

*α*STEP AS 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.

Introduction

Before using the motor unit

Only qualified personnel should work with the product.

Use the product correctly after thoroughly reading the section "Safety precautions."

The product described in this manual has been designed and manufactured for use in general industrial machinery, and must not be used for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

Overview of the product

The ***α*STEP AS** series models are unit products consisting of a high-performance micro-stepping driver and a stepping motor (***α*STEP**) with built-in rotor-position sensor. The **AS** series models incorporating ***α*STEP** are not subject to missteps, even when the load changes suddenly. The speed and amount of rotation are constantly monitored during operation, so that when an overload is about to cause the motor to misstep, any delay in response is corrected and operation continues at maximum torque. In addition to the four geared types ideal for low-speed, high-torque operation, a model equipped with an electromagnetic brake is also available, which is suitable for holding the load in position during up or down movement in applications involving vertical travel.

Motors meeting IP65 are also available.

Standards and CE marking

This product is recognized by UL. The CE marking (Low Voltage Directive and EMC Directive) is affixed to the product in accordance with EN standards.

■Applicable standards

	Applicable Standards	Certification Body	Standards File No.
Motor	UL1004, UL2111 CSA C22.2 No. 100*2 CSA C22.2 No. 77*2	UL	File No. E64199
	EN60950 EN60034-1 EN60034-5	–	–
	Driver	UL508C*1 CSA C22.2 No. 14	UL
	EN60950 EN50178	–	–

*1 For UL standard (UL508C), the product is recognized for the condition of Maximum Surrounding Air Temperature 50 °C (122 °F).

*2 **AS46** type is not recognized by UL for CSA standards.

- The names of products certified to conform with relevant standards are represented by applicable unit model motor and driver part numbers.

■Installation conditions (EN standard)

Motor and driver are to be used as a component within other equipment.

Overvoltage category: II

Pollution degree: Class 2 (or Class 3 in case of an IP65 rated motor)

Class: I

■For low voltage directive

The product is a type with machinery incorporated, so it should be installed within an enclosure.

Install the product within the enclosure in order to avoid contact with hands.

Be sure to maintain a protective ground in case hands should make contact with the product. Securely ground the protective grounding terminals of the motor and driver.

■EMC directive

This product has received EMC measures under the conditions specified in "Example of motor and driver installation and wiring" on page 24.

Be sure to conduct EMC measures with the product assembled in your equipment by referring to "Installing and wiring in compliance with EMC directive" on page 22.

Main features

- **Low-speed operation at low vibration levels**

The **αSTEP AS** series achieves smooth, low-speed operation with extremely low vibration, thanks to its micro-stepping drive, which enables stepping in very small angles.

- **Built-in alarm function**

Whenever a load greatly exceeding the motor rating is encountered, or when the motor's output shaft is constrained during operation, the driver outputs a warning alarm.

In a vertical-travel application, the electromagnetic brake may be triggered upon the detection of this alarm to prevent a moving section and the work from falling.

- **Preset speed filter**

The filter time constant that determines motor response can be set in 16 increments.

- **Preset operating current**

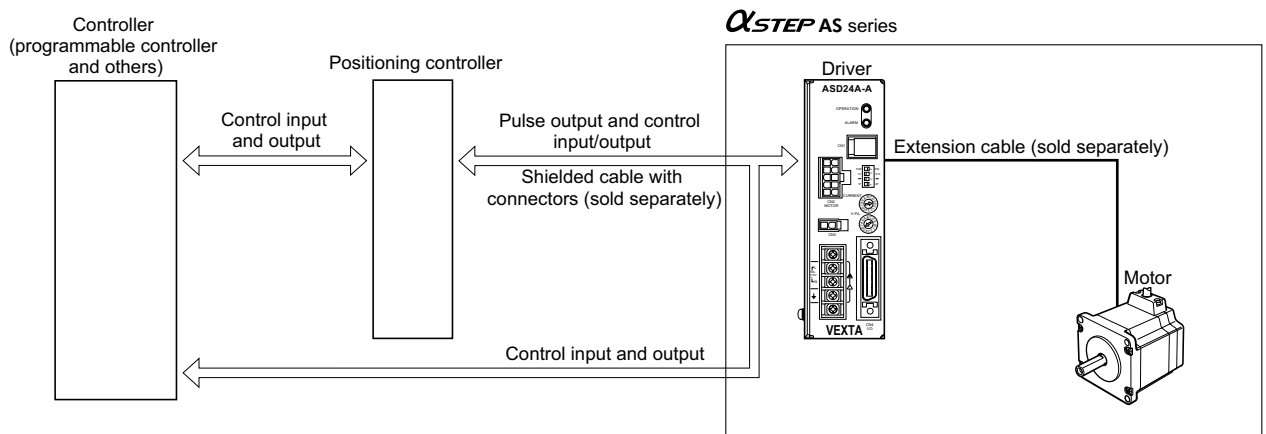
The level of motor current during operation can be set between 6 and 100% (maximum) in 16 increments.

- **Preset resolution**

The motor resolution levels can be set in four increments: 0.72°/pulse, 0.36°/pulse, 0.072°/pulse and 0.036°/pulse.

System configuration

Controllers with pulse-output functions are needed to operate the **αSTEP AS** series.



- Extension cables are available in two types: the standard type and the electromagnetic brake type. If you are using a motor with an electromagnetic brake, provide a 24 VDC power supply for the electromagnetic brake and be sure to connect the motor to the driver using an optional extension cable of the electromagnetic brake type. The electromagnetic brake will not function if the motor cable is connected directly to the driver.

The **AS46** with electromagnetic brake uses a standard extension cable in conjunction with separate lead wires for the electromagnetic brake.

- If you are using an IP65 rated motor, be sure to use an optional extension cable for IP65 rated motor (sold separately).
- The **αSTEP AS** series is available in three input-power sources: single-phase 100-115 V, single-phase 200-230 V and three-phase 200-230 V (**AS46**: single-phase 100-115 V only).

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, electric shock or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire, electric shock or injury.
- Do not transport, install the product, perform connections or inspections when the power is on. Always turn the power off before carrying out these operations. Failure to do so may result in electric shock.
- The terminals on the driver’s front panel marked with   symbol indicate the presence of high voltage. Do not touch these terminals while the power is on to avoid the risk of fire or electric shock.
- Provide a means to hold the moving parts in place for applications involving vertical travel. The motor loses holding torque when the power is shut off, allowing the moving parts to fall and possibly cause injury or damage to equipment.
- Do not use the motor’s built-in electromagnetic brake mechanism for stopping or for safety purposes. Using it for purposes other than holding the moving parts and motor in position may cause injury or damage to equipment.
- When the driver-protection function is triggered, the motor will stop and lose its holding torque, possibly causing injury or damage to equipment.
- When the driver’s protection function is triggered, first remove the cause and then clear the protection function. Continuing the operation without removing the cause of the problem may cause malfunction of the motor, leading to injury or damage to equipment.

Installation

- To prevent the risk of electric shock, use the motor and driver for class I equipment only.
- Install the motor and driver in their enclosures in order to prevent electric shock or injury.
- Install the motor and driver so as to avoid contact with hands, or ground them to prevent the risk of electric shock.

Connection

- Keep the driver’s input-power voltage within the specified range to avoid fire and electric shock.
- Connect the cables securely according to the wiring diagram in order to prevent fire and electric shock.
- Do not forcibly bend, pull or pinch the cable. Doing so may fire and electric shock.
- To prevent electric shock, be sure to install the terminal cover (supplied) over the driver’s power supply terminals after making connections.

Operation

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

Maintenance and inspection

- Do not touch the connection terminals of the driver immediately after the power is turned off (for a period of 10 seconds). The residual voltage may cause electric shock.

Repair, disassembly and modification

- Do not disassemble or modify the motor or driver. This may cause electric shock or 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 motor and driver beyond their specifications, or electric shock, injury or damage to equipment may result.
- Keep your fingers and objects out of the openings in the motor and driver, or electric shock, injury or damage to equipment may result.
- Do not touch the motor or driver during operation or immediately after stopping. The surfaces are hot and may cause a burn.

Transportation

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

Installation

- Keep the area around the motor 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 motor and driver that would obstruct ventilation.
- Provide a cover over the rotating parts (output shaft) of the motor to prevent injury.

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- To avoid injury, remain alert during operation so that the motor can be stopped immediately in an emergency.
- Before supplying power to the driver, turn all control inputs to the driver to "OFF." Otherwise, the motor may start suddenly and cause injury or damage to equipment.
- To prevent bodily injury, do not touch the rotating parts (output shaft) of the motor during operation.
- Before moving the motor directly (as in the case of manual positioning), confirm that the driver C.OFF (All windings off) input is "ON" to prevent injury.
- The motor's surface temperature may exceed 70 °C, even under normal operating conditions. If a motor is accessible during operation, post a warning label shown in the figure in a conspicuous position to prevent the risk of burns.



Warning label

- For the power supply input to the electromagnetic brake, use a DC power supply with reinforced insulation on the primary side.
- When an abnormality is noted, stop the operation immediately, or fire, electric shock or injury may occur.
- To prevent electric shock, use only an insulated screwdriver to adjust the internal switches.

Maintenance and inspection

- To prevent the risk of electric shock, do not touch the terminals while measuring the insulation resistance or conducting a voltage-resistance test.

Disposal

- When disposing of the motor or driver, treat them as ordinary industrial waste.

Precautions for use

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

- **Operate the motor at a level below the maximum torque.**

Operating the motor beyond the maximum torque or placing a continuous constraint on the output shaft may damage the motor bearings (ball bearings). Be sure to keep the motor load below the maximum torque.

- **Do not apply an overhung load in excess of the specified permissible limit.**

Be sure to operate the motor within the specified permissible limit of overhung load. Operating it under an excessive overhung load may damage the motor bearings (ball bearings).

- **Operate the motor with a surface temperature not exceeding 100 °C (212 °F).**

The driver has an overheat-protection function, but the motor has no such feature. The motor case's surface temperature may exceed 100 °C (212 °F) under certain conditions (ambient temperature, operating speed, duty cycle, etc.). Keeping the surface temperature of the motor casing below 100 °C (212 °F) will also maximize the life of the motor bearings (ball bearings).

- **About maximum static torque at excitation**

Maximum static torque at excitation represents a value obtained when the motor is excited using a rated current. When combined with a dedicated driver and while the motor is stopped motor-temperature increases are suppressed due to a current-reduction of approximately 50% by the current-cutback function. Acceleration and operation at the maximum static torque at excitation is possible in start-up, but it has approximately 50% holding power after it has stopped. When selecting a motor for your application, consider the fact that the holding power will be reduced to approximately 50% after the motor has stopped.

- **Use an electromagnetic brake type for an application involving up/down travel.**

When the motor is used in an application involving up/down travel, such as a lifter, use an electromagnetic brake type to hold the load in position. To hold the load in position, apply the electromagnetic brake only after the motor has stopped.

Do not use the brake to bring the moving motor to a halt. Repeated braking for such a purpose will wear the brake hub excessively, causing its holding ability to drop.

Since the electromagnetic brake is of the non-excitation type, it can also be used to hold the load in position upon the occurrence of a power failure. However, this is not a secure means of holding the load.

Do not use the electromagnetic brake as a safety brake.

When the driver-protection function is triggered, the motor stops as the current is turned off. The user must set a controller sequence that will cut off the power to the electromagnetic brake and hold the load in position upon detecting an "OFF" ALARM output.

- **Connecting an electromagnetic brake type**

AS46

Connect the lead wires of the electromagnetic brake to the DC power supply while ensuring the correct polarities of the leads. Be sure to connect the supplied non-polarized varistor in order to protect the switch contacts and prevent noise.

AS66, AS69, AS98

Always use an optional extension cable of the electromagnetic brake type when connecting the motor to the driver.

Connect the two lead wires for the electromagnetic brake, which extend from the extension cable, to the DC power supply while ensuring the correct polarities of the leads.

Be sure to connect the supplied non-polarized varistor in order to protect the switch contacts and prevent noise.

- **Install the driver in a vertical orientation.**

The driver's heat-dissipation function is designed according to vertical orientation. Installing the driver in any other orientation may shorten the life of electronic parts due to temperature increases within the driver.

- **Preventing leakage current**

Stray capacitance exists between the driver's current-carrying line and other current-carrying lines, the earth and the motor, respectively. A high-frequency current may leak out through such capacitance, having a detrimental effect on the surrounding equipment. The actual leakage current depends on the driver's switching frequency, the length of wiring between the driver and motor, and so on.

When providing a leakage current breaker, use the following products, for instance, which have high-frequency signal protection:

Mitsubishi Electric Corporation: NV series

Fuji Electric FA Components & Systems Co., Ltd. : EG and SG series

- **Preventing electrical noise**

See "Installing and wiring in compliance with EMC directive" on page 22 for measures with regard to noise.

- **About grease of geared motor**

On rare occasions, a small amount of grease may ooze out from the geared motor. 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 pen or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer's equipment or products.

Preparation

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

Checking the product

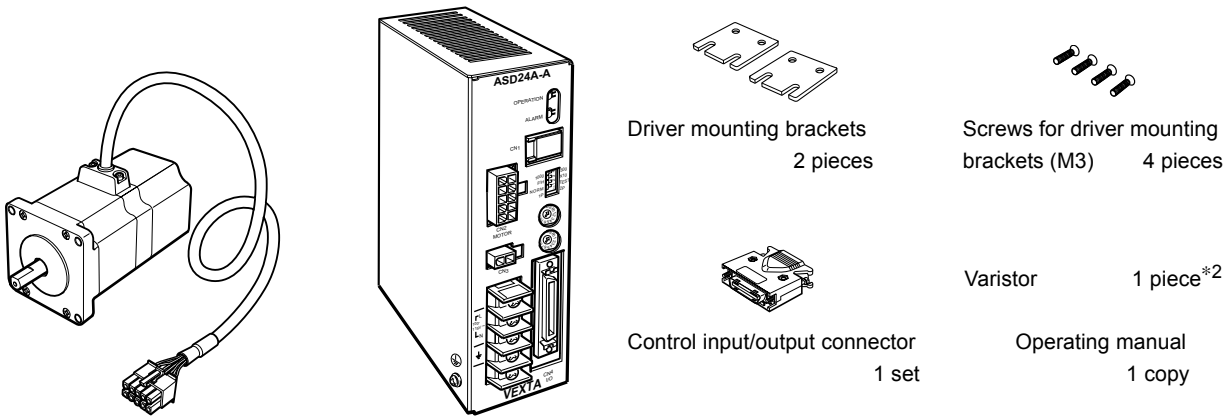
Upon opening the package, verify that the items listed below are included.

Report any missing or damaged items to the branch or sales office from which you purchased the product.

Verify the model number of the purchased unit against the number shown on the package label.

Check the model number of the motor and driver against the number shown on the nameplate.

The unit models and corresponding motor/driver combinations are listed on pages 10 to 13.



Motor 1 Unit *1
Illustration shows the **AS66** standard type with electromagnetic brake.

