Oriental motor

HM-40023-2

αSTEP

Built-In Controller (Stored Program) Package

OPERATING MANUAL

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

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

Table of contents

1 Introduction

■ Before use

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

■ Standards and CE Marking

This product is recognized by UL and certified by CSA, and bears the CE Marking (Low Voltage Directive and EMC Directives) 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 50178	—	—

∗1 For UL standard (UL 508C), the product is recognized for the condition of Maximum Surrounding Air Temperature 40 °C (104 °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 is 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 Earth in case hands should make contact with the product. Securely ground the Protective Earth Terminals of the motor and driver.

- 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 p.21.
Be sure to conduct EMC measures with the product assembled in your equipment by referring to 5.5 "Installing and wiring in compliance with EMC Directive" on p.19.

■ Hazardous substances

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

■ Main features

The unit consists of a driver with built-in host controller function and a stepping motor (α_{STEP}).

- No misstepping

  The motor uses a built-in rotor position sensor to monitor the speed and amount of rotation during use. When the motor is about to misstep due to an overload, etc., the operating mode switches to closed loop and operation continues at the motor's maximum torque.

- Achieves low-speed, low-vibration operation

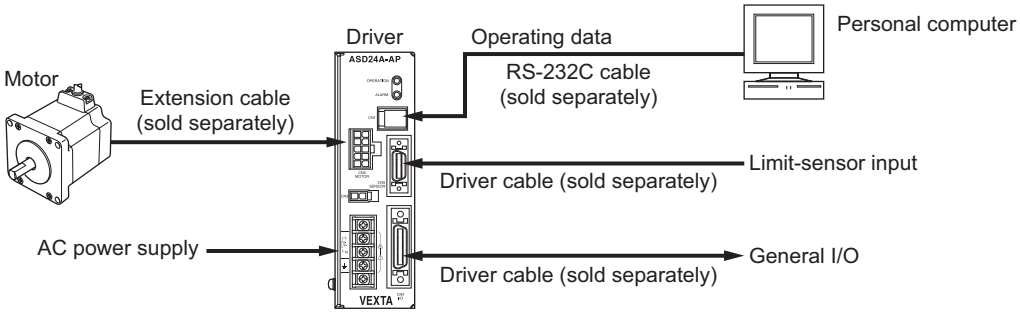
  The driver features a micro-step drive mechanism that enables operation at very small step angles. This method ensures smooth operation with minimal vibration, even at low speeds.

- A separate host controller is not necessary.

  The driver has a built-in host controller function. Therefore, positioning operation, mechanical home seeking, electrical home seeking and continuous operation can be performed without the need for a host controller. Operation data can be created or edited using a terminal program.

■ System configuration

A sample system configuration using the unit is provided below.



- The driver has a built-in host controller function, so a pulse generator or host controller is not necessary.
- Extension cables are available in two types: the standard type and the electromagnetic brake motor. If you are using a motor with an electromagnetic brake, provide a 24 VDC power supply for the electromagnetic brake and be sure to connect the motor to the driver using an optional extension cable of the electromagnetic brake motor. 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.
- Three types of input power supply 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).
- The mechanical home seeking function requires home-position detection sensors.

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.
Memo	This contains information relative to the description provided in the main text.

⚠ Warning

General

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

Installation

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

Connection

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

Operation

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

Maintenance and inspection

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

Repair, disassembly and modification

- Do not disassemble or modify the motor or driver. This may cause electric shock or injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.

⚠ Caution

General

- Do not use the motor and driver beyond their specifications, or electric shock, injury or damage to equipment may result.
- Keep your fingers and objects out of the openings in the motor and driver, or electric shock, injury or damage to equipment may result.
- Do not touch the motor or driver during operation or immediately after stopping. The surfaces are hot and may cause a burn.
- Do not carry the motor by the output shaft or motor cable. Doing so may result in injury.

Installation

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

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- 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.
- If the output shaft must be moved by hand while the motor is at a standstill, first turn off the motor’s power in order to cut off the motor current. Failure to do so may result in injury.
- The motor’s surface temperature may exceed 70 °C (158 °C), even under normal operating conditions. If a motor is accessible during operation, post a warning label shown in the figure in a conspicuous position to prevent the risk of burns.


Warning label

- For the 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.

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.

3 Precautions for use

This section covers limitations and requirements the user should consider when using this product.

■ 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.

■ Overhung load · thrust load

Always operate the motor within the allowable range of overhung load and thrust load.
Continuing to operate the motor under an overhung load and thrust load exceeding the allowable value may damage the motor's bearing (ball bearing).

Memo See p.16 for details on the permissible overhung load.

■ Surface temperature of the motor case

Be certain the motor case's surface temperature doesn't exceed 100 °C (212 °F) during use.
Although the driver has a protective function for overheating, the motor doesn't have such a function.
If the surface temperature of the motor case exceeds 100 °C (212 °F) due to a change in operating conditions (ambient temperature, operating speed, operating duty, etc.), the motor's bearing (ball bearing) may deteriorate.
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.

■ Leakage current measure

Stray capacitance exists between the driver's power lines and other power lines, ground or motors.
If high-frequency leakage current flows via this stray capacitance, the breaker switch may be tripped and the power supply will stop. Factors that influence leakage current include the driver's switching frequency and the length of wiring between the driver and motor.
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

■ Motor with electromagnetic brake

Take note of the following when using a motor with an electromagnetic brake:

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 motor 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.

- If the driver's protective function is activated, the motor will stop and lose its holding brake force. The electromagnetic brake has no direct correlation to motor operation, so a sequence must be provided via the customer's host controller with which to turn ON/OFF the power to the electromagnetic brake and thereby hold the motor's output shaft. The electromagnetic brake is of the power-off type. Set it so that the power to the electromagnetic brake will be turned OFF (the electromagnetic brake will produce holding force) whenever an electromagnetic brake control (MBC) output or alarm code (AL0, AL1 and AL2) output is detected.
- In the case of a momentary power failure, the load position maybe retained with the use of an electromagnetic brake. However, the motor must be stopped before activating the electromagnetic brake. Since the electromagnetic brake is of the power-off type, its mechanism should not be relied on to hold the load.
- Do not use the electromagnetic brake to decelerate/stop the motor, or attempt to use it as a safety brake.

■ Preventing electrical noise

See 5.5 "Installing and wiring in compliance with EMC Directive" on p.21 for measures with regard to 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.

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

4 Preparation

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

4.1 Checking the product

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

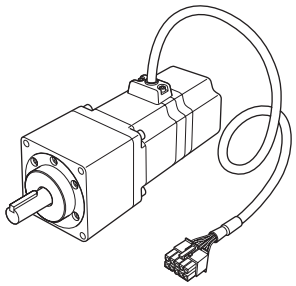
Report any missing or damaged items to the branch or sales office from which you purchased the product.

■ αSTEP Built-in controller (stored program) package

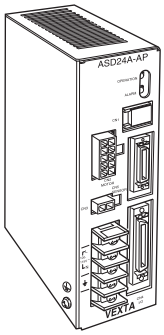
Verify the model number of the purchased unit against the number shown on the package label.

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

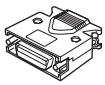
For the unit models and corresponding motor/driver combinations, see 4.3 “Combinations of motors and drivers” on p.10.



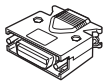
• Motor 1 Unit *



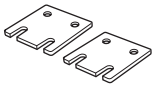
• Driver 1 Unit



• General I/O connector (36 pins) 1 set



• Sensor connector (20 pins) 1 set



• Driver mounting brackets 2 pcs.

• Varistor 1 pc.
Varistor supplied with the motor with an electromagnetic brake

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

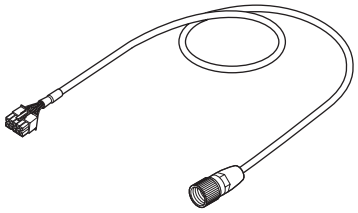
• Operating manual (this manual) 1 copy

* A parallel key (one pc.) is supplied with all geared-type motors (excluding the **AS66TH** geared type).

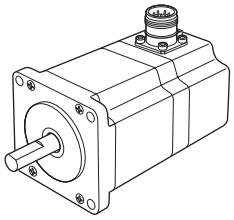
■ Dedicated connection cable (sold separately) is needed for IP65 rated motor.

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 11 “Options (Sold separately)” on p.115 for details.

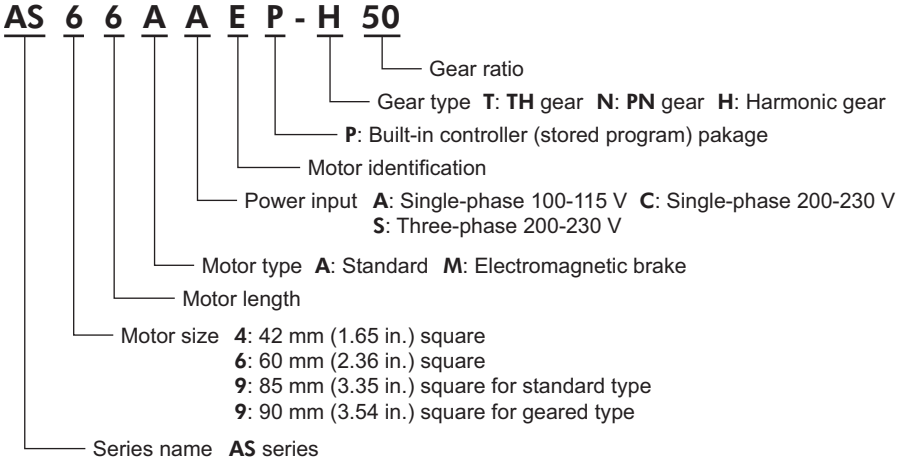


• Motor cable for IP65 rated motor (sold separately)



• IP65 rated motor

4.2 How to identify the product model



4.3 Combinations of motors and drivers

Memo An **A** (standard) or **M** (with electromagnetic brake) is entered in the blank square in the model number.

• **TH** geared type

Unit model	Motor model	Driver model
AS46□AP-T3.6	ASM46□A-T3.6	ASD13B-AP
AS46□AP-T7.2	ASM46□A-T7.2	ASD13B-AP
AS46□AP-T10	ASM46□A-T10	ASD13B-AP
AS46□AP-T20	ASM46□A-T20	ASD13C-AP
AS46□AP-T30	ASM46□A-T30	ASD13C-AP
AS66□AEP-T3.6	ASM66□AE-T3.6	ASD24B-AP
AS66□AEP-T7.2	ASM66□AE-T7.2	ASD24B-AP
AS66□AEP-T10	ASM66□AE-T10	ASD24B-AP
AS66□AEP-T20	ASM66□AE-T20	ASD24C-AP
AS66□AEP-T30	ASM66□AE-T30	ASD24C-AP
AS66□CEP-T3.6	ASM66□CE-T3.6	ASD12B-CP
AS66□CEP-T7.2	ASM66□CE-T7.2	ASD12B-CP
AS66□CEP-T10	ASM66□CE-T10	ASD12B-CP
AS66□CEP-T20	ASM66□CE-T20	ASD12C-CP
AS66□CEP-T30	ASM66□CE-T30	ASD12C-CP
AS66□SEP-T3.6	ASM66□CE-T3.6	ASD12B-SP
AS66□SEP-T7.2	ASM66□CE-T7.2	ASD12B-SP
AS66□SEP-T10	ASM66□CE-T10	ASD12B-SP
AS66□SEP-T20	ASM66□CE-T20	ASD12C-SP
AS66□SEP-T30	ASM66□CE-T30	ASD12C-SP
AS98□AEP-T3.6	ASM98□AE-T3.6	ASD30A-AP
AS98□AEP-T7.2	ASM98□AE-T7.2	ASD30A-AP
AS98□AEP-T10	ASM98□AE-T10	ASD30A-AP
AS98□AEP-T20	ASM98□AE-T20	ASD30C-AP
AS98□AEP-T30	ASM98□AE-T30	ASD30C-AP
AS98□CEP-T3.6	ASM98□CE-T3.6	ASD16A-CP
AS98□CEP-T7.2	ASM98□CE-T7.2	ASD16A-CP
AS98□CEP-T10	ASM98□CE-T10	ASD16A-CP
AS98□CEP-T20	ASM98□CE-T20	ASD16C-CP
AS98□CEP-T30	ASM98□CE-T30	ASD16C-CP
AS98□SEP-T3.6	ASM98□CE-T3.6	ASD16A-SP

• **PN** geared type

Unit model	Motor model	Driver model
AS46□AP-N7.2	ASM46□A-N7.2	ASD13A-AP
AS46□AP-N10	ASM46□A-N10	ASD13A-AP
AS66□AEP-N5	ASM66□AE-N5	ASD24A-AP
AS66□AEP-N7.2	ASM66□AE-N7.2	ASD24A-AP
AS66□AEP-N10	ASM66□AE-N10	ASD24A-AP
AS66□AEP-N25	ASM66□AE-N25	ASD24B-AP
AS66□AEP-N36	ASM66□AE-N36	ASD24C-AP
AS66□AEP-N50	ASM66□AE-N50	ASD24C-AP
AS66□CEP-N5	ASM66□CE-N5	ASD12A-CP
AS66□CEP-N7.2	ASM66□CE-N7.2	ASD12A-CP
AS66□CEP-N10	ASM66□CE-N10	ASD12A-CP
AS66□CEP-N25	ASM66□CE-N25	ASD12B-CP
AS66□CEP-N36	ASM66□CE-N36	ASD12C-CP
AS66□CEP-N50	ASM66□CE-N50	ASD12C-CP
AS66□SEP-N5	ASM66□CE-N5	ASD12A-SP
AS66□SEP-N7.2	ASM66□CE-N7.2	ASD12A-SP
AS66□SEP-N10	ASM66□CE-N10	ASD12A-SP
AS66□SEP-N25	ASM66□CE-N25	ASD12B-SP
AS66□SEP-N36	ASM66□CE-N36	ASD12C-SP
AS66□SEP-N50	ASM66□CE-N50	ASD12C-SP
AS98□AEP-N5	ASM98□AE-N5	ASD30A-AP
AS98□AEP-N7.2	ASM98□AE-N7.2	ASD30A-AP
AS98□AEP-N10	ASM98□AE-N10	ASD30A-AP
AS98□AEP-N25	ASM98□AE-N25	ASD30A-AP
AS98□AEP-N36	ASM98□AE-N36	ASD30A-AP
AS98□AEP-N50	ASM98□AE-N50	ASD30B-AP
AS98□CEP-N5	ASM98□CE-N5	ASD16A-CP
AS98□CEP-N7.2	ASM98□CE-N7.2	ASD16A-CP
AS98□CEP-N10	ASM98□CE-N10	ASD16A-CP
AS98□CEP-N25	ASM98□CE-N25	ASD16A-CP
AS98□CEP-N36	ASM98□CE-N36	ASD16A-CP

• **TH** geared type

Unit model	Motor model	Driver model
AS98□SEP-T7.2	ASM98□CE-T7.2	ASD16A-SP
AS98□SEP-T10	ASM98□CE-T10	ASD16A-SP
AS98□SEP-T20	ASM98□CE-T20	ASD16C-SP
AS98□SEP-T30	ASM98□CE-T30	ASD16C-SP

• **PN** geared type

Unit model	Motor model	Driver model
AS98□CEP-N50	ASM98□CE-N50	ASD16B-CP
AS98□SEP-N5	ASM98□CE-N5	ASD16A-SP
AS98□SEP-N7.2	ASM98□CE-N7.2	ASD16A-SP
AS98□SEP-N10	ASM98□CE-N10	ASD16A-SP
AS98□SEP-N25	ASM98□CE-N25	ASD16A-SP
AS98□SEP-N36	ASM98□CE-N36	ASD16A-SP
AS98□SEP-N50	ASM98□CE-N50	ASD16B-SP

• Harmonic geared type

Unit model	Motor model	Driver model
AS46□AP2-H50	ASM46□A2-H50	ASD13A-AP
AS46□AP2-H100	ASM46□A2-H100	ASD13A-AP
AS66□AEP-H50	ASM66□AE-H50	ASD24B-AP
AS66□AEP-H100	ASM66□AE-H100	ASD24C-AP
AS66□CEP-H50	ASM66□CE-H50	ASD12B-CP
AS66□CEP-H100	ASM66□CE-H100	ASD12C-CP
AS66□SEP-H50	ASM66□CE-H50	ASD12B-SP
AS66□SEP-H100	ASM66□CE-H100	ASD12C-SP
AS98□AEP-H50	ASM98□AE-H50	ASD30B-AP
AS98□AEP-H100	ASM98□AE-H100	ASD30B-AP
AS98□CEP-H50	ASM98□CE-H50	ASD16B-CP
AS98□CEP-H100	ASM98□CE-H100	ASD16B-CP
AS98□SEP-H50	ASM98□CE-H50	ASD16B-SP
AS98□SEP-H100	ASM98□CE-H100	ASD16B-SP

• Round shaft type

Unit model	Motor model	Driver model
AS46□AP	ASM46□A	ASD13A-AP
AS66□AEP	ASM66□AE	ASD24A-AP
AS69□AEP	ASM69□AE	ASD30D-AP
AS66□CEP	ASM66□CE	ASD12A-CP
AS69□CEP	ASM69□CE	ASD16D-CP
AS66□SEP	ASM66□CE	ASD12A-SP
AS69□SEP	ASM69□CE	ASD16D-SP
AS98□AEP	ASM98□AE	ASD30A-AP
AS911AAEP	ASM911AAE	ASD30E-AP
AS98□CEP	ASM98□CE	ASD16A-CP
AS911ACEP	ASM911ACE	ASD20A-CP
AS98□SEP	ASM98□CE	ASD16A-SP
AS911ASEP	ASM911ACE	ASD20A-SP

• Standard type IP65 rated motor

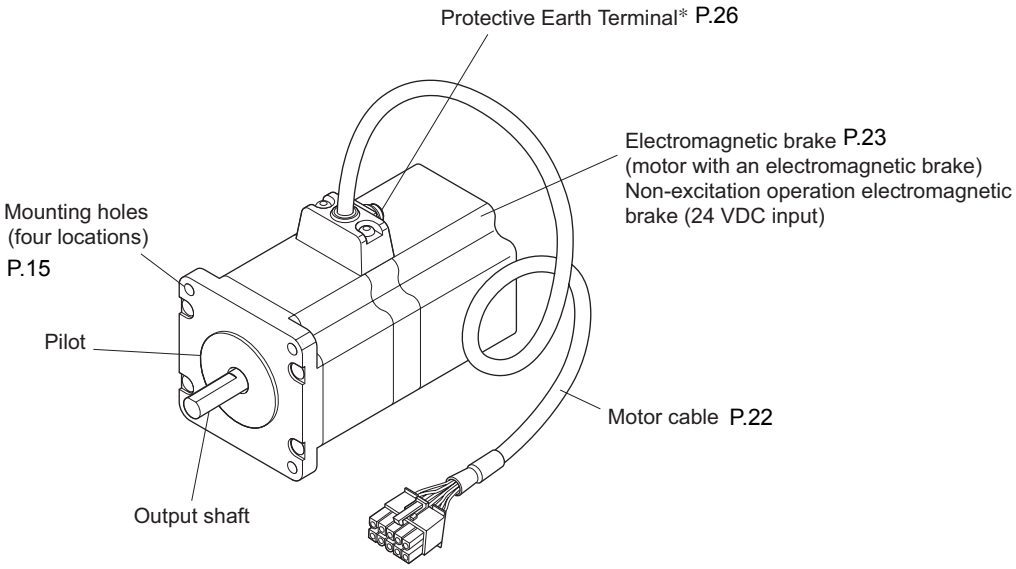
Unit model	Motor model	Driver model
AS66AATP	ASM66AAT	ASD24A-AP
AS69AATP	ASM69AAT	ASD30D-AP
AS66ACTP	ASM66ACT	ASD12A-CP
AS69ACTP	ASM69ACT	ASD16D-CP
AS66ASTP	ASM66ACT	ASD12A-SP
AS69ASTP	ASM69ACT	ASD16D-SP
AS98AATP	ASM98AAT	ASD30A-AP
AS911AATP	ASM911AAT	ASD30E-AP
AS98ACTP	ASM98ACT	ASD16A-CP
AS911ACTP	ASM911ACT	ASD20A-CP
AS98ASTP	ASM98ACT	ASD16A-SP
AS911ASTP	ASM911ACT	ASD20A-SP

4.4 Names and functions of parts

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

■ Motor

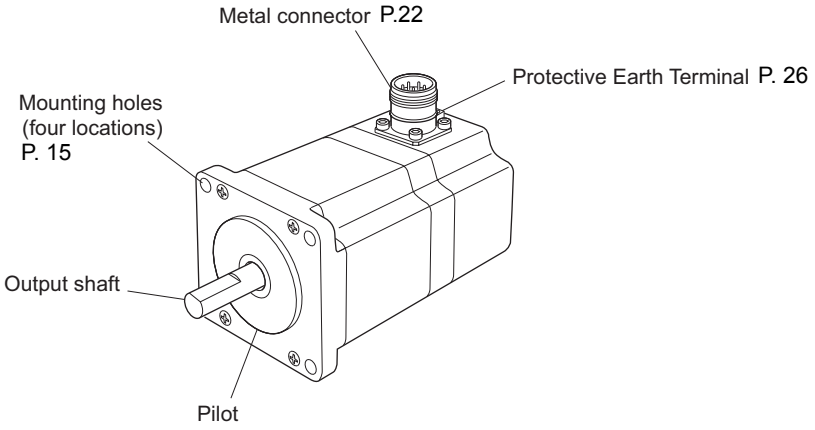
Illustration shows the standard type with electromagnetic brake (ASM66MAE).



* The ASM46 has no Protective Earth Terminals.

■ IP65 rated motor

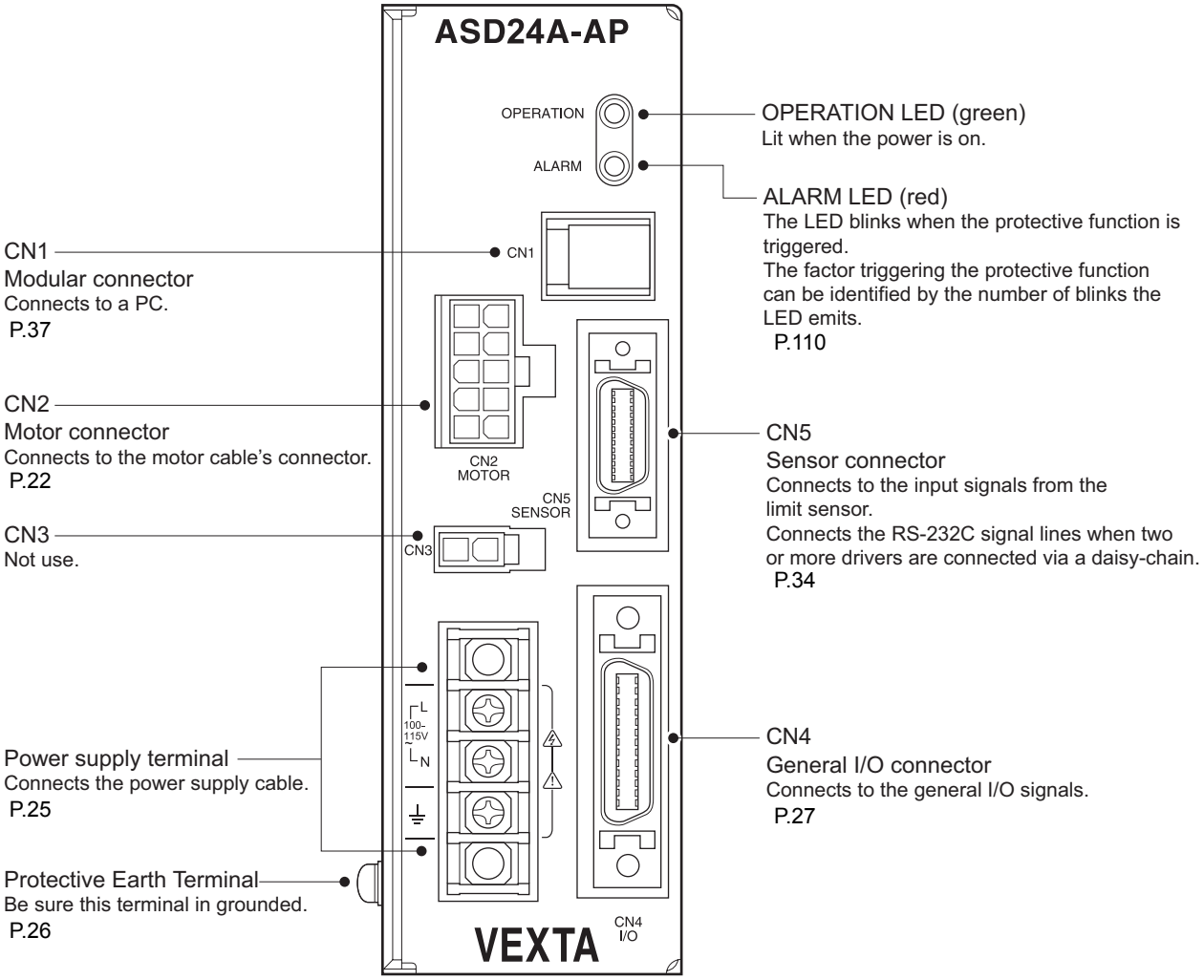
Illustration shows the IP65 rated motor (ASM911ACT).



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

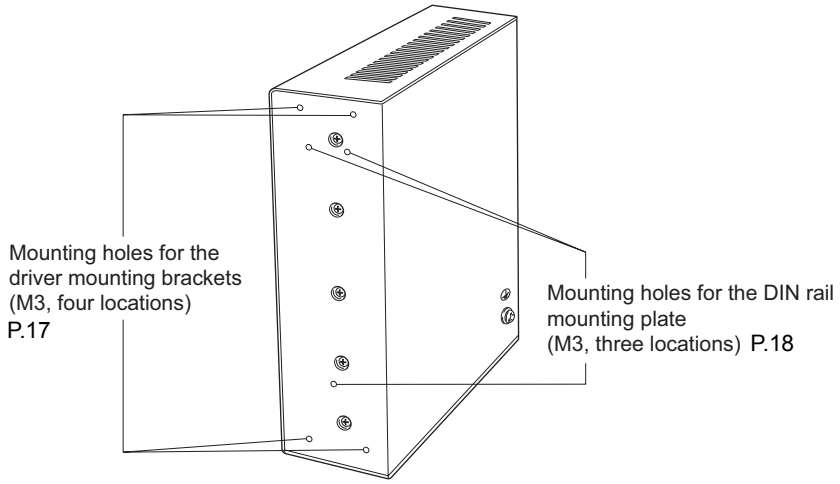
■ Driver

- Front side of driver



Memo The unit is available in three input-power supplies: single-phase 100-115 V, single-phase 200-230 V and three-phase 200-230 V (**AS46**: single-phase 100-115 V only).

- Rear side of driver



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 Directives.

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:

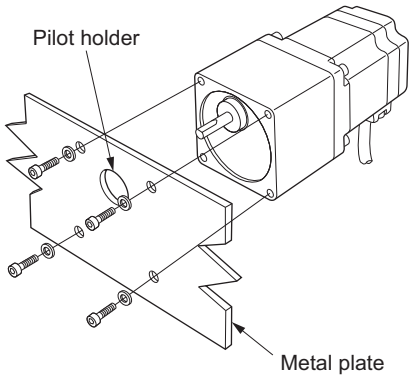
- Inside an enclosure that is installed indoors (provide vent holes)
- Operating ambient temperature
  Motor: 0 to +50 °C (+32 to +122 °F) (non-freezing)
  Motor (Harmonic geared): 0 to +40 °C (+32 to +104 °F) (non-freezing)
  Driver: 0 to +40 °C (+32 to +104 °F) (non-freezing)
- Operating ambient humidity 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 (storms, 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

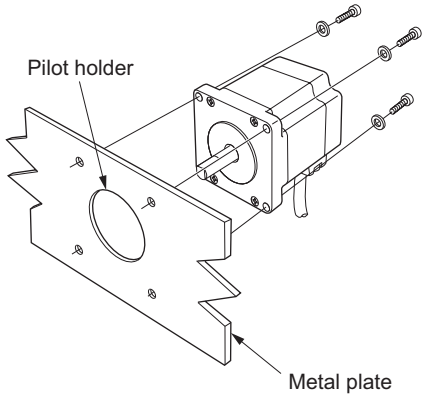
■ Installation method

1. Insert the pilot on the motor's installation surface into the counter bore or through-hole provided on a metal plate.
2. Tighten four bolts (not supplied) so that no gap is left between the motor and metal plate.

Types of installation A



Types of installation B



Motor type	Frame size [mm (in.)]	Bolt size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Types of installation
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)	
PN geared	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	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)	—	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.

Note

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

Memo Optional flexible couplings are available (sold separately).

■ 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 Be certain the overhung load and thrust load do not exceed their respective allowable values. Failure to do so may cause fatigue damage to the motor's bearing (ball bearing) and output shaft.

