



## OPERATING MANUAL

Compact linear actuator

### DRL II Series

Pulse input type Driver

## Introduction

### ■ Before use

Only qualified personnel should work with the product. Use the product correctly after thoroughly reading the section "Safety precautions."

The product described in this manual has been designed and manufactured for use in general industrial equipment. Do not use for any other purpose. For the driver power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

### ■ Overview of the product

The compact linear actuator **DRL II Series** is an actuator and driver package product consisting of a case type microstep driver offering the smooth drive function and a linear motion type actuator adopting a 5-phase stepping motor integrated with a ball screw.

### ■ Operating manuals for the DRL II series

Operating manuals for this product are listed below. After reading the following manuals, keep them in a convenient place so that you can reference them at any time.

- **DRL II Series Actuator OPERATING MANUAL**
- **DRL II Series Pulse input type Driver OPERATING MANUAL (this document)**
- **CRK Series Pulse input type OPERATING MANUAL (HM-60225)**

The OPERATING MANUAL for this product is common with the CRK Series. This manual does not come with the product. For details, contact your nearest Oriental Motor sales office.

### ■ Hazardous substances

The products do not contain the substances exceeding the restriction values of RoHS Directive (2011/65/EU).

### ■ Republic of Korea, Radio Waves Act

Seller and user shall be noticed that this equipment is suitable for electromagnetic equipments for office work (Class A) and it can be used outside home.

이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

### ■ Checking the product

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

Thank you for purchasing an Oriental Motor product. This Operating Manual describes product handling procedures and safety precautions.

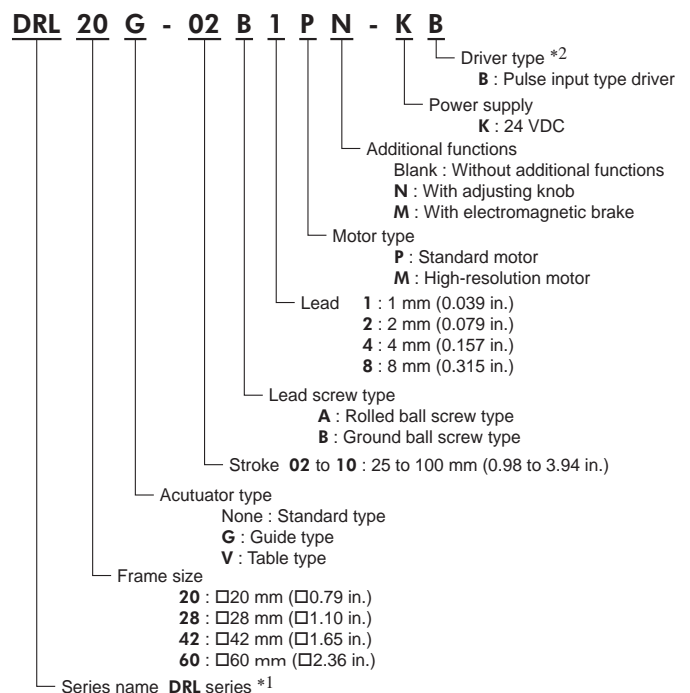
- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

- Items supplied with all actuator and driver package models
    - Actuator..... 1 unit
    - Driver ..... 1 unit
    - CN1 connector (3 pins)..... 1 pc.
    - CN2 connector (5 pins)..... 1 pc.
    - CN3 connector (10 pins)..... 1 pc.
    - **OPERATING MANUAL** (Driver: this document)..... 1 copy
    - **OPERATING MANUAL** (Actuator)..... 1 copy
  - Item supplied with the electromagnetic brake type actuator and driver package models
    - Varistor..... 1 pc.
  - Item supplied with the connector-coupled actuator and driver package models
    - Actuator connector leads [0.6 m (2 ft.), 5 pins]..... 1 pc.
- (Applicable product: All models for the **DRL20/DRL28** and models of high-resolution motor for the **DRL42/DRL60**)

The actuator (short name) and driver combinations are shown in the table below.