Driver 1 Unit

Driver mounting brackets
2 pieces

Screws for driver mounting brackets (M3) 4 pieces

Control input/output connector
1 set

Varistor 1 piece*2

Operating manual
1 copy

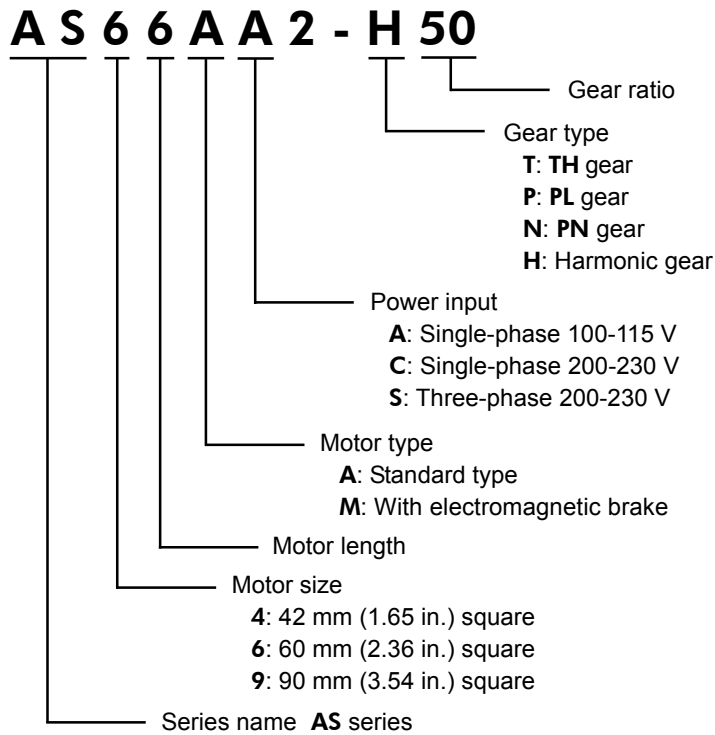
- *1 IP65 rated motors do not come with a motor cable.
For these motors, be sure to purchase an optional cable for IP65 rated motor (sold separately).
A parallel key (1 unit) is supplied with all geared type motors (excluding the **AS46TH**, **AS46PL** and **AS66TH** geared type).
- *2 Varistor supplied with the motor with an electromagnetic brake type

Options (sold separately)

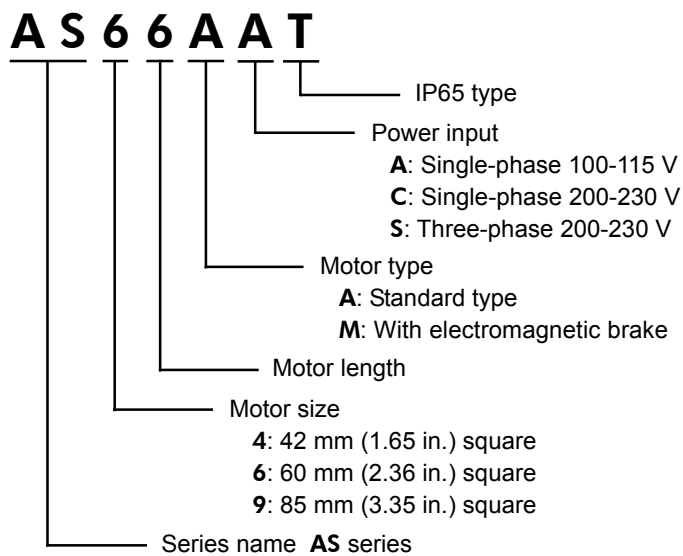
- Extension cable Pages 25 to 27 and 48
Required for extending the distance between the motor (other than IP65 rated motor) and driver.
Be sure to use the electromagnetic brake extension cable to connect an electromagnetic brake type motor the **AS66**, **AS69** and **AS98**.
Always use a standard extension cable for the **AS46**, regardless of whether or not the motor is equipped with an electromagnetic brake.
- Motor cable for IP65 rated motor Pages 25 and 48
Cable required for connecting an IP65 rated motor and a driver.
- Flexible cable Pages 25, 27 and 48
Highly flexible extension cable.
- Flexible cable for IP65 rated motor Pages 25 and 48
Highly flexible cable required for connecting an IP65 rated motor and a driver.
- DIN rail mounting plate Pages 21 and 48
Plate for mounting the driver to a DIN rail.
- Shielded cable with connectors Pages 32 and 48
Cable with connectors for driver control input/output (36 pins), providing excellent noise resistance.

How to identify the product model

Geared type



Standard type



Combinations of motors and drivers

■TH geared type

Standard type		
Unit model	Motor model	Driver model
AS46AA-T3.6	ASM46AA-T3.6	ASD13B-A
AS46AA-T7.2	ASM46AA-T7.2	ASD13B-A
AS46AA-T10	ASM46AA-T10	ASD13B-A
AS46AA-T20	ASM46AA-T20	ASD13C-A
AS46AA-T30	ASM46AA-T30	ASD13C-A
AS66AA-T3.6	ASM66AA-T3.6	ASD24B-A
AS66AA-T7.2	ASM66AA-T7.2	ASD24B-A
AS66AA-T10	ASM66AA-T10	ASD24B-A
AS66AA-T20	ASM66AA-T20	ASD24C-A
AS66AA-T30	ASM66AA-T30	ASD24C-A
AS66AC-T3.6	ASM66AC-T3.6	ASD12B-C
AS66AC-T7.2	ASM66AC-T7.2	ASD12B-C
AS66AC-T10	ASM66AC-T10	ASD12B-C
AS66AC-T20	ASM66AC-T20	ASD12C-C
AS66AC-T30	ASM66AC-T30	ASD12C-C
AS66AS-T3.6	ASM66AC-T3.6	ASD12B-S
AS66AS-T7.2	ASM66AC-T7.2	ASD12B-S
AS66AS-T10	ASM66AC-T10	ASD12B-S
AS66AS-T20	ASM66AC-T20	ASD12C-S
AS66AS-T30	ASM66AC-T30	ASD12C-S
AS98AA-T3.6	ASM98AA-T3.6	ASD30A-A
AS98AA-T7.2	ASM98AA-T7.2	ASD30A-A
AS98AA-T10	ASM98AA-T10	ASD30A-A
AS98AA-T20	ASM98AA-T20	ASD30C-A
AS98AA-T30	ASM98AA-T30	ASD30C-A
AS98AC-T3.6	ASM98AC-T3.6	ASD16A-C
AS98AC-T7.2	ASM98AC-T7.2	ASD16A-C
AS98AC-T10	ASM98AC-T10	ASD16A-C
AS98AC-T20	ASM98AC-T20	ASD16C-C
AS98AC-T30	ASM98AC-T30	ASD16C-C
AS98AS-T3.6	ASM98AC-T3.6	ASD16A-S
AS98AS-T7.2	ASM98AC-T7.2	ASD16A-S
AS98AS-T10	ASM98AC-T10	ASD16A-S
AS98AS-T20	ASM98AC-T20	ASD16C-S
AS98AS-T30	ASM98AC-T30	ASD16C-S

Electromagnetic brake type		
Unit model	Motor model	Driver model
AS46MA-T3.6	ASM46MA-T3.6	ASD13B-A
AS46MA-T7.2	ASM46MA-T7.2	ASD13B-A
AS46MA-T10	ASM46MA-T10	ASD13B-A
AS46MA-T20	ASM46MA-T20	ASD13C-A
AS46MA-T30	ASM46MA-T30	ASD13C-A
AS66MA-T3.6	ASM66MA-T3.6	ASD24B-A
AS66MA-T7.2	ASM66MA-T7.2	ASD24B-A
AS66MA-T10	ASM66MA-T10	ASD24B-A
AS66MA-T20	ASM66MA-T20	ASD24C-A
AS66MA-T30	ASM66MA-T30	ASD24C-A
AS66MC-T3.6	ASM66MC-T3.6	ASD12B-C
AS66MC-T7.2	ASM66MC-T7.2	ASD12B-C
AS66MC-T10	ASM66MC-T10	ASD12B-C
AS66MC-T20	ASM66MC-T20	ASD12C-C
AS66MC-T30	ASM66MC-T30	ASD12C-C
AS66MS-T3.6	ASM66MC-T3.6	ASD12B-S
AS66MS-T7.2	ASM66MC-T7.2	ASD12B-S
AS66MS-T10	ASM66MC-T10	ASD12B-S
AS66MS-T20	ASM66MC-T20	ASD12C-S
AS66MS-T30	ASM66MC-T30	ASD12C-S
AS98MA-T3.6	ASM98MA-T3.6	ASD30A-A
AS98MA-T7.2	ASM98MA-T7.2	ASD30A-A
AS98MA-T10	ASM98MA-T10	ASD30A-A
AS98MA-T20	ASM98MA-T20	ASD30C-A
AS98MA-T30	ASM98MA-T30	ASD30C-A
AS98MC-T3.6	ASM98MC-T3.6	ASD16A-C
AS98MC-T7.2	ASM98MC-T7.2	ASD16A-C
AS98MC-T10	ASM98MC-T10	ASD16A-C
AS98MC-T20	ASM98MC-T20	ASD16C-C
AS98MC-T30	ASM98MC-T30	ASD16C-C
AS98MS-T3.6	ASM98MC-T3.6	ASD16A-S
AS98MS-T7.2	ASM98MC-T7.2	ASD16A-S
AS98MS-T10	ASM98MC-T10	ASD16A-S
AS98MS-T20	ASM98MC-T20	ASD16C-S
AS98MS-T30	ASM98MC-T30	ASD16C-S

■ PL geared type

Standard type		
Unit model	Motor model	Driver model
AS46AA-P7.2	ASM46AA-P7.2	ASD13A-A
AS46AA-P10	ASM46AA-P10	ASD13A-A
AS46AA-P36	ASM46AA-P36	ASD13B-A
AS46AA-P50	ASM46AA-P50	ASD13C-A
AS66AA-P5	ASM66AA-P5	ASD24A-A
AS66AA-P7.2	ASM66AA-P7.2	ASD24A-A
AS66AA-P10	ASM66AA-P10	ASD24A-A
AS66AA-P25	ASM66AA-P25	ASD24B-A
AS66AA-P36	ASM66AA-P36	ASD24C-A
AS66AA-P50	ASM66AA-P50	ASD24C-A
AS66AC-P5	ASM66AC-P5	ASD12A-C
AS66AC-P7.2	ASM66AC-P7.2	ASD12A-C
AS66AC-P10	ASM66AC-P10	ASD12A-C
AS66AC-P25	ASM66AC-P25	ASD12B-C
AS66AC-P36	ASM66AC-P36	ASD12C-C
AS66AC-P50	ASM66AC-P50	ASD12C-C
AS66AS-P5	ASM66AC-P5	ASD12A-S
AS66AS-P7.2	ASM66AC-P7.2	ASD12A-S
AS66AS-P10	ASM66AC-P10	ASD12A-S
AS66AS-P25	ASM66AC-P25	ASD12B-S
AS66AS-P36	ASM66AC-P36	ASD12C-S
AS66AS-P50	ASM66AC-P50	ASD12C-S
AS98AA-P5	ASM98AA-P5	ASD30A-A
AS98AA-P7.2	ASM98AA-P7.2	ASD30A-A
AS98AA-P10	ASM98AA-P10	ASD30A-A
AS98AA-P25	ASM98AA-P25	ASD30A-A
AS98AA-P36	ASM98AA-P36	ASD30B-A
AS98AA-P50	ASM98AA-P50	ASD30B-A
AS98AC-P5	ASM98AC-P5	ASD16A-C
AS98AC-P7.2	ASM98AC-P7.2	ASD16A-C
AS98AC-P10	ASM98AC-P10	ASD16A-C
AS98AC-P25	ASM98AC-P25	ASD16A-C
AS98AC-P36	ASM98AC-P36	ASD16B-C
AS98AC-P50	ASM98AC-P50	ASD16B-C
AS98AS-P5	ASM98AC-P5	ASD16A-S
AS98AS-P7.2	ASM98AC-P7.2	ASD16A-S
AS98AS-P10	ASM98AC-P10	ASD16A-S
AS98AS-P25	ASM98AC-P25	ASD16A-S
AS98AS-P36	ASM98AC-P36	ASD16B-S
AS98AS-P50	ASM98AC-P50	ASD16B-S

Electromagnetic brake type		
Unit model	Motor model	Driver model
AS46MA-P7.2	ASM46MA-P7.2	ASD13A-A
AS46MA-P10	ASM46MA-P10	ASD13A-A
AS46MA-P36	ASM46MA-P36	ASD13B-A
AS46MA-P50	ASM46MA-P50	ASD13C-A
AS66MA-P5	ASM66MA-P5	ASD24A-A
AS66MA-P7.2	ASM66MA-P7.2	ASD24A-A
AS66MA-P10	ASM66MA-P10	ASD24A-A
AS66MA-P25	ASM66MA-P25	ASD24B-A
AS66MA-P36	ASM66MA-P36	ASD24C-A
AS66MA-P50	ASM66MA-P50	ASD24C-A
AS66MC-P5	ASM66MC-P5	ASD12A-C
AS66MC-P7.2	ASM66MC-P7.2	ASD12A-C
AS66MC-P10	ASM66MC-P10	ASD12A-C
AS66MC-P25	ASM66MC-P25	ASD12B-C
AS66MC-P36	ASM66MC-P36	ASD12C-C
AS66MC-P50	ASM66MC-P50	ASD12C-C
AS66MS-P5	ASM66MC-P5	ASD12A-S
AS66MS-P7.2	ASM66MC-P7.2	ASD12A-S
AS66MS-P10	ASM66MC-P10	ASD12A-S
AS66MS-P25	ASM66MC-P25	ASD12B-S
AS66MS-P36	ASM66MC-P36	ASD12C-S
AS66MS-P50	ASM66MC-P50	ASD12C-S
AS98MA-P5	ASM98MA-P5	ASD30A-A
AS98MA-P7.2	ASM98MA-P7.2	ASD30A-A
AS98MA-P10	ASM98MA-P10	ASD30A-A
AS98MA-P25	ASM98MA-P25	ASD30A-A
AS98MA-P36	ASM98MA-P36	ASD30B-A
AS98MA-P50	ASM98MA-P50	ASD30B-A
AS98MC-P5	ASM98MC-P5	ASD16A-C
AS98MC-P7.2	ASM98MC-P7.2	ASD16A-C
AS98MC-P10	ASM98MC-P10	ASD16A-C
AS98MC-P25	ASM98MC-P25	ASD16A-C
AS98MC-P36	ASM98MC-P36	ASD16B-C
AS98MC-P50	ASM98MC-P50	ASD16B-C
AS98MS-P5	ASM98MC-P5	ASD16A-S
AS98MS-P7.2	ASM98MC-P7.2	ASD16A-S
AS98MS-P10	ASM98MC-P10	ASD16A-S
AS98MS-P25	ASM98MC-P25	ASD16A-S
AS98MS-P36	ASM98MC-P36	ASD16B-S
AS98MS-P50	ASM98MC-P50	ASD16B-S

■PN geared type

Standard type		
Unit model	Motor model	Driver model
AS46AA-N7.2	ASM46AA-N7.2	ASD13A-A
AS46AA-N10	ASM46AA-N10	ASD13A-A
AS66AA-N5	ASM66AA-N5	ASD24A-A
AS66AA-N7.2	ASM66AA-N7.2	ASD24A-A
AS66AA-N10	ASM66AA-N10	ASD24A-A
AS66AA-N25	ASM66AA-N25	ASD24B-A
AS66AA-N36	ASM66AA-N36	ASD24C-A
AS66AA-N50	ASM66AA-N50	ASD24C-A
AS66AC-N5	ASM66AC-N5	ASD12A-C
AS66AC-N7.2	ASM66AC-N7.2	ASD12A-C
AS66AC-N10	ASM66AC-N10	ASD12A-C
AS66AC-N25	ASM66AC-N25	ASD12B-C
AS66AC-N36	ASM66AC-N36	ASD12C-C
AS66AC-N50	ASM66AC-N50	ASD12C-C
AS66AS-N5	ASM66AC-N5	ASD12A-S
AS66AS-N7.2	ASM66AC-N7.2	ASD12A-S
AS66AS-N10	ASM66AC-N10	ASD12A-S
AS66AS-N25	ASM66AC-N25	ASD12B-S
AS66AS-N36	ASM66AC-N36	ASD12C-S
AS66AS-N50	ASM66AC-N50	ASD12C-S
AS98AA-N5	ASM98AA-N5	ASD30A-A
AS98AA-N7.2	ASM98AA-N7.2	ASD30A-A
AS98AA-N10	ASM98AA-N10	ASD30A-A
AS98AA-N25	ASM98AA-N25	ASD30A-A
AS98AA-N36	ASM98AA-N36	ASD30A-A
AS98AA-N50	ASM98AA-N50	ASD30B-A
AS98AC-N5	ASM98AC-N5	ASD16A-C
AS98AC-N7.2	ASM98AC-N7.2	ASD16A-C
AS98AC-N10	ASM98AC-N10	ASD16A-C
AS98AC-N25	ASM98AC-N25	ASD16A-C
AS98AC-N36	ASM98AC-N36	ASD16A-C
AS98AC-N50	ASM98AC-N50	ASD16B-C
AS98AS-N5	ASM98AC-N5	ASD16A-S
AS98AS-N7.2	ASM98AC-N7.2	ASD16A-S
AS98AS-N10	ASM98AC-N10	ASD16A-S
AS98AS-N25	ASM98AC-N25	ASD16A-S
AS98AS-N36	ASM98AC-N36	ASD16A-S
AS98AS-N50	ASM98AC-N50	ASD16B-S

Electromagnetic brake type		
Unit model	Motor model	Driver model
AS46MA-N7.2	ASM46MA-N7.2	ASD13A-A
AS46MA-N10	ASM46MA-N10	ASD13A-A
AS66MA-N5	ASM66MA-N5	ASD24A-A
AS66MA-N7.2	ASM66MA-N7.2	ASD24A-A
AS66MA-N10	ASM66MA-N10	ASD24A-A
AS66MA-N25	ASM66MA-N25	ASD24B-A
AS66MA-N36	ASM66MA-N36	ASD24C-A
AS66MA-N50	ASM66MA-N50	ASD24C-A
AS66MC-N5	ASM66MC-N5	ASD12A-C
AS66MC-N7.2	ASM66MC-N7.2	ASD12A-C
AS66MC-N10	ASM66MC-N10	ASD12A-C
AS66MC-N25	ASM66MC-N25	ASD12B-C
AS66MC-N36	ASM66MC-N36	ASD12C-C
AS66MC-N50	ASM66MC-N50	ASD12C-C
AS66MS-N5	ASM66MC-N5	ASD12A-S
AS66MS-N7.2	ASM66MC-N7.2	ASD12A-S
AS66MS-N10	ASM66MC-N10	ASD12A-S
AS66MS-N25	ASM66MC-N25	ASD12B-S
AS66MS-N36	ASM66MC-N36	ASD12C-S
AS66MS-N50	ASM66MC-N50	ASD12C-S
AS98MA-N5	ASM98MA-N5	ASD30A-A
AS98MA-N7.2	ASM98MA-N7.2	ASD30A-A
AS98MA-N10	ASM98MA-N10	ASD30A-A
AS98MA-N25	ASM98MA-N25	ASD30A-A
AS98MA-N36	ASM98MA-N36	ASD30A-A
AS98MA-N50	ASM98MA-N50	ASD30B-A
AS98MC-N5	ASM98MC-N5	ASD16A-C
AS98MC-N7.2	ASM98MC-N7.2	ASD16A-C
AS98MC-N10	ASM98MC-N10	ASD16A-C
AS98MC-N25	ASM98MC-N25	ASD16A-C
AS98MC-N36	ASM98MC-N36	ASD16A-C
AS98MC-N50	ASM98MC-N50	ASD16B-C
AS98MS-N5	ASM98MC-N5	ASD16A-S
AS98MS-N7.2	ASM98MC-N7.2	ASD16A-S
AS98MS-N10	ASM98MC-N10	ASD16A-S
AS98MS-N25	ASM98MC-N25	ASD16A-S
AS98MS-N36	ASM98MC-N36	ASD16A-S
AS98MS-N50	ASM98MC-N50	ASD16B-S

