly before conducting a test run.	Improper settings for Basic Setup Parameters could result in no motor motion, or unstable motion, uncontrollable motion or unexpected motion, which could cause injury or accident.
	Conduct a test run with the motor alone first with all machinery disconnected.	Failure to observe this precaution could result in unstable motor motion, uncontrollable motion or other unexpected motions, which could cause injury or accident.
	For a motor with a brake, make sure to release the brake before starting the motor.	Failure to observe the precaution will result in brake or motor troubles.

■ Test Run

Table 6-3-6 Test Run Procedure
(Analog Speed Command Input)

Step	Operation
1	Before turning on the power for the amplifier or motor, check for proper wiring.
2	Turn on the control power (DC24V) for the amplifier.
3	Turn on the primary circuit power (AC200V) for the amplifier.
4	To turn Servo ON, connect the SVON pin of CN1 connector to COM-.
5	Input the Analog Speed Command voltage in low voltage, run the motor at a low speed.
6	After confirming safety of actual motor motions, increase the Analog Speed Command voltage gradually and check motor motions. Check that the rotation count has reached the target speed.

6-4. Speed Control Mode (Internal Speed Command)

6-4-1 Wiring User I/O Connector (CN1)

Table 6-4-1 User I/O Connector Pin assignments

(Internal speed command)

Name	Ref	Pin No.	Signal name	Description
User I/O ·24V Power input ·Parallel I/O ·Pulse train command input ·Analog input ·ABZ output	CN1	1	24V	Amplifier control power supply 24 V input
		2	G24V	Amplifier control power supply GND
		3	COM+	I/O power supply 24 V input
		4	SVON	Servo ON
		5	RESET	Alarm reset
		6	VCRUN1	Internal Speed Command Start1 Input (when ON, CCW rotation)
		7	VCRUN2	Internal Speed Command Start2 Input (when ON, CW rotation)
		8	VCSEL1	Internal Speed Command Selection 1 Input
		9	VCSEL2	Internal Speed Command Selection 2 Input
		10	VCSEL3	Internal Speed Command Selection 3 Input
		11	TLSEL1	Torque limit
		12	COM-	I/O power supply GND
		13	MBRK	Brake release
		14	SERVO	Servo status output
		15	—	Reserved
		16	—	Reserved
		17	T-LIMIT	Output during Torque control
		18	OCZ	Encoder Z-phase output(Open collector)
		19	SRDY+	Servo ready +
		20	SRDY-	Servo ready -
		21	ALM+	Alarm status +
		22	ALM-	Alarm status -
		23	NC1	Reserved (Do not connect)
		24	—	Reserved
		25	—	Reserved
		26	—	Reserved
		27	—	Reserved
		28	—	Reserved
		29	—	Reserved
		30	—	Reserved
		31	—	Reserved
		32	—	Reserved
		33	—	Reserved
		34	—	Reserved
		35	—	Reserved
		36	OUT_A	Encoder A-phase
		37	/OUT_A	Encoder /A-phase
		38	OUT_B	Encoder B-phase
		39	/OUT_B	Encoder/B A-phase
		40	OUT_Z	Encoder Z-phase
		41	/OUT_Z	Encoder /Z-phase
		42	SG	Signal ground
		43	485	485 of RS-485 communication
		44	/485	/485 of RS-485 communication
		45	SG	Signal ground
		46	NC2	Reserved (Do not connect)
		47	—	Reserved
		48	—	Reserved
		49	—	Reserved
		50	—	Reserved

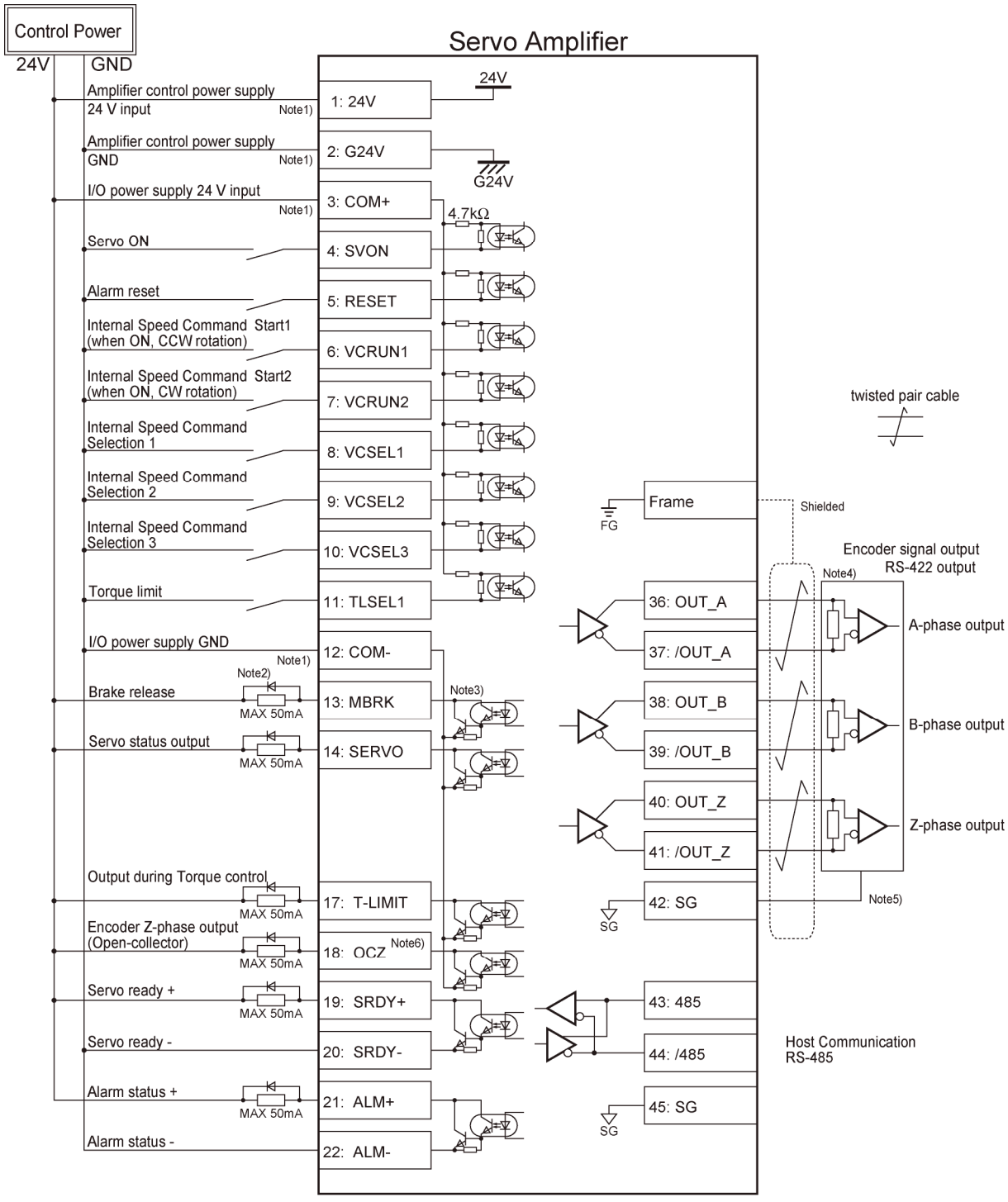


Figure 6-4-1 User I/O connector Wiring Example (Internal Speed Command)

Note 1) Have only one power supply for both the control power (24V, G24V) and I/O power (COM+, COM-).
Note 2) When driving a load containing inductance component such as relay, connect a protection circuit (diode).
Note 3) The output circuit structure is open connector and Darlington connection transistor output and connects to relay or photocoupler. Note that when Transistor ON, connector-emitter voltage VCE(SAT) is approximately 1V, which does not satisfy VIL of regular TTL IC. Hence, the output circuit structure must not be connected directly.
Note 4) As shown in the wiring diagram, make sure to connect an end termination resistor.
Note 5) Connect to the line driver signal ground of the host controller which outputs amplifier encoder output. Connecting the signal ground to the amplifier control power GND might result in malfunction.
Note 6) When Z-phase pulse width is too narrow to be measured by the host controller accurately, decrease the paired-pulse ratio with “Encoder pulse output Division and multiplication” (No. No.276.0 and No.278.0) or reduce the number of rotations to make the pulse width wider. [Pulse width] = 1/(the number of rotations)/(the paired-pulse ratio x 2^{17}).

6-4-2 Setting Basic Setup Parameters

Set the following Basic Setup Parameters to operate in Control Mode-Internal Speed Command.

Table 6-4-2 Parameter Settings required for Internal Speed Command Control Mode

Parameter No.	Parameter Name	Setting
2.0	Control mode selection	Select “1”
3.0	Command mode selection	Select “3”
388.0	Selection of Internal speed command type	Select “1”

Table 6-4-3 Speed Related Parameters for Internal Speed Command

Parameter No.	Parameter Name	Description
390.0	Acceleration time (Note 1)	Default: 1,000 [ms]
391.0	Deceleration time (Note 2)	Default: 1,000 [ms]
392.0	Target speed 1	Default: 500 [r/min]
393.0	Target speed 2	Default: 1,000 [r/min]
394.0	Target speed 3	Default: 1,500 [r/min]
395.0	Target speed 4	Default: 2,000 [r/min]
396.0	Target speed 5	Default: 2,500 [r/min]
397.0	Target speed 6	Default: 3,000 [r/min]
398.0	Target speed 7	Default: 4,000 [r/min]
399.0	Target speed 8	Default: 5,000 [r/min]

Note 1) duration for speed command to slow down from 1000 rpm to 0 rpm.

Note 2) duration for speed command to speed up from 0 rpm to 1000 rpm.


Point

Your target speed can be set at anywhere within in the specification range of the speed setting of parameters No.392.0 – No.399.0, but some motor models cannot necessarily reach the target speed. Refer to Chapter 2 Table 2-1-3 Motor Specifications when setting target speed parameters.

Setting Basic Setup Parameters and Operational Parameters can be done using the Setup Panel or S-TUNE. Refer to the following for details:

- Setup Panel: Table 6-1-2 Changing Basic Setup Parameter Setting (with Setup Panel)
- S-TUNE: Table 6-1-3 Changing Basic the Setup Parameter Setting (with S-TUNE)

6-4-3 Test Run

■ Precautions for Test Run

	Before turning on the power for the amplifier or motor, be sure that all the wiring was done properly.	Failure to observe this precaution will result in electric shock or fire, product failure, or could damage the product.
	Set the Basic Setup parameters properly before conducting a test run.	Improper settings for Basic Setup Parameters could result in no motor motion, unstable motion, or uncontrollable motion, unexpected motion, which could cause injury or accident.
	Conduct a test run with the motor alone first with all the machinery disconnected.	Failure to observe this precaution could result in unstable motor motion, uncontrollable motion or other unexpected motions, which could cause injury or accident.
	For a motor with a brake, make sure to release the brake before starting the motor.	Failure to observe this precaution will result in the brake or motor troubles.

■ Test Run

Table 6-4-4 Test Run Procedure
(Internal Speed Command)

Step	Operation
1	Before turning on the power for the amplifier or motor, make sure that working work has been all done properly.
2	Turn on the control power (DC24V) for the amplifier.
3	Turn on the primary circuit power (AC200V) for the amplifier.
4	To turn Servo ON, connect the SVON pin of CN1 connector to COM-.
5	Proceed referring to Table 6-4-5 and Table 6-4-6. Select one of target speeds with ON/OFF combinations of VCSEL1, VCSEL2, and VCSEL3, and turn on VCRUN1 or VCRUN2. The motor will rotate accordingly. ON: connect the terminal to COM- OFF: release the terminal from COM-

Table 6-4-5 Internal Speed Command: Motor Rotational Direction

Motor Rotational Direction	Operation	
	VCRUN1	VCRUN2
CCW	ON	OFF
CW	OFF	ON
Motor Stop	OFF	OFF
Motor Stop	ON	ON

Table 6-4-6 Internal Speed Command: Motor Rotational Speed

Target Speed	Operation		
	VCSEL1 (CN1 Pin No.8)	VCSEL2 (CN1 Pin No.9)	VCSEL3 (CN1 Pin No.10)
1	OFF	OFF	OFF
2	ON	OFF	OFF
3	OFF	ON	OFF
4	ON	ON	OFF
5	OFF	OFF	ON
6	ON	OFF	ON
7	OFF	ON	ON
8	ON	ON	ON

(MEMO)

6-5. Torque Control Mode (Analog Torque Command Input)

6-5-1 Wiring User I/O Connector (CN1)

Table 6-5-1 User I/O Connector Pin assignments (Analog torque command input)

Name	Ref.	Pin No.	Signal name	Description
User I/O ·24V Power input ·Parallel I/O ·Pulse train command input ·Analog input ·ABZ output	CN1	1	24V	Amplifier control power supply 24 V input
		2	G24V	Amplifier control power supply GND
		3	COM+	I/O power supply 24 V input
		4	SVON	Servo ON
		5	RESET	Alarm reset
		6	HOLD	Command input inhibit
		7	—	Reserved
		8	—	Reserved
		9	CCWL	CCW run inhibited
		10	CWL	CW run inhibited
		11	TLSEL1	Torque limit
		12	COM-	I/O power supply GND
		13	MBRK	Brake release
		14	SERVO	Servo status output
		15	—	Reserved
		16	—	Reserved
		17	T-LIMIT	Output during Torque control
		18	OCZ	Encoder Z-phase output(Open collector)
		19	SRDY+	Servo ready +
		20	SRDY-	Servo ready -
		21	ALM+	Alarm status +
		22	ALM-	Alarm status -
		23	NC1	Reserved (Do not connect)
		24	—	Reserved
		25	—	Reserved
		26	—	Reserved
		27	—	Reserved
		28	—	Reserved
		29	—	Reserved
		30	—	Reserved
		31	—	Reserved
		32	A_TRQ	Analog torque command input
		33	A_GND	Analog torque command GND
		34	—	Reserved
		35	—	Reserved
		36	OUT_A	Encoder A-phase
		37	/OUT_A	Encoder /A-phase
		38	OUT_B	Encoder B-phase
		39	/OUT_B	Encoder/B A-phase
		40	OUT_Z	Encoder Z-phase
		41	/OUT_Z	Encoder /Z-phase
		42	SG	Signal ground
		43	485	485 of RS-485 communication
		44	/485	/485 of RS-485 communication
		45	SG	Signal ground
		46	NC2	Reserved (Do not connect)
		47	—	Reserved
		48	—	Reserved
		49	—	Reserved
		50	—	Reserved

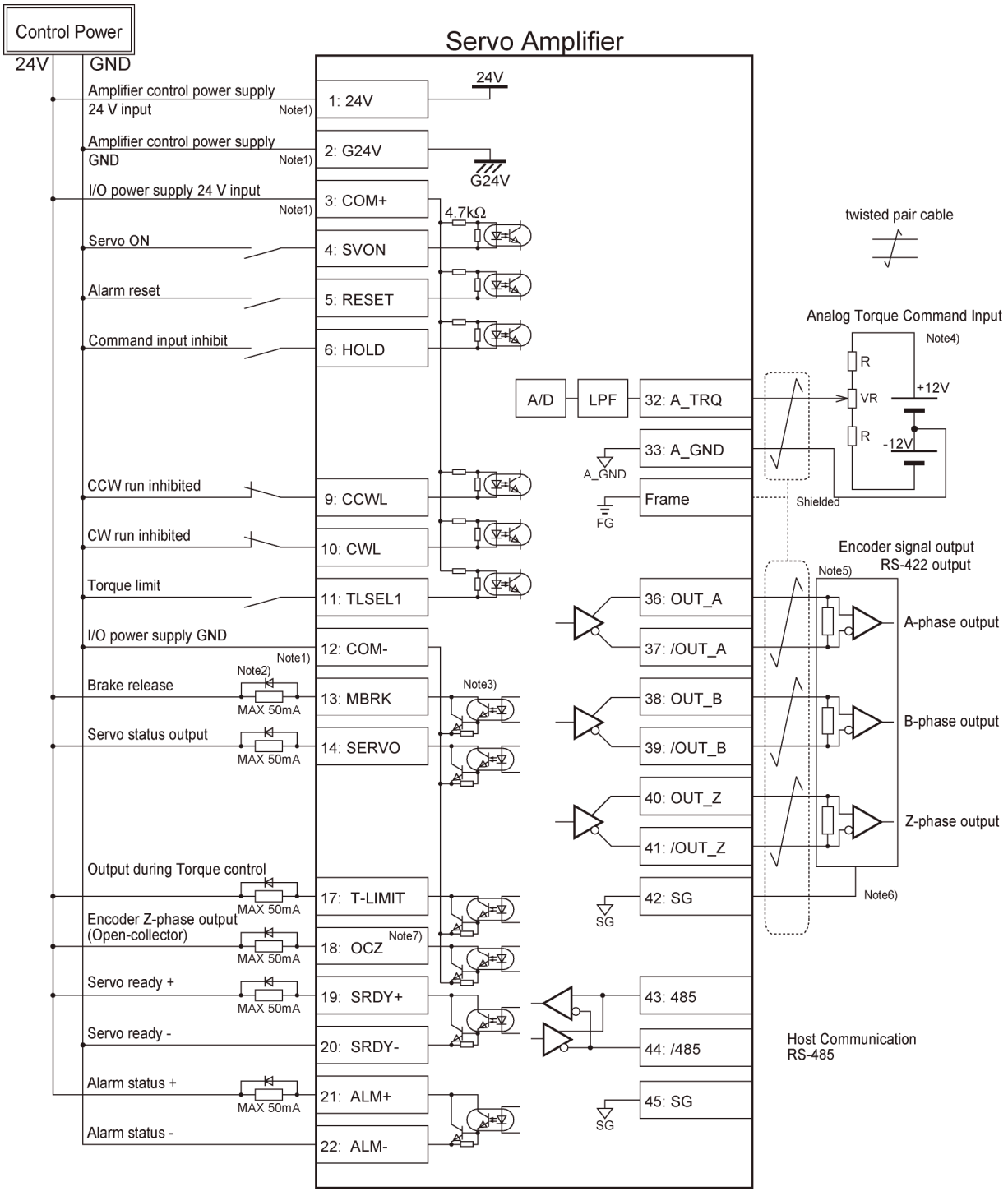


Figure 6-5-1 User I/O connector Wiring Example(Analog Torque Command Input)

Note 1) Have only one power supply for both the control power (24V, G24V) and I/O power (COM+, COM-).
Note 2) When driving a load containing inductance component such as relay, connect a protection circuit (diode).
Note 3) The output circuit structure is open connector and Darlington connection transistor output and connects to relay or photocoupler. Note that when Transistor ON, connector-emitter voltage VCE(SAT) is approximately 1V, which does not satisfy VIL of regular TTL IC. Hence, the output circuit structure must not be connected directly.
Note 4) When structuring the command circuit with a variable resistor (VR) and a resistor (R), VR should be 2kΩ 1/4W or more and R should be 100Ω～200Ω 1/4W or more, in order to have a command input voltage range of -10V to +10V. When the host analog speed command circuit is isolated from the 24V control power, connect A_GND to the host SG, not to the control power GND. When not isolated, connect A_GND to the control power GND.
Note 5) Make sure to connect a terminating resistor as shown in the wiring diagram.
Note 6) Connect to the line driver signal ground of the host controller which outputs amplifier encoder output. Connecting the signal ground to the amplifier control power GND might result in malfunction.
Note 7) When Z-phase pulse width is too narrow to be measured by the host controller accurately, decrease the paired-pulse ratio with “Encoder pulse output Division and multiplication” (No. No.276.0 and No.278.0) or reduce the number of rotations to make the pulse width wider. [Pulse width] = 1/(the number of rotations)/(the paired-pulse ratio x 2^{17}).

6-5-2 Setting Basic Setup Parameters

This section describes how to set Basic Setup parameters.

To operate the motor with Analog Torque Command Input, make sure to set the following parameters.

Table 6-5-2 Parameter Settings required for Analog Torque Command Input Control Mode

Parameter No.	Parameter	Required setting
2.0	Control mode selection	Select “2”
3.0	Command mode selection	Select “2”

Use the following parameters, Parameter No.288.0 - No.302.0 and No.152.0 based on your operational needs. For details, refer to Chapter 8「8-4 Parameter List」.

Table 6-5-3 Parameters related to Analog Torque Command Input

Parameter No.	Parameter	Description
152.0	Analog torque command Speed limit [rpm]	Set Speed limit for Analog Torque command.
288.0	Analog torque command Input filter (numerator)	Filter noise in input command voltage. Use No.302.1 along with this parameter.
289.0	Analog torque command Input filter (denominator)	
290.0	Analog torque command Input gain (numerator)	Set the torque at the maximum input command voltage (±10V). (Note 1)
291.0	Analog torque command Input gain (denominator)	
292.0	Analog torque command CCW torque limit Override (numerator)	Set Analog torque command CCW torque limit Override (Note 2)
293.0	Analog torque command CCW torque limit Override (denominator)	
294.0	Analog torque command CW torque limit Override (numerator)	Set Analog torque command CW torque limit Override (Note 2)
295.0	Analog torque command CW torque limit Override (denominator)	
300.0	Analog torque command Fixed offset value	Adjust Offset so that Motor Torque command becomes 0[0.1%] when Command input is 0V. Use No.302.2 along with this parameter.
302.0	Analog torque command Rotation direction	Refer to Table 6-5-6.
302.1	Analog torque command Input filter option	Use No.288.0 and No.289.0 along with this parameter.
302.2	Analog torque command Offset adjustment method	Use No.300.0 along with this parameter.

Note 1: Set Parameter No.289.0 (denominator) = motor maximum torque, and Parameter No.288.0 (numerator) = target maximum torque.
The following shows example settings where the motor max torque is 3,000[0.1%] and target torque is 1,000 [0.1%] at max command input voltage (±10V).

Table 6-5-4 Example Settings of Analog Torque Command - Input Filter

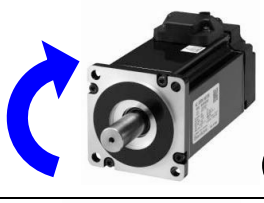
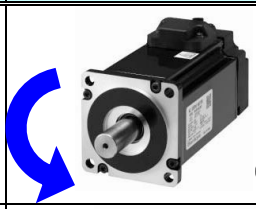
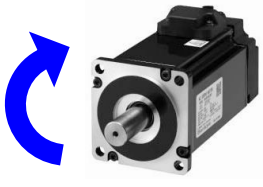
Parameter No.	Parameter	Setting
288.0	Analog torque command Input filter (numerator)	"1,000"
289.0	Analog torque command Input filter (denominator)	"3,000"

Note 2: Set Parameter No.293.0, No.295.0 (denominator) = motor maximum torque, and Parameter No.292.0, No.294.0 (numerator) = target torque limit value.
The following shows example settings of a motor of max torque = 3,000[0.1%] and max torque limit = 1,000 [0.1%].

Table 6-5-5 Example settings of Analog Torque Command Input - Torque limit Override

Direction	Parameter No.	Parameter	Setting
CCW	292.0	Analog torque command CCW torque limit Override (numerator)	"1,000"
	293.0	Analog torque command CCW torque limit Override (denominator)	"3,000"
CW	294.0	Analog torque command CW torque limit Override (numerator)	"1,000"
	295.0	Analog torque command CW torque limit Override (denominator)	"3,000"

Table 6-5-6 Parameter No.302.0 setting and Motor rotational direction (Analog Torque Command Input)

Parameter No.302.0 setting	Input analog command voltage	
	Positive voltage	Negative voltage
0	 CW	 CCW
1 【default】	 CCW	 CW

Setting Basic Setup Parameters and Operational Parameters can be done using Setup Panel or S-TUNE.

Refer to the following for details

- Setup Panel: Table 6-1-2 Changing Basic Setup Parameter Setting (with Setup Panel)
- S-TUNE: Table 6-1-3 Changing Basic Setup Parameter Setting (with S-TUNE)

6-5-3 Test Run

■ Precautions for Test Run

	Before turning on the power for the amplifier or motor, be sure that all wiring has been done properly.	Failure to observe this precaution will result in electric shock or fire, product failure, or could damage the product.
	Set the Basic Setup parameters properly before conducting a test run.	Improper settings for Basic Setup Parameters could result in no motor motion, unstable motion, or uncontrollable motion, unexpected motion, which could cause injury or accident.
	Conduct a test run with the motor alone first with all the machinery disconnected.	Failure to observe this precaution could result in unstable motor motion, uncontrollable motion or other unexpected motions, which could cause injury or accident.
	For a motor with a brake, make sure to release the brake before starting the motor.	Failure to observe this precaution will result in the brake or motor troubles.

■ Test Run

Table 6-5-7 Test Run Procedure
(Analog Torque Command Input)

Step	Operation
1	Make sure that all the wiring has been done properly.
2	Turn on the control power (DC24V) for the amplifier.
3	Turn on the primary circuit power (AC200V) for the amplifier.
4	Set a value that is small enough (around 500) for Parameter No.152.0 Speed Control value, and enforce the speed limit.
5	Connect the SVON terminal of the CN1 connector to COM- in order to turn Servo ON.
6	Input Analog torque command voltage with a low voltage and run the motor with low torque.
7	After becoming sure of safety in actual motor operation, increase the Analog Speed Command voltage gradually and check motor motions.
8	Set Parameter No.152.0 (Speed Limit) with a speed that you use in your actual operation.

6-6. Position Control Mode (Internal Position Command)

Set the parameters of Control Mode Selection and Command Mode selection as follows in order to operate in Internal Position Command Mode and use functions such as Positioner Function and Test Run.

Table 6-6-1 Necessary Parameter Settings for Internal Position Command

Parameter No.	Parameter	Setting
2.0	Control mode selection	Select “0”
3.0	Command mode selection	Select “3”

6-6-1 Positioner Function

The Positioner Function is a function to operate positioning according to I/O input from the host controller such as PLC. For this operation, “Point Table” is used. The Point Table stores motion patterns and S-TUNE is used for the Point Table setup. In addition, a dry run for the Positioner Function can be done with S-TUNE. For details, refer to a separate document「Additional Manual 4 S-FLAG Series Positioner Function」.

6-6-2 Test Run

Test Run is an operation to conduct a dry run to test step operation, back-and-forth motion etc. without connecting to the host controller such as PLC. S-TUNE is required for the Test Run operation. For details, refer to the S-TUNE Instruction Manual Chapter 3「3-8【Test Run】tab」.

6-6-3 Precautions

(1) Alarm No.10 “Position command overflow/Homing failure” will be output when the following two conditions are met:

1. The current position goes below − 1,073,741,823 or above +1,073,741,823, [command unit]
2. 「Internal position command Overflow detection option(Parameter No.643.0)」 =“1” (Enable).

With that in mind, set Parameter No.643.0「Internal position command Overflow detection option」 as follows. For details, see “Additional Manual 4 S-FLAG Series Positioner Function”.

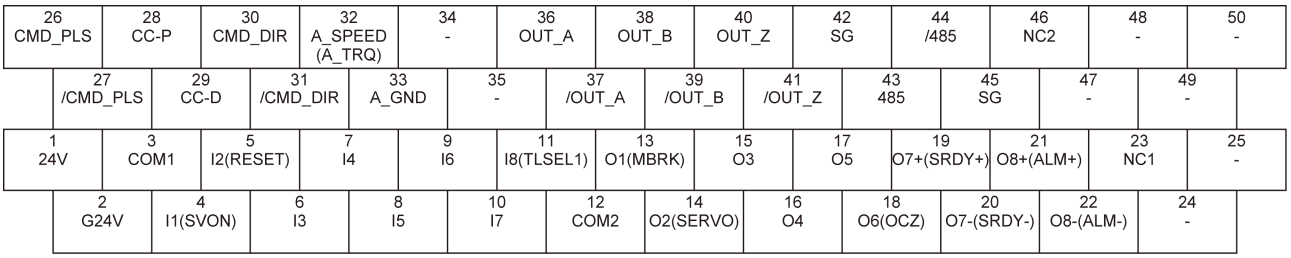
Table 6-6-2 Parameter Setting for Internal Position Command mode

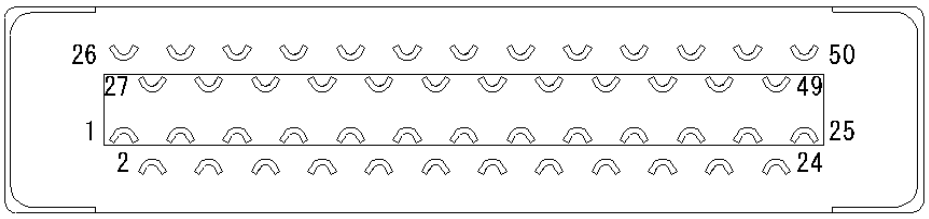
Operating method(Function)		Internal Position Command Overflow detection option (Parameter No.643.0)	
	Command method		
Positioner Function	Absolute value	0 = Disable Note 1)	1 = Enable
	Relative value	0 = Disable	
Test Run			

Note 1: This setting could cause loss of the home position in the amplifier. Make sure to perform Homing again after setting parameters.

(2) Set Parameter No.32.2 “Selection of Auto interpolation for command paired ratio”= 1(Enable), which is the default value. When 0 (Disable) is selected, changes in rotational speed might become substantial.

6-7. User I/O Connector (CN1) Pin Assignments





Pin assignments (Top)

Connector view (Bottom)

Figure 6-7-1 User I/O Connector (CN1) Pin Assignments (soldering surface)

6-7-1 Signal Description

Table 6-7-1 Input Signal and Power Supply

Signal Name	Pin No.	Description	Details
24V	1	Amplifier control power supply 24 V input	·Connect to +24V of a control power(DC24V). ·Power voltage: DC24V±10%,100mA(typ.) ·Select a control power(DC24V) whose specifications meet the SELV requirement, that is, Safety Extra Low Voltage (i.e. Non-hazardous voltage, or reinforced insulation from any hazardous voltage) power.
G24V	2	Amplifier control power supply GND	·Connect to GND of a control power(DC24V)
COM+	3	I/O power supply 24 V input	·connect to a control power(DC24V) and the common terminal of photocoupler circuit used for input. ·Power voltage: DC24V±10%,100mA(typ.)

6-7 User I/O Connector (CN1) Pin Assignments

<table>
<tr><th>Signal Name</th><th>Pin No</th><th>Description</th><th>Details</th></tr>
<tr><td>I1</td><td>4</td><td>Input Signal I1</td><td rowspan="9">·Parallel I/O input
·Functions change depending on Control Mode.
For details, refer to Table 6-7-2.
<table>
<tr><th>Control Mode</th><th colspan="2">Position Control</th><th colspan="2">Speed Control</th><th>Torque Control</th></tr>
<tr><th>Command Mode</th><th>Pulse train command</th><th>Internal Generation command</th><th>Analog command</th><th>Internal Generation command</th><th>Analog command</th></tr>
<tr><td>I1</td><td colspan="5">SVON</td></tr>
<tr><td>I2</td><td>RESET</td><td>RESET/ PCLR</td><td>RESET</td><td>RESET</td><td>RESET</td></tr>
<tr><td>I3</td><td>HOLD</td><td>PCSTART1</td><td>HOLD</td><td>VCRUIN1</td><td>HOLD</td></tr>
<tr><td>I4</td><td>PCLR</td><td>PCSEL1</td><td>(reserved)</td><td>VCRUIN2</td><td>(reserved)</td></tr>
<tr><td>I5</td><td>(reserved)</td><td>PCSEL2</td><td>(reserved)</td><td>VCS L1</td><td>(reserved)</td></tr>
<tr><td>I6</td><td>CCW</td><td>PC EL3</td><td>CCWL</td><td>VCSEL2</td><td>CCWL</td></tr>
<tr><td>I7</td><td>CWL</td><td>PCSEL4</td><td>CWL</td><td>VCSEL3</td><td>CWL</td></tr>
<tr><td>I8</td><td>TLSEL1</td><td>ORG</td><td>TLSEL1</td><td>TLSEL1</td><td>TLSEL1</td></tr>
</table></td></tr>
<tr><td>I2</td><td>5</td><td>Input Signal I2</td></tr>
<tr><td>I3</td><td>6</td><td>Input Signal I3</td></tr>
<tr><td>I4</td><td>7</td><td>Input Signal I4</td></tr>
<tr><td>I5</td><td>8</td><td>Input Signal I5</td></tr>
<tr><td>I6</td><td>9</td><td>Input Signal I6</td></tr>
<tr><td>I7</td><td>10</td><td>Input Signal I7</td></tr>
<tr><td>I8</td><td>11</td><td>Input Signal I8</td></tr>
<tr><td>COM-</td><td>12</td><td>I/O power supply GND</td><td>·connect to GND of a control power(DC24V)</td></tr>
<tr><td>CMD_ PLS</td><td>26</td><td>[Differential input]
(1) Pulse + direction Pulse
(2) Quadrature encoder pulse A-phase
(3) CCW + CW pulse CCW
[5 V open collector]
(4) 5 V power supply input of /CMD_ PLS</td><td>[Differential input] Maximum command pulse frequency: 4Mpps
(1) Input Pulse +direction Pulse (differential input) from the host controller.
(2) Input AB quadrature phase differential pulse signal A-phase (differential input) from the host controller.
(3) Input CCW+CW Pulse CCW (differential input) from the host controller.
[5 V open collector input] Maximum command pulse frequency: 200kpps
(4) 5 V power supply input terminal of /CMD_ PLS.</td></tr>
<tr><td>/CMD_ PLS</td><td>27</td><td>[Differential input]
(1) Pulse + direction /Pulse
(2) Quadrature encoder pulse /A-phase
(3) CCW + CW pulse /CCW
[5 V/24V open collector]
(4) Pulse + direction Pulse
(5) Quadrature encoder pulse A-phase
(6) CCW + CW pulse CCW</td><td>[Differential input] Maximum command pulse frequency: 4Mpps
(1) Input /Pulse +direction /Pulse (differential input) from the host controller.
(2) Input AB quadrature phase differential pulse signal /A-phase (differential input) from the host controller.
(3) Input CCW+CW Pulse /CCW (differential input) from the host controller.
[5 V open collector input] Maximum command pulse frequency: 200kpps
(4) Input Pulse +direction Pulse from the host controller.
(5) Input AB quadrature phase differential pulse signal A-phase (differential input) from the host controller.
(6) Input CCW+CW Pulse CCW from the host controller.</td></tr>
<tr><td>CC－P</td><td>28</td><td>[24 V open collector input]
(1) 24 V of /CMD_PLS</td><td>[24 V open collector input] Maximum command pulse frequency: 200kpps
(1) 24V power supply input terminal of /CMD_ PLS.</td></tr>
<tr><td>CC-D</td><td>29</td><td>[24 V open collector input]
(1) 24 V of /CMD_DIR</td><td>[24 V open collector input] Maximum command pulse frequency: 200kpps
(1) 24V power supply input terminal of /CMD_ DIR.</td></tr>
</table>

6-7 User I/O Connector (CN1) Pin Assignments

Signal Name	Pin No	Description	Details
CMD_ DIR	30	[Differential input] (1) Pulse + direction Direction [(2) Quadrature encoder pulse B-phase」 (3) CCW + CW pulse CW [5 V open collector] (4) 5 V power supply input of /CMD_ DIR	[Differential input] Maximum command pulse frequency: 4Mpps (1) Input Pulse +direction Direction (differential input) from the host controller. (2) Input AB quadrature phase differential pulse signal B-phase (differential input) from the host controller. (3) Input CCW+CW Pulse CW (differential input) from the host controller. [5 V open collector input] Maximum command pulse frequency: 200kpps (4) 5 V power supply input terminal of /CMD_ DIR.
/CMD_ DIR	31	[Differential input] (1) Pulse + direction /Direction (2) Quadrature encoder pulse /B-phase (3) CCW + CW pulse /CW [5 V /24V open collector] (4) Pulse + direction Direction (5) Quadrature encoder pulse B-phase (6) CCW + CW pulse CW	[Differential input] Maximum command pulse frequency: 4Mpps (1) Input /Pulse +direction /Direction (differential input) from the host controller. (2) Input AB quadrature phase differential pulse signal /B-phase (differential input) from the host controller. (3) Input CCW+CW Pulse /CW (differential input) from the host controller. [5 V open collector input] Maximum command pulse frequency: 200kpps (4) Input Pulse +direction Direction from the host controller. (5) Input AB quadrature phase differential pulse signal B-phase (differential input) from the host controller. (6) Input CCW+CW Pulse CW from the host controller.
A_SPEED (A_TRQ)	32	(1) Analog speed command input (2) Analog torque command input	(1) Speed command input (2) Torque command input with -10 to +10V input voltage
A_GND	33	(1) Analog ground Analog speed command GND (2) Analog ground Analog torque command GND	(1) Connected to Analog speed command input inside the servo amplifier. (2) Connected to the signal ground of Analog torque input inside the servo amplifier.
SG	42	Signal ground	·Signal ground of position information ABZ-phase output.
485	43	485 of RS-485 communication	·485 data (+) signal of RS-485 communication with the host controller
/485	44	/485 of RS-485 communication	·/485 data (-) signal of RS-485 communication with the host controller
SG	45	Signal ground	·Signal ground of RS-485 communication with the host controller

6-7 User I/O Connector (CN1) Pin Assignments

Table 6-7-2 I/O Input signal

Signal Name	Signal Description	Function	Control Mode		
			P	S	T
SVON	Servo ON	·Turn the Servo ON by connecting to COM-.	○	○	○
RESET	Alarm Reset	·Reset Alarm by connecting to COM- at the event of Alarm output. ·Note that encoder, product model code or system alarms will not be reset by this signal. You need to reboot the amplifier control power (DC24V) for that case. For details, see Chapter 7 Troubleshooting.	○	○	○
HOLD	Command input Inhibit	·Inhibit command input by connecting to COM-. When not connecting to COM-, command input is allowed. ·When the host controller inhibits command input, the motor will not run until the command input becomes allowed. ·Operating in Position Control Mode, you can save or clear the pulse counter at the event of "Command Input Inhibited" using「Selection for Position deviation counter option when Drive restriction is enabled(Parameter No.67.3)」. ·When operating in Speed Control Mode, the speed command value becomes 0 and the motor will not rotate.	△	△	○
PCLR	Deviation Counter Clear	·Clear Position deviation counter by connecting to COM-.	△	-	-
CCWL	CCW run Inhibit	·Inhibit driving the motor in CCW direction, when connection to COM- becomes open. ·Wire so that connection to COM- becomes open when the device runs over the CCW motion range. ·This signal becomes valid when「Selection of Drive restriction options(Parameter No.67.0)」= 2 (Enable CCW-drive restriction), or 3 (Enable CW/CCW-drive restriction). The default of the parameter is 0 (Disable). ·Select a deceleration method with「Deceleration method selection when Drive restriction is enabled(Parameter No.67.1)」whose default value is 1 (short brake). ·Select a stop condition with「Selection for Stop condition when Drive restriction is enabled(Parameter No.67.2)」whose default value is 0 (Free-run). ·When operating in Position Control Mode, keep the position deviation counter or not with「Selection for Position deviation counter option when Drive restriction is enabled(Parameter No.67.3)」whose default value is 0 (Keep).	△	△	○
CWL	CW run Inhibit	·Inhibit driving the motor in CW direction, when connection to COM- becomes open. ·Wire so that connection to COM- becomes open when the device runs over the CW motion range. ·This signal becomes valid when「Selection of Drive restriction options(Parameter No.67.0)」= 21(Enable CW-drive restriction), or 3 (Enable CW/CCW-drive restriction). The default of the parameter is 0 (Disable). ·Select a deceleration method with「Deceleration method selection when Drive restriction is enabled(Parameter No.67.1)」whose default value is 1 (short brake). ·Select a stop condition with「Selection for Stop condition when Drive restriction is enabled(Parameter No.67.2)」whose default value is 0 (Free-run). ·When operating in Position Control Mode, keep the position deviation counter or not with「Selection for Position deviation counter option when Drive restriction is enabled(Parameter No.67.3)」whose default value is 0 (Keep).	△	△	○
TLSEL1	Torque limit	Change Torque limit. ·This signal is valid when「Torque command limit override selection(Parameter No.144.0)」= 1 (Enable). ·When connections to TLSEL1 and COM- are open,「Torque command limit override value 1(Parameter No.147.0)」is applied. When they are closed,「Torque command limit override value 2(Parameter No.148.0)」will be applied.	△	○	○

6-7 User I/O Connector (CN1) Pin Assignments

<table>
<tr><th rowspan="2">Signal Name</th><th rowspan="2">Signal Description</th><th rowspan="2">Function</th><th colspan="3">Control Mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>PCSTART1</td><td>Start</td><td>·Valid when「Internal Position Command Operation mode(Parameter No.642.0)」= 0 (Point Table).
·By selecting a Point No. with PCSEL1, 2, 3 and 4 and connecting to COM-, the operation specified by the Point No. or Homing will be performed.
For more information regarding Homing and Point Table, refer to Additional Manual 4 S-FLAG Series Positioner Function.</td><td>Δ</td><td>-</td><td>-</td></tr>
<tr><td>PCSEL1</td><td>Point No. Selection 1</td><td rowspan="4">Select a Point No. in the table below.
<table><tr><th>Point No</th><th>PCSEL1</th><th>PCSEL2</th><th>PCSEL3</th><th>PCSEL4</th></tr><tr><td>0 *</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr><tr><td>1</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr><tr><td>2</td><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td></tr><tr><td>3</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr><tr><td>4</td><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td></tr><tr><td>5</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td></tr><tr><td>6</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td></tr><tr><td>7</td><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr><tr><td>8</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td></tr><tr><td>9</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td></tr><tr><td>10</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>11</td><td>ON</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>12</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>13</td><td>ON</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>14</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>15</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr></table>ON： connect the terminal to COM-. OFF： release the terminal from COM-.
* By setting「Point No. 0 function selection (Parameter No.646.3)」, you can choose a) Homing or b) Point Table operation, when Point No. 0 is selected.</td><td rowspan="4">Δ</td><td rowspan="4">-</td><td rowspan="4">-</td></tr>
<tr><td>PCSEL2</td><td>Point No. Selection 2</td></tr>
<tr><td>PCSEL3</td><td>Point No. Selection 3</td></tr>
<tr><td>PCSEL4</td><td>Point No. Selection 4</td></tr>
<tr><td>(HOME)
Note 1)</td><td>Homing Start</td><td>·Start Homing when connecting to COM-.
For more information regarding Homing, refer to「6-9 Homing」in this Chapter.</td><td>Δ</td><td>-</td><td>-</td></tr>
<tr><td>ORG</td><td>Home Position Sensor</td><td>·When performing Homing using Home position dog, input the Home Position Sensor signal.
Detection polarity can be changed in「Home Position Sensor input polarity (Parameter No.646.1)」. The initial setting is COM- connection open at the time of home position dog detection.</td><td>Δ</td><td>-</td><td>-</td></tr>
</table>

6-7 User I/O Connector (CN1) Pin Assignments

<table>
<tr><th rowspan="2">Signal Name</th><th rowspan="2">Signal Description</th><th rowspan="2">Function</th><th colspan="3">Control Mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>VCRUN1</td><td>Internal Speed Command Start 1</td><td>·Valid when Parameter No.388.0= 1(internal speed command (trapezoid speed command).
·Connecting to COM- will start CCW rotation.
·Set acceleration deceleration speed and target speed with the parameters No.390.0 - No.399.0. There are 8 options for target speed, and you can switch the speed with combinations of VCSEL1, VCSEL2, and VCSEL3 as shown below.</td><td>-</td><td>△</td><td>-</td></tr>
<tr><td>VCRUN2</td><td>Internal Speed Command Start 2</td><td>·Valid when Parameter No.388.0= 1(internal speed command (trapezoid speed command).
·Connecting to COM- will start CW rotation.
·Set acceleration deceleration speed and target speed with the parameters No.390.0 - No.399.0. There are 8 options for target speed, and you can switch the speed with combinations of VCSEL1, VCSEL2, and VCSEL3 as shown below.</td><td>-</td><td>△</td><td>-</td></tr>
<tr><td>VCSEL1</td><td>Speed Command Selection 1</td><td rowspan="3">Valid when Parameter No.388.0= 1(internal speed command (trapezoid speed command with 8 speeds).
Select Speed command from 8 speed command settings as combination of VCSEL1, VCSEL2, and VCSEL3.
·acceleration or deceleration speed and target speed can be set with the parameters No.390.0 - No.399.0.
<table>
<tr><th>Target Speed No.</th><th>VCSEL1</th><th>VCSEL2</th><th>VCSEL3</th></tr>
<tr><td>1</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>2</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>3</td><td>OFF</td><td>ON</td><td>OFF</td></tr>
<tr><td>4</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>5</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>6</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>7</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>8</td><td>ON</td><td>ON</td><td>ON</td></tr>
</table>
ON： connect the terminal to COM-. OFF： release the terminal from COM-</td><td rowspan="3">-</td><td rowspan="3">△</td><td rowspan="3">-</td></tr>
<tr><td>VCSEL2</td><td>Speed Command Selection 2</td></tr>
<tr><td>VCSEL3</td><td>Speed Command Selection 3</td></tr>
<tr><td>(RESET/ PCLR) Note 1)</td><td>Alarm Reset /Deviation counter Clear</td><td>·Execute RESET and PCLR by connecting to COM-. For details, refer to the each RESET and PCLR row above in this table.</td><td>△</td><td>-</td><td>-</td></tr>
</table>

※ The Control Mode column shows the following three Control Modes:

P for Position Control Mode

S for Speed Control Mode

T for Torque Control Mode

Signals marked with「○」and「□」can be input with the Control Mode.

