

## Controller Integrated 2-Phase Closed-Loop Stepper Motor Driver

### ■ Features

- Brake operation for safe control of vertical load at power OFF and alarm occur. (built-in brake type)
- Motor driver and controller integral type
- Competitive price compared to the servo motor and closed-loop function and fast response for short-distance continuous drive
- Controllable maximum 31 axis with RS485 communication
- Realizing a wide variety of operation up to 256 steps using 14 control commands combination
- 4 type of operation mode: jog mode, continuous mode, index mode, program mode
- Improved user convenience with providing 50 I/O pins
- C language library provided (32-bit, 64-bit)
- Dedicated Windows program (atMotion) provided
- Responding rapidly and maintaining torque in stop without hunting
- Easy to use without tuning (various gain settings via programming)
- Applicable to the precision equipment such as optical inspection equipment with the features of maintaining torque in stop and having no micro vibration (hunting)
- Containing 10-level resolutions (electric gear)
- Various alarms out
  - : overcurrent, overspeed, overheat, motor connection error, encoder connection error, and etc., overall 17 types
- Frame size 20mm, 28mm, 35mm, 42mm, 56mm, 60mm motors supported



**⚠ Please read "Safety Considerations" in the instruction manual before using.**



### ■ Applications

- Filed requiring preciseness such as semiconductor equipment, 3D printer, optical inspection equipment, chip mounter, cartesian robot, conveying equipment, and alignment stage.

### ■ Manual

For the detail information and instructions, please refer to user manual, user manual for communication manual and library manual and be sure to follow cautions written in the technical descriptions (catalog, website). Visit our website ([www.autonics.com](http://www.autonics.com)) to download manuals.

### ■ Software (atMotion)

- atMotion is a comprehensive motion device management program that can be used with Autonics motion controllers.
- atMotion provides GUI control for easy and convenient parameter setting and monitoring data management of multiple devices.
- Visit our website ([www.autonics.com](http://www.autonics.com)) to download the user manual and software.

< Computer specification for using software >

Item	Minimum requirements
System	IBM PC compatible computer with Intel Pentium III or above
Operations	Microsoft Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS-232 serial port (9-pin), USB port

< atMotion screen >



SENSORS

FIELD INSTRUMENTS

CONTROLLERS

MOTION DEVICES

SOFTWARE

(A) Closed Loop Stepper System

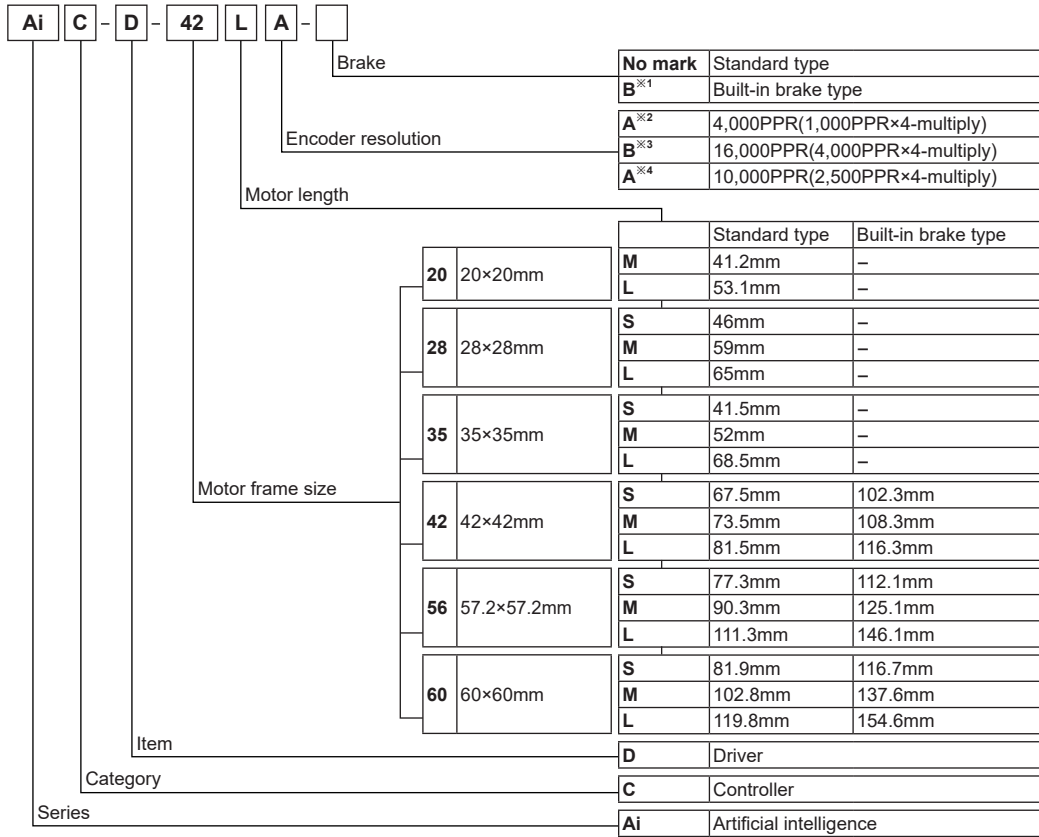
(B) Stepper Motors

(C) Stepper Motor Drivers

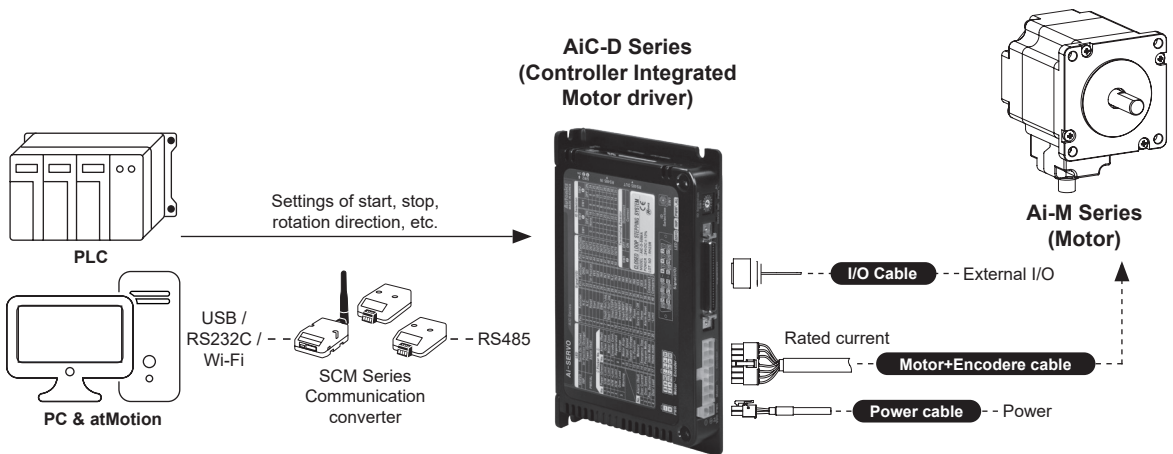
(D) Motion Controllers

# AiC-D Series

## Ordering Information



## Configuration Diagram



# 2-Phase Closed-Loop Stepper Motor Driver

## ■ Specifications

Model <sup>※1</sup>	—		AiC-D-28SB	AiC-D-35SB	AiC-D-42SA(-B)	AiC-D-56SA(-B)	AiC-D-60SA(-B)
	AiC-D-20MA	AiC-D-28MB	AiC-D-35MB	AiC-D-42MA(-B)	AiC-D-56MA(-B)	AiC-D-60MA(-B)	AiC-D-60LA(-B)
Power supply	24VDC <sup>---</sup>						
Allowable voltage range	90 to 110% of the rated voltage						
Power consumption	STOP <sup>※2</sup>	Max. 10W			Max. 10W	Max. 12W	Max. 15W
	Max. during operation <sup>※3</sup>	Max. 60W			Max. 60W	Max. 120W	Max. 240W
Max. RUN current <sup>※4</sup>	0.6A/Phase	1.0A/Phase	1.2A/Phase	1.7A/Phase	3.5A/Phase		
STOP current <sup>※5</sup>	20 to 100% of max. RUN current (factory default: 50%)						
Rotation speed	0 to 3000rpm						
Resolution <sup>※5</sup>	500 (factory default), 1000, 1600, 2000, 3600, 4000, 5000, 6400, 7200, 10000PPR		500 (factory default), 1000, 1600, 2000, 3600, 5000, 6400, 7200, 10000, 16000PPR		500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000PPR		
	Speed filter <sup>※5</sup> 0 (disable), 2, 4, 6, 8, 10, 20, 40, 60 (factory default), 80, 100, 120, 140, 160, 180, 200ms						
Positioning Gain <sup>※5</sup>	(P Gain, I Gain)=(1, 1), (2, 1), (3, 1), (4, 1), (5, 1), (1, 2), (2, 2), (3, 2), (4, 2), (5, 2), (1, 3), (2, 3), (3, 3), (4, 3), (5, 3), user setting						
Positioning range	-2,147,483,648 to +2,147,483,647						
In-Position	Fast Response: 0(factory default) to 7, Accurate Response: 0 to 7						
Motor rotation direction <sup>※5</sup>	CW, CCW						
Status indicator	<ul style="list-style-type: none"> <li>● Power/Warning indicator: green LED</li> <li>● Alarm indicator: red LED</li> <li>● In-Position indicator: yellow LED</li> <li>● Servo On/Off indicator: orange LED</li> <li>● RS485 DATA IN/OUT indicator: green, yellow LED</li> </ul>						
I/O voltage level	[H]: 5-30VDC <sup>---</sup> , [L]: 0-2VDC <sup>---</sup>						
I/O	Input <sup>※6</sup>	Exclusive input: 20, general input: 9					
	Output	<ul style="list-style-type: none"> <li>● Standard type - exclusive output: 4, general output: 10</li> <li>● Built-in brake type - exclusive output: 6, general output: 9</li> </ul>					
External power supply	VEX(recommended: 24VDC <sup>---</sup> ): 2, GEX(GND): 2						
Operation mode	Jog, Continuous, Index, Program mode						
Index step numbers	64 stpes						
Program function	Step	256 steps					
	Control command	ABS (move absolute position), INC (move incremental 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)					
	Start	Power On Program auto-start function					
	Home search	Power On Home Search auto-start function					
Home search mode	Home, limit home, zero home, torque home						
RS485 comm.	Comm. speed <sup>※5</sup>	9600, 19200, 38400, 57600, 115200(factory default) bps					
Multiaxial control	31-axis						
ID setting switch	16-bit rotary switch (0 to F), 1-bit DIP switch (ON/OFF)						
Alarm output	Overcurrent, overspeed, position tracking, overload, overheat, motor connection, encoder connection, regenerative voltage, motor misalignment, command speed, input voltage, in-position, memory, emergency stop, program drive, index drive, home search drive						
Warning output	±software limit, ±hardware limit, overload, position override						
Insulation resistance	Over 100MΩ (500VDC negger)						
Dielectric strength	1,000VAC 60Hz for 1 min						
Vibration	1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours						
Shock	300m/s <sup>2</sup> (approx. 30G) in each X, Y, Z direction for 3 times						
Envoronment	Ambient temp.	0 to 50°C, storage: -10 to 60°C					
	Ambient humi.	35 to 85%RH, storage: 10 to 90%RH					
Protection structure	IP20(IEC standard)						
Approval	CE						
Weight <sup>※6</sup>	Approx 460g (approx 300g)						

