AC SERVO MOTOR and SERVO AMPLIFIER Series S-FLAG

S-FLAG Ⅱ
Instruction Manual
- EtherCAT -

www.nidec.com/en/nidec-sankyo/

NIDEC SANKYO CORPORATION

AMO-NP-35475-41
DEC. 2019

Thank you for your purchase of the S-FLAG Ⅱ 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 "Before Using".
- After reading this Instruction Manual, always keep it handy for easy access.
- The specifications or features of the product may change without notice because of further development of the product.
- We prepared the contents of this Instruction Manual with extreme care. Please do not hesitate to contact us if you have any questions.
- We always strive to have up-to-date information in the Instruction Manual; therefore, it is subject to change without prior notice.
- The illustrations and screenshot images of S-TUNE Ⅱ included in this document may be different from the actual S-TUNE Ⅱ views.
- No reproduction in any form of this Instruction Manual, in whole or in part, may be made without written authorization from Nidec Sankyo Corporation.

DEC. 2019

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Inquiries

If you have any questions about this product, please contact our distributor.

Please ask our distributor for the latest exclusive software (S-TUNEII) and user's manual.

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This chapter describes safety precautions.

B HARDWARE

This chapter describes the specifications and installation of the motor and amplifier, and wiring of the system and I/O connector.

C PARAMETER

This chapter describes parameters and tuning methods.

D SOFTWARE

This chapter describes how to use "S-TUNE Ⅱ ".

E COMMUNICATIONS

This chapter describes EtherCAT communications.

F OPERATION

This chapter explains how to drive the motor by EtherCAT communication.

Z APPENDICES

This chapter describes troubleshooting and maintenance when an alarm occurs.

MEMO

S-FLAG Ⅱ　Instruction Manual
- EtherCAT -

A

GENERAL

1. Before Using

AMO-NP-35475-41
SF2-E-A
DEC. 2019

MEMO

1

Before Using

1. Important Safety Instructions

1. Safety Precautions

This manual uses the signs below to indicate serious but avoidable problems caused by misuse of the product. One is for death or serious bodily harm. The other is for bodily injury or product or equipment damage.

⚠ **DANGER**	Identifies information about imminent hazards that will result in death or serious injury.
⚠ **CAUTION**	Identifies information about hazards that could result in injury or equipment damage.

Throughout this document, the safety precautions that users must follow are marked as follows.

🚫	Safety Precaution - **Prohibited** Action
❗	Safety Precaution - **Mandatory** Action

The possible hazardous events are marked as follows.

⚠	**Cautions and Dangers** Causes unexpected, unstable, or uncontrolled motions. Compromises the performance or reliability of the product. Shortens the service life of the product.
⚠	**Electric shock hazard**
⚠	**Burn hazard**
⚠	**Fire hazard**
⚠	**Injury hazard**
⚠	**Failure and damage hazard**

1. Important Safety Instructions

⚠ DANGER

Sign	Precautionary Measures	If Not Observed
Installation and Wiring		
🚫	Never connect the motor directly to a commercial power supply.	🔥 💥
	Do not place any flammable items near the motor or amplifier.	🔥
❗	Protect the amplifier with a protective case and ensure the clearance between the amplifier, the case and other devices as specified in this manual.	⚡ 🔥 💥
	Install the product in a place with little dust and free from water or oil splash.	⚡ 🔥 💥
	Mount the motors and amplifiers on metallic or other noncombustible materials.	🔥
	All wiring work must be performed by certified electricians.	⚡
	Ground the FG terminals of mother and amplifiers.	⚡
	Turn off the upstream circuit breaker before wiring. Wiring must be performed correctly.	⚡ ✋ 💥
	Be sure with secure cable connections. The current-carrying components must be insulated.	⚡ 🔥 💥
Operations		
🚫	Never touch the inside of the amplifier.	♨ ⚡
	Be careful not to damage the cables. Do not apply excessive force to them or place heavy objects on top of them. Do not let any part of cables become pinched or twisted.	⚡ 💥
	Never touch the rotating component of the motor during operation.	✋
	Do not use the product where it may be subjected to water, corrosive atmosphere, flammable gas, or combustible materials.	🔥
	Do not use the product where excessive vibration or impact load is present.	⚡ ✋ 🔥
	Do not use cables soaked in water or oil.	⚡ 💥
	Do not handle wiring nor operate the motor with wet hands.	⚡ ✋ 🔥
	Do not touch the keyway if you are using a motor with a shaft-end keyway.	✋
	Do not touch the motor or amplifier heat sink. It becomes very hot.	🔥 💥
	Do not use external power to run the motor.	🔥

1. Important Safety Instructions

⚠ DANGER

Sign	Precautionary Measures	If Not Observed
Additional Precautions		
❗	Be sure to confirm the safe condition of the equipment after each earthquake.	⚡ ✋ 🔥
	To prevent a fire or personal injury during an earthquake, carry out installation work securely and properly.	⚡ ✋ 🔥 ⚠
	Install external emergency stop circuitry so that the operation can be stopped and the power supply can be shut down immediately in case of emergency.	⚡ ✋ 🔥 ⚠
Maintenance and Inspection		
🚫	Never attempt to disassemble the product.	⚡ ✋ 🔥
❗	There are hazardous voltage sections in the amplifier. Before performing any wiring or inspection, be sure to allow more than 15 minutes after the power shuts off for the internal voltage to completely discharge.	⚡

1. Important Safety Instructions

⚠ CAUTION

Sign	Precautionary Measures	If Not Observed
Installation and Wiring		
🛇	Do not directly touch the terminal portion of any connectors.	⚠ ⚠
	Do not block the air vents. Do not allow ingress of any foreign objects to the product.	⚠ ⚠
❗	Keep the motor-amplifier pairing as specified.	⚠ ⚠
	Before a test run, confirm that the motor is fixed in place, check the motions while the motor is isolated from the machinery first, then install the motor in the machinery.	⚠
	Observe the mounting method and orientation as specified.	⚠ ⚠
	Install the product in an appropriate way suitable for its main body mass and the rated output of the product.	⚠ ⚠
Operations		
🛇	Do not step on the product or place any heavy object on it.	⚠ ⚠ ⚠
	Never make drastic changes during tuning, which if not observed, will result in unstable motions.	⚠
	Do not come close to the machinery right after power restoration following a power outage. The machinery may restart unexpectedly at any moment. Take appropriate measures to ensure safety against an unexpected restart.	⚠
	Do not use the product where it may be exposed to direct sunlight.	⚠
	Do not apply impact load.	⚠
	Never use the electromagnetic contactor installed on the main power supply-side to operate or stop the motor.	⚠
	Do not use the built-in brake of the motor for regular braking purposes. It is a holding brake.	⚠ ⚠
	Do not use faulty, damaged motors or amplifies.	⚠ ⚠
❗	Confirm that the power specifications are normal.	⚠
	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.	⚠
	Upon occurrence of an alarm, remove the cause and ensure the safe condition of the equipment before resetting the alarm and restarting the machine.	⚠
	Connect the brake control relay and the emergency stop relay in series.	⚠ ⚠

1. Important Safety Instructions

⚠ CAUTION

Sign	Precautionary Measures	If Not Observed
Transportation and Storage		
🚫	Do not store the product at a location subject to water or moisture, or where toxic gases or liquids are present.	⚠
	Do not hold the cables or motor shafts during transportation.	⚠ ⚠
	When transporting the amplifier and monitor, do not drop them or let them fall.	⚠ ⚠
❗	When the product has been stored for an extended time, contact our customer service center.	⚠
	Store the product in suitable storage environments as specified in the instruction manual.	⚠
Additional Precautions		
❗	Prior to disposal of the batteries, insulate them with tape or other material. Dispose of them following the local laws and regulations.	
	When disposing of the S-FLAG Ⅱ product, treat it as industrial waste.	
Maintenance and Inspection		
🚫	Never attempt to overhaul the product.	⚠
	Do not power cycle too frequently.	⚠
	The motor, heat sink of the amplifier, and regenerative resistor may become dangerously hot. Do not touch any of them with hands when power is on or for a while after power shutdown.	⚠ ⚠
❗	If the amplifier or motor fails, shut down both the control power supply and the main circuit power supply.	⚠
	When not using the product for an extended period, be sure to turn the power off.	⚠

1. Important Safety Instructions

2. Other Considerations and Precautions

Export of this product or its applications

If the end user or applications of the product is involved in military activities or weapons, its export may be subject to "Foreign Exchange and Foreign Trade Law (Japan)" (or equivalent in your country).
Have adequate legal reviews and follow any required export procedures.
Follow the laws and regulations of the destination.

Use of the product – Not in human life related field

This product is designed and manufactured to be used for general industrial products.
Medical applications are not allowed.

Applications for special environments or purposes such as nuclear power, aerospace and transportation

Please contact us in advance of use.

Application that could cause serious accidents or damage due to product failure

Be sure to have safety device or protection device installed before using your equipment.

Applying voltage beyond the rated power range of this product

Doing so could become a fire or smoke hazard to the amplifier. Be sure to check and confirm proper wiring before turning the power on. Be particularly careful in a location such as a clean room.

Operations with the motor shaft not electrically grounded

Depending on the device or installation environment, bearing noise might be increased by galvanic corrosion of the motor bearings. Perform careful check on grounding.

Operations in environment under significant influence of external noise and static electricity

This product has been designed and manufactured to pass extensive noise tests. However, there is a possibility of unexpected behavior depending on user's environment.
Practice a fail-safe design and take adequate measures to ensure safety within the range of machine motion.

Use of the product in a manner not rated by the manufacture

Such use shall void the manufacture warranty. Be mindful before you attempt to do so.

3. Safety Standards

Not Applicable

Rating		Motor	Amplifier
EU/EC Directives	Low Voltage Directive (*1)	EN60034-1 EN60034-5	EN61800-5-1
	EMC Directive (*2)	–	EN61000-6-2 EN55011 (Class A. Group1)
	Machinery Directive	(N/A)	
UL Standards (*1)		UL1004-1 UL1004-6 (File No.E470950)	UL61800-5-1 (File No.E471456)
CSA Standards		C22.2 No.100	C22.2 No.274
South Korea Radio Law (KC)		–	KN61000-6-2 KN11
China Compulsory Product Certification System (CCC)		(N/A)	

*1) Install the product in the environment that meets the following requirements:
- Overvoltage Category III
- Class I
- Pollution Degree 2 (Circuitry)

*2) The test conditions for the machinery and equipment with this product installed may be different from our test conditions.
Such machinery or equipment must meet the safety standards for their final configurations.

*3) The motor of "MX 951" is not UL compliant.

4. Maintenance and Inspection

🚫	Never overhaul the product.
❗	For safe use of the product, be sure to perform regular maintenance and inspection on the amplifier and motor.
	Ensure the electrical and mechanical safety before each inspection.

This product assumes the following operating conditions.

Ambient Temperature	Average annual temperature of 30℃ (not exceeding the rated temperature range)
Load Factor	80% max
Operating Hours	20 hours a day

Maintenance

For safe use of the product, perform daily and periodic inspections.

Daily Inspection: Check the following before each operation:

- Ambient temperature, humidity and atmosphere
- No foreign objects or dust; especially ensure that nothing is blocking the vent holes
- No excessive bending or damage of the wires
- Power supply voltage is within the specifications
- No foreign objects in mobile components of the device and the range of motion.
- No unusual noise or smell right after the machinery starts.

Periodic Inspection: Check the following at least once a year:

- No loose clamp screw problems in the amplifier and motor.
- No deformation or discoloration in the amplifier, motor, cables, and terminal blocks due to overheating.
- No looseness in wiring fixings and terminal block screws.

1. Important Safety Instructions

5. Warranty

Terms of Warranty

The term of warranty for this product is eighteen (18) months after the date of product manufacture. However, brake-equipped motors whose number of axis accelerations and decelerations exceeded the rated maximum shall not be covered by the warranty.

Conditions of Warranty

Should any failure develop during the warranty period under normal operations in accordance to the S-FLAG Ⅱ instruction manual, Sankyo agrees to make repairs at free of charge. However, even during the warranty period, Sankyo will make only fee-based repair if the failure is due to the following reasons:

- Misuse, improper repair, or alteration of the product
- Product is dropped after purchase or damaged during transportation
- Use of this product is not within the product specifications
- Fire, earthquake, lightning, storm and flood damage, salt damage, abnormal voltage, or any other acts of God or natural disasters
- Ingress of foreign matter such as water, oil or metal chips.

This warranty does not apply to any parts or accessories that have been used longer than their rated service life.

The warranty applies to delivered products only. Sankyo shall not be liable for any indirect, incidental or consequential damage caused by the product failure or damage.

2. About Our Products

Misuse or mishandling of the product will not only result in its suboptimal performance, but also failure or shorter service life.
For safety and proper use of the product, please read the instruction manuals carefully.

About This Product and This Instruction Manual

- Product features and parts are subject to change without prior notice due to potential future product improvement initiatives.
- Please contact us in advance if you are to acquire safety standards certification etc. for equipment with this product installed.
- We have prepared the contents of this manual with extreme care. Please do not hesitate to contact us if you have any questions.
- Include the following precautions in the User Guide of your S-FLAG Ⅱ application product:
  - This is a high-voltage product which can be hazardous.
  - Residual voltage exists at the terminals and inside the equipment (even after power shutoff), which is hazardous.
  - The product contains high temperature components.
  - It is prohibited to disassemble the product.
- For optimal service life of the S-FLAG Ⅱ product, use of the product under proper conditions is essential. Follow the safety precautions and instructions described in this manual.
- We always strive to include up-to-date information in the instruction manual; therefore, it is subject to change without prior notice.
- For a copy of the latest version of the instruction manual, please contact us.
- Reproducing or copying this document, in whole or in part, without prior approval of Sankyo, is strictly prohibited.

Check Items Upon Unpacking

- Please compare the actual items received with your product purchase order.
- Inspect all items received for evidence of damage during transit.
- Should you have any problems, please contact our sales department.

2. About Our Products

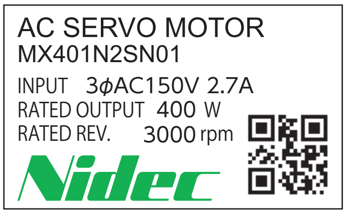
1. Product Label

Motor Label

Label 1

Motor Model

Specifications



AC SERVO MOTOR
MX401N2SN01
INPUT 3ϕAC150V 2.7A
RATED OUTPUT 400 W
RATED REV. 3000 rpm

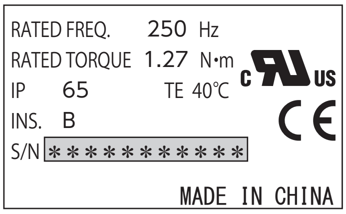
Label 2

Specifications

Product Number (Produced year and month + Serial No.)

A product number is indicated by 11 digits.

S/N: ** (Year) * (Month(*)) ******** (Serial No.)



RATED FREQ. 250 Hz
RATED TORQUE 1.27 N•m
IP 65 TE 40℃
INS. B
S/N ***********
MADE IN CHINA

Amplifier Label

Amplifier Model

Product Number (Produced year and month + Serial No.)

A product number is indicated by 11 digits.

S/N: ** (Year) * (Month(*)) ******** (Serial No.)

Specifications

AC SERVO DRIVER
MODEL DB63841
S/N
RATED INPUT 1ϕ AC200-240V 1.5kVA 50/60Hz
OUTPUT 3ϕ 0-240V 0-500Hz 4.2A
750
IP2X
MISP-REM-sld-DB63841
LISTED
IND. CONT.EQ.
AAAA
MADE IN CHINA

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*) About indication of "the month".

"1" = Jan., … "9" = Sep., "X" = Oct., "Y" = Nov., and "Z" = Dec.

2. Danger Signs

NO IMPACT/NO DISASSEMBLY LABEL

Do not remove the encoder cover. Never overhaul the encoder.
Beating the encoder cover will cause encoder failure.
Do not apply strong impact to the motor and its shaft.

HOT SURFACE WARNING

Do not touch the product during operation or for a while afterward, or you may get burned from the heat.

ELECTRIC SHOCK WARNING

Do not touch the amplifier during operation and within 15 minutes after operation, or you may get injured.

DANGER・CAUTION

Incorrect use of the amplifier may cause injury or damage. Avoid misuse or improper handling of the amplifier, or injury will result.

FG (FRAME GROUND/PROTECTIVE GROUNDING) SYMBOL

Be sure to perform grounding with the screw located at this sign.

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B

HARDWARE

AMO-NP-35475-41
SF2-E-B
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B HARDWARE

1

Specifications

1. Motors

1. Model Codes

Motors with a 23 bit Absolute Encoder

Models	MX	201	B	2	S	A	* *

Series

Code	Specifications
MX	Low Inertia
MY	Middle Inertia
MG	
MM	
MJ	
MZ	High Inertia
MH	

Rated Output

Code	Rated Output
500	50 W
101	100 W
201	200 W
401	400 W
751	750 W
851	850 W
951	1 kW
102	1 kW
132	1.3 kW
152	1.5 kW
202	2 kW

Brake

Code	Holding Brake
P	Without
B	With

The "Brake" code displays the specifications of the encoder resolution.

Voltage

Code	Specifications
2	AC200–240 V

Control Number

Code	Brake	Oil Seal	Shaft
11	Without	Without	Straight
12	With	Without	Straight
13	Without	Without	With Key
14	With	Without	With Key
15	Without	With	Straight
16	With	With	Straight
17	Without	With	With Key
18	With	With	With Key

"**1** *" of the Code shows Absolute encoder model.

Encoder

Code	Specifications
A	Absolute

The motor equipped with 23 bit encoder is a lineup only for absolute model.

Shaft end specifications/Oil Seal

Code	Shaft	Oil Seal
S (P)	Straight	Without
K (H)	With Key	Without
T (R)	Straight	With
L (J)	With Key	With

The straight shaft products are not tapped end.
( ) Shaft diameter = ⌀ 11
⌀ 11 shaft is exclusively for 200 W motor.
Please ask about this product to our distributor.

Inertia

- Low Inertia
- Middle Inertia
- High Inertia

Flange Size

- 40 mm × 40 mm
- 60 mm × 60 mm
- 80 mm × 80 mm
- 100 mm × 100 mm
- 130 mm × 130 mm

Rotational Speed

Rated Motor Speed / Max.

- 1,500 r/min / 3,000 r/min
- 2,000 r/min / 3,000 r/min
- 3,000 r/min / 5,000 r/min
- 3,000 r/min / 6,000 r/min

Encoder Resolution

- 23 bit/rev
- 17 bit/rev

IP Code

- IP65
- IP67

Motors with a 17 bit Absolute Encoder

Models MX 201 A 2 S A * *

Series	
Code	Specifications
MX	Low Inertia
MY	Middle Inertia
MG	
MM	
MJ	
MZ	High Inertia
MH	

Rated Output	
Code	Rated Output
500	50 W
101	100 W
201	200 W
401	400 W
751	750 W
851	850 W
951	1 kW
102	1 kW
132	1.3 kW
152	1.5 kW
202	2 kW

Brake	
Code	Holding Brake
N	Without
A	With

The "Brake" code displays the specifications of the encoder resolution.

Voltage	
Code	Specifications
2	AC200–240 V

Control Number			
Code	Brake	Oil Seal	Shaft
11	Without	Without	Straight
12	With	Without	Straight
13	Without	Without	With Key
14	With	Without	With Key
15	Without	With	Straight
16	With	With	Straight
17	Without	With	With Key
18	With	With	With Key

"**1** *" of the Code shows Absolute encoder model.

Encoder	
Code	Specifications
A	Absolute

Shaft end specifications/Oil Seal		
Code	Shaft	Oil Seal
S (P)	Straight	Without
K (H)	With Key	Without
T (R)	Straight	With
L (J)	With Key	With

The straight shaft products are not tapped end.
( ) Shaft diameter = ⌀ 11
⌀ 11 shaft is exclusively for 200 W motor.
Please ask about this product to our distributor.

1. Motor

Motors with a 17 bit Incremental Encoder

Models MX 201 A 2 S N * *

Series

Code	Specifications
MX	Low Inertia
MY	Middle Inertia
MG	
MM	
MJ	
MZ	High Inertia
MH	

Rated Output

Code	Rated Output
500	50 W
101	100 W
201	200 W
401	400 W
751	750 W
851	850 W
951	1 kW
102	1 kW
132	1.3 kW
152	1.5 kW
202	2 kW

Brake

Code	Holding Brake
N	Without
A	With

The "Brake" code displays the specifications of the encoder resolution.

Voltage

Code	Specifications
2	AC200–240 V

Control Number

Code	Brake	Oil Seal	Shaft
01	Without	Without	Straight
02	With	Without	Straight
03	Without	Without	With Key
04	With	Without	With Key
05	Without	With	Straight
06	With	With	Straight
07	Without	With	With Key
08	With	With	With Key

"**0** *" of the Code shows Incremental encoder model.

Encoder

Code	Specifications
N	Incremental

Shaft end specifications/Oil Seal

Code	Shaft	Oil Seal
S (P)	Straight	Without
K (H)	With Key	Without
T (R)	Straight	With
L (J)	With Key	With

The straight shaft products are not tapped end.
( ) Shaft diameter = ⌀ 11
⌀ 11 shaft is exclusively for 200 W motor.
Please ask about this product to our distributor.

1. Motor

Motor Rated Capacity	Motor Model Name Rotor Inertia & Series			Mounting Flange Size	Encoder Resolution	Rotational Speed	IP	Amplifier	Page
	L Low Inertia MX	M Middle Inertia MY MG MM MJ	H High Inertia MZ MH						23bit / 17bit
50 W	–	**MY500** **MG500**	–	40 SQUARE	23 bit ENCODER / 17 bit ENCODER	6000 3000	IP 65	DB6**YZ**41	p. 8- /p. 31-
100 W	–	**MY101** **MG101**	–	40 SQUARE	23 bit ENCODER / 17 bit ENCODER	6000 3000	IP 65	DB6**Z1**41	p. 10- /p. 33-
200 W	**MX201**	**MG201**	**MZ201**	60 SQUARE	23 bit ENCODER / 17 bit ENCODER	6000 3000	IP 65	DB6**12**41	P. 12- /p. 35-
400 W	**MX401**	**MG401**	**MZ401**	60 SQUARE	23 bit ENCODER / 17 bit ENCODER	6000 3000	IP 65	DB6**24**41	p. 15- /p. 38-
750 W	**MX751**	–	**MZ751**	80 SQUARE	23 bit ENCODER / 17 bit ENCODER	6000 3000	IP 65	DB6**38**41	p. 18- /p. 41-
850 W	–	**MJ851**	–	130 SQUARE	23 bit ENCODER / 17 bit ENCODER	3000 1500	IP 65	DB6**5B**41	p. 20 /p. 43
1 kW	**MX951**	–	–	80 SQUARE	23 bit ENCODER / 17 bit ENCODER	6000 3000	IP 65	DB6**4A**41	p. 21 /p. 44
	MX102	–	–	100 SQUARE	23 bit ENCODER / 17 bit ENCODER	5000 3000	IP 67	DB6**4A**41	p. 22 /p. 45
	–	**MM102**	**MH102**	130 SQUARE	23 bit ENCODER / 17 bit ENCODER	3000 2000	IP 67	DB6**4A**41	p. 23- /p. 46-
1.3 kW	–	**MJ132**	–	130 SQUARE	23 bit ENCODER / 17 bit ENCODER	3000 1500	IP 67	DB6**7C**41	p. 25 /p. 48
1.5 kW	**MX152**	–	–	100 SQUARE	23 bit ENCODER / 17 bit ENCODER	5000 3000	IP 67	DB6**6B**41	p. 26 /p. 49
	–	**MM152**	**MH152**	130 SQUARE	23 bit ENCODER / 17 bit ENCODER	3000 2000	IP 67	DB6**6B**41	p. 27- /p. 50-
2 kW	**MX202**	–	–	100 SQUARE	23 bit ENCODER / 17 bit ENCODER	5000 3000	IP 67	DB6**8C**41	p. 29 /p. 52
	–	**MM202**	–	130 SQUARE	23 bit ENCODER / 17 bit ENCODER	3000 2000	IP 67	DB6**8C**41	p. 30 /p. 53

2. Names of parts

Figure 1

Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | 1 kW | 1.3 kW | 1.5 kW | 2 kW

MX951

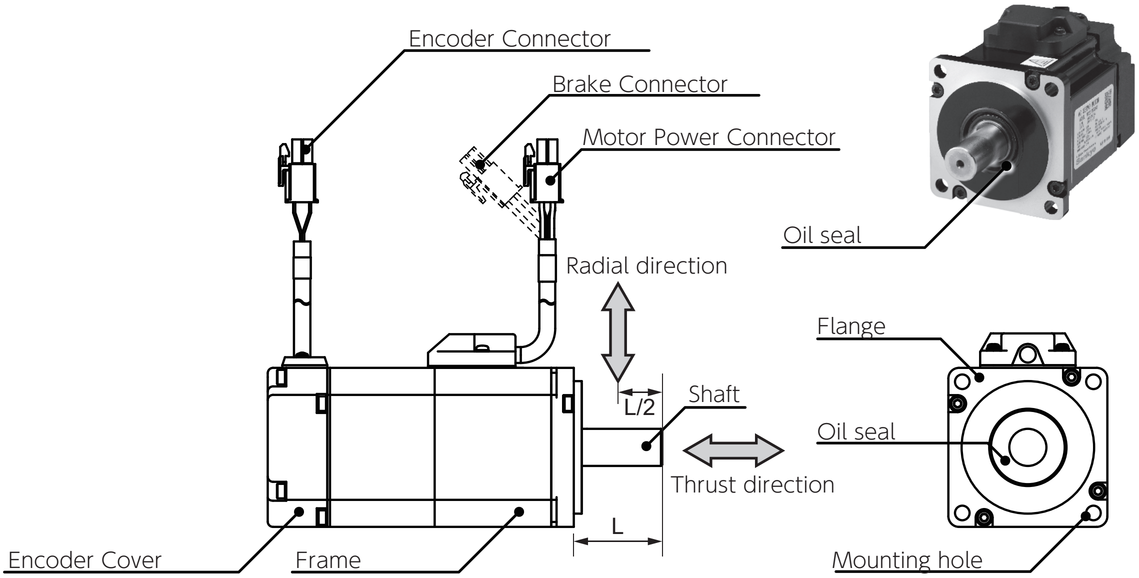
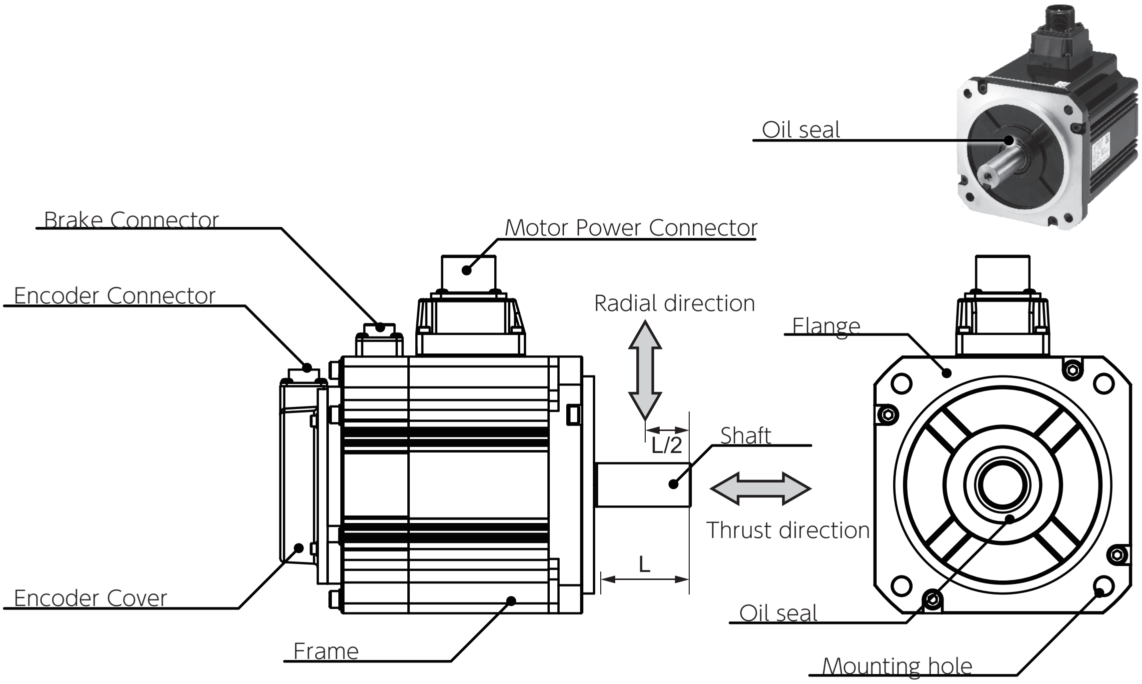


Figure 2

Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | 1 kW | 1.3 kW | 1.5 kW | 2 kW

MX102
MM102
MH102



3. Specifications

Item	Specifications
Ambient temperature for operation	0–40℃
Ambient humidity for operation	20 to 85% RH (no condensation)
Ambient temperature for storage	– 20 to 65℃ (no condensation) (not subjected to direct sunlight) 80℃ for 72 hours
Ambient humidity for storage	20 to 85% RH (no condensation)
Atmosphere for operation / storage	Indoors (not subject to direct sunlight), Free from corrosive gases, flammable gases, oil mist, dust, flammables, grinding fluid
Insulation resistance	≧ 5 MΩ at 1,000 VDC
Dielectric strength	AC 1500 V for one minute across the primary and FG
Operating altitude	≦ 1,000 m
Vibration class	V15 (JEC2121)
Vibration resistance	49 m/s^2 (5 G)
Impact resistance	98 m/s^2 (10 G)
Protective structure	IP65 : 50 W to 750 W, 1kW (Only MX951) IP67 : 1 kW (Except for MX951) to 2 kW
Electric shock protection	Class I (Mandatory grounding)
Installation environment	Pollution degree 2

The brake has polarity.

Lead wire color: Connection
Yellow (BRK +): +24 V
Blue (BRK –): GND

Incorrect wiring may result in motor failure or suboptimal performance of the motor.

1. Motor

50 W

Motor Model : MY500P2 □□** (Without brake)
MY500B2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.4
	With brake		0.6
Compatible amplifier model		–	DB6YZ41
Voltage		V	AC200–240 V
Rated output		W	50
Rated torque		N·m	0.16
Instantaneous maximum torque		N·m	0.56
Rated current (stall current)		A	0.68
Instantaneous maximum current		A	2.4
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.25
Induced voltage constant per phase		mV/(r/min)	8.8
Rated power rate	Without brake	kW/s	7.1
	With brake		5.8
Mechanical time constant	Without brake	ms	1.76
	With brake		2.15
Electrical time constant		ms	0.74
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.036
	With brake		0.043

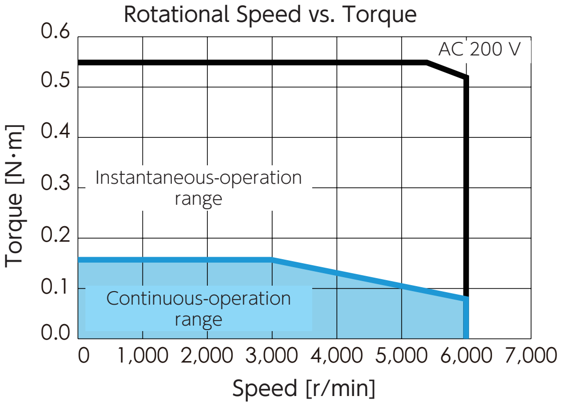
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.25
Static friction torque	N·m	≧0.16
Suction time	ms	≦35
Release time	ms	≦20
Release voltage	V	≧ DC1 V

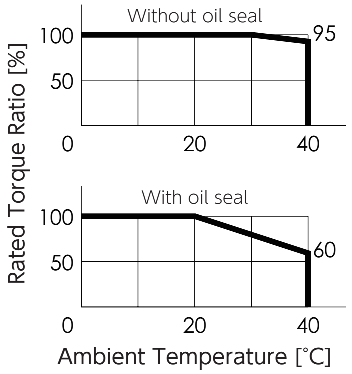
Permissible Load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

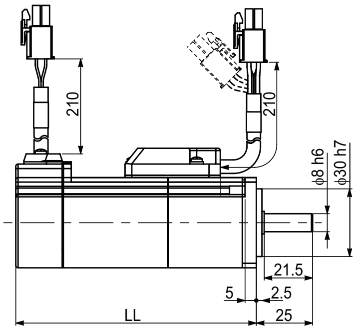


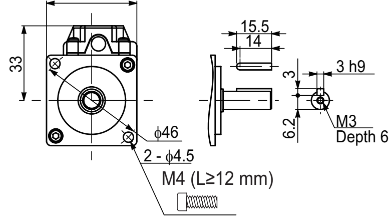
Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MY500P2S MY500P2K	MY500P2T MY500P2L	MY500B2S MY500B2K	MY500B2T MY500B2L
LL	66.4	72.0	106.8	112.4





1. Motor

Motor Model : MG500P2□□** (Without brake)
MG500B2□□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.4
	With brake		0.6
Compatible amplifier model		–	DB6YZ41
Voltage		V	AC200–240 V
Rated output		W	50
Rated torque		N·m	0.16
Instantaneous maximum torque		N·m	0.56
Rated current (stall current)		A	0.71
Instantaneous maximum current		A	2.4
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.25
Induced voltage constant per phase		mV/(r/min)	8.7
Rated power rate	Without brake	kW/s	6.4
	With brake		5.3
Mechanical time constant	Without brake	ms	2.14
	With brake		2.58
Electrical time constant		ms	0.65
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	0.040
	With brake		0.048

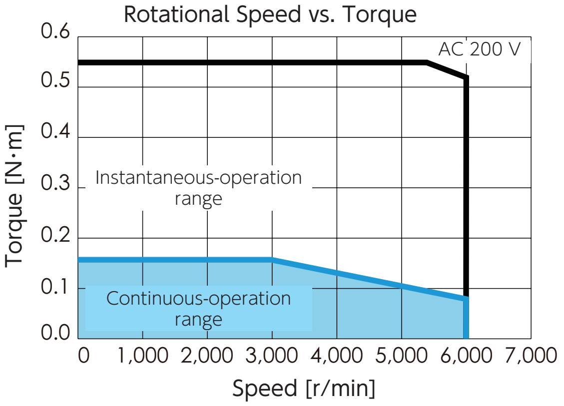
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.26
Static friction torque	N·m	≧ 0.16
Suction time	ms	≦ 35
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

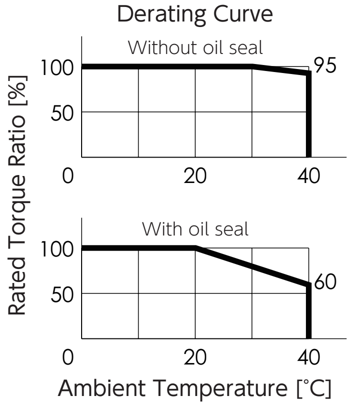
Permissible Load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

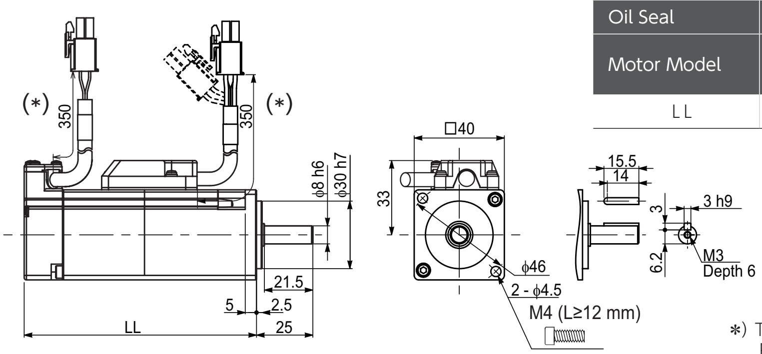


Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MG500P2S MG500P2K	MG500P2T MG500P2L	MG500B2S MG500B2K	MG500B2T MG500B2L
LL	57.1	64.7	89.5	97.1



*) The cable included in the MG500 series is 350 mm.
Please contact us if you need a 210 mm cable.

1. Motor

100 W

Motor Model : MY101P2 □□** (Without brake)
MY101B2 □□** (With brake)

Basic Specifications

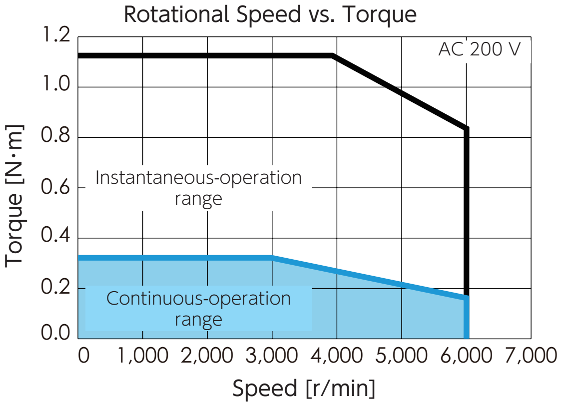
Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.5
	With brake		0.8
Compatible amplifier model		–	DB6Z141
Voltage		V	AC200–240 V
Rated output		W	100
Rated torque		N·m	0.32
Instantaneous maximum torque		N·m	1.12
Rated current (stall current)		A	0.97
Instantaneous maximum current		A	3.3
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.35
Induced voltage constant per phase		mV/(r/min)	12.3
Rated power rate	Without brake	kW/s	17.4
	With brake		15.4
Mechanical time constant	Without brake	ms	1.10
	With brake		1.25
Electrical time constant		ms	0.89
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.058
	With brake		0.066

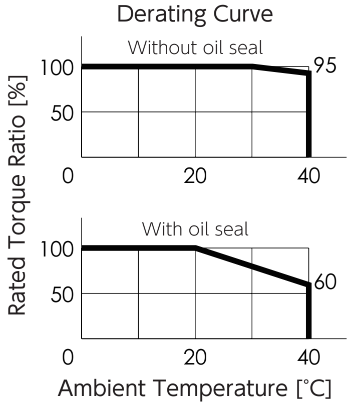
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.25
Static friction torque	N·m	≧ 0.32
Suction time	ms	≦ 35
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

Permissible Load

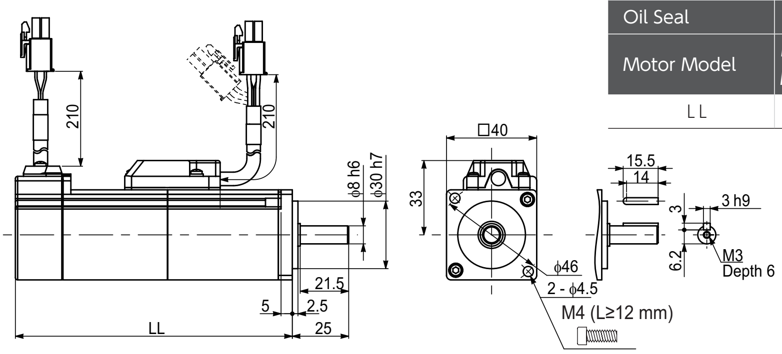
Item	Unit	Specifications
Radial	N	68
Thrust	N	58


Rotational Speed vs. Torque


Derating Curve

(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MY101P2S MY101P2K	MY101P2T MY101P2L	MY101B2S MY101B2K	MY101B2T MY101B2L
LL	82.4	88.0	122.8	128.4



1. Motor

Motor Model : MG101P2 ☐☐✻✻ (Without brake) MG101B2 ☐☐✻✻ (With brake)

100 W | 23 bit ENCODER | 40 SQUARE | M | 60 30 | IP 65

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.5
	With brake		0.7
Compatible amplifier model		–	DB6Z141
Voltage		V	AC200–240 V
Rated output		W	100
Rated torque		N·m	0.32
Instantaneous maximum torque		N·m	1.12
Rated current (stall current)		A	0.99
Instantaneous maximum current		A	3.4
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.37
Induced voltage constant per phase		mV/(r/min)	12.7
Rated power rate	Without brake	kW/s	15.5
	With brake		13.8
Mechanical time constant	Without brake	ms	1.28
	With brake		1.43
Electrical time constant		ms	0.78
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.065
	With brake		0.073

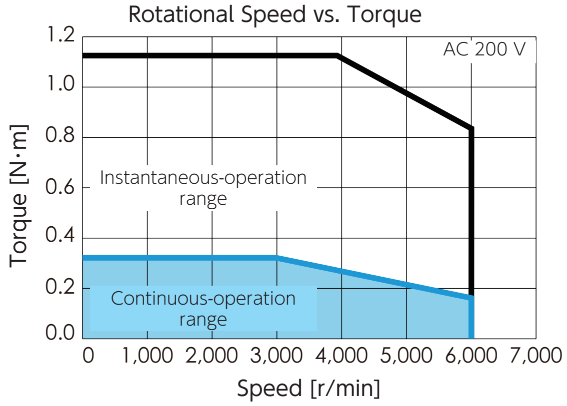
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.26
Static friction torque	N·m	≧ 0.32
Suction time	ms	≦ 35
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

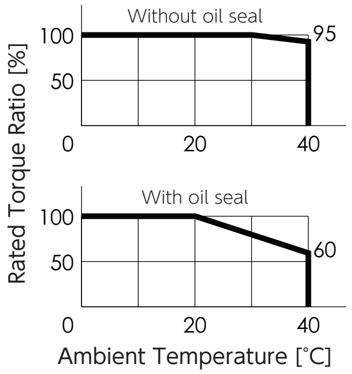
Permissible Load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

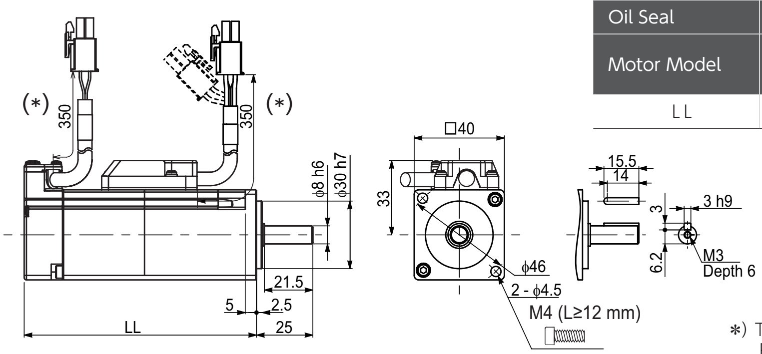


Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MG101P2S MG101P2K	MG101P2T MG101P2L	MG101B2S MG101B2K	MG101B2T MG101B2L
LL	70.7	78.3	103.1	110.7



✻) The cable included in the MG101 series is 350 mm.
Please contact us if you need a 210 mm cable.

1. Motor

200 W

Motor Model : MX201P2 □□＊＊ (Without brake)
MX201B2 □□＊＊ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	0.8
	With brake		1.3
Compatible amplifier model		–	DB61241
Voltage		V	AC200–240 V
Rated output		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(r/min)	14.3
Rated power rate	Without brake	kW/s	29.9
	With brake		24.7
Mechanical time constant	Without brake	ms	0.68
	With brake		0.83
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.14
	With brake		0.16

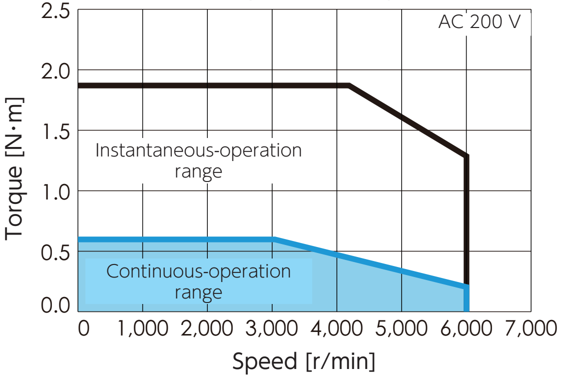
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

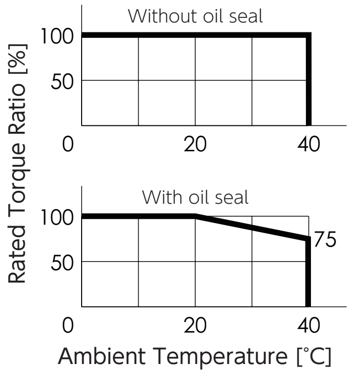
Permissible Load

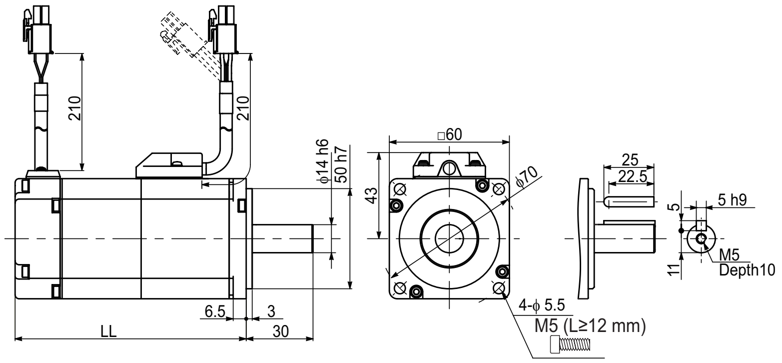
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX201P	MX201B
LL	76.5	113.0

1. Specifications

1. Motor

Motor Model : MG201P2 □□** (Without brake)
MG201B2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	0.9
	With brake		1.3
Compatible amplifier model		–	DB61241
Voltage		V	AC200–240 V
Rated output		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(r/min)	14.3
Rated power rate	Without brake	kW/s	15.9
	With brake		14.5
Mechanical time constant	Without brake	ms	1.28
	With brake		1.41
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.26
	With brake		0.28

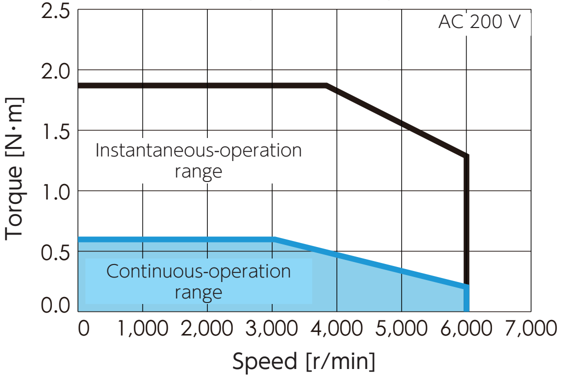
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

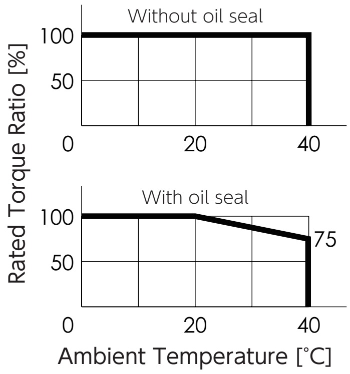
Permissible Load

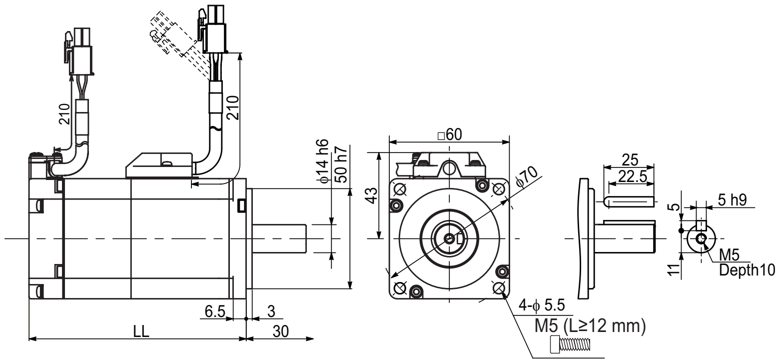
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MG201P	MG201B
LL	78.0	108.5

1. Motor

Motor Model : MZ201P2 □□** (Without brake)
MZ201B2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.0
	With brake		1.5
Compatible amplifier model		–	DB61241
Voltage		V	AC200–240 V
Rated output		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(r/min)	14.3
Rated power rate	Without brake	kW/s	9.3
	With brake		8.7
Mechanical time constant	Without brake	ms	2.19
	With brake		2.34
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.44
	With brake		0.46

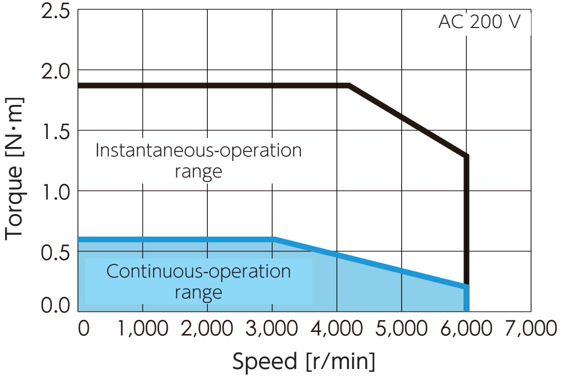
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

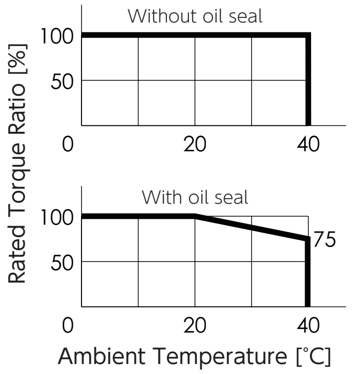
Permissible Load

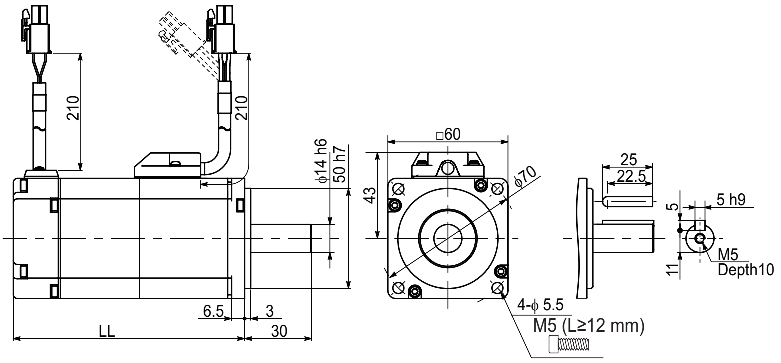
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ201P	MZ201B
LL	93.5	130.0

1. Motor

400 W

Motor Model : MX401P2 ☐☐** (Without brake)
MX401B2 ☐☐** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.1
	With brake		1.6
Compatible amplifier model		–	DB62441
Voltage		V	AC200–240 V
Rated output		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(r/min)	17.1
Rated power rate	Without brake	kW/s	71.8
	With brake		63.8
Mechanical time constant	Without brake	ms	0.45
	With brake		0.51
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.23
	With brake		0.25

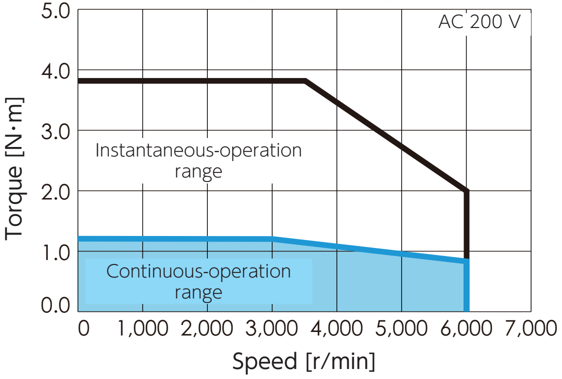
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

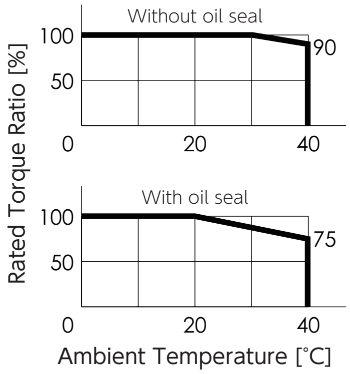
Permissible Load

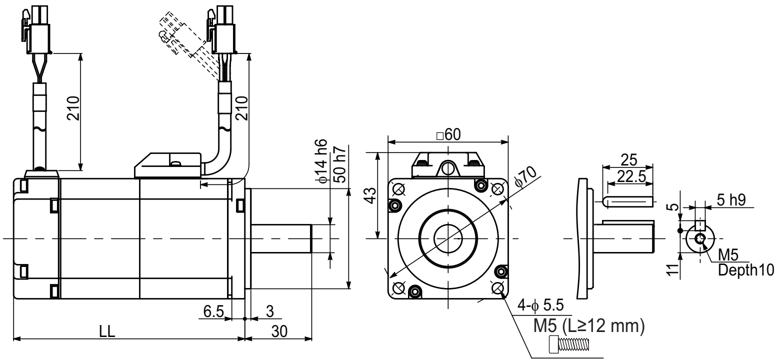
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX401P	MX401B
LL	93.5	130.0

1. Motor

Motor Model : MG401P2 □□＊＊ (Without brake)
MG401B2 □□＊＊ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.1
	With brake		1.5
Compatible amplifier model		–	DB62441
Voltage		V	AC200–240 V
Rated output		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(r/min)	17.1
Rated power rate	Without brake	kW/s	33.7
	With brake		32.1
Mechanical time constant	Without brake	ms	0.96
	With brake		1.01
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.48
	With brake		0.51

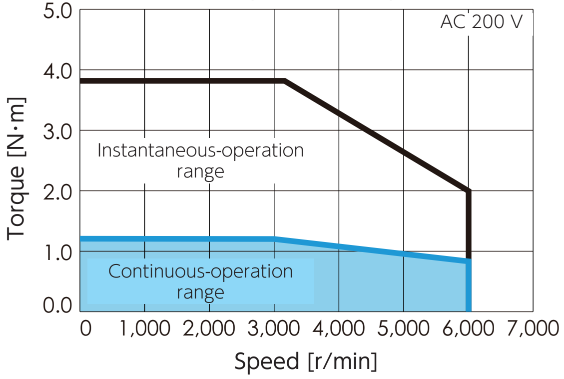
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

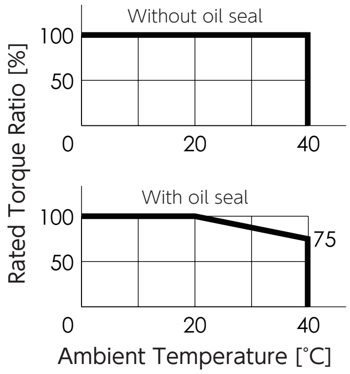
Permissible Load

Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque

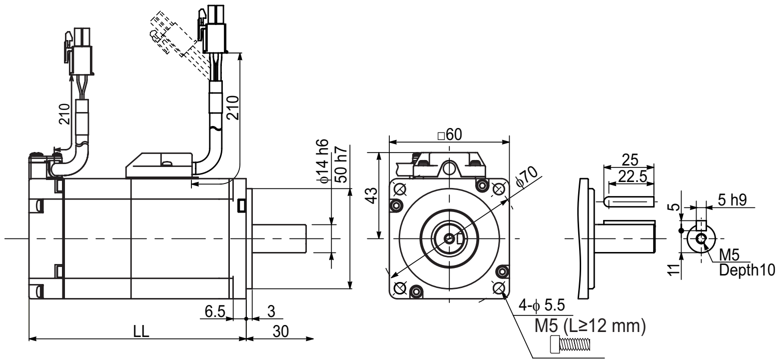


Derating Curve



(mm)

Brake	Without	With
Motor Model	MG401P	MG401B
LL	98.0	128.5



1. Motor

Motor Model : MZ401P2 □□** (Without brake)
MZ401B2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.3
	With brake		1.8
Compatible amplifier model		–	DB62441
Voltage		V	AC200–240 V
Rated output		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(r/min)	17.1
Rated power rate	Without brake	kW/s	23.2
	With brake		22.3
Mechanical time constant	Without brake	ms	1.40
	With brake		1.46
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	0.70
	With brake		0.73

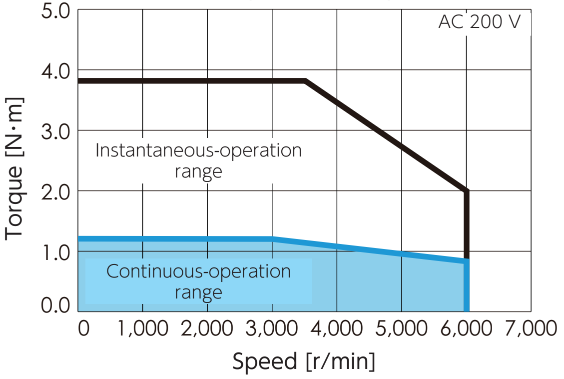
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

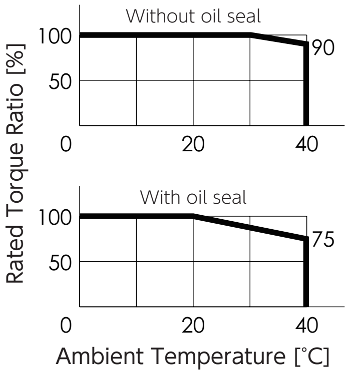
Permissible Load

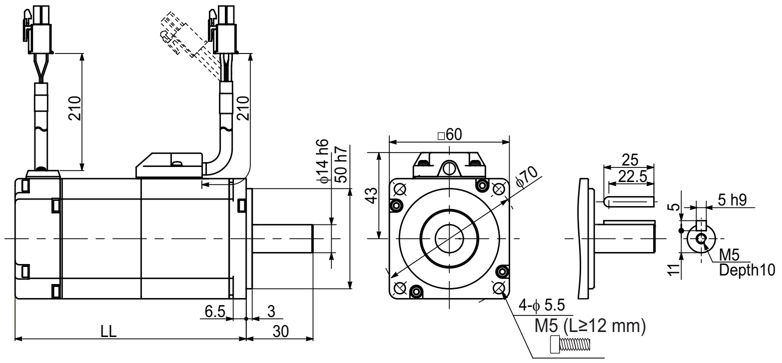
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ401P	MZ401B
LL	110.5	147.0

1. Motor

750 W

Motor Model : MX751P2 □□** (Without brake)
MX751B2 □□** (With brake)

Basic Specifications

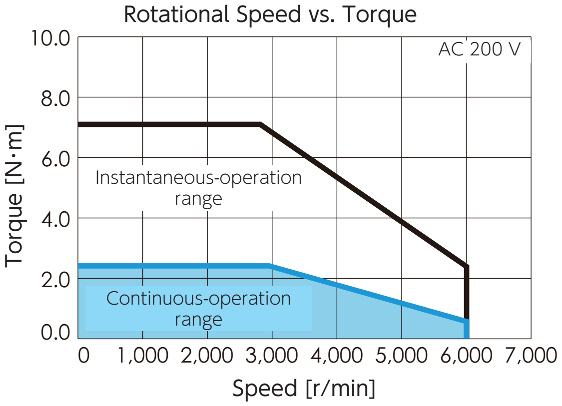
Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.2
	With brake		3.0
Compatible amplifier model		–	DB63841
Voltage		V	AC200–240 V
Rated output		W	750
Rated torque		N·m	2.39
Instantaneous maximum torque		N·m	7.1
Rated current (stall current)		A	4.2
Instantaneous maximum current		A	12.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.63
Induced voltage constant per phase		mV/(r/min)	21.9
Rated power rate	Without brake	kW/s	77.5
	With brake		61.3
Mechanical time constant	Without brake	ms	0.39
	With brake		0.50
Electrical time constant		ms	4.60
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.74
	With brake		0.93

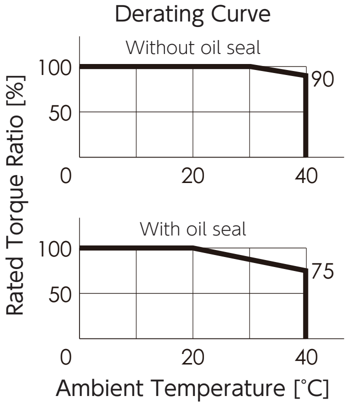
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.4
Static friction torque	N·m	≧ 2.39
Suction time	ms	≦ 70
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

Permissible Load

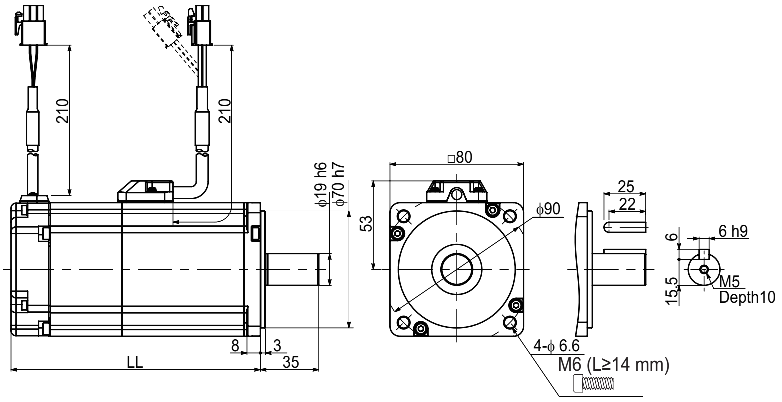
Item	Unit	Specifications
Radial	N	392
Thrust	N	147


Rotational Speed vs. Torque


Derating Curve

(mm)

Brake	Without	With
Motor Model	MX751P	MX751B
LL	107.3	144.3



1. Motor

Motor Model : MZ751P2 □□** (Without brake)
MZ751B2 □□** (With brake)

750 W | 23 bit ENCODER | 80 SQUARE | H | 60 30 | IP 65

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.5
	With brake		3.3
Compatible amplifier model		–	DB63841
Voltage		V	AC200–240 V
Rated output		W	750
Rated torque		N·m	2.39
Instantaneous maximum torque		N·m	7.1
Rated current (stall current)		A	4.2
Instantaneous maximum current		A	12.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.63
Induced voltage constant per phase		mV/(r/min)	21.9
Rated power rate	Without brake	kW/s	35.5
	With brake		31.7
Mechanical time constant	Without brake	ms	0.85
	With brake		0.96
Electrical time constant		ms	4.60
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	1.60
	With brake		1.80

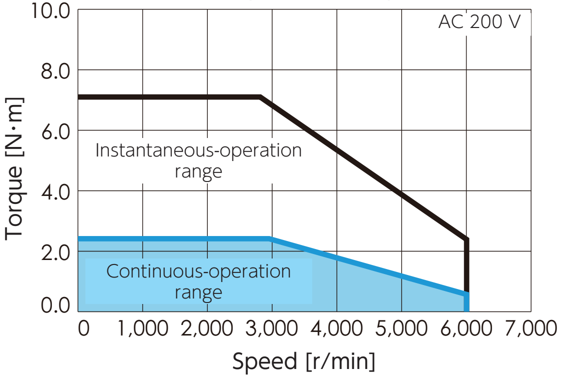
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.4
Static friction torque	N·m	≧ 2.39
Suction time	ms	≦ 70
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

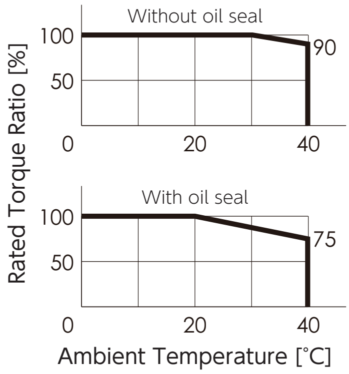
Permissible Load

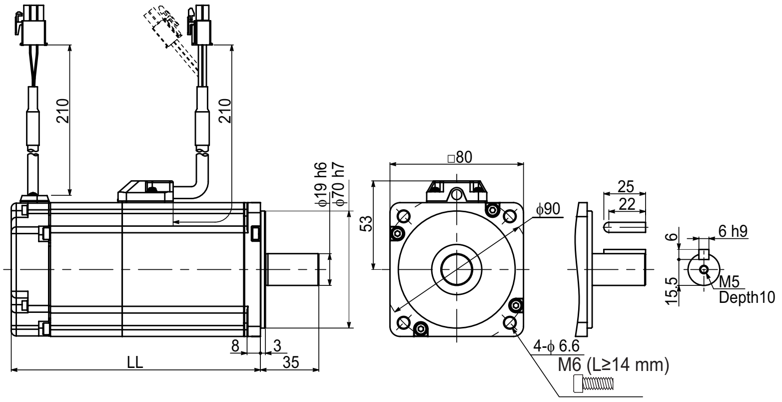
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ751P	MZ751B
LL	122.3	159.3

1. Motor

850 W

Motor Model : MJ851P2 □□＊＊ (Without brake)
MJ851B2 □□＊＊ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	6.2
	With brake		7.9
Compatible amplifier model		–	DB65B41
Voltage		V	AC200–240 V
Rated output		W	850
Rated torque		N·m	5.39
Instantaneous maximum torque		N·m	14.2
Rated current (stall current)		A	6.9
Instantaneous maximum current		A	17.0
Rated revolving speed		r/min	1,500
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.83
Induced voltage constant per phase		mV/(r/min)	28.9
Rated power rate	Without brake	kW/s	21.1
	With brake		18.3
Mechanical time constant	Without brake	ms	2.7
	With brake		3.1
Electrical time constant		ms	8.45
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	13.9
	With brake		16.0

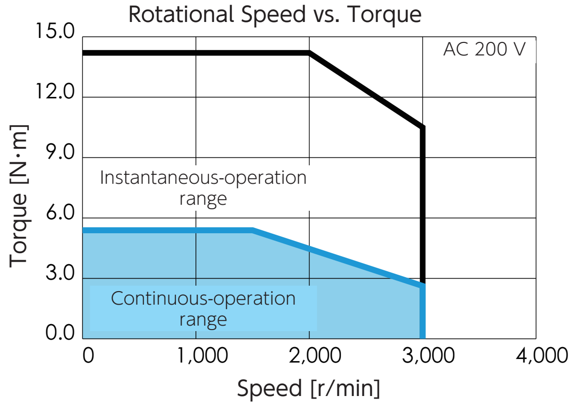
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.41
Static friction torque	N·m	≧ 12.7
Suction time	ms	≦ 100
Release time	ms	≦ 60
Release voltage	V	≧ DC1 V

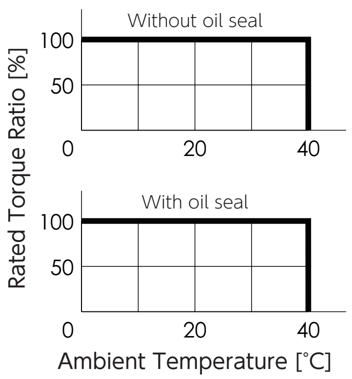
Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	98

Rotational Speed vs. Torque

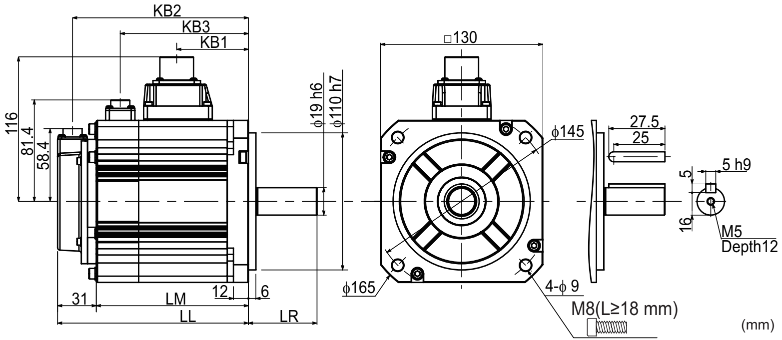


Derating Curve



(mm)

Brake	Without	With
Motor Model	MJ851P	MJ851B
LL	128.0	162.0
LM	97.0	131.0
LR	58.0	
KB1	70.0	
KB2	116.0	150.0
KB3	–	109.0



1. Specifications

1. Motor

1 kW

Motor Model : MX951P2 □□** (Without brake)
MX951B2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.8
	With brake		3.6
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	3.18
Instantaneous maximum torque		N·m	9.55
Rated current (stall current)		A	5.2
Instantaneous maximum current		A	15.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.65
Induced voltage constant per phase		mV/(r/min)	22.9
Rated power rate	Without brake	kW/s	90.8
	With brake		78.6
Mechanical time constant	Without brake	ms	0.34
	With brake		0.40
Electrical time constant		ms	3.95
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	1.12
	With brake		1.29

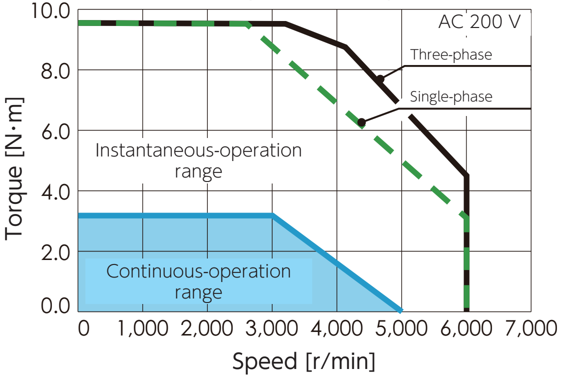
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.47
Static friction torque	N·m	≧ 3.18
Suction time	ms	≦ 70
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

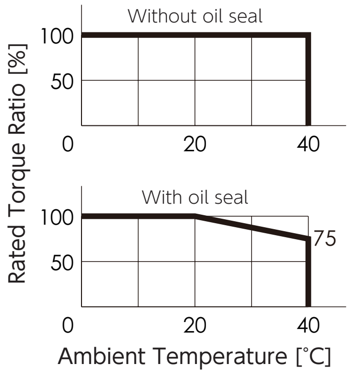
Permissible Load

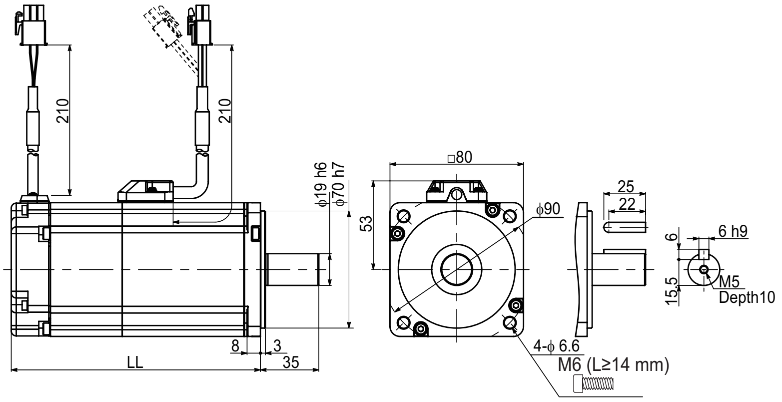
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX951P	MX951B
LL	127.3	164.3

1. Motor

Motor Model : MX102P2 □□** (Without brake)
MX102B2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	100 sq.
Approximate mass	Without brake	kg	3.9
	With brake		5.2
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	3.18
Instantaneous maximum torque		N·m	9.55
Rated current (stall current)		A	6.6
Instantaneous maximum current		A	19.9
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	5,000
Torque constant		N·m/A	0.52
Induced voltage constant per phase		mV/(r/min)	18.2
Rated power rate	Without brake	kW/s	52.3
	With brake		43.2
Mechanical time constant	Without brake	ms	0.59
	With brake		0.72
Electrical time constant		ms	5.19
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	1.91
	With brake		2.35

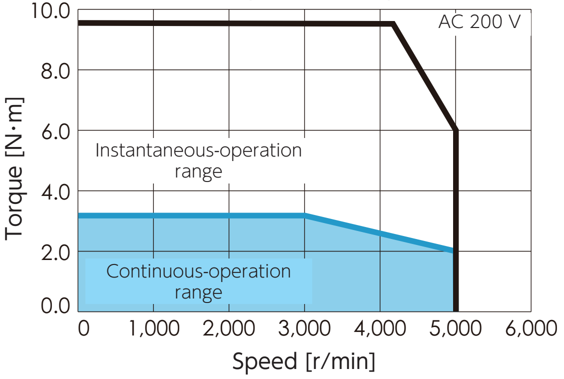
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 7.8
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

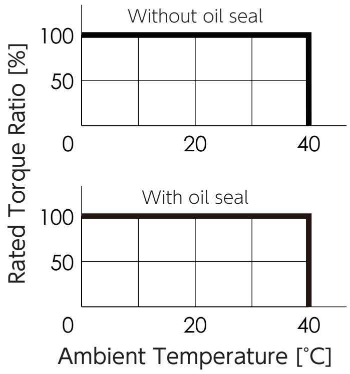
Permissible Load

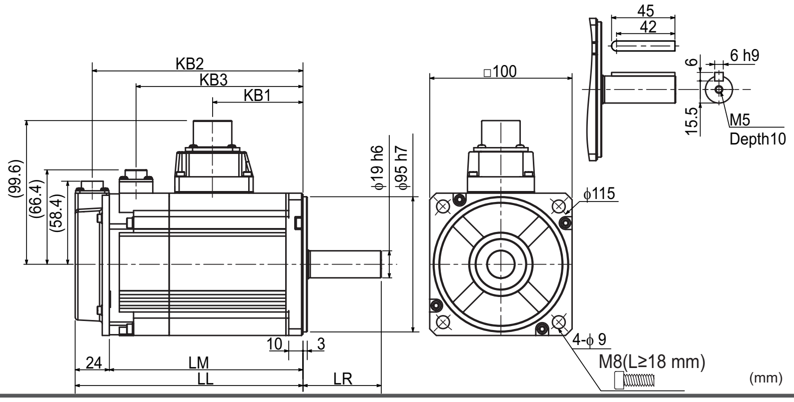
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX102P	MX102B
LL	130.0	160.0
LM	106.0	136.0
LR	55.0	
KB1	63.5	
KB2	118.0	148.0
KB3	–	117.3

1. Motor

Motor Model : MM102P2 □□✻✻ (Without brake)
MM102B2 □□✻✻ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	5.6
	With brake		7.0
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	5.6
Instantaneous maximum current		A	16.8
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.88
Induced voltage constant per phase		mV/(r/min)	30.9
Rated power rate	Without brake	kW/s	50.0
	With brake		36.5
Mechanical time constant	Without brake	ms	0.76
	With brake		1.05
Electrical time constant		ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	4.56
	With brake		6.24

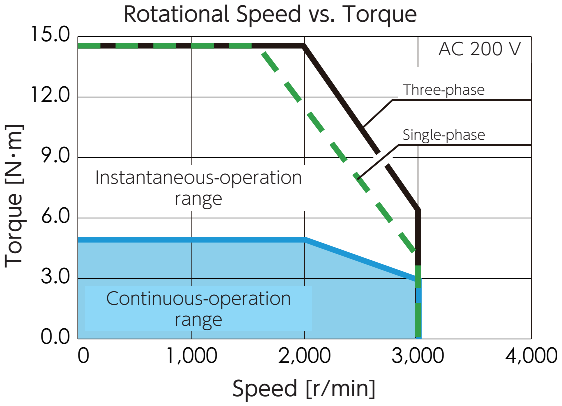
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

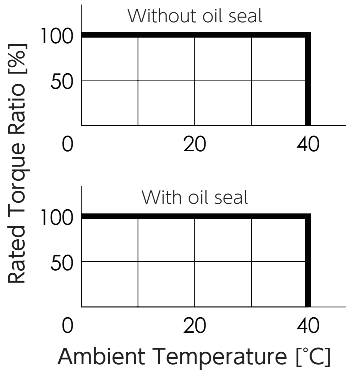
Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque

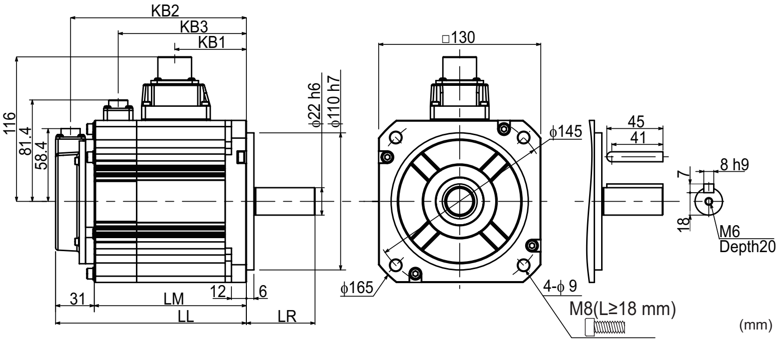


Derating Curve



(mm)

Brake	Without	With
Motor Model	MM102P	MM102B
LL	128.0	153.0
LM	97.0	122.0
LR	55.0	
KB1	57.5	
KB2	116.0	141.0
KB3	–	102.8



1. Motor

Motor Model : MH102P2 □□** (Without brake)
MH102B2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.6
	With brake		9.0
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	5.6
Instantaneous maximum current		A	16.8
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.88
Induced voltage constant per phase		mV/(r/min)	30.9
Rated power rate	Without brake	kW/s	9.2
	With brake		8.6
Mechanical time constant	Without brake	ms	4.17
	With brake		4.43
Electrical time constant		ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	24.9
	With brake		26.4

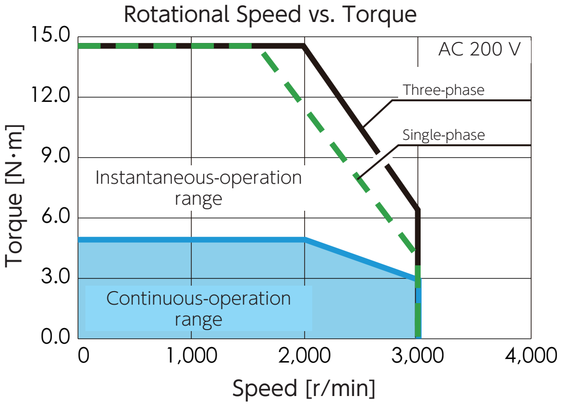
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

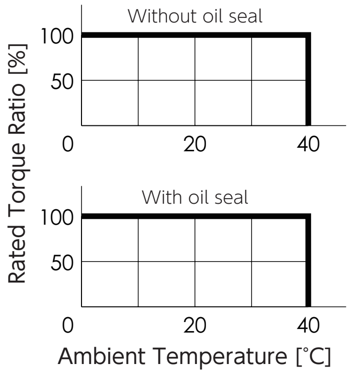
Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque

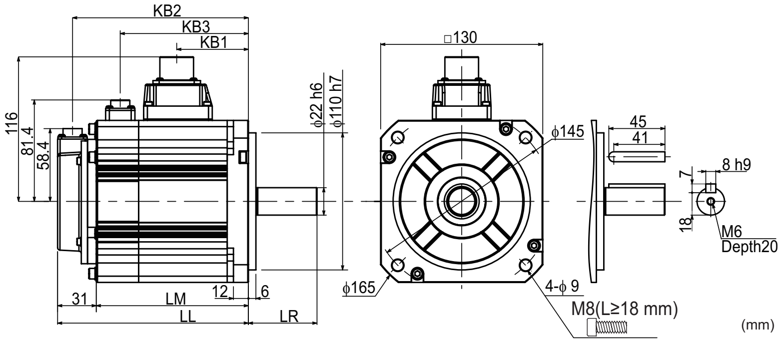


Derating Curve



(mm)

Brake	Without	With
Motor Model	MH102P	MH102B
LL	163.0	188.0
LM	132.0	157.0
LR	70.0	
KB1	92.5	
KB2	151.0	176.0
KB3	–	137.8



1. Specifications

1. Motor

1.3 kW

Motor Model : MJ132P2□□＊＊ (Without brake)
MJ132B2□□＊＊ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.7
	With brake		9.8
Compatible amplifier model		–	DB67C41
Voltage		V	AC200–240 V
Rated output		W	1,300
Rated torque		N·m	8.34
Instantaneous maximum torque		N·m	23.3
Rated current (stall current)		A	10.7
Instantaneous maximum current		A	28.0
Rated revolving speed		r/min	1,500
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.85
Induced voltage constant per phase		mV/(r/min)	29.8
Rated power rate	Without brake	kW/s	34.7
	With brake		31.3
Mechanical time constant	Without brake	ms	2.1
	With brake		2.3
Electrical time constant		ms	8.42
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	19.8
	With brake		21.9

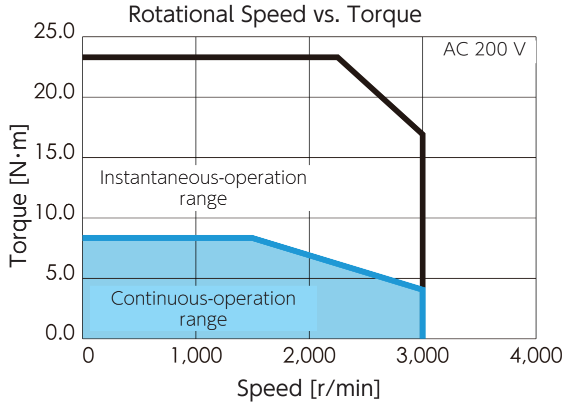
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.41
Static friction torque	N·m	≧ 19.6
Suction time	ms	≦ 100
Release time	ms	≦ 60
Release voltage	V	≧ DC1 V

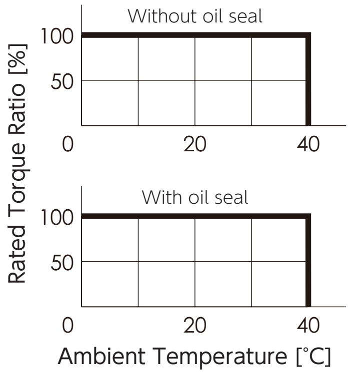
Permissible Load

Item	Unit	Specifications
Radial	N	686
Thrust	N	343

Rotational Speed vs. Torque

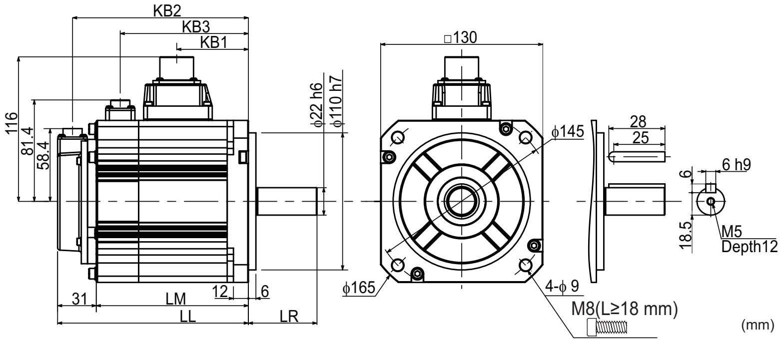


Derating Curve



(mm)

Brake	Without	With
Motor Model	MJ132P	MJ132B
LL	145.5	179.5
LM	114.5	148.5
LR	58.0	
KB1	87.5	
KB2	133.5	167.5
KB3	–	126.0



1. Motor

1.5 kW

Motor Model : MX152P2 □□ ∗∗ (Without brake)
MX152B2 □□ ∗∗ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	100 sq.
Approximate mass	Without brake	kg	4.9
	With brake		6.2
Compatible amplifier model		–	DB66B41
Voltage		V	AC200–240 V
Rated output		W	1,500
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	8.2
Instantaneous maximum current		A	24.9
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	5,000
Torque constant		N·m/A	0.64
Induced voltage constant per phase		mV/(r/min)	22.3
Rated power rate	Without brake	kW/s	81.4
	With brake		70.2
Mechanical time constant	Without brake	ms	0.50
	With brake		0.57
Electrical time constant		ms	5.95
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	2.80
	With brake		3.25

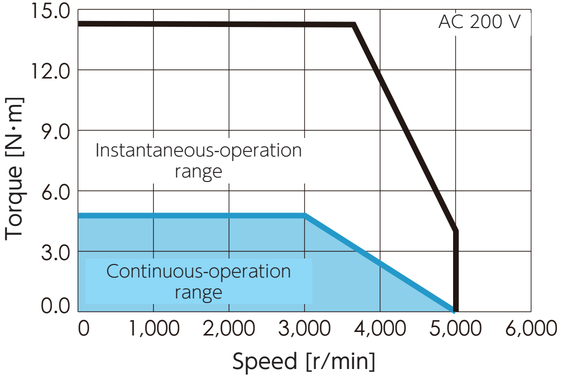
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 7.8
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

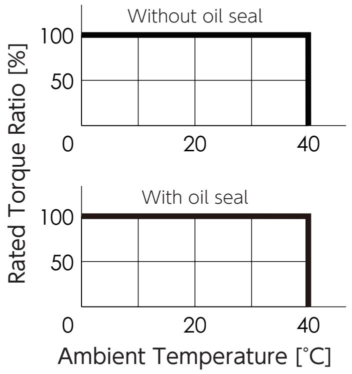
Permissible Load

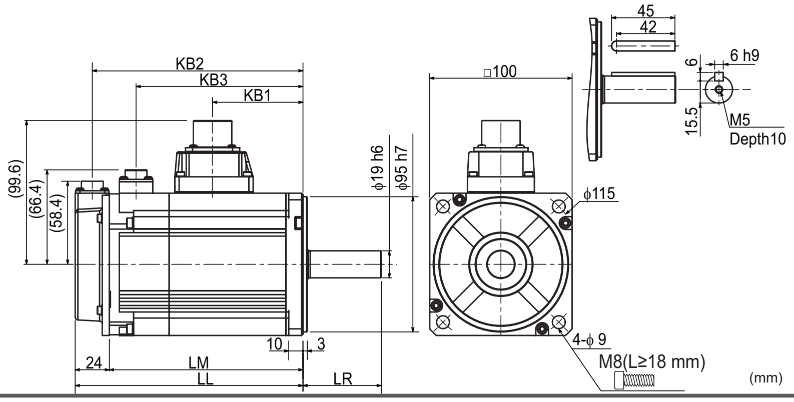
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX152P	MX152B
LL	149.0	179.0
LM	125.0	155.0
LR	55.0	
KB1	82.5	
KB2	137.0	167.0
KB3	–	136.3

1. Specifications

1. Motor

Motor Model : MM152P2 □□** (Without brake)
MM152B2 □□** (With brake)

Basic Specifications

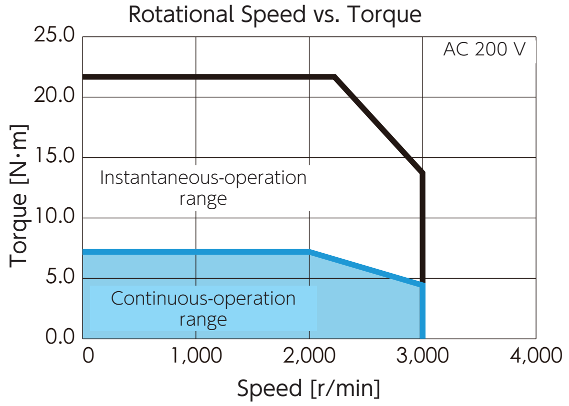
Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.0
	With brake		8.4
Compatible amplifier model		–	DB66B41
Voltage		V	AC200–240 V
Rated output		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(r/min)	28.4
Rated power rate	Without brake	kW/s	76.9
	With brake		61.4
Mechanical time constant	Without brake	ms	0.60
	With brake		0.75
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	6.67
	With brake		8.35

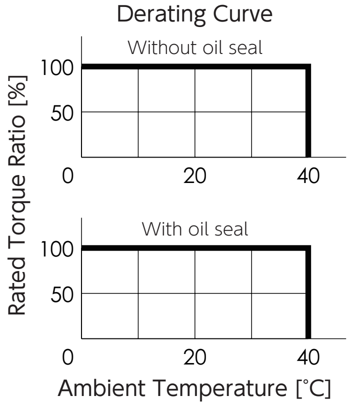
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

Permissible Load

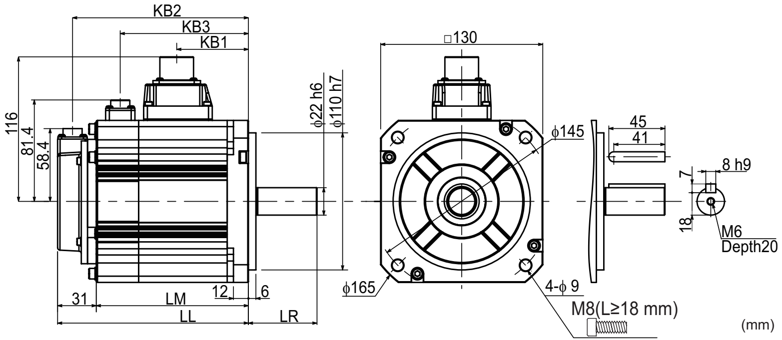
Item	Unit	Specifications
Radial	N	490
Thrust	N	196


Rotational Speed vs. Torque


Derating Curve

(mm)

Brake	Without	With
Motor Model	MM152P	MM152B
LL	145.5	170.5
LM	114.5	139.5
LR	55.0	
KB1	75.0	
KB2	133.5	158.5
KB3	–	120.3



1. Motor

Motor Model : MH152P2 ☐☐** (Without brake)
MH152B2 ☐☐** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	9.0
	With brake		10.4
Compatible amplifier model		–	DB66B41
Voltage		V	AC200–240 V
Rated output		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(r/min)	28.4
Rated power rate	Without brake	kW/s	13.8
	With brake		13.3
Mechanical time constant	Without brake	ms	3.32
	With brake		3.46
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	37.12
	With brake		38.65

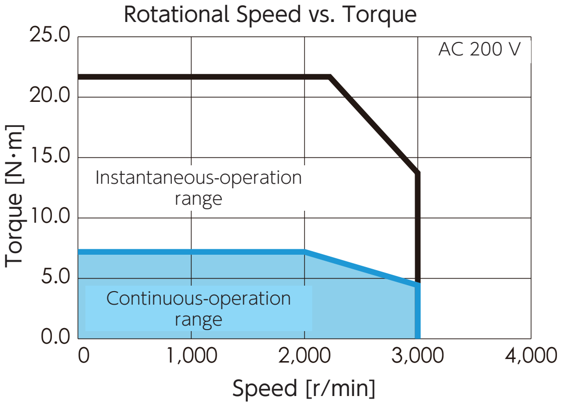
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

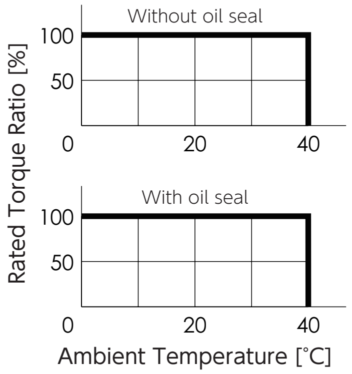
Permissible Load

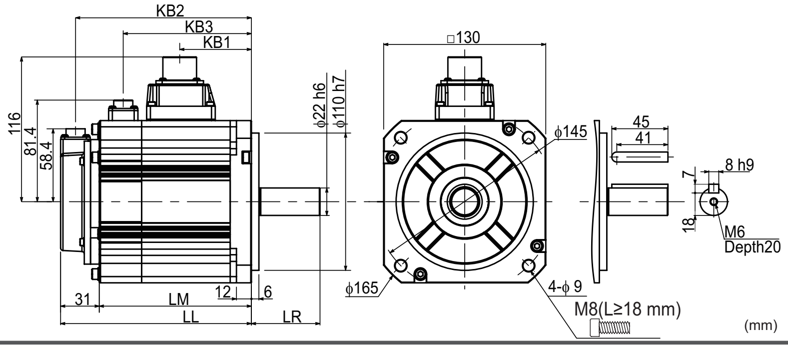
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MH152P	MH152B
LL	180.5	205.5
LM	149.5	174.5
LR	70.0	
KB1	110.0	
KB2	168.5	193.5
KB3	–	155.3

1. Specifications

1. Motor

2 kW

Motor Model : MX202P2 □□** (Without brake)
MX202B2 □□** (With brake)

2 kW | 23 bit ENCODER | 100 SQUARE | L | 50 30 | IP 67

Basic Specifications

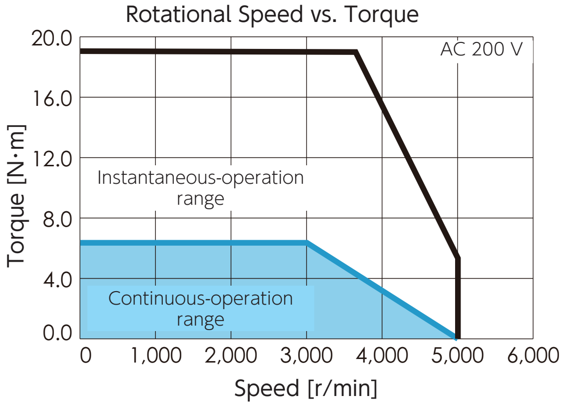
Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	100 sq.
Approximate mass	Without brake	kg	6.0
	With brake		7.3
Compatible amplifier model		–	DB68C41
Voltage		V	AC200–240 V
Rated output		W	2,000
Rated torque		N·m	6.37
Instantaneous maximum torque		N·m	19.1
Rated current (stall current)		A	11.3
Instantaneous maximum current		A	33.9
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	5,000
Torque constant		N·m/A	0.62
Induced voltage constant per phase		mV/(r/min)	21.7
Rated power rate	Without brake	kW/s	110.2
	With brake		99.2
Mechanical time constant	Without brake	ms	0.50
	With brake		0.56
Electrical time constant		ms	5.44
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	3.68
	With brake		4.09

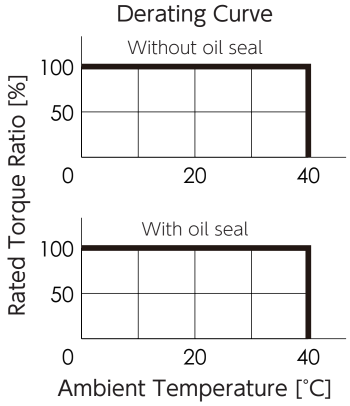
Brake Specifications

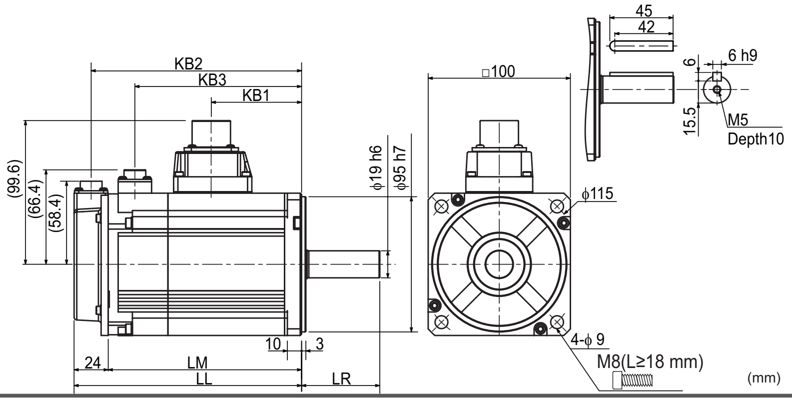
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 7.8
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	196


Rotational Speed vs. Torque


Derating Curve



(mm)

Brake	Without	With
Motor Model	MX202P	MX202B
LL	168.0	198.0
LM	144.0	174.0
LR	55.0	
KB1	101.5	
KB2	156.0	186.0
KB3	–	155.3

1. Motor

Motor Model : MM202P2 □□** (Without brake)
MM202B2 □□** (With brake)

Basic Specifications

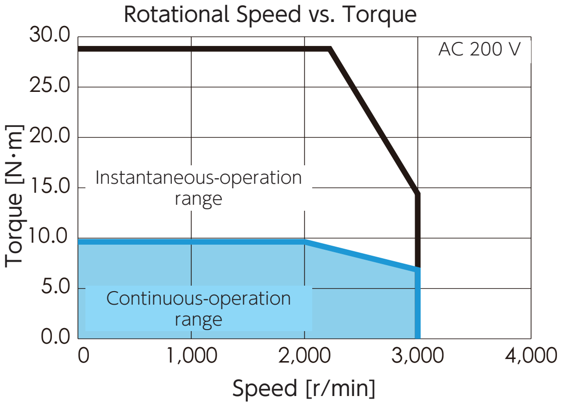
Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	8.4
	With brake		9.8
Compatible amplifier model		–	DB68C41
Voltage		V	AC200–240 V
Rated output		W	2,000
Rated torque		N·m	9.55
Instantaneous maximum torque		N·m	28.6
Rated current (stall current)		A	11.9
Instantaneous maximum current		A	35.7
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.85
Induced voltage constant per phase		mV/(r/min)	29.6
Rated power rate	Without brake	kW/s	104.9
	With brake		87.9
Mechanical time constant	Without brake	ms	0.58
	With brake		0.69
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	8.70
	With brake		10.38

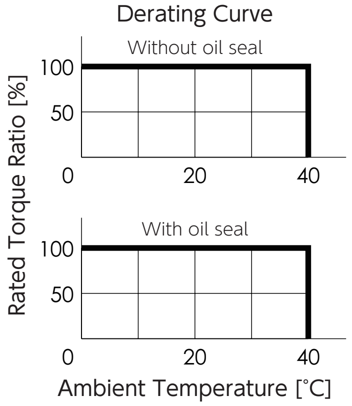
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

Permissible Load

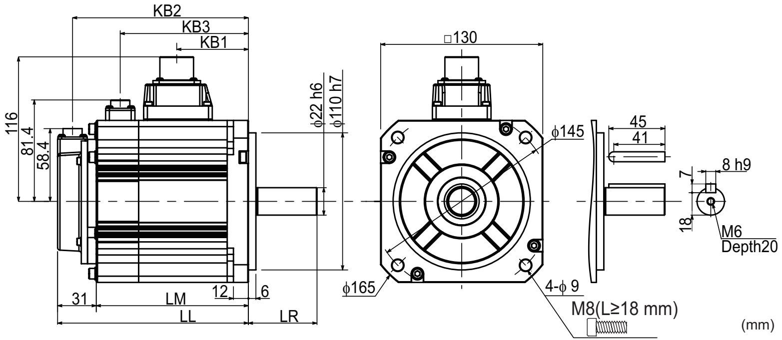
Item	Unit	Specifications
Radial	N	490
Thrust	N	196


Rotational Speed vs. Torque


Derating Curve

(mm)

Brake	Without	With
Motor Model	MM202P	MM202B
LL	163.0	188.0
LM	132.0	157.0
LR	55.0	
KB1	92.5	
KB2	151.0	176.0
KB3	–	137.8



1. Motor

50 W

Motor Model : MY500N2☐☐** (Without brake)
MY500A2☐☐** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.4
	With brake		0.6
Compatible amplifier model		–	DB6YZ41
Voltage		V	AC200–240 V
Rated output		W	50
Rated torque		N·m	0.16
Instantaneous maximum torque		N·m	0.56
Rated current (stall current)		A	0.68
Instantaneous maximum current		A	2.4
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.25
Induced voltage constant per phase		mV/(r/min)	8.8
Rated power rate	Without brake	kW/s	7.1
	With brake		5.8
Mechanical time constant	Without brake	ms	1.76
	With brake		2.15
Electrical time constant		ms	0.74
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.036
	With brake		0.043

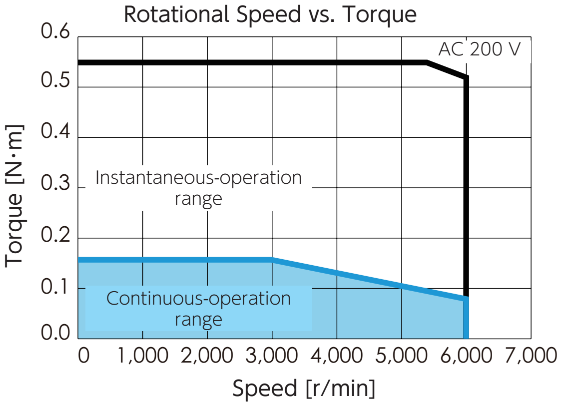
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.25
Static friction torque	N·m	≧ 0.16
Suction time	ms	≦ 35
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

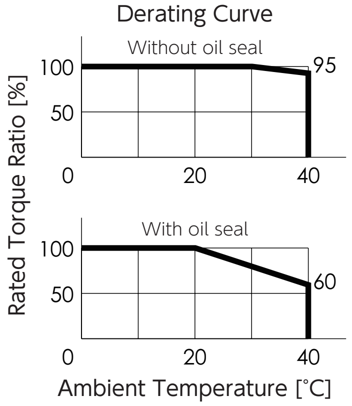
Permissible Load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

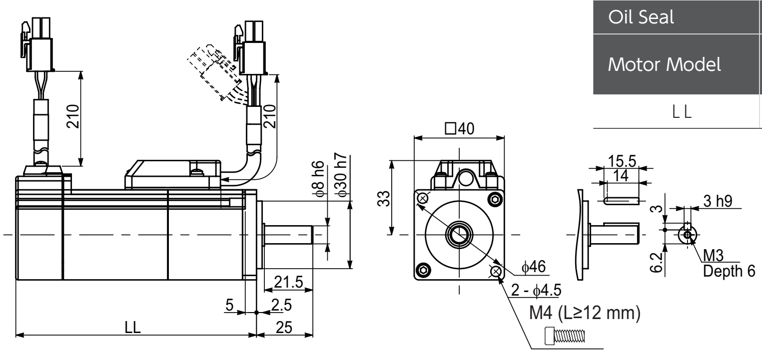


Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MY500N2S MY500N2K	MY500N2T MY500N2L	MY500A2S MY500A2K	MY500A2T MY500A2L
LL	66.4	72.0	106.8	112.4



1. Motor

Motor Model : MG500N2 □□** (Without brake)
MG500A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.4
	With brake		0.6
Compatible amplifier model		–	DB6YZ41
Voltage		V	AC200–240 V
Rated output		W	50
Rated torque		N·m	0.16
Instantaneous maximum torque		N·m	0.56
Rated current (stall current)		A	0.71
Instantaneous maximum current		A	2.4
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.25
Induced voltage constant per phase		mV/(r/min)	8.7
Rated power rate	Without brake	kW/s	6.4
	With brake		5.3
Mechanical time constant	Without brake	ms	2.14
	With brake		2.58
Electrical time constant		ms	0.65
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	0.040
	With brake		0.048

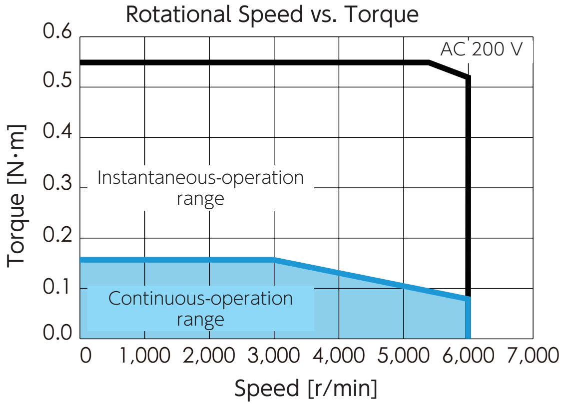
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.26
Static friction torque	N·m	≧ 0.16
Suction time	ms	≦ 35
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

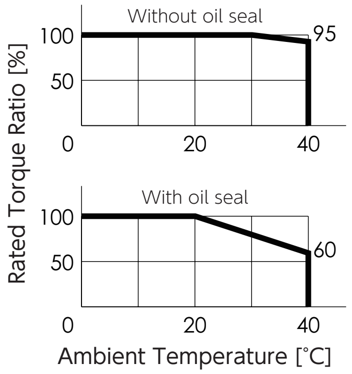
Permissible Load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

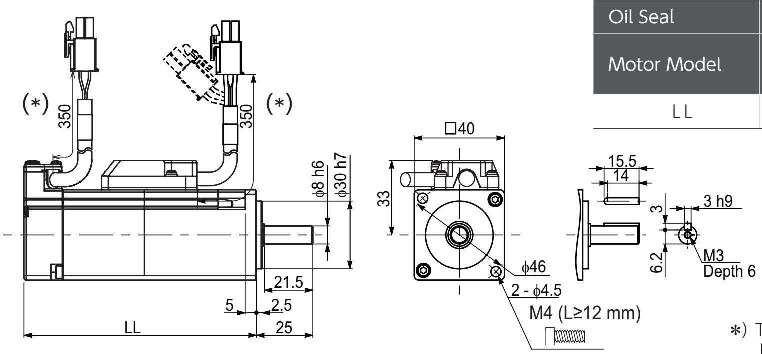


Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MG500N2S MG500N2K	MG500N2T MG500N2L	MG500A2S MG500A2K	MG500A2T MG500A2L
L L	57.1	64.7	89.5	97.1



*) The cable included in the MG500 series is 350 mm.
Please contact us if you need a 210 mm cable.

1. Motor

100 W

Motor Model : MY101N2 □□✻✻ (Without brake)
MY101A2 □□✻✻ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.5
	With brake		0.8
Compatible amplifier model		–	DB6Z141
Voltage		V	AC200–240 V
Rated output		W	100
Rated torque		N·m	0.32
Instantaneous maximum torque		N·m	1.12
Rated current (stall current)		A	0.97
Instantaneous maximum current		A	3.3
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.35
Induced voltage constant per phase		mV/(r/min)	12.3
Rated power rate	Without brake	kW/s	17.4
	With brake		15.4
Mechanical time constant	Without brake	ms	1.10
	With brake		1.25
Electrical time constant		ms	0.89
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.058
	With brake		0.066

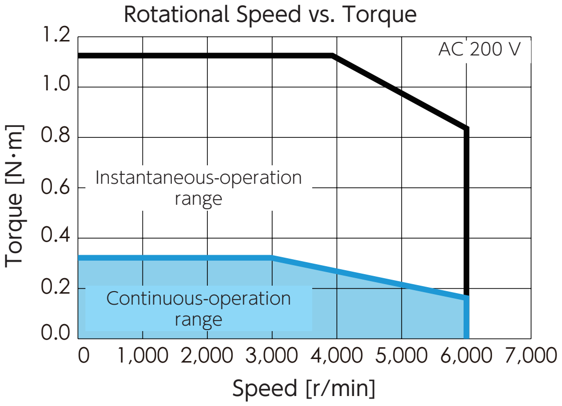
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.25
Static friction torque	N·m	≧ 0.32
Suction time	ms	≦ 35
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

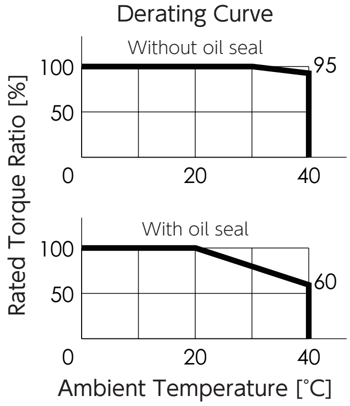
Permissible Load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

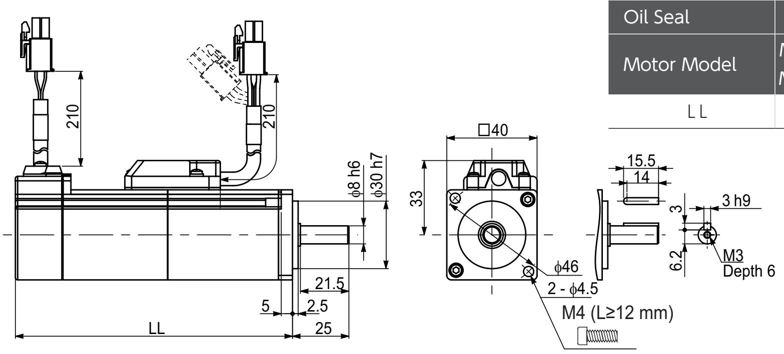


Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MY101N2S MY101N2K	MY101N2T MY101N2L	MY101A2S MY101A2K	MY101A2T MY101A2L
L L	82.4	88.0	122.8	128.4



1. Motor

Motor Model : MG101N2□□＊＊ (Without brake)
MG101A2□□＊＊ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.5
	With brake		0.7
Compatible amplifier model		–	DB6Z141
Voltage		V	AC200–240 V
Rated output		W	100
Rated torque		N·m	0.32
Instantaneous maximum torque		N·m	1.12
Rated current (stall current)		A	0.99
Instantaneous maximum current		A	3.4
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.37
Induced voltage constant per phase		mV/(r/min)	12.7
Rated power rate	Without brake	kW/s	15.5
	With brake		13.8
Mechanical time constant	Without brake	ms	1.28
	With brake		1.43
Electrical time constant		ms	0.78
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.065
	With brake		0.073

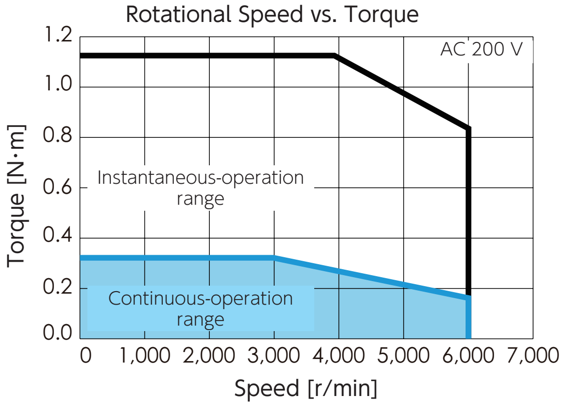
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.26
Static friction torque	N·m	≧ 0.32
Suction time	ms	≦ 35
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

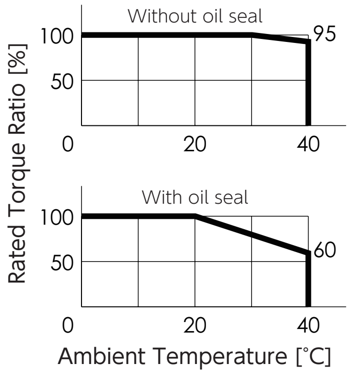
Permissible Load

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

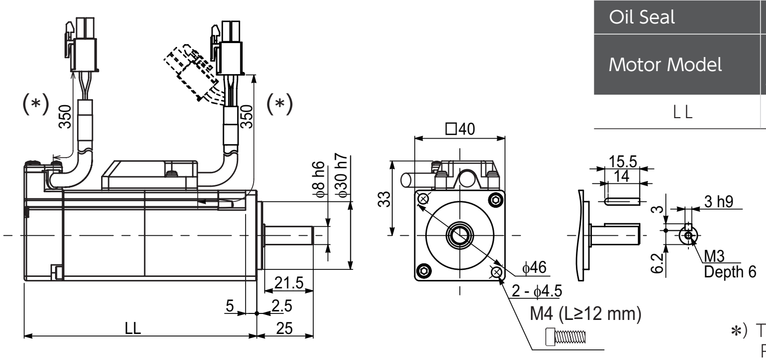


Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MG101N2S MG101N2K	MG101N2T MG101N2L	MG101A2S MG101A2K	MG101A2T MG101A2L
LL	70.7	78.3	103.1	110.7



*) The cable included in the MG101 series is 350 mm.
Please contact us if you need a 210 mm cable.