Signals marked with「□」can be changed by the Command Mode.

For details, refer to the User I/O connector CN1 Pin Assignments in each Command Mode.

Note 1: In the case of Positioner Function Option 1 (I/O)

6-7 User I/O Connector (CN1) Pin Assignments

Table 6-7-3 I/O Output Signal

<table>
<tr><th>Signal Name</th><th>Pin No</th><th>Signal Description</th><th>Function</th></tr>
<tr><td>O1</td><td>13</td><td>O1 Output</td><td rowspan="10">·Parallel I/O Output
·O7+, O7-, O8+, and O8- are Differential Output.
·Functions vary depending on your selection of Control Mode and Command Mode. Refer to Table 6-7-4 for details.
<table>
<tr><th>Control Mode</th><th colspan="2">Position Control</th><th colspan="2">Speed Control</th><th>Torque Control</th></tr>
<tr><th>Command Mode</th><th>Pulse train Input</th><th>Internal Generation Command</th><th>Analog Command</th><th>Internal Generation Command</th><th>Analog Command</th></tr>
<tr><td>O1</td><td colspan="5">MBRK</td></tr>
<tr><td>O2</td><td colspan="5">SERVO</td></tr>
<tr><td>O3</td><td>POSIN</td><td>MEND</td><td colspan="3">(reserved)</td></tr>
<tr><td>O4</td><td>(reserved)</td><td>HEND</td><td colspan="3">(reserved)</td></tr>
<tr><td>O5</td><td colspan="5">T-LIMIT</td></tr>
<tr><td>O7+</td><td colspan="5" rowspan="2">SRDY</td></tr>
<tr><td>O7-</td></tr>
<tr><td>O8+</td><td colspan="5" rowspan="2">ALM</td></tr>
<tr><td>O8-</td></tr>
</table></td></tr>
<tr><td>O2</td><td>14</td><td>O2 Output</td></tr>
<tr><td>O3</td><td>15</td><td>O3 Output</td></tr>
<tr><td>O4</td><td>16</td><td>O4 Output</td></tr>
<tr><td>O5</td><td>17</td><td>O5 Output</td></tr>
<tr><td>O7+</td><td>19</td><td>O7 Output+</td></tr>
<tr><td>O7-</td><td>20</td><td>O7 Output-</td></tr>
<tr><td>O8+</td><td>21</td><td>O8 Output+</td></tr>
<tr><td>O8-</td><td>22</td><td>O8 Output-</td></tr>
<tr><td>O6(OCZ)</td><td>18</td><td>Encoder Z-phase Output</td><td>· Open Collector Output of Encoder Z-phase signal
· Open collector output of Encoder Z-phase signal
· If the Z-phase pulse width is too narrow for the host controller to measure accurately, decrease this Encoder pulse paired ratio (No.276.0 divided by No.278.0) or reduce the number of rotations to make the pulse width wider.
· [Pulse width] = 1／(the number of rotations)／(the paired-pulse ratio x 2^{17}) Note 1)</td></tr>
<tr><td>OUT_A</td><td>36</td><td>Encoder A-phase</td><td>·Output A-phase (Differential Output) as position data to the host controller.</td></tr>
<tr><td>/OUT_A</td><td>37</td><td>Encoder /A-phase</td><td>·Output /A-phase (Differential Output) as position data to the host controller.</td></tr>
<tr><td>OUT_B</td><td>38</td><td>Encoder B-phase</td><td>·Output B-phase (Differential Output) as position data to the host controller.</td></tr>
<tr><td>/OUT_B</td><td>39</td><td>Encoder /B-phase</td><td>·Output /B-phase (Differential Output) as position data to the host controller.</td></tr>
<tr><td>OUT_Z</td><td>40</td><td>Encoder Z-phase</td><td>·Output Z-phase (Differential Output) as position data to the host controller. Note1)</td></tr>
<tr><td>/OUT_Z</td><td>41</td><td>Encoder /Z-phase</td><td>·Output /Z-phase (Differential Output) as position data to the host controller. Note1)</td></tr>
</table>

Note1) Z-phase pulse width is a value derived from a product of encoder resolution and a paired ratio (Parameter No.276.0 divided by No.278.0), and the number of motor revolutions. Z-phase pulse synchronizes with A-phase pulse and is output in a same width as A-phase pulse.

6-7 User I/O Connector (CN1) Pin Assignments

Table 6-7-4 I/O Output Signal

<table>
<tr><th rowspan="2">Signal Name</th><th rowspan="2">Signal Description</th><th rowspan="2">Function</th><th colspan="3">Control Mode</th></tr>
<tr><th>P</th><th>S</th><th>T</th></tr>
<tr><td>MBRK</td><td>Brake release</td><td>·At the timing of Electromagnetic Brake Release OK, connection to COM- becomes closed.</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>SERVO</td><td>Servo status</td><td>·At Servo ON, connection to COM- becomes closed.</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>POSIN</td><td>Positioning complete</td><td>·At Positioning Complete, connection to COM- becomes closed.</td><td>○</td><td>-</td><td>-</td></tr>
<tr><td>SRDY</td><td>Servo ready+</td><td>When the following is all met, connection to COM- becomes closed.
• Required primary circuit voltage is present.
• There are no ongoing alarms</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>ALM</td><td>Alarm status</td><td>- At Alarm On or Control Power OFF, connection to COM- becomes open.
- At control power ON with no alarms, connection to COM- becomes closed.</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>T-LIMIT</td><td>Output during Torque control</td><td>·During the motor Output Torque limit, connection to COM- becomes closed.
·What condition determines torque limit state can be specified with「Selection Of Torque Limit State Output Mode(Parameter No.144.1)」.</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>MEND</td><td>Motion Complete</td><td>·When the following is all met, connection to COM- becomes closed.
• Motor motion per Positioner Function completes
• Motor motion per Test Run completes
• Motor gets ready for next run
· closed during SERVO OFF
·For details of operation completion of Homing and that of Point Table, refer to「6-9 Homing」, and a separate document「Additional Manual 4 S-FLAG Series Positioner Function」respectively.</td><td>△</td><td>-</td><td>-</td></tr>
<tr><td>HEND</td><td>Homing Complete</td><td>At Homing complete, connection to com- becomes closed.
When home position gets lost and Homing is in progress, connection to com- becomes open.
·For details, refer to the「6-9 Homing」.</td><td>△</td><td>-</td><td>-</td></tr>
<tr><td>(PM1)
Note 1)</td><td>Point No. Output1</td><td rowspan="3">·an output signal assigned with the Special I/O setting “Position Control/Internal Generation Command Option1”.
·outputs started or completed Point table No.
·Timing of Point No. Output and its content can be selected using「Point No. Output Method (Parameter No.644.0)」,.
·Right after turning the power on for the amplifier or at Servo OFF or Homing, all three turn OFF (i.e. Point No. = 0).
ON： connect the terminal to COM-. OFF： release the terminal from COM-</td><td rowspan="3">△</td><td rowspan="3">-</td><td rowspan="3">-</td></tr>
<tr><td>(PM2)
Note 1)</td><td>Point No. Output2</td></tr>
<tr><td>(PM3)
Note 1)</td><td>Point No. Output2</td></tr>
</table>

PM1	PM2	PM3	Point No.
OFF	OFF	OFF	0,8, or other
ON	OFF	OFF	1,9
OFF	ON	OFF	2,10
ON	ON	OFF	3,11
OFF	OFF	ON	4,12
ON	OFF	ON	5,13
OFF	ON	ON	6,14
ON	ON	ON	7,15

6-7 User I/O Connector (CN1) Pin Assignments

Signal Name	Signal Description	Function	Control Mode		
			P	S	T
(MEND/ T-LIMIT) Note 1)	Operation Complete/ Output during Torque control	·an output signal with the Special I/O setting “Position Control/Internal Generation Command Option1”. ·When MEND ON and/or T-LIMIT ON, connection to COM- becomes closed. ·For details, refer to the function descriptions in each row of MEND and T-LIMIT above in this table. ·Use this signal for a device (such as press control) to switch Torque limit during motor in motion. During Press in effect, use this signal as T-LIMIT. Otherwise, use as MEND. ·Set TLSEL1(Torque Limit) ON when using this signal as T-LIMIT, and TLSEL1(Torque Limit) OFF when using it as MEND. For the Parameter setting, set「Selection Of Torque Limit State Output Mode (Parameter No144.1)」=“2”(Torque command limit Override 2). ·For details of how to use the signal, refer to a separate document「Additional Manual 4 S-FLAG Series Positioner Function」.	△	-	-

※ The Control Mode column shows the following three Control Modes:

P for Position Control Mode

S for Speed Control Mode

T for Torque Control Mode

Signals marked with「○」and「△」can be output in each Control Mode.

Signals marked with「△」can be changed with Command Mode.

For details, refer to the User I/O connector CN1 Pin Assignments in each Command Mode.

Note 1) Where Positioner Function Option 1 (I/O)

Table 6-7-5 Reserved Pins

Signal Name	Pin No.	Description	Function
NC1	23	reserved	reserved (Do not connect)
SP1	24	reserved	-
SP2	25	reserved	-
A_TRQ	34	reserved	-
A_GND	35	reserved	-
NC2	46	reserved	reserved (Do not connect)
SP3	47	reserved	-
SP4	48	reserved	-
EDM+	49	reserved	-
EDM-	50	reserved	-

6-8. Tuning

	Operate Auto Tuning only after taking safety measures to prevent any dangers, having an instant stop method in place and strategies to mitigate any impact.	Failure to observe this precaution could result in unstable motions, overshoots, or other unexpected motions which could cause injury or accident.
	While operating the Servo motor in the Auto Tuning mode, start with acceleration deceleration speed slower than your target speed. Only after becoming sure of safety of the operation, gradually increase the speed and perform tuning each time.	Failure to observe this precaution could result in unstable motions, overshoots, or other unexpected motions which could cause injury or accident.

■ In the following conditions, Auto Tuning might not be performed properly.
- Inertia ratio is too small, or too large, or load inertia is fluctuating.
- Machine rigidity is extremely low or non-linear characteristics such as backlash exist.
- The speed is low (300r/min or lower), or acceleration or deceleration speed is mild.
- Offset load is large, friction is excessive, or torque is excessively large or small.

In these situations, set the inertia ratio manually based on calculated values.

■At Servo ON or change of Control Gain set, noise or vibration might be caused until the load characteristic estimate stabilizes. Immediate stabilization indicates no error. However, if any problem persists, try the following:
- Change the Control Gain set to a smaller value.
- Set inertia ratio at the value calculated by the mechanical device.

6-8-1 Auto Tuning

■ Parameters

1) Selection of Inertia Condition (only in Position Control Mode)

■Parameter No.113.1

Characteristics of Inertia Condition (Parameter 113.1) are illustrated in Table 6-8-1and Figure 6-8-1.

Select an appropriate setting based on the load characteristic of your device.

1: Use this setting for a heavy device, a device with substantial load fluctuation, or low rigidity device; focusing on stability

2: Standard setting; characteristics between 1 and 3; the factory setting.

3: Use this setting to stabilize a light-load device quickly; focusing on convergence

Table 6-8-1 Inertia Condition Setting versus Control Characteristics

Parameter Setting	Stability against load fluctuation	Speed convergence	Position deviation at a constant speed
1	strong ↕ weak	slow ↕ fast	small ↕ large
2			
3			

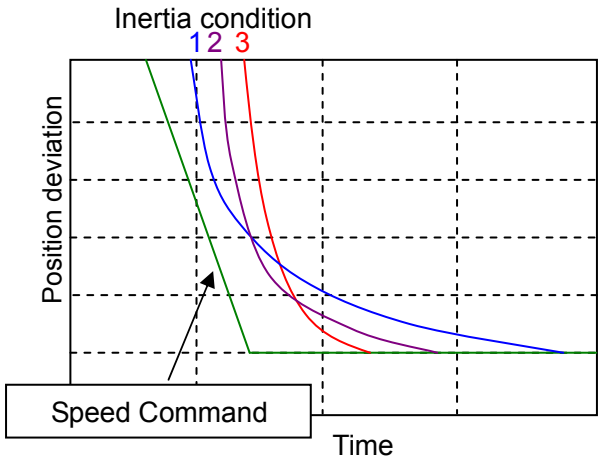


Figure 6-8-1 Differences in Position Deviation Convergence (Inertia Condition)

2) Selection of Control Gain Set

■Parameter No.113.0 (Control gain set - Position Control) and Parameter No.129.0 (Control gain set - Speed Control)

Control Gain set is a parameter that changes Control Gain 1, Control Gain 2 and Integral Gain as a set.

If the setting is in a higher range, command response becomes better and response to external disturbance becomes more severe. The settling time becomes shorter as well, but too large a value of this parameter will result in resonance. Adjust it to achieve your target level of response within a range where no resonance occurs. Start with a small value and gradually increase it while monitoring the movements.

The factory setting is “15” and you can start tuning as is. In case of vibrations, however, decrease the setting value before starting Auto Tuning.

3) Selection of Auto Tuning Mode

■Parameter No.110.0

Select 1 (Standard mode) when there is no load except for horizontal-axis. Select 2 (Unbalanced mode) when load is in non-horizontal-axis direction (e.g. the gravity). The factory setting is 1(Standard mode).

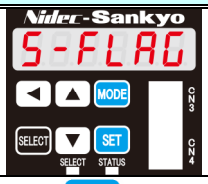
■ Auto Tuning Operation Flow

Table 6-8-2 Auto Tuning Operation Flow

Step	Operation	
1	Be sure of proper wiring.	
2	Turn on the control power (DC24V) for the amplifier.	
3	Turn on the primary circuit power (AC200V) for the amplifier.	
4	Have the Amplifier SVON input “ON” and start motor excitation. (Connect the I1 terminal to COM-).	
5	Run the motor at a low speed according to the command pulse from the host controller.	
6	Start Tuning with one of the following.	
	■ Using Setup Panel	See Table 6-1-2 Changing Basic Setup Parameter Settings (with Setup Panel).
	■ Using S-TUNE	See Table 6-1-3 Changing Basic Setup Parameter Settings (with S-TUNE).

■ Auto Tuning with Setup Panel

Table 6-8-3 Auto Tuning with Setup Panel

Display and Operation	Description
	Startup display
Press MODE 5 times	Change the mode on Setup Panel.
A_TUNE	Switched to Auto Tuning.
Press SET once.	Enter Auto Tuning mode.
P_GGLP	To switch to the Inertia Condition, press SET. Change the parameter value with ▲ or ▼, and select a value with SET. The blinking turns sold at this point. Press MODE to return.
Press ▲ once.	Change the Parameter display.
P_GSEL	To change the Control Gain set, press SET first. Change the parameter setting with ▲ or ▼, and select a value with SET. The blinking screen turns sold at this point. Press MODE to return.
	☞ In case of vibrations at the beginning of tuning, decrease the value until vibrations stop.
Press ▲ twice.	Change the Parameter display.
P_ESTd	To change the Auto Tuning mode, press SET first. Change the parameter setting with ▲ or ▼, and select a value with SET. The blinking turns solid at this point. Press MODE to return.
Press ▲ once.	Change the Parameter display.
P_TUEn	Displayed the parameter to enable/disable Real-time auto tuning.
Press SET once.	Display the current setting of “Enable/Disable Real-time auto tuning”.
H00000	Displayed the current Parameter value. The default value is “0”. The digit that can be changed is blinking.
Press ▲ twice.	Press the UP button to make a change.
H00002	Select “2”: Apply Inertia ratio and Damping ratio.
Press SET once.	Write the new Parameter setting to the amplifier’s RAM. The blinking turns sold and Auto Tuning starts simultaneously.

Move the motor back and forth using Test Run operation in S-TUNE or the external command input, and wait until the motor motion and the inertia ratio estimate settle.	
Press MODE once.	Return to the Parameter selection screen.
Press SET once.	Display the current setting of “Enable/Disable Real-time auto tuning”.
F00002	The current Parameter setting “2” is displayed. The digit that can be changed is blinking.
Press ▼ twice.	Press the DOWN button to change the parameter setting.
F00000	Select “0”: Disable Real-time auto tuning.
Press SET once.	Write the Parameter setting to the amplifier RAM. The blinking turns sold and Auto Tuning stops simultaneously.
Press MODE once.	Return to the Parameter selection screen.
Press ▼ three times.	Go to the Parameter display.
P_GSEt	To change Control Gain set, press SET first, and make changes with ▲ or ▼. Press SET to set the parameter. The blinking turns solid.
	☞ Set the Control Gain set again to achieve target responsiveness.
Press MODE twice.	Finish Auto Tuning Mode, switch the Setup Panel mode.
SAVE_P	Switched to Parameter Saving Mode.
Press SET once.	Save the new Parameter setting to the amplifier EEPROM. (While the Parameter is being saved, 『P』 in the 『SAVE_P』 display will be blinking.)
Fin_End	Finished with no error.

■ Auto Tuning with S-TUNE

Auto Tuning with S-TUNE has two modes: Simple Tuning Mode and Fine Tuning Mode.
Simple Tuning Mode is described in Table 8-6-4. For S-TUNE screen, see Figure 6-8-2 and 6-3-8.
Instructions regarding Fine Tuning Mode and other details can be found in the S-TUNE Instruction Manual.

Table 6-8-4 Auto Tuning with S-TUNE

Step	Operation
1	Start S-TUNE and select the【Auto Tuning】tab.
2	Set the Control Gain Set. Select 5, 10, 15, 20 or 30 and click “SET”.
	 In case of vibrations when Tuning started, lower the parameter setting until the vibrations stop.
3	Set Inertia Condition. (only in Position Control Mode) Select “1･･･Heavy”, “2･･･Standard”, “3･･･Light” and click “SET”.
	 Guideline on the Inertia Condition setting “1･･･Heavy”: Inertia Ratio >=10 Note 1), acceleration deceleration time >=0.1s “2･･･Standard”: Inertia Ratio <10 Note 1), acceleration deceleration time< 0.1s “3･･･Light”: Inertia Ratio =<1 Note 1), high acceleration deceleration speed
4	Set Tuning Mode Select “Standard Mode” or “Unbalanced Mode”
5	Tick [Automatic parameter update], click [START], and start Auto Tuning of Inertia ratio, Damping ratio and Load deviation. When the figure in the cell of “Damping ratio” row and [Estimate Value] column settles, click the [Stop] Button. Check the movement of your device. If you are satisfied, Tuning is considered done.
	 Make sure to click on [Stop] to finish Auto Tuning. If you start Fine Tuning Mode or Individual Tuning Mode while Auto Tuning is still in process, Tuning becomes difficult because of inertia ratio changes.
6	Set the Control Gain Set within the range high enough for no vibrations caused by Servo.
7	When satisfying tuning is done, click [Write] to save the parameters to the amplifier EEPROM.

Note 1: An inertia ratio of 1 is equivalent to an “Inertia ratio” (Parameter No.102.0) setting of 200, and likewise 10 is equivalent to 1,100.

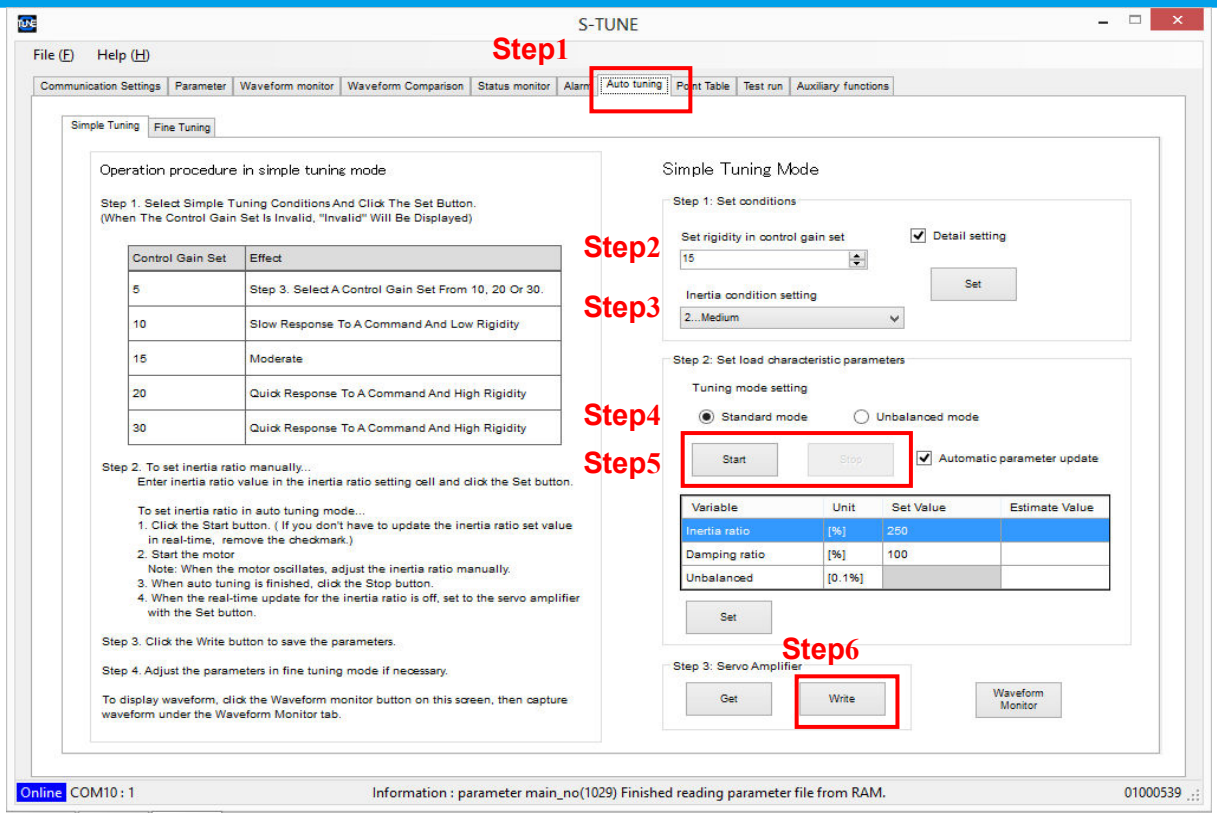


Figure 6-8-2 Auto Tuning
(Position Control Mode)

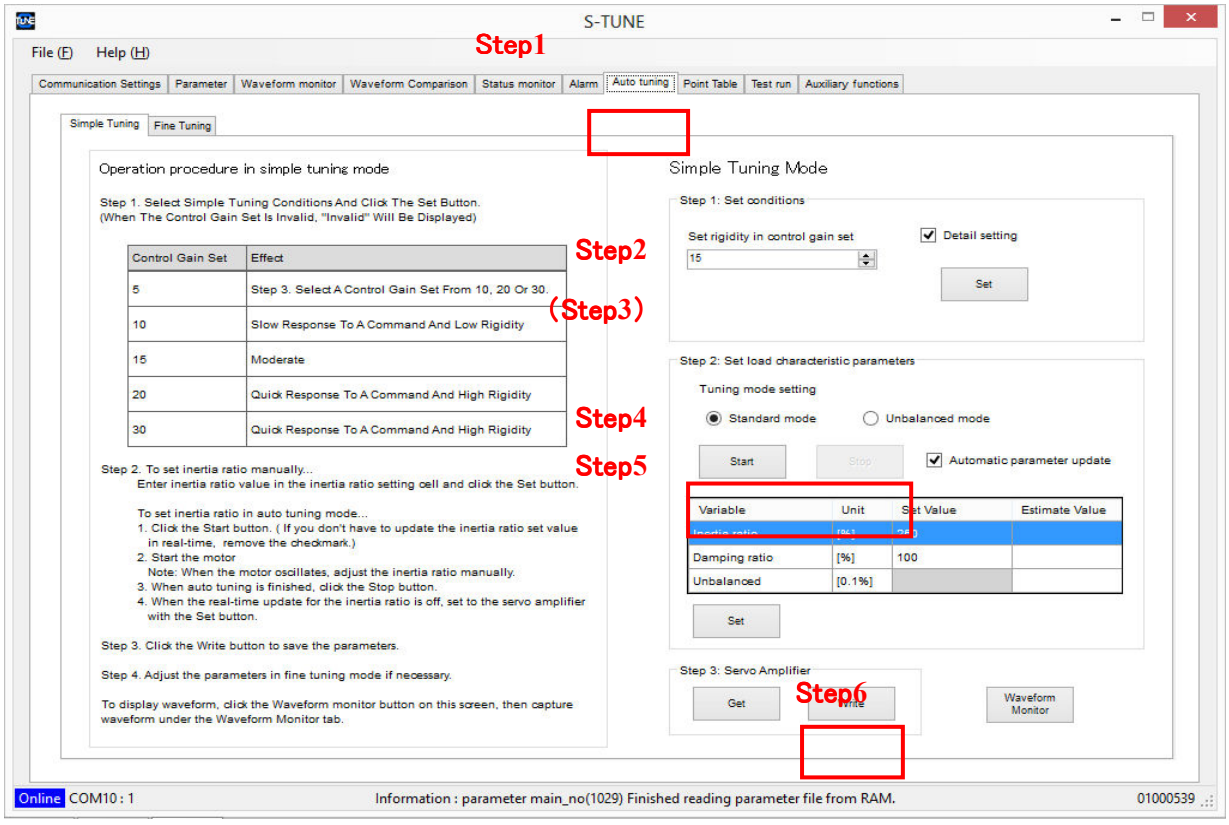


Figure 6-8-3 Auto Tuning
(Speed Control Mode)

6-8-2 Fine Tuning

After your Auto Tuning, if necessary, perform Fine Tuning in Fine Tuning Mode or with【Waveform Monitor】tab (individual tuning mode).

■ Parameters

1) Control Level

■Parameter No.114.0

Control Level is a parameter that changes Control Gain 1 and Control Gain 2 as a set. A higher Control Level provides better command tracking and shorter settling times. However, since response to external disturbance becomes more significant at the same time, too high a Control Level results in vibrations. Adjust the parameter within a range where desired response will be obtained with no vibrations.

In addition, when Parameter No.117.0 “Gain FF compensation 1 (position control)” is set in a higher range, raising the control level causes overshooting. Parameter No.117.0 “Gain FF compensation 1 (position control)” is explained in “3) Adjusting Gain 1 FF compensation” in this section. Do not start Control Level tuning until overshooting stops occurring by decreasing「Gain FF compensation 1 (position control) (Parameter No.117.0)」.

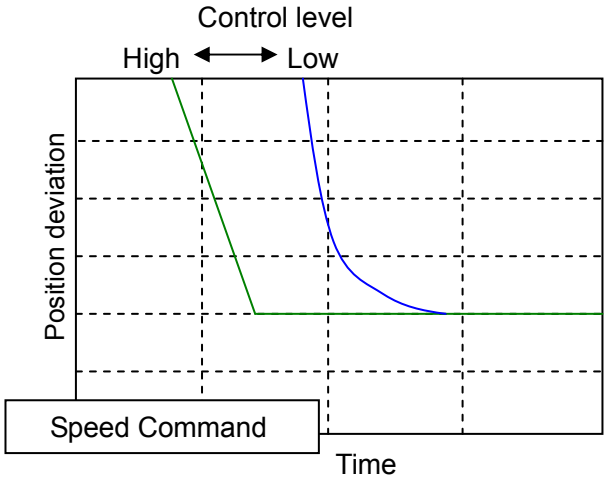


Figure 6-8-4 Differences in Position Deviation Convergence (Control Level)

2) Integral Gain

■Parameter No.119.0

Increasing Integral Gain can reduce interference of external disturbance, such as friction and load fluctuation, to convergence and also shorten settling time. However, too high Integral Gain results in vibrations. Adjust the Integral Gain within a range where desired response can be obtained with no vibrations.

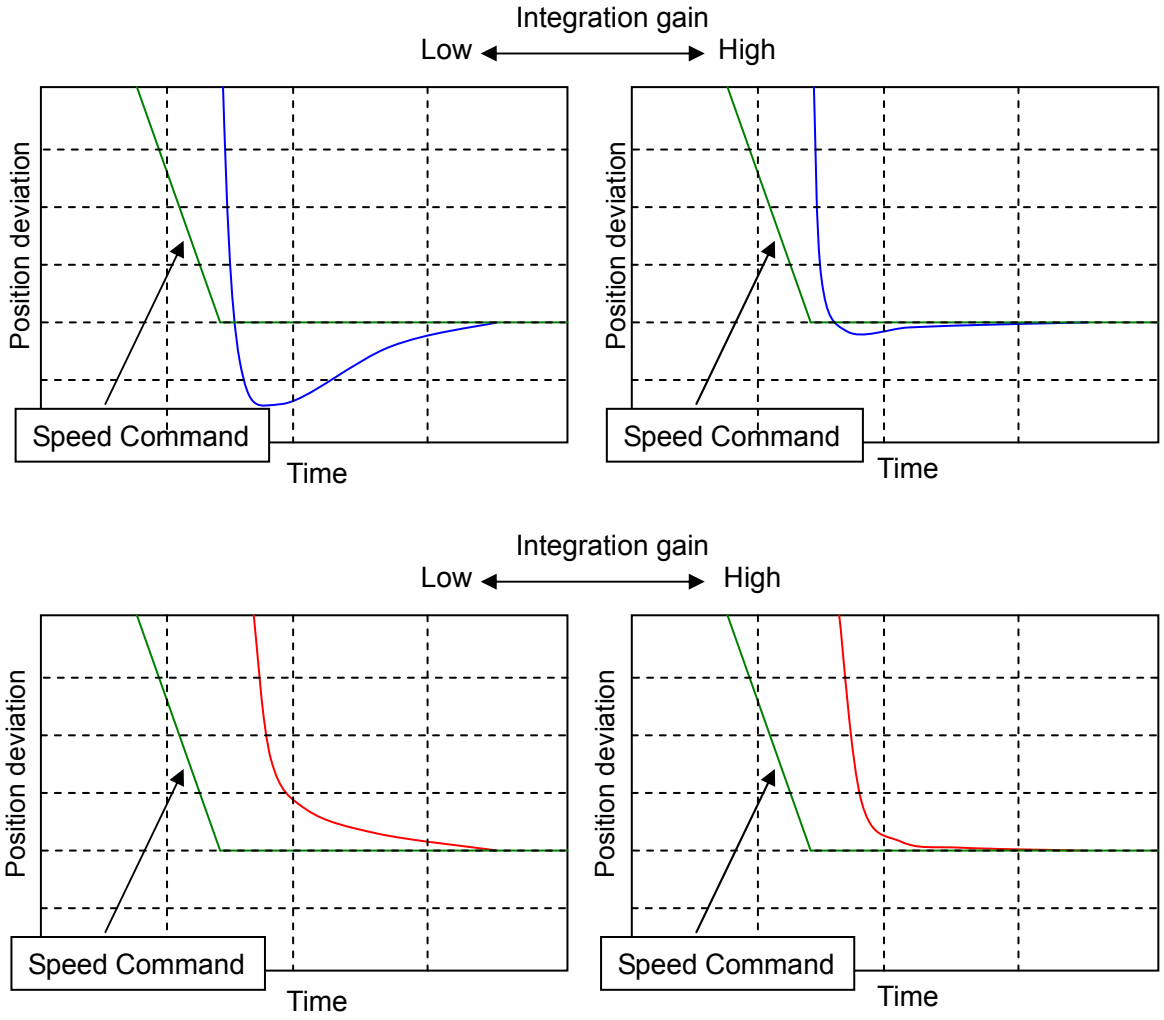


Figure 6-8-5 Differences in Position Deviation Convergence (Integral Gain)

3) Adjusting Gain 1 FF compensation

■Parameter No.117.0

By setting the Gain 1 FF Compensation in a higher range, settling time becomes shorter, but overshooting might be caused if it's too high. Adjust the parameter within a range where your desired response can be obtained with no overshooting.

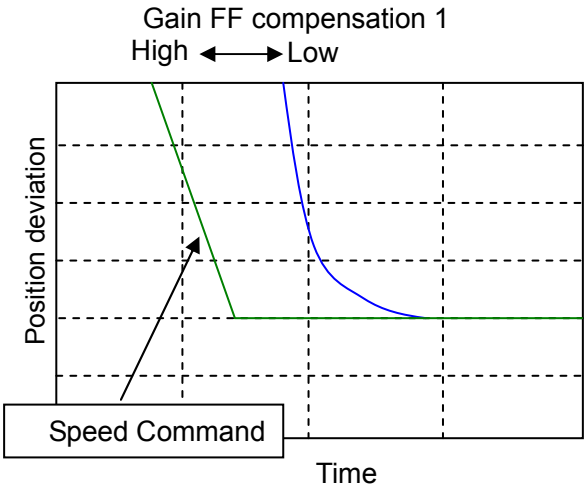


Figure 6-8-6 Differences in Position Deviation Convergence (Gain FF Compensation 1)

4) Gain 2 FF compensation

■Parameter No.118.0

Position deviation at a constant speed motion can be reduced with adjustment of Parameter No.118.0 “Gain FF compensation 2 (position control)”.

With a right inertia ratio setting, setting the parameter at 10000 minimizes the position deviation. If the parameter value is above 10,000, the position deviation starts appearing in a negative range. When the command resolution is low, the higher the gain compensation is, the louder the noise becomes.

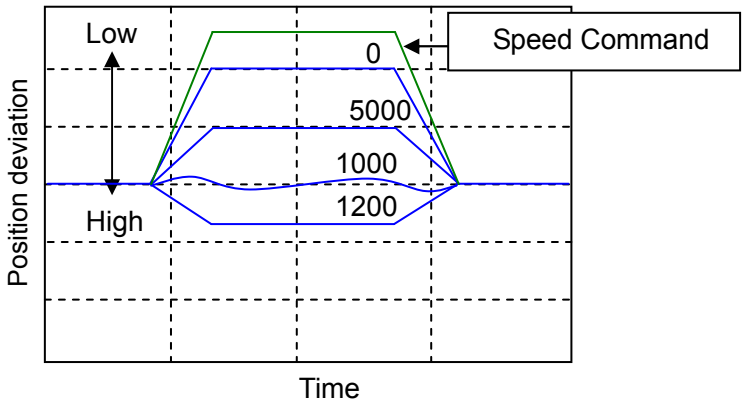
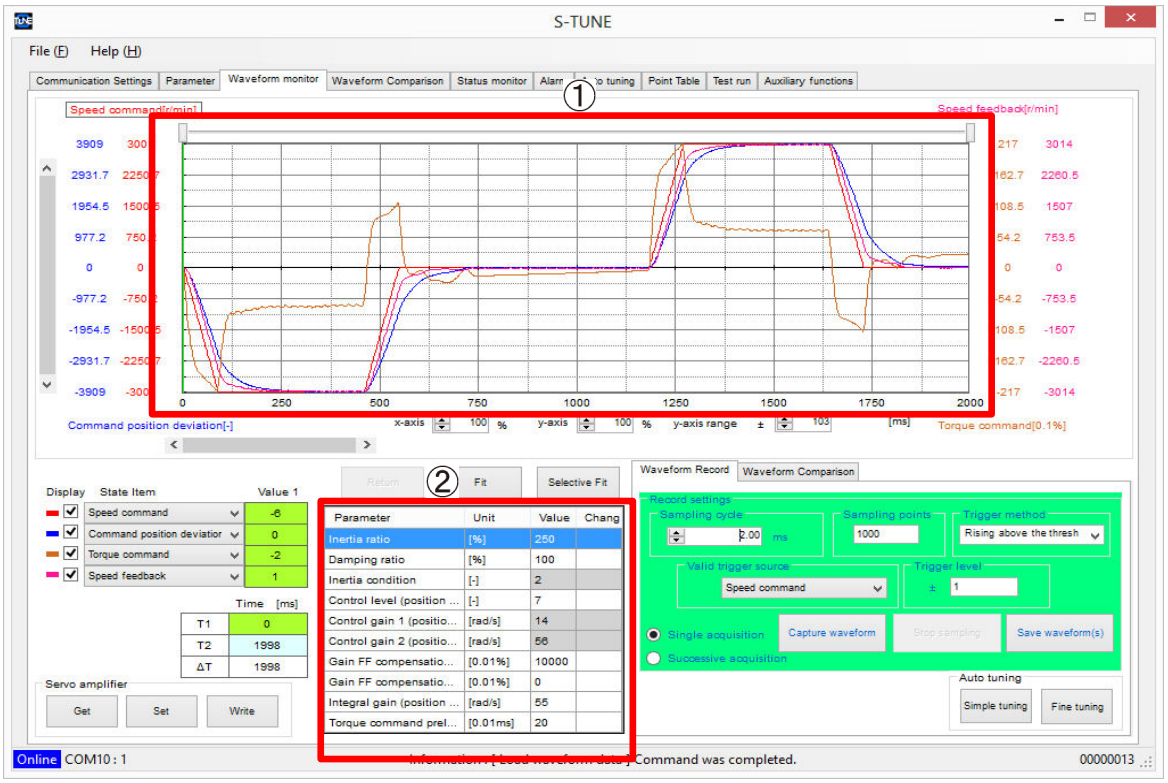


Figure 6-8-7 Differences in Position Deviation (Gain FF compensation 2)

■ Tuning on the【Waveform Monitor】tab in S-TUNE

After auto tuning, you can use the【Waveform Monitor】tab in S-TUNE to perform fine tuning as illustrated below.

