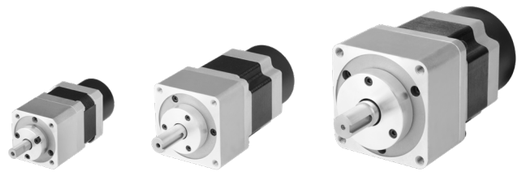
**Autonics**

# GEARED built-in BRAKE TYPE 5-PHASE STEPPER MOTOR

**INSTRUCTION MANUAL**



**[Frame size 42mm]** **[Frame size 60mm]** **[Frame size 85mm]**

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 use the brake for safety.**
   Failure to follow this instruction may result in personal injury, or product and ambient equipment damage.
3. **Fix the unit on the metal plate.**
   Failure to follow this instruction may result in personal injury, or product and ambient equipment damage.
4. **Do not connect, repair, or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in fire.
5. **Install the unit after considering counter plan against power failure.**
   Failure to follow this instruction may result in personal injury, or economic loss.
6. **Check 'Connections' before wiring.**
   Failure to follow this instruction may result in fire.
7. **Do not disassemble or modify the unit.**
   Failure to follow this instruction may result in electric shock or fire.
8. **Install the motor in the housing or ground it.**
   Failure to follow this instruction may result in electronic shock, fire, or personal injury.
9. **Make sure to install covers on motor rotating components.**
   Failure to follow this instruction may result in personal injury.
10. **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.
11. **Turn OFF the power directly when error occurs.**
    Failure to follow this instruction may result in electric shock, fire, or personal injury.

### ⚠ Caution

1. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in fire or product damage.
2. **Use dry cloth to clean the unit, and do not use water or organic solvent.**
   Failure to follow this instruction may result in fire.
3. **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.
4. **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 and degradation.

## ■ Ordering Information

**A 35K - M 5 6 6 - GB 5**

- Gear ratio: **5** 1:5; **7.2** 1:7.2; **10** 1:10
- Motor type: **GB** Geared+built-in brake type
- Motor length: **5** 47mm; **6** 59.5mm; **9** 98mm
- Motor frame size: **4** 42×42mm; **6** 60×60mm; **9** 85×85mm
- Motor phase: **5** 5-phase
- Rated current: **S** 0.75A/Phase; **M** 1.4A/Phase; **G** 2.8A/Phase
- Max. holding torque: **Square** kgf·cm (refer to ■ specification)
- Item: **A** Autonics motor

※**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

| Frame size 42mm | | | | |
|---|---|---|---|---|
| Model | | **A10K-S545-GB5** | **A15K-S545-GB7.2** | **A15K-S545-GB10** |
| Max. holding torque※1 | | 10kgf·cm (1.0N·m) | 15kgf·cm (1.5N·m) | |
| Rotor moment of inertia※2 | | 68 g·cm² (68×10⁻⁷ kg·m²) | | |
| Rated current | | 0.75 A/Phase | | |
| Basic step angle | | 0.144° / 0.072° (Full/Half step) | 0.1° / 0.05° (Full/Half step) | 0.072° / 0.036° (Full/Half step) |
| Gear ratio | | 1:5 | 1:7.2 | 1:10 |
| Allowable speed range | | 0 to 360rpm | 0 to 250rpm | 0 to 180rpm |
| Backlash [min] | | ±35' (0.58°) | | |
| Electro-Magnetic Brake | Rated excitation voltage | 24VDC⎓ ±10% | | |
| | Rated excitation current | 0.2A | | |
| | Static friction torque | 1.8kgf·cm | | |
| | Rotation part inertia | 3×10⁻⁷ kg·cm² | | |
| | Insulation class | B type (130℃) | | |
| | B type brake | Power on: brake is released, power off: brake is operating | | |
| | Operating time | Max. 15ms | | |
| | Releasing time | Max. 25ms | | |
| Weight※3 | | Approx. 0.78kg (approx. 0.72kg) | | |