1. Motor

200 W

Motor Model : MX201N2 □□** (Without brake)
MX201A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	0.8
	With brake		1.3
Compatible amplifier model		–	DB61241
Voltage		V	AC200–240 V
Rated output		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(r/min)	14.3
Rated power rate	Without brake	kW/s	29.9
	With brake		24.7
Mechanical time constant	Without brake	ms	0.68
	With brake		0.83
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.14
	With brake		0.16

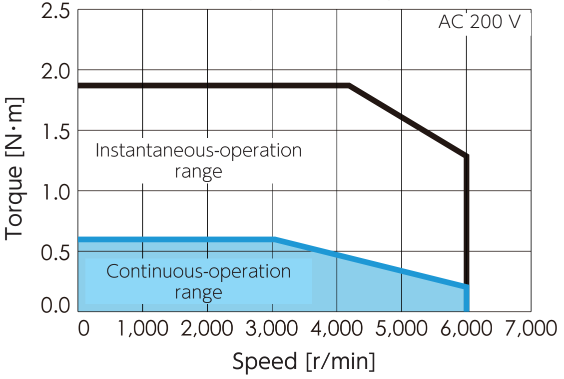
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

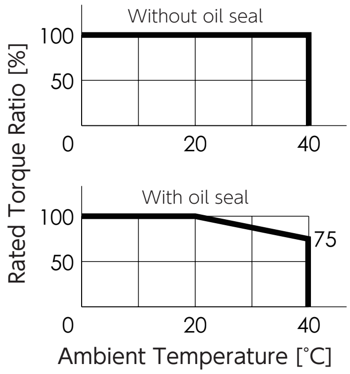
Permissible Load

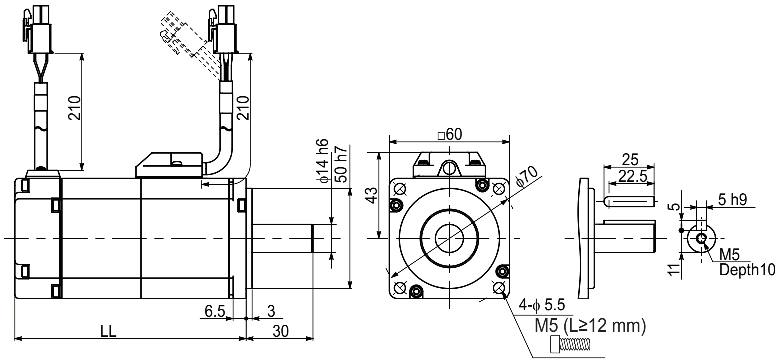
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX201N	MX201A
LL	76.5	113.0

1. Motor

Motor Model : MG201N2 □□** (Without brake)
MG201A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	0.9
	With brake		1.3
Compatible amplifier model		–	DB61241
Voltage		V	AC200–240 V
Rated output		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(r/min)	14.3
Rated power rate	Without brake	kW/s	15.9
	With brake		14.5
Mechanical time constant	Without brake	ms	1.28
	With brake		1.41
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.26
	With brake		0.28

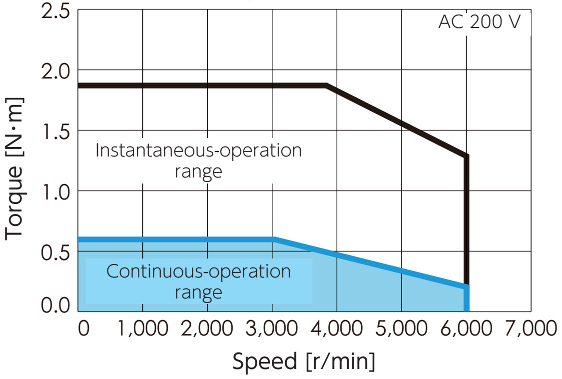
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

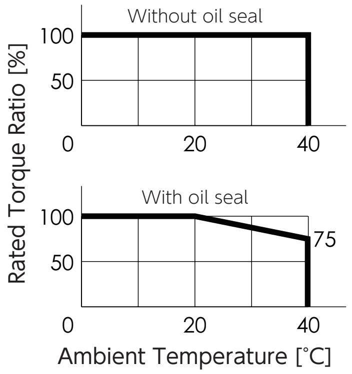
Permissible Load

Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque

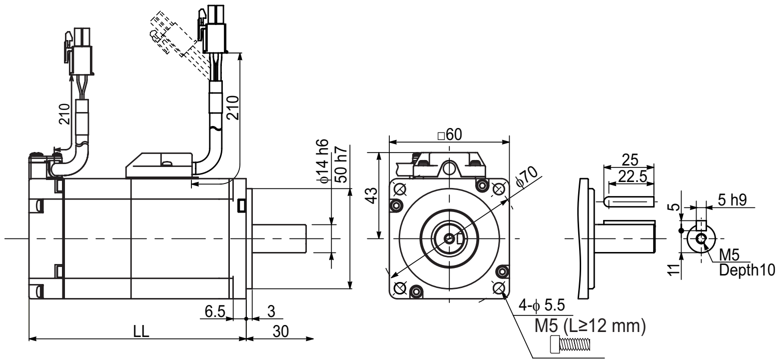


Derating Curve



(mm)

Brake	Without	With
Motor Model	MG201N	MG201A
LL	78.0	108.5



1. Motor

Motor Model : MZ201N2 □□** (Without brake)
MZ201A2 □□** (With brake)

200 W 17 bit ENCODER 60 SQUARE H 60 30 IP 65

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.0
	With brake		1.5
Compatible amplifier model		–	DB61241
Voltage		V	AC200–240 V
Rated output		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(r/min)	14.3
Rated power rate	Without brake	kW/s	9.3
	With brake		8.7
Mechanical time constant	Without brake	ms	2.19
	With brake		2.34
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.44
	With brake		0.46

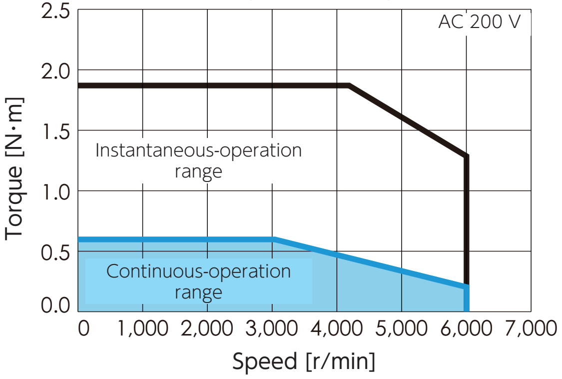
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

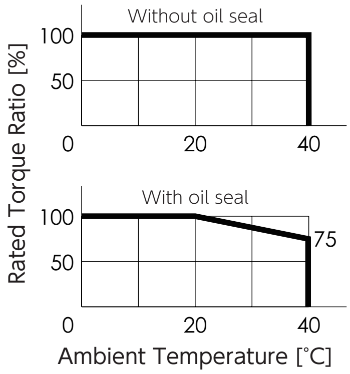
Permissible Load

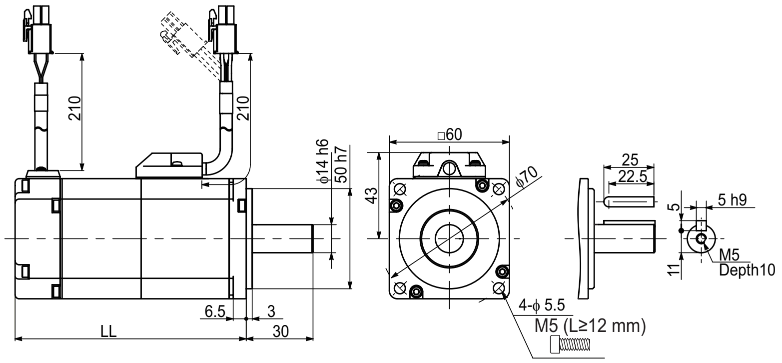
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ201N	MZ201A
LL	93.5	130.0

1. Motor

400 W

Motor Model : MX401N2 □□✱✱ (Without brake)
MX401A2 □□✱✱ (With brake)

Basic Specifications

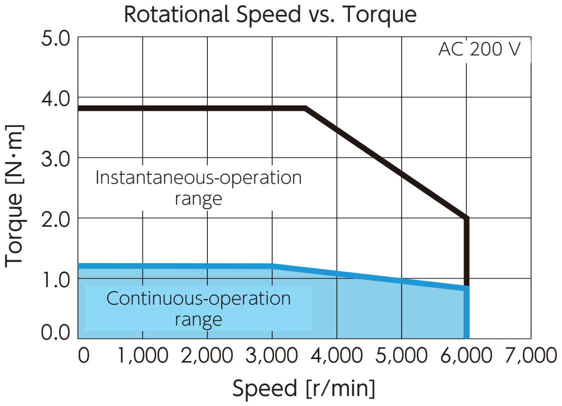
Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.1
	With brake		1.6
Compatible amplifier model		–	DB62441
Voltage		V	AC200–240 V
Rated output		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(r/min)	17.1
Rated power rate	Without brake	kW/s	71.8
	With brake		63.8
Mechanical time constant	Without brake	ms	0.45
	With brake		0.51
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.23
	With brake		0.25

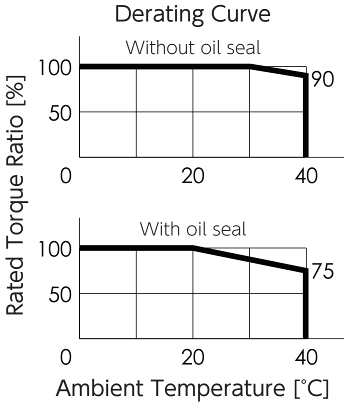
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

Permissible Load

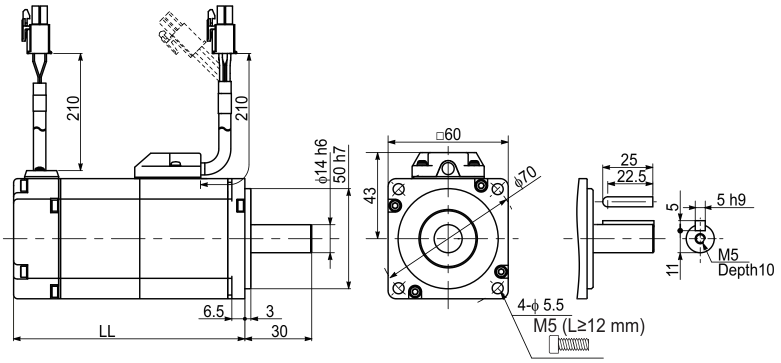
Item	Unit	Specifications
Radial	N	245
Thrust	N	98


Rotational Speed vs. Torque


Derating Curve

(mm)

Brake	Without	With
Motor Model	MX401N	MX401A
LL	93.5	130.0



1. Motor

Motor Model : MG401N2 □□** (Without brake) MG401A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.1
	With brake		1.5
Compatible amplifier model		–	DB62441
Voltage		V	AC200–240 V
Rated output		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(r/min)	17.1
Rated power rate	Without brake	kW/s	33.7
	With brake		32.1
Mechanical time constant	Without brake	ms	0.96
	With brake		1.01
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.48
	With brake		0.51

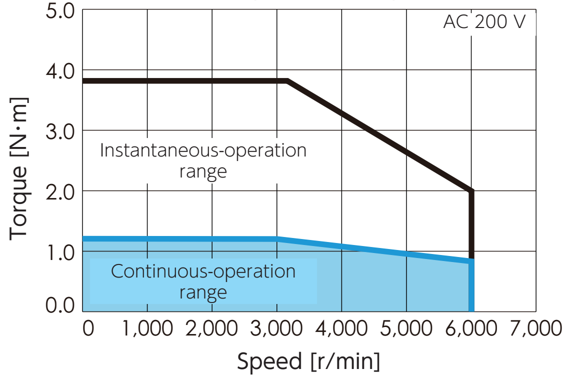
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

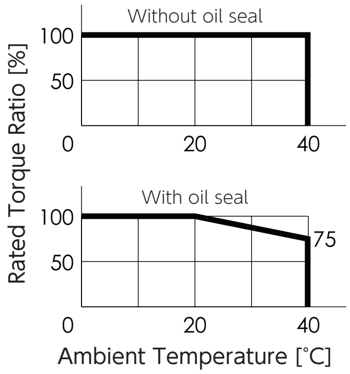
Permissible Load

Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque

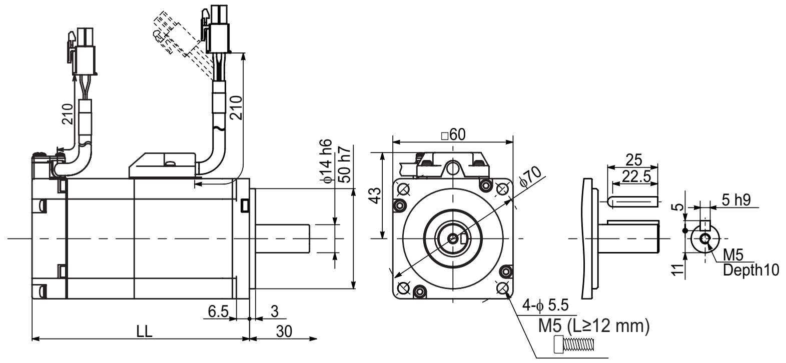


Derating Curve



(mm)

Brake	Without	With
Motor Model	MG401N	MG401A
LL	98.0	128.5



1. Motor

Motor Model : MZ401N2 □□** (Without brake)
MZ401A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.3
	With brake		1.8
Compatible amplifier model		–	DB62441
Voltage		V	AC200–240 V
Rated output		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(r/min)	17.1
Rated power rate	Without brake	kW/s	23.2
	With brake		22.3
Mechanical time constant	Without brake	ms	1.40
	With brake		1.46
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.70
	With brake		0.73

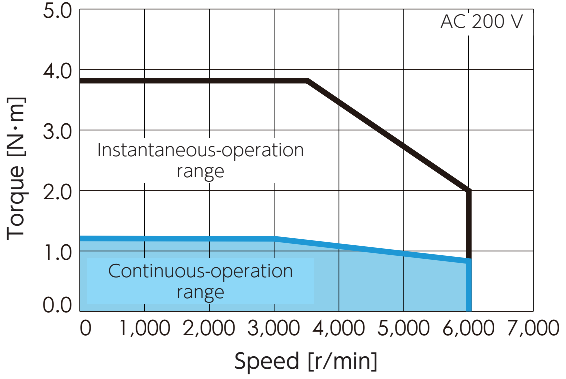
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.3
Static friction torque	N·m	≧ 1.27
Suction time	ms	≦ 50
Release time	ms	≦ 15
Release voltage	V	≧ DC1 V

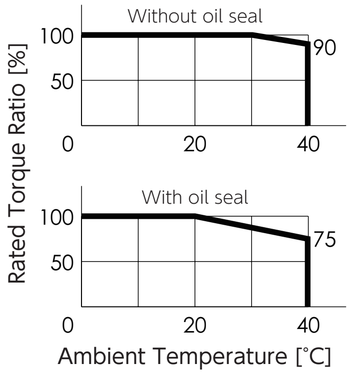
Permissible Load

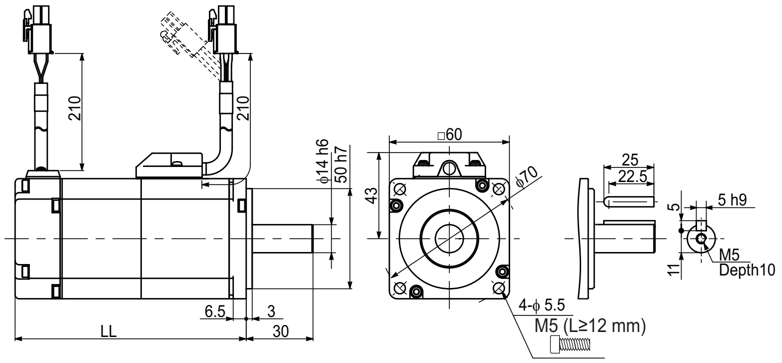
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ401N	MZ401A
LL	110.5	147.0

1. Motor

750 W

Motor Model : MX751N2 □□** (Without brake)
MX751A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.2
	With brake		3.0
Compatible amplifier model		–	DB63841
Voltage		V	AC200–240 V
Rated output		W	750
Rated torque		N·m	2.39
Instantaneous maximum torque		N·m	7.1
Rated current (stall current)		A	4.2
Instantaneous maximum current		A	12.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.63
Induced voltage constant per phase		mV/(r/min)	21.9
Rated power rate	Without brake	kW/s	77.5
	With brake		61.3
Mechanical time constant	Without brake	ms	0.39
	With brake		0.50
Electrical time constant		ms	4.60
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.74
	With brake		0.93

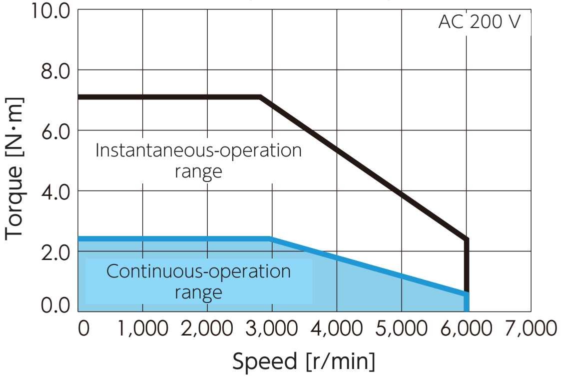
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.4
Static friction torque	N·m	≧ 2.39
Suction time	ms	≦ 70
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

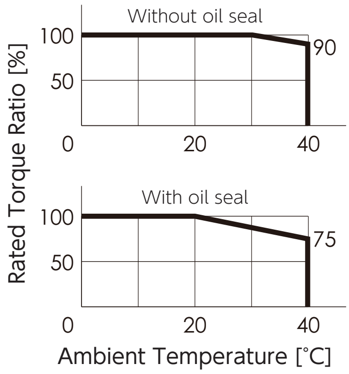
Permissible Load

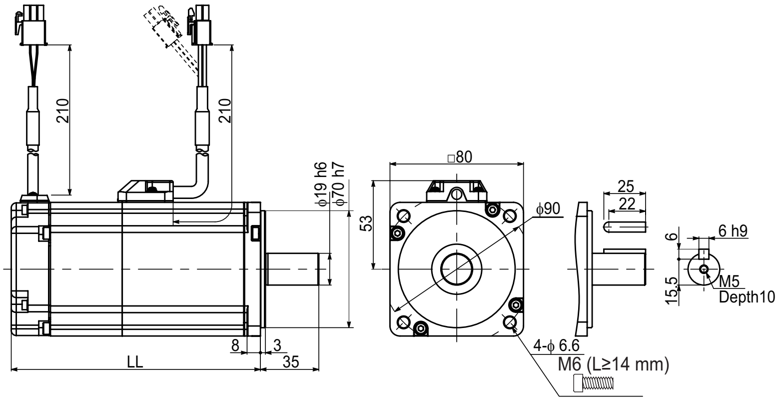
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX751N	MX751A
LL	107.3	144.3

1. Motor

Motor Model : MZ751N2□□** (Without brake)
MZ751A2□□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.5
	With brake		3.3
Compatible amplifier model		–	DB63841
Voltage		V	AC200–240 V
Rated output		W	750
Rated torque		N·m	2.39
Instantaneous maximum torque		N·m	7.1
Rated current (stall current)		A	4.2
Instantaneous maximum current		A	12.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.63
Induced voltage constant per phase		mV/(r/min)	21.9
Rated power rate	Without brake	kW/s	35.5
	With brake		31.7
Mechanical time constant	Without brake	ms	0.85
	With brake		0.96
Electrical time constant		ms	4.60
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	1.60
	With brake		1.80

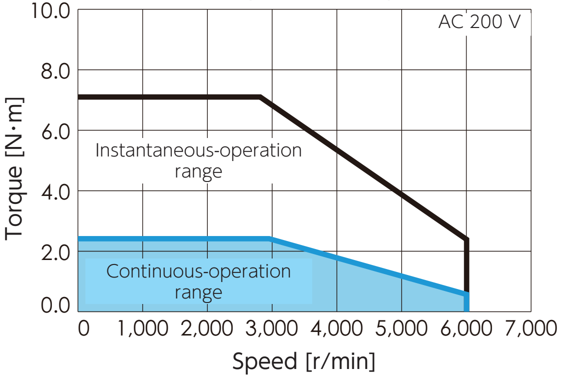
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.4
Static friction torque	N·m	≧ 2.39
Suction time	ms	≦ 70
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

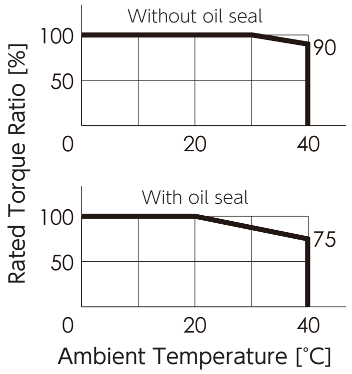
Permissible Load

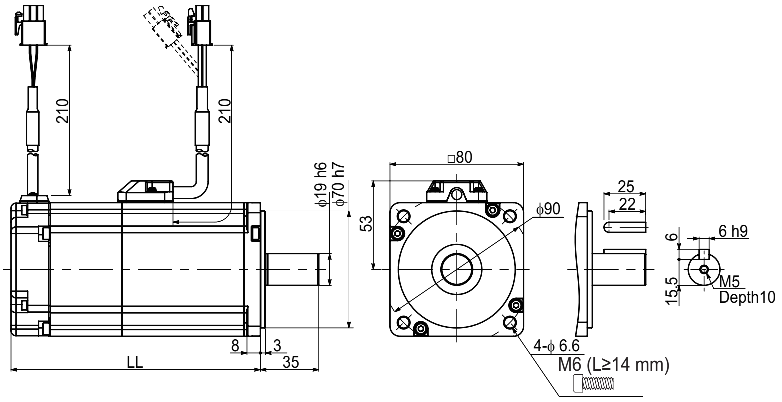
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ751N	MZ751A
LL	122.3	159.3

850 W

Motor Model : MJ851N2 ☐☐** (Without brake)
MJ851A2 ☐☐** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	6.2
	With brake		7.9
Compatible amplifier model		–	DB65B41
Voltage		V	AC200–240 V
Rated output		W	850
Rated torque		N·m	5.39
Instantaneous maximum torque		N·m	14.2
Rated current (stall current)		A	6.9
Instantaneous maximum current		A	17.0
Rated revolving speed		r/min	1,500
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.83
Induced voltage constant per phase		mV/(r/min)	28.9
Rated power rate	Without brake	kW/s	21.1
	With brake		18.3
Mechanical time constant	Without brake	ms	2.7
	With brake		3.1
Electrical time constant		ms	8.45
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	13.9
	With brake		16.0

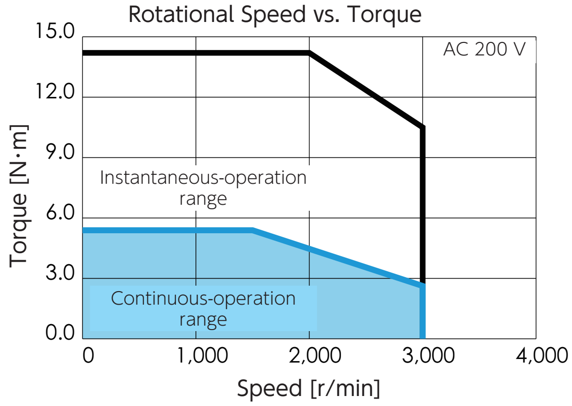
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.41
Static friction torque	N·m	≧ 12.7
Suction time	ms	≦ 100
Release time	ms	≦ 60
Release voltage	V	≧ DC1 V

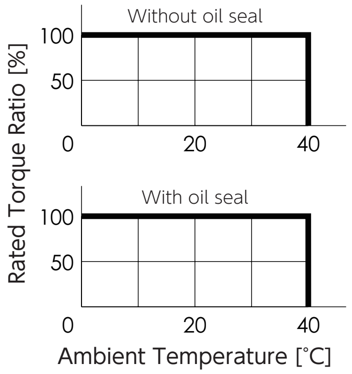
Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	98

Rotational Speed vs. Torque

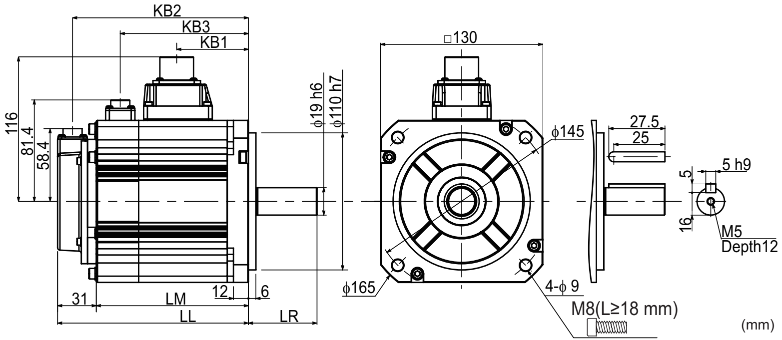


Derating Curve



(mm)

Brake	Without	With
Motor Model	MJ851N	MJ851A
LL	128.0	162.0
LM	97.0	131.0
LR	58.0	
KB1	70.0	
KB2	116.0	150.0
KB3	–	109.0



1. Motor

1 kW

Motor Model : MX951N2 □□** (Without brake)
MX951A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.8
	With brake		3.6
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	3.18
Instantaneous maximum torque		N·m	9.55
Rated current (stall current)		A	5.2
Instantaneous maximum current		A	15.2
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	6,000
Torque constant		N·m/A	0.65
Induced voltage constant per phase		mV/(r/min)	22.9
Rated power rate	Without brake	kW/s	90.8
	With brake		78.6
Mechanical time constant	Without brake	ms	0.34
	With brake		0.40
Electrical time constant		ms	3.95
Rotor moment of inertia	Without brake	$\times10^{-4}$ kg·m^2	1.12
	With brake		1.29

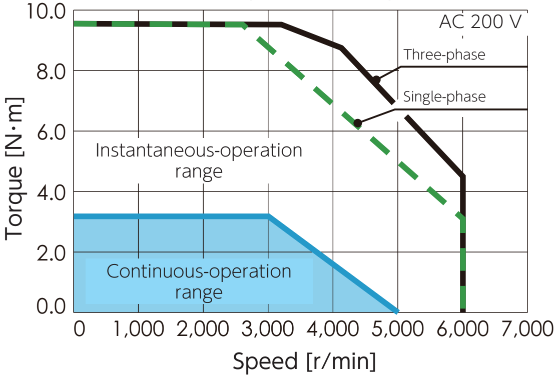
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.47
Static friction torque	N·m	≧ 3.18
Suction time	ms	≦ 70
Release time	ms	≦ 20
Release voltage	V	≧ DC1 V

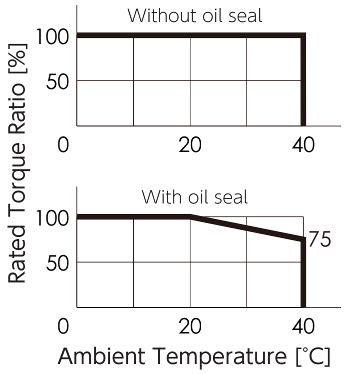
Permissible Load

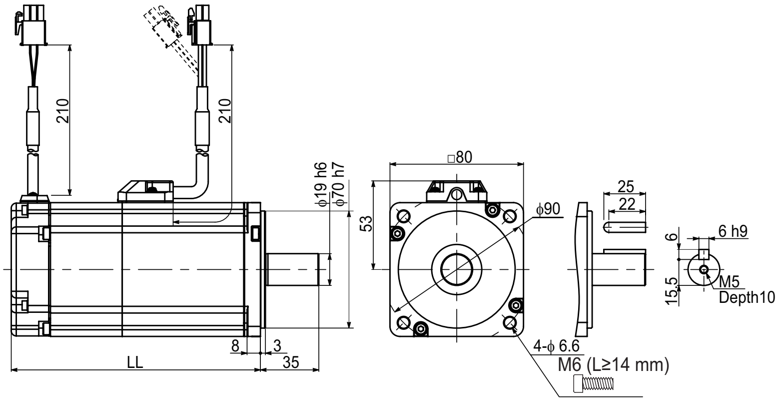
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX951N	MX951A
LL	127.3	164.3

1. Motor

Motor Model : MX102N2 □□** (Without brake)
MX102A2 □□** (With brake)

1 kW　17 bit ENCODER　100 SQUARE　L　50 30　IP67

Basic Specifications

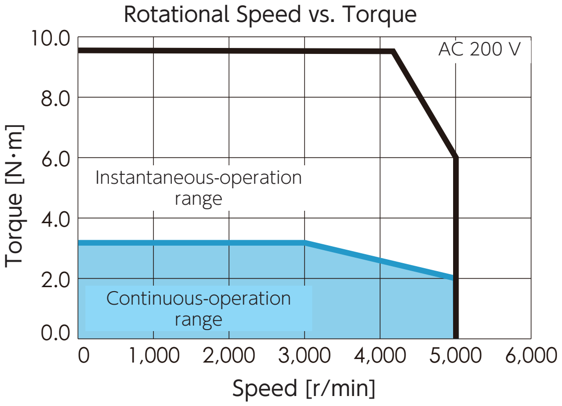
Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	100 sq.
Approximate mass	Without brake	kg	3.9
	With brake		5.2
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	3.18
Instantaneous maximum torque		N·m	9.55
Rated current (stall current)		A	6.6
Instantaneous maximum current		A	19.9
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	5,000
Torque constant		N·m/A	0.52
Induced voltage constant per phase		mV/(r/min)	18.2
Rated power rate	Without brake	kW/s	52.3
	With brake		43.2
Mechanical time constant	Without brake	ms	0.59
	With brake		0.72
Electrical time constant		ms	5.19
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	1.94
	With brake		2.35

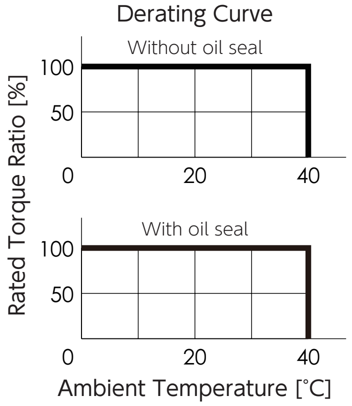
Brake Specifications

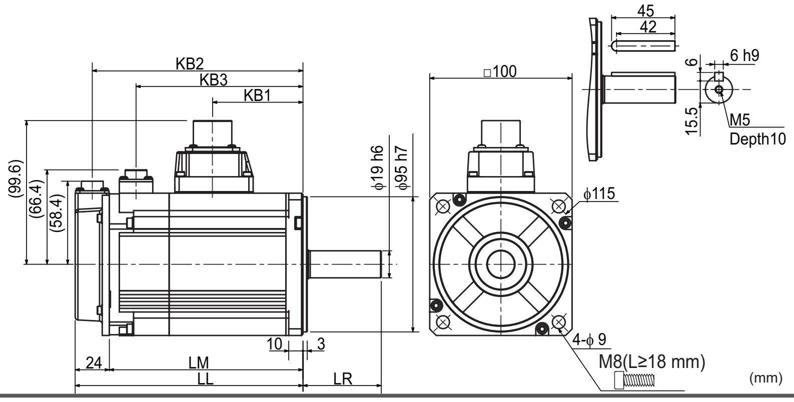
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 7.8
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	196







(mm)

Brake	Without	With
Motor Model	MX102N	MX102A
LL	130.0	160.0
LM	106.0	136.0
LR	55.0	
KB1	63.5	
KB2	118.0	148.0
KB3	–	117.3

1. Motor

Motor Model : MM102N2 □□** (Without brake)
MM102A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	5.6
	With brake		7.0
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	5.6
Instantaneous maximum current		A	16.8
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.88
Induced voltage constant per phase		mV/(r/min)	30.9
Rated power rate	Without brake	kW/s	50.0
	With brake		36.5
Mechanical time constant	Without brake	ms	0.76
	With brake		1.05
Electrical time constant		ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	4.56
	With brake		6.24

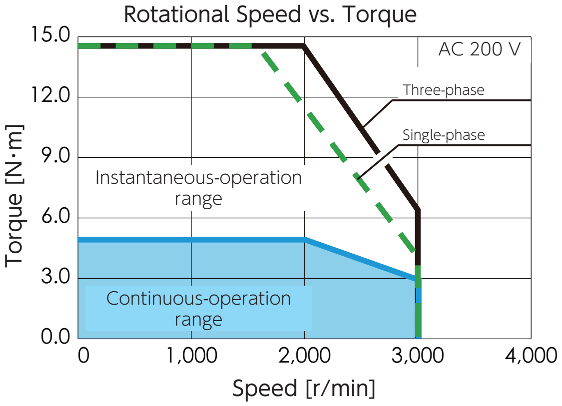
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

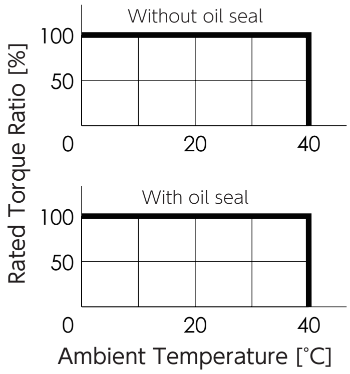
Permissible Load

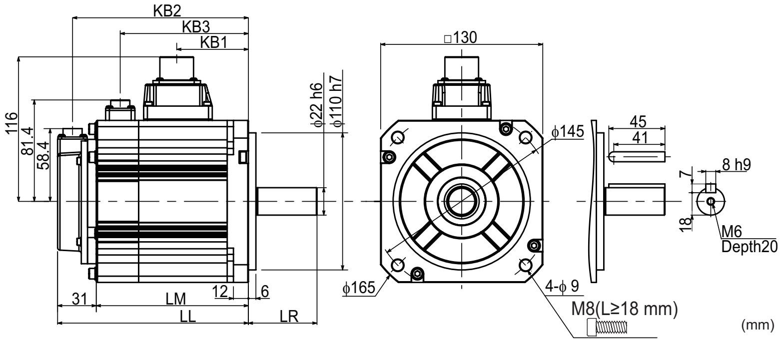
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MM102N	MM102A
LL	128.0	153.0
LM	97.0	122.0
LR	55.0	
KB1	57.5	
KB2	116.0	141.0
KB3	–	102.8

1. Motor

Motor Model : MH102N2 □□** (Without brake) MH102A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.6
	With brake		9.0
Compatible amplifier model		–	DB64A41
Voltage		V	AC200–240 V
Rated output		W	1,000
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	5.6
Instantaneous maximum current		A	16.8
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.88
Induced voltage constant per phase		mV/(r/min)	30.9
Rated power rate	Without brake	kW/s	9.2
	With brake		8.6
Mechanical time constant	Without brake	ms	4.17
	With brake		4.43
Electrical time constant		ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	24.9
	With brake		26.4

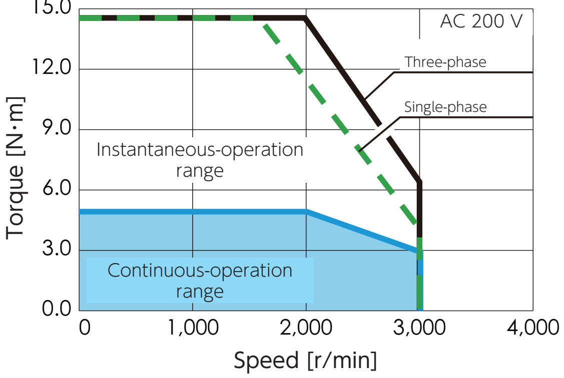
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

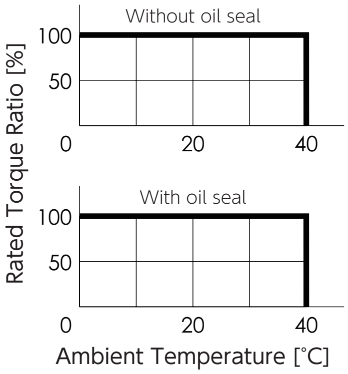
Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque

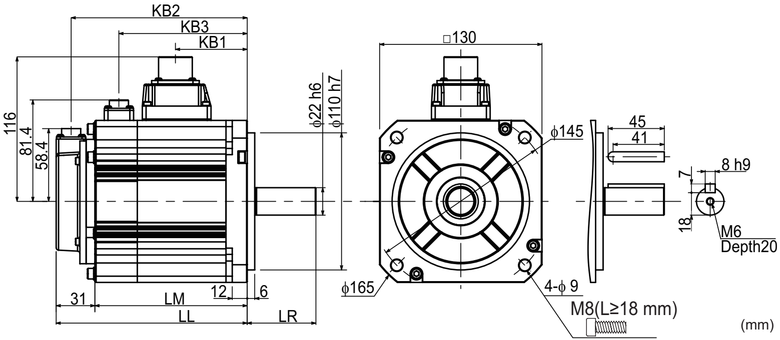


Derating Curve



(mm)

Brake	Without	With
Motor Model	MH102N	MH102A
LL	163.0	188.0
LM	132.0	157.0
LR	70.0	
KB1	92.5	
KB2	151.0	176.0
KB3	–	137.8



1. Motor

1.3 kW

Motor Model : MJ132N2 □□** (Without brake)
MJ132A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.7
	With brake		9.8
Compatible amplifier model		–	DB67C41
Voltage		V	AC200–240 V
Rated output		W	1,300
Rated torque		N·m	8.34
Instantaneous maximum torque		N·m	23.3
Rated current (stall current)		A	10.7
Instantaneous maximum current		A	28.0
Rated revolving speed		r/min	1,500
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.85
Induced voltage constant per phase		mV/(r/min)	29.8
Rated power rate	Without brake	kW/s	34.6
	With brake		31.3
Mechanical time constant	Without brake	ms	2.1
	With brake		2.3
Electrical time constant		ms	8.42
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	19.8
	With brake		21.9

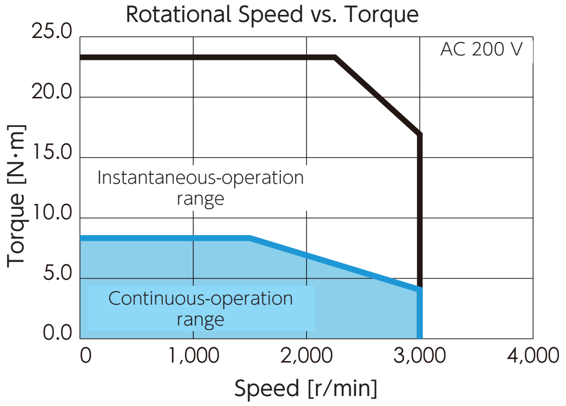
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	0.41
Static friction torque	N·m	≧ 19.6
Suction time	ms	≦ 100
Release time	ms	≦ 60
Release voltage	V	≧ DC1 V

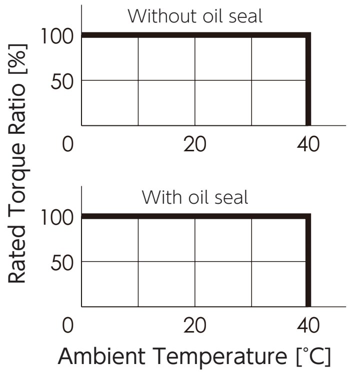
Permissible Load

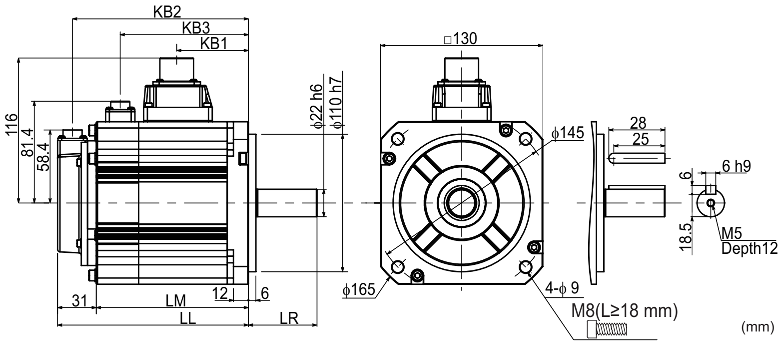
Item	Unit	Specifications
Radial	N	686
Thrust	N	343

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MJ132N	MJ132A
LL	128.0	153.0
LM	97.0	122.0
LR	55.0	
KB1	57.5	
KB2	116.0	141.0
KB3	–	102.8

1. Specifications

1. Motor

1.5 kW

Motor Model : MX152N2 □□** (Without brake)
MX152A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	100 sq.
Approximate mass	Without brake	kg	4.9
	With brake		6.2
Compatible amplifier model		–	DB66B41
Voltage		V	AC200–240 V
Rated output		W	1,500
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	8.2
Instantaneous maximum current		A	24.9
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	5,000
Torque constant		N·m/A	0.64
Induced voltage constant per phase		mV/(r/min)	22.3
Rated power rate	Without brake	kW/s	81.4
	With brake		70.2
Mechanical time constant	Without brake	ms	0.50
	With brake		0.57
Electrical time constant		ms	5.95
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	2.80
	With brake		3.25

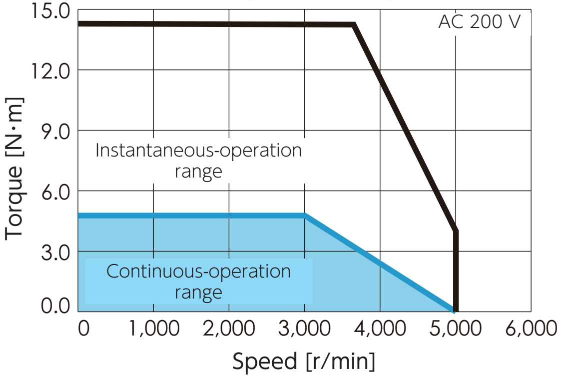
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 7.8
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

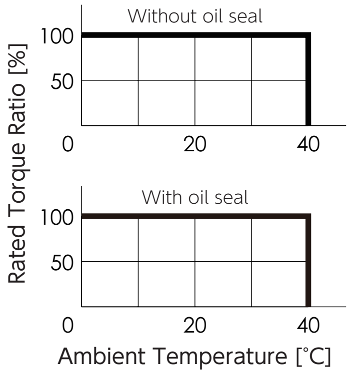
Permissible Load

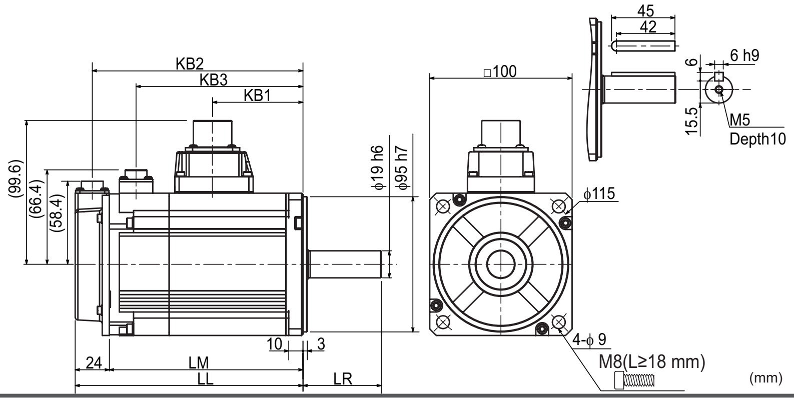
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX152N	MX152A
LL	149.0	179.0
LM	125.0	155.0
LR	55.0	
KB1	82.5	
KB2	137.0	167.0
KB3	–	136.3

1. Motor

Motor Model : MM152N2 □□** (Without brake)
MM152A2 □□** (With brake)

Basic Specifications

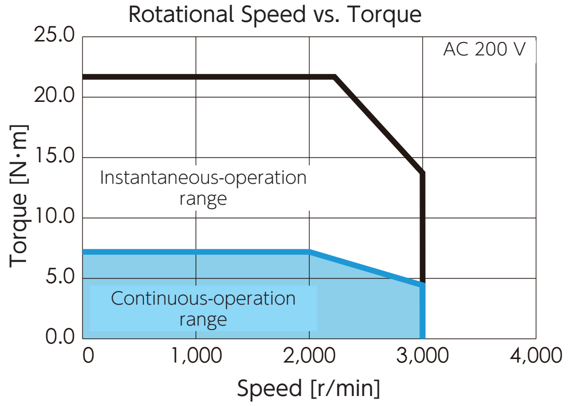
Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.0
	With brake		8.4
Compatible amplifier model		–	DB66B41
Voltage		V	AC200–240 V
Rated output		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(r/min)	28.4
Rated power rate	Without brake	kW/s	76.9
	With brake		61.4
Mechanical time constant	Without brake	ms	0.60
	With brake		0.75
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	6.67
	With brake		8.35

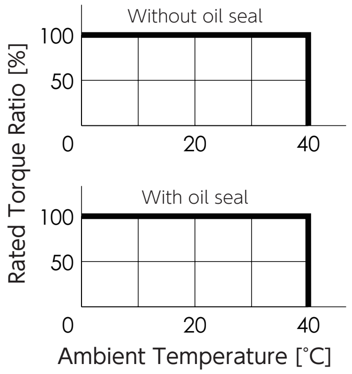
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

Permissible Load

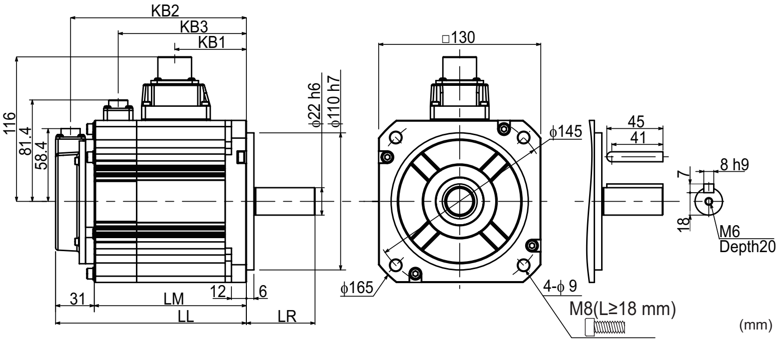
Item	Unit	Specifications
Radial	N	490
Thrust	N	196


Rotational Speed vs. Torque


Derating Curve

(mm)

Brake	Without	With
Motor Model	MM152N	MM152A
LL	145.5	170.5
LM	114.5	139.5
LR	55.0	
KB1	75.0	
KB2	133.5	158.5
KB3	–	120.3



1. Motor

Motor Model : MH152N2 □□** (Without brake)
MH152A2 □□** (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	9.0
	With brake		10.4
Compatible amplifier model		–	DB66B41
Voltage		V	AC200–240 V
Rated output		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(r/min)	28.4
Rated power rate	Without brake	kW/s	13.8
	With brake		13.3
Mechanical time constant	Without brake	ms	3.32
	With brake		3.46
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	37.12
	With brake		38.65

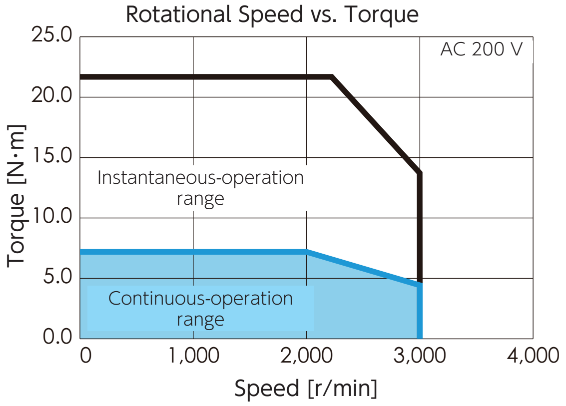
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

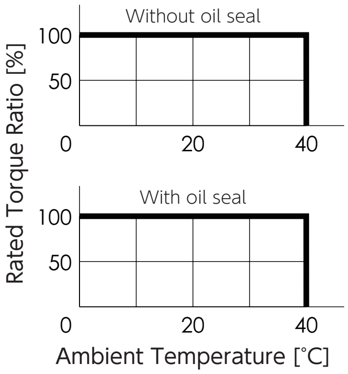
Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque

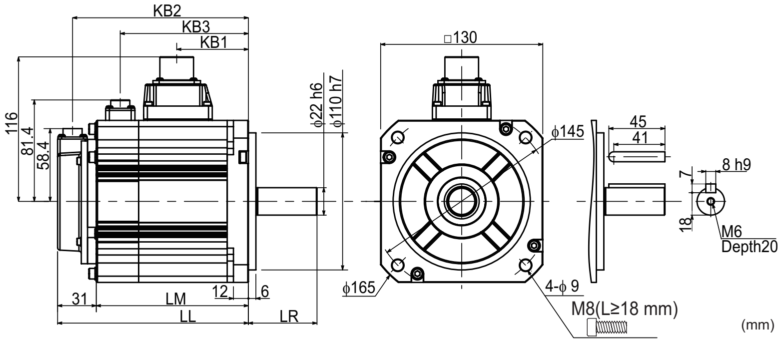


Derating Curve



(mm)

Brake	Without	With
Motor Model	MH152N	MH152A
LL	180.5	205.5
LM	149.5	174.5
LR	70.0	
KB1	110.0	
KB2	168.5	193.5
KB3	–	155.3



1. Motor

2 kW

Motor Model : MX202N2 □□＊＊ (Without brake)
MX202A2 □□＊＊ (With brake)

Basic Specifications

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	100 sq.
Approximate mass	Without brake	kg	6.0
	With brake		7.3
Compatible amplifier model		–	DB68C41
Voltage		V	AC200–240 V
Rated output		W	2,000
Rated torque		N·m	6.37
Instantaneous maximum torque		N·m	19.1
Rated current (stall current)		A	11.3
Instantaneous maximum current		A	33.9
Rated revolving speed		r/min	3,000
Maximum revolving speed		r/min	5,000
Torque constant		N·m/A	0.62
Induced voltage constant per phase		mV/(r/min)	21.7
Rated power rate	Without brake	kW/s	110.2
	With brake		99.2
Mechanical time constant	Without brake	ms	0.50
	With brake		0.56
Electrical time constant		ms	5.44
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	3.68
	With brake		4.09

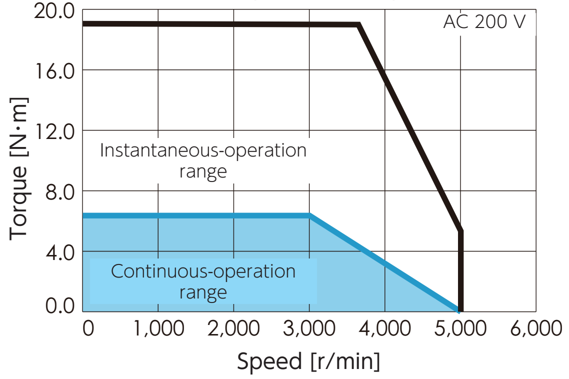
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 7.8
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

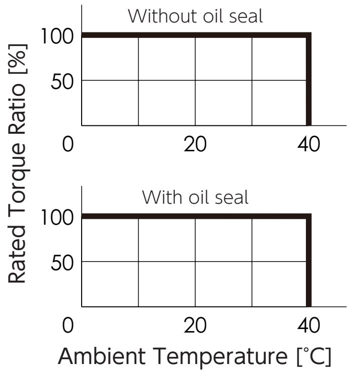
Permissible Load

Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque

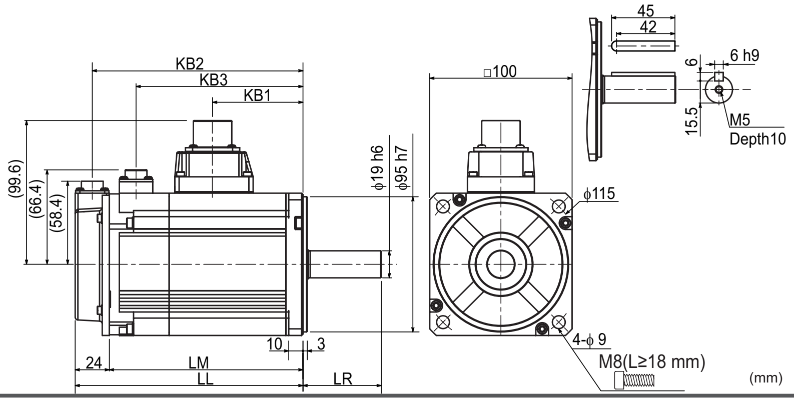


Derating Curve



(mm)

Brake	Without	With
Motor Model	MX202N	MX202A
LL	168.0	198.0
LM	144.0	174.0
LR	55.0	
KB1	101.5	
KB2	156.0	186.0
KB3	–	155.3



1. Specifications

1. Motor

Motor Model : MM202N2 □□** (Without brake)
MM202A2 □□** (With brake)

Basic Specifications

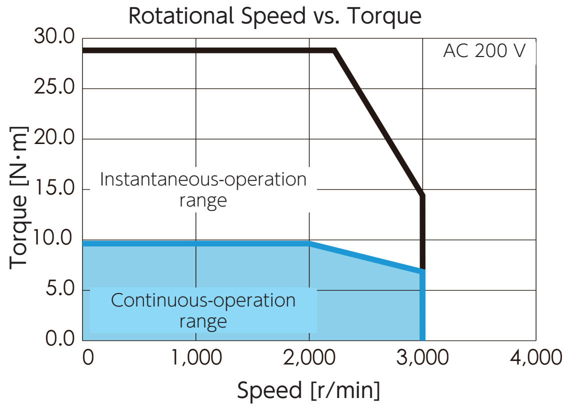
Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	8.4
	With brake		9.8
Compatible amplifier model		–	DB68C41
Voltage		V	AC200–240 V
Rated output		W	2,000
Rated torque		N·m	9.55
Instantaneous maximum torque		N·m	28.6
Rated current (stall current)		A	11.9
Instantaneous maximum current		A	35.7
Rated revolving speed		r/min	2,000
Maximum revolving speed		r/min	3,000
Torque constant		N·m/A	0.85
Induced voltage constant per phase		mV/(r/min)	29.6
Rated power rate	Without brake	kW/s	104.9
	With brake		87.9
Mechanical time constant	Without brake	ms	0.58
	With brake		0.69
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times10^{-4}$kg·m^2	8.70
	With brake		10.38

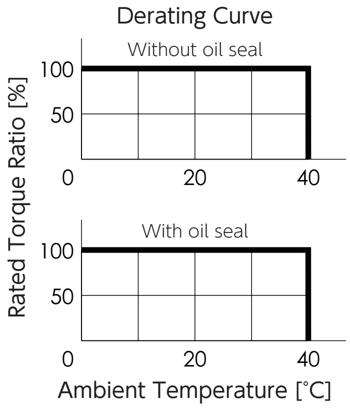
Brake Specifications

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC24 V±10%
Rated current	A	1.0
Static friction torque	N·m	≧ 9.55
Suction time	ms	≦ 120
Release time	ms	≦ 30
Release voltage	V	≧ DC1 V

Permissible Load

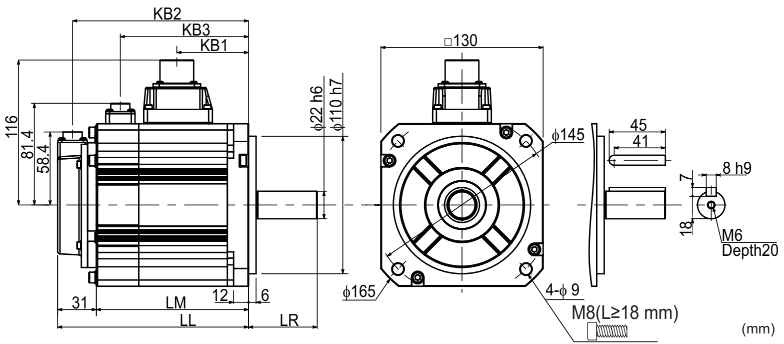
Item	Unit	Specifications
Radial	N	490
Thrust	N	196





(mm)

Brake	Without	With
Motor Model	MM202N	MM202A
LL	163.0	188.0
LM	132.0	157.0
LR	55.0	
KB1	92.5	
KB2	151.0	176.0
KB3	–	137.8



2. Encoder

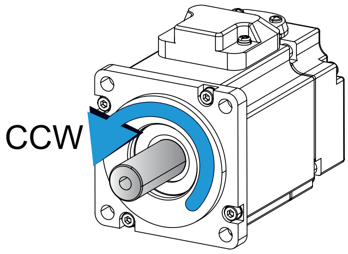
1. Specifications

Item			Specifications		
Motor model			M□□□□P2□**A**＊＊ M□□□□B2□**A**＊＊	M□□□□N2□**A**＊＊ M□□□□A2□**A**＊＊	M□□□□N2□**N**＊＊ M□□□□A2□**N**＊＊
Resolution			23 bit ENCODER Absolute **23 bit**	17 bit ENCODER Absolute **17 bit**	17 bit ENCODER Incremental **17 bit**
Environmental requirements	Ambient operating temperature		0–90°C	0–85°C	
	External disturbance magnetic field		±2 mT (20 G) or below		
Electrical specifications	Power supply	Voltage	DC 4.5 to 5.5 V (Power supply ripple ≦ 5%)		
		Current consumption	80 mA typ. (*1)	160 mA typ. (*1)	
	External battery	Voltage	DC 2.7–4.0 V	DC 2.4–4.2 V	–
		Current consumption	15 μA typ. (*2)	10 μA typ. (*2)	–
	Multi-turn count		65,536 counts		–
	Maximum revolving speed		6,000 r/min		
	Count-up direction		CCW (*3)		
Communication specification	Transmission method		Half-duplex asynchronous serial communication		
	Communication speed		4.0 Mbps	2.5 Mbps	

*1) Inrush-current is not included.

*2) Measurement conditions room temperature, the motor not in motion, battery voltage of 3.6 V.

*3) CCW when viewed from the load side shaft end.



Precautions

Using the motor with rotations of 180 degrees or less will reduce the encoder's rotational accuracy. (17 bit encoder)

For a motor equipped with a brake, follow the brake voltage and polarity specifications.

If the brake voltage is less than 12 V or the polarity is reversed, the encoder's rotational accuracy will be reduced.

3. Amplifiers

1. Model Codes

Models **DB 6 Y Z 41**

Series

Input Power Supply	
Code	Main Circuit Power & Control Power
6	AC200–240 V (*)

(*) Single- or Three-phase option depends on compatible motor.

50–750 W	: Single-phase
1 kW	: Single-phase / Three-phase
850 W, 1.3–2 kW	: Three-phase

Specifications	
Code	Specifications
41	EtherCAT

Compatible Motor		
Code	Motor Rated Power	Motor Models
Y	50 W	M□500
Z	100 W	M□101
1	200 W	M□201
2	400 W	M□401
3	750 W	M□751
4	1 kW	MX951
		M□102
5	850 W	MJ851
6	1.5 kW	M□152
7	1.3 kW	MJ132
8	2 kW	M□202

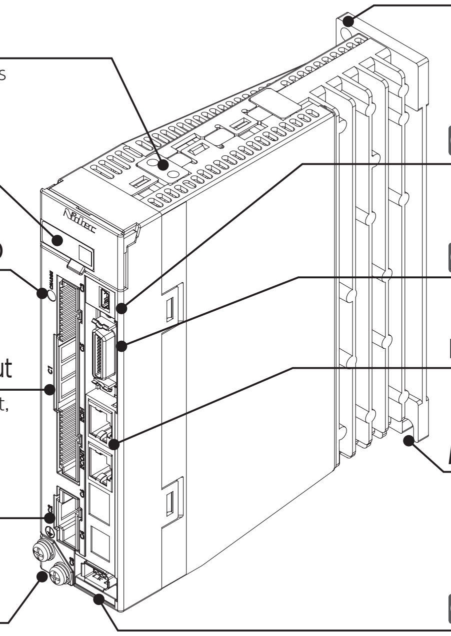
Amplifier Main circuit power	
Code	Supply
Z	50 W
1	100 W
2	200 W
4	400 W
8	750 W
A	1 kW
B	1.5 kW
C	2 kW

2. Names of parts

Figure 1

Motor rated output power: **50 W** **100 W** **200 W** 400 W 750 W 850 W 1 kW 1.3 kW 1.5 kW 2 kW

Amplifier model	DB6YZ41 DB6Z141	DB61241



Mounting holes
M4 (Effective depth = 5 mm) two locations
(Same as bottom side)

Setting panel
Used for EtherCAT communication node address setting and status display

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

Accessories
C1 Main power / Control power input
Main power input, Control power input, and Regenerative resistor connection

Accessories
C2 Motor power output
Motor power output

FG (Protective earth) terminal
Two terminals:
Attached M4x8 mm screw with spring washer

Mounting holes
⌀ 5.5 (one location)
The recommended screw: M5x12 mm, with spring washer

C3 USB connector
Used for parameter settings, tuning, and status display in the dedicated software "S-TUNE II"

C5 User I/O connector
User I/O, ABZ output

ECIN, ECOUT connector
EtherCAT communication connector

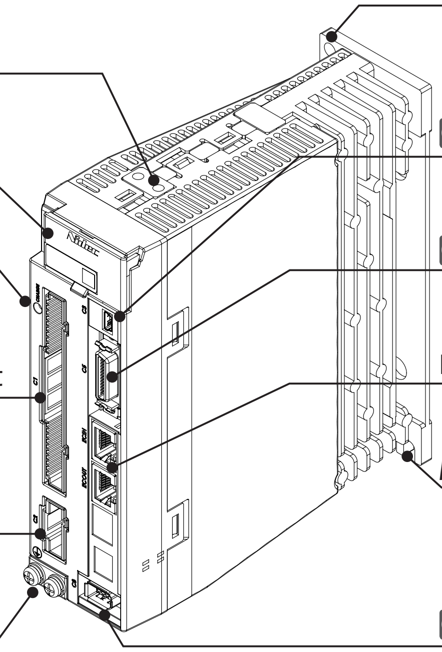
Mounting notch
⌀ 5.5 (one location)
The recommended screw: M5x12 mm, with spring washer

C8 Encoder connector
Encoder connection

Figure 2

Motor rated output power: 50 W 100 W 200 W **400 W** 750 W 850 W 1 kW 1.3 kW 1.5 kW 2 kW

Amplifier model	DB62441



Mounting holes
M4 (Effective depth = 5 mm) two locations
(Same as bottom side)

Setting panel
Used for EtherCAT communication node address setting and status display

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

Accessories
C1 Main power / Control power input
Main power input, Control power input, and Regenerative resistor connection

Accessories
C2 Motor power output
Motor power output

FG (Protective earth) terminal
Two terminals:
Attached M4x8 mm screw with spring washer

Mounting holes
⌀ 5.5 (one location)
The recommended screw: M5x12 mm, with spring washer

C3 USB connector
Used for parameter settings, tuning, and status display in the dedicated software "S-TUNE II"

C5 User I/O connector
User I/O, ABZ output

ECIN, ECOUT connector
EtherCAT communication connector

Mounting notch
⌀ 5.5 (two location)
The recommended screw: M5x12 mm, with spring washer

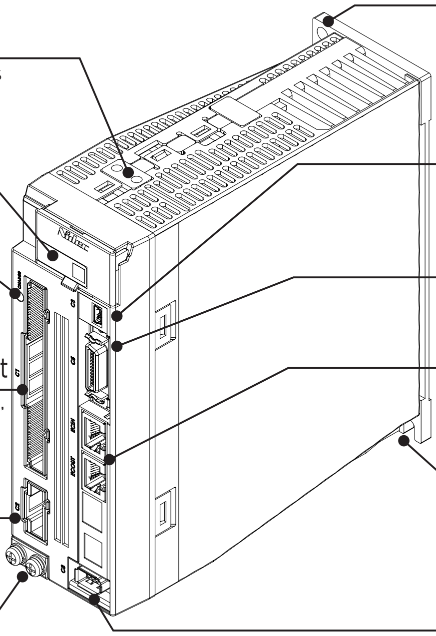
C8 Encoder connector
Encoder connection

Figure 3

Motor rated output power

50 W	100 W	200 W	400 W	**750 W**	850 W	**1 kW**	1.3 kW	1.5 kW	2 kW

Amplifier model	DB63841 DB64A41



Mounting holes
M4 (Effective depth = 5 mm) two locations
(Same as bottom side)

Setting panel
Used for EtherCAT communication node address setting and status display

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

Accessories
C1 Main power / Control power input
Main power input, Control power input, and Regenerative resistor connection

Accessories
C2 Motor power output
Motor power output

FG (Protective earth) terminal
Two terminals:
Attached M4x8 mm screw with spring washer

Mounting holes
⌀ 5.5 (one location)
The recommended screw: M5x12 mm, with spring washer

C3 USB connector
Used for parameter settings, tuning, and status display in the dedicated software "S-TUNE Ⅱ"

C5 User I/O connector
User I/O, ABZ output

ECIN, ECOUT connector
EtherCAT communication connector

Mounting notch
⌀ 5.5 (one location)
The recommended screw: M5x12 mm, with spring washer

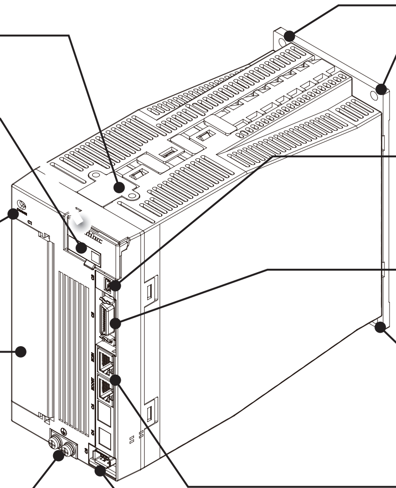
C8 Encoder connector
Encoder connection

Figure 4

Motor rated output power

50 W	100 W	200 W	400 W	750 W	**850 W**	1 kW	**1.3 kW**	**1.5 kW**	**2 kW**

Amplifier model	DB65B41 DB66B41	DB67C41 DB68C41



Mounting holes
M4 (Effective depth = 5 mm) two locations
(Same as bottom side)

Setting panel
Used for EtherCAT communication node address setting and status display

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

Terminal block
Main power input, Control power input, Regenerative resistor connection, and Motor power output
(The recommended terminal:
2-4S insulation coating ring crimp terminals)

FG (Protective earth) terminal
Two terminals:
Attached M4x8 mm screw with spring washer

Mounting holes
⌀ 5.5 (two locations)
The recommended screw: M5x12 mm, with spring washer

C3 USB connector
Used for parameter settings, tuning, and status display in the dedicated software "S-TUNE Ⅱ"

C5 User I/O connector
User I/O, ABZ output

Mounting hole
⌀ 5.5 (one location)
The recommended screw: M5x12 mm, with spring washer

ECIN, ECOUT connector
EtherCAT communication connector

C8 Encoder connector
Encoder connection

3. Specifications

Basic Specifications

Items		Specifications				
Amplifier model		DB6YZ41	DB6Z141	DB61241	DB62441	DB63841
Compatible Motor		M□500 50 W	M□101 100 W	M□201 200 W	M□401 400 W	M□751 750 W
External dimensions		(See "Dimensions")				
Mass (Kg)		0.8			1.0	1.1
Main circuit power & Control power		Single-phase AC200 V–240 V±10% 50 / 60 Hz				
Input current (Arms typ)		0.9	1.5	2.6	4.6	7.6
Control type		Three-phase PWM inverter sine-wave driven				
Output Rating	Rated current (A)	0.7	1.0	1.7	2.7	4.2
	Output frequencies (Hz)	0 - 500				
Encoder feedback		23 bit / 17 bit single-turn absolute (The product can function as a multi-turn absolute type when batteries are added.)				
Control signal (*2)	Input	7-point (24VDC system, photo-coupler input insulation)				
	Output	3-point (24VDC system, photo-coupler output insulation)				
Communication function		EtherCAT (Topology: "Daisy chain", "Star", or "Ring" are available) USB : connection to PC with "S-TUNE Ⅱ" installed				
Amplifier status display function		Amplifier status display function 2 digits of 7-segment display on Setup Panel (Indicate EtherCAT node ID)				
Regeneration function		A regenerative resistor may be installed externally (*3)				
Dynamic brake		Built-in				
Speed observer		Available				
Auto-tuning		Available				
Encoder output Division/Multiplication		Available				
Tuning & Function Setup		Available through the S-FLAG Ⅱ setup software "S-TUNE Ⅱ"				
Protective functions	By hardware	Overvoltage, low voltage, Overcurrent, Abnormal temperature, Overload				
	By software	Overspeed, Position deviation too high, Parameter errors, Encoder error				
Alarm Log		Can be referenced with the setup software "S-TUNE Ⅱ"				

3. Amplifier

Items		Specifications					
Amplifier model		DB64A41		DB65B41	DB66B41	DB67C41	DB68C41
Compatible Motor		MX951 1 kW	M□102 1 kW	MJ851 850 W	M□152 1.5 kW	MJ132 1.3 kW	M□202 2 kW
External dimensions		(See "Dimensions")					
Mass (Kg)		1.1		2.0			
Main circuit power & Control power		Three-phaseAC200–240 V (*1) ±10% 50 / 60 Hz					
Input current (Arms typ)		Single-phase：9.9 Three-phase：5.3		5.3	6.3	8.1	9.2
Control type		Three-phase PWM inverter sine-wave driven					
Output Rating	Rated current (A)	5.8	5.8	6.9	9.5	10.7	12.2
	Output frequencies (Hz)	0-500					
Encoder feedback		23 bit / 17 bit single-turn absolute (The product can function as a multi-turn absolute type when batteries are added.)					
Control signal (*2)	Input	7-point (24VDC system, photo-coupler input insulation)					
	Output	3-point (24VDC system, photo-coupler output insulation)					
Communication function		EtherCAT (Topology: "Daisy chain", "Star", or "Ring" are available) USB : connection to PC with "S-TUNE Ⅱ" installed					
Amplifier status display function		Amplifier status display function 2 digits of 7-segment display on Setup Panel (Indicate EtherCAT node ID)					
Regeneration function		A regenerative resistor may be installed externally (*3)					
Dynamic brake		Built-in					
Speed observer		Available					
Auto-tuning		Available					
Encoder output Division/Multiplication		Available					
Tuning & Function Setup		Available through the S-FLAG Ⅱ setup software "S-TUNE Ⅱ"					
Protective functions	By hardware	Overvoltage, low voltage, Overcurrent, Abnormal temperature, Overload					
	By software	Overspeed, Position deviation too high, Parameter errors, Encoder error					
Alarm Log		Can be referenced with the setup software "S-TUNE Ⅱ"					

3. Amplifier

Notice

*1) In the Amplifier DB64A41 (1 kW), single-phase can be used for primary circuit power source.
To use single-phase 200 to 240 VAC, connect it to the primary circuit power connectors L1 and L3.
For the control power supply, connect L1 and L3 of the main circuit power supply to L1C and L2C, respectively.

Item		Specifications	
Amplifier Model		DB64A41	
Compatible Motor		1 kW (MX951 □ 2 □□ **, M □ 102 □ 2 □□ **)	
Primary Circuit Power Supply	Voltage Range	Three-phase 200 to 240 VAC ± 10% 50/60 Hz	Single-phase 200 to 240 VAC ± 10% 50/60 Hz
	Input Current	Rated at 4.5 A (200 VAC input) Rated at 3.8 A (230 VAC input) Up to approximately 13 A	Rated at 8.6 A (200 VAC input) Rated at 7.3 A (230 VAC input) Up to approximately 23 A

*2) Use SELV (Safety Extra Low Voltage/Non-Hazardous Voltage) power supply to User I/O with reinforced isolation from hazardous voltage.
As a countermeasure against amplifier failure, install overcurrent protection or use power output capacity of no higher than 100 W.

*3) Regenerative resistor values do not guarantee optimal performance. If the generated heat temperature becomes too high, increase the resistance value or select a resistor whose allowable power is larger enough. Whether or not a regenerative resistor installation is necessary can be checked on the Setup Panel or S-TUNE Ⅱ.

3. Amplifier

Standard I/O

Items	Specifications
Control input	CW limit sensor, CCW limit sensor, Home sensor, External latch(2-point), Alarm reset, Emergency stop
Control output	Brake release, Alarm status, Servo ready

Operation mode

Item	Specifications
Operation mode	EtherCAT communication mode, test mode through S-TUNE Ⅱ

Environmental Specification

Items	Specifications
Ambient temperature	**For operation:** 0 to 55℃ , **For storage:** −20 to 65℃
Ambient humidity	**For operation/For storage:** 20 to 85%RH (No condensation)
Atmosphere for operation and storage	Indoors (not subject to direct sunlight), Free from corrosive gases, flammable gases, oil mist, dust, flammables, grinding fluid
Altitude	≦ 1,000 m
Vibration	≦ 5.8 m/s^2 (0.6 G) 10 to 60 Hz (no continuous operation allowed at frequency of resonance)
Dielectric strength	AC 1,500 V for one minute across the primary and FG
Electric shock protection	Class Ⅰ (mandatory grounding)
Overvoltage category	Ⅲ
Installation environment	Pollution degree 2

EtherCAT communication Specifications

Items	Specifications
Device Profile	CoE (CANOpen over EtherCAT)
Control mode	csp, csv, cst, hm
hm method (homing mode)	1-6, 17-22, 33-37
Synchronous mode	DC (Synchronized), FreeRun (not-Synchronized)
Cycle Time	250 μs, 500 μs, 1 ms, 2 ms, 4 ms

4. External Dimensions

Figure 1

Motor rated output power: **50 W** **100 W** **200 W** 400 W 750 W 850 W 1 kW 1.3 kW 1.5 kW 2 kW

Amplifier model	DB6YZ41 DB6Z141 DB61241

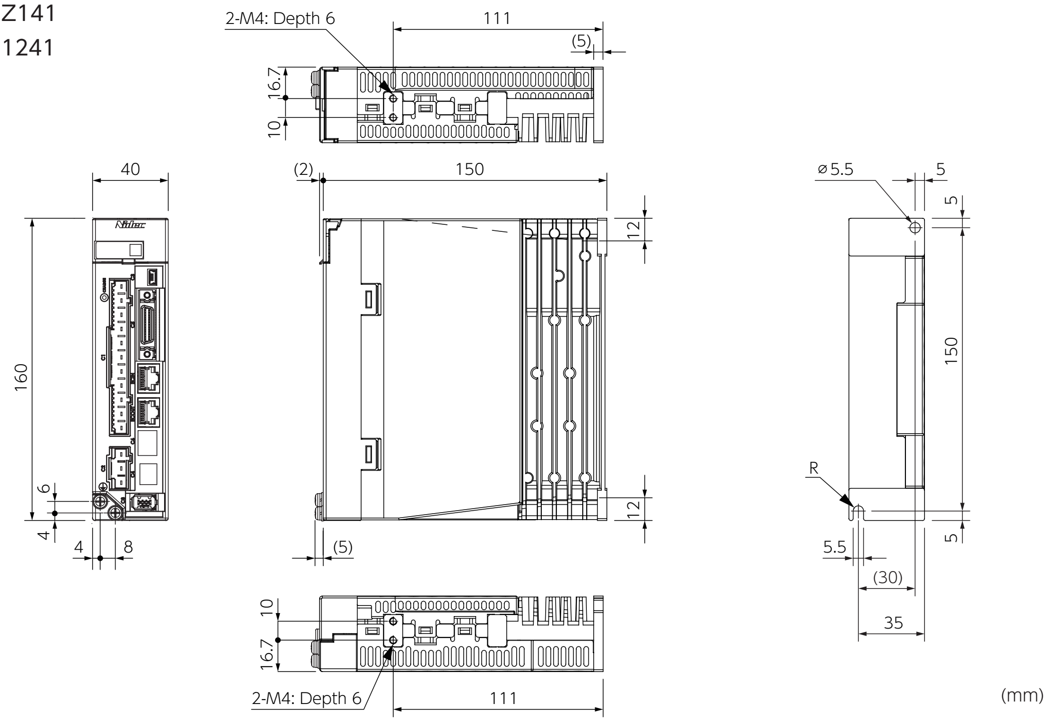
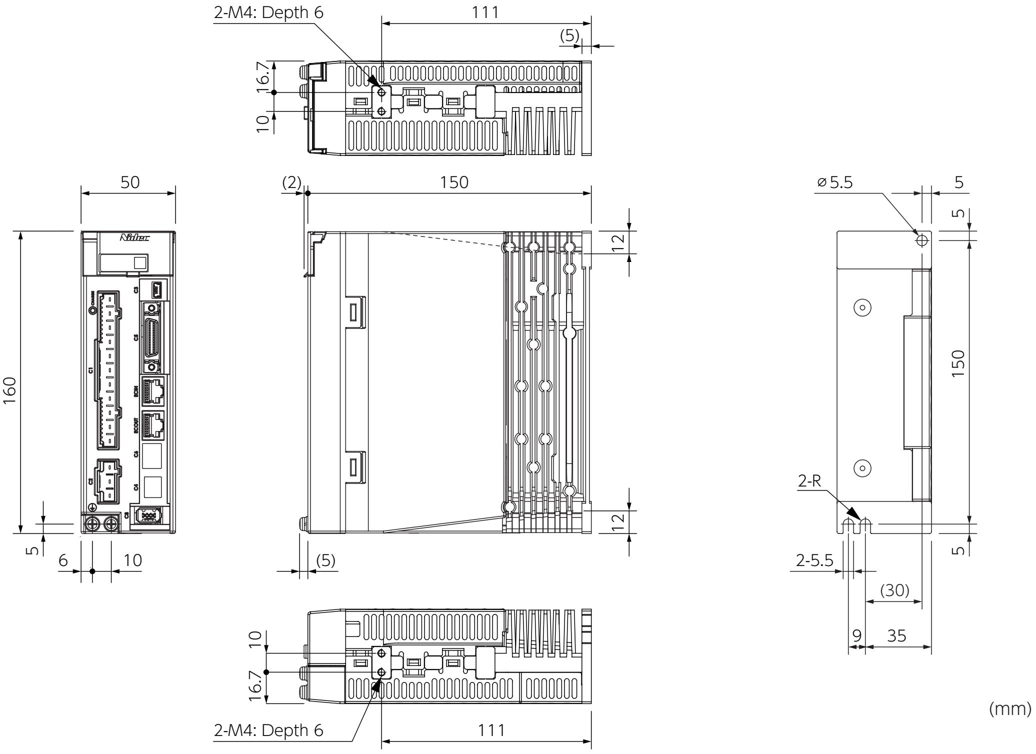


Figure 2

Motor rated output power: 50 W 100 W 200 W **400 W** 750 W 850 W 1 kW 1.3 kW 1.5 kW 2 kW

Amplifier model	DB62441



3. Amplifier

Figure 3

Motor rated output power: 50 W | 100 W | 200 W | 400 W | **750 W** | 850 W | **1 kW** | 1.3 kW | 1.5 kW | 2 kW

Amplifier model: DB63841, DB64A41

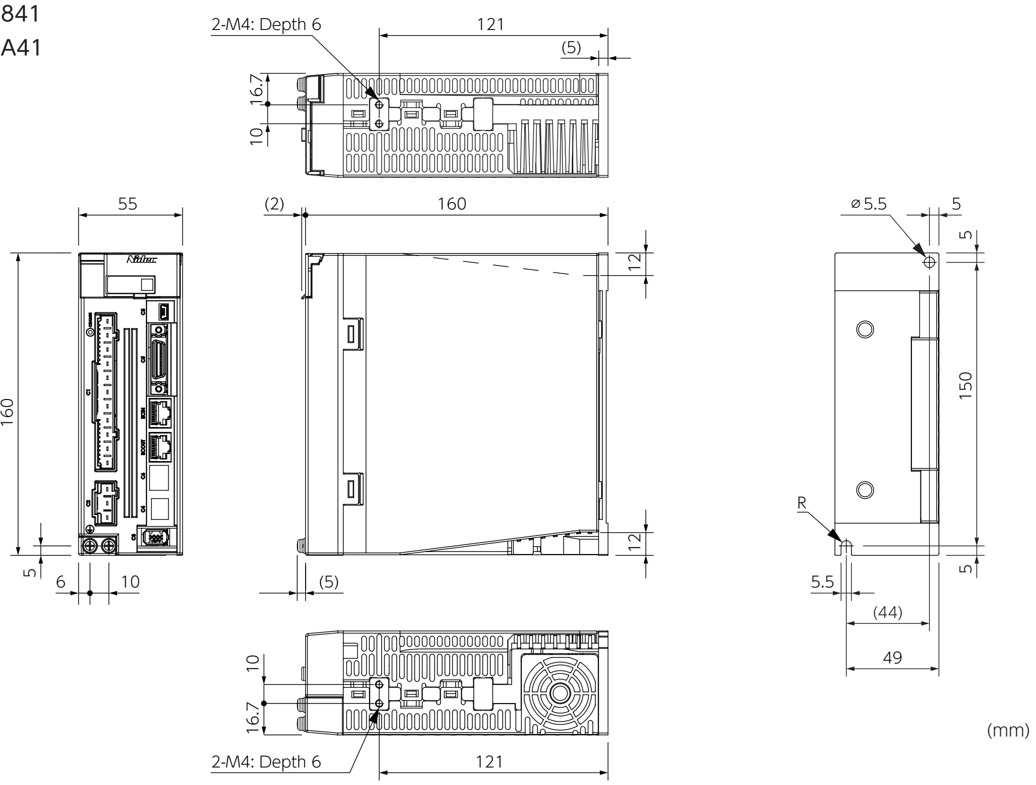
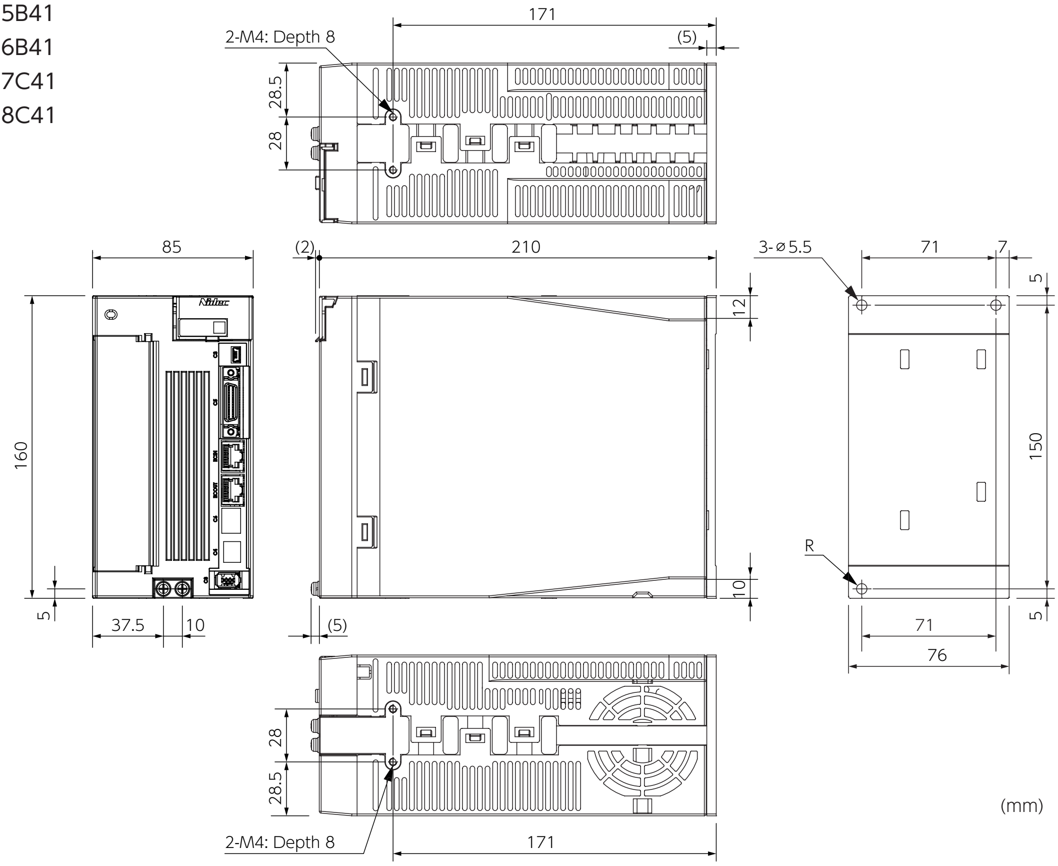


Figure 4

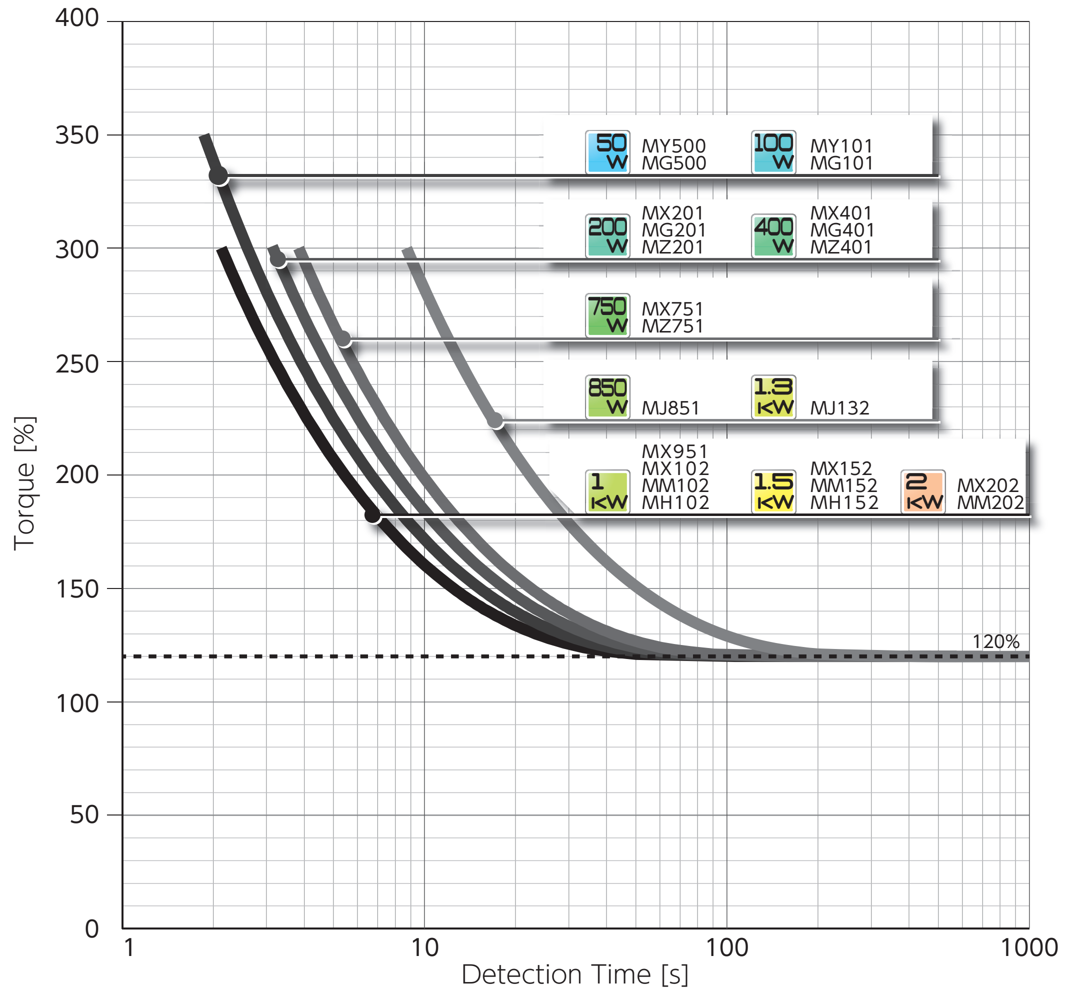
Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | **850 W** | 1 kW | **1.3 kW** | **1.5 kW** | **2 kW**

Amplifier model: DB65B41, DB66B41, DB67C41, DB68C41



5. Overload Detection Feature

S-FLAG Ⅱ series amplifiers features overload protection - overload alarm output and emergency stop upon alarm output - in case of motor operation with load level above the overload detection curve shown below.



Overload detection feature is reference data.

Be sure to use the motor within the specification temperature range and in the enough radiation environment.

Detection time may change by the radiation condition of the motor.

2

Mounting and Wiring

1. Installation

Installation and Operating Environment

Ensure that the environments for installation and operation meet the requirements specified in this document.

Should you use the product in conditions different from the specifications, please contact us.

- Do not install the product where it could be directly exposed to direct sunlight.
- Be sure to install each amplifier inside a control panel.
- Install the product in an environment free from humidity and ingress of water and oil such as cutting oil and oil mist.
- Never use the product in ambient air of explosive or flammable gases, chloride, acidic or alkaline corrosive ambiance such as sulfur dioxide, chlorine, ammonia and so on.
- Use the product in an environment free from dust, iron dust, and chips.
- Do not use the product near locations exposed to high temperatures, continuous vibrations, or excessive shock.

Precautions

- I/O device and the host control device must share one power supply (24 VDC).
- When performing maintenance, be sure to turn off the circuit breaker of the main power in advance.
- Be aware of the residual voltage in the amplifier remaining for 15 minutes after the main power shut off.
- Never attempt to replace a fuse.
- Do not touch or block the air vent of the amplifier. Do not place objects which would block the air vent.

Dust-proof and Waterproof

Be sure to compliance with the IP-code of the motor and amplifier.

Amplifier

S-FLAG Ⅱ Amplifiers are not waterproof structure.

Motor

The protective enclosure rating of motors depends on the rated output. (*)

IP65	50 W	100 W	200 W	400 W	750 W		1 kW MX951			
IP67						850 W	1 kW MX102 MM102 MH102	1.3 kW	1.5 kW	2 kW

*) Except for the shaft output component and the connectors.

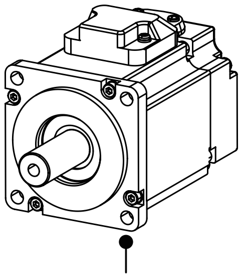
2. Mounting and Wiring

1. Installation

1. Motor Installation

Do not use any other screws but those in the recommended sizes.

The motor mounting screws are depending on its flange size.



Recommended Motor Mounting Screws

Fitting flange size	Mounting Hole	Hexagon socket head bolt	Motor
40 mm x 40 mm	2- ⌀ 4.5	M4 × L12 mm	· 50 W · 100 W
60 mm x 60 mm	4- ⌀ 5.5	M5 × L12 mm	· 200 W · 400 W
80 mm x 80 mm	4- ⌀ 6.6	M6 × L14 mm	· 750 W · 1 kW (MX951)
100 mm x 100 mm	4- ⌀ 9.0	M8 × L18 mm	· 850 W · 1 kW (M□102) · 1.3 kW · 1.5 kW · 2 kW
130 mm x 130 mm			

Use a screw longer than the recommended length.

Installation Precautions

Never remove the encoder from the motor or disassemble the motor.
The motor shaft has anti-rust oil applied at the time of shipment. Before installing the motor, wipe off the oil completely
Perform precise axis alignments. Otherwise, the motor operation will cause vibration or result in shorter service life of the motor.

Shock and Impact Force

When transporting, installing or removing the motor, do not apply excessive impact force or load.
Do not hold the encoder unit, cables, or connectors when carrying the motor.
Shock resistance of the motor is 200 m/s^2 (20 G) or less.
During installation or operation, radial load or axial load applied to each motor has to be within the withstand rating.
When attaching a coupling to the motor shaft end or removing it, avoid direct impact by a tool such as hammer.
To remove the pulley, coupling, or any other parts from the shaft, use a puller.

1. Installation

Connection with Machines

Use a coupling to absorb angle and direction deviations so that the motor shaft load will be less than the rated allowable axial load.
Otherwise, the bearing life in the motor will be shorter, or the shaft may become damaged.
If you are using a rigid coupling, install it very carefully such that the axial misalignment will be minimal.
(Using a flexible coupling is recommended.)

Countermeasure for Oil and Water

Do not use any cable immersed in water or oil.
Install the motor such that the cable side is facing downward.
Do not use the motor in an environment where it will be constantly subjected to oil or water splash.
In the case that a speed reducer to be connected to a motor will be located over the motor shaft, use an oil-sealed motor so that no oil from the speed reducer permeates into the motor.

Types of Mounting and Oil Seal

Our motors can be mounted in two different ways, horizontally and vertically. Observe the following precautions for motor installation.

Horizontal Installation

To protect the motor from oil or water, have the cable-pull side downward.

Vertical Installation

If a speed reducer is connected to a motor such that it will be located over the motor shaft, use an oil-sealed motor so that no oil from the speed reducer permeates into the motor.

Stress to the Cables

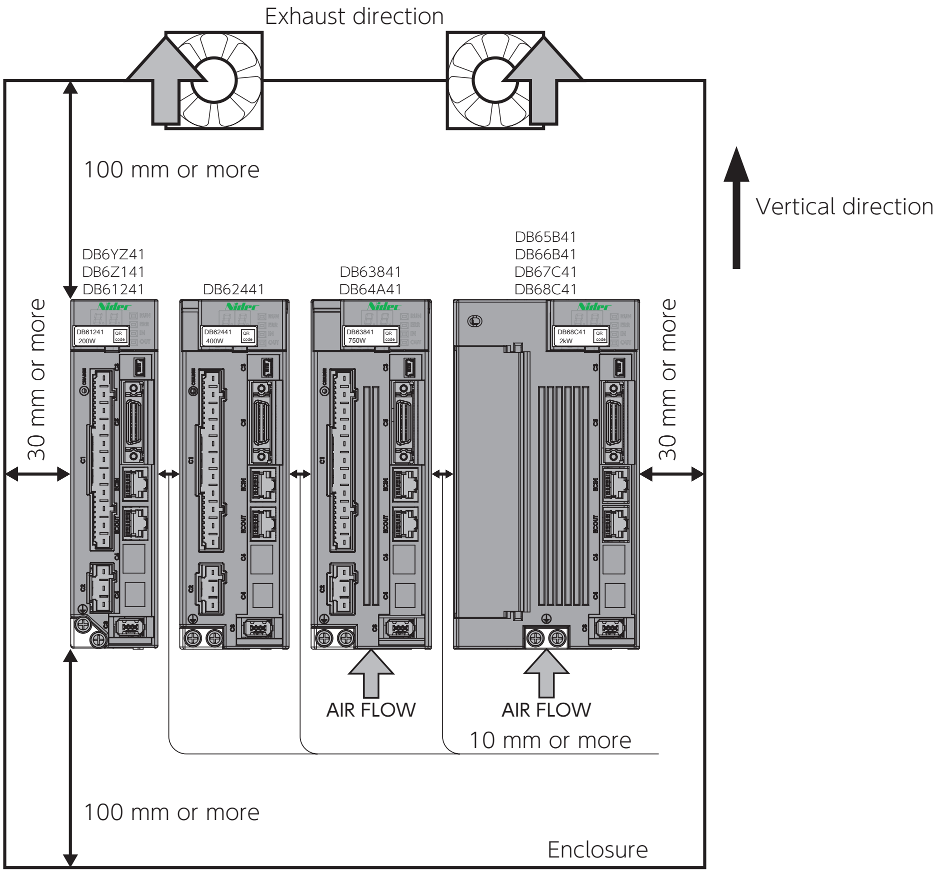
Be careful not to apply stress, such as excessive bending or motor weight, to the cable-pull part or its connecting section.
In motor movable operation, be sure to use a flexible cable.
When placing the cable in a cableveyor, minimize the bending stress to the cable.
Bending radii of the motor power cable must be more than R20 mm.

2. Amplifier Installation

🚫	Do not turn on the primary circuit power or the control power until all wiring work is completed.	⚠

Mounting Orientation and Clearance

❗	When installing amplifiers, secure required clearances for protective enclosures and control panels for heat dissipation and air flow.	⚠



- Install all amplifiers vertically. Use M5 screws

  50 W,　100 W,　200 W,　750 W,　1 kW　: Two-location
  400 W,　850 W,　1.3 kW,　1.5 kW,　2 kW　: Three-location

☞ B- 1 **Specifications:** Amplifier Dimensions

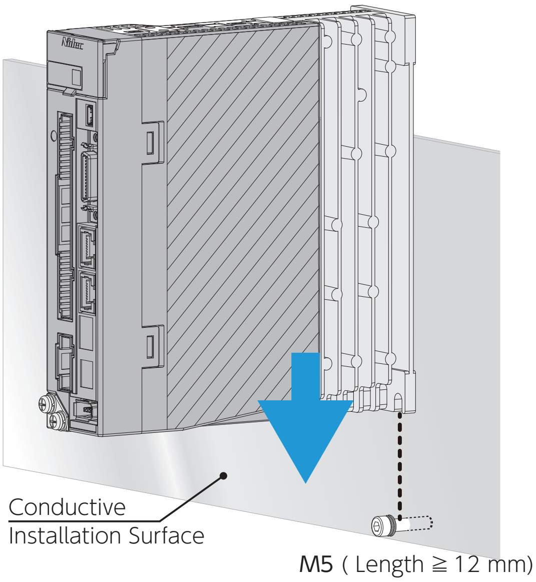
- If you are mounting the amplifier into an enclosure such as protective casing, use a fan or air conditioner so that the ambient temperature inside each board will not exceed 55°C.
- The temperature of the heat sink at its surface may become 30°C (or more) higher than the ambient temperature.
- Use heat resistant wiring materials and keep amplifiers away from heat-sensitive equipment and wiring.
- The service life of each amplifier depends on the ambient temperatures of the internal electrolytic capacitor. Electrolytic capacitors last approximately 5 to 6 years under the conditions of 30°C annual average temperature, 80% load factor, and 20 hours or less average daily operation.

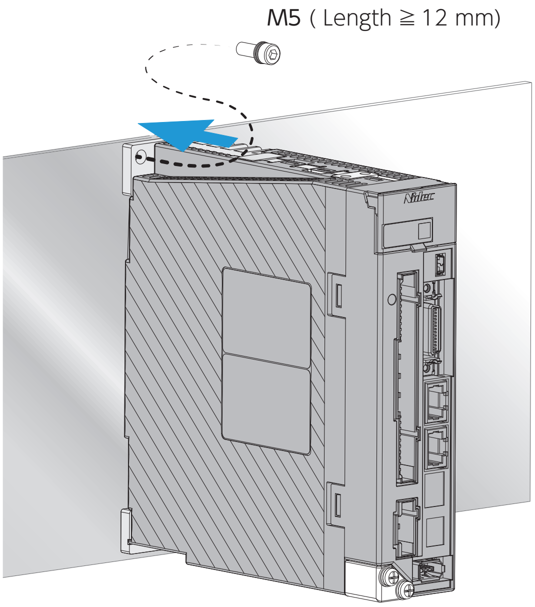
Mounting Amplifiers

Be sure to mount each amplifier on conductive surface such as aluminum brushed plate.

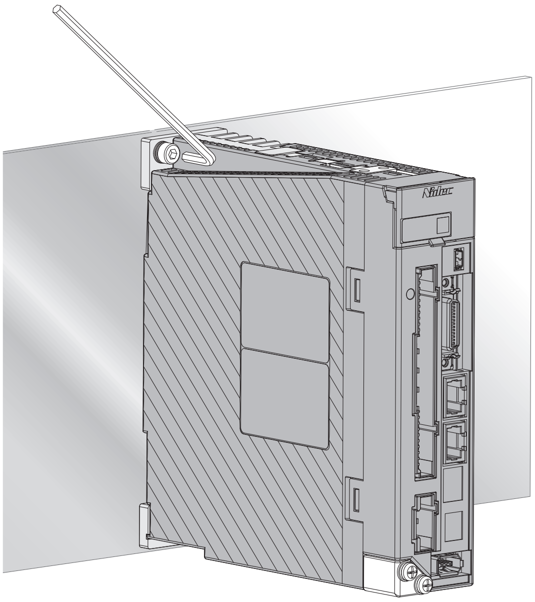
STEP 1 Hook the U-shaped installation notch of the amplifier to the bolt that has been screwed in advance.

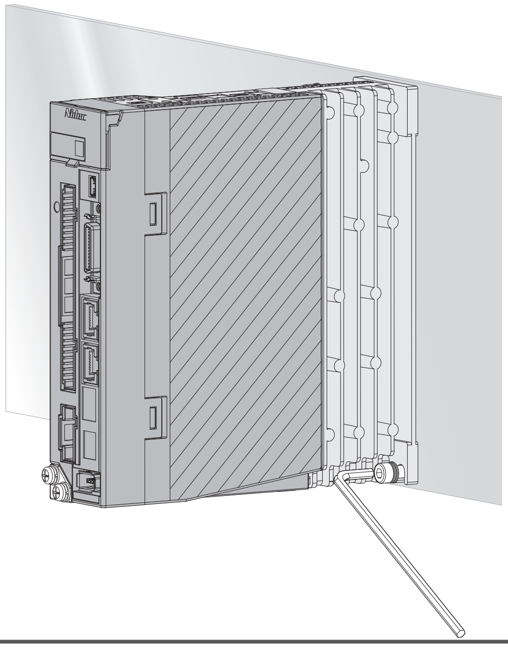
STEP 2 Tighten the mounting screws on the amplifier top.





STEP 3 Loosely screw all amplifier to the chassis first, and then securely tighten them all together.
(Tightening torque: 1.4 to 1.6 N·m)





2. System Wiring

⚠ DANGER

❗	Be mindful when wiring and handling high voltage materials	⚠ ⚠ ⚠

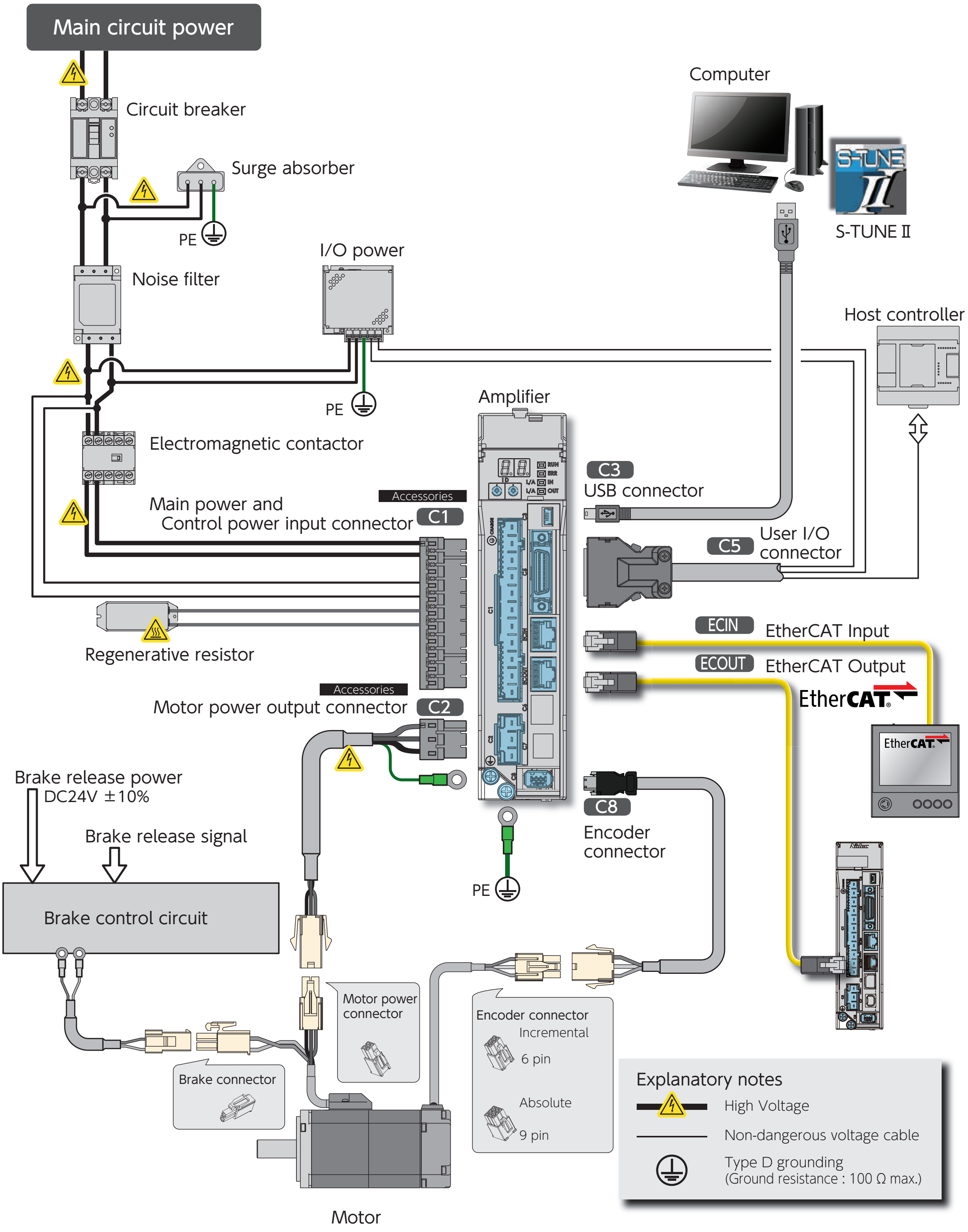
❗	To comply with the EC Directive, select appropriate devices, each of which is compliant with its applicable standards.
	FG connection is a must.
	Connect the input power of control power to the same power supply that the primary circuit power is connected to.
	Do not use the electromagnetic contactor (installed on the primary circuit power side) to run or stop the motor.
	For high-voltage cables, use wires of 600 V withstand voltage or more.
	For a C5 connector cable, use a shielded twisted-pair cable of 2 m or less.
	The encoder cable length must be 20 meters or less.
	For stranded wire, use insulation coating, rod or ring crimp terminals.