Monitor the waveform in the area ① below and adjust the parameters to obtain your target waveform in ②.



6-8-3 Tuning for Vibration Suppression

1) Vibration suppression with Smoothing filter

The following describes how to set「Position command smoothing filter 1(Parameter No.66.0)」and「Position command smoothing filter 1 - # of sampling points used for moving average No.80.0)」.

Set: 「Position command smoothing filter 1(Parameter No.66.0)」=1

「Position command smoothing filter 1 - moving average counter (Parameter No.80.0)」= a value derived from vibration frequency. A relatively large value for No.80.0 prolongs command delay time.

Formula: Parameter No.80.0 = vibration frequency[sec]×6,250

In this example, the vibration frequency = 39msec = 0.039sec. Therefore, the average count (i.e. Parameter No.80.0) = 0.039 sec x 6,250 = 24 and the delay time = 243 x 0.16ms = 38.88ms.

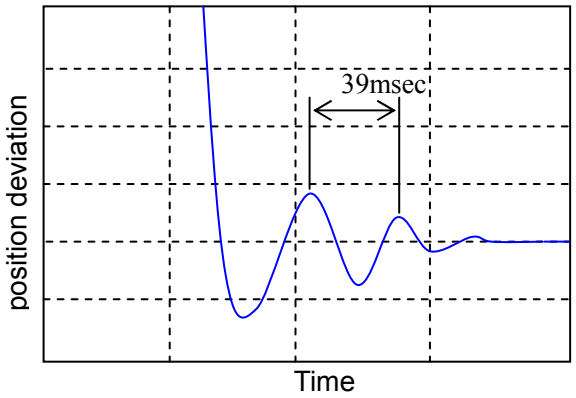


Figure 6-8-8 Before applying Position command smoothing filter 1

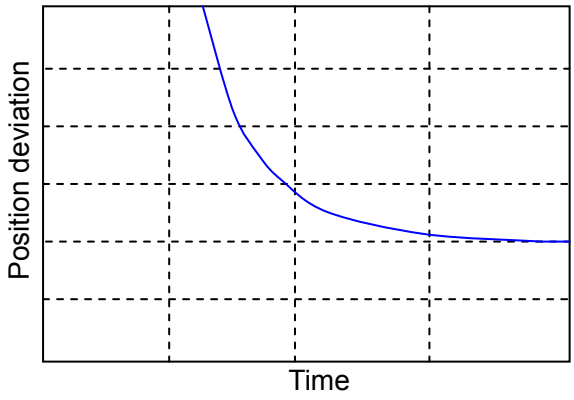


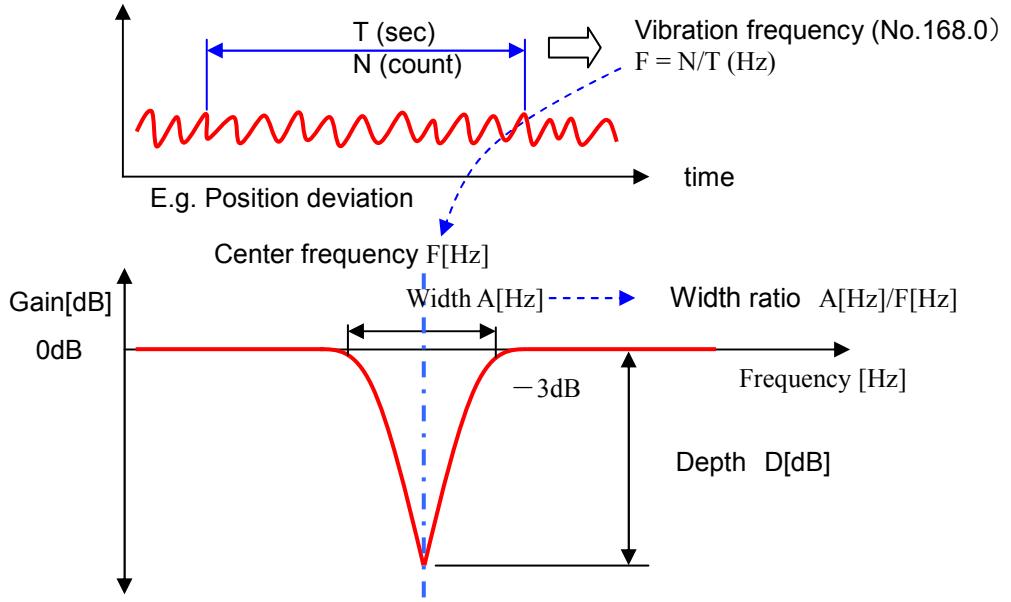
Figure 6-8-9 After applying Position command smoothing filter 1

2) Vibration suppression with Notch-filter

The following described how to adjust Torque command Notch filter parameters (No.160.1, 168.0, 169.0, and 170.0) to be used for Vibration suppression.

Set「Torque command Selection of whether to use notch filter (Parameter No.160.1)」at 1 and「Torque command Notch filter frequency(Parameter No.168.0)」at vibration frequency. Derive the vibration frequency using waveform of Torque command value when vibrations occur.
When machinery's backlash is so large that notch filter doesn't suppress resonance, increase the value of "Torque command Notch filter depth selection (Parameter No.170.0)" to make the filter with a shallow notch.

When there are multiple notch frequencies, increase the value of「Torque command Notch filter width selection (Parameter No.169.0)」to make the notch frequency width wider.



Width ratio=「Torque command Notch filter width selection (Parameter No.169.0)」×0.125
Depth ratio=「Torque command Notch filter depth selection (Parameter No.170.0)」/256

3) Vibration suppression by Low-pass filter

The following describes how to adjust two Torque command low-pass filter parameters, No.160.0 and 162.0 to suppress vibrations.

Set「Options for Torque command low-pass filter (Parameter No.160.0)」= 1(Enable). The factory setting is 1(Enable). Increasing the value of「Torque command preliminary filter time constant for Low-pass filter (Parameter No.162.0)」could resolve vibrations, but too high a value causes other vibrations due to close proximity to the control range of the responding model.

Use the following formula as a reference to estimate the possible maximum setting.

$$\frac{\text{Range of 0.1 to 0.2}}{\text{Integral Gain or (Control Gain 1+ Control Gain 2), whichever larger}} \quad \text{[Sec]}$$

6-9. Homing

6-9-1 Overview

Homing (aka Home Position Return in S-TUNE) is an operation to match a coordinate by command in the amplifier to the counterpart of the machine. When you use the Positioner Function in the amplifier, perform Homing whenever it's needed.

■ If your encoder is used as an incremental system, Homing is required every time the power gets turned on.

■ If your encoder is used as an absolute system, the requirement above is not the case if the encoder battery is backed up and Homing was done once at the time of installation.

6-9-2 Wiring and Basic Setup Parameters

For information regarding Wiring and Basic Setup Parameters, refer to a separate document 「Additional Manual 4 S-FLAG Series Positioner Function」.

■ There are three types of homing, Arbitrary Position, Press (Stopper), and Home Position Sensor (Home position dog front end). As a home position base, you have an option of using encoder Z-phase or not for any of those types.

■ To perform homing, you can use either User I/O input or S-TUNE.

■ For homing by home position sensor, use User I/O input. With S-TUNE, Homing by home position sensor cannot be performed.

6-9-3 Parameters for Each Type of Homing

(1) Arbitrary position as Base

The following parameters enclosed in red (see below) are used for homing using an arbitrary position as the home position base.
Examples of parameter settings can be found in Chapter 6「6-9-8 Details of Homing Types」.

No.	Item	Restart the servo amplifier	Unit	Value	Change settings
645.0	Base signal 1 selection for Home position	Unneces...	[-]	0	
645.1	Base signal 2 selection for Home position				
645.3	Home position Base signal 1 redetection				
646.0	Home position return direction				
646.1	Home position sensor input polarity	Unneces...	[-]	0	
646.2	Home position return Timeout option				
647.0	Home position return Torque limit option				
647.1	Action at home position return completion	Unneces...	[-]	0	
648.0	Home position return Speed				
649.0	Home position return Creep speed				
650.0	Home position return Acceleration/Deceleratio				
651.0	Home position return Shift-to-home-position qu				
653.0	Home position return Home position data				
655.0	Home position return Press detection time	Unneces...	[ms]	100	
656.0	Home position return Torque limit value	Unneces...	[0.1%]	500	
657.0	Home position return Phase Z invalidation dist				
659.0	Home position return Timeout Time				

(2) Stopper as Base (Press type)

The parameters enclosed in red (see below) are used for press-type homing using a topper as the home position base.

For details of the parameters, refer to Chapter 6「6-9-4 Details of Parameter」.

Examples of parameter settings can be found in Chapter 6「6-9-8 Details of Homing Types」.

No.	Item	Restart the servo amplifier	Unit	Value	Change settings
645.0	Base signal 1 selection for Home position	Unneces...	[-]	1	
645.1	Base signal 2 selection for Home position				
645.3	Home position Base signal 1 redetection				
646.0	Home position return direction				
646.1	Home position sensor input polarity	Unneces...	[-]	0	
646.2	Home position return Timeout option	Unneces...	[-]	1	
647.0	Home position return Torque limit option				
647.1	Action at home position return completion				
648.0	Home position return Speed			0	
649.0	Home position return Creep speed				
650.0	Home position return Acceleration/Decelera				
651.0	Home position return Shift-to-home-position				
653.0	Home position return Home position data				
655.0	Home position return Press detection time			0	
656.0	Home position return Torque limit value			0	
657.0	Home position return Phase Z invalidation				
659.0	Home position return Timeout Time	Unneces...	[10ms]	60000	

(3) Home position dog front end as Base (Home Position Sensor type)

The parameters enclosed in red (see below) are used for sensor-type homing using a home position dog front end as the home position base. For details of the parameters, refer to Chapter 6「6-9-4 Details of Parameters」.

Examples of parameter settings can be found in Chapter 6「6-9-8 Details of Homing Types」.

6-9-4 Details of Parameter Descriptions

Combinations of the following parameters determine Homing patterns.

- Parameter No.645.0: Base signal 1 selection for Home position
- Parameter No.645.1: Base signal 2 selection for Home position
- Parameter No.645.3: Home position Base signal 1 redetection
- Parameter No.646.0: Homing direction
- Parameter No.647.1: Action at Homing completion

Parameter No.	Parameter Name	Unit
645.0	Base signal 1 selection for Home position	-

Select Base signal 1 to determine Home position.

0 = Arbitrary position
1 = Stopper
2 = Home position dog frond end (default)

For example, to use an encoder Z-phase around the current position as the home position base, set this parameter 645.0 = “Arbitrary position” and Base signal 2 selection for Home position (Parameter No.645.1) =“Encoder Z-phase”.

Parameter No.	Parameter Name	Unit
645.1	Base signal 2 selection for Home position	-

Set another base signal (Base signal 2) for home position after detecting Base signal 1.

0 = None (default)
1 = Encoder Z-phase

For example, when Base signal 1 selection for Home position (Parameter No.645.0)=“ Home position dog front end” and Base signal 2 selection = “ Encoder Z-phase ”, Home position dog front end gets detected first, the motor moves by the Homing Z-phase invalidation distance (Parameter No.657.0) next, and finally the amplifier becomes to consider an encoder Z-phase position as the home position base.

Parameter No.	Parameter Name	Unit
645.3	Home position Base signal 1 redetection	-

This parameter enables or disables the function to redetect the Home Position dog front end again after detecting the Home Position dog front end and returning at the speed with「Homing Creep Speed (Parameter No.649.0)」.

Set the Homing Creep Speed in a relatively low range in order to improve detection accuracy of Home position Base signal.

0 = Disable (default)
1 = Enable

This parameter is used when「Base signal 1 selection for Home position (Parameter No.645.0)」=2 (Home position dog front end).

For example, with the parameter setting of 1(Enable), the following happens consecutively: (also see Figure 6-9-10)

1. Home Positon dog front end gets detected at the homing speed
2. the motor rotates in the reverse direction to cross over the dog front end
3. the motor rotates in the homing direction
4. the home position dog front end gets re-detected at the homing creep speed.

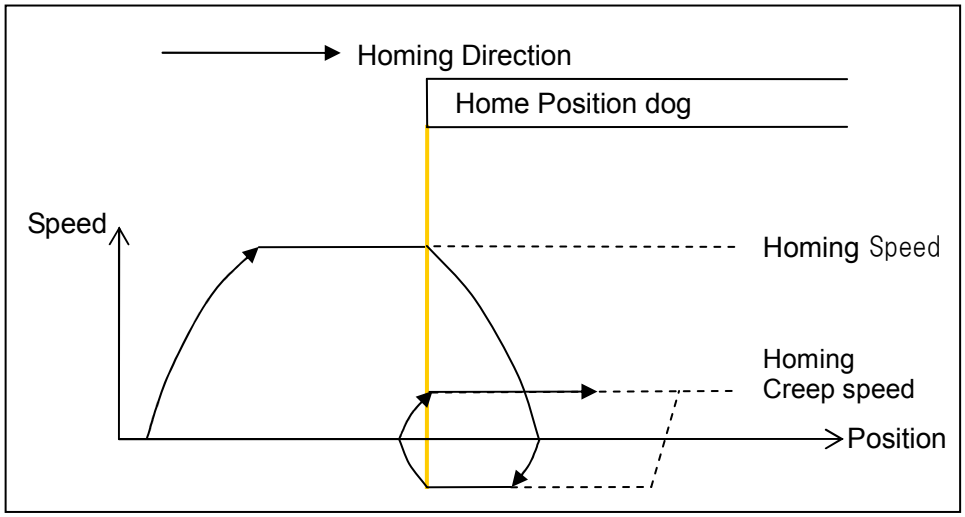


Figure 6-9-1 Redetection operation of Base signal 1 selection for Home position

Parameter No.	Parameter Name	Unit
646.0	Homing direction	-

Set Homing direction.

0 = CCW direction (default)

1 = CW direction

Case 1: Base signal 1 setting = 0 “Arbitrary position”

If you select “1: encoder Z-phase” for the parameter “Base signal 2 selection for Home position”, the homing direction will be in the direction of the Encoder Z-Phase detection.

Figure 6-9-1 shows an example where「Home Position Shift quantity (Parameter No.651.0)」is additionally set. The direction of movement by “Homing Shift-to-home-position quantity” starting from the home position base signal also will be the direction of the parameter setting. The direction of 1) Start (Homing Starts) to 2) Complete (Homing Completes) will be in the homing direction.

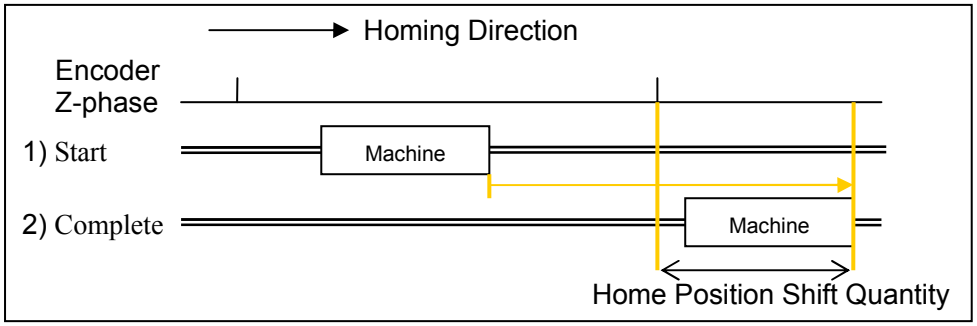


Figure 6-9-2 Homing Direction
(Arbitrary Position)

Case 2: Base signal 1 setting = 1 (Stopper)

The homing direction is in the direction of the Stopper to be detected. When setting Signal 2 Selection for Home Position = 1 (Encoder Z-phase), the detection direction of encoder Z-phase will be the opposite of homing direction.

Figure 6-9-2 is an example where「Home Position Shift quantity (Parameter No.651.0)」is additionally set. The direction of motion by shift amount specified with “Homing Shift-to-home-position quantity” from the home position base signal (i.e. z-phase) will also be the opposite. The direction of 1) Start (Homing Starts) to 2) Press will be in the homing direction, but the direction of 2) Press to 3) Complete (Homing Completes) will be the opposite.

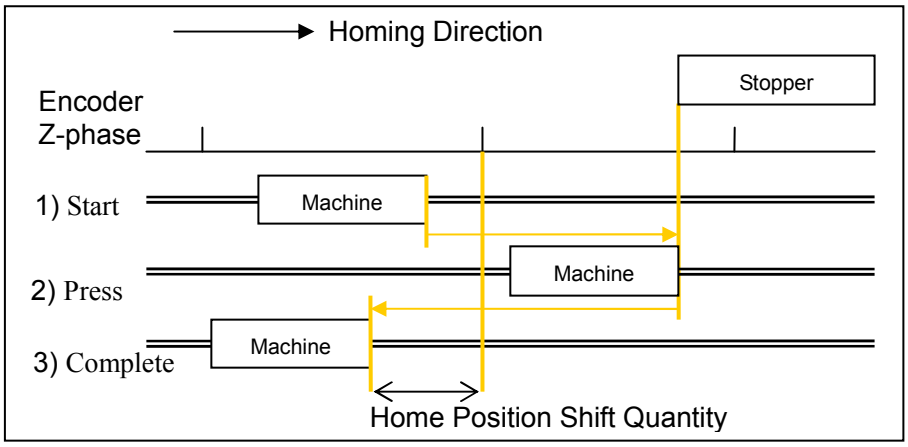


Figure 6-9-3 Homing Direction
(Stopper type)

Case 3: Base signal 1 = 2 “Home position dog front end”

Set the motion direction to be in the direction of Home position dog front end as the Homing direction.

If a starting point is in the direction of the home position dog front end, the homing direction will be the moving direction at the time of Homing Starts.

If the starting point is on the home position dog, the machine automatically moves in the opposite of homing direction and the home position dog front end will be detected when the machine leaves the home position dog behind.

When「Base Signal 2 Selection for Home Position」is set at 1(Encoder Z-phase), the homing direction will be in the direction the encoder Z-phase detection.

Figure 6-9-2 is an example where「Home Position Shift quantity (Parameter No.651.0)」is set additionally. The movement from the Base signal by Shift-to-home-position Quantity will be in the direction specified by the parameter setting. Since the starting point of homing is not on the home position dog in this example, the direction of 1)Start (Homing starts) to 2) Detect Dog (Home position dog front end is detected) and the direction of 2) Detect Dog to 3)Complete (Homing completes) are both in the homing direction.

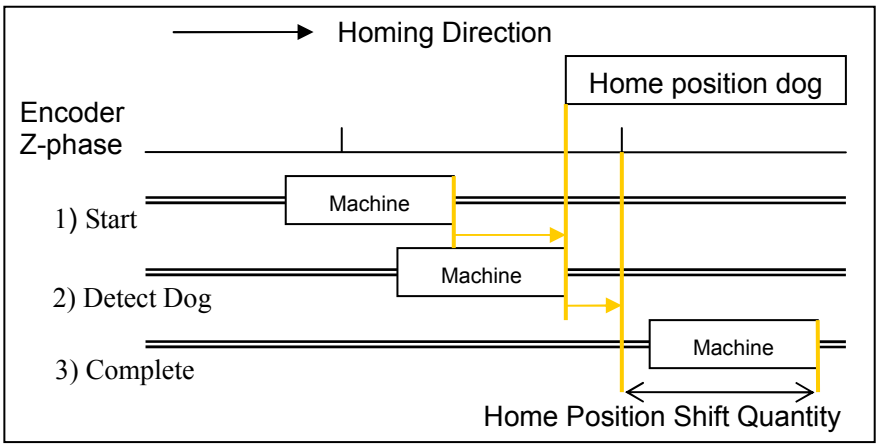


Figure 6-9-4 Homing Direction
(Home position dog front end)

Parameter No.	Parameter Name	Unit
646.1	Home position sensor input polarity	-

Set Polarity to detect User I/O input ORG that inputs Home position sensor.

0 = When OFF, detect Home position dog front end (default)

1 = When ON, detect Home position dog front end

If the setting is 0, the home position dog gets detected at both ORG and COM- =open.

If the setting is 1, the home position dog gets detected at both ORG and COM- =closed.

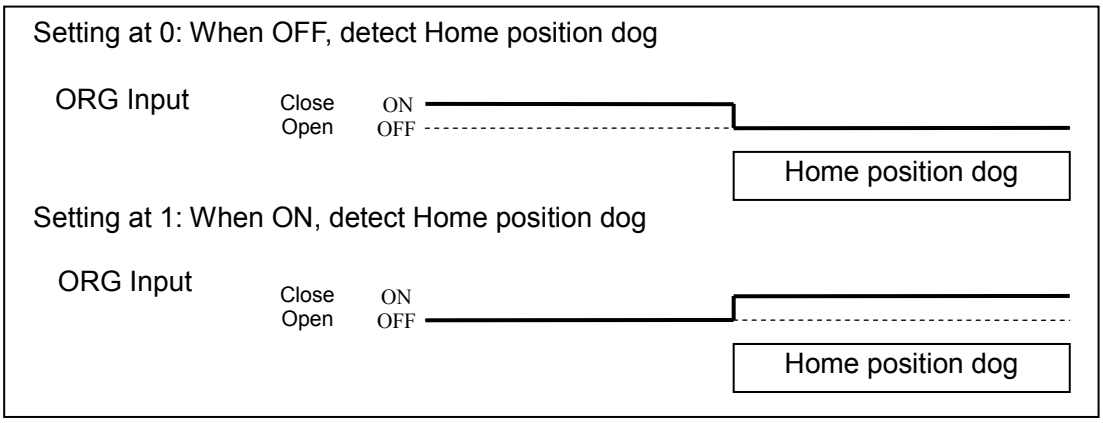


Figure 6-9-5 Home Position Sensor Input Polarity

Parameter No.	Parameter Name	Unit
646.2	Homing Timeout option	-

Enable/Disable Homing Timeout

0 = Disable

1 = Enable (default)

This parameter is a safety feature against bumping impact.

If the setting is “1” (Enable), the alarm “Position Command Overflow/Homing Failure” will occur when Homing operation doesn’t complete within the「Homing Timeout Time(Parameter No659.0)」setting and the SERVO turns OFF.

Parameter No.	Parameter Name	Unit
646.3	Point No. 0 function selection	-

Select a function to use when selecting Point. No 0 with User I/O and PCSTART1(Start) input.

0 = Homing (default)

1 = Point Table operation

If the setting is “0=Homing”, Homing will start.

If the setting is “1=Point Table operation”, the Point No.0 movement will start.

This parameter is used as a homing trigger when the I/O assignments don’t include the homing input HOME.

Parameter No.	Parameter Name	Unit
647.0	Homing Torque limit option	-

This is a safety function in case of bumping during Homing.

Set this parameter if you are using Torque limit from the start of Homing to its completion.

0 = Disable (default)

1 = Enable

The Torque Limit Value during Homing can be set with「Homing Torque Limit Value (Parameter No.656.0)」.

Note that if「Base Signal 1 Selection For Home Position (Parameter No.645.0)」is set at "Stopper", Homing Torque Limit Value(Parameter No.656.0) will be used as the Torque Limit Value at the time of Press to Stopper regardless of the Parameter No.647.0 setting.

Parameter No.	Parameter Name	Unit
647.1	Action at Homing completion	-

Select an action at Homing completion

0 = Stop (default)

1 = Move

The movement after the home position base signal gets detected and the motor makes a deceleration stop depends on the setting of the parameter.

If the setting is “0=Stop”, the motor stops after the home position base signal is detected and the motor makes the deceleration stop.

If the setting is “1=Move”, the motor makes a deceleration stop after the home positon base signal is detected, and Positioning to the Home Position will be performed accordingly.

Parameter No.	Parameter Name	Unit
648.0	Homing Speed	r/min

Set the Homing Speed.

Setting range: 0 - motor max rotation speed

Default: 500

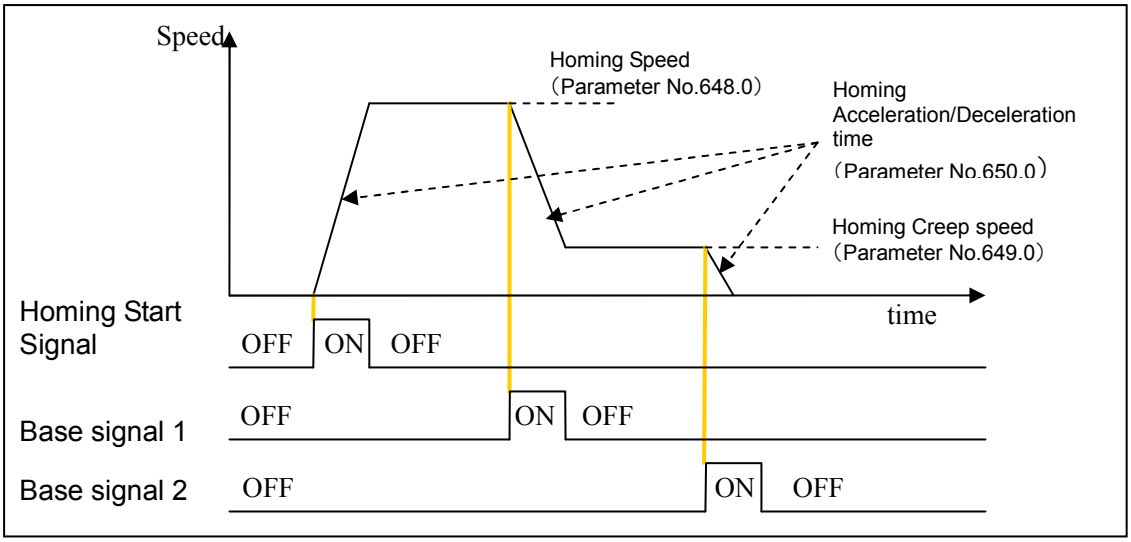


Figure 6-9-6 Homing Speed

Parameter No.	Parameter Name	Unit
649.0	Homing Creep speed	r/min

Set the Creep speed after Home position Base signal 1detection.

To improve the accuracy of home position base signal detection, select a low speed.

Setting range: 0 - motor max rotation speed

Default: 10

Parameter No.	Parameter Name	Unit
650.0	Homing Acceleration/Deceleration time	ms/1000rpm

Select a duration used as acceleration deceleration time during Homing.

This parameter specifies acceleration time for the rotational speed to go up from 0r/min to 1000r/min or deceleration time for the rotational speed to go down from 1000r/min to 0r/min.

Setting range: 0 - 5000

Default: 30

Parameter No.	Parameter Name	Unit
651.0	Homing Shift-to-home-position amount	command unit Note 1

Set shift amount from the position where the Base signal was detected to the home position.

For the movement direction, refer to「Homing Direction(Parameter No.646.0)」.

Setting range: 0 - 1,000,000,000

Default: 0[command unit]

Parameter No.	Parameter Name	Unit
653.0	Homing Home position data	command unit Note 1

Set a position after Homing Complete for home position (ABS Position Feedback data).

The ABS position feedback data at the time of Homing completion will be overwritten with this parameter setting.

Setting range: -1,000,000,000 to 1,000,000,000

Default: 0[command unit]

Parameter No.	Parameter Name	Unit
655.0	Homing Press detection time	ms

Set Torque limit detection time at the time of press Homing.

This parameter is valid when「Base Signal 1 Selection For Home Position (Parameter No.645.0)」= 1 (Stopper).

Setting range: 5 -1,000

Default: 100[ms]

Parameter No.	Parameter Name	Unit
656.0	Homing Torque limit value	0.1%

Set Torque limit value during homing. This value is measured in terms of proportion to the rated torque.

Homing Torque Limit Value (Parameter No.656.0) is used as the Torque Limit Value at the time of Press to Stopper, when the「Base Signal 1 Selection For Home Position (Parameter No.645.0)」setting is 1 (Stopper).

When the「Homing Torque Limit Option (Parameter No.647.0)」setting is “1=Enable”, this parameter setting is applied to all movements during homing. This parameter is one of safety features against bumping impact during homing.

Setting range: 10 - 3,000

Default: 500[0.1%]

Parameter No.	Parameter Name	Unit
657.0	Homing Z-phase invalidation distance	command unit Note 1)

Set a distance between the position where Base signal 1for home position is detected and the position where Z-phase detection starts.

Setting range: 0 - 1,000,000,000

Default: 0[command unit]

Parameter No.	Parameter Name	Unit
659.0	Homing Timeout Time	10ms

Set the time within which Homing must complete when using Homing Timeout function.

This parameter is valid when「Homing Timeout Option (Parameter No.646.2)」= 1 (Enable).

Setting range: 0 - 60,000

Default: 60,000[10ms]

Note 1: “Command Unit” is a value of “Encoder Unit” divided by “Position Command Pulse; denominator” (Parameter No.34.0) and multiplied by “Position Command Pulse; numerator (Parameter No.36.0)”.

$$[\mathrm{CommandUnit}] = \frac{[\mathrm{ParameterNo.36.0}]}{[\mathrm{ParameterNo.34.0}]} \times [\mathrm{EncoderUnit}]$$

The encoder unit of 131,072[pulse/rev] is converted to a command unit.

For example, provided Parameter No.34.0=32,768 and Parameter No.36.0=2,500, command unit = (2,500/32,768) x131,072 = 10,000[pulse/rev].

When the command paired-pulse ratio (i.e. No.36.0/No.34.0) is below 1, the Homing speed will not reach the speed specified by「Homing Speed (Parameter No.648.0)」or「Homing Creep Speed (Parameter No.649.0)」.

6-9-5 Details of User I/O

■ Input

Input is ON if the connection to COM- is closed and OFF if the connection to COM- is open.

(1) PCSTART1: Start (Pin No.6)

・This is a signal to start Homing. Preset the following and change PCSTART1(Pin No.6) from open to close.

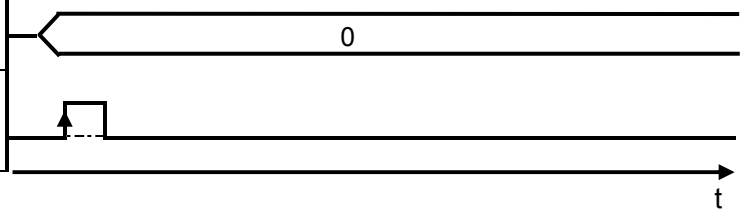
Point No. 0 Function Selection (Parameter No.646.3) ：0 (Homing)

PCSEL1...4 (User I/O Input, Pin No.7-10) ：all open

(2) PCSEL1...4: Point No. Selection (Pin No.7-10)

- Set「Point No. 0 Function Selection (Parameter No.646.3)」="0：Homing".
- If you want to execute Homing with PCSTART1, select Point No. 0 for User I/O Input PCSEL1...4(Pin No.7-10).

Item	User I/O Signal Name	I/O Input Output Status		
Point No. Selection	PCSEL 1...4	Input	-	-
Homing Start	PCSTART1	Input	ON OFF	C O



Note) "C": the contact is closed, "O": open

Figure 6-9-7 Start Homing with PCSTART1

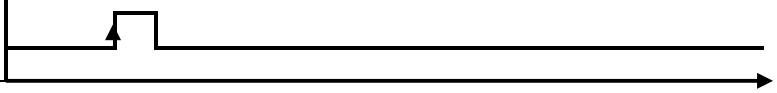
(3) HOME: Homing Start

This signal is valid if you select Positioner Function Option1.

(For information about the Option 1, refer to a separate document「Additional Manual 5 S-FLAG Series Special I/O Setup」)

Changing HOME from open to closed starts homing.

Item	User I/O Signal Name	I/O Input Output Status		
Homing Start	HOME	Input	ON OFF	C O



Note) "C": the contact is closed, "O": open

Figure 6-9-8 Start Homing with HOME

(4) ORG: Home Position Sensor (Pin No. 11)

・Input the Home Position Sensor Signal when performing homing with Home position dog.

・Set the following in advance.

- ✓ Base Signal 1 Selection For Home Position (Parameter No.645.0) = 2(Home position dog front end)
- ✓ Home Position Sensor Input Polarity(Parameter No.646.1) = (Select 0:when OFF, or 1:when ON)

With the default setting of Home Position Sensor Input Polarity Parameter, home position dog gets detected when the contact with COM- changes from closed to open.

■ Output

Output is ON when Output terminal is LOW and OFF when Output terminal is HIGH.

1. **HEND** Homing Complete (Pin No.16) Note 1)

・This signal becomes ON if Homing has been completed and the coordinate system has been established. When the「Select an Option for Absolute System (Parameter No.257.0)」setting is “Absolute System” and Homing is completed, Homing will be unnecessary next time even after rebooting the amplifier.

・HEND is OFF in the following cases:

(a) when Homing is still in progress

(b) after Homing started, but has been stopped before HEND becomes ON.

Homing gets stopped when

- Turning off the Servo while Homing still in progress with motor motions.
- Executing Deviation Counter CLEAR during while Homing still in progress with the motor in motion.
- “Drive Restriction” gets enabled during Homing with the motor in motion and Deviation Counter CLEAR gets executed.
- An alarm occurs during Homing with the motor in motion and Servo turns Off.

(c) after the power for the amplifier turns on where「Select an Option for Absolute System」setting is “Incremental System”.

(d) when Encoder multiple rotation data gets lost where the「Select an Option for Absolute System」(Parameter No.257.0)」setting is “Absolute System”

・Minimum time of the signal OFF is 3ms.

2. **MEND** Motion Complete (Pin No.15) Note 1)

・This signal is used to check if Homing can be started during Servo ON. Before starting the Homing operation, make sure that this output signal is ON.

・MEND is OFF when Servo OFF.

・Minimum time of the signal OFF is 3ms.

3. **MEND or T-LIMIT** Motion Complete or Output during Torque control

・This signal is valid when Positioner Function is selected. For details of Option 1, refer to a separate document「Additional Manual 5 S-FLAG Series Special I/O Settings」.
・When MEND or T-LIMIT is ON, this signal turns ON.
・This signal is used by a system to switch torque limit during motor motions such as control including press motion. Use it as T-LIMIT for press motion in progress, and as MEND for other motions.
・T-LIMIT makes Torque Limit TLSEL1 ON, and MEND makes TLSEL1 OFF.
・To use this output signal, set the following in advance.

1) 「Torque Command Limit Override Selection(Parameter No.144.0)」=1:Enable
2) 「Selection Of Torque Limit State Output Mode(Parameter No.144.1)=2:Torque command limit override value 2
3) 「Torque Command Limit Override Value 1(Parameter No.147.0)」=your choice (see Note2)

Note1: Parameter No.647.1「Action at Homing Completion」, HEND, and MEND

i. If「Action at Homing Completion (Parameter No.647.1)」is "1:Move", the motor makes a deceleration stop once the home position base signal is detected and HEND (Homing Complete output) turns ON. Then the motor moves to the home position as specified with the parameter and MEND (Motion Complete output) turns ON. The ABS position command value after the motion completed becomes Homing Position data.

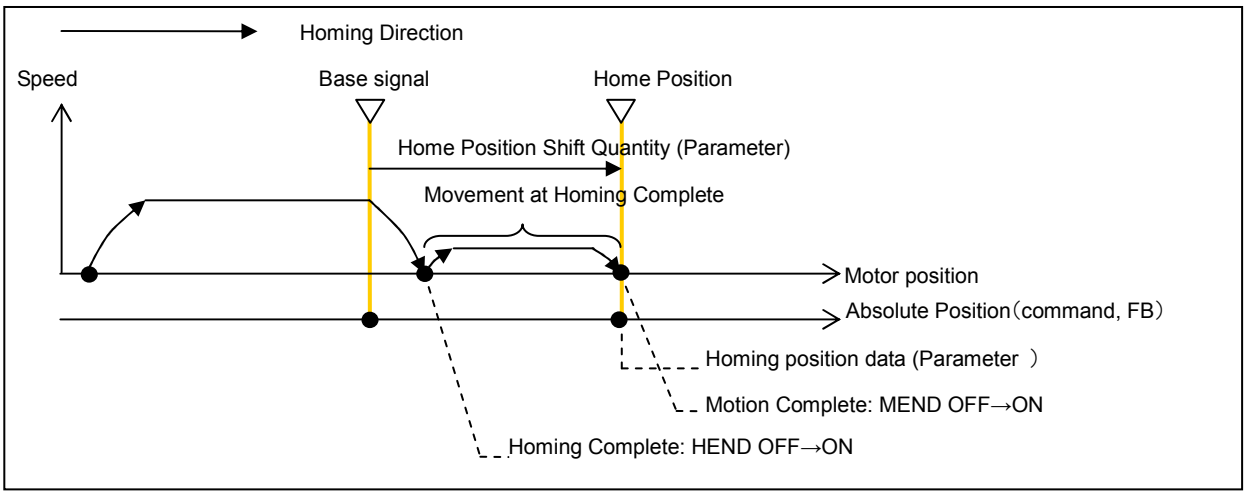


Figure 6-9-9 Action at Homing Complete (for valid settings)

ii. If Action at Homing Complete= "0: Stop", the motor makes a deceleration stop and HEND (Homing Complete output) turns ON. Then there won't be any move to the Home Position and MEND (Motion Complete output) turns ON when the motor completes the deceleration stop.

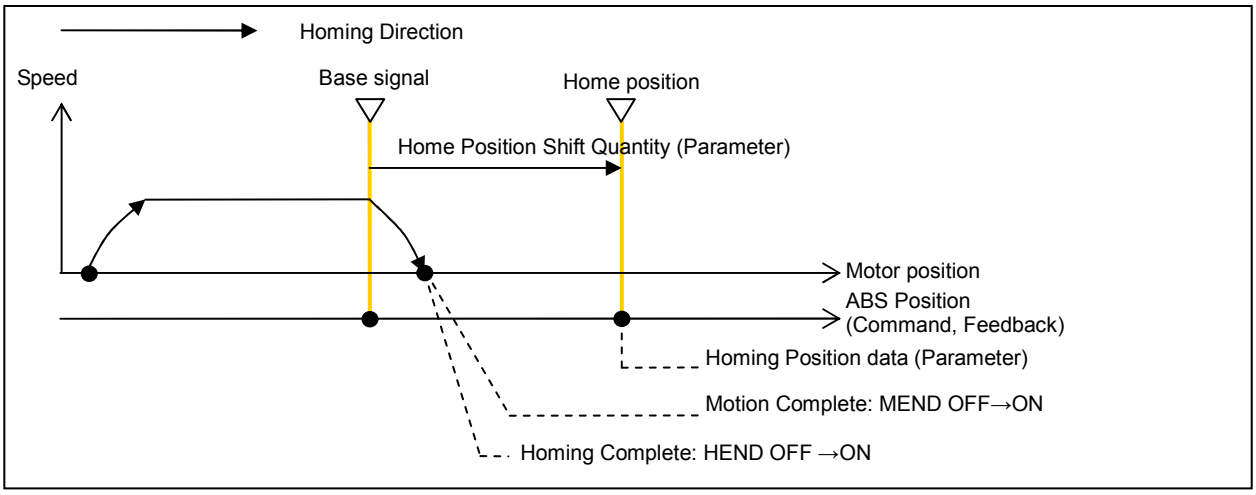


Figure 6-9-10 Action at Homing Complete (for invalid settings)

Note 2: Except for the following cases where the “Homing Torque Limit Value (Parameter No.656.0)” setting is used for a torque limit during Homing.

1) Base Signal 1 Selection for Home Position (Parameter No.645.0) = 1: Stopper

2) Homing Torque Limit Option (Parameter No.647.0) = 1: Enable

6-9-6 Important Reminders

(1) When performing Homing with a home position dog front end as home position base signal, place the home position dog at the edge of the machine.
Also for the「Homing Direction (Parameter No.646.0)」setting, choose the direction of front of Home position dog towards Home position dog front end. If you choose the direction to move away from Home position dog to be the homing direction, there is risk of bumping to the machine edge.

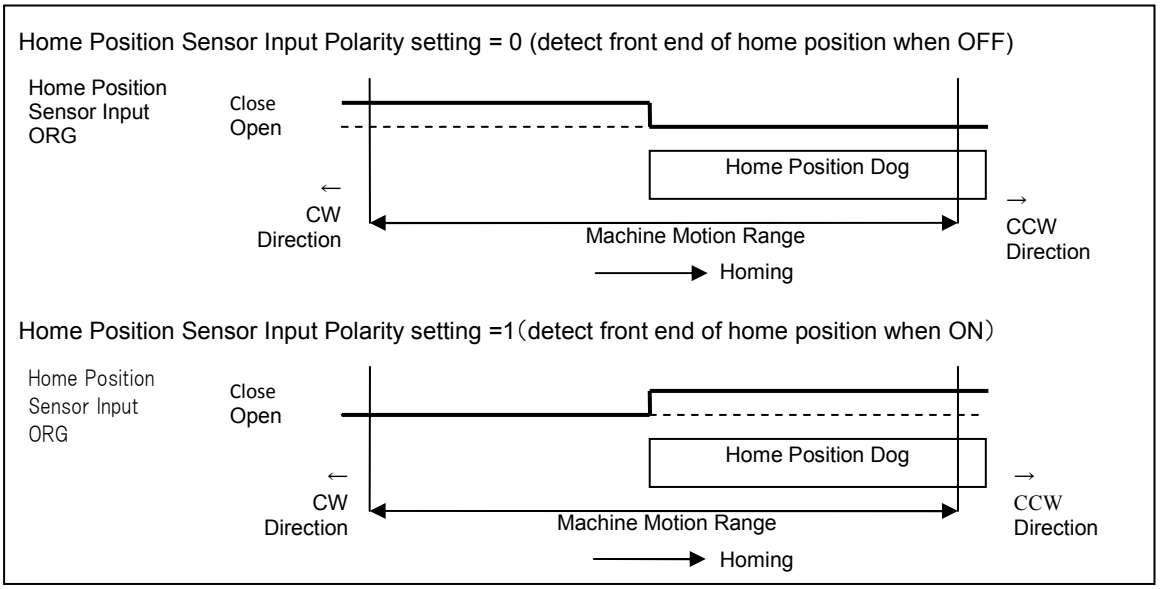


Figure 6-9-11 Arranging Home Position Dog

(2) If you changed the command paired-pulse ratio value, perform homing again after saving the parameter and rebooting the amplifier.

