

AiC Series

User Manual MMD-AiCU1-V3.4_EN

Thank you for purchasing an Autonics product.

This user manual contains information about the product and its proper use, and should be kept in a place where it will be easy to access.

Autonics

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Preface

Thank you for purchasing Autonics products.

Be sure to read and follow the **Safety Precautions** thoroughly before use.

This manual contains information about the product and how to use it properly, so keep it in a place where users can easily find it.

Manual Guide

- Use the product after fully reading the contents of the manual.
- The manual explains the product functions in detail and does not guarantee the contents other than the manual.
- Any or all of the manual may not be edited or copied without permission.
- The manual is not provided with the product.
- Download and use from our website (www.autonics.com).
- The contents of the manual are subject to change without prior notice according to the improvement of the product's performance, and upgrade notices are provided through our website.
- We put a lot of effort to make the contents of the manual a little easier and more accurate. Nevertheless, if you have any corrections or questions, please feel free to comment through our website.

Common Symbols in the Manual



Failure to follow instructions may result in serious injury or death.



Failure to follow instructions may result in injury or product damage.



Supplementary explanation of the function



Example of that function



Important information about the feature

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- Symbol ! indicates caution due to special circumstances in which hazards may occur.



Failure to follow instructions may result in serious injury or death.



Failure to follow instructions may result in injury or product damage.

Driver



WARNING

1. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime / disaster prevention devices, etc.) Failure to follow this instruction may result in personal injury, economic loss or fire.
2. Do not use the unit in the place where flammable / explosive / corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present. Failure to follow this instruction may result in explosion or fire.
3. Do not connect, repair, or inspect the unit while connected to a power source. Failure to follow this instruction may result in fire or electric shock.
4. Install the unit after considering counter plan against power failure. Failure to follow this instruction may result in personal injury, economic loss or fire.
5. Check 'Connections' before wiring. Failure to follow this instruction may result in fire.
6. Do not disassemble or modify the unit. Failure to follow this instruction may result in fire or electric shock.
7. Install the driver in the housing or ground it. Failure to follow this instruction may result in personal injury, fire or electronic shock.
8. Do not touch the unit during or after operation for a while. Failure to follow this instruction may result in burn or electric shock due to high temperature of the surface.
9. Emergency stop directly when error occurs. Failure to follow this instruction may result in personal injury or fire.



CAUTION

1. When connecting the power input, use AWG18 (0.75 mm²) cable or over.
2. Brake is non-polar. When connecting the brake, use AWG24 (0.2 mm²) cable or over.
Failure to follow this instruction may result in fire or malfunction due to contact failure.
3. To use the motor safely, do not apply external force to the motor.
4. It is recommended to use STOPPER for the vertical load.
5. Install over-current prevention device (e.g. the current breaker, etc.) to connect the driver with power.
Failure to follow this instruction may result in fire.
6. Check the control input signal before supplying power to the driver.
Failure to follow this instruction may result in personal injury or product damage by unexpected driver movement.
7. Install a safety device to maintain the vertical position after turn off the power of this driver.
Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of the motor.
8. Use the unit within the rated specifications.
Failure to follow this instruction may result in fire or product damage.
9. Use a dry cloth to clean the unit, and do not use water or organic solvent.
Failure to follow this instruction may result in fire or electric shock.
10. The driver may overheat depending on the environment.
Install the unit at the well-ventilated environment and forced cooling with a cooling fan.
Failure to follow this instruction may result in product damage or degradation by heat.
11. Keep the product away from metal chip, dust, and wire residue which flow into the unit.
Failure to follow this instruction may result in fire or product damage.
12. Use the designated motor only.
Failure to follow this instruction may result in fire or product damage.

Motor



WARNING

1. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime / disaster prevention devices, etc.)
Failure to follow this instruction may result in personal injury, economic loss or fire.

2. Do not use the unit in the place where flammable / explosive / corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.
Failure to follow this instruction may result in explosion or fire.
3. Do not use the brake for safety.
Failure to follow this instruction may result in personal injury or product and ambient equipment damage.
4. Fix the unit on the metal plate.
Failure to follow this instruction may result in personal injury or product and ambient equipment damage.
5. Do not connect, repair, or inspect the unit while connected to a power source.
Failure to follow this instruction may result in fire.
6. Install the unit after considering counter plan against power failure.
Failure to follow this instruction may result in personal injury, economic loss or fire.
7. Check 'Connections' before wiring.
Failure to follow this instruction may result in fire.
8. Do not disassemble or modify the unit.
Failure to follow this instruction may result in fire or electric shock.
9. Install the motor in the housing or ground it.
Failure to follow this instruction may result in personal injury, fire or electronic shock.
10. Make sure to install covers on motor rotating components.
Failure to follow this instruction may result in personal injury
11. Do not touch the unit during or after operation for a while.
Failure to follow this instruction may result in burn due to high temperature of the surface.
12. Upon occurrence of an error, disconnect the power source.
Failure to follow this instruction may result in personal injury, fire or electronic shock.



CAUTION

1. Use the unit within the rated specifications.
Failure to follow this instruction may result in fire or product damage.
2. Brake is non-polar. When connecting the brake, use AWG 24 (0.2 mm²) cable or over.
Failure to follow this instruction may result in malfunction due to contact failure.
3. Use a dry cloth to clean the unit, and do not use water or organic solvent.
Failure to follow this instruction may result in fire.
4. The motor may overheat depending on the environment.
Install the unit at the well-ventilated environment and forced cooling with a cooling fan.

Failure to follow this instruction may result in product damage or degradation by heat.

5. Keep the product away from metal chip, dust, and wire residue which flow into the unit.

Failure to follow this instruction may result in fire or product damage.

Cautions during Use

Driver

1. Follow instructions in 'Cautions during Use'.
Otherwise, it may cause unexpected accidents.
2. Power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Re-supply power after 1 sec from disconnected power.
4. In case of unwanted noise generating from peripherals and power, use ferrite core in the wiring.
5. Using USB type 485 converter may cause unstable communication. It is recommended to use 485 converter with separated power. (Autonics product SCM-38I is recommended.)
6. The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.
 - Power connector: AWG18
 - Motor + Encoder connector: AWG22, AWG24
 - I/O connector: AWG28
7. Keep the distance between power cable and signal cable over 10 cm.
8. Motor vibration and noise may occur in a specific frequency range.
 - Change the motor installation method or attach the damper.
 - Use the unit out of the corresponding frequency range due to changing motor RUN speed.
9. Maintain and inspect regularly the following lists.
 - Unwinding bolts and connection parts for the unit installation and load connection
 - Abnormal sound from ball-bearing of the unit
 - Damage and stress of lead cable of the unit
 - Connection error with motor
 - Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
10. This product does not contain a protection function for a motor unit.
11. This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')

- Altitude max. 2,000 m
- Pollution degree 2
- Installation category II

Motor

1. Follow instructions in 'Cautions during Use'.
Otherwise, it may cause unexpected accidents.
2. At low temperature, reducing the grease's consistency of ball-bearing and etc. causes the friction torque increment.
Start the motor gradually since motor's torque is in normal state.
3. Encoder shield cable must be connected to F.G. terminal.
4. When wiring encoder cable, separate it from high voltage cable, power cable, etc. to prevent surge and inductive noise and keep the cable length as short as possible.
Failure to follow this instruction may result in raised cable resistance, residual voltage and output waveform noise.
5. Maintain and inspect regularly the following lists.
 - Unwinding bolts and connection parts for the unit installation and load connection
 - Abnormal sound from Ball-bearing of the unit
 - Damage and stress of lead cable of the unit
 - Connection error with driver
 - Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
6. This unit may be used in the following environments.
 - Indoors (in the environment condition rated in 'Specifications')
 - Altitude max. 2,000 m
 - Pollution degree 2
 - Installation category II

Chapter 1. Product Overview

1.1. Features

The AiC series Ai-SERVO motors are 2-phase closed loop stepper motor system featuring integrated drivers and controllers. The motor system can control motion of multiple axes directly with network communication. The provided atMotion software allows easy control settings and status monitoring.

- Closed-loop system with real-time position control
- High speed & high torque drive without missing steps
- Motor driver+Controller integrated type
- Control up to 31 axes with RS-485 communication
- Windows-based software (atMotion) for easy parameter setting and monitoring
- 4 operation mode : Jog mode, Continuous mode, Index mode, Program Mode
- Built-in brake type motors available (AiC-D-B Series)

1.2. Components and Configuration Diagram

1.2.1. Components

(1) Driver

- Driver
- Instruction manual
- RS485 comm. protective connector
- Power connector
- I/O connector
- Brake connector (AiC-D-B Series)

(2) Motor

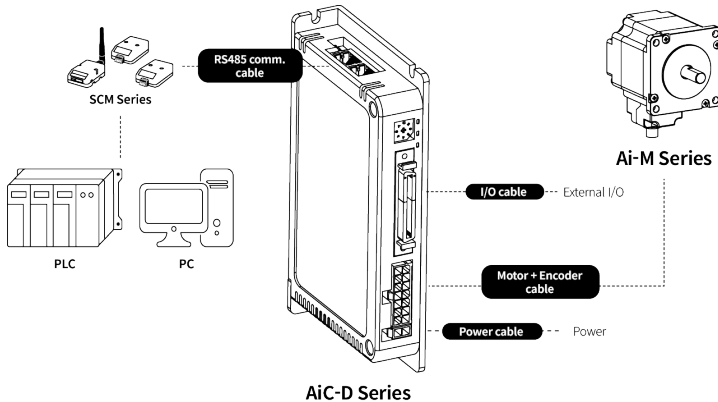
- Motor
- Instruction manual



Make sure all of the above components are included with your product package before use.

If a component is missing or damaged, please contact Autonics or your distributor.

1.2.2. Configuration Diagram



1.3. Ordering Information

1.3.1. Driver

Ai	C	-	D	-	60	L	A	-	B
①	②		③		④	⑤	⑥		⑦

Item	Description			
① Series	Ai	Artificial intelligent		
② Category	C	Controller		
③ Item	D	Driver		
④ Motor frame size	20	<input type="checkbox"/> 20 mm		
	28	<input type="checkbox"/> 28 mm		
	35	<input type="checkbox"/> 35 mm		
	42	<input type="checkbox"/> 42 mm		
	56	<input type="checkbox"/> 56 mm		
	60	<input type="checkbox"/> 60 mm		
⑤ Motor length	S	Short size		
	M	Middle size		
	L	Long size		
⑥ Encoder resolution	-		<input type="checkbox"/> 20 / 28 / 35 mm	<input type="checkbox"/> 42 / 56 / 60 mm
		A	4,000 PPR (1,000 PPR × 4)	10,000 PPR (2,500 PPR × 4)
		B	16,000 PPR (4,000 PPR × 4)	-
⑦ Motor type	No mark	Standard type		
	B	Built-in brake type		

1.3.2. Motor

Ai	-	M	-	60	L	A	-	B
①		②		③	④	⑤		⑥

Item	Description										
① Series	Ai	Artificial intelligent									
② Category	M	Motor									
③ Motor frame size	20	<input type="checkbox"/> 20 mm (20×20 mm)									
	28	<input type="checkbox"/> 28 mm (28×28 mm)									
	35	<input type="checkbox"/> 35 mm (35×35 mm)									
	42	<input type="checkbox"/> 42 mm (42×42 mm)									
	56	<input type="checkbox"/> 56 mm (57.2×57.2 mm)									
	60	<input type="checkbox"/> 60 mm (60×60 mm)									
④ Motor length (standard / built-in brake type)	S	Short size <input type="checkbox"/> 28 mm: 46 mm <input type="checkbox"/> 35 mm: 41.5 mm <input type="checkbox"/> 42 mm: 67.5 mm / 102.4 mm <input type="checkbox"/> 56 mm: 77.2 mm / 112.2 mm <input type="checkbox"/> 60 mm: 81.8 mm / 116.8 mm									
	M	Middle size <input type="checkbox"/> 20 mm: 41.2 mm <input type="checkbox"/> 28 mm: 59 mm <input type="checkbox"/> 35 mm: 52 mm <input type="checkbox"/> 42 mm: 73.5 mm / 108.4 mm <input type="checkbox"/> 56 mm: 90.2 mm / 125.2 mm <input type="checkbox"/> 60 mm: 102.7 mm / 137.7 mm									
	L	Long size <input type="checkbox"/> 20 mm: 53.1 mm <input type="checkbox"/> 28 mm: 65 mm <input type="checkbox"/> 35 mm: 68.5 mm <input type="checkbox"/> 42 mm: 81.5 mm / 116.4 mm <input type="checkbox"/> 56 mm: 111.2 mm / 146.2 mm <input type="checkbox"/> 60 mm: 119.7 mm / 154.7 mm									
⑤ Encoder resolution	-	<table border="1"> <thead> <tr> <th></th> <th><input type="checkbox"/> 20 / 28 / 35 mm</th> <th><input type="checkbox"/> 42 / 56 / 60 mm</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>4,000 PPR (1,000 PPR × 4)</td> <td>10,000 PPR (2,500 PPR × 4)</td> </tr> <tr> <td>B</td> <td>16,000 PPR (4,000 PPR × 4)</td> <td>-</td> </tr> </tbody> </table>		<input type="checkbox"/> 20 / 28 / 35 mm	<input type="checkbox"/> 42 / 56 / 60 mm	A	4,000 PPR (1,000 PPR × 4)	10,000 PPR (2,500 PPR × 4)	B	16,000 PPR (4,000 PPR × 4)	-
			<input type="checkbox"/> 20 / 28 / 35 mm	<input type="checkbox"/> 42 / 56 / 60 mm							
		A	4,000 PPR (1,000 PPR × 4)	10,000 PPR (2,500 PPR × 4)							
B	16,000 PPR (4,000 PPR × 4)	-									

Item	Description	
⑥ Motor type	No mark	Standard type
	B	Built-in brake type

1.4. Set table

1.4.1. Standard type

Motor frame	Set	Driver	Motor
□ 20 mm	AiC-20MA	AiC-D-20MA	Ai-M-20MA
	AiC-20LA	AiC-D-20LA	Ai-M-20LA
□ 28 mm	AiC-28SB	AiC-D-28SB	Ai-M-28SB
	AiC-28MB	AiC-D-28MB	Ai-M-28MB
	AiC-28LB	AiC-D-28LB	Ai-M-28LB
□ 35 mm	AiC-35SB	AiC-D-35SB	Ai-M-35SB
	AiC-35MB	AiC-D-35MB	Ai-M-35MB
	AiC-35LB	AiC-D-35LB	Ai-M-35LB
□ 42 mm	AiC-42SA	AiC-D-42SA	Ai-M-42SA
	AiC-42MA	AiC-D-42MA	Ai-M-42MA
	AiC-42LA	AiC-D-42LA	Ai-M-42LA
□ 56 mm	AiC-56SA	AiC-D-56SA	Ai-M-56SA
	AiC-56MA	AiC-D-56MA	Ai-M-56MA
	AiC-56LA	AiC-D-56LA	Ai-M-56LA
□ 60 mm	AiC-60SA	AiC-D-60SA	Ai-M-60SA
	AiC-60MA	AiC-D-60MA	Ai-M-60MA
	AiC-60LA	AiC-D-60LA	Ai-M-60LA

1.4.2. Built-in brake type

Motor frame	Set	Driver	Motor
□ 42 mm	AiC-42SA-B	AiC-D-42SA-B	Ai-M-42SA-B
	AiC-42MA-B	AiC-D-42MA-B	Ai-M-42MA-B
	AiC-42LA-B	AiC-D-42LA-B	Ai-M-42LA-B
□ 56 mm	AiC-56SA-B	AiC-D-56SA-B	Ai-M-56SA-B
	AiC-56MA-B	AiC-D-56MA-B	Ai-M-56MA-B
	AiC-56LA-B	AiC-D-56LA-B	Ai-M-56LA-B

Motor frame	Set	Driver	Motor
<input type="checkbox"/> 60 mm	AiC-60SA-B	AiC-D-60SA-B	Ai-M-60SA-B
	AiC-60MA-B	AiC-D-60MA-B	Ai-M-60MA-B
	AiC-60LA-B	AiC-D-60LA-B	Ai-M-60LA-B

Built-in geared motor and built-in rotary actuator motor are not provided as set. Please purchase the motor and driver separately. Refer to each instruction manuals for more details.

Built-in Geared

Motor frame	Set	Driver	Motor
<input type="checkbox"/> 42 mm	-	AiC-D-42MA	Ai-M-42MA-G5
			Ai-M-42MA-G7.2
			Ai-M-42MA-G10
<input type="checkbox"/> 60 mm	-	AiC-D-60MA	Ai-M-60MA-G5
			Ai-M-60MA-G7.2
			Ai-M-60MA-G10

Built-in Rotary Actuator

Motor frame	Set	Driver	Motor
<input type="checkbox"/> 60 mm	-	AiC-D-60MA	Ai-M-60MA-R5
			Ai-M-60MA-R7.2
			Ai-M-60MA-R10

Chapter 2. Specifications

2.1. Driver

Model	AiC-D-20□A	AiC-D-28□B	AiC-D-35□B
Power supply	24 VDC		
Permissible voltage range	90 to 110% of rated voltage		
Max. RUN power⁰¹⁾	≤ 60 W		
Stop power⁰²⁾	≤ 10 W		
Max. RUN current⁰³⁾	0.6 A / Phase	1.0 A / Phase	1.2 A / Phase
Stop current	20 to 100% of Max. RUN current (factory default: 50%)		
Resolution	500 (factory default), 1000, 1600, 2000, 3600, 4000, 5000, 6400, 7200, 10000 PPR	500 (factory default), 1000, 1600, 2000, 3600, 5000, 6400, 7200, 10000, 16000 PPR	

Model	AiC-D-42□A-□	AiC-D-56□A-□	AiC-D-60□A-□
Power supply	24 VDC		
Permissible voltage range	90 to 110% of rated voltage		
Max. RUN power	≤ 60 W	≤ 120 W	≤ 240 W
Stop power	≤ 10 W	≤ 12 W	≤ 15 W
Max. RUN current	1.7 A / Phase	3.5 A / Phase	
Stop current	20 to 100% of Max. RUN current (factory default: 50%)		
Resolution	500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 PPR		

01) When changing the load rapidly, instantaneous peak current may increase. The capacity of power supply should be over 1.5 to 2 times of max. RUN power.

02) Based on ambient temp. 25°C, ambient humi. 55%RH, stop current 50%

03) RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.

Run method	2-phase bipolar closed-loop control method
Speed filter	Disable, 2, 4, 6, 8, 10, 20, 40, 60 (factory default), 80, 100, 120, 140, 160, 180, 200 ms
Control Gain	0 (factory default) to 14, Fine Gain
Max. rotation speed	3000 rpm
Positioning range	-2,147,483,648 to +2,147,483,647
In-Position	Fast Response: 0 (factory default) to 7, Accurate Response: 0 to 7
Rotation direction	CW (factory default), CCW
Operation mode	Jog mode, Continuous mode, Index mode, Program mode
Home search mode	General mode, Limit mode, Zero point mode, Torque mode
Index step	64 step
Program step	256 step
Program function	Power On Program Start, Power On Home Search
Control command	ABS, INC, HOM, ICJ, IRD, OPC, OPT, JMP, REP, RPE, END, POS, TIM, CMP
Input⁰¹⁾	Exclusive input: 20, General input: 9
Output	Standard type - Exclusive output: 4, General output: 10 Built-in brake type - Exclusive output: 6, General output: 9
External power supply	VEX (recommended: 24 VDC): 2, GEX (GND): 2
Insulation resistance	≥ 100 MΩ (500 VDC megger)
Dielectric strength	Between the all charging part and the case: 1,000 VAC 60 Hz for 1 minute
Vibration	1.5 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock	300 m/s ² (≈ 30 G) in each X, Y, Z direction for 3 times
Ambient temp.	0 to 50°C, storage: -10 to 60°C (no freezing or condensation)
Ambient humi.	35 to 85%RH, storage: 10 to 90%RH (no freezing or condensation)
Protection rating	IP20 (IEC standard)
Certification	CE, UKCA, EAC
Unit weight (packaged)	≈ 300 g (≈ 460 g)

01) Brake ON/OFF function can be changed from general input IN8 in case of built-in brake type.