Frame size	Unit type	Permissible overhung load [N (lb.)]					Permissible thrust load [N (lb.)]
		Distance from the tip of motor's output shaft					
		0 mm (0 in.)	5 mm (0.2 in.)	10 mm (0.39 in.)	15 mm (0.59 in.)	20 mm (0.79 in.)	
42 mm (1.65 in.)	**AS46-T□**	10 (2.2)	14 (3.1)	20 (4.5)	30 (6.7)	—	15 (3.3)
	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 mm (2.36 in.)	**AS66-T□**	70 (15.7)	80 (18)	100 (22)	120 (27)	150 (33)	40 (9)
	AS66-N5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)	100 (22)
	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)	
	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 mm (3.35 in.)	**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 mm (3.54 in.)	**AS98-T□**	220 (49)	250 (56)	300 (67)	350 (78)	400 (90)	100 (22)
	AS98-N5	480 (108)	520 (117)	550 (123)	580 (130)	620 (139)	300 (67)
	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)

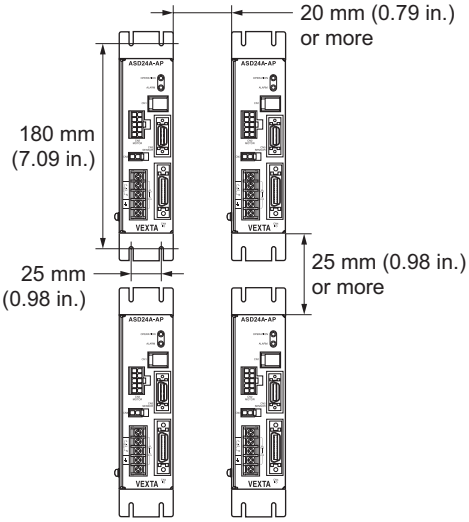
Memo

- 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.

5.4 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 near the driver.
- Check ventilation if the ambient temperature of the driver exceeds 40 °C (104 °F).
- Do not install the driver underneath the controller or other equipment vulnerable to heat.

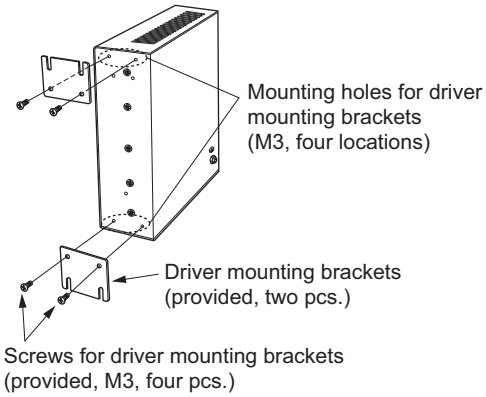
■ Installation method

When installing the driver, install it on a metal plate using driver mounting brackets, or mount it to a DIN rail.

Memo If the enclosure is subject to significant vibration, do not use a DIN rail. Instead, use the driver mounting brackets to attach the driver to a metal plate.

- Installing with the driver mounting brackets

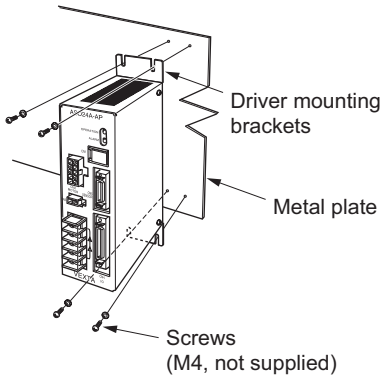
3. Attach the driver mounting brackets to the rear panel of the driver by tightening the supplied screws (M3, four pcs.) into the mounting holes provided (four locations).
Tightening torque: 0.5 to 0.6 N·m (71 to 85 oz-in)



4. Secure the driver mounting brackets to the metal plate using four screws (M4, not supplied).

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.



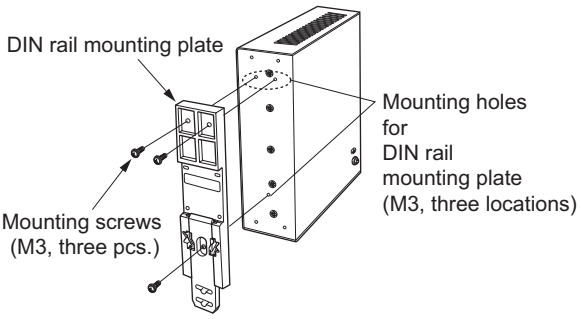
- Mounting to a DIN rail

When mounting the driver to a DIN rail, use a separately sold DIN rail mounting plate (model number **PADP01**) and attach it to a 35 mm (1.38 in.) wide DIN rail.

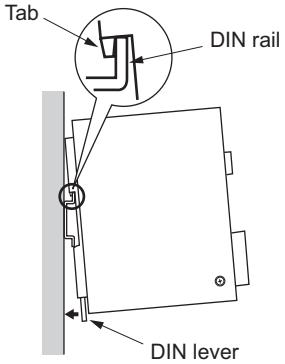
Note

- Do not use the mounting holes (M3, three locations) for the DIN rail mounting plate provided in the back of the driver for any purpose other than securing the DIN rail mounting plate.
- Be sure to use the supplied screws when securing the DIN rail mounting plate. The use of screws that would penetrate 3 mm (0.118 in.) or more through the surface of the driver may cause damage to the driver.

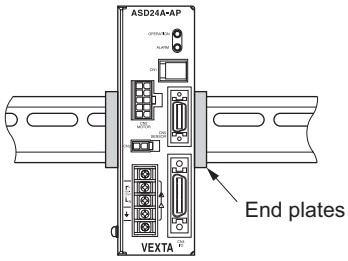
1. Attach the DIN rail mounting plate to the rear panel of the driver by tightening the supplied mounting screws into the mounting holes provided (three locations).
Tightening torque: 0.3 to 0.4 N·m (42 to 56 oz-in)



2. Pulling the DIN lever downward, hook the tab of the DIN rail mounting plate on the DIN rail and push the driver until the DIN lever locks.

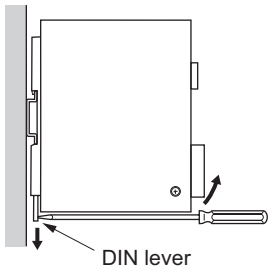


3. Secure the driver using end plates (not supplied).



- Removing from DIN rail

Pull the DIN lever down until it locks using a flat-head screwdriver, and lift the bottom of the driver to remove it from the rail. Use a force of about 10 to 20 N (2.2 to 4.5 lb.) to pull the DIN lever to lock it. Excessive force may damage the DIN lever.



5.5 Installing and wiring in compliance with EMC Directive

If effective measures are not provided to prevent the EMI caused by the unit from affecting surrounding control-systems equipment or against the EMS of the unit itself, serious failure may occur in the functions of associated mechanical devices.
The use of the following installation and wiring methods will enable the unit to be compliant with the EMC Directives (the aforementioned compliance standards).

Memo For the applicable standards, see “For Low Voltage Directive” on p.3.

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

The unit 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

■ 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.

Manufacture	Single-phase 100 V, 200 V	Three-phase 200 V
Schaffner EMC	FN2070-10-06	FN251-8-07
EPCOS AG	B84113-C-B110	—

- Install a mains filter at a point as close to the driver as possible. Further, secure the input and output cables with cable clamps or the like so that they won’t rise from the surface of the enclosure panel.
- Use as thick a cable as possible to connect the mains filter’s ground terminal with the grounding point, and do so using the shortest possible distance.
- Do not wire the AC input-side cable (AWG18: 0.75 mm^2) and the mains filter’s output cable (AWG18: 0.75 mm^2) in parallel. If they are wired in parallel, noise occurring within the enclosure will be transmitted to the power supply cable via stray capacitance, thereby reducing the mains filter’s effectiveness.

■ Connecting surge arrester

Use a surge arrester or equivalent as below table.

	Single-phase 100 V	Single-phase 200 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.

Memo See below, for details on how to ground the braided screen 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 grounding the driver

  Ground the Protective Earth Terminal on the side of the driver.
  Refer to p.26 for the way to ground the driver.

- How to grounding the motor (other than IP65 rated motor)

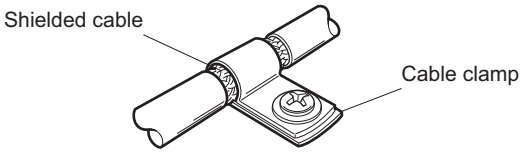
  When grounding the motor, use an external Protective Earth Terminal or connect the motor to a grounded metal plate.
  Refer to p.26 for the way to ground the motor.

- How to grounding an IP65 rated motor

  Connect the Protective Earth Terminal of the motor to the ground.
  Refer to p.26 for the way to ground the motor.

■ Wiring the signal cable

Use a shielded cable with a wire of a size ranging between AWG24 to 22 (0.2 to 0.3 mm^2) for the driver signal cable, and keep it as short as possible. When grounding the shield cable, use a metal cable clamp and ensure that it contacts the shield cable along the cable’s entire circumference. Install the cable clamp at the end of the shield cable and secure it to an appropriate grounding point.

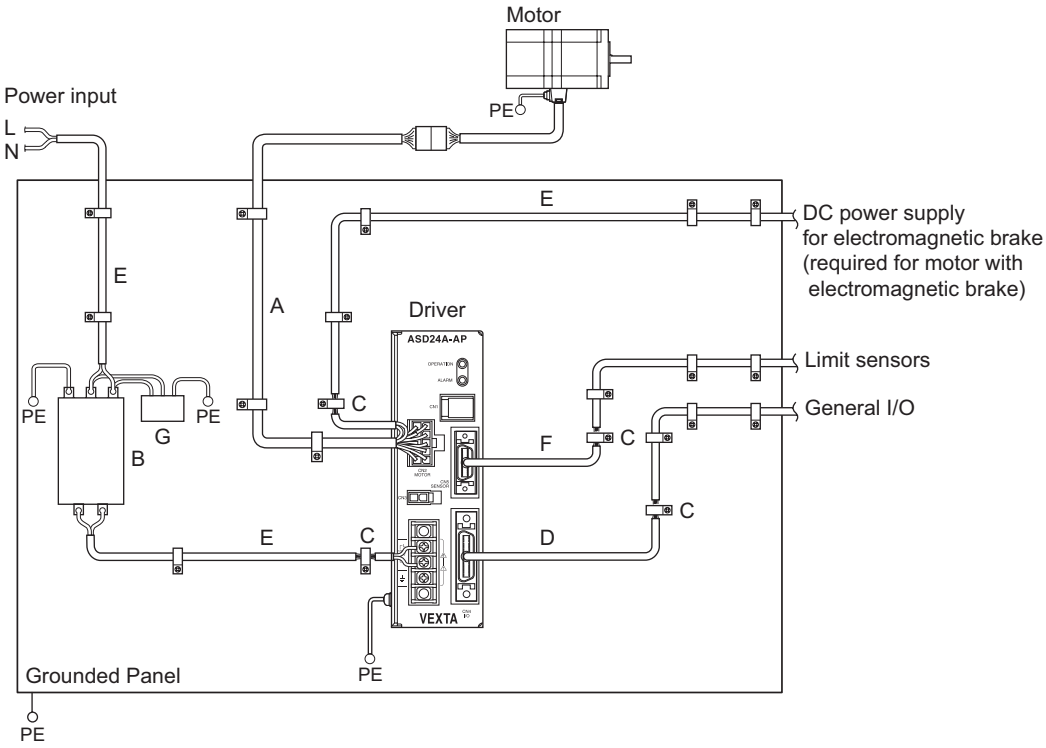


Memo A driver cable is available as an option (sold separately). Refer to p.116.

■ Notes about installation and wiring

- Grounding connections should be made directly to the grounding points so that differences won’t occur between the grounding potentials of the motor and driver and those of surrounding control-systems equipment.
- When relays or electromagnetic switches are used together with the system, use mains filters and CR circuits to suppress surges generated by them.
- Wire the cables along the shortest possible distance, being sure not to wind or bundle excess lengths.
- Separate the signal cables from the power supply cables such as the motor cable and power supply cable, and wire them so that they’re separated by a distance approximately 100 to 200 mm (3.94 to 7.87 in.). If a power cable and signal cable must cross, let them cross at a right angle. Additionally, keep a distance between the mains filter’s AC input-side cable and output-side cable.
- If an extension cable is required between the motor (other than IP65 rated motor) and driver, it is recommended that an optional extension cable (sold separately) be used, since the EMC measures are conducted using the Oriental Motor extension cable.

■ Example of motor and driver installation and wiring



A: Motor cable
B: Mains filter
C: Cable clamp
D: Braided screen cable with connectors
E: Power cable
F: Braided screen cable with connectors
G: Surge arrester

■ Static electricity

Static electricity may cause the driver to malfunction or suffer damage. Be careful when handling the driver with the power on.

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

6 Connection

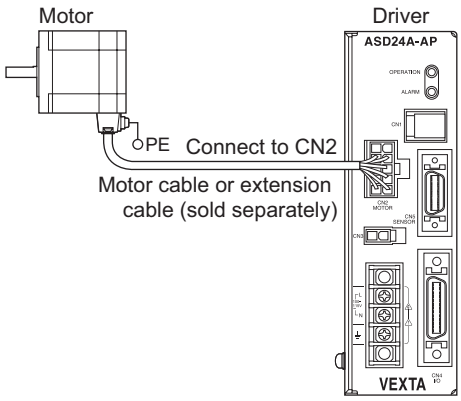
This section covers the methods and examples of connecting and grounding the driver, motor, power and controller, as well as the control I/O.

6.1 Connecting the motor (other than IP65 rated motor)

When connecting the motor with the driver, plug the motor cable or an optional relay cable (sold separately) into the driver's motor connector (CN2).

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.

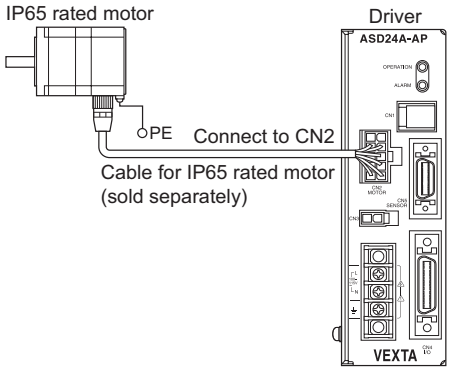


Memo

- Use an optional extension cable (sold separately) to extend the distance between the motor and driver. See 11 "Options (Sold separately)" on p.115 for the extension cable.
- When the motor is to be installed in a moving part, thereby subjecting the motor cable to repeated bending and stretching, use an optional flexible cable (sold separately). See 11 "Options (Sold separately)" on p.115 for the flexible cable.

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.

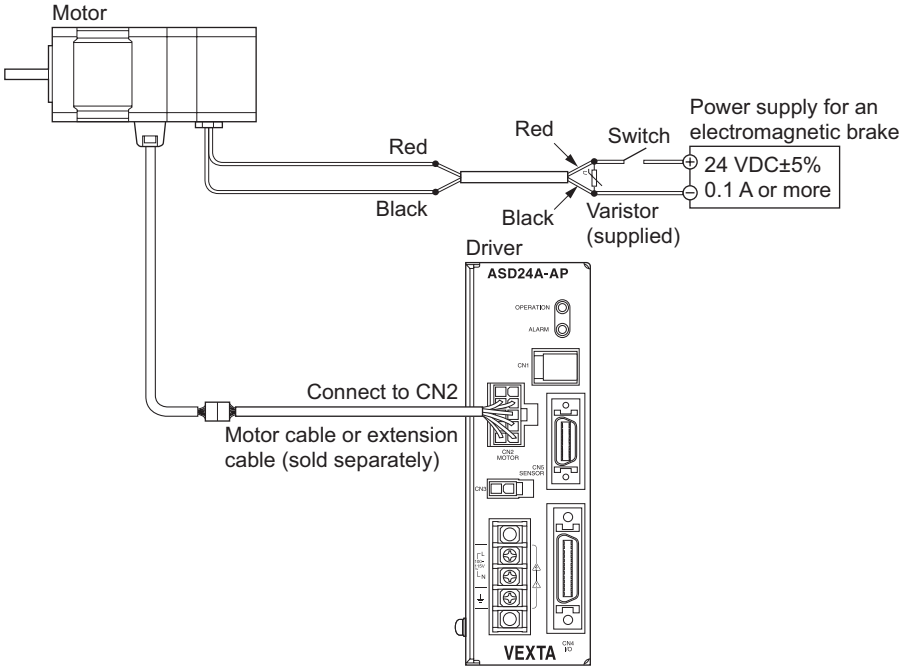


6.3 Connecting power supply for the electromagnetic brake

The electromagnetic brake operates via the ON/OFF state of its DC power supply. Provide a power supply of at least 24 VDC±5%, 0.3 A or more (**AS46**: 0.1 A or more) for the electromagnetic brake.

■ AS46

For connection between the electromagnetic brake and the DC power supply, use a shielded cable with a wire size of AWG24 to 22 (0.2 to 0.3 mm^2) to and extend the two lead wires for the electromagnetic brake [600 mm (2.36 in.), red and black], which extend from the motor, to route the wiring over the shortest possible distance.
Be sure to connect a varistor (no polarity) as a means of protecting the switch contacts and preventing noise.

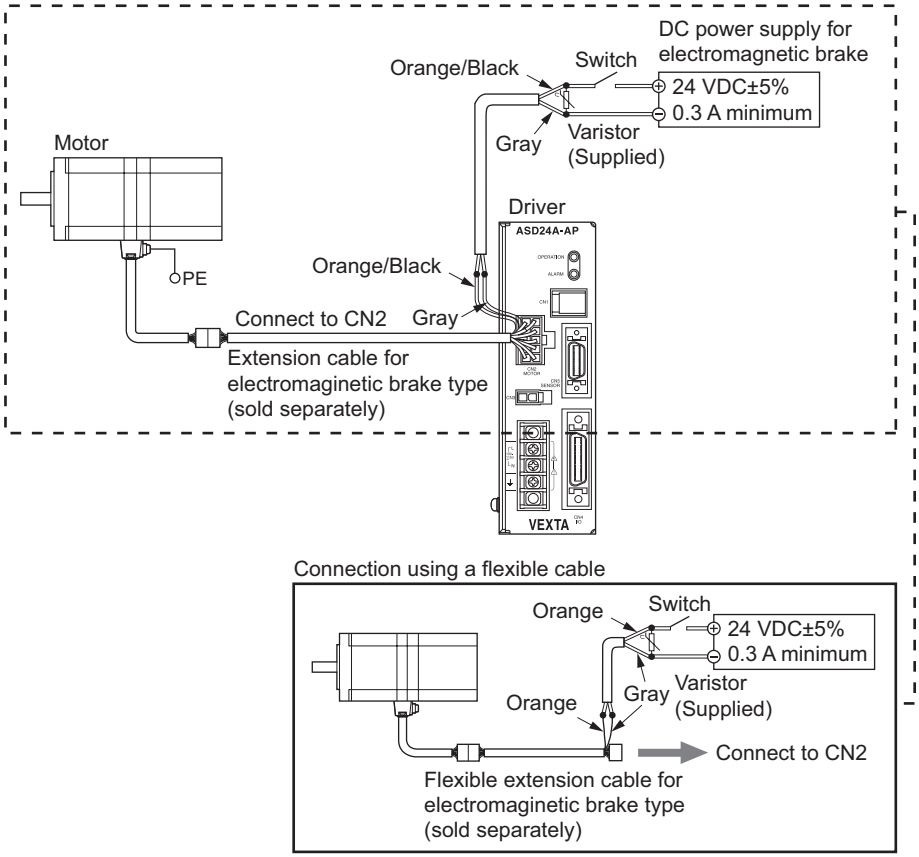


Note

- When extending the wiring distance between the motor and the driver, always use a standard extension cable regardless of whether or not the motor is equipped with an electromagnetic brake.
- 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. Be sure to connect the varistor (non-polarized) to protect the switch contacts and prevent noise.

■ AS66, AS69, AS98

Always use an optional extension cable of the electromagnetic brake motor 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. When a flexible cable for electromagnetic brake is used, the colors of the two lead wires (orange and gray) coming out of its driver connector are different from the colors of the relay cable leads.



Note

- When connecting a motor with an electromagnetic brake to the driver, use an optional extension cable for the motor with electromagnetic brake (sold separately).
- Connect to the DC power supply the two lead wires for the electromagnetic brake extending from the extension cable, being careful to observe the polarities. If the motor cable connector is connected directly without the use of an extension cable, the electromagnetic brake will not function.
- Be sure to connect the varistor (non-polarized) to protect the switch contacts and prevent noise.
- Be certain the connector is secured in place. If the connection is incomplete, operation failure or damage to the motor or driver may occur.
- Do not use the electromagnetic brake in excess of its rated values. If voltage exceeding the upper limit value is applied, the electromagnetic brake will generate excessive heat and may cause the motor to fail. If the voltage is too low, the electromagnetic brake may not be released.
- The lead wires of the electromagnetic brake have polarities and therefore must be connected properly. If the lead wires are connected in reverse polarities, the electromagnetic brake will not function as intended.

6.4 Connecting to the power supply

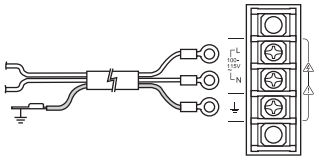
Connect the power cable to the power supply terminals located on the driver.

Note
- 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 power supply to terminals L and N.
- Connect the live side (phase line) of a power supply to terminal L.
- Connect the neutral side (neutral line) of a power supply to terminal N.
- Connect the ⏚ terminal marked to the grounding point on the power supply side.

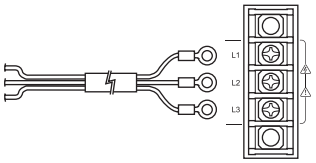
Single-phase
100-115 V
50/60 Hz
Single-phase
200-230 V
50/60 Hz



■ For three-phase 200-230 V unit

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

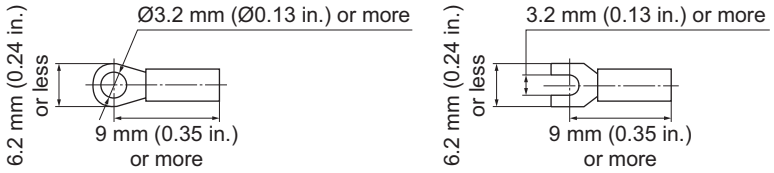
Three-phase
200-230 V
50/60 Hz



■ Terminal screw size and applicable lead wire size for power connection

Use an insulated round terminal for power supply connection.
- Screw size: M3
- Tightening torque: 0.8 N·m (113 oz-in)
- Applicable minimum lead wire size: AWG18 (0.75 mm^2)

Applicable crimp terminals



■ Current capacity

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

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.

• 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

• Three-phase 200-230 V

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

Memo 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.

6.5 Grounding the motor and driver

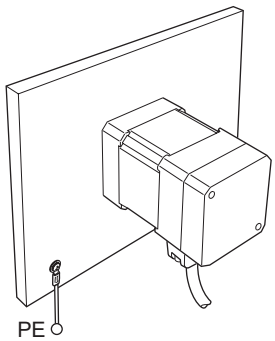
Properly ground the motor and driver.

Note When grounding, use a round crimp terminal with an insulated sheath and secure it with a mounting bolt and clip washer. The ground cable and crimp terminal are not included in the package.

■ Grounding the motor (other than IP65 rated motor)

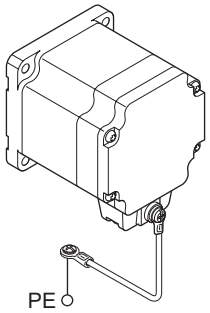
AS46

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



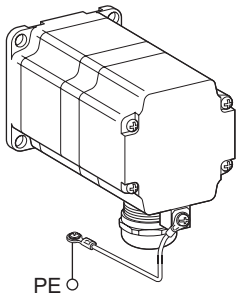
AS66, AS69, AS98, AS911

Be sure to ground the Protective Earth Terminal (screw size: M4).
Use a grounding cable of AWG18 (0.75 mm^2) or more in diameter.



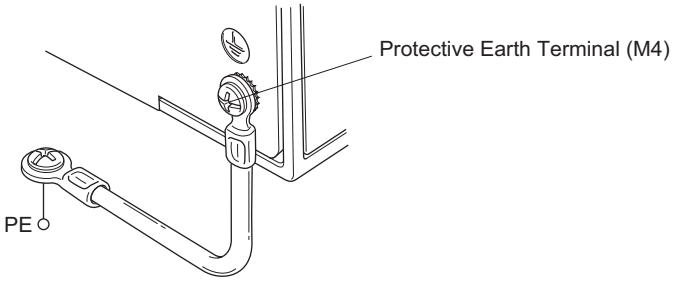
■ Grounding an IP65 rated motor

Be sure to ground the Protective Earth Terminal (screw size: M4) of the motor. Two threaded holes are provided for connecting this terminal. Use either of these holes.
Use a grounding cable of AWG18 (0.75 mm^2) or more in diameter.



■ Grounding the driver

Be sure to ground the Protective Earth Terminal (screw size: M4) located on the driver side.
Use a grounding cable of AWG18 (0.75 mm^2) or more in diameter.
Do not share the grounding cable with a welder or power equipment.
Use a round, terminal to ground the cable near the driver.



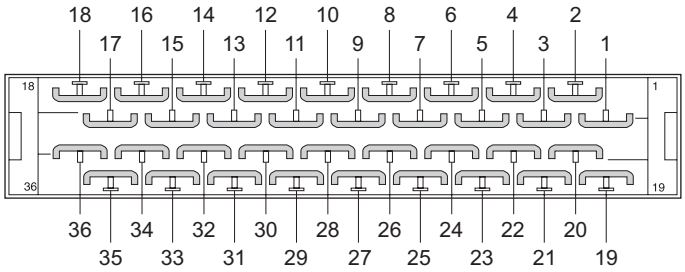
6.6 Assembling the connector

The unit comes with two soldering connectors (for sensor: 20 pins, for general I/O: 36 pins).

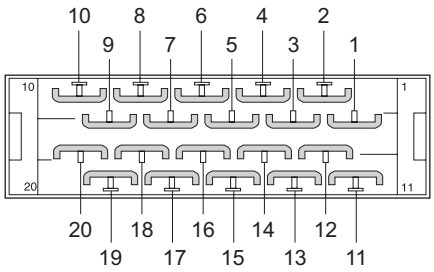
- Connect the limit sensor signals to the sensor connector. For the pin assignments, refer to p.28.
- Connect the general I/O signals to the general I/O connector. For the pin assignments, refer to p.34.

The following figure shows the pin arrangement of the connectors.

- General I/O connector (36 pins)
  Viewed from the soldering side

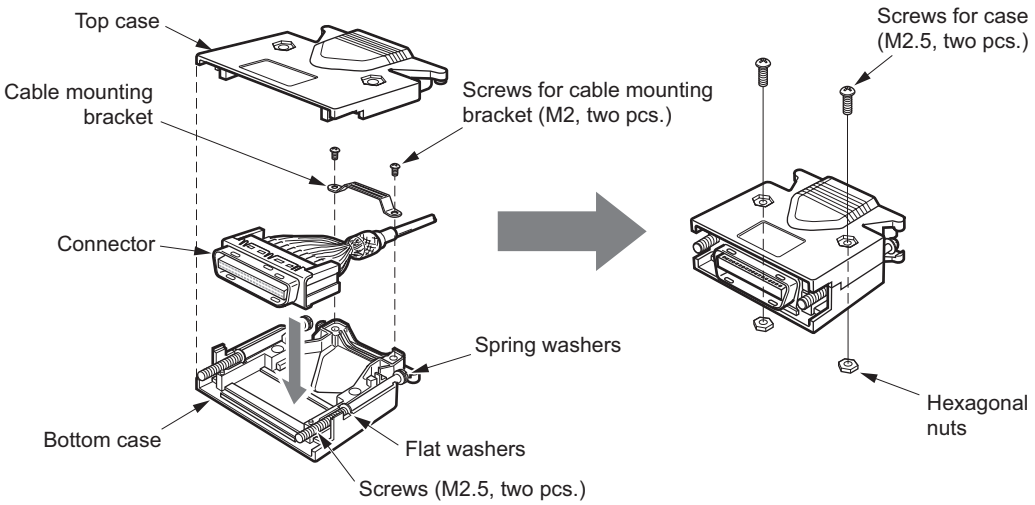


- Sensor connector (20 pins)
  Viewed from the soldering side



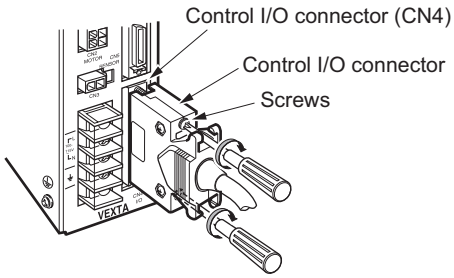
Assemble the connector as follows:

1. Solder a cable to the connector.
   The cable is not included in the package. Prepare a cable of a size ranging between AWG28 to 26 (0.08 to 0.14 mm^2).
2. Place the screws (M2.5, two pcs.) supplied with the connector in the bottom case.
   Place the screws so that their flat washers align with the indents in the case and the spring washers sit on the outside of the case.
3. Place the connector with the cable in the bottom case and screw the cable mounting bracket.
   Tighten the mounting bracket screws (M2, two pcs.) to the specified torque.
   Tightening torque: 0.3 to 0.35 N·m (42 to 49 oz-in)
4. Place the top case and assemble the top and bottom case using the supplied screws (M2.5, two pcs.) with hexagonal nuts.
   Tightening torque: 0.5 to 0.55 N·m (71 to 78 oz-in)



6.7 Connection method

Plug the 36 pins control I/O connector into the driver's control I/O connector (CN4) and tighten the screws with a flat head screwdriver.
Tightening torque: 0.3 to 0.35 N·m (42 to 49 oz-in)



■ Signal table

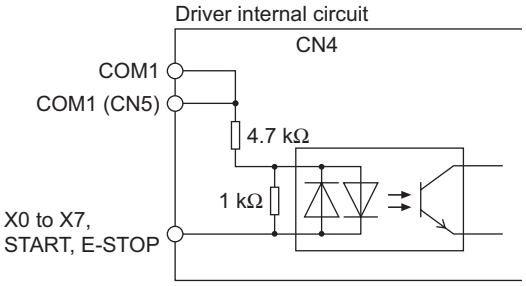
Pin No.	Signal	Description	Direction	Pin No.	Signal	Description	Direction
1	P24	Power supply for RS-232C, ASG and BSG (24 VDC)	Input	19	Y4	General output*1 (Y4 to Y7)	Output
2	N24	Power supply for RS-232C, ASG and BSG (GND)	Input	20	$\overline{Y4}$		Output
3	Y0	General output*1 (Y0 to Y3)	Output	21	Y5		Output
4	$\overline{Y0}$		Output	22	$\overline{Y5}$		Output
5	Y1		Output	23	Y6		Output
6	$\overline{Y1}$		Output	24	$\overline{Y6}$		Output
7	Y2		Output	25	Y7		Output
8	$\overline{Y2}$		Output	26	$\overline{Y7}$		Output
9	Y3		Output	27	ALM	Alarm	Output
10	$\overline{Y3}$		Output	28	$\overline{ALM}$		Output
11	ASG	Phase A pulse output (Line-driver output)	Output	29	X0	General input*2 (X0 to X7)	Input
12	$\overline{ASG}$		Output	30	X1		Input
13	BSG	Phase B pulse output (Line-driver output)	Output	31	X2		Input
14	$\overline{BSG}$		Output	32	X3		Input
15	START	Start	Input	33	X4		Input
16	E-STOP	Emergency stop	Input	34	X5		Input
17	COM1	Power supply for input signal	Input	35	X6		Input
18			Input	36	X7		Input

∗1 The following signals can be assigned arbitrarily via program settings. Additionally, the output logic of each signal can be switched.
END output, RUN output, MOVE output, HOME-P output, TIM. output, MBC output

∗2 The following signals can be assigned arbitrarily via program settings. Additionally, the input logic of each signal can be switched.
ACL input, PAUSE input, MSTOP input, RESTART input

■ Input signals

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



Note Use input signals at 24 VDC±10%.