■ Harmonic geared type

Standard type		
Unit model	Motor model	Driver model
AS46AA2-H50	ASM46AA2-H50	ASD13A-A
AS46AA2-H100	ASM46AA2-H100	ASD13A-A
AS46AA-H50	ASM46AA-H50	ASD13C-A
AS46AA-H100	ASM46AA-H100	ASD13C-A
AS66AA2-H50	ASM66AA2-H50	ASD24B-A
AS66AA2-H100	ASM66AA2-H100	ASD24C-A
AS66AC2-H50	ASM66AC2-H50	ASD12B-C
AS66AC2-H100	ASM66AC2-H100	ASD12C-C
AS66AS2-H50	ASM66AC2-H50	ASD12B-S
AS66AS2-H100	ASM66AC2-H100	ASD12C-S
AS66AA-H50	ASM66AA-H50	ASD24C-A
AS66AA-H100	ASM66AA-H100	ASD24C-A
AS66AC-H50	ASM66AC-H50	ASD12C-C
AS66AC-H100	ASM66AC-H100	ASD12C-C
AS66AS-H50	ASM66AC-H50	ASD12C-S
AS66AS-H100	ASM66AC-H100	ASD12C-S
AS98AA-H50	ASM98AA-H50	ASD30B-A
AS98AA-H100	ASM98AA-H100	ASD30B-A
AS98AC-H50	ASM98AC-H50	ASD16B-C
AS98AC-H100	ASM98AC-H100	ASD16B-C
AS98AS-H50	ASM98AC-H50	ASD16B-S
AS98AS-H100	ASM98AC-H100	ASD16B-S

■ Standard type

Standard type		
Unit model	Motor model	Driver model
AS46AA	ASM46AA	ASD13A-A
AS66AA	ASM66AA	ASD24A-A
AS69AA	ASM69AA	ASD30D-A
AS66AC	ASM66AC	ASD12A-C
AS69AC	ASM69AC	ASD16D-C
AS66AS	ASM66AC	ASD12A-S
AS69AS	ASM69AC	ASD16D-S
AS98AA	ASM98AA	ASD30A-A
AS911AA	ASM911AA	ASD30E-A
AS98AC	ASM98AC	ASD16A-C
AS911AC	ASM911AC	ASD20A-C
AS98AS	ASM98AC	ASD16A-S
AS911AS	ASM911AC	ASD20A-S

■ Standard type IP65 rated motor

Unit model	Motor model	Driver model
AS66AAT	ASM66AAT	ASD24A-A
AS69AAT	ASM69AAT	ASD30D-A
AS66ACT	ASM66ACT	ASD12A-C
AS69ACT	ASM69ACT	ASD16D-C
AS66AST	ASM66ACT	ASD12A-S
AS69AST	ASM69ACT	ASD16D-S
AS98AAT	ASM98AAT	ASD30A-A
AS911AAT	ASM911AAT	ASD30E-A
AS98ACT	ASM98ACT	ASD16A-C
AS911ACT	ASM911ACT	ASD20A-C
AS98AST	ASM98ACT	ASD16A-S
AS911AST	ASM911ACT	ASD20A-S

Electromagnetic brake type

Electromagnetic brake type		
Unit model	Motor model	Driver model
AS46MA2-H50	ASM46MA2-H50	ASD13A-A
AS46MA2-H100	ASM46MA2-H100	ASD13A-A
AS46MA-H50	ASM46MA-H50	ASD13C-A
AS46MA-H100	ASM46MA-H100	ASD13C-A
AS66MA2-H50	ASM66MA2-H50	ASD24B-A
AS66MA2-H100	ASM66MA2-H100	ASD24C-A
AS66MC2-H50	ASM66MC2-H50	ASD12B-C
AS66MC2-H100	ASM66MC2-H100	ASD12C-C
AS66MS2-H50	ASM66MC2-H50	ASD12B-S
AS66MS2-H100	ASM66MC2-H100	ASD12C-S
AS66MA-H50	ASM66MA-H50	ASD24C-A
AS66MA-H100	ASM66MA-H100	ASD24C-A
AS66MC-H50	ASM66MC-H50	ASD12C-C
AS66MC-H100	ASM66MC-H100	ASD12C-C
AS66MS-H50	ASM66MC-H50	ASD12C-S
AS66MS-H100	ASM66MC-H100	ASD12C-S
AS98MA-H50	ASM98MA-H50	ASD30B-A
AS98MA-H100	ASM98MA-H100	ASD30B-A
AS98MC-H50	ASM98MC-H50	ASD16B-C
AS98MC-H100	ASM98MC-H100	ASD16B-C
AS98MS-H50	ASM98MC-H50	ASD16B-S
AS98MS-H100	ASM98MC-H100	ASD16B-S

Electromagnetic brake type

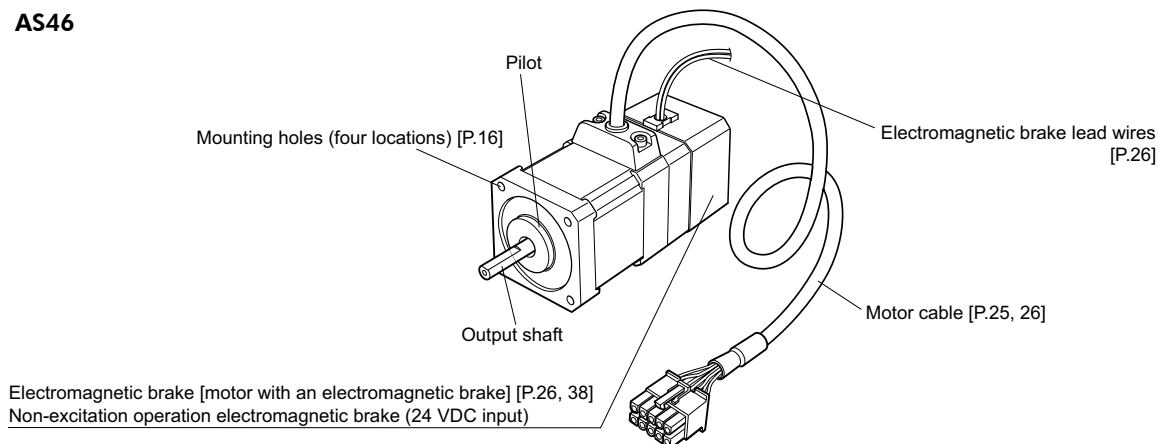
Electromagnetic brake type		
Unit model	Motor model	Driver model
AS46MA	ASM46MA	ASD13A-A
AS66MA	ASM66MA	ASD24A-A
AS69MA	ASM69MA	ASD30D-A
AS66MC	ASM66MC	ASD12A-C
AS69MC	ASM69MC	ASD16D-C
AS66MS	ASM66MC	ASD12A-S
AS69MS	ASM69MC	ASD16D-S
AS98MA	ASM98MA	ASD30A-A
AS98MC	ASM98MC	ASD16A-C
AS98MS	ASM98MC	ASD16A-S

Names and functions of parts

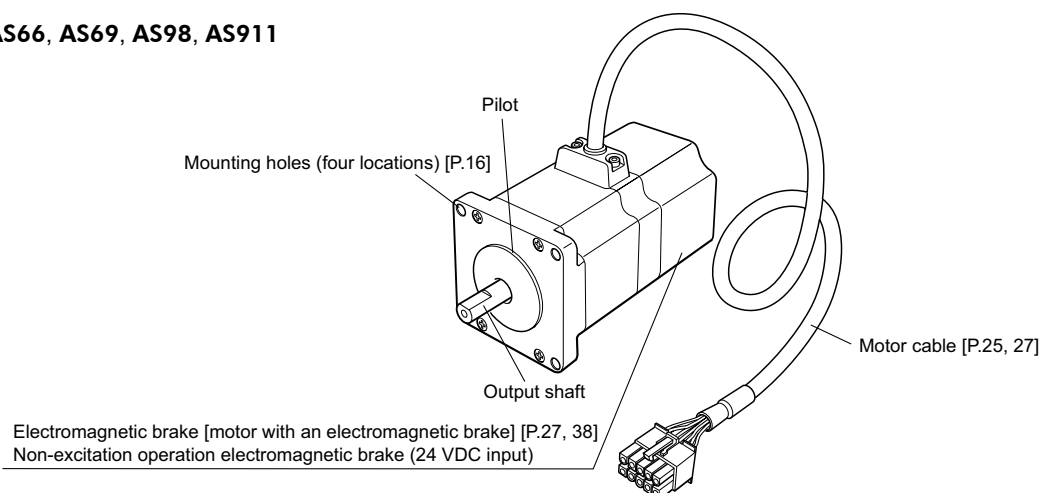
This section covers the names and functions of parts in the motor and driver.
For further details on each part, refer to the page shown in the square bracket.

Motor (other than IP65 rated motor)

AS46



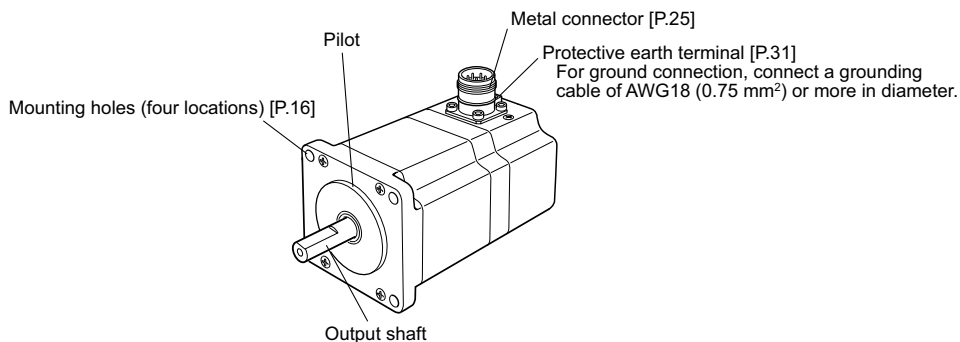
AS66, AS69, AS98, AS911



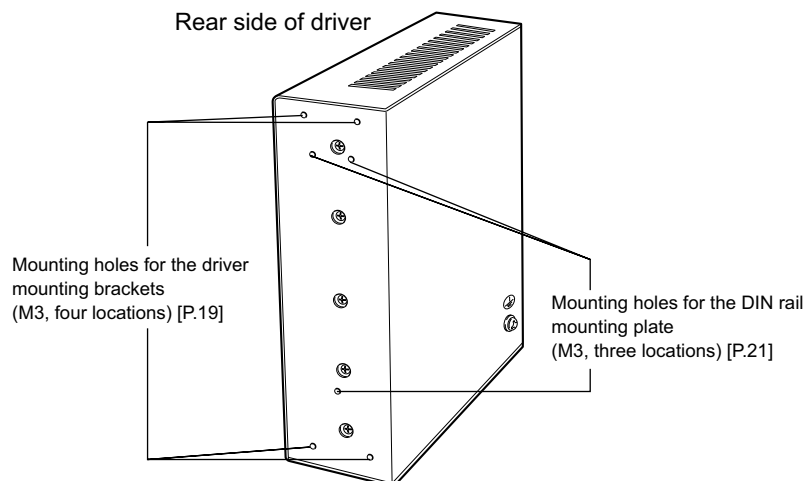
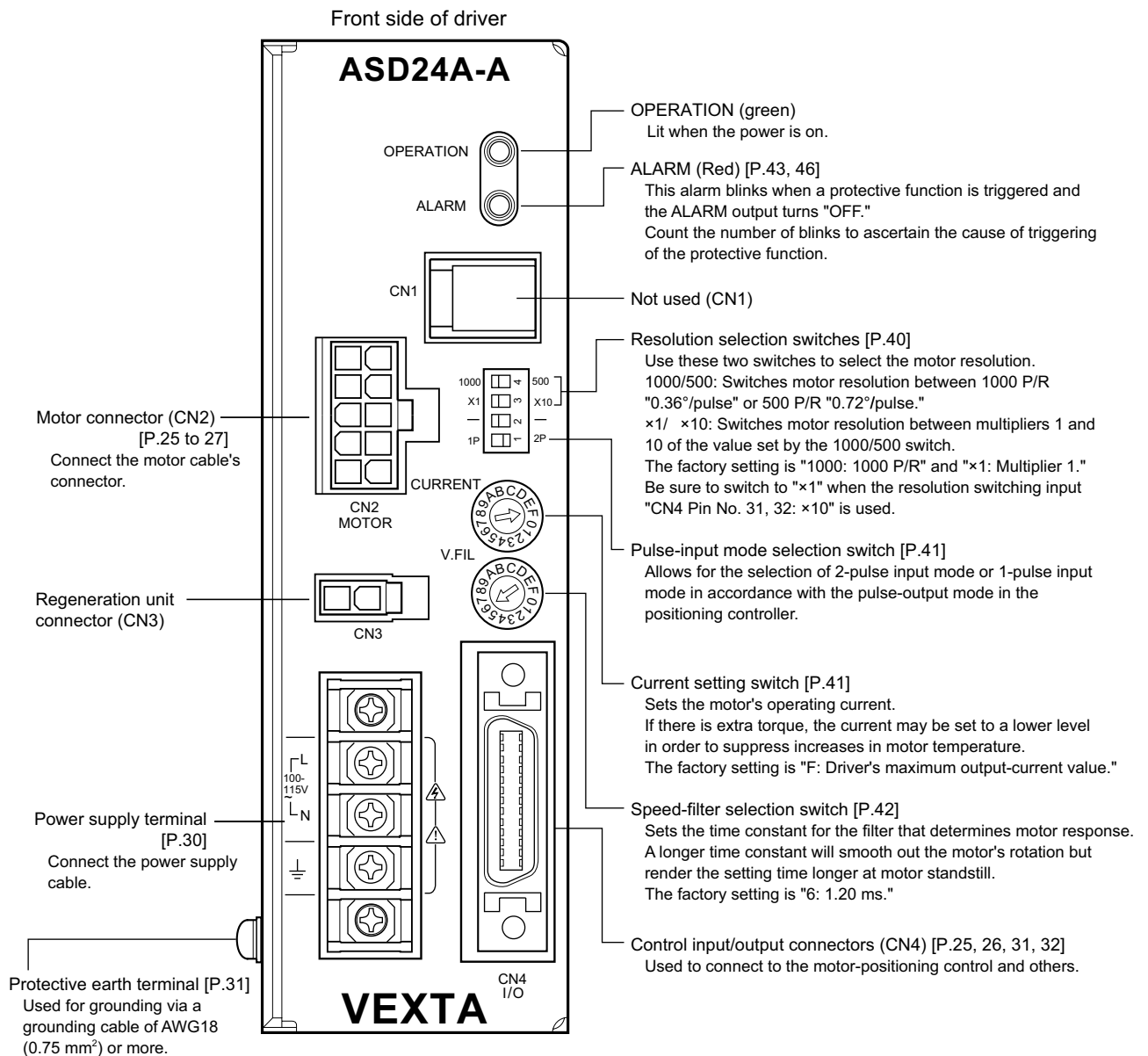
Varistor

An accessory supplied with the motor with an electromagnetic brake.
Be sure to connect the varistor when wiring the electromagnetic brake.

IP65 rated motor



* Be sure to purchase an optional cable for IP65 rated motor (sold separately).



Installation

This section covers the environment and method of installing the motor 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 (89/336/EEC, 92/31/EEC).

Location for installation

The motor 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
 - Motor: 0 to +50 °C (+32 to +122 °F) (non-freezing)
 - Harmonic geared type: 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%, maximum (non-condensing)
- Operating surrounding atmosphere
 - Motor and Driver
 - : Area that is free from an explosive nature or toxic gas (such as sulfuric gas) or liquid
 - : Area free of excessive amount dust, iron particles or the like
 - : Area not subject to splashing water (storms, water droplets), oil (oil droplets) or other liquids
 - IP65 rated motor
 - : Area that is free from an explosive nature or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m or lower above sea level

Installing the motor

■ How to install the motor

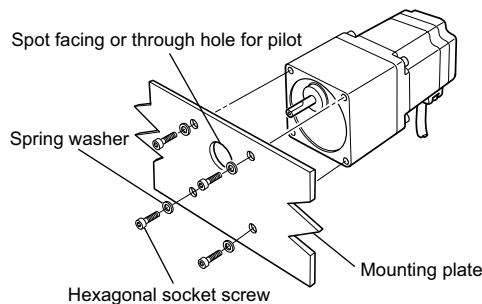
Install the motor onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity.