2.1.1. Factory Default

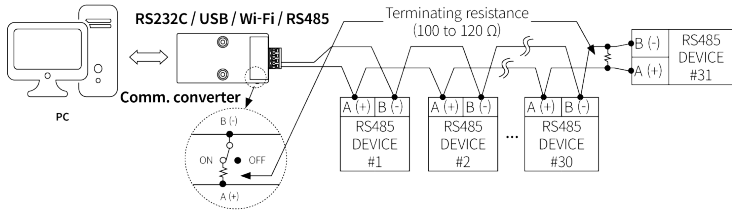
Stop current	50 % of max. RUN current
Resolution	500 PPR
Speed filter	60 ms
Control gain	0
In-Position	Fast Response: 0
Comm. speed	115,200 bps
Comm. ID setting rotary switch	1
Comm. ID setting DIP switch	OFF
Terminal resistance setting DIP switch	OFF

2.1.2. RS485 Communication Interface

Comm. protocol	Modbus RTU
Applied standard	Compliance with EIA RS485
Max. connections	31 units (address: 01 to 31)
Synchronous method	Asynchronous
Comm. method	2-wire half duplex
Comm. distance	≤ 800 m
Baud rate	9600, 19200, 38400, 57600, 115200 (factory default) bps
Start bit	1 bit (fixed)
Data bit	8 bit (fixed)
Parity bit	None (factory default), Even, Odd
Stop bit	1 bit (factory default), 2 bit



- It is not allowed to set overlapping communication address at the same communication line.
- Use twisted pair wire for RS485 communication.
- Please use twisted pair wire, which is suitable for RS485 communication, for SCM-WF48, SCM-US48I and SCM-38I.
- It is recommended to use Autonics communication converter; SCM-WF48 (Wi-Fi to RS485 · USB wireless communication converter, sold separately), SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately).
- Application of system organization



2.2. Motor

Model	Ai-M-20MA	Ai-M-20LA
Max. stop torque	0.018 N m	0.035 N m
Rotor inertia moment	$2 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	
Rated current	0.6 A / Phase	
Basic step angle	1.8° / 0.9° (Full / Half step)	
Resistance	6.6 Ω / Phase ±10%	10.5 Ω / Phase ±10%
Inductance	2.1 mH / Phase ±20%	4.0 mH / Phase ±20%
Unit weight (packaged)	≈ 0.092 kg (≈ 0.192 kg)	≈ 0.120 kg (≈ 0.219 kg)

Model	Ai-M-28SB	Ai-M-28MB	Ai-M-28LB
Max. stop torque	0.05 N m	0.14 N m	0.16 N m
Rotor inertia moment	$9 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$12 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$18 \times 10^{-7} \text{ kg} \cdot \text{m}^2$
Rated current	1.0 A / Phase		
Basic step angle	1.8° / 0.9° (Full / Half step)		
Resistance	5.78 Ω / Phase ±10%	8.8 Ω / Phase ±10%	10.1 Ω / Phase ±10%
Inductance	3.2 mH / Phase ±20%	6.0 mH / Phase ±20%	6.2 mH / Phase ±20%
Unit weight (packaged)	≈ 0.162 kg (≈ 0.260 kg)	≈ 0.222 kg (≈ 0.318 kg)	≈ 0.248 kg (≈ 0.342 kg)

Model	Ai-M-35SB	Ai-M-35MB	Ai-M-35LB
Max. stop torque	0.07 N m	0.13 N m	0.31 N m
Rotor inertia moment	$8 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$14 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$22 \times 10^{-7} \text{ kg} \cdot \text{m}^2$
Rated current	1.2 A / Phase		
Basic step angle	1.8° / 0.9° (Full / Half step)		
Resistance	2.1 Ω / Phase ±10%	3.25 Ω / Phase ±10%	5.0 Ω / Phase ±10%
Inductance	1.25 mH / Phase ±20%	2.85 mH / Phase ±20%	5.6 mH / Phase ±20%
Unit weight (packaged)	≈ 0.180 kg (≈ 0.278 kg)	≈ 0.250 kg (≈ 0.347 kg)	≈ 0.366 kg (≈ 0.456 kg)

Model	Ai-M-42SA-□	Ai-M-42MA-□	Ai-M-42LA-□
Max. stop torque	0.25 N m	0.4 N m	0.48 N m
Rotor inertia moment	$35 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$54 \times 10^{-7} \text{ kg} \cdot \text{m}^2$	$77 \times 10^{-7} \text{ kg} \cdot \text{m}^2$
Rated current	1.7 A / Phase		
Basic step angle	1.8° / 0.9° (Full / Half step)		

Model	Ai-M-42SA-□	Ai-M-42MA-□	Ai-M-42LA-□
Resistance	1.7 Ω / Phase ±10%	1.85 Ω / Phase ±10%	2.1 Ω / Phase ±10%
Inductance	1.9 mH / Phase ±20%	3.5 mH / Phase ±20%	4.4 mH / Phase ±20%
Standard type unit nit weight (packaged)	≈ 0.34 kg (≈ 0.45 kg)	≈ 0.41 kg (≈ 0.52 kg)	≈ 0.48 kg (≈ 0.59 kg)
Built-in brake type unit weight (packaged)	≈ 0.67 kg (≈ 0.77 kg)	≈ 0.73 kg (≈ 0.83 kg)	≈ 0.80 kg (≈ 0.90 kg)

Model	Ai-M-56SA-□	Ai-M-56MA-□	Ai-M-56LA-□
Max. stop torque	0.6 N m	1.2 N m	2.0 N m
Rotor inertia moment	140×10 ⁻⁷ kg · m ²	280×10 ⁻⁷ kg · m ²	480×10 ⁻⁷ kg · m ²
Rated current	3.5 A / Phase		
Basic step angle	1.8° / 0.9° (Full / Half step)		
Resistance	0.55 Ω / Phase ±10%	0.57 Ω / Phase ±10%	0.93 Ω / Phase ±10%
Inductance	1.05 mH / Phase ±20%	1.8 mH / Phase ±20%	3.7 mH / Phase ±20%
Standard type unit weight (packaged)	≈ 0.62 kg (≈ 0.76 kg)	≈ 0.85 kg (≈ 0.99 kg)	≈ 1.22 kg (≈ 1.36 kg)
Built-in brake type unit weight (packaged)	≈ 1.15 kg (≈ 1.30 kg)	≈ 1.38 kg (≈ 1.52 kg)	≈ 1.75 kg (≈ 1.90 kg)

Model	Ai-M-60SA-□	Ai-M-60MA-□	Ai-M-60LA-□
Max. stop torque	1.1 N m	2.2 N m	2.9 N m
Rotor inertia moment	240×10 ⁻⁷ kg · m ²	490×10 ⁻⁷ kg · m ²	690×10 ⁻⁷ kg · m ²
Rated current	3.5 A / Phase		
Basic step angle	1.8°+0 / 0.9° (Full / Half step)		
Resistance	1.0 Ω / Phase ±10%	1.23 Ω / Phase ±10%	1.3 Ω / Phase ±10%
Inductance	1.5 mH / Phase ±20%	2.6 mH / Phase ±20%	3.8 mH / Phase ±20%
Standard type unit nit weight (packaged)	≈ 0.75 kg (≈ 0.89 kg)	≈ 1.13 kg (≈ 1.27 kg)	≈ 1.44 kg (≈ 1.58 kg)
Built-in brake type unit weight (packaged)	≈ 1.36 kg (≈ 1.53 kg)	≈ 1.74 kg (≈ 1.90 kg)	≈ 2.07 kg (≈ 2.23 kg)

2.2.1. Common Specifications

Motor phase	2-phase
Run method	Bipolar
Insulation class	B type (130 °C)
Insulation resistance	Between Motor coil - Case: $\geq 100 \text{ M}\Omega$ (500 VDC megger)
Dielectric strength	Between the all charging part and the case: 500 VAC 50/60 Hz for 1 min
Vibration	1.5 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock	$\leq 50 \text{ G}$
Ambient temp.	0 to 50 °C, Storage: -20 to 70 °C (rated at no freezing or condensation)
Ambient humi.	20 to 85%RH, Storage: 15 to 90%RH (rated at no freezing or condensation)
Protection rating	IP30 (IEC34-5 Specifications)
Certification	CE, UKCA, EAC
Stop angle error	$\pm 0.09^\circ$ (Full step, No load)
Shaft vibration	0.03 mm T.I.R.
Radial Movement ⁰¹⁾	<input type="checkbox"/> 20 / 28 / 35 mm: $\leq 0.025 \text{ mm T.I.R. (Load: 450 g)}$ <input type="checkbox"/> 42 / 56 / 60 mm: $\leq 0.025 \text{ mm T.I.R. (Load: 25 N)}$
Axial Movement ⁰²⁾	<input type="checkbox"/> 20 / 28 / 35 mm: $\leq 0.005 \text{ mm T.I.R. (Load: 920 g)}$ <input type="checkbox"/> 42 / 56 / 60: $\leq 0.01 \text{ mm T.I.R. (Load: 50 N)}$
Shaft concentricity	0.05 mm T.I.R.
Shaft perpendicularity	0.075 mm T.I.R.

01) Amount of radial shaft displacement when applying radial load to the end of the shaft.

02) Amount of axial shaft displacement when applying axial load to the motor shaft.

2.2.2. Encoder

Encoder type	Incremental rotary encoder		
Frame size	<input type="checkbox"/> 20 mm	<input type="checkbox"/> 28 mm / <input type="checkbox"/> 35 mm	<input type="checkbox"/> 42 mm / <input type="checkbox"/> 56 mm / <input type="checkbox"/> 60 mm
Power supply	5 VDC ± 5% (ripple P-P: ≤ 5%)		
Current consumption	≤ 50 mA (No load)		
Resolution	4,000 PPR (1,000 PPR × 4)	16,000 PPR (4,000 PPR × 4)	10,000 PPR (2,500 PPR × 4)
Control output	Line driver output		
Output phase	A, /A, B, /B, Z, /Z		
Output waveform	Output Duty rate: T/2 ± T/3, A-B phase difference: T/4 ± T/4 (T = 1 cycle of A)		Output Duty rate: T/2 ± T/4, A-B phase difference: T/4 ± T/8 (T = 1 cycle of A)
Inflow current	≤ 20 mA		
Residual voltage	≤ 0.5 VDC		
Outflow current	≤ -20 mA		
Output voltage	≥ 2.5 VDC		
Response speed	≤ 1.5 μs	≤ 1 μs	≤ 0.5 μs
Max. response frequency	200 kHz	1,000 kHz	300 kHz

01) Cable length: 2 m, I sink = 20 mA

2.2.3. Brake

Frame size	<input type="checkbox"/> 42 mm	<input type="checkbox"/> 56 mm	<input type="checkbox"/> 60 mm
Rated excitation voltage ⁰¹⁾	24 VDC ± 10%		
Rated excitation current	0.208 A	0.275 A	
Static friction torque	≥ 0.18 N m	≥ 0.8 N m	
Rotation part inertia moment	6 × 10 ⁻⁷ kg · m ²	19 × 10 ⁻⁷ kg · m ²	
Insulation class	B type (130 °C)		
B type brake	Brake is released when power ON, brake is locked when power OFF.		
Operating time	≤ 25 ms	≤ 30 ms	

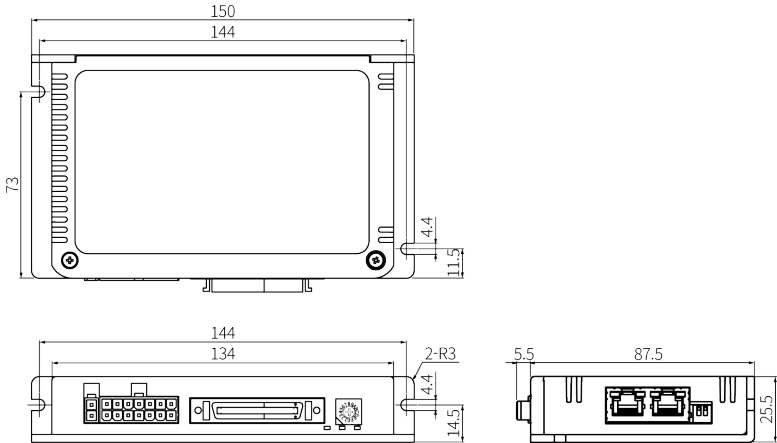
Frame size	<input type="checkbox"/> 42 mm	<input type="checkbox"/> 56 mm	<input type="checkbox"/> 60 mm
Releasing time	≤ 10 ms	≤ 20 ms	

01) In order to reduce the heat generation of the built-in brake, the voltage drops from 24 VDC to 11.5 VDC to control

Chapter 3. Dimensions

3.1. Driver

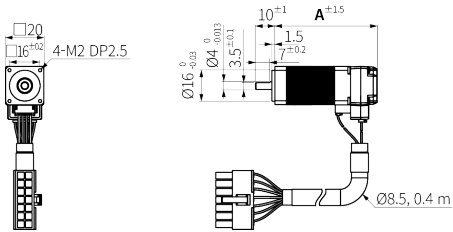
- Unit: mm, For the detailed drawings, follow the Autonics website.



3.2. Motor

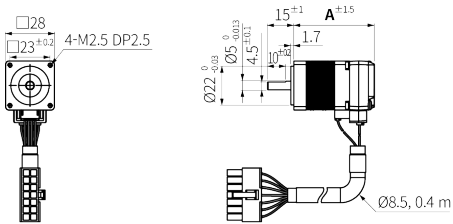
3.2.1. Standard Type

(1) Ai-M-20□A



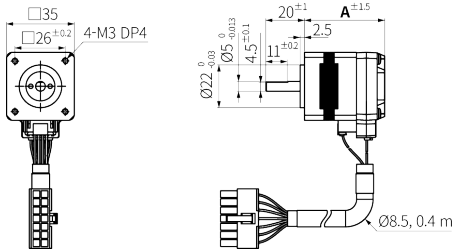
Axial length	S	M	L
A	-	41.2 mm	53.1 mm

(2) Ai-M-28□B



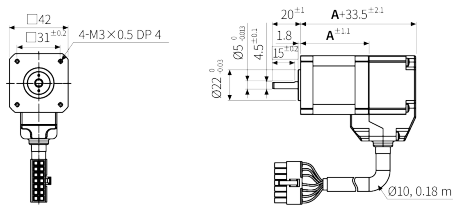
Axial length	S	M	L
A	46 mm	59 mm	65 mm

(3) Ai-M-35□B



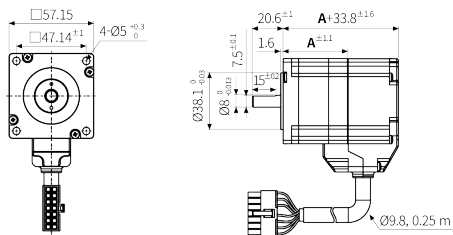
Axial length	S	M	L
A	41.5 mm	52 mm	68.5 mm

(4) Ai-M-42□A



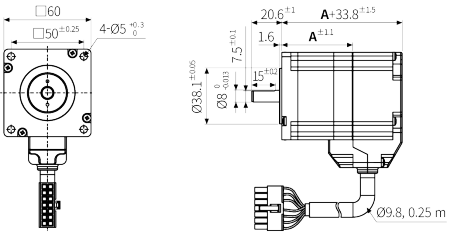
Axial length	S	M	L
A	34 mm	40 mm	48 mm

(5) Ai-M-56□A



Axial length	S	M	L
A	43.4 mm	56.4 mm	77.4 mm

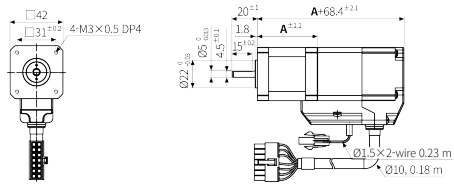
(6) Ai-M-60□A



Axial length	S	M	L
A	48 mm	68.9 mm	85.9 mm

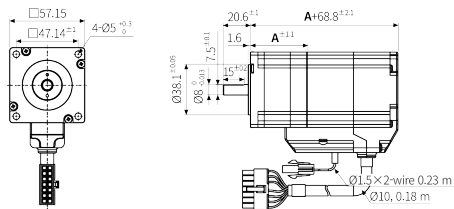
3.2.2. Built-in Brake type

(1) Ai-M-42□A-B



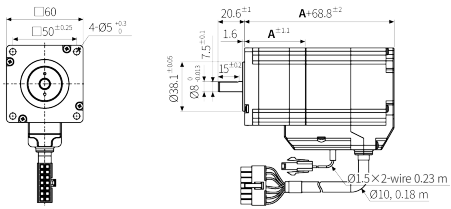
Axial length	S	M	L
A	34 mm	40 mm	48 mm

(2) Ai-M-56□A-B



Axial length	S	M	L
A	43.4 mm	56.4 mm	77.4 mm

(3) Ai-M-60 □A-B



Axial length	S	M	L
A	48 mm	68.9 mm	85.9 mm

Chapter 4. Installation of Motor

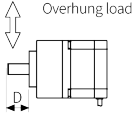
4.1. Cautions during Installation

1. Follow instructions in 'Safety Considerations' and 'Cautions during Use'.
Otherwise, it may cause unexpected accidents.
2. Install the motor in a place that meets the certain conditions specified below. It may cause product damage if it is used out of following conditions.
 - Inside of the housing which is installed indoors
(This unit is designed/manufactured for the purpose of attaching to equipment.
Install a ventilation device.)
 - The place without contact with water, oil, or other liquid
 - The place without contact with strong alkali or acidity
 - The place with less electronic noise occurs by welding machine, motor, etc.
 - The place where no radioactive substances and magnetic fields exist. It shall be no vacuum status as well.
3. Motor can be installed horizontally and vertically. Refer to allowable load in 4.2, "Installation Direction of Motor".
4. If a force (30 N) exceeding the specification is applied to the motor cable during installation, it may cause the contact failure and disconnection.
If the excessive force or frequent cable movement is required, establish safety measures before use.
5. In consideration of heat dissipation and vibration prevention, mount the motor as tight as possible against a metal panel with high thermal conductivity such as iron or aluminum.
6. It may cause product damage if the motor's surface temperature is above 90°C.
Motor can not be protected from overheating. When operating for a long time, install the product in a place with a heat protection function similar to a certain specification heat-proof plate (material: Aluminum, 240×240×5 mm).

4.2. Installation Direction of Motor

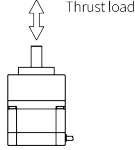
Motor can be installed in any directions-facing up, facing down and side ways. No matter which direction motors to be mounted. Be sure not to apply overhung or thrust load on the shaft. Refer to the table below for allowable shaft overhung load / thrust load.

Horizontal Installation



- D: The distance from the shaft in front end (mm)

Vertical Installation



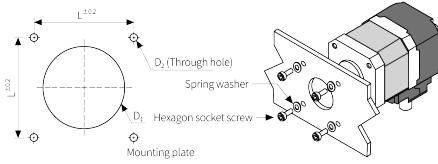
Horizontal installation: Overhung allowable load[N]

Frame size	D = 0	D = 5	D = 10	D = 15
□ 20 mm	12	15	-	-
□ 28 mm	25	34	52	-
□ 35 mm	20	25	34	52
□ 42 mm	20	25	34	52
□ 56 mm / □ 60 mm	54	67	89	130

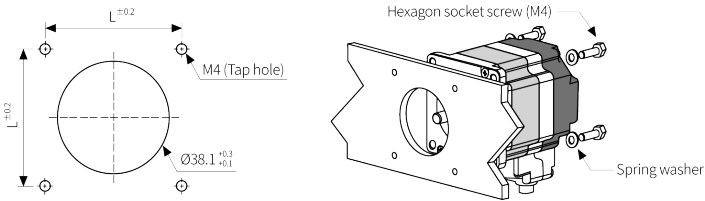
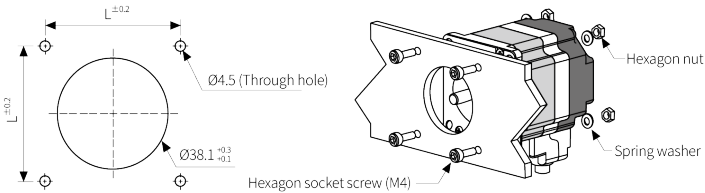
Vertical installation: Thrust allowable load [N]

Under load of motor

4.3. Panel Cut-out Dimensions



Frame size	Mounting plate thickness	Applied bolt	L	D1	D2
□ 20 mm	≥ 3 mm	M2	16 ± 0.2	$\varnothing 16^{+0.21/0}$	4- $\varnothing 2.3$
□ 28 mm	≥ 4 mm	M2.5	23 ± 0.2	$\varnothing 22^{+0.3/+0.1}$	4- $\varnothing 2.8$
□ 35 mm	≥ 4 mm	M3	26 ± 0.2	$\varnothing 22^{+0.3/+0.1}$	4- $\varnothing 3.3$
□ 42 mm	≥ 4 mm	M3	31 ± 0.2	$\varnothing 22^{+0.3/+0.1}$	4- $\varnothing 3.5$



Frame size	Mounting plate thickness	Applied bolt	L
□ 56 mm	≥ 5 mm	M4	47.14 ± 0.2
□ 60 mm			50 ± 0.2



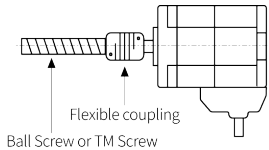
1. With considering heat radiation and vibration isolation, mount the motor as tight as possible against a metal panel having high thermal conductivity such as iron or aluminum.
2. When mounting motors, use hexagon socket screws, spring washers and flat washers.

3. Do not draw the wire with over strength 30N after wiring the encoder.

4.4. Cautions during Connection with Load

1. Do not disassemble or modify the motor shaft to connect with the load.
2. Tighten the screw not to be unscrewed when connecting with load.
3. Refer to allowable load in 4.2, “Installation Direction of Motor” and take care of potential shock when connecting with load.
4. Connect the motor shaft and the load shaft to be parallel.
5. If the center with the load is not aligned with the shaft, it may cause unexpected accidents such as severe vibration, shorten life cycle of the shaft bearing and shaft damage.
6. When attaching coupling or pulley with motor shaft, be aware of damage on motor shaft and shaft bearing.

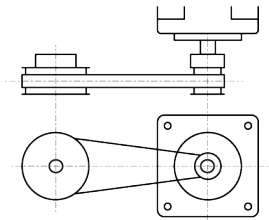
(1) Direct Load Connection with Coupling



When connecting a load such as Ball screw or Tm screw directly to the shaft of the motor, use flexible coupling as image showing above.

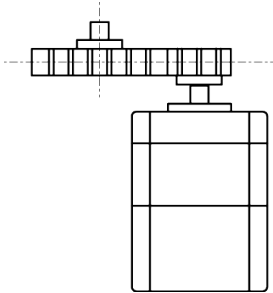
If the center of the load and the shaft is not aligned, it may cause severe vibration, damage on shaft or shortened life cycle of bearings.

(2) Load Connection with Pulley, Belt, and Wire



The motor shaft and the load shaft should be parallel. Connect the motor shaft and the line which connects the center of two pulleys to a right angle.

(3) Load Connection with Gear



The motor shaft and the load shaft should be parallel. Connect the motor shaft to the center of gear teeth side to be interlocked.

