Oriental motor

HP-P025-4

5-phase stepping motor unit
CRK Series Built-in Controller (Stored Program) Information

Thank you for purchasing an Oriental Motor product.

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 machinery, and must not be used for any other purpose.
For the driver’s 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 CRK series built-in controller (Stored program) is a unit product consisting of a 5-phase stepping motor driver with built-in controller function and a 5-phase stepping motor offering high torque with low vibration. The driver supports I/O control and RS-485 communication.
Set the operating data and parameters using RS-485 communication.

■ Hazardous substances

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

■ 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.

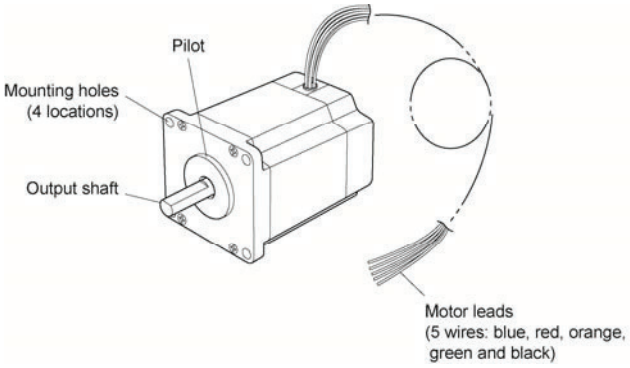
- Motor.....1 pc.
- Driver.....1 pc.
- CN1 Power supply connector (3 terminals).....1 pc.
- CN2 I/O ribbon cable/connector assembly [1 m (3.3 ft.)].....1 pc.
- CN4 lead wire/connector assembly (5 leads) [0.6 m (2 ft.)].....1 pc.
- CN5 encoder lead wire/connector assembly (9 leads) [0.6m (2 ft.)]..... 1 pc. (Encoder Motor/Driver models only)
- Information (this document).....1 copy
- Motor lead wire/connector assembly (5 leads) [0.6 m (2 ft.)]..... 1 pc. (High torque and High Resolution type motors only)
- Encoder motor lead wire/connector assembly [0.6m (2 ft.)] .....1 pc. (Encoder motors only)
- Software manual (HP-P024) is available for download for free at: www.orientalmotor.com/support/operator_manuals.htm.

An optional Immediate Motion Creator (IMC) Graphical User Interface (GUI) is available for downlad for free at:
http://www.orientalmotor.com/support/software/software.html

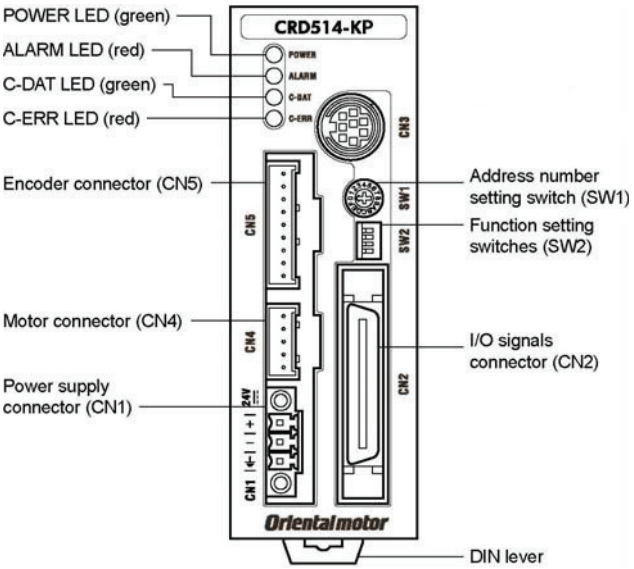
■ Names and functions of parts

● Motor

Illustration shows the PK56□ standard type.

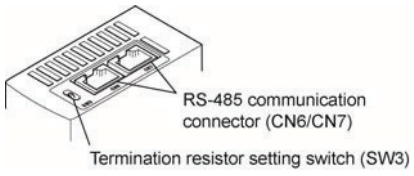


● Front of the driver



Name	Description
POWER LED (green)	This LED is lit while the main power is input.
ALARM LED (red)	This LED will blink when an alarm generates (a protective function is triggered). You can check the generated alarm by counting the number of times the LED blinks.
C-DAT LED (green)	This LED will blink or illuminate steadily when the driver is communicating with the master station properly via RS-485 communication.
C-ERR LED (red)	This LED will illuminate when a RS-485 communication error occurs with the master station.
Address number setting switch (SW1)	Set the address number for RS-485 communication.
Function setting switches (SW2)	No.1 to 3: Set the baud rate for RS-485 communication. No.4: Set device to single or multi axis mode
Power supply connector (CN1)	Connection for the main power supply (+24 VDC)
I/O signals connector (CN2)	Connection for the I/O signals.
Unused connector (CN3)	Not Used
Motor connector (CN4)	Connection for the motor.
Encoder connector (CN5)	Connection for the encoder.

