



HP-4111

**SUPER  
VEXTA®**



5 Phase Stepping Motor and Driver

# UPK·W Series

- Mounting size 42mm    Standard Type
- Mounting size 42mm    Electromagnetic Brake · Standard Type

# OPERATING MANUAL

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Thank you for purchasing ORIENTAL MOTOR products.

Please read this operating manual thoroughly before installing and operating products.

# 1. Precautions

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## 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 (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.

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
- Connector for I/O Signals..... 1
- [ Connector (Sumitomo 3M)..... 1 ]
- [ Connector Cover (Sumitomo 3M)..... 1 ]
- Operating Manual ..... 1

## 2. 2 Model Numbers and Motor/Driver Combinations

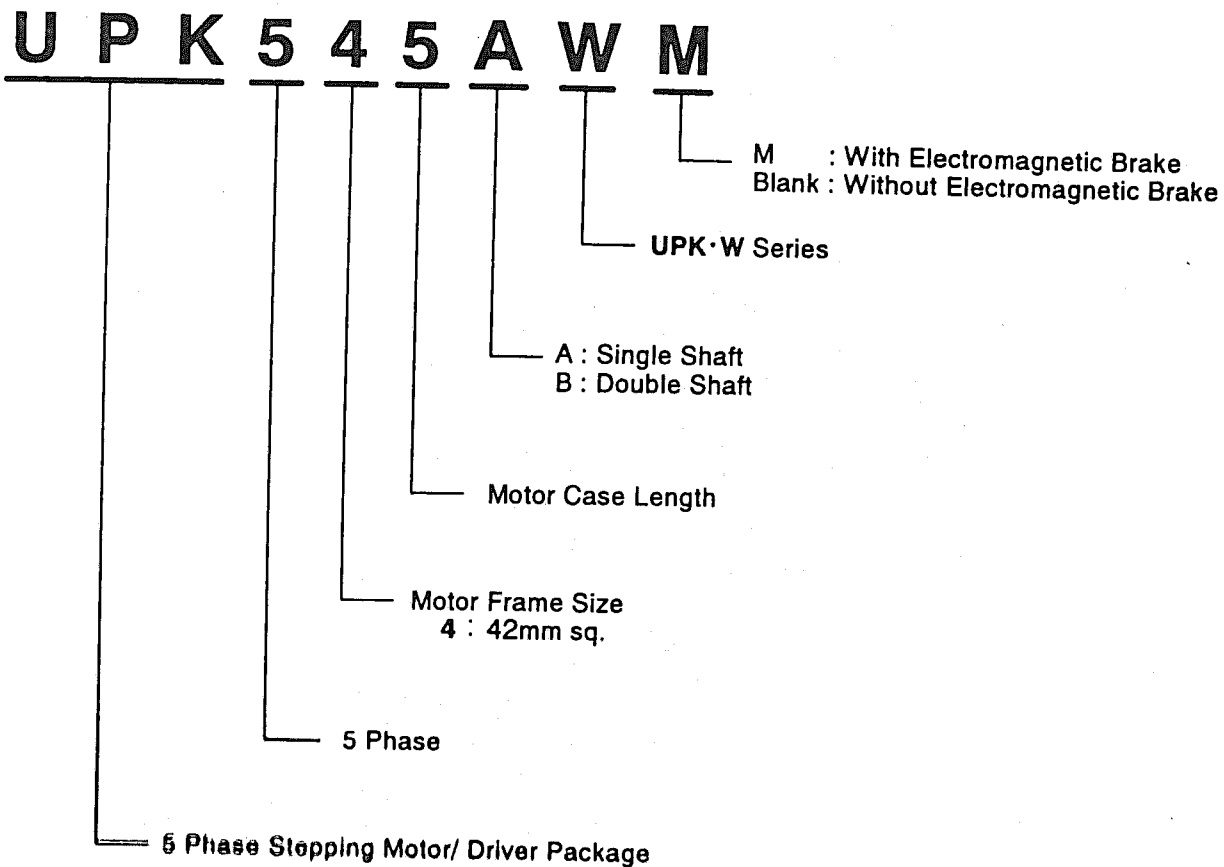
The **UPK·W** series is a combined package which includes a stepping motor and driver.  
 This operating manual is designated for the following products.

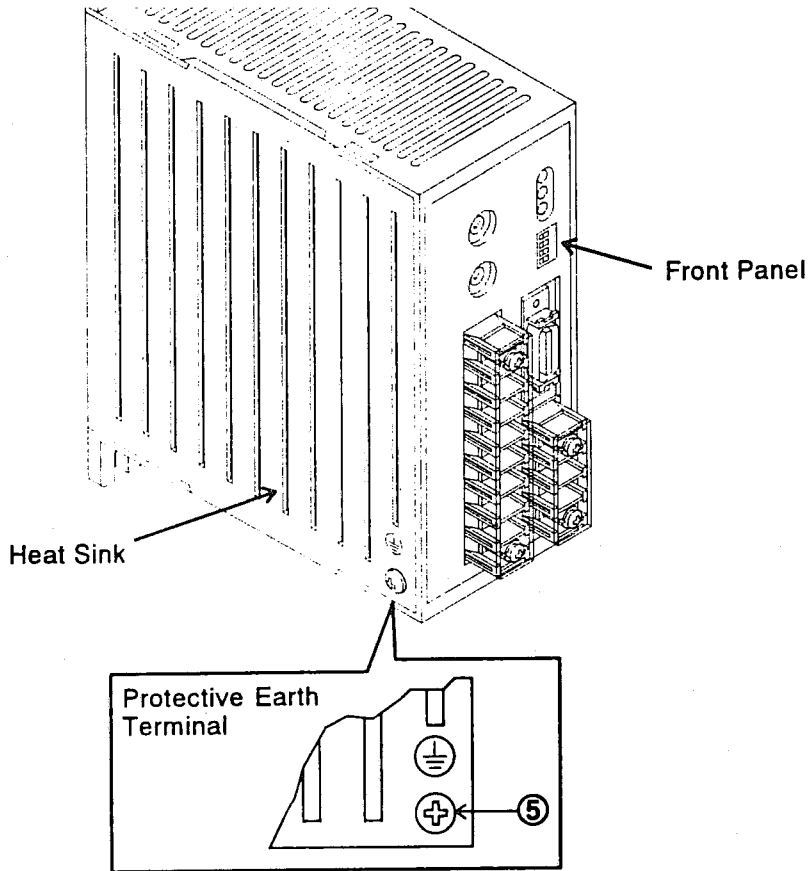
Product Type	Package Model Number	Motor		Driver	
		Model Number	Rated Current	Model Number	Output Current
Standard	UPK543AW UPK543BW UPK544AW UPK544BW UPK545AW UPK545BW	PK543AW PK543BW PK544AW PK544BW PK545AW PK545BW	0.75A/phase	UDK5107NW2	0.75A/phase (max.)
Electromagnetic Brake Standard	UPK543AWM UPK544AWM UPK545AWM	PK543AWM PK544AWM PK545AWM	0.75A/phase	UDK5107NW2-M	0.75A/phase (max.)

### Note

- The driver and motor is precision equipment and should not be dropped or subject to any physical shocks.