When installing the motor, secure it with four bolts (not supplied) through the four mounting holes provided. Leave no gap between the motor and plate.

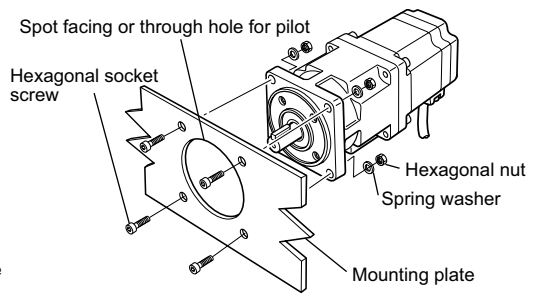
Note

Insert the pilot located on the motor's installation surface into the mounting plate's countersunk or through hole.

• Types of installation A



• Types of installation B



Motor type	Frame size	Bolt size	Tightening torque	Effective depth of bolt	Types of installation
TH geared	42 mm (1.65 in.)	M4	2 N·m (280 oz-in)	8 mm (0.315 in.)	A
	60 mm (2.36 in.)				
	90 mm (3.54 in.)				
PL, PN geared	42 mm (1.65 in.)	M4	2 N·m (280 oz-in)	8 mm (0.315 in.)	A
	60 mm (2.36 in.)				
	90 mm (3.54 in.)				
Harmonic geared AS46□A2, AS66□□2	42 mm (1.65 in.)	M5	2.5 N·m (350 oz-in)	10 mm (0.394 in.)	A
	60 mm (2.36 in.)				
	90 mm (3.54 in.)				
Harmonic geared AS46□A, AS66□□, AS98□□	42 mm (1.65 in.)	M4	2 N·m (280 oz-in)	-	B
	60 mm (2.36 in.)				
	90 mm (3.54 in.)				
Standard type	42 mm (1.65 in.)	M3	1 N·m (142 oz-in)	4.5 mm (0.177 in.)	A
	60 mm (2.36 in.)				
	85 mm (3.35 in.)				

Each of the square boxes will contain a numerical or alphabetical character representing the availability of the electromagnetic brake, power supply input or gear type.

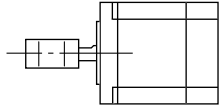
Installing a load

When connecting a load to the motor, align the centers of the motor's output shaft and load shaft.

Optional flexible couplings are available (sold separately).

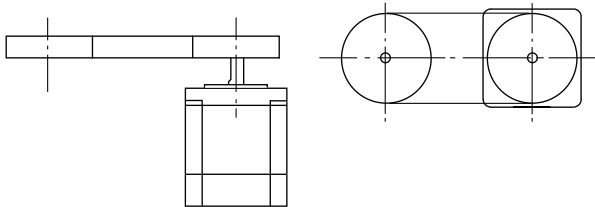
■ Direct coupling

Align the centers of the motor's output shaft and load shaft in a straight line.



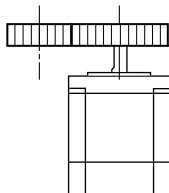
■ Using a belt drive

Align the motor's output shaft and load shaft in parallel with each other, and position both pulleys so that the line connecting their centers is at a right angle to the shafts.



■ Using a gear drive

Align the motor's output shaft and gear shaft in parallel with each other, and let the gears mesh at the center of the tooth widths.



■ Using a geared motor

With a geared motor, to connect a load to the gear output shaft having a key groove, first provide a key groove on the load and fix the load with the gear output shaft using the supplied key.

Note

- When coupling the load to the motor, pay attention to the centering of the shafts, belt tension, parallelism of the pulleys, and so on. Securely tighten the coupling and pulley set screws.
- Be careful not to damage the output shaft or the bearings when installing a coupling or pulley to the motor's output shaft.
- Do not modify or machine the motor's output shaft. Doing so may damage the bearings and destroy the motor.

Note

Failure due to fatigue may occur if the motor's bearings and output shaft are subject to repeated loading by an overhung or thrust load that is in excess of the permissible limit.

Overhung load and thrust load

The overhung load on the motor's output shaft or gear output shaft must be kept within the permissible values listed below.

The thrust load must not exceed the motor's mass.

Frame size	Unit type	Overhung load [N (lb.)]					Thrust load [N (lb.)]	
		Distance from the tip of motor's output shaft [mm (inch)]						
		0 (0)	5 (0.2)	10 (0.39)	15 (0.59)	20 (0.79)		
42 mm (1.65 in.)	AS46-T□	10 (2.2)	14 (3.1)	20 (4.5)	30 (6.7)	–	15 (3.3)	
	AS46-P7.2 AS46-P10	73 (16.4)	84 (18.9)	100 (22)	123 (27)	–	50 (11.2)	
	AS46-P36 AS46-P50	109 (24)	127 (28)	150 (33)	184 (41)	–		
	AS46-N□	100 (22)	120 (27)	150 (33)	190 (42)	–	100 (22)	
	AS46AA2-H□ AS46MA2-H□	180 (40)	220 (49)	270 (60)	360 (81)	510 (114)	220 (49)	
	AS46AA-H□ AS46MA-H□	170 (38)	200 (45)	230 (51)	280 (63)	350 (78)	200 (45)	
	AS46	20 (4.5)	25 (5.6)	34 (7.6)	52 (11.7)	–	0.5 [0.6] (1.1 [1.3])*	
	AS66-T□	70 (15.7)	80 (18)	100 (22)	120 (27)	150 (33)	40 (9)	
60 mm (2.36 in.)	AS66-P5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)	100 (22)	
	AS66-P7.2 AS66-P10	250 (56)	270 (60)	300 (67)	340 (76)	390 (87)		
	AS66-P25 AS66-P36 AS66-P50	330 (74)	360 (81)	400 (90)	450 (101)	520 (117)		
	AS66-N5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)		
	AS66-N7.2 AS66-N10	250 (56)	270 (60)	300 (67)	340 (76)	390 (87)		
	AS66-N25 AS66-N36 AS66-N50	330 (74)	360 (81)	400 (90)	450 (101)	520 (117)		
	AS66A2-H□ AS66M2-H□	320 (72)	370 (83)	440 (99)	550 (123)	720 (162)	450 (101)	
	AS66-H□	300 (67)	330 (74)	370 (83)	420 (94)	480 (108)	400 (90)	
	AS66						0.85 [1.1] {1} (1.9 [2.4] {2.2})*	
	AS69	63 (14.1)	75 (16.8)	95 (21)	130 (29)	190 (42)	1.4 [1.65] {1.5} (3.1 [3.6] {3.3})*	
	85 mm (3.35 in.)	AS98						1.8 [2.2] {2.2} (4 [4.8] {4.8})*
		AS911	260 (58)	290 (65)	340 (76)	390 (87)	480 (108)	3 {3.3} (6.6 {7.3})*
90 mm (3.54 in.)	AS98-T□	220 (49)	250 (56)	300 (67)	350 (78)	400 (90)	100 (22)	
	AS98-P5 AS98-P7.2 AS98-P10	480 (108)	540 (121)	600 (135)	680 (153)	790 (177)	300 (67)	
	AS98-P25	850 (191)	940 (210)	1050 (230)	1190 (260)	1380 (310)		
	AS98-P36	930 (200)	1030 (230)	1150 (250)	1310 (290)	1520 (340)		
	AS98-P50	1050 (230)	1160 (260)	1300 (290)	1480 (330)	1710 (380)		
	AS98-N5	480 (108)	520 (117)	550 (123)	580 (130)	620 (139)		
	AS98-N7.2 AS98-N10	480 (108)	540 (121)	600 (135)	680 (153)	790 (177)		
	AS98-N25	850 (191)	940 (210)	1050 (230)	1110 (240)	1190 (260)		
	AS98-N36	930 (200)	1030 (230)	1150 (250)	1220 (270)	1300 (290)		
	AS98-N50	1050 (230)	1160 (260)	1300 (290)	1380 (310)	1490 (330)		
	AS98-H□	1090 (240)	1150 (250)	1230 (270)	1310 (290)	1410 (310)		1300 (290)

- The square box in the unit type will contain a value representing the gear ratio.
- The figures indicated by * are the motor's mass [kg (lb.)]. The thrust load should not exceed the motor's dead mass.
- The figures in parenthesis [] are the values for the electromagnetic brake type.
- The figures in parentheses { } are the values for the IP65 rated motor.

Installing the driver

■Orientation

The driver is designed so that heat is dissipated via air convection and conduction through the enclosure.

When installing the driver in an enclosure, it must be placed in perpendicular (vertical) orientation using a DIN rail or driver mounting brackets.

■How to install the driver

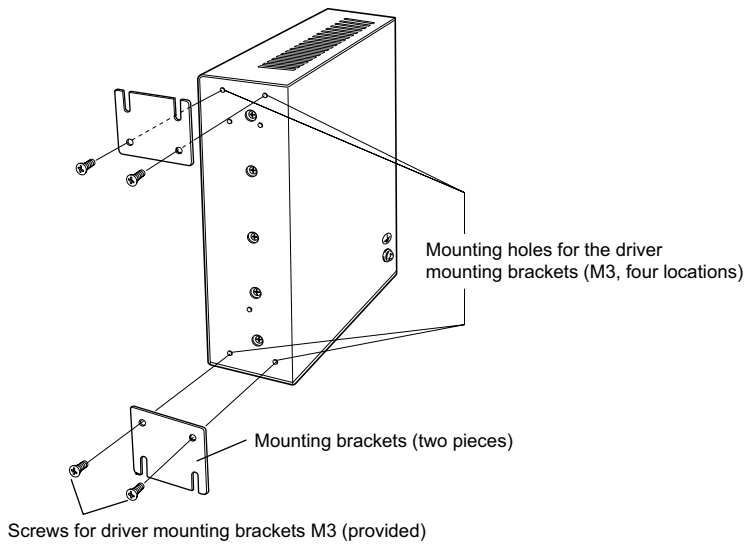
Install the driver on a flat metal plate having excellent vibration resistance and heat conductivity.

In the presence of a great amount of vibration, do not use a DIN rail. Screw down the driver directly through the use of driver mounting brackets.

If a DIN rail is to be used, use a DIN rail mounting plate (sold separately).

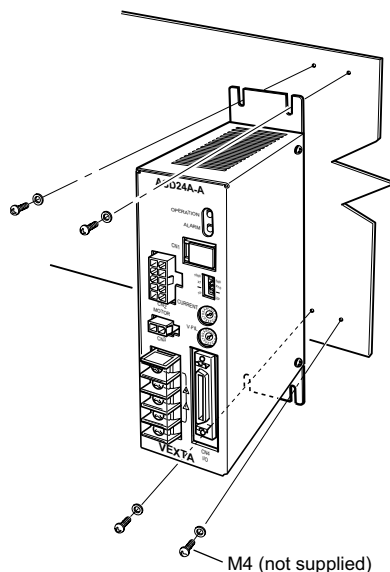
■Using driver mounting brackets

1. Attaching the driver mounting brackets



Attach the driver mounting brackets to the four mounting holes provided in the back of the driver, using optional screws for the driver mounting brackets (M3, four pieces).

2. Installing the driver



Install the driver by securing it with four bolts (M4, not supplied) through the four mounting holes provided. Leave no gap between the driver and plate.

Note

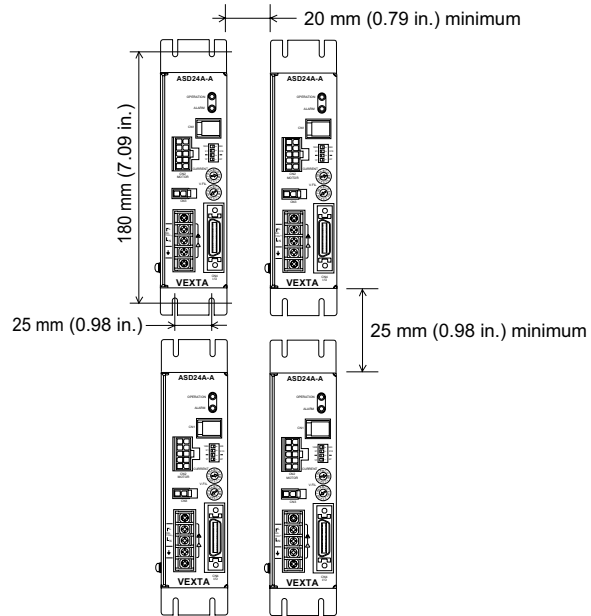
- Install the driver in an enclosure.
- Do not install any equipment that generates a large amount of heat near the driver.
- Check ventilation if the ambient temperature of the driver exceeds 50 °C (122 °F).

Note

- Do not use the mounting holes (M3, four locations) for the driver mounting brackets provided on the back of the driver for any purpose other than securing the driver mounting brackets.
- Be sure to use the supplied screws when securing the driver mounting brackets.

There must be a clearance of at least 25 mm (0.98 in.) in the horizontal and vertical directions, respectively, between the driver and enclosure or other equipment within the enclosure.

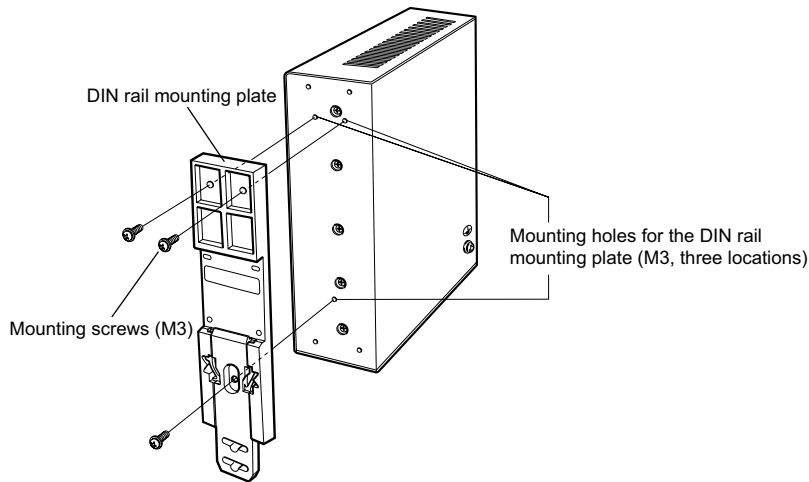
When two or more drivers are to be installed side by side, provide 20 mm (0.79 in.) and 25 mm (0.98 in.) clearances in the horizontal and vertical directions, respectively.



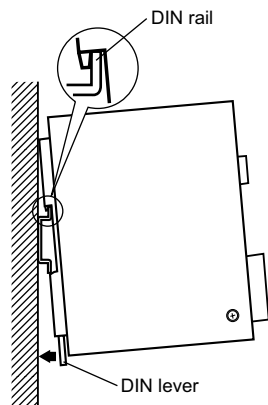
■ Mounting to DIN rail

Use a DIN rail 35 mm (1.38 in.) wide to mount the driver.

1. Attach the DIN rail mounting plate (model number: **PADP01**) to the back of the driver using the screws supplied with the plate.

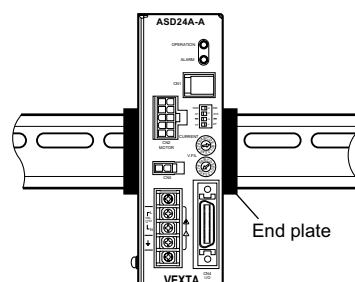
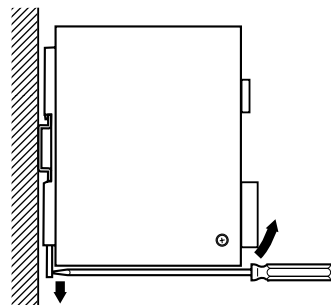


2. Pull the DIN lever down, engage the upper hooks of the DIN rail mounting plate over the DIN rail, and push the DIN lever until it locks in place.



3. Removing from DIN rail

Pull the DIN lever down until it locks using a flat blade-parallel tip type screwdriver, and lift the bottom of the driver to remove it from the rail.



Note

- Do not use the mounting holes (M3, three locations) for the DIN rail mounting plate provided in the back of the driver for any purpose other than securing the DIN rail mounting plate.
- Be sure to use the supplied screws when securing the DIN rail mounting plate. The use of screws that would penetrate 3 mm (0.12 in.) or more through the surface of the driver may cause damage to the driver.

Note

- Use force of about 10 to 20 N (2.2 to 4.5 lb.) to pull the DIN lever to lock it. Excessive force may damage the DIN lever.
- Use an end plate (not supplied) to secure the driver.

Installing and wiring in compliance with EMC directive

■ General

EMC directive (89/336/EEC, 92/31/EEC)

The **αSTEP AS** 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 motor 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

Emission Tests	EN61000-6-4
Radiated Emission Test	EN55011
Conducted Emission Test	EN55011

EMS

Immunity Tests	EN61000-6-2
Radiation Field Immunity Test	IEC61000-4-3
Electrostatic Discharge Immunity Test	IEC61000-4-2
Fast Transient/Burst Immunity Test	IEC61000-4-4
Conductive Noise Immunity Test	IEC61000-4-6
Surge Immunity Test	IEC61000-4-5
Voltage Dip Immunity Test	IEC61000-4-11
Voltage Interruption Immunity Test	IEC61000-4-11

■ Installing and wiring

Effective measures must be taken against the EMI that the **αSTEP AS** series may give to adjacent control-system equipment, as well as the EMS of the **αSTEP AS** 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 **αSTEP AS** series to be compliant with the EMC directive (the aforementioned compliance standards).

