


# AiS-D-B Series

## Built-in Brake Type 2-Phase Closed-Loop Stepper Motor Driver

### ■ Features

- Brake operation for safe control of vertical load at power OFF
- 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  
: 500, 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 (10 steps)
- Various alarms out  
: overcurrent, over speed, motor connection error, encoder connection error, and etc., overall 12 types
- Frame size 42mm, 56mm, 60mm supported
- Applied motor: Ai-M series, Ai-M-B series

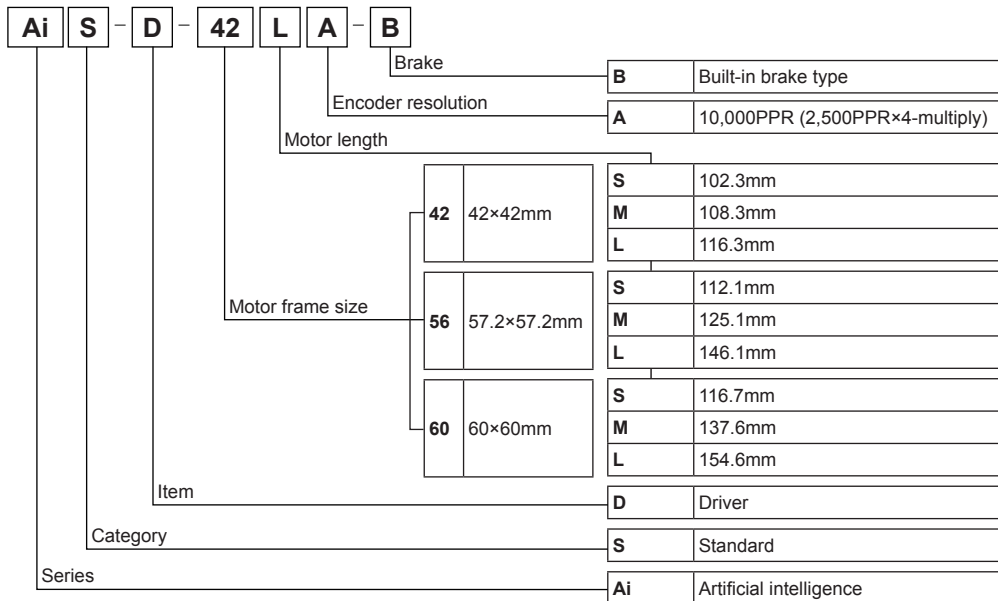
 Please read "Safety Considerations" in operation manual before using.



### ■ Applications

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

### ■ Ordering Information



### © AiS-B Series

Set	Driver	Motor
AiS-42SA-B	AiS-D-42SA-B	Ai-M-42SA-B
AiS-42MA-B	AiS-D-42MA-B	Ai-M-42MA-B
AiS-42LA-B	AiS-D-42LA-B	Ai-M-42LA-B
AiS-56SA-B	AiS-D-56SA-B	Ai-M-56SA-B
AiS-56MA-B	AiS-D-56MA-B	Ai-M-56MA-B
AiS-56LA-B	AiS-D-56LA-B	Ai-M-56LA-B
AiS-60SA-B	AiS-D-60SA-B	Ai-M-60SA-B
AiS-60MA-B	AiS-D-60MA-B	Ai-M-60MA-B
AiS-60LA-B	AiS-D-60LA-B	Ai-M-60LA-B