4.5. Installation Conditions

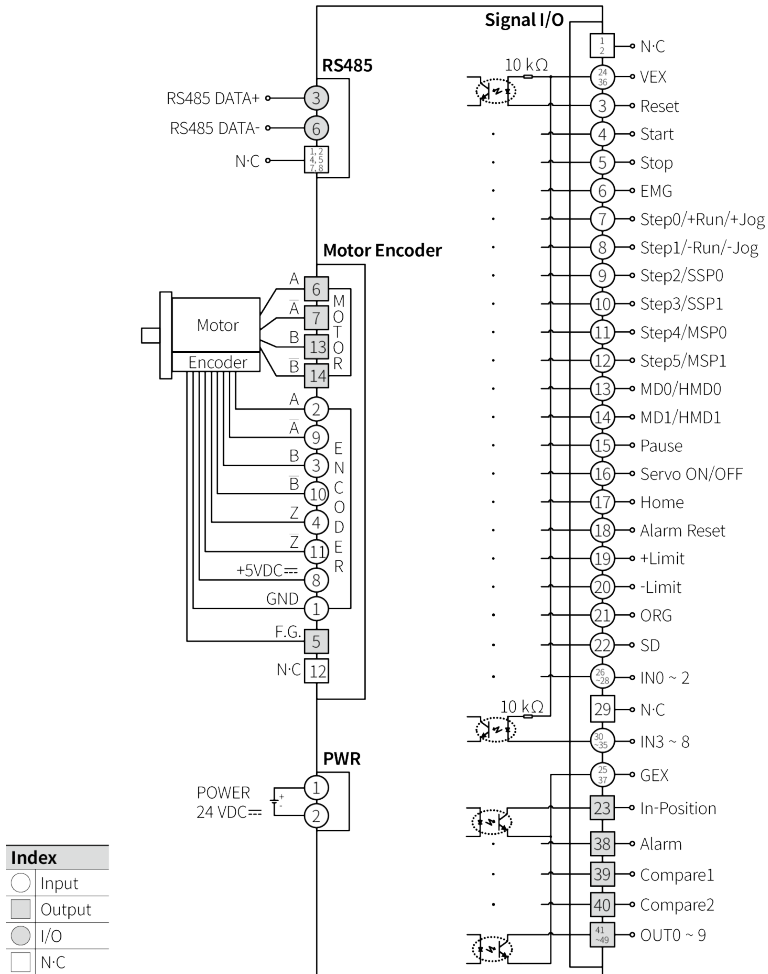
Install the motor in a place that meets certain conditions specified below.

It may cause product damage if instructions are not following.

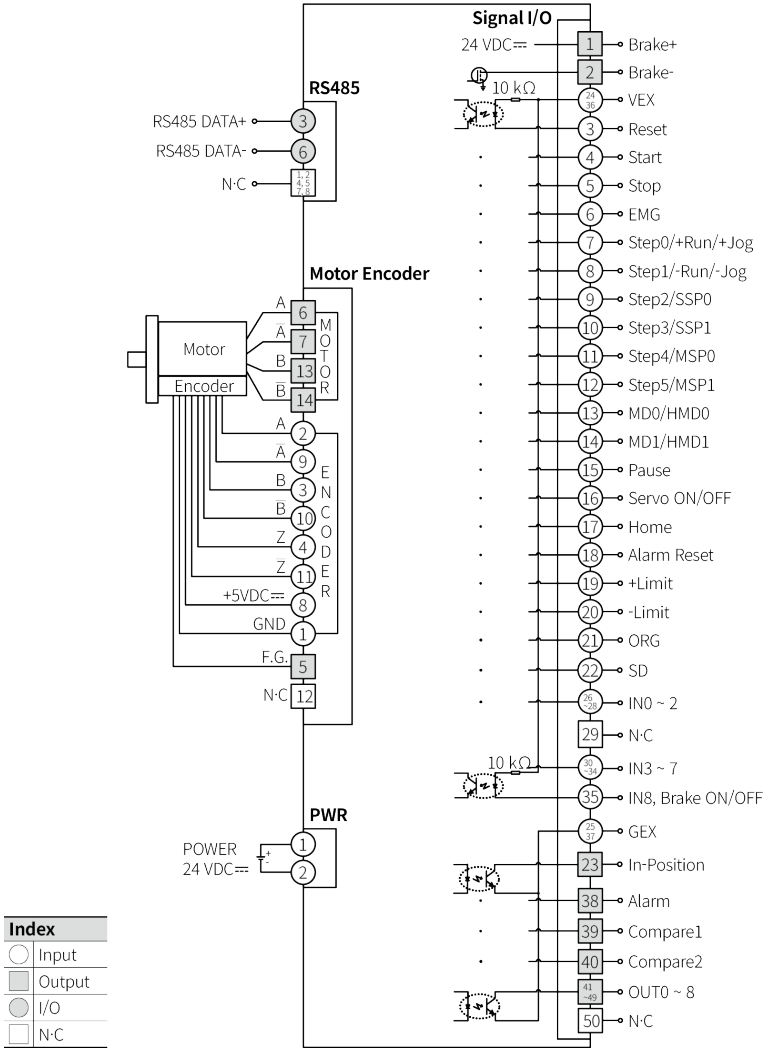
- The inner housing installed indoor (This unit is manufactured and designed for attaching to equipment. Install a ventilation device.)
- Within 0 to 50°C (at non-freezing status) of ambient temperature
- Within 20 to 85%RH (at non-dew status) of ambient humidity
- The place without explosive, flammable and corrosive gas
- The place without direct ray of light
- The place where dust or metal scrap does not enter into the unit
- The place without contact with water, oil, or other liquid
- The place without contact with strong alkali or acid material
- The place where easy heat dissipation could be made
- The place where no continuous vibration or severe shock
- The place with less salt content
- The place with less electronic noise occurs by welding machine, motor, etc.
- The place where radioactive substances and magnetic fields does not exist and is not in the vacuum status

Chapter 5. Connections

5.1. Standard type

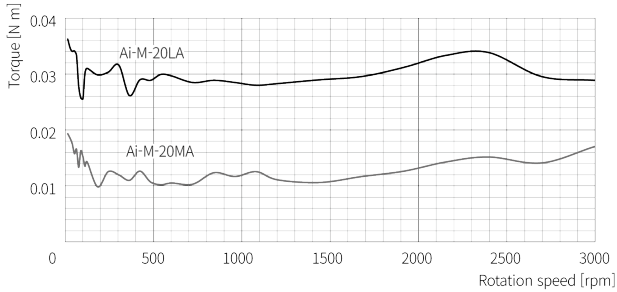


5.2. Built-in Brake type

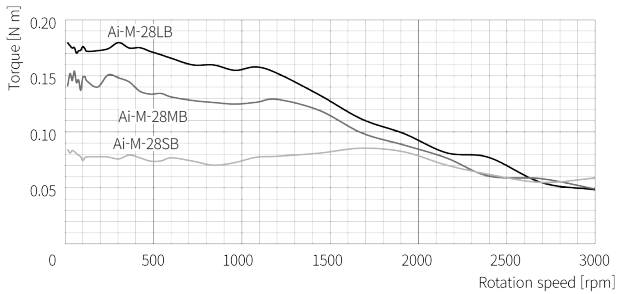


Chapter 6. Motor Torque Characteristic

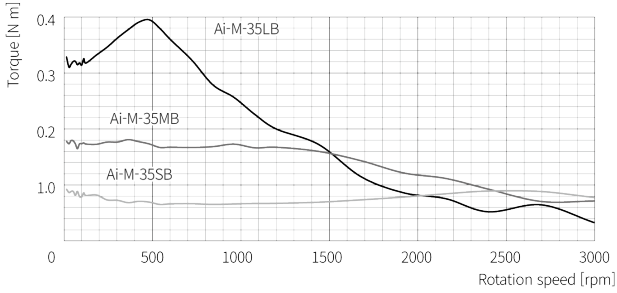
(1) Ai-M-20□A



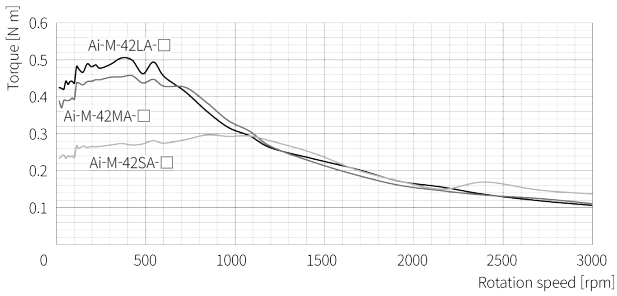
(2) Ai-M-28□B



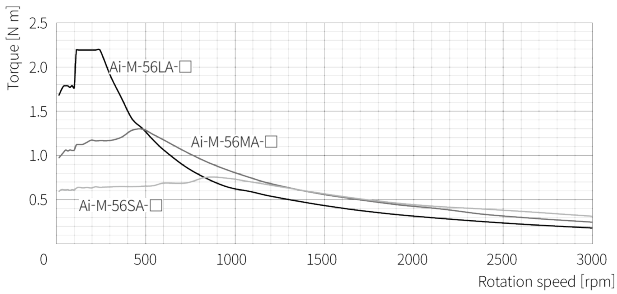
(3) Ai-M-35 □ B



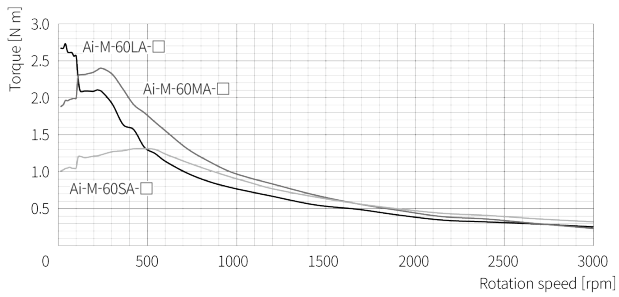
(4) Ai-M-42 □ A- □



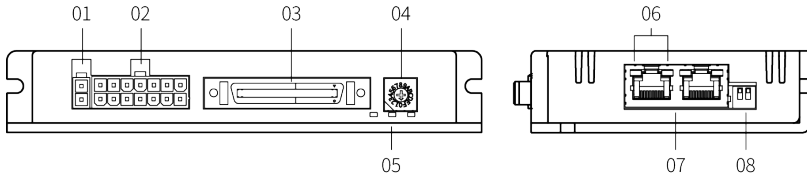
(5) Ai-M-56 □ A- □



(6) Ai-M-60□A-□



Chapter 7. Driver Unit Descriptions



1. Power connector
2. Motor + Encoder connector
3. I/O connector
4. Comm. ID setting rotary switch
5. Status indicator
6. RS485 comm. indicator
7. RS485 comm. connector
8. Comm. ID setting / Terminating resistance DIP switch

7.1. Connector Specifications

7.1.1. Suitable Specifications

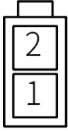
The following connectors can be used with equivalent or substitute.

Type	Connector specifications	Manufacture
Power connector	CHD1140-02, connector terminal: CTD1140	HANLIM
Motor + Encoder connector	5557-14R, connector terminal: □ 20 / 28 / 35 mm: 5556T2, □ 42 / 56 / 60 mm: 5556T	MOLEX
I/O connector	10120-3000PE, Housing: 10320-52F0-008	3M
RS485 comm. connector	RJ45 connector	-

7.1.2. Power Connector

Connects with 24 VDC power. Be sure to the polarity to correct connection.

When polarity direction is reversed, power is not turned on.

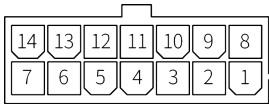


PWR

Pin	Function
1	24 VDC
2	GND

7.1.3. Motor + Encoder Connector

Connects the motor and the encoder to the driver.



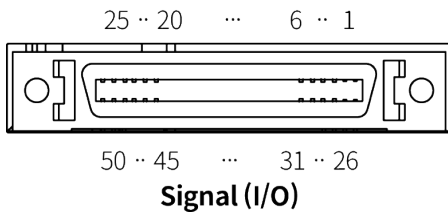
Motor **Encoder**

Pin	Function
1	GND
2	Encoder A
3	Encoder B
4	Encoder Z
5	PE
6	Motor A
7	Motor /A
8	+5 VDC
9	Encoder /A
10	Encoder /B
11	Encoder /Z
12	N · C

Pin	Function
13	Motor B
14	Motor /B

7.1.4. I/O Connector

The below table is based on built-in brake type. For standard type, refer to the footnote.



Pin	I/O	Signal	Function
1 ⁰¹⁾	Output	Brake+	Brake output (24 VDC)
2 ⁰¹⁾	Output	Brake-	Brake output(GND)
3	Input	Reset	Reset
4	Input	Start	Start drive
5	Input	Stop	Stop drive
6	Input	EMG	Emergency stop drive
7	Input	Step0/+Run/+Jog	Step designate0 / +Continuous / +Jog
8	Input	Step1/-Run/-Jog	Step designate1/-Continuous/-Jog
9	Input	Step2/SSP0	Step designate2/Start speed designate 0
10	Input	Step3/SSP1	Step designate3/Start speed designate 1
11	Input	Step4/MSP0	Step designate4/Max. speed designate 0
12	Input	Step5/MSP1	Step designate5/speed designate 1
13	Input	MD0/HMD0	Run mode designate0/Home search mode designate0
14	Input	MD1/HMD1	Run mode designate 1/Home search mode designate 1
15	Input	Pause	Pause
16	Input	Servo On/Off	Servo On/Off
17	Input	Home	Home search
18	Input	Alarm Reset	Alarm reset

Pin	I/O	Signal	Function
19	Input	+Limit	+ direction limit sensor
20	Input	-Limit	- direction limit sensor
21	Input	ORG	Home sensor
22	Input	SD	Deceleration drive signal
23	Output	In-Position	Drive end pulse
24	Input	VEX	External input power (24 VDC)
25	Input	GEX	External input GND (0 VDC)
26	Input	IN0	General input0
27	Input	IN1	General input1
28	Input	IN2	General input2
29	-	N.C	Disable
30	Input	IN3	General input3
31	Input	IN4	General input4
32	Input	IN5	General input5
33	Input	IN6	General input6
34	Input	IN7	General input7
35 ⁰²⁾	Input	IN8 / Brake ON/OFF	General input8 / Brake ON/OFF
36	Input	VEX	External input power(24 VDC)
37	Input	GEX	External input GND (0 VDC)
38	Output	Alarm	Alarm output
39	Output	Compare1	Comparison output1
40	Output	Compare2	Comparison output2
41	Output	OUT0	General output0
42	Output	OUT1	General output1
43	Output	OUT2	General output2
44	Output	OUT3	General output3
45	Output	OUT4	General output4
46	Output	OUT5	General output5
47	Output	OUT6	General output6
48	Output	OUT7	General output7
49	Output	OUT8	General output8
50 ⁰³⁾	Output	OUT9	General output9 / N.C

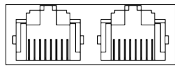
01) N.C for standard type motor.

02) Brake ON/OFF function can be switched in built-in brake type.

03) N.C for in built-in brake type.

7.1.5. RS485 Comm. Connector

Although RS485 OUT is disconnected, RXD IN / TXD OUT will operate normally since RS485 IN is in communication.



8...1 8...1
RS485 OUT RS485 IN

Pin	Function
1	N·C
2	
3	RS485 DATA+
4	N·C
5	
6	RS485 DATA-
7	N·C
8	

7.2. Switch Specifications

7.2.1. Communication ID setting rotary switch

ID setting value is applied when motor is stopped or excitation is released.



ID Selection
SW1

Setting	ID OFF	ID ON
0	Disable	16
1	1 (factory default)	17
2	2	18
3	3	19
4	4	20
5	5	21
6	6	22
7	7	23
8	8	24
9	9	25
A	10	26
B	11	27
C	12	28
D	13	29
E	14	30
F	15	31

7.2.2. Communication ID setting / Terminating resistance DIP switch

SW2



No.	Function	ON	OFF (factory default)
1	Node ID setting	ID: 16 to 31	ID: 1 to 15

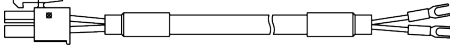
No.	Function	ON	OFF (factory default)
2	Terminating resistance (120 Ω)	Enable	Disable

7.3. Driver Status Indicator

Indicator	Color	Descriptions
Servo ON / OFF Indicator (SERVO)	Orange	Turns ON when servo is ON, Turns OFF when servo is OFF
In-Position Indicator (INP.)	Yellow	Turns ON when motor is placed at command position after positioning input
Power / Warning Indicator (PWR)	Green	Turns ON when the unit operates in normal after power is applied Flashes depending on the warning type
Alarm Indicator (AL)	Red	Flashes depending on the alarm type
RS485 Communication Indicator (RXD IN)	Yellow	Flashes when receiving data
RS485 Communication Indicator (TXD OUT)	Green	Flashes when transmitting data

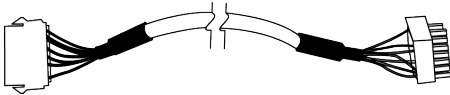
7.4. Sold Separately

7.4.1. Power Cable (CJ-PW-□)



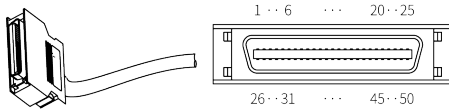
Recommended to use ferrite core at both ends of the cable.
The model name is 010, 020 which indicates the cable length.
E.g.) CJ-PW-010: 1m power cable

7.4.2. Motor + Encoder Cable (fixed type: C1D14M(B)-□, flexible type: C1DF14M(B)-□)



Recommended to use ferrite core at both ends of the cable.
The model name is 1, 2, 3, 5, 7, 10, 15, 20 which indicates the cable length.
E.g.) C1DF14M-10: 10 m flexible type Motor + Encoder cable
For built-in brake type, use dedicated cable.
(fixed type: C1D14MB-□, flexible type: C1DF14MB-□)

7.4.3. I/O Cable (CO50-MP□-R, specifications: AiC TAG)



Pin	Function (Name TAG)	Cable Color	Dot line color-number
1	N · C, Brake+	Orange	Black-1
2	N · C, Brake-		Red-1
3	Reset		Black-2
4	Start		Red-2
5	Stop		Black-3
6	EMG		Red-3
7	Step0/+Run/+Jog		Black-4
8	Step1/-Run/-Jog		Red-4
9	Step2/SSP0		Black-5
10	Step3/SSP1		Red-5
11	Step4/MSP0	Yellow	Black-1
12	Step5/MSP1		Red-1
13	MD0/HMD0		Black-2
14	MD1/HMD1		Red-2
15	Pause		Black-3
16	Servo ON/OFF		Red-3
17	Home		Black-4
18	Alarm Reset		Red-4
19	+Limit		Black-5
20	-Limit		Red-5

Pin	Function (Name TAG)	Cable Color	Dot line color-number
21	ORG	White	Black-1
22	SD		Red-1
23	In-Position		Black-2
24	VEX		Red-2
25	GEX		Black-3
26	IN0		Red-3
27	IN1		Black-4
28	IN2		Red-4
29	N · C		Black-5
30	IN3		Red-5
31	IN4	Gray	Black-1
32	IN5		Red-1
33	IN6		Black-2
34	IN7		Red-2
35	IN8, Brake ON/OFF		Black-3
36	VEX		Red-3
37	GEX		Black-4
38	Alarm		Red-4
39	Compare1 (Trigger)		Black-5
40	Compare2 (Trigger)		Red-5
41	OUT0	Pink	Black-1
42	OUT1		Red-1
43	OUT2		Black-2
44	OUT3		Red-2
45	OUT4		Black-3
46	OUT5		Red-3
47	OUT6		Black-4
48	OUT7		Red-4
49	OUT8		Black-5



Recommended to use ferrite core at both ends of the cable.

The model name is 010, 020, 030, 050, 070, 100, 150, 200 which indicates the cable length.

E.g.) CO50-MP070-R: 7m I/O cable

Chapter 8. Electromagnetic Brake

Electromagnetic brake is a device that helps maintaining the position of load in the situation of power failure or alarm occur in vertical load.



1. Electromagnetic brake does not made for maintaining load completely. Do not use as safe brake.
2. Do not use electromagnetic brake as brake stop. Brake power will be reduced due to worn out.
3. Make sure to ventilate or cool the brake so that the temperature remains below 100 °C.

8.1. Brake Connection

Connect the driver brake output pin to motor brake connector.

Brake is non-polar, when connecting the brake, use AWG22 cable or over for connection.

8.2. Brake Operation

Brake is controlled by driver automatically.

When brake cable is not connected, brake maintains lock status and motor misalignment alarm may occur.

For more information, refer to 13, Protection Function.

1. When Servo is On, brake is released automatically.
2. The brake remains lock in all status except Servo On status.



1. Brake lock is manually controllable using the Brake ON/OFF input signal. For more information, refer to 9.1.3.1, "Brake ON/OFF"
2. Brake lock is manually controllable using parameter 'Brake Off'. For more information, refer to 12.3.8, "Brake OFF".

Chapter 9. Control Input/Output

Inner signal of all input/output consists of photocoupler.

ON, [H] : photocoupler power ON

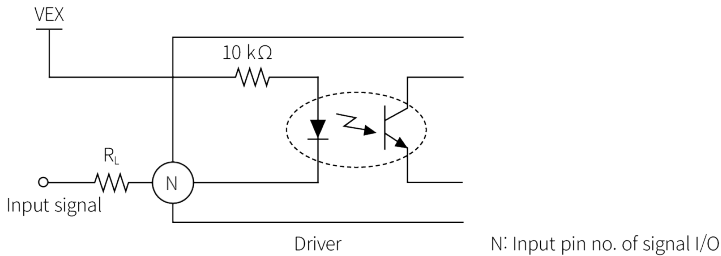
OFF, [L] : photocoupler power OFF

9.1. Input

9.1.1. Example of Input Circuit Connection

All input circuits are insulated with photocoupler. It is recommended to use 24 VDC at VEX and short RL. In case using external power over 24 VDC power, select RL value that IF (forward current of primary LED) of photocoupler to be around 2.5 mA (max. 10mA).

$$R_L = \frac{VEX - 1.25 \text{ V}}{0.0025 \text{ A}} - 10 \times 10^3 \Omega$$



9.1.2. Dedicated input

Pin	Signal	Filter ⁰¹⁾	Active ⁰²⁾	Description
3	Reset	10 ms	[H]	Reset
4	Start	1.5, 10 ms	[L], [H]	Start drive
5	Stop	1.5, 10 ms	[L], [H]	Stop drive
6	EMG	1.5, 10 ms	[L], [H]	Emergency stop drive
7	Step0 / +Run / +Jog	1.5, 10 ms	[L], [H]	Step designate0 / +Continuous / +Jog
8	Step1 / -Run / -Jog	1.5, 10 ms	[L], [H]	Step designate1/-Continuous/-Jog
9	Step2 / SSP0	1.5, 10 ms	[L], [H]	Step designate2/Start speed designate 0
10	Step3 / SSP1	1.5, 10 ms	[L], [H]	Step designate3/Start speed designate 1
11	Step4 / MSP0	1.5, 10 ms	[L], [H]	Step designate4/Max. speed designate 0
12	Step5 / MSP1	1.5, 10 ms	[L], [H]	Step designate5/speed designate 1
13	MD0 / HMD0	1.5, 10 ms	[L], [H]	Run mode designate0/Home search mode designate0
14	MD1 / HMD1	1.5, 10 ms	[L], [H]	Run mode designate 1/Home search mode designate 1
15	Pause	1.5, 10 ms	[L], [H]	Pause
16	Servo On/Off	1.5, 10 ms	[L], [H]	Servo On/Off
17	Home	1.5, 10 ms	[L], [H]	Home search
18	Alarm Reset	1.5, 10 ms	[L], [H]	Alarm reset
19	+Limit	1.5 ms	[L], [H]	+ direction limit sensor
20	-Limit	1.5 ms	[L], [H]	- direction limit sensor
21	ORG	1.5 ms	[L], [H]	Home sensor
22	SD	1.5 ms	[L], [H]	Deceleration drive signal

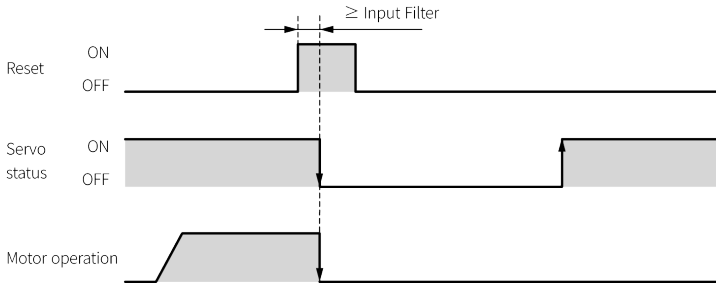
01) It is software input filter to set 1.5 ms or 10 ms of parameter 'Input Filter'. When input turns ON over the set time, it recognizes as normal signal input. (Reset is fixed as 10 ms. +Limit, -Limit, ORG, SD is fixed as 1.5 ms.)