| Frame size 60mm | | | | |
|---|---|---|---|---|
| Model | | **A35K-M566-GB5** | **A40K-M566-GB7.2** | **A50K-M566-GB10** |
| Max. holding torque※1 | | 35 kgf·cm (3.4 N·m) | 40 kgf·cm (3.9 N·m) | 50 kgf·cm (4.9 N·m) |
| Rotor moment of inertia※2 | | 280 g·cm² (280×10⁻⁷ kg·m²) | | |
| Rated current | | 1.4 A/Phase | | |
| Basic step angle | | 0.144° / 0.072° (Full/Half step) | 0.1° / 0.05° (Full/Half step) | 0.072° / 0.036° (Full/Half step) |
| Gear ratio | | 1:5 | 1:7.2 | 1:10 |
| Allowable speed range | | 0 to 360rpm | 0 to 250rpm | 0 to 180rpm |
| Backlash [min] | | ±20' (0.33°) | | |
| Electro-Magnetic Brake | Rated excitation voltage | 24VDC⎓ ±10% | | |
| | Rated excitation current | 0.33A | | |
| | Static friction torque | 8kgf·cm | | |
| | Rotation part inertia | 29×10⁻⁷ kg·cm² | | |
| | Insulation class | B type (130℃) | | |
| | B type brake | Power on: brake is released, power off: brake is operating | | |
| | Operating time | Max. 20ms | | |
| | Releasing time | Max. 25ms | | |
| Weight※3 | | Approx. 1.65kg (approx. 1.57kg) | | |

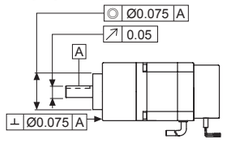
| Frame size 85mm | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | | **A140K-M599-GB5** | **A140K-G599-GB5** | **A200K-M599-GB7.2** | **A200K-G599-GB7.2** | **A200K-M599-GB10** | **A200K-G599-GB10** |
| Max. holding torque※1 | | 140 kgf·cm (13.7 N·m) | | 200 kgf·cm (19.6 N·m) | | | |
| Rotor moment of inertia※2 | | 2,700 g·cm² (2,700×10⁻⁷ kg·m²) | | | | | |
| Rated current | | 1.4 A/Phase | 2.8 A/Phase | 1.4 A/Phase | 2.8 A/Phase | 1.4 A/Phase | 2.8 A/Phase |
| Basic step angle | | 0.144° / 0.072° (Full/Half step) | | 0.1° / 0.05° (Full/Half step) | | 0.072° / 0.036° (Full/Half step) | |
| Gear ratio | | 1:5 | | 1:7.2 | | 1:10 | |
| Allowable speed range | | 0 to 360rpm | | 0 to 250rpm | | 0 to 180rpm | |
| Backlash [min] | | ±15' (0.25°) | | | | | |
| Electro-Magnetic Brake | Rated excitation voltage | 24VDC⎓ ±10% | | | | | |
| | Rated excitation current | 0.62A | | | | | |
| | Static friction torque | 40kgf·cm | | | | | |
| | Rotation part inertia | 153×10⁻⁷ kg·cm² | | | | | |
| | Insulation class | B type (130℃) | | | | | |
| | B type brake | Power on: brake is released, power off: brake is operating | | | | | |
| | Operating time | Max. 15ms | | | | | |
| | Releasing time | Max. 60ms | | | | | |
| Weight※3 | | Approx. 5.5kg (approx. 5.2kg) | | | | | |

※1: Max. holding torque is maintenance torque in stopping the motor when supply the rated current and is standard method for comparing the performance of motors.
※2: Moment of rotor inertia indicates a part, except Gear Head part.
※3: The weight includes packaging. The weight in parenthesis is for unit only.

◎ **Common specifications**

| | | |
|---|---|---|
| Operation type | | Planetary Geared type |
| Insulation class | | B type (130℃) |
| Insulation resistance | | Over 100MΩ (at 500VDC megger) between motor coil-case |
| Dielectric strength | | 1 kVAC 50/60Hz for 1 min between motor coil-case |
| Temperature rise | | 5-phase excitation for rated current, below 80℃ at stopped (resistance method) |
| Environment | Ambient temp. | -10 to 50℃, storage: -25 to 85℃ |
| | Ambient humi. | 35 to 85%RH, storage: 35 to 85%RH |
| Stop angle error※1 | | ±3' (±0.05°) |
| Shaft vibration※2 | | 0.05mm T.I.R. |
| Radial movement※3 | | Max. 0.025mm (Load 5N) |
| Axial movement※4 | | Max. 0.075mm (Load 10N) |
| Concentricity for shaft of setup in-low | | 0.075mm T.I.R. |
| Perpendicularity of set-up plate shaft | | 0.075mm T.I.R. |
| Protection structure | | IP30 (IEC34-5 standard) |

※1: Specifications are for full-step angle, with no-load (values may vary by load size.)
※2: T.I.R.(Total Indicator Reading) - The difference between the maximum and minimum readings of a dial gauge during one complete revolution of monitored reference.

