Oriental motor

HL-14063-10

OPERATING MANUAL

Compact Motorized Cylinder

DRLII Series Actuator Edition

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

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 damage caused through failure to observe this warning.

■ Overview of the product

The compact motorized cylinder **DRLII** Series (hereinafter described as cylinder) is an actuator of a linear motion mechanism that a 5-phase stepping motor is integrated with a ball screw.

■ Related operating manuals

For operating manuals, download from Oriental Motor Website Download Page or contact your nearest Oriental Motor sales office.

- **When a driver is the pulse input type, RS-485 communication type**

- **DRLII** Series OPERATING MANUAL Actuator Edition (this document)

Refer to the operating manual of the driver for contents not described in these manuals.

- **When a driver is the built-in controller type**

- **DRLII** Series OPERATING MANUAL Actuator Edition (this document)
- **DRLII** Series FLEX built-in controller type OPERATING MANUAL Driver Edition
- **CRK** Series FLEX built-in controller type USER MANUAL

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.

You must not operate the cylinder (operate the equipment for the specified purpose) if the machine in which the cylinder is installed does not satisfy the related safety standards. The factory safety manager or safety personnel in charge of the applicable machine must ensure that the machine is operated only by qualified personnel who are familiar with the operation of electronic equipment, and thereby prevent injury or damage to the equipment.
The term "qualified personnel" refers to persons who have received the necessary training or education and have pertinent experience; who are familiar with the relevant standards, regulations, accident-prevention rules and inspection conditions; who are authorized by the factory safety manager to engage in the necessary activities; and who have the ability to discern and prevent potential dangers.

⚠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.
memo	The items under this heading contain related information and contents to gain a further understanding of the text in this manual.

⚠WARNING

General

- Do not use the cylinder in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire or injury.
- Assign qualified personnel to the task of installing, wiring, operating/controlling, inspecting, and troubleshooting the cylinder. Failure to do so may result in fire, injury, or damage to equipment.
- When the cylinder is used in vertical drive such as elevating equipment etc., provide a safety brake mechanism in addition to using an electromagnetic brake type cylinder to hold the load position. The cylinder loses its holding torque when the power supply is turned off, allowing the moving part may drop, leading to injury or damage to equipment.
- Do not use the brake mechanism of the electromagnetic brake type for braking or as a safety brake. The electromagnetic brake is used for the purpose to hold the moving part and cylinder in position. Using it for braking or as a safety brake may result in injury or damage to equipment.

Installation

- Install the cylinder inside an enclosure. Failure to do so may result in injury.

Connection

- Do not forcibly bend, pull, or pinch the lead wire or cable. Doing so may result in fire.

Repair, disassembly, and modification

- Do not disassemble or modify the cylinder. Doing so may result in injury. Refer all such internal inspections and repairs to the Oriental Motor sales office from which you purchased the cylinder.

⚠CAUTION

General

- Do not use the cylinder beyond its specifications. Doing so may result in injury or damage to equipment.
- Do not touch the cylinder during operation or immediately after stopping. The surface is hot, and this may cause a skin burn(s).

Transportation

- Do not carry the cylinder by holding the ball screw, lead wire, or cable of the cylinder. Doing so may result in injury.

Installation

- Do not place combustibles around the cylinder. Doing so may result in fire or a skin burn(s).
- Do not leave anything around the cylinder that would obstruct ventilation. Doing so may result in damage to equipment.
- Provide a cover over the moving parts of the cylinder. Failure to do so may result in injury.

Operation

- Do not touch the ball screw during operating. Doing so may result in injury.
- The motor surface temperature may exceed 70 °C (158 °F) even under normal operating conditions. If the operator is allowed to approach the cylinder in operation, affix a warning label shown in the figure on a conspicuous position. Failure to do so may result in a skin burn(s).

Warning label

Precautions for use

This section covers restrictions and requirements the user should consider when using the product.

• Thrust

Always operate the cylinder under a load not exceeding the thrust. Operating the cylinder under a load beyond the thrust or allowing the ball screw to remain locked may cause damage to the bearings (ball bearings) of the motor. When using the cylinder in elevating applications, operate it under a load not applying an external force and not exceeding the maximum transportable mass in vertical direction.

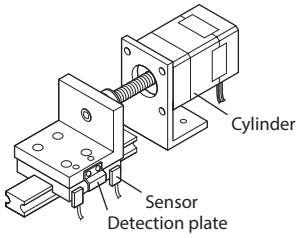
• Permissible moment

Always operate the cylinder under a moment within the permissible value. Continuing to operate the cylinder under a moment exceeding the permissible value may cause malfunction or shorter service life of the cylinder.

• Do not hit the ball screw against an object to stop.

Hitting the operating ball screw against an object to stop may cause damage to the cylinder due to an impact. When operating the cylinders, always provide a stroke-end detection sensor or limit sensor in order to prevent the ball screw from hitting the stroke end or load. If it is hit to stop, remove a load and return the ball screw at the recommended starting speed.

- Installation example of limit sensor
  The figure shows the non-guide type cylinder.



Model	Lead (mm)	Recommended starting speed (mm/s)
DRLM20, **DRLM28**	1	0.2
DRLM42	2	0.4
	8	1.6
DRLM60	4	0.8

• Do not move the position of the stopper.

The stopper is used to prevent the ball screw from retracting completely into the motor. Moving the position of the stopper may cause damage to the ball screw, resulting in cylinder malfunction or damage.

• Do not remove the joint from the ball screw.

Removing the joint causes the installation accuracy of the ball screw to decrease, resulting in malfunction.

• Take measures to keep the moving part in position if the cylinder is used in vertical drive such as elevating equipment.

The cylinder loses its holding force upon the occurrence of a power failure or when the A.W.OFF (all windings off) input is turned ON. Take measures to keep the moving part in position if the cylinder is used in vertical drive such as elevating equipment.

• Motor surface temperature

Use the cylinder in conditions where the motor surface temperature dose not exceed 90 °C (194 °F).
If the motor surface temperature exceeds 90 °C (194 °F) due to operating conditions (ambient temperature, operating speed, operating duty, etc.), a damaged motor coil or shorter service life of the bearing (ball bearing) may result.

• Grease on ball screw

Grease on the ball screw may darken slightly within a short time after the start of operation. This is not a problem if there is no abnormal noise (i.e., from deflection or interference). Wipe off the dirty grease with a soft cloth, and apply new grease.
When grease on the ball screw has darkened after the initial operation, the installation accuracy may be decreased. Refer to p.12 and check the installation accuracy of the ball screw. When grease was darkened, refer to p.15 and apply new grease.

• When conducting the insulation resistance measurement or the dielectric strength test, be sure to separate the connection between the cylinder and the driver.

Conducting the insulation resistance measurement or dielectric strength test with the cylinder and driver connected may result in damage to the product.

• Non-guide type cylinder

Provide an anti-spin mechanism for the ball screw

The non-guide type cylinders cannot be operated without an anti-spin mechanism for the ball screw because the ball screw rotates idly. Always provide an anti-spin mechanism externally to the cylinder. In addition, make sure the load installed to the ball screw is supported with a linear guide, etc.

Load to the ball screw

Applying a moment load to the ball screw may cause deterioration of the ball screw. Support a load with a linear guide etc. and install the load in the specified installation accuracy so that a moment load does not apply to the ball screw. Refer to p.12 for the installation accuracy.

Installation accuracy

When using the non-guide type cylinders, always install within the specified installation accuracy. Low accuracy of installation may result in a malfunction or shorter service life of the cylinder. Refer to p.12 for the installation accuracy.

When a carrier guide for load is provided

When a carrier guide for load is provided, always use the non-guide type cylinders. (Do not use the guide type or table type cylinders.)

• Guide type cylinder, table type cylinder

The guide type and table type cylinders can receive a moment using the load mounting holes in the joint. Use the cylinders under a moment within the permissible value.

• **Electromagnetic brake**

Use an electromagnetic brake type cylinder in vertical drive such as elevating equipment

For vertical drive such as elevating equipment etc., provide a safety brake mechanism in addition to using an electromagnetic brake type cylinder to hold the load position. When using the electromagnetic brake to hold the load position, operate it after the cylinder operation has stopped. If decelerating and stopping of the cylinder is repeated using the electromagnetic brake, the brake hub of the electromagnetic brake will wear significantly and the braking force will drop.

Connecting an electromagnetic brake

The electromagnetic brake operates via the ON/OFF status of the DC power supply. When connecting the electromagnetic brake lead wires, observe the correct polarity. Be sure to connect the included varistor (non-polar) to protect the contact of the switch or to prevent electrical noise.

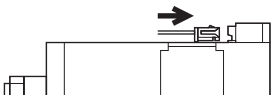
• **Adjusting knob**

Use the adjusting knob to adjust the position manually when the power is off. Do not touch the adjusting knob when the cylinder is operating. Doing so may cause the cylinder to malfunction or damage.

