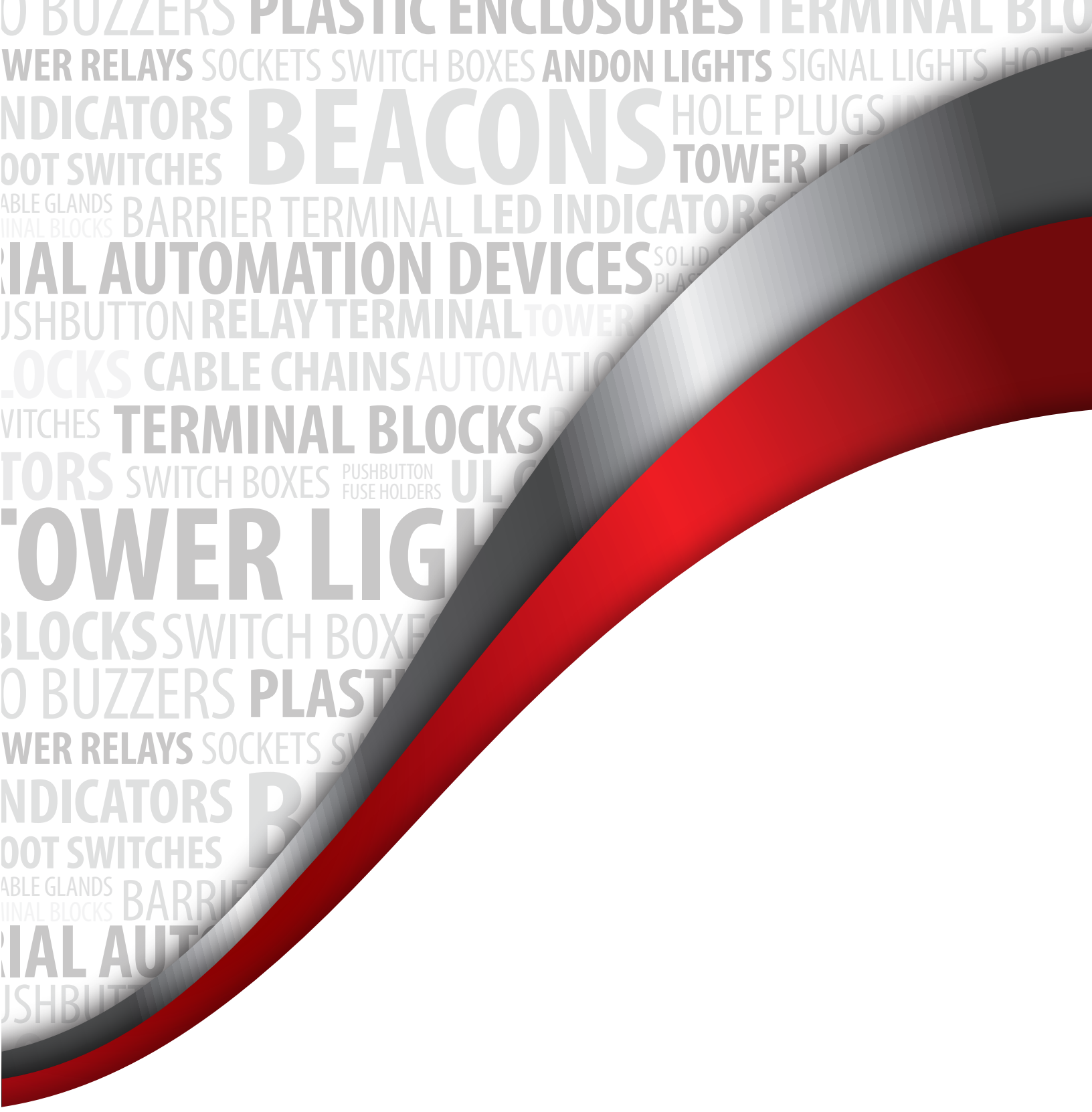
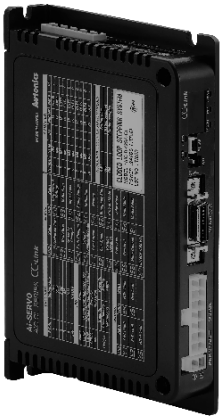


AmeriMation

MOTION DEVICE/CONTROL

Controller Integrated 2-Phase Closed-Loop Stepper Motor Driver

▣ Features



- CC-Link communication type Ai-SERVO
- Real-time position control with closed-loop system
- Controllable maximum 42 axis
- Able to check alarm and status with Alarm/Status display part (7 segment)
- Motor driver and controller integral type
- Faster response and performing low-speed/high torque for short-distance continuous drive to compare with the servo system.
- Applicable to the precision equipment such as optical inspection equipment with the features of having no micro vibration (hunting) in stop
- Dedicated Windows program (atMotion) provided for parameter setting and monitoring
- Easy and various gain setting supported through the program(GUI)
- Containing 10-level resolutions
- Frame size 20mm, 28mm, 35mm, 42mm, 56mm, 60mm motors supported (applied motor: Ai-M Series)

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) 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) 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>

▣ Ordering Information

Ai C - D - 42 L A - □ - CL

Comm. Type

CL	**C**C-**L**ink

Brake

No mark	Standard type
B※1	Built-in brake type

Encoder resolution

A※2	4,000PPR (1,000PPR×4-multiply)
B※3	16,000PPR (4,000PPR×4-multiply)
A※4	10,000PPR (2,500PPR×4-multiply)

Motor length / Motor frame size

			Standard type	Built-in brake type
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	102.3mm
		M	73.5mm	108.3mm
		L	81.5mm	116.3mm
56	57.2×57.2mm	**S**	77.3mm	112.1mm
		M	90.3mm	125.1mm
		L	111.3mm	146.1mm
60	60×60mm	**S**	81.9mm	116.7mm
		M	102.8mm	137.6mm
		L	119.8mm	154.6mm

Item

D	Driver

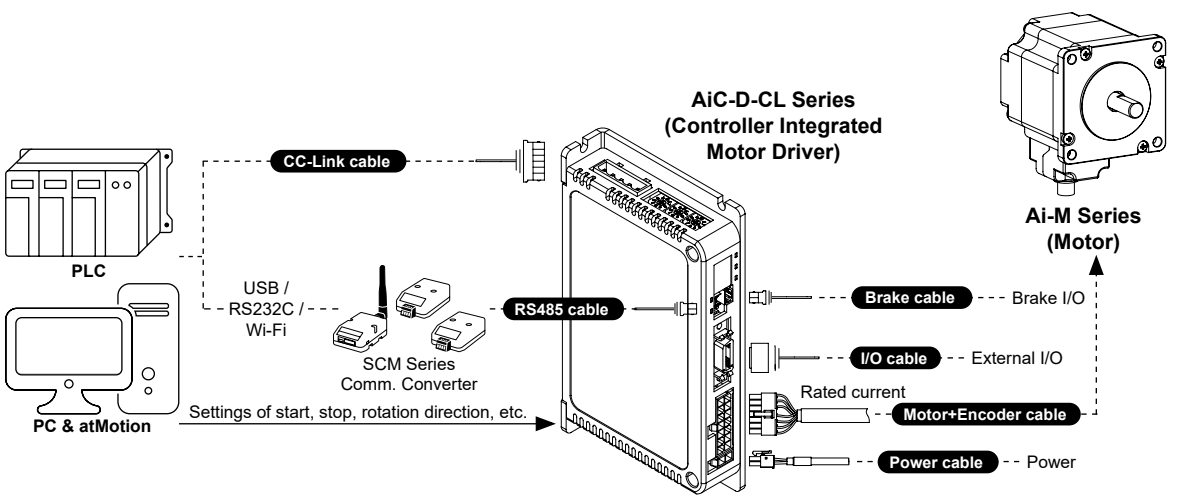
Category

C	Controller

Series

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

▣ Configuration Diagram



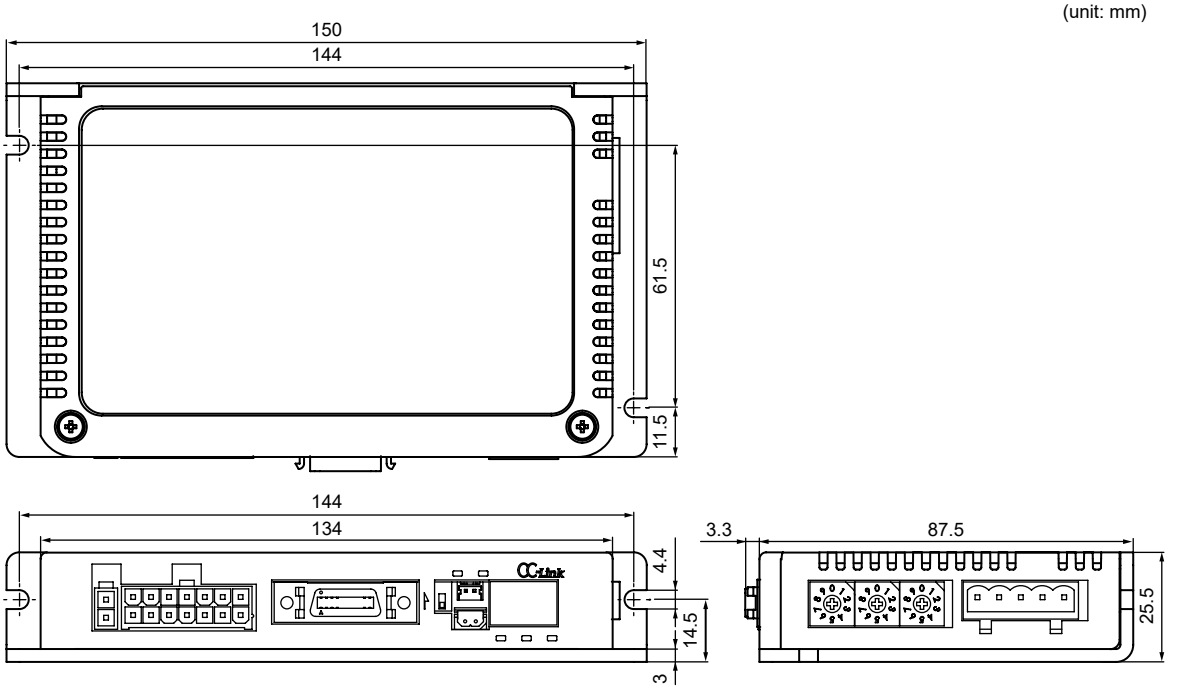
▣ Specifications

Model※1		-	AiC-D-28SB-CL	AiC-D-35SB-CL	AiC-D-42SA(-B)-CL	AiC-D-56SA(-B)-CL	AiC-D-60SA(-B)-CL
		AiC-D-20MA-CL	AiC-D-28MB-CL	AiC-D-35MB-CL	AiC-D-42MA(-B)-CL	AiC-D-56MA(-B)-CL	AiC-D-60MA(-B)-CL
		AiC-D-20LA-CL	AiC-D-28LB-CL	AiC-D-35LB-CL	AiC-D-42LA(-B)-CL	AiC-D-56LA(-B)-CL	AiC-D-60LA(-B)-CL
Power supply		24VDC⎓					
Allowable voltage range		90 to 110% of the rated voltage					
Power Consumption	STOP※2	Max. 10W			Max. 10W	Max. 12W	Max. 15W
	Max. during operation※3	Max. 60W			Max. 60W	Max. 120W	Max. 240W
Max. RUN current※4		0.6A/Phase	1.0A/Phase	1.2A/Phase	1.7A/Phase	3.5A/Phase	
STOP current※5		20 to 100% of max. RUN current (factory default: 50%)					
Rotation speed		0 to 3000rpm					
Resolution※5		500(factory default), 1000, 1600, 2000, 3600, 4000, 5000, 6400, 7200, 10000 [Pulse/Rev]	500(factory default), 1000, 1600, 2000, 3600, 5000, 6400, 7200, 10000, 16000 [Pulse/Rev]		500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000PPR		
Speed filter※5		0 (disable), 2, 4, 6, 8, 10, 20, 40, 60 (factory default), 80, 100, 120, 140, 160, 180, 200ms					
Positioning Gain※5		(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※5		CW, CCW					
Status indicator		● Power/Alarm indicator: green/red LED ● In-Position indicator: yellow LED ● Servo On/Off indicator: orange LED ● Alarm/Warning status display part: red LED 7 segment ● CC-Link status indicator: red, green LED					
I/O voltage level		[H]: 5-30VDC⎓, [L]: 0-2VDC⎓					
I/O	Input	Exclusive input: 3, general input: 8					
	Output	General output: 7					
External power supply		VEX(recommended: 24VDC⎓), GEX(GND)					
Operation mode		Jog, Continuous, Index, Program mode					
Index step numbers		64 steps					
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)					
	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※5	9600, 19200, 38400, 57600, 115200(factory default) bps					
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 mode, index mode, home search mode, comm. station setting, comm. mode setting, comm. station setting change, comm. mode setting change, comm. failure					
Warning output		±software limit, ±hardware limit, overload					
Insulation resistance		Over 100MΩ (500VDC⎓ megger)					
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^2 (approx. 30G) 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					
Weight※6		Approx 470g (approx 320g)					

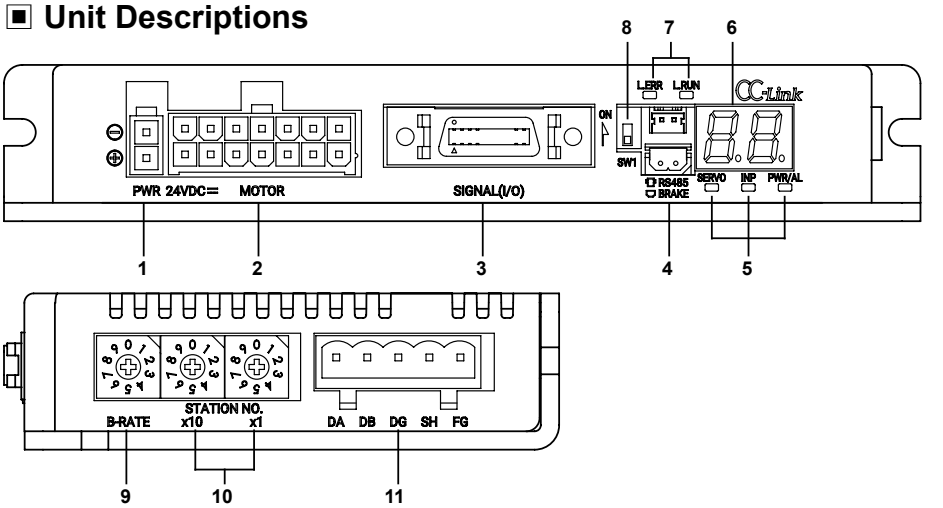
※1: The model name indicates driver type. (none: standard type, B: built-in brake type)
E.g.) AiC-D-42LA-B-CL: built-in brake type stepping motor driver.
※2: Based on the ambient temperature 25℃, ambient humidity 55%RH, and STOP current 50%.
※3: Max. power consumption during operation. When changing 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 dedicated program (atMotion).
※6: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ 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)
4-1. RS485 Communication connector (CN4: RS485)
4-2. Brake connector (CN5: BRAKE)
5-1. Servo On/Off indicator (Servo, Orange)
5-2. In-Position indicator (INP, Yellow)
5-3. Power/Alarm indicator (PWR/AL, Green/Red)
6. Alarm/Warning status display part (7 segment, Red)
7: CC-Link status indicator (L.ERR/L.RUN, Red/Green)
8: CC-Link station setting DIP switch (SW1)
9: CC-Link comm. speed setting rotary switch (B-RATE)
10: CC-Link station setting rotary switch (STATION NO.)
11: CC-Link connector (CN6: DA DB DG SH FG)

▣ Status Indicators

Status indicator	LED color	Function	Descriptions
PWR	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	Turns ON when motor is placed at command position after positioning input.
SERVO	Orange	Servo On/Off indicator	Turns ON when Servo is operating, turns OFF when servo is not operating.
L.RUN	Green	CC-Link comm. indicator	Turns ON when communication operates normally.
L.ERR	Red		Turns ON when communication failure.

▣ Driver Setting

◎ CC-Link station setting DIP switch (SW1)

Setting	CC-Link station setting
ON	2 stations occupied
OFF(factory default)	1 station occupied

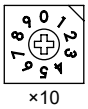
◎ CC-Link comm. speed setting rotary switch (B-RATE)

B-RATE

Setting	Comm. speed (bps)	Setting	Comm. speed (bps)
0	156k	5	Disable
1	625k	6	
2	2.5M	7	
3	5M	8	
4	10M	9	

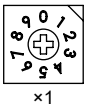
◎ CC-Link station setting rotary switch (STATION NO.)

※Set the CC-Link comm. station.
※Available setting range is 01 to 64.



×10

Setting	Station No. (×10)
0	0×10
1	1×10
2	2×10
3	3×10
4	4×10
5	5×10
6	6×10
7	Disable
8	
9	



×1

Setting	Station No. (×1)
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

▣ 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 (3)

Signal name	Descriptions	Pin no.
ORG	Home sensor	10
+Limit	+direction limit sensor	11
-Limit	-direction limit sensor	12

2. General input (8)

Signal name	Descriptions	Pin no.
IN0	General input 0	2
IN1	General input 1	3
IN2	General input 2	4
IN3	General input 3	5
IN4	General input 4	6
IN5	General input 5	7
IN6	General input 6	8
IN7	General input 7	9

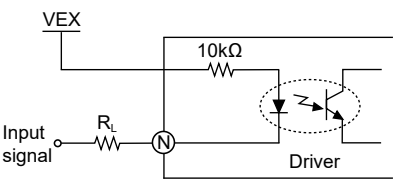
Functions can be assigned in general input IN0 to IN7.
Assignable functions are as below.

Function	Descriptions	Function	Descriptions
User Input0	User input	+Jog	+ jog drive
User Input1		-Jog	- jog drive
User Input2		Pause	Puase
User Input3		Servo On/Off	Servo ON/OFF
User Input4		Home	Home search
User Input5		Alarm Reset	Alarm reset
User Input6		SD	Slow Down
User Input7		Clear Pos.	Clear position, set current position as 0
Reset	Driver reset	Step0	Step number setting (the combination of 6 bit, 0 to 5, selectable 0 to 64)
Start	Program mode driver start	Step1	
Start Index	Index drive start	Step2	
Stop	Drive stop	Step3	
EMG	Driver emergency stop	Step4	
+RUN	+ continuous drive	Step5	
-RUN	- continuous drive	—	

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).

$$※R_L = \frac{VEX-1.25V}{0.0025A} - 10\times10^3\,\Omega$$



※N: Input pin number of CN3

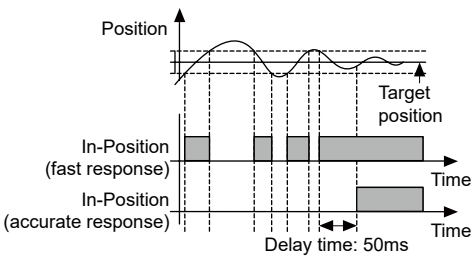
▣ Control Input/Output

◎ Output

1. 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. 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**'.

Alarm status	Alarm type	Descriptions	Motor status	Torque status
E. 1	Comm. station setting error	CC-Link station setting error	Remain	Remain
E.2	Comm. speed setting error	CC-Link speed setting error		
E.3	Comm. station setting change	CC-Link station setting change		
E.4	Comm. speed setting change	CC-Link speed setting change		
E.5	Comm. failure	Communication with CC-Link master is disconnected		
E. 1	Overcurrent error	When overcurrent flows at motor RUN element	Stop	Release
E.2	Overspeed error	When motor speed is over 4,000rpm		
E.3	Position tracking error	When the gap between position command value and current position value is over 90°		
E.4	Overload error	When applying load over the rated load for over 1 sec.		
E.5	Overheat error	When driver inner temperature is over 80℃		
E.6	Motor connection error	When motor cable connection error occurs at driver		
E.7	Encoder connection error	When encoder cable connection error occurs at driver		
E.8	Regenerative voltage error	When regenerative voltage is over 78V		
E.9	Motor misalignment	When motor is in misalignment		
E.A.	Command speed error	When command speed is over 3,500rpm		
E.b.	Input voltage error	When input voltage is out of 24VDC ±10%		
E.C.	In-Position error	When position error (over 1) is kept over 3 sec, after motor stopped		
E.d.	Memory error	When memory error is detected as power supplied		
E.E.	Emergency stop	When emergently stopped with emergency stop command	Stop	Remain
E.F.	Program mode error	When 'END' command is not exist at the last step		
E.G.	Index mode error	When other instruction is used but 'INC', 'ABS' When index command is not completed due to the stop command		
E.H.	Home search mode error	When failed to find home		

※When E.E. to E.H. alarm occurs, the motor stops, but the current flowing into the motor is not blocked.

▣ Control Input/Output

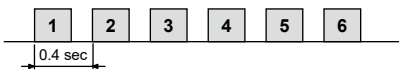
● **Warning**

-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.

Warning status	Warning type	Descriptions	Motor status	Torque status
W1	+ software limit	When normal direction (CW) software limit is ON	Stop	Remain
W2	- software limit	When reverse direction (CCW) software limit is ON		
W3	+ hardware limit	When normal direction (CW) hardware limit is ON		
W4	- hardware limit	When reverse direction (CCW) hardware limit is ON		
W5	Overload warning	When maximum load is kept connected over 10 sec (motor or driver can be overheated)	Remain	Remain

※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.
※The alarm/warning flashes 0.4 sec repeatedly.

<In case of no. 3 alarm>



3. General output (7)

Signal name	Descriptions	Pin no.
OUT0	General output 0	13
OUT1	General output 1	14
OUT2	General output 2	15
OUT3	General output 3	16
OUT4	General output 4	17
OUT5	General output 5	18
OUT6	General output 6	19

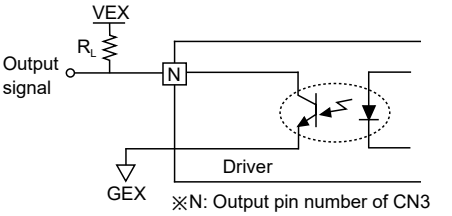
Functions can be assigned in general output OUT0 to OUT7.
Assignable functions are as right table.

Function	Descriptions
User Output0	User output
User Output1	
User Output2	
User Output3	
User Output4	
User Output5	
User Output6	
In-Position	In-Position output
Alarm	Alarm output
Warning	Warning output

4. 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.

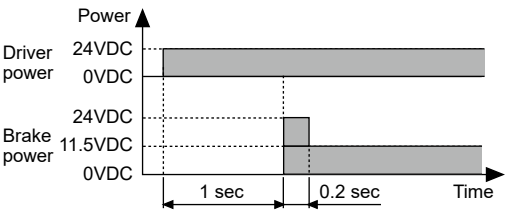
$$※R_L = \frac{VEX-0.7V}{0.01A}$$



※N: Output pin number of CN3

5. 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.
※While power is supplied to the driver, the brake is kept turning on, except in the Servo On status.

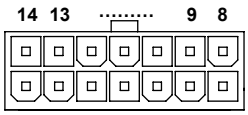
▣ Driver Connectors

◎ Connector function

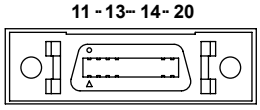
● CN1: Power connector

Pin arrangement	Pin no.	Function
	1	24VDC
	2	GND

● 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 $\overline{B}$

● CN3: I/O connector

Pin arrangement	Pin no.	I/O	Function	Pin no.	I/O	Function
	1	—	VEX	11	Exclusive input	+Limit
	2	General input	IN0	12	Exclusive input	-Limit
	3	General input	IN1	13	General output	OUT0
	4	General input	IN2	14	General output	OUT1
	5	General input	IN3	15	General output	OUT2
	6	General input	IN4	16	General output	OUT3
	7	General input	IN5	17	General output	OUT4
	8	General input	IN6	18	General output	OUT5
	9	General input	IN7	19	General output	OUT6
	10	Exclusive input	ORG	20	—	GEX

※Functions can be assigned in general input/output. For more information, refer to 'user manual'.

● RS 485 comm. connector (CN4: RS485)

Pin arrangement	Pin no.	Function
	1	RS485 DATA-
	2	RS485 DATA+

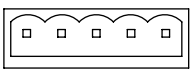
※RS485 comm. is for parameter setting and operation test instead of driver operation. When operating with CC-Link, disconnect the RS485 comm. from the device.

● Brake connector (CN5: BRAKE)

Pin arrangement	Pin no.	Function
	1	Brake-
	2	Brake+

※Corresponding connector is built-in brake type only.

● CC-Link comm. connector (CN6: DA DB DG SH FG)

Pin arrangement	Pin no.	Function	Pin no.	Function
	1	F.G.	4	DB
	2	SLD	5	DA
	3	DG	—	

◎ Connector specifications

Type		Specifications			Manufacture
		Connector	Connector terminal	Housing	
CN1	Driver	LAD1140-02	-	-	HANLIM
	Power	CHD1140-02	CTD1140	-	
CN2	Driver	35318-1420	-	-	Molex
	Motor+Encoder	5557-14R	5556T		
CN3	Driver	10220-52A2 PL	-	-	3M
	I/O connector	10150-3000PE	-	10350-52F0-008	
		CO20-MP□-R (Sold separately)	-	-	Autonics
CN4	Driver	053254-0270	-	-	Molex
	RS485 connector	51065-0200	50212-8000	-	
CN5	Driver	5268-02A	-	-	
	Brake	5264-02	5263PBT	-	
CN6	Driver	2EHDRC-05P-OR※1	-	-	Dinkle
	CC-Link connector	2ESDV-05P-OR	-	-	

※1: CC-Link dedicated cable must be used and performance can not be guaranteed when using other cables.
※ Above connectors are suitable for AiC-D-CL Series. The connectors can be used with equivalent or substitute.

▣ Communication Output

It is for parameter setting and monitoring via external devices (PC, PLC, etc.).
In CC-Link setting, the communication speed must be same between PLC and the driver.
The settable station number is 01 to 64, the station number must not be overlapped. (65 to 99 is not available)

◎ Interface

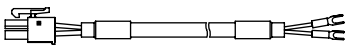
Comm. standard	CC-Link Ver.1.10	Max. transmit distance	Depend on comm. speed
Station type	Remote Device station	Remote I/O	● 1 station occupied: Ryn/RXn 32 points each ● 2 stations occupied: Ryn/RXn 64 points each
Connection cable	CC-Link dedicated cable	Remote register	● 1 station occupied: RWrn/RWwn 4 words each ● 2 stations occupied: RWrn/RWwn 8 words each
Comm. speed	156k, 625k, 2.5M, 5M, 10M bps	Command	Point table read/write, parameter read/write, read only, special command monitor only, network connection, drive control, motion control, drive status
Station number	01 to 64	Comm. setting switch	10 bit rotary switch (0 to 9): 3, 1 bit DIP switch (ON/OFF)
Number of occupied stations	1 station occupied, 2 stations occupied	—	

▣ Sold Separately

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

◎ Power cable

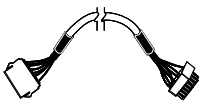
● **CJ-PW-□**



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

◎ Motor+Encoder cable

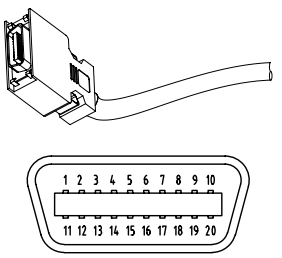
● **Normal: C1D14MB-□, Moving: C1DF14MB-□**



※□ of model name indicates cable length (1, 2, 3, 5, 7, 10, 15, 20)
(B) of model name indicates the built-in brake type, none indicates the standard type.
E.g.) C1DF14MB-10: 10m moving type, built-in brake type motor+encoder cable.

◎ I/O cable

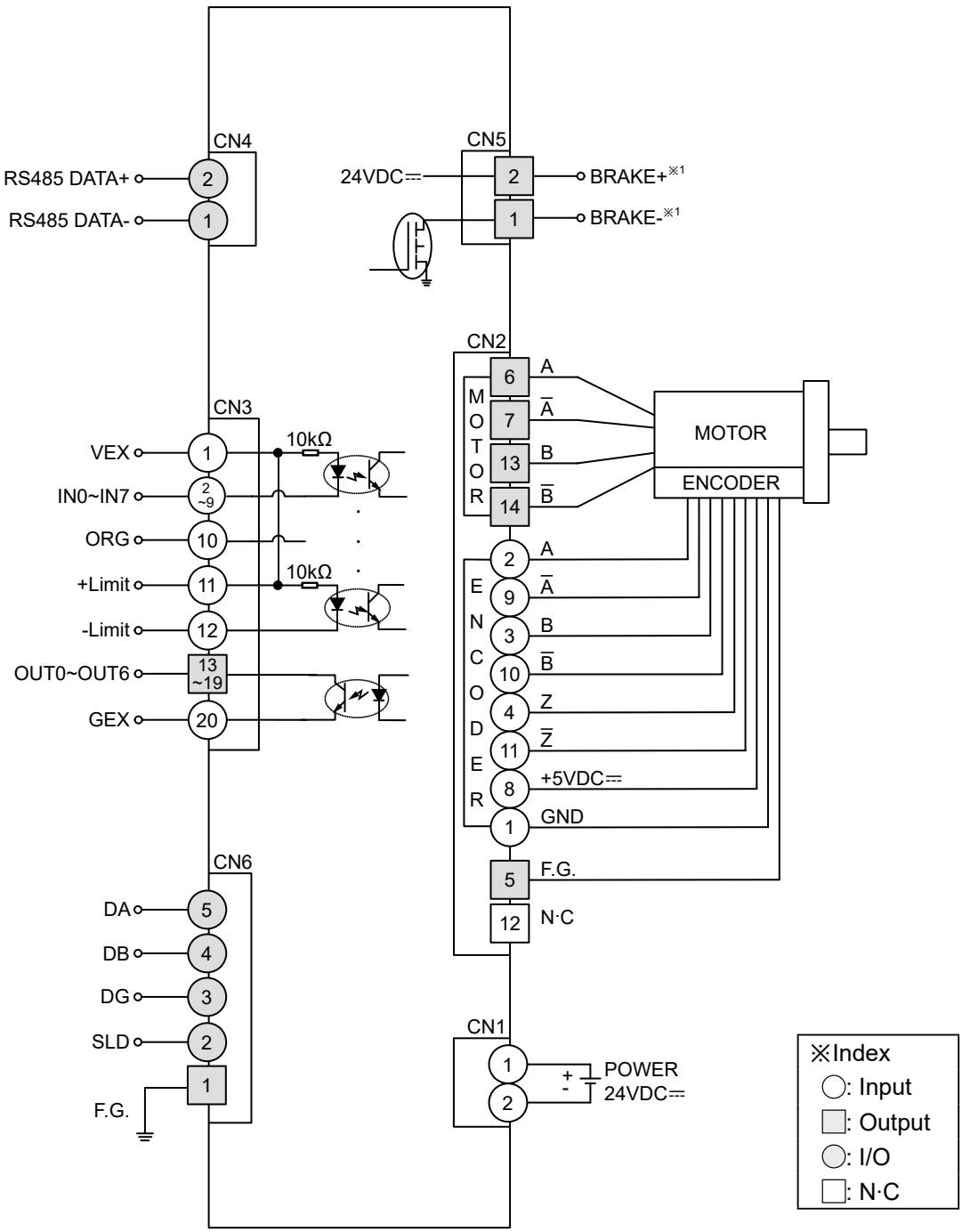
● **CO20-MP□-R**
(standard: AiC-CL TAG)



Pin no.	Function (Name TAG)	Cable color	Dot line color-numbers	Pin no.	Function (Name TAG)	Cable color	Dot line color-numbers
1	VEX	Yellow	Black-1	11	+Limit	White	Black-1
2	IN0		Red-1	12	-Limit		Red-1
3	IN1		Black-2	13	OUT0		Black-2
4	IN2		Red-2	14	OUT1		Red-2
5	IN3		Black-3	15	OUT2		Black-3
6	IN4		Red-3	16	OUT3		Red-3
7	IN5		Black-4	17	OUT4		Black-4
8	IN6		Red-4	18	OUT5		Red-4
9	IN7		Black-5	19	OUT6		Black-5
10	ORG		Red-5	20	GEX		Red-5

※□ of model name indicates cable length (010, 020, 030, 050, 070, 100, 150, 200)
E.g.) CO20-MP070-R: 7m I/O cable.

▣ Connection for Motor and Driver



※1: Corresponding pins are only in built-in brake type.
※The Connection diagram is base on built-in brake type.

▣ Troubleshooting

Malfunction	Causes	Troubleshooting
When communication is not connected	The communication cable is not connected.	Check communication cable wiring.
		Check communication cable connection correctly.
	The communication port or speed settings are not correct.	Check communication port and speed settings are correct.
When motor does not excite	Servo is not On.	Check that servo On/Off input signal is Off. In case of On, servo is Off and excitation of motor is released.
	Alarm occurs.	Check the alarm type and remove the cause of alarm.
When motor rotates to the opposite direction of the designated direction	MotorDir parameter setting is not correct.	Check the MotorDir parameter settings.
When motor drive is unstable	Connection between motor and encoder is unstable.	Check the Motor+Encoder connection cable.
	Motor gain value is not correct.	Change the Motor Gain parameter as the certain value.

▣ 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

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.

CE

▣ 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) 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) 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 >

▣ Ordering Information

Ai **C** - **D** - **42** **L** **A** - ☐

Brake

No mark	Standard type
B※1	Built-in brake type

Encoder resolution

A※2	4,000PPR(1,000PPR×4-multiply)
B※3	16,000PPR(4,000PPR×4-multiply)
A※4	10,000PPR(2,500PPR×4-multiply)

Motor length / **Motor frame size**

			Standard type	Built-in brake type
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	102.3mm
		M	73.5mm	108.3mm
		L	81.5mm	116.3mm
56	57.2×57.2mm	**S**	77.3mm	112.1mm
		M	90.3mm	125.1mm
		L	111.3mm	146.1mm
60	60×60mm	**S**	81.9mm	116.7mm
		M	102.8mm	137.6mm
		L	119.8mm	154.6mm

Item

D	Driver

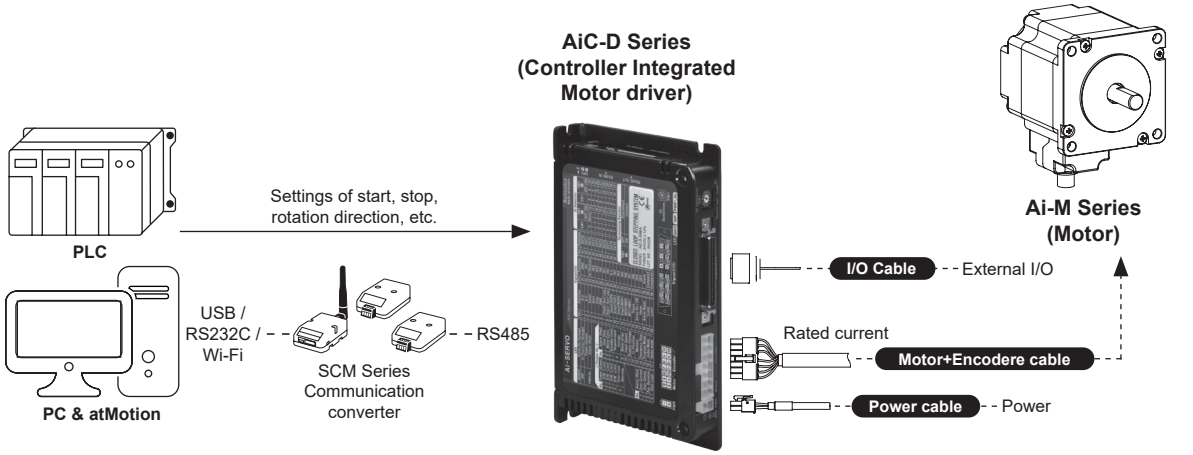
Category

C	Controller

Series

Ai	Artificial intelligence

▣ Configuration Diagram



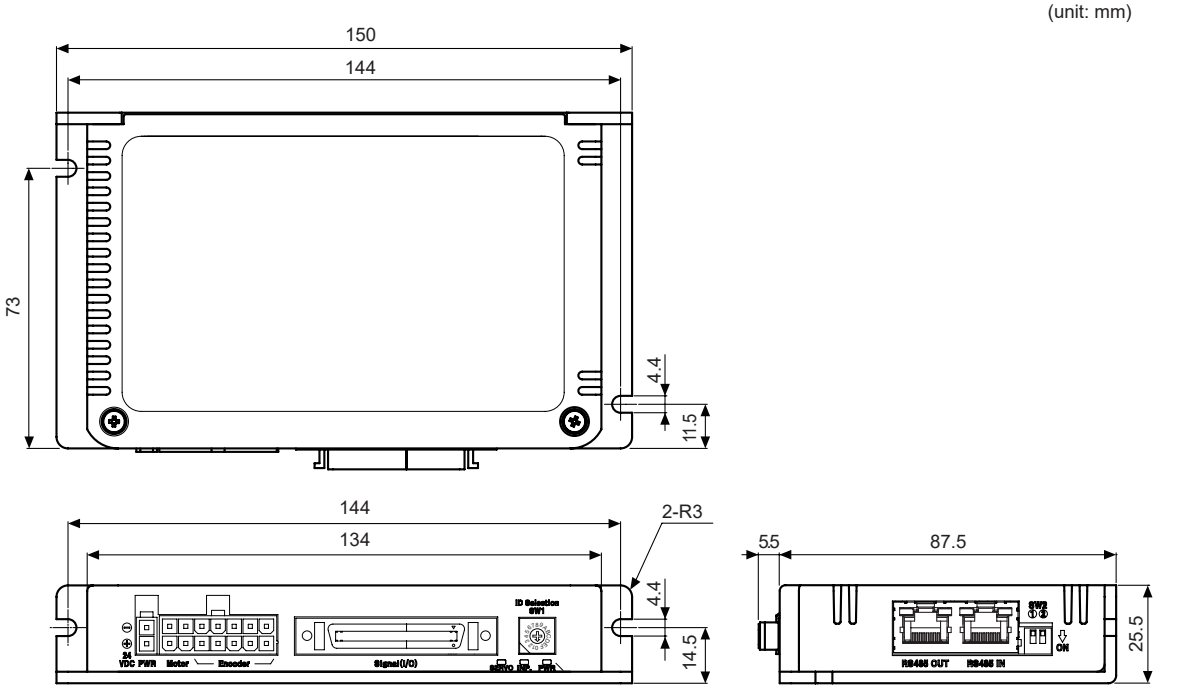
▣ Specifications

Model※1		—	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-20LA	AiC-D-28LB	AiC-D-35LB	AiC-D-42LA(-B)	AiC-D-56LA(-B)	AiC-D-60LA(-B)
Power supply		24VDC⎓					
Allowable voltage range		90 to 110% of the rated voltage					
Power consumption	STOP※2	Max. 10W			Max. 10W	Max. 12W	Max. 15W
	Max. during operation※3	Max. 60W			Max. 60W	Max. 120W	Max. 240W
Max. RUN current※4		0.6A/Phase	1.0A/Phase	1.2A/Phase	1.7A/Phase	3.5A/Phase	
STOP current※5		20 to 100% of max. RUN current (factory default: 50%)					
Rotation speed		0 to 3000rpm					
Resolution※5		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※5		0 (disable), 2, 4, 6, 8, 10, 20, 40, 60 (factory default), 80, 100, 120, 140, 160, 180, 200ms					
Positioning Gain※5		(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※5		CW, CCW					
Status indicator		● Power/Warning indicator: green LED ● Alarm indicator: red LED ● In-Position indicator: yellow LED ● Servo On/Off indicator: orange LED ● RS485 DATA IN/OUT indicator: green, yellow LED					
I/O voltage level		[H]: 5-30VDC⎓, [L]: 0-2VDC⎓					
I/O	Input※6	Exclusive input: 20, general input: 9					
	Output	● Standard type - exclusive output: 4, general output: 10 ● Built-in brake type - exclusive output: 6, general output: 9					
External power supply		VEX(recommended: 24VDC⎓): 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 outuput 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※5	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^2 (approx. 30G) in each X, Y, Z direction for 3 times					
Envoronment	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					
Weight※6		Approx 460g (approx 300g)					

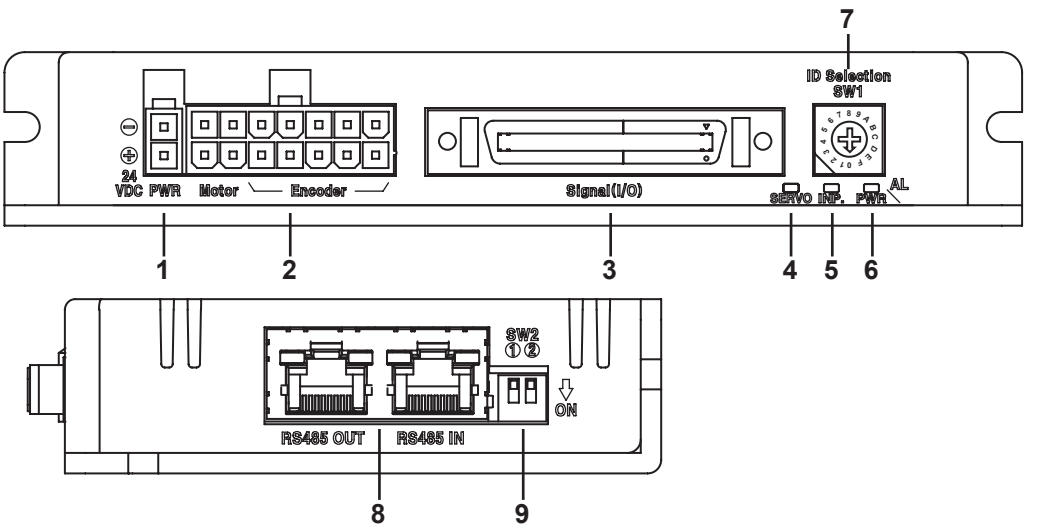
※1: The model name indicates driver type. (none: standard type, B: built-in brake type)
E.g.) AiC-D-42LA-B: built-in brake type stepping motor driver.
※2: Based on the ambient temperature 25℃, ambient humidity 55%RH, and STOP current 50%.
※3: Max. power consumption during operation. When changing the 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.

▣ 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)

▣ 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	Turns ON when motor is placed at command position after positioning input.
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	Flashes when receives data.
TXD OUT※1		Green		Flashes when sending data.

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

▣ Driver Setting

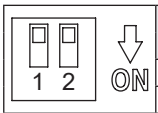
◎ SW1: ID setting switch

※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

▣ 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			

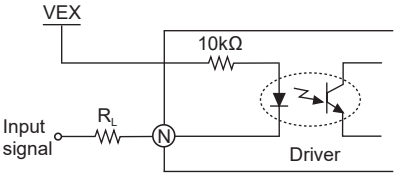
2. General input (9)

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).

※ $R_L = \frac{VEX-1.25V}{0.0025A} - 10\times10^3\,\Omega$



※N: Input pin number of CN3

◎ Output

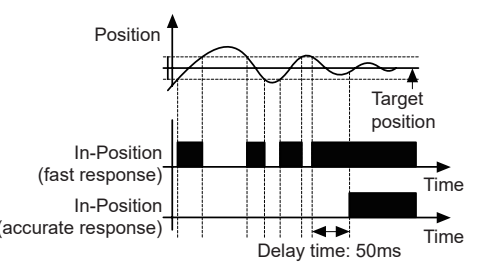
1. Exclusive output (AiC-D: 4, AiC-D-B: 6)

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



▣ Control Input/Output

3. Alarm/Warning

● Alarm

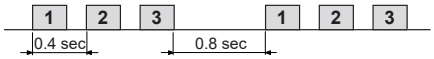
-This function stops motor to protect driver, depending on the error status such as overcurrent or overspeed.
-In case of normal status, output turns ON, and in case of alarming status, output turns OFF.
-When alarm occurs, brake operates.
-When supplying alarm reset, driver returns to the normal status.
※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℃			
	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	Stop	Remain	Release
	15	Program mode error	When 'END' command is not exist at the last step			
	16	Index mode error	When other instruction is used but 'INC', 'ABS' When index command is not completed due to the stop command			
	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

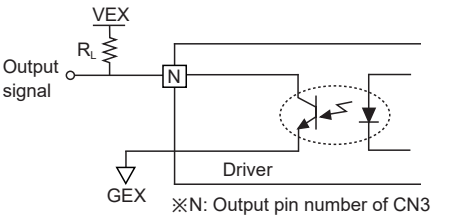
Signal name	Descriptions	Pin no.
OUT0 to OUT8	General output 0 to 8	41 to 49

▣ 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.

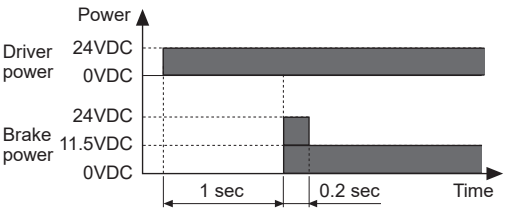
※ $R_L = \frac{VEX-0.7V}{0.01A}$



※N: Output pin number of CN3

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.
※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.).

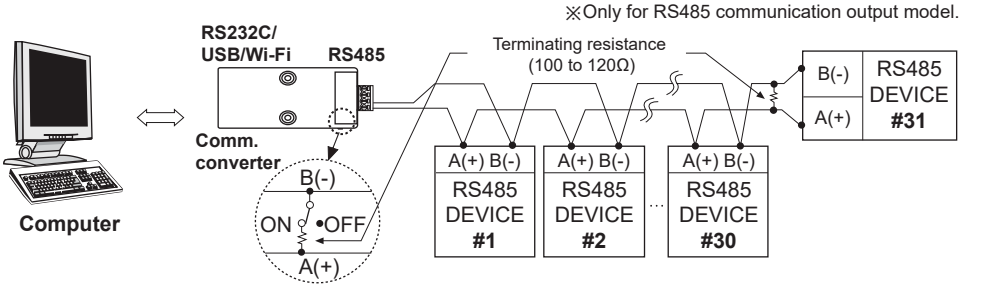
◎ Interface

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		

※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

※Only for RS485 communication output model.



※It is recommended to use Autonics communication converter;
SCM-WF48 (Wi-Fi to RS485·USB wireless communication converter, sold separately),
SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately).
Please use twisted pair wire, which is suitable for RS485 communication, for SCM-WF48, SCM-US48I and SCM-38I.