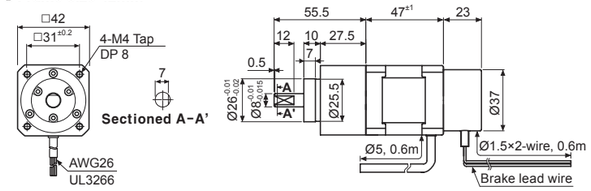



※3: Amount of radial shaft displacement when adding a radial load (5N) to the tip of the motor shaft.
※4: Amount of axial shaft displacement when adding a axial load (10N) to the shaft.
※Rotation direction of the Motor and the Gear Head output axis is same.
※Environment resistance is rated at no freezing or condensation.

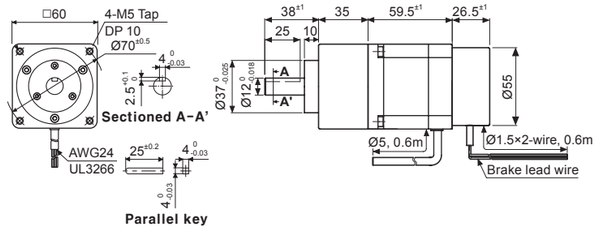
## ■ Dimensions

(unit: mm)

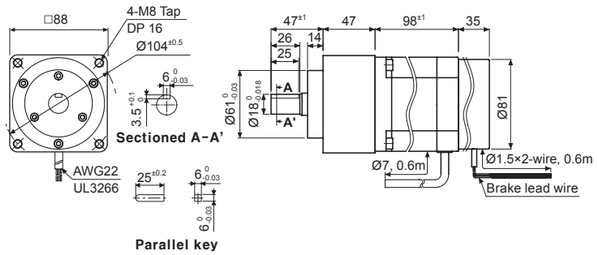
◎ **Frame size 42mm**




◎ **Frame size 60mm**

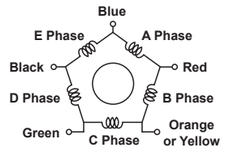



◎ **Frame size 85mm**



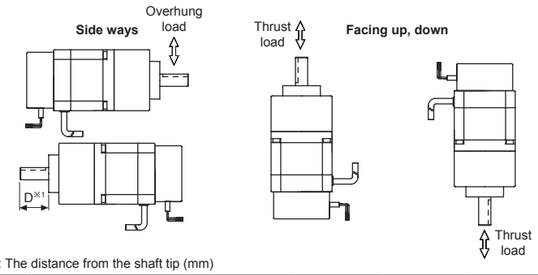

## ■ Connection Diagram

Autonics 5-phase stepper motors use pentagon wiring methods.
Therefore, it is a proper product for the 5-phase stepper motor driver which is working as a bipolar pentagon driving method.
The connections of each phase and each color of the lead-wire are as follows:




## ■ Installation

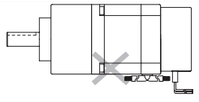
**1. Mounting direction**
Motor can be mounted in any directions-facing up, facing down and side ways.
No matter which direction motors to be mounted, be sure not to apply overhung or thrust load on the shaft.
Refer to the table below for allowable shaft overhung load / thrust load.



