2-Phase Closed-loop Stepper Motor Driver

AiS-D Series

INSTRUCTION MANUAL

TCD210117AA

Autonics

Thank you for choosing our Autonics product.
Read and understand the instruction manual and manual thoroughly before using the product.
For your safety, read and follow the below safety considerations before using.
For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.
Keep this instruction manual in a place where you can find easily.
The specifications, dimensions, etc. are subject to change without notice for product improvement. Some models may be discontinued without notice.
Follow Autonics website for the latest information.

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 mm²) cable or over.**
02. **Brake is non-polar. When connecting the brake, use AWG24 (0.2 mm²) 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 mm²) 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	-	❶	❷	❸	-	❹

❶ Frame size
Number: Frame size (Unit: mm)

❸ Encoder resolution

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

❷ Axial length
S: Short
M: Medium
L: Long

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

Product Components

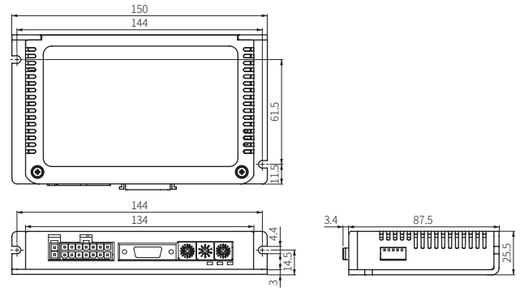
- Product
- Instruction manual
- Power connector
- I/O connector
- Brake connector (AiS-D-B Series)

Sold Separately

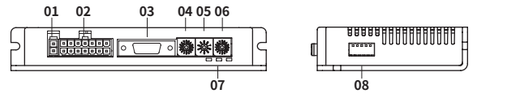
- Power cable: CJ-PW-□
- Motor + Encoder cable: C1D14M-□ (fixed type), C1DF14M-□ (flexible type)
- I/O cable: CO20-MP□-R (specifications: AiS TAG)

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 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 01)	≤ 50 W	≤ 60 W	
Stop power 02)	≤ 10 W		
Max. RUN current 03)	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 01)	≤ 60 W	≤ 120 W	≤ 240 W
Stop power 02)	S: ≤ 7 W (≤ 16 W) M: ≤ 7.5 W (≤ 16 W) L: ≤ 8 W (≤ 17 W)	S: ≤ 9.5 W (≤ 23 W) M: ≤ 10 W (≤ 23 W) L: ≤ 11 W (≤ 25 W)	S: ≤ 12 W (≤ 25 W) M: ≤ 13 W (≤ 26 W) L: ≤ 14 W (≤ 26 W)
Max. RUN current 03)	1.7 A / Phase	3.5 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, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$, 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 □ 42 / 56 / 60 mm: CW, CCW: 500 kHz
Pulse width	CW, CCW: Input Pulse Frequency Duty 50% (□ 20 mm: ≥ 2 μs, □ 28 / 35 mm: ≥ 1.25 μs) Servo ON/OFF: ≥ 1 ms 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/s² (≈ 30 G) in each X, Y, Z direction for 3 times
Ambient temp.	□ 20 / 28 / 35 mm: 0 to 50°C, storage: -20 to 70°C (no freezing or condensation) □ 42 / 56 / 60 mm: 0 to 50°C, storage: -10 to 60°C (no freezing or condensation) Built-in brake type: 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 EAC
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.

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