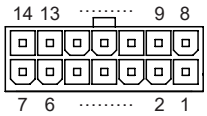
▣ Driver Connectors

◎ Connector function

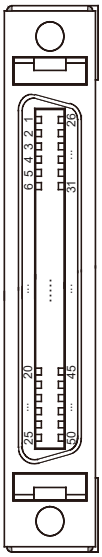
● CN1: Power connector

Pin arrangement	Pin no.	Function
	2	GND
	1	24VDC

● CN2: Motor+Encoder connector

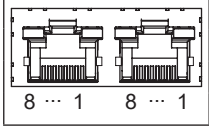
Pin arrangement	Pin no.	Function	Pin no.	Function
	1	GND	8	+5VDC
	2	Encoder A	9	Encoder $\overline{A}$
	3	Encoder B	10	Encoder $\overline{B}$
	4	Encoder Z	11	Encoder $\overline{Z}$
	5	F.G.	12	N·C
	6	Motor A	13	Motor B
	7	Motor $\overline{A}$	14	Motor $\overline{B}$

● CN3: I/O connector

Pin arrangement	Pin no.	I/O	Function	Pin no.	I/O	Function
	1※1	Output	Brake+	26	Input	IN0
	2※1	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※3
	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※2	Output	OUT9

※1: N·C for standard type motor.
※2: N·C for built-in brake type motor.
※3: Brake ON/OFF function cna 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	5557-14R	5556T2		
		Frame size 42, 56, 60mm		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

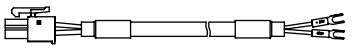
※Above connectors are suitable for AiC-D Series. You can use equivalent or substitute connectors.

▣ Sold Separately

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

◎ Power cable

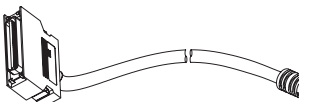
- **CJ-PW-□**

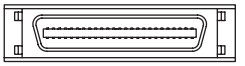


※□ of model name indicates cable length (010, 020)
E.g.) CJ-PW-010: 1m power cable.

◎ I/O cable

- **CO50-MP□-R**
  (standard: AiC TAG)



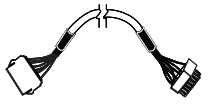


Pin no.	Function (name tag)	Cable color	Dot line color-numbers	Pin no.	Function (name tag)	Cable color	Dot line color-numbers
1	Brake+	Orange	Black-1	26	IN0	White	Red-3
2	Brake-		Red-1	27	IN1		Black-4
3	Reset		Black-2	28	IN2		Red-4
4	Start		Red-2	29	N·C		Black-5
5	Stop		Black-3	30	IN3		Red-5
6	EMG		Red-3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

※□ 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.

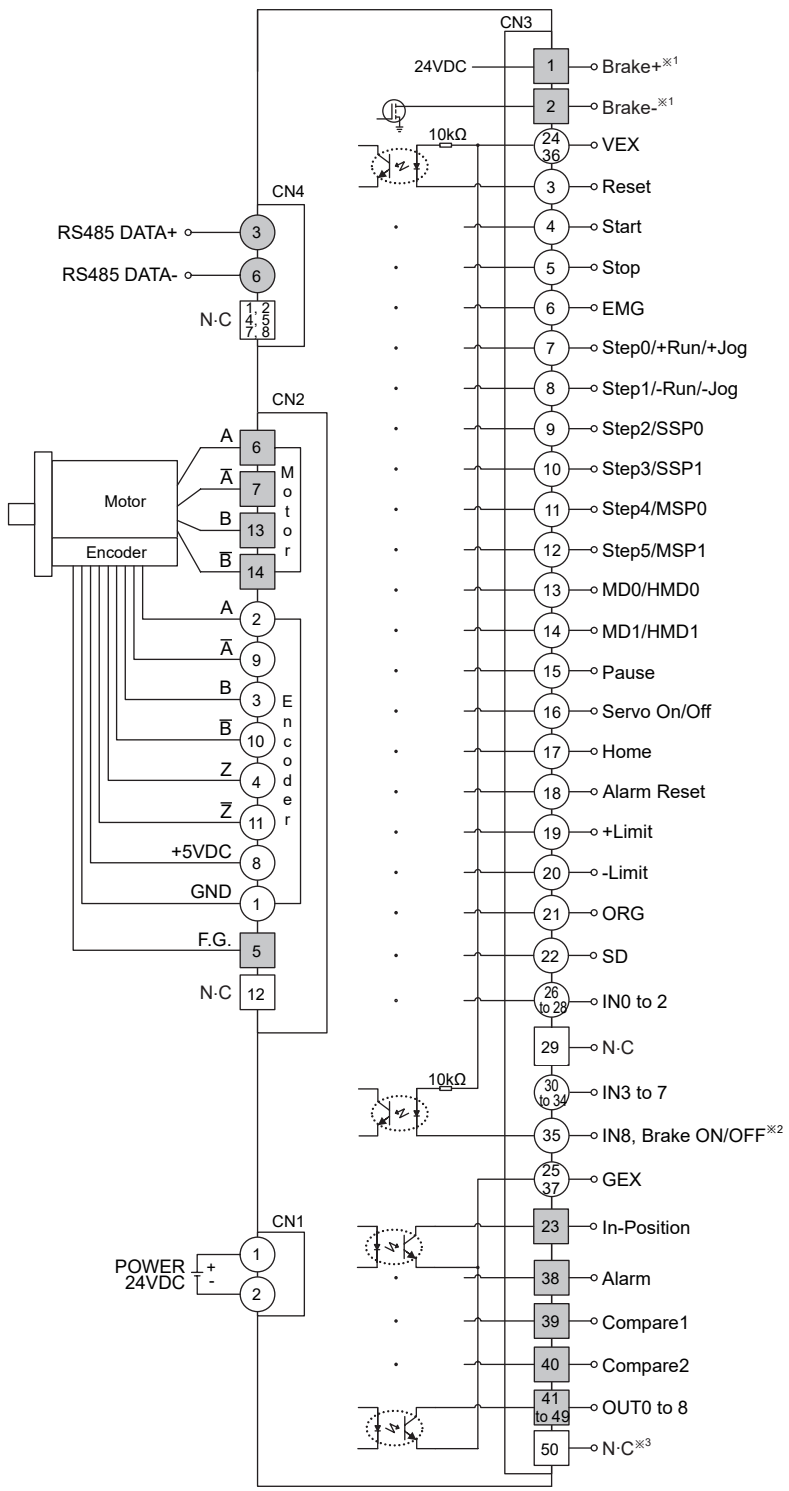
◎ Communication converter

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

- **SCM-US48I**
  (USB to RS485 converter)

- **SCM-38I**
  (RS232C to RS485 converter)

▣ 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.

▣ Troubleshooting

1. When driver communication is failed

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

2. When operation of motor is unstable

①Check that driver, motor, and brake are connected correctly.
②Check 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

AC Type 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)
- Real-time position controllable with closed-loop system
- Motor driver and controller integral type
- As AC power type, possible to omit SMPS and perform higher torque than DC power type
- Able to check alarm and status with Alarm/Status display part (7 segment)
- Controllable maximum 31 axis with RS485 communication
- Auto Current Down Mode available
- C language library provided (32-bit, 64-bit)
- Dedicated Windows program (atMotion) provided
- Easy to set various Gain with program (GUI)
- Applicable to the precision equipment such as optical inspection equipment with the features of maintaining torque in stop and having no micro vibration (hunting)
- 10 levels of resolutions available
- Frame size 42mm, 56mm, 60mm motor supported (Applied motor: AiA-M Series)

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

CE

▣ 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) 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) 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

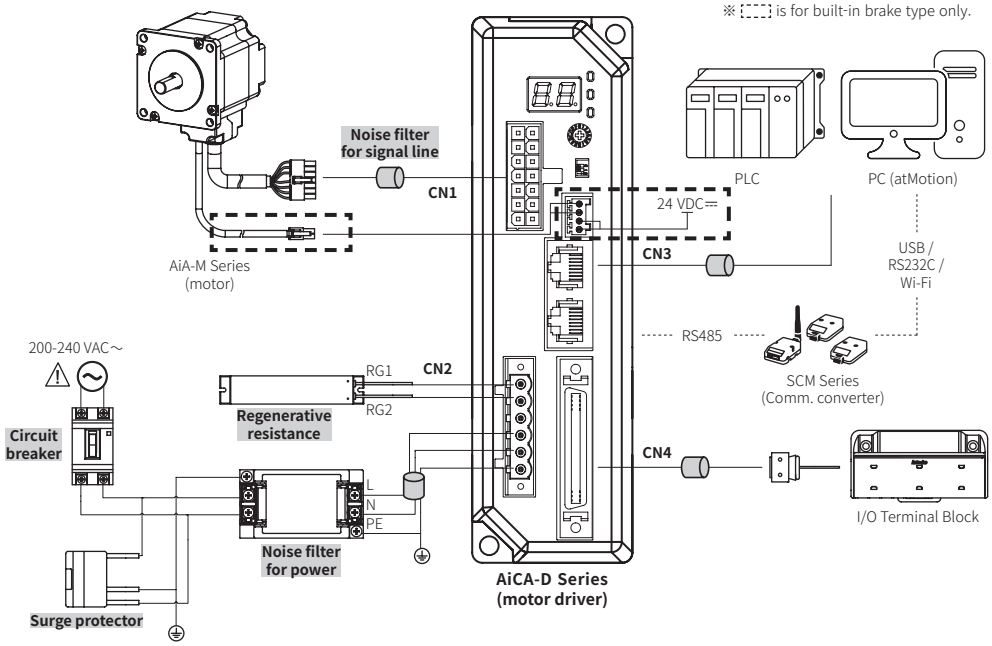
< atMotion screen >

▣ Ordering Information

Ai	C	A	-	D	-	60	M	A	□

- Brake
  - **No mark** Standard type
  - **B** Built-in brake type
- Encoder resolution
  - **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
- Voltage
  - **A** AC power
- Cateory
  - **C** Controller
- Series
  - **Ai** Artificial intelligence

▣ Configuration Diagram



※ The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.
① CN1(motor+encoder connector): AWG22, AWG24
② CN2(power connector): AWG18
③ CN3(communication connector): AWG28
④ CN4(I/O connector): AWG28
⑤ CN5(brake connector): AWG22

※ In case of unstable communication due to noise 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
Comm. line	28A2025-0A2	
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

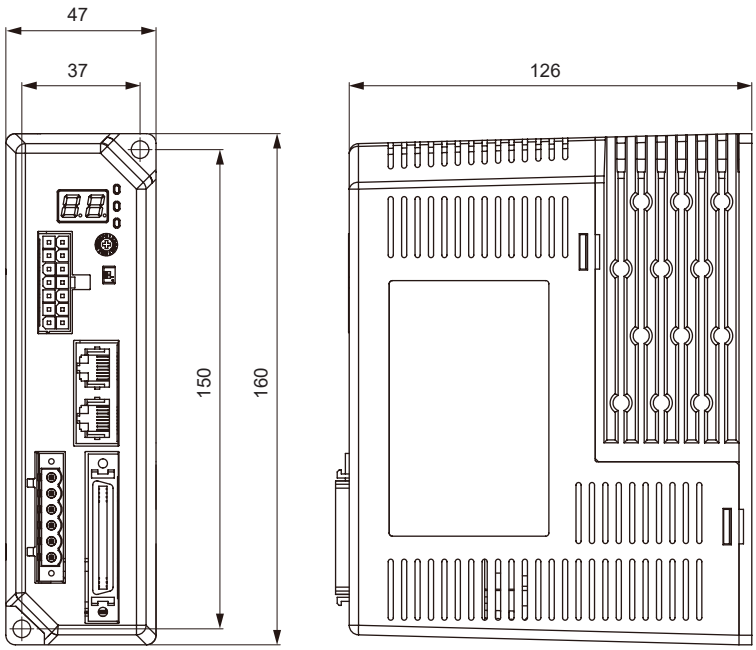
▣ Specifications

Model ※1		AiCA-D-60MA(-B)	AiCA-D-60LA(-B)	AiCA-D-86MA(-B)	AiCA-D-86LA(-B)
Power consumption	Power supply	200-240 VAC～ 50/60 Hz			
	STOP ※2	Max. 60 W		Max. 65 W	
	Max. during operation	Max. 160 W	Max. 220 W	Max. 250 W	Max. 300 W
	Max. Run current ※3	2.0 A/Phase			
Auxiliary power※4	Power supply	24 VDC⎓			
	Input current	0.3 A		0.5 A	
STOP current		20 to 100 % of max. RUN current			
Rotation speed ※5		0 to 3000 rpm			
Resolution ※5		500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 PPR			
Speed filter		0 (disable) (factory default), 2, 4, 6, 8, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200 ms			
Motor GAIN		0 (factory default) to 30, Fine Gain			
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 ※5		CW, CCW			
Status indicator		● Alarm/Status display part: orange LED 7seg. ● In-Position indicator: orange LED		● Power/Alarm indicator: green/red LED ● Servo On/Off indicator: blue LED	
I/O	Input ※6	Exclusive input: 20, general input: 9			
	Output	Exclusive output: 4, general output: 10			
External power supply		VEX (24 VDC⎓ Fixed): 2, GEX (GND): 2			
Operation mode		Jog / Continuous / Index / Program / Position / Torque mode			
Index step		64 steps			
Program function	Step	256 steps			
	Control command	ABS (move absolute position), INC (move 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), TOQ (torque control)			
	Start	Power ON program auto-start function			
	Home start	Power ON home search auto-start function			
RS485 Comm.	Comm. Speed ※5	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		Overcurrent, overspeed, position tracking, overload, overheat, motor connection, encoder connection, overvoltage, undervoltage, motor misalignment, command speed, in-position, memory, emergency stop, program mode, index mode,home search mode, brake			
Warning		±Software limit, ±hardware limit, overload			
Input resistance		4.7 kΩ (Anode Pull-up)			
Insulation resistance		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/s^2 (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			
Weight ※7		● Standard type: Approx. 1,080 g (approx. 800 g) ● Built-in brake type: Approx. 1050 g (approx. 780 g)			

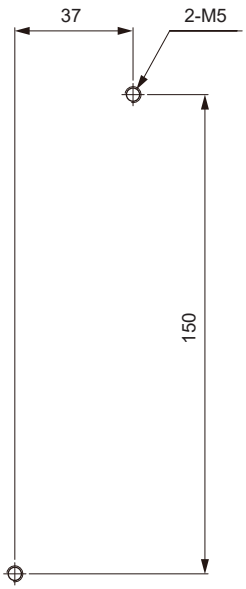
※1: The model name indicates driver type. (none: standard type, B: built-in brake type)
E.g.) AiCA-D-60MA-B: built-in brake type stepping motor driver.
※2: Based on the ambient temperature 25 ℃, ambient humidity 55 %RH and STOP current 20 %.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.
※4: Auxiliary power is only available in built-in brake type. Corresponding specification is not available in standared type.
※5: Settable with the dedicated program (atMotion).
※6: Brake ON/OFF function can be changed in general input IN8 in case of built-in brake type only.
※7: The weight includes packaging. The weight in parenthesis is for unit only.
※ Environment resistance is rated at no freezing or condensation.

▣ Dimensions

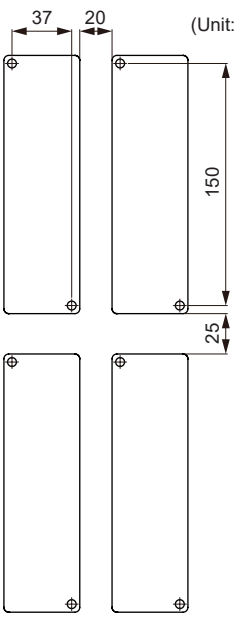
(Unit: mm)



◎ Panel cut-out

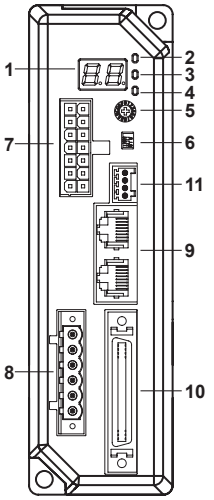


▣ Installation



※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. Communication ID setting rotary switch (ID Sel setting: 0 to F)
6. Communication ID setting/Terminating resistance DIP switch (ID, TERM)
7. Motor+Encoder connector (CN1)
8. Power connector (CN2)
9. Communication cable connector (CN3)
10. I/O connector (CN4)
11. Brake connector (CN5)※1
※1: Corresponding connector is for built-in brake type only.

▣ 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** → **3. Alarm/Warning**'.
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	Alarm, status indicator	Displays the corresponding number, status, model, etc. when Alarm occurs.
RxD IN※1	Yellow	RS485 Data I/O display	Flashes when receiving data.
TxD OUT※1	Green		Flashes when sending data.

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

▣ Driver Setting

◎ ID Sel: Communication ID setting switch

※Set Node ID of the driver.
※Depending on the ID setting of the ID/Term switch, it is possible to connect max. 31-axis.

Setting switch	Setting	ID		Setting	ID	
		ID OFF	ID ON		ID OFF	ID ON
 ID Sel	0	Disable	16	8	8	24
	1	1 (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

◎ ID, TERM: Communication ID setting/Terminating resistance DIP switch

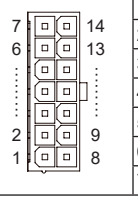
※Set Node ID of the driver.
※Set to use terminating resistance.

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

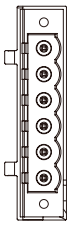
▣ Driver Connectors

◎ Connector function

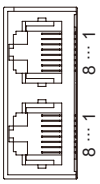
● CN1: Motor+Encoder connector

Pin arrangement	Pin no.	Fuction	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 $\overline{B}$

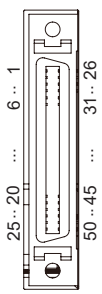
● CN2: Power connector

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

● CN3: RS485 Communication cable connector

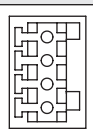
Pin arrangement	Pin no.	Function	Pin no.	Function
	1	N·C	5	N·C
	2	N·C	6	RS485 DATA-
	3	RS485 DATA+	7	N·C
	4	N·C	8	N·C

● CN4: I/O connector

Pin arrangement	Pin	I/O	Function	Pin	I/O	Function	Pin	I/O	Function	Pin	I/O	Function
	1	–	N·C	14	Input	MD1/HMD1	27	Input	IN1	40	Output	Compare2 (Trigger)
	2	–	N·C	15	Input	Pause	28	Input	IN2	41	Output	OUT0
	3	Input	Reset	16	Input	Servo On/Off	29	–	N·C	42	Output	OUT1
	4	Input	Start	17	Input	Home	30	Input	IN3	43	Output	OUT2
	5	Input	Stop	18	Input	Alarm Reset	31	Input	IN4	44	Output	OUT3
	6	Input	EMG	19	Input	+Limit	32	Input	IN5	45	Output	OUT4
	7	Input	Step0/+Run/+Jog	20	Input	-Limit	33	Input	IN6	46	Output	OUT5
	8	Input	Step1/-Run/-Jog	21	Input	ORG	34	Input	IN7	47	Output	OUT6
	9	Input	Step2/SSP0	22	Input	SD	35	Input	IN8/ Brake ON/OFF※1	48	Output	OUT7
	10	Input	Step3/SSP1	23	Output	In-Position	36	Input	VEX	49	Output	OUT8
	11	Input	Step4/MSP0	24	Input	VEX	37	Input	GEX	50	Output	OUT9
	12	Input	Step5/MSP1	25	Input	GEX	38	Output	Alarm	—		
	13	Input	MD0/HMD0	26	Input	IN0	39	Output	Compare1 (Trigger)			

※Brake ON/OFF function is added for built-in brake type.

● CN4: Brake connector

Pin arrangement	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	Communication	LS-CV-J45BBKZ	—	—	EPN.
CN4	I/O connector	10150-3000PE	—	10350-52F0-008	3M
CN5	Brake connector	ESC250V-S2330704P	—	—	Dinkle

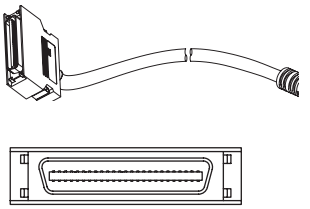
※Above connectors are suitable for AiCA-D Series

▣ Sold Separately

※Recommended to use ferrite core at both ends of the I/O cable and Motor+Encoder cable.

◎ I/O Cable

• CO50-MP□-R
(Standard: AiC TAG)

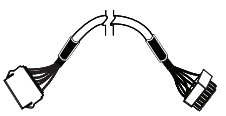


Pin no.	Function (Name TAG)	Cable color	Dot line color-numbers	Pin no.	Function (Name TAG)	Cable color	Dot line color-numbers
1	Brake+	Orange	Black-1	26	IN0	White	Red-3
2	Brake-		Red-1	27	IN1		Black-4
3	Reset		Black-2	28	IN2		Red-4
4	Start		Red-2	29	N·C		Black-5
5	Stop		Black-3	30	IN3		Red-5
6	EMG		Red-3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

※□ of model name indicates cable length (010, 020, 030, 050, 070, 100, 150, 200).
E.g.)CJ-MP50-HP070: 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)

CE K

• SCM-US48I
(USB to RS485 converter)

CE K

• SCM-38I
(RS232C to RS485 converter)

CE K

▣ Control Input/Output

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

◎ Input

1. Exclusive input (20)

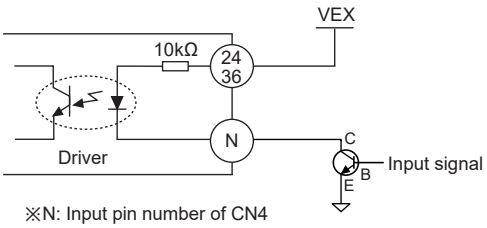
Signal name	Descriptions	Pin no.	Signal name	Descriptions	Pin no.
Reset	Reset command	3	Pause	Pause	15
Start	Drive start command	4	Servo On/Off	Servo On/Off	16
Stop	Drive stop command	5	Home	Home search	17
EMG	Drive emergency stop command	6	Alarm Reset	Alarm reset command	18
Step0/+Run/+Jog	Step designate 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	Dceleration (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~IN2	General input 0 to 2	26 to 28
IN3~IN8	General input 3 to 8	30 to 35

3. Example of input circuit connection

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



※N: Input pin number of CN4

◎ Output

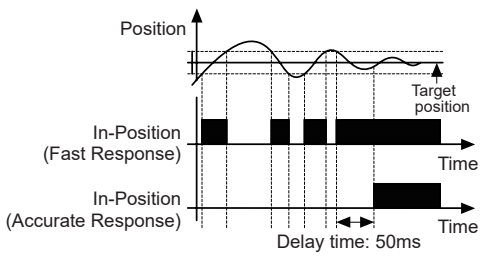
1. Exclusive output (4)

Signal name	Descriptions	Pin no.	Signal name	Descriptions	Pin no.
In-Position	Drive ending pulse	23	Compare1(Trigger)	Comparison output 1	39
Alarm	Alarm output	38	Compare2(Trigger)	Comparison output 2	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



▣ 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 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.

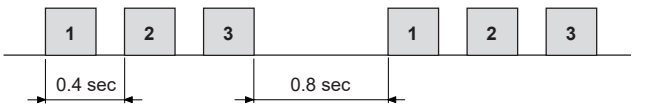
● **Alarm/Warning indicator**
-When alarm occurs, the alarm indicator (ALM, red) flashes as the times of corresponding alarm type.
-The alarm/status display part displays the number of the corresponding alarm type.

Alarm/ Status	Alarm type	Descriptions	Motor status	Torque status	Brake status※1
E1	Overcurrent error	When overcurrent flows at motor RUN element	Stop	Release	Lock
E2	Overspeed error	When motor speed is over 4,000rpm			
E3	Position tracking error	When the gap between position command value and current position value is over 90°			
E4	Overload error	When applying load over the rated load for over 1 sec			
E5	Overheat error	When heatsink temperature is over 80℃			
E6	Motor connection error	When motor cable connection error occurs at driver			
E7	Encoder connection error	When encoder cable connection error occurs at driver			
E8	Overvoltage error	When input voltage is over 240VAC～ +10%			
E9	Undervoltage error	When input voltage is under 200VAC～ -10%			
EA	Motor misalignment	When motor is in misalignment			
Eb	Command pulse error	When input pulse is over 3,500rpm			
		When pulse is input before initial alignment			
EC	In-Position error	When position error (over 1) is kept over 3 sec, after motor stopped.			
Ed	Memory error	When memory error is detected as power supplied			
EE	Emergency stop	When emergently stopped with emergency stop command	Stop	Remain	Release
EF	Program mode errer	When 'END' command is not exist at the last step			
EG	Index mode error	When other instruction is used but 'INC', 'ABS'			
		When index command is not completed du to the stop command			
EH	Home search mode error	When failed to find home			
EJ	Brake error※1	When brake failed to operate	Stop	Release	Lock

※Depending on the alarm/warning type, it displays as a segment on the Alarm/Status display part.

Warning/ Stauts	Warning type	Descriptions	Motor status	Torque status	Brake status※1
Y1	+Software limit	When normal direction (CW) software limit is ON.	Stop	Remain	Release
Y2	-Software limit	When reverse direction (CCW) software limit is ON.			
Y3	+Hardware limit	When normal direction (CW) hardware limit is ON.			
Y4	-Hardware limit	When reverse direction (CCW) hardware limit is ON.			
Y5	Overload warning	When maximum load is kept connected over 10 sec. (may cause overheat on motor and driver)	Remain	Remain	Release
Y6	Position override warning	When it is impossible to operate position override.	Stop	Remain	Release

※1: Corresponding information is for built-in brake type only.
※ Even though warning occurs, it drives as normal status and it may cause damage by fire.
It is recommended not to use the unit during warning status.
※ When alarm/warning occurs, indicators flash with interval of 0.4 sec until the alarm/warning is cleared.
<E.g. when alarm no. 3 occurs>



▣ Control Input/Output

4. Comparison output (Compare1, Compare2)

It outputs trigger pulse at the designated cycle.

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

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

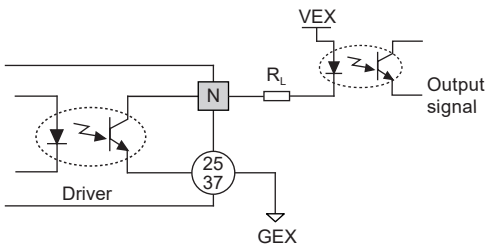
5. General output (10)

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

6. Example of output circuit connection

-In case of output, use external power (VEX) max. 12 to 24 VDC⎓, 100mA.
When current exceeds 10mA, use an external resistor R_L to adjust the current value.

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



※N: Output pin numer of CN4

▣ Communication Output

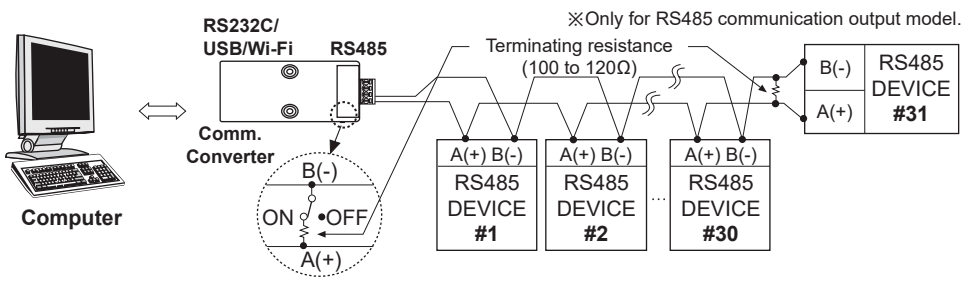
It is for parameter setting and monitoring via external devices (PC, PLC, etc.).

◎ 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	1bit (fixed)
Max. connections	31 units (address: 01 to 31)	Data bit	8bit (fixed)
Synchronous method	Asynchronous	Parity bit	None, Even, Odd
Comm. method	Two-wire half duplex	Stop bit	1-bit, 2-bit
Comm. distance	Max. 800m		

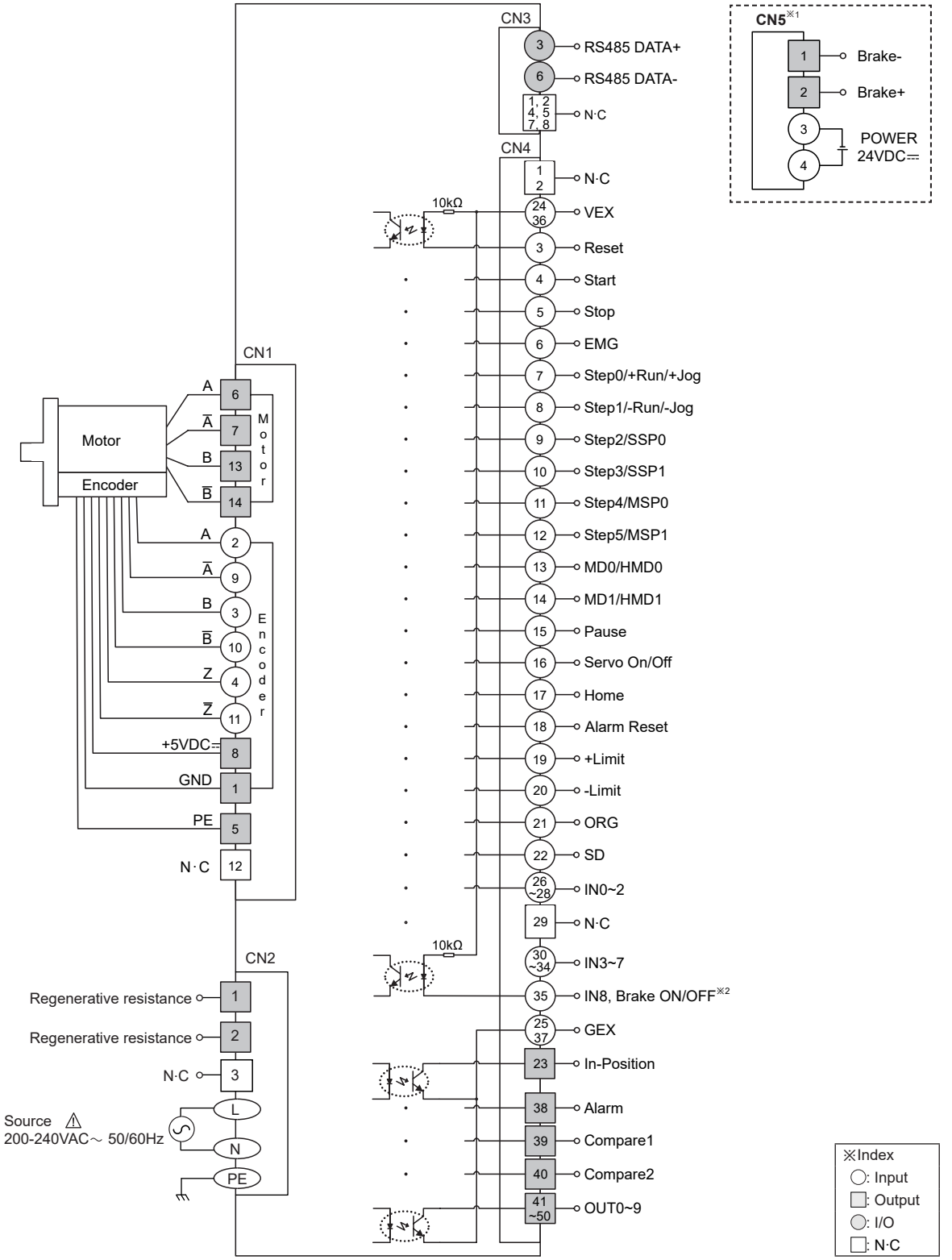
※It is not allowed to set overlapping communication address at the same communication line.
Use twisted pair wire for RS485 communication.

◎ Application of system organization



※It is recommended to use Autonics communication converter;
SCM-WF48 (Wi-Fi to RS485·USB wireless communication converter, sold separately),
SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately).
Please use twisted pair wire, which is suitable for RS485 communication, for SCM-WF48, SCM-US48I and SCM-38I.

▣ Connection of Motor and Driver



※1: Corresponding connector is for built-in brake type only.
※2: In built-in brake type, the corresponding pin can be swithed as Brake ON/OFF.

▣ Troubleshooting

Malfunction	Causes	Troubleshooting
When communication is not connected	The communication cable is not connected.	Check communication cable wiring. Check communication cable connection correctly.
	The communication port or speed settings are not correct.	Check communication port and speed settings are correct.
When motor does not excite	Servo is not ON.	Check that servo On/Off input signal is [L]. In case of [H], servo is off and excitation of motor is released.
	Alarm occurs.	Check the alarm type and remove the cause of alarm.
When motor rotates to the opposite direction of the designated direction	MotorDir parameter setting is not correct.	Check the MotorDir parameter settings.
When motor drive is unstable	Connection between motor and encoder is unstable.	Check the Motor+Encoder connection cable.
	Motor gain value is not correct.	Change the Motor Gain parameter as the certain value.

▣ Proper Usage

- Follow instructions in 'Proper Usage'.
  Otherwise, It may cause unexpected accidents.
- It is recommended to use 485 converter with the separate power.
  (Autonics product, SCM-38I, recommended)
- Install vertically so that the Alarm/Status display part located on top.
- Keep the distance between power cable and signal cable more than 10cm.
- 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 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

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)
- Realized the closed loop with higher cost-efficiency compared to servo motor system
- Rapid response which is advantageous for the short distance continuous operation
- Able to implement Low frequency operation in low speed area and high torque in high speed area
- Easy to use as much as unskilled people can use with tuning unnecessary method (Gain setting with the 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
- Various alarms out
  : overcurrent, overspeed, motor connection error, encoder connection error, and etc., overall 12 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.

■ Ordering Information

Ai **S** - **D** - **42** **L** **A** - ☐

Series: Ai

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

Category: S

S	Standard

Item: D

D	Driver

Motor frame size

20	20×20mm
28	28×28mm
35	35×35mm
42	42×42mm
56	57.2×57.2mm
60	60×60mm

Motor length

	Standard type	Built-in brake type
S	46mm	—
M	59mm	—
L	65mm	—

	Standard type	Built-in brake type
S	41.5mm	—
M	52mm	—
L	68.5mm	—

	Standard type	Built-in brake type
S	67.5mm	102.3mm
M	73.5mm	108.3mm
L	81.5mm	116.3mm

	Standard type	Built-in brake type
S	77.3mm	112.1mm
M	90.3mm	125.1mm
L	111.3mm	146.1mm

	Standard type	Built-in brake type
S	81.9mm	116.7mm
M	102.8mm	137.6mm
L	119.8mm	154.6mm

		Standard type	Built-in brake type
M	41.2mm	—	
L	53.1mm	—	

Encoder resolution

A※2	4,000PPR(1,000PPR×4-multiply)
B※3	16,000PPR(4,000PPR×4-multiply)
A※4	10,000PPR (2,500PPR×4-multiply)

Brake

No mark	Standard type
B※1	Built-in brake type

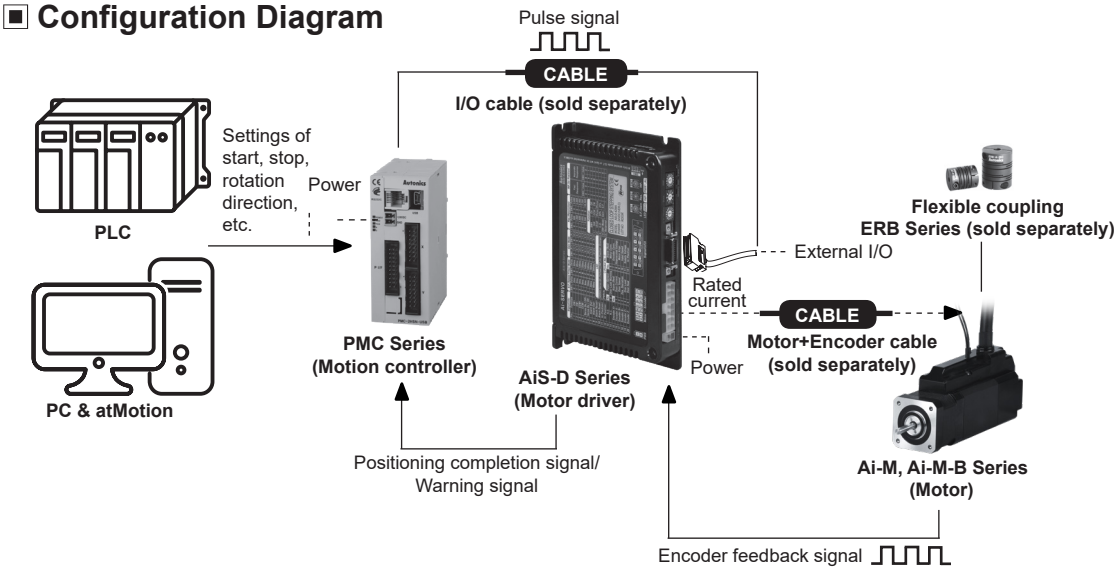
※1: Built-in brake type is only for frame size 42, 56, 60mm motors.
※2: Encoder resolution for frame size 20mm motors.
Microstep control for AiS driver, it controls up to 10,000PPR.
※3: Encoder resolution for frame size 28, 35mm motors.
※4: Encoder resolution for frame size 42, 56, 60mm motors.

▣ Specifications

Model			AiS-D-20MA	AiS-D-20LA	AiS-D-28SB	AiS-D-28MB	AiS-D-28LB	AiS-D-35SB	AiS-D-35MB	AiS-D-35LB	AiS-D-42SA-□	AiS-D-42MA-□	AiS-D-42LA-□	AiS-D-56SA-□	AiS-D-56MA-□	AiS-D-56LA-□	AiS-D-60SA-□	AiS-D-60MA-□	AiS-D-60LA-□
Power supply			24VDC⎓																
Allowable voltage range			90 to 110% of the rated voltage																
Power consumption	STOP※1	Standard type	Max. 10W								Max. 7W	Max. 7.5W	Max. 8W	Max. 9.5W	Max. 10W	Max. 11W	Max. 12W	Max. 13W	Max. 14W
		Built-in brake type	—								Max. 16W		Max. 17W	Max. 23W		Max. 25W		Max. 26W	
	Max. during operation※2	Standard type	Max. 50W		Max. 60W						Max. 60W			Max. 120W			Max. 240W		
		Built-in brake type	—																
Max. RUN current※3			0.6A/Phase		1.0A/Phase			1.2A/Phase			1.7A/Phase			3.5A/Phase					
STOP current			25% or 50% of max. RUN current (factory default: 50%)																
Rotation speed			0 to 3,000rpm																
Resolution			500 (factory default), 1000, 1600, 2000, 3600, 4000, 5000, 6400, 7200, 10000PPR		500 (factory default), 1000, 1600, 2000, 3600, 5000, 6400, 7200, 10000PPR						500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000PPR								
Speed filter			0 (disable), 2, 4, 6, 8, 10, 20, 40, 60 (factory default), 80, 100, 120, 140, 160, 180, 200ms																
Position control gain			(P Gain, I Gain)=(1, 1), (2, 1), (3, 1), (4, 1), (5, 1), (6, 1), (1, 2), (2, 2), (3, 2), (4, 2), (5, 2), (1, 3), (2, 3), (3, 3), (4, 3), (5, 3)																
In-Position			Within the range of Fast response: 0 to 7 or Accurate response: 0 to 7																
Pulse input method			1-pulse or 2-pulse input (factory default) method																
Motor rotation direction			CW (factory default), CCW																
Status indicator			● Power/Warning indicator: green LED ● Alarm indicator: red LED ● In-position indicator: yellow LED ● Servo On/Off indicator: orange LED																
Input signal			RUN pulse, servo On/Off, alarm reset (photocoupler input)																
Output signal			● In-position, alarm out (photocoupler output), ● Encoder signal (A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase, corresponding to 26C31) (line driver output),								● In-position, alarm out (photocoupler output), ● Encoder signal (A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ phase, corresponding to 26C31) (line driver output), ● Brake (built-in brake type) (at supplying moment: 24VDC for 0.2 sec, in normal status: 11.5VDC ±10%)								
Input pulse specifications	Pulse width		● CW, CCW : input pulse frequency duty 50% (min. 2μs), ● Serve On/Off : min. 1ms, ● Alarm reset : min. 20ms		● CW, CCW : input pulse frequency duty 50% (min. 1.25μs), ● Serve On/Off: min. 1ms, ● Alarm reset: min. 20ms						● CW, CCW: input pulse frequency duty 50%, ● Serve On/Off: min. 1ms, ● Alarm reset: min. 20ms								
	Rising/Falling time		CW, CCW: max. 0.5μs																
	Pulse input voltage		● CW, CCW - [H]: 4-8VDC⎓, [L]: 0-0.5VDC ● Servo On/Off, alarm reset - [H]: 24VDC⎓, [L]: 0-0.5VDC																
	Max. input pulse freq.※4		CW, CCW: 500kHz																
Input resistance			220Ω (CW, CCW), 10kΩ (servo On/Off, alarm reset)																
Insulation resistance			Over 100MΩ (at 500VDC megger)																
Dielectric strength			1,000VAC 60Hz for 1 min																
Vibration			1.5mm amplitude at frequency 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours																
Shock			300m/s^2 (approx. 30G) in each X, Y, Z direction for 3 times																
Environment	Ambient temp.		0 to 50℃, storage: -20 to 70℃								0 to 50℃, storage: -10 to 60℃ (standard type), -20 to 70℃ (built-in brake type)								
	Ambient humi.		35 to 85%RH, storage: 10 to 90%RH																
Approval			CE																
Protection structure			IP20 (IEC standard)																
Weight※5			Approx. 400g (approx. 290g)																

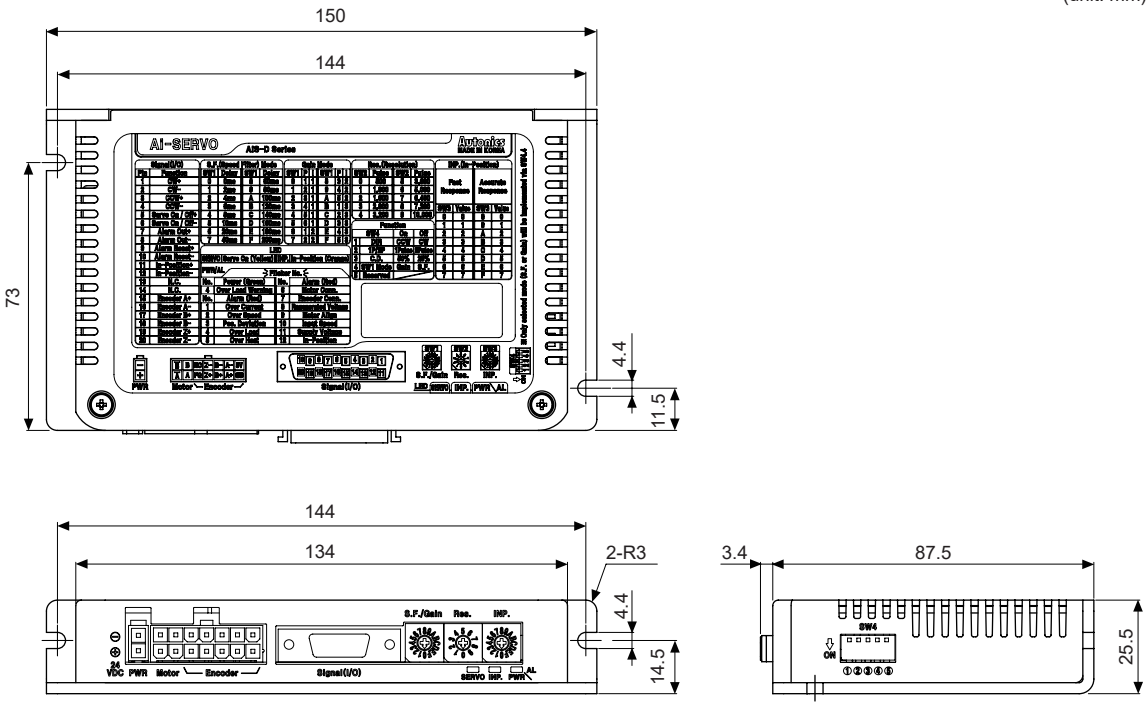
※1: Based on the ambient temperature 25℃, ambient humidity 55%RH, and STOP current 50%.
※2: Max. power consumption during operation. When changing the load rapidly, instantaneous peak current may increase.
The capacity of power supply should be over 1.5 to 2 times of max. power consumption.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.
※4: Max. input pulse frequency is max. frequency to be input and is not the same as max. pull-out frequency or max. slewing frequency.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Configuration Diagram



▣ Dimensions

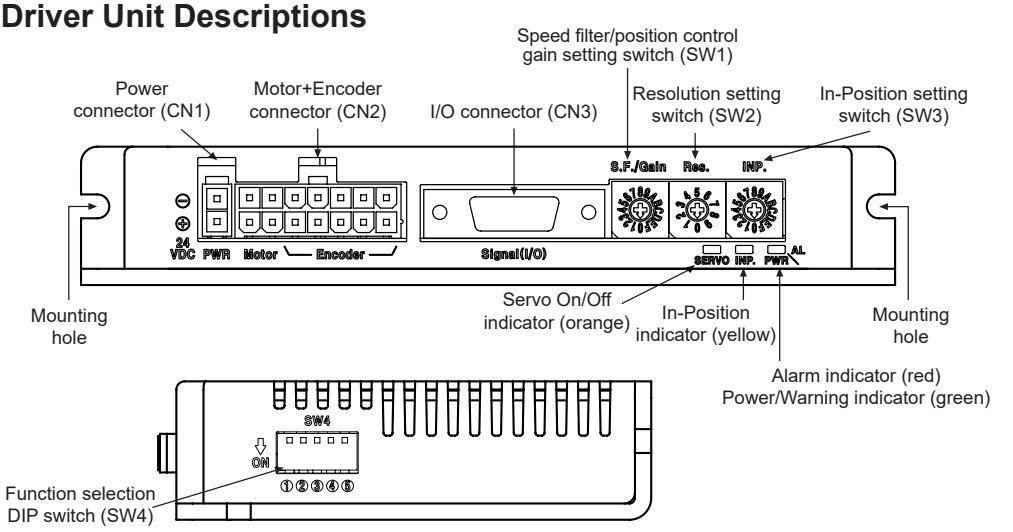
(unit: mm)



▣ Driver Status Indicators

Status indicator	LED color	Function	Descriptions
PWR	Green	Power indicator	Turns ON when the unit operates normally after supplying power
		Warning indicator	Flashes when over load 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** → **2. Alarm/Warning**'
INP.	Yellow	In-Position indicator	Turns ON when motor is placed at command position after positioning input.
SERVO	Orange	Servo On/Off indicator	Turns ON when servo is operating, turns OFF when servo is not operating.