2. System Wiring

1. System Wiring

Wiring Pattern 1

Motor rated output power	50 W	100 W	200 W	400 W	750 W	850 W	1 kW	1.3 kW	1.5 kW	2 kW



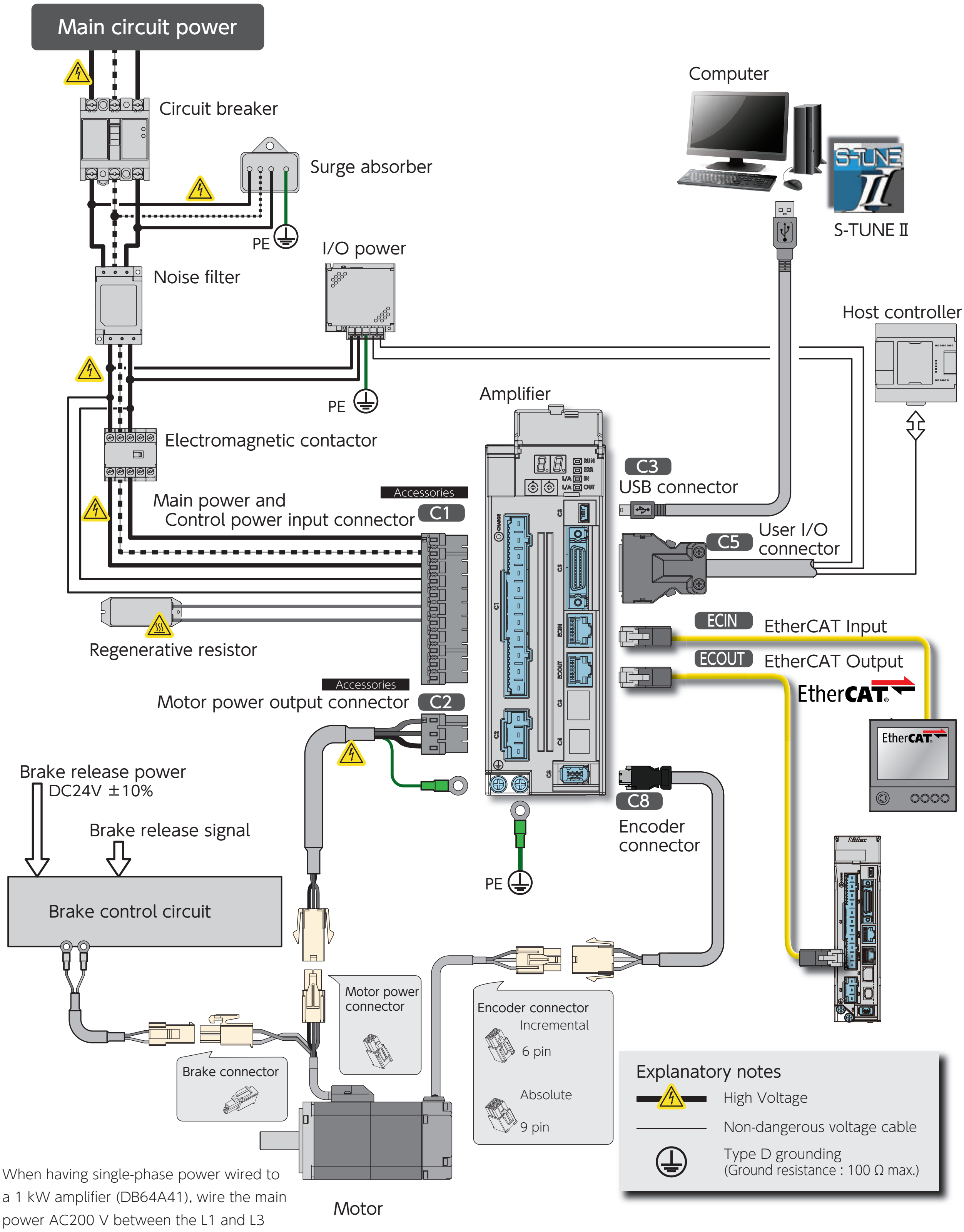
This wiring diagram depicts one example configuration:
a 200 W motor and its compatible amplifier.

2. System Wiring

Wiring Pattern 2

Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | **1 kW** | 1.3 kW | 1.5 kW | 2 kW

MX951

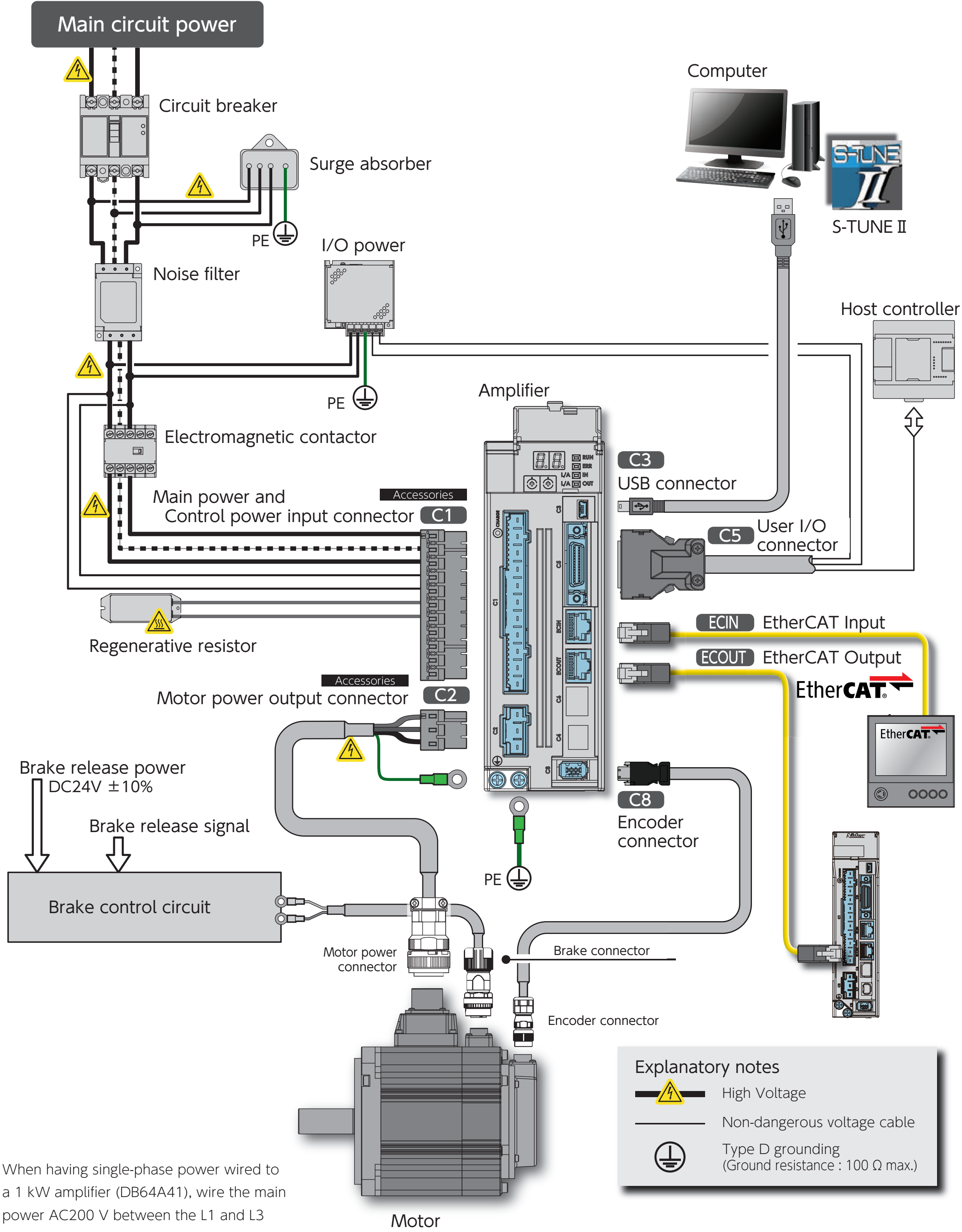


When having single-phase power wired to a 1 kW amplifier (DB64A41), wire the main power AC200 V between the L1 and L3 terminals of the amplifier.

2. System Wiring

Wiring Pattern 3

Motor rated output power	50 W	100 W	200 W	400 W	750 W	850 W	1 kW	1.3 kW	1.5 kW	2 kW
							MX102 MM102 MH102			

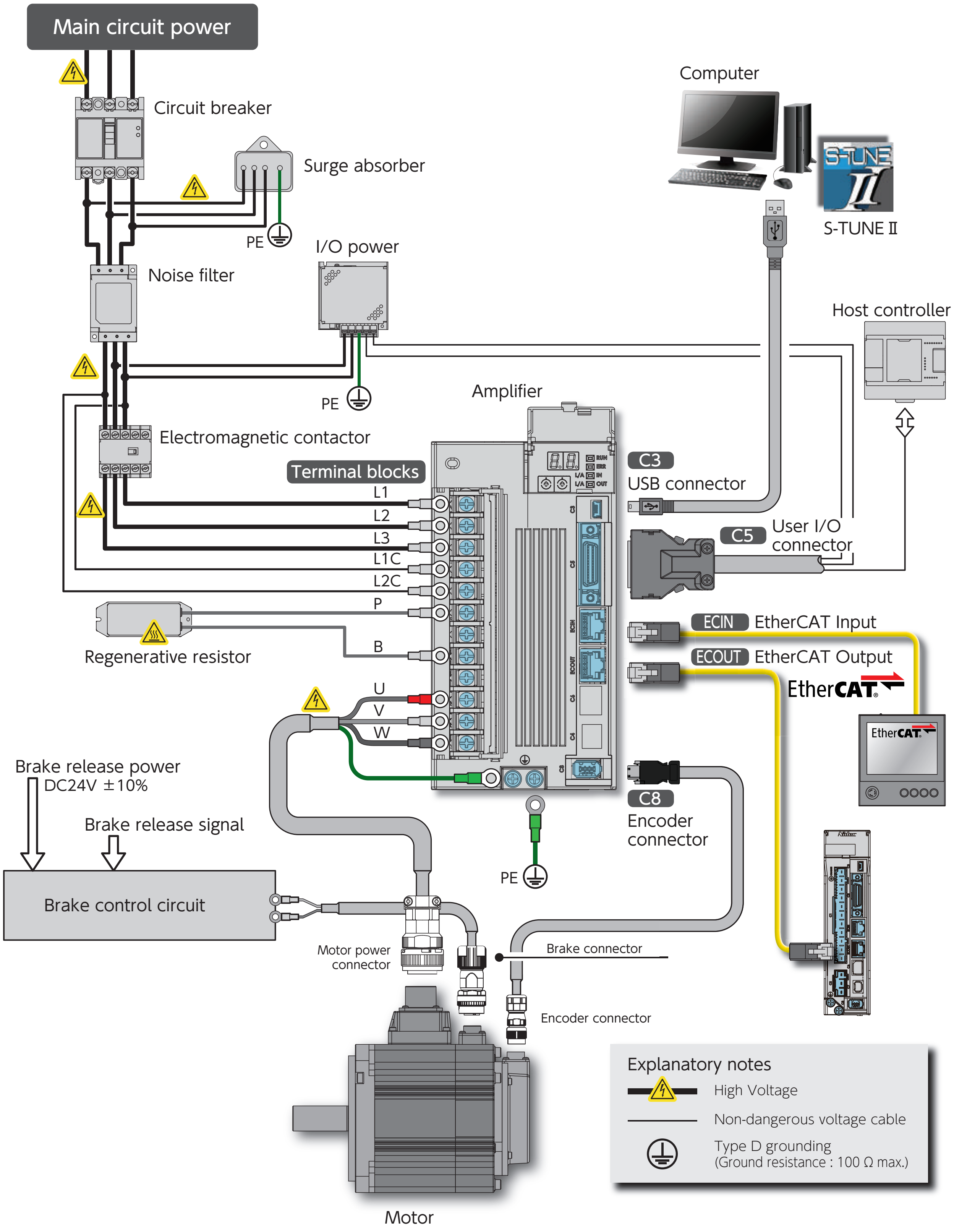


When having single-phase power wired to a 1 kW amplifier (DB64A41), wire the main power AC200 V between the L1 and L3 terminals of the amplifier.

2. System Wiring

Wiring Pattern 4

Motor rated output power: 50 W, 100 W, 200 W, 400 W, 750 W, **850 W**, 1 kW, **1.3 kW**, **1.5 kW**, **2 kW**



2. Connecting Equipment and Recommended Peripherals

Main circuit power

Please use this product in the power supply environment of Over-Voltage Category Ⅱ defined by IEC60664-1.
This is the primary circuit power for amplifiers.
Using a overvoltage protection relay is recommended.

50 W to 750 W : Single-phase AC200 V to 240 V ± 10% 50/60 Hz
850 W to 2 kW : Three-phase AC200 V to 240 V ± 10% 50/60 Hz

- When having single-phase power wired to a 1 kW amplifier, wire the primary circuit AC200 V between the L1 and L3 terminals of the amplifier.
- To avoid unbalance of the three-phase AC200 V wiring in your factory, we recommend that you consider balance of currencies in your three-phase wirings.
- Confirm that your contract with the electric power company is not limited to use of three-phase.

I/O power

This is power supply of DC24 V ± 10% for I/O power and motor brake release power.
Use a SELV (Safety Extra Low Voltage) power supply with reinforced insulation against hazardous voltages.
Be sure to connect a varistor to the motor braking release power supply.

Cables

Use of UL wires and cables suitable for motor rated output are recommended.
Should you use a cable longer than the specification, please contact us in advance.

High-voltage cables (Main circuit power cable, Control power cable)、FG cables:
AWG14 / 600 V breakdown voltage or equivalent
Regenerative resistor connecting cable
AWG18 / 600 V breakdown voltage or equivalent
Motor power cables:
50–750 W : AWG18 / 300 V breakdown voltage or equivalent
850 W-2 kW : AWG14 / 300 V breakdown voltage or equivalent
NOTE: 1 kW motors may use AWG16 cables as well.
Encoder cables:
AWG22 and AWG24 compound / 30 V breakdown voltage or equivalent
Shielded cables with twisted pair wires
Length not exceeding 20 m
User I/O cable:
AWG26 / 300 V breakdown voltage or equivalent
Shielded cables with twisted pair wires
Length not exceeding 2 m

Circuit breaker

To protect the power supply line, circuit breakers shut the circuit down in the event of over-current.
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 an earth leakage circuit breaker that we recommend.

Recommended Product	Fuji Electric Co., Ltd.	Single-phase : EW32AAG-2P020B Three-phase : EW32AAG-3P020B

20 A for single-phase (three-phase) 200 V Leakage current of 30 mA.
An equivalent product is acceptable. Select the capacity and other characteristics according to your entire system configuration.

Noise filter

Noise filters prevent ingress of external noise from the power supply line. To ensure compliance with EMC, use the recommended noise filter.

Recommended Product	OKAYA Electric Industries Co., Ltd.	Three-phase: 3SUPF-BE □□ -ER-6- □

Included in S-FLAG Ⅱ amplifier's EMC testing.
Select the capacity and other characteristics according to your entire system configuration.

2. System Wiring

Electromagnetic contactor

This is an on/off switch for the main power supply. Use a surge absorber on the input side of the primary circuit power supply.

Recommended Product	Fuji Electric Co., Ltd.	SK06G-E10

An equivalent product is acceptable.
Select the capacity and other characteristics according to your entire system configuration.

Surge absorber

To ensure compliance with EMC, connect the recommended surge absorber to the primary side of primary circuit power supply.

Recommended Product	OKAYA Electric Industries Co., Ltd.	Single-phase: LV275DI-Q4 Three-phase: LV275DI-U4

Included in S-FLAG Ⅱ amplifier's EMC testing

Signal line noise filter/ferrite core

To ensure compliance with EMC, use the recommended signal line noise filter/ferrite core.

Recommended Product	SEIWA ELECTRIC MFG. CO., LTD. (MISUMI)	E04SR401938 (ATCK-1130)

Included in S-FLAG Ⅱ amplifier's EMC testing

Regenerative resistor

This product is not equipped with regenerative resistor. If the smoothing capacitor inside the servo amplifier cannot absorb regenerative power, an external regenerative resistor is required. As a guideline, check the regeneration state on the settings panel, and use a regenerative resistor if the regenerative voltage warning is ON.
Build an overheating prevention circuit using a resistor which has built-in thermostat.
If the temperature of generated heat becomes high, you can suppress the heat by installing a cooling device, or selecting a resistor whose allowable power is 5 to 10 times larger than regenerative voltage.

Recommended Product	Chiba Techno Co., Ltd.	For 50-750 W : CAN100S 47 Ω J For 1 kW : CAN400S 30 Ω J For 850 W, 1.3-2 kW : CAN750S 20 Ω J

When considering a regenerative resistor other than the recommended above, use the following as a guideline.

Motor Model	50 W M□500	100 W M□101	200 W M□201	400 W M□401	750 W M□751	1 kW MX951 M□102	850 W MJ851	1.3 kW MJ132	1.5 kW M□152	2 kW M□202
Rated output	50 W	100 W	200 W	400 W	750 W	1 kW	850 W	1.3 kW	1.5 kW	2 kW
Regeneration resistance	40–50 Ω					30 Ω	20 Ω			
Regeneration allowable voltage	20 W					40 W	60 W			
Recommended Wattage	100–200 W					400–800 W	600–1,200 W			

The regeneration resistance values do not guarantee the optimal performance. Regeneration allowable voltages above are minimum values as a point of reference.
The regeneration resistor may become very hot. It requires sufficient margin of regeneration allowable power.

Grounding

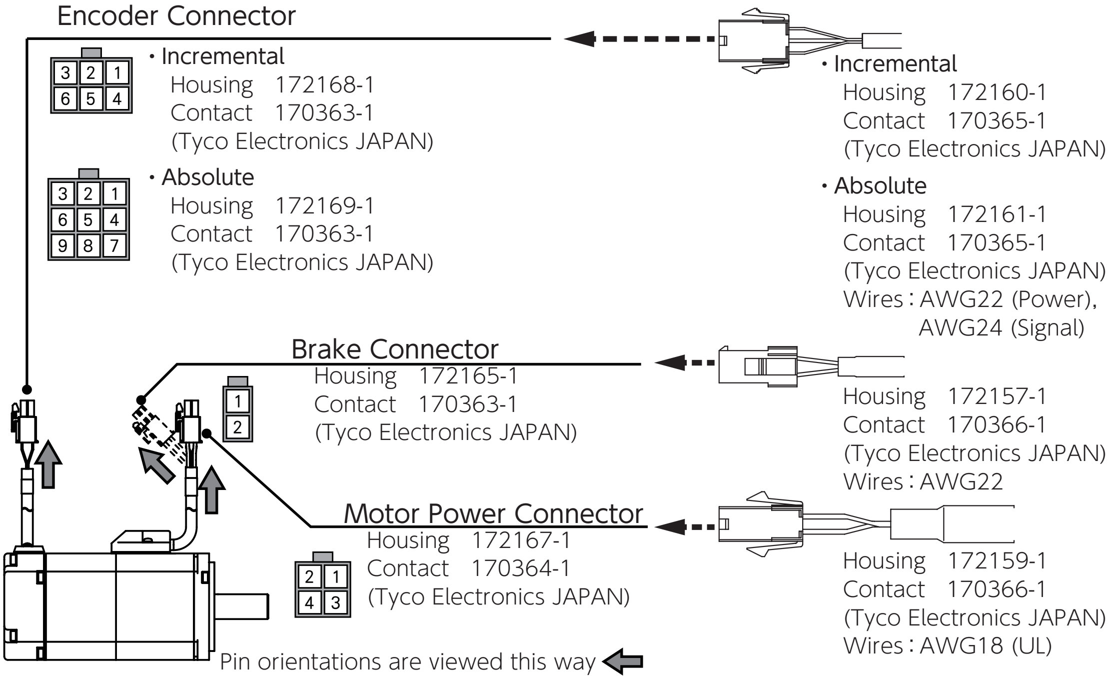
Since this product is Class I device, protective grounding is mandatory.
(Type D grounding: grounding resistance of up to 100 Ω)
Properly ground the product using protective grounding terminals through EMC-compatible casing and control panel.

3. Wiring to Connectors and Signals

1. Motor Connector Pinouts

Motor Connector Pinout

Motor rated output power	50 W	100 W	200 W	400 W	750 W	850 W	1 kW	1.3 kW	1.5 kW	2 kW
							MX951			



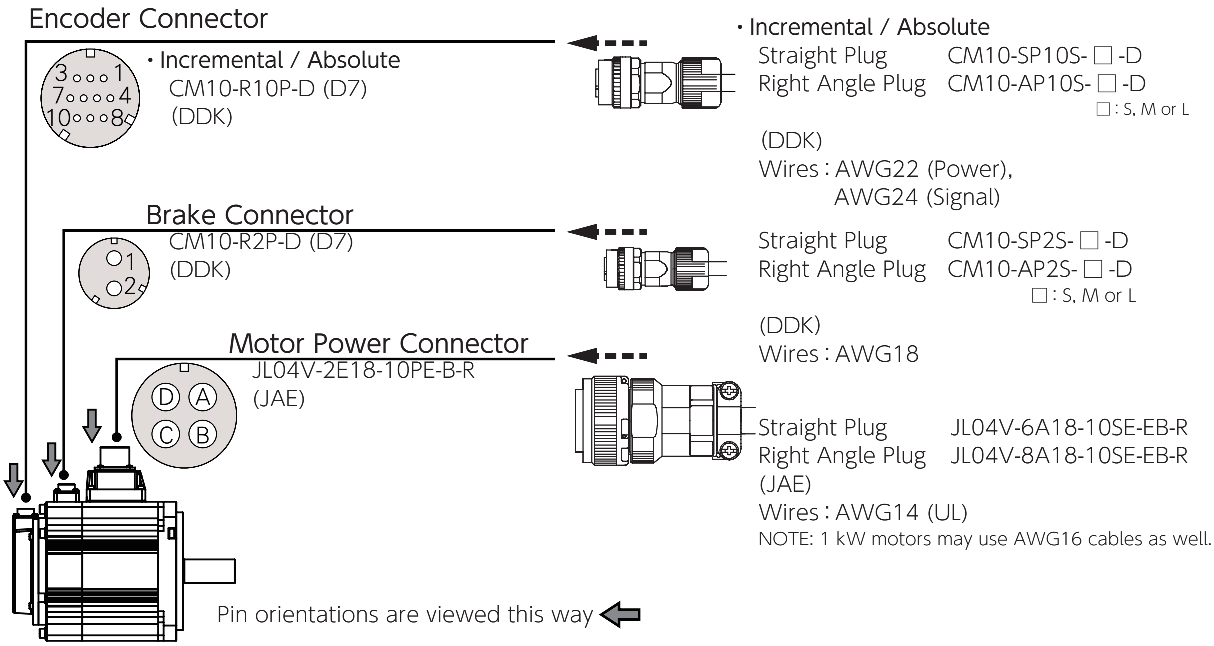
Name	Pin No.	Signal	Description
Motor Power	1	U	Motor power U-phase
	2	V	Motor power V-phase
	3	W	Motor power W-phase
	4	FG	Motor frame ground
Brake (*1)	1	BRK+	Brake power supply DC24V
	2	BRK−	Brake power supply GND
Encoder (Incremental)	1	−	(No Connect)
	2	+D	Serial communication data + Data
	3	−D	Serial communication data − Data
	4	VCC	Encoder power supply +5 V
	5	SG	Signal ground
	6	SHIELD	Shield
Encoder (Absolute)	1	BAT	External battery (*2)
	2	−	(No Connect)
	3	SHIELD	Shield
	4	+D	Serial communication data + Data
	5	−D	Serial communication data − Data
	6	−	(No Connect)
	7	VCC	Encoder power supply +5 V
	8	SG	Signal ground
	9	−	(No Connect)

*1) Only for a motor equipped with a brake
*2) Connect the negative pole of the battery to SG (Signal Ground).

Motor Connector Pinout

Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | 1 kW | 1.3 kW | 1.5 kW | 2 kW

MX102
MM102
MH102



Name	Pin No.	Signal	Description
Motor Power	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 +5 V
	2	SG	Signal ground
	3, 4	−	(No Connect)
	5	+D	Serial communication data + Data
	6	−D	Serial communication data − Data
	7, 8, 9	−	(No Connect)
	10	SHIELD	Shield
Encoder (Absolute)	1	VCC	Encoder power supply +5 V
	2	SG	Signal ground
	3	−	(No Connect)
	4	BAT	External battery (*2)
	5	+D	Serial communication data + Data
	6	−D	Serial communication data − Data
	7, 8	−	(No Connect)
	9	SG	Signal ground
	10	SHIELD	Shield

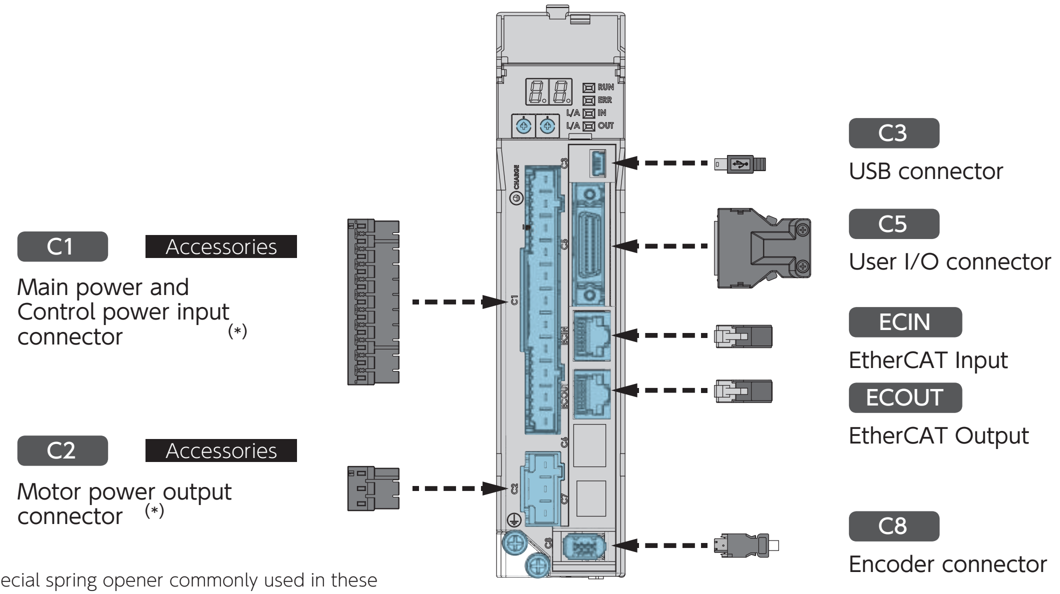
*1) Only for a motor equipped with a brake
*2) Connect the negative pole of the battery to SG (Signal Ground).

2. Amplifier Connectors and Pinouts

Amplifier Connector Layout

Amplifier Connectors

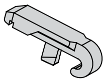
Motor rated output power: 50 W, 100 W, 200 W, 400 W, 750 W, 850 W, 1 kW, 1.3 kW, 1.5 kW, 2 kW



*) A special spring opener commonly used in these connectors is an accessary.
To prevent loss, please store in the designated place after use.

The shape of this amplifier is an example of 200 W.
The connector arrangement is the same for other amplifiers.

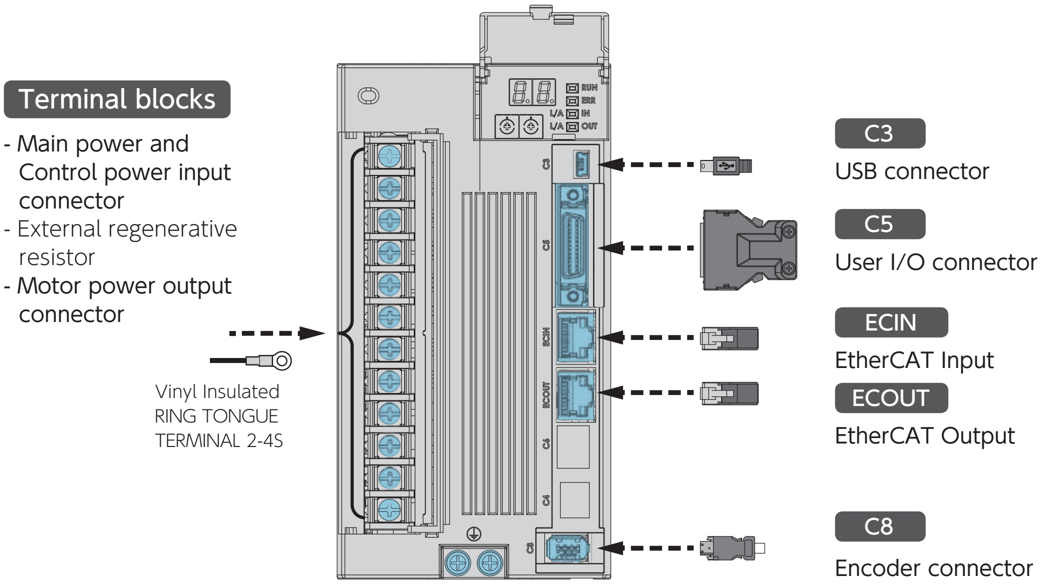
Accessories Spring Opener



1981045-1
(Tyco Electronics JAPAN)

Amplifier Connectors

Motor rated output power: 50 W, 100 W, 200 W, 400 W, 750 W, 850 W, 1 kW, 1.3 kW, 1.5 kW, 2 kW



The 850 W and 1.3 -2 kW amplifiers shapes are all the same.

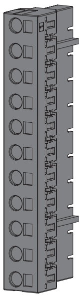
Amplifier Connectors Pinout

Amplifier Connectors Pinout

Motor rated output power 50 W 100 W 200 W 400 W 750 W 850 W 1 kW 1.3 kW 1.5 kW 2 kW

C1 Accessories

Main power and Control power input connector



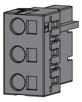
1-2229794-1
(Tyco Electronics JAPAN)

Pin No.	Signal	Description
1	L1	Main Power (Main Circuit)
2	L2	Main Power (Main Circuit)
3	L3	Main Power (Main Circuit)
4	L1C	Main Power (Control Circuit)
5	L2C	Main Power (Control Circuit)
6	B1/+	External Regenerative resistor connection (+)
7	B2	External Regenerative resistor connection (−)
8	B3	Regenerative resistor connection Switch
9	⊖ 1	(Reserved)
10	⊖ 2	(Reserved)
11	⊖	No Connect

When having single-phase power wired to a 1 kW amplifier (DB64A41), wire the main power AC200 V between the L1 and L3 terminals of the amplifier.

C2 Accessories

Motor Power output connector



3-2229794-1
(Tyco Electronics JAPAN)

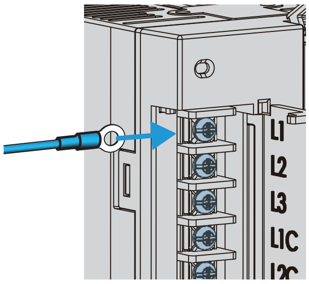
Pin No.	Signal	Description
1	U	Motor power U-phase
2	V	Motor power V-phase
3	W	Motor power W-phase

Amplifier Connectors Pinout

Motor rated output power 50 W 100 W 200 W 400 W 750 W 850 W 1 kW 1.3 kW 1.5 kW 2 kW

Terminal blocks

- Main power and Control power input connector
- External regenerative resistor
- Motor power output connector



Signal	Description
L1	Main Power (Main Circuit)
L2	Main Power (Main Circuit)
L3	Main Power (Main Circuit)
L1C	Main Power (Control Circuit)
L2C	Main Power (Control Circuit)
P	External Regenerative resistor connection (+)
RB	(No Connect)
B	External Regenerative resistor connection (−)
N	(No Connect)
U	Motor power U-phase
V	Motor power V-phase
W	Motor power W-phase

3. Wiring to Connectors and Signals

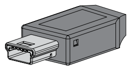
Amplifier Connectors Pinout

Amplifier Connectors Pinout

Motor rated output power									
50 W	100 W	200 W	400 W	750 W	850 W	1 kW	1.3 kW	1.5 kW	2 kW

C3

USB connector

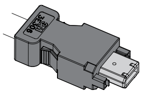


USB mini B

Pin No.	Signal	Description
1	VBUS	USB power supply +5 V
2	D−	USB data −
3	D+	USB data +
4	−	(No Connect)
5	SG	USB signal ground

C8

Encoder connector

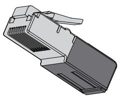


Connector: 3E206-0100KV (3M)
Cover: 3E306-3200-008 (3M)
Wires: AWG22 (Power), AWG24 (Signal)

Pin No.	Signal	Description
1	VCC	Encoder power supply +5 V
2	SG	Signal ground
3, 4	−	(No Connect)
5	+D	Encoder signal data +
6	−D	Encoder signal data −
SHELL	FG	SHIELD wired to the connector casing

ECIN **ECOUT**

EtherCAT Connector



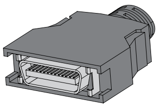
RJ45

Pin No.	Signal	Description
1	TX+	Transmit / Receive data +
2	TX−	Transmit / Receive data −
3	RX+	Receive / Transmit data +
4, 5	−	(No Connect)
6	RX −	Receive / Transmit data −
7, 8	−	(No Connect)
SHELL	FG	SHIELD wired to the connector casing

Be sure to use TIA/EIA -568 Category 5 e or higher (Shielded) cables.

C5

User I/O connector



(26 pin)

Connector 10126-3000-PE (3M)
Cover 10326 (3M)
or Equivalent alternatives
Wires : AWG26

3. Wiring to Connectors and Signals

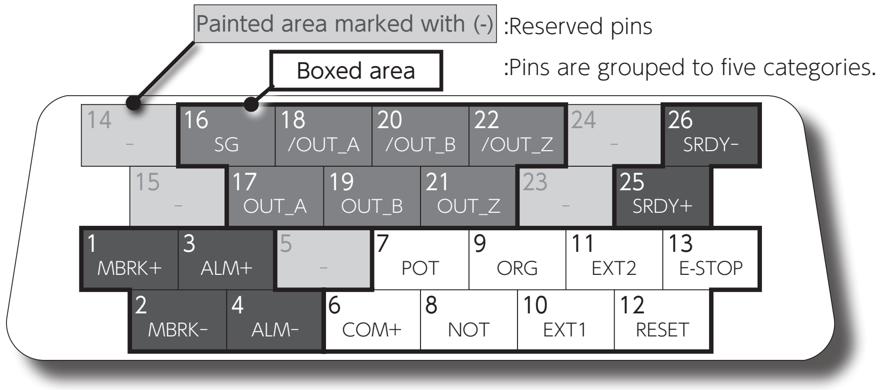
Pinout Diagram

A pinout diagram of C5 connector pinout. Pins are grouped to three categories.

Pins Group	Description
General-Purpose Input INPUT	Input terminals connecting from the host controller, such as I/O power, and control signals. You can change the input logic. (*)
General-Purpose Output OUTPUT	An output terminal such as Servo Status that connects to the host controller. You can change the output logic. (*)
Encoder Output	A terminal to output encoder pulse to the host controller.

*) ☞ Page 23 Descriptions of C5 Connector Signals

A pinout diagram illustrates the pinout on the User I/O Connector soldering surface.
Do not connect anything to reserved pins.



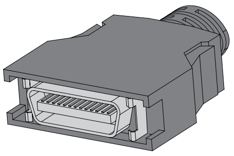
C5 Connector Wiring Example

Example of C5 Connector wiring.
For actual wiring, check the pin numbers etched on the connector body as well.
For further details, refer to Descriptions of C5 Connector Signals and Interface Circuit of C5 Connector.

☞ Page 23 Descriptions of C5 Connector Signals
☞ Page 29 I/F Circuit of C5 Connector

C5 User I/O Connector

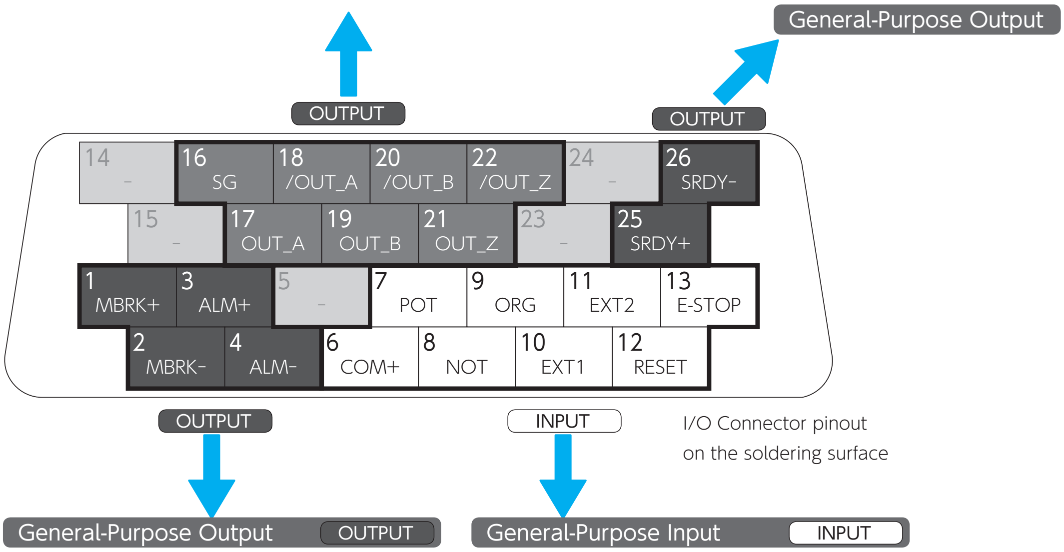
Pinout Diagram



Connector 10126-3000-PE (3M)
Cover 10326 (3M)
or Equivalent alternatives
Wires : AWG26

Encoder Output

Pin No.	Signal Description
16	**SG** Signal ground
17	**OUT_A** A-phase
18	**/OUT_A** /A-phase
19	**OUT_B** B-phase
20	**/OUT_B** /B-phase
21	**OUT_Z** Z-phase
22	**/OUT_Z** /Z-phase



I/O Connector pinout
on the soldering surface

General-Purpose Output OUTPUT

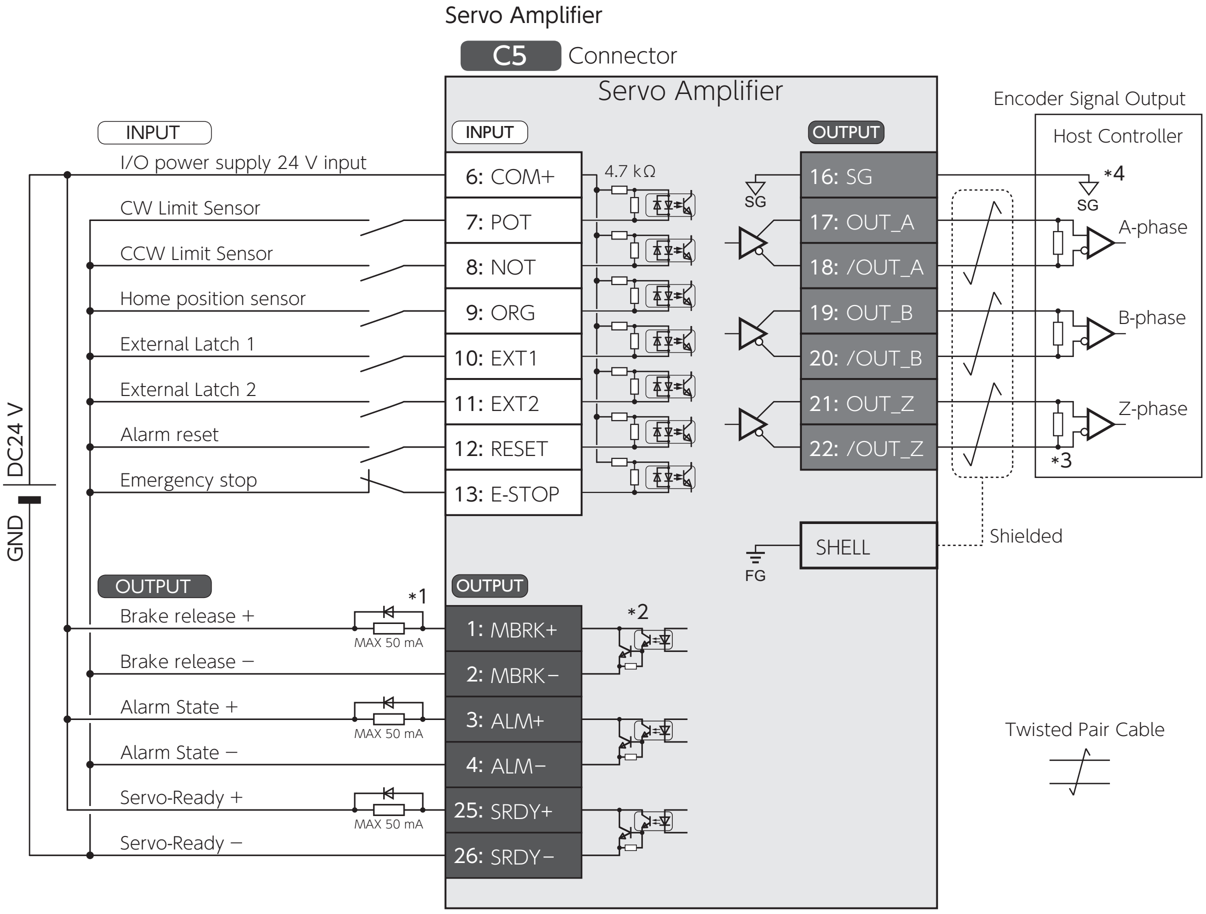
Pin No.	Signal Description
1	**MBRK+** Brake release +
2	**MBRK−** Brake release −
3	**ALM +** Alarm status +
4	**ALM−** Alarm status −
25	**SRDY +** Servo ready +
26	**SRDY−** Servo ready −

General-Purpose Input INPUT

Pin No.	Signal Description
6	**COM+** I/O Power 24 V
7	**POT** CW Limit Sensor
8	**NOT** CCW Limit Sensor
9	**ORG** Home position sensor
10	**EXT1** External Latch 1
11	**EXT2** External Latch 2
12	**RESET** Alarm reset
13	**E-STOP** Emergency stop

3. Wiring to Connectors and Signals

C5 Connector Wiring Example



*1) When driving a load containing inductance component such as relay, connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.

☞ P. 28 PO Connections to General-Purpose Output Signal

*2) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage V_{CE} (SAT) is approximately 1 V; a standard TTL IC does not satisfy V_{IL} and cannot be connected directly.

*3) Be sure to connect a termination resistor of approximately 220 Ω.

*4) Make the connection to the communication IC signal ground of the host controller that amplifier encoder output signals are connecting to.
Connecting signal ground SG to control power GND may result in malfunction.

3. Wiring to C1 and C2 connectors, or Terminal Blocks

DANGER

Be sure to follow the following precautions when wiring to the C1 and C2 connectors.

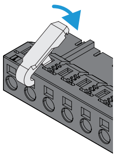
- Be sure to disconnect the connector from the amplifier before wiring.
- Insert one cable at each wire insertion point.
- When inserting the cable, be careful not to let the whiskers of the wires protrude from the wire insertion port, and do not touch other wires or electrodes.
- Connect the power to the amplifier after all wiring is completed.

STEP 1 Trimming the cable wrap.

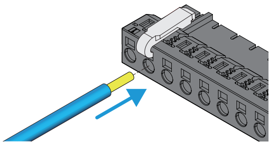
C1 and C2 connector: 50 W | 100 W | 200 W | 400 W | 750 W | 1 kW

STEP 2 Amplifiers of 1 kW and 750 W or less are wired to C1 and C2 connectors.
Remove the C1 and C2 connectors from the amplifier.

STEP 3 Attach the spring opener to the connector and press it down.



STEP 4 Insert the wires until they meet. Then release the spring opener to fix the wires.



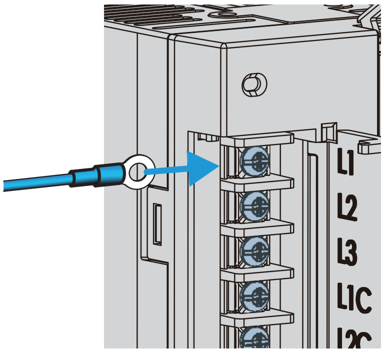
STEP 5 Connect the C1 and C2 connectors to the amplifier.

Terminal Blocks: 850 W | 1.3 kW | 1.5 kW | 2 kW

STEP 2 Amplifiers of 850 W and 1.3 kW or higher are screw terminals.
Connect the cable with round terminals.

Recommended Terminal:
2 -4 S Round Terminal with Insulation

STEP 3 Tighten the round terminals.
(tightening torque of 1.0 -1.2 N·m.)



4. Descriptions of C5 Connector Signals

Review the functions of each pin of C5 connector before using the product.

Pins marked with this icon enables you to change the input/output logic.

Pin number on C5

For the diagram, refer to this page

Pin No.	9	I/F Circuit	PI (P. 29)
Signal		Description	
INPUT **ORG** Home Sensor		OPEN Home sensor has not been detected. CLOSED Home sensor has been detected. ■ Related Parameters ·No.645.0 Enables you to select home-dog-front. ·No.646.1 Enables you to change the polarity of home sensor detection.	

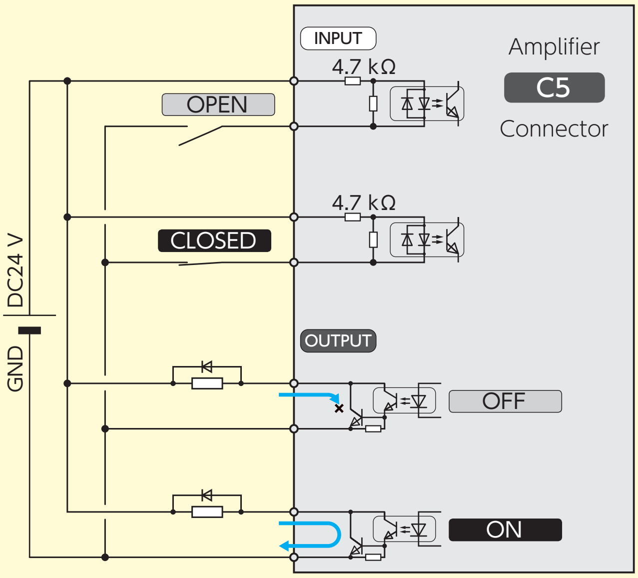
Indicates signal behaviors.

INPUT

- · OPEN : No contact with COM−
- · CLOSED : Contact with COM−

OUTPUT

- · OFF : Output transistor OFF
- · ON : Output transistor ON



3. Wiring to Connectors and Signals

General-Purpose Output

Pin No.	1, 2	I/F Circuit	PO (P. 30)
Signal		Description	
OUTPUT **MBRK+** (Pin No.1) **MBRK−** (Pin No.2) Brake Release		OFF Does not release the brake. ON Releases the brake. ■ TIP The motor brake cannot be driven directly. To drive the motor brake, be sure to use a relay. Place a surge absorber to suppress surge voltage caused by relay's on/off. Note that, if you use a diode instead of a surge absorber, the time between brake release and brake clamp is longer.	

Pin No.	3, 4	I/F Circuit	PO (P. 30)
Signal		Description	
OUTPUT **ALM+** (Pin No.21) **ALM−** (Pin No.22) Alarm		OFF In one of the following conditions An alarm is occurring. Control power is not supplied to the amplifier. ON The following conditions are met at the same time. No alarm is occurring. Control power is supplied to the amplifier. ■ TIP The emitter side of the output transistor is independent of COM−. Cascade connection to multiple amplifiers is possible. ☞ **Z- 1 Troubleshooting** Alarms and Remedies	

3. Wiring to Connectors and Signals

Pin No.	25, 26	I/F Circuit	PO (P. 30)
Signal		Description	
P⇄N OUTPUT **SRDY+** (Pin No.25) **SRDY−** (Pin No.26) Servo ready		OFF In one of the following conditions An alarm is occurring. The primary circuit power is not supplied to the amplifier. ON The following conditions are met at the same time. No alarm is occurring. The primary circuit power is supplied to the amplifier. ■ TIP The emitter side of the output transistor is independent of COM−. Cascade connection to multiple amplifiers is possible.	

General-Purpose Input

Pin No.	6	I/F Circuit	PS (P. 29)
Signal		Description	
COM+ I/O power supply 24 V input		A common power supply for optical isolators of general-purpose input circuit. Power voltage: DC24 V ± 10% Use SELV power supply with reinforced insulation that is isolated from hazardous voltages.	

Pin No.	7	I/F Circuit	PI (P. 29)
Signal		Description	
P⇄N INPUT **POT** CW Limit Sensor		OPEN CW Limit Sensor signal input is **not** detected. CLOSED CW Limit Sensor signal input is detected.	

Pin No.	8	I/F Circuit	PI (P. 29)
Signal		Description	
P⇄N INPUT **NOT** CCW Limit Sensor		OPEN CCW Limit Sensor signal input is **not** detected. CLOSED CCW Limit Sensor signal input is detected.	

Pin No.	9	I/F Circuit	PI (P. 29)
Signal		Description	
P⇄N INPUT **ORG** Home Sensor		OPEN Home sensor has not been detected. CLOSED Home sensor has been detected. ■ Related Parameters ・No.645.0 Enables you to select home-dog-front. ・No.646.1 Enables you to change the polarity of home sensor detection.	

Pin No. 10, 11	I/F Circuit PI (P. 29)
Signal	Description
INPUT **EXT1** External Latch 1 **EXT2** External Latch 2	OPEN Position feedback data is **not** latched. CLOSED Position feedback data is latched by the timing to which a signal was input.

Pin No. 12	I/F Circuit PI (P. 29)
Signal	Description
INPUT **RESET** Alarm Reset	CLOSED Resets an alarm. ■ TIP •Be sure to turn off this signal after alarm reset execution. •Encoder-, product code-, and system- alarms are not reset by this signal. •You must cycle control power of the amplifier. ☞ **Z- 1 Troubleshooting** Alarms and Remedies

Pin No. 13	I/F Circuit PI (P. 29)
Signal	Description
INPUT **E-STOP** Emergency Stop	OPEN The motor makes an emergency stop. Deceleration stop starts upon Servo OFF and the motor stops its motion. No alarm occurs. A warning is output by parameter setting. ☞ **Z- 2 Technical Information** Functions

3. Wiring to Connectors and Signals

Encoder Output

Pin No.	16–22	I/F Circuit	EO (P. 31)

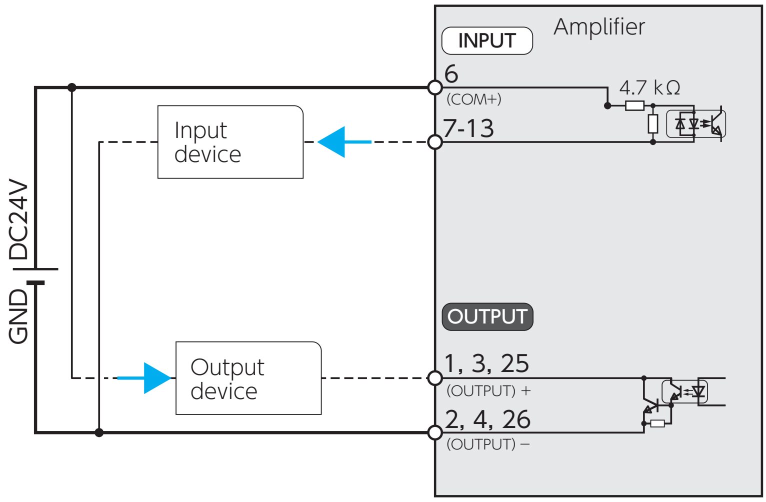
Signal	Description
OUT_A (Pin No.17) **/OUT_A** (Pin No.18) A-phase output **OUT_B** (Pin No.19) **/OUT_B** (Pin No.20) B-phase output **OUT_Z** (Pin No.21) **/OUT_Z** (Pin No.22) Z-phase output **SG** (Pin No.16) Signal ground	**OUT_A, /OUT_A:** **OUT_B, /OUT_B:** **OUT_Z, /OUT_Z:** Differential output of encoder signal divided and multiplied (equivalent to RS-422) **SG:** Signal ground of the communication IC in the output circuit. This signal is connected to signal ground inside the amplifier. It is isolated from control power (G24 V, COM−). Make the connection to signal ground of the communication IC of the host controller.

3. Wiring to Connectors and Signals

5. C5 I/F Circuit

PS Connection to DC24V Power Supply

Connect I/O power supply.



PI Connections to General-Purpose Input Signal

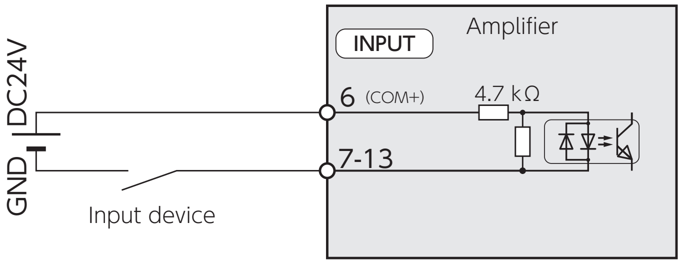
Pin No.6

Connect to I/O power supply. Use power supply of 24 V ± 10%.

Pin No.7 to No.13

Connect to input devices such as switch, open-collector output transistor, and relay contact.

When the input device contact is closed and the contact pair of general-purpose pin and power supply GND becomes closed, the amplifier turns on.



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3. Wiring to Connectors and Signals

PO Connections to General-Purpose Output Signal

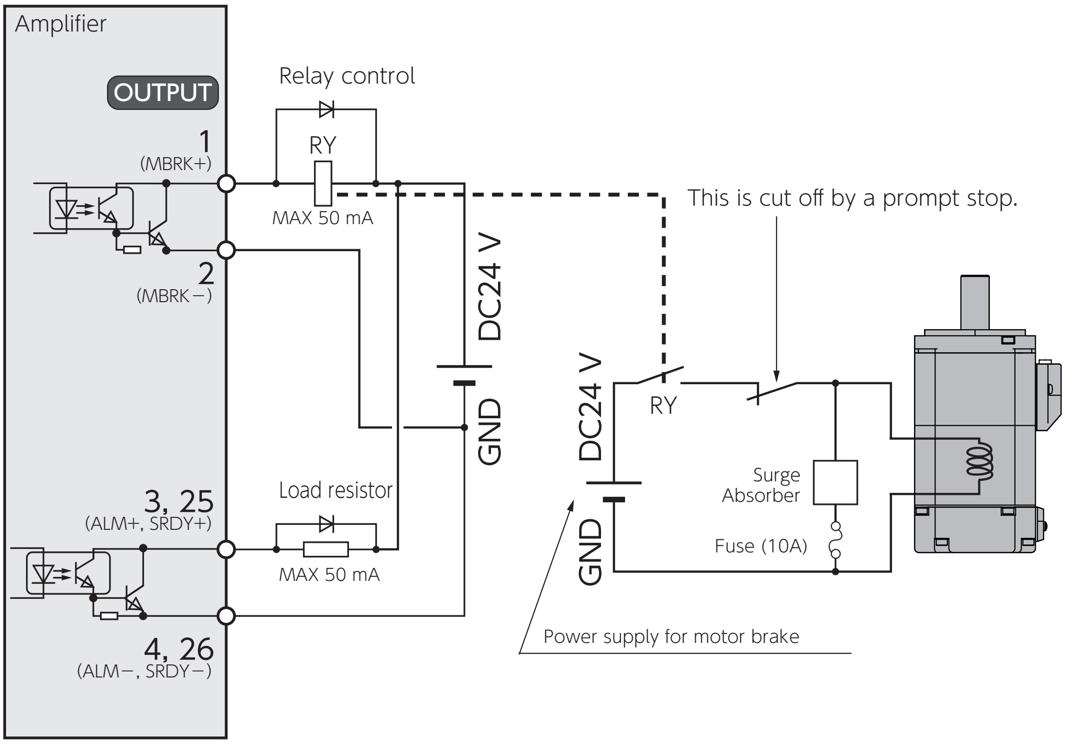
The motor brake cannot be driven directly. To drive the motor brake, be sure to use a relay.

When driving a load containing inductance component such as relay, connect a protection circuit (diode). Install a diode in the direction shown in the figure below.

The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators. When the transistor is on, connector-emitter voltage V_{CE} (SAT) is approximately 1 V; a standard TTL IC does not satisfy V_{IL}, and cannot be directly connected.

The maximum rating of output circuit is 30 V 50 mA.

The emitter side of the output transistor is independent.

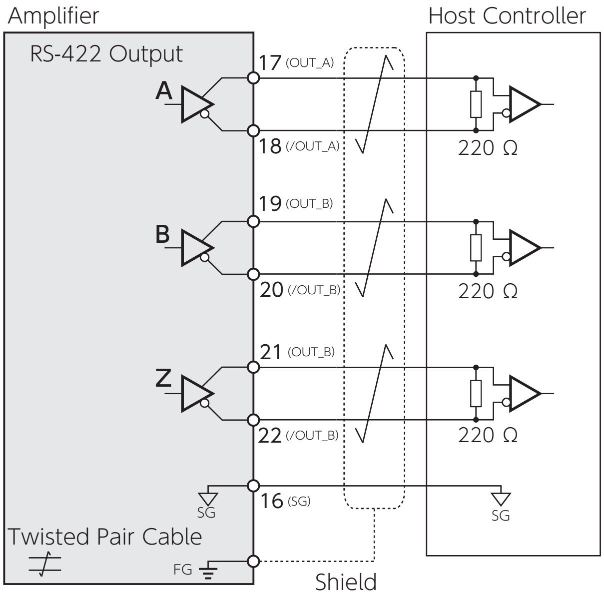


EO Connection to Encoder Output Circuit

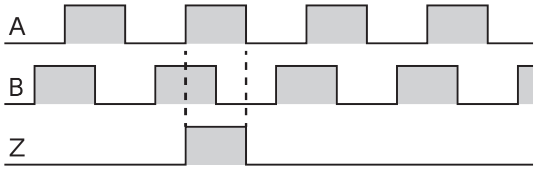
Differential output of encoder signal (A-phase, B-phase, Z-phase) which has been processed with pulse division ratio.

Be sure to connect a termination resistor to the receiver circuit of the host controller.
Approximately 220 Ω (1/4 W or more)
Signal ground of the communication IC in the output circuit is connected to signal ground inside the amplifier.
Connect signal ground of communications IC of the host controller to Pin No.16.

Be sure to use shielded twisted-pair cable as a noise countermeasure.



Encoder Z-phase is synchronized with A-phase and output.



4. Cables

Recommended cable wires

Connection cables required for this product are sold separately. Those can be purchased at the MISUMI online store.
Use our recommendations below to select cables based on your actual usage. (Equivalent alternatives are also good)
Should you use a cable longer than the specification, please contact us in advance.

Cable Name	AWG	UL	Temperature Rating	Voltage Rating	Note
Motor power (≦ 750 W)	18	2517	105°C	300 V	
Motor power (≧ 850 W)	14	2517	105°C	300 V	AWG16 wires can be used only for 1 kW motors
Main circuit power (Including FG cable)	14	1015	105°C	600 V	AWG16 wires can be used only for 1 kW motors.
Encoder	Power：22 Signal：24	20276	80°C	30 V	Shielded twisted pair cables of length no exceeding 20 m
User I/O	26	1007	80°C	300 V	Shielded twisted pair cables of length no exceeding 2 m
Regenerative resistor	18	1015	105°C	600 V	
Brake	18	2517	105°C	300 V	1 pair (2 cores)

Cable Name	Specification	Note
EtherCAT communication	CAT5e	Shielded cable is recommended

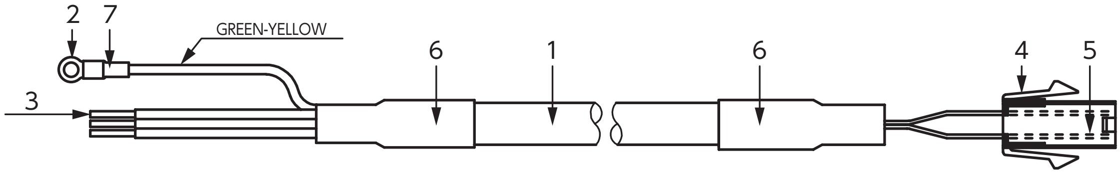
Motor Power Cable

Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | 1 kW | 1.3 kW | 1.5 kW | 2 kW

MX951

4 HOUSING

Pin No.	Signal	Color
1	U	RED
2	V	WHITE
3	W	BLUE
4	FG	GREEN - YELLOW



No.	Item	Model	Supplier
1	CABLE	NA3CT-18-4 (for fixed wiring) NA3CTR-18-4 (for movable wiring)	MISUMI Group Ink
2	RING TONGUE TERMINAL	R2-4	J.S.T. Mfg. Co., Ltd.
3	FERRULE	216-143	WAGO JAPAN
4	HOUSING	172159-1	Tyco Electronics JAPAN
5	TERMINAL	170366-1	Tyco Electronics JAPAN
6	SUMITUBE	F(Z) 11x0.25	Sumitomo Electric Industries
7	(MARKER TUBE)	(arbitrary)	(arbitrary)

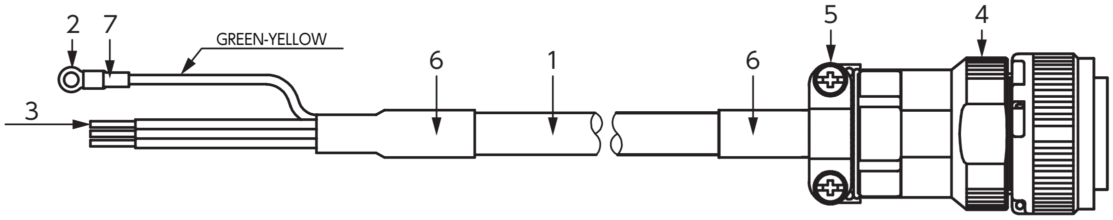
Motor Power Cable

Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | 1 kW | 1.3 kW | 1.5 kW | 2 kW

MX102
MM102
MH102

4 PLUG

Pin No.	Signal	Color
1	U	RED
2	V	WHITE
3	W	BLUE
4	FG	GREEN - YELLOW



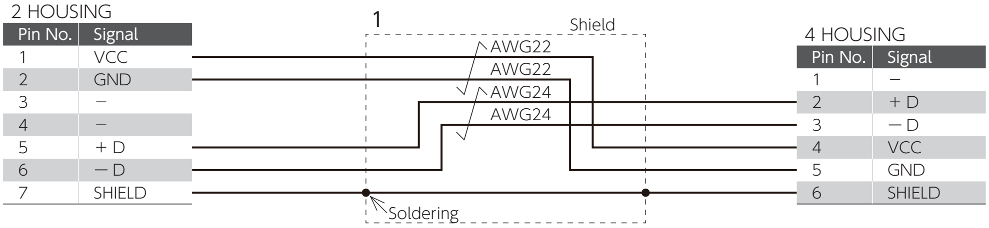
No.	Item	Model	Supplier
1	CABLE	NA6CT-14-4 (for fixed wiring) NA6CTR-14-4 (for movable wiring)	MISUMI Group Ink
2	RING TONGUE TERMINAL	R2-4	J.S.T. Mfg. Co., Ltd.
3	FERRULE	216-106	WAGO JAPAN
4	PLUG	JL04V-6A18-10SE-EB-R	JAE
5	CABLE CLAMP	JL04V-18CK13-CR-R	JAE
6	SUMITUBE	F(Z) 14x0.3	Sumitomo Electric Industries
7	(MARKER TUBE)	(arbitrary)	(arbitrary)

Encoder Cable

Motor rated output power: ~~50 W~~ ~~100 W~~ ~~200 W~~ ~~400 W~~ ~~750 W~~ ~~850 W~~ **1 kW** ~~1.3 kW~~ ~~1.5 kW~~ ~~2 kW~~

MX951

(Incremental)

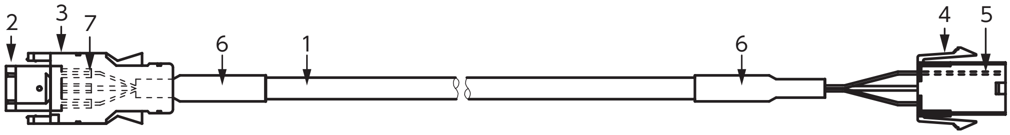


2 HOUSING

Pin No.	Signal
1	VCC
2	GND
3	–
4	–
5	+ D
6	– D
7	SHIELD

4 HOUSING

Pin No.	Signal
1	–
2	+ D
3	– D
4	VCC
5	GND
6	SHIELD



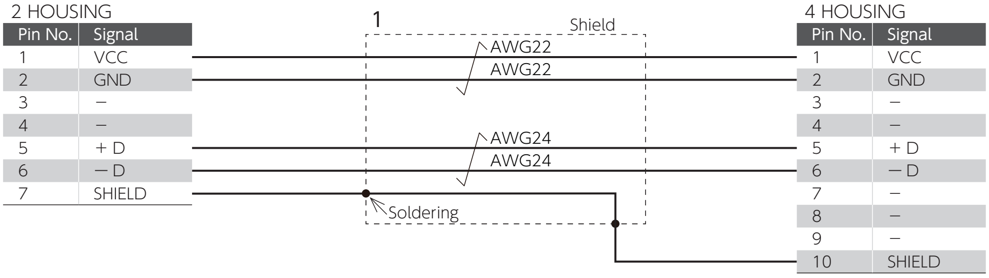
No.	Item	Model	Supplier
1	CABLE	NA20276TSB-C (for fixed wiring) NA20276RRSB-C (for movable wiring)	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	172160-1	Tyco Electronics JAPAN
5	TERMINAL	170365-1	Tyco Electronics JAPAN
6	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
7	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries

Encoder Cable

Motor rated output power: ~~50 W~~ ~~100 W~~ ~~200 W~~ ~~400 W~~ ~~750 W~~ **850 W** **1 kW** **1.3 kW** **1.5 kW** **2 kW**

MX102
MM102
MH102

(Incremental)

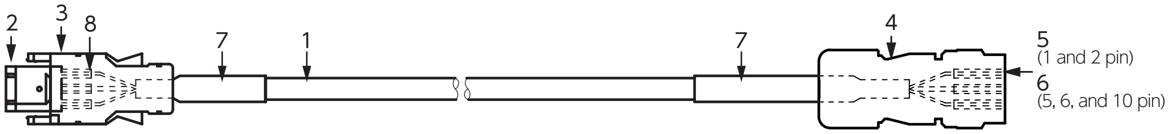


2 HOUSING

Pin No.	Signal
1	VCC
2	GND
3	–
4	–
5	+ D
6	– D
7	SHIELD

4 HOUSING

Pin No.	Signal
1	VCC
2	GND
3	–
4	–
5	+ D
6	– D
7	–
8	–
9	–
10	SHIELD



No.	Item	Model	Supplier
1	CABLE	NA20276TSB-C (for fixed wiring) NA20276RRSB-C (for movable wiring)	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	CM10-SP10S-M	DDK
5	TERMINAL	CM10-#22SC(C1)(D8)	DDK
6	TERMINAL	CM10-#22SC(C2)(D8)	DDK
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries

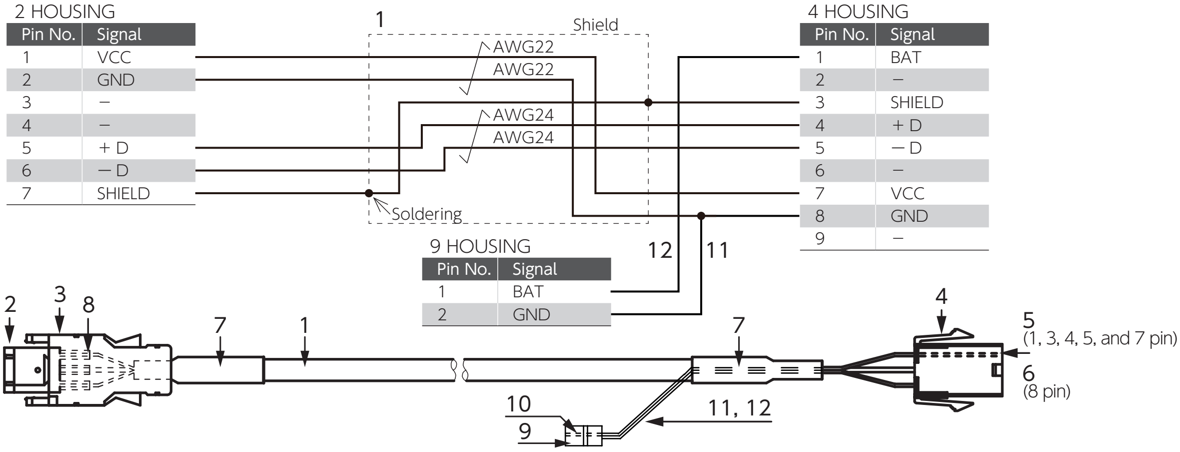
4. Cables

Encoder Cable

(Absolute)

Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | 1 kW | 1.3 kW | 1.5 kW | 2 kW

MX951



2 HOUSING

Pin No.	Signal
1	VCC
2	GND
3	–
4	–
5	+ D
6	– D
7	SHIELD

4 HOUSING

Pin No.	Signal
1	BAT
2	–
3	SHIELD
4	+ D
5	– D
6	–
7	VCC
8	GND
9	–

9 HOUSING

Pin No.	Signal
1	BAT
2	GND

No.	Item	Model	Supplier
1	CABLE	NA20276TSB-C (for fixed wiring) NA20276RRSB-C (for movable wiring)	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	172161-1	Tyco Electronics JAPAN
5	TERMINAL	170365-1	Tyco Electronics JAPAN
6	TERMINAL	170366-1	Tyco Electronics JAPAN
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries
9	HOUSING	DF3-2EP-2C	Hirose Electric
10	TERMINAL	DF3-EP2428PCFA	Hirose Electric
11	CABLE	NAUL1007-24-BK	MISUMI Group Ink
12	CABLE	NAUL1007-24-R	MISUMI Group Ink

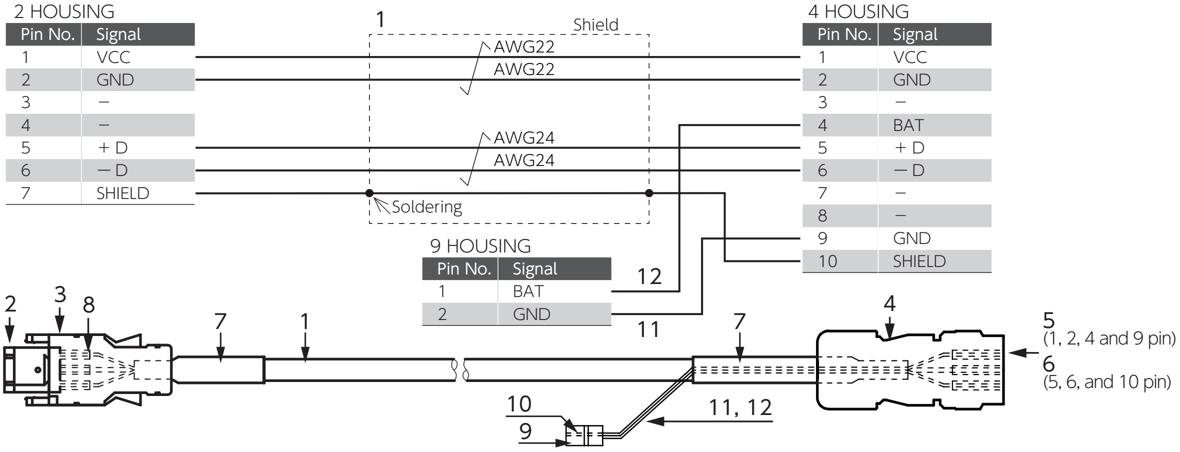
4. Cables

Encoder Cable

Motor rated output power: 50 W, 100 W, 200 W, 400 W, 750 W, **850 W**, **1 kW**, **1.3 kW**, **1.5 kW**, **2 kW**

(Absolute)

MX102
MM102
MH102



2 HOUSING

Pin No.	Signal
1	VCC
2	GND
3	−
4	−
5	+ D
6	− D
7	SHIELD

4 HOUSING

Pin No.	Signal
1	VCC
2	GND
3	−
4	BAT
5	+ D
6	− D
7	−
8	−
9	GND
10	SHIELD

9 HOUSING

Pin No.	Signal
1	BAT
2	GND

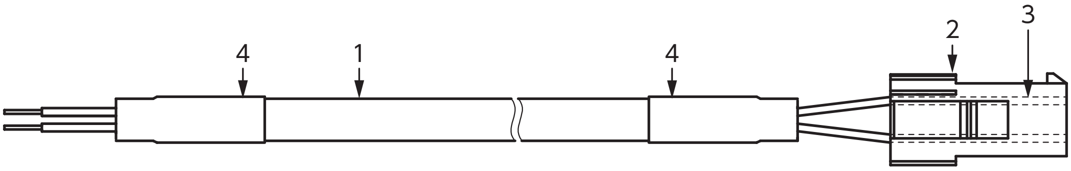
No.	Item	Model	Supplier
1	CABLE	NA20276TSB-C (for fixed wiring) NA20276RRSB-C (for movable wiring)	MISUMI Group Ink
2	HOUSING	3E206-0100KV	3M
3	COVER	3E306-3200-008	3M
4	HOUSING	CM10-SP10S-M	DDK
5	TERMINAL	CM10-#22SC(C1)(D8)	DDK
6	TERMINAL	CM10-#22SC(C2)(D8)	DDK
7	SUMITUBE	F(Z) 7x0.25	Sumitomo Electric Industries
8	SUMITUBE	F(Z) 3/64 or 1.5x0.2	Sumitomo Electric Industries
9	HOUSING	DF3-2EP-2C	Hirose Electric
10	TERMINAL	DF3-EP2428PCFA	Hirose Electric
11	CABLE	NAUL1007-24-BK	MISUMI Group Ink
12	CABLE	NAUL1007-24-R	MISUMI Group Ink

Brake Cable

Motor rated output power	50 W	100 W	200 W	400 W	750 W	850 W	1 kW	1.3 kW	1.5 kW	2 kW
							MX951			

2 HOUSING

Pin No.	Signal	Color
1	BRK +	BRACK
2	BRK −	BRACK



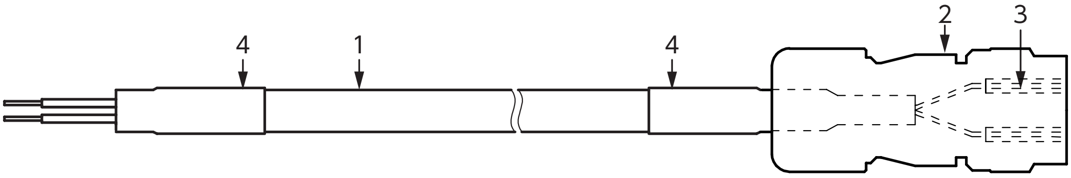
No.	Item	Model	Supplier
1	CABLE	MAST-UL2517-19-2 (for fixed wiring) NA3UCR-18-2 (for movable wiring)	MISUMI Group Ink
2	HOUSING	172157-1	Tyco Electronics JAPAN
3	TERMINAL	170366-1 or 170639-1	Tyco Electronics JAPAN
4	SUMITUBE	F(Z) 8x0.25	Sumitomo Electric Industries

Brake Cable

Motor rated output power	50 W	100 W	200 W	400 W	750 W	850 W	1 kW	1.3 kW	1.5 kW	2 kW
							MX102 MM102 MH102			

2 PLUG

Pin No.	Signal	Color
1	BRK +	BRACK
2	BRK −	BRACK



No.	Item	Model	Supplier
1	CABLE	MAST-UL2517-19-2 (for fixed wiring) NA3UCR-18-2 (for movable wiring)	MISUMI Group Ink
2	PLUG	CM10-SP2S-M-D	DDK
3	CONTACT	CM10-#22SC(S2)(D8)-100	DDK
4	SUMITUBE	F(Z) 8x0.25	Sumitomo Electric Industries

MEMO

S-FLAG Ⅱ　Instruction Manual
- EtherCAT -

C

PARAMETER

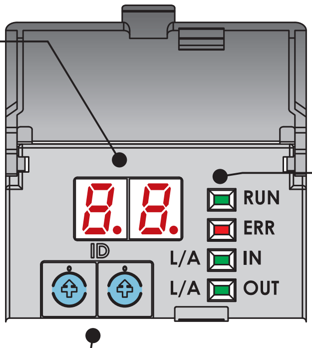
AMO-NP-35475-41
SF2-E-C
DEC. 2019

MEMO

1

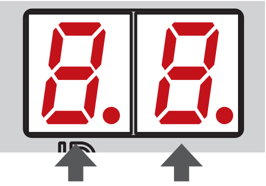
Setup Panel

1. Names of Parts



7-segment display

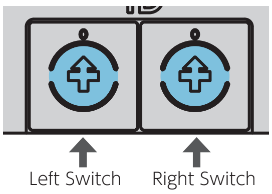
2-digit
EtherCAT node address
Status (Alarm and Warning)
Servo status



Rotary Switch

Setting the EtherCAT node address

Left Switch: Setting the 10th place of node address
Right Switch: Setting the 1st place of node address



Set the node address before turning on the power.

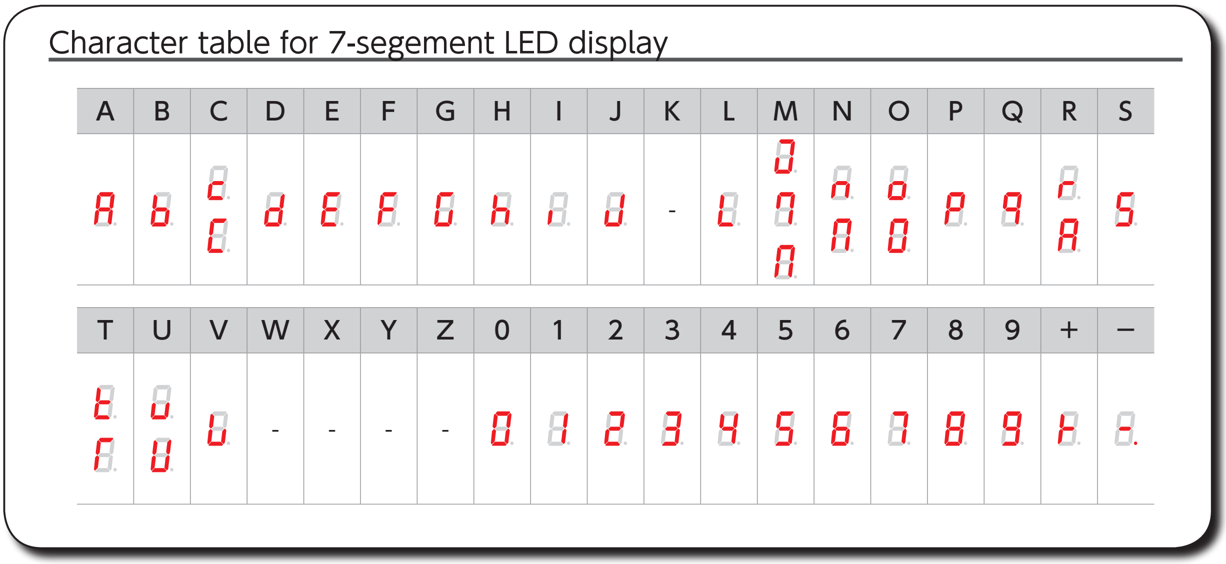
EtherCAT Status Indicator LED

RUN (Green)
This shows an operational status of a servo amplifier.

ERR(Red)
It lights up when an error occurs.

L/A IN (Green) Link/Activity IN
This shows the EtherCAT communication state.

L/A OUT (Green) Link/Activity OUT
This shows the EtherCAT communication state.



Character table for 7-segement LED display

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
										-								

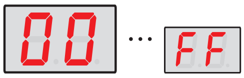
T	U	V	W	X	Y	Z	0	1	2	3	4	5	6	7	8	9	+	–
			-	-	-	-												

2. Functions — 7-segment display

When the control power supply is turned on, the following items are displayed on the 7-segment display.

Turn on the control power

EtherCAT Communication node address



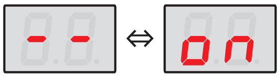
2 seconds later

Displays the node address of the EtherCAT communication.

Displays for approximately 2 seconds.

If an alarm occurs when the amplifier is started, the node address is not displayed.

Servo Status

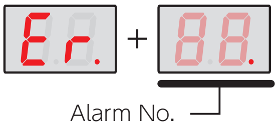


Indicates the servo status of the amplifier.

It is not displayed when an alarm occurs.

- - Servo **OFF**   on Servo **ON**

Alarm Status

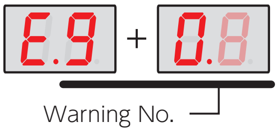


Displays the alarm number that has occurred.

The alarms are from No. 00 to No. 35.

☞ Z- 1 Troubleshooting

Warning Status



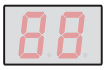
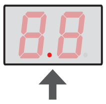
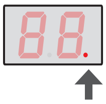
Displays the warning number that has occurred.

The warnings are from No. 900 to No. 904.

☞ Z- 1 Troubleshooting

How to distinguish by lighting a period

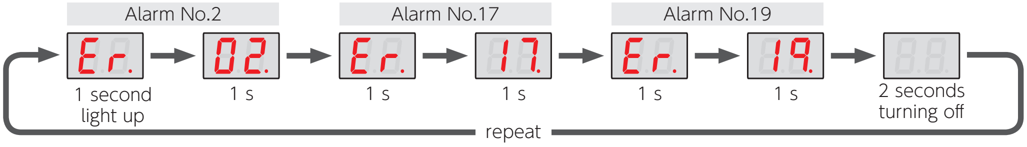
You can identify the status displayed by the lighted position of the period segment.

Node address	Warning	Alarm
 No period LED lights up	 The left side period LED lights up.	 The right side period LED lights up.

How to display multiple alarms and/or warnings

When multiple alarms (and /or warnings) are generated, the alarm is displayed at one-second intervals.
When all alarms are displayed, the lamp goes off for 2 seconds and the alarm is displayed repeatedly.

Example) When alarm No. 2, No. 17 or No. 19 is happening



MEMO

2

Parameters

1. Introduction

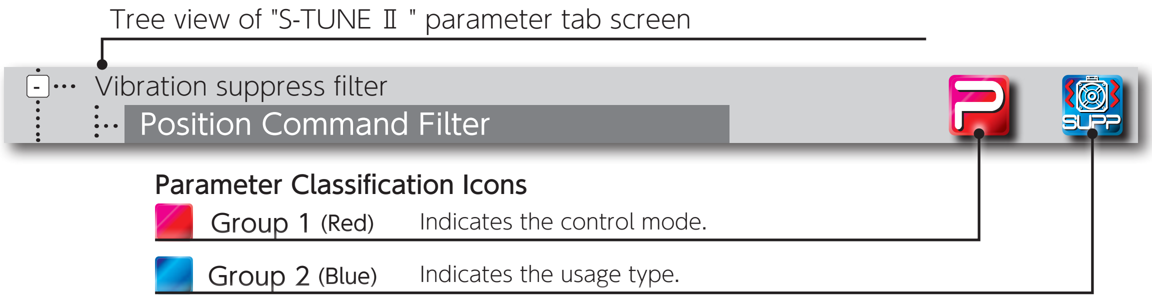
Remark

Some of the tuning parameters are dependent on the settings of other parameters, which makes the values of dependent parameters invalid even if they are within the specification range.

Control Mode	Name	No.
Position Control Mode	Control gain 1	115.0
	Control gain 2	116.0
	Gain FF compensation 1	117.0
	Gain FF compensation 2	118.0
	Integral gain	119.0
Velocity Control Mode	Control gain 1	131.0
	Gain FF Compensation 1	132.0
	Integral gain	133.0

Overview of the parameter list

Title Header

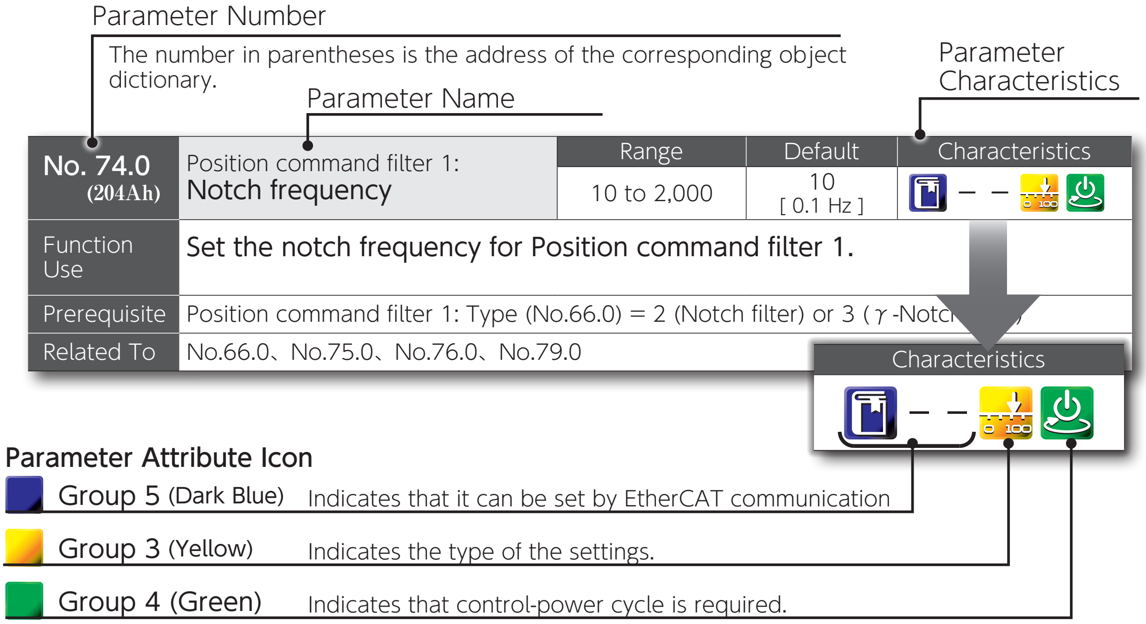


Parameter Classification Icons

🟥 Group 1 (Red) Indicates the control mode.

🟦 Group 2 (Blue) Indicates the usage type.

Parameter Description



Parameter Number: The number in parentheses is the address of the corresponding object dictionary.

No. 74.0 (204Ah)	Position command filter 1: Notch frequency	Range	Default	Characteristics
		10 to 2,000	10 [0.1 Hz]	
Function Use	Set the notch frequency for Position command filter 1.			
Prerequisite	Position command filter 1: Type (No.66.0) = 2 (Notch filter) or 3 (γ -Notc			
Related To	No.66.0、No.75.0、No.76.0、No.79.0			

Parameter Attribute Icon

🟦 Group 5 (Dark Blue) Indicates that it can be set by EtherCAT communication

🟨 Group 3 (Yellow) Indicates the type of the settings.

🟩 Group 4 (Green) Indicates that control-power cycle is required.

Characteristics of Parameters

The parameters are categorized into five groups according to their functions, uses, and features. The following icons are used to represent their characteristics.

Group	Icon	Meaning
1 (Red)	Basic	Used for all Control Modes
	Position Control Mode	Used for Position Control Mode
	Velocity Control Mode	Used for Velocity Control Mode
	Torque Control Mode	Used for Torque Control Mode
2 (Blue)	Operation Control	Used for setting the operation method.
	Stop Setting	Used for configuring Stop processes in case of emergency or drive restriction
	Tuning	Gain parameters that require Tuning
	Homing	Used for positioning operation in Position Control Mode
	Alarm Detection	Used for configuring Alarm Detection and Timing of Alarm Detection
	Position Control Internal Command	Used for Internal Position Command in Position Control Mode
	Vibration Control	Parameters related to Vibration Control
3 (Yellow)	Switch	Parameters to enable or disable functions
	Selection	Used for selecting conditions from multiple items based on your operational purposes
	Numeric Value	Numeric values are set for these parameters, for example, pulse paired ratio or filter setup parameters.
4 (Green)	Control Power Cycle	Those parameters need power cycling for their setting changes to take effect.
5 (Dark Blue)	EtherCAT Communication	These parameters allow access to the amplifier via EtherCAT communication.
	Object Dictionary	These parameters are related to the EtherCAT communication object dictionary.
	Hide	These parameters are hidden by S-TUNE Ⅱ during EtherCAT communication.
	Read Only	These parameters cannot be written from S-TUNE Ⅱ to the amplifier during EtherCAT communication.

2. List of Parameters

1. In the order of S-TUNE Ⅱ display

Basic Parameters

Name				EtherCAT		No.
Basic Settings	Control mode					2.0
	Command mode				🔒	3.0
	Torque command limit	Switch			🔒	144.0
		Torque limit output			🔒	144.1
		Value 1			🔒	147.0
	Torque command offset			2092h		146.0
	Servo OFF: Delay time			20EDh		237.0
	Brake release: Delay time			20EEh		238.0
	Absolute system			2101h		257.0
	Wraparound	Minimum value		21CAh		458.0
☞ P.13-		Maximum value		21CCh		460.0
Stop Settings	Drive Restriction Input	Setup		2043h		67.0
		Deceleration method		2043h		67.1
		Idling status		2043h		67.2
		Retaining position deviation counter		2043h		67.3
	Deceleration Stop	Torque command limit				151.0
		Upon Servo Off	Method	20E0h		224.0
			DBRK output after stopping	20E0h		224.3
		When alarm is on	Method	20E9h		233.0
			DBRK output after stopping	20E9h		233.3
		Release conditions		20E0h		224.1
		Operating time		20E2h		226.0
		Cancellation speed		20E3h		227.0
		Upon control power failure	Switch	20E0h		224.2
			Operating time	20E4h		228.0
		Status during free-run		20E8h		232.1
		Brake engagement	Timing	20E8h		232.3
			Delay time	20EAh		234.0
			Rotational speed	20EBh		235.0
	Quick Stop	Smoothing filter	Switch	20E1h		225.2
			Moving average counter	20E5h		229.0
		Short brake operation after a stop		20E8h		232.2
		Extension Time		20ECh		236.0
		Deceleration time		20EFh		239.0
	Emergency Stop (*)	Warning output	Switch	20E1h		225.0
☞ P.17-			Timing	20E1h		225.1

*) This parameter is described in "Error detection setting".

2. List of Parameters

In the order of S-TUNE Ⅱ display

Basic Parameters

Name				EtherCAT		No.
Error detection settings	Warning latch time			200Ch		12.0
	Alarm output timing			200Dh		13.0
	Position deviation Error detection	Switch		2041h		65.0
		Value		6065h	🔒	87.0
		Delay time				89.0
	Position deviation Warning detection	Value		216Bh		363.0
		Delay time		206Dh		365.0
	Speed deviation Error detection	Switch		2041h		65.1
		Value		205Ah		90.0
		Delay time		205Bh		91.0
	Emergency stop	Warning output	Switch	20E1h		225.0
			Timing	20E1h		225.1
	Encoder	Overheat detection	Switch	2103h		259.0
			Value	210Bh		267.0
		Battery Voltage drop detection	Switch	2103h		259.1
			Value	210Ch		268.0
		Motor rotating position at encoder error	Holding method	2178h		376.0
			Holding time	2179h		377.0
	Voltage Sag Detection Delay time			2131h		305.0
	EtherCAT communication setting			21DAh		474.0
☞ P.26-	Internal position - Overflow detection					643.0

This list may be different from the order in which S-TUNEII displays it.

2. List of Parameters

In the order of S-TUNE Ⅱ display

Position Control Mode

Name				EtherCAT	No.
Position command input	EtherCAT communication	Pulse ratio	Interpolation	2020h	32.2
			Numerator	6091-01h	34.0
			Denominator	6092-02h	36.0
☞ P.31-		Feed forward delay compensation		2042h	66.3
Tuning Parameters Settings	Tuning	Inertia ratio		2066h	102.0
		Damping ratio		2067h	103.0
		Inertia ratio upper bound		206Ah	106.0
		Mode switch		206Eh	110.0
		Tuning items		206Eh	110.1
		Control gain set	Automatic switch	2078h	120.0
			Upper bound	2078h	120.1
			Tuning constant	2079h	121.0
	Gain parameter	Control gain set		2071h	113.0
		Inertia conditions		2071h	113.1
		Control level		2072h	114.0
		Control gain 1		2073h	115.0
		Control gain 2		2074h	116.0
		Gain FF compensation 1		2075h	117.0
		Gain FF compensation 2		2076h	118.0
		Integral gain		2077h	119.0
☞ P.33-	Current control gain			20C1h	193.0
Homing	Home reference signal selection			🚫	645.0
	Encoder Z-phase selection			🚫	645.1
	Re-detection of home position dog			🚫	645.3
	Direction			🚫	646.0
	Sensor dog polarity			🚫	646.1
	Timeout	Switch		🚫	646.2
		Time		🚫	659.0
	Torque command limit	Switch		🚫	647.0
		Value		🚫	656.0
	Time to detect press stopper			🚫	655.0
	Creep speed switch			🚫	647.1
	Rapid speed			🚫	648.0
	Creep speed			🚫	649.0
	Acceleration/Deceleration time			🚫	650.0
	Amount of home position shift			🚫	651.0
	Home position data			🚫	653.0
☞ P.39-	Z-phase disabled distance			🚫	657.0

The point table parameters for internal position control are not displayed on the parameter tab screen of S-TUNEⅡ. These parameters are displayed in the Point Table tabbed screen. See page 44 and later for detailed descriptions of the parameters.

In the order of S-TUNE Ⅱ display

Velocity Control Mode

Name			EtherCAT		No.
Velocity Command Input ☞ P.51-	EtherCAT communication	Rotational direction	203Eh		62.0
Tuning Parameters Settings	Tuning Parameter (*)	Inertia ratio	2066h		102.0
		Damping ratio	2067h		103.0
		Inertia ratio upper bound	206Ah		106.0
		Mode switch	206Eh		110.0
		Items	206Eh		110.1
	Gain Parameter	Control gain set	2081h		129.0
		Control level	2082h		130.0
		Control gain 1	2083h		131.0
		Gain FF compensation 1	2084h		132.0
		Integral gain	2085h		133.0
☞ P.52-	Current control gain		20C1h		193.0

*) These parameters are common to the position control mode. For details of each parameter, refer to the corresponding page of the position control mode.

Torque Control Mode

Name			EtherCAT		No.
Torque Command Input ☞ P.54-	EtherCAT communication	Direction of rotation	212Eh		302.0
		Speed Limit	6080h	🔒	152.0

2. List of Parameters

In the order of S-TUNE Ⅱ display

Vibration Suppress Filter

P V T

Name			EtherCAT	No.
Position Command Filter (*) SUPP ☞ P.55-	Filter 1	Selection	2042h	66.0
		Smoothing 1 Moving average counter	2050h	80.0
		Notch frequency	204Ah	74.0
		Notch width	204Bh	75.0
		High frequency gain	204Ch	76.0
		Notch depth	204Fh	79.0
	Filter 2	Selection	2052h	82.0
		Notch frequency	2053h	83.0
		Notch width	2054h	84.0
		High frequency gain	2055h	85.0
		Notch depth	2056h	86.0
	Filter 3	Selection	2052h	82.1
		Notch frequency	2165h	357.0
		Notch width	2166h	358.0
		High frequency gain	2167h	359.0
		Notch depth	2168h	360.0
	Filter 4	Selection	2042h	66.1
		Smoothing 2 Moving average counter	2051h	81.0
Torque Command Filter SUPP ☞ P.61-	Low-pass filter	Switch	20A0h	160.0
		Auto setting	20A0h	160.2
		Time constant	20A2h	162.0
	Notch filter	Switch	20A0h	160.1
		Frequency	20A8h	168.0
		Width	20A9h	169.0
		Depth	20AAh	170.0
	Notch filter 2	Switch	20A0h	160.3
		Frequency	20ABh	171.0
		Width	20ACh	172.0
		Depth	20ADh	173.0

*) The position command filter is used only in the position control mode.

2. List of Parameters

2. In the order of parameter No.

No.	Name	EtherCAT		☞
2.0	Control mode			P. 13
3.0	Command mode		🔒	P. 13
12.0	Warning latch time	200Ch		P. 26
13.0	Timing for alarm output	200Dh		P. 26
32.2	EtherCAT Communication - Auto interpolations for paired ratio	2020h		P. 31
34.0	EtherCAT Communication - Paired ratio (Numerator)	6091h		P. 32
36.0	EtherCAT Communication - Paired ratio (Denominator)	6091h		P. 32
62.0	EtherCAT Communication Velocity command - Rotational direction	203Eh		P. 51
65.0	Position deviation excess detection - Switch	2041h		P. 27
65.1	Speed deviation error detection - Switch	2041h		P. 27
66.0	Position command filter 1 - Type	2042h		P. 55
66.1	Position command filter 4 - Selection	2042h		P. 55
66.3	EtherCAT Communication - Feedforward delay compensation	2042h		P. 32
67.0	Drive restriction input - Setup	2043h		P. 17
67.1	Drive restriction input - Deceleration method	2043h		P. 17
67.2	Drive restriction input - Standstill sate	2043h		P. 17
67.3	Drive restriction input - Keep position deviation counter	2043h		P. 17
74.0	Position command filter 1 - Notch Frequency	204Ah		P. 56
75.0	Position command filter 1 - Width	204Bh		P. 56
76.0	Position command filter 1 - High frequency gain constant	204Ch		P. 56
79.0	Position command filter 1 - Depth	204Fh		P. 56
80.0	Position command smoothing filter 1 Moving average order	2050h		P. 57
81.0	Position command filter 4 - smoothing 2 moving average order	2051h		P. 57
82.0	Position command filter 2 - Type	2052h		P. 58
82.1	Position command filter 3 - Type	2052h		P. 58
83.0	Position command filter 2 - Notch Frequency	2053h		P. 58
84.0	Position command filter 2 - Width	2054h		P. 58
85.0	Position command filter 2 - High frequency gain constant	2055h		P. 59
86.0	Position command filter 2 - Depth	2056h		P. 59
87.0	Position deviation error detection - Value	6065h	🔒	P. 27
89.0	Position deviation error detection - Delay time			P. 27
90.0	Speed deviation error detection - Value	205Ah		P. 28
91.0	Speed deviation error detection - Delay time	205Bh		P. 28

Icon Description

EtherCAT Communication	These parameters allow access to the amplifier via EtherCAT communication.
Object Dictionary	These parameters are related to the EtherCAT communication object dictionary.
Hide	These parameters are hidden by S-TUNE Ⅱ during EtherCAT communication.
🔒 Read Only	These parameters cannot be written from S-TUNE Ⅱ to the amplifier during EtherCAT communication.

2. List of Parameters

In the order of parameter No.

No.	Name	EtherCAT		☞
102.0	Inertia ratio	2066h		P. 33
103.0	Damping ratio	2067h		P. 33
106.0	Tuning - Inertia ratio upper limit	206Ah		P. 33
110.0	Tuning - Mode switch	206Eh		P. 33
110.1	Tuning - Tuning option	206Eh		P. 34
113.0	Position control - Control gain set	2071h		P. 34
113.1	Position control - Inertia condition	2071h		P. 35
114.0	Position control - Control level	2072h		P. 35
115.0	Position control - Control gain 1	2073h		P. 36
116.0	Position control - Control gain 2	2074h		P. 36
117.0	Position control - Gain FF compensation 1	2075h		P. 37
118.0	Position control - Gain FF compensation 1	2076h		P. 37
119.0	Position control - Integral gain	2077h		P. 37
120.1	Tuning - Control gain set upper limit	2078h		P. 38
121.0	Tuning - Tuning Constant	2079h		P. 38
129.0	Speed control - Control gain set	2081h		P. 52
130.0	Speed control - Control level	2082h		P. 52
131.0	Speed control - Control gain 1	2083h		P. 53
132.0	Speed control - Gain FF compensation 1	2084h		P. 53
133.0	Speed control - Integral gain	2085h		P. 53
144.0	Torque command limit - Switch		🔒	P. 13
144.1	Torque command limit - Torque limit output		🔒	P. 14
146.0	Torque command offset	2092h		P. 14
147.0	Torque command limit - Value 1		🔒	P. 14
151.0	Deceleration stop - Torque command limit			P. 18
152.0	EtherCAT Communication Torque command - Speed limit	6080h	🔒	P. 54
160.0	Torque command filter - Low-pass filter switch	20A0h		P. 61
160.1	Torque command filter - Notch filter switch	20A0h		P. 61
160.2	Torque command filter - Auto setting	20A0h		P. 61
160.3	Torque command filter 2 - Notch filter switch	20A0h		P. 61
162.0	Torque command filter - Low-pass filter time constant	20A2h		P. 62
168.0	Torque command filter - Notch filter frequency	20A8h		P. 62
169.0	Torque command filter - Notch filter width	20A9h		P. 62
170.0	Torque command filter - Notch filter depth	20AAh		P. 63
171.0	Torque command filter 2 - Notch filter frequency	20ABh		P. 63
172.0	Torque command filter 2 - Notch filter width	20ACh		P. 63
173.0	Torque command filter 2 - Notch filter depth	20ADh		P. 64

2. List of Parameters

In the order of parameter No.

No.	Name	EtherCAT	☞
193.0	Current Control Gain Switch	20C1h	P. 38
224.0	Deceleration stop - Method (at Servo Off)	20E0h	P. 18
224.1	Deceleration stop - Release condition	20E0h	P. 18
224.2	Deceleration stop - Switch (in case of control power error)	20E0h	P. 19
224.3	Deceleration stop - DBRK output after deceleration stop (at Servo Off)	20E0h	P. 19
225.0	Emergency stop - Warning output switch	20E1h	P. 19
225.1	Emergency stop - Timing for alarm output	20E1h	P. 19
225.2	Immediate stop - Smoothing filter switch	20E1h	P. 20
226.0	Deceleration stop - Working time	20E2h	P. 20
227.0	Deceleration stop - Rotational speed to end deceleration stop	20E3h	P. 20
228.0	Deceleration stop - Operating time (in case of control power error)	20E4h	P. 21
229.0	Immediate stop - Moving average counter for speed command smoothing filter	20E5h	P. 21
232.1	Deceleration stop - Deceleration stop state during free-run	20E8h	P. 22
232.2	Immediate stop - Short brake after the stop	20E8h	P. 22
232.3	Deceleration stop - Timing for braking	20E8h	P. 22
233.0	Deceleration stop - Method (in case of alarm)	20E9h	P. 23
233.3	Deceleration stop - DBRK output after the stop (in case of alarm)	20E9h	P. 24
234.0	Deceleration stop - delay time for brake to engage	20EAh	P. 25
235.0	Deceleration stop - rotational speed to have brake engaged	20EBh	P. 25
236.0	Immediate stop - Time extension	20ECh	P. 25
237.0	Delay time for Servo off	20EDh	P. 15
238.0	Delay time for mechanical brake release	20EEh	P. 15
239.0	Quick stop - Decelerating time	20EFh	P. 25
257.0	Absolute system	2101h	P. 15
259.0	Encoder - Overheat detection output switch	2103h	P. 28
259.1	Encoder - Low battery voltage detection output switch	2103h	P. 28
267.0	Encoder - Temperature to detect overheat	210Bh	P. 29
268.0	Encoder - Voltage to detect low battery voltage	210Ch	P. 29
302.0	EtherCAT Communication Torque command - Rotation direction	212Eh	P. 54
305.0	Momentary voltage drop detection - Delay time	2131h	P. 29
357.0	Position command filter 3 - Notch Frequency	2165h	P. 60
358.0	Position command filter 3 - Notch width	2166h	P. 60
359.0	Position command filter 3 - High frequency gain constant	2167h	P. 60
360.0	Position command filter 3 - Notch depth	2168h	P. 60
363.0	Position deviation warning detection - Value	216Bh	P. 29
365.0	Position deviation warning detection - Delay time	216Dh	P. 29
376.0	Motor rotating position at encoder error - holding method	2178h	P. 30
377.0	Motor rotating position at encoder error - holding time	2179h	P. 30
458.0	Wraparound minimum	21CAh	P. 16
460.0	Wraparound maximum	21CCh	P. 16
474.0	EtherCAT Communication Setting	21DAh	P. 30

In the order of parameter No.

No.	Name	CAT EtherCAT	☞
643.0	Internal position: Overflow detection		P. 45
645.0	Homing - Home base signal selection	⊘	P. 39
645.1	Homing - Encoder Z-phase as base signal	⊘	P. 39
645.3	Homing - Re-detection of home position dog	⊘	P. 39
646.0	Homing - Direction	⊘	P. 40
646.1	Homing - Sensor dog polarity	⊘	P. 41
646.2	Homing - Timeout switch	⊘	P. 41
647.0	Homing - Torque command limit switch	⊘	P. 41
647.1	Homing - Creeping switch	⊘	P. 42
648.0	Homing - Homing speed	⊘	P. 42
649.0	Homing - Creeping speed	⊘	P. 43
650.0	Homing - Acceleration/Deceleration time	⊘	P. 43
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720.0···	Internal Position: Point table Command method	⊘	P. 45
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The internal position control point table parameters (No.720.0 or later) are not displayed on the parameter tab screen of S-TUNE Ⅱ. These parameters are displayed in the Point Table tabbed screen. See page 44 and later for detailed descriptions of the parameters.

Icon Description

CAT	EtherCAT Communication	These parameters allow access to the amplifier via EtherCAT communication.
▯	Object Dictionary	These parameters are related to the EtherCAT communication object dictionary.
⊘	Hide	These parameters are hidden by S-TUNE Ⅱ during EtherCAT communication.
🔒	Read Only	These parameters cannot be written from S-TUNE Ⅱ to the amplifier during EtherCAT communication.

1. Basic Parameters

Basic Parameters

Basic Settings

No. 2.0	Control mode	Settings	Default	Characteristics
		0, 1, 2	0	— — — AB ⏻

Function Use

Select Control Mode.

Settings	Control Mode
0	Position Control Mode
1	Velocity Control Mode
2	Torque Control Mode

Related To No.3.0

No. 3.0	Command mode	Settings	Default	Characteristics
		3, 10	10	— — 🔒 AB ⏻

Function Use

Select Command Mode.

Settings \ Control Mode (No.2.0)	Position (0)	Velocity (1)	Torque (2)
3: Internal command	Yes	–	–
10: EtherCAT	Yes	Yes	Yes

Related To No.2.0

No. 144.0	Torque command limit: Switch	Settings	Default	Characteristics
		0, 1	0	— — 🔒 ON OFF —

Function Use

Enable/Disable Torque Command Limit

Settings	Selection	Error Detection	
		Position deviation: No.65.0 Speed deviation : No.65.1	Error Detection Value: No.87.0, No.90.0 Delay time : No.89.0, No.91.0
0	Disable	–	–
1	Enable	0 (Disable)	–
		1 (Enable)	Select an appropriate value.

If you are to select 1 for this parameter, configure the above settings so that Position deviation error (Alarm No.6) and Speed deviation error (Alarm No.5) will be avoided.

