Oriental motor

HG-8032-7

Hollow Rotary Actuators

DG Series

OPERATING MANUAL

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

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

Table of contents

1 Introduction

■ Before use

Only qualified personnel should work with the product.
Use the product correctly after thoroughly reading the section 2 “Safety precautions” on page 5.
The product described in this manual has been designed and manufactured for use in general industrial machinery, and must not be used for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Overview of the product

The **DG** series models are the hollow rotary actuator for high-precision positioning. It uses the α_{STEP} stepping motor, with a rotor position sensor, as its power unit. (hereinafter referred to as “actuator”.)

■ Standards and CE Marking

This product is recognized by UL and certified by CSA, and bears the CE Marking (EMC Directive) in compliance with the EN Standards.

	Model	Applicable Standards	Certification Body	Standards File No.	CE Marking
Motor	ASM34AK-D ASM34BK-D	UL 60950 CSA C22.2 No.60950	UL	E208200	EMC Directive
Driver	ASD10A-K	UL 508C CSA C22.2 No.14		E171462	
		UL 1950 CSA C22.2 No.950		E208200	

∗ Approval conditions for UL 60950 and UL 1950: Class III equipment, SELV circuit, Pollution degree 2

∗ For unit models, Oriental Motor declares conformance with the EMC Directive individually.

∗ Drivers have no provision for motor over temperature protection. Motor over temperature protection is required at end application.

- For Low Voltage Directive

This product is not subject to the EC’s Low Voltage Directive because its input power supply voltage is 24 VDC. However, the user is advised to perform the following steps when conducting product installation and connection.

- This product is designed for use within machinery, so it should be installed within an enclosure.
- For the driver, use a power supply with reinforced insulation on its primary and secondary sides.

- For EMC Directive

  This product has received EMC measures under the conditions specified in “Sample installation and wiring for the DC power input specification” on page 25.
  Be sure to conduct EMC measures with the product assembled in your equipment by referring to 5.7 “Installing and wiring in compliance with EMC Directive” on page 23.

■ Hazardous substances

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

■ Main features

- Direct installation of a load axis

  A table, arm or other load can be mounted directly on the output table. Thus, it reduces the need for fastening members such as couplings and friction conclusion tool, power-transmission members such as belt pulleys, and assembly man-hours.

- High-precision positioning without backlash

  The non-backlash mechanism allows for highly precise positioning with 2′ (0.033°) of lost motion.

- Hollow, large-diameter structure

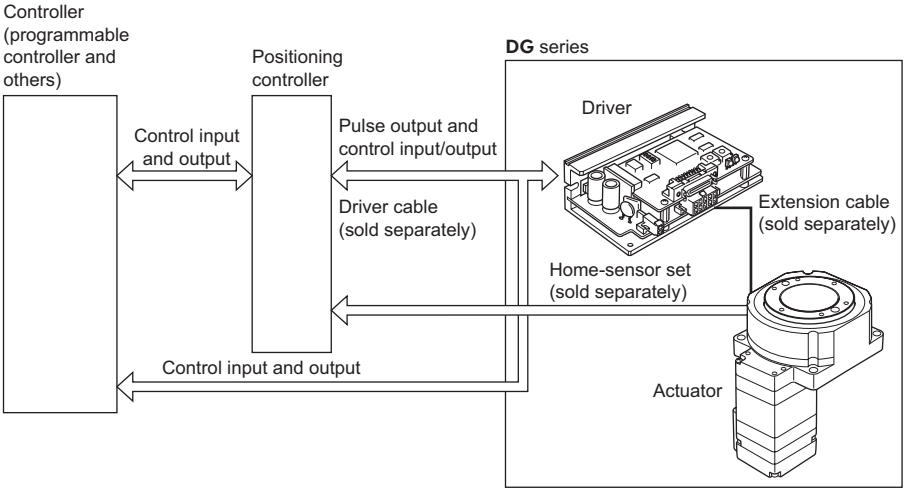
  The output table has a hollow structure with a diameter of 28 mm (1.10 in.). As a result your equipment design can be simplified and installation space reduced by routing tubes and wires through the hollow section.

- Quick response, high reliability

  The αSTEP stepping motor used in the **DG** series does not allow missteps, even with a sudden change in load. The speed and amount of rotation are monitored during operation, and when the possibility of a misstep is detected due to an overload, etc., the response delay is corrected and operation continues within the maximum operating torque range.

■ System configuration

Controllers with pulse output functions are needed to operate the **DG** series.



Home-detection sensors are required when the return to mechanical home is performed. For the application requiring home detection, the home-sensor set is available as an option (sold separately). Refer to page 50.

2 Safety precautions

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

⚠Warning	Handling the product without observing the instructions that accompany a “Warning” symbol may result in serious injury or death.
⚠Caution	Handling the product without observing the instructions that accompany a “Caution” symbol may result in injury or property damage.
Note	The items under this heading contain important handling instructions that the user should observe to ensure safe use of the product.

⚠Warning

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire or injury.
- Provide a means to hold the moving parts in place for applications involving vertical travel. The actuator loses holding torque when the power is shut off, allowing the moving parts to fall and possibly cause injury or damage to equipment.
- When the driver’s protective function is triggered, the motor will stop and lose its holding torque, possibly causing injury or damage to equipment.
- When the driver’s protective function is triggered, first remove the cause and then clear the protective function. Continuing the operation without determining the cause of the problem may cause malfunction of the actuator, leading to injury or damage to equipment.

Installation

- Install the actuator and driver in their enclosures in order to prevent injury.

Connection

- Keep the driver’s power supply input 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 pitch the cable. Doing so may result in fire.

Operation

- Turn off the driver power in the event of a power failure, otherwise the actuator may suddenly start when the power is restored and may cause injury or damage to equipment.
- Do not turn the C.OFF (All windings off) input to "ON" while the actuator is operating. The actuator will stop and lose its holding ability, which may result in injury or damage to equipment.

Repair, disassembly and modification

- Do not disassemble or modify the actuator or 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

General

- Do not use the actuator and driver beyond their specifications, or injury or damage to equipment may result.
- Keep your fingers and objects out of the openings in the actuator and driver, or fire or injury may occur.
- Do not touch the actuator or driver's heat radiating plate during operation or immediately after stopping. The surfaces are hot and may cause a burn.

Transportation

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

Installation

- Keep the area around the actuator and driver free of combustible materials in order to prevent fire or a burn.
- To prevent the risk of damage to equipment, leave nothing around the actuator and driver that would obstruct ventilation.
- Provide a cover over the rotating parts of the output table to prevent injury.

Operation

- Use the actuator 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 inputs to the driver to "OFF." Otherwise, the actuator may start suddenly and cause injury or damage to equipment.

- To prevent bodily injury, do not touch the rotating parts (output table) of the actuator during operation.
- Before moving the output table directly (as in the case of manual positioning), confirm that the driver C.OFF (All windings off) input is “ON” to prevent injury.
- The actuator’s surface temperature may exceed 70 °C (158 °F), even under normal operating conditions. If an actuator is accessible during operation, post a warning label shown in the figure in a conspicuous position to prevent the risk of burns.

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.

Disposal

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

3 Precautions for use

This section covers limitations and requirements the user should consider when using the **DG** series.

- Conduct the insulation resistance measurement or withstand voltage test separately on the actuator and the driver.

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

- Do not apply moment load and thrust load in excess of the specified permissible limit.

  Be sure to operate the actuator within the specified permissible limit of moment load and thrust load. Operating it under an excessive moment load and thrust load may damage the actuator bearings (ball bearing). See page 17 for details.

- Do not make an impact with the actuator.

  Do not drop the actuator. Also, do not strike or hammer the motor unit and mechanical unit. Doing so may cause the positioning accuracy decrease, the rotor position detection sensor damage and the actuator service life reduction.

- Set the surface temperature of the actuators as follows:

  When using the actuator, set its operating conditions (operating speed, operating duty, etc.) so that the following temperatures are maintained.

  When the optional home-sensor set is not used

  Use the actuator at the ambient operating temperature of 0 to +50 °C (+32 to +122 °F) and motor surface temperature of 100 °C (212 °F) or less. If the motor surface temperature exceeds 100 °C (212 °F), the life of the bearing (ball bearing) employed in the motor will be diminished to a significant extent.

  When the optional home-sensor set is used

  Use the actuator at the ambient operating temperature of 0 to +40 °C (+32 to +104 °F) and motor surface temperature of 90 °C (194 °F) or less. If the motor surface temperature exceeds 90 °C (194 °F), the temperatures of the photomicrosensors employed as home sensors will rise and the life of the sensor will be diminished to a significant extent.

- For use with a lift device, provide a means to prevent the moving part from dropping.

  When the driver's protective function is actuated, the current to the actuator will be cut off and the actuator will stop (i.e. the holding force will be lost). In a lift device such as a lifter, provide a means to prevent the moving part from dropping.

- About maximum static torque at excitation

  The maximum static torque at excitation indicates the output table's holding torque at standstill. The current-cutback function, which suppresses the increase in motor temperature, maintains the maximum static torque at excitation to approximately 50% of the permissible torque. When selecting the actuator, consider the maximum static torque at excitation in addition to the permissible torque.

- About permissible speed

  Use the actuator within the permissible speed. The permissible speed indicates the permissible speed (r/min) of the output table. If the actuator is operated at speeds exceeding the permissible speed, the life of the actuator may be diminished to a significant extent.

- About the **DG** series with double motor shafts

  The **DG** series includes models with double motor shafts. With these models, do not apply load toque, overhung load or thrust load on the shaft opposite the motor's output shaft.

- M2.5 screw holes for home sensor installation

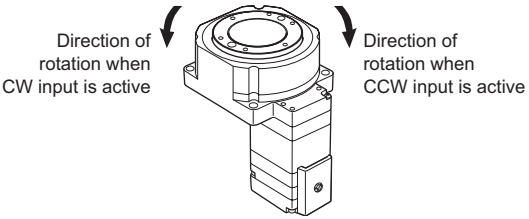
  The M2.5 screw holes provided in the gear mechanism of the actuator is used for installing the optional home-sensor set (sold separately). Do not use these holes for any purpose other than installation of the home sensor.

