



High-Torque 2-Phase Stepping Motor Unit

CSK Series

OPERATING MANUAL

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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.

Notes to the user

- This product must be handled by qualified personnel with expert knowledge of electrical and mechanical engineering. Before using the product, read “Safety precautions” carefully to ensure correct use.
- The product is designed and manufactured for use as an internal component for general industrial equipment. Do not use the product for any other purpose. For the driver, use a DC power source with reinforced insulation provided on the primary and secondary sides. Oriental Motor shall not be liable whatsoever for any damage arising from a failure to observe this warning.
- Should you require the inspection or repair of internal parts, contact the Oriental Motor office where you purchased the product.
- Oriental Motor shall not be liable whatsoever for any patent-related problem arising out of the use of any information, circuitry or equipment mentioned in this document.
- The technical specifications are subject to change without prior notice for the purpose of enhancing the performance of the product.
- The utmost care has been taken to ensure that all information contained in the operating manual is correct. However, please contact your nearest Oriental Motor office should you find any unclear descriptions, errors or omissions.
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Before using this product

This section covers an overview of the **CSK** Series and explains how to comply with the EC Directives, as well as items included in the package.

Introduction

The **CSK** Series high-torque 2-phase stepping motor is a unit product consisting of a driver of the open-chassis type, photocoupler I/O specification and a 2-phase stepping motor designed for high-torque operation. The **CSK** Series includes three types. The standard type has a base motor step angle of 1.8° , while the high-resolution type has a base step angle of 0.9° . A geared type is also available.

Main features

● Compact driver

The **CSK** Series adopts a compact driver using DC power-supply input, making it ideal for use as an internal component in general industrial equipment.

● Two step-angle settings

Either full step or half step can be selected as the step-angle setting for the motor. See page 30.

Type	Full step	Half step
Standard type Geared type*	$1.8^\circ/\text{step}$	$0.9^\circ/\text{step}$
High-resolution type	$0.9^\circ/\text{step}$	$0.45^\circ/\text{step}$

* The step angle of the geared type varies, depending on the gear ratio.

● Adjustable motor-driving currents

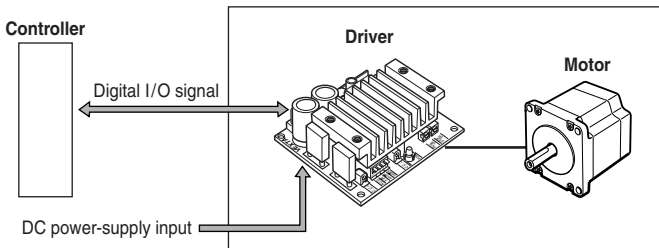
The operating current and standstill current of the motor can be adjusted individually. See page 32, 34.

● High-torque geared motor

The geared type adopts a directly coupled gearhead designed to withstand high torque. Eight gear ratios are available: 3.6:1, 7.2:1, 9:1, 10:1, 18:1, 36:1, 50:1 and 100:1.

■ System configuration

Operating the **CSK** Series requires a controller equipped with a pulse-output function.



As for the voltage supply to the driver, use an EMC-compliant DC power source with reinforced insulation on both the primary and secondary sides.

Compliance with the EC Directives

If compliance with the European Low-Voltage Directive and EMC Directive is required, the user is advised to take full responsibility for the following measures:

The installation conditions that must be satisfied to meet the above directives are as follows:

1. Install the motor and driver inside an enclosure.
2. Use an EMC-compliant DC power source with reinforced insulation on both the primary and secondary sides.
3. Provide protective grounding for the DC power source.
4. Use braided-screen cable for I/O cables.
5. Use a mains filter.

■ Low-Voltage Directive (73/23/EEC)

The **CSK** Series motors and drivers are not subject to the Low-Voltage Directive, since their input power-source voltage is 36 VDC or below. However, the product must satisfy the following conditions with regard to installation and connection:

- Use the product in a protected environment within an enclosure.
- As for the driver's and digital I/O signal's power source, use a DC power source with reinforced insulation on both the primary and secondary sides.

Item	Motor	Driver
Degree of protection	IP20	IP00
Installation conditions	Built-in component (overvoltage category I, pollution degree 2, class III equipment)	

■ EMC Directive (89/336/EEC, 92/31/EEC)

The **CSK** Series motors and drivers have been measured for EMC compliance in accordance with "Installing and wiring for EMC measurement" on page 21.

The user is responsible for ensure compliance with the EMC Directive, based on the installation and wiring reflecting "Installing and Wiring in Compliance with the EMC Directive" on page 20.

Checking the product

Open the package and confirm that all of the following items are available.

Should you find any item missing or damaged, contact the Oriental Motor office where you purchased the product.

Check the model number of the unit against the model number on the package label.

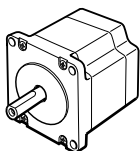
Check the model number of the motor and driver against the model number shown on the respective name-plates.

For the motor-driver combinations of the respective models, see “List of combinations” on page 48.

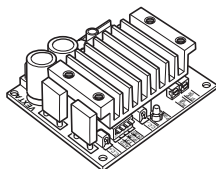
Standard type

● CSK24, CSK26 types

- Motor 1 unit



- Driver 1 unit



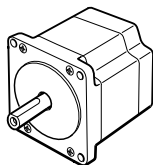
- Connector housings/contacts

Connector	Housing	Contact
● I/O and power supply	1 piece 1-171822-2 12 poles (AMP)	20 pieces 170204-2 (AMP)
● Motor	1 piece 171822-6 6 poles (AMP)	

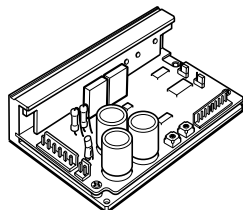
- Operating manual 1 copy

● CSK29 types

- Motor 1 unit



- Driver 1 unit



- Connector housings/contacts

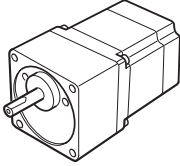
Connector	Housing	Contact
● I/O	1 piece 1-171822-9 9 poles (AMP)	9 pieces 170204-2 (AMP)
● Motor	1 piece VHR-6N 6 poles (JST)	8 pieces BVH-21T-P1.1 (JST)
● Power supply	1 piece VHR-2N 2 poles (JST)	

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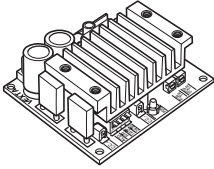
Geared type

● CSK24SG, CSK26SG types

- Motor 1 unit



- Driver 1 unit



- Connector housings/contacts

Connector	Housing	Contact
● I/O and power supply	1 piece 1-171822-2 12 poles (AMP)	20 pieces 170204-2 (AMP)
● Motor	1 piece 171822-6 6 poles (AMP)	

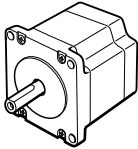
- Motor mounting screws 4 pieces
CSK24SG type: (M3 Cross-recessed screw)
CSK26SG type: (M4 Hexagonal socket screw)

- Operating manual 1 copy

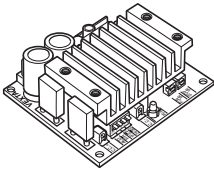
High-resolution type

● CSK24M, CSK26M types

- Motor 1 unit



- Driver 1 unit



- Connector housings/contacts

Connector	Housing	Contact
● I/O and power supply	1 piece 1-171822-2 12 poles (AMP)	20 pieces 170204-2 (AMP)
● Motor	1 piece 171822-6 6 poles (AMP)	

- Operating manual 1 copy

NOTE

- When removing the driver from the conductive protection bag, make sure your hands are not charged with static electricity. This is to prevent damage to the driver due to static electricity.

■ How to read the model number

Standard type

CSK 2 6 6 - A P

① ② ③ ④ ⑤ ⑥

No.	Explanation
①	Name of the series
②	Number of phases: 2
③	4 : 42 mm (1.65 inch) square 6 : 56.4 mm (2.22 inch) square 9 : 85 mm (3.35 inch) square
④	Motor length
⑤	A : Single shaft B : Double shaft
⑥	Photocoupler input

Geared type

CSK 2 6 4 A P - SG 3.6

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

No.	Explanation
①	Name of the series
②	Number of phases: 2
③	4 : 42 mm (1.65 inch) square 6 : 60 mm (2.36 inch) square
④	Motor length
⑤	A : Single shaft B : Double shaft
⑥	Photocoupler input
⑦	SH geared type
⑧	Gear ratio

High-resolution type

CSK 2 6 6 M A P

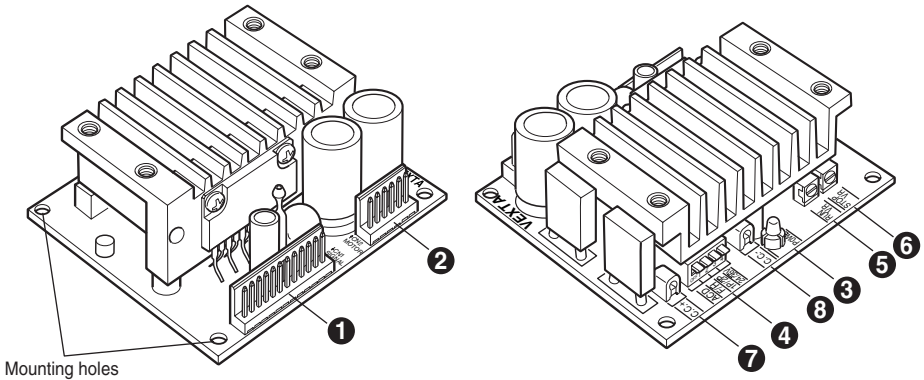
① ② ③ ④ ⑤ ⑥ ⑦

No.	Explanation
①	Name of the series
②	Number of phases: 2
③	4 : 42 mm (1.65 inch) square 6 : 56.4 mm (2.22 inch) square
④	Motor length
⑤	High-resolution type
⑥	A : Single shaft B : Double shaft
⑦	Photocoupler input

■ Names and functions of driver parts

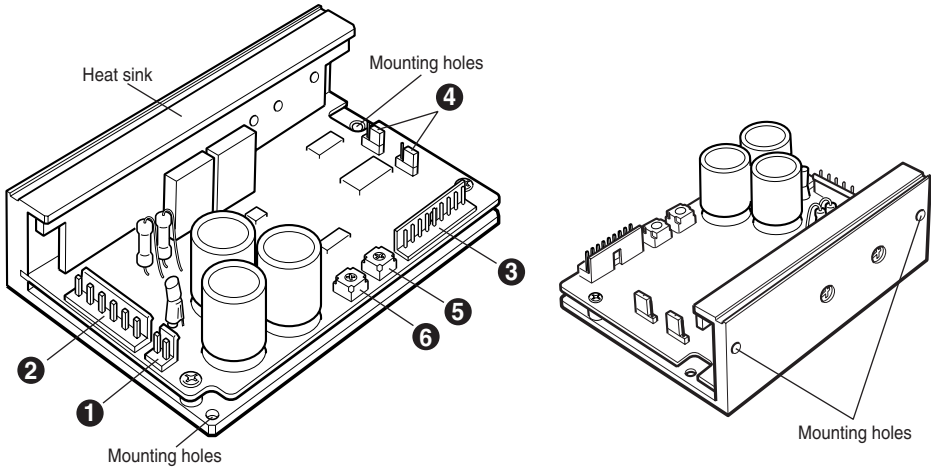
This section covers the names and functions of the driver's respective parts.
See the reference page indicated for details on each part.