※1: The model name indicates driver type. (none: standard type, B: built-in brake type)  
E.g.) AiC-D-42LA-B: built-in brake type stepping motor driver.

※2: Based on the ambient temperature 25°C, ambient humidity 55%RH, and STOP current 50%.

※3: Max. power consumption during operation. When changing the load rapidly, instantaneous peak current may increase.  
The capacity of power supply should be over 1.5 to 2 times of max. power consumption.

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

※5: Settable with the edicated program (atMotion).

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

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

※Environment resistance is rated at no freezing or condensation.

SENSORS

FIELD INSTRUMENTS

CONTROLLERS

MOTION DEVICES

SOFTWARE

(A) Closed Loop Stepper System

(B) Stepper Motors

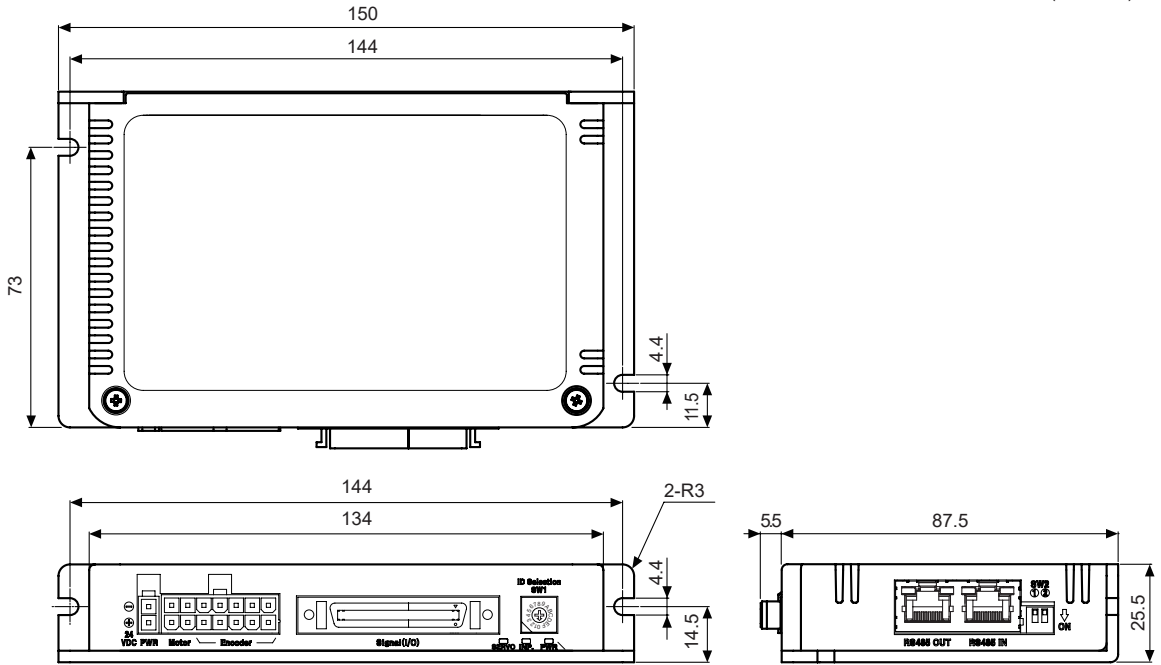
(C) Stepper Motor Drivers

(D) Motion Controllers

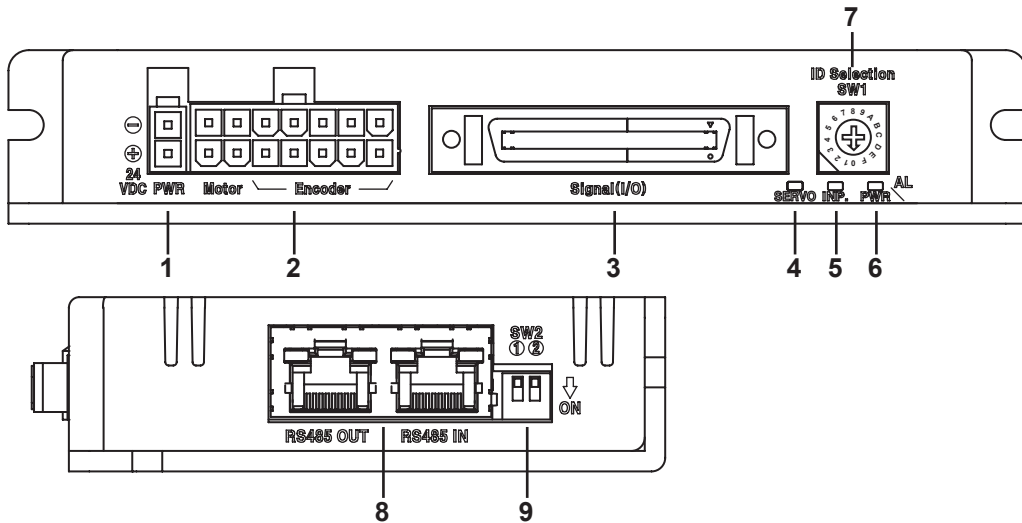
# AiC-D Series

## ■ Dimensions

(unit: mm)



## ■ Unit Descriptions



1. Power connector (CN1: PWR)
2. Motor+Encoder connector (CN2: Motor / Encoder)
3. I/O connector (CN3: Signal I/O)
4. Servo On/Off indicator (Servo, Orange)
5. In-Position indicator (INP., Yellow)
6. Power/Alarm indicator (PWR/AL, Green/Red)
7. Communication ID setting rotary switch (ID Selection SW1)
8. RS485 Communication connector (CN4: RS485 OUT / RS485 IN)
9. Communication ID setting/Terminating resistance setting DIP switch (SW2)

# 2-Phase Closed-Loop Stepper Motor Driver

## ■ Status Indicators

Status indicator	Location	LED color	Function	Descriptions
PWR	Front	Green	Power indicator	Turns ON when the unit operates normally after supplying power.
			Warning indicator	Flashes when limit signal is input or overload status is maintained
AL		Red	Alarm indicator	When alarm occurs, it flashes in various ways depending on the situation. Refer to '■ Control Input/Output → ○ Output → 3. Alarm/Warning'.
INP.			Yellow	In-Position indicator
SERVO		Orange	Servo On/Off indicator	Turns ON when Servo is operating, turns OFF when servo is not operating.
RXD IN*1		Right side	Yellow	RS485 Data I/O display
TXD OUT*1	Green		RS485 Data I/O display	Flashes when sending data.


\*1: Although RS485 OUT is disconnected, RXD IN/TXD OUT operates normally, if RS485 IN is communicating.

## ■ Driver Setting

### ○ SW1: ID setting switch

※Set Node ID of the driver.

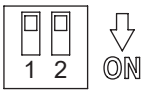
※Depending on the 1 switch setting of the SW2, it is possible to connect max. 31-axis.

Setting switch	Setting	ID		Setting	ID	
		SW2 1 OFF	SW2 1 ON		SW2 1 OFF	SW2 1 ON
 ID Selection SW1	0	Disable	16	8	8	24
	1	1 (factory default)	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

### ○ SW2: ID setting/Terminating resistance DIP switch

※Set Node ID of the driver.

※Set to use terminating resistance.

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

SENSORS

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# AiC-D Series

## Control Input/Output

Inner signal of all input/output consists of photocoupler.

ON, [H]: photocoupler power ON

OFF, [L]: photocoupler power OFF

※ Brake operation is only for built-in brake type.

### Input

#### 1. Exclusive input (20)

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

#### 2. General input (9)

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

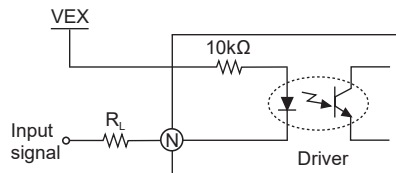
#### 3. Example of input circuit connection

-All input circuits are insulated with photocoupler, and separate external power (recommended: 24VDC) is necessary.

-Case of using external power 24VDC does not require  $R_L$ .

-In case using external power over 24VDC, select  $R_L$  value that  $I_F$  (forward current of primary LED) of photocoupler to be around 2.5mA (max. 10mA).

