AiSA-D Series

AC Type 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)
● Higher cost-efficiency compared to servo motor drivers
● Torque control mode supported
● Able to check alarms and status with Alarm/Status display part (7 segment)
● Rapid response which is advantageous for the short distance continuous operation
● Able to implement Low frequency operation and high torque in low speed area
● Low current drive at middle·high speed area
● Max. stop torque at current down mode (available vertical load attaching)
● Easy to set various Gain with rotary switch
● Applicable to the precision equipment such as optical inspection equipment
  with the features of maintaining torque in stop and having no micro vibration (hunting)
● Various resolutions
  : 500, 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 (10 steps)
● 10-levels of resolution setting
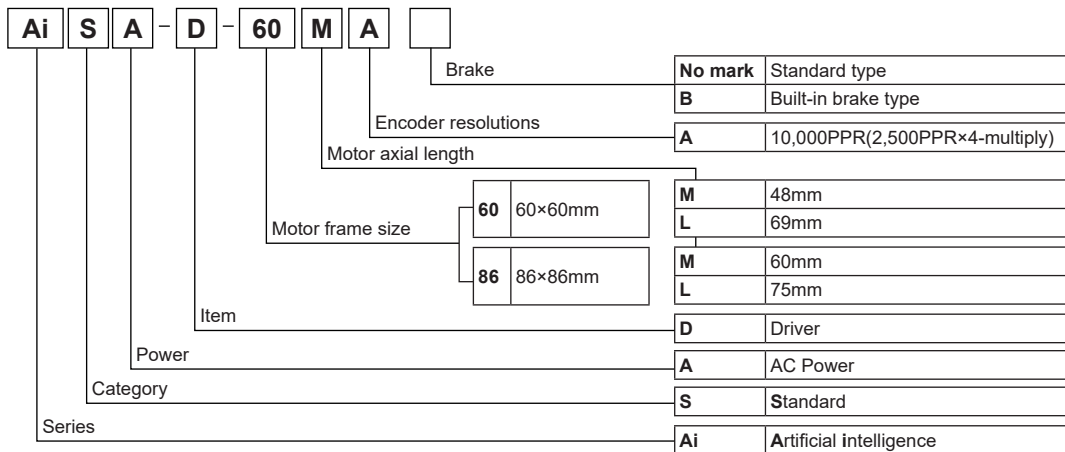● Frame size 60mm, 86mm (Applied Motor: AiA-M Series)

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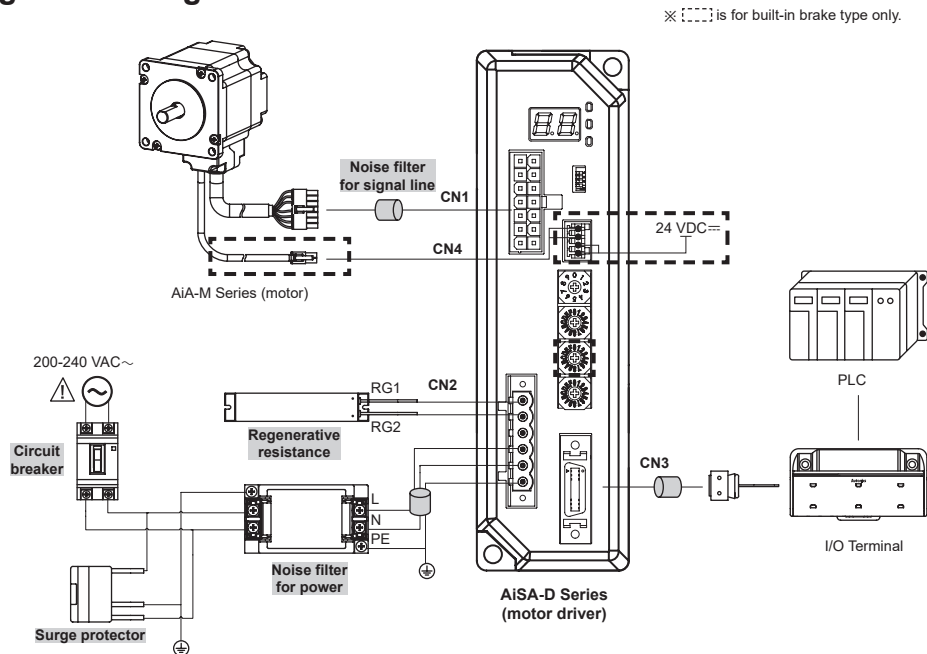**in the instruction manual before using.**

C E

▣ Applications

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

▣ Ordering Information

Ai	S	A	–	D	–	60	M	A		

Brake	**No mark**	Standard type
	B	Built-in brake type
Encoder resolutions	**A**	10,000PPR(2,500PPR×4-multiply)
Motor axial length		

Motor frame size	**60**	60×60mm	**M**	48mm
			L	69mm
	86	86×86mm	**M**	60mm
			L	75mm

Item	**D**	Driver
Power	**A**	AC Power
Category	**S**	**S**tandard
Series	**Ai**	**A**rtificial **i**ntelligence

AC Type 2-Phase Closed-Loop Stepper Motor Driver

■ Configuration Diagram

※ ⌐⌐⌐ is for built-in brake type only.

※ 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
　② CN2(power connector): AWG18
　③ CN3(I/O connector): AWG28
　④ CN4(brake connector): AWG22
※ In case of unwanted noise generating from peripherals and power, use ferrite core in the wiring.
※ ▨ is sold separately.

◎ Noise filter for signal line

-Connect to wiring to suppress external noise.
-Depending on frequency, filtered noise may different.

Model	Specification	Manufacture
Motor line, I/O signal line	28A5776-0A2	Lairdtech
Power line	28A5131-0A2	

◎ 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	Specification	Manufacture
IRC100	● Resistance: 100Ω ±5%, ● Rated Power: 60W(standby), 100W(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	Specification	Manufacture
RNS-2006	● Rated voltage: 250V ● Rated current: 6A ● Max. leakage current: 1mA	Orient Electronics

◎ Surge protector

Protect the product from external noise and surge by connecting power.
※ Be sure to disconnect the surge protector when testing internal pressure.
　It may result in porduct damage.

Model	Specification	Manufacture
LT-C12G801W	● Nomial discharge current: 2500A ● Max. discharge current: 5000A ● Voltage protection level: 1.5kV	OTOWA Electric Co. Ltd

AiSA-D Series

■ Specifications

Model[1]		AiSA-D-60MA(-B)	AiSA-D-60LA(-B)	AiSA-D-86MA(-B)	AiSA-D-86LA(-B)
Power consumption	Power supply	200-240 VAC∼ 50/60 Hz			
	STOP[2]	Max. 60 W		Max. 65 W	Max. 70 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	Standard type	20% or 30% of max. RUN current (factory default: 30%)			
	Built-in brake type	20 to 100% of max. RUN current			
Rotation speed		0 to 3000 rpm			
Resolution[5]		500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 PPR			
Speed filter[5]		0 (disable) (factory default), 2, 4, 6, 8, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200 ms			
Motor GAIN[5]	Standard type	Within the range of motor gain: 1 to 32			
	Built-in brake type	Standard GAIN: 0 to F, Inertia GAIN: 0 to F			
In-Position[5]		Fast Response: 0 (factory default) to 7, Accurate Response: 0 to 7			
Pulse input method[5]		1-pulse or 2-pulse input (factory default) method			
Motor rotation direction[5]		CW (factory default), CCW			
Status indicator		● Alarm/Status display part: orange LED 7 seg. (built-in brake type: red LED 8 seg.) ● Power/Alarm indicator: green/red LED ● In-Position indicator: orange LED ● Servo On/Off indicator: blue LED			
I/O	Input	CW, CCW (Run pulse) Servo On/Off (photocoupler input) - [H]: 24 VDC⎓, [L]: 0-0.5 VDC⎓, Pulse width - min. 1 ms Alarm reset (photocoupler input) - [H]: 24 VDC⎓, [L]: 0-0.5 VDC⎓, Pulse width - min. 10 ms			
	Output	● Photocoupler: In-Position, Alarm out ● Line driver: encoder signal (phase A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$)			
Operation mode[4]		Standard, Torque mode			
Input pulse specifications	Pulse width	CW, CCW: input pulse frequency duty 50 %,			
	Rising/Falling time	CW, CCW: max. 0.5 µs			
	Pulse input voltage	CW, CCW - [H]: 4-8 VDC⎓, [L]: 0-0.5 VDC⎓			
	Max. input pulse freq.[6]	CW, CCW: 500 kHz			
Alarm		Overcurrent, overspeed, position tracking, overload, overheat, motor connection, encoder connection, overvoltage, undervoltage, motor misalignment, command pulse, in-position, brake[4]			
Input resistance	Standard type	220Ω (CW, CCW), 10kΩ (Servo On/Off, alarm reset)			
	Built-in brake type	4.7 kΩ (Anode Pull-up)			
Insulation resistance	Standard type	Over 100MΩ (at 500VDC⎓ megger)			
	Built-in brake type	Over 200 MΩ (at 500 VDC⎓ megger)			
Dielectric strength		1,500 VAC∼ 60 Hz for 1 min			
Vibration		1.5 mm amplitude at frequency of 10 to 55 Hz (for 1 min) in each X, Y, Z direction for 2 hours			
Shock		300 m/s² (approx. 30 G) in each X, Y, Z direction for 3 times			
Environment	Ambient temp.	0 to 50 ℃, storage: -10 to 60 ℃			
	Ambient humi.	35 to 85 %RH, storage: 10 to 90 %RH			
Protection structure		IP20 (IEC standard)			
Approval		CE ℝoHS			
Weight[7]	Standard type	Approx. 920 g (approx. 800 g)			
	Built-in brake type	Approx. 1,020 g (approx. 780 g)			