◆ Connecting mains filter for power source line

Connect a mains filter in the AC input line to prevent the noise generated in the driver from propagating externally through the power-source line.

Use a mains filter or equivalent as below table.

Manufacturer	Single-phase 100-115 V Single-phase 200-230 V	Three-phase 200-230 V
Schaffner EMC AG	FN2070-10-06	FN251-8-07
EPCOS	B84113-C-B110	–

Install the mains filter as close to the driver as possible, and use cable clamps and other means to secure the input and output cables 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 mm² or more) parallel with the mains-filter output cable (AWG18: 0.75 mm² 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.

◆ Connecting surge arrester

Use a surge arrester or equivalent as below table.

Manufacturer	Single-phase 100-115 V	Single-phase 200-230 V
OKAYA ELECTRIC INDUSTRIES CO., LTD.	R·A·V-781BWZ-2A, R·A·V-781BWZ-4, R·C·M-601BQZ-4	
PHOENIX CONTACT GmbH & Co. KG	PT2-PE/S120AC-ST	PT2-PE/S230AC-ST
	VAL-MS 230 VF ST	

Note

When measuring dielectric strength of the equipment, be sure to remove the surge arrester, or the surge arrester may be damaged.

◆Power supply for electromagnetic brake (for electromagnetic brake motor only)

If an external DC power source is required for the use of the electromagnetic brake, use a DC power source that complies with the EMC directive.

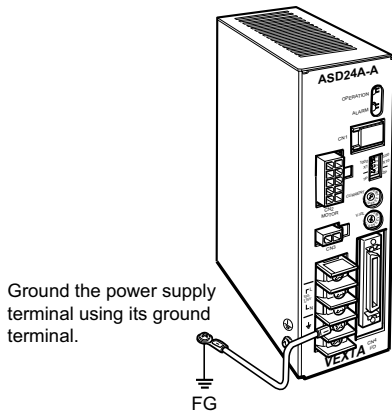
Use a shielded cable for wiring, and keep the wiring and grounding as short as possible. Refer to "Wiring the signal cable" for details on how to ground the shielded cable.

◆How to ground

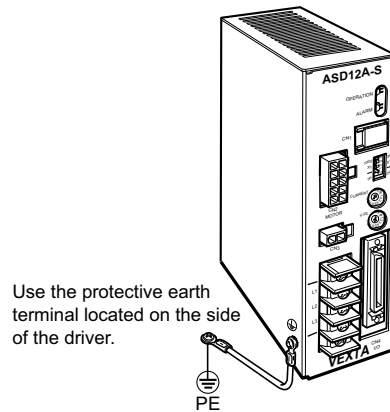
The cable used to ground the driver, motor and mains filter must be as thick and short to the grounding point as possible so that no potential difference is generated. Choose a large, thick and uniformly conductive surface for the grounding point.

How to ground the driver

◆Single-phase 100/200 V input



◆Three-phase 200 V input



How to ground the motor (other than IP65 rated motor)

Scrape the paint away from the mounting flange and connect the grounding cable along with a set screw to the grounding point, using an inner-clip washer.

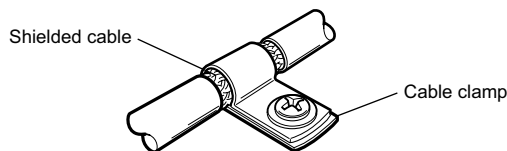
How to ground an IP65 rated motor

Connect the protective earth terminal of the motor to the ground.

◆Wiring the signal cable

Use a shielded cable of AWG24 (0.2 mm²) 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.



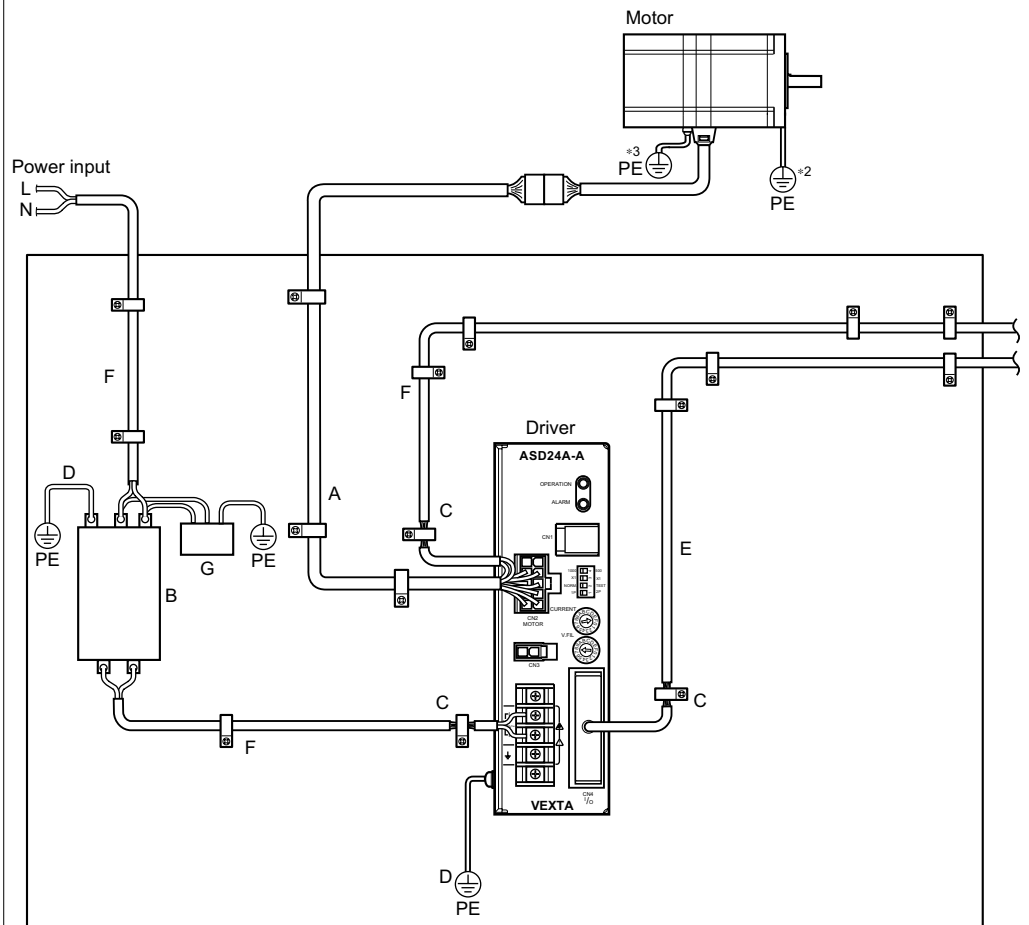
◆Notes about installation and wiring

- Connect the motor, 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 motor (other than IP65 rated motor) 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.

◆ Example of motor and driver installation and wiring



- A : Motor cable*1
- B : Main filter
- C : Cable clamp
- D : Protective earth cable
- E : Signal cable
- F : Power cable
- G : Surge arrester

*1 Be sure to use an optional cable for IP65 rated motor (sold separately) with an IP65 rated motor.

*2 Other than IP65 rated motor

*3 IP65 rated motor

■ 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.

Connection

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

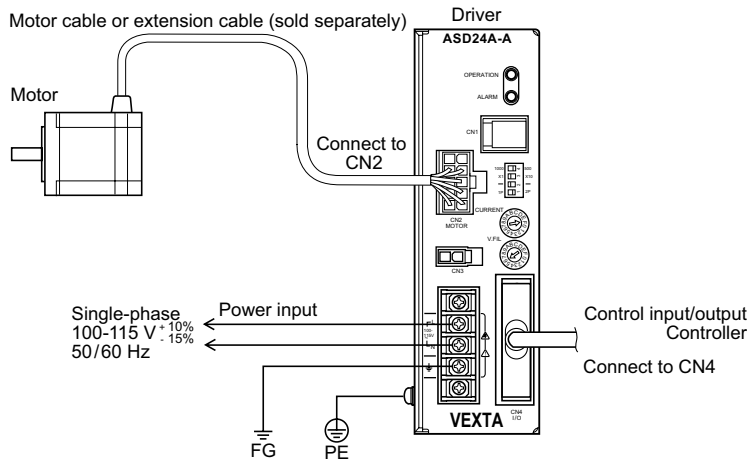
Connecting the motor (other than IP65 rated motor)

Plug the connector of the motor cable or the extension cable into the driver's motor connector (CN2).

Push the plug until it clicks to ensure a solid connection.

Use an optional extension cable (sold separately) to extend the distance between the motor and driver.

Refer to page 48 of "Appendix" for the extension cable.



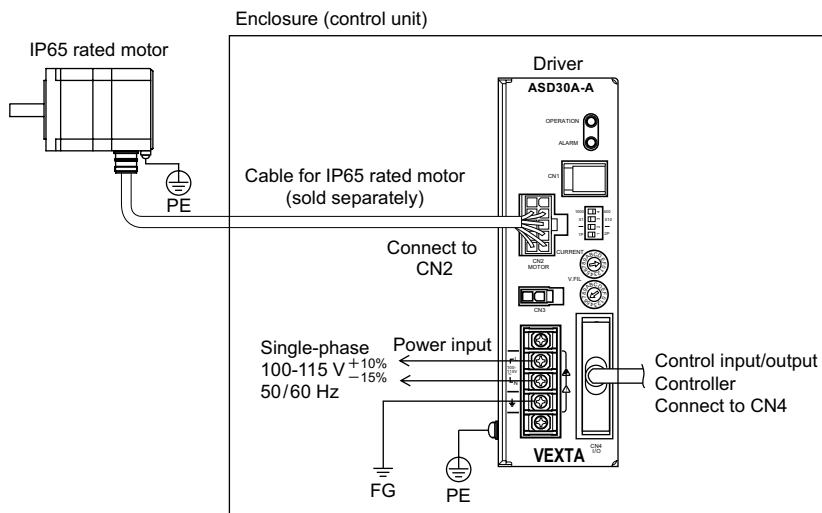
Note

- Have the connector plugged in securely. Insecure connector connection may cause malfunction or damage to the motor or driver.
- To disconnect the plug, pull the plug while using the fingers to press the latches on the plug.
- When the motor 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 page 48 of "Appendix" for the flexible cable.
- Be sure to purchase and use an optional electromagnetic brake type extension cable (sold separately) to connect an electromagnetic brake type motor to the driver. Direct connection to the motor cable will not operate the brake.

Connecting an IP65 rated motor

When connecting an IP65 rated motor to a driver, be sure to use an optional cable for IP65 rated motor (sold separately).

To connect a metal connector, align the cutout in the receptacle with that in the plug and securely tighten the connector.



Note

- The **AS46** with electromagnetic brake uses a standard extension cable in conjunction with separate lead wires for the electromagnetic brake.
- Applying a voltage over the specification will increase the temperature rise in the electromagnetic brake and may damage the motor. Conversely, insufficient voltage may prevent the brake from releasing.
- Be sure to connect the varistor (non-polarized) to protect the switch contacts and prevent noise.
- The lead wires for the electromagnetic brake are polarized. Connecting the lead wires in reversed polarity will not properly operate the electromagnetic brake.

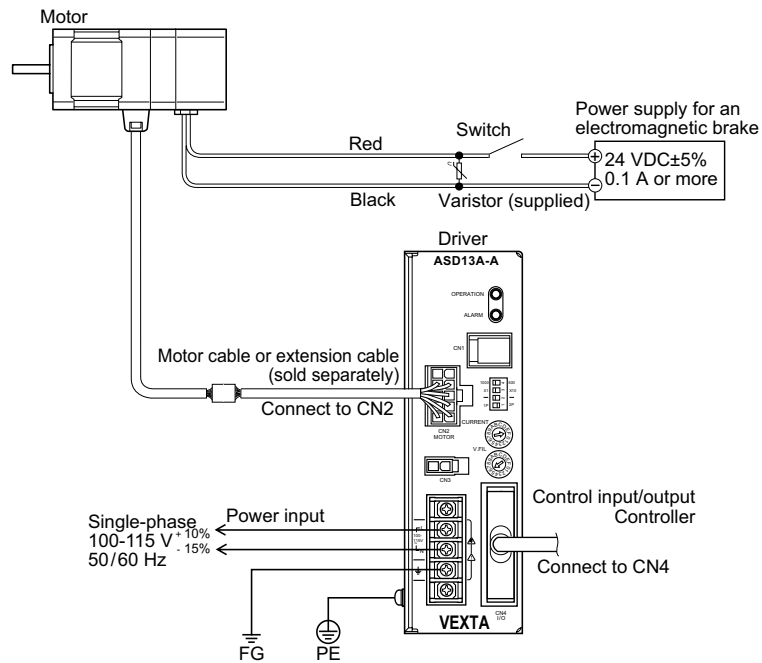
Connecting an electromagnetic brake type

Provide a DC power supply cable of 24 VDC±5% at 0.3 A or more (**AS46**: 0.1 A or more). Use a shielded cable of AWG24 (0.2 mm²) or more in diameter to connect the electromagnetic brake to the DC power supply, keeping the length as short as possible.

◆AS46

Use red and black lead wires [600 mm (23.6 in.)].

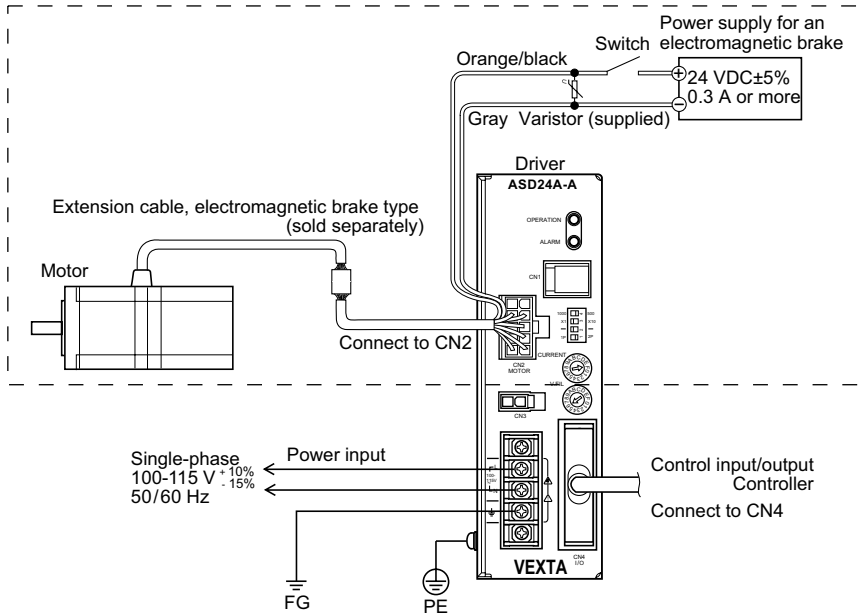
1. Connect the red lead wire to the +24 V terminal of the DC power supply.
2. Connect the black lead wire to the GND terminal of the DC power supply.
3. Connect the varistor in parallel across the +24 V and GND terminals of the DC power supply.
The varistor is non-polarized.



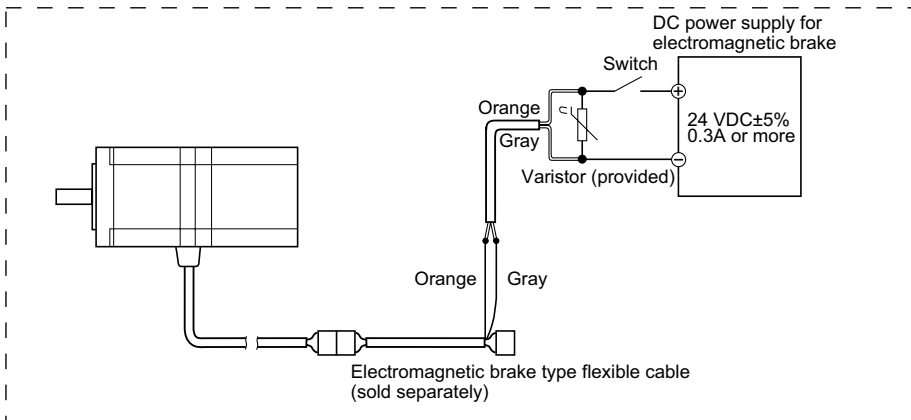
◆AS66, AS69, AS98

Use two (orange/black and gray) lead wires [60 mm (2.36 in.)] from the driver's connector side.

1. Connect the orange/black lead wire to the +24 V terminal of the DC power supply.
2. Connect the gray lead wire to the GND terminal of the DC power supply.
3. Connect the varistor in parallel across the +24 V and GND terminals of the DC power supply. The varistor is non-polarized.



The colors of the two lead wires (orange and gray) extending from the driver's connector side of the flexible cable of the electromagnetic brake type differ from those of the extension cable.