● CSD2109-P, CSD2112-P, CSD2120-P



- 1 I/O power-supply connector (CN1 SIGNAL) → 24**
Connected to I/O signals and a 24 VDC or 36 VDC power supply.
- 2 Motor connector (CN2 MOTOR) → 24**
Connected to motor leads.
- 3 Power-supply input indicator LED (POWER)**
Remains lit while current is supplied (green).
- 4 Function-setting switches**
These switches are used to set driver functions.
 - Automatic current-cutback function switch (ACD) → 30
This switch enables or disables the automatic current-cutback function.
The switch is factory-set to [ON: enable automatic current-cutback].
 - Step-angle switch (F/H) → 30
This switch sets the motor's step angle (full step/half step).
The switch is factory-set to [ON (F): full step].
 - Pulse-input mode switch (1P/2P) → 31
Set to 2-pulse input mode or 1-pulse input mode according to the pulse output mode of the positioning controller.
The switch is factory-set to [OFF (2P): 2-pulse input mode].
 - Power-supply voltage switch (24/36 V) → 31
Set to 24 V or 36 V, according to the driver's power-supply voltage.
The switch is factory-set to [ON (24 V)].
- 5 Potentiometer for adjusting the motor operating current (RUN VR) → 33**
This potentiometer sets the operating current of the motor.
If there is sufficient torque, the current setting can be reduced to suppress increases in motor/driver temperatures.
The potentiometer is factory-set to [the rated current].
- 6 Potentiometer for adjusting the motor standstill current (STOP VR) → 33**
This potentiometer sets the current when the motor is at a standstill (in the current-cutback state).
The potentiometer is factory-set to [40 percent of the rated current].
- 7 Positive check terminal for motor operating current (C.C. +) → 35**
This terminal is used to check the motor operating current.
- 8 Negative check terminal for motor operating current (C.C. -) → 35**
This terminal is used to check the motor operating current.

● CSD2140P, CSD2145P



- 1 Power-supply connector (CN1 POWER) → 25**
Connected to a 24 VDC power supply.
- 2 Motor connector (CN2 MOTOR) → 25**
Connected to motor leads.
- 3 I/O connector (CN3) → 25**
Connected to I/O signals.
- 4 Function-setting switches**
These switches are used to set driver functions.
 - **Automatic current-cutback function switch (C.C/A.C.D) → 30**
This switch enables or disables the automatic current-cutback function.
The switch is factory-set to [A.C.D: enable automatic current-cutback].
 - **Step-angle switch (FULL/HALF) → 30**
This switch sets the motor's step angle (full step/half step).
The switch is factory-set to [FULL: full step].
- 5 Potentiometer for adjusting the motor operating current (RUN VR) → 34**
This potentiometer sets the operating current of the motor.
If there is sufficient torque, the current setting can be reduced to suppress increases in motor/driver temperatures.
The volume is factory-set to [the rated current].
- 6 Potentiometer for adjusting the motor standstill current (STOP VR) → 35**
This potentiometer sets the current when the motor is at a standstill (in the current-cutback state).
The volume is factory-set to [40 percent of the rated current].

Safety precautions

This product is designed for incorporation into industrial equipment. Touching the product during operation may result in bodily injury or property damage, since the output shaft is rotating and the surface remains very hot.

To prevent bodily injury or damage to the product, be sure the product is handled and operated only by qualified personnel familiar with operations involving electronic equipment.

The precautions provided in this section are intended to ensure safe and correct use of the product, thereby preventing damage or injury to the user or other personnel. Fully understand the meaning of each item before using the product.



Warning

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



Caution

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

NOTE

These notes appear throughout the manual and describe items that must be observed by the user in certain situations to ensure correct use of the product.



Warning

General

- Do not use the product in an atmosphere containing explosive, flammable or corrosive gases, in a place exposed to water, or near flammable objects. Doing so may result in fire 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 or injury.
- Provide a measure to retain the position of the movable part of the equipment when the product is used in a vertical application. The motor loses its holding capability when the power is cut off. Without an appropriate measure the movable part will descend, resulting in injury or equipment damage.

Installation

- Install the motor and driver in an enclosure so that the operator cannot touch them. Direct contact may result in injury.

Connection

- Always use the driver with a power source of the rated voltage. Failure to do so may result in fire or electric shock.
- For the driver, use a DC power source with reinforced insulation provided on the primary and secondary sides. Failure to do so may result in electric shock.
- The digital I/O part does not have reinforced insulation. For the digital I/O, use a DC power source with reinforced insulation provided on the primary and secondary sides. Failure to do so may result in electric shock.
- Connect the product correctly and securely according to the wiring diagram. Failure to do so may result in fire.

Operation

- Turn off the power to the driver in case of a power failure. Failure to do so may result in injury or equipment damage when the motor starts suddenly upon power recovery.
- Do not turn the C.OFF (current-off) input to ON while the motor is operating. If the input is turned ON, the motor will stop and lose its holding capability, causing possible injury or equipment damage.

Repair, disassembly and modification

- Do not repair, disassemble or modify the driver. Doing so may result in fire or injury.



Caution

General

- Do not use the motor and driver beyond their specifications. Doing so may result in injury or equipment damage.
- Do not touch the motor or driver's heat sink while the driver is conducting current. Doing so may result in burns.

Transportation

- Do not hold the motor by the output shaft or cable. Doing so may result in injury.

Installation

- Do not place flammable objects near the motor or driver. Doing so may result in fire or burns.
- Do not place objects near the motor or driver that may prevent proper ventilation. Doing so may result in equipment damage.
- Provide a cover for the rotating part of the motor (output shaft). Failure to do so may result in injury.

Operation

- Use a motor and driver in the specified combination. Failure to do so may result in fire or equipment damage.
- Before operating, confirm that the emergency-stop function is working properly. Failure to do so may result in injury.
- Turn on the power to the driver after making sure all control inputs of the driver are turned OFF. Failure to do so may cause the motor to start accidentally, resulting in injury or equipment damage.
- If the motor's output shaft must be moved directly by hand (for manual alignment, etc.), do so after confirming that the driver's C.OFF (current-off) input is ON. Failure to do so may result in injury.
- Do not touch the rotating part of the motor (output shaft) during operation. Doing so may result in injury.
- Should you find any abnormality, immediately turn off the power to the driver. Failure to do so may result in fire or injury.

Disposal

- When disposing of the motor and driver, treat them as ordinary industrial waste. Engage a certified waste-disposal service to carry out the disposal.

Precautions for use

This section covers the limitations and points to note regarding use of the **CSK** Series.

● Overhung load

Always operate the motor within the allowable overhung load.

Continuing to operate the motor under an overhung load exceeding the allowable value may damage the motor bearing or output shaft.

● Motor case temperature

When operating the motor, keep the motor's case temperature to 100°C (212°F) or below.

If that temperature exceeds 100°C (212°F) due to operating conditions (ambient temperature, operating speed, duty, etc.), the motor coil may be burned or the life of the bearing shortened.

● Driver's heat-sink temperature

When operating the motor, keep the driver's heat-sink temperature to 80°C (176°F) or below.

If the temperature exceeds 80°C (176°F), the driver may be damaged.

● Provide a measure to retain the position of the equipment's movable part when this unit is used in a vertical application

The motor loses its holding-brake force when the power is cut off. Therefore, provide a measure to retain the position of the equipment's movable part when this unit is used in a vertical application such as a lifter.

● Maximum static torque at excitation

The maximum static torque at excitation represents the torque when the motor is excited at the rated current. If the motor is combined with a dedicated driver, the automatic current-cutback function reduces the maximum static torque at excitation to around 40 percent. (The specific value varies, depending on the motor standstill current that is set.) Once started, the motor can be accelerated or operated at the maximum static torque at excitation. However, the holding torque drops to around 40 percent while the motor is at a standstill. Therefore, when selecting a motor consider the reduced holding torque at motor standstill of around 40 percent of the maximum static torque at excitation.

● Driver connectors

Always use the supplied connectors for connecting the power supply, I/O signals and motor to the driver. When crimp-fitting the leads to the contact, secure a strong connection using a crimping tool as specified by the connector manufacturer. Oriental Motor does not supply crimping tools.

● Measure insulation resistance or conduct a dielectric-strength test on your product alone

Measuring insulation resistance or conducting dielectric-strength test with the motor and driver connected may damage your product.

Geared type

● Allowable torque

Operate the motor by making sure the sum of the acceleration/deceleration torque at the starting/stopping of the motor and the load (friction) torque doesn't exceed the allowable torque.

Operating the motor in excess of the allowable torque may result in a damaged gear.

● Allowable speed range

Operate the motor at speeds within the allowable range.

Operating the motor at a speed outside the allowable range may result in a shorter gear life.

● Backlash

The gear output shaft is subject to backlash of 1° to 2°. Backlash refers to the looseness at the gear output shaft, as generated when the input side of the gear is fixed.

To reduce the effect of backlash, perform positioning operations from one direction only—either from the CW direction or the CCW direction.

● Rotating direction of the gear output shaft

The relationship between the rotating direction of the motor shaft and that of the gear output shaft changes as follows, depending on the gear ratio.

Rotating direction	Gear ratio
Same as the rotating direction of motor shaft	3.6:1, 7.2:1, 9:1, 10:1, 50:1, 100:1
Opposite the rotating direction of motor shaft	18:1, 36:1

Installation

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

Warning

- Install the motor and driver in an enclosure so that the operator cannot touch them. Direct contact may result in injury.

Location for installation

The motor and driver are designed for use in an environment of pollution degree 2.

Install it in a well-ventilated place satisfying the following conditions, where the product can be easily accessed for the purpose of inspection.

- Inside an enclosure installed indoors (with ventilation hole provided)
- Ambient temperature: Motor -10°C to $+50^{\circ}\text{C}$ ($+14^{\circ}\text{F}$ to $+122^{\circ}\text{F}$) [non-freezing]
Driver 0°C to $+40^{\circ}\text{C}$ ($+32^{\circ}\text{F}$ to $+104^{\circ}\text{F}$) [non-freezing]
- Ambient humidity: 85% or less (no dew condensation)
- A place free of explosive gasses, or toxic gases (sulfide gas, etc.) or liquids
- A place not exposed to direct sunlight
- A place not exposed to significant amounts of dust or iron powder
- A place not exposed to water (rain, water droplets), oil (oil droplets) or other liquids
- A place not exposed to air having a high salt content
- A place not subject to continuous vibration or excessive shock
- A place not subject to significant electromagnetic noise caused by welding machines, power equipment, etc.
- A non-vacuum place without radioactive substances or magnetic fields

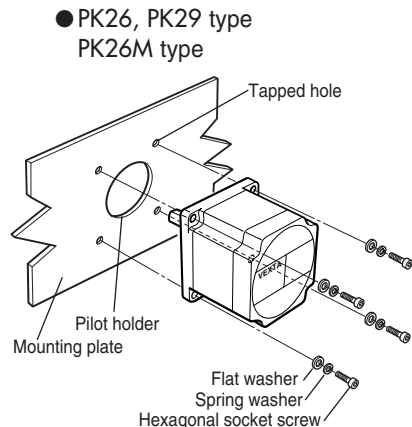
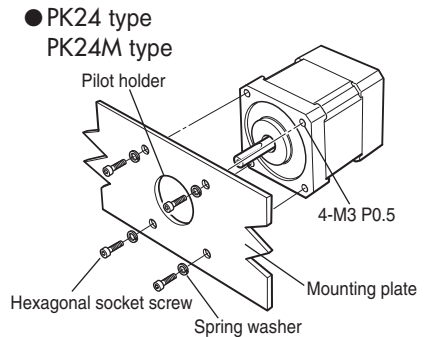
Installing the motor

■ Installation method

Install the motor on an appropriate metal plate with-in the enclosure.

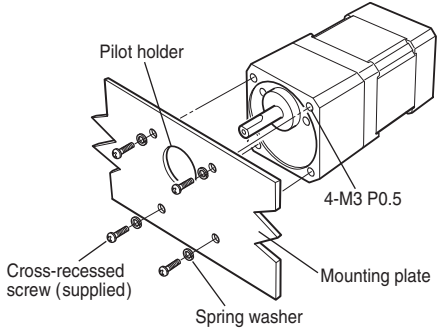
1. Insert the pilot located on the motor's installation surface into the metal plate's countersunk hole or through-hole.
2. Securely tighten the four screws so as to leave no gaps between the motor's installation surface and the metal plate.

