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Oriental motor

HM-40016-3

αSTEP AS Series

OPERATING MANUAL

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

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

Table of contents

1 Introduction 2
2 Safety precautions 4
3 Precautions for use 6
4 Preparation 8
4.1 Checking the product 8
4.2 How to identify the product model 9
4.3 Combinations of motors and drivers 9
4.4 Names and functions of parts 14
5 Installation 16
5.1 Location for installation 16
5.2 Installing the motor 16
5.3 Installing a load 17
5.4 Permissible overhung load and permissible thrust load 18
5.5 Installing the driver 20
5.6 Installing and wiring in compliance with EMC Directive 22
6 Connection 25
6.1 Connecting the motor (other than IP65 rated motor) 25
6.2 Connecting an IP65 rated motor 25
6.3 Connecting an electromagnetic brake motor 26
6.4 Connection example for the control input/output 28
6.5 Connecting to the power supply 31
6.6 Grounding the motor and driver 32
6.7 Connecting control input/output 33
6.8 About control input/output 35
6.9 Timing chart 41
7 Setting 42
7.1 Resolution 42
7.2 Pulse input modes 43
7.3 Operating current 43
7.4 Speed filter 44
8 Protective functions 45
8.1 Descriptions of protective functions and numbers of LED blinks 45
8.2 How to clear a protective function 45
9 Inspection 46
10 Troubleshooting and remedial actions 47
11 Main specifications 49
12 Options (sold separately) 50

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1 Introduction

■ Before use

Only qualified personnel should work with the product.
Use the product correctly after thoroughly reading the section 2 “Safety precautions” on page 4.
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 αSTEP **AS** series models are unit products consisting of a high-performance micro-stepping driver and a stepping motor (αSTEP) with built-in rotor-position sensor. The **AS** series models incorporating αSTEP 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.
Motors meeting IP65 are also available.

■ Standards and CE Marking

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

- Applicable Standards

	Applicable Standards	Certification Body	Standards File No.
Motor	UL 1004, UL 2111 CSA C22.2 No.100*2 CSA C22.2 No.77*2	UL	E64199
	EN 60950-1 EN 60034-1 EN 60034-5 IEC 60664-1	—	—
Driver	UL 508C*1 CSA C22.2 No.14	UL	E171462
	EN 60950-1 EN 50178	—	—

∗1 For UL standard (UL 508C), 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)
Protection against electric shock: 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 Earth Terminals of the motor and driver.

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

  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 5.6 “Installing and wiring in compliance with EMC Directive” on page 22.

■ Hazardous substances

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

■ 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

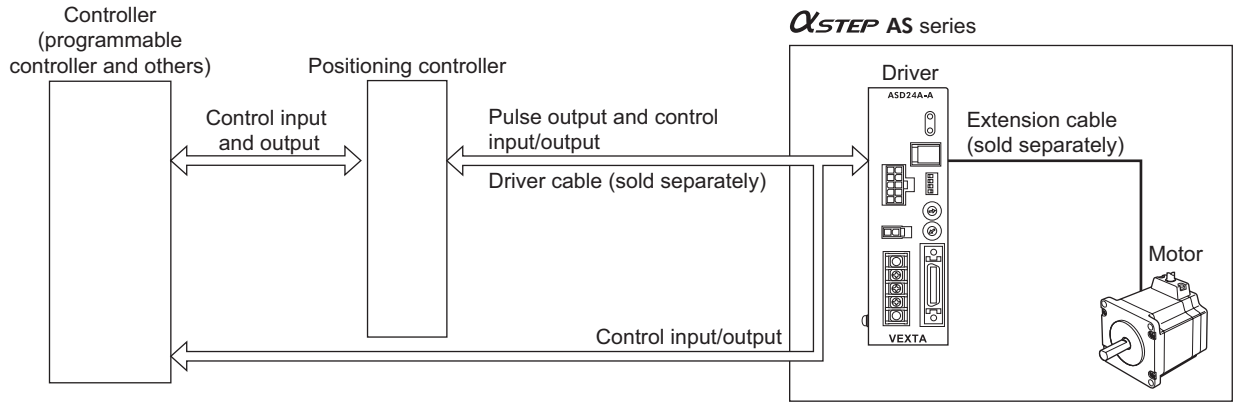
  The level of motor current during operation can be set between 6 to 100% (maximum) in 16 increments.

- 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 an electromagnetic brake motor, provide a 24 VDC power supply for the electromagnetic brake separately from the control power supply and always use an optional extension cable of the electromagnetic brake type (sold separately) for connection. 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).
- Three types of input power supplies can be used: single-phase 100-115 V, single-phase 200-230 V and three-phase 200-230 V (**AS46**: single-phase 100-115 V only).

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2 Safety precautions

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

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

⚠ Warning

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire, 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, injury or damage to equipment.
- 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 and driver, 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.

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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 fire, electric shock, or injury may result.
- Do not touch the motor or driver during operation or immediately after stopping. The surfaces are hot and may cause a skin burn(s).

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 skin burn(s).
- 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.
- Provide an emergency-stop device or emergency-stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- Before supplying power to the driver, turn all control inputs to the driver to “OFF.” Otherwise, the 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 (158 °F), 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 skin burn(s).


Warning label

- For the control input and output power supply, use a power supply with reinforced insulation provided on the primary side, and provide it separately from the power supply for the electromagnetic brake. Failure to do so may result in electric shock.
- Immediately when trouble has occurred, stop running and turn off the driver power. Failure to do so may result in fire, electric shock or injury.
- 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

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

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3 Precautions for use

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

■ Conduct the insulation resistance measurement or withstand voltage test separately on the motor and the driver.

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

■ Do not apply an overhung load and thrust load in excess of the specified permissible limit.

Be sure to operate the motor within the specified permissible limit of overhung load and thrust load. Operating it under an excessive overhung load and thrust load may damage the motor bearings (ball bearings).
See page 18 for details.

■ 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).
Use the harmonic geared type motor in a condition where the gear case temperature does not exceed 70 °C (158 °F), in order to prevent deterioration of grease in the gear.

■ 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.

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■ Connecting an electromagnetic brake motor

When using an electromagnetic brake motor, provide a power supply for the electromagnetic brake separately from the control I/O power supply.

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

■ About maximum torque of geared type motor

Always operate the geared type motor under a load not exceeding the maximum torque. If the load exceeds the maximum torque, the gear will be damaged.

■ 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 pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer's equipment or products.

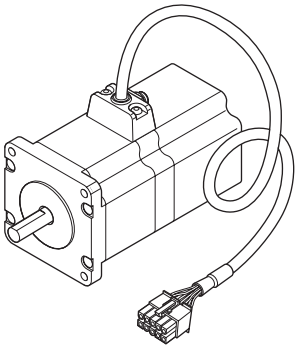
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4 Preparation

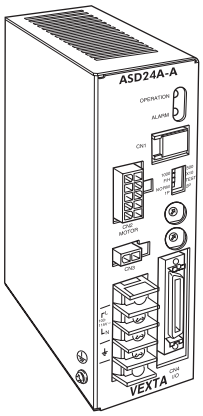
This section covers the points to be checked along with the names and functions of respective parts.

4.1 Checking the product

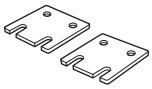
Upon opening the package, verify that the items listed below are included.
Report any missing or damaged items to the branch or sales office from which you purchased the product.
Verify the model number of the purchased unit against the number shown on the package label.
Check the model number of the motor and driver against the number shown on the nameplate.
The unit models and corresponding motor/driver combinations are listed on page 9.



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



- Driver 1 Unit



- Driver mounting brackets 2 pcs.



- Screws for driver mounting brackets (M3) 4 pcs.



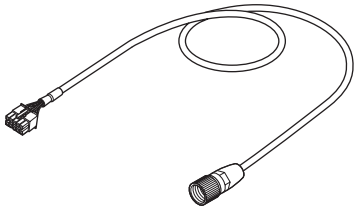
- Control input/output connector 1 set

- Varistor*2 1 pc.
- Operating manual (This manual) 1 copy

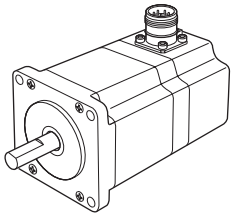
*1 A parallel key (1 pc.) is supplied with all geared type motors (excluding the **AS46TH**, **AS46PL** and **AS66TH** geared type).
*2 Varistor supplied with the motor with an electromagnetic brake.

■ Dedicated connection cable (sold separately) is needed for IP65 rated motor.

If you are using an IP65 rated motor, be sure to purchase an optional dedicated connection cable for IP65 rated motor (sold separately). Without the dedicated connection cable, can not connect.
See 12 “Options (sold separately)” on page 50 for details.



- Dedicated connection cable for IP65 rated motor (sold separately)

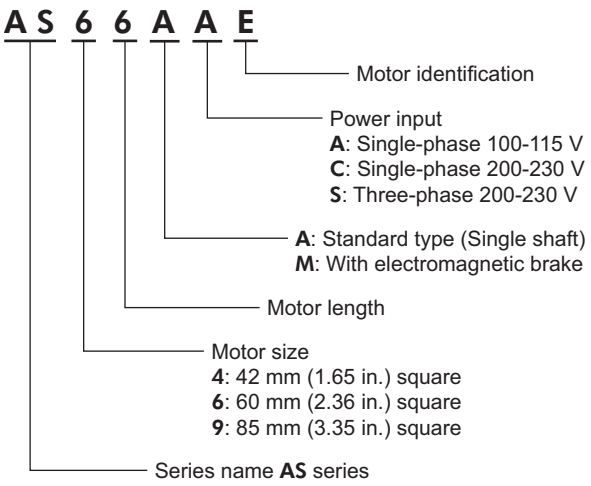


- IP65 rated motor

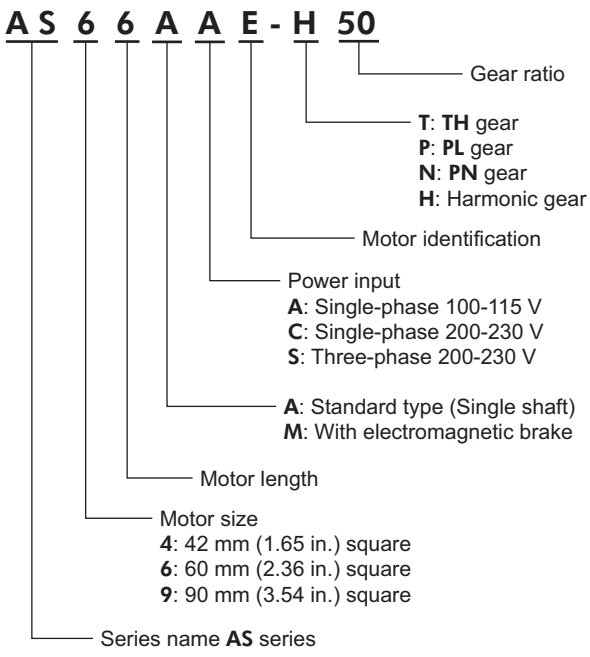
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4.2 How to identify the product model

■ Standard type



■ Geared type



4.3 Combinations of motors and drivers

• Standard type

Unit model	Motor model	Driver model
AS46AA	ASM46AA	ASD13A-A
AS66AAE	ASM66AAE	ASD24A-A
AS69AAE	ASM69AAE	ASD30D-A
AS66ACE	ASM66ACE	ASD12A-C
AS69ACE	ASM69ACE	ASD16D-C
AS66ASE	ASM66ACE	ASD12A-S
AS69ASE	ASM69ACE	ASD16D-S
AS98AAE	ASM98AAE	ASD30A-A
AS911AAE	ASM911AAE	ASD30E-A
AS98ACE	ASM98ACE	ASD16A-C
AS911ACE	ASM911ACE	ASD20A-C
AS98ASE	ASM98ACE	ASD16A-S
AS911ASE	ASM911ACE	ASD20A-S

• Standard type with electromagnetic brake

Unit model	Motor model	Driver model
AS46MA	ASM46MA	ASD13A-A
AS66MAE	ASM66MAE	ASD24A-A
AS69MAE	ASM69MAE	ASD30D-A
AS66MCE	ASM66MCE	ASD12A-C
AS69MCE	ASM69MCE	ASD16D-C
AS66MSE	ASM66MCE	ASD12A-S
AS69MSE	ASM69MCE	ASD16D-S
AS98MAE	ASM98MAE	ASD30A-A
AS98MCE	ASM98MCE	ASD16A-C
AS98MSE	ASM98MCE	ASD16A-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

Unit model	Motor model	Driver model
AS98AAT	ASM98AAT	ASD30A-A
AS911AAT	ASM911AAT	ASD30E-A
AS98ACT	ASM98ACT	ASD16A-C
AS911ACT	ASM911ACT	ASD20A-C
AS98AST	ASM98ACT	ASD16A-S
AS911AST	ASM911ACT	ASD20A-S

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• **TH** geared 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
AS66AAE-T3.6	ASM66AAE-T3.6	ASD24B-A
AS66AAE-T7.2	ASM66AAE-T7.2	ASD24B-A
AS66AAE-T10	ASM66AAE-T10	ASD24B-A
AS66AAE-T20	ASM66AAE-T20	ASD24C-A
AS66AAE-T30	ASM66AAE-T30	ASD24C-A
AS66ACE-T3.6	ASM66ACE-T3.6	ASD12B-C
AS66ACE-T7.2	ASM66ACE-T7.2	ASD12B-C
AS66ACE-T10	ASM66ACE-T10	ASD12B-C
AS66ACE-T20	ASM66ACE-T20	ASD12C-C
AS66ACE-T30	ASM66ACE-T30	ASD12C-C
AS66ASE-T3.6	ASM66ACE-T3.6	ASD12B-S
AS66ASE-T7.2	ASM66ACE-T7.2	ASD12B-S
AS66ASE-T10	ASM66ACE-T10	ASD12B-S
AS66ASE-T20	ASM66ACE-T20	ASD12C-S
AS66ASE-T30	ASM66ACE-T30	ASD12C-S
AS98AAE-T3.6	ASM98AAE-T3.6	ASD30A-A
AS98AAE-T7.2	ASM98AAE-T7.2	ASD30A-A
AS98AAE-T10	ASM98AAE-T10	ASD30A-A
AS98AAE-T20	ASM98AAE-T20	ASD30C-A
AS98AAE-T30	ASM98AAE-T30	ASD30C-A
AS98ACE-T3.6	ASM98ACE-T3.6	ASD16A-C
AS98ACE-T7.2	ASM98ACE-T7.2	ASD16A-C
AS98ACE-T10	ASM98ACE-T10	ASD16A-C
AS98ACE-T20	ASM98ACE-T20	ASD16C-C
AS98ACE-T30	ASM98ACE-T30	ASD16C-C
AS98ASE-T3.6	ASM98ACE-T3.6	ASD16A-S
AS98ASE-T7.2	ASM98ACE-T7.2	ASD16A-S
AS98ASE-T10	ASM98ACE-T10	ASD16A-S
AS98ASE-T20	ASM98ACE-T20	ASD16C-S
AS98ASE-T30	ASM98ACE-T30	ASD16C-S

