Oriental motor

HL-8025

Rack and Pinion Systems
LS Linear Head
OPERATING MANUAL

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.

Table of contents

1 Introduction

1.1 Before use

Only qualified personnel should work with the product. Use the product correctly after thoroughly reading the section “Safety precautions.”
Should you require the inspection or repair of internal parts, please contact the Oriental Motor branch or sales office from which you purchased the product.
The product described in this manual has been designed and manufactured for use in general industrial machinery, and must not be used for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Hazardous substances

RoHS (Directive 2002/95/EC 27Jan.2003) compliant

1.2 Safety precautions

The precautions described below are intended to prevent danger or injury to the user and other personnel through safe, correct use of the product. Use the product only after carefully reading and fully understanding these instructions.

⚠ 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 safe use of the product.

⚠ Caution

- Do not use the linear head beyond its specifications. Doing so may result in injury or equipment damage.
- Confirm that the product matches the order. Installing a wrong product may result in injury.
- Do not transport the product by holding the rack or case only. If the case or rack drops, injury may result.
- When moving the rack up and down, always affix the rack. If the case or rack drops, injury may result.
- Operate the product after securely affixing the linear head. Failure to do so may result in injury or equipment damage.
- Be sure to install a cover, etc., on the moving part. Failure to do so may result in injury.
- Check the moving direction before assembling the product into a machine. Failure to do so may result in injury or equipment damage.
- Do not touch the linear head while the linear head is operating. Injury may result.
- Before operating, confirm that the emergency-stop function is working properly. Failure to do so may result in injury.
- Do not disassemble or modify the linear head. This may cause injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.
- To dispose of the linear head, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.
- On rare occasions, a small amount of grease may ooze out from the rack. 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.

1.3 Precautions for use

This section covers limitations and requirements the user should consider when using the **LS** linear head.

- Operate the motor at or below the maximum transportable mass.

  If the motor is operated while receiving a load greater than the maximum transportable mass, the rack tooth surface or pinion, may be damaged. Always operate the motor under a load equivalent to or below the maximum transportable mass.

- Do not apply an overhung load in excess of the specified permissible limit.

  If the motor is operated continuously under an overhang load exceeding the permissible limit, the rack bushings may be worn quickly or even damaged. Always keep the overhang load to the permissible limit or below.
  Even if the overhang load is kept to the permissible limit or below, repeated operation of the lineard motor will still cause the rack bushings to wear. To suppress rack bushing wear, install a guide, etc., to reduce the overhang load or rotational torque.

- Do not stop the rack by means of contact.

  Never allow the moving rack to contact a hard object. The shock may damage the rack tooth surface, pinion and/or gear.

- Reversing the rack

  Be sure to reverse the lineard motor before either end of the rack enters the rack bushing. The rack operates properly when being supported by the rack bushings on both sides of the rack case.

- Lubricating the rack

  Do not wipe grease off the rack surface or the tooth surface meshing with the pinion. Grease is pre-charged in the rack case before shipment. If grease is wiped off, the rack and pinion life will become shorter. Always keep the rack surface and tooth surface properly greased during operation.
  If the rack is used in a lift device or at a high ambient temperature, grease may drip. If dripping grease becomes a concern, place an oil pan underneath the rack.

- Measures to prevent the rack from dropping

  The electromagnetic brake built into the electromagnetic brake motor is of the non-excitation operation type. While power is not supplied to the electromagnetic brake, the rack is held in position. When power is supplied, the brake will be released and the rack will become movable.
  When the linear head is installed in the direction allowing the rack to move up and down, the load and/or rack may drop if the electromagnetic brake is released in a standstill state.
  Lay a buffer material, etc., underneath to prevent damage that may otherwise result from dropping of the load and/or rack.

2 Preparation

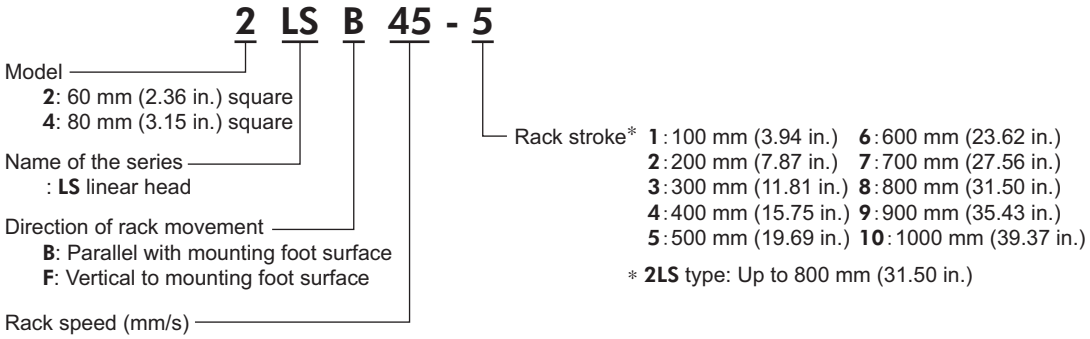
This section covers items you should check before using this **LS** linear head.

