**Standard / Built-in Brake Type AC Power Input**
**2-Phase Closed-loop Stepper Motor (□ 60 mm, □ 86 mm)**

# AiA-M Series

# INSTRUCTION MANUAL

TCD210115AA

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 use the brake for safety.**
Failure to follow this instruction may result in personal injury or product and ambient equipment damage.
**04. Fix the unit on the metal plate.**
Failure to follow this instruction may result in personal injury or product and ambient equipment damage.
**05. Do not connect, repair, or inspect the unit while connected to a power source.**
Failure to follow this instruction may result in fire.
**06. Install the unit after considering counter plan against power failure.**
Failure to follow this instruction may result in personal injury, economic loss or fire.
**07. Check 'Connections' before wiring.**
Failure to follow this instruction may result in fire.
**08. Do not disassemble or modify the unit.**
Failure to follow this instruction may result in fire or electric shock.
**09. Install the motor in the housing or ground it.**
Failure to follow this instruction may result in personal injury, fire or electronic shock.
**10. Make sure to install covers on motor rotating components.**
Failure to follow this instruction may result in personal injury
**11. Do not touch the unit during or after operation for a while.**
Failure to follow this instruction may result in burn due to high temperature of the surface.
**12. Upon occurrence of an error, disconnect the power source.**
Failure to follow this instruction may result in personal injury, fire or electronic shock.

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

**01. Use the unit within the rated specifications.**
Failure to follow this instruction may result in fire or product damage.
**02. Brake is non-polar. When connecting the brake, use AWG 24 (0.2 mm²) cable or over.**
Failure to follow this instruction may result in malfunction due to contact failure.
**03. 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.
**04. The motor 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.
**05. 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.

## Cautions during Use

- Follow instructions in 'Cautions during Use'.
  Otherwise, it may cause unexpected accidents.
- At low temperature, reducing the grease's consistency of ball-baring and etc. causes the friction torque increment.
  Start the motor gradually since motor's torque is in normal state.
- Encoder shield cable must be connected to F.G. terminal.
- When wiring encoder cable, separate it from high voltage cable, power cable, etc. to prevent surge and inductive noise and keep the cable length as short as possible.
  Failure to follow this instruction may result in raised cable resistance, residual voltage and output waveform noise.
- 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 driver
  - Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
- This unit may be used in the following environments.
  - Indoors (in the environment condition rated in 'Specifications')
  - Altitude max. 2,000 m
  - Pollution degree 2
  - Installation category II

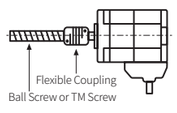
## Cautions during Installation

- Follow instructions in 'Safety Considerations' and 'Cautions during Use'.
  Otherwise, it may cause unexpected accidents.
- Install the motor in a place that meets the certain conditions specified below. It may cause product damage if it is used out of following conditions.
  - Inside of the housing which is installed indoors
    (This unit is designed/manufactured for the purpose of attaching to equipment.
    Install a ventilation device.)
  - The place without contact with water, oil, or other liquid
  - The place without contact with strong alkali or acidity
  - The place with less electronic noise occurs by welding machine, motor, etc.
  - The place where no radioactive substances and magnetic fields exist. It shall be no vacuum status as well.
- Motor can be installed horizontally and vertically. Refer to 'Shaft Allowable Load along Installation Direction'.
- If a force (30 N) exceeding the specification is applied to the motor cable during installation, it may cause the contact failure and disconnection.
  If the excessive force or frequent cable movement is required, establish safety measures before use.
- In consideration of heat dissipation and vibration prevention, mount the motor as tight as possible against a metal panel with high thermal conductivity such as iron or aluminum.

## Cautions during Connection with Load

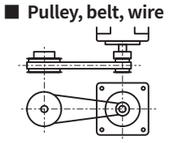
- Do not disassemble or modify the motor shaft to connect with the load.
- Tighten the screw not to be unscrewed when connecting with load.
- Refer to 'Shaft Allowable Load along Installation Direction' and take care of potential shock when connecting with load.
- Connect the motor shaft and the load shaft to be parallel.
- If the center with the load is not aligned with the shaft, it may cause unexpected accidents such as severe vibration, shorten life cycle of the shaft bearing and shaft damage.
- When attaching coupling or pulley with motor shaft, be aware of damage on motor shaft and shaft bearing.

### ■ Coupling



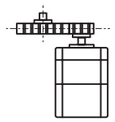

When connecting the load directly to the motor shaft, use a flexible coupling (ERB Series).