※1: The model name indicates driver type. (none: standard type, B: built-in brake type)
　　E.g.) AiSA-D-60MA-B: built-in brake type stepping motor driver.
※2: Based on the ambient temperature 25 ℃, 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: Corresponding specification is only available in built-in brake type and is not available in standared type.
※5: Settings are available with the switches located on the front. When setting, the power must not be applied and cannot be set after power is applied.
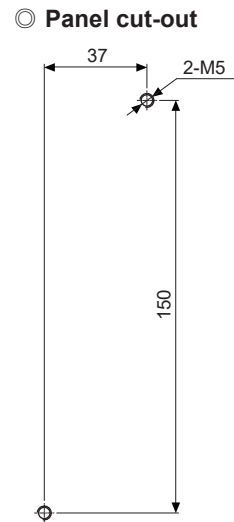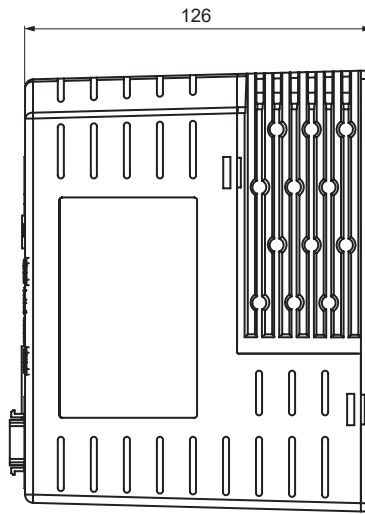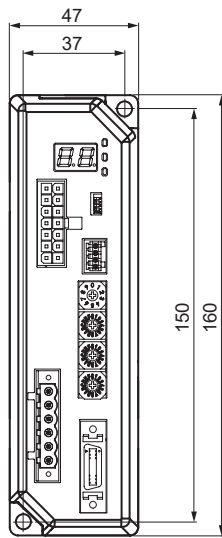※6: Max. input pulse frequency is max. frequency to be input and is not the same as max. pull-out frequency or max. slewing frequency.
※7: The weight includes packaging. The weight in parentheses is for unit only.
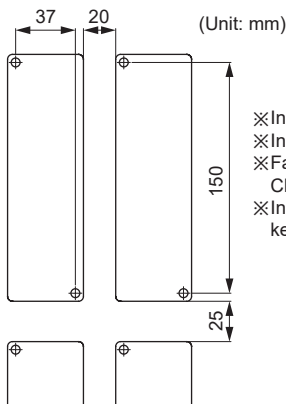※ Environment resistance is rated at no freezing or condensation.

# AC Type 2-Phase Closed-Loop Stepper Motor Driver

▣ Dimensions

◎ **Panel cut-out**

▣ Installation

(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.

▣ Unit Descriptions
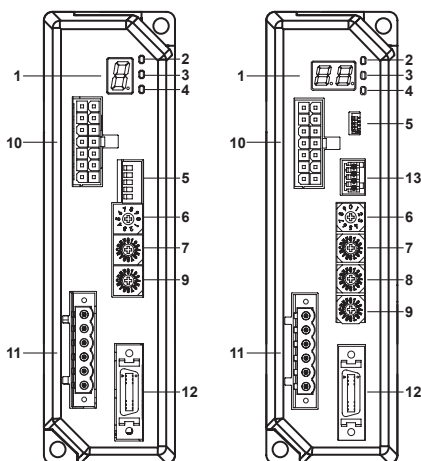
1. Alarm/Status display part (orange)

2. Power/Alarm indicator (PWR/ALM) (green/red)

3. In-Position indicator (INP) (orange)

4. Servo On/Off indicator (SERVO) (blue)

5. Function selection DIP switch

6. Resolution rotary switch (RES)

7. Motor gain setting rotary switch (GAIN)

8. Speed filter / Limit setting rotary switch (S.F) [1]

9. In-Position setting rotary switch (INP)

10. Motor+Encoder connector (CN1)

11. Power connector (CN2)

12. I/O connector (CN3)

13. Brake connector (CN4) [1]

※1: Corresponding connector and switch are for built-in brake type only.

AiSA-D Series

▣ Driver Status Indicators
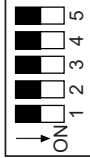
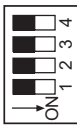| Indicator & Display part	LED color	Function	Descriptions
PWR/ALM	Green	Power indicator	Turns ON when the unit operates normally after supplying power
	Red	Alarm indicator	When alarm occurs, it flashes in various ways depending on the situation. Refer to '▣ **Control Input/Output** → ◎ **Output** → **2. Alarm**'.
INP	Orange	In-Position indicator	Turns ON when motor is placed at command position after positioning input.
SERVO	Blue	Servo On/Off indicator	Turns ON when Servo is operating, turns OFF when servo is not operating.
Alarm/Status display part	Red (built-in brake type: orange)	Alarm, status indicator	When alarm occurs, it displays number of the corresponding alarm and the setting number of the rotary switches (RES/GAIN/INP)

▣ Driver Setting

◎ Function selection DIP switch
-Set rotation direction, stop current, pulse input method, motor gain, torque mode and etc.

[Standard type]

No.	Name	Function	Switch position	
			ON	OFF (factory default)
1	DIR	Rotation direction	CCW	CW
2	1P/2P	Pulse input method	1-pulse input method	2-pulse input method
3	CD	STOP current	20% of max. RUN current	30% of max. RUN current
4	GM	Gain setting	High gain	Low gain
5※1	RVD	Test mode	Test mode	Normal mode

※1: Set to OFF when using the device. It is only for the operation test in manufacturing process.

[Built-in brake type]

| No.	Name	Function	Switch position	
			ON	OFF (factory default)
1	DIR	Rotation direction	CCW	CW
2	1P/2P	Pulse input method	1-Pulse input method	2-Pulse input method
3	GS H/L	Motor GAIN setting	Inertia GAIN	Standard GAIN
4	TM	Torque mode	Torque mode	Standard mode

● Pulse input method

※ 1-pulse input method
   CW: rotation operation signal input
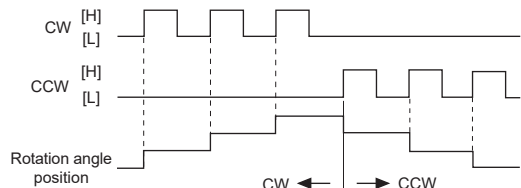   CCW: rotation direction signal input
      ([H]: forward rotation, [L]: reverse rotation)
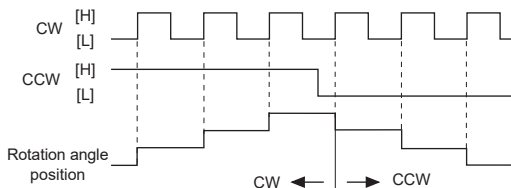
※ 2-pulse input method
   CW: forward rotation signal input
   CCW: reverse rotation signal input

※ [H]: photocoupler ON (voltage of both ends 4-8VDC), [L]: photocoupler OFF (voltage of both ends 0-0.5VDC)

● STOP current

-In order to decrease motor heat and current consumption at motor stopping moment (in case there is no input during the time of the double width of last input pulse), set the stop current supplied to the motor phase.

AC Type 2-Phase Closed-Loop Stepper Motor Driver

◎ RES: Resolution setting switch

-Set the resolution of driver.
-The number of pulses per 1 rotation by resolution is each 500, 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000.
-Modified setting values are not applied in the running status, and the values will be applied after motor stopped.

| Setting	Pulse/Revolution	Resolution	Setting	Pulse/Revolution	Resolution
0(factory default)	500	2.5	5	3600	18
1	1000	5	6	5000	25
2	1600	8	7	6400	32
3	2000	10	8	7200	36
4	3200	16	9	10000	50

RES

◎ GAIN: Motor gain setting switch
-Depending on GM OFF or GS H/L switch setting, the motor sets GAIN.
-Motor GAIN is selectable from 32 GAIN.
-The larger gain is, the more improved transient response becomes and the less error occurs.
※ At the lowest system load status, raise the gain value until motor vibrates and set to 1 to 2 level lower.

Standard type	GM OFF - Low GAIN		GM ON - High GAIN	
Built-in brake type	GS H/L OFF - Standard GAIN		GS H/L ON - Inertia GAIN	
Setting	GAIN	Setting	GAIN	Setting	GAIN	Setting	GAIN
0	×1	8	×9	0	×17	8	×25
1	×2	9	×10	1	×18	9	×26
2	×3	A	×11	2	×19	A	×27
3	×4	B	×12	3	×20	B	×28
4	×5	C	×13	4	×21	C	×29
5	×6	D	×14	5	×22	D	×30
6	×7	E	×15	6	×23	E	×31
7	×8	F	×16	7	×24	F	×32

GAIN
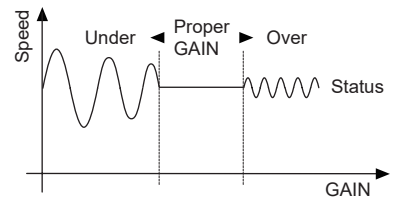
◎ S.F: Speed Filter / Limit setting switch
-Corresponding switch is only available in built-in brake type.
-Depending on TM switch setting, speed filter and speed limit function can be set.

● Speed Filter
-In standard mode, it sets the delay time between the command position and the motor position.
-It determines the responsiveness of the motor to the command and smoothly follows the speed even if the load changes or disturbance occurs.