• **TH** geared type with electromagnetic brake

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
AS66MAE-T3.6	ASM66MAE-T3.6	ASD24B-A
AS66MAE-T7.2	ASM66MAE-T7.2	ASD24B-A
AS66MAE-T10	ASM66MAE-T10	ASD24B-A
AS66MAE-T20	ASM66MAE-T20	ASD24C-A
AS66MAE-T30	ASM66MAE-T30	ASD24C-A
AS66MCE-T3.6	ASM66MCE-T3.6	ASD12B-C
AS66MCE-T7.2	ASM66MCE-T7.2	ASD12B-C
AS66MCE-T10	ASM66MCE-T10	ASD12B-C
AS66MCE-T20	ASM66MCE-T20	ASD12C-C
AS66MCE-T30	ASM66MCE-T30	ASD12C-C
AS66MSE-T3.6	ASM66MCE-T3.6	ASD12B-S
AS66MSE-T7.2	ASM66MCE-T7.2	ASD12B-S
AS66MSE-T10	ASM66MCE-T10	ASD12B-S
AS66MSE-T20	ASM66MCE-T20	ASD12C-S
AS66MSE-T30	ASM66MCE-T30	ASD12C-S
AS98MAE-T3.6	ASM98MAE-T3.6	ASD30A-A
AS98MAE-T7.2	ASM98MAE-T7.2	ASD30A-A
AS98MAE-T10	ASM98MAE-T10	ASD30A-A
AS98MAE-T20	ASM98MAE-T20	ASD30C-A
AS98MAE-T30	ASM98MAE-T30	ASD30C-A
AS98MCE-T3.6	ASM98MCE-T3.6	ASD16A-C
AS98MCE-T7.2	ASM98MCE-T7.2	ASD16A-C
AS98MCE-T10	ASM98MCE-T10	ASD16A-C
AS98MCE-T20	ASM98MCE-T20	ASD16C-C
AS98MCE-T30	ASM98MCE-T30	ASD16C-C
AS98MSE-T3.6	ASM98MCE-T3.6	ASD16A-S
AS98MSE-T7.2	ASM98MCE-T7.2	ASD16A-S
AS98MSE-T10	ASM98MCE-T10	ASD16A-S
AS98MSE-T20	ASM98MCE-T20	ASD16C-S
AS98MSE-T30	ASM98MCE-T30	ASD16C-S

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• **PL** geared 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
AS66AAE-P5	ASM66AAE-P5	ASD24A-A
AS66AAE-P7.2	ASM66AAE-P7.2	ASD24A-A
AS66AAE-P10	ASM66AAE-P10	ASD24A-A
AS66AAE-P25	ASM66AAE-P25	ASD24B-A
AS66AAE-P36	ASM66AAE-P36	ASD24C-A
AS66AAE-P50	ASM66AAE-P50	ASD24C-A
AS66ACE-P5	ASM66ACE-P5	ASD12A-C
AS66ACE-P7.2	ASM66ACE-P7.2	ASD12A-C
AS66ACE-P10	ASM66ACE-P10	ASD12A-C
AS66ACE-P25	ASM66ACE-P25	ASD12B-C
AS66ACE-P36	ASM66ACE-P36	ASD12C-C
AS66ACE-P50	ASM66ACE-P50	ASD12C-C
AS66ASE-P5	ASM66ACE-P5	ASD12A-S
AS66ASE-P7.2	ASM66ACE-P7.2	ASD12A-S
AS66ASE-P10	ASM66ACE-P10	ASD12A-S
AS66ASE-P25	ASM66ACE-P25	ASD12B-S
AS66ASE-P36	ASM66ACE-P36	ASD12C-S
AS66ASE-P50	ASM66ACE-P50	ASD12C-S
AS98AAE-P5	ASM98AAE-P5	ASD30A-A
AS98AAE-P7.2	ASM98AAE-P7.2	ASD30A-A
AS98AAE-P10	ASM98AAE-P10	ASD30A-A
AS98AAE-P25	ASM98AAE-P25	ASD30A-A
AS98AAE-P36	ASM98AAE-P36	ASD30B-A
AS98AAE-P50	ASM98AAE-P50	ASD30B-A
AS98ACE-P5	ASM98ACE-P5	ASD16A-C
AS98ACE-P7.2	ASM98ACE-P7.2	ASD16A-C
AS98ACE-P10	ASM98ACE-P10	ASD16A-C
AS98ACE-P25	ASM98ACE-P25	ASD16A-C
AS98ACE-P36	ASM98ACE-P36	ASD16B-C
AS98ACE-P50	ASM98ACE-P50	ASD16B-C
AS98ASE-P5	ASM98ACE-P5	ASD16A-S
AS98ASE-P7.2	ASM98ACE-P7.2	ASD16A-S
AS98ASE-P10	ASM98ACE-P10	ASD16A-S
AS98ASE-P25	ASM98ACE-P25	ASD16A-S
AS98ASE-P36	ASM98ACE-P36	ASD16B-S
AS98ASE-P50	ASM98ACE-P50	ASD16B-S

• **PL** geared type with electromagnetic brake

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
AS66MAE-P5	ASM66MAE-P5	ASD24A-A
AS66MAE-P7.2	ASM66MAE-P7.2	ASD24A-A
AS66MAE-P10	ASM66MAE-P10	ASD24A-A
AS66MAE-P25	ASM66MAE-P25	ASD24B-A
AS66MAE-P36	ASM66MAE-P36	ASD24C-A
AS66MAE-P50	ASM66MAE-P50	ASD24C-A
AS66MCE-P5	ASM66MCE-P5	ASD12A-C
AS66MCE-P7.2	ASM66MCE-P7.2	ASD12A-C
AS66MCE-P10	ASM66MCE-P10	ASD12A-C
AS66MCE-P25	ASM66MCE-P25	ASD12B-C
AS66MCE-P36	ASM66MCE-P36	ASD12C-C
AS66MCE-P50	ASM66MCE-P50	ASD12C-C
AS66MSE-P5	ASM66MCE-P5	ASD12A-S
AS66MSE-P7.2	ASM66MCE-P7.2	ASD12A-S
AS66MSE-P10	ASM66MCE-P10	ASD12A-S
AS66MSE-P25	ASM66MCE-P25	ASD12B-S
AS66MSE-P36	ASM66MCE-P36	ASD12C-S
AS66MSE-P50	ASM66MCE-P50	ASD12C-S
AS98MAE-P5	ASM98MAE-P5	ASD30A-A
AS98MAE-P7.2	ASM98MAE-P7.2	ASD30A-A
AS98MAE-P10	ASM98MAE-P10	ASD30A-A
AS98MAE-P25	ASM98MAE-P25	ASD30A-A
AS98MAE-P36	ASM98MAE-P36	ASD30B-A
AS98MAE-P50	ASM98MAE-P50	ASD30B-A
AS98MCE-P5	ASM98MCE-P5	ASD16A-C
AS98MCE-P7.2	ASM98MCE-P7.2	ASD16A-C
AS98MCE-P10	ASM98MCE-P10	ASD16A-C
AS98MCE-P25	ASM98MCE-P25	ASD16A-C
AS98MCE-P36	ASM98MCE-P36	ASD16B-C
AS98MCE-P50	ASM98MCE-P50	ASD16B-C
AS98MSE-P5	ASM98MCE-P5	ASD16A-S
AS98MSE-P7.2	ASM98MCE-P7.2	ASD16A-S
AS98MSE-P10	ASM98MCE-P10	ASD16A-S
AS98MSE-P25	ASM98MCE-P25	ASD16A-S
AS98MSE-P36	ASM98MCE-P36	ASD16B-S
AS98MSE-P50	ASM98MCE-P50	ASD16B-S

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• **PN** geared type

Unit model	Motor model	Driver model
AS46AA-N7.2	ASM46AA-N7.2	ASD13A-A
AS46AA-N10	ASM46AA-N10	ASD13A-A
AS66AAE-N5	ASM66AAE-N5	ASD24A-A
AS66AAE-N7.2	ASM66AAE-N7.2	ASD24A-A
AS66AAE-N10	ASM66AAE-N10	ASD24A-A
AS66AAE-N25	ASM66AAE-N25	ASD24B-A
AS66AAE-N36	ASM66AAE-N36	ASD24C-A
AS66AAE-N50	ASM66AAE-N50	ASD24C-A
AS66ACE-N5	ASM66ACE-N5	ASD12A-C
AS66ACE-N7.2	ASM66ACE-N7.2	ASD12A-C
AS66ACE-N10	ASM66ACE-N10	ASD12A-C
AS66ACE-N25	ASM66ACE-N25	ASD12B-C
AS66ACE-N36	ASM66ACE-N36	ASD12C-C
AS66ACE-N50	ASM66ACE-N50	ASD12C-C
AS66ASE-N5	ASM66ACE-N5	ASD12A-S
AS66ASE-N7.2	ASM66ACE-N7.2	ASD12A-S
AS66ASE-N10	ASM66ACE-N10	ASD12A-S
AS66ASE-N25	ASM66ACE-N25	ASD12B-S
AS66ASE-N36	ASM66ACE-N36	ASD12C-S
AS66ASE-N50	ASM66ACE-N50	ASD12C-S
AS98AAE-N5	ASM98AAE-N5	ASD30A-A
AS98AAE-N7.2	ASM98AAE-N7.2	ASD30A-A
AS98AAE-N10	ASM98AAE-N10	ASD30A-A
AS98AAE-N25	ASM98AAE-N25	ASD30A-A
AS98AAE-N36	ASM98AAE-N36	ASD30A-A
AS98AAE-N50	ASM98AAE-N50	ASD30B-A
AS98ACE-N5	ASM98ACE-N5	ASD16A-C
AS98ACE-N7.2	ASM98ACE-N7.2	ASD16A-C
AS98ACE-N10	ASM98ACE-N10	ASD16A-C
AS98ACE-N25	ASM98ACE-N25	ASD16A-C
AS98ACE-N36	ASM98ACE-N36	ASD16A-C
AS98ACE-N50	ASM98ACE-N50	ASD16B-C
AS98ASE-N5	ASM98ACE-N5	ASD16A-S
AS98ASE-N7.2	ASM98ACE-N7.2	ASD16A-S
AS98ASE-N10	ASM98ACE-N10	ASD16A-S
AS98ASE-N25	ASM98ACE-N25	ASD16A-S
AS98ASE-N36	ASM98ACE-N36	ASD16A-S
AS98ASE-N50	ASM98ACE-N50	ASD16B-S

• **PN** geared type with electromagnetic brake

Unit model	Motor model	Driver model
AS46MA-N7.2	ASM46MA-N7.2	ASD13A-A
AS46MA-N10	ASM46MA-N10	ASD13A-A
AS66MAE-N5	ASM66MAE-N5	ASD24A-A
AS66MAE-N7.2	ASM66MAE-N7.2	ASD24A-A
AS66MAE-N10	ASM66MAE-N10	ASD24A-A
AS66MAE-N25	ASM66MAE-N25	ASD24B-A
AS66MAE-N36	ASM66MAE-N36	ASD24C-A
AS66MAE-N50	ASM66MAE-N50	ASD24C-A
AS66MCE-N5	ASM66MCE-N5	ASD12A-C
AS66MCE-N7.2	ASM66MCE-N7.2	ASD12A-C
AS66MCE-N10	ASM66MCE-N10	ASD12A-C
AS66MCE-N25	ASM66MCE-N25	ASD12B-C
AS66MCE-N36	ASM66MCE-N36	ASD12C-C
AS66MCE-N50	ASM66MCE-N50	ASD12C-C
AS66MSE-N5	ASM66MCE-N5	ASD12A-S
AS66MSE-N7.2	ASM66MCE-N7.2	ASD12A-S
AS66MSE-N10	ASM66MCE-N10	ASD12A-S
AS66MSE-N25	ASM66MCE-N25	ASD12B-S
AS66MSE-N36	ASM66MCE-N36	ASD12C-S
AS66MSE-N50	ASM66MCE-N50	ASD12C-S
AS98MAE-N5	ASM98MAE-N5	ASD30A-A
AS98MAE-N7.2	ASM98MAE-N7.2	ASD30A-A
AS98MAE-N10	ASM98MAE-N10	ASD30A-A
AS98MAE-N25	ASM98MAE-N25	ASD30A-A
AS98MAE-N36	ASM98MAE-N36	ASD30A-A
AS98MAE-N50	ASM98MAE-N50	ASD30B-A
AS98MCE-N5	ASM98MCE-N5	ASD16A-C
AS98MCE-N7.2	ASM98MCE-N7.2	ASD16A-C
AS98MCE-N10	ASM98MCE-N10	ASD16A-C
AS98MCE-N25	ASM98MCE-N25	ASD16A-C
AS98MCE-N36	ASM98MCE-N36	ASD16A-C
AS98MCE-N50	ASM98MCE-N50	ASD16B-C
AS98MSE-N5	ASM98MCE-N5	ASD16A-S
AS98MSE-N7.2	ASM98MCE-N7.2	ASD16A-S
AS98MSE-N10	ASM98MCE-N10	ASD16A-S
AS98MSE-N25	ASM98MCE-N25	ASD16A-S
AS98MSE-N36	ASM98MCE-N36	ASD16A-S
AS98MSE-N50	ASM98MCE-N50	ASD16B-S