● Top of the driver



Name	Description
Termination resistor setting switch (SW3)	Set the termination resistor (120 Ω) for RS-485 communication.
RS-485 communication connector (CN6/CN7)	Connect the RS-485 communication cable. (Not Supplied)

Installation

■ Location for installation

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

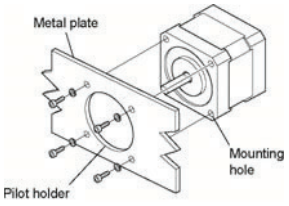
- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature
  Motor: -10 to +50 °C (+14 to +122 °F) (non-freezing)
  Driver: 0 to +40 °C (+32 to +104 °F) (non-freezing)
- Operating ambient humidity 85% or less (non-condensing)
- Area that is free of explosive 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

■ Installing the motor

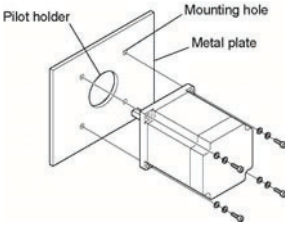
The motor can be installed in any direction. Install the motor onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity. When installing the motor, secure it with four bolts (not supplied) through the four mounting holes. Do not leave a gap between the motor and metal plate.

Note Insert the pilot located on the motor's installation surface into the mounting plate's pilot hole.

Installation method A



Installation method B



Screw size, tightening torque and installation method

Motor type (with or without Encoder)	Frame size [mm (in.)]	Nominal size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Installation method
Standard, High resolution, High Torque	20 (0.79)	M2	0.25 (35.4)	2.5 (0098	A
	28 (1.10)	M2.5	0.5 (70.8)		
	42 (1.65)	M3	1 (142)	4.5 (0.177)	
	60 (2.36)	M4	2 (280)	–	B
TH geared	28 (1.10)	M2.5	0.5 (70.8)	4 (0.157)	A
	42 (1.65) 60 (2.36)	M4	2 (280)	8 (0.315)	
PS geared	28 (1.10)	M3	1 (142)	6 (0.236)	A
	42 (1.65)	M4	2 (280)	8 (0.315)	
	60 (2.36)	M5	2.5 (350)	10 (0.394)	
Harmonic geared	20 (0.79)	M2	0.35 (49)	3 (0.118)	A
	30 (1.18)	M3	1 (142)	4 (0.167)	
	42 (1.65)	M3	1.4 (198)	6 (0.236)	
	60 (2.36)	M4	2.5 (350)	6 (0.236)	

■ Permissible overhung load and permissible thrust load

The overhung load on the motor's output shaft or gear output shaft must be kept within the permissible values for each part number. The thrust load must not exceed the motor's mass. Please visit our website, www.orientalmotor.com, for more specific information for each motor type.

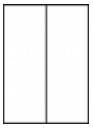
Installing the driver

● Installation direction

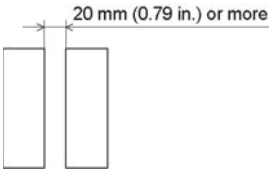
Use a DIN rail 35 mm (1.38 in.) wide to mount the driver. Provide 50 mm (1.97 in.) clearances in the horizontal and vertical directions between the driver and enclosure or other equipment within the enclosure.
Refer to the following figure for the required distances between adjacent drivers when two or more drivers are installed in parallel.

Note Be sure to install (position) the driver vertically. When the driver is installed in any position other than vertical, the heat radiation capability of the driver will drop.

• CRD503-KP, CRD507-KP, CRD507H-KP
Two or more CRD503-KP, CRD507-KP or CRD507H-KP units can be placed in contact with each other in the horizontal direction. Provide a clearance of 50 mm (1.97 in.) or more in the vertical direction.

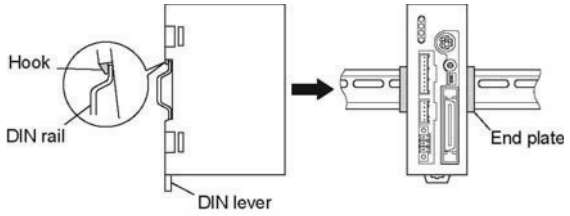


• CRD514-KP
Provide a clearance of 20 mm (0.79 in.) or more in the horizontal direction, and 50 mm (1.97 in.) or more in the vertical direction.