▣ Driver Unit Descriptions



▣ Driver Setting

◎ SW1: Speed filter setting switch or position control gain setting switch

-SW1 shifts its mode between the speed filter setting or the position control gain setting, depending on 4th pin in SW4 as follows.
-Modified setting values are not applied in the running status, and the values will be applied after motor stopped.

4th pin in SW4	Setting
OFF	Speed filter
ON	Position control gain

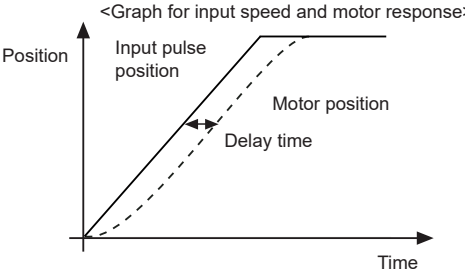
• Speed filter setting

-Speed filter decides operation responsiveness of the motor to input pulse.
-Set the delay time between the position of input pulse and the position of motor to prevent load changing or disturbance with soft operation function.
※If the setting value is too high, the synchronous response by command is decreased.

Setting switch	Setting	Delay time	Setting	Delay time
 S.F./Gain	0	Disable	8 ※1	60ms
	1	2ms	9	80ms
	2	4ms	A	100ms
	3	6ms	B	120ms
	4	8ms	C	140ms
	5	10ms	D	160ms
	6	20ms	E	180ms
	7	40ms	F	200ms

※

<Graph for input speed and motor response>



• Position control gain setting

-Position control gain decides responsiveness of the motor to position command.
-Gain setting in motor stationary state, depending on load of motor, realizes rapid positioning and stabilized performance.
-P_Gain: Adjust vibration in running drive.
-I_Gain: Adjust vibration in accelerating/decelerating drive.

Setting switch	Setting	Gain		Setting	Gain	
		P	I		P	I
 S.F./Gain	0	1	1	8 (factory default)	3	2
	1	2	1	9	4	2
	2	3	1	A	5	2
	3	4	1	B	1	3
	4	5	1	C	2	3
	5	6	1	D	3	3
	6	1	2	E	4	3
	7	2	2	F	5	3

◎ SW2: Resolution setting switch

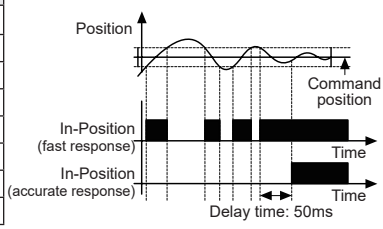
-Set the resolution of driver.
-Refer to the table below for the number of pulses per 1 rotation by resolution.
-Modified setting values are not applied in the running status, and the values will be applied after motor stopped.

Setting switch	Setting	Frame size 20mm		Frame size 28/35mm		Frame size 42/56/60mm	
		Pulse/Revolution	Resolution	Pulse/Revolution	Resolution	Pulse/Revolution	Resolution
 RES.	0 (factory default)	500	2.5	500	2.5	500	2.5
	1	1000	5	1000	5	1000	5
	2	1600	8	1600	8	1600	8
	3	2000	10	2000	10	2000	10
	4	3600	18	3600	18	3200	16
	5	4000	20	5000	25	3600	18
	6	5000	25	6400	32	5000	25
	7	6400	32	7200	36	6400	32
	8	7200	36	10000	50	7200	36
	9	10000	50	16000	80	10000	50

◎ SW3: 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.

Setting switch	Fast response		Accurate response	
	Setting	Value	Setting	Value
 INP.	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



◎ SW4: Function selection DIP switch

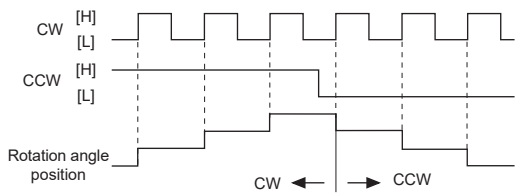
-Set rotation direction, pulse input method, STOP current, SW1 setting, and test mode.

Setting switch	No.	Name	Function	Switch position	
				ON	OFF (factory default)
	1※1	DIR	Rotation direction	CCW	CW
	2※1	1P/2P	Pulse input method	1-pulse input method	2-pulse input method
	3※2	C.D.	STOP current	25% of max. RUN current	50% of max. RUN current
	4※2	SW1 Mode	SW1 setting	Position control gain	Speed filter
	5※3	Reserved	Test mode	Test mode	Normal mode

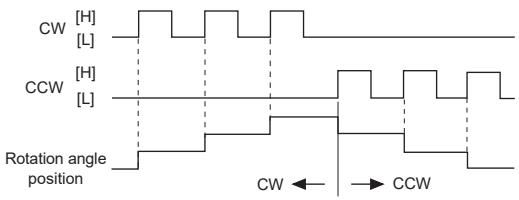
※1: When motor runs or stops, modified setting values will be applied immediately.
※2: Modified setting values are not applied in the running status, and the values will be applied after motor stopped.
※3: Set to OFF when using the device. It is only for the operation test in manufacturing process.

• 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.

▣ 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. Position command pulse

- Pulse input is selectable from 1-pulse input method and 2-pulse input method. (Refer to '◎ **SW4: 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

-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. Brake operates.
-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. Brake is released.
※Use this function after stopping the motor.
※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. Brake is released.
※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**'.

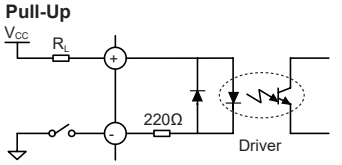
4. Example of input circuit connection

• Input pulse (CW, CCW)

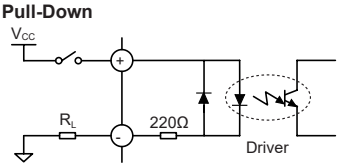
-It is recommended to use 5VDC at V_{CC} and short the R_L.
-In case V_{CC} is over 5VDC, calculate R_L value using following formula and use V_{CC} below 30VDC. ※$R_L = \frac{V_{CC}-2.17V}{0.011A} - 220\Omega$
-In case V_{CC} is 12, 24VDC, refer to the table below for R_L.

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

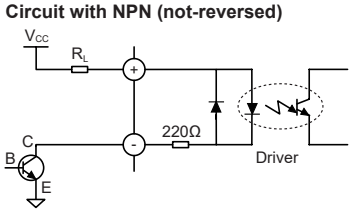
A. Pull-Up



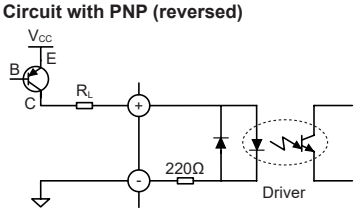
B. Pull-Down



C. Circuit with NPN (not-reversed)

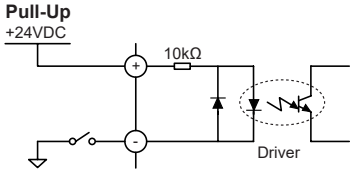


D. Circuit with PNP (reversed)

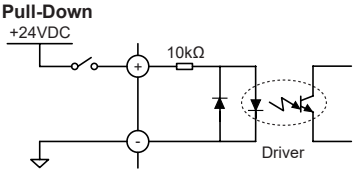


• External input (Servo On/Off, Alarm Reset)

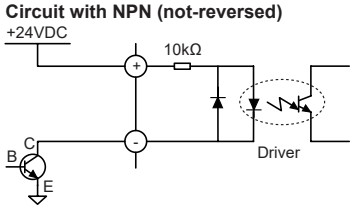
A. Pull-Up



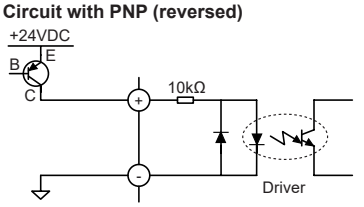
B. Pull-Down



C. Circuit with NPN (not-reversed)



D. Circuit with PNP (reversed)



◎ 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 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**'.

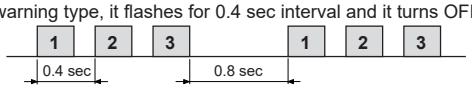
2. Alarm/Warning

● Alarm
-This function stops motor to protect driver, depending on the error status such as over current or over speed.
-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**'.

● Warning
- This function notices dangers with the alarm indicator prior to over load alarm.
- When turning out from the alarming condition, driver returns to the normal status automatically.

Alarm indicator	No. of flashing	Alarm type		Descriptions	Motor stop	Maintain torque
AL (red)	1	Overcurrent error		When over current flows at motor RUN element	O	×
	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℃		
	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 pulse error				
	11	Input voltage error	Frame size 20, 28, 35mm	When Input voltage is out of 21-27VDC ±5%		
			Frame size 42, 56, 60mm	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.		
Warning indicator	No. of flashing	Warning type		Descriptions	Motor stop	Maintain torque
PWR (green)	4	Overload warning		When maximum load is kept connected over 10 sec. (motor or driver can be overheated)	×	O

※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 the alarm/warning type, it flashes for 0.4 sec interval and it turns OFF for 0.8 sec repeatedly.
< E.g. case of alarm 3 >



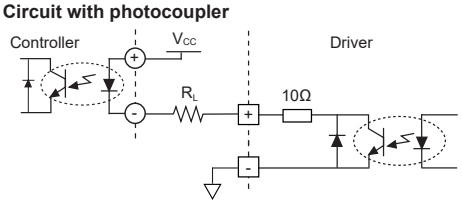
3. Example of output circuit connection

-It is recommend 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.

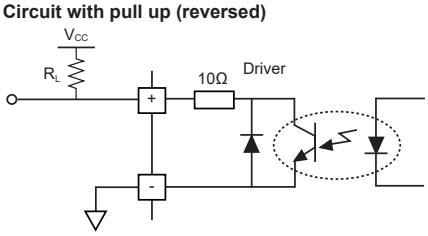
※A: $R_L = \frac{V_{CC}\text{-}0.3V\text{-}V_F}{0.025A} - 10\Omega$ ※B, C: $R_L = \frac{V_{CC}\text{-}0.3V}{0.025A} - 10\Omega$

(V_F is LED forward voltage of primary photocoupler.)

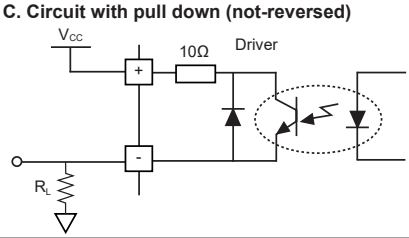
A. Circuit with photocoupler



B. Circuit with pull up (reversed)

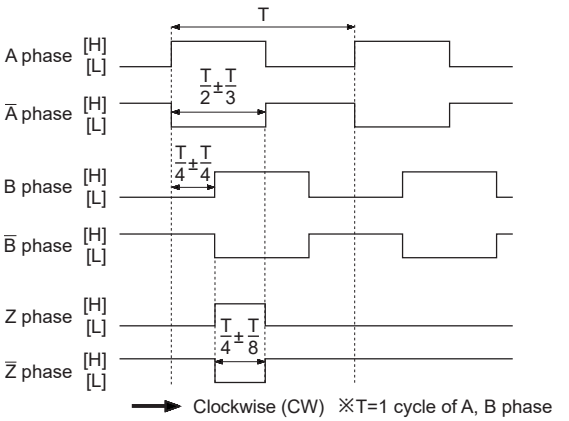


C. Circuit with pull down (not-reversed)

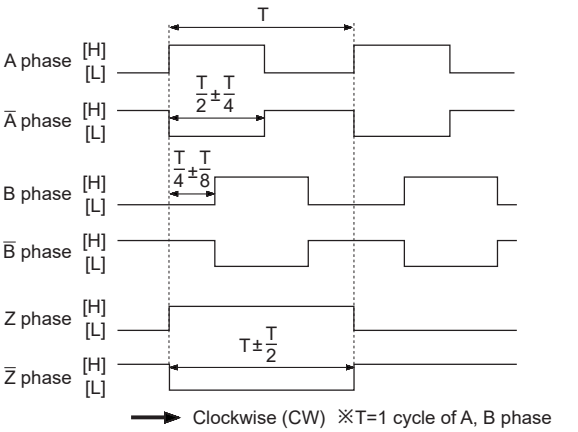


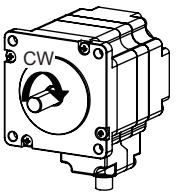
4. Encoder output waveforms

◎ **Frame size 20, 28, 35mm**



◎ **Frame size 42, 56, 60mm**

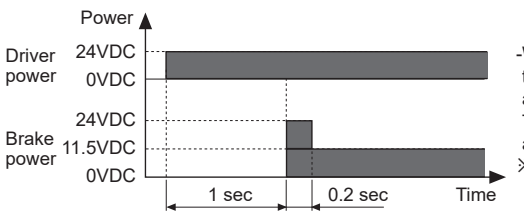




※It is recommended to use Line driver output (corresponding to 26C32) at RECEIVER end of encoder output and terminating resisters (100-150Ω) in parallel at both ends of each phase (A, Ā, B, B̄, Z, Z̄, corresponding to 26C31).

5. Brake output

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

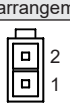


-When supplying power to the driver after connecting the driver and brake, the rated excitation voltage is supplied and the brake power is released after approx. 1 sec.
Then after approx. 0.2 sec, the excitation voltage is decreased to 11.5VDC and the released brake power is maintained.
※While power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

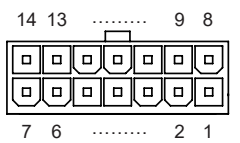
▣ Driver Connectors

◎ Connector function

● CN1: Power connector

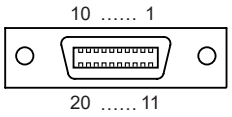
Pin arrangement	Pin no.	Function
	2	GND
	1	24VDC

● CN2: Motor+Encoder Connector

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

▣ Driver Connectors

● CN3: I/O connector

Pin arrangement	Pin no.	Input/ Output	Function	Pin no.	Input/ Output	Function
	1	Input	CW+	11	Output	In-Position+
	2	Input	CW-	12	Output	In-Position-
	3	Input	CCW+	13	Output	Brake+
	4	Input	CCW-	14	Output	Brake-
	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 $\overline{Z}$

◎ Connector specifications

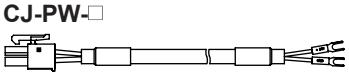
Type			Specifications			Manufacture
			Connector	Connector terminal	Housing	
CN1	Driver		0039301020	—	—	Molex
	Power		CHD1140-02	CTD1140	—	HANLIM
CN2	Driver		35318-1420	—	—	Molex
	Motor+ Encoder	Frame size 20, 28, 35mm	5557-14R	5556T2	—	Molex
		Frame size 42, 56, 60mm		5556T		
CN3	Driver		10220-52A2 PL	—	—	3M
	I/O connector		10120-3000PE	—	10320-52F0-008	3M
			CJ-MP20-HP□ (sold separately)	—	—	Autonics

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

▣ Sold Separately

◎ Power cable

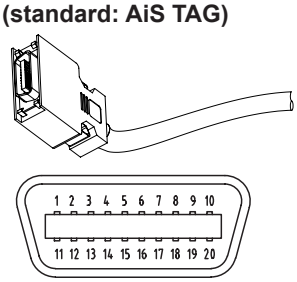
● CJ-PW-□



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

◎ I/O cable

● CJ-MP20-HP□
(standard: AiS TAG)

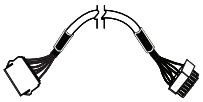


Pin no.	Function (name tag)	Cable color	Dot line color-numbers	Pin no.	Function (name tag)	Cable color	Dot line color-numbers
1	CW+	Yellow	Black-1	11	In-Position+	White	Black-1
2	CW-		Red-1	12	In-Position-		Red-1
3	CCW+		Black-2	13	Brake+		Black-2
4	CCW-		Red-2	14	Brake-		Red-2
5	Servo On/Off+		Black-3	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, 030, 050, 070, 100, 150, 200)
E.g.) CJ-MP20-HP070: 7m I/O cable.

◎ Motor+Encoder cable

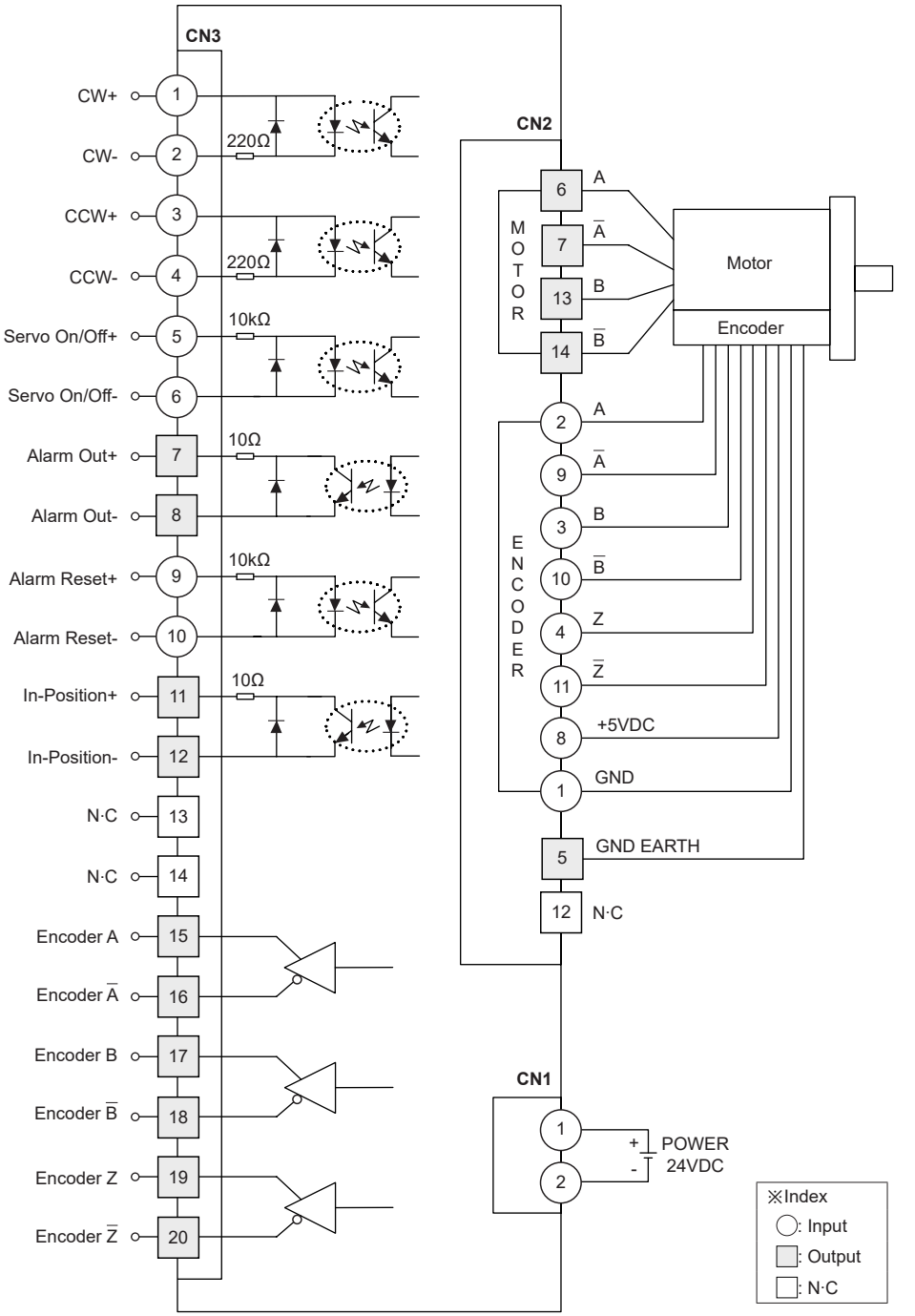
● Normal: C1D14M-□, Moving: C1DF14M-□



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

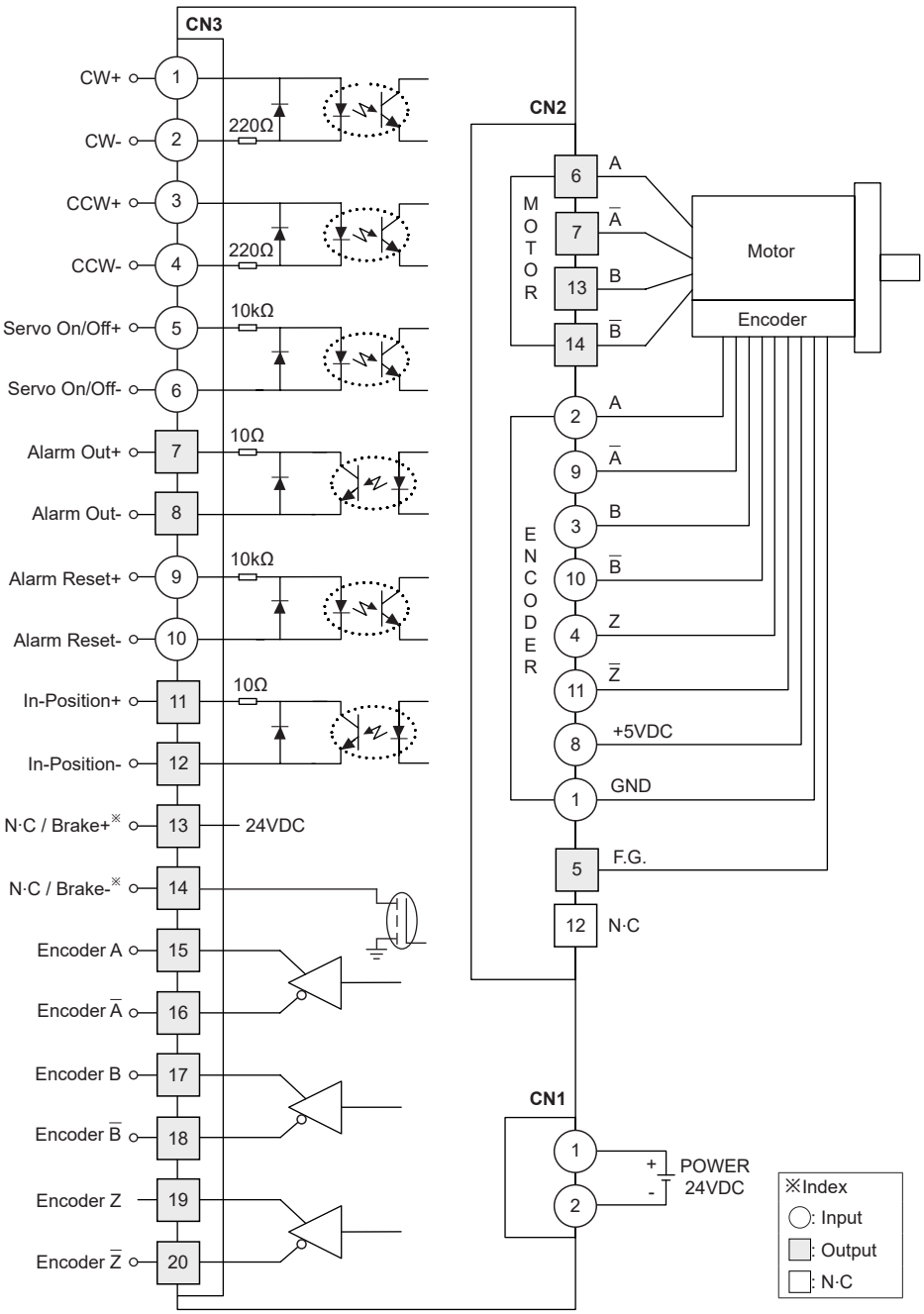
▣ Connection for Motor and Driver

◎ **Standard type, Frame size 20, 28, 35mm**



▣ Connection for Motor and Driver

◎ **Standard / Brake type, Frame size 42, 56, 60mm**



※For standard type, pin 13: N·C
pin 14: N·C
For brake type, pin 13: Brake+
pin 14: Brake-

▣ 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.
- 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.
- 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.
- Use twisted pair (over 0.2mm^2) for the signal cable which should be shorter than 2m.
- 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.
  ①Change motor installation method or attach the damper.
  ②Use 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.
  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 motor
  ⑤Inconsistency 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.
  ①Indoors (in the environment condition rated in 'Specifications')
  ②Altitude max. 2,000m
  ③Pollution degree 2
  ④Installation category II

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.

CE

▣ Applications

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

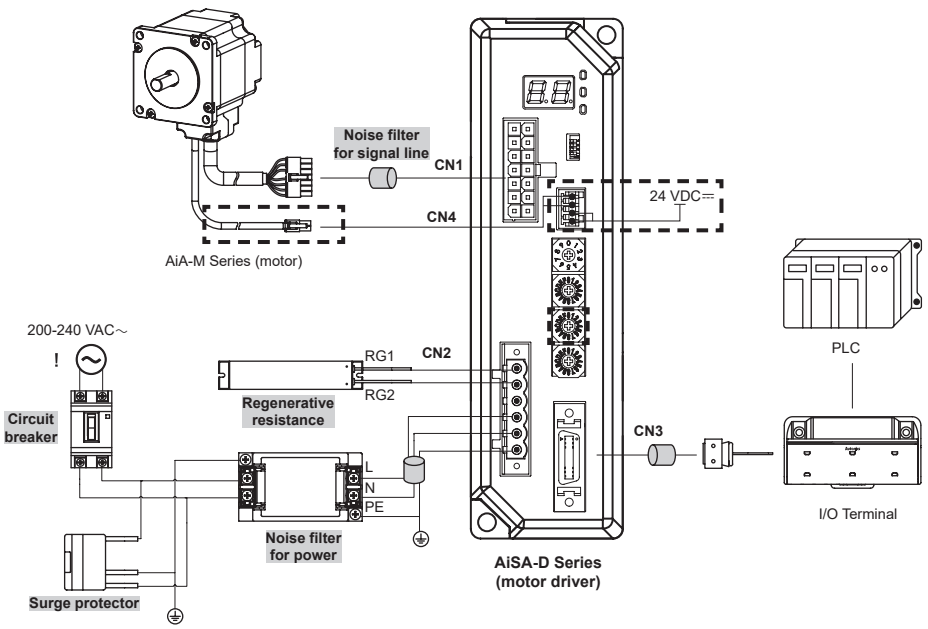
▣ Ordering Information

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
  - **M** 48mm
  - **L** 69mm
- Motor frame size
  - **60** 60×60mm
    - **M** 60mm
    - **L** 75mm
  - **86** 86×86mm
    - **M** 60mm
    - **L** 75mm
- Item
  - **D** Driver
- Power
  - **A** AC Power
- Category
  - **S** **S**tandard
- Series
  - **Ai** **A**rtificial **i**ntelligence

▣ 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.

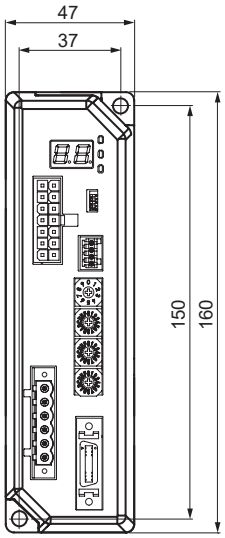
Model	Specification	Manufacture
LT-C12G801W	● Nomial discharge current: 2500A ● Max. discharge current: 5000A ● Voltage protection level: 1.5kV	OTOWA Electric Co. Ltd

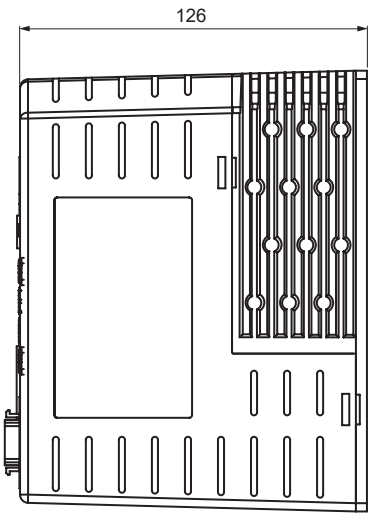
▣ Specifications

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/s^2 (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)			

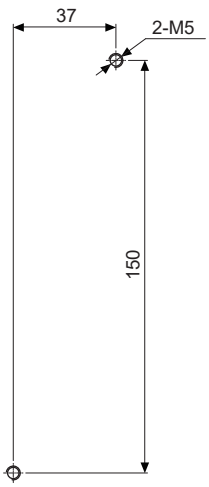
※1: The model name indicates driver type. (none: standard type, B: built-in brake type)
E.g.) AiSA-D-60MA-B: built-in brake type stepping motor driver.
※2: Based on the ambient temperature 25 ℃, ambient humidity 55 %RH, and STOP current 20 %.
※3: RUN current varies depending on the input RUN frequency 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.

▣ Dimensions

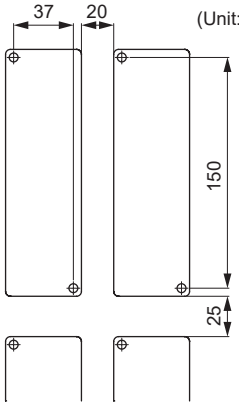




◎ Panel cut-out

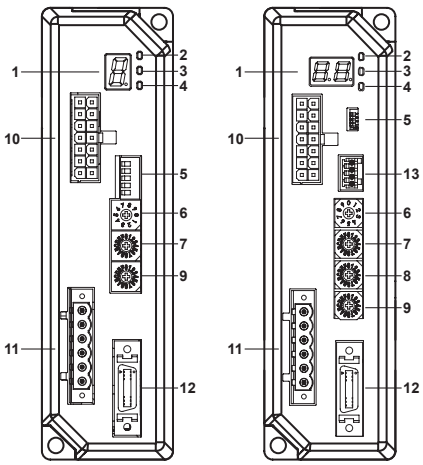


▣ Installation



※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.

▣ Driver Status Indicators

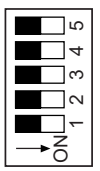
Indicator & Display part	LED color	Function	Descriptions
PWR/ALM	Green	Power indicator	Turns ON when the unit operates normally after supplying power
	Red	Alarm indicator	When alarm occurs, it flashes in various ways depending on the situation. Refer to '▣ **Control Input/Output** → ◎ **Output** → **2. 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.

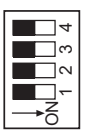
[Standard type]



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.

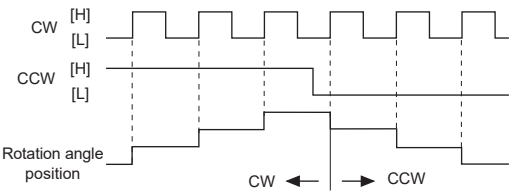
[Built-in brake type]



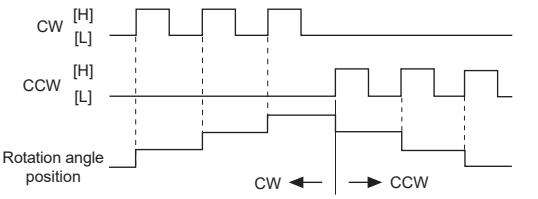
No.	Name	Function	Switch position	
			ON	OFF (factory default)
1	DIR	Rotation direction	CCW	CW
2	1P/2P	Pulse input method	1-Pulse input method	2-Pulse input method
3	GS H/L	Motor GAIN setting	Inertia GAIN	Standard GAIN
4	TM	Torque mode	Torque mode	Standard mode

● 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



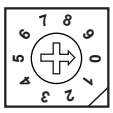
※ [H]: photocoupler ON (voltage of both ends 4-8VDC), [L]: photocoupler OFF (voltage of both ends 0-0.5VDC)

● 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.

◎ 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.


RES

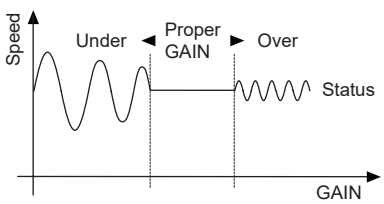
Setting	Pulse/Revolution	Resolution	Setting	Pulse/Revolution	Resolution
0(factory default)	500	2.5	5	3600	18
1	1000	5	6	5000	25
2	1600	8	7	6400	32
3	2000	10	8	7200	36
4	3200	16	9	10000	50

◎ 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.


GAIN

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



◎ 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

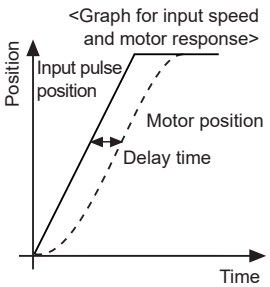
-In standard mode, it sets the delay time between the command position and the motor position.
-It determines the responsiveness of the motor to the command and smoothly follows the speed even if the load changes or disturbance occurs.

● 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.


GAIN

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

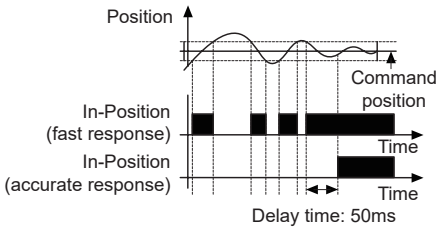


◎ INP: In-Position setting swtich

-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.


INP

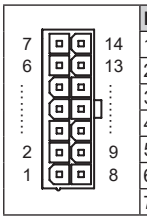
Fast response		Accurate response	
Setting	Value	Setting	Value
0 (factory default)	0	8	0
1	±1	9	±1
2	±2	A	±2
3	±3	B	±3
4	±4	C	±4
5	±5	D	±5
6	±6	E	±6
7	±7	F	±7



▣ Driver Connectors

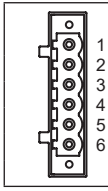
◎ Connector function

● CN1: Motor+Encoder Connector



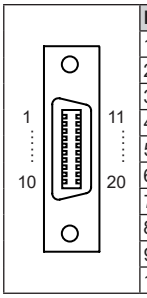
Pin no.	Function	Pin no.	Function
1	GND	8	+5VDC
2	Encoder A	9	Encoder $\overline{A}$
3	Encoder B	10	Encoder $\overline{B}$
4	Encoder Z	11	Encoder $\overline{Z}$
5	PE	12	N·C
6	Motor A	13	Motor B
7	Motor $\overline{A}$	14	Motor $\overline{B}$

● CN2: Power connector



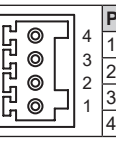
Pin no.	Function
1	Regenerative resistance
2	
3	N·C
4	Power
5	
6	PE

● 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

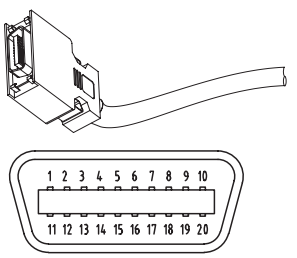
※Above connectors are suitable for AiSA-D Series.

▣ 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)

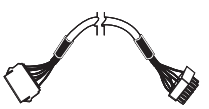


Pin no.	Function (name tag)	Cable color	Dot line color-numbers	Pin no.	Function (name tag)	Cable color	Dot line color-numbers
1	CW+	Yellow	Black-1	11	In-Position+	White	Black-1
2	CW-		Red-1	12	In-Position-		Red-1
3	CCW+		Black-2	13	—		Black-2
4	CCW-		Red-2	14	—		Red-2
5	Servo On/Off+		Black-3	15	Encoder 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.

▣ 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]

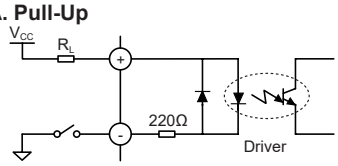
● Input pulse (CW, CCW)

-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.

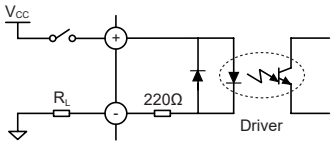
※$R_L = \frac{V_{CC} - 2.17V}{0.011A} - 220\Omega$

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

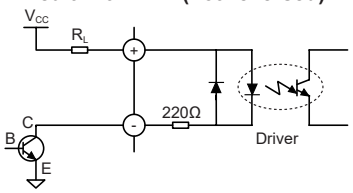
A. Pull-Up



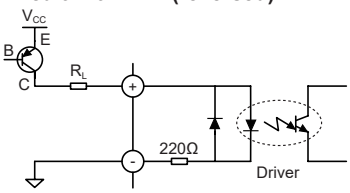
B. Pull-Down



C. Circuit with NPN (not-reversed)

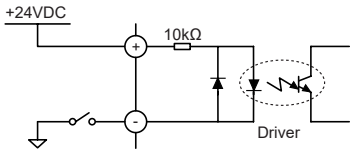


D. Circuit with PNP (reversed)

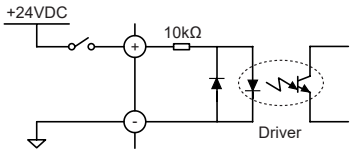


● External input (Servo On/Off, Alarm Reset)

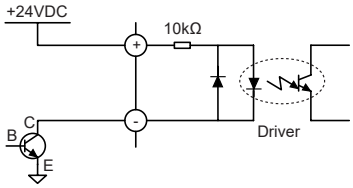
A. Pull-Up



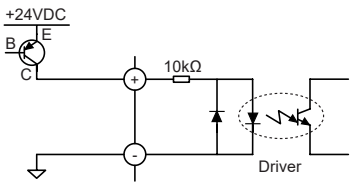
B. Pull-Down



C. Circuit with NPN (not-reversed)



D. Circuit with PNP (reversed)



[Built-in brake type]

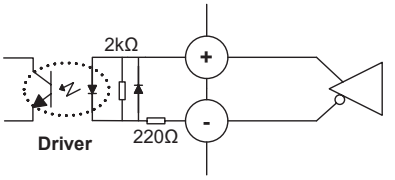
● Input pulse (CW, CCW)

-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.

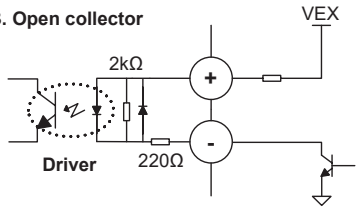
$$※R_L = \frac{V_{EX}-2.17V}{0.011A} - 220Ω$$

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

A. Differential line driver



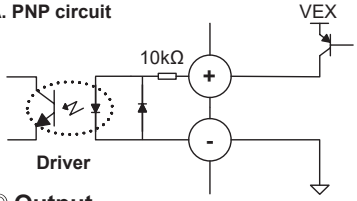
B. Open collector



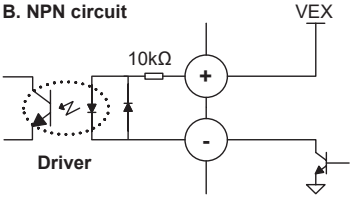
● External Input (Servo On/Off, Alarm Reset)

-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**'.

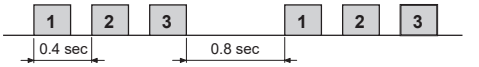
● Alarm/Status display

-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	O	X
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		
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>



3. Example of output circuit connection

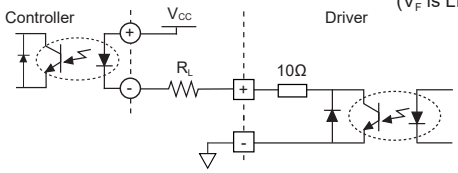
[Standard type]

-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.

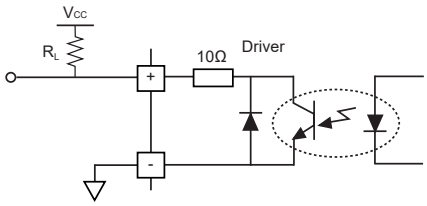
※A: $R_L = \frac{V_{CC}-0.3V-V_F}{0.025A} - 10\Omega$ ※B, C: $R_L = \frac{V_{CC}-0.3V}{0.025A} - 10\Omega$

(V_F is LED forward voltage of primary photocoupler.)

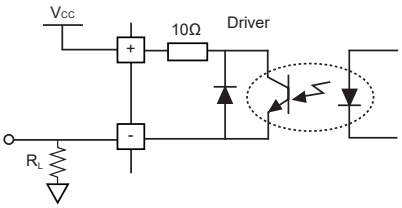
A. Circuit with photocoupler



B. Circuit with pull up (reversed)



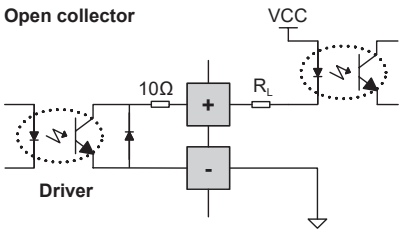
C. Circuit with pull down (not-reversed)



[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.

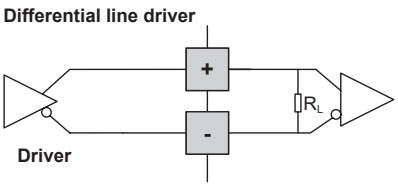


※$R_L = \frac{V_{CC}-0.7V-V_F}{0.01A} - 10\Omega$

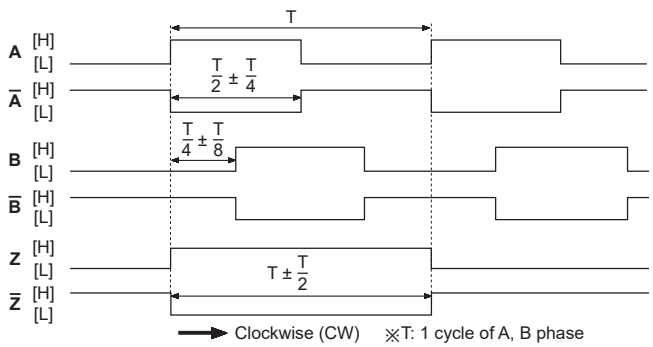
V_F: LED forward voltage of primary photocoupler

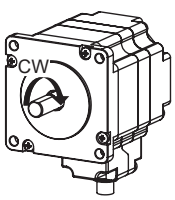
● Encoder output signal circuit

-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.



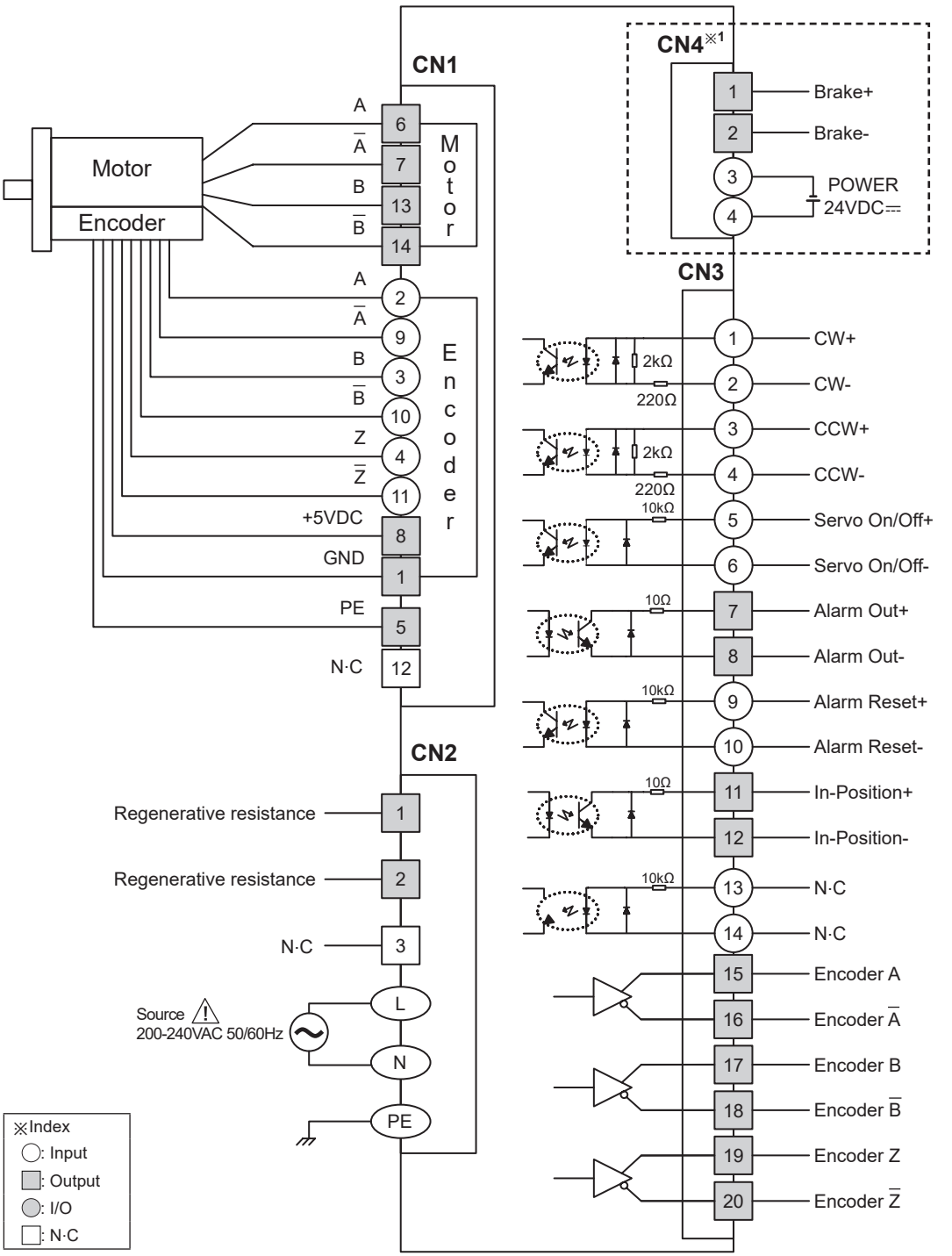
4. Encoder output waveforms





※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).

▣ Connection for Motor and Driver



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

▣ 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.

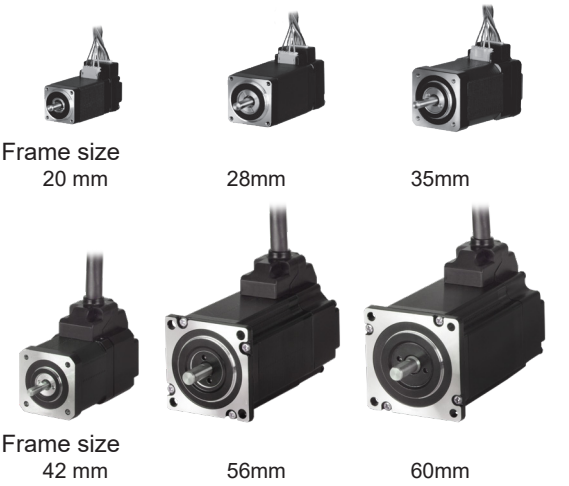
▣ Proper Usage

- 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

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 | 42 mm | 56mm | 60mm

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

▣ Ordering Information

Ai - **M** - **42** **L** **A**

Encoder resolution	**A**※1	4,000PPR(1,000PPR×4-multiply)	
	B※2	16,000PPR(4,000PPR×4-multiply)	
	A※3	10,000PPR(2,500PPR×4-multiply)	
Motor length			
Motor frame size	**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.

