



5-Phase Stepping Motor Unit UFK·W Series

OPERATING MANUAL



Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

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

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1 Introduction

■ Before using the motor unit

Only qualified personnel should work with the product.

Use the product correctly after thoroughly reading the section 2 “Safety precautions” on page 4.

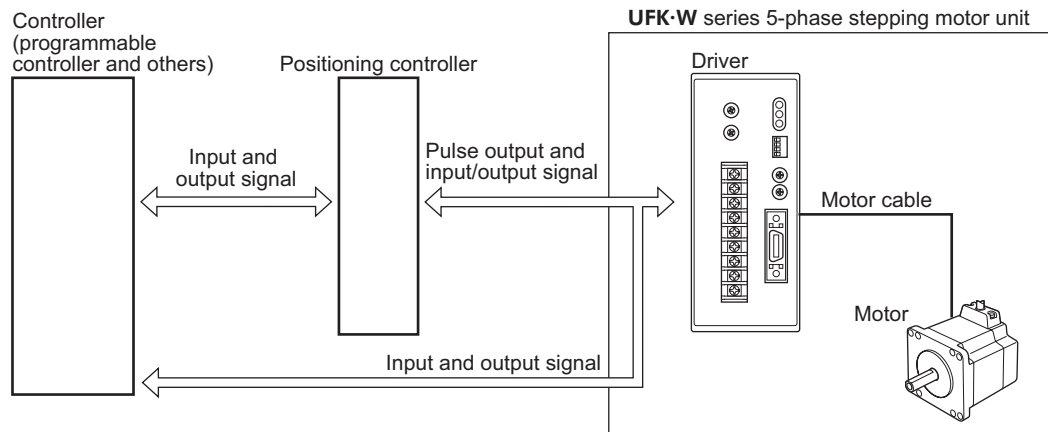
The product described in this manual has been designed and manufactured for use in general industrial machinery, and must not be used for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ Overview of the product

The **UFK·W** series 5-phase stepping motors are unit products consisting of high-performance micro-stepping driver and a 5-phase stepping motor of high-torque, low-vibration design. Oriental Motor has achieved low-vibration and low-noise operation through the use of a micro-stepping drive that electrically divides the motor’s basic step angle.

■ System configuration

Controllers with pulse output functions are needed to operate the **UFK·W** series 5-phase stepping motor units.



■ 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.	CE Marking
Motor	UL 1004, UL 519 CSA C22.2 No.100 CSA C22.2 No.77	UL	E64199	Low Voltage Directive
	EN 60950 EN 60034-1 EN 60034-5	VDE	License No.114293ÜG	
Driver	UL 508C* CSA C22.2 No.14	UL	E171462	
	EN 60950 EN 50178	Conforming to the respective standards.		

* For UL Standard (UL 508C), the product is recognized for the condition of Maximum Surrounding Air Temperature 50 °C (122 °F).

- The names of products certified to conform with relevant standards are represented by applicable unit model motor and driver part numbers.
- The temperature-rise test, as required by the VDE Standards, is conducted with the aluminum heat sink attached. The size and thickness of the heat sink are as described below.

Motor frame size [mm (in.)]	Size [mm (in.)]	Thickness [mm (in.)]
□60 (2.36)	160 × 160 (6.30 × 6.30)	10 (0.39)
□85 (3.35), □90 (3.54)	250 × 250 (9.84 × 9.84)	

● Installation conditions (EN Standard)

	Motor	Driver
Single-phase 100–115 V	Motor is to be used as a component within other equipment. Overvoltage category: II Pollution degree: 2 Protection against electric shock: Class I	Driver is to be used as a component within other equipment. Overvoltage category: II Pollution degree: 2 Protection against electric shock: Class I



● For Low Voltage Directive

This product is designed for use as a built-in component.

- Install the product within an enclosure in order to avoid contact with the hands.
- Be sure to maintain a Protective Earth in case the hands should make contact with the product. Securely ground the Protective Earth Terminals of the motor and driver.



2 Safety precautions

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

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

Warning

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire, electric shock or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire, electric shock, injury or damage to equipment.
- Do not transport, install the product, perform connections or inspections when the power is on. Always turn the power off before carrying out these operations. Failure to do so may result in electric shock.
- The terminals on the driver’s front panel marked with a   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 causing 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’s overheat-protection function is triggered, shut off the power immediately. Turn the power back on only after determining the cause. Continuing the operation without determining 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.
- If A.C.O. (Automatic current off) on the driver’s overheat-protection function is disabled, set it so that the motor is stopped upon detection of O.H. (overheat) output in order to prevent the risk of fire.
- 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 30 seconds). The residual voltage may cause electric shock.

Repair, disassembly and modification

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



Caution

General

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

Transportation

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

Installation

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

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- Provide an emergency-stop device or emergency-stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- Before supplying power to the driver, turn all input signals to the driver to “OFF.” Otherwise, the motor may start suddenly and cause injury or damage to equipment.
- To prevent bodily injury, do not touch the rotating parts (output shaft) of the motor during operation.
- Before moving the motor with the hands (as in the case of manual positioning), confirm that the driver C.OFF (All windings off) input is “ON” prevent injury.
- Immediately when trouble has occurred, stop running and turn off the driver power. Failure to do so may result in fire, electric shock or injury.
- To prevent electric shock, use only an insulated screwdriver to adjust the driver switches.
- When operating the key-equipped motor by itself, be sure the key inserted into the output shaft is fixed in position. Failure to do so may result in injury if the key should fly out.
- The motor’s surface temperature may exceed 70 °C (158 °F), even under normal operating conditions. If a motor is accessible during operation, post the warning label shown in the figure in a conspicuous position to prevent the risk of skin burn(s).



Warning
label

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 the **UFK-W** series 5-phase stepping motor unit.

- **Conduct the insulation resistance measurement or withstand voltage test separately on the motor and the driver.**
 Conducting the insulation resistance measurement or withstand voltage test with the motor and driver connected may result in injury or damage to equipment.
- **Do not apply an overhung load and thrust load in excess of the specified permissible limit.**
 Be sure to operate the motor within the specified permissible limit of overhung load and thrust load. Operating it under an excessive overhung load and thrust load may damage the motor bearings (ball bearings).
- **Operate the motor with a surface temperature not exceeding 100 °C (212 °F).**
 The driver has an overheat-protection function, but the motor has no such feature. The motor casing's surface temperature may exceed 100 °C (212 °F) under certain conditions (ambient temperature, operating speed, duty cycle, etc.). Keeping the surface temperature of the motor casing below 100 °C (212 °F) will also maximize the life of the motor bearings (ball bearings). When a harmonic geared type is used, make sure the gear case temperature is kept at 70 °C (158 °F) or below to prevent degradation of grease applied to the gear.
- **About maximum static torque at excitation**
 Maximum static torque at excitation represents a value obtained when the motor is excited using the rated current. When the motor is combined with a dedicated driver, the maximum static torque at excitation drops to approximately 50% due to the current cutback function that suppresses the rise in motor temperature in a standstill state. Acceleration and operation at the maximum static torque at excitation is possible in start-up, but it only 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.
- **Install the driver in a vertical position.**
 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.
- **Use the motor equipped with an electromagnetic brake for an application involving vertical travel.**
 For an application involving vertical travel, select a motor equipped with an electromagnetic brake so that the load can be held in position. Use the electromagnetic brake to hold the load only after the motor stops. Do not use the electromagnetic brake for the purpose of stopping the motor. Repeated use of the electromagnetic brake for the purpose of stopping may cause excessive wear in the brake hub, thus reducing the brake's holding capability. Since the electromagnetic brake is of the non-excitation type, it can also be used to hold the load in position in the event of a power failure. However, do not use the electromagnetic brake as a safety brake of your equipment, since it is not designed as a mechanism capable of securely holding the load.
- **Connecting a motor with an electromagnetic brake**
 The electromagnetic brake operates via the ON/OFF status of the driver's internal DC power supply. When connecting the motor, verify that the connection for the electromagnetic brake's lead wires has the correct polarity.
- **Preventing leakage current**
 Stray capacitance exists between the driver's current-carrying line and other current-carrying lines, the earth and the motor, respectively. A high-frequency current may leak out through such capacitance, having a detrimental effect on the surrounding equipment. The actual leakage current depends on the driver's switching frequency, the length of wiring between the driver and motor, and so on.
 When providing a leakage current breaker, use the following products, for instance, which have high-frequency signal protection:
 Mitsubishi Electric Corporation: NV series
 Fuji Electric FA Components & Systems Co., Ltd.: EG and SG series

- **Preventing electrical noise**

Take the following anti-noise measures to prevent malfunction of the motor and driver due to external noise.

Wiring the motor

Use braided-screen cable for connection between the motor and driver.

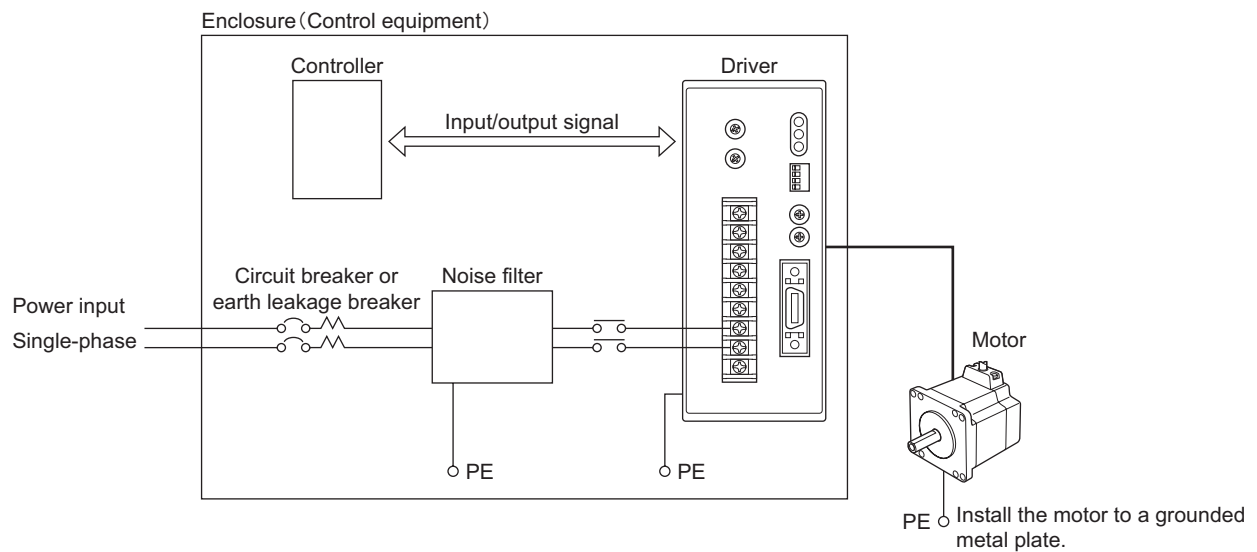
Wiring the input/output cables

- Minimize the length of the input/output cables.
- Wire the input/output cables by maintaining a minimum distance of 300 mm (11.81 in.) from the inductive loads of electromagnetic relays, etc., as well as the power lines of the power source, motor and the like.
Do not wire the input/output cables in the same duct or pipe in which power lines are wired.