Standard type, High-resolution type

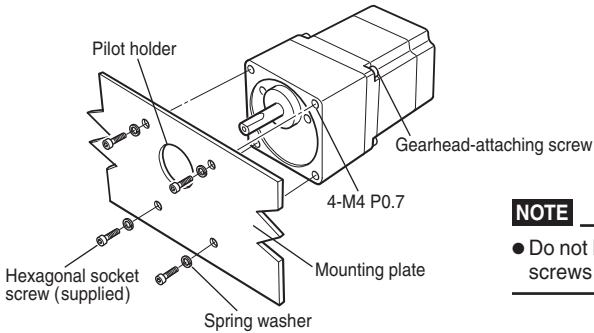


Geared type

● PK24SG type



● PK26SG type



NOTE

- Do not loosen the gearhead-attaching screws (four pieces).

Type	Nominal size	Tightening torque	Effective depth
Standard type	PK24 type	M3	1 N·m (142 oz-in)
	PK26 type	M4	2 N·m (280 oz-in)
	PK29 type	M5	3 N·m (420 oz-in)
Geared type	PK24SG type	M3	1 N·m (142 oz-in)
	PK26SG type	M4	2 N·m (280 oz-in)
High-resolution type	PK24M type	M3	1 N·m (142 oz-in)
	PK26M type	M4	2 N·m (280 oz-in)

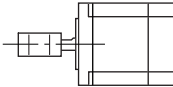
Installing a load

When installing a load to the motor, align the centerlines of the motor's output shaft and load shaft.

An optional flexible coupling (sold separately) may be used.

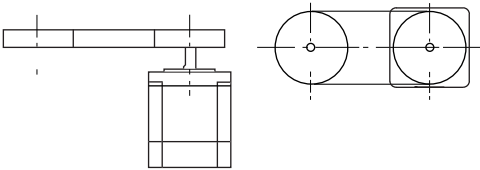
● Direct connection via a coupling

The centerline of the motor's output shaft and that of the load shaft must form a single line.



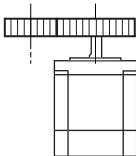
● Belt connection

The motor's output shaft and load shaft must be parallel with each other, with the shafts forming right angles with the line connecting the centers of two pulleys.



● Gear connection

The motor's output shaft and gear shaft must be parallel with each other, with the gear teeth engaging correctly.



NOTE

- When connecting the motor's output shaft with a load, pay attention to the center alignment, belt tension, parallelism of the pulleys, etc. Securely tighten the coupling and pulley-tightening screws.
 - Use caution so as not to damage the output shaft or bearing when installing a coupling or pulleys to the motor's output shaft.
 - Do not modify or machine the motor's output shaft. Doing so may damage the bearing, resulting in a failed motor.
-

Overhung load and thrust load

The overhung load applied to the motor's output shaft must not exceed the allowable values shown in the table below.

The thrust load of the standard type and high-resolution type must not exceed the mass of the motor being used.

■ Allowable overhung loads

Type		Distance from tip of output shaft mm (inch)				
		0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)
Standard type	PK24 type	20 N (4.5 lb.)	25 N (5.6 lb.)	34 N (7.6 lb.)	52 N (11.7 lb.)	—
	PK26 type	54 N (12.1 lb.)	67 N (15 lb.)	89 N (20 lb.)	130 N (29 lb.)	—
	PK29 type	260 N (58 lb.)	290 N (65 lb.)	340 N (76 lb.)	390 N (87 lb.)	480 N (108 lb.)
Geared type	PK24SG type	10 N (2.2 lb.)	15 N (3.3 lb.)	20 N (4.5 lb.)	30 N (6.7 lb.)	—
	PK26SG type Gear ratio: 3.6 to 10	30 N (6.7 lb.)	40 N (9 lb.)	50 N (11.2 lb.)	60 N (13.5 lb.)	70 N (15.7 lb.)
	PK26SG type Gear ratio: 18 to 100	80 N (18 lb.)	100 N (22 lb.)	120 N (27 lb.)	140 N (31 lb.)	160 N (36 lb.)
High-resolution type	PK24M type	20 N (4.5 lb.)	25 N (5.6 lb.)	34 N (7.6 lb.)	52 N (11.7 lb.)	—
	PK26M type	54 N (12.1 lb.)	67 N (15 lb.)	89 N (20 lb.)	130 N (29 lb.)	—

NOTE

- If the overhung load or thrust load has exceed the allowable values, the motor bearing or output shaft may undergo fatigue failure due to repeated applications of load.

Installing the driver

When installing the driver in an enclosure, be sure to follow the diagram illustrated below.

Provide a minimum clearance of 25 mm (1 inch) in the horizontal direction or 50 mm (2 inch) in the vertical direction between the driver and enclosure or other equipment within the enclosure.

When installing two or more drivers side by side, provide a minimum clearance of 20 mm (0.79 inch) between drivers.

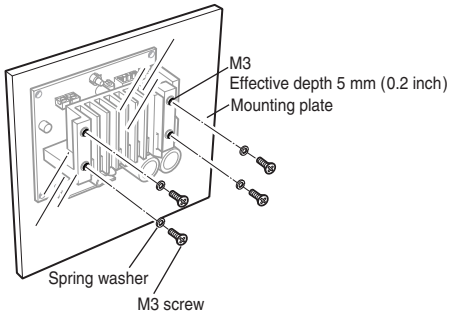
CSD2109-P, CSD2112-P, CSD2120-P

Mount the printed circuit board or heat sink to the mounting plate.

(Screws and spacers are not supplied.)

Mounting the heat sink

Mount the heat sink to the mounting plate using M3 screws.

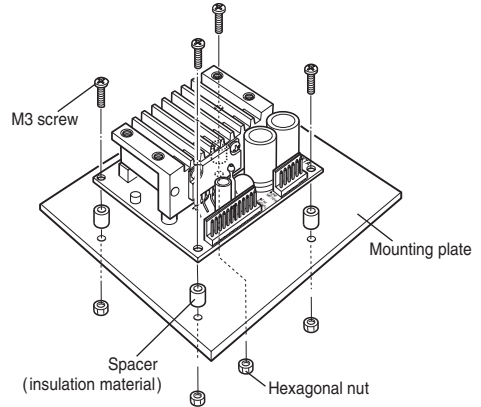


Mounting the printed circuit board

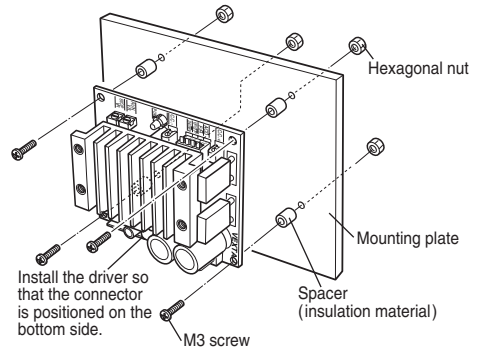
Mount the printed circuit board to the mounting plate using M3 screws.

Insert a spacer [5 mm (0.2 inch) or thicker] between the printed circuit board and the mounting plate.

● Installation in the horizontal direction



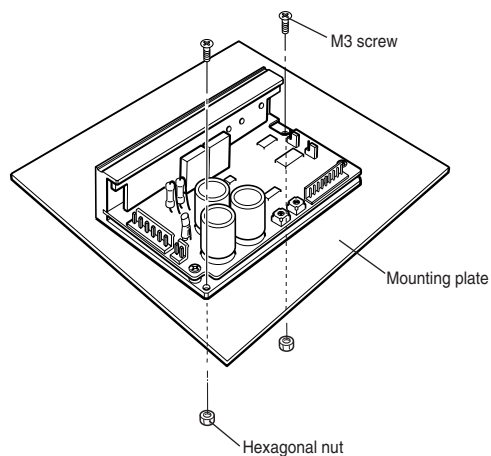
● Installation in the vertical direction



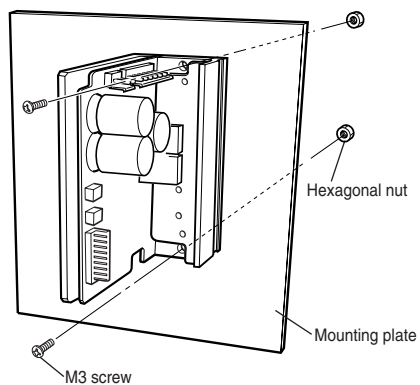
CSD2140P, CSD2145P

Mount the driver to the mounting plate using M3 screws.

● Installation in the horizontal direction



● Installation in the vertical direction



NOTE

- Do not install equipments generating significant heat or noise in the vicinity of the driver.
- Adjust the ventilation condition if the ambient temperature of the driver exceeds 40°C (104°F).

Installing and wiring in compliance with the EMC Directive

Effective measures must be taken with regard to EMI (electromagnetic interference) caused by the **CSK** Series motor and/or driver in the control-system equipment operating nearby and EMS (electromagnetic susceptibility) of the **CSK** Series motor and/or driver. Failure to do so may result in serious impairment of the machine's functionality.

Oriental Motor conducts EMC measurement of its **CSK** Series motors and drivers in accordance with "Installing and wiring for EMC measurement" on page 21.

The user is responsible for ensuring the machine's compliance with the EMC Directive, based on the installation and wiring explained below.

Applicable standards

EMI

Emission Test	EN50081-2
Radiated Emission Test	EN55011

EMS

Immunity Tests	EN61000-6-2
Radiation Field Immunity Test	IEC61000-4-3
Fast Transient/Burst Immunity Test	IEC61000-4-4
Conductive Noise Immunity Test	IEC61000-4-6

■ Power source

The **CSK** Series products are specifically designed for DC power-source input. Use a DC power source compliant with the EMC Directive.

■ Mains filter

Connect a mains filter on the input side of the transformer so as to prevent the noise generated in the driver from being transmitted externally via the power-supply line.

Oriental Motor recommends the following mains filters based on the results of internal testing:

Manufacturer	Model
CORCOM	10ESK1
TDK	ZAG2210-11S

- Install the mains filter as close to the AC input terminal of the DC power-source as possible. Also, secure the input/output cables using cable clamps or the like so that the cables won't lift from the surface of the enclosure panel.
- Connect the ground terminal of the mains filter to the ground point over the shortest distance using a cable of the largest possible size.
- Do not wire the AC input cable (AWG18: 0.75 mm²) and the output cable of the mains filter (AWG18: 0.75 mm²) in parallel. If these two cables are wired in parallel, noise inside the enclosure will be connected to the power-supply cable via stray capacitance, reducing the effect of the mains filter.

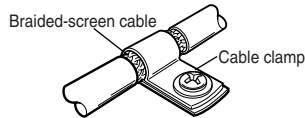
■ Grounding method

When grounding the driver and mains filter, use a cable of the largest possible size and connect to the ground point over the shortest distance so that no potential difference will be generated at the grounded position. The ground point must be a large, thick and uniform conductive surface. Install the motor onto a grounded metal surface.

■ Wiring of digital I/O cables

Use braided-screen cable between AWG24 (0.2 mm²) and AWG22 (0.3 mm²) for the driver's digital I/O cables. Wire the digital I/O cables over the shortest possible distance.

When grounding a braided-screen cable, use a metal cable clamp that contacts the braided-screen cable over the entire perimeter. Install the cable clamp at the tip of the braided-screen cable and connect it to an appropriate ground point.

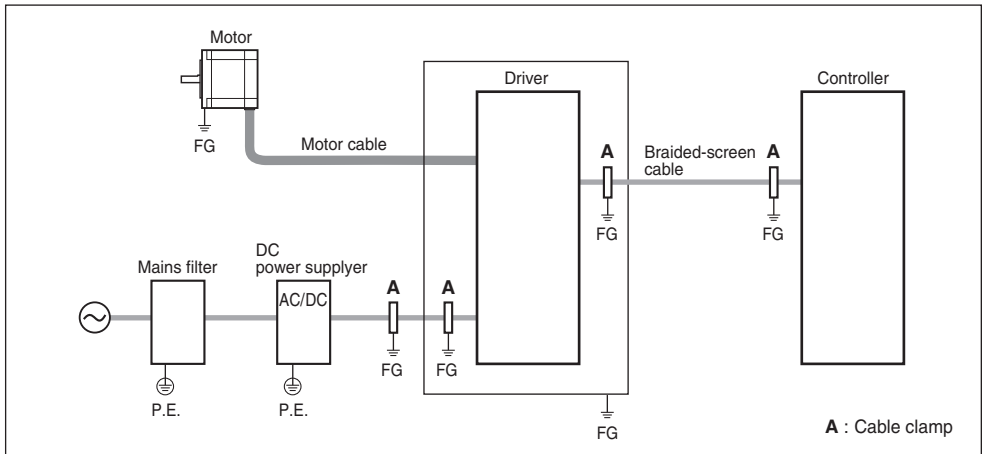


■ Other wiring

- When grounding the driver, connect the ground cable directly to the ground point so that a difference will not be generated between the driver's ground potential and the ground potential of the control-system equipment operating nearby.
- When a relay or electromagnetic switch is used in the same circuit, use a mains filter or CR circuit to absorb any possible surge.
- Keep the cable lengths as short as possible. Do not wind or bundle extra lengths.
- Separate the power cables such as motor cable and power-supply cable from the signal cables, and wire them apart by around 100 to 200 mm (3.93 to 7.87 inch). If a power cable must cross over a signal cable, wire them at right angles. Keep an appropriate distance between the AC input cable and output cable of the mains filter.