02) It is voltage level to recognize input signal as ON. It is available to set each input. (however, reset is fixed as [H].)

e.g.) [H]: photocoupler power ON, it recognizes as ON, [L]: photocoupler power OFF, it recognizes as ON

9.1.2.1. Reset

When 'Reset' signal is input, driver is reset and it operates same as resupplying the power. During motor driving, it stops immediately and the driver is reset.



9.1.2.2. Start

When 'Start' signal is input, it starts drive as the set mode; index mode 'MD0', 'MD1' or program mode. It does not operate the other modes.

For more information about operation, refer to 10.1, "I/O Signal Control Drive".

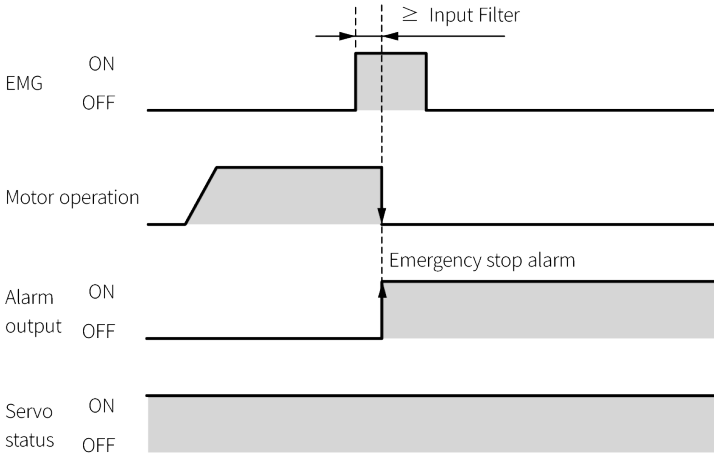
9.1.2.3. Stop

1. When 'Stop' signal is input, the operation mode stops.
2. During continuous driving, it decelerates and stops the motor according to 'Deceleration Time 1' parameter setting.
3. During program mode driving, it stops after complete the current step.
4. During home search, it decelerates and stops according to 'Home Search Deceleration Time' parameter setting.

For more information about operation, refer to 10.1, "I/O Signal Control Drive".

9.1.2.4. EMG (Emergency)

When 'EMG' signal is input, the motor stops immediately, emergency stop alarm occurs. Alarm output is [H] Active fixed and the output signal is ON, photocoupler power is ON. The motor is not servo OFF.



When emergency stop alarm occurs, all drive stops and all output turn OFF regardless of the 'Output Mode(Alarm)' parameter setting.

9.1.2.5. Step0 to 5

It is available to set the drive step address of index mode or program mode among 0 to 63 by 6-digit bit of 'Step0' to 'Step5'.

- Step0 = Least significant bit
- Step5 = Most significant bit

- Step address (0: OFF, 1: ON)

Adr	Ste p5	Ste p4	Ste p3	Ste p2	Ste p1	Ste p0	번 지	Ste p5	Ste p4	Ste p3	Ste p2	Ste p1	Ste p0
0	0	0	0	0	0	0	32	1	0	0	0	0	0
1	0	0	0	0	0	1	33	1	0	0	0	0	1
2	0	0	0	0	1	0	34	1	0	0	0	1	0
3	0	0	0	0	1	1	35	1	0	0	0	1	1
4	0	0	0	1	0	0	36	1	0	0	1	0	0
5	0	0	0	1	0	1	37	1	0	0	1	0	1
6	0	0	0	1	1	0	38	1	0	0	1	1	0
7	0	0	0	1	1	1	39	1	0	0	1	1	1
8	0	0	1	0	0	0	40	1	0	1	0	0	0
9	0	0	1	0	0	1	41	1	0	1	0	0	1
10	0	0	1	0	1	0	42	1	0	1	0	1	0
11	0	0	1	0	1	1	43	1	0	1	0	1	1
12	0	0	1	1	0	0	44	1	0	1	1	0	0
13	0	0	1	1	0	1	45	1	0	1	1	0	1
14	0	0	1	1	1	0	46	1	0	1	1	1	0
15	0	0	1	1	1	1	47	1	0	1	1	1	1
16	0	1	0	0	0	0	48	1	1	0	0	0	0
17	0	1	0	0	0	1	49	1	1	0	0	0	1
18	0	1	0	0	1	0	50	1	1	0	0	1	0
19	0	1	0	0	1	1	51	1	1	0	0	1	1
20	0	1	0	1	0	0	52	1	1	0	1	0	0
21	0	1	0	1	0	1	53	1	1	0	1	0	1
22	0	1	0	1	1	0	54	1	1	0	1	1	0
23	0	1	0	1	1	1	55	1	1	0	1	1	1
24	0	1	1	0	0	0	56	1	1	1	0	0	0
25	0	1	1	0	0	1	57	1	1	1	0	0	1

Adr	Ste p5	Ste p4	Ste p3	Ste p2	Ste p1	Ste p0	번지	Ste p5	Ste p4	Ste p3	Ste p2	Ste p1	Ste p0
26	0	1	1	0	1	0	58	1	1	1	0	1	0
27	0	1	1	0	1	1	59	1	1	1	0	1	1
28	0	1	1	1	0	0	60	1	1	1	1	0	0
29	0	1	1	1	0	1	61	1	1	1	1	0	1
30	0	1	1	1	1	0	62	1	1	1	1	1	0
31	0	1	1	1	1	1	63	1	1	1	1	1	1

9.1.2.6. ±Run

When continuous mode is set as ‘MD0’, ‘MD1’ and ‘±Run’ signal is input, according to the set parameter, it drives to CW (+Run) / CCW (-Run) direction as continuous drive.

For more information about operation, refer to 10.1.3, “Continuous Drive”.

9.1.2.7. ±Jog

When jog mode is set as ‘MD0’, ‘MD1’ and during ‘±Jog’ signal is input, according to the set parameter, it drives to CW(+Jog)/CCW(-Jog) direction.

For more information about operation, refer to 10.1.2, “Jog Drive”.



If +Jog signal and -Jog signal are supplied at the same time, the motor stops.

9.1.2.8. SSP0, 1 (Start speed)

It is available to set the start drive speed of jog mode, continuous mode by 2-digit bit of SSP0, SSP1.

	SSP1	SSP0
Start speed 1	OFF	OFF
Start speed 2	OFF	ON
Start speed 3	ON	OFF
Start speed 4	ON	ON



Start speed 5 is not available.

9.1.2.9. MSP0, 1 (Max speed)

It is available to set the max. drive speed of jog mode, continuous mode by 2-digit bit of MSP0, MSP1.

	MSP1	MSP0
Max speed 1	OFF	OFF
Max speed 2	OFF	ON
Max speed 3	ON	OFF
Max speed 4	ON	ON



Max speed 5 is not available.

9.1.2.10. MD0, 1 / HMD0, 1 (Mode/Home mode)

(1) MD0, 1

It is available to set the drive mode among 4 types by 2-digit bit of MSP0, MSP1.

- Index drive starts when index mode is set and 'Start' signal is input.
- Jog drive operates when jog mode is set and '±Jog' signal is input.
- Continuous drive operates when continuous mode is set and '±Run' signal is input.
- Program drive starts when program mode is set and 'Start' signal is input.

	MD1	MD0
Index drive	OFF	OFF
Jog drive	OFF	ON
Continuous drive	ON	OFF
Program drive	ON	ON

(2) HMD0, 1

It is available to set the home search mode among 4 types by 2-digit bit of 'HMD0', 'HMD1'.

- Home search drive starts when home search mode is set and 'Home' signal is input.

	HMD1	HMD0
Home search	OFF	OFF
Limit home search	OFF	ON
Zero home search	ON	OFF
Torque home search	ON	ON

9.1.2.11. Pause

When 'Pause' signal is input, the drive mode pauses.

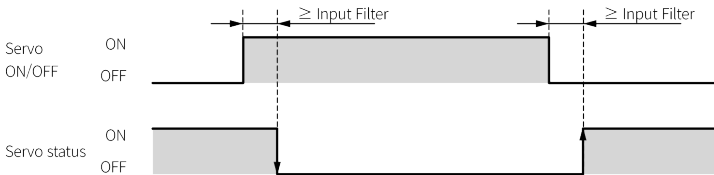
- During continuous mode driving, it decelerates and stops when pause signal is ON. When pause signal is OFF, it starts drive. If pause signal is OFF before stopping the motor, the motor stops and it starts drive as continuous mode.
- When pause signal is ON during program mode drive, it pauses after completing the current step driving. After start signal is ON, it starts drive from the next step of the paused one.

For more information about operation, refer to 10.1, “I/O Signal Control Drive”.

9.1.2.12. Servo On/Off

When 'Servo On/Off' signal is input, motor current is cut and it turns servo OFF status.

- Servo On/Off signal input,
: It recognizes as servo OFF signal and the phase current of motor is blocked and torque is released.
- Servo On/Off signal input is released
: It recognizes as servo ON signal and the phase current of motor is supplied and torque is return.



In case of brake motor, in case of servo OFF status, brake is locked.

In case of brake motor, in case of servo OFF status, the brake is available to control by 'Brake On/Off' signal input or 'Brake Off' parameter setting.

For more information, refer to 9.1.3.1, “Brake ON/OFF” or 12.2, “Home Search”.



The motor must stop.

9.1.2.13. Home

When 'Home' signal is input, home search drive starts as the set mode by 2-digit bit of 'HMD0' 'HMD1'.

Home search speed and acceleration/deceleration time is available to set at atMotion.

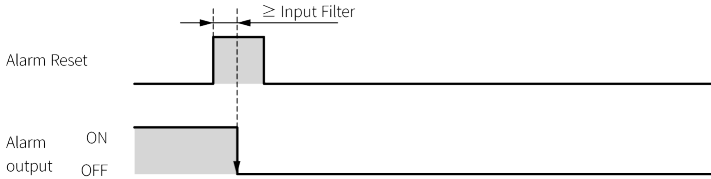
For more information, refer to 10.2.5, “Home Search Mode”.

9.1.2.14. Alarm Reset

When alarm occurs and 'Alarm Reset' signal is input, the alarm is clear.

When alarm is cleared, the alarm indicator and the alarm output turn OFF and the driver returns to normal status.

Alarm output is [H] Active fixed and the output signal is ON, photocoupler power is ON.

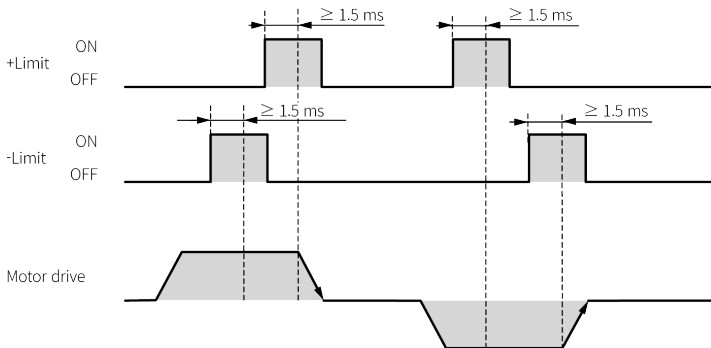


If alarm causes are not removed, the driver does not return to normal status even if 'Alarm Reset' signal is input.

9.1.2.15. \pm Limit

When ' \pm Limit' signal is input, it recognizes as \pm hardware limit input and it decelerates and stops or stops immediately according to the 'Limit Stop Mode' parameter.

- +Limit=CW direction limit sensor signal
- -Limit=CCW direction limit sensor signal

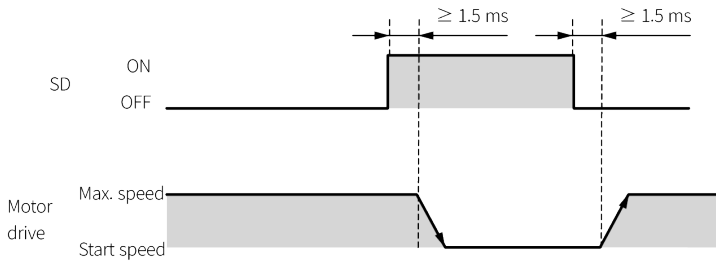


9.1.2.16. ORG (Origin)

When 'ORG' signal is input during home search mode driving, it is recognized as home sensor. For more information, refer to 10.1.5, "Home Search".

9.1.2.17. SD (Slow Down)

When 'SD' signal is input, it decelerates as the set start drive speed.



9.1.3. General input

It is general input at program mode. It is used with ICJ, IRD instruction.

Pin	Signal	Filter ⁰¹⁾	Active ⁰²⁾	Description
26	IN0	1.5, 10 ms	[L], [H]	General input 0
27	IN1	1.5, 10 ms	[L], [H]	General input 1
28	IN2	1.5, 10 ms	[L], [H]	General input 2
30	IN3	1.5, 10 ms	[L], [H]	General input 3
31	IN4	1.5, 10 ms	[L], [H]	General input 4
32	IN5	1.5, 10 ms	[L], [H]	General input 5
33	IN6	1.5, 10 ms	[L], [H]	General input 6
34	IN7	1.5, 10 ms	[L], [H]	General input 7
35	IN8, Brake ON/OFF ⁰³⁾	1.5, 10 ms	[L], [H]	General input 8, Brake ON/OFF

01) It is software input filter to set 1.5 ms or 10 ms of parameter 'Input Filter'. When input turns ON over the set time, it recognizes as normal signal input.

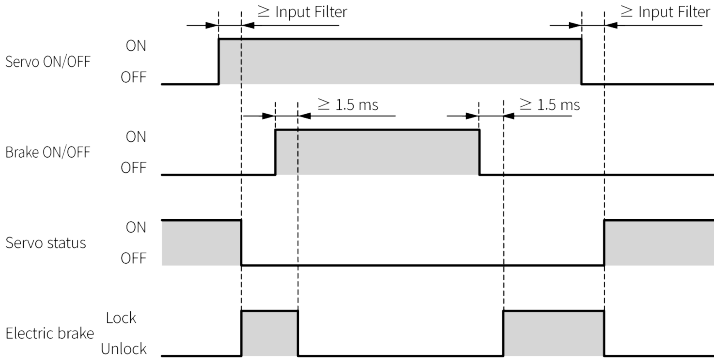
02) It is voltage level to recognize input signal as ON. It is available to set each input. (however, reset is fixed as [L].) e.g.) [H]: photocoupler power ON, it recognizes as ON, [L]: photocoupler power OFF, it recognizes as ON

03) Brake ON/OFF function can be switched in built-in brake type.

9.1.3.1. Brake ON/OFF

The 'Select IN8/BRAKE' parameter setting is available to select IN8 input as general input or 'Brake ON/OFF'.

- Brake ON/OFF signal is ON: Brake is released
- Brake ON/OFF signal is OFF: Brake is lock



Brake ON/OFF is only available in Servo Off status. When servo is On, this function is disable for safety.

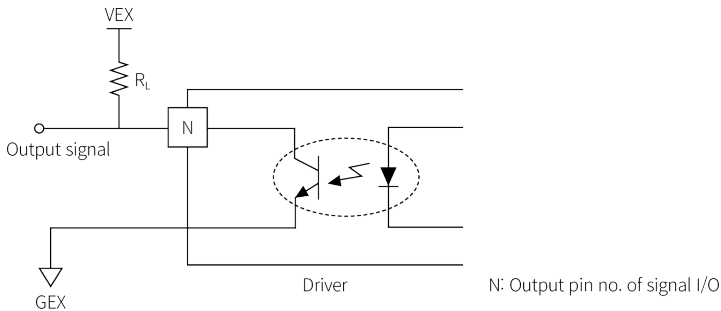
9.2. Output

9.2.1. Example of Output Circuit Connection

All output circuits are insulated with photocoupler.

External power input is available from 5 to 80 VDC with the open collector method. Select RL value that IC (collector current of secondary)of photocoupler to be around 10 mA.

$$R_L = \frac{VEX - 0.7 V}{0.01 A} \Omega$$



9.2.2. Dedicated output

Brake operation is only for built-in brake type.

Pin	Signal	Filter	Active ⁰¹⁾	Description
1	Brake +	-	-	Brake output (24VDC)
2 ⁰²⁾	Brake -	-	-	Brake output (GND)
23	In-Position	-	[L]	Drive ending pulse
38	Alarm	-	[H]	Alarm output
39	Compare1(Trig- ger)	-	[L]	Compare output 1
40	Comparer2(Trig- ger)	-	[L]	Compare output 2

01) It is voltage level to recognize input signal as ON. It is available to set each input. (however, reset is fixed as [L].) e.g.) [H]: photocoupler power ON, it recognizes as ON, [L]: photocoupler power OFF, it recognizes as ON

02) N.C for standard type motor.

9.2.2.1. In-Position

In-Position output is output condition of the positioning complete signal.

If the gap between target position and actual motor position is under in-position setting value, in-position output turns to ON and the in-position indicator turns ON.

In reverse, in-position output turns to OFF and the in-position indicator turns OFF.

For more accurate control, check the in-position output before operating the next one.

For more information, refer to 12.3.6, "In-Position".

9.2.2.2. Alarm / Warning

When alarm occurs the phase current of motor is blocked and output is OFF.

Depending on the alarm type, the power / warning indicator flashes.

In connected communication, alarm type can be checked in atMotion.

For more information, refer to 13, Protection Function.

9.2.2.3. Compare1, Compare2

It maintains the output by comparing the set position value with the current position value, or operates as a one-shot whenever these the set period is reached from the reference position.

For more information, refer to 12.3.12, "Compare".

Mode	Description
0	Not used
1	If the current position value is greater than or equal to the set position value, the output is maintained as ON.
2	If the current position value is less than or equal to the set position value, the output is maintained as ON.
3	Each time the set period is reached from the reference position, the output operates as one-shot ⁰¹⁾ .

01) One-shot: Output that occurs once for the time set by Pulse Width.

9.2.3. General output

It is general output at program mode.

It is used with OPC, OPT instruction.

(1) Standard type

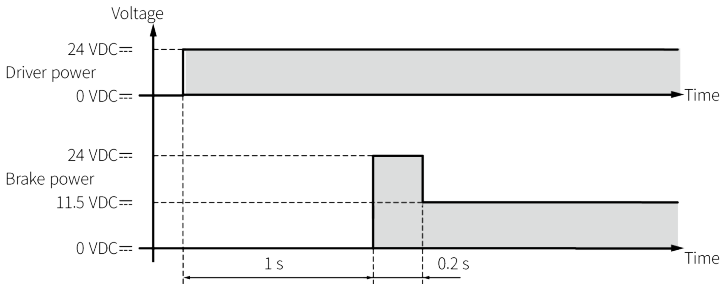
Pin	Signal	Description
41 to 50	OUT0 to OUT9	General output 0 to 9

(2) Built-in brake type

Pin	Signal	Description
41 to 49	OUT0 to OUT8	General output 0 to 8

9.2.3.1. Brake

In order to reduce heat in the brake, connected to the motor, the driver outputs DC power to turn off the brake.



When supplying power to the driver after connecting the driver and brake, the rated excitation voltage is supplied and the brake power is released after approx. 1 sec. Then after approx. 0.2 sec, the excitation voltage is decreased to 11.5 VDC and the released brake power is maintained.



While power is supplied to the driver, the brake is kept turning on, except in the Servo On status.

Chapter 10. Drive

There are 4 drive modes and position drive, home search operation.
It operates each drive mode by I/O input.

Drive mode	Description
Index mode	Designates and operates the one step among the saved instruction of the program
Jog mode	Outputs drive while instruction input signal is ON to \pm direction
Continuous mode	Starts drive output when instruction input signal turns ON once to \pm direction. Stops it when the signal turns stop.
Position drive	Outputs drive until the designated position is reached.
Program mode	Operates by the designated program.
Home search	Operates home search.

Drive mode comparison table

Drive mode	I/O signal control	atMotion control	Modbus comm.	Via Visual Studio ⁰¹⁾
Index mode	○	○	○	○
Jog mode	○	○	×	×
Continuous mode	○	○	○	○
Position drive	×	○	○	○
Program mode	○	○	○	○
Home search	○	○	○	○

01) For control drive via Visual Studio, refer to the library manual.



Do not operate instructions by I/O during communication between the driver and the PC (atMotion) (only monitoring is available.) It may cause malfunction due to double input.