Connecting noise filter for power supply line

Insert a noise filter in the driver's AC power supply input part to prevent noise from propagating to the driver and peripherals through the power supply line.

Ground the noise filter using the cable of AWG16 (wire diameter of 1.25 mm²) or more.



- **About maximum torque of geared motor**

Always operate geared types with loads not exceeding their maximum torque. If a geared type is operated with a load exceeding 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 of the geared motor. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer's equipment or products.

4 Preparation

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

4.1 Checking the product

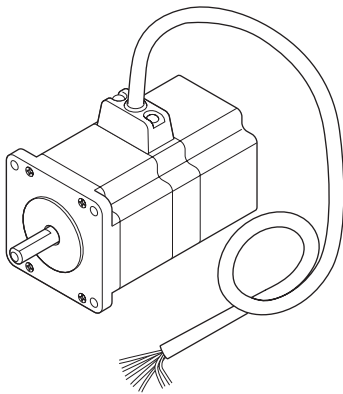
Verify that the items listed below are included.

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

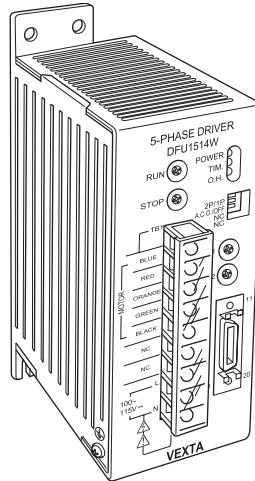
Verify the model number of the purchased unit against the number shown on the package label.

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

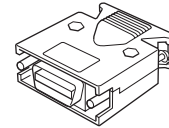
The unit models and corresponding motor/driver combinations are listed on pages 10 to 11.



Motor 1 unit
Illustration shows the standard type with electromagnetic brake.



Driver 1 unit



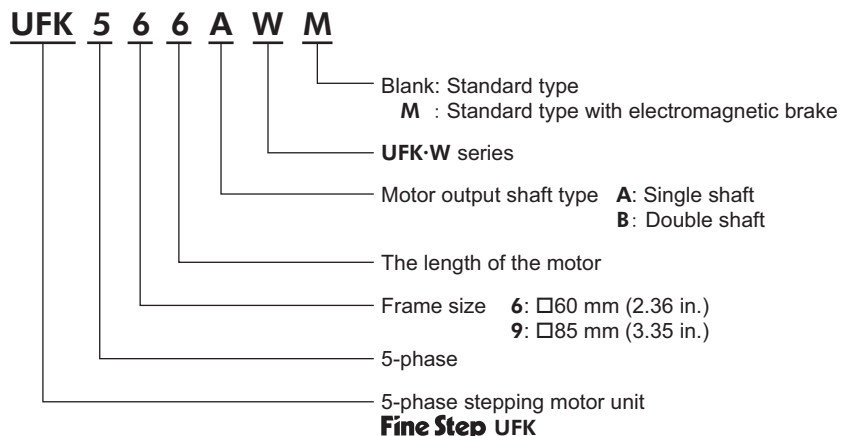
Input/output signal connector 1 set

Operating manual (this manual) 1 copy

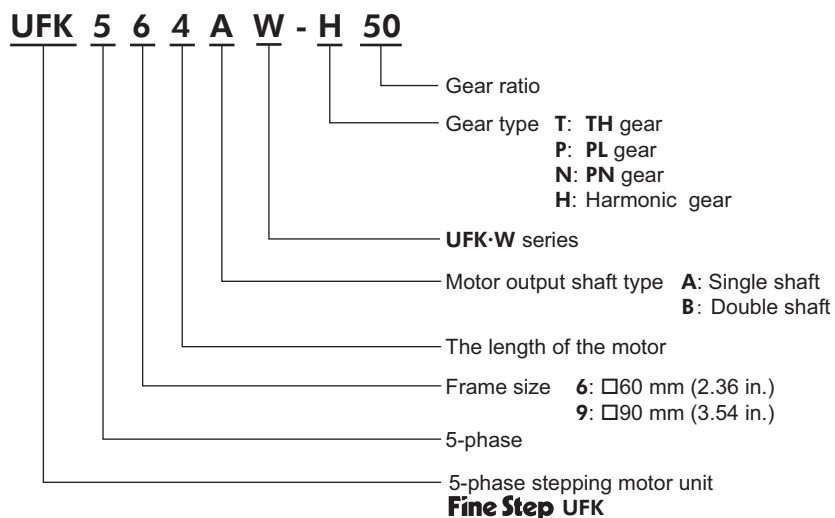
- A parallel key (1 pc.) comes with all geared types (excluding **TH** geared types **UFK56□**).
- All geared types (excluding the harmonic geared type) come with hexagonal socket head bolts (four pieces) for installing the motor.

4.2 How to identify the product model

■ Standard type, Standard type with electromagnetic brake



■ Geared type



4.3 Combinations of motors and drivers

- Standard type

Unit model	Motor model	Driver model
UFK564AW	PK564AW	DFU1514W
UFK564BW	PK564BW	
UFK566AW	PK566AW	
UFK566BW	PK566BW	
UFK569AW	PK569AW	
UFK569BW	PK569BW	
UFK596AW	PK596AW	
UFK596BW	PK596BW	
UFK599AW	PK599AW	
UFK599BW	PK599BW	
UFK5913AW	PK5913AW	
UFK5913BW	PK5913BW	

- TH geared type

Unit model	Motor model	Driver model
UFK564AW-T3.6	PK564AW-T3.6	DFU1514W
UFK564BW-T3.6	PK564BW-T3.6	
UFK564AW-T7.2	PK564AW-T7.2	
UFK564BW-T7.2	PK564BW-T7.2	
UFK564AW-T10	PK564AW-T10	
UFK564BW-T10	PK564BW-T10	
UFK564AW-T20	PK564AW-T20	
UFK564BW-T20	PK564BW-T20	
UFK564AW-T30	PK564AW-T30	
UFK564BW-T30	PK564BW-T30	
UFK596AW-T3.6	PK596AW-T3.6	
UFK596BW-T3.6	PK596BW-T3.6	
UFK596AW-T7.2	PK596AW-T7.2	
UFK596BW-T7.2	PK596BW-T7.2	
UFK596AW-T10	PK596AW1-T10	
UFK596BW-T10	PK596BW1-T10	
UFK596AW-T20	PK596AW1-T20	
UFK596BW-T20	PK596BW1-T20	
UFK596AW-T30	PK596AW1-T30	
UFK596BW-T30	PK596BW1-T30	

- Standard type with electromagnetic brake

Unit model	Motor model	Driver model
UFK564AWM	PK564AWM	DFU1514W-M
UFK566AWM	PK566AWM	
UFK569AWM	PK569AWM	
UFK596AWM	PK596AWM	
UFK599AWM	PK599AWM	
UFK5913AWM	PK5913AWM	

- PL geared type

Unit model	Motor model	Driver model
UFK566AW-P5	PK566AW-P5	DFU1514W
UFK566BW-P5	PK566BW-P5	
UFK566AW-P7.2	PK566AW-P7.2	
UFK566BW-P7.2	PK566BW-P7.2	
UFK566AW-P10	PK566AW-P10	
UFK566BW-P10	PK566BW-P10	
UFK564AW-P25	PK564AW-P25	
UFK564BW-P25	PK564BW-P25	
UFK564AW-P36	PK564AW-P36	
UFK564BW-P36	PK564BW-P36	
UFK564AW-P50	PK564AW-P50	
UFK564BW-P50	PK564BW-P50	
UFK599AW-P5	PK599AW-P5	
UFK599BW-P5	PK599BW-P5	
UFK599AW-P7.2	PK599AW-P7.2	
UFK599BW-P7.2	PK599BW-P7.2	
UFK599AW-P10	PK599AW-P10	
UFK599BW-P10	PK599BW-P10	
UFK596AW-P25	PK596AW-P25	
UFK596BW-P25	PK596BW-P25	
UFK596AW-P36	PK596AW-P36	
UFK596BW-P36	PK596BW-P36	
UFK596AW-P50	PK596AW-P50	
UFK596BW-P50	PK596BW-P50	

• PN geared type

Unit model	Motor model	Driver model
UFK566AW-N5	PK566AW-N5	DFU1514W
UFK566BW-N5	PK566BW-N5	
UFK566AW-N7.2	PK566AW-N7.2	
UFK566BW-N7.2	PK566BW-N7.2	
UFK566AW-N10	PK566AW-N10	
UFK566BW-N10	PK566BW-N10	
UFK564AW-N25	PK564AW-N25	
UFK564BW-N25	PK564BW-N25	
UFK564AW-N36	PK564AW-N36	
UFK564BW-N36	PK564BW-N36	
UFK564AW-N50	PK564AW-N50	
UFK564BW-N50	PK564BW-N50	

• Harmonic geared type

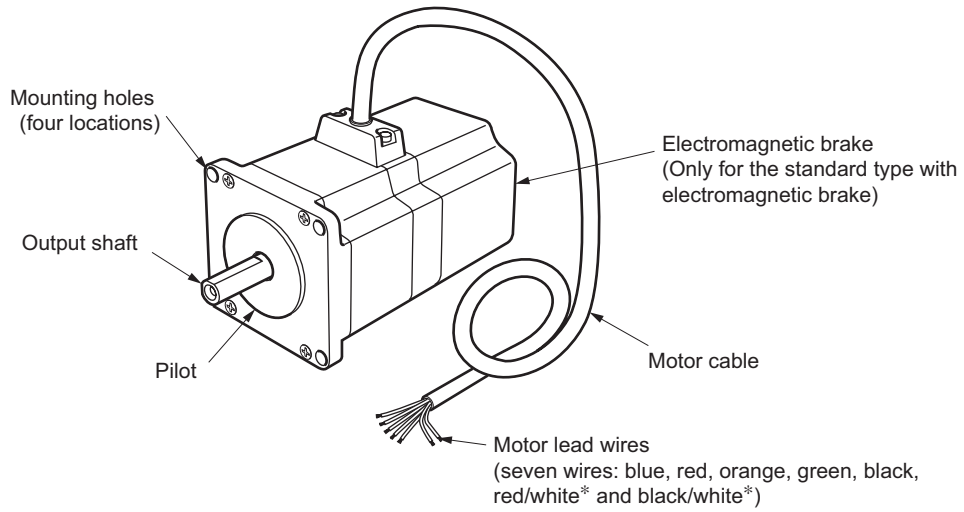
Unit model	Motor model	Driver model
UFK564AW-H50	PK564AW2-H50	DFU1514W
UFK564BW-H50	PK564BW2-H50	
UFK564AW-H100	PK564AW2-H100	
UFK564BW-H100	PK564BW2-H100	
UFK596AW-H50	PK596AW1-H50	
UFK596BW-H50	PK596BW1-H50	
UFK596AW-H100	PK596AW1-H100	
UFK596BW-H100	PK596BW1-H100	