■ Installing and wiring for EMC measurement

The installation/wiring conditions of the motor, driver and DC power source for the EMC measurement of **CSK** Series products are shown below:



Motor cable length: 300 mm (12 inch) (standard length of the motor)

Digital I/O cable length: 2000 mm (6.6 feet) (between the driver and controller)

Connection

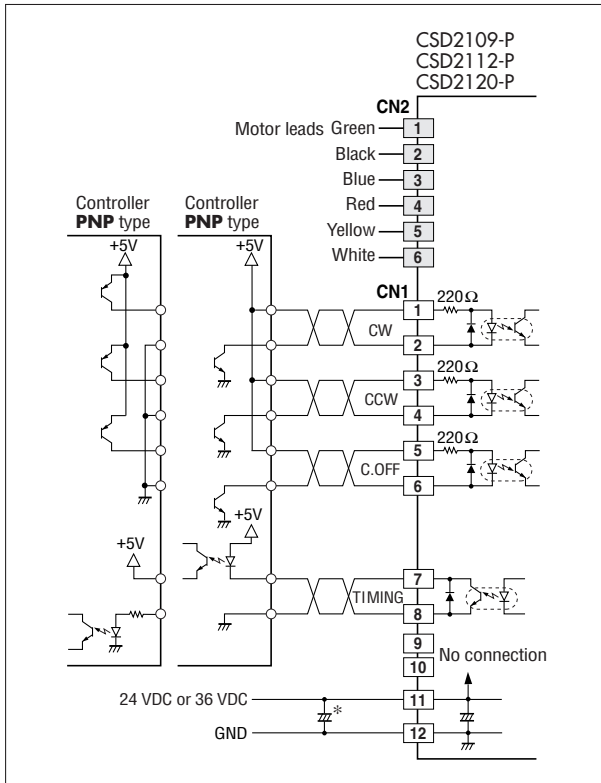
This section covers the methods of connecting the driver, motor, power and controller, as well as the grounding method, connection examples and I/O interface.

Connection examples

CSD2109-P, CSD2112-P, CSD2120-P

The driver's power-supply voltage can be selected from 24 VDC or 36 VDC.

Be sure to check the setting of the power-supply voltage switch. ➔ See page 31.



■ Crimp-fitting the contact

When crimp-fitting the contact, secure a strong connection using a crimping tool as specified by the contact manufacturer.

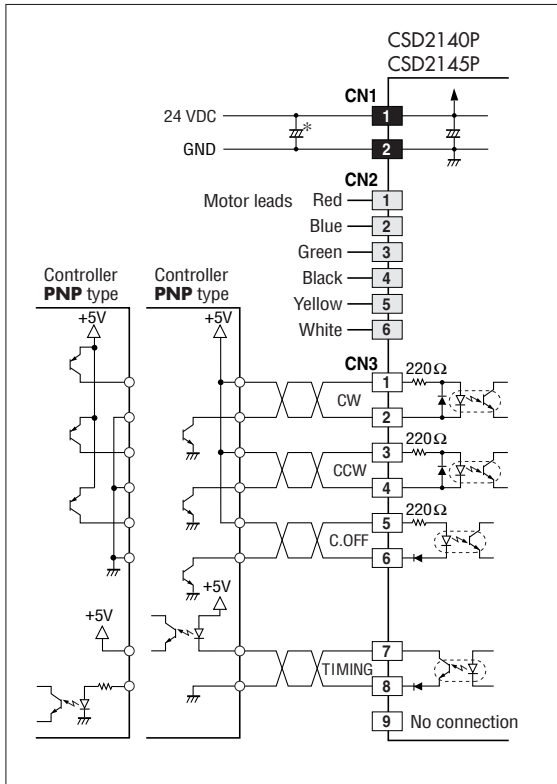
Connector	Contact	Manufacturer	Crimping tool model number
CN1	170204-2	AMP	189509-1
CN2	170204-2	AMP	189509-1

NOTE

- To operate the CSD2120-P at a motor speed of 600 r/min or greater using the 36 VDC power supply, connect to the power line an electrolytic capacitor* having a minimum rating of 50 V and capacity of 10,000 μ F or greater.

CSD2140P, CSD2145P

The driver's power-supply voltage is 24 VDC.



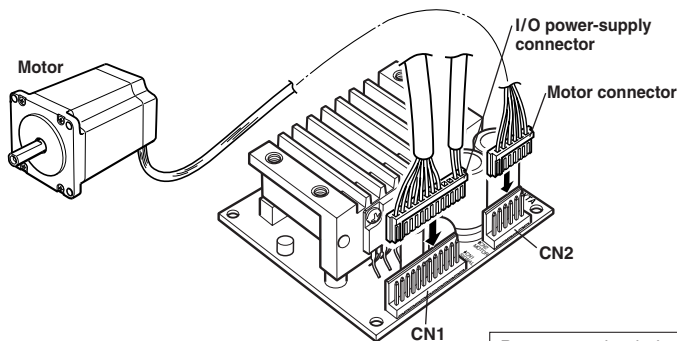
■ Crimp-fitting the contact

When crimp-fitting the contact, secure a strong connection using a crimping tool as specified by the contact manufacturer.

Connector	Contact	Manufacturer	Crimping tool model number
CN1	BVH-21T-P1.1	JST	YC-160R
CN2	BVH-21T-P1.1	JST	YC-160R
CN3	170204-2	AMP	189509-1

NOTE

- To perform an abrupt deceleration or drive an inertial load 10 times greater than the rotor's inertia, connect to the power line an electrolytic capacitor* having a minimum rating of 50 V and capacity of 12,000 μF or greater.



Be sure to check the setting of the power supply voltage switch. → 31

Connecting the power supply, I/O signals

Insert the I/O power-supply connector into the driver's I/O and power-supply connector (CN1).

Use a cable of AWG 20 (0.5 mm²) for the power-supply line.

■ Power-supply voltage

The driver's input power-supply voltage is 24 VDC ±10% or 36 VDC ±10% (containing 10% or less ripple).

Use a power supply that can deliver a stable current capacity of 2.8 A or greater.

■ Connector pin assignments

CN1 SIGNAL

Pin No.	Signal name	Explanation
1	+CW/PLS	In 2-pulse input mode: CW-pulse input
2	-CW/PLS	In 1-pulse input mode: PLS(pulse) input
3	+CCW/DIR.	In 2-pulse input mode: CCW-pulse input
4	-CCW/DIR.	In 1-pulse input mode: DIR.(rotation-direction) input
5	+C.OFF	Current-off input
6	-C.OFF	
7	+TIMING	Timing output
8	-TIMING	
9	NC	Not used
10		
11	+24/36V	+24 VDC ±10% or +36 VDC ±10%
12	GND	

Connecting the motor

Insert the motor connector into the driver's motor connector (CN2).

■ Connector pin assignments

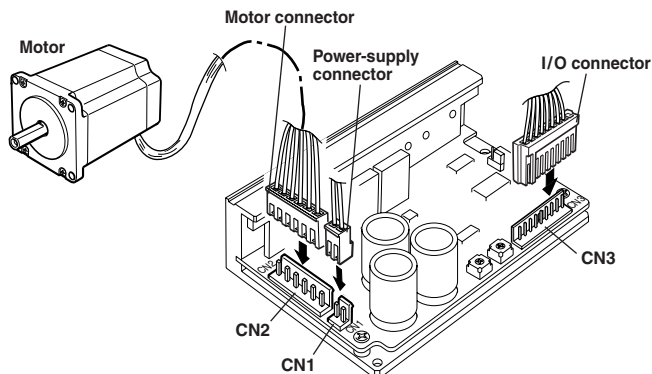
CN2 MOTOR

Pin No.	Signal name	Explanation
1	GREEN	Connect the green motor lead.
2	BLACK	Connect the black motor lead.
3	BLUE	Connect the blue motor lead.
4	RED	Connect the red motor lead.
5	YELLOW	Connect the yellow motor lead.
6	WHITE	Connect the white motor lead.

NOTE

- Pay attention to polarity when connecting the power supply. Connecting the power supply in reverse polarity may damage the driver.
- Firmly insert the connector in position. Incomplete connection of the connector may cause operation failure, or may damage the motor or driver.
- Do not wire the driver's power-supply cable in the same conduit in which another power line or the motor cable is wired.
- When you want to turn on the power again or pull out the motor cable connector, do so 10 seconds or more after power has been turned off.

CSD2140P, CSD2145P



Connecting the power supply

Insert the power-supply connector into the driver's power supply connector (CN1).

Use a cable of AWG 20 to 18 (0.5 to 0.75 mm²) for the power-supply line.

Power-supply voltage

The driver's input power-supply voltage is 24 VDC $\pm 10\%$ (containing 10% or less ripple).

Use a power supply that can deliver a stable current capacity of 5.5 A or greater.

Connector pin assignments

CN1 POWER

Pin No.	Signal name	Explanation
1	+24V	+24 VDC $\pm 10\%$
2	GND	

Connecting the motor

Insert the motor connector into the driver's motor connector (CN2).

Connector pin assignments

CN2 MOTOR

Pin No.	Signal name	Explanation
1	RED	Connect the red motor lead.
2	BLUE	Connect the blue motor lead.
3	GREEN	Connect the green motor lead.
4	BLACK	Connect the black motor lead.
5	YELLOW	Connect the yellow motor lead.
6	WHITE	Connect the white motor lead.

Connecting I/O signals

Insert the I/O signal connector into the driver's I/O connector (CN3).

Connector pin assignments

CN3 SIGNAL

Pin No.	Signal name	Explanation
1	+CW	CW pulse input
2	-CW	
3	+CCW	CCW pulse input
4	-CCW	
5	+C.OFF	Current-off input
6	-C.OFF	
7	+TIMING	Timing output
8	-TIMING	
9	NC	Not used

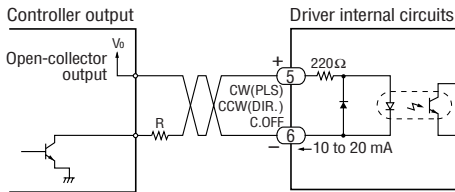
NOTE

- Pay attention to polarity when connecting the power supply. Connecting the power supply in reverse polarity may damage the driver.
- Firmly insert the connector in position. Incomplete connection of the connector may cause operation failure, or may damage the motor or driver.
- Do not wire the driver's power-supply cable in the same conduit in which another power line or the motor cable is wired.
- When you want to turn on the power again or pull out the motor cable connector, do so 10 seconds or more after power has been turned off.

Explanation of I/O signals

Input signals

All driver input signals are photocoupler inputs. The signal state indicates the “ON: current supplied” or “OFF: current not supplied” status of the internal photocoupler rather than the voltage level of the signal.