● Speed Limit
-In torque mode, it sets the speed limit.
-When the rotation speed reaches the speed limit value, the torque control may become unstable. Set value greater than the speed to be limited.

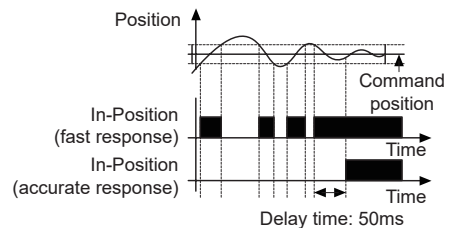| Speed Filter (TM OFF)				Speed Limit (TM ON)			
Setting	Delay time	Setting	Delay time	Setting	Limit speed	Setting	Limit speed
0	Disable	8	60 ms	0	10 rpm	8	90 rpm
1	2 ms	9	80 ms	1	20 rpm	9	120 rpm
2	4 ms	A	100 ms	2	30 rpm	A	150 rpm
3	6 ms	B	120 ms	3	40 rpm	B	200 rpm
4	8 ms	C	140 ms	4	50 rpm	C	250 rpm
5	10 ms	D	160 ms	5	60 rpm	D	300 rpm
6	20 ms	E	180 ms	6	70 rpm	E	380 rpm
7	40 ms	F	200 ms	7	80 rpm	F	500 rpm

GAIN
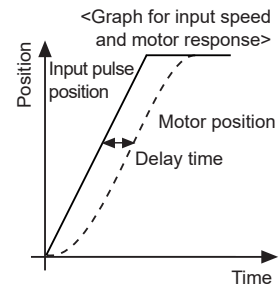
◎ INP: In-Position setting swtich

-After position command pulse has finished, if the gap between target position and real position is under In-Position setting value, positioning completion pulse is output.
-Modified setting values are not applied in the running status, and the values will be applied after motor stopped.

Fast response		Accurate response	
Setting	Value	Setting	Value
0 (factory default)	0	8	0
1	±1	9	±1
2	±2	A	±2
3	±3	B	±3
4	±4	C	±4
5	±5	D	±5
6	±6	E	±6
7	±7	F	±7

INP

AiSA-D Series

◼ Driver Connectors

◎ Connector function

● CN1: Motor+Encoder Connector

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

● CN2: Power connector

Pin no.	Function
1	Regenerative resistance
2	
3	N·C
4	Power
5	
6	PE

● CN3: I/O connector

Pin no.	I/O	Function	Pin no.	I/O	Function
1	Input	CW+	11	Output	In-Position+
2	Input	CW-	12	Output	In-Position-
3	Input	CCW+	13	——	N·C
4	Input	CCW-	14	——	N·C
5	Input	Servo On/Off+	15	Output	Encoder A
6	Input	Servo On/Off-	16	Output	Encoder $\overline{A}$
7	Output	Alarm Out+	17	Output	Encoder B
8	Output	Alarm Out-	18	Output	Encoder $\overline{B}$
9	Input	Alarm Reset+	19	Output	Encoder Z
10	Input	Alarm Reset-	20	Output	Encoder $\overline{Z}$

● CN4: Brake connector

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

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

◎ Connector specifications

| Type		Specifications			Manufacture
		Connector	Connector terminal	Housing	
CN1	Motor+Encoder	5557-14R	5556T	——	Molex
CN2	Power	5ESDVM-06P-OR	——	——	Dinkle
CN3	I/O connector	10120-3000PE	——	10320-52F0-008	3M
CN4	Brake connector	ESC250V-S2330704P	——	——	Dinkle

※Above connectors are suitable for AiSA-D Series.

◼ Sold Separately

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

◎ I/O cable

● CO20-MP☐-R (standard: AiS TAG)
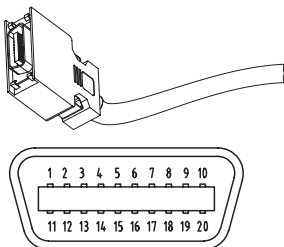
| Pin no.	Function (name tag)	Cable color	Dot line color-numbers	Pin no.	Function (name tag)	Cable color	Dot line color-numbers
1	CW+	Yellow	Black-1	11	In-Position+	White	Black-1
2	CW-		Red-1	12	In-Position-		Red-1
3	CCW+		Black-2	13	——		Black-2
4	CCW-		Red-2	14	——		Red-2
5	Servo On/Off+		Black-3	15	Encoder A+		Black-3
6	Servo On/Off-		Red-3	16	Encoder A-		Red-3
7	Alarm Out+		Black-4	17	Encoder B+		Black-4
8	Alarm Out-		Red-4	18	Encoder B-		Red-4
9	Alarm Reset+		Black-5	19	Encoder Z+		Black-5
10	Alarm Reset-		Red-5	20	Encoder Z-		Red-5

※☐ of model name indicates cable length (010, 020).
　For corresponding EMC standard, cable length should be below 2m.
　E.g.) CO20-MP020-R: 2m I/O cable.

◎ Motor+Encoder cable

● Normal: C1D14M-☐, Moving: C1DF14M-☐
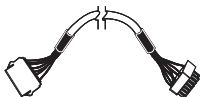
※ ☐ of model name indicates cable length (1, 2, 3, 5, 7, 10)
　E.g.) C1DF14M-10: 10m moving type motor+encoder cable.

AC Type 2-Phase Closed-Loop Stepper Motor Driver

◼ Contol Input/Output

Inner signal of all input/output consists of photocoupler.
ON, [H]: photocoupler power ON
OFF, [L]: photocoupler power OFF

◎ Input

1. Position command pulse
-Pulse input is selectable from 1-pulse input method and 2-pulse input method.
 (Refer to '◎ **SW1: Function selection DIP switch**'.)
-When using extending cable, it is recommended to connect Common mode choke coil (2mH) to the CW, CCW terminal in series connection.

2. Servo On/Off
-This signal is for rotating axis of motor using external force or used for manual positioning.
-Servo On/Off signal maintains over 1ms as [H]
 : Regarded as Servo Off signal and phase current is cut to release torque.
  The Servo ON indicator, the In-Position output and indicator turns OFF.
-Servo On/Off signal maintains over 1ms as [L]
 : Regarded as Servo On signal and phase current is supplied to gain torque.
  The Servo ON indicator, the In-Position output and indicator turns ON.
※Stop the motor for using the signal.
※Refer to **'4. Example of input circuit connection'**.

3. Alarm Reset
-This signal is for clearing the alarm.
-Alarm reset signal maintains over 20ms as [H]
 : Alarm is cleared, the alarm indicator and alarm output turns OFF, and the driver returns to normal status.
※If the causes of the alarm are not removed, driver may not be returned to the normal status even with alarm reset.
※Refer to **'4. Example of input circuit connection'**.

4. Example of input circuit connection
 [Standard type]
● **Input pulse (CW, CCW)**
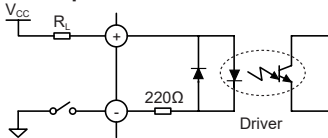-It is recommended to use 5VDC at V_{CC} and short the R_L.
-In case V_{CC} is over 5VDC, calculate R_L value using following formula and use V_{CC} below 30VDC.
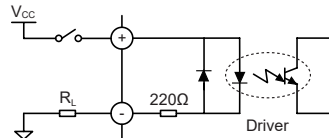-In case V_{cc} is 12, 24VDC, refer to the table as follow.

$$※R_L = \frac{V_{CC}-2.17V}{0.011A} - 220\Omega$$

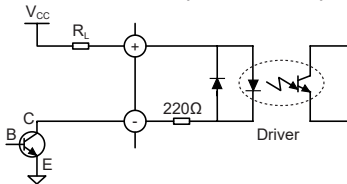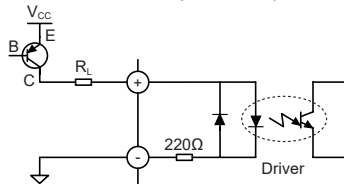| V_{CC}	R_L
12VDC	680Ω (min. 0.25W)
24VDC	1.8kΩ (min. 0.5W)

A. Pull-Up

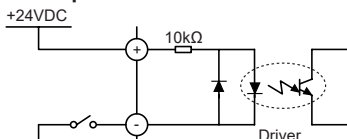**B. Pull-Down**

C. Circuit with NPN (not-reversed)
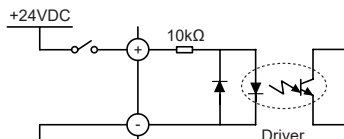

D. Circuit with PNP (reversed)

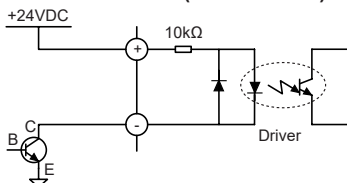● **External input (Servo On/Off, Alarm Reset)**
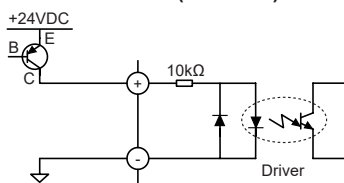
A. Pull-Up

B. Pull-Down

C. Circuit with NPN (not-reversed)

D. Circuit with PNP (reversed)

SENSORS

FIELD INSTRUMENTS

CONTROLLERS

MOTION DEVICES

SOFTWARE

(A) Closed Loop Stepper System

(B) Stepper Motors

(C) Stepper Motor Drivers

(D) Motion Controllers

AiSA-D Series

[Built-in brake type]

● Input pulse (CW, CCW)

