

# AC Power Input 2-Phase Closed-loop Stepper Motor Driver



## AiSA-D Series PRODUCT MANUAL

For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.

### Features

- Closed-loop system with real-time position control
- High speed & high torque drive without missing steps
- Supports 200 - 240 VAC ~ AC power
- Easy operation setting with external adjuster (Gain, Speed filter, In-position, Resolution)
- 7 segment display for alarm / status reading
- Supports torque mode
- Supports Auto Current Down mode
- Built-in brake type motors available (AiSA-D-B Series)

### Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ symbol indicates caution due to special circumstances in which hazards may occur.

**⚠ Warning** Failure to follow instructions may result in serious injury or death.

- 01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime / disaster prevention devices, etc.)**  
Failure to follow this instruction may result in personal injury, economic loss or fire.
- 02. Do not use the unit in the place where flammable / explosive / corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.**  
Failure to follow this instruction may result in explosion or fire.
- 03. Do not connect, repair, or inspect the unit while connected to a power source.**  
Failure to follow this instruction may result in fire or electric shock.
- 04. Install the unit after considering counter plan against power failure.**  
Failure to follow this instruction may result in personal injury, economic loss or fire.
- 05. Check 'Connections' before wiring.**  
Failure to follow this instruction may result in fire.
- 06. Do not disassemble or modify the unit.**  
Failure to follow this instruction may result in fire or electric shock.
- 07. Install the driver in the housing or ground it.**  
Failure to follow this instruction may result in personal injury, fire or electronic shock.
- 08. Do not touch the unit during or after operation for a while.**  
Failure to follow this instruction may result in burn or electric shock due to high temperature of the surface.
- 09. Emergency stop directly when error occurs.**  
Failure to follow this instruction may result in personal injury or fire.

**⚠ Caution** Failure to follow instructions may result in injury or product damage.

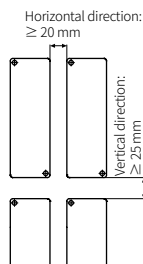
- 01. When connecting the power input, use AWG18 (0.75 mm<sup>2</sup>) cable or over.**
- 02. Brake is non-polar. When connecting the brake, use AWG24 (0.2 mm<sup>2</sup>) cable or over.**  
Failure to follow this instruction may result in fire or malfunction due to contact failure.
- 03. To use the motor safely, do not apply external force to the motor.**  
It is recommended to use STOPPER for the vertical load.
- 04. Install over-current prevention device (e.g. the current breaker, etc.) to connect the driver with power.**  
Failure to follow this instruction may result in fire.
- 05. Check the control input signal before supplying power to the driver.**  
Failure to follow this instruction may result in personal injury or product damage by unexpected driver movement.
- 06. Install a safety device to maintain the vertical position after turn off the power of this driver.**  
Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of the motor.
- 07. Use the unit within the rated specifications.**  
Failure to follow this instruction may result in fire or product damage.
- 08. Use a dry cloth to clean the unit, and do not use water or organic solvent.**  
Failure to follow this instruction may result in fire or electric shock.
- 09. The driver may overheat depending on the environment. Install the unit at the well-ventilated environment and forced cooling with a cooling fan.**  
Failure to follow this instruction may result in product damage or degradation by heat.
- 10. Keep the product away from metal chip, dust, and wire residue which flow into the unit.**  
Failure to follow this instruction may result in fire or product damage.
- 11. Use the designated motor only.**  
Failure to follow this instruction may result in fire or product damage.

