

5 Phase Stepping Motor and Driver

UFK · W Series

● TH Geared Type

OPERATING MANUAL



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Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

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

1. Precautions

Precautions for Installation



- Do not use in a place where there is flammable gas and/or corrosive gas.
- Products for use only in equipment of protection class I .
- The motor and the driver must be properly grounded.
- When installing the motor into your equipment, ensure that the motor lead wires are fixed and do not move.
In addition, do not apply any pressure to these lead wires.
- Installation must be performed by a qualified installer.
- Ensure the driver's terminal cover is attached before using products.

Precautions for Operation

- Always turn off the power to the driver before conducting checks or performing work on the product.
- The chassis temperature of this motor and driver can exceed 70°C (158°F) (depending on operation conditions).
In case this product is accessible during operation, please attach the following warning label so that it is clearly visible.



Warning label

- The   markings on the driver's front panel indicate high voltage terminals. Do not touch these terminals while the power is ON. Contact could cause electric shock or fire.

Precautions for Troubleshooting

- Refer to "Troubleshooting" (chapter 9) if the motor or driver is not functioning properly. If the problem can not be corrected, contact your nearest ORIENTAL MOTOR office as indicated at the back of this manual. Do not disassemble the motor or driver.
- The driver incorporates double-pole/neutral fusing for the power input. If the driver POWER LED is Off, it is possible that only the neutral fuse is tripped. High voltage supplied on the hot side may cause electric shock. Turn the power Off immediately and request service.

2. Product Verification

2.1 Equipment Checklist

Confirm that the following equipment is included in your package.

Contact your nearest sales office if something is either not included or damaged.

- Motor 1
- Driver 1
- Hex Socket Screws for Mounting Motor 4
- Parallel Key 1

Enter A (single shaft) or B (double shaft) in the within the model numbers.

Motor/Driver Package Model Number	Mounting Screws	Parallel Key [mm (inch)]
UFK564 <input type="checkbox"/> W-T3.6 UFK564 <input type="checkbox"/> W-T7.2 UFK564 <input type="checkbox"/> W-T10 UFK564 <input type="checkbox"/> W-T20 UFK564 <input type="checkbox"/> W-T30	M4 × P0.7 × 18	_____
UFK596 <input type="checkbox"/> W-T3.6 UFK596 <input type="checkbox"/> W-T7.2 UFK596 <input type="checkbox"/> W-T10 UFK596 <input type="checkbox"/> W-T20 UFK596 <input type="checkbox"/> W-T30	M8 × P1.25 × 18	4 × 4 × 25 (0.157 × 0.157 × 0.984)

- Connector for I/O Signals
 - (Connector (MOLEX) 1)
 - (Connector Cover (MOLEX) 1)
- Operating Manual 1

2.2 Model Numbers and Motor/Driver Combinations

The **UFK · W** series is a combined package which includes a stepping motor and a driver.

This operating manual is designated for the following products.

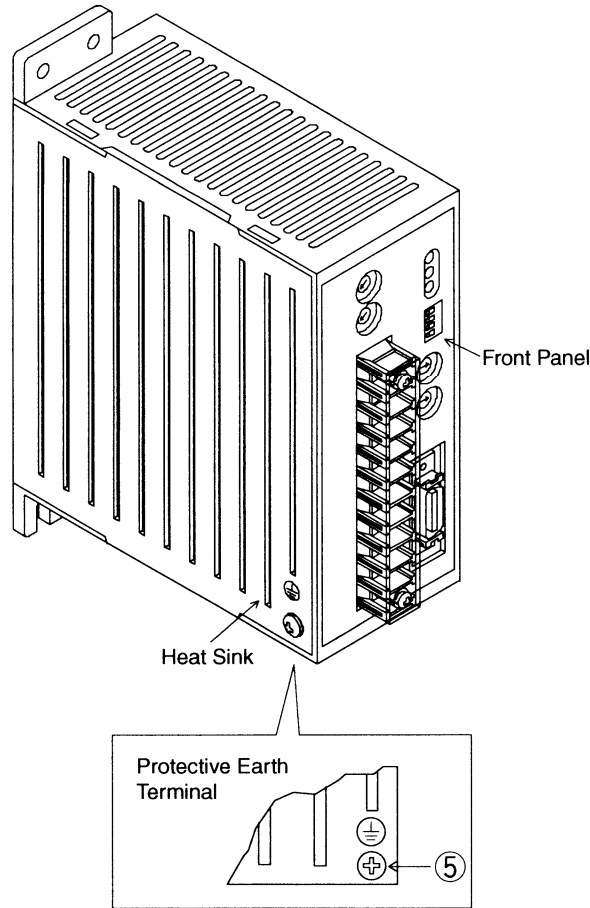
Enter A (single shaft) or B (double shaft) in the within the model numbers.

Package Model Number	Power Source Specifications	Motor			Driver	
		Model Number	Gear Ratio	Rated Current	Model Number	Output Current
UFK564 <input type="checkbox"/> W-T3.6 UFK564 <input type="checkbox"/> W-T7.2 UFK564 <input type="checkbox"/> W-T10 UFK564 <input type="checkbox"/> W-T20 UFK564 <input type="checkbox"/> W-T30	Single phase 100-115V	PK564 <input type="checkbox"/> W-T3.6	1 : 3.6	1.4A/phase	DFU1514W	1.4A/phase (max.)
PK564 <input type="checkbox"/> W-T7.2		1 : 7.2				
PK564 <input type="checkbox"/> W-T10		1 : 10				
PK564 <input type="checkbox"/> W-T20		1 : 20				
PK564 <input type="checkbox"/> W-T30		1 : 30				
PK596 <input type="checkbox"/> W-T3.6		1 : 3.6				
PK596 <input type="checkbox"/> W-T7.2		1 : 7.2				
PK596 <input type="checkbox"/> W1-T10		1 : 10				
PK596 <input type="checkbox"/> W1-T20		1 : 20				
PK596 <input type="checkbox"/> W1-T30		1 : 30				

Note

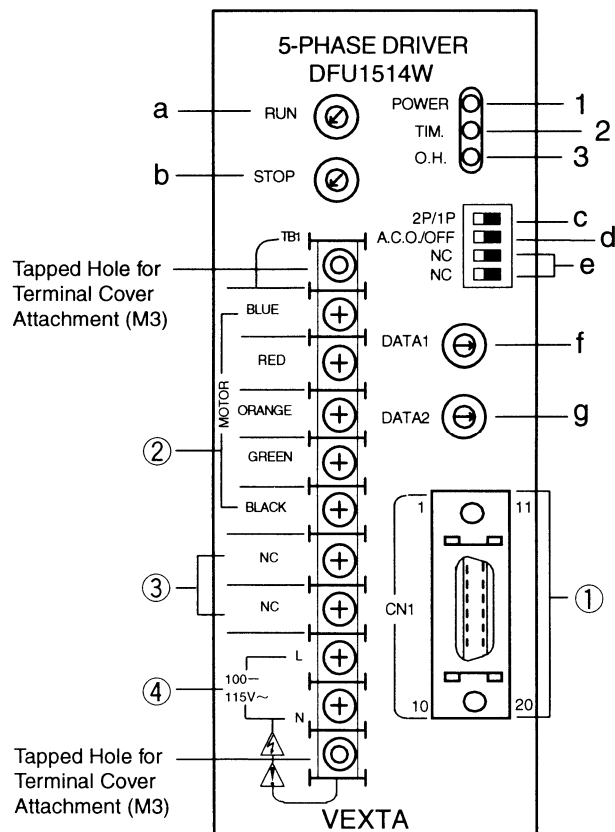
- The driver and the motor are precision equipments and should not be dropped or subject to any physical shocks.