- P24 input, N24 input

These inputs are for the external power supply required for the RS-232C communication, ASG and BSG outputs.
Make sure to use a power supply of at least 24 VDC±10%, 0.05 A.
If the same power supply is going to be used for the RS-232C, ASG, BSG and other external I/O, make sure to use a power supply of at least 24 VDC±10%, 0.2 A.

- START input

This signal starts the program named "STARTUP."

OFF → ON edge to start "STARTUP" program

Note When starting a program, the system resets all program variables to 0 and cancels signal assignment for all general I/O ports.

- E-STOP input

This signal is used to forcibly stop the operation.
Set the stopping method using the ESTOPACT command.
Additionally, the input logic can be changed using the ESTOPLV command. (The factory setting of this command is normally open.)

OFF → ON edge to stop operation

- COM1 input

This is an external power supply terminal for input signals.
This signal is internally connected to terminals COM1 of CN5.

- X0 to X7 inputs

The X0 through X7 inputs can be used as input ports for general signals.
The status of each port can be read using an IN command or INx command.
The general signals assignable to the X0 through X7 inputs are listed below. Use a corresponding command to assign each signal.

- ACL input..... INACL command
- PAUSE input ..... INPAUSE command
- MSTOP input..... INMSTOP command
- RESTART input..... INRESTART command

Note The assigned general Input signals will be reset by any of the following operations.

- When turning on the AC power.
- When starting a program by the RUN command or the START input.
- When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).

- ACL input

This signal is used to reset the alarm that has been generated by the driver's protective function.
Input an ACL signal once after removing the cause that has triggered the protective function.

ON → OFF edge to reset the alarm

Note See the "Resetting the protective function" on p.112 for details.

- PAUSE input

This signal stops the motor operation temporarily.
If the PAUSE input is turned ON during positioning operation and mechanical home seeking, the remaining steps will be retained. When the RESTART input is turned ON, the motor resumes operation.
If the PAUSE input is turned ON during continuous operation or mechanical home seeking, motor will slow down and stop.

ON → OFF edge to pause

Note Only the motor operation is paused. The program execution will not stop.

- RESTART input

This signal resumes the motor operation that has been paused by the input of a PAUSE signal.

- MSTOP input

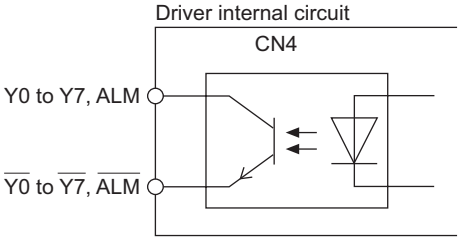
This signal stops the motor operation.
Unlike with the PAUSE input, the remaining steps will not be retained if the MSTOP input is turned ON during positioning operation.
Set the stopping method using the MSTOPACT command.

Note Only the motor operation is paused. The program execution will not stop.

■ Output signals

All output signals of the driver are photocoupler 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 Use output signals at 30 VDC or below and at 4 to 8 mA.



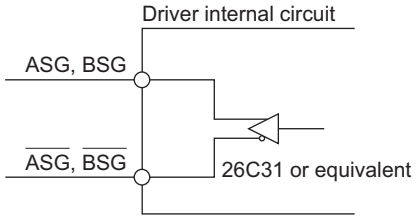
- ASG output, BSG output

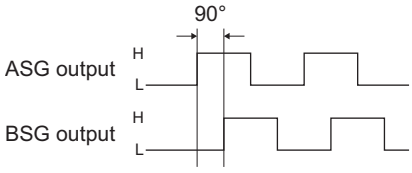
To monitor the motor position, connect these signals to a counter, etc.

Note
- Be sure to input 24 VDC±10% to the P24 and N24 input terminals when using the ASG output and BSG output.
- Pulse output is subject to a maximum delay of 1 ms. Relative to the motor's motion. Use the ASG output and BSG output to check the stopping position.

The pulse resolution is the same as the motor resolution at the time of power on.
The ASG output and BSG output have a phase difference of 90° in electrical angle.

• Line driver output (26C31 or equivalent)





- ALM output

This signal is output when an alarm is generated by the driver's protective function.
The reason for triggering of the protective function can be identified through the blink count of the alarm LED, or ALM command.
To reset the ALM output, remove the cause of the alarm and then perform one of the following procedures after ensuring safety:

- Turn the ACL input to ON.
- Enter an ALMCLR command.
- Turn off the power, wait at least 10 seconds, then turn it back on.

Memo For the protective functions, see "Types of protective functions and check methods" on p.110.

ON: Normal
OFF: Alarm state

- Y0 to Y7 output

The Y0 through Y7 outputs can be used as output ports for general signals.
The status of each port can be read using an OUT command or OUTx command.
The general signals assignable to the Y0 through Y7 outputs are listed below. Use the corresponding command to assign each signal.

- END output ..... OUTEND command
- RUN output ..... OUTRUN command
- MOVE output ..... OUTMOVE command
- HOME-P output..... OUTHOMEP command
- TIM. output ..... OUTTIM command
- MBC output..... OUTMBC command

Note The assigned general output signals will be reset by any of the following operations.

- When turning on the AC power.
- When starting a program by the RUN command or the START input.
- When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).

- END output

This signal is output when the motor motion is complete.
The rotor position will be within a maximum of ±1.8° of the command position after motor motion is complete.

ON: Motor is stopped
OFF: Motor is operating

- RUN output

This signal is output while positioning operation, continuous operation, mechanical home seeking or electrical home seeking is executed.
Whereas the MOVE output turns ON only when the motor is operating, the RUN output also turns ON when the motor is in pause.

Operating condition	RUN output	MOVE output
Operating	ON	ON
Operation complete	OFF	OFF
Pausing	ON	OFF

ON: Executing operation
OFF: Operation complete

- MOVE output

This signal is output while the motor is operating.

ON: Motor is operating
OFF: Motor is stopped

- HOME-P output

  This signal is output under any of the 3 followings conditions.
  1) Mechanical home seeking is complete.
  2) Electrical home seeking is complete.
  3) When the motor is at the absolute home position (PC 0).

- TIM. output

  Timing signal is output.
  By using this signal together with the HOMELS input by connecting them with an AND logic operator, you can increase the accuracy of origin detection.

- MBC output

  This is an electromagnetic brake control signal.
  The MBC output turns OFF when the motor loses its holding torque due to a current cutoff or alarm.
  The customer's host controller should be set so that it detects an MBC output OFF and turns ON/OFF the power to the electromagnetic brake, thereby activating it.

ON: Electromagnetic brake is released OFF: Electromagnetic brake is activated

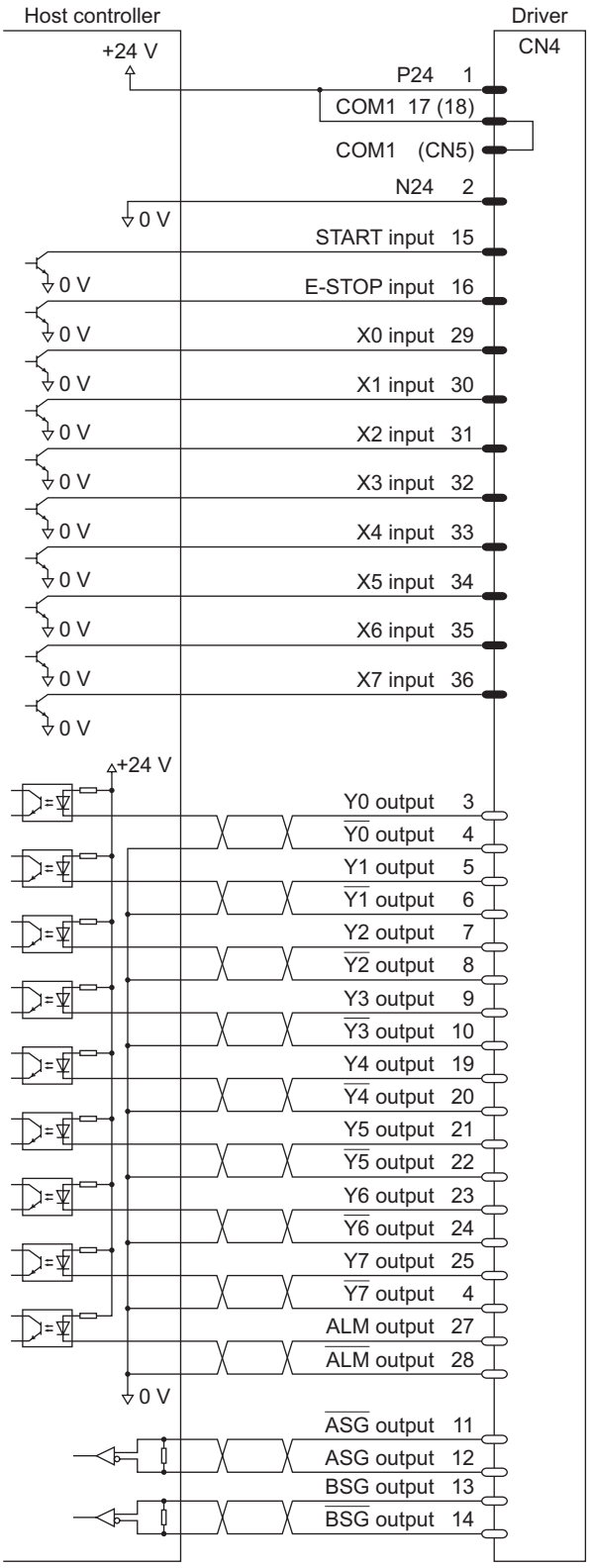
  Note Once the motor has lost its holding torque, the equipment may move due to gravity or the presence of a load before the electromagnetic brake generates holding force.

  Memo See "MBC output" on p.41 for a timing chart of MBC output turns OFF.

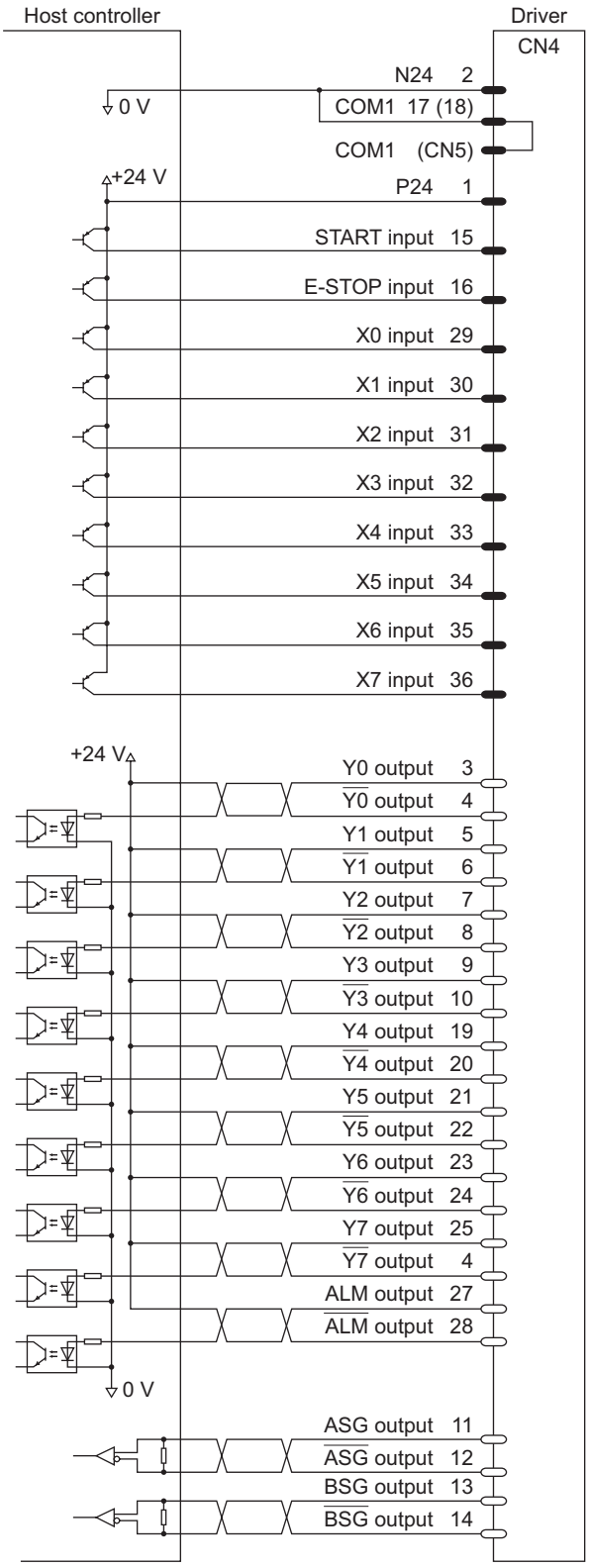
■ Connection example

Note
- Use input signals at 24 VDC±10%.
- Use output signals at 30 VDC or below and at 4 to 8 mA.

• Current source input and current sink output

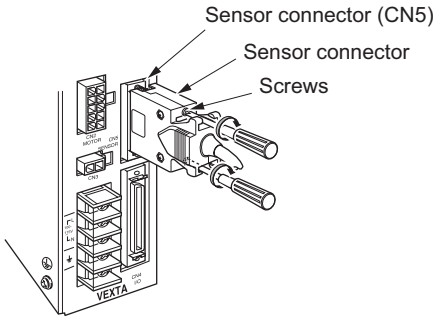


• Current sink input and current source output



6.8 Connecting the limit sensors (CN5)

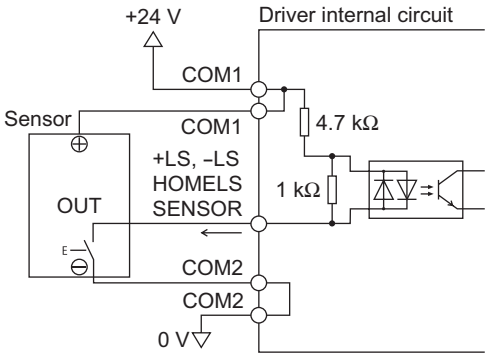
Plug the 20 pins sensor connector into the driver's sensor connector (CN5) and tighten the screws with a flat-head screwdriver.
Tightening torque: 0.3 to 0.35 N·m (42 to 49 oz-in)



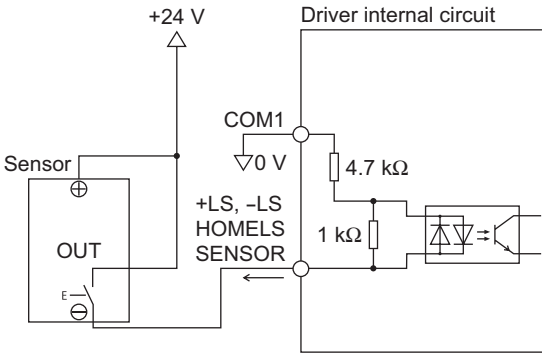
■ Signal table

Pin No.	Signal	Description	Direction	Pin No.	Signal	Description	Direction
1	COM1	Power supply for input signal	Input	11	COM1	Power supply for input signal	Input
2	COM2	Power supply for input signal	Input	12	COM2	Power supply for input signal	Input
3	−	No connection	−	13	+LS	+LS limit sensor	Input
4	−	No connection	−	14	−LS	−LS limit sensor	Input
5	TX	RS-232C Transmit	Output	15	HOMELS	HOME sensor	Input
6	−	No connection	−	16	SENSOR	Sensor	Input
7	RX	RS-232C Receive	Input	17	−	No connection	−
8	−	No connection	−	18	−	No connection	−
9	−	No connection	−	19	COM1	Power supply for input signal	Input
10	N24	External power supply terminal (GND)	Input	20	COM2	Power supply for input signal	Input

■ Input signals



Example of current sink output circuit connection



Example of current source output circuit connection

Note

- Use the input signals at 24 VDC±10%.
- Pin Nos.1, 11, and 19 are all connected to common COM1 internally.
- Pin Nos.2, 12, and 20 are all connected to common COM2 internally.
- COM1 for CN4 and COM1 for CN5 are internally common.

- COM1 input

This is a power supply input terminal for limit-sensor signals.
The power supply voltage must be 24 VDC±10%.
This signal is internally connected to terminals COM1 of CN4.

- COM2 input

This is a power supply input terminal for limit-sensor signals.
Use it when sharing the input signal power supply among two or more drivers.

- +LS input, −LS input

These signals are input from +LS and −LS.
The input logic can be changed using the OTLV command. (The factory setting of this command is normally open.)

Note Input logic for the +LS input and −LS input cannot be set separately.

Continuous operation and positioning operation

When a +LS or −LS is detected, the driver's protective function (hard-limit detection) is activated.
As a result, the ALM output is turned OFF and the motor stops.
Set the stopping method using the OTACT command.
To pull out of +LS or −LS, cancel the protective function by inputting an ACL signal once or by using the ALMCLR command. Then perform mechanical home seeking routine or operate the motor in the direction opposite that of the limit sensor during continuous operation.

Memo
- For information on protective functions, see "Types of protective functions and check methods" on p.110.
- For the ALM output, see p.31.

Mechanical home seeking routine

When a +LS or −LS is detected, the motor operates in the direction opposite that of the detected limit.

- HOMELS input

This signal is input from HOMELS.
Connect the HOMELS when mechanical home seeking is performed in 3-sensor mode.
When mechanical home seeking is performed in 3-sensor mode, the HOMELS becomes the mechanical home.
The input logic can be changed using the HOMELV command. (The factory setting of this command is normally open.)

- SENSOR input

This signal is input from SENSOR.
The input logic can be changed using the SENSORLV command. (The factory setting of this command is normally open.)

Mechanical home seeking routine

This input is used when detecting the mechanical home at a specific point on the motor's output shaft or load shaft using a slotted disc, etc. The accuracy of mechanical home hunting increases if this input is used in conjunction with the TIMING signal.

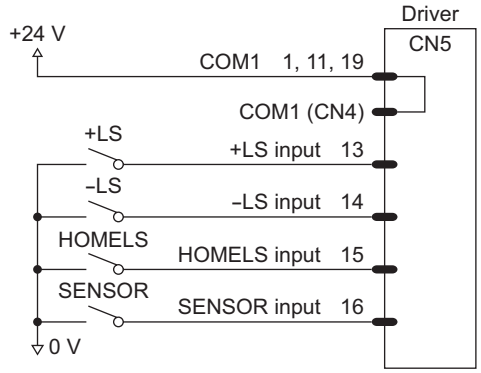
Continuous operation

The motor can be stopped forcibly upon the detection of SENSOR.
Set the stopping method using the SENSORACT command.

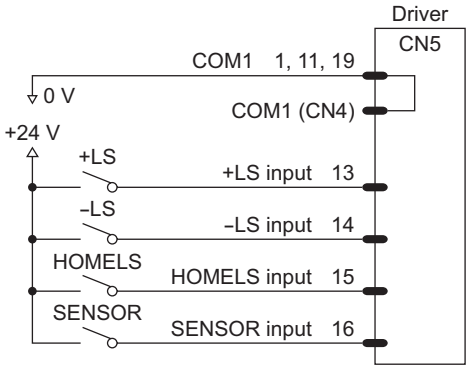
Note If the SENSOR input is used in mechanical home hunting, it cannot be used during continuous operation.

■ Connection example

• Current source input



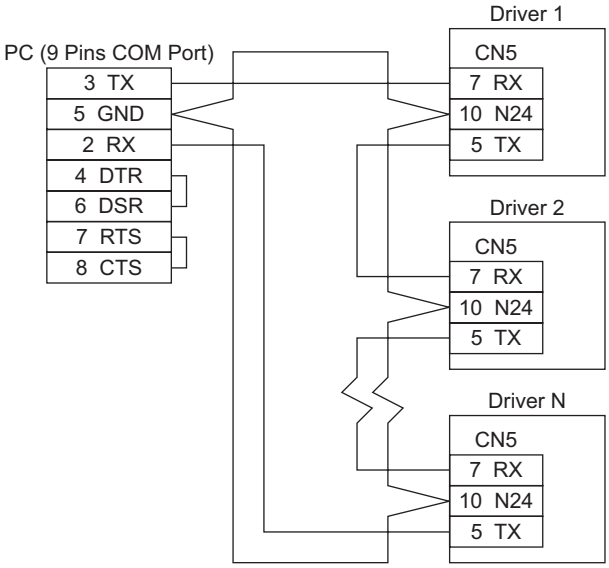
• Current sink input



Note Use input signals at 24 VDC±10%.

■ Daisy-chain connections

Use the RS-232C communication pins (TX, RX and N24) of the sensor connector (CN5) when connecting two or more drivers via a daisy-chain (up to 36 drivers).



Note
- A maximum of 36 drivers can be connected via a daisy-chain.
- The maximum distance between drivers when using a daisy-chain connection should be 15 m (49.2 ft.).

Memo See 12.3 “Daisy-chain connection procedure” on p.121 for the daisy-chain connection procedure.

• TX, RX

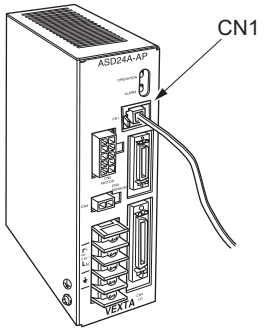
These communication terminals are used when implementing daisy-chain connections.

Note
- Confirm that each driver is supplied 24 VDC±10% (P24 and N24) of CN4 from outside for communication.
- The maximum distance between drivers when using a daisy-chain connection should be 15 m (49.2 ft.).
- Wire the RS-232C signal lines over the shortest possible distance. It is recommended that the signal lines be shielded to protect them from noise interference.
- Do not use the RS-232C communication port (CN1).

Memo See 12.3 “Daisy-chain connection procedure” on p.121 for the daisy-chain connection procedure.

6.9 Connecting the driver with the personal computer (CN1)

■ Connection method

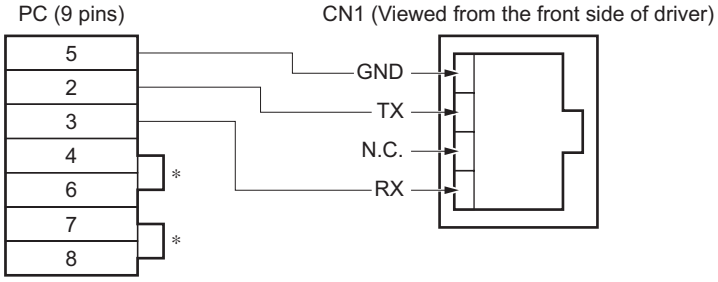


Connect a PC using an RS-232C cable (4 conductor modular plug: RJ22). Plug in the optional RS-232C cable, **FC04W5** (sold separately) to the RS-232C communications port (CN1) of the driver.

Note

- Confirm that 24 VDC is supplied to the driver's external power supply input terminals (P24 and N24).
- Wire the RS-232C signal lines over the shortest possible distance.
  It is recommended that the signal lines be shielded to protect them from noise interference.
- Use this method when connecting only one driver. See "Daisy-chain connections" on p.36 when two or more drivers are connected via a daisy-chain.

■ Pin assignments and wiring



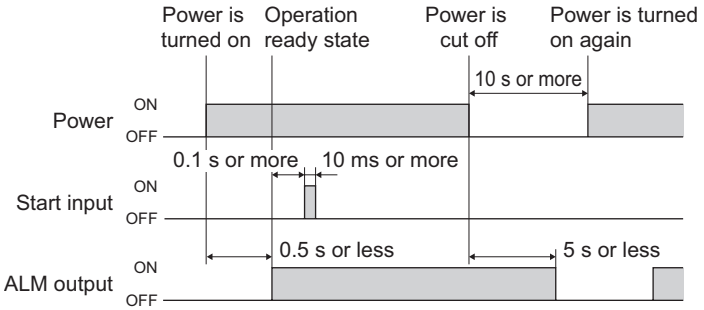
∗ Short pins 4 and 6 together, as well as pins 7 and 8 together.

■ Communication specifications

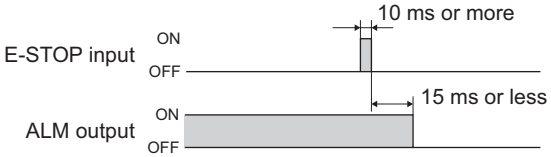
Item	Description
Electrical characteristics	In conformance with RS-232C.
Transmission method	Start-stop synchronous method, NRZ (Non-Return to Zero), full-duplex
Data length	8 bits, 1 stop bit, no parity
Transmission speed	9600 bps
Protocol	TTY (CR+LF)
Connector specification	Modular (4 lines, 4 pins)

6.10 Timing chart

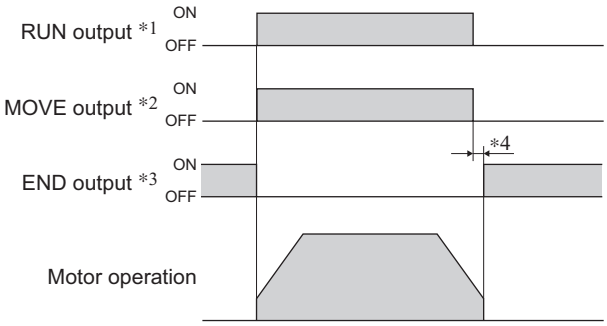
■ Upon turning on the power



■ When the E-STOP input is turned ON



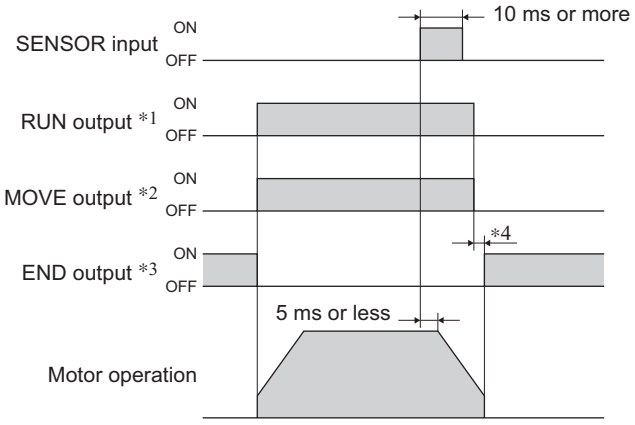
■ Starting/stopping during positioning operation, electrical home seeking and mechanical home seeking



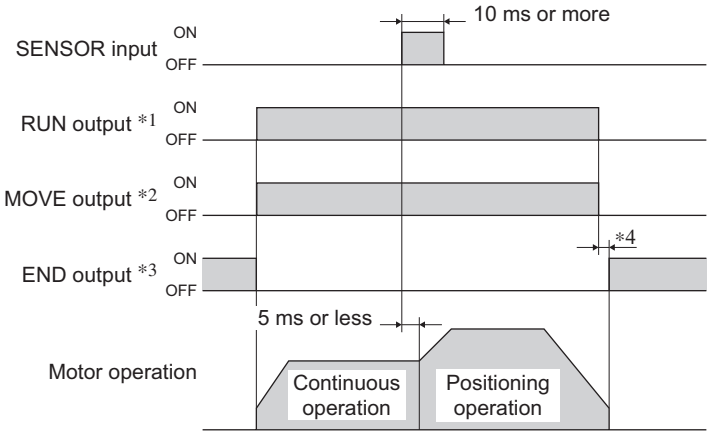
∗1 This applies when the RUN output is assigned to a general output port.
∗2 This applies when the MOVE output is assigned to a general output port.
∗3 This applies when the END output is assigned to a general output port.
∗4 The time required after the operation is complete until the END output turns ON will vary, depending on the load condition and setting condition such as the speed-filter setting.