▣ 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·cm^2 (2×10^{-7}kg·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·cm^2 (9×10^{-7}kg·m^2)	12g·cm^2 (12×10^{-7}kg·m^2)	18g·cm^2 (18×10^{-7}kg·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·cm^2 (8×10^{-7}kg·m^2)	14g·cm^2 (14×10^{-7}kg·m^2)	22g·cm^2 (22×10^{-7}kg·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·cm^2 (35×10^{-7}kg·m^2)	54g·cm^2 (54×10^{-7}kg·m^2)	77g·cm^2 (77×10^{-7}kg·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·cm^2 (140×10^{-7}kg·m^2)	280g·cm^2 (280×10^{-7}kg·m^2)	480g·cm^2 (480×10^{-7}kg·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·cm^2 (240×10^{-7}kg·m^2)	490g·cm^2 (490×10^{-7}kg·m^2)	690g·cm^2 (690×10^{-7}kg·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.

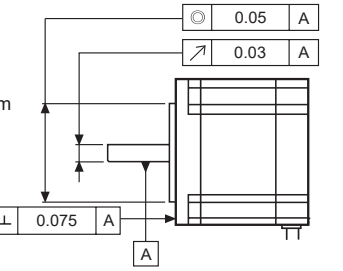
▣ Specifications

• 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		CE
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.

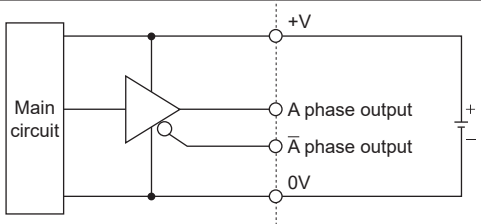
• Frame size 42, 56, 60mm

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)

■ Encoder Control Output Diagram

Line driver output

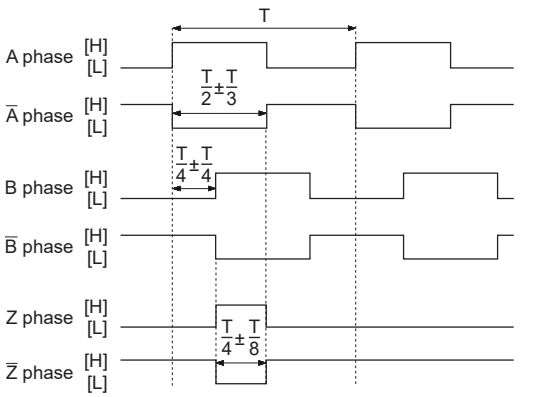
Rotary encoder circuit	Load connection

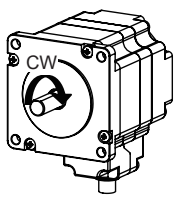


※All output circuits of A, Ā, B, B̄, Z, Z̄ phase are the same.

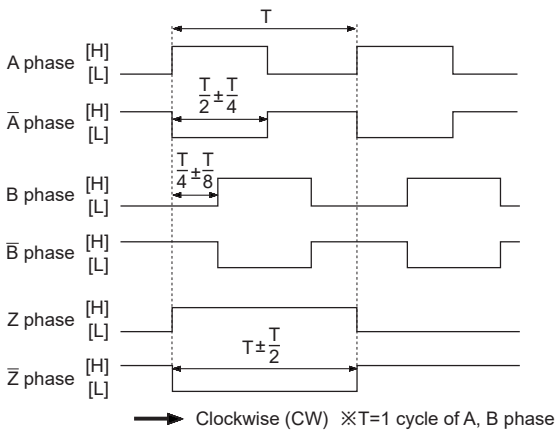
■ Encoder Output Waveforms

◎ Frame size 20, 28, 35mm



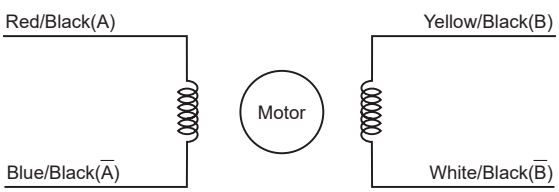


◎ Frame size 42, 56, 60mm



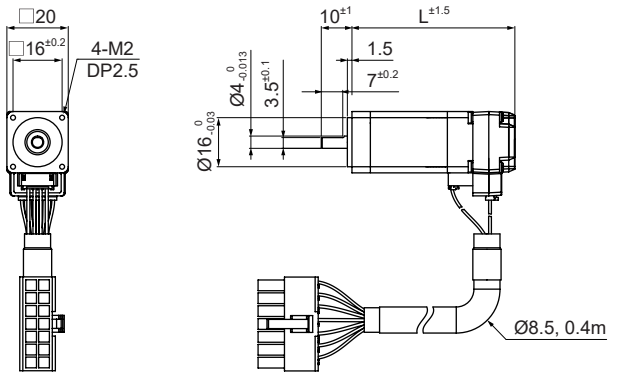
■ Connection Diagram

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



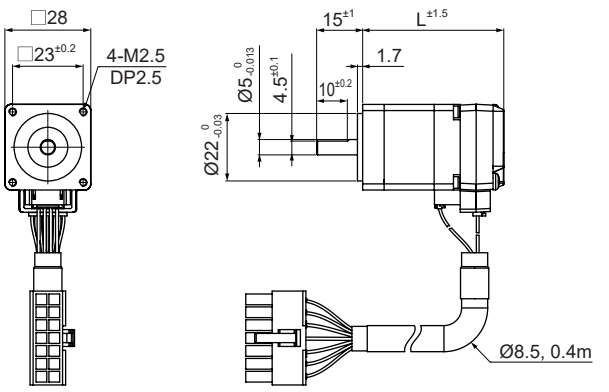
▣ Dimensions

◎ Frame size 20mm



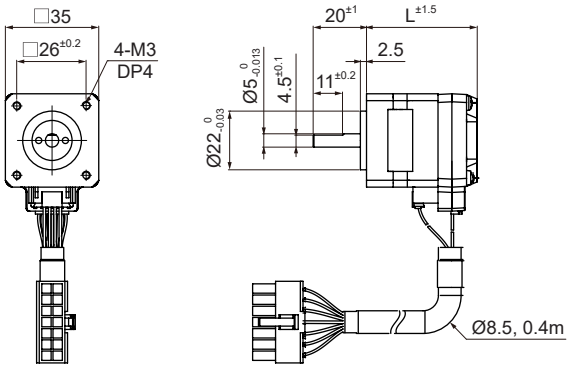
Model	L
Ai-M-20MA	41.2
Ai-M-20LA	53.1

◎ Frame size 28mm



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

◎ Frame size 35mm

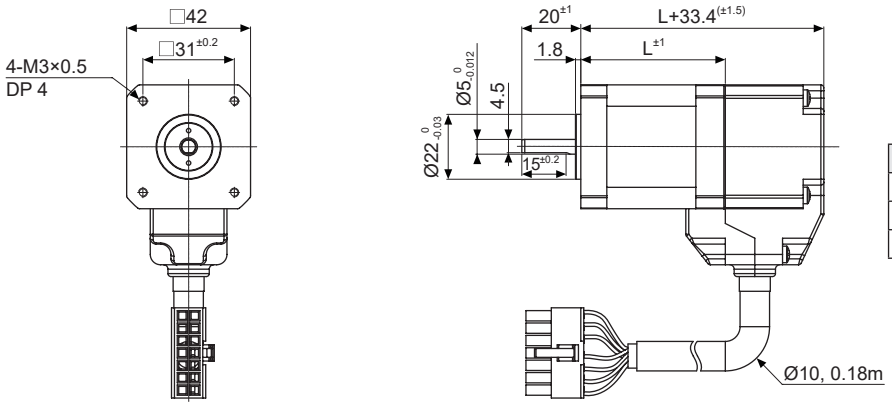


Model	L
Ai-M-35SB	41.5
Ai-M-35MB	52
Ai-M-35LB	68.5

▣ Dimensions

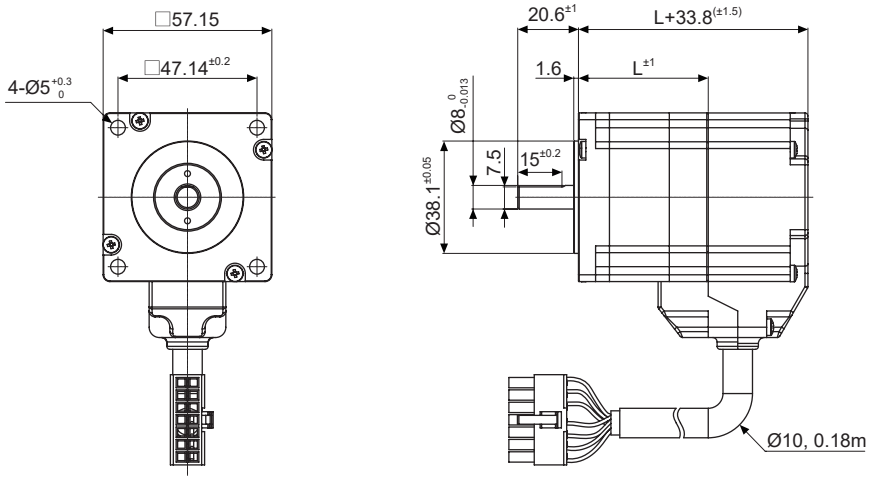
(unit: mm)

◎ Frame size 42mm



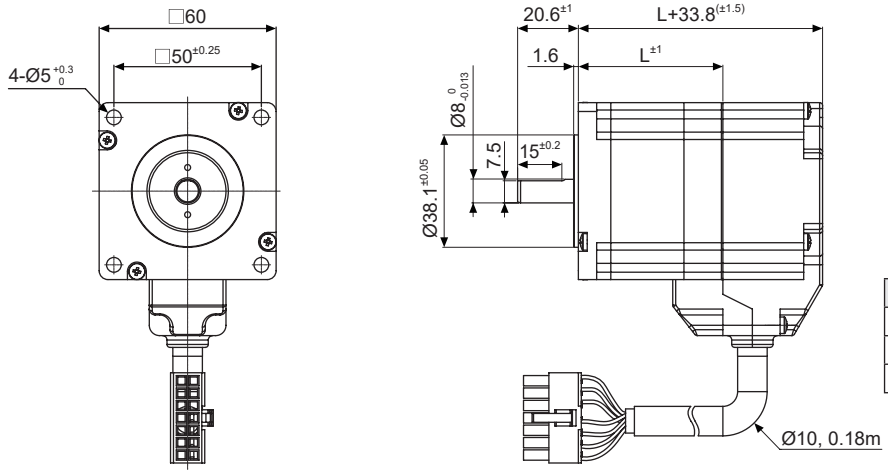
Model	L
Ai-M-42SA	34.1
Ai-M-42MA	40.1
Ai-M-42LA	48.1

◎ Frame size 56mm



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

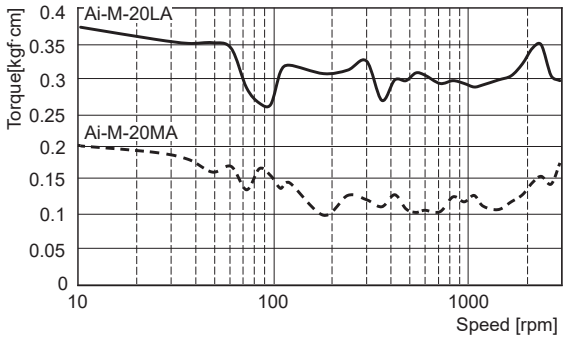
◎ Frame size 60mm



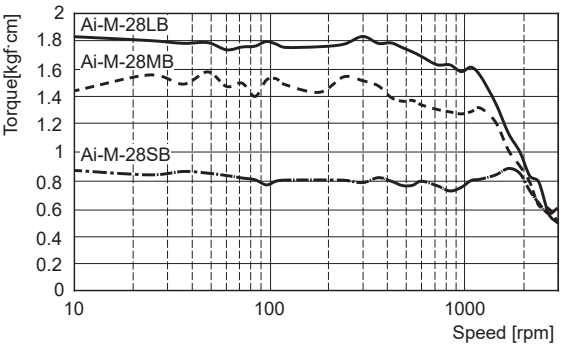
Model	L
Ai-M-60SA	48.1
Ai-M-60MA	69
Ai-M-60LA	86

▣ Motor Characteristics

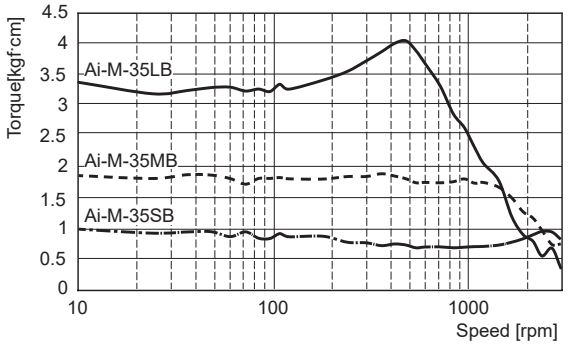
◎ Frame size 20mm



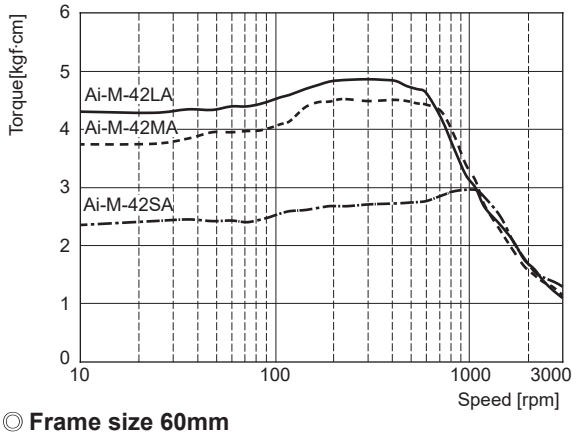
◎ Frame size 28mm



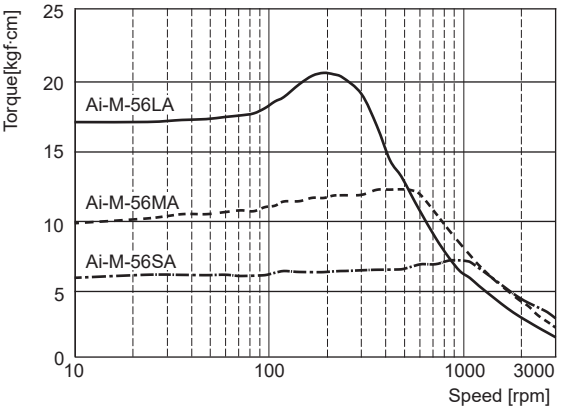
◎ Frame size 35mm



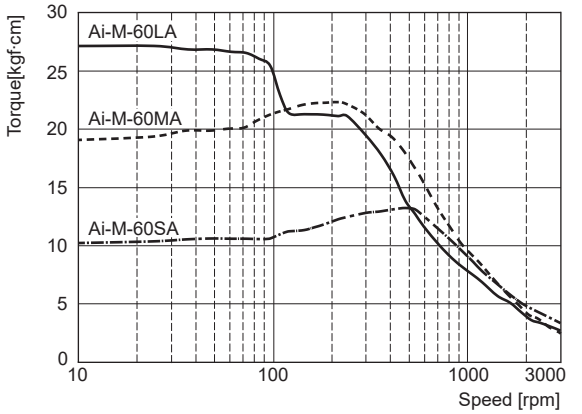
◎ Frame size 42mm



◎ Frame size 56mm

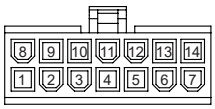


◎ Frame size 60mm



▣ Motor Connectors

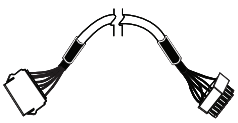
◎ CN2: Motor+Encoder Connector

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

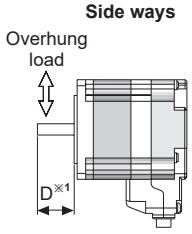
※1: □ indicates cable length (1, 2, 3, 5, 7, 10).
E.g.) C1DF14M-10: 10m moving type motor+encoder cable.

▣ Motor Installation

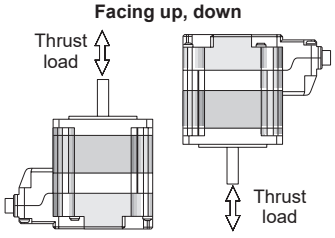
1. Mounting direction

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



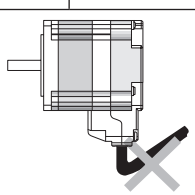
Facing up, down



※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.

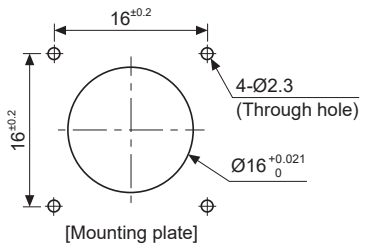


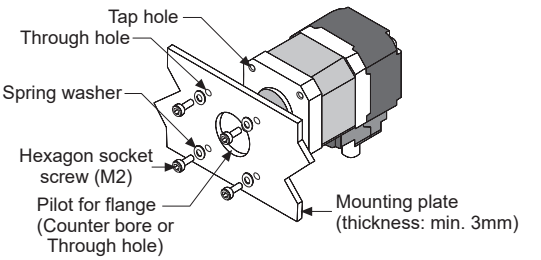
▣ Motor Installation

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.

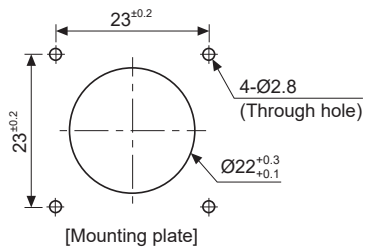
◎ Frame size 20mm

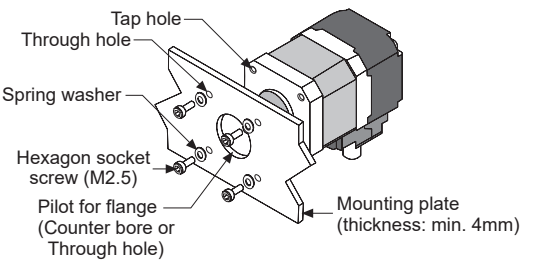




※Do not draw the wire with over strength 5N after wiring the encoder.

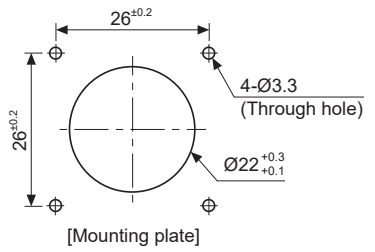
◎ Frame size 28mm

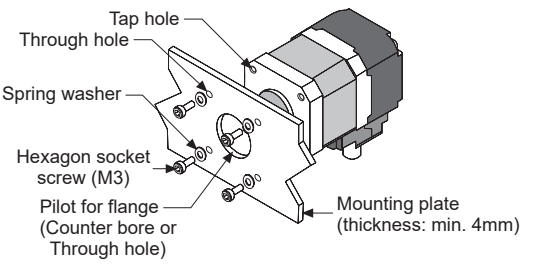




※Do not draw the wire with over strength 5N after wiring the encoder.

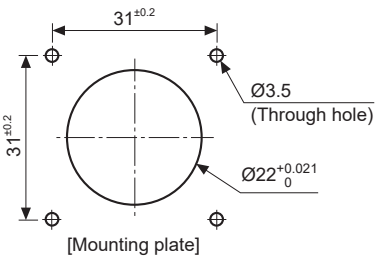
◎ Frame size 35mm

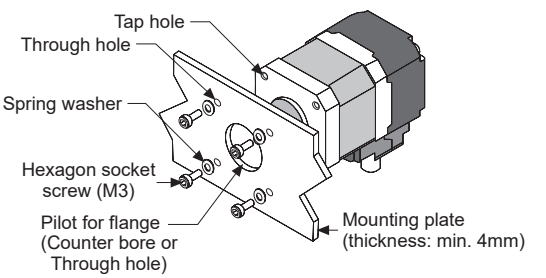




※Do not draw the wire with over strength 5N after wiring the encoder.

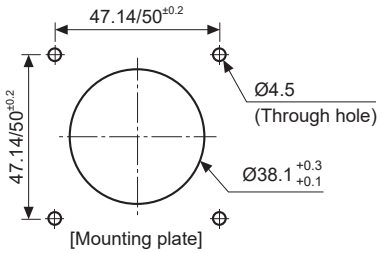
◎ Frame size 42mm

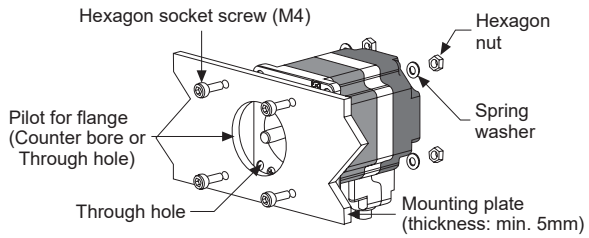


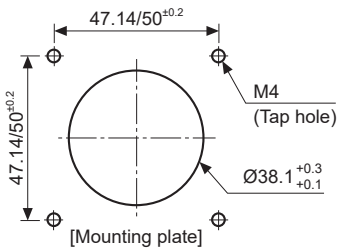


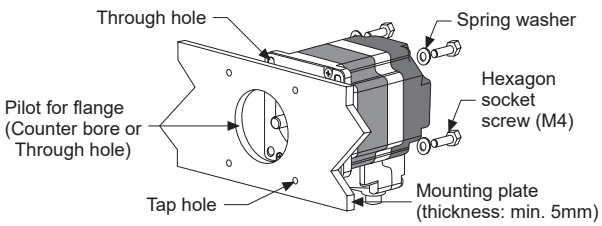
※Do not draw the wire with over strength 30N after wiring the encoder.

◎ Frame size 56mm/60mm





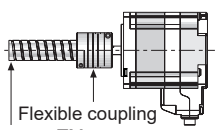
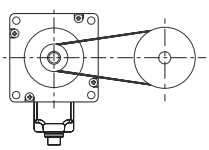
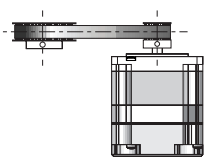




※Do not draw the wire with over strength 30N after wiring the encoder.

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

▣ 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

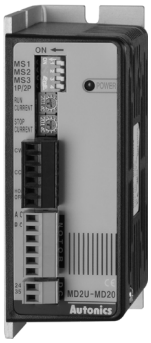
- Follow instructions in 'Proper Usage'.
  Otherwise, it may cause unexpected accidents.
- Using motors at low temperature may cause reducing ball bearing's grease consistency and friction torque is increased.
  Start the motor in a steady manner since motor's torque is not to be influenced.
- If wiring 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

Compact and High-Performance of 2-Phase Stepper Motor Driver

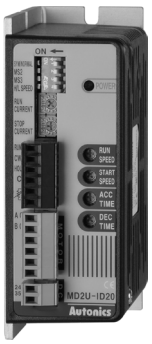
■ Features

- Unipolar constant current drive type
- Enable to brake when it stops by STOP current adjustment
- Low speed and precise control with microstep (MD2U-MD20)
- Insulate using photocoupler to minimize the influence by external noise
- Power supply: 24-35VDC

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



MD2U-MD20



MD2U-ID20

■ Ordering Information

MD 2 U – M D 20

RUN current	20	2A/Phase
Power supply	D	24-35VDC
Step method (resolution)	M	Micro Step (20-division)
	I	Intelligent type
Drive method	U	Unipolar drive
Motor phase	2	2-phase
Item	MD	Motor Driver

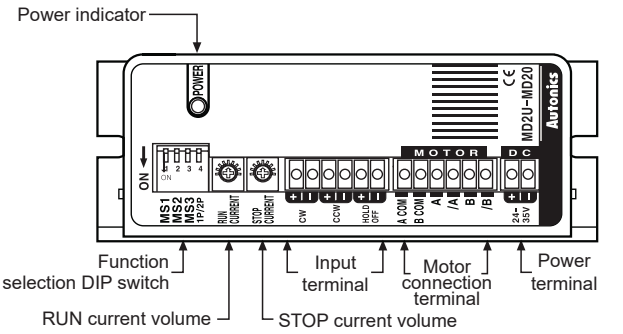
■ Specifications

Model		MD2U-MD20	MD2U-ID20
Power supply※1		24-35VDC⎓	
Allowable voltage range		90 to 110% of the rated voltage	
Max. current consumption※2		3A	
RUN current※3		0.5-2A/Phase	
STOP current		20 to 70% of RUN current (set by STOP current volume)	
Drive method		Unipolar constant current drive type	
Basic step angle		1.8˚/Step	
Max. drive speed		—	1500rpm
Resolution		1, 2, 4, 5, 8, 10, 16, 20-division (1.8˚ to 0.09˚/Step)	
Input pulse characteristic	Input pulse width	Min. 10μs (CW, CCW), min. 1ms (HOLD OFF)	—
	Duty rate	50% (CW, CCW)	
	Rising/Falling time	Max. 0.5μs (CW, CCW)	
	Pulse input voltage	[H]: 4-8VDC⎓, [L]: 0-0.5VDC⎓	
	Max. input current	4mA (CW, CCW), 10mA (HOLD OFF)	
	Max. input pulse freq.※4	Max. 50kHz (CW, CCW)	
Input resistance		300Ω (CW, CCW), 390Ω (HOLD OFF)	3.3kΩ (CW/CCW, RUN/STOP, HOLD OFF)
Insulation resistance		Over 200MΩ (at 500VDC megger, between all terminals and case)	
Dielectric strength		1000VAC 50/60Hz for 1 min (between all terminals and case)	
Noise immunity		±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours	
Shock	Vibration	300m/s² (approx. 30G) 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: 35 to 85%RH	
Approval		CE	
Weight※5		Approx. 295g (approx. 180g)	Approx. 303g (approx. 190g)

※1: Since torque characteristics are improved but the driver temperature rises with the 30VDC power supply, the driver should be installed at the well ventilated environment. Torque is variable by power supply.
※2: Based on the ambient temperature 25℃, ambient humidity 55%RH.
※3: RUN current varies depending on the input RUN frequency, and the max. instantaneous RUN current varies also.
※4: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

2-Phase Micro Stepper Driver [MD2U-MD20]

▣ Unit Descriptions



※Refer to '▣ **Secifications**'.

▣ Functions

◎ Function selection DIP switch

● Microstep, pulse input method setting

No.	Name	Function	Switch position	
			ON	OFF
1	MS1	Microstep setting	(see below)	
2	MS2			
3	MS3			
4	1P/2P	Pulse input method	1-pulse input method	2-pulse input method

MS1	MS2	MS3	Resolution
ON	ON	ON	1 (Full-step)
ON	ON	OFF	2-division
ON	OFF	ON	4-division
ON	OFF	OFF	5-division
OFF	ON	ON	8-division
OFF	ON	OFF	10-division
OFF	OFF	ON	16-division
OFF	OFF	OFF	20-division

● Resolution setting (MS1/MS2/MS3)

- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle(1.8°) of 2-phase stepping motor by set resolution value.

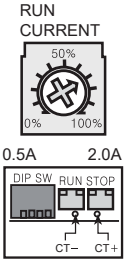
$$\text{E.g.) Set step angle} = \frac{\text{Basic angle (1.8°)}}{\text{Resolution}}$$

※Change resolution setting value only when the motor stops.

● 1P/2P

- The switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

◎ Setting RUN current



- RUN current setting is for the current provided to the motor in running status.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat of the motor is increased.
※Set RUN current properly for the load within the rated current range of the motor.
※RUN current setting range: 0.5 to 2.0A
※RUN current setting method: Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (max. 150rpm)

$$\text{E.g.) Input voltage (3V)} \times \frac{2}{3} = \text{2A (motor excitation current)}$$

※Change RUN current only when the motor stops.

◎ Setting STOP current

- STOP current setting is for the current provided to the motor in stopped status, preventing severe heat of the motor.
- This function is for reducing the heat by variable resistance ratio setting within 0 to 100% of RUN current setting range (actual setting range: 20 to 70%).
  E.g.) In case of RUN current setting value is 2A and
  STOP current setting value is 0% (actual setting range: 20%),
  STOP current 2A × 0.2 = 0.4A

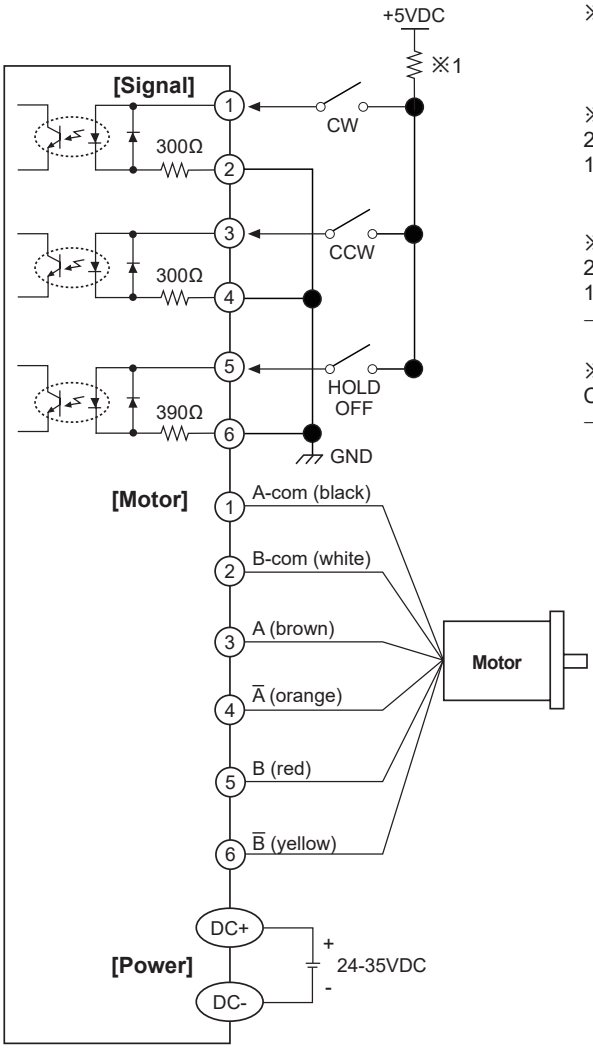
※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set low, the heat of the motor is also low.
※Change STOP current only when the motor stops.

◎ HOLD OFF function

- This signal is for rotating axis of the motor with external force or manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Use this function only when the motor stops.
※Refer to '▣ **I/O Circuit and Connections**'.

▣ I/O Circuit and Connections



※1: If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.
(input power max. 24VDC, input current 10-20mA)

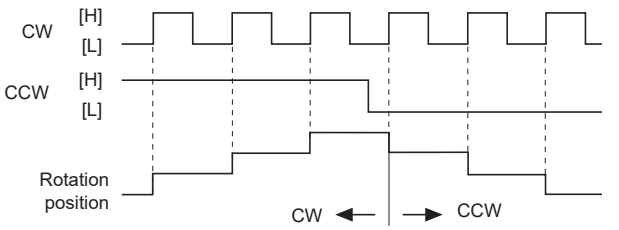
※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

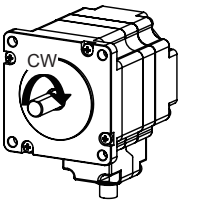
※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→[H]: CW, [L]: CCW

※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

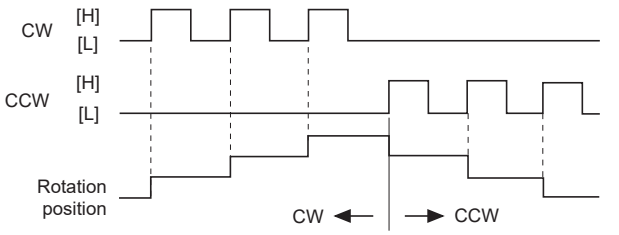
▣ Time Chart

● 1 pulse input method





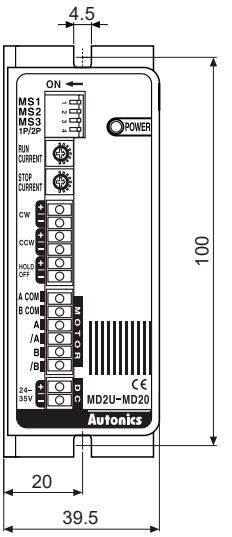
● 2 pulse input method

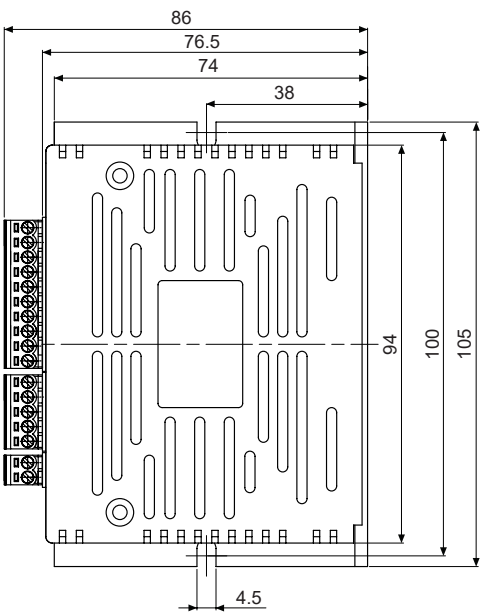


※Do not input CW, CCW signals at the same time in 2-pulse input method.
It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].

▣ Dimensions

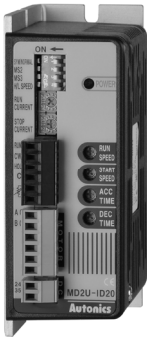
(unit: mm)

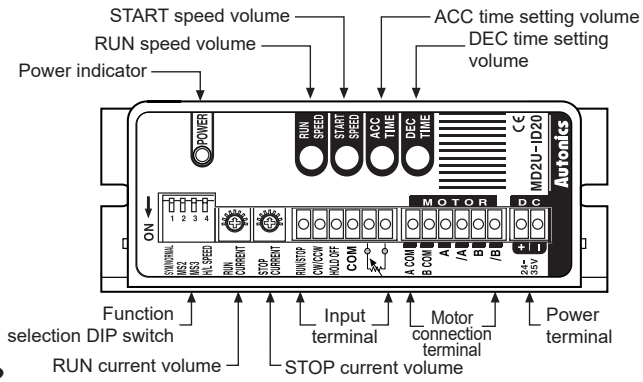




2-Phase Intelligent Stepper Motor Driver [MD2U-ID20]

▣ Unit Descriptions





※Refer to '▣ **Specifications**'.

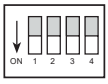
◎ Intelligent type stepper motor driver?

MD2U-ID20 is an intelligent type stepper motor driver including all features to control 2-phase stepper motors so that no controllers are required.

- Realizing AC motor's driving features to stepper motors
- Controlling START speed, RUN speed and ACC/DEC speed
- User-friendly design to realize various functions (front switch and volume)

▣ Functions

◎ Function selection DIP switch

	No.	Name	Function	Switch position	
				ON	OFF
	1	SYM/ NORMAL	SYM/NORMAL	Symmetry	Asymmetry
	2	MS2	Max. speed		
	3	MS3			
	4	H/L SPEED	High/Low speed		

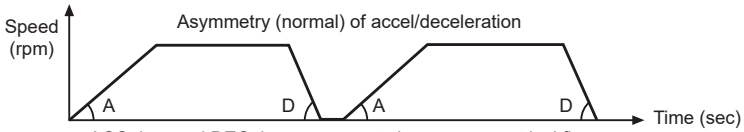
MS2	MS3	H/L SPEED	Max. speed (rpm)
ON	ON	ON: High speed	1500
ON	OFF		1350
OFF	ON		1000
OFF	OFF		500
D※1	D※1	OFF: Low speed	150

※1: D=Don't care

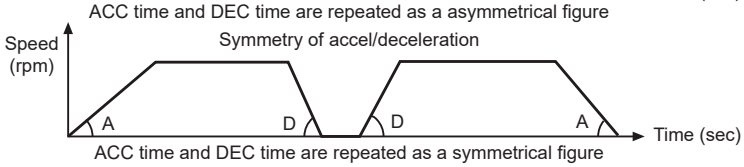
※Reboot the driver after changing function selection switch.

◎ Selection of Symmetry/Asymmetry

※The function to make the ACC/DEC time of run-speed as asymmetry or symmetry using DIP switch No. 1.



ACC time and DEC time are repeated as a asymmetrical figure



ACC time and DEC time are repeated as a symmetrical figure

※It is able to set the gradient (acceleration and deceleration time) as ACC/DEC time.

◎ Selection of max. speed (MS2, MS3)

※The function to select the max. speed of motors.

※The max. speed of stepper motor is changed by MS2/MS3 and Hi/Low speed.

※The features of run and vibration are able to change depending on MS2, MS3.

※Lower the max. speed to run a motor smoothly.

◎ Selection of H/L SPEED

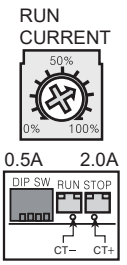
※H/L SPEED mode selection switch

: Accel/deceleration control is not available in Low speed mode since all sections are included in Pull-in range.

※Low speed mode: It is able to drive a motor up to 150rpm of max. drive speed.

※High speed mode: It is able to drive a motor up to 1500rpm of max. drive speed.

◎ Setting RUN current



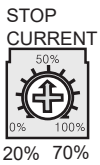
- RUN current setting is for the current provided to the motor in running status.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat of the motor is increased.
※Set RUN current properly for the load within the rated current range of the motor.
※RUN current setting range: 0.5 to 2.0A
※RUN current setting method: Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (max. 150rpm)

E.g.) Input voltage (3V) × $\frac{2}{3}$ = 2A (motor excitation current)

※Change RUN current only when the motor stops.

◎ Setting STOP current

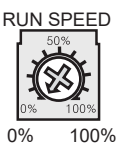


- STOP current setting is for the current provided to the motor in stopped status, preventing severe heat of the motor.
- This function is for reducing the heat by variable resistance ratio setting within 0 to 100% of RUN current setting range (actual setting range: 20 to 70%).

E.g.) In case of RUN current setting value is 2A and
STOP current setting value is 0%(actual setting range: 20%),
STOP current 2A × 0.2 = 0.4A

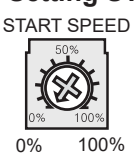
※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set low, the heat of the motor is also low.
※Change STOP current only when the motor stops.

◎ Setting RUN speed



※It sets max. RUN speed.
※Max. RUN speed can be different depending on max. speed setting (MS2, MS3) and driving mode setting (Hi/Low speed).
※Since missing step can occur due to max. input pulse frequency of motors, consider motor type and its RUN current when setting max. RUN speed.
※Set the value only when the motor stops.

◎ Setting START speed



※It sets START speed.
※Max. START speed value is same with RUN speed value.
※Although START speed must be set within max. starting frequency, it is recommended to set up START speed within 0 to 50% for stable driving.
※Set the value only when the motor stops.

◎ Setting ACC time

※It sets the acceleration time from START speed to max. RUN speed.
※Operates in AT_1 operation mode when ACC time is under 33.3%, AT_2 operation mode when ACC time is under 66.6%, and AT_3 operation mode when ACC time is over 66.6%.
※AT_1 is 0.5 sec when RUN speed=100%, START speed=0%.
※AT_2 is 1 sec when RUN speed=100%, START speed=0%.
※AT_3 is 2 sec when RUN speed=100%, START speed=0%.
※Set the value only when the motor stops.

◎ Setting DEC time

※It sets the deceleration time from max. RUN speed to STOP.
※Operates in DT_1 operation mode when DEC time is under 33.3%, DT_2 operation mode when DEC time is under 66.6%, and DT_3 operation mode when DEC time is over 66.6%.
※DT_1 is 0.5 sec when RUN speed=100%, START speed=0%.
※DT_2 is 1 sec when RUN speed=100%, START speed=0%.
※DT_3 is 2 sec when RUN speed=100%, START speed=0%.
※Set the value only when the motor stops.

※ACC Time and DEC Time are declined in proportion to the setting value of START speed.
※The figures above indicate the factory default for each value.

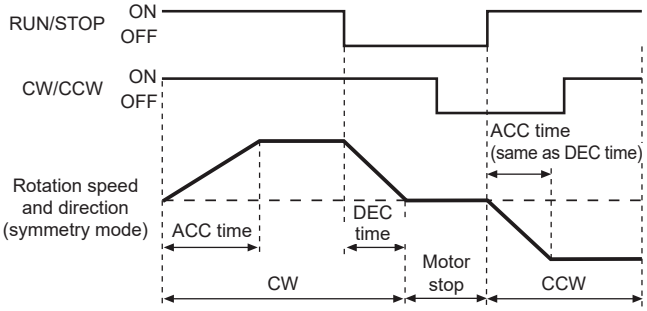
◎ HOLD OFF function

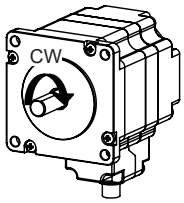
- This signal is for rotating axis of the motor with external force or manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Use this function only when the motor stops.
※Refer to '▣ **I/O Circuit and Connections**'.

▣ Time Chart

◎ High speed mode



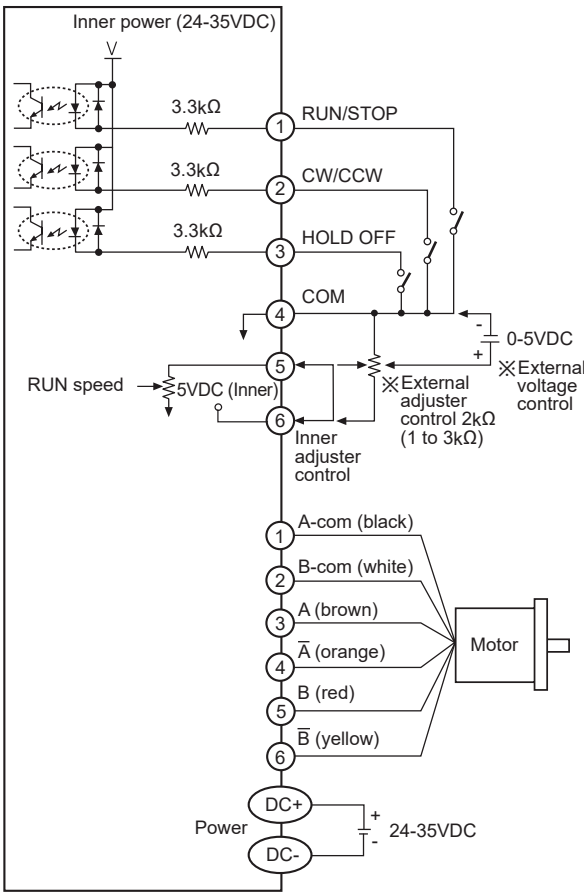


※It accelerates up to RUN speed during ACC time after RUN signal is ON and decelerates during DEC time after it is OFF.
※It is disable to change the direction during the signal is ON.
※It takes 0.5sec for deceleration when DEC time is "0%".

◎ Low speed mode

Max. RUN speed is 150rpm and ACC and DEC time are not available.
It is same with High speed to change RUN/STOP and direction.

▣ I/O Circuit and Connections



※Inner adjuster is correlated to external adjuster control and external voltage control. Make sure that inner adjuster must be set to maximum in order to set maximum RUN speed using external adjuster and external voltage.

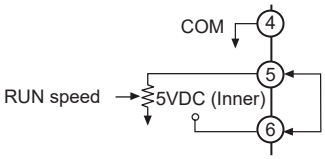
※RUN/STOP signal input
→ [ON]: RUN, [OFF]: STOP

※Direction signal input
→ [ON]: CW, [OFF]: CCW

※HOLD OFF signal iuput
→ [ON]: HOLD OFF, [OFF]: HOLD ON

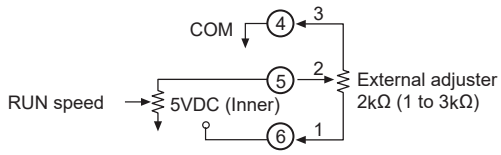
● Inner adjuster control (Adjusting RUN speed with front VR)

Make the connection between terminal No.5 and No.6.



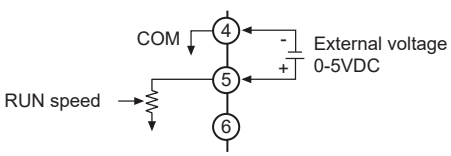
● External adjuster control (Adjusting RUN speed with connecting external variable resistance)

Connect variable resistance 2kΩ (1 to 3kΩ) for external adjuster control. If variable resistance is too low, full range setting might not be possible. Make sure to adjust RUN speed VR to maximum for external adjuster control.



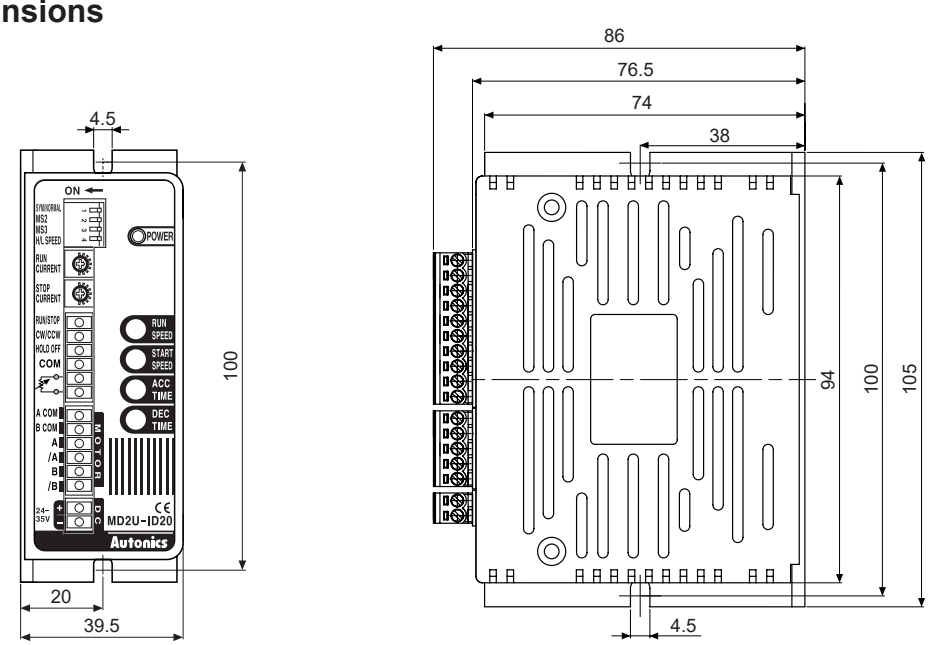
● External voltage control (Adjusting RUN speed with external voltage input)

Make sure to adjust RUN speed VR to maximum external voltage control.