- About the actuators screws

  Do not loosen or remove the actuator screws. To do so may cause the positioning accuracy to drop or result in actuator damage.

- About the rotating direction of the actuators

  The CW and CCW inputs provided as driver input signals indicate the opposite directions to the output table's direction of rotation. When the CW input is active, the output table rotates counterclockwise. When the CCW input is active, the output table rotates clockwise.



- About the hollow section

  The hollow section rotates with the output table. When routing tubes or wires through the hollow section, provide the means to prevent wear or wire breakage due to contact with the interior walls of the hollow section.

- Preventing electrical noise

  See 5.7 “Installing and wiring in compliance with EMC Directive” on page 23 for measures with regard to noise.

- About grease of actuators

  On rare occasions, a small amount of grease may ooze out from the actuator. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer’s equipment or products.

4 Preparation

This section covers the points to be checked along with the names and functions of respective parts.

4.1 Checking the product

Upon opening the package, 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.

- Actuator ..... 1 unit
- Driver ..... 1 unit
- Control input/output connector ..... 1 set
- Power supply connector 5557-02R-210 (molex) ..... 1 pc.
- Power supply connector crimp terminal 5556TL (molex) ..... 2 pcs.
- 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.

Verify the model number of the purchased unit against the number shown on the package label. Check the model number of the actuator and driver against the number shown on the nameplate. The unit models and corresponding actuator/driver combinations are listed below.

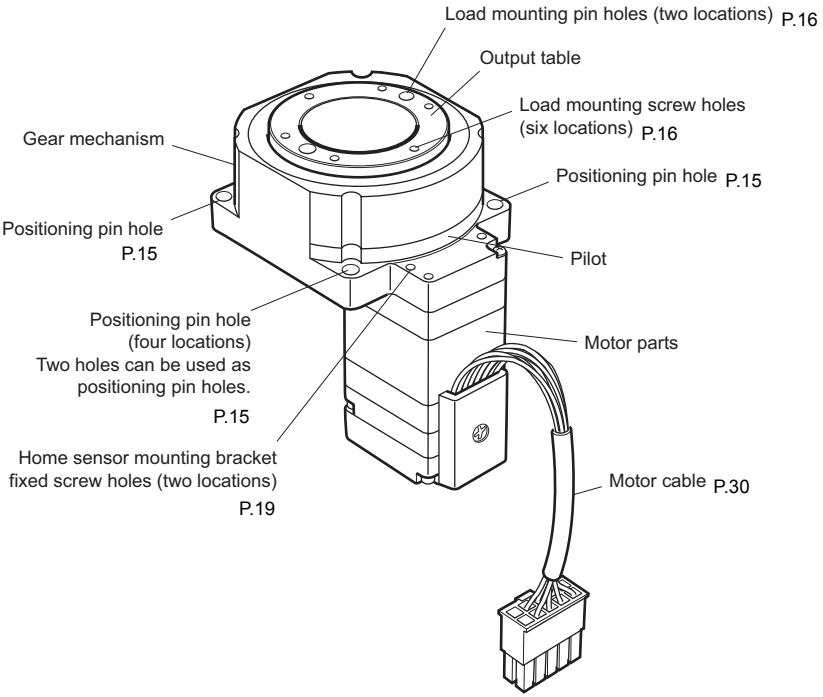
4.2 Combinations of actuators and drivers

Unit model	Actuator model	Driver model
DG60-ASAK	DGM60-ASAK	ASD10A-K
DG60-ASBK	DGM60-ASBK	

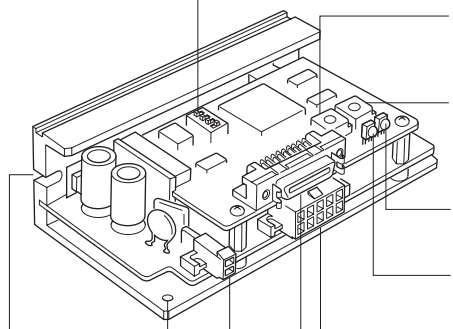
4.3 Names and functions of parts

This section covers the names and functions of parts in the actuator and driver.

- Actuator



- Driver



• Function select switch (SW3)
Allows for the selection of actuator resolution and pulse input mode.

◆Resolution select switches P.40
Use these two switches to select the actuator resolution. The factory setting is "1000: 18000 P/R" and "×1: Multiplier 1." Be sure to switch to "×1" when the resolution switching input "CN3 Pin No.31, 32: ×10" is used.

◆Pulse-input mode select switch P.41
Allows for the selection of 2-pulse input mode or 1-pulse input mode in accordance with the pulse output mode in the positioning controller. The factory setting is "2P: 2-Pulse Input Mode."

• Speed-filter select switch (SW2) P.43
Sets the time constant for the filter that determines response. The factory setting is "6: 1.20 ms."

• Current setting switch (SW1) P.42
Sets the operating current. The factory setting is "F: Driver maximum output-current value."

• OPERATION LED (Green)
Lit when the power is on.

• ALARM LED (Red) P.44
This alarm blinks when a protective function is triggered and the ALARM output turns "OFF."

• Motor connector (CN2) P.30
Connect the motor cable connector.

• Control input/output connectors (CN3) P.31
Used to connect to the position control and others.

• Power supply connector (CN1) P.29
Connect the power supply connector. 24 VDC±10%

• Mounting holes (two locations)

• Mounting cutouts (two locations)

5 Installation

This section covers the environment and method of installing the actuator and driver, along with load installation.
Also covered in this section are the installation and wiring methods that are in compliance with the relevant EMC Directives.

5.1 Location for installation

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

- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature
  When the home-sensor set is not used
    Actuator: 0 to +50 °C (+32 to +122 °F) (non-freezing)
    Driver: 0 to +50 °C (+32 to +122 °F) (non-freezing)
  When the home-sensor set is used
    Actuator: 0 to +40 °C (+32 to +104 °F) (non-freezing)
    Driver: 0 to +50 °C (+32 to +122 °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 (rains, 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

5.2 Installing the actuator

■ Installation direction

The actuator can be installed in any direction.

■ Installation method

Affix the actuator to the mounting plate with screws (M4) using the four mounting holes.
Of the four mounting holes, two (the diagonal pair) have a size of $Ø5^{+0.012}_{0}$ mm ($Ø0.196\ 9^{+0.000\ 5}_{0}$ in.). They can be combined with positioning pins to position the actuator relative to the equipment.

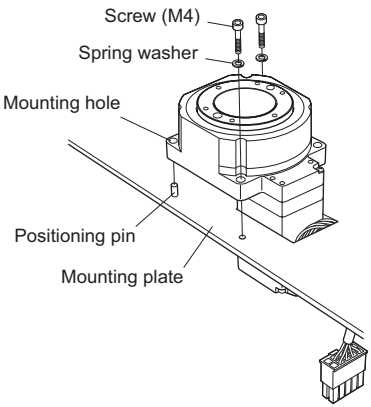
Bolt size	Tightening torque	Mounting plate thickness and material
M4	2 N·m (280 oz-in)	Iron/aluminum plate 5 mm (0.197 in.) or thicker

Note

- Do not loosen or remove the actuator screws. To do so may cause the positioning accuracy to drop or result in actuator damage.
- Do not diagonally insert or forcibly assemble the actuator into the holes in the mounting plate. The pilot section may be scratched, resulting in damage to the actuator.
- Be sure the positioning pins are secured to the mounting plate. Driving the pins into the actuator may damage the actuator due to impact.
- Do not drop the actuator. Also, do not strike or hammer the motor unit and mechanical unit. Doing so may cause the positioning accuracy decrease, the rotor position detection sensor damage and the actuator service life reduction.

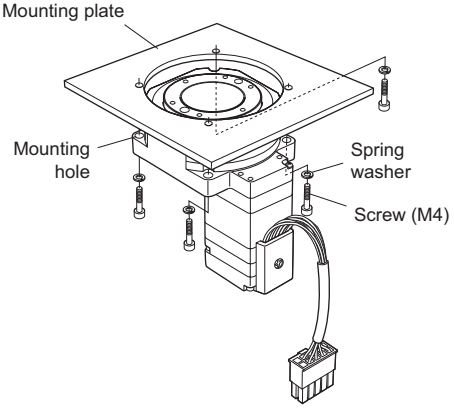
- When installing from above the mounting plate

Provide a motor relief hole in the mounting plate. The figure illustrates the use of two mounting holes for accurate positioning in combination with the positioning pins. All four mounting holes can be used to secure the actuator to the mounting plate with screws.



- When installing from below the mounting plate

  Fit the pilot section of the actuator into the pilot-receiving cutout.



Note When the optional home-sensor set (sold separately) is used, the actuator cannot be installed from below the mounting plate.

5.3 Securing the load to the output table

Install the load with screws using the load-mounting screw holes (six locations) in the output table. The output table has two load-mounting pin holes of $\text{Ø}5\,^{+0.012}_{0}$ mm ($\text{Ø}0.196\,9\,^{+0.000\,5}_{0}$ in.) in diameter and 6 mm (0.236 in.) in depth. These holes can be combined with the positioning pins for accurate positioning of the load.

Bolt size	Tightening torque	Effective depth of bolt	Material of load
M3	1 N·m (142 oz-in)	8 mm (0.315 in.)	Iron or Aluminum

Note Be sure the positioning pins are secured to the load. Driving the pins into the output table may damage the bearing due to impact or an excessive moment of inertia.

5.4 Permissible moment load and permissible thrust load

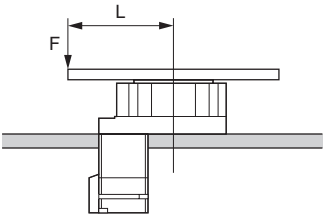
The permissible moment load and permissible thrust load must not exceed the values shown in the table below.

Permissible moment load	Permissible thrust load
2 N·m (280 oz-in)	100 N (22 lb.)