Model (short name)	Actuator model (short name)	Driver model
<b>DRL20</b>	DRLM20	LRD503-K
<b>DRL28</b>	DRLM28	LRD507-K
<b>DRL42</b>	DRLM42	
<b>DRL60</b>	DRLM60	LRD514-K

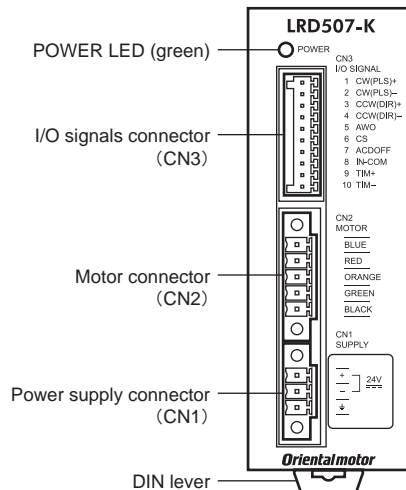
- How to identify the model for the **DRL II Series** actuator and driver package and the actuator model



\*1 : The actuator models begin with a description of "DRLM."  
 \*2 : The code that describes the driver is not included for the actuator models.

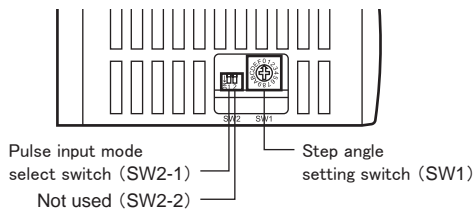
## Names and functions of parts

### Front side of the driver



Name	Description
POWER LED (Green)	This LED is lit while the power is input.
Power supply connector (CN1)	Connects the main power supply (+24 VDC).
Motor connector (CN2)	Connects the motor.
I/O signal connector (CN3)	Connects the I/O signals of the controller.

### Upper side of the driver



Name	Description
Step angle setting switch (SW1)	Sets the step angle.
Pulse input mode select switch (SW2-1)	Selects the pulse input mode.

## Installation

### Location for installation

The driver has been designed and manufactured for use as components to be installed inside equipment. Install them 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 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 (rain, water droplets), oil (oil droplets) or other liquids
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks

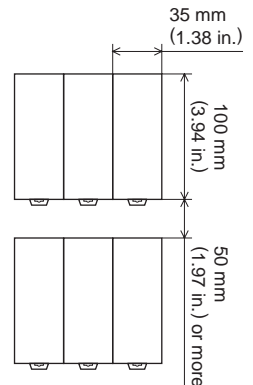
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m (3300 ft.) or lower above sea level

### Installing the driver

#### Installation direction

Mount the driver to a 35 mm (1.38 in.) width DIN rail. When installing two or more drivers in parallel, it is possible to install them closely in the horizontal direction. Provide a minimum clearance of 50 mm (1.97 in.) in the vertical direction.

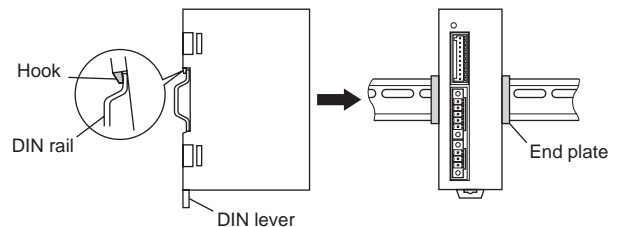
When installing three or more drivers closely, the heat generation of the inside drivers become high. Install the less frequently used drivers toward the inside.



- Note**
- Install the driver in an enclosure whose pollution degree is 2 or better environment, or whose degree of protection is IP54 minimum.
  - Be sure to install the driver vertically (vertical position). If the driver is installed in the direction other than vertical position, its heat radiation effect will deteriorate.

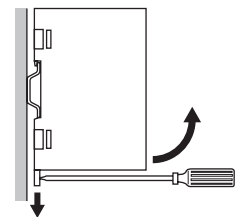
#### Installation method

Pull down the driver DIN lever and lock it. Hang the hook at the rear to the DIN rail, and push in the driver. After installation, secure the both sides of the driver with the end plate.