Note

Extension cables are available in two types: the standard type and the electromagnetic brake type. If you are using a motor with an electromagnetic brake, provide a 24 VDC power supply for the electromagnetic brake and be sure to connect the motor to the driver using an optional extension cable of the electromagnetic brake type. The electromagnetic brake will not function if the motor cable is connected directly to the driver.

Note

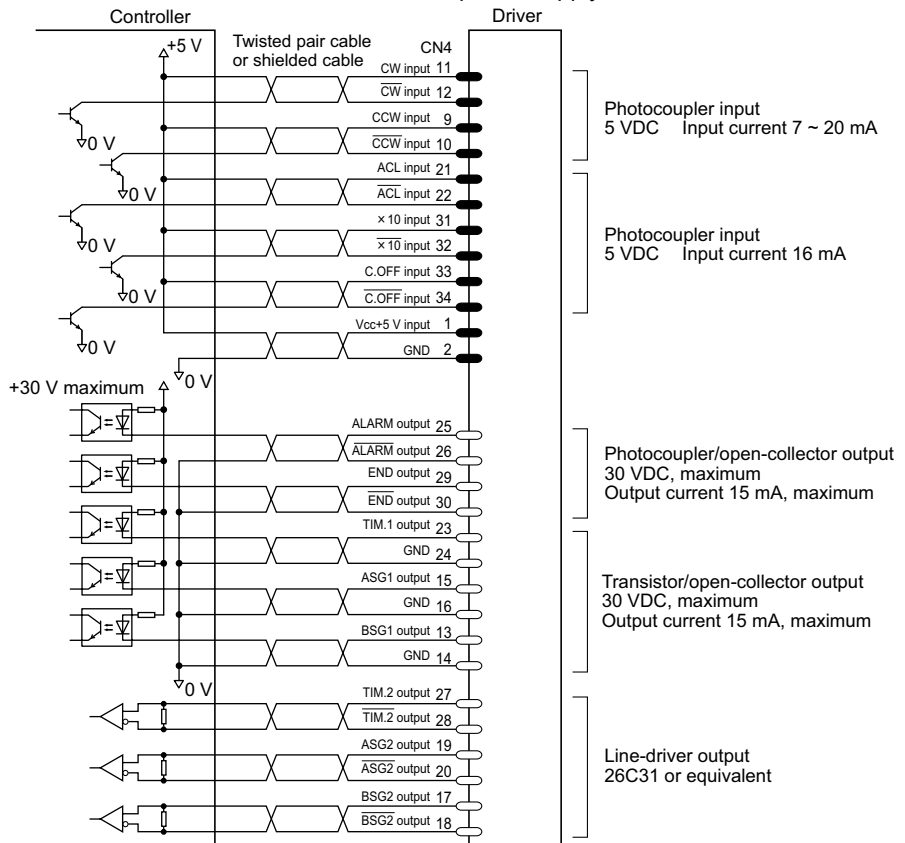
Be sure to use the same voltage for C.OFF, ×10 and ACL inputs and TIM.1/TIM.2, ASG1/ASG2 and BSG1/BSG2 outputs. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.

Connection example for the control input/output

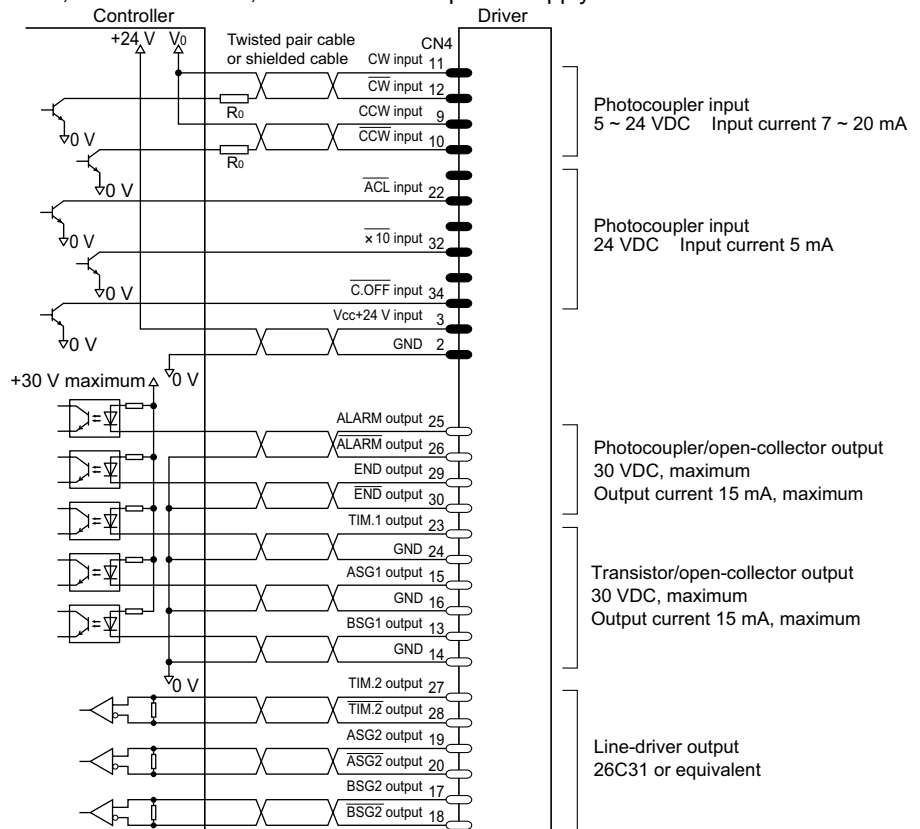
- Either 5 or 24 VDC is selected as a signal voltage for the C.OFF input, ×10 input and ACL input.
- The TIM.1/TIM.2 outputs, ASG1/ASG2 outputs and BSG1/BSG2 outputs require a 5 or 24 VDC power.

■ In case of current sourcing inputs and current sinking outputs

When ACL, resolution select, C.OFF controller power supply is 5 VDC.



When ACL, resolution select, C.OFF controller power supply is 24 VDC.



Note

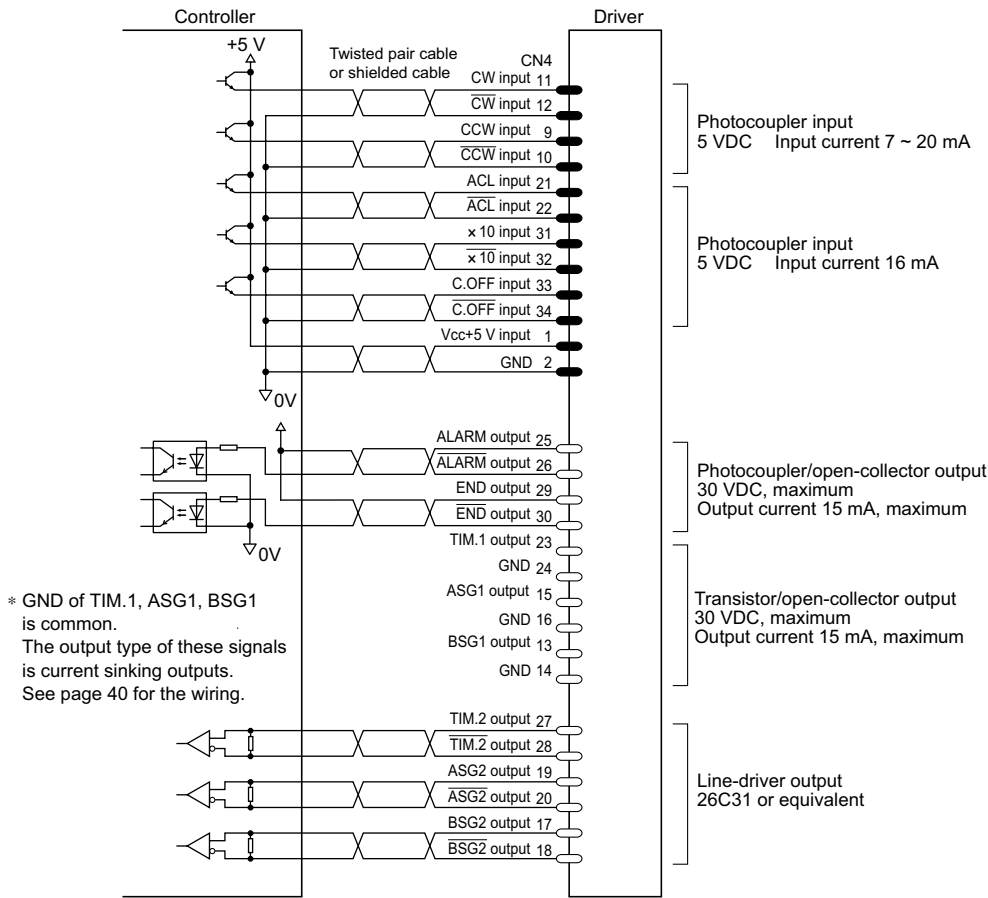
The CW and CCW inputs are of the 5 VDC input specification. If V_0 exceeds 5 V, connect external resistor R_0 .

Example)

When V_0 is 24 VDC

R_0 : 1.5 to 2.2 k Ω , 0.5 W min.

■ In case of current sinking inputs and current sourcing outputs



* GND of TIM.1, ASG1, BSG1 is common.
The output type of these signals is current sinking outputs.
See page 40 for the wiring.

Note

Be sure to use the same voltage for C.OFF, x10 and ACL inputs and TIM.1/TIM.2, ASG1/ASG2 and BSG1/BSG2 outputs.
Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.

Note

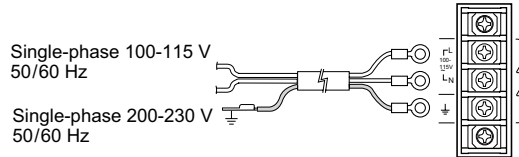
- Furnish a power supply capable of supplying adequate driver input current. If the current capacity is insufficient, the transformer may be damaged, or the motor may run erratically due to a drop in torque.
- Do not run the driver's power cable through a conduit containing other power lines or motor cables.
- After shutting down the power, wait at least 10 seconds before turning it back on, unplugging, or plugging in the motor's cable connector.

Connecting to the power supply

Connect the power cable to the L and N terminals or the L1, L2 and L3 terminals of the power supply terminals located on the driver.

■For Single-phase 100-115 V unit • Single-phase 200-230 V unit

Connect the live side of the power cable to the L terminal and the neutral side to the N terminal. Connect the \perp terminal to the grounding point of the power source.



Use a power supply capable of supplying the current capacity as shown below.

◆Single-phase 100-115 V

Unit name	Current capacity
AS46□□	3.3 A or more
AS66□□	5 A or more
AS69□□	6.4 A or more
AS98□□	6 A or more
AS911□□	6.5 A or more

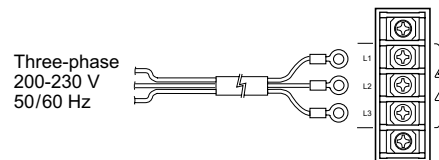
◆Single-phase 200-230 V

Unit name	Current capacity
AS66□□	3 A or more
AS69□□	3.9 A or more
AS98□□	3.5 A or more
AS911□□	4.5 A or more

Each of the square boxes will contain a numerical or alphabetical character representing the availability of the electromagnetic brake, power supply input or gear type.

■For three-phase 200-230 V unit

Connect the U, V and W phase lines of the three-phase 200-230 V power cable to the L1, L2 and L3 terminals, respectively.



Use a power supply capable of supplying the current capacity as shown below.

Unit name	Current capacity
AS66□□	1.5 A or more
AS69□□	2.2 A or more
AS98□□	1.9 A or more
AS911□□	2.4 A or more

Each of the square boxes will contain a numerical or alphabetical character representing the availability of the electromagnetic brake, power supply input or gear type.

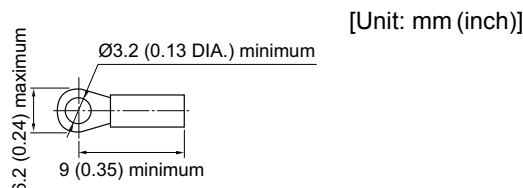
■Terminal screw size and lead wire size for power connection

Screw size: M3

Tightening torque: 0.8 to 1.0 N·m (113 to 142 oz-in)

Applicable minimum lead wire size: AWG18 (0.75 mm²)

Use round, insulated crimp terminals for connection.



Grounding the motor and driver

■ Grounding the motor (other than IP65 rated motor)

◆ AS46

Install the motor to the grounded metal plate.

Use a grounding cable of AWG18 (0.75 mm²) or more in diameter.

Use a round, insulated crimp terminal in combination with an inner-clip washer and bolt it in place to secure the grounding connection.

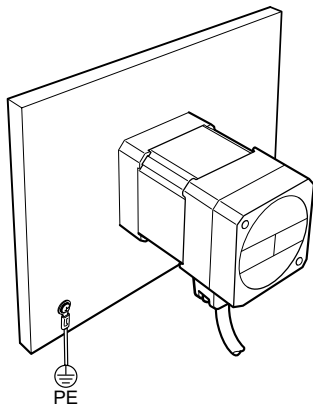
◆ AS66, AS69, AS98, AS911

Ground the motor using one of its four mounting holes.

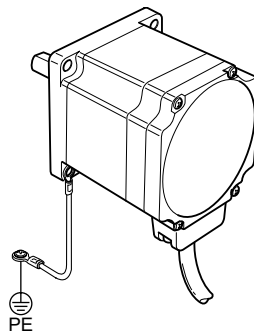
Use a grounding cable of AWG18 (0.75 mm²) or more in diameter.

Use a round, insulated crimp terminal in combination with an inner-clip washer and bolt it in place to secure the grounding connection.

• AS46



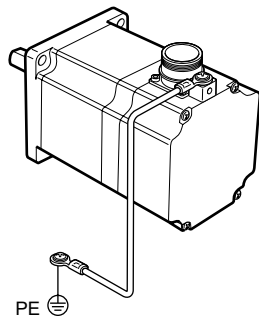
• AS66, AS69, AS98, AS911



■ Grounding an IP65 rated motor

Be sure to ground the protective earth terminal (screw size: M4) of the motor. Two threaded holes are provided for connecting this terminal. Use either of these holes.

Use a grounding cable of AWG18 (0.75 mm²) or more in diameter.



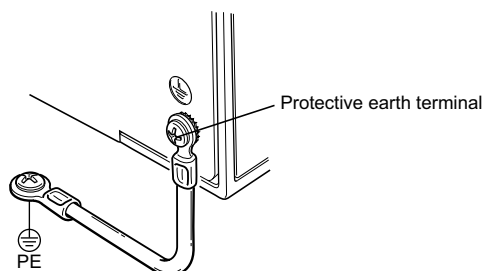
■ Grounding the driver

Be sure to ground the protective earth terminal (screw size: M4) located on the driver side.

Use a grounding cable of AWG18 (0.75 mm²) or more in diameter.

Do not share the grounding cable with a welder or power equipment.

Use a round, insulated crimp terminal to ground the cable near the driver.

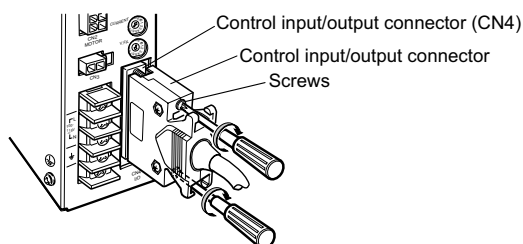


Connecting control input/output

■Connecting control input/output connector

Connect the control input/output connector (supplied, 36 pins) to the driver. Solder the control input/output cable (AWG28: 0.08 mm² or more) to the connector. Assemble the connector and connector cover with the supplied screws. Use a shielded cable, such as the optional shielded cable with connectors (sold separately). Refer to the following paragraph, "Assembling the control input/output connector".

Insert the control input/output connector into the control input/output connector CN4 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 (42.5 to 49.6 oz-in)

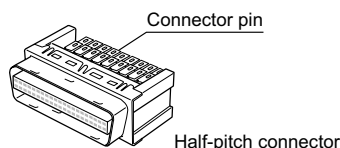
■Assembling the control input/output connector

Solder the control input/output cable to the half-pitch connector (36 pins), then install the connector cover over the half-pitch connector.

◆Soldering the cable to the half-pitch connector

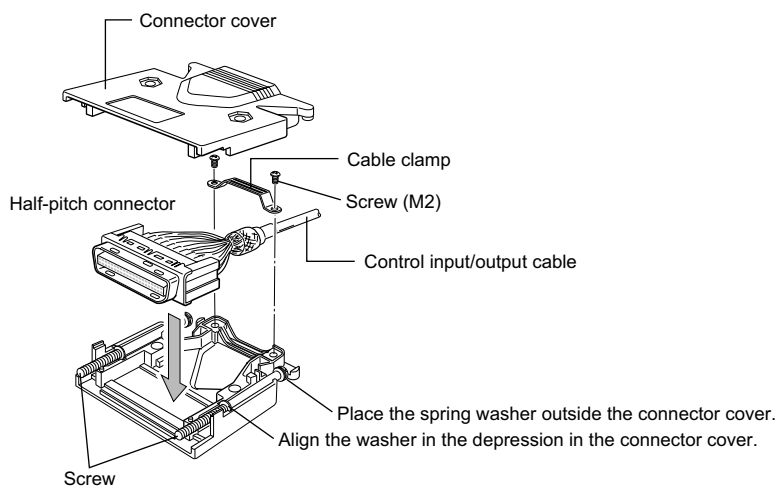
Solder the input/output signal cable (AWG28: 0.08 mm² or more) to the half-pitch connector (36 pins).