The moment load and thrust load can be calculated using the formulas below:

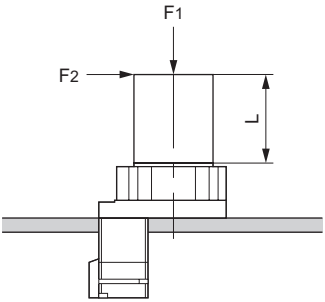
Example 1: When external force F is applied at distance L from the center of the output table

Thrust load [N (lb.)] Fs = F + Mass of load × g (acceleration of gravity)
Moment load [N·m (oz-in)] M = F × L



Example 2: When external forces F_1 and F_2 are applied at distance L from the mounting surface of the output table

Thrust load [N (lb.)] Fs = F_1 + Jig and mass of load × g (acceleration of gravity)
Moment load [N·m (oz-in)] M = F_2 × (L + 0.01)



5.5 Installing the driver

■ Installation direction

Since the driver remains in operation even when the actuator is at rest, and therefore generates a larger amount of heat than other control system equipment, provide ventilation near the driver.
Install the driver on a flat metal plate having excellent vibration resistance and heat conductivity.
Install the driver in vertical or horizontal orientation by securing it with two bolts (M3, not supplied) through the driver's mounting holes or mounting cutouts. Leave no gap between the driver and metal plate. Any other installation method will reduce the driver's ability to dissipate heat.

■ Installation method

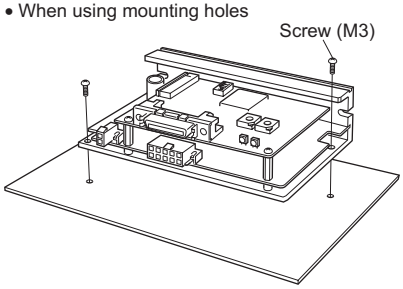
There must be a clearance of at least 25 mm (0.98 in.) and 50 mm (1.97 in.) in the horizontal and vertical directions, respectively, between the driver and enclosure or other equipment. When two or more drivers are to be installed side by side, provide 20 mm (0.79 in.) and 50 mm (1.97 in.) clearances in the horizontal and vertical directions, respectively.

Note

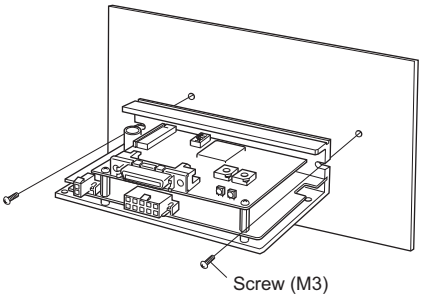
- Install the driver in an enclosure.
- Do not install any equipment that generates a large amount of heat near the driver.
- Check ventilation if the ambient temperature of the driver exceeds 40 °C (104 °F).

- Horizontal installation

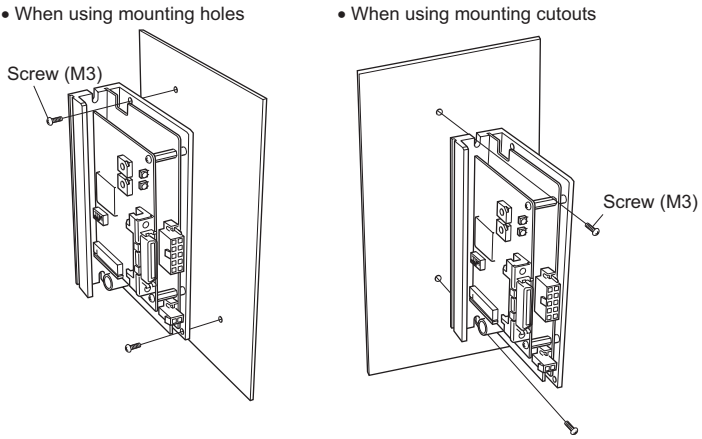
• When using mounting holes



• When using mounting cutouts



- Vertical installation



5.6 Installation of home-sensor set (sold separately)

■ Home position sensor setting details

Home-sensor set (**PADG-SA**: NPN output, **PADG-SAY**: PNP output) of the following parts:

Photomicrosensor .....1 pc.
EE-SX672A (Supplied with **PADG-SA**, OMRON Corporation)
EE-SX672R (Supplied with **PADG-SAY**, OMRON Corporation)
Connector with cables .....1 pc.
EE-1010-R (OMRON Corporation) length 2 m (6.6 ft.)
Mounting bracket for sensor .....1 pc.
Shield plate .....1 pc.
Screw (M3, Spring washer, Washer) .....2 pcs.
Hexagonal socket head screw (M2.5) .....4 pcs.

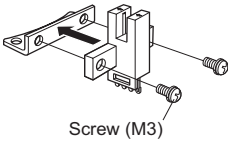
■ Installation method

Install the home-sensor set (**PADG-SA** or **PADG-SAY**) to the actuator by following the procedure below

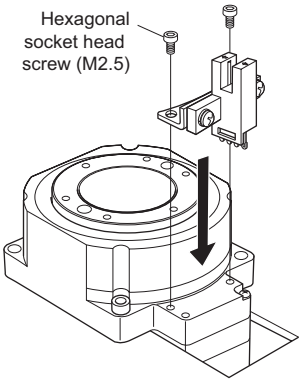
Note

- Do not install the home-sensor set while the power is supplied. To do so may result in injury or equipment damage.
- Be sure to install the sensor and shield plate in the direction shown in the figure. Installing them in the wrong direction may disable sensor detection or cause the shield plate to contact the sensor and result in sensor damage.
- When installing the sensor bracket and shield plate to the actuator, be sure to use the supplied screws.

1. Affix the sensor to the sensor bracket using the supplied screws (M3 × 2).
Tightening torque: 0.6 N·m (85 oz-in)

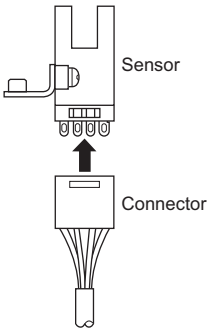


2. Affix the bracket and sensor assembly to the gear mechanism of the actuator using the supplied hexagonal socket head screws (M2.5 × 2).
Tightening torque: 0.5 N·m (71 oz-in)



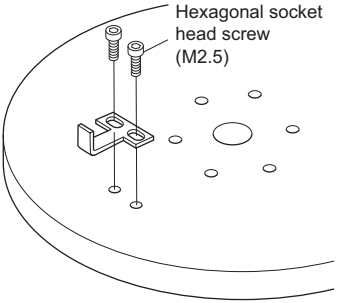
Note Do not use the M2.5 screw holes to install the home sensor, as provided in the actuator, for any purpose other than installation of the home-sensor set.

3. Plug the connector with cable into the sensor.
Firmly insert the sensor connector by aligning its orientation with the connector.



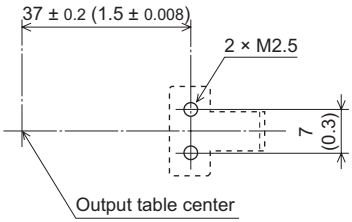
Note
- Do not install or remove the connector with cable while the power is being supplied. Doing so may damage the sensor.
- When removing the connector with a cable, do not pull it by the cables. Pull out the connector while pressing it firmly from the top and bottom.

4. Use the hexagonal socket head screws (M2.5 × 2) to affix the shield plate to the load, which will be mounted to the output table.
Tightening torque: 0.5 N·m (71 oz-in)

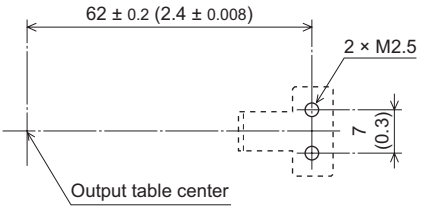


Machining dimensions of shield plate for installation [unit: mm (in.)]

When providing mounting holes on the table center side



When providing mounting holes on the opposite side of the table center



5. Affix the load and shield plate assembly to the output table.

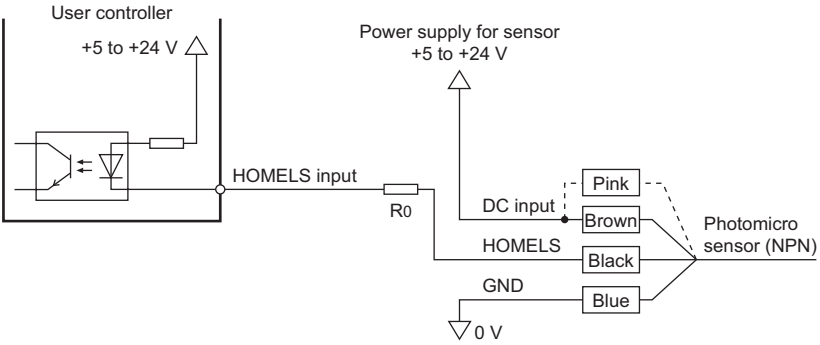
Note

- The photomicrosensor is designed for use within equipment and therefore has no special means of protection against disturbances from external sources of light. If the actuator is to be used under an incandescent lamp or in conditions that are subject to disturbances from external light, provide the means to prevent such interference.
- Use the sensors after confirming that there is no looseness, play or other abnormality due to vibration, impact, etc.
- Place the power cables such as the motor and power supply cables as far apart as possible from the signal cables. If they have to cross, cross them at a right angle.
- To prevent sensor deterioration due to heat, set the operating conditions (speed and operating duty) of the actuator in such a way that the ambient operating temperature remains at 0 to +40 °C (+32 to +104 °F) and the motor surface temperature remains at 90 °C (194 °F) or less.
- To prevent malfunctioning due to the adhesion of dust on the sensors, clean and/or replace the sensors regularly.
- Use a common GND for the sensor power and user's controller power. Any difference in GND potential will result in a sensor malfunction.

■ Sensor wire connection

- Connection diagram when the home-sensor set **PADG-SA** is used.