■ Starting/stopping during continuous operation

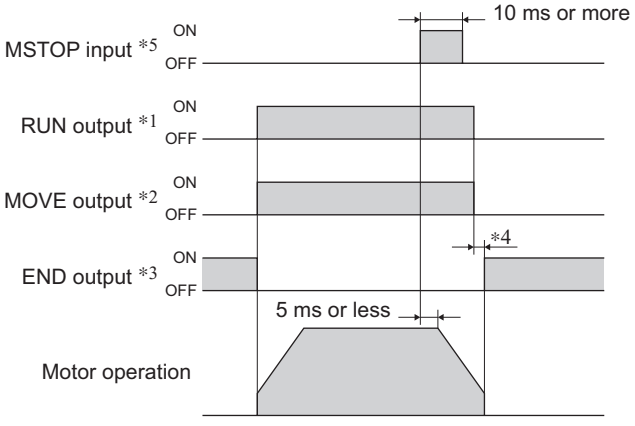
- When the SENSOR input is used: When the stopping action after SENSOR input is either immediate stop or deceleration stop



- When the SENSOR input is used: When the stopping action after SENSOR input isvariable-speed operation

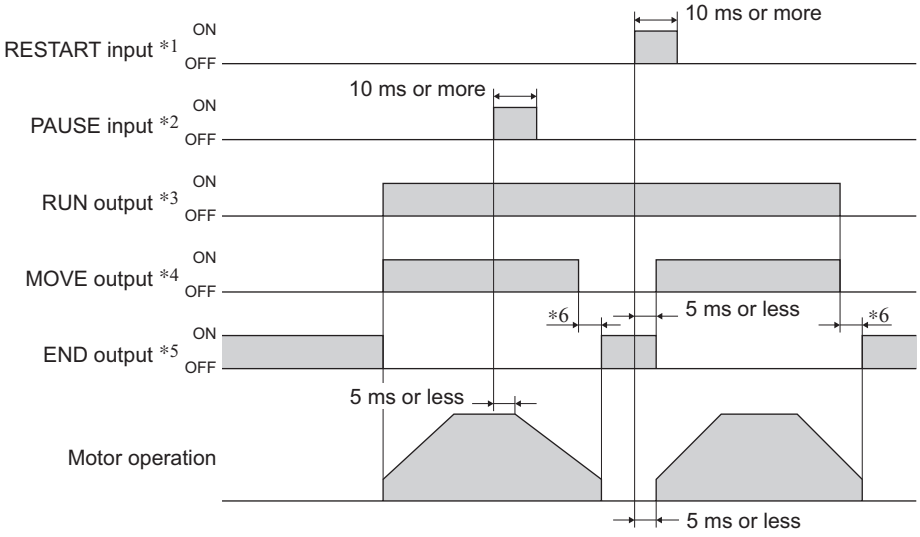


- When the SENSOR input is not used:



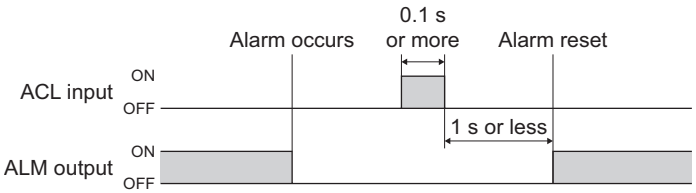
∗1 This applies when the RUN output is assigned to a general output port.
∗2 This applies when the MOVE output is assigned to a general output port.
∗3 This applies when the END output is assigned to a general output port.
∗4 The time required after the operation is complete until the END output turns ON will vary, depending on the load condition and setting condition such as the speed-filter setting.
∗5 This applies when the MSTOP input is assigned to a general input port.

■ At temporary stop (PAUSE input)



∗1 This applies when the RESTART input is assigned to a general input port.
∗2 This applies when the PAUSE input is assigned to a general input port.
∗3 This applies when the RUN output is assigned to a general output port.
∗4 This applies when the MOVE output is assigned to a general output port.
∗5 This applies when the END output is assigned to a general output port.
∗6 The time required after the operation is complete until the END output turns ON will vary, depending on the load condition and setting condition such as the speed-filter setting.

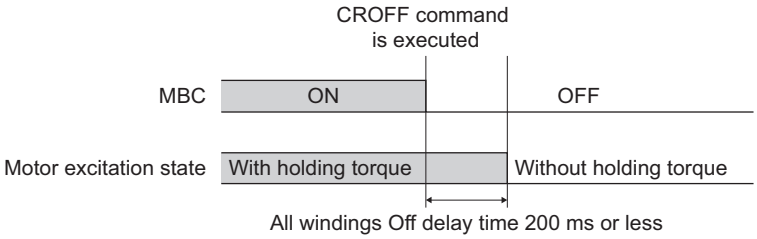
■ ALM output and ACL input



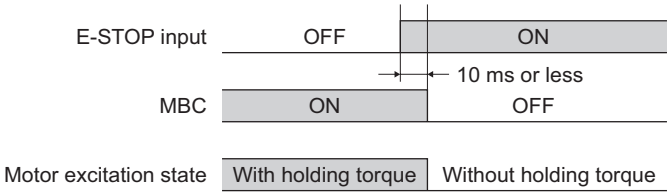
■ MBC output

The MBC output turns OFF when the motor loses its holding brake force after the current has been cut off or a protective function has been activated.

- When the CROFF command is executed

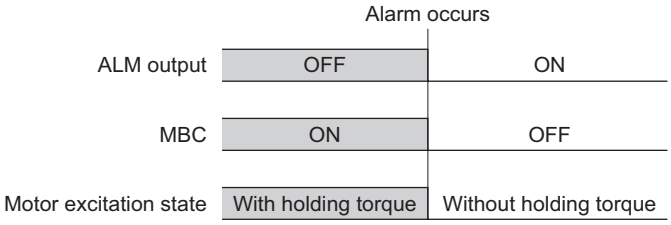


- When the stopping method upon E-STOP input is “current OFF”



Note When the stopping action upon E-STOP input is set to “current OFF,” the motor immediately enters a current-OFF (unexcited) state. Note that the equipment may continue to operate due to gravity, etc., until the brake is applied.

- When a protective function to turn the current off is activated



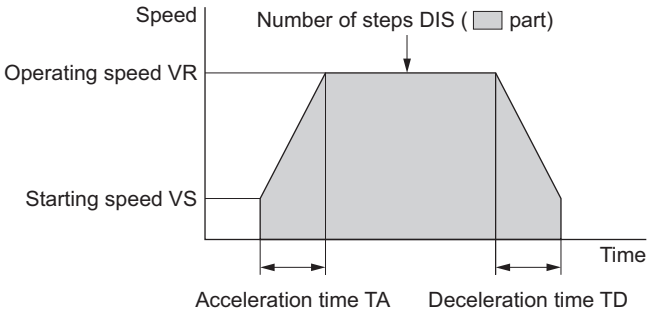
Note When the stopping action upon E-STOP input is set to “current OFF,” the motor immediately enters a current-OFF (unexcited) state. Note that the equipment may continue to operate due to gravity, etc., until the brake is applied.

7 Types of operation

αSTEP built-in controller (stored program) package supports four types of operation: positioning operation, continuous operation, electrical home seeking and mechanical home seeking.
This section explains each of these operations.

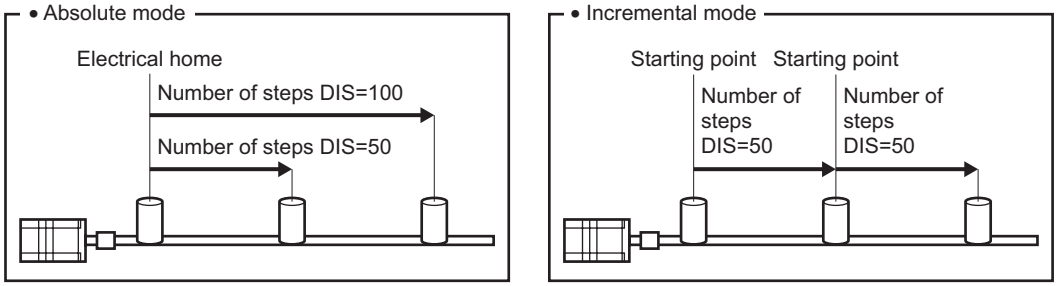
7.1 Positioning operation

Positioning operation is one in which motor speed, number of steps and other items are set as operating data and then executed.
When positioning operation is executed, the motor starts at the starting speed VS and accelerates to the operating speed VR over the acceleration time TA. After reaching the operating speed, the motor continues to operate at that speed. When the stopping position approaches, the motor decelerates to the starting speed VS over the deceleration time TD, and then stops.
Linked operation can be set in which the next operation starts without stopping the operation currently being executed.



■ Positioning modes

Two positioning modes are available for use in the positioning operation: Absolute mode and Incremental mode.
In Absolute mode the number of steps from electrical home is set.
In Incremental mode each motor destination becomes the starting point for the next movement. This mode is suitable when the same number of steps is repeatedly used.

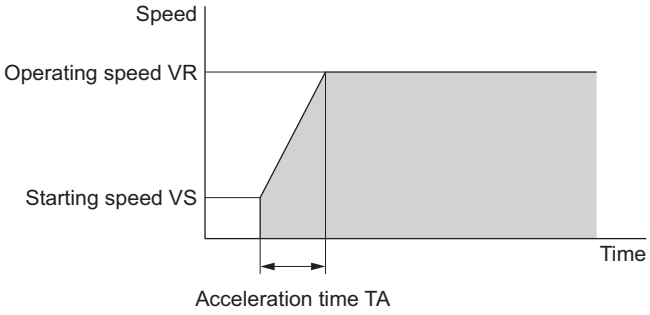


7.2 Continuous operation

Continuous operation refers to a type of operation in which the motor continues to operate until an MSTOP command is input or a signal to stop the operation (MSTOP input, E-STOP input or SENSOR input) is turned ON. The motor starts at the starting speed VS and accelerates to the operating speed VR over the acceleration time TA.
The stopping action for continuous operation varies, depending on the command or signal used.

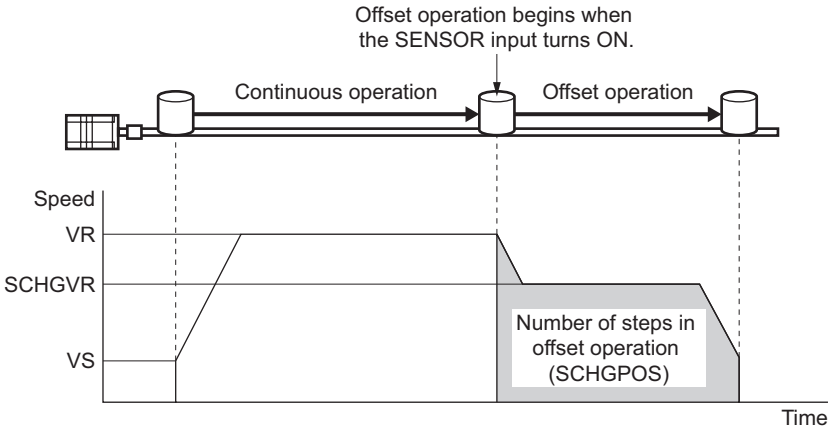
Signals · Command	Description
MSTOP command MSTOP input E-STOP input	The motor decelerates to a stop.
SENSOR input	Set the motor action using a SENSORACT command. Four motor actions can be set with a SENSORACT command: immediate stop, deceleration stop, non-action (the motor doesn't stop but continues to operate), and offset operation (variable-speed operation is executed according to the number of steps set in the SCHGPOS command).

Note The SENSOR input is not active in mechanical home hunting.



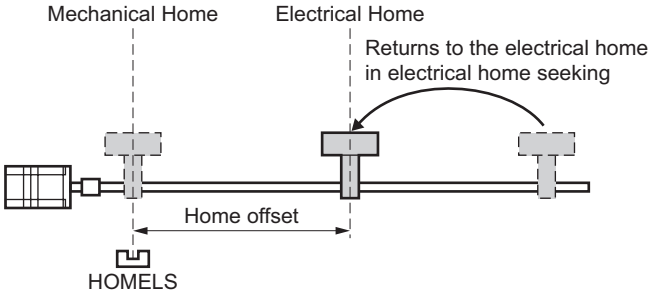
■ Offset operation

Offset operation refers to a type of operation in which the motor travels the number of steps set in the SCHGPOS command before stopping, when the SENSOR input is turned ON. To perform offset operation, set the number of offset steps and operating speed.



7.3 Electrical home seeking and mechanical home seeking

The unit counts the number of steps during operation using the driver's internal counter. The position at which the counter value becomes 0 is called "electrical home," and accordingly the operation that returns the motor to its electrical home is called "electrical home seeking." On the other hand, the home defined by devices such as sensors is called "mechanical home," and the operation that detects the mechanical home is called "mechanical home seeking." When mechanical home seeking is complete, the internal counter is reset to 0, meaning that the mechanical home position thus becomes the electrical home also.
To set the electrical home at a position different from that of mechanical home, set the home offset (offset from mechanical home).
When a home offset is set, the internal counter is reset to 0 once the motor has traveled the offset amount after detecting the mechanical home. In other words, the home offset position is set as the electrical home.



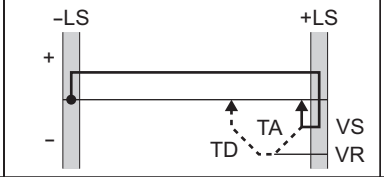
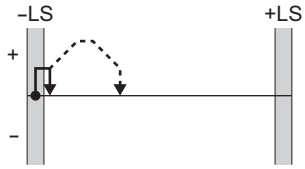
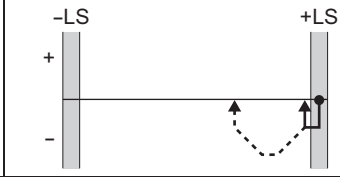
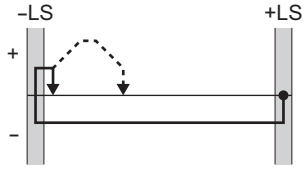
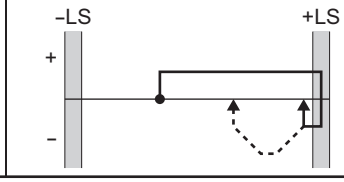
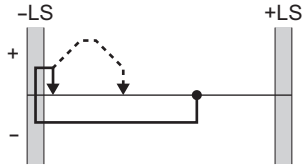
Note When turning on the power, or resetting a specific alarm (See p.112), the position counter value is reset to zero. It is necessary to set an electrical home again by executing the mechanical home seeking.

7.4 Mechanical home seeking

Mechanical home seeking is an operation in which the motor travels from the current position and returns to the mechanical home (sensor position).
Mechanical home seeking is performed in two modes—2-sensor mode and 3-sensor mode—depending on the number of detection sensors installed in the system. In 2-sensor mode, there are two types of sensors (+LS and −LS) used to return the current position to mechanical home at a constant speed. Either the +LS or −LS position becomes the mechanical home. In 3-sensor mode, there are three types of sensors (+LS, −LS and HOMELS) used to return the current position to mechanical home at high speed. The HOMELS position becomes the mechanical home.
When a home offset from mechanical home is set, the motor stops at the home offset position when mechanical home seeking is complete.

- 2-sensor mode

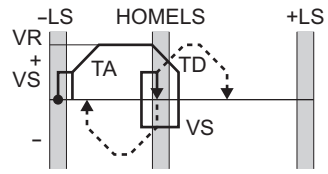
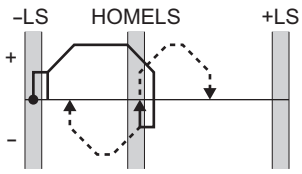
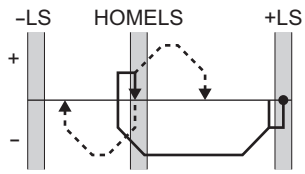
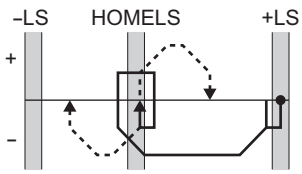
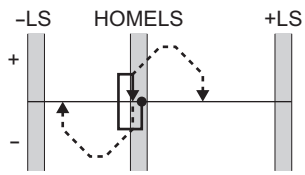
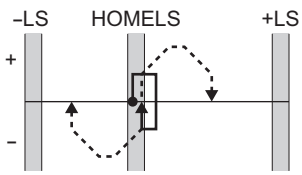
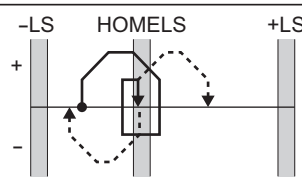
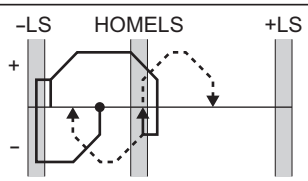
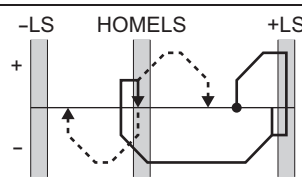
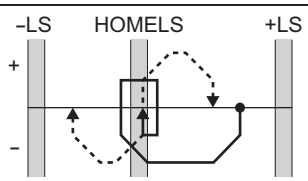
------ indicates when home-offset travel has been set.

Starting position of mechanical home seeking	Starting direction of mechanical home seeking: +	Starting direction of mechanical home seeking: –
–LS		
+LS		
between –LS and +LS		

Memo | In 2-sensor mode, VS is used as the operating speed.

- 3-sensor mode

------ indicates when home-offset travel has been set.

Starting position of mechanical home seeking	Starting direction of mechanical home seeking: +	Starting direction of mechanical home seeking: –
–LS		
+LS		
HOMELS		
between HOMELS and –LS		
between HOMELS and +LS		

Memo | In 3-sensor mode, VR is the operating speed.

8 Program creation and execution

This chapter explains the methods used to create new programs, edit existing programs and execute programs.

8.1 Overview of operation

Driver commands and programs are created by entering commands and parameters from a terminal program. You can choose one of three operating modes (monitor mode, program-edit mode and sequence mode) to begin a desired task from a terminal.

- Monitor mode

The system starts in this mode when the driver's power is input.
In the monitor mode you can create, delete, copy and lock programs. Additionally, the status of the driver and I/O signals can be monitored.

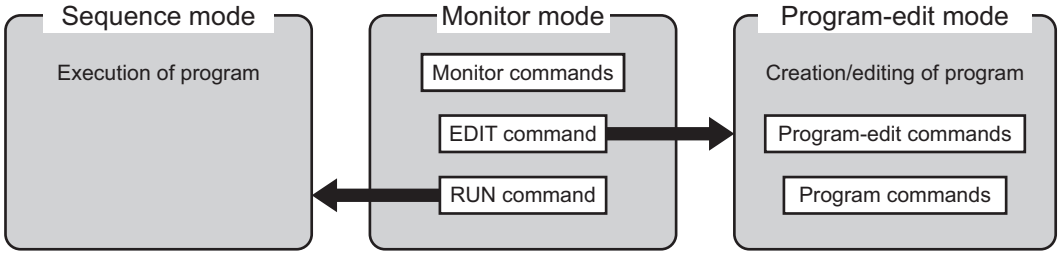
- Program-edit mode

The system enters this mode when "EDIT" is entered in the monitor mode.
In the program-edit mode you can edit a program by changing, inserting or deleting the specified lines. You can also perform a syntax check.

- Sequence mode

The system enters this mode and executes the specified program when "RUN" is entered in the monitor mode.
Program execution ends when any of the following conditions is satisfied:

- The END command or STOP command written in the program is executed
- The E-STOP input is turned ON
- The ESC key is pressed
- An error has occurred



8.2 Communication and terminal specifications

Please set up the terminal program used when creating a program to the following specifications.

■ Communication specification

Item	Description
Electrical characteristics	In conformance with RS-232C.
Transmission method	Start-stop synchronous method, NRZ (Non-Return to Zero), full-duplex
Data length	8 bits, 1 stop bit, no parity
Transmission speed	9600 bps
Connector specification	Modular (4 lines, 4 pins)
Protocol	TTY (CR+LF)

■ Terminal specification

- ASCII mode
- VT 100 compatible recommended
- Handshake: None
- Word wrap: None
- Local echo: None
- Beep sound: ON
- Transmission CR: C-R (It is not transform and add to LF)

8.3 Creating a program

Programs contain data with which to define motor operation, such as the operating speed and travel.
When a program is started, the commands entered in the program are executed in order.
Programs are stored in the driver's memory.

1. Connect the driver with the terminal.
2. Enter a monitor command "EDIT ∗" (∗ indicates a program name).
   Insert a space between "EDIT" and the program name.
   When the command is entered, a message indicating a blank program (This program is new.) is displayed.
   Subsequently, "(1)" is displayed and the system enters the program-edit mode.
   You can now create a program.

```
ALPHA STEP DRIVER

>EDIT SAMPLE1
This program is new.
Program Name : SAMPLE1
(1)
```

3. Enter commands and parameters by referring to Chapter 6 "Command List" and create a program.
   The following shows a sample program. This program, SAMPLE1, executes an absolute positioning operation at a starting speed of 100 Hz and operating speed of 3000 Hz, with a distance of 5000 steps.

```
ALPHA STEP DRIVER

>EDIT SAMPLE1
This program is new.
Program Name : SAMPLE1
(1) VS=100
(2) VR=3000
(3) DIS=5000
(4) MA
(5) END
```

4. When the program entry is complete, press the ESC key.
The program is saved in the memory and a syntax check is performed. When an error in syntax is found, the line number on which the error was found is displayed together with the nature of the error.

```
ALPHA STEP DRIVER

>EDIT SAMPLE1
This program is new.
Program Name : SAMPLE1
(1) VS=100
(2) VR=3000
(3) DIS=5000
(4) MA
(5) END
(6)

/* Save Program */

>_
```

The following example shows that an error was found in the parameter in line 3 (out-of-range error).

```
ALPHA STEP DRIVER

>EDIT SAMPLE2
This program is new.
Program Name : SAMPLE2
(1) VS=100
(2) VR=3000
(3) DIS= 500000000000000
(4) MA
(5) END
(6)

          line No.3     Number out of range
          Syntax Error
>_
```

8.4 Editing a program

In the program-edit mode, existing programs can be edited by changing, inserting and deleting lines. The method used to enter commands is the same as when creating a new program.

1. Enter the monitor command “EDIT ∗” (∗ indicates a program name).
   Insert a space between “EDIT” and the program name.
   The system enters the program-edit mode and displays the contents of the selected program for editing.

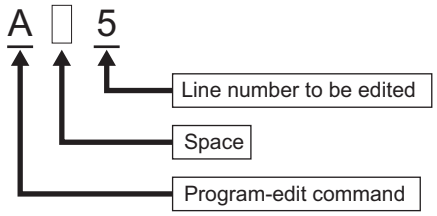
```
ALPHA STEP DRIVER

>EDIT PROGRAM1
This program is already exists.

Program Name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : _
```

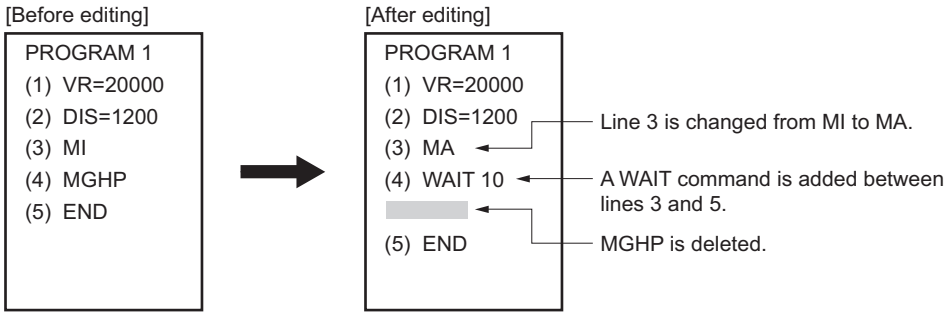
2. Enter a program-edit command and a line number according to the edit operation you wish to perform.
   Insert a space between the program-edit command and the line number.



Command	Description
A	Alter (change)
D	Delete
I	Insert
X	Cut
P	Paste
C	Copy
S	Save, syntax check
Q	Quit without saving
HELP or H	Display help

■ Example of line editing

This section explains the steps to edit PROGRAM1 as follows:



1. Enter “EDIT PROGRAM1” and press the Enter key.
   After the contents of PRGORAM1 are displayed, “>>COMMAND:” is displayed and the monitor waits for editing input.

```
ALPHA STEP DRIVER

>EDIT PROGRAM1
This program is already exists.

Program Name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : _
```

2. Change line 3 from “MI” to “MA” using the following steps:

   a. Enter “A 3” and press the Enter key.
      Line 3 becomes editable.

```
ALPHA STEP DRIVER

>EDIT PROGRAM1
This program is already exists.

Program Name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : A 3
(3) MI
(3) _
```

b. Enter “MA.”

```
ALPHA STEP DRIVER

>EDIT PROGRAM1
This program is already exists.

Program Name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : A 3
(3) MI
(3) MA
```

c. Press the Enter key.
Line 3 of PROGRAM1 is changed to “MA.” The command prompt is displayed and the monitor waits for the next program-edit command.

```
Program Name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : A 3
(3) MI
(3) MA

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) MGHP
(5) END

>>COMMAND : _
```

3. Insert “WAIT 10” below line 3 using the following steps:

a. Enter “I 4” and press the Enter key.
Line 4 is added, and the monitor waits for a command.

```
(1) VR=20000
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : A 3
(3) MI
(3) MA

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) MGHP
(5) END

>>COMMAND : I 4
(4) _
```

b. Enter “WAIT 10.”

```
(1) VR=20000
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : A 3
(3) MI
(3) MA

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) MGHP
(5) END

>>COMMAND : I 4
(4) WAIT 10
```

c. Press the Enter key.
“WAIT 10” is added to line 4 of PROGRAM1.
You will now insert a new line at line 5.

```
(2) DIS=1200
(3) MI
(4) MGHP
(5) END

>>COMMAND : A 3
(3) MI
(3) MA

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) MGHP
(5) END

>>COMMAND : I 4
(4) WAIT 10
(5)
```

d. Press the ESC key.
A new line is inserted and each of the subsequent line numbers increases by one. The command prompt is displayed and the monitor waits for the next program-edit command.

```
(1) VR=20000
(2) DIS=1200
(3) MA
(4) MGHP
(5) END

>>COMMAND : I 4
(4) WAIT 10
(5) _

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) MGHP
(6) END

>>COMMAND : _
```

4. Delete “MGHP” from line 5 using the following steps:

a. Enter “D 5” and press the Enter key.
A message to confirm the deletion (Delete OK? (Y/N)) is displayed.

```
(3) MA
(4) MGHP
(5) END

>>COMMAND : I 4
(4) WAIT 10
(5) _

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) MGHP
(6) END

>>COMMAND : D 5
(5) MGHP
            Delete OK? ( Y/N )
```

b. Enter “Y.”
Line 5 of PROGRAM1 is deleted, and each of the subsequent line numbers decreases by one. The command prompt is displayed and the monitor waits for the next program-edit command.

```
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) MGHP
(6) END

>>COMMAND : D 5
(5) MGHP
            Delete OK? ( Y/N ) Y

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) END

>>COMMAND : _
```

■ Ending the edit session

1. Enter the command “S” to end the session after saving the edited contents, then press the Enter key.
   A message to confirm the save (Program Save? (Y/N)) is displayed.

```
(3) MA
(4) WAIT 10
(5) MGHP
(6) END

>>COMMAND : D 5
(5) MGHP
            Delete OK? ( Y/N ) Y

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) END

>>COMMAND : S

            Program Save? ( Y/N )
```

2. Enter “Y.”
   The edited contents are saved, and a syntax check is performed.
   When an error in syntax is found, the line number on which the error was found is displayed together with the nature of the error. When the syntax check is complete, a “>” (command prompt) is displayed.

```
>>COMMAND : D 5
(5) MGHP
            Delete OK? ( Y/N ) Y

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) END

>>COMMAND : S

            Program Save? ( Y/N ) Y

/* Save Program */

>_
```

8.5 Executing a program

You can execute programs stored in the driver's memory.
Enter a command on the terminal screen to execute the program.

■ Executing a program with a terminal

1. Connect the driver with the terminal.
2. Enter a monitor command "RUN ∗" (∗ indicates a program name).
   Insert a space between "RUN" and the program name.
   When the command is entered, the system enters the sequence mode and executes the program.

■ Executing a program with a START input

When the START input is turned ON, the STARTUP program is executed.

Note When starting a program, the system resets all program variables to 0 and cancels signal assignments for all general I/O ports.
Example: If the signal assignments for general I/O ports are different between program A and program B, when program B is started the settings in program A are cleared and the assignments in program B are set again.

8.6 Error messages displayed on the terminal

This section lists error messages that may be displayed on the terminal during program creation, syntax check and program execution.

■ Error messages displayed during program creation

∗∗∗ Maximum number of lines exceeded ∗∗∗

Description	The number of lines in the program has exceeded 64.
Cause/action	Revise the program so that the number of lines is 64 or less.

∗∗∗ Maximum number of programs exceeded ∗∗∗

Description	The maximum number of programs already exists.
Cause/action	To create a new program, delete one existing program.

∗∗∗ Maximum program size (1 Kbyte) exceeded ∗∗∗

Description	The program size has exceeded 1 kB.
Cause/action	Revise the program so that the program size is 1 kB or less.