Related To No.65.0、No.65.1、No.87.0、No.89.0、No.90.0、No.91.0

About Unit Notation

- In this manual, [E-pulse] and [C-pulse] represent the pulse unit that represents the position information of the motor shaft.
  [E-pulse] = [Encoder pulse] :
  This is the value obtained by dividing and multiplying the command pulse of the Host controller by parameter No.34.0 and No.36.0. It is used for calculation inside the amplifier.
  [C-pulse] = [Command pulse] :
  The unit of command pulse for the Host controller.
- The unit of each parameter is described in the [initial value] column. Unitless is a dimensionless quantity.

Basic Parameters

Basic Settings

No. 144.1	Torque command limit: **Torque limit output**	Settings	Default	Characteristics
		0, 1, 2	0	– – 🔒 AB –

Function Use

Select one of the condition sets to output that the motor is in a "torque limiting state".

T-LIMIT (Pin No.17) of I/O connector will output the torque limiting state, when, in each row in the table below, 1) any of the parameters marked ○ is set with a valid value, or 2) the one marked with △ is not configured.

Settings	Torque command limit: Value 1 No.147.0	Torque command limit: Value 2 No.148.0	Motor Max output Torque value	Homing Torque command limit value No.656.0	Speed Limit No.152.0
0	○	○	○	○	△
1	○	○	–	–	–
2	–	○	–	–	–

Prerequisite	Torque command limit switch (No.144.0) = 1 (Enable)
Related To	No.144.0、No.147.0、No.148.0、No.152.0、No.656.0

No.146.0 (2092h)	**Torque command offset**	Settings	Default	Characteristics
		−1,000 to 1,000	0 [0.1%]	📖 – – 0 100 –

Function Use

Adjust this parameter when the constant offset load torque is always applied to the motor by the gravity in the vertical axis. Set Torque command offset as a proportion relative to rated torque.

No. 147.0	Torque command limit: **Value 1**	Range	Default	Characteristics
		0 to 65,535	(See below)	– – 🔒 0 100 –

Function Use

Set a torque command limit value as % of the rated torque (100%).

Two torque command limits can be set with Value 1 and 2.

- When TLSEL1 (Pin No.11) of the I/O connector is open, Value 1 (No.147.0) is applied. When closed, Value 2 (No.148.0) will be applied.
- The setting of 3,000 or above indicates 300% of the max rated torque.
- If the parameter is set to above 1,000, an overload error will occur in the specified time, depending on the overload characteristic.
- Under some operating conditions, overcurrent error may occur. If this happens, set the upper bound to 2,400.

■ No.147.0 Default

Each motor series have their own default values.

Motor Capacity	Default
50 W, 100 W	3,500 [0.1%]
200 W to 2 kW	3,000 [0.1%]

Prerequisite	Torque command limit switch (No.144.0) = 1 (Enable)
Related To	No.144.0、No.144.1

Basic Parameters

Basic Settings

No. 237.0 (20EDh)	Servo OFF: Delay time	Range	Default	Characteristics
		0 to 3,125	0 [100µs]	▣ – – ▣ –

Function Use

This parameter indicates the delay time the motor excitation off after the Enable Operation (0x6040,3) turns off.

By adjusting the timing to end motor excitation after the brake is engaged, brake-equipped axes such as vertical axis can be prevented from falling off.

■ Default: 0 ms

Related To No.238.0

No. 238.0 (20EEh)	Bake release: Delay time	Range	Default	Characteristics
		0 to 3,125	40 [100µs]	▣ – – ▣ –

Function Use

This item indicates the delay time of brake release signal (MBRK) ON after the motor excitement starts.

By adjusting the timing to release the brake after the motion excitement starts, brake-equipped axes such as vertical axis can be prevented from falling off.

■ Default: 4 ms

Related To No.237.0

No. 257.0 (2101h)	Absolute system	Settings	Default	Characteristics
		0, 1, 2	0	▣ – – AB ⏻

Function Use

Select either Absolute system or Incremental system.

Settings	System	Multi-rotation counter Overflow detection
0	Incremental	–
1	Absolute	Disable
2	Absolute	Enable

Using this parameter in absolute systems

- Setting "2" (this is the usual setting)
  Exceeding the encoder absolute value range of -4,294,967,296 to 4,294,967,295 (± 32,767 multi-turn data) will result in Alarm No.11 (encoder multi-turn counter overflow).
  If this happens, correct the command such that motions will be kept within the absolute value range.

- Setting "1"
  Use this setting when absolute value of single-turn is needed for continuous turns only in one direction.
  Exceeding the encoder absolute value range will result in a position that is significantly off from the position specified by next command.
  Set Pulse Paired Ratio, so that the single-turn angel can be accurately detected with sufficient resolution even outside of the range.

Basic Parameters
Basic Settings

No. 458.0 (21CAh)	Wraparound **Minimum value**	Range	Default	Characteristics
		−2,147,483,648 to 0	−2,147,483,648	– – –
Function Use	Set the minimum value for wraparound.			
Related To	No.460.0			

No. 460.0 (21CCh)	Wraparound **Maximum value**	Range	Default	Characteristics
		0 to 2,147,483,648	2,147,483,648	– – –
Function Use	Set the maximum value for wraparound.			
Related To	No.458.0			

Basic Parameters

Stop Settings

No. 67.0 (2043h)	Drive restriction input: Setup	Settings	Default	Characteristics
		0 to 3	0	🕮 – – AB ⏻

Function Use

By installing sensors at the ends of linear motion, you can restrict the drive beyond the motion range.

When "Enable" is selected for this parameter, starting the motor will be blocked by I/O input ON.

Settings	CW Drive restriction	CCW Drive restriction
0	Disable	Disable
1	Enable	Disable
2	Disable	Enable
3	Enable	Enable

Related To No.67.1、No.67.2、No.67.3

		Settings	Default	Characteristics
No. 67.1 (2043h)	Drive restriction input: Deceleration method	0, 1, 2	1	🕮 – – AB ⏻
No. 67.2 (2043h)	Drive restriction input: Idling status	0, 1	0	

Function Use

Select the deceleration method upon drive restriction input and specify the idling state after the motor stopped its motion.

Use one of the following four combinations.

Possible Combinations	Deceleration method (No.67.1)	Idling status (No.67.2)
1	0: Free Run	0: Free Run
2	1: Short Brake	
3	2: Quick Stop	1: Zero Clamp
4		0: Free Run

Prerequisite Drive restriction input: Setup (No.67.0) = 1, 2 or 3 (Enable)

Related To No.67.0、No.67.3

No. 67.3 (2043h)	Drive restriction input: Retaining position deviation counter	Settings	Default	Characteristics
		0, 1	0	🕮 – – AB ⏻

Function Use

Motor's stopping upon drive restriction input results in position deviation from the input pulse.
Use this parameter to select either keep or clear that position deviation.

Settings	Position Deviation Counter
0	Keep
1	Clear

Related To No.67.0、No.67.1、No.67.2

Basic Parameters

Stop Settings

No. 151.0	Deceleration stop: Torque command limit	Range	Default	Characteristics
		0 to 65,535	2,400 [0.1%]	— — — ⬇ —

Function Use

If [Deceleration stop: Method (when the servo is off) (No.224.0)] = 2 (quick stop), set the value of torque command limit at the time of a quick stop as a ratio to the rated torque (100%).

- The setting of 3,000 or above results in 300% of the max torque of each motor.
- If the parameter is set to above 1,000, an overload error will occur in the given time, depending on the overload characteristic.
- Under some operating conditions, overcurrent error may occur.
  If this happens, set the upper bound to the range with 2,400.

Prerequisite	Deceleration stop: Method (upon servo is off) (No.224.0) = 2 (Quick stop)
Related To	No.224.0

No. 224.0 (20E0h)	Deceleration stop: Method (upon Servo Off)	Settings	Default	Characteristics
		0 to 3	3	▣ — — ▨ —

Function Use

Specify the deceleration stop method in case of servo off while motor is rotating.

Settings	Description
0	F RUN Free run
1	S STOP Short brake
2	P STOP Quick stop
3	D STOP Dynamic brake

Related To	No.151.0、No.224.1、No.224.3、No.225.2、No.226.0、No.227.0、No.229.0、No.232.1、No.232.2、No.236.0、No.239.0

No. 224.1 (20E0h)	Deceleration stop: Release conditions	Settings	Default	Characteristics
		0, 1	1	▣ — — ▨ —

Function Use

This parameter indicates conditions to cancel a deceleration stop, if an alarm occurs or the Servo ON signal turns OFF.
It is used for a motor which is slowing down as specified with Deceleration stop: Method (upon Servo Off) (No.224.0).

Settings	Deceleration stop Operating time (No.226.0)	Deceleration stop Rotational speed to cancel (No.227.0)
0	○	–
1	○	○

Prerequisite	Deceleration stop Method (upon servo off) (No.224.0) = 1 (Short brake) or 2 (Quick stop)
Related To	No.224.0、No.226.0、No.227.0

Basic Parameters

Stop Settings

No.	Name	Settings	Default	Characteristics
No. 224.2 (20E0h)	Deceleration stop: Switch (upon control power failure)	0, 1	1	📘 — — ON OFF —

Function Use

Enable/Disable deceleration stop when an alarm of voltage drop error in the control power supply occurs.

Settings	Deceleration stop
0	Disable
1	Enable

Related To: No.228.0

No.	Name	Settings	Default	Characteristics
No. 224.3 (20E0h)	Deceleration stop: DBRK output after stopping (upon Servo Off)	0, 1	1	📘 — — A⇄B —

Function Use

Select Stop State when the servo is off

Settings	Description
0	F RUN Free run
1	D STOP Dynamic brake

Prerequisite: No.224.0、No.232.1

No.	Name	Settings	Default	Characteristics
No. 225.0 (20E1h)	Emergency stop: Warning output switch	0, 1	0	📘 — — A⇄B —

Function Use

Set whether a warning to be output or not in case of E-stop input.

Settings	Warning output
0	Disable
1	Enable

No.	Name	Settings	Default	Characteristics
No. 225.1 (20E1h)	Emergency stop: Warning output timing	0, 1	0	📘 — — A⇄B —

Function Use

Specify when to output warning in case of E-stop input.

Settings	Warning output timing
0	After the motor makes a deceleration stop
1	Immediately after the warning occurs

Prerequisite: Emergency stop: Warning output switch (No.225.0) = 1 (Output warning)

Basic Parameters

Stop Settings

No. 225.2 (20E1h)	Quick stop: Smoothing filter - Switch	Settings	Default	Characteristics
		0, 1	0	▣ – – ON OFF –

Function Use

Enable/Disable the Velocity Command smoothing filter at the time of a quick stop.

This filter suppresses vibration caused by drastic velocity change.

Settings	Velocity Command smoothing filter
0	Disable
1	Enable

Prerequisite No.229.0

No. 226.0 (20E2h)	Deceleration stop: Operating time	Range	Default	Characteristics
		0 to 16,383	500 [100μs]	▣ – – 0 100 –

Function Use

This parameter indicates <u>deceleration stop operation time</u> in case an alarm occurs or the Servo ON signal turns OFF. It is used for a motor which is slowing down as specified with the deceleration stop method (No.224.0).

■ Default: 50 ms (Converted to Time)

Prerequisite Deceleration stop Method (upon servo off) (No.224.0) = 1 (Short brake) or 2 (Quick stop)

Related To No.224.0、No.224.1、No.227.0

No. 227.0 (20E3h)	Deceleration stop: Rotational speed to end deceleration stop	Range	Default	Characteristics
		0 to 1,000	50 [r/min]	▣ – – 0 100 –

Function Use

This parameter indicates <u>rotational speed to cancel deceleration-stop</u> in case an alarm occurs or the Servo ON signal turns OFF.

It is used for a motor which is slowing down as specified with the deceleration stop method (No.224.0).

Prerequisite Deceleration stop: Method (No.224.0) = 1 (Short brake) or 2 (Quick stop)
& Deceleration stop: Release conditions (No.224.1) = 1

Related To No.224.0、No.224.1、No.226.0

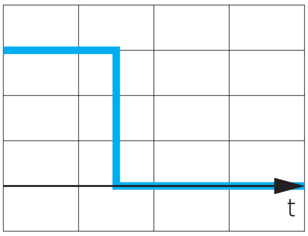
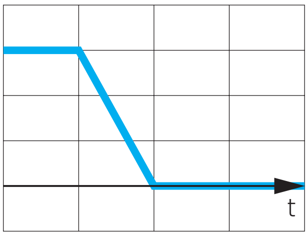
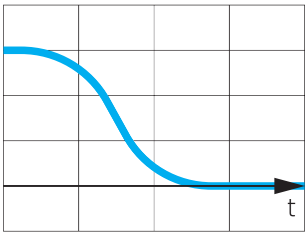
Basic Parameters

Stop Settings

		Range	Default	Characteristics
No. 228.0 (20E4h)	Deceleration stop: Operating time (upon control power error)	0 to 16,383	100 [100µs]	▣ — — ▨ —
Function Use	Set Deceleration stop time in the event of the alarm output due to a control power error. ■ Default: 10 ms (Converted to Time)			
Prerequisite	Deceleration stop: Switch (upon control power failure) (No.224.2) = 1 (Enable)			
Related To	No.224.2			

		Range	Default	Characteristics
No. 229.0 (20E5h)	Quick stop: Smoothing filter - Moving average counter	1 to 1,000	40 [-]	▣ — — ▨ —
Function Use	This item indicates moving average count of velocity command smoothing filter while the motor is making a quick stop. The lager the parameter value, the smoother acceleration/deceleration is and the slower the response. **Delay Time Calculation Formula** 100µs × Moving average count = delay time The positioning will take as long as the delay time specified above, set this item within the range acceptable to the equipment.			
Prerequisite	Quick stop: Smoothing filter switch (No.225.2) = 1 (Enable)			
Related To	No.225.2、No.239.0			

■ Waveforms for each combination of enable/disable Deceleration Stop and Smoothing Filter.

Deceleration Stop	Disable	Enable	Enable
Smoothing Filter	Disable	Disable	Enable
Command waveform			

Basic Parameters

Stop Settings

No. 232.1 (20E8h)	Deceleration stop: **Status during free-run**	Settings	Default	Characteristics
		0, 1	1	📘 – – A⇄B –

Function Use

Select on or off for deceleration stop status during free-run.

Settings	Deceleration stop status
0	OFF (not consider as deceleration stop) As soon as the servo status becomes OFF, the brake release (MBRK) becomes open and the brake becomes engaged. With the configuration of No.224.3 (upon servo off) and No.233.3 (upon alarm on), the dynamic brake release signal (DBRK) immediately turns off and the dynamic brake becomes engaged.
1	ON (consider as deceleration stop) When the servo state becomes OFF, the deceleration stop status becomes ON. MBRK remains closed and the brake remains disengaged until the deceleration stop status becomes OFF. With the configuration of No.224.3 (upon servo off) and No.233.3 (upon alarm on), the dynamic brake release (DBRK) will remain ON and the dynamic braking will remain disengaged until the deceleration stop status becomes OFF.

No. 232.2 (20E8h)	Quick stop: **Short brake operation after a stop**	Settings	Default	Characteristics
		0, 1	0	📘 – – A⇄B –

Function Use

Enable/Disable short braking after a quick stop.

Settings	Short braking
0	Enable
1	Disable

Prerequisite: Deceleration stop: Method (when servo off) (No.224.0) = 2 (Quick stop)

No. 232.3 (20E8h)	Deceleration stop: **Brake engagement - Timing**	Settings	Default	Characteristics
		0, 1	0	📘 – – A⇄B –

Function Use

Set the timing for the brake to be engaged in a brake-equipped motor.

(That is, set the timing to open MBRK (Brake Release))

Settings	Brake engagement timing
0	When the deceleration stop status is off, or the motor rotation speed becomes lower than the setting of **Deceleration stop: Cancellation speed** (No.227.0)
1	When the deceleration stop status is off, or the motor rotation speed becomes lower than the setting of **Deceleration stop: Brake engagement - Rotation speed** (235.0), or the braking time reaches the value of **Deceleration stop: Brake engagement - Delay time** (No.234.0).

Related To: No.234.0、No.235.0

Basic Parameters

Stop Settings

No. 233.0 (20E9h)	Deceleration Stop: Method (when alarm is on)	Settings	Default	Characteristics
		0 to 7	1	📘 — — AB —

Function Use

Select a deceleration stop method in case of alarm while motor is in motion.

Each alarm group uses a different stop method. (*1)

Settings	Stop method		
	Group ①	Group ② (*2), ③ , ④	Group ⑤
0	F RUN	F RUN	F RUN
1	D STOP	D STOP	D STOP
2	F RUN	S STOP	S STOP
3	D STOP	S STOP	S STOP
4	F RUN	F RUN	P STOP
5	D STOP	D STOP	P STOP
6	F RUN	S STOP	P STOP
7	D STOP	S STOP	P STOP

*1) Alarms are categorized into five groups.

*2) When **Deceleration stop: Method** (No.224.0) = 0 (Disable), the motor will be stopped by the group ① method. After the amount of time specified by **Deceleration stop: Operating time** (No.228.0) elapses, the motor will be stopped by the group ① method.

F RUN	Free run	P STOP	Quick stop	S STOP	Short brake	D STOP	Dynamic brake

Basic Parameters

Stop Settings

Group	Alarm No.	Alarm Name
①	14	Overvoltage error
	23	Switch circuitry error
	24	Overcurrent error
	25	Inverter error 1
	26	Inverter error 2
	27	Current sensor error
	29	Voltage error (Internal control power DC5V)
②	22	Voltage error (Internal control power DC24V)
	32	Power supply error (Control circuit AC power)
③	16	Encoder error (Received data)
	17	Encoder error (No response)
	18	Encoder error (Hardware)

Group	Alarm No.	Alarm Name
④	0	System error
	1	EEPROM data error
	2	Product code error (Mismatching code)
	7	Overload error
	19	Encoder error (Communication)
	20	Encoder error (Multi-turn data)
	21	Encoder error (Voltage drop)
	34	Product code error (Undefined model code)
⑤	3	EtherCAT communication error
	4	Overspeed error
	5	Velocity deviation error
	6	Position deviation error
	8	Command overspeed error
	10	Positioning command overflow error /Homing failure
	11	Multi-turn counter error
	12	Overheat error
	15	Power supply error (Primary circuit AC power)
	28	Encoder error (Overheat)

No. 233.3 (20E9h)	Deceleration Stop: DBRK output after stopping (when alarm is on)	Settings	Default	Characteristics
		0, 1	1	📖 — — A⇄B —

Function Use

Select the type of idling in case of alarm.

Settings	Idle State
0	Free run
1	Dynamic brake

Basic Parameters

Stop Settings

No. 234.0 (20EAh)	Deceleration Stop: **Brake engagement - Delay time**	Range	Default	Characteristics
		0 to 16,383	0 [100µs]	▣ – – ▣ –
Function Use	Set the delay time between two events: 1) SVON (servo-on) opens while the motor is in motion or an alarm occurs, and 2) the brake becomes engaged. ■ Default: 0 ms (Converted to Time)			
Prerequisite	Timing of brake engagement (No.232.3) = 1			

No. 235.0 (20EBh)	Deceleration Stop: **Brake engagement - Rotational speed**	Range	Default	Characteristics
		0 to 1,000	50 [r/min]	▣ – – ▣ –
Function Use	Set the motor rotational speed to engage the brake when 1) SVON (servo-on) opens while the motor is in motion or 2) an alarm occurs.			
Prerequisite	Timing of brake engagement (No.232.3) = 1			

No. 236.0 (20ECh)	Quick stop: **Extension Time**	Range	Default	Characteristics
		0 to 3,125	0 [100µs]	▣ – – ▣ –
Function Use	This item indicates how long the quick stop to be kept after the deceleration stop complete conditions were met. It is used to compensate the brake response time. ■ Default: 0 ms (Converted to Time) This parameter is valid only when the Deceleration Stop Method is "quick stop". This parameter is invalid if the servo turns off while the motor idling. Use **Servo OFF: Delay time** (No.237.0) to compensate the brake response time when the servo turns off during motor idling.			
Prerequisite	Deceleration stop: Method (No.224.0) = 2 (Quick stop)			
Related To	No.224,0、No.233.0、No.237.0			

No. 239.0 (20EFh)	Quick stop: **Deceleration time**	Range	Default	Characteristics
		0 to 100	0 [ms]	▣ – – ▣ –
Function Use	This item indicates decelerating time after a quick stop. Set the time-length for speed command to change from 1,000 r/min to 0 r/min.			
Related To	No.224.0、No.232.2、No.236.0			

Basic Parameters

Error Detection Settings

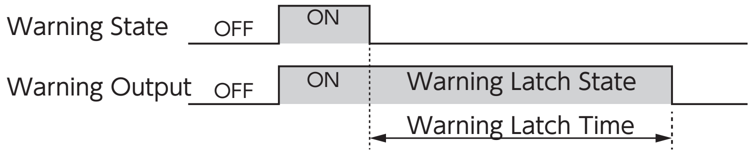
No. 12.0 (200Ch)	Warning latch time	Range	Default	Characteristics
		0 to 200	1 [50ms]	▣ – – ▣ –

Function Use

Specify the length of latch time for warning output.

Setting	Description
0	No limit
1 to 200	Latching Time = Setting Value × 50 ms

Warning Output time = Waring State time + Warning Latch time



Close RESET to release the alarm latch and turn the warning off.

Related To No.225.0、No.225.1

No. 13.0 (200Dh)	Alarm output timing	Settings	Default	Characteristics
		0, 1	0	▣ – – ▣ –

Function Use

Specify when to output an alarm.

Settings	Output timing
0	After the motor decelerates to stop
1	Immediately after an alarm occurs

Remark If **Deceleration Stop: Method (when alarm is on)** (No.233.0) = 0 (free-run), the alarm signal will be output regardless of this parameter setting.

Basic Parameters

Error Detection Settings

No. 65.0 (2041h)	Position deviation error detection: **Switch**	Settings	Default	Characteristics
		0 to 3	1	▮ – – A⇄B –

Function Use	
	Specify what to output when excessive position deviation is detected.

Settings	Output selection
0	No detect (No output)
1	Alarm output
2	Warning output
3	Alarm and Warning output

When using Torque command limit, select 0 (No output) so that an alarm will not occur in a torque limit state.

Related To	No.87.0、No.89.0、No.363.0、No.365.0

No. 65.1 (2041h)	Speed deviation error detection: **Switch**	Settings	Default	Characteristics
		0, 1	1	▮ – – ON OFF –

Function Use	
	Enable/Disable Speed Deviation Error Detection.

Settings	Speed deviation error detection
0	Disable
1	Enable

When using Torque command limit, select "Disable" so that an alarm will not occur during limiting.

Related To	No.90.0、No.91.0

No. 87.0 (6065h)	Position deviation error detection: **Value**	Range	Default	Characteristics
		0 to 10,000	1,500 [0.001rev]	▮ – 🔒 0 100 –

Function Use	
	This parameter sets a threshold value for a position deviation error detection.

The higher the value, the less likely to detect position deviation error.

Prerequisite	Position deviation error detection: Switch (No.65.0) = 1 (Enable)
Related To	No.65.0, No.89.0

No. 89.0	Position deviation error detection: **Delay time**	Range	Default	Characteristics
		0 to 32,767	400 [100µs]	– – – 0 100 –

Function Use	
	This parameter sets a delay time for a position deviation error (Alarm No.6) to be output after the position deviation exceeded the setting of [Position deviation error detection value (No.87.0)]

The higher the value, the longer it takes for the error to be output.

■ Default: 40 ms (Converted to Time)

Prerequisite	Position deviation error detection: Switch (No.65.0) = 1 (Enable)
Related To	No.65.0、No.87.0

Basic Parameters

Error Detection Settings

No. 90.0 (205Ah)	Speed deviation error detection: **Value**	Range	Default	Characteristics
		0 to 10,000	1,500 [r/min]	📖 – – 0 100 –

Function Use	This parameter sets a threshold value for a speed deviation error detection. The higher the value, the less likely to detect a speed deviation error.
Prerequisite	Speed deviation error detection - Switch (No.65.1) = 1 (Enable)
Related To	No.65.1、No.91.0

No. 91.0 (205Bh)	Speed deviation error detection: **Delay time**	Range	Default	Characteristics
		0 to 32,767	400 [100μs]	📖 – – 0 100 –

Function Use	This parameter sets a delay time for a speed deviation error (Alarm No.5) to be detected after the speed deviation exceeded the setting of "Speed deviation error - Detection value"(No.90.0). The higher the value, the longer the error detection time. ■ Default: 40 ms (Converted to Time)
Prerequisite	Speed deviation error detection - Switch (No.65.1) = 1 (Enable)
Related To	No.65.1、No.90.0

No. 259.0 (2103h)	Encoder: **Overheat detection - switch**	Settings	Default	Characteristics
		0, 1, 2	0	📖 – – A⇄B –

Function Use	Select what to output when overheat of the encoder is detected.

Settings	Output
0	No output
1	Warning output
2	Alarm output

No. 259.1 (2103h)	Encoder: **Battery voltage drop detection - switch**	Settings	Default	Characteristics
		0, 1	0	📖 – – A⇄B –

Function Use	Select what to output when encoder battery voltage drop is detected.

Settings	Output
0	No output
1	Warning output

Basic Parameters

Error Detection Settings

		Range	Default	Characteristics
No. 267.0 (210Bh)	Encoder: Overheat detection - Value	0 to 127	85 [℃]	▣ − − ▨ −
Function Use	Set the value to detect overheat of the encoder. (for reference only)			
Related To	No.259.0			

		Range	Default	Characteristics
No. 268.0 (210Ch)	Encoder: Battery voltage drop detection - Value	0 to 100	24 [0.1V]	▣ − − ▨ −
Function Use	Set the value to detect voltage drop of the encoder.			
Related To	No.259.0			

		Range	Default	Characteristics
No. 305.0 (2131h)	Voltage Drop Detection: Delay time	20 to 50,000	80 [ms]	▣ − − ▨ −
Function Use	Set the delay time to voltage sag of the primary circuit power supply. (voltage sag=detect a dip in voltage)			
Remark	Detection of a voltage sag will result in Alarm No.15. Set this parameter suitable to your operating conditions.			

		Range	Default	Characteristics
No. 363.0 (216Bh)	Position deviation warning detection: Value	0 to 2,147,483,647	100 [E-pulse]	▣ − − ▨ −
Function Use	Set the value to detect position deviation warning. The position deviation warning will be detected when the position deviation exceeds this parameter value.			
Prerequisite	Position deviation error detection: Switch (No.65.0) = 2 (Warning output), or 3 (Alarm and Warning output)			
Related To	No.65.0、No.365.0			

		Range	Default	Characteristics
No. 365.0 (216Dh)	Position deviation warning detection: Delay time	0 to 65,535	500 [100μs]	▣ − − ▨ −
Function Use	Set the delay time to detect the position deviation warning. ■ Default: 50 ms (Converted to Time)			
Prerequisite	Position deviation error detection: Switch (No.65.0) = 2 (Warning output), or 3 (Alarm and Warning output)			
Related To	No.65.0、No.363.0			

Basic Parameters

Error Detection Settings

No.376.0 (2178h)	Motor rotating position at encoder error holding method	Range	Default	Characteristics
		0, 2	0	📕 – – A⇄B –

Function Use

Select method for motor rotating position holding at encoder error.

Settings	Methods
0	Disable
2	Keep torque command value Setting range

Related To No.377.0

No.377.0 (2179h)	Motor rotating position at encoder error holding time	Range	Default	Characteristics
		0 to 200	100 [ms]	📕 – – 0 100 –

Function Use

Set operation time for motor rotating position holding at encoder error.

Related To No.376.0

No.474.0 (21DAh)	Error detection settings EtherCAT Communication Setting	Range	Default	Characteristics
		0, 1	1	📕 – – A⇄B –

Function Use

Select whether the amplifier detects alarm No.3 when EtherCAT communication error occurs.

Settings	Alarm No.3
0	NOT detect
1	Detect

2. Position Control Mode

Position Control Mode

Position Command Input

No. 32.2 (2020h)	Pulse train command: Interpolation with pulse ratio	Settings	Default	Characteristics
		0, 1	1	– –
Function Use	Enable/Disable the interpolation to smooth a command where C-pulse Ratio is set.			
Related To	No.32.0、No.34.0、No.36.0			

Settings	Interpolation with pulse ratio
0	Disable
1	Enable

Position Control Mode

Position Command Input

		Range	Default	Characteristics
No. 34.0 (6091-01h)	Pulse train command: Ratio (Numerator)	17bit 1 to 65,535 23bit 1 to 8,388,608	1,000 [-]	— —
No. 36.0 (6091-02h)	Pulse train command: Ratio (Denominator)			

Function Use

Use these two parameters to set the multiplier and divider for the position C-pulse .

When the pulse count per rotation of host command is not equal to its counterpart of motor, select one of the following for (Numerator)/(Denominator).

(Numerator)=(motor pulse count per rotation)/4=32,768
(Denominator)=(host C-pulse count per rotation)/4

$$\frac{\boxed{34.0}}{\boxed{36.0}} = \frac{\text{motor pulse count per rotation}}{\text{host C-pulse count per rotation}} = \frac{\text{motor pulse count per rotation / 4}}{\text{host C-pulse count per rotation / 4}}$$

■ Setting Example

unit: [pulse/rev]

A Host Command Pulse count per rotation	B No.34.0	C (= A × 1/4) No.36.0
16,384	32,768 =131,072 (*) ÷ 4	4,096
10,000		2,500
4,096		1,024
4,000		1,000

*) 131,072 is the pulse count per rotation of the motor.
The default setting values are assumed 131,072 pulses of the host C-pulse number per a rotation.

Remark

Range of Pulse Ratio (Numerator/Denominator)
・Pulse train command: x0.001 to x1,000
・Internal Position Command: x1 to x1,000

		Settings	Default	Characteristics
No. 66.3 (2042h)	Pulse train command: Feed forward delay compensation	0, 1	1	— —

Function Use

Enable/Disable Feed Forward Delay Compensation in Position Control Mode.

Settings	Feed forward delay compensation
0	Disable
1	Enable

Remark

Usually, set 1 (enable)
You can set this item only with S-TUNE Ⅱ, not with the Setup Panel.

Position Control Mode

Tuning Parameters

No. 102.0 (2066h)	Tuning: Inertia ratio	Range	Default	Characteristics
		100 to 10,000	250 [%]	▣ – – ▣ –

Function Use	Specify the ratio of the device load inertia to motor rotor inertia (moment of inertia). $\text{Inertia Ratio} = \dfrac{\text{Load Inertia} + \text{Rotor Inertia}}{\text{Rotor Inertia}} \times 100\%$ Inertia ratio is estimated by auto-tuning. When estimation is difficult (for example, too large an inertia ratio or too large a torque value), you can enter a calculated value of load inertia. If vibration occurs after deceleration or acceleration, increase the inertia ratio.
Remark	The inertia ratio being too large or too small will cause noise.

No. 103.0 (2067h)	Tuning: Damping ratio	Range	Default	Characteristics
		10 to 5,000	100 [%]	▣ – – ▣ –

Function Use	This parameter can be used for tuning to improve poor settling due to viscous friction, or too large an inertia ratio. Increasing (or decreasing) this parameter value in event of overshoot (or undershoot respectively) may make the settling time shorter. The value of this parameter is estimated along with inertia ratio simultaneously if **Tuning: Items** (No.110.1) = 2 (start).
Prerequisite	Position Control Mode, Velocity Control Mode
Related To	No.110.1

No. 106.0 (206Ah)	Tuning: Inertia ratio upper bound	Range	Default	Characteristics
		100 to 10,000	3,000 [%]	▣ – – ▣ –

Function Use	Set the upper bound of the inertia ratio automatically adjusted in Quick Tuning.
Prerequisite	Tuning: Control gain set - Automatic switch (No.120.0): 1 (Enable)
Related To	No.110.1、No.120.0

No. 110.0 (206Eh)	Tuning: Mode switch	Settings	Default	Characteristics
		1, 2	2	▣ – – ▣ –

Function Use

Select a tuning condition depending on the direction of load or the presence of unbalanced load.

Settings	Mode	Motion direction of the device connected to the motor
1	Standard	Horizontal axis force
2	Offset Load	Non-horizontal axis force

Use Offset Load Mode even for the case of axis force (horizontal motion)

Prerequisite	Position Control Mode, Velocity Control Mode

Position Control Mode

Tuning Parameters

No. 110.1 (206Eh)	Tuning: **Items**	Settings	Default	Characteristics
		0, 1, 2	0	▣ – – ▣ –
Function Use	Select Start or Stop for tuning depending on the your willing to estimate items.			
Prerequisite	Position Control Mode, Velocity Control Mode			

Settings (Tuning)	Estimate items	
	Inertia ratio	Damping ratio
0 (Stop)	No estimate	No estimate
1 (Start)	Estimate	
2 (Start)		Estimate

No. 113.0 (2071h)	Tuning: **Position control mode - Control gain set**	Range	Default	Characteristics
		5 to 45	15 [-]	▣ – – ▣ –
Function Use	Select one control gain set for Position Control Mode.			
Prerequisite	Position Control Mode			

Select one control gain set for Position Control Mode.

Control Gain 1 (No.115.0), **Control Gain 2** (No.116.0), and **Integral Gain** (No.119.0) are set to the preset values of pairs.

■ Noise Solutions
① Use **Torque command filter: Notch filter** (such as No.160.1).
② Decrease the value of **Integral Gain** (No.119.0).
③ Decrease the value of **Control Gain 2** (No.116.0).

If the above does not work, lower Control Gain Set.

Setting	Command Response	Rigidity	Settling Time	Possibility of Noise
5	Slower	Lower	Longer	Lower
↕	↕	↕	↕	↕
45	Faster	Higher	Shorter	Higher

Remark

- Too large a value of this item may cause noise.
- The default value varies depending on the setting of **Position Control Mode - Inertia conditions** (No.113.1).
- If **Torque command filter: Low-pass filter - Auto setting** (No.160.2) = 1 (auto setting ON), then **Torque command filter: Low-pass filter - Time constant** (No.162.0) will be included in the gain set.

Related To No.113.1、No.114.0、No.115.0、No.116.0、No.117.0、No.118.0、No.119.0、No.162.0

Position Control Mode
Tuning Parameters

No. 113.1 (2071h)	Tuning: Position control mode - Inertia conditions	Settings	Default	Characteristics
		1, 2, 3	2	■ — — ■ —

Function Use

Set the inertia conditions for Position Control Mode.

This parameter is used to determine the ratio of **Control Gain 1** (No.115.0) to **Control Gain 2** (No.116.0), which would be appropriate to equipment characteristics.

Settings	Description
1	Heavy-load equipment or equipment with substantial load fluctuation Equipment with low rigidity, robot arms, and so on
2	(medium setting) For example, general transport machines
3	Light-load equipment Equipment that demands high-speed operation or requires settling

Prerequisite	Position Control Mode
Related To	No.113.0、No.115.0、No.116.0

No. 114.0 (2072h)	Tuning: Position control mode - Control level	Range	Default	Characteristics
		5 to 45	15 [-]	■ — — ■ —

Function Use

Set the Control Level of Position Control Mode.

With this parameter, both **Control Gain 1** (No.115.0) and **Control Gain 2** (No.116.0) can be set to the preset values of pairs.

■ Noise Solutions
① Use **Torque command filter: Notch filter - Switch** (such as No.160.1).
② Decrease **Position control mode - Integral gain** (No.119.0).
③ Decrease **Position control mode - Control gain 2** (No.116.0).

If any of the above does not work, decrease the Control Gain Set value.

Setting	Command Response	Rigidity	Settling Time	Possibility of Noise
5	Slower	Lower	Longer	Lower
↕	↕	↕	↕	↕
45	Faster	Higher	Shorter	Higher

Prerequisite	Position Control Mode
Remark	· Setting Control Level will invalidate the setting of **Control gain set** (No.113.0). · The specified values of **Control Gain 1** (No.115.0) and **Control Gain 2** (No.116.0) vary depending on **Inertia conditions** (No.113.1).
Related To	No.113.0、No.113.1、No.115.0、No.116.0

Position Control Mode

Tuning Parameters

No. 115.0 (2073h)	Tuning: Position control mode - Control gain 1	Range	Default	Characteristics
		5 to 1,000	50 [rad/s]	▣ – – ▦ –
Function Use	Set Control Gain 1 for Position Control Mode. Increasing this parameter value reduces position deviations after the command becomes zero. Increase it when the position deviation convergence at the time of settling is not good. Set a value smaller than the value of **Control Gain 2** (No.116.0).			
Prerequisite	Position Control Mode			
Remark	· Making a change to any of the following will also change other tuning parameters (such as **Control Gain 2**) to the prearranged parameter set all at once. - **Control Gain Set** (No.113.0) - **Inertia conditions** (No.113.1) - **Control Level** (No.114.0) · To reduce the position deviation of the command being input, raise **Control Gain 2** (No.116.0).			
Related To	No.113.0、No.113.1、No.114.0、No.116.0、No.117.0			

No. 116.0 (2074h)	Tuning: Position control mode - Control gain 2	Range	Default	Characteristics
		80 to 5,000	200 [rad/s]	▣ – – ▦ –
Function Use	Set Control Gain 2 for Position Control Mode. Increasing this parameter value decreases the position deviation during command input. Increasing the parameter value provides faster command response; however, too large a value may result in noise. Set a value larger than the value of **Control Gain 1** (No.115.0). ■ Noise Solutions ① Use **Torque command filter: Notch filter** (such as No.160.1) ② Lower **Integral Gain** (No.119.0) If the above does not work, decrease the **Control Gain 2**.			
Prerequisite	Position Control Mode			
Remark	· Making a change to any of the following will also change other tuning parameters (such as **Control Gain 1**) to the prearranged parameter set all at once. - **Control Gain Set** (No.113.0) - **Inertia conditions** (No.113.1) - **Control Level** (No.114.0) · To reduce position deviations after the command becomes zero, increase the value of **Control Gain 1** (No.115.0).			
Related To	No.113.0、No.113.1、No.114.0、No.115.0、No.118.0			

Position Control Mode

Tuning Parameters

No. 117.0 (2075h)	Tuning: Position control mode - Gain FF compensation 1	Range	Default	Characteristics
		0 to 15,000	10,000 [0.01%]	📖 – – 0 100 –

Function Use	Set the Field Forward Compensation Rate (speed) with respect to Control Gain 1 (No.115.0) for Position Control Mode. Using this parameter is effective to shorten the settling time. Adjust this item after setting the following: Inertia ratio (No.102.0), Control gain set (No.113.0), Control level (No.114.0), Control gain 1 (No.115.0), Control gain 2 (No.116.0) Too high a value of this parameter will result in overshooting, and too low in undershooting. Set relatively a moderate value.
Prerequisite	Position Control Mode
Related To	No.113.0、No.115.0、No.118.0

No. 118.0 (2076h)	Tuning: Position control mode - Gain FF compensation 2	Range	Default	Characteristics
		0 to 15,000	0 [0.01%]	📖 – – 0 100 –

Function Use	Set Field Forward Compensation Rate (Torque) with respect to [Control Gain 2 (No.116.0)] for Position Control Mode. Using this item will reduce position deviations during operation. Setting this item to around 10,000 will make the position deviations during operation almost zero. Raise the value of this item only after reducing the position deviation, by using **Gain FF Compensation 1** (No.117.0) at settling. ■ Noise Solutions Adjusting **Filter 4: Smoothing 2- Moving average counter** (No.81.0) may reduce the noise.
Prerequisite	Position Control Mode
Related To	No.113.0、No.116.0、No.117.0

No. 119.0 (2077h)	Tuning: Position control mode - Integral gain	Range	Default	Characteristics
		45 to 5,000	160 [rad/s]	📖 – – 0 100 –

Function Use	Set the Integral Gain for Position Control mode. Increasing the value of Integral Gain will improve the convergence (interfered by friction or load fluctuation) at the time of settling, and reduce position deviations. This will result in rigid and sensitive motions. ■ Noise Solutions ① Use **Torque command filter: Notch filter** (such as No.160.1). ② Decrease the value of **Integral Gain**
Prerequisite	Position Control Mode
Remark	This parameter will reset to the default if **Inertia conditions** (No.113.1) or **Control Gain Set** (No.113.0) is changed.
Related To	No.113.0

Position Control Mode

Tuning Parameters

No. 120.1 (2078h)	Tuning: Control gain set - Upper bound	Range	Default	Characteristics
		5 to 45	15 [-]	▨ – – ▨ –
Function Use	Set the upper bound of Control Gain Set in Auto Tuning of Control Gain Set.			
Prerequisite	Position Control Mode			
Related To	No.106.0、No.120.0			

No. 121.0 (2079h)	Tuning: Control gain set - Tuning constant	Range	Default	Characteristics
		1 to 200	24 [-]	▨ – – ▨ –
Function Use	This parameter is used for Quick Tuning. Usually the default value is used. It is a constant of proportionality to calculate (**Control Gain 1** + **Control Gain 2**) based on the Inertia ratio setting value in their inverse proportionality. Set it to a small value only if Quick Tuning has caused vibration in an extremely poor rigidity equipment.			
Prerequisite	Position Control Mode Tuning: Control gain set - Automatic switch (No.120.0): 1 (Enable)			
Remark	This parameter is not displayed on the Setup Panel.			
Related To	No.120.0			

<table>
<tr><td>No. 193.0
(20C1h)</td><td>Tuning:
Current control gain</td><td>Settings</td><td>Default</td><td>Characteristics</td></tr>
<tr><td></td><td></td><td>0, 1</td><td>0</td><td>▨ – – ▨ ▨</td></tr>
<tr><td>Function
Use</td><td colspan="4">This parameter is used to adjust the gain level of the current control component.
Select 1 to reduce noise generated at the time of servo-on stop.
<table>
<tr><th>Settings</th><th>Level</th><th>Noise</th><th>Response</th></tr>
<tr><td>0</td><td>Standard</td><td>More</td><td>Faster</td></tr>
<tr><td>1</td><td>Low</td><td>Less</td><td>Slower</td></tr>
</table></td></tr>
<tr><td>Remark</td><td colspan="4">・If you changed the setting, perform tuning again.
・Selecting 1 hurts response; Adjust within the acceptable range.</td></tr>
</table>

Position Control Mode

Homing

		Settings	Default	Characteristics
No. 645.0	Homing: Home reference signal selection	0, 1	0	– ⊘ – A B –

Function Use

Select the signal that the home position will be referenced to.

Settings	Reference Signal 1
0	Any user specified position
1	Stopper

		Settings	Default	Characteristics
No. 645.1	Homing: Encoder Z-phase selection	0, 1	0	– ⊘ – ON OFF –

Function Use

To add encoder Z-phase as the reference position after the Home Reference Signal is detected, set this parameter to 1.

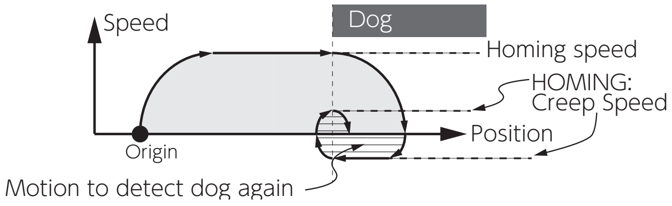
Settings	Encoder Z-phase Signal
0	Disable
1	Enable

		Settings	Default	Characteristics
No. 645.3	Homing: Re-detection of home position dog	0, 1	0	– ⊘ – ON OFF –

Function Use

Use this parameter, after detecting dog-front-end, to re-detect the dog-front-end at a speed specified with the homing creep speed parameter.

Settings	Re-detecting motion
0	Disable
1	Enable



Prerequisite Homing: Home reference signal selection (No.645.0): 2(home dog-front-end)

Position Control Mode

Homing

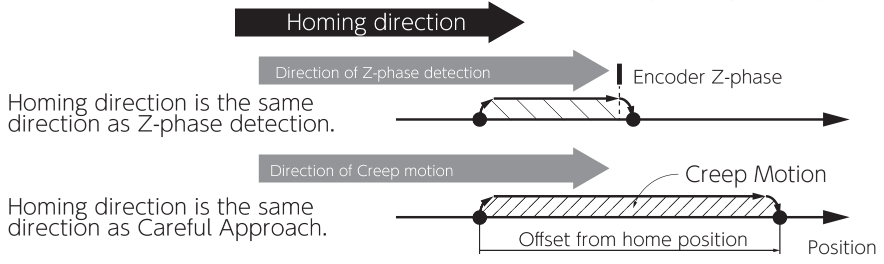
		Settings	Default	Characteristics
No. 646.0	Homing: Direction	0, 1	0	– 🚫 – ON OFF –

Function Use

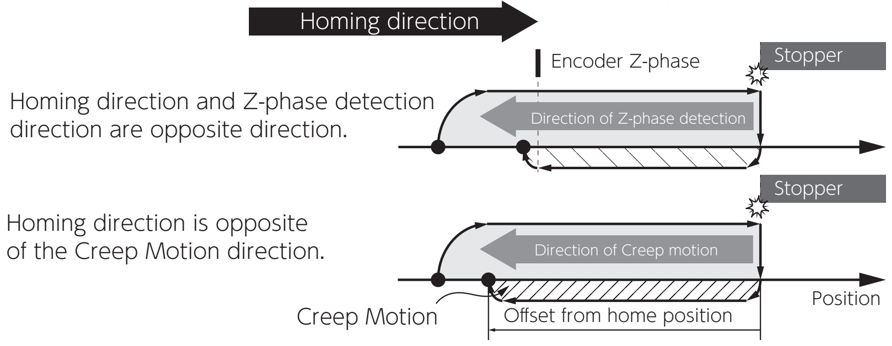
Specify the homing direction.

Settings	Direction of rotation
0	CCW
1	CW

■ When Homing Home Reference Signal selection (No.645.0) = 0 (Any user specified position)



■ When Homing Home Reference Signal selection (No.645.0) =1 (Stopper)



Related To No.645.0、No.645.1、No.645.3

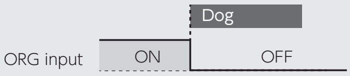
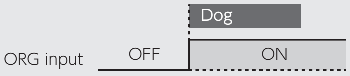
Position Control Mode

Homing

No. 646.1	Homing: Sensor dog polarity	Settings	Default	Characteristics
		0, 1	0	– ⊘ – A⇄B –

Function Use

Select the polarity for the home sensor signal input ORG (Pin No.11) of C5 to detect the dog-front-end.

Settings	Detection Polarity	
0	Detect where ORG = OFF	
1	Detect where ORG = ON	

No. 646.2	Homing: Timeout switch	Settings	Default	Characteristics
		0, 1	1	– ⊘ – ON OFF –

Function Use

Enable/Disable Homing Timeout.
This item is a safety measure against collisions.

Settings	Timeout
0	Disable
1	Enable

When the time since homing started exceeds the setting of **Timeout Time** (No.659.0), Alarm No.10 (internal position command overflow fault / homing failure) is output leading to servo off.

No. 647.0	Homing: Torque command limit switch	Settings	Default	Characteristics
		0, 1	0	– ⊘ – ON OFF –

Function Use

Enable/Disable torque command limit during Homing. This item is a safety measure against collisions during Homing.

Settings	Torque Command Limit
0	Disable
1	Enable

Remark

For Homing by using stopper, this parameter setting does not matter. The torque limit used for press detection will be always the setting of **Homing torque command limit value** (No.656.0) regardless of this parameter setting.

Related To No.656.0

Position Control Mode

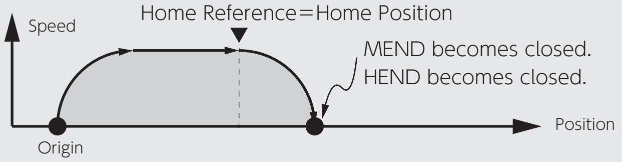
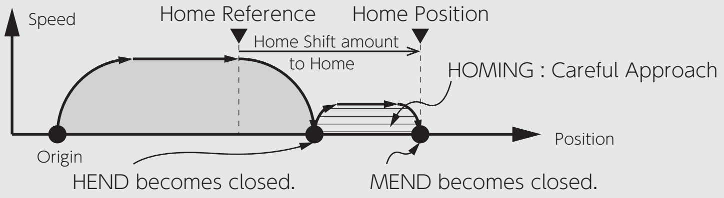
Homing

No. 647.1	Homing: Creep speed switch	Settings	Default	Characteristics
		0, 1	0	– – ON OFF –

Function Use

Enable/Disable homing motion after home reference signal detection.

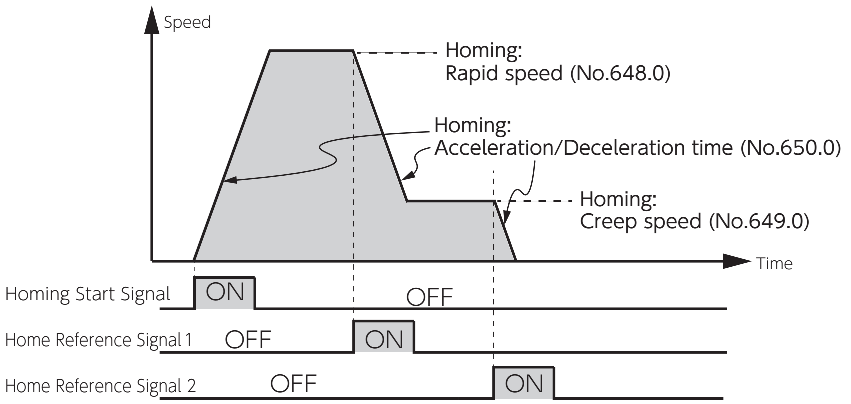
Set to 0 to only detect the home reference signal.
Set to 1 if any motions are intended after the reference signal detection.

Settings	Motion afterwards
0	None After home reference signal is detected, the motor decelerates to stop and homing completes. 
1	Move After home reference signal is detected and then the motor decelerates to stop, motion to carefully approach to the home position follows according to the parameter setting. 

No. 648.0	Homing: Rapid speed	Range	Default	Characteristics
		0 to 6,300	500 [r/min]	– – –

Function Use

Specify the speed value for rough approach motion before the home reference signal is detected.



Position Control Mode

Homing

No. 649.0	Homing: **Creep speed**	Range	Default	Characteristics
		0 to 6,300	10 [r/min]	– ⊘ – ↓ –
Function Use	Specify the speed for careful approach after the home signal is detected. To improve accuracy to detect the home reference signal, select a lower speed.			
Prerequisite	Homing: Creep speed switch (No.647.1): 1 (Move)			
Related To	No.645.0、No.647.1、No.648.0			

No. 650.0	Homing: **Acceleration/Deceleration time**	Range	Default	Characteristics
		0 to 5,000	30 [ms]	– ⊘ – ↓ –
Function Use	Set Acceleration/Deceleration Time for homing. This item indicates time amount for a speed to change 1,000 r/min. Applies to **Rapid Speed** (No.648.0) and **Creep Speed** (No.649.0)			
Remark	If the load is more than 10 times of inertia ratio, set this parameter to a value larger than the default. Otherwise, vibration may occur.			

No. 651.0	Homing: **Amount of home position shift**	Range	Default	Characteristics
		0 to 1,000,000,000	0 [C-pulse]	– ⊘ – ↓ –
Function Use	Use this parameter to set shift amount from home signal or encoder Z-phase to home.			
Related To	No.646.0			

No. 653.0	Homing: **Home position data**	Range	Default	Characteristics
		−1,000,000,000 to 1,000,000,000	0 [C-pulse]	– ⊘ – ↓ –
Function Use	This parameter value overwrites the home coordinate (ABS position feedback value) upon Homing complete.			

No. 655.0	Homing: **Time to detect press stopper**	Range	Default	Characteristics
		5 to 1,000	100 [ms]	– ⊘ – ↓ –
Function Use	This parameter indicates the torque command limiting time, which is a time amount for home to be detected after the stopper was pressed.			
Related To	No.645.0、No.647.0			

Position Control Mode

Homing

No. 656.0	Homing: Torque command limit value	Range	Default	Characteristics
		10 to 3,000	500 [0.1%]	– ⊘ – ↓ –
Function Use	This parameter indicates a ratio of torque command limit value (during homing) to the rated torque. The parameter is used as a safety measure against collisions during Homing. It is a torque command limit value in Homing by using stopper.			
Prerequisite	Homing: Home Reference Signal selection (No.645.0) = 1 (Stopper) or Torque command limit switch (No.647.0) = 1 (Enable)			
Related To	No.645.0、No.647.0			

No. 657.0	Homing: Z-phase disabled distance	Range	Default	Characteristics
		0 to1,000,000,000	0 [C-pulse]	– ⊘ – ↓ –
Function Use	Set the shift amount between a detection position of home signal and a starting position of z-phase detection.			

No. 659.0	Homing: Timeout time	Range	Default	Characteristics
		0 to 60,000	60,000 [10ms]	– ⊘ – ↓ –
Function Use	Set the timeout time for homing. This is a safety measure in case of fault during homing.			
Prerequisite	Timeout Switch (No.646.2) = 1 (Disable)			
Related To	No.646.2			

Position Control Mode

Internal Position Command

No. 643.0	Internal position: Overflow detection	Settings	Default	Characteristics
		0, 1	1	— — — ON OFF —

Function Use

Enable/Disable the multi-turn encoder counter overflow detection function for Positioner Drive using ABS value.
This function is a protective measure against absolute position loss of the encoder.

If Internal Position Command exceeds the absolute value range (± 1,073,741,823), or shift amount per one command exceeds the range (± 2,147,487,647), overflow will be detected, resulting in Alarm No.10.

Settings	Overflow Detection
0	Disable (*1)
1	Enable (*2)

*1) For repeating rotations only in one direction, when you need absolute value of single-turn angle, set **Absolute system** (No.257.0) =1 (Multi-turn counter overflow detection disabled)

*2) When you set **Absolute system** (No.257.0) = 2 (Multi-rotation counter overflow detection enabled), Alarm No.11 occurs if multi-turn data exceeds the rated range (± 32,767).
Select a value for internal position command not larger than the rated value.

Remark

- "Absolute Value" Operation using Positioner, and Testing.
  Set this parameter to "0" and the command method for point table to "relative value".
  Setting "absolute value" will result in Alarm No.10.
- When the setting was changed from "0" to "1", perform homing.

Related To No.257.0

No. 720.0 No. 740.0 … No. 1020.0	Internal Position: Point table Command method (*)	Settings	Default	Characteristics
		0, 1	0	— — — ON OFF —

Function Use

Select the command method for point table.

Settings	Command Method	Position to be set
0	Absolute value	Target position
1	Relative value	Shit amount from the current position to the target position

The internal position control point table parameters (No.720.0 or later) are not displayed on the parameter tab screen of S-TUNE Ⅱ. These parameters are displayed in the Point Table tabbed screen. See page 44 and later for detailed descriptions of the parameters.

*) See the Point Table Parameter List to look up a point number and its corresponding parameter numbers.

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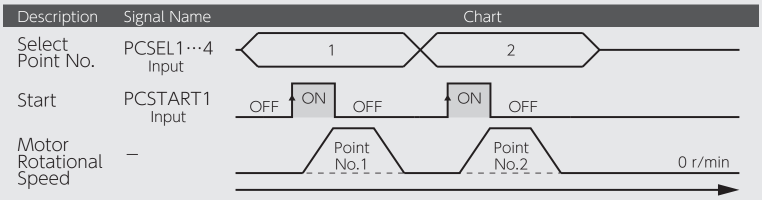
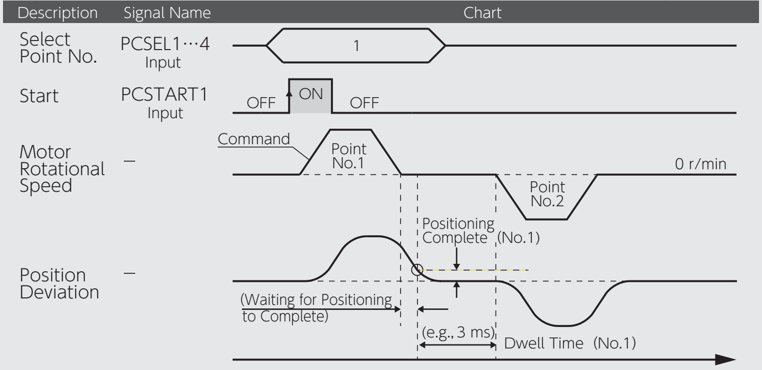
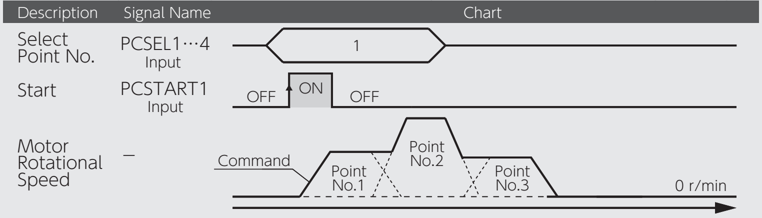
Position Control Mode
Internal Position Command

No. 720.1 No. 740.1 … No. 1020.1	Internal Position: Point table Operation (*)	Settings	Default	Characteristics
		0, 1	0	– – – ▨ –

Function Use

Select the Running Motion of Point Table.

<table>
<tr><th>Settings</th><th>Running Motion</th></tr>
<tr><td>0</td><td>Single:
After the motion commanded by this point number is complete, the subsequent point numbers will not be executed.
Example: Point No.1 and 2 are set to "Single".
 </td></tr>
<tr><td>1</td><td>Continuous:
The subsequent point number(s) will be executed one after another.

Example-1: The dwell time is set to 1 or above (for example, 3 ms).
Then positioning will be executed according to each point. After the positioning is determined to be completed, the next motion will not start until the dwell time elapses.

Example-2: The dwell time is set to 0.
The motor will keep rotating and the rotational speed will continuously change.
 </td></tr>
</table>

The internal position control point table parameters (No.720.0 or later) are not displayed on the parameter tab screen of S-TUNE Ⅱ. These parameters are displayed in the Point Table tabbed screen. See page 44 and later for detailed descriptions of the parameters.

*) See the Point Table Parameter List to look up a point number and its corresponding parameter numbers.

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Position Control Mode
Internal Position Command

No. 720.3 No. 740.3 … No. 1020.3	Internal Position: Point table Enable/Disable (*)	Settings	Default	Characteristics
		0, 1	0	— — — ON OFF —

Function Use

Enable/Disable Point Table.

Settings	Enable/Disable
0	Disable The point number assigned "disable" is not executed and any subsequent point numbers assigned "enable" are executed.
1	Enable The point number assigned "enable" is executed

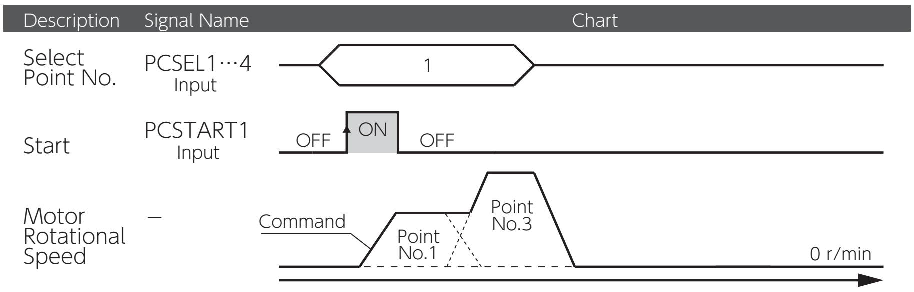
If the point number with the "disable" setting is specified,
among the subsequent point numbers, the first one with "enable" will be executed.

If there is a "disabled" point number during a series of "continuous" motions,
that "disabled" point number will not be executed and the first "enabled" subsequent point number will be executed.

If point number with "continuous" motion and "0" dwell time,
motions before and after that point number will be executed one after the other and the speed will change continuously.

Example:
If Point No.1 is specified and Start signal is input were the following Point number settings are as follows, Point No.2 will not be executed and Point No.1 and No.3 will be executed continuously.

Point No.	Motion	Dwell time	Enable/Disable
1	Continuous	0	Enable
2	Continuous	(any value)	Disable
3	Single	(any value)	Enable



■ TIP
For the last point number set to "enable" (i.e. last to be executed), set its Running Motion to "single".
If you set "continuous" to the last enabled point number, Operation Complete output (MEND) will remain off and the next motion will be not be started. If that happens, perform the following.

User I/O operation
Turn the servo off or input Clear Deviation Counter.

S-TUNE Ⅱ operation
Turn the servo off or click the STOP button.

Position Control Mode

Internal Position Command

No. 722.0 No. 742.0 … No. 1022.0	Internal Position: Point table Position $^{(*)}$	Range	Default	Characteristics
		−1,073,741,823 to +1,073,741,823	0 [E-pulse]	– – – 0 100 –
Function Use	Set the target position in Point Table. ■ If Relative Value is selected as the Command method, position data will determine the shift amount. Enter a positive value for CCW rotation or a negative value for CW rotation. ■ If Absolute Value is selected as the Command method, position data will determine the target position. This value corresponds to ABS Position Command value (Status No.74).			
Related To	No.643.0			

No. 724.0 No. 744.0 … No. 1024.0	Internal Position: Point table Rotational speed $^{(*)}$	Range	Default	Characteristics
		0 to 6,300	0 [r/min]	– – – 0 100 –
Function Use	Set the motor rotational speed for the Point Table. Set this to a speed no higher than the max rotational speed of the motor.			

No. 726.0 No. 746.0 … No. 1026.0	Internal Position: Point table Acceleration time $^{(*)}$	Range	Default	Characteristics
		0 to 5,000	30 [ms]	– – – 0 100 –
Function Use	Set the acceleration time for the Point table. This item indicates the amount of time for a speed command to change from 0 r/min to 1,000 r/min. In the default setting, it takes 90 ms for the rotational speed to change from 0 r/min to 3,000 r/min.			

No. 727.0 No. 747.0 … No. 1027.0	Internal Position: Point table Deceleration time $^{(*)}$	Range	Default	Characteristics
		0 to 5,000	30 [ms]	– – – 0 100 –
Function Use	Set the deceleration time for the Point Table. This item indicates the amount of time for a speed command to change from 0 r/min to 1,000 r/min. In the default setting, it takes 90 ms for the rotational speed to change from 3,000 r/min to 0 r/min.			

The internal position control point table parameters (No.720.0 or later) are not displayed on the parameter tab screen of S-TUNE Ⅱ. These parameters are displayed in the Point Table tabbed screen. See page 44 and later for detailed descriptions of the parameters.

*) See the Point Table Parameter List to look up a point number and its corresponding parameter numbers.

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Position Control Mode

Internal Position Command

No. 728.0 No. 748.0 … No. 1028.0	Internal Position: Point table Dwell time (*)	Range	Default	Characteristics
		0 to 20,000	1 [ms]	– – – ▨ –

Function Use

Set the dwell time for the Point Table.

Dwell time is the wait time for the next Point-Table motion to be executed after a Point-Table motion is complete.

■ Motion after the dwell time elapses:
Single motion: MEND will be ON.
Continuous motions: the motion commanded by the next point number will start.

If Running Motion is "Continuous" and the dwell time is set to 0, the motion will be according to the speed assigned by point numbers -one after another continuously. If the dwell time is set to 0, the acceleration/deceleration setting in the first point number selected upon CW start PCSTART1 ON will be applied, and the settings of subsequent point numbers will be discarded.

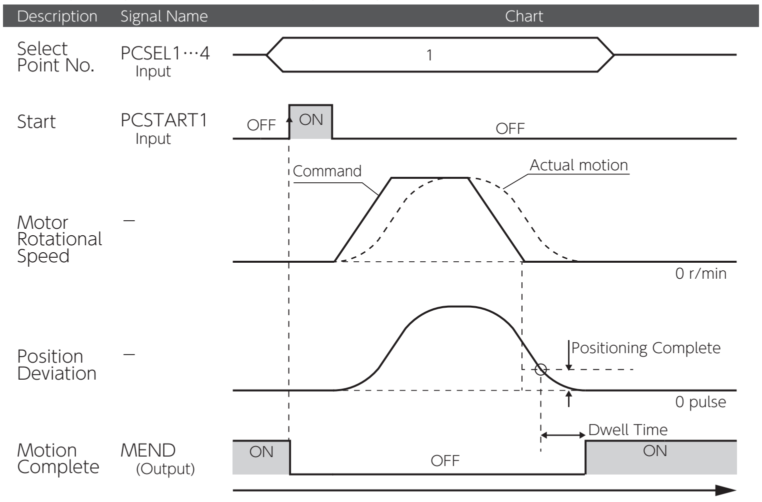
No. 729.0 No. 749.0 … No. 1029.0	Internal Position: Point table Positioning completion (*)	Range	Default	Characteristics
		0 to 32,767	20 [E-pulse]	– – – ▨ –

Function Use

Set the range for positioning complete by the Point table.

Set a position deviation threshold to determine whether or not positioning is complete.
After the motion specified by the point number has been complete, when the position deviation falls in the range set by this item and then the Dwell time elapses, the MEND (motion end) signal turns ON.

■ **Timing Diagram** of Positioning Complete and Dwell Time



Position Control Mode

Internal Position Command

Point Table Parameter List

Point No.	Position [C-pulse]	Rotational speed [r/min]	Acceleration time [ms]	Deceleration time [ms]	Command method [-]	Dwell time [ms]	Operation [-]	Positioning completion [E-pulse]	Enable /Disable [-]
0	No. 722.0	No. 724.0	No. 726.0	No. 727.0	No. 720.0	No. 728.0	No. 720.1	No. 729.0	No. 720.3
1	No. 742.0	No. 744.0	No. 746.0	No. 747.0	No. 740.0	No. 748.0	No. 740.1	No. 749.0	No. 740.3
2	No. 762.0	No. 764.0	No. 766.0	No. 767.0	No. 760.0	No. 768.0	No. 760.1	No. 769.0	No. 760.3
3	No. 782.0	No. 784.0	No. 786.0	No. 787.0	No. 780.0	No. 788.0	No. 780.1	No. 789.0	No. 780.3
4	No. 802.0	No. 804.0	No. 806.0	No. 807.0	No. 800.0	No. 808.0	No. 800.1	No. 809.0	No. 800.3
5	No. 822.0	No. 824.0	No. 826.0	No. 827.0	No. 820.0	No. 828.0	No. 820.1	No. 829.0	No. 820.3
6	No. 842.0	No. 844.0	No. 846.0	No. 847.0	No. 840.0	No. 848.0	No. 840.1	No. 849.0	No. 840.3
7	No. 862.0	No. 864.0	No. 866.0	No. 867.0	No. 860.0	No. 868.0	No. 860.1	No. 869.0	No. 860.3
8	No. 882.0	No. 884.0	No. 886.0	No. 887.0	No. 880.0	No. 888.0	No. 880.1	No. 889.0	No. 880.3
9	No. 902.0	No. 904.0	No. 906.0	No. 907.0	No. 900.0	No. 908.0	No. 900.1	No. 909.0	No. 900.3
10	No. 922.0	No. 924.0	No. 926.0	No. 927.0	No. 920.0	No. 928.0	No. 920.1	No. 929.0	No. 920.3
11	No. 942.0	No. 944.0	No. 946.0	No. 947.0	No. 940.0	No. 948.0	No. 940.1	No. 949.0	No. 940.3
12	No. 962.0	No. 964.0	No. 966.0	No. 967.0	No. 960.0	No. 968.0	No. 960.1	No. 969.0	No. 960.3
13	No. 982.0	No. 984.0	No. 986.0	No. 987.0	No. 980.0	No. 988.0	No. 980.1	No. 989.0	No. 980.3
14	No. 1002.0	No. 1004.0	No. 1006.0	No. 1007.0	No. 1000.0	No. 1008.0	No. 1000.1	No. 1009.0	No. 1000.3
15	No. 1022.0	No. 1024.0	No. 1026.0	No. 1027.0	No. 1020.0	No. 1028.0	No. 1020.1	No. 1029.0	No. 1020.3

The internal position control point table parameters (No.720.0 or later) are not displayed on the parameter tab screen of S-TUNE Ⅱ. These parameters are displayed in the Point Table tabbed screen. See page 44 and later for detailed descriptions of the parameters.

3. Velocity Control Mode

Velocity Control Mode

Velocity Command Input

No. 62.0 (203Eh)	EtherCAT Communication Velocity command: Rotational direction	Settings	Default	Characteristics
		0, 1	1	– –
Function Use	Select the rotational direction of EtherCAT Communication velocity command input.			

Settings	Negative Voltage Input	Positive Voltage Input
0	CCW Rotation	CW Rotation
1	CW Rotation	CCW Rotation

Velocity Control Mode

Tuning Parameters

No. 129.0 (2081h)	Tuning: Velocity control mode - Control gain set	Range	Default	Characteristics
		1 to 46	15 [-]	▣ – – ▨ –

Function Use

Set the Control Gain Set for Velocity Control Mode.
With this, Control gain 1 (No.131.0) and Integral gain (No.133.0) will be set to the default together.

■ **Noise Solutions**
① Use **Torque command filter: Notch filter** (such as No.160.1)
② Decrease **Integral gain** (No.133.0)

If the above does not work, lower the Control Grain Set.

Setting	Command Response	Rigidity	Settling Time	Possibility of Noise
1	Slower	Lower	Longer	Lower
↕	↕	↕	↕	↕
46	Faster	Higher	Shorter	Higher

Prerequisite	Velocity Control Mode
Remark	· Too large a value may result in noise. · If **Torque command filter: Low-pass filter constant** (No.162.0) is set to 1 (auto setting ON), **Torque command filter: Low-pass filter auto setting** (No.160.2) will be included in the gain set.
Related To	No.131.0、No.132.0、No.133.0、No.162.0

No. 130.0 (2082h)	Tuning: Velocity control mode - Control level	Range	Default	Characteristics
		1 to 46	15 [-]	▣ – – ▨ –

Function Use

Specify the Control Level for Velocity Control Mode.

Set **Control Gain 1** (No.131.0) to the preset value which was prepared every established each control level.

■ **Noise Solutions**
① Use **Torque command filter: Notch filter** (such as No.160.1).
② Decrease **Integral Gain** (No.133.0).

If any of the above does not work, then lower the **Control Level**.

Setting	Command Response	Rigidity	Settling Time	Possibility of Noise
1	Slower	Lower	Longer	Lower
↕	↕	↕	↕	↕
46	Faster	Higher	Shorter	Higher

Prerequisite	Velocity Control Mode
Remark	Setting Control Level will invalidate the setting of **Control gain set** (No.129.0).
Related To	No.129.0、No.131.0、No.133.0、No.162.0

The following common parameters are described in "position control tuning parameter".
No.102.0, No.103.0, No.106.0, No.110.0, No.110.1

Velocity Control Mode

Tuning Parameters

No. 131.0 (2083h)	Tuning: Velocity control mode - Control gain 1	Range	Default	Characteristics
		100 to 6,000	399 [rad/s]	▣ — — ▨ —
Function Use	Set Control Gain 1 for Velocity Control Mode. The larger this parameter is, the smaller the speed deviation of the command being input becomes. Increasing this parameter value provides faster command response; however, too large a value may result in noise. ■ Noise Solutions ① Use **Torque command filter: Notch filter** (such as No.160.1). ② Decrease **Integral Gain** (No.133.0). If any of the above does not work, lower the **Control Gain 1**.			
Prerequisite	Velocity Control Mode			
Remark	Making a change to any of the following will also change other tuning parameters (such as Gain FF Compensation 1) to the prearranged parameter set all at once. · **Control gain set** (No.129.0) · **Control level** (No.130.0)			
Related To	No.129.0、No.130.0、No.132.0			

No. 132.0 (2084h)	Tuning: Velocity control mode - Gain FF compensation 1	Range	Default	Characteristics
		0 to 15,000	0 [0.01%]	▣ — — ▨ —
Function Use	Set Field Forward Compensation Rate with respect to Control Gain 1 for Velocity Control Mode. Increase the value of this parameter to provide faster command response. In the event of noise, decrease the setting value a little.			
Prerequisite	Velocity Control Mode			
Related To	No.129.0、No.130.0、No.131.0、No.133.0、No.162.0			

No. 133.0 (2085h)	Tuning: Velocity control mode - Integral gain	Range	Default	Characteristics
		45 to 5,000	300 [rad/s]	▣ — — ▨ —
Function Use	Set the Integral Gain for Velocity Control Mode. Increase the value of Integral Gain to improve the convergence (interfered by friction or load fluctuation) at the time of settling, and reduce position deviations. This will result in rigid and sensitive motions. ■ Noise Solutions ① Use **Torque command filter: Notch filter** (such as No.160.1). ② Decrease the value of **Integral Gain**.			
Prerequisite	Velocity Control Mode			
Remark	This parameter will reset to the prearranged value if Inertia conditions or **Control Gain Set** is changed.			
Related To	No.129.0、No.130.0、No.131.0、No.132.0、No.162.0			

4. Torque Control Mode

Torque Control Mode

Torque Command Input

T CTRL

		Range	Default	Characteristics
No. 152.0 (6080h)	EtherCAT Communication Torque command: Speed Limit	0 to 10,000	Max. motor speed [r/min]	▣ – 🔒 ▣ –
Function Use	Set the speed limit for Torque Control Mode.			
Prerequisite	Torque Control Mode			

		Settings	Default	Characteristics
No. 302.0 (212Eh)	EtherCAT Communication Torque command: Direction of rotation	0, 1	1	▣ – – ▣ –
Function Use	Specify the rotational direction of EtherCAT Communication torque command input.			

Settings	Negative Voltage Input	Positive Voltage Input
0	CCW Rotation	CW Rotation
1	CW Rotation	CCW Rotation

5. Vibration Suppress Filter

Vibration suppress filter
Position Command Filter

<table>
<tr><th rowspan="2">No. 66.0
(2042h)</th><th rowspan="2">Position command filter 1:
Selection</th><th>Settings</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>0 to 3</td><td>0</td><td>▣ — — B ⏻</td></tr>
<tr><td>Function
Use</td><td colspan="4">Select no filter or one of the three filters:
<table>
<tr><th>Settings</th><th>Filter Type</th></tr>
<tr><td>0</td><td>No filter</td></tr>
<tr><td>1</td><td>Smoothing Filter 1</td></tr>
<tr><td>2</td><td>Notch filter</td></tr>
<tr><td>3</td><td>γ -Notch Filter</td></tr>
</table></td></tr>
<tr><td>Remark</td><td colspan="4">If you are to use Smoothing Filter 1, try Filter 4 (Smoothing Filter 2) first.</td></tr>
<tr><td>Related To</td><td colspan="4">No.80.0、No.74.0、No.75.0、No.76.0、No.79.0</td></tr>
</table>

<table>
<tr><th rowspan="2">No. 66.1</th><th rowspan="2">Position command filter 4:
Selection</th><th>Settings</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>0, 1</td><td>1</td><td>— — — ON OFF ⏻</td></tr>
<tr><td>Function
Use</td><td colspan="4">Enable/Disable Position command Smoothing Filter 2 for Filter 4.
<table>
<tr><th>Settings</th><th>Filter</th></tr>
<tr><td>0</td><td>Disable</td></tr>
<tr><td>1</td><td>Enable</td></tr>
</table></td></tr>
<tr><td>Remark</td><td colspan="4">If you are to use Smoothing Filter 1, try Filter 4 (Smoothing Filter 2) first.</td></tr>
<tr><td>Related To</td><td colspan="4">No.81.0</td></tr>
</table>

Vibration suppress filter

Position Command Filter

No. 74.0 (204Ah)	Position command filter 1: Notch frequency	Range	Default	Characteristics
		10 to 2,000	10 [0.1Hz]	– –

Function Use

Set the notch frequency for Position command filter 1.

Prerequisite	Position command filter 1: Type (No.66.0) = 2 (Notch filter) or 3 (γ -Notch filter)
Related To	No.66.0、No.75.0、No.76.0、No.79.0

No. 75.0 (204Bh)	Position command filter 1: Notch width	Range	Default	Characteristics
		128 to 2,048	512 [-]	– –

Function Use

Set the width of notch of Position Command Filter 1.

Setting	Notch Width
Smaller	Narrower
Larger	Wider

Prerequisite	Position command filter 1: Type (No.66.0) = 2 (Notch filter)
Related To	No.66.0、No.74.0、No.79.0

No. 76.0 (204Ch)	Position command filter 1: High frequency gain	Range	Default	Characteristics
		50 to 200	100 [-]	– –

Function Use

Set the high frequency gain of Position Command Filter1.

Setting	Effect
50	x0.25
100	x1
200	x4

Smaller setting value gives better vibration suppression.
Larger setting value gives faster motion.

Prerequisite	Position command filter 1: Type (No.66.0) = 3 (γ -Notch filter).
Related To	No.66.0、No.74.0、No.79.0

No. 79.0 (204Fh)	Position command filter 1: Notch depth	Range	Default	Characteristics
		0 to 100	0 [-]	– –

Function Use

Set the notch depth of Position command filter 1.

Setting	Notch Depth
0	Complete shutoff of notch frequency input
100	100% pass-through

Smaller setting value gives deeper filter.
Larger setting value gives shallower filter.

Prerequisite	Position command filter 1: Type (No.66.0) = 2 (Notch filter) or 3 (γ -Notch filter)
Related To	No.66.0、No.74.0、No.75.0、No.76.0

Vibration suppress filter

Position Command Filter

No.	Name	Range	Default	Characteristics
No. 80.0 (2050h)	Position command filter 1: Smoothing 1 - Moving average counter	1 to 6,250	40 [-]	– –
No. 81.0 (2051h)	Position command filter 4: Smoothing 2 - Moving average counter	1 to 1,250	16 [-]	

Function Use

These items are used to smooth the speed changes in high deceleration/acceleration, and can be used to suppress vibrations at settling time as well.

Use Filter 4 (Smoothing Filter 2) first.
To increase the smoothing effect further, use Filter 1 (Smoothing filter 1).

A larger value makes acceleration and deceleration smoother, but the response will become slower.
See the table below for the delay time calculation formula.
Filter 4 (Smoothing Filter 2) suppress the vibrations caused by the Gain FF compensation 2.

Delay time Calculation Formula
100 μs × Moving average count = Delay time

■ Setup of Vibration Suppression
Positioning will take longer as much as the delay time specified above. Set this item within the range acceptable to the equipment.
① Check the vibration interval in waveforms of position deviation and torque command at settling time.
② Calculate the moving average count as described below.
③ Using Filter 4 may reduce the resonant vibrations.
④ If suppression of the vibrations is not effective enough, recalculate the moving average count based on the vibration interval, and set it to Filter 1.

Moving average count and Vibration interval to compress
10,000 × Vibration interval [s] = Moving average count

Prerequisite

Position command filter 1: Selection (No.66.0) = 1 (Smoothing filter 1)
Position command filter 4: Selection (No.66.1) = 1 (Enable)

Remark

Before setting this parameter, wait at least 3 secs after the motor stops. In addition, configure it where the C-pulse is not being input.
Setting this parameter during pulse input or presence of residual pulse could cause positioning failure.
The larger the setting is, the longer the delay time from command input becomes.

The default value of Position command filter 1: Type (No.66.0) is 0 (no filter).

Related To

No.66.0、No.66.1

Vibration suppress filter

Position Command Filter

No. 82.0 (2052h)	Position command filter 2: Selection	Settings	Default	Characteristics
		0 to 3	0	– –

Function Use

Set the Position Command Filter 2.

Settings	Filter Type
0	No filter
1	Reserved (Do not use)
2	Notch filter
3	γ-Notch Filter

Related To	No.83.0、No.84.0、No.85.0、No.86.0

No. 82.1 (2052h)	Position command filter 3: Selection	Settings	Default	Characteristics
		0 to 3	0	– –

Function Use

Set Position Command Filter 3.

Settings	Filter Type
0	No filter
1	Reserved (Do not use)
2	Notch filter
3	γ-Notch Filter

Related To	No.357.0、No.358.0、No.359.0、No.360.0

No. 83.0 (2053h)	Position command filter 2: Notch frequency	Range	Default	Characteristics
		10 to 2,000	10 [0.1Hz]	– –
Function Use	Set the notch frequency for Position command filter 2.			
Prerequisite	Position command filter 2: Select (No.82.0) = 2 (Notch filter) or 3 (γ-Notch filter)			
Related To	No.82.0、No.84.0、No.85.0、No.86.0			

No. 84.0 (2054h)	Position command filter 2: Notch width	Range	Default	Characteristics
		128 to 2,048	512 [-]	– –

Function Use

Set the notch width of Position Command Filter 2.

Setting	Notch Width
Smaller	Narrower
Larger	Wider

Prerequisite	Position command filter 2: Select (No.82.0) = 2 (Notch filter)
Related To	No.82.0、No.83.0、No.85.0、No.86.0

Vibration suppress filter

Position Command Filter

No. 85.0 (2055h)	Position command filter 2: High frequency gain	Range	Default	Characteristics
		50 to 200	100 [-]	– –

Function Use

Set the high frequency gain for Position Command Filter 2.

Setting	Effect
50	x0.25
100	x1
200	x4

Smaller setting value gives better vibration suppression.
Larger setting value gives faster motion.

Prerequisite	Position command filter 2: Type (No.82.0) = 3 (γ-Notch Filter)
Related To	No.82.0、No.83.0、No.86.0

No. 86.0 (2056h)	Position command filter 2: Notch depth	Range	Default	Characteristics
		0 to 100	0 [-]	– –

Function Use

Specify the notch depth of Position Command Filter2.

Setting	Effect
0	Complete shutoff of notch frequency input
100	100% pass-through

Smaller setting value gives deeper filter.
Larger setting value gives shallower filter.

Prerequisite	Position command filter 2: Select (No.82.0) = 2 (Notch filter) or 3 (γ-Notch filter)
Related To	No.82.0、No.83.0、No.84.0、No.85.0

Vibration suppress filter

Position Command Filter

		Range	Default	Characteristics
No. 357.0 (2165h)	Position command filter 3: Notch frequency	10 to 2,000	10 [0.1Hz]	– –

Function Use	Set the notch frequency for Position Command Filter 3.
Prerequisite	Position command filter 3: Type (No.82.1) = 2 (Notch filter) or 3 (γ -Notch Filter)
Related To	No.82.1、No.358.0、No.359.0、No.360.0

		Range	Default	Characteristics
No. 358.0 (2166h)	Position command filter 3: Notch width	128 to 2,048	512 [-]	– –

Function Use: Set the width of notch of Position Command Filter3.

Setting	Notch Width
Smaller	Narrower
Larger	Wider

Prerequisite	Position command filter 3: Type (No.82.1) = 2 (Notch filter)
Related To	No.82.1、No.357.0、No.360.0

		Range	Default	Characteristics
No. 359.0 (2167h)	Position command filter 3: High frequency gain	50 to 200	100 [-]	– –

Function Use: Set the high frequency gain for Position Command Filter3.

Setting	Effect
50	x0.25
100	x1
200	x4

Smaller setting value gives better vibration suppression. Larger setting value gives faster motion.

Prerequisite	Position command filter 3: Type (No.82.1) = 3 (γ -Notch Filter)
Related To	No.82.1、No.357.0、No.360.0

		Range	Default	Characteristics
No. 360.0 (2168h)	Position command filter 3: Notch depth	0 to 100	0 [-]	– –

Function Use: Set the depth for Position Command Filter 3.

Setting	Notch Depth
0	Complete shutoff of notch frequency input
100	100% pass-through

Smaller setting value gives deeper filter. Larger setting value gives shallower filter.

Prerequisite	Position command filter 3: Type (No.82.1) = 2 (Notch filter) or 3 (γ -Notch Filter)
Related To	No.82.1、No.357.0、No.358.0、No.359.0

Vibration suppress filter

Torque Command Filter

P V T SUPP

No.	Name	Settings	Default	Characteristics
No. 160.0 (20A0h)	Torque command filter: Low-pass filter - Switch	0, 1	1	▮ – – ON/OFF –

Function Use

Enable/Disable Low-pass filter.

This filter is a first-order IIR filter.

Settings	First-order IIR filter
0	Disable
1	Enable

Related To No.113.0、No.160.2、No.162.0

No.	Name	Settings	Default	Characteristics
No. 160.1 (20A0h)	Torque command filter: Notch filter - Switch	0, 1	0	▮ – – ON/OFF –

Function Use

Enable/Disable Notch filter.

Settings	Notch filter
0	Disable
1	Enable

Related To No.168.0、No.169.0、No.170.0

No.	Name	Settings	Default	Characteristics
No. 160.2 (20A0h)	Torque command filter: Low-pass filter - Auto setting	0, 1	0	▮ – – ON/OFF –

Function Use

Enable/Disable the automatic configuration of [Torque command filter: Low-pass filter time constant (No.162.0)] according to the settings of the control gain sets; Position Control Mode (No.113.0) and Velocity Control Mode (No.129.0).

Settings	Auto setting
0	Auto setting OFF
1	Auto setting ON

Prerequisite Torque command filter: Low-pass filter switch (No.160.0) = 1 (Enable)

Related To No.113.0、No.129.0、No.160.0、No.162.0

No.	Name	Settings	Default	Characteristics
No. 160.3 (20A0h)	Torque command filter: Notch filter 2 - Switch	0, 1	0	▮ – – ON/OFF –

Function Use

Enable/Disable Torque command Notch filter 2

Settings	Torque command- Notch filter 2
0	Disable
1	Enable

Related To No.171.0, No.172.0, No.173.0

Vibration suppress filter

Torque Command Filter

P V T SUPP

No. 162.0 (20A2h)	Torque command filter: **Low-pass filter - Time constant**	Range	Default	Characteristics
		0 to 65,535	(See below) [0.01 ms]	▣ − − ▨ −
Function Use	Set the primary IIR filter time constant of [Torque command filter: Low-pass filter switch (No.160.0)] = 1 (Enable) Condition for Time Constant: $\frac{(0.1 \text{ to } 0.2)}{\max((\omega 1+\omega 2), \omega_q)}$ [s] or below ■ Default Each motor series have their own default values.			
Prerequisite	Torque command filter: Low-pass filter switch (No.160.0) = 1 (Enable)			
Remark	Example: Calculating in time unit and converting to frequency 20 [0.01 ms/rad] → 5,000 rad/s (equivalent to 796 Hz)			
Related To	No.113.0、No.160.0、No.160.2			

Motor Capacity	Default [0.01 ms]
50 W to 750 W	0
1 kW to 2 kW	10

No. 168.0 (20A8h)	Torque command filter: **Notch filter - Frequency**	Range	Default	Characteristics
		0 to 2,500	2,500 [Hz]	▣ − − ▨ −
Function Use	Set the notch frequency for the Torque command filter - notch filter. This item is measured with S-TUNE Ⅱ .			
Prerequisite	Torque command filter: Notch filter switch (No.160.1) = 1 (Enable)			
Related To	No.160.1、No.169.0、No.170.0			

No. 169.0 (20A9h)	Torque command filter: **Notch filter - Width**	Range	Default	Characteristics
		1 to 16	8	▣ − − ▨ −
Function Use	Set the notch width of torque command notch filter. In the default setting of this parameter, notch width=notch frequency (a factor of x1). The larger this item is, the larger the notch width is. In the case of multiple notch frequencies, this item increases the notch width.			
Prerequisite	Torque command filter: Notch filter switch (No.160.1) = 1 (Enable)			
Related To	No.160.1、No.168.0、No.170.0			

Setting	Factor	Notch Width
16	x2	Large
12	x1.5	↕
8	x1	
4	x0.5	Small

Vibration suppress filter

Torque Command Filter

P V T SUPP

No. 170.0 (20AAh)	Torque command filter: **Notch filter - Depth**	Range	Default	Characteristics
		0 to 256	0 [-]	▣ – – ▣ –

Function Use

Set the depth at the notch frequency of Torque command Notch filter.

Setting	Notch Depth
0	Complete shutoff of notch frequency input
↕	↕
256	100% pass-through

- The larger this item is, the shallower the notch depth is.
- If the noise cannot be eliminated by setting a notch filter, increase the setting gradually (e.g., 50, 100, 150 and so on), which decreases the notch depth.

Prerequisite	Torque command filter: Notch filter switch (No.160.1) = 1 (Enable)
Related To	No.160.1 No.168.0 No.169.0

No. 171.0 (20ABh)	Torque command filter: **Notch filter 2 - Frequency**	Range	Default	Characteristics
		0 to 2,500	2,500 [Hz]	▣ – – ▣ –

Function Use	Set the notch frequency of torque command notch filter 2.
Prerequisite	Torque command filter: Notch filter 2 switch (No.160.3) = 1 (Enable)
Related To	No.160.3、No.172.0、No.173.0

No. 172.0 (20ACh)	Torque command filter: **Notch filter 2 - Width**	Range	Default	Characteristics
		1 to 16	8	▣ – – ▣ –

Function Use

Set the notch width of torque command notch filter 2.

In the default setting of this parameter, notch width=notch frequency (a factor of x1).
The larger this item is, the larger the notch width is.
In the case of multiple notch frequencies, this item increases the notch width.

Setting	Factor	Notch Width
16	x2	Large
12	x1.5	↕
8	x1	
4	x0.5	Small

Prerequisite	Torque command filter: Notch filter 2 switch (No.160.3) = 1 (Enable)
Related To	No.160.3、No.171.0、No.173.0

Vibration suppress filter

Torque Command Filter

No. 173.0 (20ADh)	Torque command filter: Notch filter 2 - Depth	Range	Default	Characteristics
		0 to 256	0 [-]	— — —

Function Use

Set the depth at the notch frequency of Torque command Notch filter 2.

Setting	Notch Depth
0	0% pass-through
↕	↕
256	100% pass-through

- The larger this item is, the shallower the notch depth is.
- If the noise cannot be eliminated by setting a notch filter, increase the setting gradually (e.g., 50, 100, 150 and so on), which decreases the notch depth.

Prerequisite	Torque command filter: Notch filter switch (No.160.1) = 1 (Enable)
Related To	No.160.3、No.171.0、No.172.0

3

Tuning

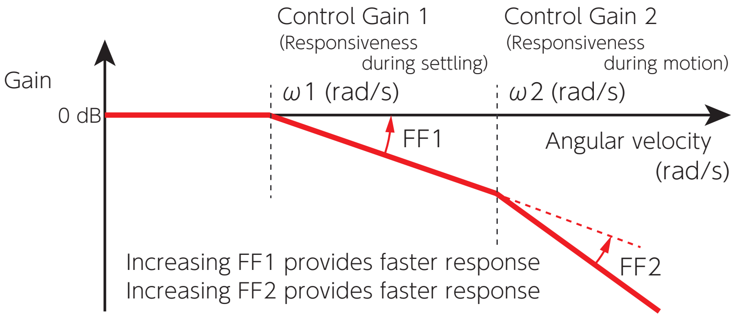
1. Introduction

The goal of amplifier tuning is having a good control over the motor and optimizing equipment performance in responding to commands from the host controller.

The position control method employs two degrees of freedom with the model-matching control. This method enables you to adjust command response and turbulence response independently without compromising the stability of your equipment.

S-FLAG Ⅱ is a servo system that does not let overshooting and undershooting happen when the equipment inertia ratio is set appropriately.

S-FLAG Ⅱ features response models with two cutoff frequencies: ω 1 (Control Gain 1) and ω 2 (Control Gain 2)



Response model for position control and two cutoff frequencies

Code	EFFECT
ω 1 Control Gain 1	Responsiveness at settling Increasing this item will reduce the position deviation at settling (after command ends).
ω 2 Control Gain 2	Responsiveness during operation Increasing this item will reduce the position deviation during operation (while command being input).
FF1 FF Compensation 1	Command compensation for ω 1 Increasing this item will improve the ω 1 response.
FF2 FF Compensation 2	Command compensation for ω 2 Increasing this item will improve the ω 2 response.

The relation between cutoff frequencies and control gain parameters.

- Position loop gain (*1) : $\frac{\omega 1 \omega 2}{\omega 1 + \omega 2}$
- Velocity loop gain (*2) : $\omega 1 + \omega 2$

---

*1) Position loop gain It is equivalent to the “Kp” in a P-PI control.
*2) Velocity loop gain It is equivalent to the “Kv” in a P-PI control.

1. Introduction

Control Gain Set

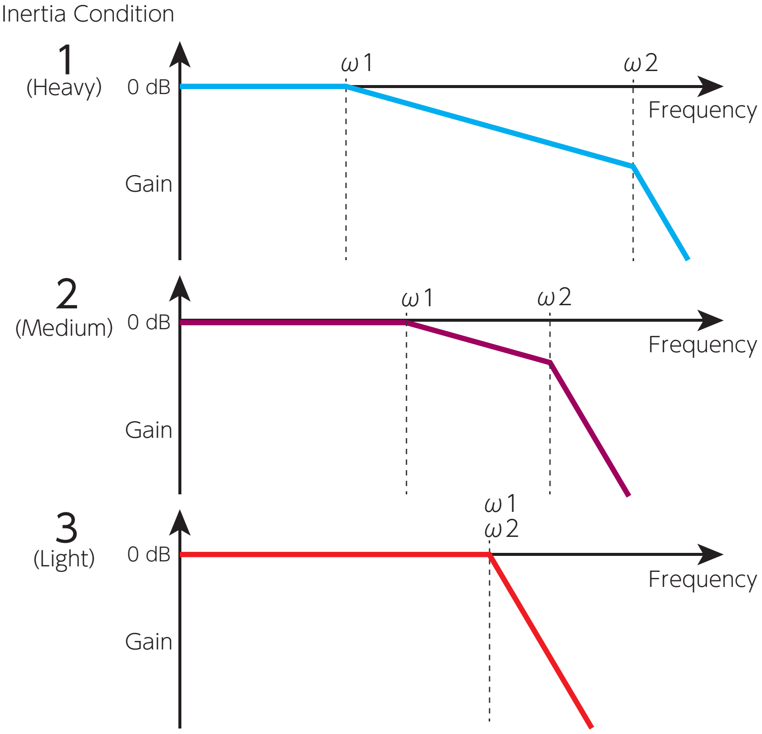
The following prearranged sets of parameters for each control mode enable you to perform tuning easily. (*)

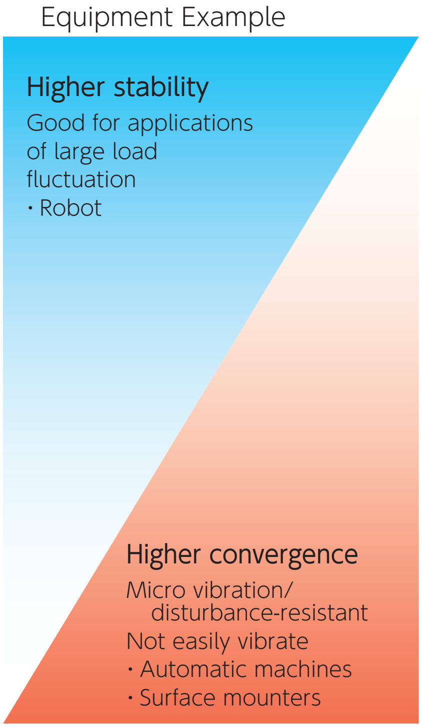
*) If the [Torque command filter: Low-pass filter auto setting (No.160.2)] is set to 1(auto setting ON), "Torque command filter: Low-pass filter" will be included in the gain set.

Control Mode	Parameter Set
Position Control Mode P	Control Gain 1, Control Gain 2, Integral Gain
Velocity Control Mode V	Control Gain 1, Integral Gain

Inertia Condition

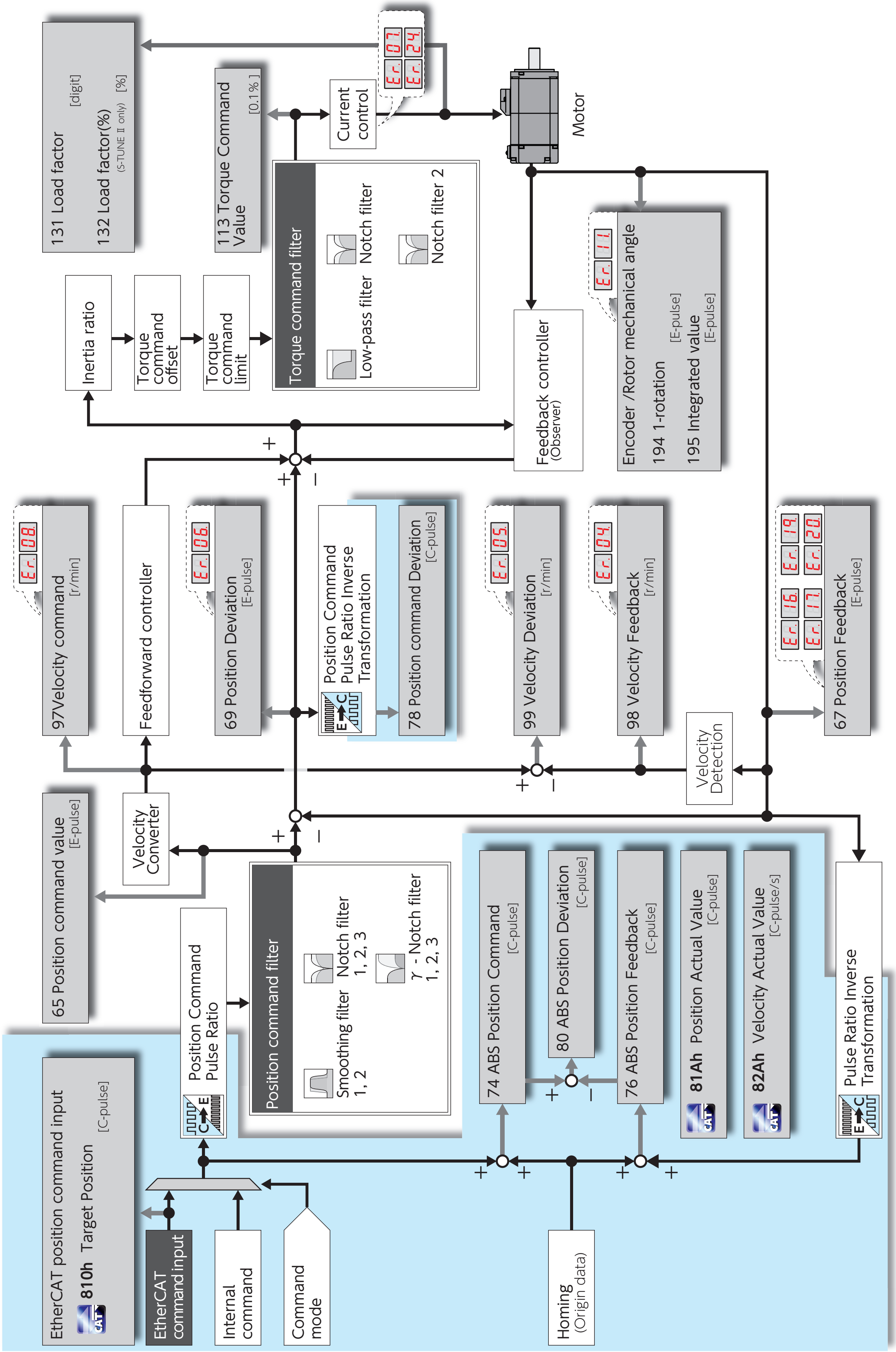
S-FLAG Ⅱ features three response models to support a variety of equipment.
Three models are different in ratios of Control Gain 1 (ω 1) and Control Gain 2 (ω 2) and you can select the one suitable to the stability and convergence of your equipment.