(3) When performing homing based on encoder Z-phase, arrange the start position of Z-phase detection away from proximity to the Z-phase of the motor. Otherwise, the detection position of Z-phase could become inconsistent. The position of Z-phase can be checked at the position where the status value of “encoder one rotation angle data” = 0.

(4) When the one of the following occurs during homing with motion, homing gets interrupted and Homing Status becomes incomplete.

- Turn Servo OFF
- Execute Deviation Counter Clear. When Deviation Counter Clear is executed, the motor stops immediately.
- Drive Restriction is input and Deviation Counter Clear gets executed.

(5) Set「Selection of Auto Interpolation for Command paired ratio (Parameter No.32.2)」=1:Enable. When No.32.2=0: Disable, the rotational speed change might become larger.

6-9-7 Operations

Homing can be performed using User I/O input or S-TUNE.

1) Using User I/O Input

1) Set the parameters listed in Table 6-9-1.

2) Start Homing as follows:

· Select a Point No. 0 with PCSEL1–4, and input PCSTART1.

· When the I/O setting of Option 1 is selected, input HOME.

Refer to「6-9-5 Details of User I/O」

Check that MEND is ON with Servo ON before starting homing except for few exceptions. If MEND is OFF during Servo ON, the homing command will not be accepted.

Table 6-9-1 Basic Setup Parameter Settings required for Homing with User I/O

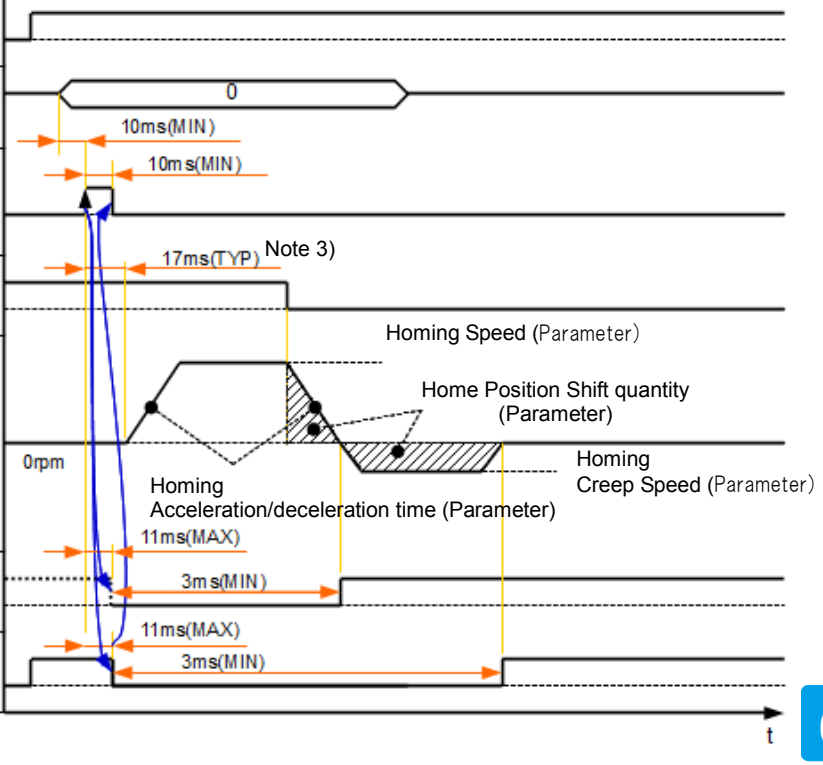
No.	Parameter	Select	Value description
2.0	Control Mode Selection	0	Position Control Mode
3.0	Command Mode Selection	3	Internal Generation Command
9.0	Operation Mode Selection Note 1)	0	I/O
642.0	Internal Position Command Operation Mode Selection	0	Point Table

Note 1) The Operation Mode Selection becomes I/O when turning on the power to the amplifier. On the Setup Panel, neither display nor setup can be done. When the setting was changed in S-TUNE, change it back to I/O in S-TUNE.

■Timing Chart

The following illustrates how to perform operations using User I/O Input. The Homing operation with Home position dog front end is used as an example below.

Item	User I/O Signal Name	I/O Input Output Status		
Servo State	SERVO	Input	ON OFF	C O
Point No. Selection	PCSEL1...4	Input	-	-
Homing Start	PCSTART1 (HOME)	Input	ON OFF	C O
Home position sensor	ORG	Input	ON OFF	C O
Motor Rotational Speed Note 2)	-	-	-	-
Return Complete	HEND	Output	ON OFF	C O
Operation Complete Note 1)	MEND	Output	ON OFF	C O



Note1: In order to use MEND with User I/O output MEND/T-LIMIT, turn the T-LIMIT output OFF with necessary parameter settings and TLSEL1 output OFF. Refer to「6-9-5 Details of User I/O」.

Note2: This assumes there is no chattering of I/O input. When chattering occurs, the startup will be delayed.

Note3: Start-up time depends on conditions.

Figure 6-9-12 Timing Chart
(Homing with User I/O)

Table 6-9-2 Process of Homing with User I/O

Step	Operation	Description
1	Setting homing related parameters	Set the parameter Homing Speed, Homing Creep Speed, and Homing acceleration deceleration time.
2	Check if homing can be started	Check that MEND is ON. If it's OFF, wait.
3	Select a Point No.	Have all of PCSEL1..4 open to specify Point No.0, which however is unnecessary when you are starting homing with HOME
4	Start the homing operation	Wait for 10 ms or longer after PCSEL1..4 input, then change PCSTART1 or HOME from open to closed.
5	Check Operation Execution	Wait until MEND turns OFF. Then turn PCSTART or HOME back OFF.
6	Check Motion Completion	Check MEND for Motion Complete. MEND turning OFF from ON indicates that the operation has been completed.
7	Check Homing operation Complete	After making sure that the operation has been competed, check HEND for Homing Complete. HEND being ON indicates Homing Complete.

2) Homing in S-TUNE

Table 6-9-3 Parameter Settings Required for Homing in S-TUNE

No.	Parameter	Setting	Description
2.0	Control Mode Selection	0	Position Control Mode
3.0	Command Mode Selection	3	Internal Generation Command
9.0	Operation Mode Selection	1	Communication
642.0	Internal Position Command Operation Mode	0	Point Table

Note: Homing is also called as “Home Position Return” in the S-TUNE interface.

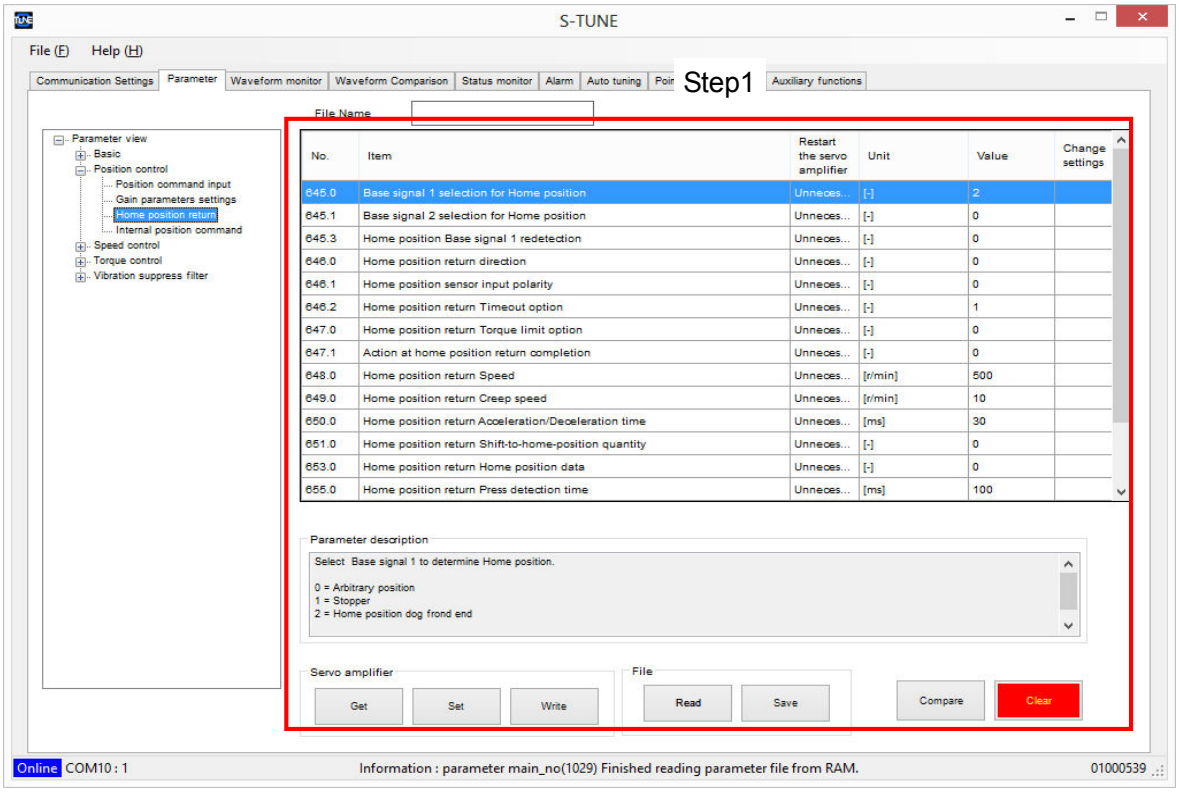


Figure 6-9-13 Homing Operation Method 1 (S-TUNE)

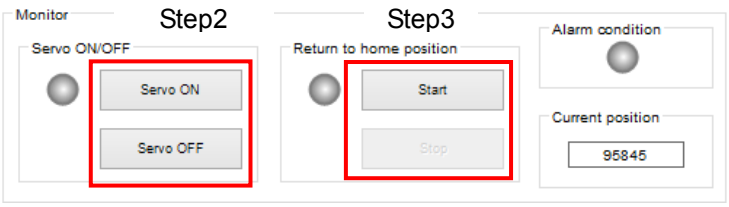


Figure 6-9-14 Homing Operation Method 2 (S-TUNE)

Step 1. Set parameters for Homing on the【Parameter】tab. As for how to set parameters, refer to this chapter「6-9-8 Details of Homing Types」.

Step 2. Open the【Point Table】tab. Click the [SERVO ON] button to turn Servo ON.

Step 3. Click the [Start] button to start Homing. To stop Homing, click the [STOP] button. When Homing has been completed, the light on the left of the [START] button flashes green and the position at the time of Home Positon Return Complete appears below [Current Position].

6-9-8 Details of Homing Types

(A) Homing with Arbitrary Position

This type of homing uses the current position or the encoder Z-phase near the current position.

■ Parameters

Table 6-9-4 Parameters related to Homing by Arbitrary Position

Parameter No.	Parameter Name	General description and particular settings
645.0	Base Signal 1 Selection For Home Position	Select “0=Arbitrary Position”.
645.1	Base Signal 2 Selection For Home Position	Use this parameter when using an encoder Z-phase as Home Position Base.
646.0	Homing Direction	Select a movement direction of Homing
647.1	Action at Homing Completion	Use this parameter when the motor is to make a move to the home position after the home base signal 1 is detected.
649.0	Homing Creep Speed	Set a rotational speed after Home Position Base signal 1 is detected.
650.0	Homing acceleration delectation time	Specify acceleration or deceleration time for Homing.
651.0	Homing Shift-to-home-position Quantity	Specify a motor’s motion amount from the Home Position Base to the Home Position.
653.0	Homing Position data	Set a home position coordinate at the time of Homing complete.
657.0	Homing Z-phase invalidation distance	Set a distance between a position of Base signal 1 detection and the starting point of encoder z-phase detection. If you select (none) for Home Position Base Signal 2, this parameter is irrelevant.

Examples going forwards use the following parameter settings.

Table 6-9-5 Parameter Setting Example for the Arbitrary Position Type

Parameter No.	Parameter Name	Setting
646.0	Homing Direction	0 = CCW Direction
647.1	Action at Homing Completion	1 = Move

1) When not using an encoder Z-phase, set Parameter No. 645.1「Base Signal 2 Selection for Home Position」= 0: None.

Item	User I/O Signal Name	I/O Input Output Status		
Motor Rotational Speed	-	-	-	-

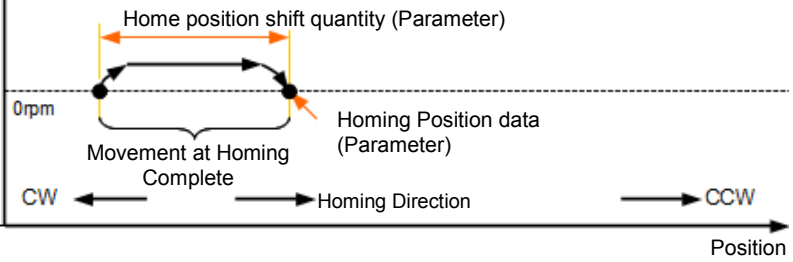
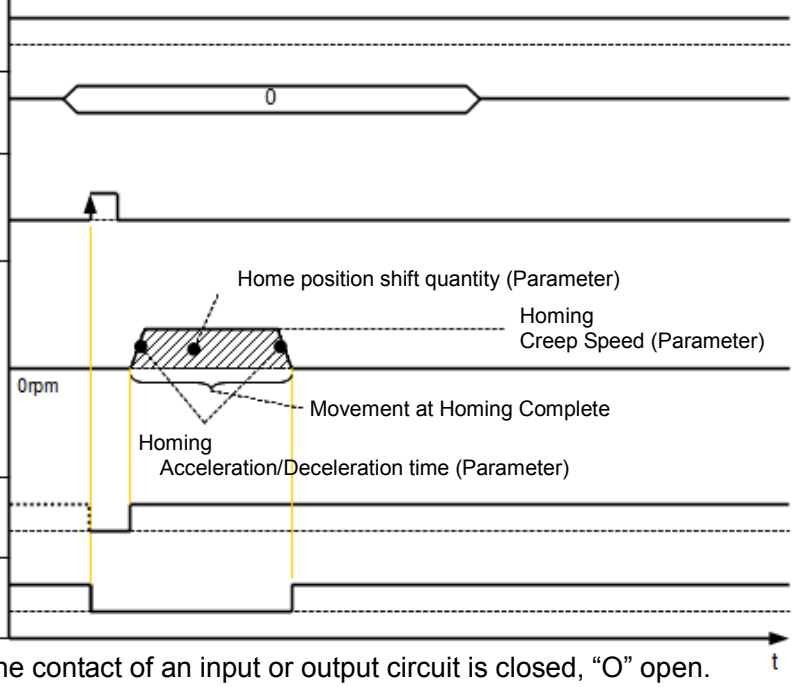


Figure 6-9-15 Chart of Position Projected on X-axis
(Homing Using an Arbitrary Position)

Item	User I/O Signal Name	I/O Input Output Status		
Servo Status	SERVO	Input	ON OFF	C O
Point No. Selection	PCSEL1...4	Input	-	-
Homing Start	PCSTART1 (HOME)	Input	ON OFF	C O
Motor Rotational Speed	-	-	-	-
Return Complete	HEND	Output	ON OFF	C O
Operation Complete	MEND	Output	ON OFF	C O



Note: “C” in I/O Status indicates that the contact of an input or output circuit is closed, “O” open.

Figure 6-9-16 Timing Chart
(Homing with Arbitrary Position)

・When setting「Action at Homing Completion(Parameter No647.1)」= “Stop”, the operation finishes without motor movement to the home position.

2) When using Encoder Z-phase
Set「Base Signal 2 Selection for Home Position」Parameter =“1: Encoder Z-phase”.

Item	User I/O Signal Name	I/O Input Output Status		
Encoder Z phase	-	Internal	ON OFF	-
Motor Rotational Speed	-	-	-	-

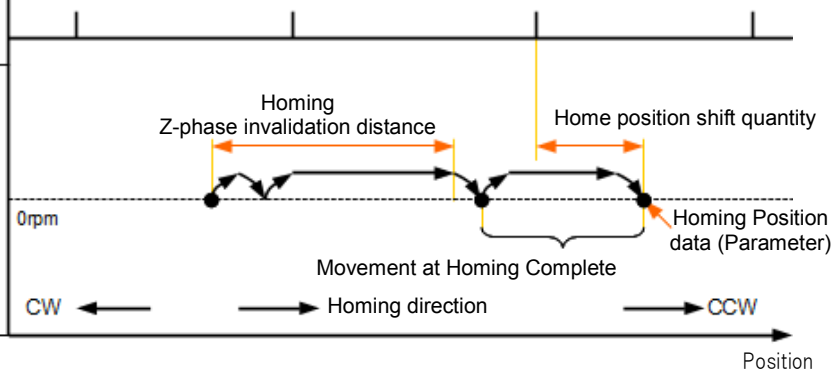
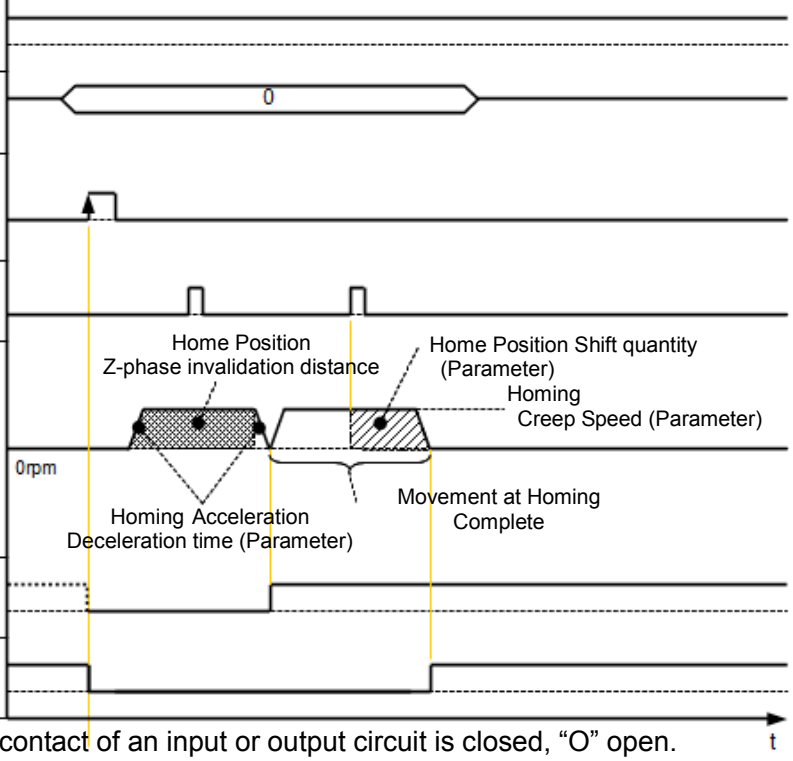


Figure 6-9-17 Chart of Position Projected on X-axis
(Homing with Arbitrary Position or Z-Phase)

Item	User I/O Signal Name	I/O Input Output Status		
Servo Status	SERVO	Input	ON OFF	C O
Point No. Selection	PCSEL1...4	Input	-	-
Homing Start	PCSTART1 (HOME)	Input	ON OFF	C O
Encoder Z-phase	-	Internal	ON OFF	-
Motor Rotational Speed	-	-	-	-
Return Complete	HEND	Output	ON OFF	C O
Operation Complete	MEND	Output	ON OFF	C O



Note: “C” in I/O Status indicates that the contact of an input or output circuit is closed, “O” open.

Figure 6-9-18 Timing Chart
(Homing with Arbitrary Position or Z-Phase)

・If「Action at Homing Completion(Parameter No.647.1)」=“0:Stop”, the operation completes without motor movement to the home position.

3) Homing during Servo OFF
For the setting of「Action at Homing Completion (Parameter No.647.1)」=“1:Move”, Servo must be ON except for the following conditions. If all those conditions are met, you can perform homing even during Servo OFF.

Parameter No.	Parameter Name	Setting
645.0	Base Signal 1 Selection for Home Position	0:arbitrary position
647.1	Action at Homing Completion	0:stop
657.0	Homing Z-phase invalidation distance	0

(B) Homing with Stopper (Press Type)

This type of homing uses a stopper position or an encoder z-phase in the proximity of the stopper.

■ Parameters

Table 6-9-6 Parameters related to Homing with a Stopper

Parameter No.	Parameter Name	General description and particular settings
645.0	Base signal 1 selection for Home position	Select 1:Stopper
645.1	Base signal 2 selection for Home position	Use this parameter to, after detecting the Home position Base signal 1, detect an encoder z-phase and make it the home position base.
646.0	Homing direction	Set the direction to detect the stopper.
647.1	Action at Homing completion	Use this parameter for motor movement to the home position after the home base signal 1 is detected.
648.0	Homing Speed	Set a rotational speed before the motor bumps to the stopper.
649.0	Homing Creep speed	Set a rotational speed after the motor bumps to the stopper.
650.0	Homing Acceleration/Deceleration time	Set acceleration or deceleration time for Homing.
651.0	Homing Shift-to-home-position quantity	Set motor's shift amount from the Home Position Base to Home Position.
653.0	Homing Home position data	Set a home position coordinate at the time of Homing complete.
655.0	Homing Press detection time	Specify a time for the bumping position (i.e. pressed position) to be recognized as the home position base.
656.0	Homing Torque limit value	Set Torque limit value at the time of Homing. This value is measured in terms of proportion to rated torque. This parameter setting will be used as a torque limit during Homing using a stopper.
657.0	Homing Z-phase invalidation distance	Set a distance between Base signal detection and startup of Z-phase detection. This parameter is not irrelevant if "none" is selected for Home Position base signal 2.

Examples going forwards use the following parameter settings.

Table 6-9-7 Parameter Setting Example for Homing using a Stopper

Parameter No.	Parameter Name	Setting
646.0	Homing direction	0: CCW
647.1	Action at Homing completion	1: Move

1) When not using an encoder Z-phase, set
「Base Signal 2 Selection For Home Position (Parameter No.645.1)」="0: none"

Item	User I/O Signal Name	I/O Input Output Status		
Motor Rotational Speed	-	-	-	-

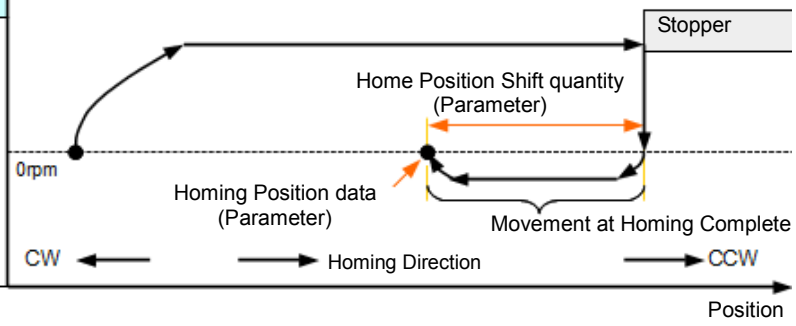
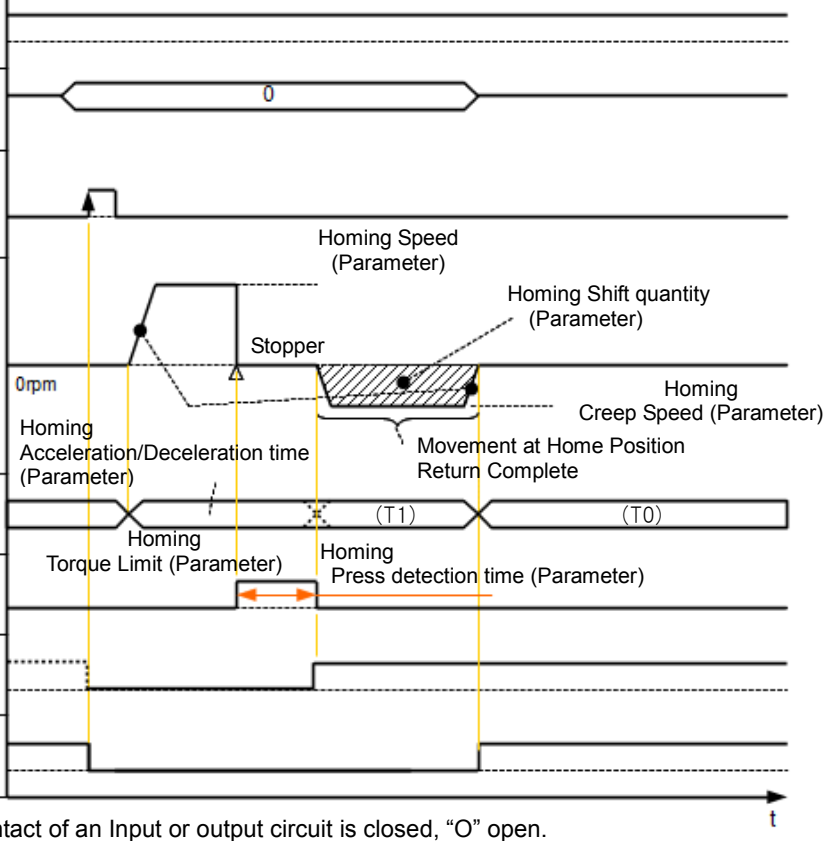


Figure 6-9-19 Chart of Position Projected on X-axis
(Homing with Stopper)

Item	User I/O Signal Name	I/O Input Output Status		
Servo Status	SERVO	Input	ON OFF	C O
Point No. Selection	PCSEL1...4	Input	-	-
Homing Start	PCSTART1 (HOME)	Input	ON OFF	C O
Motor Rotational Speed	-	-	-	-
Torque limit	-	Internal	-	-
Torque limit State	-	Internal	ON OFF	-
Return Complete	HEND	Output	ON OFF	C O
Operation Complete	MEND	Output	ON OFF	C O



Note: “C” in I/O Status indicates that the contact of an Input or output circuit is closed, “O” open.

Figure 6-9-20 Timing Chart
(Homing with Stopper)

- When you have the setting of「Action at Homing Completion(Parameter No647.1)」= “Stop”, the operation finishes without motor’s movement to the home position.
- Torque Limit Value (T0) after Homing Completion resets to the default.
- Torque Limit Value at the beginning of Homing through the end of the pressed time can be set with「Homing Torque Limit Value(Parameter No647.0)」.
- Torque Limit Value (T1) at the end of Homing pressed time through Homing Complete remains the Homing Torque Limit Value if「Homing Torque Limit Option (Parameter No.647.0)」=“1:Enable”. If 0:Disable, T1 resets to the default.
- When a time specified by「Homing Press detection time (Parameter No.655.0)」 passes after the beginning of output torque limit, a cordinate will be establised based on the stop position, and Home Positon Base 1 gets fixed.

2) When using an encoder Z-phase, set「Base Signal 2 Selection For Home Position (Parameter No.645.1)」="1: Encoder Z-phase".

Item	User I/O Signal Name	I/O Input Output Status		
Encoder Z phase	-	Internal	ON OFF	-
Motor Rotational Speed	-	-	-	-

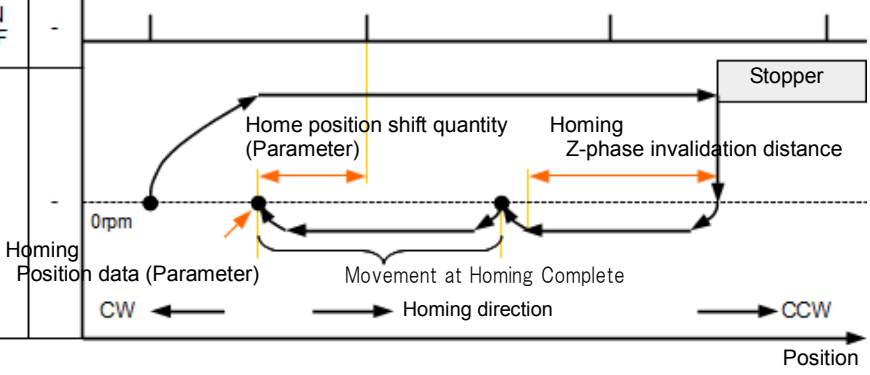
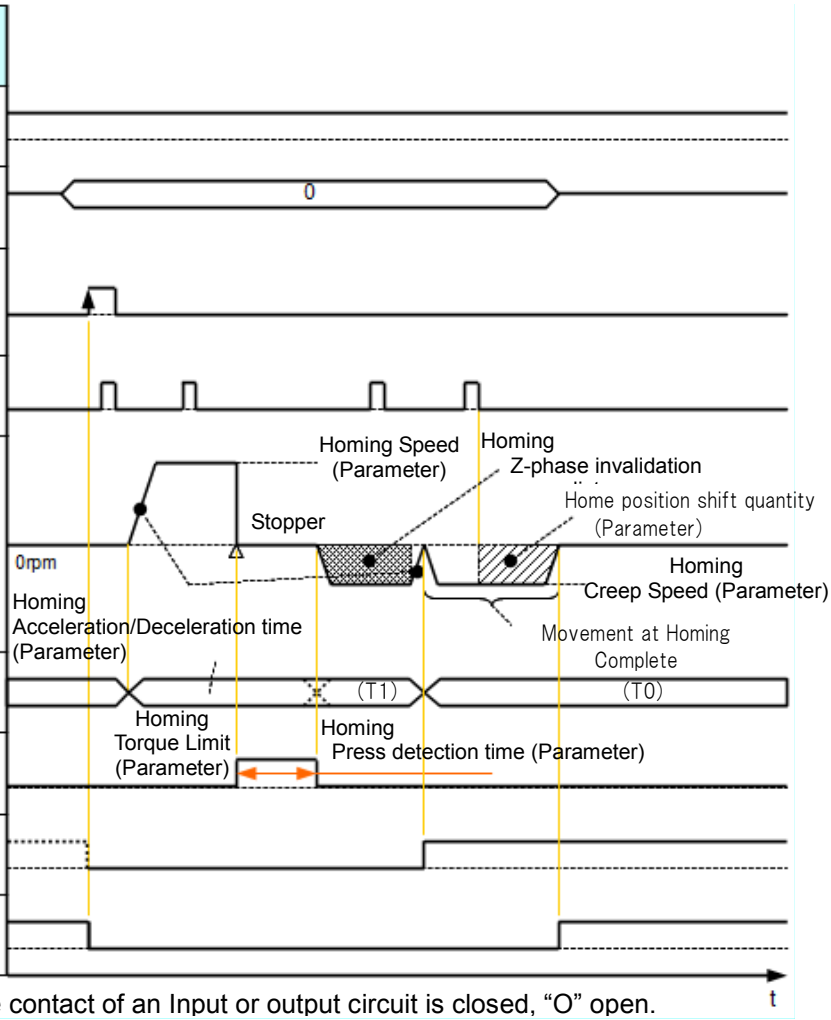


Figure 6-9-21 Chart of Position Projected on X-axis
(Homing with Stopper or Encoder Z-phase)

Item	User I/O Signal Name	I/O Input Output Status		
Servo Status	SERVO	Input	ON OFF	C O
Point No. Selection	PCSEL1...4	Input	-	-
Homing Start	PCSTART1 (HOME)	Input	ON OFF	C O
Encoder Z phase	-	Internal	ON OFF	-
Motor Rotational Speed	-	-	-	-
Torque limit	-	Internal	-	-
Torque limit State	-	Internal	ON OFF	-
Return Complete	HEND	Output	ON OFF	C O
Operation Complete	MEND	Output	ON OFF	C O



Note) “C” in I/O Status indicates that the contact of an Input or output circuit is closed, “O” open.

Figure 6-9-22 Timing Chart

(Homing with Stopper or Z-phase)

- If「Action at Homing Completion(Parameter No.647.1)」=“0:Stop” is your setting, Homing operation finishes without motor movement to the home position.
- After Homing completion, Torque Limit Value (T0) will reset to the default.
- Torque Limit Value at the beginning of Homing to the end of Homing pressed time is 「Homing Torque Limit Value(Parameter No.647.0)」.
- Torque Limit Value (T1) at the end of Homing pressed time till Homing Complete remains the Homing Torque Limit Value if「Homing Torque Limit Option (Parameter No.647.0)」 =“1:Enable” is your setting. If 0: Disable, T1 resets to the default.
- When a time specified by「Homing Press Detection Time Homing Press Detection Time(Parameter No.655.0)」passes after the beginning of output torque limit, a cordinate will be estabilised based on the stop position, and Home Positon Base 1 gets fixed.

(C) Homing with home position dog front end (home position sensor type)

This type of homing uses a home position sensor or an encoder Z-phase in the proximity of the home position sensor as the home position.

■ Parameters

Table 6-9-8 Parameters related to Homing with Home position dog front end

Parameter No.	Parameter Name	General description and particular settings
645.0	Base Signal 1 Selection For Home Position	Select “2= Home position dog front end”
645.1	Base Signal 2 Selection For Home Position	Use this parameter to, after detecting the Home position Base signal 1, detect an encoder z-phase to be used as the home position base.
645.3	Home position Base signal 1 redetection	Use this parameter, after detecting dog front end at a speed specified with the homing speed parameter, to redetect it at a speed specified with the homing creep speed parameter.
646.0	Homing Direction	Select the direction of front of home position dog to the home position dog front end.
646.1	Home Position Sensor Input Polarity	Set Input Polarity of the Home Position Sensor signal ORG.
647.1	Action at Homing Completion	Use this parameter for motor movement to the home position after the home base signal 1 is detected.
648.0	Homing Speed	Set a rotational speed before Home position dog front end gets detected.
649.0	Homing Creep Speed	Set a rotational speed after Home position dog front end has been detected.
650.0	Homing Acceleration or Deceleration time	Set acceleration or deceleration time for Homing.
651.0	Homing Shift-to-home-position Quantity	Set a motor’s shift amount from the Home Position Base to Home Position.
653.0	Homing Position data	Set a home position coordinate at the time of Homing complete.
657.0	Homing Z-phase invalidation distance	Set a distance between Base signal detection and startup of Z-phase detection. This parameter is not irrelevant if “none” is selected for Home Position base signal 2.

Examples going forwards use the following parameter settings.

Table 6-9-9 Parameter Setting Example for homing with Home position dog front end

Parameter No.	Parameter Name	Setting
645.3	Internal position command Overflow detection option	1 = Enable
646.0	Homing Direction	0 = CCW Direction
646.1	Home Position Sensor Input Polarity	0 = When OFF, detect Home position dog front end
647.1	Action at Homing Completion	1 = Move

1) When not using an encoder Z-phase as Base, set「Base Signal 2 Selection for Home Position (Parameter No.645.1)」="0:none".

Item	User I/O Signal Name	I/O Input Output status		
Home position sensor	ORG	Input	ON OFF	C O
Motor Rotational Speed	-	-	-	-

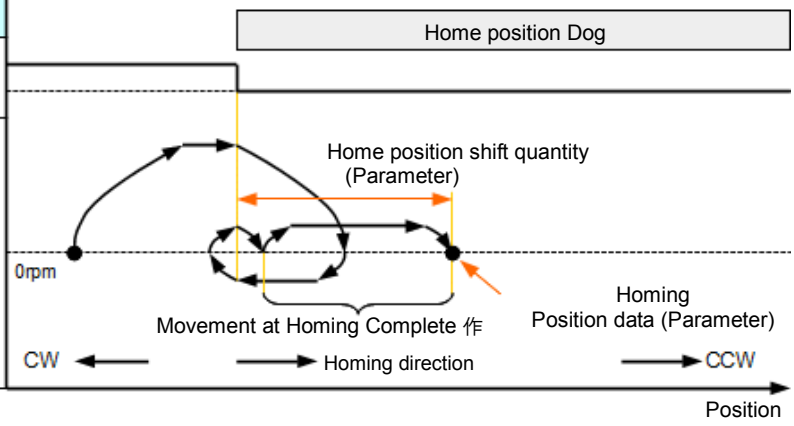
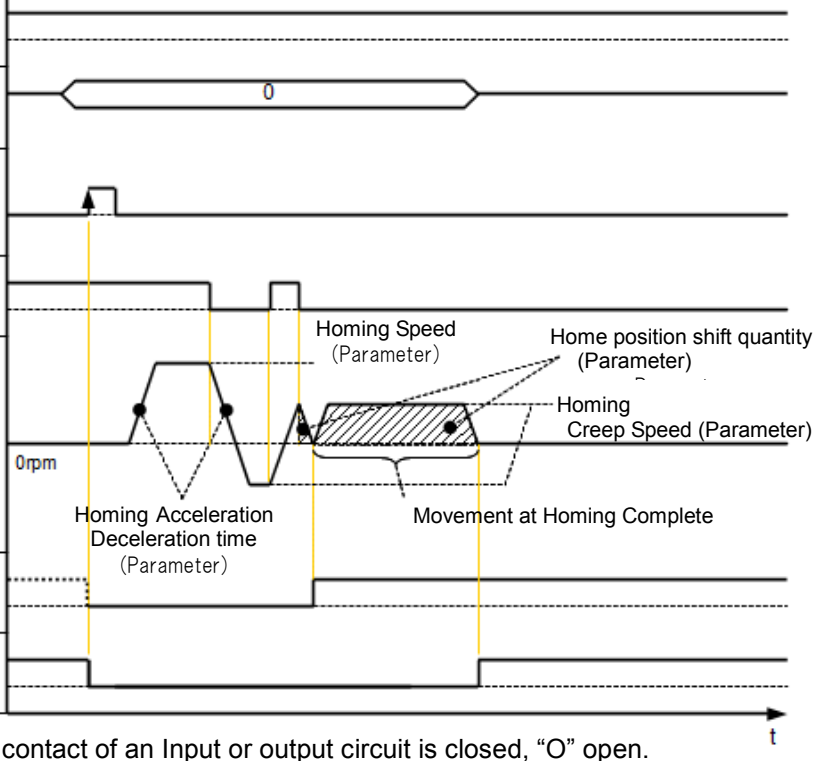


Figure 6-9-23 Chart of Position Projected on X-axis
(Homing using the dog front end)

Item	User I/O Signal Name	I/O Input Output Status		
Servo Status	SERVO	Input	ON OFF	C O
Point No. Selection	PCSEL1...4	Input	-	-
Homing Start	PCSTART1 (HOME)	Input	ON OFF	C O
Home position sensor	ORG	Input	ON OFF	C O
Motor Rotational Speed	-	-	-	-
Return Complete	HEND	Output	ON OFF	C O
Operation Complete	MEND	Output	ON OFF	C O



Note) “C” in I/O Status indicates that the contact of an Input or output circuit is closed, “O” open.

Figure 6-9-24 Timing Chart

(Homing with Front End of Home Position Dog)

- If「Action at Homing Completion(Parameter No.647.1)」=“0:Stop” is your setting, Homing operation finishes without the motor moving to the home position.
- If「Home Position Base Signal 1 Redetection(Parameter No.645.3)」=“0:Disable” is your setting, the motor doesn’t move backwards after detection of the home position dog front end.
- When starting point of Homing is on a home position dog, the motor moves backwards departing from the home position dog, and turnaround and move forward at the Homing Creep Speed until the dog front end gets detected.

2) When using an encoder Z-phase as Base, set「Base Signal 2 Selection For Home Position (Parameter No.645.1)」="1: Encoder Z-phase ".