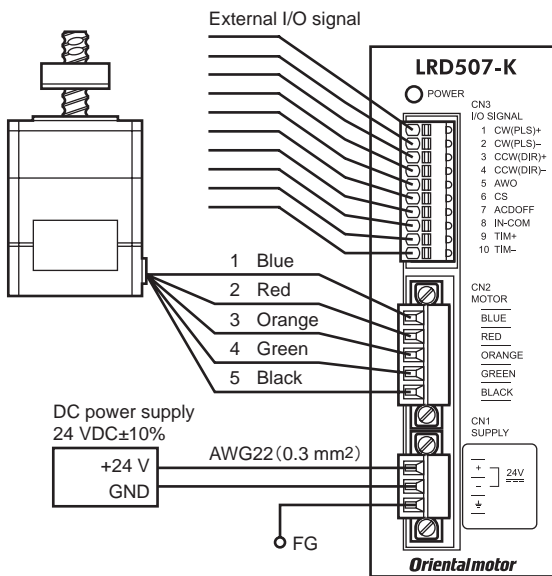
#### Removing from DIN rail

Pull the DIN lever down until it locks using a flat tip screwdriver, and lift the bottom of the driver to remove it from the rail. Use force of about 10 to 20 N (2.2 to 4.5 lb.) to pull the DIN lever to lock it. Excessive force may damage the DIN lever.



## Connection

### ■ Connection example



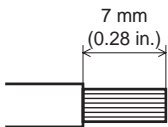
### ■ Power supply current capacity

Driver model	LRD503-K	LRD507-K	LRD514-K
Power supply input voltage	24 VDC ± 10%		
Power supply current capacity	0.7 A or more	1.4 A or more	2.5 A or more

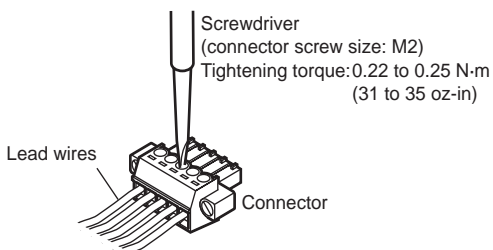
### ■ Connecting method

#### • Common to CN1 and CN2

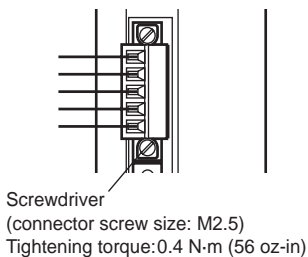
1. Strip the insulation cover of the lead wire by 7 mm (0.28 in.)



2. Insert each lead wire into the connector and tighten the screw.



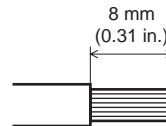
3. Insert the connector and tighten the screws.



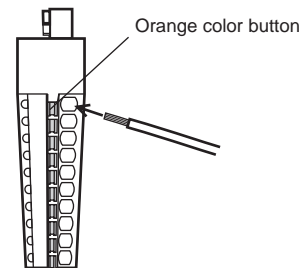
- Note**
- Have the connector plugged in securely. Insecure connections may cause malfunction or damage to the motor or driver.
  - When cycling the power or plugging/unplugging the connector, turn off the power and wait for 5 seconds before doing so.

#### • CN3

1. Strip the insulation cover of the lead wire by 8 mm (0.31 in.)



2. Insert the lead wire while pushing the button of the orange color with a screwdriver.



3. After having inserted, release the button to secure the lead wire.

- Note**
- When connecting, pay attention to the polarity of the power supply. Reverse-polarity connection may cause damage to the driver.
  - Do not wire the power supply cable in the same cable duct with other power line or motor cable.