● Notes when the connection cable is used

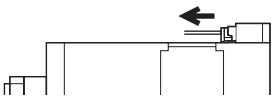
• **When inserting the connector**

Hold the connector main body, and insert it in straight securely. Inserting the connector in an inclined state may result in damage to connector or a connection failure.



• **When pulling out the connector**

Hold the connector main body, and pull off in straight. Pulling out the connector with holding the lead wire may result in damage to the connector.



Note Secure the lead wires at the connection part of the connector to prevent the connector or terminals from receiving stress due to bending or self-weight of lead wires. Also, do not excessively bend the lead wires near the connection part of the connector. Applying stress on the lead wires may cause poor contact or disconnection, leading to malfunction or heat generation.

Preparation

■ Checking the cylinder

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.

- Compact motorized cylinder ..... 1 unit
- Instructions and Precautions for Safe Use ..... 1 copy
- Varistor ..... 1 pc. *1
- Connection cable [0.6 m (2 ft.)] ..... 1 pc. *2

*1 Electromagnetic brake type cylinder only.
*2 Connector-coupled type cylinder only.

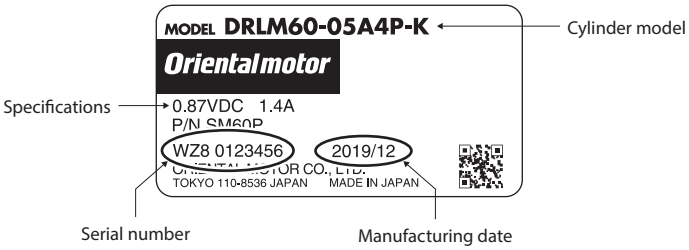
■ How to identify the product model

DRLM 60 G - 05 B 4 M N - K
1 2 3 4 5 6 7 8 9

1	Series	**DRLM**: **DRLII** Series
2	Frame size	**20**: 20 mm **28**: 28 mm **42**: 42 mm **60**: 60 mm
3	Type	**G**: Guide type **V**: Table type Blank: Non-guide type
4	Stroke	**02** to **10**: 25 to 100 mm
5	Ball screw type	**A**: Rolled ball screw **B**: Precision ball screw
6	Lead	**1**: 1 mm **2**: 2 mm **4**: 4 mm **8**: 8 mm
7	Motor type	**P**: Standard **M**: High-resolution
8	Additional function	**N**: With adjusting knob **M**: With electromagnetic brake Blank: Without additional function
9	Motor power supply type	**K**: DC power supply input

■ Information about nameplate

The figure shows an example.



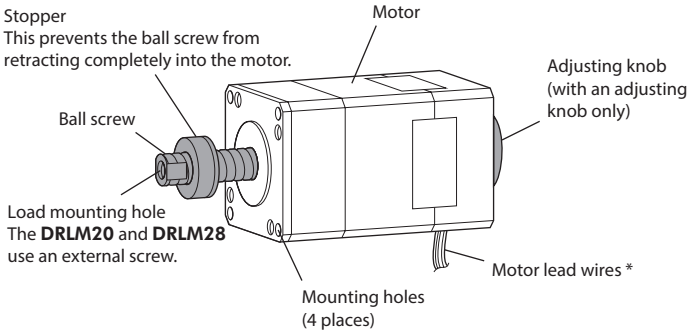
memo The position describing the information may vary depending on the product.

■ Names and functions of parts

The areas indicated in gray color represent a moving part.

● Non-guide type cylinder

The figure shows the **DRLM60-05A4PN-K**.

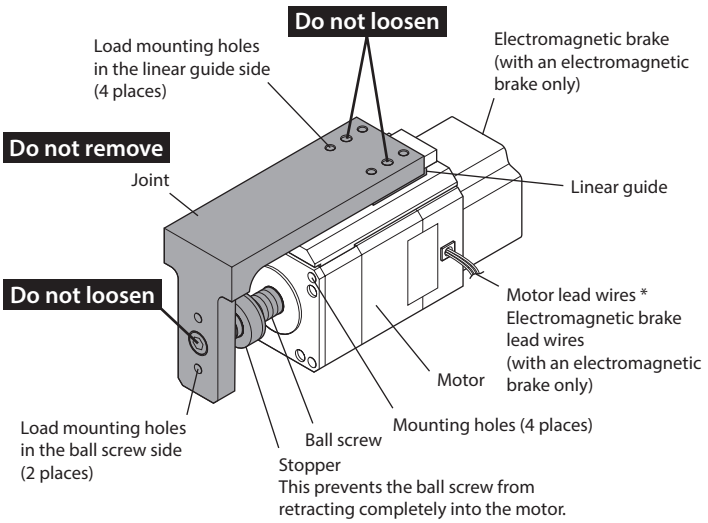


* A connection cable is included with the connector-coupled type products.

● Guide type cylinder

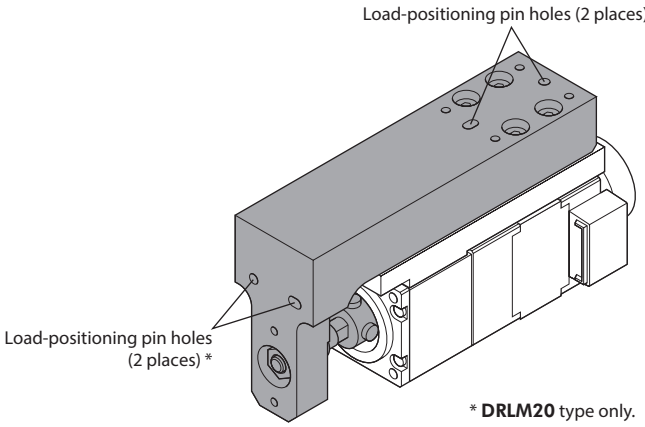
Note Do not remove the joint from the ball screw. The installation accuracy of the ball screw will decrease, resulting in a malfunctioning cylinder.

The figure shows the **DRLM60G-05A4PM-K**.



* A connection cable is included with the connector-coupled type products.

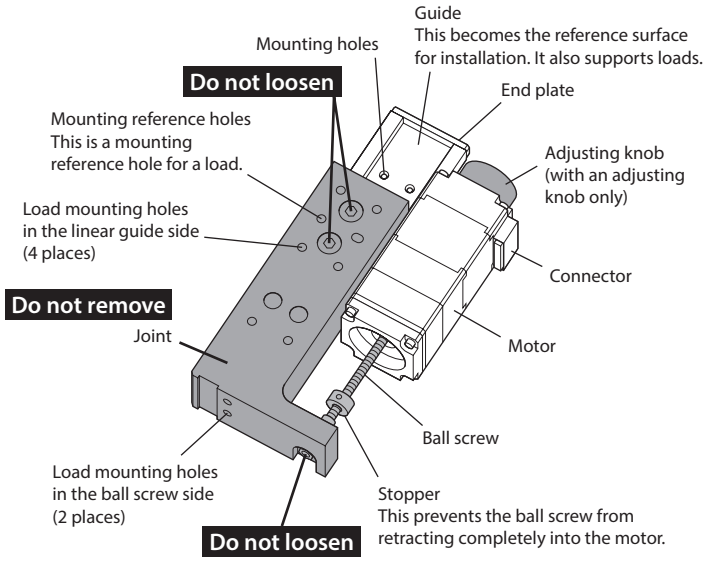
The figure shows the **DRLM20G-02B1PN-K**.



● Table type cylinder

Note Do not remove the joint from the ball screw. The installation accuracy of the ball screw will decrease, resulting in a malfunctioning cylinder.

The figure shows the **DRLM28V-03A1PN-K**.



■ Driver for possible combinations

Cylinder model	Driver model		
	Pulse input type	RS-485 communication type	Built-in controller type
DRLM20	**CVD503BR-K CVD503B-K CVD503-K**	**CVD5B-KR CVD5BR-KR**	**LRD503-KD**
DRLM28 DRLM42	**CVD507BR-K CVD507B-K CVD507-K**		**LRD507-KD**
DRLM60	**CVD514BR-K CVD514B-K CVD514-K**		**LRD514-KD**

Installation

This section covers the location and method of installing the cylinder, and attaching the load.

■ Installing the non-guide type

● Location for installation

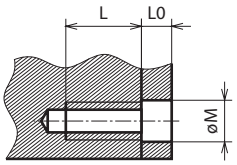
The cylinder is designed and manufactured to be incorporated in equipment. Install the cylinder in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature: 0 to +40 °C (+32 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 vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Up to 1,000 m (3,300 ft.) above sea level

● Installation method

The cylinder can be installed in any direction.
Install the cylinder onto an appropriate metal flat mounting plate [thickness approximately 5 mm (0.2 in.) or more] having excellent vibration resistance and heat conductivity. If a high accuracy is required, design the thickness of the mounting plate in consideration of installation conditions such as load condition, rigidity, vibration, and others.
Values of the tightening torque are recommended. Tighten with an appropriate torque according to the design conditions of the mounting plate, centering adjustment plate, and load.