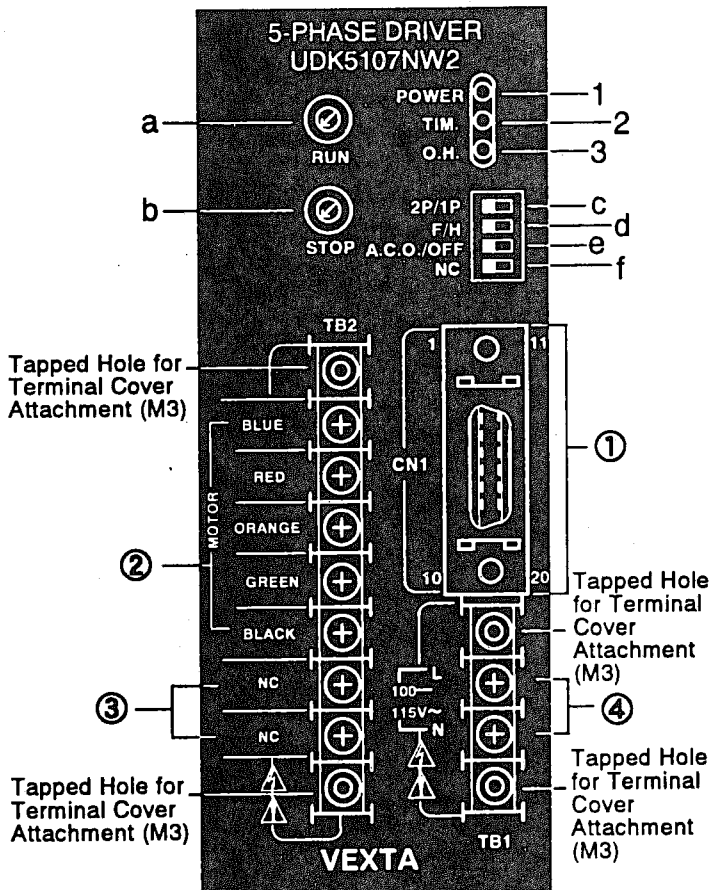
## 2. 3 Interpreting The Model Number





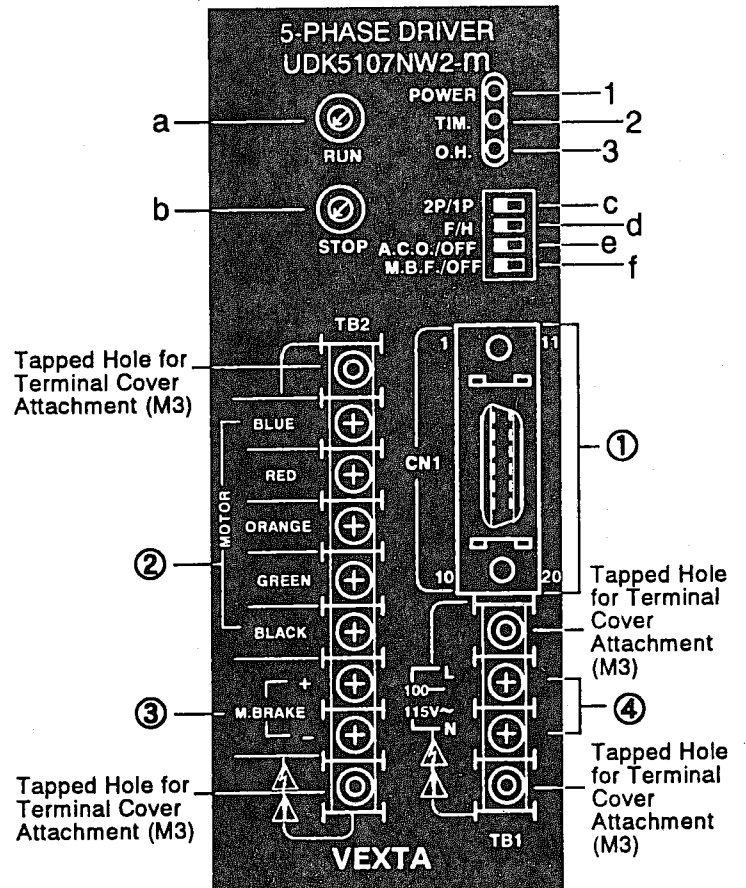
Front Panel

Standard Type Driver : UDK5107NW2



Electromagnetic Brake

Standard Type Driver : UDK5107NW2-M



## 3. 1 LED Indicators

The LED indicators show the state of various input/output signals.  
They are indicated on page 5 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±15% (50/60Hz) is input.	—
2 Excitation Timing Signal Output LED	TIM.	Green	Lights when the excitation timing signal is output.	Page 22
3 Overheat Signal Output LED	O.H.	Red	Lights when the overheat signal is output.	Page 23,24

## 3. 2 Switches

The switches adjust the motor current and enable/disable the various functions.  
They are indicated on page 5 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 32,33
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 32,33
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 14
d Step Angle Switch	F/H	F	The motor step angle can be set to full step or half step with this switch.	Page 14,15
e 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. This function can be enabled or disabled with this switch.	Page 14,15
No Connection (For without electromagnetic brake type only)	NC	NC	This switch is not used. It is an open switch which is not connected to the driver's circuitry.	—
f Electromagnetic Brake Function Switch (For electromagnetic brake type only)	M.B.F/OFF	M.B.F	Electromagnetic Brake Type only This switch sets the electromagnetic brake operation mode: M.B.F : Normally released, engaged when power is off OFF : Normally engaged released through the M.B.FREE signal	Page 14,15

Indication	Signal Direction	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 will rotate one step in the clockwise direction. (When in 1 pulse input mode a pulse signal is input to this terminal.)	Page16,17 18
		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 will rotate one step in the counterclockwise direction. (When in 1 pulse input mode a rotation direction signal is input to this terminal.)	Page16,17 18
		4			
		5	Output Current Off Signal Input Terminal	The output current off signal is input to this terminal. When a signal is input to the terminal the driver will cut the power 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 19
		6	Electromagnetic Brake Release Signal Input Terminal (For Electromagnetic Brake Type only)	The electromagnetic brake release signal is input to this terminal. When a signal is input to the terminal the driver will release the electromagnetic brake. This terminal is used to release and engage the brake, when the Electromagnetic Brake Function switch is turned OFF.	Page20,21
	10	+ Common Terminal	This is the positive common terminal for the input signal (output current 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 through the winding) is in the initial stage.	Page 22
		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. This is used to prevent excess heat from damaging the driver.	Page23,24
20		- Common Terminal	This is the negative common terminal for the output signals.		

### Motor

Indication		Terminal Name	Function	Page Reference
② TB2	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.	Page26,27 30
③ TB2	M.BRAKE (For electromagnetic brake type only)	Electromagnetic Brake Connection Terminal	For electromagnetic brake type use only. It is not used for other drivers. It is indicated NC( no connection.) on the panel. This is the output terminal for the electromagnetic brake. Connection + Terminal : Connect it to the Red / White wire. - Terminal : Connect it to the Black / White wire.	Page26,27 30

### Power Supply

Indication		Terminal Name	Function	Page Reference
④ TB1	100~ 115V~	Power Supply Connection Terminal	Connect this terminal to a power source of single phase 100~115V±15% 50/60Hz.	Page26,27 31
⑤		Protective Earth Terminal	This terminal is connected to the driver casing. (M4 screw size)	Page30,31

# 4. Installation

## 4. 1 Motor Installation

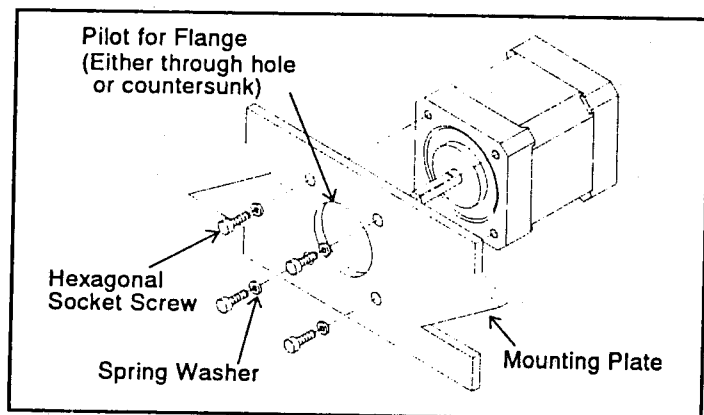
### 4. 1. 1 Motor Installation Location

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  $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$  (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
- For the use of single phase 200-230V, connect to power supply via an isolation transformer.

### 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.(prepared by users)

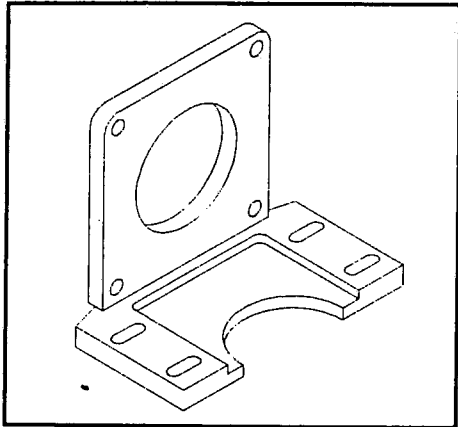
- Hexagonal Socket Screws ..... 4
- Spring Washers ..... 4
- Hexagonal Nuts ..... 4

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

Motor Frame Size	Package Model Number	Screw Type	Tightening Torque
42mm	UPK543 <input type="checkbox"/> W, UPK543AWM UPK544 <input type="checkbox"/> W, UPK544AWM UPK545 <input type="checkbox"/> W, UPK545AWM	M3	1 N·m

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

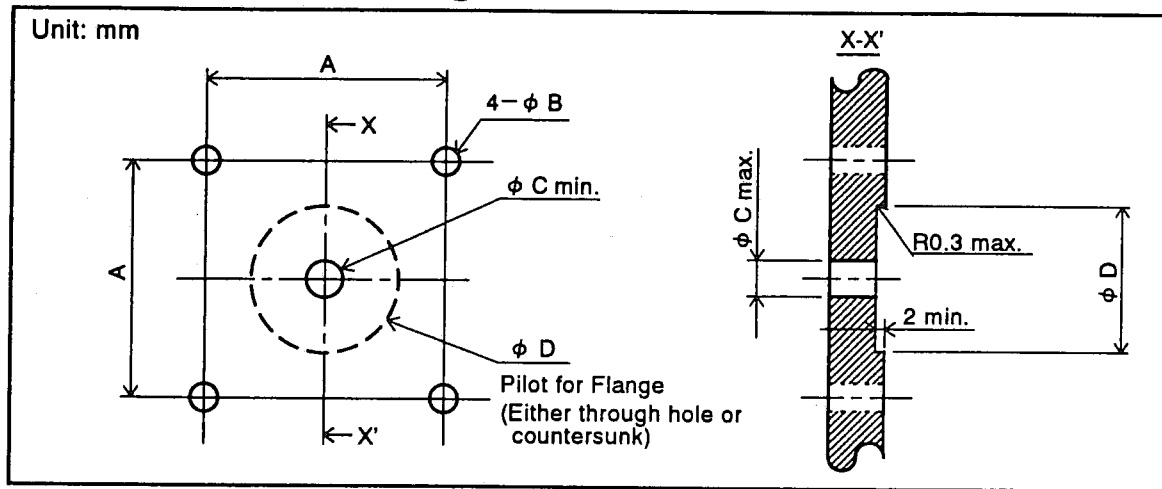
An optional (sold separately) motor mounting bracket is available for your convenience.



Mounting Bracket Model Number	Motor Frame Size	Stepping Motor/Driver Package Model Number
PAL0P PAF0P	42mm	UPK543□W, UPK543AWM UPK544□W, UPK544AWM UPK545□W, UPK545AWM

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

### 4. 1. 3 Motor Mounting Plate Dimensions

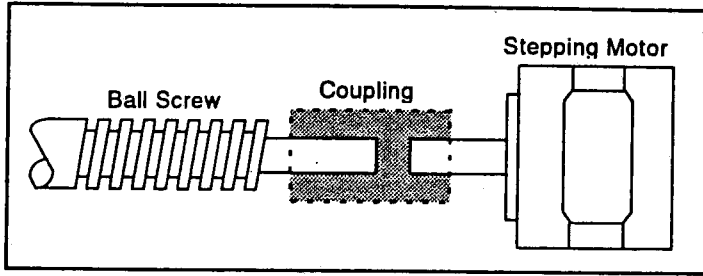


Enter A (single shaft) or B (double shaft) in the □ within the model numbers.