# Built-in Brake Type 2-Phase Closed-Loop Stepper Motor Driver

## Specifications

Model	AiS-D-42SA-B	AiS-D-42MA-B	AiS-D-42LA-B	AiS-D-56SA-B	AiS-D-56MA-B	AiS-D-56LA-B	AiS-D-60SA-B	AiS-D-60MA-B	AiS-D-60LA-B	
Power supply	24VDC---									
Allowable voltage range	90 to 110% of the rated voltage									
Power consumption	STOP <sup>※1</sup>	Max. 16W	Max. 17W	Max. 23W	Max. 25W	Max. 26W				
	Max. during operation <sup>※2</sup>	Max. 60W		Max. 120W		Max. 240W				
	Max. RUN current <sup>※3</sup>	1.7A/Phase			3.5A/Phase					
STOP current	25% or 50% of max. RUN current (factory default: 50%)									
Rotation speed	0 to 3000rpm									
Resolution	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	<ul style="list-style-type: none"> <li>Power/Warning indicator: green LED</li> <li>Alarm indicator: red LED</li> <li>In-position indicator: yellow LED</li> <li>Servo On/Off indicator: orange LED</li> </ul>									
Input signal	RUN pulse, servo On/Off, alarm reset (photocoupler input)									
Output signal	In-position, alarm out (photocoupler output), brake (at supplying moment: 24VDC for 0.2 sec, in normal status: 11.5VDC ±10%), encoder signal (A, Ā, B, B̄, Z, Z̄ phase, corresponding to 26C31) (line driver output)									
Input pulse specifications	Pulse width	CW, CCW: input pulse frequency duty 50%, servo 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. <sup>※4</sup>	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 <sup>2</sup> (approx. 30G) in each X, Y, Z direction for 3 times									
Environment	Ambient temperature	0 to 50°C, storage: -20 to 70°C								
	Ambient humidity	35 to 85%RH, storage: 10 to 90%RH								
Approval	CE									
Protection structure	IP20 (IEC standard)									
Weight <sup>※5</sup>	Approx. 400g (approx. 290g)									

※1: Based on the ambient temperature 25°C, 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.

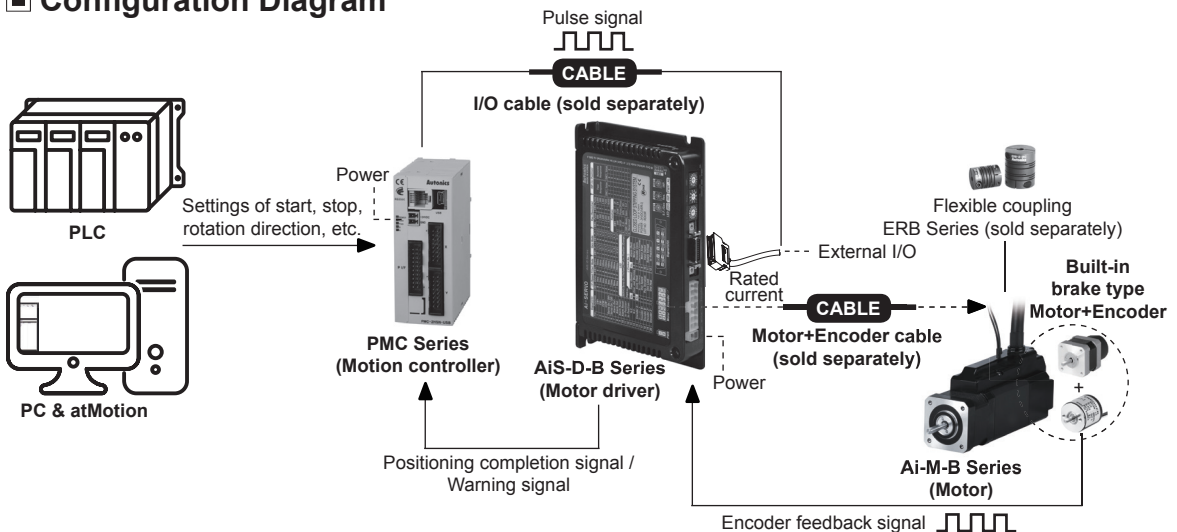
※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.