## Cautions during Use

- Follow instructions in 'Cautions during Use'. 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.
- In case of unwanted noise generating from peripherals and power, use ferrite core in the wiring.
- The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.
  - Motor + Encoder connector: AWG 22
  - Power connector: AWG 18
  - I/O connector: AWG 28
  - Brake connector: AWG 22
- Keep the distance between power cable and signal cable over 10 cm.
- Install vertically so that the alarm / status display part is located on top.
- For heat radiation of the driver, install a fan.
- Do not change any setting switches (Function, Resolution, Control Gain, Speed filter/limit, In-Position switches) during the operation.
- Do not input external signal until the driver is initialized (In-Position LED ON) after power is applied.
- Motor vibration and noise may occur in a specific frequency range.
  - Change the motor installation method or attach the damper.
  - Use the unit out of the corresponding frequency range due to changing motor RUN speed.
- Maintain and inspect regularly the following lists.
  - Unwinding bolts and connection parts for the unit installation and load connection
  - Abnormal sound from ball-bearing of the unit
  - Damage and stress of lead cable of the unit
  - Connection error with motor
  - Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
- This product does not contain a protection function for a motor unit.
- This unit may be used in the following environments.
  - Indoors (in the environment condition rated in 'Specifications')
  - Altitude max. 2,000 m
  - Pollution degree 2
  - Installation category II

## Cautions during 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 specifications and install on the well-heat dissipated area
- In case of installing the drivers more than two, keep distance at least 20 mm in horizontal direction and at least 25 mm in vertical direction.



## Ordering Information

This is only for reference, the actual product does not support all combinations.. For selecting the specified model, follow the Autonics website. Select a model that matches the ordering information of the motor and the driver.

**AiSA - D - ① ② ③ - ④**

### ① Frame size

Number: Frame size (mm)

### ② Axial length

M: Medium

L: Long

### ③ Encoder resolution

A: 10,000 PPR (2,500 PPR × 4-multiply)

### ④ Motor type

No mark: Standard type

B: Built-in brake type

## Product Components

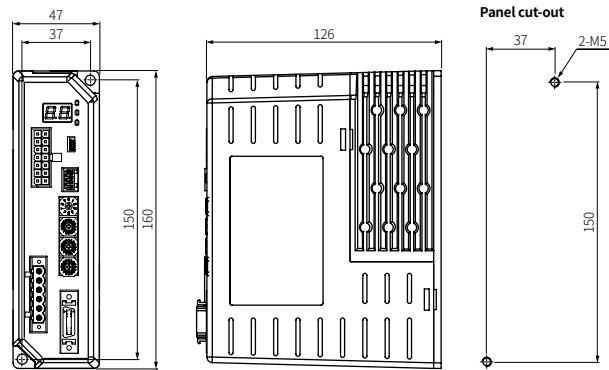
- Product
- Instruction manual
- Power connector
- I/O connector
- Brake connector (AiSA-D-B Series)

## Sold Separately

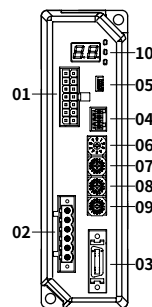
- Motor + Encoder cable: C1D14M-□ (fixed type), C1DF14M-□ (flexible type)
- I/O cable: CO20-MP□-R (specifications: AiS TAG)

## Dimensions

- Unit: mm, For the detailed drawings, follow the Autonics website.



## Unit Descriptions



### 01. Motor + Encoder connector

### 02. Power connector

### 03. I/O connector

### 04. Brake connector

### 05. Function selection DIP switch

### 06. Resolution setting rotary Switch

### 07. Control Gain setting rotary switch

### 08. Speed filter / Speed limit setting rotary switch

### 09. In-Position setting rotary switch

### 10. Status display part / indicators

## Status Display Part / Indicators

Display part / Indicator	Color	Descriptions
Status display part (7 segment)	Red	Displays the rotating status by rotation direction, speed when normal status Displays the set torque % when torque mode and normal status Displays the corresponding number and the set rotary switch
Power / Alarm indicator (PWR/AL)	Green	Turns ON when the unit operates in normal after power is applied Flashes depending on the warning type
	Red	Flashes depending on the alarm type
In-Position indicator (INP)	Yellow	Turns ON when motor is placed at command position after positioning input
Servo ON / OFF indicator (SERVO)	Orange	Turns ON when servo is ON, Turns OFF when servo is OFF

## Alarm

The status display part displays segment depending on Alarm / Warning type. Depending on the alarm type, it flashes for 0.4 sec interval and it turns OFF for 0.8 sec repeatedly.