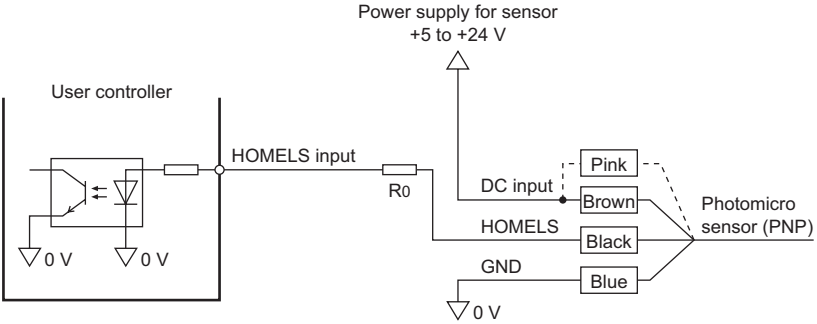
  The power supply must be 5 VDC or more and 24 VDC or less. The current must be 100 mA or less. If the current exceeds 100 mA, connect an external resistor R0.



∗ The pink lead (broken line) is connected to the brown lead if the sensor logic is N.C. (normally-closed). If the sensor logic is N.O. (normally-open), the pink lead is not connected.

- Connection diagram when the home-sensor set **PADG-SAY** is used.

  The power supply must be 5 VDC or more and 24 VDC or less. The current must be 50 mA or less. If the current exceeds 50 mA, connect an external resistor R0.



∗ The pink lead (broken line) is connected to the brown lead if the sensor logic is N.C. (normally-closed). If the sensor logic is N.O. (normally-open), the pink lead is not connected.

5.7 Installing and wiring in compliance with EMC Directive

■ General

EMC Directive

The **DG** series has been designed and manufactured for incorporation in general industrial machinery. The EMC Directive requires that the equipment incorporating this product comply with these directives.
The installation and wiring method for the actuator and driver are the basic methods that would effectively allow the customer's equipment to be compliant with the EMC Directive.
The compliance of the final machinery with the EMC Directive will depend on such factors as the configuration, wiring, layout and risk involved in the control-system equipment and electrical parts. It therefore must be verified through EMC measures by the customer of the machinery.

Applicable Standards

EMI	EN 61000-6-4 EN 61800-3 EN 55051 group 1 class A
EMS	EN 61000-6-2 EN 61800-3

■ Installing and wiring in compliance with EMC Directive

Effective measures must be taken against the EMI that the **DG** series may give to adjacent control-system equipment, as well as the EMS of the **DG** series itself, in order to prevent a serious functional impediment in the machinery.
The use of the following installation and wiring methods will enable the **DG** series to be compliant with the EMC Directive (the aforementioned compliance standards).

- About power source

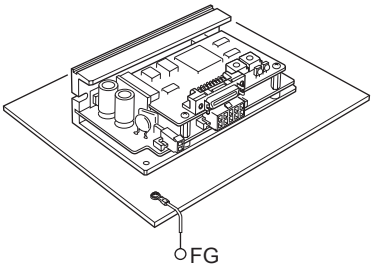
The **DG** series products are of the DC power input specification. Use a DC power supply (such as a switching power supply) that is optimally compliant with the EMC directive. If a transformer is used in the power supply, be sure to connect a mains filter to the input side of the transformer.

- Connecting mains filter for power source line

  Install a mains filter on the input side of the DC power supply in order to prevent the noise generated within the driver from propagating outside via the DC power source line. For mains filters, use HF2010A (SOSHIN ELECTRIC CO.,LTD), FN2070-10-06 (Schaffner EMC), or an equivalent.
  Install the mains filter as close to the AC input terminal of DC power source as possible, and use cable clamps and other means to secure the input and output cables (AWG18: 0.75 mm^2 or more) firmly to the surface of the enclosure. Connect the ground terminal of the mains filter to the grounding point, using as thick and short a wire as possible.
  Do not place the AC input cable (AWG18: 0.75 mm^2 or more) parallel with the mains filter output cable (AWG18: 0.75 mm^2 or more). Parallel placement will reduce mains filter effectiveness if the enclosure's internal noise is directly coupled to the power supply cable by means of stray capacitance.

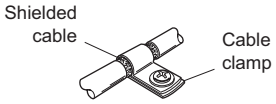
- How to ground

  The cable used to ground the driver, actuator and mains filter must be as thick and short to the grounding point as possible so that no potential difference is generated. Choose a large, thick and uniformly conductive surface for the grounding point.

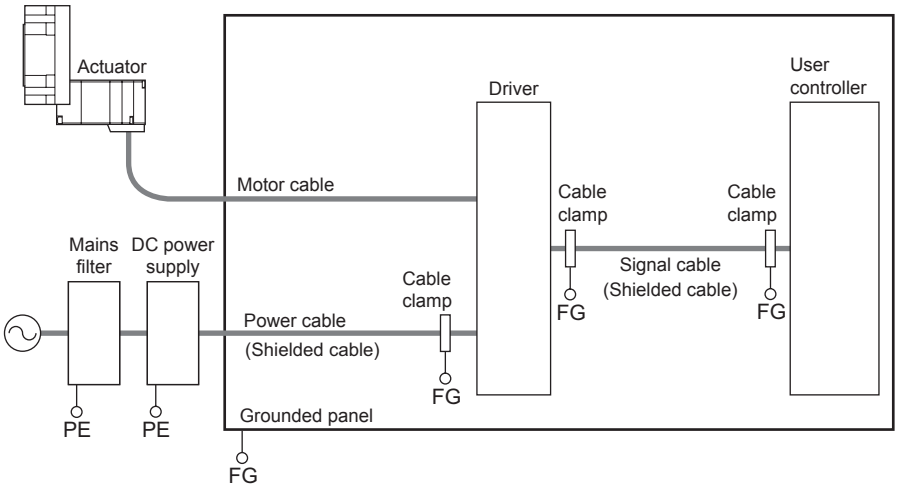


- Wiring the power cable and signal cable

  Use a shielded cable of AWG18 (0.75 mm^2) or more in diameter for the driver power cable. Use a shielded cable of AWG28 (0.08 mm^2) or more in diameter for the driver signal cable, and keep it as short as possible. Contact the nearest sales office for a shielded cable (sold separately).
  To ground a shielded cable, use a metal clamp or similar device that will maintain contact with the entire circumference of the shielded cable. Attach a cable clamp as close to the end of the cable as possible, and connect it to an appropriate grounding point as shown in the figure.



- Notes about installation and wiring
  - Connect the actuator, driver and other peripheral control equipment directly to the grounding point so as to prevent a potential difference from developing between grounds.
  - When relays or electromagnetic switches are used together with the system, use mains filters and CR circuits to suppress surges generated by them.
  - Keep cables as short as possible without coiling and bundling extra lengths.
  - Place the power cables such as the motor and power supply cables as far apart [100 to 200 mm (3.94 to 7.87 in.)] as possible from the signal cables. If they have to cross, cross them at a right angle. Place the AC input cable and output cable of a mains filter separately from each other.
  - If an extension cable is required between the actuator and driver, it is recommended that an optional extension cable (sold separately) be used, since the EMC measures are conducted using the Oriental Motor extension cable.
- Sample installation and wiring for the DC power input specification



■ Precautions about static electricity

Static electricity may cause the driver to malfunction or suffer damage. Be careful when handling the driver with the power on. Always use an insulated screwdriver to adjust the driver's built-in motor current switch.

Note Do not come close to or touch the driver while the power is on.

6 Connection

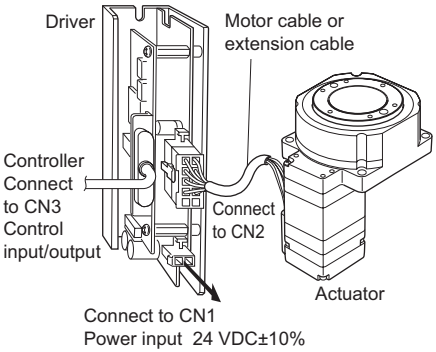
This section covers the methods and examples of connecting and grounding the driver, actuator, power and controller, as well as the control input/output.

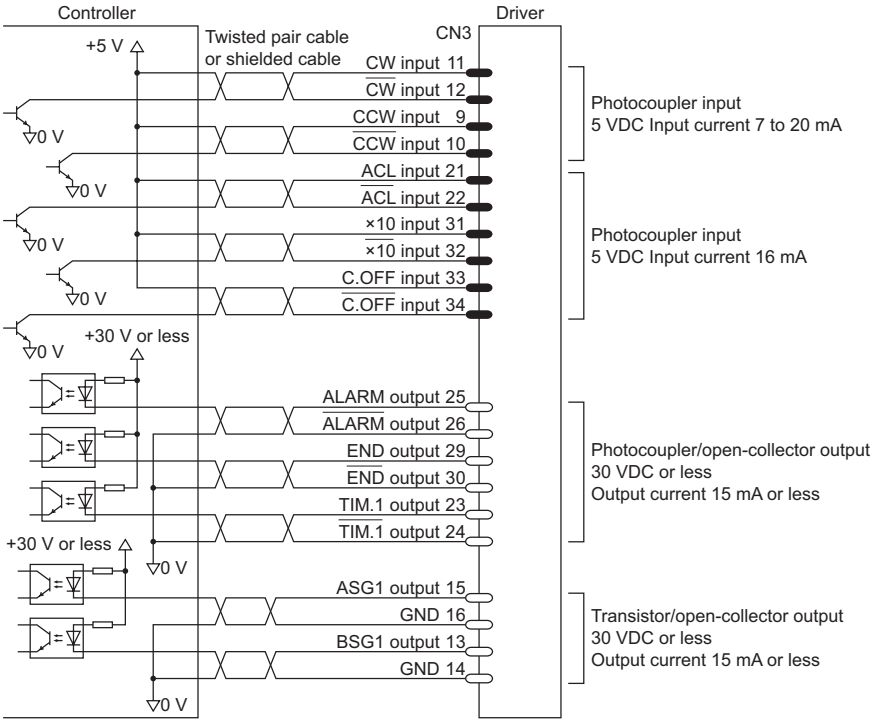
6.1 Connection example

■ In the case of current sourcing inputs and current sinking outputs

- Connection of 5 VDC

  Either 5 or 24 VDC is selected as a signal voltage for the C.OFF input, ×10 input and ACL input.