• Details of mounting hole



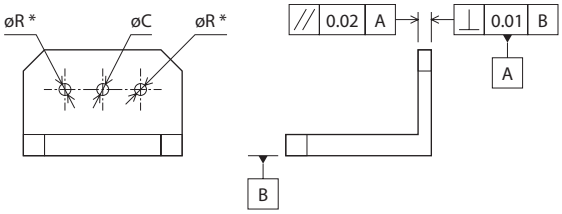
Model	Nominal size	Tightening torque [N·m (oz-in)]	Dimension of mounting hole (mm)		
			øM	L0	L (Effective depth of screw thread)
DRLM20	M2	0.4 (57)	2.3	2	5
DRLM28	M2.5	0.6 (85)	3	2	6
DRLM42	M4	1.8 (260)	–	–	8
DRLM60	M5	5.0 (710)	5.5	4	10

● Component parts design

The following shows the recommended design dimension of component parts and jigs required for when the actuator is installed.

• Movable plate

Design a screw shaft mounting hole (øC) of the movable plate in consideration of a margin so that the stacking tolerances of parts can be adjusted.



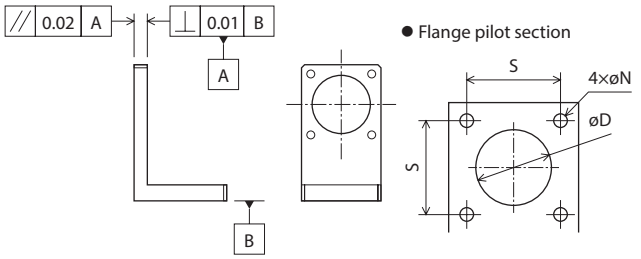
* They are needed when the accuracy of component parts is not enough to perform centering.

Model	When centering is possible	When centering is difficult	
	øC	øC	øR
DRLM20	3.3	4	3.5
DRLM28	3.3	4	4
DRLM42	4.5	5	4
DRLM60	9	9	6

Unit: mm

• Mounting plate

Perform machining of a flange pilot (counterbore or through hole) on the mounting plate.
Design the flange pilot according to the centering shaft (jig) if the accuracy of component parts is not enough to perform centering.
The figure shows an example for a through hole.



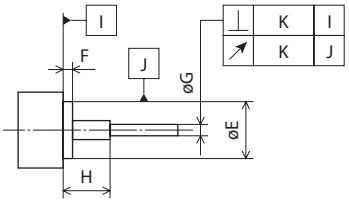
Model	øD	øN	S
DRLM20	$16^{+0.018}_{0}$	2.3	16±0.1
DRLM28	$22^{+0.021}_{0}$	3	23±0.1
DRLM42	$25^{+0.021}_{0}$	4.5	31±0.1
DRLM60	$36^{+0.025}_{0}$	5.5	50±0.1

Unit: mm

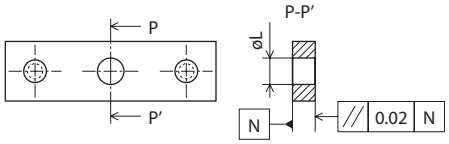
• Centering shaft and centering adjustment plate

The centering shaft and the centering adjustment plate are jigs used for when the accuracy of component parts is not enough to perform centering. Also, it is used when the stacking tolerance of parts is adjusted.

Centering shaft



Centering adjustment plate



Model	øE	F	øG	H	K	øL
DRLM20	$16^{-0.006}_{-0.017}$	1.5	$3^{0}_{-0.02}$	10.5	0.01	$3^{+0.010}_{0}$
DRLM28	$22^{-0.007}_{-0.020}$	1.5	$3^{0}_{-0.02}$	10.5	0.01	$3^{+0.010}_{0}$
DRLM42	$25^{-0.007}_{-0.020}$	2	$4^{-0.004}_{-0.012}$	20	0.02	$4^{+0.012}_{0}$
DRLM60	$36^{-0.009}_{-0.025}$	2	$8^{-0.005}_{-0.014}$	24.5	0.02	$8^{+0.015}_{0}$

Unit: mm

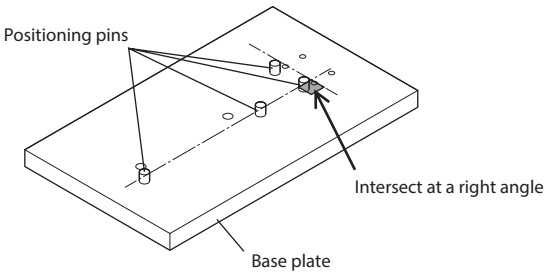
● Installation procedure

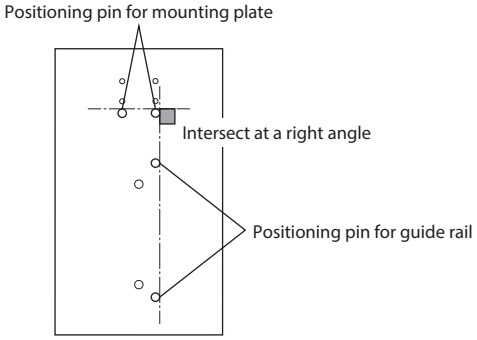
The installation procedure varies based on the accuracy of component parts of equipment.

- If the accuracy of component parts enables centering without adjustment: Centering does not required.
- If the accuracy of component parts is not enough to perform centering: Perform centering using jigs.

Step1	Installing the positioning pin

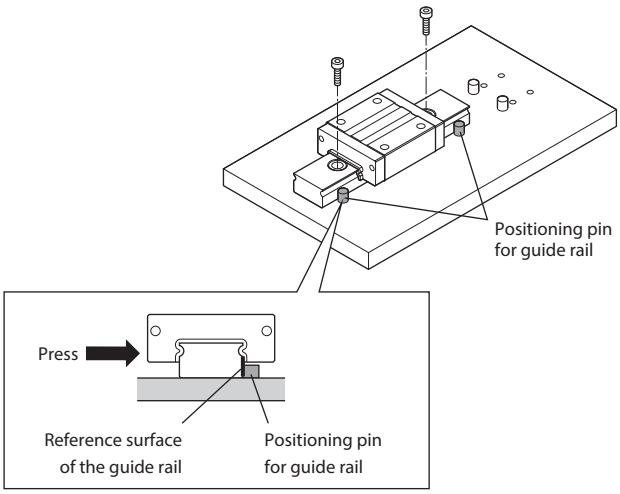
Install positioning pins (each 2 pcs.), which are used to set the position of the guide rail and mounting plate, on the base plate.





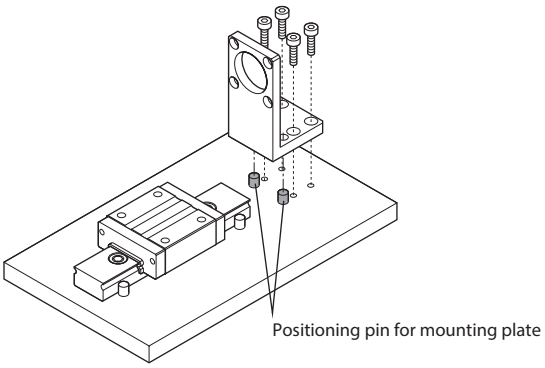
Step2 Installing the guide rail

Secure a guide rail to the base plate using screws while pressing the reference surface of the guide rail to the positioning pin.
Check the manufacturer of a guide rail for the position of the reference surface of the guide rail.



Step3 Installing the mounting plate

Place the mounting plate on the pins, and secure the mounting plate to the base plate with screws.

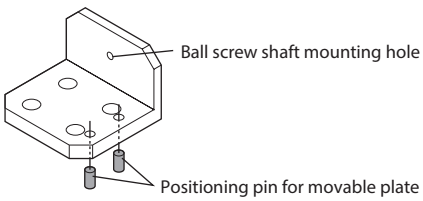


Step4 Installing the movable plate

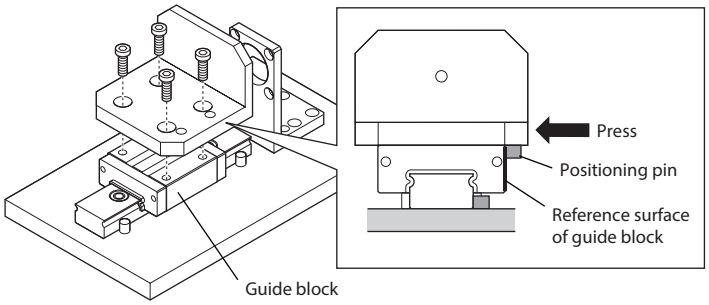
Install the movable plate to the guide block. The installation method varies depending on the accuracy of component parts.

- **If the accuracy of component parts enables centering without adjustment**

1. Install positioning pins on the movable plate.

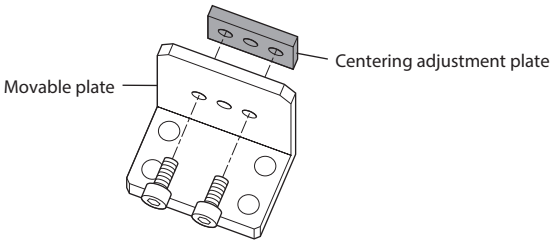


2. Secure the movable plate to the guide block using screws while pressing the positioning pins on the movable plate to the reference surface of the guide block.
Check the manufacturer of a guide rail for the position of the reference surface of the guide block.