2.1 Checking the product

Open the package and confirm that all of the following items are available.
Should you find any item missing or damaged, contact the Oriental Motor office where you purchased the product.

- Linear head 1 unit
- OPERATING MANUAL (this manual) 1 copy

2.2 How to read the model number



2.3 Combinations of motors and linear head

Standard AC motors that can be combined with the linear head are listed below.
In addition to the products specified below, you can also combine **GN** pinion motors.

Recommended motor	Application		**2LS** type	**4LS** type
World **K** series **MSS·W** series	Constant speed	Motor leads type	**2RK6GN-AW2J**	**4RK25GN-AW2J**
			2RK6GN-AW2U	**4RK25GN-AW2U**
			2RK6GN-CW2J	**4RK25GN-CW2J**
			2RK6GN-CW2E	**4RK25GN-CW2E**
		Terminal box type	**2RK6GN-AW2TJ**	**4RK25GN-AW2TJ**
			2RK6GN-AW2TU	**4RK25GN-AW2TU**
			2RK6GN-CW2TJ	**4RK25GN-CW2TJ**
			2RK6GN-CW2TE	**4RK25GN-CW2TE**
	Position holding		**2RK6GN-AW2MJ**	**4RK25GN-AW2MJ**
			2RK6GN-CW2MJ	**4RK25GN-CW2MJ**
			2IK6GN-SW2M	**4IK25GN-SW2M**
	Speed change		**MSS206-411W2J-□**	**MSS425-411W2J-□**
			MSS206-412W2J-□	**MSS425-412W2J-□**
	Push-motion		**2TK3GN-AW2J**	**4TK10GN-AW2J**
			2TK3GN-AW2U	**4TK10GN-AW2U**
			2TK3GN-CW2J	**4TK10GN-CW2J**
			2TK3GN-CW2E	**4TK10GN-CW2E**

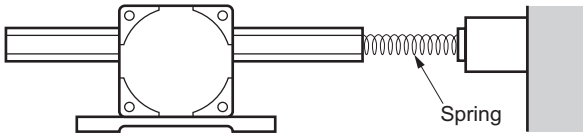
* This table lists representative motors that can be combined. In addition to the above, **GN** pinion motors of □60 mm (2.36 in.) and □80 mm (3.15 in.) can also be combined with the **2LS** type and **4LS** type, respectively.
□ in the model name represents a number indicating to the length of cable.

Recommended motor	Application		**2LS** type	**4LS** type
K series **MSD** series	Constant speed	Motor leads type	**2RK6GN-A**	**4RK25GN-A**
			2RK6GN-C	**4RK25GN-C**
	Position holding		**2RK6GN-AM**	**4RK25GN-AM**
			2RK6GN-CM	**4RK25GN-CM**
			—	**4IK25GN-SM**
			BMR206-411	**BMR425-411**
			BMR206-412	**BMR425-412**
	Speed change		**MSD206-411D/U**	**MSD425-411D/U**
			MSD206-412D/U	**MSD425-412D/U**
	Push-motion		**2TK3CGN-A**	**4TK10CGN-A**