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• Harmonic geared type

Unit model	Motor model	Driver model
AS46AA2-H50	ASM46AA2-H50	ASD13A-A
AS46AA2-H100	ASM46AA2-H100	ASD13A-A
AS66AAE-H50	ASM66AAE-H50	ASD24B-A
AS66AAE-H100	ASM66AAE-H100	ASD24C-A
AS66ACE-H50	ASM66ACE-H50	ASD12B-C
AS66ACE-H100	ASM66ACE-H100	ASD12C-C
AS66ASE-H50	ASM66ACE-H50	ASD12B-S
AS66ASE-H100	ASM66ACE-H100	ASD12C-S
AS98AAE-H50	ASM98AAE-H50	ASD30B-A
AS98AAE-H100	ASM98AAE-H100	ASD30B-A
AS98ACE-H50	ASM98ACE-H50	ASD16B-C
AS98ACE-H100	ASM98ACE-H100	ASD16B-C
AS98ASE-H50	ASM98ACE-H50	ASD16B-S
AS98ASE-H100	ASM98ACE-H100	ASD16B-S

• Harmonic geared type with electromagnetic brake

Unit model	Motor model	Driver model
AS46MA2-H50	ASM46MA2-H50	ASD13A-A
AS46MA2-H100	ASM46MA2-H100	ASD13A-A
AS66MAE-H50	ASM66MAE-H50	ASD24B-A
AS66MAE-H100	ASM66MAE-H100	ASD24C-A
AS66MCE-H50	ASM66MCE-H50	ASD12B-C
AS66MCE-H100	ASM66MCE-H100	ASD12C-C
AS66MSE-H50	ASM66MCE-H50	ASD12B-S
AS66MSE-H100	ASM66MCE-H100	ASD12C-S
AS98MAE-H50	ASM98MAE-H50	ASD30B-A
AS98MAE-H100	ASM98MAE-H100	ASD30B-A
AS98MCE-H50	ASM98MCE-H50	ASD16B-C
AS98MCE-H100	ASM98MCE-H100	ASD16B-C
AS98MSE-H50	ASM98MCE-H50	ASD16B-S
AS98MSE-H100	ASM98MCE-H100	ASD16B-S

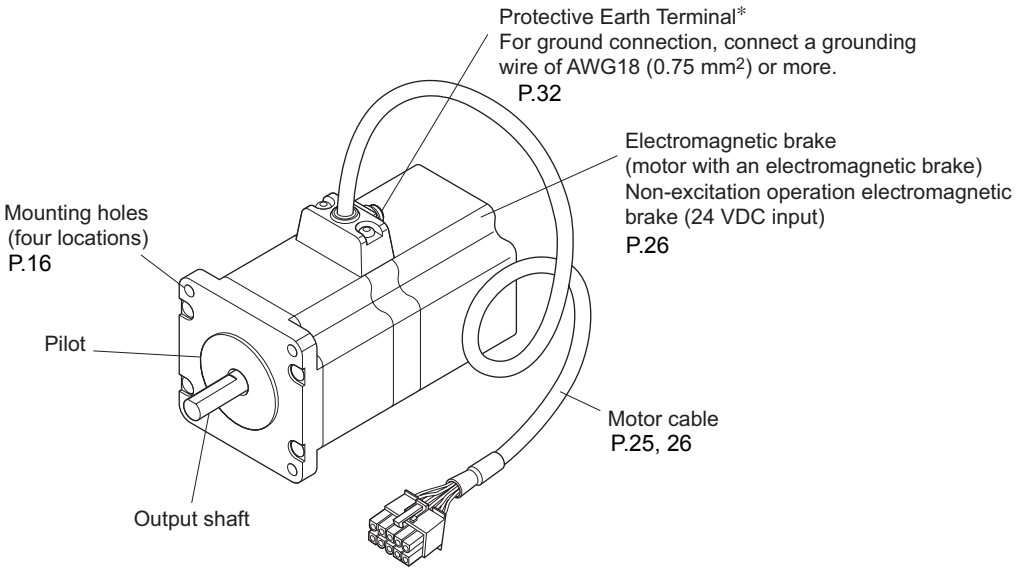
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4.4 Names and functions of parts

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

■ Motor

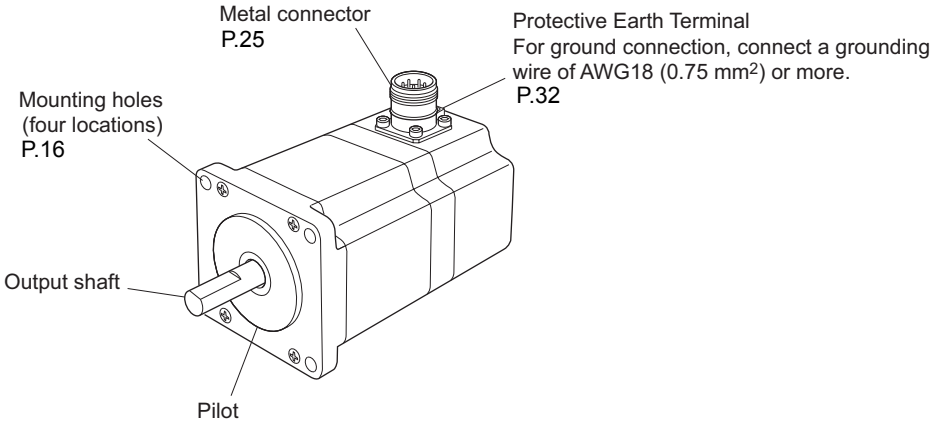
Illustration shows the standard type with electromagnetic brake (ASM66MAE).



* The ASM46 has no Protective Earth Terminals.

■ IP65 rated motor

Illustration shows the IP65 rated motor (ASM911ACT).

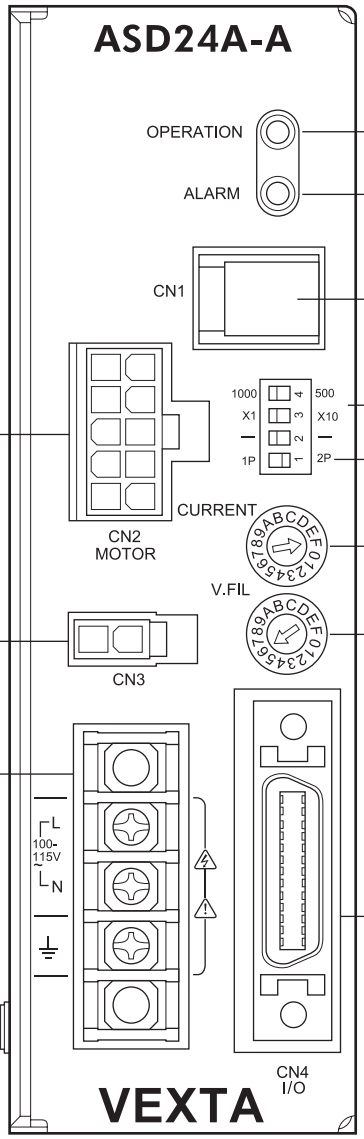


Note Be sure to purchase an optional dedicated connection cable for IP65 rated motor (sold separately).

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■ Driver

Front side of driver



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

ALARM LED (Red) P.45, 48
This alarm blinks when a protective function is triggered and the ALARM output turns "OFF."
Count the number of blinks to ascertain the cause of triggering of the protective function.

Not used (CN1)

Resolution select switches P.42
Use these two switches to select the motor resolution.
1000/500: Switches motor resolution between 1000 P/R "0.36°/pulse" or 500 P/R "0.72°/pulse."
×1/×10: Switches motor resolution between multipliers 1 and 10 of the value set by the 1000/500 switch.
The factory setting is "1000: 1000 P/R" and "×1: Multiplier 1." Be sure to switch to "×1" when the resolution select input "CN4 Pin No. 31, 32: ×10" is used.

Motor connector (CN2)
Connect the motor cable's connector.
P.25, 26

Pulse-input mode select switch P.43
Allows for the selection of 2-pulse input mode or 1-pulse input mode in accordance with the pulse-output mode in the positioning controller.

Not used (CN3)

Current setting switch P.43
Sets the motor's operating current.
If there is extra torque, the current may be set to a lower level in order to suppress increases in motor and driver temperature. The factory setting is "F: Driver's maximum output-current value."

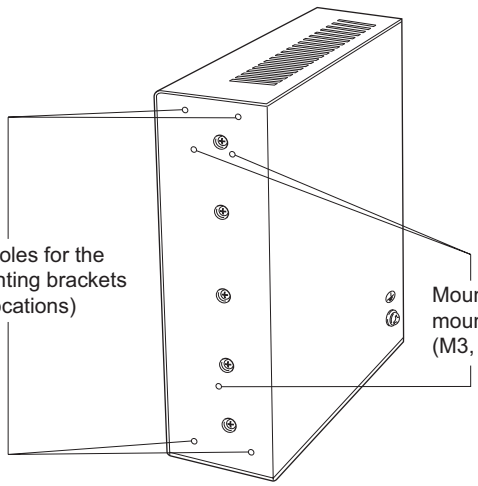
Power supply terminal
Connect the power supply cable.
P.31

Speed-filter select switch P.44
Sets the time constant for the filter that determines motor response. A longer time constant will smooth out the motor's rotation but render the setting time longer at motor standstill. The factory setting is "6: 1.20 ms."

Control input/output connectors (CN4) P.33, 35
Used to connect to the motor-positioning control and others.

Protective Earth Terminal
Used for grounding via a grounding cable of AWG18 (0.75 mm^2) or more.
P.32

Rear side of driver



Mounting holes for the driver mounting brackets (M3, four locations)
P.20

Mounting holes for the DIN rail mounting plate (M3, three locations) P.21

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5 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 Directive.

5.1 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% or less (non-condensing)
- Operating surrounding atmosphere
  Motor and Driver : Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
  : Area free of excessive amount of dust, iron particles or the like
  : Area not subject to splashing water (rains, water droplets), oil (oil droplets) or other liquids
  IP65 rated motor : Area that is free of explosive atmosphere or toxic gas (such as sulfuric gas) or liquid
- Area not exposed to direct sun
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum

5.2 Installing the motor

■ Installation direction

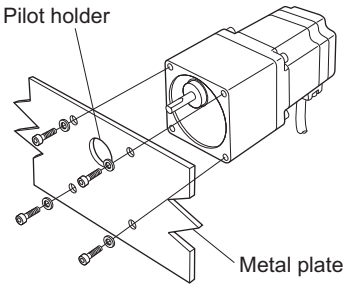
The motor can be installed in any direction.

■ Installation method

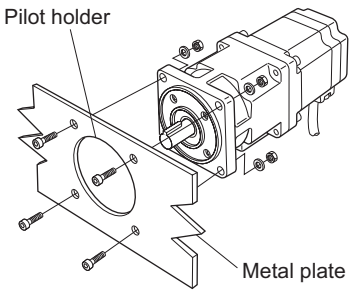
Install the motor onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity.
When installing the motor, secure it with four bolts (not supplied) through the four mounting holes provided.
Leave no gap between the motor and plate.

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

Installation method A



Installation method B



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Motor type	Frame size [mm (in.)]	Bolt size	Tightening torque [N·m (oz-in)]	Effective depth of thread [mm (in.)]	Installation method
Standard	42 (1.65)	M3	1 (142)	4.5 (0.177)	A
	60 (2.36)	M4	2 (280)	—	B
	85 (3.35)	M6	3 (420)	—	
TH geared	42 (1.65) 60 (2.36)	M4	2 (280)	8 (0.315)	A
	90 (3.54)	M8	4 (560)	15 (0.591)	
PL, **PN** geared Harmonic geared **AS46□A2** **AS66□□**	42 (1.65)	M4	2 (280)	8 (0.315)	A
	60 (2.36)	M5	2.5 (350)	10 (0.394)	
	90 (3.54)	M8	4 (560)	15 (0.591)	
Harmonic geared **AS98□□**	90 (3.54)	M8	4 (560)	—	B

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

5.3 Installing a load

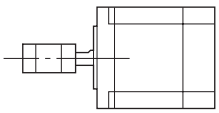
When connecting a load to the motor, align the centers of the motor's output shaft and load shaft.
The overhung load and the thrust load must be kept within the permissible values.
Optional flexible couplings are available (sold separately).

Note

- When coupling the load to the motor, pay attention to the centering of the shafts, belt tension, parallelism of the pulleys. 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 bearing, resulting in a failed motor.
- When inserting a parallel key into the gear output shaft, do not apply excessive force by using a hammer or similar tool. Application of strong impact may damage the output shaft or bearings.

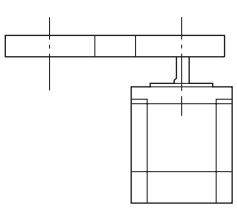
- Using a coupling

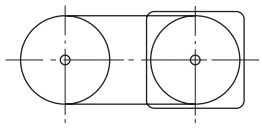
  Align the centers of the motor's output shaft and load shaft in a straight line.



- Using a belt drive

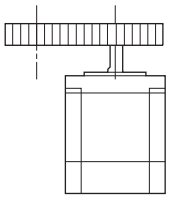
  Align the motor's output shaft and load shaft in parallel with each other, and position both pulleys so that the line connecting their centers is at a right angle to the shafts.





- 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.



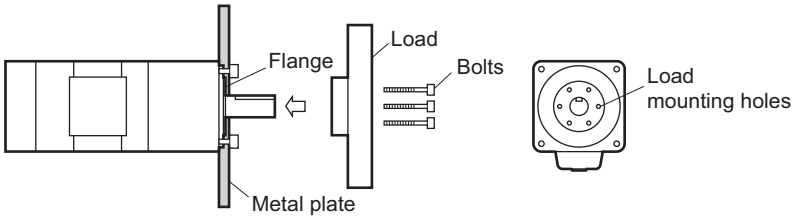
- Connecting with a key (Geared motor)

  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.