Unit: mm

Motor Frame Size	Package Model Number	Mounting Plate Thickness	A	φ B	φ C	φ D
42mm	UPK543□W, UPK543AWM UPK544□W, UPK544AWM UPK545□W, UPK545AWM	4 min.	31 ± 0.1	3.5	5.5 min.	22 <sup>+0.033</sup> <sub>0</sub>

## 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 flexible coupling.

### Note

- Inadequate alignment may reduce the life span of the motor bearings or 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.

### Permissible overhung load and permissible thrust load

Do not exceed the permissible overhung load as indicated in the following chart. The thrust load should not exceed the weight of your motor.

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

[Unit: N]

Motor Frame Size	Package Model Number	Distance from the End of the Shaft [mm]			
		0	5	10	15
42mm	UPK543 <input type="checkbox"/> W, UPK543AWM UPK544 <input type="checkbox"/> W, UPK544AWM UPK545 <input type="checkbox"/> W, UPK545AWM	20	25	34	52

### 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 (non-freezing). Install a forced-air cooling fan if ambient temperatures exceed 50°C.
- **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 between the driver and other equipment or structure.** If using more than one driver, leave a space of at least 20mm 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.
- **For the use of single phase 200-230V, connect to power supply via an isolation transformer.**

### 4.2.2 How to Install the Driver

The drivers (UDK5107NW2, UDK5107NW2-M) are designed to cool naturally by convection. Be sure to install the driver in an upright position as indicated below.

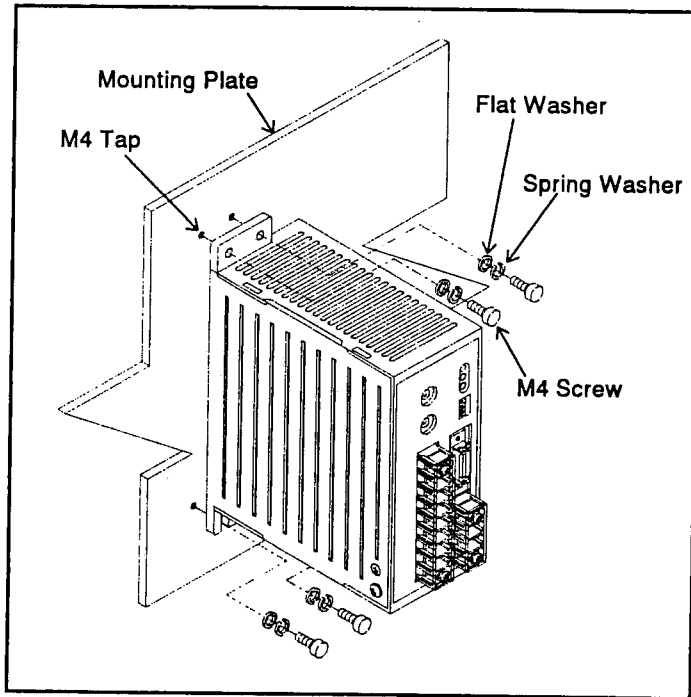
The following hardware is needed to mount the driver. (prepared by users)

- M4 Screws ..... 4
- M4 Flat Washers ..... 4
- M4 Spring Washers ..... 4

## When mounting the driver to a vertical surface

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

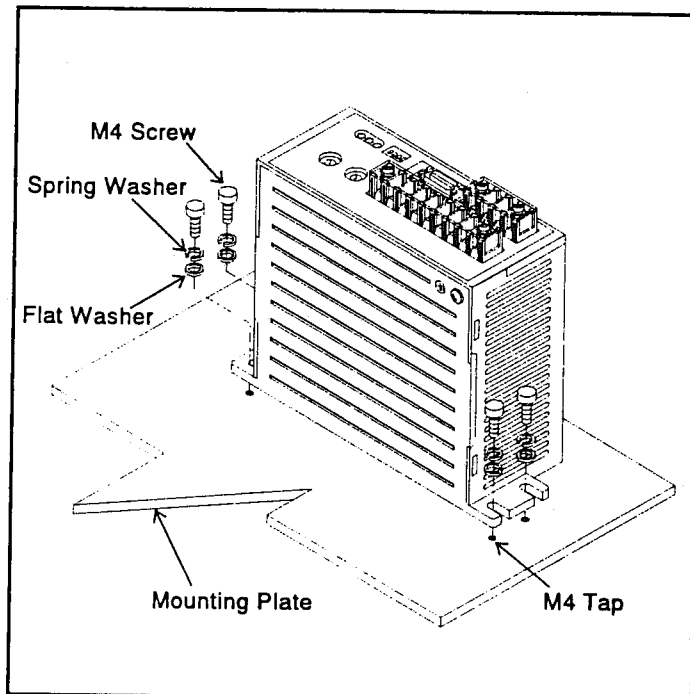
The mounting plate should be at least 2mm thick and be made of steel, aluminum or other material having good thermal conductivity.



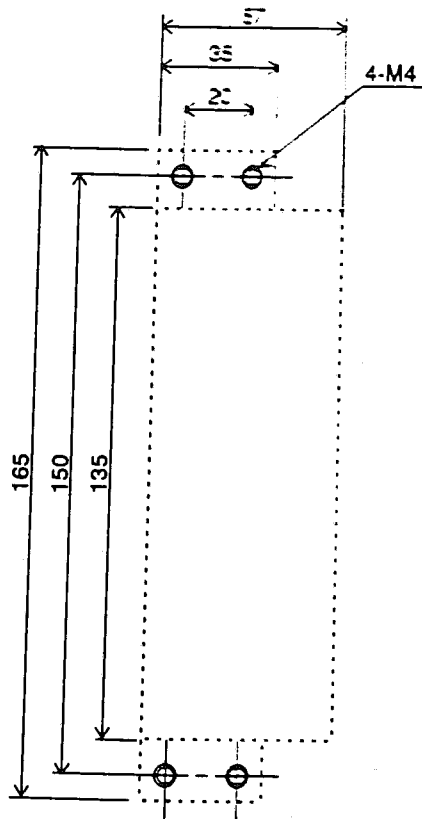
## When mounting the driver to a horizontal surface

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

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



### 4. 2. 3 Driver Mounting Plate Dimensions Unit: mm

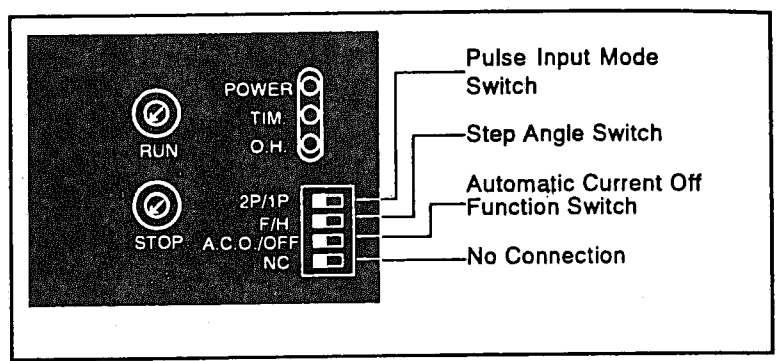


# 5. DRIVER FUNCTION SWITCHES

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

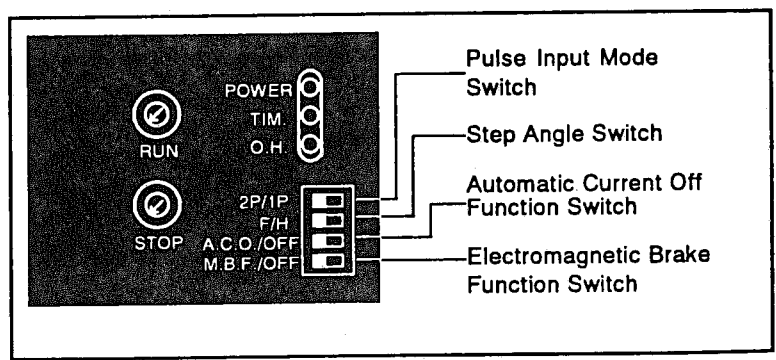
## Driver Front Panel

### Standard Type UDK5107NW2



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

### Electromagnetic Brake Standard Type UDK5107NW2-M

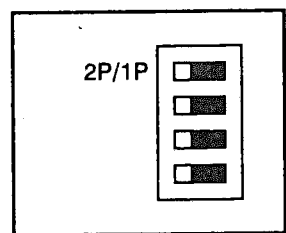


The white square section of the function switch represents the switch lever.

## 5. 1 Pulse Input Mode Switch

(Factory Setting: 2P)

UDK5107NW2  
UDK5107NW2-M



2P ← → 1P

Select the appropriate pulse input mode to correspond to your controller with this switch.

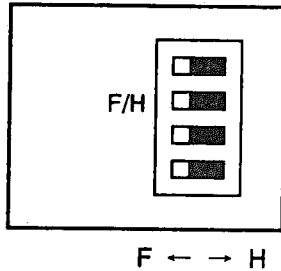
When the pulse input mode switch is set to the 2P position, 2 pulse input mode is established and motor rotation is controlled by CW and CCW pulse signals.

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 16, 17, and 18 for details.)

## 5. 2 Step Angle Switch

UDK5107NW2  
UDK5107NW2-M



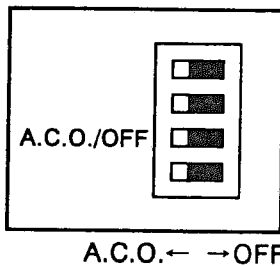
(Factory Setting: F)

When the switch is set to:

- "F" (Full step) : 1 step =  $0.72^\circ$  (1 rotation = 500 pulses)
- "H" (Half step) : 1 step =  $0.36^\circ$  (1 rotation = 1000 pulses)

## 5. 3 Automatic Current Off Function Switch

UDK5107NW2  
UDK5107NW2-M



(Factory Setting: A.C.O.)

