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User Manual

Closed-Loop Stepper System

AiCA-D Series

MMD-AiCAU1-V1.1-2008US

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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.

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Preface

Thank you for purchasing Autonics product.





Please familiarize yourself with the information contained in the **Safety Considerations** section before using this product.

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

User Manual Guide



- Please familiarize yourself with the information in this manual before using the product.
- This manual provides detailed information on the product's features. It does not offer any guarantee concerning matters beyond the scope of this manual.
- This manual may not be edited or reproduced in either part or whole without permission.
- This manual is not provided as part of the product package.
Visit our website (www.autonics.com) to download a copy.
- The manual's content may vary depending on changes to the product's software and other unforeseen developments within Autonics, and is subject to change without prior notice. Upgrade notice is provided through out the website.
- We contrived to describe this manual more easily and correctly. However, if there are any corrections or questions, please notify us these on our website.

User Manual Symbols

Symbol	Descriptions
 Note	Supplementary information for a particular feature.
 Warning	Failure to follow instructions can result in serious injury or death.
 Caution	Failure to follow instructions can lead to a minor injury or product damage.
 Ex.	An example of the concerned feature's use.
※1	Annotation mark.

Safety Considerations

- Following these safety considerations will ensure the safe and proper use of the product and help prevent accidents, as well as minimizing possible hazards.
- Safety considerations are categorized as Warnings and Cautions, as defined below:

 Warning	Warning	Failure to follow these instructions may result in serious injury or death.
 Caution	Caution	Failure to follow these instructions may result in personal injury or product damage.



Warning

- 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.
- Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.
Failure to follow this instruction may result in explosion or fire.
- 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.
- Install the unit after considering counter plan against power failure.
Failure to follow this instruction may result in personal injury or economic loss or fire.
- Re-supply power after min. 20 sec from disconnected power.
Failure to follow this instruction may result in product damage or malfunction.
- Check 'Connections' before wiring.
Failure to follow this instruction may result in fire.
- For installing the unit, ground it exclusively and use over AWG 18 (0.75mm²) ground cable.
Failure to follow this instruction may result in electric shock.
- Do not disassemble or modify the unit.
Failure to follow this instruction may result in fire or electric shock.
- Insulate the connector not to be exposed.
Failure to follow this instruction may result in electric shock.
- Install the driver in the grounded housing or ground it.
Failure to follow this instruction may result in personal injury, fire or electric shock.
- 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.
- Do not remove the connector during or after operation for a while.
Failure to follow this instruction may result in electric shock or product damage.
- Emergency stop directly when error occurs. Failure to follow this instruction may result in personal injury or fire.

**Caution**

- When connecting the power input, use AWG 18 (0.75mm²) cable or over.
- Brake is non-polar. When connecting the brake, use AWG22 (0.3mm²) cable or over.
Failure to follow this instruction may result in fire or malfunction due to contact failure.
- Install overcurrent prevention device (e.g. the current breaker, etc) to connect the driver with power.
Failure to follow this instruction may result in fire.
- 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 signal.
- 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.
- Use the unit within the rated specifications.
Failure to follow this instruction may result in fire or product damage.
- Use 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.
- The driver may overheat depending on the environment.
Install the unit in the well ventilated place and forced cooling with a cooling fan.
Failure to follow this instruction may result in product damage and degradation by heat.
- Keep metal chip, dust, and wire residue from flowing into the unit.
Failure to follow this instruction may result in fire or product damage.
- Use the designated motor only.
Failure to follow this instruction may result in fire or product damage.

The above specifications, dimensions, etc. are subject to change and some models may be discontinued without notice.

Be sure to follow cautions written in the instruction manual, user manual, and the technical descriptions (catalog, website).

Cautions during Use

- Follow instructions in 'Cautions during Use'.
Otherwise, it may cause unexpected accidents.
- It is recommended to use 485 converter with the separate power.
(Autonics product, SCM-38I, recommended)
- Keep the distance between power cable and signal cable more than 10cm.
- Motor vibration and noise can occur in specific frequency period.
 - ① Change motor installation method or attach the damper.
 - ② Use and set the gain value.
- For using motor, it is recommended to maintenance and inspection regularly.
 - ① Unwinding bolts and connection parts for the unit installation and load connection
 - ② Strange sound from ball bearing of the unit
 - ③ Damage and stress of lead cable of the unit
 - ④ Connection error with motor
 - ⑤ Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
- This product does not prepare protection function for a motor.
- This unit may be used in the following environments.
 - ① Indoors (in the environment condition rated in 'Specifications')
 - ② Altitude max. 2,000m
 - ③ Pollution degree 2
 - ④ Installation category II

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1 Product Overview

1.1 Features

AiCA Series is a closed-loop stepper motor driver with integrated stepping motor driver and motion controller, which is able to control up to 31-axis simultaneously or independently through network communication.

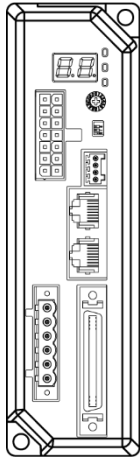
In addition, as AC power system, the SMPS is not required for power connection and motor system can maintain higher torque during high speed drive compared to DC type motor.

- Brake operation for safe control of vertical load at power OFF and alarm occur. (Built-in brake type)
- Real-time position controllable with closed-loop system
- Motor driver and controller integral type
- Torque control mode supported
- As AC power type, possible to omit SMPS and perform higher torque than DC power type
- Able to check alarm and status with Alarm/Warning display (7 segment)
- Controllable maximum 31 axis with RS485 communication
- Auto Current Down Mode available
- C language library provided (32-bit, 64-bit)
- Dedicated Windows program (atMotion) provided
- Easy to set various Gain with program (GUI)
- Applicable to the precision equipment such as optical inspection equipment with the features of maintaining torque in stop and having no micro vibration (hunting)
- 10-levels of resolution setting
- Frame size 60mm, 86mm (Applied motor: AiA-M Series)

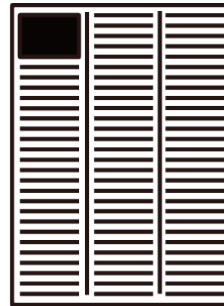
1.2 Components and Configuration Diagram

1.2.1 Components

1.2.1.1 Driver

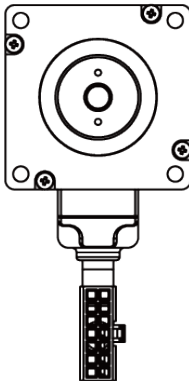


AiCA-D Series

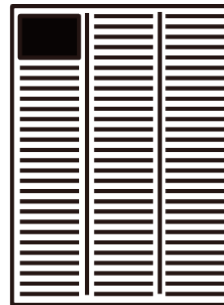


Instruction manual

1.2.1.2 Motor



AiA-M Series



Instruction manual

1.2.1.3 Connectors

- Power connector
- Brake connector
- I/O connector
- Communication protect connector



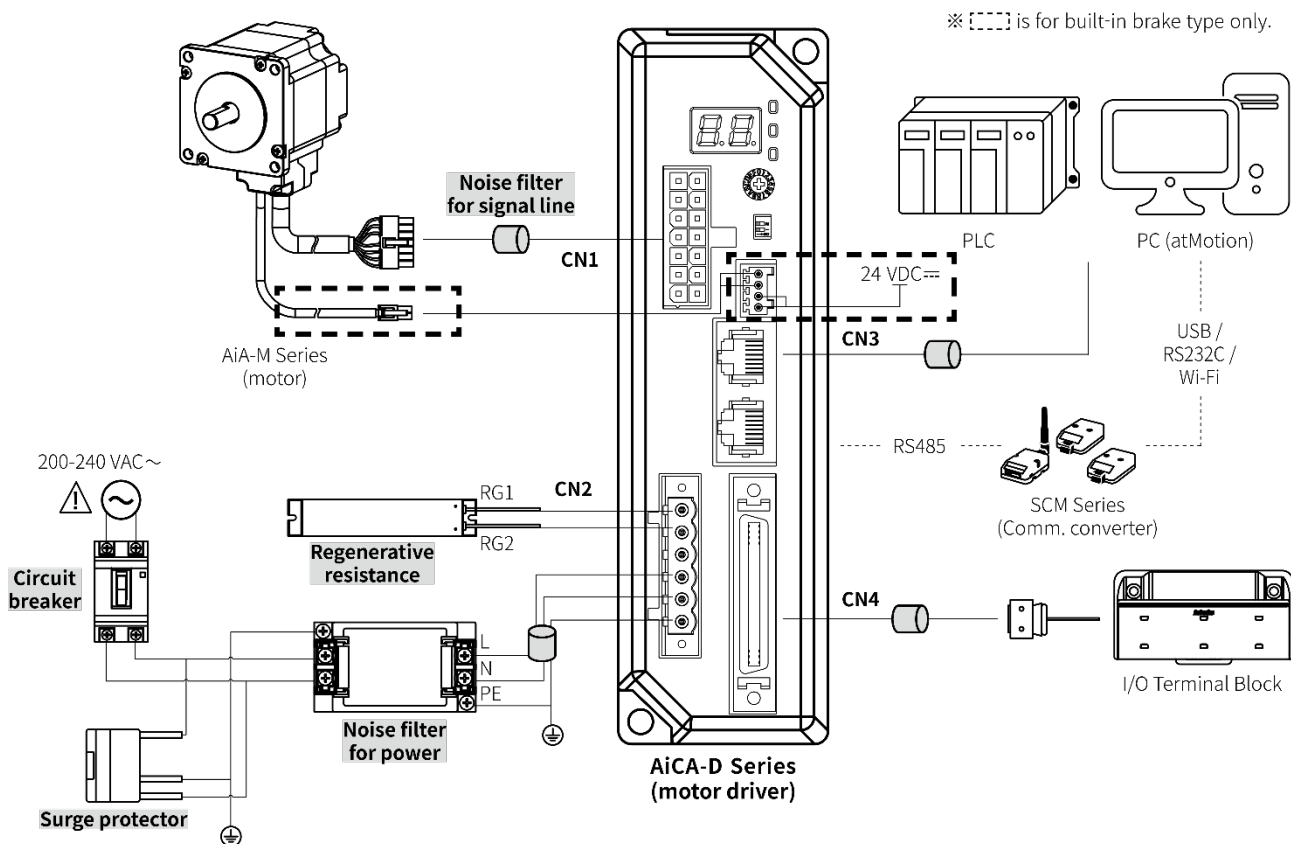
Note

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 the product distributor.

※ I/O cable, motor+encoder cable and power cable are sold separately.

For more information, refer to the '7.5 Sold Separately'.

1.2.2 Configuration Diagram



Note

※ The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.

- ① CN1 (motor+encoder connector): AWG22, AWG24
- ② CN2 (power connector): AWG18
- ③ CN3 (communication cable connector): AWG28
- ④ CN4 (I/O connector): AWG28
- ⑤ CN5 (brake connector): AWG 22

※ In case communication is unstable due to the noise generated by supplied power or peripheral device, use ferrite core at communication line.

※ [] is sold separately.

※ I/O cable, motor+encoder cable and pwer calbe are sold separately.
For more information, refer to '7.5 Sold Separately'.

- Regenerative resistance

Connect Pin No. 1, 2 on power connector (CN2).

Use in condition of the high inertia load or the short deceleration time.

Forced cooling is required in condition of high surface temperature of regenerative resistance.

Model	Specifications	Manufacture
IRC100	<ul style="list-style-type: none"> Resistance: $100\ \Omega \pm 5\%$ Specified power: 60 W(standby), 100 W(heatsink attached) 	RARA Electronics Corp.

- Noise filter for power

Connect the power to suppress external noise.

- The wires should be connected as short as possible and grounded.

Model	Specifications	Manufacture
RNS-2006	<ul style="list-style-type: none"> Specified power: 250 V Specified current: 6 A Max. leakage current: 1 mA 	Orient Electronics

- Surge protector

Protect the product from external noise and surge by connecting power.

Model	Specifications	Manufacture
LT-C12G801W	<ul style="list-style-type: none"> Nominal discharge current: 2500 A Max. discharge current: 5000 A Voltage protection level: 1.5 kV 	OTOWA Electric Co. Ltd



Note

- ※ Be sure to disconnect the surge protector when testing internal pressure. It may result in product damage.

- Noise filter for signal line

Connect to wiring to suppress external noise.

Depending on frequency, filtered noise may differ.

Applications	Specifications	Manufacture
Comm. wire	28A2025-0A2	Lairdtech
Motor wire	28A5776-0A2	
Power wire	28A5131-0A2	

1.3 Ordering Information

Ai	C	A	-	D	-	60	M	A
①	②	③		④		⑤	⑥	⑦

Item	Description	
① Series	Ai	Artificial intelligent
② Category	No mark	Motor
	C	Controller
③ Power	A	AC Power
④ Item	M	Motor
	D	Driver
⑤ Motor frame size	60	60 x 60mm
	86	86 x 86mm
⑥ Motor axial length	M	Middle – Frame size 60mm: 48mm, Frame size 86mm: 60mm
	L	Long – Frame size 60mm: 69mm, Frame size 86mm: 75mm
⑦ Encoder resolution	A	10,000PPR (2,500PPR x 4-multiply)
⑧ Brake	No mark	Standard type
	B	Built-in brake type.

1.4 Models

1.4.1 Standard Type

Set	Driver	Motor
AiCA-60MA	AiCA-D-60MA	AiA-M-60MA
AiCA-60LA	AiCA-D-60LA	AiA-M-60LA
AiCA-86MA	AiCA-D-86MA	AiA-M-86MA
AiCA-86LA	AiCA-D-86LA	AiA-M-86LA

1.4.2 Built-in Brake Type

Set	Driver	Motor
AiCA-60MA-B	AiCA-D-60MA-B	AiA-M-60MA-B
AiCA-60LA-B	AiCA-D-60LA-B	AiA-M-60LA-B
AiCA-86MA-B	AiCA-D-86MA-B	AiA-M-86MA-B
AiCA-86LA-B	AiCA-D-86LA-B	AiA-M-86LA-B

2 Specifications

2.1 Driver

Model ※1		AiCA-D-60MA(-B)	AiCA-D-60LA(-B)	AiCA-D-86MA(-B)	AiCA-D-86LA(-B)
Power consumption	Power supply	200-240 VAC～			
	STOP ※2	Max. 60 W		Max. 65 W	
	Max. during operation	Max. 160 W	Max. 220 W	Max. 250 W	Max. 300 W
	Max. RUN current ※3	2.0 A/Phase			
Auxiliary power ※4	Power supply	24 VDC＝			
	Input current	0.3 A		0.5 A	
STOP current		20 to 100% of max. RUN current			
Rotation speed ※5		0 to 3000rpm			
Resolution ※5		500, 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 PPR			
Speed filter		0 (disable), 2, 4, 6, 8, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200 ms			
Motor GAIN		0 to 30, Fine Gain			
Positioning range		-2,147,483,648 to +2,147,483,647			
In-Position		Fast Response: 0 to 7 or Accurate Response: 0 to 7			
Motor rotation direction ※5		CW, CCW			
Status indicator		● Alarm/Status display part: orange LED 7seg. ● Power/Alarm indicator: green/red LED ● In-Position indicator: orange LED ● Servo On/Off indicator: blue LED			
I/O	Input ※6	Exclusive input: 20, general input: 9			
	Output	Exclusive output: 4, general output: 10			
External power supply		VEX (default: 24 VDC＝): 2, GEX (GND): 2			
Operation mode		Jog / Continuous / Index / Program / Position / Torque mode			
Index step		64 steps			
Program function	Step	256 steps			
	Control command	ABS (move absolute position), INC (move relative position),HOM (home search), ICJ (jump input condition), IRD (waiting input),OPC (on/off of output port), OPT (on pulse from output port), JMP (jump), REP (start repetition), RPE (end repetition), END (end program), POS (position set), TIM (timer), CMP (compare output), TOQ (torque control)			
	Start	Power On program auto-start function			
	Home search	Power On home search auto-start function			
RS485 Comm.	Comm.speed ※5	9600, 19200, 38400, 57600, 115200 (factory default) bps			
Multiaxial control		31-axis			

Model ※1		AiCA-D-60MA(-B)	AiCA-D-60LA(-B)	AiCA-D-86MA(-B)	AiCA-D-86LA(-B)
ID setting switch		16-bit rotary switch (0 to F), 1-bit DIP switch (ON/OFF)			
Alarm		Over current, over speed, position tracking, over load, over heat, motor connection, encoder connection, over voltage, under voltage, motor misalignment, command speed, In-Position, memory, emergency stop, program mode, index mode, home search mode, brake			
Warning		± Software limit, ± hardware limit, over load			
Input resistance		4.7 kΩ (Anode Pull-up)			
Insulation resistance		Over 200 MΩ (at 500 VDC≡ megger)			
Dielectric strength		1,500 VAC ~ 60Hz for 1min			
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		300 m/s ² (approx. 30 G) in each X, Y, Z direction for 3 times			
Environment	Ambient temp.	0 to 50 °C, storage: -10 to 60 °C			
	Ambient humi.	35 to 85 %RH, storage: 10 to 90 %RH			
Sold separately		<ul style="list-style-type: none"> I/O cable: CO50-MP□-R ※7 (standard: AiC TAG) Motor+Encoder cable – normal: C1D14M-□ ※8 / moving: C1DF14M-□ ※8 Communication converter: SCM-WF48, SCM-US48I, SCM-38I 			
Protection structure		IP20 (IEC standard)			
Approval		CE			
Weight ※9		<ul style="list-style-type: none"> Standard type: Approx. 1,080g (approx. 800g) Built-in brake type: Approx. 1,050g (approx. 780g) 			

※1: The model name indicates driver type (none: standard type, B: built-in brake type)

E.g.) AiCA-D-60MA-B: built-in brake type stepping motor driver.

※2: Based on the ambient temperature 25°C, ambient humidity 55%RH, and STOP current 20%.

※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.

※4: Auxiliary power is only available in built-in brake type. Corresponding specification is not available in standard type.

※5: Settable with the dedicated program.

※6: Brake ON/OFF function can be changed in general input IN8 in case of built-in brake type only.

※7 □ of model name indicates cable length (010, 020, 030, 050, 070, 100, 150, 200).

For corresponding EMC standard, cable length should be below 2m.

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

※8 □ of model name indicates cable length (1, 2, 3, 5, 7, 10, 15, 20).

E.g.) C1DF14M-10: 10m moving type motor+encoder cable.

※9 The weight includes packaging. The weight in parenthesis is for unit only.

※Environment resistance is rated at no freezing or condensation.

2.1.1 Factory Default

Function		Factory default
Resolution		500PPR
Speed filter		0
Motor GAIN		0
In-Position		0
Communication speed		115,200bps
Communication ID setting switch (ID Sel)		1
Communication ID setting / Terminating resistance setting DIP switch (ID, TERM)	Communication ID setting (ID)	OFF
	Terminating resistance setting (TERM)	OFF

2.1.2 Communication Output

It is for parameter setting and monitoring via external devices (PC, PLC, etc.)

2.1.2.1 Interface

Comm. Protocol	Modbus RTU	Comm. Speed	9600, 19200, 38400, 57600, 115200 bps
Connection type	RS485	Comm. Response wait time	5 to 99 msec
Application standard	Compliance with EIA RS485	Start bit	1-bit (fixed)
Max. connection	31units (address: 01 to 31)	Data bit	8-bit (fixed)
Synchronous method	Asynchronous	Parity bit	None, Even, Odd
Comm. Method	Two-wire half duplex	Stop bit	1-bit, 2-bit
Comm. distance	Max. 800m	-	

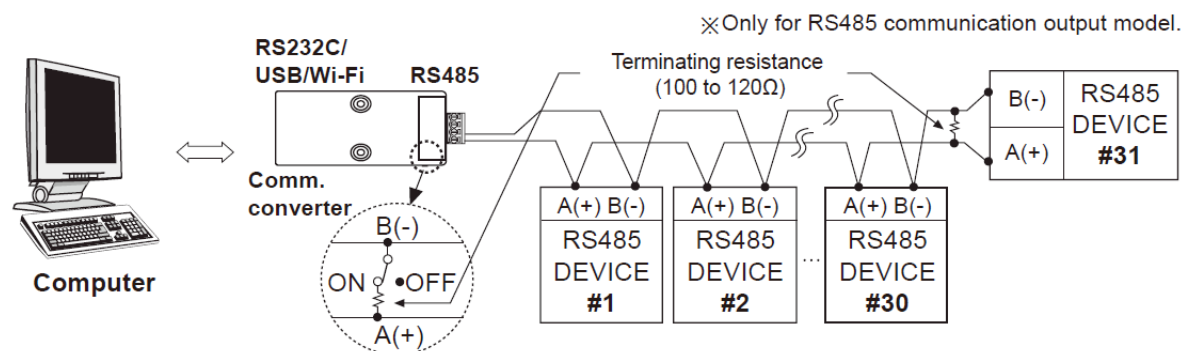


Caution

It is not allowed to set overlapping communication address at the same communication line.

Use twisted pair wire for RS485 communication.

2.1.2.2 Application of System organization



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).



Caution

Please use twisted pair wire, which is suitable for RS485 communication, for SCM-WF48, SCM-US48I and SCM-38I.

2.2 Motor

Model ^{※1}		AiA-M-60MA	AiA-M-60LA	AiA-M-86MA	AiA-M-86LA
Max. stop torque ^{※2}		1.1N·m	2.2N·m	2.8N·m	4.0N·m
Rotor moment of inertia		240g·cm ² (240 x 10 ⁻⁷ kg·m ²)	490g·cm ² (490 x 10 ⁻⁷ kg·m ²)	1,100g·cm ² (1,100 x 10 ⁻⁷ kg·m ²)	1,800g·cm ² (1,800 x 10 ⁻⁷ kg·m ²)
Rated current		2.0A/Phase			
Resistance ±10%		1.5Ω/Phase	2.4Ω/Phase	2.3Ω/Phase	1.9Ω/Phase
Inductance ±20%		3.9mH/Phase	8.5mH/Phase	11.5mH/Phase	16.2mH/Phase
Weight ^{※3}	Standard type	Approx. 0.95kg (approx. 0.75kg)	Approx. 1.35kg (approx. 1.15kg)	Approx. 2.00kg (approx. 1.70kg)	Approx. 2.60kg (approx. 2.30kg)
	Built-in brake type	Approx. 1.53 kg (Approx. 1.35 kg)	Approx. 1.90 kg (Approx. 1.75 kg)	Approx. 2.76 kg (Approx. 2.50 kg)	Approx. 3.36 kg (Approx. 3.10 kg)

※1: The model name indicates driver type (none: standard type, B: built-in brake type)

E.g.) AiCA-D-60MA-B: built-in brake type stepping motor driver.

※2: Max. holding torque is standard torque when supplying the rated current

(2-phase holding) and stopping the motor for comparing the specifications of motors.

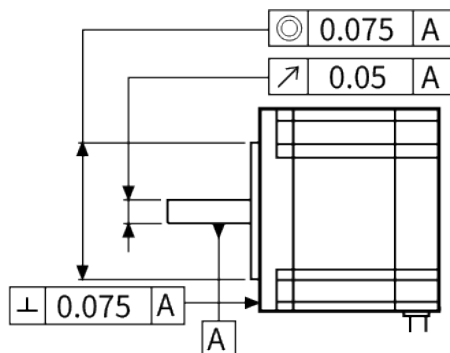
※3: The weight includes packaging. The weight in parenthesis is for unit only.