∗∗∗ Memory read error ∗∗∗

Description	The data stored in the memory is damaged.
Cause/action	Delete the program, then enter it again.

∗∗∗ Parameter error ∗∗∗

Description	An incorrect parameter
Cause/action	Enter the correct parameter.

∗∗∗ Program name error ∗∗∗

Description	An incorrect program name
Cause/action	Enter the program name using alphanumeric characters.

∗∗∗ Unrecognized command ∗∗∗

Description	An incorrect command
Cause/action	Enter the correct command.

■ Error messages displayed during syntax check

Calcuration operation error

Description	An incorrect operator
Cause/action	Enter the correct operator.

ENDIF without IF

Description	There is no IF statement corresponding to the ENDIF command.
Cause/action	Revise the structure of the IF statement.

ENDL without LOOP

Description	There is no LOOP statement corresponding to the ENDL command.
Cause/action	Revise the structure of the LOOP statement.

IF without ENDIF

Description	There is no ENDIF in the IF statement.
Cause/action	Revise the structure of the IF statement, making sure one ENDIF command is entered for one IF command.

Illegal function call

Description	A command not requiring parameter has a parameter.
Cause/action	Delete the parameter.

Invalid argument

Description	A command requiring a parameter does not have one.
Cause/action	Enter the parameter.

LOOP without ENDL

Description	There is no ENDL in the LOOP statement.
Cause/action	Revise the structure of the LOOP statement, making sure one ENDL command is entered for one LOOP command.

Number out of range

Description	The parameter exceeds the range of −8 388 608 to +8 388 607.
Cause/action	Enter the correct value.

Syntax error

Description	The program has a syntax error.
Cause/action	Enter the correct commands and values.

WEND without WHILE

Description	There is no WHILE statement corresponding to the WEND command.
Cause/action	Revise the structure of the WHILE statement.

WHILE without WEND

Description	There is no WEND in the WHILE statement.
Cause/action	Revise the structure of the WHILE statement, making sure one WEND command is entered for one WHILE command.

■ Error messages displayed during program execution

Divide by zero

Description Zero division was executed.
Cause/action Revise the program.

Invalid I/O port assignment

Description The signal assignment method for general I/O ports was wrong.
Cause/action Assign signals correctly

Memory read error

Description The data stored in the memory is damaged.
Cause/action Delete the program, then enter it again.

Number out of range

Description The parameter has exceeded its setting range.
Cause/action Enter the correct value.

Out of memory

Description Nesting became deep too much by LOOP~ENDL, CALL, etc., and stack filled.
Cause/action Please make nesting shallow.

PC command error

Description A PC command was executed while the motor was operating or was not energized.
Cause/action Execute the PC command while the motor is at a standstill in the energized state.

Target program does not exit

Description The called program does not exist.
Cause/action Enter a program name that exists.

Unexecutable program

Description The executed program is not executable.
Cause/action Execute a program that is executable.

Variable value overflow

Description The operation result has exceeded the range of −8,388,608 to +8,388,607.
Cause/action Revise the program so that the operation result falls within the specified range.

■ Error messages relating to monitor commands

Command error

Description An incorrect command
Cause/action Enter a correct command.

Data out of range

Description The data has exceeded its setting range.
Cause/action Enter the correct value.

Motor is now running

Description An operation command was entered while the motor was operating.
Cause/action Enter an operation command after the motor stops.

Parameter error

Description An incorrect parameter
Cause/action Enter the correct parameter.

*** Program memory full ***

Description The maximum number of programs already exists.
Cause/action To create a new program, delete one existing program.

Target program name already exists

Description The entered program name already exists.
Cause/action Enter a program name that does not exist.

This program is locked

Description The program is locked.
Cause/action Release the lock before editing.

This program doesn’t exist

Description The program does not exist.
Cause/action Check the program name.

9 Command list

This chapter explains the keys and commands used in communication between the driver and a terminal program.

9.1 Command entry format

■ General

- Enter commands using single-byte alphanumeric characters.
  Commands are not case-sensitive.
- A character string comprised of a command or a command and parameter (s) is called a "line." Only one command can be entered per line.
- Enter a command or a command and parameter (s), then press the ENTER key.
  The entered command will be executed.
- Only integer numbers can be input.

■ Monitor commands and program-edit commands

- Insert a space between the command and parameter, or between the command and program name.
  Example) VS 1000
  DEL PROGRAM1

■ Program commands

- Insert an equal sign (=) between the command and parameter.
  Example) VS=1000
- Always enter an END or RET command in the last line of the program.
  If there is no END command or RET command, the program will not be executed correctly.
- To break a LOOP statement or WHILE statement in the middle, use a BREAKL command or BREAKW command.
  If a JMP command is used to break these statements in the middle, the program will not be executed correctly.
- There is no limit to the number of times that the IF, LOOP, and WHILE statements can be nested (as long as the program does not exceed 64 lines).
- Operations containing program variables take the form of binomial decimal operation.
  The following 10 operators can be used to perform various operations:
  Example) A=X * Y

Operator	Description
+	Addition
−	Subtraction
*	Multiplication
/	Division
%	Modulo (remainder)
&	AND for each bit
|	OR for each bit
^	XOR for each bit
<<	Shift to left bit
>>	Shift to right bit

In an IF or WHILE statement, use the following relational operators:
Example) IF (a!=b)

Operator	Description
a==b	a is equal to b.
a!=b	a is not equal to b.
a<b	a is smaller than b.
a>b	a is larger than b.
a<=b	a is equal to or smaller than b.
a>=b	a is equal to or larger than b.

9.2 Classification of commands

The commands used in αSTEP built-in controller (stored program) pacage programs are classified into three groups: monitor commands, program-edit commands and program commands.

■ Monitor commands

Monitor commands are executed in the monitor mode.
Monitor commands are classified as follows, in accordance with their particular functions:

- Display functions

Command name	Description	Reference
DIR	Display program status	p.63
HELP1, HELP2, HELP3	Display help for monitor commands	p.64
IO	Monitor I/O	p.64
LIST	Display program	p.65
PC	Display command position counter	p.65
REPORT	Display system report	p.66

- Parameter-set functions

When parameters are set using the following commands, the setting becomes effective immediately.
The parameters set by these commands remain effective for all operations until they are changed in the program.

Command name	Description	Reference
CRRUN	Operating current	p.66
CRSTOP	Standstill current	p.66
DIRINV	Rotation direction of motor's output shaft	p.66
DIS	Number of steps	p.66
GEAR1, GEAR2	Electronic gears	p.67
ID	Driver axis setting	p.67
LIMN, LIMP	Software limits	p.67
MSTOPACT	Motor-stopping action upon pressing ESC key or MSTOP input	p.67
OLTIME	Overload detection time	p.67
OVERFLOW	Overflow revolutions	p.68
STRSW	Motor excitation at power-on	p.68
TA	Acceleration time	p.68
TD	Deceleration time	p.68
VFIL	Speed filter	p.68
VR	Operating speed	p.69
VS	Starting speed	p.69

- Operation-execution functions

Command name	Description	Reference
EHOME	Electrical home seeking	p.70
MA	Absolute positioning operation	p.70
MCN, MCP	Continuous operation	p.70
MGHN, MGHP	Mechanical home seeking	p.70
MI	Incremental positioning operation	p.70

- Program-edit functions

Command name	Description	Reference
COPY	Copy program	p.71
DEL	Delete program	p.71
EDIT	Change to program-edit mode	p.71
LOCK	Lock program	p.72
PROGCR	Clear all programs	p.72
REN	Change program name	p.72
UNLOCK	Release program lock	p.72

- Other functions

Command name	Description	Reference
ALMCLR	Clear alarm	p.72
CROFF	Current OFF (motor not energized)	p.72
CRON	Current ON (motor energized)	p.72
IN	General-input port monitor	p.73
MIPRM	Initialize parameters	p.73
OUT	General-output port control (All ports)	p.73
OUTX (X=0 to 7)	General-output port control (1 port at a time)	p.74
RUN	Change to sequence mode	p.74
@0 to @9, @A to @Z	Communication axis call	p.74
<ESC> Key	Stop the motor and program	p.74

■ Program-edit commands

Program-edit commands are executed in the program-edit mode.

Command name	Description	Reference
A	Alter (change) line	p.75
C	Copy line	p.75
D	Delete line	p.75
I	Insert line	p.75
P	Paste line	p.75
Q	Exit program-edit mode (without saving)	p.75
S	Save and exit program	p.76
X	Cut line	p.76
HELP or H	Display help for program-edit commands	p.76

■ Program commands

Program commands are used when creating a program.

Command name	Description	Reference	Command name	Description	Reference
ACLINV	Alarm clear input logic	p.77	LOOP	LOOP statement	p.88
ALM	Alarm code	p.77	MA	Absolute positioning operation	p.88
BREAKL	Break LOOP statement	p.78	MBCINV	MBC output logic	p.88
BREAKW	Break WHILE statement	p.78	MCN, MCP	Continuous operation	p.89
CALL	Call subroutine	p.78	MGHN, MGHP	Mechanical home seeking	p.89
CROFF	Motor non-excitation	p.79	MI	Incremental positioning operation	p.89
CRON	Motor excitation	p.79	MOVEINV	MOVE output logic	p.90
CRRUN	Operating current	p.79	MSTOPACT	Motor-stopping method upon pressing ESC key or MSTOP input	p.90
CRSTOP	Standstill current	p.79	MSTOP	Motor stop	p.90
DIRINV	Rotation direction of motor's output shaft	p.80	MSTOPINV	MSTOP input logic	p.91
DIS	Number of steps in positioning operation	p.80	OFFSET	Offset for mechanical home seeking	p.91
EHOME	Electrical home seeking	p.80	OLTIME	Overload detection time	p.91
ELSE	Branching when condition result of IF statement is false	p.80	OTACT	Stopping action at overtravel	p.92
END	End of program	p.81	OTLV	Hardware-limit sensor logic	p.92
ENDIF	End of IF statement	p.81	OUT	General-output port control (All ports)	p.93
ENDINV	END output logic	p.81	OUTx (x=0 to 7)	General-output port control (1 port at a time)	p.93
ENDL	End of LOOP statement	p.81	OUTEND	END output assignment	p.94
ESTOPACT	Motor-stopping method upon E-STOP input	p.82	OUTHOMEP	HOME-P output assignment	p.94
ESTOPLV	E-STOP-input sensor logic	p.82	OUTMBC	MBC output assignment	p.94
GEAR1,GEAR2	Electronic gears	p.82	OUTMOVE	MOVE output assignment	p.95
HOMELV	HOMELS-input sensor logic	p.82	OUTRUN	RUN output assignment	p.95
HOMEPINV	HOME-P output logic	p.83	OUTSG	Output-signal status read	p.96
HOMETYP	Origin-detection method for mechanical home seeking	p.83	OUTTIM	TIM. output assignment	p.96
IF	Conditional branching of IF statement	p.84	OVERFLOW	Overflow revolutions	p.97
IN	General-input port monitor	p.84	PAUSEINV	PAUSE input logic	p.97
INx (x=0 to 7)	Individual port monitor	p.84	PC	Command position counter	p.97
INACL	Alarm clear input assignment	p.85	RESTARTINV	RESTART input logic	p.98
INITIO	Initialization of general-input port assignment	p.85	RET	Return from subroutine	p.98
INMSTOP	MSTOP input assignment	p.85	RUNINV	RUN output logic	p.98
INPAUSE	PAUSE input assignment	p.86	SAS	Transmission of text	p.99
INRESTART	RESTART input assignment	p.86	SCHGPOS	Number of steps in offset operation after SENSOR input	p.99
JMP	Jump to another line in program	p.86	SCHGVR	Operating speed of offset operation after SENSOR input	p.99
KB	Input value from a keyboard into a program	p.87	SENSORACT	Motor action after SENSOR input	p.100
LIMN, LIMP	Software limits	p.87	SENSORLV	SENSOR-input sensor logic	p.100

Command name	Description	Reference	Command name	Description	Reference
SLACT	Motor action at software overtravel	p.101	WAIT	Wait time	p.105
STOP	Forced stop of program	p.101	WEND	End of WHILE statement	p.105
TA	Acceleration time	p.102	WHILE	WHILE statement	p.105
TD	Deceleration time	p.102	A to Z	Program variables	p.106
TIMER	Software timer	p.102	DISx (x=0 to 3)	Command position in linked operation	p.106
TIMINV	TIM. output logic	p.103	INCABSx (x=0 to 3)	Positioning mode of linked operation	p.107
VFIL	Speed-filter gain	p.103	LINKx (x=0 to 2)	One-shot/linked	p.108
VR	Operating speed	p.104	MIx (x=0 to 3)	Linked operation start	p.109
VS	Starting speed	p.104	VRx (x=0 to 3)	Operating speed of linked operation	p.109

9.3 Details of monitor commands

■ Display functions

DIR

Name	Program status display
Input range	None
Description	Displays the status of the specified program (locked/not locked, executable/not executable).

Example

```
ALPHA STEP DRIVER

>DIR
            SEQUENCE DIRECTORY :

            Program :  STARTUP  (    ,Exe)  Program :  SAMPLE1  (    ,Exe)
            Program :  SAMPLE2  (    ,Exe)  Program :  SAMPLE3  (    ,Exe)
            Program :  TEST1    (    ,Exe)  Program :  TEST2    (    ,Exe)
            Program :  TEST3    (    ,Exe)  Program :  TEST4    (    ,Exe)
```

HELP1, HELP2, HELP3

Name	Monitor-command help
Input range	None
Description	Display help for monitor commands.

Example

```
ALPHA STEP DRIVER

>HELP1
        ∗COMMAND LIST1
        IO              | I/O monitor
        MIPRM           | memory initialize of parameter
        REPORT          | Parameter and I/O status report
        ALMCLR          | Alarm clear
        CRON            | Current ON
        CROFF           | Current OFF
        PC              | position counter
        DIS d           | distance d=[−8388608..8388607]
        VR d            | running velocity d=[0..500000]
        VS d            | starting velocity d=[0..500000]
        TA d            | acceleration time d=[10..10000]
        TD d            | deceleration time d=[10..10000]
        MI              | start INDEX motion (INC)
        MA              | start INDEX motion (ABS)
        MCP             | start SCAN motion (+ direction)
        MCN             | start SCAN motion (− direction)
        MGHP            | start HOME motion (+ direction)
        MGHN            | start HOME motion (− direction)
```

IO

Name	I/O monitor
Input range	None
Description	Displays the ON/OFF status of the I/O signals photocoupler. “1” indicates ON status, while “0” indicates OFF status. This command can also be used to check the signals assigned to general I/O signals.

Example

```
>IO
/   IO REPORT   /-------------------------------------------------------------------------------------------
        ESTOP = 0                   START = 0
        HOMELS = 0      SENSOR = 1      +LS = 0      −LS = 1
            IN0 = [ Status : 0,         Set Signal : general port      ]
            IN1 = [ Status : 0,         Set Signal : general port      ]
            IN2 = [ Status : 0,         Set Signal : general port      ]
            IN3 = [ Status : 0,         Set Signal : general port      ]
            IN4 = [ Status : 0,         Set Signal : general port      ]
            IN5 = [ Status : 0,         Set Signal : general port      ]
            IN6 = [ Status : 0,         Set Signal : general port      ]
            IN7 = [ Status : 0,         Set Signal : general port      ]

        ALM = 0
        OUT0 = [ Status : 0,        Set Signal : general port      ]
        OUT1 = [ Status : 0,        Set Signal : general port      ]
        OUT2 = [ Status : 0,        Set Signal : general port      ]
        OUT3 = [ Status : 0,        Set Signal : general port      ]
        OUT4 = [ Status : 0,        Set Signal : general port      ]
        OUT5 = [ Status : 0,        Set Signal : general port      ]
        OUT6 = [ Status : 0,        Set Signal : general port      ]
        OUT7 = [ Status : 0,        Set Signal : general port      ]
-------------------------------------------------------------------------------------------------------
```

LIST

Name	Program display
Input range	Program name (eight characters or less)
Description	Displays the contents of the specified program. Insert a space between the command and program name.

Example

```
ALPHA STEP DRIVER

>LIST PROGRAM1

Program PROGRAM1
(1) VR=2000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) END
>
```

PC

Name	Command position counter
Input range	−8,388,608 to +8,388,607 [steps]
Description	Displays the value in the command position counter.

Example

```
ALPHA STEP DRIVER

>PC
              PC = 0
>
```

REPORT

Name	System report display
Input range	None
Description	Displays system reports.

Example

```
>REPORT
/  HARDWARE REPORT  /----------------------------------------------------------------------------------------
          +LS = 0   −LS = 0   HOMELS = 0   SENSOR = 0
          START = 0   ESTOP = 0
          IN0 = 0   IN1 = 0    IN2 = 0   IN3 = 0
          IN4 = 0   IN5 = 0    IN6 = 0   IN7 = 0
          OUT0 = 0   OUT1 = 0   OUT2 = 0   OUT3 = 0
          OUT4 = 0   OUT5 = 0   OUT6 = 0   OUT7 = 0
/  PARAMETER REPORT  /---------------------------------------------------------------------------------------
          STRSW = 1   GEAR1 = 1000   GEAR2 = 100   CRRUN = 100   CRSTOP = 50
          VFIL = 70   VS = 50   VR = 10000
          TA = 100   TD = 100   DIRINV = 0   DIS = 2000
          LIMP = 8388607   LIMN = −8388608
          OLTIME = 50   OVERFLOW = 150   ID = 0
/  POSITION REPORT  /----------------------------------------------------------------------------------------
          PC = 0
/  ALARM HISTORY  /------------------------------------------------------------------------------------------
          ALARM HISTORY(1..10) = 42, 42, 42, 42, 42, 42, 42, 68, 66, 66
          ALARM CODE(Now) = 42
```

9.4 Parameter-set functions

CRRUN

Name	Operating current	
Input range	0 to 100 [%] (initial value: 100)	
Description	Sets the motor operating current. Set as a ratio to the motor's rated current.	
Example	>CRRUN 80	The operating current is set to 80 percent of the rated current.

CRSTOP

Name	Standstill current	
Input range	0 to 50 [%] (initial value: 50)	
Description	Sets the motor standstill current. Set as a ratio to the motor's rated current.	
Example	>CRSTOP 40	The standstill current is set to 40 percent of the rated current.

DIRINV

Name	Motor direction	
Input range	0 or 1 (initial value: 0)	
Description	0: CW direction (positive direction) 1: CCW direction (positive direction) Sets the positive direction of motor rotation.	
Example	>DIRINV 1	The positive direction is set to the CCW direction.

Note 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 rotate in the opposite direction of the motor shaft.

DIS

Name	Number of steps	
Input range	−8,388,608 to +8,388,607 [steps] (initial value: 0)	
Description	Sets the number of steps. The value set by this command remains effective until it is changed.	
Example	>DIS 50000	The number of steps is set to 50000.

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

GEAR1, GEAR2

Name	Electronic gears
Input range	1 to 10000 (initial value: GEAR1 = 1000, GEAR2 = 100)
Description	Set the electronic gears. The motor resolution is set as follows, in accordance with the settings of electronic gears: $\text{Motor resolution (step/rev)} = \frac{\text{GEAR1}}{\text{GEAR2}} \times 100$ Set GEAR1 and GEAR2 within the following range: $\text{Motor speed (r/min)} = \frac{\text{GEAR2}}{\text{GEAR1} \times 100} \times \text{Operating speed} \times 60$ Set the motor speed in accordance with the values of GEAR1 and GEAR2. $500 \leqq \frac{\text{GEAR1}}{\text{GEAR2}} \times 100 \leqq 10000$
Example	>GEAR1 100 >GEAR2 20 — The motor resolution is given as (100/20) × 100 = 500 steps/rev.

ID

Name	Driver axis setting
Input range	0 to 9, A to Z (initial value: 0)
Description	Sets the axis number for each driver when two or more drivers are connected via a daisy-chain (up to 36 drivers).
Example	>ID 1 — The driver's axis number is set to 1.

Note
- When implementing daisy-chain connections, connect the axes to the RS-232C communication port (CN1) one by one and set the axis number.
- Do not use duplicate ID numbers.

LIMN, LIMP

Name	Software limits
Input range	−8,388,608 to +8,388,607 [steps] (Initial value: LIMN = −8,388,608, LIMP = +8,388,607)
Description	Sets the software limits. The software limit is a limit controlled via the software. Set the limits on the negative side and positive side using the LIMN command and LIMP command, respectively.
Example	>LIMN −10000 — The software limit on the negative side is set to −10000. >LIMP 10000 — The software limit on the positive side is set to 10000.

Note After completing the mechanical home seeking, this setting becomes active. When turning on the power, or resetting a specific alarm (See p.112), this setting becomes invalid. In each case, it is necessary to complete the mechanical home seeking operation to set the software limits.

MSTOPACT

Name	Motor-stopping method upon pressing ESC key or MSTOP input
Input range	0 or 1 (initial value: 1) 0: Immediate stop 1: Decelerate to stop
Description	Sets how the motor is stopped when the ESC key is pressed or the MSTOP input is turned ON. When the MSTOP input is turned ON, the motor will stop but the program will not.
Example	>MSTOPACT 1 — The motor decelerates to a stop when the MSTOP input is turned ON.

OLTIME

Name	Overload detection time
Input range	Input range: 5 to 250 [× 0.1 s] (initial value: 50 (5.0 s.))
Description	Sets the time until an overload protection alarm (alarm code: 30h) is detected.
Example	>OLTIME 200 — The overload protection time is set to 200 (200 × 0.1 = 20 s.).

Note This setting becomes effective once the power is turned off and on again.

OVERFLOW

Name	Overflow revolutions	
Input range	1 to 30000 [× 0.02 revolutions] (initial value: 150 (3 revolutions))	
Description	Sets the overflow revolutions until an excessive position-deviation alarm (alarm code: 10h) is detected.	
Example	>OVERFLOW 100	The overflow revolutions are set to 100 (100 × 0.02 = 2 revolutions).

Note This setting becomes effective once the power is turned off and on again.

STRSW

Name	Motor excitation at power-on	
Input range	0 or 1 (initial value: 1) 0: Not excited (current OFF) 1: Excited (current ON)	
Description	Description: Sets whether or not the motor is excited when the power is input to the driver. The value set by this command remains effective until it is changed.	
Example	>STRSW 1	The motor is excited (current ON) when the power is input.

TA

Name	Acceleration time	
Input range	10 to 500,000 [ms] (initial value: 1000)	
Description	Sets the acceleration time. The value set by this command remains effective until it is changed.	
Example	>TA 100	The acceleration time is set to 100 ms.

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

TD

Name	Deceleration time	
Input range	10 to 500,000 [ms] (initial value: 1000)	
Description	Sets the deceleration time. The value set by this command remains effective until it is changed.	
Example	>TD 100	The deceleration time is set to 100 ms.

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

VFIL

Name	Speed-filter gain	
Input range	1 to 1024 (initial value: 70)	
Description	Sets the speed-filter gain. When a speed-filter gain is set, motor action becomes more smooth at start and stop, and thus vibration and shock can be reduced. Setting a smaller speed-filter gain makes the motor operation smoother, but synchronism with commands can be lost. Set an appropriate speed-filter gain according to the motor's load and application. The value set by this command remains effective until it is changed. $\text{Filter time constant (ms)} = \frac{1}{\text{Speed-filter gain}} \times 81.92$	
Example	>VFIL 90	The speed-filter gain is set to 90.

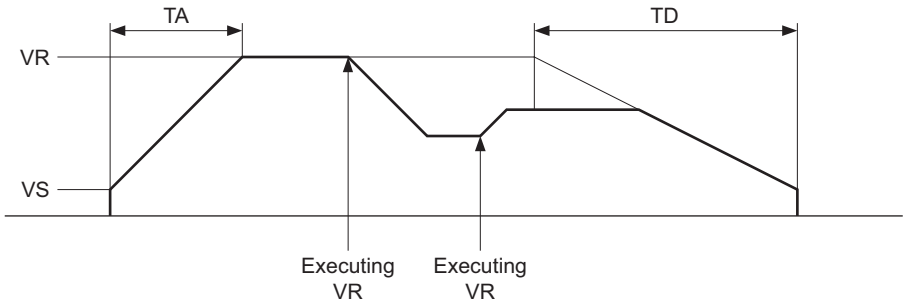
Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

VR

Name	Operating speed	
Input range	1 to 500,000 [Hz] (initial value: 1000)	
Description	Sets the operating speed. The value set by this command remains effective until it is changed.	
Example	>VR 5000	The operating speed is set to 5000 Hz.

Note

- The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.
- The operating speed for INDEX, SCAN and RETURN modes can be changed by using this command. This operating speed can not be changed during a mechanical home seeking operation.
- As for the acceleration/deceleration rates during speed-change operation, the acceleration rate is set by the acceleration time (TA) from the starting speed (VS) to the operating speed (VR). When the operation finally stops, the motor decelerates at the deceleration rate set by the deceleration time (TD) from the operating speed (VR) to the starting speed (VS). (See the figure below.)



VS

Name	Starting speed	
Input range	1 to 500,000 [Hz] (initial value: 100)	
Description	Sets the starting speed. The value set by this command remains effective until it is changed.	
Example	>VS 1000	The starting speed is set to 1000 Hz.

Note

The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

■ Operation-execution functions

EHOME

Name	Electrical home seeking	
Input range	None	
Description	Executes electrical home seeking. For electrical home seeking, see 7.3 “Electrical home seeking and mechanical home seeking” on p.44	
Example	>EHOME	Electrical home seeking is executed.

MA

Name	Absolute positioning operation	
Input range	None	
Description	Executes the absolute positioning operation. For the absolute positioning operation, see 7.1 “Positioning operation” on p.42.	
Example	>MA	Absolute positioning operation is executed.

MCN, MCP

Name	Continuous operation	
Input range	None	
Description	Executes continuous operation. The MCN command executes continuous operation in the negative direction, while the MCP command executes the same in the positive direction. For continuous operation, see 7.2 “Continuous operation” on p.43.	
Example	>MCN	Continuous operation is executed in the negative direction.

MGHN, MGHP

Name	Mechanical home seeking	
Input range	None	
Description	Executes mechanical home seeking. The MGHN command executes mechanical home seeking in the negative direction, while the MGHP command executes the same in the positive direction. If the starting speed VS is lower than 250 Hz during origin detection, VS is automatically set to 250 Hz. For mechanical home seeking, see 7.4 “Mechanical home seeking” on p.44.	
Example	>MGHP	Mechanical home seeking is executed in the positive direction.

MI

Name	Incremental positioning operation	
Input range	None	
Description	Executes the incremental positioning operation. For incremental positioning operation, see 7.1 “Positioning operation” on p.42.	
Example	>MI	Incremental positioning operation is executed.

■ Program-edit functions

COPY

Name	Program copy
Input range	Program name 1 (eight characters or less), program name 2 (eight characters or less)
Description	When this command is entered in the “COPY program name 1 program name 2” format, program name 1 will be copied to program name 2.
Example	>COPY PROG1 PROG2 “PROG1” is copied to “PROG2.”

DEL

Name	Program deletion
Input range	Program name (eight characters or less)
Description	Deletes the specified program. When this command is entered, a confirmation message (Program Delete? (Y/N)) will be displayed. Enter “Y” to delete the specified program.

Example

```
ALPHA STEP DRIVER

>DEL PROGRAM1

Program name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) END

                Program Delete? ( Y/N )
```

EDIT

Name	Change to program-edit mode
Input range	Program name (eight characters or less)
Description	The system enters the program-edit mode to allow editing of the specified program.

Example

```
ALPHA STEP DRIVER

>EDIT PROGRAM1
This program already exists.

Program name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) END

>>COMMAND : _
```

LOCK

Name	Program lock	
Input range	Program name (eight characters or less)	
Description	Locks the specified program to disable editing or deletion. Whether or not the program is locked can be checked with a DIR command.	
Example	>LOCK PROG1	PROG1 is locked.

PROGCLR

Name	All program clear	
Input range	None	
Description	Clears all programs.	
Example	>PROGCLR	All programs are cleared.

REN

Name	Program name change	
Input range	Program name 1 (eight characters or less), program name 2 (eight characters or less)	
Description	When this command is entered in the “REN program name 1 program name 2 ” format, the name of program name 1 will be changed to that of program name 2.	
Example	>REN PROG1 PROG2	The name of “PROG1” is changed to that of “PROG2.”

UNLOCK

Name	Program lock release	
Input range	Program name (eight characters or less)	
Description	Releases the program that has been locked with a LOCK command, to enable editing and deletion.	
Example	>UNLOCK PROG1	PROG1’s lock is released.

■ Other functions

ALMCLR

Name	Alarm clear	
Input range	None	
Description	Resets the alarm being presented. For resetting the alarm, see “Resetting the protective function” on p.112.	
Example	>ALMCLR	The alarm is reset.

Note See “Resetting the protective function” on p.112 for details.

CROFF

Name	Motor non-excitation	
Input range	None	
Description	Stops the excitation of the motor (current OFF).	
Example	>CROFF	The motor is not energized.

CRON

Name	Motor excitation	
Input range	None	
Description	Excites the motor (current ON).	
Example	>CRON	The motor is energized.