※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

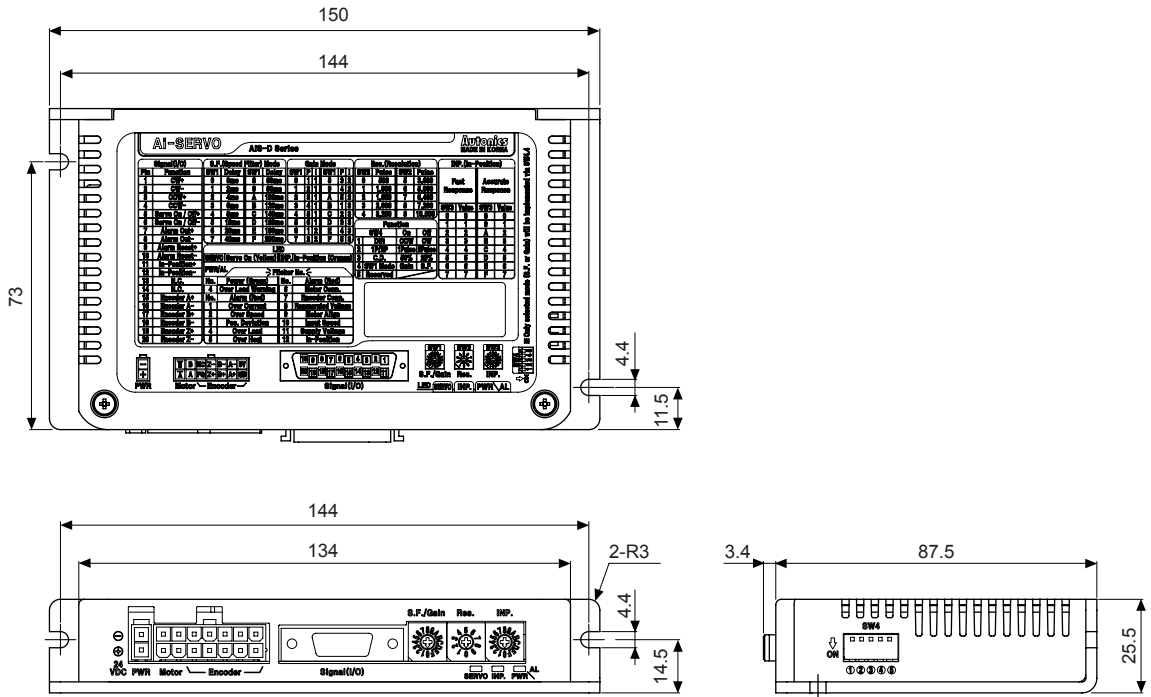


- (A) Photoelectric Sensors
- (B) Fiber Optic Sensors
- (C) Door/Area Sensors
- (D) Proximity Sensors
- (E) Pressure Sensors
- (F) Rotary Encoders
- (G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
- (H) Temperature Controllers
- (I) SSRs / Power Controllers
- (J) Counters
- (K) Timers
- (L) Panel Meters
- (M) Tacho / Speed / Pulse Meters
- (N) Display Units
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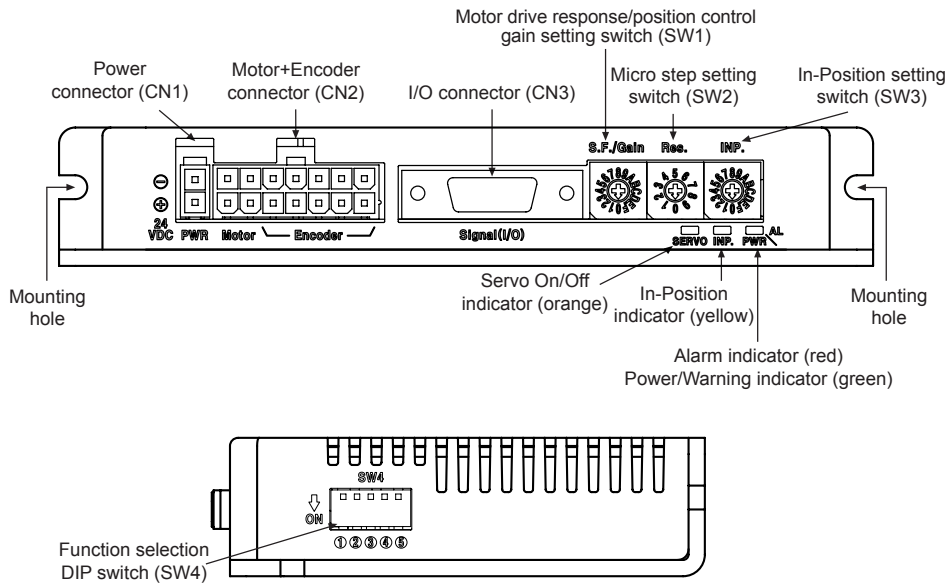
# AiS-D-B Series