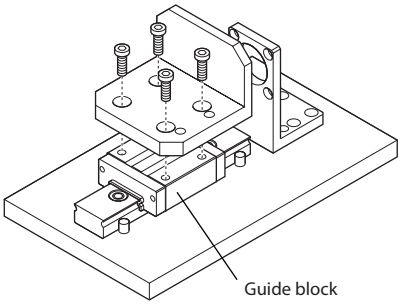


- **If the accuracy of component parts is not enough to perform centering**

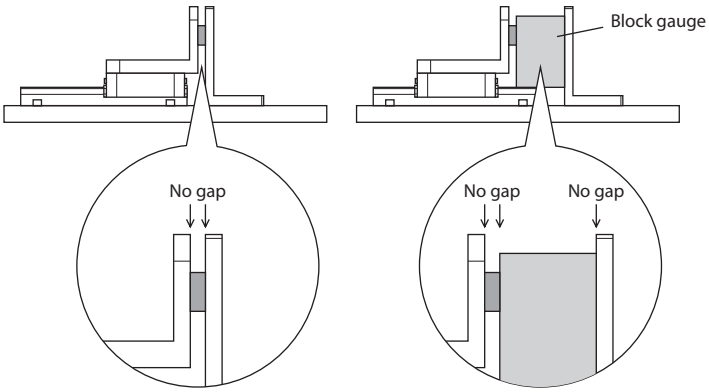
1. Secure the centering adjustment plate to the movable plate using screws.



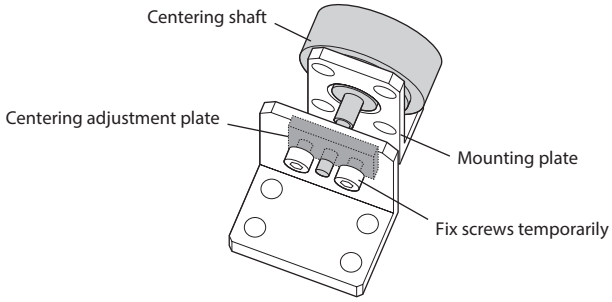
2. Secure the movable plate to the guide block using screws.



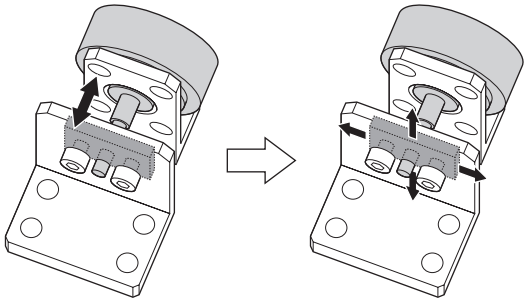
3. Move the movable plate closer to the mounting plate, and check that there is no gap between the plates.
When there is a distance between the movable plate and the mounting plate, put a block gauge, and check that there is no gap between the plates.
If there is a gap, reinstall the movable plate.



4. Using the centering shaft to resemble the actuator, insert the centering shaft to the mounting plate.
   Loosen the screws securing the centering adjustment plate, and temporarily fix the screws so as to move slightly when touching the centering adjustment plate.



5. Slide the movable plate to check that it moves smoothly, and tighten the screws on the centering adjustment plate.
   If the movable plate does not move smoothly, adjust axis misalignment between the centering shaft and the centering adjustment plate while moving the centering adjustment plate from right to left or up and down.

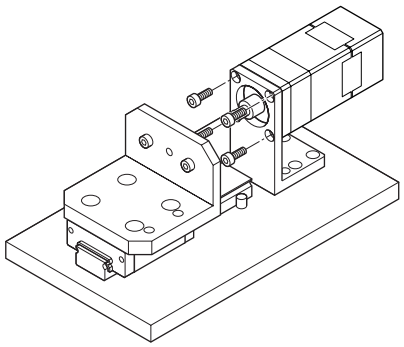


Model	Screw size	Tightening torque [N·m (oz-in)]
DRLM20	M2.5	0.4 (57)
DRLM28	M3	0.6 (85)
DRLM42	M3	0.6 (85)
DRLM60	M5	3 (420)

6. Remove the centering shaft.

Step5 Installing the actuator

Secure the actuator to the mount plate using screws.



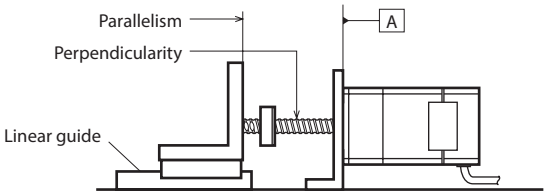
Model	Screw size	Tightening torque [N·m (oz-in)]
DRLM20	M2	0.4 (57)
DRLM28	M2.5	0.6 (85)
DRLM42	M4	1.8 (256)
DRLM60	M5	5 (710)

● Installing a load

Note When transporting the equipment with the cylinder installed, be sure to remove a load on the ball screw.

• Installation accuracy

The non-guide type cylinder cannot operate because the ball screw rotates idly if an anti-spin mechanism of the ball screw is not provided. Be sure to install an anti-spin mechanism, such as a linear guide, with the installation accuracy shown in the figure when mounting a load on the ball screw. Also, be sure to support a load mounted on the ball screw using a linear guide, etc.



Model	Perpendicularity	Parallelism
DRLM20	⊥ ø0.02 A	// 0.02 A
DRLM28	⊥ ø0.03 A	// 0.03 A
DRLM42, **DRLM60**	⊥ ø0.05 A	// 0.05 A

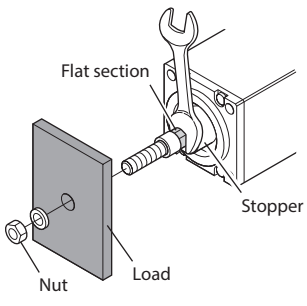
Unit: mm

Note
- Be sure to check the installation accuracy using a lever type dial test indicator or feeler gauge etc. Low installation accuracy may result in malfunction of the cylinder or shorter service life of the cylinder.
- When noise from a cylinder has generated or grease on the ball screw has darkened after the initial operation, the installation accuracy may be decreased. Check the installation accuracy of the ball screw.

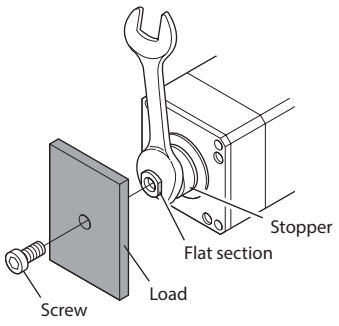
• Installation method

1. Retract the ball screw until it stops at the stopper.
2. Holding the flat section of the ball screw with a wrench, secure the load with a screw (or nut, in the case of the **DRLM20** and **DRLM28**).
   Use in combination with a thread locking adhesive is recommended.

DRLM20, **DRLM28**



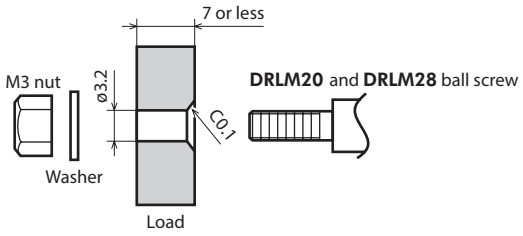
DRLM42, **DRLM60**



Model	Nominal size of screw or nut	Tightening torque [N·m (oz-in)]
DRLM20, **DRLM28**	M3 nut	0.6 (85)
DRLM42	M4 screw	1.8 (260)
DRLM60	M8 screw	5.0 (710)

Note

When a load is installed to the non-guide type cylinders of the **DRLM20** and **DRLM28**, chamfer the mounting hole of the ball screw side of the load by 0.1 mm. If the contact surface of the ball screw is chamfered, the ball screw may incline, leading to malfunction or shorter service life of the cylinder.

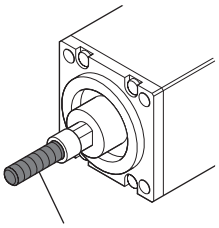


Unit: mm

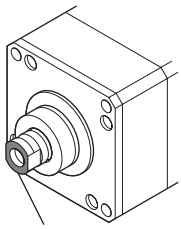
memo

- Screw, nut, and washer are not included with the cylinder.
- Grease is applied on the ball screw. When a thread locking adhesive is used in combination, wipe off the grease on the place shown in the figure using a soft cloth. If the grease is remained applied, a thread locking adhesive may not become hard.