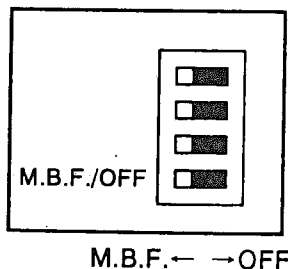
When the automatic current off function switch is set to the A.C.O. position, the automatic current off function is enabled. While enabled, if the internal temperature of the driver rises above  $80^\circ\text{C}$ , the overheat signal will be output, and the current to the motor will be cut off. (Refer to pages 23, 24 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. 4 Electromagnetic Brake Function Switch (Electromagnetic Brake Type only)

UDK5107NW2-M



(Factory Setting: M.B.F.)

When the electromagnetic function switch is set to the M.B.F. position, the electromagnetic brake is released (free) under normal conditions. If the driver power is cut off by a power failure etc., the brake will engage and hold the motor and load in position.

When the switch is set to the OFF position the electromagnetic brake is engaged, and the motor shaft is held in position. To release the brake for motor operation, input the electromagnetic brake release signal.

(For instructions refer to pages 20, 21, "Electromagnetic Brake Release Signal")

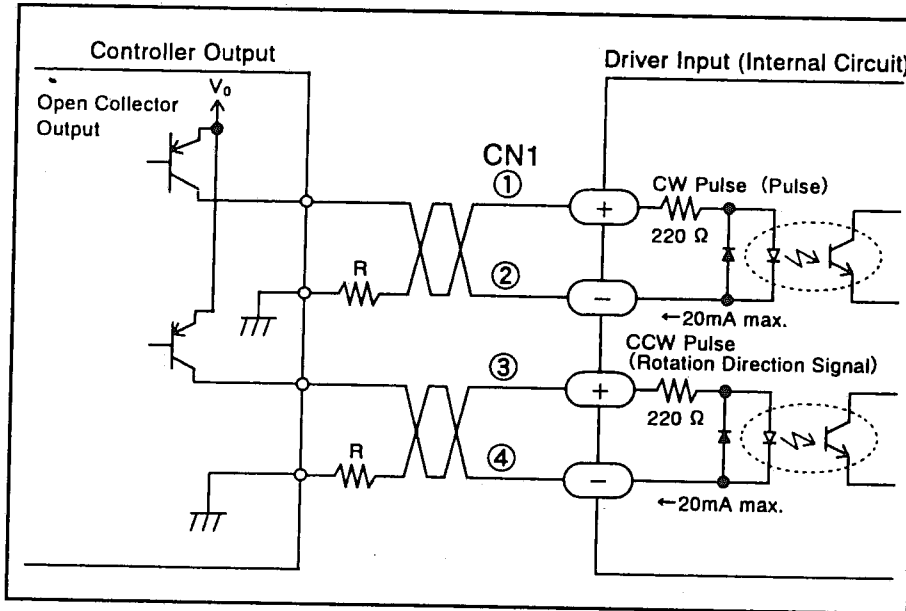
# 6. 1 Input Signals

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

## 6. 1. 1 CW Pulse / Pulse Signals CCW Pulse / Rotation Direction Signals

The diagram below shows the input circuits and an example connection to a controller. Connections differ depending on your controller output signal type.

### Source (PNP) Type



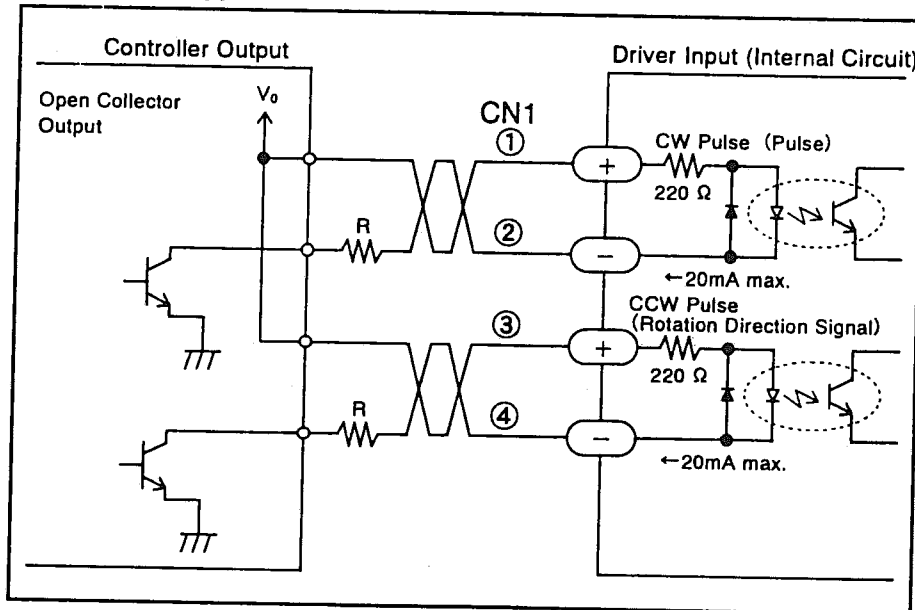
The number within ○ refers to the pin number of driver connector CN1.

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 20mA.

### Sink (NPN) Type



## 2 Pulse Input Mode

### CW\* pulse signal

When a negative logic pulse is input to the CW pulse / pulse signal input terminal, the motor rotates one step in the clockwise direction on the pulse rising edge.

### CCW\* pulse signal

When a negative logic pulse is input to the CCW pulse / rotation direction signal input terminal, the motor rotates one step in the counterclockwise direction on the pulse rising edge.

\* 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

When a negative logic pulse is input to the CW pulse / pulse signal input terminal, the motor rotates one step on the pulse rising edge.

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.

An "L" level signal input (photocoupler : ON) commands a clockwise direction rotation.

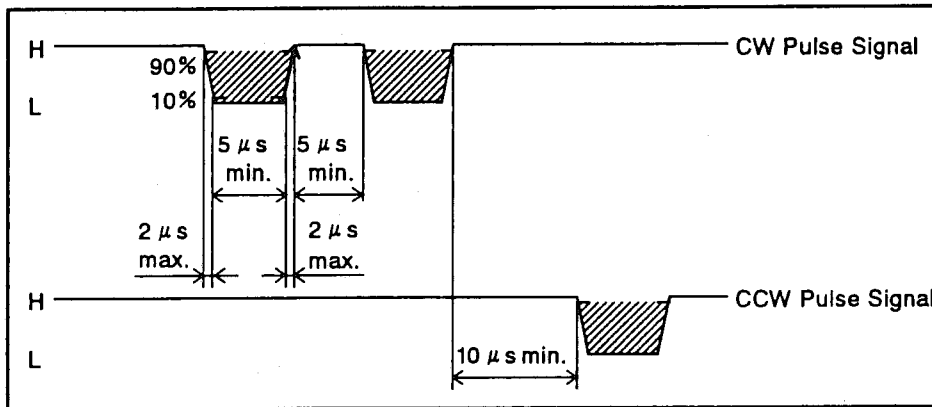
An "H" level signal input (photocoupler : OFF) commands a counterclockwise direction rotation.

## Relation to the Pulse Input Mode Switch (See page 14)

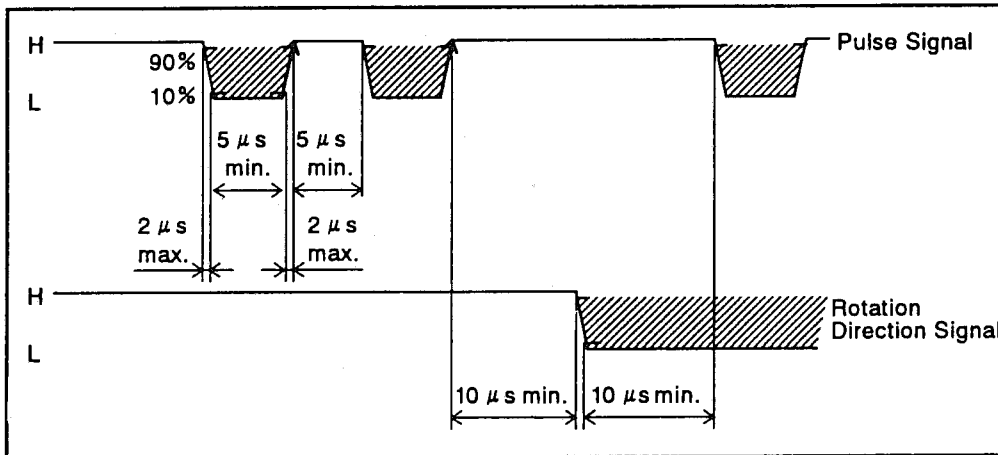
When the switch is set to the 2P position, motor rotation is controlled by CW pulse signals and CCW pulse signals.  
When the switch is set to the 1P position, motor rotation is controlled by pulse signals and rotation direction signals.