4.4 Names and functions of parts

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

■ Motor

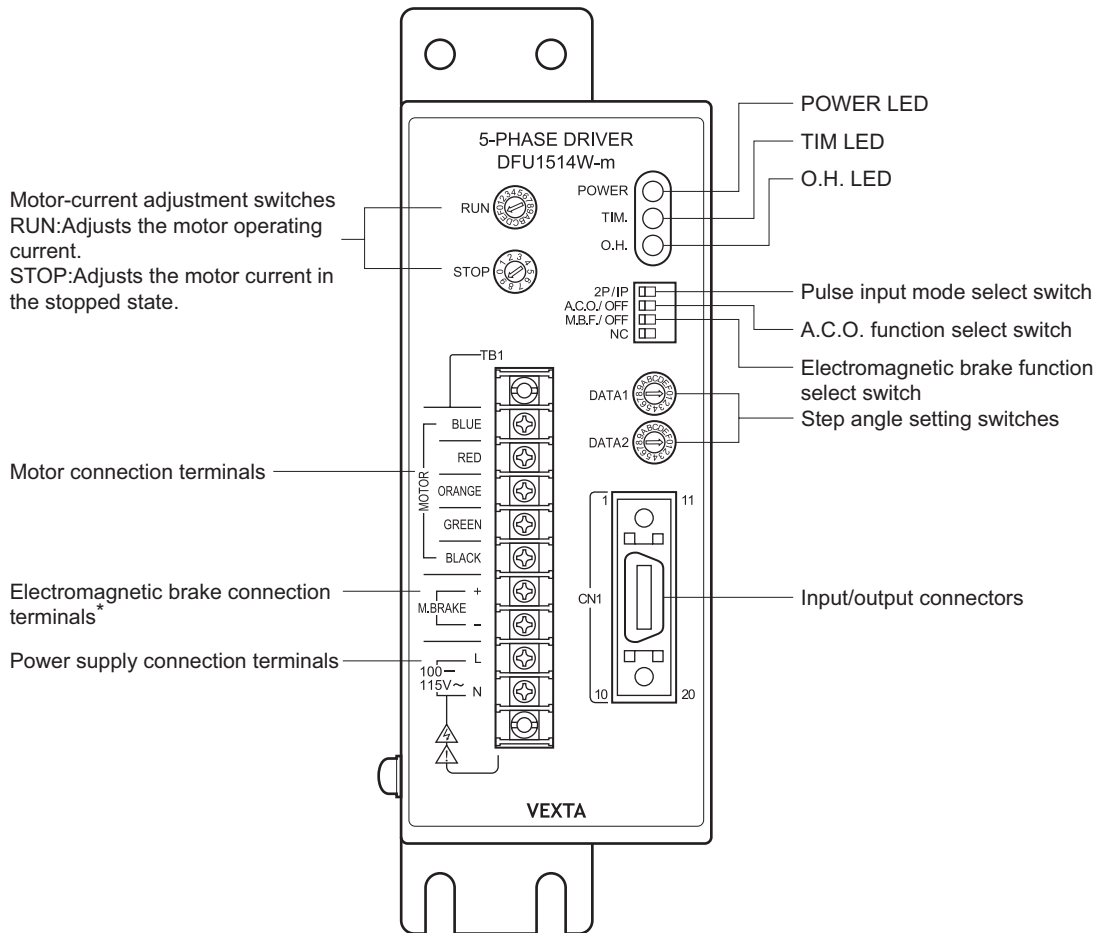
Illustration shows the standard type with electromagnetic brake (**UFK56□**).



* Only for the standard type with electromagnetic brake

■ Driver

Illustration shows the driver for **UFK56□**.



* Motors with an electromagnetic brake only

Names	Description
POWER LED (green)	Lit when the power is on.
TIM LED (green)	Lit when the excitation timing output is ON.
O.H. LED (red)	Lit when overheat protection is activated and the overheat output turns ON.
Pulse input mode select switch	Allows for the selection of 2-pulse input mode or 1-pulse input mode in accordance with the pulse output mode in the positioning controller. The factory setting is "2P" (2-pulse input mode).
A.C.O. function select switch	Set the function to automatically cut off the motor current when the internal temperature of the driver reaches approx. 80 °C (176 °F). A.C.O.: Automatic current off function enable OFF: Automatic current off function disable Factory setting: A.C.O.
Electromagnetic brake function select switch*	Sets whether to operate the electromagnetic brake other than when the power is cut off. Set this switch to "OFF" if the position need not be held other than when the power is cut off. The factory setting is "M.B.F." (electromagnetic brake free).
Motor current adjustment switches	RUN: Adjusts the motor's operating current. An ammeter is not required. The factory setting is "F". STOP: Adjusts the motor's standstill current. An ammeter is not required. The current is automatically reduced to standstill current approximately 0.1 sec. after pulse signals stop. The factory setting is "9".
Step angle setting switches	Sets the motor's step angle. Each of the two switches allows for a setting of 16 step angles. Selection is made through C/S (step angle switching) input. The factory settings is "0: 0.72°" with both switches.
Input/output connectors (CN1)	Connect the input/output signals.
Motor connection terminals	These are motor output terminals. Connect the motor lead wires according to the colors shown on the front panel.
Electromagnetic brake connection terminals*	These are power output terminals for electromagnetic brake. Connect the electromagnetic brake lead wires. Positive terminal: Connect the red/white lead wire. Negative terminal: Connect the black/white lead wire.
Power supply connection terminals	Connect the power supply.

* Motors with an electromagnetic brake only

5 Installation

This section covers the environment and method of installing the motor and driver, along with load installation.

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: -10 to +50 °C (+14 to +122 °F) (non-freezing)

Harmonic geared type: 0 to +40 °C (+32 to +104 °F) (non-freezing)

Driver: 0 to +50 °C (+32 to +122 °F) (non-freezing)

- Operating ambient humidity 85% or less (non-condensing)
- 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 (rain, water droplets), oil (oil droplets) or other liquids
- Area not exposed to direct sun
- Area free of excessive salt
- Area not subject to continuous vibration or excessive shocks
- Area free of excessive electromagnetic noise (from welders, power machinery, etc.)
- Area free of radioactive materials, magnetic fields or vacuum
- 1000 m (3300 ft.) or less above sea level

5.2 Installing the motor

■ Installation direction

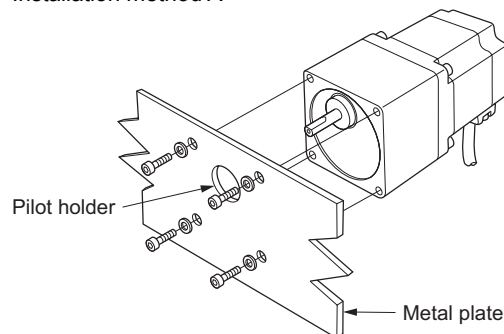
The motor can be installed in any direction.

■ Installation method

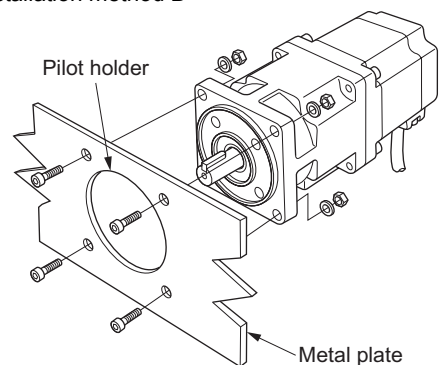
Install the motor onto an appropriate flat metal plate having excellent vibration resistance and heat conductivity. When installing the motor, secure it with four bolts (excluding the harmonic geared type) through the four mounting holes provided. Leave no gap between the motor and plate. Optional motor mounting brackets are available (sold separately).

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

Installation method A



Installation method B



Motor type	Frame size [mm (in.)]	Bolt size	Tightening torque [N·m (oz-in)]	Effective depth of bolt [mm (in.)]	Type of installation
Standard type Standard type with electromagnetic brake	□60 (2.36)	M4	2 (280)	-	B
	□85 (3.35)	M5	3 (420)		
TH geared type	□60 (2.36)	M4	2 (280)	8 (0.315)	A
	□90 (3.54)	M8	4 (560)	15 (0.591)	
PL geared type	□60 (2.36)	M5	2.5 (350)	10 (0.394)	A
	□90 (3.54)	M8	4 (560)	15 (0.591)	
PN geared type	□60 (2.36)	M5	2.5 (350)	10 (0.394)	A
Harmonic geared type	□60 (2.36)	M5	2.5 (350)	-	B
	□90 (3.54)	M8	4 (560)	-	

5.3 Installing a load

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

Also, keep the overhang load and thrust load to the permissible values or below.

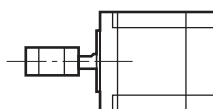
Optional flexible couplings are available (sold separately).

Note

- When coupling the load to the motor, pay attention to the centering of the shafts, belt tension, parallelism of the pulleys, 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.