## ■ Dimensions

(unit: mm)



## ■ Driver Unit Descriptions



# Built-in Brake Type 2-Phase Closed-Loop Stepper Motor Driver

## ■ 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 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.

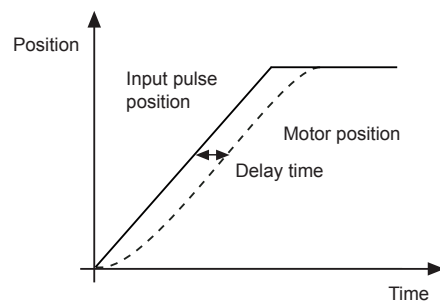
4th pin in SW4	Setting
OFF	Speed filter
ON	Position control gain

#### ● 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
 S.F./Gain	0	Disable
	1	2ms
	2	4ms
	3	6ms
	4	8ms
	5	10ms
	6	20ms
	7	40ms
	8 (factory default)	60ms
	9	80ms
	A	100ms
	B	120ms
	C	140ms
	D	160ms
	E	180ms
	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 status.
- I\_Gain: Adjust vibration in accelerating/decelerating status.

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

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## © SW2: Resolution setting switch

-Set the resolution of driver.

-The number of pulses per 1 rotation by resolution is each 500, 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000.

-Modified setting values are not applied in the running status, and the values will be applied after motor stopped.

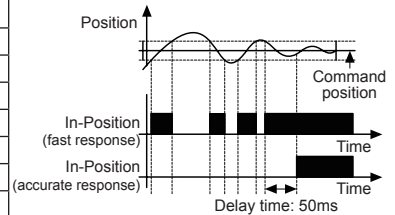
Setting switch	Setting	Pulse/Revolution	Resolution
	0 (factory default)	500	2.5
	1	1000	5
	2	1600	8
	3	2000	10
	4	3200	16
	5	3600	18
	6	5000	25
	7	6400	32
	8	7200	36
	9	10000	50

## © SW3: In-Position setting switch

-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
	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 <sup>※1</sup>	DIR	Rotation direction	CCW	CW
	2 <sup>※2</sup>	1P/2P	Pulse input method	1-pulse input method	2-pulse input method
	3 <sup>※2</sup>	C.D.	STOP current	25% of max. RUN current	50% of max. RUN current
	4 <sup>※2</sup>	SW1 Mode	SW1 setting	Position control gain	Speed filter
	5 <sup>※3</sup>	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 operation test in manufacturing process.

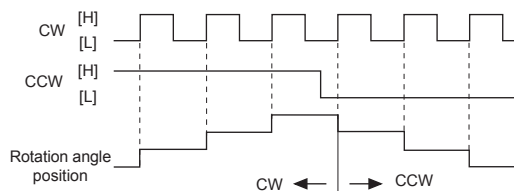
### ● Pulse input method

※1-pulse input method

CW: rotation operation signal input

CCW: rotation direction signal input

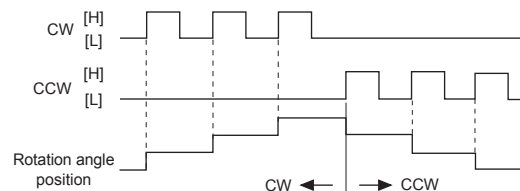
([H]: forward rotation, [L]: reverse rotation)



※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.