### ■ Alarm

Display	No. of flashing	Alarm type	Display	No. of flashing	Alarm type
E 1	1	Overcurrent error	E 8	8	Overvoltage error
E 2	2	Overspeed error	E 9	9	Undervoltage error
E 3	3	Position tracking error	E A	10	Motor alignment error
E 4	4	Overload error	E b	11	Input pulse error
E 5	5	Overheat error	E C	12	In-Position error
E 6	6	Motor connection error	E d	13	Brake connection error
E 7	7	Encoder connection error	-	-	-

## Specifications



Model	AiSA-D-60MA-□	AiSA-D-60LA-□	AiSA-D-86MA-□	AiSA-D-86LA-□
Main	Power supply	200 - 240 VAC ~ 50 / 60 Hz		
	Max. RUN power <sup>01)</sup>	≤ 800 VA		
	Stop power <sup>02)</sup>	≤ 60 VA	≤ 65 VA	≤ 70 VA
AUX <sup>03)</sup>	Power supply	24 VDC =		
	Input current	0.3 A	0.5 A	
Max. RUN current <sup>04)</sup>	2.0 A / Phase			
Stop current	20% to 100% of max. RUN current			
Resolution	500 (factory default), 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000 PPR			

01) 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. RUN power.

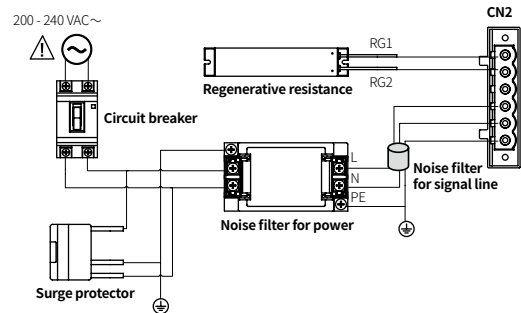
02) Based on ambient temp. 25°C, ambient humi. 55%RH, stop current 50%

03) Auxiliary power is only available in built-in brake type and not available in standard type.

04) RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also.

Run method	2-phase bipolar closed-loop control method
Speed filter	Disable (factory default), 2, 4, 6, 8, 10, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200 ms
Control Gain	Standard Gain: 0 to F, Inertia Gain: 0 to F
Max. rotation speed	3000 rpm
In-Position	Fast Response: 0 (factory default) to 7, Accurate Response: 0 to 7
Rotation direction	CW (factory default), CCW
Operation mode	Standard mode, Torque mode
Input	CW/CCW (RUN pulse), Servo ON/OFF, Alarm Reset (Photocoupler input)
Output	In-Position, Alarm Out (Photocoupler output), Encoder Signal (A, $\bar{A}$ , B, $\bar{B}$ , Z, $\bar{Z}$ , Line driver output)
Pulse input method	1 pulse, 2 pulse (factory default)
Pulse input voltage	CW, CCW-[H]: 4 - 8 VDC =, [L]: 0 - 0.5 VDC =, Servo ON/OFF, Alarm Reset-[H]: 24 VDC =, [L]: 0 - 0.5 VDC =
Max. input pulse frequency	CW, CCW: 500 kHz
Pulse width	CW, CCW: Input pulse frequency duty 50% Servo ON/OFF: ≥ 1 ms Alarm Reset: ≥ 10 ms
Rise fall time	CW, CCW: < 0.5 μs
Input resistance	4.7 kΩ (Anode Pull-Up)
Insulation resistance	≥ 200 MΩ (500 VDC = megger)
Dielectric strength	Between the all charging part and the case: 1,500 VAC ~ 60 Hz for 1 minute
Vibration	1.5 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock	300 m/s <sup>2</sup> (≈ 30 G) in each X, Y, Z direction for 3 times
Ambient temp.	0 to 50°C, storage: -10 to 60°C (no freezing or condensation)
Ambient humi.	35 to 85%RH, storage: 10 to 90%RH (no freezing or condensation)
Protection rating	IP20 (IEC standard)
Certification	CE  
Unit weight (packaged)	≈ 780 g (≈ 1,020 g)