2.2.1 Common Specifications

Standard step angle		1.8° / 0.9° (Full / Half step)
Motor phase		2 phase
Run method		Bipolar
Insulation class		B type (130°C)
Insulation resistance		Over 100MΩ (at 500VDC megger) between motor coil-case
Dielectric strength		500VAC 50/60Hz for 1 min between motor coil-case
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		Approx. max. 50G
Environment	Ambient temperature	<ul style="list-style-type: none"> • Standard type: 0 to 50°C, storage: -20 to 70°C • Built-in brake type: 0 to 40°C, storage: -20 to 70°C
	Ambient humidity	20 to 85%RH, storage: 15 to 90%RH
Approval		CE
Protection structure		IP30 (IEC34-5 standard)
Stop angle error ^{※1}		±0.09°
Shaft vibration ^{※2}		0.03mm T.I.R.
Radial movement ^{※3}		Max. 0.025mm (load 25N)
Axial movement ^{※4}		Max. 0.01mm (load 50N)
Concentricity for shaft of setup in-low		0.05mm T.I.R.
Perpendicularity of set-up plate shaft		0.075mm T.I.R.

※1: Specifications are for full-step angle, without load. (Values may vary by load size)

※2: T.I.R. (Total Indicator Reading): Indicate total dial gauge quantity in case of one complete rotating monitored reference around a base point.



※3: Amount of radial shaft displacement when adding a radial load (25N) to the tip of the motor shaft.

※4: Amount of axial shaft displacement when adding a axial load (50N) to the shaft.

※Environment resistance is rated at no freezing or condensation.

2.2.2 Encoder

Item		INCREMENTAL rotary encoder	
Resolution		10,000PPR (2,500PPR x 4 -multiply)	
Electrical specification	Output phase	A, \bar{A} , B, \bar{B} , Z, \bar{Z}	
	Output duty ratio	$\frac{T}{2} \pm \frac{T}{4}$ (T=1 cycle of A phase)	
	Phase difference of output	Output between A and B phase: $\frac{T}{4} \pm \frac{T}{8}$ (T=1 cycle of A phase)	
	Control output	Line driver output	<ul style="list-style-type: none"> • [Low] – Load current: max. 20mA, Residual voltage: max. 0.5VDC • [High] – Load current: max. -20mA, Output voltage: min. 2.5VDC
	Response time (rise, fall)	Max. 0.5 μ s (cable length: 2m, I sink=20mA)	
	Max. response frequency	300kHz	
	Power supply	5VDC \pm 5% (ripple P-P: max. 5%)	
	Current consumption	Max. 50mA (disconnection of the load)	

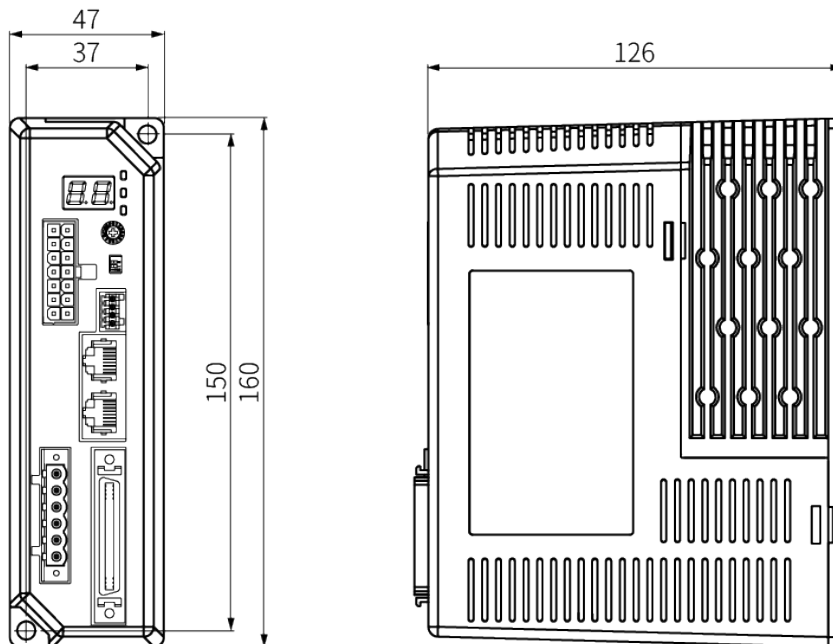
2.2.3 Brake

Motor frame size	60 mm	86 mm
Rated excitation voltage	24 VDC \pm 10%	
Rated excitation current	0.275 A	0.479 A
Static friction torque	0.75 N m	2.6 N m
Rotation part inertia moment	19 g·cm ² (1.9 × 10 ⁻⁶ kg·m ²)	120 g·cm ² (12 × 10 ⁻⁶ kg·m ²)
Insulation class	B type (130 °C)	
B type brake	Power ON: brake is released, Power OFF: brake is locked	
Operating time	30 ms	40 ms
Releasing time	10 ms	25 ms

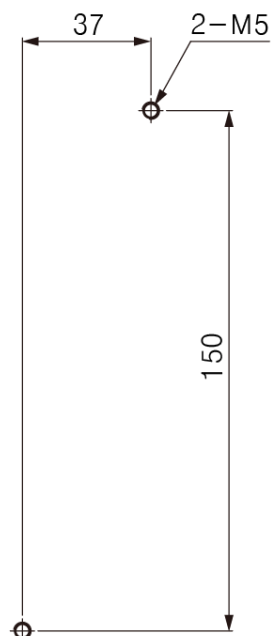
3 Dimensions

3.1 Driver

(unit: mm)



3.1.1 Panel Cut-out



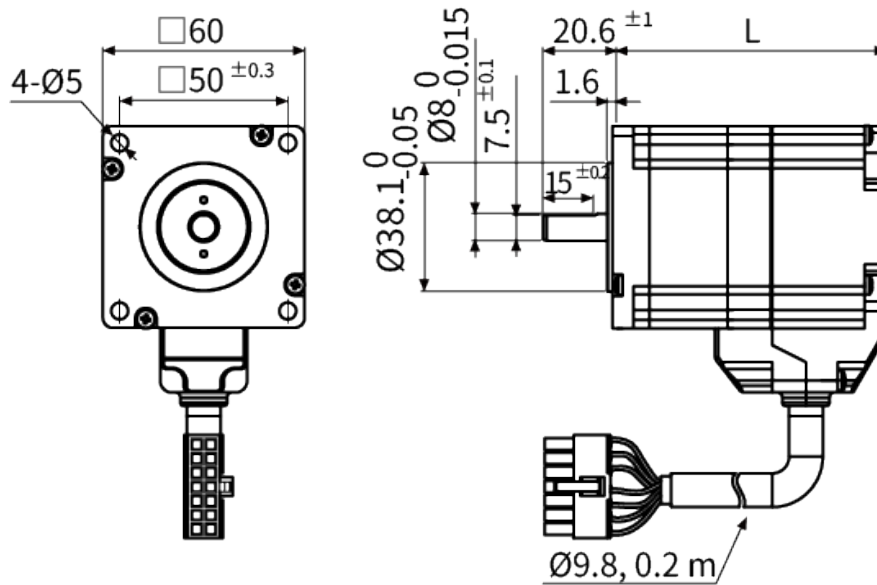
Note

Be sure that these figures may differ from the actual units.

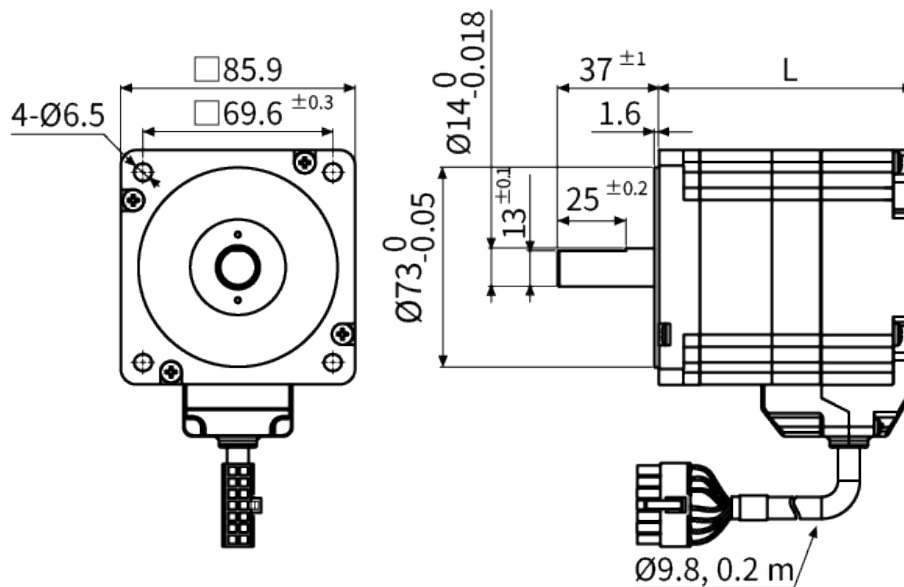
3.2 Motor

3.2.1 Standard Type

3.2.1.1 Frame Size 60 mm



3.2.1.2 Frame Size 86 mm

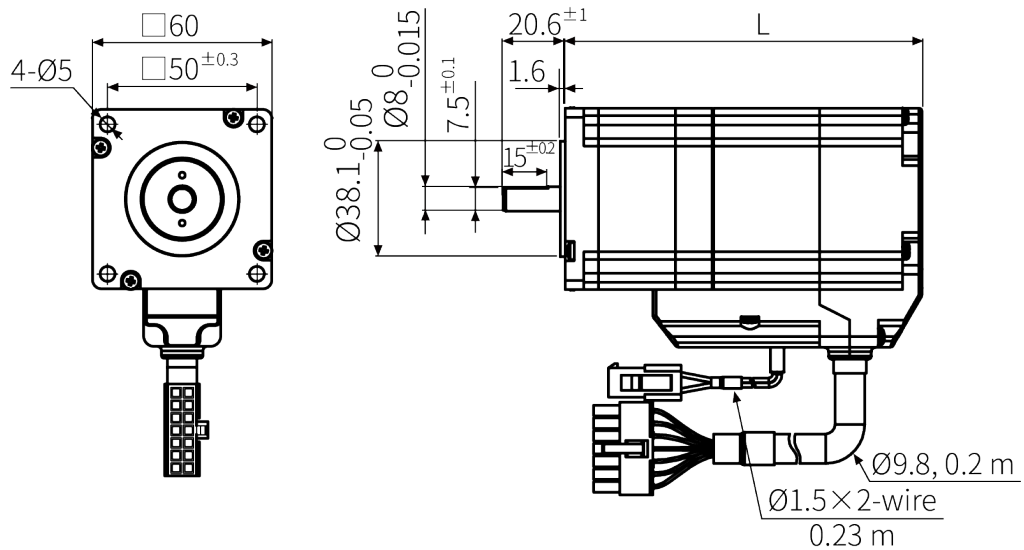


Note

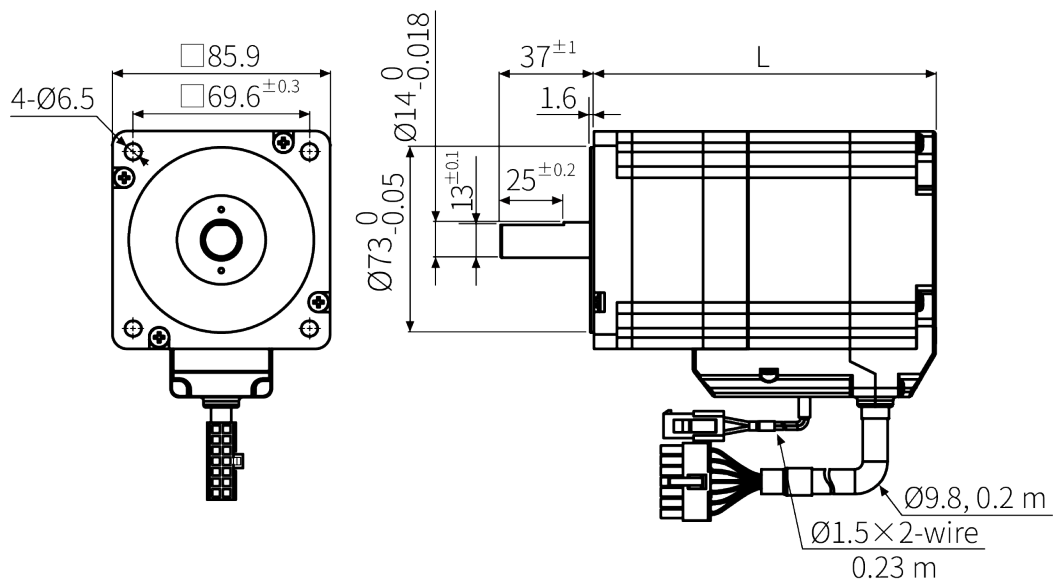
Model	L	Model	L
AiA-M-60MA	47.4	AiA-M-86MA	59.5
AiA-M-60LA	68.3	AiA-M-86LA	74

3.2.2 Built-in Brake Type

3.2.2.1 Frame Size 60 mm



3.2.2.2 Frame Size 86 mm



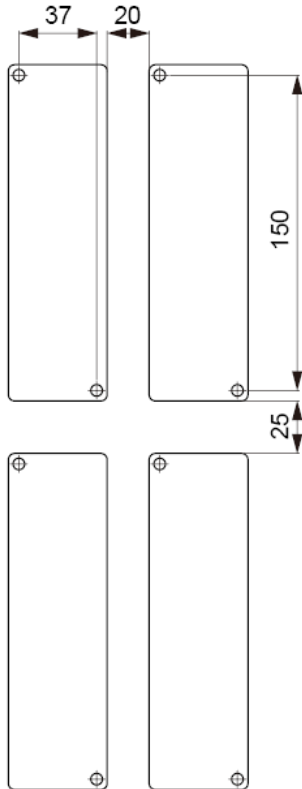
Note

Model	L	Model	L
AiA-M-60MA-B	117.8	AiA-M-86MA-B	134.8
AiA-M-60LA-B	138.8	AiA-M-86LA-B	148.8

4 Installation

4.1 Installation of Driver

(unit: mm)



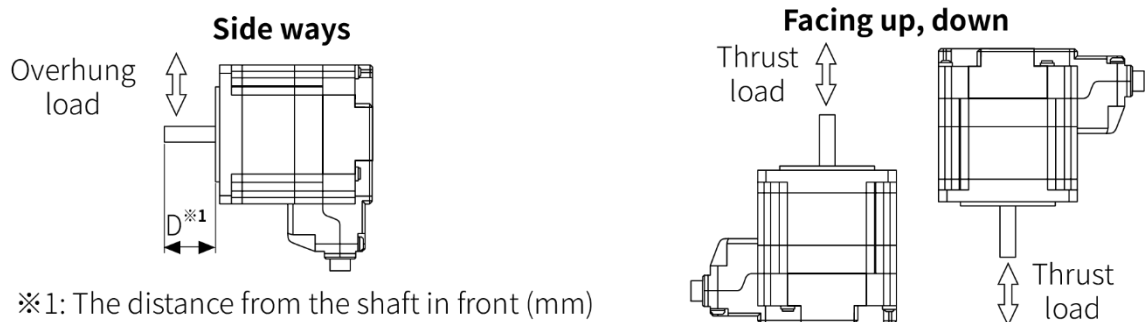
- ※ Install on the metal plate with high thermal conductivity for heat dissipation of the driver.
- ※ Install in the well-ventilated area and install the cooling fan in the unventilated environment.
- ※ Failure to heat dissipation may result in damage or malfunction due to the stress on the product.
- ※ Check the environment of use within the rated specifications and install on the well-heat dissipated area.
- ※ In case of installing the drivers more than two, keep distance at least 20mm in the horizontal direction and at least 25mm in the vertical direction.

4.2 Installation of Motor

4.2.1 Mounting Direction of Motor

Motor can be mounted 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.

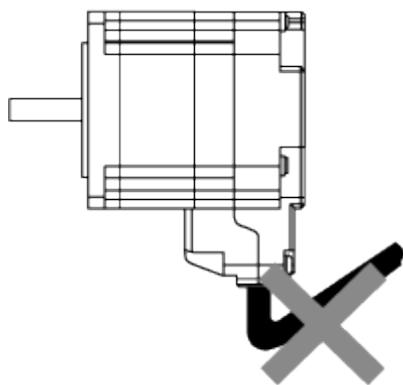


Motor size	The distance from the shaft in front (mm), Allowable overhung load [N]				Allowable thrust load
	D=0	D=5	D=10	D=15	
Frame size 60mm	54	67	89	130	Below motor weight
Frame size 86mm	260	290	340	390	

Do not apply excessive force on motor cable when mounting motors.

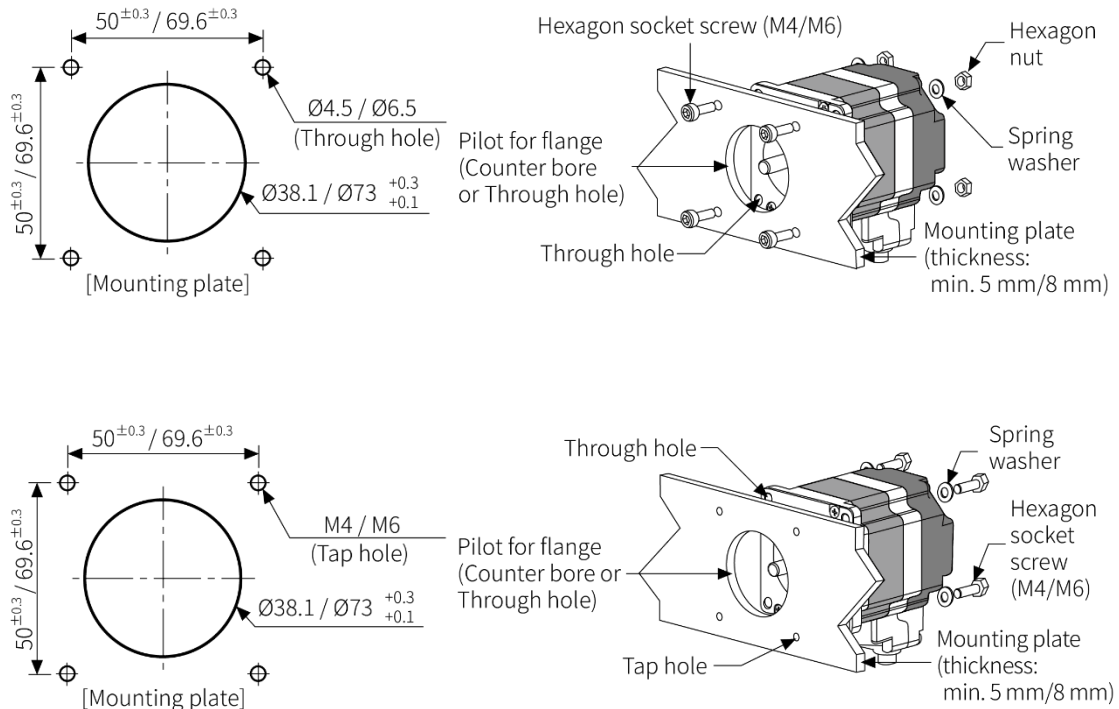
Do not forcibly pull or insert the cable. It may cause poor connection or disconnection of the cable.

In case of frequent cable movement required application, proper safety countermeasures must be ensured.



4.2.2 Mounting of Motor

4.2.2.1 Frame Size 60mm / Frame Size 86mm



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.

When mounting motors, use hexagon socket screws, spring washers and flat washers.

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

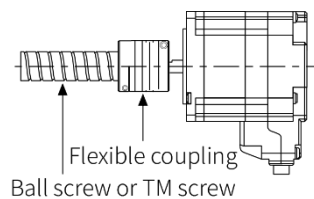
4.2.3 Connection with Load

When connecting the load, be sure of alignment of the center, tension of the belt, and parallel of the pulley.

When connecting the load such as a pulley or a belt, be cautious of the allowable thrust load, radial load, and shock, as well as tighten the screw for a coupling or a pulley not to be unscrewed.

When attach a coupling or a pulley to the shaft, be cautious of damage on shaft or bearings and it is banned to disassemble or change structure of the device or the shaft for connecting with a load.

4.2.3.1 Direct Load Connection with Coupling

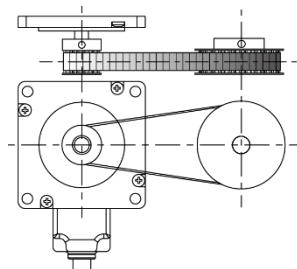


※ Use Autonics flexible coupling (ERB Series)

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.

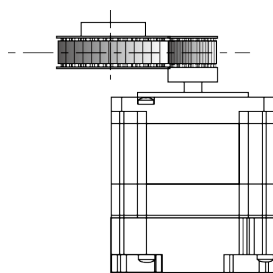
If the center of the load and the shaft is not aligned, it may cause severe vibration, damage on shaft or shortened life cycle of bearings.

4.2.3.2 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.

4.2.3.3 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.

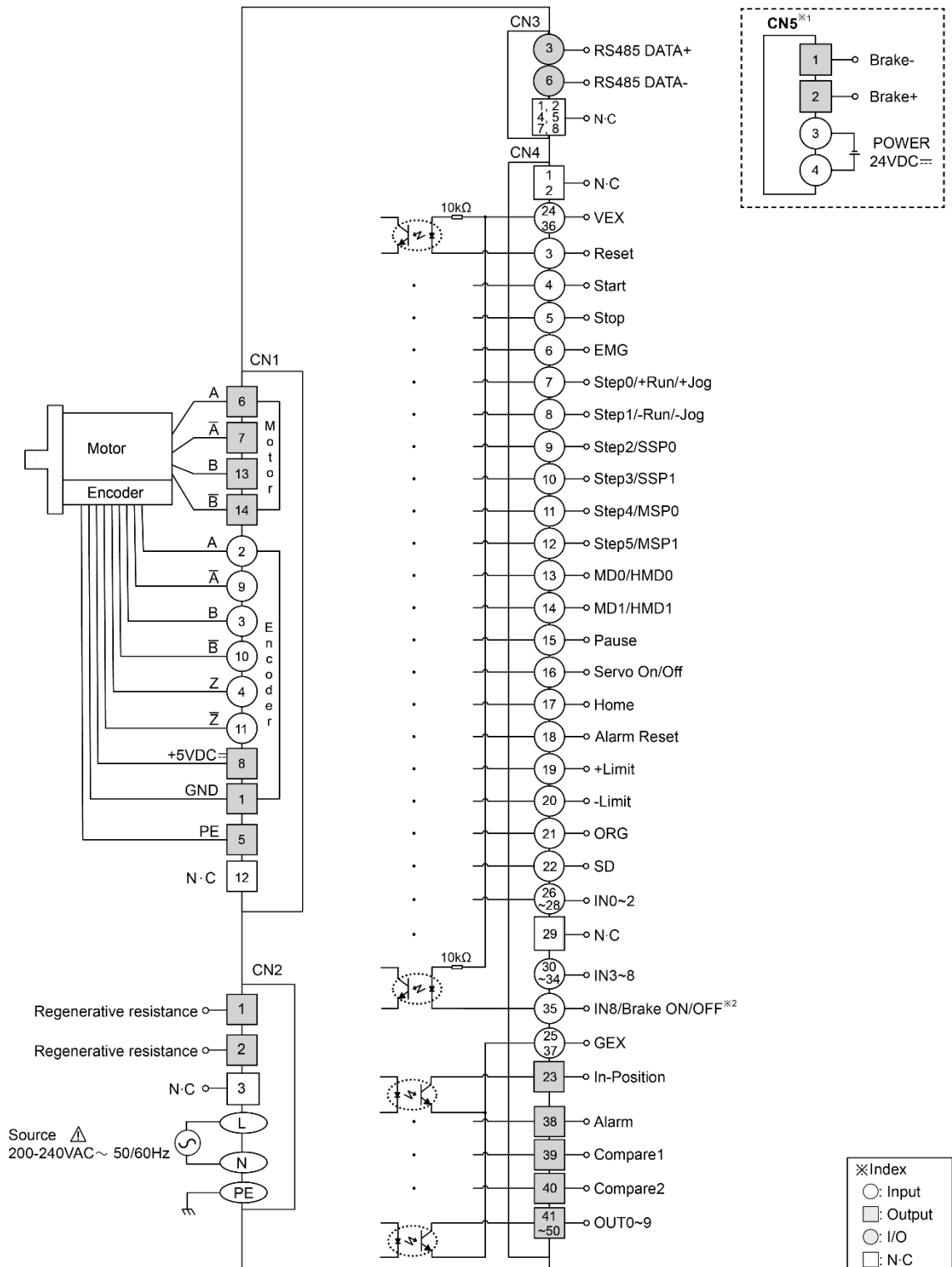
4.2.4 Installation Conditions

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

It may cause product damage if instructions are not following.

