

# 2-Phase Closed-loop Stepper Motor Driver



## AiS-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
- Easy operation setting with external adjuster (Gain, Speed filter, In-position, Resolution)
- Built-in brake type motors available (AiS-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.**
- 04. It is recommended to use STOPPER for the vertical load.**
- 05. 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.
- 06. 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.
- 07. 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.
- 08. Use the unit within the rated specifications.**  
Failure to follow this instruction may result in fire or product damage.
- 09. 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.
- 10. 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.
- 11. 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.
- 12. 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.
- Power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- Re-supply power after 1 sec from disconnected power.
- Do not input CW, CCW signal at the same time in 2 pulse input method.
- The thickness of cable should be same or thicker than the below specifications when connecting the cable for connector.
  - Power connector: AWG18
  - Motor + Encoder connector: AWG22, AWG24
  - I/O connector: AWG28
- When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.
- Use twisted pair (over 0.2 mm<sup>2</sup>) for the signal cable within 2 m.
- Keep the distance between power cable and signal cable over 10 cm.
- 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

## 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.

**AiS - D - ① ② ③ - ④**

### ① Frame size

Number: Frame size (Unit: mm)

### ③ Encoder resolution

|   | □ 20 / 28 / 35 mm             | □ 42 / 56 / 60 mm             |
|---|-------------------------------|-------------------------------|
| A | 4,000 PPR<br>(1,000 PPR × 4)  | 10,000 PPR<br>(2,500 PPR × 4) |
| B | 16,000 PPR<br>(4,000 PPR × 4) | -                             |

### ② Axial length

S: Short  
M: Medium  
L: Long

### ④ Motor type

No mark: Standard type  
B: Built-in brake type

## Product Components

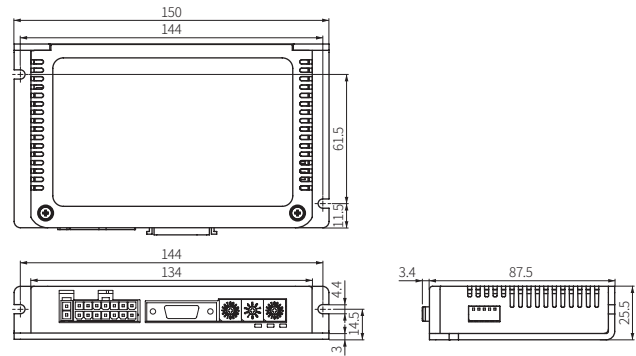
- Product
- Instruction manual
- Power connector
- I/O connector
- Brake connector (AiS-D-B Series)

## Sold Separately

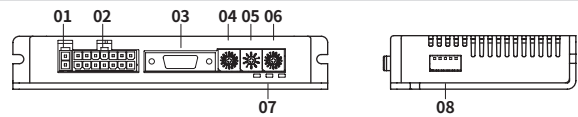
- Power cable: CJ-PW-□
- Motor + Encoder cable: C1D14M-□ (fixed type), C1DF14M-□ (flexible type)
- I/O cable: CO20-MP□-R (specifications: AiS TAG)

## Dimensions

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



## Unit Descriptions



**01. Power connector**

**02. Motor + Encoder connector**

**03. I/O connector**

**04. Speed filter / Control Gain setting rotary switch**

**05. Resolution setting rotary switch**

**06. In-Position setting rotary switch**

**07. Status indicator**

**08. Function selection DIP switch**

## Status Indicators

| Indicator                        | Color  | Descriptions                                                                                              |
|----------------------------------|--------|-----------------------------------------------------------------------------------------------------------|
| Servo ON / OFF indicator (SERVO) | Orange | Turns ON when servo is ON, Turns OFF when servo is OFF                                                    |
| In-Position indicator (INP.)     | Yellow | Turns ON when motor is placed at command position after positioning input                                 |
| Power / Alarm indicator (PWR/AL) | Green  | Turns ON when the unit operates in normal after power is applied<br>Flashes depending on the warning type |
|                                  | Red    | Flashes depending on the alarm type                                                                       |

## Alarm / Warning

Depending on the alarm type, it flashes for 0.4 sec interval and it turns OFF for 0.8 sec repeatedly.