DRLM20, DRLM28



DRLM42, DRLM60



■ Installing the guide type

● Location for installation

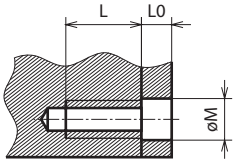
The cylinder is designed and manufactured to be incorporated in equipment. Install the cylinder in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature: 0 to +40 °C (+32 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 vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Up to 1,000 m (3,300 ft.) above sea level

● Installation method

The cylinder can be installed in any direction.
Install the cylinder onto an appropriate metal flat mounting plate [thickness approximately 5 mm (0.2 in.) or more] having excellent vibration resistance and heat conductivity. If a high accuracy is required, design the thickness of the mounting plate in consideration of installation conditions such as load condition, rigidity, vibration, and others.
Values of the tightening torque are recommended. Tighten with an appropriate torque according to the design conditions of the mounting plate, base plate, and load.

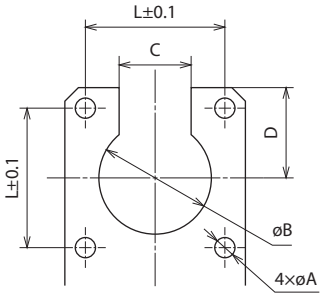
• Details of mounting hole



Model	Nominal size	Tightening torque [N·m (oz-in)]	Dimension of mounting hole (mm)		
			øM	L0	L (Effective depth of screw thread)
DRLM20G	M2	0.4 (57)	2.3	2	5
DRLM28G	M2.5	0.6 (85)	3	2	6
DRLM42G	M4	1.8 (260)	–	–	8
DRLM60G	M5	5.0 (710)	5.5	4	10

• Plate cutout for mounting

Perform machining for a through hole of the flange pilot and a clearance groove of the stopper on the mounting plate.

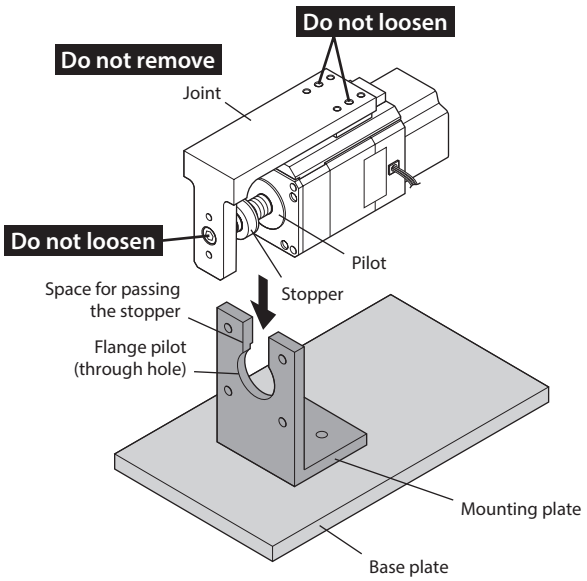


Model	L	øA	øB	C	D
DRLM20G	16	2.3	$16^{+0.018}_{0}$	10	11
DRLM28G	23	3	$22^{+0.021}_{0}$	15	15
DRLM42G	31	4.5	$25^{+0.021}_{0}$	16	22
DRLM60G	50	5.5	$36^{+0.025}_{0}$	28	31

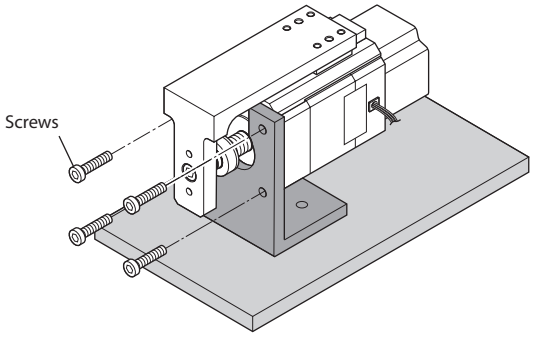
Unit: mm

• Installation procedure

1. Insert the pilot located on the cylinder installation surface into the flange pilot having performed counterbore or through-hole machining of the mounting plate.



2. Securely tighten with four screws so that there is no gap between the cylinder installation surface and the mounting plate.



Note Do not remove the joint from the ball screw. The installation accuracy of the ball screw will decrease, resulting in a malfunctioning cylinder.

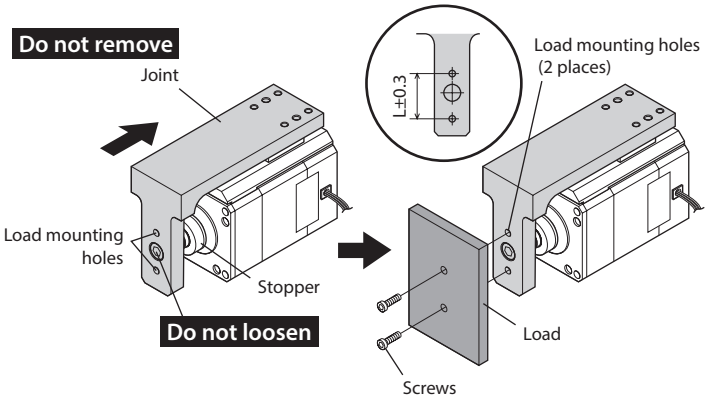
● Installing a load

Note When transporting the equipment with the cylinder installed, be sure to remove a load on the ball screw.

Load mounting holes are provided at two places, the ball screw side and the linear guide side. Use these holes in accordance with your purpose.

• When using load mounting holes in the ball screw side of the joint

1. Retract the ball screw until it stops at the stopper.
2. Install a load to the joint with screws (not included) using the load mounting holes.

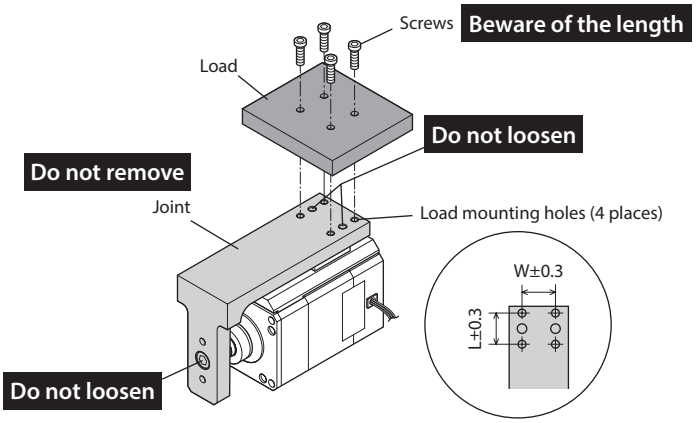


Model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of screw thread (mm)	L (mm)
DRLM20G	M2	0.4 (57)	4	15
DRLM28G	M2.5	0.6 (85)	5	16
DRLM42G	M4	1.0 (142)	7.5	20
DRLM60G	M5	2.0 (280)	11.5	30

Note Do not remove the joint from the ball screw. The installation accuracy of the ball screw will decrease, resulting in a malfunctioning cylinder.

• When using load mounting holes in the linear guide side of the joint

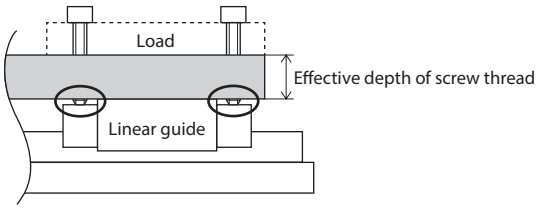
Install a load to the joint with screws (not included) using the load mounting holes.



Model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of screw thread (mm)	L (mm)	W (mm)
DRLM20G	M2	0.4 (57)	4	18	12
DRLM28G	M2.5	0.6 (85)	3.5	18	12
DRLM42G	M4	1.0 (142)	5.5	24	19
DRLM60G	M5	2.0 (280)	5.5	22	28

Note

- When using the load mounting holes in the linear guide side, use screws that do not exceed the effective depth of screw threads in the linear guide. Use of long screws exceeding the effective depth of screw threads may damage the linear guide.



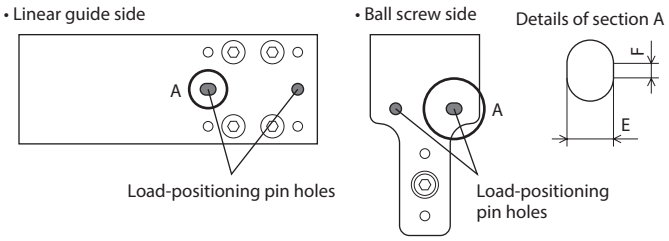
- Do not remove the joint from the ball screw. The installation accuracy of the ball screw will decrease, resulting in a malfunctioning cylinder

• Load-positioning pin holes of joint (DRLM20G type only)

Two types of load-positioning pin holes, which are an elongated hole and a round hole, are provided one place each on the joint of **DRLM20G**. If installation repeatability is required when installing a load, use the load-positioning pin holes.

Specifications of load-positioning pin holes

The same specifications are applied to both the linear guide and ball screw sides.