## Pulse Waveform Characteristics

### 2 Pulse Input Mode



### 1 Pulse Input Mode

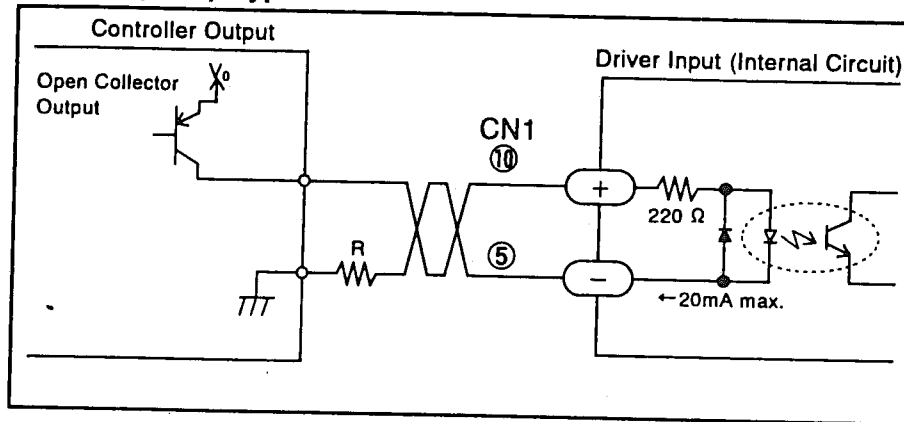


- The shaded area indicates when the photocoupler diode is ON. The motor moves on the pulse rising edge as indicated by the arrow.
- The pulse voltage is "H" level (photocoupler : OFF)=4~5V, "L" level (photocoupler : ON)=0~0.5V
- Input pulse signals should have a pulse width over 5 μsec, pulse rise/fall below 2 μsec, and a pulse duty below 50%.
- Keep the pulse signal at "H" level when no pulses are being input.
- The minimum interval time when changing rotation directions is 10 μsec. 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 at "L" level will result in erratic motor rotation.
- In 1 pulse input mode, leave the pulse signal at rest ("H" level) when changing rotation directions.

## 6. 1. 2 Output Current Off Signal

The diagram below shows the input circuit and an example connection to a controller. Connections differ depending on your controller output signal type.

### Source (PNP) Type

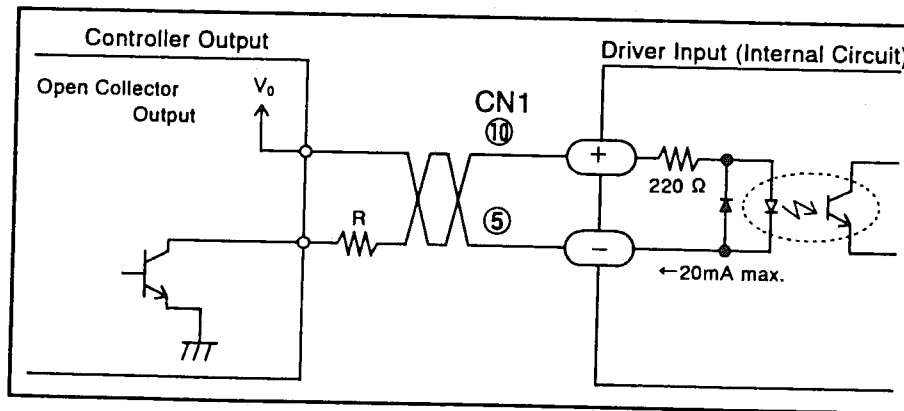


The number within  $\bigcirc$  refers to the pin number of driver connector CN1.

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.

### Sink (NPN) Type



When the Output current off signal is at "L" level (photocoupler : ON), 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.

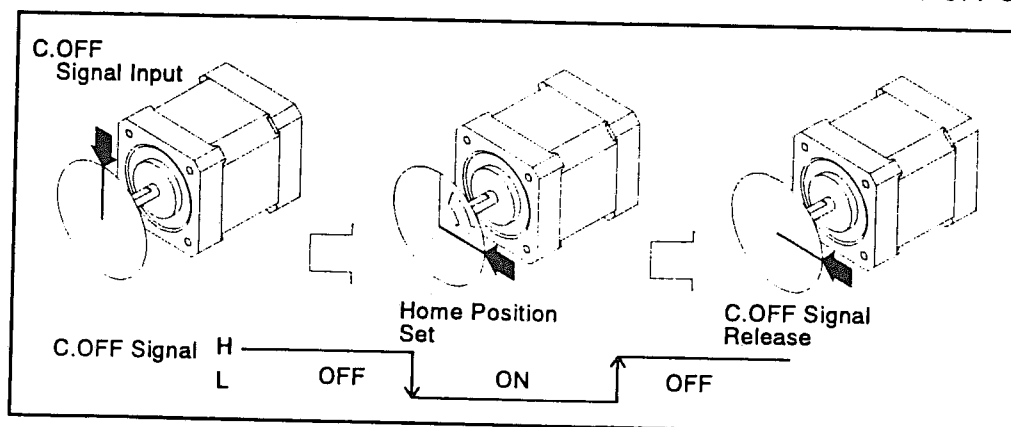
When the output current off signal is at "H" level (photocoupler : OFF), the motor holding torque is proportional to the current set by the current adjustment rotary switches. During motor operation be sure to keep the signal at "H" level. This signal is used when moving the motor by external force or manual home positioning etc. is desired. If this function is not needed, it is not necessary to connect this terminal.

Switching the output current off signal from "L" level to "H" level does not alter the excitation sequence.

When the motor shaft is manually adjusted with the output current off signal input, the shaft will shift up to  $\pm 3.6^\circ$  from the position set after the output current off signal is released.

## Manual Detection of the Home Position

Input the output current off signal, set the motor to the desired position, then release the C.OFF signal.



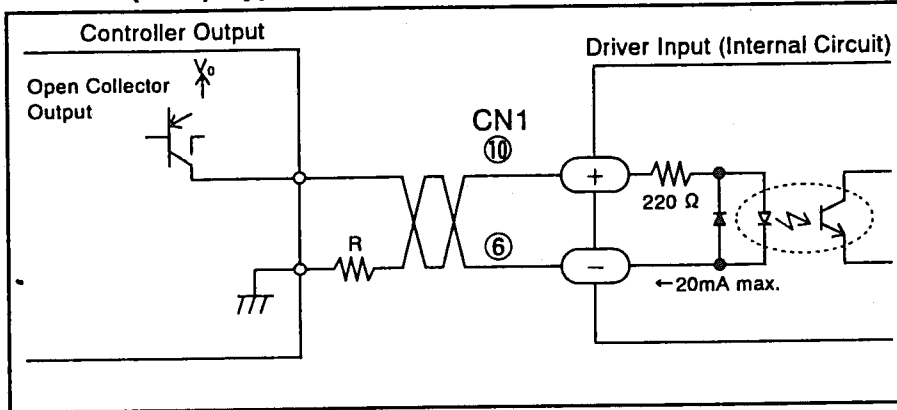
### Note

- When rotating the output shaft during manual detection at the electromagnetic brake type, then release the electromagnetic brake.

## 6. 1. 3 Electromagnetic Brake Release Signal (Electromagnetic Brake Type Only)

Connections differ depending on your controller output signal type.

### Source (PNP) Type



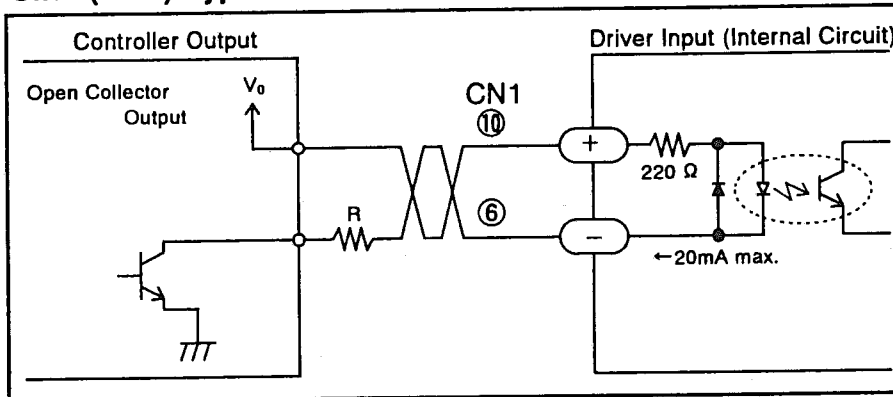
The number within ○ refers to the pin number of driver connector CN1.

Terminal ⑩ is also common for the output current off 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.

### Sink (NPN) Type



When the Electromagnetic Brake Release signal is at "L" level (photocoupler ON), the electromagnetic brake released and the motor is ready for operation.

When the Electromagnetic Brake Release signal is at the "H" level (photocoupler OFF), the electromagnetic brake engaged and the motor shaft is held in position.

When the motor is at rest (pulse signals at rest), using the output current off signal while the motor is held in position with the electromagnetic brake allows for a reduction in motor heat generation and power consumption.

## Relation to the Electromagnetic Brake Function Switch

(See pages 14, 15)

When the switch is set to the OFF position, the brake is engaged and released through the Electromagnetic Brake Release signal.

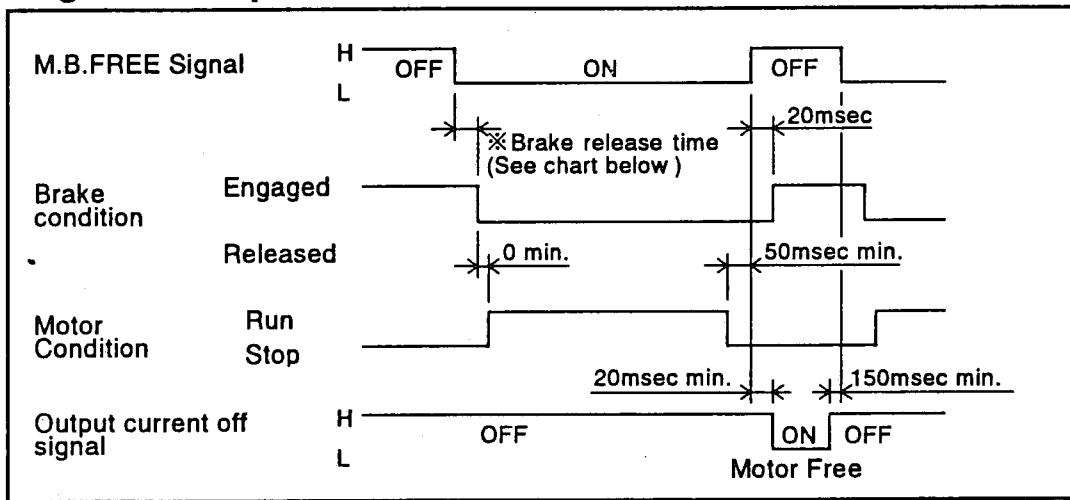
When the switch is set to the MBF position, the brake is only engaged when the driver power is OFF, and cannot be released through a signal. (The Electromagnetic Brake Release signal is not valid.)