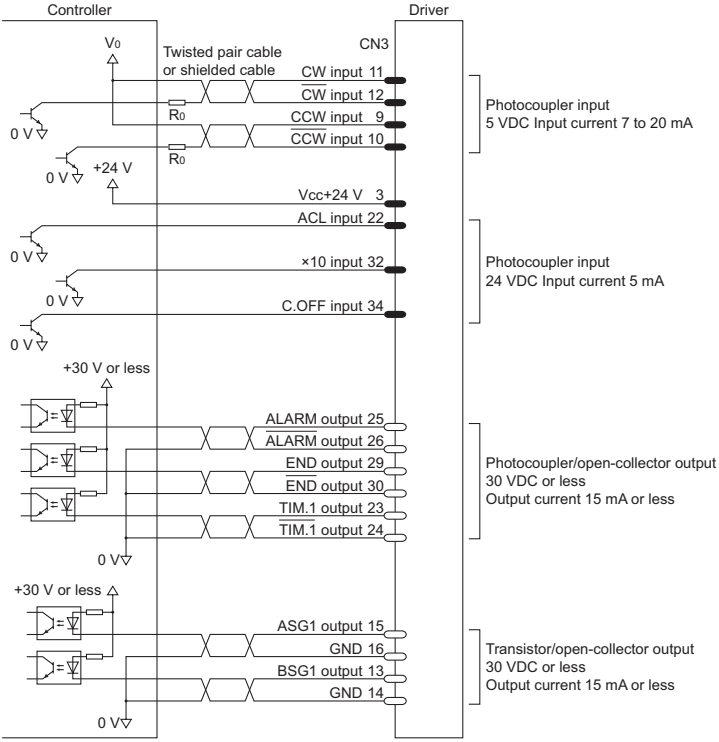


Note

- The CW and CCW inputs provided as driver input signals indicate the opposite directions to the output table's direction of rotation. When the CW input is active, the output table rotates counterclockwise. When the CCW input is active, the output table rotates clockwise.
- Be certain the control input/output cable that connects the driver and controller is as short as possible. The maximum input frequency will decrease as the cable length increases.

- Connection of 24 VDC

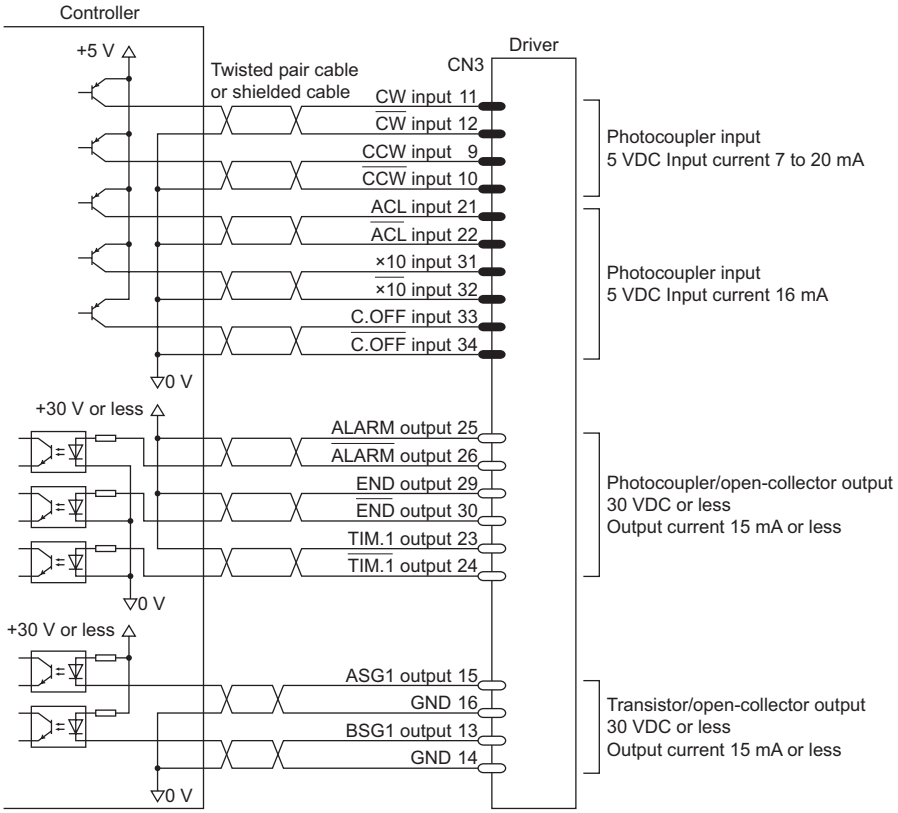
Either 5 or 24 VDC is selected as a signal voltage for the C.OFF input, ×10 input and ACL input.



Note

- The CW and CCW inputs provided as driver input signals indicate the opposite directions to the output table's direction of rotation. When the CW input is active, the output table rotates counterclockwise. When the CCW input is active, the output table rotates clockwise.
- The CW and CCW inputs are of the 5 VDC input specification. If V_0 exceeds 5 V, connect external resistor R_0.
  Example) When V_0 is 24 VDC R_0: 1.5 to 2.2 kΩ, 0.5 W or more.

■ In the case of current sinking inputs and current sourcing outputs



Note

- GND of ASG1, BSG1 is common.
- The output type of these signals is current sinking outputs. See page 37 for the wiring.

6.2 Connecting to the power supply

The driver's input power supply voltage should be 24 VDC±10% (10% ripple max.). Use a power supply ensuring a steady supply of 1.0 A or greater.

■ Crimping the crimp terminal

Securely crimp the terminal to the power supply connector using the crimping tool specified by the connector manufacturer. We do not provide crimping tools. Use a power cable of AWG20 to 18 (0.5 to 0.75 mm^2) in diameter. When connecting the cable, be careful regarding the polarity of the power source. Incorrect power source polarity could damage the driver.

Product number of the specified crimping tool manufactured by Molex

57026-5000 (for UL 1007) or 57027-5000 (for UL 1015)

Note

- Have the connector plugged in securely. Insecure connection may cause malfunction or damage to the actuator or driver.
- When pulling out a connector, pull it out by slightly expanding the latch part of the connectors using a precision screwdriver.
- Do not run the driver's power cable through a conduit containing other power lines or motor cables.
- After shutting down the power, wait at least 5 seconds before turning it back on, unplugging or plugging in the motor's cable connector.

■ Connector configuration

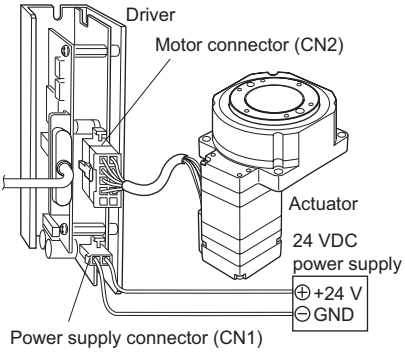
Power supply connector

Connector	Pin No.	Signal	Description
CN1	1	+24 V	24 VDC±10%
	2	GND	

Securely insert the crimp terminal into the power supply connector so that the terminal will not bend or be out of position. Failure to do so may damage the actuator and driver.

■ Connecting the power supply connector

Plug of the power supply connector into the driver's power supply connector (CN1).



6.3 Connecting the actuator

Plug the connector of the motor cable into the driver's motor connector (CN2). Use an optional extension cable (sold separately) to extend the distance between the actuator and driver. Refer to 11 "Options (sold separately)" on page 50 for the extension cable.

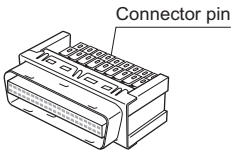
Note

- Have the connector plugged in securely. Insecure connector connection may cause malfunction or damage to the actuator or driver.
- To disconnect the plug, pull the plug while using the fingers to press the latches on the plug.
- When the actuator is to be installed in a moving part, thereby subjecting the motor cable to repeated bending and stretching, use an optional flexible cable (sold separately). Refer to 11 "Options (sold separately)" on page 50 for the flexible cable.

6.4 Connecting control input/output

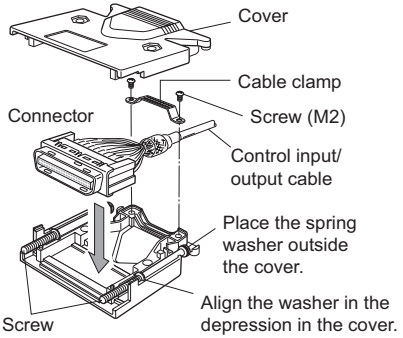
■ Assembling the control input/output connector

Solder the control input/output cable (AWG28: 0.08 mm^2 or more) to the connector (36 pins). Assemble the connector and cover with the supplied screws. For the pin assignments, refer to page 32.
We provide optional driver cable allowing one-touch connection with a driver, as well as connector-terminal block conversion unit (sold separately). Refer to page 50 for details.

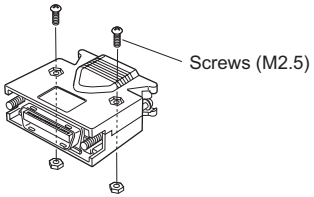


- Assembling the connector and the cover

1. Attach the supplied screws (two pieces) to the cover and insert the connector with the control input/output cable soldered to it.
   Adjust the cable clamp to its correct position.

