**Autonics**

# 2-Phase Closed-Loop Stepper Motor Driver
# AiS-D-B SERIES

**INSTRUCTION MANUAL**

CE

Thank you for choosing our Autonics product.
**Please read the following safety considerations before use.**

## ▣ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※⚠ symbol represents caution due to special circumstances in which hazards may occur.

**⚠ Warning** Failure to follow these instructions may result in serious injury or death.
**⚠ Caution** Failure to follow these instructions may result in personal injury or product damage.

### ⚠ Warning

1. **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 fire, personal injury, or economic loss.
2. **Do not connect, repair, or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in fire.
3. **Install the unit after considering counter plan against power failure.**
   Failure to follow this instruction may result in personal injury, or economic loss.
4. **Check 'Connections' before wiring.**
   Failure to follow this instruction may result in fire.
5. **Do not disassemble or modify the unit.**
   Failure to follow this instruction may result in fire.
6. **Install the driver in the grounded housing or ground it directly.**
   Failure to follow this instruction may result in personal injury, or fire.
7. **Do not touch the unit during or after operation for a while.**
   Failure to follow this instruction may result in or burn due to high temperature of the surface.
8. **Emergency stop directly when error occurs.**
   Failure to follow this instruction may result in fire, or personal injury.

### ⚠ Caution

1. **When connecting the power input, use AWG 18 (0.75mm²) cable or over.**
2. **Brake is non-polar. When connecting the brake, use AWG 24 (0.2mm²) cable or over.**
   Failure to follow this instruction may result in fire or malfunction due to contact failure.
3. **To use the motor safely, do not apply external force to the motor.**
4. **It is recommended to use STOPPER for the vertical load.**
5. **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.
6. **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 signal.
7. **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.
8. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in fire or product damage.
9. **Use dry cloth to clean the unit, and do not use water or organic solvent.**
   Failure to follow this instruction may result in electric shock or fire.
10. **Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
    Failure to follow this instruction may result in fire or explosion.
11. **The driver may overheat depending on the environment.**
    **Install the unit in the well ventilated place and forced cooling with a cooling fan.**
    Failure to follow this instruction may result in product damage and degradation.
12. **Keep metal chip, dust, and wire residue from flowing into the unit.**
    Failure to follow this instruction may result in fire or product damage.
13. **Use the designated motor only.**
    Failure to follow this instruction may result in fire or product damage.

## ▣ Ordering Information

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

| | | | |
|---|---|---|---|
| Brake | B | Built-in brake type | |
| Encoder resolution | A | 10,000PPR (2,500PPR×4-multiply) | |
| Motor length | 42 | 42×42mm | S 102.3mm |
| | | | M 108.3mm |
| | | | L 116.3mm |
| Motor frame size | 56 | 57.2×57.2mm | S 112.1mm |
| | | | M 125.1mm |
| | | | L 146.1mm |
| | 60 | 60×60mm | S 116.7mm |
| | | | M 137.6mm |
| | | | L 154.6mm |
| Item | D | Driver | |
| Category | S | Standard | |
| Series | Ai | Artificial Intelligence | |

| 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 |

※**The above specifications are subject to change and some models may be discontinued without notice.**
※**Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).**

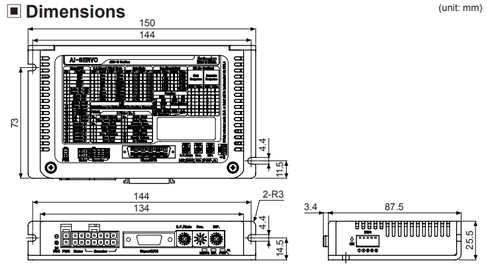
## ▣ Specifications

| 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※1 | Max. 16W | Max. 17W | Max. 23W | | Max. 25W | | Max. 26W | |
| | Max. during operation※2 | Max. 60W | | Max. 120W | | | Max. 240W | | |
| Max. RUN current※3 | 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 | ● Power/Warning indicator: green LED ● Alarm indicator: red LED, ● In-Position indicator: yellow LED ● Servo On/Off indicator: orange LED | | | | | | | | |
| Input signal | RUN pulse, Servo On/Off, alarm reset (photocoupler input) | | | | | | | | |
| Output signal | In-Position, alarm out (photocoupler output), brake (at supplying moment: 24VDC for 0.2 sec, in normal status: 11.5VDC ±10%) Encoder signal (A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ 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 | | | | | | | | |
| Input pulse specifications: Rising/Falling time | CW, CCW: max. 0.5μs | | | | | | | | |
| Input pulse specifications: Pulse input voltage | CW, CCW - [H]: 4-8VDC⎓, [L]: 0-0.5VDC<br>Servo On/Off, alarm reset - [H]: 24VDC⎓, [L]: 0-0.5VDC | | | | | | | | |
| Input pulse specifications: Max. input pulse freq.※4 | CW, CCW: 500kHz | | | | | | | | |
| Input resistance | 220Ω (CW, CCW), 10kΩ (Servo On/Off, alarm reset) | | | | | | | | |
| Insulation resistance | Over 100MΩ (at 500VDC megger) | | | | | | | | |
| Dielectric strength | 1,000VAC 60Hz for 1 min | | | | | | | | |
| Vibration | 1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours | | | | | | | | |
| Shock | 300m/s² (approx. 30G) in each X, Y, Z direction for 3 times | | | | | | | | |
| Environment: Ambient temp. | 0 to 50°C, storage: -20 to 70°C | | | | | | | | |
| Environment: Ambient humi. | 35 to 85%RH, storage: 10 to 90%RH | | | | | | | | |
| Approval | CE | | | | | | | | |
| Protection structure | IP20 (IEC standard) | | | | | | | | |
| Weight※5 | Approx. 400g (approx. 290g) | | | | | | | | |