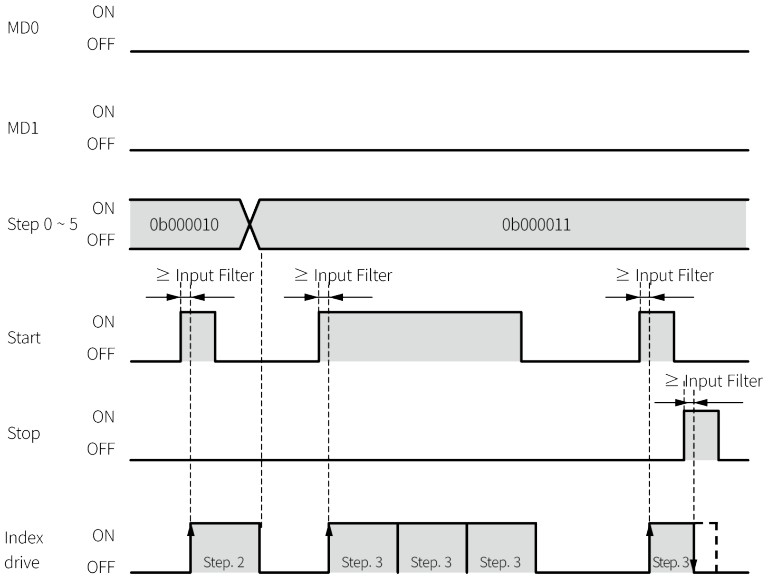
10.1. I/O Signal Control Drive

10.1.1. Index Drive

At index mode, it operates the one step of “ABS” or “INC” instruction from the program.

Drive method

1. Set drive mode: ‘MD0’ = 0, ‘MD1’ = 0 as index mode.
2. It is available to set the drive step number from 0 to 63 combining with “Step0” to ”Step5”.
3. When “Start” input signal turns ON, the designated one step operates.
4. It stops when one step is complete.
5. When “Stop” signal inputs, it stops emergently and index drive error alarm occurs.



When it sets as ‘Step0’=0, ‘Step1’=1, ‘Step2’=0, ‘Step3’=0, ‘Step4’=0, ‘Step5’=0 and ‘Start’ input signal turns ON, it operates program step 2. (Step0 = Least significant bit, Step5 = Most significant bit)



- Before operating index mode drive, the designated program step must have the instruction.

- The specified step operates repeatably if the “Start” signal is input continuously.



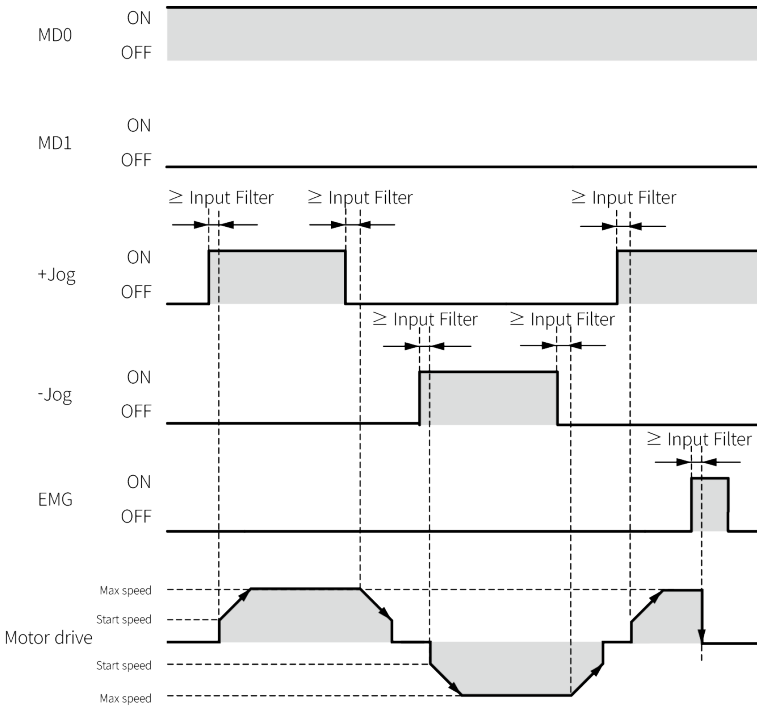
When driving the step which does not have “ABS” or “INC” instruction, Index drive error occurs.

10.1.2. Jog Drive

At jog mode, it operates motor to CW direction or CCW direction while “+Jog” or “-Jog” signal is ON.

Drive method

1. Set drive mode: ‘MD0’ = 1, ‘MD1’ = 0 as Jog mode.
2. Select start drive speed combining with “SSP0”, ”SSP1”.
3. Select max. drive speed combining with “MSP0”, ”MSP1”.
4. Drives to CW direction or CCW direction while “+Jog” or “-Jog” signal inputs.
5. When “EMG” signal inputs, it stops emergently.



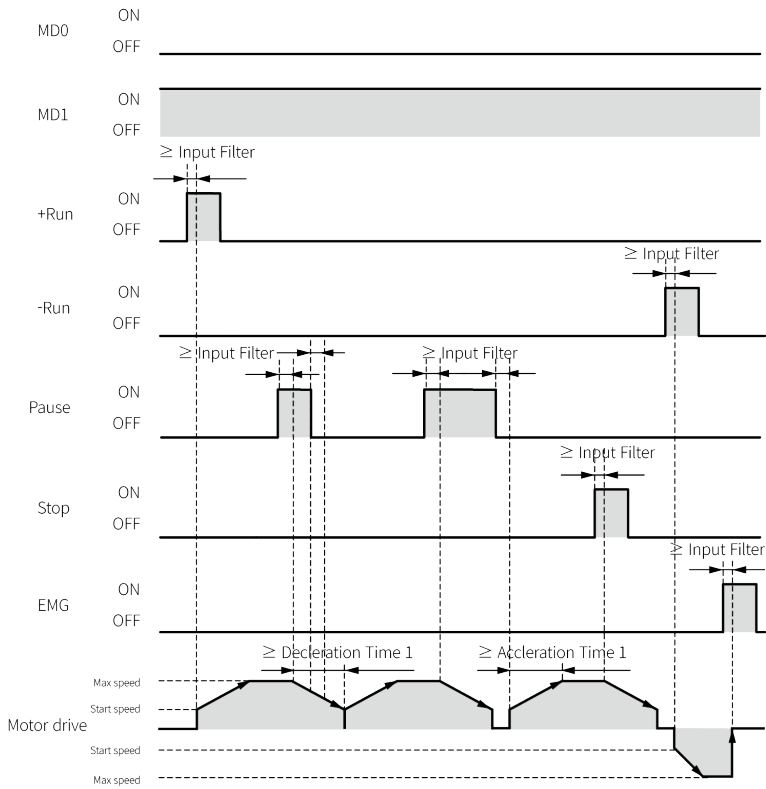
- If ‘+Jog’ and ‘-Jog’ signals are input at the same time, the motor stops.
- It cannot stop by “Stop” signal input.

10.1.3. Continuous Drive

At continuous mode, it operates motor continuously to CW direction or CCW direction while “+Run” or “-Run” signal is ON.

Drive method

1. Set drive mode: ‘MD0’ = 0, ‘MD1’ =1 as continuous mode.
2. Select start drive speed combining with “SSP0”, “SSP1”.
3. Select max. drive speed combining with ‘MSP0’, ‘MSP1’.
4. Drives to CW direction or CCW direction while “+Run” or “-Run” signal inputs.
5. It stops decelerately while the “Pause” signal is input, and continuously operates when the “Pause” signal is released.
6. It stops when “Stop” signal is input or limit signal in the moving direction is input.
7. When “EMG” signal inputs, it stops emergently.



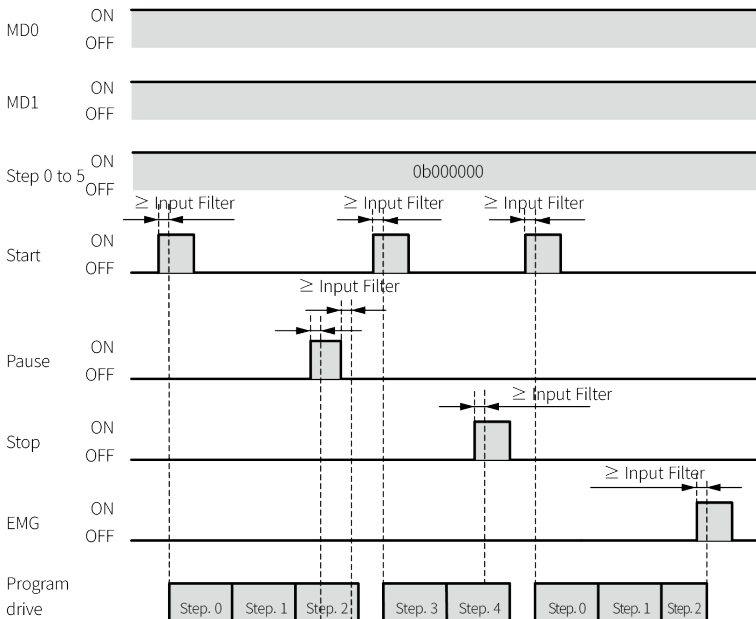
If the "Pause" signal is released before the deceleration stop is completed, the continuous mode operation starts immediately after the stop.

10.1.4. Program Drive

At program mode, it operates the designated program from pre-selected step to 255-step sequentially.

Drive method

1. Set drive mode: 'MD0' = 1, 'MD1' = 1 as program mode.
2. Set start step among 0 to 63 combining with 'Step0' to 'Step5'.
3. When "Start" input signal turns ON, it drives according to the set program.
4. When "Pause" signal inputs, it pauses after completing the step. When "Start" signal inputs again, it drives from the completed next step.
5. When "Stop" signal inputs, it stops after completing the step. When "Start" signal inputs again, it drives from the first step.
6. When "EMG" signal inputs, it stops emergently.
7. When "END" signal inputs, program mode drive is end.



- In order to execute program mode operation, the program must be saved in advance.

- When “Power On Program Start” parameter is Enable, it operates program mode drive when resupplying power.



For end of program mode, “END” signal must be input. If there is no “END” instruction input, Program drive error occurs.

10.1.5. Home Search

When "HOME" signal inputs, it operates home search drive combining with 'HMD0', 'HMD1'.
For more information, refer to 12.2, "Home Search".

Drive method

1. Set home search mode combining with "HMD0", "HMD1".
2. When "HOME" signal inputs, it operates home search according to the set mode.
3. When "STOP" signal inputs or limit signal of the direction inputs, it stops.
4. When "EMG" signal inputs, it stops emergently.

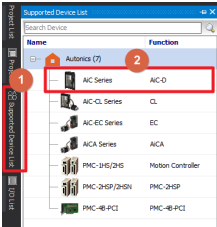


If the parameter "Power On Home Search" is set as Enable and the power is applied, Home search mode operates automatically.

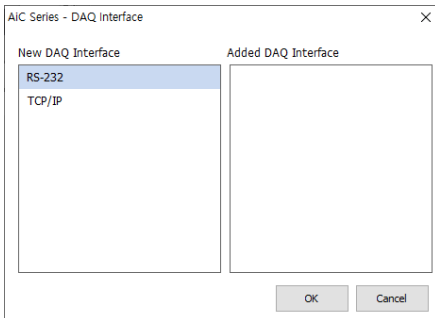
10.2. atMotion Control Drive

atMotion run and setting

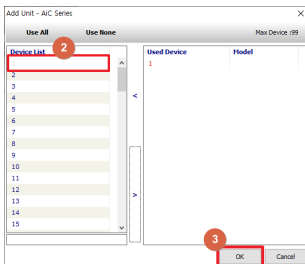
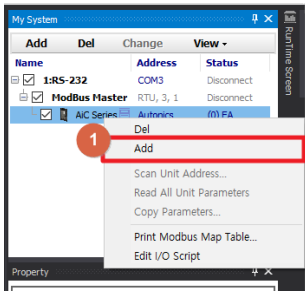
1. Visit our website (www.autonics.com) to download and install newest version of 'atMotion'.
2. Run 'atMotion' which is installed on PC.
3. On the left side, select ① 'Supported Device List' - ② 'AiC Series'.



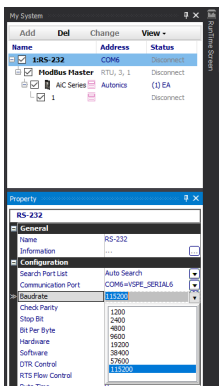
4. Set communication method as 'RS-232' at New DAQ interface.



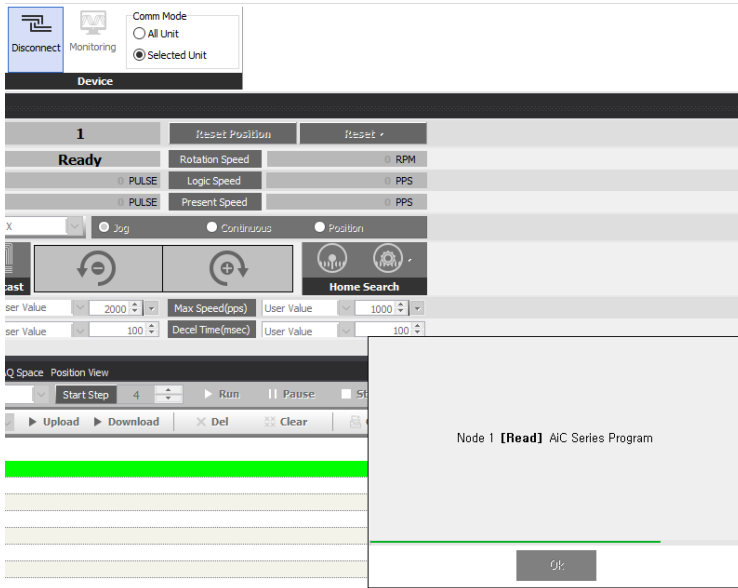
- Right click the newly added device on 'My System' then click ① 'Add'.
When ② 'Add Unit' window displays, double click the device list or click the arrow, placed in the middle of the window, to create node number then select ③ 'OK'.



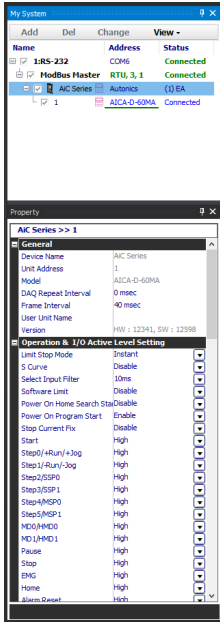
- Select 'RS-232' on the right side of the window, set the communication port, and baud rate for the connected device.








7. Click 'Connect' on the upper side of the window to connect the communication.





8. To make sure the communication is connected properly, check the 'My System' items on the right side of the window to figure out the device node setting.





10.2.1. Jog Mode

Motion Control					
Select Node	1	Reset Position	Reset		
Running Status	Ready	Rotation Speed	0 RPM		
Logic Position	0 PULSE	Logic Speed	0 PPS		
Present Position	0 PULSE	Present Speed	0 PPS		
Axis	X	<input type="radio"/> Jog	<input type="radio"/> Continuous <input type="radio"/> Position		
 EMG	 Broadcast		  Home Search		
Start Speed(pps)	User Value	2000	Max Speed(pps)	User Value	1000
Accel Time(msec)	User Value	100	Decel Time(msec)	User Value	100

Jog mode operates the motor in CW or CCW direction by clicking  or  button.

Drive method

1. Select 'Jog' on Motion Control – mode selection box.
2. Set the 'Start Speed', 'Max Speed', 'Accel Rate', 'Decel Rate' value for jog mode.
3. Motor begins to operate to designated direction by clicking  or  button.
4. Operation stops by releasing the button.





Start Speed, Max Speed, Accel Rate and Decel Rate can be loaded from the saved value without entering these values.

10.2.2. Continuous Mode




Motion Control			
Select Node	1	Reset Position	Reset ▾
Running Status	Ready	Rotation Speed	0 RPM
Logic Position	0 PULSE	Logic Speed	0 PPS
Present Position	0 PULSE	Present Speed	0 PPS
Axis	X ▾	<input type="radio"/> Jog	<input checked="" type="radio"/> Continuous
<input type="checkbox"/> EMG	<input type="checkbox"/> Broadcast	<input type="checkbox"/> Home Search	<input type="checkbox"/> Home Search
Start Speed(pps)	User Value ▾ 2000 ▾	Max Speed(pps)	User Value ▾ 1000 ▾
Accel Time(msec)	User Value ▾ 100 ▾	Decel Time(msec)	User Value ▾ 100 ▾

Continuous mode outputs pulse continuously in the designated direction until stop command from upper level or stop signal from outside. Continuous mode and home search mode is applicable for this function.

Stop commands include deceleration stop and immediate stop. Deceleration stop is operated when final operation speed is lower than the initial operation speed or in all cases except for reset or emergency stop.

Continuous mode operates the motor continuously in CW or CCW direction by clicking  or  button.

Drive method

1. Select 'Continuous' on Motion Control – mode selection box.
2. Set the 'Start Speed', 'Max Speed' value for continuous mode.
3. Motor begins to operate to designated direction by clicking  or  button.
4. Operation stops by clicking  button or when the designated direction limit signal is applied.






Start Speed, Max Speed, Accel Rate and Decel Rate can be loaded from the saved value without entering these values.

10.2.3. Position Mode

Motion Control					
Select Mode	1	Reset Position	Reset		
Running Status	Ready	Rotation Speed	0 RPM		
Logic Position	0 PULSE	Logic Speed	0 PPS		
Present Position	0 PULSE	Present Speed	0 PPS		
Axis	X	<input type="radio"/> Jog	<input type="radio"/> Continuous <input type="radio"/> Position		
EMG	Broadcast	<input type="button" value="←"/> <input type="button" value="→"/> <input type="button" value="↻"/>	Relative Positio <input type="text" value="0"/>		
Start Speed(pps)	User Value	2000	Max Speed(pps)	User Value	1000
Accel Time(msec)	User Value	100	Decel Time(msec)	User Value	100

atMotion provides 'relative position' and 'absolute position' control. Relative position control moves by the input pulse based on current position. Absolute position control moves by the input pulse based as the origin. The position value may change depending on the parameter 'Resolution' setting. Check the actual position displayed on the program screen to move the position.

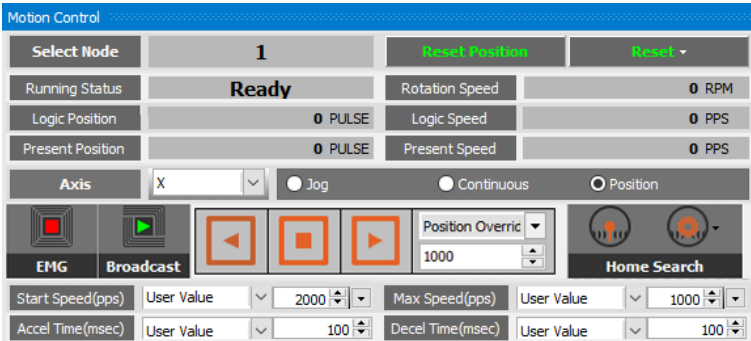
Drive method

1. Select 'Position' on Motion Control – mode selection box.
2. Set the 'Start Speed', 'Max Speed', 'Accel Rate', 'Decel Rate' value for position mode.
3. Select the position control method between 'Relative Position' and 'Absolute Position'.
4. After entering designated position value, select ,  ,  to input pulse value in the desired direction to move the position.
5. If the middle  button is clicked during the position moving, it does not reach the entered position and stops immediately by decelerating operation.



- Start Speed, Max Speed, Accel Rate and Decel Rate can be loaded from the saved value without entering these values.
- Recognize the position when the initial power is entered as the origin. To change the origin, run home search mode.
- To specify the current position as the origin, click the 'Reset Position' button to set as the origin

10.2.3.1. Position Override



atMotion provides 'Position Override' control.






Position override control moves by changing the target position without stopping operation during position mode.

The command must be executed before reaching the initial target position. When the initial target is reached, subsequent position override commands are not executed.

The position value may change depending on the parameter 'Resolution' setting.

Check the actual position displayed on the program screen to move the position.

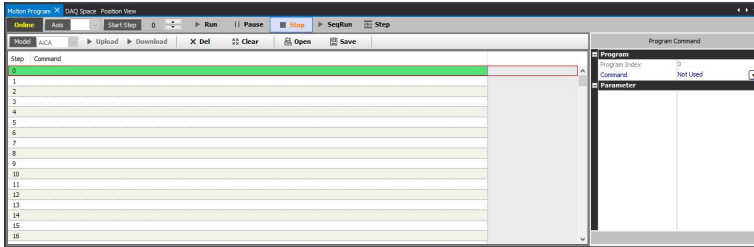
Drive method

1. Select 'Position' on Motion Control – mode selection box.
2. Set the 'Start Speed', 'Max Speed', 'Accel Rate', 'Decel Rate' value for position mode.
3. Select the position control method between 'Relative Position' and 'Absolute Position'.
4. After entering designated position value, select , ,  to input pulse value in the desired direction to move the position.
5. Before reaching the target position, switch control mode as position override and enter the desired position value, select , ,  to assign new target position.
6. If the middle  button is clicked during the position moving, it does not reach the entered position and stops immediately by decelerating operation.



If the position override operation is not available properly, the override warning occurs and the final target position is reached at the specified starting speed.

10.2.4. Program Mode



To end the program operation, 'END' command must be entered at the end of the step. Program mode error alarm will occur when the 'END' command is not entered.

There are 256 steps in range of 0 to 255.

If the parameter 'Power On Program Start' is set to 'Enable', it automatically executes the saved program operation sequentially at initial power on.

Drive method

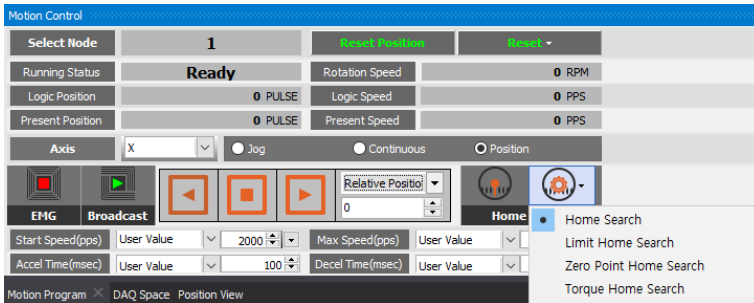
1. Enter the command at the desired step.
2. When step input is completed, click **SeqRun** button to execute program operation sequentially.
3. To start from a step other than step 0, select the step number from **Start Step** and click **Run** button.
4. Click **Pause** button to finish the active step and pause the motor. Click **Run** button to start the next step.
While Program mode is in pause, click **Stop** button will return to ready status.
5. Click **Stop** button to finalized and stop the active step. Click **Run** button to restart at the designated step.
6. When the program command 'END' reaches the entered step during program operation, the program operation is terminated.