- ① The inner housing installed indoor
(This unit is manufactured and designed for attaching to equipment.
Install a ventilation device.)
- ② Within 0 to 50°C (at non-freezing status) of ambient temperature
- ③ Within 20 to 85%RH (at non-dew status) of ambient humidity
- ④ The place without explosive, flammable and corrosive gas
- ⑤ The place without direct ray of light
- ⑥ The place where dust or metal scrap does not enter into the unit
- ⑦ The place without contact with water, oil, or other liquid
- ⑧ The place without contact with strong alkali or acid material
- ⑨ The place where easy heat dissipation could be made
- ⑩ The place where no continuous vibration or severe shock
- ⑪ The place with less salt content
- ⑫ The place with less electronic noise occurs by welding machine, motor, etc.
- ⑬ The place where radioactive substances and magnetic fields does not exist and is not in the vacuum status

5 Connection

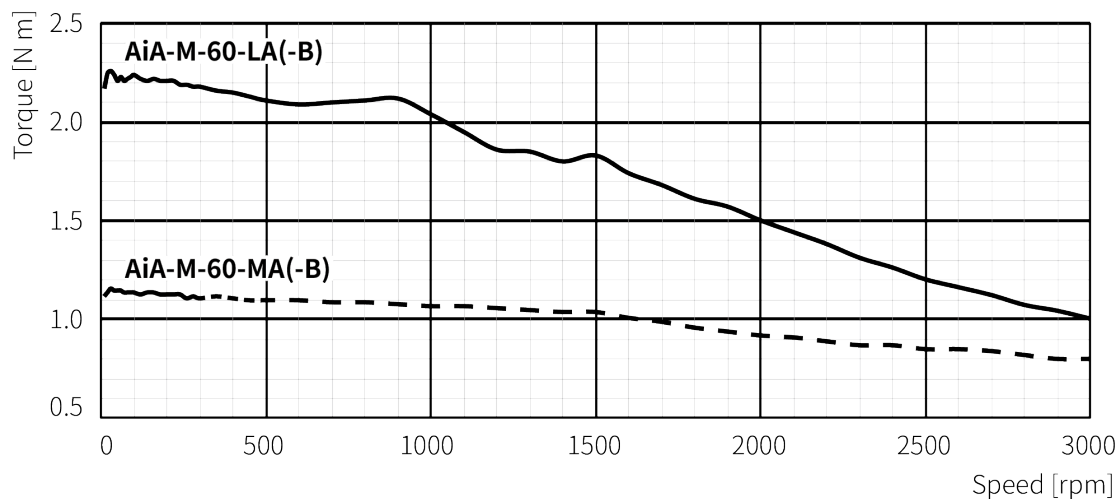


※1. Corresponding connector is for built-in brake type only.

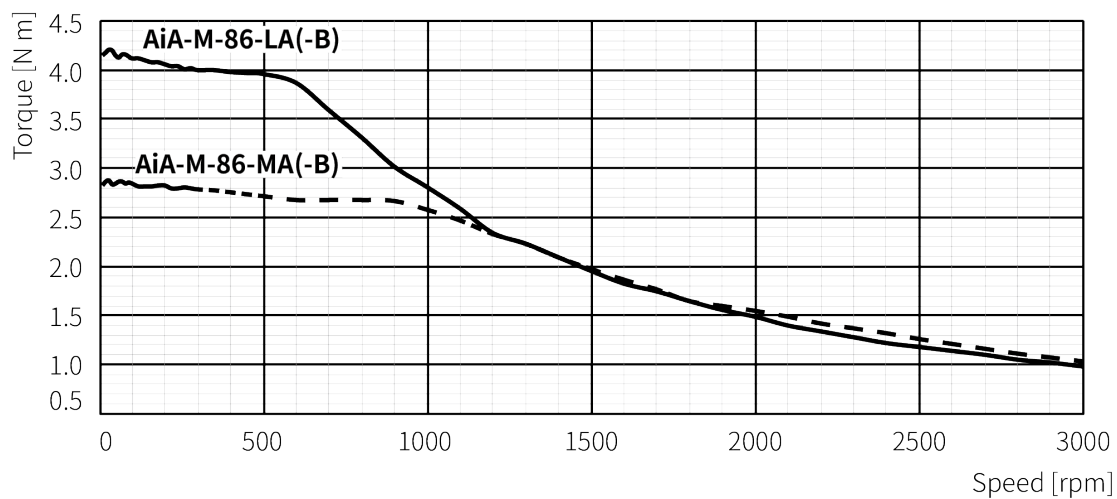
※2. Corresponding pin is for built-in brake type only. In case of standard type, only IN8 is available.

6 Characteristics

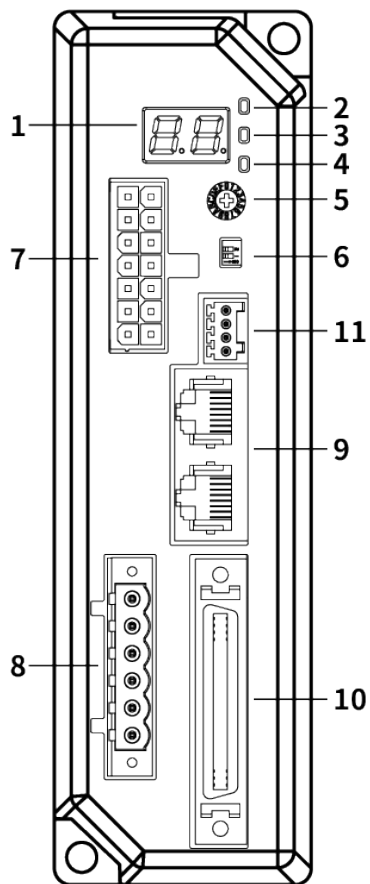
6.1 Frame Size 60mm



6.2 Frame Size 86mm



7 Driver Unit Descriptions



1. Alarm/Status display part (orange)
2. Power/Alarm indicator (PWR/ALM) (green/red)
3. In-Position indicator (INP) (orange)
4. Servo On/Off indicator (SERVO) (blue)
5. Communication ID setting switch (ID Sel)
6. Communication ID setting/Terminating resistance setting Dip switch (ID, TERM)
7. Motor+Encoder connector (CN1)
8. Power connector (CN2)
9. Communication cable connector (CN3)
10. I/O connector (CN4)
11. Brake connector (CN5)^{※1}

※1: Corresponding connector is for built-in brake type only.

7.1 Driver Status Indicator

Indicator & Display part	LED color	Function	Descriptions
Alarm/Status display part	Orange	Alarm, status indicator	Displays the corresponding number, status of operation, etc when Alarm occurs.
PWR/ALM	Green	Power indicator	Turns ON when the unit operates normally after supplying power.
	Red	Alarm indicator	When alarm occurs, it flashes in various ways depending on the situation. Refer to '13.1 Alarm'.
INP.	Orange	In-Position indicator	Turns ON when motor is placed at command position after positioning input. Turns OFF in torque mode.
SERVO	Blue	Servo On/Off indicator	Turns ON when servo is operating, turns OFF when servo is not operating.


7.2 Switches

7.2.1 ID Sel

: Communication ID Setting Switch

Set Node ID of the driver.

Depending on the ID setting of the ID/TERM switch, it is possible to connect max. 31-axis.

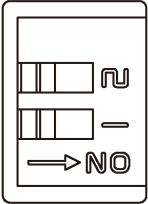
Setting switch	Setting	ID		Setting	ID	
		ID OFF	ID ON		ID OFF	ID ON
 ID Sel	0	Disable	16	8	8	24
	1	1	17	9	9	25
	2	2	18	A	10	26
	3	3	19	B	11	27
	4	4	20	C	12	28
	5	5	21	D	13	29
	6	6	22	E	14	30
	7	7	23	F	15	31

7.2.2 ID, TERM

: Communication ID Setting/Terminating Resistance DIP Switch

Set Node ID of the driver.

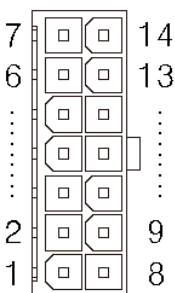
Set to use terminating resistance.

	No.	Function	Switch position	
			ON	OFF
	1	ID setting	ID: 16 to 31	ID: 1 to 15
	2	Terminating resistance	Use terminating resistance (120Ω)	Do not use terminating resistance

7.3 ConnConnectors

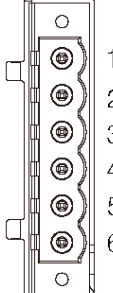
7.3.1 CN1: Motor+Encoder Connector

Connects the motor and the encoder to the driver.

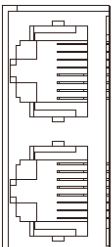
Pin arrangement	Pin no.	Function	Pin no.	Function
	1	GND	8	+5VDC
	2	Encoder A	9	Encoder \bar{A}
	3	Encoder B	10	Encoder \bar{B}
	4	Encoder Z	11	Encoder \bar{Z}
	5	F.G.	12	N.C
	6	Motor A	13	Motor B
	7	Motor \bar{A}	14	Motor \bar{B}

7.3.2 CN2: Power Connector

Connects with 200-240VAC power.

Pin arrangement	Pin no.	Function
	1	Connect regenerative resistance
	2	
	3	N.C
	4	AC power input
	5	
	6	PE

7.3.3 CN3: RS485 Communication Cable Connector

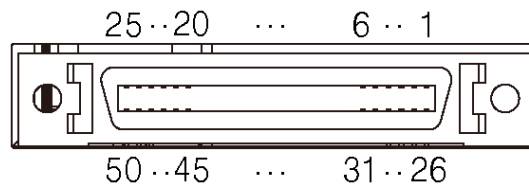
Pin arrangement	Pin no.	Function	Pin no.	Function
	1	N.C	5	N.C
	2	N.C	6	RS485 DATA-
	3	RS485 DATA+	7	N.C
	4	N.C	8	N.C



Note

- RxD indicator (yellow): Flashes when data input
- TxD indicator (green): Flashes when data output
- ※ Although RS485 OUT is disconnected, RxD IN/TxD OUT operates normally, if RS485 In is communicating.

7.3.4 CN4: I/O Connector



Pin no.	I/O	Signal	Filter ^{*1}	Active ^{*2}	Function
1	-	N.C	-	-	Disable
2	-	N.C	-	-	Disable
3	Input	Reset	1.5, 10 msec	[L]	Reset
4	Input	Start	1.5, 10 msec	[L], [H]	Start drive
5	Input	Stop	1.5, 10 msec	[L], [H]	Stop drive
6	Input	EMG	1.5, 10 msec	[L], [H]	Emergency stop drive
7	Input	Step0/+Run/+Jog	1.5, 10 msec	[L], [H]	Step designate0/+Continuous/+Jog
8	Input	Step1/-Run/-Jog	1.5, 10 msec	[L], [H]	Step designate1/-Continuous/-Jog
9	Input	Step2/SSP0	1.5, 10 msec	[L], [H]	Step designate2/ Start speed designate 0
10	Input	Step3/SSP1	1.5, 10 msec	[L], [H]	Step designate3/ Start speed designate 1
11	Input	Step4/MSP0	1.5, 10 msec	[L], [H]	Step designate4/ Max. speed designate 0
12	Input	Step5/MSP1	1.5, 10 msec	[L], [H]	Step designate5/ Max. speed designate 1
13	Input	MD0/HMD0	1.5, 10 msec	[L], [H]	Run mode designate0/ Home search mode designate0
14	Input	MD1/HMD1	1.5, 10 msec	[L], [H]	Run mode designate 1/ Home search mode designate 1
15	Input	Pause	1.5, 10 msec	[L], [H]	Pause
16	Input	Servo On/Off	1.5, 10 msec	[L], [H]	Servo On/Off
17	Input	Home	1.5, 10 msec	[L], [H]	Home search
18	Input	Alarm Reset	1.5, 10 msec	[L], [H]	Alarm reset
19	Input	+Limit	1.5 msec	[L], [H]	+ direction limit sensor
20	Input	-Limit	1.5 msec	[L], [H]	- direction limit sensor
21	Input	ORG	1.5 msec	[L], [H]	Home sensor
22	Input	SD	1.5 msec	[L], [H]	deceleration drive signal
23	Output	In-Position	-	-	Drive end pulse
24	Input	VEX	-	-	External input power (24VDC)
25	Input	GEX	-	-	External input GND (0VDC)
26	Input	IN0	1.5, 10 msec	[L], [H]	General input0
27	Input	IN1	1.5, 10 msec	[L], [H]	General input1
28	Input	IN2	1.5, 10 msec	[L], [H]	General input2

Pin no.	I/O	Signal	Filter※1	Active※2	Function
29	-	N.C	-	-	Disable
30	Input	IN3	1.5, 10 msec	[L], [H]	General input3
31	Input	IN4	1.5, 10 msec	[L], [H]	General input4
32	Input	IN5	1.5, 10 msec	[L], [H]	General input5
33	Input	IN6	1.5, 10 msec	[L], [H]	General input6
34	Input	IN7	1.5 msec	[L], [H]	General input7
35	Input	IN8 Brake ON/OFF ※3	1.5 msec	[L], [H]	General input8 Brake ON/OFF
36	Input	VEX	-	-	External input power (24VDC)
37	Input	GEX	-	-	External input GND (0VDC)
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	Output	OUT9	-	-	General output9

※1: It is software input filter to set 10 msec or 1.5 msec of parameter 'Input Filter'.

The filter of +Limit, ORG, SD, IN7 to 9 is fixed as 1.5 msec. When input turns ON over the set time, it recognizes as normal signal input.

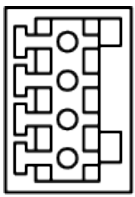
※2: It is voltage level to recognize input signal as ON. It is available to set each input.

[H]: 5-30VDC, [L]: 0-2VDC (however, reset is fixed as [L].)

※3: Brake ON/OFF function can be switched in built-in brake type.

7.3.5 Brake connector

Corresponding connector is for built-in brake type only.

Pin arrangement	Pin no.	Function
	1	24 VDC=
	2	GND
	3	Brake +
	4	Brake -

7.4 Connector Specifications

Type		Specifications			Manufacture
		Connector	Connector terminal	Housing	
CN1	Motor+Encoder	5557-14R	5556T	-	Molex
CN2	Power	5ESDVM-06P-OR	-	-	Dinkle
CN3	Communication	RJ45	-	-	-
	Protect connector	LS-CV-J45BBKZ (EPN.)	-	-	-
CN4	I/O connector	10150-3000PE	-	10350-52F0-008	3M
CN5	Brake connector	ESC250V-S2330704P	-	-	Dinkle

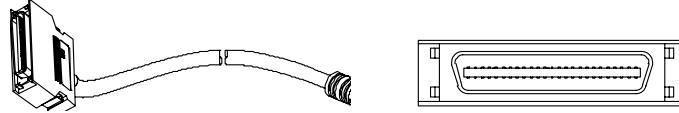


Note

Above connectors are suitable for AiCA-D Series.

7.5 Sold Separately

7.5.1 I/O Cable (CO50-MP□-R, standard: AiC TAG)



Pin no.	Function (name tag)	Cable color	Dot line color-numbers	Pin no.	Function (name tag)	Cable color	Dot line color-numbers
1	BRAKE+	Orange	Black-1	26	IN0	White	Red-3
2	BRAKE-		Red-1	27	IN1		Black-4
3	RESET		Black-2	28	IN2		Red-4
4	START		Red-2	29	N.C		Black-5
5	STOP		Black-3	30	IN3		Red-5
6	EMG		Red-3	31	IN4	Gray	Black-1
7	STEP0/+RUN/+JOG		Black-4	32	IN5		Red-1
8	STEP1/-RUN/-JOG		Red-4	33	IN6		Black-2
9	STEP2/SSP0		Black-5	34	IN7		Red-2
10	STEP3/SSP1		Red-5	35	IN8/ Brake ON/OFF		Black-3
11	STEP4/MSP0	Yellow	Black-1	36	VEX		Red-3
12	STEP5/MSP1		Red-1	37	GEX		Black-4
13	MD0/HMD0		Black-2	38	ALARM		Red-4
14	MD1/HMD1		Red-2	39	COMPARE1		Black-5
15	PAUSE		Black-3	40	COMPARE2		Red-5
16	SERVO ON/OFF		Red-3	41	OUT0	Pink	Black-1
17	HOME		Black-4	42	OUT1		Red-1
18	ALARM RESET		Red-4	43	OUT2		Black-2
19	+LIMIT		Black-5	44	OUT3		Red-2
20	-LIMIT		Red-5	45	OUT4		Black-3
21	ORG	White	Black-1	46	OUT5		Red-3
22	SD		Red-1	47	OUT6		Black-4
23	IN POSITION		Black-2	48	OUT7		Red-4
24	VEX		Red-2	49	OUT8		Black-5
25	GEX		Black-3	50	OUT9		Red-5

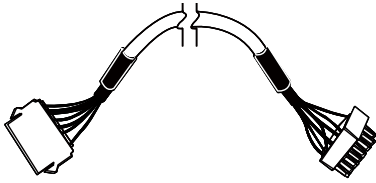


Note

□ of model name indicates the cable length (010, 020, 030, 050, 070, 100, 150, 200).
For corresponding EMC standard, cable length should be below 2m.

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

7.5.2 Motor+Encoder Cable (Normal: C1D14M-□/Moving: C1DF14M-□)



Note

□ of model name indicates cable length (1, 2, 3, 5, 7, 10, 15, 20).

E.g.) C1DF14M-10: 10m moving type motor+encoder cable

7.5.3 Communication Converter

- SCM-WF48 (Wi-Fi to RS485 · USB wireless communication converter)



- SCM-US48I (USB to RS485 converter)



- SCM-38I (RS232C to RS485 converter)



8 Electromagnetic Brake

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



Caution

- Electromagnetic brake does not made for maintaining load completely. Do not use as safe brake.
- Do not use electromagnetic brake as brake stop. Brake power will be reduced due to worn brake.
Make sure to use the exclusive power for electromagnetic brake.
- In case of using auxiliary power supply for electromagnetic brake, do not mix the power with the power supply for I/O signals.
Failure to follow this instruction may result in electromagnetic brake damage or malfunction due to outer disturbnace.

8.1 Brake Connection

Connect the brake connector (CN5) to motor brake connector and input auxiliary power with 24 VDC=.

When connecting the brake, use AWG22 cable or over for connection.

8.2 Brake Operation

The auxiliary power 24 VDC \equiv input is required to release brake. When the auxiliary power does not input, Brake error (E \cup) alarm occurs. For more information, refer to '13.1 Alarm'.

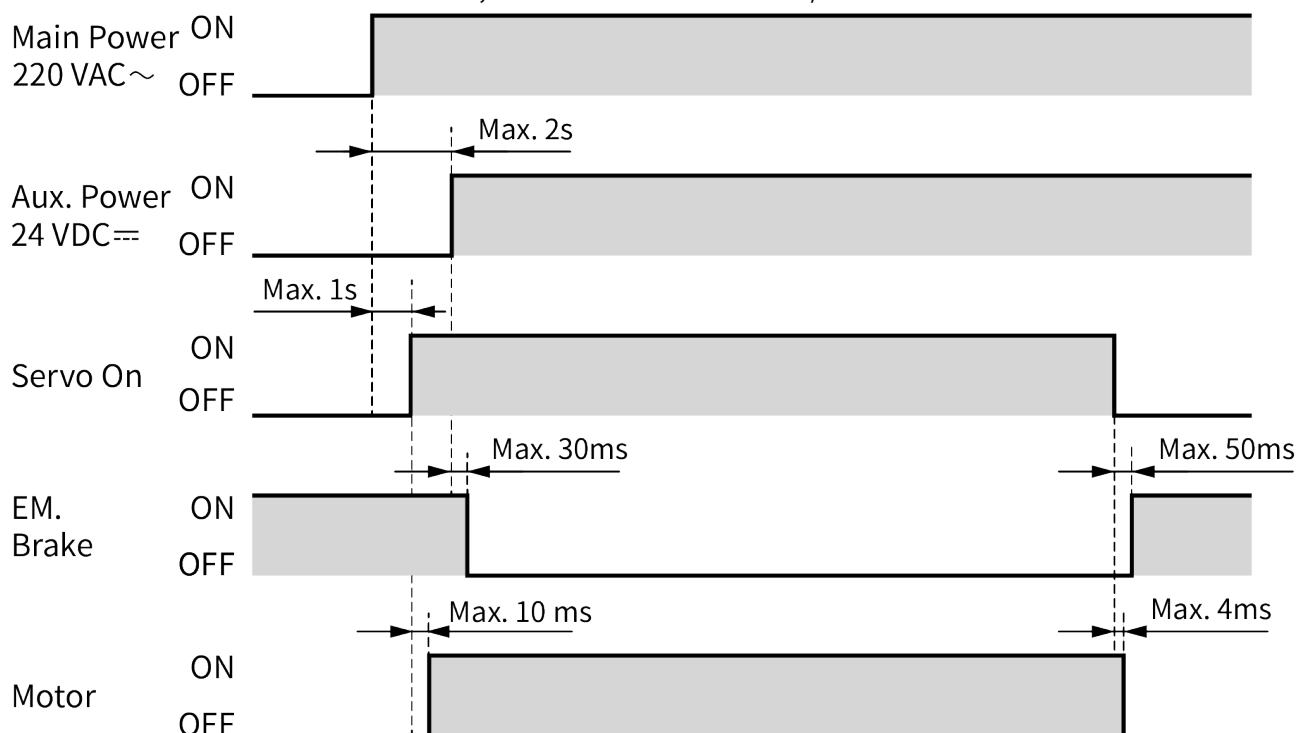
- When Servo is On, brake is released automatically.
- The brake remains lock inn all status except Servo On status.



Note

※ Brake lock is manually controllable using the Brake ON/OFF input signal.

For more information, refer to '9.1.2.16 Brake ON/OFF'.



9 Control Input/Output

Inner signal of all input/output consists of photocoupler.

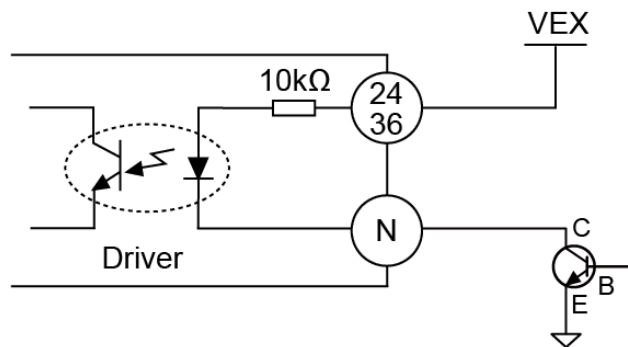
ON: photocoupler power ON

OFF: photocoupler power OFF

9.1 Input

9.1.1 Example of Input Circuit Connection

In case of input, use external power (VEX) 24VDC=.