Model	Recommended size of positioning pin	Round hole		Elongated hole		
		Diameter	Depth	E	F	Depth
DRLM20G	$\phi 2^{\ 0}_{-0.01}$	$\phi 2^{+0.02}_{\ 0}$	3	$2^{+0.02}_{\ 0}$	1	3

Unit: mm

Note Be sure to secure the positioning pin to the load side. Pressing the positioning pins into the joint may cause damage to the cylinder.

memo When mounting the load at a right angle with respect to the joint, use only the round positioning pin hole to adjust the angle.

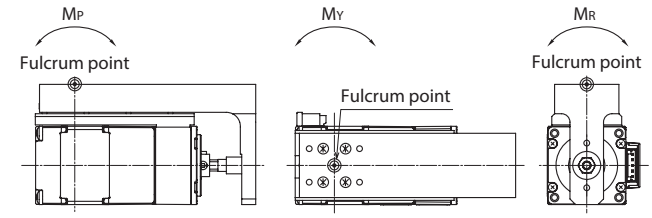
• Notes when installing a load

The guide type cylinders can receive a moment. Be sure to use the cylinder within the specified values in the table. Continuing to operate the cylinder in a state where a moment exceeding a value in the table is applied may cause malfunction or shorter service life of the cylinder.
If the ball screw is required to move when installing a load to the electromagnetic brake type cylinder, refer to p.14 and connect the lead wires of the electromagnetic brake to the power supply. When the power supply is turned on, the electromagnetic brake is released, and the moving part of the cylinder can be moved by hand.

Permissible moment

Model	M_P	M_Y	M_R
DRLM20G	0.1	0.05	0.15
DRLM28G	0.13	0.07	0.3
DRLM42G	0.5	0.25	0.8
DRLM60G	0.6	0.35	2.2

Unit: N·m



■ Installing the table type

● Location for installation

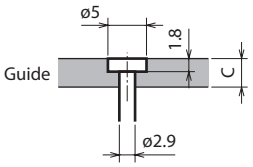
The cylinder is designed and manufactured to be incorporated in equipment. Install the cylinder in a well-ventilated location that provides easy access for inspection. The location must also satisfy the following conditions:

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature: +5 to +40 °C (+41 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 vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- Up to 1,000 m (3,300 ft.) above sea level

● Installation method

The cylinder can be installed in any direction.
Install the cylinder onto an appropriate metal flat mounting plate [thickness approximately 5 mm (0.2 in.) or more] having excellent vibration resistance and heat conductivity. If a high accuracy is required, design the thickness of the mounting plate in consideration of installation conditions such as load condition, rigidity, vibration, and others.
Values of the tightening torque are recommended. Tighten with an appropriate torque according to the design conditions of the base plate and load.

• Details of mounting hole



Model	Nominal size	Tightening torque [N·m (oz-in)]	C (mm)
DRLM20V	M2.5	0.4 (57)	3.5
DRLM28V			3.0

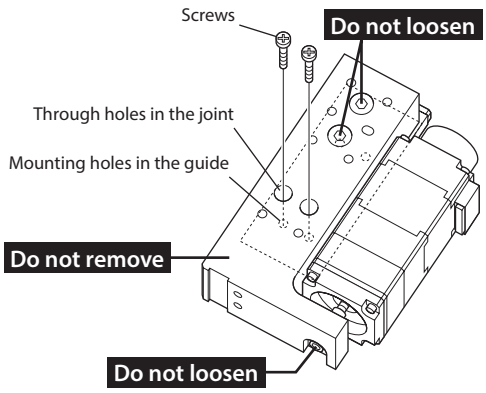
Note When installing the cylinder, use screws having a thread height of less than 1.8 mm. Exceeding 1.8 mm causes the screw to protrude from the mounting hole of the guide, resulting in damage to the guide.

• Installation procedure

Note The cylinder is required to install while moving the joint. In this case, if the lead wires are short-circuited, the holding torque may generate to cause the joint to make heavy and get hard to move.

1. Manually push the joint (turn the adjusting knob if the cylinder has the adjusting knob), and align the through holes in the joint with the mounting holes provided in the guide.

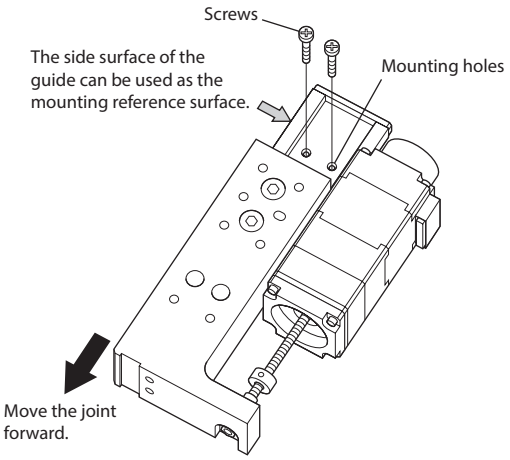
2. Temporarily tighten screws (not included) into the mounting holes.
   Recommended screw: Cross-recessed round head screw
   Nominal size: M2.5



Note

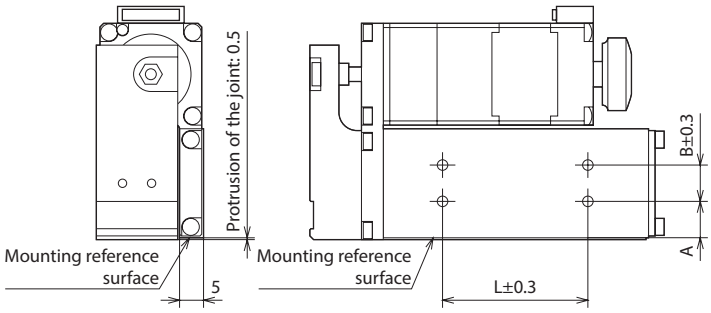
- The effective depth of screw thread on the mounting surface must be 5 mm or more, and be sure to use screws with sufficient length.
- If a screw falls off when the through holes in the joint and the mounting holes are not aligned properly, it may fall into the gap of the guide. Be sure to align the through holes in the joint with the mounting holes.

3. Move the joint forward until the other mounting holes become visible, and then tighten screws (not included) into the mounting holes.



4. Move the joint backward, and finally tighten the screws having been in the temporarily tightened state in the procedure 2.
   Secure so that no gap remains between the cylinder and the mounting plate.
   Tightening torque: 0.4 N·m (57 oz-in)

- **Reference drawing for mounting**



Model	L	A	B
DRLM20V	35	8	9
DRLM28V	40	10	10

Unit: mm

Note

Do not remove the joint from the ball screw. The installation accuracy of the ball screw will decrease, resulting in a malfunctioning cylinder.

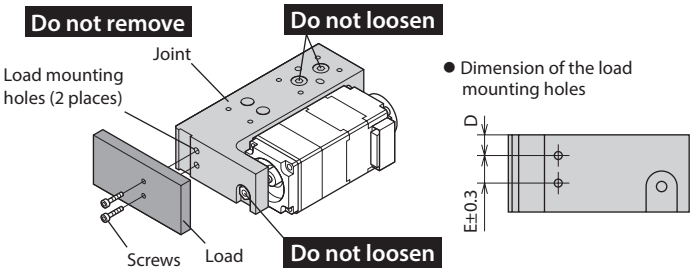
● Installing a load

Note

When transporting the equipment with the cylinder installed, be sure to remove a load on the ball screw.

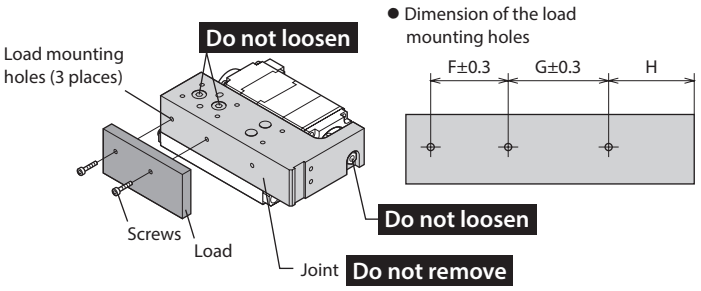
Install a load to the joint with screws (not included) using the load mounting holes.
Load mounting holes are located in three places: the ball screw side, the joint side surface, and the joint upper surface. Use these holes in accordance with your purpose.

- **When installing a load using the load mounting holes in the ball screw side**



Model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of screw thread (mm)	D (mm)	E (mm)
DRLM20V	M3	1.0 (142)	6	3.5	7
DRLM28V				7.2	8

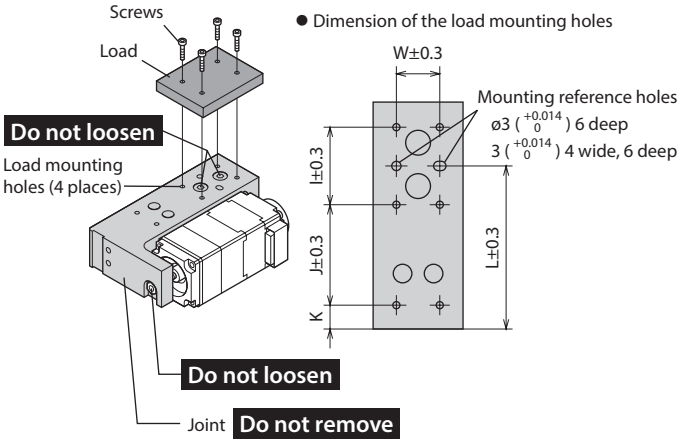
- **When installing a load using the load mounting holes in the joint side surface**



Model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of screw thread (mm)	F (mm)	G (mm)	H (mm)
DRLM20V	M3	1.0 (142)	6	20	39.5	17.9
DRLM28V				25	31.9	27.5

• When installing a load using the load mounting holes in the joint upper surface

Load mounting reference holes are located in the joint upper surface. When reproducibility is required for mounting loads, use these mounting reference holes.