IN (Monitor mode)

Name	General-input port monitor
Input range	None
Description	Indicates the status of input signals. • Only the ON (1) or OFF (0) status of the photocoupler is shown. • The setting of the ＊INV command (e.g. MOVEINV) has no effect on the value shown with this command. • The status of the inputs are displayed as follows sequentially from the left. E-STOP START_HOMELS SENSOR +LS −LS_X0 X1 X2 X3 X4 X5 X6 X7

Example

```
>IN                    General-input port monitor
  00 0010 01000000     +LS and X1 input are ON
>
```

Note If any of the general I/O ports have been assigned to a particular function (e.g. INPAUSE, OUTMOVE), those assignments will become invalid when this command is executed in the monitor mode. If you input the START signal, it will start the program which is named “STARTUP”. And if you input the E-STOP and/or +/-LS, it will turn on the alarm.

MIPRM

Name	Parameter initialization	
Input range	None	
Description	Initializes parameters stored in the memory and returns them to their initial values.	
Example	>MIPRM	Parameters stored in the memory are initialized.

OUT (Monitor mode)

Name	General-output port control (All ports)
Input range	0 to 255
Description	Controls the ON/OFF state of a general-output signal port at one time.

General output port	Assigned bit (0: ON, 1: OFF)	Decimal value
Y0 output	Bit 0	01
Y1 output	Bit 1	02
Y2 output	Bit 2	04
Y3 output	Bit 3	08
Y4 output	Bit 4	16
Y5 output	Bit 5	32
Y6 output	Bit 6	64
Y7 output	Bit 7	128

Only the ON (1) or OFF (0) status of the photocoupler is shown. The setting of the ＊INV command (e.g. MOVEINV) has no effect on the value shown with this command.

Example

```
>OUT 33                Turn on outputs Y0 and Y5
```

Note If any of the general I/O ports have been assigned to a particular function (e.g. INPAUSE, OUTMOVE), those assignments will become invalid when this command is executed in the monitor mode.

OUT x (x = 0 to 7) (Monitor mode)

Name	General-output port control (1 port at a time)	
Input range	0 or 1 0: OFF 1: ON	
Description	Controls the ON/OFF of general output port number x. Only the ON (1) or OFF (0) status of the photocoupler is shown. The setting of the *INV command (e.g. MOVEINV) has no effect on the value shown with this command.	
Example	>OUT0 1	Turn on output Y0

Note If any of the general I/O ports have been assigned to a particular function (e.g. INPAUSE, OUTMOVE), those assignments will become invalid when this command is executed in the monitor mode.

RUN

Name	Change to sequence mode	
Input range	Program name (eight characters or less)	
Description	The system enters the sequence mode and executes the specified program.	
Example	>RUN PROG1	The system enters the sequence mode and executes PROG1.

Note When starting a program, the system resets all program variables to 0 and cancels signal assignment for all general I/O ports.

@0 to @9, @A to @Z

Name	Communication axis call	
Input range	None	
Description	Calls a specific driver used for communication when two or more drivers are connected via a daisy-chain (up to 36 drivers).	
Example	>@1	The driver whose axis number is 1 is called and connected to the communication line.

<ESC> Key

Name	Stop the motor and program
Input range	None
Description	The motor and any running program are stopped by an <ESC> key input. The motor will stop according to the set up of the MSTOPACT command.
Example	> <ESC>

9.5 Details of program-edit commands

Specifications of program-edit commands

- Maximum number of commands entered per line: 1 command
- Maximum number of lines per program: 64 lines

A

Name	Alter line	
Input range	Line number	
Description	Allows changes to the contents of the specified line. Insert a space between the command and line number.	
Example	>>COMMAND: A 2	The contents of line 2 are changed.
	(2) TD=50	The contents currently set in line 2 are displayed.
	(2)	Enter new contents.

C

Name	Copy line	
Input range	Line number 1, line number 2	
Description	When this command is entered in the “C line number 1 line number 2” format, line number 1 through line number 2 will be copied and stored in the buffer. Insert a space between the command and line number 1, and between line number 1 and line number 2.	
Example	>>COMMAND: C 2 4	Lines 2 through 4 are copied and stored in the buffer.

D

Name	Delete line	
Input range	Line number	
Description	Deletes the specified line. Insert a space between the command and line number. When this command is entered, a confirmation message (Delete OK? (Y/N)) will be displayed. Enter “Y” to delete the specified line number.	
Example	>>COMMAND: D 2	Line 2 is deleted.

I

Name	Insert line	
Input range	Line number	
Description	Inserts a new line at the specified line. Insert a space between the command and line number.	
Example	>>COMMAND: I 2	A new line is inserted at line 2.
	(2)	Enter new contents.

P

Name	Paste line	
Input range	Line number	
Description	Pastes onto the specified line the contents copied with a “C” command or “X” command. Insert a space between the command and line number.	
Example	>>COMMAND: P 2	The contents cut with an X command are pasted onto line 2.

Q

Name	End of program-edit mode (without save operation)	
Input range	None	
Description	Ends the program-edit mode without saving the program being edited. When this command is entered, a confirmation message (Not Save? (Y/N)) will be displayed. Enter “Y” to end the program-edit mode without saving the program.	
Example	>>COMMAND: Q	The program-edit mode will be ended without saving the program being edited.

S

Name	Program save/end of program
Input range	None
Description	Saves the program being edited and performs a syntax check (compiling function). When this command is entered, a confirmation message (Program Save? (Y/N)) will be displayed. Enter “Y” to save the program and perform the syntax check. If an error in syntax is found, the line number where the error was found is displayed together with the nature of the error.

Example

```
>>COMMAND : D 5
(5) MGHP
            Delete OK? ( Y/N ) Y

Program PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) WAIT 10
(5) END

>>COMMAND : S

            Program Save? ( Y/N ) Y

/*Save Program */

> _
```

X

Name	Cut line
Input range	Line number 1, line number 2
Description	When this command is entered in the “X line number 1 line number 2” format, line number 1 through line number 2 will be cut and stored in the buffer. Insert a space between the command and line number 1, and between line number 1 and line number 2.
Example	>>COMMAND: X 2 4 Lines 2 through 4 are cut and stored in the buffer.

HELP or H

Name	Program-edit command help
Input range	None
Description	Displays help for program-edit commands.

Example

```
ALPHA STEP DRIVER

>EDIT PROGRAM1
This program already exists.

Program Name : PROGRAM1
(1) VR=20000
(2) DIS=1200
(3) MA
(4) MGHP
(5) END

>>COMMAND : HELP
            A x             | line No.x is altered
            C x1 x2         | lines are copy from line No.x1 to line No.x2
            D x             | line No.x is deleted
            HELP or H       | print editor commands help
            I x             | lines are inserted from line No.x
            P x             | lines are pasted from line No.x
            Q(ESC)          | quit editor
            S               | save program
            X x1 x2         | lines are cut from line No.x1 to line No.x2
```

9.6 Details of program commands

■ How to use the list

Command name	
Name	Indicates the name of the command.
Input range	Indicates the parameter range of the command.
Description	Gives a description of the command.
Access	Indicates the type of memory access. Write: Values are written to memory. Read: Values are read from memory. Command: Appropriate action takes place in accordance with the command setting, without the memory being accessed.
Related commands	Indicates related commands.
Command execution	Indicates operating modes in which this command can be executed. Monitor: Monitor mode Program: Program-edit mode
Example	Gives an example of use or sample program.

ACLINV

Name	Alarm clear input logic	
Input range	0 or 1 (initial value: 0) 0: Action takes place when the photocoupler toggles from ON to OFF. 1: Action takes place when the photocoupler toggles from OFF to ON (inverted).	
Description	Sets the logic for the general input port to which ACL input is assigned.	
Access	Write only	
Related commands	INACL	
Command execution	Program	
Example	(1) INACL=3 (2) ACLINV=1	The ACL input is assigned to the X3 input port. The ACL input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INACL must be entered before ACLINV.

ALM

Name	Alarm code	
Input range	0 to 255	
Description	Outputs alarm codes under protective functions as decimal values. For alarm codes, see "Types of protective functions and check methods" on p.110.	
Access	Read only	
Related commands	ALMCLR	
Command execution	Program	
Example	(1) IF (ALM=16) (2) OUT0=1 (3) ENDIF	If the alarm code is 16 (10 h: excessive position deviation) . The Y0 output is turned ON if the alarm code is 16. The IF statement is ended.

BREAKL

Name	LOOP statement break	
Input range	Condition statement	
Description	Ends a LOOP statement in the middle.	
Access	Command	
Related commands	LOOP, ENDL	
Command execution	Program	
Example	(1) LOOP	The portion up to line 9 is infinitely repeated.
	(2) MI	Incremental positioning operation is executed.
	(3) WAIT 10	The program waits 1 s.
	(4) BREAKL (IN1=1)	If the X1 input is ON, the LOOP statement in line 1 is ended in the middle.
	(5) LOOP 10	The portion up to line 8 is repeated 10 times.
	(6) MI	Incremental positioning operation is executed.
	(7) WAIT 5	The program waits 0.5 s.
	(8) ENDL	The LOOP statement in line 5 is ended.
	(9) ENDL	The LOOP statement in line 1 is ended.
	(10)MI	Incremental positioning operation is executed.

BREAKW

Name	WHILE statement break	
Input range	Condition statement	
Description	Ends a WHILE statement in the middle.	
Access	Command	
Related commands	WHILE, WEND	
Command execution	Program	
Example	(1) WHILE (IN1=1)	If the X1 input is ON, the portion up to line 7 is repeated.
	(2) CALL PROG1	PROG1 is called.
	(3) WHILE (IN2=0)	If the X2 input is OFF, the portion up to line 6 is repeated.
	(4) CALL PROG2	PROG2 is called.
	(5) BREAKW (IN1=1)	If the X1 input is ON, the WHILE statement in line 3 is ended in the middle.
	(6) WEND	The WHILE statement in line 3 is ended.
	(7) WEND	The WHILE statement in line 1 is ended.

CALL

Name	Subroutine call	
Input range	File name (eight characters or less)	
Description	Calls a subroutine. When a RET command is entered, the execution target returns to the original program.	
Access	Command	
Related commands	RET	
Command execution	Program	
Example	PROGRAM SAMPLE1	
	(1) VS=500	The starting speed is set to 500 Hz.
	(2) CALL SAMPLE2	The program named SAMPLE2 is called.
	(3) MI	Incremental positioning operation is executed.
	(4) END	The program is ended.
	PROGRAM SAMPLE2	
	(1) OUT1=1	The Y1 output is turned ON.
	(2) VR=10000	The operating speed is set to 10000 Hz.
	(3) DIS=10000	The number of steps is set to 10000.
	(4) RET	Returns to the original program (SAMPLE1).

CROFF

Name	Motor non-excitation	
Input range	None	
Description	Stops the excitation of the motor (current OFF).	
Access	Command	
Related commands	CRON	
Command execution	Monitor or program	
Example	(1) CROFF	The motor is not energized.

CRON

Name	Motor excitation	
Input range	None	
Description	Excites the motor (current ON)	
Access	Command	
Related commands	CROFF	
Command execution	Monitor or program	
Example	(1) CRON	The motor is energized.

CRRUN

Name	Operating current	
Input range	0 to 100 [%] (initial value: 100)	
Description	Sets the motor operating current. Set as a ratio to the motor's rated current.	
Access	Read and write	
Related commands	CRSTOP	
Command execution	Monitor or program	
Example	(1) CRRUN=80	The operating current is set to 80 percent of the rated current.
	(2) CRSTOP=40	The standstill current is set to 40 percent of the rated current

CRSTOP

Name	Standstill current	
Input range	0 to 50 [%] (initial value: 50)	
Description	Sets the motor standstill current. Set as a ratio to the motor's rated current.	
Access	Read and write	
Related commands	CRRUN	
Command execution	Monitor or program	
Example	(1) CRRUN=80	The operating current is set to 80 percent of the rated current.
	(2) CRSTOP=40	The standstill current is set to 40 percent of the rated current.

DIRINV

Name	Motor direction invert	
Input range	0 or 1 (initial value: 0) 0: CW direction (positive direction) 1: CCW direction (positive direction)	
Description	Sets the positive direction of the motor shaft rotation.	
Access	Read and write	
Related commands	MI, MA, MCP, MCN, MGHP, MGHN	
Command execution	Monitor or program	
Example	(1) DIRINV=1	The position direction is set to the CCW direction.
	(2) DIS=10000	The number of steps is set to 10000.
	(3) MI	Incremental positioning operation is executed (movement of 10000 steps in the CCW direction).
	(4) DIS=−10000	The number of steps is set to −10000.
	(5) MI	Incremental positioning operation is executed (movement of 10000 steps in the CW direction).

Note 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 rotate in the opposite direction of the motor shaft.

DIS

Name	Number of steps in positioning operation	
Input range	−8,388,608 to +8,388,607 [steps] (initial value: 0)	
Description	Sets the number of steps in the positioning operation.	
Access	Read and write	
Related commands	MI, MA, VR, VS	
Command execution	Monitor or program	
Example	(1) DIS=1000	The number of steps is set to 1000.

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

EHOME

Name	Electrical home seeking	
Input range	None	
Description	Executes electrical home seeking. For electrical home seeking, see 7.3 "Electrical home seeking and mechanical home seeking" on p.44.	
Access	Command	
Related commands	VR, VS	
Command execution	Monitor or program	
Example	(1) VS=500	The starting speed is set to 500 Hz.
	(2) VR=30000	The operating speed is set to 30000 Hz.
	(3) EHOME	Electrical home seeking is executed.

ELSE

Name	Branching when result of IF statement is false	
Input range	None	
Description	Indicates the branching destination when the result of the IF statement is "false."	
Access	Command	
Related commands	IF, ENDIF	
Command execution	Program	
Example	(1) IF (IN0=1)	Checks whether or not the X0 input is ON.
	(2) CALL SAMPLE1	SAMPLE1 is called if the X0 input is ON.
	(3) ELSE	The current line jumps to this line if the X0 input is OFF.
	(4) CALL SAMPLE2	SAMPLE2 is called if the X0 input is OFF.
	(5) ENDIF	The IF statement is ended.

END

Name	End of program	
Input range	None	
Description	Ends a program. Always enter an END command at the end of the program. Without an END command or RET command, an error will occur when the program is saved.	
Access	Command	
Related commands	None	
Command execution	Program	
Example	(1) OUT1=0	The Y1 output is turned OFF.
	(2) OUT2=1	The Y2 output is turned ON.
	(3) END	The program is ended.

ENDIF

Name	End of IF statement	
Input range	None	
Description	Ends an IF statement.	
Access	Command	
Related commands	IF, ELSE	
Command execution	Program	
Example	(1) IF (IN0=1)	Checks whether or not the X0 input is ON.
	(2) CALL SAMPLE1	SAMPLE1 is called if the X0 input is ON.
	(3) ELSE	The current line jumps to this line if the X0 input is OFF.
	(4) CALL SAMPLE2	SAMPLE2 is called if the X0 input is OFF.
	(5) ENDIF	The IF statement is ended.

ENDINV

Name	END output logic	
Input range	0 or 1 (initial value: 0) 0: ON when END is output 1: OFF when END is output (inverted)	
Description	Sets the logic for the general output port to which END output is assigned.	
Access	Write only	
Related commands	OUTEND	
Command execution	Program	
Example	(1) OUTEND=1	The END output is assigned to the Y1 output port.
	(2) ENDINV=1	The END output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTEND must be entered before ENDINV.

ENDL

Name	End of LOOP statement	
Input range	None	
Description	Ends a LOOP statement.	
Access	Command	
Related commands	LOOP, BREAKL	
Command execution	Program	
Example	(1) LOOP 10	The portion up to line 4 is repeated 10 times.
	(2) MI	Incremental positioning operation is executed.
	(3) WAIT 10	The program waits 1 s.
	(4) ENDL	The LOOP statement is ended.

ESTOPACT

Name	Motor-stopping method upon E-STOP input	
Input range	0 or 1 (initial value: 1) 0: Current OFF 1: Immediate stop	
Description	Sets how the motor is stopped when the E-STOP input is turned ON.	
Access	Read and write	
Related commands	ESTOPLV	
Command execution	Program	
Example	(1) ESTOPACT=1	The motor is stopped immediately when the E-STOP input is turned ON.

ESTOPLV

Name	E-STOP-input sensor logic	
Input range	0 or 1 (initial value: 0) 0: Contact A (N.O.: Normally open) 1: Contact B (N.C.: Normally closed)	
Description	Sets the sensor logic for E-STOP input.	
Access	Read and write	
Related commands	ESTOPACT	
Command execution	Program	
Example	(1) ESTOPLV=1	The E-STOP sensor logic is set to contact B (N.C.: Normally closed).

GEAR1 (numerator), GEAR2 (denominator)

Name	Electronic gears	
Input range	1 to 10000 (initial value of GEAR1: 1000, initial value of GEAR2: 100)	
Description	Sets the electronic gears. GEAR1 (numerator), GEAR2 (denominator) The motor resolution is set as follows, in accordance with the settings of electronic gears: $\text{Motor resolution (step/rev)} = \frac{\text{GEAR1}}{\text{GEAR2}} \times 100$ Set GEAR1 and GEAR2 within the following range: $500 \leqq \frac{\text{GEAR1}}{\text{GEAR2}} \times 100 \leqq 10000$ Set the motor speed in accordance with the values of GEAR1 and GEAR2. $\text{Motor speed (r/min)} = \frac{\text{GEAR2}}{\text{GEAR1} \times 100} \times \text{Operating speed} \times 60$	
Access	Read and write	
Related commands	PC	
Command execution	Monitor or program	
Example	(1) GEAR1=100 (2) GEAR2=20 (3) VR=25000	 The motor resolution is given as (100/20) × 100 = 500 steps/rev. The operation speed is set to 25000 Hz. $\text{Motor speed (r/min)} = \frac{25000}{500} \times 60 = 3000 \text{ (r/min)}$

HOMELV

Name	HOMELS input logic	
Input range	0 or 1 (initial value: 0) 0: Contact A (N.O.: Normally open) 1: Contact B (N.C.: Normally closed)	
Description	Sets the sensor logic for HOMELS input.	
Access	Read and write	
Related commands	None	
Command execution	Program	
Example	(1) HOMELV=0	The HOMELS input logic is set to contact A (N.O.: Normally open).

HOMEPINV

Name	HOME-P output logic	
Input range	0 or 1 (initial value: 0) 0: ON when HOME-P is output 1: OFF when HOME-P is output (inverted)	
Description	Sets the logic for the general output port to which HOME-P output is assigned.	
Access	Write only	
Related commands	OUTHOMEP	
Command execution	Program	
Example	(1) OUTHOMEP=1	The HOME-P output is assigned to the Y1 output port.
	(2) HOMEPINV=1	The HOME-P output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTHOMEP must be entered before HOMEPINV.

HOMETYP

Name: Origin-detection method for mechanical home seeking

Input range: 0 to 7 (initial value: 4)
Example) Set "5" when only the TIM. signal is used in 3-sensor mode.

HOMETYP	Mechanical home sensor		SENSOR
	TIM.	SENSOR	
0	×	×	2-sensor mode
1	○	×	
2	×	○	
3	○	○	
4	×	×	3-sensor mode
5	○	×	
6	×	○	
7	○	○	

○: used, ×: not used

Description: Sets the sensor mode for mechanical home seeking and the use of timing signal and SENSOR input. The timing signal is output for 50 times per revolution of the motor's output shaft. Use of timing signal and SENSOR input increases the accuracy of origin detection.

Access: Read and write

Related commands: VS, VR, OFFSET, MGHP, MGHN

Command execution: Program

Example:

(1) HOMETYP=5	Origin detection is performed in 3-sensor mode using the timing signal.
(2) OFFSET=10000	The offset for mechanical home seeking is set to 10000.
(3) MGHP	Mechanical home seeking is executed in the positive direction.

Note

- When SENSOR input is used in mechanical home seeking, it cannot be used in continuous operation.
- The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

IF

Name	Conditional branching of IF statement	
Input range	Condition statement (= =, !=, <=, >=, < or >)	
Description	Executes the conditional branching of an IF statement. Always set one ENDIF command for one IF command.	
Access	Command	
Related commands	ELSE, ENDIF	
Command execution	Program	
Example	(1) A=10000	10000 is substituted for program variable A.
	(2) IF (A=PC)	Checks whether or not the position counter value is equal to the value of variable A.
	(3) OUT1=1	The Y1 output is turned ON if the result is true.
	(4) ELSE	The current line jumps to this line if the result is false.
	(5) OUT1=0	The Y1 output is turned OFF if the result if false.
	(6) ENDIF	The IF statement is ended.

IN (Program mode)

Name	General-input port monitor
Input range	0 to 255
Description	Indicates the status of general input ports. Only the ON (1) or OFF (0) status of the photocoupler is shown, and INV setting (inverting of logic) is not shown for each input signal.

General input port	Assigned bit	Decimal value
X0 input	Bit 0	01
X1 input	Bit 1	02
X2 input	Bit 2	04
X3 input	Bit 3	08
X4 input	Bit 4	16
X5 input	Bit 5	32
X6 input	Bit 6	64
X7 input	Bit 7	128

Access	Read only	
Related commands	IN0 to IN7, INACL, INPAUSE, INMSTOP, INITIO	
Command execution	Program	
Example	(1) IF (IN=10)	Checks whether or not the X1 input and X3 input are both ON.
	(2) CALL PROG0	PROG0 is called if both the X1 input and X3 input are ON.
	(3) ELSE	The current line jumps to this line if neither the X1 input nor X3 input is ON.
	(4) CALL PROG1	PROG1 is called if neither the X1 input nor X3 input is ON.
	(5) ENDIF	The IF statement is ended.

INx (x = 0 to 7) (Program mode)

Name	Individual port monitor	
Input range	0 or 1 0: OFF 1: ON	
Description	Indicates the status of general input port number x. Only the ON (1) or OFF (0) status of the photocoupler is shown, and INV setting (inverting of logic) is not shown for each input signal.	
Access	Read only	
Related commands	IN	
Command execution	Program	
Example	(1) INMSTOP=4	The MSTOP input is assigned to the X4 input port.
	(2) MSTOPINV=1	The MSTP input logic is inverted.
	(3) IF (IN4=0)	Checks whether or not the X4 input is OFF.
	(4) CALL PROG1	PROG1 is called if the MSTOP input is OFF.
	(5) ENDIF	The IF statement is ended.

INACL

Name	ACL input assignment	
Input range	0 to 7	
Description	Assigns ACL input to a general input port. For ACL input, see p.30.	
Access	Write only	
Related commands	ACLINV, IN, INITIO	
Command execution	Program	
Example	(1) INACL=3	The ACL input is assigned to the X3 input port.
	(2) ACLINV=1	The ACL input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INACL must be entered before ACLINV.

INITIO

Name	Initialization of general I/O port assignments	
Input range	None	
Description	Cancels the signal assignments for general I/O ports.	
Access	Command	
Related commands	IN, INACL, INMSTOP, INPAUSE, INRESTART, OUTEND, OUTHOMEP, OUTMBC, OUTMOVE, OUTRUN, OUTTIM	
Command execution	Program	
Example	(1) INITIO	The assignments for general I/O ports are initialized.

INMSTOP

Name	MSTOP input assignment	
Input range	0 to 7	
Description	Assigns MSTOP input to a general input port. For MSTOP input, see p.30.	
Access	Write only	
Related commands	MSTOPINV, IN, INITIO	
Command execution	Program	
Example	(1) INMSTOP=3	The MSTOP input is assigned to the X3 input port.
	(2) MSTOPINV=1	The MSTOP input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INMSTOP must be entered before MSTOPINV.

INPAUSE

Name	PAUSE input assignment	
Input range	0 to 7	
Description	Assigns PAUSE input to a general input port. For PAUSE input , see p.30.	
Access	Write only	
Related commands	PAUSEINV, IN, INITIO	
Command execution	Program	
Example	(1) INPAUSE=3	The PAUSE input is assigned to the X3 input port.
	(2) PAUSEINV=1	The PAUSE input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INPAUSE must be entered before PAUSEINV.

INRESTART

Name	RESTART input assignment	
Input range	0 to 7	
Description	Assigns RESTART input to a general input port. For RESTART input, see p.30.	
Access	Write only	
Related commands	RESTARTINV, IN, INITIO	
Command execution	Program	
Example	(1) INRESTART=3	The RESTART input is assigned to the X3 input port.
	(2) RESTARTINV=1	The RESTART input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INRESTART must be entered before RESTARTINV.

JMP

Name	Jump to another line in program	
Input range	1 to 64 (line number)	
Description	The current line jumps to another line in the program, regardless of the set conditions. A JMP command does not break a WHILE statement or LOOP statement in the middle. To break a WHILE statement, use the BREAKW command. To break a LOOP statement, use the BREAKL command.	
Access	Command	
Related commands	None	
Command execution	Program	
Example	1) DIS=10000	The number of steps is set to 10000.
	2) VR=50000	The operating speed is set to 50000 Hz.
	3) MI	Incremental positioning operation is executed.
	4) WAIT 10	The program waits 1 s.
	5) JMP 3	The current line jumps to line 3.

KB

Name	Input value from a keyboard into a program.	
Input range	−8,388,608 to +8,388,607	
Description	Value is substituted directly for a parameter when entered via a keyboard entry. (If the “ENTER” key is pressed with no number assign a 0 will be substituted for the parameter.)	
Access	Command	
Related commands	SAS	
Command execution	Program	
Example	(1) SAS PROGRAM No.?	Desired PROGRAM No.? is transmitted to the terminal.
	(2) A = KB	Value from keyboard is substituted for program variable A.
	(3) IF(1 = A)	Checks if A=1
	(4) CALL PROG_1	The program named PROG_1 is called.
	(5) ENDIF	The IF statement is ended.

Note When a KB command is encountered, the program stops executing until the ENTER key is input.

LIMN, LIMP

Name	Software limits	
Input range	−8,388,608 to +8,388,607 [steps] (initial value of LIMN: −8,388,608, initial value of LIMP: +8,388,607)	
Description	Set the software limits. The software limit is a limit controlled via the software. Use a LIMN command or LIMP command to set the software limit on the negative side or positive side, respectively.	
Access	Read and write	
Related commands	SLACT, DIRINV	
Command execution	Monitor or program	
Example	(1) LIMN=−10000	The software limit on the negative side is set to −10000.
	(2) LIMP=10000	The software limit on the positive side is set to 10000.
	(3) MI	Incremental positioning operation is executed. (The corresponding software limit is triggered when the position counter value becomes 10000 or −10000.)
	(4) END	The program is ended.

Note After completing the mechanical home seeking, this setting becomes effective. When turning on the power, or resetting a specific alarm (See p.112), this setting becomes invalid. In each case, it is necessary to complete the mechanical home seeking operation to set the software limits.

LOOP

Name	LOOP statement	
Input range	1 to 8,388,607 (An infinite loop is executed when the count is not defined.)	
Description	Repeats the portion between the LOOP command and ENDL command for the specified number of times. Always set one ENDL command for one LOOP command.	
Access	Command	
Related commands	BREAKL, ENDL	
Command execution	Program	
Example	(1) LOOP 10	The portion up to line 4 is repeated 10 times.
	(2) MI	Incremental positioning operation is executed.
	(3) WAIT 10	The program waits 1s.
	(4) ENDL	The LOOP statement in line 1 is ended.
	(5) LOOP	The portion up to line 11 is infinitely repeated.
	(6) MI	Incremental positioning operation is executed.
	(7) WAIT 10	The program waits 1 s.
	(8) IF (IN1=1)	Checks whether or not the X1 input is ON.
	(9) BREAKL	If the X1 input is ON, the LOOP statement in line 5 is ended in the middle.
	(10) ENDIF	The IF statement is ended.
	(11) ENDL	The LOOP statement in line 5 is ended.

MA

Name	Absolute positioning operation	
Input range	None	
Description	Executes absolute positioning operation. For absolute positioning operation, see 7.1 “Positioning operation” on p.42.	
Access	Command	
Related commands	DIS, VR, VS, TA, TD, MI	
Command execution	Monitor or program	
Example	(1) DIS=1000	The number of steps is set to 1000.
	(2) MA	Absolute positioning operation is executed.

MBCINV

Name	MBC output logic	
Input range	0 or 1 (initial value: 0) 0: ON when MBC is output 1: OFF when MBC is output (inverting)	
Description	Sets the logic for the general output port to which MBC output is assigned.	
Access	Write only	
Related commands	OUTMBC	
Command execution	Program	
Example	(1) OUTMBC=1	The MBC output is assigned to the Y1 output port.
	(2) MBCINV=1	The MBC output logic is inverted.

Note

- The command value is not saved in the driver’s memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTMBC must be entered before MBCINV.

MCN, MCP

Name	Continuous operation	
Input range	None	
Description	Execute continuous operation. The MCN command executes continuous operation in the negative direction, while the MCP command executes the same in the positive direction. For continuous operation, see7.2 “Continuous operation” on p.43.	
Access	Command	
Related commands	VR, VS, TA, TD	
Command execution	Monitor or program	
Example	(1) VR=10000	The operating speed is set to 10000 Hz.
	(2) MCP	Continuous operation is executed in the positive direction.