Note

N: Input pin number of CN4

9.1.2 Exclusive Input

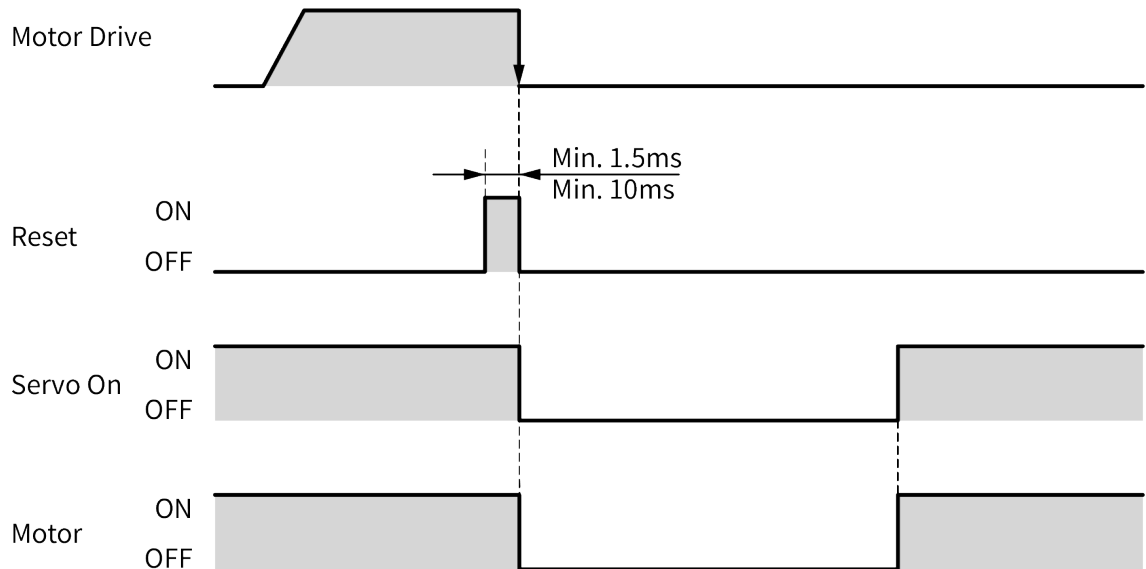
Pin no.	Signal name	Descriptions
3	Reset	Reset command
4	Start	Drive start command
5	Stop	Drive stop command
6	EMG	Drive emergency stop command
7	Step0/+Run/+Jog	Step designate 0/+Continuous/+Jog
8	Step1/-Run/-Jog	Step designate 1/-Continuous/-Jog
9	Step2/SSP0	Step designate 2/ Start speed designate 0
10	Step3/SSP1	Step designate 3/ Start speed designate 1
11	Step4/MSP0	Step designate 4/ Max. speed designate 0
12	Step5/MSP1	Step designate 5/ Max. speed designate 1
13	MD0/HMD0	Operation mode designate 0/Home search mode designate 0
14	MD1/HMD1	Operation mode designate 1/Home search mode designate 1
15	Pause	Pause
16	Servo On/Off	Servo On/Off
17	Home	Home search
18	Alarm Reset	Alarm reset command
19	+Limit	+ direction limit sensor
20	-Limit	- direction limit sensor
21	ORG	Home sensor
22	SD	Deceleration (Deceleration stop) signal
35	Brake ON/OFF	Brake ON/OFF

9.1.2.1 Reset

When driver is reset, it operates same as resupplying the power.

The parameter which is saved at atMotion is not reset.

During motor driving, it stops immediately and the driver is reset.



9.1.2.2 Start

It starts drive as the set mode; index mode or program mode.

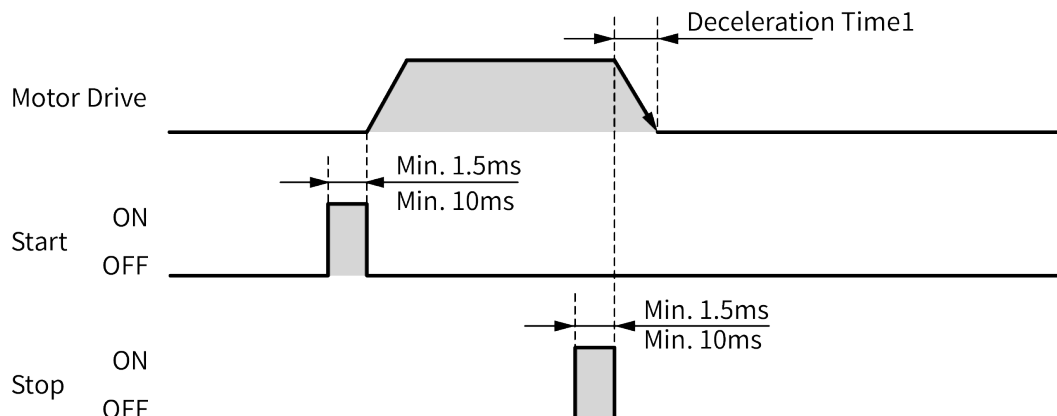


Note

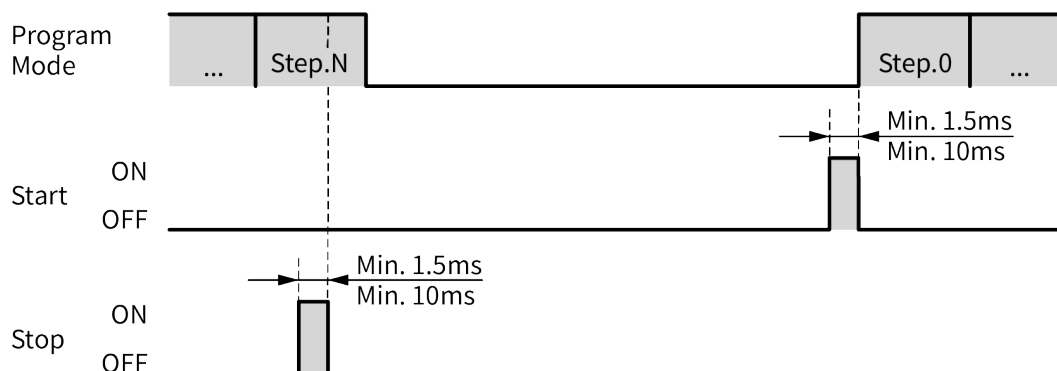
- When it stops by stop instruction during driving with program mode, supplying start input, it starts drive from the first step.
- When it pauses by pause instruction during driving with program mode, supplying start input, it starts drive from the next step of the paused one.

9.1.2.3 Stop

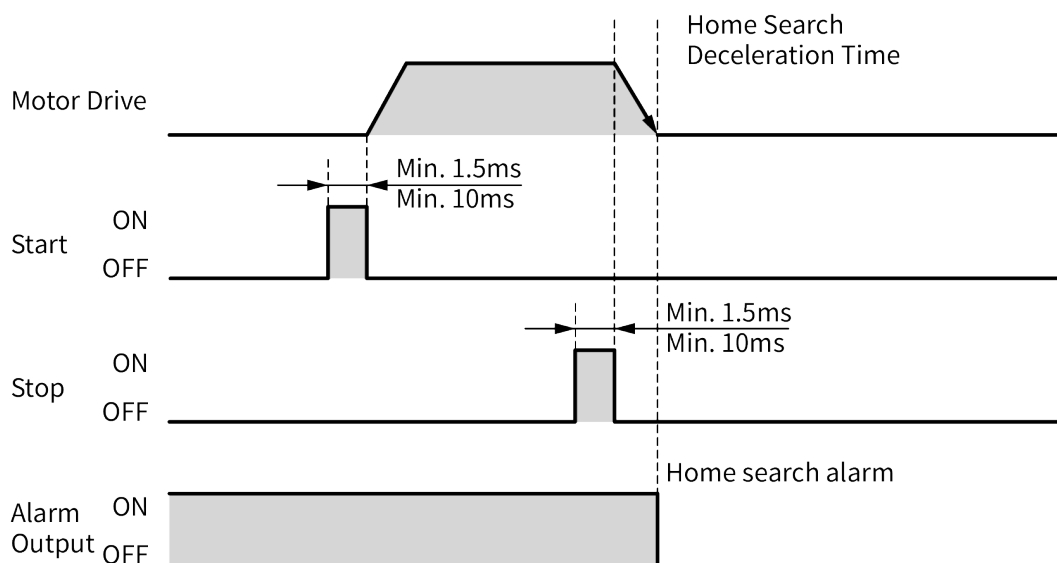
- During continuous driving, it decelerates and stops the motor according to 'Deceleration Time 1' parameter setting.



- During program mode driving, it stops after complete the current step.



- During home search, it decelerates and stops according to 'Home Search Deceleration Time' parameter setting. In this case, home search mode error (EH) alarm occurs.

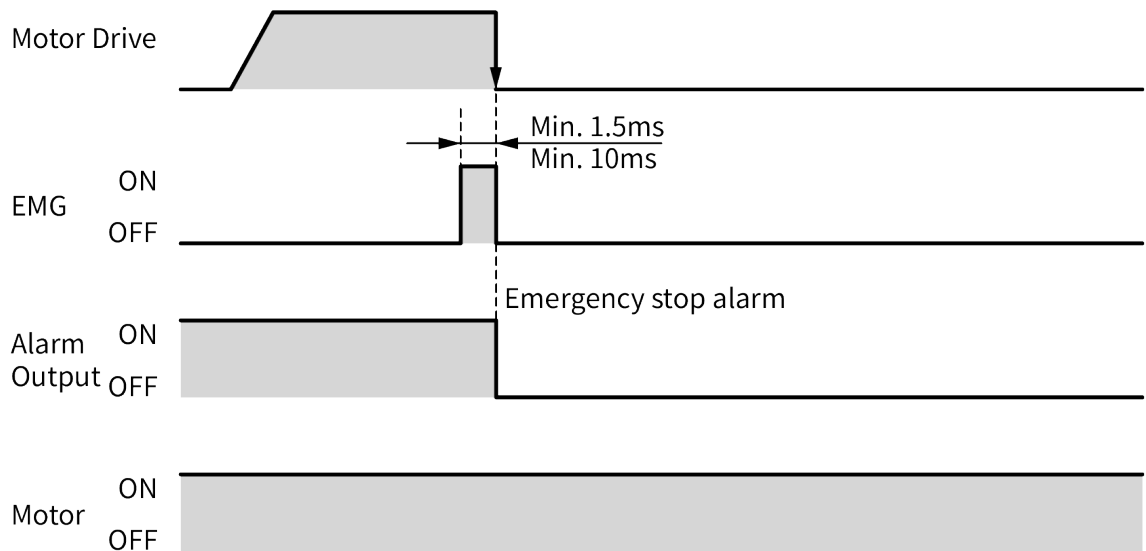


9.1.2.4 EMG (emergency)

Motor stops immediately, emergency stop alarm (E E) occurs.

The current of motor is not blocked.

During stopping motor, EMG instruction does not run.



**Note**

- Program drive mode step address

Address	Input signal						Address	Input signal					
	Step5	Step4	Step3	Step2	Step1	Step0		Step5	Step4	Step3	Step2	Step1	Step0
1	0	0	0	0	0	0	33	1	0	0	0	0	0
2	0	0	0	0	0	1	34	1	0	0	0	0	1
3	0	0	0	0	1	0	35	1	0	0	0	1	0
4	0	0	0	0	1	1	36	1	0	0	0	1	1
5	0	0	0	1	0	0	37	1	0	0	1	0	0
6	0	0	0	1	0	1	38	1	0	0	1	0	1
7	0	0	0	1	1	0	39	1	0	0	1	1	0
8	0	0	0	1	1	1	40	1	0	0	1	1	1
9	0	0	1	0	0	0	41	1	0	1	0	0	0
10	0	0	1	0	0	1	42	1	0	1	0	0	1
11	0	0	1	0	1	0	43	1	0	1	0	1	0
12	0	0	1	0	1	1	44	1	0	1	0	1	1
13	0	0	1	1	0	0	45	1	0	1	1	0	0
14	0	0	1	1	0	1	46	1	0	1	1	0	1
15	0	0	1	1	1	0	47	1	0	1	1	1	0
16	0	0	1	1	1	1	48	1	0	1	1	1	1
17	0	1	0	0	0	0	49	1	1	0	0	0	0
18	0	1	0	0	0	1	50	1	1	0	0	0	1
19	0	1	0	0	1	0	51	1	1	0	0	1	0
20	0	1	0	0	1	1	52	1	1	0	0	1	1
21	0	1	0	1	0	0	53	1	1	0	1	0	0
22	0	1	0	1	0	1	54	1	1	0	1	0	1
23	0	1	0	1	1	0	55	1	1	0	1	1	0
24	0	1	0	1	1	1	56	1	1	0	1	1	1
25	0	1	1	0	0	0	57	1	1	1	0	0	0
26	0	1	1	0	0	1	58	1	1	1	0	0	1
27	0	1	1	0	1	0	59	1	1	1	0	1	0
28	0	1	1	0	1	1	60	1	1	1	0	1	1
29	0	1	1	1	0	0	61	1	1	1	1	0	0
30	0	1	1	1	0	1	62	1	1	1	1	0	1
31	0	1	1	1	1	0	63	1	1	1	1	1	0
32	0	1	1	1	1	1	64	1	1	1	1	1	1

- 0: OFF, 1: ON

9.1.2.5 Step0, 1/ \pm Run/ \pm Jog

Operate according to the mode selection of “MD0”, “MD1”.

(1) Step0, 1

It is available to set the start address of program mode among 0 to 63 range by 6-digit bit of Step0 to Step5.



Note

- Refer to ‘Program drive mode step address’

(2) \pm Run

Accordng to the set parameter, it drives to CW (+Run) / CCW (-Run) direction as continuous mode.

(3) \pm Jog

Accordng to the set parameter, it drives to CW (+Jog) / CCW (-Jog) direction during ON jog signal.



Note

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

9.1.2.6 Step2, 3/SSP0, 1 (start speed)

(1) Step2, 3

It is available to set the start address of program mode among 0 to 63 range by 6-digit bit of Step0 to Step5.

**Note**

- Refer to 'Program drive mode step address'

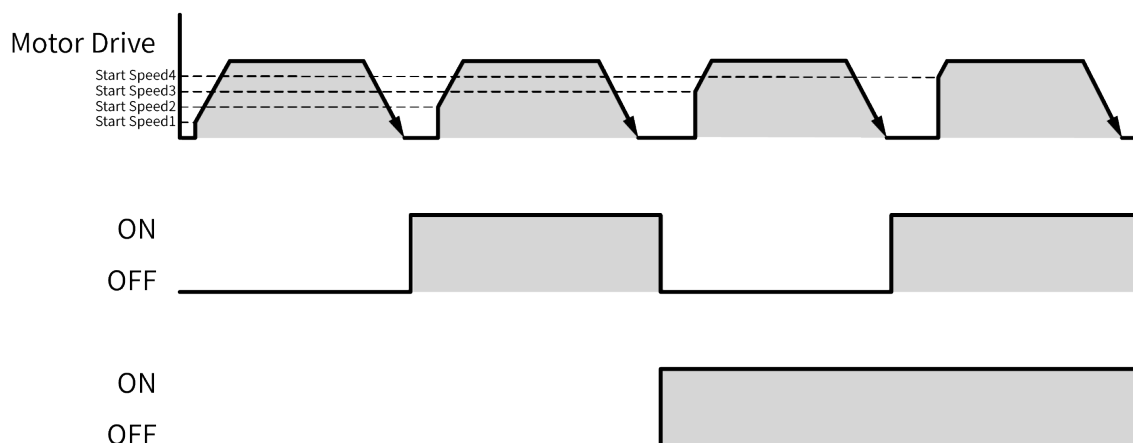
(2) SSP0, 1

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

**Note**

Start speed 5 is not available.



9.1.2.7 Step4, 5/MSP0, 1 (max speed)

Operate according to the mode selection of “MD0”, “MD1”.

(1) Step4, 5

It is available to set the start address of program mode among 0 to 63 range by 6-digit bit of Step0 to Step5.

- Step 0 = LSB
- Step 5 = MSB



Note

- Refer to ‘Program drive mode step address’

(2) MSP0, 1

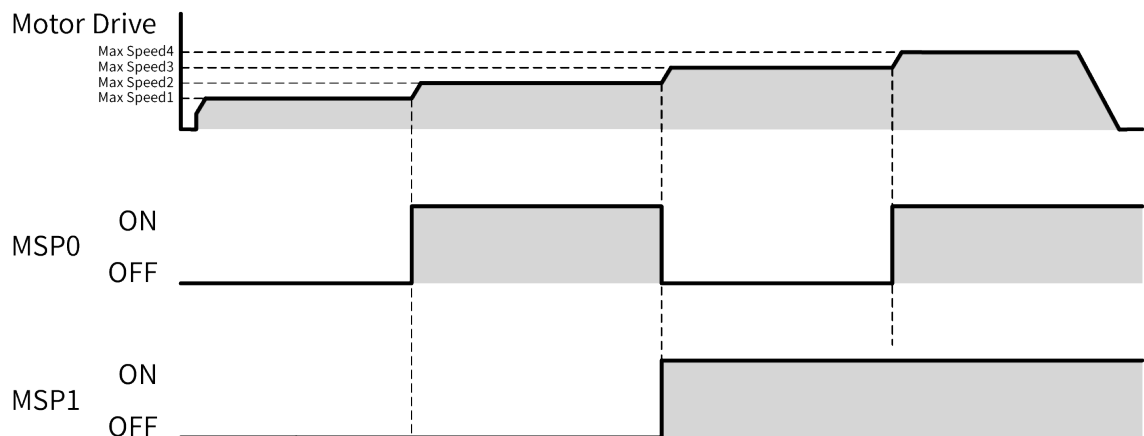
It is available to set the max. drive speed of jog mode, continuous mode by 2-digit bit of MSP0, MSP1.

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



Note

Max speed 5 is not available.



9.1.2.8 MD0, 1/HMD0, 1 (mode/home mode)

Drive mode and home search mode can be selected.

(1) MD0, 1

When it is not home search mode, it is available to set the drive mode among 4 types.

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

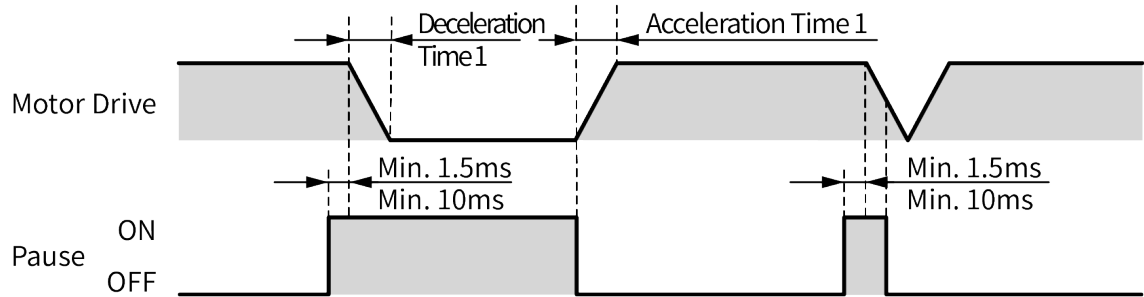
(2) HMD0, 1

When home signal is ON, it is available to set the home search mode among 4 types.

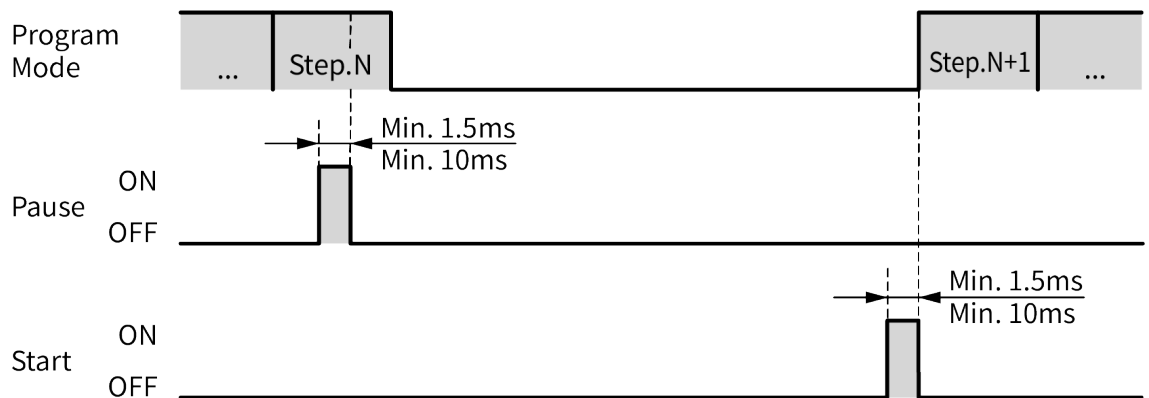
	HMD1	HMD0
Home search	OFF	OFF
Limit home search	OFF	ON
Zero point home search	ON	OFF
Torque home search	ON	ON

9.1.2.9 Pause

- 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.



9.1.2.10 Servo On/Off

It is for adjusting shaft position of motor by external force manually.

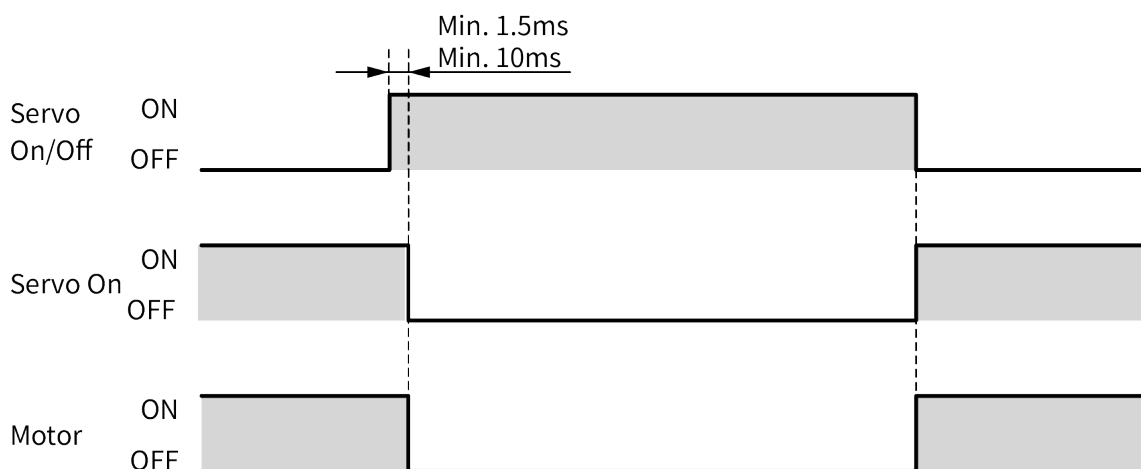
When Servo is Off in built-in brake type, brake turns into lock status. the brake status can be changed as release status manually by using Brake ON/OFF signal. For more information, refer to '9.1.2.16 Brake ON/OFF'.

- Servo On/Off signal is ON over 1.5 msec or 10 msec.
: It recognizes as servo off signal and the phase current of motor is blocked and torque is released.
Servo On indicator, In-Position Output and the indicator turn OFF.
- Servo On/Off signal is Off over 1.5 msec or 10 msec.
: It recognizes as servo on signal and the phase current of motor is supplied and torque is return.
Servo On indicator, In-Position Output and the indicator turn ON.



Note

Only available when motor is stopped. Make sure the motor completely stop before use.



9.1.2.11 Home

Home search mode is set at 'Home Search Method' parameter.

As below 4 parameters, it is available to set home search speed and acceleration/deceleration time.

