2Phase Hybrid Stepping Motors
KA Series

A new round motor with superior balance and a compact design.
The best magnetic balance is employed in our round type stepping motor. Motor performance is greatly improved using the latest technology of three dimensional magnetic field analysis and robust design.

**Features**

1. **High torque**
2. **Low vibration**
3. **Silent operation**
4. **High position accuracy**

Both high torque and low vibration performance were achieved.
- The round core provides the best magnetic balance. High torque performance is also achieved by optimizing the design with three dimensional magnetic filed analysis. More than 30% higher holding torque was achieved and pull-out torque was also improved. (Refer to Fig. 1 and 2)

- Low vibration and low rotational fluctuation were realized by reducing the detent torque using three dimensional magnetic field analysis. Rotational fluctuation was reduced about 30%.

- Position accuracy was improved by minimizing the deviation of induced voltage. Position accuracy was improved about 30%. (Refer to Fig.4)
Shaft size and mounting dimension compatibility between the 42sq. & KA50 and the 56sq. & KA60.

Space Saving: High torque performance with shorter motor.

All models are RoHS compliant.

- Three dimensional magnetic field analysis: The magnetic strength is shown three dimensionally and the highest efficiency core shape is determined.
- Robust design: A design method that is not influenced by the variation in parts to eliminate product performance variation.

Max. Allowable Load / Runout for Motor Shaft

Load for Motor Shaft

<table>
<thead>
<tr>
<th>Type</th>
<th>Thrust load</th>
<th>Radial load</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td>Load</td>
</tr>
<tr>
<td>KA50</td>
<td>14.7 N [1.5 kgf] [3.3 lb]</td>
<td>19.6 N [2.0 kgf] [4.4 lb]</td>
</tr>
<tr>
<td>KA60</td>
<td>40 N [4.1 kgf] [9.0 lb]</td>
<td>70 N [7.1 kgf] [15.8 lb]</td>
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Shaft Run Out

<p>| | |</p>
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<tr>
<th></th>
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<tbody>
<tr>
<td>Shaft run out</td>
<td>0.05 T.I.R. [mm]¹</td>
</tr>
<tr>
<td>Concentricity between shaft and mounting circle</td>
<td>0.075 T.I.R. [mm]¹</td>
</tr>
<tr>
<td>Perpendicularity between shaft and mounting face</td>
<td>0.075 T.I.R. [mm]¹</td>
</tr>
</tbody>
</table>

* T.I.R. (Total Indicator Reading)

Specification

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature rise</td>
<td>70 K max (By resistance method)</td>
</tr>
<tr>
<td>Insulation class</td>
<td>Class E equivalent</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>100 MΩ min. At 500 V DC (at normal temp. &amp; humidity, between lead and case)</td>
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<tr>
<td>Dielectric strength</td>
<td>500 V AC 50 Hz for 1 minute (at normal temp. &amp; humidity, between lead and case)</td>
</tr>
<tr>
<td>Ambient temp. range</td>
<td>-10 °C ~ +50 °C</td>
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<tr>
<td>Storage temperature range</td>
<td>-20 °C ~ +70 °C</td>
</tr>
<tr>
<td>Humidity range in operation and storage</td>
<td>5 % ~ 95 % RH (noncondensing)</td>
</tr>
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</table>
## KA50 Series (1.8 degree/step)

### Standard Specifications

#### UNIPOLAR

<table>
<thead>
<tr>
<th>Model</th>
<th>Step angle</th>
<th>Voltage</th>
<th>Current</th>
<th>Resistance</th>
<th>Inductance</th>
<th>Holding torque</th>
<th>Detent torque</th>
<th>Rotor inertia</th>
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#### BIPOLAR

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<th>Voltage</th>
<th>Current</th>
<th>Resistance</th>
<th>Inductance</th>
<th>Holding torque</th>
<th>Detent torque</th>
<th>Rotor inertia</th>
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### Outline

Unit = mm (inch)

### Connection Diagrams

**Rotational direction**

**UNIPOLAR**

CW viewed from rotor shaft when using the following sequence diagram.

**BIPOLAR**

CW viewed from rotor shaft when using the following sequence diagram.