### ■ Alarm

| No. of flashing | Alarm type              | No. of flashing | Alarm type                 |
|-----------------|-------------------------|-----------------|----------------------------|
| 1               | Overcurrent error       | 7               | Encoder connection error   |
| 2               | Overspeed error         | 8               | Regenerative voltage error |
| 3               | Position tracking error | 9               | Motor alignment error      |
| 4               | Overload error          | 10              | Input pulse error          |
| 5               | Overheat error          | 11              | Input voltage error        |
| 6               | Motor connection error  | 12              | In-Position error          |

### ■ Warning

| No. of flashing | Warning type     |
|-----------------|------------------|
| 4               | Overload warning |

## Specifications

| Model                            | AiS-D-20□A                                                                       | AiS-D-28□B                                                                        | AiS-D-35□B    |
|----------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------|
| Power supply                     | 24 VDC± ±10%                                                                     |                                                                                   |               |
| Max. RUN power <sup>(01)</sup>   | ≤ 50 W                                                                           | ≤ 60 W                                                                            |               |
| Stop power <sup>(02)</sup>       | ≤ 10 W                                                                           |                                                                                   |               |
| Max. RUN current <sup>(03)</sup> | 0.6 A / Phase                                                                    | 1.0 A / Phase                                                                     | 1.2 A / Phase |
| Stop current                     | 25% or 50% (factory default: 50%) of max. RUN current                            |                                                                                   |               |
| Resolution                       | 500 (factory default), 1000, 1600, 2000, 3600, 4000, 5000, 6400, 7200, 10000 PPR | 500 (factory default), 1000, 1600, 2000, 3600, 5000, 6400, 7200, 10000, 16000 PPR |               |

| Model                            | AiS-D-42□A-□                                                                     | AiS-D-56□A-□                                                    | AiS-D-60□A-□                                                   |
|----------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------|
| Power supply                     | 24 VDC± ±10%                                                                     |                                                                 |                                                                |
| Max. RUN power <sup>(01)</sup>   | ≤ 60 W                                                                           | ≤ 120 W                                                         | ≤ 240 W                                                        |
| Stop power <sup>(02)</sup>       | S: ≤ 7 W (≤ 16 W)<br>M: ≤ 7.5 W (≤ 16 W)<br>L: ≤ 8 W (≤ 17 W)                    | S: ≤ 9.5 W (≤ 23 W)<br>M: ≤ 10 W (≤ 23 W)<br>L: ≤ 11 W (≤ 25 W) | S: ≤ 12 W (≤ 25 W)<br>M: ≤ 13 W (≤ 26 W)<br>L: ≤ 14 W (≤ 26 W) |
| Max. RUN current <sup>(03)</sup> | 1.7 A / Phase                                                                    |                                                                 |                                                                |
| Stop current                     | 25% or 50% (factory default: 50%) 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%. The value in the bracket indicates built-in brake type.

03) 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, 2, 4, 6, 8, 10, 20, 40, 60 (factory default), 80, 100, 120, 140, 160, 180, 200 ms                                                                                   |
| Control Gain               | (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)                                      |
| 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                                                                                                                                                    |
| Input                      | CW/CCW (RUN pulse), Servo ON/OFF, Alarm Reset (Photocoupler input)                                                                                                           |
| Output                     | In-Position, Alarm Out (Photocoupler output), Encoder Signal (A, Ā, B, B̄, Z, Z̄, Line driver output), Brake (at supplying: 0.2 sec 24 VDC±, normal status: 11.5 VDC± ±10%) |
| 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 | □ 20 / 28 / 35 mm: CW, CCW: 800 kHz<br>□ 42 / 56 / 60 mm: CW, CCW: 500 kHz                                                                                                   |
| Pulse width                | CW, CCW: Input Pulse Frequency Duty 50%<br>(□ 20 mm: ≥ 2 μs, □ 28 / 35 mm: ≥ 1.25 μs)<br>Servo ON/OFF: ≥ 1 ms<br>Alarm Reset: ≥ 20 ms                                        |
| Rise fall time             | CW, CCW: < 0.5 μs                                                                                                                                                            |