3. Names and Functions of Driver Parts



Front Panel

DFU1514W



3.1 LED Indications

The LED indicators show the state of various input/output signals.

They are indicated on page 4 as 1 ~ 3.

LED Name	Indication	Color	Condition When LED ON	Page Reference
1 Power Input LED	POWER	Green	Lights when single phase 100–115V \pm 15% (50/60Hz) is input.	—
2 Excitation Timing Signal Output LED	TIM.	Green	Lights when the excitation timing signal is output.	Page 19
3 Overheat Signal Output LED	O.H.	Red	Lights when the overheat signal is output.	Page 20, 21

3.2 Switches

The switches adjust the motor current and enable/disable the various functions.

They are indicated on page 4 as a ~ f.


Switch Name	Indication	Factory setting	Function	Page Reference
a Motor Running Current Adjustment Rotary Switch	RUN	F	The motor's running current can be adjusted with this digital switch. Adjustment is simple, and an ammeter is not necessary.	Page 27, 28
b Motor Standstill Current Adjustment Rotary Switch	STOP	9	The motor's standstill current can be adjusted with this digital switch. Adjustment is simple and an ammeter is not necessary.	Page 27, 28
c Pulse Input Mode Switch	2P/1P	2P	The pulse signal input mode can be set to 1 pulse input mode or 2 pulse input mode with this switch.	Page 12
d Automatic Current Off Function Switch	A.C.O./OFF	A.C.O.	This function will automatically cut the power to the motor when the internal temperature of the driver rises above 80°C (176°F). This function can be enabled or disabled with this switch.	Page 12
e No Connection	NC	NC	This switch has no function. It is a open switch which is not connected to the driver's circuitry.	—
f Step Resolution Switch	DATA1	0	The step angle can be set to one of 16 different resolutions from 0.72° to 0.00288°/step with each of these switches.	Page 12, 13
g Step Resolution Switch	DATA2	0	Selection of the step resolution switch is determined by an external signal. The factory setting is 0.72°/step.	

3.3 Terminals

I/O Signals [Common to UDK5114NW2 and UDK5214NW]

Indication	Signal Type	Pin No.	Terminal Name	Function	Page Reference
① CN1	Input Signals	1	CW Pulse / Pulse Signal Input Terminal	The CW direction command signal is input to this terminal. When a pulse is input to the terminal, the motor output shaft rotates one step in the clockwise direction. (When in 1 pulse input mode a pulse signal is input to this terminal.)	Page 14, 15 16
		2			
		3	CCW Pulse / Rotation Direction Signal Input Terminal	The CCW direction command signal is input to this terminal. When a pulse is input to the terminal, the motor output shaft rotates one step in the counterclockwise direction. (When in 1 pulse input mode a rotation direction signal is input to this terminal.)	Page 14, 15 16
		4			
		5	All Windings Off Signal Input Terminal	The all windings off signal is input to this terminal. When a signal is input to the terminal, the driver cut the current supply to the motor. The motor torque will then be reduced to zero and the motor shaft can be rotated freely for adjustment. This function is used when manual positioning etc. is required.	Page 17
		7	Step Angle Select Signal Input Terminal	The step angle select signal is input to this terminal. This signal selects one of the two step angles set by the step resolution switches. This signal is used to change the step angle as required by operating conditions etc.	Page 18
	10	+Common Terminal	This is the positive common terminal for the input signal (all windings off signal).	—	
	Output Signals	11	Excitation Timing Signal Output Terminal	The excitation timing signal is output from this terminal. This signal is output when the motor excitation (current running though the winding) is in the initial stage.	Page 19
		12	Overheat Signal Output Terminal	The overheat signal is output from this terminal. This signal is output when the internal temperature of the driver rises above 80 °C (176°F). This is used to prevent excess heat from damaging the driver.	Page 20, 21
		20	-Common Terminal	This is the negative common terminal for the output signals.	—

Motor/Power Supply

Indication	Terminal Name	Function	Page Reference
② TB1	MOTOR	Motor Connection Terminal This is the output terminal for the motor. Match the colors indicated on the driver front panel to the motor lead wires for connection.	Page 22, 25
③ TB1	NC	No connection This terminal is not used. It is a open terminal which is not connected to the driver's circuitry.	—
④ TB1	100-115V ~	Power Supply Connection Terminal Connect this terminal to a power source of single phase 100-115V ± 15% (50/60Hz).	Page 22, 26
⑤		Protective Earth Terminal This terminal is connected to the driver casing. (M4 screw size)	Page 25, 26

4. Installation

4.1 Motor Installation

4.1.1 Motor Installation Location

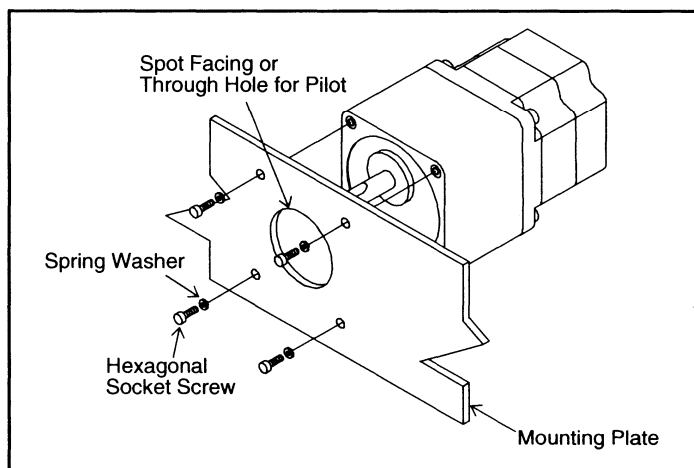
To prevent motor damage, install in a location with the following conditions.

- Indoors (The motor is designed and manufactured to be used as an internal component within other equipment.)
- Ambient temperature range $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$ ($14^{\circ}\text{F} \sim 122^{\circ}\text{F}$) (non-freezing)
- Ambient humidity below 85% (non-condensing)
- No explosive, combustible, or corrosive gases
- No direct sunlight
- No dust or conductive particles (i.e. metal chips or shavings, pins, or wire fragments etc.)
- No water, oil, or other fluids
- Where the motor is able to dissipate heat easily
- No continuous vibration or sudden shocks
- No nearby radiation, magnetic field, or air vacuum environment

4.1.2 How to Install the Motor

To allow for heat dissipation and to prevent vibration, be sure to securely attach the motor to solid metal surface.