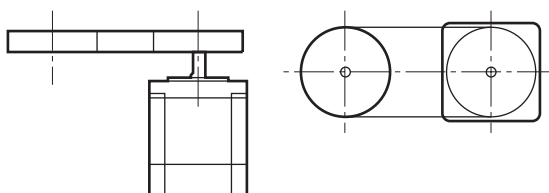
■ Using a coupling

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



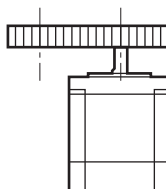
■ Using a belt drive

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



■ Using a gear drive

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



■ Connecting with a key (Geared motor)

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

5.4 Permissible overhung load and permissible thrust load

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

Note

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

Frame size [mm (in.)]	Unit model	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.)	
□60 (2.36)	UFK564						0.6 [0.9] (1.3 [2])*
	UFK566	63 (14.1)	75 (16.8)	95 (21)	130 (29)	190 (42)	0.8 [1.1] (1.8 [2.4])*
	UFK569						1.3 [1.6] (2.9 [3.5])*
	UFK564-T□	70 (15.7)	80 (18)	100 (22)	120 (27)	150 (33)	40 (9)
	UFK566-P5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)	100 (22)
	UFK566-P7.2 UFK566-P10	250 (56)	270 (60)	300 (67)	340 (76)	390 (87)	
	UFK564-P25 UFK564-P36 UFK564-P50	330 (74)	360 (81)	400 (90)	450 (101)	520 (117)	
	UFK566-N5	200 (45)	220 (49)	250 (56)	280 (63)	320 (72)	
	UFK566-N7.2 UFK566-N10	250 (56)	270 (60)	300 (67)	340 (76)	390 (87)	
	UFK564-N25 UFK564-N36 UFK564-N50	330 (74)	360 (81)	400 (90)	450 (101)	520 (117)	
	UFK564-H□	300 (67)	330 (74)	370 (83)	420(94)	480 (108)	
□85 (3.35)	UFK596						
	UFK599	260 (58)	290 (65)	340 (76)	390 (87)	480 (108)	2.8 [3.5] (6.2 [7.7])*
	UFK5913						3.8 [4.5] (8.4 [9.9])*
□90 (3.54)	UFK596-T□	220 (49)	250 (56)	300 (67)	350 (78)	400 (90)	100 (22)
	UFK599-P5 UFK599-P7.2 UFK599-P10	480 (108)	540 (121)	600 (135)	680(153)	790 (177)	300 (67)
	UFK596-P25	850 (191)	940(210)	1050 (230)	1190 (260)	1380 (310)	
	UFK596-P36	930 (200)	1030 (230)	1150 (250)	1310 (290)	1520 (340)	
	UFK596-P50	1050 (230)	1160 (260)	1300 (290)	1480 (330)	1710 (380)	
	UFK596-H□	1090 (240)	1150 (250)	1230 (270)	1310 (290)	1410 (310)	

- 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 motor with electromagnetic brake.

5.5 Installing the driver

■ Installation direction

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

When installing the driver in an enclosure, it must be placed in perpendicular (vertical) position using the four mounting holes provided in the driver.

■ Installation method

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

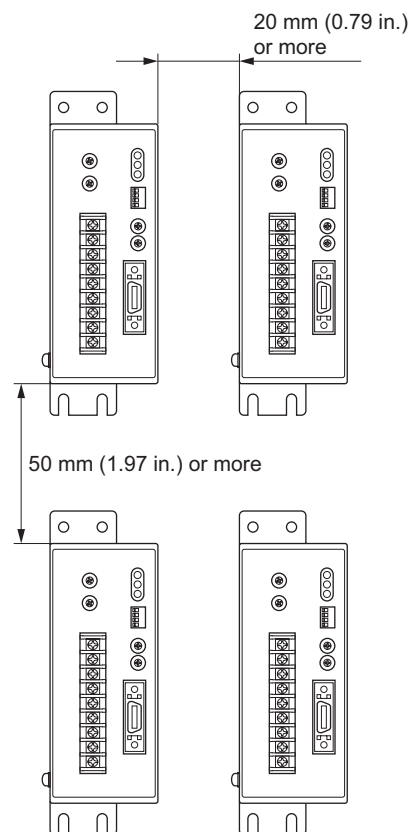
Install the driver by securing it with four bolts (M4, not supplied) through the four mounting holes provided. Leave no gap between the driver and plate.

There must be a clearance of at least 25 mm (0.98 in.) and 50 mm (1.97 in.) in the horizontal and vertical directions, respectively, between the driver and other equipment.

When two or more drivers are to be installed side by side, provide 20 mm (0.79 in.) and 50 mm (1.97 in.) clearances in the horizontal and vertical directions, respectively.

Note

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



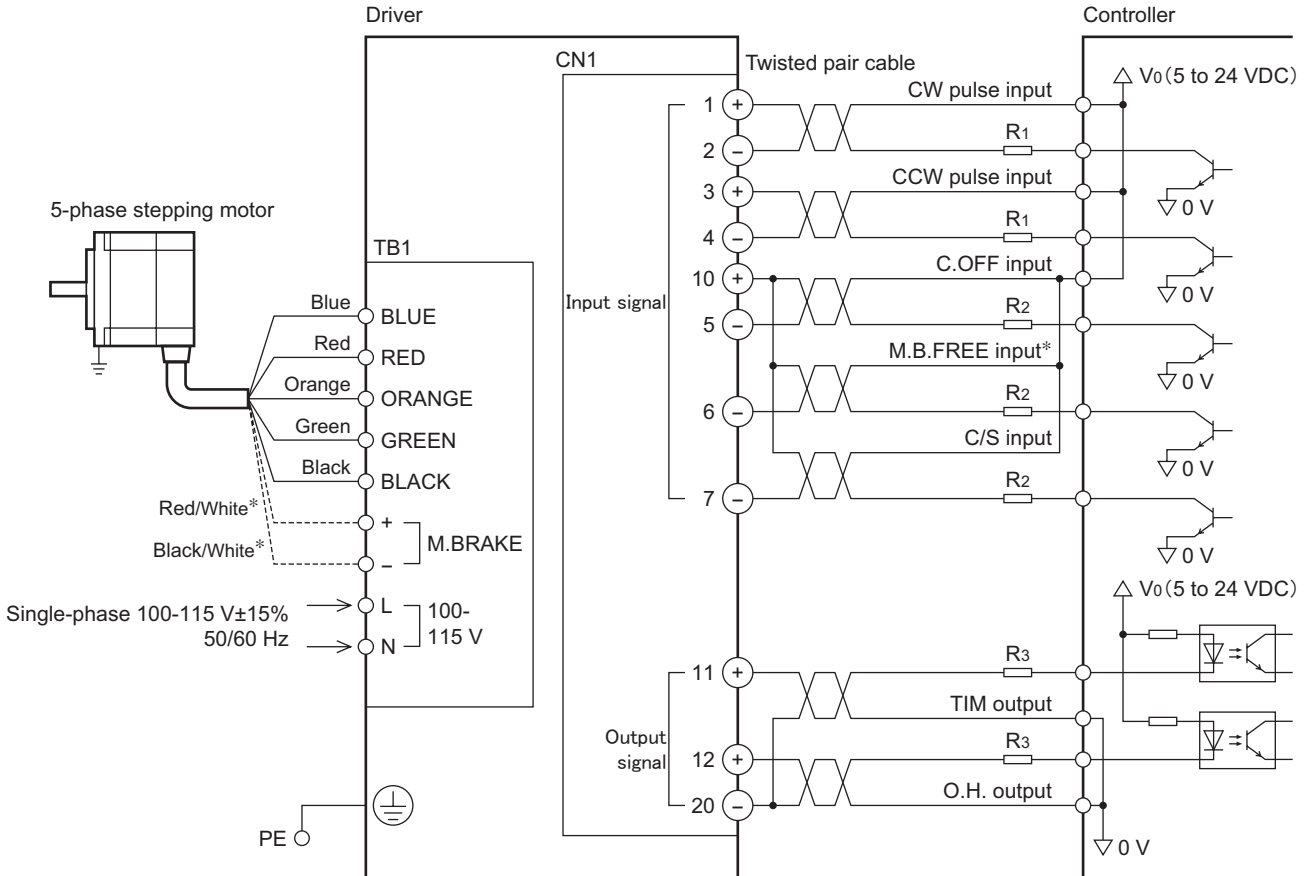
6 Connection

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

6.1 Connection example

A connection example of an electromagnetic brake type is shown.

Example of connection with a current sink output circuit



* Motors with an electromagnetic brake only

Note

- 5 VDC can be directly connected and applied. If the voltage exceeds 5 VDC, be sure to connect an external resistor to prevent the current exceeding 15 mA from flowing through the CW input and CCW input, or the current exceeding 20 mA from flowing through the C.OFF input, the M.B.FREE input and the C/S input. Applying a voltage beyond 5 VDC without using an external resistor will damage the internal elements. Example: When V_0 is 24 VDC
 R_1 : 1.5 to 2.2 k Ω 0.5 W or more
- Use output signals with a power supply not exceeding 24 VDC and 10 mA. If these specifications are exceeded, the internal elements may be damaged. Check the specification of the connected equipment.
- Be certain the input/output signal cable that connects the driver and controller is as short as possible. The maximum input frequency will decrease as the cable length increases.

6.2 Connecting the power supply

Connect the power cable to the driver's power supply terminals.

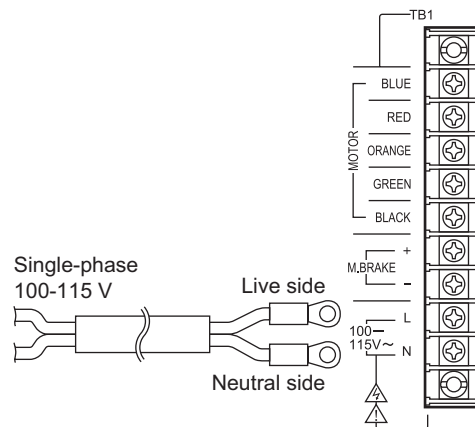
■ Connection method

Connect the live side to the L terminal and the neutral side to the N terminal.

Use a power supply capable of supplying single-phase 100-115 V \pm 15% at 4.5 A or greater.

Note

- Furnish a power supply capable of supplying adequate driver input current. If the current capacity is insufficient, the transformer may be damaged, or the motor may run erratically due to a drop in torque.
- Do not run the driver's power cable through a conduit containing other power lines or motor cables.



■ Terminal screw size and lead wire size for power connection

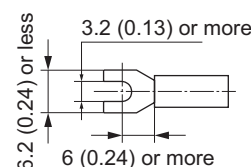
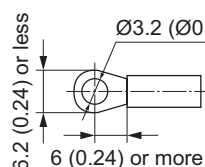
Screw size: M3

Tightening torque: 0.5 N·m (71 oz-in)

Applicable minimum lead wire size: AWG18 (0.75 mm²)

Appropriate crimp terminal

[Unit: mm (in.)]

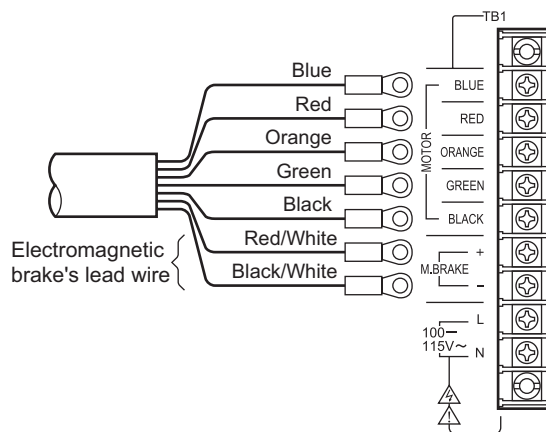


6.3 Connecting the motor and driver

Connect the motor cable (five wires: blue, red, orange, green and black) to the driver's motor/power supply terminals.

For the motor with an electromagnetic brake, also connect the electromagnetic brake's lead wires (two wires: red/white, black/white).

Illustration shows the motor with electromagnetic brake.