Model	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of screw thread (mm)
DRLM20V **DRLM28V**	M3	1.0 (142)	6

Model	I	J	K	L	W
DRLM20V	20	39.5	17.9	67.4	10
DRLM28V	25	31.9	27.5	71.9	14

Unit: mm

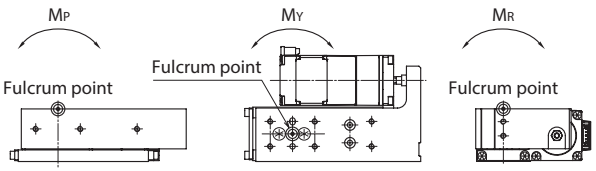
• Notes when installing a load

The table type cylinders can receive a moment. Be sure to use the cylinder within the specified values in the table. Continuing to operate the cylinder in a state where a moment exceeding a value in the table is applied may cause malfunction or shorter service life of the cylinder.

Permissible moment

Model	M_P	M_Y	M_R
DRLM20V	0.4	0.4	0.8
DRLM28V	0.7	0.7	1.5

Unit: N·m



● Installing the home sensor for the table type

• Details of home sensor set

The following parts are used in our home sensor set **PADRL-S□**.

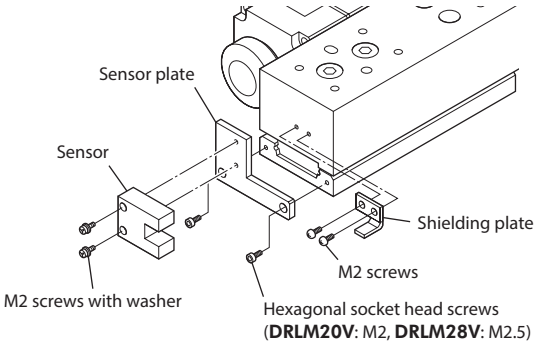
Parts	Number of pieces
Sensor Model: PM-U25 (Panasonic Industrial Devices SUNX Co., Ltd.)	1 pc.
Sensor plate	1 pc.
Shielding plate	1 pc.
M2 screw with washer (for mounting the sensor)	2 pcs.
M2 screw (for mounting the shielding plate)	2 pcs.
Hexagonal socket head screw (for mounting the sensor plate) • **DRLM20V** : M2 • **DRLM28V** : M2.5	2 pcs.

Note

- The sensor has no special means of protection against disturbance light because it is designed to be incorporated in equipment. If the cylinder is to be used under an incandescent lamp or in conditions that are subject to disturbances from external light, provide the means to prevent such interference.
- Use the sensors after confirming that there is no looseness, play or other abnormality due to vibration, impact, etc.
- To prevent malfunctioning due to the adhesion of dust on the sensors, clean and/or replace the sensors regularly.

• Installation of the sensor

1. Remove the end plate from the guide, and using hexagonal socket head screws (**DRLM20V**: M2, **DRLM28V**: M2.5) install the sensor plate instead. Tightening torque: 0.4 N·m (57 oz-in)
2. Install the shielding plate with M2 screws using the screw holes in the rear area of the joint. Tightening torque: 0.2 N·m (28 oz-in)
3. Install the sensor to the sensor plate using M2 screws with washer. Tightening torque: 0.15 N·m (21 oz-in)

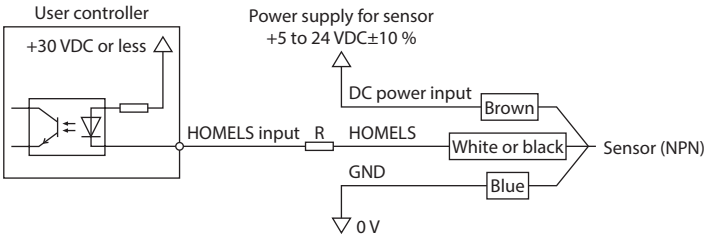


Note

- Do not install the home sensor set while the power is being supplied. Doing so may result in injury or damage to equipment.
- Be sure to install the sensor and shielding plate in the direction shown in the figure. Installing them in the wrong direction may disable sensor detection or cause the shielding plate to contact the sensor and result in sensor damage.
- When installing the sensor plate and shielding plate to the cylinder, be sure to use the included screws.
- Install the sensor so as not to contact with the shielding plate.

• **Sensor wire connection**

Use output signals of the sensor at 5 to 24 VDC, 50 mA or less. If the current value exceeds 50 mA, connect an external resistor R.
Output operation can be selected from either ON when light is shielded or ON when light is induced. Use either one of them as appropriate.



- Output operation turns ON when light is shielded: Connect white lead wire.
- Output operation turns ON when light is induced: Connect black lead wire.
- Be sure to insulate the unconnected lead wire.

Note

- Wire to separate the sensor lines away from the power lines such as the motor lead wires, connection cable, and power supply cable as far apart as possible. If the sensor lines and power lines have to cross, cross them at a right angle.
- Use a common GND for the sensor and driver. Any difference in GND potential will result in a sensor malfunction.

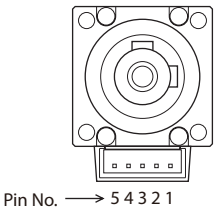
Connection

This section covers the connection methods for the driver and the electromagnetic brake.

■ Connecting the driver

For details, refer to the operating manual of the driver.
Refer to p.1 for operating manuals in details.

● Pin assignments



Driver pin No.	Connector-coupled type cylinder		Lead wire type cylinder
	Pin No.	Lead wire colors of connection cable	Lead wire colors
1	1	Blue	Blue
2	2	Red	Red
3	3	Orange	Orange
4	4	Green	Green
5	5	Black	Black

● Applicable connector and lead wire

Be sure to use a connector housing, contact, and designated crimp tool in the combinations shown in the table.

DRLM20, DRLM28

Manufacturer: Molex, LLC

Connector housing	51065-0500
Contact	50212-8100
Designated crimp tool	57176-5000
Conductor size	AWG24 (0.2 mm^2)

DRLM42

There are two types of applicable connectors. Use either one shown in the table.

Manufacturer: Molex, LLC

	Applicable connector 1	Applicable connector 2
Connector housing	51103-0500	51163-0500
Contact	50351-8100	50752-8200
Designated crimp tool	57295-5000 or 63811-8100	200218-4900
Conductor size	AWG22 (0.3 mm^2)	

DRLM60

Manufacturer: J.S.T. Mfg. Co., Ltd.

Connector housing	VHR-5N
Contact	BVH-21T-P1.1
Designated crimp tool	YC-160R
Conductor size	AWG22 (0.3 mm^2)

■ Connecting the electromagnetic brake

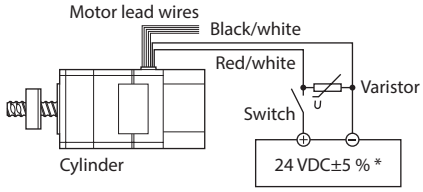
The electromagnetic brake operates via the ON/OFF status of the DC power supply. For exclusive use of the electromagnetic brake, provide a power supply of 24 VDC±5 % 0.08 A or more for the **DRLM42**, or that of 24 VDC ±5 % 0.25 A or more for the **DRLM60**. Use a shielded cable of AWG24 (0.2 mm^2) or more in diameter to connect the electromagnetic brake to the DC power supply, keeping the length as short as possible.

● Connecting power supply for the electromagnetic brake

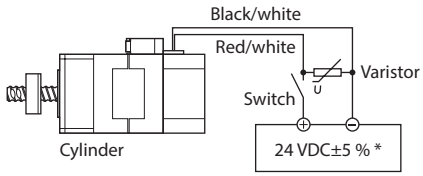
Connect the two lead wires [600 mm (24 in.)] from the cylinder to the DC power supply.

1. Connect the red/white lead wire to the +24 V terminal of the DC power supply.
2. Connect the black/white lead wire to the GND terminal of the DC power supply.
3. Connect the included varistor in parallel across the +24 V and GND terminals of the DC power supply.