The motor flange incorporates a pilot diameter. Use this pilot diameter as a guide for alignment when mounting the motor.



The following hardware is needed to mount the motor.

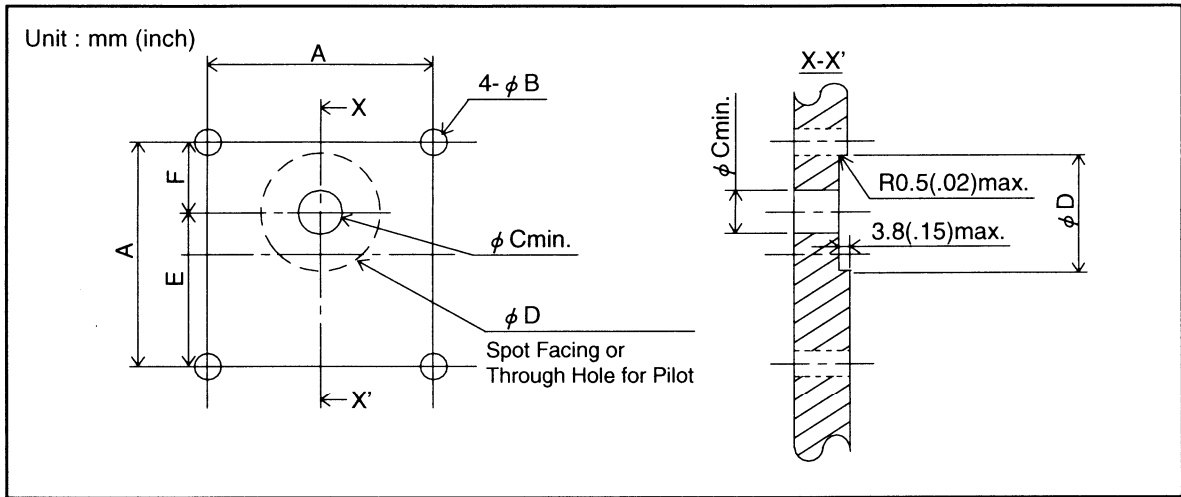
- Hexagonal Socket Screws 4 (included)
- Spring Washers 4 (prepared by users)

Enter A (single shaft) or B (double shaft) in the within the model numbers.

Motor Frame Size mm (inch)	Motor Model Number	Screw Type	Tightening Torque N·m (oz-in)
60 (2.36)	PK564 <input type="checkbox"/> W-T3.6, PK564 <input type="checkbox"/> W-T7.2 PK564 <input type="checkbox"/> W-T10, PK564 <input type="checkbox"/> W-T20 PK564 <input type="checkbox"/> W-P30	M4	2 (277)
90 (3.54)	PK596 <input type="checkbox"/> W-T3.6, PK596 <input type="checkbox"/> W-T7.2 PK596 <input type="checkbox"/> W1-T10, PK596 <input type="checkbox"/> W1-T20 PK596 <input type="checkbox"/> W1-T30	M8	4 (554)

Select hexagonal socket screws with length appropriate for the thickness of the mounting plate.

4.1.3 Motor Mounting Plate Dimensions

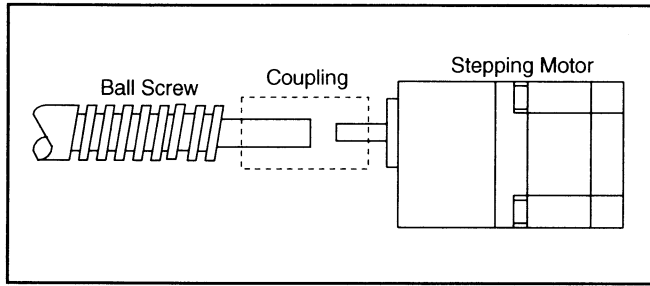


Enter A (single shaft) or B (double shaft) in the within the model numbers.

[Unit : mm (inch)]

Motor Frame Size	Motor Model Number	Mounting Plate Thickness	A	ϕB	ϕC	ϕD	E	F
60 (2.36)	PK564 <input type="checkbox"/> W-T3.6 PK564 <input type="checkbox"/> W-T7.2 PK564 <input type="checkbox"/> W-T10 PK564 <input type="checkbox"/> W-T20 PK564 <input type="checkbox"/> W-T30	5 (.20) min.	49.5 ± 0.2 ($1.95 \pm .008$)	4.5 (.18DIA)	8.5min. (.33DIA)	$23^{+0.033}_0$ (.907DIA) (.906DIA)	34.75 ± 0.2 ($1.368 \pm .007$)	14.75 ± 0.2 (.581 \pm .007)
90 (3.54)	PK596 <input type="checkbox"/> W-T3.6 PK596 <input type="checkbox"/> W-T7.2 PK596 <input type="checkbox"/> W1-T10 PK596 <input type="checkbox"/> W1-T20 PK596 <input type="checkbox"/> W1-T30	12 (.47) min.	73.5 ± 0.2 ($2.89 \pm .008$)	8.5 (.34DIA)	12.5min. (.49DIA)	$35^{+0.039}_0$ (1.379DIA) (1.378DIA)	54.75 ± 0.2 ($2.156 \pm .007$)	18.75 ± 0.2 (.738 \pm .007)

4.1.4 Connecting the Motor to the Drive Mechanism (Load)



Proper alignment is necessary when connecting the drive mechanism (load) to the motor shaft. Use a flexible coupling.

Note

- Inadequate alignment will cause vibration, shorten the bearing life, and possibly damage the motor shaft.
- When attaching a coupling, timing pulley, or other equipment, do not jolt the motor shaft by abruptly adding weight etc., or exceed the permissible overhung and thrust loads as this may damage the motor.
- Avoid an excess of impact force when use a hammer.

Permissible overhung load and permissible thrust load

Do not exceed the overhung and thrust load permissible values as indicated in the chart .

Enter A (single shaft) or B (double shaft) in the within the model numbers.

[Unit : N (lbs.)]

Motor Frame Size mm (inch)	Motor Model Number	Overhung Load					Thrust Load
		Distance from the End of the Shaft [mm (inch)]					
		0 (0)	5 (.2)	10 (.4)	15 (.6)	20 (.8)	
60 (2.36)	PK564 <input type="checkbox"/> W-T3.6	70 (15.4)	80 (17.6)	100 (22.0)	120 (26.4)	150 (33.0)	40 (8.8)
	PK564 <input type="checkbox"/> W-T7.2						
	PK564 <input type="checkbox"/> W-T10						
	PK564 <input type="checkbox"/> W-T20						
	PK564 <input type="checkbox"/> W-T30						
90 (3.54)	PK596 <input type="checkbox"/> W-T3.6	220 (48.5)	250 (55.1)	300 (66.1)	350 (77.1)	400 (88.1)	100 (22.0)
	PK596 <input type="checkbox"/> W-T7.2						
	PK596 <input type="checkbox"/> W1-T10						
	PK596 <input type="checkbox"/> W1-T20						
	PK596 <input type="checkbox"/> W1-T30						

Note

- Exceeding the permissible overhung load or permissible thrust load will damage or shorten the life span of the bearings and motor shaft.