## Power Supply Configuration Diagram



### ■ Noise filter for signal line

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

Type	Model	Manufacture
Motor line, I/O signal line	28A5776-0A2	Lairdtech
Power line	28A5131-0A2	
Communication line	28A2025-0A2	

### ■ Noise filter for power

Connect the power to suppress external noise.  
The wires should be connected as short as possible and grounded.

Model	Specifications	Manufacture
RNS-2006	Rated voltage: 250 V Rated current: 6 A Max. leakage current: 1 mA	Orient Electronics

### ■ Regenerative resistance

Connect the pin 1, 2 on the power connector.  
Use in condition of the high inertia load or the short deceleration time.  
Forced cooling is required in condition of high surface temperature of regenerative resistance.

Model	Specifications	Manufacture
IRC100	Resistance: 100 Ω ±5%, Rated power: 60 W (standby), 100 W (heatsink attached)	Rara Electronics Corp.

### ■ 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 product damage.

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

## Troubleshooting

Malfunction	Causes	Troubleshooting
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.
When motor rotates to the opposite direction of the designated direction	Rotation direction setting is incorrect.	Check the DIR setting in the function selection DIP switch.
When motor drives unstable	Connection between motor and encoder is unstable.	Check the driver and motor are connected correctly.
	Control Gain value is not correct.	Change the Control Gain rotary switch.

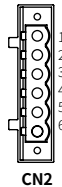
## Connectors

### Motor + Encoder connector



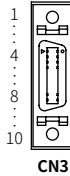
Pin	Function	Pin	Function
1	GND	8	+5 VDC≐
2	Encoder A	9	Encoder $\bar{A}$
3	Encoder B	10	Encoder $\bar{B}$
4	Encoder Z	11	Encoder $\bar{Z}$
5	PE	12	N·C
6	Motor A	13	Motor B
7	Motor $\bar{A}$	14	Motor $\bar{B}$

### Power connector



Pin	Function
1	Regenerative resistance
2	
3	N·C
4	AC power input
5	PE

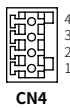
### I/O connector



Pin	Function	Pin	Function
1	CW+	11	In-Position+
2	CW-	12	In-Position-
3	CCW+	13	N·C
4	CCW-	14	N·C
5	Servo ON/OFF+	15	Encoder A
6	Servo ON/OFF-	16	Encoder $\bar{A}$
7	Alarm Out+	17	Encoder B
8	Alarm Out-	18	Encoder $\bar{B}$
9	Alarm Reset+	19	Encoder Z
10	Alarm Reset-	20	Encoder $\bar{Z}$

### Brake connector

- Only available in built-in brake type.



Pin	Function
1	24 VDC≐
2	GND
3	Brake+
4	Brake-

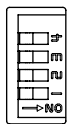
### Suitable specifications

- The product performance can not be guaranteed when using other than the following connectors.

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

## Switch

### Function selection DIP switch

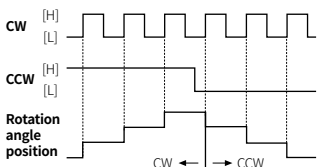


No.	Function	ON	OFF (factory default)	Settings apply
1	Rotation direction	CCW	CW	Immediately
2	Pulse input method	1 pulse input	2 pulse input	
3	Control Gain	Inertia Gain	Standard Gain	When motor stops
4	Torque mode	Torque mode	Standard mode	

#### Pulse Input method

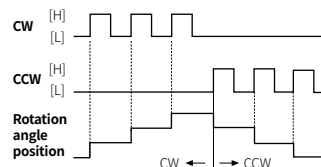
1 Pulse Input method

- CW: Operating rotation 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 - 8 VDC≐), [L]: photocoupler OFF (voltage of both ends 0 - 0.5 VDC≐)

#### 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.

### Resolution Setting Rotary Switch (RES)

The setting will be applied when motor stops.