- Home Search Max Speed
- Home Search Start Speed
- Home Search Acceleration Time
- Home Search Deceleration Time

	Home
Driving mode	OFF
Home search mode	ON

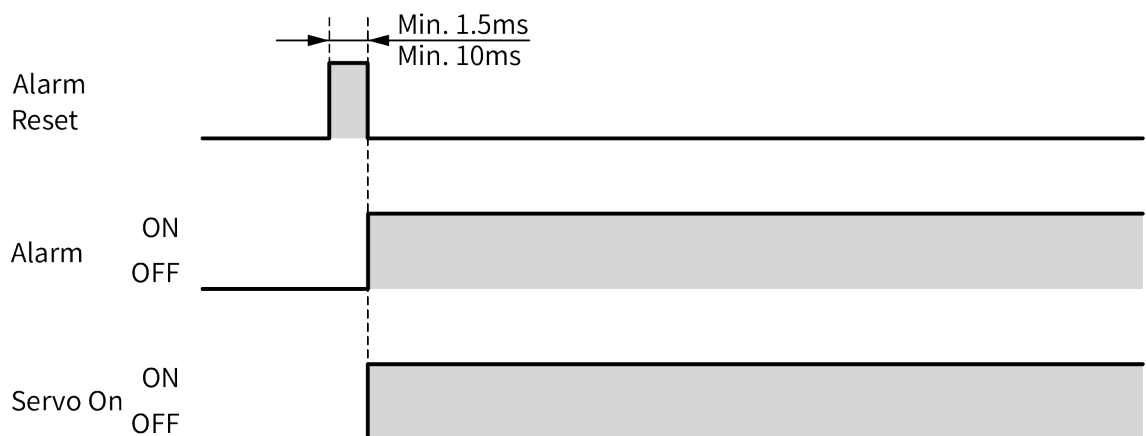
9.1.2.12 Alarm Reset

- It is for alarm reset.
- When alarm reset signal is [H].
: alarm is reset and the alarm indicator and alarm output turns OFF.
The driver returns to normal status.



Note

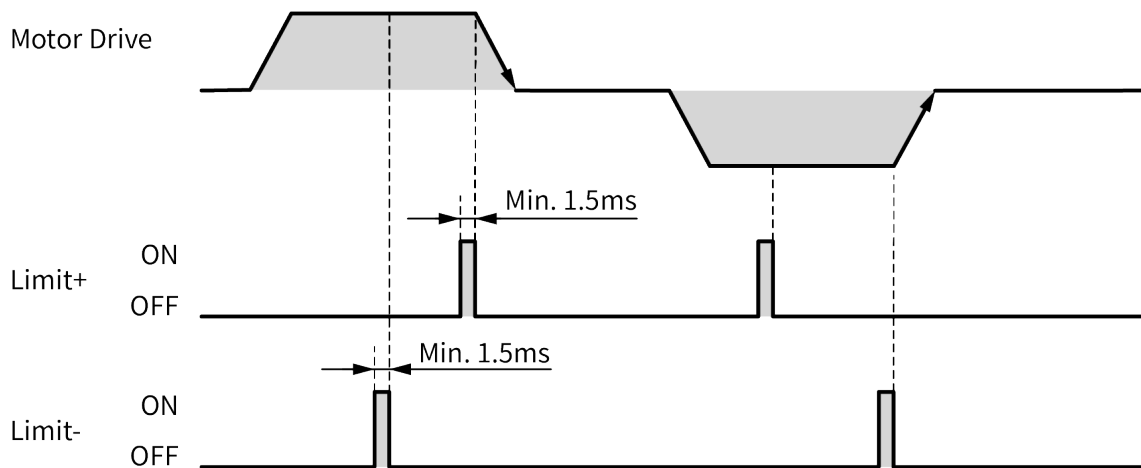
If alarm causes are not removed, the driver does not return to normal status.



9.1.2.13 \pm Limit

When supplying the \pm limit signal over 1.5 msec, it recognizes as \pm hardware limit input and it decelerates and stops or stops immediately according to the set parameter.

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

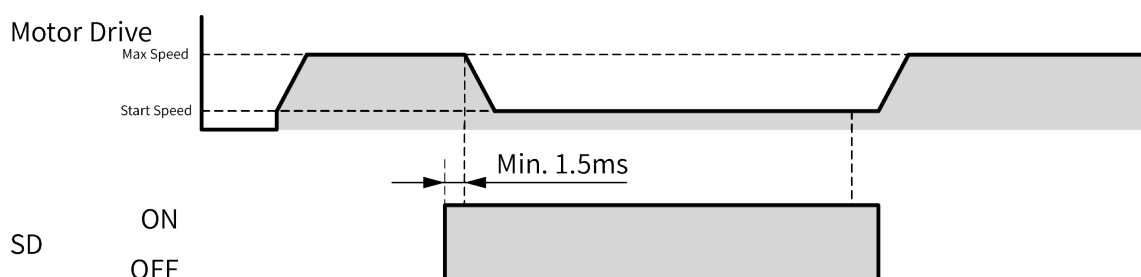


9.1.2.14 ORG (origin)

During driving as general home search mode, it is used as home sensor input. When supplying ORG signal over 1.5 msec, it recognizes as home sensor.

9.1.2.15 SD (slow down)

When supplying SD signal over 1.5 msec, the set the start drive speed decelerates.



9.1.2.16 Brake ON/OFF

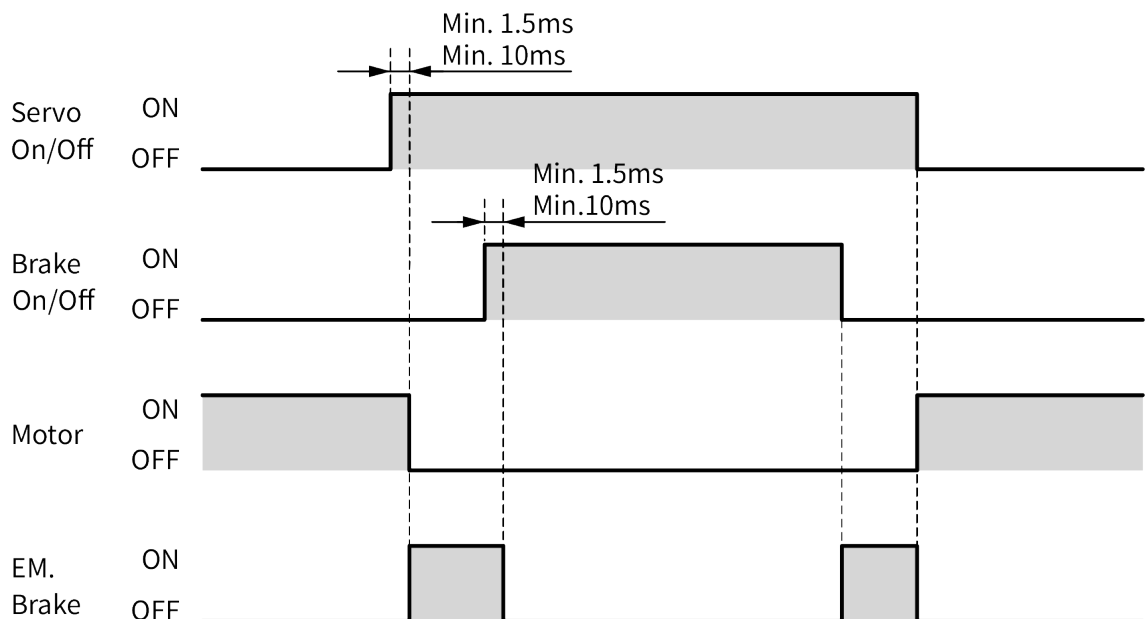
IN8 input can be selected as Brake ON/OFF through the parameter selection.

- When Brake ON/OFF signal remains ON more than 1.5 msec or 10 msec, Brake is released.
- When Brake ON/OFF signal remains OFF more than 1.5 msec or 10 msec, Brake is locked.



Note

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



9.1.3 General Input

Signal name	Descriptions	Pin no.
IN0 to IN2	General input 0 to 2	26 to 28
IN3 to IN8	General input 3 to 8	30 to 35

It is general input at program mode.

It is used with ICJ, IRD instruction.

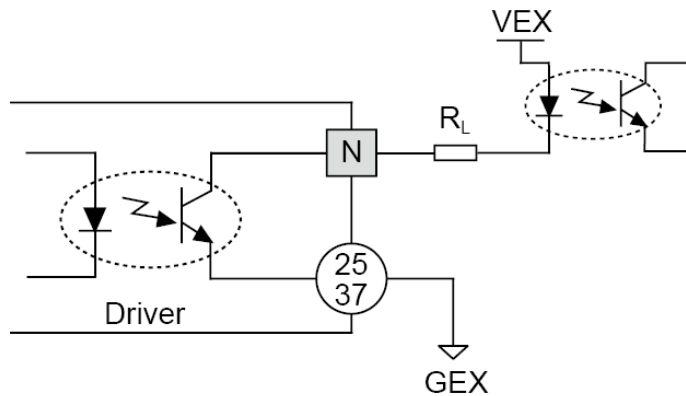
- IN0 to IN7
When supplying over 1.5 msec, it recognizes as input
- IN8
When supplying over 10 msec or 1.5 msec (set at 'Input Filter' parameter), it recognizes as input.

9.2 Output

9.2.1 Example of Output Circuit Connection

In case of output, use external power (VEX) max. 12 to 24VDC, 10mA

When current exceeds 10mA, use an external resistor R_L to adjust the current value.



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



Note

N: Output pin number of CN4

VF: Photocoupler primary LED forward voltage

9.2.2 Exclusive Output

Signal name	Descriptions	Pin no.
In-Position	Drive ending pulse	23
Alarm	Alarm output	38
Compare 1 (Trigger)	Compare output 1	39
Compare 2 (Trigger)	Compare output 2	40

9.2.2.1 In-Position

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

When In-Position completes, In-Position output becomes [H] and In-Position indicator turns ON.

During In-position operation, In-Position output becomes [L] and In-Position indicator turns OFF.

The signal outputs depending on the set In-Position value

For more information, refer to '12.2.3 In-Position'.

9.2.2.2 Alarm

In normal state, output is ON and when alarm occurs, output is OFF.

Depending on the alarm type, it displays the alarm number on the alarm / status display part and flashes as much as the alarm number on the alarm indicator.

In connected communication, Alarm can be displayed in atMotion program.

For more information, refer to '13 Protection Function'.

9.2.2.3 Compare1, Compare2

It outputs trigger pulse at the designated cycle.

Mode	Description
0	Not use comparison output.
1	Comparison output turns ON when the present absolute position value is same or bigger than the set position value.
2	Comparison output turns ON when the present absolute position value is same or smaller than the set position value.
3	Trigger pulses output with the set interval (Compare 1 Period or Compare 2 Period) and width (Compare 1 Pulse Width or Compare 2 Pulse Width).

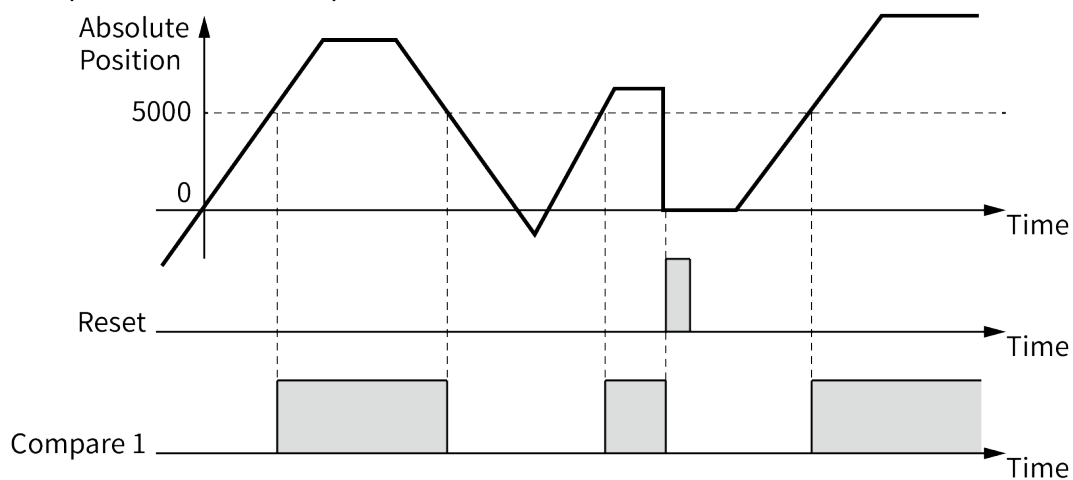


Note

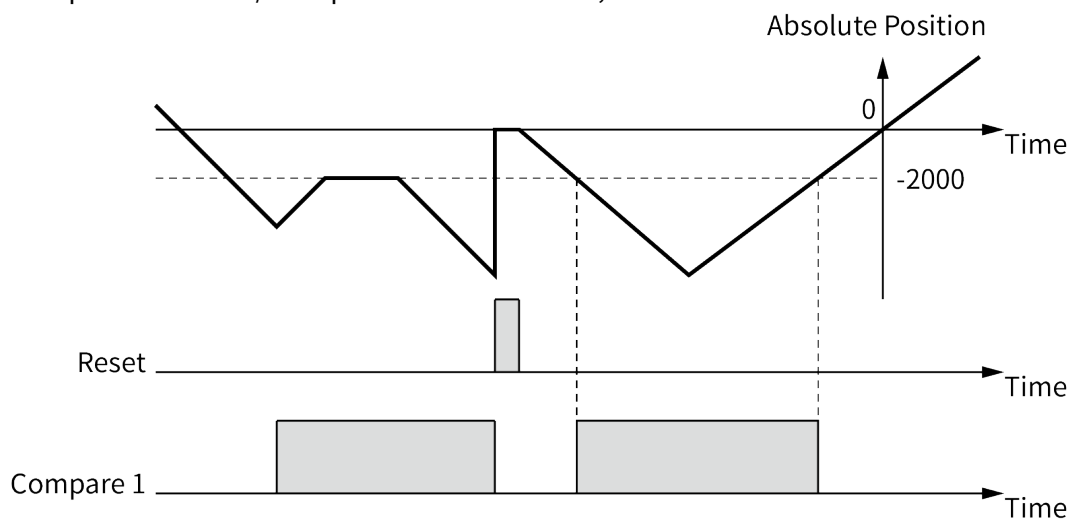
- ※ Setting range of Compare 1 Position, Compare 2 Position:
-2,147,483,648 to +2,147,483,647
- ※ Setting range of Compare 1 Period, Compare 2 Period:
1 to 2,147,483,648 [pulse]
- ※ Setting range of Compare 1 Pulse Width, Compare 2 Pulse Width :
1 to 1,000 [msec]

**Ex.**

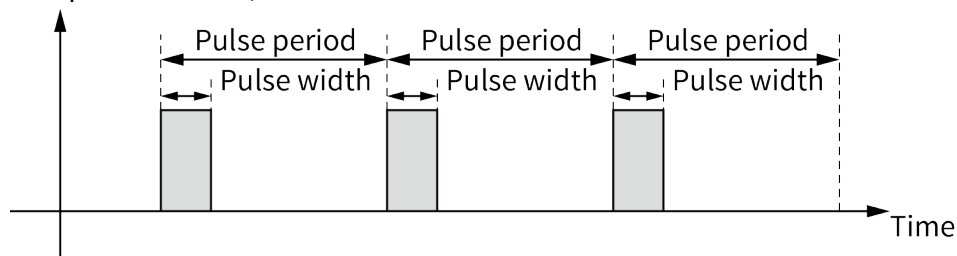
- Compare 1 Mode=1 / Compare 1 Position=5000,



- Compare 1 Mode=2 / Compare 1 Position=-2000,



- Compare 1 Mode=3,



9.2.3 General Output

Signal name	Description	Pin no.
OUT0 to OUT9	General Output 0 to 9	41 to 50

It is general output at program mode.

It is used with OPC, OPT instruction.



Note

By setting the parameter 'Output Mode (Alarm)', the output can be maintained or initialized when the alarm occurs.

Parameter	Setting	Description
Output Mode (Alarm)	Holding	Output maintained
	Reset	Output initialized

10 Drive

AiCA Series has various drive modes and home search, as table below.

It operates each drive mode by I/O input and atMotion.

Drive mode name	Descriptions
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 mode	Outputs drive while position reaches to designated value.
Torque mode	Outputs continuous drive by designated torque.
Program mode	Operates by the designated program.
Home search	Operates home search



Caution

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 Mode

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

- Index mode drive

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

When operating the other instruction, error occurs.

1st Drive mode: “MD0”=0, “MD1”=0

2nd Select Index mode.

: It is available to set the step number from 0 to 63 combining with “Step0” to “Step5”.

3rd Start drive.

: When “Start” input signal turns ON, the designated one step operates.

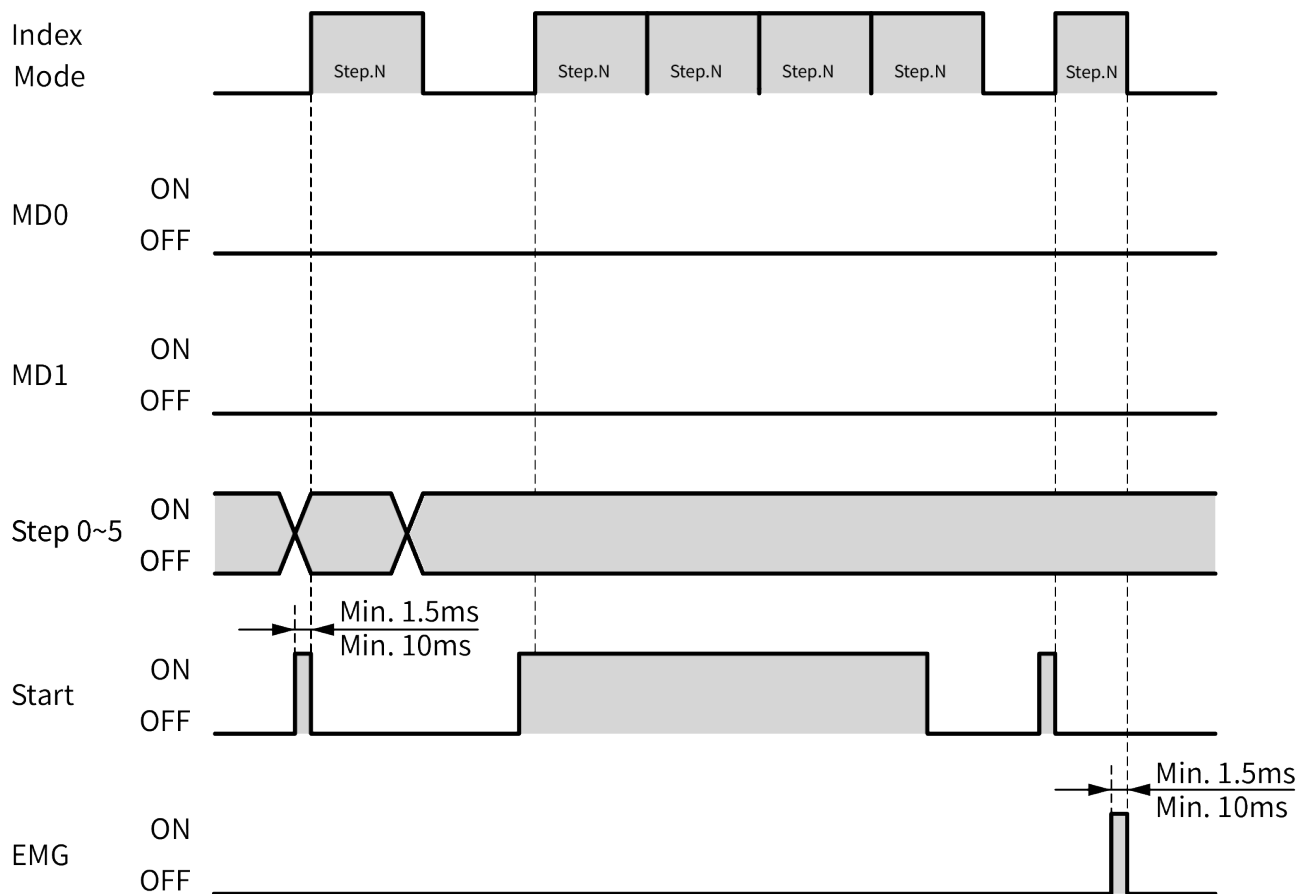
4th Emergency stop

: When “EMG” signal inputs, it stops emergently.



Caution

- When it stops by stop signal input, Index mode error alarm (E 6) occurs.
- When driving the step which does not have “ABS” or “INC” instruction, Index mode error alarm (E 6) occurs.
- The specified step operates repeatedly if the “Start” signal is input continuously.



10.1.2 Jog Mode

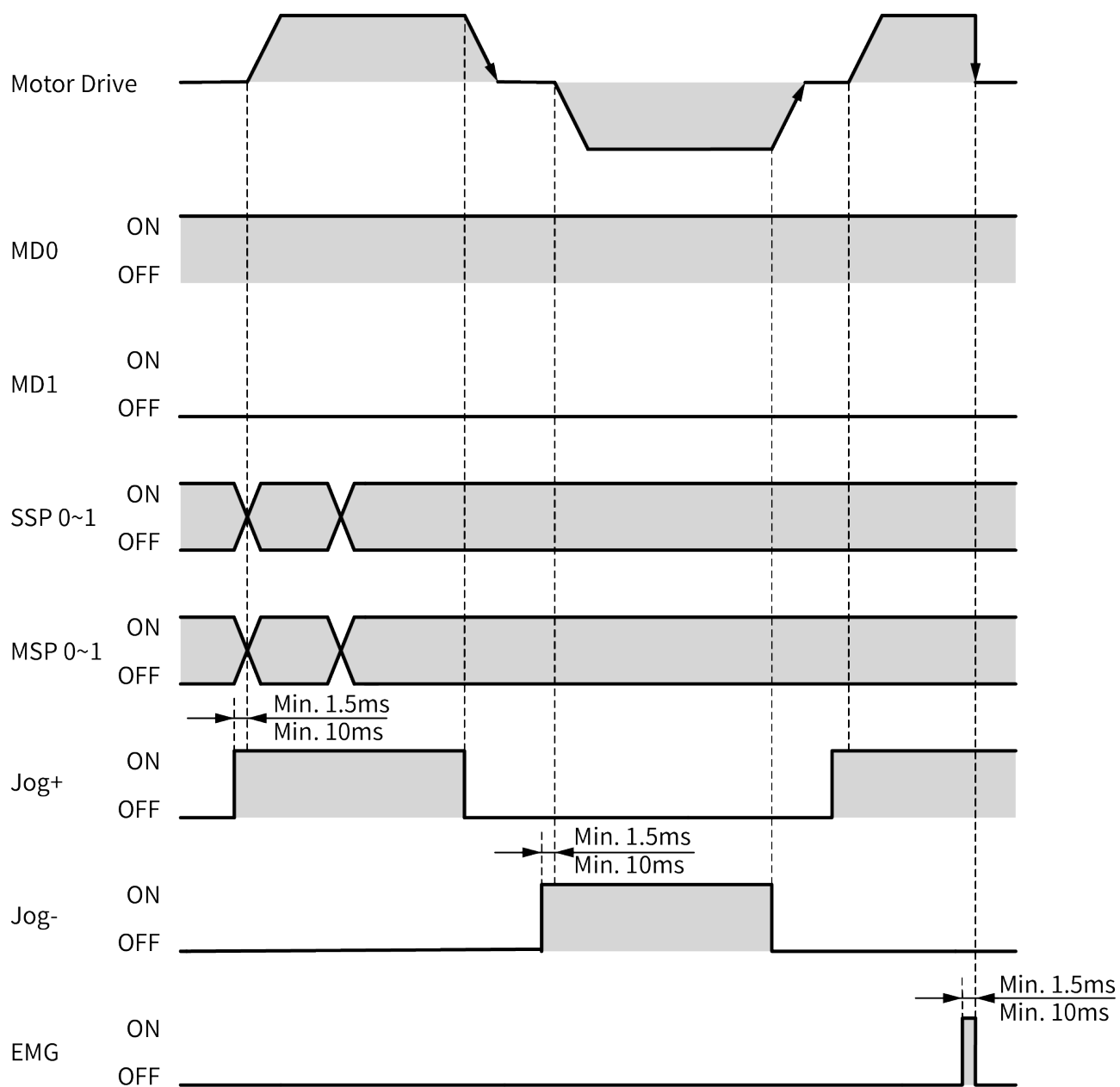
At jog mode, it operates motor to CW direction or CCW direction while “+Jog” or “-Jog” signal is ON.