▣ Dimensions

(unit: mm)



▣ Proper Usage

- Follow instructions in 'Proper Usage'. Otherwise, it may cause unexpected accidents.
- 24-35VDC 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.
- When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.
- Set RUN current within the range of motor's rated current depending on the load.
  When the rated motor current is over, the heat may be increased and motor may be damaged.
- If motor stops, switching for STOP current executed by the current down function.
  When hold off signal is [H] or current down function is off, the switching does not execute.
- Use twisted pair (over 0.2mm^2) for the signal cable which should be shorter than 2m.
- 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.
- If the TEST switch is ON, the motor operates immediately and it may be dangerous.
- Do not change any setting switches (function, run/stop current, resolution switches) during the operation or after supplying power.
  Failure to follow this instruction may result in malfunction.
- Motor vibration and noise can occur in specific frequency period
  ①Change motor installation method or attach the damper.
  ②Use the unit out of the dedicated frequence range when vibration and noise occurs due to changing motor RUN speed.
- 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 motor
  ⑤Inconsistency 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.
  ①Indoors (in the environment condition rated in 'Specifications')
  ②Altitude max. 2,000m
  ③Pollution degree 2
  ④Installation category II

Small, Light, High Speed & Torque 5-Phase Stepper Motor Driver

▣ Features

- Bipolar constant pentagon drive method
- Includes auto current down and self-diagnosis function
- Low speed rotation and high accuracy controlling with microstep-driving (MD5-HD14, MD5-HF14, MD5-HF14-AO, MD5-HF28)
  [Max. resolution 250 division: In case of 5-phase stepper motor of which basic step angle is 0.72°, it enables to control up to 0.00288° per pulse and it requires 125,000 pulses per rotation.]
- Photocoupler input insulation method to minimize the effects from external noise

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

(only for MD5-HF14(-AO), MD5-HF28 model)

▣ Ordering Information

MD 5 – H F 14 – □

Output	No mark	Zero point excitation output※1
	AO	Alarm output
RUN current	14	1.4A/Phase
	28	2.8A/Phase
Power supply	D	20-35VDC
	F	100-220VAC
Step type (resolution)	H	Micro step (250-division)
	N	Normal Step
Motor phase	5	5-phase
Item	MD	Motor Driver

※1: Except MD5-ND14

※KR-55MC can be replaced with MD5-HD14.
※KR-5MC can be replaced with MD5-ND14.
※MD5-MF14 can be replaced with MD5-HF14.
※KR-505G can be replaced with MD5-HF28.

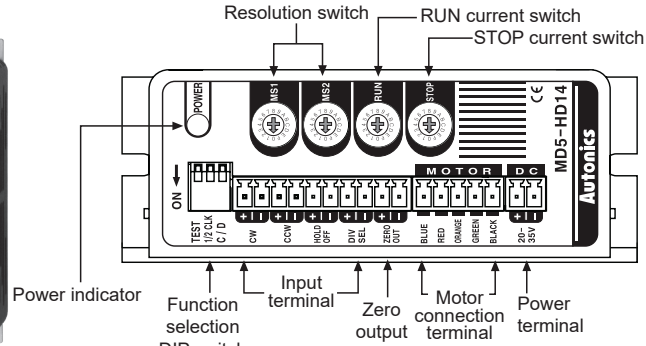
▣ Specifications

Model		MD5-HD14	MD5-HF14	MD5-HF14-AO	MD5-HF28	MD5-ND14
Power supply		20-35VDC⎓※1	100-220VAC～ 50/60Hz			20-35VDC⎓※1
Allowable voltage range		90 to 110% of the rated voltage				
Max. current consumption※2		3A			5A	3A
RUN current※3		0.4-1.4A/Phase			1.0-2.8A/Phase	0.5-1.5A/Phase
STOP current		27 to 90% of RUN current (set by STOP current switch)				25 to 75% of RUN current (set by STOP current volume)
Drive method		Bipolar constant current pentagon drive				
Basic step angle		0.72°/step				
Resolution		1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250-division (0.72° to 0.00288°/Step)				1, 2-division (0.72°, 0.36°/step)
Input pulse characteristic	Pulse width	Min. 1μs (CW, CCW), Min. 1ms (HOLD OFF)				Min. 10μs (CW, CCW), Min. 1ms (HOLD OFF)
	Duty rate	50% (CW, CCW)				
	Rising/Falling time	Below 130ns (CW, CCW)				
	Pulse input voltage	[H]: 4-8VDC⎓, [L]: 0-0.5VDC				
	Pulse input current	7.5-14mA (CW, CCW), 10-16mA (HOLD OFF, DIVISION SELECTION, ZERO OUT)※4				
	Max. input pulse frequency※5	Max. 500kHz (CW, CCW)				Max. 50kHz (CW, CCW)
Input resistance		270Ω (CW, CCW), 390Ω (HOLD OFF, DIVISION SELECTION), 10Ω (ZERO OUT)		270Ω (CW, CCW), 390Ω (HOLD OFF), 10Ω (ALARM)	270Ω (CW, CCW), 390Ω (HOLD OFF, DIVISION SELECTION), 10Ω (ZERO OUT)	390Ω (CW, CCW, HOLD OFF)
Insulation resistance		Over 100MΩ (at 500VDC megger, between all terminals and case)				
Dielectric strength		1000VAC 50/60Hz for 1min (between all terminals and case)				
Noise immunity		±500V the square wave noise (pulse width: 1μs) by the noise simulator	±2kV the square wave noise (pulse width: 1μs) by the noise simulator			±500V the square wave noise (pulse width: 1μs) by the noise simulator
Vibration	Mechanical	1.5mm amplitude at frequency 5 to 60Hz (for 1 min) in each X, Y, Z direction for 2 hours				
	Malfunction	1.5mm amplitude at frequency 5 to 60Hz (for 1 min) in each X, Y, Z direction for 10 min				
Environment	Ambient temp.	0 to 40℃, storage: -10 to 60℃	0 to 50℃, storage: -10 to 60℃			0 to 40℃, storage: -10 to 60℃
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH				
Approval		CE	CE cULus	CE cULus	CE cULus	CE
Weight※6		Approx. 327.5g (approx. 220g)	Approx. 840g (approx. 680g)	Approx. 820g (approx. 660g)	Approx. 1.35kg (approx. 1.2kg)	Approx. 183g (approx. 130g)

※1: When using over 30VDC power supply, torque characteristics are improved but the driver temperature raise. The unit should be installed at the well ventilation environment.
※2: Based on ambient temperature 25℃, ambient humidity 55%RH.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also varies depending on the load.
※4: In case of MD5-HF14-AO, MD5-ND14, there are no DIVISION SELECTION, ZERO OUT function.
※5: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.
※6: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

5-Phase Micro Stepper Motor Driver [MD5-HD14]

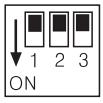
▣ Unit Description



※Refer to '▣ **Specifications**'.

▣ Functions

◎ Function selection DIP switch



No.	Name	Function	Switch position	
			ON	OFF (default)
1	TEST	Self diagnosis function	30rpm rotation	Not use
2	1/2 CLK	Pulse input method	1-pulse input method	2-pulse input method
3	C/D	Auto current down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 1/2 CLK

- 1/2 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

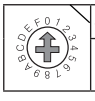
◎ Setting RUN current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- Setting RUN current is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ Setting STOP current

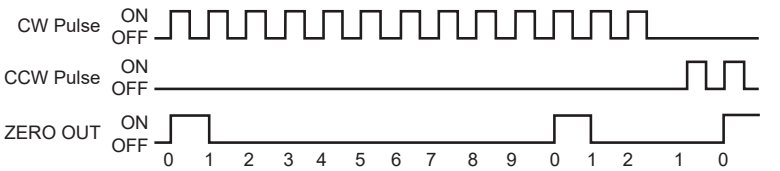


Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- Setting STOP current is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ Zero point excitation output signal (ZERO OUT)



- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis.
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
  (50 outputs per 1 rotation of the motor.)
  E.g.) Full step: outputs one time by 10 pulses input, 20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to '■ **I/O Circuit and Connections**'.

◎ Setting Microstep (microstep: resolution)

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

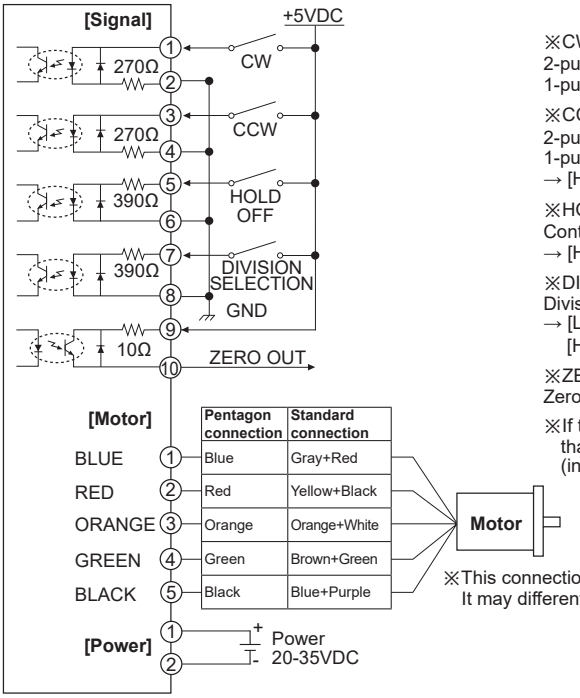
- **Setting Resolution (same as MS1, MS2)**
- The MS1, MS2 switches is for resolution setting.
- Select MS2 or MS2 by DIVISION SELECTION signal ([L]: MS1, [H]: MS2)
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as below.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear
  E.g) 0.72° / 10 (1:10) = 0.072°

※Must stop the motor before changing the resolution.

■ I/O Circuit and Connections



Pentagon connection	Standard connection
Blue	Gray+Red
Red	Yellow+Black
Orange	Orange+White
Green	Brown+Green
Black	Blue+Purple

※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

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

※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

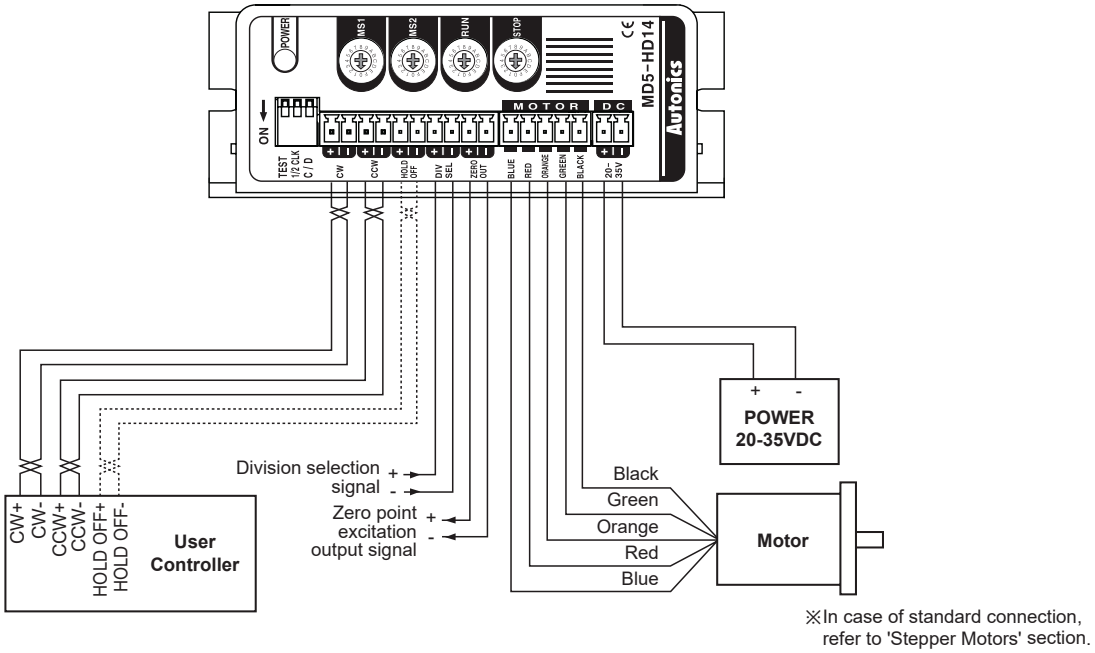
※DIVISION SELECTION
Division selection signal
→ [L]: Operated by MS1 setting resolution
[H]: Operated by MS2 setting resolution

※ZERO OUT
Zero point excitation output signal → Zero point status ON

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input power max. 24VDC, input current 10-20mA)

※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

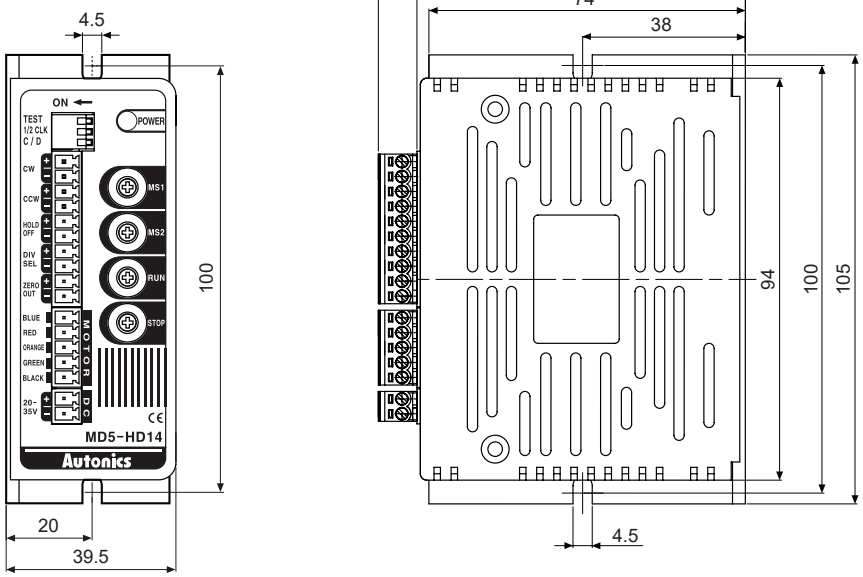
▣ Connections



※In case of standard connection, refer to 'Stepper Motors' section.

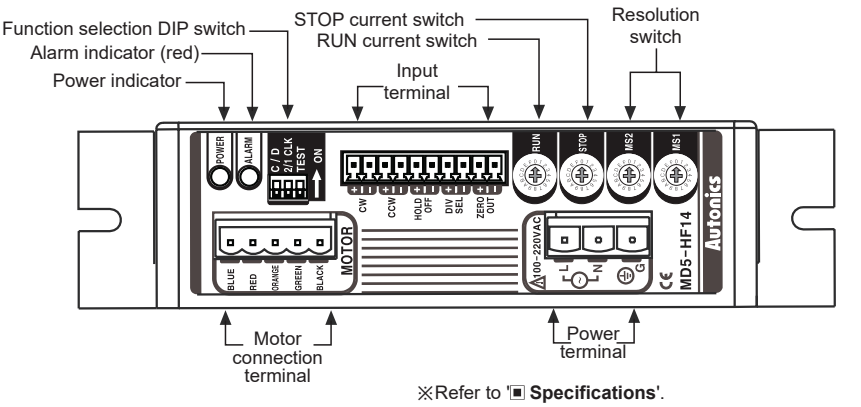
▣ Dimensions

(unit: mm)



5-Phase Micro Stepper Motor Driver [MD5-HF14]

▣ Unit Description



※Refer to '▣ **Specifications**'.

▣ Functions

◎ Function selection DIP switch

No.	Name	Function	Switch position	
			ON	OFF (default)
1	TEST	Self diagnosis function	30rpm rotation	Not use
2	2/1 CLK	Pulse input method	1-pulse input method	2-pulse input method
3	C/D	Auto current down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 2/1 CLK

- 2/1 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

◎ Setting RUN current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- Setting RUN current is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

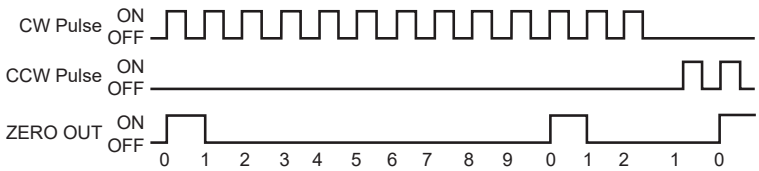
◎ Setting STOP current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- Setting STOP current is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ Zero point excitation output signal (ZERO OUT)



- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis .
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
  (50 outputs per 1 rotation of the motor.)
  E.g.) Full step: outputs one time by 10 pulses input, 20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to '■ **I/O Circuit and Connections**'.

◎ Setting Microstep (microstep: resolution)

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

- **Setting Resolution (same as MS1, MS2)**
- The MS1, MS2 switches is for resolution setting.
- Select MS2 or MS2 by DIVISION SELECTION signal ([L]: MS1, [H]: MS2)
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as follow.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear
  E.g) 0.72° / 10 (1:10) = 0.072°

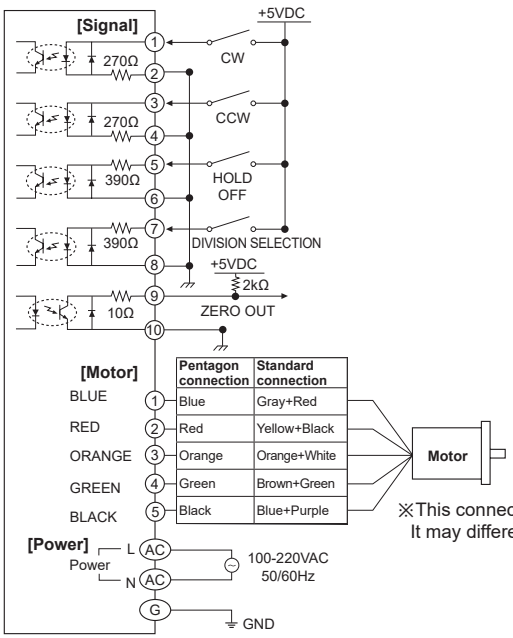
※Must stop the motor before changing the resolution.

◎ Alarm indication

- Overheat: When the temperature of driver base is over 80℃, the alarm indicator (red) turns ON and motor stops with holding the excision.
- Overcurrent: When overcurrent occurs due to motor damage by burn, driver damage, or error, the alarm indicator (red) turns ON and the motor becomes HOLD OFF.

※Turn OFF the power and remove the causes of alarm. Re-supply the power and the alarm indicator turns OFF and the driver is normal operation.

■ I/O Circuit and Connections

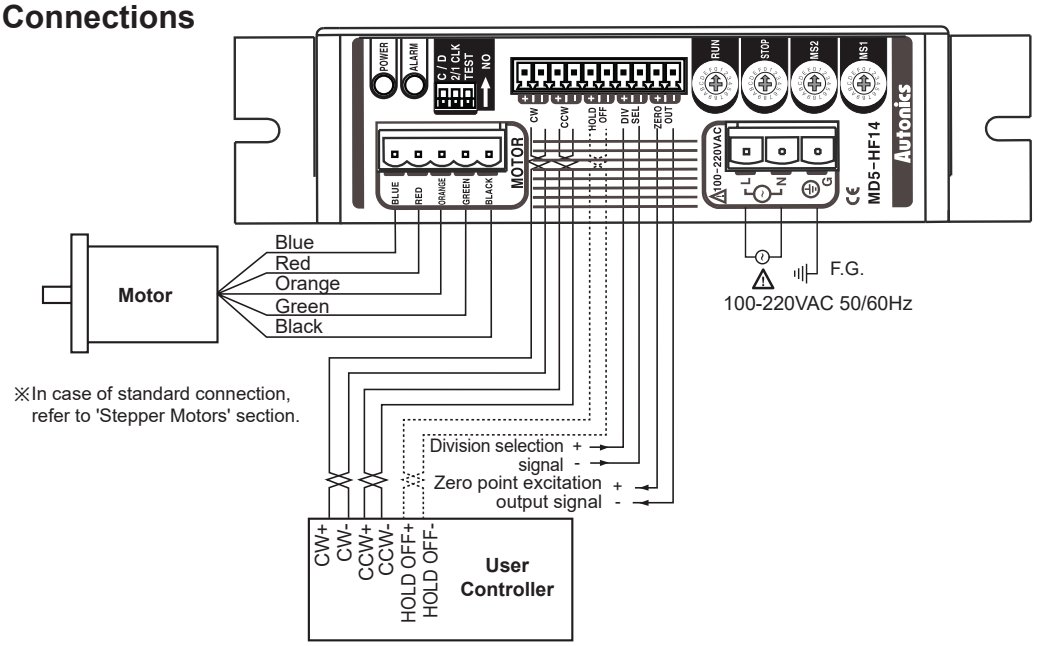


※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)
※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF
※DIVISION SELECTION
Division selection signal
→ [L]: Operated by switch MS1
[H]: Operated by switch MS2
※ZERO OUT
Zero point excitation output signal → Zero point status ON

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input power max. 24VDC, input current 10-20mA)

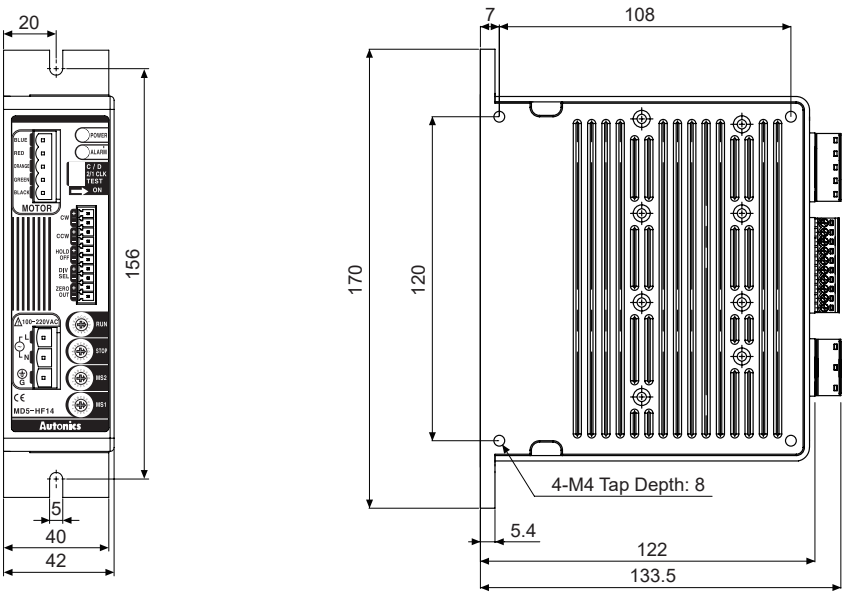
※This connection cable color is only for Autonics motors. It may different cable color when using other motors.

▣ Connections



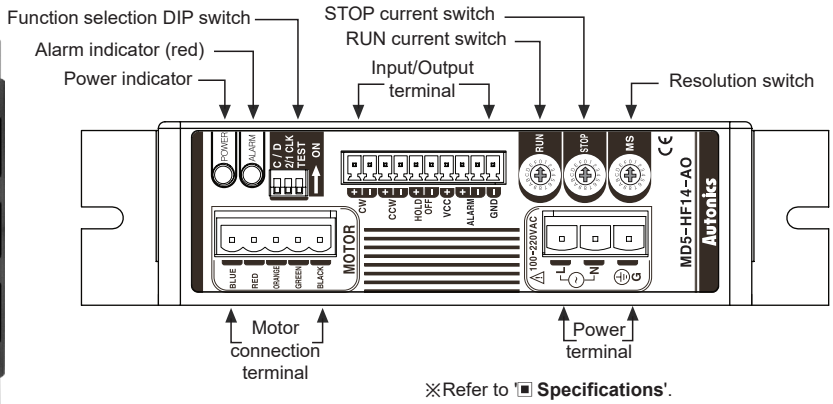
▣ Dimensions

(unit: mm)



5-Phase Micro Stepper Motor Driver [MD5-HF14-AO]

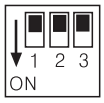
▣ Unit Description



※Refer to '▣ **Specifications**'.

▣ Functions

◎ Function selection DIP switch



No.	Name	Function	Switch position	
			ON	OFF (default)
1	TEST	Self diagnosis function	30rpm rotation	Not use
2	2/1 CLK	Pulse input method	1-pulse input method	2-pulse input method
3	C/D	Auto current down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 2/1 CLK

- 2/1 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

◎ Setting RUN current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- Setting RUN current is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ Setting STOP current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- Setting STOP current is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.

E.g.) Set RUN current as 1.4A and STOP current as 40%.
STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to '■ **I/O Circuit and Connections**'.

◎ Setting Microstep (microstep: resolution)

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

● Setting Resolution (MS1)

- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as below.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear
  E.g) 0.72° / 10 (1:10) = 0.072°

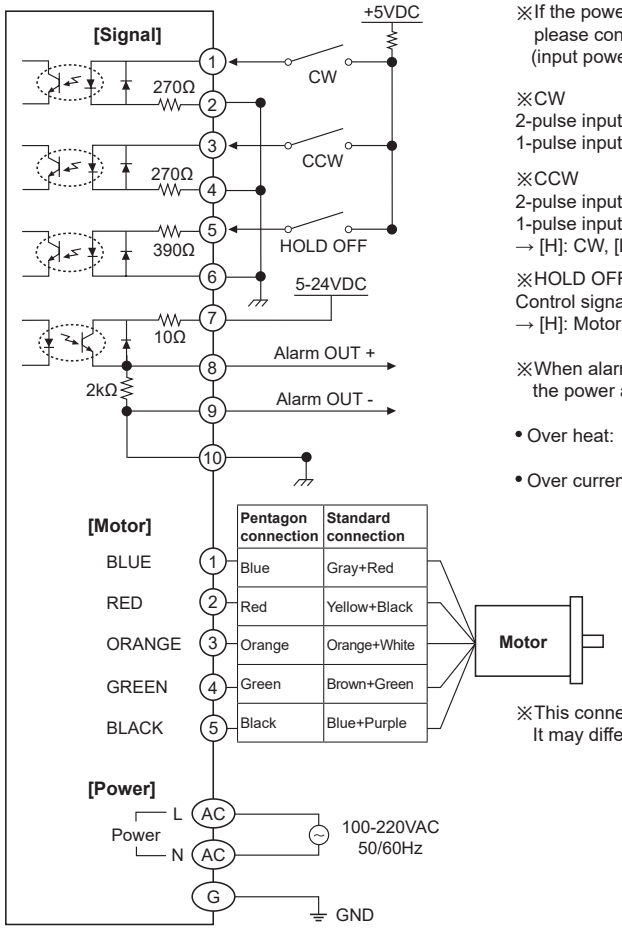
※Must stop the motor before changing the resolution.

◎ Alarm indication/output

- Overheat: When the temperature of driver base is over 80℃, the alarm indicator (red) turns ON and motor stops and alarm output turns ON with holding the excision.
- Overcurrent: When overcurrent occurs due to motor damage by burn, driver damage, or error, the alarm indicator (red) turns ON and alarm output turns ON. The motor becomes HOLD OFF.

※Turn OFF the power and remove the causes of alarm. Re-supply the power and the alarm indicator turns OFF and alarm output turns OFF. The driver is normal operation.

■ I/O Circuit and Connections



※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.
(input power max. 24VDC, input current 10-24mA)

※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

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

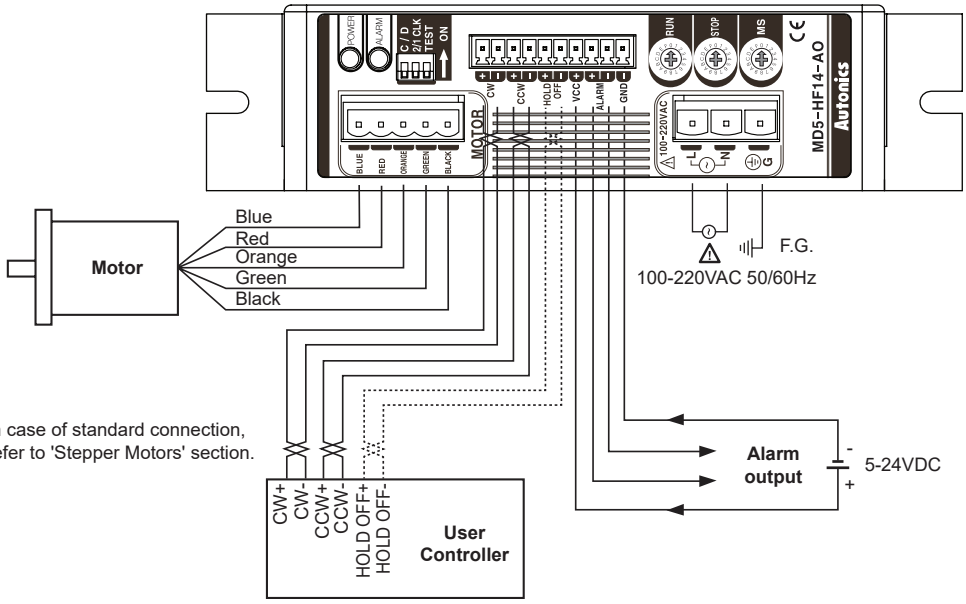
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

※When alarm occurs, the motor becomes HOLD OFF. Turn OFF the power and remove the causes to normal operation.

- Over heat:
- Over current:

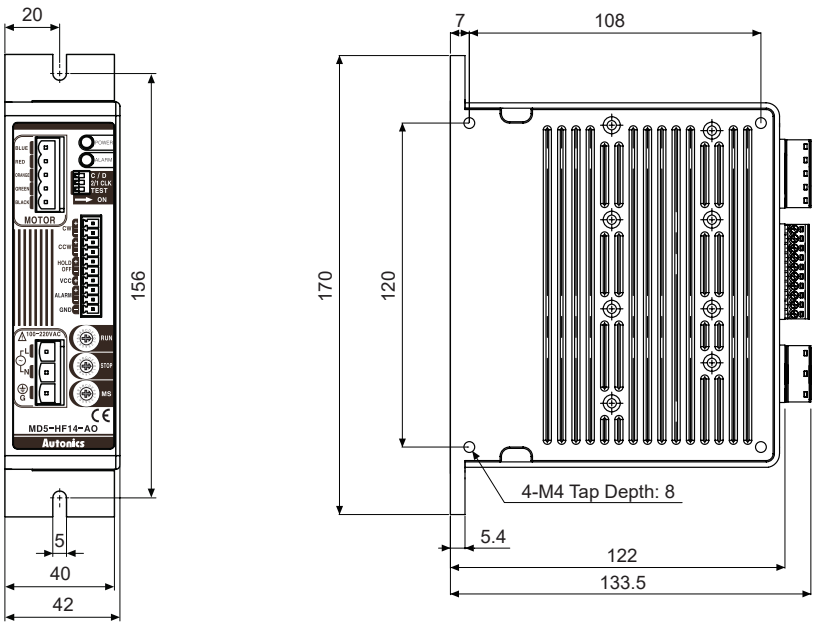
※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

▣ Connections



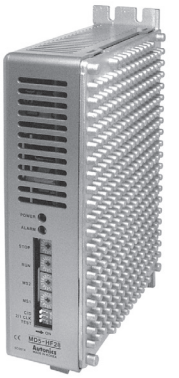
▣ Dimensions

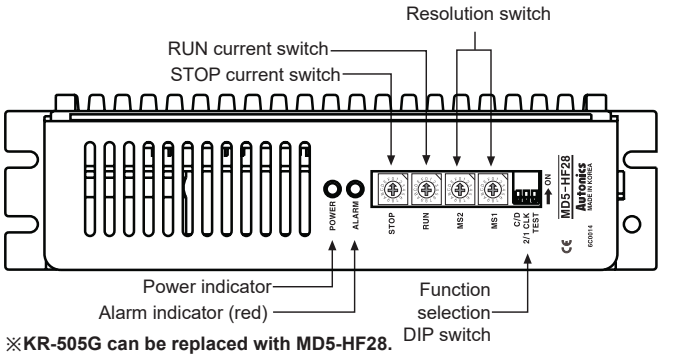
(unit: mm)



5-Phase Microstep Motor Driver [MD5-HF28]

▣ Unit Description



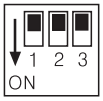


※**KR-505G can be replaced with MD5-HF28.**
※**Power supply 100-220VAC and socket type wire terminal blocks are upgraded comparing to KR Series.**

※Refer to '▣ **Specifications**'.

▣ Functions

◎ Function selection DIP switch



No.	Name	Function	Switch position	
			ON	OFF (default)
1	TEST	Self diagnosis function	30rpm rotation	Not use
2	2/1 CLK	Pulse input method	1-pulse input method	2-pulse input method
3	C/D	Auto Current Down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 2/1 CLK

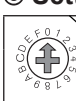
- 2/1 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the STOP current switch.

◎ Setting RUN current



Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	1.14	1.25	1.36	1.50	1.63	1.74	1.86	1.97	2.10	2.20	2.30	2.40	2.50	2.60	2.78	2.88

- Setting RUN current is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ Setting STOP current

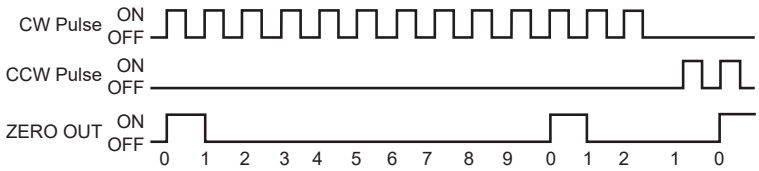
Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- Setting STOP current is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.

E.g.) Set RUN current as 2.5A and STOP current as 40%.
STOP current is set as 2.5A×0.4=1A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ Zero point excitation output signal (ZERO OUT)



- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis.
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
  (50 outputs per 1 rotation of the motor.)
  E.g.) Full step: outputs one time by 10 pulses input, 20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to '▣ **I/O Circuit and Connections**'.

◎ Setting Microstep (microstep: resolution)

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

- **Setting Resolution (same as MS1, MS2)**
- The MS1, MS2 switches is for resolution setting.
- Select MS2 or MS2 by DIVISION SELECTION signal ([L]: MS1, [H]: MS2)
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as follow.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle / gear ratio = Step angle applied gear E.g) 0.72° / 10 (1:10) = 0.072°

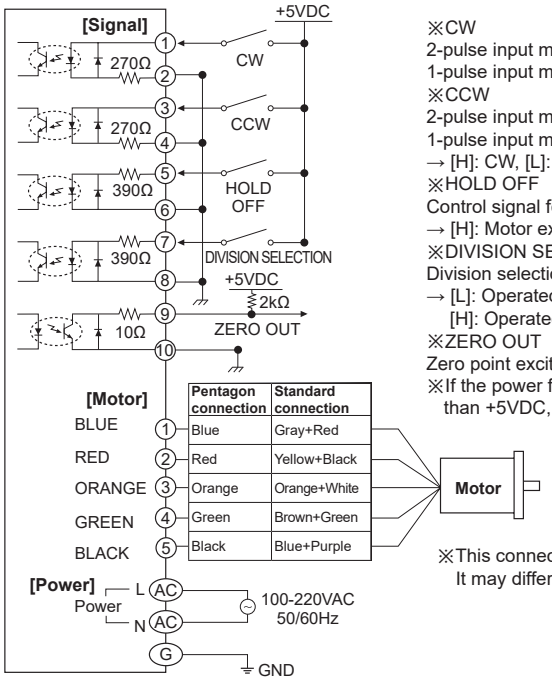
※Must stop the motor before changing the resolution.

◎ Alarm indication

- Overheat: When the temperature of driver base is over 80℃, the alarm indicator (red) turns ON and motor stops with holding the excision.
- Overcurrent: When overcurrent occurs due to motor damage by burn, driver damage, or error, the alarm indicator (red) turns ON and the motor becomes HOLD OFF.

※Turn OFF the power and remove the causes of alarm. Re-supply the power and the alarm indicator turns OFF and the driver is normal operation.

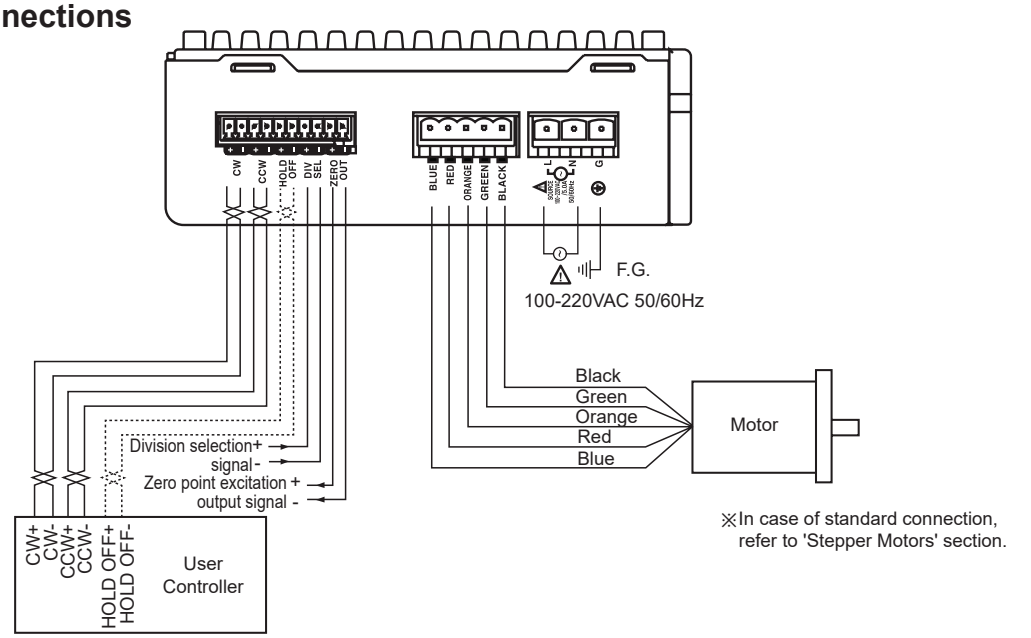
▣ I/O Circuit and Connections



※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)
※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF
※DIVISION SELECTION
Division selection signal
→ [L]: Operated by switch MS1
[H]: Operated by switch MS2
※ZERO OUT
Zero point excitation output signal → Zero point status ON
※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.

※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

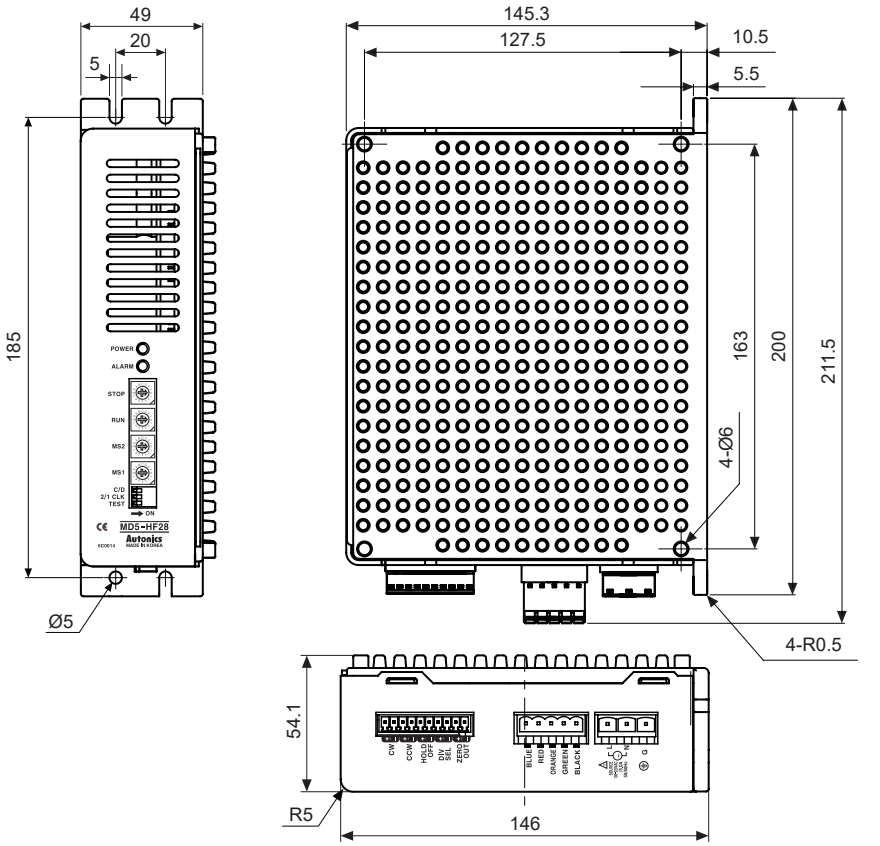
▣ Connections



※In case of standard connection, refer to 'Stepper Motors' section.

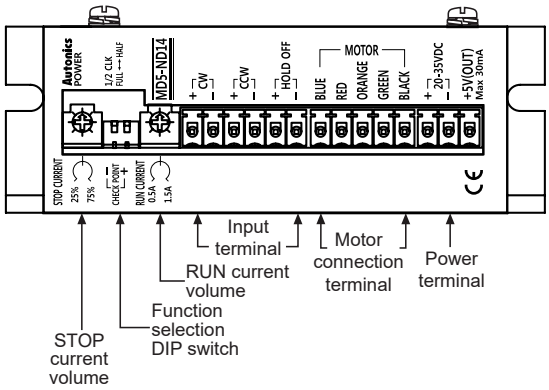
▣ Dimensions

(unit: mm)



5-Phase Stepper Motor Driver [MD5-ND14]

▣ Unit Description



※Refer to '▣ **Specifications**'.

▣ Functions

◎ Function selection DIP switch

No.	Nameplate	Function	Switch position	
			ON	OFF (default)
1	1/2 CLK	Pulse input method	1-pulse input method	2-pulse input method
2	FULL↔HALF	Select resolution	1-division (0.72°)	2-division (0.36°)

※Changing pulse input method or resolution is available only when stepper motor stops.
If changing the resolution during operation, the motor may be out of phase.

● 1/2 CLK

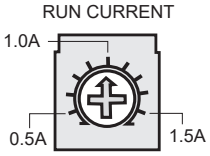
- 1/2 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● FULL ↔ HALF

- FULL ↔ HALF switch is to set basic step angle for 5-phase stepper motor.

※Change resolution only when the motor stops.

◎ Setting RUN current



- Setting RUN current is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

◎ Setting STOP current

- Setting STOP current is for the current provided for motor when the motor stops.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A.

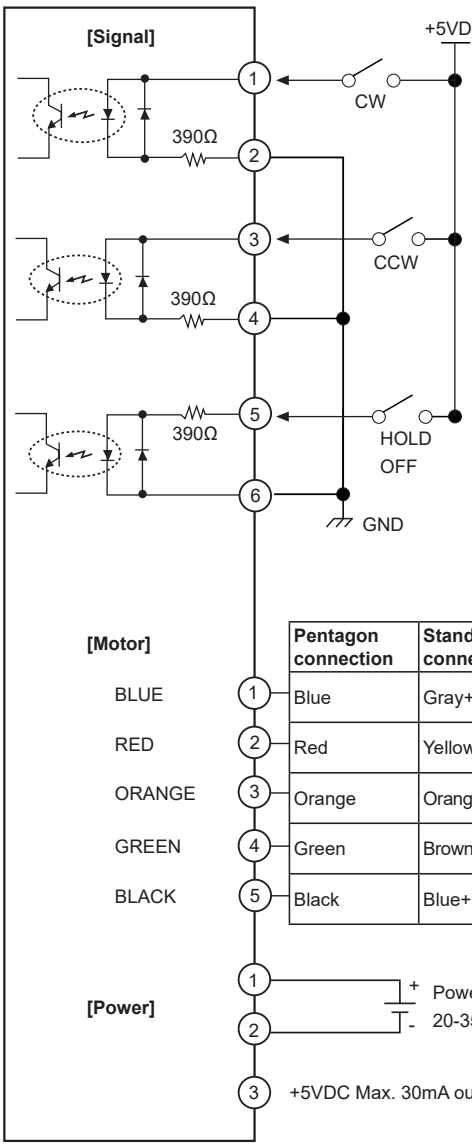
※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to '▣ **I/O Circuit and Connections**'.

▣ I/O Circuit and Connections



※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

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

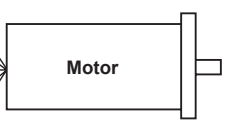
※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input voltage max. 24VDC, input current 10-20mA)

※In case of standard connection, refer to 'Stepper Motors' section.

[Motor]

		Pentagon connection	Standard connection
BLUE	1	Blue	Gray+Red
RED	2	Red	Yellow+Black
ORANGE	3	Orange	Orange+White
GREEN	4	Green	Brown+Green
BLACK	5	Black	Blue+Purple



※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

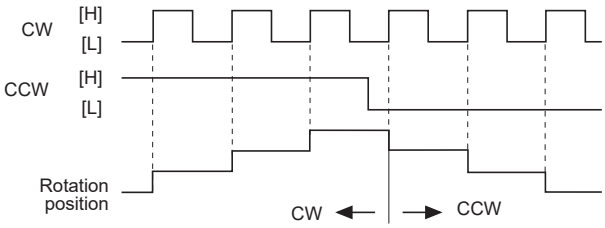
[Power]

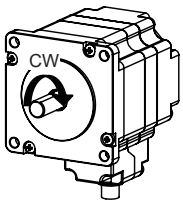
1 (+) Power
2 (-) 20-35VDC

3 +5VDC Max. 30mA output

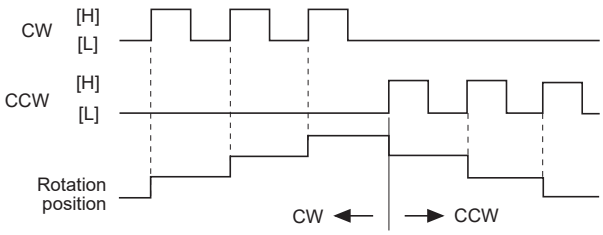
▣ Time Chart

◎ 1-pulse input method





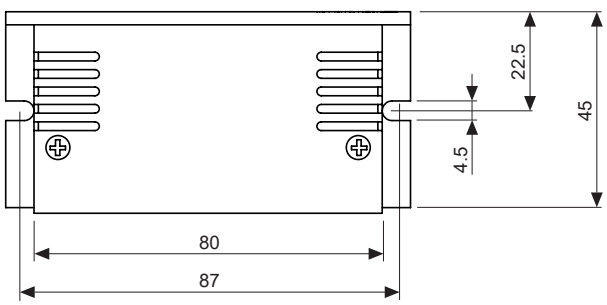
◎ 2-pulse input method

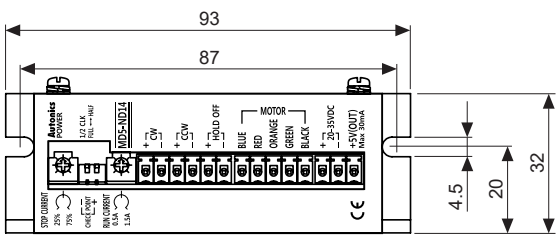


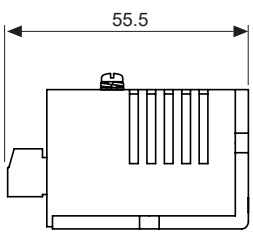
※Do not input CW, CCW signals at the same time in 2-pulse input method.
It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].