For more information, refer to 11, Program Instructions.

To execute only one step, select the desired step and click **Step** button.



However, executing a step with a command other than 'ABS' or 'INC', or clicking **Stop** button during the step operation, Index mode error alarm will occur.

10.2.5. Home Search Mode



There are 4 types of home search mode can be executed; 'Normal', 'Limit', 'Zero' and 'Torque'. If the parameter 'Power On Home Search' is set to 'Enable', it automatically executes the home search mode from the time when the power is applied and motor alignment is completed. (However, Home search mode error alarm occurs when it is executed by zero point home search mode operation.)



Drive method

1. Click  button to select the home search operation mode.
2. Set the value of Start Speed, Max Speed, Accel Rate and Decel Rate for Home search mode.
3. Click  button to execute the home search operation.
4. When the home is found, the home search operation is completed.

10.2.5.1. Normal Home Search

Connect the external origin sensor to 'ORG' and receive the signal output from the sensor to designate as home.

Drive method

1. Click  button and select 'Home Search'.
2. Click  button to execute the home search operation.
3. When the operation is executed, the motor operates in the direction set in the parameter 'Home Search Direction'.
4. Operation starts according to the start speed set in the parameter 'Home Search Start Speed', and acceleration starts according to the acceleration time set in the parameter 'Home Search Acceleration Time'.
5. The constant speed operation is performed until a signal is input to the origin sensor 'ORG', when the maximum speed set in the parameter 'Home Search Max Speed' is reached.
6. If a signal is input to the limit sensor (\pm Limit) before the signal is input to the origin sensor 'ORG', after the deceleration stop, it operates in the opposite direction to find the origin.
7. When a signal is input to the origin sensor 'ORG', the motor decelerates and stops according to the deceleration time set in the parameter 'Home Search Deceleration Time'.
8. After stop, it moves to the opposite direction as far as the distance past the origin sensor at the start speed set in the parameter 'Home Search Start Speed' to find the origin sensor and stops.
9. When the origin found, the operation completion signal (In-Position) is output and the In-Position indicator lights to indicate the status.





- If a value other than 0 is set in the parameter 'Home Search Offset', it moves to the set position value after finding the home and outputs the operation completion signal (In-Position) and lights up in the In-Position indicator to display the status.
- If a value other than 0 is set in the parameter 'Home Search Position Set', the position specified after finding the home is set to the set value other than 0.
- In normal home search mode, Home search mode error alarm occurs if the ORG signal does not input until it reaches the opposite limit sensor past the limit sensor (\pm Limit).

10.2.5.2. Limit Home Search

Connect the external limit sensor to '±Limit' and receive the signal output from the sensor to designate as home.

If the parameter 'Software Limit' is set to 'Enable', the home search mode is available with Software ±Limit.

Drive method

1. Click  button and select 'Limit Home Search'.
2. Click  button to execute the home search operation.
3. When the operation is executed, the motor operates in the direction set in the parameter 'Home Search Direction'.
4. Operation starts according to the start speed set in the parameter 'Home Search Start Speed'; and acceleration starts according to the acceleration time set in the parameter 'Home Search Acceleration Time'.
5. The constant speed operation is performed until a signal is input to the limit sensor '±Limit' when the maximum speed set in the parameter 'Home Search Max Speed' is reached.
6. If a signal is input to the limit sensor (±Limit) or reaches to Software ±Limit, the motor decelerates and stops according to the deceleration time set in the parameter 'Home Search Deceleration Time'.
7. After stop, it moves to the opposite direction as far as the distance past the limit sensor at the start speed set in the parameter 'Home Search Start Speed' to find the limit sensor and stops.
8. When the home found, the operation completion signal (In-Position) is output and the In-Position indicator lights to indicate the status.



- If a value other than 0 is set in the parameter 'Home Search Offset', it moves to the set position value after finding the home and outputs the operation completion signal (In-Position) and lights up in the In-Position indicator to display the status.
- If a value other than 0 is set in the parameter 'Home Search Position Set', the position specified after finding the origin is set to the set value other than 0.
- If the deceleration time is set long during deceleration and stop, it may collide with the structure, so the deceleration time should be set short or the limit sensor should be installed from the structure with sufficient margin.

10.2.5.3. Zero Point Home Search



Zero point home search operation can be performed by specifying zero point (absolute coordinate '0') as home.

To change the home position, use 'Reset Position'.

The zero point should be re-assigned since the zero point is also reset when reset or resupplying the power.

Home search mode error alarm occurs since the zero point is not assigned when use automatically execution by setting parameter 'Power On Home Search' is set to 'Enable'.

Drive method

1. Click  button and select 'Zero Point Home Search'.
2. Click  button to execute the home search operation.
3. When the operation is executed, the motor operates in the direction set in the parameter 'Home Search Direction'.
4. Operation starts according to the start speed set in the parameter 'Home Search Start Speed', and acceleration starts according to the acceleration time set in the parameter 'Home Search Acceleration Time'.
5. The constant speed operation is performed when the maximum speed set in the parameter 'Home Search Max Speed' is reached.
6. As closer to home (zero point), the motor decelerates and stops according to the deceleration time set in the parameter 'Home Search Deceleration Time'.
7. When the home found, the operation completion signal (In-Position) is output and the In-Position indicator lights to indicate the status.





- If a value other than 0 is set in the parameter 'Home Search Offset', it moves to the set position value after finding the home and outputs the operation completion signal (In-Position) and lights up in the In-Position indicator to display the status.
- If a value other than 0 is set in the parameter 'Home Search Position Set', the position specified after finding the origin is set to the set value other than 0.

10.2.5.4. Torque Home Search

If there is no home sensor and limit sensor, home search mode can be executed by contact with a specific instrument.

If the torque value is output as much as the value set in the parameter 'Home Search Torque' after contacting a specific device, the position that has moved in the opposite direction by the position value set in the parameter 'Home Search Offset' is designated as the origin.

Drive method

1. Click  button and select 'Torque Home Search'.
2. Click  button to execute the home search operation.
3. When the operation is executed, the motor operates in the direction set in the parameter 'Home Search Direction'.
4. Operation starts according to the start speed set in the parameter 'Home Search Start Speed'; and acceleration starts according to the acceleration time set in the parameter 'Home Search Acceleration Time'.
5. The constant speed operation is performed until contact is made with a specific instrument.
6. Stops when the load is applied as the torque value set in the parameter 'Home Search Torque' by contacting a specific instrument.
7. After stop, it moves to the opposite direction as far as the distance past the limit sensor at the start speed set in the parameter 'Home Search Start Speed' and stops.
8. The operation completion signal (In-Position) is output and the In-Position indicator lights to indicate the status.



If a value other than 0 is set in the parameter 'Home Search Position Set', the position specified after finding the origin is set to the set value other than 0.

10.3. Modbus Communication Control Drive

Set the operation value at the operation status group and turn ON the desired command at the operation command group via Modbus communication to control drive.

You can check the total Mapping Table at the communication manual.

10.3.1. Continuous Drive

Drive Method

1. Set the operation status group

: Set the start speed, final speed, acceleration time, deceleration time of the operation status group.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400003 (0002)	Start speed H	Setting initial value of resupplying power
400004 (0003)	Start speed L	
400005 (0004)	Final speed H	
400006 (0005)	Final speed L	
400007 (0006)	Acceleration time	
400008 (0007)	Deceleration time	

2. Continuous CW or CCW operation command

: If +Run is ON, it operates in CW, and if -Run is ON, it rotates in CCW at the operation command group.

: It stops when immediate stop or decelerating stop is turned on at the operation command group.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000016 (000F)	Step0/+Run/+Jog	CW operation	1: Run
000017 (0010)	Step1/-Run/-Jog	CCW operation	
000023 (0016)	Stop	Immediate stop	
000024 (0017)		Decelerating stop	

10.3.2. Position Drive

Drive Method

1. Set the operation status group

: Set the position to move, start speed, final speed, acceleration time, deceleration time of the operation status group.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400003 (0002)	Start speed H	Setting initial value of resupplying power
400004 (0003)	Start speed L	
400005 (0004)	Final speed H	
400006 (0005)	Final speed L	
400007 (0006)	Acceleration time	
400008 (0007)	Deceleration time	
400009 (0008)	Position to move H	Default: 0
400010 (0009)	Position to move L	

2. Move absolute position or Move relative position command

: When move absolute position is ON, it moves absolute position. When move relative position is ON, it moves relative position at the operation command group.

: If the decelerating stop of the operation command group is turned on during position move, it cannot reach the set position to move and immediately decelerates and stops.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000018 (0011)	-	Move absolute position	1: Run
000019 (0012)	-	Move relative position	
000023 (0016)	Stop	Immediate stop	
000024 (0017)		Decelerating stop	

10.3.2.1. Position Override

Drive Method

1. Set the operation status group

: Set position to move, start speed, final speed, acceleration time, deceleration time of the operation status group.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400003 (0002)	Start speed H	Setting initial value of resupplying power
400004 (0003)	Start speed L	
400005 (0004)	Final speed H	
400006 (0005)	Final speed L	
400007 (0006)	Acceleration time	
400008 (0007)	Deceleration time	
400009 (0008)	Position to move H	Default: 0
400010 (0009)	Position to move L	

2. Move absolute position or Move relative position command

: When move absolute position is ON, it moves absolute position. When move relative position is ON, it moves relative position at the operation command group.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000018 (0011)	-	Move absolute position	1: Run
000019 (0012)	-	Move relative position	
000023 (0016)	Stop	Immediate stop	
000024 (0017)		Decelerating stop	
000029 (001C)	-	Move position override	

3. Move position override command

: After entering the new target position value into Position to move of the operation status group, if the Move position override of the operation command group is turned on before reaching the target position, the position moves to the new target position.

: If the decelerating stop of the operation command group is turned on during position movement, the set position to move cannot be reached, and the operation decelerates immediately and stops.

10.3.3. Program Drive

Drive Method

1. Program command input
: Input program command to the desired step via atMotion.
2. Set the operation status group
: Set program start address of operation status group.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400011 (000A)	Program starting address	0 to 255

3. Program mode start command
:Set program mode start of the operation command group as ON to start program mode from the set start address.
: Set pause program mode of the operation command group as ON to pause after the step in operation is finished.
: Set end program mode of the operation command group as ON to stop after the step in operation is finished.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000021 (0014)	Start	Program mode start	1: Run
000025 (0018)	Pause	Pause program mode	
000026 (0019)	-	End program mode	

10.3.4. Home Search Drive

10.3.4.1. Home Search Drive

Drive Method

1. Set the operation status group

: Set home search command type setting of the operation status group as 0.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400012 (000B)	Home search command type setting	0 to 3

2. Set home search parameter group

: Set home search max. running speed, home search initial running speed, home search acceleration time setting, home search deceleration time setting, home search motor rotation direction of the home search parameter group.

Home search parameter group [Func: 03/06/16, R/W: R/W]: No. 405101 to No. 405200

No (Address)	Description	Set range	Unit
405051 (13BA)	Home search max. running speed	2 MSB (Most Significant Byte)	pps
405052 (13BB)	Home search max. running speed	2 LSB (Least Significant Byte)	pps
405053 (13BC)	Home search initial running speed	2 MSB (Most Significant Byte)	pps
405054 (13BD)	Home search initial running speed	2 LSB (Least Significant Byte)	pps
405055 (13BE)	Home search acceleration time setting	1 to 10,000	msec
405056 (13BF)	Home search deceleration time setting	1 to 10,000	msec
405057 (13C0)	Home search motor rotation direction	0: CW, 1: CCW	-

3. Home search mode start command

: Set home search mode start of the operation command group as ON to start general home search drive. It receives the external origin sensor (ORG) signal and completes home search drive.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000022 (0015)	Home	Home search mode start	1: Run

10.3.4.2. Limit Home Search

Drive Method

1. Set the operation status group

: Set home search command type setting of the operation status group as 1.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400012 (000B)	Home search command type setting	0 to 3

2. Set home search parameter group

: Set home search max. running speed, home search initial running speed, home search acceleration time setting, home search deceleration time setting, home search motor rotation direction of the home search parameter group.

Home search parameter group [Func: 03/06/16, R/W: R/W]: No. 405101 to No. 405200

No (Address)	Description	Set range	Unit
405051 (13BA)	Home search max. running speed	2 MSB (Most Significant Byte)	pps
405052 (13BB)	Home search max. running speed	2 LSB (Least Significant Byte)	pps
405053 (13BC)	Home search initial running speed	2 MSB (Most Significant Byte)	pps
405054 (13BD)	Home search initial running speed	2 LSB (Least Significant Byte)	pps
405055 (13BE)	Home search acceleration time setting	1 to 10,000	msec
405056 (13BF)	Home search deceleration time setting	1 to 10,000	msec
405057 (13C0)	Home search motor rotation direction	0: CW, 1: CCW	-

3. Home search mode start command

: Set home search mode start of the operation command group as ON to start limit home search drive. It receives the external limit sensor signal (\pm Limit) and completes home search drive.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000022 (0015)	Home	Home search mode start	1: Run

10.3.4.3. Zero Point Home Search

Drive Method

1. Set the operation status group

: Set home search command type setting of the operation status group as 2.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400012 (000B)	Home search command type setting	0 to 3

2. Set home search parameter

:Set home search max. running speed, home search initial running speed, home search acceleration time setting, home search deceleration time setting of the home search parameter group.

Home search parameter group [Func: 03/06/16, R/W: R/W]: No. 405101 to No. 405200

No (Address)	Description	Set range	Unit
405051 (13BA)	Home search max. running speed	2 MSB (Most Significant Byte)	pps
405052 (13BB)	Home search max. running speed	2 LSB (Least Significant Byte)	pps
405053 (13BC)	Home search initial running speed	2 MSB (Most Significant Byte)	pps
405054 (13BD)	Home search initial running speed	2 LSB (Least Significant Byte)	pps
405055 (13BE)	Home search acceleration time setting	1 to 10,000	msec
405056 (13BF)	Home search deceleration time setting	1 to 10,000	msec

3. Home search mode start command

: Set home search mode start of the operation command group as ON to start zero point home search. When the zero point is found, the home search drive is completed.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000022 (0015)	Home	Home search mode start	1: Run

10.3.4.4. Torque Home Search

Drive Method

1. Set the operation status group

: Set home search command type setting of the operation status group as 3.

Operation status group [Func: 03/06/16, R/W: R/W]: No. 400001 to No. 400050

No (Address)	Description	Set range
400012 (000B)	Home search command type setting	0 to 3

2. Set home search parameter

: Set home search max. running speed, home search initial running speed, home search acceleration time setting, home search deceleration time setting, home search torque setting of the home search parameter group.

Home search parameter group [Func: 03/06/16, R/W: R/W]: No. 405101 to No. 405200

No (Address)	Description	Set range	Unit
405051 (13BA)	Home search max. running speed	2 MSB (Most Significant Byte)	pps
405052 (13BB)	Home search max. running speed	2 LSB (Least Significant Byte)	pps
405053 (13BC)	Home search initial running speed	2 MSB (Most Significant Byte)	pps
405054 (13BD)	Home search initial running speed	2 LSB (Least Significant Byte)	pps
405055 (13BE)	Home search acceleration time setting	1 to 10,000	msec
405056 (13BF)	Home search deceleration time setting	1 to 10,000	msec
405063 (13C6)	Home search torque setting	20 to 100	%

3. Home search mode start command

: Set home search mode start of the operation command group as ON to start torque home search drive. When a load is applied as much as the set torque value, the home search drive is completed.

Operation command group [Func: 05, R/W: W]: No. 000011 to No. 000030

Broadcast available (except move position override)

No (Address)	I/O Pin	Description	Set range
000022 (0015)	Home	Home search mode start	1: Run

Chapter 11. Program Instructions

There are 14 program instructions as below table.

Type	Instruction	Description
Drive	ABS	Absolute position move
	INC	Relative position move
	HOM	Home search
Input/Output	ICJ	Input condition jump
	IRD	Input wait
	OPC	Output port ON/OFF
	OPT	Output port ON pulse
	CMP	Compare output
Program control	JMP	Jump
	REP	Repeat start
	RPE	Repeat end
	END	Program end
	POS	Position set
	TIM	Ready

11.1. Drive Instruction

11.1.1. ABS (absolute position move)

It is for moving to absolute position by a specified distance from home.

Instruction	DATA				
ABS	Instruction	Start speed	Max speed	Acceleration	Deceleration
	Position		S Curve	S Curve time	Continuation

For more information, refer to 12.1.1, “Fixed Pulse and Continuous Pulse Drive”.

Start speed (start drive speed)

- Select the start drive speed during drive.
- Set the start drive speed from 1 to 5.
- When selecting start speed as 6, it is available to set as the desired value.

Max speed (max. drive speed)

- Select the max. drive speed during drive.
- Set the max. drive speed from 1 to 5.
- When selecting max. speed as 6, it is available to set as the desired value.

Acceleration

- Set the acceleration time of drive.
- Set the acceleration time from 1 to 5.
- When selecting acceleration as 6, it is available to set as the desired value.

Deceleration

- Set the deceleration time of drive.
- Set the deceleration time from 1 to 5.
- When selecting deceleration as 6, it is available to set as the desired value.

Position

- Moving position inputs as absolute value.
- In case of “Present position–Moving position > 2,147,483,647” or “Present position–Moving position < -2,147,483,648”, it is out of range to move and program mode error occurs.

S Curve

- Set use/not use of S-curve acceleration/deceleration.
 - Enable = Use S-curve acceleration/deceleration

- Disable = Not use S-curve acceleration/deceleration

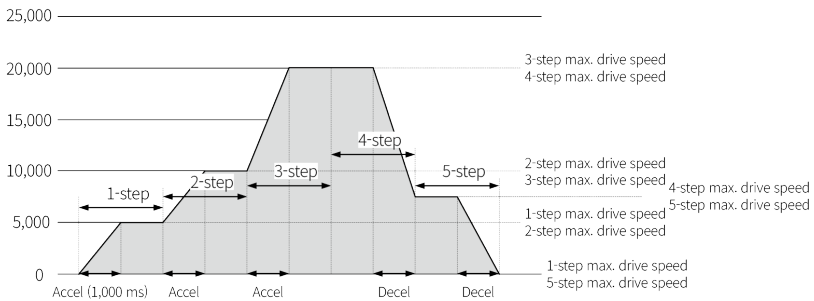
S Curve Time

When using S curve, set the S-curve acceleration/deceleration time.

Continuation

It drives continuously removing acceleration/deceleration time of each step at program mode.
Set the use/not use continuation.

- Enable = Use Continuation
- Disable = Not use Continuation



Step	Acceleration time (ms)	Deceleration time (ms)	Start drive speed(pps)	Max. drive speed (pps)
1	1,000	0	500	5,000
2	1,000	0	5,000	10,000
3	1,000	0	10,000	20,000
4	0	1,000	7,000	20,000
5	0	1,000	0	7,000



- For the step with acceleration, set deceleration time as 0 ms.
- For the step with deceleration, set acceleration time as 0 ms.

11.1.2. INC (relative position move)

It is for moving to relative position by a specified distance from current position.

Instruction	DATA				
	INC	Instruction	Start speed	Max speed	Acceleration
Position		S Curve	S Curve time	Continuation	

For more information, refer to 12.1.1, “Fixed Pulse and Continuous Pulse Drive”.

Start speed (start drive speed)

- Select the start drive speed during drive.
- Set the start drive speed from 1 to 5.
- When selecting start speed as 6, it is available to set as the desired value.

Max speed (max. drive speed)

- Select the max. drive speed during drive.
- Set the max. drive speed from 1 to 5.
- When selecting max. speed as 6, it is available to set as the desired value.

Acceleration

- Set the acceleration time of drive.
- Set the acceleration time from 1 to 5.
- When selecting acceleration as 6, it is available to set as the desired value.

Deceleration

- Set the deceleration time of drive.
- Set the deceleration time from 1 to 5.
- When selecting deceleration as 6, it is available to set as the desired value.

Position

- Moving position inputs as relative position value.
- Moving range for input is -2,147,483,648 to 2,147,483,647.

S Curve

Set use/not use of S-curve acceleration/deceleration.

- Enable=Use S-curve acceleration/deceleration
- Disable=Not use S-curve acceleration/deceleration

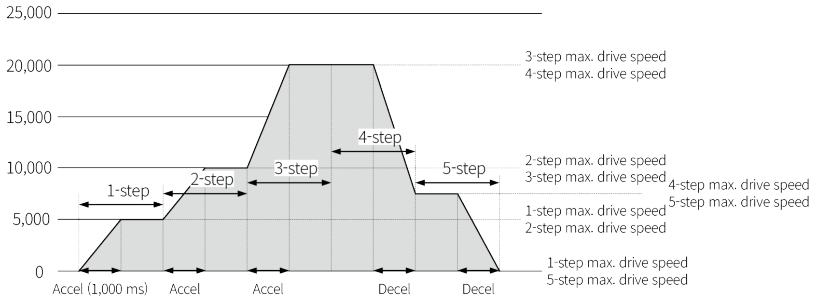
S Curve Time

When using S curve, set the S-curve acceleration/deceleration time.

Continuation

It drives continuously removing acceleration/deceleration time of each step at program mode.
Set the use/not use continuation.

- Enable=Use continuation
- Disable=Not use continuation



Step	Acceleration time (ms)	Deceleration time (ms)	Start drive speed(pps)	Max. drive speed (pps)
1	1,000	0	500	5,000
2	1,000	0	5,000	10,000
3	1,000	0	10,000	20,000
4	0	1,000	7,000	20,000
5	0	1,000	0	7,000



- For the step with acceleration, set deceleration time as 0 ms.
- For the step with deceleration, set acceleration time as 0 ms.

11.1.3. HOM (home search)

It is for home search according to the set parameter of Home Search Mode (Home search mode).
For more information, refer to 12.2, “Home Search”.

Instruction	DATA
HOM	Instruction

11.2. Input/Output Instruction

11.2.1. ICJ (input condition jump)

It is for jumping to the set step (Step No.) when the selected input port is activated.

When the input port is deactivated, it runs the next step.

Instruction	DATA		
ICJ	Instruction	Step No.	Input port

Step No.