For the pin assignments, refer to page 33.

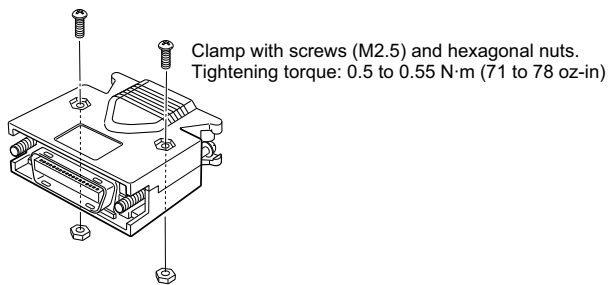


◆Assembling the half-pitch connector and the connector cover

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



2. Attach the other connector cover and clamp both connector covers together with screws and nuts.



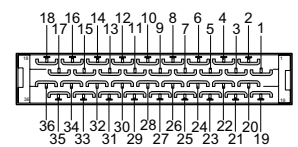
■Connector pin functions

Pin No.	Signal	Description	Direction
1	Vcc+5 V	5 VDC	Input
2	GND	GND	
3	Vcc+24 V	24 VDC	
4	—	Not used	—
5	—	Not used	—
6	—	Not used	—
7	—	Not used	—
8	—	Not used	—
9	CCW (DIR)	CCW pulse (ON: CW, OFF: CCW)	Input
10	$\overline{\text{CCW}}$ (DIR)		
11	CW (PLS)	CW pulse (Pulse)	Input
12	$\overline{\text{CW}}$ (PLS)		
13	BSG1	B-phase pulse output	Output
14	GND	Open-collector	
15	ASG1	A-phase pulse output	Output
16	GND	Open-collector	
17	BSG2	B-phase pulse output	Output
18	$\overline{\text{BSG2}}$	Line driver	
19	ASG2	A-phase pulse output	Output
20	$\overline{\text{ASG2}}$	Line driver	
21	ACL	Alarm clear	Input
22	$\overline{\text{ACL}}$		
23	TIM.1	Timing	Output
24	GND	Open-collector	
25	ALARM	Alarm	Output
26	$\overline{\text{ALARM}}$		
27	TIM.2	Timing	Output
28	$\overline{\text{TIM.2}}$	Line driver	
29	END	Positioning complete	Output
30	$\overline{\text{END}}$		
31	$\times 10$	Resolution switch	Input
32	$\overline{\times 10}$		
33	C.OFF	All Windings Off	Input
34	$\overline{\text{C.OFF}}$		
35	—	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 selector switch.
- Be sure to use the same voltage for C.OFF, $\times 10$ and ACL inputs and TIM.1/TIM.2, ASG1/ASG2 and BSG1/BSG2 outputs. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.

Connector pin assignments



Viewed from the soldering side

Note

Be sure to use the same voltage for C.OFF, ×10 and ACL inputs and TIM.1/TIM.2, ASG1/ASG2 and BSG1/BSG2 outputs. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.

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.
- 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 motor will not operate properly.
- The direction of rotation is defined as the rotation direction of the motor shaft. The output shaft of the TH geared typed motors with ratios of 20:1 and 30:1, as well as all ratios of the harmonic geared type motors, rotate in the opposite direction of the motor shaft.

About control input/output

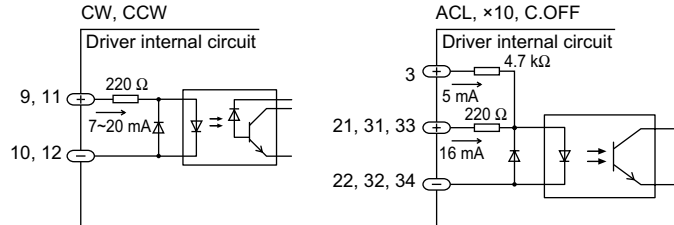
Input signals

All input signals of the driver are photocoupler inputs.

For C.OFF input, ×10 input and ACL input a signal voltage of either 5 or 24 VDC can be selected. Be sure to use it with voltage of either 5 or 24 VDC.

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.

The following explains the connection state in the case of current sink input.



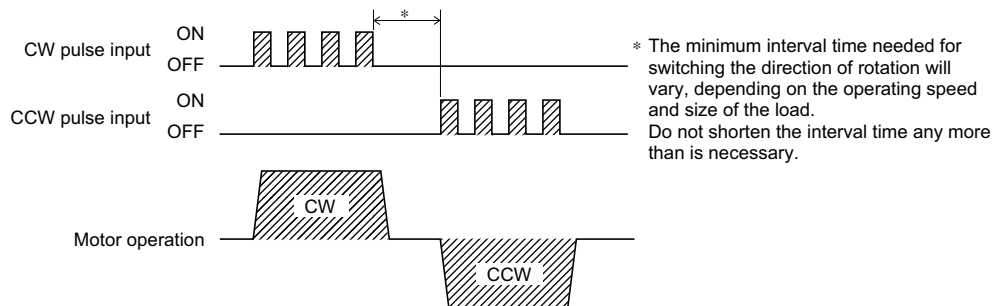
CW pulse input and CCW pulse input

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. For the electromagnetic brake type, wait at least 0.1 second after releasing the electromagnetic brake, then input pulse signals. When an electromagnetic brake type is used, also refer to "Operating the electromagnetic brake" at the end of this section.

2-pulse input mode

Connect the CW pulse and CCW pulse of the controller to pin No.12, "CW input," and pin No. 10, "CCW input," respectively.

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

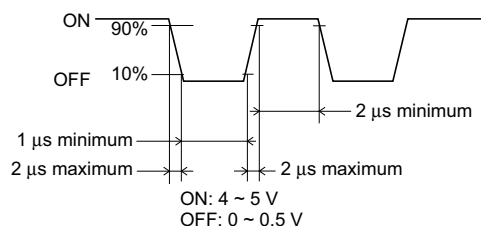


Set the input pulse voltage to the CW and CCW pulse inputs at 5 VDC.

If the voltage exceeds 5 VDC, insert an external resistor to limit the input current to nearly 10 mA.

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

Use an input-pulse signal with a waveform having a sharp rise and fall, as shown in the figure.

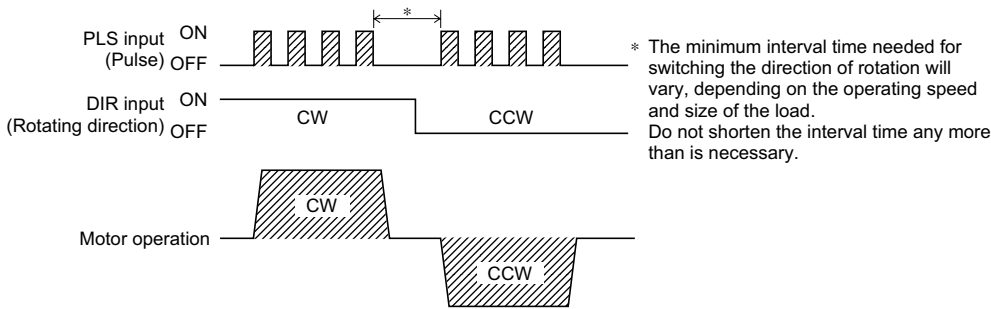


The figure shows the voltage levels of pulse signals.

1-pulse input mode

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.

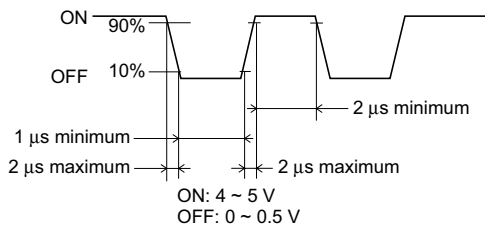
1. When the DIR input is "ON," a rise of the "PLS input" from "OFF" to "ON" will rotate the motor one step in the CW direction.
2. When the DIR input is "OFF," a rise of the "PLS pulse input" from "OFF" to "ON" will rotate the motor one step in the CCW direction.



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.

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

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.

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.

Note

Be sure to set the resolution selection switch to "x1" when "x10 input" is used.
 If the switch is set to "x10," the resolution will remain at 10 times, regardless of the "ON" or "OFF" resolution-selector input.

Note

- The overcurrent protection, EEPROM data error and system error protective functions cannot be cleared.
 When any of these functions are triggered, contact the nearest customer-service center, branch or sales office.
- 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 10 seconds before turning the power back on.

◆C.OFF (All windings off) input

Use the signal only when the motor's output shaft must be rotated manually for position adjustment.

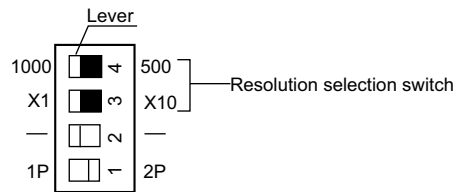
⚠ Warning • Do not turn the C.OFF (All windings off) input to "ON" while the motor is operating. The motor will stop and lose its holding ability, which may result in injury or damage to equipment.

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

◆x10 (Resolution selection) input

Selects and switches to 10 times either of the resolution "500: 0.72°/pulse" or "1000: 0.36°/pulse" that has been selected with the resolution selection switch.
 For instance, if "1000: 0.36°/pulse" has been selected, this signal can switch between the 0.36° step rotation and 0.036° step rotation.
 Refer to page 40 for the selection of the resolution selection switch.

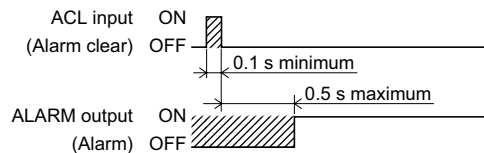
1. Turning the x10 input to "ON" will select/switch to "x10 resolution."
2. Turning the x10 input to "OFF" will select/switch to "x1 resolution."



◆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 "Protective functions" on page 43.

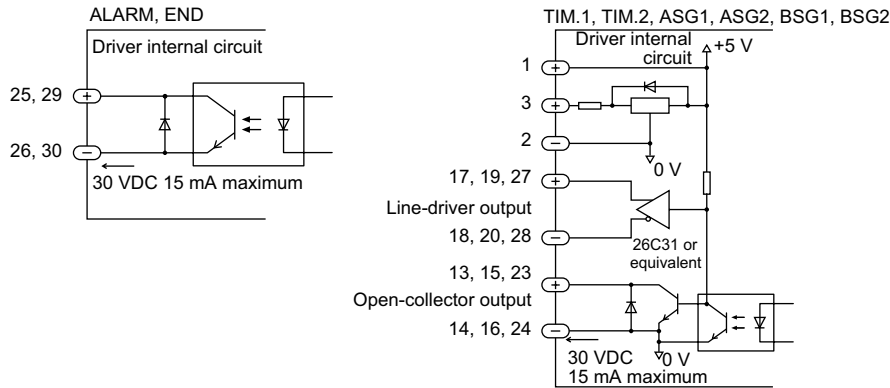
Setting the ACL input in the ON state clears the ALARM output.
 To cancel the ALARM output, be sure to remove the cause of the problem that has triggered the protective function before turning the power back on.



■Output signals

Driver output signals are photocoupler/open-collector output, transistor open-collector output for the TIM.1, ASG1 and BSG1 outputs, and line-driver output for the TIM.2, ASG2 and BSG2 outputs.

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

Be sure to use the same voltage for C.OFF, ×10 and ACL inputs and TIM.1/TIM.2, ASG1/ASG2 and BSG1/BSG2 outputs.

◆ALARM output

ALARM output remains “ON” when the driver is operating normally, then turns “OFF” when a protective function is triggered.

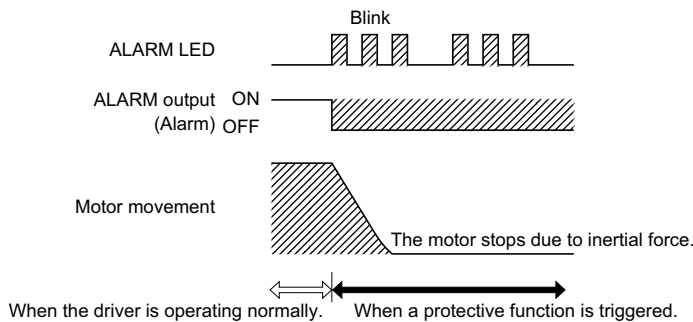
Detect this ALARM output on the controller side and cancel the command to operate the motor thereafter.

Error detection by the driver, such as overload and overcurrent during motor operation, turns the ALARM output “OFF,” blinks the ALARM LED on the driver, and simultaneously shuts off the motor current to stop motor operation.

Count the number of the ALARM LED blinks to identify the particular protective function that has been triggered. For details, refer to “Protective functions” on page 43.

Note

The operation of the photocoupler is reversed on the ALARM output only. The ALARM output turns “OFF” when protective function is triggered.

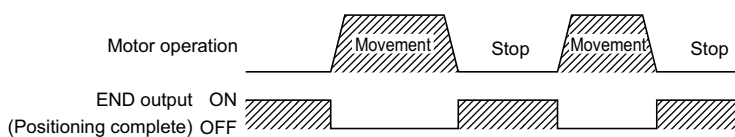


◆END (Positioning complete) output

END output turns “ON” when motor 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 $\pm 1.8^\circ$ 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.

Note

If TIM. output is to be detected, set the pulse speed at 500 Hz or less. Use the ×10 (resolution selection) input to switch the resolution only when TIM. output is in the “ON” state and the motor stops. If the resolution is switched under any other conditions, TIM. output may not turn “ON” even when the output shaft has rotated 7.2°.

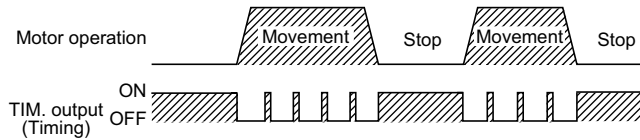
Note

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

◆TIM. (Timing) output

TIM. output are available in two types: transistor open-collector output and line-driver output. Use either one to suit the input system of the positioning controller. The use of TIM. output requires separate 5 or 24 VDC power.

TIM. output turns “ON” whenever the motor’s output shaft rotates 7.2°.

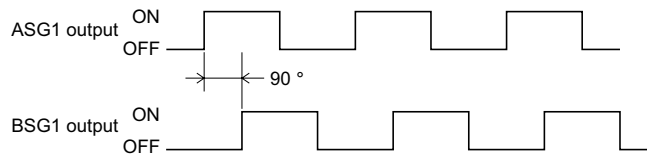


◆ASG output and BSG output

ASG and BSG outputs are available in two types: transistor open-collector output and line-driver output. Use either type to suit the input system of the counter unit and other functions of the controller. The use of ASG and BSG outputs requires separate 5 or 24 VDC power.

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 selection switch).

Counting ASG output pulses allows the motor position to be monitored.



ASG output: Outputs pulse while the motor operates.

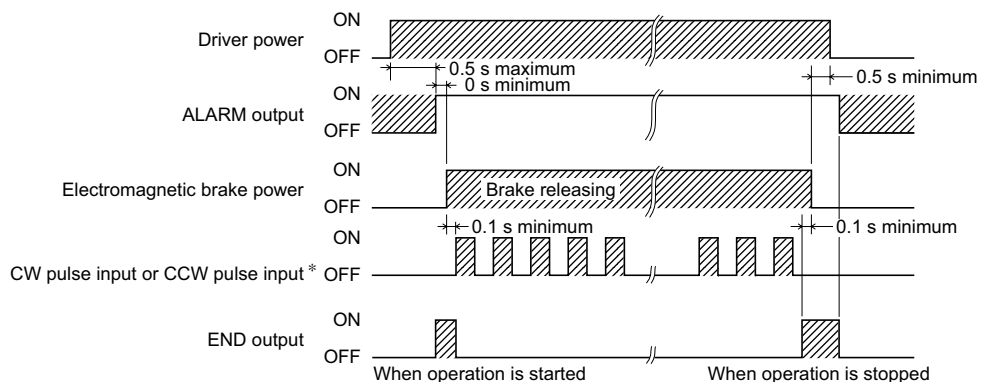
BSG output: Detects the direction of motor rotation. It has a 90° phase difference with regard to ASG output.

The level of BSG output at the rise time of ASG output indicates the direction of motor rotation.

■Operating the electromagnetic brake

Operate the electromagnetic brake as follows:

1. ALARM output is in the “OFF” state immediately after the driver power is turned on. Check to see that ALARM output has been reset (turned from OFF to ON), then turn on the electromagnetic brake.
2. Before inputting pulse signals to operate the motor, set the motor in the ready state by “releasing” the electromagnetic brake.
3. To allow the electromagnetic brake to “hold” the load after the motor has completed its operation, turn the electromagnetic brake off only after verifying that END (positioning complete) output has turned from “OFF” to “ON.”