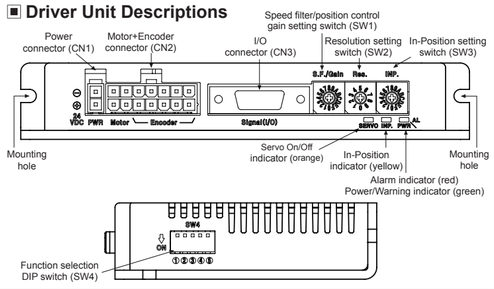
※1: Based on the ambient temperature 25°C, ambient humidity 55%RH, and STOP current 50%.
※2: Max. power consumption during operation. When changing the load rapidly, instantaneous peak current may increase. The capacity of power supply should be over 1.5 to 2 times of max. power consumption.
※3: RUN 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.

## ▣ Dimensions

(unit: mm)




## ▣ Driver Unit Descriptions




## ▣ 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. |

## ▣ Connection Connectors of Driver

○ **Connector function**

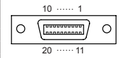
● **CN1: Power connector**

| Pin arrangement | Pin No. | Function |
|---|---|---|
|  | 2 | GND |
| | 1 | 24VDC |

● **CN2: Motor+Encoder connector**


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

● **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 $\overline{A}$ |
| | 7 | Output | Alarm Out+ | 17 | Output | Encoder B |
| | 8 | Output | Alarm Out- | 18 | Output | Encoder $\overline{B}$ |
| | 9 | Input | Alarm Reset+ | 19 | Output | Encoder Z |
| | 10 | Input | Alarm Reset- | 20 | Output | Encoder $\overline{Z}$ |

## ▣ Driver Setting

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

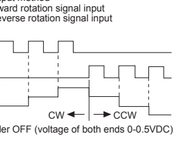
| 4th pin in SW4 | Setting |
|---|---|
| OFF | Speed filter |
| ON | Position control gain |

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

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

※1: Factory default

<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 during drive.
-I_Gain: Adjust vibration in acceleration/deceleration zone.

| Setting switch | Setting | Gain | | Setting | Gain | |
|---|---|---|---|---|---|---|
| | | P | I | | P | I |
|  | 0 | 1 | 1 | 8※1 | 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 |
| S.F./Gain | 7 | 2 | 2 | F | 5 | 3 |

※1: Factory default

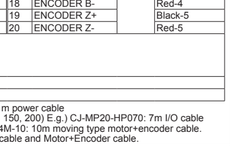
○ **SW2: Resolution setting switch**
-Set the resolution of driver.
-The number of pulses per 1 rotation by resolution is each 500, 1000, 1600, 2000, 3200, 3600, 5000, 6400, 7200, 10000.
-Modified setting values are not applied in the running status, and the values will be applied after motor stopped.

| 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 |
| RES. | 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※1 | 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 |
| INP. | 7 | ±7 | F | ±7 |

※1: Factory default




○ **SW4: Function selection DIP switch**
-Set rotation direction, pulse input method, STOP current, SW1 setting, and test mode.

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

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

● Pulse input method

※1-pulse input method
-CW: Rotation operation signal input
-CCW: Rotation direction signal input
([H]: Forward rotation, [L]: Reverse rotation)




※2-pulse input method
-CW: Forward rotation signal input
-CCW: Reverse rotation signal input




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

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

○ **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) | — | — | Autonics |

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

○ **Cable (sold separately)**

| Type | Model | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Power cable | CJ-PW-□※1 | | | | | | | |
| I/O cable | CJ-MP20-HP□※2 (sold separately, 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 |
| Motor+ Encoder cable | Normal C1D14M-□※3<br>Moving C1DF14M-□※3 | | | | | | | |

※1: □ indicates cable length (010, 020) E.g.) CJ-PW-010: 1m power cable
※2: □ indicates cable length (010, 020, 030, 050, 070, 100, 150, 200) E.g.) CJ-MP20-HP070: 7m I/O cable
※3: □ indicates cable length (1, 2, 3, 5, 7, 10) E.g.) C1DF14M-10: 10m moving type motor+encoder cable.
※It is recommended to use ferrite core at power cable, I/O cable and Motor+Encoder cable.