▣ Dimensions

(unit: mm)



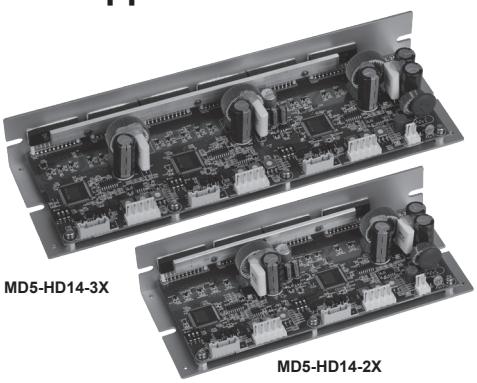




Low Noise, Low Vibration Multi-Axis 5-Phase Stepper Motor Driver

▣ Features

- **Simultaneous operation of 2, 3-axis by single power supply 20-35VDC**
- Small, light weight and advanced quality by custom IC and surface mounted circuit
- Realizing low noise, low vibration rotation with microstep-driving
- Low speed rotation and high accuracy controlling with microstep-driving
- Max. resolution 250 division: In case of 5-phase stepper motor of which basic step angle is 0.72°, it enables to control up to 0.00288° per pulse
- Includes auto current down and self-diagnosis function
- Photocoupler input insulation method to minimize the effects from external noise



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

▣ Ordering Information

MD 5 – H D 14 – 2X

Axis	2X	2-axis
	3X	3-axis※1
RUN current	14	1.4A/Phase
Power supply	D	20-35VDC
Step type (resolution)	H	Micro step (250-division)
Motor phase	5	5-phase
Item	MD	Motor Driver

※1: Built-in zero point excitation output signal is optional.

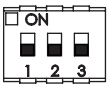
▣ Specifications

Model		**MD5-HD14-2X**	**MD5-HD14-3X**
Power supply※1		20-35VDC⎓	
Allowable voltage fluctuation range		90 to 110% of the rated voltage	
Max. current consumption※2		5A	7A
RUN current※3		0.4-1.4A/Phase	
STOP current		27 to 90% of RUN current (set by STOP current switch)	
Drive method		Bipolar constant current pentagon drive	
Basic step angle		0.72°/Step	
Resolution		1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250-division (0.72° to 0.00288°/Step)	
Input pulse characteristic	Pulse width	Min. 1μs (CW, CCW), Min. 1ms (HOLD OFF)	
	Duty rate	50% (CW, CCW)	
	Rising/Falling time	Below 130ns (CW, CCW)	
	Pulse input voltage	[H]: 4-8VDC⎓, [L]: 0-0.5VDC	
	Pulse input current	7.5-14mA (CW, CCW), 10-16mA (HOLD OFF, ZERO OUT)	
	Max. input pulse frequency※4	Max. 500kHz (CW, CCW)	
Input resistance		270Ω (CW, CCW), 390Ω (HOLD OFF), 10Ω (ZERO OUT)	
Insulation resistance		Over 100MΩ (at 500VDC megger, between all terminals and base)	
Dielectric strength		1,000VAC 50/60Hz for 1 min (between all terminals and base)	
Noise immunity		±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical	1.5mm amplitude at frequency 5 to 60Hz (for 1 min) in each X, Y, Z direction for 2 hours	
	Malfunction	1.5mm amplitude at frequency 5 to 60Hz (for 1 min) in each X, Y, Z direction for 10 min	
Envi-ron-ment	Ambient temp.	0 to 40℃, storage: -10 to 60℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH	
Approval		CE	
Weight※5		Approx. 446g (approx. 292g)	Approx. 597g (approx. 411g)

※1: When using over 30VDC power supply, torque characteristics are improved but the driver temperature raise. The unit should be installed at the well ventilation environment.
※2: Based on ambient temperature 25℃, ambient humidity 55%RH.
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also varies depending on the load.
※4: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.
※5: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Functions

◎ Function selection DIP switch



No.	Name	Function	Switch position	
			ON	OFF (default)
1	TEST	Self diagnosis function	30rpm rotation	Not use
2	1/2 CLK	Pulse input method	1-pulse input method	2-pulse input method
3	C/D	Auto Current Down	Not use	Use

● TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.

※Be sure that the TEST switch is OFF before supplying the power.
If the TEST switch is ON, the motor operates immediately and it may be dangerous.

● 1/2 CLK

- 1/2 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

● C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.

※Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
※Set the STOP current by the Setting STOP current switch.

◎ Setting RUN current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

- Setting RUN current is for the current provided for motor when the motor runs.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat is severe.
※Set RUN current within the range of motor's rated current according to its load.
※Change RUN current only when the motor stops.

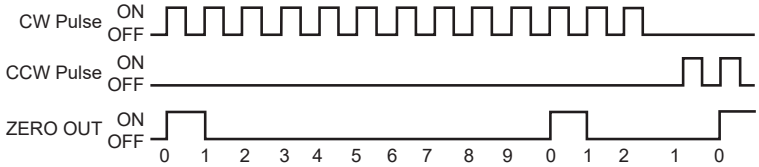
◎ Setting STOP current

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

- Setting STOP current is for the current provided for motor when the motor stops.
- This setting is applied when using C/D (current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
  E.g.) Set RUN current as 1.4A and STOP current as 40%.
  STOP current is set as 1.4A×0.4=0.56A

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set too low, the heat is lower.
※Change STOP current only when the motor stops.

◎ Zero point excitation output signal (ZERO OUT) [Option]



- This output indicates the initial step of excitation order of stepper motor and rotation position of motor axis.
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
  (50 outputs per 1 rotation of the motor.)
  E.g.) Full step: outputs one time by 10 pulses input,
  20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
- When hold off signal maintains over 1ms as [H], motor excitation is released.
- When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.

※Must stop the motor for using this function.
※Refer to '▣ **I/O Circuit and Connections**'.

◎ Setting Microstep (microstep: resolution)

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250
Step angle	0.72°	0.36°	0.18°	0.144°	0.09°	0.072°	0.045°	0.036°	0.0288°	0.018°	0.0144°	0.009°	0.0072°	0.00576°	0.0036°	0.00288°

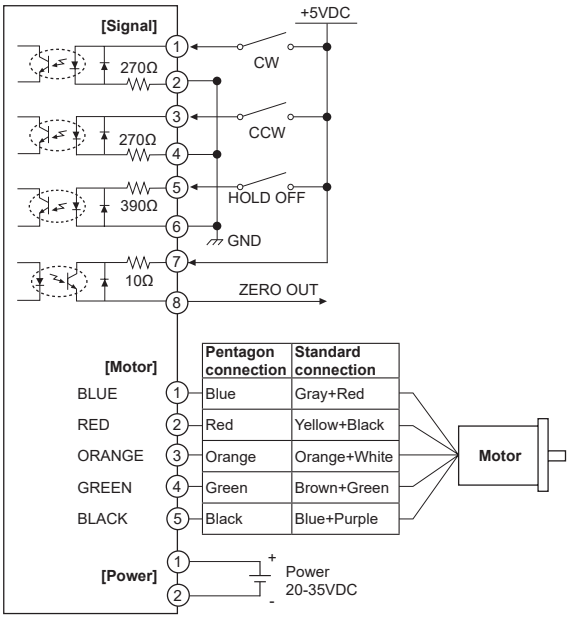
- **Resolution (MS1)**
- The set step angle is dividing basic step angle (0.72°) of 5-phase stepper motor by setting value.
- The calculation formula of divided step angle is as below.

$$\text{Set step angle} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
  Step angle/gear ratio = Step angle applied gear
  E.g) 0.72°/10 (1:10) = 0.072°

※Must stop the motor before changing the resolution.

■ I/O Circuit and Connections



※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)

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

※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF

※ZERO OUT (option)
Zero point excitation output signal → Zero point status ON

※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside. (input voltage max. 24VDC, input current 10-20mA)

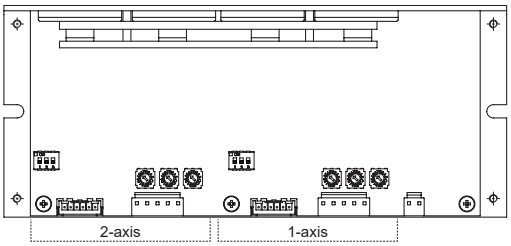
※In case of standard connection, refer to 'Stepper Motors' section

※This connection cable color is only for Autonics motors. It may different cable color when using other motors.

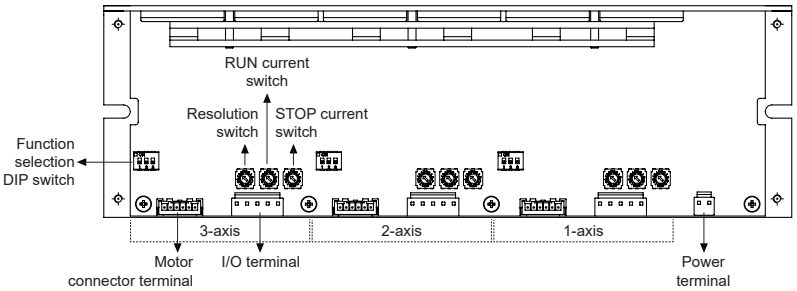
※Power input of 2/3-axis are used as same and I/O terminals are proportional to the number of axes.

■ Unit Description

◎ MD5-HD14-2X



◎ MD5-HD14-3X

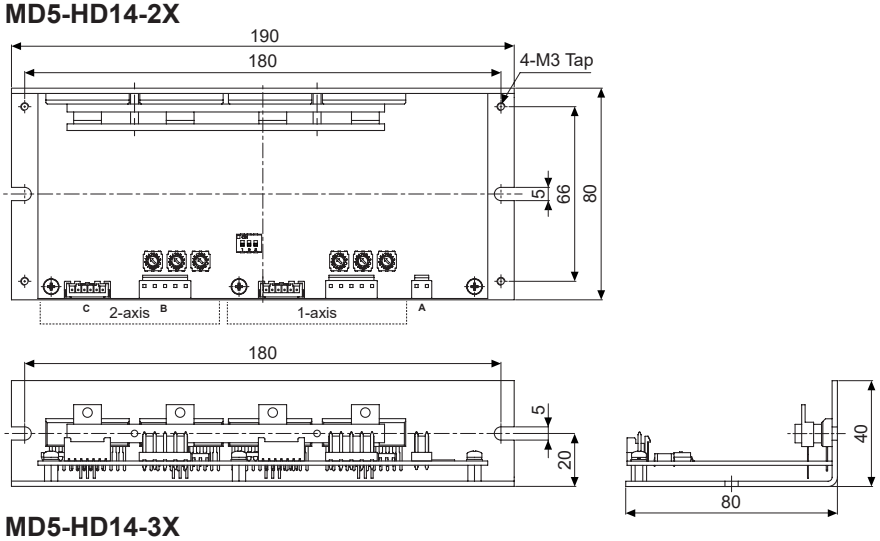


※Each axis structure is same.

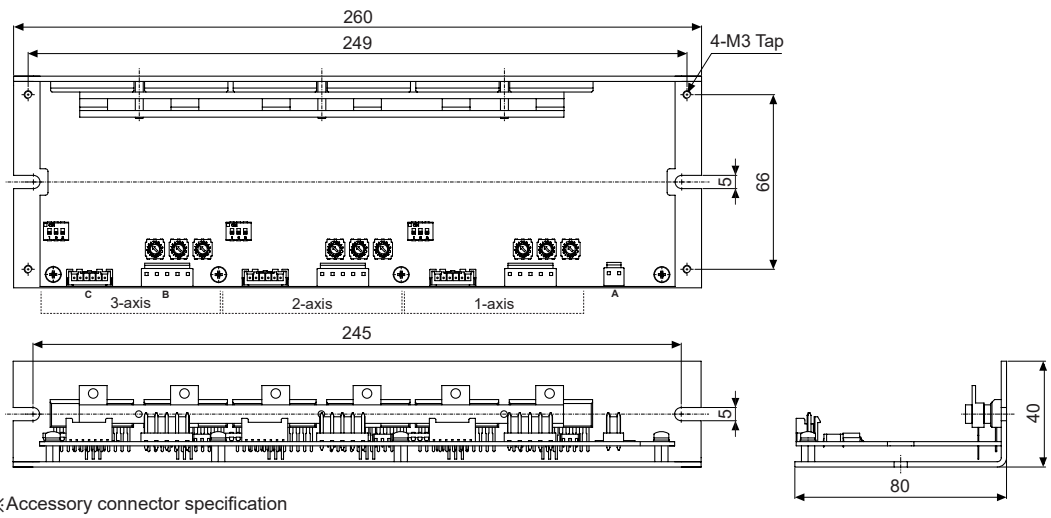
▣ Dimensions

◎ MD5-HD14-2X

(unit: mm)



◎ MD5-HD14-3X

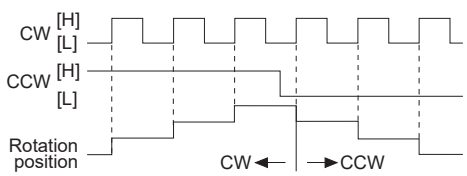


※Accessory connector specification

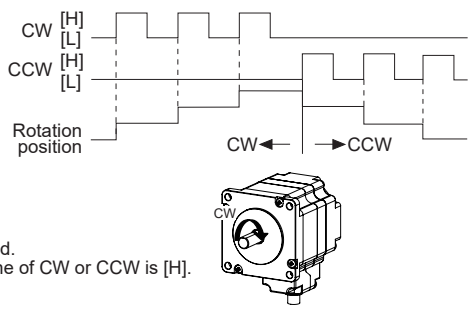
Accessory		Connector		Qty.	
		Manufacturer	Model No.	MD5-HD14-2X	MD5-HD14-3X
A	Power 2-wire housing	JST	VHR-2N	1	1
B	Motor 5-wire housing		VHR-5N	2	3
C	Signal 6-wire housing		XAP-06V-1	2	3
—	Power/Motor terminal pin		SVH-21T-P1.1	12	17
—	Signal terminal pin		SXA -001T-P0.6	12	18

▣ Time Chart

◎ 1-pulse input method



◎ 2-pulse input method



※Do not input CW, CCW signals at the same time in 2-pulse input method.
It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].

▣ Cautions during Use (Common Specifications of 5-Phase Stepper Motor Driver)

1. For signal input

①Do not input CW, CCW signal at the same time in 2-pulse input method. Failure to follow this instruction may result in malfunction. It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].
②When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.

2. For RUN current, STOP current setting

①Set RUN current within the range of motor's rated current. Failure to follow this instruction may result in severe heat of motor or motor damage.
②If motor stops, switching for STOP current executed by the current down function. When hold off signal is [H] or current down function is OFF, the switching does not execute. (except MD5-ND14)
③Use the power for supplying sufficient current to the motor.
④Check the polarity of power before operating the unit. (only for MD5-HD14, HD14-2X/3X, ND14)

3. For rotating motor

(only for MD5-HD14, HD14-2X/3X, ND14)

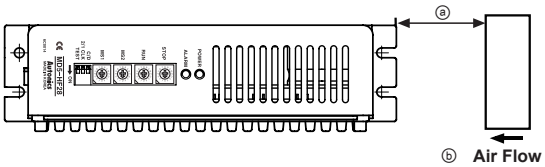
①For rotating the motor when driver power turns OFF, separate the motor from the driver.
(if not, the driver power turns ON)
②For rotating the motor when driver power turns ON, use Hold OFF function.

4. For cable connection

①Use twisted pair (over 0.2mm^2) for the signal cable which should be shorter than 2m.
②The thickness of cable should be same or thicker than the motor cable's when extending the motor cable.
③Must separate between the signal cable and the power cable over 10cm.

5. For installation

①The unit must be installed with heat protection. The conditions of ②, ③ should be satisfied. (※MD5-ND14)
②In order to increase heat protection efficiency of the driver, must install the heat sink close to metal panel and keep it well-ventilated.
③Excessive heat generation may occur on driver. Keep the heat sink under 80℃ when installing the unit.
(at over 80℃, forcible cooling shall be required.)
④If the unit is installed in distribution panel, enclosed space or place with heat, it may cause product damage by heat. Install a ventilation. (only for MD5-HF28)
⑤For heat radiation of driver, install a fan as below figure. (distance between the ⓐ fan and the unit: approx. within 70mm, ⓑ min. airflow: 0.71m^3/min at least)
(only for MD5-HF28)



6. For using setting switches

①Be sure that the TEST switch is OFF before supplying the power. If the TEST switch is ON, the motor operates immediately and it may be dangerous.
(except MD5-ND14)
②Do not change any setting switch during the operation or after supplying power. It may cause malfunction.

7. Autonics motor driver does not prepare protection function for a motor.

8. This product may be used in the following environments.

① Indoors
② Altitude max. 2,000m
③ Pollution degree 2
④ Installation category II

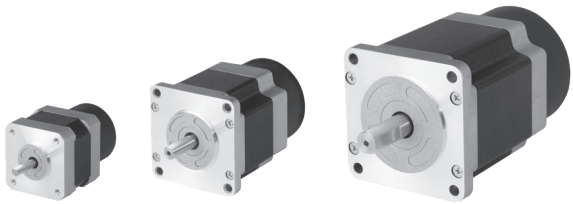
Frame Size 24mm/42mm/60mm/85mm Shaft Type Motor
Frame Size 42mm/60mm/85mm Built-in Brake Type Motor

▣ Features

- Compact design and light weight with high accuracy, speed and torque
- Suitable for small-sized equipment applications
- Frame size 42mm/60mm/85mm built-in brake of shaft type for compact equipment (AK-B Series)
- Brake force is released (AK-B Series) when applying power on brake wire
- Cost-effective

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

Frame size
24mm 42mm 60mm 85mm



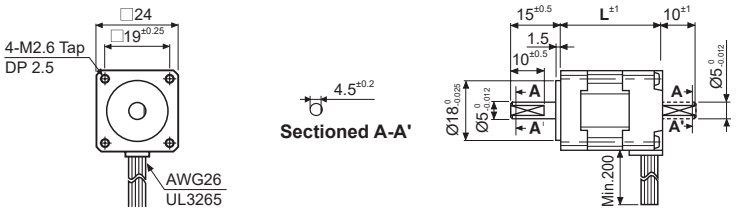
Frame size
42mm Brake built-in type
60mm Brake built-in type
85mm Brake built-in type

▣ Dimensions

※These dimensions are for dual shaft models. Single shaft models do not include shafts indicated in the dotted lines.
※For flexible coupling (ERB series) information, refer to '**ERB Series**' in '**Rotary encoder**'. (frame size 24mm, 48mm, 60mm (shaft type))
※Brake is non-polar and be sure to observe rated excitation voltage (24VDC). (except frame size 24mm)
SW1 ON: brake release / SW1 OFF: brake execute

◎ Frame size 24mm

(unit: mm)

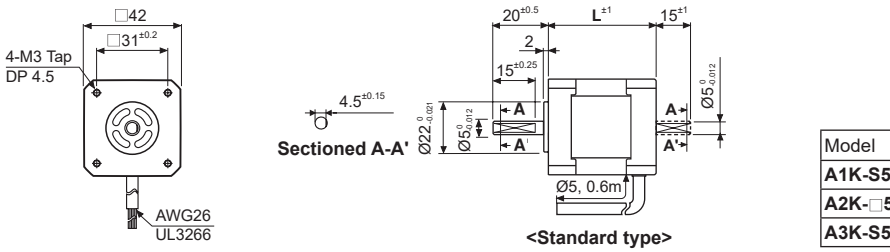


(unit: mm)

Model	L
02K-S523(W)	30.5
04K-S525(W)	46.5

◎ Frame size 42mm

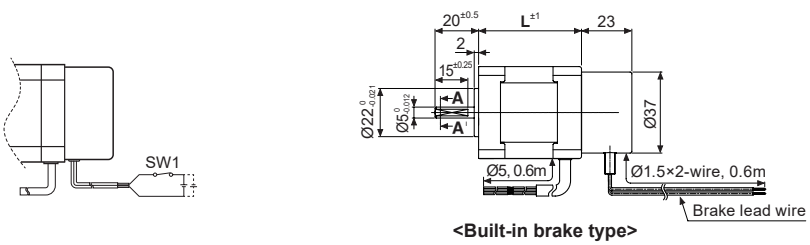
(unit: mm)



<Standard type>

(unit: mm)

Model	L
A1K-S543(W)-B	33
A2K-□544(W)-B	39
A3K-S545(W)-B	47

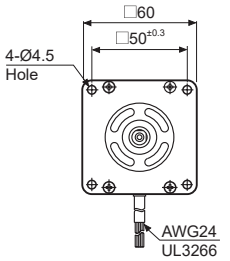


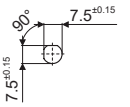
<Built-in brake type>

▣ Dimensions

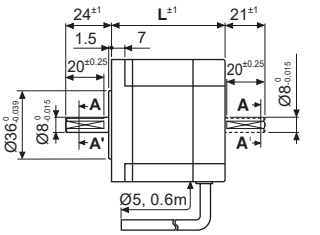
◎ Frame size 60mm

(unit: mm)





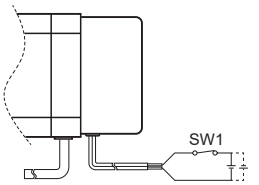
Sectioned A-A'

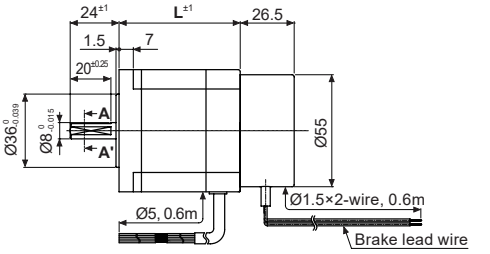


<Standard type>

(unit: mm)

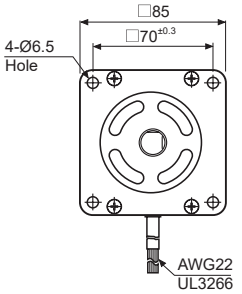
Model	L
A4K-□564(W)-B	48.5
A8K-□566(W)-B	59.5
A16K-□569(W)-B	89

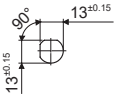




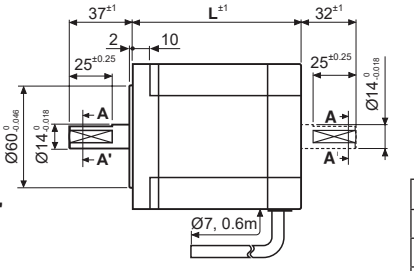
<Built-in brake type>

◎ Frame size 85mm





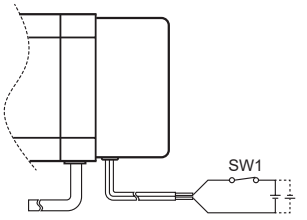
Sectioned A-A'

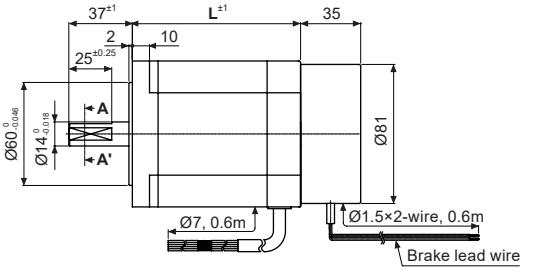


<Standard type>

(unit: mm)

Model	L
A21K-□596(W)-B	68
A41K-□599(W)-B	98
A63K-□5913(W)-B	128

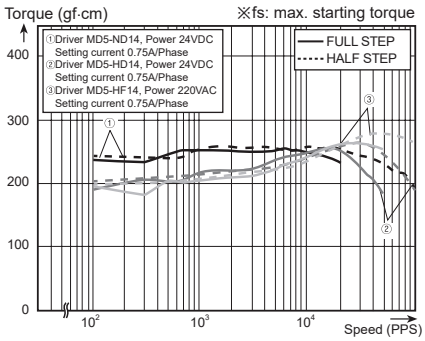




<Built-in brake type>

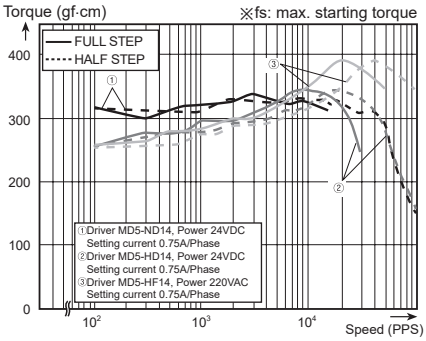
▣ Characteristic

● 02K-S523



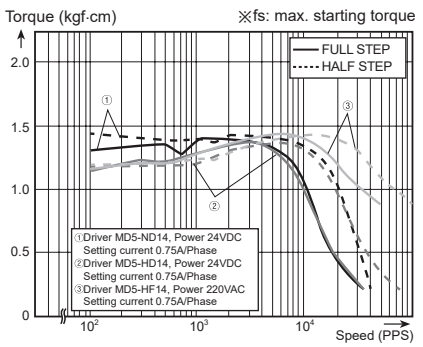
① fs Full Step: 3.6kpps, Half Step: 7.1kpps
② fs Full Step: 3.7kpps, Half Step: 7.2kpps
③ fs Full Step: 3.8kpps, Half Step: 7.5kpps

● 04K-S525



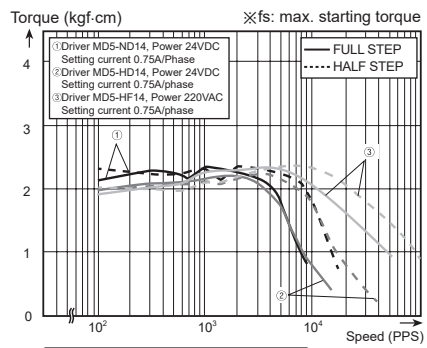
①fs Full Step: 3.1kpps, Half Step: 6.1kpps
②fs Full Step: 3.2kpps, Half Step: 6.3kpps
③fs Full Step: 3.3kpps, Half Step: 6.5kpps

● A1K-S543 / A1K-S543-B



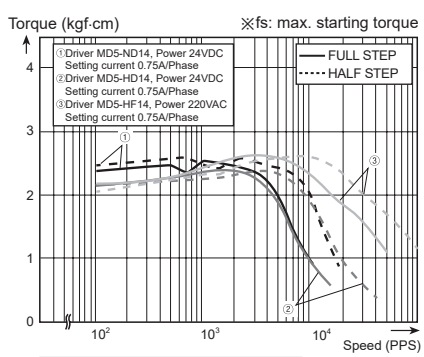
①fs Full Step: 3.3kpps, Half Step: 6.6kpps
②fs Full Step: 3.4kpps, Half Step: 6.7kpps
③fs Full Step: 3.5kpps, Half Step: 6.8kpps

● A2K-□544 / A2K-□544-B



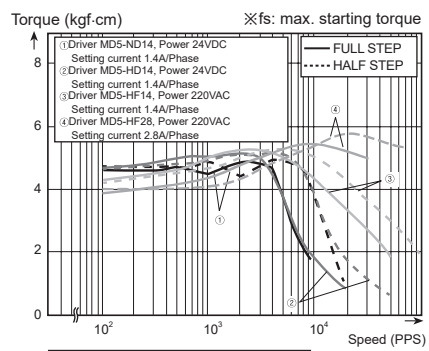
①fs Full Step: 3.2kpps, Half Step: 6.3kpps
②fs Full Step: 3.3kpps, Half Step: 6.5kpps
③fs Full Step: 3.4kpps, Half Step: 6.7kpps

● A3K-S545 / A3K-S545-B



①fs Full Step: 3kpps, Half Step: 5.9kpps
②fs Full Step: 3.1kpps, Half Step: 6.1kpps
③fs Full Step: 3.2kpps, Half Step: 6.4kpps

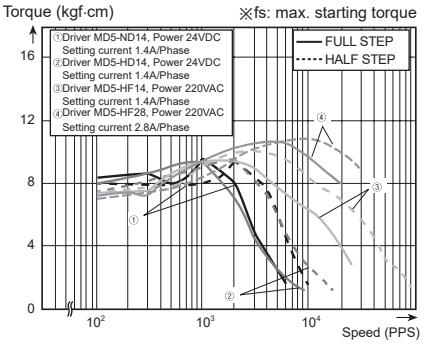
● A4K-□564 / A4K-M564-B



①fs Full Step: 2.7kpps, Half Step: 5.3kpps
②fs Full Step: 2.7kpps, Half Step: 5.8kpps
③fs Full Step: 3.7kpps, Half Step: 7.2kpps
④fs Full Step: 3.4kpps, Half Step: 6.8kpps

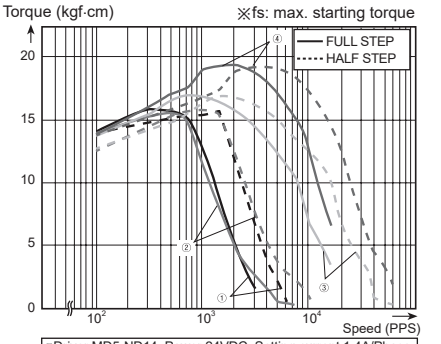
■ Characteristic

● A8K-□566 / A8K-M566-B



①fs Full Step: 2.1kpps, Half Step: 4.1kpps
②fs Full Step: 2.1kpps, Half Step: 4.2kpps
③fs Full Step: 3.2kpps, Half Step: 6.3kpps
④fs Full Step: 3.3kpps, Half Step: 6.6kpps

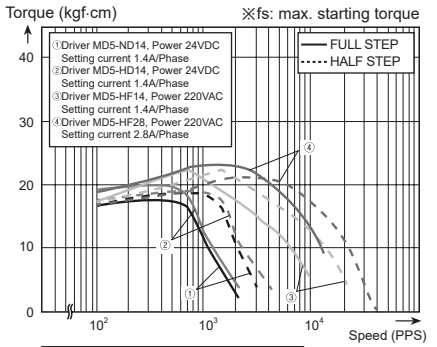
● A16K-□569 / A16K-□569-B



①Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
②Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

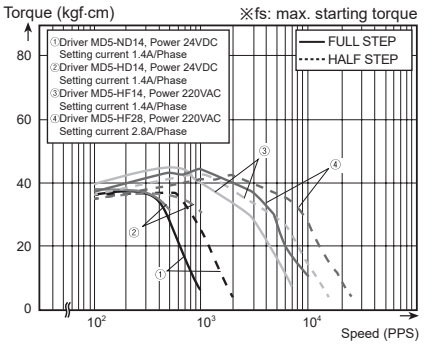
①fs Full Step: 1.8kpps, Half Step: 3.5kpps
②fs Full Step: 1.9kpps, Half Step: 3.5kpps
③fs Full Step: 2.6kpps, Half Step: 5.2kpps
④fs Full Step: 3.4kpps, Half Step: 6.8kpps

● A21K-□596 / A21K-□596-B



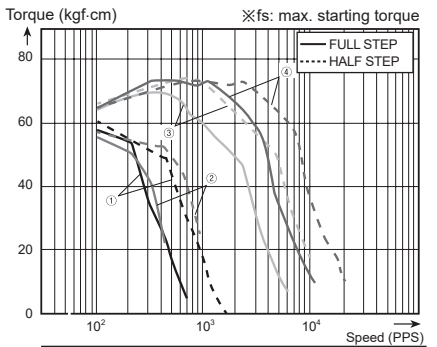
①fs Full Step: 1.5kpps, Half Step: 2.9kpps
②fs Full Step: 1.6kpps, Half Step: 3.1kpps
③fs Full Step: 2.2kpps, Half Step: 4.4kpps
④fs Full Step: 2.3kpps, Half Step: 4.6kpps

● A41K-□599 / A41K-□599-B



①fs Full Step: 1.4kpps, Half Step: 2.7kpps
②fs Full Step: 1.5kpps, Half Step: 2.9kpps
③fs Full Step: 1.8kpps, Half Step: 3.6kpps
④fs Full Step: 2.1kpps, Half Step: 4.3kpps

● A63K-□5913 / A63K-□5913-B



①Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
②Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

①fs Full Step: 1kpps, Half Step: 2.1kpps
②fs Full Step: 1.1kpps, Half Step: 2.2kpps
③fs Full Step: 1.8kpps, Half Step: 3.6kpps
④fs Full Step: 1.9kpps, Half Step: 3.8kpps

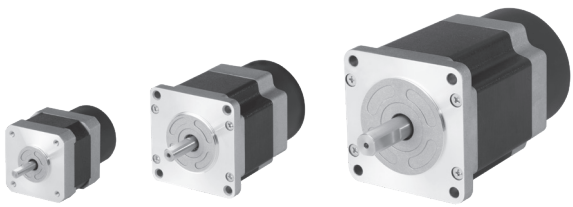
Frame Size 24mm/42mm/60mm/85mm Shaft Type Motor
Frame Size 42mm/60mm/85mm Built-in Brake Type Motor

▣ Features

- Compact design and light weight with high accuracy, speed and torque
- Suitable for small-sized equipment applications
- Frame size 42mm/60mm/85mm built-in brake of shaft type for compact equipment (AK-B Series)
- Brake force is released (AK-B Series) when applying power on brake wire
- Cost-effective

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

Frame size
24mm 42mm 60mm 85mm



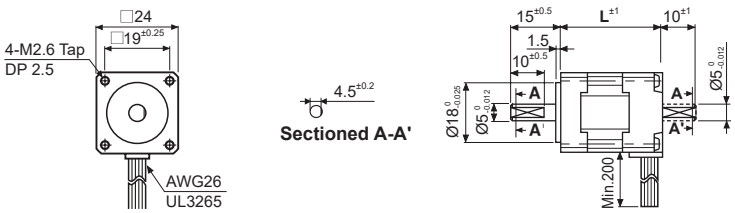
Frame size
42mm Brake built-in type
60mm Brake built-in type
85mm Brake built-in type

▣ Dimensions

※These dimensions are for dual shaft models. Single shaft models do not include shafts indicated in the dotted lines.
※For flexible coupling (ERB series) information, refer to '**ERB Series**' in '**Rotary encoder**'. (frame size 24mm, 48mm, 60mm (shaft type))
※Brake is non-polar and be sure to observe rated excitation voltage (24VDC). (except frame size 24mm)
SW1 ON: brake release / SW1 OFF: brake execute

◎ Frame size 24mm

(unit: mm)

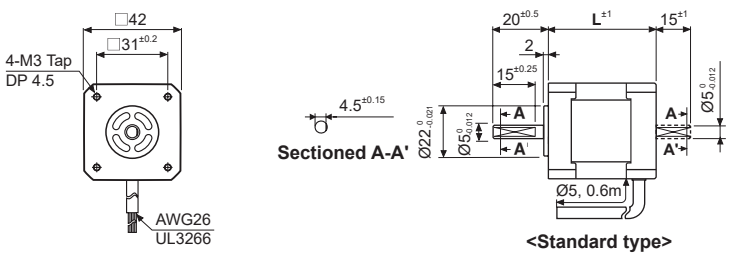


(unit: mm)

Model	L
02K-S523(W)	30.5
04K-S525(W)	46.5

◎ Frame size 42mm

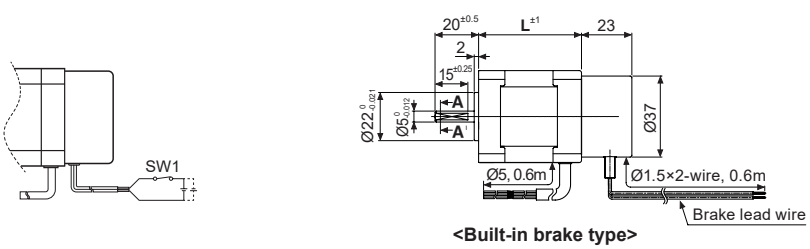
(unit: mm)



<Standard type>

(unit: mm)

Model	L
A1K-S543(W)-B	33
A2K-□544(W)-B	39
A3K-S545(W)-B	47

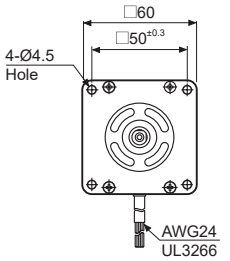


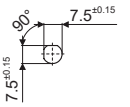
<Built-in brake type>

▣ Dimensions

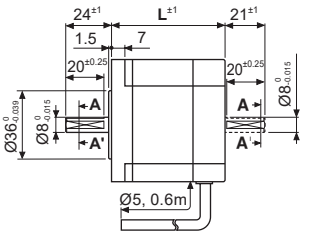
◎ Frame size 60mm

(unit: mm)





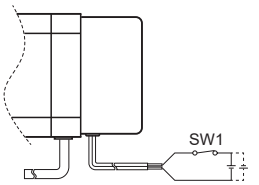
Sectioned A-A'

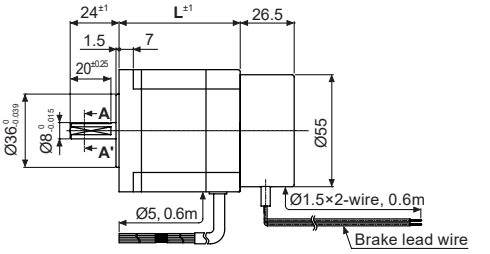


<Standard type>

(unit: mm)

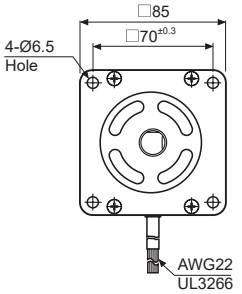
Model	L
A4K-□564(W)-B	48.5
A8K-□566(W)-B	59.5
A16K-□569(W)-B	89

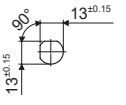




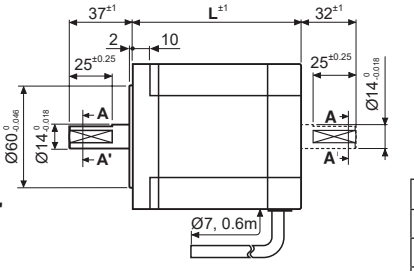
<Built-in brake type>

◎ Frame size 85mm





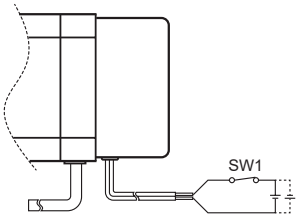
Sectioned A-A'

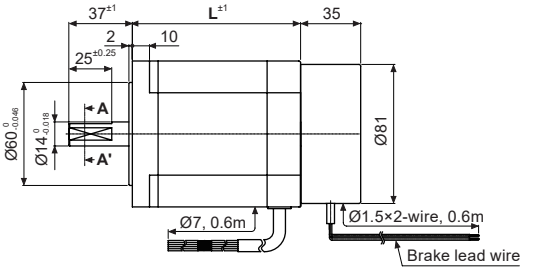


<Standard type>

(unit: mm)

Model	L
A21K-□596(W)-B	68
A41K-□599(W)-B	98
A63K-□5913(W)-B	128

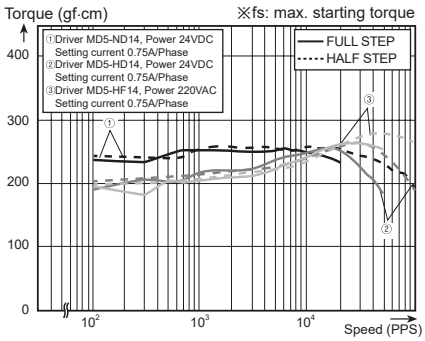




<Built-in brake type>

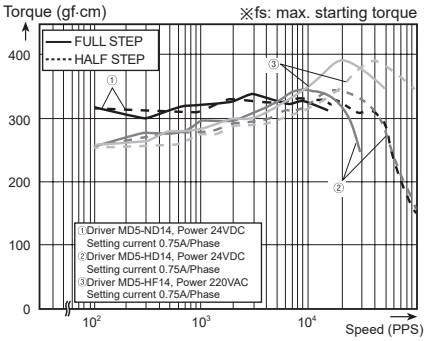
▣ Characteristic

● 02K-S523



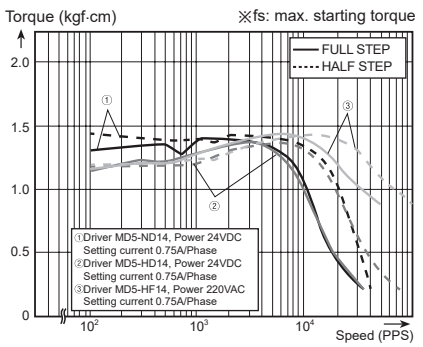
① fs Full Step: 3.6kpps, Half Step: 7.1kpps
② fs Full Step: 3.7kpps, Half Step: 7.2kpps
③ fs Full Step: 3.8kpps, Half Step: 7.5kpps

● 04K-S525



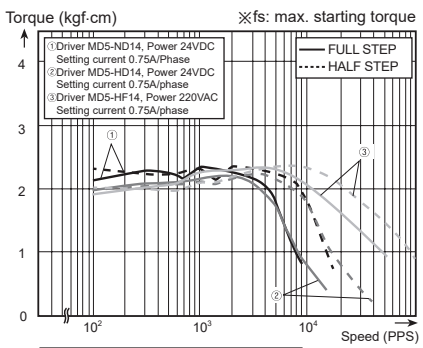
①fs Full Step: 3.1kpps, Half Step: 6.1kpps
②fs Full Step: 3.2kpps, Half Step: 6.3kpps
③fs Full Step: 3.3kpps, Half Step: 6.5kpps

● A1K-S543 / A1K-S543-B



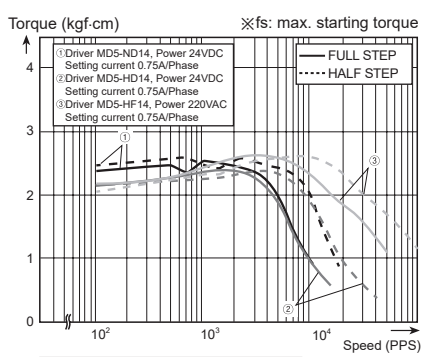
①fs Full Step: 3.3kpps, Half Step: 6.6kpps
②fs Full Step: 3.4kpps, Half Step: 6.7kpps
③fs Full Step: 3.5kpps, Half Step: 6.8kpps

● A2K-□544 / A2K-□544-B



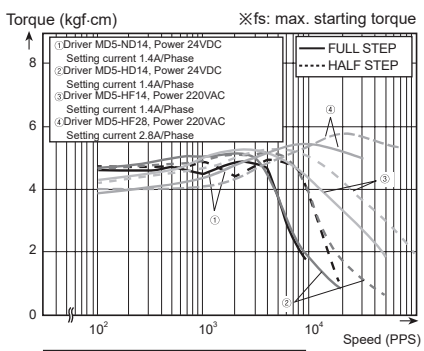
①fs Full Step: 3.2kpps, Half Step: 6.3kpps
②fs Full Step: 3.3kpps, Half Step: 6.5kpps
③fs Full Step: 3.4kpps, Half Step: 6.7kpps

● A3K-S545 / A3K-S545-B



①fs Full Step: 3kpps, Half Step: 5.9kpps
②fs Full Step: 3.1kpps, Half Step: 6.1kpps
③fs Full Step: 3.2kpps, Half Step: 6.4kpps

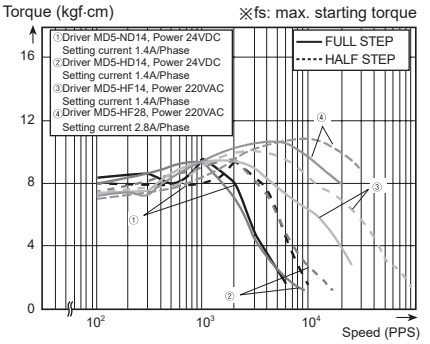
● A4K-□564 / A4K-M564-B



①fs Full Step: 2.7kpps, Half Step: 5.3kpps
②fs Full Step: 2.7kpps, Half Step: 5.8kpps
③fs Full Step: 3.7kpps, Half Step: 7.2kpps
④fs Full Step: 3.4kpps, Half Step: 6.8kpps

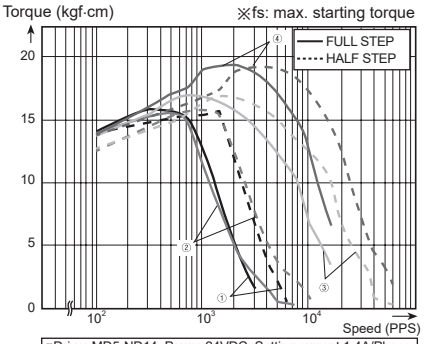
■ Characteristic

● A8K-□566 / A8K-M566-B



①fs Full Step: 2.1kpps, Half Step: 4.1kpps
②fs Full Step: 2.1kpps, Half Step: 4.2kpps
③fs Full Step: 3.2kpps, Half Step: 6.3kpps
④fs Full Step: 3.3kpps, Half Step: 6.6kpps

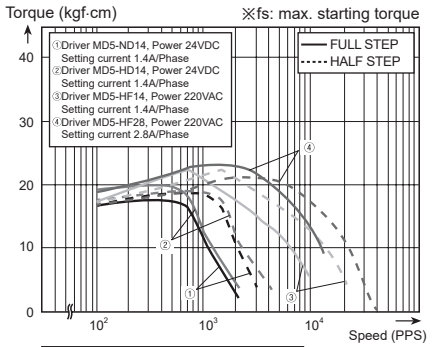
● A16K-□569 / A16K-□569-B



①Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
②Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

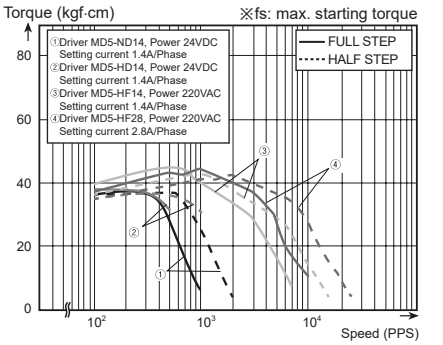
①fs Full Step: 1.8kpps, Half Step: 3.5kpps
②fs Full Step: 1.9kpps, Half Step: 3.5kpps
③fs Full Step: 2.6kpps, Half Step: 5.2kpps
④fs Full Step: 3.4kpps, Half Step: 6.8kpps

● A21K-□596 / A21K-□596-B



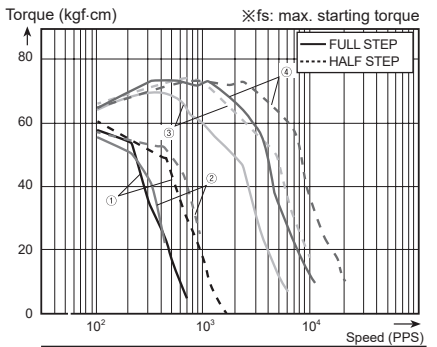
①fs Full Step: 1.5kpps, Half Step: 2.9kpps
②fs Full Step: 1.6kpps, Half Step: 3.1kpps
③fs Full Step: 2.2kpps, Half Step: 4.4kpps
④fs Full Step: 2.3kpps, Half Step: 4.6kpps

● A41K-□599 / A41K-□599-B



①fs Full Step: 1.4kpps, Half Step: 2.7kpps
②fs Full Step: 1.5kpps, Half Step: 2.9kpps
③fs Full Step: 1.8kpps, Half Step: 3.6kpps
④fs Full Step: 2.1kpps, Half Step: 4.3kpps

● A63K-□5913 / A63K-□5913-B



①Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
②Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

①fs Full Step: 1kpps, Half Step: 2.1kpps
②fs Full Step: 1.1kpps, Half Step: 2.2kpps
③fs Full Step: 1.8kpps, Half Step: 3.6kpps
④fs Full Step: 1.9kpps, Half Step: 3.8kpps

Frame Size 42mm/60mm/85mm Hollow Shaft Type Motor

▣ Features

- Removable coupling connecting Ball-screw, TM-screw directly
- Remove resonance (vibration, noise) without coupling
- Compact design and light weight with high accuracy, speed and torque
- Suitable for small-sized equipment applications
- Cost-effective

Frame size
42mm 60mm 85mm

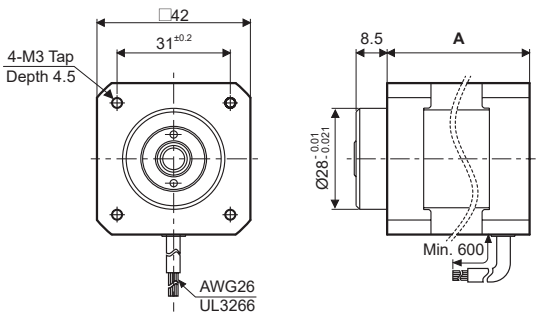
Please read "Safety Considerations" in the instruction manual before using.