■ Terminal screw size and lead wire size for power connection

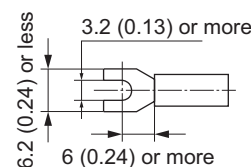
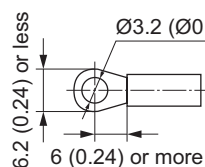
Screw size: M3

Tightening torque: 0.5 N·m (71 oz-in)

Applicable minimum lead wire size: AWG20 (0.5 mm²)

Appropriate crimp terminal

[Unit: mm (in.)]



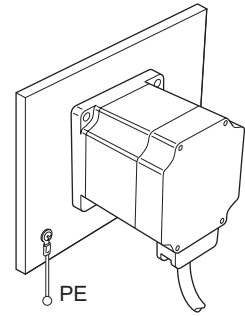
6.4 Grounding the motor and driver

■ Grounding the motor

Install the motor to the grounded metal plate.

Use a grounding wire thicker than AWG18 (0.75 mm²).

When grounding, use a round terminal and affix it with a mounting screw over a crow washer.



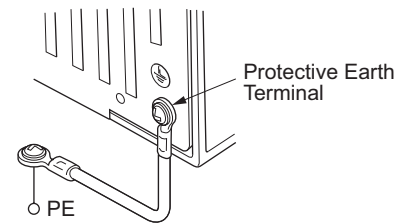
■ Grounding the driver

Be sure to ground the Protective Earth Terminal (screw size: M4) located on the driver side.

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

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

Use a round terminal to ground the cable near the driver.

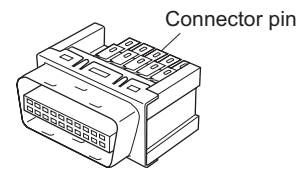


6.5 Connecting the input/output signals

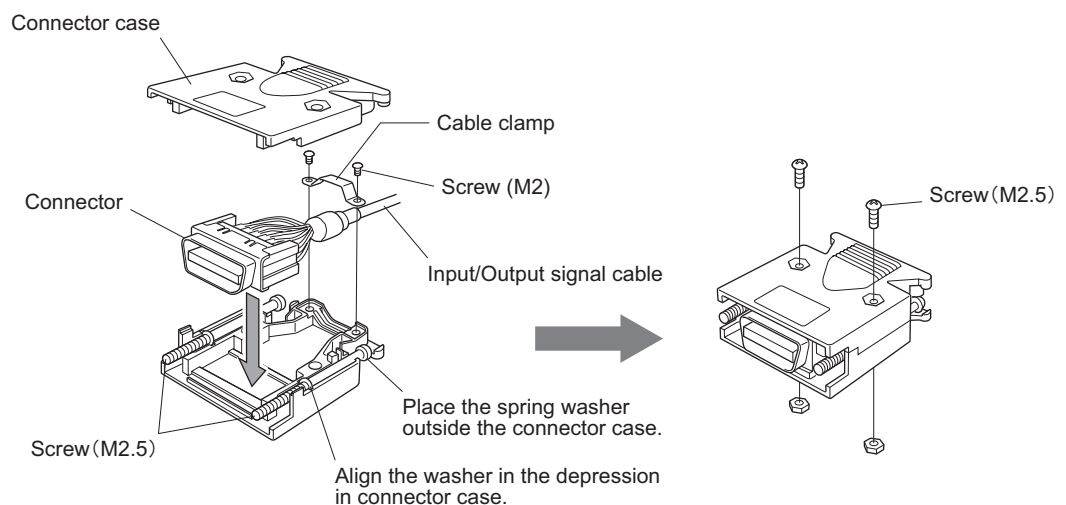
■ Connecting the input/output signal connector

After soldering the input/output signal cable (AWG28: 0.08 mm² or more) to the connector (20 pins), assemble the connector with the case using the supplied screws. Use a shielded cable. For the pin assignments, refer to page 21.

We provide optional driver cable allowing one-touch connection with a driver. See page 37 for details.



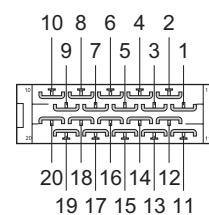
1. Attach the supplied screws (two pieces) to the connector case and insert the half-pitch connector with the input/output signal cable soldered to it. Adjust the cable clamp to its correct position.
2. Attach the other connector case and clamp both connector case together with screws and nuts.
Tightening torque: 0.5 to 0.55 N·m (71 to 78 oz-in)



Connector pin functions

Pin No.	Signal	Description	Type
1	+CW (+PLS)	CW pulse (pulse)	Input
2	-CW (-PLS)		
3	+CCW (+DIR)	CCW pulse (rotation direction)	Input
4	-CCW (-DIR)		
5	-C.OFF	Output current off	Input
6	-M.B.FREE *	Electromagnetic brake release	Input
7	+C/S	Step angle switching	Input
8	-	No used	-
9	-	No used	-
10	+COM	+Common	Input
11	+TIM	Excitation timing	Output
12	+O.H.	Overheat	Output
13	-	No used	-
14	-	No used	-
15	-	No used	-
16	-	No used	-
17	-	No used	-
18	-	No used	-
19	-	No used	-
20	-COM	-Common	Output

• Connector pin assignments



Viewed from the
soldering side

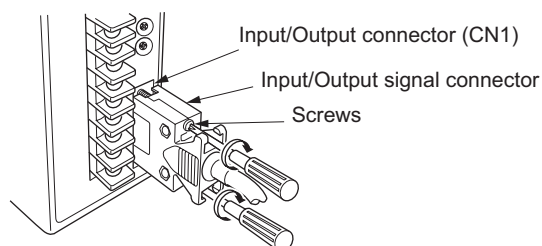
The functions shown in parentheses are enabled when “1P: 1-Pulse input mode” is selected through the pulse input mode select switch.

* Motors with an electromagnetic brake only

■ Connecting the input/output signals

Insert the input/output signal connector into the input/output signal connector CN1 on the driver side, and tighten the screw with a flat tip screwdriver.

Tightening torque: 0.3 to 0.35 N·m
(42 to 49 oz-in)



6.6 About input/output signals

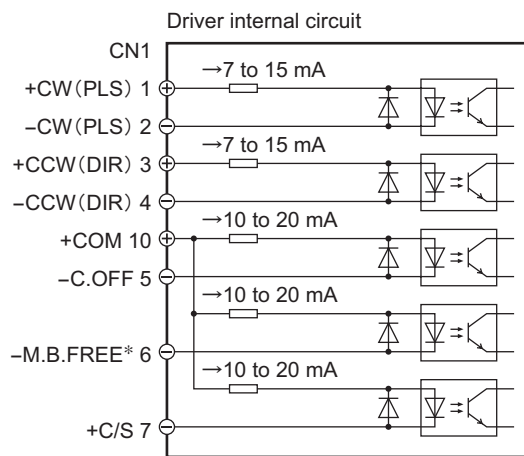
Input signals

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 5 VDC can be directly connected. If the voltage exceeds 5 VDC, be sure to connect an external resistor to prevent the current exceeding 15 mA from flowing through the CW input and CCW input, or the current exceeding 20 mA from flowing through the C.OFF input, the M.B.FREE input and the C/S input. Applying a voltage beyond 5 VDC without using an external resistor will damage the internal elements.

Example: When V_0 is 24 VDC $R_1, R_2: 1.5$ to $2.2\text{ k}\Omega$ 0.5 W or more



Pin No.	Signal name
1	+CW (+PLS)
2	-CW (-PLS)
3	+CCW (+DIR)
4	-CCW (-DIR)
5	-C.OFF
6	-M.B.FREE*
7	+C/S
10	+COM

* Motors with an electromagnetic brake only

• CW (PLS) input and CCW (DIR) input

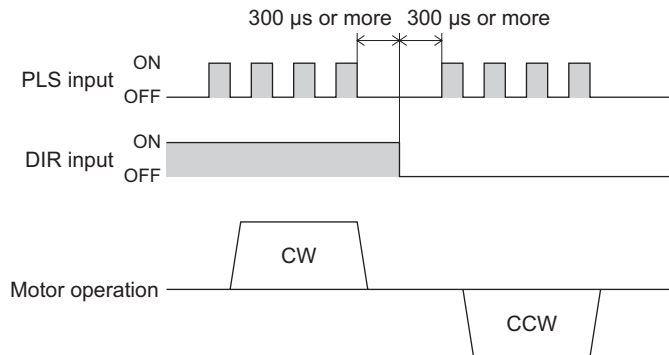
With this driver, either 2-pulse input mode or 1-pulse input mode may be selected in accordance with the controller used. Refer to page 30 for details on how to set the pulse input mode.

- Note**
- The minimum interval time needed for switching the direction of rotation will vary, depending on the operating speed and size of the load. Do not shorten the interval time any more than is necessary.
 - If no pulse is input, be sure to keep the photocoupler in “OFF” state. Do not input a CW pulse and CCW pulse simultaneously. If a pulse is input while the other photocoupler is in the “ON” state, the motor will not operate properly.
 - The direction of rotation is defined as the rotation direction of the motor shaft. The output shaft of the **TH** geared typed motors with ratios of 20:1 and 30:1, as well as all ratios of the harmonic geared type motors, rotate in the opposite direction of the motor shaft.

1-pulse input mode

Connect the controller pulse to Pin No.2 “-PLS input” and the rotating direction to Pin No.4 “-DIR input.”

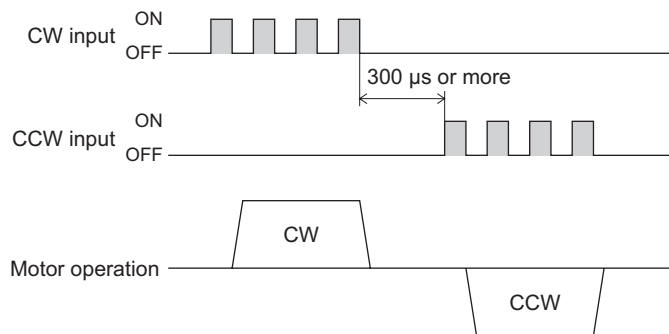
- When the DIR input is “ON,” a fall of the “PLS input” from “ON” to “OFF” will rotate the motor one step in the CW direction.
- When the DIR input is “OFF” a fall of the “PLS input” from “ON” to “OFF” will rotate the motor one step in the CCW direction.



2-pulse input mode (Factory setting)

In 2-pulse input mode, the pin functions will be as follows: Pin No.2, “-CW input” Pin No.4, “-CCW pulse input”

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



Pulse waveform · Voltage

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

See below for the voltage between terminals.

ON: +4 to 5 V

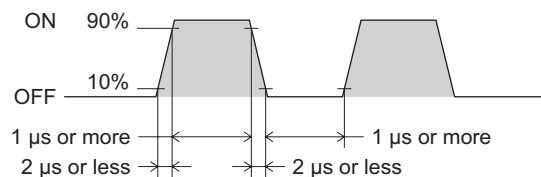
OFF: 0 to +0.5 V

The voltage of pulse and rotating direction input to the CW pulse input and CCW pulse input shall be 5 VDC.