Use 5 VDC as the input-signal voltage. If the input-signal voltage exceeds 5 VDC, connect an appropriate external resistance in order to keep the input current to 10 to 20 mA.

$$R = \frac{V_0}{20\text{mA}} - 220 [\Omega]$$

● CW (PLS) input and CCW (DIR.) input

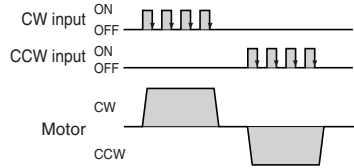
The driver (CSD2109-P, CSD2112-P or CSD2120-P) supports both 1-pulse input mode and 2-pulse input mode. The user can select an appropriate mode in accordance with the positioning controller used. How to set the pulse-input mode ➔ See page 31.

The direction of rotation indicates the direction in which the motor's output shaft rotates, as viewed from the motor-mounting surface. The output shaft of the geared type rotates in the direction opposite the motor's rotation when the gear ratio is 18:1 or 36:1.

◆ 2-pulse input mode (factory setting)

Connect the CW-pulse and CCW-pulse signals from the positioning controller to the CW and CCW inputs, respectively.

1. When the CW input is turned from “ON” to “OFF”, the motor rotates one step in the clockwise direction.
2. When the CCW input is turned from “ON” to “OFF”, the motor rotates one step in the counterclockwise direction.



NOTE

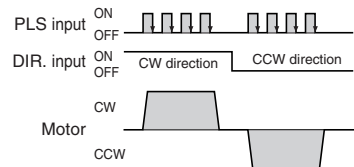
- The minimum interval of rotation-direction switching changes according to the operating speed and size of the load.
- If a pulse signal is not input, be sure to set the photocoupler to “OFF”. Do not input pulse signals to the CW and CCW inputs simultaneously. If one input receives a pulse signal while the other input has its photocoupler turned to “ON”, the motor cannot operate correctly.

◆ 1-pulse input mode

It is used for only CSD2109-P, CSD2112-P and CSD2120-P.

Connect the pulse signal and rotation-direction signal from the positioning controller to PLS and DIR., respectively.

1. When the PLS input is turned from “ON” to “OFF” while the DIR. input is set to “ON”, the motor rotates one step in the clockwise direction.
2. When the PLS input is turned from “ON” to “OFF” while the DIR. input is set to “OFF”, the motor rotates one step in the counterclockwise direction.

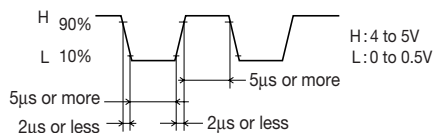


NOTE

- The minimum interval of rotation-direction switching changes according to the operating speed and size of the load.

Pulse-signal waveform

- Input pulse signals having a waveform with sharp rise/fall edges, as shown below.



The figure shows the pulse signal's voltage level.

■ C.OFF (current-off) input

This input is used to adjust the position by manually moving the motor's output shaft from the load side.

⚠ Warning

- Do not turn the C.OFF input to ON while the motor is operating. If the input is turned ON, the motor will stop and lose its holding capability. A load may descend, resulting in injury or equipment damage.

⚠ Caution

- If the motor's output shaft must be moved directly by hand (for manual alignment, etc.), do so after confirming that the driver's C.OFF (current-off) input is ON. Failure to do so may result in injury.

1. When the C.OFF input is turned to "ON", the driver cuts off the current supply to the motor and the motor loses its holding torque. In this condition, the position of the output shaft can be adjusted manually.
2. When the C.OFF input is turned to "OFF", the driver resumes the current supply to the driver and restores the motor's holding torque.

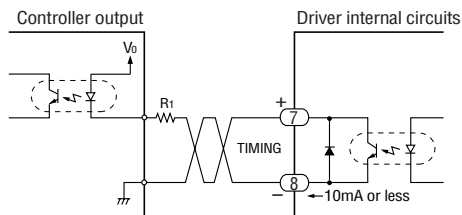
NOTE

- When operating the motor, always keep the C.OFF input in the "OFF" state.

■ Output signals

All driver output signals are photocoupler/open-collector outputs.

The signal state indicates the "ON: current supplied" or "OFF: current not supplied" status of the internal photocoupler or transistor rather than the voltage level of the signal.



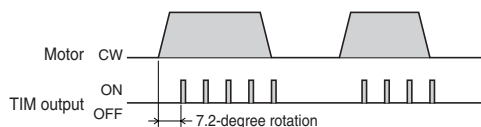
Use 24 VDC as the output-signal voltage.

If the output-signal voltage exceeds 24 VDC, connect an appropriate external resistance in order to keep the output current to 10 mA or below.

$$R_1 = \frac{V_0}{10\text{mA}} [\Omega]$$

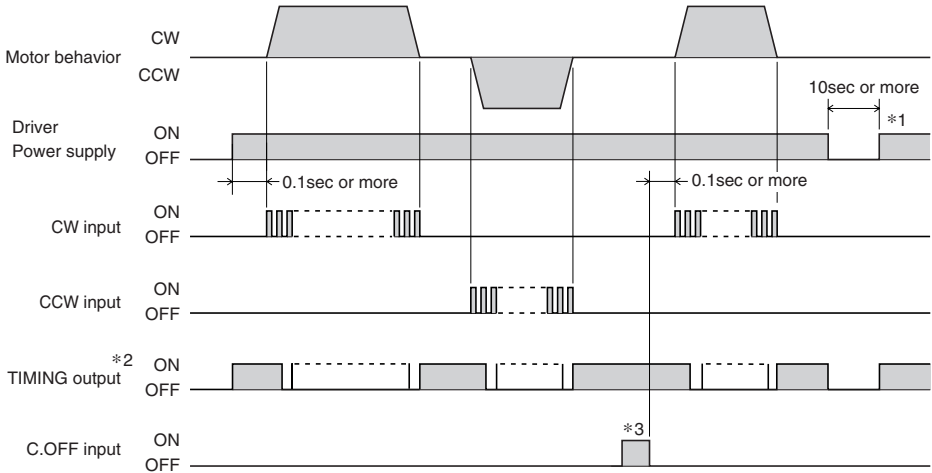
● TIMING (timing) output

The TIMING output turns ON with each 7.2-degree rotation of the motor's output shaft.



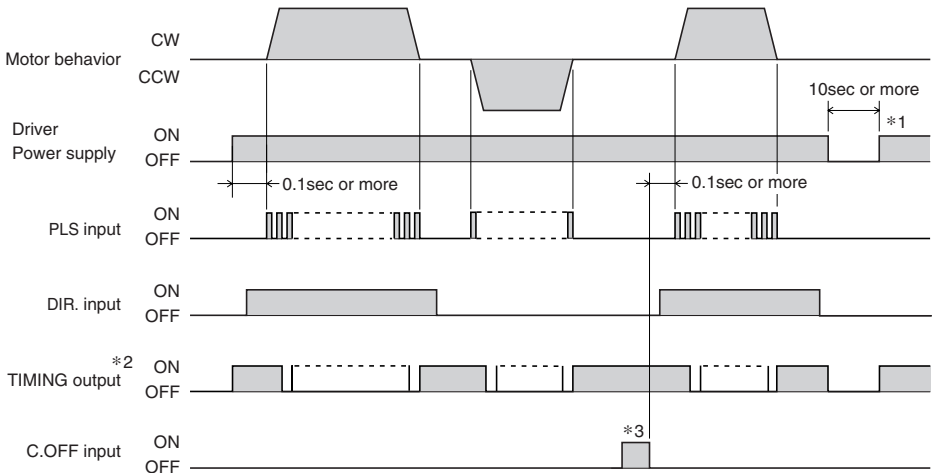
Timing charts

● 2-pulse input mode



- *1. After turning off the power supply, wait at least 10 seconds before turning it on again.
- *2. The TIMING output indicates the state of motor operation based on a multiple of 7.2 degrees.
- *3. When the C.OFF input is turned to "ON", the motor current turns off and the motor loses its holding torque.

● 1-pulse input mode (CSD2109-P, CSD2112-P and CSD2120-P only)



- *1. After turning off the power supply, wait at least 10 seconds before turning it on again.
- *2. The TIMING output indicates the state of motor operation based on a multiple of 7.2 degrees.
- *3. When the C.OFF input is turned to "ON", the motor current turns off and the motor loses its holding torque.

Setting

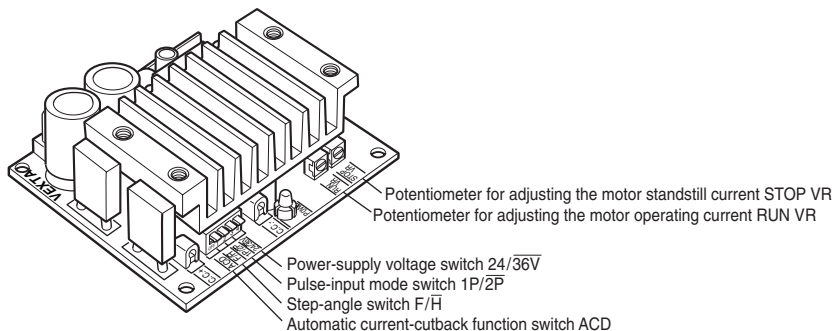
This section covers how to set driver functions and adjust motor currents.

You can set the automatic current-cutback function, step angle and pulse-input mode or adjust motor currents using the various switches (jumper sockets) on the driver.

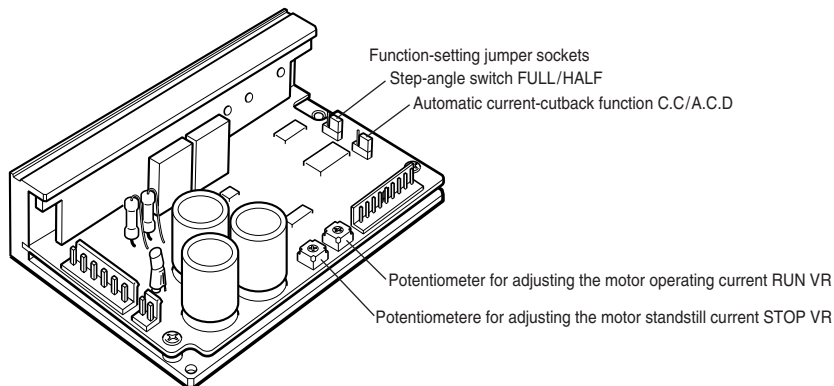
NOTE

- When changing the setting of a driver function, be sure to turn off the power supply beforehand. The new setting becomes effective when the power is turned on again.
- The driver may malfunction or become damaged due to the effects of static electricity. While the driver is receiving current, handle the driver carefully and do not come near or touch the driver.
- When operating a function switch, jumper socket or current adjustment potentiometer, be sure to use an insulated screwdriver.

CSD2109-P, CSD2112-P, CSD2120-P



CSD2140P, CSD2145P



Automatic current-cutback function

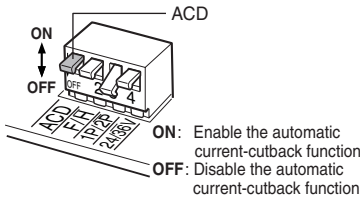
Set the automatic current-cutback function using the automatic current-cutback function switch (jumper socket).

CSD2109-P, CSD2112-P, CSD2120-P

Automatic current-cutback function switch (ACD)

Factory setting:
ON (enable automatic current-cutback)

- Set this switch to ON to enable the automatic current-cutback function.
- Set this switch to OFF to disable the automatic current-cutback function.



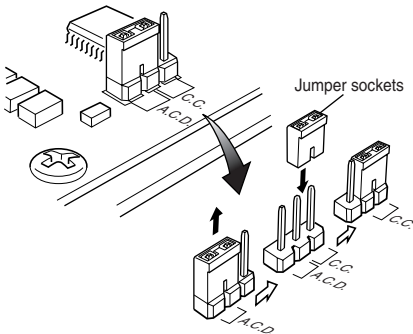
CSD2140P, CSD2145P

Automatic current-cutback function switch (C.C/A.C.D)

Factory setting:
A.C.D (enable automatic current-cutback)

Change the jumper sockets.

- Set this switch to A.C.D to enable the automatic current-cutback function.
- Set this switch to C.C to disable the automatic current-cutback function.



Step angle

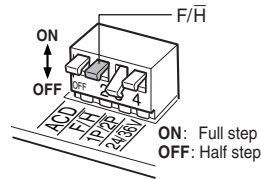
Set the step angle of the motor using the step-angle switch (jumper socket).