MGHN, MGHP

Name	Mechanical home seeking	
Input range	None	
Description	Execute mechanical home seeking. The MGHN command executes mechanical home seeking in the negative direction, while the MGHP command executes the same in the positive direction. If the starting speed VS is lower than 250 Hz during origin detection, VS is automatically set to 250 Hz. When the timing signal is used, set the motor resolution to a multiple of 50. The timing signal is output for 50 times per revolution of the motor’s output shaft. For mechanical home seeking, see 7.4 “Mechanical home seeking” on p.44.	
Access	Command	
Related commands	VS, VR, OFFSET, HOMETYP	
Command execution	Monitor or program	
Example	(1) HOMETYP=5	Origin detection is performed in 3-sensor mode using the timing signal.
	(2) OFFSET=10000	The offset for mechanical home seeking is set to 10000.
	(3) MGHP	Mechanical home seeking is executed in the positive direction.
	(4) CALL HOMED	The program HOMED (a program to ensure homing operation is complete) is executed.
	Subroutine HOMED (A program which ensures a MGHP or MGHN move is complete before further motion occurs) PROGRAM: HOMED	
	(1) Z=OUTSG&20	The operation result of OUTSG&20 is substituted for program variable Z.
	(2) WHILE (Z!=20)	If Z!=20, the portion up to line 4 is repeated (while the HOME-P and END signals=0).
	(3) Z=OUTSG&20	The operation result of OUTSG&20 is substituted for program variable Z.
	(4) WEND	The WHILE statement is ended.
	(5) RET	The subroutine call is ended.

MI

Name	Incremental positioning operation	
Input range	None	
Description	Executes incremental positioning operation. For incremental positioning operation, see 7.1 “Positioning operation” on p.42.	
Access	Command	
Related commands	DIS, VR, VS, TA, TD, MA	
Command execution	Monitor or program	
Example	(1) TA=50	The acceleration time is set to 50 ms.
	(2) TD=50	The deceleration time is set to 50 ms.
	(3) VS=500	The starting speed is set to 500 Hz.
	(4) VR=20000	The operating speed is set to 20000 Hz.
	(5) MI	Incremental positioning operation is executed.

MOVEINV

Name	MOVE output logic	
Input range	0 or 1 (initial value: 0) 0: ON when MOVE is output 1: OFF when MOVE is output (inverting)	
Description	Sets the logic for the general output port to which MOVE output is assigned.	
Access	Write only	
Related commands	OUTMOVE	
Command execution	Program	
Example	(1) OUTMOVE=1	The MOVE output is assigned to the Y1 output port.
	(2) MOVEINV=1	The MOVE output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTMOVE must be entered before MOVEINV.

MSTOPACT

Name	Motor-stopping method upon pressing ESC key or MSTOP input	
Input range	0 or 1 (initial value: 1) 0: Immediate stop 1: Decelerate to a stop	
Description	Sets how the motor is stopped when the ESC key is pressed or the MSTOP input is turned ON. When the MSTOP input is turned ON, the motor will stop but the program will not.	
Access	Read and write	
Related commands	MSTOP, INMSTOP, MSTOPINV	
Command execution	Monitor or program	
Example	(1) MSTOPACT=1	The motor decelerates to a stop when the MSTOP input is turned ON.

MSTOP

Name	Motor stop	
Input range	None	
Description	Stops the motor. The motor stops in accordance with the stopping action set by the MSTOPACT command, which is a monitor command.	
Access	Command	
Related commands	None (MSTOPACT, a monitor command)	
Command execution	Program	
Example	(1) VR=50000	The operating speed of continuous operation is set to 50000 Hz.
	(2) MCN	Continuous operation is executed in the negative direction.
	(3) WAIT 30	The program waits 3 s.
	(4) MSTOP	The motor is stopped.

MSTOPINV

Name	MSTOP input logic	
Input range	0 or 1 (initial value: 0) 0: Action takes place when ON. 1: Action takes place when OFF (inverted).	
Description	Sets the logic for the general input port to which MSTOP input is assigned.	
Access	Write only	
Related commands	INMSTOP	
Command execution	Program	
Example	(1) INMSTOP=3	The MSTOP input is assigned to the X3 input port.
	(2) MSTOPINV=1	The MSTOP input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INMSTOP must be entered before MSTOPINV.

OFFSET

Name	Offset for mechanical home seeking	
Input range	−8,388,608 to +8,388,607 [steps] (initial value: 0)	
Description	Sets the offset for mechanical home seeking.	
Access	Read and write	
Related commands	MGHN, MGHP, VR, VS	
Command execution	Program	
Example	(1) HOMETYP=5	Origin detection is performed in 3-sensor mode using the timing signal.
	(2) OFFSET=10000	The offset for mechanical home seeking is set to 10000.
	(3) MGHP	Mechanical home seeking is executed in the positive direction.

Note

- The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.
- If the value of VR is changed during a mechanical home seeking operation, the speed of the offset operation will be changed.

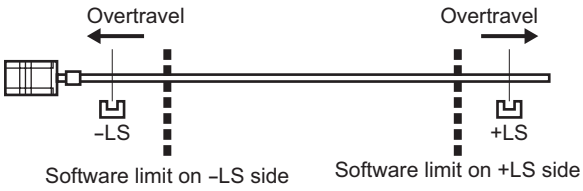
OLTIME

Name	Overload detection time	
Input range	5 to 250 [× 0.1 s.] (initial value: 50 (5.0 s.))	
Description	Sets the time until an overload protection alarm (alarm code: 30h) is detected.	
Access	Read and write	
Related commands	ALM	
Command execution	Monitor or program	
Example	(1) OLTIME=200	The overload protection time is set to 200 (200 × 0.1 = 20 s.).
	(2) IF (ALM=48)	Checks whether or not the alarm code is 48 (= 30h: overload protection).
	(3) OUT1=1	If the alarm code is 48, the Y1 output is turned ON.
	(4) ENDIF	The IF statement is ended.

Note This setting becomes effective once the power is turned off and on again.

OTACT

Name	Stopping action on overtravel	
Input range	0 or 1 (initial value: 0) 0: Immediate stop 1: Decelerate to a stop	
Description	Sets the stopping action to be executed when overtravel occurs. Overtravel means the motor operates beyond its +/-LS position. The following operations can be executed when overtravel occurs. • Mechanical home seeking • Continuous operation in the opposite direction of the LS detected (The motor gets out of the overtravel range at the starting speed and then stops.).	
Access	Read and write	
Related commands	OTLV	
Command execution	Program	
Example	(1) OTACT=1	When overtravel occurs, the motor decelerates to a stop.



OTLV

Name	Hardware-limit sensor logic	
Input range	0 or 1 (initial value: 0) 0: Contact A (N.O.: Normally open) 1: Contact B (N.C.: Normally closed)	
Description	Sets the sensor limit for hardware limits.	
Access	Read and write	
Related commands	OTACT	
Command execution	Program	
Example	(1) OTLV=1	The hardware-limit sensor logic is set to contact B (N.C.: Normally closed.).

OUT (Program mode)

Name	General-output port monitor
Input range	0 to 255
Description	Indicates the status of general output ports.

General output port	Assigned bit	Decimal value
Y0 output	Bit 0	01
Y1 output	Bit 1	02
Y2 output	Bit 2	04
Y3 output	Bit 3	08
Y4 output	Bit 4	16
Y5 output	Bit 5	32
Y6 output	Bit 6	64
Y7 output	Bit 7	128

Only the ON (1) or OFF (0) status of the photocoupler is shown, and INV setting (inverting of logic) is not shown for each output signal. No status is displayed for ports to which output signals have been assigned.

Access	Read and write	
Related commands	OUT0 to OUT7, OUTEND, OUTRUN, OUTMOVE, OUTTIM, OUTHOMEP, OUTMBC	
Command execution	Program	
Example	(1) IF (OUT=33)	Checks whether or not the Y0 output and Y5 output are both ON.
	(2) CALL PROG1	PROG1 is called if both the Y0 output and Y5 output are ON.
	(3) ELSE	The current line jumps to this line if neither the Y0 output nor Y5 output is ON.
	(4) CALL PROG2	PROG2 is called if neither the Y0 output nor Y5 output is ON.
	(5) ENDIF	The IF statement is ended.

OUTx (x = 0 to 7) (Program mode)

Name	General-output port control	
Input range	0 or 1 0: OFF 1: ON	
Description	Controls the ON/Off of general output port number x. The setting is invalid with ports to which output signals have been assigned.	
Access	Write only	
Related commands	OUT	
Command execution	Program	
Example	(1) OUT1=1	The Y1 output is turned ON.

OUTEND

Name	END output assignment	
Input range	0 to 7	
Description	Assigns END output to a general output port. For END output, see p.31.	
Access	Write only	
Related commands	ENDINV, OUT, INITIO	
Command execution	Program	
Example	(1) OUTEND=1	The END output is assigned to the Y1 output port.
	(2) ENDINV=1	The END output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTEND must be entered before ENDINV.

OUTHOMEP

Name	HOME-P output assignment	
Input range	0 to 7	
Description	Assigns HOME-P output to a general output port. For HOME-P output, see p.32.	
Access	Write only	
Related commands	HOMEPINV, OUT, INITIO	
Command execution	Program	
Example	(1) OUTHOMEP=1	The HOME-P output is assigned to the Y1 output port.
	(2) HOMEPINV=1	The HOME-P output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTHOMEP must be entered before HOMEPINV.

OUTMBC

Name	MBC output assignment	
Input range	0 to 7	
Description	Assigns MBC output to a general output port. For MBC output, see p.32.	
Access	Write only	
Related commands	MBCINV, OUT, INITIO	
Command execution	Program	
Example	(1) OUTMBC=1	The MBC output is assigned to the Y1 output port.
	(2) MBCINV=1	The MBC output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTMBC must be entered before MBCINV.

OUTMOVE

Name	MOVE output assignment	
Input range	0 to 7	
Description	Assigns MOVE output to a general output port. For MOVE output, see p.31.	
Access	Write only	
Related commands	MOVEINV, OUT, INITIO	
Command execution	Program	
Example	(1) OUTMOVE=1	The MOVE output is assigned to the Y1 output port.
	(2) MOVEINV=1	The MOVE output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTMOVE must be entered before MOVEINV.

OUTRUN

Name	RUN output assignment	
Input range	0 to 7	
Description	Assigns RUN output to a general output port. For RUN output, see p.31.	
Access	Write only	
Related commands	RUNINV, OUT, INITIO	
Command execution	Program	
Example	(1) OUTRUN=1	The RUN output is assigned to the Y1 output port.
	(2) RUNINV=1	The RUN output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTRUN must be entered before RUNINV.

OUTSG

Name	Output-signal status read
Input range	0 to 63
Description	Reads the status of assignable output signals.

Signal name	Assigned bit (0: Non-active, 1: Active)	Decimal value
RUN	Bit 0	01
MOVE	Bit 1	02
END	Bit 2	04
TIM.	Bit 3	08
HOME-P	Bit 4	16
MBC	Bit 5	32

Access	Read only	
Related commands	None	
Command execution	Program	
Example	PROGRAM WAITEN	
	(1) J=OUTSG&4	The status of END input is substituted for program variable J.
	(2) WHILE (J!=4)	The step is repeated until the value in variable J becomes 4 (until the END input is turned ON).
	(3) J=OUTSG&4	The status of END input is substituted for program variable J.
	(4) WEND	The WHILE statement is ended.

Memo By using the OUTSG command, you can know when motor motion has started (EHOME, MA, MCN, MCP, MGHN, MGHP, MI and MIx).

OUTTIM

Name	TIM. output assignment	
Input range	0 to 7	
Description	Assigns TIM. output to a general output port. For TIM. output, see p.32.	
Access	Write only	
Related commands	TIMINV, OUT, INITIO	
Command execution	Program	
Example	(1) OUTTIM=1	The TIM output is assigned to the Y1 output port.
	(2) TIMINV=1	The TIM output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTTIM must be entered before TIMINV.

OVERFLOW

Name	Overflow revolutions	
Input range	1 to 30000 [× 0.02 revolutions] (initial value: 150)	
Description	Sets the overflow revolutions until an excessive position-deviation alarm (alarm code: 10h) is detected	
Access	Read and write	
Related commands	ALM	
Command execution	Monitor or program	
Example	(1) OVERFLOW=100	The overflow revolutions are set to 100 (100 × 0.02 = 2 revolutions).
	(2) IF (ALM=16)	Checks whether or not the alarm code is 16 (= 10h: excessive position deviation).
	(3) OUT0=1	If the alarm code is 16, the Y0 output is turned ON.
	(4) ENDIF	The IF statement is ended.

Note This setting becomes effective once the power is turned off and on again.

PAUSEINV

Name	PAUSE input logic	
Input range	0 or 1 (initial value: 0) 0: Action takes place when ON. 1: Action takes place when OFF (inverted).	
Description	Sets the logic for the general input port to which PAUSE input is assigned.	
Access	Write only	
Related commands	INPAUSE	
Command execution	Program	
Example	(1) INPAUSE=1	The PAUSE input is assigned to the X1 input port.
	(2) PAUSEINV=1	The PAUSE input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INPAUSE must be entered before PAUSEINV.

PC

Name	Command position counter	
Input range	−8,388,608 to +8,388,607 [steps]	
Description	Displays the counter value of the internal command position.	
Access	Read and write A value can be written while the motor is at a standstill in the energized state.	
Related commands	GEAR1, GEAR2	
Command execution	Monitor or program	
Example	(1) DIS=1000	The number of steps is set to 1000.
	(2) MI	Incremental positioning operation is executed.
	(3) PC	The value in the internal position counter is displayed.

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

RESTARTINV

Name	RESTART input logic	
Input range	0 or 1 (initial value: 0) 0: Action takes place when ON. 1: Action takes place when OFF (inverted).	
Description	Sets the logic for the general input port to which RESTART input is assigned.	
Access	Write only	
Related commands	INRESTART	
Command execution	Program	
Example	(1) INRESTART=3	The RESTART input is assigned to the X3 input port.
	(2) RESTARTINV=1	The RESTART input logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- INRESTART must be entered before RESTARTINV.

RET

Name	Return from subroutine	
Input range	None	
Description	Returns the execution target to the original program from a subroutine call. Enter the RET command in the last step of the program. The execution target doesn't return from the subroutine call if the command is written in the middle of the program. Without an END command or RET command, an error will occur when the program is saved.	
Access	Command	
Related commands	CALL	
Command execution	Program	
Example	(1) OUT1=1	The Y1 output is turned ON.
	(2) VR=10000	The operating speed is set to 10000 Hz.
	(3) DIS=10000	The number of steps is set to 10000.
	(4) RET	Returns to the original program.

RUNINV

Name	RUN output logic	
Input range	0 or 1 (initial value: 0) 0: ON when RUN is output 1: OFF when RUN is output (inverting)	
Description	Sets the logic for the general output port to which RUN output is assigned.	
Access	Write only	
Related commands	OUTRUN	
Command execution	Program	
Example	(1) OUTRUN=1	The RUN output is assigned to the Y1 output port.
	(2) RUNINV=1	The RUN output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTRUN must be entered before RUNINV.

SAS

Name	Transmission of text	
Input range	Text (ASCII code up to 12 characters)	
Description	ASCII code is transmitted to the terminal of the computer.	
Access	Command	
Related commands	None	
Command execution	Program	
Example	(1) SAS INDEX_START	INDEX_START is transmitted to the terminal.
	(2) MI	Incremental positioning operation is executed.

Note No “#” character available for transmission.

SCHGPOS

Name	Number of steps in offset operation after SENSOR input	
Input range	0 to +8,388,607 [steps] (initial value: 0)	
Description	Sets the number of steps for execution of offset operation when the SENSORACT command is set with “4: Execute offset operation based on the number of steps set by the SCHGPOS/SCHGVR command.” For offset operation, see 7.2 “Continuous operation” on p.43.	
Access	Read and write	
Related commands	MCN, MCP, SCHGVR, SENSORACT	
Command execution	Program	
Example	(1) SENSORACT=4	Offset operation is executed after the SENSOR input is turned ON.
	(2) SCHGVR=5000	The operating speed of offset operation is set to 5000 Hz.
	(3) SCHGPOS=1000	The number of steps in offset operation is set to 1000.
	(4) MCP	Continuous operation is executed in the positive direction.

Note The command value is not saved in the driver’s memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

SCHGVR

Name	Operating speed of offset operation after SENSOR input	
Input range	1 to 500,000 [Hz] (initial value: 1000 Hz)	
Description	Sets the operating speed for execution of offset operation when the SENSORACT command is set with “4: Execute offset operation based on the number of steps set by the SCHGPOS/SCHGVR command.” For offset operation, see 7.2 “Continuous operation” on p.43.	
Access	Read and write	
Related commands	MCN, MCP, SCHGPOS, SENSORACT	
Command execution	Program	
Example	(1) SENSORACT=4	Offset operation is executed after the SENSOR input is turned ON.
	(2) SCHGVR=5000	The operating speed of offset operation is set to 5000 Hz.
	(3) SCHGPOS=1000	The number of steps in offset operation is set to 1000.
	(4) MCP	Continuous operation is executed in the positive direction.

Note The command value is not saved in the driver’s memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

SENSORACT

Name	Motor action after SENSOR input	
Input range	1 to 4 (initial value: 3) 1: Immediate stop 2: Decelerate to a stop 3: No action (The motor doesn't stop but continues to operate.) 4: Offset operation is executed based on the number of steps set by the SCHGPOS/SCHGVR command.	
Description	Sets the motor action to take place when the SENSOR input is turned ON during continuous operation.	
Access	Read and write	
Related commands	MCN, MCP, SCHGPOS, SCHGVR	
Command execution	Program	
Example	(1) SENSORACT=4	Offset operation is executed after the SENSOR input is turned ON.
	(2) SCHGVR=5000	The operating speed of offset operation is set to 5000 Hz.
	(3) SCHGPOS=1000	The number of steps in offset operation is set to 1000.
	(4) MCP	Continuous operation is executed in the positive direction.

Note When SENSOR input is used in mechanical home seeking, it cannot be used in continuous operation.

SENSORLV

Name	SENSOR input logic	
Input range	0 or 1 (initial value: 0) 0: Contact A (N.O.: Normally open) 1: Contact B (N.C.: Normally closed)	
Description	Sets the sensor logic for SENSOR input.	
Access	Read and write	
Related commands	None	
Command execution	Program	
Example	(1) SENSORLV=0	The SENSOR input logic is set to contact A (N.O.: Normally open).

SLACT

Name	Motor action at software limit overtravel	
Input range	0 or 1 (initial value: 1) 0: Software overtravel disable 1: Software overtravel enable	
Description	Sets whether or not to stop the motor when software overtravel occurs. Software overtravel means the motor operates beyond its software limit. When software overtravel has occurred, the following operations can be executed once the alarm is cleared. • Mechanical home seeking • Continuous operation in the opposite direction to the software limit detected (The motor gets out of the overtravel range at the starting speed and then stops.)	
Access	Read and write	
Related commands	LIMN, LIMP	
Command execution	Program	
Example	(1) LIMP=50000 (2) LIMN=−20000 (3) SLACT=1 (4) MI	The software limit on the positive side is set to 50000. The software limit on the negative side is set to −20000. Software overtravel is enabled. Incremental positioning operation is executed.

Note

- The value set by this command becomes effective after mechanical home seeking is executed.
- After completing the mechanical home seeking, this setting becomes active. When turning on the power, or resetting a specific alarm (See p.112), this setting becomes invalid. In each case, it is necessary to complete the mechanical home seeking operation to set the software limits.

STOP

Name	Forced stop of program	
Input range	None	
Description	Ends a program.	
Access	Command	
Related commands	None	
Command execution	Program	
Example	(1) LOOP (2) IF (A=100) (3) STOP (4) ELSE (5) MI (6) ENDIF (7) ENDL (8) END	The portion up to line 7 is infinitely repeated. Checks whether or not program variable A is 100. If program variable A is 100, the program is ended. If program variable A is not 100, the current line jumps to this line. If program variable A is not 100, incremental positioning operation is executed. The IF statement is ended. The LOOP statement is ended. The program is ended.

TA

Name	Acceleration time	
Input range	10 to 50000 [ms.] (initial value: 1000)	
Description	Sets the acceleration time.	
Access	Read and write	
Related commands	TD	
Command execution	Monitor or program	
Example	(1) TA=100	The acceleration time is set to 100 ms.
	(2) TD=100	The deceleration time is set to 100 ms.
	(3) VS=500	The starting speed is set to 500 Hz.
	(4) DIS=10000	The number of steps is set to 10000.
	(5) VR=50000	The operating speed is set to 50000 Hz.
	(6) MI	Incremental positioning operation is executed.

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

TD

Name	Deceleration time	
Input range	10 to 50000 [ms.] (initial value: 1000)	
Description	Sets the deceleration time.	
Access	Read and write	
Related commands	TA	
Command execution	Monitor or program	
Example	(1) TA=100	The acceleration time is set to 100 ms.
	(2) TD=100	The deceleration time is set to 100 ms.
	(3) VS=500	The starting speed is set to 500 Hz.
	(4) DIS=10000	The number of steps is set to 10000.
	(5) VR=50000	The operating speed is set to 50000 Hz.
	(6) MI	Incremental positioning operation is executed.

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

TIMER

Name	Software timer	
Input range	0 to 8,388,607 [ms.]	
Description	Sets the software timer. The timer is counted, regardless of command execution.	
Access	Read and write	
Related commands	WAIT	
Command execution	Program	
Example	(1) LOOP	The portion up to line 6 is infinitely repeated.
	(2) TIMER=0	The timer is initialized.
	(3) MI	Incremental positioning operation is executed.
	(4) WHILE (TIMER<3,000)	The steps are repeated when the value in the software timer is less than 3000 ms.
	(5) WEND	The WHILE statement is ended.
	(6) ENDL	The LOOP statement is ended.

TIMINV

Name	TIM. output logic	
Input range	0 or 1 (initial value: 0) 0: ON when TIM. is output 1: OFF when TIM. is output (inverted)	
Description	Sets the logic for the general output port to which TIM. output is assigned.	
Access	Write only	
Related commands	OUTTIM	
Command execution	Program	
Example	(1) OUTTIM=1 (2) TIMINV=1	The TIM. output is assigned to the Y1 output port. The TIM. output logic is inverted.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- OUTTIM must be entered before TIMINV.

VFIL

Name	Speed-filter gain	
Input range	1 to 1024 (initial value: 70)	
Description	Sets the speed-filter gain. When a speed-filter gain is set, motor action becomes more smooth at start and stop, and thus vibration and shock can be reduced. Setting a smaller speed-filter gain makes the motor operation smoother, but synchronism with commands can be lost. Set an appropriate speed-filter gain according to the motor's load and application. $\text{Filter time constant (ms)} = \frac{1}{\text{Speed-filter gain}} \times 81.92$	
Access	Read and write	
Related commands	None	
Command execution	Monitor or program	
Example	(1) VFIL=90	The speed-filter gain is set to 90.

Note

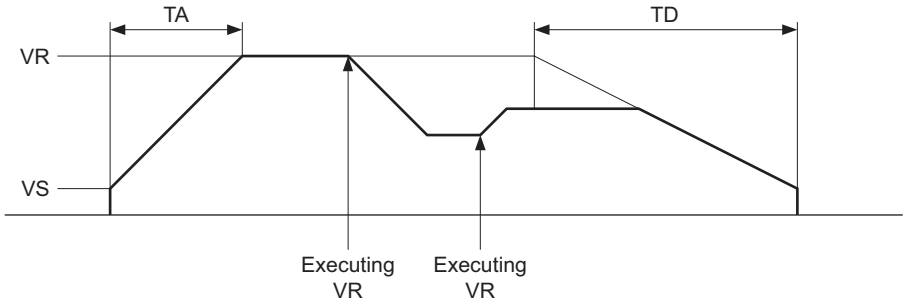
The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

VR

Name	Operating speed	
Input range	1 to 500,000 [Hz] (initial value: 1000)	
Description	Sets the operating speed.	
Access	Read and write	
Related commands	MI, MA, MCN, MCP, EHOME, VS, MGHN, MGHP	
Command execution	Monitor or program	
Example	(1) VS=500	The starting speed is set to 500 Hz.
	(2) VR=50000	The operating speed is set to 50000 Hz.
	(3) DIS=20000	The number of steps is set to 20000.
	(4) MI	Incremental positioning operation is executed.

Note

- The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.
- The operating speed for INDEX, SCAN and RETURN modes can be changed by using this command. This operating speed can not be changed during a mechanical home seeking operation.
- As for the acceleration/deceleration rates during speed-change operation, the acceleration rate is set by the acceleration time (TA) from the starting speed (VS) to the operating speed (VR). When the operation finally stops, the motor decelerates at the deceleration rate set by the deceleration time (TD) from the operating speed (VR) to the starting speed (VS). (See the figure below.)



VS

Name	Starting speed	
Input range	1 to 500,000 [Hz] (initial value: 100)	
Description	Sets the starting speed.	
Access	Read and write	
Related commands	MI, MA, MCN, MCP, EHOME, VR, MGHN, MGHP	
Command execution	Monitor or program	
Example	(1) VS=500	The starting speed is set to 500 Hz.
	(2) VR=50000	The operating speed is set to 50000 Hz.
	(3) DIS=20000	The number of steps is set to 20000.
	(4) MI	Incremental positioning operation is executed.

Note

The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

WAIT

Name	Wait time	
Input range	1 to 1,000,000 [× 0.1 s]	
Description	Sets the wait time	
Access	Write only	
Related commands	TIMER	
Command execution	Program	
Example	(1) LOOP 10	The portion up to line 4 is repeated 10 times.
	(2) MI	Incremental positioning operation is executed.
	(3) WAIT 10	The program waits 1 s.
	(4) ENDL	The LOOP statement is ended.

WEND

Name	End of WHILE statement	
Input range	None	
Description	Ends a WHILE statement	
Access	Command	
Related commands	WHILE, BREAKW	
Command execution	Program	
Example	(1) WHILE (IN1=1)	If the X1 input is ON, the portion up to line 6 is repeated.
	(2) CALL PROG1	PROG1 is called.
	(3) WHILE (A<100)	If program variable A is smaller than 100, the portion up to line 5 is repeated.
	(4) CALL PROG2	PROG2 is called.
	(5) WEND	The WHILE statement in line 3 is ended.
	(6) WEND	The WHILE statement in line 1 is ended.

WHILE

Name	WHILE statement	
Input range	Condition statement	
Description	Executes the conditional branching of a WHILE statement. Always set one WEND command for one WHILE command.	
Access	Command	
Related commands	WEND, BREAKW	
Command execution	Program	
Example	(1) WHILE (IN1=1)	If the X1 input is ON, the portion up to line 6 is repeated.
	(2) CALL PROG1	PROG1 is called.
	(3) WHILE (A<100)	If program variable A is smaller than 100, the portion up to line 5 is repeated.
	(4) CALL PROG2	PROG2 is called.
	(5) WEND	The WHILE statement in line 3 is ended.
	(6) WEND	The WHILE statement in line 1 is ended.

A to Z

Name	Program variables	
Input range	−8,388,608 to +8,388,607 (initial value: 0)	
Description	These are program variables. They can be used as variables for the loop counter, command values or equations in a program. When a program is started, all program variables are automatically reset to 0.	
Access	Read and write	
Related commands	None	
Command execution	Program	
Example	(1) WHILE (IN1=1)	If the X1 input is ON, the portion up to line 7 is repeated.
	(2) CALL PROG1	PROG1 is called.
	(3) WHILE (A<100)	If program variable A is smaller than 100, the portion up to line 6 is repeated.
	(4) A	Show the value of A.
	(5) CALL PROG2	PROG2 is called.
	(6) WEND	The WHILE statement in line 3 is ended.
	(7) WEND	The WHILE statement in line 1 is ended.

Note

- The command value is not saved in the driver's memory (NVRAM). Executing any of the following operations will reset this value to the default value set by the factory at the time of shipment.
  When turning on the AC power.
  When starting a program by the RUN command or the START input.
  When resetting a specific alarm by the ALMCLR command or the ACL input (See p.112).
- When variables are used in a subroutine, they are stored and executable in a calling program.

DISx (x = 0 to 3)

Name	Number of steps in linked operation	
Input range	−8,388,608 to +8,388,607 [steps] (initial value: 0)	
Description	This command is used for linked operation. It sets the number of steps in linked operation.	
Access	Read and write	
Related commands	MIx, LINKx, INCABSx, VRx	
Command execution	Program	
Example	(1) DIS0=10000	The number of steps for operation number 0 is set to 10000.
	(2) DIS1=20000	The number of steps for operation number 1 is set to 20000.
	(3) DIS2=30000	The number of steps for operation number 2 is set to 30000.
	(4) VR0=10000	The operating speed for operation number 0 is set to
	(5) VR1=20000	10000 Hz.
	(6) VR2=30000	The operating speed for operation number 1 is set to
	(7) INCABS0=1	20000 Hz.
		The operating speed for operation number 2 is set to
	(8) INCABS1=1	30000 Hz.
		The positioning mode for operation number 0 is set to
	(9) INCABS2=1	incremental.
		The positioning mode for operation number 1 is set to
	(10) LINK0=1	incremental.
	(11) LINK1=1	The positioning mode for operation number 2 is set to
	(12) LINK2=0	incremental.
	(13) MI0	Operation number 0 is set to linked.
		Operation number 1 is set to linked.
		Operation number 2 is set to one-shot.
		Start the operation for operation number 0. (Numbers 0 through 2 are linked.)

Note

The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

INCABSx (x = 0 to 3)

Name	Positioning mode of linked operation	
Input range	0 or 1 (initial value: 1) 0: Absolute operation 1: Incremental operation	
Description	This command is used for linked operation. It sets either absolute or incremental as the positioning mode for linked operation.	
Access	Write only	
Related commands	DISx, MIx, LINKx, VRx	
Command execution	Program	
Example	(1) DIS0=10000	The number of steps for operation number 0 is set to 10000.
	(2) DIS1=20000	The number of steps for operation number 1 is set to 20000.
	(3) DIS2=30000	The number of steps for operation number 2 is set to 30000.
	(4) VR0=10000	The operating speed for operation number 0 is set to 10000 Hz.
	(5) VR1=20000	The operating speed for operation number 1 is set to 20000 Hz.
	(6) VR2=30000	The operating speed for operation number 2 is set to 30000 Hz.
	(7) INCABS0=1	The positioning mode for operation number 0 is set to incremental.
	(8) INCABS1=1	The positioning mode for operation number 1 is set to incremental.
	(9) INCABS2=1	The positioning mode for operation number 2 is set to incremental.
	(10) LINK0=1	Operation number 0 is set to linked.
	(11) LINK1=1	Operation number 1 is set to linked.
	(12) LINK2=0	Operation number 2 is set to one-shot.
	(13) MI0	Start the operation for operation number 0. (Numbers 0 through 2 are linked.)