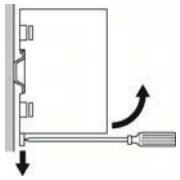
● Installation method

Push up the driver's DIN lever until it locks. Hang the hook at the rear to the DIN rail, and push in the driver. After installation, fix the both sides of the driver with an 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 a force of about 10 to 20 N (2.2 to 4.5 lb.) to pull the DIN lever down to lock it. Excessive force may damage the DIN lever.



Pin assignments lists

■ CN1: Power supply connector

Connect using the supplied CN1connector (3 terminals).

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

■ CN2: I/O signals connector

Connect using the supplied CN2 ribbon cable/connector assembly.

Lead wire color	Upper ribbon cable		
	Pin No.	Signal name	Description
Brown-1	A1	IN-COM0	Input common
Red-1	A2	START	Start input
Orange-1	A3	ALMCLR	Alarm Clear input
Yellow-1	A4	CROFF	Current Off input
Green-1	A5	ABORT	ABORT input
Blue-1	A6	IN1	General inputs *
Purple-1	A7	IN2	
Gray-1	A8	IN3	
White-1	A9	IN4	
Black-1	A10	IN5	
Brown-2	A11	IN6	
Red-2	A12	HOME	Homing Operation input
Orange-2	A13	PSTOP	Panic Stop input
Yellow-2	A14	SENSOR	Sensor input
Green-2	A15	+LS	+ Limit Sensor input
Blue-2	A16	-LS	− Limit Sensor input
Purple-2	A17	HOMES	Mechanical Home Sensor input
Gray-2	A18	SLIT	Slit sensor input
White-2	A19	N.C.	Not used
Black-2	A20	IN-COM1	Sensor input common

* The function of General Input 1(IN1) to 6(IN6) can be assigned unique functions using the "INxxx" commands.

Lead wire color	Lower ribbon cable		
	Pin No.	Signal name	Description
Brown-3	B1	MOVE+	Motor Moving output
Red-3	B2	MOVE−	
Orange-3	B3	ALM+	Alarm output
Yellow-3	B4	ALM−	
Green-3	B5	OUT1+	General output 1 *
Blue-3	B6	OUT1−	
Purple-3	B7	OUT2+	General output 2 *
Gray-3	B8	OUT2−	
White-3	B9	OUT3+	General output 3 *
Black-3	B10	OUT3−	
Brown-4	B11	OUT4+	General output 4 *
Red-4	B12	OUT4−	
Orange-4	B13	N.C.	Not used
Yellow-4	B14	N.C.	Not used
Green-4	B15	PLS-OUT+	Pulse output (Line driver output)
Blue-4	B16	PLS-OUT−	
Purple-4	B17	DIR-OUT+	Direction output (Line driver output)
Gray-4	B18	DIR-OUT−	
White-4	B19	GND	GND
Black-4	B20	N.C.	Not used

* The function of General Output 1(Out1) to 4(Out4) can be assigned unique functions using the "OUTxxx" commands.

■ CN4: Motor connector

Connect the motor using the supplied CN4 leadwire/connector assembly (5 leads).

Pin No.	Name	Description
1	BLUE	Blue motor lead
2	RED	Red motor lead
3	ORANGE	Orange motor lead
4	GREEN	Green motor lead
5	BLACK	Black motor lead

■ CN5: Encoder connector

If an encoder is to be used, connect the encoder using the supplied CN5 leadwire/connector assembly (9 leads).

Pin No.	Signal name	Lead wire color	Description
1	ENC-A+	Red	Encoder input A-channel (Line receiver)
2	ENC-A−	Brown	
3	ENC-B+	Green	Encoder input B- channel (Line receiver)
4	ENC-B−	Blue	
5	ENC-I+	Yellow	Encoder input Index signal (Line receiver)
6	ENC-I−	Orange	
7	+5 VDC OUT	White	+5 VDC power supply output for encoder
8	GND	Black	GND
9	SHIELD	Purple	Shield (connect to GND)

■ CN6/7: RS-485 communication connector

Use these connectors to connect to RS-485 communication.

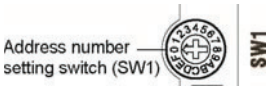
Pin No.	Signal name	Description
1	N.C.	Not used
2	GND	GND
3	TR+	RS-485 communication signal (+)
4	N.C.	Not used
5	N.C.	Not used
6	TR−	RS-485 communication signal (−)
7	N.C.	Not used
8	N.C.	Not used

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.