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- Installing on the flange surface (Harmonic geared type)

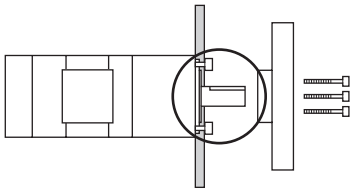
With a harmonic geared type, a load can be installed directly to the gear using the load mounting holes provided on the flange surface (excluding **AS98-H□**).



Unit model	Bolt size	Number of bolts	Tightening torque [N·m (oz-in)]	Effective depth of thread [mm (in.)]
AS46-H□	M3	6	1.4 (198)	5 (0.2)
AS66-H□	M4	6	2.5 (350)	6 (0.24)

Note

- When installing a load on the flange surface, the load cannot be affixed using the key groove in the output shaft.
- Design an appropriate installation layout so that the load will not contact the metal plate or bolts used for installing the motor.



5.4 Permissible overhung load and permissible thrust load

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

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.

Frame size [mm (in.)]	Unit type	Permissible overhung load [N (lb.)] Distance from the tip of motor's output shaft [mm (in.)]					Permissible thrust load [N (lb.)]
		0 (0)	5 (0.20)	10 (0.39)	15 (0.59)	20 (0.79)	
42 (1.65)	**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)
	AS46-H□	180 (40)	220 (49)	270 (60)	360 (81)	510 (114)	220 (49)
	AS46	20 (4.5)	25 (5.6)	34 (7.6)	52 (11.7)	—	0.5 [0.6] (1.1 [1.3]) *
60 (2.36)	**AS66-T□**	70 (15.7)	80 (18)	100 (22)	120 (27)	150 (33)	40 (9)
	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)	

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Frame size [mm (in.)]	Unit type	Permissible overhung load [N (lb.)]					Permissible thrust load [N (lb.)]
		Distance from the tip of motor's output shaft [mm (in.)]					
		0 (0)	5 (0.20)	10 (0.39)	15 (0.59)	20 (0.79)	
60 (2.36)	**AS66-H□**	320 (72)	370 (83)	440 (99)	550 (123)	720 (162)	450 (101)
	AS66	63 (14.1)	75 (16.8)	95 (21)	130 (29)	190 (42)	0.85 [1.1] {1} (1.9 [2.4] {2.2}) *
	AS69						1.4 [1.65] {1.5} (3.1 [3.6] {3.3}) *
85 (3.35)	**AS98**	260 (58)	290 (65)	340 (76)	390 (87)	480 (108)	1.8 [2.2] {2.2} (4 [4.8] {4.8}) *
	AS911						3 {3.3} (6.6 {7.3}) *
90 (3.54)	**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.

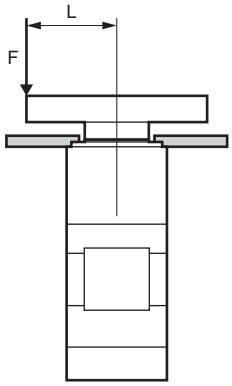
- The figures indicated by * are the motor's mass [kg (lb.)]. The thrust load should not exceed the motor's dead mass.
  The figures in parenthesis [ ] are the values for the electromagnetic brake motor.
  The figures in parentheses { } are the values for the IP65 rated motor.

- Permissible moment load of the harmonic geared type

When installing an arm or table on the flange surface, calculate the moment load using the formula below if the flange surface receives any eccentric load.
The moment load should not exceed the permissible value specified in the table.

Moment load : M [N·m (oz-in)] = F × L

Unit model	Permissible moment load [N·m (oz-in)]
AS46-H□	5.6 (790)
AS66-H□	11.6 (1640)



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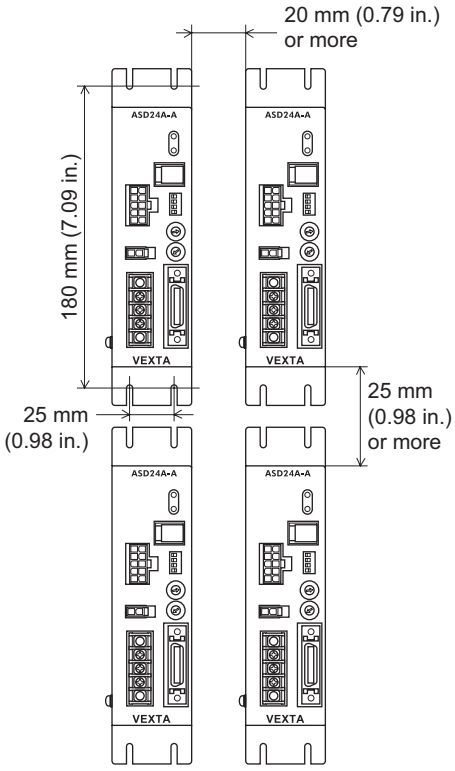
5.5 Installing the driver

■ Installation direction

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.
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.

Note

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

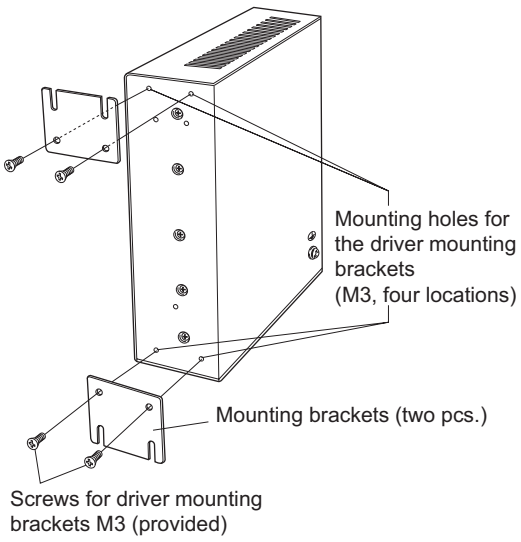


■ Installation method

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).

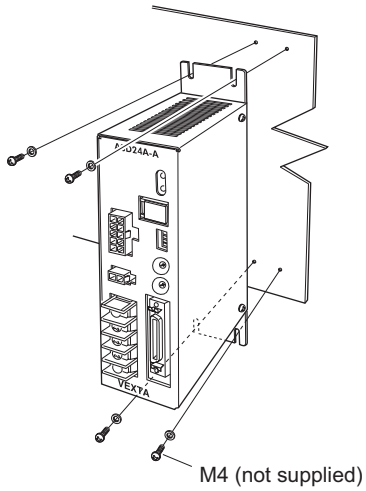
- Using driver mounting brackets

1. 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 pcs.).
   Tightening torque: 0.5 to 0.6 N·m
   (71 to 85 oz-in)



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2. 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.



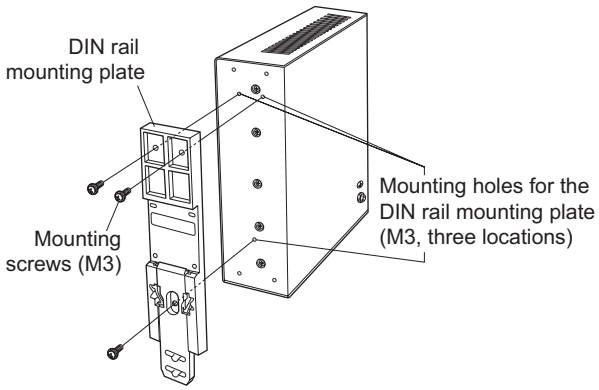
Note

- 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.

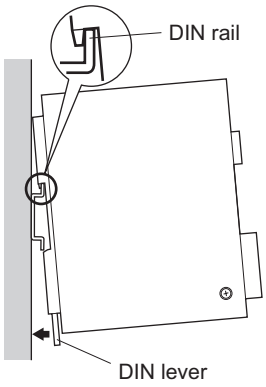
- Mounting to DIN rail

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.
Tightening torque: 0.3 to 0.4 N·m (42 to 56 oz-in)

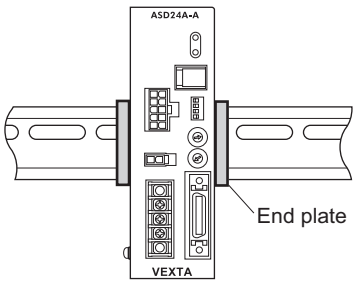


2. Pull the DIN lever down, engage the upper hooks of the DIN rail mounting plate over the DIN rail, and push the DIN lever until it locks in place.



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.
- Use an end plate (not supplied) to secure the driver.

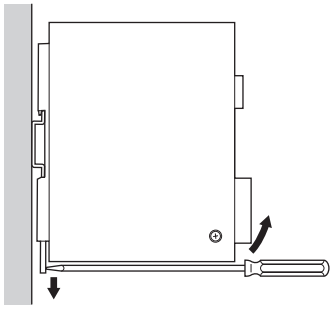


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- Removing from DIN rail

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

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.



5.6 Installing and wiring in compliance with EMC Directive

■ Introduction

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 Radiated Emission Test Conducted Emission Test	EN 61000-6-4 EN 55011 EN 55011
EMS	Immunity Tests Radiation Field Immunity Test Electrostatic Discharge Immunity Test Fast Transient / Burst Immunity Test Conductive Noise Immunity Test Surge Immunity Test Voltage Dip Immunity Test Voltage Interruption Immunity Test	EN 61000-6-2 IEC 61000-4-3 IEC 61000-4-2 IEC 61000-4-4 IEC 61000-4-6 IEC 61000-4-5 IEC 61000-4-11 IEC 61000-4-11

■ Installing and wiring in compliance with EMC Directive

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 supply line

Connect a mains filter in the AC input line to prevent the noise generated in the driver from propagating externally through the power supply 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	FN2070-10-06	FN251-8-07
EPCOS AG	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 mm^2 or more) parallel with the mains-filter output cable (AWG18: 0.75 mm^2 or more). Parallel placement will reduce mains-filter effectiveness if the enclosure's internal noise is directly coupled to the power supply cable by means of stray capacitance.

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- 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-4, R·C·M-601BQZ-4	
PHOENIX CONTACT GmbH & Co. KG	PT2-PE/S120AC-ST	PT2-PE/S230AC-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 supply is required for the use of the electromagnetic brake, use a DC power supply 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 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 motor (other than IP65 rated motor)

When grounding the motor, use an external Protective Earth Terminal or connect the motor to a grounded metal plate. Refer to page 32 for the way to ground the motor.

How to ground an IP65 rated motor

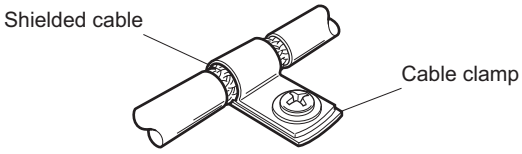
Connect the Protective Earth Terminal of the motor to the ground.
Refer to page 32 for the way to ground the IP65 rated motor.

How to ground the driver

Be sure to connect the Protective Earth Terminal located on the driver side to the ground.
Refer to page 32 for the way to ground the driver.

- Wiring the signal cable

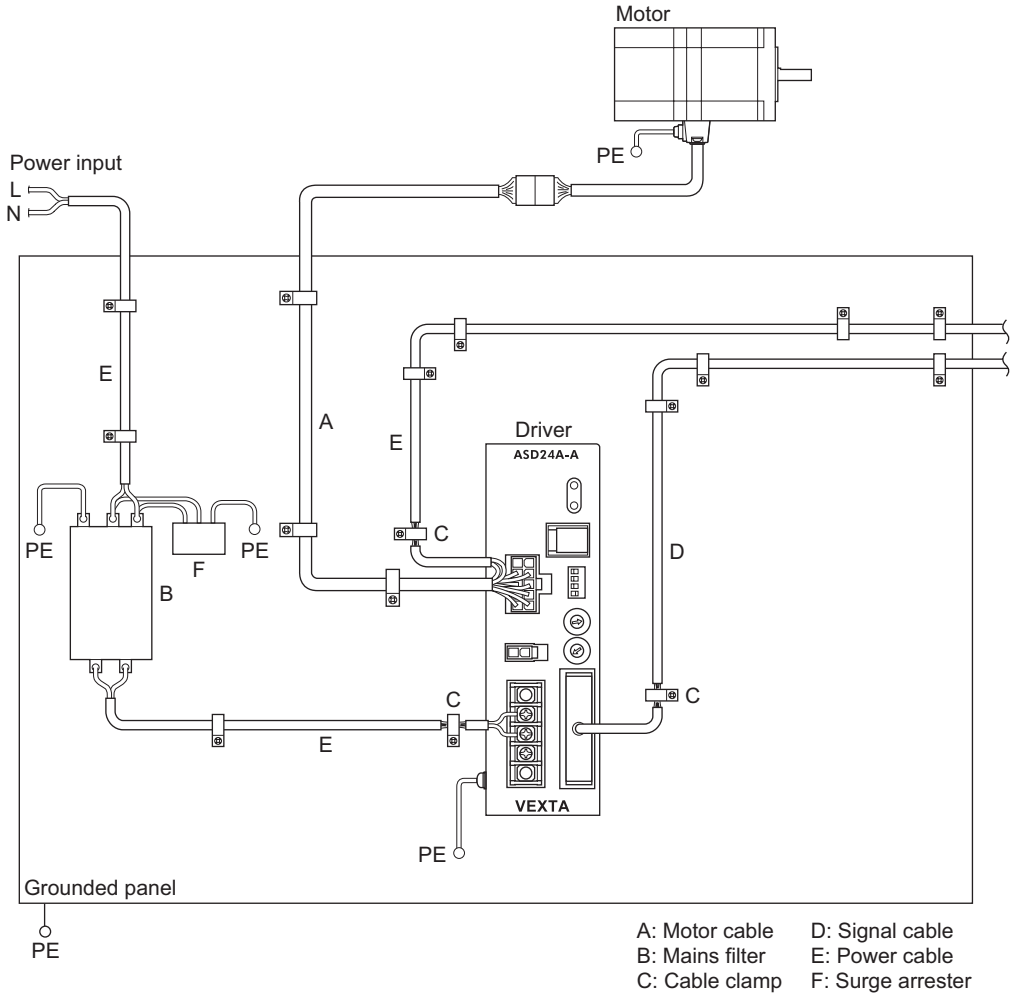
Use a shielded cable of AWG24 (0.2 mm^2) or more for the driver signal cable, and keep it as short as possible. Contact the nearest sales office for a shielded cable (sold separately).
To ground a shielded cable, use a metal clamp or similar device that will maintain contact with the entire circumference of the shielded cable. Attach a cable clamp as close to the end of the cable as possible, and connect it 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.