### ■ Connecting the electromagnetic brake

#### • Connecting the power supply for electromagnetic brake

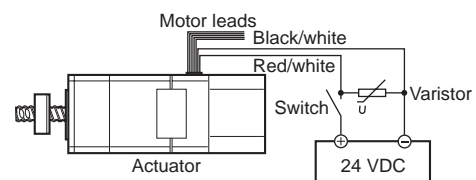
The electromagnetic brake operates via the ON/OFF status of the DC power supply. Provide a DC power supply of 24 VDC ± 5% 0.08 A or more for the **DRL42**, or 24 VDC ± 5% 0.25 A or more for the **DRL60**, for use exclusively for the electromagnetic brake. Use a shielded cable of AWG24 (0.2 mm<sup>2</sup>) or thicker to connect the electromagnetic brake to the DC power supply, keeping the length as short as possible.

#### • Connecting method

Connect two lead wires [600 mm (23.6 in.)] from the actuator to the DC power supply.

1. Connect the red/white lead wire to the +24 VDC terminal of the DC power supply.
2. Connect the black/white lead wire to the ground terminal.
3. Connect the surge suppressor (Varistor:supplied) in parallel between the +24 VDC terminal and ground terminal of the DC power supply.

The surge suppressor does not have polarity.



- Note**
- Do not apply the voltage beyond its specifications. Doing so may increase the temperature rise in the electromagnetic brake, resulting in damage to the actuator. Conversely, insufficient voltage may prevent the brake from releasing.
  - Be sure to connect the surge suppressor 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 in reverse polarity will not properly operate the electromagnetic brake.
  - Provide separate power supplies for the I/O signals and the electromagnetic brake.

## Pin assignments list

### ■ CN1: Power supply connector

Connect using the supplied CN1 connector (3 pins).

Pin No.	Name	Description
1	+24 VDC	+24 VDC power supply input
2	GND	Power supply GND
3	FG	Frame Ground

### ■ CN2: Motor connector

Connect using the supplied CN2 connector (5 pins).

Pin No.	Description
1	Blue motor lead wire
2	Red motor lead wire
3	Orange motor lead wire
4	Green motor lead wire
5	Black motor lead wire

### ■ CN3: I/O signal connector

Connect using the supplied CN3 connector (10 pins).

Pin No.	Type	Signal name	Description
1	Input	CW(PLS)+*	CW pulse signal (Pulse signal)*
2		CW(PLS)-*	
3		CCW(DIR)+*	CCW pulse signal (Rotation direction signal)*
4		CCW(DIR)-*	
5		AWO	All winding off signal
6		CS	Step angle select signal
7	Output	ACDOFF	Automatic current cutback release signal
8		IN-COM	Input common
9		TIM+	Timing signal
10		TIM-	

\* The descriptions in parentheses apply to the 1-pulse input mode.

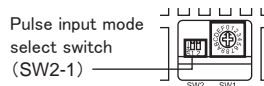
## Setting the switches

**Note** Be sure to turn off the driver power before setting the switches. If the switches are set while the power is still on, the new switch settings will not become effective until the driver power is cycled.

### ■ Pulse input mode

Either the 1-pulse input mode or 2-pulse input mode can be selected in accordance with the controller used.

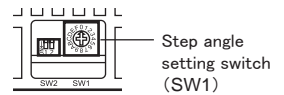
The factory setting of the pulse-input mode depends on the destination country.



ON : 1-pulse input mode  
OFF : 2-pulse input mode

### ■ Step angle (Resolution)

Set a desired step angle using the step angle setting switch (SW1). See the following table for the step angles that can be set. The following table is an example for 1 mm lead of the actuator.



Factory setting: 0

SW1 Dial setting	Number of divisions	Resolution (mm)	Step angle (°)
0	1	0.002	0.72
1	2	0.001	0.36
2	2.5	0.0008	0.288
3	4	0.0005	0.18
4	5	0.0004	0.144
5	8	0.00025	0.09
6	10	0.0002	0.072
7	20	0.0001	0.036
8	25	0.00008	0.0288
9	40	0.00005	0.018
A	50	0.00004	0.0144
B	80	0.000025	0.009
C	100	0.00002	0.0072
D	125	0.000016	0.00576
E	200	0.00001	0.0036
F	250	0.000008	0.00288

- Note**
- The resolutions are given as theoretical values.
  - For the high-resolution motor, the resolution is half of the amount on the table.
  - Do not change the resolution select switch while the actuator is operating. Doing so may cause the actuator to malfunction.