Item	User I/O Signal Name	I/O Input Output status		
Home position sensor	ORG	Input	ON OFF	C O
Encoder Z phase	-	Internal	ON OFF	-
Motor Rotational Speed	-	-	-	-

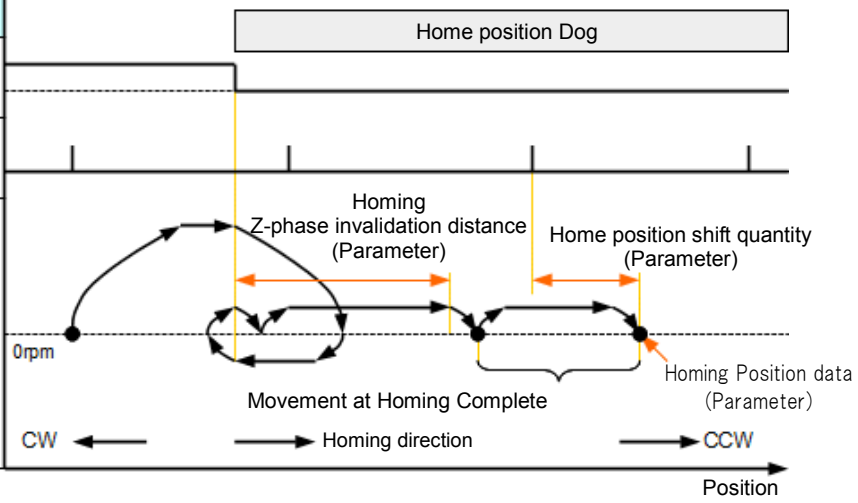
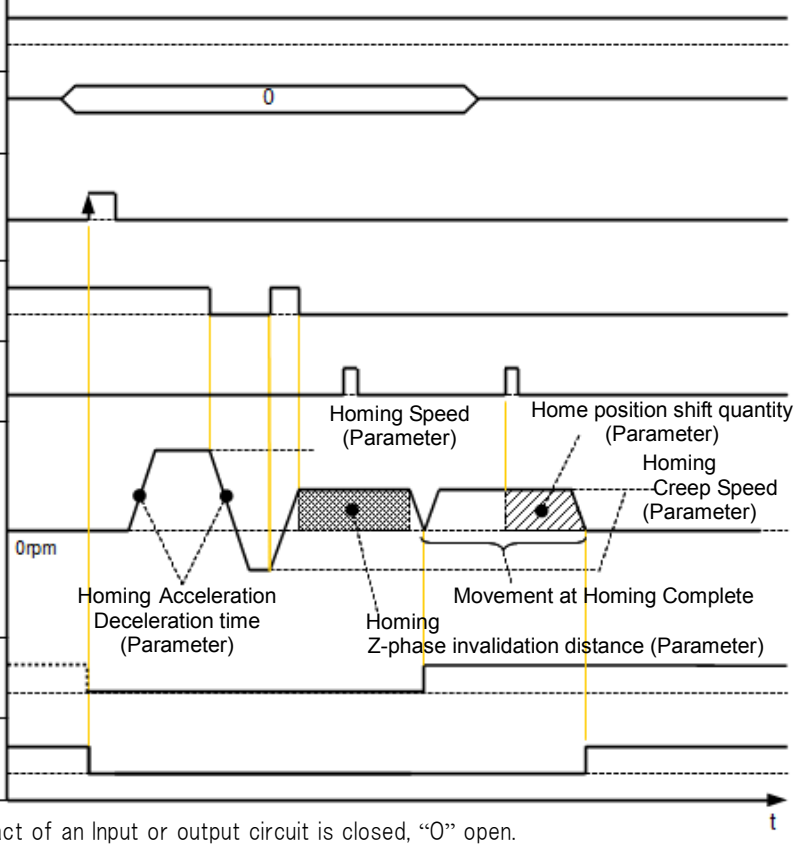


Figure 6-9-25 Chart of Position Projected on X-axis
(Homing with Dog Front End or Z-phase)

Item	User I/O Signal Name	I/O Input Output status		
Servo Status	SERVO	Input	ON OFF	C O
Point No. Selection	PCSEL1...4	Input	-	-
Homing Start	PCSTART1 (HOME)	Input	ON OFF	C O
Home position sensor	ORG	Input	ON OFF	C O
Encoder Z phase	-	Internal	ON OFF	-
Motor Rotational Speed	-	-	-	-
Return Complete	HEND	Output	ON OFF	C O
Operation Complete	MEND	Output	ON OFF	C O



Note) "C" in I/O Status indicates that the contact of an Input or output circuit is closed, "O" open.

Figure 6-9-26 Timing Chart

(Homing with Dog Front End or Z-phase)

- If「Action at Homing Completion(Parameter No.647.1)」="0:Stop" is your setting, Homing operation finishes without motor movement to the home position.
- If「Home Position Base Signal 1 Redetection(Parameter No.645.3)」="0:Disable" is your setting, the motor doesn't move backwards after the detection of Home position dog front end.
- When starting point of Homing is on a home position dog, the motor moves backwards departing from the home position dog, and turnaround and move forward at the Homing Creep Speed till the dog front end gets detected.

3) Moving away from the home position dog

The following describes cases when the setting of Parameter No.645.0「Base Signal 1 Selection for Home Position」is “2: Home position dog front end”.

If the starting point is on a home position dog, the motor moves backwards until homing can be started, then homing starts.

Here is an example where the starting point is on a home position dog and「Base Signal 2 Selection For Home Position (Parameter No.645.1)」=“1: Encoder Z-phase ”

Regardless of the setting of「Home Position Base Signal 1 Redetection (Parameter No.645.3)」, the motor moves backwards and moves forward at the specified creep speed. That is, after moving against the homing Direction and moving away the home position dog, the motor turns back to move at the Homing Creep Speed until the home position dog gets detected again.

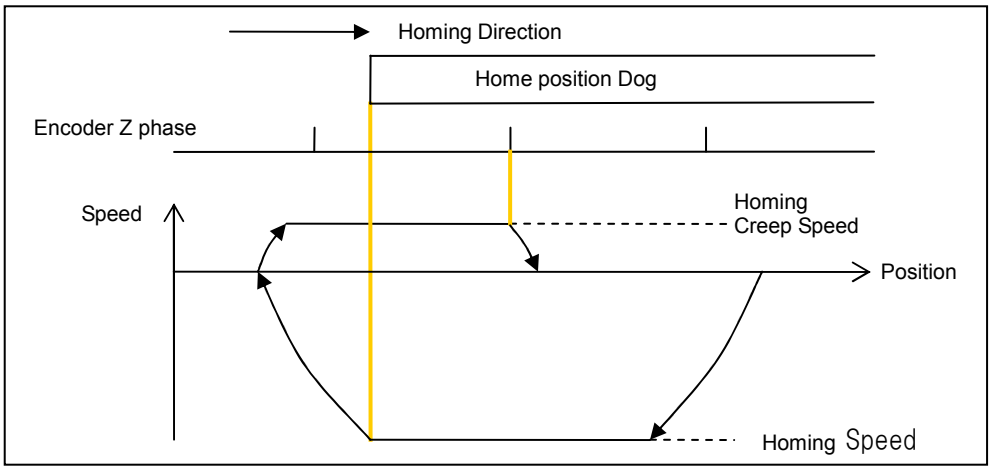


Figure 6-9-27 Moving Away From Home Position Dog
(When the starting point is on a home position dog)

7. Troubleshooting

7 Troubleshooting

Contents

Figures

Tables

7-1. Alarm Displays

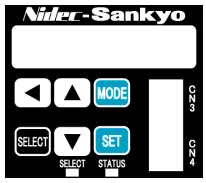
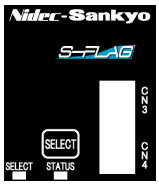
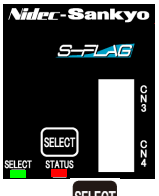
■ Alarm Displays

When an alarm occurs, the STATUS LED of the amplifier will turn from green to red and the Setup Panel displays『Err.**』(** is an alarm number). Refer to Table 7-2-1 List of Alarms for problem details and solutions corresponding to the alarm number.
Note that『Err.**』will not be displayed in Parameter Setting Mode, Auto Tuning Mode, Parameter Saving Mode, and Auxiliary Function Mode. When the MODE button is pressed several times to switch to another mode,『Err.**』will be displayed. To find how to work with the Setup Panel, please refer to the section 4-3 selecting an Operation Mode in Chapter 4.

■ Alarm Displays for Multi-Axis Amplifier

When an alarm occurs, the STATUS LED of the amplifier will turn from green to red.
Select the amplifier that outputs the alarm by pressing the SELECT button, and show the alarm display on the Setup panel of the main amplifier.

Table 7-1-1 LED STATUS Display

STATUS LED	Meaning	Setup Panel display example on Single-shaft amplifier or Main amplifier	Setup Panel display on Sub-amplifier	Status details
Dim	The amplifier is idle.			Control power OFF or Amplifier not starting
Green light	Normal（No alarms）			Control power ON and Amplifier working
Red light	Alarm ON (This example is showing Alarm No.15)		 Press SELECT to display on the main amplifier.	For the Alarm No. and corresponding status and solutions, refer to Table 7-2-1 “List of Alarms”.

■ Alarm Display on S-TUNE

Alarm information can be found on the current alarm under the “ALARM” tab in the S-FLAG setup application “S-TUNE” interface. Refer to the “S-TUNE instruction manual” to operate S-TUNE. Please have the alarm information in hand when contacting us regarding the alarm message.

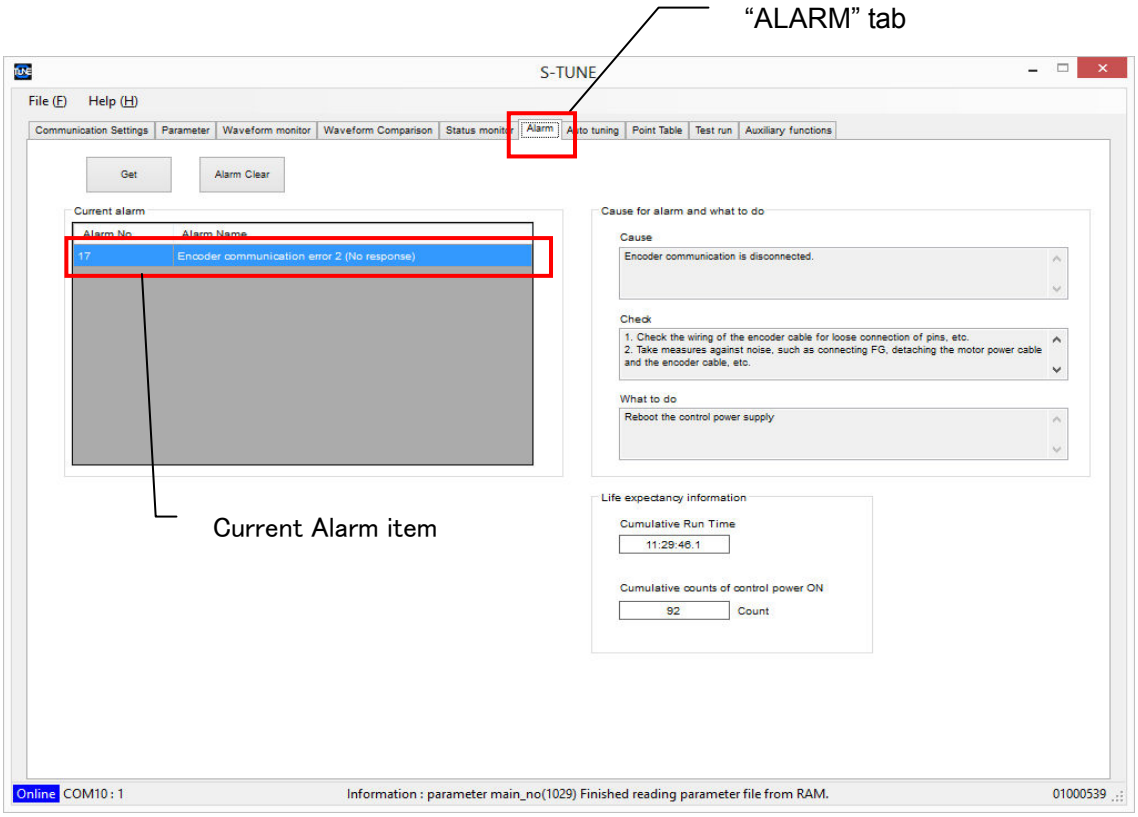


Figure 7-1-1 Alarm Display under the ALARM tab in S-TUNE

7-2. Alarms and Solutions

Please refer to Table. 7.2.1 List of Alarms for troubleshooting for alarms and alarm reset methods.

The following describes three ways to reset alarms depending on the alarm type.

① Signal Reset

This is a way to reset an alarm by sending the alarm reset signal (CN1 RESET) from the host controller to the amplifier. Refer to the section 5-6 and 5-7 in Chapter 5 “Timing Chart “and input the RESET signal.

② Control Power Restart

Restart the control power.

③ Encoder Status Clear and Control Power Restart

After executing Encoder Status Clear through S-TUNE, reboot the control power.

Table 7-2-1 List of Alarms

Alarm No.	Alarm Content	When the alarm occurs	Problem details and Troubleshooting	Reset Alarm by
0	System Error	After turning on the control power	· Errors in control circuit · Please contact us at our agency office.	②
1	EEP data error		· Errors upon writing parameters · Check the cable and write the parameters again.	①
2	Product code error		· Failing to read in the product type code · Check for proper paring of the motor and amplifier. · Check the encoder cable wiring.	②
4	Overspeed error	After turning the servo	· Errors in Position Control and Speed Control. · Adjust parameter setting. · Check for improper commands. E.g. the revolving speed is too high, acceleration time is too short, and so on. · Check the wiring of the motor power cable and encoder cable. · Check that the brake is released.	①
5	Speed deviation error			
6	Position deviation error			
7	Overload error			
8	Command overspeed error			
9	Encoder pulse output frequency error	After turning on the control power	· The frequency of the encoder pulse output is exceeding 4Mpps. · Check the values of the parameters No.276.0/278.0 “Encoder pulse output Division and multiplication (Numerator)/(Denominator)” · Check the encoder pulse count.	②

7−2 Alarms and Solutions

Alarm No.	Alarm Content	When the alarm occurs	Problem details and Troubleshooting	Reset Alarm by
10	Positioning command overflow/home position return failure	After turning on the servo	· The internal position command is exceeding the absolute range (i.e. between -1,073,741,823 and +1,073,741,823) or one command shift amount exceeds +/-2,147,483,647. · Timeout error occurred during home position return. · Check the Internal position command. · Check the position of positioning operation, inching, and shift amount setting of test run. · Check the parameter setting for home position return.	①
11	Encoder multi-rotation counter overflow	After turning on the control power	· The multi-rotation data of the encoder is over the default value (32767). · Check the value of Absolute system selection (Parameter No.257.0). · Verify Movement amount is within 32767 rotations.	②
12	Overheat error	After turning on the servo	· Control circuit overheat · Lower the ambient temperature below the specification temperature. · Install the amplifier as instructed in “3-1.5 Mounting Orientation and Space” in Chapter 3.	①
14	Overvoltage error		· Control primary circuit voltage is abnormally high. · Check regenerative voltage alarm signal, and if needed, install a regenerative resistor.	
15	Power supply error		· Primary circuit voltage error (high or low) in the power supply part, AC200V error, or regeneration continuously ON. · Check the wiring of the AC200V cable and the primary circuit power supply distribution cable. · Refer to the sections 5.1 and 5.2 in Chapter 5 and adjust the AC200V power supply input and timing of the servo-on. · Check the regenerative voltage alarm signal, and if needed, install a regenerative resistor.	
16	Encoder communication Error 1 (Error in the received data)	After turning on the control power	· Primary circuit voltage error in the power supply part · Check the wiring of the encoder cable for loose connection of pins, etc. · Take measures against noise, such as connecting FG, detaching the motor power cable and the encoder cable, etc.	②
17	Encoder communication Error 2 (No response)		· Encoder communication is disconnected. · Check the wiring of the encoder cable for loose connection of pins, etc. · Take measures against noise, such as connecting FG, detaching the motor power cable and the encoder cable, etc. · If the encoder cable is too long, make it short. The recommended cable length is 20 meters or less.	

7–2 Alarms and Solutions

Alarm No.	Alarm Content	When the alarm occurs	Problem details and Troubleshooting	Reset Alarm by
18	Encoder error	After turning on the control power	· Error(s) in the encoder itself · Contact us at our agency office.	②
19	Encoder communication Error 3 (no communication in both ways)		· The initial communication with the encoder is disconnected. · Check the wiring of the encoder cable. · When the encoder cable is too long, shorten it. The recommended cable length is 20 meters or less.	
20	Multi-rotation data error		· Multi-rotation data is rapidly changing temporarily. · Check the wiring of the encoder cable for loose connection of pins, etc. · Take measures against noise, such as connecting FG, detaching the motor power cable and the encoder cable, etc.	
21	Encoder voltage drop	After turning on the control power	· Multi-rotation data is rapidly changing temporarily due to the encoder voltage drop. · Check whether the battery voltage is not dropping when you are using the absolute encoder. · Check whether the battery cable is detached.	③
22	Voltage drop in the control power supply	After turning the servo on	· Voltage drop in the control power supply (DC24V	①
23	Base circuit disconnection		· No power supply to the base circuit. · Contact us at our agency office.	
24	Overcurrent error		· Control circuit error · Check the wiring of the motor power cable and the primary circuit power distribution cable for ground fault, UVW mistake, and etc. · If rapid ccw/cw reversals of rotation are observed, slow down the reversals of rotation, for example by extending acceleration/deceleration time or putting in command smoothing.	
25	Inverter error 1		· Control circuit error · Check the wiring of the motor power supply cable and the primary circuit power distribution cable for ground fault, UVW mistake, and etc.	
26	Inverter error 2 (Servo ON timeout)			
27	Current sensor error		· Current sensor error · Check the ambient temperature of the amplifier. · Contact us at our agency office.	
29	Voltage drop in the 5V control power supply		· Voltage drop in the control power supply (DC5V) · Check whether there is no short circuit in the wiring of the encoder cable. · Contact us at our agency office.	

7-3. Troubleshooting for other problems

Check the following if the amplifier doesn't get turned on or the motor doesn't rotate even though there are no alarms.

Problem	Problem details	Reference
Problem 1 No display on Setup Panel	The control power is on, but S-FLAG is not displayed on Setup Panel.	Table 7-3-1
Problem 2 Servomotor not ON	S-FLAG is displayed on the Setup Panel, but the servomotor doesn't get turned on.	Table 7-3-2
Problem 3 No motor rotation	The servomotor is on, but it is not rotating.	Table 7-3-3
Problem 4 Unstable motor movement	The motor movements are unstable.	Table 7-3-4
Problem 5 Vibration and abnormal noise	The motor vibrates or makes noise.	Table 7-3-5

7−3 Troubleshooting for other problems

■ Problem 1 (No display on Setup Panel)

The control power is on, but S-FLAG is not displayed on the Setup Panel.

Table 7-3-1 Problem 1
(No display on Setup Panel)

Cause	Solution
The control power DC24V is not connected to the User I/O connector.	Connect the User I/O connector to DC24V. Connect DC24V to the pins 1 and 3, GND to the pins 2 and 12.
The User I/O connector is loose.	Tighten the connections.
The DC24V voltage is low.	Check the DC24V voltage capacity.
The amplifier is faulty.	Contact us at our agency office.

■ Problem 2 (Servomotor not ON)

S-FLAG is displayed on the Setup Panel, but the servomotor doesn't get turned on.

Table 7-3-2 Problem 2
(Servomotor not ON)

Cause	Solution
The servo on signal (SVON) hasn't been sent.	Input the SVON signal of the host controller to the User I/O connector.
Alarm No.15 is displayed. No input of AC200V power supply	Check if the CHARGE LED is on. If not, check if the AC200V connectors (L1/L2/L3) are not loose and there is no problem with the AC200V output.
"Alarm 15" is displayed. For the multi-axis amplifier, the primary circuit power is not on.	Turn on the primary circuit power supply.
The motor power output connector (U/V/W) is loose.	Install the connectors tight. Refer to the connector installation instructions in the S-FLAG instruction manual.
The amplifier is faulty.	Please contact us at our agency office.

■ Problem 3 (No motor rotation)

The servomotor is on, but it is not rotating.

Table 7-3-3 Problem 3
(No motor rotation)

Cause	Solution
Basic parameter setting is not right.	Refer to Table 6-2-4, Table 6-3-2, Table 6-4-2, and Table 6-5-2 in Chapter 6, and make the basic parameter settings right for the control mode that you are using. For Position Control mode and Internal Position Command mode, see the reference material No. 4 S-FLAG series Positioner functions.
Mainframe command input is not right.	Check the mainframe command input. Examine the waveforms of Pulse Train command input (Position) or Analogue Speed command input, and make sure that appropriate commands are entered. Check parameters such as “division and multiplication (Numerator/Denominator)”. It’s possible that the motor is rotating extremely slowly.
Connection problem in the User I/O connector command input	Have proper connections referring to Figure 6-2-1, Figure 6-2-2, Figure 6-2-3, Figure 6-3-1, Figure 6-4-1, and Figure 6-5-1 in Chapter 6. For Position Control mode and the Internal Position Command mode, please refer to the reference material No. 4 S-FLAG series Positioner Functions.
No command input is allowed.	Make “HOLD” and “COM-” pins of the User I/O connector open.
Torque command limit setting is not right.	When using the torque command limit, have proper settings for the parameters No.147.0 and No.148.0.
The CW/CCW-drive restriction is enabled.	When not using the CW/CCW-drive restriction capability, set the parameter 67.0 to “0”. When having the drive restriction enabled, connect both CCWL and CWL pins of the user I/O connector with either “COM-“ or “closed” (e.g. CCWL with closed and CWL with COM-).

■ Problem 4 (Unstable motor movement)

The motor movements are unstable.

Table 7-3-4 Problem 4
(Unstable motor movements)

Cause	Solution
FG or GND isn't connected properly.	Have the FG or GND properly connected.
Speed command or Position command is not stable.	Check the command input of the motor using "waveform monitor" in S-TUNE. Check connections and tighten any loose wiring and connections.
Tuning is not complete.	Adjust the parameters.
The motor rotates without any host command input.	For Position Control, set a right value in the parameter No.33.0 "Pulse train command - Input filter selection". For Speed Control, adjust the parameter No. 60.0 "Analog speed command - Fixed offset value". For Torque Control, adjust the parameter No.300.0 "Analog torque command Fixed offset value".
The command is under noise interference.	In environments prone to noise interference, use shielded twist-pair cables for the I/O cable. Do likewise for the encoder cable and also have the cable length not exceeding 20m.

Cause	Solution
The positioning is off.	In the Position Control mode or Pulse train command mode, set a right value in the parameter No.33.0 “Pulse train command - Input filter selection”. Check if the pulse output of a host controller such as PLC is not exceeding the upper limit. Check agreements between the following pairs: 1. Status of No.33 “Pulse train command input – position” vs output from the host controller 2. Status of No.65 “Position command” vs Status of No.67 “Position feedback” 3. A product of Status of No.67 and parameters No.276.0/278.0 “Encoder pulse output Division and multiplication (Numerator)/(Denominator)” vs Position feedback from the host control device If any disagreements are discovered, noise interference could be a cause of the problem. Take countermeasures for noise such as correct FG connection, adjustment of the parameter No.33.0, use of shielded twisted-pair cables for the I/O cable and so on. In the case of 2 above, it’s possible that the control gain is not valid and the positioning deviation is not converging. Adjust the control gain if that’s the case.

Cause	Solution
Home position return is off the point.	Check the command input from the host device. In S-TUNE, observe the waveforms of the Pulse train command input (Position) or Analog speed command input and check if a normal command is entered. Check if the host controller is obtaining the Z-phase correctly. If the Z-phase pulse width is too small, make the pulse width wider using the parameters No. No.276.0 and No.278.0 “Encoder pulse output Division and multiplication (Numerator)/(Denominator)”. As a rule of thumb, PLC requires pulse width of 1ms or larger. When operating Home Position Return with the positioner functions refer to the section 6.9 “Return to Home Position” in Chapter 6 and set each parameter to an appropriate value.

7−3 Troubleshooting for other problems

■Problem 5 (Vibration and Abnormal Noise)

The servomotor vibrates or makes abnormal noise.

Table 7-3-5 Problem 5
(Vibration and Abnormal Noise)

Cause	Solution
Gain is too large.	Adjust the gain.
There is looseness or misalignments in machines or devices.	Check for installation of the motor, decelerator, couplers and so on.
Interference noise is occurring.	Check the cable lengths and shields. Isolate the high voltage cable such as a motor power cable from the signal cable such as encoder cables.
The device and the motor are resonating.	In case of vibration with low frequencies, adjust the position command smoothing filter. In case of vibration with high frequencies, adjust the low-pass-filter or notch-filter.
The combination of the amplifier and the motor is not right.	Check the motor model code under the “Communication Settings” tab in S-TUNE. When the combination of the motor to amplifiers is not right, delete the EEPROM parameters and change the motor model.

8. Appendix

8 Appendix

Contents

8 Appendix

Figures

Tables

8-1. Cables

Connection cables for the Servo products are sold separately.
Standard cables for S-FLAG Series can be purchased at the Misumi Corporation online store using Misumi e-Catalog. You can take advantages of this store for small orders based on cable lengths you need and expect fast delivery. For the Sankyo Servo motor standard cables, follow the link to the Misumi site at our website: http://www.nidec-sankyo.co.jp/product/motor/servo_cable.html.
Prepare cables suitable for the actual conditions of your use. See below for our recommendations.

8-1-1 Recommended Cable Materials

Table 8-1-1 Recommended Cable Materials

Cable for	AWG	UL	Resistance to Heat	Remark
Motor power (750W or less)	18	2517	105℃	
Motor power (1kW or more)	14 (Note 1)	2501	105℃	
AC200V input (750W or less) Including FG cable	18	1015 equivalent	105℃	
AC200V input (1kW or more) Including FG cable	14 (Note 1)	1015 equivalent	105℃	
Encoder	Power :22 Signal:24	20276	80℃	5-pair (10-core) with shield 20m max (when using shielded twisted-pair cables)
User I/O	26	1007 equivalent	80℃	shielded twisted-pair cable 50cm or shorter
Regeneration resistor connection	18	1015	105℃	
Brake	18	2517	105℃	1-pair (2-core)
Main circuit DC power distribution (750W or less) (Note 2)	18	1015	105℃	
Main circuit DC power distribution (1kW or more) (Note 2)	14 (Note 1)	1015	105℃	
Communication between amplifiers (Note 2)	28	20539 equivalent	80℃	10-core flat cable Included (2.54mm pitch)

Select cable lengths suitable for the actual configuration of yours.

Note 1) For the 1kW servomotor, AWG16 cables may be used.

Note 2) This is for multi-axis amplifiers.

8-1-2 Example of Recommended Cables

■ Motor Cable (750W or less)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA3CT-18-4		株式会社 MISUMI MISUMI Group Ink
2	裸圧着端子丸型 RING TONGUE TERMINAL	R2-4	日本圧着端子相当品可 J.S.T. equivalent goods	日本圧着端子製造(株) J.S.T. Mfg.CO.,Ltd.
3	フェルール FERRULE	216-143	ワゴジャパン相当品可 WAGO equivalent goods	ワゴジャパン(株) WAGO
4	ハウジング HOUSING	172159-1		タイコエレクトロニクスアンプ(株) AMP
5	ターミナル TERMINAL	170366-1		タイコエレクトロニクスアンプ(株) AMP
6	スミチューブF(Z) SUMITUBE F(Z)	11X0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
7	マークチューブ MARK TUBE		印字内容<FG> 印字色:黒 下地色:白 Print collor:black Base collor:white	

注:⑤AMP製ターミナルはリード線絶縁被覆外形に合わせること。

④の結線
LEAD WIRE CONNECTION ④

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号名 SIGNAL
1	AWG18	RED	U
2		WHITE	V
3		BLUE	W
4		GREEN and YELLOW	FG

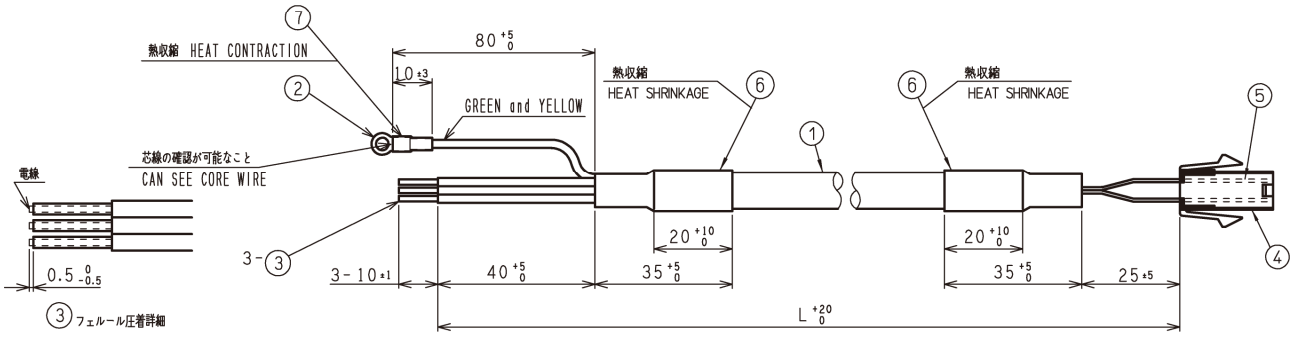


Figure 8-1-1 Motor Cable (750W or less, for stationary)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA3CTR-18-4		株式会社 MISUMI MISUMI Group Ink
2	裸圧着端子丸型 RING TONGUE TERMINAL	R2-4	日本圧着端子相当品可 J.S.T. equivalent goods	日本圧着端子製造(株) J.S.T. Mfg.CO.,Ltd.
3	フェルール FERRULE	216-143	ワゴジャパン相当品可 WAGO equivalent goods	ワゴジャパン(株) WAGO
4	ハウジング HOUSING	172159-1		タイコエレクトロニクスアンプ(株) AMP
5	ターミナル TERMINAL	170366-1		タイコエレクトロニクスアンプ(株) AMP
6	スミチューブF(Z) SUMITUBE F(Z)	11X0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
7	マークチューブ MARK TUBE		印字内容<FG> 印字色:黒 下地色:白 Print collor:black Base collor:white	

注:⑤AMP製ターミナルはリード線絶縁被覆外形に合わせること。

④の結線
LEAD WIRE CONNECTION ④

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号名 SIGNAL
1	AWG18	RED	U
2		WHITE	V
3		BLUE	W
4		GREEN and YELLOW	FG

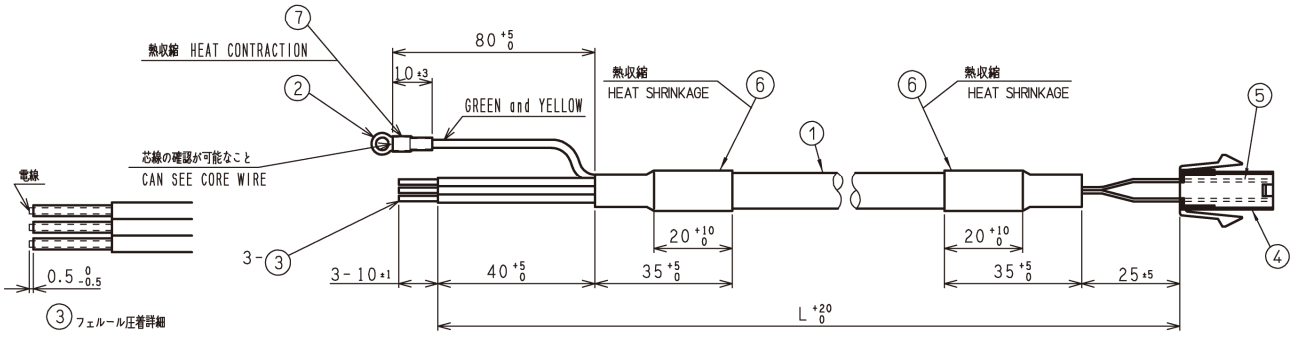


Figure 8-1-2 Motor Cable (750W or less, for mobile)

■ Motor Cable (1kW or more)

項番	品　名	型　名	備　考	メーカー名
1	リード線 CABLE	NA6CT-14-4		株式会社 MISUMI MISUMI Group Ink
2	裸圧着端子丸型 RING TONGUE TERMINAL	R2-4	日本圧着端子相当品可 J.S.T. equivalent goods	日本圧着端子製造(株) J.S.T. Mfg.CO.,Ltd.
3	フェルール FERRULE	216-106	ワゴジャパン相当品可 WAGO equivalent goods	ワゴジャパン(株) WAGO
4	プラグ PLUG	NMS3106B-18-10-S		日本電子工業(株) JAE
5	ケーブルクランプ CABLE CLAMP	NMS3057-10A		日本電子工業(株) JAE
6	スミチューブF(Z) SUMITUBE F(Z)	14X0.3	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
7	マークチューブ MARK TUBE		印字内容<FG> 印字色：黒 下地色：白 Print color:black Base color:white	

④ の結線
LEAD WIRE CONNECTION ④

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号名 SIGNAL
1	AWG14	RED	U
2		WHITE	V
3		BLUE	W
4		GREEN and YELLOW	FG

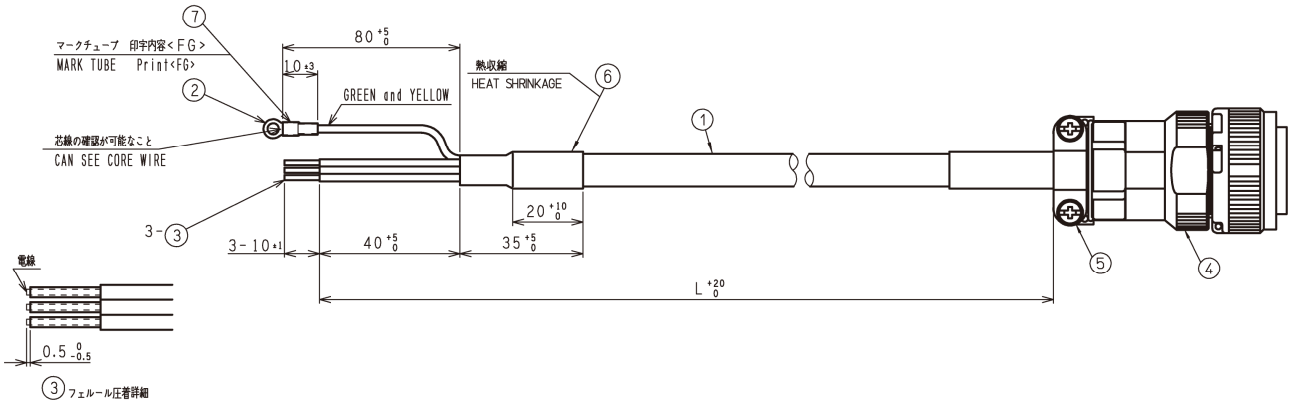


Figure 8-1-3　Motor Cable (1kW or more, for stationary)

項番	品　名	型　名	備　考	メーカー名
1	リード線 CABLE	NA6CTR-14-4		株式会社 MISUMI MISUMI Group Ink
2	裸圧着端子丸型 RING TONGUE TERMINAL	R2-4	日本圧着端子相当品可 J.S.T. equivalent goods	日本圧着端子製造(株) J.S.T. Mfg.CO.,Ltd.
3	フェルール FERRULE	216-106	ワゴジャパン相当品可 WAGO equivalent goods	ワゴジャパン(株) WAGO
4	プラグ PLUG	NMS3106B-18-10-S		日本電子工業(株) JAE
5	ケーブルクランプ CABLE CLAMP	NMS3057-10A		日本電子工業(株) JAE
6	スミチューブF(Z) SUMITUBE F(Z)	14X0.3	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
7	マークチューブ MARK TUBE		印字内容<FG> 印字色：黒 下地色：白 Print color:black Base color:white	

④ の結線
LEAD WIRE CONNECTION ④

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号名 SIGNAL
1	AWG14	RED	U
2		WHITE	V
3		BLUE	W
4		GREEN and YELLOW	FG

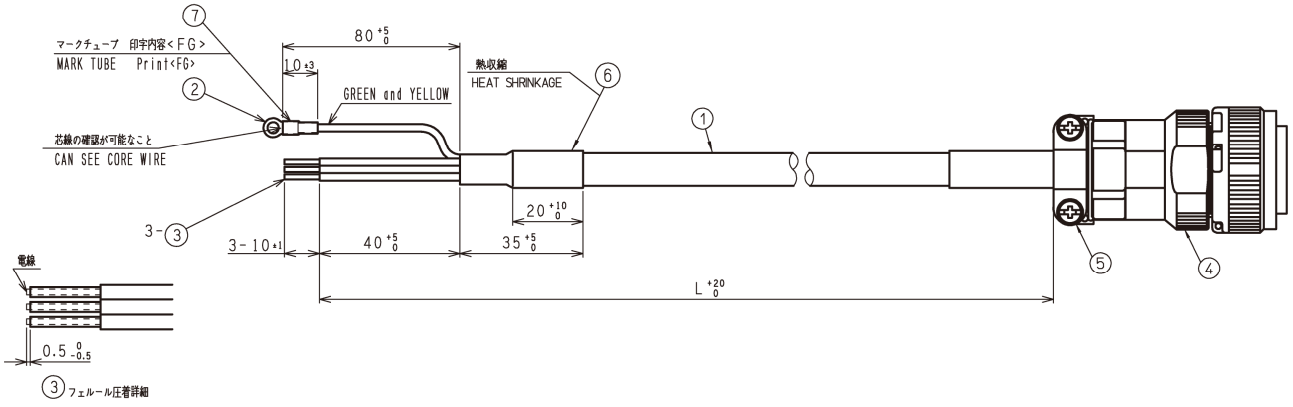


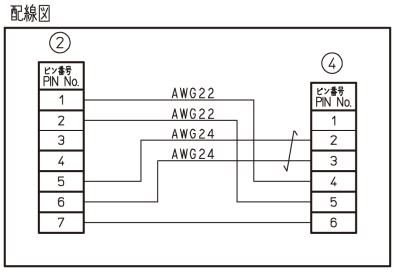
Figure 8-1-4　Motor Cable (1kW or more, for mobile)

■ Encoder Cable (Incremental 750W or less)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276TSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	172160-1		タイコエレクトロニクスアンプ(株) AMP
5	ターミナル TERMINAL	170365-1		タイコエレクトロニクスアンプ(株) AMP
6	スミチューブF(Z) SUMITUBE F(Z)	7X0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
7	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5X0.2	黒色 BLACK	

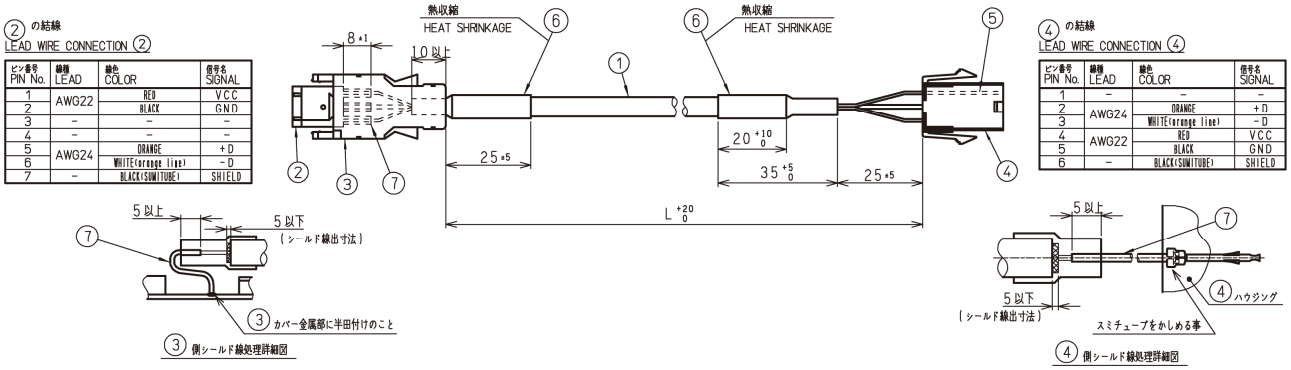
注：⑤AMP製ターミナルはリード線絶縁被覆外形に合わせること。

配線図



②の結線 LEAD WIRE CONNECTION ②

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号名 SIGNAL
1	AWG22	RED	VCC
2		BLACK	GND
3	–	–	–
4	–	–	–
5	AWG24	ORANGE	+D
6		WHITE(orange line)	-D
7	–	BLACK(SUMITUBE)	SHIELD



④の結線 LEAD WIRE CONNECTION ④

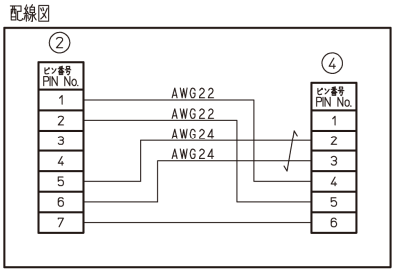
ピン番号 PIN No.	線種 LEAD	色 COLOR	信号名 SIGNAL
1	–	–	–
2	AWG24	ORANGE	+D
3		WHITE(orange line)	-D
4	AWG22	RED	VCC
5		BLACK	GND
6	–	BLACK(SUMITUBE)	SHIELD

Figure 8-1-5 Encoder Cable (750W or less, for stationary)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276RRSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	172160-1		タイコエレクトロニクスアンプ(株) AMP
5	ターミナル TERMINAL	170365-1		タイコエレクトロニクスアンプ(株) AMP
6	スミチューブF(Z) SUMITUBE F(Z)	7X0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
7	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5X0.2	黒色 BLACK	