4.2 Driver Installation

4.2.1 Driver Installation Location

To prevent driver damage, install in a location with the following conditions.

- Indoors (The driver is designed and manufactured to be used as an internal component within other equipment.)
- Ambient temperature range 0°C ~ +50°C (32°F ~ 122°F) (non-freezing). Install a forced-air cooling fan if ambient temperatures exceed 50°C (122°F).
- Ambient humidity below 85% (non-condensing)
- No explosive, combustible, or corrosive gases
- No direct sunlight
- No dust or conductive particles (i.e. metal chips or shavings, pins, or wire fragments etc.)
- No water, oil, or other fluids
- Where the driver is able to dissipate heat easily
- No continuous vibration or sudden shocks
- No nearby radiation, magnetic field, or air vacuum environment
- If the driver is installed in a switch box or other enclosed area, and near a heat source, be sure to establish ventilation holes. The heat generated by the driver will cause the ambient temperature to rise which could consequently damage the driver.
- If the driver is installed near a source of vibration, and this vibration is transmitted to the driver, attach a shock absorber to prevent driver damage.
- If the driver is installed near a source of noise interference (i.e. high frequency welding machine, electromagnetic switch, etc.) install a noise filter, or connect it to a separate power source to reduce the effect of the interference, otherwise the motor may not operate correctly.
- Leave a space of at least 25mm (1.0in.) between the driver and other equipment or structure. If using more than one driver, leave a space of at least 20mm (.787in.) between each driver. Driver heat generation will cause the ambient temperature to rise, and if the permissible ambient operating temperature is exceeded, driver damage may result.

4.2.2 How to Install the Driver

The driver is designed to cool naturally by convection.

Be sure to install the driver in an upright position as indicated on the next page.

The following hardware (not supplied) is needed to mount the driver.

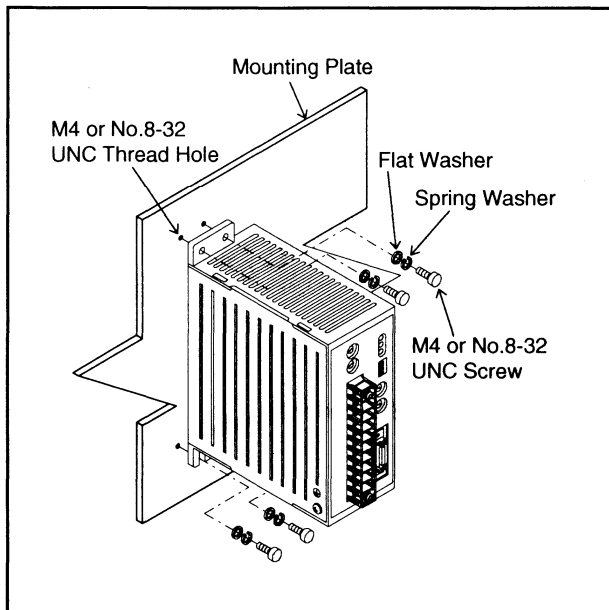
- M4 or No.8-32UNC Screws 4
- M4 or No.8 Flat Washers 4
- M4 or No.8 Spring Washers 4

Mounting the driver

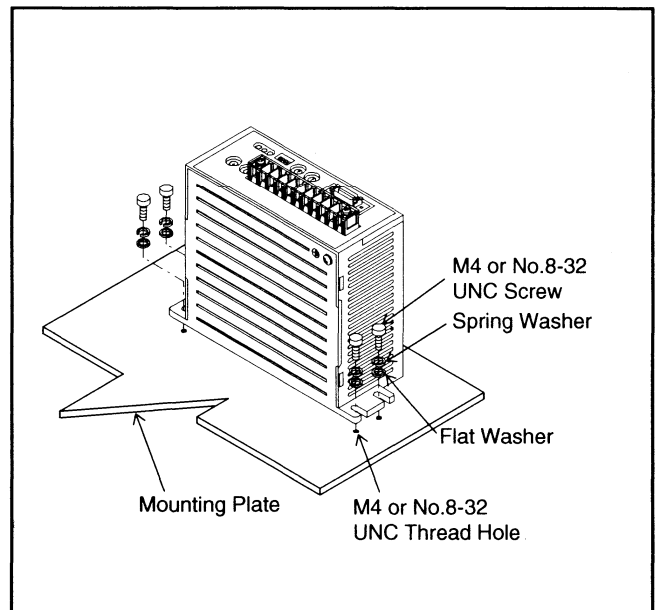
Secure the driver to a mounting plate within your equipment. (Secured through 4 screws)

The mounting plate should be at least 2mm (.0787in.) thick and be made of steel, aluminum or other material having good thermal conductivity.

Vertical Surface

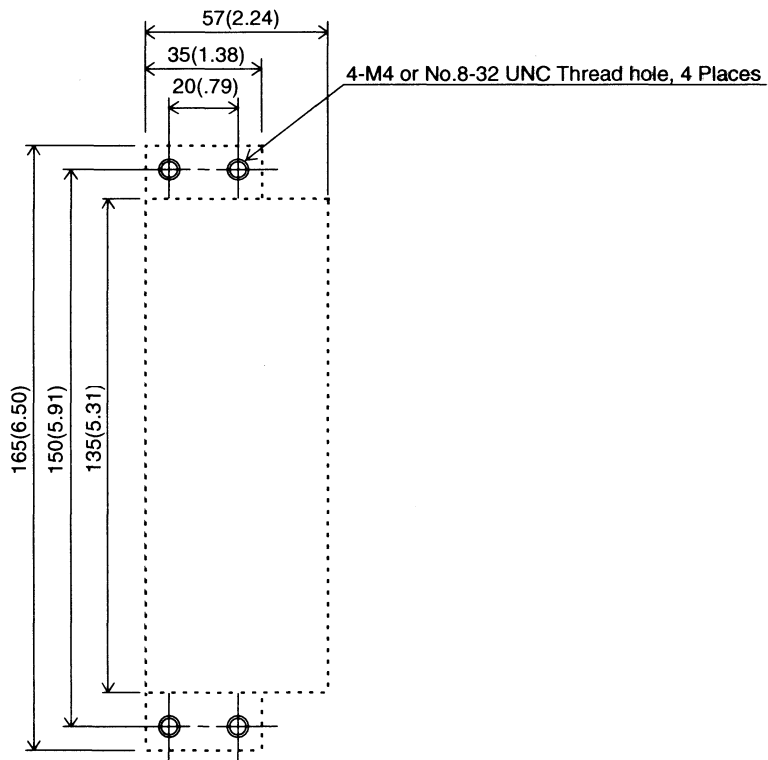


Horizontal Surface



4.2.3 Driver Mounting Plate Dimensions

Unit : mm (inch)