# Built-in Brake Type 2-Phase Closed-Loop Stepper Motor Driver

## ■ Control 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 '◎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 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 example of input circuit connection.

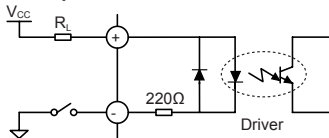
#### 4. Example of input circuit connection

##### ● Input pulse (CW, CCW)

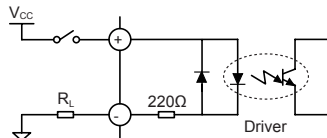
- It is recommended to use 5VDC at  $V_{CC}$  and short the  $R_L$ .
- In case  $V_{CC}$  is over 5VDC, calculate  $R_L$  value using following formula and use  $V_{CC}$  below 30VDC.  $\times R_L = \frac{V_{CC} - 2.17V}{0.011A} - 220\Omega$
- In case  $V_{CC}$  is 12, 24VDC, refer to table on the right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

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

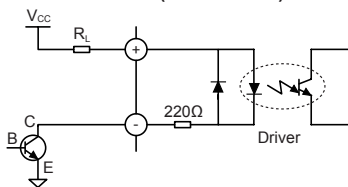
##### A. Pull-Up



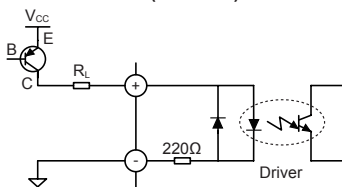
##### B. Pull-Down



##### C. Circuit with NPN (not-reversed)

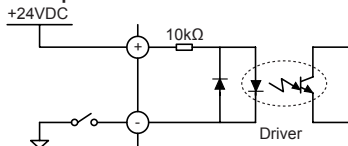


##### D. Circuit with PNP (reversed)

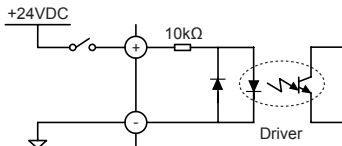


##### ● External input (Servo On/Off, Alarm Reset)

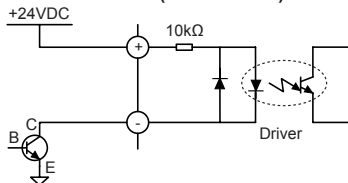
##### A. Pull-Up



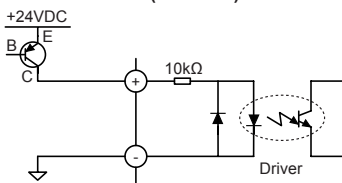
##### B. Pull-Down



##### C. Circuit with NPN (not-reversed)



##### D. Circuit with PNP (reversed)



(A)	Photoelectric Sensors
(B)	Fiber Optic Sensors
(C)	Door/Area Sensors
(D)	Proximity Sensors
(E)	Pressure Sensors
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# AiS-D-B Series

## ◎ 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 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 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.

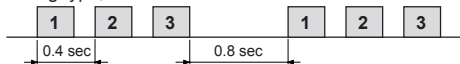
Alarm indicator	No. of flashing	Alarm type	Descriptions	Motor stop	Maintain torque
AL (red)	1	Over current error	When over current flows at motor RUN element	O	x
	2	Over speed error	When motor speed is over 4,000rpm		
	3	Position tracking error	When the gap between position command value and current position value is over 90°		
	4	Over load error	When applying load over the rated load for over 1 sec		
	5	Over heat error	When driver inner temperature is over 80°C		
	6	Motor connection error	When motor cable connection error occurs at driver		
	7	Encoder connection error	When encoder cable connection error occurs at driver		
	8	Regenerative voltage error	When regenerative voltage is over 78V		
	9	Motor misalignment	When motor is in misalignment		
	10	Command pulse error	When Input pulse 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.		
Warning indicator	No. of flashing	Warning type	Descriptions	Motor stop	Maintain torque
PWR (green)	4	Over load warning	When maximum load is kept connected over 10 sec. (motor or driver can be overheated)	x	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