-Use external power (VEX) 5 VDC⎓ in pulse input.
-When input power is exceeded, it may result the product damage.
-In case the external pulse input power (VEX) is over 5VDC, use external resistor R_L.
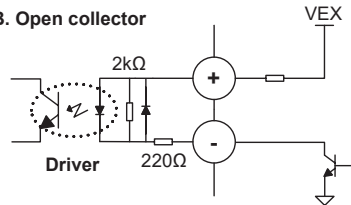-In case the external pulse input power (VEX) is over 12, 24VDC, refer to the R_L as table below.

$$※R_L = \frac{V_{EX}-2.17V}{0.011A} - 220Ω$$

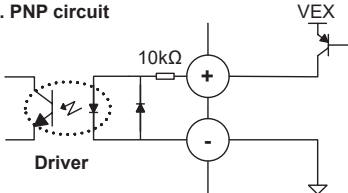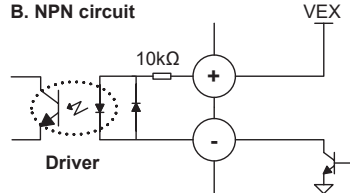| V_{CC}	R_L
12VDC	680Ω(Min. 0.25W)
24VDC	1.7kΩ(Min.0.5W)

A. Differential line driver
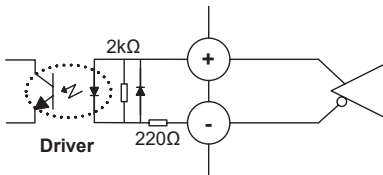
B. Open collector

● External Input (Servo On/Off, Alarm Reset)

-Use external power (VEX) 24 VDC⎓ in external input Servo On/Off and Alarm Reset.

A. PNP circuit

B. NPN circuit

◎ Output

1. 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 to [H] and the In-Position indicator turns ON.
-In reverse, when the gap is over In-Position setting value, In-Position output turns to [L] and the In-Position indicator turns OFF.
-For accurate drive, check the In-Position output again and execute the next drive.
※Refer to '**3. Example of output circuit connection**'.

2. Alarm

● Alarm

-This function stops motor to protect driver, depending on the error status such as overcurrent or overspeed.
-In case of normal status, output is [H], and in case of alarming status, output is [L].
-When supplying alarm reset, driver returns to the normal status.
※ Refer to '**3. Example of output circuit connection**'.

● Alarm/Status display

-When alarm occurs, the alarm indicator (ALM, red) flashes as the times of corresponding alarm type.
-The alarm/status display part displays the number of the corresponding alarm type.

No. of flashing	Alarm/Status	Alarm type	Descriptions	Motor stop	Maintain torque
1	E1	Overcurrent error	When overcurrent flows at motor RUN element		
2	E2	Overspeed error	When motor speed is over 3,500rpm		
3	E3	Position tracking error	When the gap between position command value and current position value is over 90°		
4	E4	Overload error	When applying load over the rated load for over 1 sec		
5	E5	Overheat error	When heatsink temperature is over 90℃		
6	E6	Motor connection error	When motor cable connection error occurs at driver		
7	E7	Encoder connection error	When encoder cable connection error occurs at driver	O	X
8	E8	Overvoltage error	When input voltage is over 240VAC +10%		
9	E9	Undervoltage error[1]	When input voltage is under 200VAC -10%		
10	EA	Motor misalignment	When motor is in misalignment		
11	Eb	Command pulse error	When input pulse is over 3,500rpm		
			When pulse is input before initial alignment		
12	EC	In-Position error	When position error (over 1) is kept over 3 sec, after motor stopped.		
13	Ed	Brake error[2]	When brake failed to operate.		

※1: When cutting off the power, the undervoltage error occurring is normal operation.
※2: Corresponding alarm is only available in built-in brake type.
※Depending on the alarm type, it flashes for 0.4 sec interval and it turns OFF for 0.8 sec repeatedly.

<E.g. case of alarm 3>

| 1 | 2 | 3 | | 1 | 2 | 3 |

0.4 sec   0.8 sec

Autonics
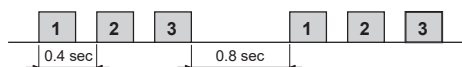
AC Type 2-Phase Closed-Loop Stepper Motor Driver
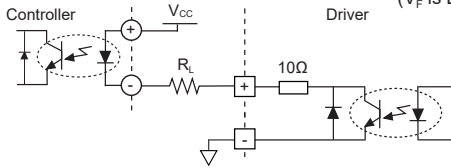
3. Example of output circuit connection

[Standard type]

-It is recommended to use below 50VDC at V_{CC}. Use the R_L for I_C (collector current of secondary detector) of photocoupler inside the driver to be within 25mA following the below formula.
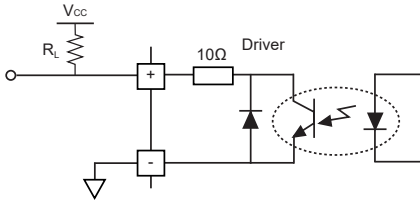
$$※A: R_L = \frac{V_{CC}-0.3V-V_F}{0.025A} - 10Ω \qquad ※B, C: R_L = \frac{V_{CC}-0.3V}{0.025A} - 10Ω$$

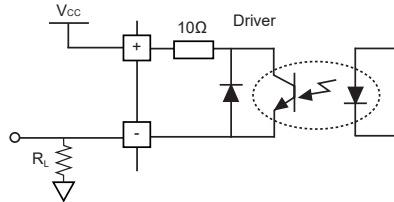(V_F is LED forward voltage of primary photocoupler.)

A. Circuit with photocoupler

B. Circuit with pull up (reversed)

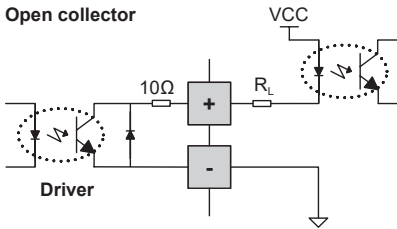### C. Circuit with pull down (not-reversed)

[Built-in brake type]

● External output signal ciruit

-Use external power (VCC) max. 30 VDC, 10mA for output.
-When current is over 10mA, use external resistor R_L to control current.

$$※R_L = \frac{V_{CC}-0.7V-V_F}{0.01A} - 10Ω$$

V_F: LED forward voltage of primary photocoupler

● Encoder output signal circuit

-Encoder output signal uses a line driver (26C32).
-Connect the terminal resistance R_L of 100 to 150Ω in parallel to both ends (A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$) of each phase of encoder.

4. Encoder output waveforms

Clockwise (CW)   ※T: 1 cycle of A, B phase
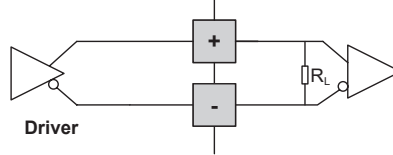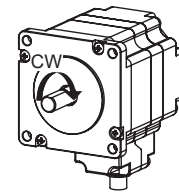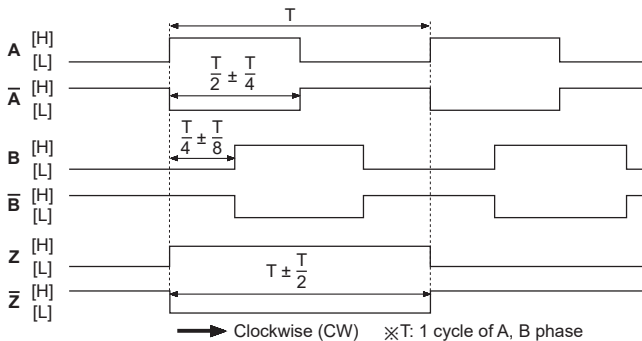
※It is recommended to use Line driver output (corresponding to 26C32) at RECEIVER end of encoder output and terminating resisters (100-150Ω) in parallel at both ends of each phase (A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, corresponding to 26C31).

AiSA-D Series

▣ Connection for Motor and Driver

CN1

Motor / Encoder

	Pin	
A	6	Motor
Ā	7	
B	13	
B̄	14	
A	2	Encoder
Ā	9	
B	3	
B̄	10	
Z	4	
Z̄	11	
+5VDC	8	
GND	1	
PE	5	
N·C	12	