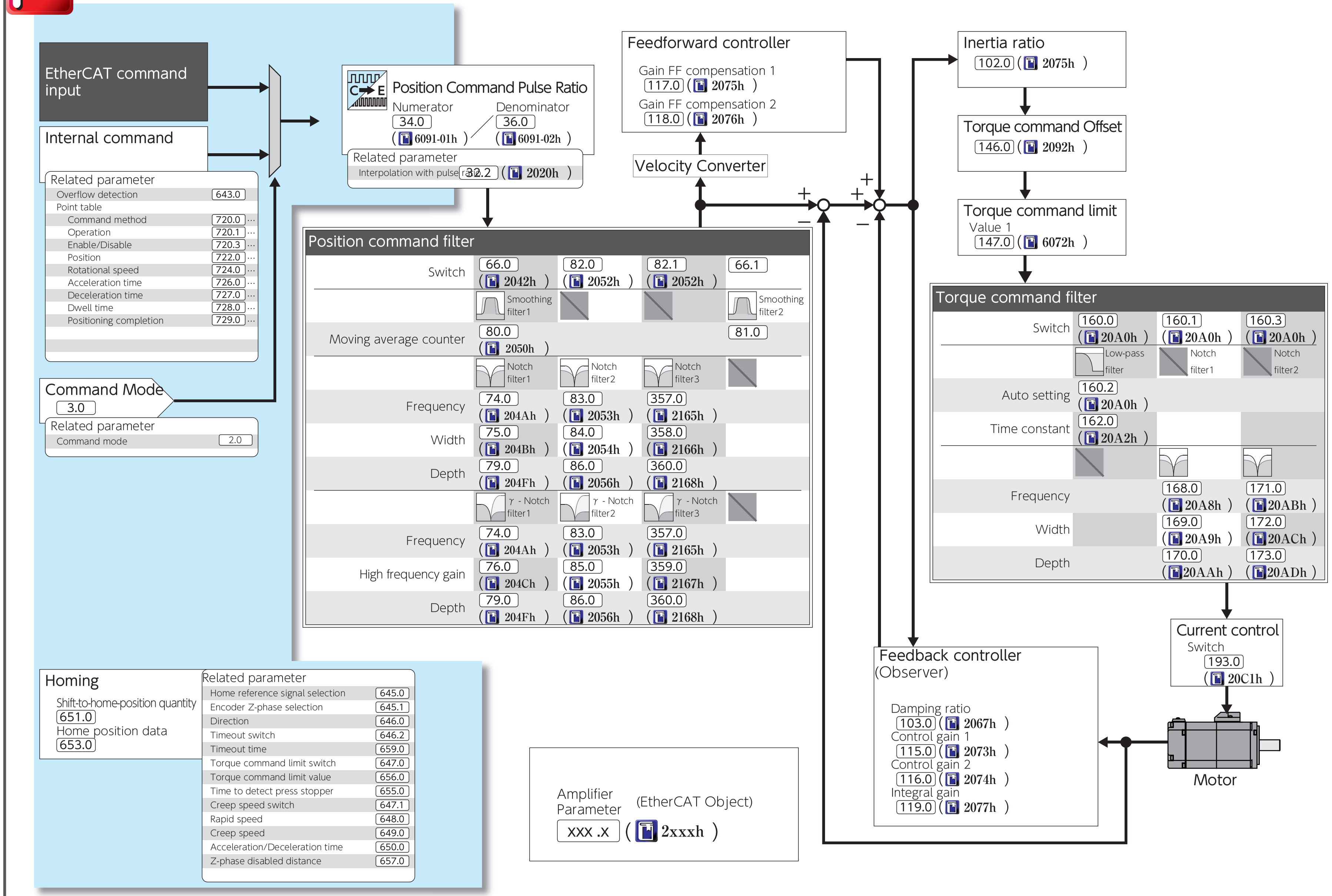


1. Introduction

1. Control Block Diagram



Position Control Mode (Related parameter)



Internal command — Related parameter

Overflow detection	643.0
Point table	
Command method	720.0 …
Operation	720.1 …
Enable/Disable	720.3 …
Position	722.0 …
Rotational speed	724.0 …
Acceleration time	726.0 …
Deceleration time	727.0 …
Dwell time	728.0 …
Positioning completion	729.0 …

Command Mode — Related parameter

Command mode	2.0

Position command filter

Switch	66.0 (2042h)	82.0 (2052h)	82.1 (2052h)	66.1
	Smoothing filter1			Smoothing filter2
Moving average counter	80.0 (2050h)			81.0
	Notch filter1	Notch filter2	Notch filter3	
Frequency	74.0 (204Ah)	83.0 (2053h)	357.0 (2165h)	
Width	75.0 (204Bh)	84.0 (2054h)	358.0 (2166h)	
Depth	79.0 (204Fh)	86.0 (2056h)	360.0 (2168h)	
	γ - Notch filter1	γ - Notch filter2	γ - Notch filter3	
Frequency	74.0 (204Ah)	83.0 (2053h)	357.0 (2165h)	
High frequency gain	76.0 (204Ch)	85.0 (2055h)	359.0 (2167h)	
Depth	79.0 (204Fh)	86.0 (2056h)	360.0 (2168h)	

Torque command filter

Switch	160.0 (20A0h)	160.1 (20A0h)	160.3 (20A0h)
	Low-pass filter	Notch filter1	Notch filter2
Auto setting	160.2 (20A0h)		
Time constant	162.0 (20A2h)		
Frequency		168.0 (20A8h)	171.0 (20ABh)
Width		169.0 (20A9h)	172.0 (20ACh)
Depth		170.0 (20AAh)	173.0 (20ADh)

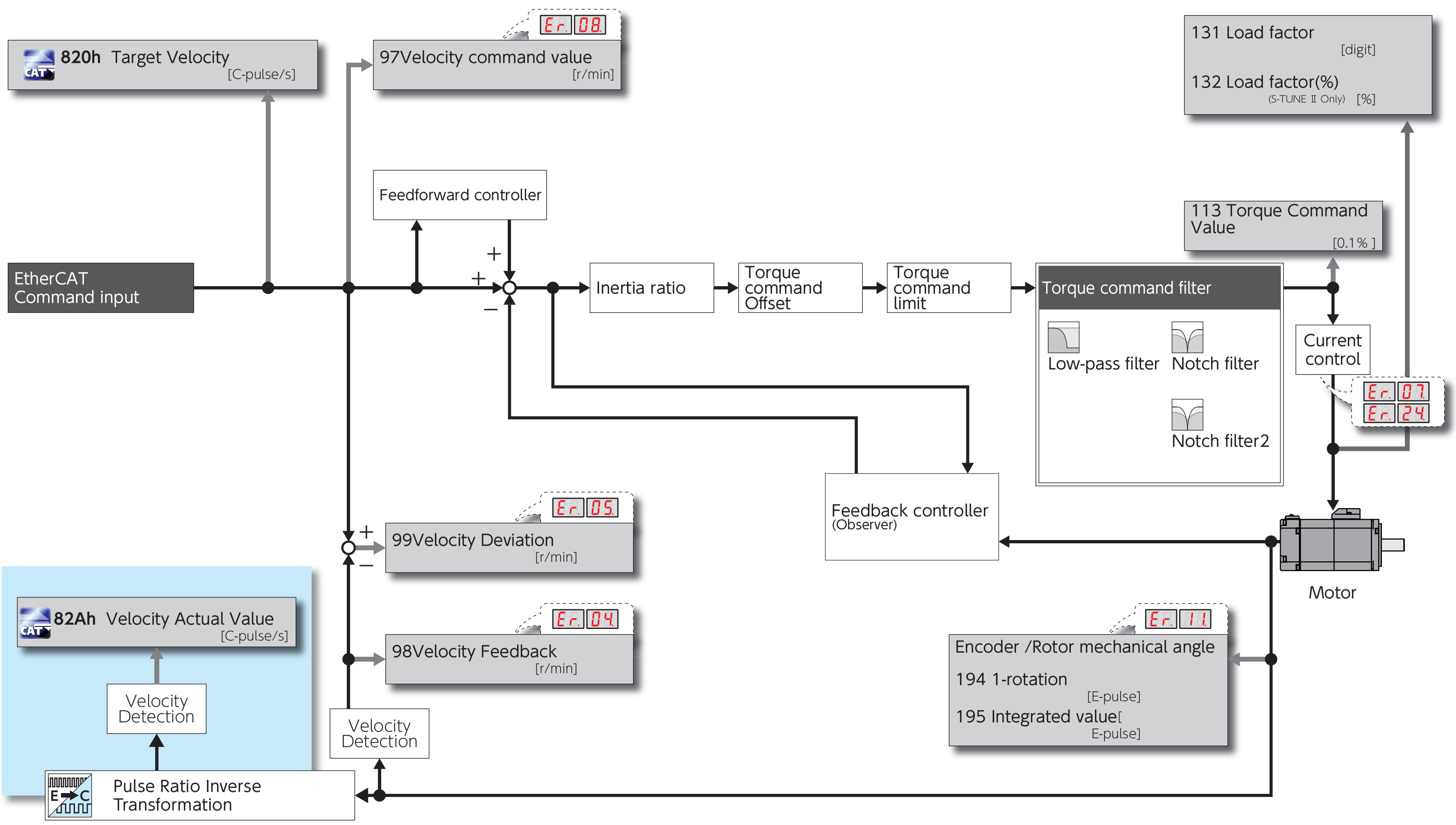
Homing

Shift-to-home-position quantity 651.0
Home position data 653.0

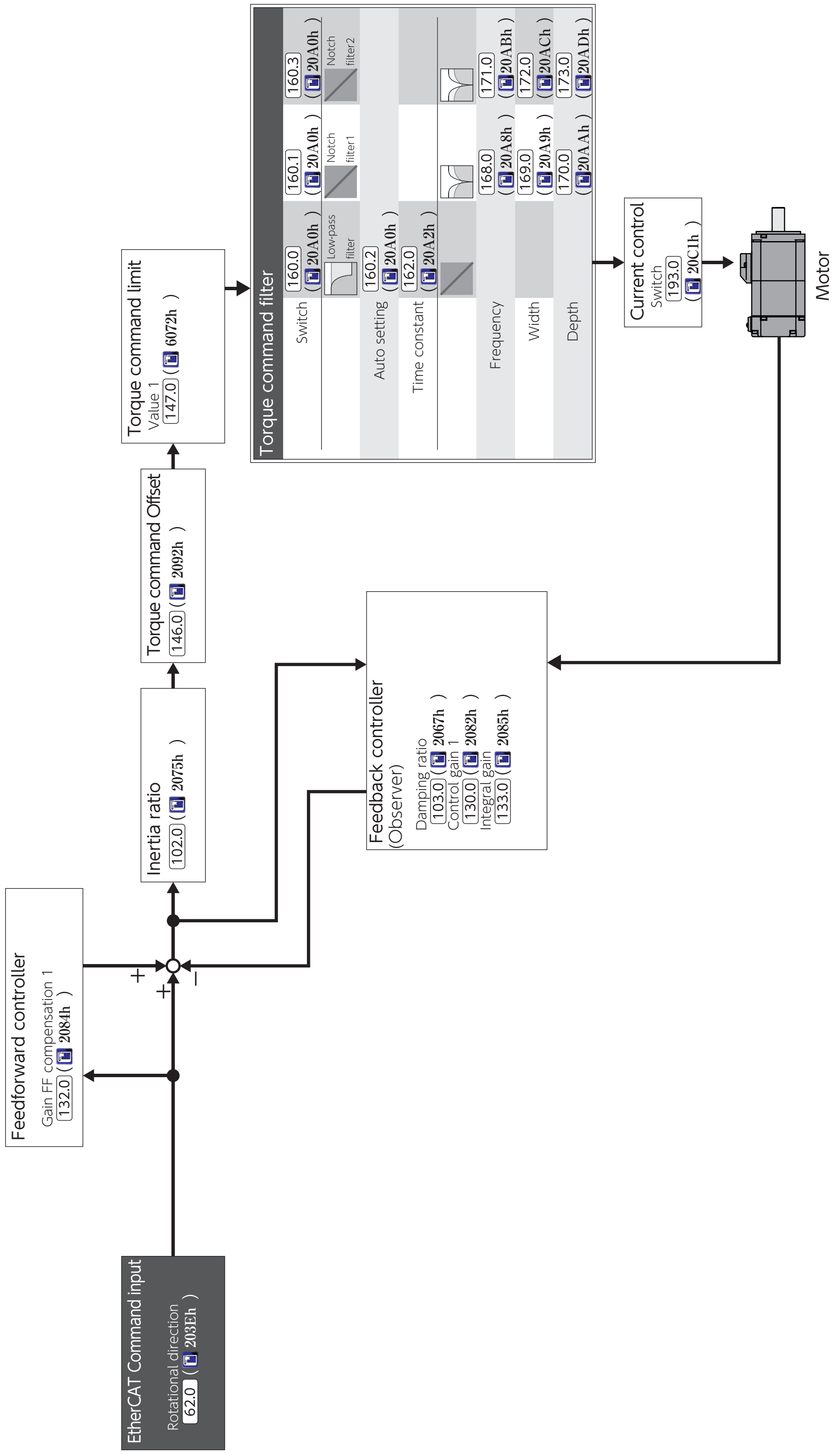
Related parameter

Home reference signal selection	645.0
Encoder Z-phase selection	645.1
Direction	646.0
Timeout switch	646.2
Timeout time	659.0
Torque command limit switch	647.0
Torque command limit value	656.0
Time to detect press stopper	655.0
Creep speed switch	647.1
Rapid speed	648.0
Creep speed	649.0
Acceleration/Deceleration time	650.0
Z-phase disabled distance	657.0

Velocity Control Mode



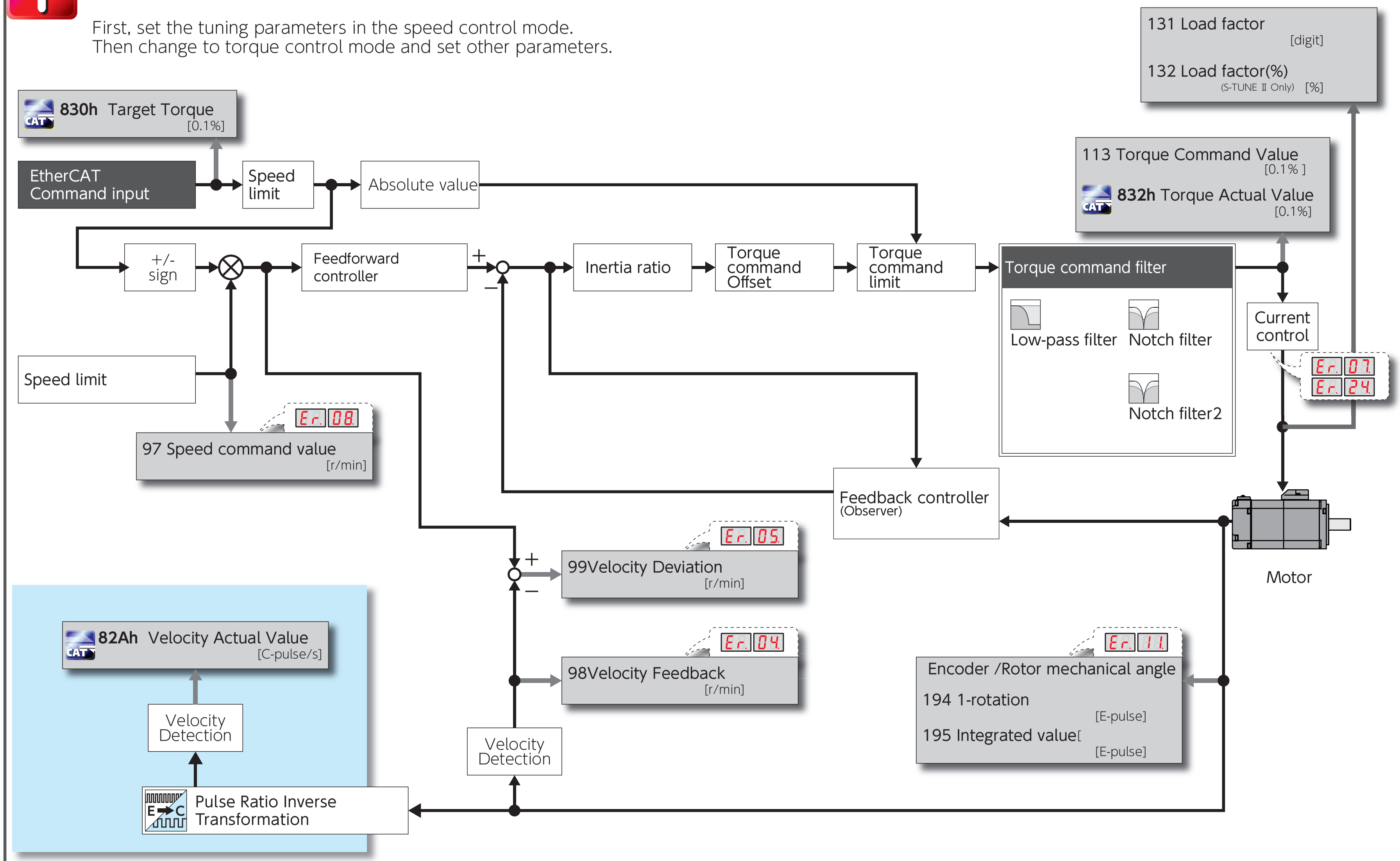
Velocity Control Mode (Related parameter)



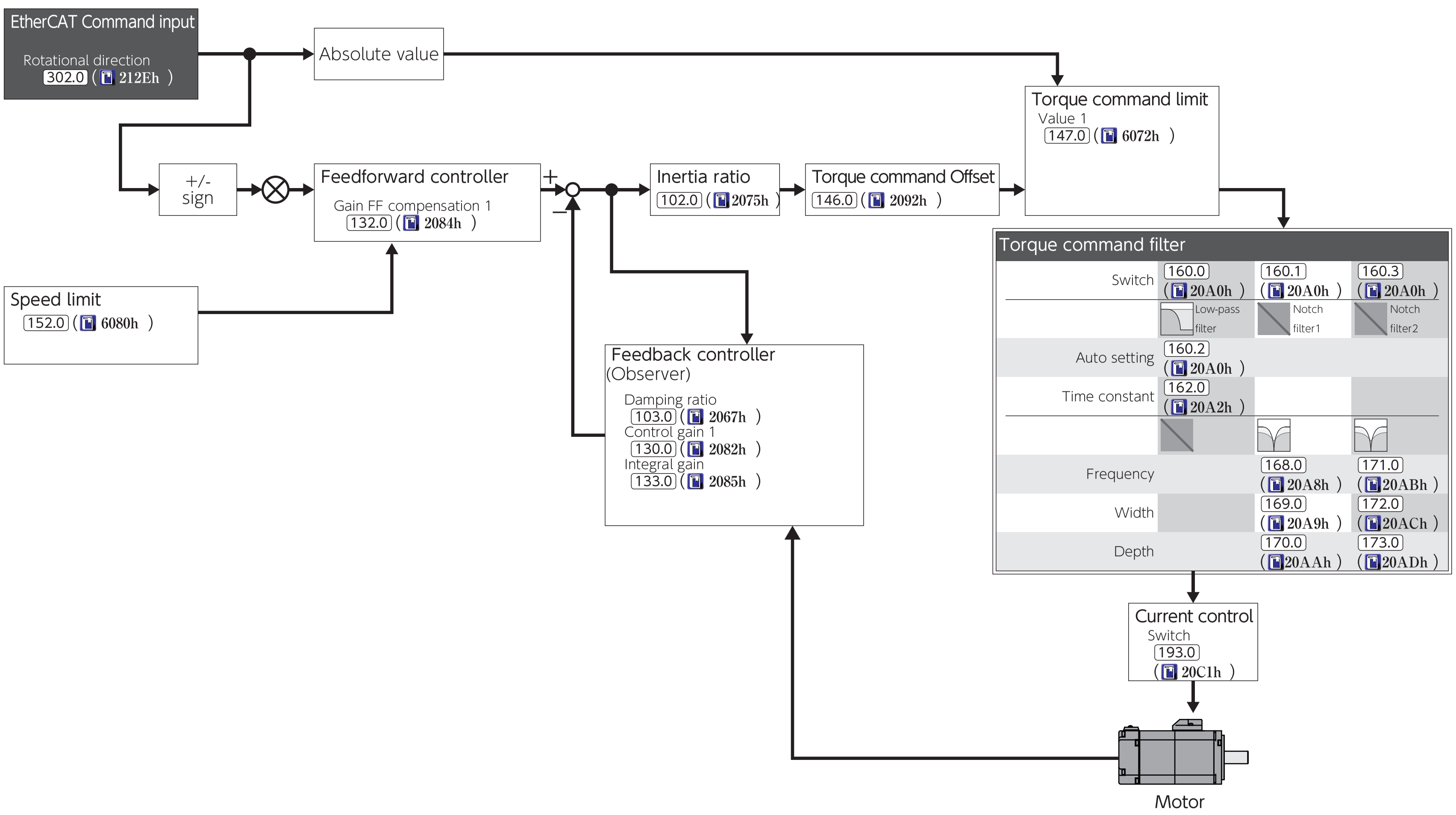
Switch	160.0 (20A0h) Low-pass filter	160.1 (20A0h) Notch filter1	160.3 (20A0h) Notch filter2
Auto setting	160.2 (20A0h)		
Time constant	162.0 (20A2h)		
Frequency		168.0 (20A8h)	171.0 (20ABh)
Width		169.0 (20A9h)	172.0 (20ACh)
Depth		170.0 (20AAh)	173.0 (20ADh)

Torque Control Mode

First, set the tuning parameters in the speed control mode.
Then change to torque control mode and set other parameters.



Torque Control Mode (Related parameter)



2. Tuning Procedure

❗	Before getting started with tuning, be sure to implement safety measures such as hazard prevention, quick stop and impact mitigation measures.	⚠ ⚠ ⚠
❗	When operating the servo motor for tuning, start with acceleration/ deceleration speeds slower than your target speed. Ensure safety first, then gradually increase the speed and perform tuning each time.	

For optimal performance of amplifier functions and features, you need set the parameters to the amplifier. Wrong parameter settings will cause unexpected behaviors or troubles to the motor. Please read the Instruction Manuals very carefully to figure out the settings that will best suit to your operational conditions.

Step	Operation
1	Verify that all wiring has been performed properly.
2	Turn on the control power to the amplifier.
3	Turn on the primary circuit power to the amplifier.
4	Input the Enable Operation (0x6040,3) signal to turn the servo ON.
5	Input the EtherCAT command from the host controller and operate the motor at low speed.
6	Use the setup support software S-TUNE Ⅱ. Install it on a user-supplied computer.

Any of the following may interrupt proper performance of Quick Tuning or Auto Tuning.
- The inertia ratio is less than 3 or above 20. (*1)
- The load inertia is fluctuating.
- Machine rigidity is extremely low.
- Non-linear characteristics such as backlash exist.
- The speed is low (800 r/min or lower). (*2)
- The acceleration or deceleration speed is moderate (around 2,000 r/min/s).
- The torque is extremely large or small.

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

*1) When a too big load inertia is connected, the estimated inertia ratio value will be restricted by the upper limit value settled by the upper limit value of the inertia ratio (No.106.0).

*2) Proper tuning may not be possible in the case of 300 r/min or below.

2. Tuning Procedure

Position Control Mode

Stage 1 Quick Tuning	**Setting the Inertia ratio and Optimizing Control Gain Set** The inertia ratio value is presumed automatically. The control gain set will be automatically adjusted according to the auto estimate of inertia ratio. This method does not generate noise caused by disagreement between the inertia ratio and the gain set. ☞ Page 12　Quick Tuning on S-TUNE Ⅱ
Stage 2 Final Tuning	**Optimizing the settling time and deviation Suppressing vibration and noise** After Quick Tuning was performed, you might need further adjustments for some of the parameters individually. Final Tuning will improve responsiveness, settling time, and degree of freedom to achieve optimal performance of equipment. ☞ Page 15　Final Tuning: position control mode

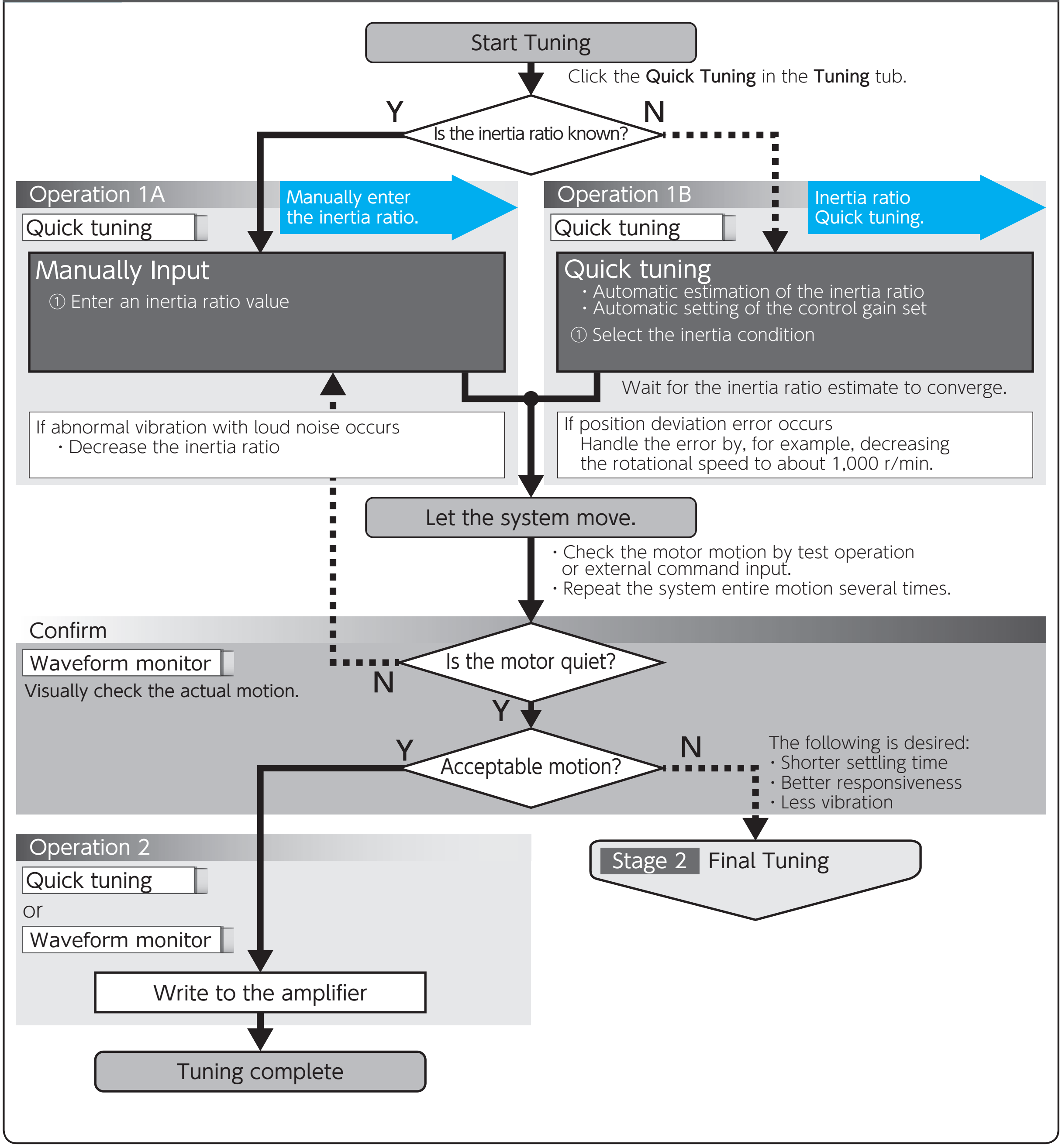
Velocity Control Mode

Stage 1 Auto Tuning	**Setting the Inertia ratio and Optimizing Control Gain Set** The inertia ratio value is presumed automatically. You can select one of the control gain sets according to your equipment. Auto estimated inertia ratio will be applied. ☞ Page 17　Auto Tuning on S-TUNE Ⅱ
Stage 2 Final Tuning	**Optimizing the settling time and deviation Suppressing vibration and noise** After Auto Tuning was performed, you might need further adjustments for some of the parameters individually. Final Tuning will improve responsiveness, settling time, and degree of freedom to achieve optimal performance of equipment. ☞ Page 20　Final Tuning: Velocity control mode

1. Position Control Mode

Quick Tuning on S-TUNE Ⅱ

Stage 1 Setting the Inertia ratio and Optimizing Control Gain Set



Click the **Quick Tuning** in the **Tuning** tub.

Quick tuning
- Automatic estimation of the inertia ratio
- Automatic setting of the control gain set

① Select the inertia condition

Wait for the inertia ratio estimate to converge.

If abnormal vibration with loud noise occurs
- Decrease the inertia ratio

If position deviation error occurs
Handle the error by, for example, decreasing the rotational speed to about 1,000 r/min.

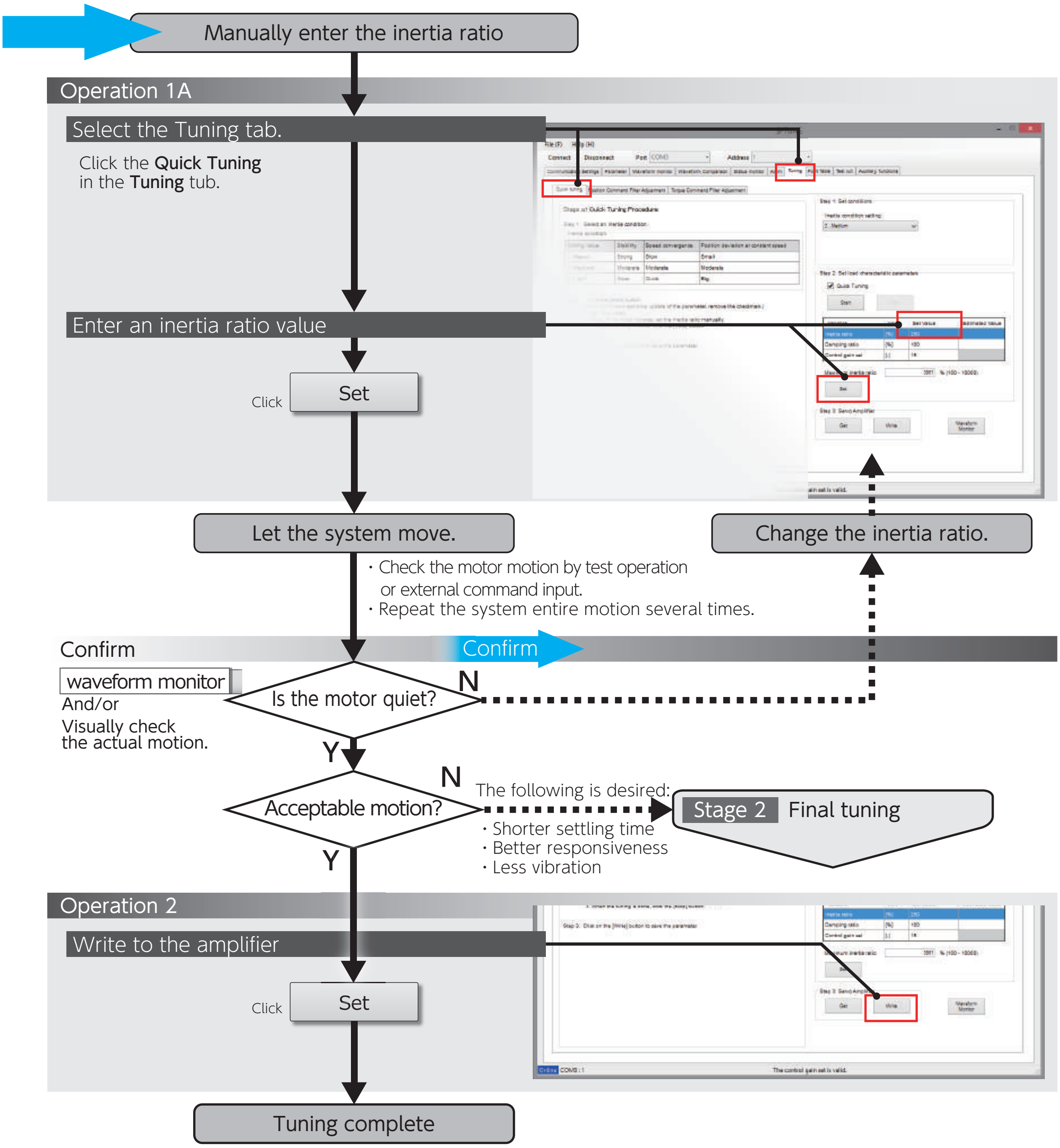
- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

Visually check the actual motion.

The following is desired:
- Shorter settling time
- Better responsiveness
- Less vibration

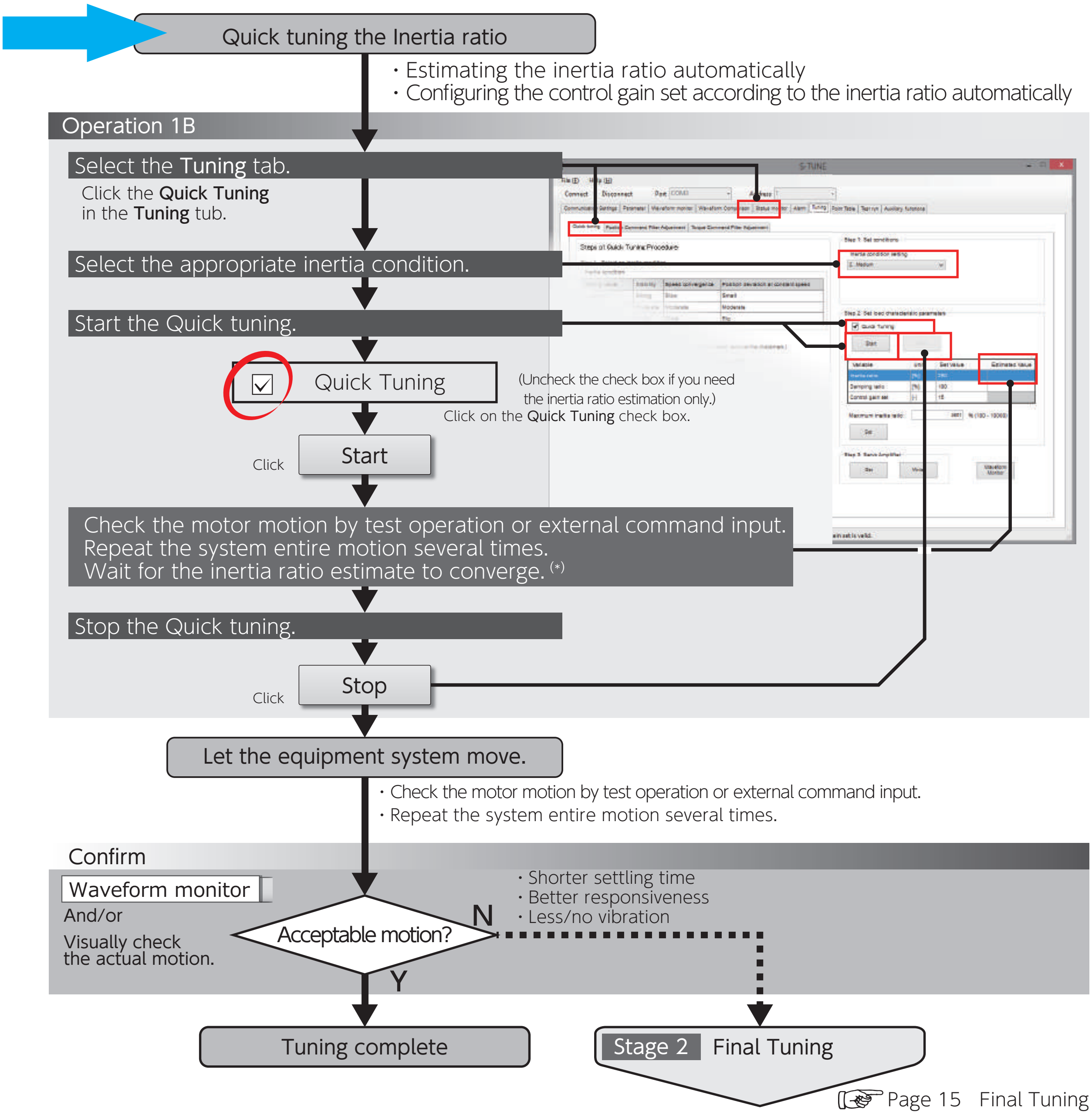
2. Tuning Procedure

Quick Tuning on S-TUNE Ⅱ : Operation 1A



2. Tuning Procedure

Quick Tuning on S-TUNE Ⅱ : Operation 1B



Quick tuning the Inertia ratio

- Estimating the inertia ratio automatically
- Configuring the control gain set according to the inertia ratio automatically

Operation 1B

Select the **Tuning** tab.

Click the **Quick Tuning** in the **Tuning** tub.

Select the appropriate inertia condition.

Start the Quick tuning.

☑ Quick Tuning

(Uncheck the check box if you need the inertia ratio estimation only.)

Click on the **Quick Tuning** check box.

Click Start

Check the motor motion by test operation or external command input.
Repeat the system entire motion several times.
Wait for the inertia ratio estimate to converge. (*)

Stop the Quick tuning.

Click Stop

Let the equipment system move.

- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

Confirm

Waveform monitor
And/or
Visually check the actual motion.

Acceptable motion?

- Shorter settling time
- Better responsiveness
- Less/no vibration

Y: Tuning complete

N: Stage 2 Final Tuning

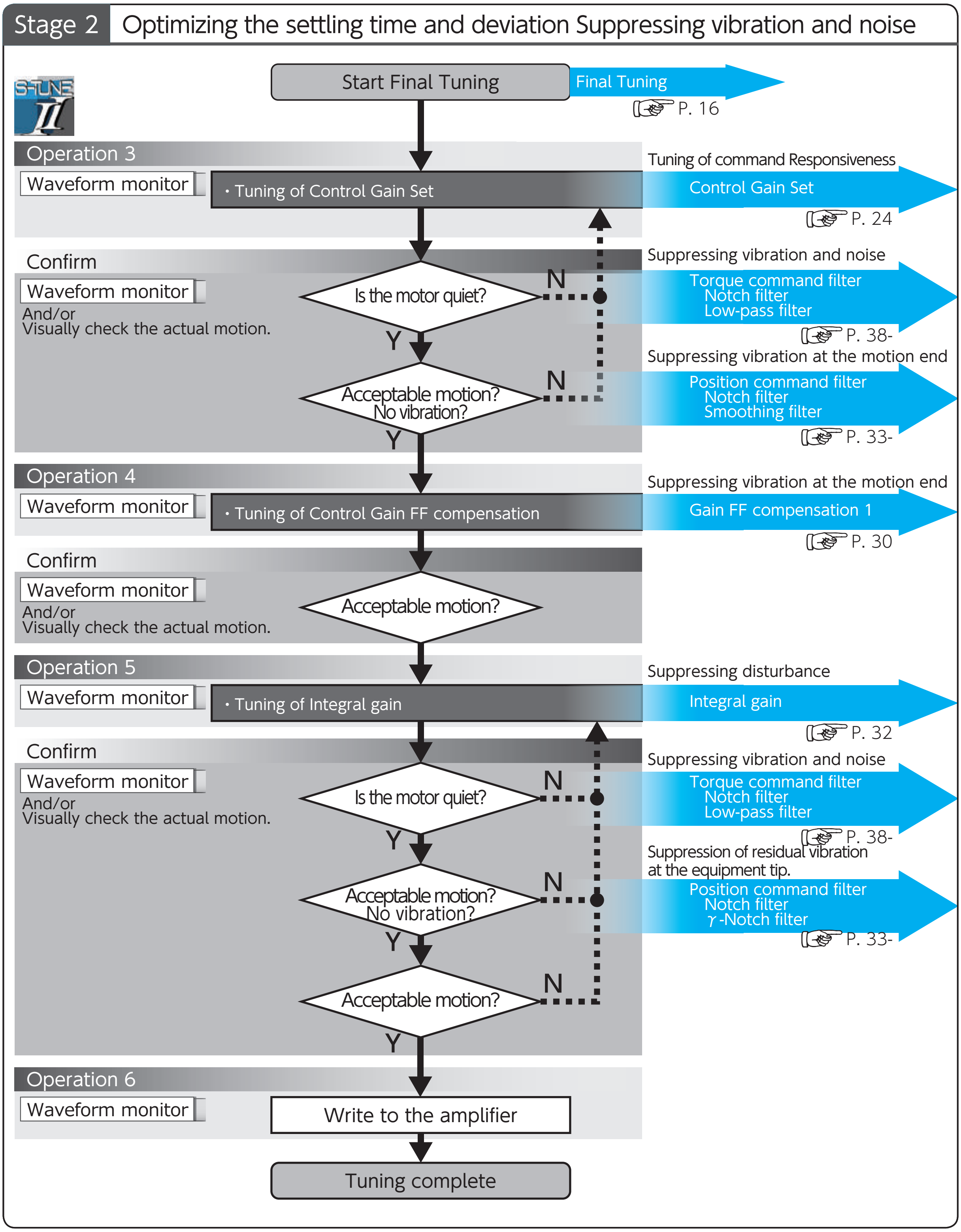
☞ Page 15 Final Tuning

*) Extremely large load may cause vibration. In such a case, decrease the parameter setting of Tuning: Control gain set - Tuning constant (No.121.0).

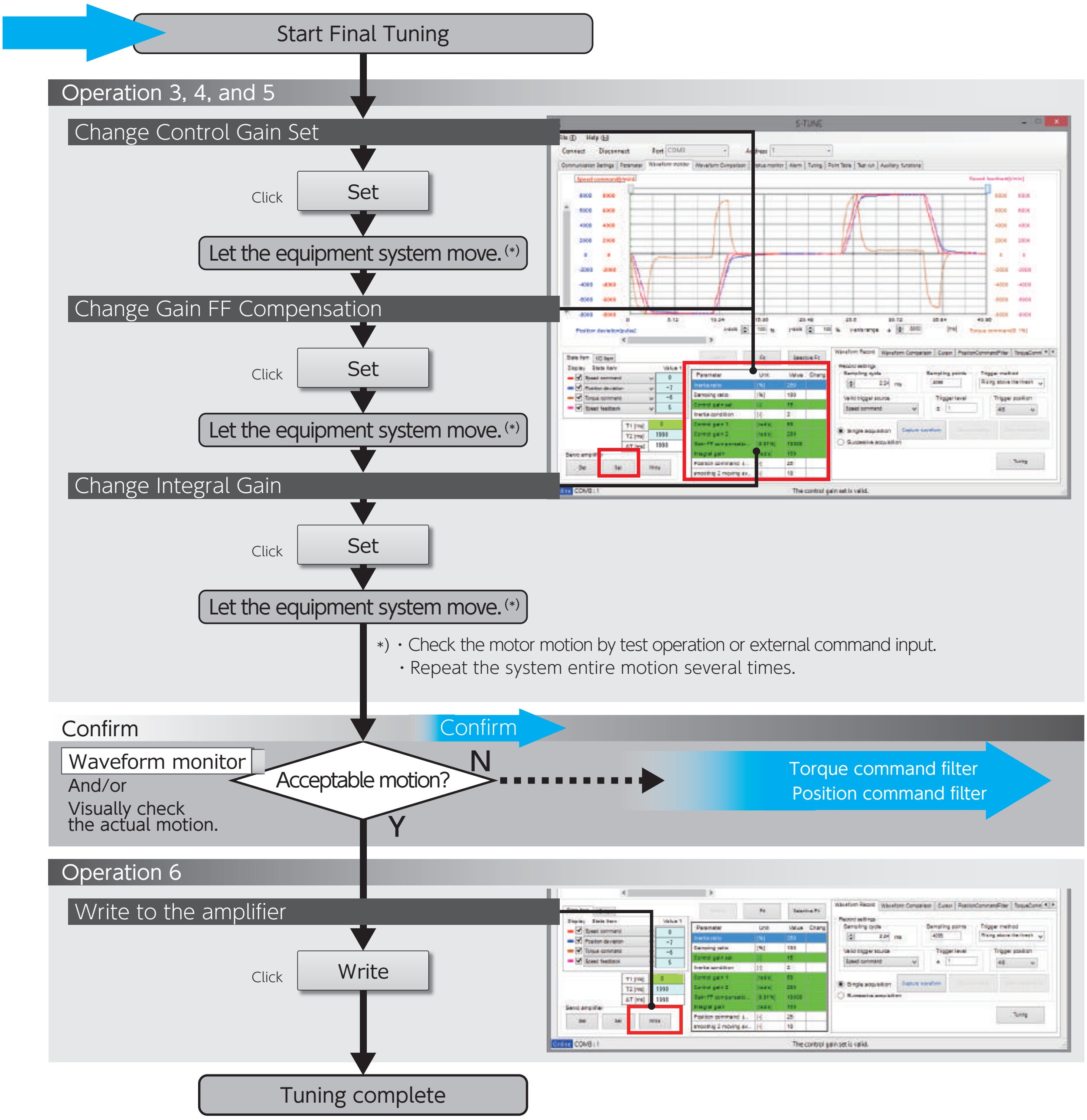
Make sure to click on Stop to finish Quick Tuning.

Starting Final Tuning Mode while Quick Tuning is still in process will make the tuning difficult because of inertia ratio changes.

Final Tuning: Position Control Mode



Final Tuning

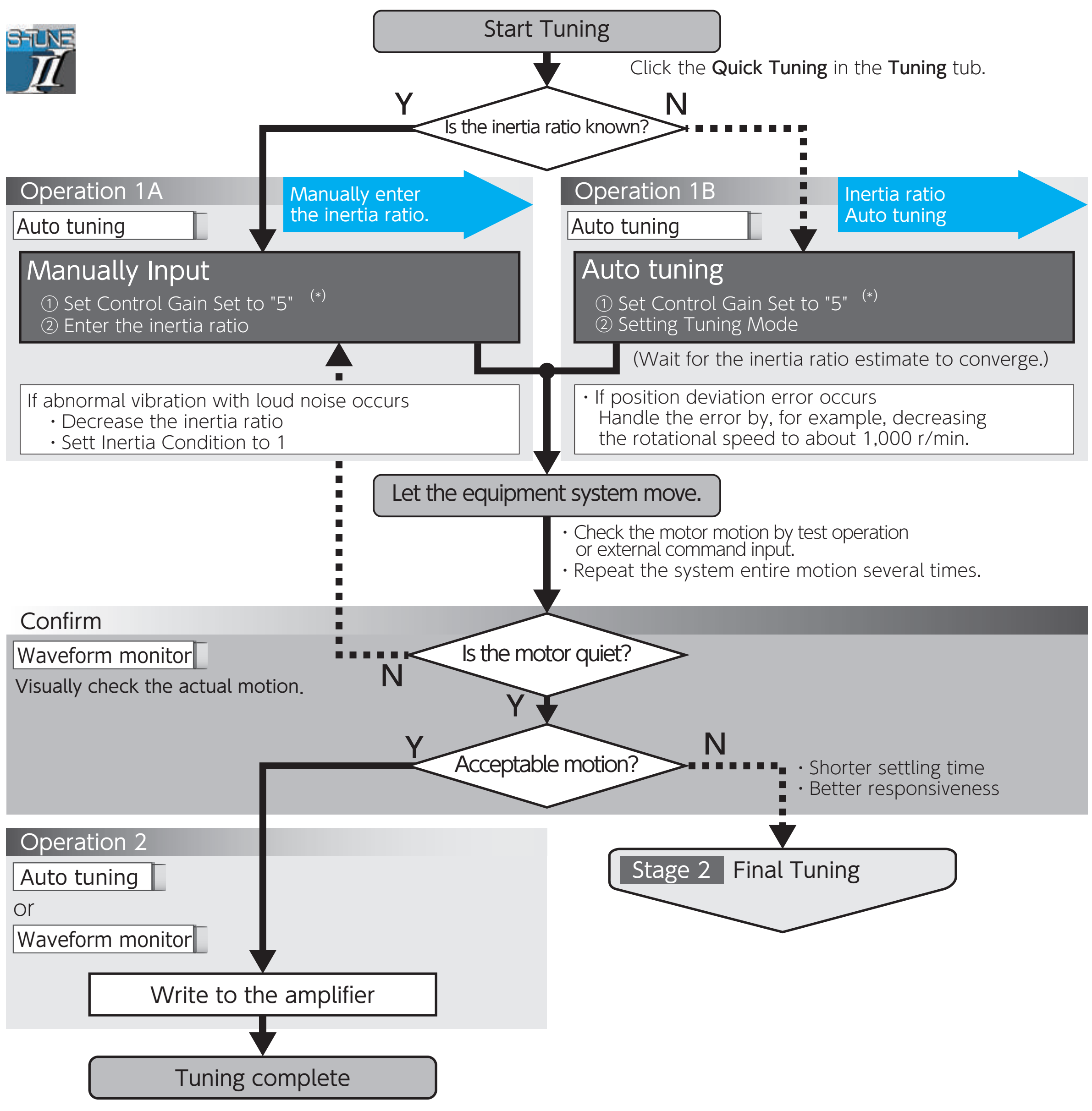


*) ・Check the motor motion by test operation or external command input.
・Repeat the system entire motion several times.

2. Velocity Control Mode

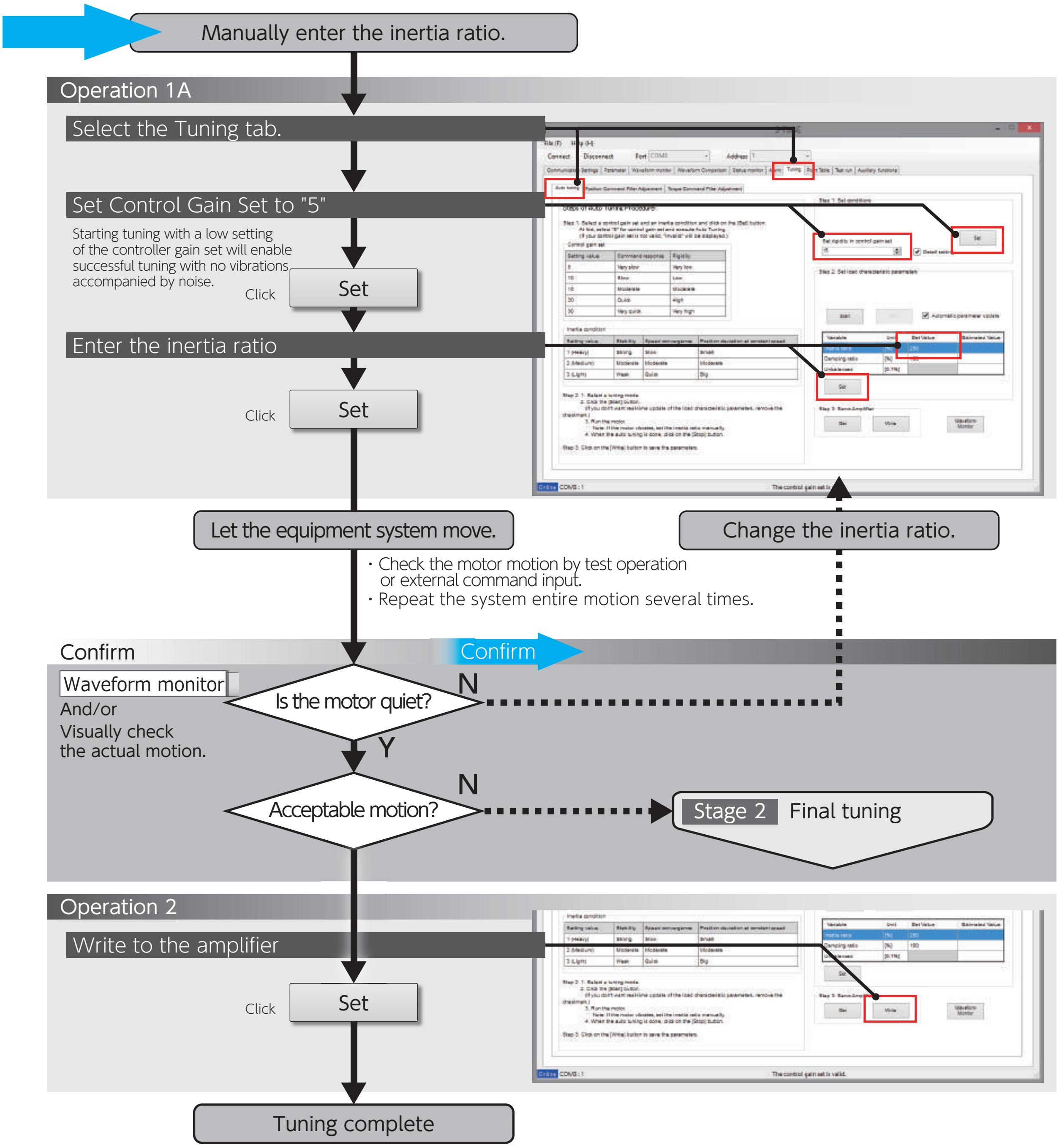
Auto Tuning on S-TUNE Ⅱ

Stage 1 Setting the Inertia ratio and Optimizing Control Gain Set



*) Starting tuning with a low setting of the controller gain set will enable successful tuning with no vibrations accompanied by noise.

Auto Tuning on S-TUNE Ⅱ : Operation 1A



Manually enter the inertia ratio.

Operation 1A

Select the Tuning tab.

Set Control Gain Set to "5"

Starting tuning with a low setting of the controller gain set will enable successful tuning with no vibrations accompanied by noise.

Click Set

Enter the inertia ratio

Click Set

Let the equipment system move.

- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

Change the inertia ratio.

Confirm

Waveform monitor
And/or
Visually check the actual motion.

Confirm

Is the motor quiet? N / Y

Acceptable motion? N

Stage 2 Final tuning

Operation 2

Write to the amplifier

Click Set

Tuning complete

2. Tuning Procedure

Auto Tuning on S-TUNE Ⅱ : Operation 1B

Inertia ratio estimation by the auto tuning

Operation 1B

Select the Tuning tab

Set Control Gain Set to "5"

Starting tuning with a low setting of the controller gain set will enable successful tuning with no vibrations accompanied by noise.

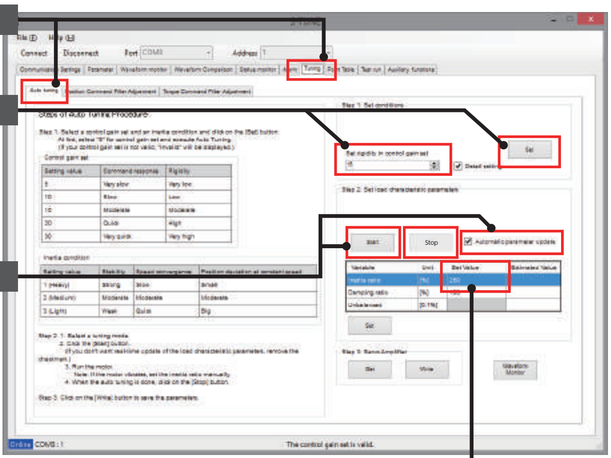
Click **Set**

Start the Auto tuning

☑ Automatic parameter update

Click on the check box.

Click **Start**



Check the motor motion by test operation or external command input.
Repeat the system entire motion several times.
Wait for the inertia ratio estimate to converge.

Stop the Auto tuning

Click **Stop**

Confirm

Waveform monitor
And/or
Visually check the actual motion.

Is the motor quiet? — N → Manually enter the inertia ratio.

Y ↓

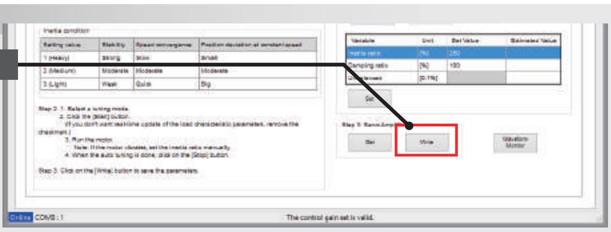
Acceptable motion? — N → Stage 2 Final tuning
- Shorter settling time
- Better responsiveness

Y ↓

Operation 2

Write to the amplifier

Click **Set**



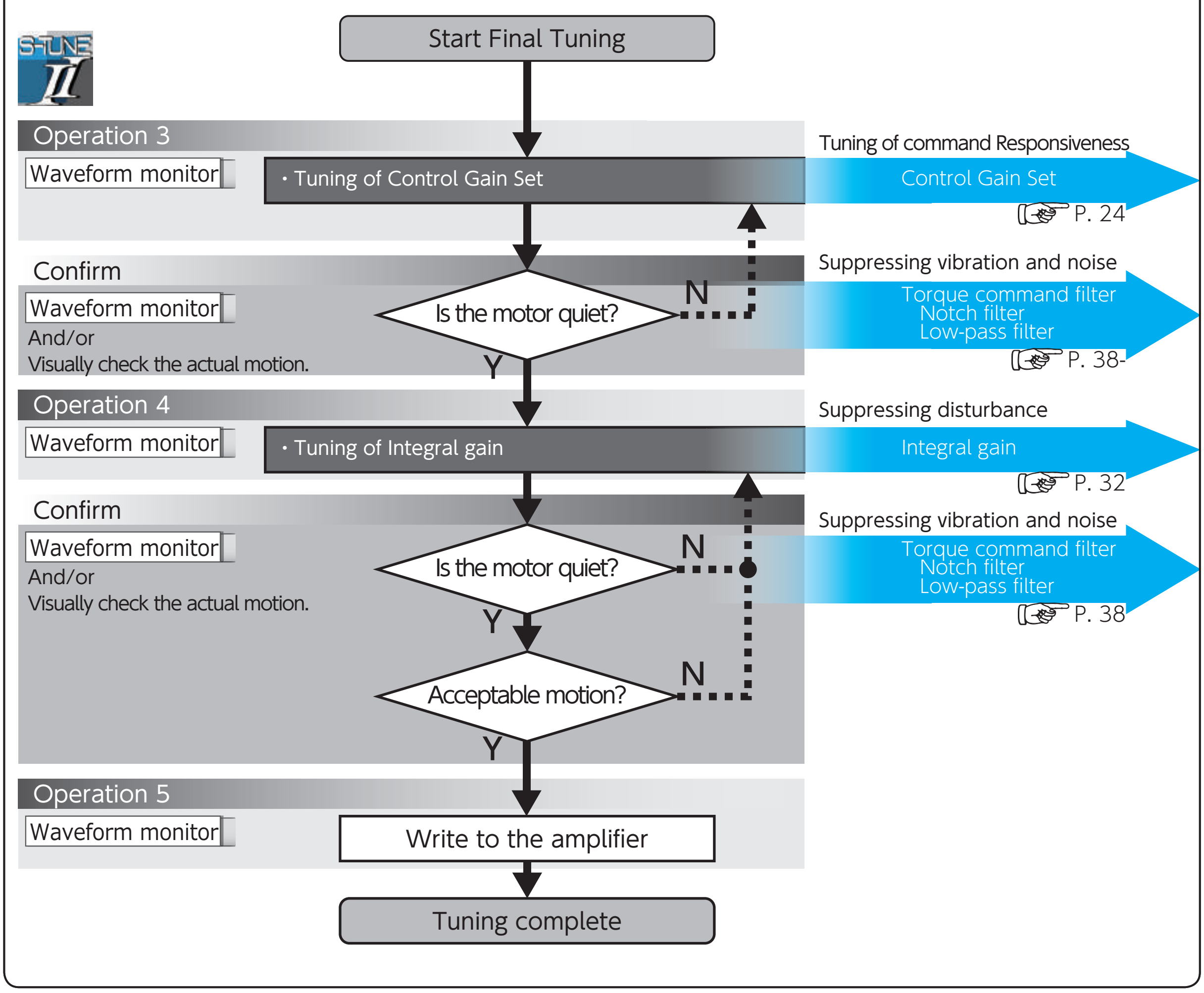
Tuning complete

Make sure to click on Stop to finish Auto Tuning.

Starting Final Tuning Mode while Auto Tuning is still in process will make the tuning difficult because of inertia ratio changes.

Final Tuning: Velocity Control Mode

Stage 2 Optimizing the settling time and deviation Suppressing vibration and noise



Final Tuning

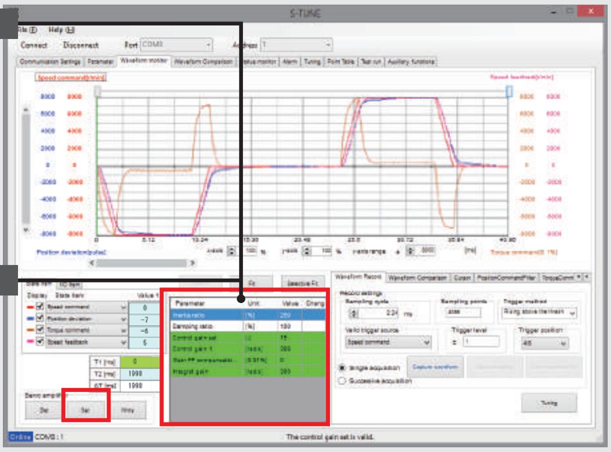
Start Final Tuning

Operation 3 and 4

Change Control Gain Set

Click Set

Let the equipment system move.(*)



Change Integral Gain

Click Set

Let the equipment system move.(*)

*) ・Check the motor motion by test operation or external command input.
・Repeat the system entire motion several times.

Confirm

Waveform monitor
And/or
Visually check
the actual motion.

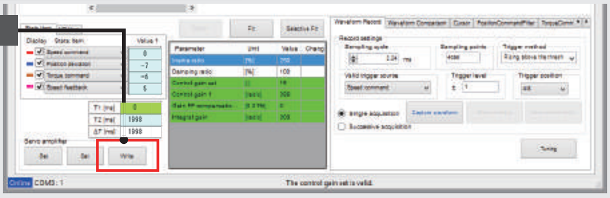
Acceptable motion?

N → Confirm
Torque command filter
Notch filter
Low-pass filter

Y

Operation 5

Click Write



Tuning complete

2. Tuning Procedure

Confirm

Check the machine motion

Check the motor motions in test operation or by external command input.
Repeat the previous steps from the beginning.

Confirm

Select the Tuning tab

Waveform monitor tab

Select items to measure.

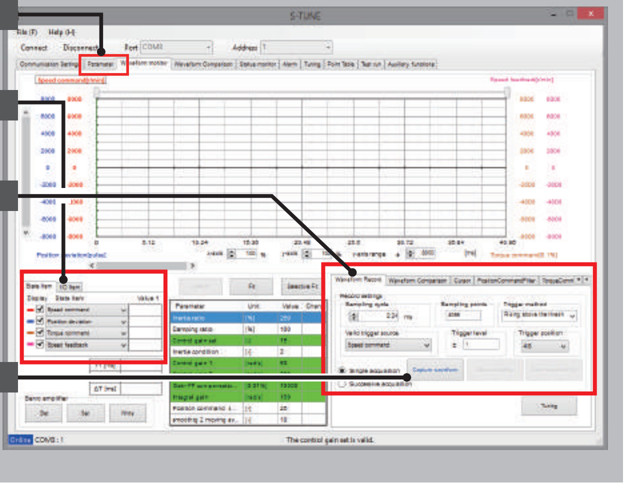
State Item tab

Select measurement conditions.

Waveform Record tab

Start Measuring

Click Capture waveform



3. Tuning Parameters

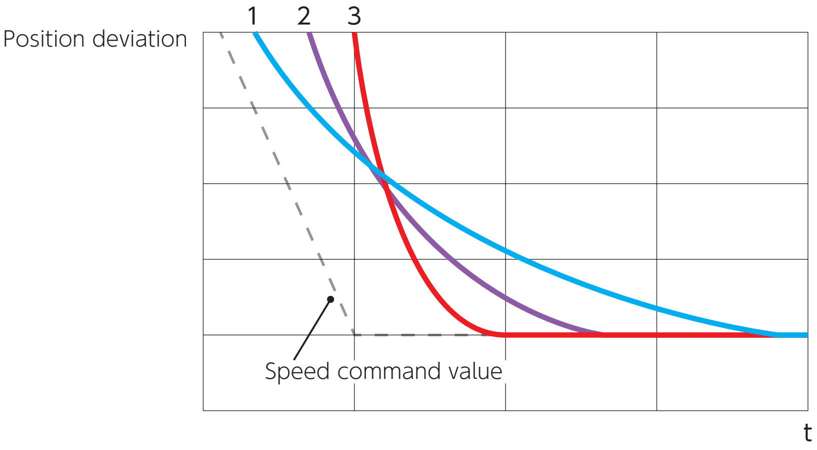
1. Tuning

Inertia Condition

P V T

Function	To make the tuning operation easier, select the inertia condition suitable to your equipment. The inertia conditions that you select will determine the Control Gain 1-2 combination and their ratio.
Parameter No.113.1	Position Control Mode: Inertia conditions
Tuning Tip	Prioritize either stability or convergence according to the load and rigidity of your equipment. Be aware of the trade-off between stability and convergence.

Settings	Intended Use	Effect
1	heavy-load, high fluctuation equipment low-rigid equipment robot arms etc.	Better Stability ↕ Better Convergence
2 (Default)	(moderate setting) general transport machines	
3	light-load equipment equipment that demands high-speed operation or settling-required	



Difference in convergence characteristics depending on the inertia condition settings

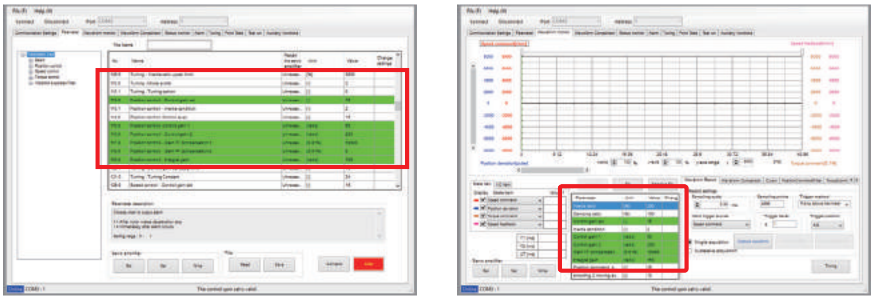
3. Tuning Parameters

Control Gain Set

P V T

Function	With this parameter, a set of the tuning parameters can be set to their defaults all at once.(*1) Increasing the value of this parameter will improve the command response, position deviation during motion, settling time, and control rigidity.		
Parameter Set	No.113.0 (Position Control Mode)	Control level	No.114.0
		Control Gain 1	No.115.0
		Control Gain 2	No.116.0
		Integral gain	No.119.0
		Torque command filter: Low-pass filter time constant (*2)	No.162.0
	No.129.0 (Velocity Control Mode)	Control level	No.130.0
		Control Gain 1	No.131.0
		Integral gain	No.133.0
		Torque command filter: Low-pass filter time constant (*2)	No.162.0
Remark	Too high a setting will cause noise. When increasing the value, check the resulting operation to avoid oscillation or vibration.		
Tuning Tip	• Set the value to 5 first to fix the inertia ratio. • Gradually increase the setting value while watching the motion. If noise occurs, use a notch filter or decrease the low-pass filter setting. ☞ Page 39 Torque Command Filter: Notch filter ☞ Page 40 Torque Command Low-Pass Filter		

*1) In the S-TUNE Ⅱ parameters grouped in the control gain set are highlighted in green.



*2) This is when Low-pass filter auto Setting (No.160.2) = 1 (auto setting ON)

Control gain set settings	Command Responsiveness	Rigidity	Settling Time	Noise
5	Slow	Low	Long	Unlikely
10	↑ ↓	↑ ↓	↑ ↓	↑ ↓
15 (Default)				
20				
30	Quick	High	Short	Likely

Under the Auto Tuning tab, tick the detail setup box, and then select from 1-46 one by one.

3. Tuning Parameters

Mode Switch

P V T

Function	Change the mode based on the direction of the load inertia and whether offset load is present or not.		
Parameter No.110.0	Settings	Mode	Balanced load or unbalanced load
	1	Standard Mode	Balanced load (horizontal motion)
	2 (Default)	Unbalanced Load Mode	Unbalanced load such as gravity is present
Remark	Use the Unbalanced Load Mode even for the case of balanced load (horizontal-axis motion).		
Prerequisite	Position Control Mode, Velocity Control Mode		

Tuning Items

P V T

Function	Setting the item(s) to be estimated during tuning.		
Parameter No.110.1	Settings (Tuning)	Estimate items	
		Inertia ratio	Damping ratio
	0 (Tuning Stop) (Default)	Do not estimate	Do not estimate
	1 (Tuning Start)	Estimate	
	2 (Tuning Start)		Estimate
Prerequisite	Position Control Mode, Velocity Control Mode		

3. Tuning Parameters

2. Final Tuning

Inertia Ratio

P V T

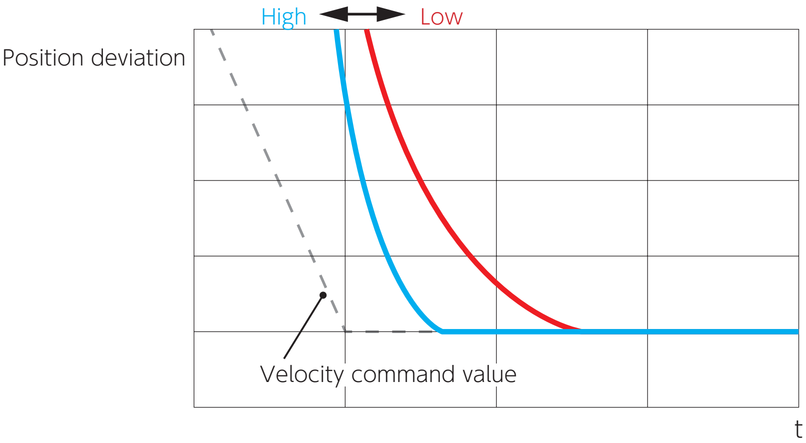
Function	Set the ratio of the load inertia to the rotor inertia of the motor. This item represents the ratio of the motor axis moment of inertia to the load moment of inertia. The inertia ratio used in S-FLAG Ⅱ includes the motor rotor inertia (=100%). Example: inertia ratio 200% = motor rotor inertia 100% + output axis load 100% inertia ratio 1100% = motor rotor inertia 100% + output axis load 1000% $\text{Inertia ratio} = \dfrac{(\text{load inertia}) + (\text{Rotor inertia})}{(\text{Rotor inertia})} \times 100\ [\%]$
Parameter No.102.0	Default: 250 [%]
	Setting range: 100 to 10,000
Remark	Settings that are not right for the equipment will cause noise or vibration.
Tuning Tip	Start with setting a right inertia ratio which will make your tuning easier. The auto estimate of inertia ratio during Quick Tuning will be capped by the **upper bound limit** (No.106.0). If the estimate value of the inertia ratio is higher than the upper limit, manually enter the estimated value after suppressing the vibration and noise with a notch filter first. Select the best inertia condition and set the **control gain set** (No.113.0, No.129.0) to "5" to perform the quick-tuning and auto-tuning. In case of vibrations at settling, perform damping adjustment and perform tuning again. Because this tuning must be performed under the condition where the inertia can be estimated, we recommend that you obtain the ratio estimate in test operation.

3. Tuning Parameters

Position Control Mode: Control Gain 1

P V T

Function	Increasing this parameter value will reduce the position deviation after the command becomes zero. Increase when the convergence of the position deviation at settling is not good.
Parameter No.115.0	Default: 50 [rad/s] Setting range: 5 to 1,000
Remark	Select a value no higher than **Position Control Mode: Control Gain 2** (No.116.0). Set a value smaller than the value of **Control Gain 2** (No.116.0). Making a change to any of the following will also change other tuning parameters (such as Control Gain 2) to the prearranged parameter set all at once. ・**Control Gain Set** (No.113.0) ・**Inertia conditions** (No.113.1) ・**Control Level** (No.114.0)
Tuning Tip	Increasing this parameter setting will improve the settling time in cases when increasing the control gain set or control level does not resolve poor convergence of position deviation, or noise is too much that the control gain set or control level should not be increased.



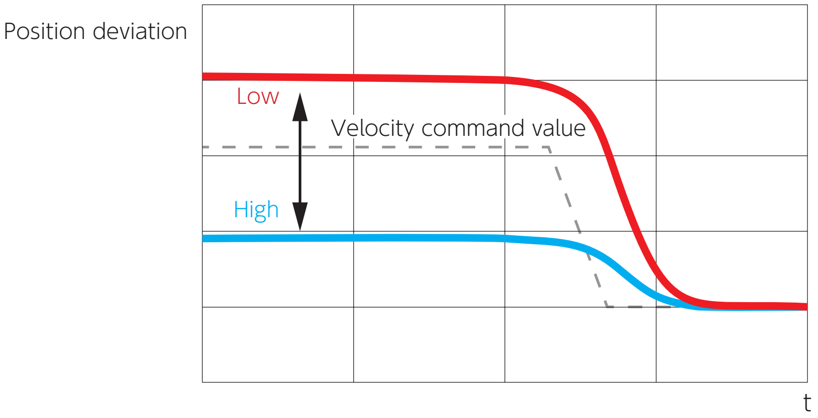
Differences in Position Deviation Convergence

3. Tuning Parameters

Position Control Mode: Control Gain 2

P V T

Function	Increasing this parameter value will reduce the position deviation during command input. Increasing the parameter value provides faster command response; however, too large a value may result in noise.
Parameter No.116.0	Default: 200 [rad/s] Setting range: 80 to 5,000
Remark	Set a value larger than the value of **Control Gain 1** (No.115.0). To reduce position deviations after the command becomes zero, increase the value of **Control Gain 1** (No.115.0). The tuning parameters such as the **Control gain 1** will be changed to the group of the preset value depending on changing the following parameters. ・**Control gain set** (No.113.0) ・**Inertia conditions** (No.113.1) ・**Control level** (No.114.0)
Tuning Tip	Use this parameter when the load inertia or the load fluctuation is large. The responsiveness will be improved and the movement will be smoother. Noise Solutions ① Use **Torque command filter: Notch filter** (such as No.160.1). ② Lower **Torque command filter: Low-pass filter constant** (No.162.0). ③ Lower **Integral gain** (No.119.0). When no improvement have been seen if these ①, ②, and ③ method had been performed, please decrease the No.116.0 value.

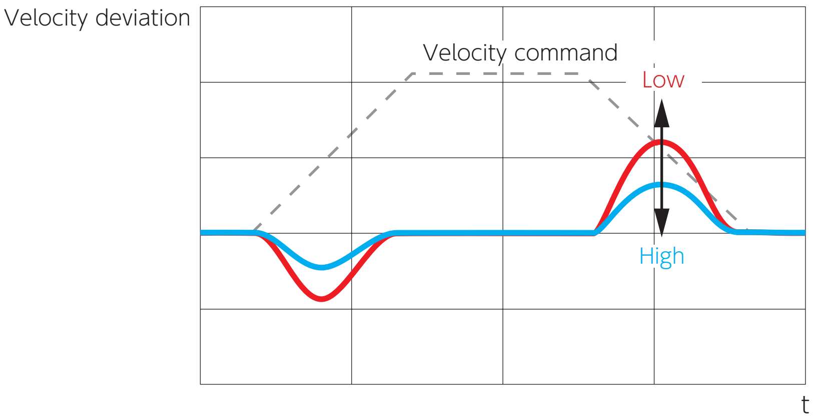


Differences in Position Deviation Convergence

Velocity Control Mode: Control Gain 1

P V T

Function	Increasing this parameter value will reduce the velocity deviation during the acceleration/deceleration. Increasing the parameter value provides faster command response; however, too large a value may result in noise.
Parameter No.131.0	Default: 399 [rad/s] Setting range: 100 to 6,000
Remark	Making a change to any of the following will also change other tuning parameters (such as **Gain FF Compensation 1**) to the prearranged parameter set all at once. ・**Control gain set** (No.129.0) ・**Control level** (No.130.0)
Tuning Tip	Use this parameter when the load inertia or the load fluctuation is large. The responsiveness will be improved and the movement will be smoother. Noise Solutions ① Use **Torque command filter: Notch filter** (such as No.160.1). ② Lower **Torque command filter: Low-pass filter constant** (No.162.0). ③ Lower **Integral gain** (No.133.0) When no improvement have been seen if these ①, ②, and ③ method had been performed, please decrease the No.131.0 value.

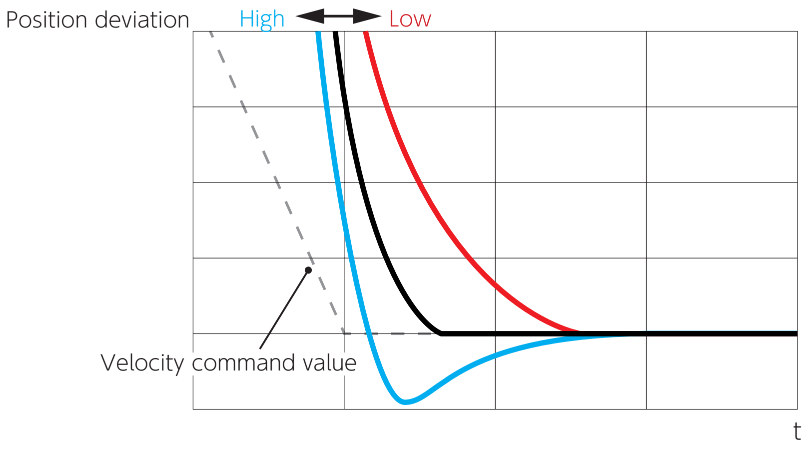


Differences in Velocity Deviation Convergence

Position Control Mode: Gain FF Compensation 1

P V T

Function	This parameter will improve the responsiveness at a low gains setting. Set the Field Forward Compensation Rate (velocity) with respect to **Control Gain 1** (No.115.0) for Position Control Mode. Using this parameter is effective to shorten the settling time.
Parameter No.117.0	Default: 10,000 [0.01%]
	Setting range: 0 to 15,000
Remark	Guideline for Tuning If the inertia ratio is right, setting this parameter to 10,000 will not cause overshooting nor undershooting.
Tuning Tip	· Set the following before adjusting this parameter: **Inertia ratio** (No.102.0), **Control gain set** (No.113.0), **Control Gain 1** (No.115.0), and **Control Gain 2** (No.116.0) · Setting this parameter too low will result in undershooting, too high in overshooting. Target the value which would make the settling time shorter. · Too high a value of this parameter will result in overshooting, and too low in undershooting. Set relatively a moderate value. Inertia condition Coarse tuning amount 1: increment by 10 2: increment by 100

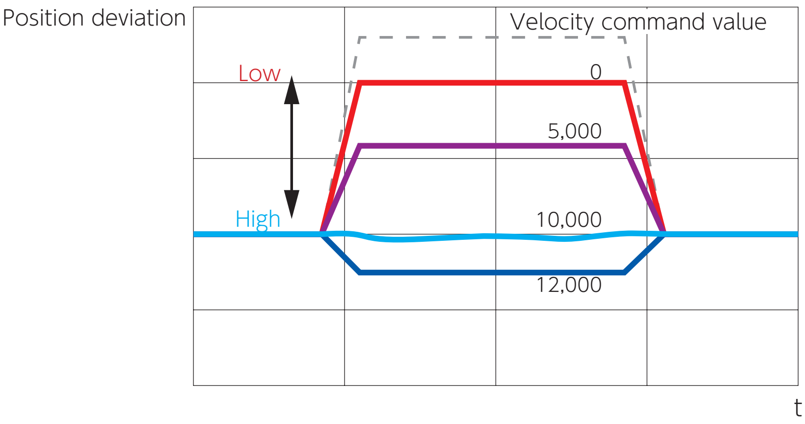


Differences in Position Deviation Convergence

Position Control Mode: Gain FF Compensation 2

P V T

Function	Increasing this parameter value will reduce the position deviation of the motor running at a constant speed. Raise the value of this item only after reducing the position deviation, by using **Gain FF Compensation 1** (No.117.0) at settling.
Parameter No.118.0	Default: 0 [0.01%]
	Setting range: 0 to 15,000
Remark	If this parameter value is above 10,000, the position deviation will start appearing in a negative range. When the command resolution is low, increasing this parameter value will result in louder running sound.
Tuning Tip	With a right inertia ratio setting, setting this parameter to 10,000 minimizes the position deviation. Noise Solutions Adjusting **Filter 4: Smoothing 2- Moving average counter** (No.81.0) may reduce the noise.

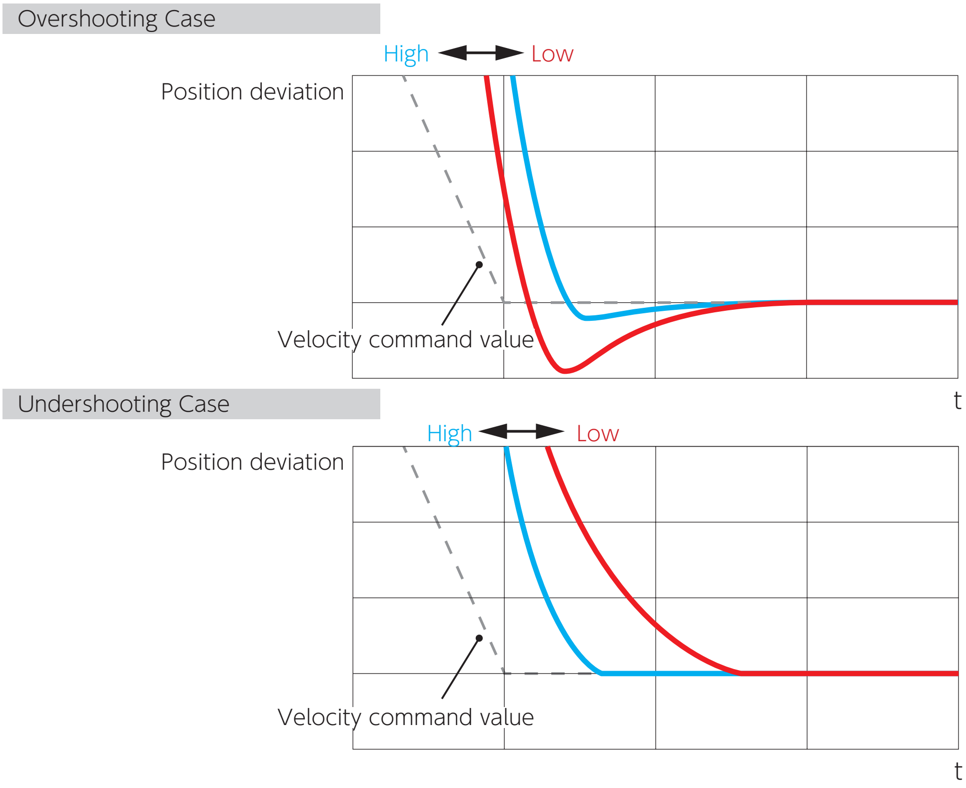


Differences in Position Deviation Convergence

Integral Gain

P V T

Function	Set the Integral Gain. Increasing the integral gain will improve poor convergence due to friction and load fluctuation at settling and reduce the position deviations. This will result in rigid and sensitive motions.		
Parameter No.119.0	Position Control Mode	Default :	160 [rad/s]
		Setting range :	45 to 5,000
Parameter No.133.0	Velocity Control Mode	Default :	300 [rad/s]
		Setting range :	45 to 5,000
Remark	This parameter will reset to the default if the Control Gain Set is changed. Too high an integral gain will cause noise. Adjust the value within the range of no noise to achieve your desired responsiveness.		
Tuning Tip	Adjust the integral gain after setting the **control level** (or adjust Control Gain 1 and 2 each) and FF compensation. Noise Solutions ① **Use Torque command filter: Notch filter** (such as No.160.1) ② Decrease the value of **Integral Gain**. If noise occurs, decrease the setting of this parameter or apply a torque command notch filter. ☞ Page 39 Torque Command Notch Filter		



Differences in Position Deviation Convergence

3. Position Command Filter

Optimizing the settling time and deviation Suppressing vibration and noise

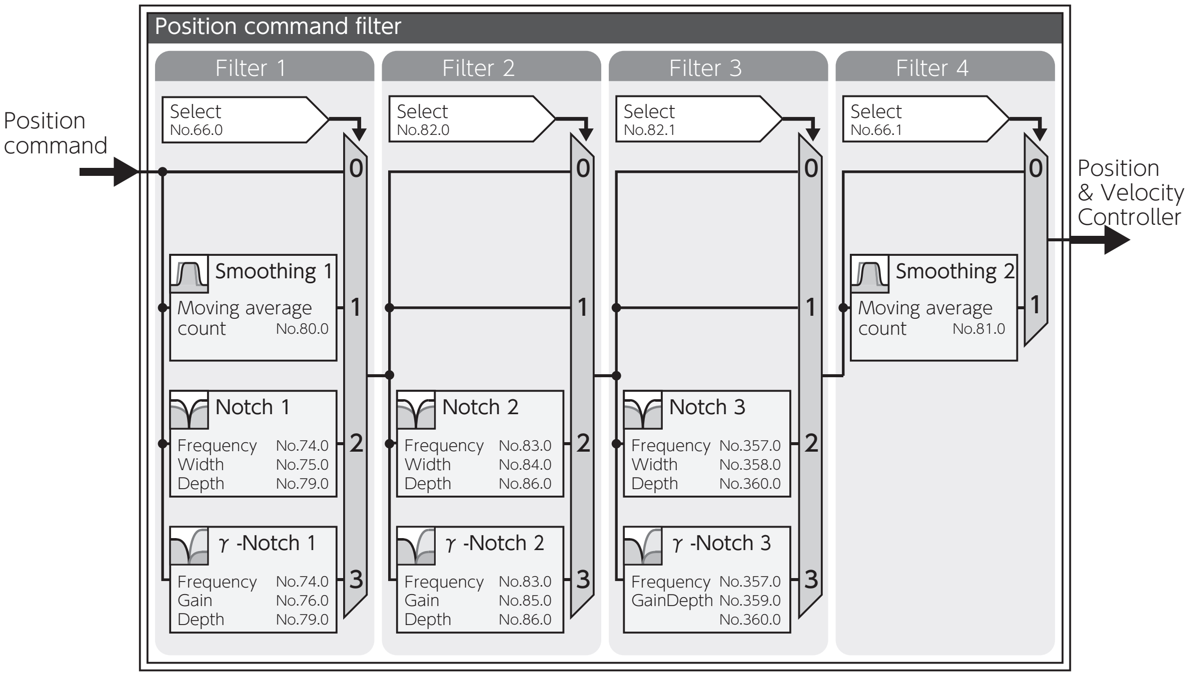
Check the following before using Position command filter
- The command from the host controller is correct.
- The equipment is installed firmly and properly.
- The gain parameters such as inertia ratio are correctly set.
- The command smoothing filters 2 (and 1) are set.
- Vibration is now unlikely to occur thanks to the decreased integral gain.

Filter	Overview	Refer to
Smoothing	**Position Command Smoothing Filter** Effective in smoothing the position command and suppressing vibration at the time of positioning.	P. 35

Apply the following notch filters if the machine end point is still vibrating after sufficient tuning was performed and the smoothing filter was set.

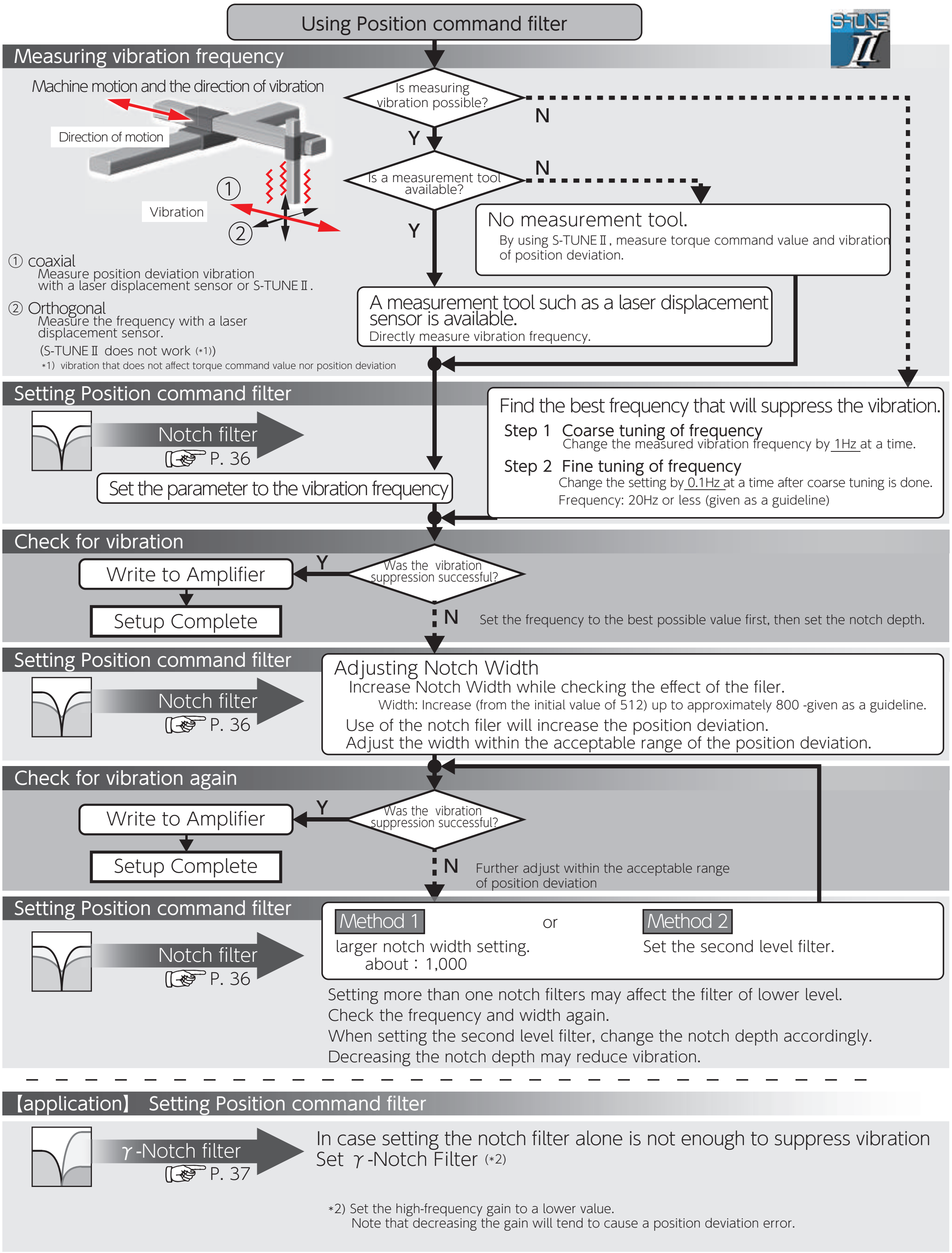
Filter	Overview	Refer to
Notch	**Position Command Notch filter** Effective in suppressing vibration of mechanical systems where the vibration does not appear in the torque output waveform. When compared to the command smoothing filter, the position command filter is more effective in reducing the absolute position deviation (Status No.80).	P. 34 P. 36
γ -Notch	**Position Command γ -Notch Filter** Effective in suppressing vibration of mechanical systems where the vibration does not appear in the torque output waveform. This filter has flexibility of changing the gain setting in the range higher than notch frequencies. This item will reduce the position deviation impacted by use of notch filer.	P. 34 P. 37

Up to four levels of Position command filter are available.



Block Diagram of Position Command Filter (Details)

3. Tuning Parameters



Using Position command filter

Measuring vibration frequency

① coaxial
Measure position deviation vibration with a laser displacement sensor or S-TUNE II.

② Orthogonal
Measure the frequency with a laser displacement sensor.
(S-TUNE II does not work (*1))

*1) vibration that does not affect torque command value nor position deviation

No measurement tool.
By using S-TUNE II, measure torque command value and vibration of position deviation.

A measurement tool such as a laser displacement sensor is available.
Directly measure vibration frequency.

Setting Position command filter

Notch filter ☞ P. 36

Set the parameter to the vibration frequency

Find the best frequency that will suppress the vibration.

Step 1 Coarse tuning of frequency
Change the measured vibration frequency by 1Hz at a time.

Step 2 Fine tuning of frequency
Change the setting by 0.1Hz at a time after coarse tuning is done.
Frequency: 20Hz or less (given as a guideline)

Check for vibration

Write to Amplifier

Setup Complete

Set the frequency to the best possible value first, then set the notch depth.

Setting Position command filter

Notch filter ☞ P. 36

Adjusting Notch Width
Increase Notch Width while checking the effect of the filer.
Width: Increase (from the initial value of 512) up to approximately 800 -given as a guideline.
Use of the notch filer will increase the position deviation.
Adjust the width within the acceptable range of the position deviation.

Check for vibration again

Write to Amplifier

Setup Complete

Further adjust within the acceptable range of position deviation

Setting Position command filter

Notch filter ☞ P. 36

Method 1
larger notch width setting.
about : 1,000

or

Method 2
Set the second level filter.

Setting more than one notch filters may affect the filter of lower level.
Check the frequency and width again.
When setting the second level filter, change the notch depth accordingly.
Decreasing the notch depth may reduce vibration.

【application】 Setting Position command filter

γ-Notch filter ☞ P. 37

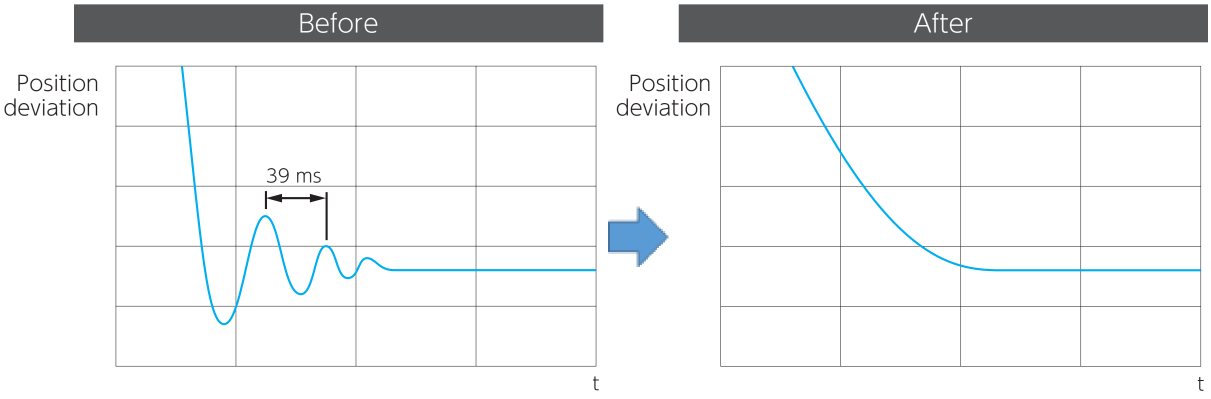
In case setting the notch filter alone is not enough to suppress vibration
Set γ-Notch Filter (*2)

*2) Set the high-frequency gain to a lower value.
Note that decreasing the gain will tend to cause a position deviation error.

Position Command Smoothing Filters 1 and 2

PVT

Function	The smoothing filters smooth the position command and suppress vibrations.		
Parameter	Position command filter 1: Type Select	No.66.0	Default: 0 Setting range: 0 to 3
	Position command filter 4: Switch Select	No.66.1	Default: 1 Setting range: 0, 1
	Position command filter 1: Smoothing 1 -Moving average counter	No.80.0	Default: 40 Setting range: 1 to 6,250
	Position command filter 4: Smoothing 2 -Moving average counter	No.81.0	Default: 16 Setting range: 1 to 1,250
Remark	Before setting any of the parameters, wait for at least 3 secs after the motor stops and then set it while the command pulse is not being input. Changing the parameter setting during pulse input or with presence of pulse residue could cause shift in position. The larger setting will result in longer command time delay.		
Tuning Tip	① Measure the vibration period from the position deviation of setting and the vibration waveform of the torque command value. ② Use the following formula to calculate the moving average:. ③ Setting filter 4 may suppress resonance. ④ If the damping effect is small, calculate the moving average frequency from the vibration period again and set it to Filter 1.Calculation formula: Moving Average Count Derived from Vibration Frequency 10,000 × vibration frequency[s] = parameter value In the example below, when the vibration frequency is 39 ms, the average count = 10,000 x 0.039 = 390; the delay time will be 39 ms. ☞ C- 2 Parameters		



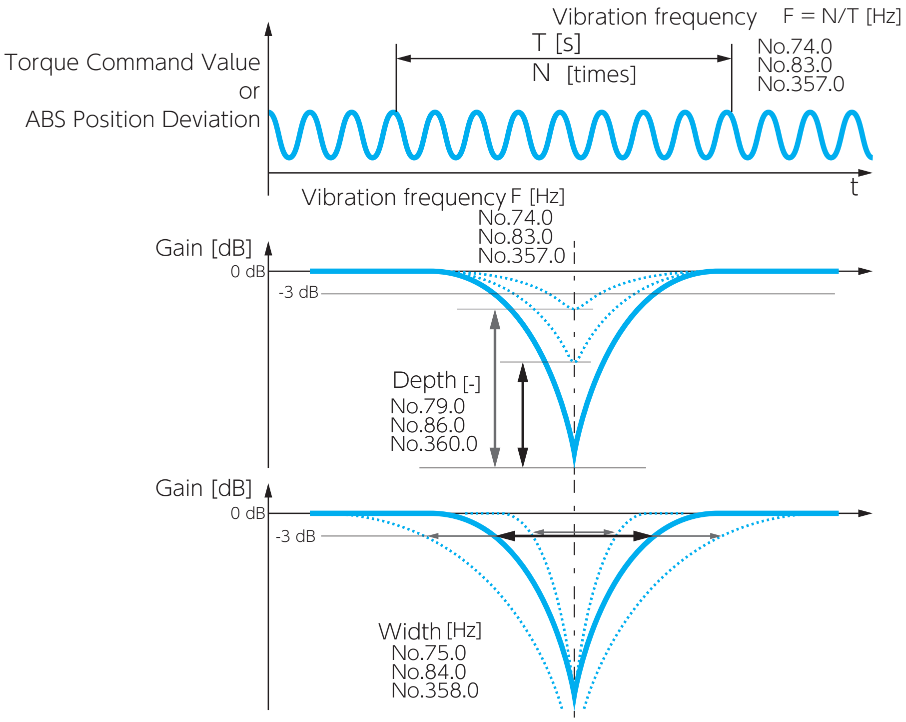
Effect of Smoothing Filter

3. Tuning Parameters

Position Command Notch Filter

<table>
<tr><td>Function</td><td colspan="6">Apply this filter if the machine end point is still vibrating after sufficient tuning was performed and the smoothing filter was applied.
Has vibration suppression effect on mechanical systems where the vibrations don't appear in the torque output waveform.
When compared to the command smoothing filter, the position command filter is more effective in reducing the absolute position deviation (Status No.80).</td></tr>
<tr><td rowspan="7">Parameter</td><td colspan="3">Notch Filter</td><td>Filter 1</td><td>Filter 2</td><td>Filter 3</td></tr>
<tr><td rowspan="2">Frequency</td><td>Default:</td><td>10 [0.1 Hz]</td><td rowspan="2">No.74.0</td><td rowspan="2">No.83.0</td><td rowspan="2">No.357.0</td></tr>
<tr><td>Setting range:</td><td>10 to 2,000</td></tr>
<tr><td rowspan="2">Width</td><td>Default:</td><td>512</td><td rowspan="2">No.75.0</td><td rowspan="2">No.84.0</td><td rowspan="2">No.358.0</td></tr>
<tr><td>Setting range:</td><td>128 to 2,048</td></tr>
<tr><td rowspan="2">Depth</td><td>Default:</td><td>0</td><td rowspan="2">No.79.0</td><td rowspan="2">No.86.0</td><td rowspan="2">No.360.0</td></tr>
<tr><td>Setting range:</td><td>0 to 100</td></tr>
<tr><td>Remark</td><td colspan="6">Increasing the notch width will make the position deviation large.
Too large a notch width or setting the second level notch filter will result in better vibration suppression; however, the position deviation will be larger. Set this filter within the acceptable range of position deviation.</td></tr>
<tr><td>Tuning Tip</td><td colspan="6">Check the following before applying the filter
・The command from the host controller is reasonable
・The equipment is installed firmly and properly.
・The gain parameters such as inertia ratio are properly set.
・The command smoothing filters 2 (and 1) are set.
・The integral gain has been decreased and vibrations are unlikely to occur.

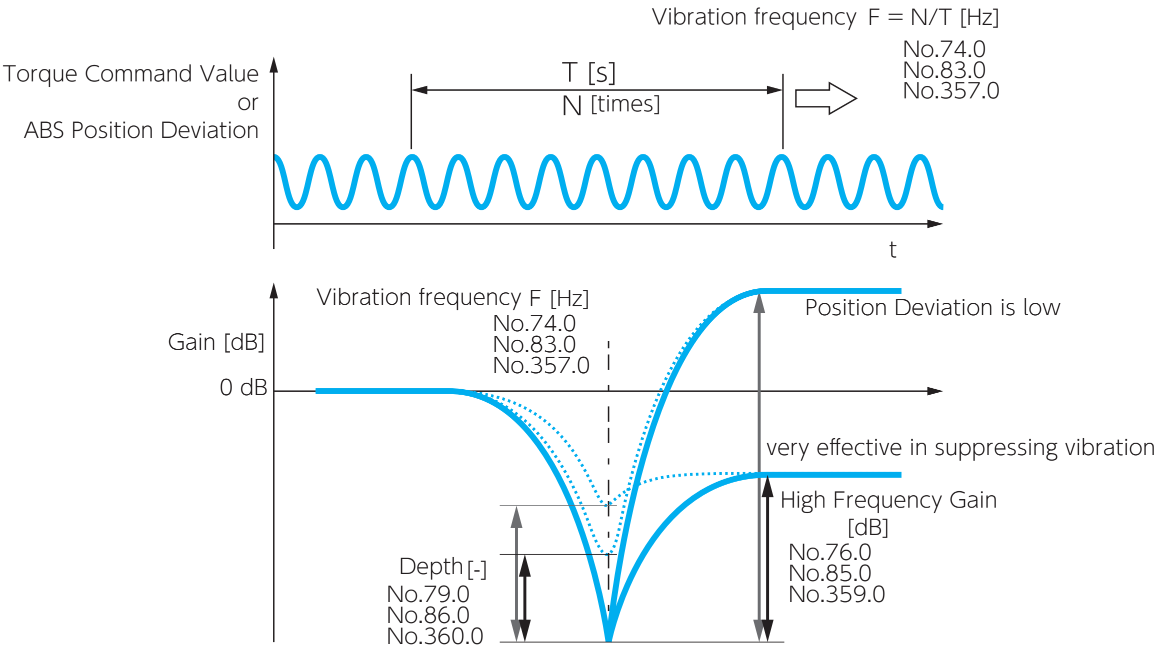
Start the equipment operation and apply the vibration frequency (measured at the equipment end) to the notch frequency. If the vibration cannot be suppressed, increase the notch width (by 800 as a rough standard). To reduce the position deviation during operation, increase the notch depth of a smaller vibration frequency.
☞ C- 2 Parameters</td></tr>
</table>



Position Command γ -Notch Filter

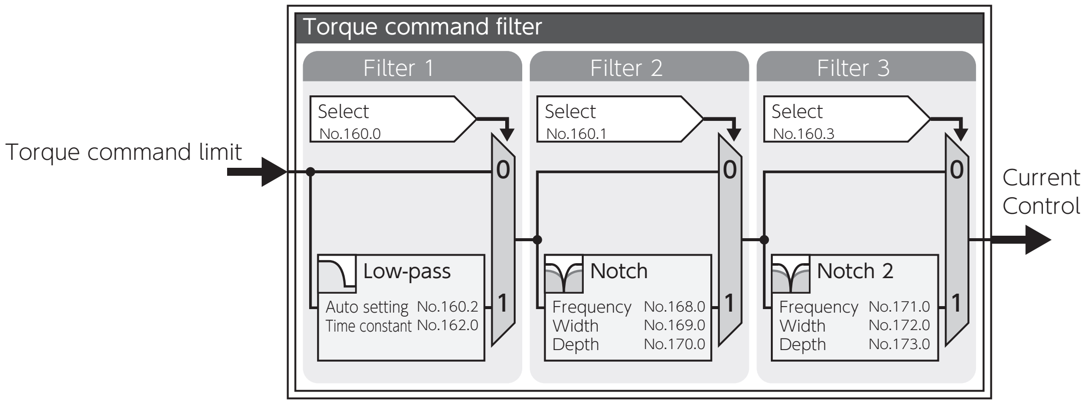
P V T

Function	Use this filter, if the machine end point is still vibrating even after applying a notch filter in addition to sufficient tuning and a smoothing filter. This filter has vibration suppression effect on mechanical systems where the vibrations don't appear in the torque output waveform. It has flexibility of changing the gain setting in a range higher than notch frequency. Use this filter when it's expected that using a notch filter will reduce the position deviation.
Remark	Increasing the high frequency gain too much may result in noise. Decreasing the high frequency gain too much will tend to cause position deviation error. Set this filter within the acceptable range.
Tuning Tip	Check the following before applying the filter ・The command from the host controller is reasonable ・The equipment is installed firmly and properly. ・The gain parameters such as inertia ratio are properly set. ・The command smoothing filter 2 and 1 are set. ・The integral gain has been decreased and vibrations are unlikely to occur. Start the equipment operation and apply the vibration frequency (measured at the equipment end) to the notch frequency. To reduce the position deviation, gradually increase the high frequency gain setting. To reduce the position deviation during operation, increase the depth selection parameter with of a smaller vibration frequency. ☞ C- 2 Parameters



4. Torque Command Filter

Filter	Overview	Refer to
Notch	**Torque Command Filter: Notch Filter** This filter is effective in removing vibration elements from torque command and suppressing noise and vibration.	P. 39
Low-pass	**Torque Command Low-Pass Filter** This filter is effective in smoothing the position command and suppressing vibration at the time of positioning.	P. 40

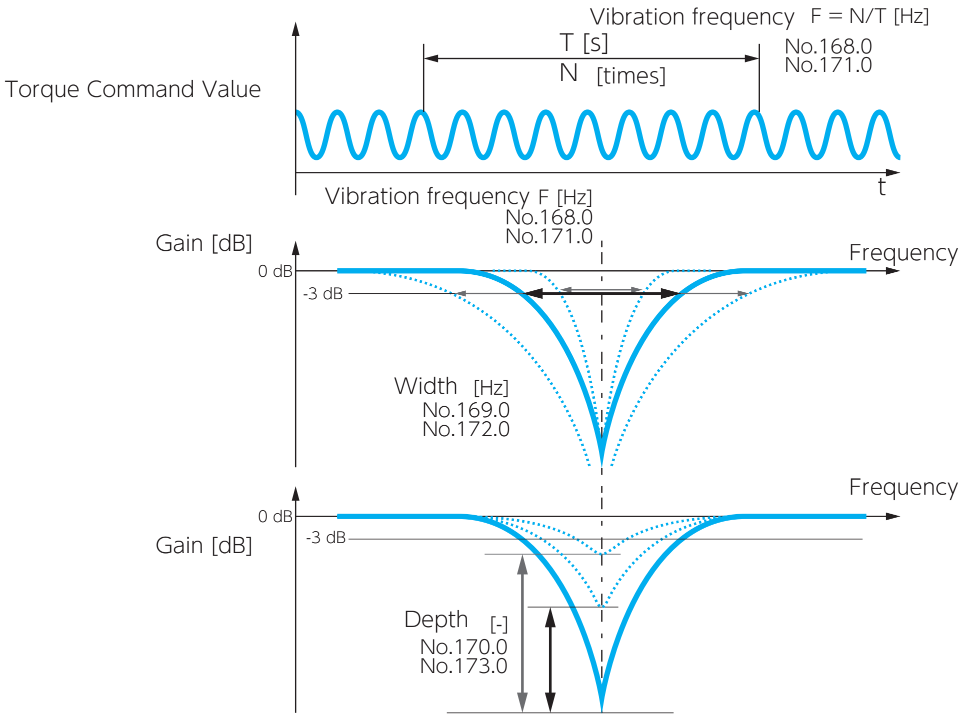


Block Diagram of Torque Command Filter with Details

Torque Command Filter: Notch Filter

PVT

Function	This filter is effective in suppressing noise and vibrations by removing vibration factors from the torque command.				
Parameter	Notch filter			Filter	Filter 2
	Switch	Default:	0	No.160.1	No.160.3
		Settings:	0, 1		
	Frequency	Default:	2,500 Hz	No.168.0	No.171.0
		Setting range:	0 to 2,500		
	Width	Default:	8	No.169.0	No.172.0
		Setting range:	1 to 16		
	Depth	Default:	0	No.170.0	No.173.0
		Setting range:	0 to 256		
Remark	Set this item only after the machinery is installed properly. Unless the equipment is installed correctly, the filter performance will be suboptimal.				
Tuning Tip	Set **Notch filter switch** (No.160.1) =1(enable) and set the value of **Notch filter frequency** (No.168.0) to be a vibration frequency. Calculate the vibration frequency using the waveform of, for example, the torque command when vibration is occurring. In the case of multiple vibration frequencies, set the second level notch filter. Alternatively, use this filter together with the **low-pass filter** (No.160.0, No.160.2, No.162.0) or increase **Notch filter - Width** (No.169.0). If applying the notch filter cannot stop resonant vibrations due to considerable machinery rattles, increase **Notch filter- Depth** (No.170.0) to 50,100,150 and so on, so that the actual notch depth will be shallower. ☞ **C- 2 Parameters**				



3. Tuning Parameters

Torque Command Low-Pass Filter

P V T

Function	Setting relatively a large value may suppress vibrations.			
Parameter	Low-Pass Filter			
	Switch	Default:	1	No.160.0
		Settings:	0, 1	
	Auto setting	Default:	0	No.160.2
		Settings:	0, 1	
	Time constant	Default:	0 [0.01 ms/rad](less than 100 W) 10 [0.01 ms/rad](over 200 W)	No.162.0
		Setting range:	0 to 65,535	
Remark	Setting a larger value means getting closer to the control range of the response model: another type of vibration will occur.			

Tuning Tip

Set **Torque command filter: Notch filter switch** (No.160.1) =1 (enable).
A rough estimate of possible max value for the filter can be obtained as follows.

$$\frac{(0.1 \text{ to } 0.2)}{\max((\omega 1+\omega 2), \omega_q)} \text{ [s] or below}$$

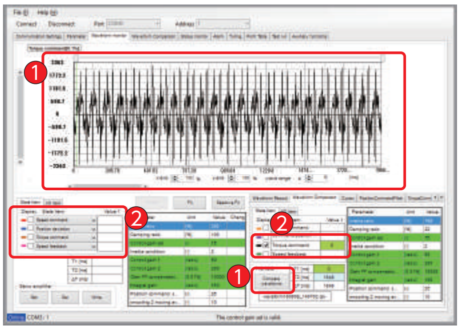
	Position Control Mode		Velocity Control Mode	
ω 1	Control Gain 1	No.115.0	Control Gain 1	No.131.0
ω 2	Control Gain 2	No.116.0	–	–
ω q	Integral Gain	No.119.0	Integral Gain	No.133.0

☞ C- 2 Parameters

4. Using S-TUNE Ⅱ to Measure Vibration Frequency (FFT)

① Load the waveforms measured or waveform data saved to display.
(The example shown on the right is saved waveform data.)

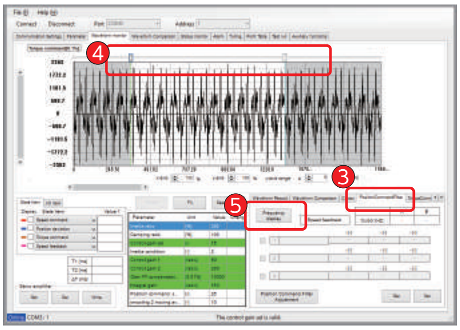
② Select a parameter of which the vibration frequency is to be investigated.
Mark the check box to display the waveform.



③ Select Position Command Filter or Torque Command Filter

④ Select a range to investigate vibration frequency.
If the position command filter or torque command filter is selected, the second cursor location of the chart will be determined based on the 1st cursor location such that the display range will contain 2^n sample points.

⑤ Click Frequency display .
The x-axis unit will be changed from time [ms] to frequency [Hz]. The display unit of the graph in the range between the 1st and 2nd cursors will be converted to frequency.

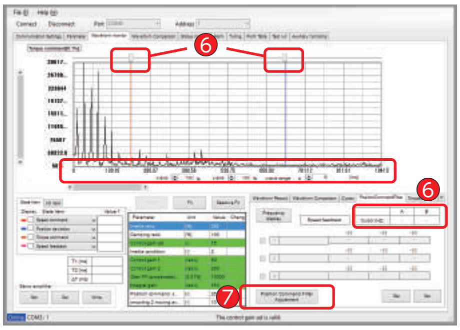


When the x-axis unit on the graph is switched to frequency, the cursor colors will change.
The table will show the frequency in red on column A and blue on column B.

⑥ Read the peak value by using the cursor.

⑦ Click on Position Command Filter Adjustment or Torque Command Filter Adjustment

This will take you to the filter setup window under the tuning tab where a filter can bet set.

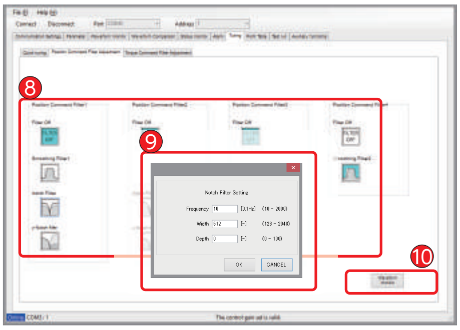


4. Using S-TUNE Ⅱ to Measure Vibration Frequency (FFT)

⑧ Click on the icon for the filter that you want to set.
Up to four levels of the position command filters are and three levels of torque command filters are available.

⑨ Set the filter parameters.
For the notch filer, enter the vibration frequency measured.

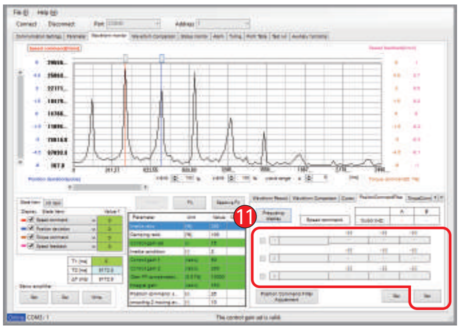
⑩ Click on Waveform monitor to return to the waveform monitor.



Notch Filter Setting
Frequency 10 [0.1Hz] (10 - 2000)
Width 512 [-] (128 - 2048)
Depth 0 [-] (0 - 100)

The filter that you just set will be shown on the list.

⑪ Unchecking the check box will switch ON/OFF of the filer.
Switch on to verify the filter effect. Switching off will not lose the filter parameter.



Tip for Notch Filter Setup

When you are setting a notch filter, use the initial value for the notch width and check the effect first.
After setting the notch filer, start the equipment, verify the filter effect, and lower the notch frequency gradually.
Measure the waveforms to find the best filter conditions such as frequency, width, and depth.
The notch frequency varies depending on the equipment

S-FLAG Ⅱ　Instruction Manual
- Standard model-
- EtherCAT communication model -

D

SOFTWARE

1. About S-TUNE Ⅱ

2. Operations

AMO-NP-35475-11
SF2-P/E-D
DEC. 2019

MEMO

1

About S-TUNE Ⅱ

1. Cautions for Proper Use

⚠ DANGER

Sign	Precautionary Measures	If Not Observed
Connections and Operations		
🚫	Do not make drastic changes to parameters during tuning. If this precaution is not followed, the motor motion will become unstable.	⚠ ⚠
❗	Before making parameter changes, carefully review the S-FLAG Ⅱ Instruction Manual and technical data.	⚠ ⚠ ⚠
	Before operating the motor for test run or homing, ensure the safety of its surrounding area.	⚠ ⚠

❗	Please study this manual first and use the product properly and safety.