CSD2109-P, CSD2112-P, CSD2120-P

Step-angle switch (F/H)

Factory setting: ON (full step)

- Set this switch to ON to use the full-step setting.
- Set this switch to OFF to use the half-step setting.



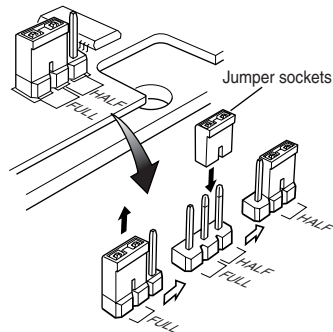
CSD2140P, CSD2145P

Step-angle switch (FULL/HALF)

Factory setting: FULL (full step)

Change the jumper sockets.

- Set this switch to FULL to use the full-step setting.
- Set this switch to HALF to use the half-step setting.



Setting the step angle

Type	Full step	Half step
Standard type		
Geared type*	1.8°/step	0.9°/step
High-resolution type	0.9°/step	0.45°/step

* The step angle of the geared type varies, depending on the gear ratio.

Pulse-input mode

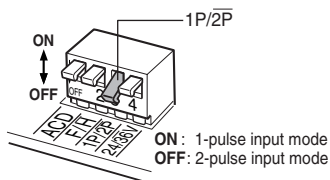
CSD2109-P, CSD2112-P, CSD2120-P only

Set the pulse-input mode using the pulse-input mode switch.

Pulse-input mode switch (1P/2P)

Factory setting: OFF (2P: 2-pulse input mode)

- Set the switch to OFF to control the motor using two pulse inputs of CW and CCW
→ **2-pulse input mode**
- Set the switch to ON to control the motor using the pulse input and the rotation-direction input indicating the direction of motor rotation
→ **1-pulse input mode**



Power-supply voltage

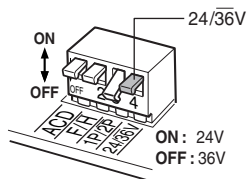
CSD2109-P, CSD2112-P, CSD2120-P only

Be sure to set the power-supply voltage switch according to the driver's power-supply input voltage.

Power-supply voltage switch (24/36V)

Factory setting: 24V

- Set the switch to ON when the power-supply voltage is 24 VDC.
- Set the switch to OFF when the power-supply voltage is 36 VDC.



Motor currents

Set the motor currents during operation and in the current-cutback state.

Motor operating current

Factory setting: Motor's rated current

If the load is small and there is sufficient torque, the operating current can be reduced to suppress vibration and temperature rise of the motor.

Motor standstill current

Factory setting: 40 percent of motor operating current

NOTE

- Setting the motor operating current too low may affect the motor's starting characteristics and position-retention performance.

■ Setting method

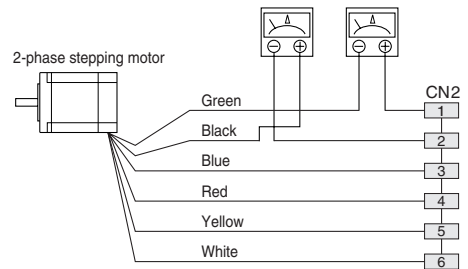
An ammeter or tester is needed to set the motor current.

Note that a tester is required only for the CSD2109-P, CSD2112-P and CSD2120-P.

Setting with an ammeter

CSD2109-P, CSD2112-P, CSD2120-P

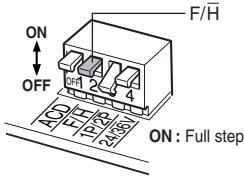
Connect the driver, motor and DC ammeter.



Motor operating current

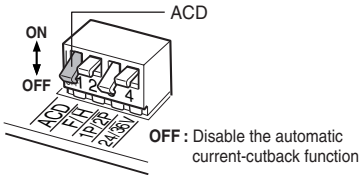
1. Set the step angle to full step.

Set the step-angle switch (F/H) to "ON".



2. Disable the automatic current-cutback function.

Set the automatic current-cutback function switch (ACD) to "OFF".



3. Turn on the power supply.

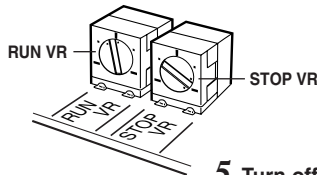
Wait until the motor reaches its operating current.

4. Manipulate the potentiometer for adjusting the motor operating current (RUN VR).

Adjust the potentiometer using an insulated screwdriver.

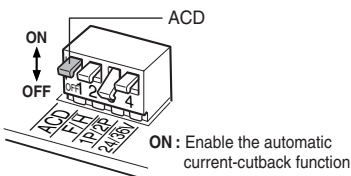
The sum of two DC-ammeter readings indicates the current per motor phase.

Be sure to adjust the current to the motor's rated current or below.



5. Turn off the power supply.

6. Set the automatic current-cutback function switch (ACD) to "ON" again.

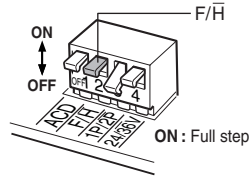


This completes the adjustment of the motor operating current.

Motor standstill current

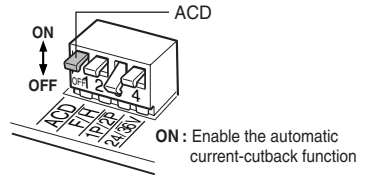
1. Set the step angle to full step.

Set the step-angle switch (F/H) to "ON".



2. Enable the automatic current-cutback function.

Set the automatic current-cutback function switch (ACD) to "ON".



3. Turn on the power supply.

Wait until the motor reaches its standstill current.

4. Manipulate the potentiometer for adjusting the motor standstill current (STOP VR).

Adjust the potentiometer using an insulated screwdriver.

The sum of two DC-ammeter readings indicates the current per motor phase.

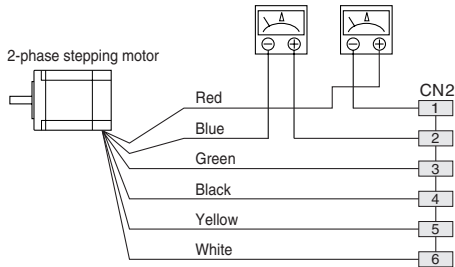
Be sure to adjust the current to 40 percent of the motor's rated current or below.

5. Turn off the power supply.

This completes the adjustment of the motor standstill current.

CSD2140P, CSD2145P

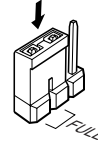
Connect the driver, motor and DC ammeter.



Motor operating current

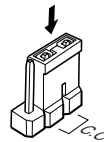
1. Set the step angle to full step.

Set the jumper socket for the step-angle switch (FULL/HALF) to "FULL".



2. Disable the automatic current-cutback function.

Set the jumper socket for automatic current-cutback function (C.C/A.C.D) to "C.C".



3. Turn on the power supply.

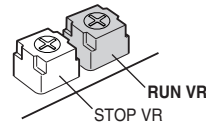
Wait until the motor reaches its operating current.

4. Manipulate the potentiometer for adjusting the motor operating current (RUN VR).

Adjust the potentiometer using an insulated screwdriver.

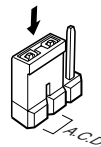
The sum of two DC-ammeter readings indicates the current per motor phase.

Be sure to adjust the current to the motor's rated current or below.



5. Turn off the power supply.

6. Set the jumper socket for automatic current-cutback function (C.C/A.C.D) to "A.C.D" again.

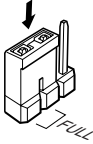


This completes the adjustment of the motor operating current.

Motor standstill current

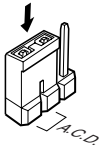
1. Set the step angle to full step.

Set the jumper socket for the step-angle switch (FULL/HALF) to "FULL".



2. Enable the automatic current-cutback function.

Set the jumper socket for automatic current-cutback function (C.C/A.C.D) to "A.C.D".



3. Turn on the power supply.

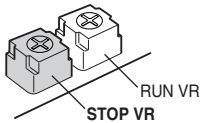
Wait until the motor reaches its standstill current.

4. Manipulate the potentiometer for adjusting the motor standstill current (STOP VR).

Adjust the potentiometer using an insulated screwdriver.

The sum of two DC-ammeter readings indicates the current per motor phase.

Be sure to adjust the current to 40 percent of the motor's rated current or below.



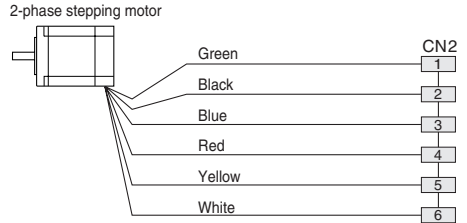
5. Turn off the power supply.

This completes the adjustment of the motor standstill current.

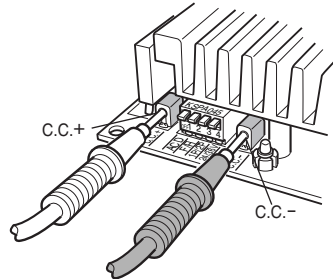
Setting with a tester

CSD2109-P, CSD2112-P, CSD2120-P only

Connect the driver and motor.



Insert the tester probes (approx. 2.1 mm in diameter) into the motor-current check terminals (+C.C, -C.C).

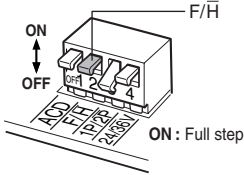


Set the tester to the voltage-measuring range.

Motor operating current

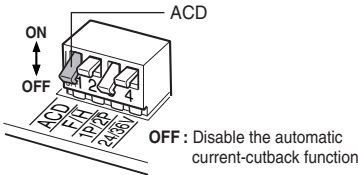
1. Set the step angle to full step.

Set the step-angle switch (F/H) to "ON".



2. Disable the automatic current-cutback function.

Set the automatic current-cutback function switch (ACD) to "OFF".



3. Turn on the power supply.

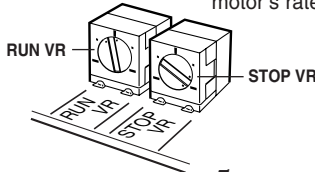
Wait until the motor reaches its operating current.

4. Manipulate the potentiometer for adjusting the motor operating current (RUN VR).

Adjust the potentiometer using an insulated screwdriver.

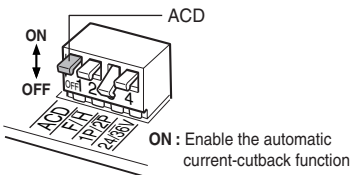
The tester voltage indicates the current per motor phase.

Be sure to adjust the current to the motor's rated current or below.



5. Turn off the power supply.

6. Set the automatic current-cutback function switch (ACD) to "ON" again.

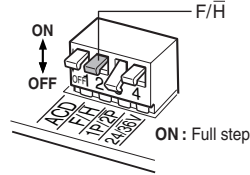


This completes the adjustment of the motor operating current.

Motor standstill current

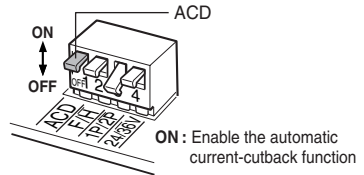
1. Set the step angle to full step.

Set the step-angle switch (F/H) to "ON".



2. Enable the automatic current-cutback function.

Set the automatic current-cutback function switch (ACD) to "ON".



3. Turn on the power supply.

Wait until the motor reaches its standstill current.

4. Manipulate the potentiometer for adjusting the motor standstill current (STOP VR).

Adjust the potentiometer using an insulated screwdriver.

The tester voltage indicates the current per motor phase.

Be sure to adjust the current to 40 percent of the motor's rated current or below.

5. Turn off the power supply.

This completes the adjustment of the motor standstill current.