If the voltage exceeds 5 VDC, connect an external resistor to limit the input current to 7 to 15 mA.

$$R = \frac{V-1.5}{15 \text{ mA}} - 220 [\Omega]$$

R: External resistor
V: Pulse voltage



- C.OFF (All windings off) input

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

 **Warning**

Do not turn the C.OFF input to "ON" while the motor is operating. The motor will stop and lose its holding ability. As a result, the load will fall and may cause injury or damage to equipment.

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

Note

- Normally, keep the C.OFF input in the "OFF" state or leave it disconnected.
- Do not input pulse signals immediately after switching the C.OFF signal to OFF, since doing so will affect the motor's starting characteristics. As a general rule, wait at least 150 ms before inputting a pulse signal.

- C/S (step angle switching) input

Selects and switches between the two step angle switches (DATA1 and DATA2).

For instance, if "DATA1: 0.72°" and "DATA2: 0.072°" have been selected, this signal can switch between the 0.72°/step rotation and 0.072°/step rotation.

For the values of step angles set through DATA1 and DATA2, refer to 7.1 "Step angle" on page 28.

- Turning the C/S input to "OFF" will select/switch to "DATA1."
- Turning the C/S input to "ON" will select/switch to "DATA2."

Note

- With the C/S input, the status of selection is read when the power to the driver is turned on.
- Do not switch the C/S input while the motor is operating, or the motor may misstep and stop or cause an offset in position.
- If the C/S input must be used to switch the step angles, do so while the driver's TIM output is "ON" and the motor is at rest. Switching the C/S input under any other condition may disable the TIM output and TIM LED ON/OFF functions. For further information on the TIM output, refer to page 25.

- M.B.FREE (electromagnetic brake free) input (motors with an electromagnetic brake only)

Setting the electromagnetic brake function select switch (refer to page 31) to the "OFF" side allows control over releasing and holding the electromagnetic brake via the M.B.FREE input.

To operate the motor, be sure to release the electromagnetic brake by turning the M.B.FREE input to "ON."

- Setting the M.B.FREE input to "ON" causes the driver to "release" the electromagnetic brake and allow motor operation.
- Setting the M.B.FREE input to "OFF" causes the driver to "hold" the electromagnetic brake.

Note

An abrupt fluctuation in the load may cause the motor to misstep* during operation, start-up or standstill. The motor is not equipped with a function that triggers the electromagnetic brake upon the occurrence of a misstep. Therefore, when using the motor for an application involving vertical travel, perform sufficient test runs by conducting a test using the actual load to make sure that the motor is capable of driving the load without fail.

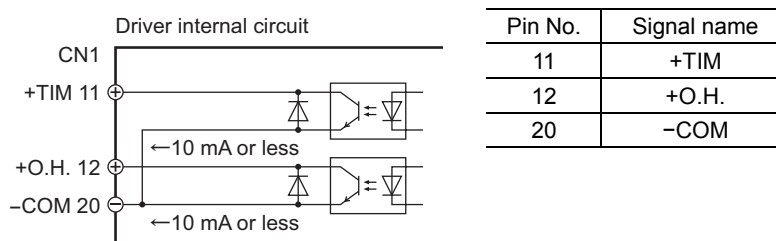
* Misstep: The term "misstep" refers to a condition in which the motor undergoes a rapid speed change or receives an excessive load and consequently stops or causes an offset in position due to its inability to turn synchronously with the pulse input.

Output signals

All output signals of the driver are photocoupler/open-collector 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 with a power supply not exceeding 24 VDC and 10 mA. If these specifications are exceeded, the internal elements may be damaged. Check the specification of the connected equipment.



• TIM (excitation timing) output

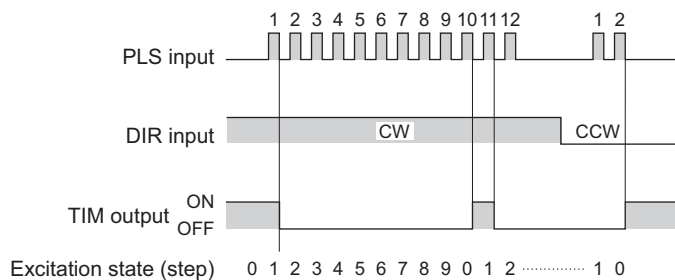
The TIM output turns “ON” to light the TIM LED when the excitation state indicates the excitation home position (step “0”). The motor’s excitation state is reset to the excitation home position when the driver’s power is turned on.

The TIM output turns “ON” each time the motor, synchronized with the pulse input, rotates 7.2° . When detecting the mechanical home position in mechanical equipment, the home position will be detected more accurately by configuring an AND circuit using the mechanical home position sensor and this TIM output, since it will reduce variance in the stopping position of the motor inside the mechanical home position’s sensing range.

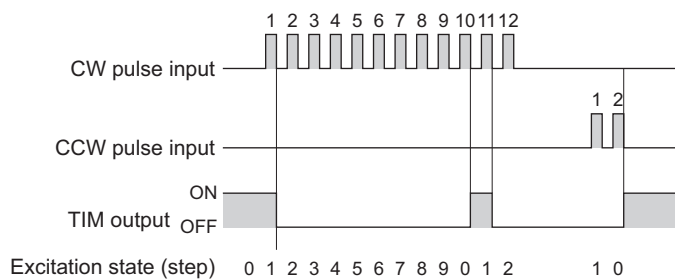
Note

- When the TIM output is used, set the number of pulses or step angle so that the motor’s output shaft will stop at an integer multiple of 7.2° .
- If the C/S input is used to switch the step angles, do so while the driver’s TIM output is “ON” and the motor is at rest. Switching the C/S input under any other condition may disable the TIM output and TIM LED ON/OFF functions.

1-pulse input mode, 0.72° stepping



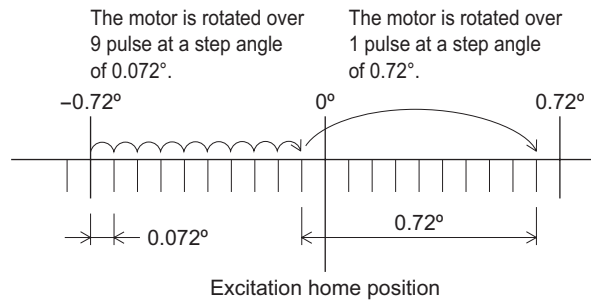
2-pulse input mode, 0.72° stepping



Example of TIM output not turning “ON”

The figure below shows a condition in which the motor operates for a period of nine pulses at a step angle of 0.072°/step, and then operates for one pulse at a step angle of 0.72°/step.

The TIM output will not switch to “ON” once the excitation origin is exceeded, as shown in the figure.



• **O.H. (overheat) output**

The O.H. output remains “OFF” when the driver is operating normally, then turns “ON” to light the O.H. LED when overheat protection is triggered.

Check the operating conditions of the motor and the ventilation within the enclosure when overheat protection is triggered.

Warning
<p>If the automatic current off function is cancelled, the O.H. output should be detected upon actuation of the driver’s overheat protection function in order to stop the motor. Failure to do so may result in fire.</p>

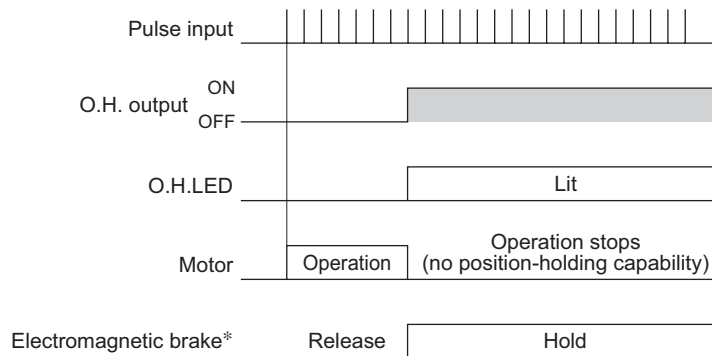
Motor operation is stopped

Set the A.C.O. function select switch to “A.C.O.: Automatic current off”.

The O.H. output is turned “OFF” when the internal temperature of the driver reaches approx. 80 °C (176 °F)

Output current is shut off to stop the motor, regardless of pulse input.

Then the electromagnetic brake holds.



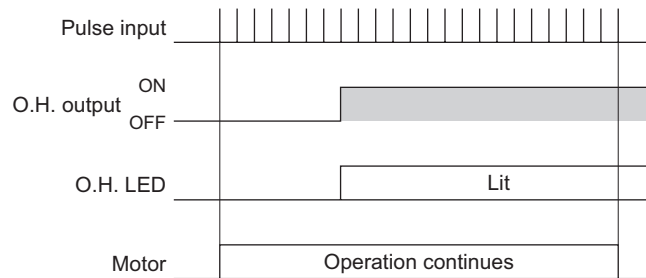
* Motors with an electromagnetic brake only

Motor operation is continued

Set the A.C.O. function select switch to “OFF: Automatic current off disable”.

The O.H. output is turned “OFF” when the driver’s internal temperature reaches approx. 80 °C (176 °F). Output current remains on and the motor continues to operate.

Then the electromagnetic brake is not actuated.



* Motors with an electromagnetic brake only

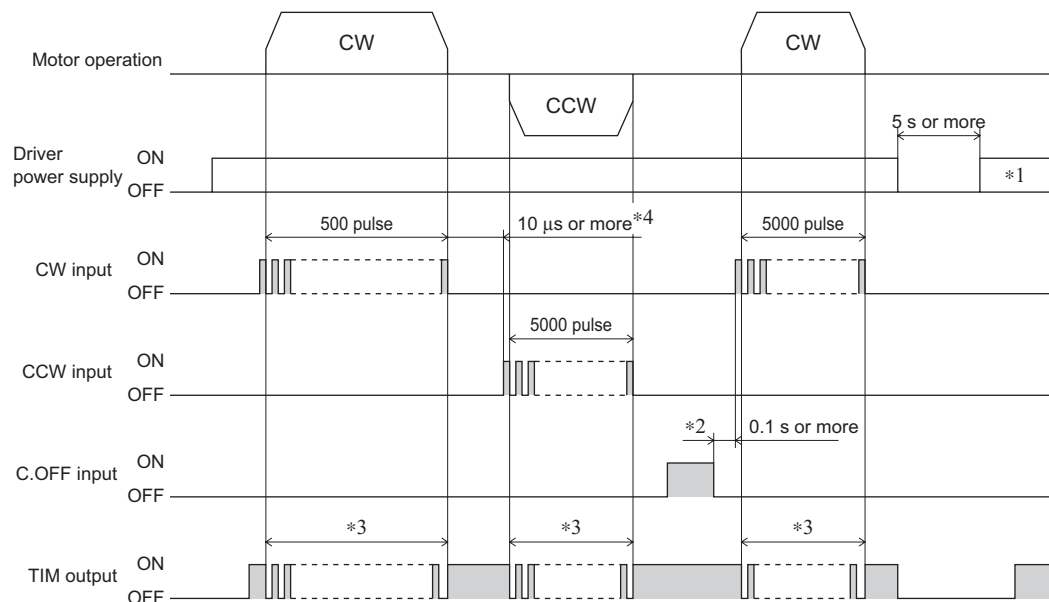
Canceling the O.H. output

- To cancel the O.H. output, be sure to remove the cause of the problem that has triggered overheating protection before turning the power back on. After the power has been shut off, wait for at least 5 seconds before turning the power back on.
- Turning the power back on after the internal temperature of the driver has fallen below 80 °C (176 °F) resets the overheating-protection function.