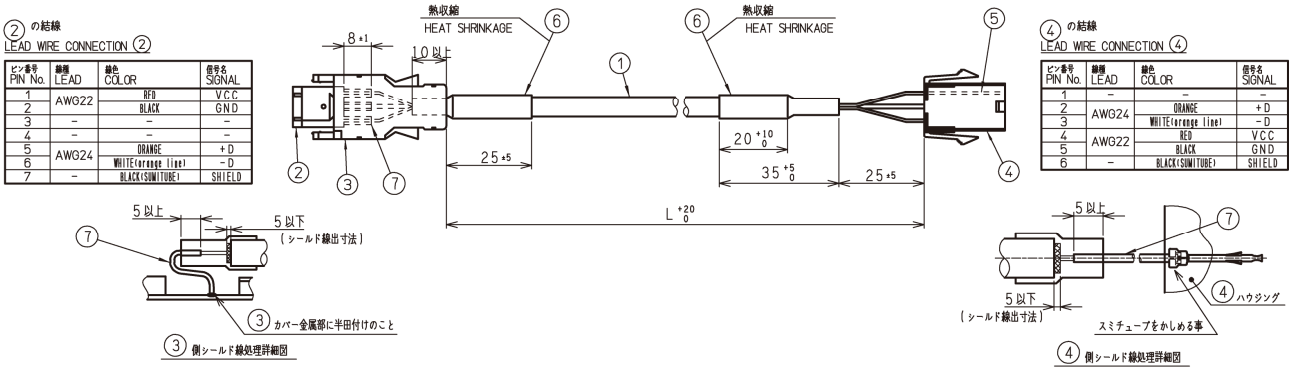
注：⑤AMP製ターミナルはリード線絶縁被覆外形に合わせること。

配線図



②の結線 LEAD WIRE CONNECTION ②

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号名 SIGNAL
1	AWG22	RED	VCC
2		BLACK	GND
3	–	–	–
4	–	–	–
5	AWG24	ORANGE	+D
6		WHITE(orange line)	-D
7	–	BLACK(SUMITUBE)	SHIELD



④の結線 LEAD WIRE CONNECTION ④

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号名 SIGNAL
1	–	–	–
2	AWG24	ORANGE	+D
3		WHITE(orange line)	-D
4	AWG22	RED	VCC
5		BLACK	GND
6	–	BLACK(SUMITUBE)	SHIELD

Figure 8-1-6 Encoder Cable (750W or less, for mobile)

■ Encoder Cable (Incremental 1kW or more)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276TSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	CM10-SP10S-M		第一電子工業(株) DDK
5	ターミナル TERMINAL	CM10-#22SC(C1)(D8)	1PIN 2PIN に圧着	第一電子工業(株) DDK
6	ターミナル TERMINAL	CM10-#22SC(C2)(D8)	5PIN 6PIN 10PIN に圧着	第一電子工業(株) DDK
7	スミチューブF(Z) SUMITUBE F(Z)	7×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
8	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5×0.2	黒色 BLACK	

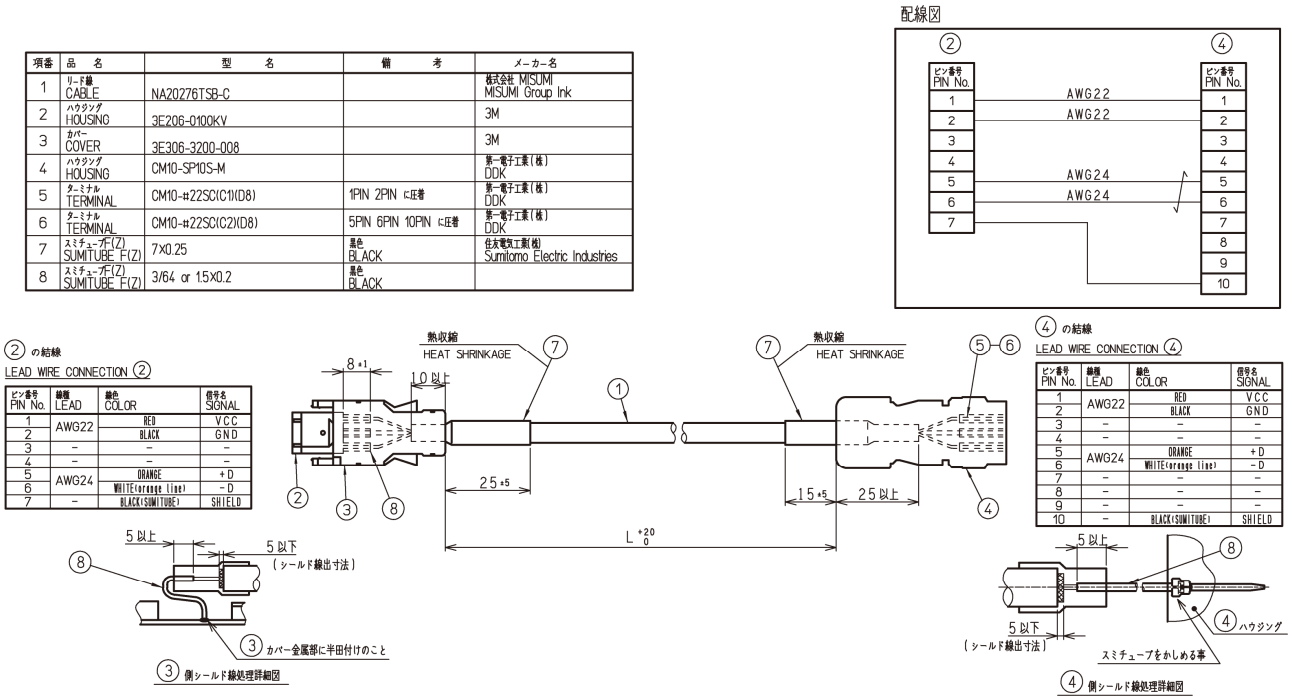


Figure 8-1-7 Encoder Cable (1kW or more, for stationary)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276RRSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	CM10-SP10S-M		第一電子工業(株) DDK
5	ターミナル TERMINAL	CM10-#22SC(C1)(D8)	1PIN 2PIN に圧着	第一電子工業(株) DDK
6	ターミナル TERMINAL	CM10-#22SC(C2)(D8)	5PIN 6PIN 10PIN に圧着	第一電子工業(株) DDK
7	スミチューブF(Z) SUMITUBE F(Z)	7×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
8	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5×0.2	黒色 BLACK	

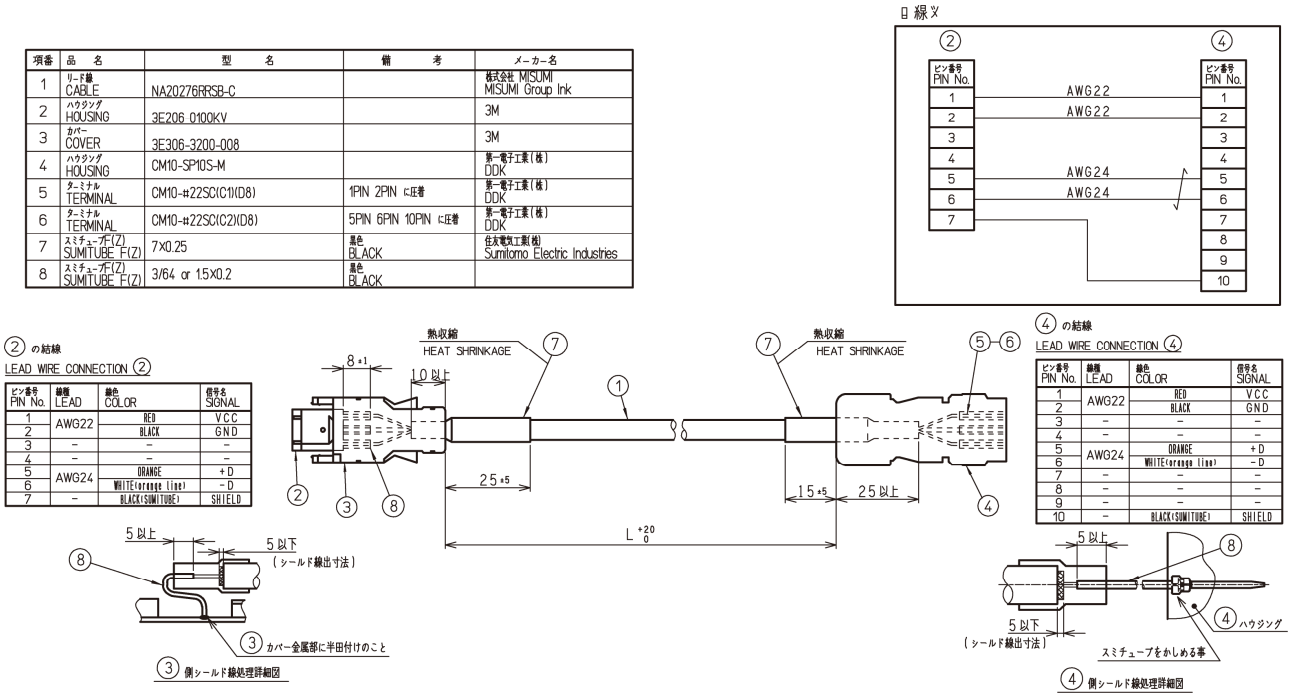


Figure 8-1-8 Encoder Cable (1kW or more, for mobile)

■ Encoder Cable (Absolute 750W or less)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276TSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	172161-1		タイコエレクトロニクス ジャパン合同会社 Tyco Electronics Japan G.K.
5	ターミナル TERMINAL	170365-1		タイコエレクトロニクス ジャパン合同会社 Tyco Electronics Japan G.K.
6	ターミナル TERMINAL	170366-1		タイコエレクトロニクス ジャパン合同会社 Tyco Electronics Japan G.K.
7	スミチューブF(Z) SUMITUBE F(Z)	7×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
8	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5×0.2	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
9	ハウジング HOUSING	DF3-2EP-2C		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
10	ターミナル TERMINAL	DF3-EP2428PCFA		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
11	リード線 CABLE	NAUL1007-24-BK	黒色 BLACK	株式会社 MISUMI MISUMI Group Ink
12	リード線 CABLE	NAUL1007-24-R	赤色 RED	株式会社 MISUMI MISUMI Group Ink

結線・配線図

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号 SIGNAL
1	AWG22	RED	VCC
2	AWG22	BLACK	GND
3	-	-	-
4	-	-	-
5	AWG24	ORANGE	+D
6	AWG24	WHITE(ORANGE Line)	-D
7	-	BLACK(SUMITUBE)	SHIELD

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号 SIGNAL
1	AWG24	RED	BAT
2	AWG24	BLACK	GND

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号 SIGNAL
1	AWG24	RED	BAT
2	-	-	-
3	-	BLACK(SUMITUBE)	SHIELD
4	AWG24	ORANGE	+D
5	AWG24	WHITE(ORANGE Line)	-D
6	-	-	-
7	AWG22	RED	VCC
8	AWG22 AWG24	BLACK ① BLACK ⑪	GND
9	-	-	-

注：⑤⑥ ターミナルはリード線絶縁被覆外形に合わせること。

注：⑥ターミナルは ④ の8Pinに適用し ①のBLACKと⑪を2本圧着する。

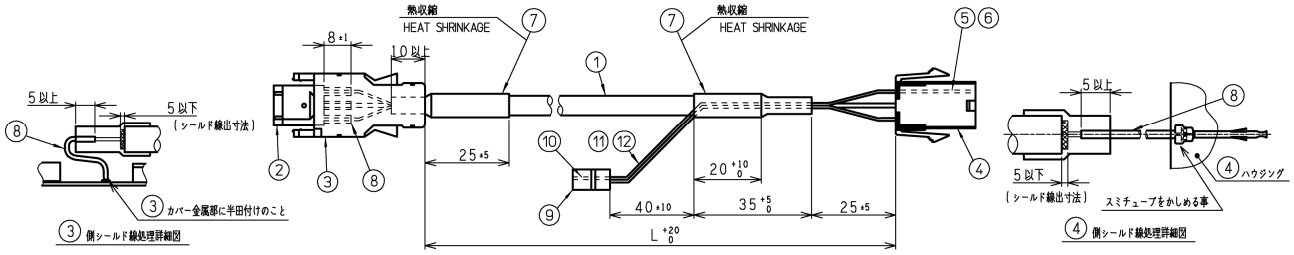


Figure 8-1-9 Encoder Cable (750W or less, for stationary)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276RRSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	172161-1		タイコエレクトロニクス ジャパン合同会社 Tyco Electronics Japan G.K.
5	ターミナル TERMINAL	170365-1		タイコエレクトロニクス ジャパン合同会社 Tyco Electronics Japan G.K.
6	ターミナル TERMINAL	170366-1		タイコエレクトロニクス ジャパン合同会社 Tyco Electronics Japan G.K.
7	スミチューブF(Z) SUMITUBE F(Z)	7×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
8	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5×0.2	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
9	ハウジング HOUSING	DF3-2EP-2C		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
10	ターミナル TERMINAL	DF3-EP2428PCFA		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
11	リード線 CABLE	NAUL1007-24-BK	黒色 BLACK	株式会社 MISUMI MISUMI Group Ink
12	リード線 CABLE	NAUL1007-24-R	赤色 RED	株式会社 MISUMI MISUMI Group Ink

結線・配線図

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号 SIGNAL
1	AWG22	RED	VCC
2	AWG22	BLACK	GND
3	-	-	-
4	-	-	-
5	AWG24	ORANGE	+D
6	AWG24	WHITE(ORANGE Line)	-D
7	-	BLACK(SUMITUBE)	SHIELD

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号 SIGNAL
1	AWG24	RED	BAT
2	AWG24	BLACK	GND

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号 SIGNAL
1	AWG24	RED	BAT
2	-	-	-
3	-	BLACK(SUMITUBE)	SHIELD
4	AWG24	ORANGE	+D
5	AWG24	WHITE(ORANGE Line)	-D
6	-	-	-
7	AWG22	RED	VCC
8	AWG22 AWG24	BLACK ① BLACK ⑪	GND
9	-	-	-

注：⑤⑥ ターミナルはリード線絶縁被覆外形に合わせること。

注：⑥ターミナルは ④ の8Pinに適用し ①のBLACKと⑪を2本圧着する。

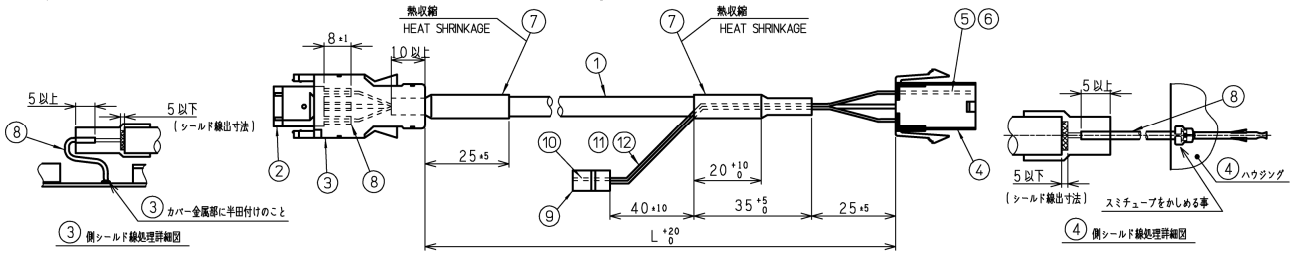


Figure 8-1-10 Encoder Cable (750W or less, for mobile)

■ Encoder Cable (Absolute 1kW or more)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276TSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	CM10-SP10S-M		第一電子工業(株) DDK
5	ターミナル TERMINAL	CM10-#22SC(C1)(D8)	1,2,4,9Pin に圧着	第一電子工業(株) DDK
6	ターミナル TERMINAL	CM10-#22SC(C2)(D8)	5,6,10Pin に圧着	第一電子工業(株) DDK
7	スミチューブF(Z) SUMITUBE F(Z)	7×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
8	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5×0.2	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
9	ハウジング HOUSING	DF3-2EP-2C		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
10	ターミナル TERMINAL	DF3-EP2428PCFA		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
11	リード線 CABLE	NAUL1007-24-BK	黒色 BLACK	株式会社 MISUMI MISUMI Group Ink
12	リード線 CABLE	NAUL1007-24-R	赤色 RED	株式会社 MISUMI MISUMI Group Ink

結線・配線図

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号 SIGNAL
1	AWG22	RED	VCC
2	AWG22	BLACK	GND
3	-	-	-
4	-	-	-
5	AWG24	ORANGE	+D
6	AWG24	WHITE(ORANGE Line)	-D
7	-	BLACK(SUMITUBE)	SHIELD

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号 SIGNAL
1	AWG24	RED	BAT
2	AWG24	BLACK	GND

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号 SIGNAL
1	AWG22	RED	VCC
2	AWG22	BLACK	GND
3	-	-	-
4	AWG24	RED	BAT
5	AWG24	ORANGE	+D
6	AWG24	WHITE(ORANGE Line)	-D
7	-	-	-
8	-	-	-
9	AWG24	BLACK	GND
10	-	BLACK(SUMITUBE)	SHIELD

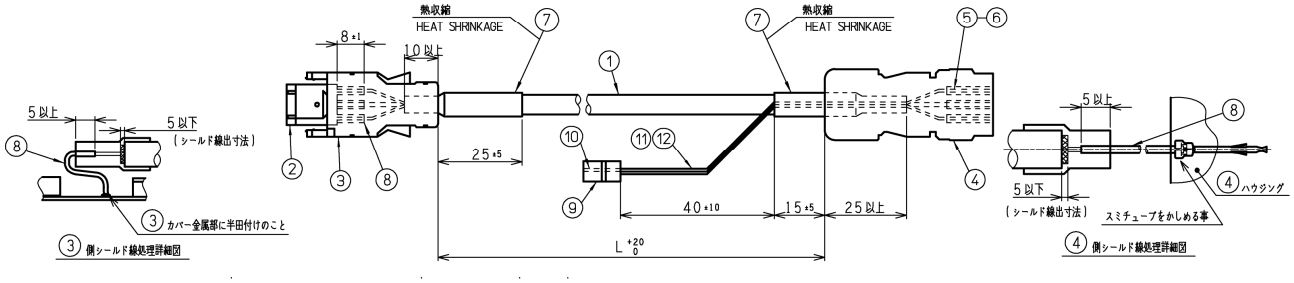


Figure 8-1-11 Encoder Cable (1kW or more, for stationary)

項番	品名	型名	備考	メーカー名
1	リード線 CABLE	NA20276RRSB-C		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	3E206-0100KV		3M
3	カバー COVER	3E306-3200-008		3M
4	ハウジング HOUSING	CM10-SP10S-M		第一電子工業(株) DDK
5	ターミナル TERMINAL	CM10-#22SC(C1)(D8)	1,2Pin に圧着	第一電子工業(株) DDK
6	ターミナル TERMINAL	CM10-#22SC(C2)(D8)	4,5,6,9,10Pin に圧着	第一電子工業(株) DDK
7	スミチューブF(Z) SUMITUBE F(Z)	7×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
8	スミチューブF(Z) SUMITUBE F(Z)	3/64 or 1.5×0.2	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries
9	ハウジング HOUSING	DF3-2EP-2C		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
10	ターミナル TERMINAL	DF3-EP2428PCFA		ヒロセ電機(株) HIROSE ELECTRIC CO.,LTD
11	リード線 CABLE	NAUL1007-24-BK	黒色 BLACK	株式会社 MISUMI MISUMI Group Ink
12	リード線 CABLE	NAUL1007-24-R	赤色 RED	株式会社 MISUMI MISUMI Group Ink

結線・配線図

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号 SIGNAL
1	AWG22	RED	VCC
2	AWG22	BLACK	GND
3	-	-	-
4	-	-	-
5	AWG24	ORANGE	+D
6	AWG24	WHITE(ORANGE Line)	-D
7	-	BLACK(SUMITUBE)	SHIELD

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号 SIGNAL
1	AWG24	RED	BAT
2	AWG24	BLACK	GND

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号 SIGNAL
1	AWG22	RED	VCC
2	AWG22	BLACK	GND
3	-	-	-
4	AWG24	RED	BAT
5	AWG24	ORANGE	+D
6	AWG24	WHITE(ORANGE Line)	-D
7	-	-	-
8	-	-	-
9	AWG24	BLACK	GND
10	-	BLACK(SUMITUBE)	SHIELD

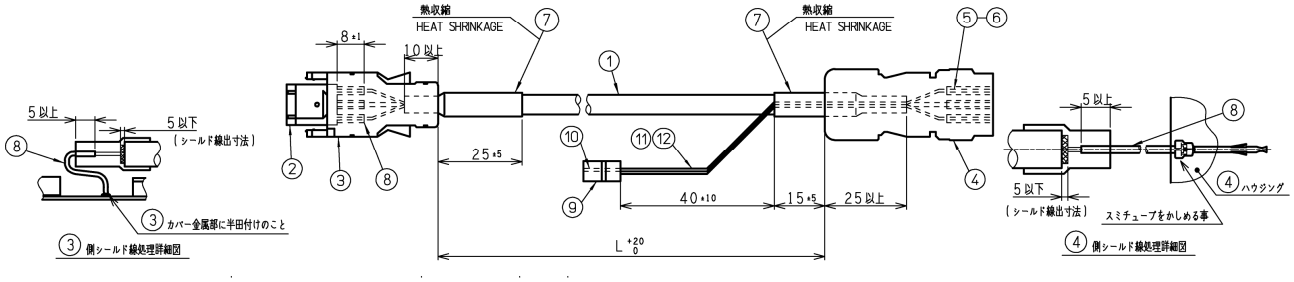


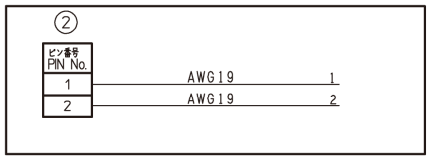
Figure 8-1-12 Encoder Cable (1kW or more, for mobile)

■ Brake Cable（750W or less）

項番	品　名	型　名	備　考	メーカー名
1	リード線 CABLE	MAST-UL2517-19-2		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	172157-1		タイコエレクトロニクスアンプ(株) AMP
3	ターミナル TERMINAL	170366-1 or 170639-1		タイコエレクトロニクスアンプ(株) AMP
4	スミチューブF(Z) SUMITUBE F(Z)	8×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries

注：③AMP製ターミナルはリード線絶縁被覆外形に合わせること。

配線図



②の結線
LEAD WIRE CONNECTION ②

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号名 SIGNAL
1	AWG19	BLACK 1	BRK+
2		BLACK(white line)	BRK-

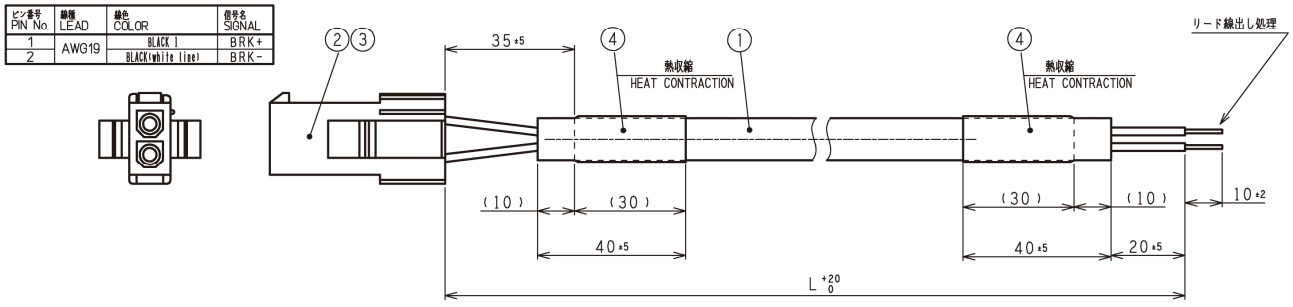
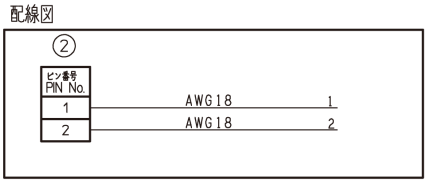


Figure 8-1-13　Brake Cable (750W or less, for stationary)

項番	品　名	型　名	備　考	メーカー名
1	リード線 CABLE	NA3UCR-18-2		株式会社 MISUMI MISUMI Group Ink
2	ハウジング HOUSING	172157-1		タイコエレクトロニクスアンプ(株) AMP
3	ターミナル TERMINAL	170366-1 or 170639-1		タイコエレクトロニクスアンプ(株) AMP
4	スミチューブF(Z) SUMITUBE F(Z)	8×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries

注：③AMP製ターミナルはリード線絶縁被覆外形に合わせること。

配線図



②の結線
LEAD WIRE CONNECTION ②

ピン番号 PIN No.	線種 LEAD	色 COLOR	信号名 SIGNAL
1	AWG18	BLACK 1	BRK+
2		BLACK 2	BRK-

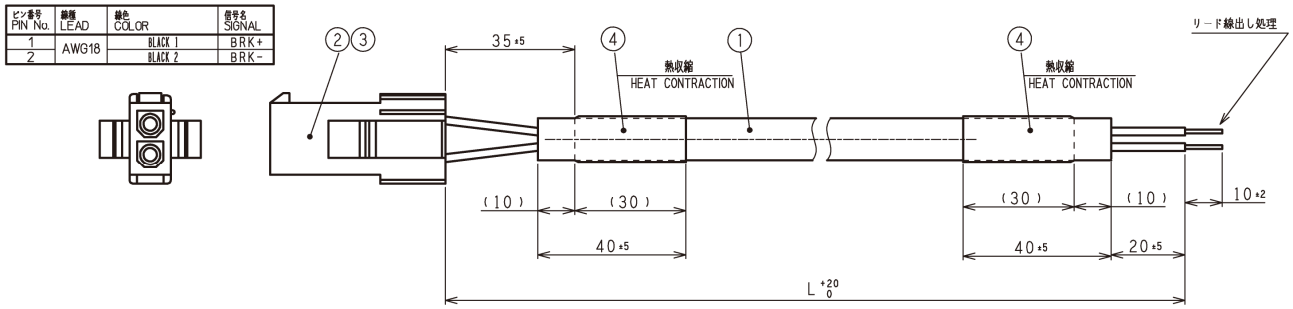
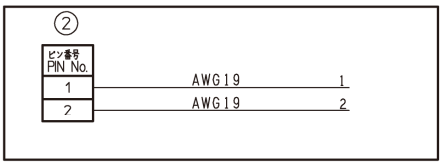


Figure 8-1-14　Brake Cable (750W or less, for mobile)

■ Brake Cable（1kW or more）

項番	品　名	型　名	備　考	メーカー名
1	リード線 CABLE	MAST-UL2517-19-2		株式会社 MISUMI MISUMI Group Inc
2	プラグ PLUG	CM10-SP2S-M-D		第一電子工業(株) DDK
3	コンタクト CONTACT	CM10-#22SC(S2)(D8)-100		第一電子工業(株) DDK
4	スミチューブF(Z) SUMITUBE F(Z)	8×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries

配線図



② の結線
LEAD WIRE CONNECTION ②

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号名 SIGNAL
1	AWG19	BLACK 1	BRK+
2		BLACK(white line)	BRK-

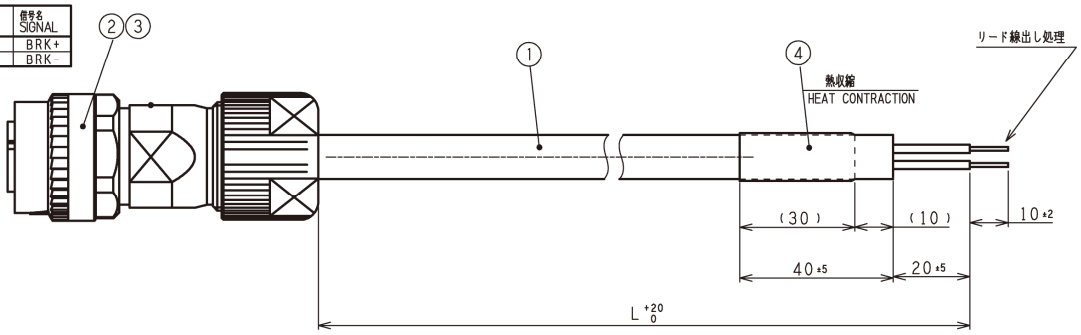
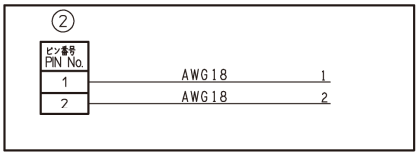


Figure 8-1-15　Brake Cable (1kW or more, for stationary)

項番	品　名	型　名	備　考	メーカー名
1	リード線 CABLE	NA3UCR-18-2		株式会社 MISUMI MISUMI Group Inc
2	プラグ PLUG	CM10-SP2S-M-D		第一電子工業(株) DDK
3	コンタクト CONTACT	CM10-#22SC(S2)(D8)-100		第一電子工業(株) DDK
4	スミチューブF(Z) SUMITUBE F(Z)	8×0.25	黒色 BLACK	住友電気工業(株) Sumitomo Electric Industries

配線図



② の結線
LEAD WIRE CONNECTION ②

ピン番号 PIN No.	線種 LEAD	線色 COLOR	信号名 SIGNAL
1	AWG18	BLACK 1	BRK+
2		BLACK 2	BRK-

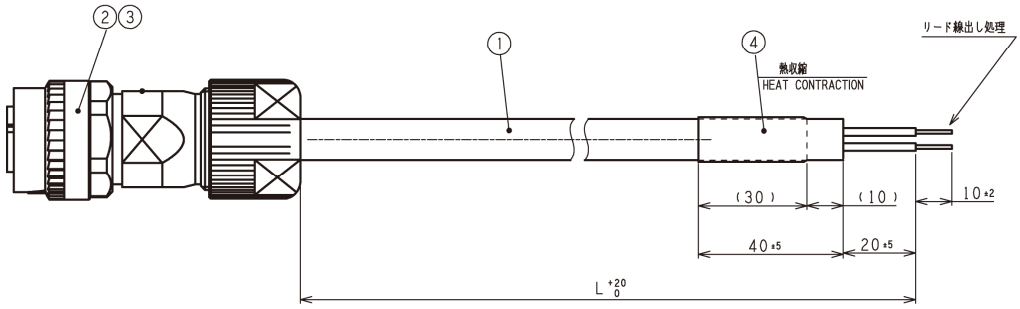


Figure 8-1-16　Brake Cable (1kW or more, for mobile)

8-2. Included Connectors

8-2-1 Connections and Disconnections of Connectors and Cables

① Included connectors for the Servo amplifier :
an AC200V input/regeneration resistor connector and a motor power output connector

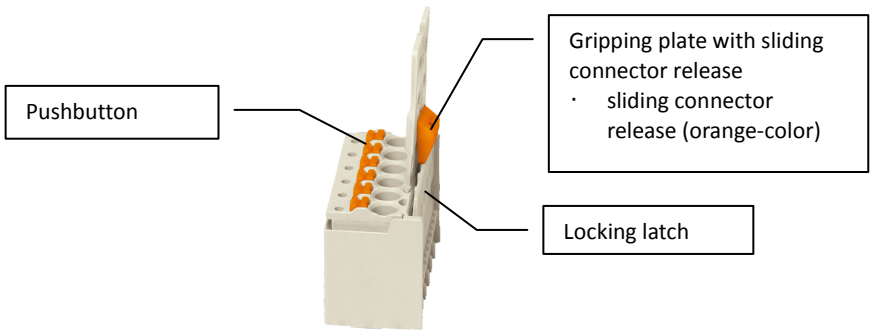
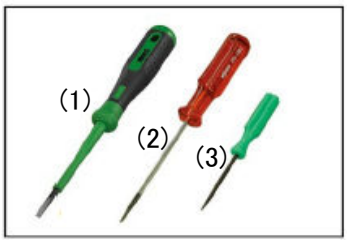


Figure 8-2-1 Connector Parts

② Recommended tolls and how to strip cables

Screwdrivers (specifically for pushbutton manipulation):
Use those for connection (or disconnection) of cables to (or from) connectors.

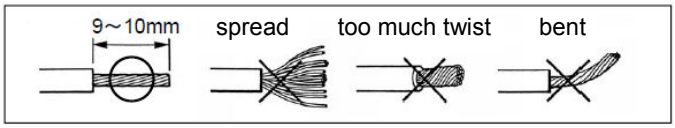


(1) 210-720 (standard type made in Europe)
(2) 210-120j (standard type made in japan)
(3) 210-350/01(short type)

· Wire stripper: Use one which makes a clean cut and doesn't damage wires.

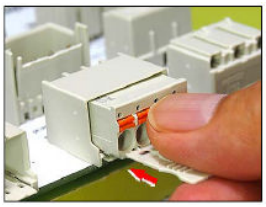
206-124 QUICKSTRIP 10

· Trim cable wrap and keep inner wires in good shape like the first one below.

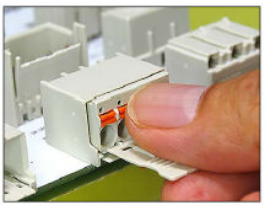


③ Connecting connectors

■ How to connect the AC200V input/regeneration resistor connector

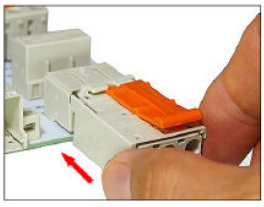


Hold the grip plate and insert the connector.

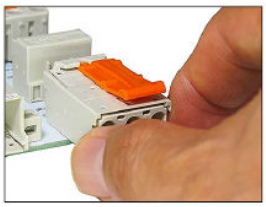


Keep pushing it in until the locking latch makes a clicking sound.

■How to connect the motor power output connector



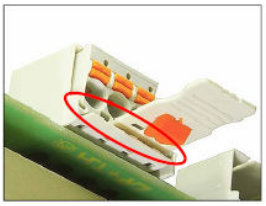
Hold the frame of the connector and insert the connector.



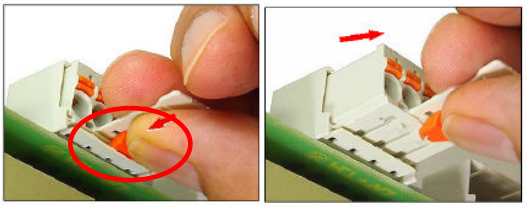
Keep pushing it in until the locking latch makes a clicking sound.

④ Disconnecting the connectors

■ How to disconnect the AC200V input/regeneration resistor connector

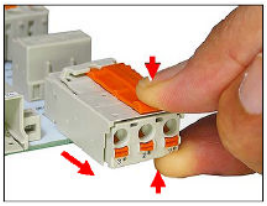


The connector is fixed with the locking latch (circled part in red).



Plug in an unlocking tool between the connector and the locking latch (left) and pull out the connector (right).

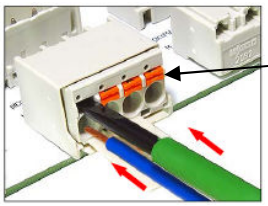
■How to disconnect the motor power output connector



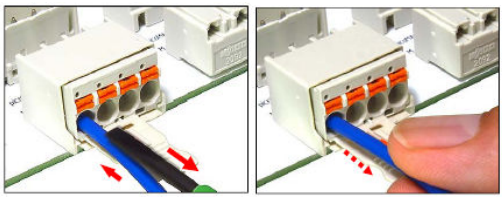
Hold the connector between two fingers from the top and the bottom and pull it.

⑤ Connecting cables

■How to connect a cable to AC200V input/regeneration resistor connector

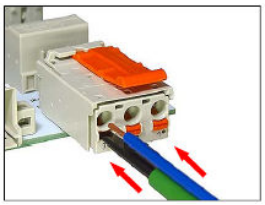


While pushing in the pushbutton with a screwdriver, insert the cable.

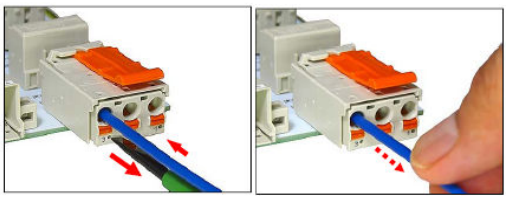


Release the pushbutton while holding in the cable. Pull the cable slightly and make sure that the cable connection is not loose.

■How to connect a cable to the motor power output connector



While pushing in the pushbutton with a screwdriver, plug in the cable.

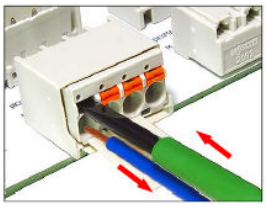


Release the pushbutton while holding in the cable. Pull the cable slightly and make sure that the cable connection is not loose.

⑥ Disconnecting cables

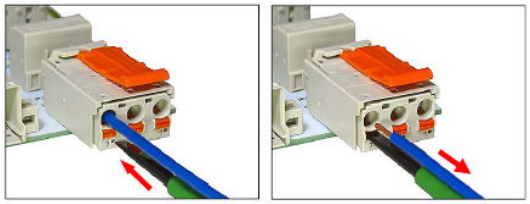
■ How to disconnect a cable from AC200V input/regeneration resistor connector

AC200V



While pushing in the pushbutton, pull out the cable.

■ How to disconnect a cable from the motor power output connector



While pushing in the pushbutton, pull out the cable.

8-3. Control Block Diagram

8-3-1 Position Control Block Diagram

The position control block diagram is shown in Figure 8-3-1 below.

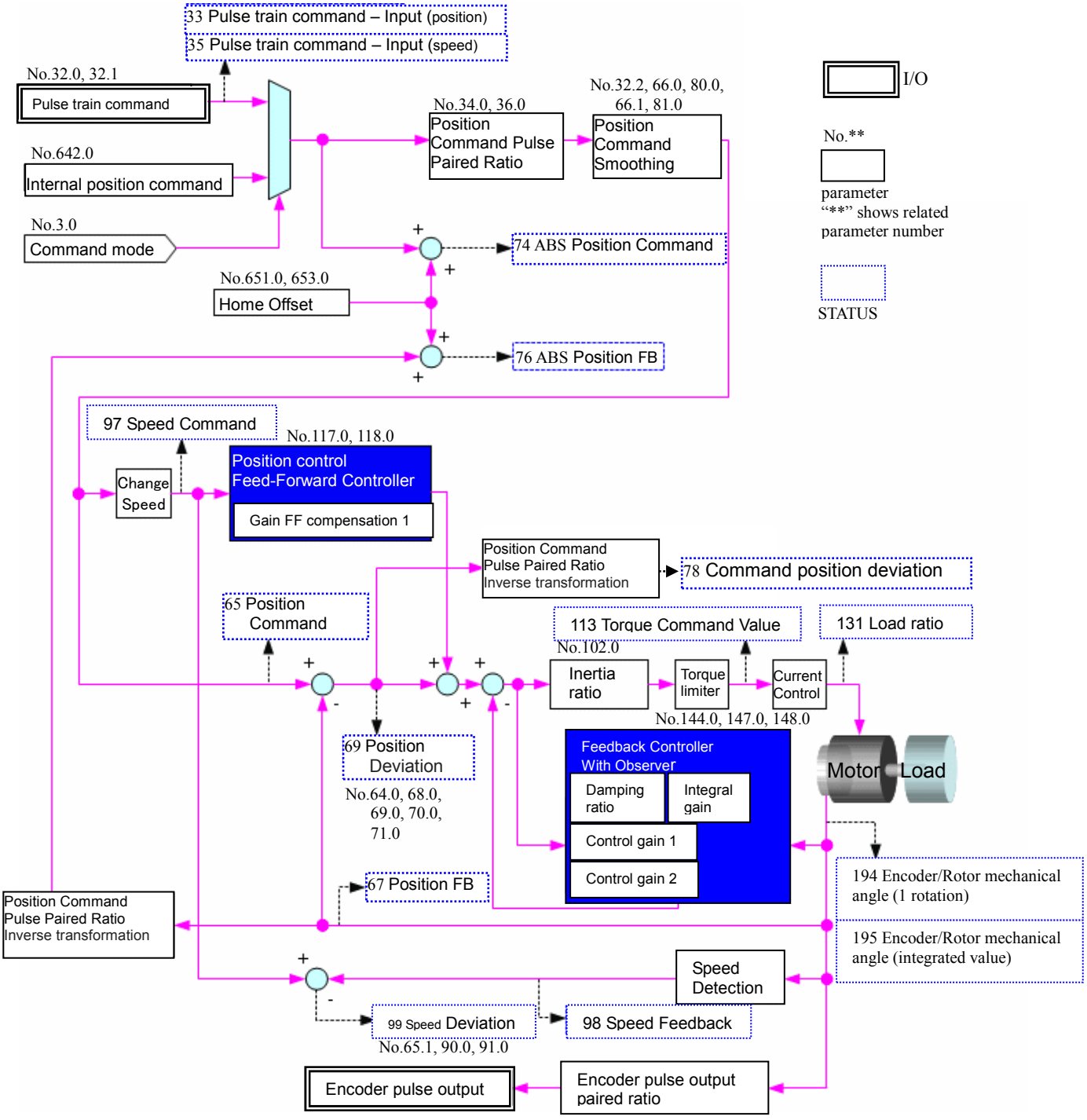


Figure 8-3-1 Control Block Diagram（Position Control）

8-3-2 Speed Control Block Diagram

The speed controller block diagram is shown in Figure 8-3-2 below.