CN4※1

1	Brake+
2	Brake-
3	POWER 24VDC
4	

CN3

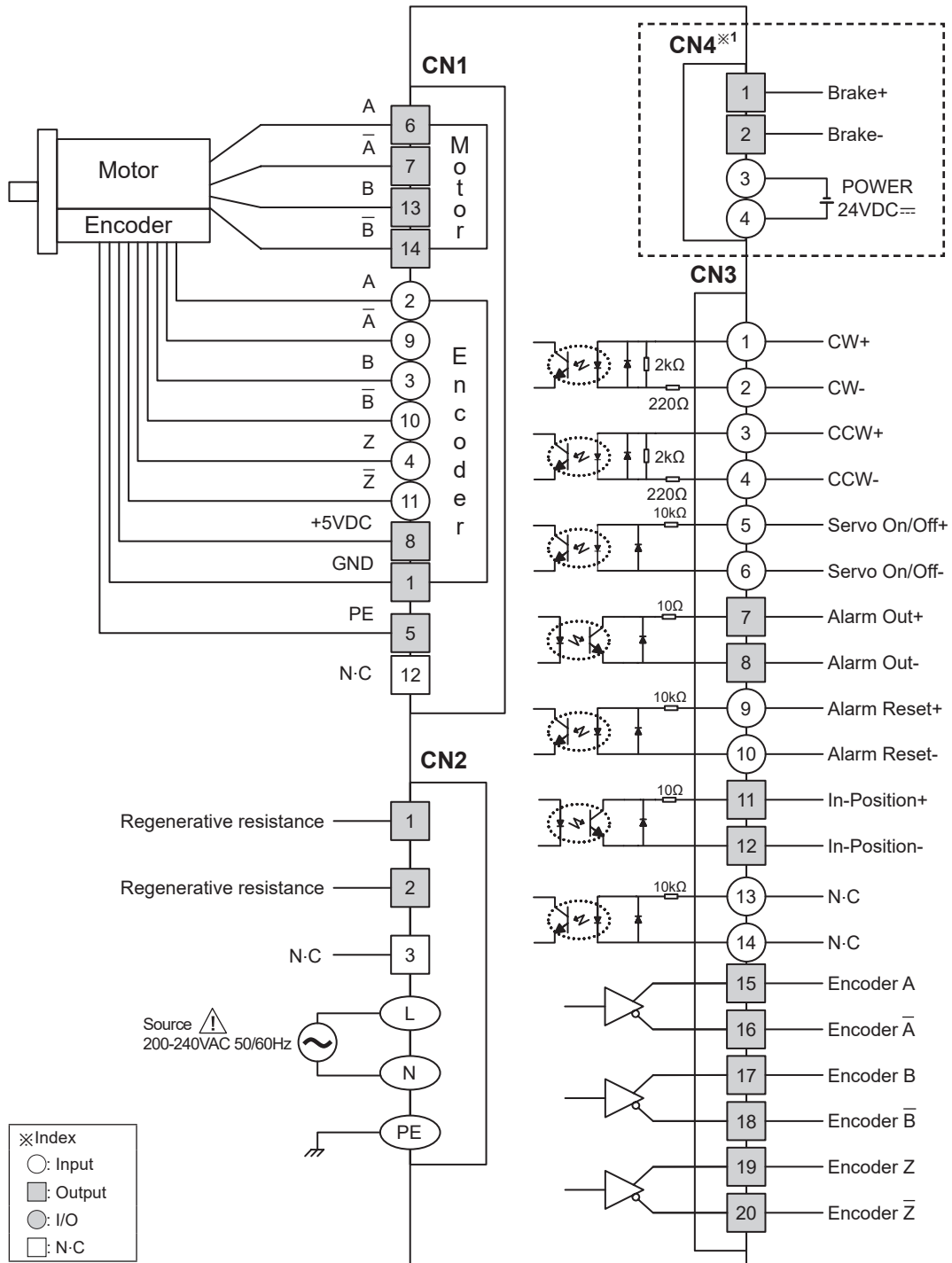| 1	CW+
2	CW-
3	CCW+
4	CCW-
5	Servo On/Off+
6	Servo On/Off-
7	Alarm Out+
8	Alarm Out-
9	Alarm Reset+
10	Alarm Reset-
11	In-Position+
12	In-Position-
13	N·C
14	N·C
15	Encoder A
16	Encoder Ā
17	Encoder B
18	Encoder B̄
19	Encoder Z
20	Encoder Z̄

2kΩ 220Ω 2kΩ 220Ω 10kΩ 10Ω 10kΩ 10Ω 10kΩ

CN2

Regenerative resistance	1
Regenerative resistance	2
N·C	3
Source ⚠ 200-240VAC 50/60Hz	L
	N
	PE

※Index
○ : Input
▢ (gray) : Output
◐ : I/O
□ : N·C

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

Autonics

AC Type 2-Phase Closed-Loop Stepper Motor Driver

◉ Troubleshooting

Malfunction	Causes	Troubleshooting
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	Rotation direction setting is not correct.	Check the DIR setting in the function selection DIP switch.
When motor drive is unstable	Connection between motor and encoder is unstable.	Check the Motor+Encoder connection cable.
	Motor gain value is not correct.	Check motor GAIN setting rotary switch (GAIN) value.

◉ Proper Usage

● Follow instructions in 'Proper Usage'. Otherwise, it may cause unexpected accidents.
● Do not input CW, CCW signal at the same time in 2-pulse input method.
● When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.
● To extend the motor+encoder cable, use the designated the cable.
● Keep the distance between power cable and signal cable more than 10cm.
● Install the unit vertically on the alarm/status display part upper side.
● For heat radiation of the driver, install a fan.
● Do not change any setting switches (function, resolution, motor gain, in-position switches) during the operation or after supplying power. Failure to follow this instruction may result in malfunction.
● Do not input external signal until the driver is initialized (In-Position LED ON) after power is applied.
● 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

SENSORS

FIELD INSTRUMENTS

CONTROLLERS

MOTION DEVICES

SOFTWARE

(A) Closed Loop Stepper System

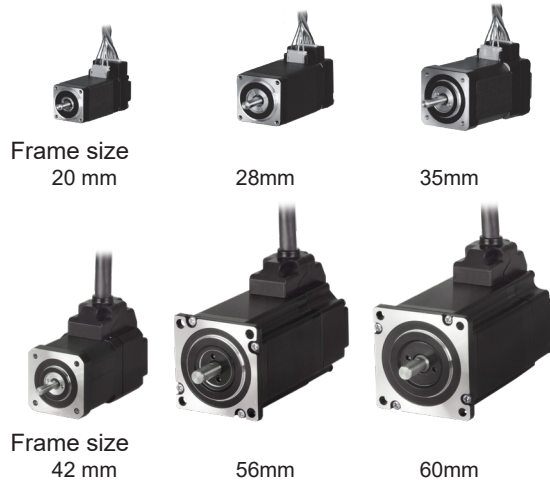(B) Stepper Motors

(C) Stepper Motor Drivers

(D) Motion Controllers

Ai-M Series
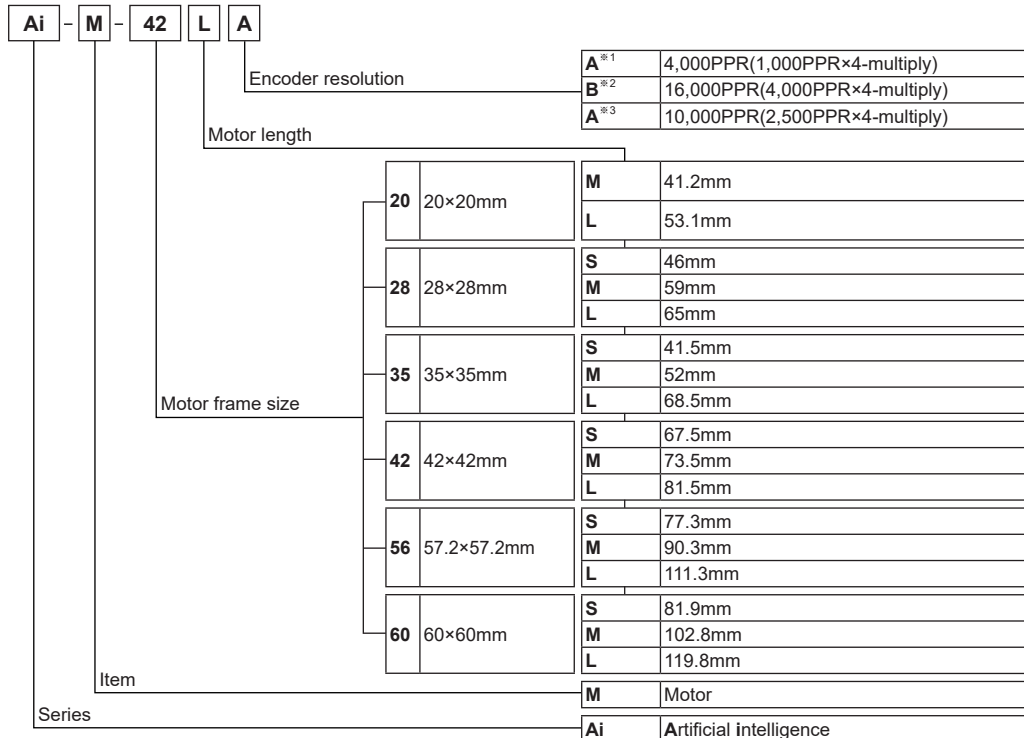
2-Phase Closed-Loop Stepper Motor

▣ 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

Frame size
20 mm   28mm   35mm

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

CE

Frame size
42 mm   56mm   60mm

▣ Ordering Information

| Ai | – | M | – | 42 | L | A |

A[※1]	4,000PPR(1,000PPR×4-multiply)	Encoder resolution
B[※2]	16,000PPR(4,000PPR×4-multiply)	
A[※3]	10,000PPR(2,500PPR×4-multiply)	Motor length

Motor frame size		Motor length	
20	20×20mm	**M**	41.2mm
		L	53.1mm
28	28×28mm	**S**	46mm
		M	59mm
		L	65mm
35	35×35mm	**S**	41.5mm
		M	52mm
		L	68.5mm
42	42×42mm	**S**	67.5mm
		M	73.5mm
		L	81.5mm
56	57.2×57.2mm	**S**	77.3mm
		M	90.3mm
		L	111.3mm
60	60×60mm	**S**	81.9mm
		M	102.8mm
		L	119.8mm

Item		
M	Motor	

Series		
Ai	**A**rtificial **i**ntelligence	

※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.