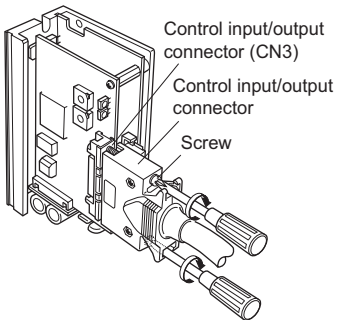


2. Attach the other cover and clamp both connector covers together with screws and nuts.
   Tightening torque: 0.5 to 0.55 N·m
   (71 to 78 oz-in)

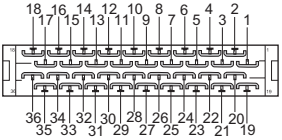


■ Connecting control input/output connector

Insert the control input/output connector into the control input/output connector CN3 on the driver side, and tighten the screw with a flat blade-parallel tip type screwdriver.
Tightening torque: 0.3 to 0.35 N·m
(42 to 49 oz-in)



Connector pin assignments
(Viewed from the soldering side)



■ Connector pin functions

Pin No.	Signal	Description	Direction	Pin No.	Signal	Description	Direction
1	—	Not used	—	19	—	Not used	—
2	GND	External power source	Input	20	—	Not used	—
3	Vcc+24 V			21	ACL	Alarm clear	Input
4	—	Not used	—	22	$\overline{\text{ACL}}$		
5	—	Not used	—	23	TIM.1	Timing Open-collector	Output
6	—	Not used	—	24	$\overline{\text{TIM.1}}$		
7	—	Not used	—	25	ALARM	Alarm	Output
8	—	Not used	—	26	$\overline{\text{ALARM}}$		
9	CCW (DIR.)	CCW pulse (ON: CW, OFF: CCW)	Input	27	—	Not used	—
10	$\overline{\text{CCW}}$ ($\overline{\text{DIR.}}$)			28	—	Not used	—
11	CW (PLS)	CW pulse (Pulse)	Input	29	END	Positioning complete	Output
12	$\overline{\text{CW}}$ ($\overline{\text{PLS}}$)			30	$\overline{\text{END}}$		
13	BSG1	B-phase pulse output Open-collector	Output	31	×10	Resolution switch	Input
14	GND			32	$\overline{\times 10}$		
15	ASG1	A-phase pulse output Open-collector	Output	33	C.OFF	All Windings Off	Input
16	GND			34	$\overline{\text{C.OFF}}$		
17	—	Not used	—	35	—	Not used	—
18	—	Not used	—	36	—	Not used	—

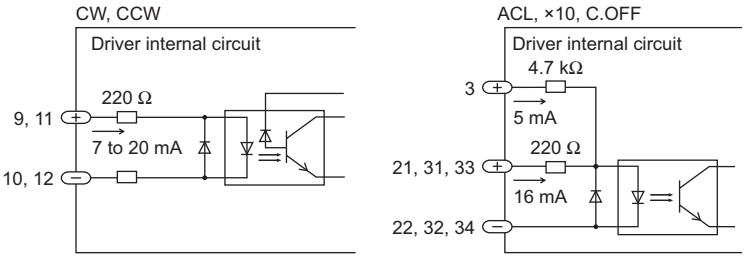
Note

- The functions shown in parentheses are enabled when “1P: 1-Pulse Input Mode” is selected through the pulse-input mode select switch.
- The CW and CCW inputs provided as driver input signals indicate the opposite directions to the output table’s direction of rotation. When the CW input is active, the output table rotates counterclockwise. When the CCW input is active, the output table rotates clockwise.

6.5 About control input/output

■ Input signals

All input signals of the driver are photocoupler inputs.
The signal state represents the “ON: Carrying current” or “OFF: Not carrying current” state of the internal photocoupler rather than the voltage level of the signal.



Note

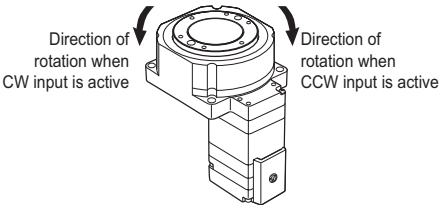
If no pulse is to be input, be sure to keep the photocoupler in “OFF” state. Do not input a CW pulse and CCW pulse simultaneously. If a pulse is input while the other photocoupler is in the “ON” state, the actuator will not operate properly.

- CW input and CCW input

With this driver either 2-pulse input mode or 1-pulse input mode may be selected in accordance with the controller used. Refer to page 41 for details on how to set the pulse-input mode.
ALARM output is in the “OFF” state immediately after the driver power is turned on. Check to see that ALARM output has been turned from “OFF” to “ON” before inputting pulse signals.

Note

The CW and CCW inputs provided as driver input signals indicate the opposite directions to the output table’s direction of rotation. When the CW input is active, the output table rotates counterclockwise. When the CCW input is active, the output table rotates clockwise.

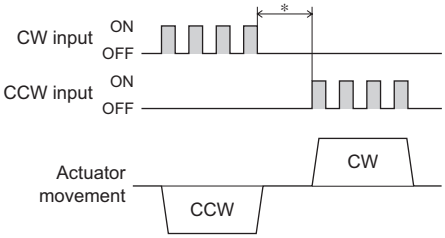


Note The factory setting of the pulse input mode depends on the destination country. Check the pulse input mode setting in accordance with the pulse mode in the controller used.

2-pulse input mode

Connect the CW pulse and CCW pulse of the controller to pin No.12, "$\overline{\text{CW}}$ input," and pin No.10, "$\overline{\text{CCW}}$ input," respectively.

- When the CW pulse input changes from the "OFF" state to "ON" state, the actuator will rotate one step in the CCW direction.
- When the CCW pulse input changes from the "OFF" state to "ON" state, the actuator will rotate one step in the CW direction.



∗ The minimum interval time needed for switching the direction of rotation will vary, depending on the operating speed and size of the load. Do not shorten the interval time any more than is necessary.

Set the input pulse voltage to the CW and CCW pulse inputs at 5 VDC.
If the voltage exceeds 5 VDC, insert an external resistor to limit the input current to nearly 10 mA.

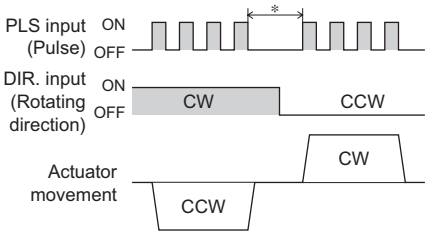
$$R = \frac{V - 1.5}{10\ \text{mA}} - 220\ [\Omega]$$

R: external resistor
V: Pulse voltage

1-pulse input mode

In 1-pulse input mode, the pin functions will be as follows: pin No.11, "PLS input"; pin No.12, "$\overline{\text{PLS}}$ input"; pin No.9, "DIR. input"; and pin No.10, "$\overline{\text{DIR}}$. input." Connect the pulse signal of the controller to pin No.11 and No.12, and the rotating direction signal to pin No.9 and No.10, respectively.

- When the DIR. input is "ON," a rise of the "PLS input" from "OFF" to "ON" will rotate the actuator one step in the CCW direction.
- When the DIR. input is "OFF," a rise of the "PLS pulse input" from "OFF" to "ON" will rotate the actuator one step in the CW direction.



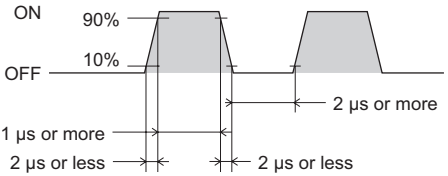
∗ The minimum interval time needed for switching the direction of rotation will vary, depending on the operating speed and size of the load. Do not shorten the interval time any more than is necessary.

The voltage of pulse and rotation direction input to the PLS input and DIR. input shall be 5 VDC. If the voltage exceeds 5 VDC, connect an external resistor to limit the input current to nearly 10 mA.

$$R = \frac{V - 1.5}{10\ mA} - 220\ [\Omega]$$

R: external resistor
V: Pulse voltage

Use an input-pulse signal with a waveform having a sharp rise and fall, as shown in the figure. The figure shows the voltage levels of pulse signals.



ON: 4 to 5 V
OFF: 0 to 0.5 V

- C.OFF (All windings off) input

Use the signal only when the output table must be rotated manually for position adjustment.

- When the C.OFF input is turned "ON," the driver will shut off the output current and the actuator will lose its excitation holding torque. This, however, will allow you to adjust the load position manually.
- When the C.OFF input is turned "OFF," the driver will turn the output current to "ON" again and the actuator's excitation holding torque will be restored. The C.OFF input must be "OFF" when operating the actuator.

Note

- Normally, keep the C.OFF input in the "OFF" state or leave it disconnected.
- Turning the C.OFF input to "ON" resets the deviation counter in the driver.

- ×10 (Resolution select) input

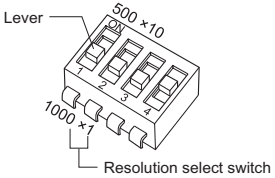
Selects and switches to 10 times either of the resolution "500: 0.04°/pulse" or "1000: 0.02°/ pulse" that has been selected with the resolution select switch.
For instance, if "1000: 0.02°/pulse" has been selected, this signal can switch between the 0.02° step rotation and 0.002° step rotation.
Refer to page 40 for the selection of the resolution select switch.
The resolution select switch [1000/500] is based on the motor resolution. The resolution of the actuator is 18 times the motor resolution. Refer to the table below.

Resolution select switch	Output table resolution	1 step rotation angle
500 × 1	9000	0.04°
1000 × 1	18000	0.02°
500 × 10	90000	0.004°
1000 × 10	180000	0.002°

- Turning the ×10 input to “ON” will select and switch to “×10 resolution.”
- Turning the ×10 input to “OFF” will select and switch to “×1 resolution.”

Note

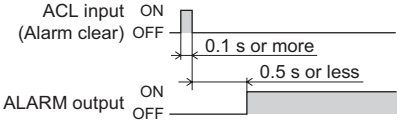
Be sure to set the resolution select switch to “×1” when “×10 input” is used. If the switch is set to “×10,” the resolution will remain at 10 times, regardless of the “ON” or “OFF” resolution select input.



- ACL (Alarm clear) input

The input clears the ALARM output issued when a protective function has been triggered. The ALARM output remains “ON” when the driver is operating normally, then turns “OFF” when a protective function is triggered. For details, refer to “ALARM output” on page 37 and 8 “Protective functions” on page 44.

Setting the ACL input in the ON state clears the ALARM output. To cancel the ALARM output, be sure to remove the cause of the problem that has triggered the protective function before turning the power back on.

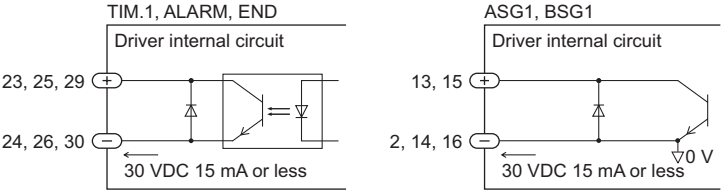


Note

- Turning the power back on will clear the ALARM output. To cancel the ALARM output, be sure to remove the cause of the problem that has triggered the protective function before turning the power back on. After the power has been shut off, wait at least 5 seconds before turning the power back on.
- The EEPROM data error and system error cannot be cleared using the ACL input. Clear these errors by cycling the power. If the problem persists, please contact the nearest office.