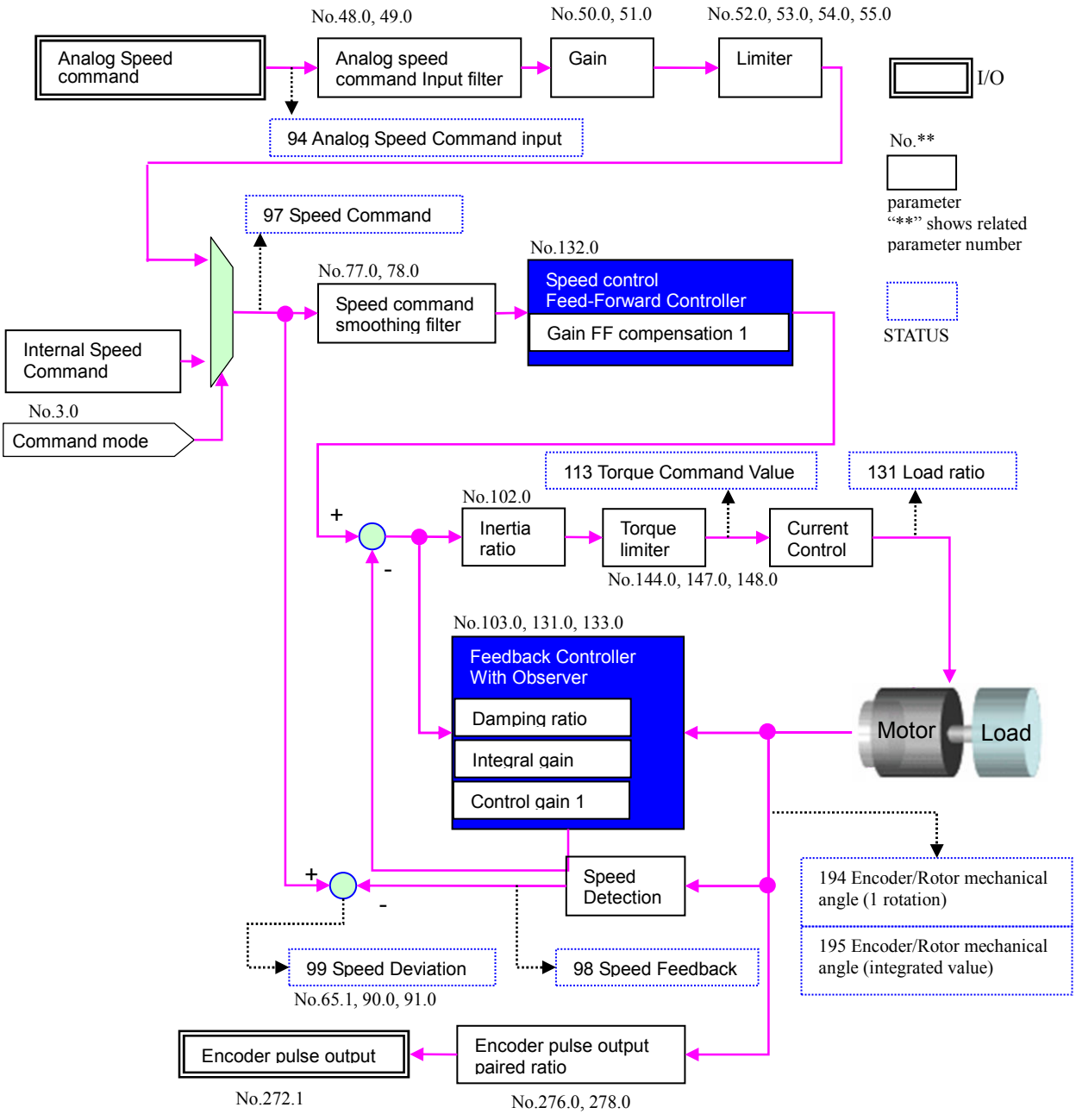


Figure 8-3-2 Control Block Diagram（Speed Control）

8-3-3 Torque Control Block Diagram

The torque controller block diagram is shown in Figure 8-3-3 below.

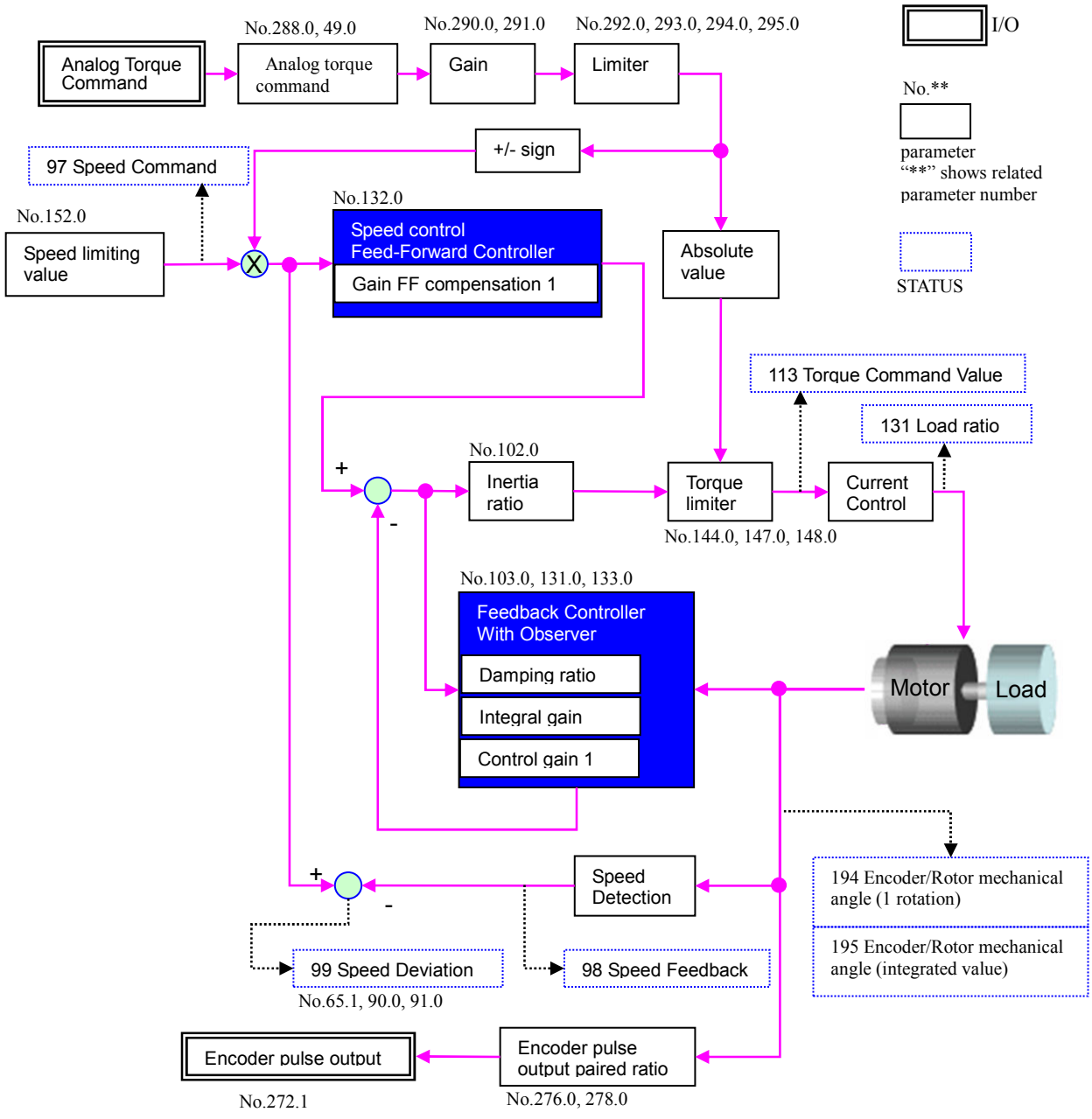


Figure 8-3-3 Control Block Diagram（Torque Control）

8-4. Parameter List

Table 8-4-2 “Parameter List” describes the S-FLAG parameters.

Table 8-4-1 Contents of Parameter List

Column Header & Parameter type	Meaning
No.	Parameter Number
Fraction form (xxx/yyy) in the No. column	Indicates a ratio where a value of the parameter No.xxx is the numerator and a value of the parameter No.yyy is the denominator Example: 34.0/36.0 Where Numerator = a value of Parameter No.34.0 and Denominator = a value of Parameter No.36.0
〔Basic Setup〕 in the Parameter column	Parameters initially defined by the configuration of your system
〔Tuning〕 in the Parameter column	Parameters such as Servo gain used for Tuning according to your operational desires
〔Special Setup〕 in the Parameter column	Optional parameters used for special purposes
Details	Parameter details, including initial values and setting ranges
DC24V Power Off and On	This column indicates whether it is necessary to turn the DC24V power Off and On again after saving parameters in the EEPROM. “Yes” indicates necessary and “No” indicates unnecessary.

Notes on parameters:

Each S-FLAG parameter used for Tuning operations has a unique setting range, but some of the parameter settings depend on other parameter settings, which occasionally makes a parameter value invalid even though it is within the specification range. The following are the parameters whose setting ranges are dominated by other parameter settings.

No.115.0 Control Gain 1 (Position Control Mode)
No.116.0 Control Gain 2 (Position Control Mode)
No.119.0 Integral Gain (Position Control Mode)
No.131.0 Control Gain 1 (Speed Control Mode)
No.133.0 Integral Gain (Speed Control Mode)

8-4 Parameter List

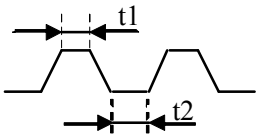
Table 8-4-2 Parameter List

No.	Parameter	Details	DC24V Power Cycle
2.0	〔Basic Setup〕 Control mode selection	Select Control Mode Caution! "Do not change during Servo ON." 0 = Position Control Mode 1 = Speed Control Mode 2= torque control mode Default value: 0（Position Control Mode） Setting range: 0 or 1	Yes
3.0	〔Basic Setup〕 Command mode selection	Select Command Mode 0 = zero command （Select in Position Control, or Speed Control） 1 = pulse train command（Select in Position Control） 2 = analog command （Select in Speed Control） 3 = internal generation command（Select in Speed Control） Default value: 1（pulse train command） Setting range: 0 - 3	Yes
4.0	〔Basic Setup〕 Communication address	Set communication address of the servo amplifier When not using RS-485 commutation, set to 1. When using it, set different values to all the shafts, referring to Chapter 3, Section 3-4 "RS-485 Communication". Default value: 1 Setting range: 1 - 32	Yes
8.0	〔Basic Setup〕 Selection of host communication method	Select a host communication method 0 = Disable 1 = 485 asynchronous serial communication Connect the RS-485 signal cable. When using RS-485 asynchronous serial commination, select 1. Otherwise, select 0. Communication via USB is always available regardless of this parameter setting. Default value: 0 (Disable) Setting range: 0 or 1	Yes
9.0	〔Basic Setup〕 Selection of Operation mode	Select Operation mode 0 = I/O 1 = Communication When selecting 1, you can operate the signal assigned to the input port of Parallel I/O with S-TUNE. In this case, input from Parallel I/O will be invalid. When selecting 0, input from Parallel I/O will be valid. In this case, you cannot operate the signal assigned to the input port of Parallel I/O with S-TUNE. Default value: 0 (I/O) Setting range: 0 or 1	No
11.0	〔Basic Setup〕 RS485 communication Minimum response time	Set Minimum response time by RS485 communication. Using Minimum response time, you can adjust the response timing from the amplifier. For details of response timing, refer to "Communication timing" in the Supplemental Manual 3 "Communication Interface". Default value: 3 Setting range: 0 - 255	Yes
32.0	〔Basic Setup〕 Pulse train command - Input mode	Select a input mode of Pulse train command input. For details, refer to "Table 2-2-3 Pulse command input forms, in Chapter 2 Section 2-2-3 Basic Specifications of this S-FLAGS Instruction Manual". 0 = Pulse/Direction ： input in pulse and direction 1= QEP ： input in quadrature phase (A-phase, B-Phase） 2= CCW/CW ： input in positive or negative pulse Default value: 0（Pulse/Direction） Setting range: 0 - 2	Yes
32.1	〔Basic Setup〕 Pulse train command - Rotational direction	Set Rotational direction of Pulse train command input. For details, refer to "Section 6-2-7 Setting Basic Setup Parameters (Position Control), Table 6-2-7 Parameter No.32.1 setting and Motor rotational direction（Pulse train command）" in this S-FLAG Instruction Manual, Chapter 6. 0 = countdown in CCW motion 1 = count-up in CCW motion Default value: 1 (count-up in CCW motion) Setting range: 0 or 1	Yes
32.2	〔Basic Setup〕 Selection of Auto interpolation for command paired ratio	Use this parameter to smooth command automatically when "command paired ratio" is set. 0 = Disable 1 = Enable Default value:1 (Enable) Setting range: 0 or 1	Yes

8-4 Parameter List

<table>
<tr><th>No.</th><th>Parameter</th><th>Details</th><th>DC24V
Power Cycle</th></tr>
<tr><td>32.3</td><td>〔Basic Setup〕
Selection of Pulse train input logic</td><td>Select logic for pulse train input.
0 = Positive logic:　count in rising from Low to High
1 = Negative logic:　count in falling from High to Low
Default value:　0(Positive logic)
Setting range:　0 or 1</td><td>Yes</td></tr>
<tr><td>33.0</td><td>〔Basic Setup〕
Pulse train command - Input filter selection</td><td>Pulse train command Input filter is a function to reduce malfunctions due to noise.

Select Input filter for Pulse train command
0= no filter
1= passing pulse width 25ns
2= passing pulse width 50ns
3= passing pulse width 100ns
4= passing pulse width 150ns
5= passing pulse width 200ns
6= passing pulse width 300ns
7= passing pulse width 400ns
8= passing pulse width 600ns
9= passing pulse width 800ns
10= passing pulse width 1000ns
11= passing pulse width 1200ns
12= passing pulse width 1600ns
13= passing pulse width 2000ns
14= passing pulse width 2300ns
15= passing pulse width 3100ns

If Pulse train command input is open collector, select a most appropriate filter.　The best fit can be found in the table below looking up your input pulse frequency crossed by pulse duty.
Pulse Frequency by Pulse Duty for the best filter selection
<table><tr><th>Pulse Frequency count \ Duty(%)</th><th>50</th><th>40</th><th>30</th><th>20</th><th>10</th></tr><tr><td>100kpps</td><td>12</td><td>11</td><td>10</td><td>8</td><td>6</td></tr><tr><td>200kpps</td><td>9</td><td>8</td><td>7</td><td>6</td><td>4</td></tr></table>
 
Min [t1, t2] is the passing pulse width.

When the input frequency is high, select a small passing pulse width.　To improve noise resistance, select a larger passing pulse width.
Default value:　4 （passing pulse width <=150ns ）
Setting range: 0 or 15</td><td>Yes</td></tr>
<tr><td>34.0
／
36.0</td><td>〔Basic Setup〕
Position Command Pulse Paired Ratio

Numerator/ Denominator</td><td>This is a parameter to change Position command pulse paired ratio.
When pulse count per rotation of host command is not equal to pulse count per rotation of motor, select a value, using this command, for “numerator/denominator = (motor pulse count per one rotation)/(host command pulse count per one rotation of host command”.
See the table below for parameter value examples for pulse count per rotation.　The value for S-FLAG’s pulse count per rotation is 131,072[pulse/rev], which is outside the setting range.　In such a case, use, for example, ¼ of 131,072 (i.e. 32768)　in the numerator parameter and ¼ of host command pulse count per rotation in the denominator parameter.

<table><tr><th>Host command pulse count　per rotation [pulse/rev]</th><th>Command paired ratio (Numerator) No.34.0</th><th>Command paired ratio (Denominator) No.36.0</th></tr><tr><td>31,072</td><td>1,000（default）</td><td>1,000（default）</td></tr><tr><td>16,384</td><td>32,768</td><td>4,096</td></tr><tr><td>10,000</td><td>32,768</td><td>2,500</td></tr><tr><td>4,096</td><td>32,768</td><td>1,024</td></tr><tr><td>4,000</td><td>32,768</td><td>1,000</td></tr></table>

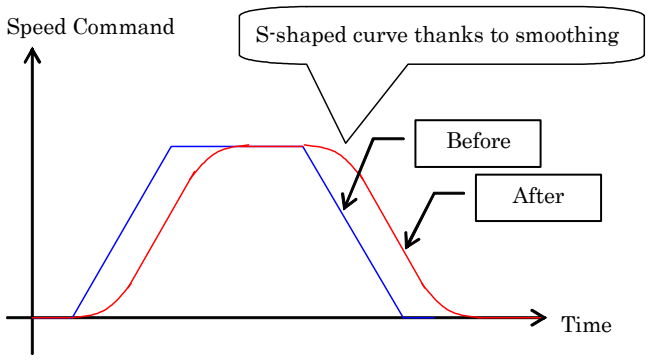
Default value:（Numerator）/（Denominator）= 1,000/1,000
Setting range:（Numerator）1 - 65,535,（Denominator）1 - 65,535
Setting range for the ratio（Numerator）/（Denominator） should be [0.001 – 1,000] for Pulse train position command, and [1 – 1,000] for Internal position command.
Otherwise, error-free operations are not guaranteed.</td><td>Yes</td></tr>
</table>

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
48.0 ／ 49.0	〔Tuning〕 Analog speed command Input filter constant Numerator/ Denominator	This is a parameter for Low pass filter to smooth Analog command input. This parameter is valid when No.62.1 "Analog speed command - Input filter selection" = 1. Smaller value means stronger smoothing and slower response to command. Larger value means better response to command, but prone to noise interference. Do not make（Numerator)/(Denominator）above 1. Otherwise, filtering will not be performed. Default value:（Numerator)/(Denominator)= 16,000/65,535 Setting range: 0 - 65,535/1 - 65,535	No
50.0 ／ 51.0	〔Tuning〕 Analog speed command Input Gain Numerator/ Denominator	Set Numerator in Gain of Analog speed command input. The motor rotational speed is max where Numerator/Denominator = 1 with Analog command voltage ±10V input. The motor rotational direction can be changed by sign and polarity selectin of analog command voltage. ※ For the max rotational speed, refer to S-FLAG Instruction Manual Chapter 2「2-1-4 Basic Specifications」. A higher value of this parameter can reduce position proportional gain of the host controller. Default value:（Numerator)/(Denominator)= 1,000/1,000 Setting range: 0 - 65,535/1 - 65,535	No
52.0 ／ 53.0	〔Basic Setup〕 Analog speed command - CCW speed limit override value Numerator/ Denominator	Set CCW speed limit override value of Analog speed command. Analog command CCW speed limit = allowable maximum rotational speed × (override value (Numerator)/override value (Denominator)) Default value:（Numerator)/(Denominator)= 5,000/5,000 Setting range: 0 - 65,535/1 - 65,535	No
54.0 ／ 55.0	〔Basic Setup〕 Analog speed command - CW speed limit override value Numerator/ Denominator	Set CW speed limit override value of Analog speed command. Analog command CW speed limit = allowable maximum rotational speed × (override value (Numerator)/override value (Denominator)) Default value:（Numerator)/(Denominator)= 5,000/5,000 Setting range: 0 - 65,535/1 - 65,535	No
60.0	〔Basic Setup〕 Analog speed command - Fixed offset value	Select an Offset adjusting value when Manual Tuning is selected as Offset tuning method for Analog speed command. This parameter is valid when No.62.2 "Analog speed command - Offset tuning method d" = 1. Have the input voltage 0, and adjust it so that the status of Analog speed command input becomes 0 r/min. Here is how to set this parameter: 1. Servo ON (when the Offset value is not right, the motor rotates) 2. When the motor is rotating in the range ±10r/min, set the speed within ±10r/min and examine the motor behavior. When the motor is rotating CCW, have -50, similarly when rotating CW, have +50. 3. Monitoring the motor movement, select a value for the parameter. If the motor is rotating CCW, have a positive direction value. If the motor is rotating CW, have a positive direction value.	No
62.0	〔Basic Setup〕 Analog speed command - Rotational direction	Set Rotational direction of Analog speed command input. For details, see Table 6-3-6 “Analog Speed Command Input Parameter No.62.0 setting and Motor rotational direction” in S-FLAG Instruction Manual Chapter 6, Section 6-3-2 Setting Basic Parameters(Speed Control) . 0 = CCW rotation by a negative input; CW rotation by a positive input 1 = CCW rotation by a positive input; CW rotation by a negative input Default value: 1（CCW rotation by a positive input） Setting range: 0 or 1	No
62.1	〔Basic Setup〕 Analog speed command - Input filter	Enable/Disable Analog speed command - Input filter. To set a constant for the input filer, use No.48.0 and No.49.0. 0 = Disable 1 = Enable (Primary IIRFilter) Default value: 1 (Enable) Setting range: 0 or 1	No
62.2	〔Basic Setup〕 Analog speed command - Offset tuning method	Select Offset tuning method for Analog speed command 0 = Auto tuning 1 = Manual tuning Auto tuning is a tuning method to automatically adjust the Offset value so that the speed command becomes 0 r/min with the input voltage at Servo ON. Manual tuning is a tuning method to manually adjust the Offset value, so that the speed command becomes 0 r/min with a 0V Input voltage. The Offset value can be adjusted with Parameter No.60.0 (Analog speed command - Fixed offset value).	No

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
64.0	〔Basic Setup〕 Positioning completion determination method	Enable/Disable Completion determination to output a signal for Positioning completion 0 = Position deviation and Speed 1 = Position deviation, Speed and Pulse train command input(Speed) “0” ; Positioning Completion signal will be output when both Position Deviation and Speed enter the ranges set with No.68.0 Positioning completion range and No. 69.0 Positioning completion speed, respectively. “1” ; Positioning Compete signal will be output when Position deviation, Speed, and Pulse train command input(Speed) enter the ranges set with No.68.0 Positioning completion range, No.69.0 Positioning completion speed, and No.70.0. Positioning completion Pulse train command input (speed), respectively. A delay time of positioning completion to completion signal output can be selected in No.71.0 Positioning completion Detection delay time. Default value: 0 Setting range: 0 or 1	No
65.0	〔Special Setup〕 Selection of Position deviation error detection	Enable/Disable Position deviation error detection. Usually 1 (Enable) is used. Select 0 only when using Torque command limit. When using Torque command limit, you can select a Detection value for Position deviation error in No.87.0 Position deviation error Detection value and a delay time for error output in No.89.0 Position deviation error Detection delay time. 0 = Disable 1 = Enable Default value: 1（Enable） Setting range: 0 or 1	No
65.1	〔Special Setup〕 Selection of Speed deviation error detection	Enable/Disable Speed deviation error detection. Usually 1(Enable) is used. Select 0(Disable) only when using Torque command limit. Set Speed deviation value for error detection with No.90.0 and Delay time of an alarm output with No.91.0. 0 = Disable 1 = Enable Default value: 1（Enable） Setting range: 0 or 1	No

<table>
<tr><th>No.</th><th>Parameter</th><th>Details</th><th>DC24V
Power Cycle</th></tr>
<tr><td>66.0
66.1</td><td>〔Tuning〕
Position command smoothing filter 1 and filter 2 selection</td><td>Enable/Disable Position command smoothing filter 1（No.66.0） and Position command smoothing filter 2（No.66.1）.
0 = Disable
1 = Enable
With the smoothing filter is used, the command will be smoother as illustrated blow.
 

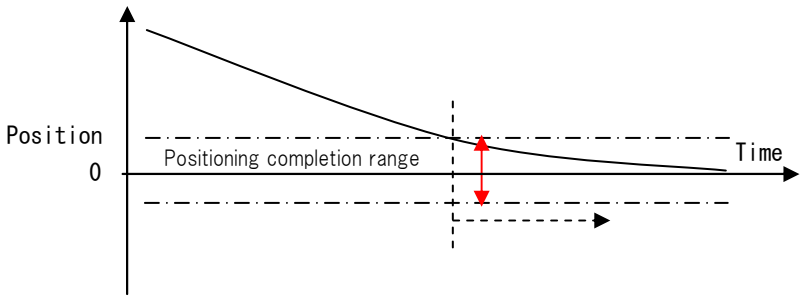
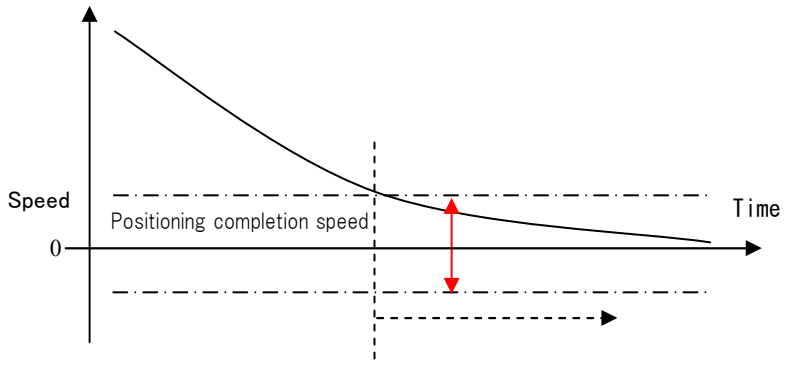
【Tuning Method】

Use these parameters when the command acceleration or deceleration speed is high . Also they can be used to suppress resonating vibration during Positioning .
There are cases where assigning the resonant frequency measured in waveform of Torque Command value to Position command smoothing filter 1 moving average No.80.0 or Position command smoothing filter 2 moving average No.81.0 could suppress resonating vibration. The correlations between resonant frequency and moving averages that suppress resonance are described in the parameter No. 80.0 and No. 81.0 row.
Caution! Set this parameter at least 1.5 seconds later after the command pulse input turns “0” and also when the command pulse is not being input. Turn the Servo OFF when setting this parameter. Setting it during pulse input or presence of pulse residue could cause positioning failure.
Default value: 0 for Command smoothing filter1 (disable)
1 for Command smoothing filter 2 (enable)
Setting range: 0 or 1</td><td>Yes</td></tr>
<tr><td>66.3</td><td>〔Special Setup〕
Feed forward delay compensation selection in Position Control Mode</td><td>Enable/Disable Feed forward delay compensation in Position Control Mode
0 = Disable
1 = Enable
Note: Usually keep this parameter enabled. This can’t be changed on the Setup Panel.
Default value: 1（Enable）
Setting range: 0 or 1</td><td>Yes</td></tr>
<tr><td>67.0</td><td>〔Basic Setup〕
Selection of Drive restriction options</td><td>Select Drive restriction option
Caution! Do not change the setting of this parameter during Servo ON.
0 = Disable
1 = Enable CW-drive restriction
2 = Enable CCW-drive restriction
3 = Enable CW/CCW-drive restriction
Default value: 0(Disable)
Setting range: 0 - 3</td><td>Yes</td></tr>
<tr><td>67.1</td><td>〔Basic Setup〕
Deceleration method selection when Drive restriction is enabled</td><td>Select a deceleration method when Drive restriction is enabled
Caution! Do not change the setting of this parameter during Servo ON. Also select only one of the following 4 combinations of No.67.1 and No.67.2.

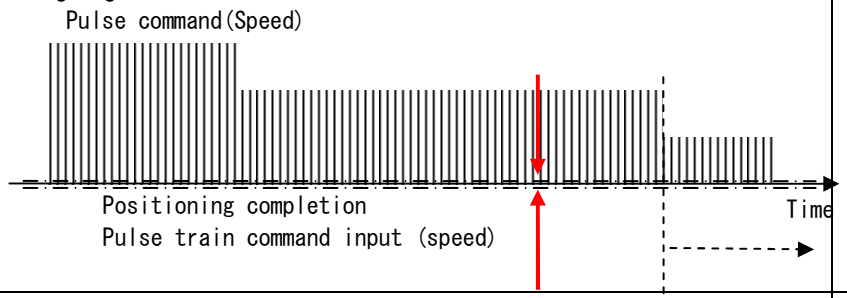
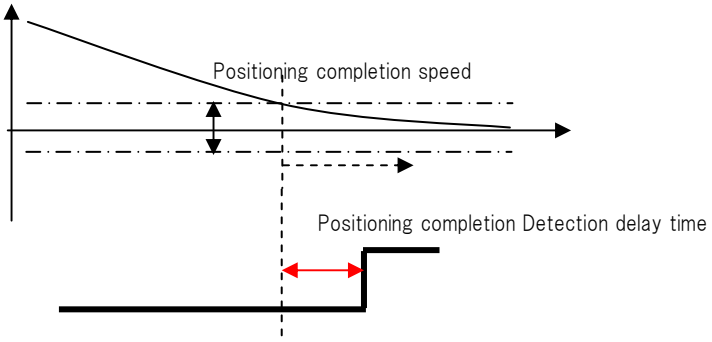
0 = free-run
1 = short brake
3 = prompt stop
Default value: 1
Setting range: 0 - 2

<table><tr><th>Combination</th><th>Deceleration Method No.67.1</th><th>Stop Method No.67.2</th></tr><tr><td>1</td><td>0：free-run</td><td>0：free-run</td></tr><tr><td>2</td><td>1：short brake</td><td>0：free-run</td></tr><tr><td>3</td><td>2：prompt stop</td><td>1：zero clamp</td></tr><tr><td>4</td><td>2：prompt stop</td><td>0：free-run</td></tr></table></td><td>Yes</td></tr>
</table>

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
67.2	〔Basic Setup〕 Selection for Stop condition when Drive restriction is enabled	Select Stop condition when Drive restriction is enabled. Caution! Do not change the setting of this parameter during Servo ON. Also select only one of the 4 options listed above for a combination of No.67.1 and No.67.2. 0 = free-run 1 = zero clamp Default value: 0 (free-run) Setting range: 0 or 1	Yes
67.3	〔Basic Setup〕 Selection for Position deviation counter option when Drive restriction is enabled	Keep or Clear Position deviation counter when Drive restriction is enabled. Caution! Do not change the setting of this parameter during Servo ON. 0 = Keep 1 = Clear Default value: 0 Setting range: 0 or 1	Yes
68.0	〔Basic Setup〕 Positioning completion range	As a guidance to output a Positioning Completion signal POSIN to the host controller, use this parameter to set Pulse Width to determine Positioning Completion. Select a value lower than the pulse count used for the host controller to determine Positioning competition. Default value: 40 [pulse] （ ±40[pulse] ） Setting range: 0 - 32,767 	No
69.0	〔Basic Setup〕 Positioning completion speed	As a guidance to output the Positioning Completion signal POSIN to the host controller, select a rotational speed to determine Positioning Completion. Select a value lower than the pulse count used for the host controller to determine Positioning competition. Default value: 750W or less: 2 [pulse/160μs] (±2 [pulse/160μs])･･･5.72[r/min] 1kW or more: 2 [pulse/200μs] (±2 [pulse/200μs])･･･4.58[r/min] Setting range: 0 - 32,767 	No

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
70.0	〔Basic Setup〕 Positioning completion Pulse train command input (speed)	As a guidance to output a Positioning Completion signal POSIN to the host controller, set a speed of Pulse train command input to determine Positioning Completion. Usually 0 is the standard value. Default value: 750W or less: 0 [pulse/160μs] (±0 [pulse/160μs]) 1kW or more: 0 [pulse/200μs] (±0 [pulse/200μs]) Setting range: 0 - 32,767 	No
71.0	〔Basic Setup〕 Positioning completion Detection delay time	Set Delay time between Positioning completion and Completion signal (POSIN) output to the host controller. Default value: 750W or less: 20 [160μs]･･･3.2ms 1kW or more: 16 [200μs]･･･3.2ms Setting range: 0 - 65,000 	No
77.0	〔Tuning〕 Speed command smoothing filter selection	Enable/Disable Speed command smoothing filter. Set Moving average time with No.78.0. 0 = Disable 1 = Enable Default value: 0(Disable) Setting range: 0 or 1	No
78.0	〔Tuning〕 Moving average time for Speed command smoothing filter	Set Moving average time for Speed command smoothing filter. This parameter is valid when No. 77.0 "Speed command smoothing filter selection" = 1. Default value: 100 [ms] Setting range: 1 - 1,000	No

8-4 Parameter List

<table>
<tr><th>No.</th><th>Parameter</th><th>Details</th><th>DC24V
Power Cycle</th></tr>
<tr><td>80.0

81.0</td><td>〔Tuning〕
Position command smoothing filter 1 - moving average counter

Position command smoothing filter 2 - moving average counter</td><td>No.80.0 is valid when No.66.0 "Position command smoothing filter 1 selection " = 1 (Enable).
No.81.0 is valid when No.66.1 "Position command smoothing filter 2 selection " = 1 (Enable).
A larger value makes acceleration and deceleration smoother, but the response will be slower.
Position command smoothing filter 1 can be set in range of 1 – 6250, and Position command smoothing filter 2 in 1– 1250.
Moving average time is calculate in the following formula.
200- 750W: Moving average time = # of sampling points * 0.16ms
1k – 2kW: Moving average time = # of sampling points * 0.2ms

【Tuning Method】
• Smoothing should be set within the allowable range of the device, because the positioning time is delayed by the above moving average time.
• In case of resonant vibration of the device when running at a constant speed after acceleration or during positioning after deceleration, use the cursor to check the vibration interval in waveforms of Torque command first. Then set Position command smoothing filter 1 or Position command smoothing filter 2 at a moving average counter to suppress the vibration interval. This process might suppress resonant vibrations.

See examples below.

750W or less: Smoothing Filter Setting ＝ 6250×(Vibration interval [s])
1kW or more: Smoothing Filter Setting ＝ 5000×(Vibration interval[s])
<table><tr><td># of Moving average sample points
No.80.0 or No.81.0</td><td>64</td><td>256</td><td>102</td><td>4096</td></tr><tr><td>750W or less:Vibration interval(s)</td><td>0.01</td><td>0.043</td><td>0.167</td><td>0.667</td></tr><tr><td>1kW or more:Vibration interval(s)</td><td>0.013</td><td>0.05</td><td>0.2</td><td>0.833</td></tr></table>• Position command smoothing filer 2 can prevent vibrations due to Gain FF compensation 2.

Caution!
Set this parameter at least 1.5 seconds later after the command pulse input turns “0” and also when the command pulse is not being input. If possible, turn the Servo OFF when setting this parameter. Setting it during pulse input or presence of pulse residue could cause positioning failure.

Default value: Filter1 ： 25 for 200 - 750W, 20 for 1k - 2kW
Filter2 ： 10 for 200 - 750W, 10 for 1k - 2kW
Setting range: Filter1: 1 - 6,250
Filter2 :1 - 1,250</td><td>Yes</td></tr>
<tr><td>87.0</td><td>〔Special Setup〕
Position deviation error Detection value</td><td>Set Detection value for Position deviation error. This parameter is valid when No.65 "Position deviation error detection" =1, which is the usual setting.
When Position deviation exceeds the parameter setting, a Position deviation error will be output. The larger the parameter value is, the more difficult it is to detect Position deviation error.
Default value: 196,608[pulse] ※ equivalent to pulse count of 1.5 rotations.
Setting range: 0 - 2,147,483,647</td><td>No</td></tr>
<tr><td>89.0</td><td>〔Special Setup〕
Position deviation error Detection delay time</td><td>This parameter is valid when No.65 "Position deviation error detection" = 1, which is the usual setting.
This parameter sets Delay time between detection of position deviation error (i.e. exceeding the value in No.87 “Position deviation error Detection value”) and an error signal output.
The larger the parameter value is, the longer it takes to output the error.
Default value: for 200 - 750W ： 250 [160μs]･･･40ms
for 1k - 2kW ： 200 [200μs]･･･40ms
Setting range: 0 - 32,767</td><td>No</td></tr>
</table>

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
90.0	〔Special Setup〕 Speed deviation error Detection value	This parameter is valid when No.65.1 "Speed deviation error detection" =1, which is the usual setting. When Speed deviation exceeds the setting of this parameter, a Speed deviation error will be detected. The larger this parameter value is, the more difficult to detect a Speed deviation error. Default value: for 200 - 750W ： 524 [pulse/160μs] ･･･1,499[r/min] for 1k - 2kW ： 655 [pulse/200μs] ･･･1,499[r/min] Setting range: 0 - 32,767	No
91.0	〔Special Setup〕 Speed deviation error Detection delay time	This parameter is valid when No.65.1 "Speed deviation error detection" =1, which is the usual setting. This parameter sets Delay time between detection of Speed deviation error (i.e. exceeding the value in No.90 “Speed deviation error Detection value”) and an error signal output. The larger the parameter value is, the longer it takes to output the error. Default value: for 200 - 750W ： 250 [160μs] ･･･40ms for 1k - 2kW ： 200 [200μs]･･･40ms Setting range: 0 - 32,767	No
102.0	〔Tuning〕 Inertia ratio	Set Inertia ratio by the device load. Default value: 250 [%] Setting range: 100 - 3,000	No
103.0	〔Tuning〕 Damping ratio	Set Damping ratio on the device side. Changing this parameter could improve the settling time in case of poor stabilization due to viscous friction, or high inertia ratio. Default value: 100 [%] Setting range: 10 - 5,000	No
110.0	〔Tuning〕 Setting of auto tuning mode	Set Auto tuning mode. If motions of the device connected to the motor are along the horizontal axis, select 1. Otherwise select 2. 1 = Standard mode 2 = Unbalanced mode Default value: 1（Standard mode） Setting range: 1 or 2	No
110.1	〔Tuning〕 Selection whether to use of real-time auto tuning	Enable/Disable Real-time auto tuning 0 = Disable 1= Apply Inertia ratio 2= Apply Inertia ratio and Damping ratio Default value: 0（Disable） Setting range: 0 - 2	No
113.0	〔Tuning〕 Control gain set (position control)	Set Control gain set in Position Control Mode In case of slow response to a command or less rigid drive system, select a low value. In case of fast response to a command or highly rigid drive system, select a high value. Setting this parameter will automatically set No. 115.0 -119.0. Setting No.113.1 Inertia condition = 0 (Servo Amplifier Ver. 2.0.4.0 or prior) makes the No.113.0 setting range 1 - 46. Default value: 15 Setting range: 5 - 45	No
113.1	〔Tuning〕 Inertia condition	Set Inertia condition in Position Control Mode 0= Servo amplifier version 2.0.4.0 or prior 1= Heavy ; for a heavier and less rigid device, or a device with substantial load fluctuation. 2= Medium ; standard setting 3= Light ; for frequent reverse rotations of a light load Default value: 2（Medium） Setting range: 0 - 3	No
114.0	〔Tuning〕 Control level (position control)	To set Control level in Position Control Mode. Select a low value in case of slow command response, or less rigid drive system. Select a high value in case of fast command response, or more rigid drive system. If this parameter is set, No.115.0 and No.116.0 will be automatically set and No.113.0 will be disabled. Setting No.113.1 Inertia condition to 0 (Servo Amplifier Ver. 2.0.4.0 or prior) makes the setting range of this parameter 1-46. Default value: 15 Setting range: 5 - 45	No
115.0	〔Tuning〕 Control gain 1 (position control)	Set Control Gain 1 in Position Control Mode. A large parameter value makes stabilization time shorter. Select a value less than or equal to Control gain 2. Default value: 50 [rad/s] Setting range: 5 - 1,000	No

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
116.0	〔Tuning〕 Control gain 2 (position control)	Set Control Gain 2 in Position Control Mode. A large parameter value improves the command response. However, too high a value results in overshooting or vibrations. When No.113.0 or No.114.0 is adjusted in Tuning operation, this parameter could be automatically set outside the Setting range below. Default value: 200 [rad/s] Setting range: 80 - 5,000	No
117.0	〔Tuning〕 Gain FF compensation 1 (position control)	Set feed forward compensation rate (speed) for Control gain 1 in Position Control Mode. After finalizing the inertia ratio, adjust this parameter for a shorter stabilizing time. Too high a value results in overshooting, and too low in a longer stabilizing time. Default value: 10,000 [0.01%] Setting range: 0 - 15,000	No
118.0	〔Tuning〕 Gain FF compensation 2 (position control)	Set feed forward compensation rate (torque) for Control gain 2 in Position Control Mode. Use this parameter to reduce position deviation and improve tracking accuracy during operation. Increase this parameter value after making stabilizing time shorter with Gain FF compensation 1. In case of vibration, adjusting No.81.0 “Position command smoothing filter 2 - # of sampling points used for moving average” might suppress the vibration. Default value: 0 [0.01%] Setting range: 0 - 15,000	No
119.0	〔Tuning〕 Integral gain (position control)	Set Integral gain in Position Control Mode to adjust the efficiency of external disturbance suppression. Select a high gain to expect faster position control convergence during stabilizing positioning. Too high a value causes vibrations. When No.113.0 Control gain set, or No.114.0 is adjusted in Tuning operation, this parameter could be automatically set outside the Setting range below. Default value: 160 [rad/s] Setting range: 45 - 5,000	No
129.0	〔Tuning〕 Control gain set (speed control)	Select a control gain set in Speed Control Mode. In case of slow command response, or less rigid drive system, select a low value. In case of fast command response, or more rigid drive system, select a high value. When this parameter is adjusted, No. 131.0 - 133.0 will be set automatically. Default value: 15 Setting range: 1 - 46	No
130.0	〔Tuning〕 Control level (speed control)	Select a Control level in Speed Control Mode. In case of slow command response, or less rigid drive system, select a low value. In case of fast command response, or more rigid drive system, select a high value. When this parameter is used, No.131.0 will be set automatically and No.129.0 will be disabled. Default value: 15 Setting range: 1 - 46	No
131.0	〔Tuning〕 Control gain 1 (speed control)	Set Control Gain 1 in Speed Control Mode. This parameter is equivalent to Speed proportional gain. Default value: 399 [rad/s] Setting range: 100 - 6,000	No
132.0	〔Tuning〕 Gain FF compensation 1 (speed control)	Set Feed forward compensation rate in Speed Control Mode A large parameter value makes the command response faster. However, too high a value may cause overshooting or vibrations. Default value: 0 [0.01%] Setting range: 0 - 15,000	No
133.0	〔Tuning〕 Integral gain (speed control)	Set Integral gain in Speed Control Mode. A high parameter value reduces speed deviation caused by external disturbance. Too high a value results in vibration. Default value: 300 [rad/s] Setting range: 45 - 5,000	No
144.0	〔Basic Setup〕 Torque command limit override selection	Enable/Disable Torque command limit Override. The torque command limit override value will be set with No.147.0 and No.148.0. When using Torque command limit 1) Set No.65.0 Enable/Disable Position deviation error detection to “0” (Disable) 2) Set No.65.1 Enable/Disable Speed deviation error detection to “0” (Disable) If command deviations are small with the above setting 1) or 2), it is not a problem to select “1” (Enable) for this parameter even when Torque command limit is enabled. 0 = Disable 1 = Enable Default value: 0（Disable） Setting range: 0 or 1	No