- Jog mode drive
 - 1st Dive mode: “MD0”=1, “MD1”=0
 - 2nd Select start drive speed.
 - : It is available to set the start drive speed combining with “SSP0”, ”SSP1”.
 - 3rd Select max. drive speed.
 - : It is available to set the max. drive speed combining with “MSP0”, ”MSP1”.
 - 4th Drive: It drives to CW direction or CCW direction while “+Jog” or “-Jog” signal inputs.
 - 5th Emergency stop
 - : When “EMG” signal inputs, it stops emergently.



Note

- It cannot stop by “Stop” signal input.
- If the both signal “+Jog” and “-Jog” enter at the same time, the motor stops.



10.1.3 Continuous Mode

At continuous mode, it operates motor continuously when drive signal inputs to the designated direction.

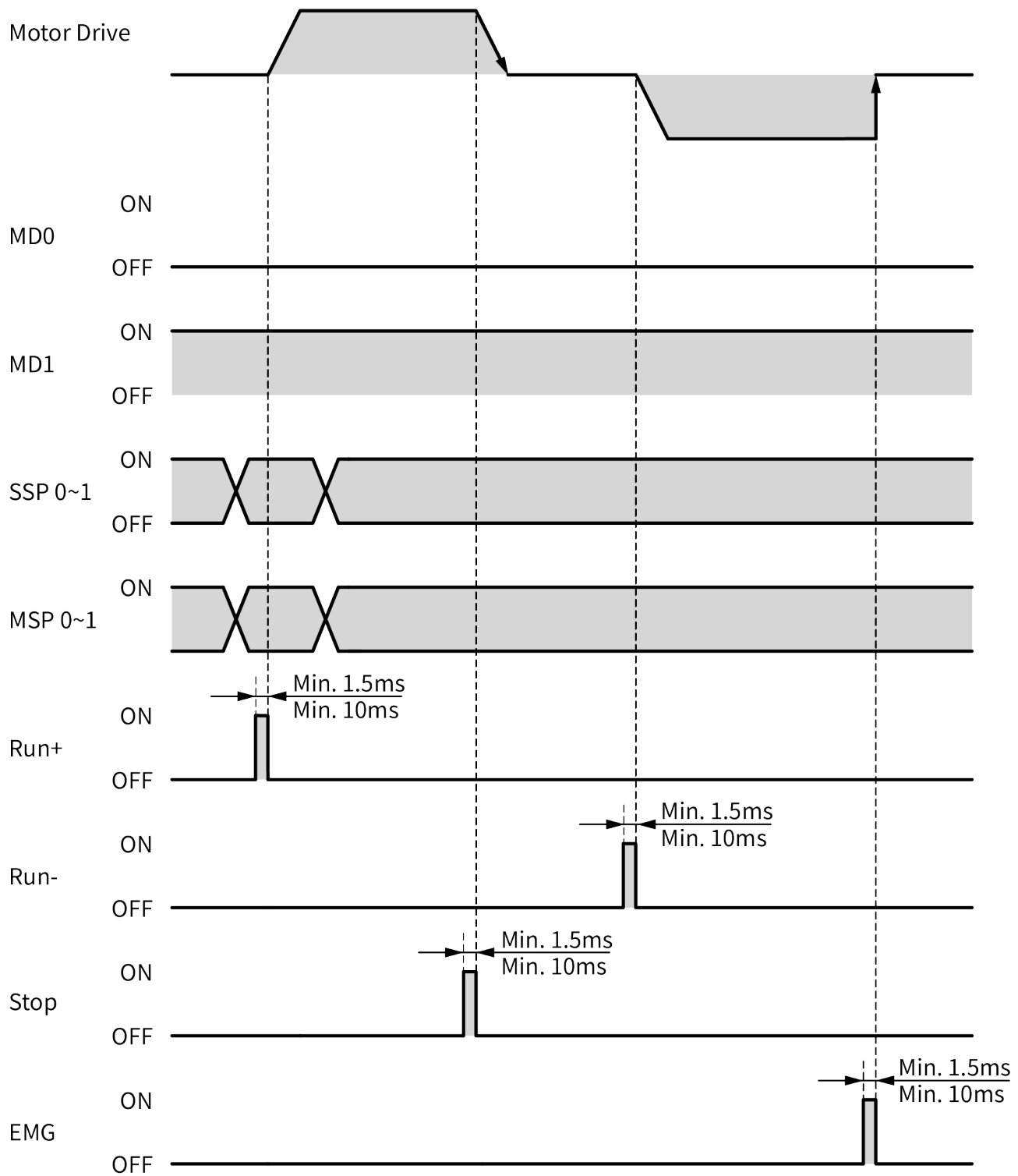
When STOP signal inputs or limit signal of the direction inputs, it stops.

- Continuous mode drive
 - 1st Drive mode: “MD0”=0, “MD1”=1
 - 2nd Select start drive speed.
 - : It is available to set the start drive speed combining with “SSP0”, “SSP1”.
 - 3rd Select max. drive speed.
 - : It is available to set the max. drive speed combining with “MSP0”, “MSP1”.
 - 4th Drive: When “+Run” or “-Run” signal inputs, it drives to CW direction or CCW direction.
 - 5th Stop: When “STOP” signal inputs or limit signal of the direction inputs, it stops.
 - 6th Emergency stop: When “EMG” signal inputs, it stops emergently.



Note

- If the both signal “+Run” and “-Run” enter at the same time, the motor stops.



10.1.4 Program Mode

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

- Program mode drive
The saved program should exist at memory.
1st Drive mode: “MD0” = 1, “MD1” = 1
2nd Drive
: When “Start” input signal turns ON, it drives according to the set program.
3rd Pause
: When “Pause” signal inputs, it stops after completing the step.
When “Start” signal inputs again, it drives from the completed next step.
4th Stop
: When “Stop” signal inputs, it stops after completing the step.
When “Start” signal inputs again, it drives from the first step.
5th When “EMG” signal inputs, it stops emergently.
6th Program end: When “END” signal inputs, program mode drive is end.



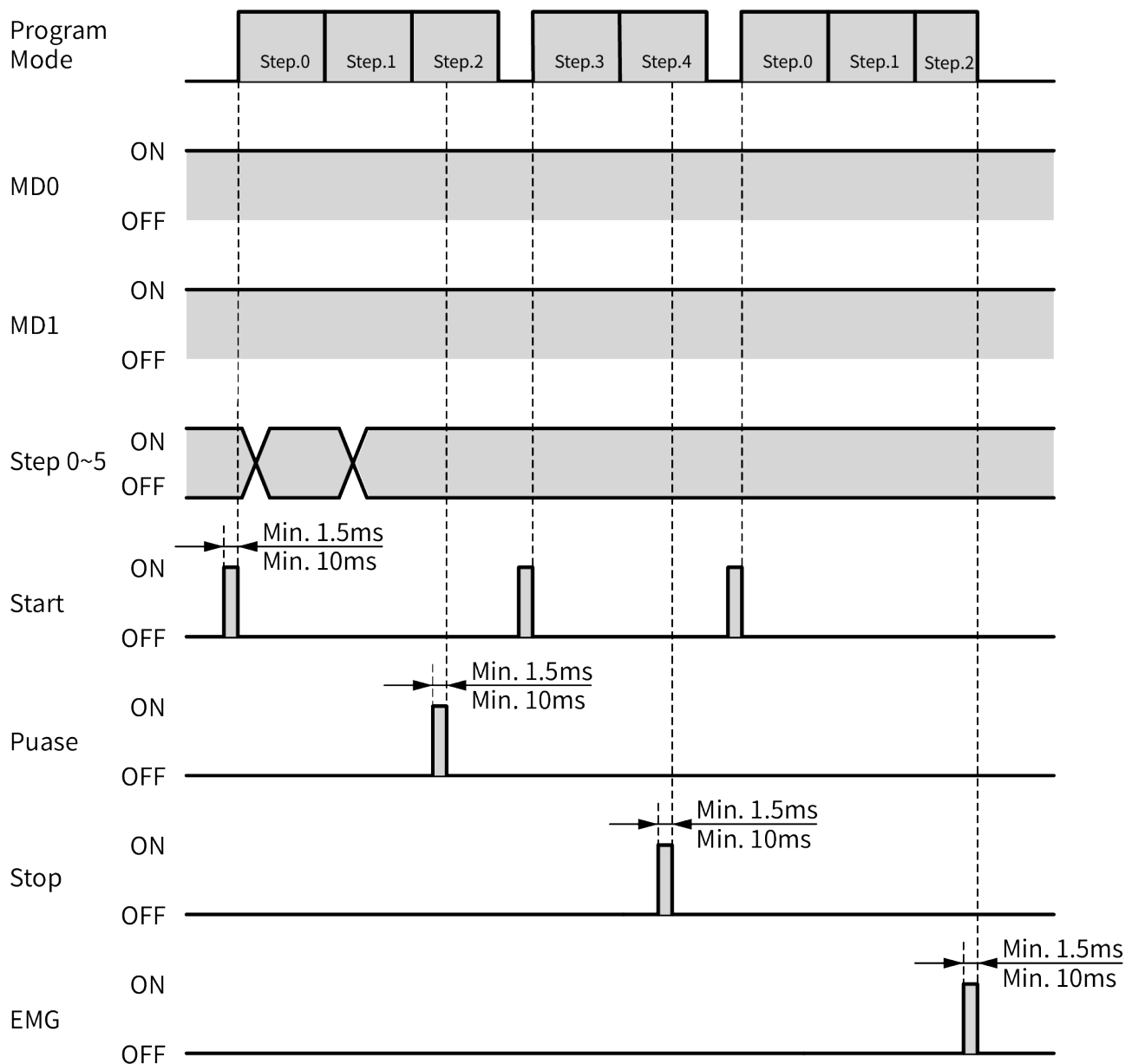
Note

- 256 steps (0 to 255) can be assigned by the atMotion program.
- When “Power On Program Start” parameter is Enable, it operates program mode drive when resupplying power.



Caution

- For end of program mode, “END” signal must be input.
If there is no “END” instruction input, Program mode error alarm (E F) occurs.



10.1.5 Home Search

According to the setting of “HOME Active Level” parameter, it operates home search drive by [H] or [L] input.

- Home search drive

1st Drive mode

: It is available to set the home search mode combining with “HMD0”, “HMD1”.

2nd Drive

: When “HOME” signal inputs, it operates home search according to the set mode.

3rd Stop

: When “STOP” signal inputs or limit signal of the direction inputs, it stops.

4th Emergency stop

: When “EMG” signal inputs, it stops emergently.

5th Complete

: When the home is found, home search ends.



Caution

- If the “Power On Home Search” parameter is enabled, the home search operates when the power is applied. If it is set to zero point home search, Home search mode error alarm (EH) occurs.

10.1.5.2 Limit Home Search (home search method=1)

It operates home search by limit sensor.

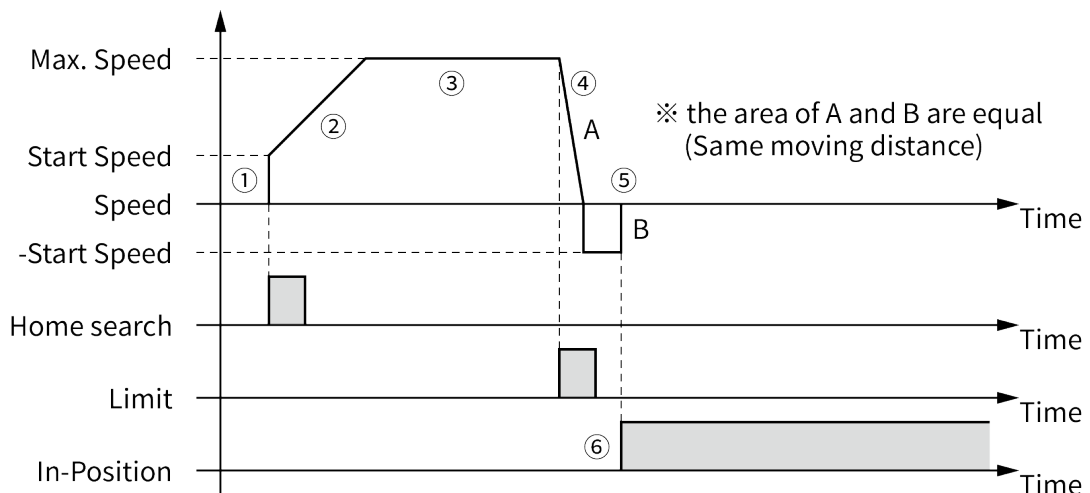
Assigns the home by receiving the output signal from the sensor by connecting external limit sensor on exclusive input “ \pm Limit” (pin no. 19 and 20).

- 1st Limit Home Search Drive It operates home search drive to the set direction at “Home Search Direction”.
- 2nd 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”.
- 3rd 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”.
- 4th If “ \pm Limit (\pm direction limit sensor)” signal inputs or it arrives to “Software Limit \pm (\pm software limit)”, it decelerates with the set deceleration time at “Home Search Deceleration Time” and stops.
- 5th 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.
- 6th After finding home, “In-Position” signal outputs and the “INP. indicator (orange)” turns ON.



Note

- At “Home Search Offset”, the other value except 0 is set, it moves for the setting value with start drive speed, “In-Position” signal outputs, and the “INP. indicator (orange)” turns ON.



Caution

- 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.

10.1.5.3 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.

- Zero Point Home Search Drive

1st 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.

2nd The set direction at “Home Search Direction” is ignored and it operates drive at the set home direction.

3rd 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”.

4th After acceleration drive is complete, it operates constant speed drive with the set max. drive speed at “Home Search Max speed”.

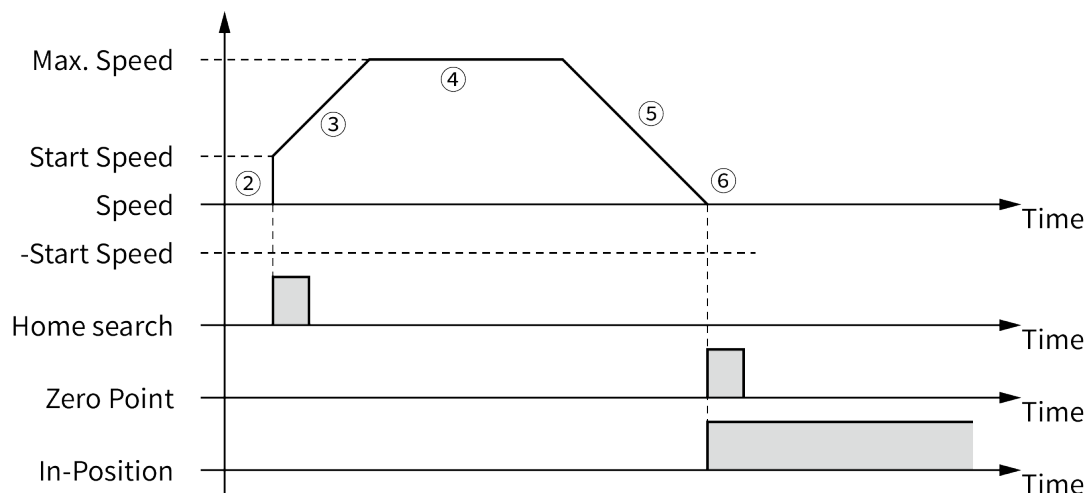
5th When it is close to home, it decelerates with the set deceleration time at “Home Search Deceleration Time” and it stops.

6th After finding home, “In-Position” signal utputs and the “INP. indicator (orange)” turns ON.



Note

- At “Home Search Offset”, the other value except 0 is set, it moves for the setting value with start drive speed, “In-Position” signal outputs, and the “INP. indicator (orange)” turns ON.



**Caution**

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

10.1.5.4 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.

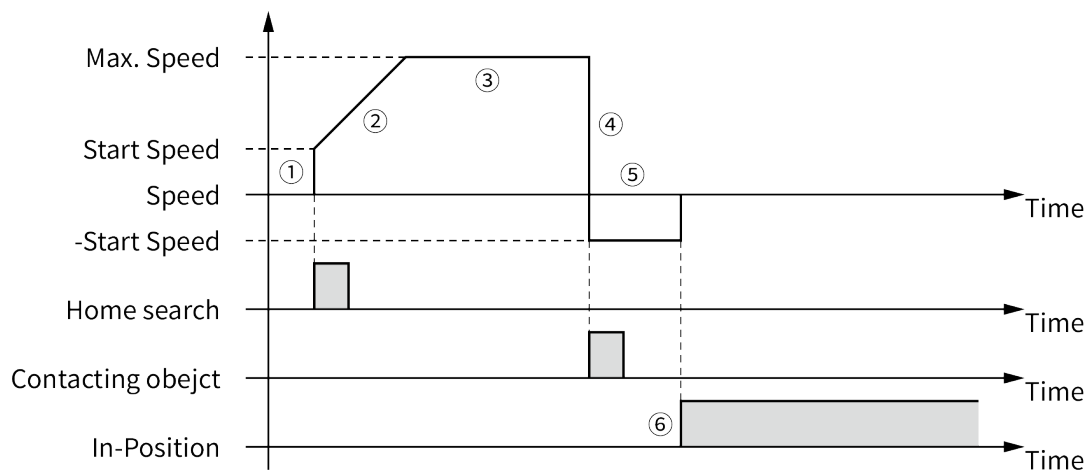
When the torque value is output as much as the value set in the parameter “Home Search Torque” by contacting a specific object, assign the position moved by the value set in the parameter “Home Search Offset” as the home.

- 1st Torque Home Search Drive It operates home search drive to the set direction at “Home Search Direction”.
- 2nd 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”.
- 3rd 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”.
- 4th When 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”.
- 5th After stops, it rotates and stops to the reverse direction with the start drive speed and rotation value set from atMotion.
- 6th After finding home, “In-Position” signal outputs and the “INP. indicator (orange)” turns ON.



Note

- At “Home Search Offset”, the other value except 0 is set, it moves for the setting value with start drive speed, “In-Position” signal outputs, and the “INP. indicator (orange)” turns ON.



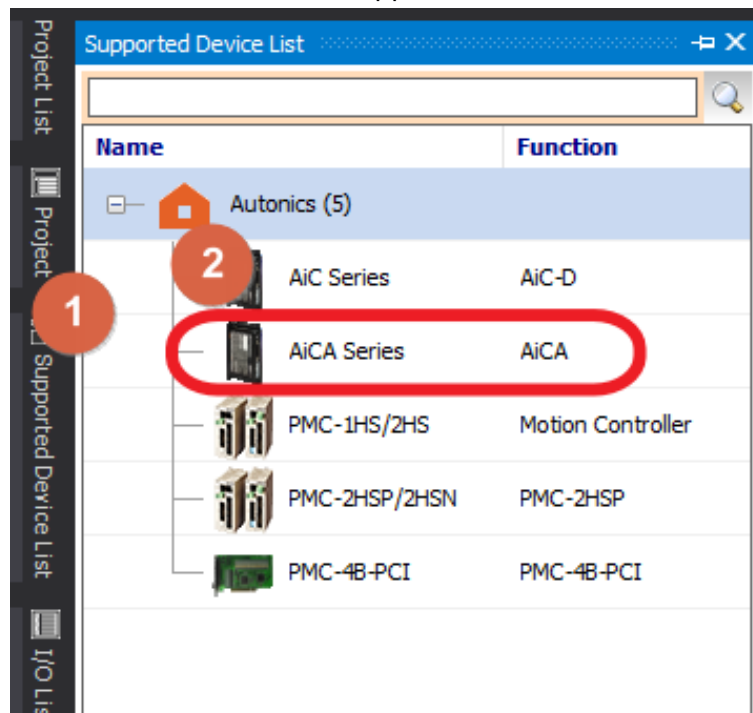
10.2 atMotion Control Drive

- atMotion run and setting

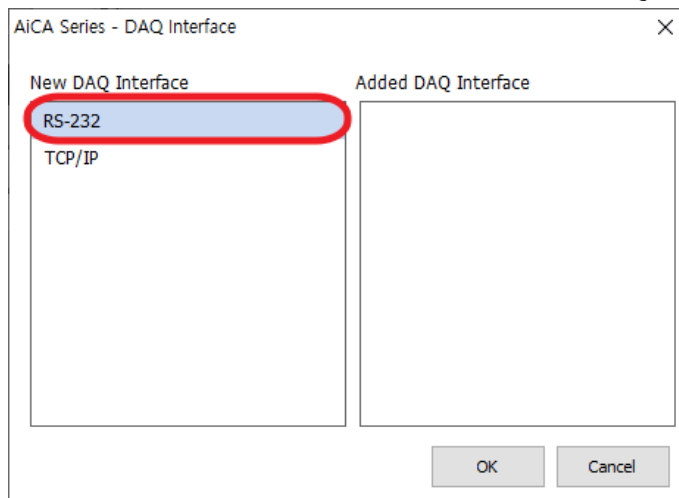
1st Visit our website (www.autonics.com) to download and install newest version of 'atMotion'.

2nd Run 'atMotion' which is installed on PC.

3rd On the left side, select ① 'Supported Device List' - ② 'AiCA Series'.

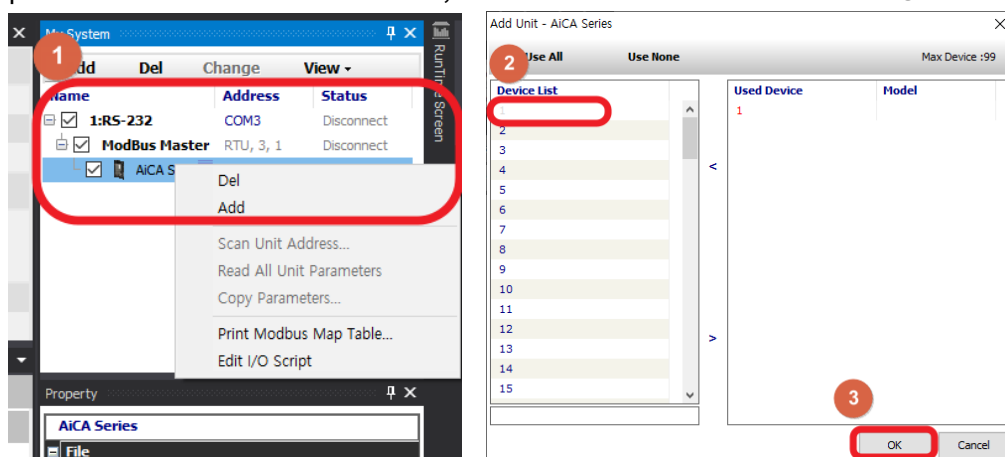


4th Set communication method as 'RS-232' at New DAQ interface

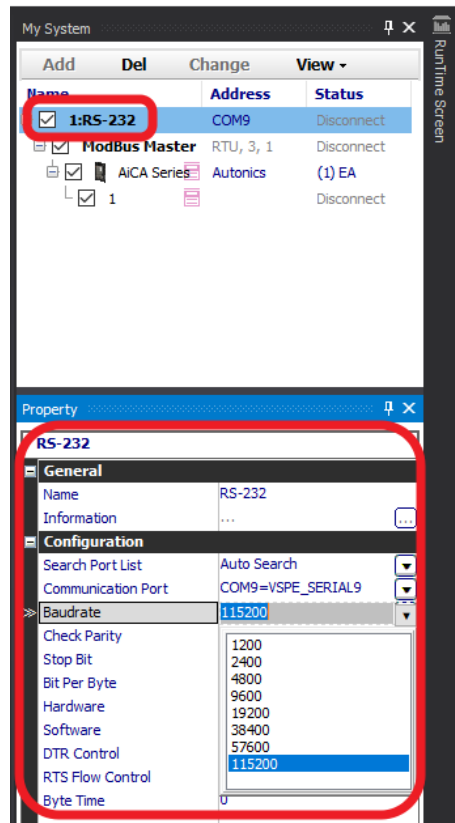


5th Right click the newly added device on 'My System' then click ① 'Add'.