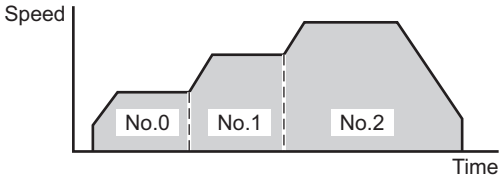
Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

LINKx (x = 0 to 2)

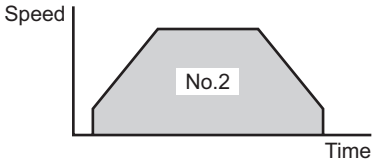
Name	One-shot/linked
Input range	0 or 1 (initial value: 0) 0: One-shot operation 1: Linked operation
Description	This command is used for linked operation. It sets either one-shot or linked for the linked operation. When “linked” is selected, the next LINKx operation is linked.

LINKx	Setting value
LINK0	1 (linked)
LINK1	1 (linked)
LINK2	0 (one-shot)

• When LINK0 is executed



• When LINK2 is executed



Access	Write only
Related commands	DISx, MIx, LINKx, VRx
Command execution	Program

Example

(1) DIS0=10000	The number of steps for operation number 0 is set to 10000.
(2) DIS1=20000	The number of steps for operation number 1 is set to 20000.
(3) DIS2=30000	The number of steps for operation number 2 is set to 30000.
(4) VR0=10000	The operating speed for operation number 0 is set to 10000 Hz.
(5) VR1=20000	The operating speed for operation number 1 is set to 20000 Hz.
(6) VR2=30000	The operating speed for operation number 2 is set to 30000 Hz.
(7) INCABS0=1	The positioning mode for operation number 0 is set to incremental.
(8) INCABS1=1	The positioning mode for operation number 1 is set to incremental.
(9) INCABS2=1	The positioning mode for operation number 2 is set to incremental.
(10) LINK0=1	Operation number 0 is set to linked.
(11) LINK1=1	Operation number 1 is set to linked.
(12) LINK2=0	Operation number 2 is set to one-shot.
(13) MI0	Start the operation for operation number 0. (Numbers 0 through 2 are linked.)

Note

- The command value is not saved in the driver’s memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.
- Linked operations can only operate in one direction. The distance of all linked motions must occur in the same motor rotation direction.

MIx (x = 0 to 3)

Name	Linked operation start	
Input range	None	
Description	This command is used for linked operation. It executes linked operation.	
Access	Command	
Related commands	DISx, INCABSx, LINKx, VRx	
Command execution	Program	
Example	(1) DIS0=10000	The number of steps for operation number 0 is set to 10000.
	(2) DIS1=20000	The number of steps for operation number 1 is set to 20000.
	(3) DIS2=30000	The number of steps for operation number 2 is set to 30000.
	(4) VR0=10000	The operating speed for operation number 0 is set to
	(5) VR1=20000	10000 Hz.
	(6) VR2=30000	The operating speed for operation number 1 is set to
	(7) INCABS0=1	20000 Hz.
		The operating speed for operation number 2 is set to
	(8) INCABS1=1	30000 Hz.
		The positioning mode for operation number 0 is set to
	(9) INCABS2=1	incremental.
		The positioning mode for operation number 1 is set to
	(10) LINK0=1	incremental.
	(11) LINK1=1	The positioning mode for operation number 2 is set to
	(12) LINK2=0	incremental.
	(13) MI0	Operation number 0 is set to linked.
		Operation number 1 is set to linked.
		Operation number 2 is set to one-shot.
		Start the operation for operation number 0. (Numbers 0 through 2 are linked.)

VRx (x = 0 to 3)

Name	Operating speed of linked operation	
Input range	1 to 500,000 [Hz] (initial value: 1000 Hz)	
Description	This command is used for linked operation. It sets the operating speed of linked operation.	
Access	Read and write	
Related commands	DISx, INCABSx, LINKx, MIx	
Command execution	Program	
Example	(1) DIS0=10000	The number of steps for operation number 0 is set to 10000.
	(2) DIS1=20000	The number of steps for operation number 1 is set to 20000.
	(3) DIS2=30000	The number of steps for operation number 2 is set to 30000.
	(4) VR0=10000	The operating speed for operation number 0 is set to
	(5) VR1=20000	10000 Hz.
	(6) VR2=30000	The operating speed for operation number 1 is set to
	(7) INCABS0=1	20000 Hz.
		The operating speed for operation number 2 is set to
	(8) INCABS1=1	30000 Hz.
		The positioning mode for operation number 0 is set to
	(9) INCABS2=1	incremental.
		The positioning mode for operation number 1 is set to
	(10) LINK0=1	incremental.
	(11) LINK1=1	The positioning mode for operation number 2 is set to
	(12) LINK2=0	incremental.
	(13) MI0	Operation number 0 is set to linked.
		Operation number 1 is set to linked.
		Operation number 2 is set to one-shot.
		Start the operation for operation number 0. (Numbers 0 through 2 are linked.)

Note The command value is not saved in the driver's memory (NVRAM). When turning on the power, or resetting a specific alarm (See p.112), this value is reset to the default value set by the factory at the time of shipment.

10 Maintenance/Inspection

Protective functions and procedures for inspection and troubleshooting/diagnostics

10.1 Protective functions

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

■ Types of protective functions and check methods

The driver has protective functions to protect itself from rising ambient temperatures, poor connections with power supply and motor cables, abnormal operations and the like.
When a protective function is triggered, the ALARM LED on the front side of the driver blinks and the ALM (alarm) output is turned OFF. The ALM output turns OFF upon the activation of a protective function, and turns ON once the system is returned to normal condition. Depending on the type of protective function, the current to the motor may be cut off, whereupon the motor will lose its holding torque.

■ Types of protective functions

Protective function	When it is activated	Alarm code output	No. of times the ALARM LED blinks	Operation	Reset
Stack overflow	Too many nested LOOP, ENDL, CALL, etc.	90h (Decimal: 144)	1	The program stops. The motor performs stop operation set by MSTOPACT.	Possible
Memory read error	The data stored in the memory is damaged.	91h (Decimal: 145)			
Program reference error	The called program does not exist.	94h (Decimal: 148)			
Compilation error	The executed program is not executable.	95h (Decimal: 149)			
Operation result overflow	The operation result exceeds the range of −8,388,608 to +8,388,607.	98h (Decimal: 152)			
Parameter out-of-range error	The parameter exceeds its setting range.	99h (Decimal: 153)			
Divide by zero	Divide by zero was executed.	9Ah (Decimal: 154)			
General I/O definition error	The signal assignment method for general I/O ports was not correct.	9Ch (Decimal: 156)			
PC command execution error	A PC command was executed while the motor was operating or not energized.	9Dh (Decimal: 157)			
Overheat protection	The temperature of the heat sink in the driver has reached approx. 85 °C (185 °F).	21h (Decimal: 33)	2	The motor loses it's holding torque.	Possible
Overload protection	A load exceeding the maximum torque has applied to the motor for the duration set by the OLTIME command.	30h (Decimal: 48)			
Overspeed error	The speed of the motor's output shaft has exceeded 5000 r/min.	31h (Decimal: 49)			
Overvoltage protection	The driver's primary inverter voltage has exceeded the limit of tolerance.	22h (Decimal: 34)	3	The motor loses it's holding torque.	Possible
Excessive position deviation	The position of the motor's output shaft has deviated from the position specified by the operation command, by at least the number of revolutions set by the OVERFLOW command.	10h (Decimal: 16)	4	The motor loses it's holding torque.	Possible
Overcurrent protection	An excessive current has flowed into the power element of the driver's inverter section.	20h (Decimal: 32)	5	The motor loses it's holding torque.	Impossible

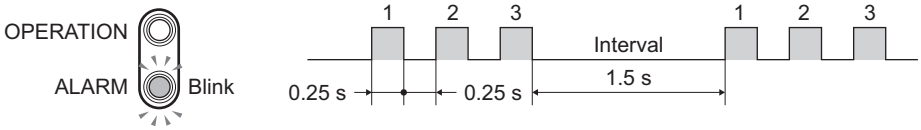
Protective function	When it is activated	Alarm code output	No. of times the ALARM LED blinks	Operation	Reset
Emergency stop	An E-STOP signal has been input.	68h (Decimal: 104)	6	The program stops. The motor loses it's holding torque (ESTOPACT = 0).	Possible
Incorrect limit-sensor logic	Both the +LS and −LS are ON simultaneously.	60h (Decimal: 96)	7	The motor stops immediately.	Possible
Reverse limit-sensor connection	The +LS and −LS are connected in reverse.	61h (Decimal: 97)			
Mechanical home seeking error	Mechanical home seeking could not been executed correctly.	62h (Decimal: 98)			
Overtravel	The motor has exceeded its hardware limit.	66h (Decimal: 102)		The program stops. The motor stops immediately (ESOPACT = 1).	
Software overtravel	The motor has exceeded its software limit.	67h (Decimal: 103)		Decelerates to a stop.	
Emergency stop	An E-STOP signal has been input.	68h (Decimal: 104)		The motor stops immediately.	
Invalid operation data	An inoperable operation pattern has been started.	70h (Decimal: 112)		Motion is stopped.	
Resolver sensor error	The motor cable has not been connected or a motor's error has occurred in a sensor.	42h (Decimal: 66)	8	The motor loses it's holding torque.	Impossible
Initial rotor revolution error	The driver's power was turned on while the motor's output shaft was turning by external force.	43h (Decimal: 67)			
NVRAM error	Motor control parameters has been damage.	41h (Decimal: 65)	9	The motor loses it's holding torque.	Impossible
System error	Driver failure has occurred.	F0h (Decimal: 240)	Stays ON.	The motor loses it's holding torque.	Impossible

■ How to check protective functions

The type of protective function that has been activated can be checked using the following three methods:

- Count how many times the ALARM LED blinks on the front side of the driver.

An example of the ALARM LED's blinking cycle is shown in the figure below.
Example: Overvoltage protection



- Checking the alarm code on a PC

When a PC is connected, enter the ALM command to check the alarm code.

■ Resetting the protective function

To reset the ALM (alarm) output, always remove the cause that has triggered the protective function and perform either of the following operations:

- Input an ACL (alarm clear) signal once.
  ON → OFF edge to reset the alarm.
- Enter an ALMCLR command.
- Turn off the power, wait at least 10 seconds, then turn it back on.

Note

- When the following alarms (protective functions) are reset by the ALMCLR command or the ACL input, the following initializations are executed.
  Alarms (protective functions) are: Overheat, Overload, Overspeed, Overvoltage, and Excessive position deviation Initializations are: The program stops. The assignment and the logical setting of the general I/O port are released. The electrical home is reset and the software limit becomes invalid.
- The following alarms (protective functions) are not reset by the ALMCLR command or the ACL input.
  Alarms (protective functions) are: Resolver sensor error, Initial rotor revolution error, NVRAM data error, Overcurrent, System error.
  To reset these alarms, remove the cause of the alarm, turn off the power after ensuring safety, wait at least 10 seconds, and then turn on the power. These require removal of AC input.

10.2 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.

10.3 Troubleshooting and remedial actions

If the motor and/or driver operation is not normal while the motor is running, check this section and take appropriate action. If operation is still not normal, contact your nearest Oriental Motor office.

Memo Perform failure diagnosis using the following methods:
- Check the alarm code shown in the display area.
- Count how many times the driver's ALARM LED blinks.

Motor phenomenon	Alarm code output	No. of times the ALARM LED blinks	Protective function	Contents	Description action
The program stops. The motor stops immediately.	90h (Decimal: 144)	1	Stack overflow	Too many nested LOOP, ENDL, CALL, etc.	Reduce the number of nested commands.
	91h (Decimal: 145)		Memory read error	The data stored in the memory is damaged.	Delete the program, then enter it again.
	94h (Decimal: 148)		Program reference error	The called program does not exist.	Enter a program name that exists.
	95h (Decimal: 149)		Compilation error	The executed program is not executable.	Execute a program that is executable.
	98h (Decimal: 152)		Operation result overflow	The operation result exceeds the range of −8,388,608 to +8,388,607.	Revise the program so that the operation result falls within the specified range.
	99h (Decimal: 153)		Parameter out-of-range error	The parameter exceeds its setting range.	Enter the correct value.
	9Ah (Decimal: 154)		Divide by zero	Divide by zero was executed.	Revise the program.
	9Ch (Decimal: 156)		General I/O definition error	The signal assignment method for general I/O ports was not correct.	Assign signals correctly.
	9Dh (Decimal: 157)		PC command execution error	A PC command was executed while the motor was operating or not energized.	Execute the PC command while the motor is at a standstill in the energized state.
The motor lacks holding brake force.	21h (Decimal: 33)	2	Overheat protection	The temperature of the heat sink in the driver has reached approx. 85 °C (185 °F).	Revise the ventilation condition so that the ambient temperature of the driver becomes 40 °C (104 °F) or below.
	30h (Decimal: 48)		Overload protection	A load exceeding the maximum torque has applied to the motor for the duration set by the OLTIME command.	Review the load and acceleration/deceleration rates again.
	31h (Decimal: 49)		Overspeed error	The speed of the motor's output shaft has exceeded 5000 r/min.	Set the speed of the motor's output shaft to 5000 r/min or less.
	22h (Decimal: 34)	3	Overvoltage protection	The driver's primary inverter voltage has exceeded the limit of tolerance.	When an alarm has occurred during acceleration/deceleration: Reduce the inertial load or increase the acceleration/deceleration rate. Gravitational operation: Reduce the load or speed, or use an optional regeneration unit (sold separately).

Motor phenomenon	Alarm code output	No. of times the ALARM LED blinks	Protective function	Contents	Description action
The motor lacks holding brake force.	10h (Decimal: 16)	4	Excessive position deviation	The position of the motor's output shaft has deviated from the position specified by the operation command, by at least the number of revolutions set by the OVERFLOW command.	Reduce the inertial load, load torque or command speed, or increase the acceleration/deceleration rates.
	20h (Decimal: 32)	5	Overcurrent protection	An excessive current has flowed into the power element of the driver's inverter section.	The motor cable, motor or driver's output element has shorted. Send the product for inspection.
The motor lacks holding torque.	42h (Decimal: 66)	8	Resolver sensor error	The motor cable has not been connected or a motor's error has occurred in a sensor.	Check the motor cable connection.
	43h (Decimal: 67)		Initial rotor revolution error	The driver's power was turned on while the motor's output shaft was turning by external force.	Make sure the motor's output shaft does not turn by external force when the power is input.
	41h (Decimal: 65)	9	NVRAM error	Motor control parameters has been damage.	Send the product for inspection.
	F0h (Decimal: 240)	Stays ON.	System error	Driver failure has occurred.	Contact the Oriental Motor branch or sales office from which you purchased the product to request repair.
Immediately stops.	60h (Decimal: 96)	7	Incorrect limit-sensor logic	Both the +LS and −LS are ON simultaneously.	Check the logic setting for hardware limit sensors [contact A (N.O.) or B (N.C.)].
	61h (Decimal: 97)		Reverse limit-sensor connection	The +LS and −LS are connected in reverse.	Connect the +LS and −LS correctly.
	62h (Decimal: 98)		Mechanical home seeking error	Mechanical home seeking could not been executed correctly.	Check the hardware limits, installation of HOMELS, wiring, and operation data used for the mechanical home seeking.
Decelerates to a stop.	67h (Decimal: 103)	7	Software overtravel	The motor has exceeded its software limit.	Revise the operation data or change the software limit range.
Stops at the parameter-set value.	68h (Decimal: 104)	6/7	Emergency stop	An E-STOP signal has been input.	Revise the operation data.
	66h (Decimal: 102)	7	Overtravel	The motor has exceeded its hardware limit.	Check the equipment.
Does not operate.	70h (Decimal: 112)	7	Invalid operation data	An inoperable operation pattern has been started.	Revise the operation data.

11 Options (Sold separately)

■ RS-232C cable

This cable is necessary when connecting the driver to a PC.
Model: **FC04W5**

■ Motor 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.

- Extention cables 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 (23.0)
CC10AST	10 (32.8)
CC15AST	15 (49.2)
CC20AST	20 (65.6)

- Flexible extension cabls for IP65 rated motor

Model	Length [m (ft.)]
CC01SAR2	1 (3.3)
CC02SAR2	2 (6.6)
CC03SAR2	3 (9.8)
CC05SAR2	5 (16.4)
CC07SAR2	7 (23.0)
CC10SAR2	10 (32.8)

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

■ Extension cables

Required to extend the distance between the motor (other than IP65 rated motor) and driver.

- For Standard

Model	Length [m (ft.)]
CC01AIP	1 (3.3)
CC02AIP	2 (6.6)
CC03AIP	3 (9.8)
CC05AIP	5 (16.4)
CC07AIP	7 (23.0)
CC10AIP	10 (32.8)
CC15AIP	15 (49.2)
CC20AIP	20 (65.6)

- For Electromagnetic Brake

Model	Length [m (ft.)]
CC01AIPM	1 (3.3)
CC02AIPM	2 (6.6)
CC03AIPM	3 (9.8)
CC05AIPM	5 (16.4)
CC07AIPM	7 (23.0)
CC10AIPM	10 (32.8)
CC15AIPM	15 (49.2)
CC20AIPM	20 (65.6)

■ Flexible extension cables

Highly flexible extension cable required to extend the distance between the motor (other than IP65 rated motor) and driver.

• For Standard

Model	Length [m (ft.)]
CC01SAR	1 (3.3)
CC02SAR	2 (6.6)
CC03SAR	3 (9.8)
CC05SAR	5 (16.4)
CC07SAR	7 (23.0)
CC10SAR	10 (32.8)

• For Electromagnetic Brake

Model	Length [m (ft.)]
CC01SARM2	1 (3.3)
CC02SARM2	2 (6.6)
CC03SARM2	3 (9.8)
CC05SARM2	5 (16.4)
CC07SARM2	7 (23.0)
CC10SARM2	10 (32.8)

■ DIN rail mounting plate

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

■ Driver cables

This shielded cable with connector provides outstanding noise resistance.

Model	Length [m (ft.)]	Purpose
CC36D1-1	1 (3.3)	36 pins
CC36D2-1	2 (6.6)	
CC20D1-1	1 (3.3)	20 pins
CC20D2-1	2 (6.6)	

■ Connector-terminal block conversion unit

Use this cable to connect the driver to a host controller via the terminal block.

Model	Length [m (ft.)]	Purpose
CC36T1	1 (3.3)	36 pins
CC20T1	1 (3.3)	20 pins

12 Appendix

12.1 Specifications

■ Main specifications

Item		Motor (other than IP65 rated motor)	IP65 rated motor	Driver
Protective range		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)	0 to +40 °C (+32 to +104 °F) (non-freezing)
	Humidity	85% or less (non-condensing)		
	Altitude	Up to 1000 m (3300 ft.) above sea level		
	Surrounding atmosphere	No corrosive gas, dust, water or oil	No corrosive gas	No corrosive gas, dust, water or oil
Storage environment	Ambient temperature	−20 to +60 °C (−4 to +140 °F) (non-freezing)		−20 to +70 °C (−4 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)		
	Altitude	Up to 3000 m (10 000 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)		−20 to +70 °C (−4 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)		
	Altitude	Up to 3000 m (10000 ft.) above sea level		
	Surrounding atmosphere	No corrosive gas, dust, water or oil	No corrosive gas	No corrosive gas, dust, water or oil

* Excluding the gap between the shaft and the flange

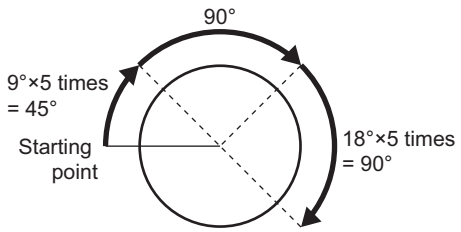
■ Driver specifications

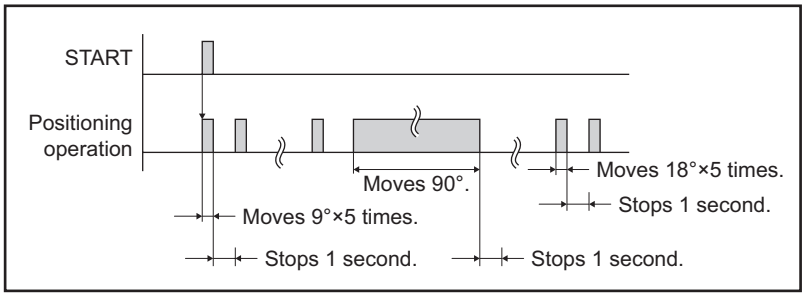
Positioning control	• Incremental (relative distance specification) mode/Absolute (absolute position specification) mode • One-shot operation/Linked operation (A maximum of 4 data can be linked.) • Steps per data: −8,388,608 steps to +8,388,607 steps • Operating speed: 1 Hz to 500 kHz (set in 1 Hz increments) • Acceleration/deceleration time*: 10 ms to 10000 ms	
Operating modes	• Positioning operation • Mechanical home seeking • Continuous operation • Electrical home seeking	
Mechanical home seeking function	Home seeking operation is performed from the entire range using mechanical-detection signals (+LS, −LS, HOMELS).	
Other functions	• Motor-resolution setting function (electronic gear 1, electronic gear 2) • Current setting function • Speed-filter gain setting function • Setting function for direction of motor rotation • Emergency stop function • Sensor logic setting function • Over-travel function • Software over-travel function • Alarm trace-back function • Daisy-chain connections	
Input signals	Control inputs (10):	24 VDC, photocoupler, input resistance 4.7 kΩ X0 to X7, START, E-STOP
	Sensor inputs (4):	24 VDC, photocoupler, input resistance 4.7 kΩ HOMELS, +LS, −LS, SENSOR
Output signals	Control outputs (9):	Photocoupler/open-collector output (External operating conditions: 30 VDC or below, 4 to 8 mA) ALM, Y0 to Y7 Line driver output (26C31 or equivalent) ASG, BSG
Communication specifications	• Electrical characteristics: In conformance with RS-232C. • Transmission method: Start-stop synchronous method, NRZ (Non-Return to Zero), full-duplex • Data length: 8bits, 1 stop bit, no parity • Transmission speed: 9600 bps • Protocol: TTY (CR + LF) • Connector specification: Modular (4lines, 4pins)	
User program	• Maximum number of programs: 14 (including the STARTUP program) • Maximum number of lines: 64 per program • Command per line: 1 (single state) • Program variables: 26 (A to Z)	

* The acceleration and deceleration times can be set separately.

12.2 Sample programs

■ Repeated positioning operation





- Main program

  Applicable motor: **AS66AAE**
  Motor resolution: 10 000 steps/rev

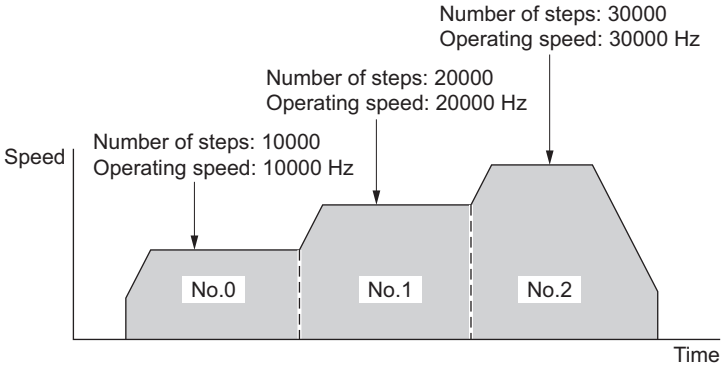
(1) TA=100	The acceleration time is set to 100 ms.
(2) TD=100	The deceleration time is set to 100 ms.
(3) GEAR1=1000	Electronic gear 1 is set to 1000.
(4) GEAR2=10	Electronic gear 2 is set to 10.
	(Motor resolution = 1000/10 × 100 = 10 000 [steps/rev])
(5) VS=100	The starting speed is set to 100 Hz.
(6) LOOP 5	Lines 6 through 11 are repeated five times.
(7) DIS=250	The number of steps is set to 250.
(8) MI	Incremental positioning operation is executed.
(9) CALL WAITEND	The program WAITEND (a program to wait for END signal) is executed.
(10) WAIT 10	The program waits 1 s.
(11) ENDL	The LOOP statement is ended.
(12) DIS=2500	The number of steps is set to 2500.
(13) MI	Incremental positioning operation is executed.
(14) CALL WAITEND	The program WAITEND (a program to wait for END signal) is executed.
(15) WAIT 10	The program waits 1 s.
(16) LOOP 5	Lines 17 through 21 are repeated five times.
(17) DIS=500	The number of steps is set to 500.
(18) MI	Incremental positioning operation is executed.
(19) CALL WAITEND	The program WAITEND (a program to wait for END signal) is executed.
(20) WAIT 10	The program waits 1 s.
(21) ENDL	The LOOP statement is ended.
(22) END	The program is ended.

- Subroutine WAITEND (A program which stands by until the END signal is turned on.)

  PROGRAM: WAITEND

(1) A=OUTSG&4	The operation result of OUTSG&4 is substituted for program variable A.
(2) WHILE (A!=4)	If A! = 4, the portion up to line 4 is repeated (while the END signal = 0).
(3) A=OUTSG&4	The operation result of OUTSG&4 is substituted for program variable A.
(4) WEND	The WHILE statement is ended.
(5) RET	The subroutine call is ended.

■ Executing linked operation



LINKx	Setting value
LINK0	1 (linked)
LINK1	1 (linked)
LINK2	0 (one-shot)

(1) DIS0=10000	The number of steps for operation number 0 is set to 10000.
(2) DIS1=20000	The number of steps for operation number 1 is set to 20000.
(3) DIS2=30000	The number of steps for operation number 2 is set to 30000.
(4) VR0=10000	The operating speed for operation number 0 is set to 10000 Hz.
(5) VR1=20000	The operating speed for operation number 1 is set to 20000 Hz.
(6) VR2=30000	The operating speed for operation number 2 is set to 30000 Hz.
(7) INCABS0=1	The positioning mode for operation number 0 is set to incremental.
(8) INCABS1=1	The positioning mode for operation number 1 is set to incremental.
(9) INCABS2=1	The positioning mode for operation number 2 is set to incremental.
(10) LINK0=1	Operation number 0 is set to linked.
(11) LINK1=1	Operation number 1 is set to linked.
(12) LINK2=0	Operation number 2 is set to one-shot.
(13) MI0	Start the operation for operation number 0. (Numbers 0 through 2 are linked.)
(14) END	The program is ended.

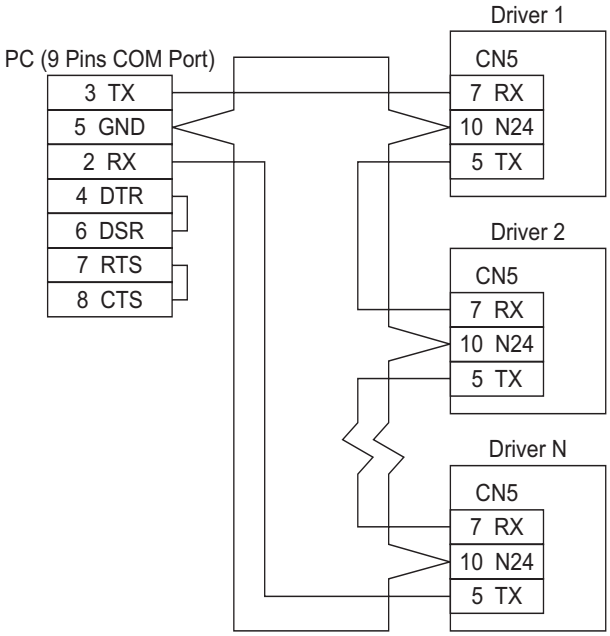
12.3 Daisy-chain connection procedure

This section describes the procedure used to connect two or more drivers via a daisy-chain (up to 36 drivers).

1. Set the drivers' axis numbers.
   Set the axis number for each driver using an ID command (driver axis setting: 0 to 9, A to Z). When setting axis numbers, connect the axes to the RS-232C communication port (CN1) one by one before implementing daisy-chain connections. Do not use duplicate axis numbers.
   Example) Setting 1 as an ID.

```
>ID 1          The driver's axis number is set to 1.
   ID = 1
>
```

2. Implement daisy-chain connections.
   An example of connecting three drivers via a daisy-chain is shown below.



Note The maximum distance between drivers when using a daisy-chain connection should be 15 m (49.2 ft.).

3. Perform communication via a daisy-chain.
   Call the specific driver used for communication via an @command. When the power is turned on, the communication driver is set to the one whose axis number is 0.
   Example) Connect the driver whose axis number is 1 to the communication line.

```
@1             When the power is turned on, the communication driver is set to the one whose
               axis number is 0. As a result, a prompt (">") is not output.
>              Executing a "@1" command connects driver 1, and a prompt is output.
>@2            Driver 2 is connected.
>ID            The axis number of the connected driver is read.
   ID = 2
>
```

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