When using the Electromagnetic Brake Release signal, be sure to keep the switch set to the OFF position.

# Timing Chart

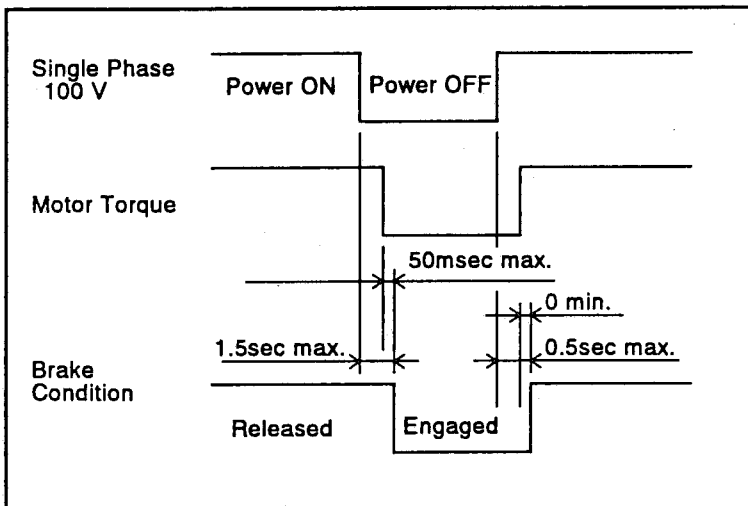
The timing charts below show conditions when the electromagnetic brake function switch is set to the OFF position.

## During Normal Operation



Package Model Number	Brake Release Time
UPK543AWM UPK544AWM UPK545AWM	30msec

## During Power OFF / ON



### Note

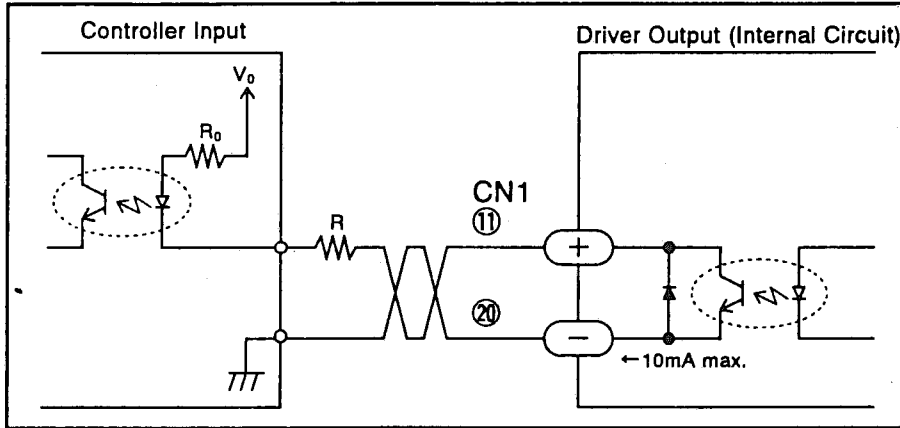
- Once power has been turned off, wait at least 5 seconds before turning it on again.

## 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.

Terminal  $\textcircled{20}$  is also the common for the overheat signal.

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 when the motor excitation (current flowing through the winding) is in the initial stage (step "0" at power up).

When connected as shown in the example connection, the signal will be "L" level (photocoupler : ON) at step "0".

The excitation timing signal can be used to increase the accuracy of home position detection by setting the mechanical home position of your equipment (photo-sensor etc.) to coincide with the excitation sequence initial stage (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 7.2° rotation of the motor output shaft.

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 5,6)

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 Angle Switch (See page 14,15)

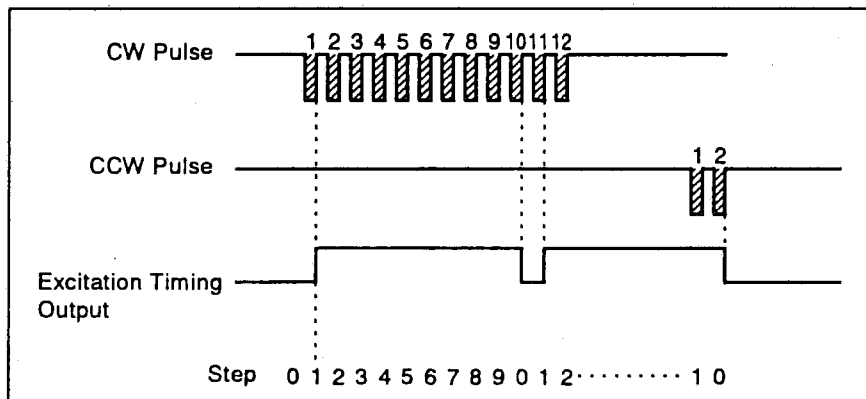
When the switch is set to the F position:

Full step : signal is output once every 10 pulses

When the switch is set to the H position:

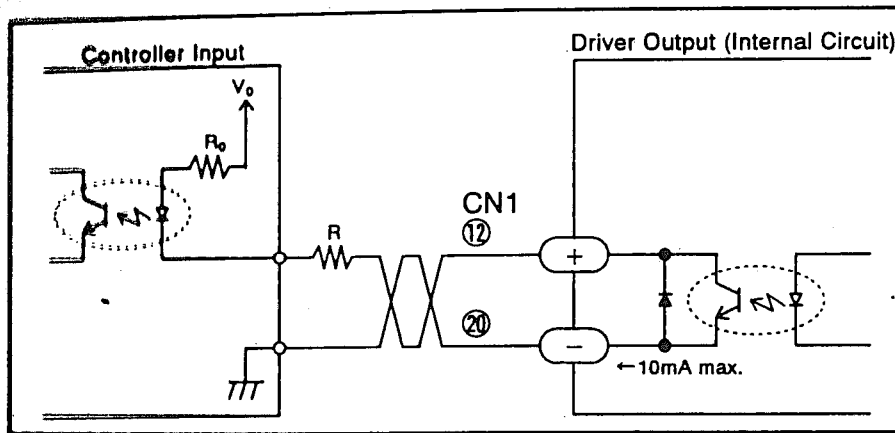
Half step : signal is output once every 20 pulses

### Timing chart when in full step mode



## 6.2.2 Overheat 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.

Terminal  $\textcircled{20}$  is also the common for the excitation timing signal.

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  $80^{\circ}\text{C}$ .

When connected as shown in the example connection, the signal will be "H" level (photocopler : OFF) during normal conditions, and "L" level (photocopler : ON) when the temperature exceeds above  $80^{\circ}\text{C}$ .

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.

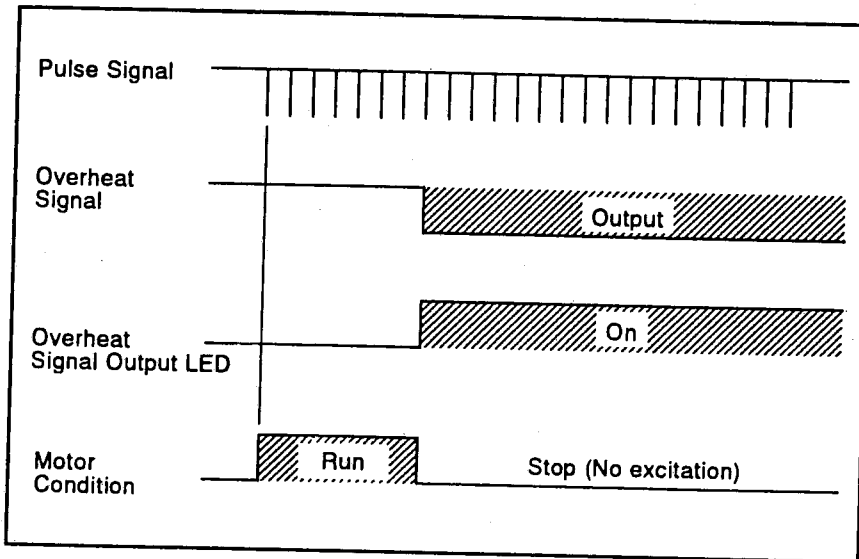
### Relation to the Overheat Signal Output (O.H.) LED (See pages 5,6)

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

# Relation to the Automatic Current Off Function Switch (See pages 14,15)

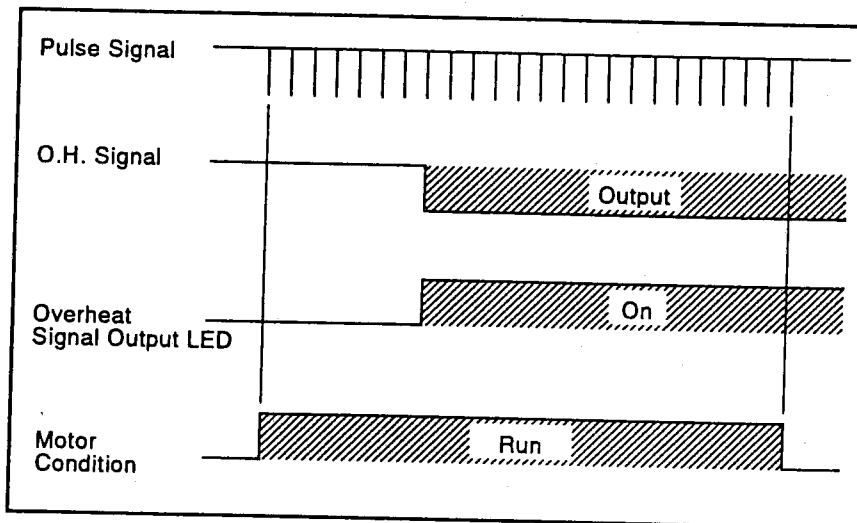
## When set to A.C.O.

