Oriental motor

HM-60358-5

OPERATING MANUAL

Low-Speed Synchronous Motor

SMK Series

Thank you for purchasing an Oriental Motor product. This Operating Manual describes product handling procedures and safety precautions.
- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

Introduction

■ Before use

Only qualified personnel of electrical and mechanical engineering should work with the product.
Use the product correctly after thoroughly reading the section "Safety precautions." In addition, be sure to observe the contents described in warning, caution, and note in this manual.
The product described in this manual is designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any compensation for damage caused through failure to observe this warning.

Safety precautions

The precautions described below are intended to ensure the safe and correct use of the product, and to prevent the customer and others from exposure to the risk of injury. Use the product only after carefully reading and fully understanding these instructions.

Description of signs

⚠WARNING	Handling the product without observing the instructions that accompany a "WARNING" symbol may result in serious injury or death.
⚠CAUTION	Handling the product without observing the instructions that accompany a "CAUTION" symbol may result in injury or property damage.
Note	The items under this heading contain important handling instructions that the user should observe to ensure the safe use of the product.

Description of graphic symbols

⃠	Indicates "prohibited" actions that must not be performed.	❗	Indicates "compulsory" actions that must be performed.

⚠WARNING

⃠	• Do not use the motor in explosive or corrosive environments, in the presence of flammable gases, in places subjected to splashing water, or near combustibles. Doing so may result in fire or injury. • Do not forcibly bend, pull or pinch the motor lead wire or cable. Doing so may result in fire. • Do not disassemble or modify the motor. Doing so may result in injury. • Be sure to insulate the connection terminals of the capacitor and external resistor. Failure to do so may result in electric shock. • Do not touch the connection terminals of the motor or capacitor immediately (within 30 seconds) after the power is turned off. The residual voltage may cause electric shock. • Keep fingers and objects out of the openings in the product. Failure to do so may result in fire, electric shock, or injury.
❗	• Assign qualified personnel to the task of installing, wiring, operating/controlling, inspecting and troubleshooting the motor. Failure to do so my result in fire or injury. • Turn off the power in the event of a power failure. Otherwise, the motor may suddenly start when the power is restored, causing injury or damage to equipment. • Install the motor inside an enclosure. Failure to do so may result in injury. • Install the motor inside a grounded enclosure. Failure to do so may result in electric shock or injury.

⚠WARNING

❗	• Be sure to ground the motor. Failure to do so may result in electric shock. • Connect the motor securely in accordance with the connection example. Failure to do so may result in fire. • [**SMK014K**] Use a power supply with reinforced insulation between the primary and secondary sides. Failure to do so may result in electric shock. • For a power supply for DC excitation, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.

⚠CAUTION

⃠	• Do not use the motor beyond its specifications. Doing so may result in injury or damage to equipment. • Do not touch the motor and external resistor during operation or immediately after stopping. Doing so may result in a skin burn(s). • Do not carry the motor by holding the motor output shaft, motor lead wires or cable. Doing so may cause injury. • Do not use the motor near flammable objects. Doing so may result in fire or a skin burn(s). • Do not leave anything around the motor that would obstruct ventilation. Doing so may result in damage to equipment. • Do not touch the rotating part (output shaft) during operation. Doing so may cause injury.
❗	• Provide a cover over the rotating parts (output shaft) of the motor. Failure to do so may result in injury. • Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury. • Immediately when a problem occurred, stop operation and turn off the power supply. Failure to do so may result in fire or injury. • The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the motor in operation, affix a warning label shown in the figure on a conspicuous position. Failure to do so may result in skin burn(s).  Warning label

Precautions for use

• Do not give any constraint to the motor output shaft.

If the motor output shaft is constrained with a load torque exceeding the motor torque, the motor cannot be started and a vibrating condition will occur, resulting in a significant decrease in motor life. Be sure to use a load torque that is less than the motor torque.

• Grease leakage

On rare occasions, a small amount of grease may ooze out from the geared motor. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer's equipment or products.

• Allowable torque

Operate the motor by making sure the sum of the acceleration/deceleration torque at the starting/stopping of the motor and the load (friction) torque doesn't exceed the allowable torque. Operating the motor in excess of the allowable torque may result in a damaged gear part.

Preparation

■ Checking the product

Verify that the items listed below are included. Report any missing or damaged items to the Oriental Motor sales office from which you purchased the product.