Autonics

2-Phase Closed-Loop Stepper Motor

■ Specifications

◎ Motor

● Frame size 20mm

Model	Ai-M-20MA	Ai-M-20LA
Max. holding torque[※1]	0.183kgf·cm (0.018N·m)	0.357kgf·cm (0.035N·m)
Rotor moment of inertia	$2g \cdot cm^2$ $(2 \times 10^{-7}kg \cdot m^2)$	
Rated current	0.6A/Phase	
Resistance	6.6Ω/Phase ±10%	10.5Ω/Phase ±10%
Inductance	2.1mH/Phase ±20%	4.0mH/Phase ±20%
Weight[※2]	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[※1]	0.51kgf·cm (0.05N·m)	1.42kgf·cm (0.14N·m)	1.63kgf·cm (0.16N·m)
Rotor moment of inertia	$9g \cdot cm^2$ $(9 \times 10^{-7}kg \cdot m^2)$	$12g \cdot cm^2$ $(12 \times 10^{-7}kg \cdot m^2)$	$18g \cdot cm^2$ $(18 \times 10^{-7}kg \cdot m^2)$
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[※2]	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[※1]	0.714kgf·cm (0.07N·m)	1.326kgf·cm (0.13N·m)	3.162kgf·cm (0.31N·m)
Rotor moment of inertia	$8g \cdot cm^2$ $(8 \times 10^{-7}kg \cdot m^2)$	$14g \cdot cm^2$ $(14 \times 10^{-7}kg \cdot m^2)$	$22g \cdot cm^2$ $(22 \times 10^{-7}kg \cdot m^2)$
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[※2]	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[※1]	2.55kgf·cm (0.25N·m)	4.08kgf·cm (0.4N·m)	4.89kgf·cm (0.48N·m)
Rotor moment of inertia	$35g \cdot cm^2$ $(35 \times 10^{-7}kg \cdot m^2)$	$54g \cdot cm^2$ $(54 \times 10^{-7}kg \cdot m^2)$	$77g \cdot cm^2$ $(77 \times 10^{-7}kg \cdot m^2)$
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[※2]	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[※1]	6.12kgf·cm (0.6N·m)	12.24kgf·cm (1.2N·m)	20.39kgf·cm (2.0N·m)
Rotor moment of inertia	$140g \cdot cm^2$ $(140 \times 10^{-7}kg \cdot m^2)$	$280g \cdot cm^2$ $(280 \times 10^{-7}kg \cdot m^2)$	$480g \cdot cm^2$ $(480 \times 10^{-7}kg \cdot m^2)$
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[※2]	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[※1]	11.22kgf·cm (1.1N·m)	22.43kgf·cm (2.2N·m)	29.57kgf·cm (2.9N·m)
Rotor moment of inertia	$240g \cdot cm^2$ $(240 \times 10^{-7}kg \cdot m^2)$	$490g \cdot cm^2$ $(490 \times 10^{-7}kg \cdot m^2)$	$690g \cdot cm^2$ $(690 \times 10^{-7}kg \cdot m^2)$
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[※2]	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.

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℃)
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℃, storage: -20 to 70℃
	Ambient humidity	20 to 85%RH, storage: 15 to 90%RH
Approval		$C \epsilon$
Protection structure		IP30 (IEC34-5 standard)
Stop angle error[※1]		±0.09°
Shaft vibration[※2]		0.03mm T.I.R.
Radial Movement[※3]	Frame size 20, 28, 35mm	Max. 0.025mm (load 450g)
	Frame size 42, 56, 60mm	Max. 0.025mm (load 25N)
Axial Movement[※4]	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 a 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.
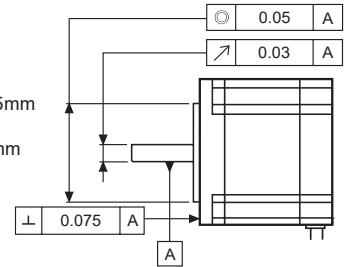
◎ Encoder

• Frame size 20, 28, 35mm

| Item		Magnetic incremental rotary encoder
Resolution	Frame size 20mm[※1]	4,000PPR (1,000PPR×4-multiply)
	Frame size 28, 35mm	16,000PPR (4,000PPR×4-multiply)
Electrical specification	Output phase	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ 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, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ 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)

Autonics

2-Phase Closed-Loop Stepper Motor

■ Encoder Control Output Diagram

Line driver output	
Rotary encoder circuit	Load connection
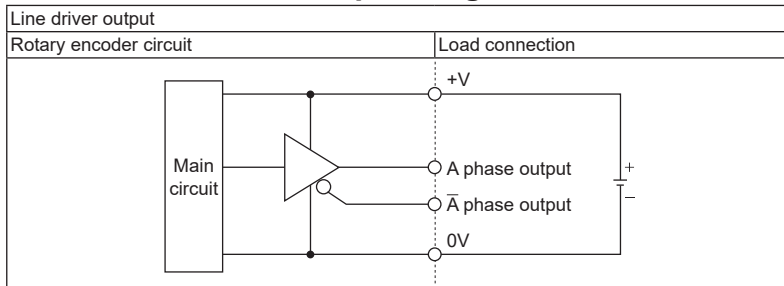
※All output circuits of A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase are the same.

(Y)
Closed Loop
Stepper System

(Z)
Stepper Motors

(AA)
Drivers

(AB)
Motion
Controllers

■ Encoder Output Waveforms

◎ **Frame size 20, 28, 35mm**
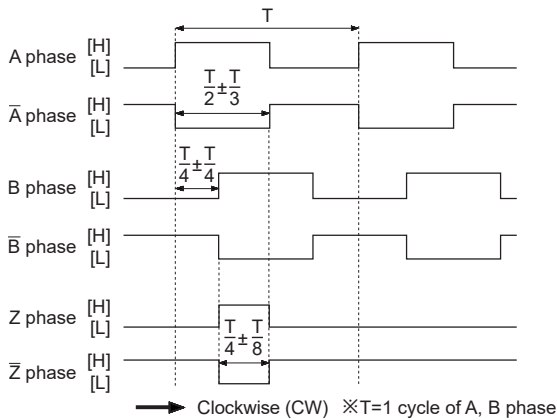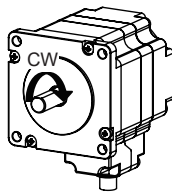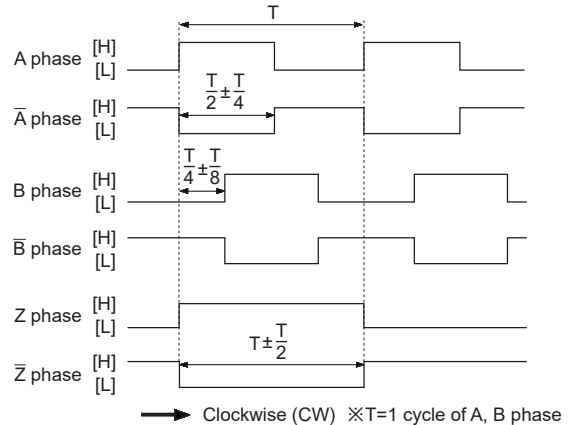
Clockwise (CW) ※T=1 cycle of A, B phase

◎ **Frame size 42, 56, 60mm**

Clockwise (CW) ※T=1 cycle of A, B phase

■ 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:
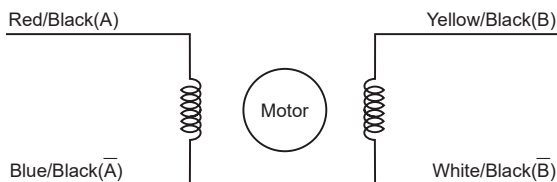
Ai-M Series

■ Dimensions

◎ Frame size 20mm
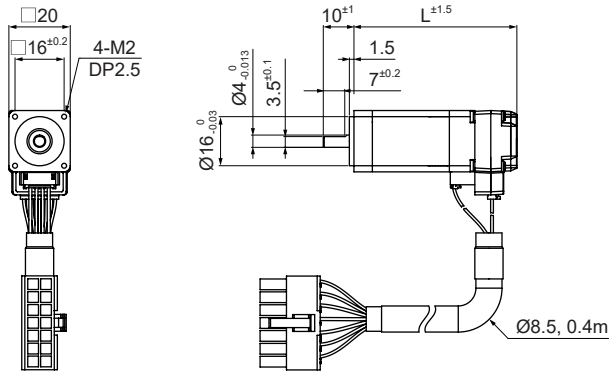
Model	L
Ai-M-20MA	41.2
Ai-M-20LA	53.1

◎ Frame size 28mm
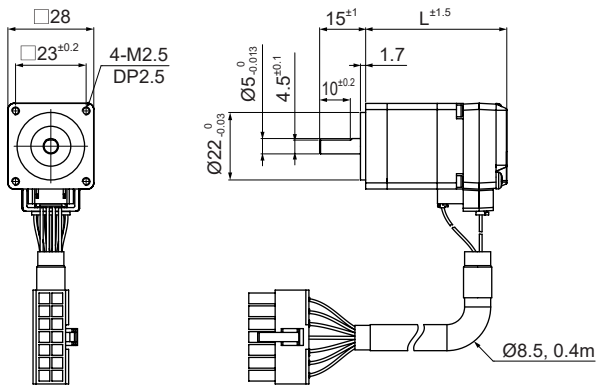
Model	L
Ai-M-28SB	46
Ai-M-28MB	59
Ai-M-28LB	65