### Accessories: Lead assy

**UNIPOLAR**

- Housing: 51004-1100 (male)
- Contact: 59333-8000 (male)
- Lead: UL3266 AWG22

**BIPOLAR**

- Housing: 51004-1100 (male)
- Contact: 59333-8000 (male)
- Lead: UL3266 AWG22
KA60 Series (1.8 degree/step)

Standard Specifications

### UNIPOLAR

<table>
<thead>
<tr>
<th>Model</th>
<th>Step angle</th>
<th>Voltage</th>
<th>Current</th>
<th>Resistance</th>
<th>Inductance</th>
<th>Holding torque</th>
<th>Detent torque</th>
<th>Rotor inertia</th>
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### BIPOLAR

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<td>227</td>
<td>60</td>
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Outline  
unit = mm (inch)

Connection Diagrams

Rotational direction

**UNIPOLAR**

CW viewed from rotor shaft when using the following sequence diagram.

<table>
<thead>
<tr>
<th>EXCITING SEQUENCE</th>
<th>MODEL</th>
<th>PHASE</th>
<th>PIN No.</th>
<th>COLOR OF LEAD</th>
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<td>PIN No. 1</td>
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<td></td>
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<td>PIN No. 2</td>
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<tr>
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<td></td>
<td>PIN No. 3</td>
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<tr>
<td></td>
<td></td>
<td>PIN No. 4</td>
<td>55381</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PIN No. 5</td>
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<td></td>
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</tbody>
</table>

**BIPOLAR**

CW viewed from rotor shaft when using the following sequence diagram.

<table>
<thead>
<tr>
<th>EXCITING SEQUENCE</th>
<th>MODEL</th>
<th>PHASE</th>
<th>PIN No.</th>
<th>COLOR OF LEAD</th>
</tr>
</thead>
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<td>PIN No. 2</td>
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<td>RED</td>
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<td>B</td>
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<td></td>
<td></td>
<td>PIN No. 6</td>
<td>55381</td>
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</tr>
</tbody>
</table>

Accessories: Lead assy

**UNIPOLAR**

Model: KA60JM2  
Housing: 51004-1100 (male)  
Contact: 59333-8500 (male)  
Lead: UL3266 AWG22

**BIPOLAR**

Model: KA60LM2  
Housing: 51004-1100 (male)  
Contact: 59333-8500 (male)  
Lead: UL3266 AWG22
Speed-Torque Characteristics

**UNIPOLAR**

KA60JM2-501

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]

KA60KM2-501

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]

KA60LM2-501

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]

**BIPOLAR**

KA60JM2-551

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]

KA60KM2-551

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]

KA60LM2-551

| DRIVER: Constant-current driver
| Vdc: 24 [V]
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| INERTIAL: 275 [g cm²]

KA60JM2-552

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]

KA60KM2-552

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]

KA60LM2-552

| DRIVER: Constant-current driver
| Vdc: 24 [V]
| CURRENT: 3.3 [A/Phase]
| EXCITING MODE: 2Phase
| INERTIAL: 275 [g cm²]
KA50 Series (0.9 degree/step)

High-resolution Motors

Standard Specifications

**UNIPOLAR**

<table>
<thead>
<tr>
<th>Model</th>
<th>Step angle</th>
<th>Voltage (V/Ø)</th>
<th>Current (A/Ø)</th>
<th>Resistance (Ω)</th>
<th>Inductance (mH/Ø)</th>
<th>Holding torque (mN·m)</th>
<th>Detent torque (mN·m)</th>
<th>Rotor inertia (g·cm²)</th>
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**BIPOLAR**

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<th>Voltage (V/Ø)</th>
<th>Current (A/Ø)</th>
<th>Resistance (Ω)</th>
<th>Inductance (mH/Ø)</th>
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<th>Rotor inertia (g·cm²)</th>
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<td>458</td>
<td>65</td>
<td>18.2</td>
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</tbody>
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**Outline** unit = mm (inch)

**Connection Diagrams**

Rotational direction

**UNIPOLAR**

CCW viewed from rotor shaft when using the following sequence diagram.

**BIPOLAR**

CCW viewed from rotor shaft when using the following sequence diagram.