Set the step number to jump. Setting range is 0 to 255.

Input port

Select Input port number.

For more information of input port number, refer to 9.1.3, “General input”.



At the loop between REP, RPE instruction, do not use ICJ (Input condition jump).

11.2.2. IRD (input wait)

It is for moving the next step when the selected input port is activated.

When the input port is deactivated, it waits at the current step until the active status.

Instruction	DATA	
IRD	Instruction	Input port

Input port

Select the input port number.

For more information of input port number, refer to 9.1.3, “General input”.

11.2.3. OPC (output port ON/OFF)

It turns ON/OFF the selected output port.

Instruction	DATA		
OPC	Instruction	Output port	Level

Output port

Output port: Select the output port number.

For more information of output port number, refer to 9.2.3, “General output”.

Level

When setting as Enable, it turns ON. When setting as Disable, it turns OFF

11.2.4. OPT (output port ON pulse)

It turns the set output port ON during the set ON time.

Instruction	DATA			
OPT	Instruction	On Time	Output port	Next step

On Time

Set the ON time for output port.

Setting range is 1 to 10,000 msec.

Output port

Set the output port number.

For more information about output port number, refer to 9.2.3, “General output”.

Next step

- ON: It moves to the next step regardless of output operation.
- OFF: It turns the set output port ON during the set ON time. After the time, it moves to the next step.

11.2.5. CMP (compare output)

It outputs trigger pulse for the set period.

For more information, refer to 9.2.2.3, “Compare1, Compare2”.

Instruction	DATA					
CMP	Instruction	Pos	Port	Mode	Width	Period

Position

Set the trigger position of output signal.

Setting range is -2,147,483,648 to 2,147,483,647.

Compare Port

Set the compare output port number.

Compare Mode

Set the compare output mode.

Pulse Width

Set the output pulse width.

Applied when compare mode is 3. Setting range is 1 to 1,000 msec.

Pulse Period

Set the output pulse period.

Applied when compare mode is 3. Setting range is 1 to 2,147,483,647.

11.3. Program Control Instruction

11.3.1. JMP (jump)

It jumps to the designated step (Step No.).

Instruction	DATA	
JMP	Instruction	Step No.

Step No.

Set the step number to jump. Setting range is 0 to 255.



- When using JMP instruction, be sure to the position of END instruction.
- At the loop between REP, RPE instruction, do not use JMP (jump).

It sets the position value.

Instruction	DATA	
POS	Instruction	Position

Position

Set the position value. Setting range is -2,147,483,648 to +2,147,483,647.

11.3.6. TIM (ready)

It is ready instruction for the set time.

Instruction	DATA	
TIM	Instruction	Delay Time

Delay Time

Set the wait time as msec. Set the Delay Time level from 1 to 5.

When selecting Delay Time level as 'User Value', it is available to set as the desired value in the range of 1 to 10,000 msec.

Chapter 12. Driver Function

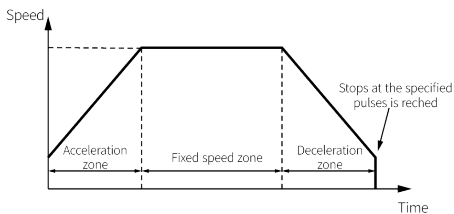
12.1. General Drive

12.1.1. Fixed Pulse and Continuous Pulse Drive

Drive pulse output on each axis is basically in CW/CCW directions by drive instruction of a fixed or continuous pulse.

12.1.1.1. Fixed Pulse Drive

Fixed pulse drive is used to move something a fixed amount. It operates fixed speed or acceleration/deceleration drive for a specified number of output pulses. Acceleration/Deceleration fixed pulse drive starts to reduce speed when remaining output pulse is less than the pulse used for acceleration. It ends drive when it finishes generating pulse, as shown in the image below.



Absolute position movement and relative position movement

There are absolute position movement and relative position movement. These are fixed pulse drive.

(1) Absolute Position Move

Absolute position movement drives from home to the position of a specified distance.

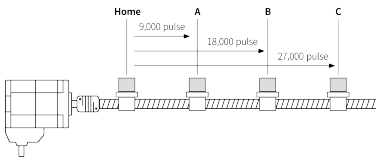
This is ABS command in program mode.

Absolute position movement

Absolute position move is a command based on home.

For example, if the command moving 9,000 pulse for 3 times using the Absolute Position Move (ABS), it arrives to the point A in the diagram below.

Absolute Position Move (ABS) command must be set each 9,000/18,000/27,000 pulse to reach A, B, C points in the diagram below.



(2) Relative Position Move

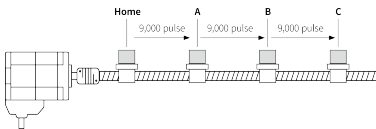
Relative position movement sets a distance to drive from present coordinates.

This is INC of program mode.

Relative position movement

Relative position move is as the diagram below.

For example, if the command moving 9,000 pulse for 3 times using the Relative Position Move (INC), it arrives to the point A, B, C sequentially in the diagram below.



12.1.1.2. Continuous Drive

Continuous pulse drive outputs drive pulse sequentially until the stop command from the high level or external stop signal becomes active. Continuous mode and home search mode are in this category.

Decelerating stop and immediate stop are in stop instruction. Slow stop is applied in almost every case except when drive speed is lower than start speed, reset and emergency stop.

12.1.2. Speed Curve (Curve)

Drive pulse output of each axis operates by CW direction, CCW direction fixed pulse drive instruction or continuous drive instruction. It can also operate speed curve of fixed speed, trapezoidal acceleration/deceleration, S-curve acceleration/deceleration by operation mode setting or parameter.

12.1.2.1. Constant Speed Drive

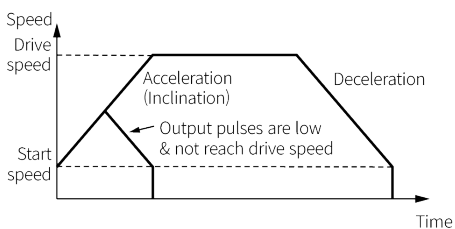
Constant speed drive outputs pulse at a constant speed.

When the start drive speed and the max. drive speed are set as same value or the acceleration or the deceleration time is set as 0, it operates constant speed drive without acceleration/ deceleration.

This max. drive speed settings should be higher than or same as start drive speed.

12.1.2.2. Symmetric Trapezoidal Acceleration/Deceleration Drive

- Trapezoidal acceleration/deceleration drive accelerates from start speed to drive speed trapezoids with an inclination of the designated acceleration.
- Set acceleration/deceleration time as msec at “Acceleration Time 1 to 5”, “Deceleration Time 1 to 5” parameter.
- It counts the pulses consumed while accelerating to a specified drive speed, and starts decelerating when the remaining output pulse becomes less than accelerating pulse. This decelerating drive reduces speed to start speed with specified acceleration. In continuous pulse drive, it decelerates to start speed when the stop signal is activated, and stops immediately when it reaches start speed.



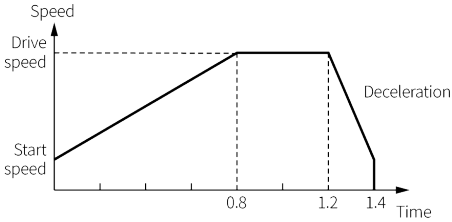
- When speed override operates during constant speed drive, the set acceleration/deceleration time is changeable.
- For continuous drive or jog drive by I/O, acceleration/deceleration time is set at “Acceleration Time 1”, “Deceleration Time 1”.
- When it arrives with not the max. drive speed at the target position due to long acceleration time and short command position, acceleration time may be changed.

12.1.1.3. Asymmetric Trapezoidal Acceleration/Deceleration Drive

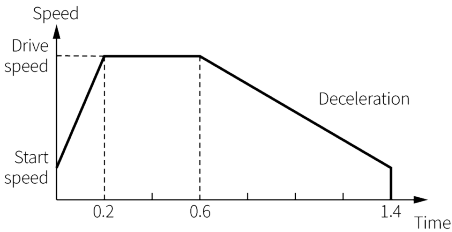
It is available as asymmetric trapezoidal acceleration/deceleration drive which is different between acceleration speed and deceleration speed.

For moving the object to the vertical direction such as stacking device of semiconductor wafer, the gravity acceleration speed is added to the object and acceleration speed and deceleration speed for up/down movement should be different.

In this case, it operates asymmetric trapezoidal acceleration/deceleration drive.



When deceleration speed is higher than acceleration speed,

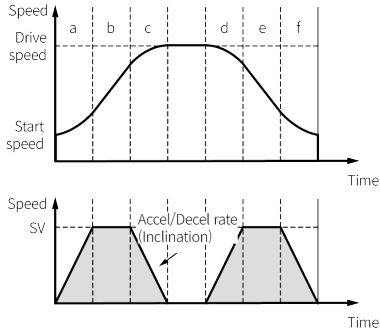


When acceleration speed is higher than deceleration speed

12.1.2.4. S Curve (S-curve acceleration/deceleration)

S curve generates an S shape speed curve according to linear increase/decrease of drive acceleration/deceleration. It smoothly increases and reduces speed when starting and stopping, and helps achieve smoother operation.

- a, b, c = Acceleration Time
- d, e, f = Deceleration Time
- S curve occurs at the a, c, d, f zones during the set “S Curve Time”.
- When “S Curve Time” is set the half of “Acceleration Time (=Deceleration Time)”, it operates S curve without b, e (trapezoidal zone).

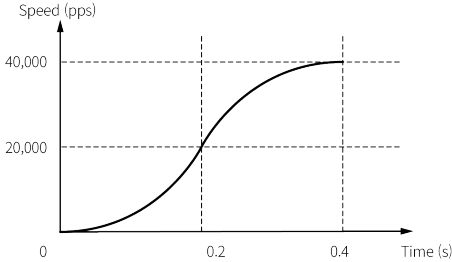


Precautions for S curve acceleration/deceleration drive

- In a fixed pulse S curve acceleration/deceleration drive, you cannot change speed while driving.
- At S-curve acceleration/deceleration fixed pulse drive, “S Curve Time (S-curve acceleration/deceleration time)” is set 1/2 of “Acceleration Time (=Deceleration Time)”.
If it is set over 1/2, the drive pulse ends during deceleration before arriving the start drive speed or it outputs the left drive pulses as start drive speed and does not stop even though arriving the start drive speed.
- During S curve operation, acceleration/deceleration time should be set as same. If it is set differently, deceleration time is set same as acceleration time.

Example of S-curve acceleration/deceleration parameter setting (full S-curve acceleration/deceleration)

This example is S-curve acceleration with start drive speed 0 pps and max. drive speed 40 kpps during 0.4 sec. For full S-curve acceleration drive without trapezoidal zone, set the “S Curve Time” as 0.2 sec which is half of acceleration time.



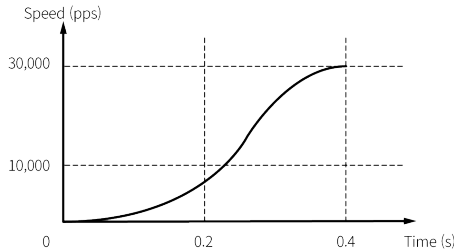
1. Start drive speed as 0 is ignored.
2. This is full S-curve acceleration. During 0.2 sec, it drives trapezoidal acceleration up to 20,000 pps.
3. At the left 0.2 sec, it drives trapezoidal deceleration up to 40,000 pps.

For each setting value of parameters and descriptions, refer to the below table.

Parameter	SV	Description
Acceleration Time (acceleration time)	4000 ms	For S-curve drive, acceleration/deceleration time should be same.
Deceleration Time (deceleration time)	4000 ms	
S Curve Time (S-curve accel/decel time)	2000 ms	For S-curve drive without trapezoidal, it should be set the half of acceleration/deceleration time.
Start Speed (start drive speed)	0 pps	-
Max Speed (max. drive speed)	40000 pps	-

Example of S-curve acceleration/deceleration parameter setting (partial S-curve acceleration/deceleration)

This example is S-curve acceleration with start drive speed 0 pps and max. drive speed 40 kpps during 0.6 sec. Follow the below graph.



1. Start drive speed as 0 is ignored.
2. During 0.2 sec, it drives trapezoidal acceleration up to 10,000 pps.
3. During 0.2 to 0.4 sec, it maintains the certain acceleration speed up to 30,000 pps.
4. At the left 0.2 sec, it drives trapezoidal deceleration up to 40,000 pps.

For each setting value of parameters and descriptions, refer to the below table.

Parameter	SV	Description
Acceleration Time (acceleration time)	6000 ms	For S-curve drive, acceleration/deceleration time should be same.
Deceleration Time (deceleration time)	6000 ms	
S Curve Time (S-curve accel/decel time)	2000 ms	It applies start drive speed + S Curve Time and max. drive speed - S Curve Time.
Start Speed (start drive speed)	0 pps	-
Max Speed (max. drive speed)	40000 pps	-

Comparing S curve and Trapezoid acceleration/deceleration drive

Trapezoid acceleration/deceleration may cause problems at start and end points in a very sensitive system. When used for a system that must be heavy, fast and accurate, and acceleration sharply changes at start and end points, it is hard on the system. On the other hand, S curve smoothly increases acceleration at the start point and decreases it smoothly at the end point. Therefore S curve acceleration/deceleration is recommended for sensitive systems.



12.2. Home Search

It operates home search drive using “HOM” command during program mode drive.

If the parameter ‘Power On Home Search’ is set to ‘Enable’, it automatically executes the home search mode from the time when the power is applied.



“Stop” or “EMG” command make stop home search drive.
Home search drive is canceled when it stops.

12.2.1. General Home Search (Home Search Method = 0)

It operates home search by home sensor.

Assigns the home by receiving the output signal from the sensor by connecting external home sensor on exclusive input “ORG” (pin 21).

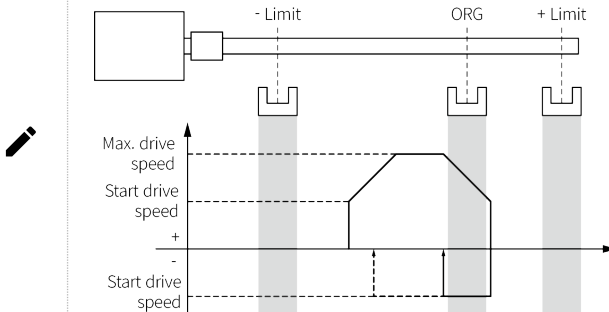
There are two types of general home search as below, it can be set by setting value in “Home search completion method” parameter.

Parameter	Setting range	Description
Home search completion method	0 : Home sensor OFF complete 1 : Home sensor ON complete	Factory default: 0

Home sensor OFF complete (Home search completion method: 0)

1. It operates home search drive to the set direction at “Home Search Direction”.
2. It starts drive with the set start drive speed at “Home Search Start Speed” and operates acceleration drive with the set acceleration time at “Home Search Acceleration Time”.
3. When acceleration drive is completed, it operates constant speed drive until “ORG (home sensor)” signal inputs with the set max. drive speed at “Home Search Max speed”.
4. If “ \pm Limit (\pm direction limit sensor)” signal inputs before “ORG (home sensor)” signal inputs, it decelerates and stops drive. The constant speed operation is performed until a signal is input to the origin sensor ‘ORG’, when the maximum speed set in the parameter ‘Home Search Max Speed’ is reached.
5. If “ORG (home sensor)” signal inputs, it decelerates with the set deceleration time at the “Home Search Deceleration Time” and stops.
6. After stops, it moves home sensor to the reverse direction for the passing distance from home with the set start drive speed at “Home Search Start Speed”, finds home sensor and stops when ORG (home sensor) signal is OFF.
7. After finding home, “In-Position” signal outputs and the “INP. indicator (orange)” turns ON.

When Home Search Offset is set a value other than 0, it moves at the set maximum drive speed and In-Position signal is ON and the INP. indicator (orange) turns ON.

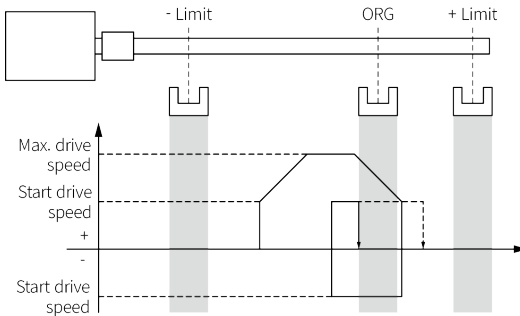


→ is when Home Search Offset is set a value other than 0.

Home sensor ON complete (Home search completion method: 1)

1. It operates home search drive to the set direction at “Home Search Direction”.
2. It starts drive with the set start drive speed at “Home Search Start Speed” and operates acceleration drive with the set acceleration time at “Home Search Acceleration Time”.
3. When acceleration drive is completed, it operates constant speed drive until “ORG (home sensor)” signal inputs with the set max. drive speed at “Home Search Max speed”.
4. If “ \pm Limit (\pm direction limit sensor)” signal inputs before “ORG (home sensor)” signal inputs, it decelerates and stops drive. The constant speed operation is performed until a signal is input to the origin sensor ‘ORG’, when the maximum speed set in the parameter ‘Home Search Max Speed’ is reached.
5. If “ORG (home sensor)” signal inputs, it decelerates with the set deceleration time at the “Home Search Deceleration Time” and stops.
6. After stops, it moves home sensor to the reverse direction for the passing distance from home with the set start drive speed at “Home Search Start Speed”, finds home sensor and stops when ORG (home sensor) signal is ON.
7. After finding home, “In-Position” signal outputs and the “INP. indicator (orange)” turns ON.

When Home Search Offset is set a value other than 0, it moves at the set maximum drive speed and In-Position signal is ON and the INP. indicator (orange) turns ON.



→ is when Home Search Offset is set a value other than 0.

12.2.2. Limit Home Search (Home Search Method = 1)

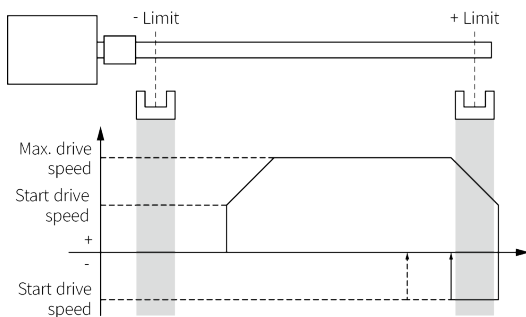
It operates home search by limit sensor.

Assigns the home by receiving the output signal from the sensor by connecting external limit sensor on exclusive input “ \pm Limit” (pin 19 and 20)

Drive method

1. Limit Home Search Drive operates home search drive to the set direction at “Home Search Direction”.
2. It starts drive with the set start drive speed at “Home Search Start Speed” and operates acceleration drive with the set acceleration time at “Home Search Acceleration Time”.
3. When acceleration drive is completed, it operates constant speed drive until meeting the limit sensor with the set max. drive speed at “Home Search Max speed”.
4. When the \pm Limit (\pm direction limit sensor) signal is input, it stops immediately when the Instant mode is set to Limit Stop Mode setting, and when the Slow mode is set, it decelerates and stops according to the deceleration time set "Home Search Deceleration Time".
5. After stops, it moves to the reverse direction for the passing distance from limit sensor with the set start drive speed at “Home Search Start Speed”, finds limit sensor and stops.
6. After finding home, “In-Position” signal outputs and the “INP. indicator (orange)” turns ON.

When Home Search Offset is set a value other than 0, it moves at the set maximum drive speed and In-Position signal is ON and the INP. indicator (orange) turns ON.



→ is when Home Search Offset is set a value other than 0.

- For deceleration stop, set the deceleration time shortly. In case of long deceleration time, it may conflict with the structure.



- Install the limit sensor with the certain distance from the structure.

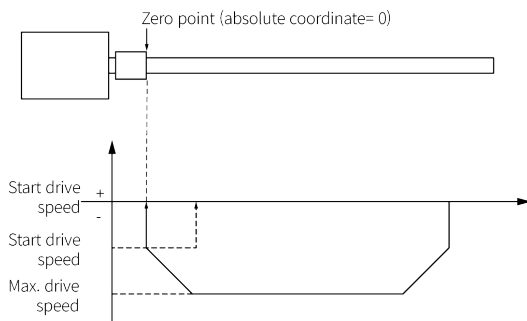
12.2.3. Zero Point Home Search (Home Search Method = 2)

It operates home search by zero point (absolute coordinate=0) when there is no home sensor, limit sensor.

Drive method

1. Set the zero (absolute coordinate=0) as home.
For changing home position, use the position reset. If changing zero position by I/O, move the zero to the desired position and supply “RESET” signal and it resets.
When reset or resupplying power, the zero point is also reset.
2. The set direction at “Home Search Direction” is ignored and it operates drive at the set home direction.
3. It starts drive with the set start drive speed at “Home Search Start Speed”, and it operates acceleration drive with the set acceleration time at “Home Search Acceleration Time”.
4. After acceleration drive is complete, it operates constant speed drive with the set max. drive speed at “Home Search Max speed”.
5. When it is close to home, it decelerates with the set deceleration time at “Home Search Deceleration Time” and it stops.
6. After finding home, “In-Position” signal outputs and the “INP. indicator (orange)” turns ON.

When Home Search Offset is set a value other than 0, it moves at the set maximum drive speed and In-Position signal is ON and the INP. indicator (orange) turns ON.



→ is when Home Search Offset is set a value other than 0.



If the parameter “Power On Home Search” is set as Enable and the power is applied, Home search mode error alarm will occur due to unassigned zero point.

12.2.4. Torque Home Search (Home Search Method = 3)

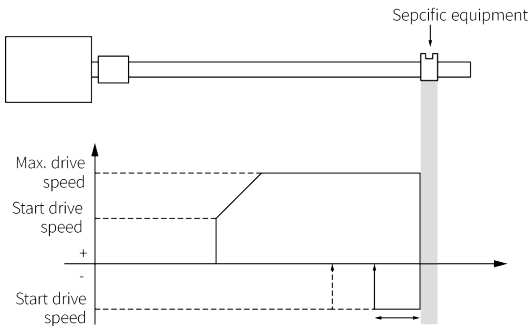
It operates home search by contact with the specific equipment when there is no home sensor, limit sensor.