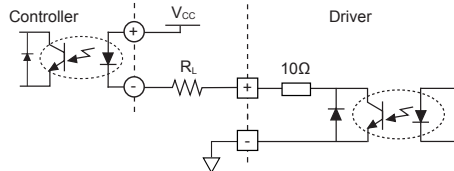
-It is recommend to use below 50VDC at  $V_{CC}$ .

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.

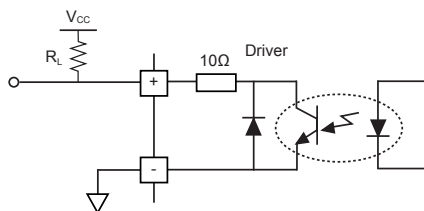
$$\text{※A: } R_L = \frac{V_{CC} - 0.3V - V_F}{0.025A} - 10\Omega \quad \text{※B, C: } R_L = \frac{V_{CC} - 0.3V}{0.025A} - 10\Omega$$

( $V_F$  is LED forward voltage of primary photocoupler.)

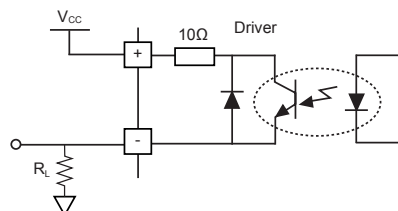
#### A. Circuit with photocoupler



#### B. Circuit with pull up (reversed)

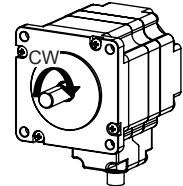
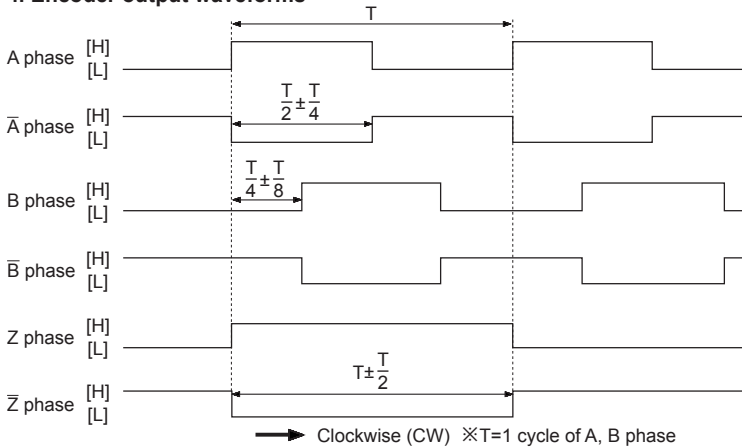


#### C. Circuit with pull down (not-reversed)



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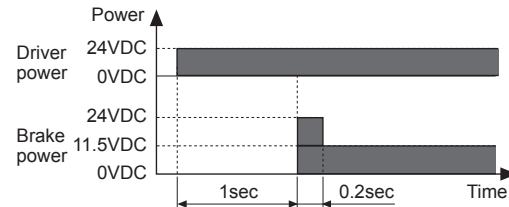
## 4. Encoder output waveforms



※It is recommended to use Line driver output (corresponding to 26C32) at RECEIVER end of encoder output and terminating resistors (100-150Ω) in parallel at both ends of each phase (A,  $\bar{A}$ , B,  $\bar{B}$ , Z,  $\bar{Z}$ , 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.