- Motor ..... 1 unit
- Mounting screw ..... 4 pcs. (Included with geared motor)
- Capacitor..... 1 pc.
- Capacitor cap ..... 1 pc. *
- External resistor..... 1 pc. (Included with the **SMK5** type)
- OPERATING MANUAL ..... 1 copy (this document)

* Included with 0.6 µF, 1.2 µF, and 2.5 µF capacitors.

Information about included capacitor and external resistor

Motor model	Capacitor		External resistor	
	Model	Capacitance (µF)	Ω	W
SMK014K-A **SMK014K-B**	CH120 or CH120CFAUL2	12	–	–
SMK014A-A **SMK014A-B** **SMK014MA-A** **SMK014MA-B** **SMK0A-□A** * **SMK0A-□B** *	CH06BFAUL	0.6	–	–
SMK237A-A **SMK237A-B** **SMK216A-GN** **SMK216A-GNB**	CH12UL or CH12FAUL	1.2	–	–
SMK5100A-A **SMK5100A-B** **SMK5160A-A** **SMK5160A-B**	CH25UL or CH25FAUL2	2.5	400	30
SMK5100C-A **SMK5100C-B**	CH06BUL or CH06BFAUL	0.6	1,500	30
SMK550A-GN **SMK550A-GNB**		0.6	400	30
SMK550C-GN **SMK550C-GNB**	CH035B or CH035BFAUL	0.35	2,000	30

* The box (□) in the model name indicates a number representing the gear ratio.

Installation

■ Installation location

The motor is designed and manufactured to be incorporated in equipment. Install it in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature –10 to +40 °C (+14 to +104 °F) (non-freezing)
- Operating ambient humidity 85 % or less (non-condensing)
- Area free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive amount of dust, iron particles or the like
- Area not subject to splashing water (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibrations or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1,000 m (3,300 ft.) or lower above sea level

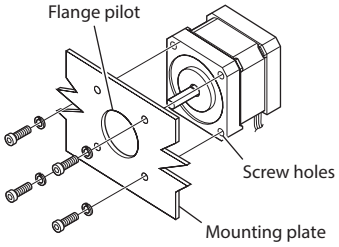
■ Installation method

Install the motor onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity. When installing the motor, secure it with screws so that there is no gap between the motor and metal plate. The values of the tightening torque are ecommended. Tighten the screws to a torque appropriate for the design condition of the metal surface being installed.

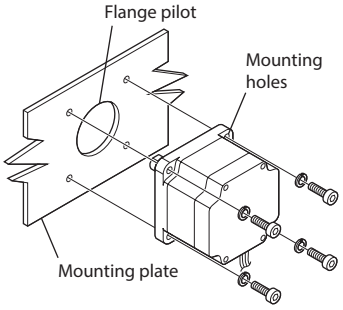
● Round shaft type

Using the four mounting holes (or screw holes) on the motor mounting surface, secure the motor with four screws (not included).
Fit the pilot on the motor mounting surface into a flange pilot.

• SMK0 type



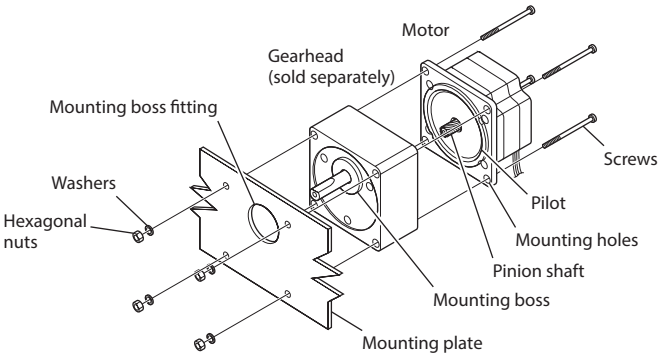
• SMK2, SMK5 types



Motor type	Nominal size	Tightening torque [N•m (oz-in)]
SMK0 type	M3	1 (142)
SMK2 type	M4	2 (280)
SMK5 type	M5	3 (420)

● Pinion shaft type

Assemble a gearhead (sold separately) with a motor. Match the pilot of the gearhead and motor, and assemble them while slowly turning the gearhead clockwise/counterclockwise.
And secure with the screw set included with the gearhead using four mounting holes on the motor frame.
Fit the mounting boss on the gearhead mounting surface into the mounting boss fitting.



Note Do not assemble the motor and gearhead forcibly, nor bring the pinion shaft into forcible contact with the gearhead's side plate or gear. This precaution must be observed in order to avoid abnormal noise or reduced service life in the gearhead.