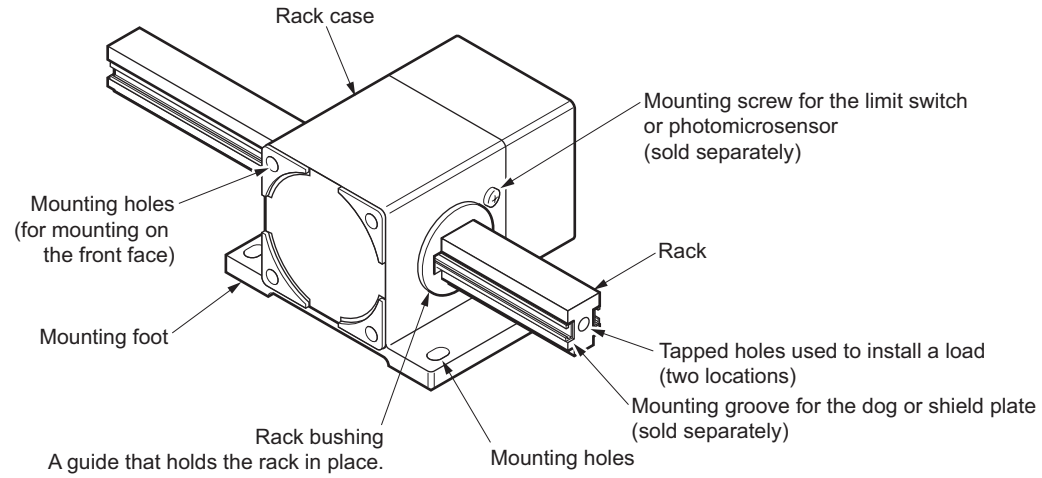
∗ This table lists representative motors that can be combined. In addition to the above, **GN** pinion motors of □60 mm (2.36 in.) and □80 mm (3.15 in.) can also be combined with the **2LS** type and **4LS** type, respectively.

Note

- When performing constrained operation using a torque motor, do not cause the motor to stop upon contacting a hard stop. Doing so will not only generate excessive torque, but also transmit inertial impact force to the linear head, which will significantly reduce the service life of the linear head.
- When performing push-motion operation using a torque motor, use a spring or other buffer material on the pushed section. If push-motion operation is performed without using any buffer material, the internal gear may be damaged due to rotor inertia.



2.4 Names and functions of parts



3 Installation

This section covers the linear head's installation location and method, as well as the method of installing a load.

3.1 Location for installation

The linear head is designed and manufactured for use as a built-in component in industrial equipment. Install it in a well-ventilated place satisfying the following conditions, where the product can be easily accessed for the purpose of inspection.

- Inside an enclosure installed indoors (with ventilation hole provided)
- Ambient temperature: –10 to +50 °C (+14 to +122 °F) (non-freezing)
- Ambient humidity: 85% or less (non-condensing)
- Area that is 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 (rains, water droplets), oil (oil droplets) or other liquids
- Area not subject to continuous vibration or excessive shocks

3.2 Installing the linear head

Install the linear head using the mounting feet, or mounting holes provided on the front face.
Securely affix the linear head to a grounded metal plate.

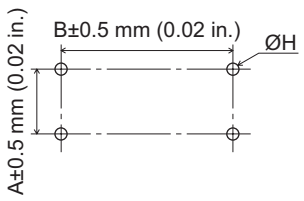
Note

- When installing the linear head in the direction allowing the rack to move up and down, take appropriate measures to prevent dropping and collision of the rack. If the rack drops, the tooth surface, pinion and gear of the rack may be damaged.
- If you are using a photomicrosensor, install it after installing the lineard motor.

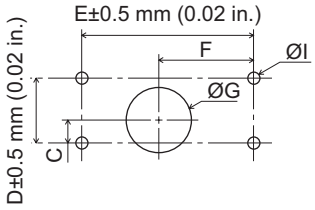
■ Installation using a mounting foot

1. Drill mounting holes or tapped holes in the metal plate used to install the linear head.
With the F type, also drill a hole (G) for guiding the rack.

• Machining dimensions for mounting holes for B type



• Machining dimensions for mounting holes for F type

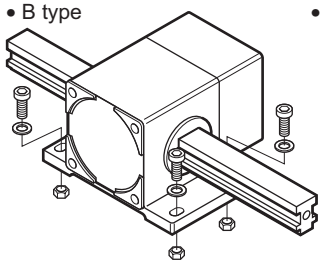


Linear head model	B type [mm (in.)]			F type [mm (in.)]					
	A	B	ØH	C	D	E	F	ØG	ØI
2LS type	35 (1.38)	92 (3.62)	6.5 (0.26)	12.5 (0.49)	35 (1.38)	92 (3.62)	51 (2.01)	35 (1.38)	6.5 (0.26)
4LS type	30 (1.18)	100 (3.94)	8.5 (0.33)	15 (0.59)	30 (1.18)	100 (3.94)	58 (2.28)	45 (1.77)	8.5 (0.33)

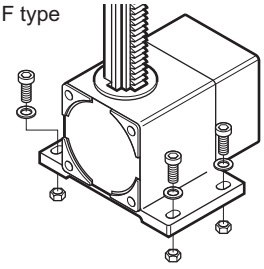
2. Affix the linear head using four screws (not supplied) in a manner leaving no gaps between the linear head and metal plate.