6.7 Timing chart

Operation condition of this timing chart is as follows.

- Pulse input mode: 2-pulse input mode
- DATA1: “0” (0.72° step)
- DATA2: “6” (0.072° step)



*1 After turning off the power, wait at least 5 seconds before turning the power back on.

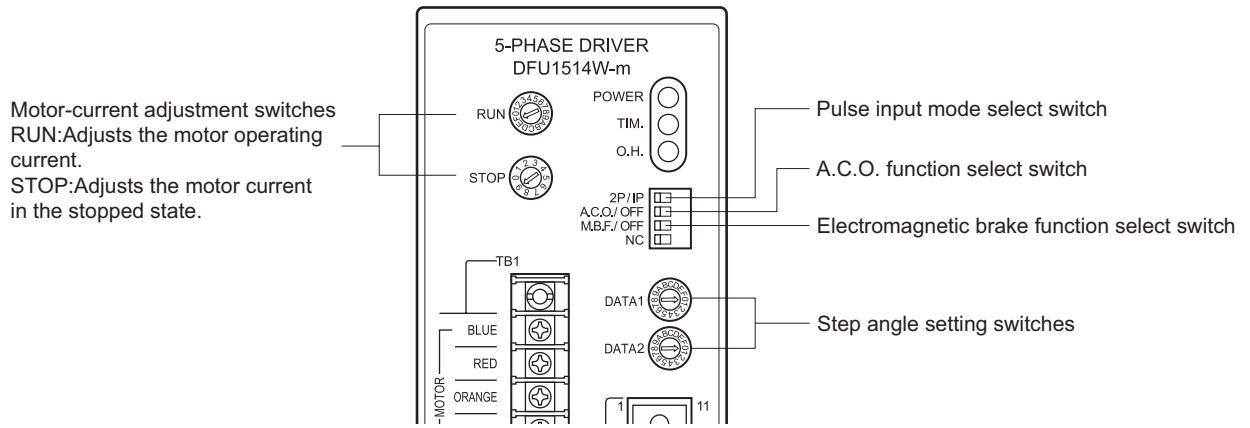
*2 When the C.OFF input is turned to “ON,” the motor’s current is turned off and the motor loses its holding ability.

*3 Signal is output once every 7.2° rotation of the motor output shaft.

*4 The minimum interval time needed for switching the direction of rotation will vary, depending on the operating speed and size of the load.

7 Setting

This section covers the switching and settings of driver functions.



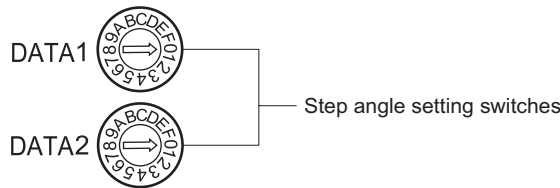
* Types with an electromagnetic brake only

7.1 Step angle

Use the step angle setting switches DATA1 and DATA2 to choose the desired step angle.

Factory settings: DATA1 [0: 0.72°]

DATA2 [0: 0.72°]



With each of the two switches, step angles can be preset in 16 steps and a desired setting can be selected through C/S (step angle switching) input. For further details on C/S input, refer to page 24.

To change the step angle, change the DATA1 or DATA2 dial setting using an insulated screwdriver. The dial provides 16 settings (from 0 to 9 and A to F). The dial settings and corresponding step angles are shown in the table below.

The step angles corresponding to the respective dial settings are identical for DATA1 and DATA2.

Dial setting	Step angle (°)	Dial setting	Step angle (°)
0	0.72	8	0.0288
1	0.36	9	0.018
2	0.288	A	0.0144
3	0.18	B	0.009
4	0.144	C	0.0072
5	0.09	D	0.00576
6	0.072	E	0.0036
7	0.036	F	0.00288

Note

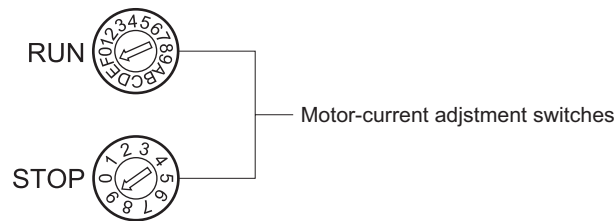
Do not switch the C/S input or the step angle setting switch while the motor is operating, or the motor may misstep and stall.

7.2 Adjusting motor currents

Use the motor-current adjustment switches “RUN” and “STOP” to set current levels for the motor.

Factory settings: [RUN] F: 1.4 A/phase

[STOP] 9: 49%



The switch provides a selection of 16 (from “0” to “9” and “A” to “F”).

The switch sets the amount of reduction in motor current relative to the operating current at 10 different levels between “0” and “9.” The motor current in the stopped state will be the operating current multiplied by the set cutback rate.

To adjust each motor current, switch the [RUN] or [STOP] dial setting using an insulated screwdriver.

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

• [RUN]		• [STOP]	
Dial setting	Operating current [A/phase]	Dial setting	Current cutback rate [%]
0	0.47	0	21
1	0.53	1	21
2	0.59	2	23
3	0.65	3	27
4	0.71	4	30
5	0.78	5	34
6	0.84	6	38
7	0.90	7	41
8	0.96	8	45
9	1.03	9	49
A	1.09		
B	1.15		
C	1.21		
D	1.28		
E	1.34		
F	1.40		

Example: Motor-current adjustment switch [RUN: F] [STOP: 4]

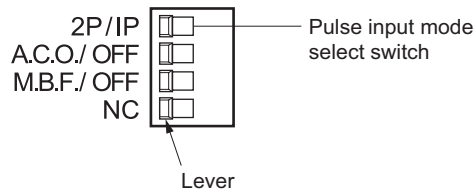
RUN current: 1.4 A, STOP current: 0.42 A

Note

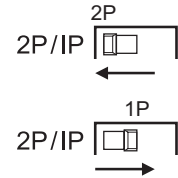
- The maximum value of the motor’s operating current is set as its rated current. Setting the motor’s current slightly lower may have a favorable effect in terms of suppressing increases in motor temperature and reducing vibration, if the load is relatively small and there is extra torque.
- In the stopped state the motor’s current may drop to as low as 21% for of the operating current. Excessively low motor current in the stopped state may cause a problem in starting the motor or holding the load in position. Do not reduce the stopped-state current any more than is necessary.

7.3 Pulse input modes

Either the 2-pulse or 1-pulse input mode may be selected in accordance with the controller used.
 Factory setting 2P (2-pulse input mode)



- When the motor is to be controlled through 2-pulse signal input via the CW pulse signal and CCW pulse signal, set the pulse input mode select switch to “2P.”
- When the motor is to be controlled through the pulse signal and the rotating-direction signal that specifies the motor’s direction of rotation, set the pulse input mode select switch to “1P.”



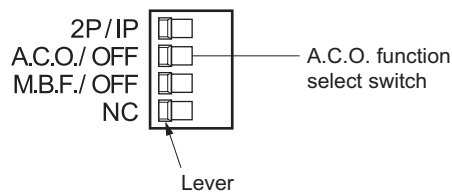
7.4 Automatic current off function

⚠ Warning

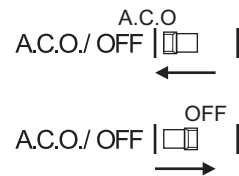
If “A.C.O. (Automatic current off)” on the driver’s overheat-protection function is disabled, set it so that the motor is stopped upon detection of O.H. (overheat) output to prevent the risk of fire.

This function enables the user to select whether the motor is stopped or allowed to continue operating when the driver’s overheat-protection function is triggered.

Factory setting A.C.O.: Motor is stopped



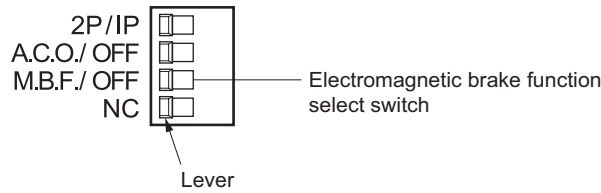
- To stop the motor when overheat protection is triggered, set the switch to the “A.C.O.” side.
 Then the electromagnetic brake is actuated and it holds.
- To keep the motor running even after overheat protection is triggered, set the switch to the “OFF” side.
 Then the output current is not turned OFF and the electromagnetic brake is not actuated.



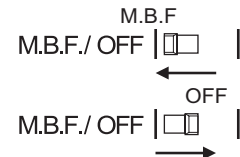
7.5 Electromagnetic brake function (motors with an electromagnetic brake only)

You can use the electromagnetic-brake function selector switch to set whether to actuate the electromagnetic brake when the motor is operating.

Factory setting “M.B.F.” (release the electromagnetic brake)



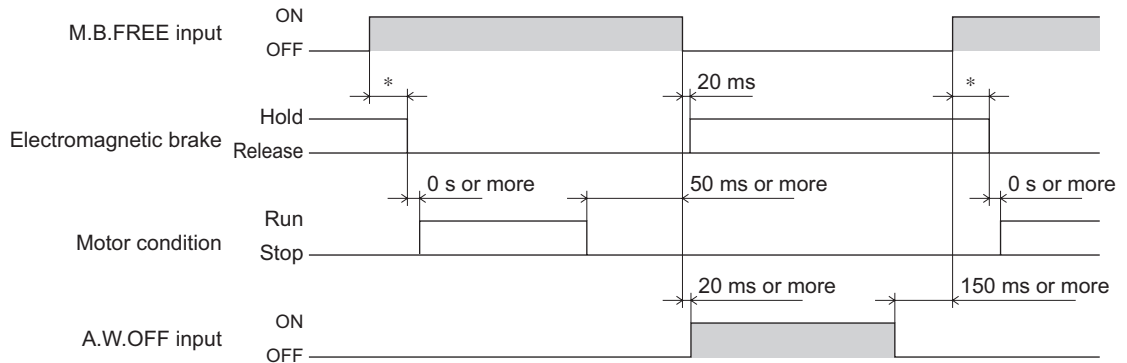
- To release the electromagnetic brake when the power is input, set the switch to the “M.B.F.” side.
- To actuate the electromagnetic brake when the power is input, set the switch to the “OFF” side. You can use the M.B. FREE input to release or actuate the electromagnetic brake.