- Conversion formula for number of divisions

$$\text{Number of divisions} = \frac{\text{Basic resolution [mm (in.)]}}{\text{Resolution [mm (in.)]}}$$

- Basic resolution list

Model	Basic resolution [mm (in.)]	
	Standard motor	High-resolution motor
<b>DRL20</b> [Lead 1 mm (0.039 in.)]	0.002 (0.000079)	—
<b>DRL28</b> [Lead 1 mm (0.039 in.)]	0.002 (0.000079)	0.001 (0.000039)
<b>DRL42</b> [Lead 2 mm (0.079 in.)]	0.004 (0.00016)	0.002 (0.000079)
<b>DRL42</b> [Lead 8 mm (0.315 in.)]	0.016 (0.00063)	—
<b>DRL60</b> [Lead 4 mm (0.157 in.)]	0.008 (0.00031)	0.004 (0.00016)

## 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.

### Warning

Handling the product without observing the instructions that accompany a “Warning” symbol may result in serious injury or death.

#### General

- Do not use the product 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 product. Failure to do so may result in fire or injury.
- When the actuator is used for vertical drive such as elevating equipment etc., provide a safety brake mechanism in addition to using an electromagnetic brake type actuator to hold the load position. The actuator loses its holding torque if the power is shut off, allowing the moving part to fall and possibly cause injury or damage to equipment.
- Do not use the brake mechanism of the electromagnetic brake type actuator to reduce speed or as a safety brake. Use the electromagnetic brake to hold the moving part or actuator in position. Failure to do so may result in injury or damage to equipment.

#### Installation

- Install the driver in an enclosure in order to prevent injury.

#### Connection

- Always use the driver with a power supply of the rated voltage. Failure to do so may result in fire.
- For the driver power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock.
- Connect the lead wires and cables securely according to the wiring diagram. Failure to do so may result in fire.
- Do not forcibly bend, pull or pinch the power supply cable or motor lead wire. Doing so may result in fire.

#### Operation

- Turn off the power supply to the driver in case of a power failure. Failure to do so may result in injury or equipment damage when the actuator starts suddenly upon power recovery.
- Do not turn the AWO input ON while operating the actuator. Doing so may cause the actuator to stop and to lose the holding torque, and possibly cause injury or damage to equipment.
- Set the operating speed and travel amount so that the moving part (screw shaft) of the actuator does not stop by hitting the stroke end or load. Failure to do so may result in injury or damage to equipment.
- Do not set the operating current or standstill current too low. Doing so may cause the moving part to fall, resulting in injury or damage to equipment.

#### Repair, disassembly and modification

- Do not disassemble or modify the driver. This may cause injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.

### Caution

Handling the product without observing the instructions that accompany a “Caution” symbol may result in injury or property damage.

#### General

- Do not use the driver beyond its specifications. Doing so may result in injury or damage to equipment.
- Do not touch the driver while operating or immediately after stopping. The driver surface is hot and may cause a skin burn(s).
- Do not forcibly bend or pull the power supply cable or motor lead wire that is connected to the driver. Doing so may cause stress to the driver, which may result in damage.

#### Installation

- Keep the area around the driver free of combustible materials. Failure to do so may result in fire or skin burn(s).
- Do not leave anything around the driver that would obstruct ventilation. Doing so may result in damage to equipment.

#### Operation

- Use the actuator and driver in the specified combination. Failure to do so may result in fire.
- 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.
- Turn on the power to the driver after making sure all input signals of the driver are turned OFF. Failure to do so may cause the actuator to start accidentally, resulting in injury or damage to equipment.
- Do not touch the moving part (screw shaft) of the actuator while operating. Doing so may cause injury.
- Before moving the moving part (screw shaft) directly by hands (manual alignment, etc.), confirm that the AWO input of the driver is turned ON. Failure to do so may result in injury.
- Immediately when trouble has occurred, stop running and turn off the driver power. Failure to do so may result in fire or injury.