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
144.1	〔Basic Setup〕 Selection of Torque limit state output mode	Select an output condition for Torque limit state 0 = All Torque limit states: • Torque limit state per No.147.0 Torque command limit Override 1 • Torque limit state per No.148.0 Torque command limit Override 2 • Torque limit state per Motor's maximum output torque value • Torque limit state per No.656.0 Homing Torque limit • No speed limit in Torque control mode 1 = Torque limit state per No.147.0 Torque command limit Override 1 or No.148.0 Torque command limit Override 2 2 = Torque limit state per No.148.0 Torque command limit Override 2 Default value: 0（All states） Setting range: 0 - 2	No
147.0 148.0	〔Basic Setup〕 Torque command limit override value 1, 2	This parameter is enabled when No.144.0 "Use of Torque command limit override" = 1 (Enable). Set Torque command limit value as a proportion relative to Rated torque. Two torque command limits can be set with Limit override value 1 and 2. Default value: 3,000 [0.1%] for override1, 2,000[0.1%] for override2 Setting range: 0 - 65,535	No
151.0	〔Basic Setup〕 Torque command limit override value at prompt stop	If you select 2 (prompt stop) in No.224.0 Deceleration stop at Servo off: method selection, you can set Torque command limit override value as a proportion relative to rated torque at a time of prompt stop. Default value: 5,000 [0.1%] Note that 3,000 or above means Torque command limit is max torque of 300%. 1,000 or above results in overload error in a certain time depending on overload characteristics. Also depending on this parameter setting and operation conditions, over current error might occur. When that happens, set this parameter to 2,400 max. Setting range: 0 - 65,535	No
152.0	〔Basic Setup〕 Analog torque command Speed limit	Set Speed limit for Analog Torque command Default value: max rotational speed per the motor model specification Setting range: 0 or 10,000	No
160.0	〔Tuning〕 Options for Torque command low-pass filter	Select an option for Torque command Low-pass filter 0 = no filter 1 = preliminary IIR filter Default value: 1 (preliminary IIR filter) Setting range: 0 or 1	No
160.1	〔Tuning〕 Torque command Selection of whether to use notch filter	Set Torque command Notch filter 0 = Disable 1 = Enable Default value:0 (Disable) Setting range: 0 or 1	No
160.2	〔Tuning〕 Turn auto setting on or off for Torque command Low-pass filter	Select ON or OFF for the function to automatically set No.162.0 "Torque command preliminary filter time constant for Low-pass filter" responding to Gain set which are set with No.113.0 and No.129.0. 0= Auto setting OFF 1= Auto setting ON Default value: 1 (Auto setting ON) Setting range: 0 or 1	No
162.0	〔Tuning〕 Torque command preliminary filter time constant for Low-pass filter	Set Preliminary filter time constant for Torque command Low-pass filter. Default value: 20 [0.01ms]･･･0.2ms Setting range: 0 - 65,535	No
168.0	〔Tuning〕 Torque command Notch filter frequency	Set Notch frequency of Notch filter for Torque command. Default value: 5,000 [Hz] Setting range: 0 - 5,000	No
169.0	〔Tuning〕 Torque command Notch filter width selection	Set Notch frequency width of Notch filter for Torque command. Select a ratio of A) frequency range resulting in damping ratio -3[dB] to B)the notch frequency where frequency depth No170.0= 0. The larger the value is, the wider the notch width becomes. Default value: 8 Setting range: 1 - 16	No

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
170.0	〔Tuning〕 Torque command Notch filter depth selection	Set Notch frequency depth of Notch filter for Torque command. This parameter indicates a ratio of Output to Input, where 0 means 100% block of the notch frequency input, and 256 means 100% pass-through. The larger the parameter value is, the shallow the notch depth becomes. Default value: 0 Setting range: 0 - 256	No
224.0	〔Basic Setup〕 Deceleration stop at Servo OFF: method selection	Select Deceleration stop method when an alarm occurs or Servo signal ON turns OFF. 0 = No brake 1 = Short brake mode 2 = Prompt stop Default value: 1（Short brake mode） Setting range: 0 - 2	No
224.1	〔Basic Setup〕 Deceleration stop at Servo OFF: cancelation reason	Select a condition to cancel deceleration stop when an alarm occurs or Servo signal ON turns OFF. 0 = Operating time 1 = # of rotations or operating time upon cancelation Default value: 1（# of rotations or operating time upon cancelation） Setting range: 0 or 1	No
224.2	〔Basic Setup〕 Use of a deceleration stop in case of control power supply voltage drop	If you select 1 (Enable) in this parameter, you can use the parameter No.228.0 “Deceleration stop time at control power voltage drop error” in case of an alarm output of control power supply voltage drop error during the motor in motion. 0 = Disable 1 = Enable Default value: 1（Enable） Setting range: 0 or 1	No
226.0	〔Basic Setup〕 Deceleration stop: operating time	Set Deceleration stop operating time for deceleration stop when an alarm is output during the motor in motion, or Servo ON signal turns OFF. Note that if you set No.224.0 = 0(no brake), this parameter is invalid. Default value: For 200- 750W, 313 [160μs]･･･50ms For 1k – 2kW, 250 [200μs] ･･･50ms Setting range: 0 - 16,383	No
227.0	〔Basic Setup〕 Deceleration stop: the number of rotation for stop cancelation	Set the number of rotations to cancel deceleration stop when an alarm is output during the motor in motion, or Servo ON signal turns OFF.. Note that if you set No.224.0 = 0(no brake), this parameter is invalid. Default value: for 200 - 750W, 17[pulse/160μs]･･･50r/min For 1k - 2kW, 22[pulse/200μs]･･･50r/min Setting range: 0 - 32,767	No
228.0	〔Basic Setup〕 Deceleration stop time at Control power voltage drop	Set Deceleration stop time at an alarm output of the control power voltage drop error during the motor in motion. Default value: 62[160μs] ･･･10ms Setting range: 0 or 16,383 [ms]	No
237.0	〔Basic Setup〕 Delay time for Servo OFF	Set a delay time between Motor excitation start and Servo ON signal(SVON) turning OFF. （The COM- and SVON pins being open indicates that Servo ON input signal is OFF. ） Default value: for 200 - 750W, 0 [160μs] for 1k - 2kW, 0 [200μs] Setting range: 0 - 3,125	No
238.0	〔Basic Setup〕 Delay time for mechanical brake release	Set a delay time between Motor excitation start and the mechanical brake release signal（MBRK）turning ON. (COM- and MBRK terminals being closed indicates the brake release signal ON.) Default value: 200 - 750W： 25 [160μs] ･･･4ms 1k - 2kW： 20 [200μs]･･･4ms Setting range: 0 - 3,125	No
257.0	〔Basic Setup〕 Select an option for Absolute system	Select Absolute system or Incremental system. 0 = Incremental system 1 = Absolute system (multi-rotation counter overflow detection disabled) 2 = Absolute system (multi-rotation counter overflow detection enabled) Default value: 0（Incremental system） Setting range: 0 - 2	Yes
272.1	〔Basic Setup〕 Encoder pulse output Rotational direction	Set rotational direction for Encoder pulse output 0 = Counting down in CCW rotation 1 = Counting up in CCW rotation Default value: 1（Up counting in the case of CCW rotation）	Yes

8-4 Parameter List

<table>
<tr><th>No.</th><th>Parameter</th><th>Details</th><th>DC24V
Power Cycle</th></tr>
<tr><td>276.0
／
278.0</td><td>〔Basic Setup〕
Encoder pulse output
Paired ratio
Numerator/Denominator</td><td>Set Encoder pulse output paired ratio with these two parameters.
When the encoder pulse count per rotation of the host controller and the pulse count per rotation of the motor don't agree, set (Numerator)／(Denominator) = (the encoder pulse count per rotation of the host controller)／(the pulse count per rotation of the motor).
If the Z-phase pulse width is too narrow for the host controller to measure accurately, decrease this Encoder pulse ratio (No.276.0 divided by No.278.0) or decrease the number of rotations to make the pulse width wider.
[Pulse width] = 1／(the number of rotations)／(the paired-pulse ratio x 2^{17})
See the table below for parameter value examples for encoder pulse count per rotation.
S-FLAG motor's pulse count per rotation is 131,072[pulse/rev], which is outside the setting range. In such a case, use ¼ of 131,072 (i.e. 32,768) for the paired ratio (denominator) and ¼ of "host command encoder pulse count per rotation" for the paired ratio (numerator) parameter.
<table><tr><th>Host command pulse count per rotation [pulse/rev]</th><th>Encoder pulse output command paired ratio (Numerator) No.276.0</th><th>Encoder pulse output command paired ratio (Denominator) No.278.0</th></tr><tr><td>131,072</td><td>1,000(default)</td><td>1,000(default)</td></tr><tr><td>16,384</td><td>4,096</td><td>32,768</td></tr><tr><td>10,000</td><td>2,500</td><td>32,768</td></tr><tr><td>4,096</td><td>1,024</td><td>32,768</td></tr><tr><td>4,000</td><td>1,000</td><td>32,768</td></tr></table>
Default value:（Numerator)/(Denominator）= 1,000/8,000
Setting range: Numerator 1 - 65,535
Denominator 1 - 65,535
The setting range for the paired ratio(Numerator)/(Denominator）is 1/32,768 to 1.
Note that [Encoder output resolution] × [(Numerator)/(Denominator)] has to be a multiple of 4.
Also keep the output frequency 4Mpps (specification max value) or less.</td><td>Yes</td></tr>
<tr><td>288.0
／
289.0</td><td>〔Tuning〕
Analog torque command Input filter

Numerator/Denominator</td><td>Analog torque command Input filter is calculated with these two parameters for the low-pass filter that smooths analog torque command input.
Valid when No.302.1 Analog torque command Input filter option = 1(Enable).
Smaller value ⇒ stronger smoothing and slower response to command.
Larger value ⇒ better response to command, but prone to noise interference.
Do not set（Numerator)/(Denominator）above 1. When（Numerator)/(Denominator）= 1, Filtering will not be performed.
Default value:（Numerator)/(Denominator)= 16,000/65,535
Setting range: 0 - 65,535/1 - 65,535</td><td>No</td></tr>
<tr><td>290.0
／
291.0</td><td>〔Tuning〕
Analog torque command Input gain
Numerator/Denominator</td><td>Set Analog torque command Input gain.
When（Numerator)/(Denominator）= 1 and analog command voltage ±10V input, the motor torque becomes max. Depending on a sign of Analog command voltage and a polarity selection, the motor rotational direction differ.
For the information regarding max torque, refer to Chapter 2 Section 2-1-4 Basic Specifications.
Default value:（Numerator)/(Denominator)= 3,100/3,100 (Depending on motor models)
Setting range: 0 - 65,535/1 - 65,535</td><td>No</td></tr>
<tr><td>292.0
／
293.0</td><td>〔Basic Setup〕
Analog torque command CCW torque limit Override
Numerator/
Denominator</td><td>Set Analog torque command CCW torque limit Override with these two parameters.
Analog command CCW torque limit=
(motor max torque)×(Override(Numerator))/(Override(Denominator))
Default value:（Numerator)/(Denominator)= 3,100/3,100 (depending on motor model)
Setting range:0 - 65,535/1 - 65,535</td><td>No</td></tr>
<tr><td>294.0
／
295.0</td><td>〔Basic Setup〕
Analog torque command CW torque limit Override
Numerator/
Denominator</td><td>Set Analog torque command CW torque limit Override with these two parameters.
Analog command CW torque limit=
(motor max rotation torque)×(Override(Numerator))/(Override(Denominator))
Default value:（Numerator)/(Denominator)= 3,100/3,100 (depending on motor model)
Setting range: 0 - 65,535/1 - 65,535</td><td>No</td></tr>
</table>

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
300.0	〔Basic Setup〕 Analog torque command Fixed offset value	Set Analog torque command Fixed offset value when Analog torque command Offset tuning method is auto tuning. Valid when Analog torque command Offset adjustment method (No.302.2) = 1(Auto Tuning). Set this parameter so that Analog torque command input state becomes 0% at Input voltage of 0V. Here is how to set the parameter: Caution! Never perform Tuning with other devices connected. Perform Tuning with the motor alone. 1.Set an appropriate value for Analog torque command Speed limit(No.152.0). 2.Turn the Servo ON. (The motor will rotate if the offset is not right). 3.Set a Offset value observing the Torque command value. Default value: 0 Setting range: -32,768 - 32,767	No
302.0	〔Basic Setup〕 Analog torque command Rotation direction	Set Rotation direction of Analog torque command input. For details, refer to Chapter 6, Section “6-5-2 Setting Basic Setup Parameters (Torque Control), Table 6-5-6 “Parameter No.302.0 setting and Motor rotational direction (Analog Torque Command Input)”」 0 = CCW rotation per negative input voltage : CW rotation per positive input voltage 1 = CCW rotation per positive input voltage : CW rotation per negative input voltage Default value: 1（CCW rotation by positive input voltage） Setting range: 0 or 1	No
302.1	〔Basic Setup〕 Analog torque command Input filter option	Enable/Disable Input filter for Analog torque command. Set Input Filter with No.288.0 and No.289.0. 0 = Disable 1 = Enable Default value: 1 (Enable) Setting range: 0 or 1	No
302.2	〔Basic Setup〕 Analog torque command Offset adjustment method	Select Offset adjustment method for Analog torque command. Auto tuning is a tuning method to automatically adjust the Offset value so that Torque command becomes 0% at the input voltage of Servo ON state. Manual tuning is a tuning method to manually adjust the Offset value, which makes Torque command becomes 0% at the time of 0V Input voltage. The Offset value can be adjusted with Parameter No.300.0:Analog torque command Fixed offset value. 0 = Auto tuning 1 = Manual tuning Default value: 1（Manual tuning） Setting range: 0 or 1	No
385.0	〔Basic Setup〕 Acceleration time for the JOG operation.	Set Acceleration time for the JOG operation. This parameter sets a duration for the speed command to accelerate from 0 r/min to 1000 r/min. Default value: 1,000[ms] Setting range: 0 - 6,0000[ms]	No
386.0	〔Basic Setup〕 Deceleration time for the JOG operation.	Set Deceleration time for the JOG operation. This parameter sets a duration for the speed command to decelerate from 1000 r/min to 0 r/min. Default value: 1,000[ms] Setting range: 0 - 60,000[ms]	No
387.0	〔Basic Setup〕 Target speed of the JOG operation.	Set a target speed of the JOG operation. Default value: 300[r/min] Setting range:0 - 6300[r/min] for 50 - 100W 0 - 5000[r/min] for 200 - 400W 4500[r/min] for 750W 0 - 3000[r/min] for 1k - 2kW Caution! When the number of rotation exceeds the specified maximum, an alarm will occur. Set this parameter at the max or less.	No
388.0	〔Basic Setup〕 Selection of Internal speed command type	Enable this parameter by setting Control Mode (No.2.0) = 1(Speed Control Mode) and Command mode selection (No.3.0) = 3 (internal generation command). Set Internal speed command type using this parameter. Set the internal speed command acceleration time using No.390.0 and No.391.0, and Target speed using No.392.0 - 399.0. 0 = zero command input 1 = internal speed command (trapezoid speed command with 8 speeds) Default value: 0 (zero command input) Setting range: 0 or 1	No

8-4 Parameter List

<table>
<tr><th>No.</th><th>Parameter</th><th>Details</th><th>DC24V
Power Cycle</th></tr>
<tr><td>390.0</td><td>〔Basic Setup〕
Internal speed command
Acceleration time</td><td>Enable this parameter by setting Control Mode No.2.0 = 1(Speed Control Mode), Command mode selection No.3.0= 3(internal generation command), Selection of Internal speed command type No.388.0 = 1(trapezoid speed command).
Set Acceleration time for Internal speed command using this parameter. This parameter sets a duration for the speed command to slow down from 1000 [r/min] to 0 [r/min]. Set Internal speed command Deceleration time with No.391.0 and Target speed with No.392.0 - 399.0.
Default value: 1,000 [ms]
Setting range: 0 - 60000</td><td>No</td></tr>
<tr><td>391.0</td><td>〔Basic Setup〕
Internal speed command
Deceleration time</td><td>Enable this parameter by setting Control Mode No.2.0 = 1: Speed Control Mode, Command mode selection No.3.0=3(internal generation command), and Selection of Internal speed command type No.38=1(trapezoid speed command).
Set Deceleration time for Internal speed command with this parameter. This parameter sets a duration for the speed command to speed up from 0 [r/min] to 1000 [r/min]. Set Internal speed command Acceleration time using No.390.0 and Target speed using No.392.0 - 399.0.
Default value: 1,000 [ms]
Setting range: 0 - 60,000</td><td>No</td></tr>
<tr><td>392.0
393.0
394.0
395.0
396.0
397.0
398.0
399.0</td><td>〔Basic Setup〕
Internal speed command
Target speed 1.
Target speed 2.
Target speed 3.
Target speed 4.
Target speed 5.
Target speed 6.
Target speed 7.
Target speed 8.</td><td>Valid when Control Mode(No.2.0) =1(Speed Control Mode), Command mode selection(No.3.0) = 3(internal generation command), and Selection of Internal speed command type(No.388.0) = 1(trapezoid speed command).
Set Internal speed command Acceleration time and Deceleration time with No.390.0 and No.391.0 respectively.
Set Target speed for 8 options used for Internal speed command input.
Select one of the following target speed No. by combining CN1 Pin No.8, 9 and 10.
<table>
<tr><th>Target Speed No.</th><th>I5
（CN1 Pin No.8）</th><th>I6
（CN1 Pin No. 9）</th><th>I7
（CN1 Pin No.10）</th></tr>
<tr><td>1</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>2</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>3</td><td>OFF</td><td>ON</td><td>OFF</td></tr>
<tr><td>4</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>5</td><td>OFF</td><td>OFF</td><td>ON</td></tr>
<tr><td>6</td><td>ON</td><td>OFF</td><td>ON</td></tr>
<tr><td>7</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>8</td><td>ON</td><td>ON</td><td>ON</td></tr>
</table>
ON： Short-circuit to COM- OFF： Release from COM-
Default value: Target speed 1 ： 500 [r/min]
Target speed 2 ： 1,000 [r/min]
Target speed 3 ： 1,500 [r/min]
Target speed 4 ： 2,000 [r/min]
Target speed 5 ： 2,500 [r/min]
Target speed 6 ： 3,000 [r/min]
Target speed 7 ： 4,000（200 - 750W motor） [r/min]
3,000（1k - 2kW motor） [r/min]
Target speed 8 ： 5,000（200W， 400W motor） [r/min]
4,500（750W motor） [r/min]
3,000（1k - 2kW motor） [r/min]
Setting range: 0 - maximum motor rotational speed</td><td>No</td></tr>
<tr><td>642.0</td><td>〔Basic Setup〕
Internal position command Operation mode</td><td>Select an Operation mode for Position Control Mode(Internal position command).
0 = Point Table
1 = Communication operation
2 = Manual pulse train input
Default value: 1（Communication operation）
Setting range: 0 - 2</td><td>No</td></tr>
</table>

No.	Parameter	Details	DC24V Power Cycle
643.0	〔Special Setup〕 Internal position command Overflow detection option	Enable/Disable Internal position command Overflow detection function. 0 = Disable 1 = Enable This parameter is a protective function to prevent the encoder from losing the absolute position due to the target position being set outside the absolute position range (-1,073,741,823 ─ +1,073,741,823) during a Point Table operation or a Communication operation (in particular Test run). When 1(Enable) is selected, an internal position command overflow alarm will occur when the operation target position (per ABS position command value) is set outside the absolute position range. When 0(Disable) is selected, relative movement beyond the absolute position range is possible, but absolute movement is not possible. Relative movement: movement based on a relative position specified with the point-table command method, or the test run operation Absolute movement: movement based on an absolute position specified with the point-table command method. For details, refer to Supplemental Manual 4: S-FLAG Series Positioner Function. Default value: 1（Enable） Setting range: 0 or 1	Yes
644.0	〔Special Setup〕 Point No. output method	Select a method to output a point No. with User I/O output PM1…3 during Positioner operation. 0 = Output Motion Start Point at Motion Start 1 = Output Motion Start Point at Motion End 2 = Output The Point No. at Motion Start each time For details, refer to Additional Manual 4: S-FLAG Series Positioner Function. Default value: 1（output Operation start point at Operation end） Setting range: 0 - 2	No
645.0	〔Special Setup〕 Base signal 1 selection for Home position	Select Base signal 1 to determine Home position. 0 = Arbitrary position 1 = Stopper 2 = Home position dog front end （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 2（Home position dog front end） Setting range: 0 - 2	No
645.1	〔Special Setup〕 Base signal 2 selection for Home position	Set another base signal after detecting the Home position Base signal 1. 0 = None 1 = Encoder Z-phase （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0（Disable） Setting range: 0 or 1	No
645.3	〔Special Setup〕 Home position Base signal 1 redetection	Enable/Disable a function to detect with a creep speed again after detecting the home position dog front end. 0 = Disable 1 = Enable （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0（Disable） Setting range: 0 or 1	No
646.0	〔Special Setup〕 Homing direction	Set Homing direction. 0 = CCW direction 1 = CW direction （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0（CCW direction） Setting range: 0 or 1	No
646.1	〔Special Setup〕 Home position sensor input polarity	Set Home position sensor input polarity. 0 = detect Home position dog front end at OFF 1 = detect Home position dog front end at ON （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0（detect Home position dog front end at OFF） Setting range: 0 or 1	No
646.2	〔Special Setup〕 Homing Timeout option	Enable/Disable Homing Timeout. 0 = Disable 1 = Enable （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 1（Enable） Setting range: 0 or 1	No

8-4 Parameter List

No.	Parameter	Details	DC24V Power Cycle
646.3	〔Special Setup〕 Point No. 0 function selection	When Point No. is set at 0 and PCSTART1 (Start) is User I/O input, select a function (for that case); Homing or Use of Point Table. 0 = Homing 1 = Point Table operation （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0（Homing） Setting range: 0 or 1	No
647.0	〔Special Setup〕 Homing Torque limit option	This is a safety function in case of bumping during Homing. Set this parameter if you are using Torque limit from the start of Homing to its completion. 0 = Disable 1 = Enable Note that in Homing using Stopper, the torque limit used for Press detection will be always Homing torque limit setting (No.656.0) regardless of this parameter setting. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0（Disable） Setting range: 0 or 1	No
647.1	〔Special Setup〕 Action at Homing completion	Select 1 (Move) for motor movement after Home position Base signal 1 detection. 0 = Stop 1 = Move （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0（Stop） Setting range: 0 or 1	No
648.0	〔Special Setup〕 Homing Speed	Set Homing Speed to reach detection of home position base signal 1. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 500[r/min] Setting range: 0 - motor max rotation speed	No
649.0	〔Special Setup〕 Homing Creep speed	Set Creep speed after Home position Base signal 1 is detected. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 10[r/min] Setting range: 0 - motor max rotation speed	No
650.0	〔Special Setup〕 Homing Acceleration/Deceleration time	Set Acceleration/Deceleration time for Homing. This parameter sets Acceleration time or Deceleration time per 1000r/min. In case of load inertia ratio being 10 or above, set a value larger than the default value of 30. Otherwise, vibrations could occur. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 30[ms/ 1,000r/min] Setting range: 0 - 5,000	No
651.0	〔Special Setup〕 Homing Shift-to-home-position quantity	Set a shift amount from a base signal such as Z-phase to the home position. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0[command unit] Setting range: 0 - 1,000,000,000	No
653.0	〔Special Setup〕 Homing Home position data	Set a home position coordinate at the time of Homing complete. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0[command unit] Setting range: -1,000,000,000 - 1,000,000,000	No
655.0	〔Special Setup〕 Homing Press detection time	Set Torque limit detection time at the time of press Homing. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 100[ms] Setting range: 5 - 1,000	No
656.0	〔Special Setup〕 Homing Torque limit value	Set Torque limit value at the time of Homing. This value is measured in terms of proportion to rated torque. This parameter setting will be used as a torque limit during Homing using a stopper. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 500[0.1%] Setting range: 10 - 3,000	No
657.0	〔Special Setup〕 Homing Z-phase invalidation distance	Set a distance from the position where Base signal 1 for home position is detected to the position where Z-phase detection starts. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 0[command unit] Setting range: 0 - 1,000,000,000	No
659.0	〔Special Setup〕 Homing Timeout Time	Set Homing timeout time when using Homing Timeout function. （For details, refer to the section 6-9 “Homing” in Chapter 6.） Default value: 60,000[10ms] Setting range: 0 - 60,000	No

8-5. Status List

S-FLAG Status codes are described in Table 8-5-1 below.

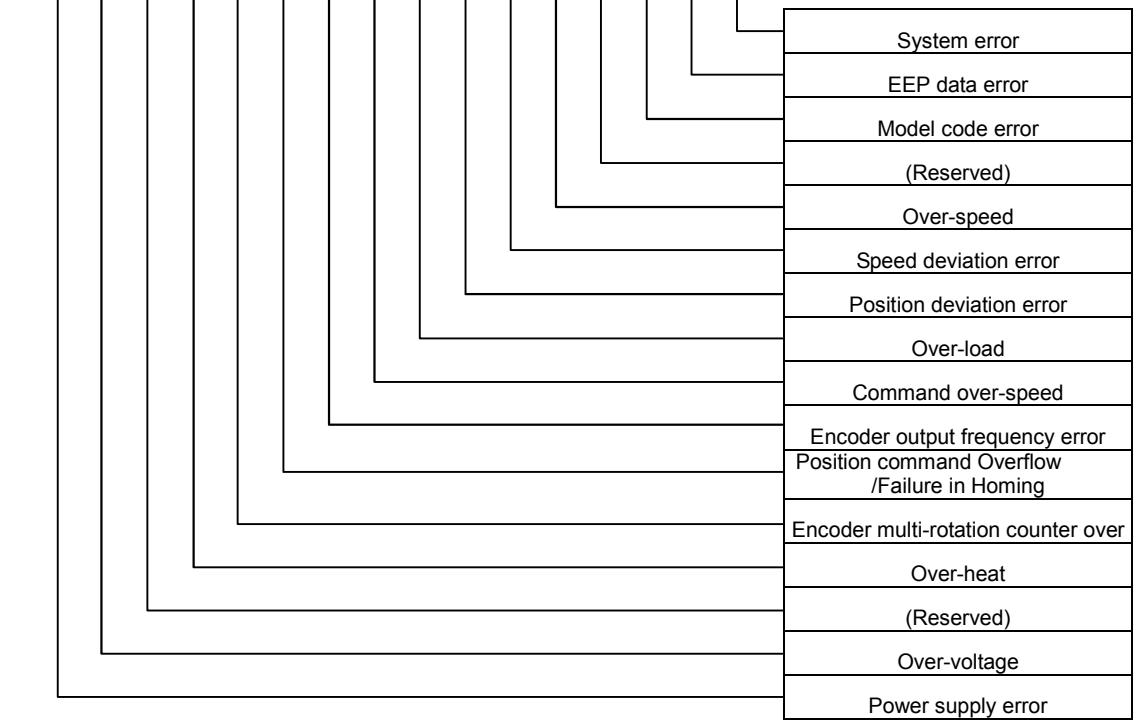
Table 8-5-1 Status List

Status No.	Item	Unit	Content	Byte [byte]	Signed
Select 0 or 1 using RS485 host command	Alarm Status	[-]	If RS485 communication is used, Alarm Status can be obtained by GET_STATE_VALUE_2 or GET_STATE_VALUE_4 command. Alarm status is an unsigned 4 byte value. With the command GET_STATE_VALUE_4, all 4 bytes be can obtained with Status No. 0. With the command GET_STATE_VALUE_2, lower two bytes will be obtained with No.0, and upper two bytes will be obtained with Status No. 1. By converting Alarm status to binary, you can learn alarm content assigned to each bit. (See Note 1) For details of each alarm and troubleshooting, refer to Chapter 7 Troubleshooting.	2 or 4 with RS485 host command	No

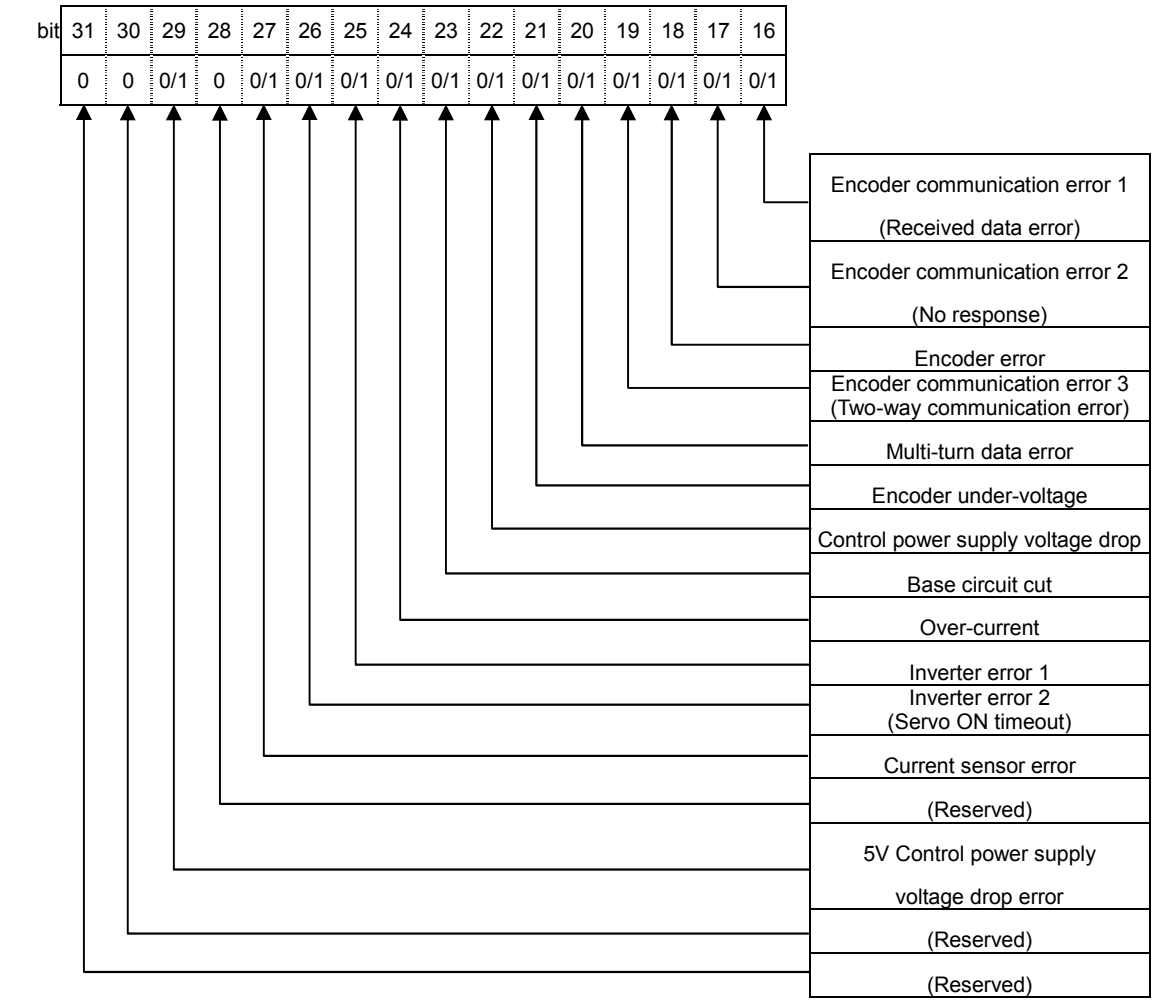
Note1) Bit assignments for Alarm status are as follows.

Lower part

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0/1	0/1	0	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0	0/1	0/1	0/1



Upper part


bit
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
0 0 0/1 0 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1
Encoder communication error 1
(Received data error)
Encoder communication error 2
(No response)
Encoder error
Encoder communication error 3
(Two-way communication error)
Multi-turn data error
Encoder under-voltage
Control power supply voltage drop
Base circuit cut
Over-current
Inverter error 1
Inverter error 2
(Servo ON timeout)
Current sensor error
(Reserved)
5V Control power supply
voltage drop error
(Reserved)
(Reserved)

8-5 Status List

Status No.	Item	Unit	Details	Byte [byte]	Signed
16	Parallel I/O Status	[-]	Indicates Parallel I/O Status. Refer to “4-4-3 Parallel I/O Status” for Status display on the Setup Panel. On the【Wave Form Monitor】tab in S-TUNE, a sum of I/O bits will be displayed in decimal waveform, similarly on the【Status Monitor】tab in binary. (See Note 2) This indicates status of Parallel I/O I1-I8 and O1-O8. Note that O6 indicates “encoder Z-phase output”, but the status display is fixed at 0.	2	No

Note 2) Bit assignments for Parallel I/O Status are as follows:

	I8	I7	I6	I5	I4	I3	I2	I1	O8	O7	O6	O5	O4	O3	O2	O1
bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0/1	0/1	0/0	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0	0/1	0/1	0/1	0/1	0/1

Position Control		Speed Control		Torque Control
Pulse train	Internal	Analog	Internal	Analog
MBRK				
SERVO				
POSIN	MEND	(Reserved)		
(Reserved)	HEND	(Reserved)		
T-LIMIT				
OCZ（fixed at 0）				
SRDY				
ALM				
SVON				
RESET	RESET/PCLR	RESET	RESET	RESET
HOLD	PCSTART1	HOLD	VCRUIN1	HOLD
PCLR	PCSEL1	(Reserved	VCRUIN2	(Reserved)
(Reserved)	PCSEL2	(Reserved	VCSEL1	(Reserved)
CCW	PCSEL3	CCWL	VCSEL2	CCWL
CWL	PCSEL4	CWL	VCSEL3	CWL
TLSEL1	ORG	TLSEL1	TLSEL1	TLSEL1

8-5 Status List

Status No.	Item	Unit	Description	Byte [byte]	Signed
24	Control part temperature	[℃]	Temperature at the amplifier control part. Install the amplifier in an ambient temperature of 85℃ max.	2	Yes
33	Pulse train command input (Position)	[pulse]	Pulse count output from the host controller.	4	Yes
35	Pulse train command input (Speed)	750W or less [pulse/160μs] 1 - 2kW [pulse/200μs]	Indicates a differential per 160 μs or 200 μ of Pulse train command input (Position). During Tuning, monitor this waveform and a waveform of the speed deviation (or position deviation) at the same time and check the positioning time and vibrations to see if the motor is following the command. Make sure that there is no command input of extremely short acceleration or deceleration time. You need acceleration time and deceleration time settings appropriate for the motor. When acceleration time or deceleration time setting is too short, the motor will not be able to follow the command and tend to vibrate. ※ In case of short acceleration or deceleration time setting, use Pulse train position command – Smoothing function.	2	Yes
49	Analog speed command input	[r/min]	Indicates Analog speed command output from the host controller. This is actually a command value input to the speed loop after applying Smoothing filter and Gain. During Analog speed command input, monitor this waveform and the speed deviation waveform at the same time, check if the motor is following the command and there is any vibration.	2	Yes
64	Positioning status	[-]	"0" indicates Positioning Not Complete and "1" indicates Positioning Complete.	2	No
65	Position command	[pulse]	Indicates a command value input to the position loop after applying paired ratio and smoothing filter to Pulse train command input (Position) Internal position command. This is measured in encoder pulse unit.	4	Yes
67	Position feedback	[pulse]	Indicates the actual motor position feedback from the encoder. This is measured in encoder pulse unit.	4	Yes
69	Position deviation	[pulse]	Indicates a deviation (in the command pulse unit) of a position command value from a position feedback value. It's measured in encoder pulse unit. This is an important status item for tuning operations in Position control. Check Positioning time, that is how long it takes for the position deviation settling in the range of the device's required range after Pulse train command input becomes zero. Also check motor vibrations. To make the positioning time shorter or suppress motor vibrations, adjust the gain to attain the device's required specification. Also in case of device vibration, check resonance frequency in waveforms of Position deviation and Torque command value. Set No.80.0 (or No.81.0) "the Position command smoothing filter 1 (or 2) moving average" to suppress resonating vibration and check the waveforms to see the vibration was indeed suppressed.	4	Yes
74	ABS Position command	[command pulse unit]	Indicates Position command measured in command pulse unit.	4	Yes
76	ABS Position feedback	[command pulse unit]	Indicates motor position feedback from the encoder, measured in command pulse unit.	4	Yes

8-5 Status List

Status No.	Item	Unit	Description	Byte [byte]	Signed
78	Command position deviation	[command pulse unit]	Indicates a deviation of Position command from Position feedback, measured in command pulse unit.	4	Yes
97	Speed command	[r/min]	Indicates a command input from Position loop and Analog speed command to Speed loop. During Tuning, monitor this wave form and the waveform of the position deviation (or speed deviation) at the same time and check the positioning time and vibrations to see if the motor is following the command. Make sure that there is no command input of extremely short acceleration or deceleration time. You need acceleration time and deceleration time settings appropriate for the motor. When acceleration time or deceleration time setting is too short, the motor will not be able to follow the command and tend to vibrate. ※ In case of short acceleration or deceleration time setting, use Pulse train position command − Smoothing function.	2	Yes
98	Speed feedback	[r/min]	Indicates a speed waveform feedback from the encoder responding to Speed command. Check the responsiveness to command and actual rotation counts compare to the command rotation counts.	2	Yes
99	Speed deviation	[r/min]	Indicates a deviation waveform of Speed command and Speed feedback. This is used for Speed control. Check the speed deviation during acceleration or deceleration and perform Gain tuning to improve command responsiveness required by the device specifications. When the speed deviation is large, perform tuning operation; Gain FF compensation 1 first, and Integral Gain next. ※ For Position Control Mode, this status is used as reference only.	2	Yes
113	Torque command value	[0.1%]	Indicates a Torque command value. The value being 1,000 means the rated torque. Check the torque size during acceleration or deceleration, and compare the maximum instantaneous torque and the rated torque. • A steady torque should be the Rated torque or less. • A Instantaneous torque should be, as a guideline, 80% of Instantaneous Maximum torque. • When Torque command reaches the Instantaneous maximum torque (i.e. torque saturation state), there will be no output and an alarm will occur after the specified time passes. Take a countermeasure against torque saturation state in order to prevent command response from slowing down. Example countermeasure are: a) use No.80.0 or No.81.0 to adjust Position command smoothing filter - # of sampling points used for moving average, b) reset so that acceleration/deceleration speed of command output from the host controller will be moderate, c) install a decelerator to make the inertia ratio smaller, and so on. • In case of Torque command being constantly larger than the rated torque, install a decelerator or raise the motor output so that inertia ratio becomes smaller. In case of device vibration problem, check resonant frequency in waveforms of Torque command or position deviation. Input Position command smoothing filter moving average counter to suppress the resonant frequency, and check the waveform to see if that worked . Or switching to a motor with high rotor inertia is effective.	2	Yes
131	Load ratio	[digit]	Waveform indicating a load ratio imposed to the motor. This value is equivalent to an effective torque. A value of up to around 1,000（1,000[digit]=100[%] is acceptable, but above around 1440 means “Overload error”. During continuous operations, make it 1,000[digit] max.	2	No

8-5 Status List

Status No.	Item	Unit	Description	Byte [byte]	Signed
194	Encoder/Rotor mechanical angle (1 rotation)	[pulse]	Data of absolute angle per rotation, whose range is 0 - 13,1072(17bit)	4	No
195	Encoder/Rotor mechanical angle (integrated value)	[pulse]	When using an absolute encoder, this is absolute data which is multi-rotation integrated value angle output from the encoder. The value is 32bit. Since multi-ration data 16 bit and one rotation angle data 17 bit are output from the encoder, total of 33 bit multi-rotation absolute value data will be output. For details, refer to Chapter 2 Section 2-1-6 Encoder specifications.	4	Yes
228	Regeneration state	[-]	Indicates Regeneration status. To see how to display Regeneration state on the Setup Panel, refer to 4-4-4 Regeneration State. In S-TUNE【Wave Form Monitor】, a sum of I/O bits will be displayed in decimal waveform, similarly【Status Monitor】the I/O bits will be displayed in binary. bit0:Regeneration control output bit8:Regeneration threshold warning bit9:Regeneration threshold	2	No
232	Primary circuit power voltage	[0.1V]	Displays the primary circuit power voltage. The value is for reference only. ※this function is available for the amplifier model「DA2□□2*」.	2	No

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