- ■ Nidec Sankyo shall not be liable for any injuries or damages caused by any parameters or programs set by non-Sankyo personnel, or by malfunctions or failures of S-TUNE Ⅱ .
- ■ S-TUNE Ⅱ , the Instruction Manual, and any documentations related to S-TUNE Ⅱ , including the trademarks, logos and copyrights in them, are all attributed to Nidec Sankyo Corporation, regardless of whether they are registered or not.
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2. System Requirements for S-TUNE Ⅱ

Product Overview

S-TUNE Ⅱ is a dedicated setup software to be installed on a user-supplied Computer connecting to a S-FLAG Ⅱ servo amplifier with a USB cable.
It enables you to perform the following operations easily.

Features:

- setting, saving, and writing amplifier parameters
- measuring, saving, and comparing data, by using a graphical waveform monitor
- monitoring the state of amplifier, alarm, and input/output
- gain tuning and setting filters
- point-table operation, test operation and homing

System Requirements for S-TUNE Ⅱ

Computer	OS	Windows® 7 (32-bit, 64-bit) Windows® 8 (64-bit) Windows® 10 (64-bit)
	Language	Japanese, Chinese (Simplified), Chinese (Traditional), Korean, and English
	CPU	1 GHz or higher (32-bit or 64-bit)
	RAM	1 GB or more (32-bit) 2 GB or more (64-bit)
	Hard Disk	Free space of 512 MB or more
	Serial Communications	USB port
	Monitor	1024 × 768 Pixel or more Resolution 24-bit color (True Color) or higher
Cable	USB A - USB mini B	For certain noise environment, a signal noise filter cable is recommended.

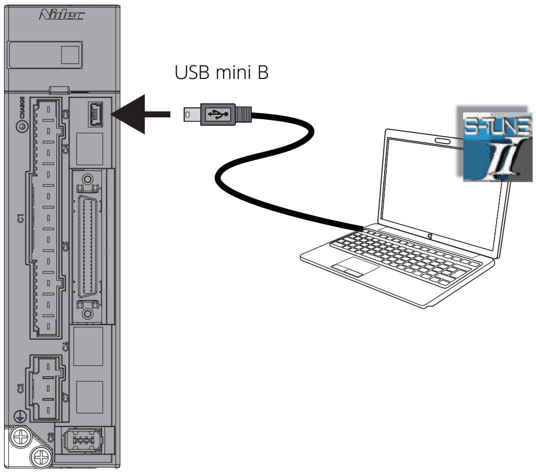
Microsoft., Windows is registered trademark of Microsoft Corporation in the United States and other countries.

Other company's names, product's names and so on are each company's registered marks.

When S-TUNE Ⅱ is used with other programs at the same time, S-TUNE Ⅱ operation may become unstable.
Use S-TUNE Ⅱ alone.

Connecting Amplifier and Computer

Install S-TUNE Ⅱ on your Computer.
Connect a USB cable to C3 at the front of the amplifier.



3. Installing S-TUNE Ⅱ

Installing

Step	Operation
Step 1	Turn on your computer to start Windows. ・Close any applications if they are opened. ・If your amplifier is connected to the computer, disconnect it before turning on the computer.
Step 2	Unzip the S-TUNE2 installer zip file on your desktop. ・S-TUNE Ⅱ cannot be installed on network drives. ・The computer must have .NET Framework installed. If not, Microsoft .NET Framework 4.0 installer will start when you try to install S-TUNE Ⅱ . For the first time installation : S-TUNE2-FULL_Ver- “*Version No.*” .zip Included ".NET Framework" For upgrading : S-TUNE2_Ver- “*Version No.*” .zip Does not included ".NET Framework"
Step 3	Double-click on setup.exe in the unzipped folder. Do not turn off the computer until installation finishes. Do not start other programs during installation.
Step 4	When installation finishes, a desktop shortcut icon will be created.
Step 5	S-TUNE Ⅱ will be installed in the following folder. C:\Program Files \NIDEC-SANKYO CORP\S-TUNE2 C:\Program Files (x86)\NIDEC-SANKYO CORP\S-TUNE2 (in 64-bit version)

What to Do If Installation Is Cancelled

To communicate with the amplifier, S-TUNE Ⅱ uses Windows system files (see below).
S-TUNE Ⅱ installer automatically cancels installation if it cannot find those system files in your computer.
If the installation is cancelled, be sure that the system files reside in the exact locations shown below.

C:\WINDOWS\system32\drivers\usbser.sys
C:\WINDOWS\inf\mdmcpq.inf

Uninstalling S-TUNE Ⅱ

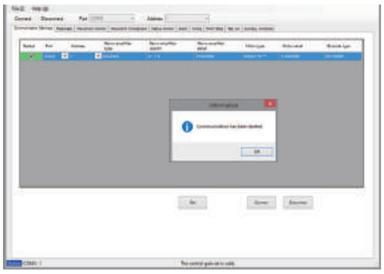
Go to **Control Panel → Programs**.
Click on **Uninstall a program**. Select **S-TUNE2** and click **Uninstall**.

2

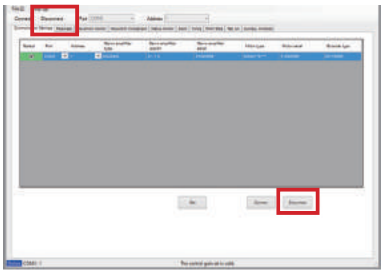
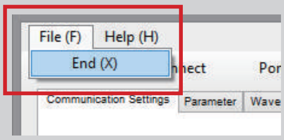
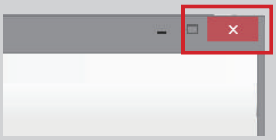
Operations

1. Overview

Start S-TUNE Ⅱ

Step	Operation
Step 1	Turn on the control power to the amplifier and plug in the USB cable to C3 firmly.
Step 2	Double-click on the desktop icon of S-TUNE Ⅱ .
Step 3	S-TUNE Ⅱ starts and the window under the communications setup tab opens. 

Close S-TUNE Ⅱ

Step	Operation
Step 1	Click on **Disconnect** on the Quick Access Tool bar at the top or click on Disconnect in the Communication Settings view. 
Step 2	In the S-TUNE Ⅱ view menu, select File -> End (X). (Or click ✕ on the S-TUNE Ⅱ title bar.)  

1. Overview

Using Keyboard

The following table explains key notations used in this document.

Key/Symbol	Explanation
[↑] [←] [↓] [→]	Up, Down, Left, and Right Arrow keys. Use these to toggle menu items. Selected items will be highlighted.
Numbers (0 to 9)	Number keys. Use them to type in a number.
[ESC]	Escape key (ESC or Esc). Press to redo an entry.
[ENTER]	Enter key (ENTER, Enter, RETURN, or Return). Use this key to execute the item you selected under a menu, or to finish entering a number.

Selecting Menu Items

Using the mouse, move the cursor to the menu item or the button you want, and left click to execute.
Alternatively, you can use arrow keys to navigate to the menu you want and press Enter key to an item.

Entering Numbers

Type in using number keys.
Numeric data such as parameter values are decimal. Enter a number in a decimal format. Binary and hexadecimal numbers are not acceptable.
To cancel a number that you are typing, press the ESC key.

1. Overview

Common Buttons

The following are the common buttons you can use under S-TUNE Ⅱ tabs.

Button	Function
Get	Read information from the amplifier RAM
Set	Write the parameters to the amplifier RAM
Write	Write the parameters to the amplifier EEPROM
Read	Read a file* saved in your Computer and display on the screen *For example, a parameter file or point table file
Save	Save the current settings to your Computer Use this button, for example, when you want to copy the same information to another amplifier.
Waveform Monitor	Jump to the **Waveform monitor** tab

Files Used in S-TUNE Ⅱ

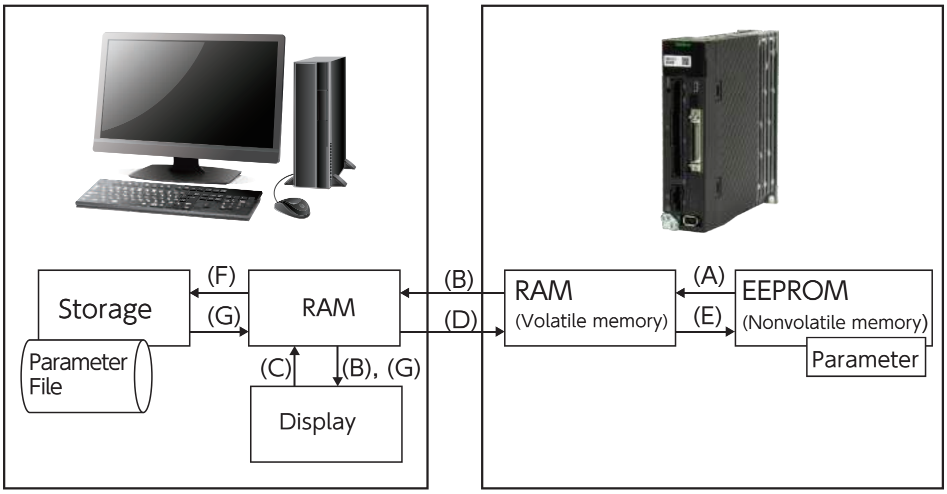
S-TUNE Ⅱ allows you to save the following data files in your Computer.
Use these files to analyze motor motions or copy the same settings to another amplifier.

File	Default File Name	Extension	Tab to use
Parameters	parameter_YYMMDD_hhmmss	.xml	・Parameters
Waveforms	waveformYYMMDD_hhmmss	.csv	・Waveform Monitor ・Waveform Comparison
Status variable log	statevaluelog_YYMMDD_hhmmss	.csv	・Status Monitor
Point table parameters	pointtable_YYMMDD_hhmmss	.xml	・Point Table
I/O pinouts	IoSetting_YYMMDD_hhmmss	.xml	・Auxiliary Functions

Do not edit any saved files or change their extension. If you do, S-TUNE Ⅱ will not be able to read the file.
The default file names include time stamps (YYMMDD_hhmmss).

1. Overview

Parameter Data Flow



Tracer Arrow	Execution Timing	Operation
(A)	Turning on the control power	Read the parameters from the amplifier EEPROM to its RAM.
(B)	Completing communications connection between S-TUNE Ⅱ and the amplifier	Obtain the parameter data from the amplifier RAM to the computer and display on the screen.
(C)	Entering parameter values	Enter parameter values in the input fields on the screen and prepare to set them to the amplifier.
(D)	Clicking Set	Set the parameters to the amplifier RAM.
(E)	Clicking Write	Write the parameters to the amplifier EEPROM.
(F)	Clicking Save	Save the parameter settings to the file.
(G)	Clicking Read	Read the parameters from the file and display on the screen.

2. Using Tabs in S-TUNE Ⅱ

This section describes functions of the tabs in S-TUNE Ⅱ. For details, refer to the pages listed below.

Communication Settings

Parameter

☞ Page 8

- Connecting or disconnecting communications with the amplifier
- Obtaining the model information and the serial number from the amplifier and displaying on the screen

Parameter

Waveform monitor

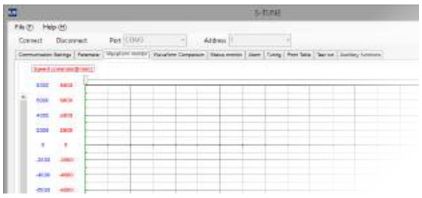
☞ Page 9

- Setting all parameters included in the parameter list and checking them
- Saving parameter values in a file, or reading them from the file

Waveform monitor

Waveform Comparison

☞ Page 12



- Displaying waveforms of status variables
- Checking positioning time and vibration status, tuning parameters, and optimizing
- Saving waveform data in a file or reading it from the file
- Setting filters

Waveform Comparison

Status monitor

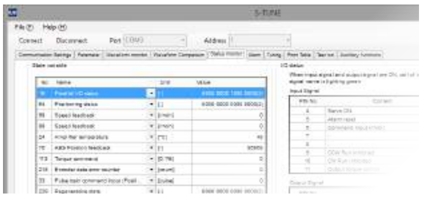
☞ Page 22

- Displaying waveforms of status data obtained under the [Waveform monitor] tab, and comparing them on two windows

Status monitor

Alarm

☞ Page 24



- Monitoring status data of the amplifier
- Saving the status data in a file

2. Using Tabs in S-TUNE Ⅱ

Alarm

Tuning

☞ Page 26

- Displaying alarm status of the amplifier
- Checking cause and remedy of the alarm
- Checking how to reset the alarm signal of the amplifier
- Checking the information on the amplifier life expectancy
- Checking the alarm history

Tuning

Point Table

☞ Page 27

- Automatically adjusting the tuning parameters
- Setting filters

Point Table

Test run

☞ Page 31

- Setting motions by Positioner function
- Saving the point table data in a file, or reading it from the file

Test run

Auxiliary functions

☞ Page 33

- Without connecting to the host controller, performing simulation of motor's repetitive motions for tuning

Test run

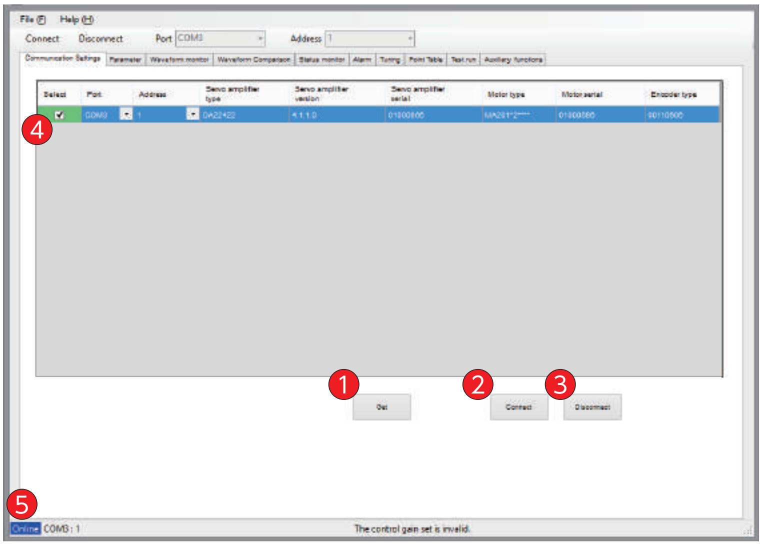
Auxiliary functions

☞ Page 35

- Clearing multi-turn data after checking alarm status
- Setting or changing I/O settings for each control mode or command mode

2. Using Tabs in S-TUNE Ⅱ

1. Communications Setup



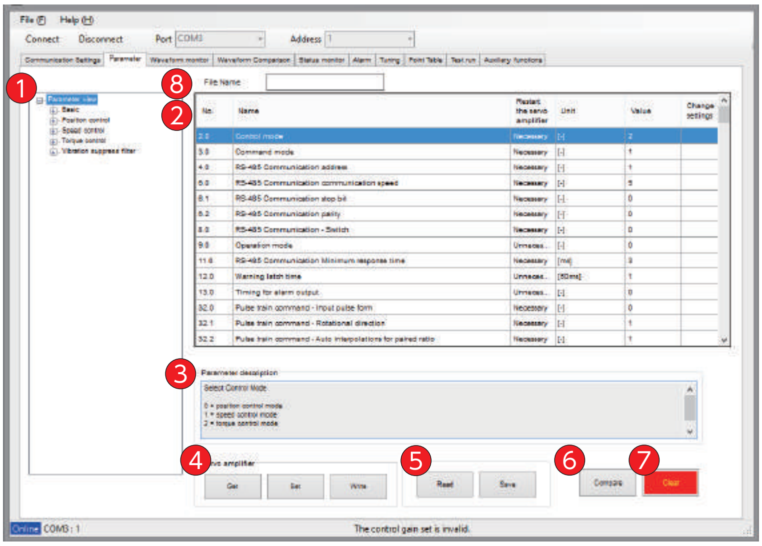
COM3 : 1

The control gain set is invalid.

No.	Button/Function	Explanation
①	Get	Click to obtain information about the amplifier.
②	Connect	Click to open the serial port to interface with the amplifier. When the connection is complete, ④ turns blue and ⑤ changes to Online .
③	Disconnect	Click to close the serial port and disconnect communications from the amplifier. When the communications are closed, ④ turns blue and ⑤ changes to Offline .
④	Connection confirmation 1	The checkbox (in the **Select** column) of the selected port is ticked. When the serial port becomes open, the color of checkbox cell changes from blue to green.
⑤	Connection confirmation 2	This box can be seen under any tabs and lets you check the connection status anytime. Offline : Not connected Online : Connected

2. Using Tabs in S-TUNE Ⅱ

2. Parameters



No.	Name	Restart the servo amplifier	Unit	Value	Change settings
2.0	Control mode	Necessary	[-]	2	
3.0	Command mode	Necessary	[-]	1	
4.0	RS-485 Communication address	Necessary	[-]	1	
6.0	RS-485 Communication communication speed	Necessary	[-]	5	
6.1	RS-485 Communication stop bit	Necessary	[-]	0	
6.2	RS-485 Communication parity	Necessary	[-]	0	
8.0	RS-485 Communication - Switch	Necessary	[-]	0	
9.0	Operation mode	Unneces...	[-]	0	
11.0	RS-485 Communication Minimum response time	Necessary	[ms]	3	
12.0	Warning latch time	Unneces...	[50ms]	1	
13.0	Timing for alarm output	Unneces...	[-]	0	
32.0	Pulse train command - Input pulse form	Necessary	[-]	0	
32.1	Pulse train command - Rotational direction	Necessary	[-]	1	
32.2	Pulse train command - Auto interpolations for paired ratio	Necessary	[-]	1	

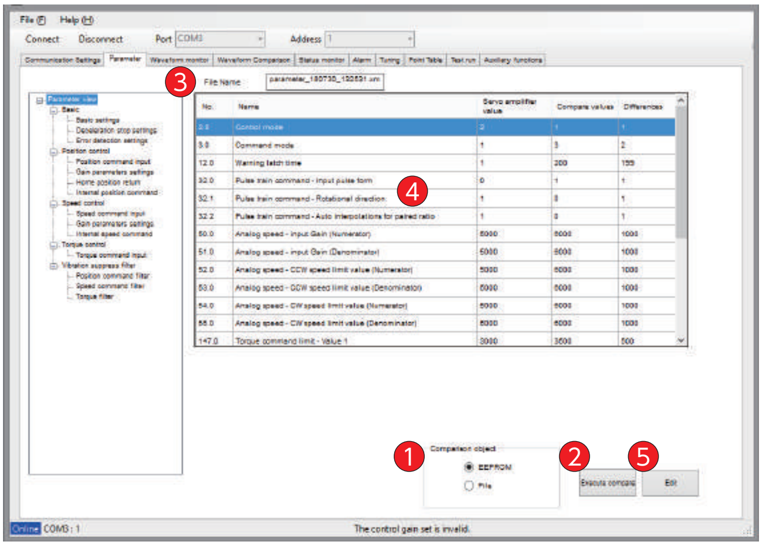
Select Control Mode

0 = position control mode
1 = speed control mode
2 = torque control mode

The control gain set is invalid.

No.	Button/Function	Explanation
①	List of Parameter Groups	In this list, related parameters are grouped together according to their usages. Select a group to display the parameters of the group in ②
②	Parameter Table	Parameters are displayed in ascending order of the parameter numbers. Select the parameter number and double-click the value to edit. An asterisk appears on the rightmost cell when you make a value change or read a file. Click Set ; the asterisk disappears. If the Restart the servo amplifier column shows "necessary", you need cycle power for changes that you made to parameter settings to take effect. Click Write and cycle the control power of the amplifier.
③	Parameter Description	This box displays explanation for the parameter selected in ② .
④	Servo amplifier	Get : Pull the values of selected parameters from the amplifier RAM. Set : Write new parameter settings to the amplifier RAM. Write : Write the new parameter settings to the amplifier EEPROM.
⑤	File	Read : Read the data you created before and display. Save : Save the parameter values you edited to a file. Use this to copy the same settings to another amplifier.
⑥	Compare	Compare : Jump to the parameter comparison screen. Comparing the parameter value in the RAM of the amplifier with the parameter value editing on the S-TUNE Ⅱ . Execute compare : Compare the edited parameters with the data saved in EEPROM or a file. Edit : Return to the parameter table ② .
⑦	Clear	Delete the parameter data in EEPPROM. Use this for factory reset or when replacing the motor. Parameter settings of the motor model that you connect next will be automatically set. We recommend data backup before you start operations.
⑧	File Name	Name of the parameter data file that S-TUNE Ⅱ read. parameter_YYMMDD.xml

Comparing Parameter Values



No.	Name	Servo amplifier value	Compare values	Differences
2.0	Control mode	2	1	1
3.0	Command mode	1	3	2
12.0	Warning latch time	1	200	199
32.0	Pulse train command - input pulse form	0	1	1
32.1	Pulse train command - Rotational direction	1	0	1
32.2	Pulse train command - Auto interpolations for paired ratio	1	0	1
50.0	Analog speed - input Gain (Numerator)	6000	5000	1000
51.0	Analog speed - input Gain (Denominator)	5000	6000	1000
52.0	Analog speed - CCW speed limit value (Numerator)	5000	6000	1000
53.0	Analog speed - CCW speed limit value (Denominator)	6000	5000	1000
54.0	Analog speed - CW speed limit value (Numerator)	5000	6000	1000
55.0	Analog speed - CW speed limit value (Denominator)	6000	5000	1000
147.0	Torque command limit - Value 1	3000	3500	500

COM3 : 1

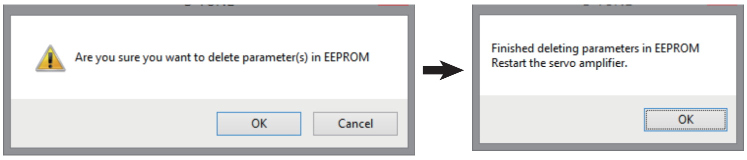
The control gain set is invalid.

No.	Button/Function	Explanation
①	What data to compare	Select which data you want to compare with the data in RAM. Select EEPROM or File.
②	Execute compare	At first, click on the Set button. (The parameter(s) is/are written in at the RAM of the amplifier.) Execute compare Executes Compare and shows the result in the data display area. If two sets of data are completely matching, the table will be blank.
③	File Name	Name of the parameter data file you selected for comparison. parameter_YYMMDD.xml
④	Parameter settings comparison table	No. : Parameter number Name : Parameter name Servo amplifier value : Parameter value residing in the amplifier RAM. Compare value : Value to compare with (in EEPROM or the file that you selected) Difference : The difference between the value in RAM and the value compared.
⑤	Edit	Jump to the parameter edit window.

Replacing with a Different Type of Motor

Use a right pair of motor and amplifier.
If a wrong pair has been set accidentally, clear the parameter data in the amplifier EEPROM first, then use a right pair.

Procedure for Parameter Clear

Step	Description
Step 1	Connect the amplifier and the computer. Turn on the control power. (You don't need to turn on the primary circuit power.)
Step 2	Click on Clear under the Parameter tab.
Step 3	 Are you sure you want to delete parameter(s) in EEPROM Finished deleting parameters in EEPROM Restart the servo amplifier. Click OK : to clear parameter data, Click Cancel : to cancel. If Parameter Clear failed, repeat this procedure from the beginning.

After clearing the parameter data in EEPROM, be sure to do the control power cycling according the following procedures.

Automatically Identifying Motor Model and Output Rating

Step	Description
Step 1	Clear the parameters.
Step 2	Disconnect the primary circuit power supply and the control power supply.
Step 3	Replace the motor and connect the encoder cable.
Step 4	Reapply the control power to the amplifier. The default parameter values for the new motor will be automatically set to EEPROM.
Step 5	Verify that the alarm statuses are all normal.

3. Waveform Monitor

⚠ DANGER

Do not use an inappropriate value for any parameter.

Or the motor will become uncontrolled. Secure safety for the work area before gain tuning.

Secure safety in surrounding areas and take safety measures such as emergency stop.

To optimize gain tuning, observe not only waveforms, but also noise and vibrations, jerky or smooth movements in the motor and the equipment.

2. Using Tabs in S-TUNE Ⅱ

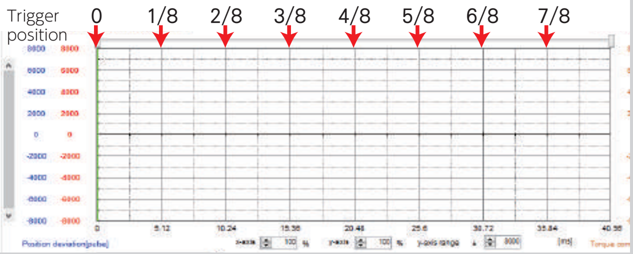
No.	Button/Function	Explanation
①	Chart Display Area	You can use the mouse in this area. • Drag to zoom a rectangle area that you select. • Right-click to capture the waveform. • Wheel button Use the Scroll wheel to change the max value to be included in the chart while the waveform is selected. This can be done in the x-axis or y-axis zoom %, or y-axis range cell where the cursor is blinking. Scrolling without specifying the area moves the left green cursor on the chart.
②	Cursor icons	Move the cursor icons horizontally to display the time values in ⑦ . Cursor 1 (green) for T1, Cursor 2 (blue) for T2.
③	Fit	Click to fit the waveform chart to the chart display area such that the max value.
	Selective Fit	This icon adjusts the selected waveform display range such that the average of the max and min y-values of the data is centered in the chart display window. When y-value fluctuations are relatively small, the waveform you want to see might appear only at the upper side or lower side of the display window. **Selective Fit** can fix this problem. To select a variable for which you want to change the waveform display range, click on the variable label (i.e. a status name) in the chart area. The status variable selected will be shown with a black border (e.g., Speed command [r/min]).
	Return	Click Return to see the previous display view of the waveform. You can go back up to the fifth one. Click Fit to clear the history of display changes.
④	X-axis scale	Enter a zoom percentage for x-axis.
	Y-axis scale	Enter a zoom percentage for y-axis.
	Y-axis range	Specify the display range for y-axis.
⑤	Scroll bars	Use the horizontal bar to change the x-axis display range. Use the vertical bar to change the y-axis display range.

No.	Button/Function	Explanation
⑥	State Item	Select up to four state items (i.e. status variables), from the pull-down menu, that you want to display in waveform. Those four items you selected will be saved in a file. In the case of 4-byte status data, only the lower 2-byte is displayed.
	I/O Item	The I/O items are also displayed in waveform. Four I/O items selected here will be saved to a file.
⑦	Time	Time measured at the location of the cursor positions. T1 : time at the green cursor T2 : time at the blue cursor △T : difference between T1 and T2
⑧	Parameters Window	Displays parameters that can be set in the **Waveform monitor** tab and display-only parameters. The rows highlighted in green are parameters grouped together in the control gain set. Parameters with grayed out **Value** cells are display-only.
⑨	Servo amplifier Click Get	: to read the parameters from the amplifier.
	Click Set	: to set the parameters to the amplifier RAM.
	Click Write	: to save the parameter to the amplifier EEPROM.

2. Using Tabs in S-TUNE Ⅱ

Waveform Record

Set the waveform measurement conditions here.
Save the obtained waveforms and tuning parameters to a file.

<table>
<tr><th>Button/Function</th><th>Explanation</th></tr>
<tr><td>Sampling cycle</td><td>Default : 2.00 [ms]   Set in increments of: 0.05 [ms]
Sampling cycle = (Range of motor moving time) ÷ (Sampling Points)</td></tr>
<tr><td>Sampling Points</td><td>Enter the number of sampling points per measurement.
Initial value: 1,000 points, Range: 1 to 4,096 points</td></tr>
<tr><td>Trigger method</td><td>Select the trigger method to obtain waveform data. At first, select rising edge to measure the series of motions from start to finish.
<table>
<tr><th>Setting</th><th>Preferred when</th><th>Recording starts when</th><th>Recording ends when</th></tr>
<tr><td>Rising above the threshold
(i.e. Rising edge)</td><td>• Checking statuses immediately after a motion starts.
• Trying to get a general idea on the whole movement.</td><td>The value of Valid trigger source has exceeded the Trigger Level setting.</td><td rowspan="2">The number of points sampled has exceeded the Sampling points setting.</td></tr>
<tr><td>Force trigger</td><td>• Actual motion is too slow for the rising edge trigger to get to work.
• Checking a specific part of consecutive operations.</td><td>Capture waveform
has been clicked.</td></tr>
</table>
Note: "Falling edge" option is not available.</td></tr>
<tr><td>Valid trigger source</td><td>Select a state variable that will work as the trigger to start recording waveform data (state variables).</td></tr>
<tr><td>Trigger level</td><td>Set the threshold value to start recording waveform data.
When the selected variable exceeds the threshold, recording will start.
Range: 0 to 32,767</td></tr>
<tr><td>Trigger position</td><td>Set the trigger position. You can select up to eight positions starting from the left.
0 : Left end of the chart, 1/8 : Leftmost solid line, 7/8 : Rightmost solid line

</td></tr>
<tr><td>Sampling method</td><td>Single acquisition: to obtain data only once for the specified number of sampling points.
Successive acquisition: "Single acquisition" is repeated and waveform chart continues to update until Stop sampling is clicked.</td></tr>
<tr><td>Capture waveform</td><td>Start obtaining waveform data.</td></tr>
<tr><td>Stop sampling</td><td>Stop obtaining waveform data.</td></tr>
<tr><td>Save waveform(s)</td><td>Save the obtained waveform data and the tuning parameter settings in a CSV file.</td></tr>
<tr><td>Tuning</td><td>Jump to the Quick Tuning tab under the Tuning tab.</td></tr>
</table>

Waveform Comparison

Use this tab to display and compare waveforms of the data read from the waveform file and waveforms of sampled data.

Button/Function	Explanation
State Item (i.e. Status variables)	Select items that you want to display in waveforms. Eight waveforms including those from the sampled items ⑥ can be displayed. Y-axis units are displayed for four items from the top selected in ⑥ .
I/O Item	I/O data from another waveform file. Displays up to four when Parallel I/O Status is selected as status item.
Parameters	Parameter values of waveform that have been read from wave form the file.
Time	T1 and T2 are time figures indicated by the cursor positions. (*)
Compare waveforms	Read the saved data.
waveformYYMMDD_hhmmss.csv	Name of the file that has been read from the computer.

Cursor

Enables numeric comparison of the waveforms displayed in the chart area. Up to eight waveforms can be displayed - your measured waveforms at the top and waveforms-read by the waveform comparison tab from the file- on the bottom.
Value 1 at Cursor 1 (green),　Value 2 at Cursor 2 (blue)

Button/Function	Explanation
State items (i.e. Status variables) I/O items	Y values (at the cursors) of the items you selected are displayed.

2. Using Tabs in S-TUNE Ⅱ

Position Command Filter

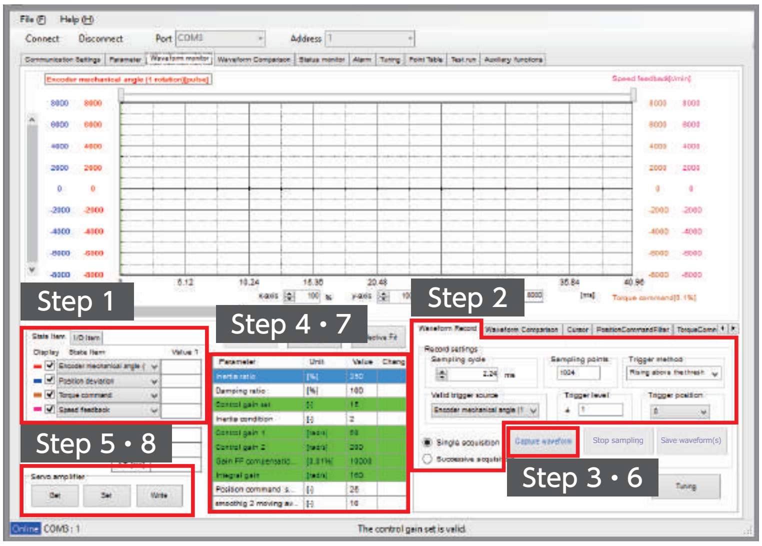
Torque Command Filter

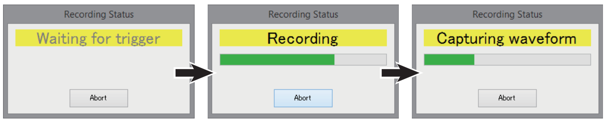
Use these tabs to check fluctuating position deviation values and torque command values in waveform chart and select the filters that you want to set. (*)

Button/Function	Explanation
Frequency display	This item changes the chart units from time [ms] to frequency [Hz]. When the display mode is changed to frequency, the cursor colors change to red and blue. Column A and Column B show frequencies at the red and blue cursors respectively. In frequency charts, Cursor 2 position is determined to be at 2^n sampling point starting from the Cursor 1 position. Read the peak value; use Position Command Filter Adjustment or Torque Command Filter Adjustment to jump to the Tuning tab to set filters. You can set to four levels of filters. After setting filters, you can check the settings under Position Command Filer tab and the Torque Command Filter tab.
Time View	Click to switch the chart units from frequency [Hz] to time [ms]. In the time unit mode, the cursor colors are green and light blue, and Columns A and B are blank.
Position Command Filter Adjustment	Click to jump to **Position Command Filter Adjustment** under the **Tuning** tab.
Torque Command Filter Adjustment	Click to jump to **Torque Command Filter Adjustment** under the **Tuning** tab.
Get	Read filter parameters from the amplifier.
Set	Write the filter parameters to the amplifier RAM.
☑ (Checkbox)	You can enable or disable the filter that you set by checking or unchecking the checkbox. Unchecking the checkbox does not erase the filter setting.

*) Under these tabs, the second cursor in the time unit mode is positioned at the 2^n sampling point starting from the first cursor position. Conversion to frequency is applied to the range between the 1st and 2nd cursors

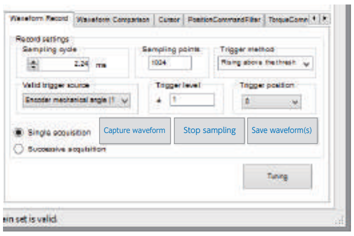
Procedure 1　Waveform Display



Step	Description
Step 1	Select status items that you want to obtain waveforms for.
Step 2	Set measurement conditions.
Step 3	Click on Capture waveform  ・The popup dialog "Waiting for trigger" does not change to "Recording" until the enabled trigger source reaches the trigger specified level. In case that the dialog "Waiting for trigger" remains unchanged, select the "Force trigger" method instead or decrease the trigger level. ・If you click Abort in the middle of the process, the data will have been captured up to the point of abort.
Step 4	Adjust the parameters. ☞ C- 3 Tuning
Step 5	Click Set to write the parameters to the amplifier RAM.
Step 6	Click Capture waveform to see the waveforms.
Step 7	Continue adjusting the parameters until you obtain desired waveforms.
Step 8	Click Write to write the parameters to EEPROM of the amplifier.

2. Using Tabs in S-TUNE Ⅱ

Procedure 2　Saving waveform data



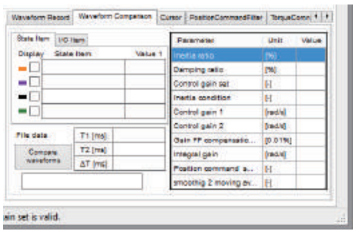
Sampling cycle 2.24 ms
Sampling points 1024
Trigger method Rising above the thresh
Valid trigger source Encoder mechanical angle [1
Trigger level + 1
Trigger position 0
● Single acquisition
○ Successive acquisition
ain set is valid.

Step	Description
Step 1	Click on Save waveform(s) under the **Waveform Record** tab.
Step 2	A dialog box will prompt you to select a waveform file name.
Step 3	Select the name of a waveform file you want to save the waveform data to and click Save .

Use the saved file when you want to use the same measurement conditions next time.

File content	Data of waveforms displayed and parameters
Default directory to save waveform files	C:\Users******\Documents\NIDEC-SANKYO\S-TUNE2\Waves
Default file name	waveformYYMMDD_hhmmss.csv

Procedure 3　Reading waveform data



Parameter	Unit	Value
Inertia ratio	[%]	
Damping ratio	[%]	
Control gain set	[-]	
Inertia condition	[-]	
Control gain 1	[rad/s]	
Control gain 2	[rad/s]	
Gain FF compensatio...	[0.01%]	
Integral gain	[rad/s]	
Position command a...	[-]	
smoothig 2 moving av...	[-]	

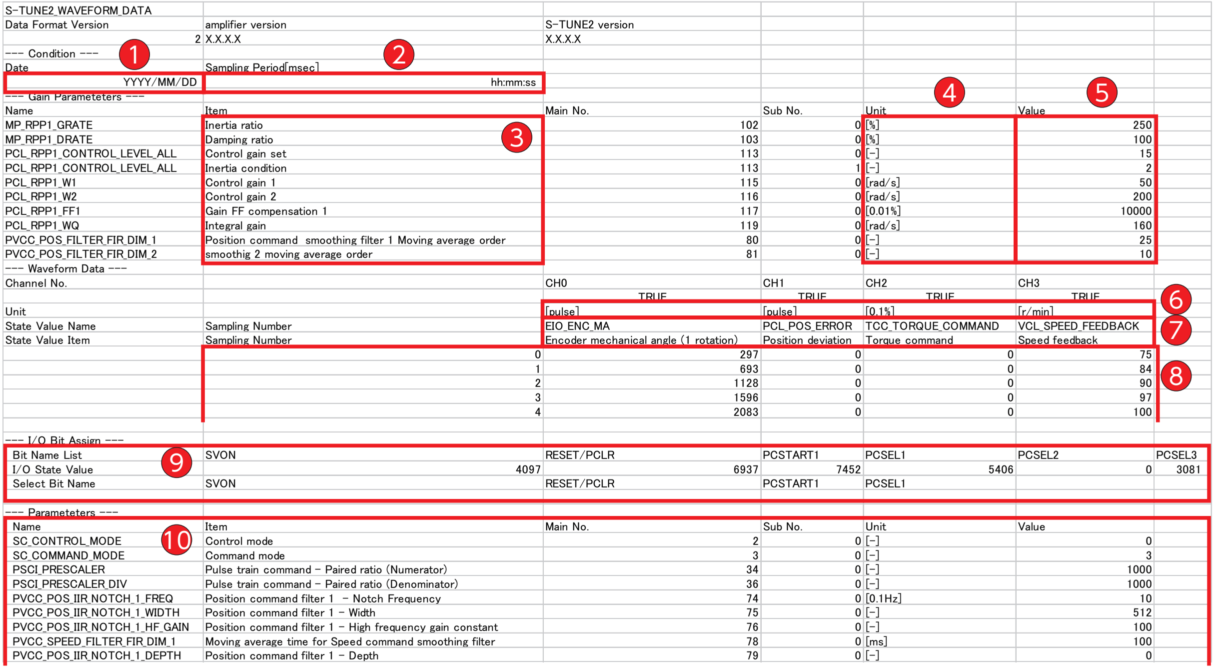
ain set is valid.

Step	Description
Step 1	Click Compare waveforms under the **Waveform Comparison** tab.
Step 2	A dialog box will prompt you to select a waveform file.
Step 3	Select a file and click Open . (The file name that you selected appears in the box below the **Compare waveform** button. For example, waveformYYMMDD_hhmmss.csv)

NOTE

- The color of the waveform matches the color shown on the display check mark, not the one used when you saved the data.
- The data read from the file is displayed in the Value1 column.
- Under the Waveform monitor tab, waveforms of most recent data and data read from the file are both displayed in one chart.
  The **Waveform Comparison** tab lets you compare waveform charts of two data sources side by side vertically.

Procedure 4 Reading Waveform File



S-TUNE2_WAVEFORM_DATA						
Data Format Version	amplifier version	S-TUNE2 version				
2	X.X.X.X	X.X.X.X				
--- Condition ---						
Date	Sampling Period[msec]					
YYYY/MM/DD	hh:mm:ss					
--- Gain Parameteters ---						
Name	Item	Main No.	Sub No.	Unit	Value	
MP_RPP1_GRATE	Inertia ratio	102	0	[%]	250	
MP_RPP1_DRATE	Damping ratio	103	0	[%]	100	
PCL_RPP1_CONTROL_LEVEL_ALL	Control gain set	113	0	[-]	15	
PCL_RPP1_CONTROL_LEVEL_ALL	Inertia condition	113	1	[-]	2	
PCL_RPP1_W1	Control gain 1	115	0	[rad/s]	50	
PCL_RPP1_W2	Control gain 2	116	0	[rad/s]	200	
PCL_RPP1_FF1	Gain FF compensation 1	117	0	[0.01%]	10000	
PCL_RPP1_WQ	Integral gain	119	0	[rad/s]	160	
PVCC_POS_FILTER_FIR_DIM_1	Position command smoothing filter 1 Moving average order	80	0	[-]	25	
PVCC_POS_FILTER_FIR_DIM_2	smoothig 2 moving average order	81	0	[-]	10	
--- Waveform Data ---						
Channel No.		CH0	CH1	CH2	CH3	
		TRUE	TRUE	TRUE	TRUE	
Unit		[pulse]	[pulse]	[0.1%]	[r/min]	
State Value Name	Sampling Number	EIO_ENC_MA	PCL_POS_ERROR	TCC_TORQUE_COMMAND	VCL_SPEED_FEEDBACK	
State Value Item	Sampling Number	Encoder mechanical angle (1 rotation)	Position deviation	Torque command	Speed feedback	
	0	297	0	0	75	
	1	693	0	0	84	
	2	1128	0	0	90	
	3	1596	0	0	97	
	4	2083	0	0	100	
--- I/O Bit Assign ---						
Bit Name List	SVON	RESET/PCLR	PCSTART1	PCSEL1	PCSEL2	PCSEL3
I/O State Value	4097	6937	7452	5406	0	3081
Select Bit Name	SVON	RESET/PCLR	PCSTART1	PCSEL1		
--- Parameteters ---						
Name	Item	Main No.	Sub No.	Unit	Value	
SC_CONTROL_MODE	Control mode	2	0	[-]	0	
SC_COMMAND_MODE	Command mode	3	0	[-]	3	
PSCI_PRESCALER	Pulse train command – Paired ratio (Numerator)	34	0	[-]	1000	
PSCI_PRESCALER_DIV	Pulse train command – Paired ratio (Denominator)	36	0	[-]	1000	
PVCC_POS_IIR_NOTCH_1_FREQ	Position command filter 1 – Notch Frequency	74	0	[0.1Hz]	10	
PVCC_POS_IIR_NOTCH_1_WIDTH	Position command filter 1 – Width	75	0	[-]	512	
PVCC_POS_IIR_NOTCH_1_HF_GAIN	Position command filter 1 – High frequency gain constant	76	0	[-]	100	
PVCC_SPEED_FILTER_FIR_DIM_1	Moving average time for Speed command smoothing filter	78	0	[ms]	100	
PVCC_POS_IIR_NOTCH_1_DEPTH	Position command filter 1 – Depth	79	0	[-]	0	

--- Condition ---		
①	Date	Data timestamp for saving a file
②	Sampling Period [msec]	Sampling cycle
--- Gain Parameters ---		
③	Item	Tuning parameter names
④	Unit	Tuning parameter units
⑤	Value	Tuning parameter values
--- Waveform Data---		
⑥	Unit	Measurement units of status items
⑦	State Value Item	Amplifier status variable names
⑧	Status data	Time series data of status variables
---I/O Bit Assign---		
⑨	I/O data	
---I/O Bit Assign---		
⑩	Information of related parameters	

MEMO

4. Waveform Comparison

Display	State Item	Value
☑	Encoder mechanica...	41
☑	Position deviation	0
☑	Torque command	0
☑	Speed feedback	47

Parameter	Unit	Val
Inertia ratio	[%]	250
Damping ratio	[%]	100
Control gain set	[-]	15
Inertia condition	[-]	2
Control gain 1	[rad/s]	50
Control gain 2	[rad/s]	200

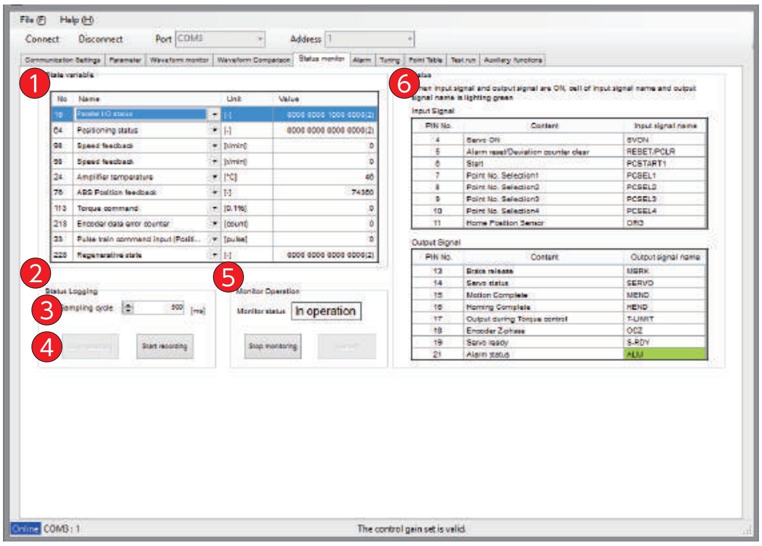
2. Using Tabs in S-TUNE Ⅱ

Displaying Waveforms

No.	Button/Function	Explanation
①	Scroll bars	Use the horizontal bar to scroll sideways. Use the vertical bar to scroll up and down.
②	Cursor	Move the cursor horizontally to display the x coordinate in ⑩ (Time [ms]).
③	Compare waveforms	Click to read the data created earlier.
④	waveformYYMMDD_hhmmss.csv	The name of the file that the data was read from.
⑤	Fit	Click to fit the waveform chart to the chart display area such that the max value of the selected waveform will be the max y-coordinate..
⑥	Return	Click to go back to the previous waveform display (i.e. undo **Fit**.). You can go back up to the fifth one. Click Fit to reset the history.
⑦	x-axis zoom %	Enter a zoom percentage for x-axis.
	y-axis zoom %	Enter a zoom percentage for y-axis.
	y-axis range	Specify the display range of y-axis.
⑧	Chart Display Area	You can use the mouse in the Chart area. Drag to specify a rectangle area to zoom in. Right-click to copy the waveform. Use the scroll wheel in any input cell of x-axis zoom %, y-axis zoom %, or y-axis range where the cursor is blinking, to change the max value of the selected item to be included in the chart. Click on the cursor button ② and then use the scroll wheel to move the green cursor.
⑨	State Item	Click the checkbox of the item that you want to see its waveform for. You can select up to four items.
⑩	Time	The measured value at the x-axis cursor position.
⑪	Parameter	Displays the parameter values at the time when waveform data was obtained.

2. Using Tabs in S-TUNE Ⅱ

5. Status Monitor



State variable

No	Name	Unit	Value
16	Parallel I/O status	[-]	0000 0000 1000 0000(2)
64	Positioning status	[-]	0000 0000 0000 0000(2)
98	Speed feedback	[r/min]	0
56	Speed feedback	[r/min]	0
24	Amplifier temperature	[°C]	40
76	ABS Position feedback	[-]	74380
113	Torque command	[0.1%]	0
218	Encoder data error counter	[count]	0
33	Pulse train command input (Posit...	[pulse]	0
228	Regenerative state	[-]	0000 0000 0000 0000(2)

Monitor status: In operation

Status

When input signal and output signal are ON, cell of input signal name and output signal name is lighting green.

Input Signal

PIN No.	Content	Input signal name
4	Servo ON	SVON
5	Alarm reset/Deviation counter clear	RESET/PCLR
6	Start	PCSTART1
7	Point No. Selection1	PCSEL1
8	Point No. Selection2	PCSEL2
9	Point No. Selection3	PCSEL3
10	Point No. Selection4	PCSEL4
11	Home Position Sensor	ORG

Output Signal

PIN No.	Content	Output signal name
13	Brake release	MBRK
14	Servo status	SERVO
15	Motion Complete	MEND
16	Homing Complete	HEND
17	Output during Torque control	T-LIMIT
18	Encoder Z-phase	OCZ
19	Servo ready	S-RDY
21	Alarm status	🟩 ALM

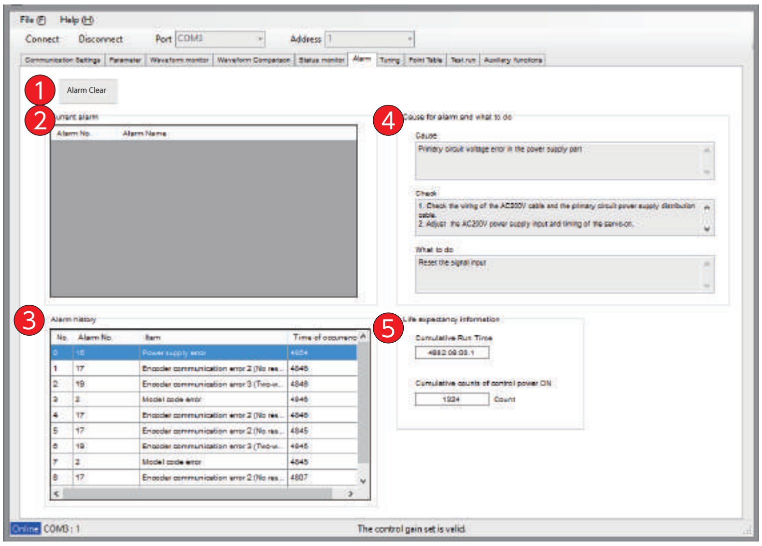
COM3 : 1

The control gain set is valid.

No.	Button/Function	Explanation
①	State variable	Select up to ten status variables that you want to monitor. The data is displayed at the same time. Display example: [0000 0000 0000 0000(2)] where (2) indicates binary. ☞ Z- 2 **Technical Information** Status Display
②	Status Logging	Lets you obtain status log.
③	Sampling cycle	Range: 500 to 100,000 [ms] Set in increments of: 500 [ms]
④	Stop recording Start recording	Click Start recording after setting the sampling cycle. Click Stop recording to stop logging. The data will be saved to a csv file. Default file name: statevaluelog_YYMMDD_hhmmss.csv
⑤	Monitor Operation	Clicking the [Status monitor] tab starts monitoring. Use Stop monitoring or Restart to stop or resume monitoring.
⑥	I/O status	When an input or output signal turns on, its signal name cell turns green.

2. Using Tabs in S-TUNE Ⅱ

6. Alarm



Cause
Primary circuit voltage error in the power supply part

Check
1. Check the wiring of the AC200V cable and the primary circuit power supply distribution cable.
2. Adjust the AC200V power supply input and timing of the servo-on.

What to do
Reset the signal input

No.	Alarm No.	Item	Time of occurrence
0	15	Power supply error	4854
1	17	Encoder communication error 2 (No res...	4846
2	19	Encoder communication error 3 (Two-w...	4848
3	2	Model code error	4846
4	17	Encoder communication error 2 (No res...	4846
5	17	Encoder communication error 2 (No res...	4845
6	19	Encoder communication error 3 (Two-w...	4845
7	2	Model code error	4845
8	17	Encoder communication error 2 (No res...	4807

Cumulative Run Time: 4882:09:08.1

Cumulative counts of control power ON: 1324 Count

Online COM3 : 1 The control gain set is valid.

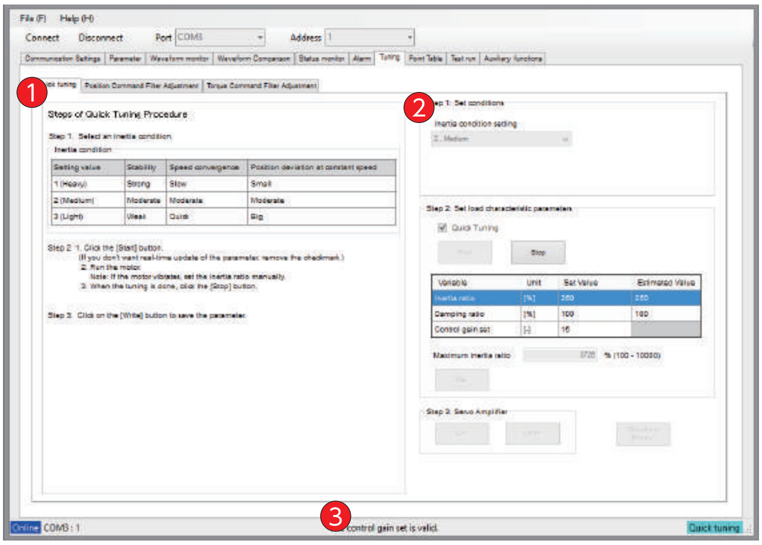
No.	Button/Function	Explanation
①	Alam Clear	Click to clear amplifier alarms. Clearing alarms 1. Remove the cause of the alarm(s). 2. Under the **Parameters** tab, set Operation Mode (No.9.0) to 1 (communication). 3. Click **Alarm Clear**.
②	Current alarm	Displays a list of current alarms.
③	Alarm history	Displays up to ten most recent alarms.
④	Cause for alarm and what to do	Shows possible causes of the alarm selected in ② and troubleshooting.
⑤	Life expectancy information	Shows guidelines for regular maintenance and product life. Cumulative Run Time: This item indicates the total amplifier runtime (in [hhhhhh:mm:ss.s]) since the control power was supplied to it for the first time. Cumulative counts of control power ON: This item indicates how many times the control power was turned on to the amplifier since the first time

☞ **Z- 1 Troubleshooting**

7. Tuning

Quick tuning

Position control mode only



Steps of Quick Tuning Procedure

Step 1. Select an inertia condition.

Inertia condition

Setting value	Stability	Speed convergence	Position deviation at constant speed
1 (Heavy)	Strong	Slow	Small
2 (Medium)	Moderate	Moderate	Moderate
3 (Light)	Weak	Quick	Big

Step 2. 1. Click the [Start] button.
(If you don't want real-time update of the parameter, remove the checkmark.)
2. Run the motor.
Note: If the motor vibrates, set the inertia ratio manually.
3. When the tuning is done, click the [Stop] button.

Step 3. Click on the [Write] button to save the parameter.

Step 1: Set conditions

Inertia condition setting: 2 : Medium

Step 2: Set load characteristic parameters

☑ Quick Tuning

Variable	Unit	Set Value	Estimated Value
Inertia ratio	[%]	250	250
Damping ratio	[%]	100	100
Control gain set	[-]	16	

Maximum inertia ratio 3720 % (100 - 10000)

Step 3: Servo Amplifier

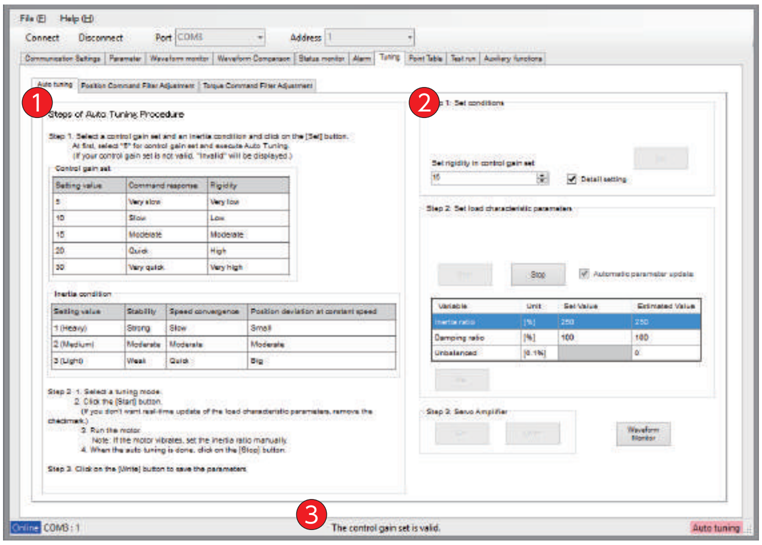
Control gain set is valid.

No.	Procedure/Button	Explanation
①	Operating Procedure	This is a guidance of the "Quick Tuning".
②	Conditions	Set a load related parameter of the motor.
	Step 1	Set the appropriate inertia condition : Choose a inertia condition to machine system connecting to your motor.
	Step 2	Setting of the load related parameters : ☑ : Quick Tuning If you check "Quick Tuning", the inertia ratio value is estimated automatically, and then the value is set to the amplifier RAM one by one. Uncheck the check box if you need the inertia ratio estimation only. Click Start : to start a Quick Tuning Click Stop : to stop a Quick Tuning Inertia ratio upper bound If you try to enter the inertia ratio by manually, enter a value in the "Set value" cell. Set : Write the new parameter settings to the amplifier RAM.
	Step 3	Get : Pull the values of the parameters from the amplifier RAM Write : Write the new parameter settings to the amplifier EEPROM.
	Waveform Monitor	Jump to the Wave Monitor window.
③	Tuning status indicator	This indicator shows a tuning condition.

2. Using Tabs in S-TUNE Ⅱ

Auto tuning

Velocity Control Mode only



Steps of Auto Tuning Procedure

Step 1. Select a control gain set and an inertia condition and click on the [Set] button.
At first, select "5" for control gain set and execute Auto Tuning.
(If your control gain set is not valid, "Invalid" will be displayed.)

Control gain set

Setting value	Command response	Rigidity
5	Very slow	Very low
10	Slow	Low
15	Moderate	Moderate
20	Quick	High
30	Very quick	Very high

Inertia condition

Setting value	Stability	Speed convergence	Position deviation at constant speed
1 (Heavy)	Strong	Slow	Small
2 (Medium)	Moderate	Moderate	Moderate
3 (Light)	Weak	Quick	Big

Step 2 1. Select a tuning mode.
2. Click the [Start] button.
(If you don't want real-time update of the load characteristic parameters, remove the checkmark.)
3. Run the motor.
Note: If the motor vibrates, set the inertia ratio manually.
4. When the auto tuning is done, click on the [Stop] button.

Step 3. Click on the [Write] button to save the parameters.

Step 1: Set conditions

Set rigidity in control gain set: 15

☑ Detail setting

Step 2: Set load characteristic parameters

☑ Automatic parameter update

Variable	Unit	Set Value	Estimated Value
Inertia ratio	[%]	250	250
Damping ratio	[%]	100	100
Unbalanced	[0.1%]		0

Step 3: Servo Amplifier

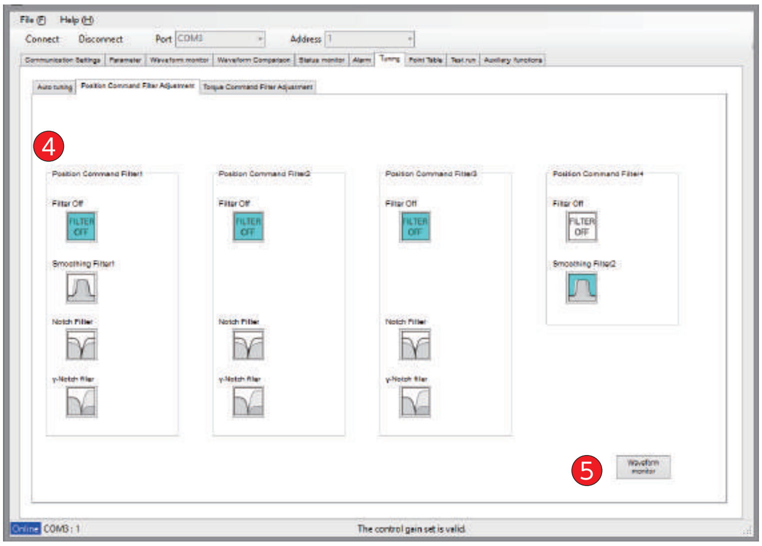
COM3 : 1

The control gain set is valid.

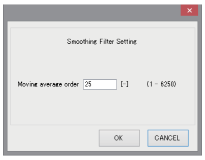
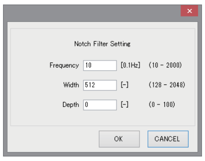
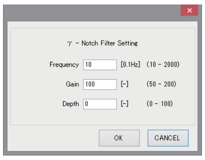
Auto tuning

<table>
<tr><th>No.</th><th>Button/Function</th><th>Explanation</th></tr>
<tr><td>①</td><td>Step of Auto Tuning Procedure</td><td>Auto Tuning Operation</td></tr>
<tr><td>②</td><td>Conditions
Step 1</td><td>Adjust load characteristic parameters.
Setting rigidity (Control Gain Set):
Start with the lowest value 5, then gradually increase the value.
<table>
<tr><th></th><th>Range</th><th>Increment by</th></tr>
<tr><td>☐ Detail setting</td><td>5 to 30</td><td>5</td></tr>
<tr><td>☑ Detail setting</td><td>1 to 46</td><td>1</td></tr>
</table>
Inertia ratio upper bound
If you try to enter the inertia ratio by manually, enter a value in the "Set value" cell.
Set : Write the new parameter settings to the amplifier RAM.</td></tr>
<tr><td></td><td>Step 2</td><td>Estimating the inertia ratio automatically:
Click Start : to start Auto-tuning
Click Stop : to end Auto-tuning
☑ : Automatic parameter update
The parameter value will be estimated and set to the amplifier RAM.
Manually enter the inertia ratio:
Enter a value in the "Set Value" column.
Set : to set data to the amplifier RAM.</td></tr>
<tr><td></td><td>Step 3</td><td>Click Get : to read data from the amplifier RAM.
Click Write : to write data to the amplifier EEPROM.</td></tr>
<tr><td></td><td>Waveform Monitor</td><td>Click this button to jump to the Waveform tab.</td></tr>
<tr><td>③</td><td>Status display</td><td>Tuning status is displayed here.</td></tr>
</table>

Adjusting Position command filter



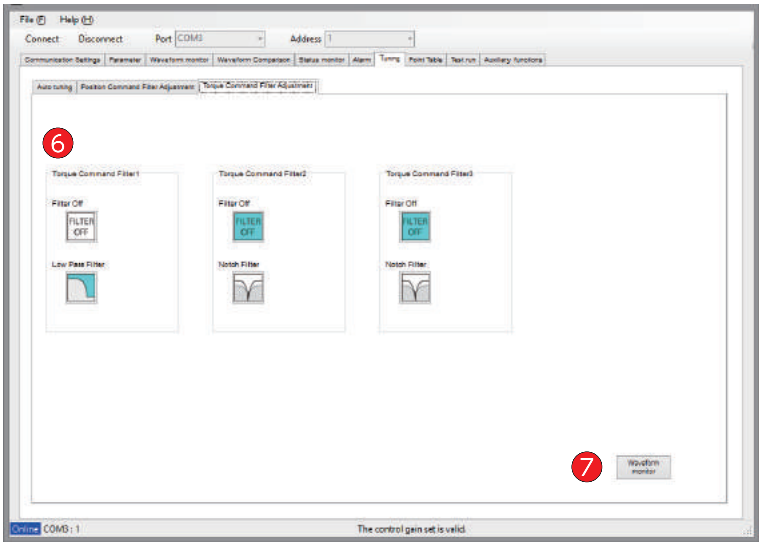
The control gain set is valid.

No.	Button/Function	Explanation
④	Position Command Filter 1-4	For each filter, select whether use it or not. If selected, a pop-up box opens. Enter the specific value you want. The selected icon turns blue.
	Filter Off	Select this if you are not setting up any filters. Click the icon to toggle between disable FILTER OFF (no filter) and enable FILTER OFF (use filter).
	Smoothing Filter  Smoothing Filter Setting Moving average order 25 [-] (1 - 6250) OK CANCEL	Set the moving average count. Click on the icon to toggle between enable and disable .
	Notch Filter  Notch Filter Setting Frequency 10 [0.1Hz] (10 - 2000) Width 512 [-] (128 - 2048) Depth 0 [-] (0 - 100) OK CANCEL	Set frequency [0.1 Hz], width, and depth. Click on the icon to toggle between enable and disable .
	γ -Notch filter  γ - Notch Filter Setting Frequency 10 [0.1Hz] (10 - 2000) Gain 100 [-] (50 - 200) Depth 0 [-] (0 - 100) OK CANCEL	Set frequency [0.1 Hz], gain, and depth. Click on the icon to toggle between enable and disable .
⑤	Waveform monitor	Click to jump to the **Waveform Monitor** tab.

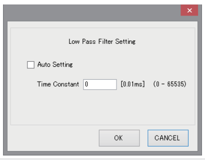
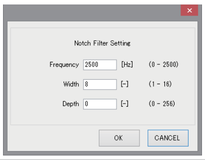
☞ **C- 3 Tuning**

2. Using Tabs in S-TUNE Ⅱ

Adjusting Torque Command Filter

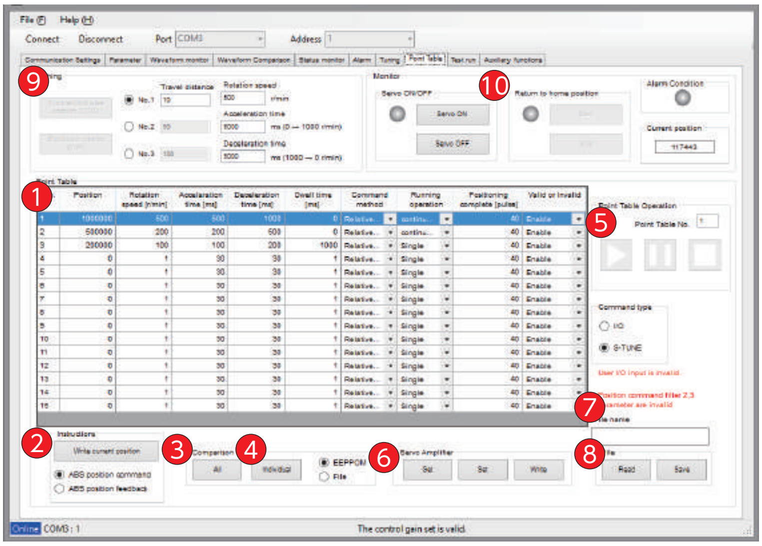


The control gain set is valid.

No.	Button/Function	Explanation
⑥	Torque Command Filter 1-3	For each filter, select whether use it or not. If selected, a dialog box opens. Enter the specific value you want. The selected icon turns blue.
	Filter Off	Select this if you are not setting up any filters. Click the icon to toggle between disable FILTER OFF (no filter) or enable FILTER OFF (use filter).
	Low Pass Filter  Low Pass Filter Setting ☐ Auto Setting Time Constant 0 [0.01ms] (0 - 65535) OK CANCEL	Set the time constant [0.01ms]. Click on the icon to toggle between enable and disable .
	Notch Filter  Notch Filter Setting Frequency 2500 [Hz] (0 - 2500) Width 8 [-] (1 - 16) Depth 0 [-] (0 - 256) OK CANCEL	Set frequency [Hz], width, and depth. Click on the icon to toggle between enable and disable .
⑦	Waveform monitor	Click this button to jump to the **Waveform Monitor** tab.

☞ C- 3 Tuning

8. Point Table



Port: COM3

Address: 1

● No.1 Travel distance: 10

○ No.2: 10

○ No.3: 100

Rotation speed: 500 r/min

Acceleration time: 5000 ms (0 → 1000 r/min)

Deceleration time: 5000 ms (1000 → 0 r/min)

Current position: 117443

Point Table

	Position	Rotation speed [r/min]	Acceleration time [ms]	Deceleration time [ms]	Dwell time [ms]	Command method	Running operation	Positioning complete [pulse]	Valid or Invalid
1	1000000	500	500	1000	0	Relative...	contin...	40	Enable
2	500000	200	200	500	0	Relative...	contin...	40	Enable
3	250000	100	100	200	1000	Relative...	Single	40	Enable
4	0	1	30	30	1	Relative...	Single	40	Enable
5	0	1	30	30	1	Relative...	Single	40	Enable
6	0	1	30	30	1	Relative...	Single	40	Enable
7	0	1	30	30	1	Relative...	Single	40	Enable
8	0	1	30	30	1	Relative...	Single	40	Enable
9	0	1	30	30	1	Relative...	Single	40	Enable
10	0	1	30	30	1	Relative...	Single	40	Enable
11	0	1	30	30	1	Relative...	Single	40	Enable
12	0	1	30	30	1	Relative...	Single	40	Enable
13	0	1	30	30	1	Relative...	Single	40	Enable
14	0	1	30	30	1	Relative...	Single	40	Enable
15	0	1	30	30	1	Relative...	Single	40	Enable

Point Table No.: 1

Command type: ○ I/O ● S-TUNE

User I/O input is invalid.

Position command filter 2,3 parameter are invalid

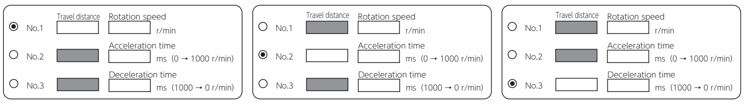
File name:

● ABS position command ○ ABS position feedback

● EEPROM ○ File

Online COM3 : 1

The control gain set is valid.

No.	Button/Function	Explanation
①	Point Table	Enter point table data for up to 16-point numbers.
②	Instructions	Writes the current position to the cell in the [Position] column of the selected Point No.
③	Comparison All	Click to compare the following two versions for all point numbers. a) data currently being edited in the table b) data from the **EEPROM** or **File** that you select. Wherever two versions are not identical, the cell in the table will turn red. Click Complete to return to the main window.
④	Comparison Individual	Click to compare the two versions (a and b above) for the selected point numbers. Click Edit to return to the main window.
⑤	Point Table Operation	Operate test-run according to the point table. Point table No. ☐ : Enter the point number you want to start with. ▶ : Start ⏸ : Pause ☐ : Stop
⑥	Servo Amplifier	Click Get to read data from the amplifier RAM. Click Set to write data to the amplifier RAM. Click Write to write data to the amplifier EEPROM.
⑦	File name	Name of the file read by pointtable_YYMMDD_hhmmss.xml .
⑧	File	Click Read to open the point table parameter file created earlier. Click Save to save the point table parameters to a file.
⑨	Inching	Fine tuning with specified parameter values. You can set three motion patterns (No.1 to 3). Range Travel distance (amount of movement): 0 to 1,073,741,823 [E-pulse] Rotational speed: 0 to maximum rotational speed of motor [r/min] Acceleration/deceleration time: 0 to 5,000 [ms] Counterclockwise rotation (CCW) Clockwise rotation (CW) : One clicking per one pattern motion 
⑩	Return to home position	Start : The lamp to the left will turn green when homing is complete; the box below Current Position will show the post-homing position. Click Stop to stop homing

Procedure

Step	Description
Step 1	Set the following under the **Parameter** tab.

Parameter Name	No.	Setting	Description	Standard	EtherCAT
Control Mode	2.0	0 :	Position Control Mode	Yes	Yes
Command Mode	3.0	3 :	Internal Command	Yes	Yes
Internal Position -Operation Mode	642.0	0 :	Point Table	Yes	–

Step	Description
Step 2	Create a point table; set and write it to the amplifier. ☞ F- 1 Operations
Step 3	Work with the point table operation buttons (⑤).

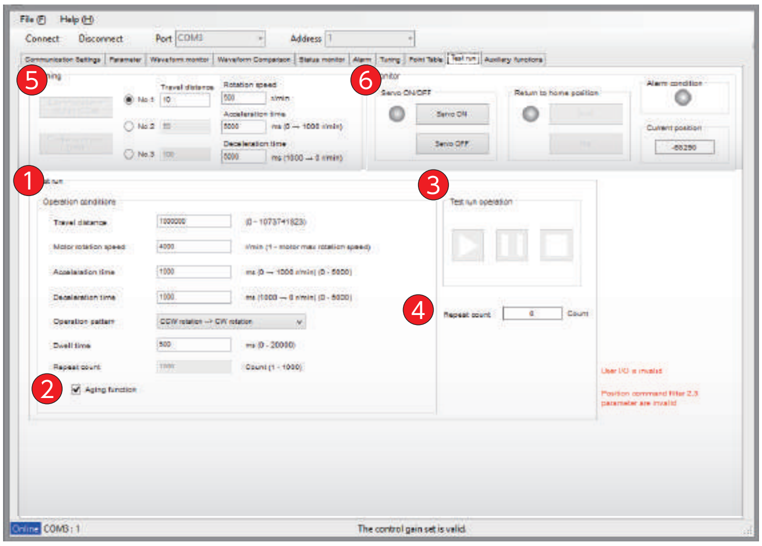
Additional ; Inching (⑨) and Homing (⑩) can be done under the **Point Table** tab.

9. Test Run

⚠ DANGER

Testing operation involves actual motor motion and could be dangerous. Secure safety in surrounding areas and take safety measures such as emergency stop.

Test run is a motion control feature of S-TUNE Ⅱ that you can use without the host controller.
Use this feature to check motor motions or perform tuning.



No.1 Travel distance 10
No.2
No.3
Rotation speed 500 r/min
Acceleration time 5000 ms (0 → 1000 r/min)
Deceleration time 5000 ms (1000 → 0 r/min)
Current position -65290

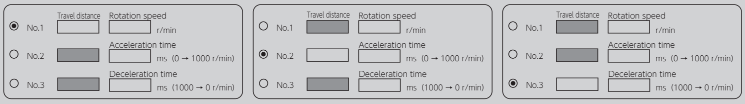
Travel distance 1000000 (0 - 1073741823)
Motor rotation speed 4000 r/min (1 - motor max rotation speed)
Acceleration time 1000 ms (0 → 1000 r/min) (0 - 5000)
Deceleration time 1000 ms (1000 → 0 r/min) (0 - 5000)
Operation pattern CCW rotation -> CW rotation
Dwell time 500 ms (0 - 20000)
Repeat count 1000 Count (1 - 1000)
☑ Aging function
Repeat count 0 Count

User I/O is invalid
Position command filter 2,3 parameter are invalid

COM3 : 1
The control gain set is valid.

No.	Button/Function	Explanation
①	Operation conditions Travel distance :	Range: 0 to 1,073,741,823 [E-pulse]
	Motor rotation speed :	Range: 1 to Maximum rotational speed [r/min]
	Acceleration time :	Time for the rotational speed to change from 0 to 1,000 rpm. Range: 0 to 5,000 [ms]
	Deceleration time :	Time for the rotational speed to change from 1,000 to 0 rpm. Range: 0 to 5,000 [ms]
	Motion pattern :	Click [CCW rotation ∨] for a CCW motion only. Click [CCW rotation -> CW rotation ∨] for a CCW motion and then a CW motion. Click [CW rotation -> CCW rotation ∨] for a CW motion and then a CCW motion. Click [CW rotation ∨] for a CW motion only.
	Dwell time :	Wait time between rotations. The wait time setting may not work when other applications are running on your computer.
	Repeat count :	Set how many times the specified motion pattern should be repeated. Range: 1 to 1,000 times

2. Using Tabs in S-TUNE Ⅱ

No.	Button/Function	Explanation
②	☑ Aging function	Check the checkbox to disable the repeat count setting so that the motor will keep running. Click ⏸ to pause, and ☐ to stop.
③	Test run operation	▶ : Start ⏸ : Pause ☐ : Stop
④	Repeat count	Displays how many times the specified motion was repeated.
⑤	Inching	Fine tuning with specified parameter values. You can set three motion patterns (No.1 to 3).  Range Travel amount: 0 to 1,073,741,823 [E-pulse] Rotational speed: 0 to Maximum rotational speed [r/min] Acceleration/deceleration time: 0 to 5,000 [ms] Counterclockwise rotation (CCW) Clockwise rotation (CW) : one clicking per one pattern motion
⑥	Return to home position	When Homing finishes, the indicator to the left of Start button will turn green and Current position cell will show the current position resulting from homing. Click Stop to stop homing

Procedure

Step	Operation
Step 1	Set the following under the **Parameter** tab.
Step 2	Set the **Operating conditions** in the **Test run** area.
Step 3	Click on the **Start** button below **Test run** operation.

Parameter Name	No.	Setting	Standard	EtherCAT
Control Mode	2.0	0 : Position Control Mode	Yes	Yes
Command Mode	3.0	3 : Internal Command	Yes	Yes
Internal Position -Operation Mode	642.0	1 : Communication motion	Yes	–

Additional

1. Inching (⑤) and Homing (⑥) can be performed as well.
2. Under the following operating conditions, an alarm will occur and test run will stop when the number of repetitions exceeds the Repeat count setting.
   The **Motion pattern** setting is CCW rotation or CW rotation and the aging function checkbox (☑) is check-marked.
   If you want non-stop test runs, set the following in addition to the above parameters.
   Internal Position: Overflow detection (No.643.0) = 0 (disable)
3. If the communication with the amplifier becomes disconnected, the test run will stop.
   To resume, reconnect to the amplifier and restart the test run.

⚠ DANGER

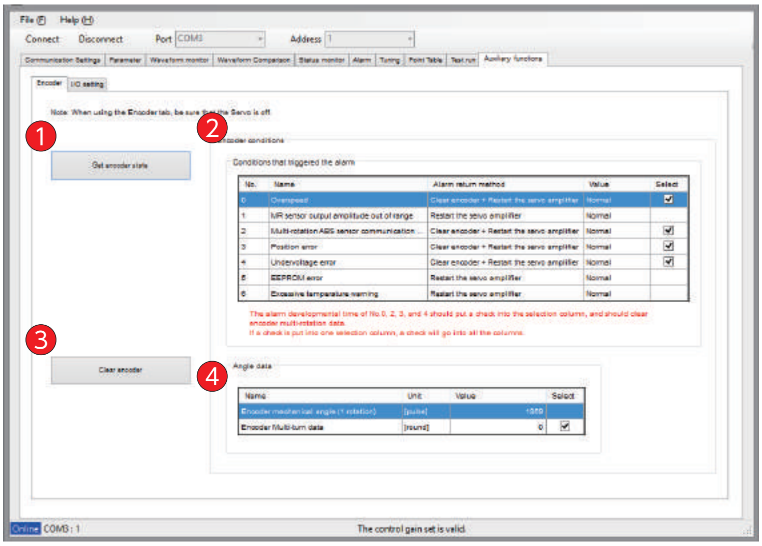
To prevent fire and injuries in case of earthquake, ensure secure installation.
After earthquake, be sure to confirm safety before resuming operation.

10. Auxiliary Functions

Encoder tab

CAUTION

!	Use the Encoder tab only in a Servo OFF state.	⚠



Note: When using the Encoder tab, be sure that the Servo is off

No.	Name	Alarm return method	Value	Select
0	Overspeed	Clear encoder + Restart the servo amplifier	Normal	☑
1	MR sensor output amplitude out of range	Restart the servo amplifier	Normal	
2	Multi-rotation ABS sensor communication ...	Clear encoder + Restart the servo amplifier	Normal	☑
3	Position error	Clear encoder + Restart the servo amplifier	Normal	☑
4	Undervoltage error	Clear encoder + Restart the servo amplifier	Normal	☑
5	EEPROM error	Restart the servo amplifier	Normal	
6	Excessive temperature warning	Restart the servo amplifier	Normal	

The alarm developmental time of No.0, 2, 3, and 4 should put a check into the selection column, and should clear encoder multi-rotation data.
If a check is put into one selection column, a check will go into all the columns.

Name	Unit	Value	Select
Encoder mechanical angle (1 rotation)	[pulse]	1059	
Encoder Multi-turn data	[round]	0	☑

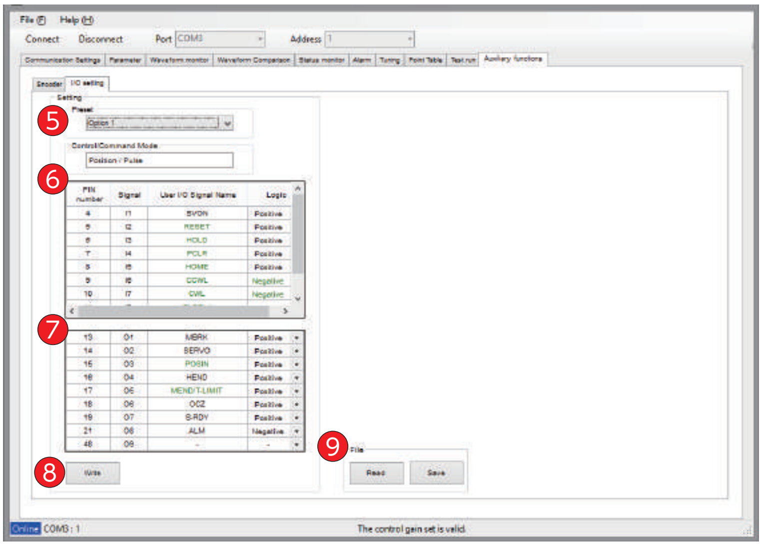
COM3 : 1
The control gain set is valid.

No.	Button/Function	Explanation
①	Get encoder state	Click this to obtain encoder status and display in the ② .
②	Encoder conditions	This area displays encoder status. If there is any abnormity (i.e. the Value column shows "abnormal"), fix the problem and clear the alarm.
③	Clear encoder	This clears encoder alarms and multi-turn data all at once. Click this button only after clicking on one of the box ☑ in ② or ④ .
④	Angle data	This area displays current encoder angle data. Click on Clear encoder to clear encoder multi-turn data.

2. Using Tabs in S-TUNE Ⅱ

I/O Setting tab

Select from the **Preset** pull down menu.



Port: COM3

Address: 1

Preset: Option 1

Control/Command Mode: Position / Pulse

PIN number	Signal	User I/O Signal Name	Logic
4	I1	SVON	Positive
5	I2	RESET	Positive
6	I3	HOLD	Positive
7	I4	PCLR	Positive
8	I5	HOME	Positive
9	I6	CCWL	Negative
10	I7	CWL	Negative

13	O1	MBRK	Positive
14	O2	SERVO	Positive
15	O3	POSIN	Positive
16	O4	HEND	Positive
17	O5	MEND/T-LIMIT	Positive
18	O6	OCZ	Positive
19	O7	S-RDY	Positive
21	O8	ALM	Negative
48	O9	-	-

Online COM3 : 1

The control gain set is valid.

No.	Button/Function	Explanation
⑤	Preset	Check the box under **Control/Command Mode**. Select from the **Preset** pull down menu.
⑥	Pinout - Input signals	Verify I/O input settings. When the presetting is changed, a changed signal name will be green indication.
⑦	Pinout - Output signals	Verify I/O output settings. When the presetting is changed, a changed signal name will be green indication.
⑧	Write	Click to write the parameters to the amplifier EEPROM
⑨	File	Read : Click to read and display the saved I/O pinout data. Save : Click to save I/O pinout data in the XML format.

☞ B- 2 **Mounting and Wiring**

Note) Only Standard model servo amplifier can change I/O pin assignment.

MEMO

S-FLAG Ⅱ Instruction Manual
- EtherCAT -

F

OPERATION

AMO-NP-35475-41
SF2-E-F
DEC. 2019

MEMO

1

Operation

1. Overview

Operation modes supported by the this product

The product supports the CiA 402 drive profile.The available operation modes are as follows.
The operation mode is set with the 6060 h (Modes of operation) object.
Some bits of the Control word and Status word differ for each mode of operation.
See the description of each operation mode for the different bits for each operation mode.

Operation modes	6060h value
Cyclic synchronous position mode (CSP)	8
Cyclic synchronous velocity mode (CSV)	9
Cyclic synchronous torque mode (CST)	10
Homing Mode (HM)	6

1. Overview

1. Control mode setting

6502h Supported drive modes

6052 h indicates the control mode supported by this product.

6502h	Supported drive modes				
Sub-index:	00h	–			
Access:	RW	**Data Type:**	U32	**Unit:**	–
Default:	–			**Range:**	0 to 4,294,967,295
Description:	Indicates the supported control modes. (see below)				

Indicates the supported control modes.

bit	Control mode	Abbreviation	Support*
0	Profile Position control mode	pp	●
1	Velocity control mode	vl	×
2	Profile Velocity control mode	pv	×
3	Profile Torque control mode	tq	×
4	Rsv.		-
5	Homing mode	hm	●
6	Interpolated Position mode	ip	×
7	Cyclic synchronous position mode	csp	●
8	Cyclic synchronous velocity mode	csv	●
9	Cyclic synchronous torque mode	cst	●
10-31	Rsv.	-	-

*) The supported modes depend on the software version.

6060h Modes of operation

6060 h sets the servo amplifier control mode.

6060h	Modes of operation				
Sub-index:	**00h**	–			
Access:	RW	Data Type:	I8	Unit:	–
Default:	–			Range:	– 128 to 127
Description:	Sets the control mode of the servo amplifier.				

value	Mode of operation	Abbreviation	Support*
-128 to -1	Rsv.	-	-
0	Mode not changed/Mode not set	-	●
1	Profile position control mode	pp	×
2	Velocity control mode	vl	×
3	Profile Velocity control mode	pv	×
4	Profile Torque control mode	tq	×
5	Rsv.		-
6	Homing mode	hm	●
7	Interpolated Position mode	ip	×
8	Cyclic synchronous position mode	csp	●
9	Cyclic synchronous velocity mode	csv	●
10	Cyclic synchronous torque mode	cst	●
11-127	Rsv.	-	-

*) The supported modes depend on the software version.

6061h Modes of operation display

6061 h indicates the servo amplifier control mode.

6061h	Modes of operation display				
Sub-index:	**00h**	–			
Access:	RO	Data Type:	I8	Unit:	–
Default:	–			Range:	– 128 to 127
Description:	Indicates the current control mode of the servo amplifier.				

value	Mode of operation	Abbreviation	Support*
-128 to -1	Rsv.	-	-
0	Mode not changed/Mode not set	-	●
1	Profile position control mode	pp	×
2	Velocity control mode	vl	×
3	Profile Velocity control mode	pv	×
4	Profile Torque control mode	tq	×
5	Rsv.		-
6	Homing mode	hm	●
7	Interpolated Position mode	ip	×
8	Cyclic synchronous position mode	csp	●
9	Cyclic synchronous velocity mode	csv	●
10	Cyclic synchronous torque mode	cst	●
11-127	Rsv.	-	-

*) The supported modes depend on the software version.

1. Operation

1. Overview

2. Drive profile (CiA402)

6040h Controlword

6040 h is a command to control slave devices such as PDS state transition.

6040h	Controlword				
Sub-index:	00h	–			
Access:	RW	**Data Type:**	U16	**Unit:**	–
Default:	–			**Range:**	0 to 65,535
Description:	Sets control commands to the servo amplifier such as PDS state transition.				

bit	Descriptions
0	Switch on
1	Enable voltage
2	Quick stop
3	Enable operation
4	**Operation mode specific**
5	
6	
7	Fault reset
8	halt
9	**Operation mode specific**
10	Rsv.
11	
12	
13	
14	
15	

Command coding

Command	Bits of the controlword					PDS Transitions
	bit 7 Fault reset	bit 3 Enable operation	bit 2 Quick stop	bit 1 Enable voltage	bit 0 Switch on	
Shutdown	0	X	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3
Switch on + Enable operation	0	1	1	1	1	3+4 (*1)
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0 (*2)	1	X	7, 10, 11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4, 16
Fault reset	↑	X	X	X	X	15

*1) Execute "Enable operation" command after "Switch on" command.

*2) "Quick stop" command is enabled with a value of "0". This is the opposite of other bit logic.

6041h Statusword

6041 h indicates the status of the slave device.

6041h	Statusword				
Sub-index:	00h	–			
Access:	RW	Data Type:	U16	Unit:	–
Default:	–			Range:	0 to 65,535
Description:	Indicates the status of the servo amplifier.				

bit	Descriptions
0	Ready to Switch on
1	Switch on
2	Operation enable
3	Fault
4	Voltage enable
5	Quick stop
6	Switch on disabled
7	Warning
8	Rsv.
9	Remote
10	Operation mode specific
11	Internal limit active
12	Operation mode specific
13	
14	
15	

The PDS state is indicated by Bit 6,5,3-0.

Statusword	PDS state	
xxxx xxxx x0xx 0000 (b)	Not ready to switch on	Initialization not complete
xxxx xxxx x1xx 0000 (b)	Switch on disabled	Initialization complete
xxxx xxxx x01x 0001 (b)	Ready to switch on	Main circuit power OFF
xxxx xxxx x01x 0011 (b)	Switched on	Servo Off/Servo Ready
xxxx xxxx x01x 0111 (b)	Operation enabled	Servo On
xxxx xxxx x00x 0111 (b)	Quick stop active	Quick stop
xxxx xxxx x0xx 1111 (b)	Fault reaction active	Error determination
xxxx xxxx x0xx 1000 (b)	Fault	Error state

bit 4 (Voltage enable):

1: The main circuit power supply voltage is applied to the PDS.

bit 5 (Quick stop):

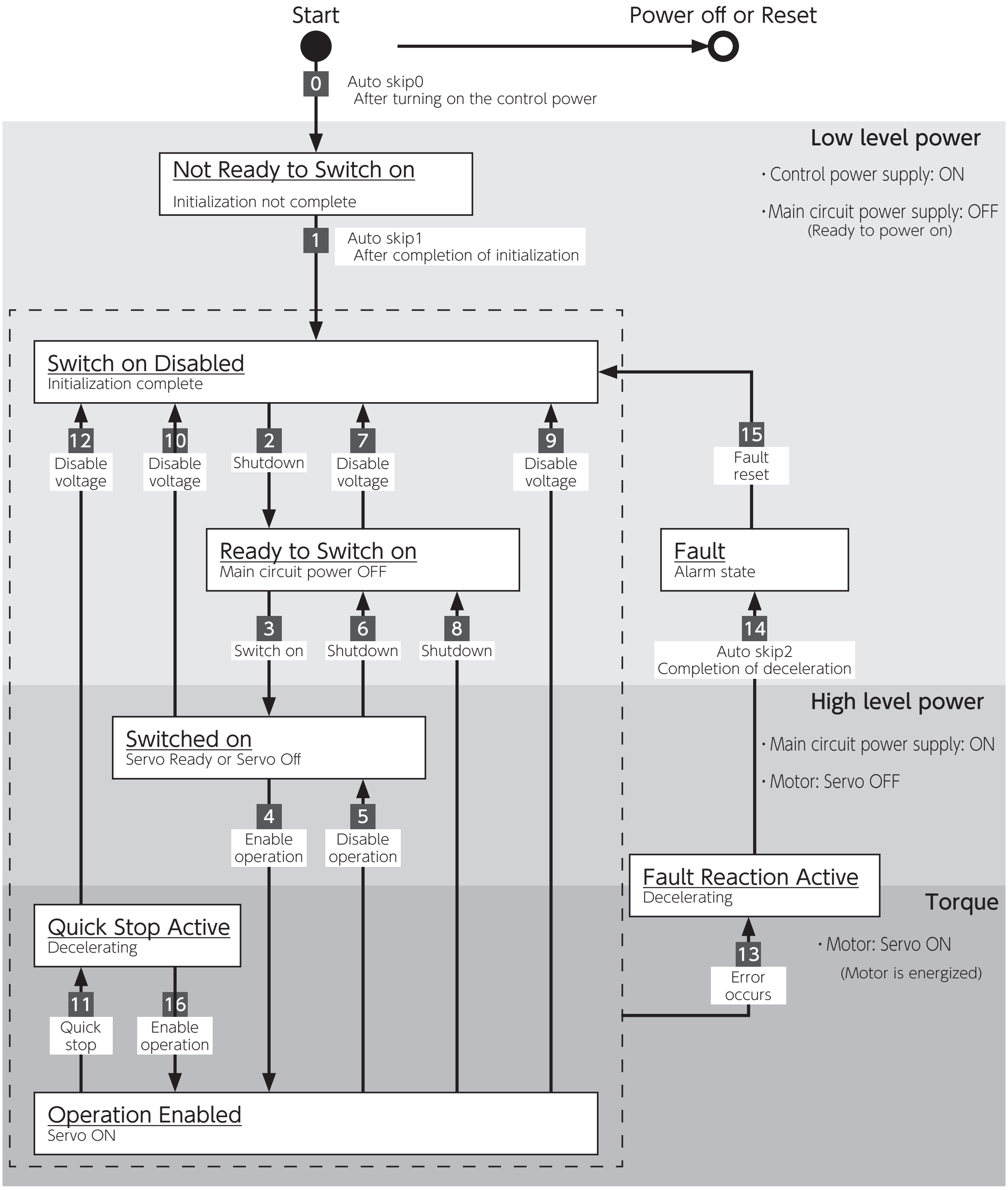
0: PDS receives "Quick stop" command.
"Quick stop" command is enabled with a value of "0". This is the opposite of other bit logic.

bit 7 (Warning):

1: A warning has occurred. The PDS state does not change when a warning occurs.
(The motor continues to operate.)

3. PDS (Power Drive System)

FSA (Finite State Automaton)



n is the PDS Transition number. (n: 0-16)

1. Overview

The FSA State

State	Descriptions
Not Ready to Switch on	Control power is supplied to the slave device and control power is established. The slave device is initializing or performing a self-test.
Switch on Disabled	The slave device is initialized and ready to set parameters. The main circuit power supply should not be turned on.
Ready to Switch on	The main circuit power supply is permitted to be turned on. The parameter is configurable, but the function is disabled.
Switched on	The main circuit power is supplied and ready to accept "Operation Enabled". The slave device can set parameters. This amplifier can perform a state transition even when the main power supply is OFF.
Operation Enabled	The drive function is enabled and the motor is energized. No alarms. The slave device can set parameters.
Quick Stop Active	"Quick stop" is executing. The drive function is enabled and the motor is energized.
Fault Reaction Active	An alarm has occurred on the slave device then "Quick stop" is executing. The motor is energized.
Fault	An alarm has been occurred on the slave device then "Fault reaction" is completed. The drive function is disabled. The main circuit power supply is turned on or off by an application.

2. Cyclic synchronous position mode (CSP)

In Cyclic synchronous position mode, the command position is generated by the master controller. The slave device operates by receiving the command position every interpolation period.

To use cyclic synchronization position mode, set the 6060 h (Modes of operation) object to "8".

Objects Used in Cyclic Synchronous Position Mode

Index	Sub-Index	Name	Units	Type	Access	PdoMapping
603Fh	00h	Error code	–	U16	RO	TxPDO
6040h	00h	Controlword	–	U16	RW	RxPDO
6041h	00h	Statusword	–	U16	RO	TxPDO
6062h	00h	Position demand value	pulse	I32	RO	TxPDO
6064h	00h	Position actual value	pulse	I32	RO	TxPDO
6065h	00h	Following error window	pulse	U32	RW	No
6072h	00h	Max torque	0.1%	U16	RW	RxPDO
6077h	00h	Torque actual value	0.1%	I16	RO	TxPDO
607Ah	00h	Target position	pulse	I32	RW	RxPDO
6080h	00h	Max motor speed	r/min	U32	RW	RxPDO
60B0h	00h	Position offset	pulse	I32	RW	RxPDO
60B1h	00h	Velocity offset	pluse/s	I32	RW	RxPDO
60B2h	00h	Torque offset	0.1%	I16	RW	RxPDO
60F4h	00h	Following error actual value	pulse	I32	RO	TxPDO
60FDh	00h	Digital inputs	–	U32	RO	TxPDO

2. Cyclic synchronous position mode (CSP)

6040h Controlword on Cyclic synchronous position mode

6040 h is a command to control slave devices such as PDS state transition.

6040h	Controlword				
Sub-index:	00h	–			
Access:	RW	Data Type:	U16	Unit:	–
Default:	–			Range:	0 to 65,535
Description:	Sets control commands to the servo amplifier such as PDS state transition.				

bit	Descriptions
0	Sensor on
1	Enable voltage
2	Quick stop
3	Enable operation
4	Rsv.
5	
6	
7	Fault reset
8	Halt
9	Rsv.
10	
11	
12	
13	
14	
15	

bit 8 (Halt):

0: Permits the cyclic synchronous position function.

1: Motor stop by 605Dh (Halt option code)

2. Cyclic synchronous position mode (CSP)

6041h Statusword on Cyclic synchronous position mode

6041 h indicates the status of the slave device.

6041h	Statusword				
Sub-index:	00h	–			
Access:	RW	Data Type:	U16	Unit:	–
Default:	–			Range:	0 to 65,535
Description:	Indicates the status of the servo amplifier.				

bit	Descriptions
0	Ready to switch on
1	Switch on
2	Operation enable
3	Fault
4	Voltage enable
5	Quick stop
6	Switch on disabled
7	Warning
8	Rsv.
9	Remote
10	**Rsv.**
11	Internal limit active
12	**Drive follows command value**
13	**Following error**
14	Rsv.
15	

bit 12 (Drive follows command value):

0: Not following the command position

1: Following the command position

bit 13 (Following error):

If the value of 60F4h (Following error actual value) has exceeded the setting range of 6065h(Following error window) for a certain period of time, the 6041h value becomes "1".

0: No excessive position deviation

1: Position deviation excess alarm

3. Cyclic synchronous velocity mode (CSV)

In Cyclic synchronous velocity mode, the command velocity is generated by the master controller. The slave device operates by receiving the command velocity every interpolation period.

To use cyclic synchronization position mode, set the 6060 h (Modes of operation) object to "9".

Objects Used in Cyclic Synchronous Velocity Mode

Index	Sub-Index	Name	Units	Type	Access	PdoMapping
603Fh	00h	Error code	–	U16	RO	TxPDO
6040h	00h	Controlword	–	U16	RW	RxPDO
6041h	00h	Statusword	–	U16	RO	TxPDO
6072h	00h	Max torque	0.1%	U16	RW	RxPDO
6080h	00h	Max motor speed	r/min	U32	RW	RxPDO
60B1h	00h	Velocity offset	pulse/s	I32	RW	RxPDO
60B2h	00h	Torque offset	0.1%	I16	RW	RxPDO
60FFh	00h	Target velocity	pulse/s	I32	RW	RxPDO

3. Cyclic synchronous velocity mode (CSV)

6040h Controlword on Cyclic synchronous velocity mode

6040 h is a command to control slave devices such as PDS state transition.

6040h	Controlword				
Sub-index:	**00h**	–			
Access:	RW	**Data Type:**	**U16**	**Unit:**	–
Default:	–			**Range:**	0 to 65,535
Description:	Sets control commands to the servo amplifier such as PDS state transition.				

bit	Descriptions
0	Sensor on
1	Enable voltage
2	Quick stop
3	Enable operation
4	Rsv.
5	
6	
7	Fault reset
8	Halt
9	Rsv.
10	
11	
12	
13	
14	
15	

bit 8 (Halt):

0: Permits the cyclic synchronous velocity function.

1: Motor stop by 605Dh (Halt option code)

6041h Statusword on Cyclic synchronous velocity mode

6041 h indicates the status of the slave device.

6041h	Statusword				
Sub-index:	00h	–			
Access:	RW	Data Type:	U16	Unit:	–
Default:	–			Range:	0 to 65,535
Description:	Indicates the status of the servo amplifier.				

bit	Descriptions
0	Ready to switch on
1	Switch on
2	Operation enable
3	Fault
4	Voltage enable
5	Quick stop
6	Switch on disabled
7	Warning
8	Rsv.
9	Remote
10	**Rsv.**
11	Internal limit active
12	**Drive follows command value**
13	**Rsv.**
14	Rsv.
15	

bit 12 (Drive follows command value):

0: Not following the command velocity

1: Following the command velocity

4. Cyclic synchronous torque mode (CST)

In Cyclic synchronous velocity mode, the command torque is generated by the master controller. The slave device operates by receiving the command torque every interpolation period.

To use cyclic synchronization position mode, set the 6060 h (Modes of operation) object to "10".

Objects Used in Cyclic Synchronous Torque Mode

Index	Sub-Index	Name	Units	Type	Access	PdoMapping
603Fh	00h	Error code	–	U16	RO	TxPDO
6040h	00h	Controlword	–	U16	RW	RxPDO
6041h	00h	Statusword	–	U16	RO	TxPDO
6071h	00h	Target torque	0.1%	I16	RW	RxPDO
6072h	00h	Max torque	0.1%	U16	RW	RxPDO
6080h	00h	Max motor speed	r/min	U32	RW	RxPDO
60B2h	00h	Torque offset	0.1%	I16	RW	RxPDO

6040h Controlword on Cyclic synchronous torque mode

6040h is a command to control slave devices such as PDS state transition.

6040h	Controlword				
Sub-index:	00h	–			
Access:	RW	Data Type:	U16	Unit:	–
Default:	–			Range:	0 to 65,535
Description:	Sets control commands to the servo amplifier such as PDS state transition.				

bit	Descriptions
0	Sensor on
1	Enable voltage
2	Quick stop
3	Enable operation
4	Rsv.
5	
6	
7	Fault reset
8	Halt
9	Rsv.
10	
11	
12	
13	
14	
15	

bit 8 (Halt):

0: Permits the cyclic synchronous torque function.

1: Motor stop by 605Dh (Halt option code)

4. Cyclic synchronous torque mode (CST)

6041h Statusword on Cyclic synchronous torque mode

6041 h indicates the status of the slave device.

6041h	Statusword				
Sub-index:	**00h**	–			
Access:	RW	**Data Type:**	U16	**Unit:**	–
Default:	–			**Range:**	0 to 65,535
Description:	Indicates the status of the servo amplifier.				

bit	Descriptions
0	Ready to switch on
1	Switch on
2	Operation enable
3	Fault
4	Voltage enable
5	Quick stop
6	Switch on disabled
7	Warning
8	Rsv.
9	Remote
10	**Rsv.**
11	Internal limit active
12	**Drive follows command value**
13	**Rsv.**
14	Rsv.
15	

bit 12 (Drive follows command value):

0: Not following the command torque

1: Following the command torque

5. Homing Mode (HM)

Homing mode is a position control mode in which homing is performed by setting the operating speed, acceleration and operating method.
For an incremental motor, always perform homing after turning on the power.

To set the homing mode, set the 6060 h (Modes of operation) object to "6".

Object used for Homing

Index	Sub-Index	Name	Units	Type	Access	PdoMapping
6040h	00h	Controlword	–	U16	RW	RxPDO
6041h	00h	Statusword	–	U16	RO	TxPDO
607Ch	00h	Home offset	pulse	I32	RW	RxPDO
6098h	00h	Homing method	–	I8	RW	RxPDO
6099h	–	Homing speeds	–	–	–	–
	00h	Highest sub-index supported	–	U8	RO	No
	01h	Speed during search for switch	pulse/s	U32	RW	RxPDO
	02h	Speed during search for zero	pulse/s	U32	RW	RxPDO
609Ah	00h	Homing acceleration	pulse/s^2	U32	RW	No

6040 h Controlword in Homing mode

6040 h is a command to control slave devices such as PDS state transition.

6040h	Controlword				
Sub-index:	00h	–			
Access:	RW	**Data Type:**	U16	**Unit:**	–
Default:	–			**Range:**	0 to 65,535
Description:	Sets control commands to the servo amplifier such as PDS state transition.				

bit	Descriptions
0	Switch on
1	Enable voltage
2	Quick stop
3	Enable operation
4	**Homing operation start**
5	Rsv.
6	
7	Fault reset
8	Halt
9	Rsv.
10	
11	
12	
13	
14	
15	

When the set value of bit 4 (homing operation start) of 6040 h (Controlword) is changed from 0 to 1, the parameter used in the homing mode is loaded at the rising edge and the operation starts.

5. Homing Mode (HM)

6041 h Statusword in homing mode

6041 h indicates the status of the slave device.

6041h	Statusword				
Sub-index:	**00h**	–			
Access:	RW	Data Type:	U16	Unit:	–
Default:	–			Range:	0 to 65,535
Description:	Indicates the status of the servo amplifier.				

bit	Descriptions
0	Ready to switch on
1	Switch on
2	Operation enable
3	Fault
4	Voltage enable
5	Quick stop
6	Switch on disabled
7	Warning
8	Rsv.
9	Remote
10	**Target reached**
11	Internal limit active
12	**Homing attained**
13	**Homing error**
14	Rsv.
15	

bit 10 (Target reached):
- **0**: Executing
- **1**: Stop

bit 12 (Homing attained):
- **0**: Homing is not completed.
- **1**: Homing is completed.

bit 13 (Homing error):
- **0**: No Error
- **1**: There is an error related to Homing.

Bit 10, 12, and 13 indicate the homing status.

Statusword	Status of Homing mode
xx00 x0xx xxxx xxxx (b)	"Homing" is in progress
xx00 x1xx xxxx xxxx (b)	"Homing" is interrupted or not started.
xx01 x0xx xxxx xxxx (b)	"Homing" is completed, but the motor has not reached the target position.
xx01 x1xx xxxx xxxx (b)	"Homing" is completed.
xx10 x0xx xxxx xxxx (b)	An error related to "homing" was detected, but operation is continuing.
xx10 x1xx xxxx xxxx (b)	An error related to "homing" was detected, then the motor has stopped.

5. Homing Mode (HM)

List of Homing Methods

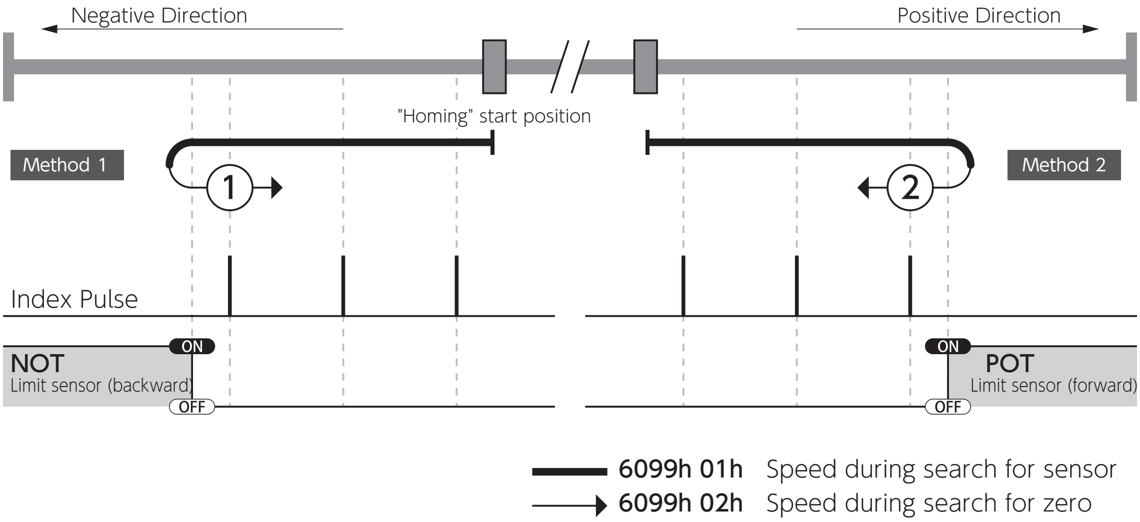
Method	Type of Homing mode	Support
1	Homing on **negative limit sensor** and **index pulse**	●
2	Homing on **positive limit sensor** and **index pulse**	●
3, 4	Homing on **positive home sensor** and **index pulse**	●
5, 6	Homing on **negative home sensor** and **index pulse**	●
7-16	–	×
17	Homing on **negative limit sensor**	●
18	Homing on **positive limit sensor**	●
19, 20	Homing on **positive home sensor**	●
21, 22	Homing on **negative home sensor**	●
23-32	–	×
33, 34	Homing on **index pulse**	●
35, 37	Homing on **current position**	●

As of January 2019.

Method 35 (Homing on current position) was discontinued in CiA402 Work Draft CANopen Drive and motion control device profile part2 Version : 3.0.1.13(26 April 2012). Use "Method 37" for new designs.