When the torque value is output as much as the value set in the parameter “Home Search Torque” by contacting a specific object, assign the position moved by the value set in the parameter “Home Search Offset” as the home.

Drive method

1. Torque Home Search DriveIt operates home search drive to the set direction at “Home Search Direction”.
2. It starts drive with the set start drive speed at “Home Search Start Speed” and operates acceleration drive with the set acceleration time at “Home Search Acceleration Time”.
3. When acceleration drive is completed, it operates constant speed drive until contacting the specific equipment with the set max. drive speed at “Home Search Max speed”.
4. Then it contacts with the specific equipment, the current of motor is higher. It stops when the current of motor is same value as the set value at “Home Search Torque”.
5. After stops, it rotates and stops to the reverse direction with the start drive speed and rotation value set from atMotion.
“In-Position” signal outputs and the “INP. indicator (orange)” turns ON.

When Home Search Offset is set a value other than 0, it moves at the set maximum drive speed and In-Position signal is ON and the INP. indicator (orange) turns ON.



→ is when Home Search Offset is set a value other than 0.

12.3. Other Functions

12.3.1. Limit Operation

Hardware and software limits can be used to stop drive.

Hardware limit

Install a limit sensor to the machine to monitor system operation directly. Connect Nlmt+/- (Pin19, 20) at I/O connector (CN3).

Set Instant (instant stop) / Slow (deceleration stop) at Limit Stop Mode (limit Stop mode) of Operation Mode.

Software limit

Unlike the input of hardware limit signal by external sensor, this limit function is set using internal position data. To operate software limit, set software limit (software limit) as Enable. High and low limit values can be set the each axis separately at \pm software limit (\pm software limit) parameter.

Operation mode	SV	Parameter	SV
Software Limit	Enable	+Software Limit	100,000
		-Software Limit	-50,000

When the setting value is as above, the position value operates among -50,000 to 100,000 range. When it is out of the range, the drive decelerates and stops.



Hardware limit operates independently regardless of the software limit settings, and only hardware limit except limit home search is operated during home search.

12.3.2. Position Control Gain Setting

It is available to set responsiveness of motor to position instruction at the parameter. According to the motor load, set the gain for fast positioning and soft movement.

- P Gain: Adjusts vibration during drive
- I Gain: Adjusts vibration in acceleration/deceleration zone.
- The set gain value applies when motor stops.

Parameter	SV	P value (ratio)	I value (ratio)
Gain	0 (factory default)	1	1
	1	2	1
	2	3	1
	3	4	1
	4	5	1
	5	1	2
	6	2	2
	7	3	2
	8	4	2
	9	5	2
	10	1	3
	11	2	3
	12	3	3
	13	4	3
	14	5	3
15	User setting		

- When GAIN is set as 1,
P:I = 2:1 The set value is the ratio between P and I.
- When GAIN is set as 15,
user can set each GAIN value at the atMotion.



Parameter	Setting range	Unit
P Gain	0 to 7	0.001
I Gain	0 to 4	0.001



Speed Filter and PI GAIN can be set at the same time.

12.3.3. Stop Current

When it stops, set the stop current supplied at the motor phase to decrease motor heat and current consumption.

Factory default is 50% of max. run current. It is available to set at the parameter.

Parameter	Setting range	Unit	Unit value	Factory default
Stop Current	20 to 100	%	1	50

12.3.4. Stop Current Fix

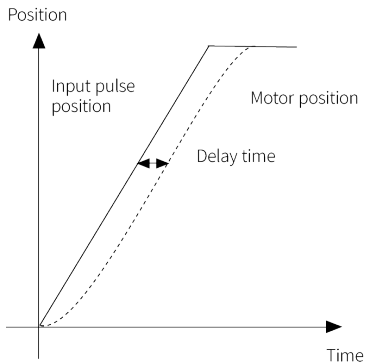
Set the stop current control method; Enable, Disable (factory default).

- Enable: Fixed stop current
It maintains stop current as the set value at the parameter.
- Disable: Setting stop current
It adjusts by stop current load and it is able to reduce over heat of motor.

12.3.5. Speed Filter

It is available to set motor drive response according to the instruction at the parameter.

Set the speed filter value for time delay between the command position and motor. It is able to drive softly even though load changing or disturbance occurs.



Parameter	Setting range	Value(ms)
Speed Filter	0	Disable
	1	2
	2	4
	3	6
	4	8
	5	10
	6	20
	7	40
	8 (factory default)	60
	9	80
	10	100
	11	120
	12	140
	13	160
	14	180
15	200	

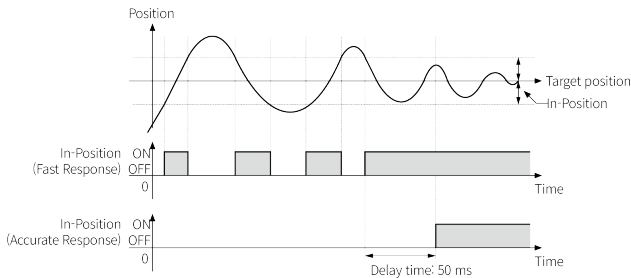
12.3.6. In-Position

In-Position output is output condition of positioning completion signal.

If the gap between target position and real position is under in-position setting value after position command pulse has finished, in-position output turns ON and the in-position indicator turns ON.

In reverse, in-position output turns OFF and the in-position indicator turns OFF.

- **Fast Response:** When gap between the target position and the current position is lower than the setting value, it outputs in-position signal immediately.
- **Accurate Response:** When gap between the target position and the current position is lower than the setting value and maintains over 50 ms, it outputs in-position signal.



Type	Setting range	Value
Fast Response	0 (factory default)	0
	1	± 1
	2	± 2
	3	± 3
	4	± 4
	5	± 5
	6	± 6
Accurate Response	7	± 7
	8	0
	9	± 1
	10	± 2
	11	± 3
	12	± 4
	13	± 5
	14	± 6
15	± 7	



For accurate control, check the in-position output before the next drive.

12.3.7. Servo OFF

‘Servo Off’ parameter setting is available to control servo status.

Setting	Description
Enable	The phase current is cut to the motor and torque is released
Disable	The phase current is supplied and torque is returned.



- For the safety reason, this is not available while motor is in operation.
- In case of brake motor, in Servo Off status, brake is locked. Brake is available to control by parameter setting. For more information, refer to 9.1.3.1, “Brake ON/OFF” or 12.3.8, “Brake OFF”.

12.3.8. Brake OFF

Brake is available to control at servo off status.

Setting	Description
Enable	Releases brake
Disable	Locks brake

12.3.9. Output Mode(Alarm)

In case of alarm occurring, it is selectable to general output signal is maintained or reset.

When ‘Output Mode(Alarm)’ parameter is set as Holding, it maintains general output signal or is set as Reset, it reset general output.

Setting	Description
Holding	Output maintained
Reset	Output reset



For emergency stop alarm, general output signal is reset regardless of ‘Output Mode(Alarm)’ setting.

12.3.10. Motor Direction

Sets the rotating direction of the motor during Jog and Continuous operation.

Even when the power is applied again, the motor will rotate in the direction set in the parameter “Motor Dir”.

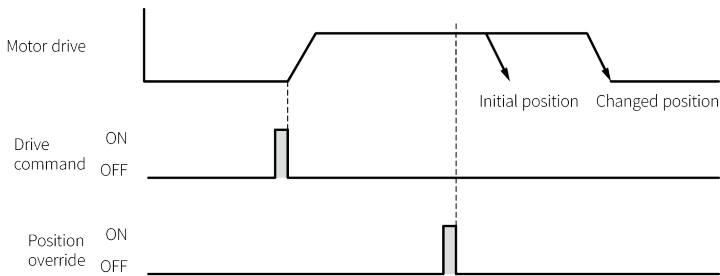
DIR setting	+Jog/+Run	-Jog/-Run
Forward	Rotates to CW direction	Rotates to CCW direction
Backward	Rotates to CCW direction	Rotates to CW direction

12.3.11. Position Override

Position override moves by changing the target position without stopping operation during position mode.

The command must be executed before reaching the initial target position. When the initial target is reached, subsequent position override commands are not executed.

The position value may change depending on the parameter ‘Resolution’ setting.



If the position override operation is not available properly, the override warning occurs and the final target position is reached at the specified starting speed.

12.3.12. Compare

It maintains the output by comparing the set position value with the current position value, or operates as a one-shot whenever these the set period is reached from the reference position.

Mode	Description
0	Not used
1	If the current position value is greater than or equal to the set position value, the output is maintained as ON.
2	If the current position value is less than or equal to the set position value, the output is maintained as ON.
3	Each time the set period is reached from the reference position, the output operates as one-shot ⁰¹⁾ .

01) One-shot: Output that occurs once for the time set by Pulse Width.

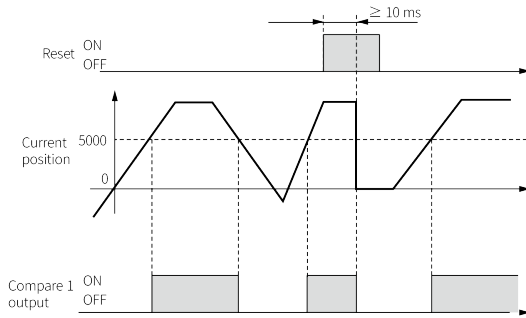
Compare1, Compare2 output mode setting is according to the 'Compare1 Mode' and 'Compare2 Mode' parameter settings.

Refer to the below table for each mode and parameters.

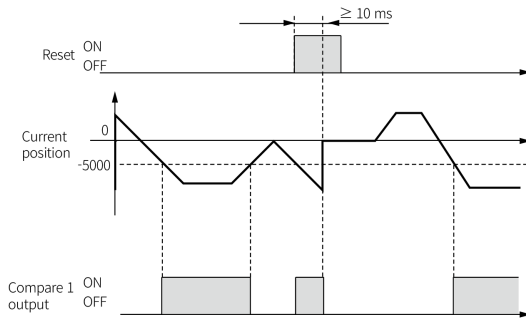
Mode	Parameter	Setting range	Unit	Description
1, 2	Compare1 Position	-2,147,483,648	pulse	Position value setting
	Compare2 Position	to 2,147,483,647		
3	Compare1 Period	1 to 2,147,483,647	pulse	Period setting
	Compare2 Period			
	Compare1 Pulse Width	1 to 1,000	msec	One-shot output time setting
	Compare2 Pulse Width			



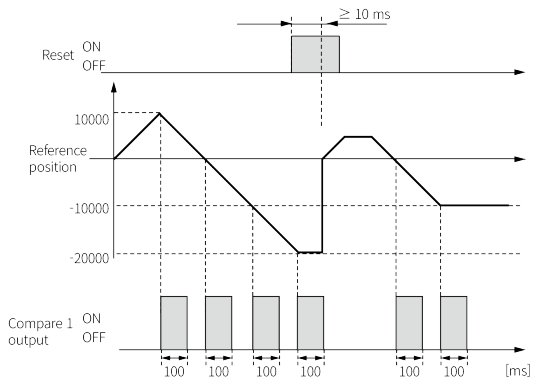
- During program mode drive operation, the compare output mode of the general mode is 0.
- Using program mode 'CMP' command, the parameter value is set within the command parameter value.
- Completed program mode, compare output mode is 0.



Compare 1 Mode = 1 / Compare 1 Position = 5000,



Compare 1 Mode = 2 / Compare 1 Position = -5000,



**Compare1 Mode = 3 / Compare1 Period = 10000 /
Compare1 Pulse Width = 100 ,**





The below conditions, Compare Mode 3 reference position is reset.

- Changing parameter 'Compare Mode' SV
- Changing parameter 'Compare Period' SV
- Run/Complete program mode drive
- Using program mode 'POS' command
- Reset the current position
- Complete home search
- Changing resolution

12.3.13. Power On Home Search

Power on home search automatically performs home search when power is supplied to the system or the system is reset by external input signal.

Parameter	Setting range	Factory default
Power On Home Search	Enable/Disable	Disable



- When you set power on home search to [Enable], home search related settings must be done separately. If you do not fully understand before starting this operation, it may cause fatal injury.
- Do not change [Power On Home Search] setting while in operation. Change in the main window after the operation is stopped. If it is enabled along with [Power On Program Start], the program automatically starts after home search is complete. However, this method is not stable, so set only one of two to [Enable]. If you need to use these two functions together, enable [Power On Program Start] and then set HOM (home search) command at the first step of the program.

12.3.14. Power On Program Start

Power On Program Start automatically operates registered programs when power is supplied to the system or the system is reset by external input signal.

Parameter	Setting range	Factory default
Power On Program Start	Enable/Disable	Disable



- When you use [Power On Program Start], use TIM (timer) command for the first step and set the command to be executed after a specified time. Using timer command is more stable than auto-starting the program immediately after power is turned ON.
- Do not change [Power On Program Start] setting while in operation. Change in the main window after the operation is stopped.
- Do not edit or change [Operation Mode] or [Parameter] section while the program is running by [Power On Program Start]. Change in the main window after stopping the program.
- If it is [Enabled] on [Power On home search], the program automatically starts after home search is complete. However, this method is not stable, so set only one of two to [Enable]. If you need to use these two functions together, enable [Power On Program Start] and then set HOM (home search) command at the first step of the program.

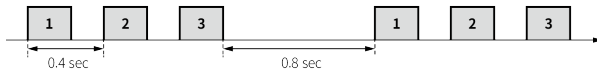
Chapter 13. Protection Function

13.1. Alarm

- This function stops motor to protect driver, depending on the error status such as over current or over speed.
- After removing the cause of alarm, re-supply power or apply the signal on Alarm Reset, the driver returns to the normal status.



- Depending on the alarm/warning type, it displays as a segment and indicator on the Alarm/Status display part.
When alarm/warning occurs, indicators flash with interval of 0.4 sec and turn OFF with interval of 0.8 sec until the alarm/warning is cleared.
<e.g.: alarm no. 3>



(1) Motor stops, torque releases and brake locks

Alarm descriptions are displayed by the number of flashes of the alarm indicator. The causes and measures to be taken are as follows.

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
1	Over current error	When over current flows at motor RUN element	1. Over load 2. Insufficient SMPS capacity	1. Change operation condition or reduce load so that sudden load fluctuation does not occur. 2. Check that less than the recommended SMPS capacity is used. 3. Check driver break.

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
2	Over speed error	When motor speed is over 4,000rpm	<ol style="list-style-type: none"> 1. When overload is applied and released at a moment. 2. Turning more than 4,000 rpm by external force. 	<ol style="list-style-type: none"> 1. Change operation condition or reduce load so that sudden load fluctuation does not occur. 2. Change the operating condition so that the motor does not rotate more than 4,000 rpm.
3	Position tracking error	When the gap between position command value and current position value is over 90°	<ol style="list-style-type: none"> 1. Over load 2. Motor connector and cable connection error 3. Burnout of line driver IC in encoder 	<ol style="list-style-type: none"> 1. Change operation condition or reduce load so that sudden load fluctuation does not occur. 2. Check motor connector and cable connection. 3. Replace the line driver IC in encoder.
4	Overload error	When applying load over the rated load for over 1 sec.	<ol style="list-style-type: none"> 1. Over load 2. Insufficient SMPS capacity 	<ol style="list-style-type: none"> 1. Change operation condition or reduce load so that sudden load fluctuation does not occur. 2. Check that less than the recommended SMPS capacity is used. 3. Check driver break.
5	Overheat error	When driver inner temperature is over 80°C	<ol style="list-style-type: none"> 1. Installed in an enclosed space 	<ol style="list-style-type: none"> 1. Change the installation environment. <ul style="list-style-type: none"> -Air flow around driver installation. -Heat dissipation (heat sink or fan)

No. of flashin g	Alarm type	Descriptions	Causes	Troubleshooting
6	Motor connection error	When motor cable connection error occurs at driver	<ol style="list-style-type: none"> 1. Motor connector and cable connection error 2. Burnout of the inverter in the driver 	<ol style="list-style-type: none"> 1. Check motor connector and cable connection. 2. Replace burned parts of the inverter in the driver.
7	Encoder connection error	When encoder cable connection error occurs at driver	<ol style="list-style-type: none"> 1. Motor connector and cable connection error 2. Burnout of line driver IC in encoder 	<ol style="list-style-type: none"> 1. Check motor connector and cable connection. 2. Replace the line driver IC in encoder.
8	Regenerative voltage error	When regenerative voltage is over 78V	<ol style="list-style-type: none"> 1. Over load 2. Excessive force due to rapid deceleration 	<ol style="list-style-type: none"> 1. Change operation condition or reduce load so that sudden load fluctuation does not occur.
9	Motor misalignment	When motor is in misalignment	<ol style="list-style-type: none"> 1. Motor connector and cable connector error 2. Burnout of line driver IC in driver 3. Burnout of line driver IC in encoder 4. Burnout of the inverter in the driver 	<ol style="list-style-type: none"> 1. Check motor connector and cable connection. 2. Replace the line driver IC in driver. 3. Replace the line driver IC in encoder. 4. Replace burned parts of the inverter in the driver.
10	Command speed error	When command speed is over 3,500rpm	<ol style="list-style-type: none"> 1. Enter error of user command speed input 	<ol style="list-style-type: none"> 1. Use recommended specifications.(max. 3,000rpm input) 2. Enter the speed value (PPS) by checking the resolution.

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
11	Input voltage error	When input voltage is out of 24VDC \pm 10%	<ol style="list-style-type: none"> 1. Over load 2. Insufficient SMPS capacity 3. Power input over the specification (24 VDC \pm 10%) 	<ol style="list-style-type: none"> 1. Change operation condition or reduce load so that sudden load fluctuation does not occur. 2. Check that less than the recommended SMPS capacity is used. 3. Check the power specification. (24 VDC \pm 10%)
12	In-Position error	When position error (over 1) is kept over 3 sec, after motor stopped.	<ol style="list-style-type: none"> 1. Over load 2. Lack of stop torque. 	<ol style="list-style-type: none"> 1. Change operation condition or reduce load so that sudden load fluctuation does not occur. 2. Increase stop torque as 50% or use the other motor with higher torque.
13	Memory error	When memory error is detected as power supplied	<ol style="list-style-type: none"> 1. EEPROM error 	<ol style="list-style-type: none"> 1. Replace EEPROM parts.

(2) Motor stops, torque maintains and brake releases

Alarm descriptions are displayed by the number of flashes of the alarm indicator. The causes and measures to be taken are as follows.

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
14	Emergency stop	When emergently stopped with emergency stop command	1. When emergency stop enters	1. Check EMG signal. 2. Check Active Level Setting of EMG signal.
15	Program mode error	When 'END' command is not exist at the last step	1. If there is no 'END' instruction at the last step of the program 2. If there is an empty step in the middle of the program.	1. Add 'END' command at last step of program. 2. Remove an empty step in middle of a program.
16	Index mode error	When other instruction is used but 'INC', 'ABS' When index command is not completed due to the stop command	1. When running a step with commands other than 'INC' and 'ABS'. 2. When entering the stop command during driving on index mode	1. Check whether the command of the step is 'INC' or 'ABS' 2. Check that the selected step number is correct.
17	Home search mode error	When failed to find home	1. If there is no 'ORG' or '+/- Limit' input 2. If load above the set value is not applied (torque home search) 3. When a stop command is issued during home search operation	1. Check if the ORG signal is correctly input (general home search) 2. Check if the +/- Limit signal is correctly input (limit home search) 3. Check if the +/- Limit signal is correctly set with the motor rotation direction. (CW direction: +Limit, CCW direction: -Limit) 4. Change the value of the Home search Torque parameter (torque home search)

- When emergency stop alarm occurs, all drive stops and all output turn OFF regardless of the output remain setting.

13.2. Warning

- This function notices dangers with the alarm indicator prior to motor stop with limit signal or over load alarm.
- When turning out from the alarming condition, driver returns to the normal status automatically.
 - Even though warning occurs, it drives as normal and it keep allow the current.
 - Even though warning occurs, it drives as normal status and it may cause damage by fire.
 - It is recommended not to use the unit during warning status. Depending on the alarm/warning type, it displays on the Alarm/Power indicator.

Warning descriptions are displayed by the number of flashes of the alarm indicator. The causes and measures to be taken are as follows.

No. of flashing	Warning type	Descriptions	Causes	Troubleshooting
1	S/W +Limit	When normal direction (CW) software limit is ON	1. When the current position reaches the S/W + Limit value	1. Check S/W \pm Limit parameter value.
2	S/W -Limit	When reverse direction (CCW) software limit is ON	1. When the current position reaches the S/W - Limit value	
3	H/W +Limit	When normal direction (CW) hardware limit is ON	1. When + Limit signal (I/O pin 19) is input	1. Check the \pm Limit signal is input correctly. 2. Check if the \pm - Limit signal is correctly set with the motor rotation direction.(CW direction: + Limit, CCW direction: - Limit)
4	H/W -Limit	When reverse direction (CCW) hardware limit is ON	1. When - Limit signal (I/O pin 20) is input	
5	Over load warning	When maximum load is kept connected over 10 sec	1. Over load	1. Change operation condition or reduce load so that sudden load fluctuation does not occur.

No. of flashing	Warning type	Descriptions	Causes	Troubleshooting
6	Position override	When it is impossible to operate position override	1. When value which position override cannot be operated is entered	1. Change operation condition to avoid sudden speed and position change. 2. Change operation condition to avoid speed and position change during accel/decel.

- Other warnings may occur during the overload warning and the motor will not stop.
- H/W limit warning does not occur in home search mode.

Chapter 14. Troubleshooting

Malfunction	Causes	Troubleshooting
When communication is not connected	The communication cable is not connected.	Check communication cable wiring. Check communication cable connected correctly.
	The communication port or speed settings are not correct.	Check communication port and speed settings are correct.
When motor does not excite	Servo is not ON.	Check that Servo ON/OFF input signal is OFF. In case of ON, servo is OFF and excitation of motor is released.
	Alarm occurs.	Check the alarm type and remove the cause.
When motor rotates to the opposite direction of the designated direction	MotorDir parameter setting is not correct.	Check the MotorDir parameter settings.
When motor drives unstable	Connection between motor and encoder is unstable.	Check the driver and motor are connected correctly.
	Control Gain value is not correct.	Change the Control Gain parameter as the appropriate value.

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Dimensions or specifications on this manual are subject to change and some models may be discontinued without notice.

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