Setting	PPR	Resolution	Setting	PPR	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

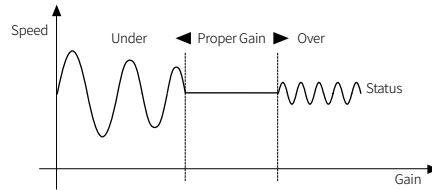
### Control Gain Setting Rotary Switch (GAIN)

Depending on Control Gain switch setting, the motor sets Gain as high or low. 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

Setting	Standard Gain	Setting	Standard Gain	Setting	Inertia Gain	Setting	Inertia 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



### Speed filter / Speed limit setting rotary switch

Depending on torque mode DIP switch setting, speed filter or speed limit function can be set.

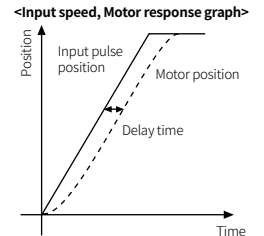
#### Speed filter

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.



S.F

Setting	Delay	Setting	Delay
0 (factory default)	Disable	8	60 ms
1	2 ms	9	80 ms
2	4 ms	A	100 ms
3	6 ms	B	120 ms
4	8 ms	C	140 ms
5	10 ms	D	160 ms
6	20 ms	E	180 ms
7	40 ms	F	200 ms



#### 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.



S.F

Setting	Limit speed	Setting	Limit speed
0	10 rpm	8	90 rpm
1	20 rpm	9	120 rpm
2	30 rpm	A	150 rpm
3	40 rpm	B	200 rpm
4	50 rpm	C	250 rpm
5	60 rpm	D	300 rpm
6	70 rpm	E	380 rpm
7	80 rpm	F	500 rpm

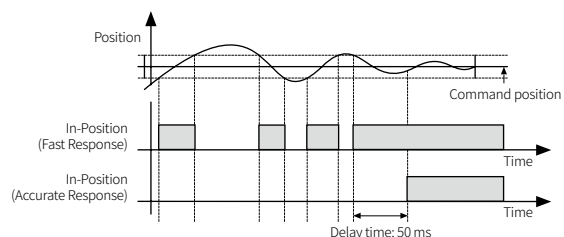
### In-Position setting rotary switch

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. The setting will be applied when motor stops.