|                        |                                                                                                                                                                                                                                                                     |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input resistance       | 220 Ω (CW, CCW), 10 kΩ (Servo ON/OFF, Alarm Reset)                                                                                                                                                                                                                  |
| Insulation resistance  | ≥ 100 MΩ (500 VDC± megger)                                                                                                                                                                                                                                          |
| Dielectric strength    | 1,000 VAC~ 60 Hz for 1 minute                                                                                                                                                                                                                                       |
| Vibration              | 1.5 mm double amplitude at frequency 10 to 55 Hz (for 1 minute) in each X, Y, Z direction for 2 hours                                                                                                                                                               |
| Shock                  | 300 m/s <sup>2</sup> (≈ 3 G) in each X, Y, Z direction for 3 times                                                                                                                                                                                                  |
| Ambient temp.          | □ 20 / 28 / 35 mm:<br>0 to 50°C, storage: -20 to 70°C (no freezing or condensation)<br>□ 42 / 56 / 60 mm:<br>0 to 50°C, storage: -10 to 60°C (no freezing or condensation)<br>Built-in brake type:<br>0 to 50°C, storage: -20 to 70°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)                                                                                                                                                                                                                                                 |
| Approval               | CE EMI                                                                                                                                                                                                                                                              |
| Unit weight (packaged) | ≈ 290 g (≈ 400 g)                                                                                                                                                                                                                                                   |

## 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

### Power connector

| Pin | Function |
|-----|----------|
| 1   | 24VDC±   |
| 2   | GND      |

### Motor + Encoder connector

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

### I/O connector

| Pin | Function      | Pin | Function     |
|-----|---------------|-----|--------------|
| 1   | CW+           | 11  | In-Position+ |
| 2   | CW-           | 12  | In-Position- |
| 3   | CCW+          | 13  | Brake+       |
| 4   | CCW-          | 14  | Brake-       |
| 5   | Servo ON/OFF+ | 15  | Encoder A    |
| 6   | Servo ON/OFF- | 16  | Encoder Ā   |
| 7   | Alarm Out+    | 17  | Encoder B    |
| 8   | Alarm Out-    | 18  | Encoder B̄   |
| 9   | Alarm Reset+  | 19  | Encoder Z    |
| 10  | Alarm Reset-  | 20  | Encoder Z̄   |

### Suitable specifications

The following connectors can be used with equivalent or substitute.

| Type                      | Connector Specifications                                                               | Manufacture |
|---------------------------|----------------------------------------------------------------------------------------|-------------|
| Power connector           | CHD1140-02, connector terminal: CTD1140                                                | HANLIM      |
| Motor + Encoder connector | 5557-14R, connector terminal:<br>□ 20 / 28 / 35 mm: 5556T2<br>□ 42 / 56 / 60 mm: 5556T | Molex       |
| I/O connector             | 10120-3000PE, housing: 10320-52F0-008                                                  | 3M          |

## Switch

### Speed filter / Control Gain setting rotary switch

Depending on mode selection switch setting, speed filter or position control gain can be set. The setting will be applied when motor stops.

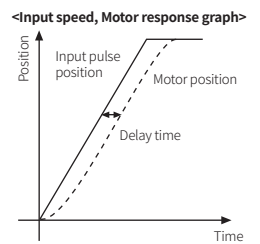
#### Speed filter

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



S.F./Gain



#### Control Gain

Control Gain sets the responsiveness of the motor to position command. Gain setting when motor stops, 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 | Control Gain |   | Setting             | Control Gain |   |
|---------|--------------|---|---------------------|--------------|---|
|         | P            | I |                     | P            | I |
| 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 |



S.F./Gain

## Resolution setting rotary switch

The setting will be applied when motor stops.



Res.

| Setting             | □ 20 / 42 / 56 / 60 mm |            | □ 28 / 35 mm |            |
|---------------------|------------------------|------------|--------------|------------|
|                     | PPR                    | Resolution | PPR          | Resolution |
| 0 (factory default) | 500                    | 2.5        | 500          | 2.5        |
| 1                   | 1000                   | 5          | 1000         | 5          |
| 2                   | 1600                   | 8          | 1600         | 8          |
| 3                   | 2000                   | 10         | 2000         | 10         |
| 4                   | 3200                   | 16         | 3600         | 18         |
| 5                   | 3600                   | 18         | 5000         | 25         |
| 6                   | 5000                   | 25         | 6400         | 32         |
| 7                   | 6400                   | 32         | 7200         | 36         |
| 8                   | 7200                   | 36         | 10000        | 50         |
| 9                   | 10000                  | 50         | 16000        | 80         |

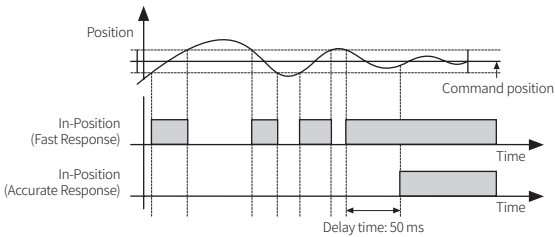
## In-Position setting rotary switch

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.