◎ Frame size 35mm
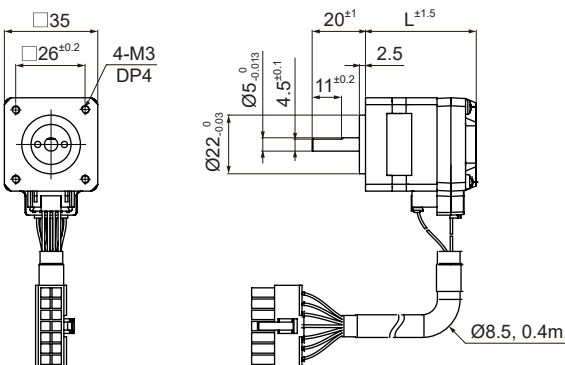
Model	L
Ai-M-35SB	41.5
Ai-M-35MB	52
Ai-M-35LB	68.5

Autonics

2-Phase Closed-Loop Stepper Motor

■ Dimensions

◎ **Frame size 42mm**

(unit: mm)

4-M3×0.5
DP 4

□42
□31$^{±0.2}$

20$^{±1}$ L+33.4$^{(±1.5)}$
1.8 L$^{±1}$
Ø5$_{-0.012}^{0}$
4.5
Ø22$_{-0.03}^{0}$
15$^{±0.2}$
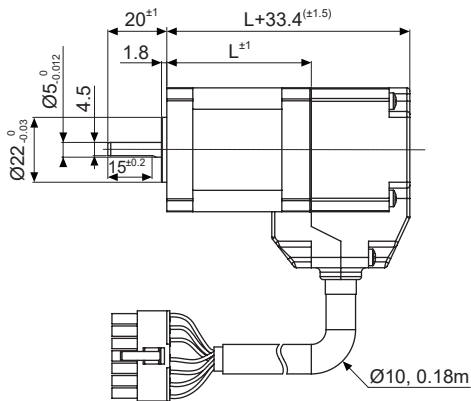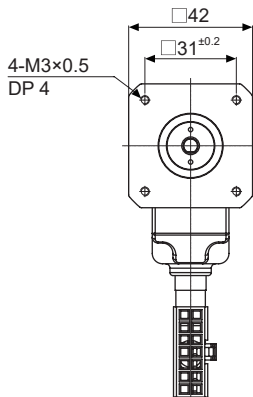
Model	L
Ai-M-42SA	34.1
Ai-M-42MA	40.1
Ai-M-42LA	48.1

Ø10, 0.18m

◎ **Frame size 56mm**

□57.15
□47.14$^{±0.2}$
4-Ø5$_{0}^{+0.3}$

20.6$^{±1}$ L+33.8$^{(±1.5)}$
1.6 L$^{±1}$
Ø8$_{-0.013}^{0}$
7.5
Ø38.1$^{±0.05}$
15$^{±0.2}$
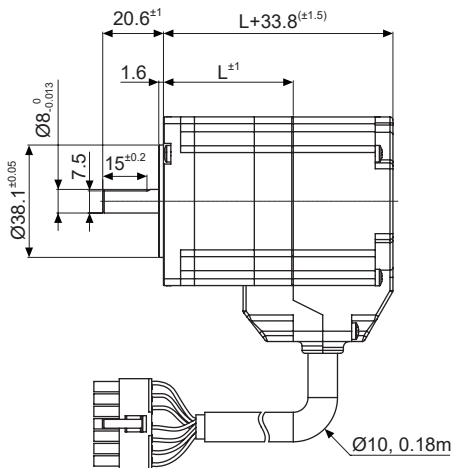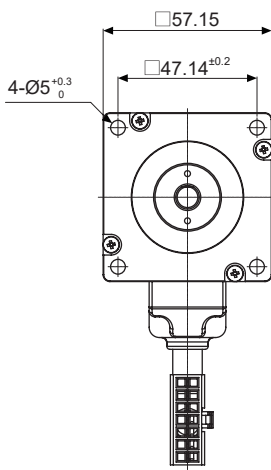
Model	L
Ai-M-56SA	43.5
Ai-M-56MA	56.5
Ai-M-56LA	77.5

Ø10, 0.18m

◎ **Frame size 60mm**

□60
□50$^{±0.25}$
4-Ø5$_{0}^{+0.3}$

20.6$^{±1}$ L+33.8$^{(±1.5)}$
1.6 L$^{±1}$
Ø8$_{-0.013}^{0}$
7.5
Ø38.1$^{±0.05}$
15$^{±0.2}$
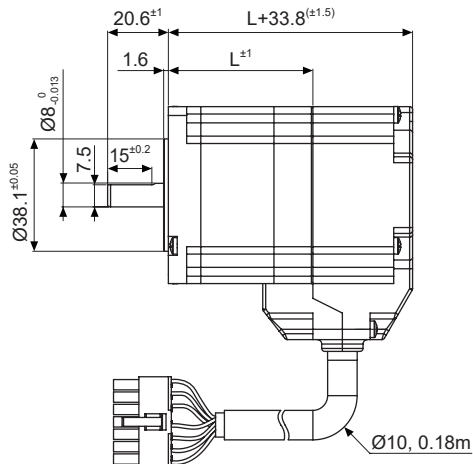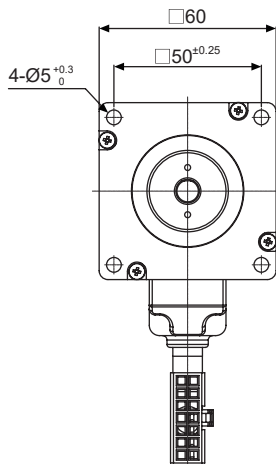
Model	L
Ai-M-60SA	48.1
Ai-M-60MA	69
Ai-M-60LA	86

Ø10, 0.18m

Ai-M Series

■ Motor Characteristics

◎ Frame size 20mm
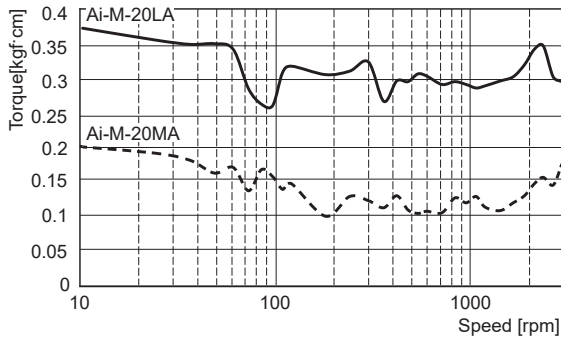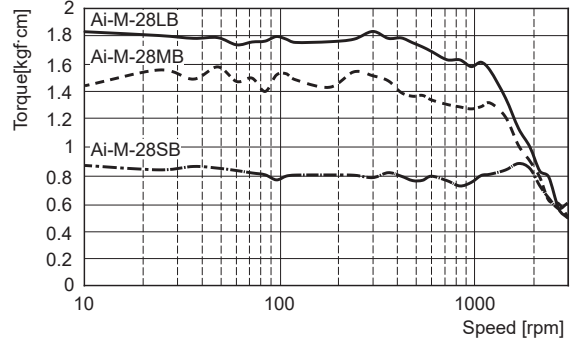
Ai-M-20LA
Ai-M-20MA

Torque[kgf·cm]
Speed [rpm]

◎ Frame size 28mm

Ai-M-28LB
Ai-M-28MB
Ai-M-28SB

Torque[kgf·cm]
Speed [rpm]

◎ Frame size 35mm

Ai-M-35LB
Ai-M-35MB
Ai-M-35SB

Torque[kgf·cm]
Speed [rpm]

◎ Frame size 42mm

Ai-M-42LA
Ai-M-42MA
Ai-M-42SA

Torque[kgf·cm]
Speed [rpm]

◎ Frame size 56mm

Ai-M-56LA
Ai-M-56MA
Ai-M-56SA

Torque[kgf·cm]
Speed [rpm]

◎ Frame size 60mm

Ai-M-60LA
Ai-M-60MA
Ai-M-60SA

Torque[kgf·cm]
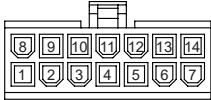Speed [rpm]

Autonics
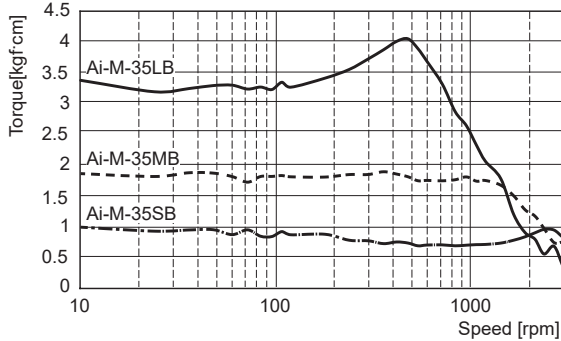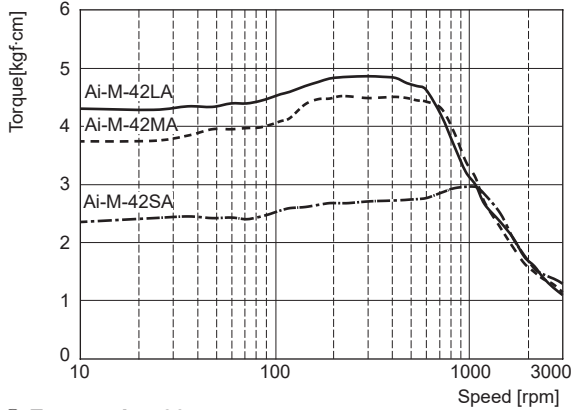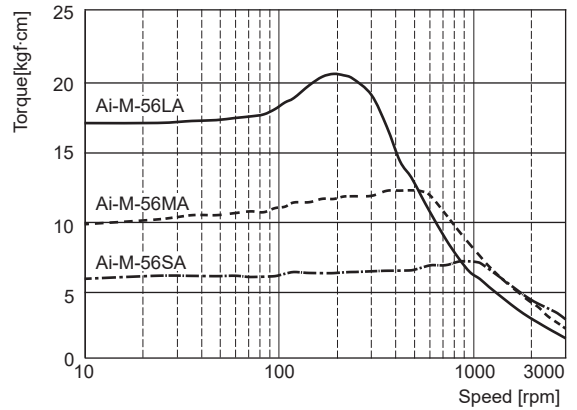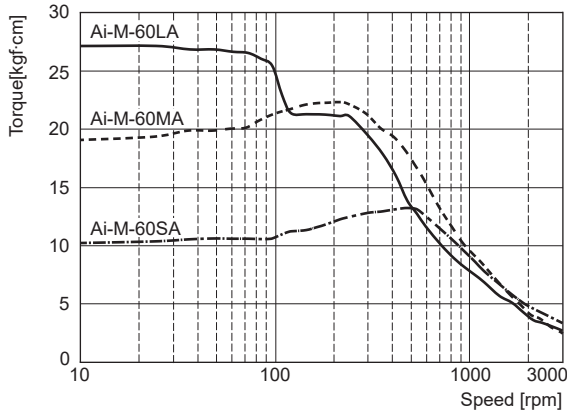
2-Phase Closed-Loop Stepper Motor