Note Once the power is cut off, the electromagnetic brake will actuate to hold the motor output shaft in position.

■ Timing chart (When the electromagnetic brake function select switch is set to “OFF”)

- During operation

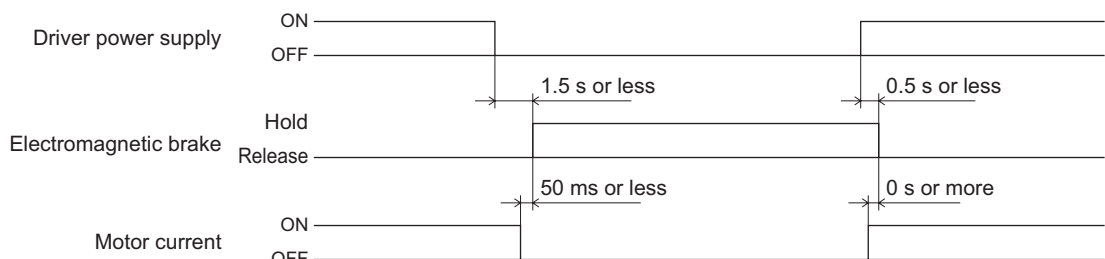


* Brake release time (Refer to the table below)

Frame size [mm (in.)]	Brake release time (ms)
□60 (2.36)	30
□85 (3.35)	50

- To operate the motor, turn the M.B.FREE input to “ON,” thereby “releasing” the electromagnetic brake.
- Input the pulse signal after releasing the electromagnetic brake.
- To set the electromagnetic brake to “hold” after the motor stops, turn the M.B.FREE input to “OFF.” The output current will not be turned OFF.
- To turn OFF the output current when the motor stops, turn the C.OFF input to “ON.”

- When the power supply is off



8 Overheat protection function

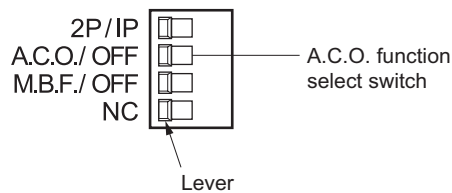
Overheat protection is triggered when the driver's internal temperature reaches approx. 80 °C (176 °F), upon which the O.H. output is turned "ON" and the O.H. LED (red) turns on.

⚠ Warning

If "A.C.O. (Automatic current off)" on the driver's overheat-protection function is disabled, set it so that the motor is stopped upon detection of O.H. (overheat) output to prevent the risk of fire.

8.1 Stopping the motor operation

The automatic current off function select switch has been set to "A.C.O." before shipment. When overheat protection is triggered, output current will be turned off and motor operation stopped regardless of the pulse input at the time.



8.2 Allowing the motor operation to continue

If you wish to allow the motor operation to continue even after overheat protection is triggered, set the A.C.O. function select switch to the "OFF" side. The output current will not be turned off and the motor will continue to operate.

At the completion of motor operation, shut off the driver's power promptly.

8.3 Canceling the O.H. output

- To cancel O.H. output, first remove the cause of the problem that had triggered overheat protection and then turn on the power again. After turning off the power, wait at least 5 seconds before turning the power back on.
- Overheat protection is cancelled if the power is turned on again after the temperature within the driver drops below 80 °C (176 °F).

9 Inspection

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

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

■ During Inspection

- Are any of the motor mounting screws loose?
- Are there any abnormal sounds from the motor's bearing section (ball bearings) or elsewhere?
- Is there any deviation between the centers of the motor's output shaft and load shaft?
- Do any of the motor cables have damage or stress, or is there any play at the section for connection with the driver?
- 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 driver?

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

10 Troubleshooting and remedial actions

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

Certain items must be checked with the power on. Be careful not to touch the live connections.

Phenomenon	Possible cause	Remedial action
<ul style="list-style-type: none"> The motor is not excited. The motor's output shaft can be turned easily with the hands. (The motor equipped with an electromagnetic brake can be turned easily with the hands, once the brake is released.) 	Bad connection of the motor cable.	Check the connections between the motor and driver.
	Incorrect setting of the current-adjustment switch. If the setting is too small, reduced motor torque results in unstable operation.	Return the driver's current-adjustment switch to the factory setting and check again. RUN: F STOP: 9
	C.OFF input is ON.	Turn the C.OFF input to OFF and confirm that the motor shaft is held in position.
	The driver's overheat protection is active. (The O.H. LED is lit.) The motor will not be held in position if the automatic current off function select switch is set to "A.C.O."	Shut off the driver's power and check the cause of the problem that had triggered overheat protection. Take appropriate action and turn on the power again.
The motor does not run.	Bad connection of the pulse input line. The TIM LED (green) is not flashing.	<ul style="list-style-type: none"> Check the connections of the controller and driver. Check the pulse signal specifications (voltage and width.)
	In 2-pulse input mode, the CW and CCW inputs are both ON at the same time.	Input the pulse signal either to the CW or CCW side. Also, make sure the terminal with no input is set to OFF.
	In 1-pulse input mode, the pulse signal is connected to the DIR input.	Connect the pulse input signal to the PLS input.
The motor rotates in the direction opposite that which is specified.	In 2-pulse input mode, the CW and CCW pulses are connected in reverse.	Connect the CW pulse to the CW input and CCW pulse to CCW input.
	In 1-pulse input mode, the DIR input is set in reverse.	Set to ON to rotate the CW direction or OFF to the CCW direction.
The geared output shaft rotates in the direction opposite motor rotation.	A geared type is used whose rotating direction is opposite that of the motor shaft.	<ul style="list-style-type: none"> TH geared type rotates in the direction opposite motor rotation at gear ratios of 20:1 and 30:1. All harmonic geared types rotate in the direction opposite motor rotation.
Motor operation is unstable.	Bad connection of the motor cable.	Recheck the connection between the driver and motor.
	Incorrect setting of the current-adjustment switch. If the setting is too small, reduced motor torque results in unstable operation.	Return the driver's current-adjustment switch to the factory setting and check again. RUN: F STOP: 9
	Bad connection of the pulse input line. The TIM LED (green) is not flashing.	Check the connections of the controller and driver. Review the specifications (voltage and width) for input pulse.

Phenomenon	Possible cause	Remedial action
The motor missteps during acceleration or operation.	Misalignment of the motor's output shaft and load shaft.	Check the coupling of the motor output shaft and load shaft.
	Excessive load or large fluctuation in the load.	Check for a large fluctuation in the load during motor operation. If the problem does not occur after reducing the motor's operating speed, i.e., increasing the torque, a review of load conditions is required.
	The starting pulse speed is too high.	Reduce the starting pulse speed to a level at which starting becomes stable.
	The acceleration (deceleration) time is too short.	Increase the acceleration (deceleration) time to a level at which starting becomes stable.
	Noise is affecting operation.	Verify operation by using only the motor, driver and controller needed for operation. If noise is confirmed, take remedial actions such as isolating the noise source, performing wiring again, changing the signal cable to a shielded cable, and installing a ferrite core.
Vibration is large.	Misalignment of the motor's output shaft and load shaft.	Check the coupling of the motor's output shaft and load shaft.
	Resonating motor	If vibration subsides at a different operating-pulse speed, the motor is resonating. Modify the set operating-pulse speed or reduce the step angle.
	Small load	Reduce the operating current. If the motor's output torque is too large for the load, vibration will increase.
The overheat-protection function is active.	Inappropriate installation environment for the driver.	<ul style="list-style-type: none"> • Install the driver on a metal enclosure surface to promote heat dissipation. • Lower the ambient temperature to a range between 0 to +50 °C (+32 to +122 °F) by improving the ventilation or providing forced cooling of the driver.
	Continuous operation at an operating-pulse speed that increases the driver's input current.	Change the set operating-pulse speed or reduce the operating time by referring to the driver's input current in the speed-torque characteristics in the catalog.
The electromagnetic brake does not hold.	M.B.FREE input is "ON."	When the electromagnetic brake-function select switch is set to "OFF," turn "OFF" the M.B.FREE input to set the electromagnetic brake to hold. When the electromagnetic brake-function select switch is set to "M.B.F.," the electromagnetic brake will not hold unless the power to the driver is turned OFF.
The TIM output does not turn "ON."	The step angle switch signal was input when no excitation-timing signal was output.	Turn the C/S input to "ON" when the TIM output is ON.

11 Specifications

This section covers the main specifications of the **UFK-W** series 5-phase stepping motors. Refer to the catalog for detailed specifications, torque characteristics and dimensions.

		Motor	Driver
Degree of protection		IP30	IP00
Operation environment	Ambient temperature	-10 to +50 °C (+14 to +122 °F) (non-freezing) Harmonic geared type: 0 to +40 °C (+32 to +104 °F) (non-freezing)	0 to +50 °C (+32 to +122 °F) (non-freezing)
	Humidity	85% or less (non-condensing)	
	Altitude	Up to 1000 m (3300 ft.) above sea level	
	Surrounding atmosphere	No corrosive gas, dust, water or oil	
Storage environment	Ambient temperature	-25 to +70 °C (-13 to +158 °F) (non-freezing) Harmonic geared type: -20 to +60 °C (-4 to +140 °F) (non-freezing)	-25 to +70 °C (-13 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)	
	Altitude	Up to 3000 m (10 000 ft.) above sea level	
	Surrounding atmosphere	No corrosive gas, dust, water or oil	
Shipping environment	Ambient temperature	-25 to +70 °C (-13 to +158 °F) (non-freezing) Harmonic geared type: -20 to +60 °C (-4 to +140 °F) (non-freezing)	-25 to +70 °C (-13 to +158 °F) (non-freezing)
	Humidity	85% or less (non-condensing)	
	Altitude	Up to 3000 m (10 000 ft.) above sea level	
	Surrounding atmosphere	No corrosive gas, dust, water or oil	

12 Options (Sold separately)

■ Extension cable

These cables are used to extend the wiring length between the motor and driver. (Can not used for motors with an electromagnetic brake)

Model	Length [m (ft.)]	Number of cores
CC05PK5	5 (16.4)	5
CC10PK5	10 (32.8)	
CC20PK5	20 (65.6)	

■ Driver cable

A shielded cable for driver control inputs/outputs (20 pins) offering excellent noise resistance. It comes with a half-pitch connector allowing one-touch connection to a driver.

Model	Length [m (ft.)]
CC20D1-1	1 (3.3)
CC20D2-1	2 (6.6)

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