■ Current-adjusting potentiometer and current values

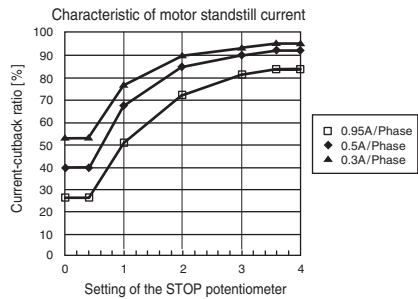
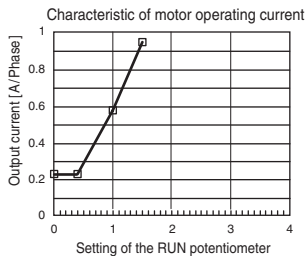
- The characteristic of motor operating current indicates the output current corresponding to the setting of the potentiometer for adjusting the motor operating current.

- The characteristic of motor standstill current indicates the current-cutback ratio corresponding to the setting of the potentiometer for adjusting the motor standstill current.

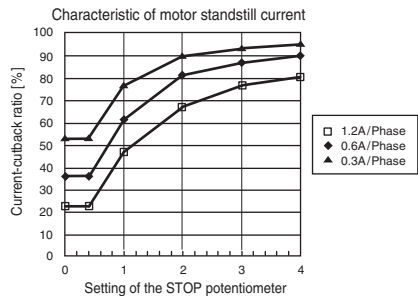
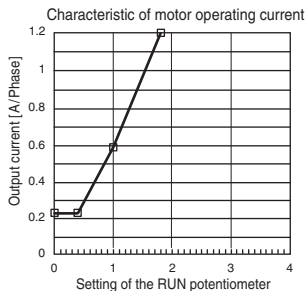
The current-cutback ratio changes according to the set motor operating current.

$$\text{Current-cutback ratio (\%)} = \frac{\text{Motor standstill current (A/phase)}}{\text{Motor operating current (A/phase)}} \times 100$$

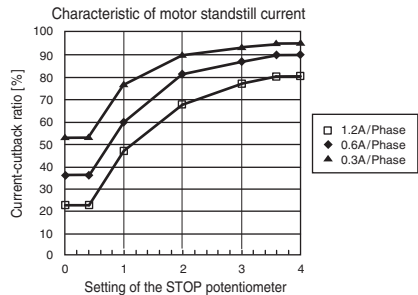
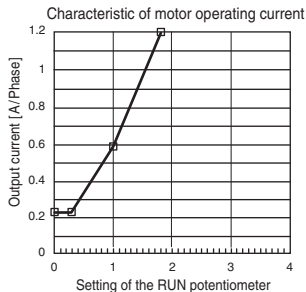
● CSK243 type, CSK243SG type, CSK243M type



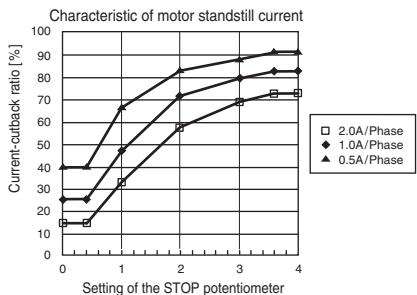
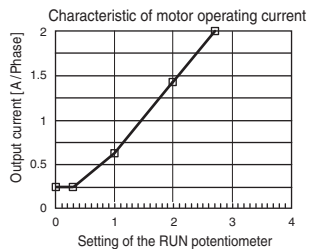
● CSK244 type, CSK244M type



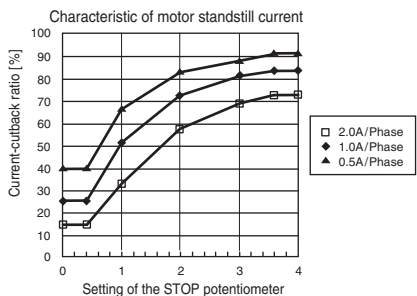
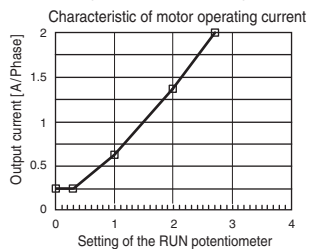
● CSK245 type, CSK245M type



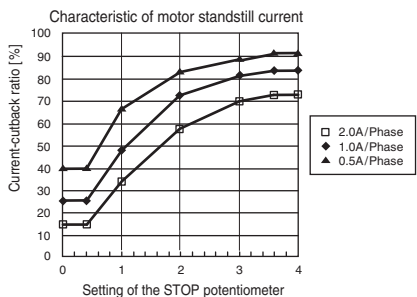
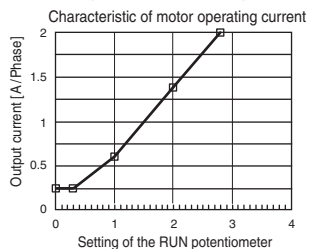
● **CSK264** type, **CSK264SG** type, **CSK264M** type



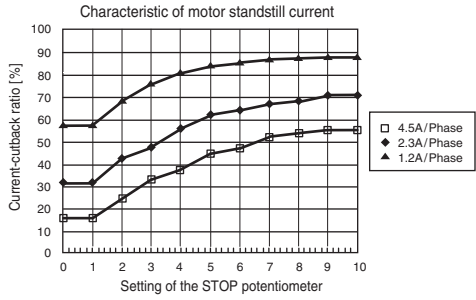
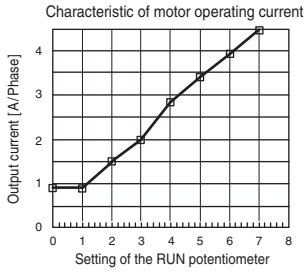
● **CSK266** type, **CSK266M** type



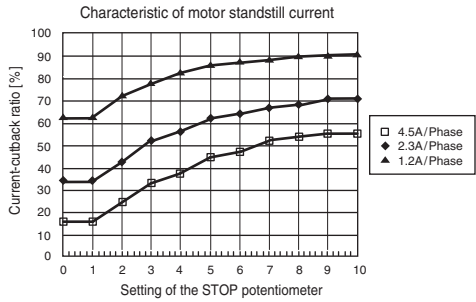
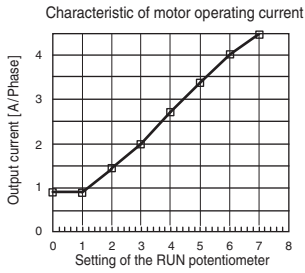
● **CSK268** type, **CSK268M** type



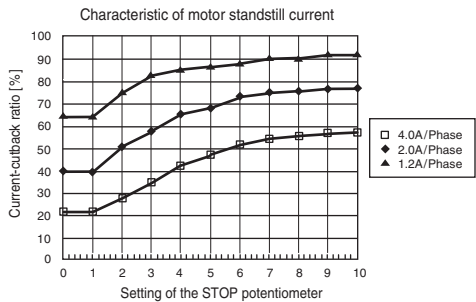
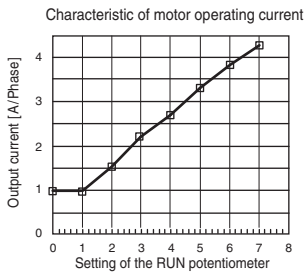
● **CSK296** type



● **CSK299** type



● **CSK2913** type



Inspection

It is recommended that the following items be checked regularly after operation. Should an abnormality be noted, discontinue any use and contact your nearest Oriental Motor office.

Inspection items

- Are there any loose motor-mounting screws ?
- Is the motor bearing (ball bearing) or gearhead generating noise ?
- Is there offset between the center of the motor's output shaft (gearhead output shaft) and that of the load shaft ?
- Is the motor cable scratched or stressed, or is the connection with the driver loose ?
- Is there any foreign deposit on the driver ?
- Are there any loose driver-mounting screws, or connector ?
- Are any of the power elements or smoothing capacitors inside the driver giving off a bad smell or showing other signs of abnormality ?

NOTE

- The driver uses semiconductor elements, so exercise due caution when handling the driver. The driver may be damaged by the effects of static electricity, etc.

Troubleshooting and remedial actions

During motor operation, the motor or driver may fail to operate properly due to an error in speed setting or inappropriate connection. If the motor doesn't operate properly, refer to this section and take appropriate action. If the problem persists, contact your nearest Oriental Motor office.

Phenomenon	Possible cause	Remedial action
The motor is not excited The output shaft can be moved by hand	● The C.OFF input is turned "ON"	● Turn the C.OFF input to "OFF" and determine whether the motor is excited
The motor doesn't turn	● Poor contact at the CW input or CCW input	● Check the controller and driver connections ● Check the pulse-signal specifications (voltage, width)
	● Both the CW and CCW inputs are turned to "ON" in 2-pulse input mode	● Input pulse signal to either the CW input or CCW input at a time ● Be sure to turn "OFF" the terminal not receiving input

Phenomenon	Possible cause	Remedial action
The motor rotates opposite to the specified direction	<ul style="list-style-type: none"> ● The pulse signal is connected to the DIR input in 1-pulse input mode 	<ul style="list-style-type: none"> ● Connect pulse signal to the PLS input (This applies to the CSD2109-P, CSD2112-P and CSD2120-P only)
	<ul style="list-style-type: none"> ● The CW input and CCW input are connected in reverse, when the 2-pulse input mode is selected 	<ul style="list-style-type: none"> ● Connect the CW pulse signal and CCW pulse signal to the CW input and CCW input, respectively
	<ul style="list-style-type: none"> ● The DIR. input is set in reverse, when the 1-pulse input mode is selected 	<ul style="list-style-type: none"> ● Turn the switch “ON” when the direction is set to CW; turn it “OFF” when the direction is set to CCW (This applies to the CSD2109-P, CSD2112-P and CSD2120-P only)
The gear output shaft rotates opposite to the specified direction	<ul style="list-style-type: none"> ● The direction of motor rotation is specified in reverse (when the gear ratio is 18:1 or 36:1) 	<ul style="list-style-type: none"> ● The gear output shaft rotates in the direction opposite the motor’s rotation when the gear ratio is 18:1 or 36:1 In this case, specify the motor direction as the direction opposite the rotation of the gear output shaft
Motor operation is unstable	<ul style="list-style-type: none"> ● Inappropriately adjusted motor operating current If the set current is small, the output torque also becomes small, resulting in unstable operation 	<ul style="list-style-type: none"> ● Return the motor operating current to the factory-set value and check the operation
	<ul style="list-style-type: none"> ● Poor connection of the pulse signal 	<ul style="list-style-type: none"> ● Check the controller and driver connections ● Check the pulse-signal specifications (voltage, width)
	<ul style="list-style-type: none"> ● The starting speed is too high 	<ul style="list-style-type: none"> ● Set a lower starting speed at which the motor can be started stably
	<ul style="list-style-type: none"> ● The acceleration (deceleration) time is too short 	<ul style="list-style-type: none"> ● Set a longer acceleration (deceleration) time at which the motor can be started stably Check the operation by connecting only the motor, driver and controllers needed for operation
	<ul style="list-style-type: none"> ● Effect of noise 	<ul style="list-style-type: none"> ● If effect of noise is confirmed, take an appropriate action such as isolating the motor from the noise source, redoing the wiring or changing the signal cables to shielded wires
The motor vibrates significantly	<ul style="list-style-type: none"> ● Small load 	<ul style="list-style-type: none"> ● Reduce the motor operating current using the adjustment potentiometer Vibration increases if the motor’s output torque is too large with respect to the load

Specifications

Motor

Standard type

■ CSK24 type

Motor models	Single shaft	PK243-01A	PK244-01A	PK245-01A
	Double shaft	PK243-01B	PK244-01B	PK245-01B
Maximum static torque at excitation *1	N·m (oz·in)	0.16 (22)	0.26 (36)	0.32 (45)
Rotor inertia	kg·m ² (oz·in ²)	35 × 10 ⁻⁷ (0.191)	54 × 10 ⁻⁷ (0.3)	68 × 10 ⁻⁷ (0.37)
Rated current	A/phase	0.95	1.2	1.2
Base step angle		1.8°		
Mass	kg (lb.)	0.21 (0.462)	0.27 (0.594)	0.35 (0.77)
Ambient temperature		-10°C to +50°C (+14°F to +122°F)		