### ■ Pulley, belt, wire



Connect the motor shaft and the line which connects the center of two pulleys to be perpendicular.

### ■ Gear



Connect the motor shaft to the center of gear teeth to be interlocked.

## Troubleshooting

| Malfunction | Troubleshooting |
|---|---|
| When motor does not excite | Check the connection status between controller and driver and pulse input specifications (voltage, width). |
| | Check the pulse and direction signal are connected correctly. |
| When motor rotates to the opposite direction of the designated direction | When the driver's RUN mode is 1-pulse input method, CCW input [H] is for forward, [L] is for backward. When the driver's RUN mode is 2-pulse input method, check CW and CCW pulse input are changed. |
| When motor drives unstable | Check the driver and motor are connected correctly. |
| | Check the driver pulse input specifications (voltage, width). |

## Ordering Information

This is only for reference, the actual product does not support all combinations..
For selecting the specified model, follow the Autonics website.

AiA - M - ❶ ❷ A - ❸

**❶ Frame size**
Number: Frame size (unit: mm)

**❷ Axial length**
M: Medium
L: Long

**❸ Motor type**
No mark: Standard type
B: Built-in brake type

## Product Components

- Product
- Instruction manual

## Sold Separately

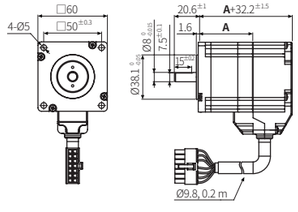
- Motor + Encoder cable: C1D14M-□ (fixed type), C1DF14M-□ (flexible type)
- Flexible coupling: ERB Series

## Dimensions

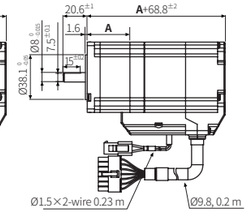
- Unit: mm, For the detailed drawings, follow the Autonics website.

### ■ □ 60 mm

Standard type



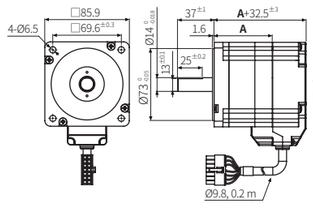

Built-in brake type



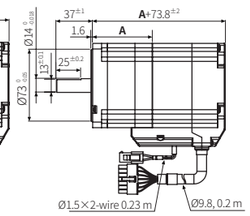

| Axial length | M | L |
|---|---|---|
| A | 49 | 70 |

### ■ □ 86 mm

Standard type




Built-in brake type

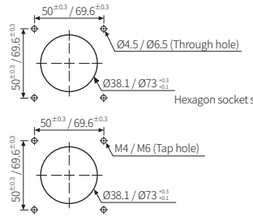



| Axial length | M | L |
|---|---|---|
| A | 61 | 75 |

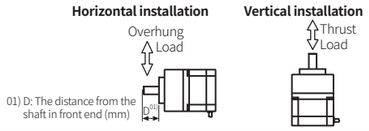
## Panel Cut-out Dimensions

### ■ □ 60 mm / □ 86 mm

- Mounting plate Thickness: ≥ 5 mm / 8 mm




## Shaft Allowable Load along Installation Direction




| Frame size | Horizontal installation: Overhung allowable load [N] | | | | Vertical installation: Thrust allowable load [N] |
|---|---|---|---|---|---|
| | D = 0 | D = 5 | D = 10 | D = 15 | |
| □ 60 mm | 54 | 67 | 89 | 130 | Under load of motor |
| □ 86 mm | 260 | 290 | 340 | 390 | |

## Specifications

| Model | AiA-M-60MA-□ | AiA-M-60LA-□ |
|---|---|---|
| Max. stop torque | 1.1 N m | 2.2 N m |
| Rotor inertia moment | 240×10⁻⁷ kg · m² | 490×10⁻⁷ kg · m² |
| Rated current | 2.0 A / Phase | |
| Basic step angle | 1.8° / 0.9° (Full / Half step) | |
| Resistance | 1.5 Ω / Phase ±10% | 2.4 Ω / Phase ±10% |
| Inductance | 3.9 mH / Phase ±20% | 8.5 mH / Phase ±20% |
| Unit weight (packaged) 01) | ≈ 0.75 kg (≈ 0.95 kg) | ≈ 1.15 kg (≈ 1.35 kg) |
| | ≈ 1.35 kg (≈ 1.53 kg) | ≈ 1.75 kg (≈ 1.90 kg) |