Combinations of motors and gearheads (sold separately)

Use the pinion shaft type in combination with the following gearhead:

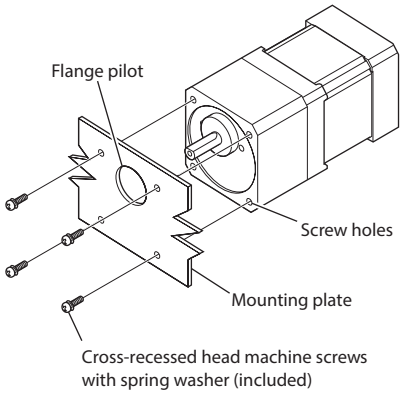
Motor model	Applicable gearhead model (sold separately) *
SMK216A-GN, **SMK216A-GNB**	**2GN□K**, **2GN□S**
SMK550A-GN, **SMK550A-GNB**	**5GN□K**, **5GN□S**
SMK550C-GN, **SMK550C-GNB**	

* The box (□) in the gearhead model indicates a number representing the gear ratio.

● Geared motor (SMK0A type)

Use four screw holes on the motor mounting surface to secure with the included mounting screws.

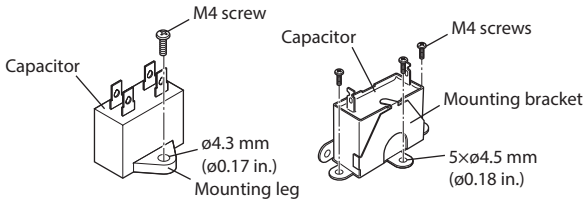
- Nominal size: M3
- Tightening torque: 1 N·m (142 oz-in)



■ Installing the capacitor

Use a M4 screw (not included) to install the capacitor securely.
Tightening torque: 1 N·m (142 oz-in) or less

- Type with mounting leg
- Type with mounting bracket



■ Installing a load

When installing a load to the motor, align the centers of the motor output shaft and load shaft.
When installing a flexible coupling or pulley on the motor output shaft, do so without damaging the output shaft and bearings.

■ Permissible radial load and permissible axial load

The radial load and axial load on the motor output shaft must be kept under the permissible values in the table.

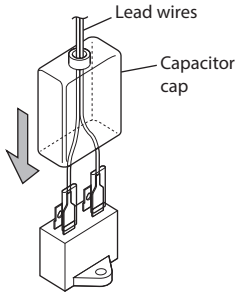
Motor type	Permissible radial load [N (lb.)]					Permissible axial load [N (lb.)]
	Distance from the tip of output shaft [mm (in.)]					
	0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)	
SMK014A **SMK014K** **SMK014M**	20 (4.5)	25 (5.6)	34 (7.6)	52 (11.7)	–	10 (2.2)
SMK0A *	10 (2.2)	15 (3.3)	20 (4.5)	30 (6.7)	–	15 (3.3)
SMK237	54 (12.1)	67 (15)	89 (20)	130 (29)	–	20 (4.5)
SMK5100 **SMK5160**	260 (58)	290 (65)	340 (76)	390 (87)	480 (108)	60 (13.5)

* This table indicates the permissible radial load and permissible axial load of the gearhead.

Connection and operation

■ Installing the capacitor cap

If a capacitor cap is included with a capacitor, pass the lead wires through the capacitor cap before connecting them to the capacitor terminals. Then, cover with the capacitor cap.

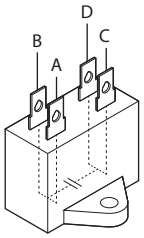


■ Connection

Be sure to connect the included capacitor as shown in the figures.
An external resistor is also included in the **SMK5** type. Be sure to connect it.

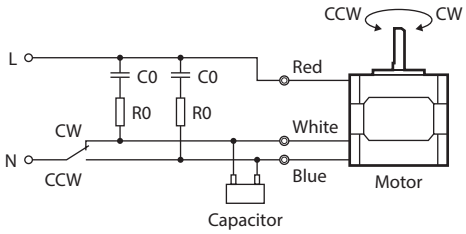
Note Be sure to connect a CR circuit for surge suppression in order to protect switches and contacts. It is also available in our products. Check on the Oriental Motor Website for the model name.

memo In a four-terminal capacitor, the terminal pairs A-B and C-D are internally connected.
Therefore, the capacitor is electrically equivalent to a two-terminal capacitor.