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



※N: Input pin number of CN3

### Output

#### 1. Exclusive output (AiC-D: 4, AiC-D-B: 6)

Signal name	Descriptions	Pin no.	Signal name	Descriptions	Pin no.
Brake+	Brake output (24VDC)	1	Alarm	Alarm output	38
Brake-	Brake output (GND)	2	Compare1 (trigger)	Comparison output1	39
In-Position	Drive ending pulse	23	Compare2 (trigger)	Comparison output2	40

#### 2. In-Position

-In-Position output represents output is output 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,

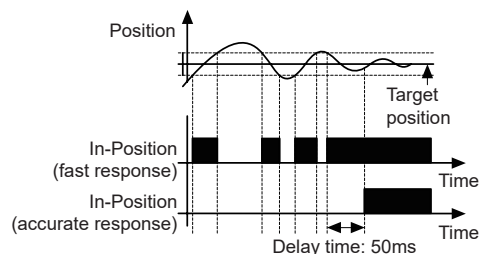
In-Position output turns ON and In-Position indicator turns ON.

-In reverse, when the gap is over In-Position setting value, In-Position output turns OFF and the In-Position indicator turns OFF.

※ For accurate drive, check the In-Position output again and execute the next drive.

※ Refer to '6. Example of output circuit connection'.

Fast Response		Accurate Response	
Setting	Value	Setting	Value
0 (factory default)	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



# 2-Phase Closed-Loop Stepper Motor Driver

## Control Input/Output

### 3. Alarm/Warning

#### • Alarm

- This function stops motor to protect driver, depending on the error status such as overcurrent or overspeed.
- In case of normal status, output turns ON, and in case of alarming status, output turns OFF.
- When alarm occurs, brake operates.
- When supplying alarm reset, driver returns to the normal status.
- ※Refer to '6. Example of output circuit connection'.

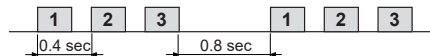
#### • Warning

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

Alarm indicator	No. of flashing	Alarm type	Descriptions	Motor status	Torque status	Brake status			
AL (red)	1	Overcurrent error	When overcurrent flows at motor RUN element	Stop	Release	Lock			
	2	Overspeed error	When motor speed is over 4,000rpm						
	3	Position tracking error	When the gap between position command value and current position value is over 90°						
	4	Overload error	When applying load over the rated load for over 1 sec.						
	5	Overheat error	When driver inner temperature is over 80°C						
	6	Motor connection error	When motor cable connection error occurs at driver						
	7	Encoder connection error	When encoder cable connection error occurs at driver						
	8	Regenerative voltage error	When regenerative voltage is over 78V						
	9	Motor misalignment	When motor is in misalignment						
	10	Command speed error	When command speed is over 3,500rpm						
	11	Input voltage error	When input voltage is out of 24VDC ±10%						
	12	In-Position error	When position error (over 1) is kept over 3 sec, after motor stopped						
	13	Memory error	When memory error is detected as power supplied						
	14	Emergency stop	When emergently stopped with emergency stop command						
	15	Program mode error	When 'END' command is not exist at the last step				Stop	Remain	Release
	16	Index mode error	When other instruction is used but 'INC', 'ABS'						
	17	Home search mode error	When failed to find home						
Warning indicator	No. of flashing	Warning type	Descriptions	Motor status	Torque status	Brake status			
PWR (green)	1	+ software limit	When normal direction (CW) software limit is ON	Stop	Remain	Release			
	2	- software limit	When reverse direction (CCW) software limit is ON						
	3	+ hardware limit	When normal direction (CW) hardware limit is ON						
	4	- hardware limit	When reverse direction (CCW) hardware limit is ON						
	5	Overload warning	When maximum load is kept connected over 10 sec (motor or driver can be overheated)	Remain	Remain	Release			
	6	Position override warning	When position override is failed to operate	Stop	Remain	Release			

※Even though warning occurs, it drives as normal status and it may cause damage by fire.  
It is recommend not to use the unit during warning status.

※Depending on alarm/warning type, it flashes 0.4 sec interval and it turns OFF for 0.8 sec repeatedly.  
<In case of no. 3 alarm>



### 4. Comparison output (compare1, compare2)

Outputs trigger pulse on the certain interval that user has set.

Mode	Descriptions
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 and width.

※Please refer to the user manual to learn how to set.

### 5. General output (AiC-D: 10, AiC-D-B: 9)

#### • Standard type

Signal name	Descriptions	Pin no.
OUT0 to OUT9	General output 0 to 9	41 to 50

#### • Built-in brake type

Signal name	Descriptions	Pin no.
OUT0 to OUT8	General output 0 to 8	41 to 49

SENSORS

FIELD INSTRUMENTS

CONTROLLERS

MOTION DEVICES

SOFTWARE

(A) Closed Loop Stepper System

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(C) Stepper Motor Drivers

(D) Motion Controllers

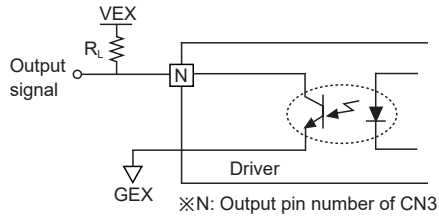
# AiC-D Series

## Control Input/Output

### 6. Example of output circuit connection

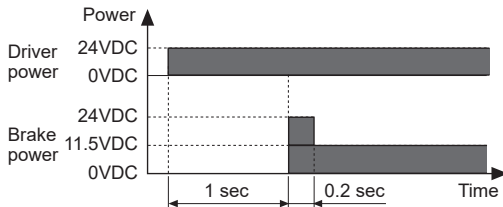
-All output circuits are insulated with photocoupler.  
 -External power input is available from 5VDC to 80VDC with the open collector method.  
 Select  $R_L$  value that  $I_C$  (collector current of secondary LED) of photocoupler to be around 10mA.

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



### 7. Brake output

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



-When supplying power to the driver after connecting the driver and brake, the rated excitation voltage is supplied and the brake power is released after approx. 1 sec.  
 Then after approx. 0.2 sec, the excitation voltage is decreased to 11.5VDC and the released brake power is maintained.  
 $\ast$ While power is supplied to the driver, the brake is kept turning on, except in the Servo On status.

## Communication Output

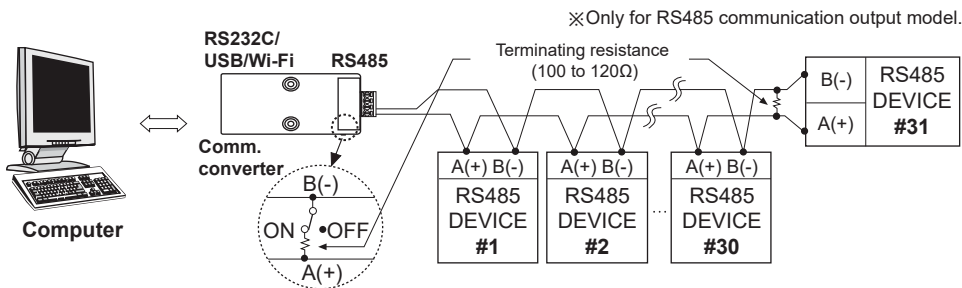
It is for parameter setting and monitoring via external devices (PC, PLC, etc.).

### Interface

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

$\ast$ It is not allowed to set overlapping communication address at the same communication line.  
 Use twisted pair wire for RS485 communication.

### Application of system organization



$\ast$ It is recommended to use Autonic communication converter;  
 SCM-WF48 (Wi-Fi to RS485-USB wireless communication converter, sold separately).  
 SCM-US481 (USB to RS485 converter, sold separately), SCM-381 (RS232C to RS485 converter, sold separately).  
 Please use twisted pair wire, which is suitable for RS485 communication, for SCM-WF48, SCM-US481 and SCM-381.




# 2-Phase Closed-Loop Stepper Motor Driver

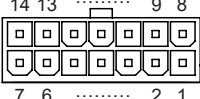
## ■ Driver Connectors

### ◎ Connector function

#### ● CN1: Power connector

Pin arrangement	Pin no.	Function
	2	GND
	1	24VDC

#### ● CN2: Motor+Encoder connector

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

#### ● CN3: I/O connector

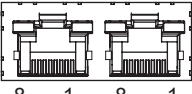
Pin arrangement	Pin no.	I/O	Function	Pin no.	I/O	Function
	1 <sup>※1</sup>	Output	Brake+	26	Input	IN0
	2 <sup>※1</sup>	Output	Brake-	27	Input	IN1
	3	Input	Reset	28	Input	IN2
	4	Input	Start	29	—	N·C
	5	Input	Stop	30	Input	IN3
	6	Input	EMG	31	Input	IN4
	7	Input	Step0/+Run/+Jog	32	Input	IN5
	8	Input	Step1/-Run/-Jog	33	Input	IN6
	9	Input	Step2/SSP0	34	Input	IN7
	10	Input	Step3/SSP1	35	Input	IN8, Brake ON/OFF <sup>※3</sup>
	11	Input	Step4/MSP0	36	Input	VEX
	12	Input	Step5/MSP1	37	Input	GEX
	13	Input	MD0/HMD0	38	Output	Alarm
	14	Input	MD1/HMD1	39	Output	Compare1 (Trigger)
	15	Input	Pause	40	Output	Compare2 (Trigger)
	16	Input	Servo On/Off	41	Output	OUT0
	17	Input	Home	42	Output	OUT1
	18	Input	Alarm Reset	43	Output	OUT2
	19	Input	+Limit	44	Output	OUT3
	20	Input	-Limit	45	Output	OUT4
	21	Input	ORG	46	Output	OUT5
	22	Input	SD	47	Output	OUT6
	23	Output	In-Position	48	Output	OUT7
	24	Input	VEX	49	Output	OUT8
	25	Input	GEX	50 <sup>※2</sup>	Output	OUT9

※1: N·C for standard type motor.