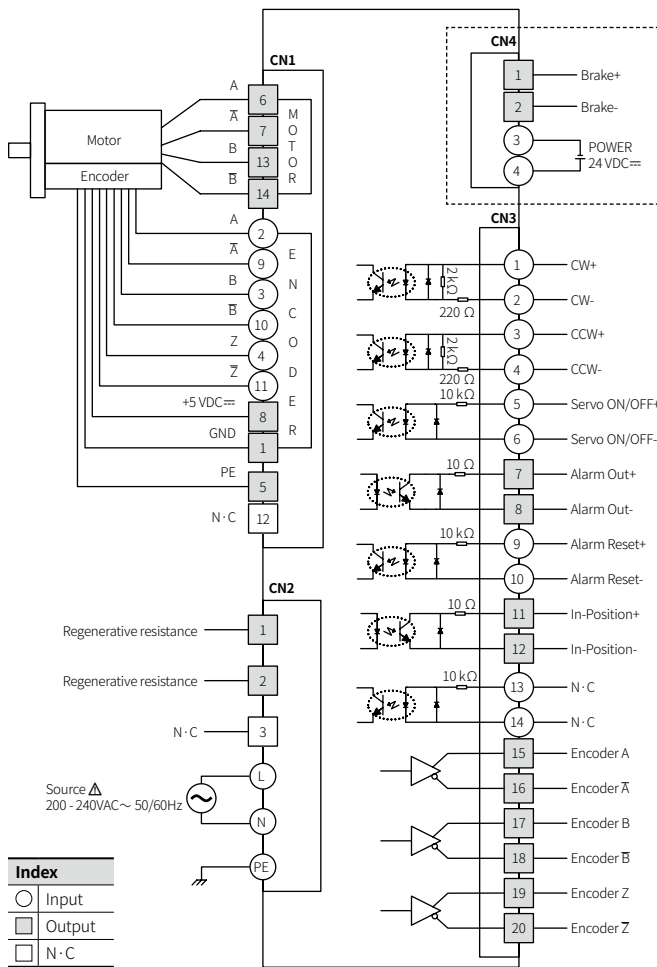


INP

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



## Connections



### Index

○	Input
◻	Output
◻	N-C

• [N-C] is only available in built-in brake type.

## Control Input

### Position command pulse

- Pulse input is selectable from 1-pulse input method and 2-pulse input method.
- When using extending cable, it is recommended to connect Common mode choke coil (2 mH) to the CW, CCW terminal in series connection.

### Servo ON/OFF

- This signal is for rotating axis of motor using external force or used for manual positioning.
- [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.
- [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.
- The signal operates when input more than 1 ms.
- The signal is available when the motor is stopped.

### Alarm Reset

- This signal is for resetting the alarm.
- [H]: Alarm is reset, the alarm indicator and alarm output turns OFF, and the driver returns to normal status. Brake is released.
- The signal operates when input more than 20 ms.
- If the causes of the alarm are not removed, driver may not be returned to the normal status even with alarm reset.

### Example of input pulse (CW, CCW) circuit connection

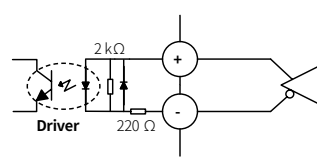
- In case of pulse input, use external power (VEX) 5 VDC.
- The product may be damaged if input power is exceeded. In case VEX is over 5 VDC, calculate  $R_L$  value using following formular.

$$R_L = \frac{VEX - 2.17 V}{0.011 A} - 220 \Omega$$

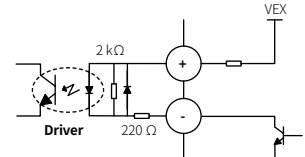
- In case VEX is 12, 24 VDC, refer  $R_L$  value as following table.

VEX	$R_L$
12 VDC	680 Ω (≥ 0.25 W)
24 VDC	1.8 kΩ (≥ 0.5 W)

### Pull-Up circuit



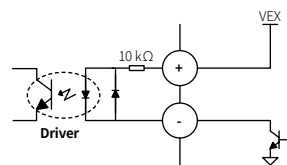
### Pull-Down circuit



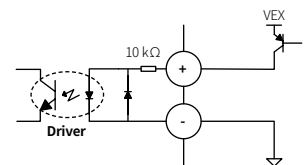
### Example of external input (Servo ON/OFF, Alarm Reset) circuit connection

- Use external power (VEX) 24 VDC in external input Servo ON/OFF and Alarm Reset.

#### NPN (not-reversed) circuit



#### PNP (reversed) circuit



## Control Output

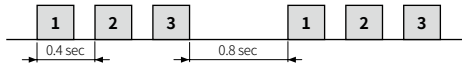
### In-Position

- 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.

### Alarm

- Alarm / Warning status display part displays segment depending on Alarm / Warning type.
- Depending on the alarm type, it flashes for 0.4 sec interval and it turns OFF for 0.8 sec repeatedly.

<e.g: alarm no. 3>



- 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 Alarm Reset is applied, driver returns to the normal status.
- When alarm occurs, motor stops, torque remains, Brake locks.