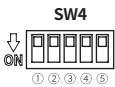


INP.

| 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   |



## Function selection DIP switch



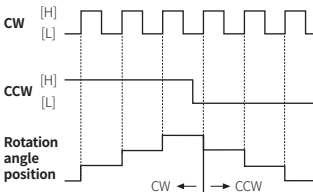
| No. | Function                 | ON                      | OFF (factory default)   | Settings apply   |
|-----|--------------------------|-------------------------|-------------------------|------------------|
| 1   | Rotation direction       | CCW                     | CW                      | Immediately      |
| 2   | Pulse input method       | 1 pulse input           | 2 pulse input           |                  |
| 3   | Stop current             | 25% of max. RUN current | 50% of max. RUN current | When motor stops |
| 4   | SW1 setting              | Coltrol Gain            | Speed filter            |                  |
| 5   | Test mode <sup>01)</sup> | Test mode               | Normal mode             | -                |

01) This function is for the operation test in manufacturing process. Do not change from OFF status.

### • Pulse input method

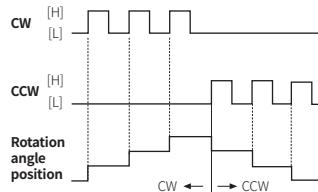
1 Pulse Input method

- 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

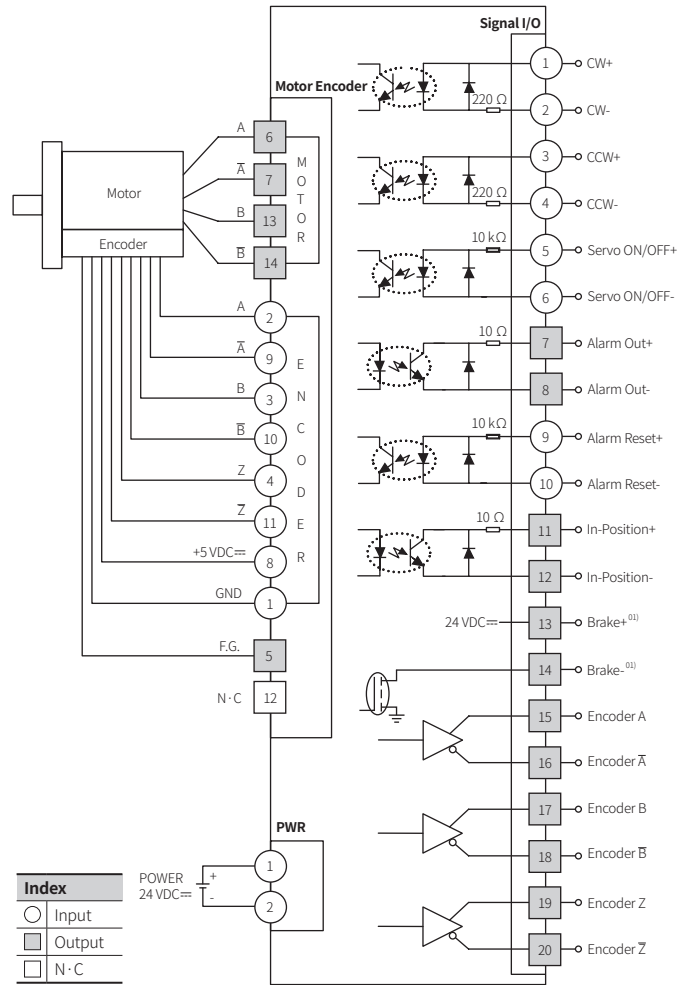


• [H]: photocoupler ON (voltage of both ends 4 - 8 VDC $\Rightarrow$ ), [L]: photocoupler OFF (voltage of both ends 0 - 0.5 VDC $\Rightarrow$ )

### • 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.

## Connections



01) The corresponding pin is N-C in standard 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

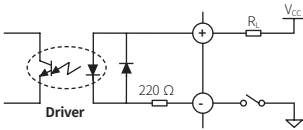
- In case of pulse input, use external power ( $V_{CC}$ ) 5 VDC $\equiv$ .
- In case  $V_{CC}$  is over 5 VDC $\equiv$ , calculate  $R_L$  value using following formular and  $V_{CC}$  must be under 30 VDC $\equiv$ .