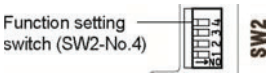
■ Address number

Set the address number using the address setting switch (SW1).
Factory setting:
SW1: 0, (address number 0)



■ Multi-axis mode

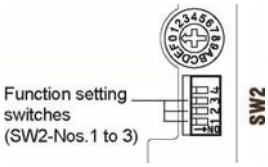
Set the to device to multi-axis mode using the multi-axis mode setting switch (SW2-No.4) to ON.
Factory setting:
SW2-No.4: OFF, (single axis mode)



Address number	SW1
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

■ Baud rate

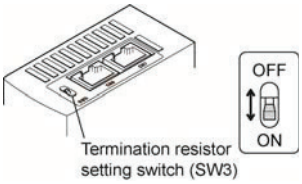
Set the baud rate using Nos. 1 to 3 of the function setting switch (SW2).
Factory setting:
All OFF (9600 bps)



Baud rate (bps)	SW2-No.3	SW2-No.2	SW2-No.1
9600	OFF	OFF	OFF
19200	OFF	OFF	ON
38400	OFF	ON	OFF
57600	OFF	ON	ON
115,200	ON	OFF	OFF
115,200	ON	OFF	ON
115,200	ON	ON	OFF
115,200	ON	ON	ON

■ Termination resistor

Set the termination resistor for RS-485 communication (120 Ω) using the termination resistor setting switch (SW3).
Factory setting:
OFF (termination resistor disabled)



SW3	Termination resistor (120 Ω)
OFF	Disabled
ON	Enabled

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, electric shock or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire, electric shock or injury.
- The motor will lose its holding torque when the power supply or motor excitation turned off. If this product is used in a vertical application, be sure to provide a measure for the position retention of moving parts. Failure to provide such a measure may cause the moving parts to fall, resulting in injury or damage to the equipment.
- With certain types of alarms (protective functions), the motor may stop when the alarm generates and the holding torque will be lost as a result. This will result in injury or damage to equipment.
- When an alarm is generated, first remove the cause and then clear the alarm. Continuing the operation without removing the cause of the problem may cause malfunction of the motor and driver, leading to injury or damage to equipment.

- Connection
- Keep the driver's input-power voltage within the specified range to avoid fire.
- For the driver's 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 cables securely according to the wiring diagram in order to prevent fire.
- Do not forcibly bend, pull or pinch the power supply cable and motor cable. Doing so may cause a fire. This will cause stress to the connecting section and may result in damage to equipment.

Operation

- Turn off the driver power in the event of a power failure, or the motor may suddenly start when the power is restored and may cause injury or damage to equipment.
- Do not turn the excitation to off while the motor is operating. The motor will stop and lose its holding ability, which may result in injury or damage to equipment.
- Configure an interlock circuit using a sequence program so that when a RS-485 communication error occurs, the entire system including the driver will operate safely.

Repair, disassembly and modification

- Do not disassemble or modify the motor and 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 motor and driver beyond its specifications, or injury or damage to equipment may result.
- Keep your fingers and objects out of the openings in the motor and driver, or fire or injury may result.
- Do not touch the motor and driver during operation or immediately after stopping. The surface is hot and may cause a skin burn(s).

Transportation

- Do not hold the motor output shaft or motor cable. This may cause injury.

Installation

- Install the motor and driver in the enclosure in order to prevent injury.
- Keep the area around the motor and driver free of combustible materials in order to prevent fire or a skin burn(s).
- Provide a cover over the rotating parts (output shaft) of the motor to prevent injury.

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a 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.
- Before supplying power to the driver, turn all control input to the driver to OFF. Otherwise, the motor may start suddenly at power ON and cause injury or damage to equipment.
- Set the speed and acceleration/deceleration rate at reasonable levels. Otherwise, the motor will misstep and the moving part may move in an unexpected direction, resulting in injury or damage to equipment.
- Do not touch the rotating part (output shaft) during operation. This may cause injury.
- Before moving the motor directly with the hands, confirm that the power supply or motor excitation turned off and motor current is cut off. Failure not to do 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 running motor, attach a warning label as shown below in a conspicuous position. Failure to do so may result in skin burn(s).

Warning label

- Immediately when trouble has occurred, stop running and turn off the driver power. Failure to do so may result in fire or injury.
- Static electricity may cause the driver to malfunction or suffer damage. While the driver is receiving power, do not touch the driver. Use only an insulated screwdriver to adjust the driver's switches.

Disposal

- To dispose of the motor and driver, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste. If you have any question, contact your nearest Oriental Motor branch or sales office.

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