- ① The overheat signal is output when the internal temperature of the driver exceeds above 80°C during operation.
- ② Regardless of any pulse signals input, motor excitation will cease (shaft free) and the motor will come to a natural stop.



## When set to OFF

- ① The overheat signal is output when the internal temperature of the driver exceeds above 80°C during operation.
- ② The motor will continue to run regardless of the overheat signal output.

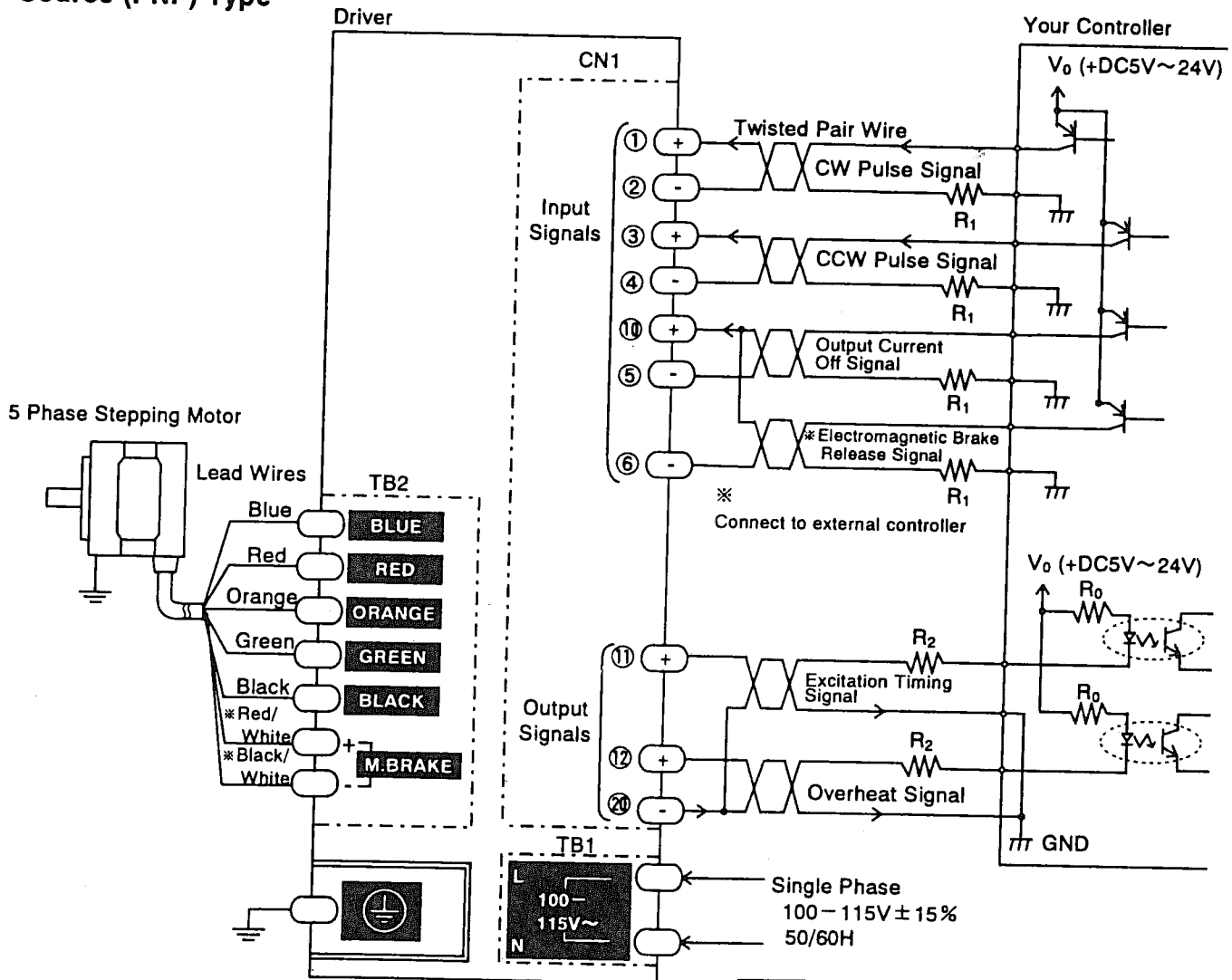


1. Connect the motor and driver.
2. Connect the driver and controller.
3. Ground the motor, driver, and controller.
4. Connect the power to the driver.

## 7.1 Example Connections

The connections between the motor, driver, and controller are explained below. The illustration on the following page is a simplification of the front panel of the UDK5107NW2-M driver. Connections differ depending on your controller output signal type.

### Source (PNP) Type



- indicates the terminals as labeled on the driver.
- indicates the connector or terminal block.
- ▭ indicates the heat sink side of the driver.
- The numbers within ○ on the driver indicate the for connector CN1.
- ※ indicates electromagnetic brake type only.

### Note

- The Output Current Off function and the electromagnetic Brake Release function will be disabled if both terminals are connected.

### Input signal connections

- Keep the voltage between DC5V and DC24V.
- When voltage is equal to DC5V, external resistance  $R_1$  is not necessary.
- When voltage is above DC5V, connect external resistance  $R_1$  and keep the input current below 20mA.

### Output signal connections

- Keep the voltage between DC5V and DC24V.
- Keep the current below 10mA.
- If the current exceeds 10mA, connect external resistance  $R_2$ .

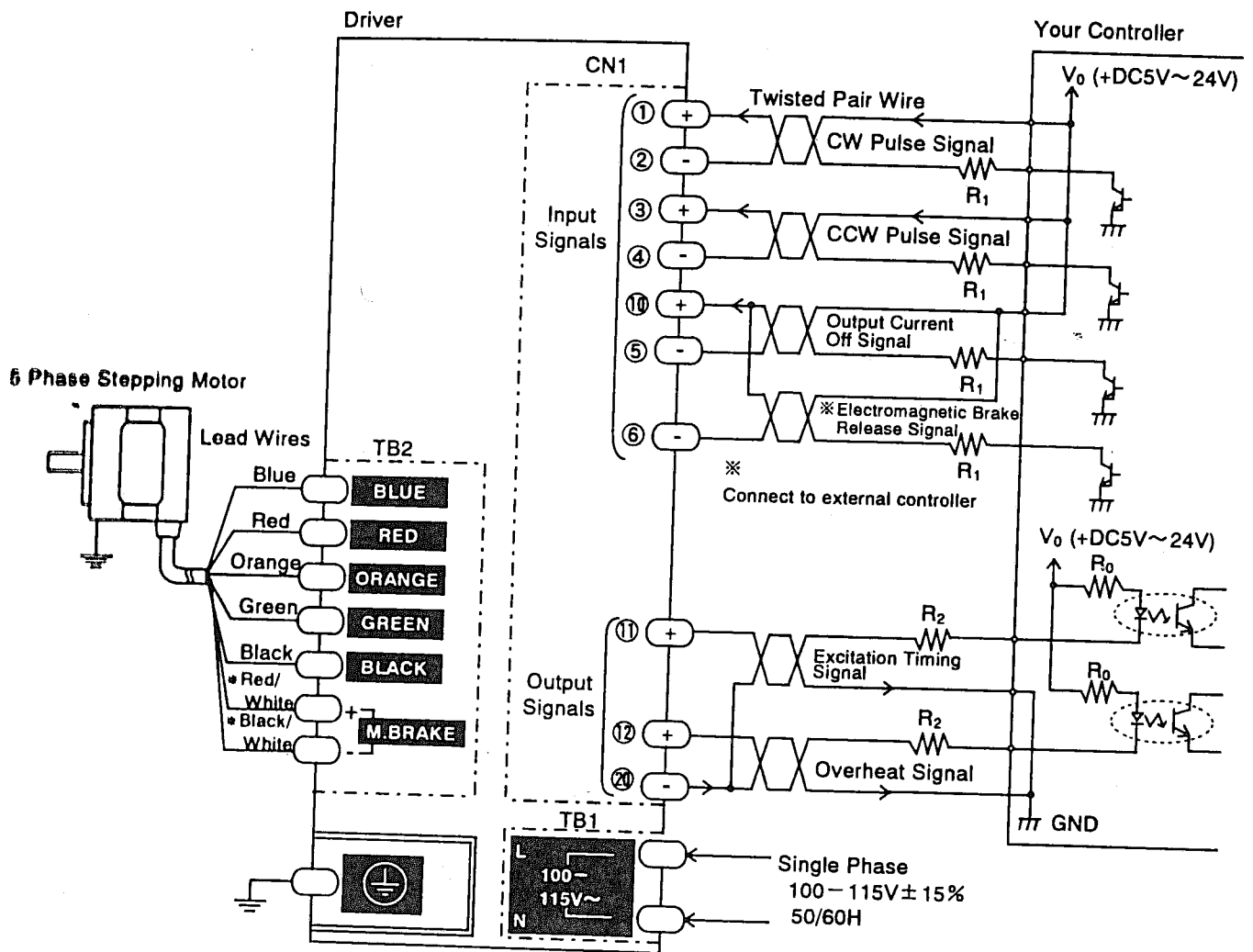
### Terminal connections

- Refer to pages 30 and 31 and securely connect the terminals.

- ※ The connection of the input signal shown above is two-pulse input mode.

For one-pulse input mode turn the pulse input mode switch to 「1P」, and input pulse signal to CW pulse input terminal and input direction signal to CCW pulse input terminal. (Refer to the pages 14, 16, 17, and 18 for details.)

# Sink (NPN) Type



indicates the terminals as labeled on the driver front panel.  
 indicates the connector or terminal block.  
 indicates the heat sink side of the driver.  
 The numbers within    on the driver indicate the pin number for connector CN1.  
 ※ indicates electromagnetic brake type only.