▣ Dimensions

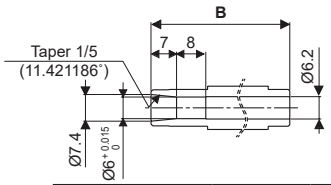
※Depending on processing of shaft to be assembled, hollow shaft type can be used both single and dual shaft.

(unit: mm)

◎ Frame size 42mm

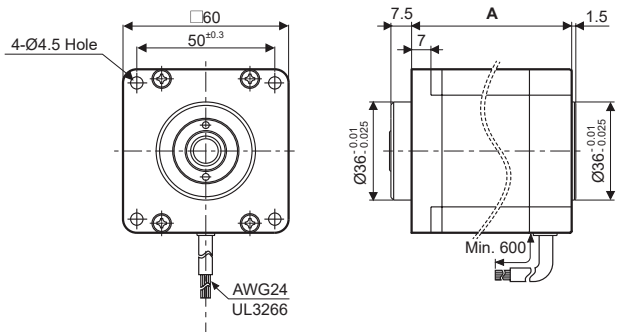


● Hole dimensions

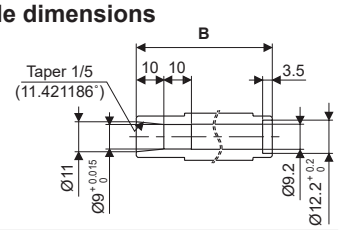


Model	A	B
AH1K-S543-□	33	38
AH2K-S544-□	39	44
AH3K-S545-□	47	52

◎ Frame size 60mm

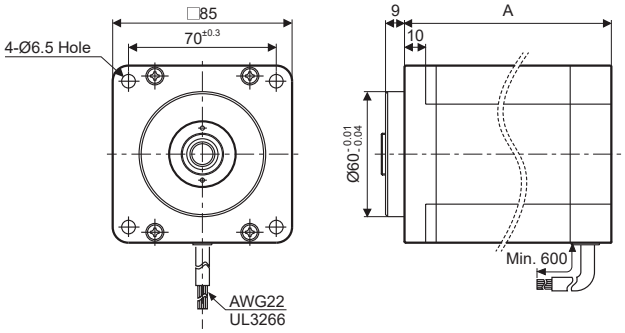


● Hole dimensions

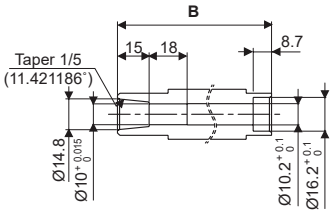


Model	A	B
AH4K-□564(W)-□	48.5	49.3
AH8K-□566(W)-□	59.5	60.3
AH16K-□569(W)-□	89	89.8

◎ Frame size 85mm



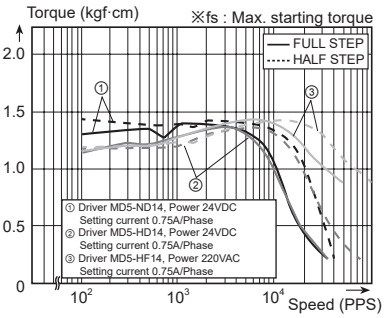
● Hole dimensions



Model	A	B
AH21K-□596(W)-□	68	73
AH41K-□599(W)-□	98	102.5
AH63K-□5913(W)-□	128	133

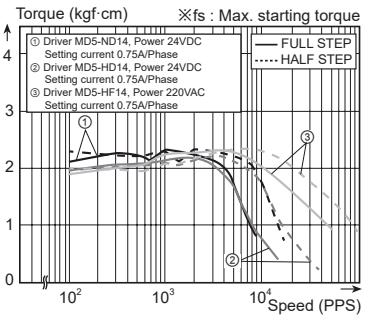
▣ Characteristic

● AH1K-S543-□



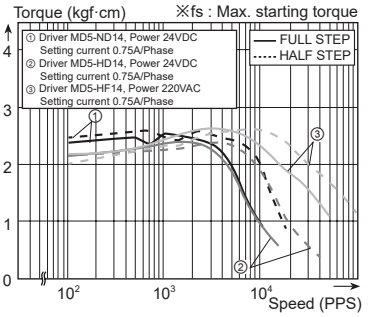
① fs Full Step: 3.3kpps, Half Step: 6.6kpps
② fs Full Step: 3.4kpps, Half Step: 6.7kpps
③ fs Full Step: 3.5kpps, Half Step: 6.8kpps

● AH2K-S544-□



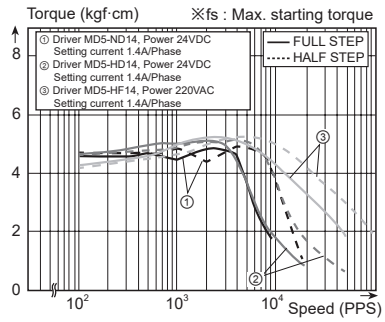
① fs Full Step: 3.2kpps, Half Step: 6.3kpps
② fs Full Step: 3.3kpps, Half Step: 6.5kpps
③ fs Full Step: 3.4kpps, Half Step: 6.7kpps

● AH3K-S545-□



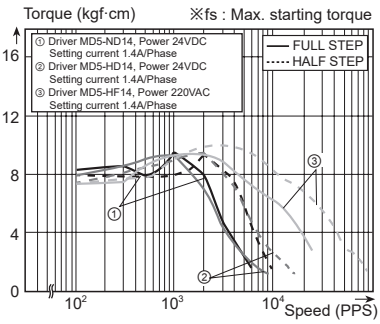
① fs Full Step: 3kpps, Half Step: 5.9kpps
② fs Full Step: 3.1kpps, Half Step: 6.1kpps
③ fs Full Step: 3.2kpps, Half Step: 6.4kpps

● AH4K-S(M)□564(W)-□



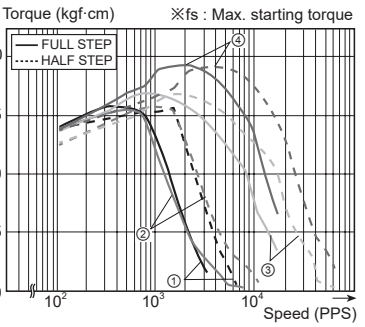
① fs Full Step: 2.7kpps, Half Step: 5.3kpps
② fs Full Step: 2.7kpps, Half Step: 5.8kpps
③ fs Full Step: 3.7kpps, Half Step: 7.2kpps

● AH8K-S(M)□566(W)-□



① fs Full Step: 2.1kpps, Half Step: 4.1kpps
② fs Full Step: 2.1kpps, Half Step: 4.2kpps
③ fs Full Step: 3.2kpps, Half Step: 6.3kpps

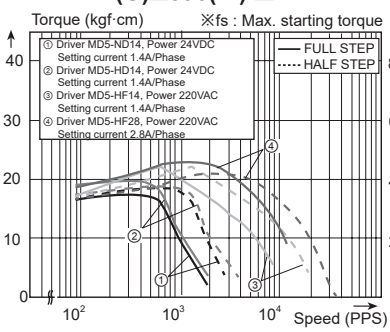
● AH16K-M(G)□569(W)-□



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④ Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

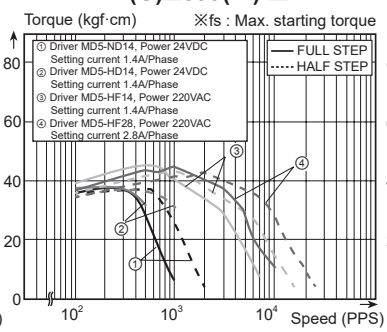
① fs Full Step: 1.8kpps, Half Step: 3.5kpps
② fs Full Step: 1.9kpps, Half Step: 3.5kpps
③ fs Full Step: 2.6kpps, Half Step: 5.2kpps
④ fs Full Step: 3.4kpps, Half Step: 6.8kpps

● AH21K-M(G)□596(W)-□



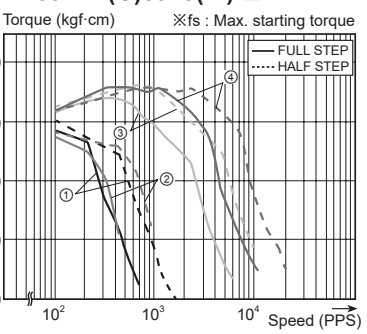
① fs Full Step: 1.5kpps, Half Step: 2.9kpps
② fs Full Step: 1.6kpps, Half Step: 3.1kpps
③ fs Full Step: 2.2kpps, Half Step: 4.4kpps
④ fs Full Step: 2.3kpps, Half Step: 4.6kpps

● AH41K-M(G)□599(W)-□



① fs Full Step: 1.4kpps, Half Step: 2.7kpps
② fs Full Step: 1.5kpps, Half Step: 2.9kpps
③ fs Full Step: 1.8kpps, Half Step: 3.6kpps
④ fs Full Step: 2.1kpps, Half Step: 4.3kpps

● AH63K-M(G)5913(W)-□



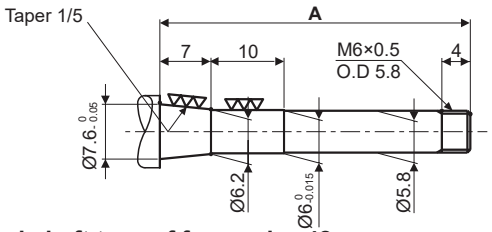
① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
④ Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

① fs Full Step: 1kpps, Half Step: 2.1kpps
② fs Full Step: 1.1kpps, Half Step: 2.2kpps
③ fs Full Step: 1.8kpps, Half Step: 3.6kpps
④ fs Full Step: 1.9kpps, Half Step: 3.8kpps

▣ Processing Example for Shaft Assembly

In order to assemble external shafts into Autonics motors, the shafts must be processed as shown in the figures below.

● Single shaft type of frame size 42mm

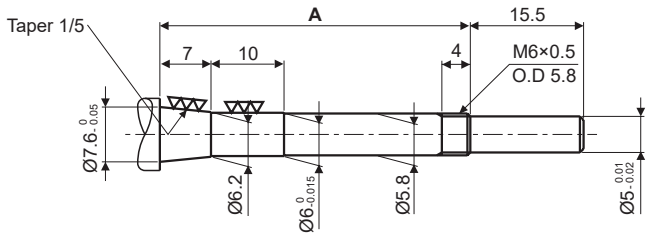


(unit: mm)

Model	A
AH1K-S543-□	42.5
AH2K-S544-□	48.5
AH3K-S545-□	56.5

※Lock nut is included.

● Dual shaft type of frame size 42mm

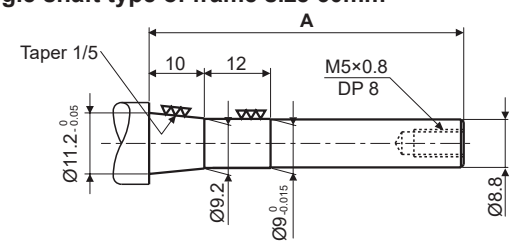


(unit: mm)

Model	A
AH1K-□543W-□	42.5
AH2K-□544W-□	48.5
AH3K-□545W-□	56.5

※Lock nut is included.

● Single shaft type of frame size 60mm

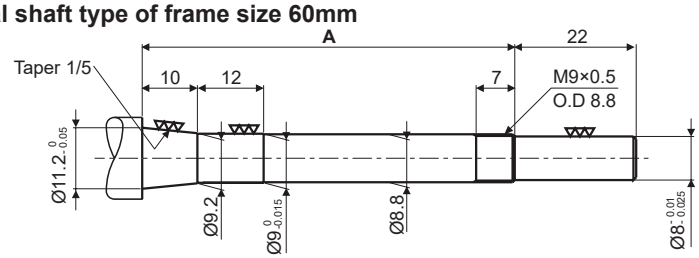


(unit: mm)

Model	A
AH4K-□564-□	46
AH8K-□566-□	57
AH16K-□569-□	86.5

※Hexagon wrench bolt, flat washer, spring washer and lock washer are included.

● Dual shaft type of frame size 60mm

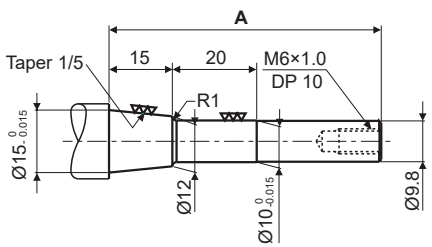


(unit: mm)

Model	A
AH4K-□564W-□	56.5
AH8K-□566W-□	67.5
AH16K-□569W-□	97

※Lock nut is included.

● Single shaft type of frame size 85mm

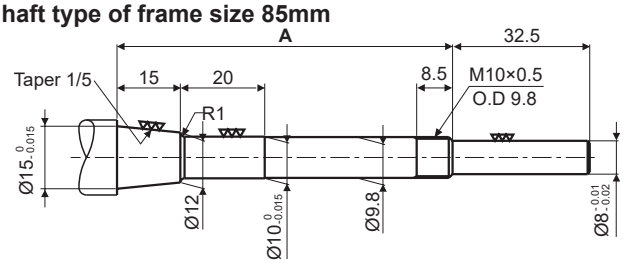


(unit: mm)

Model	A
AH21K-□596-□	64.5
AH41K-□599-□	94
AH63K-□5913-□	124.5

※Hexagon wrench bolt, flat washer, spring washer and lock washer are included.

● Dual shaft type of frame size 85mm



(unit: mm)

Model	A
AH21K-□596W-□	79.5
AH41K-□599W-□	109.5
AH63K-□5913W-□	139.5

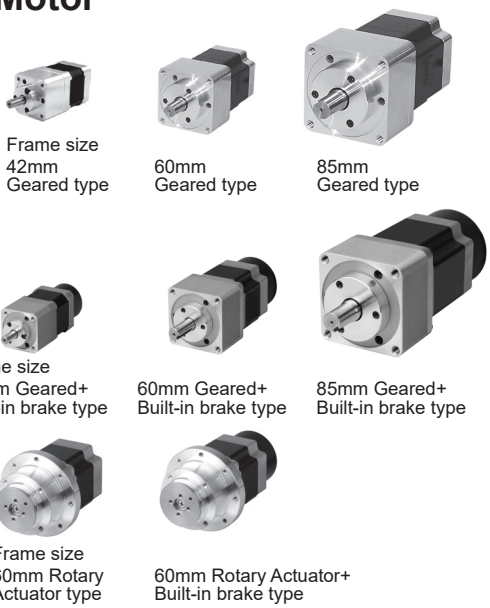
※Lock nut is included.

Frame Size 42mm/60mm/85mm Geared Type /Geared+Built-in Brake Type Motor Frame Size 60mm Rotary Actuator Type /Rotary Actuator+Built-in Brake Type Motor

▣ Features

- Compact design and light weight with high accuracy, speed and torque
- Cost-effective
- Backlash
  Frame size 42mm: ±35' (0.58°),
  60mm: ±20' (0.33°), 85mm: ±15' (0.25°)
- Brake force is released when applying 24VDC on brake wire
- Basic step angle
  1:5→ 0.144°, 1:7.2→ 0.1°, 1:10→ 0.072°
- Allowable speed
  1:5→ 0 to 360rpm, 1:7.2→ 0 to 250rpm
  1:10→ 0 to 180rpm

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

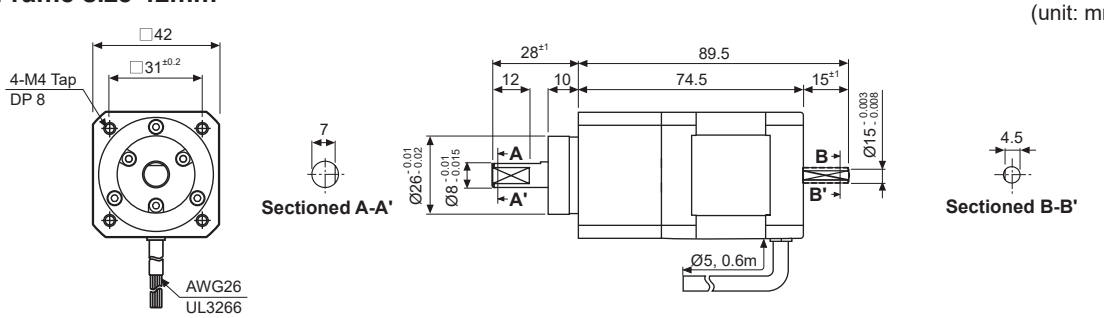


▣ Dimensions

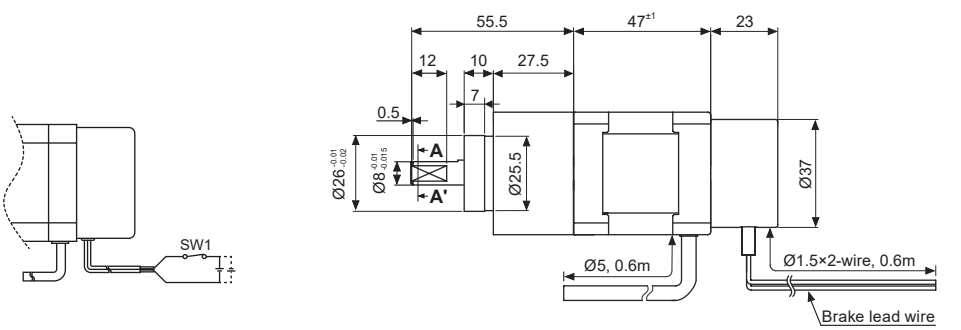
※These dimensions are for dual shaft models. Single shaft models do not include shafts indicated in the dotted lines.
※For flexible coupling (ERB series) information, refer to '**ERB Series**' in '**Rotary encoder**'.
(frame size 60mm, 85mm: geared type, geared+built-in brake type)
※Brake is non-polar and be sure to observe rated excitation voltage (24VDC).
※SW1 ON: brake release / SW1 OFF: brake execute

◎ Frame size 42mm

(unit: mm)



<Geared type>

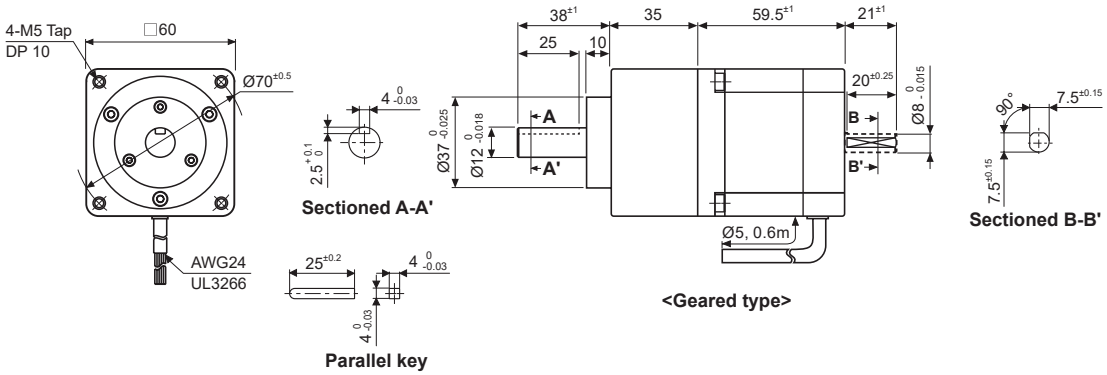


<Geared+built-in brake type>

▣ Dimensions

◎ Frame size 60mm

(unit: mm)



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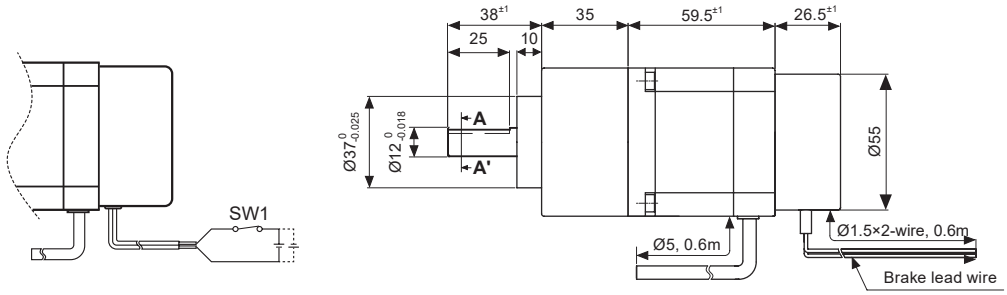
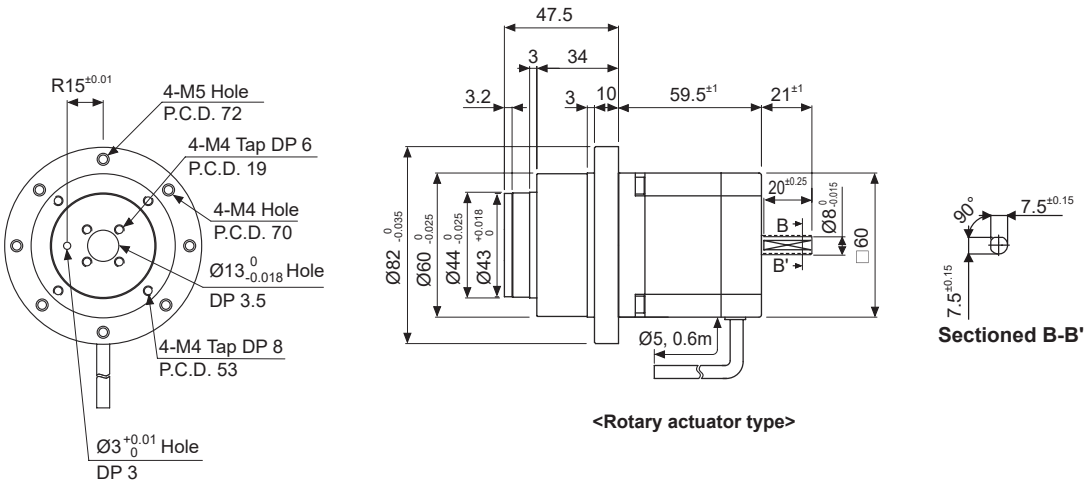
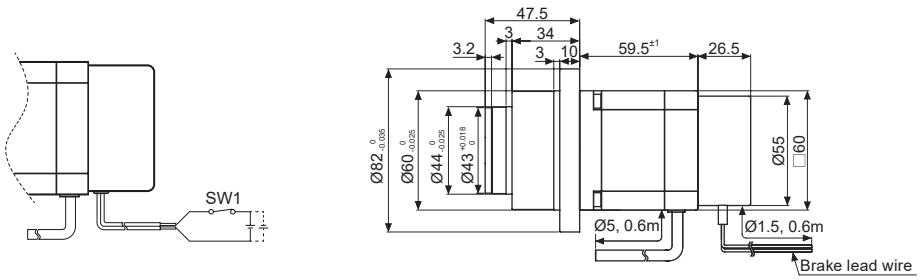


<Geared+built-in brake type>



<Rotary actuator type>

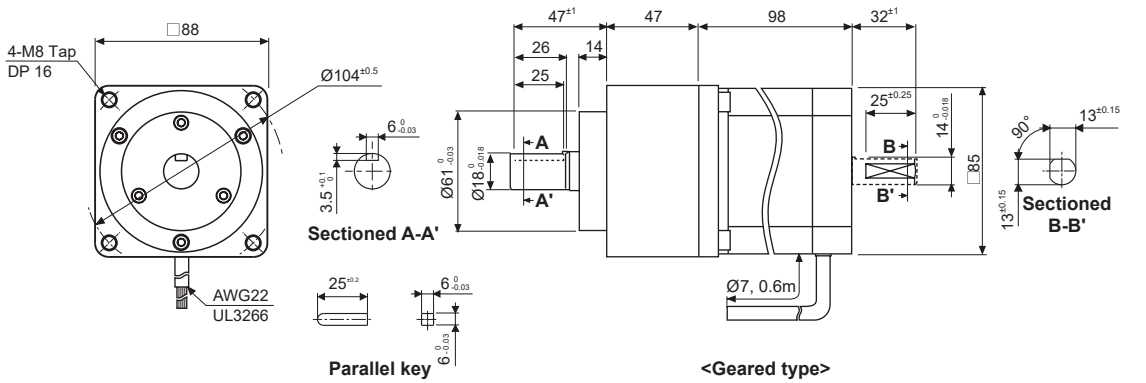


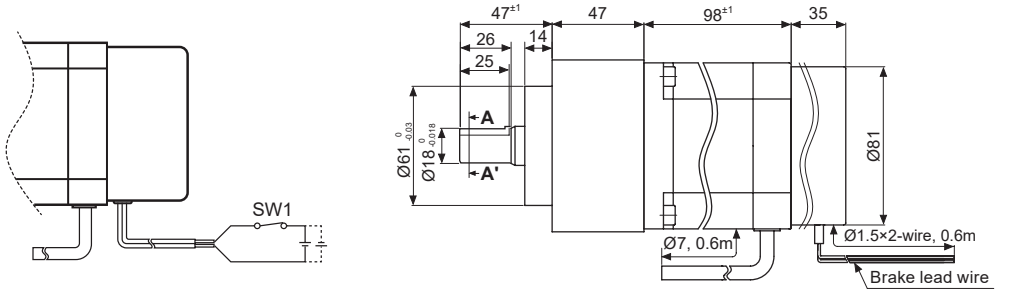
<Rotary actuator+built-in brake type>

▣ Dimensions

◎ Frame size 85mm

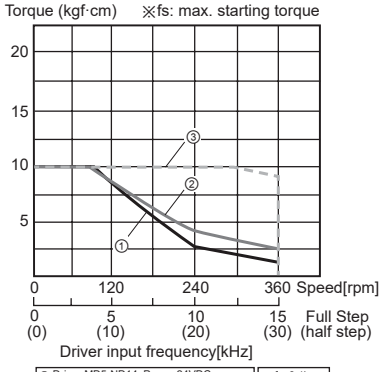
(unit: mm)





▣ Characteristic

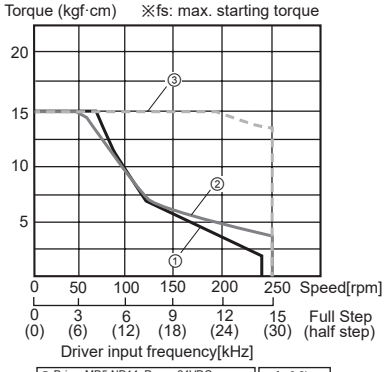
● A10K-S545(W)-G5
A10K-S545-GB5



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs: 3.1kpps
② fs: 3.2kpps
③ fs: 3.2kpps

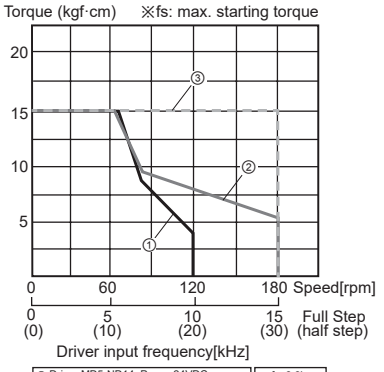
● A15K-S545(W)-G7.2
A15K-S545-GB7.2



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs: 3.2kpps
② fs: 3.3kpps
③ fs: 3.4kpps

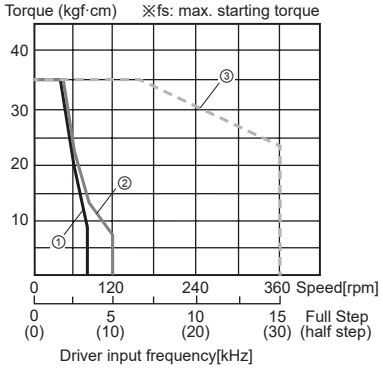
● A15K-S545(W)-G10
A15K-S545-GB10



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs: 3.3kpps
② fs: 3.3kpps
③ fs: 3.4kpps

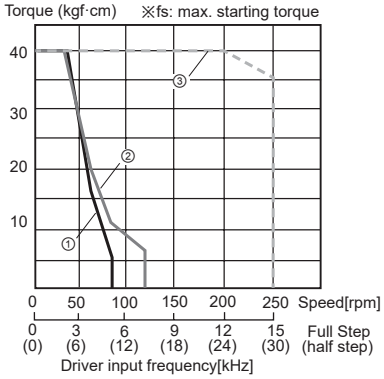
● A35K-M566(W)-□5
A35K-M566-□B5



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs: 2.3kpps
② fs: 2.3kpps
③ fs: 2.6kpps

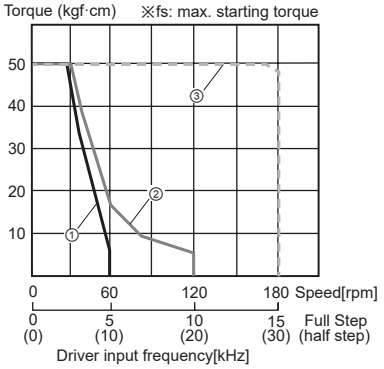
● A40K-M566(W)-□7.2
A40K-M566-□B7.2



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs: 2.2kpps
② fs: 2.3kpps
③ fs: 2.6kpps

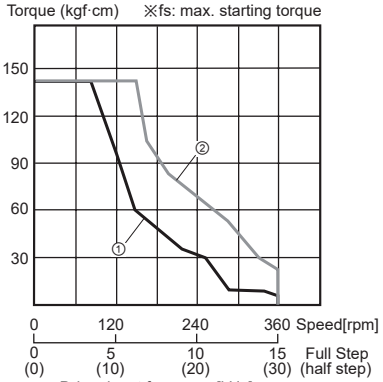
● A50K-M566(W)-□10
A50K-M566-□B10



① Driver MD5-ND14, Power 24VDC, Setting current 1.4A/Phase
② Driver MD5-HD14, Power 24VDC, Setting current 1.4A/Phase
③ Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase

① fs: 2.3kpps
② fs: 2.3kpps
③ fs: 2.8kpps

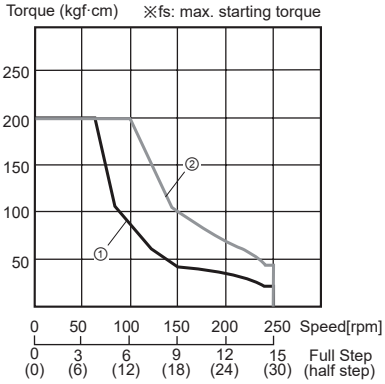
● A140K-□599(W)-G5
A140K-□599-GB5



① Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
② Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

① fs: 1.8kpps
② fs: 2.1kpps

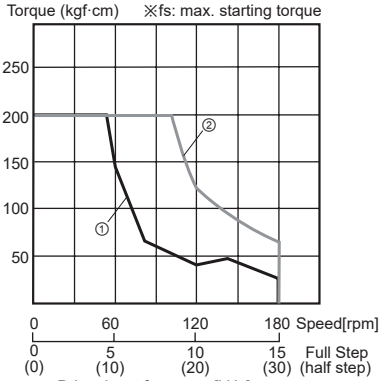
● A200K-□599(W)-G7.2
A200K-□599-GB7.2



① Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
② Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

① fs: 1.8kpps
② fs: 2.1kpps

● A200K-□599(W)-G10
A200K-□599-GB10



① Driver MD5-HF14, Power 220VAC, Setting current 1.4A/Phase
② Driver MD5-HF28, Power 220VAC, Setting current 2.8A/Phase

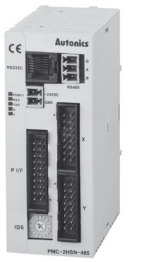
① fs: 1.9kpps
② fs: 2.1kpps

2-axis High Speed Interpolation/Normal Motion Controller

▣ Features

- Independent 2-axis controlling with high operating speed of max. 4Mpps
- Linear/Circular interpolation control (PMC-2HSP)
- Realizing a wide variety of operation up to 200 steps using 17 control commands combination (13 commands except arc/linear interpolation command for PMC-2HSN series)
- Various control interface available (USB, RS232C, RS485, Parallel I/F)
- Controlling up to 32 axes (16-unit) via RS485 serial communication (Modbus RTU)
- 4 operation modes: Jog, Continuous, Index, Program mode
- Symmetrical/asymmetrical trapezoid, S-shaped de/acceleration driving function


PMC-2HS□-USB


PMC-2HS□-485

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

(except for PMC-2HS□-485)

▣ User Manual

Please refer to user manual for detailed instructions and specifications.
Visit our website (www.autonics.com) to download user manual and software [atMotion].
User manual describes installing software, setting parameter and program, operation mode, and multi-axis operation, etc. to operate motion controller.

▣ Software (atMotion)

atMotion is the windows software designed to operate motion control for motion device.

- Compatible with Microsoft Windows 98, NT, XP (32-bit, 64-bit), Vista (32-bit, 64-bit), 7 (32-bit, 64-bit),8 (32-bit, 64-bit) and 10 (32-bit, 64-bit)
- Supports 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps communication speeds
- Available to use on all OS supported COM ports (COM1 to COM256)
- Multilingual support (Korean, English)
- Provides the calculator for convenience (calculates PPS, center of interpolation, end coordinates)

< 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 >

▣ Standard Operation Method

There are three methods to operate the motion controller.

- Operation by PC
  Connect a PC and the controller with communication cable and run dedicated program (atMotion).
- Operation by Parallel I/F
  Connect a sequence controller or switch to Parallel I/F.
- Operation by serial communication (dedicated communication protocol)
  Using serial communication protocol, operate according to program writing by user.

▣ Ordering Information

PMC – **2HSP** – **USB**

Communication type	USB	USB / RS232C
	485	RS485 / RS232C
Axis/Type	2HSP	2-axis high speed interpolation
	2HSN	2-axis high speed normal
Item	PMC	Programmable Motion Controller

▣ Specifications

Model		PMC-2HSP-USB	PMC-2HSP-485	PMC-2HSN-USB	PMC-2HSN-485
Control axes		2-axis			
Motor for control		Pulse train input stepper motor or servo motor			
Power supply		24VDC⎓			
Allowable voltage range		90 to 110% of rated voltage			
Power consumption		Max. 6W			
In-Position range		-8,388,608 to 8,388,607 (selectable absolute/relative value, available pulse-scaling function)			
Drive speed		1pps to 4Mpps (1 to 8,000pps×magnification 1 to 500)			
Pulse output method		1-Pulse/2-Pulse output method (line driver output)			
Operation mode		Jog / Continuous / Index / Program mode			
Number of index steps		64 indexes per axis			
Program function	Steps	200-step			
	Control command	ABS, INC, HOM, LID※1, CID※1, FID※1, RID※1, TIM, JMP, REP, RPE, ICJ, IRD, OPC, OPT, NOP, END			
	Start	Available power On program auto start setting			
	Home search	Available power On home search setting			
Home search mode		High speed near home search (Step 1) → Low speed near home search (Step 2) → Encoder Z phase search (Step 3) → Offset movement (Step 4)			
I/O		• Parallel I/F (CN3): 13 inputs, 4 outputs • X-axis (CN4) / Y-axis (CN5): 8 inputs, 6 outputs (general-purpose I/O, two of each)			
Environ-ment	Ambient temperature	0 to 45℃, storage: -15 to 70℃			
	Ambient humidity	20 to 90%RH, storage: 20 to 90%RH			
Accessory		• [Common] Power connector, I/O connector: 3 (PI/F, X-axis, Y-axis), RS232C communication cable (1.5m): 1 • [USB type] USB communication cable 1m: 1 •[RS485 type] RS485 connector: 1			
Approval		CE K	CE	CE K	CE
Weight※2		Approx. 344g (approx. 101.5g)	Approx. 308.7g (approx. 101.6g)	Approx. 344g (approx. 101.5g)	Approx. 308.7g (approx. 101.6g)

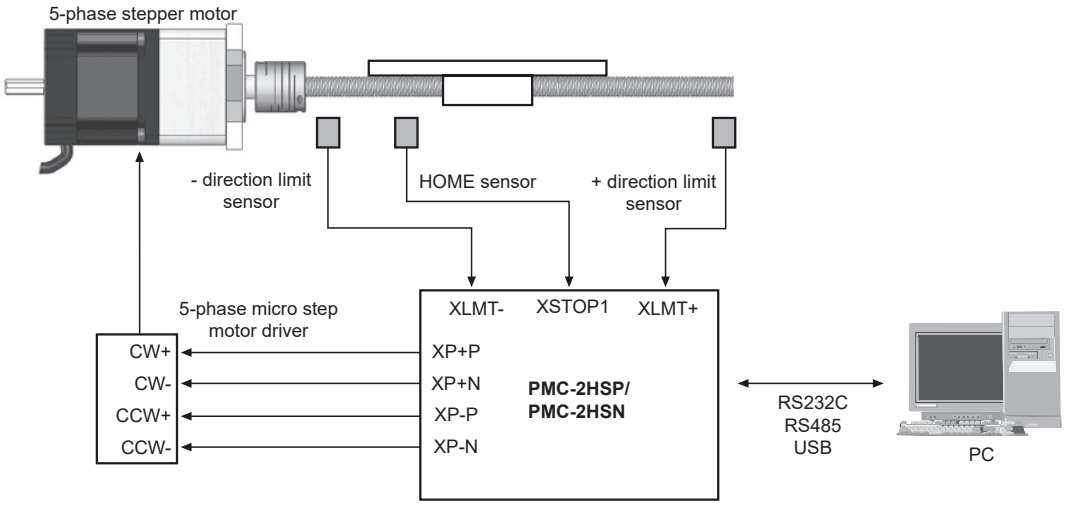
※1: These commands are only for PMC-2HSP series.
※2: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing of condensation.

▣ Program Commands

Command type	Code	Description
Drive commands	ABS	Move absolute position
	INC	Move relative position
	HOM	Home search
	LID※1	2-axis linear interpolation
	CID※1	2-axis CW circular interpolation
	FID※1	2-axis CW arc interpolation
	RID※1	2-axis CCW arc interpolation
I/O commands	ICJ	Jump input condition
	IRD	Stand-by external input
	OPC	ON/OFF output port
	OPT	ON pulse from output port
Program control commands	JMP	Jump
	REP	Start repetition
	RPE	End repetition
	END	End program
Others	TIM	Timer
	NOP	No operation

※1: These commands are only for PMC-2HSP series.

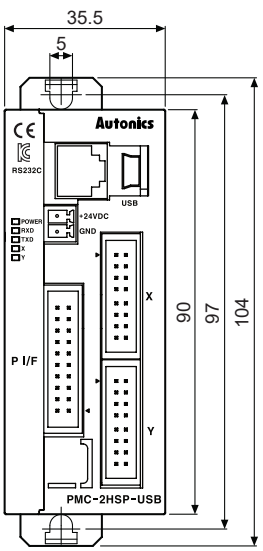
▣ Connections

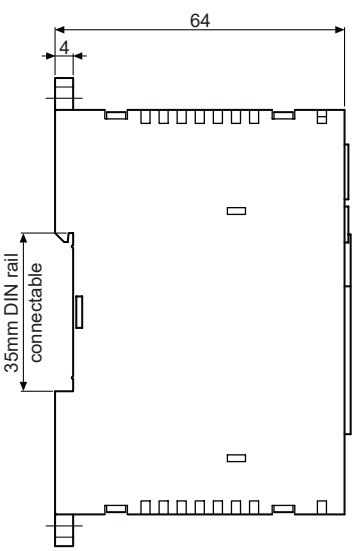


< Basic configuration of the motion controller (configuration only for X-axis) >

▣ Dimensions

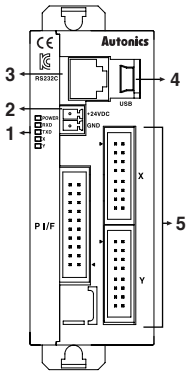
(unit: mm)



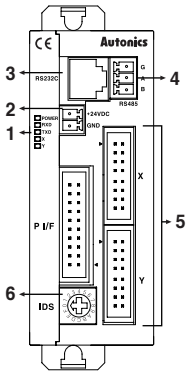


▣ Unit Descriptions

◎ PMC-2HS□-USB



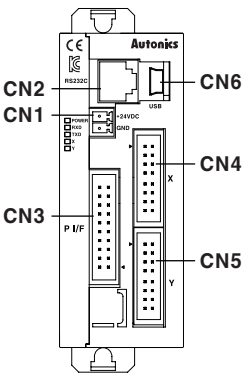
◎ PMC-2HS□-485



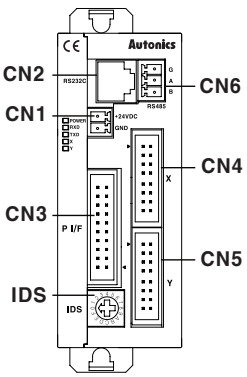
1. **Power / Status indicator**
   Used to indicate power, communication status of the controller, and operation status of each axis.
2. **Power connector terminal**
   Used to connect power for controller
3. **RS232C connector terminal**
   Used to connect RS232 serial (RJ12-DSUB9) connection cable
4. **USB/RS485 connector terminal**
   Used to connect USB and RS485 connection cable
5. **External I/O connector terminal**
   Used to operate various drives through input and output of Parallel I/F, X, Y
6. **ID select switch**
   Used to set unique ID for each node in case of RS485 communication

▣ External I/O Terminal Connection

◎ PMC-2HS□-USB



◎ PMC-2HS□-485



● Connector

Connector no.	Description
CN1	Power connector
CN2	RS232C connector
CN3	Parallel I/F connector
CN4	X-axis I/O connector
CN5	Y-axis I/O connector
CN6	PMC-2HSP/2HSN-USB: USB connector
	PMC-2HSP/2HSN-485: RS485 connector
IDS	ID selection switch

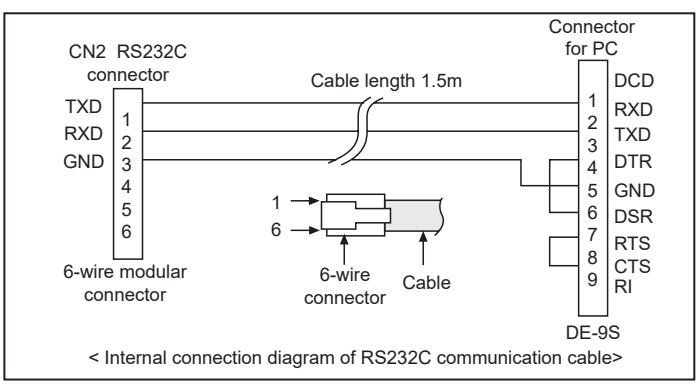
▣ CN1: Power Connector

Pin no.	Signal name
1	24VDC
2	GND (0V)

▣ CN2: RS232C Connector

Pin no.	Signal name	I/O	Description
1	TXD	Output	Receiving data
2	RXD	Input	Transmitting data
3	GND	—	Ground
4	—	—	N·C
5	—	—	
6	—	—	

※The internal connection diagram of RS232C communication cable is shown on the right.



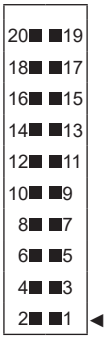
< Internal connection diagram of RS232C communication cable>

▣ CN3: Parallel I/F Connector

The Parallel I/F connector which is connected with a sequencer or mechanical contacts operates motion controller same as PC program. When input signal is ON, the input signal terminal and GEX terminal are connected by mechanical contacts or open collector output and open collector output transistor is ON when the output signal is ON.

Pin no.	Signal name	I/O	Description
1	RESET	Input	Reset
2	HOME	Input	Home search start command
3	STROBE	Input	Drive start command
4	X/JOG Y+	Input	X-axis designate/Jog Y+
5	Y/JOG Y-	Input	Y-axis designate/Jog Y-
6	STEPSL0/RUN+/JOG X+	Input	Register designate 0/Run+/Jog X+
7	STEPSL1/RUN-/JOG X-	Input	Register designate 1/Run-/Jog X-
8	STEPSL2/SPD0	Input	Register designate 2/Drive speed designate 0
9	STEPSL3/SPD1	Input	Register designate 3/Drive speed designate 1
10	STEPSL4/JOG	Input	Register designate 4/Jog designate
11	STEPSL5/STOP	Input	Register designate 5/Drive stop
12	MODE0	Input	Operation mode designate 0
13	MODE1	Input	Operation mode designate 1
14	X DRIVE/END	Output	X-axis drive/Drive end pulse
15	Y DRIVE/END	Output	Y-axis drive/Drive end pulse
16	X ERROR	Output	X-axis error
17	Y ERROR	Output	Y-axis error
18	GEX	—	Ground
19	GEX	—	Ground
20	VEX	—	Power supply for sensor (24VDC, max. 100mA)

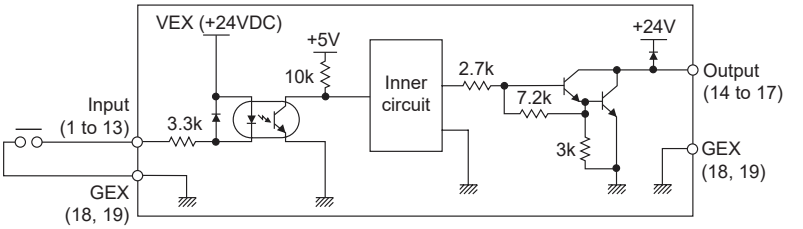
<CN3 pin number>



[Hirose connector]: HIF3BA-20PA-2.54DS
[Connector socket specification]: Contact the manufacture for the socket and cable.