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- Example of motor and driver installation and wiring



■ 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.

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6 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.

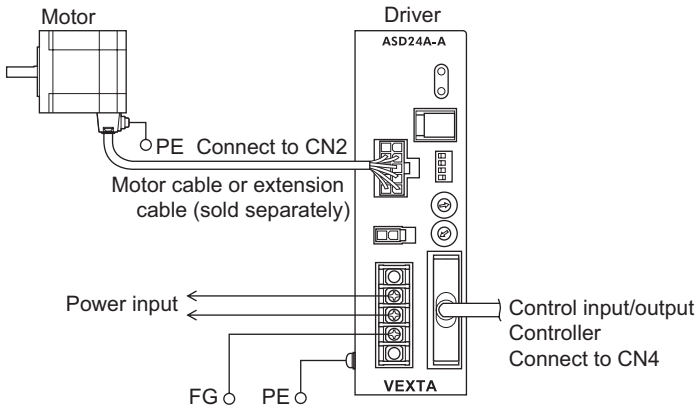
6.1 Connecting the motor (other than IP65 rated motor)

Plug the connector of the motor cable or the extension cable into the driver's motor connector (CN2). Use an optional extension cable (sold separately) to extend the distance between the motor and driver. Refer to 12 "Options (sold separately)" on page 50 for the extension cable.

Note

- Have the connector plugged in securely. Insecure connector connection may cause malfunction or damage to the motor or driver.
- To disconnect the plug, pull the plug while using the fingers to press the latches on the plug.
- When installing the motor to a moving part, use an optional flexible extension cable offering excellent flexibility (sold separately).
  Refer to 12 "Options (sold separately)" on page 50 for the flexible extension cable.
- Be certain the control input/output cable that connects the driver and controller is as short as possible. The maximum input frequency will decrease as the cable length increases.

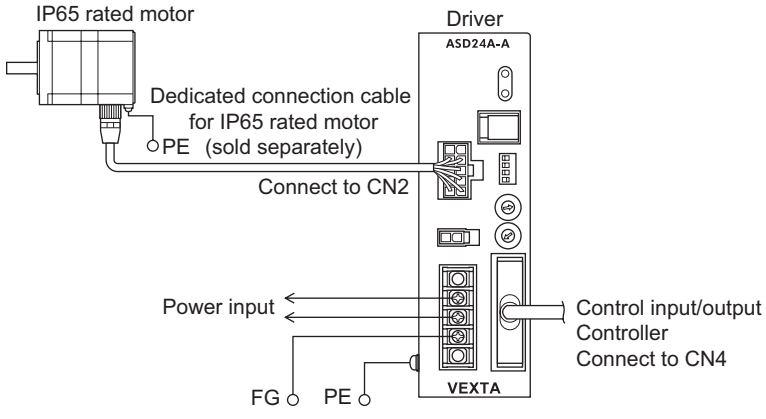
- Connection example



6.2 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.

- Connection example



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6.3 Connecting an electromagnetic brake motor

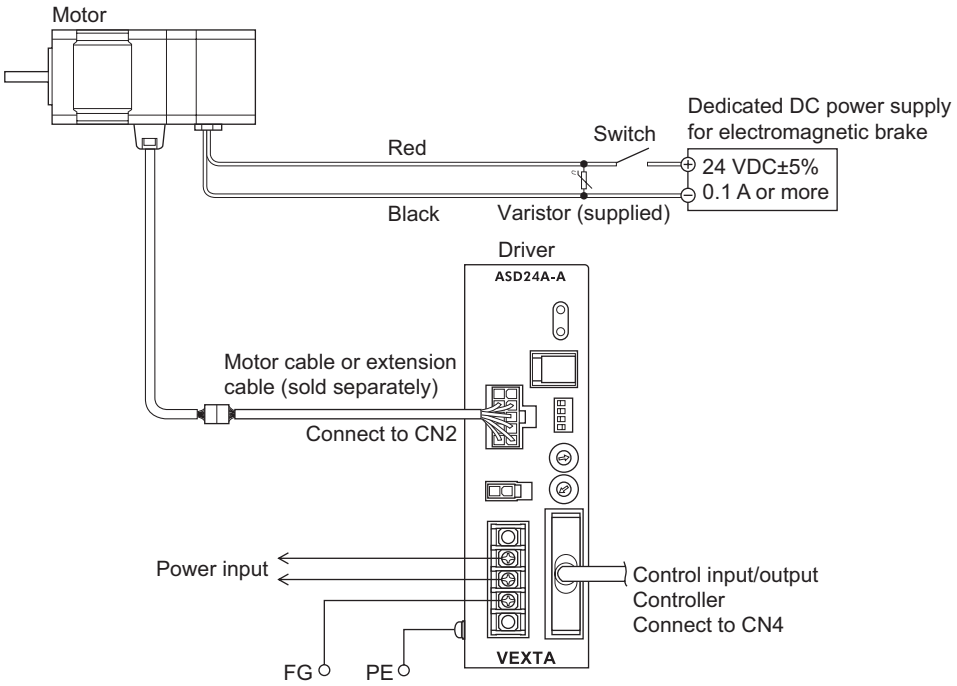
Provide a dedicated DC power supply of 24 VDC ± 5% and 0.3 A or more (**AS46**: 0.1 A or more) for the electromagnetic brake. Use a shielded cable of AWG24 (0.2 mm^2) or more to connect the electromagnetic brake to the DC power supply, keeping the length as short as possible.

■ 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.

- Connection example



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.
- Provide separate power supplies for the control input/output and the electromagnetic brake.

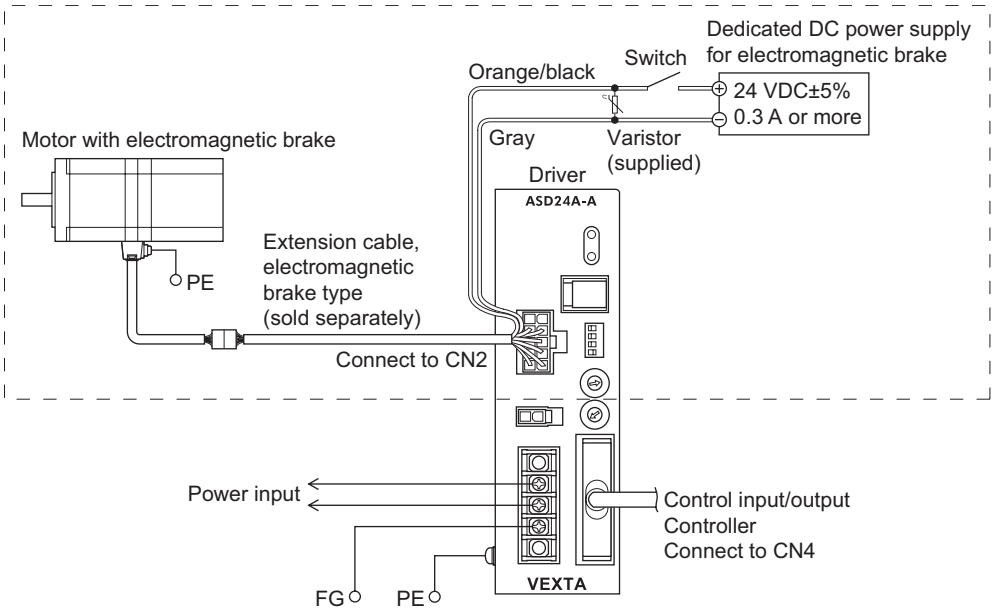
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■ AS66, AS69, AS98

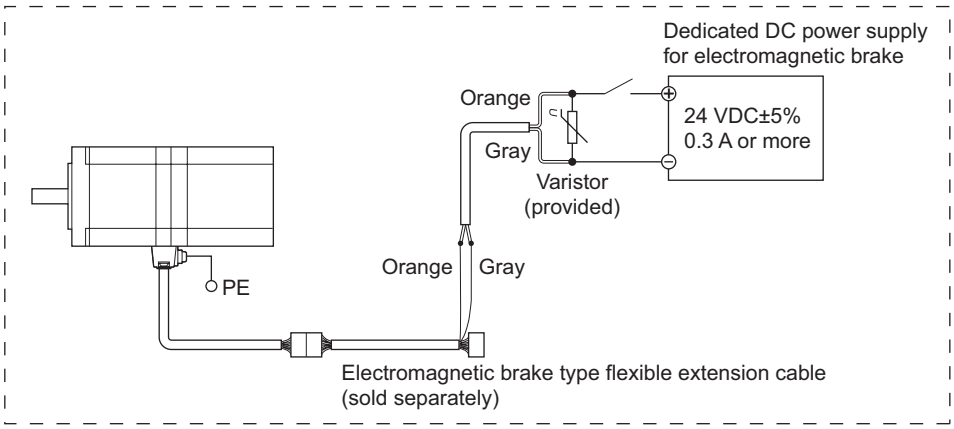
Use two (orange/black and gray) lead wires [60 mm (2.36 in.)] from the driver's connector side.

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.

- Connection example



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



Note

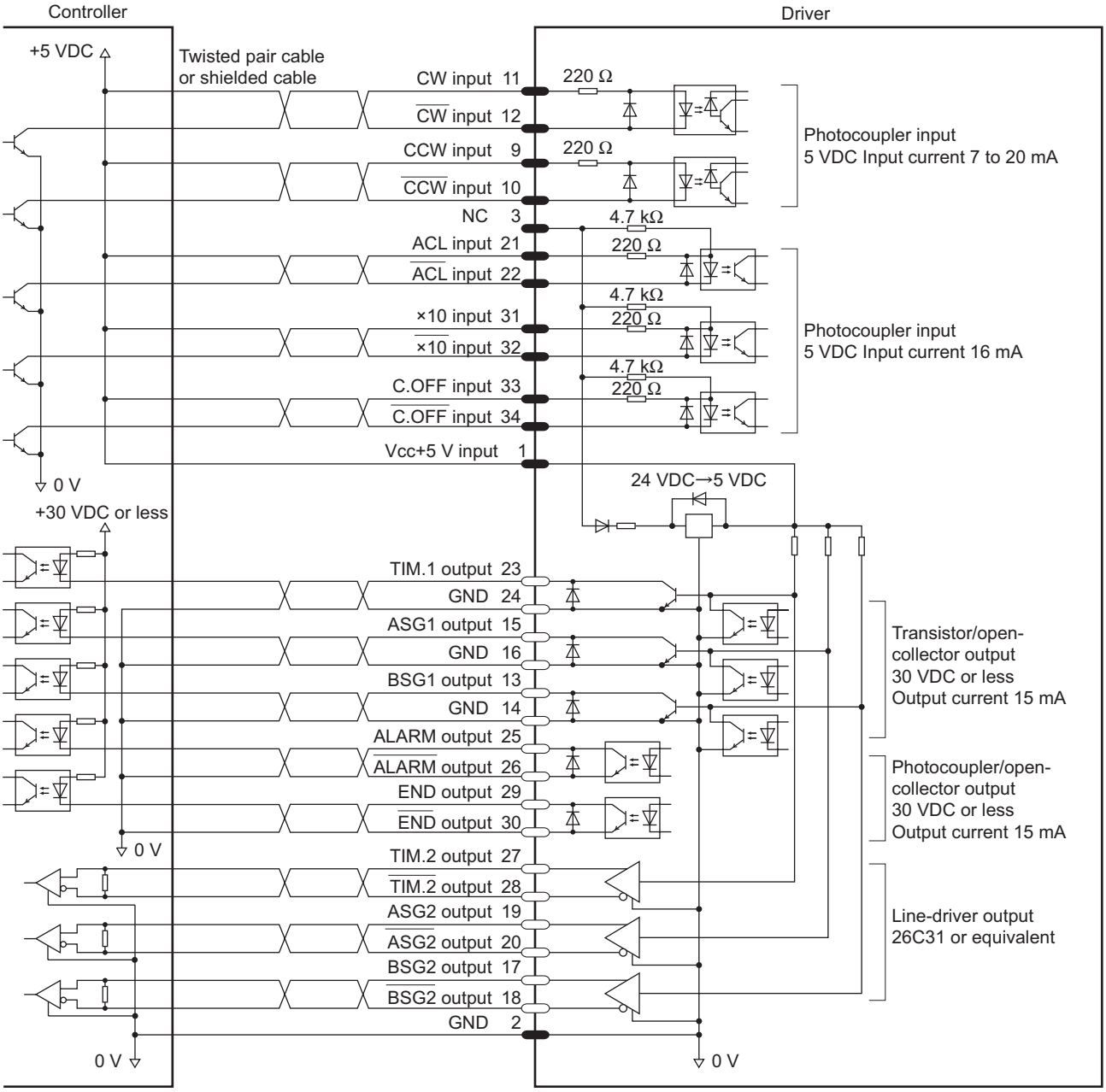
- Extension cables are available in two types: the standard type and the electromagnetic brake type. When using an electromagnetic brake motor, always use an optional extension cable of the electromagnetic brake type (sold separately) for connection. The electromagnetic brake will not function if the motor cable is connected directly to the driver.
- Provide separate power supplies for the control input/output and the electromagnetic brake.

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6.4 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.