● Lead wire type cylinder



● Connector-coupled type cylinder

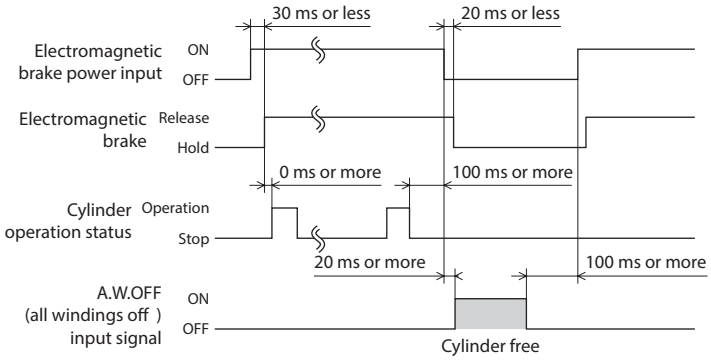


* Refer to the following current capacities for the DC power supply.
DRLM42: 0.08 A or more
DRLM60: 0.25 A or more

Note

- Do not apply the voltage beyond its specifications. Doing so may increase heat generation in the electromagnetic brake, resulting in damage to the cylinder. Conversely, insufficient voltage may prevent the brake from releasing.
- Be sure to connect the varistor to protect the contact of the switch or to prevent electrical noise.
- Connect the lead wires of the electromagnetic brake in the correct polarities since they have polarities. Connecting the lead wires with their polarities reversed will not properly operate the electromagnetic brake.
- Provide separate power supplies for the I/O signals and the electromagnetic brake.

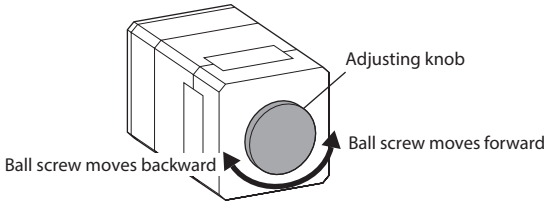
● Timing chart for the electromagnetic brake



Notes when operating

■ How to use the adjusting knob (adjusting knob type only)

Use when adjusting the position of the ball screw. Turn off the power supply and move the ball screw by turning the adjusting knob manually. Turning the adjusting knob by one revolution moves the ball screw by the length of the lead. Adjust the position within the effective stroke range.



Note Do not touch the adjusting knob when the cylinder is operating. Doing so may cause the cylinder to malfunction or damage.

■ Operating speed at low temperature (reference values)

If the ambient temperature is a value in brackets/parentheses shown in the table, make sure that the maximum speed is the specified value or less.

• Standard type motor

Model	Non-guide type cylinder Guide type cylinder	Table type cylinder
DRLM20	13 [0 to +10 °C (32 to 50 °F)]	13 [+5 to +15 °C (41 to 59 °F)]
DRLM28	15 [0 to +10 °C (32 to 50 °F)] 24 [+10 to +15 °C (50 to 59 °F)]	10 [+5 to +15 °C (41 to 59 °F)] 24 [+15 to +20 °C (59 to 68 °F)]
DRLM42 (Lead 2 mm)	20 [0 to +10 °C (32 to 50 °F)]	–
DRLM42 (Lead 8 mm)	80 [0 to +10 °C (32 to 50 °F)]	–
DRLM60	32 [0 to +15 °C (32 to 59 °F)]	–

Unit: mm/s

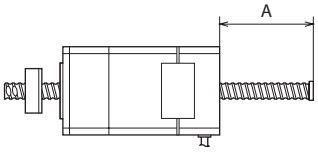
• High-resolution type motor

Model	Non-guide type cylinder Guide type cylinder
DRLM28	12 [0 to +10 °C (32 to 50 °F)]
DRLM42	15 [0 to +10 °C (32 to 50 °F)]
DRLM60	22 [0 to +10 °C (32 to 50 °F)]

Unit: mm/s

■ Ball screw projection

With cylinders whose stroke is 60 mm or more, the long ball screw projects from the end face of the cylinder as shown in the figure. For these cylinders, provide a sufficient space in the rear to prevent the ball screw from contacting other parts, etc.



Model	Maximum projection length A
DRLM28-06 (stroke 60 mm)	28
DRLM42-10 (stroke 100 mm)	73
DRLM60-10 (stroke 100 mm)	64

Unit: mm

Inspection and maintenance

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

● Maintenance item

- Check if any of the screws having installed the cylinder comes loose.
- Check if an unusual noise is generated from the motor, ball screw, linear guide, etc. of the cylinder.
- Check if a damage or stress is applied on the lead wire or cable.
- Check if the connection part between the cylinder and driver comes loose.
- Check if the cylinder ball screw and the load shaft are out of alignment.
- Check if grease on the ball screw or linear guide of the cylinder is darken.

■ Maintenance of grease

When grease on the ball screw or linear guide of the cylinder has become dirty, wipe off the dirty grease completely with a soft cloth, and apply new grease.

● Grease check interval

- Once every week of operation
- Once every month

● Recommended grease

• Non-guide type, guide type cylinder

Ball screw: AFC Grease (THK CO., LTD.)
Linear guide: Multemp PS No. 2 (KYODO YUSHI CO., LTD.)

• Table type cylinder

Ball screw, Linear guide: AFE-CA Grease (THK CO., LTD.)

Note Wear protective goggles when applying grease. Pay attention to safety and handle the grease carefully by following the instructions provided with that product. If grease gets into the eyes or comes in contact with the skin, immediately flush the area thoroughly with water.

■ 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.

Troubleshooting

During cylinder operation, the cylinder may fail to function properly due to an improper setting or wiring. When the cylinder cannot be operated properly, refer to the contents provided in this chapter and take appropriate action. If the problem persists, contact your nearest Oriental Motor sales office.

Phenomenon	Possible cause	Remedial action
The ball screw does not move with being jammed.	The ball screw was hit against an object to stop.	Return the ball screw at the recommended starting speed shown in the table next. After that, check the following items. If the ball screw does not return, remove the load. • Does the screw for mounting a load come loose? • Are the ball screw and the load damaged? • Are the positions of the stopper and the home position displaced? • Is the mounting accuracy changed?
The ball screw does not operate at the command speed.	The thrust of the cylinder is not enough against a load.	Review the load.
The ball screw rotates idly.	An anti-spin mechanism is not provided.	Provide an anti-spin mechanism such as a guide rail or movable plate.
Malfunction of cylinder.	The installation accuracy is low.	Check the installation accuracy.
The thrust of the cylinder has lowered.	The wiring distance is exceeded the specification value.	Set the distance between the cylinder and driver within 10 m (32.8 ft.).
	The viscosity of the grease was changed.	Refer to "General specifications", and check the operating ambient temperature.

Recommended starting speed

Model	Lead (mm)	Recommended starting speed (mm/s)
DRLM20, **DRLM28**	1	0.2
DRLM42	2	0.4
	8	1.6
DRLM60	4	0.8

Specifications

■ Product specifications

Check on the Oriental Motor Website for the product specifications.

■ General specifications

Operating environment	Ambient temperature	0 to +40 °C [+32 to +104 °F] * (non-freezing)
	Ambient humidity	85 % or less (non-condensing)
	Altitude	Up to 1,000 m (3,300 ft.) above sea level
Storage environment, Shipping environment	Ambient temperature	–20 to +60 °C [–4 to +140 °F] (non-freezing)
	Ambient humidity	85 % or less (non-condensing)
	Altitude	Up to 3,000 m (10,000 ft.) above sea level
Heat resistance class	130 (B)	
Insulation resistance	100 MΩ or more when 500 VDC megger is applied between the case and the motor windings.	
Dielectric strength	Sufficient to withstand the following for 1 minute. The box (☐) in the model name indicates **G** (guide type), **V** (table type), or blank (non-guide type) representing the type. Case - Motor windings – **DRLM20☐**, **DRLM28☐**, **DRLM42☐** (High-resolution): AC0.5 kV 50 Hz or 60 Hz – **DRLM42☐**, **DRLM60☐** (High-resolution): AC1.0 kV 50 Hz or 60 Hz – **DRLM60☐**: AC1.5 kV 50 Hz or 60 Hz	

* **DRLM20V**, **DRLM28V**: +5 to +40 °C (+41 to +104 °F)

Regulations and standards

■ CE Marking

● EMC Directive

The EMC test is conducted in a state where the cylinder is connected to the driver. The driver that is combined with the cylinder complies with the EMC Directive. For details, refer to the operating manual of the driver.

■ RoHS Directive

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

Accessories

● Home sensor set (for the table type cylinder)

These are sensor sets for return-to-home operation (NPN output type).

Model name	Applicable product
PADRL-S20	**DRLM20**
PADRL-S28	**DRLM28**

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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

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

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

ORIENTAL MOTOR (THAILAND) CO., LTD.
Tel:1800-888-881

ORIENTAL MOTOR (INDIA) PVT. LTD.
Tel:1800-120-1995 (For English)
1800-121-4149 (For Hindi)

TAIWAN ORIENTAL MOTOR CO., LTD.
Tel:0800-060708

SHANGHAI ORIENTAL MOTOR CO., LTD.
Tel:400-820-6516

INA ORIENTAL MOTOR CO., LTD.
Korea
Tel:080-777-2042