Linear head model	Mounting foot thickness [mm (in.)]
2LS type	9 (0.35)
4LS type	12 (0.47)

• B type

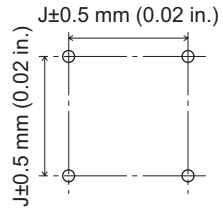


• F type



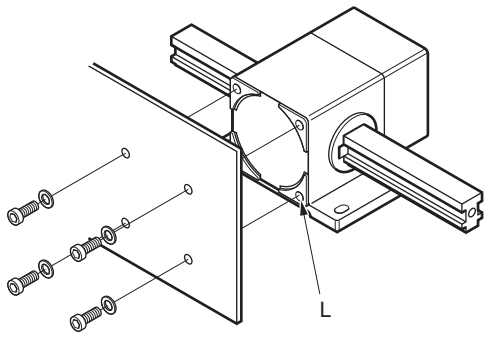
■ Installation using mounting holes on the front face

1. Drill mounting holes or tapped holes in the metal plate used to install the linear head.
The same machining dimensions for mounting holes apply to both the B type and F type.



Linear head model	J [mm (in.)]
2LS type	47 (1.85)
4LS type	62 (2.44)

2. Affix the linear head using four screws (not supplied) in a manner leaving no gaps between the linear head and metal plate.

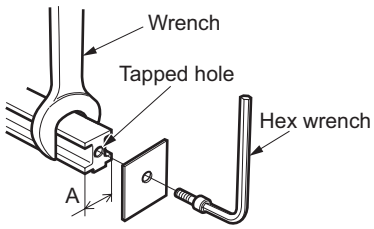


Linear head model	L
2LS type	M6 Effective depth 10 mm (0.39 in.)
4LS type	M8 Effective depth 10 mm (0.39 in.)

3.3 Installing a load

Install the load using hexagonal socket head bolts (not supplied) through the tapped holes provided on the end face of the rack.
When installing the load, always secure the rack with a wrench so that the rack will not receive rotational force while the load is affixed.

Note When installing the load, align the axial centerline of the rack with that of the load.



Linear head model	Thread size	Effective depth [mm (in.)]	Dimension A [mm (in.)]
2LS type	M5	10 (0.39)	16 (0.63)
4LS type	M8	15 (0.59)	20 (0.79)

■ Maximum overhung load

Keep the overhung load received by the rack end to or below the permissible value, as applicable, specified in the table below.

Stroke [mm (in.)]	Linear head model		Stroke [mm (in.)]	Linear head model	
	2LS type [N (lb.)]	**4LS** type [N (lb.)]		**2LS** type [N (lb.)]	**4LS** type [N (lb.)]
100 (3.94)	55 (12.3)	120 (27)	600 (23.62)	15 (3.3)	40 (9)
200 (7.87)	40 (9)	90 (20)	700 (27.56)	12 (2.7)	40 (9)
300 (11.81)	30 (6.7)	70 (15.7)	800 (31.50)	8 (1.8)	25 (5.6)
400 (15.75)	25 (5.6)	60 (13.5)	900 (35.43)	—	20 (4.5)
500 (19.69)	20 (4.5)	50 (11.2)	1000 (39.37)	—	15 (3.3)

Note Even if the overhung load does not exceed the permissible value, it is recommended to still install a guide, etc., to reduce or disperse the overhung load.

■ Maximum rotational torque (moment)

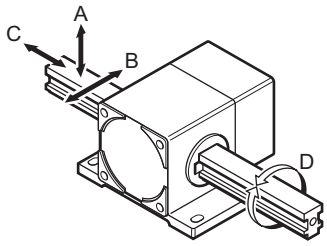
Keep the rotational torque received by the rack to or below the permissible value, as applicable, specified in the table below.

Linear head model	Permissible rotational torque (moment) on rack
2LS type	0.3 N·m (2.6 lb-in) or less
4LS type	0.5 N·m (4.4 lb-in) or less

Note If the rack receives excessive rotational torque, the rack bushing will wear quickly.

■ Gap along the rack

There is a slight gap between the rack and rack bushing of the linear head. The initial gap dimensions are specified in the table below.