■ 5 VDC (Connecting to a current sink output circuit)

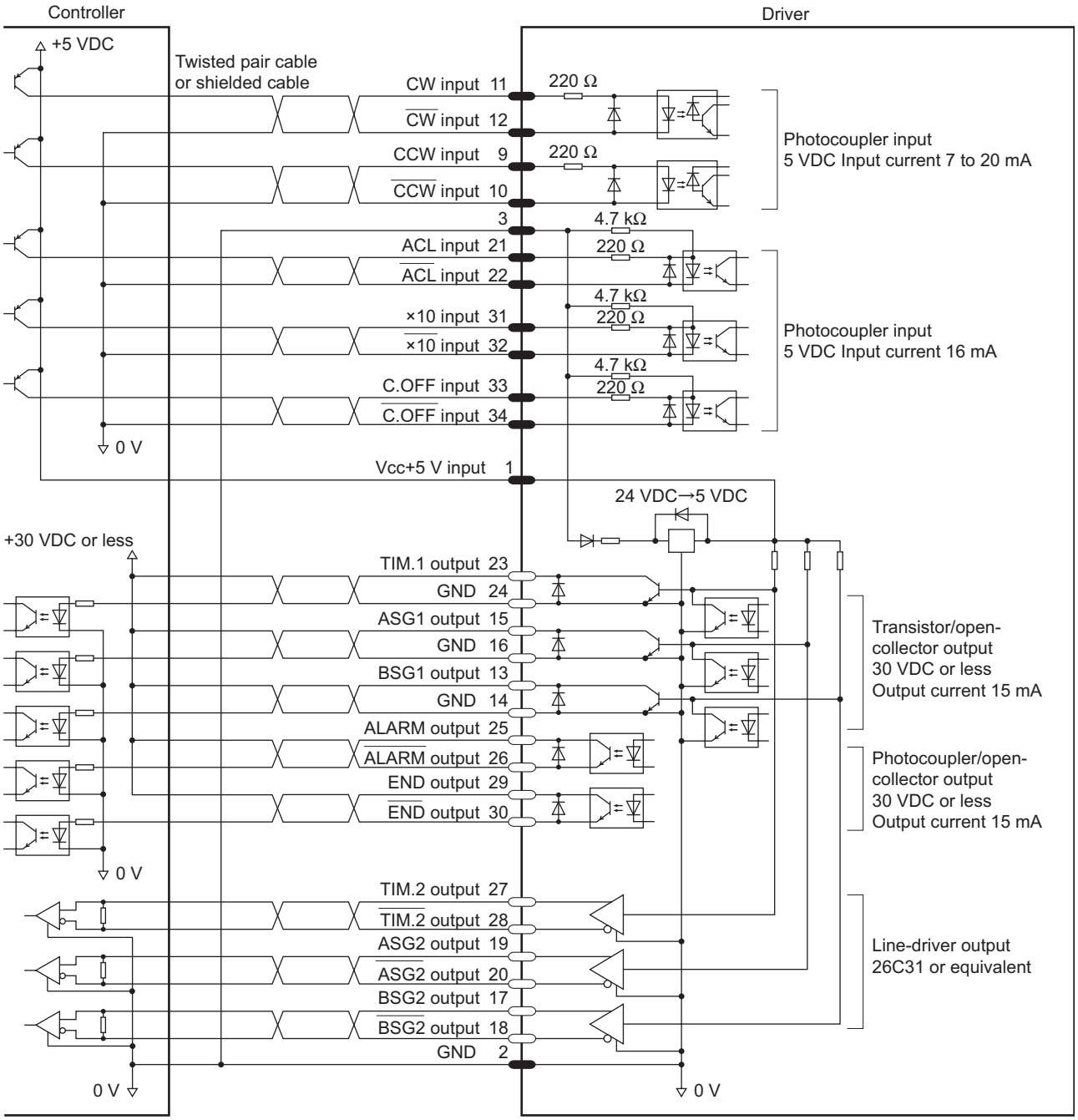


Note

- The same voltage must be set for the following two voltages. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.
  ・Voltage for ACL input, ×10 input and C. OFF input (Pin Nos. 21, 22, 31, 32, 33 and 34)
  ・Voltage for TIM.1/TIM.2 outputs, ASG1/ASG2 outputs and BSG1/BSG2 outputs (Pin Nos. 1 and 2)
- Use output signals with a power supply not exceeding 30 VDC and 15 mA. If these specifications are exceeded, the internal elements may be damaged. Check the specification of the connected equipment.
- Connect a terminal resistor of 100 Ω or more between the driver and the input of the line receiver.

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■ 5 VDC (Connecting to a current source output circuit)

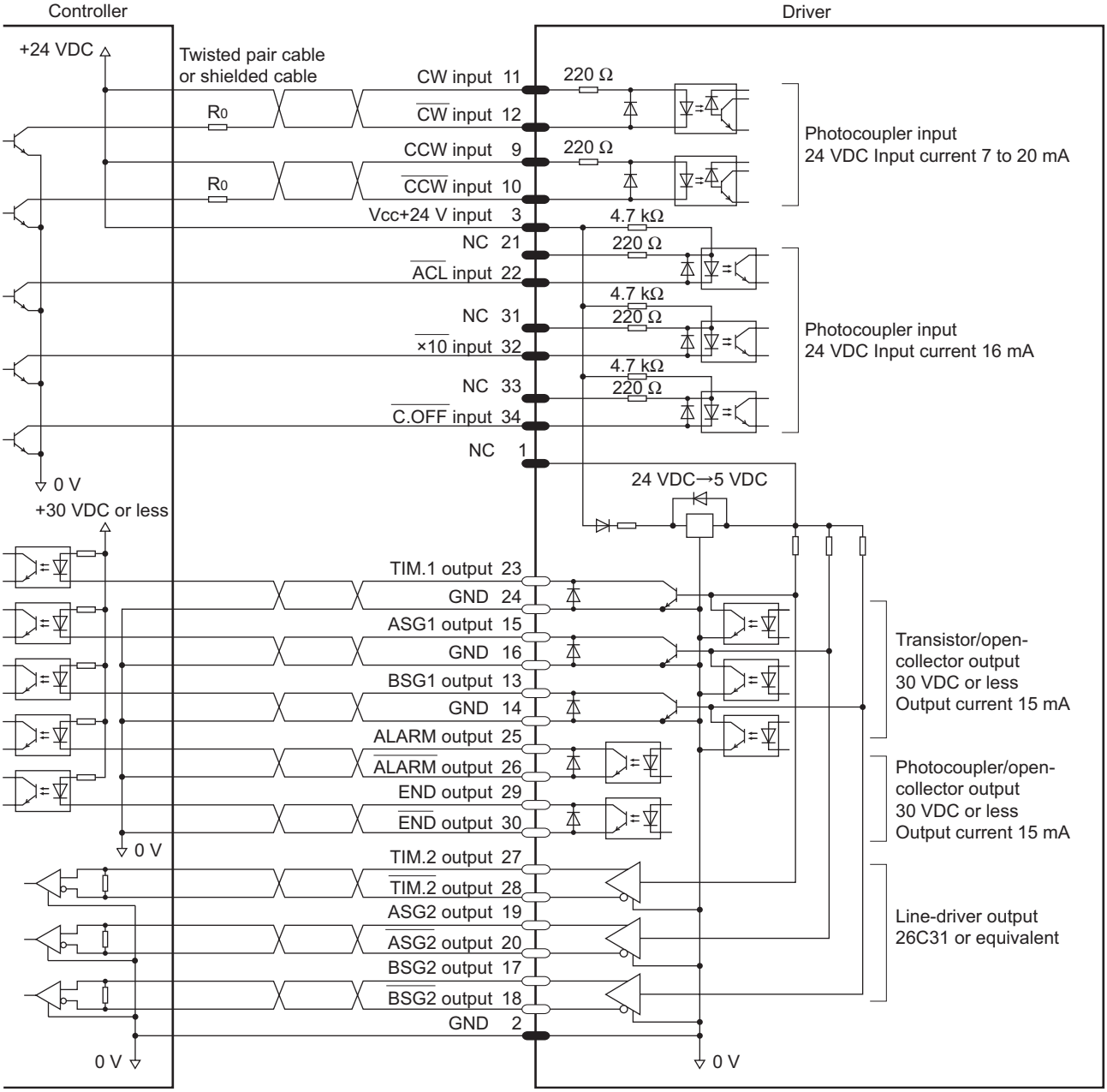


Note

- The same voltage must be set for the following two voltages. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.
  - ・Voltage for ACL input, ×10 input and C. OFF input (Pin Nos. 21, 22, 31, 32, 33 and 34)
  - ・Voltage for TIM.1/TIM.2 outputs, ASG1/ASG2 outputs and BSG1/BSG2 outputs (Pin Nos. 1 and 2)
- Use output signals with a power supply not exceeding 30 VDC and 15 mA. If these specifications are exceeded, the internal elements may be damaged. Check the specification of the connected equipment.
- Connect a terminal resistor of 100 Ω or more between the driver and the input of the line receiver.

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■ 24 VDC



Note

- The CW and CCW inputs are of the 5 VDC input specification. If the voltage to be applied is above 5 VDC, be sure to connect an external resistor to prevent the current from exceeding 20 mA. Applying a voltage above 5 VDC without using an external resistor will damage the elements.
  Example) When V_0 is 24 VDC R_0: 1.5 to 2.2 kΩ, 0.5 W or more.
- Use output signals with a power supply not exceeding 30 VDC and 15 mA. If these specifications are exceeded, the internal elements may be damaged. Check the specification of the connected equipment.
- Connect a terminal resistor of 100 Ω or more between the driver and the input of the line receiver.

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6.5 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.

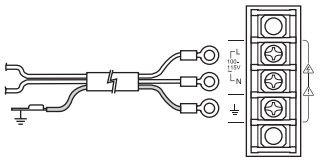
Note

- 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.

■ 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 ⏚ terminal to the grounding point of the power supply.
Use a power supply capable of supplying the current capacity as shown below.

Single-phase
100-115 V
50/60 Hz
Single-phase
200-230 V
50/60 Hz



Single-phase 100-115 V

Unit model	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

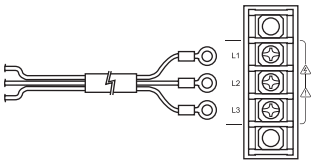
Unit model	Current capacity
AS66□□	3 A or more
AS69□□	3.9 A or more
AS98□□	3.5 A or more
AS911□□	4.5 A or more

∗ 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.

Three-phase
200-230 V
50/60 Hz



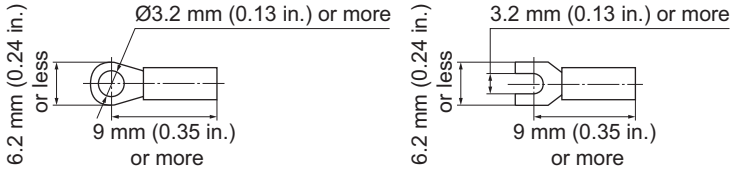
Unit model	Current capacity
AS66□□	1.5 A or more
AS69□□	2.2 A or more
AS98□□	1.9 A or more
AS911□□	2.4 A or more

∗ 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 applicable lead wire size for power connection

- Screw size: M3
- Tightening torque: 0.8 N·m (113 oz-in)
- Applicable minimum lead wire size: AWG18 (0.75 mm^2)

■ Applicable insulated crimp terminals



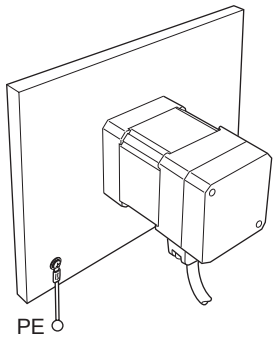
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6.6 Grounding the motor and driver

■ Grounding the motor (other than IP65 rated motor)

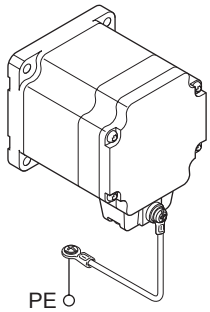
- **AS46**

  Install the motor to the grounded metal plate.
  Use a grounding wire of AWG18 (0.75 mm^2) or more.
  Use a round, terminal in combination with an inner-clip washer and bolt it in place to secure the grounding connection.



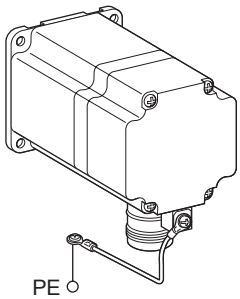
- **AS66**, **AS69**, **AS98**, **AS911**

  Be sure to ground the Protective Earth Terminal (screw size: M4).
  Tightening torque: 1.2 N·m (170 oz-in)
  Use a grounding wire of AWG18 (0.75 mm^2) or more.



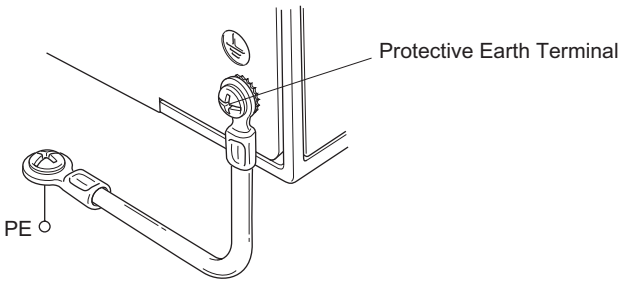
■ Grounding an IP65 rated motor

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.
Tightening torque: 1.2 N·m (170 oz-in)
Use a grounding wire of AWG18 (0.75 mm^2) or more.



■ Grounding the driver

Be sure to ground the Protective Earth Terminal (screw size: M4) located on the driver side.
Tightening torque: 0.5 to 0.6 N·m (71 to 85 oz-in)
Use a grounding wire of AWG18 (0.75 mm^2) or more.
Do not share the grounding cable with a welder or power equipment.
Use a round terminal to ground the cable near the driver.

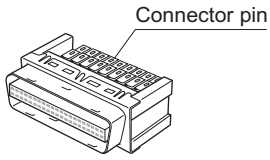


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6.7 Connecting control input/output

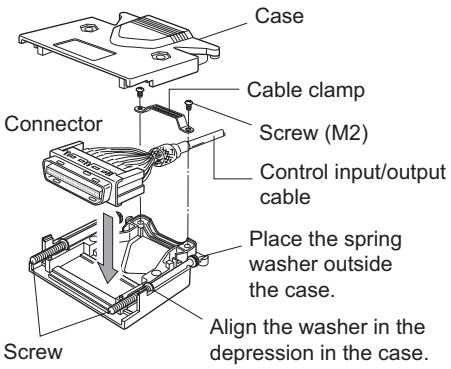
■ Assembling the control input/output connector

Solder the control input/output cable (AWG28: 0.08 mm^2 or more) to the connector (36 pins). Assemble the connector and cover with the supplied screws. Use a shielded cable.
For the pin assignments, refer to page 34.
We provide optional driver cable allowing one-touch connection with a driver, as well as connector-terminal block conversion unit. Refer to page 50 for details.