※2: N·C for built-in brake type motor.

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

#### ● CN4: RS485 communication cable connector

Pin arrangement	Pin no.	I/O	Function	Pin no.	I/O	Function
	1	—	N·C	5	—	N·C
	2	—	N·C	6	Input/Output	RS485 DATA-
	3	Input/Output	RS485 DATA+	7	—	N·C
	4	—	N·C	8	—	N·C

### ◎ Connector specifications

Type	Specifications			Manufacture
	Connector	Connector terminal	Housing	
CN1	Driver	3930-1020 (5569-02A2)	—	Molex
	Power	CHD1140-02	CTD1140	HANLIM
CN2	Driver	35318-1420	—	Molex
	Motor+Encoder	Frame size 20, 28, 35mm Frame size 42, 56, 60mm	5557-14R 5556T2 5556T	
CN3	Driver	10250-52A2 PL	—	3M
	I/O connector	10150-3000PE	10350-52F0-008	
CN4	Driver	KRM-U-02-8-8-4-7M5	—	KINNEXA

※Above connectors are suitable for AiC-D Series. You can use equivalent or substitute connectors.

SENSORS

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(A) Closed Loop Stepper System

(B) Stepper Motors

(C) Stepper Motor Drivers

(D) Motion Controllers

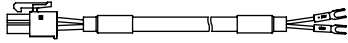
# AiC-D Series

## ■ Sold Separately

※It is recommended to use ferrite core at power cable, I/O cable and Motor+Encoder cable.

### ○ Power cable

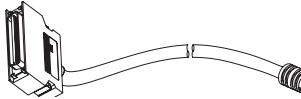
#### ● CJ-PW-□



※□ of model name indicates cable length (010, 020)  
E.g.) CJ-PW-010: 1m power cable.

### ○ I/O cable

#### ● CO50-MP□-R (standard: AiC TAG)

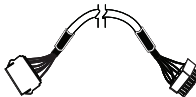


Pin no.	Function (name tag)	Cable color	Dot line color-numbers	Pin no.	Function (name tag)	Cable color	Dot line color-numbers	
1	Brake+	Orange	Black-1	26	IN0	White	Red-3	
2	Brake-		Red-1	27	IN1		Black-4	
3	Reset		Black-2	28	IN2		Red-4	
4	Start		Red-2	29	N-C		Black-5	
5	Stop		Black-3	30	IN3		Red-5	
6	EMG		Red-3	31	IN4	Black-1		
7	Step0/+RUN/+JOG	Yellow	Black-4	32	IN5	Gray	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		Black-1	36	VEX		Red-3	
12	Step5/MSP1		Red-1	37	GEX	Black-4		
13	MD0/HMD0		White	Black-2	38	Alarm	Pink	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		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	Black-1		46	OUT5	Red-3		
22	SD	Red-1		47	OUT6	Black-4		
23	In-Position	White	Black-2	48	OUT7	Red-4		
24	VEX		Red-2	49	OUT8	Black-5		
25	GEX		Black-3	50	OUT9	Red-5		

※□ of model name indicates cable length (010, 020, 030, 050, 070, 100, 150, 200)  
E.g.) CO50-MP070-R: 7m I/O cable.

### ○ Motor+Encoder cable

#### ● Normal: C1D14M-□, Moving: C1DF14M-□



※□ of model name indicates cable length (1, 2, 3, 5, 7, 10, 15, 20)  
E.g.) C1DF14M-10: 10m moving type motor+encoder cable.

### ○ Communication converter

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



#### ● SCM-US481 (USB to RS485 converter)

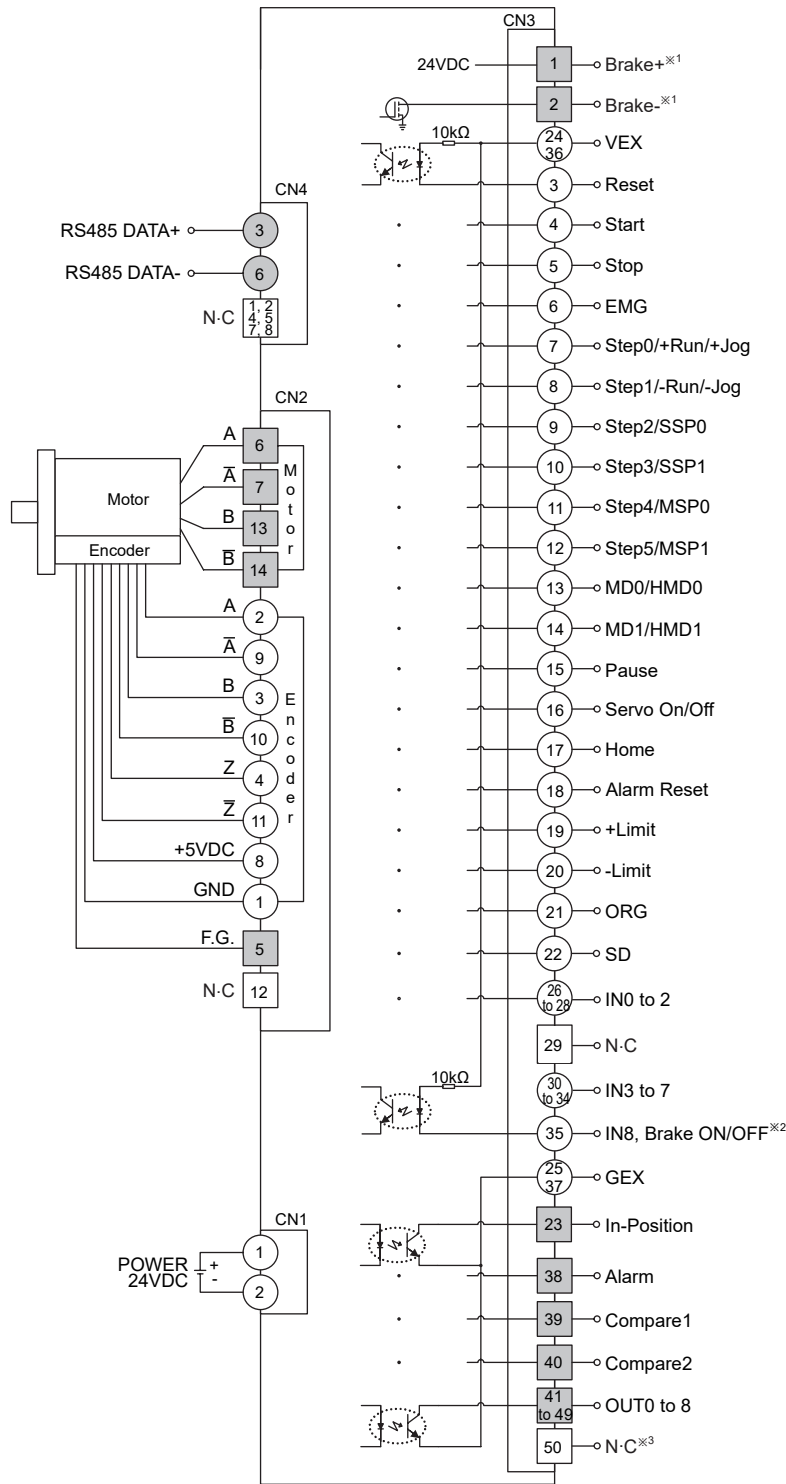


#### ● SCM-381 (RS232C to RS485 converter)



# 2-Phase Closed-Loop Stepper Motor Driver

## ■ Connection for Motor and Driver



※1: Corresponding pins are N-C in standard type.

※2: In built-in brake type, the corresponding pin can be switched as Brake ON/OFF.

※3: It corresponds to OUT9(output) in standard type.

※The Connection diagram is base on built-in brake type.

SENSORS
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(A) Closed Loop Stepper System
(B) Stepper Motors
(C) Stepper Motor Drivers
(D) Motion Controllers

## ■ Troubleshooting

### 1. When driver communication is failed

- ① Check whether the connection between driver and communication cable is correct.
- ② Check whether the port and communication speed is set correctly in the dedicated communication program.

### 2. When operation of motor is unstable

- ① Check that driver, motor, and brake are connected correctly.
  - ② Check whether operation command is set correctly (e.g. speed, accel/deceleration speed).
- 

## ■ Proper Usage

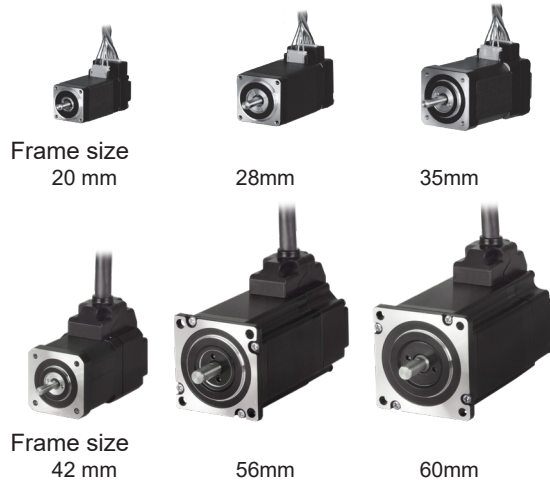
- Follow instructions in 'Proper Usage'.  
Otherwise, It may cause unexpected accidents.
- 24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Re-supply power after min. 1 sec from disconnected power.
- In case communication is unstable due to the noise generated by supplied power or peripheral device, use ferrite core at communication line.
- It is recommended to use 485 converter with the separate power.  
(Autonics product, SCM Series recommended)
- The thickness of cable should be same or thicker than the motor cable's when extending the motor cable.
- 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 the unit out of the dedicated frequency range when vibration and noise occurs due to changing motor RUN speed.
- 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