Moving direction	Gap (initial dimension)
A, B direction	2 mm (0.08 in.) or less
C direction	0.5 mm (0.02 in.) or less
D direction	0.5° or less

The above gap dimensions in directions A and B are measured at 500 mm (19.69 in.) from the end face of the case on the linear head.
As the motor is operated repeatedly, the rack bushing will wear and the gap along the rack will increase.
To suppress rack bushing wear, install a guide, etc., to reduce the overhung load or rotational torque.

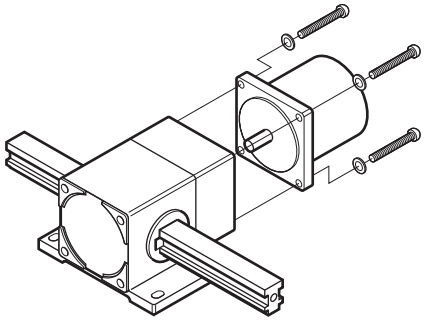
3.4 Assembling the motor

The assembly method varies between the **2LS** type and **4LS** type.

Note
- When assembling the motor, do not damage the motor shaft and gear. Noise will occur.
- In the case of a motor of the terminal box type, assemble the motor in a manner preventing the terminal box from contacting the limit switch.

■ 2LS Type

1. Affix the gear case and rack case using an adhesive tape, etc., so that the two will not separate from each other.
2. Remove the screws and washers assembling the gear case and rack case.
3. Assemble the motor, and affix the motor, gear case and rack case using the screws and washers removed in the preceding step.
   Tightening torque: 1.8 N·m (250 oz-in)



■ 4LS Type

Affix the motor to the gear case using the supplied screws.
Tightening torque: 3.8 N·m (530 oz-in)

3.5 Actions to be taken upon detachment of the rack

If the rack detaches during installation or operation, take the following actions:

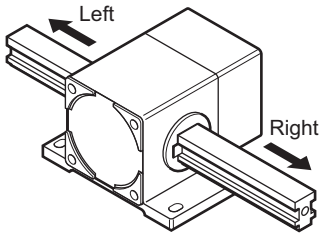
1. Turn off the power and remove the load.
2. With the **2LS** type, affix the gear and rack case using an adhesive tape, etc., so that the two will not separate from each other.
3. Remove the screws affixing the motor, and take out the motor.
4. Insert the detached rack through the rack bushing.
   Push in the rack until it comes out from the rack bushing on the opposite side.
5. Assemble the motor by paying careful attention not to cause the rack to detach.

4 Operation

■ Rotating direction of the motor output shaft and moving direction of the rack

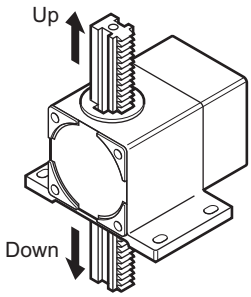
The rotating direction of the motor output shaft and moving direction of the rack, as viewed from the motor output shaft, are shown below.

B type



Linear head model	Rotating direction of the motor shaft	
	Clockwise (CW)	Counterclockwise (CCW)
2LSB10	Left	Right
2LSB20	Right	Left
2LSB45	Left	Right
4LSB10	Right	Left
4LSB20	Right	Left
4LSB45	Left	Right

F type



Linear head model	Rotating direction of the motor shaft	
	Clockwise (CW)	Counterclockwise (CCW)
2LSF10	Down	Up
2LSF20	Up	Down
2LSF45	Down	Up
4LSF10	Up	Down
4LSF20	Up	Down
4LSF45	Down	Up

The rack surface and the gear face that meshes with the pinion are lubricated using grease. Do not wipe off grease on the rack surface or between teeth. Doing so will reduce the service life of the linear head.

5 Troubleshooting and remedial actions

If the linear head does not operate normally, take appropriate actions by referring to the information provided in this chapter. If the problem persists after you have taken the necessary actions, contact our Technical Support Line.

Condition	Possible cause	Action if problem is found
The rack does not move.	The rack is detached.	Check if the rack is detached. If the rack is detached, insert the rack again by referring to page 9.
	The rack is biting into the rack bushing due to load received in the rotating direction of the rack.	Turn the rack in the direction opposite to the received load, until it no longer bites into the bushing.
	Rack movement is locked by a guide, etc.	Remove the cause of the locked rack and ensure that the rack is only pushed.
	Foreign matter is biting into the rack.	Remove the foreign matter.
The rack moves in the direction opposite to the specified direction.	The rack is not viewed in the correct direction.	Check the moving direction by referring to page 10.

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