▣ Motor Connectors
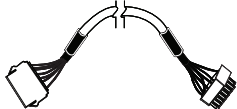
◎ CN2: Motor+Encoder Connector

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

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

※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-□[※1]	C1DF14M-□[※1]

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

(Y)
Closed Loop
Stepper System

(Z)
Stepper Motors

(AA)
Drivers

(AB)
Motion
Controllers

▣ 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.
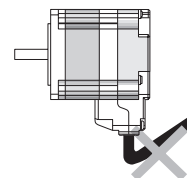
Side ways

Facing up, down
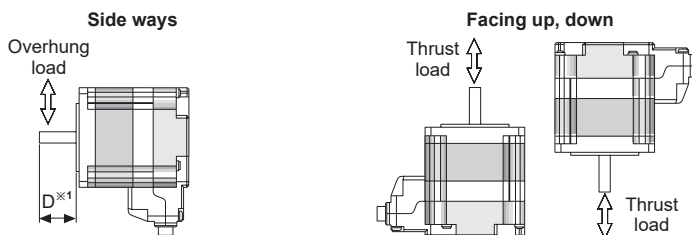
※1: The distance from the shaft in front (mm)

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.
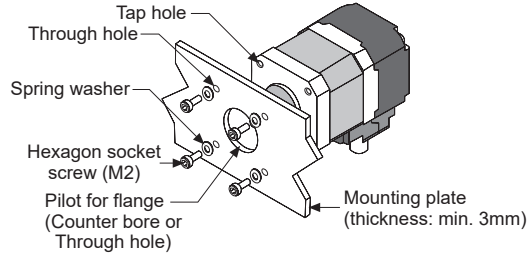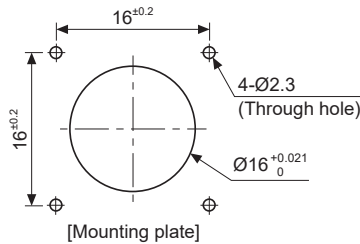
Ai-M Series

◼ 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.
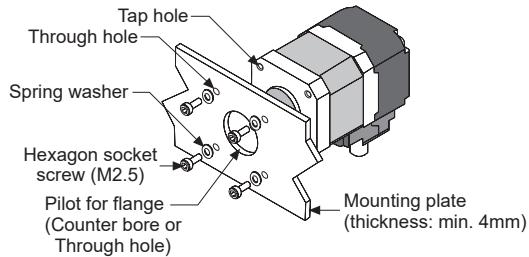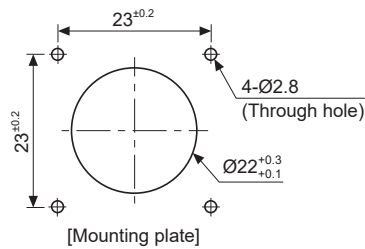When mounting motors, use hexagon socket screws, hexagon nuts, spring washers and flat washers.
Refer to the table below for allowable thickness of mounting plate and using bolt.
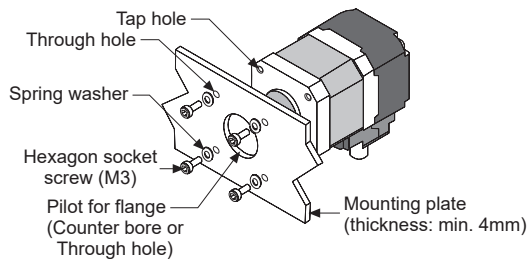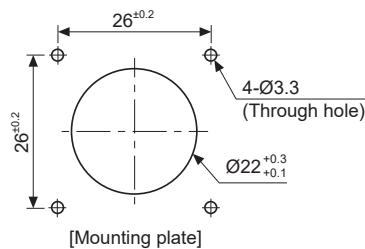
◎ Frame size 20mm

[Mounting plate]

16$^{\pm0.2}$
16$^{\pm0.2}$
4-Ø2.3 (Through hole)
Ø16$^{+0.021}_{0}$

Tap hole
Through hole
Spring washer
Hexagon socket screw (M2)
Pilot for flange (Counter bore or Through hole)
Mounting plate (thickness: min. 3mm)

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

◎ Frame size 28mm

[Mounting plate]

23$^{\pm0.2}$
23$^{\pm0.2}$
4-Ø2.8 (Through hole)
Ø22$^{+0.3}_{+0.1}$

Tap hole
Through hole
Spring washer
Hexagon socket screw (M2.5)
Pilot for flange (Counter bore or Through hole)
Mounting plate (thickness: min. 4mm)

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

◎ Frame size 35mm

[Mounting plate]

26$^{\pm0.2}$
26$^{\pm0.2}$
4-Ø3.3 (Through hole)
Ø22$^{+0.3}_{+0.1}$

Tap hole
Through hole
Spring washer
Hexagon socket screw (M3)
Pilot for flange (Counter bore or Through hole)
Mounting plate (thickness: min. 4mm)

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

◎ Frame size 42mm

[Mounting plate]

31$^{\pm0.2}$
31$^{\pm0.2}$
Ø3.5 (Through hole)
Ø22$^{+0.021}_{0}$

Tap hole
Through hole
Spring washer
Hexagon socket screw (M3)
Pilot for flange (Counter bore or Through hole)
Mounting plate (thickness: min. 4mm)
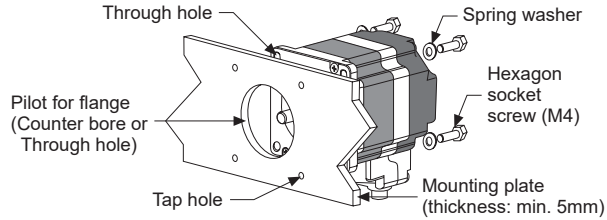
※Do not draw the wire with over strength 30N after wiring the encoder.

Autonics

2-Phase Closed-Loop Stepper Motor

SENSORS

CONTROLLERS

MOTION DEVICES

SOFTWARE

(Y)
Closed Loop
Stepper System

(Z)
Stepper Motors

(AA)
Drivers

(AB)
Motion
Controllers

◎ **Frame size 56mm/60mm**

47.14/50$^{±0.2}$

47.14/50$^{±0.2}$

Ø4.5
(Through hole)

Ø38.1 $^{+0.3}_{+0.1}$

[Mounting plate]

Hexagon socket screw (M4)

Hexagon nut

Spring washer

Pilot for flange
(Counter bore or
Through hole)

Through hole

Mounting plate
(thickness: min. 5mm)

47.14/50$^{±0.2}$

47.14/50$^{±0.2}$

M4
(Tap hole)

Ø38.1 $^{+0.3}_{+0.1}$

[Mounting plate]

Through hole

Spring washer

Pilot for flange
(Counter bore or
Through hole)

Hexagon
socket
screw (M4)

Tap hole

Mounting plate
(thickness: min. 5mm)

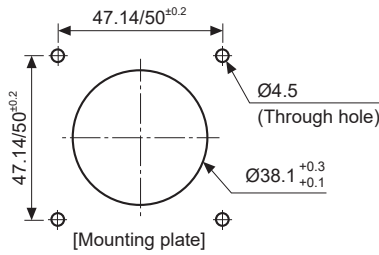※Do not draw the wire with over strength 30N after wiring the encoder.

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
Flexible coupling Ball screw or TM screw ※Use Autonics flexible coupling (ERB Series).		
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.	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.	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. 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℃ (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.

Ai-M Series

◨ Troubleshooting

1. When motor does not rotate
　①Check the connection status between controller and driver, and pulse input specifications (voltage, width).
　②Check the pulse and direction signal are connected correctly.
2. When motor rotates to the opposite direction of the designated direction
　①When RUN mode is 1-pulse input method, CCW input [H] is for forward, [L] is for backward.
　②When RUN mode is 2-pulse input method, check CW and CCW pulse input are changed or not.
3. When motor drive is unstable
　①Check that driver and motor are connected correctly.
　②Check 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.
　①Unwinding bolts and connection parts for the unit installation and load connection
　②Strange sound from ball bearing of the unit
　③Damage and stress of lead cable of the unit
　④Connection error with driver
　⑤Inconsistency 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.
　①Indoors (in the environment condition rated in 'Specifications')
　②Altitude max. 2,000m
　③Pollution degree 2
　④Installation category II