# Ai-M Series

## 2-Phase Closed-Loop Stepper Motor

### ■ Features

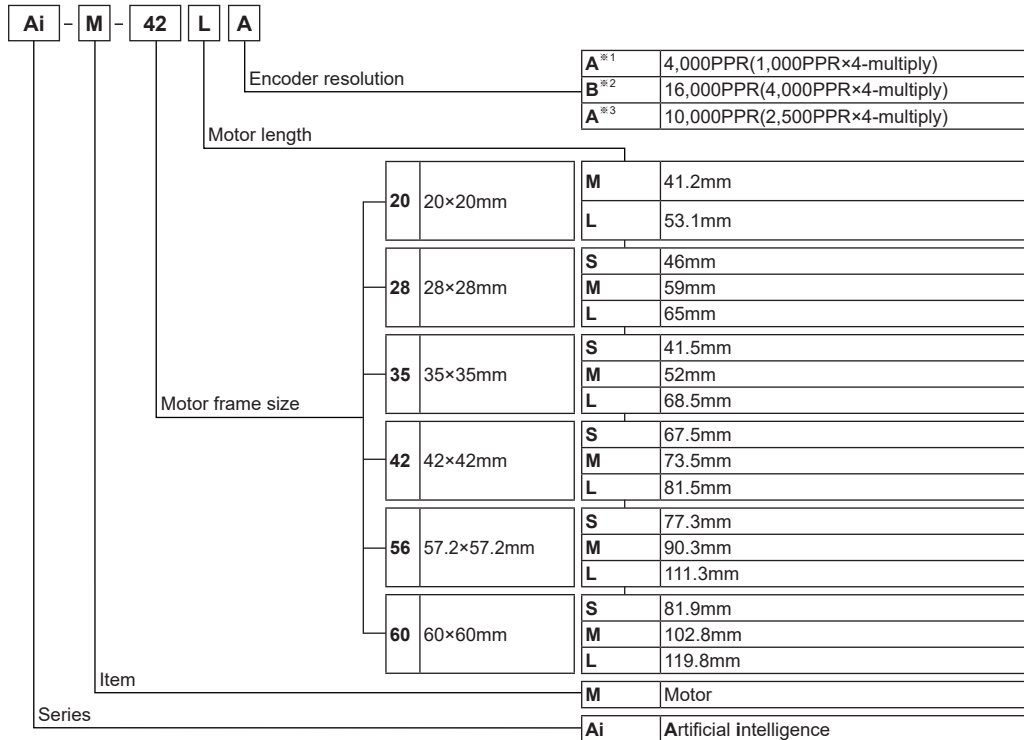
- Minimal heat generating, high torque motor (control voltage 55V)
- Higher cost-efficiency compared to conventional servo motors
- Available in motor frame size 20mm, 28mm, 35mm, 42mm, 56mm, 60mm



 Please read "Safety Considerations" in the instruction manual before using.



### ■ Ordering Information



※ 1: Encoder resolution for frame size 20mm motors.  
 Microstep control for AiS driver, it controls up to 10,000PPR.  
 ※ 2: Encoder resolution for frame size 28, 35mm motors.  
 ※ 3: Encoder resolution for frame size 42, 56, 60mm motors.

# 2-Phase Closed-Loop Stepper Motor

## ■ Specifications

### ◎ Motor

#### ● Frame size 20mm

Model	Ai-M-20MA	Ai-M-20LA
Max. holding torque <sup>※1</sup>	0.183kgf·cm (0.018N·m)	0.357kgf·cm (0.035N·m)
Rotor moment of inertia	2g·cm <sup>2</sup> (2×10 <sup>-7</sup> kg·m <sup>2</sup> )	
Rated current	0.6A/Phase	
Resistance	6.6Ω/Phase ±10%	10.5Ω/Phase ±10%
Inductance	2.1mH/Phase ±20%	4.0mH/Phase ±20%
Weight <sup>※2</sup>	Approx. 0.192kg (approx. 0.092kg)	Approx. 0.219kg (approx. 0.120kg)

#### ● Frame size 28mm

Model	Ai-M-28SB	Ai-M-28MB	Ai-M-28LB
Max. holding torque <sup>※1</sup>	0.51kgf·cm (0.05N·m)	1.42kgf·cm (0.14N·m)	1.63kgf·cm (0.16N·m)
Rotor moment of inertia	9g·cm <sup>2</sup> (9×10 <sup>-7</sup> kg·m <sup>2</sup> )	12g·cm <sup>2</sup> (12×10 <sup>-7</sup> kg·m <sup>2</sup> )	18g·cm <sup>2</sup> (18×10 <sup>-7</sup> kg·m <sup>2</sup> )
Rated current	1.0A/Phase		
Resistance	5.78Ω/Phase ±10%	8.8Ω/Phase ±10%	10.1Ω/Phase ±10%
Inductance	3.2mH/Phase ±20%	6.0mH/Phase ±20%	6.2mH/Phase ±20%
Weight <sup>※2</sup>	Approx. 0.260kg (approx. 0.162kg)	Approx. 0.318kg (approx. 0.222kg)	Approx. 0.342kg (approx. 0.248kg)

#### ● Frame size 35mm

Model	Ai-M-35SB	Ai-M-35MB	Ai-M-35LB
Max. holding torque <sup>※1</sup>	0.714kgf·cm (0.07N·m)	1.326kgf·cm (0.13N·m)	3.162kgf·cm (0.31N·m)
Rotor moment of inertia	8g·cm <sup>2</sup> (8×10 <sup>-7</sup> kg·m <sup>2</sup> )	14g·cm <sup>2</sup> (14×10 <sup>-7</sup> kg·m <sup>2</sup> )	22g·cm <sup>2</sup> (22×10 <sup>-7</sup> kg·m <sup>2</sup> )
Rated current	1.2A/Phase		
Resistance	2.1Ω/Phase ±10%	3.25Ω/Phase ±10%	5.0Ω/Phase ±10%
Inductance	1.25mH/Phase ±20%	2.85mH/Phase ±20%	5.6mH/Phase ±20%
Weight <sup>※2</sup>	Approx. 0.278g (approx. 0.180kg)	Approx. 0.347kg (approx. 0.250kg)	Approx. 0.456kg (approx. 0.366kg)

#### ● Frame size 42mm

Model	Ai-M-42SA	Ai-M-42MA	Ai-M-42LA
Max. holding torque <sup>※1</sup>	2.55kgf·cm (0.25N·m)	4.08kgf·cm (0.4N·m)	4.89kgf·cm (0.48N·m)
Rotor moment of inertia	35g·cm <sup>2</sup> (35×10 <sup>-7</sup> kg·m <sup>2</sup> )	54g·cm <sup>2</sup> (54×10 <sup>-7</sup> kg·m <sup>2</sup> )	77g·cm <sup>2</sup> (77×10 <sup>-7</sup> kg·m <sup>2</sup> )
Rated current	1.7A/Phase		
Resistance	1.7Ω/Phase ±10%	1.85Ω/Phase ±10%	2.1Ω/Phase ±10%
Inductance	1.9mH/Phase ±20%	3.5mH/Phase ±20%	4.4mH/Phase ±20%
Weight <sup>※2</sup>	Approx. 0.45kg (approx. 0.34kg)	Approx. 0.52kg (approx. 0.41kg)	Approx. 0.59kg (approx. 0.48kg)

#### ● Frame size 56mm

Model	Ai-M-56SA	Ai-M-56MA	Ai-M-56LA
Max. holding torque <sup>※1</sup>	6.12kgf·cm (0.6N·m)	12.24kgf·cm (1.2N·m)	20.39kgf·cm (2.0N·m)
Rotor moment of inertia	140g·cm <sup>2</sup> (140×10 <sup>-7</sup> kg·m <sup>2</sup> )	280g·cm <sup>2</sup> (280×10 <sup>-7</sup> kg·m <sup>2</sup> )	480g·cm <sup>2</sup> (480×10 <sup>-7</sup> kg·m <sup>2</sup> )
Rated current	3.5A/Phase		
Resistance	0.55Ω/Phase ±10%	0.57Ω/Phase ±10%	0.93Ω/Phase ±10%
Inductance	1.05mH/Phase ±20%	1.8mH/Phase ±20%	3.7mH/Phase ±20%
Weight <sup>※2</sup>	Approx. 0.76kg (approx. 0.62kg)	Approx. 0.99kg (approx. 0.85kg)	Approx. 1.36kg (approx. 1.22kg)

#### ● Frame size 60mm

Model	Ai-M-60SA	Ai-M-60MA	Ai-M-60LA
Max. holding torque <sup>※1</sup>	11.22kgf·cm (1.1N·m)	22.43kgf·cm (2.2N·m)	29.57kgf·cm (2.9N·m)
Rotor moment of inertia	240g·cm <sup>2</sup> (240×10 <sup>-7</sup> kg·m <sup>2</sup> )	490g·cm <sup>2</sup> (490×10 <sup>-7</sup> kg·m <sup>2</sup> )	690g·cm <sup>2</sup> (690×10 <sup>-7</sup> kg·m <sup>2</sup> )
Rated current	3.5A/Phase		
Resistance	1.0Ω/Phase ±10%	1.23Ω/Phase ±10%	1.3Ω/Phase ±10%
Inductance	1.5mH/Phase ±20%	2.6mH/Phase ±20%	3.8mH/Phase ±20%
Weight <sup>※2</sup>	Approx. 0.89kg (approx. 0.75kg)	Approx. 1.27kg (approx. 1.13kg)	Approx. 1.58kg (approx. 1.44kg)

※1: Max. holding torque is maintenance torque of stopping the motor when supplying the rated current (2-phase excitation) and is the standard for comparing the performance of motors.