## ■ Connection Connectors of Driver

### ◎ 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 $\bar{A}$
	3	Encoder B	10	Encoder $\bar{B}$
	4	Encoder Z	11	Encoder $\bar{Z}$
	5	F.G.	12	N-C
	6	Motor A	13	Motor B
	7	Motor $\bar{A}$	14	Motor $\bar{B}$

#### ● 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 $\bar{A}$
	7	Output	Alarm out+	17	Output	Encoder B
	8	Output	Alarm out-	18	Output	Encoder $\bar{B}$
	9	Input	Alarm reset+	19	Output	Encoder Z
	10	Input	Alarm reset-	20	Output	Encoder $\bar{Z}$

(A) Photoelectric Sensors

(B) Fiber Optic Sensors

(C) Door/Area Sensors

(D) Proximity Sensors

(E) Pressure Sensors

(F) Rotary Encoders

(G) Connectors/  
Connector Cables/  
Sensor Distribution  
Boxes/Sockets

(H) Temperature Controllers

(I) SSRs / Power Controllers

(J) Counters

(K) Timers

(L) Panel Meters

(M) Tacho / Speed / Pulse Meters

(N) Display Units

(O) Sensor Controllers

(P) Switching Mode Power Supplies

(Q) Stepper Motors & Drivers & Controllers

(R) Graphic/ Logic Panels

(S) Field Network Devices

(T) Software



# AiS-D-B Series

## ◎ Connector specifications

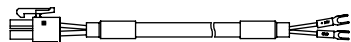
Type		Specifications			Manufacture
		Connector	Connector terminal	Housing	
CN1	Driver	0039301020	—	—	Molex
	Power	CHD1140-02	CTD1140	—	HANLIM
CN2	Driver	35318-1420	—	—	Molex
	Motor+Encoder	5557-14R	5556T	—	Molex
CN3	Driver	10220-52A2 PL	—	—	3M
	I/O connector	10120-3000PE	—	10320-52F0-008	3M
		CJ-MP20-HP□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

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

## ■ Sold Separately

### ◎ Power cable

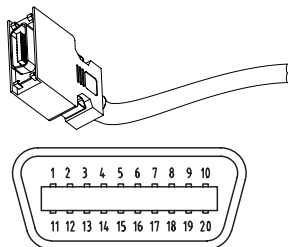
#### ● CJ-PW-□



※□ 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)

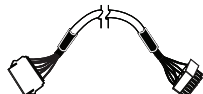


Pin no.	Function (name tag)	Cable color	Dot line color-numbers	Pin no.	Function (name tag)	Cable color	Dot line color-numbers
1	CW+	Yellow	Black-1	11	IN POSITION+	White	Black-1
2	CW-		Red-1	12	IN POSITION-		Red-1
3	CCW+		Black-2	13	BRAKE+		Black-2
4	CCW-		Red-2	14	BRAKE-		Red-2
5	SERVO ON/OFF+		Black-3	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