**Accessories: Lead assy**

**UNIPOLAR**

Housing: 51004-1100 (molex)
Contact: 59333-8000 (molex)

**BIPOLAR**

Housing: 51004-1100 (molex)
Contact: 59333-8000 (molex)
Speed-Torque Characteristics

UNIPOLAR

KA50HM1-501
- DRIVER: Constant-current driver
- CURRENT: 2.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50JM1-501
- DRIVER: Constant-current driver
- CURRENT: 2.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50KM1-501
- DRIVER: Constant-current driver
- CURRENT: 2.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50HM1-502
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 1.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50JM1-502
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 1.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50KM1-502
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 1.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

BIPOLAR

KA50HM1-551
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 2.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50JM1-551
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 2.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50KM1-551
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 2.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50HM1-552
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 1.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50JM1-552
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 1.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]

KA50KM1-552
- DRIVER: Constant-current driver
- Vcc: 24 [V]
- CURRENT: 1.0 [A/Phase]
- EXCITING MODE: 2Phase
- INERTIAL: 40 [g cm²]
### KA Series Semi-Standard

#### Motor with D-cut Single Shaft

(Model example)

KA50JM2-501 ⇒ KA50JM2-50101

**Model List**

<table>
<thead>
<tr>
<th>UNIPOLAR</th>
<th>K50 1.8 degree/step</th>
<th>K60 1.8 degree/step</th>
<th>K50 0.9 degree/step</th>
</tr>
</thead>
<tbody>
<tr>
<td>K50HM2-501</td>
<td>K60JM2-50101</td>
<td>K50HM1-50101</td>
<td></td>
</tr>
<tr>
<td>K50HM2-50201</td>
<td>K60JM2-50201</td>
<td>K50HM1-50201</td>
<td></td>
</tr>
<tr>
<td>K50JM2-50101</td>
<td>K60KM2-50101</td>
<td>K50JM1-50101</td>
<td></td>
</tr>
<tr>
<td>K50JM2-50201</td>
<td>K60KM2-50201</td>
<td>K50JM1-50201</td>
<td></td>
</tr>
</tbody>
</table>

**BIPOLAR**

| K50HM2-55101 | K60JM2-55101 | K50HM1-55101 |
| K50HM2-55201 | K60JM2-55201 | K50HM1-55201 |
| K50JM2-55101 | K60KM2-55101 | K50JM1-55101 |
| K50JM2-55201 | K60KM2-55201 | K50JM1-55201 |

The basic motor characteristics, connection diagrams, and accessories (lead connectors) conform to the standard specifications.

#### Outline

**unit = mm (inch)**

**Single shaft specification**

... (diagram and data)

---

#### Motor with D-cut Double Shaft

(Model example)

UNIPOLAR KA50JM2-501 ⇒ KA50JM2-511

BIPOLAR KA50JM2-551 ⇒ KA50JM2-561

**Model List**

<table>
<thead>
<tr>
<th>UNIPOLAR</th>
<th>K50 1.8 degree/step</th>
<th>K60 1.8 degree/step</th>
<th>K50 0.9 degree/step</th>
</tr>
</thead>
<tbody>
<tr>
<td>K50HM2-511</td>
<td>K60JM2-511</td>
<td>K50HM1-511</td>
<td></td>
</tr>
<tr>
<td>K50HM2-512</td>
<td>K60JM2-512</td>
<td>K50HM1-512</td>
<td></td>
</tr>
<tr>
<td>K50JM2-511</td>
<td>K60KM2-511</td>
<td>K50JM1-511</td>
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</tr>
<tr>
<td>K50JM2-512</td>
<td>K60KM2-512</td>
<td>K50JM1-512</td>
<td></td>
</tr>
<tr>
<td>K50KM2-511</td>
<td>K60LM2-511</td>
<td>K50KM1-511</td>
<td></td>
</tr>
<tr>
<td>K50KM2-512</td>
<td>K60LM2-512</td>
<td>K50KM1-512</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BIPOLAR</th>
<th>K50 1.8 degree/step</th>
<th>K60 1.8 degree/step</th>
<th>K50 0.9 degree/step</th>
</tr>
</thead>
<tbody>
<tr>
<td>K50HM2-551</td>
<td>K60JM2-551</td>
<td>K50HM1-551</td>
<td></td>
</tr>
<tr>
<td>K50HM2-552</td>
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<td>K60KM2-551</td>
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<tr>
<td>K50JM2-552</td>
<td>K60KM2-552</td>
<td>K50JM1-552</td>
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</tr>
<tr>
<td>K50KM2-551</td>
<td>K60LM2-551</td>
<td>K50KM1-551</td>
<td></td>
</tr>
<tr>
<td>K50KM2-552</td>
<td>K60LM2-552</td>
<td>K50KM1-552</td>
<td></td>
</tr>
</tbody>
</table>

The basic motor characteristics, connection diagrams, and accessories (lead connectors) conform to the standard specifications.
Motor with Encoder