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

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(Y) Closed Loop Stepper System

(Z) Stepper Motors

(AA) Drivers

(AB) Motion Controllers

# Ai-M Series

## Specifications

### 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 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock	Approx. max. 50G	
Environment	Ambient temperature	0 to 50°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 <sup>※1</sup>	±0.09°	
Shaft vibration <sup>※2</sup>	0.03mm T.I.R.	
Radial Movement <sup>※3</sup>	Frame size 20, 28, 35mm	Max. 0.025mm (load 450g)
	Frame size 42, 56, 60mm	Max. 0.025mm (load 25N)
Axial Movement <sup>※4</sup>	Frame size 20, 28, 35mm	Max. 0.05mm (load 920g)
	Frame size 42, 56, 60mm	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)

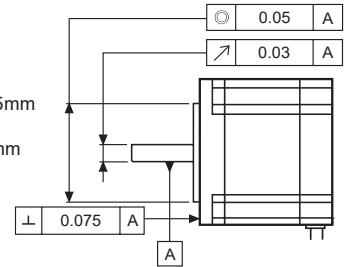
※2: T.I.R. (Total Indicator Reading)

- Indicates total quantity of dial gauge in case of 1 rotation of measuring part around the reference point.

※3: Amount of radial shaft displacement when adding a radial load (450g for frame size 20, 28, 35mm and 25N for frame size 42, 56, 60mm) to the tip of the motor shaft.

※4: Amount of axial shaft displacement when adding an axial load (920g for frame size 20, 28, 35mm and 50N for frame size 42, 56, 60mm) to the shaft.

※Environment resistance is rated at no freezing or condensation.



### Encoder

#### Frame size 20, 28, 35mm

Item	Magnetic incremental rotary encoder		
Resolution	Frame size 20mm <sup>※1</sup>	4,000PPR (1,000PPR×4-multiply)	
	Frame size 28, 35mm	16,000PPR (4,000PPR×4-multiply)	
Electrical specification	Output phase	A, $\bar{A}$ , B, $\bar{B}$ , Z, $\bar{Z}$ phase	
	Output duty rate	$\frac{T}{2} \pm \frac{T}{3}$ (T=1 cycle of A phase)	
	Phase difference of output	Output between A and B phase: $\frac{T}{4} \pm \frac{T}{4}$ (T=1 cycle of A phase)	
	Control output	Line driver output	• [Low] - Load current: max. 20mA, residual voltage: max. 0.5VDC= • [High] - Load current: max. -20mA, output voltage: min. 2.5VDC= =
		Response time (rise, fall)	Frame size 20mm: Max. 1.5μs (cable length: 2m, I sink = 20mA) Frame size 28, 35mm: Max. 1μs (cable length: 2m, I sink = 20mA)
	Max. response frequency	Frame size 20mm	200kHz
		Frame size 28, 35mm	1,000kHz
	Power supply	5VDC= ±5% (ripple P-P: max. 5%)	
	Current consumption	Max. 50mA (disconnection of the load)	

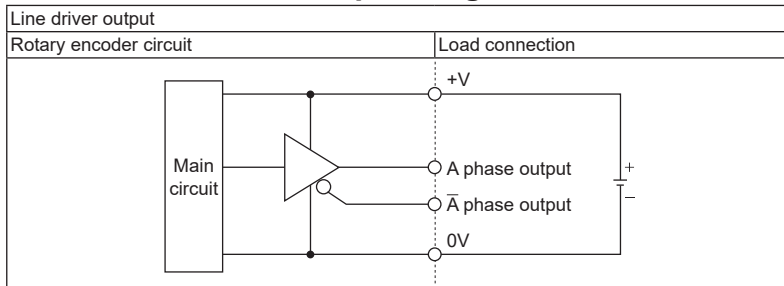
※1: Microstep control for AiS driver, it controls up to 10,000PPR.

#### Frame size 42, 56, 60mm

Item	Incremental rotary encoder		
Resolution	10,000PPR (2,500PPR×4-multiply)		
Electrical specification	Output phase	A, $\bar{A}$ , B, $\bar{B}$ , Z, $\bar{Z}$ phase	
	Output duty rate	$\frac{T}{2} \pm \frac{T}{4}$ (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	• [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. 0.5μs (cable length: 2m, I sink = 20mA)
	Max. response frequency	300kHz	
	Power supply	5VDC= ±5% (ripple P-P: max. 5%)	
	Current consumption	Max. 50mA (disconnection of the load)	

# 2-Phase Closed-Loop Stepper Motor

## Encoder Control Output Diagram

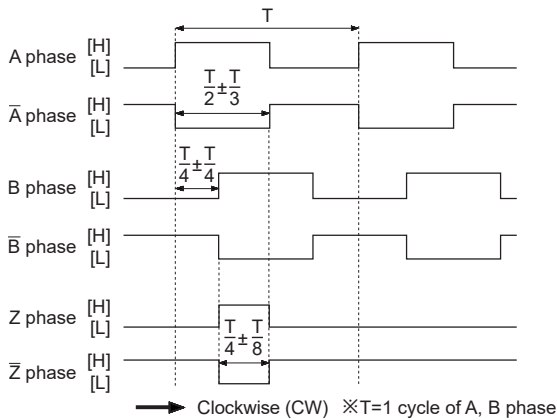


※All output circuits of A,  $\bar{A}$ , B,  $\bar{B}$ , Z,  $\bar{Z}$  phase are the same.

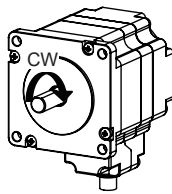
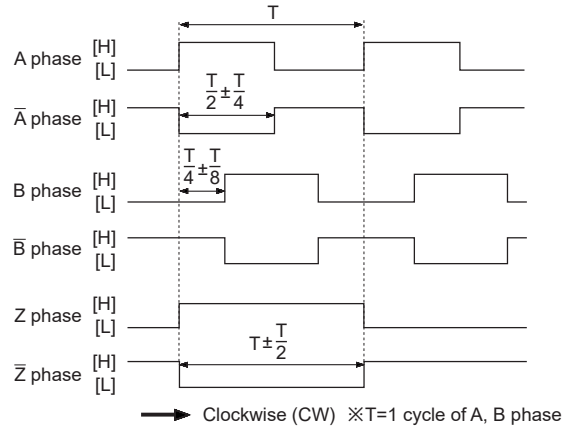
SENSORS
CONTROLLERS
MOTION DEVICES
SOFTWARE

## Encoder Output Waveforms

### ○ Frame size 20, 28, 35mm



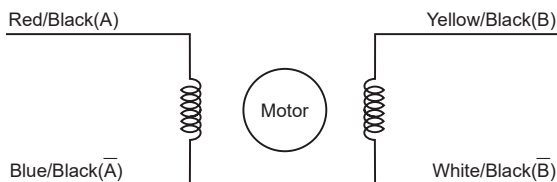
### ○ Frame size 42, 56, 60mm



(Y) Closed Loop Stepper System
(Z) Stepper Motors
(AA) Drivers
(AB) Motion Controllers

## Connection Diagram

Autonics 2 phase closed-loop stepper motors take bipolar wiring methods. The wiring colors for each phase and lead-wire are as the followings:

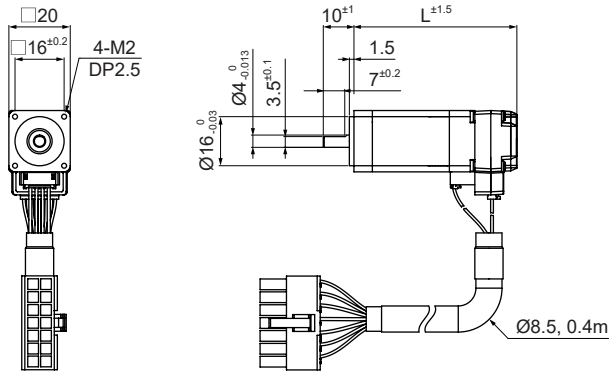




# Ai-M Series

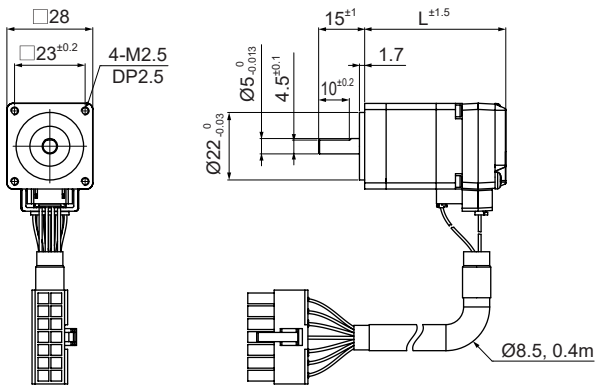
## ■ Dimensions

### ○ Frame size 20mm



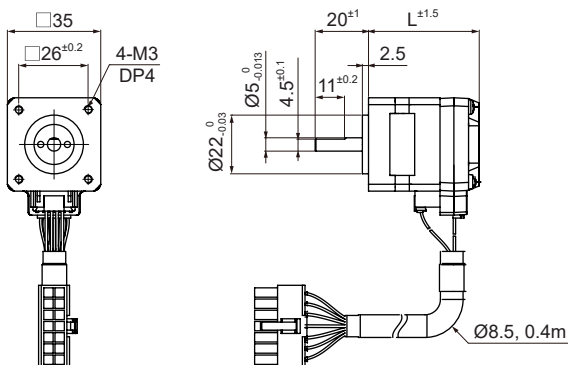
Model	L
Ai-M-20MA	41.2
Ai-M-20LA	53.1

### ○ Frame size 28mm



Model	L
Ai-M-28SB	46
Ai-M-28MB	59
Ai-M-28LB	65

### ○ Frame size 35mm



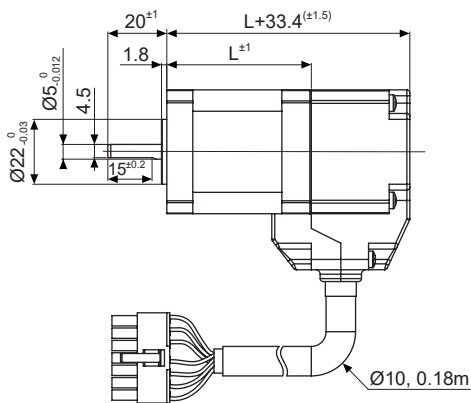
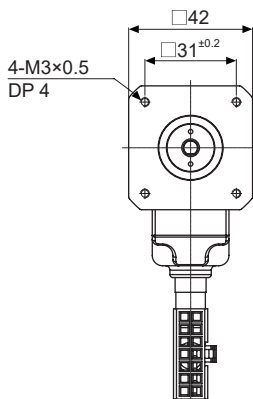
Model	L
Ai-M-35SB	41.5
Ai-M-35MB	52
Ai-M-35LB	68.5