■ Output signals

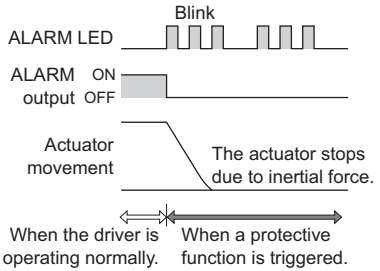
Driver output signals are photocoupler/open-collector output (ALARM, END and TIM.1) and transistor open-collector output (ASG1 and BSG1). The signal state represents the "ON: Carrying current" or "OFF: Not carrying current" state of the internal photocoupler rather than the voltage level of the signal.



- ALARM output

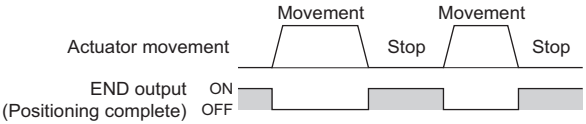
ALARM output remains "ON" when the driver is operating normally, then turns "OFF" when a protective function is triggered. Detect this ALARM output on the controller side and cancel the command to operate the actuator thereafter.

Error detection by the driver, such as overload and overcurrent during actuator operation, turns the ALARM output "OFF," blinks the ALARM LED on the driver, and simultaneously shuts off the actuator current to stop actuator operation. Count the number of the ALARM LED blinks to identify the particular protective function that has been triggered. For details, refer to 8 "Protective functions" on page 44.



- END (Positioning complete) output

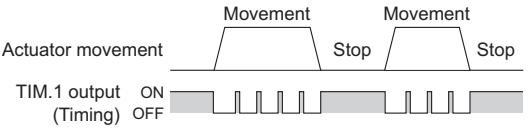
END output turns "ON" when actuator movement is complete. Conditions for the issuance of END output are as follows:
END output is issued when the pulse speed is 500 Hz or less, and the rotor has positioned within ±0.1° of the commanded position.



Note The timing of the END output turning "ON" after the pulse stops will vary, depending on the conditions of the load, the pulse input, and the speed-filter setting.

- TIM.1 (timing) output

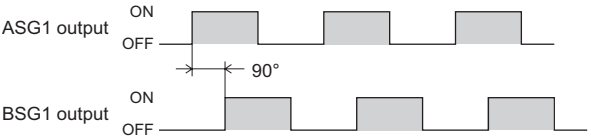
TIM.1 output turns “ON” whenever the output table rotates 0.4°.



Note If TIM.1 output is to be detected, set the pulse speed at 500 Hz or less. Use the ×10 input to switch the resolution only when TIM.1 output is in the “ON” state and the actuator stops. If the resolution is switched under any other conditions, TIM.1 output may not turn “ON” even when the output table has rotated 0.4°.

- ASG1 output and BSG1 output

ASG1 and BSG1 outputs are available in transistor open-collector output.
The output-pulse resolution will be the same as the motor resolution at the time power is supplied to the driver (as set by the resolution select switch).
The resolution of the output table is 18 times the motor resolution. Counting the ASG1 output pulses allows the motor position to be monitored.

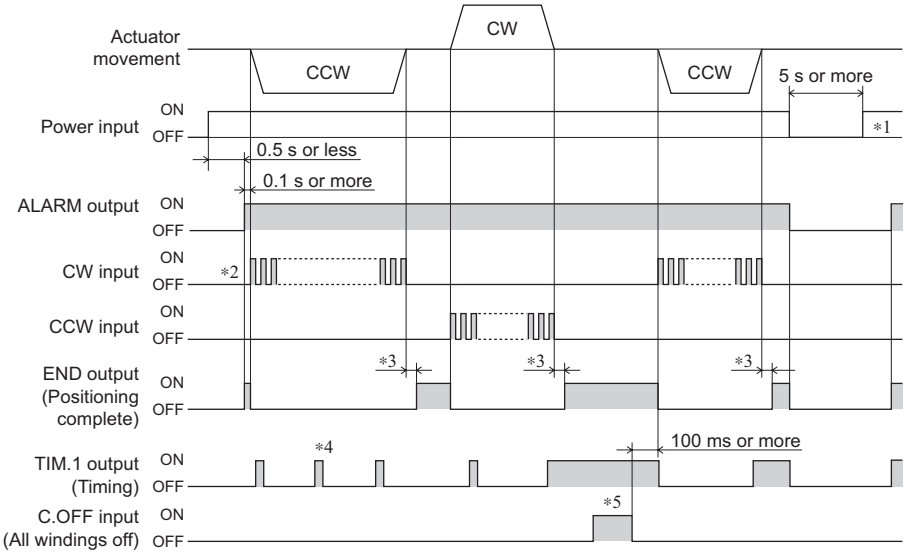


ASG1 output: Outputs pulse while the actuator operates.
BSG1 output: Detects the direction of actuator rotation. It has a 90° phase difference with regard to ASG1 output. The level of BSG1 output at the rise time of ASG1 output indicates the direction of actuator rotation.

Note The pulse-output delays behind actuator rotation by up to 1 ms. The output may be used to verify the actuator’s stop position.

6.6 Timing chart

Note The CW and CCW inputs provided as driver input signals indicate the opposite directions to the output table's direction of rotation. When the CW input is active, the output table rotates counterclockwise. When the CCW input is active, the output table rotates clockwise.



∗1 After the power has been shut off, wait at least 5 seconds before turning the power back on.

∗2 To input the CW or CCW signal pulse, wait at least 0.1 second after clearing the ALARM output.

∗3 The turning of END output to "ON" does not necessarily mean the actuator has stopped. Provide enough of a time delay for a halt, which will vary, depending on the acceleration/deceleration rates and load condition. The time for END output to turn "ON" after the pulse signal stops will vary, depending on the pulse-signal input condition and speed-filter setting condition.

∗4 Detect TIM.1 output only at a pulse speed of 500 Hz or less. No accurate detection is possible at a speed over 500 Hz.

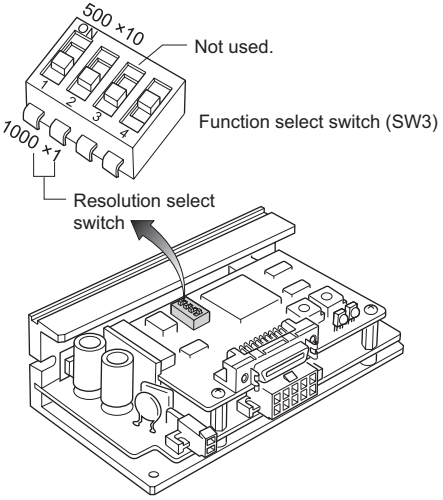
∗5 Turning C.OFF input "ON" shuts off the actuator current, at which time the actuator loses its holding ability. It also clears the value on the deviation counter.

7 Setting

This section covers the selection and settings of driver functions.

7.1 Resolution

Use the resolution select switch "1000/500" and "×1/×10" to set the actuator resolution. The resolution of the output table is 18 times the motor resolution. A total of four resolution levels may be selected, with ×10 input "CN3 Pin No.31, 32" used to switch between 1000 and 10000 and between 500 and 5000. Refer to page 35 for the use of ×10 input.
For the relationship between the resolution select switch setting and the output table's resolution, refer to page 35.



Factory settings

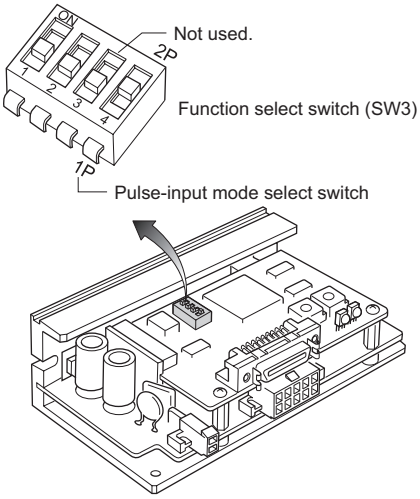
[1000]: 18000 P/R (0.02°/pulse)
[×1]: Multiplier 1

Note

- Be sure to shut off the power before using the resolution select switch. The new resolution takes effect when the power is turned on again.
- Be sure to set the resolution select switch to "×1" when "×10 input" is used. If the switch is set to "×10," "×10" input becomes invalid.

7.2 Pulse-input mode

Either the 2-pulse or 1-pulse input mode may be selected in accordance with the controller used.
When the actuator is to be controlled through 2-pulse signal input via the CW pulse signal and CCW pulse signal, set the pulse-input mode select switch to “2P.”
When the actuator is to be controlled through the PLS (pulse) and the DIR. (rotating-direction), set the pulse-input mode select switch to “1P.”



Note

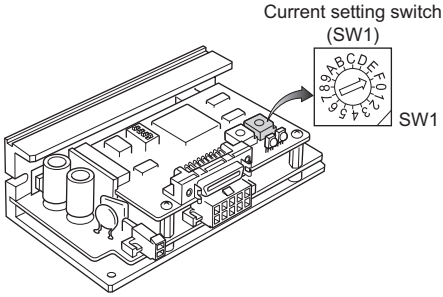
- Be sure to shut off the power before using the pulse-input mode select switch. The new pulse input mode takes effect when the power is turned on again.
- The factory setting of the pulse input mode depends on the destination country. Check the pulse input mode setting in accordance with the pulse mode in the controller used.

7.3 Operating current

Use the current setting switch “SW1” to set the actuator’s operating current.
Set the operating current as a product of the maximum driver output current “F,” which is 100%, multiplied by the operating current percentage corresponding to the given dial.
The switch provides a selection of 16 levels ranging between “0” and “F.”
If there is extra torque, the current may be set to a lower level in order to suppress increases in motor temperature.