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

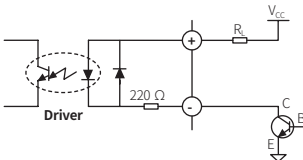
- In case  $V_{CC}$  is 12, 24 VDC $\equiv$ , refer  $R_L$  value as following table.

| $V_{CC}$        | $R_L$                           |
|-----------------|---------------------------------|
| 12 VDC $\equiv$ | 680 $\Omega$ ( $\geq 0.25 W$ )  |
| 24 VDC $\equiv$ | 1.8 k $\Omega$ ( $\geq 0.5 W$ ) |

#### Pull-Up circuit

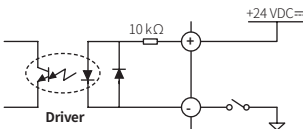


#### NPN (not-reversed) circuit

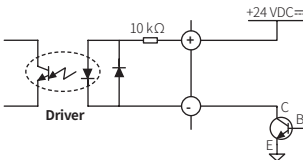


### Example of external input (Servo ON/OFF, Alarm Reset) circuit connection

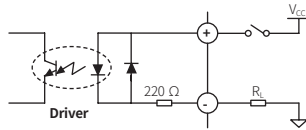
#### Pull-Up circuit



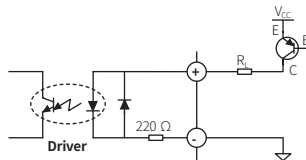
#### NPN (not-reversed) circuit



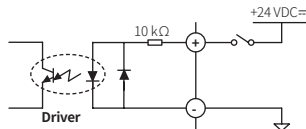
#### Pull-Down circuit



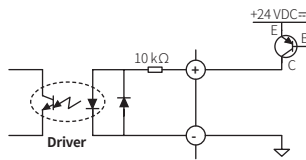
#### PNP (reversed) circuit



#### Pull-Down 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 / Warning

- 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>



### 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 Alarm Reset is applied, driver returns to the normal status.

- When alarm occurs, motor stops, torque remains, Brake locks.

| No. of flashing | Alarm type                    | Descriptions                                                                                                                                                                                                                                                                                             |            |                   |                   |                 |
|-----------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------|-------------------|-----------------|
| 1               | Overcurrent error             | When overcurrent flows at motor RUN element                                                                                                                                                                                                                                                              |            |                   |                   |                 |
| 2               | Overspeed error               | When motor speed is over 4,000 rpm                                                                                                                                                                                                                                                                       |            |                   |                   |                 |
| 3               | Position tracking error       | When the gap between position command value and current position value is over 90°                                                                                                                                                                                                                       |            |                   |                   |                 |
| 4               | Overload error                | When applying load over the rated load for over 1 sec                                                                                                                                                                                                                                                    |            |                   |                   |                 |
| 5               | Overheat error                | When driver inner temperature is over 80°C                                                                                                                                                                                                                                                               |            |                   |                   |                 |
| 6               | Motor connection error        | When motor cable connection error occurs at driver                                                                                                                                                                                                                                                       |            |                   |                   |                 |
| 7               | Encoder connection error      | When encoder cable connection error occurs at driver                                                                                                                                                                                                                                                     |            |                   |                   |                 |
| 8               | Regenerative voltage error    | When regenerative voltage is over 78 V                                                                                                                                                                                                                                                                   |            |                   |                   |                 |
| 9               | Motor alignment error         | When motor is in misalignment                                                                                                                                                                                                                                                                            |            |                   |                   |                 |
| 10              | Input pulse error             | When Input pulse is over 3,500rpm                                                                                                                                                                                                                                                                        |            |                   |                   |                 |
| 11              | Input voltage error           | When input voltage is out of allowable range                                                                                                                                                                                                                                                             |            |                   |                   |                 |
|                 |                               | <table border="1"> <thead> <tr> <th>Frame size</th> <th>□ 20 / 28 / 35 mm</th> <th>□ 42 / 56 / 60 mm</th> </tr> </thead> <tbody> <tr> <td>Allowable range</td> <td>21 - 27 VDC<math>\equiv</math> <math>\pm</math>5%</td> <td>24 VDC<math>\equiv</math> <math>\pm</math>10%</td> </tr> </tbody> </table> | Frame size | □ 20 / 28 / 35 mm | □ 42 / 56 / 60 mm | Allowable range |
| Frame size      | □ 20 / 28 / 35 mm             | □ 42 / 56 / 60 mm                                                                                                                                                                                                                                                                                        |            |                   |                   |                 |
| Allowable range | 21 - 27 VDC $\equiv$ $\pm$ 5% | 24 VDC $\equiv$ $\pm$ 10%                                                                                                                                                                                                                                                                                |            |                   |                   |                 |
| 12              | In-Position error             | When position error (over 1) is kept over 3 sec, after motor stopped.                                                                                                                                                                                                                                    |            |                   |                   |                 |