# 2-Phase Closed-Loop Stepper Motor

## Dimensions

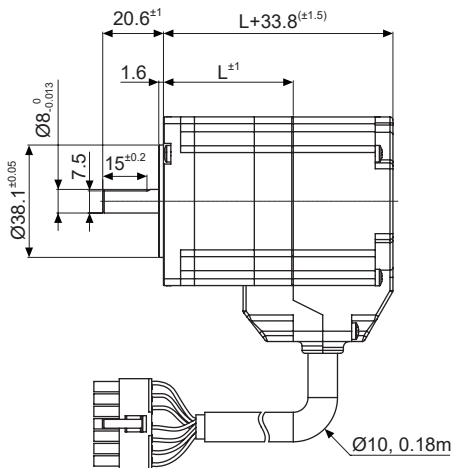
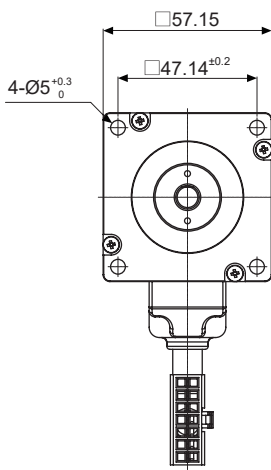
### Frame size 42mm

(unit: mm)



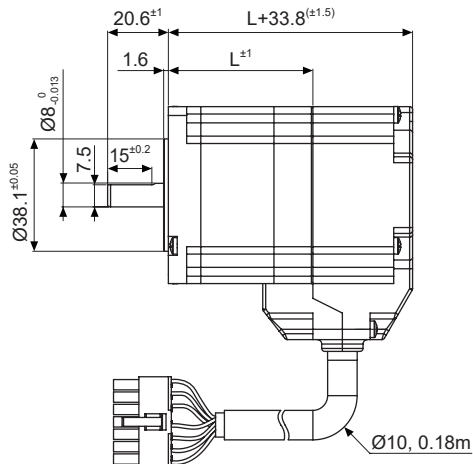
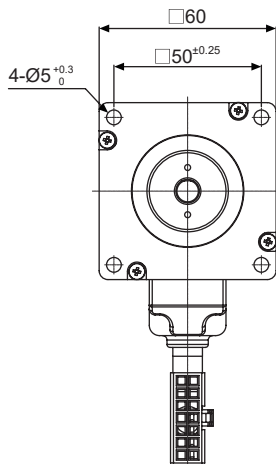
Model	L
Ai-M-42SA	34.1
Ai-M-42MA	40.1
Ai-M-42LA	48.1

### Frame size 56mm



Model	L
Ai-M-56SA	43.5
Ai-M-56MA	56.5
Ai-M-56LA	77.5

### Frame size 60mm



Model	L
Ai-M-60SA	48.1
Ai-M-60MA	69
Ai-M-60LA	86

SENSORS

CONTROLLERS

MOTION DEVICES

SOFTWARE

(Y) Closed Loop Stepper System

(Z) Stepper Motors

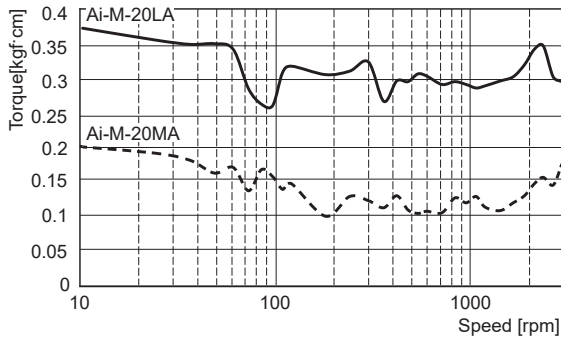
(AA) Drivers

(AB) Motion Controllers

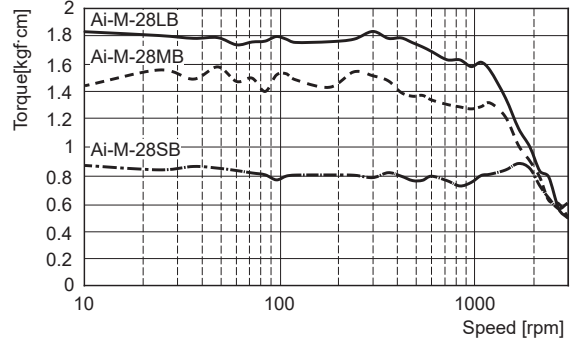
# Ai-M Series

## Motor Characteristics

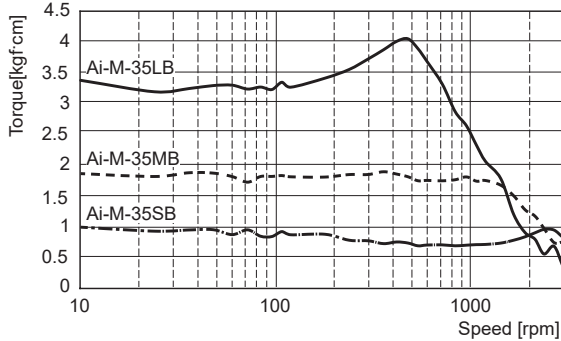
### Frame size 20mm



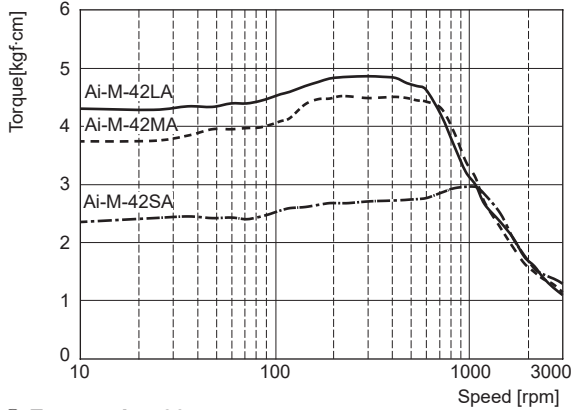
### Frame size 28mm



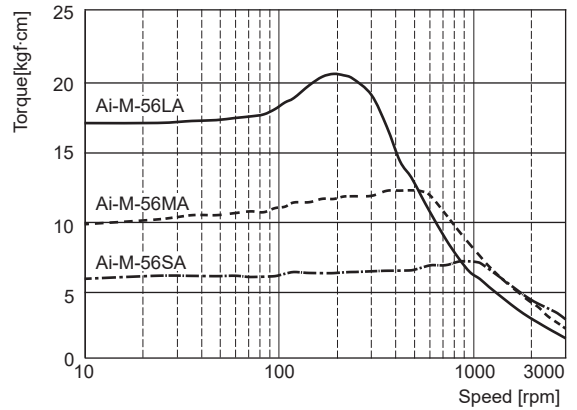
### Frame size 35mm



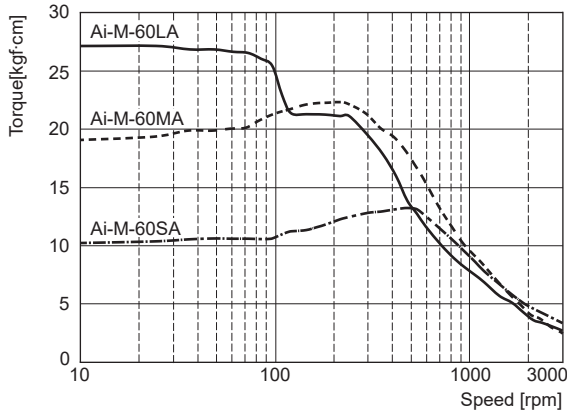
### Frame size 42mm



### Frame size 56mm



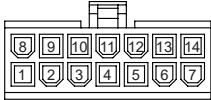
### Frame size 60mm



# 2-Phase Closed-Loop Stepper Motor

## Motor Connectors

### ● CN2: Motor+Encoder Connector

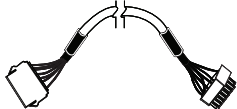
Pin arrangement	Pin no.	Function	Pin no.	Function
	1	GND	8	+5VDC
	2	Encoder A	9	Encoder $\bar{A}$
	3	Encoder B	10	Encoder $\bar{B}$
	4	Encoder Z	11	Encoder $\bar{Z}$
	5	F.G.	12	N-C
	6	Motor A	13	Motor B
	7	Motor $\bar{A}$	14	Motor $\bar{B}$

Type			Specifications			Manufacture
Motor+	Encoder	Frame size 20, 28, 35mm Frame size 42, 56, 60mm	Connector	Connector terminal	Housing	
CN2	Motor+	Frame size 20, 28, 35mm Frame size 42, 56, 60mm	5557-14R	5556T2 5556T	—	Molex

※Above connectors are suitable for Ai-M Series. You can use equivalent or substitute connectors.

### ● Cable (sold separately)

Type	Model	
Motor+Encoder cable	Normal	Moving
	C1D14M-□ <sup>※1</sup>	C1DF14M-□ <sup>※1</sup>

※1: □ indicates cable length (1, 2, 3, 5, 7, 10).