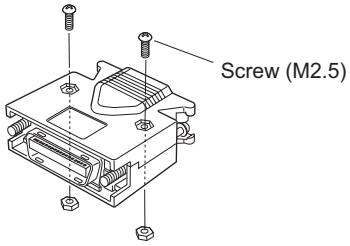


- Assembling the connector and the case

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

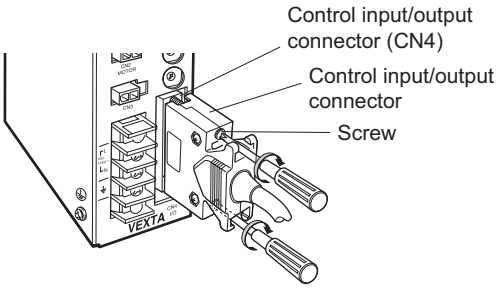


2. Attach the other case and clamp both connector cases together with screws and nuts.
   Tightening torque: 0.5 to 0.55 N·m (71 to 78 oz-in)



■ Connecting control input/output connector

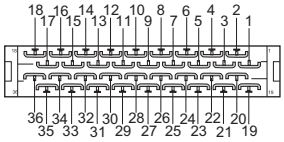
Insert the control input/output connector into the control input/output connector CN4 on the driver side, and tighten the screw with a flat tip screwdriver.
Tightening torque: 0.3 to 0.35 N·m (42 to 49 oz-in)



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■ Connector pin functions

Connector pin assignments
(Viewed from the soldering side)



Pin No.	Signal	Description		Direction
1	Vcc+5 V	5 VDC	External power supply	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 Open-collector		Output
14	GND			
15	ASG1	A-phase pulse output Open-collector		Output
16	GND			
17	BSG2	B-phase pulse output Line driver		Output
18	$\overline{\text{BSG2}}$			
19	ASG2	A-phase pulse output Line driver		Output
20	$\overline{\text{ASG2}}$			
21	ACL	Alarm clear		Input
22	$\overline{\text{ACL}}$			
23	TIM.1	Timing Open-collector		Output
24	GND			
25	ALARM	Alarm		Output
26	$\overline{\text{ALARM}}$			
27	TIM.2	Timing Line driver		Output
28	$\overline{\text{TIM.2}}$			
29	END	Positioning complete		Output
30	$\overline{\text{END}}$			
31	×10	Resolution select		Input
32	$\overline{\text{×10}}$			
33	C.OFF	All Windings Off		Input
34	$\overline{\text{C.OFF}}$			
35	—	Not used		—
36	—	Not used		—

Note

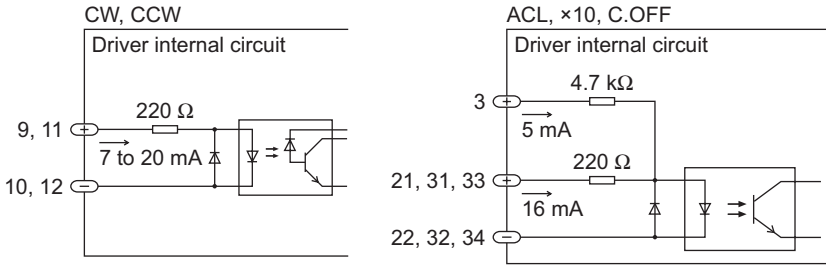
- The functions shown in parentheses are enabled when “1P: 1-Pulse Input Mode” is selected through the pulse-input mode select switch.
- The same voltage must be set for the following two voltages. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.
  ・Voltage for ACL input, ×10 input and C. OFF input (Pin Nos. 21, 22, 31, 32, 33 and 34)
  ・Voltage for TIM.1/TIM.2 outputs, ASG1/ASG2 outputs and BSG1/BSG2 outputs (Pin Nos. 1 and 2)

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6.8 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.



Note The same voltage must be set for the following two voltages. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.
・Voltage for ACL input, ×10 input and C. OFF input (Pin Nos. 21, 22, 31, 32, 33 and 34)
・Voltage for TIM.1/TIM.2 outputs, ASG1/ASG2 outputs and BSG1/BSG2 outputs (Pin Nos. 1 and 2)

- CW input and CCW input

With this driver either 2-pulse input mode or 1-pulse input mode may be selected in accordance with the controller used. Refer to page 43 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” on page 40.

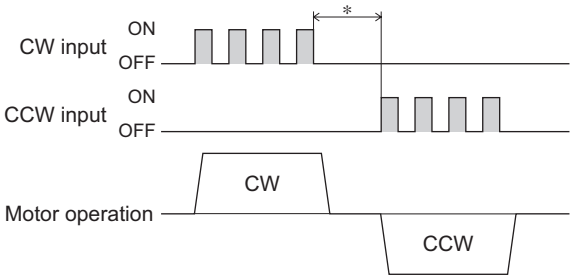
Note
- The factory setting of the pulse-input mode depends on the destination country. Check the pulse-input mode setting in accordance with the pulse mode in the controller used.
- If no pulse is to be input, be sure to keep the photocoupler in “OFF” state. Do not input a CW pulse and CCW pulse simultaneously. 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.

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2-pulse input mode

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

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



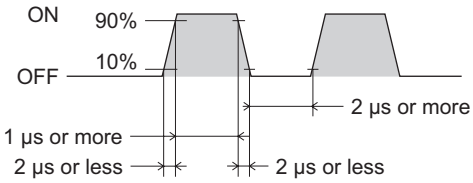
∗ The minimum interval time needed for switching the direction of rotation will vary, depending on the operating speed and size of the load. Do not shorten the interval time any more than is necessary.

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

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

R: External resistor
V: Pulse voltage

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



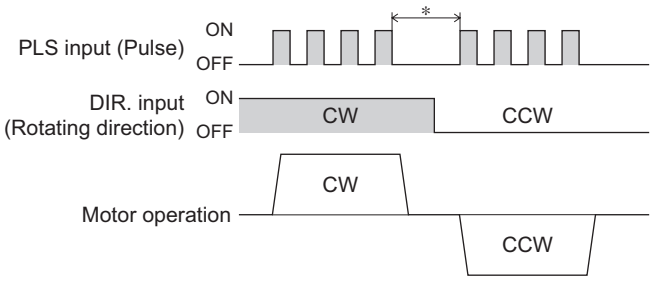
ON: 4 to 5 V
OFF: 0 to 0.5 V

The figure shows the voltage levels of pulse signals.

1-pulse input mode

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

- When the DIR. input is "ON," a rise of the "PLS input" from "OFF" to "ON" will rotate the motor one step in the CW direction.
- 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 minimum interval time needed for switching the direction of rotation will vary, depending on the operating speed and size of the load. Do not shorten the interval time any more than is necessary.

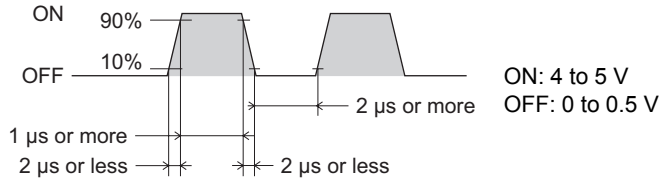
The voltage of pulse and rotation direction input to the PLS input and DIR. input shall be 5 VDC.
If the voltage exceeds 5 VDC, connect an external resistor to limit the input current to nearly 10 mA.

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

R: external resistor
V: Pulse voltage

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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.

- C.OFF (All windings off) input

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

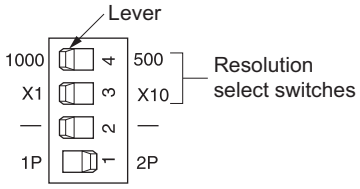
Note
- Normally, keep the C.OFF input in the "OFF" state or leave it disconnected.
- Turning the C.OFF input to "ON" resets the deviation counter in the driver.

- 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.
- 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.

- ×10 (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 select switches.
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 42 for the selection of the resolution select switches.

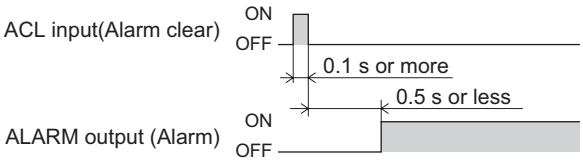
Note Be sure to set the resolution select switch to "×1" when "×10 input" is used. If the switch is set to "×10," the resolution will remain at 10 times, regardless of the "ON" or "OFF" resolution select input.



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

- 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 38 and 8 "Protective functions" on page 45.
Setting the ACL input is turned from ON to OFF state clears the ALARM output.
To cancel the ALARM output, be sure to remove the cause of the problem that has triggered the protective function before turning the power back on.

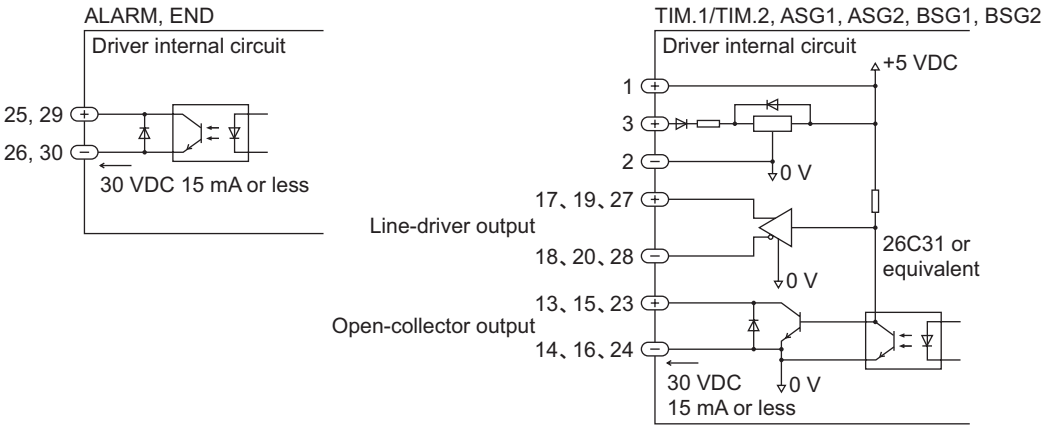


Note
- Turning the power back on will clear the ALARM output. To cancel the ALARM output, be sure to remove the cause of the problem that has triggered the protective function before turning the power back on. After the power has been shut off, wait at least 10 seconds before turning the power back on.
- The overcurrent protection, EEPROM data error and system error cannot be cleared using the ACL input. Clear these errors by cycling the power. If the problem persists, please contact the nearest office.

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■ Output signals

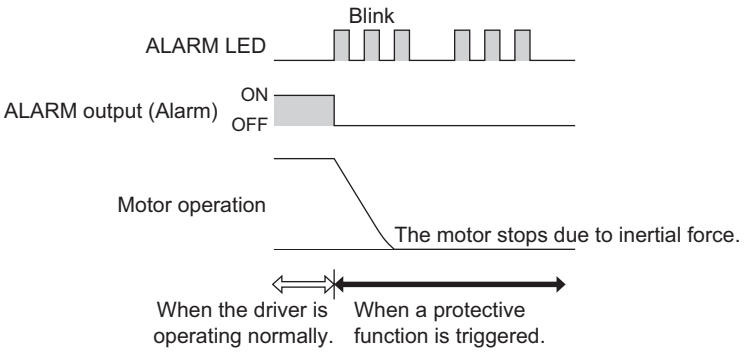
Driver output signals are photocoupler/open-collector output, transistor open-collector output for the TIM.1, ASG1 and BSG1 outputs, and line-driver output for the TIM.2, ASG2 and BSG2 outputs.
The signal state represents the "ON: Carrying current" or "OFF: Not carrying current" state of the internal photocoupler rather than the voltage level of the signal.



Note The same voltage must be set for the following two voltages. Connecting both 5 and 24 VDC power supplies may damage the driver and power supplies.
・Voltage for ACL input, ×10 input and C. OFF input (Pin Nos. 21, 22, 31, 32, 33 and 34)
・Voltage for TIM.1/TIM.2 outputs, ASG1/ASG2 outputs and BSG1/BSG2 outputs (Pin Nos. 1 and 2)

- ALARM output

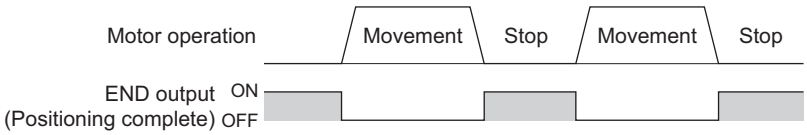
ALARM output remains "ON" when the driver is operating normally, then turns "OFF" when a protective function is triggered.
Detect this ALARM output on the controller side and cancel the command to operate the motor thereafter.
Error detection by the driver, such as overload and overcurrent during motor 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 8 "Protective functions" on page 45.



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- END (Positioning complete) output

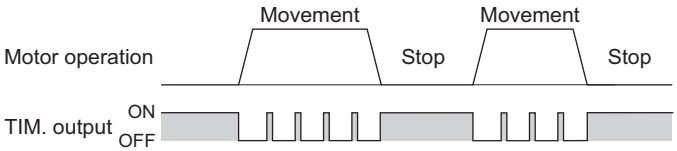
END output turns “ON” when motor movement is complete.
Conditions for the issuance of END output are as follows: END output is issued when the pulse speed is 500 Hz or less, and the rotor has positioned within ±1.8° of the commanded position.



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

- TIM. (Timing) output

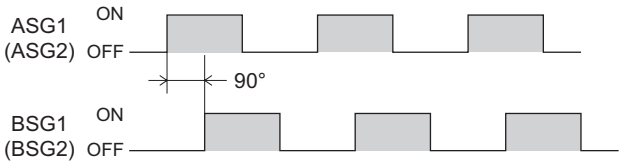
TIM. output are available in two types: transistor open-collector output and line-driver output. Use either one to suit the input system of the positioning controller.
The use of TIM. output requires separate 5 or 24 VDC power supply.
TIM. output turns “ON” whenever the motor’s output shaft rotates 7.2°.



Note If TIM. output is to be detected, set the pulse speed at 500 Hz or less. Use the ×10 input to switch the resolution only when TIM. 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°.