#### Disposal

- To dispose of the driver, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.

## Precautions for use

- Conduct the insulation resistance test or dielectric strength test separately on the actuator and the driver

Conducting the insulation resistance measurement or withstand voltage test with the actuator and driver connected may result in injury or damage to equipment.

- Acceleration (acceleration/deceleration rate)

The acceleration (acceleration/deceleration rate) when starting or stopping the actuator must be within the specified range, irrespective of the loaded mass. Operating at the acceleration (acceleration/deceleration rate) beyond the specified range may result in a loss of position.

- **Operating speed**

The operating speed of the actuator must be within the specified range, including during acceleration.

- **Do not stop the moving part (screw shaft) by hitting the stroke end or load**

Do not stop the moving part (screw shaft) by hitting the stroke end or equipment when operating. The mechanical impact may cause damage to the actuator. If the moving part (screw shaft) hits the stroke end or equipment, remove the load and return the moving part (screw shaft) at the recommended starting speed.

- **Use an electromagnetic brake type actuator in vertical drive such as an elevating equipment**

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

- **Regeneration**

When a large inertial load is operated at high speed, regeneration energy will generate and increase the power supply voltage, which may damage the driver. Check the operating condition so that regeneration voltage will not generate.



- Unauthorized reproduction or copying of all or part of this manual is prohibited.
- Oriental Motor shall not be liable whatsoever for any problems relating to industrial property rights arising from use of any information, circuit, equipment or device provided or referenced in this manual.
- Characteristics, specifications and dimensions are subject to change without notice.
- While we make every effort to offer accurate information in the manual, we welcome your input. Should you find unclear descriptions, errors or omissions, please contact the nearest office.
- **Orientalmotor** is a registered trademark or trademark of Oriental Motor Co., Ltd., in Japan and other countries.

© Copyright ORIENTAL MOTOR CO., LTD. 2013

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

ORIENTAL MOTOR U.S.A. CORP. Technical Support Tel:(800)468-3982 8:30 A.M. to 5:00 P.M., P.S.T. (M-F) 7:30 A.M. to 5:00 P.M., C.S.T. (M-F) E-mail: techsupport@orientalmotor.com www.orientalmotor.com	SHANGHAI ORIENTAL MOTOR CO.,LTD. Tel:400-820-6516 Fax:021-6278-0269
ORIENTAL MOTOR (EUROPA) GmbH Headquarters and Düsseldorf Office Tel:0211-52067-00 Fax:0211-52067-099 Munich Office Tel:089-3181225-00 Fax:089-3181225-25 Hamburg Office Tel:040-76910443 Fax:040-76910445	TAIWAN ORIENTAL MOTOR CO.,LTD. Tel:(02)8228-0707 Fax:(02)8228-0708 SINGAPORE ORIENTAL MOTOR PTE LTD Tel:+65-6745-7344 Fax:+65-6745-9405 ORIENTAL MOTOR (MALAYSIA) SDN. BHD. Tel:(03)22875778 Fax:(03)22875528 ORIENTAL MOTOR (THAILAND) CO.,LTD. Tel:+66-2-251-1871 Fax:+66-2-251-1872
ORIENTAL MOTOR (UK) LTD. Tel:01256-347090 Fax:01256-347099	INA ORIENTAL MOTOR CO.,LTD. KOREA Tel:080-777-2042 Fax:02-2026-5495
ORIENTAL MOTOR (FRANCE) SARL Tel:01 47 86 97 50 Fax:01 47 82 45 16	ORIENTAL MOTOR CO.,LTD. Headquarters Tokyo, Japan Tel:03-6744-0361 Fax:03-5826-2576
ORIENTAL MOTOR ITALIA s.r.l. Tel:02-93906346 Fax:02-93906348	