(Model example)
KA50JM2-501 ⇒ 2 Channel KA50JM2E2-501
3 Channel KA50JM2E3-501

Model List

<table>
<thead>
<tr>
<th>KA50 1.8 degree/step</th>
<th>KA60 1.8 degree/step</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UNIPOLAR</strong></td>
<td></td>
</tr>
<tr>
<td>Base motor</td>
<td>2 Channel</td>
</tr>
<tr>
<td>KA50HM2-501</td>
<td>KA50HM2E2-501</td>
</tr>
<tr>
<td>KA50HM2-502</td>
<td>KA50HM2E2-502</td>
</tr>
<tr>
<td>KA50JM2-501</td>
<td>KA50JM2E2-501</td>
</tr>
<tr>
<td>KA50JM2-502</td>
<td>KA50JM2E2-502</td>
</tr>
<tr>
<td>KA50KM2-501</td>
<td>KA50KM2E2-501</td>
</tr>
<tr>
<td>KA50KM2-502</td>
<td>KA50KM2E2-502</td>
</tr>
<tr>
<td><strong>BIPOLAR</strong></td>
<td></td>
</tr>
<tr>
<td>Base motor</td>
<td>2 Channel</td>
</tr>
<tr>
<td>KA50HM2E3-501</td>
<td>KA50HM2E3-502</td>
</tr>
<tr>
<td>KA50JM2E3-501</td>
<td>KA50JM2E3-502</td>
</tr>
<tr>
<td>KA50KM2E3-501</td>
<td>KA50KM2E3-502</td>
</tr>
</tbody>
</table>

Outline  unit = mm (inch)

Encoder specification

<table>
<thead>
<tr>
<th>Resolution [P/R]</th>
<th>KA50, KA60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power-supply voltage</td>
<td>DC 5V ±0.5 V</td>
</tr>
<tr>
<td>Output aspect</td>
<td>2 Channel (A, B aspect) or 3 Channel (A, B, I aspect)</td>
</tr>
<tr>
<td>Output wave form</td>
<td>TTL</td>
</tr>
</tbody>
</table>

Recommended pull-up resistor value

<table>
<thead>
<tr>
<th></th>
<th>2 Channel</th>
<th>3 Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>R [Ω]</td>
<td>11 k</td>
<td>2.7 k</td>
</tr>
</tbody>
</table>

The basic motor characteristics, connection diagrams, and accessories (lead connectors) conform to the standard specifications.
www.japanservo.com
Japan Servo Co., Ltd., Sales Headquarters
7 Kanda-Mitsui-cho
Chiyoda-ku, Tokyo 101-0053 Japan
Tel: +81- (0) 3-3292-3506
Fax: +81- (0) 3-3292-3509

Japan Servo USA Inc.
2050 Center Ave. Suite 318
Fort Lee, NJ 07024
Tel: +1- (0) 201-585-0720
Fax: +1- (0) 201-585-0670

Japan Servo Co., Ltd. Europe Branch
PO Box 1099, 3840 BB Harderwijk
The Netherlands
Tel: +31- (0) 3414-27575
Fax: +31- (0) 3414-2388

PO Box 7084, Hook, Hampshire, RG27 9XL, UK
Tel: +44- (0) 1256-767712
Fax: +44- (0) 1256-767715

Japan Servo Co., Ltd. Singapore Branch
No. 50, kallang Avenue #05-01,
Noel Corporate Buildings, Singapore 339505
Tel: +65- (0) 6743-7655
Fax: +65- (0) 6842-7839

Japan Servo (Hong Kong) Limited
Unit 1008-09, Saxon Tower, 7 Cheung Shun Street,
Lai Chi Kok, Kowloon, HONG KONG
Tel: +852- (0) 2314-0037
Fax: +852- (0) 2314-4768

Japan Servo (Hong Kong) Limited
Taiwan Representative Office
Rm.1001, No.88, Sec.2,
Chung Shan N.Rd.,Taipei 104 Taiwan
Nidec Taiwan Corporation.
FAX +852- (0) 3007-8924

WARNING
●Please do not exceed the specifications noted in this catalogue, otherwise there is a chance of electric shock, injury, or other damage.
●Any modifications made to this motor are beyond the limits of our guarantee. Japan Servo cannot take responsibility for any customer modifications.
●Please ensure that a thorough evaluation has been done before using this motor in medical equipment or other devices related to human lives.
●Please ensure that a thorough evaluation has been done before using this motor in applications that have a serious effect on the public.

NOTE
●Figures in this catalogue are average measured values. Please request the product delivery specification when preparing a purchase specification.
●The dimensions, specifications, and components contained in this catalogue are subject to change without prior notice due to further product improvements.