- 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 supply.
The output-pulse resolution will be the same as the motor resolution at the time power is supplied to the driver.
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.

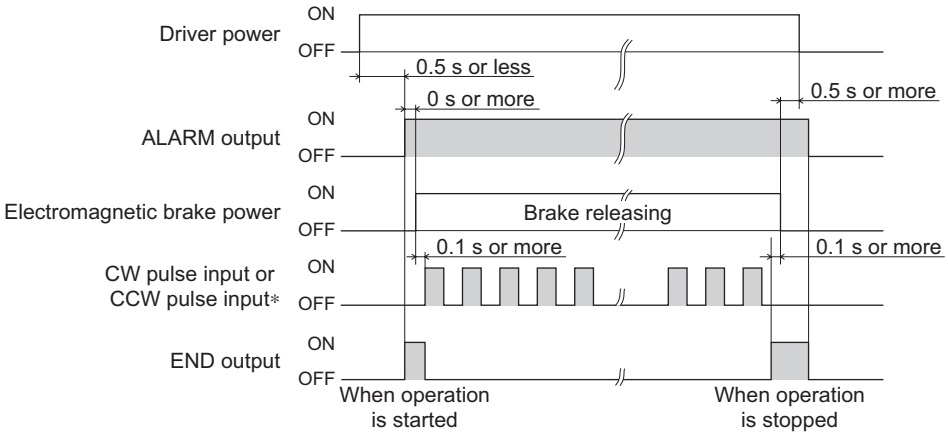
Note The pulse-output delays behind motor rotation by up to 1 ms. The output may be used to verify the motor’s stop position.

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■ 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 input is enabled when 2-pulse input mode is selected

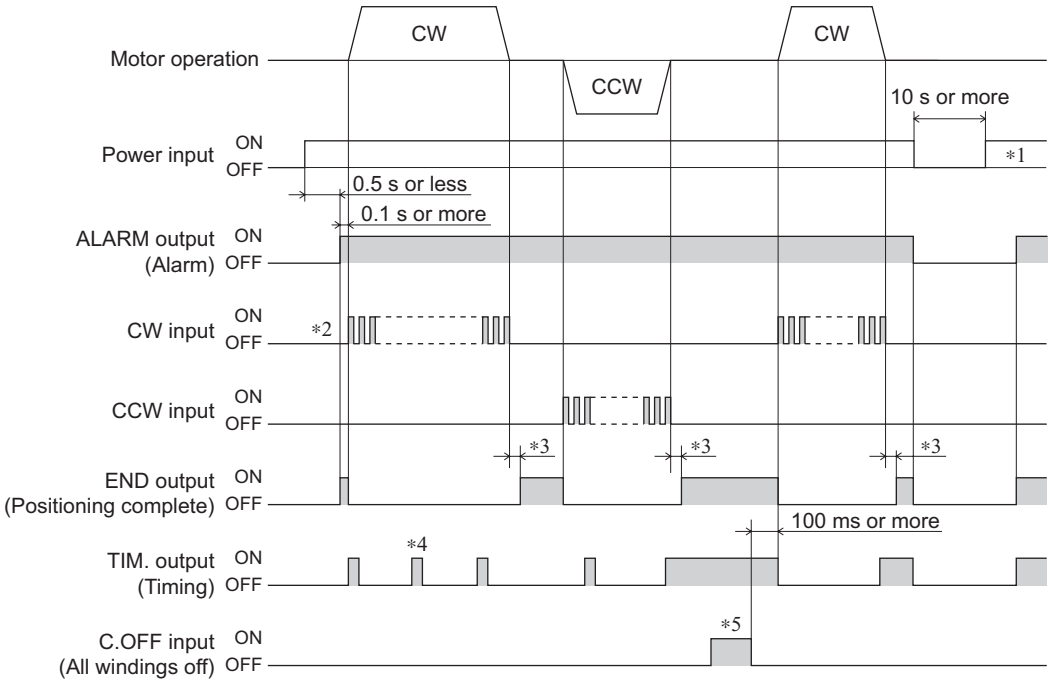
Note To hold the load in position, apply the electromagnetic brake only after the motor has stopped. Do not use the brake to bring the moving motor to a halt. Repeated braking for such a purpose will wear the brake hub excessively, causing a decrease in its ability to hold.

- 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.

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6.9 Timing chart



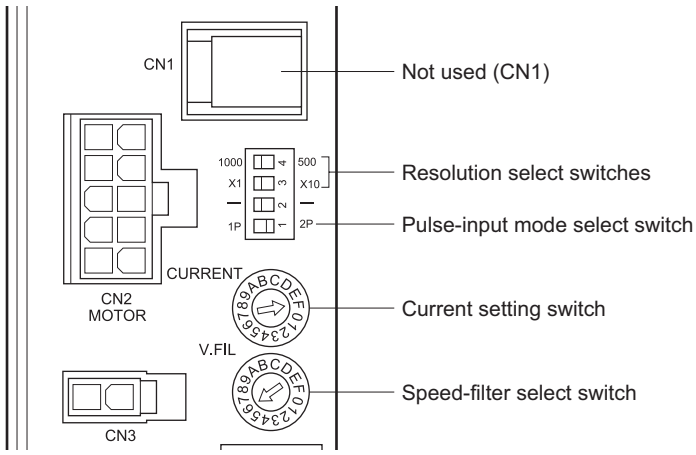
∗1 After the power has been shut off, wait at least 10 seconds before turning the power back on.
∗2 To input the CW or CCW signal pulse, wait at least 0.1 second after clearing the ALARM output.
∗3 The turning of END output to “ON” does not necessarily mean the motor has stopped. Provide enough of a 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.

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7 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.

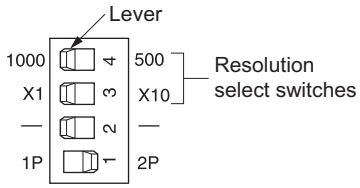


7.1 Resolution

Use the resolution select switches "1000/500" and "×1/×10" to set the motor resolution.

Factory settings

[1000]: 1000 P/R (0.36°/pulse)
[×1]: Multiplier 1



Note

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

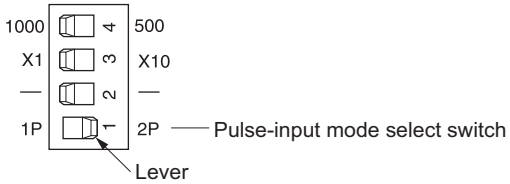
A total of four resolution levels may be selected, with ×10 input "CN4 Pin No.31, 32" used to switch between 1000 and 10000 and between 500 and 5000.
Refer to page 37 for the use of ×10 input.
Refer to the following table for details of the relationship between the setting of the resolution select switches and resolution of the geared output shaft in the geared type.

Gear ratio	Resolution			
	1000P/R	10000P/R	500P/R	5000P/R
3.6:1	0.1°/Pulse	0.01°/Pulse	0.2°/Pulse	0.02°/Pulse
5:1	0.072°/Pulse	0.0072°/Pulse	0.144°/Pulse	0.0144°/Pulse
7.2:1	0.05°/Pulse	0.005°/Pulse	0.1°/Pulse	0.01°/Pulse
10:1	0.036°/Pulse	0.0036°/Pulse	0.072°/Pulse	0.0072°/Pulse
20:1	0.018°/Pulse	0.0018°/Pulse	0.036°/Pulse	0.0036°/Pulse
25:1	0.0144°/Pulse	0.00144°/Pulse	0.0288°/Pulse	0.00288°/Pulse
30:1	0.012°/Pulse	0.0012°/Pulse	0.024°/Pulse	0.0024°/Pulse
36:1	0.01°/Pulse	0.001°/Pulse	0.02°/Pulse	0.002°/Pulse
50:1	0.0072°/Pulse	0.00072°/Pulse	0.0144°/Pulse	0.00144°/Pulse
100:1	0.0036°/Pulse	0.00036°/Pulse	0.0072°/Pulse	0.00072°/Pulse

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7.2 Pulse input modes

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



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 select switch. The new pulse mode takes effect when the power is turned on again.

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 select switch to “2P.”



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

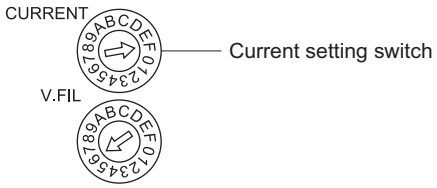


7.3 Operating current

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



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.

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

Dial setting	Operating current rate (%)
8	56
9	63
A	69
B	75
C	81
D	88
E	94
F	100

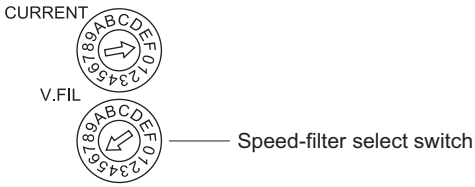
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7.4 Speed filter

Use the speed-filter select 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” to “F.” When a larger value is selected, it will reduce shock when the motor is started and stopped, and will minimize low-speed vibration.
The greater the filter time constant, the smoother the motor movement becomes. However, command synchronicity will decrease. Select an optimal value to fit the load and application.

Factory setting

[6]: 1.20 ms

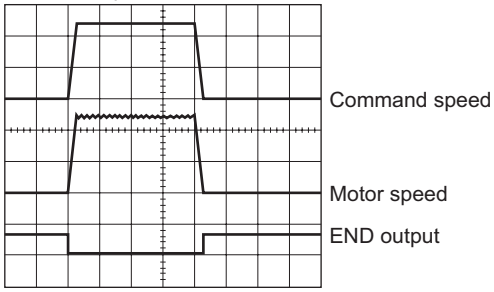


The dial settings and corresponding levels of filter time constants are as follows:

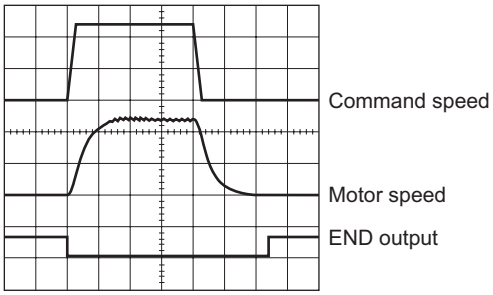
Dial setting	Filter time (ms)
0	None
1	0.12
2	0.16
3	0.27
4	0.41
5	0.82
6	1.20
7	1.60

Dial setting	Filter time (ms)
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 select switch is set to "0"



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



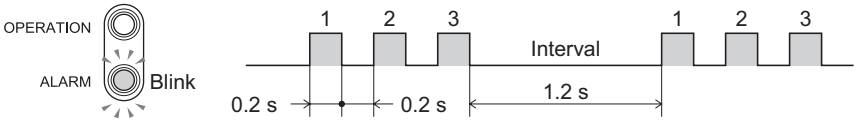
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8 Protective functions

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

8.1 Descriptions of protective functions and numbers of LED blinks

The driver is provided with functions that protect the driver from ambient temperature increases, improper power-supply 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 38.



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	Function	Conditions
1	Overheat protection	When the temperature of the heat sink inside the driver has reached approx. 85 C° (185 °F).
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 voltage on the primary side of the driver inverter has exceeded the 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.
ALARM LED turns on.	System error	When the driver is out of order.

8.2 How to clear a protective function

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

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

Note

- To clear the ALARM output, be sure to remove the cause of the problem that has triggered the protective function before either giving a one-shot ACL input or turning the power back on. After turning off the power, wait at least 10 seconds before turning the power back on.
- The overcurrent protection, EEPROM data error and system error cannot be cleared using the ACL input. Clear these errors by cycling the power. If the problem persists, please contact the nearest office.

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9 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?

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

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10 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.	• Check the connections of the controller and driver. • Review the specifications (voltage and width) for the input pulse.
	In 2-pulse input mode, the CW and CCW pulse inputs are both “ON” at the same time.	Input the pulse signal either to the CW or CCW input. Make sure the terminal with no input is set to “OFF.”
	In 1-pulse input mode, the pulse signal is connected to the DIR. input.	Connect the pulse signal to the PLS input.
	Electromagnetic brake is holding (electromagnetic brake motor only).	Release the electromagnetic brake by turning the power on.
The motor rotates in the direction opposite that which is specified.	In 2-pulse input mode, 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.
	In 1-pulse input mode, 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.	• **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.	• 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 setting 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.”

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■ 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 to 8 times (0.2 second on and 0.2 second off) and repeating the same number after 1.2 second each; and the continuous blinking mode.

Number of ALARM LED blinks	Type of alarm and possible cause	Remedial action
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.	• Check power supply connections. • Reduce load in a vertical-travel application.
4	Speed error protection. Overloading or incorrect speed filter setting.	Reduce load or slightly increase the speed-filter setting.
5	Overcurrent protection. Short-circuited motor cable.	Shut off the driver power and check the motor cable and driver connectors. Then turn the driver power back on.
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, please contact the nearest office.
8	Sensor error. Bad motor-cable connection or open line.	Shut off the driver power and check the motor cable and driver connectors. Then turn the driver power back on.
ALARM LED turns on.	System error. The driver is out of order.	Turn on the driver power. If the error persists, please contact the nearest office.

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11 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 (other than IP65 rated motor)	IP65 rated motor	Driver
Degree of protection		ASM46: IP20 ASM66, ASM69, ASM98, ASM911: IP30	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)	
	Ambient 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)
	Ambient 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)
	Ambient 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

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12 Options (sold separately)

■ Dedicated connection cable for IP65 rated motor

Cable required for connecting an IP65 rated motor and a driver.
Without the dedicated connection cable, can not connect. Be sure to purchase this cable.

- Dedicated connection cable for IP65 rated motor

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)

- Dedicated flexible connection cable for IP65 rated motor

Highly flexible cable required to extend the distance between the motor and 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)

■ Extension cable

Required to extend the distance between the motor and driver.

- Extension cable

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)

- Extension cable for 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)

■ Flexible extension cable

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

- Flexible extension cable

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)

- Flexible extension cable for 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)

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■ DIN rail mounting plate

Plate for mounting the driver to a DIN rail [35 mm (1.38 in.)].
Model: **PADP01**

■ Driver cable

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

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

■ Connector-terminal block conversion unit

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

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