## ▣ Control Input/Output

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

○ **Output**

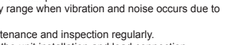
**1. In-Position**
-In-Position output is output condition of positioning completion signal.
-If the gap between target position and real position is under In-Position setting value after position command pulse has finished, In-Position output turns to [H] and the In-Position indicator turns ON.
-In reverse, when the gap is over In-Position setting value, In-Position output turns to [L] and the In-Position indicator turns OFF.
-For accurate drive, check the In-Position output again and execute the next drive.
※Refer to 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 alarm occurs, brake operates.
-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 | × |
| | 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) | × | 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>

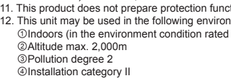



**3. Example of output circuit connection**
-It is recommended to use below 50VDC at $V_{CC}$. Use the $R_L$ for $I_C$ (collector current of secondary detector) of photocoupler inside the driver to be within 25mA following the below formula.

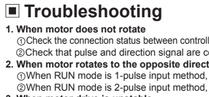
※A: $R_L = \frac{V_{CC} - 0.3V - V_F}{0.025A} - 10\Omega$ ※B, C: $R_L = \frac{V_{CC} - 0.3V}{0.025A} - 10\Omega$

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

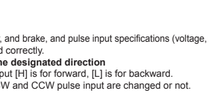
A. Circuit with photocoupler




B. Circuit with pull up (reversed)




C. Circuit with pull down (not-reversed)




**4. Encoder output waveforms**




※T=1 cycle of A, B phase
※It is recommended to use Line driver output (corresponding to 26C32) at RECEIVER end of encoder output and terminating resisters (100-150Ω) in parallel at both ends of each phase (A, Ā, B, B̄, Z, Z̄, corresponding to 26C31).

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




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

## ▣ Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
2. 24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
3. Re-supply power after min. 1 sec from disconnected power.
4. Do not input CW, CCW signal at the same time in 2-pulse input method.
5. When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.
6. Use twisted pair (over 0.2mm²) for the signal cable which should be shorter than 2m.
7. The thickness of cable should be same or thicker than the motor cable's when extending the motor cable.
8. Keep the distance between power cable and signal cable more than 10cm.
9. Motor vibration and noise can occur in specific frequency period
   ①Change motor installation method or attach the damper.
   ②Use the unit out of the dedicated frequency range when vibration and noise occurs due to changing motor RUN speed.
10. For using motor, it is recommended to maintenance and inspection regularly.
    ①Unwinding bolts and connection parts for the unit installation and load connection
    ②Strange sound from ball bearing of the unit
    ③Damage and stress of lead cable of the unit
    ④Connection error with motor
    ⑤Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
11. This product does not prepare protection function for a motor.
12. This unit may be used in the following environments.
    ①Indoors (in the environment condition rated in 'Specifications')
    ②Altitude max. 2,000m
    ③Pollution degree 2
    ④Installation category II

## ▣ Troubleshooting

**1. When motor does not rotate**
①Check the connection status between controller, driver, and brake, and pulse input specifications (voltage, width).
②Check that pulse and direction signal are connected correctly.
**2. When motor rotates to the opposite direction of the designated direction**
①When RUN mode is 1-pulse input method, CCW input [H] is for forward, [L] is for backward.
②When RUN mode is 2-pulse input method, check CW and CCW pulse input are changed or not.
**3. When motor drive is unstable**
①Check that driver, motor, and brake are connected correctly.
②Check the driver pulse input specifications (voltage, width).

○ **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.

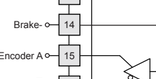
**4. Example of input circuit connection**
● Input pulse (CW, CCW)
-It is recommended to use 5VDC at $V_{CC}$ and short the $R_L$.
-In case $V_{CC}$ is over 5VDC, calculate $R_L$ value using following formula and use $V_{CC}$ below 30VDC.

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

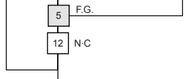
-In case $V_{CC}$ is 12, 24VDC, refer to table on the right for $R_L$.

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

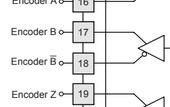
A. Pull-Up



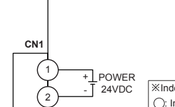

B. Pull-Down




C. Circuit with NPN (not-reversed)




D. Circuit with PNP (reversed)

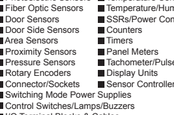



● External input (Servo On/Off, Alarm Reset)

A. Pull-Up


B. Pull-Down


C. Circuit with NPN (not-reversed)




D. Circuit with PNP (reversed)


## ▣ Connection for Motor and Driver




## ▣ Major Products

- Photoelectric Sensors
- Fiber Optic Sensors
- Door Sensors
- Door Side Sensors
- Area Sensors
- Proximity Sensors
- Pressure Sensors
- Rotary Encoders
- Connector/Sockets
- Switching Mode Power Supplies
- Control Switches/Lamps/Buzzers
- I/O Terminal Blocks & Cables
- Stepper Motors/Drivers/Motion Controllers
- Graphic/Logic Panels
- Field Network Devices
- Laser Marking System (Fiber, $CO_2$, Nd: YAG)
- Laser Welding/Cutting System
- Temperature Controllers
- Temperature/Humidity Transducers
- SSRs/Power Controllers
- Counters
- Timers
- Panel Meters
- Tachometer/Pulse (Rate) Meters
- Display Units
- Sensor Controllers

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