### Warning

This function notices dangers with the alarm indicator prior to over load alarm.

When releasing from the warning condition, driver returns to the normal status automatically.

Even though warning occurs, it drives as normal status but it may cause damage by fire.

It is recommend not to use the unit during warning status.

- When warning occurs, motor remains, torque remains, Brake releases.

| No. of flashing | Warning type     | Descriptions                                                                         |
|-----------------|------------------|--------------------------------------------------------------------------------------|
| 4               | Overload Warning | When maximum load is kept connected over 10 sec. (motor or driver can be overheated) |

### Example of external output signal circuit connection

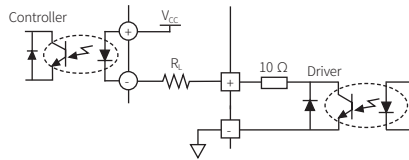
- It is recommended to use  $V_{CC}$  below 50 VDC $\equiv$  and use  $R_L$  for Ic (secondary detector collector current) of photocoupler inside the driver to be within 25 mA by referring the table as follows.

$$\text{Photocoupler circuit: } R_L = \frac{V_{CC} - 0.3 V - V_F}{0.025 A} - 10 \Omega$$

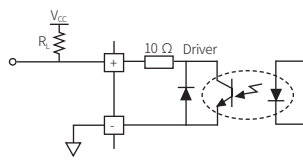
$$\text{Pull-Up, Pull-Down circuit: } R_L = \frac{V_{CC} - 0.3 V}{0.025 A} - 10 \Omega$$

- $V_F$ : LED Forward Voltage of primary photocoupler

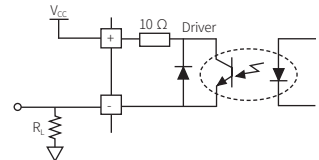
#### Photocoupler circuit



#### Pull-Up circuit (reversed)

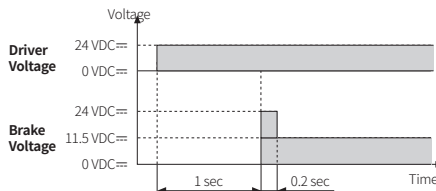


#### Pull-Down circuit (not-reversed)



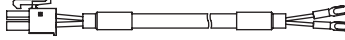
### Brake output

- In order to reduce heat in the brake, the driver outputs DC power to remain brake releasing.
- When supplying power to the driver after connecting the driver and brake, the rated excitation voltage is supplied and the brake is released after approx. 1 sec.  
Then after approx. 0.2 sec, the excitation voltage is decreased to 11.5 VDC $\equiv$  and the released brake power is maintained.
- While power is applied to the driver, the brake is kept turning on, except in the Servo ON status.



## Sold Separately : Power Cable

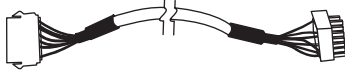
### ■ CJ-PW-□



- Recommended to use ferrite core at both ends of the cable.
- The model name is 010, 020 which indicates the cable length.  
E.g.) CJ-PW-010: 1 m power cable

## Sold Separately : Motor + Encoder Cable

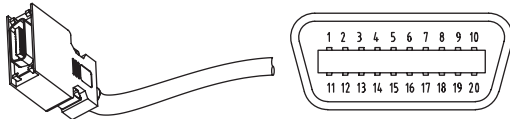
### ■ Fixed type: C1D14M-□, Flexible type: C1DF14M-□



- 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  | Brake+              |             | Black-2               |
| 14  | Brake-              |             | 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