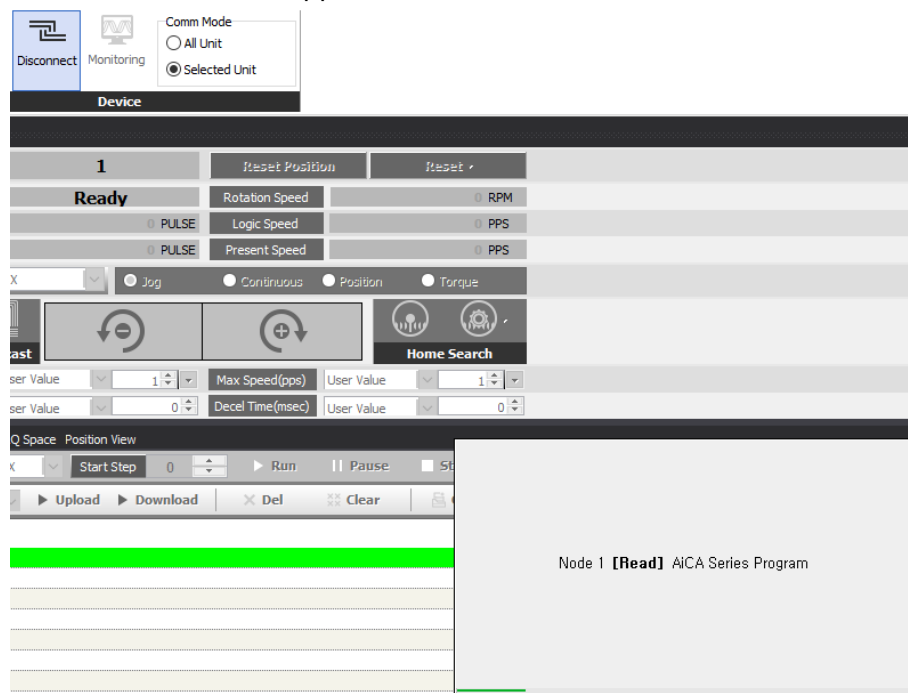
When ② 'Add Unit' window displays, double click the device list or click the arrow, placed in the middle of the window, to create node number then select ③ 'OK'.



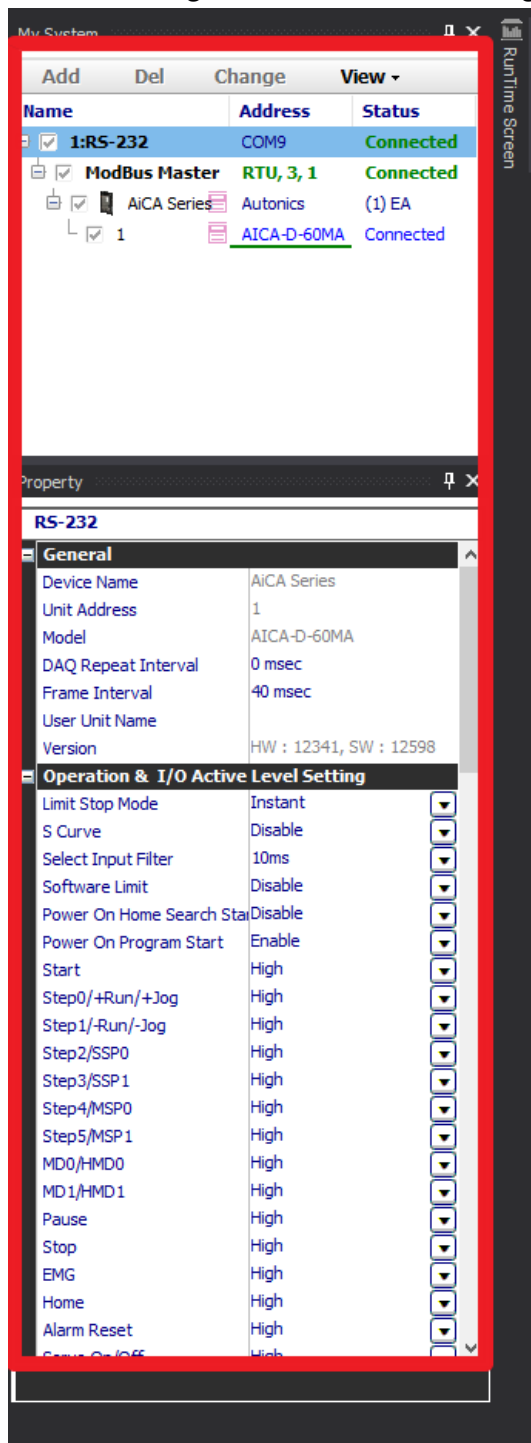
6th Select 'RS-232' on the right side of the window, set the communication port, and baud rate for the connected device.





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





8th 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 <input type="radio"/> Torque	
EMG	Broadcast	<div>   </div>	
<div> <div>Start Speed(pps)</div> <div>User Value</div> <div>2000</div> </div>		<div> <div>Max Speed(pps)</div> <div>User Value</div> <div>1000</div> </div>	
<div> <div>Accel Time(msec)</div> <div>User Value</div> <div>100</div> </div>		<div> <div>Decel Time(msec)</div> <div>User Value</div> <div>100</div> </div>	

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




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



Note



- 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="radio"/> Position <input type="radio"/> Torque	
EMG	Broadcast	  	
Start Speed(pps)	User Value	2000	Max Speed(pps)
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.

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



Note

- 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

The screenshot shows the 'Motion Control' interface with the following elements:

- Select Node:** 1
- Reset Position:** (Green button)
- Reset:** (Green dropdown)
- 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
- Mode Selection:** Jog, Continuous, Position (selected), Torque
- EMG:** (Red square icon)
- Broadcast:** (Green square icon)
- Relative Position:** (Dropdown menu)
- Home Search:** (Gear icon)
- 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.

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



Note

- 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

The screenshot displays the 'Motion Control' interface. At the top, 'Select Node' is set to '1', with 'Reset Position' and 'Reset' buttons. The 'Running Status' is 'Ready'. Below this, 'Logic Position' and 'Present Position' are both '0 PULSE'. 'Rotation Speed', 'Logic Speed', and 'Present Speed' are all '0 RPM' or '0 PPS'. The 'Axis' is set to 'X'. Control modes 'Jog', 'Continuous', 'Position', and 'Torque' are shown, with 'Position' selected. A 'Position Override' section includes a dropdown menu and a numeric input field set to '1000'. To the right are 'Home Search' buttons. At the bottom, speed and acceleration settings are shown: 'Start Speed(pps)' is 'User Value' with a value of '2000', 'Max Speed(pps)' is 'User Value' with a value of '1000', 'Accel Time(msec)' is 'User Value' with a value of '100', and 'Decel Time(msec)' is 'User Value' with a value of '100'.






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.

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



Note




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

10.2.4 Torque Mode

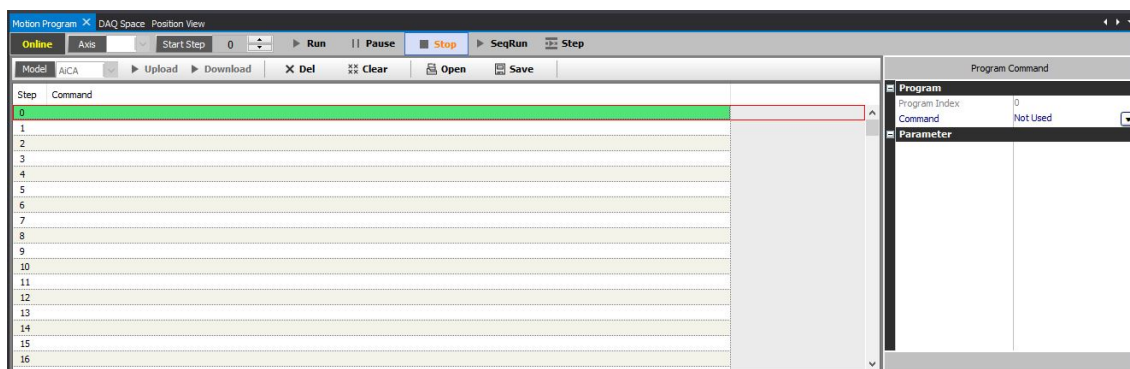
The screenshot displays the 'Motion Control' software interface. At the top, a blue header bar contains the title 'Motion Control'. Below this, the interface is organized into several sections:

- Mode Selection:** A 'Select Mode' dropdown is set to '1'. To its right are two green buttons: 'Reset Position' and 'Reset'.
- Status and Speeds:** The 'Running Status' is 'Ready'. Below it, 'Logic Position' and 'Present Position' are both '0 PULSE'. To the right, 'Rotation Speed', 'Logic Speed', and 'Present Speed' are all '0 RPM' or '0 PPS'.
- Axis and Mode Selection:** The 'Axis' dropdown is set to 'X'. Below it are three radio buttons: 'Jog', 'Continuous', and 'Position'. To the right, the 'Torque' mode is selected with a radio button.
- Control Buttons:** A row of buttons includes 'EMG' (red square), 'Broadcast' (green play icon), and three orange square buttons with left, center, and right arrows for direction control.
- Parameters:** 'Torque(%)' is set to '0' and 'Rise Time(msec)' is set to '100'. To the right are 'Home' and 'Search' icons.
- Speed and Time Settings:** At the bottom, four input fields are shown: 'Start Speed(pps)' (User Value, 2000), 'Max Speed(pps)' (User Value, 1000), 'Accel Time(msec)' (User Value, 100), and 'Decel Time(msec)' (User Value, 100).

Control the motor by setting the torque that the motor can operate at the specified speed.

- Torque mode operation
 - 1st Select 'Torque' on Motion Control – mode selection box.
 - 2nd Limit the max speed by setting the parameter 'T_Mode Limit Speed'.
 - 3rd Set the desired torque in percentage, and assign the 'Rise Time' to reach the output torque.
 - 4th Control the motor torque by clicking the  and  to designated direction.
 - 5th By clicking  button to stop the motor.

10.2.5 Program Mode



To end the program operation, 'END' command must be entered at the end of the step. Program mode error alarm (E F) 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.

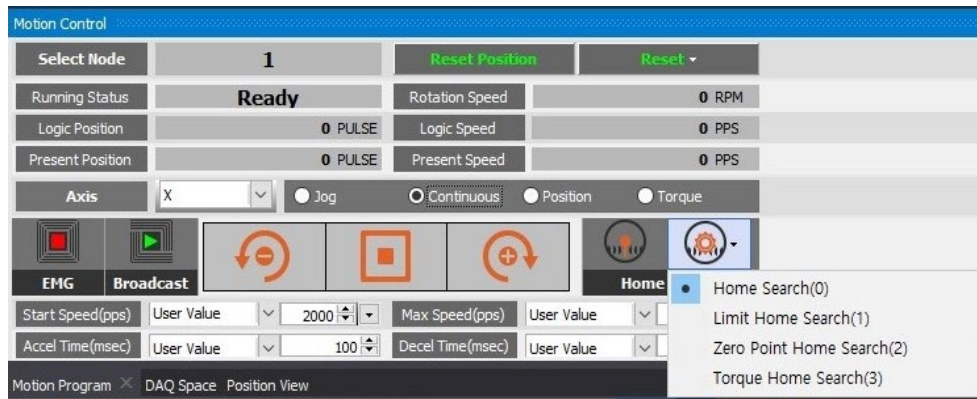
- Program mode operation
 - 1st Enter the command at the desired step.
 - 2nd When step input is completed, click **SeqRun** button to execute program operation sequentially.
 - 3rd To start from a step other than step 0, select the step number from **Start Step** 0 and click the **Run** button.
 - 4th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



Note

- For more information, refer to '11 Program Instructions'.
- To execute only one step, select the desired step and click the **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 (E G) will occur.


10.2.6 Home Search Mode




There are 4 types of home search mode can be executed; 'Nomal', 'Limit', 'Position' 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 (E H) occurs when it is executed by zero point home search mode operation.)

- Home search mode operation

1st Click  button to select the home search operation mode.



2nd Set the value of Start Speed, Max Speed, Accel Rate and Decel Rate for Home search mode.

3rd Click  button to execute the home search operation.

4th When the home is found, the home search operation is completed.

10.2.6.1 Normal Home Search

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

- 1st Click  button and select 'Normal'.
- 2nd Click  button to execute the home search operation.
- 3rd When the operation is executed, the motor operates in the direction set in the parameter 'Home Search Direction'.
- 4th 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'.
- 5th 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.
- 6th 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.
- 7th 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'.
- 8th 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.
- 9th When the origin found, the operation completion signal (In-Position) is output and the In-Position indicator lights to indicate the status.





Note

- 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 (EH) occurs if the ORG signal does not input until it reaches the opposite limit sensor past the limit sensor (\pm Limit).

10.2.6.2 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.

- 1st Click  button and select 'Limit'.
- 2nd Click  button to execute the home search operation.
- 3rd When the operation is executed, the motor operates in the direction set in the parameter 'Home Search Direction'.
- 4th 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'.
- 5th 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.
- 6th 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'.
- 7th 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.
- 8th When the home found, the operation completion signal (In-Position) is output and the In-Position indicator lights to indicate the status.



Note

- 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.



10.2.6.3 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 (EH) occurs since the zero point is not assigned when use automatically execution by setting parameter 'Power On Home Search' is set to 'Enable'.

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





Note

- 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.

10.2.6.4 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.

- 1st Click  button and select 'Position'.
- 2nd Click  button to execute the home search operation.
- 3rd When the operation is executed, the motor operates in the direction set in the parameter 'Home Search Direction'.
- 4th 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'.
- 5th The constant speed operation is performed until contact is made with a specific instrument.
- 6th Stops when the load is applied as the torque value set in the parameter 'Home Search Torque' by contacting a specific instrument.
- 7th 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.
- 8th The operation completion signal (In-Position) is output and the In-Position indicator lights to indicate the status.



Note

- 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.

11 Program Instructions

There are 15 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
Torque mode	TOQ	Torque mode drive

11.1 Drive Instruction

11.1.1 ABS (Absolute position move)

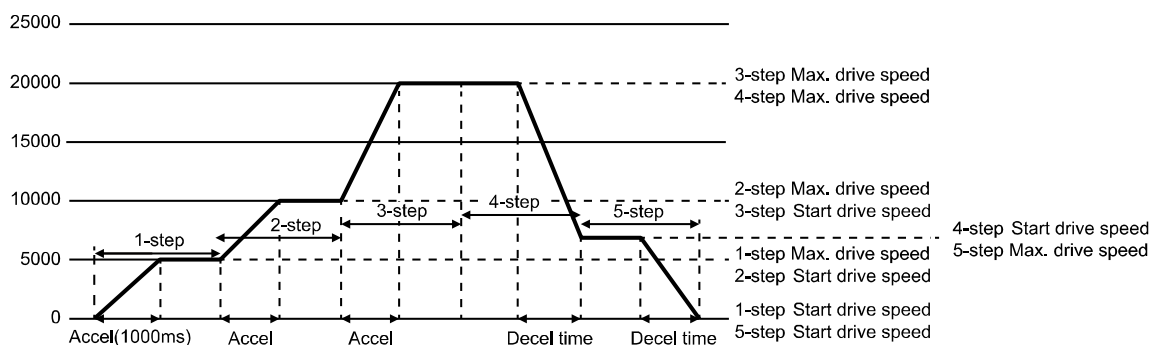
It is for moving to absolute position by a specified distance from home.

Instruction	DATA								
ABS	Instruction	Pos	Start	Max	Acc	Dec	S Enable	S Time	C Enable

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

- Position
: Input moving position value.
In case of moving range is over -2,147,483,648 to 2,147,483,647, the program mode error (E F) occurs
- Start speed level (start drive speed)
: Select the start drive speed during drive.
Set the start drive speed from 1 to 5.
When selecting 'User Value', it is available to set as the desired value.
- Max speed level (max. drive speed)
: Select the max. drive speed during drive.
Set the max. drive speed from 1 to 5.
When selecting 'User Value', it is available to set as the desired value.
- Accel time level
: Set the acceleration time of drive.
Set the acceleration time from 1 to 5.
When selecting 'User Value', it is available to set as the desired value.
- Decel time level
: Set the deceleration time of drive.
Set the deceleration time from 1 to 5.
When selecting 'User Value', it is available to set as the desired value.
- S Curve enable
: Set use/not use of S-curve acceleration/deceleration.
 - Enable=Use S-curve acceleration/deceleration
 - Disable=Not use S-curve acceleration/deceleration
- S Curve Acc/Dec Time
: When using S curve, set the S-curve acceleration/deceleration time.

- Continue enable
: 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 (msec)	Deceleration time (msec)	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



Note

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

11.1.2 INC (Relative position move)

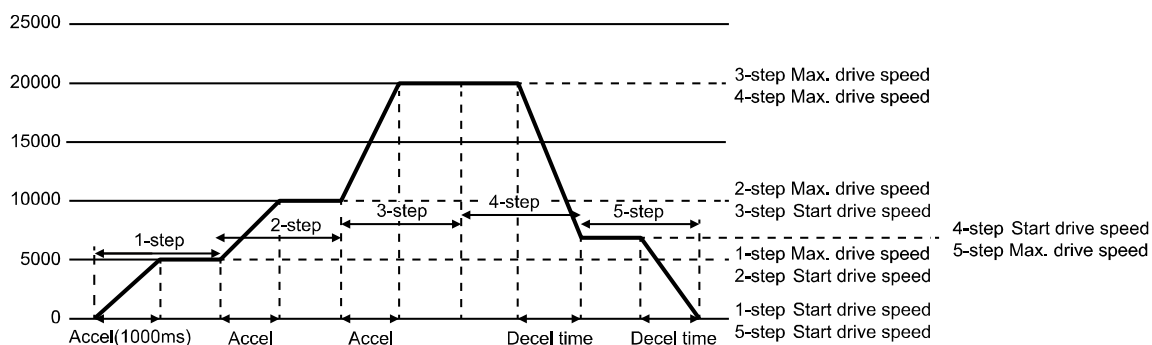
It is for moving to relative position by a specified distance from current position.

Instruction	DATA								
INC	Instruction	Pos	Start	Max	Acc	Dec	S Enable	S Time	C Enable

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

- Position
: Input moving position value.
In case of moving range is over -2,147,483,648 to 2,147,483,647, the program mode error (E F) occurs
- Start speed level (start drive speed)
: Select the start drive speed during drive.
Set the start drive speed from 1 to 5.
When selecting 'User Value', it is available to set as the desired value.
- Max speed level (max. drive speed)
: Select the max. drive speed during drive.
Set the max. drive speed from 1 to 5.
When selecting 'User Value', it is available to set as the desired value.
- Accel time level
: Set the acceleration time of drive.
Set the acceleration time from 1 to 5.
When selecting 'User Value', it is available to set as the desired value.
- Decel time level
: Set the deceleration time of drive.
Set the deceleration time from 1 to 5.
When selecting d'User Value', it is available to set as the desired value.
- S Curve enable
: Set use/not use of S-curve acceleration/deceleration.
 - Enable=Use S-curve acceleration/deceleration
 - Disable=Not use S-curve acceleration/deceleration
- S Curve Acc/Dec Time
: When using S curve, set the S-curve acceleration/deceleration time.

- Continue enable
: 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 (msec)	Deceleration time (msec)	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



Note

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

11.1.3 HOM (Home search)

It is for home search according to the set parameter of Home Search Mode (Home search mode).

Instruction	DATA	
HOM	Instruction	Mode

- Home mode
 - : Select the home search mode.
 - Home Search – it moves to assigned home direction and ends the operation by recognizing the point where the home sensor is ON as Home.
 - Limit Home Search – it moves to assigned home direction and ends the operation by recognizing the point where the Limit sensor is ON.
 - Zero Point Home Search – it moves to the user-assigned home and ends the operation after reaching the point.
 - Torque Home Search – when a certain torque is output by contacting a specific object, it is set in the opposite direction and ends the operation by recognizing as Home.

For more information, refer to '9.5 Home search'.

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	Port	Step

- Input port: Select Input port number.
For more information of input port number, refer to '9.1.3 General Input'.
- Step Number: Set the step number to jump. Setting range is 0 to 255.



Caution

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	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	Port	OnOff

- Output port: Select the output port number.
For more information of output port number, refer to '9.2.3 General Output'.
- ON/OFF: 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	Port	Next	Time

- 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.
- On Time level: Set the ON time for output port.
Set the On time level from 1 to 5.
When selecting On time level as 6, it is available to set as the desired value.
Setting range is 1 to 10,000 msec.

11.2.5 CMP (Compare output)

It outputs trigger pulse for the set period.

Instruction	DATA					
CMP	Instruction	Pos	Port	Mode	Width	Period

For more information, refer to '8.2.1.3 Compare1, Compare2'.

- Position
: Set the trigger position of output signal.
Setting range is 1 to 10,000 msec
- 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 10,000 msec.
- Pulse Period
: Set the output pulse period.
Applied when compare mode is 3.
Setting range is 1 to 2,147,483,647.

11.3.3 RPE (Repeat end)

It is end instruction of REP (repeat start).

Instruction	DATA
RPE	Instruction

It operates repeatedly at the set times from REP (repeat start) instruction to the RPE (repeat end) instruction.



Caution

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

11.3.4 END (Program end)

It ends program. You must enter this instruction at the end of program.

Instruction	DATA
END	Instruction

11.3.5 POS (Position set)

It sets the position value.

Instruction	DATA
POS	Instruction Pos

- 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

- Delay Time level
: Set the wait time as msec.
Set the Delay Time level from 1 to 5.
When selecting Delay Time level as 6, it is available to set as the desired value.

11.4 Torque Mode Command

11.4.1 TOQ (Torque mode drive)

Run torque drive mode.

The drive speed is able to controll with T_Mode Limit Speed parameter.

Instruction	DATA		
TOQ	Instruction	Torque	Torque Time

- Torque
: Set the torque on motor's output.
Setting range is -100 to 100%.
Operates CCW direction in -sign and CW direction in +sign.
- Torque Acc Time
: Set the rise time until motor torque is output.
Setting range is 0 to 5,000 msec.