Display	No. of flashing	Alarm type	Descriptions
E 1	1	Overcurrent error	When overcurrent flows at motor RUN element
E 2	2	Overspeed error	When motor speed is over 3,500 rpm
E 3	3	Position tracking error	When the gap between position command value and current position value is over 90°
E 4	4	Overload error	When applying load over the rated load for over 1 sec
E 5	5	Overheat error	When heatsink temperature is over 90°C
E 6	6	Motor connection error	When motor cable connection error occurs at driver
E 7	7	Encoder connection error	When encoder cable connection error occurs at driver
E 8	8	Overvoltage error	When input voltage is over 240 VAC ~ +10%
E 9	9	Undervoltage error	When input voltage is under 200 VAC ~ -10%
E A	10	Motor alignment error	When motor is in misalignment
E b	11	Input pulse error	When input pulse is over 3,500 rpm When pulse is input before initial alignment
E C	12	In-Position error	When position error (over 1) is kept over 3 sec, after motor stopped
E d	13	Brake error	When brake failed to operate.

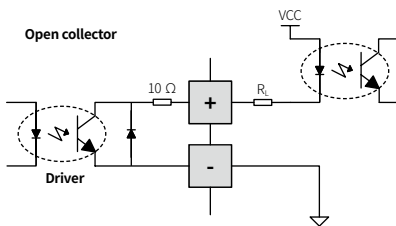
• It is normal operation that undervoltage error alarm occurs when power is cut off.

### Example of external output signal circuit connection

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

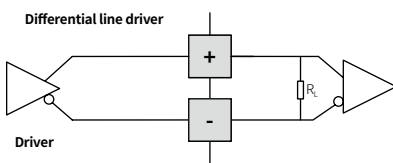
$$R_L = \frac{V_{CC} - 0.7V - V_f}{0.01A} - 10\Omega$$

$V_f$ : LED Forward Voltage of primary photocoupler



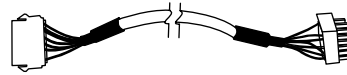
### Example of encoder output signal circuit connection

- Encoder output signal uses a line driver (26C32).
- Connect the terminal resistance  $R_L$  of 100 to 150  $\Omega$  in parallel to both ends of each phase of encoder.



## Sold Separately : Motor + Encoder Cable

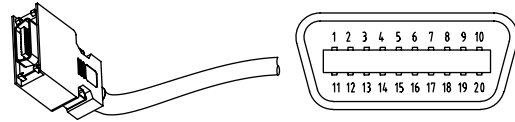
### Fixed type: C1D14M-□, Flexible type: C1DF14M-□



- Recommended to use ferrite core at both ends of the cable.
- The model name is 1, 2, 3, 5, 7, 10, 15, 20 which indicates the cable length. E.g.) C1DF14M-10: 10 m flexible type, Motor + Encoder cable

## Sold Separately : I/O Cable

### CO20-MP□-R (specifications: AiS TAG)



Pin	Function (Name TAG)	Cable color	Dot line color-number
1	CW+	Yellow	Black-1
2	CW-		Red-1
3	CCW+		Black-2
4	CCW-		Red-2
5	Servo ON/OFF+		Black-3
6	Servo ON/OFF-		Red-3
7	Alarm Out+		Black-4
8	Alarm Out-		Red-4
9	Alarm Reset+		Black-5
10	Alarm Reset-		Red-5
11	In-Position+	White	Black-1
12	In-Position-		Red-1
13	-		Black-2
14	-		Red-2
15	Encoder A		Black-3
16	Encoder $\bar{A}$		Red-3
17	Encoder B		Black-4
18	Encoder $\bar{B}$		Red-4
19	Encoder Z		Black-5
20	Encoder $\bar{Z}$		Red-5

- Recommended to use ferrite core at both ends of the cable.
- The model name is 010, 020, 030, 050, 070, 100, 150, 200 which indicates the cable length. E.g.) CO20-MP070-R: 7 m I/O cable