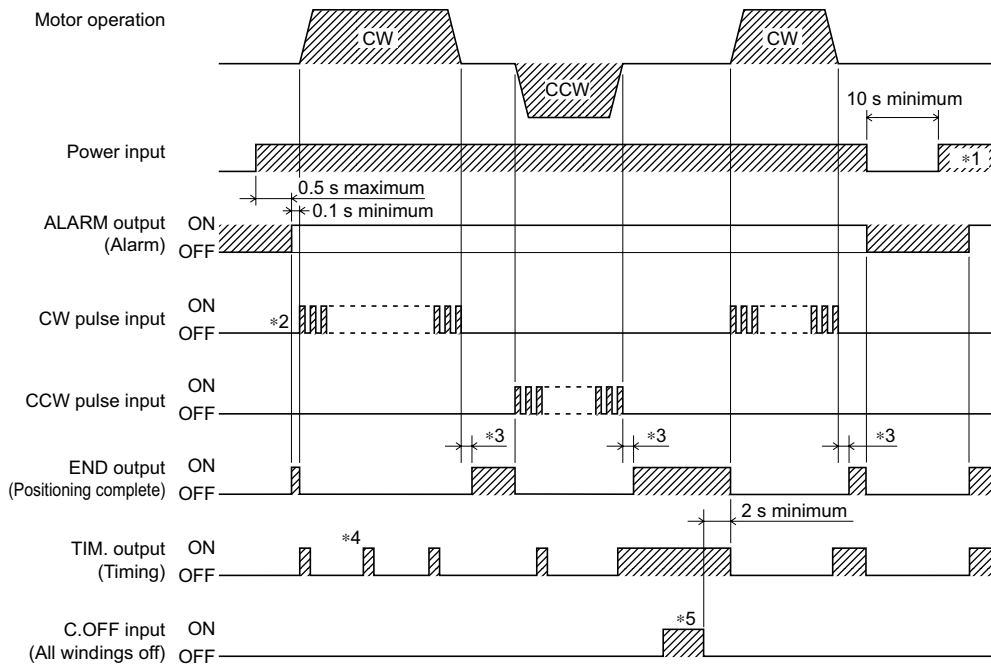
* CCW pulse input is enabled when 2-pulse input mode is selected

◆About providing for ALARM output

When the driver-protection function is triggered, the motor stops as the current is turned off. The motor loses its holding ability, which in a vertical-travel application may cause the load to fall.

The user must set a controller sequence that will cut off the power to the electromagnetic brake and hold the load in position upon detecting an "OFF" ALARM output.

Timing chart



*1 After the power has been shut off, wait at least 10 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 motor 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. 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 motor current, at which time the motor loses its holding ability.

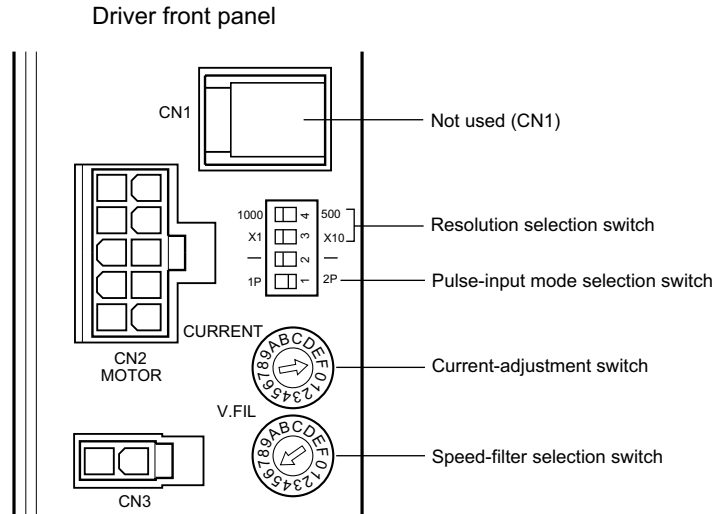
It also clears the value on the deviation counter.

Setting

This section covers the selection and settings of driver functions.

The various switches provided on the driver's front panel allow for the setting of resolution, pulse-input mode, current level and speed filter.

Warning • Before working on the system, shut off the power to the driver and wait 10 seconds. Failure to do so may result in electric shock.



Note

- Be sure to shut off the power before using the resolution selection switch. The new resolution takes effect when the power is turned on again.
- Be sure to switch to “×1” when resolution switching input is used. The “×10” setting disables resolution switching input.

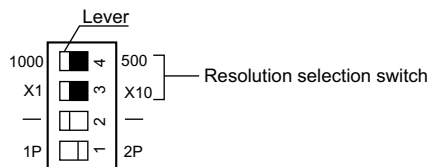
Resolution

Use the resolution selection switch “1000/500” and “×1/×10” to set the motor resolution.

Factory settings

[1000]: 1000 P/R (0.36°/pulse)

[×1]: Multiplier 1



A total of four resolution levels may be selected, with ×10 (resolution selection) input “CN4 Pin No.31, 32” used to switch between 1000 and 10000 and between 500 and 5000.

Refer to page 36 for the use of ×10 input (resolution selection).

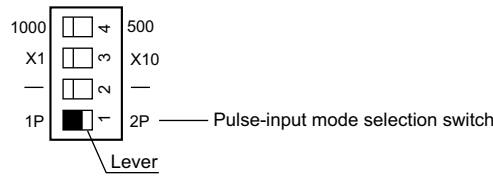
Refer to the following table for details of the relationship between the setting of the resolution selection switch and resolution of the geared output shaft in the geared type.

Gear ratio	3.6:1	5:1	7.2:1	10:1	20:1	
Resolution	1000 P/R	0.1°/Pulse	0.072°/Pulse	0.05°/Pulse	0.036°/Pulse	0.018°/Pulse
	10000 P/R	0.01°/Pulse	0.0072°/Pulse	0.005°/Pulse	0.0036°/Pulse	0.0018°/Pulse
	500 P/R	0.2°/Pulse	0.144°/Pulse	0.1°/Pulse	0.072°/Pulse	0.036°/Pulse
	5000 P/R	0.02°/Pulse	0.0144°/Pulse	0.01°/Pulse	0.0072°/Pulse	0.0036°/Pulse

Gear ratio	25:1	30:1	36:1	50:1	100:1	
Resolution	1000 P/R	0.0144°/Pulse	0.012°/Pulse	0.01°/Pulse	0.0072°/Pulse	0.0036°/Pulse
	10000 P/R	0.00144°/Pulse	0.0012°/Pulse	0.001°/Pulse	0.00072°/Pulse	0.00036°/Pulse
	500 P/R	0.0288°/Pulse	0.024°/Pulse	0.02°/Pulse	0.0144°/Pulse	0.0072°/Pulse
	5000 P/R	0.00288°/Pulse	0.0024°/Pulse	0.002°/Pulse	0.00144°/Pulse	0.00072°/Pulse

Pulse input modes

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



When the motor is to be controlled through 2-pulse signal input via the CW pulse signal and CCW pulse signal, set the pulse-input mode selection switch to “2P.”



When the motor is to be controlled through the PLS (pulse) and the DIR (rotating-direction), set the pulse-input mode selection switch to “1P.”



Operating current

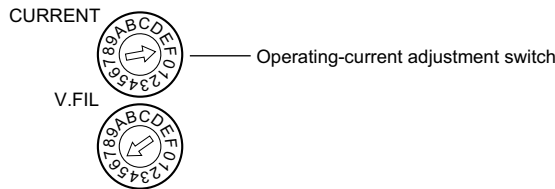
Use the operating-current adjustment switch “CURRENT” to set the motor’s operating current. Set the operating current as a product of the maximum driver output current “F,” which is 100%, multiplied by the operating current percentage corresponding to the given dial.

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

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.
- Be sure to shut off the power before using the pulse-input mode selection switch. The new pulse mode takes effect when the power is turned on again.

Note

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

Speed filter

Use the speed-filter selection switch "V.FIL" to select the filter time constant that determines the motor'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 motor is started and stopped, and will minimize low-speed vibration.

An unnecessarily large filter time constant, however, will smooth out the motor 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

CURRENT



V.FIL

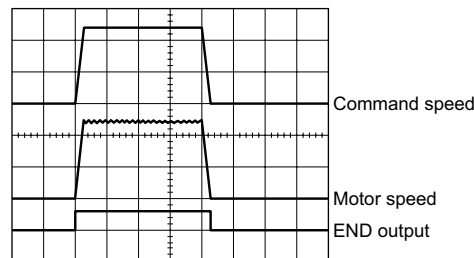


Speed-filter selection switch

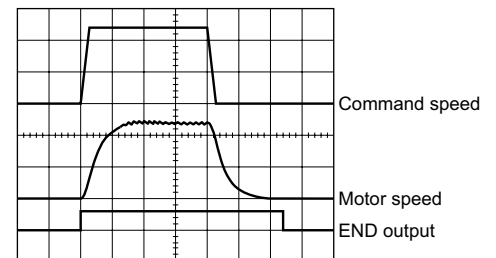
The dial settings and corresponding levels of filter time constants are as follows:

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

When the speed-filter selection switch is set to "0"



When the speed-filter selection switch is set to "E"



Protective functions

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

⚠ Warning

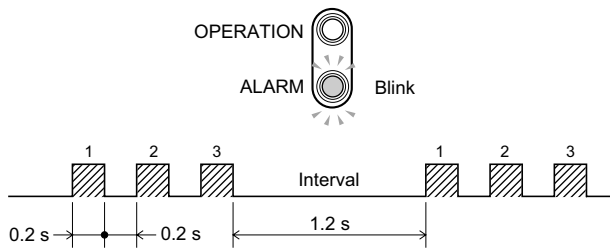
- When the driver-protection function is triggered, the motor will stop and lose its holding torque, possibly causing injury or damage to equipment.
- When the driver's protection function is triggered, first remove the cause and then clear the protection function. Continuing the operation without removing the cause of the problem may cause malfunction of the motor, leading to injury or damage to equipment.

Note

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

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 motor current is shut off in order to stop the motor. 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.

No. of blinks	Protective function	Conditions
1	Overheat protection	When a heat-radiating unit within the driver reaches approx. 85 °C.
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 motor has not normally followed up on pulse input.
5	Overcurrent protection	When an excessive current flows through the driver inverter's power element.
6	Overspeed	When the motor shaft speed exceeds 5000 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.

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 10 seconds before turning the power back on.
- The overcurrent protection, EEPROM data error and system error protective functions cannot be cleared. When any of these functions are triggered, contact the nearest customer-service center, branch or sales office.

Note

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

Inspection

It is recommended that periodic inspections be conducted for the items listed below after each operation of the motor.

If an abnormal condition is noted, discontinue any use and contact your nearest office.

During inspection:

- Are any of the motor mounting screws loose?
- Check for any unusual noises in the motor's bearings (ball bearings) or other moving parts.
- Are the motor's output shaft (or gear output shaft) and load shaft out of alignment?
- 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 or power-connection terminal screws loose?
- Are there any strange smells or appearances in the power elements and filtering capacitors within the driver?

Troubleshooting and remedial actions

During motor operation, the motor or driver may fail to function properly due to an improper speed setting or wiring. When the motor 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 motor does not operate properly even though the ALARM LED is not blinking, refer to the table below:

Phenomenon	Possible cause	Remedial action
The motor is not excited. The motor can be turned with the hands.	C.OFF input is "ON."	Turn the C.OFF input to "OFF" and confirm that the motor is excited.
The motor does not run.	Bad connection for CW or CCW input.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.
	Electromagnetic brake is holding (electromagnetic brake type only).	Release the electromagnetic brake by turning the power on.
The motor rotates in the direction opposite that which is specified.	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 rotating direction input is set in reverse.	Set to "ON" when setting the CW direction or "OFF" when setting the CCW direction.
The geared output shaft rotates in the direction opposite motor rotation.	A geared type is used whose rotating direction is opposite that of the motor shaft.	<ul style="list-style-type: none"> • TH geared type rotates in the direction opposite motor rotation at gear ratios of 20:1 and 30:1. • All harmonic geared types rotate in the direction opposite motor rotation.
Motor operation is unstable.	Bad connection of the pulse signal line.	<ul style="list-style-type: none"> • Check the connections of the controller and driver. • Review the specifications (voltage and width) for input pulse.
Vibration is great.	Small load	Reduce the current by adjusting the driver's current adjustment switch. If the motor's output torque is too great for the load, vibration will increase.
The electromagnetic brake does not hold.	The electromagnetic brake is turned on.	To use an electromagnetic brake to hold the load in position after the motor has stopped, turn off the electromagnetic brake.
The TIM. output does not turn "ON."	The "×10" input is turned "OFF" during operation.	When the "×10" input is turned "OFF," the TIM. output may not turn "ON."

■ 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 1 and 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
1	Overheat protection. Driver ambient temperature exceeded 50 °C (122 °F).	Review motor's operating condition and ventilation in the enclosure.
2	Overload protection. Overloading.	Reduce the motor load.
3	Overvoltage protection. Incorrect power connection or loading beyond the regenerative ability of the driver.	<ul style="list-style-type: none">• 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 reduce the speed-filter setting.
5	Overcurrent protection. Short-circuited motor cable.	Check motor cables and connectors to the driver.
6	Excessive speed. Excessively high operating-pulse speed.	Set the speed of the motor shaft at 5000 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.
Continuous	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.

Main specifications

This section covers the main specifications of the ***αSTEP AS*** series.

Refer to the catalog for detailed specifications, torque characteristics and dimensions.

		Motor	IP65 rated motor	Driver
Protective range		IP20	IP65 *	IP10
Operation environment	Ambient temperature	0 to +50 °C (+32 to +122 °F) (non-freezing) Harmonic geared type: 0 to +40 °C (+32 to +104 °F) (non-freezing)	0 to +50 °C (+32 to +122 °F) (non-freezing)	
	Humidity	85% or less (non-condensing)		
	Altitude	Up to 1000 m (3300 ft.) above sea level		
	Surrounding atmosphere	No corrosive gas, dust, water or oil	No corrosive gas	No corrosive gas, dust, water or oil
Storage environment	Ambient temperature	-20 to +60 °C (-4 to +140 °F) (non-freezing)		-25 to +70 °C (-13 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)		
	Altitude	Up to 3000 m (10000 ft.) above sea level		
	Surrounding atmosphere	No corrosive gas, dust, water or oil	No corrosive gas	No corrosive gas, dust, water or oil
Shipping environment	Ambient temperature	-20 to +60 °C (-4 to +140 °F) (non-freezing)		-25 to +70 °C (-13 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)		
	Altitude	Up to 3000 m (10000 ft.) above sea level		
	Surrounding atmosphere	No corrosive gas, dust, water or oil	No corrosive gas	No corrosive gas, dust, water or oil

* Excluding the gap between the shaft and the flange

Appendix

Options (sold separately)

■Extension cable

Required to extend the distance between the motor and driver.

Standard type

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)
CC15AIP	15 (49.2)
CC20AIP	20 (65.6)

Electromagnetic brake type

Model	Length [m (ft.)]
CC01AIPM	1 (3.3)
CC02AIPM	2 (6.6)
CC03AIPM	3 (9.8)
CC05AIPM	5 (16.4)
CC07AIPM	7 (23)
CC10AIPM	10 (32.8)
CC15AIPM	15 (49.2)
CC20AIPM	20 (65.6)

■Motor cable for IP65 rated motor

Cable required for connecting an IP65 rated motor and a driver.

Model	Length [m (ft.)]
CC01AST	1 (3.3)
CC02AST	2 (6.6)
CC03AST	3 (9.8)
CC05AST	5 (16.4)
CC07AST	7 (23)
CC10AST	10 (32.8)
CC15AST	15 (49.2)
CC20AST	20 (65.6)

Note) The connector on the driver side does not conform to IP65.

■Flexible cable

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

Standard type

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)

Electromagnetic brake type

Model	Length [m (ft.)]
CC01SARM2	1 (3.3)
CC02SARM2	2 (6.6)
CC03SARM2	3 (9.8)
CC05SARM2	5 (16.4)
CC07SARM2	7 (23)
CC10SARM2	10 (32.8)

■Flexible cable for IP65 rated motor

Highly flexible cable required for connecting an IP65 rated motor and a driver.

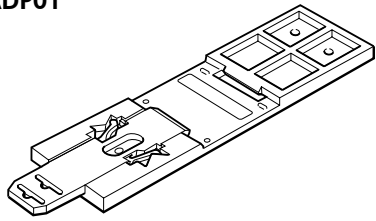
Model	Length [m (ft.)]
CC01SAR2	1 (3.3)
CC02SAR2	2 (6.6)
CC03SAR2	3 (9.8)
CC05SAR2	5 (16.4)
CC07SAR2	7 (23)
CC10SAR2	10 (32.8)

Note) The connector on the driver side does not conform to IP65.

■DIN rail mounting plate

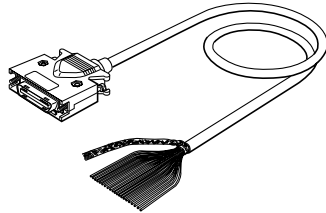
Plate for mounting the driver to a DIN rail [35 mm (1.38 in.)].

Model: **PADP01**



■Shielded cable with connectors


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)





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