12 Driver Function

12.1 General Drive

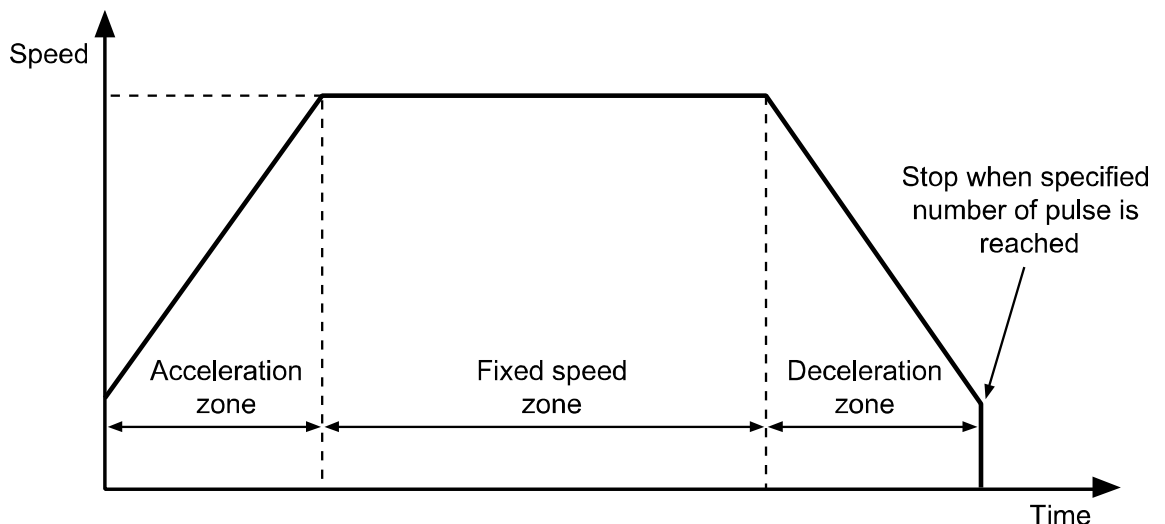
12.1.1 Fixed Pulse and Continuous Pulse Drive

Drive pulse output on each axis is basically in +/- 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.



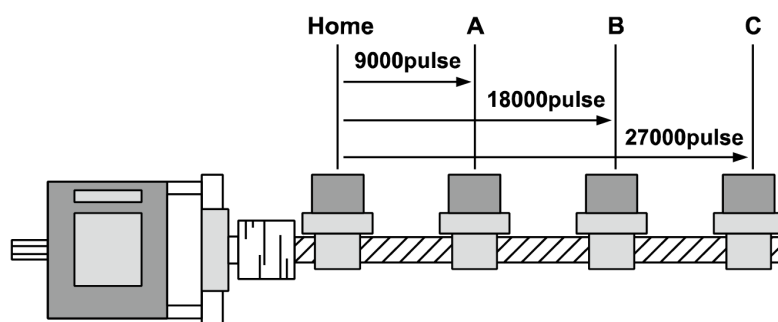
- Absolute position movement and relative position movement
: There are absolute position movement and relative position movement.
These are fixed pulse drive.

(1) Absolute Position Move

Absolute position movement drives from home to the position of a specified distance.
This is ABS command in program mode.

**Ex.**

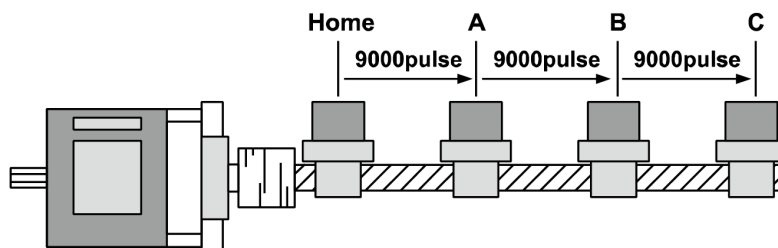
- Absolute Position Move is a command based on home.
- For example, if the command moving 9,000 pulse for 3 times using the Absolute Position Move (ABS), it arrives to the point A in the diagram below.
- Absolute Position Move (ABS) command must be set each 9,000/18,000/27,000 pulse to reach A, B, C 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.

**Ex.**

- 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 initial speed, reset and emergency stop.

12.1.2 Speed Curve

Drive pulse output of each axis operates by CW direction, CCW direction fixed pulse drive instruction or continuous drive instruction. However, it can 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

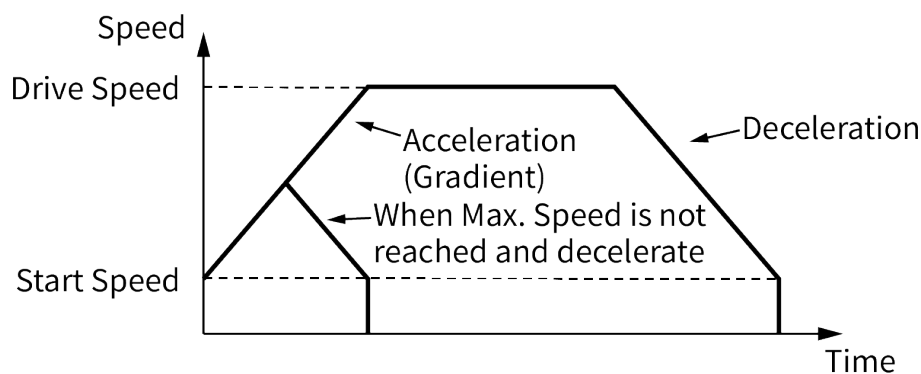
Trapezoidal acceleration/deceleration drive accelerates from initial speed to drive speed trapezoidally with an inclination of the designated acceleration.

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 initial speed with specified acceleration.

In continuous pulse drive, it decelerates to initial speed when the stop signal is activated, and stops immediately when it reaches initial speed.



Note

- 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.

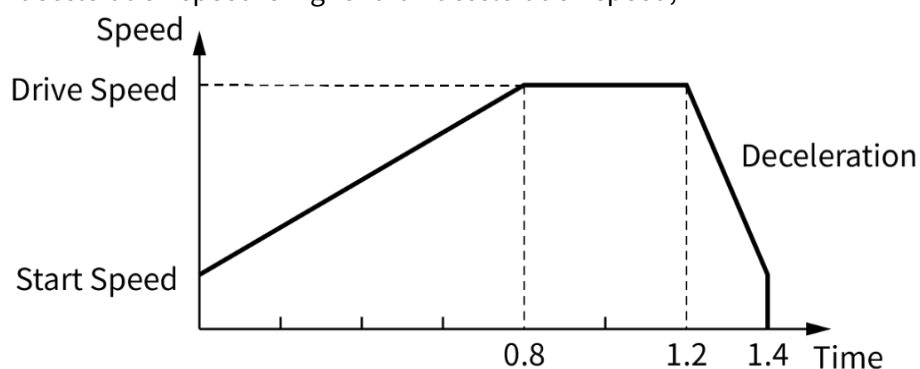
12.1.2.3 Asymmetric Trapezoidal Acceleration/Deceleration Drive

AiCA-D is available as asymmetric trapezoidal acceleration/deceleration drive which is different between acceleration speed and deceleration speed.

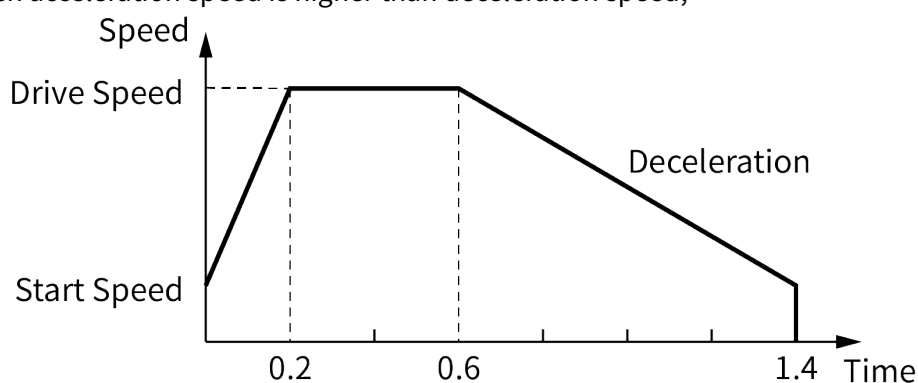
For moving the object to the vertical direction such as stacking device of semi-conductor wafer, the gravity acceleration speed is added to the object and acceleration speed and deceleration speed for up/down movement should be different.

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)

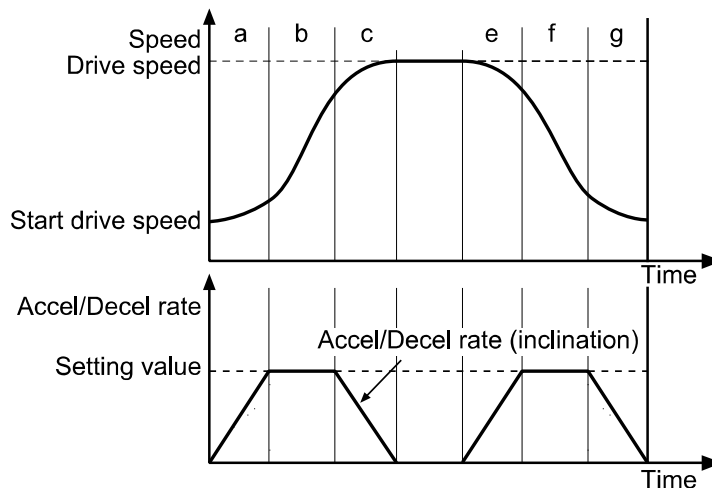
S curve generates an S shape speed curve according to linear increase/decrease of drive acceleration/deceleration.

It smoothly increases and reduces speed when starting and stopping, and helps achieve smoother operation.



Note

- 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).



Caution

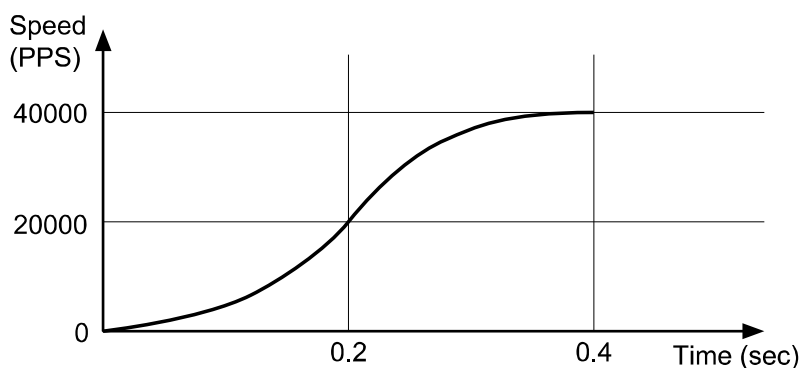
Precautions for S curve acceleration/deceleration drive

- 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.

**Ex.**

- 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.



1st Start drive speed as 0 is ignored.

2nd This is full S-curve acceleration.

During 0.2 sec, it drives trapezoidal acceleration up to 20,000pps.

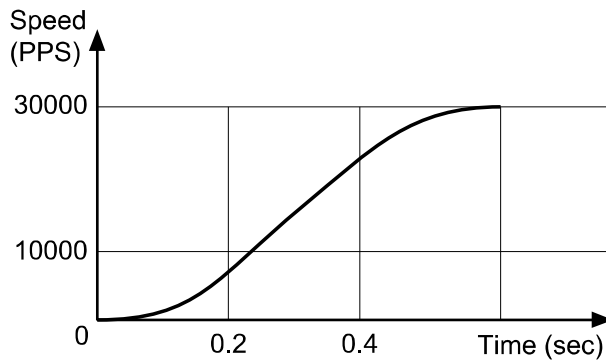
3rd At the left 0.2 sec, it drives trapezoidal deceleration up to 40,000pps.

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

Parameter	Setting value	Description
Acceleration Time	4000 msec	For S-curve drive, acceleration/ deceleration time should be same.
Deceleration Time	4000 msec	
S Curve Time (S-curve acceleration/deceleration time)	2000 msec	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.



1st Start drive speed as 0 is ignored.

2nd During 0.2 sec, it drives trapezoidal acceleration up to 10,000pps.

3rd During 0.2 to 0.4 sec, it maintains the certain acceleration speed up to 30,000pps.

4th At the left 0.2 sec, it drives trapezoidal deceleration up to 40,000pps.

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

Parameter	Setting value	Description
Acceleration Time	6000 msec	For S-curve drive, acceleration/deceleration time should be same.
Deceleration Time	6000 msec	
S Curve Time (S-curve acceleration/deceleration time)	2000 msec	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 Other Functions

12.2.1 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 each axis separately at \pm software limit (\pm software limit) parameter.

Operation Mode	Setting value	Parameter	Setting value
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.



Note

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

12.2.2 Motor Gain

The motor response of position command can be changed by parameter setting.

Depending on the load of motor, assign gain value to make faster position decision and smoother movement.

As Gain gets bigger, the transient response improves and error gets lesser, motor specification gets stable.

Assigned Gain value is applied when motor stops

Parameter	Setting	Bandwidth	Setting	Bandwidth
Motor GAIN	0	×1	16	×17
	1	×2	17	×18
	2	×3	18	×19
	3	×4	19	×20
	4	×5	20	×21
	5	×6	21	×22
	6	×7	22	×23
	7	×8	23	×24
	8	×9	24	×25
	9	×10	25	×26
	10	×11	26	×27
	11	×12	27	×28
	12	×13	28	×29
	13	×14	29	×30
	14	×15	39	×31
	15	×16	Fine Gain	User setting

- Fine Gain

When setting Motor GAIN parameter, P Gain and I Gain value can be set directly through atMotion.

- P Gain: In case of use as friction load, improve motor response by controlling Gain.
- I Gain: In case of use as inertial load, improve motor response by controlling Gain.

Parameter	Setting range	Unit
P Gain	0.000 to 32.000	0.001
I Gain	0.000 to 32.000	0.001

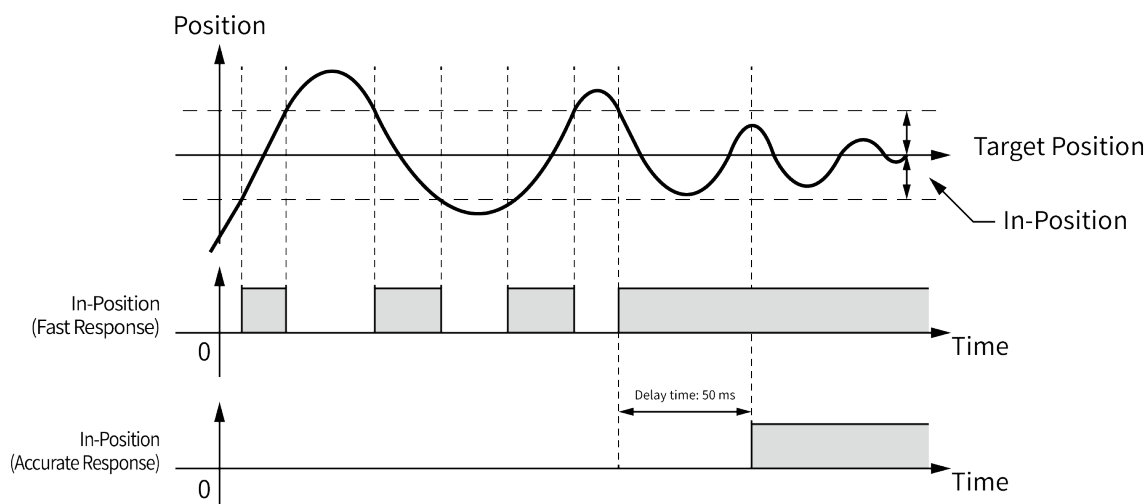
12.2.3 In-Position

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, when the gap is over in-position setting value, 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 msec, it outputs in-position signal.



Fast response		Accurate response	
Setting	Value	Setting	Value
0	0	8	0
1	± 1	9	± 1
2	± 2	10	± 2
3	± 3	11	± 3
4	± 4	12	± 4
5	± 5	13	± 5
6	± 6	14	± 6
7	± 7	15	± 7



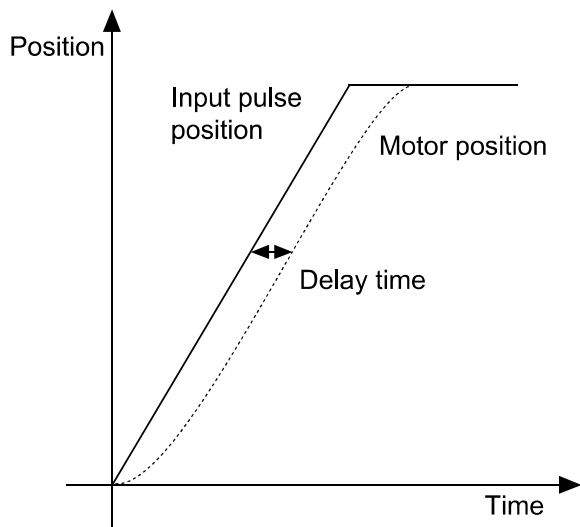
Note

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

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

12.2.5 Servo Off

This signal is for rotating the shaft using external force or used for manual positioning.

Servo Off signal is input while motor is stopped, the phase current is cut to release torque.

In Servo Off status, brake is locked. In case of changing as released status, apply signal on input signal “Brake ON/OFF”.



Note

For the safety reason, this is not available while motor is in operation.

12.2.6 Initial Angular Direction

Sets the initial motor alignment direction when the power is applied.

Even when the power is applied again, the initial angle is aligned in the direction set in the parameter “Initial Angular Dir”.

DIR setting	Forward	Backward
Initial Angular Direction	Rotates to CW direction	Rotates to CCW direction



Note

The rotating direction is based on facing the shaft, rotating right is clockwise (CW) direction.

12.2.7 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”.

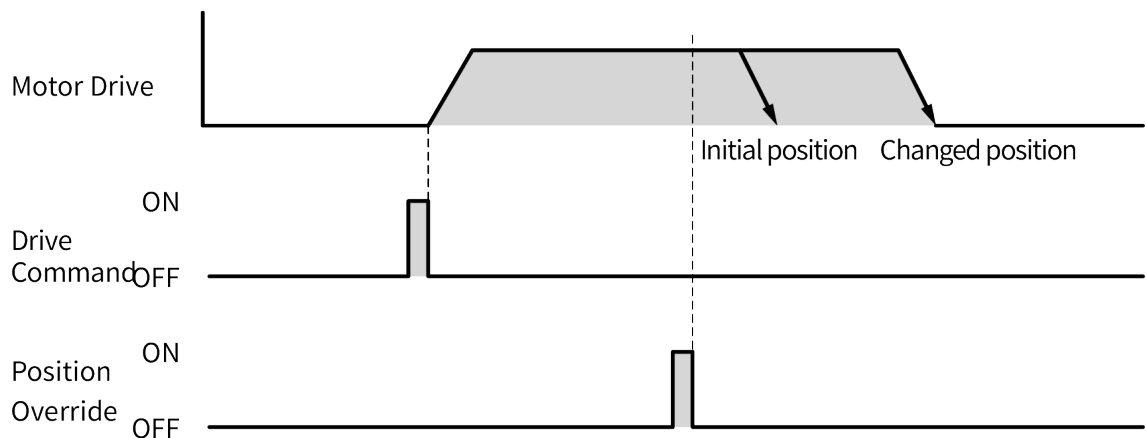
DIR setting	+Jog/+Run	-Jog/-Run
Forward	Rotates to CW direction	Rotates to CCW direction
Backward	Rotates to CCW direction	Rotates to CW direction

12.2.8 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.



Note

- If the position override operation is not available properly, the position override warning occurs and the final target position is reached at the specified starting speed.
- For more information of operation refer to '10.2.3.1 Position Override'.

13 Protection Function

13.1 Alarm

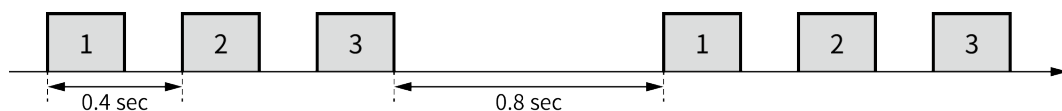
- This function stops motor to protect driver, depending on the error status such as over current or over speed.
- After removing the cause of alarm, re-supply power or apply the signal on Alarm Reset, the driver returns to the normal status.



Note

- ※ 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. In case of alarm no. 3>



1) Motor stops, torque releases and brake locks

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
1 (E 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.
2 (E 2)	Over speed error	When motor speed is over 3,500rpm	1. When overload is applied and released at a moment. 2. Turning more than 4,000 rpm by external force.	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 (E 3)	Position tracking error	When the gap between position command value and current position value is over 90°	1. Over load 2. Motor connector and cable connection error 3. Burnout of line driver IC in encoder	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.

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
4 (E 4)	Over load error	When applying load over the rated load for over 1 sec.	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.
5 (E 5)	Over heat error	When driver inner temperature is over 85°C	1. Installed in an enclosed space	1. Change the installation environment. -Air flow around driver installation. -Heat dissipation (heat sink or fan)
6 (E 6)	Motor connection error	When motor cable connection error occurs at driver	1. Motor connector and cable connection error 2. Burnout of the inverter in the driver	1. Check motor connector and cable connection. 2. Replace burned parts of the inverter in the driver.
7 (E 7)	Encoder connection error	When encoder cable connection error occurs at driver	1. Motor connector and cable connection error 2. Burnout of line driver IC in encoder	1. Check motor connector and cable connection. 2. Replace the line driver IC in encoder.
8 (E 8)	Over voltage error	When input voltage is over 24VAC +10%	1. Over load 2. Counter electromotive force overflow due to rapid deceleration	1. Change operation condition or reduce load so that sudden load fluctuation does not occur.
9 (E 9)	Under voltage error	When input voltage is under 24VAC-10%	1. Low voltage	1. Change operation condition or reduce load so that sudden load fluctuation does not occur.
10 (E A)	Motor mis-alignment	When motor is in misalignment	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	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.
11 (E b)	Input pulse error	When input pulse is over 3,500rpm When input pulse is input before initial motor alignment	1. Enter error of user command speed input	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
12 (E L)	In-Position error	When position error (over 1) is kept over 3 sec, after motor stopped.	1. Over load 2. Lack of stop torque.	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 (E d)	Memory error	When memory error is detected as power supplied	1. EEPROM error	1. Replace EEPROM parts.

2) Motor stops, torque maintains and brake releases

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
14 (E E)	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 (E F)	Program mode error	When 'END' command does 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 (E G)	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 (E H)	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)

(3) Motor stops, torque maintains and brake locks

No. of flashing	Alarm type	Descriptions	Causes	Troubleshooting
18 (E J)	Brake error	When brake failed to operate	1. If there is no auxiliary power applied 2. Brake connector or cable connection error 3. Brake is damaged	1. Check auxiliary power 2. Check brake connector and cable 3. Replace brake motor

13.2 Warning

- This function notices dangers with the warning indicator prior to motor stop with limit signal or over load warning.
- When turning out from the warning condition, driver returns to the normal status automatically.



Note

※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 as a segment and indicator on the Alarm/Status display part.

No. of flashing	Warning type	Descriptions	Causes	Troubleshooting
ㄱ 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 + Limit parameter value.
ㄱ 2	S/W -Limit	When reverse direction (CCW) software limit is ON	1. When the current position reaches the S/W - Limit value	1. Check S/W - Limit parameter value.
ㄱ 3	H/W +Limit	When normal direction (CW) hardware limit is ON	1. When + Limit signal (I/O no. 19-pin) is input	1. Check the + Limit signal is input correctly. 2. Check if the +/- Limit signal is correctly set with the motor rotation direction. (CW direction: + Limit, CCW direction: - Limit)
ㄱ 4	H/W -Limit	When reverse direction (CCW) hardware limit is ON	1. When - Limit signal (I/O no. 20-pin) is input	
ㄱ 5	Overload 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.
ㄱ 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 position change.

※ Other warning can be occurred during Overload warning, and the motor does not stop.

14 Troubleshooting

Malfunction	Causes	Troubleshooting
When communication is not connected	The communication cable is not connected.	Check communication cable wiring. Check communication cable connection 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 [L]. In case of [H], servo is off and excitation of motor is released.
	Alarm occurs.	Check the alarm type and remove the cause of alarm.
When motor rotates to the opposite direction of the designated direction	MotorDir parameter setting is not correct.	Check the MotorDir parameter settings.
When motor drive is unstable	Connection between motor and encoder is unstable.	Check the Motor+Encoder connection cable.
	Motor gain value is not correct.	Change the Motor Gain parameter as the certain value.

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