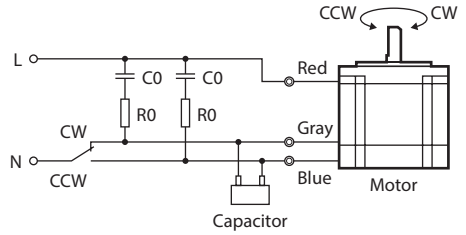


● The connection example

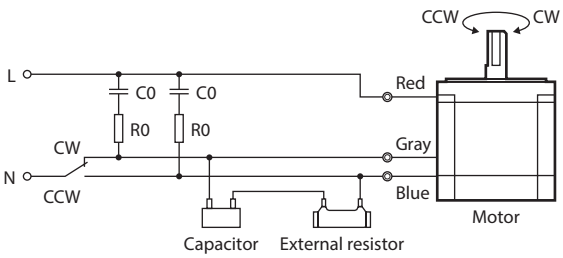
SMK0 type



SMK2 type



SMK5 type



● About insulation

Be sure to insulate the following connection part. Use insulation components such as a capacitor cap or heat-shrinkable tube.

- Connection part of the motor lead wire and power supply
- Connection part of the motor lead wire and capacitor
- Connection part of the motor lead wire and External resistor (**SMK5** type only)

■ Operation

- Setting the switch to the CW side rotates the motor output shaft in the clockwise direction. Setting the switch to the CCW side rotates the motor output shaft in the counterclockwise direction. The rotation direction of the motor output shaft indicates as viewed from the output shaft side.
- If the power supply is turned off, the motor stops.

Note

- The output shaft of the pinion motors with ratios of **25**, **30** and **36** rotate in the opposite direction of the motor output shaft.
- The output shaft of the geared motors with ratios of **15**, **18**, **100** and **120** rotate in the opposite direction of the motor output shaft.

● About DC excitation

If a DC voltage is applied to the motor, a holding force larger than the holding torque can be obtained. For details, check on the Oriental Motor Website.

Maintenance/inspection

■ Inspection

It is recommended that periodic inspections would be conducted for the items listed below after each operation of the motor. If an abnormal condition is noted, discontinue any use and contact your nearest Oriental Motor sales office.

Inspection item

- Check if any of the screws having installed the motor is loose.
- Check if an unusual noise is generated from a bearing part (ball bearings) of the motor.
- Check if a damage or stress is applied on the motor lead wire or cable.
- Check if the motor output shaft and the load shaft are out of alignment.
- Check if the capacitance of the capacitor has decreased.
  Even if the capacitance does not decrease, It is recommended to replace the capacitor after 10 years of use.

■ Warranty

Check on the Oriental Motor Website for the product warranty.

■ Disposal

Dispose the product correctly in accordance with laws and regulations, or instructions of local governments.

Specifications and general specifications

Check on the Oriental Motor Website for the product specifications and general specifications.

Regulations and standards

■ UL Standards (Except for the SMK0 type)

Certification Body	File No.
UL	E64199

■ CE Marking (Except for the SMK0 type)

Motors of AC power input type are affixed the CE Marking under the Low Voltage Directive.

● Low Voltage Directive

Installation conditions (EN Standard)

- To be incorporated in equipment.
- Overvoltage category: II
- Pollution degree: 2
- Protection against electric shock: Class I

● RoHS Directive

This product does not contain the substances exceeding the restriction values.

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• Please contact your nearest Oriental Motor office for further information.

ORIENTAL MOTOR U.S.A. CORP.
Technical Support Tel:800-468-3982
8:30am EST to 5:00pm PST (M-F)

ORIENTAL MOTOR (EUROPA) GmbH
Schiessstraße 44, 40549 Düsseldorf, Germany
Technical Support Tel:00 800/22 55 66 22

ORIENTAL MOTOR (UK) LTD.
Blythe Valley Business Park,
Central Blvd Blythe Valley Park,
Solihull B90 8AG, United Kingdom
Tel:+44-1926-671220

ORIENTAL MOTOR (FRANCE) SARL
Tel:+33-1 47 86 97 50

ORIENTAL MOTOR ITALIA s.r.l.
Tel:+39-02-93906347

ORIENTAL MOTOR CO., LTD.
4-8-1Higashiueno,Taito-ku,Tokyo 110-8536
Japan
Tel:+81-3-6744-0361
www.orientalmotor.co.jp/ja

ORIENTAL MOTOR ASIA PACIFIC PTE. LTD.
Singapore
Tel:1800-842-0280

ORIENTAL MOTOR (MALAYSIA) SDN. BHD.
Tel:1800-806-161

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ORIENTAL MOTOR (INDIA) PVT. LTD.
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Korea
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