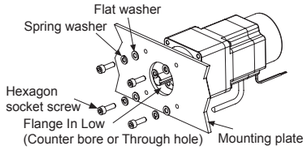

※1: The distance from the shaft tip (mm)

| Motor size | The distance from the shaft in front (mm), Allowable overhung load [kgf (N)] | | | | | Allowable thrust load [kgf (N)] |
|---|---|---|---|---|---|---|
| | D=0 | D=5 | D=10 | D=15 | D=20 | |
| Frame size 42mm | 7.3 (72) | 8.4 (82) | 10 (98) | 12.3 (121) | — | 5 (49) |
| Frame size 60mm | 25 (245) | 27 (265) | 30 (294) | 34 (333) | 39 (382) | 10 (98) |
| Frame size 85mm | 48 (471) | 54 (530) | 60 (588) | 68 (667) | 79 (775) | 30 (294) |

Do not apply excessive force on motor cable when mounting motors.
Do not forcibly pull or insert the cable. It may cause poor connection or disconnection of the cable.
In case of frequent cable movement required application, proper safety countermeasures must be ensured.

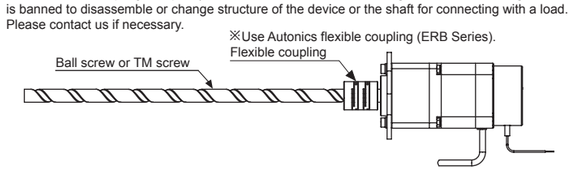


**2. Motor mounting**
With considering heat radiation and vibration isolation, mount the motor as tight as possible against a metal panel having high thermal conductivity such as iron or aluminum.
When mounting motors, use hexagon socket screws, spring washers and flat washers.
Refer to the table below for allowable thickness of mounting plate and using bolt.




| Motor size | The thickness of mounting plate | Using bolt |
|---|---|---|
| Frame size 42mm | Min. 5mm | M4 |
| Frame size 60mm | Min. 8mm | M5 |
| Frame size 85mm | Min. 12mm | M8 |

**3. Connection with load**
When connecting the load, be sure of alignment of the center, tension of the belt, and parallel of the pulley. When connecting the load such as a pulley or a belt, be cautious of the allowable thrust load, radial load, and shock, as well as tighten the screw for a coupling or a pulley not to be unscrewed.
When attach a coupling or a pulley to the shaft, be cautious of damage on shaft or bearings and it is banned to disassemble or change structure of the device or the shaft for connecting with a load.
Please contact us if necessary.




When connecting a load such as Ball screw or Tm screw directly to the shaft of the motor, use flexible coupling as image showing above. If the center of the load and the shaft is not aligned, it may cause severe vibration, damage on shaft or shortened life cycle of bearings.

**4. Installation condition**
Install the motor in a place that meets certain conditions specified below.
It may cause product damage if instructions are not following.
①The inner housing installed indoor
(This unit is manufactured and designed for attaching to equipment. Install a ventilation device.)
②Within -10 to 50℃ (at non-freezing status) of ambient temperature
③Within 35 to 85%RH (at non-dew status) of ambient humidity
④The place without explosive, flammable and corrosive gas
⑤The place without direct ray of light
⑥The place where dust or metal scrap does not enter into the unit
⑦The place without contact with water, oil, or other liquid
⑧The place without contact with strong alkali or acid material
⑨The place where easy heat dissipation could be made
⑩The place where no continuous vibration or severe shock
⑪The place with less salt content
⑫The place with less electronic noise occurs by welding machine, motor, etc.
⑬The place where radioactive substances and magnetic fields does not exist and is not in the vacuum status

## ■ Cautions during Use

1. Follow instructions in 'Cautions during Use'.
   Otherwise, It may cause unexpected accidents.
2. Using motors at low temperature may cause reducing ball bearing's grease and gear part consistency and friction torque is increased.
   Start the motor in a steady manner since motor's torque is not to be influenced.
3. When power is supplied or not to the brake, the unit may occur clack sound.
4. When drive the motor, supply power to electro-magnetic brake for releasing the brake.
   When the brake pad is worn out, the product life cycle is shorten, the rated static friction torque is reduced.
5. Be careful of backlash when positioning the motors in both CW/CCW directions.
   Geared type stepper motor use the high accuracy gear for positioning and it realizes low backlash. However, when positioning the motor in both CW/CCW directions, it may cause problem.
   Therefore, make sure that motor positioning will be made in one single direction in case of geared type motors.
6. 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 driver
   ⑤Inconsistency between the axis of motor output and the center, concentric (eccentric, declination) of the load, etc.
7. 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

## ■ 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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