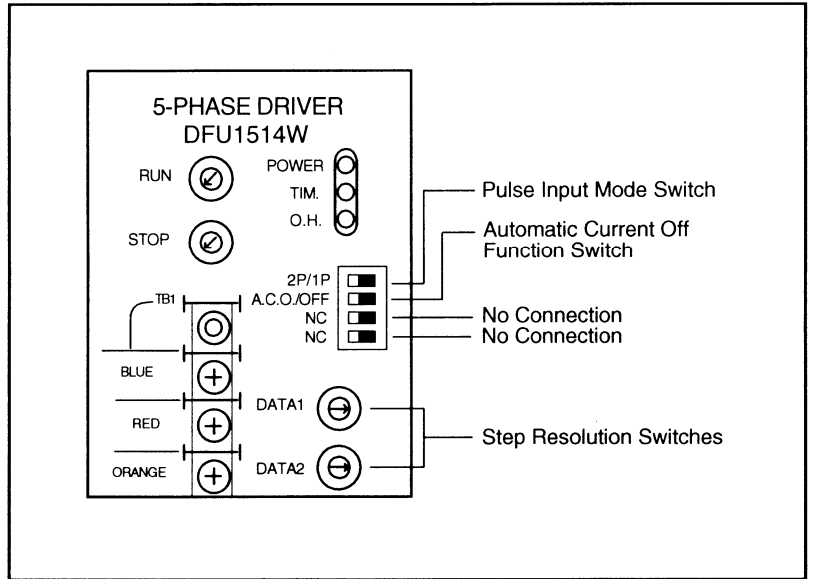


5. Driver Function Switches

The driver has various operation functions which are set with the function switches.

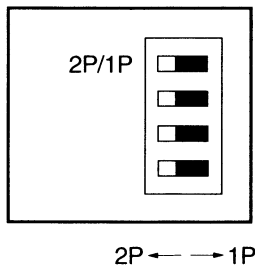
Driver Front Panel

DFU1514W



The white square section of the function switch represents the switch lever.

5.1 Pulse Input Mode Switch

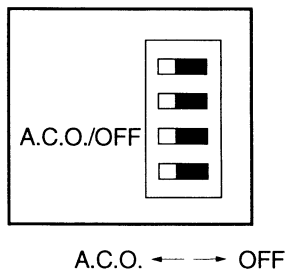


(Factory Setting : 2P)

Select the appropriate pulse input mode to correspond to your controller with this switch.
 When the pulse input mode switch is set to the 2P position, 2 pulse input mode is established and motor rotation is controlled by CW and CCW pulse signals.
 When the switch is set to the 1P position, 1 pulse input mode is established and motor rotation is controlled by pulse signals and rotation direction signals.
 (Refer to pages 14, 15 and 16 for details.)

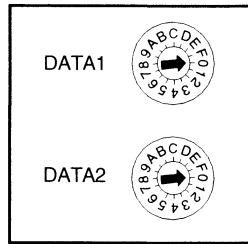
5.2 Automatic Current Off Function Switch

(Factory Setting : A.C.O.)



When the automatic current off function switch is set to the A.C.O. position, the automatic current off function is enabled. While enabled, if the internal temperature of the driver rises above 80°C (176°F), the overheat signal will be output, and the current to the motor will be cut off. (Refer to pages 20, 21 for details on the overheat signal.)
 Cutting off the current to the motor will prevent driver heat damage. When the switch is set to the OFF position, the automatic current off function is disabled.

5.3 Step Resolution Switches



(Factory Setting : 0)

The motor step angle can be set to two separate step resolutions using the step resolution switches DATA1 and DATA2.

(For instructions on how to select the resolution switch refer to page 18 "Step Angle Select Signal")

To change the step angle, adjust the DATA1 or DATA2 switch with a small slot head screwdriver.

DATA1 and DATA2 switch settings and corresponding step angles are shown in the chart below.

Switch Setting	Output Shaft Step Angle [° /step]				
	Gear Ratio 1 : 3.6	Gear Ratio 1 : 7.2	Gear Ratio 1 : 10	Gear Ratio 1 : 20	Gear Ratio 1 : 30
0	0.2	0.1	0.072	0.036	0.024
1	0.1	0.05	0.036	0.018	0.012
2	0.08	0.04	0.0288	0.0144	0.0096
3	0.05	0.025	0.018	0.009	0.006
4	0.04	0.02	0.0144	0.0072	0.0048
5	0.025	0.0125	0.009	0.0045	0.003
6	0.02	0.01	0.0072	0.0036	0.0024
7	0.01	0.005	0.0036	0.0018	0.0012
8	0.008	0.004	0.00288	0.00144	0.00086
9	0.005	0.0025	0.00188	0.0009	0.0006
A	0.004	0.002	0.00144	0.00072	0.00048
B	0.0025	0.00125	0.0009	0.00045	0.0003
C	0.002	0.001	0.00072	0.00036	0.00024
D	0.0016	0.0008	0.000576	0.000288	0.000192
E	0.001	0.0005	0.00036	0.00018	0.00012
F	0.0008	0.0004	0.000288	0.000144	0.000096

6. Input / Output Signals

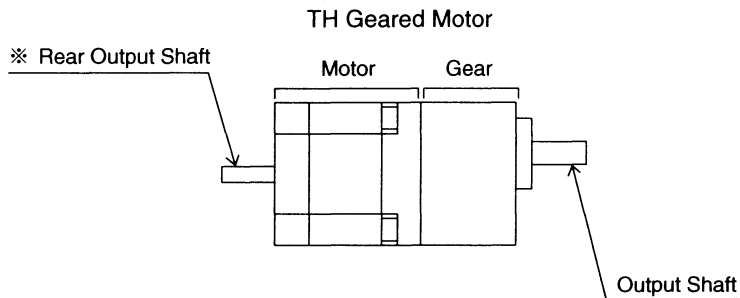
6.1 Input Signals

The input signals to the driver and their functions are specified below.

The diagrams of this section are example connections to the CURRENT SINK (NPN) type controller.