	Specifications	Manufacture
Connector socket	HIF3BA-20D-2.54R	Hirose Electric
I/O cable (sold separately)	CO20-HP□-L, CO20-HP□-R	Autonics

▣ Input/Output Connections of CN3

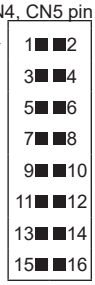


▣ CN4, CN5: X, Y-Axis Input/Output Connector

CN4 and CN5 are I/O signals for X-axis and Y-axis respectively.
The pin arrangement of CN4 and CN5 are equal. 'n' in the table means X for CN4 and Y for CN5.

Pin no.	Signal name	I/O	Description
1	n P+P	Output	Drive pulse in the CW + direction
2	n P+N	Output	Drive pulse in the CW - direction
3	n P-P	Output	Drive pulse in the CCW + direction
4	n P-N	Output	Drive pulse in the CCW - direction
5	n OUT0	Output	General output 0
6	n OUT1	Output	General output 1
7	n IN0	Input	General input 0
8	n IN1	Input	General input 1
9	n STOP2	Input	Encoder Z-phase
10	n STOP1	Input	Home
11	n STOP0	Input	Near Home
12	n LMT+	Input	+ direction limit
13	n LMT-	Input	- direction limit
14	EMG	Input	Emergency stop
15	GEX	—	Ground
16	VEX	—	Power supply for sensor (24VDC, max. 100mA)

<CN4, CN5 pin no.>

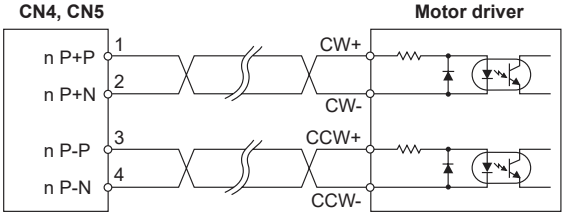


[Hirose connector]: HIF3BA-16PA-2.54DS
[Connector socket specification]: Contact the manufacture for the socket and cable.

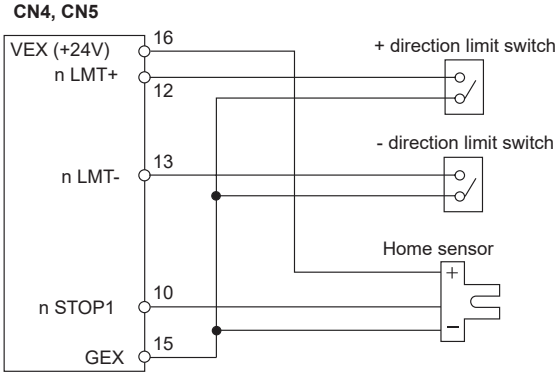
	Specifications	Manufacture
Connector socket	HIF3BA-16D-2.54R	Hirose Electric

※CN4, 5 input/output is same as CN3 input/output connections.
Drive pulse output of motion controller which is inputted to motor driver is line driver output.

E.g. Connection with a motor driver



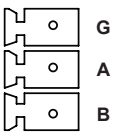
E.g. Connect of Limit and Home signal



▣ CN6: RS485 Connector

Pin no.	Signal name	I/O	Description
1	B (-)	I/O	Transmitting / Receiving data
2	A (+)	I/O	Transmitting / Receiving data
3	G	—	※1

※1: Connect the ground when it is required depending on communication environments.



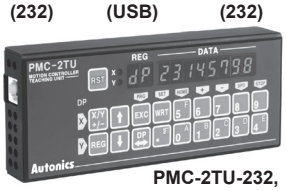
1·2-Axis High Speed Programmable Motion Controller

▣ Features

- Max. 4Mpps high-speed operation
- 4 operation modes: Jog, Continuous, Index, Program mode
- 12 control command and 64 steps of operations
- Parallel I/O terminal built in which is connectable on PLC
- Create and edit operating programs, parameters by dedicated software
- Easy to operation of X, Y stage with joy stick
- RS232C port for all types
- Teaching and monitoring function by using teaching unit (PMC-2TU-232, sold separately)

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

PMC-1HS (USB) **PMC-1HS (232)** **PMC-2HS (USB)** **PMC-2HS (232)**



PMC-2TU-232, sold separately

▣ Manual

For the detail information and instructions, please refer to user manual and be sure to follow cautions written in the technical descriptions (catalog, website). Visit our website (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) 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 >

▣ Standard Operation Method

There are four methods to operate PMC-1HS/PMC-2HS.

- Start with PC
  Connect a PC and the motion controller body via a communication cable, starts the operation program.
- Start with Parallel I/F
  Connect a sequence controller or switch to the Parallel I/F.
- Start with teaching unit (PMC-2TU-232, sold separately)
  Connect a communication cable annexed to a teaching unit (PMC-2TU-232).
  It is available to execute Jog output, home output and programs by drive operation of teaching unit.
- Control by serial communication
  The PMC-1HS/2HS Series provides serial communication commands.
  The PMC-1HS/2HS is connected to a PC or a sequence controller via an USB cable or RS-232C communication cable and it can control axes by means of user's independent program.

▣ Ordering Information

PMC – **2HS** – **USB**

Communication type	232	RS232C
	USB	USB, RS232C multiple use
Axis/Type	1HS	1-axis high speed stand-alone
	2HS	2-axis high speed stand-alone
Item	PMC	Programmable Motion Controller

▣ Specifications

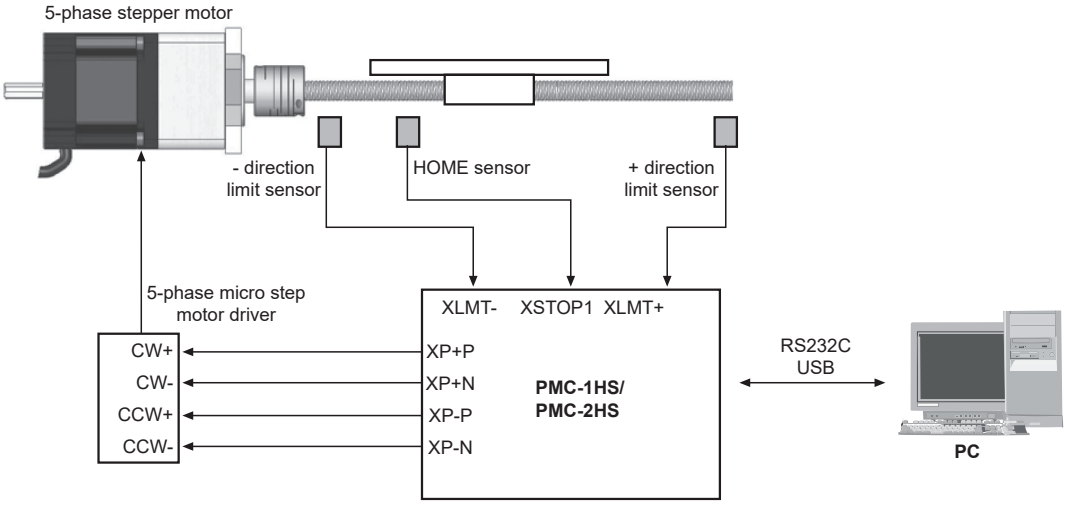
Model		PMC-1HS-232	PMC-1HS-USB	PMC-2HS-232	PMC-2HS-USB
Control axes		1-axis		2-axis (Each axis can be independently programmed)	
Motor for control		Pulse train input stepper motor or servo motor			
Power supply		24VDC⎓ ±10%			
Power consumption		Max. 6W			
Operation mode		Jog / Continuous / Index / Program mode			
In-Position setting		ABSOLUTE / INCREMENTAL method			
Number of index steps		64 indexes per axis			
In-Position range		-8,388,608 to +8,388,607 (supports pulse scaling function)			
Number of drive speed		4			
Drive Speed		1pps to 4Mpps (1 to 8,000×magnification 1 to 500)			
Pulse output method		2-pulse output method (line driver output)			
Home search mode		High speed near home search (Step 1) → Low speed near home search (Step 2) → Encoder Z-phase search (Step 3) → Offset movement (Step 4). Configuring the detection direction and Enable/Disable in each step.			
Program function	Save	EEPROM			
	Steps	64-step			
	Control command	ABS, INC, HOM, IJP, OUT, OTP, JMP, REP, RPE, END, TIM, NOP (12 types)			
	Start	Available power ON program auto start setting			
	Home search	Available power ON home search setting			
General output		1-point		2-point	
Control interface		Parallel I/F			
Environment	Ambient temp.	0 to 45℃			
	Ambient humidity	35 to 85%RH			
Accessory	Common	User manual, CD			
	Power connector	[CN1] MC1, 5/2-ST-3.5 (PHOENIX): 1			
	RS-232C connector	[CN2] RS-232C communication cable (1.5m): 1			
	P I/F connector	[CN3] 20P MIL standard, 2.54mm connector: 1			
	X-axis I/O connector	[CN4] 16P MIL standard, 2.54mm connector: 1 (In case of 2HS, using 2)			
	Y-axis I/O connector	—		[CN5] 16P MIL standard, 2.54mm connector: 1	
	USB connector	—	USB communication cable (1m): 1	—	USB communication cable (1m): 1
Approval		CE			
Weight※1		Approx. 386g (approx. 96.8g)	Approx. 421.6g (approx. 96.9g)	Approx. 393.6g (approx. 100.2g)	Approx. 432.2g (approx. 100.4g)

※1: The weight includes packing. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing of condensation.

▣ Program Commands

Command type	Code	Description
Drive commands	ABS	Move absolute position
	INC	Move relative position
	HOM	Home search
I/O commands	IJP	Jump input condition
	OUT	ON/OFF of output port
	OTP	ON pulse from output port (certain time)
Program control commands	JMP	Jump
	REP	Start repetition
	RPE	End repetition
	END	End program
Others	TIM	Timer
	NOP	No operation

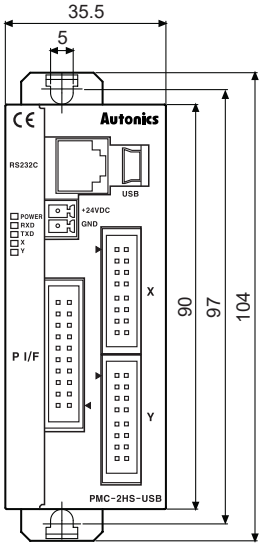
▣ Connections

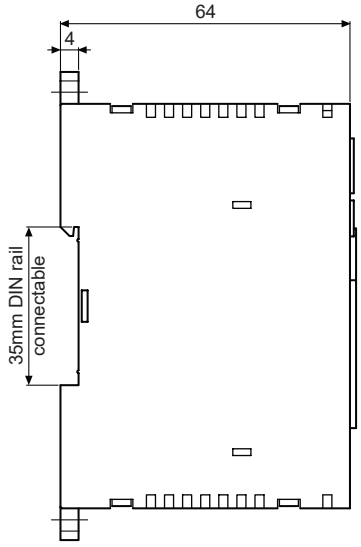


< Basic configuration of the motion controller (configuration only for X-axis) >

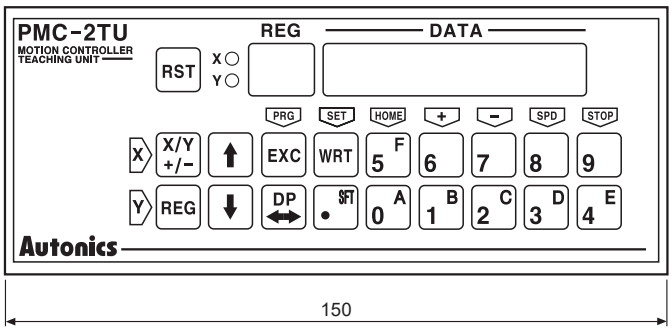
▣ Dimensions

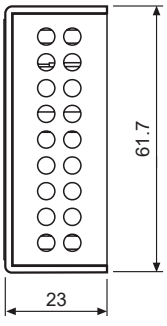
(unit: mm)



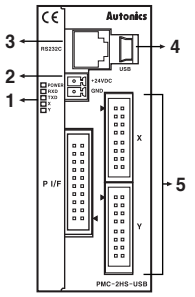


◎ Sold separately (teaching unit, PMC-2TU-232)



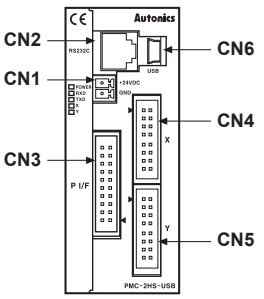


▣ Unit Descriptions



1. **Power / Status indicator**
   Used to indicate power, communication status of the controller, and operation status of each axis.
2. **Power connector terminal**
   Used to connect power for controller
3. **RS232C connector terminal**
   Used to connect RS232 serial (RJ12-DSUB9) connection cable
4. **USB/RS485 connector terminal**
   Used to connect USB and RS485 connection cable
5. **External I/O connector terminal**
   Used to operate various drives through input and output of Parallel I/F, X, Y

▣ External I/O Terminal Connection



Connector No.	Description
CN1	Power connector
CN2	RS232C connector (connect with PMC-2TU-232)
CN3	Parallel I/F connector
CN4	X-axis I/O connector
CN5	Y-axis I/O connector
CN6	USB connector

※PMC-1HS-232 does not have CN5 and CN6,
PMC-1HS-USB does not have CN5, and
PMC-2HS-232 does not have CN6.

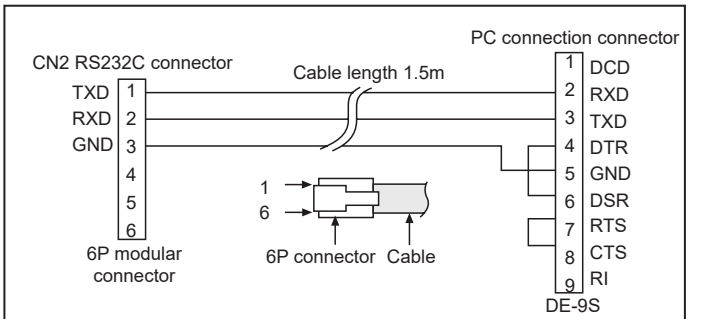
▣ CN1: Power Connector

Pin No.	Signal name
1	24VDC
2	GND (0V)

▣ CN2: RS232C Connector

Pin No.	Signal name	Input/Output	Description
1	TXD	Output	Transmitting data
2	RXD	Input	Receiving data
3	GND	—	Ground
4	—	—	N·C
5	—	—	
6	—	—	

※The internal connection diagram of RS232C communication cable is as shown below.



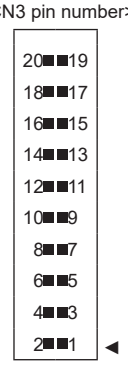
< Internal connection diagram of RS232C communication cable>

▣ CN3: Parallel I/F Connector

Motion controller is controlled via Parallel I/F connected with a sequencer or mechanical junction as the dedicated program.
'The input signal is in the ON state' means that the input signal and GEX terminal is connected via a mechanical junction or an open collector.
'The output is in the ON state' means that an open collector output transistor becomes high.

Pin No.	Signal name	Input/Output	Description
1	RESET	Input	Reset
2	HOME	Input	Home search start
3	STROBE	Input	Drive start
4	X/JOG Y+	Input	X-axis setting/Jog 2 mode Y+
5	Y/JOG Y-	Input	Y-axis setting/Jog 2 mode Y-
6	REGSL0/RUN+/JOG X+	Input	Register setting 0/Run+/Jog 2 mode X+
7	REGSL1/RUN-/JOG X-	Input	Register setting 1/Run-/Jog 2 mode X-
8	REGSL2/SPD0	Input	Register setting 2/Drive speed setting 0
9	REGSL3/SPD1	Input	Register setting 3/Drive speed setting 1
10	REGSL4/JOG	Input	Register setting 4/Jog setting
11	REGSL5/STOP	Input	Register setting 5/Drive stop
12	MODE0	Input	Operation mode setting 0
13	MODE1	Input	Operation mode setting 1
14	X DRIVE/END	Output	X-axis drive/Drive end pulse
15	Y DRIVE/END	Output	Y-axis drive/Drive end pulse
16	X ERROR	Output	X-axis error
17	Y ERROR	Output	Y-axis error
18	GEX	0V	GND
19	GEX	0V	GND
20	VEX	+24V	Power output for sensor (less than 24VDC, 100mA)

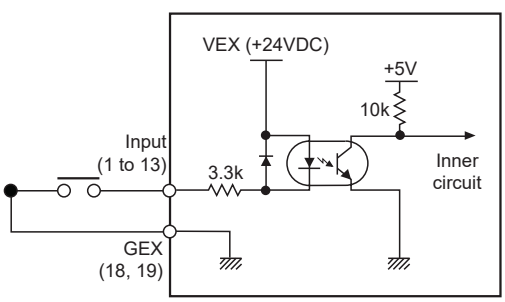
<CN3 pin number>



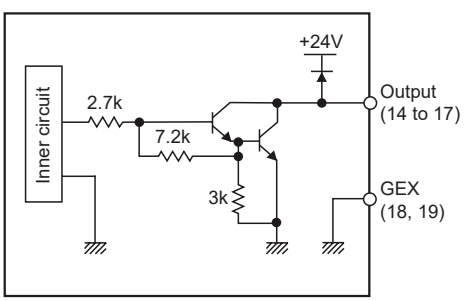
[Hirose connector]: HIF3BA-20PA-2.54DS
[Connector socket specification]: Contact the manufacture for the socket and cable.

	Specifications	Manufacture
Connector socket	HIF3BA-20D-2.54R	Hirose Electric
I/O cable (sold separately)	CO20-HP□-L, CO20-HP□-R	Autonics

▣ Input/Output Connections of CN3



< CN3 control input connections >



< CN3 control output connections >

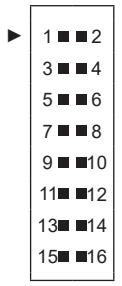
▣ CN4, CN5: X, Y-Axis Input/Output Connector

CN4 and CN5 are the I/O signal connector for X-axis and Y-axis respectively.
The pin arrangement of CN4 and CN5 are equal. PMC-1HS does not have CN5.
'n' in the below table means X for CN4 and Y for CN5.

Pin No.	Signal name	Input/Output	Description
1	nP+P	Output	CW +direction drive pulse
2	nP+N	Output	CW -direction drive pulse
3	nP-P	Output	CCW +direction drive pulse
4	nP-N	Output	CCW -direction drive pulse
5	n OUT0	Output	General output 0/DCC
6	n INPOS	Input	Servo In-Position complete
7	n ALARM	Input	Servo alarm
8	GEX	0V	GND
9	n STOP2	Input	Encoder Z-phase
10	n STOP1	Input	Home
11	n STOP0	Input	Near Home
12	n LMT+	Input	LMT+
13	n LMT-	Input	LMT-
14	EMG	Input	Emergency stop
15	GEX	0V	GND
16	VEX	+24V	Power output for sensor (less than 24VDC, 100mA)

※CN4, 5 input/output circuit except drive pulse is same as CN3 input/output circuit.
Drive pulse output of motion controller which input by motor driver is line driver output.

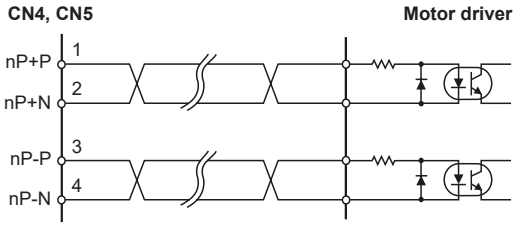
<CN4, CN5 pin number>



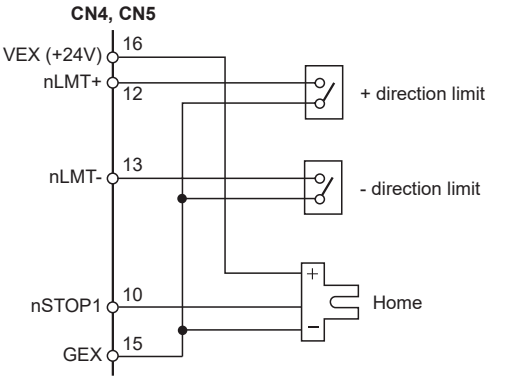
[Hirose connector]: HIF3BA-16PA-2.54DS
[Connector socket specification]: Contact the manufacture for the socket and cable.

	Specifications	Manufacture
Connector socket	HIF3BA-16D-2.54R	Hirose Electric

E.g. Connection with a motor driver



E.g. Connect of Limit and Home signal



▣ Teaching Unit PMC-2TU-232 (sold separately)

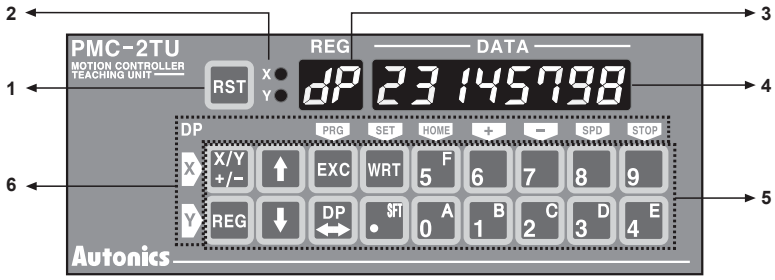
The teaching unit (PMC-2TU-232) is a device that builds the operation mode parameter and operation program for the main body without a PC. In addition, it can carry out the start of the operation program, the home search and Jog operation. The teaching unit is used by connection the private cable (1.5m) to the RS-232C connector (CN2) of the main body.

PMC-2TU-232
connection cable (accessory)

Teaching unit consists of data edit mode and drive operation mode.
The data edit mode displays a register number to the REG of the display part, and the drive handling mode displays dp (drive operation). When turned on, it starts as the drive handling mode (dp display).
The [DP] button is used to convert the status of the data edit mode and the drive operation mode.

Mode	Operation	REG display
Data edit	• Adding operation mode parameter and operation program • Index drive operation	Register number
Drive handling	• Displaying the current position • Jog operation • Home search • Program execution	dP (drive operation)

The front panel of the teaching unit is as shown below;

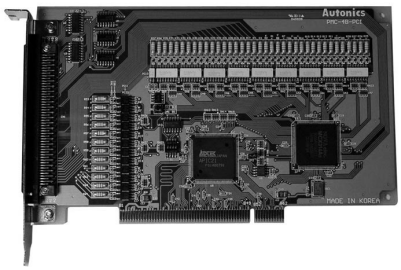


1. Reset: Reset the controller and teaching unit.
2. X/Y display: Display the currently selected axis.
3. Register number display/dp
: Displays the currently selected register number when data is editing and dp when operating drive.
4. Data display
: Displays the data of each register when data is editing and the current position of the selected axis when operating drive.
5. Input button
• X/Y: Converts the selecting axis. It is used to convert the sign of an input value when the value is entered and a mode data that the mode data is entered.
• REG: It is used to input the register number to display.
If this button is pressed on the data input, the data input is canceled and returns to the state before the data input.
• ↑↓: Increases / decreases the displayed register number.
• EXC: Runs the displayed command. However, this command is only valid for ABS, INC, OUT, OTP and HOM 1 to 4 commands.
• DP: Converts the drive handling status and the data edit status.
• WRT: Adds a value when data is editing.
6. Button display for drive operation
: Displays button function as yellow letters to the left or the top of the input button in drive handling status.
The top end and the bottom end of the button handle X-axis and Y-axis respectively.

4-axis Board Type Programmable Motion Controller

■ Features

- Available to control 4-axis independent AC servo motor and stepper motor
- PC-PCI card
- Auto home search and synchronous operation
- Interpolation on circular/linear, bit pattern/continuous/ accel/deceleration drive
- 2/3-axis constant linear velocity.
- Compatible with windows 98, NT, 2000, XP, 7
- Supports Labview library and help, C language library and examples (download at Autonics website)



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

※Visit our website (www.autonics.com) to download manual and software.

■ Software (atMotion)

atMotion is the windows software designed to operate motion control for motion device.

- Compatible with Microsoft Windows 98, NT, XP (32-bit, 64-bit), Vista (32-bit, 64-bit), 7 (32-bit, 64-bit), 8 (32-bit, 64-bit) and 10 (32-bit, 64-bit)
- Supports 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps communication speeds
- Available to use on all OS supported COM ports (COM1 to COM256)
- Multilingual support (korean, english)
- Provides the calculator for convenience (calculates PPS, center of interpolation, end coordinates)

■ Ordering Information

PMC – **4B** – **PCI**

Connection type	PCI	PCI
Axis/Type	4B	4-axis board type
Item	PMC	Programmable motion controller

■ Specifications

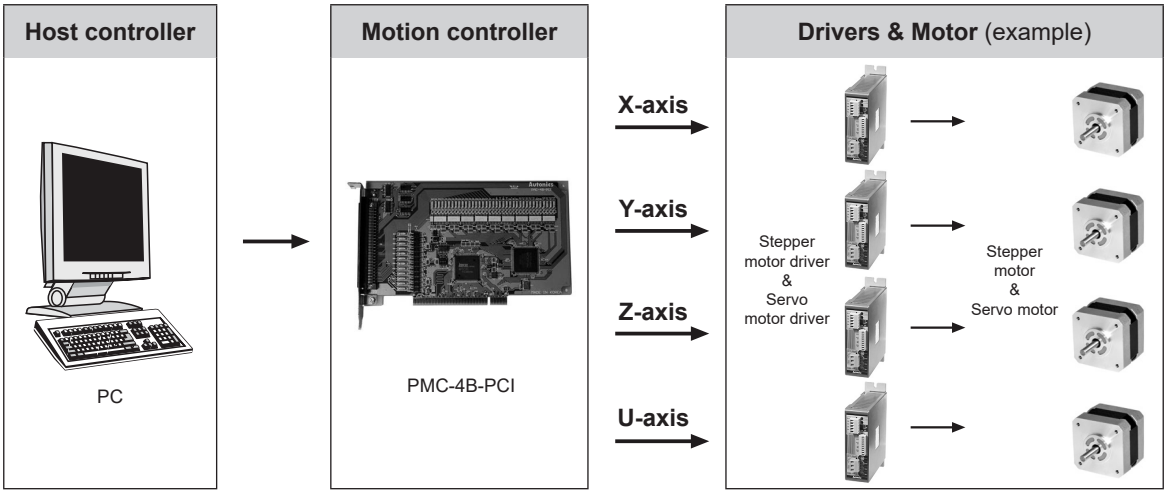
Model		**PMC-4B-PCI**
Control axes		4-axis
Power supply		5VDC⎓ (uses PC inner power)
External power supply		12-24VDC⎓
Allowable voltage range		90 to 110% of rated voltage
CPU data bus		8/16-bit selectable
2/3-axis linear interpolation	Range	-2,147,483,648 to 2,147,483,647 for each axis
	Speed	1pps to 4Mpps
	Position accuracy	Max. ±0.5LSB (within all interpolation range)
Circular interpolation	Range	-2,147,483,648 to 2,147,483,647 for each axis
	Speed	1pps to 4Mpps
	Position accuracy	Max. ±1 LSB (within all interpolation range)
2/3-axis bit pattern interpolation speed		1 to 4Mpps (depends on CPU data setup time)
Other interpolations		Selectable the axis, constant linear velocity, consecutive interpolation, interpolation step transmission (command, external signal)
Driver pulse output (X, Y-axis common specifications)		Output speed range: 1pps to 4Mpps
		Output speed accuracy: max ±0.1% (for setting value)
		Speed magnification: 1 to 500
		S jerk speed: 954 to 62.5×10^6pps/sec (mag.=1) (accel/decel increase rate) 477×10^3 to 31.25×10^9pps/sec (mag.=500)
		Accel/Decel: 125 to 1×10^6pps/sec (mag.=1) 62.5×10^3 to 500×10^6pps/sec (mag.=500)
		Initial velocity: 1 to 8,000pps (mag.=1) / 500 to 4×10^6pps (mag.=500)
		Drive speed: 1 to 8,000pps (mag.=1) / 500 to 4×10^6pps (mag.=500)
		Number of output pulses: 0 to 4,294,967,295 (fixed pulse drive)
		Speed curve: constant speed, symmetric/asymmetric linear accel/decel, parabola S curve drive
		Fixed pulse drive deceleration mode auto deceleration (asymmetric linear accel/decel function)/ Manual deceleration
		Changeable output pulse for driving, drive speed
		Selectable individual 2-pulse/1-pulse direction method
		Selectable drive pulse logic level, changeable output terminal
Encoder input pulse		Inputtable 2-phase pulse/Up-Down pulse, selectable 2-phase pulse 1/2/4 multiply

▣ Specifications

Position counter		Logic position counter (for output pulse) count range: -2,147,483,648 to +2,147,483,647 Actual position counter (for input pulse) count range: -2,147,483,648 to 2,147,483,647
Compare register		Comp. +register position comparison range: -2,147,483,648 to +2,147,483,647
		Comp. -register position comparison range: -2,147,483,648 to +2,147,483,647
		Output/Signal output when the present value of the counter and the user position counter are same by comparing
		Enables to operate as software limit
Auto home search		High speed near home search (Step1) → Low speed near home search (Step2)
Interrupt function (except interpolation)		1 drive pulse output when changing position counter ≥ Comp.-, when changing position counter ≥ Comp.+, when changing position counter < Comp.-, when changing position counter < Comp.+, when starting constant speed in accel/decel drive, when ending constant speed in accel/decel drive when ending drive, when ending auto home search, when running synchronous operation
Drive adjustment by external signal		Enable to fixed/continuous pulse drive of +/- direction by EXP+/EXP- signal
		Enable to drive 2-phase encoder signal mode (encoder input)
External deceleration stop/ immediate stop signal		IN 0 to 3 each axis 4-point
		Selectable signal valid/invalid and logical level, usable as general input
Input signal for servo motor		Selectable alarm, INPOS signal valid/invalid and logic level
General output signal		OUT 4 to 7 each axis 4-point (uses same terminal with drive status output signal)
Drive status signal output		ASND (accelerating), DSND (decelerating)
Overrun limit signal input		Selectable + direction, - direction each 1-point and logic level
		At active, selectable immediate stop/decelerate stop
Emergency stop signal input		EMG 1-point, stops drive pulse of all axes by low level
Integral filter		Built-in integral filter at each input signal input terminal, selectable pass time (8 types)
Others		Selectable the axis, constant linear velocity, consecutive interpolation, interpolation step transmission (command, external signal)
Environment	Ambient temperature	0 to 45℃, storage: -10 to 55℃
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Approval		CE KC
Weight※1		Approx. 654.4g (approx. 100.4g)

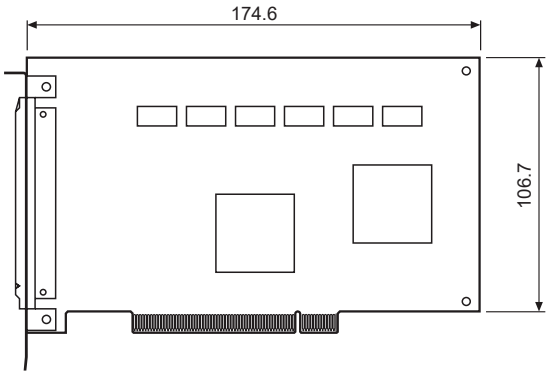
※1: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing of condensation.

▣ System



▣ Dimensions

(unit: mm)

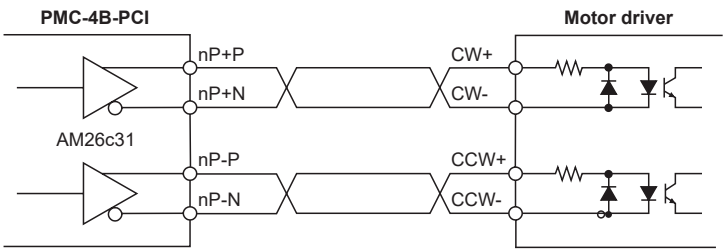


▣ Connections

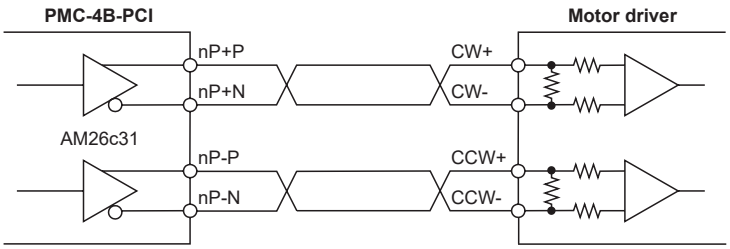
◎ Connection of pulse output signal (nP+P/N, nP-P/N)

Drive pulse output generates drive pulse signal of +/- direction using line driver (AM26c31) of differential output.
Followings are examples of connection with motor drivers with photocoupler or line driver input.

● Example for the connection with a motor driver of photocoupler input



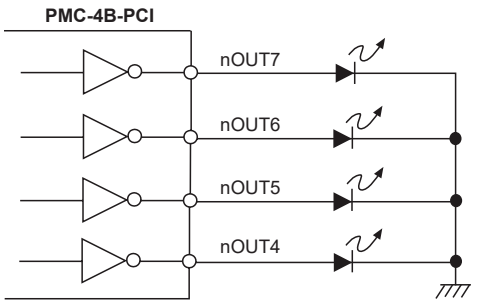
● Example for the connection with a motor driver of line driver



※It is recommended to use twisted pair shield wire for pulse output signal of driver operation regarding EMC.

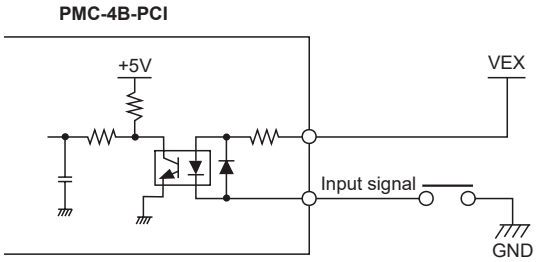
◎ Connection of common output signal (nOUT4 to 7)

Output signal is outputted by buffer (74LS06), and all outputs are OFF after reset.



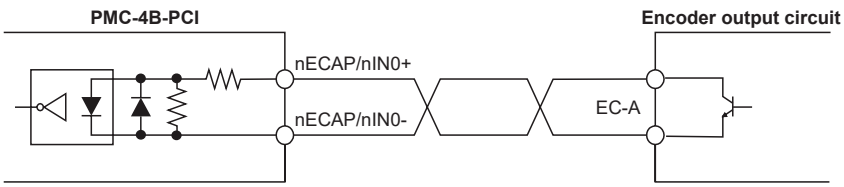
▣ Connections

◎ Connection of input signal (nIN1 to 3, nINPOS, nALRAM, nEXP+/-, EMG)

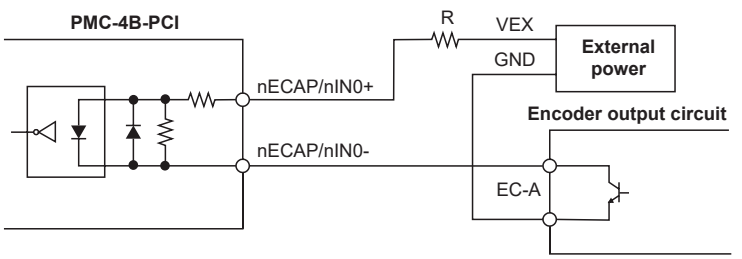


◎ Connection of encoder input signal (nECAP/N, nECBP/N) and nINO+/- signal

● Example for the connection with line driver of differential output



● Example for the connection with encoder of NPN open collector output

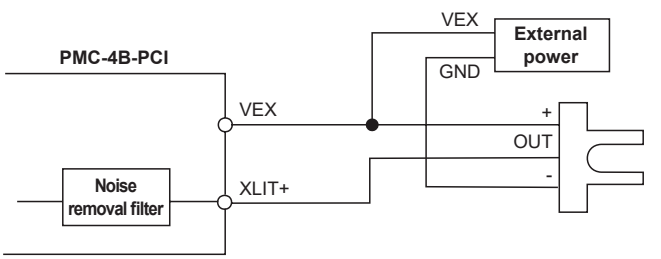


External voltage	Resistance (R)
5V	0
12V	820Ω 1/4W
24V	2kΩ 1W

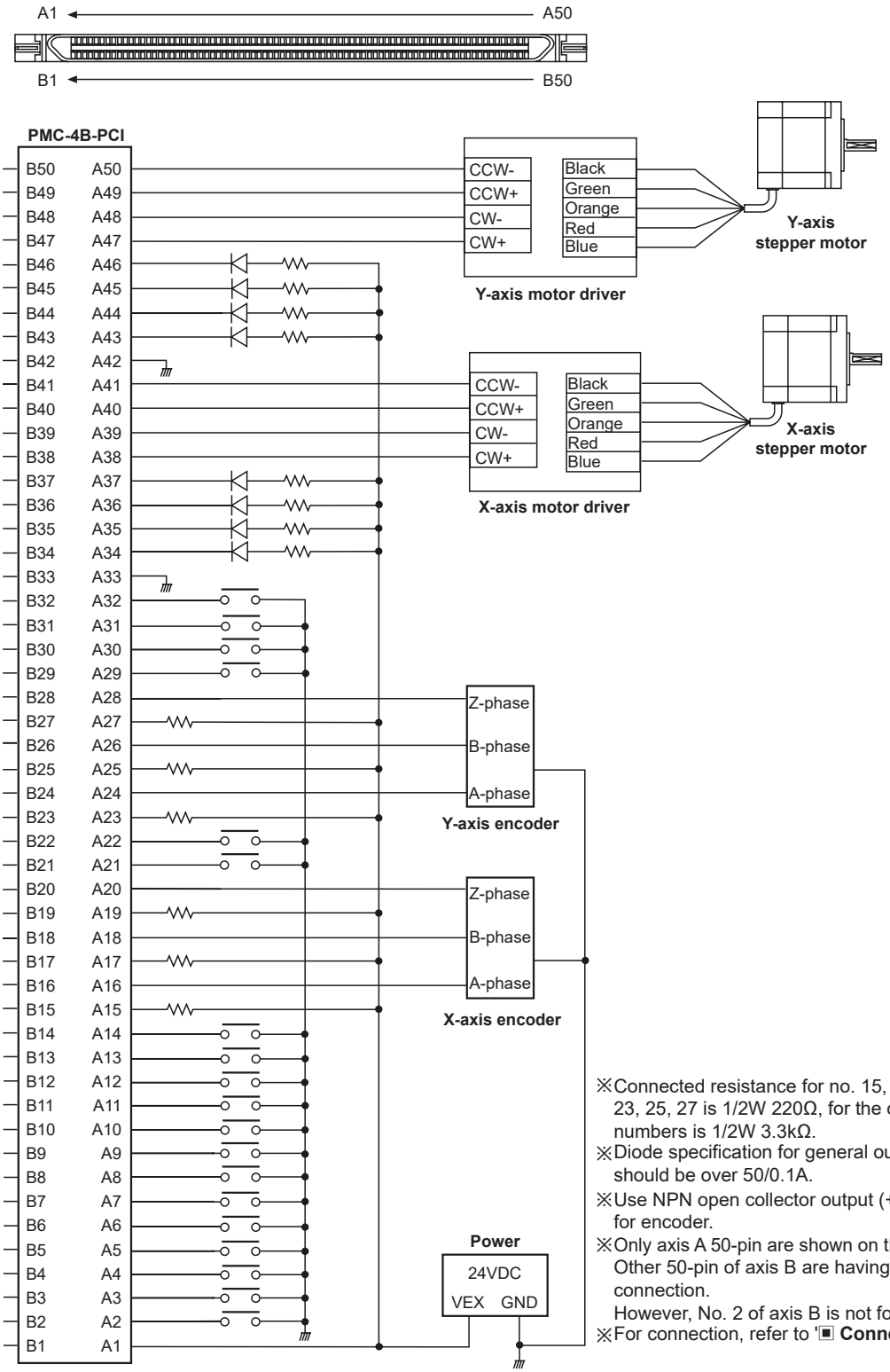
※Encoder A, B, Z phase are same connection.

◎ Connection of limit input signal (nLMIT+/-)

The outgoing cable of limit signal can be affected by noise. Since it can not be removed only with photocoupler, the filter circuit is built in PMC-4B-PCI. Please set enough passing time (FL=2, 3).



▣ Input/Output Connections



※Connected resistance for no. 15, 17, 19, 23, 25, 27 is 1/2W 220Ω, for the other numbers is 1/2W 3.3kΩ.
※Diode specification for general output pin should be over 50/0.1A.
※Use NPN open collector output (+12VDC) for encoder.
※Only axis A 50-pin are shown on the figure. Other 50-pin of axis B are having same connection.
However, No. 2 of axis B is not for use.
※For connection, refer to '▣ **Connections**'.

▣ Input/Output Specifications

Pin no.	Signal	Description	Pin no.	Signal	Pin description
A1	VEX	12-24VDC	B1	VEX	12-24VDC
A2	EMG	Emergency stop (4-axis stop)	B2	-	N·C
A3	XLMIT+	X-axis + direction limit	B3	ZLMIT+	Z-axis + direction limit
A4	XLMIT-	X-axis - direction limit	B4	ZLMIT-	Z-axis – direction limit
A5	XIN1	X-axis input signal (home signal)	B5	ZIN1	Z-axis input signal (home signal)
A6	XIN0	X-axis input signal (near home signal)	B6	ZIN0	Z-axis input signal (near home signal)
A7	XIN3	X-axis input signal (encoder Z phase signal)	B7	ZIN3	Z-axis input signal (encoder Z phase signal)
A8	YLMIT+	Y-axis + direction limit	B8	ULMIT+	U-axis +direction limit
A9	YLMIT-	Y-axis - direction limit	B9	ULMIT-	U-axis -direction limit
A10	YIN1	Y-axis input signal (home signal)	B10	UIN1	U-axis input signal (home signal)
A11	YIN0	Y-axis input signal (near home signal)	B11	UIN0	U-axis input signal (near home signal)
A12	YIN3	Y-axis input signal (encoder Z phase signal)	B12	UIN3	U-axis input signal (encoder Z phase signal)
A13	XINPOS	X-axis In-Position input	B13	ZINPOS	Z-axis In-Position input
A14	XALRAM	X-axis alarm input	B14	ZALRAM	Z-axis alarm input
A15	XECAP	X-axis Encoder A phase+	B15	ZECAP	Z-axis Encoder A phase+
A16	XECAN	X-axis Encoder A phase-	B16	ZECAN	Z-axis Encoder A phase-
A17	XECBP	X-axis Encoder B phase+	B17	ZECBP	Z-axis Encoder B phase+
A18	XECBN	X-axis Encoder B phase-	B18	ZECBN	Z-axis Encoder B phase-
A19	XECZP	X-axis Encoder Z phase+	B19	ZECZP	Z-axis Encoder Z phase+
A20	XECZN	X-axis Encoder Z phase-	B20	ZECZN	Z-axis Encoder Z phase-
A21	YINPOS	Y-axis In-Position input	B21	UINPOS	U-axis In-Position input
A22	YALARM	Y-axis alarm input	B22	UALARM	U-axis alarm input
A23	YECAP	Y-axis Encoder A phase+	B23	UECAP	U-axis Encoder A phase+
A24	YECAN	Y-axis Encoder A phase-	B24	UECAN	U-axis Encoder A phase-
A25	YECBP	Y-axis Encoder B phase+	B25	UECBP	U-axis Encoder B phase+
A26	YECBN	Y-axis Encoder B phase-	B26	UECBN	U-axis Encoder B phase-
A27	YECZP	Y-axis Encoder Z phase+	B27	UECZP	U-axis Encoder Z phase+
A28	YECZN	Y-axis Encoder Z phase-	B28	UECZN	U-axis Encoder Z phase-
A29	XEXP+	X-axis manual + drive	B29	ZEXP+	Z-axis manual + drive
A30	XEXP-	X-axis manual - drive	B30	ZEXP-	Z-axis manual - drive
A31	YEXP+	Y-axis manual + drive	B31	UEXP+	U-axis manual + drive
A32	YEXP-	Y-axis manual - drive	B32	UEXP-	U-axis manual - drive
A33	GND	GND	B33	GND	GND
A34	XOUT4/CMPP	X-axis general output	B34	ZOUT4/CMPP	Z-axis general output
A35	XOUT5/CMPM	X-axis general output	B35	ZOUT5/CMPM	Z-axis general output
A36	XOUT6/ASND	X-axis general output	B36	ZOUT6/ASND	Z-axis general output
A37	XOUT7/DSND	X-axis general output	B37	ZOUT7/ DSND	Z-axis general output
A38	XP+P	X-axis +direction +drive signal output	B38	ZP+P	Z-axis +direction +drive signal output
A39	XP+N	X-axis +direction -drive signal output	B39	ZP+N	Z-axis +direction -drive signal output
A40	XP-P	X-axis -direction +drive signal output	B40	ZP-P	Z-axis -direction +drive signal output
A41	XP-N	X-axis -direction -drive signal output	B41	ZP-N	Z-axis -direction -drive signal output
A42	GND	GND	B42	GND	GND
A43	YOUT4/CMPP	Y-axis general output	B43	UOUT4/CMPP	U-axis general output
A44	YOUT5/CMPM	Y-axis general output	B44	UOUT5/CMPM	U-axis general output
A45	YOUT6/ASND	Y-axis general output	B45	UOUT6/ASND	U-axis general output
A46	YOUT7/DSND	Y-axis general output	B46	UOUT7/DSND	U-axis general output
A47	YP+P	Y-axis +direction +drive signal output	B47	UP+P	U-axis +direction +drive signal output
A48	YP+N	Y-axis +direction -drive signal output	B48	UP+N	U-axis +direction -drive signal output
A49	YP-P	Y-axis -direction +drive signal output	B49	UP-P	U-axis -direction +drive signal output
A50	YP-N	Y-axis -direction -drive signal output	B50	UP-N	U-axis -direction -drive signal output

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