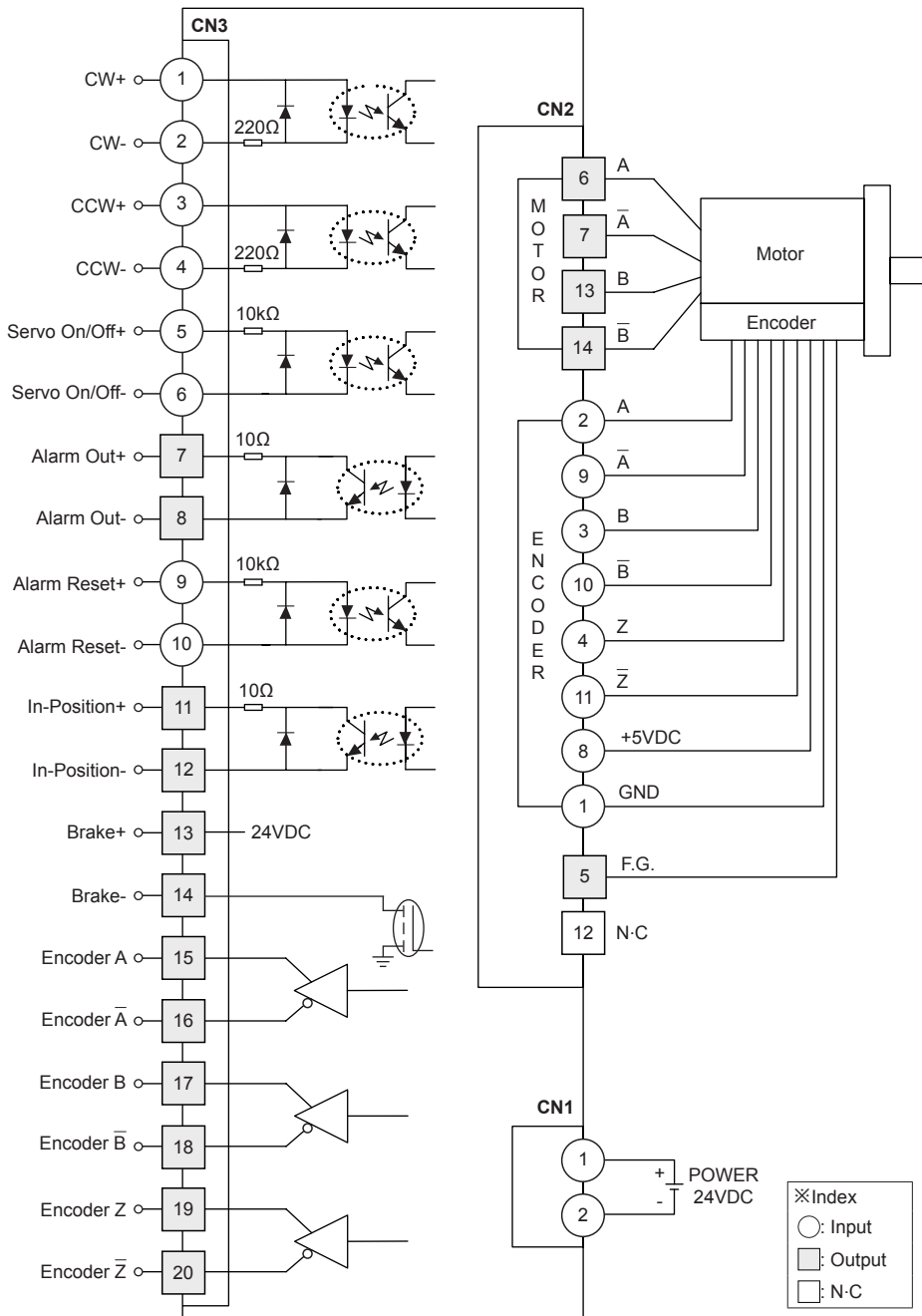
#### ● Normal: CID14M-□, Moving: CIDF14M-□



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

# Built-in Brake Type 2-Phase Closed-Loop Stepper Motor Driver

## ■ Connection for Motor and Driver



## ■ Troubleshooting

### 1. When motor does not rotate

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

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

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

### 3. When motor drive is unstable

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

(A)	Photoelectric Sensors
(B)	Fiber Optic Sensors
(C)	Door/Area Sensors
(D)	Proximity Sensors
(E)	Pressure Sensors
(F)	Rotary Encoders
(G)	Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
(H)	Temperature Controllers
(I)	SSRs / Power Controllers
(J)	Counters
(K)	Timers
(L)	Panel Meters
(M)	Tacho / Speed / Pulse Meters
(N)	Display Units
(O)	Sensor Controllers
(P)	Switching Mode Power Supplies
(Q)	Stepper Motors & Drivers & Controllers
(R)	Graphic/ Logic Panels
(S)	Field Network Devices
(T)	Software

# AiS-D-B Series

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## ■ 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<sup>2</sup>) 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.
  - 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