5. Homing Mode (HM)

Method 1	Homing on **negative limit sensor (NOT)** and **index pulse**
Method 2	Homing on **positive limit sensor (POT)** and **index pulse**



Method 1

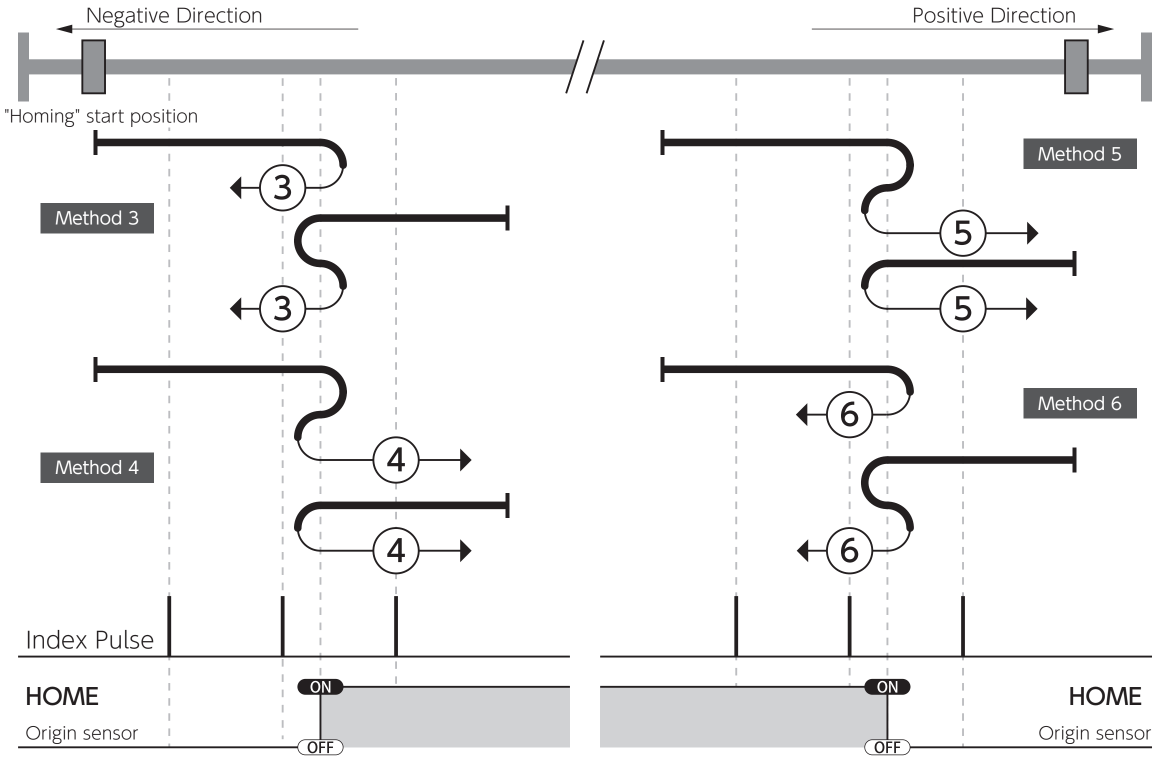
- When the "**NOT** (backward direction limit sensor : pin No. 8 of I/O connector)" is OFF, the moving direction at the Homing start is to the left of this figure (The motor rotates CCW.).
- When the "NOT" input is turned ON, the motor moves to the right (The motor is CW.) at a low speed.
- Then, the position where the first index pulse is detected becomes the origin. ①

Method 2

- When the "**POT** (forward direction limit sensor : pin No. 7 of I/O connector)" is OFF, the moving direction at the Homing start is to the right of this figure (The motor rotates CW.).
- When the "POT" input is turned ON, the motor moves to the left (The motor is CCW.) at a low speed.
- Then, the position where the first index pulse is detected becomes the origin. ②

5. Homing Mode (HM)

Method 3 Method 4	Homing on **positive home sensor** and **index pulse**
Method 5 Method 6	Homing on **negative home sensor** and **index pulse**

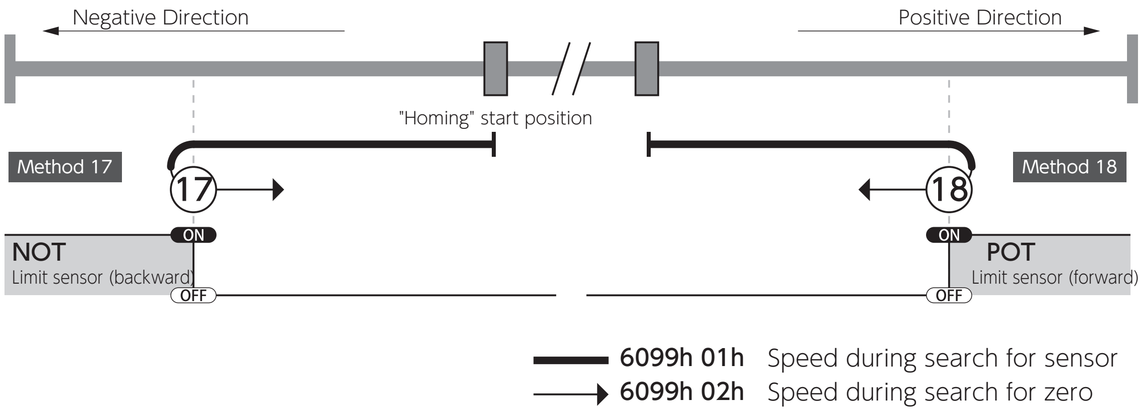


▬	**6099h 01h**	Speed during search for sensor
→	**6099h 02h**	Speed during search for zero

Method 3 Method 4 Method 5 Method 6

- The moving direction depends on the input state of "**HOME** (Origin sensor: pin No. 9 of I/O connector)" when "Homing" is started.
- When the Origin sensor is detected, the motor changes its moving direction and moves at low speed.
- After that, the position where the first Index pulse is found becomes Origin. ③④⑤⑥

Method 17	Homing on **negative limit sensor (NOT)**
Method18	Homing on **positive limit sensor (POT)**



Method 17

- When the "**NOT** (backward direction limit sensor : pin No. 8 of I/O connector)" is OFF, the moving direction at the Homing start is to the left of this figure (The motor rotates CCW.).
- The position where the "**NOT**" input signal turns ON is the origin. ⑰

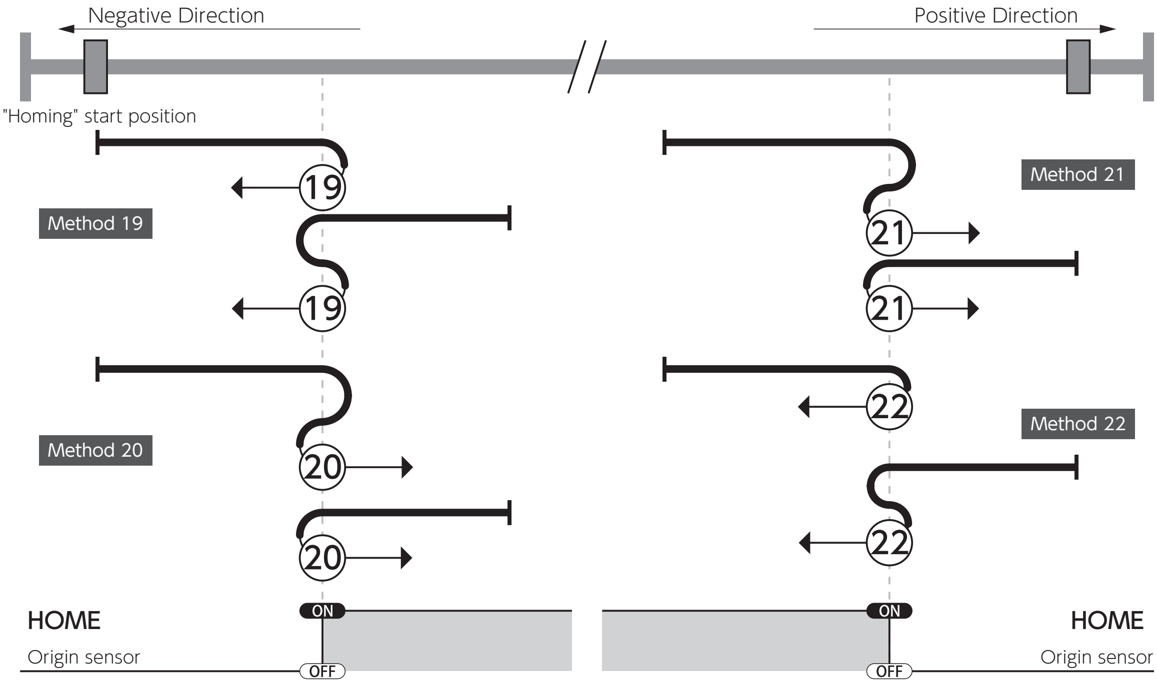
Method 18

- When the "**POT** (forward direction limit sensor : pin No. 7 of I/O connector)" is OFF, the moving direction at the Homing start is to the right of this figure (The motor rotates CW.).
- The position where the "**POT**" input signal turns ON is the origin. ⑱

- These methods are the same as not using Index Pulse in "Method 1" and "Method 2", respectively.

5. Homing Mode (HM)

Method 19 Method 20	Homing on **positive home sensor**
Method 21 Method 22	Homing on **negative home sensor**



━━ **6099h 01h** Speed during search for sensor
──▶ **6099h 02h** Speed during search for zero

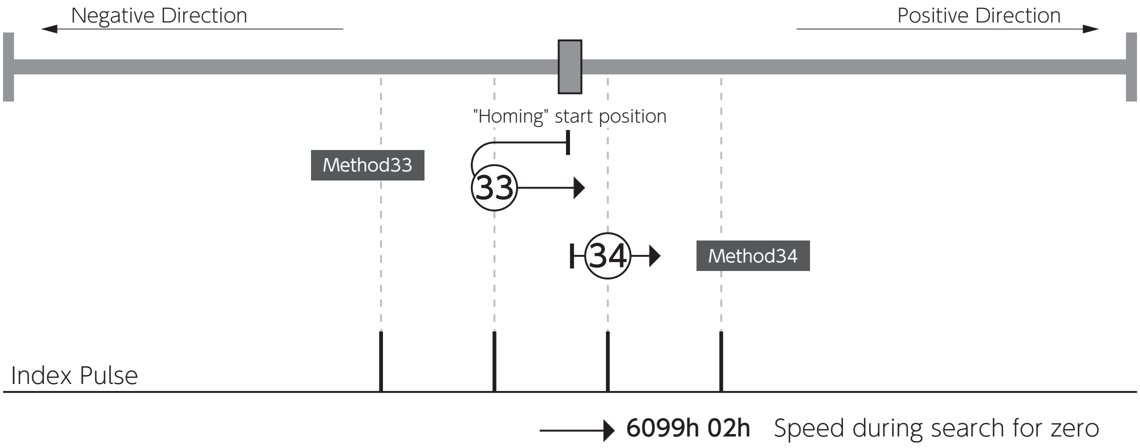
Method 19 Method 20 Method 21 Method 22

- The moving direction depends on the input state of "**HOME** (Origin sensor: pin No. 9 of I/O connector)" when "Homing" is started.
- The position where the first Index pulse is found becomes Origin. ⑲⑳㉑㉒

- These methods are the same as not using Index Pulse in "Method 3-6", respectively.

5. Homing Mode (HM)

Method 33 Method 34 Homing on **index Pulse**

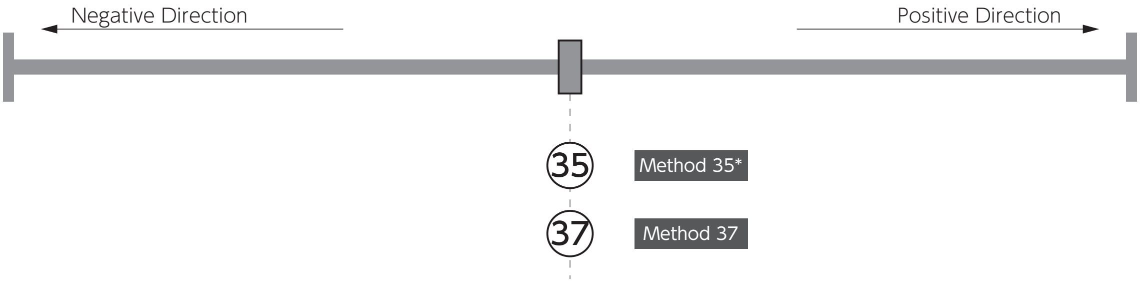


Method 33 **Method 34**

- The nearest index pulse position detected from "Homing" start position is the origin.
- The moving direction for Method 33 is to the left of the figure (The motor is CCW.). ㉝
- The moving direction for Method 34 is to the right of the figure (The motor is CW.). ㉞

5. Homing Mode (HM)

Method 35 Method 37 Homing on **current position**



Start homing: **0→1**

6040h 04h : Homing operation

*) Method 35 (Homing on current position) was discontinued in CiA402 Work Draft CANopen Drive and motion control device profile part2 Version : 3.0.1.13(26 April 2012). Use "Method 37" for new designs.

Method 35 **Method 37**

- The starting point of Homing is the origin. ㉟㊲
- At the timing when the "Homing" has started, the following objects are initialized:.
  6062h (Position demand value) = **6064h** (Position actual value) = **607Ch** (Home offset)

- These Methods can execute even if the PDS state is not "Operation enable".

5. Homing Mode (HM)

Procedure for the Homing

STEP1 Object Settings

Set the parameters for the following objects:.

Object	Things to do
6098h	Select the Homing method (Choose from1-6, 17-22, or 33-37)
607Ch	Set the Home offset value.
6060h	Change the operation mode to "6 (Homing)"
6099h 01h	Set the motor speed to detect the Origin sensor.
6099h 02h	Set motor speed to detect index pulse.
609Ah	Set the motor acceleration

STEP2 Start "Homing"

Set bit 4 of 6040h (Controlword) to "1" after Servo ON.

Object	Things to do
6040h	Set 0010h

STEP3 Searching the Origin

Execute Homing with the method set to 6098h.

STEP4 Confirm

Check that bit 12 of 6041 h (Statusword) becomes "1".

STEP5 Exit "Homing"

Object	Things to do
6040h	Make the bit 4 to "0" (Exit Homing).
6060h	Change the operating mode to suit your own application.

2

Connecting to the Master Controller

1. Preface

Connecting to the Master Controller

This product can be driven by connecting it to a master controller made by another manufacturer. If you are using a master controller other than those listed below, please refer to the operation manual of the product.

List of the master controller

manufacturer	Name of the software
Beckhoff	TwinCAT® (TwinCAT XAE)

TwinCAT® is a software developed and licensed by Beckhoff Automation GmbH, Germany. for real-time control of industrial machinery.

1. Connect to the master controller

Open EtherCAT communication and prepare for operation

Start Connect the master controller and slave devices (servo amplifier) with the EtherCAT cable and turn on the power.

1 Save "ESI (*) files (.xml files)" to the appropriate folder on the master controller.

*) ESI : EtherCAT Slave Information.
The ESI file is an XML format file that describes the identification information such as the manufacturer name and model number of the EtherCAT slave device, as well as information necessary for setting and communication.

2 Start the software "TwinCAT XAE".

3 Create a new project.

4 The master controller scans the EtherCAT network.

5 Set the system clock.

6 Set the servo amplifier.

Finish Operation preparations are complete.

TIP !

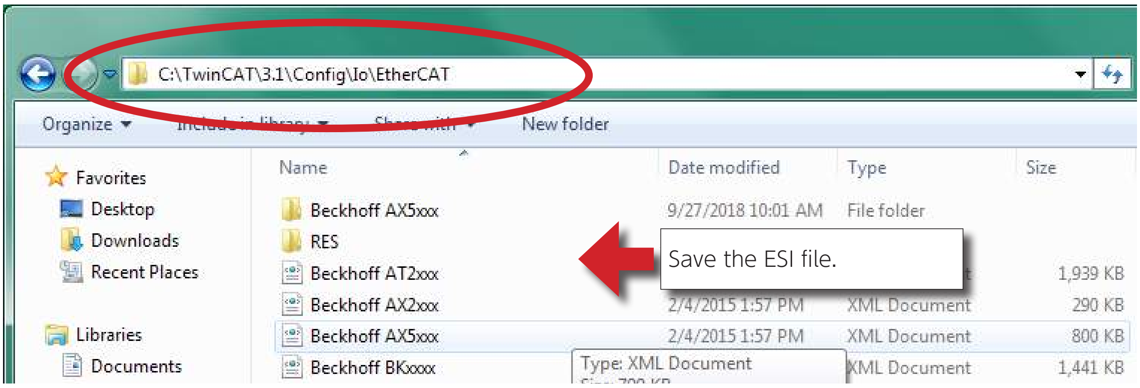
You may need to enter a Security Code when starting TwinCAT 3.

1. Make sure that the five characters displayed are correctly transcribed into the text box.
2. Click on OK button.

When an exact match is made, the text you type is green.

1 Save "ESI (*) files (.xml files)" to the appropriate folder on the master controller.

Folder pass : **"C:\TwinCAT\3.1\Config\Io\EtherCAT\"**



Name	Date modified	Type	Size
Beckhoff AX5xxx	9/27/2018 10:01 AM	File folder	
RES			
Beckhoff AT2xxx			1,939 KB
Beckhoff AX2xxx	2/4/2015 1:57 PM	XML Document	290 KB
Beckhoff AX5xxx	2/4/2015 1:57 PM	XML Document	800 KB
Beckhoff BKxxxx		XML Document	1,441 KB

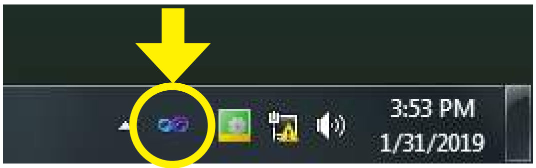
Type: XML Document

Save the ESI file.

The ESI file (.xml files) contains configuration information for the product.
The master controller must be restarted after the .xml file is downloaded to the master.

Be sure to use the ESI file for the device connected to the slave device.
Make sure the ESI file version matches the amplifier version.

2 Start the software "TwinCAT XAE".



The TwinCAT.XAE icon is in the task tray.

It is useful to create a shortcut on your desktop.

When the EtherCAT cable is connected correctly between the master and the slave (amplifier), the ECIN LED (green) of the amplifier lights up.

When multiple amplifiers are connected, the ECIN and ECOUT LEDs of the connected amplifiers light up.

TIP !

Operation modes in TwinCAT3

The icon color distinguishes the mode currently selected by the icon color.

Green

RUN

This mode allows real-time operation of PLC and C/C + + tasks.

You can set TwinCAT to automatically enable RUN mode at startup.

Blue

CONFIG

This mode is used to configure network, I/O, motion, and program development and configuration. When Free Run is enabled, network communication occurs in non-real-time.

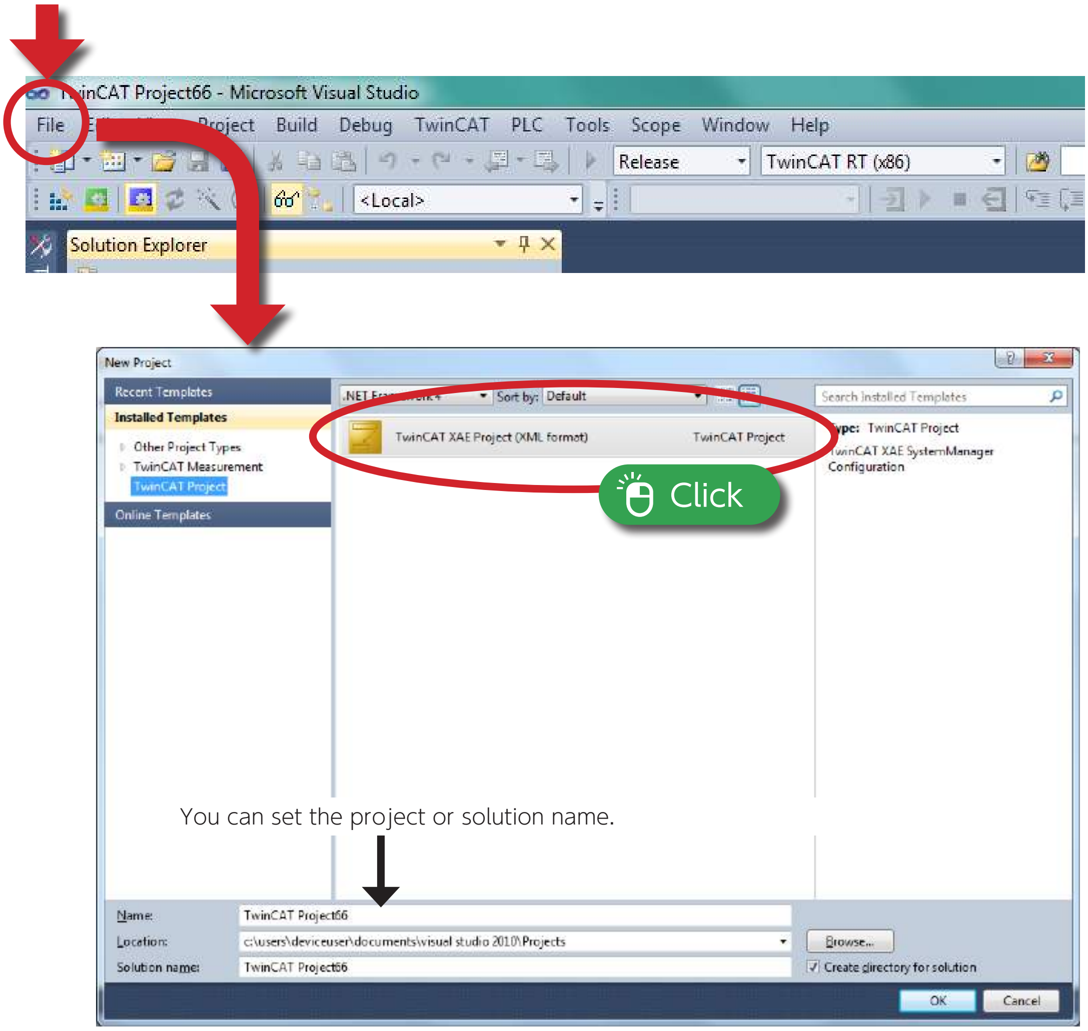
You can also check the operation of the I/O terminal.

Red

The red icon indicates "Mode is switching".

3 Create a new project.

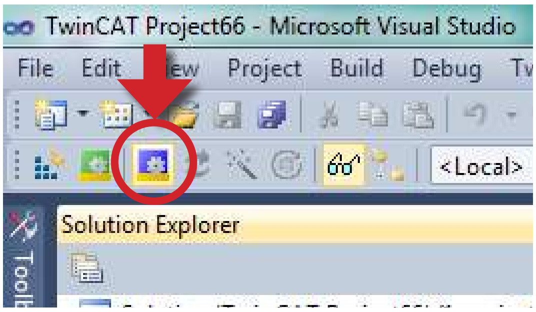
Select "File" → "New" → "Project" from the menu to create a new project.



You can set the project or solution name.

Name: TwinCAT Project66
Location: c:\users\deviceuser\documents\visual studio 2010\Projects
Solution name: TwinCAT Project66
☑ Create directory for solution

Switch TwinCAT operation mode to "CONFIG" mode after creating a project.

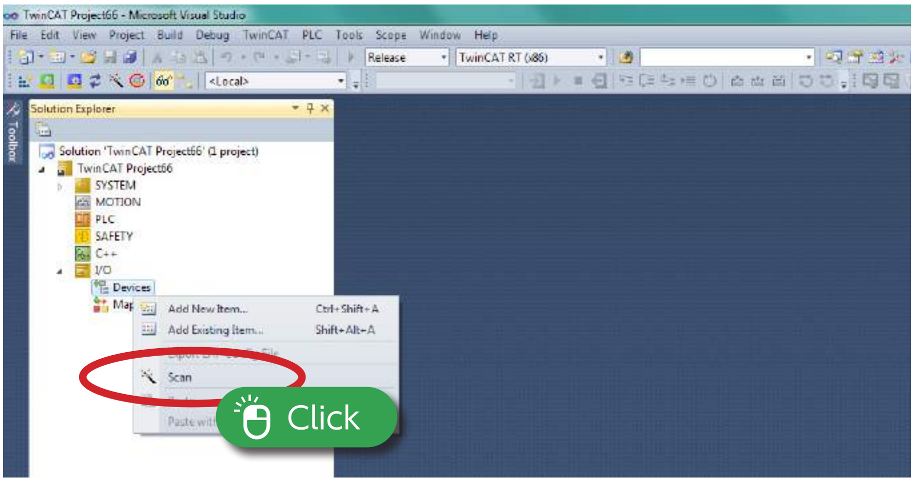


Saving the project file allows you to save the connection information with the amplifier, settings, and test operation conditions. Saved settings can be read when starting the software.

☞ P. 24 4. Save project
P. 25 5. Open project

4 The master controller scans the EtherCAT network.

Select "I/O" → "Device" in the TwinCAT System Manager navigation tree, right-click and select "Scan".



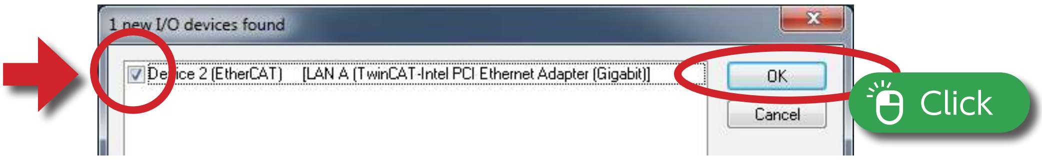
!

Before execute "Scan" verify the following:

1. EtherCAT cable must be connected between master and slave.
2. Power must be turned on for the master and the slave.
3. The "Link" LED of the master and slave must be on.

The screen shows the slave devices that are connected.

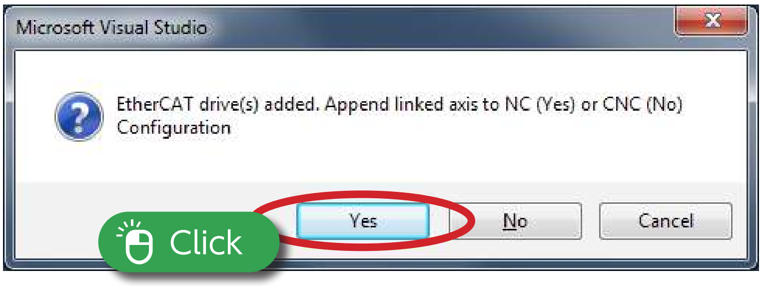
Make sure the checkbox has "check mark".


1 new I/O devices found

☑ Device 2 (EtherCAT) [LAN A (TwinCAT-Intel PCI Ethernet Adapter (Gigabit)]

When OK button is clicked, the dialog "Scan for Boxes" is displayed, so select Yes button.

Select "NC" or "CNC" according to the slave device whose connection has been confirmed.


Microsoft Visual Studio

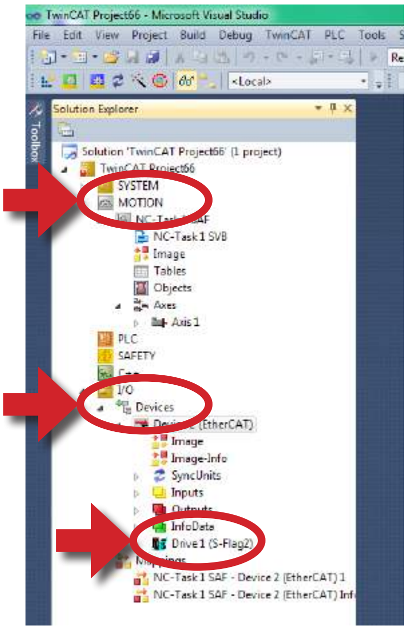
EtherCAT drive(s) added. Append linked axis to NC (Yes) or CNC (No) Configuration

!

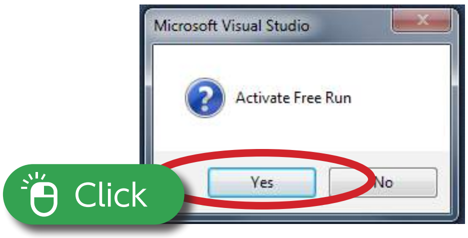
If the slave device is a servo driver, select Yes .

2. Use Beckhoff's "TwinCAT"

After "Scan" completes, "MOTION" is added to the TwinCAT System Manager navigation tree and "Device" is added to "I/O".
" Drive (S-Flag2)" is added to the "Device" tree.



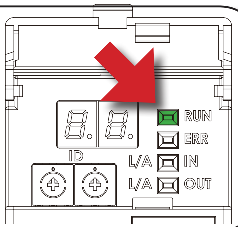
The Activate Free Run dialog will appear.
Click on Yes button.



Activate Free Run

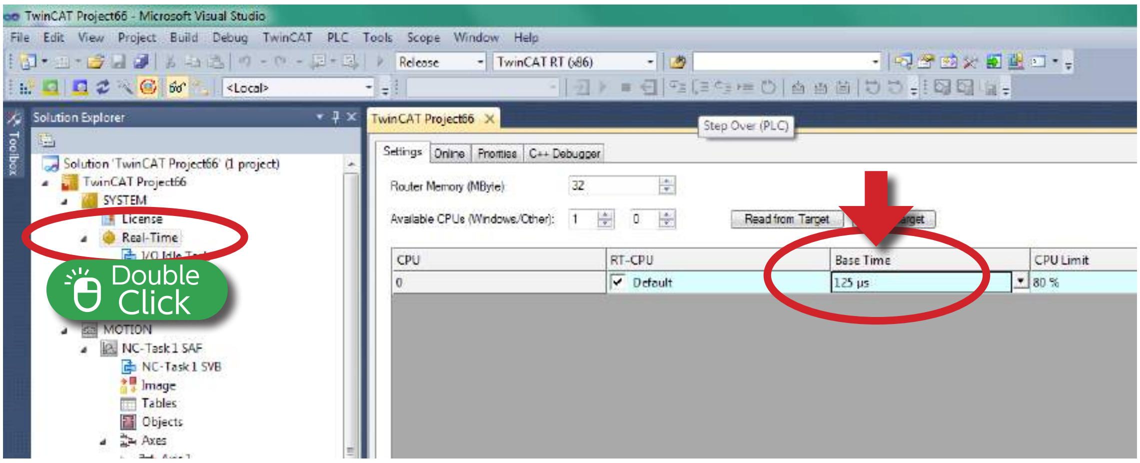
About Free Run

In Free Run mode, EtherCAT communication operation can be performed in CONFIG mode. In Free Run status, "RUN LED" of the slave lights up.



5 Set the system clock.

Set the "System clock (= Base Time)" to 125 µs by double-clicking "Real-Time" from the "SYSTEM" in the TwinCAT System Manager navigation tree.

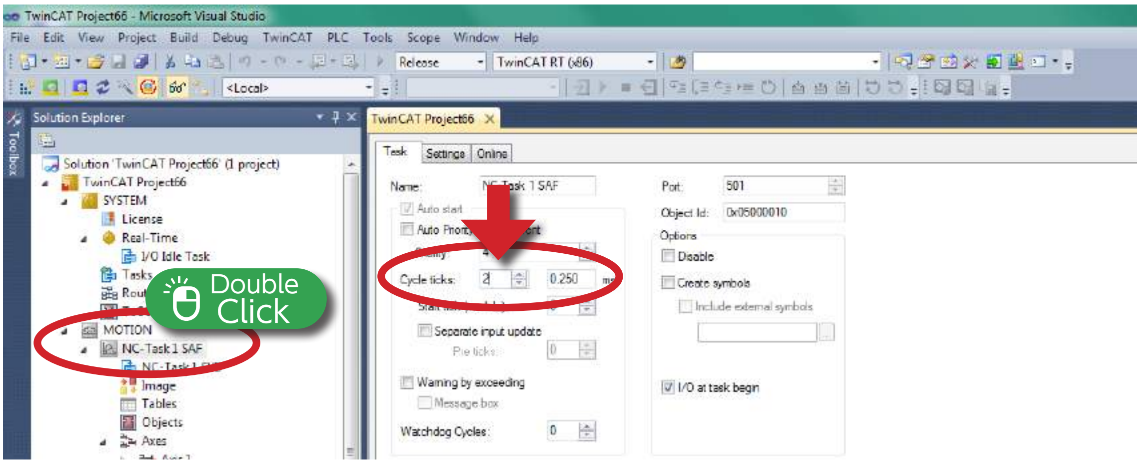


Router Memory (MByte): 32

Available CPUs (Windows/Other): 1 0

CPU	RT-CPU	Base Time	CPU Limit
0	☑ Default	125 µs	80 %

Double-click "NC-Task" in the "MOTION", and set Cycle ticks to "2".



Name: NC-Task 1 SAF

Port: 501

Object Id: 0x05000010

☑ Auto start

☐ Auto Priority Management

Priority: 4

Cycle ticks: 2 0.250 ms

Start tick (modulo): 0

☐ Separate input update

Pre ticks: 0

☐ Warning by exceeding

☐ Message box

Watchdog Cycles: 0

Options

☐ Disable

☐ Create symbols

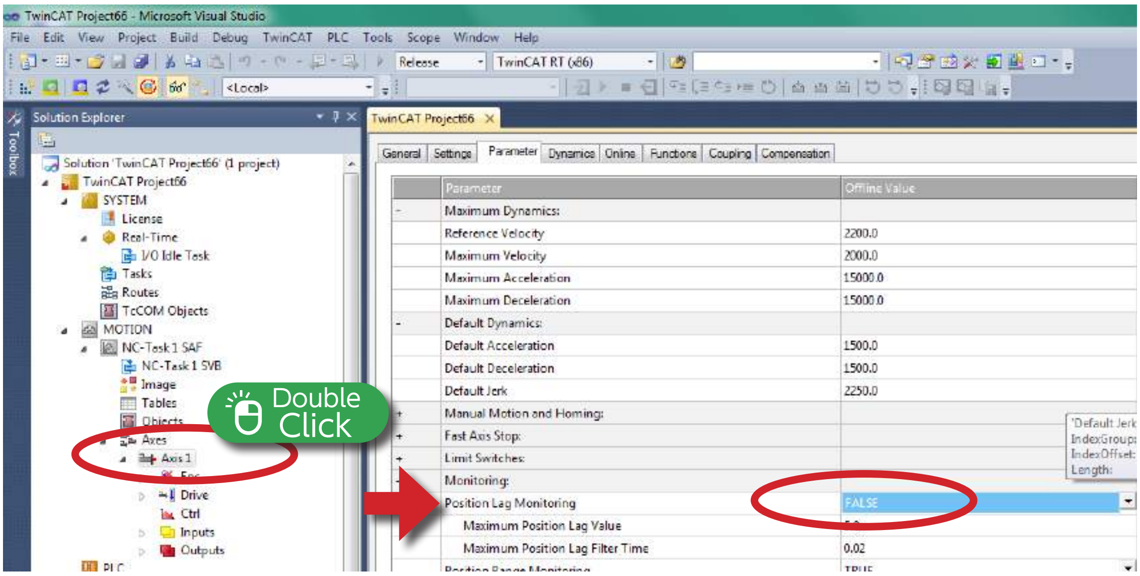
☐ Include external symbols

☑ I/O at task begin

2. Use Beckhoff's "TwinCAT"

6 Set the servo amplifier.

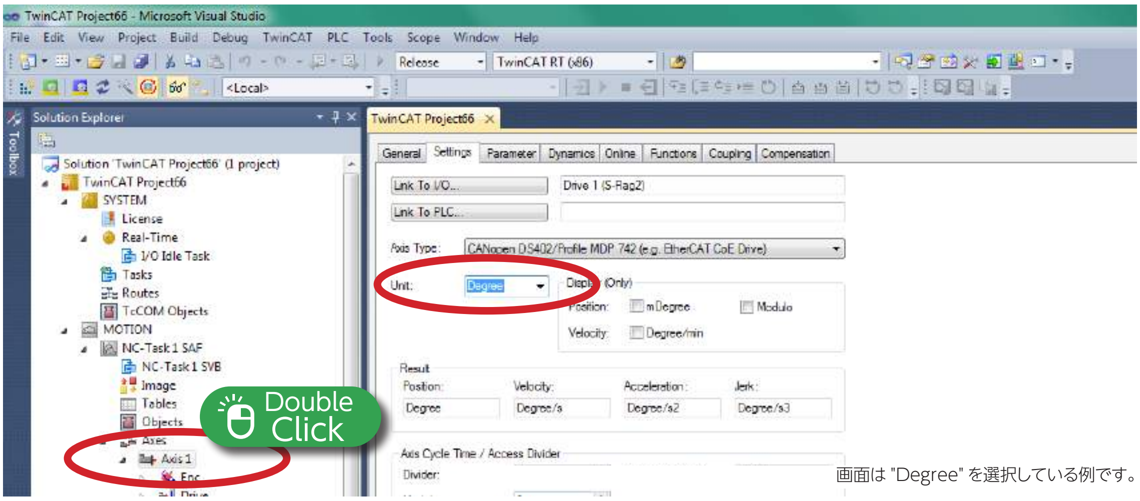
Double-click "Axis1" in "MOTION" → "NC-Task xxx" → "Axes", and set the Position Lag Monitoring setting in the Parameter tab to "FALSE" (*).



	Parameter	Offline Value
-	Maximum Dynamics:	
	Reference Velocity	2200.0
	Maximum Velocity	2000.0
	Maximum Acceleration	15000.0
	Maximum Deceleration	15000.0
-	Default Dynamics:	
	Default Acceleration	1500.0
	Default Deceleration	1500.0
	Default Jerk	2250.0
+	Manual Motion and Homing:	
+	Fast Axis Stop:	
+	Limit Switches:	
-	Monitoring:	
	Position Lag Monitoring	FALSE
	Maximum Position Lag Value	
	Maximum Position Lag Filter Time	0.02

*)【暫定】この設定により、マスタによる「位置偏差過大」が誤検出されるのを防ぎます。

Double-click "Axis1" in "MOTION" → "NC-Task xxx" → "Axes" and select the Unit setting in the Setting tab.



Link To I/O...: Drive 1 (S-Flag2)

Axis Type: CANopen DS402/Profile MDP 742 (e.g. EtherCAT CoE Drive)

Unit: Degree

Display (Only) Position: ☐ mDegree ☐ Modulo

Velocity: ☐ Degree/min

Result
Position: Degree
Velocity: Degree/s
Acceleration: Degree/s2
Jerk: Degree/s3

Divider:

画面は "Degree" を選択している例です。

TIP !

About the "Unit"

Degree: The angle of the motor's mechanical axis.
mm : The amount of mechanical movement such as the slider.

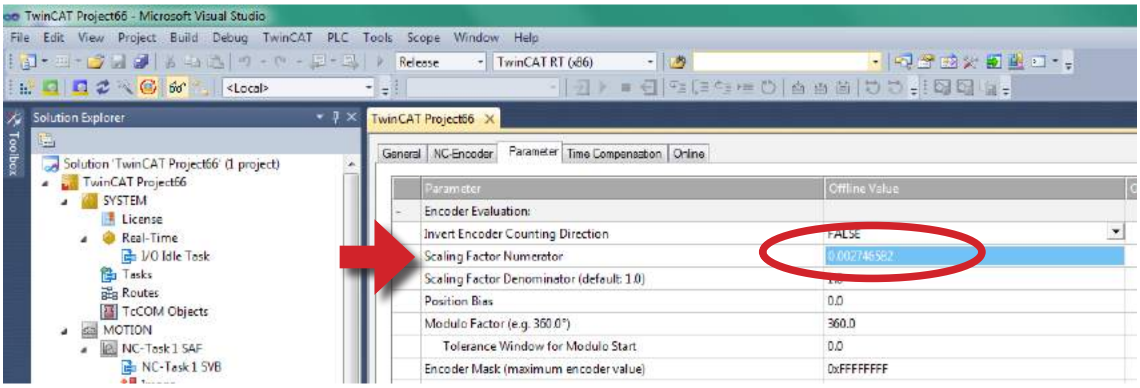
2. Use Beckhoff's "TwinCAT"

6 Set the servo amplifier.

Enter a value for the Scaling Factor Numerator in the Parameter tab,

(When "Degree" is selected in Unit)
"Scaling Factor Numerator" value = 0.002746582 deg/INC

This is an example of a 17 bit encoder.
360 (deg)/131,072 (INC) = 0.002746582



Parameter	Offline Value
Encoder Evaluation:	
Invert Encoder Counting Direction	FALSE
Scaling Factor Numerator	0.002746582
Scaling Factor Denominator (default: 1.0)	1.0
Position Bias	0.0
Modulo Factor (e.g. 360.0°)	360.0
Tolerance Window for Modulo Start	0.0
Encoder Mask (maximum encoder value)	0xFFFFFFFF

Be sure to enter the value in all digits that can be entered accurately.

If the number is rounded, the motor may not operate correctly.

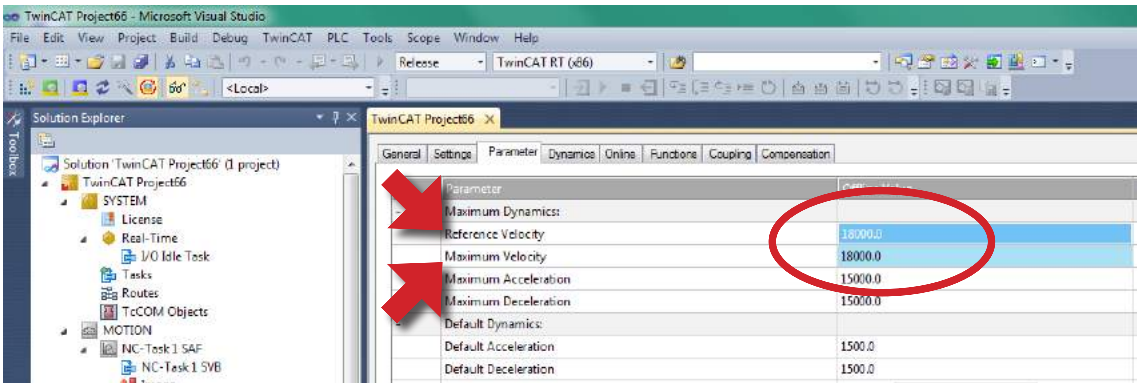
On the Parameter tab, set "Reference Velocity" and "Maximum Velocity" to 36,000.0 respectively.

Examples

"Reference Velocity" value = 36,000.0 Degree/s
"Maximum Velocity" value = 36,000.0 Degree/s

Set the maximum speed of the motor to be used.

This is an example of a motor with a maximum speed of 6,000 rpm.
6,000 rpm × 360 (deg) / 60 (s) = 36,000 Degree/s

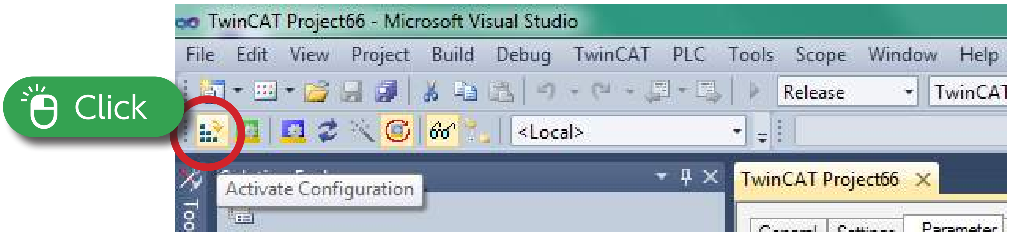


Parameter	Offline Value
Maximum Dynamics:	
Reference Velocity	18000.0
Maximum Velocity	18000.0
Maximum Acceleration	15000.0
Maximum Deceleration	15000.0
Default Dynamics:	
Default Acceleration	1500.0
Default Deceleration	1500.0

This is an example of setting 18,000.0 (= 3000 rpm).

6 Set the servo amplifier.

When you have completed all the settings, click Activate Configuration to accept the settings.



A confirmation dialog for switching to "RUN mode" is displayed.
Select Yes to go on.

Finish

Operation preparations are complete.

You can switch the TwinCAT 3 operation mode using the (RUN mode) or (CONFIG mode) button on the toolbar.

The operational mode of TwinCAT3 is displayed in the bottom right corner of the task tray or TwinCAT3 window.

2. Use "TwinCAT" to run the motor (test operation)

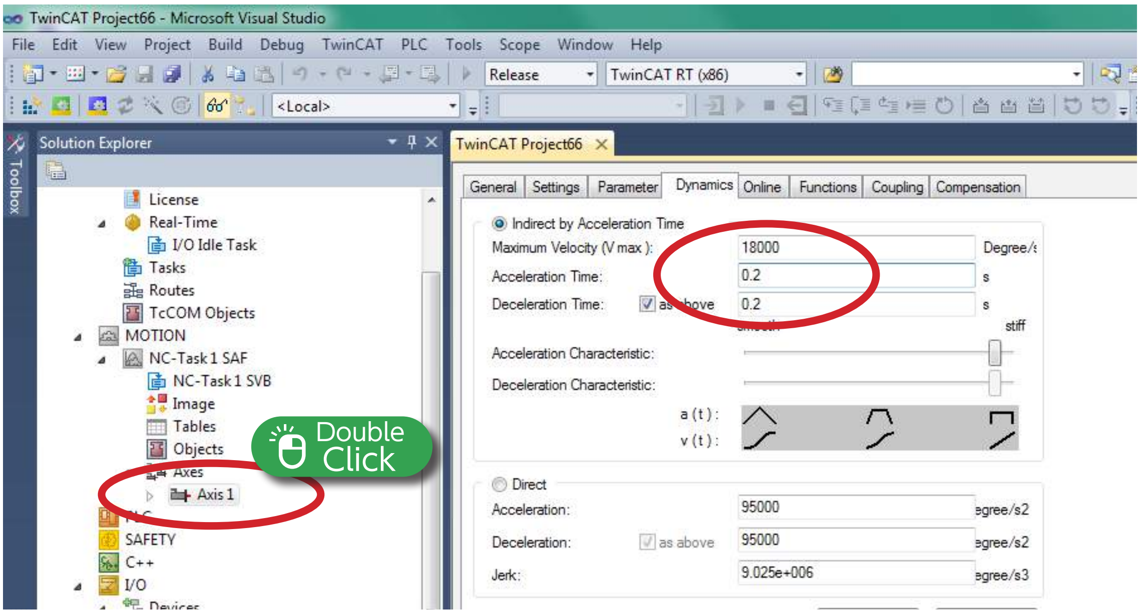
Setting operating conditions for test operation

Set the maximum speed, acceleration time and deceleration time of the motor.

Double-click "Axis1" in "MOTION" → "NC-Task xxx" → "Axes" to display the Dynamics tab.

Examples

"Maximum Velocity (V max)" value = 18,000 Degree/s
"Acceleration Time" value = 0.2 s
"Deceleration Time" value = 0.2 s



● Indirect by Acceleration Time
Maximum Velocity (V max): 18000 Degree/s
Acceleration Time: 0.2 s
Deceleration Time: ☑ as above 0.2 s
Acceleration Characteristic:
Deceleration Characteristic:
○ Direct
Acceleration: 95000 egree/s2
Deceleration: ☑ as above 95000 egree/s2
Jerk: 9.025e+006 egree/s3

This example sets the maximum speed to 3,000 rpm, the acceleration time to 0.2 s, and the deceleration time to 0.2 s.

In order to take the test operation safety,
- Set the maximum rotation speed to a small value.
- Set the acceleration/deceleration time to a larger value.

Adjust the value gradually after confirming safety.

TIP !

About Acceleration/Deceleration time

These settings specify the time from the current speed (Include the state of shutdown) to the target speed.

Setting a larger value makes gradual acceleration/deceleration.

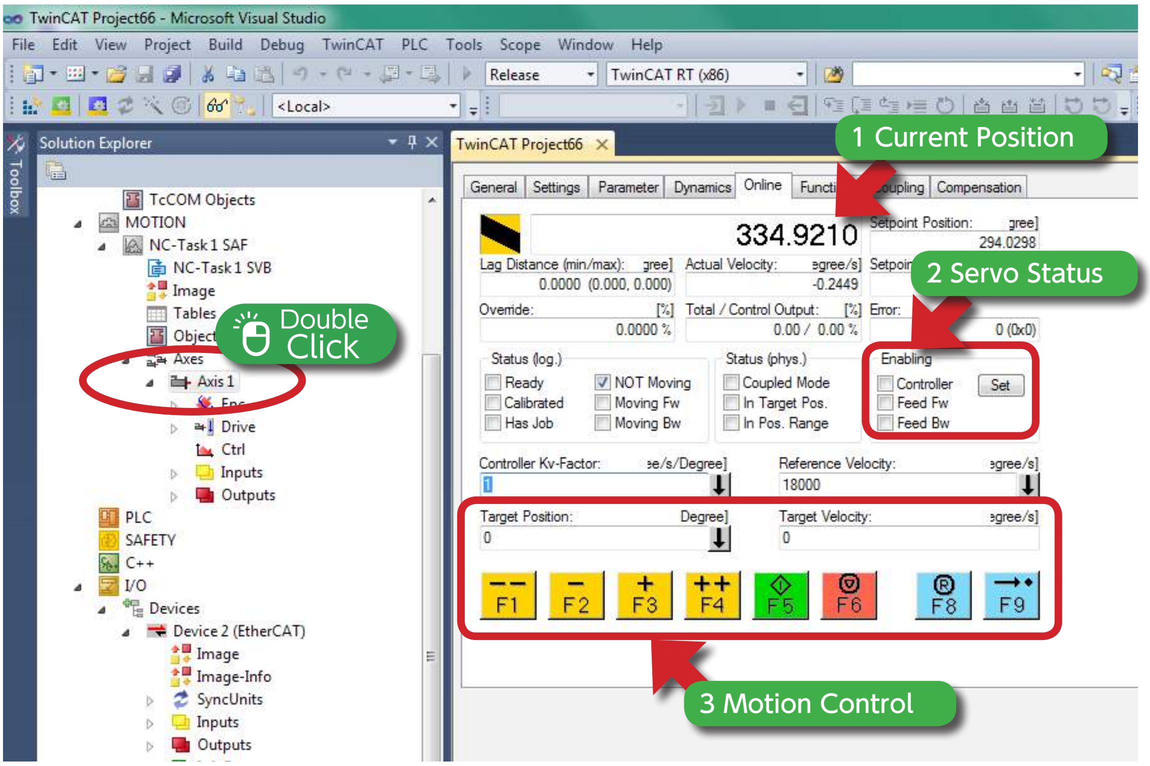
Setting a lower value makes sudden acceleration/deceleration.

2. Use Beckhoff's "TwinCAT"

Test motion (Jog motion and single motion)

"Jog motion" moves the motor while the button is pressed.
"Single motion" moves the motor toward the set target position.

Double-click "Axis1" in "MOTION" → "NC-Task xxx" → "Axes" to display the Online tab.



334.9210

Setpoint Position: [Degree] 294.0298

Lag Distance (min/max): [Degree] 0.0000 (0.000, 0.000)

Actual Velocity: [Degree/s] -0.2449

Override: [%] 0.0000 %

Total / Control Output: [%] 0.00 / 0.00 %

Error: 0 (0x0)

Status (log.)
- ☐ Ready
- ☐ Calibrated
- ☐ Has Job
- ☑ NOT Moving
- ☐ Moving Fw
- ☐ Moving Bw

Status (phys.)
- ☐ Coupled Mode
- ☐ In Target Pos.
- ☐ In Pos. Range

Enabling
- ☐ Controller
- ☐ Feed Fw
- ☐ Feed Bw

Controller Kv-Factor: [Degree/s/Degree] 1

Reference Velocity: [Degree/s] 18000

Target Position: [Degree] 0

Target Velocity: [Degree/s] 0

1 Current Position

The current position is displayed in the unit set in "Unit" on the Setting tab.

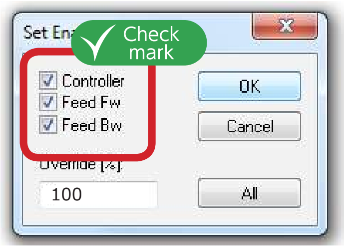
2 Servo Status

Displays the Servo status. To control the Servo status, click on the Set button and go to the configuration screen.

Servo on

To turn Servo on, click on the Set button and check the checkbox in the dialog below. The "Override " value must be 100%.

Click on the OK button to accept the settings.



☑ Controller
☑ Feed Fw
☑ Feed Bw
Override [%]: 100

Controller : Check the box to turn it on "Servo On".
Feed Fw : Check the box to accept "Forward" command.
Feed Bw : Check the box to accept "reverse" command.

Servo off

To turn Servo off, click on the Set button and uncheck the checkbox in the dialog below.

Click on the OK button to accept the settings.

3 Motion Control

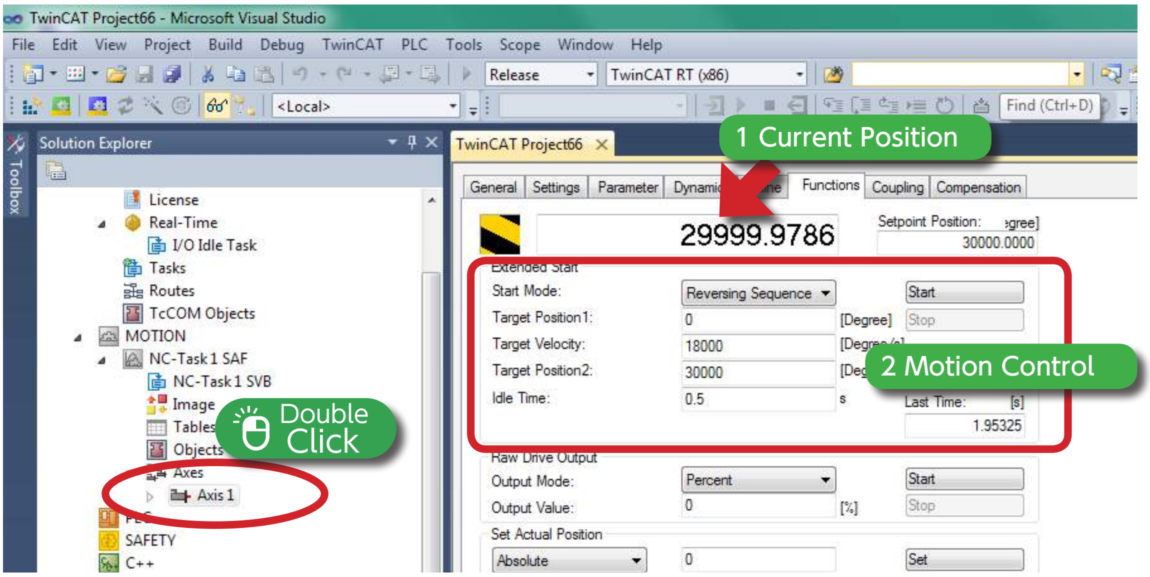
Move the motor with Jog motion or Single motion.
(You can also press the button on your keyboard that matches each button.)

Key	Works
−− F1	Jog motion The motor moves while the button is pressed. The motor moves at high speed in the reverse direction.
− F2	Jog motion The motor moves at low speed in the reverse direction.
+ F3	Jog motion The motor moves at low speed in the forward direction.
++ F4	Jog motion The motor moves at high speed in the forward direction.
◈ F5	Single motion The motor moves under the conditions set in "Target Position" and "Target Velocity".
⊗ F6	Single motion The motor stops single operation.
® F8	Reset the motor operation.

Test motion (Repetitive motion)

The motor can be "repetitive motion" assuming actual equipment.

Double-click "Axis1" in "MOTION" "NC-Task xxx" "Axes" to display the Functions tab.



29999.9786

Setpoint Position: [Degree] 30000.0000

Extended Start

Start Mode: Reversing Sequence — Start / Stop

Target Position1: 0 [Degree]

Target Velocity: 18000 [Degree/s]

Target Position2: 30000 [Degree]

Idle Time: 0.5 s

Last Time: [s] 1.95325

Raw Drive Output

Output Mode: Percent — Start / Stop

Output Value: 0 [%]

Set Actual Position

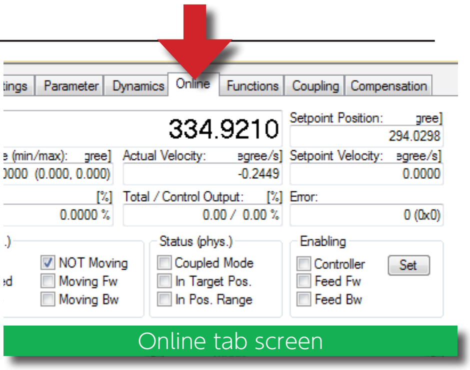
Absolute 0 — Set

TIP !

About "Servo state" control

Servo ON/OFF control function is not available in the "Function" tab.

To control the servo status, click the Set button in the "Enabling" frame of the "Online" tab.



334.9210

Setpoint Position: [Degree] 294.0298

(min/max): [Degree] 0.0000 (0.000, 0.000)

Actual Velocity: [Degree/s] -0.2449

Setpoint Velocity: [Degree/s] 0.0000

[%] 0.0000 %

Total / Control Output: [%] 0.00 / 0.00 %

Error: 0 (0x0)

☑ NOT Moving
☐ Moving Fw
☐ Moving Bw

Status (phys.)
☐ Coupled Mode
☐ In Target Pos.
☐ In Pos. Range

Enabling
☐ Controller
☐ Feed Fw
☐ Feed Bw
Set

Online tab screen

Before starting repetitive motion, do enough Jog motion or single motion to make sure you can move safely.

Then, perform sufficient repetitive motion at low speed to ensure safe operation before incorporating the motor into actual equipment.

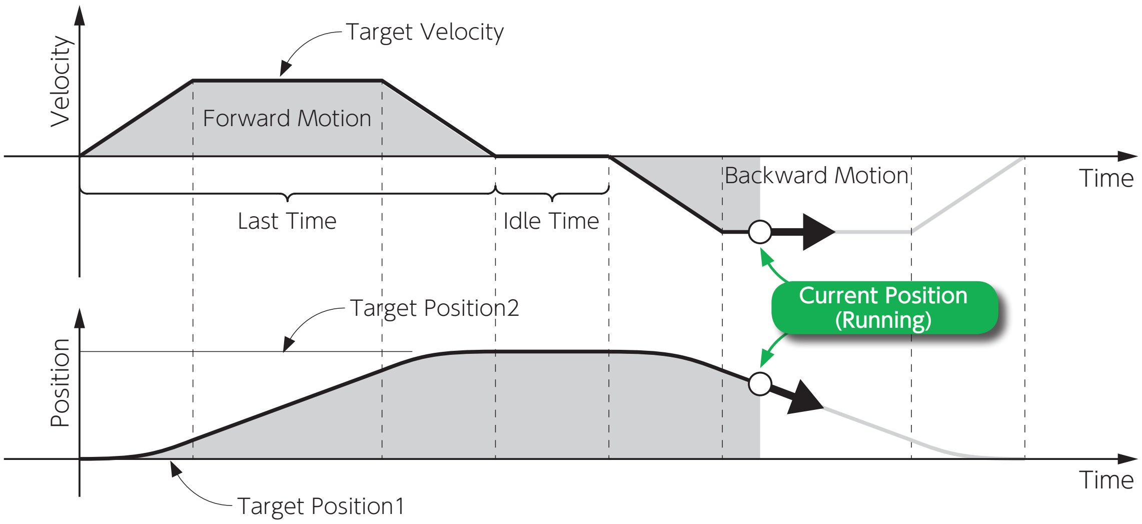
1 Current Position

The current position is displayed in the unit set in "Unit" on the Setting tab.

2 Motion Control

Items	Descriptions
Start Mode	Select the motion type. ・Reversing Sequence ・Absolute ・Relative ・Endless + (Continuous operation in one direction) …and so on.
Target Postion1	Set the target position (Start Position).
Target Velocity	Set the operating velocity.
Target Position2	Set the target position (stop position).
Idle Time	Set the time to wait for the next motion.
Last Time	Displays the duration(*) of the last motion. *) Time from "Motion Start" to "Positioning completion". The "Idle Time" is not included.
Start Button Stop Button	motion control buttons.

Example of "Repetitive motion"



3. Homing on TwinCAT (hm mode)

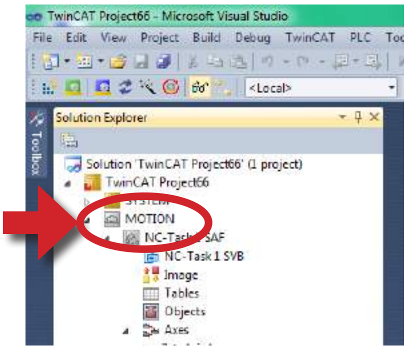
Executes Homing motion specified by EiA402 by using TwinCAT3.

TIP !

Possession of the object

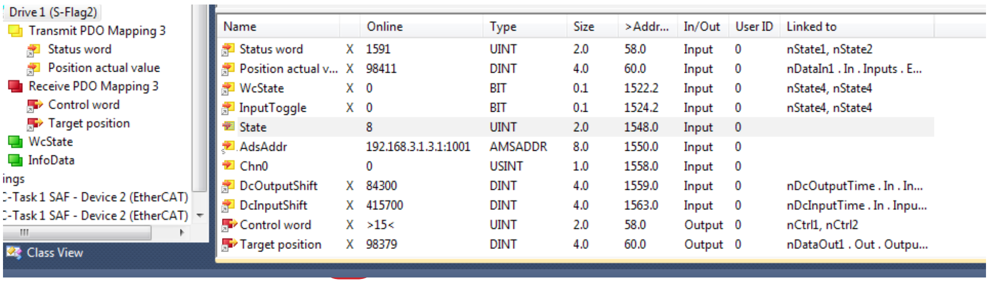
If Master controller recognizes the slave device as "NC" when scanning EtherCAT network, the Master has no permission to access to object.

(System Manager navigation tree view showing "MOTION")



To directly rewrite values such as Controlword and TargetPosition object, use the "Online Force" function described on the following pages.

The object which has no permission, is shown as "X" in the object tree view.



Name		Online	Type	Size	>Addr...	In/Out	User ID	Linked to
Status word	X	1591	UINT	2.0	58.0	Input	0	nState1, nState2
Position actual v...	X	98411	DINT	4.0	60.0	Input	0	nDataIn1 . In . Inputs . E...
WcState	X	0	BIT	0.1	1522.2	Input	0	nState4, nState4
InputToggle	X	0	BIT	0.1	1524.2	Input	0	nState4, nState4
State		8	UINT	2.0	1548.0	Input	0	
AdsAddr		192.168.3.1.3.1:1001	AMSADDR	8.0	1550.0	Input	0	
Chn0		0	USINT	1.0	1558.0	Input	0	
DcOutputShift	X	84300	DINT	4.0	1559.0	Input	0	nDcOutputTime . In . In...
DcInputShift	X	415700	DINT	4.0	1563.0	Input	0	nDcInputTime . In . Inpu...
Control word	X	>15<	UINT	2.0	58.0	Output	0	nCtrl1, nCtrl2
Target position	X	98379	DINT	4.0	60.0	Output	0	nDataOut1 . Out . Outpu...

Before starting Homing motion, do enough Jog motion or single motion to make sure you can move safely.
When using an Origin sensor, etc., confirm that the sensor is connected correctly and that it operates correctly.
Ensure that all equipment operates safely.

2. Use Beckhoff's "TwinCAT"

Homing

Start

Before starting Homing motion, do enough Jog motion or single motion to make sure you can move safely.
When using an Origin sensor, etc., confirm that the sensor is connected correctly and that it operates correctly.

1 Servo ON.

2 Switch the operation mode to the homing mode.

3 Set the Homing motion conditions.

4 Start homing.

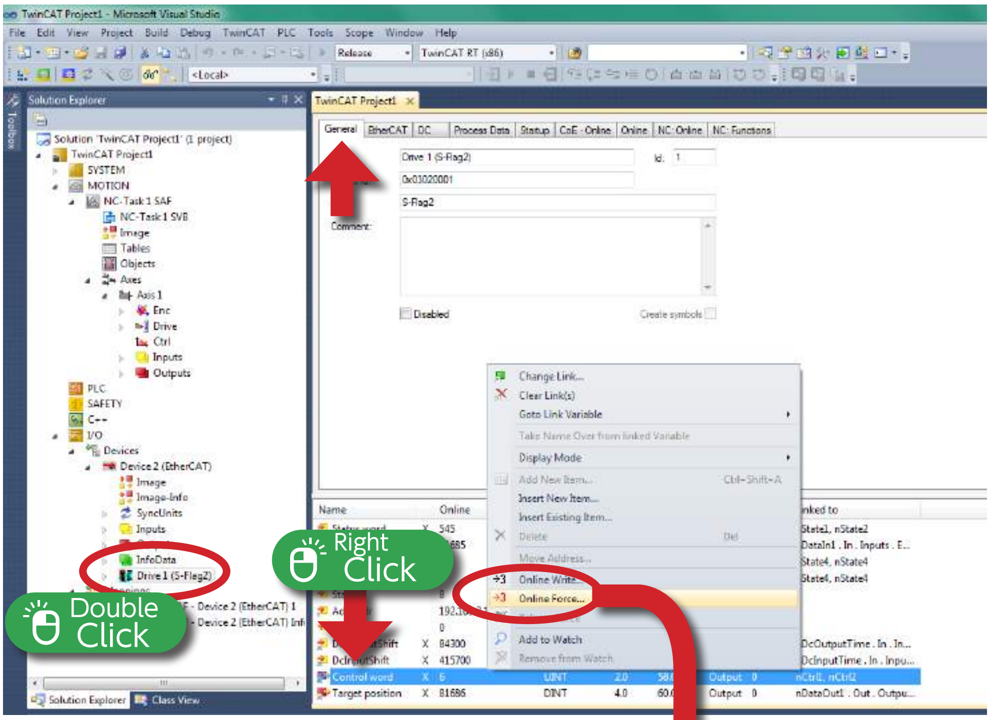
Finish

Operation preparations are complete.

1 Servo ON.

Use "Controlword (6040 h)" to make a PDS state transition.

- Double-click "Device1 (S-Flag2)" in "I/O" to display the "General" tab.
- Right-click "Control word" in the object list and select "Online Force".



Drive 1 (S-Flag2)

Id: 1

0x03020001

S-Flag2

Name		Online	Type	Size		In/Out		Linked to
Control word	X	6	UINT	2.0	58.0	Output	0	nCtrl1 . nCtrl2
Target position	X	81686	DINT	4.0	60.0	Output	0	nDataOut1 . Out . Outpu...

Set the Control word value as follows.

Transition to the "Shutdown" state.

Dec: 6 OK Click

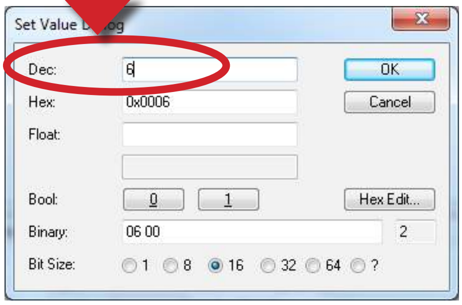
Transition to the "Switch on" state.

Dec: 7 OK Click

Transition to the "Enable operation" state.

Dec: 15 OK Click

Servo ON



Dec: 6

Hex: 0x0006

Float:

Bool: 0 1

Binary: 06 00 2

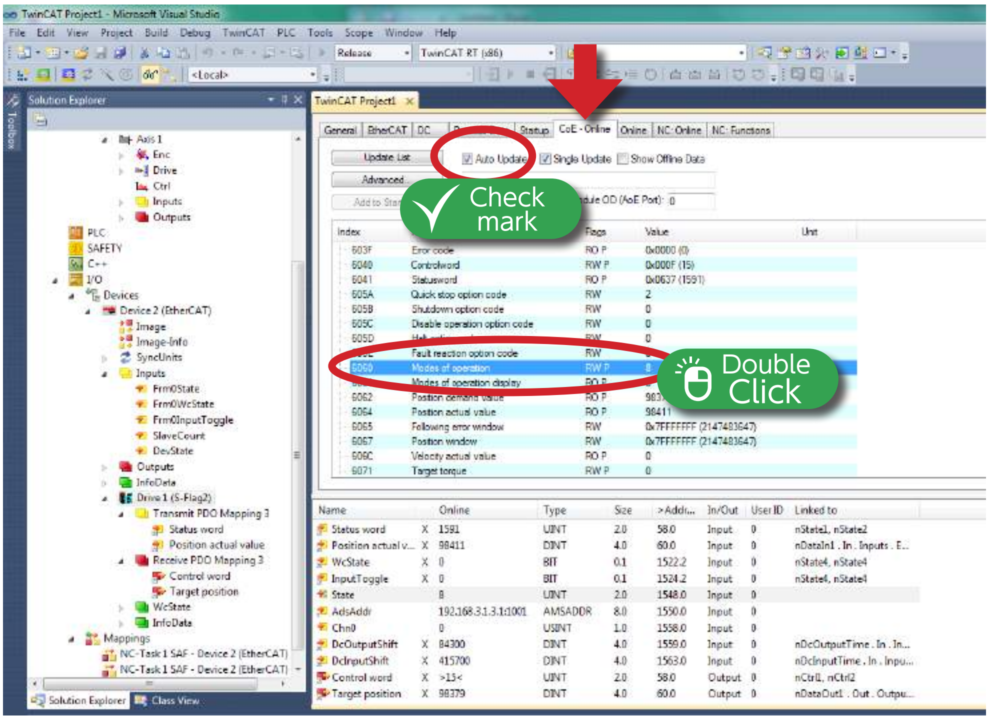
Bit Size: ○ 1 ○ 8 ● 16 ○ 32 ○ 64 ○ ?

2. Use Beckhoff's "TwinCAT"

2 Switch the operation mode to the homing mode.

Switches Modes of Operation (6060 h) from "CSP mode" to "hm mode".

- Switch to the "CoE" tab.
- Check the "Auto Update" checkbox.
- Double-click "6060 Modes of Operation" from the object list.



☑ Auto Update ☑ Single Update ☐ Show Offline Data

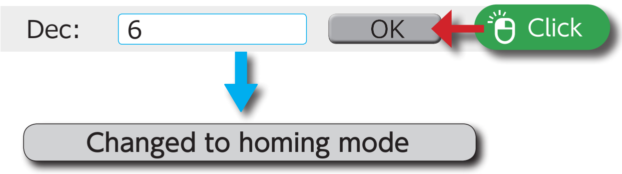
Module OD (AoE Port): 0

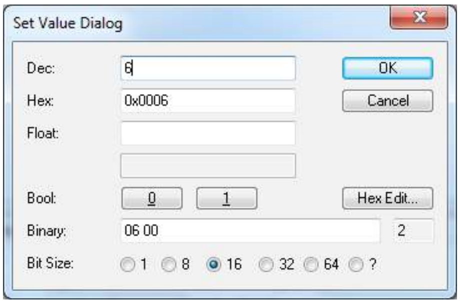
Index	Name	Flags	Value	Unit
603F	Error code	RO P	0x0000 (0)	
6040	Controlword	RW P	0x000F (15)	
6041	Statusword	RO P	0x0637 (1591)	
605A	Quick stop option code	RW	2	
605B	Shutdown option code	RW	0	
605C	Disable operation option code	RW	0	
605D	[illegible]	RW	0	
[illegible]	Fault reaction option code	RW	[illegible]	
6060	Modes of operation	RW P	8	
[illegible]	Modes of operation display	RO P	[illegible]	
6062	Position demand value	RO P	983[illegible]	
6064	Position actual value	RO P	98411	
6065	Following error window	RW	0x7FFFFFFF (2147483647)	
6067	Position window	RW	0x7FFFFFFF (2147483647)	
606C	Velocity actual value	RO P	0	
6071	Target torque	RW P	0	

Name		Online	Type	Size	>Addr...	In/Out	User ID	Linked to
Status word	X	1591	UINT	2.0	58.0	Input	0	nState1, nState2
Position actual v...	X	98411	DINT	4.0	60.0	Input	0	nDataIn1 . In . Inputs . E...
WcState	X	0	BIT	0.1	1522.2	Input	0	nState4, nState4
InputToggle	X	0	BIT	0.1	1524.2	Input	0	nState4, nState4
State		8	UINT	2.0	1548.0	Input	0	
AdsAddr		192.168.3.1.3.1:1001	AMSADDR	8.0	1550.0	Input	0	
Chn0		0	USINT	1.0	1558.0	Input	0	
DcOutputShift	X	84300	DINT	4.0	1559.0	Input	0	nDcOutputTime . In . In...
DcInputShift	X	415700	DINT	4.0	1563.0	Input	0	nDcInputTime . In . Inpu...
Control word	X	>15<	UINT	2.0	58.0	Output	0	nCtrl1, nCtrl2
Target position	X	98379	DINT	4.0	60.0	Output	0	nDataOut1 . Out . Outpu...

Set the Modes of operation value to "6" (hm mode).

Switch to "hm mode".





Dec: 6

Hex: 0x0006

Float:

Bool: 0 1

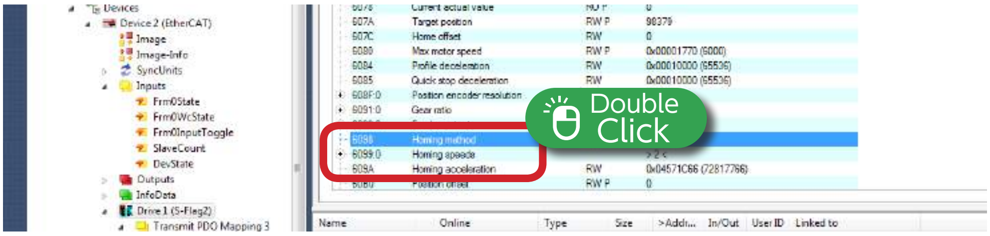
Binary: 06 00 2

Bit Size: ○ 1 ○ 8 ● 16 ○ 32 ○ 64 ○ ?

3 Set the Homing motion conditions.

Set the "Homing method (6098 h)", "Homing speeds (6099 h)", and "Homing acceleration (609 Ah)".

- Double-click "6098 Homing method", "Homing speeds", and "homing acceleration" respectively from the object list.



607A	Target position	RW P	98379
607C	Home offset	RW	0
6080	Max motor speed	RW P	0x00001770 (6000)
6084	Profile deceleration	RW	0x00010000 (65536)
6085	Quick stop deceleration	RW	0x00010000 (65536)
608F:0	Position encoder resolution		
6091:0	Gear ratio		
6098	Homing method		
6099:0	Homing speeds		> 2 <
609A	Homing acceleration	RW	0x04571C66 (72817766)

Homing method

Selects the type of homing operation. (Range: 1 -6, 17 -22, 33 -35, 37)

See [**1** **Operations**] for more information.

Homing speeds

Sets the speed of homing operation. (Unit: pulse/s)

sub-index: "01h"··· Speed at home sensor detection (high speed)

Corresponds to amp parameter No. 648.0 (Unit: rpm).

sub-index: "02h"···Speed to detect index pulse (low speed)

Corresponds to amp parameter No. 649.0 (Unit: rpm).

Homing acceleration

Sets the acceleration of homing operation. (Unit: pulse/s^2)

Corresponds to amp parameter No. 650.0 (Units: ms/1,000 rpm).

Configuration Complete

Relations between amplifier parameter values and TwinCAT3 settings

Convert [rpm] to [pulse/s] (For a 17 bit encoder)

Example: The motor rotational velocity of 100 rpm is converted to pulse/s unit for setting by TwinCAT3.

100 [rpm] = 100 [rev] × 131,072 [pulse/rev] / 60 [s] = **218,453.33···[pulse/s]**

Convert [ms/(1,000 rpm)] to [pulse/s^2] (For a 17 bit encoder)

Example:The motor acceleration/deceleration time of 30 ms/(1,000 rpm) is converted to pulse/s2 units for setting in TwinCAT3.

30 [ms/(1,000 rpm)] = 0.03 [s]/(1,000 [rev] × 13,1072 [pulse/rev]) / 60 [s]

= 0.03/(1,000 × 131,072) × 60 [s^2/pulse]

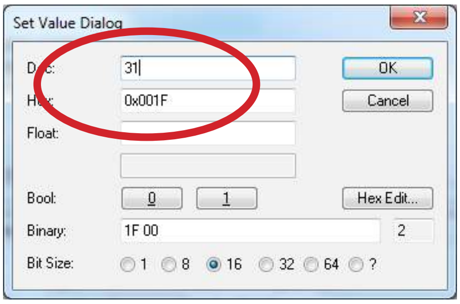
invert the result of this calculation → **72,817,777.77···[pulse/s^2]**

4 Start homing.

Setting bit 4 of Controlword (6040 h) to 1 starts homing.

- Right-click "Control word" in the object list and choose "Online Force".

Being the Servo ON state, the "Control word" value is "15 (= 000Fh)".
Set "31 (= 001Fh)" to set bit 4 (Homing operation start) to "1".


Set Value Dialog

Dec: 31

Hex: 0x001F

Float:

Binary: 1F 00 2

Bit Size: ○ 1 ○ 8 ● 16 ○ 32 ○ 64 ○ ?

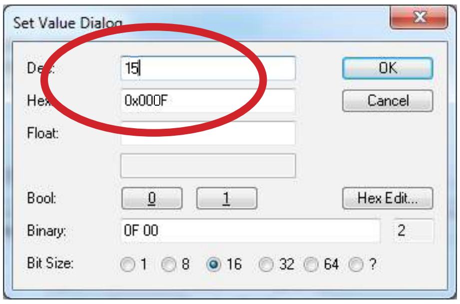
Homing starts.

Dec: 31 OK ← Click

Homing starts.

- When the homing operation is completed(*), right-click "Control word" and select "Online Force".

Set bit4 (Homing operation start) back to "0".
Then, set the value to "15 (= 000Fh)".


Set Value Dialog

Dec: 15

Hex: 0x000F

Float:

Binary: 0F 00 2

Bit Size: ○ 1 ○ 8 ● 16 ○ 32 ○ 64 ○ ?

Closes the homing operation.

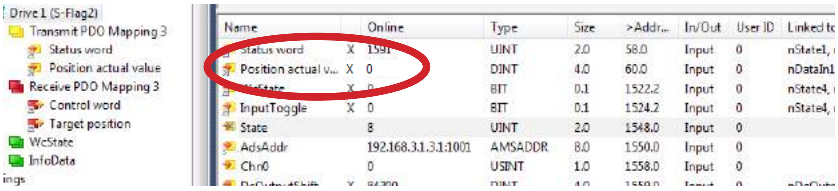
Dec: 15 OK ← Click

Homing is completed.

*) You can check the completion of homing with Statusword (6041 h).
See [**1 Operations**] for more information.

After the homing operation is completed

The "Position Actual Value" becomes "0".



Name		Online	Type	Size	>Addr...	In/Out	User ID	Linked to
Status word	X	1591	UINT	2.0	58.0	Input	0	nState1,
Position actual v...	X	0	DINT	4.0	60.0	Input	0	nDataIn1
WcState	X	0	BIT	0.1	1522.2	Input	0	nState4,
InputToggle	X	0	BIT	0.1	1524.2	Input	0	nState4,
State		8	UINT	2.0	1548.0	Input	0	
AdsAddr		192.168.3.1.3.1:1001	AMSADDR	8.0	1550.0	Input	0	
Chn0		0	USINT	1.0	1558.0	Input	0	

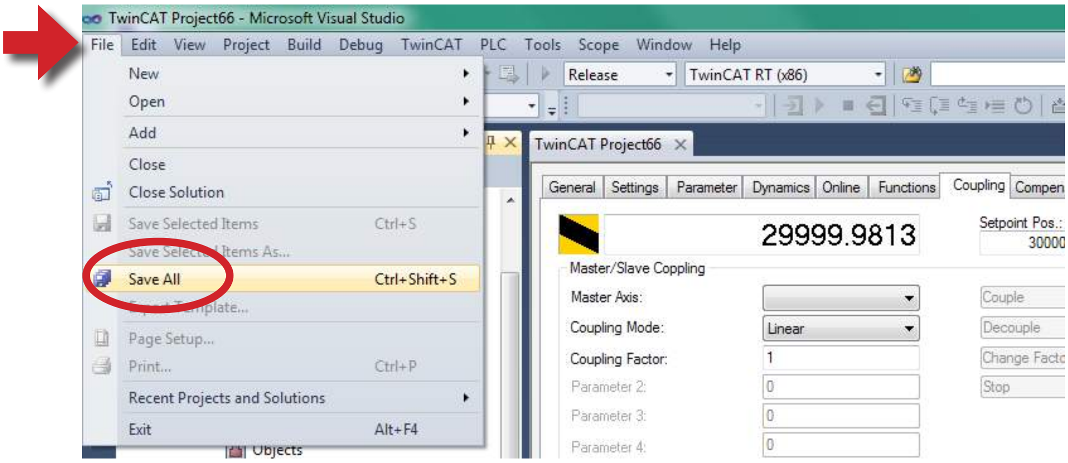
2. Use Beckhoff's "TwinCAT"

4. Save Project file

Save the project.

The project file stores connection information, settings, and test operation conditions. You can retrieve a saved project file.

Save the project file by choosing "Save All" from the "File" menu.



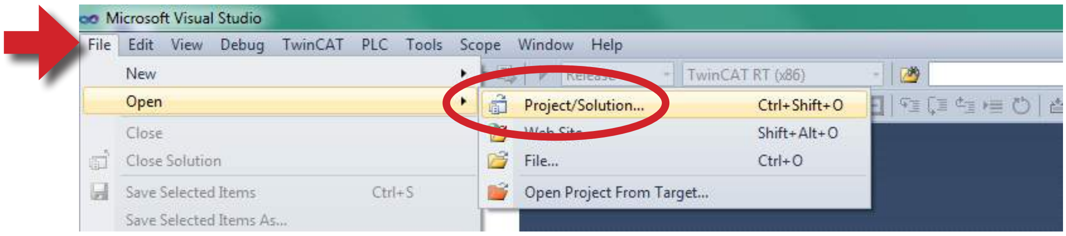
Finish

Saving the project file is complete.

5. Open Project file

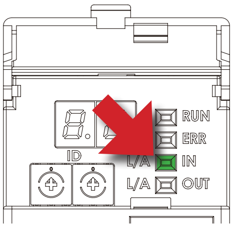
Open a saved project file.

Select "Project/Solution" in "File" → "Open" to open the saved project.



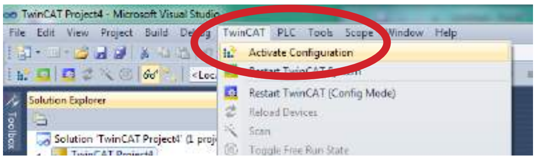
Turn on the control power to the amplifier.

Wait until the L/A IN LED turns green to indicate that EtherCAT communication has been established.



Click on Activate Configuration to accept the configuration.

If there is no button on the toolbar, there is also a "Activate Configuration" button in the "TwinCAT" menu.



Finish

Reading the project file is complete.

MEMO

3

Timing Diagrams

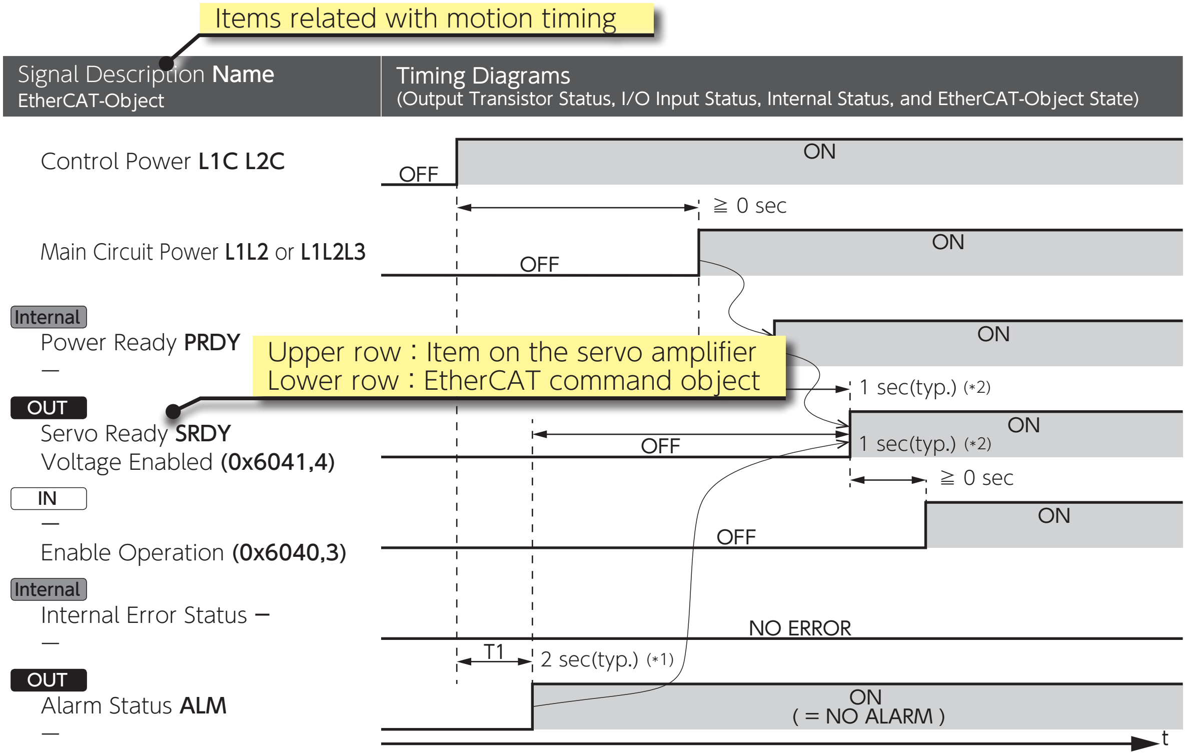
1. Timing Diagram Overview

List of Timing Diagrams

When designing a host controller system, consider the timing of control signal input from the controller to the amplifier, or alarm signal output from the amplifier.

Description	Refer to
1. Turning the Power On	P. 3
2. Servo OFF → ON	P. 4
3. Servo ON → OFF (Motor idling)	P. 5
4. Servo ON → OFF (Motor rotating)	P. 6
5. Alarm Occurs	P. 7
6. Alarm Reset	P. 8
7. Brake Release	P. 9
8. Dynamic Brake Release	P. 10
9. Deceleration Stop Status During Free Run	P. 11
10. Delay time for Quick Stop Complete	P. 12

Timing Diagram Overview



OUT : Output Signal

Output State	I/O Output Status (EtherCAT Command State)
OFF	Output Transistor is OFF. (0)
ON	Output Transistor is ON. (1)

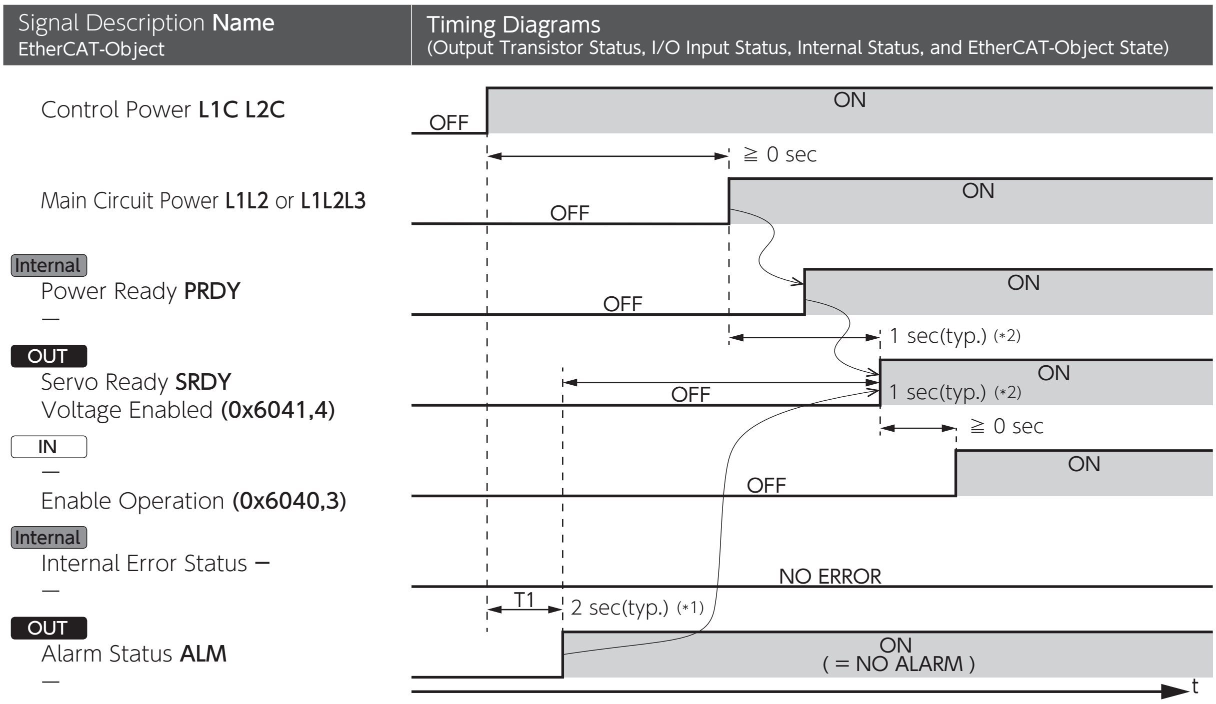
IN : Input Signal

Input State	I/O Input Status (EtherCAT Command State)
OFF	Open (0)
ON	Close (1)

Internal : Internal Status of the Amplifier

2. Timing Diagrams

1. Turning the Power On

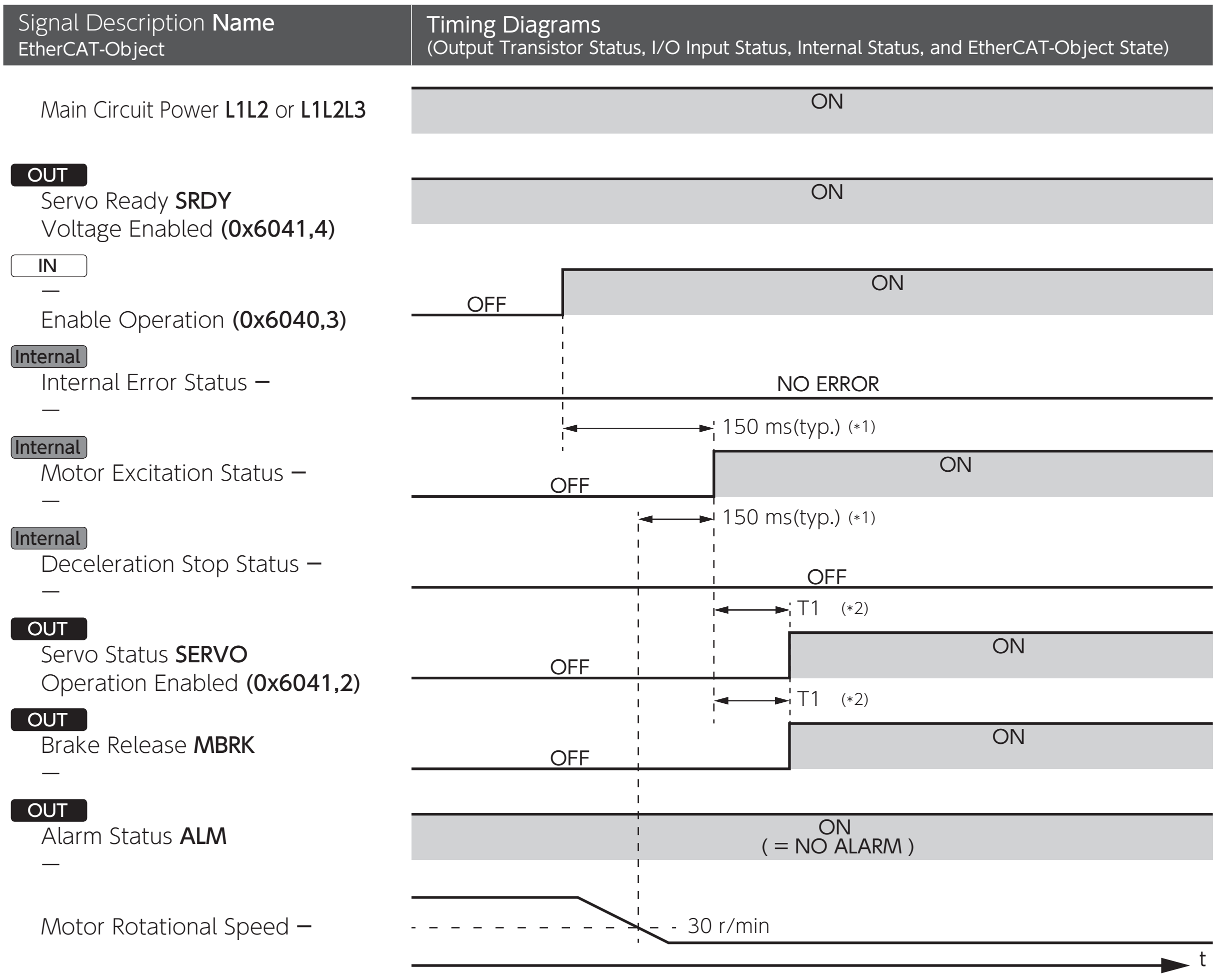


*1) After Clear Parameter execution, T1 needs approximately 10 seconds for parameter initialization.

*2) **SRDY** turns ON when **Primary Circuit Power** and **PRDY** turns ON consecutively while **Internal Error Status** remains No Errors.

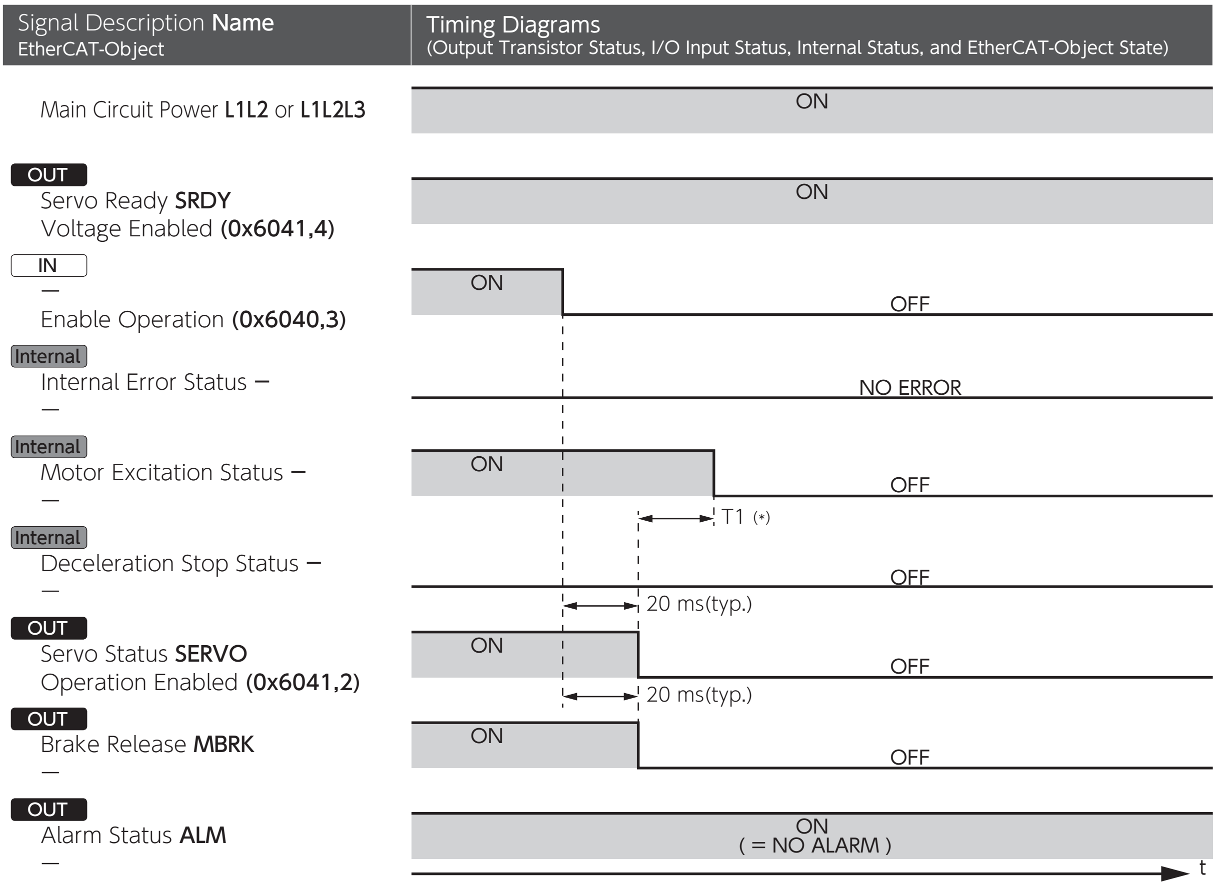
2. Timing Diagrams

2. Servo OFF → ON



*1) **Motor Excitation Status** remains OFF until **Motor Rotational Speed** drops to 30 r/min or below.
*2) T1 is specified by Bake-Release Delay Time (No.238.0).

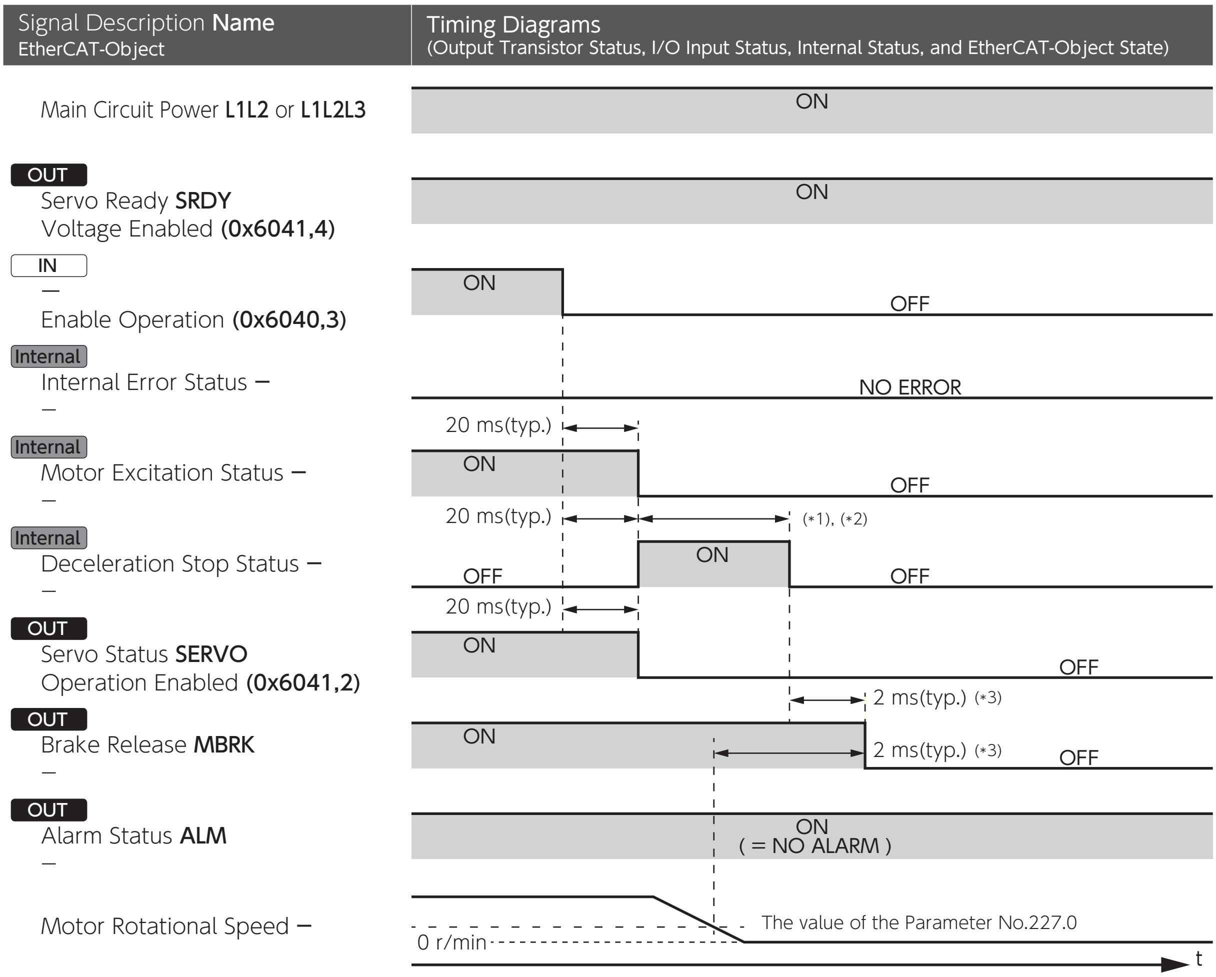
3. Servo ON → OFF (Motor idling)



*) T1 is specified by Servo OFF Delay time (No.237.0).

2. Timing Diagrams

4. Servo ON → OFF (Motor rotating)



*1) The motor decelerates according to the method specified by Deceleration Stop Method (No.224.0)

*2) Quick stop or Short brake ends when deceleration stop conditions set by parameters (No.224.1, No.226.0, and No.227.0) are met.

*3) Deceleration Stop Method (No.224.0) = 2 (quick stop) or 1 (short brake)

MBRK turns OFF when one of the following conditions is met :

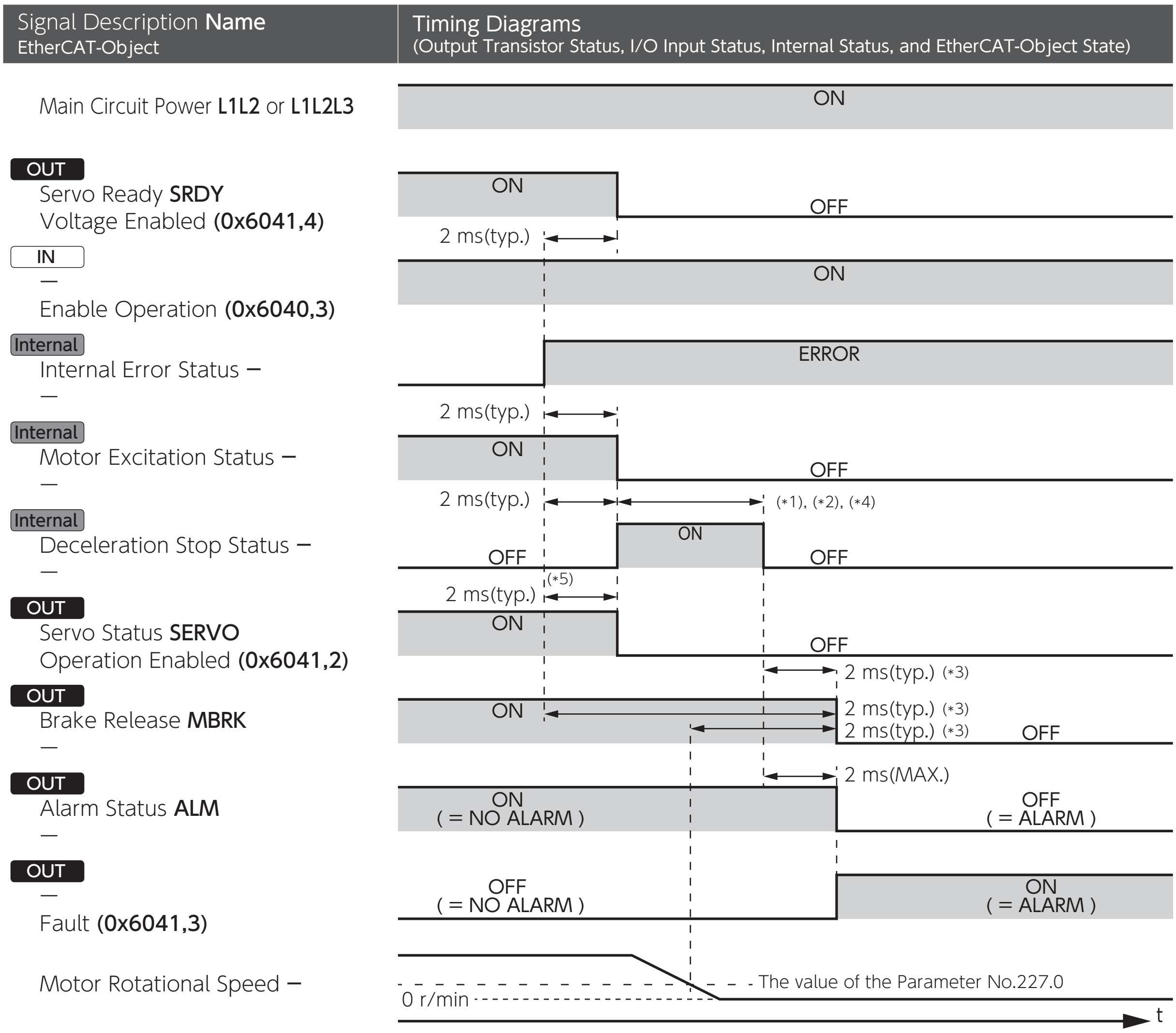
a) **Deceleration Stop Status** turns OFF

b) The rotational speed drops to the value specified by **Deceleration stop Rotational speed to cancel** (No.227.0) or below.

Deceleration Stop Method (No.224.0) = 0 (free run)

MBRK turns OFF when **Motor Excitation Status** becomes OFF.

5. Alarm Occurs



*1) The motor will stop per Deceleration Stop Method (No.224.0) as follows.

2 (quick stop) or 1 (short brake)	: the motor decelerates and stops by short brake.
0 (Free-run)	: no brake.

*2) **Deceleration Stop Status** ends when deceleration stop conditions set by the parameters (No.224.1, No.226.0, and No.227.0) are met.

*3) Timing of **MBRK** turning OFF

If Deceleration Stop Method (No.224.0) = 2 (quick stop) or 1 (short brake),
MBRK turns OFF when one of the following conditions is met.
1) **Deceleration Stop Status** turns OFF
2) **Motor Rotational Speed** drops to the value specified by the parameter No.227.0 or below.

If Deceleration Stop Method (No.224.0) = 0 (no brake),
MBRK turns OFF when **Motor Excitation Status** turns OFF.

If any of the following alarms occurs,
MBRK turns OFF when the internal error status becomes **ERROR**.

a) Encoder related errors	b) Control Power voltage drop error
c) Errors related to Inverter output part	d) Overvoltage error

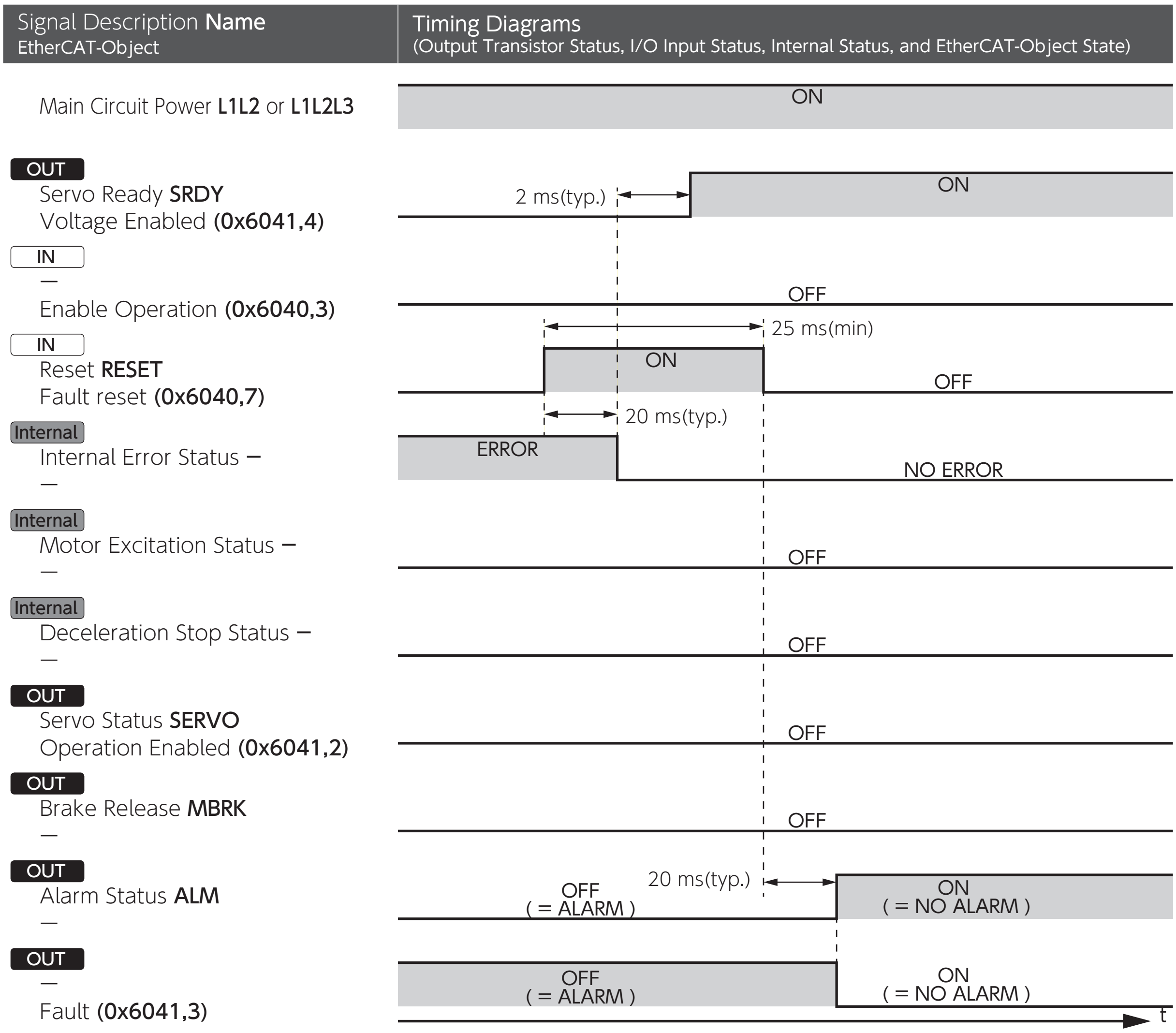
If any alarm except above four occurs, the motion pattern will be exactly as this timing diagram suggests.