6.1.1 CW Pulse / Pulse Signals CCW Pulse / Rotation Direction Signals

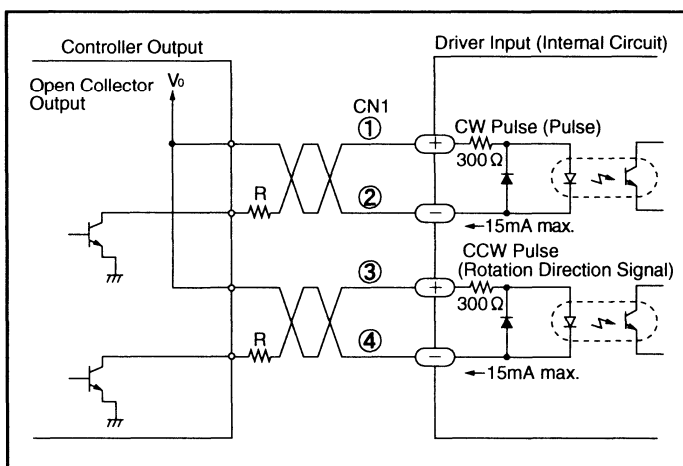
The direction of output shaft rotation and rear output shaft rotation depend on the gear ratio applied. For gear ratios 1:3.6, 1:7.2, and 1:10, the motor rotation direction is the same as the output shaft rotation direction, and for gear ratios 1:20 and 1:30, the motor rotation direction is opposite to the output shaft rotation direction.



Gear Ratio	Output Shaft Rotation Direction	※ Rear Output Shaft Rotation Direction
1:3.6, 1:7.2, 1:10	Clockwise	Clockwise
	Counterclockwise	Counterclockwise
1:20, 1:30	Counterclockwise	Clockwise
	Clockwise	Counterclockwise

※ Double shaft type only

The diagram below shows the input circuits and an example connection to a controller.



The number within \bigcirc refers to the pin number of driver connector CN1.

The information in the brackets () refers to signals when in 1 pulse input mode.

Keep the voltage between DC5V and DC24V.

When voltage is equal to DC5V, external resistance R is not necessary.

When voltage is above DC5V, connect external resistance R and keep the input current below 15mA.

2 Pulse Input Mode

CW* pulse signal

When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the clockwise direction for gear ratios 1:3.6, 1:7.2, and 1:10, and one step in the counterclockwise direction for gear ratios 1:20 and 1:30.

CCW* pulse signal

When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the counterclockwise direction for gear ratios 1:3.6, 1:7.2, and 1:10, and one step in the clockwise direction for gear ratios 1:20 and 1:30.

* CW and CCW refer to clockwise and counterclockwise directions respectively, from a reference point of facing the motor output shaft.

1 Pulse Input Mode

Pulse signal

Pulse signal is input to the CW pulse / pulse signal input terminal.

When the photocoupler state changes from "ON" to "OFF", the motor rotates one step.

The direction of rotation is determined by the following rotation direction signals.

Rotation direction signal

The rotation direction signal is input to CCW pulse / rotation direction signal input terminal.

For gear ratios 1:3.6, 1:7.2, and 1:10, a "photocoupler ON" signal input commands a clockwise direction rotation, and a "photocoupler OFF" signal input commands a counterclockwise direction rotation.

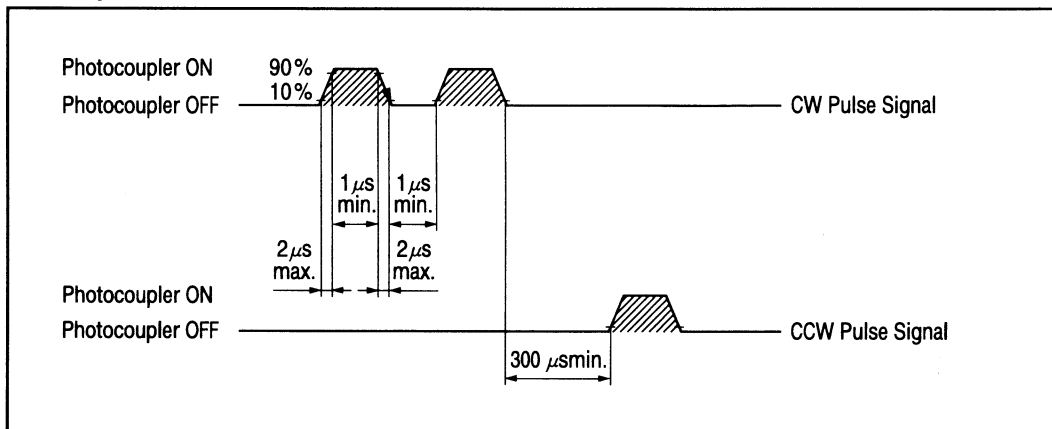
For gear ratios 1:20 and 1:30, a "photocoupler ON" signal input commands a counterclockwise direction rotation, and a "photocoupler OFF" signal input commands a clockwise direction rotation.

Relation to the Pulse Input Mode Switch (See page 12)

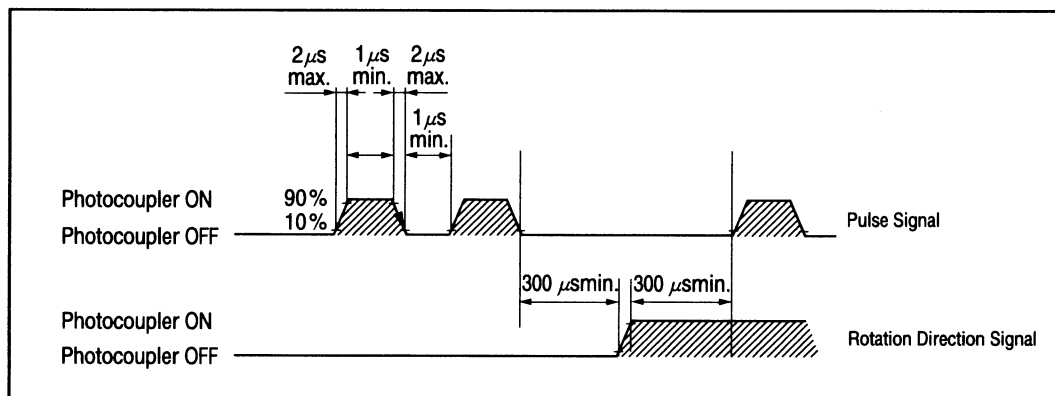
When the switch is set to the 2P position, motor rotation is controlled by CW pulse signals and CCW pulse signals.

When the switch is set to the 1P position, motor rotation is controlled by pulse signals and rotation direction signals.