Factory setting

[F]: Driver’s maximum output-current value



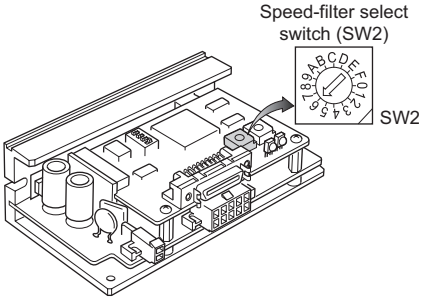
The dial settings and corresponding levels of operating current rates are as follows:

Dial setting	Operating current rate [%]	Dial setting	Operating current rate [%]
0	6	8	56
1	13	9	63
2	19	A	69
3	25	B	75
4	31	C	81
5	38	D	88
6	44	E	94
7	50	F	100

Note An excessively low operating current level may cause a problem when starting the actuator or holding the load in position. Do not reduce the current any more than is necessary.

7.4 Speed filter

Use the speed-filter select switch “SW2” to select the filter time constant that determines the actuator’s response to pulse input.
The switch provides a selection of 16 levels ranging between “0” and “F.” When a larger value is selected, it will reduce shock when the actuator is started and stopped, and will minimize low-speed vibration.
An unnecessarily large filter time constant, however, will smooth out the actuator movement further but with a reduced ability to synchronize to the pulse input and extended settling time when stopping. Select an optimal value to fit the load and application.



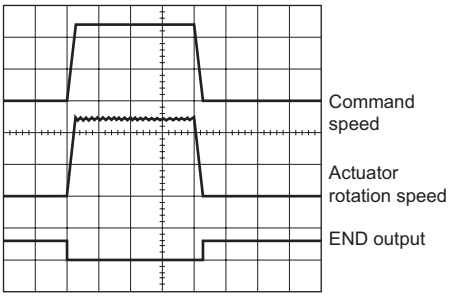
Factory setting

[6]: 1.20 ms

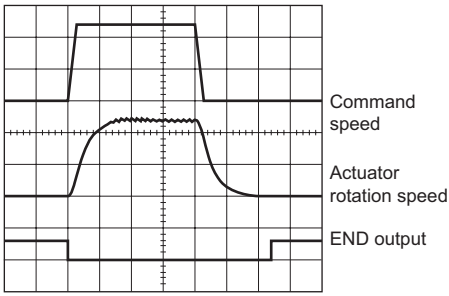
The dial settings and corresponding levels of filter time constants are as follows:

Dial setting	Filter time [ms]	Dial setting	Filter time [ms]
0	None	8	2.70
1	0.12	9	4.10
2	0.16	A	8.20
3	0.27	B	12.0
4	0.41	C	16.0
5	0.82	D	27.0
6	1.20	E	41.0
7	1.60	F	82.0

When the speed-filter selector switch is set to [0]



When the speed-filter selector switch is set to [E]



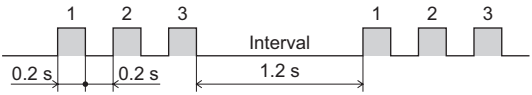
8 Protective functions

This section covers the driver-protection functions and methods used to clear the triggered function.

8.1 Descriptions of protective functions and numbers of LED blinks

The driver is provided with functions that protect the driver from ambient temperature increases, improper power-source or motor-cable connections, and the occurrence of operating errors. When a protective function is triggered, the ALARM LED on the front panel blinks, ALARM output turns OFF, and simultaneously the actuator current is shut off in order to stop the actuator. ALARM output remains "ON" when the driver is operating normally, then turns "OFF" when a protective function is triggered. For details, refer to "ALARM output" on page 37.

ALARM LED blinking cycle (example: for overvoltage protection)



The number of ALARM LED blinks varies according to the nature of the triggered protective function, thereby facilitating action and recovery from the abnormal conditions causing the function to be triggered. The table below gives descriptions of protective functions and their corresponding numbers of blinks.

Number of ALARM LED Blinks	Protective function	Conditions
2	Overload protection	When a load exceeding the maximum torque is applied to the motor for five seconds or more.
3	Overvoltage protection	When the driver inverter's primary voltage exceeds a permissible value.
4	Speed error protection	When the actuator has not normally followed up on pulse input.
6	Overspeed	When the output table speed exceeds 270 r/min.
7	EEPROM data error	When the motor parameter in the driver is damaged.
8	Sensor error	When power turns on without the connection of a motor cable to the driver.
Continuous	System error	When the driver is out of order.

8.2 How to clear a protective function

When a driver-protection function is triggered, turning the ALARM output OFF by employing either of the following methods may clear ALARM output (return to "ON"):

- Give a one-shot ACL (Alarm clear) input to clear the ALARM output.
- Turn the power back on.

Note

- To clear the ALARM output, be sure to remove the cause of the problem that has triggered the protective function before either giving a one-shot ACL input or turning the power back on. After turning off the power, wait at least 5 seconds before turning the power back on.
- The EEPROM data error and system error cannot be cleared using the ACL input. Clear these errors by cycling the power. If the problem persists, please contact the nearest office.

9 Inspection

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

■ During inspection

- Are any of the actuator mounting screws loose?
- Check for any unusual noises in the actuator's bearings (ball bearing) or other moving parts.
- In sure that the screws used to tighten the output table and load are not loose.
- Are there any scratches, signs of stress or loose driver connections in the motor cable?
- Check for a blocked opening of the driver case.
- Are any of the driver mounting screws loose?
- Are there any strange smells or appearances in the driver?

Note The driver uses semiconductor elements, so be extremely careful when handling them. Static electricity may damage the driver.

10 Troubleshooting and remedial actions

During actuator operation, the actuator or driver may fail to function properly due to an improper speed setting or wiring. When the actuator cannot be operated correctly, refer to the contents provided in this section and take appropriate action. If the problem persists, contact your nearest office.

■ If ALARM LED is not blinking

If the actuator does not operate properly even though the ALARM LED is not blinking, refer to the table below:

Phenomenon	Possible cause	Remedial action
• The actuator is not excited. • The actuator can be turned with the hands.	C.OFF input is “ON.”	Turn the C.OFF input to “OFF” and confirm that the actuator is excited.
The actuator does not run.	Bad connection for CW or CCW input.	• Check the connections of the controller and driver. • Review the specifications (voltage and width) for the input pulse.
	In 2-pulse input mode, the CW and CCW pulse inputs are both “ON” at the same time.	Input the pulse signal either to the CW or CCW input. Make sure the terminal with no input is set to “OFF.”
	In 1-pulse input mode, the pulse signal is connected to the DIR. input.	Connect the pulse signal to the PLS input.
The actuator rotates in the direction opposite that which is specified (The CW and CCW inputs provided as driver input signals indicate the opposite directions to the output table’s direction of rotation).	When 2-pulse input mode is selected, the CW and CCW pulse inputs are connected in reverse.	Connect the CW pulse input to the CW pulse input and CCW pulse input to CCW pulse input.
	When 1-pulse input mode is selected, the DIR. input is set in reverse.	Set to “ON” when setting the CW direction or “OFF” when setting the CCW direction.
Actuator operation is unstable.	Bad connection of the pulse signal line.	• Check the connections of the controller and driver. • Review the specifications (voltage and width) for input pulse.

Phenomenon	Possible cause	Remedial action
Vibration is great.	Small load.	Reduce the current by adjusting the driver's current adjustment switch. If the actuator's output torque is too great for the load, vibration will increase.
The TIM.1 output does not turn "ON."	The "×10" input is turned "OFF" during operation.	When the "×10" input is turned "OFF," the TIM.1 output may not turn "ON."
Positioning accuracy is poor.	The screws affixing the actuator or load are skewed.	Tighten the screws to the specified torque.
	The pulse count input is incorrect.	Check the pulse count setting.
	Bad connection of the pulse signal line.	Check the connections of the controller and driver.
	The load's friction torque is excessive.	Reduce the friction torque or perform positioning from one direction only.

■ If the ALARM LED is blinking

If the ALARM LED is blinking, count the number of blinks and refer to the table below:
The ALARM LED blinks in two modes: blinking in groups of between 2 to 8 times (0.2 second on and 0.2 second off) and repeating the same number after 1.2 second each; and the continuous blinking mode.

Number of ALARM LED Blinks	Type of alarm and possible cause	Remedial action
2	Overload protection. Overloading.	Reduce the actuator load.
3	Overvoltage protection. Incorrect power connection or loading beyond the regenerative ability of the driver.	• Check power-source connections. • Reduce load in a vertical-travel application.
4	Speed error protection. Overloading or incorrect speed filter setting.	Reduce load or slightly increase the speed-filter setting.
6	Excessive speed. Excessively high operating-pulse speed.	Set the speed of the output table at 200 r/min or less.
7	EEPROM data error. Error in driver.	Turn on the driver power. If the error persists, contact the branch or sales office from which you purchased the product and request repair.
8	Sensor error. Bad motor-cable connection or open line.	Shut off the driver power and check the motor cable and driver connectors. Then turn the driver power back on.
ALARM LED turns on.	System error. The driver is out of order.	Turn the driver power on. If the error persists, contact the branch or sales office from which you purchased the product and request repair.

11 Options (sold separately)

- Extension cable

  Required to extend the distance between the actuator and driver.

Model	Length [m (ft.)]
CC01AIP	1 (3.3)
CC02AIP	2 (6.6)
CC03AIP	3 (9.8)
CC05AIP	5 (16.4)
CC07AIP	7 (23)
CC10AIP	10 (32.8)

- Flexible cable

  Highly flexible cable required to extend the distance between the actuator and driver.

Model	Length [m (ft.)]
CC01SAR	1 (3.3)
CC02SAR	2 (6.6)
CC03SAR	3 (9.8)
CC05SAR	5 (16.4)
CC07SAR	7 (23)
CC10SAR	10 (32.8)

- Home-sensor set

  Used to perform the return-to-home operation.
  Model: **PADG-SA** (NPN), **PADG-SAY** (PNP)

- Driver cable

  Cable with connectors for driver control input/output (36 pins), providing excellent noise resistance.

Model	Length [m (ft.)]
CC36D1-1	1 (3.3)
CC36D2-1	2 (6.6)

- Connector-terminal block conversion unit

  Use this cable to connect the driver to a host controller via the terminal block.
  [Cable length: 1 m (3.3 ft.)]
  Model: **CC36T1**

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