| Model | AiA-M-86MA-□ | AiA-M-86LA-□ |
|---|---|---|
| Max. stop torque | 2.8 N m | 4.0 N m |
| Rotor inertia moment | 1,100×10⁻⁷ kg · m² | 1,800×10⁻⁷ kg · m² |
| Rated current | 2.0 A / Phase | |
| Basic step angle | 1.8° / 0.9° (Full / Half step) | |
| Resistance | 2.3 Ω / Phase ±10% | 1.9 Ω / Phase ±10% |
| Inductance | 11.5 mH / Phase ±20% | 16.2 mH / Phase ±20% |
| Unit weight (packaged) 01) | ≈ 1.70 kg (≈ 2.00 kg) | ≈ 2.30 kg (≈ 2.60 kg) |
| | ≈ 2.50 kg (≈ 2.76 kg) | ≈ 3.10 kg (≈ 3.36 kg) |

01) Listed in order of Standard type / Built-in brake type

| | |
|---|---|
| Motor phase | 2-phase |
| Run method | Bipolar |
| Insulation class | B type (130°C) |
| Insulation resistance | Between motor coil and case: ≥ 100 MΩ (500 VDC⎓ megger) |
| Dielectric strength | Between motor coil and case: 1,000 VAC~ 50 / 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 | ≲ 50 G |
| Ambient temp. | 0 to 50°C, storage: -20 to 70°C (no freezing or condensation) |
| Ambient humi. | 20 to 85%RH, storage: 15 to 90%RH (no freezing or condensation) |
| Protection rating | IP30 (IEC34-5 standard) |
| Approval | CE |
| Stop angle error | ± 0.09° (Full step, no load) |
| Shaft vibration | 0.03 mm T.I.R. |
| Radial movement 01) | ≤ 0.025 mm T.I.R. |
| Axial movement 02) | ≤ 0.01 mm T.I.R. |
| Shaft concentricity | 0.05 mm T.I.R. |
| Shaft perpendicularity | 0.075 mm T.I.R. |

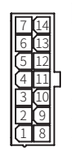
01) Amount of radial shaft displacement when applying radial load (25 N) to the end of the shaft.
02) Amount of axial shaft displacement when applying axial load (50 N) to the shaft.

| Encoder type | Incremental Rotary Encoder |
|---|---|
| Power supply | 5 VDC⎓ ± 5% (ripple P-P: ≤ 5%) |
| Current consumption | ≤ 50 mA (No load) |
| Resolution | 10,000 PPR (2,500 PPR × 4) |
| Control output | Line driver Output |
| Output phase | A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ |
| Output waveform | Output Duty rate: $\frac{T}{2} \pm \frac{T}{4}$, A-B phase difference: $\frac{T}{4} \pm \frac{T}{8}$ (T = 1 cycle of A) |
| Inflow current | ≤ 20 mA |
| Residual voltage | ≤ 0.5 VDC⎓ |
| Outflow current | ≤ -20 mA |
| Output voltage | ≥ 2.5 VDC⎓ |
| Response speed | ≤ 0.5 μs (Cable length: 2 m, I sink = 20 mA) |
| Max. response freq. | 300 kHz |

| Built-in brake type frame size | □ 60 mm | □ 86 mm |
|---|---|---|
| Rated excitation voltage | 24 VDC⎓ ±10% | |
| Rated excitation current | 0.275 A | 0.479 A |
| Static friction torque | 0.75 N m | 2.6 N m |
| Rotation part inertia moment | 1.9×10⁻⁶ kg · m² | 12×10⁻⁶ kg · m² |
| Insulation class | B type (130°C) | |
| B type brake | Brake is released when power ON, brake is locked when power OFF | |
| Operating time | 30 ms | 40 ms |
| Releasing time | 10 ms | 25 ms |

## Connectors

### ■ Motor + Encoder connector




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

### ■ Brake connector


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

### ■ Suitable Specifications

| Type | Connector Specifications | Manufacture |
|---|---|---|
| Motor + Encoder connector | 5557-14R (Connector Terminal: 5556T) | Molex |
| Brake connector | 5559-02P (Connector Terminal: 5558T) | Molex |


18, Bansong-ro 513Beon-gil, Haeundae-gu, Busan, Republic of Korea, 48002
**www.autonics.com | +82-2-2048-1577 | sales@autonics.com**


Autonics