Pulse Waveform Characteristics (Photocoupler state corresponding the input pulse) 2 Pulse Input Mode



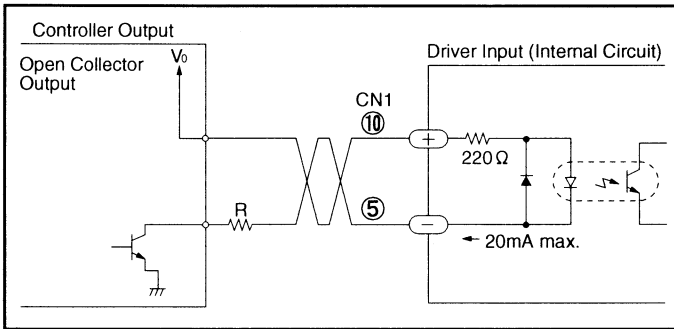
1 Pulse Input Mode



- The shaded area indicates when the photocoupler diode is ON. The motor moves when the photocoupler state changes from ON to OFF as indicated by the arrow.
- The pulse voltage is $4 \sim 5\text{V}$ in the "photocoupler ON" state, and $0 \sim 0.5\text{V}$ in the "photocoupler OFF" state.
- Input pulse signals should have a pulse width over $1\ \mu\text{sec}$, pulse rise/fall below $2\ \mu\text{sec}$, and a pulse duty below 50%.
- Keep the pulse signal in the "photocoupler OFF" state when no pulse is being input.
- The minimum interval time when changing rotation directions is $300\ \mu\text{sec}$.
This value varies greatly depending on the motor type, pulse frequency, and load inertia. It may be necessary to increase this time interval.
- In 2 pulse input mode, do not input CW and CCW pulse signals at the same time. Inputting a pulse signal while the other pulse signal is already in the "photocoupler ON" state will result in erratic motor rotation.
- In 1 pulse input mode, leave the pulse signal at rest "photocoupler OFF" when changing rotation directions.

6.1.2 All Windings Off Signal

The diagram below shows the input circuit and an example connection to a controller.



The number within \bigcirc refers to the pin number of driver connector CN1.

Keep the voltage between DC5V and DC24V.

When voltage is equal to DC5V, external resistance R is not necessary.

When voltage is above DC5V, connect external resistance R, and keep the input current below 20mA.

When the all windings off signal is in the “photocopler ON” state, the current to the motor is cut off and motor torque is reduced to zero. The motor output shaft can then be rotated freely by hand.

When the all windings off signal is in the “photocopler OFF” state, the motor holding torque is proportional to the current set by the current adjustment rotary switches. During motor operation be sure to keep the signal in the “photocopler OFF” state.

This signal is used when moving the motor by external force or manual home positioning etc. is desired. If this function is not needed, it is not necessary to connect this terminal.

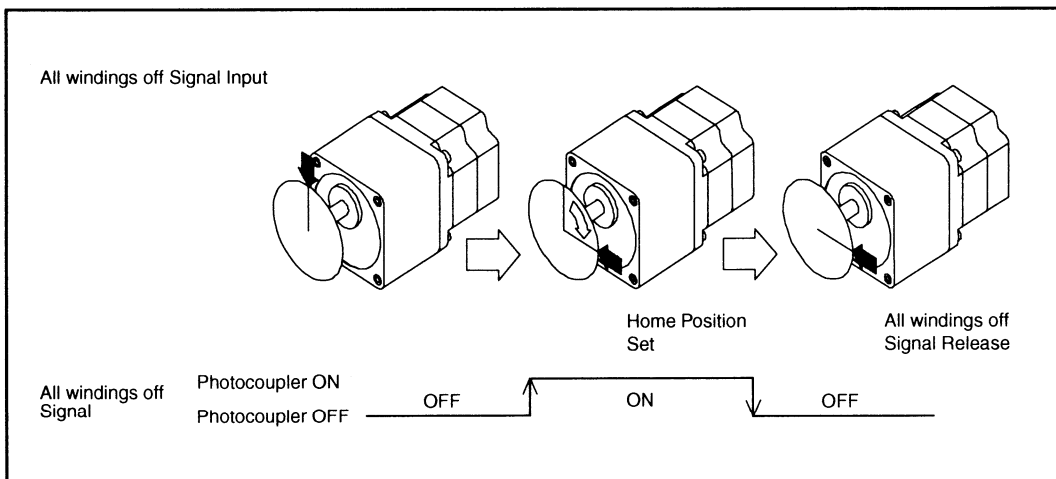
Switching the all windings off signal from “photocopler ON” to “photocopler OFF” does not alter the excitation sequence.

When the motor shaft is manually adjusted with the all windings off signal input, the shaft will shift from the position set after the all windings off signal is released up to $\pm 3.6^\circ$ divided by the gear ratio. (Example : A motor with a gear ratio of 1:10 will shift up to $\pm 0.36^\circ$.)

Manual Detection of the Home Position

Input the all windings off signal, set the motor to the desired position, then release the all windings off signal.

The TH geared type has a small amount of holding torque when the motor is not energized. This is a normal characteristic of the TH geared type.

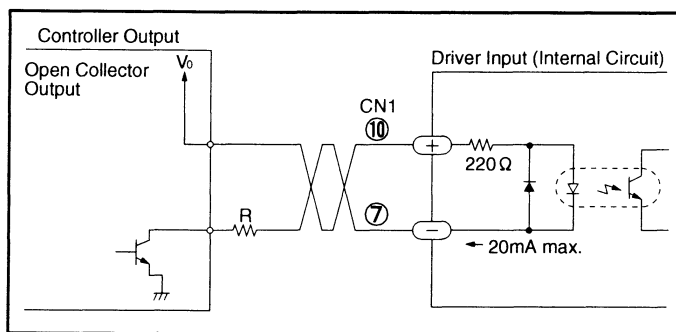


Note

- Be sure to input the all windings off signal before manually rotating the output shaft of the TH geared type, otherwise motor damage may result.

6.1.3 Step Angle Select Signal

The diagram below shows the input circuit and an example connection to a controller.



The number within \bigcirc refers to the pin number of driver connector CN1.

Terminal ⑩ is also the common for the step angle select signal.

Keep the voltage between DC5V and DC24V.

When voltage is equal to DC5V, external resistance R is not necessary.

When voltage is above DC5V, connect external resistance R, and keep the input current below 20mA.

When the step angle select signal is at "photocoupler OFF", the step angle set by step resolution switch DATA1 is selected, and when the step angle select signal is at "photocoupler ON", the step angle set by step resolution switch DATA2 is selected. This signal can be used to change the motor speed or amount of rotation without altering the input pulses.

Relation to the Step Resolution Switches (See page 13)

Each step resolution switch (DATA1 and DATA2) can set a step angle from 16 possible resolutions of 0.72° to 0.00288° .

Note

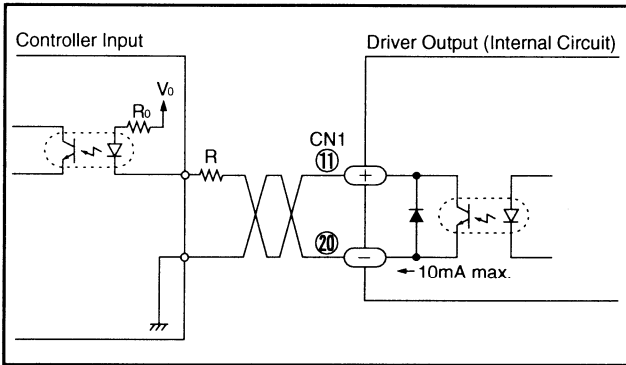
- Input the step angle select signal only when the driver power is Off, or when pulse signals are at rest while the excitation timing signal output LED is On. If the step angle select signal is input at other times, the excitation timing signal output and excitation timing LED may not function. (See pages 19, 20)

6.2 Output Signals

The output signals from the driver and their functions are specified below.