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

■ CSK26 type

Motor models	Single shaft	PK264-02A	PK266-02A	PK268-02A
	Double shaft	PK264-02B	PK266-02B	PK268-02B
Maximum static torque at excitation *1	N·m (oz·in)	0.39 (55)	0.9 (127)	1.35 (191)
Rotor inertia	kg·m ² (oz·in ²)	120 × 10 ⁻⁷ (0.66)	300 × 10 ⁻⁷ (1.64)	480 × 10 ⁻⁷ (2.6)
Rated current	A/phase	2		
Base step angle		1.8°		
Mass	kg (lb.)	0.45 (0.99)	0.7 (1.54)	1 (2.2)
Ambient temperature		-10°C to +50°C (+14°F to +122°F)		

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

■ CSK29 type

Motor models	Single shaft	PK296-03A	PK299-03A	PK2913-02A
	Double shaft	PK296-03B	PK299-03B	PK2913-02B
Maximum static torque at excitation *1	N·m (oz·in)	2.2 (310)	4.4 (620)	6.6 (930)
Rotor inertia	kg·m ² (oz·in ²)	1400x10 ⁻⁷ (7.7)	2700x10 ⁻⁷ (14.8)	4000x10 ⁻⁷ (22)
Rated current	A/phase	4.5		4
Base step angle		1.8°		
Mass	kg (lb.)	1.7 (3.74)	2.8 (6.16)	3.8 (8.36)
Ambient temperature		-10°C to +50°C (+14°F to +122°F)		

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

Geared type

■ CSK24SG type

Motor models	Single shaft	PK243A1-SG3.6	PK243A1-SG7.2	PK243A1-SG9	PK243A1-SG10
	Double shaft	PK243B1-SG3.6	PK243B1-SG7.2	PK243B1-SG9	PK243B1-SG10
Maximum static torque at excitation *1	N·m (lb-in)	0.2 (1.77)	0.4 (3.5)	0.5 (4.4)	0.56 (4.9)
Rotor inertia	kg·m ² (oz-in ²)	35x10 ⁻⁷ (0.191)			
Rated current	A/phase	0.95			
Base step angle		0.5°	0.25°	0.2°	0.18°
Gear ratio		3.6:1	7.2:1	9:1	10:1
Allowable torque	N·m (lb-in)	0.2 (1.77)	0.4 (3.5)	0.5 (4.4)	0.56 (4.9)
Allowable speed range (output shaft speed)	Full step	0 to 500 r/min	0 to 250 r/min	0 to 200 r/min	0 to 180 r/min
	Half step				
Mass	kg (lb.)	0.35 (0.77)			
Ambient temperature		-10°C to +50°C (+14°F to +122°F)			

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

Motor models	Single shaft	PK243A1-SG18	PK243A1-SG36	PK243A1-SG50	PK243A1-SG100
	Double shaft	PK243B1-SG18	PK243B1-SG36	PK243B1-SG50	PK243B1-SG100
Maximum static torque at excitation *1	N·m (lb-in)	0.8 (7.0)			
Rotor inertia	kg·m ² (oz-in ²)	35x10 ⁻⁷ (0.191)			
Rated current	A/phase	0.95			
Base step angle		0.1°	0.05°	0.036°	0.018°
Gear ratio		18:1	36:1	50:1	100:1
Allowable torque	N·m (lb-in)	0.8 (7.0)			
Allowable speed range (output shaft speed)	Full step	0 to 100 r/min	0 to 50 r/min	0 to 36 r/min	0 to 18 r/min
	Half step				
Mass	kg (lb.)	0.35 (0.77)			
Ambient temperature		-10°C to +50°C (+14°F to +122°F)			

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

■ CSK26SG type

Motor models	Single shaft	PK264A2-SG3.6	PK264A2-SG7.2	PK264A2-SG9	PK264A2-SG10
	Double shaft	PK264B2-SG3.6	PK264B2-SG7.2	PK264B2-SG9	PK264B2-SG10
Maximum static torque at excitation *1	N·m (lb·in)	1.0 (8.8)	2.0 (17.7)	2.5 (22)	2.7 (23)
Rotor inertia	kg·m ² (oz·in ²)	120x10 ⁻⁷ (0.66)			
Rated current	A/phase	2			
Base step angle		0.5°	0.25°	0.2°	0.18°
Gear ratio		3.6 : 1	7.2 : 1	9 : 1	10 : 1
Allowable torque	N·m (lb·in)	1.0 (8.8)	2.0 (17.7)	2.5 (22)	2.7 (23)
Allowable speed range (output shaft speed)	Full step	0 to 500 r/min	0 to 250 r/min	0 to 200 r/min	0 to 180 r/min
	Half step				
Mass	kg (lb.)	0.75 (1.65)			
Ambient temperature		-10°C to +50°C (+14°F to +122°F)			

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

Motor models	Single shaft	PK264A2-SG18	PK264A2-SG36	PK264A2-SG50	PK264A2-SG100
	Double shaft	PK264B2-SG18	PK264B2-SG36	PK264B2-SG50	PK264B2-SG100
Maximum static torque at excitation *1	N·m (lb·in)	3.0 (26)	4.0 (35)	4.0 (35)	4.0 (35)
Rotor inertia	kg·m ² (oz·in ²)	120x10 ⁻⁷ (0.66)			
Rated current	A/phase	2			
Base step angle		0.1°	0.05°	0.036°	0.018°
Gear ratio		18 : 1	36 : 1	50 : 1	100 : 1
Allowable torque	N·m (lb·in)	3.0 (26)	4.0 (35)	4.0 (35)	4.0 (35)
Allowable speed range (output shaft speed)	Full step	0 to 100 r/min	0 to 50 r/min	0 to 36 r/min	0 to 18 r/min
	Half step				
Mass	kg (lb.)	0.75 (1.65)			
Ambient temperature		-10°C to +50°C (+14°F to +122°F)			

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

High-resolution type

■ CSK24M type

Motor models	Single shaft	PK243MA	PK244MA	PK245MA
	Double shaft	PK243MB	PK244MB	PK245MB
Maximum static torque at excitation *1	N·m (oz·in)	0.16 (22)	0.26 (36)	0.32 (45)
Rotor inertia	kg·m ² (oz·in ²)	35 × 10 ⁻⁷ (0.191)	54 × 10 ⁻⁷ (0.3)	68 × 10 ⁻⁷ (0.37)
Rated current	A/phase	0.95	1.2	1.2
Base step angle		0.9°		
Mass	kg (lb.)	0.21 (0.462)	0.27 (0.594)	0.35 (0.77)
Ambient temperature		-10°C to +50°C (+14°F to +122°F)		

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

■ CSK26M type

Motor models	Single shaft	PK264MA	PK266MA	PK268MA
	Double shaft	PK264MB	PK266MB	PK268MB
Maximum static torque at excitation *1	N·m (oz·in)	0.39 (55)	0.9 (127)	1.35 (191)
Rotor inertia	kg·m ² (oz·in ²)	120 × 10 ⁻⁷ (0.66)	300 × 10 ⁻⁷ (1.65)	480 × 10 ⁻⁷ (2.6)
Rated current	A/phase	2		
Base step angle		0.9°		
Mass	kg (lb.)	0.45 (0.99)	0.7 (1.54)	1 (2.2)
Ambient temperature		-10°C to +50°C (+14°F to +122°F)		

*1. The maximum static torque at excitation indicates the value when a rated current is applied to the motor (2-phase excitation).

When the motor is combined with a dedicated driver, the torque drops to approximately 40 percent of the specification value due to the current-cutback function.

Driver

Driver model	CSD2109-P	CSD2112-P	CSD2120-P
Power-supply input voltage *1	24 VDC±10% 1.4 A or 36 VDC±10% 1.4A	24 VDC±10% 1.6 A or 36 VDC±10% 1.6A	24 VDC±10% 2.8 A or 36 VDC±10% 2.8A
Output current	A/phase 0.95	1.2	2.0
Excitation modes	Full step	● Standard type : 1.8° (2-phase excitation) ● High-resolution type : 0.9° (2 phase excitation)	
	Half step	● Standard type : 0.9° (1-2 phase excitation) ● High-resolution type : 0.45° (1-2 phase excitation)	
Input signals	Photocoupler input 5 VDC, input resistance 220 Ω, input current 10 to 20 mA CW (PLS), CCW (DIR.), C.OFF		
Output signals	Photocouple/open-collector output 24 VDC or less, 10 mA or less TIMING		
Functions	Automatic current-cutback, step-angle switching, pulse-input mode switching, pulse-supply voltage switching		
Indicator (LED)	Power-supply input (green)		
Cooling method	Natural air-cooling		
Mass	kg (lb.)	0.12 (0.264)	
Ambient temperatures	0°C to +40°C (+32°F to +104°F)		

*1. The current value shown for each driver power-supply input indicates the maximum input value. (The specific value changes, depending on the pulse speed.) For details, see the speed-torque characteristic diagram in the catalog.

Driver model	CSD2140P	CSD2145P
Power-supply input voltage *1	24 VDC±10% 5.5 A	24 VDC±10% 5.5 A
Output current	A/phase 4.0	4.5
Excitation modes	Full step	1.8° (2-phase excitation)
	Half step	0.9° (1-2 phase excitation)
Input signals	Photocoupler input 5 VDC, input resistance 220 Ω, input current 10 to 20 mA CW, CCW, C.OFF	
Output signals	Photocouple/open-collector output 24 VDC or less, 10 mA or less TIMING	
Functions	Automatic current-cutback, step-angle switching	
Cooling method	Natural air-cooling	
Mass	kg (lb.)	0.2 (0.44)
Ambient temperatures	0°C to +40°C (+32°F to +104°F)	

*1. The current value shown for each driver power-supply input indicates the maximum input value. (The specific value changes, depending on the pulse speed.) For details, see the speed-torque characteristic diagram in the catalog.

■ List of combinations

Standard type

Unit model	Motor model	Driver model
CSK243-AP	PK243-01A	CSD2109-P
CSK243-BP	PK243-01B	
CSK244-AP	PK244-01A	CSD2112-P
CSK244-BP	PK244-01B	
CSK245-AP	PK245-01A	
CSK245-BP	PK245-01B	
CSK264-AP	PK264-02A	CSD2120-P
CSK264-BP	PK264-02B	
CSK266-AP	PK266-02A	
CSK266-BP	PK266-02B	
CSK268-AP	PK268-02A	
CSK268-BP	PK268-02B	
CSK296-AP	PK296-03A	CSD2145P
CSK296-BP	PK296-03B	
CSK299-AP	PK299-03A	
CSK299-BP	PK299-03B	
CSK2913-AP	PK2913-02A	CSD2140P
CSK2913-BP	PK2913-02B	

Geared type

Unit model	Motor model	Driver model
CSK243AP-SG <input type="checkbox"/>	PK243A1-SG <input type="checkbox"/>	CSD2109-P
CSK243BP-SG <input type="checkbox"/>	PK243B1-SG <input type="checkbox"/>	
CSK264AP-SG <input type="checkbox"/>	PK264A2-SG <input type="checkbox"/>	CSD2120-P
CSK264BP-SG <input type="checkbox"/>	PK264B2-SG <input type="checkbox"/>	

The blank square in the model will contain a number indicating the gear ratio.
Gear ratio: **3.6, 7.2, 9, 10, 18, 36, 50** or **100**.

High-resolution type

Unit model	Motor model	Driver model
CSK243MAP	PK243MA	CSD2109-P
CSK243MBP	PK243MB	
CSK244MAP	PK244MA	CSD2112-P
CSK244MBP	PK244MB	
CSK245MAP	PK245MA	
CSK245MBP	PK245MB	
CSK264MAP	PK264MA	CSD2120-P
CSK264MBP	PK264MB	
CSK266MAP	PK266MA	
CSK266MBP	PK266MB	
CSK268MAP	PK268MA	
CSK268MBP	PK268MB	

Option

Cable

These cable sets are used for connection of the power supply, I/O signals and motor. Each cable is equipped with a driver connector.

Model	Length	Applicable type
LCS01CSK2	600 mm (24 inch)	CSK24, CSK24M, CSK24SG type CSK26, CSK26M, CSK26SG type
LCS01SD2	600 mm (24 inch)	CSK29 type



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