*4) Deceleration Stop behaves as follows depending on the error type :
a) Encoder related errors : Deceleration Stop per Deceleration stop operating time (Parameter No.226.0)
b) Control Power voltage drop error : Deceleration Stop per Deceleration stop (upon control power failure) Operating time (No.228.0)
c) Errors related to Inverter output part : Free-run

*5) In case of the following alarms, **Servo Status** will remain ON until **Deceleration Stop Status** turns OFF.
a) Encoder related errors
b) Control power voltage drop error

2. Timing Diagrams

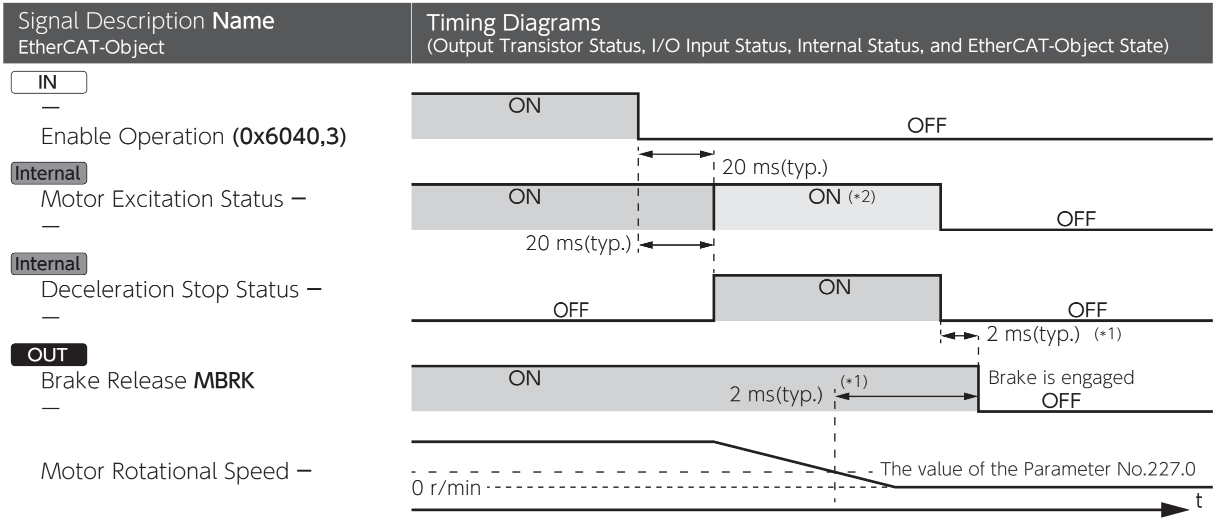
6. Alarm Reset



2. Timing Diagrams

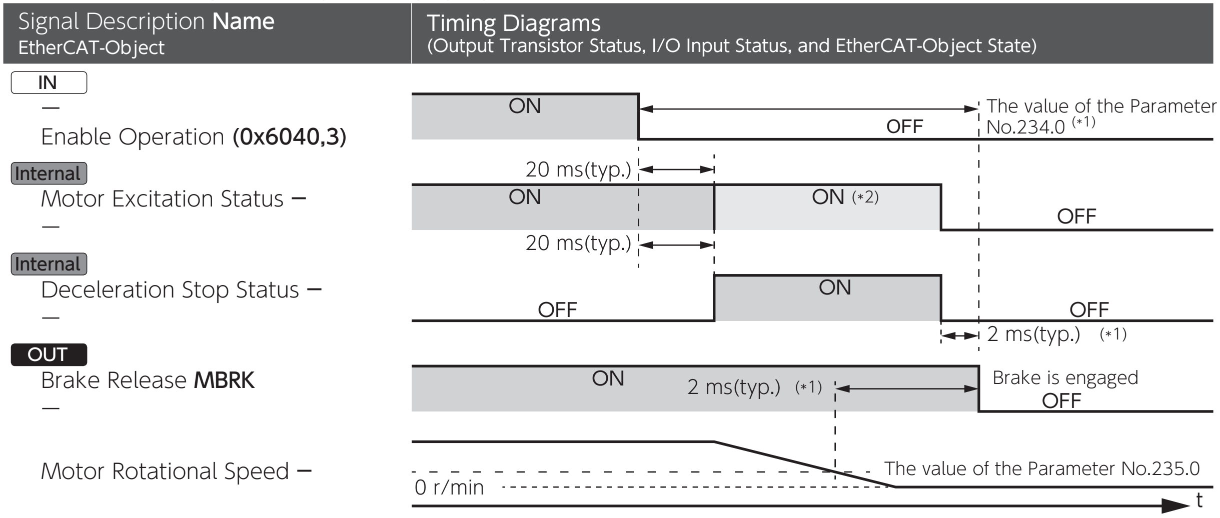
7. Brake Release

Deceleration Stop : Timing for Engaging Brake (No.232.3) = 0



*1) **MBRK** turns OFF is when one of the following becomes true, a) Deceleration Stop completes, or b) **Motor rotational speed** drops to the value of **Deceleration stop - Rotational speed to cancel** (No.227.0) or below.
*2) If the deceleration stop method is quick stop, the motor will remain excited during deceleration stop.

Deceleration Stop : Timing for Engaging Brake (No.232.3) = 1

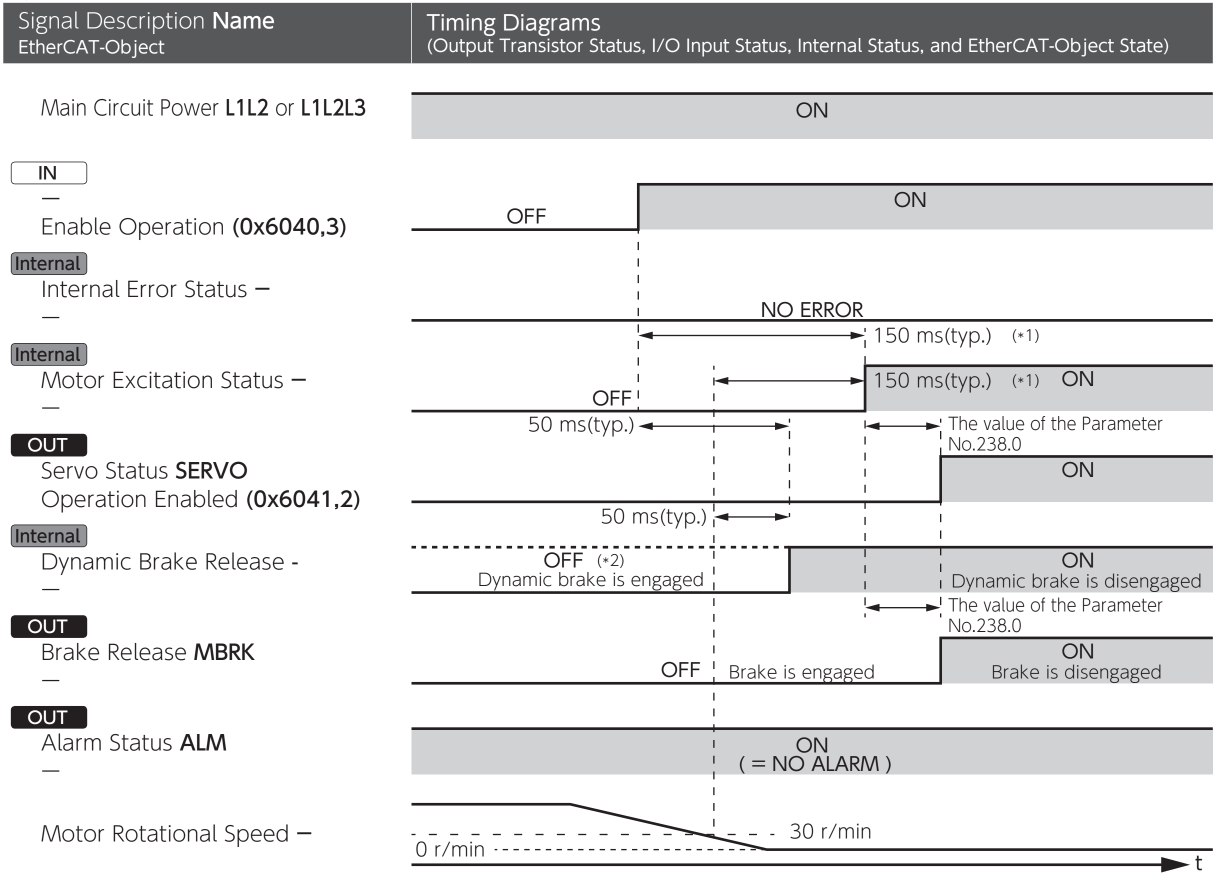


*1) **MBRK** turns OFF is when one of the following becomes true, a) Deceleration Stop completes, or b) Motor rotational speed, after the time specified by Parameter No.234.0 elapses, drops to the value specified by Parameter No.235.0 or below.
*2) If the deceleration stop method is quick stop, the motor will remain excited during deceleration stop.

2. Timing Diagrams

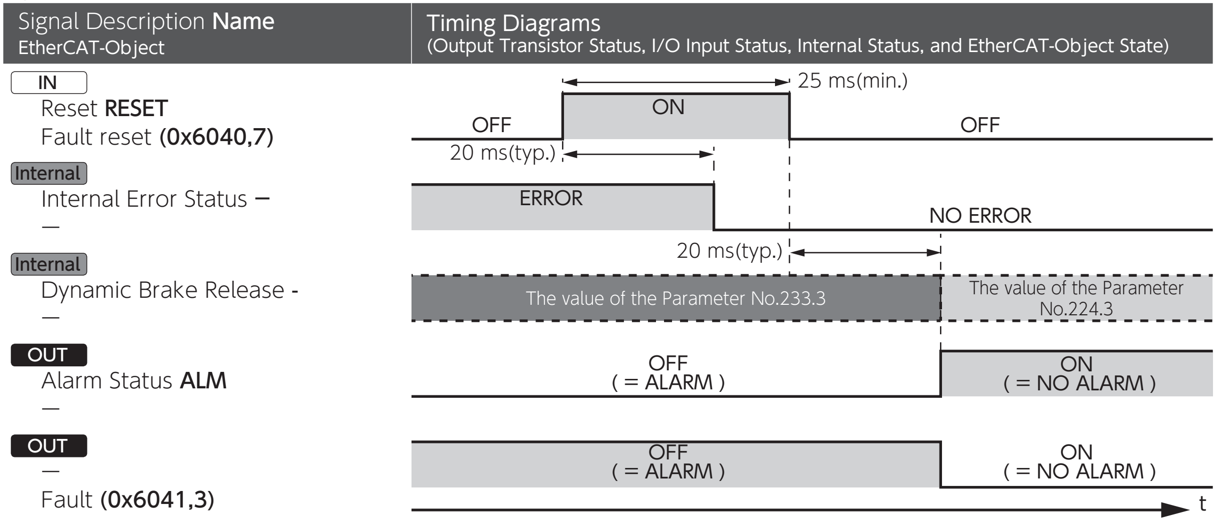
8. Dynamic Brake Release

Upon Servo ON, if Deceleration stop (when Servo is OFF) : Method (No.224.0) = 3 (dynamic brake)



*1) **SERVO** does not turn ON until **Motor Rotational Speed** drops below 30 r/min.
*2) When **DBRK** output (No.224.3) = 1 (dynamic brake) after a stop per Deceleration Stop (when Servo is OFF)

Upon Alarm Clear, if Deceleration stop (when Servo is OFF) Method (No.224.0) = 3 (dynamic brake)

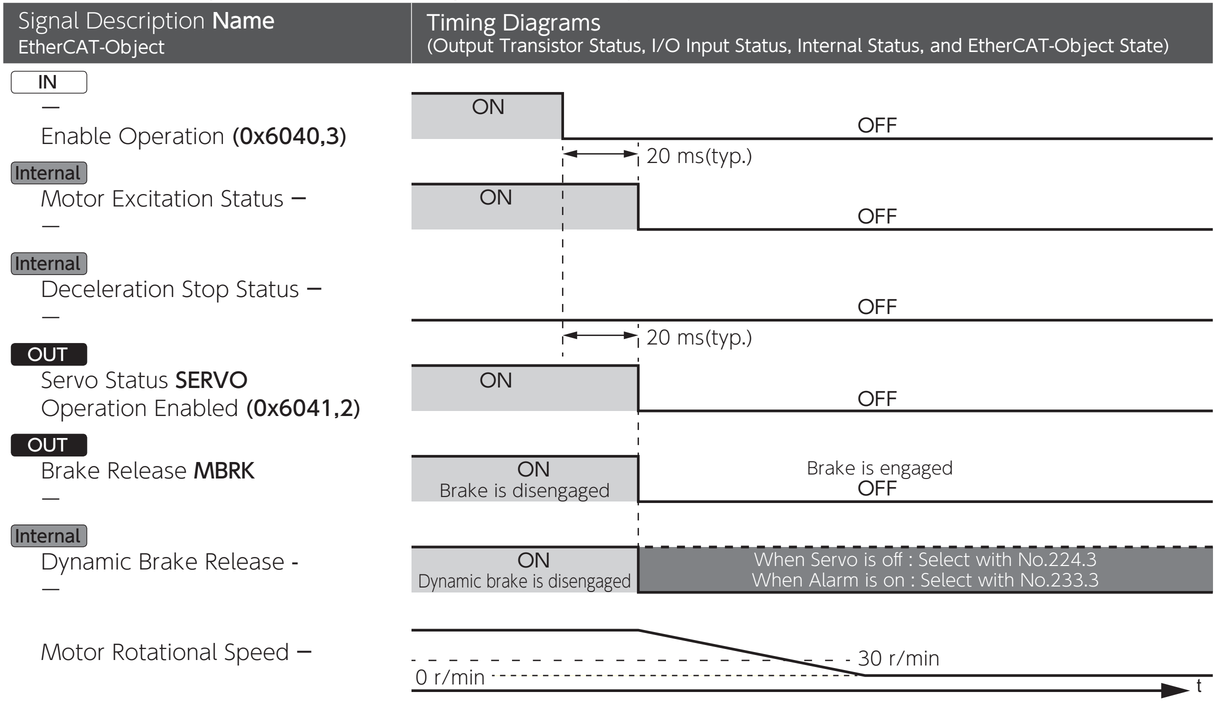


2. Timing Diagrams

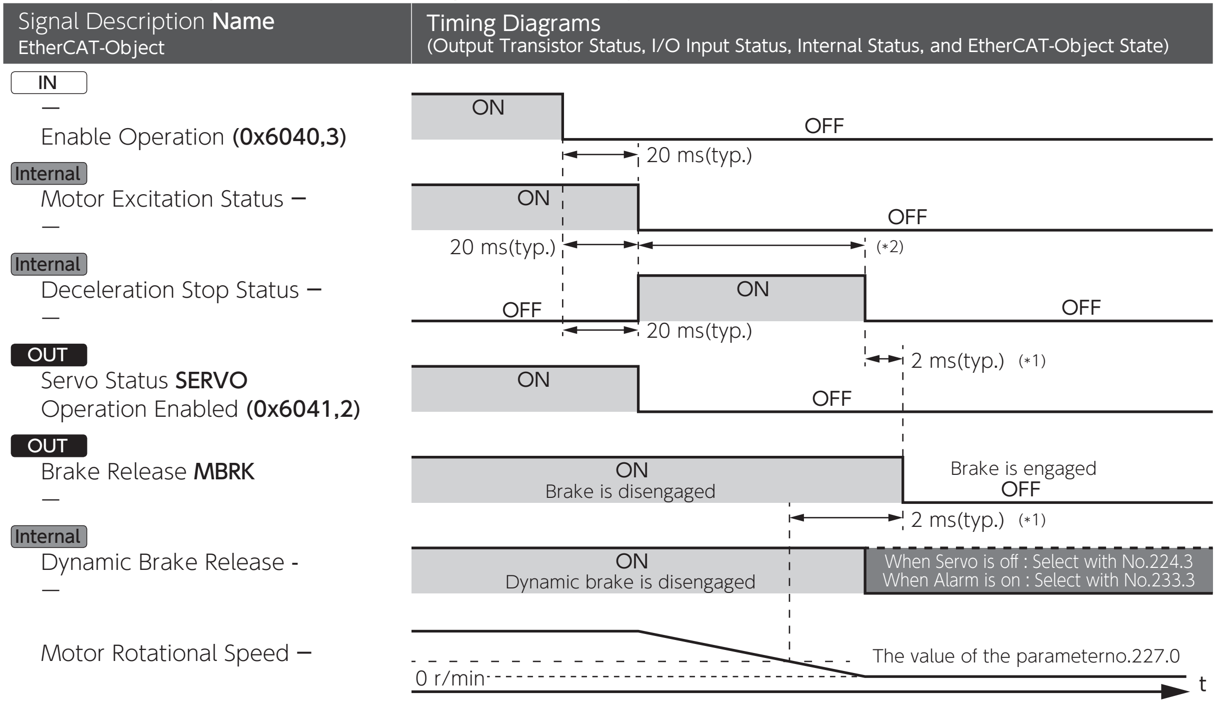
9. Deceleration Stop Status During Free Run

Deceleration Stop Status where **Deceleration Stop Method (at Servo OFF)** (No.224.0) and **Deceleration Stop Method (at Alarm ON)** (No.233.0) are set to free run.

Deceleration stop : Deceleration stop status during free-run (No.232.1) = 0 (OFF)



Deceleration stop : Deceleration stop status during free-run (No.232.1) = 1 (ON)



*1) **MBRK** turns OFF when one of the following conditions is met :
a) **Deceleration Stop Status** turns OFF.
b) **Motor Rotational Speed** drops to the value of **Deceleration stop - Rotational speed to cancel** (No.227.0) or below.
*2) **Deceleration Stop Status turns** OFF when deceleration stop conditions (No.224.1, 226.0, or 227.0) are met.

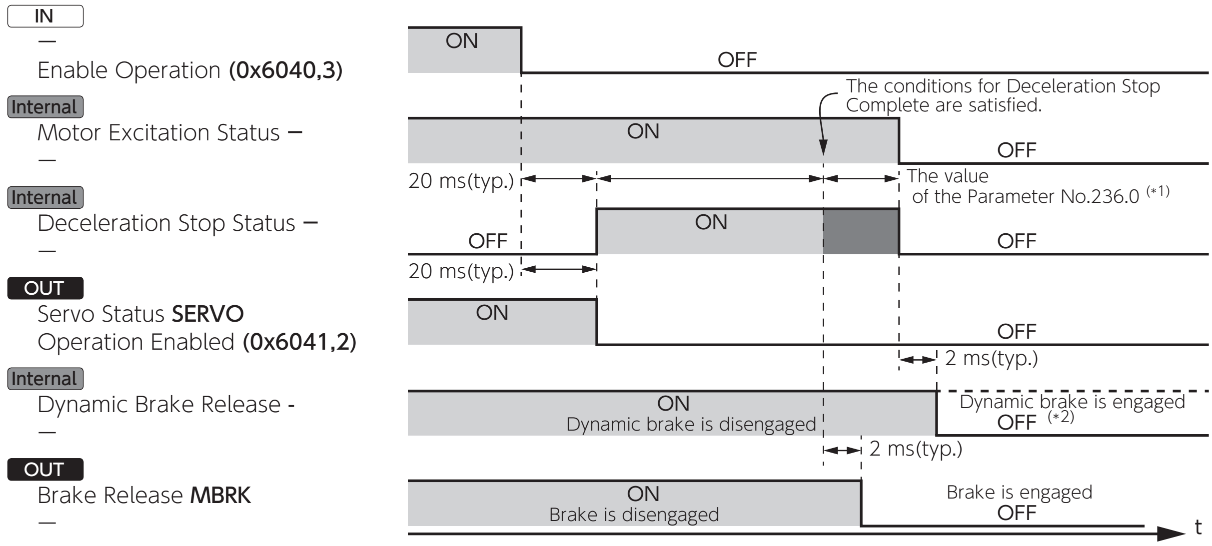
2. Timing Diagrams

10. Deceleration Stop Status on "Quick Stop" configuration

When Servo becomes OFF while motor is in motion and then the motor decelerates to stop by the quick stop method.

Deceleration stop : Method (at Servo OFF) (No.224) = 2 (quick stop)

Signal Description **Name** EtherCAT-Object	Timing Diagrams (Output Transistor Status, I/O Input Status, Internal Status, and EtherCAT-Object State)



*1) **Deceleration Stop Status** turns OFF after the deceleration stop conditions set by the Parameters (No.224.1, 226.0, and 227.0) are met and the time amount set to **Quick Brake Delay Time** (No.236.0) elapses.

*2) When **DBRK** output (No.224.3) = 1 (dynamic brake) after Deceleration Stop (at Servo OFF) ends.

S-FLAG Ⅱ Instruction Manual
- EtherCAT -

Z

APPENDICES

1. Troubleshooting

2. Technical Information

AMO-NP-35475-41
SF2-E-Z
DEC. 2019

MEMO

1

Troubleshooting

1. Checking Warnings and Alarms

Warnings and alarm numbers can be viewed on the Setup Panel or S-TUNE Ⅱ.
When an alarm and a warning occur at the same time, the alarm will be displayed first.
For possible cause and remedy, verify on the warning or alarm list.
The alarm history keeps up to ten alarms including the current one. (*)

*) Alarm No.22 (control power supply error) and Warning numbers are not logged in the alarm history.

The alarm numbers and the cumulative run time (in hours) up to the time of alarm are logged.

Note: The amplifier version can be checked with S-TUNE Ⅱ.

☞ D- 1 About S-TUNE Ⅱ

1. Using the Setup Panel

When a warning occurs, the amplifier LED blinks green. In addition, the Setup Panel will automatically display the corresponding warning No.

When an alarm occurs, the amplifier LED changes from solid green to solid red. In addition, the Setup Panel will automatically display the alarm No.

☞ C- 1 Setup Panel

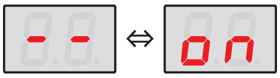
EtherCAT communication node address

Displays the node address of the EtherCAT communication.

Displays for approximately 2 seconds.

If an alarm occurs when the amplifier is started, the node address is not displayed.

Servo status



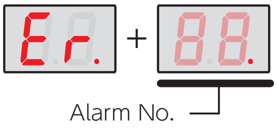
Indicates the servo status of the amplifier.

The servo status is not displayed when an alarm occurs.

Servo **OFF**

Servo **ON**

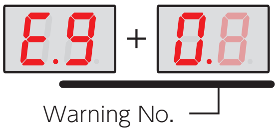
Alarm status



Displays the alarm number that has occurred.

The alarms are from No.00 to No.34.

Warning status



Displays the warning number that has occurred.

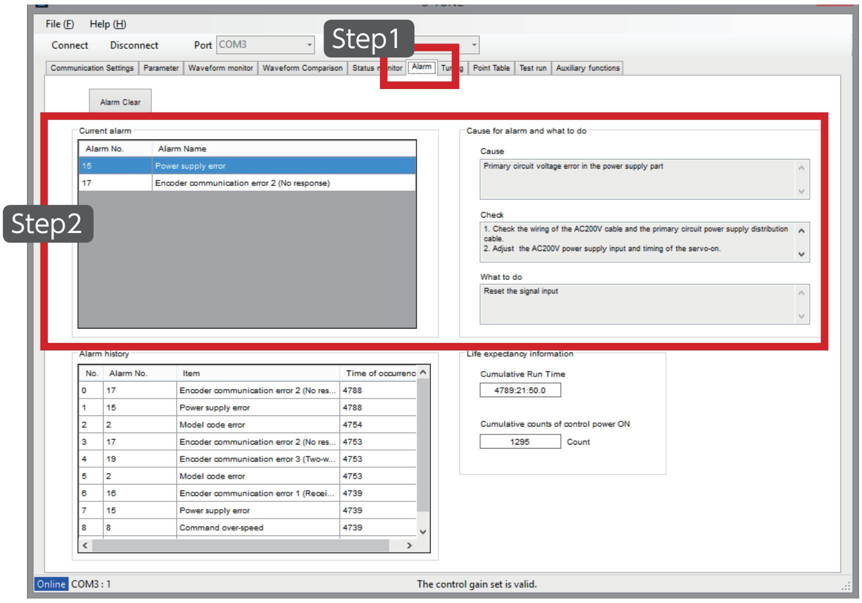
The warnings are from No.900 to No.904.

1. Checking Warnings and Alarms

2. Using S-TUNE Ⅱ

Turn on the control power AC200 V to the amplifier and start S-TUNE Ⅱ.
For information on the warning/alarm, check "Alarm currently occurring" under the [Alarm] tab.
If you are not sure what to do, contact us with the alarm number and its description.

☞ D- 1 About S-TUNE Ⅱ



Port COM3

Current alarm

Alarm No.	Alarm Name
15	Power supply error
17	Encoder communication error 2 (No response)

Cause for alarm and what to do

Cause: Primary circuit voltage error in the power supply part

Check: 1. Check the wiring of the AC200V cable and the primary circuit power supply distribution cable.
2. Adjust the AC200V power supply input and timing of the servo-on.

What to do: Reset the signal input

Alarm history

No.	Alarm No.	Item	Time of occurrenc
0	17	Encoder communication error 2 (No res...	4788
1	15	Power supply error	4788
2	2	Model code error	4754
3	17	Encoder communication error 2 (No res...	4753
4	19	Encoder communication error 3 (Two-w...	4753
5	2	Model code error	4753
6	16	Encoder communication error 1 (Recei...	4739
7	15	Power supply error	4739
8	8	Command over-speed	4739

Life expectancy information

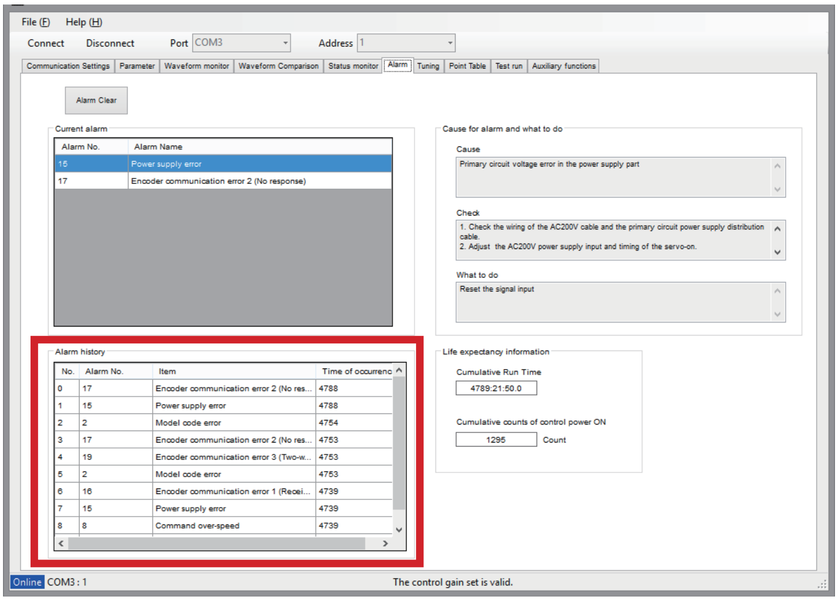
Cumulative Run Time: 4789:21:50.0

Cumulative counts of control power ON: 1295 Count

Online COM3 : 1   The control gain set is valid.

Step1 Select the Alarm tab in S-TUNE Ⅱ.
Step2 See [Current alarm] and [Cause for the alarm] and [What to do] windows for details.

Checking the Alarm History in S-TUNE Ⅱ



Port COM3   Address 1

Current alarm

Alarm No.	Alarm Name
15	Power supply error
17	Encoder communication error 2 (No response)

Cause for alarm and what to do

Cause: Primary circuit voltage error in the power supply part

Check: 1. Check the wiring of the AC200V cable and the primary circuit power supply distribution cable.
2. Adjust the AC200V power supply input and timing of the servo-on.

What to do: Reset the signal input

Alarm history

No.	Alarm No.	Item	Time of occurrenc
0	17	Encoder communication error 2 (No res...	4788
1	15	Power supply error	4788
2	2	Model code error	4754
3	17	Encoder communication error 2 (No res...	4753
4	19	Encoder communication error 3 (Two-w...	4753
5	2	Model code error	4753
6	16	Encoder communication error 1 (Recei...	4739
7	15	Power supply error	4739
8	8	Command over-speed	4739

Life expectancy information

Cumulative Run Time: 4789:21:50.0

Cumulative counts of control power ON: 1295 Count

Online COM3 : 1   The control gain set is valid.

The alarm history area shows a list of the alarms.

2. Warnings and Remedies

1. Warning Output

There are two ways to output warnings.

1. Setup Panel Output

During waring output, the warning number will appear on the Setup Panel.

Warning No.	Display	Warning Description	Refer to
900	E.9 ···> 0.0	Encoder overheat detection	P. 6
901	E.9 ···> 0.1	Encoder battery voltage drop error detection	P. 6
902	E.9 ···> 0.2	Emergency stop	P. 6
903	E.9 ···> 0.3	Encoder communication warning	P. 7
904	E.9 ···> 0.4	Excessive position deviation	P. 7

2. S-TUNE Ⅱ

Select the Alarm tab in S-TUNE Ⅱ.
See [Current alarm] and [Alarm history] windows for details.

☞ **D- 1 About S-TUNE Ⅱ**

2. Warnings and Remedies

2. Warning Details

Warning No.	900	Encoder overheat detection
Symptom and Possible Cause	The temperature inside the absolute encoder has exceeded the temperature value specified by Encoder: Overheat detection - Value (No.267.0). An alarm can be output in place of the warning.	
Remedy	Lower ambient temperatures and improve thermal radiation conditions. Check the setting of **Encoder: Overheat detection - Value** (No.267.0).	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector C5.	

Warning No.	901	Encoder battery voltage drop error detection
Symptom and Possible Cause	The battery voltage of the absolute encoder dropped below the voltage set by Encoder: Battery voltage drop detection - Value (No.268.0).	
Remedy	Replace the battery in the absolute encoder. Check the **Encoder: Battery voltage drop detection - Value** (No.268.0).	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector C5.	

Warning No.	902	Emergency stop
Symptom and Possible Cause	E-STOP by I/O is open.	
Remedy	Close E-STOP of the I/O. Check for proper I/O connections.	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector C5.	
Related To	**Z- 2 Technical Information**	

2. Warnings and Remedies

Warning No.	903	Encoder communication warning
Symptom and Possible Cause	**Failed to obtain ABS encoder temperature and battery voltage data.**	
Remedy	Check for wire disconnection or loose connection of pins. Keep the cable length no longer than 20 meters. Check for noise interference. → Use a shielded twist-pair cable. → Keep the encoder cable away from the motor power cable. → Connect FG firmly. → Use ferrite core for the motor power cable and encoder cable. If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector C5.	

Warning No.	904	Excessive position deviation
Symptom and Possible Cause	**The position deviation consecutively exceeded the setting of Position deviation warning detection: Value (No.363.0) and the setting of Position deviation warning detection: Delay time (No.365.0).**	
Remedy	Adjust the tuning parameters. Check the command from the host controller. Check the wiring. Verify that the brake is released. Verify that the motor is not in a torque limit state per torque command limit. Check the settings of **Position deviation warning detection: Value** (No.363.0) and **Position deviation warning detection: Delay time** (No.365.0).	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector C5.	

1. Troubleshooting

3. Alarms and Remedies

1. List of Alarms

Alarm No.	Display	Alarm Name	Refer to
0	Er. ···> 00.	System error	P. 9
1	Er. ···> 01.	EEPROM data error	P. 9
2	Er. ···> 02.	Product code error (Mismatching code)	P. 9
3	Er. ···> 03.	EtherCAT communication error	P. 9
4	Er. ···> 04.	Overspeed error	P. 10
5	Er. ···> 05.	Velocity deviation error	P. 10
6	Er. ···> 06.	Position deviation error	P. 10
7	Er. ···> 07.	Overload error	P. 11
8	Er. ···> 08.	Command overspeed error	P. 11
10	Er. ···> 10.	Positioning command overflow error /Homing failure	P. 12
11	Er. ···> 11.	Multi-turn counter error	P. 12
12	Er. ···> 12.	Overheat error	P. 12
14	Er. ···> 14.	Overvoltage error	P. 13
15	Er. ···> 15.	Power supply error (Primary circuit AC power)	P. 13
16	Er. ···> 16.	Encoder error (Received data)	P. 14

3. Alarms and Remedies

Alarm No.	Display	Alarm Name	Refer to
17	Er. ···> 17.	Encoder error (No response)	P. 14
18	Er. ···> 18.	Encoder error (Hardware)	P. 14
19	Er. ···> 19.	Encoder error (Communication)	P. 14
20	Er. ···> 20.	Encoder error (Multi-turn data)	P. 14
21	Er. ···> 21.	Encoder error (Voltage drop)	P. 15
22	Er. ···> 22.	Voltage error (Internal control power DC24V)	P. 15
23	Er. ···> 23.	Switch circuitry error	P. 15
24	Er. ···> 24.	Overcurrent error	P. 15
25	Er. ···> 25.	Inverter error 1	P. 16
26	Er. ···> 26.	Inverter error 2	P. 16
27	Er. ···> 27.	Current sensor error	P. 16
28	Er. ···> 28.	Encoder error (Overheat)	P. 16
29	Er. ···> 29.	Voltage error (Internal control power DC5V)	P. 16
32	Er. ···> 32.	Power supply error (Control circuit AC power)	P. 17
34	Er. ···> 34.	Product code error (Undefined model code)	P. 17

2. Alarm Details

Alarm No.	0	System error
Symptom and Possible Cause	Error in the control circuit The control circuit CPU is not operating normally.	
Remedy	Please contact our distributor.	
Reset Method	⏻	

Alarm No.	1	EEPROM data error
Symptom and Possible Cause	Error at Write Parameters	
Remedy	Check the interface cable and re-write the parameters.	
Reset Method	RST	

Alarm No.	2	Product code error (Mismatching code)
Symptom and Possible Cause	Unable to read the product code The amplifier-motor pairing was wrong. The encoder cable was not connected to the amplifier correctly. (This includes wiring disconnection)	
Remedy	Check the motor-amplifier pairing. Check the encoder cable connections.	
Reset Method	⏻	

Alarm No.	3	EtherCAT communication error
Symptom and Possible Cause	EtherCAT communication is not working properly.	
Remedy	・Check the "command mode (Parameter No.3.0)" value is 10. ・Check the EtherCAT communication cable. ・Check the connection status (ESM) with the host controller. ・Check for noise. → Use a shielded cable. If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	RST	

3. Alarms and Remedies

Alarm No.	4	Overspeed error
Symptom and Possible Cause	The motor rotational speed exceeded the rated maximum rotational speed. The command from the host controller was not appropriate. There were residual pulses due to drive restriction or other reasons.	
Remedy	Adjust the Tuning parameters. Check the command. Verify that the location of the limit sensor hasn't shifted.	
Reset Method	RST	

Alarm No.	5	Velocity deviation error
Symptom and Possible Cause	Position control/Speed control error. The command was not appropriate. The load was too heavy and could not keep up with the command speed. **Speed deviation error detection: Value** (No.90.0) was not appropriate.	
Remedy	Check the command from the host controller. Adjust the tuning parameters. Check the setting of **Speed deviation error detection: Value** (No.90.0). Verify that the brake is released. Verify that the motor is not in a torque limit state per torque command limit.	
Reset Method	RST	

Alarm No.	6	Position deviation error
Symptom and Possible Cause	Position Control Error. The acceleration time was too short. There was wrong connection or disconnection of the motor power cable or encoder cable. **Position deviation error detection: Value** (No.87.0) was not appropriate.	
Remedy	Adjust the tuning parameters. Check the command from the host controller. Check the wiring. Check the setting of **Position deviation error detection: Value** (No.87.0). Verify that the brake is disengaged. Verify that the motor is not in a torque limit state per torque command limit.	
Reset Method	RST	

RST RESET Signal	⏻ Control-power cycle	CLR CLEAR Encoder
① Eliminate the cause. ② input RESET signal to the RESET terminal on the connector C5.	① Eliminate the cause. ② Cycle control-power.	① Eliminate the cause. ② Execute CLEAR Encoder ③ Cycle control-power. After power cycle, perform Homing.

<table>
<tr><th>Alarm No.</th><th>7</th><th>Overload error</th></tr>
<tr><td>Symptom
and
Possible Cause</td><td colspan="2">Position Control Error.
Immediately after the operation started
1. The motor did not move at all.
2. The motor moved a little.
3. An alarm occurred after the motor started moving.
During operation
4. An alarm occurred at the same timings during of motions.
The acceleration time was too short.
The motor was not accelerating when the alarm occurred.
(The machine collided with some object.)
5. The motor capacity was too small (i.e. the load was too large).
6. The vibration was significant upon alarm occurrence.
7. Tuning parameters or command(s) were not appropriate.
(The motor changed its rotational direction abruptly)
8. Noise was generated.</td></tr>
<tr><td>Remedy</td><td colspan="2">Executing overloaded motions continuously may burnout the motor.

1. 2. Check the motor power cable connections.
3. Verify that the user-selected motor capacity is appropriate.
Verify that the brake is disengaged.
Verify that the deceleration ratio is appropriate.
4. During Acceleration - Check the acceleration time, torque wave form and load ratio.
Not During Acceleration - Verify that there are no obstacles inside the work area of the equipment.
5. Check the torque waveforms and load ratio.
Check the inertia ratio.
Increase the motor capacity. Install a decelerator
6. 7. Adjust the Tuning parameters.
Verify that there are no commands to cause a sudden change in the motor rotational direction.
Configure moderate commands, for example, use command smoothing filer.
8. Configure countermeasures for noise such as a notch filter or low-pass filter.</td></tr>
<tr><td>Reset Method</td><td colspan="2">RST</td></tr>
</table>

<table>
<tr><th>Alarm No.</th><th>8</th><th>Command overspeed error</th></tr>
<tr><td>Symptom
and
Possible Cause</td><td colspan="2">Position Control Error.
The position control input exceeded the max rotational speed.
The command from the host controller was not appropriate.</td></tr>
<tr><td>Remedy</td><td colspan="2">Check the **EtherCAT communication command: Ratio** (No.34.0 and No.36.0).
Check the commands from the host controller.</td></tr>
<tr><td>Reset Method</td><td colspan="2">RST</td></tr>
</table>

3. Alarms and Remedies

Alarm No.	10	Positioning command overflow error/Homing failure
Symptom and Possible Cause	External position command exceeded the absolute value range of ± 1,073,741,823. The shift amount per one of commands exceeded the ± 2,147,483,647 range. Homing failed and timed out.	
Remedy	Select a value different from the current setting of **Internal Position: Overflow detection** (No.643.0). Adjust the parameters such that the shift amount will be within the ± 1,073,741,823 range. Adjust the shift amount of Positioner motion, inching and testing each. Adjust the Homing related parameters.	
Reset Method	RST	

Alarm No.	11	Multi-turn counter error
Symptom and Possible Cause	Multi-turn data of the encoder has exceeded the ± 32,767 range.	
Remedy	Check the setting of **Absolute system** (No.257.0). Verify that the multi-turn motion amount is within the ± 32,767 range.	
Reset Method	⏻	

Alarm No.	12	Overheat error
Symptom and Possible Cause	The control circuit temperature has exceeded the upper limit.	
Remedy	Check the amplifier's installation method and environment. Lower the ambient temperature to below the rating.	
Reset Method	RST	

Alarm No.	14	Overvoltage error
Symptom and Possible Cause	The primary circuit voltage of the control component has exceeded the amplifier circuit limits.	
Remedy	If the alarm occurs only during deceleration By using the Setup Panel or S-TUNE Ⅱ, check the regeneration status, which tells you if a regenerative resistor is necessary. If necessary, install a regenerative resistor. Check the motion patterns of commands. Use a command filter and gradually decrease the speed. If the alarm occurs regardless of deceleration Verify that the primary circuit power voltage is within specification. Check for voltage changes while the whole system is operating.	
Reset Method	RST	

Alarm No.	15	Power supply error (Primary circuit AC power)
Symptom and Possible Cause	The primary circuit voltage is abnormally high or low. The primary circuit power was not supplied. The primary circuit power was not within the input range. The primary power voltage fluctuated and exceeded the rated range. Enable Operation (0x6040,3) signal was input without primary circuit power supply. Anomaly of the regenerative control circuit operating time lasted longer than a specific amount of time. Regeneration ON status lasted.	
Remedy	If the alarm occurred between servo on and operation startup Verify that the primary circuit power is connected to the amplifier. Check the primary circuit power voltage. Check the timing of primary circuit power input and Enable Operation (0x6040,3) signal input. If the alarm occurred during motor operation Check for no voltage fluctuations due to the whole system operation. Provide enough power supply so that the system experiences no voltage fluctuations. If the alarm occurs during deceleration Check the regenerative voltage warning spinal on the Setup Panel or S-TUNE Ⅱ. If a regenerative voltage warning occurs, install a regenerative resistor. Check the motion patterns directed by commands. Gradually decrease speeds by using a command smoothing filter.	
Reset Method	RST	

RST RESET Signal	⏻ Control-power cycle	CLR CLEAR Encoder
① Eliminate the cause. ② input RESET signal to the RESET terminal on the connector C5.	① Eliminate the cause. ② Cycle control-power.	① Eliminate the cause. ② Execute CLEAR Encoder ③ Cycle control-power. After power cycle, perform Homing.

3. Alarms and Remedies

Alarm No.	16	Encoder error (Received data)
Symptom and Possible Cause	Encoder data changed rapidly for a short period of time.	
Alarm No.	17	Encoder error (No response)
Symptom and Possible Cause	Encoder communications were disconnected.	
Alarm No.	19	Encoder error (Communication)
Symptom and Possible Cause	The initial communication with the encoder failed.	
Alarm No.	20	Encoder error (Multi-turn data)
Symptom and Possible Cause	Absolute encoder data changed rapidly for a short period of time. At the time of starting, the encoder failed to receive multi-turn data internally.	
Remedy	Check for wire disconnection or loose connection of pins. Keep the cable length no longer than 20 meters. Check for noise interference. → Use a shielded twist-pair cable. → Keep the encoder cable away from the motor power cable. → Connect FG firmly. → Use ferrite core for motor power cable and encoder cable. Check that the encoder temperature does not exceed the specified range. If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	⏻	

Alarm No.	18	Encoder error (Hardware)
Symptom and Possible Cause	Anomaly of the encoder itself has been detected. The encoder temperature has exceeded the specification and output data has become abnormal. The battery voltage of the absolute encoder dropped or the battery became disconnected. (Alarm No.21 is output in this case)	
Remedy	Check for wire disconnection or loose connection of pins. Keep the cable length no longer than 20 meters. Check for noise interference. → Use a shielded twist-pair cable. → Keep the encoder cable away from the motor power cable. → Connect FG firmly. → Use ferrite core for motor power cable and encoder cable. Check that the encoder temperature does not exceed the specified range. If you are using an absolute system → Replace the battery, connect it, and initialize the encoder. If any of the above didn't resolve the issue, Check the alarm number in the S-TUNE Ⅱ and contact our distributor.	
Reset Method	⏻	

Alarm No.	21	Encoder error (Voltage drop)
Symptom and Possible Cause	The battery voltage dropped. The batter became disconnected. It was the first start-up after the battery was connected.	
Remedy	Check for low battery voltage. Check for loose battery cable. Initialize the encoder.	
Reset Method	⏻	

Alarm No.	22	Voltage error (Internal control power DC24V)
Symptom and Possible Cause	The control power voltage (24VDC) inside of the amplifier has dropped.	
Remedy	Check the control power AC200 V voltage. Check for insufficient control power capacity. This alarm may be output at the same time as other alarms such as Alarm No.15 (Power error). Check all the alarms that are occurring. This alarm will not remain in the alarm history.	
Reset Method	RST	

Alarm No.	23	Switch circuitry error
Symptom and Possible Cause	Control circuit is faulty.	
Remedy	Please contact our distributor.	
Reset Method	RST	

Alarm No.	24	Overcurrent error
Symptom and Possible Cause	Anomaly of motor control current inside of the amplifier has been detected.	
Remedy	Check the motor power cable. → Grounding fault → Wiring mistake in the motor power cable connection Check the Tuning parameters and motor motion patterns. → Increase the acceleration/deceleration time of command. → Enable/Disable Position command filter 1 and 4 (No.66.0, No.66.1, No.80.0, and No.81.0). Allow motor motion by disengaging the brake or removing from the stopper. Check the encoder cable. → Connection (bad connection) → Use a twist-pair cable If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	RST	

3. Alarms and Remedies

Alarm No.	25	Inverter error 1
Symptom and Possible Cause	Anomaly in the control circuit has been detected.	
Alarm No.	26	Inverter error 2
Symptom and Possible Cause	Anomaly in the control circuit has been detected. SERVO ON timed out.	
Remedy	Check the motor power cable. → Grounding fault → Wiring mistake in motor power cable connections If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	RST	

Alarm No.	27	Current sensor error
Symptom and Possible Cause	The ambient temperature of the current sensor was high. Anomaly of the current sensor has been detected.	
Remedy	Check the installation method and environment. If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	RST	

Alarm No.	28	Encoder error (Overheat)
Symptom and Possible Cause	The encoder board temperature has reached the upper limit.	
Remedy	Check the installation method and environment of the motor. Decrease the ambient temperature of the motor below the specification.	
Reset Method	RST	

Alarm No.	29	Voltage error (Internal control power DC5V)
Symptom and Possible Cause	The control power voltage (5VDC) inside of the amplifier has dropped.	
Remedy	Verify that there is no short-circuit in encoder cable connections. If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	RST	

3. Alarms and Remedies

Alarm No.	32	Power supply error (Control circuit AC power)
Symptom and Possible Cause	Abnormality of high or low control voltage ・The control power was not input. ・The control power supply voltage was out of the input range. ・The control power supply voltage fluctuated and went out of range.	
Remedy	・Check the control power supply voltage. ・Check that there is no voltage fluctuation due to the operation of the entire equipment. ・Use a power supply with sufficient supply capacity to prevent voltage fluctuation. If any of the above didn't resolve the issue, please contact our distributor.	
Reset Method	RST	

Alarm No.	34	Product code error (Undefined model code)
Symptom and Possible Cause	Encoder communication was lost. The motor model code is incorrect.	
Remedy	Please contact our distributor.	
Reset Method	[illegible] ⏻	

4. Troubleshooting

Check the following if the amplifier does not start and the motor does not rotate although no alarm is output.

Problem	Symptom	Refer to
Problem 1 No display on the Setup Panel	The Setup Panel does not show.	P. 19

Problem	Symptom	Refer to
Problem 2 Servomotor not turning ON	The Setup Panel shows, but the servo cannot be turned on.	P. 20

Problem	Symptom	Refer to
Problem 3 No motor rotation	The servo is on, but the motor does not rotate.	P. 21

Problem	Symptom	Refer to
Problem 4 Unstable motor motions	The motor does rotate, but its motions are unstable.	P. 22

Problem	Symptom	Refer to
Problem 5 Positional aberration	The motor does rotate, but position aberration occurs.	P. 23

Problem	Symptom	Refer to
Problem 6 Vibration and abnormal noise	The motor is experiencing vibration or abnormal noise.	P. 24

Problem	Symptom	Refer to
Problem 7 EtherCAT communication cannot be established	Cannot transition to OP mode (ErrLED flashing)	P. 25

Problem	Symptom	Refer to
Problem 8 Servomotor not turning ON-2	The motor is not energized.	P. 26

Problem	Symptom	Refer to
Problem 9 No motor rotation-2	The motor does not rotate or rotates but stops.	P. 27

4. Troubleshooting

Problem 1. No display on the Setup Panel

The Setup Panel does not show.

Cause	Remedy
The controller power is not connected to the user I/O connector.	Connect the controller power to the amplifier.
Loose user I/O connector	Connect the user I/O connector firmly.
The control power voltage is low.	Check the control power voltage capacity.
The amplifier is faulty.	Please contact our distributor.

4. Troubleshooting

Problem 2. Servomotor not turning ON

The Setup Panel shows, but the servo cannot be turned on.

Cause	Remedy
The Enable Operation (0x6040,3) signal is not being input.	Check the EtherCAT communication cable for proper connections. Input the Enable Operation (0x6040,3) signal.
The primary circuit power is not supplied. (Alarm No.15 is displayed)	Verify that CHARGE LED is on. If it is off, verify that the primary circuit power is not loose, and the primary circuit power is output.
The motor power connector is loose.	Connect the user I/O connector firmly.
The amplifier is faulty.	Please contact our distributor.

4. Troubleshooting

Problem 3. No motor rotation

The servo is on, but the motor does not rotate.

Cause	Remedy
The parameters are not set right.	Correctly set the parameters required for the control mode that you are using. ☞ **F- 1 Operations**
Command from the host controller is not correctly input.	Check the command from the host controller. Use S-TUNE Ⅱ to measure the input command waveforms and verify that normal commands are input. Check the parameters such as pulse ratio. It is possible that the motor is rotating very slowly.
The command input pins of user I/O connector are not connected correctly.	Check for proper connections. ☞ **B- 2 Mounting and Wiring**
Torque command limit is not set right.	Verify that **Torque command limit: Value 1 and Value 2** (No.147.0, No.148.0) are set correctly.

4. Troubleshooting

Problem 4. Unstable motor motions

The motor does rotate, but its motions are unstable.

Cause	Remedy
FG and GND are not connected correctly.	Connect FG and GND correctly.
Speed/Position commands are unstable.	On the waveform monitor in S-TUNE Ⅱ, check the command from the host controller. Check for proper connection of the I/O connector.
Tuning is incomplete.	Adjust the parameters.

4. Troubleshooting

Problem 5. Positional aberration

The motor does rotate, but position aberration occurs.

Cause	Remedy
The command signal is interfered with noise.	Check the following two items. 1. Status 810h Target Position (EtherCAT communication position command input) agrees with the host controller output. 2. Status No.65 "Position command" and Status No.67 "Position feedback" agree. If any of the above conditions fails, take countermeasures for noise. -Connect FG correctly. -Select a shielded twist-pair wire for the I/O cable. -For the encoder cable, select a shielded twist-pair wire of no longer than 20 m.
The position deviation is not converging.	Verify that Status No.65 (Position command value) and Status No.67 (Position feedback) agree. If not, adjust the tuning parameters.
The host controller is not obtaining encoder Z-phase correctly.	Check the command from the host controller. Verify that a normal command is input. Verify that the host controller is obtaining Z-phase correctly.
Output pulse frequency of the host controller is above the upper limit.	Verify that the output pulse frequency of the host controller such as PLC is not above the upper limit.

4. Troubleshooting

Problem 6. Vibration and abnormal noise

The motor is experiencing vibration or abnormal noise.

Cause	Remedy
Tuning parameter settings are not appropriate.	Set the Control Gain 1, Control Gain 2, Integral Gain to lower values. Especially for highly rigid equipment such as ball screws, set the **Current control gain** (No.193.0) to "1" if noise occurs at servo-on stop. ☞ **C- 3 Tuning**
Cranky or loose machines and equipment	Check the installation of the motor, decelerator, couplers, and so on.
Noise interference is occurring.	Check the length or shield of each cable. Isolate the high voltage cable such as motor power cable from the signal cable such as encoder cables.
The equipment and the motor are resonating.	For low-frequency vibration, adjust the position command smoothing filter. For high-frequency vibration, adjust the low-pass filter or notch filter.
Motor load is substantially large (*) (Alarm No.7 is displayed)	Set the inertia condition parameter to "Heavy" Keep adjusting the Position Command Smoothing Filter to smooth command until the vibration at the time of acceleration becomes eliminated. Set the **Inertia ratio** (No.102.0) to 3,000. To stabilize the motions, increase Integral gain value according to Control Gain 1 and Control Gain 2.
The current pairing of amplifier and motor is not right.	Check the motor model code under "Communication Settings" tab in S-TUNEⅡ. In case of wrong pairing, clear the parameters saved in EEPROM and change the motor model code.

*) This problem may occur in a low-rigidity case such as belt drive whose load inertia ratio is over 30 times.

4. Troubleshooting

Problem 7. EtherCAT communication cannot be established

Cannot transition to OP mode (ErrLED flashing)

Cause	Remedy
The amplifier is set to internal command mode.	Check if the value of parameter No.3.0 (command mode) is 10 (EtherCAT directive).
EtherCAT communication cycle out of specification.	The communication cycles are 250 µs, 500 µs, 1 ms, 2 ms, and 4 ms. Set to one of the above values.
ESM (EtherCAT State Machine) State Transition Control is Incorrect,	Set the amplifier in the following order: Init → PreOP → SafeOP → OP.
ESI file is incorrect	Use an ESI file with the same version as the F/W version of the amplifier.
Unsupported object is mapped to PDO.	Check the PDO mapping.
Incorrect LAN cable connection	Check the wiring of the LAN cable.

4. Troubleshooting

Problem 8. Servomotor not turning ON-2

The motor is not energized.

Cause	Remedy
DC (Distribution clock) is disabled (FreeRun or SM).	Enable the DC setting. In "Disable" setting, EtherCAT communication and Object Dictionary Read/Write are possible, but motor operation such as servo ON is not possible.
Mode of operation is set to a mode other than the available mode.	Set to CSP (8), CSV (9), CST (10) or Homing (6).
PDS (Power Drive Systems) State Transition Control is Incorrect,	Check the specifications for the CiA 402 PDS transition. Check that the amplifier transition is complete before issuing the next transition command. (Switch on disabled -> Ready to switch on -> Switched on -> Operation enabled)
EtherCAT communication cycle out of specification.	Set the amplifier in the following order: Init → PreOP → SafeOP → OP.
The torque upper limit value is not appropriate.	Check the Max torque (6072h) setting.
Main circuit power is not supplied correctly. (SRDY not successful)	Check the wiring and voltage.
E-Stop (emergency stop) signal is input.	Check the wiring of the E-Stop signal. Check the polarity setting of the E-Stop signal input.
The amplifier is in an alarm state.	Recover from the alarm state.
The motor power cable is not connected.	Check the connection of the motor power cable.

4. Troubleshooting

Problem 9. No motor rotation-2

The motor does not rotate or rotates but stops.

Cause	Remedy
"Mode of operation" and "command input method" do not match.	The command for each mode must be inputted with the following object CSP (8) : Target position (607Ah) CSV (9) : Target velocity (60FFh) CST (10) : Target Torque (6071h) Homing(6) : The command is generated inside the amplifier. Homing starts using Controlword (6040h) bit 4.
The setting of the speed upper limit or the torque upper limit is not appropriate.	Check the settings for each of the following objects. Max torque (6072h) Max motor speed (6080h) Max profile velocity (6081h)
Drive inhibit signal is input.	Check the wiring and setting of the drive inhibit signal (POT or NOT).

MEMO

2

Technical Information

1. Absolute System

1. Overview

By using the absolute system, you do not have to perform Homing after cycling power.

Preparations

To configure an absolute system, prepare the following items.

① A motor equipped with absolute-encode and an amplifier that supports absolute system.

② A backup battery

③ An absolute encoder Cable

☞ P. 4 Backup Batteries

☞ P. 6 Absolute Encoder Cable

Checking the model code

Use the modes that supports absolute systems.

Motor Product Code:

Common to 23 Bit and 17 Bit encoder

M□ □□□ □ 2 □ A * *

Encoder	
Code	Specifications
N	Incremental
A	Absolute

2. System Configuration

Connection Method

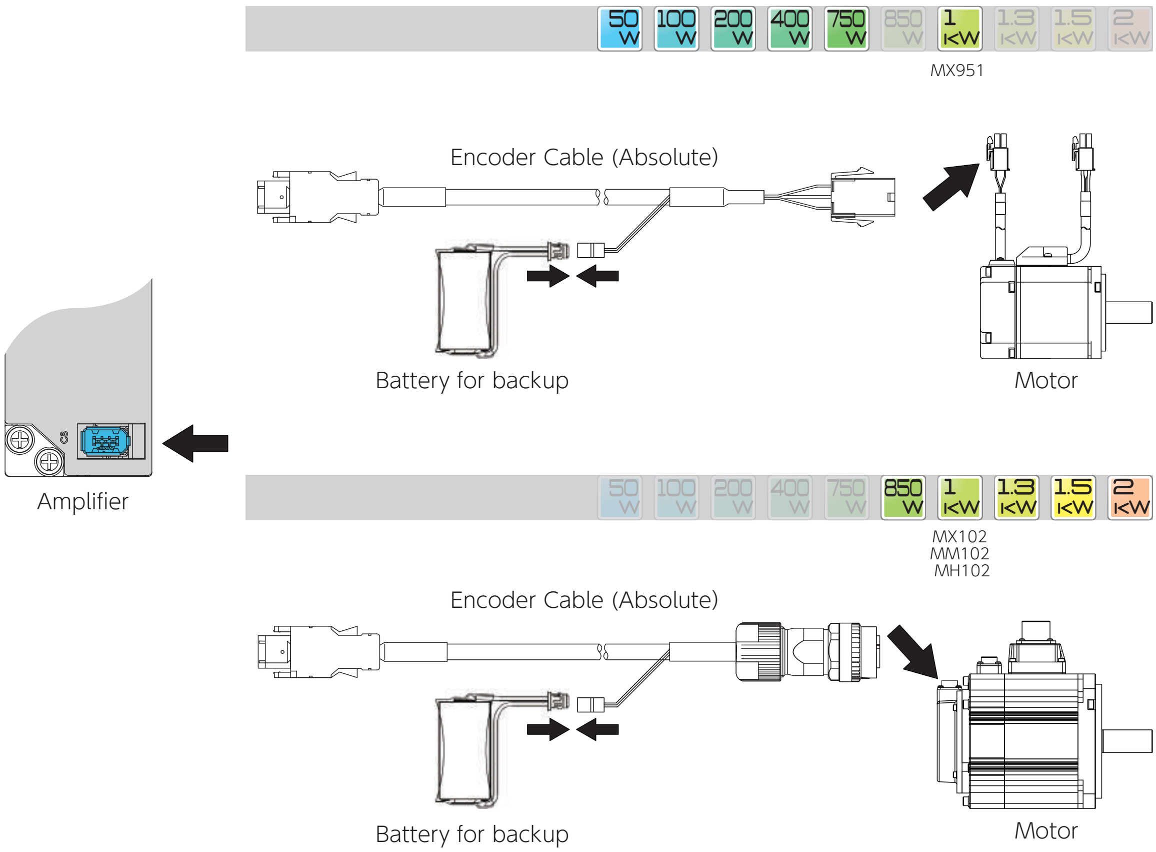
1. To ensure safety, power off the primary power and the control power first, and then connect the absolute encoder cable.
   ☞ Refer to the figure below.

2. Be sure of the right connecting direction, and connect the backup battery correctly.
   ☞ P. 4 Backup Battery

3. After connecting the battery, secure the battery to the absolute encoder cable by using a cable tie.
   ☞ P. 5 Securing the Battery

4. Initialize the absolute encoder.
   ☞ P. 7 Initializing Absolute Encoder

Cable and Battery Connections



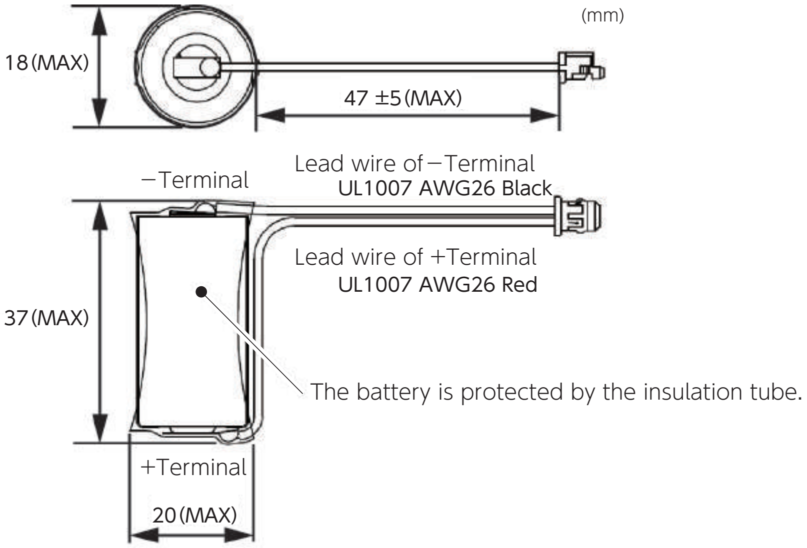
3. Backup Battery

Recommended Specifications

Item	Specifications	Remark
Model Code	CR17335E-R-CH3	Manufactured by FDK (*) Series battery:CR17335E-R
Nominal Voltage	3.0 V	–
Nominal Capacity	1,600 mAh	Nominal capacity is determined at the voltage of 2.0 V when the battery was discharged at a standard current level under the 23℃ environment.
Maximum Continuous Discharge Current	500 mA	Under the 23℃ environment
Dimensions	See the figure below.	No obvious deformation or damage Clear label print
Exterior	Insulation tubing	–
Terminal	Housing :DF3-2S-2C Contact :DF3E-2428SCFC Lead wire:UL 1007 AWG26 Red (+)、Black (−)	Connector: Hirose Electric
Mass	17 g	reference value
Temperature Range	Operating temperature: −40℃ to +70℃	No dew condensation
Recommended Storage Conditions	Temperature:10℃ to 30℃ Humidity:60% RH or less	–

*) This is a primary lithium battery. Do not try to charge it, or it may explode.

Dimensions



1. Absolute System

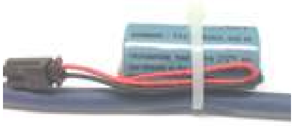
Precautions for Battery Storage and Installation

Avoid places subjected to any of the following:
- Direct sunlight, rain drops
- Corrosive atmosphere, oil mist, or iron powder
- Poor ventilation or high humidity
- Dirt or dust
- Vibrations
- Impact to the installed battery

Securing the Battery

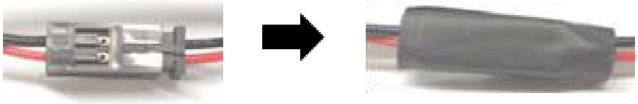
1. Securing the Battery

Secure the battery to the cable, for example, using a cable tie.
We recommend using a cable tie tensioning tool.
Holding strength of the cable tie should be 11.6 to 44.2 N.



2. Protecting the Battery Connector Part

Protect the exposed part of the battery connector terminal with a heat shrink tube.



Replacing the Battery

When the battery voltage drops, Alarm No.21 (Encoder voltage drop) occurs. In this case, you need to replace the battery to a new one.
When replacing the battery, be sure to keep the control power (24 V) of the amplifier ON. Otherwise, you will lose the multi-turn data and need to perform homing again.

CAUTION

- Be careful not to connect the battery in the wrong way.
- Do not attempt to disassemble the battery.
- Do not short circuit the battery.
- Never attempt to charge the recommended battery.

Disposal of Batteries

Dispose of used batteries according to local government regulations.

4. Absolute Encoder Cable

Recommended Products

You can purchase recommended cables at the online shop of Misumi Corporation.

Making Your Own Cable

⚠ CAUTION

🚫	Ensure correct wiring.	⚠ ⚠ ⚠
!	Select a battery that meets the specifications of the recommended one. Replace the battery at a reasonable interval, taking the batter life into consideration.	⚠

The connectors and cables needed to make your own cable are user-supplied.

☞ **B-** **2** Mounting and Wiring

1. Absolute System

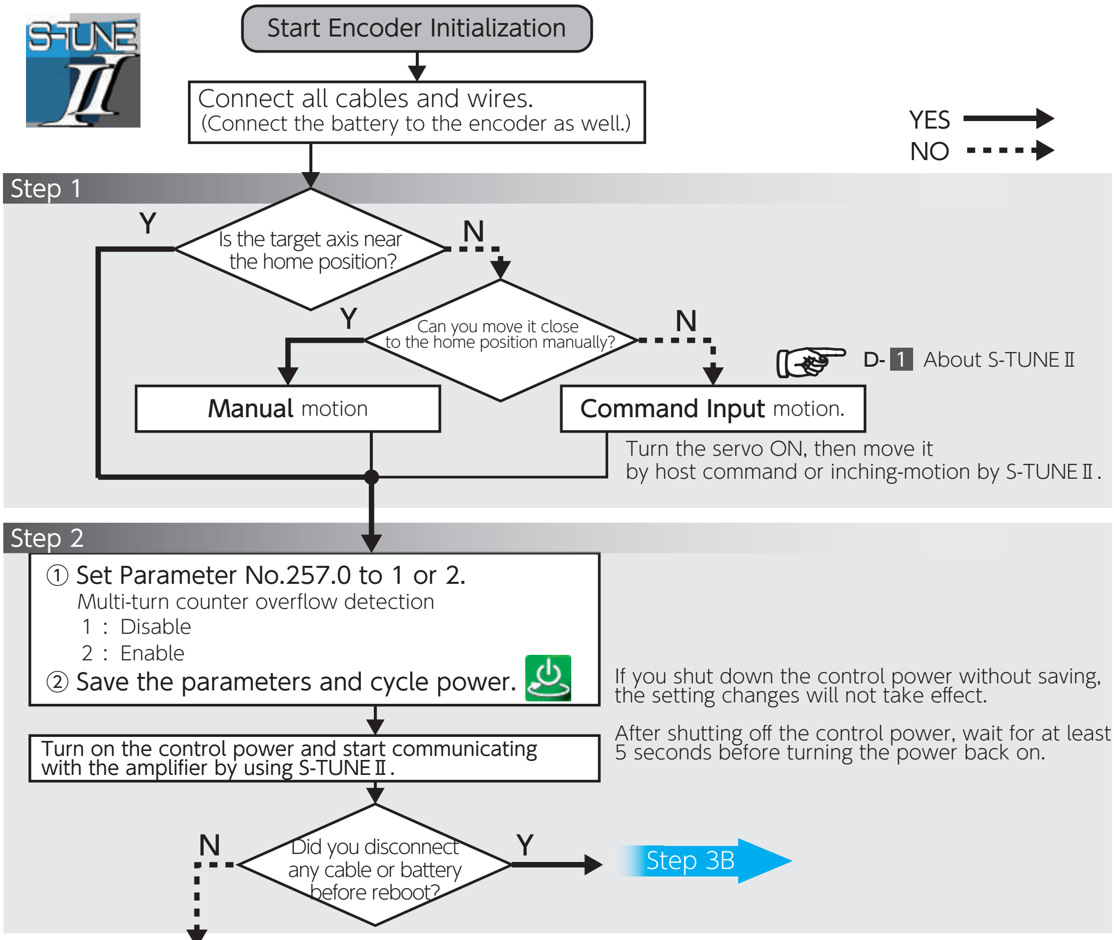
5. Initializing Absolute Encoder

When using an absolute system for the first time or using it after replacing the motor, you need to initialize the encoder.
Use the Encoder Clear function by using S-TUNE Ⅱ to initialize the encoder. And then restart your amplifier.

Only multi-turn data will be initialized and single-turn absolute data will not.

❗	Initialize the absolute encoder before performing homing.	⚠ ⚠

Initializing Encoder with S-TUNE Ⅱ



Start Encoder Initialization

Connect all cables and wires.
(Connect the battery to the encoder as well.)

YES ⟶
NO - - - ➝

Step 1

Is the target axis near the home position? (Y / N)

Can you move it close to the home position manually? (Y / N)

Manual motion

Command Input motion.

Turn the servo ON, then move it by host command or inching-motion by S-TUNE Ⅱ.

☞ **D-** 1 About S-TUNE Ⅱ

Step 2

① Set Parameter No.257.0 to 1 or 2.
Multi-turn counter overflow detection
1 : Disable
2 : Enable
② Save the parameters and cycle power.

If you shut down the control power without saving, the setting changes will not take effect.

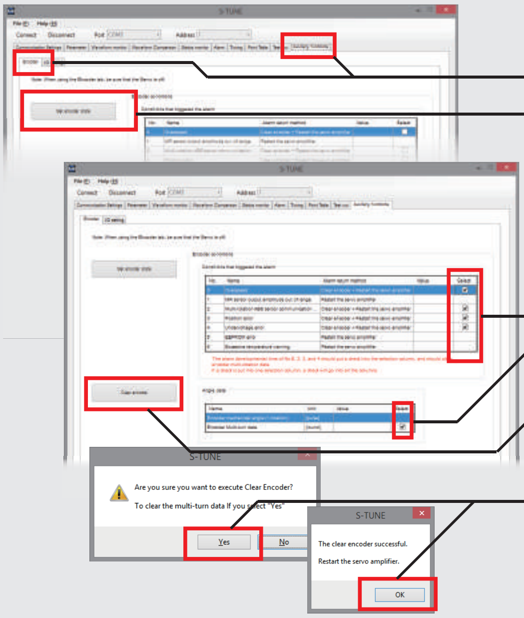
After shutting off the control power, wait for at least 5 seconds before turning the power back on.

Turn on the control power and start communicating with the amplifier by using S-TUNE Ⅱ.

Did you disconnect any cable or battery before reboot? (N / Y)

Y ⟶ Step 3B

Step 3A



Are you sure you want to execute Clear Encoder?
To clear the multi-turn data If you select "Yes"

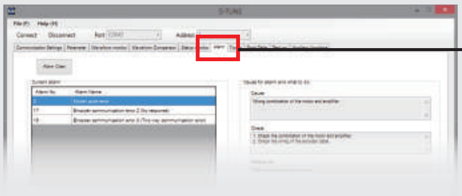
The clear encoder successful.
Restart the servo amplifier.

1. Under the Auxiliary function tab, click Encoder
2. Click on Get Encoder Status.
3. Check one of the boxes.
4. Click Clear encoder .
Until checking the boxes, the Clear encoder button does not work.
5. Click Yes .
6. Cycle the control power.

Confirm ➝

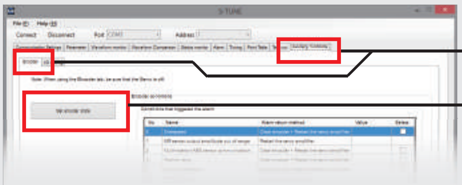
Initializing Encoder with S-TUNE Ⅱ (continued)

Step 3B

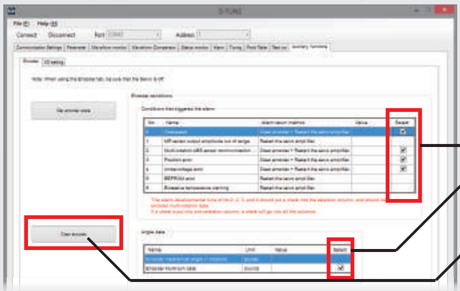


1. Under the Alarms tab, check the following alarms that are occurring.

No. 18	Encoder error (hardware)
No. 20	Encoder error (multi-turn data)
No. 21	Encoder error (voltage drop)

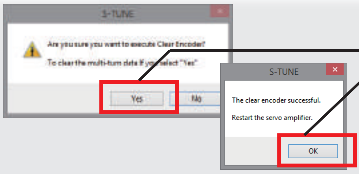


2. Under the Auxiliary functions tab, select Encoder.
3. Click on Get Encoder Status.



4. Check one of the boxes.
5. Click Clear encoder .

Until checking the boxes, the encoder clear button does not work.



S-TUNE

Are you sure you want to execute Clear Encoder?

To clear the multi-turn data If you select "Yes"

S-TUNE

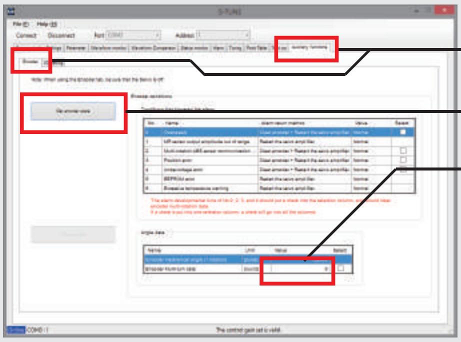
The clear encoder successful.

Restart the servo amplifier.

6. Click Yes .
7. Cycle the control power.

Confirm

Turn on the control power and start communicating with the amplifier by using S-TUNE Ⅱ.



1. Under the Auxiliary functions tab, select Encoder.
2. Click on Show Encoder Status.
3. Verify that this value is 0.

If an alarm occurs

① Check the following.
  - Is the battery connected correctly ?
  - Is the battery voltage normal ?
  - Is the encoder cable connected correctly ?
  - Are the wiring and connections all correct ?

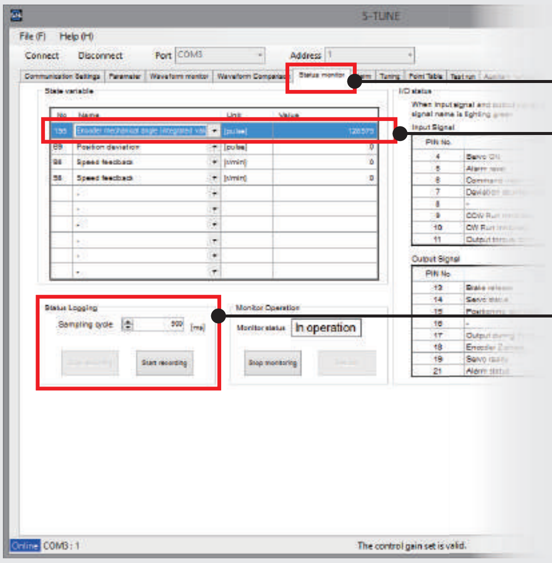
② Repeat Step 3.

END

6. Obtaining Absolute Data

Start S-TUNE Ⅱ and start communicating with the amplifier.

Use the【Status monitor】tab.



1. Display the Status monitor view.

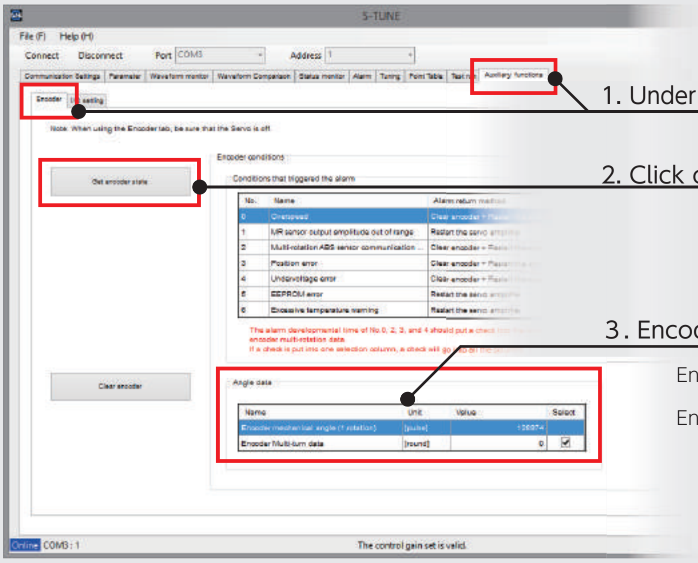
2. Select Encoder/Rotor mechanical angle (integrated value)

Encoder mechanical angle (integrated value) ··· Ⓐ
(=Absolute data)

3. Set the sampling cycle, and then click Start recording .

Data capture continues until you click Stop recording .

Use the【Auxiliary functions】tab.



1. Under the Auxiliary functions tab, select Encoder.

2. Click on Get encoder state .

3. Encoder data is displayed.

Encoder mechanical angle (1 rotation) ··· Ⓑ

Encoder Multi-turn data ··· Ⓒ

The formula to calculate the absolute data

Below is the formula to derive absolute data (Encoder mechanical angle (integrated value))。

Ⓐ = Ⓑ + Ⓒ× (Encoder Resolution)

Ⓐ: Encoder mechanical angle (integrated value)
(=Absolute data)

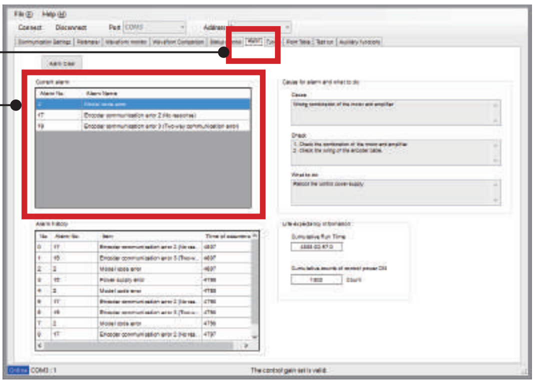
Ⓑ: Encoder mechanical angle (1 rotation)

Ⓒ: Encoder Multi-turn data

7. Alarm

By using S-TUNE Ⅱ, you can check alarms that has occurred when using an absolute system.
These alarms cannot be cleared by Alarm Reset or cycling the control power. To reset alarms, execute ENCODER CLEAR at the Auxiliary functions tab, and then cycle the control power.

1. Click on the Alarms tab.
2. Check the alarms that are occurring.



Alarm No.	Alarm Description	Symptoms and Remedy
11	Multi-turn counter error	· Multi-turn data of the encoder has exceeded the specification. · Check the setting of **Absolute system** (No.257.0). · Verify that rotational data is no higher than 32,767 rotations.
18	Encoder error (Hardware)	· Anomaly of the encoder itself. · Check the alarm details. ☞ P. 12 Encoder Alarms
20	Encoder error (Multi-turn data)	· Multi-turn data being reset. · Check for the encoder cable connection problems such as poor pin contact. · Take noise countermeasures. For example, separate the motor power cable from the encoder cable.
21	Encoder error (Voltage drop)	· Multi-turn data being reset due to low battery voltage. · Check for low battery voltage and loose connection of the battery cable. · Initialize the encoder.

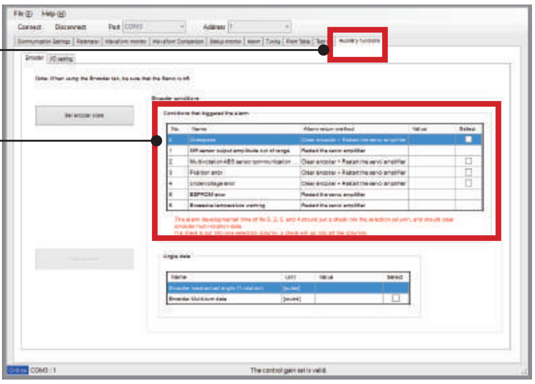
1. Absolute System

Encoder Alarms

Use S-TUNE Ⅱ to check alarms from the encoder. In case of Alarm No.18, No.20, or No.21, you can check the details under the Auxiliary Functions tab in S-TUNE Ⅱ.
These alarms cannot be cleared by Alarm Reset or cycle the control power. To reset alarms, execute ENCODER CLEAR, and then cycle the control power.
If cycling power does not solve the problem, please contact our distributor.

1. Click on the Auxiliary Functions Tab.

2.Check alarms that are occurring.



No.	Name	Description of Symptom
0	Overvelocity error	Multi-turn sensor error occurred during backup, or overvelocity error occurred upon the control power on.
1	Angle sensor output Amplitude error	Abnormal amplitude of Angle sensor output amplitude.
2	Multi-turn ABS sensor communication error	Could not obtain multi-turn data during upon the control power on.
3	Position error	The single-turn sensor value and multi-turn sensor value do not agree because of faulty sensor; the encoder position data is unreliable.
4	Voltage drop error	Relevant only to absolute encoders. The supply voltage fell below the rated voltage range upon the control power OFF.
5	EEPROM error	The saved data in EEPROM is unreliable.
6	Overheat warning	The temperature of the encoder board exceeded the user-specified temperature.

Encoder battery voltage drop warning (Warning No.901 E.9 0.1)

The Setup panel displays a warning when the battery voltage falls below the parameter No.268.0 setting value.

This warning isn't show to【Auxiliary functions】tab but is shown to【Alarm】tab of S-TUNE Ⅱ.

The battery voltage is checked at the time of power turning on and every time interval. hour afterwards.

- 17bit … Every one hour
- 23bit … Every one second

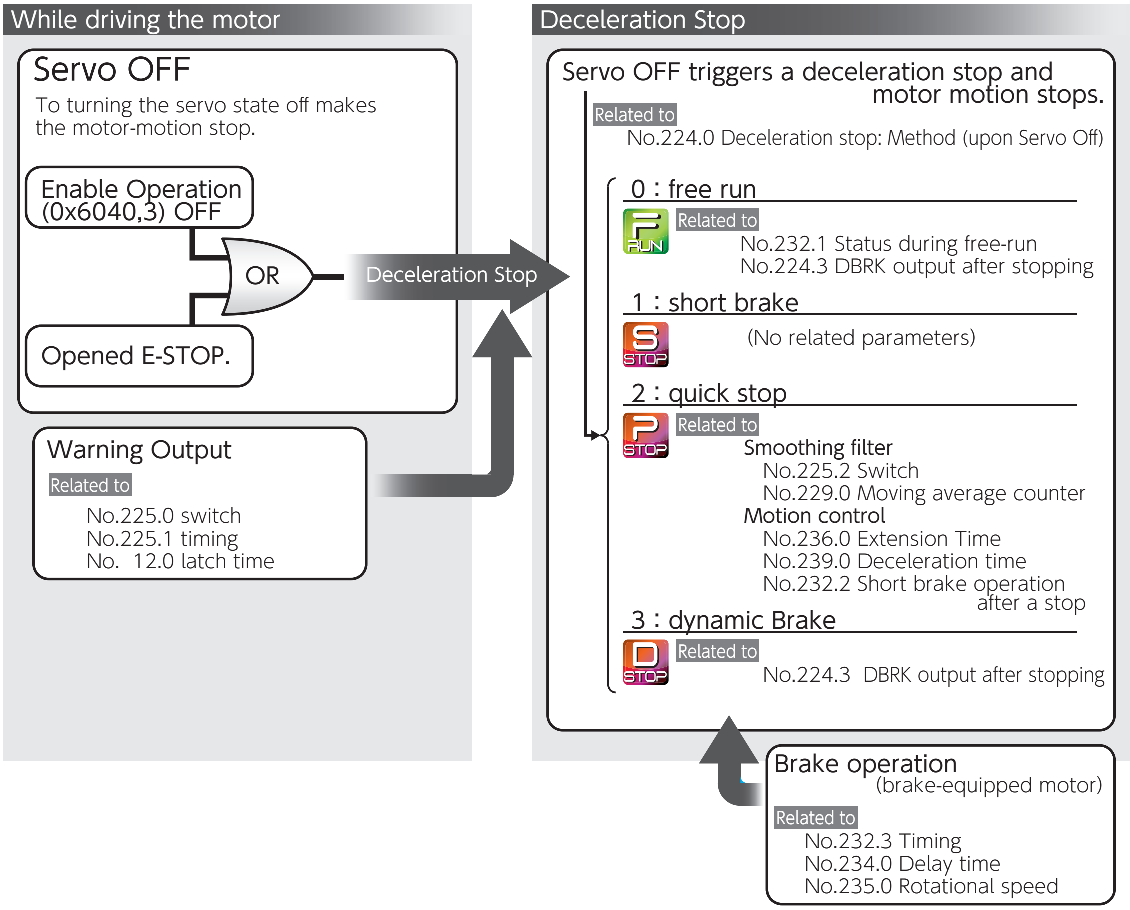
2. Function

1. Emergency Stop

When you open User I/O E-STOP, Emergency Stop Status becomes ON.
Servo-OFF triggers deceleration stop and motor motion stops.
No alarm is output. A warning is output by parameter settings. Close E-STOP to cancel Emergency Stop Status to resume motor operation.
The emergency stop function is always enabled regardless parameter settings; however, you need to set related parameters so that a warning is output upon Emergency Stop Status ON.

Deceleration Stop Setup

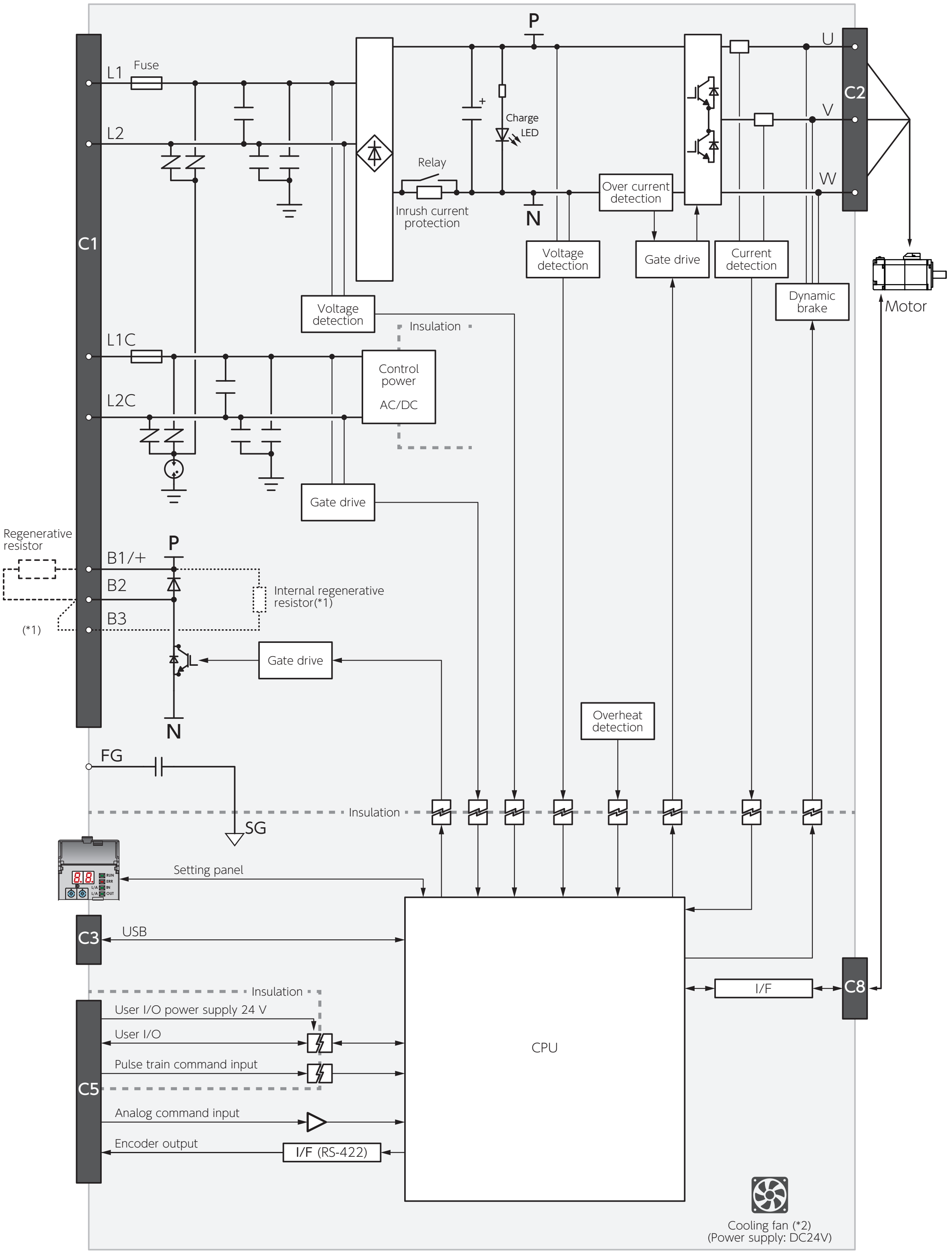
When you turn Servo status OFF while operating the motor, the motor makes a deceleration stop according to the method predetermined by parameters.



3. Amplifier Circuit System Block Diagram

1. Amplifier Circuit System Block Diagram

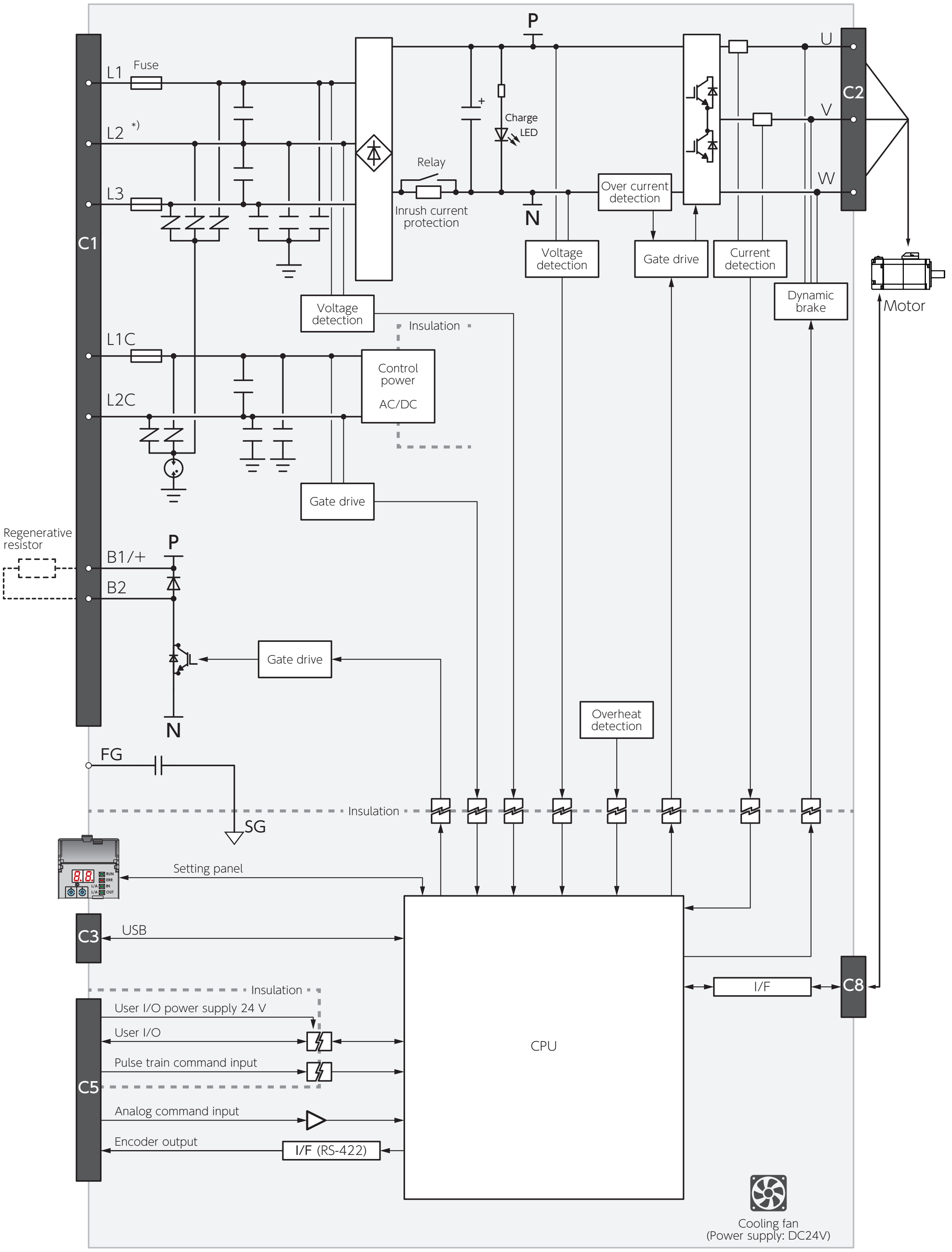
Amplifier Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | 850 W | 1 kW | 1.3 kW | 1.5 kW | 2 kW



*1): Option 400W and 750W amplifier only
*2): 750W amplifier only

3. Amplifier Circuit System Block Diagram

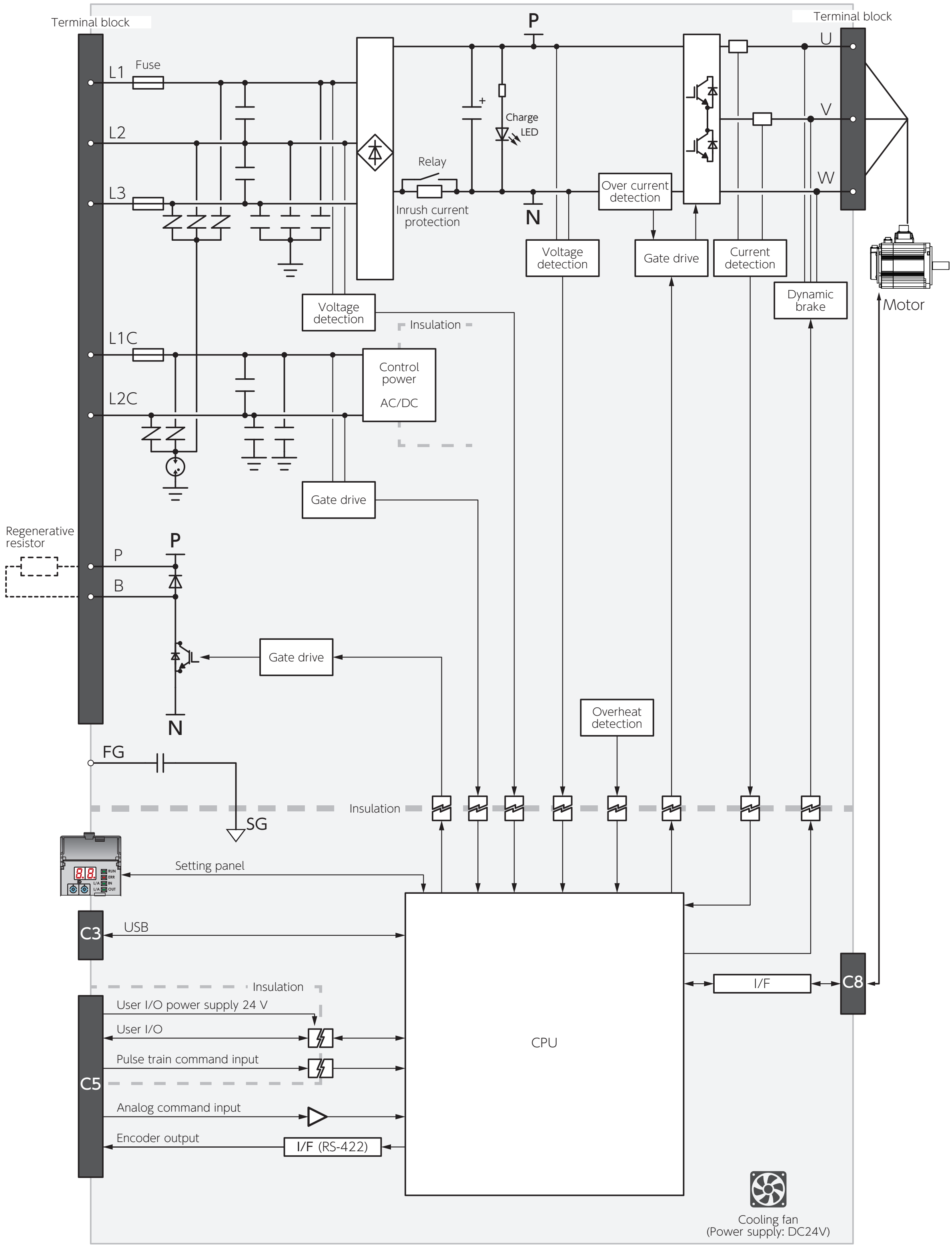
Amplifier Motor rated output power 50 W 100 W 200 W 400 W 750 W 850 W **1 kW** 1.3 kW 1.5 kW 2 kW



*): When having single-phase power wired to a 1 kW amplifier (DB64A11), wire the main power AC200 V between the L1 and L3 terminals of the amplifier.

3. Amplifier Circuit System Block Diagram

Amplifier Motor rated output power: 50 W | 100 W | 200 W | 400 W | 750 W | **850 W** | 1 kW | **1.3 kW** | **1.5 kW** | **2 kW**



4. Status Display

1. Introduction

You can check status data by using S-TUNEⅡ.

Note

This manual uses the following two types of pulse units to explain status variables.

Unit of **E-pulse** (= Encoder pulse)
This unit is pulse count of the amplifier control block, based on the pulses equivalent to single turn of the motor which is 23-bit (or 17-bit). It is a pulse value resulting from division/ multiplication in the amplifier.

Unit of **C-pulse** (= Command pulse)
This unit is based on pulse count corresponding to single turn of the motor in the host controller's perspective.
This is a pre-division/multiplication value.

4. Status Display

2. List of Status Variables

Status Variables of Servo Amplifier

Status No.	Status Variable	Units	Refer to
16	I/O Status	–	P. 19
24	Control Component Temperature	℃	P. 19
64	Positioning Status	–	P. 20
65	Internal Command Value	E-pulse	P. 20
67	Position Feedback	E-pulse	P. 20
69	Position Deviation	E-pulse	P. 20
74	ABS Position Command	C-pulse	P. 21
76	Absolute Position Feedback	C-pulse	P. 21
78	Command Position Deviation	C-pulse	P. 21
80	ABS Position Deviation	C-pulse	P. 21
97	Speed Command Value	r/min	P. 21
98	Speed Feedback	r/min	P. 22
99	Speed Deviation	r/min	P. 22
113	Torque Command Value	0.1%	P. 22
131	Load Factor	digit	P. 23
132	Load Factor(%)	%	P. 23
194	Encoder/Rotor mechanical angle (single-turn value)	E-pulse	P. 23
195	Encoder/Rotor mechanical angle (integrated value)	E-pulse	P. 23
205	Encoder Temperature	℃	P. 24
206	Encoder Battery Voltage	0.1 V	P. 24
216	Encoder Communication Retry Count	times	P. 24
218	Encoder Data Error Count	times	P. 24
228	Regeneration Status	–	P. 25
232	Primary Circuit Power Supply Voltage	0.1 V	P. 25
371	Inertia Ratio Estimate	%	P. 25

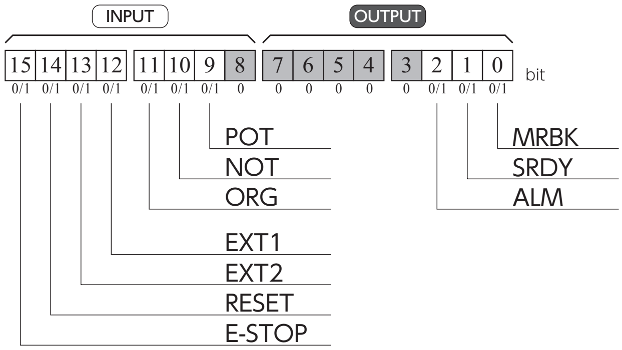
Status Variables of EtherCAT Communication Objects

Status No.	Status Variable	Units	Refer to
2064	Target Position	C-pulse	P. 26
2074	Position actual value	C-pulse	P. 26
2080	Target Velocity	C-pulse/s	P. 26
2090	Velocity actual value	C-pulse/s	P. 26
2096	Target Torque	0.1%	P. 26
2098	Torque actual value	0.1%	P. 26

3. Details of Each Status Variable

Status	I/O Status	Units
Status No.	16	–
Description	This item indicated the I/O Status of the CN1 connector. You can check the I/O Status under【waveform monitor】and【status monitor】in S-TUNE Ⅱ. 【waveform monitor】 displays total value of I/O bits in decimal. 【status monitor】 displays I/O bits in binary.	

Bit Tables



Status	Control Component Temperature	Units
Status No.	24	℃
Description	Indicates the temperature at the amplifier control block. Install the amplifier in a place where the temperature at the control block will not exceed 85℃.	

4. Status Display

Status	Positioning Status	Units
Status No.	64	–
Description	Indicates whether positioning is completed or not 0: Not completed 1: Completed	

Status	Internal Command Value	Units
Status No.	65	E-pulse
Description	Indicates the command value being input to the positioning loop. This is a value of the position command input divided/multiplied and smoothed.	

Status	Position Feedback	Units
Status No.	67	E-pulse
Description	Indicates the position data of the motor returned from the encoder to the amplifier.	

Status	Position Deviation	Units
Status No.	69	E-pulse
Description	Indicates deviation between the position command and position feedback. This value is important for tuning in position control mode, enabling you to do the following: To check the positioning time—for the position deviation to settle into your desired range after the position command became 0—and vibration. To adjust gains such that the positioning time will be shorter and vibration will be suppressed, so the specifications for the equipment will be satisfied To check resonant frequency, in case of equipment vibration, by using waveforms of position deviation or torque limit value. To see whether vibration was suppressed by checking waveforms after specifying the vibration frequency for the following position command filters. · **Filter 1 (Smoothing filter 1) Moving average counter** (No.80.0) · **Filter 4 (Smoothing filter 2) Moving average counter** (No.81.0)	

4. Status Display

Status	ABS　Position Command	Units
Status No.	74	C-pulse
Description	This indicates a position command value based on the home-position offset.	

Status	Absolute Position Feedback	Units
Status No.	76	C-pulse
Description	Indicates the absolute position data returned from the encoder to the amplifier.	

Status	Command Position Deviation	Units
Status No.	78	C-pulse
Description	Indicates the deviation between a position command value and the feedbacked position value.	

Status	ABS Position Deviation	Units
Status No.	80	C-pulse
Description	Indicates the deviation between a value of ABS Position Command (Status No.74) and the value of ABS Positioning Feedback (Status No.76).	

Status	Velocity Command Value	Units
Status No.	97	r/min
Description	Indicates the velocity command value. While tuning, by measuring this value (waveform data displayed in S-TUNE Ⅱ) and position deviation (or speed deviation) at the same time, you can check command response with positioning time and vibration. Verify that no commands with extremely short acceleration/deceleration time are input from the host controller. If a command's acceleration/deceleration time is too short, the motor will be unable to keep up and vibration will easily occur. If you want to set a short acceleration/deceleration time, use a position command smoothing filter.	

4. Status Display

Status	Speed Feedback	Units
Status No.	98	r/min
Description	Indicates the speed value returned from the encoder to the amplifier. With this, you can check command response and motor rotational speed.	

Status	Speed Deviation	Units
Status No.	99	r/min
Description	Deviation between the speed command and the speed feedback. This item is used in Velocity Control Mode. With this, you can check the deviation during acceleration/deceleration, and adjust gains so that the value becomes within the desired range for the equipment. If the speed deviation is too large, make the adjustment with Control Gain 1 first, then Integral Gain next. This item is a reference value In Position Control Mode	

Status	Torque Command Value	Units
Status No.	113	0.1 %
Description	Indicates the value of torque command. The value of 1,000 equals to the rated torque. You can check the torque range during acceleration time and compare to the rated torque and the instantaneous maximum torque. ・RMS torque: Keep this below the rated torque. ・Instantaneous torque: Use the motor such that this will be approximately 80% of instantaneous peak torque. When the RMS torque command value reaches the instantaneous max torque value (that is, toque saturation), the torque output will be limited and an alarm will occur after the predetermined time will have elapses. Torque saturation causes slow response. Take countermeasures. For example, ① Set Position command filter. ・**Filter 1 (Smoothing filter 1) Moving average counter** (No.80.0) ・**Filter 4 (Smoothing filter 2) Moving average counter** (No.81.0) ② Smooth acceleration/deceleration of the command output from the host controller. ③ Install a speed reducer to decrease the inertia ratio. ④ Select a new motor to increase the rotor inertia or increase the capacity to decrease the inertia ratio.	

4. Status Display

Status	Load Factor	Units
Status No.	131	digit
Description	Indicates the motor load factor. The value of 1,000 is equivalent to 100% of the rated load. This item becoming 1,440 (120%) is an indicator of overload. Adjust the operating conditions such that this value remains under 1,000. Calculation formula: Motor load factor% = √ (Load factor digit × 10)	

Status	Load Factor (%)	Units
Status No.	132	%
Description	The motor load factor is presented in%. (S-TUNE Ⅱ only)	

Status	Encoder/rotor mechanical angle (single-turn value)	Units
Status No.	194	E-pulse
Description	Indicates single-turn data of the motor. This value is an absolute value.	

Status	Encoder/rotor mechanical angle (integrated value)	Units
Status No.	195	E-pulse
Description	This indicates multi-turn data of the motor. It is presented as a total of encoder feedback pulses. (Single-turn value) + (Encoder resolution × Encoder Multi-turn data) This item is the absolute data if you are using an absolute encoder.	

4. Status Display

Status	Encoder temperature	Units
Status No.	205	℃
Description	Indicates the encoder internal temperature. (for reference only)	

Status	Encoder battery voltage	Units
Status No.	206	0.1 V
Description	Indicates the voltage of the encoder backup battery.	

Status	Encoder communication retry times	Units
Status No.	216	times
Description	Indicates the communication retry count upon encoder communication error.	

Status	Encoder Data Error Counter	Units
Status No.	218	times
Description	Indicates the cumulative count of errors in receiving encoder data.	

Status	Regeneration Status	Units
Status No.	228	–
Description	This item indicates the regeneration status of the amplifier power circuit. Setup Panel ☞ C- **1** **Setup Panel** S-TUNE Ⅱ 【waveform monitor】 displays total value of I/O bits in decimal. 【status monitor】 displays I/O bits in binary.	

Bit Tables

Regeneration Status								Error detection							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0/1	0/1	0	0	0	0	0	0	0	0/1

bit

・・・1 : Being output

bit	Name and Meaning
0	**Regeneration control output** Indicates the operation status of the regenerative power processing circuit.
8	**Regeneration voltage warning** Indicates the primary circuit power voltage has reached the warning level. You need to connect a regenerative resistor to the amplifier.
9	**Regeneration voltage threshold** Indicates the primary circuit power voltage has reached the threshold. A power error, alarm **No.14** or **No.15** , will occur if the regenerative resistor is not connected.

Status	Primary Circuit Power Voltage	Units
Status No.	232	0.1 V
Description	Indicates the primary circuit power voltage (for reference only).	

Status	Inertia Ratio Estimate	Units
Status No.	371	–
Description	This item indicates the inertia ratio value estimated in auto turning.	

Status	Target Position	Units
Status No.	2064	C-pulse
Description	Set the position command value.	

Status	Position actual value	Units
Status No.	2074	C-pulse
Description	Displays the actual position of the motor.	

Status	Target Velocity	Units
Status No.	2080	C-pulse/s
Description	Sets the velocity command.	

Status	Velocity actual value	Units
Status No.	2090	C-pulse/s
Description	Displays the actual velocity of the motor.	

Status	Target Torque	Units
Status No.	2096	0.1%
Description	Sets the torque command value.	

Status	Torque actual value	Units
Status No.	2098	0.1%
Description	Displays the actual torque value.	

MEMO

Nidec

All for dreams