6.2.1 Excitation Timing Signal

The diagram below shows the output circuit and an example connection to a controller.



The number within \bigcirc refers to the pin number of driver connector CN1.

Keep the voltage between DC5V and DC24V.

Keep the current below 10mA.

If the current exceeds 10mA, connect external resistance R.

The excitation timing signal is output to indicate when the motor excitation (current flowing through the winding) is in the initial stage (step "0" at power up).

The excitation timing signal can be used to increase the accuracy of home position detection by setting mechanical home position of your equipment (photo-sensor etc.) to coincide with the excitation sequence initial stage (step "0").

When connected as shown in the example connection, the signal will be "photocoupler ON" at step "0".

The excitation timing signal is output simultaneously with a pulse input each time the excitation sequence returns to step "0".

The excitation sequence will complete one cycle for every motor output shaft rotation of 7.2° divided by the gear ratio.
(Example : 0.72° for a motor with a gear ratio of 1:10)

When the power is turned ON, the excitation sequence is reset to step "0".

Relation to the Excitation Timing Signal Output (TIM.) LED (See pages 4, 5)

The TIM. LED lights when the excitation signal is output.

While the motor is rotating, the LED will turn ON and OFF at a high speed and will appear to be continuously lit.

Relation to the Step Resolution Switches (See pages 12, 13)

The excitation timing signal is output once for each number of pulses equivalent to 7.2° divided by the gear ratio and the output shaft step angle setting.

Example : Gear ratio 1:10, output shaft step angle 0.072° /step

$$7.2^\circ \div 10 \div 0.072^\circ = 10 \text{ pulses}$$

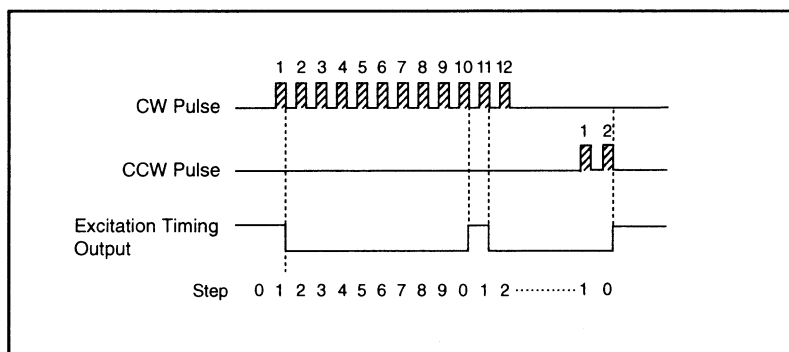
The signal is output once every 10 pulses.

Gear ratio 1:10, output shaft step angle 0.0072° /step

$$7.2^\circ \div 10 \div 0.0072^\circ = 100 \text{ pulses}$$

The signal is output once every 100 pulses.

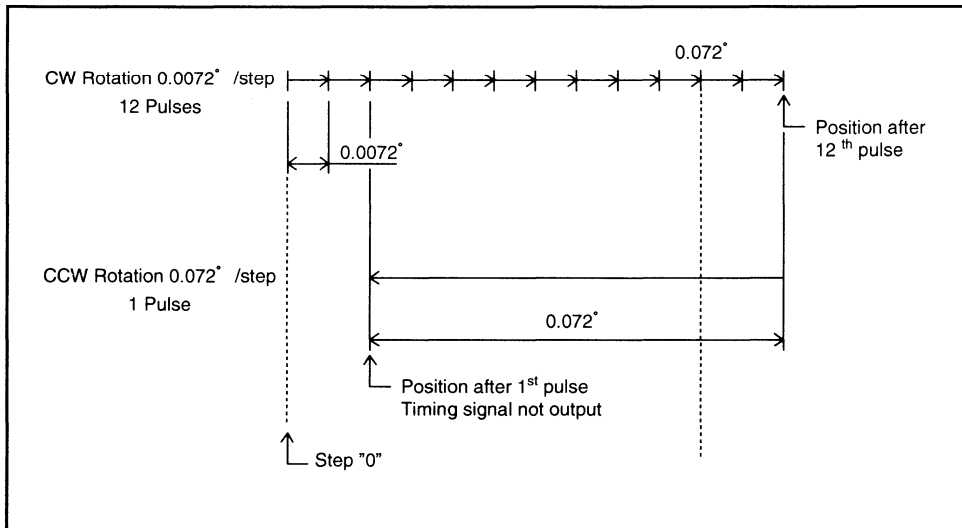
Timing chart : Gear ratio 1:10, Output shaft step angle 0.072° /step



When using the excitation timing signal, set the number of input pulses and the step angle in combinations which allow the motor shaft to stop at positions which are multiples of 7.2° .

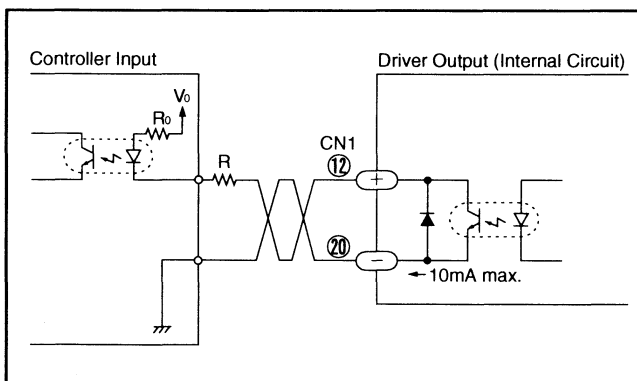
When using the step angle select signal to change the step angle, be aware that depending on the number of pulses and step angle settings, there are conditions such as shown below in which the excitation timing signal will not be output.

Example : For the gear ratio 1:10, if input 12 pulses in clockwise direction when the output shaft step angle is $0.0072^\circ / \text{step}$, then change the output shaft step angle to $0.072^\circ / \text{step}$ and input 1 pulse in counterclockwise direction.



6.2.2 Overheat Signal

The diagram below shows the output circuit and an example of the connection to a controller.



The number within \bigcirc refers to the pin number of driver connector CN1.

Keep the voltage between DC5V and DC24V.

Keep the current below 10mA.

If the current exceeds 10mA, connect external resistance R.

The overheat signal is output to protect the driver from heat damage if the internal temperature of the driver rises above 80°C (176°F).

When connected as shown in the example connection, the signal will be "photocopier OFF" during normal conditions, and "photocopier ON" when the temperature exceeds above 80°C (176°F).

When the overheat signal is output, turn the driver power OFF, then adjust the operating conditions (ambient temperature, driver/controller settings, etc.), or use a fan etc. to cool the driver. After taking appropriate measures, turn the power ON. Turning the power ON will reset the overheat signal, and release the automatic current off condition.

Relation to the Overheat Signal Output (O.H.) LED (See pages 4, 5)

The O.H. LED lights when the overheat signal is output.