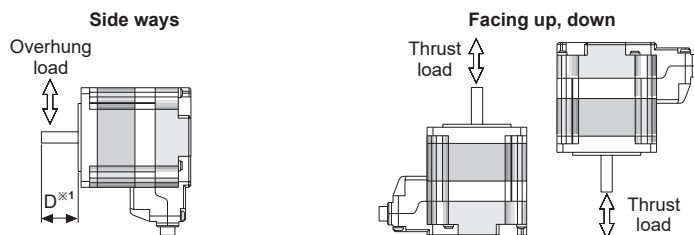
E.g.) C1DF14M-10: 10m moving type motor+encoder cable.

## Motor Installation

### 1. Mounting direction

Motor can be mounted in any directions-facing up, facing down and side ways.

No matter which direction motors to be mounted, make sure not to apply overhung or thrust load on the shaft. Refer to the table below for allowable shaft overhung load / thrust load.

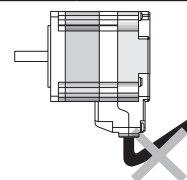


※1: The distance from the shaft in front (mm)

Motor size	The distance from the shaft in front (mm), Allowable overhung load [kgf (N)]				Allowable thrust load
	D=0	D=5	D=10	D=15	
Frame size 20mm	1.22 (12)	1.53 (15)	—	—	Under the load of motor
Frame size 28mm	2.55 (25)	3.46 (34)	5.3 (52)	—	
Frame size 35mm	2 (20)	2.55 (25)	3.46 (34)	5.3 (52)	
Frame size 42mm	2 (20)	2.6 (25)	3.5 (34)	5.3 (52)	
Frame size 56mm	5.5 (54)	6.8 (67)	9.1 (89)	13.3 (130)	
Frame size 60mm					

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

Do not forcibly pull or insert the cable. It may cause poor connection or disconnection of the cable by force. In case of frequent cable movement required application, proper safety countermeasures must be ensured.



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# Ai-M Series

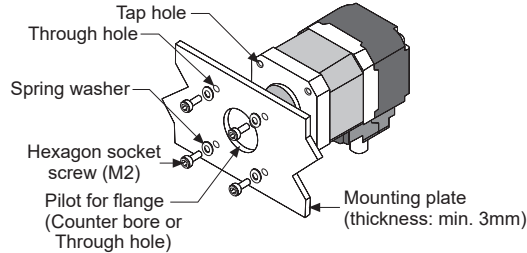
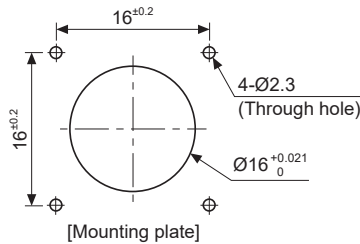
## Motor Installation

### 2. Mounting method

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.

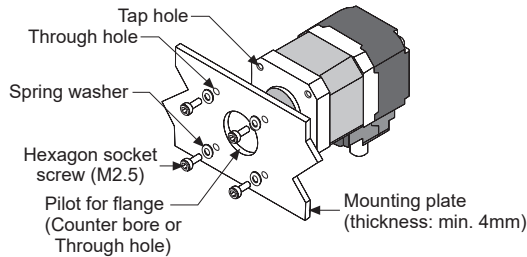
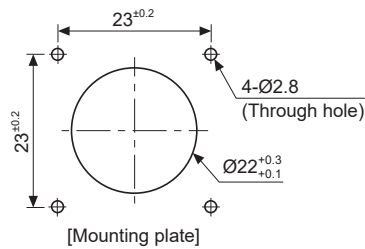
When mounting motors, use hexagon socket screws, hexagon nuts, spring washers and flat washers. Refer to the table below for allowable thickness of mounting plate and using bolt.

#### ○ Frame size 20mm



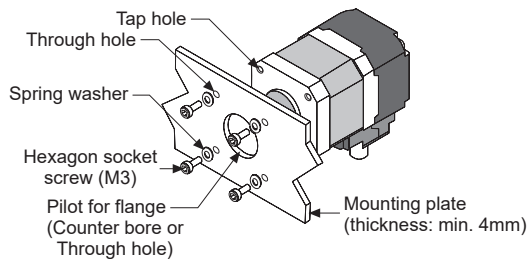
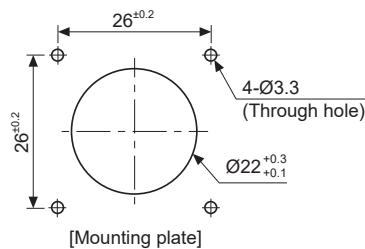
※Do not draw the wire with over strength 5N after wiring the encoder.

#### ○ Frame size 28mm



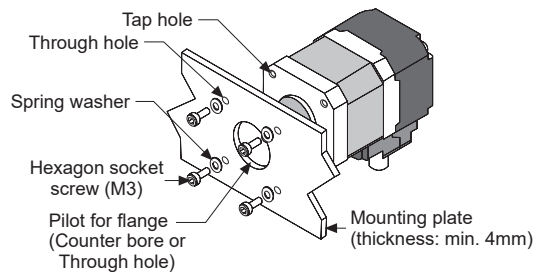
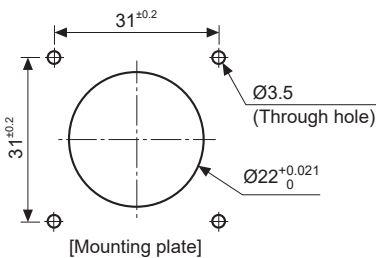
※Do not draw the wire with over strength 5N after wiring the encoder.

#### ○ Frame size 35mm



※Do not draw the wire with over strength 5N after wiring the encoder.

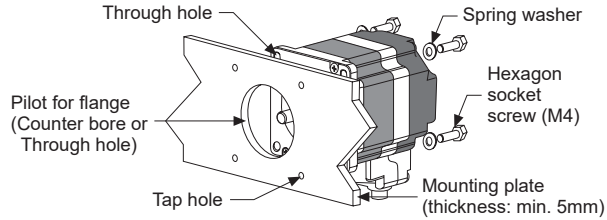
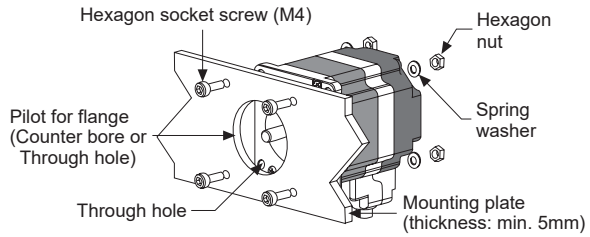
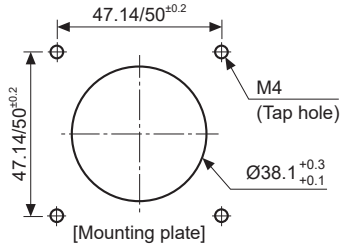
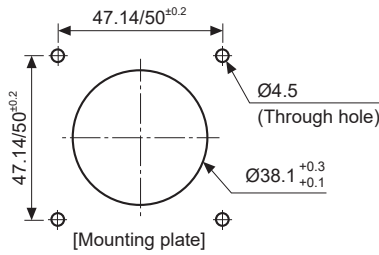
#### ○ Frame size 42mm



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

# 2-Phase Closed-Loop Stepper Motor

## ◎ Frame size 56mm/60mm



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

## 3. Connection with load

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

When connecting the load such as a pulley, a belt, be sure of the allowable thrust load, radial load, and shock.

Tighten the screw for a coupling or a pulley not to be unscrewed.

When connecting a coupling or a pulley on the motor shaft, be sure of damage of the motor shaft and the motor shaft bearing.

Do not disassemble or modify the motor shaft to connect with the load.

Direct load connection with coupling	Load connection with pulley, belt, and wire	Load connection with gear
<p>Flexible coupling Ball screw or TM screw ※Use Autonics flexible coupling (ERB Series).</p>		
<p>When connecting the load directly (ball screw, TM screw, etc) to the motor shaft, use a flexible coupling as shown in the above figure. If the center of the load is not aligned with that of shaft, it may cause severe vibration, shaft damage or shorten life cycle of the shaft bearing.</p>	<p>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.</p>	<p>The motor shaft and the load shaft should be parallel. Connect the motor shaft to the center of gear teeth side to be interlocked.</p>

## 4. Installation condition

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

It may cause product damage if it is used out of following conditions.

① Inside of the housing which is installed indoors

(This unit is manufactured for the purpose of 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 acidity

⑨ The place where easy heat dissipation could be made

⑩ The place without 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 no radioactive substances and magnetic fields exist. It shall be no vacuum status as well.

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## ■ Troubleshooting

### 1. When motor does not rotate

- ① Check the connection status between controller and driver, and pulse input specifications (voltage, width).
- ② Check the pulse and direction signal are connected correctly.

### 2. When motor rotates to the opposite direction of the designated direction

- ① When RUN mode is 1-pulse input method, CCW input [H] is for forward, [L] is for backward.
- ② When RUN mode is 2-pulse input method, check CW and CCW pulse input are changed or not.

### 3. When motor drive is unstable

- ① Check that driver and motor are connected correctly.
  - ② Check the driver pulse input specifications (voltage, width).
- 

## ■ Proper Usage

- Follow instructions in 'Proper Usage'.  
Otherwise, it may cause unexpected accidents.
- Using motors at low temperature may cause reducing ball bearing's grease consistency and friction torque is increased.  
Start the motor in a steady manner since motor's torque is not to be influenced.
- If wiring encoder cable, separate it from high voltage line or power cable for preventing surge and inductive noise.  
The cable length should be as short as possible.  
Failure to follow this instruction may result in raised cable resistance, residual voltage, and output waveform noise.
- Must connect the encoder shield cable to the F.G. terminal.
- 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 driver
  - ⑤ Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
- 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