## Input signal connections

- Keep the voltage between DC5V and DC24V.
- When voltage is equal to DC5V, external resistance  $R_1$  is not necessary.
- When voltage is above DC5V, connect external resistance  $R_1$  and keep the input current below 20mA.

## Output signal connections

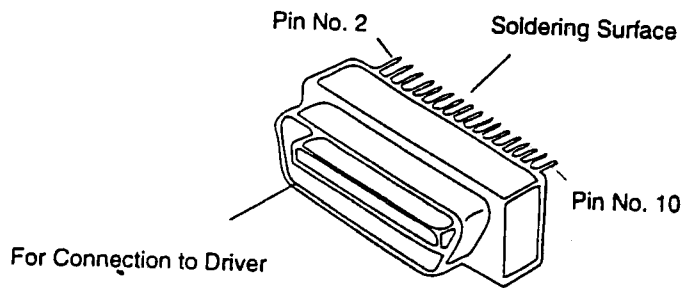
- Keep the voltage between DC5V and DC24V.
- Keep the current below 10mA.
- If the current exceeds 10mA, connect external resistance  $R_2$ .

## Terminal connections

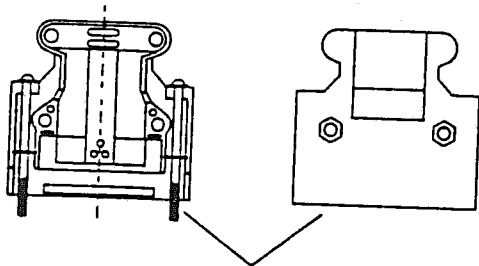
- Refer to pages 30 and 31, and securely connect the terminals.
- The connection of the input signal shown above is two-pulse input mode.
- For one-pulse input mode turn the pulse input mode switch to 「1P」, and input pulse signal to CW pulse input terminal and input direction signal to CCW pulse input terminal. (Refer to the pages 14,16,17, and 18 for details.)

## 7. 2 Preparing the I/O Signal Connector

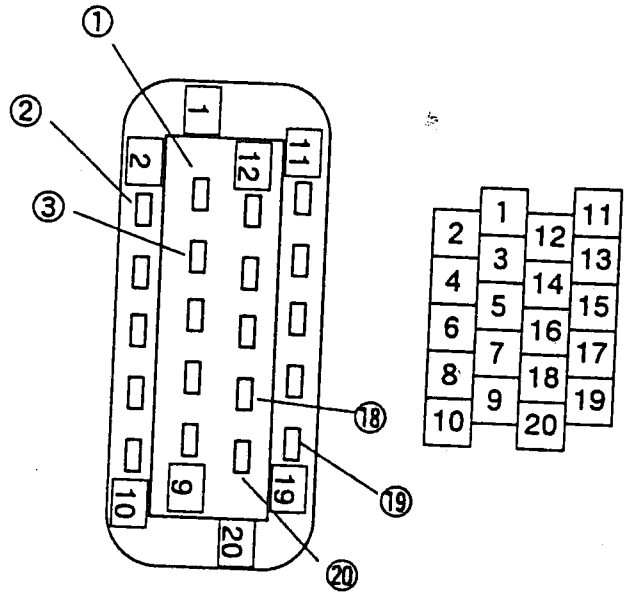
Refer to the terminal description chart of section 3.3(page 7) and solder the signal lines to the relevant pin numbers. After soldering, assemble the I/O signal connector and connect it to the driver connector CN1.



Connector



Connector Cover



Connector Pin Arrangement  
(As seen from side to be soldered)

### I/O Signal Connector

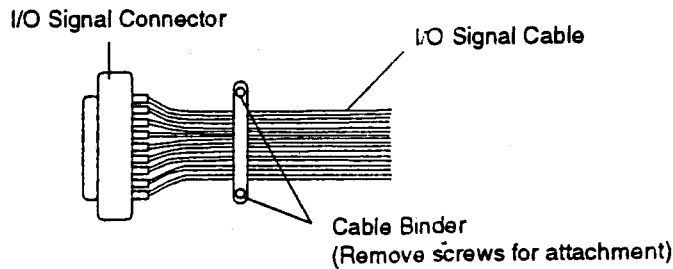
Connector: 10120-3000VE (Sumitomo 3M)

Connector cover: 10320-52A0-008 (Sumitomo 3M)

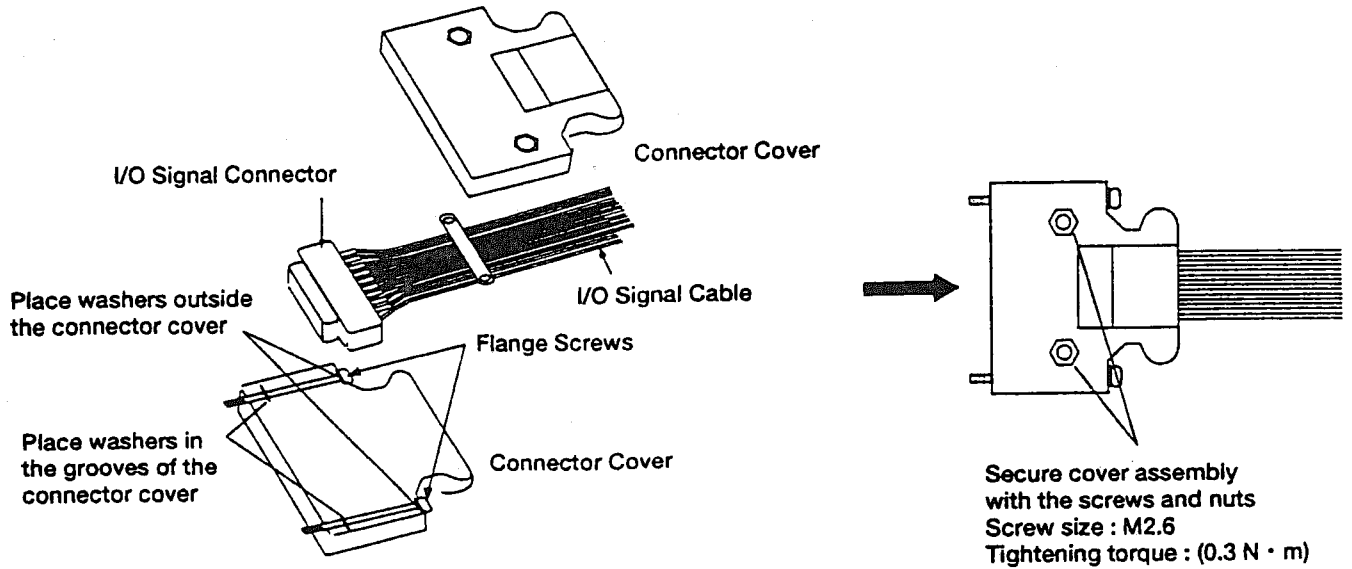
# 7.3 Connector Cover Assembly and Connection to the Driver

After soldering the signal lines to the I/O connector, attach the connector cover.

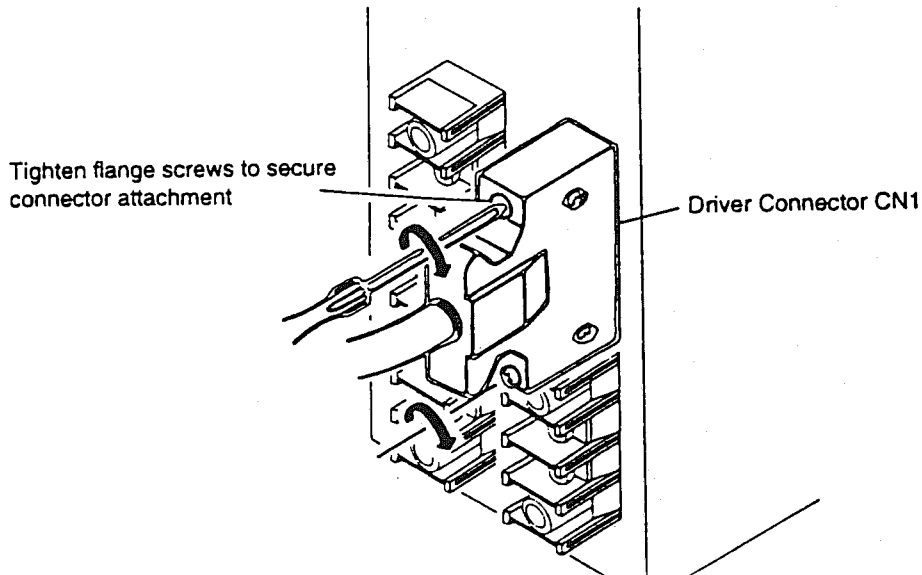
- (1) Attach the metal cable binder to the I/O cable.



- (2) Place the I/O cable and flange screws in the connector cover.  
Place the washers as shown in the diagram below.  
Connect both sides of the connector cover and secure the assembly with the screws and nuts.



- (3) Plug the I/O connector into driver connector CN1, then tighten the flange screws to secure the connector to the driver. (Screw tightening torque: 0.15~0.25N · m)

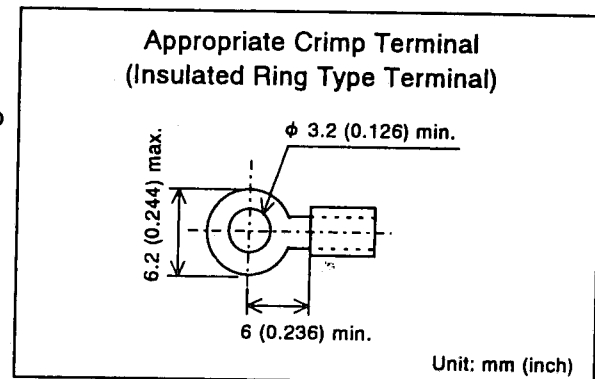


## 7. 4 Connecting the Motor and Driver

Connect the motor to the driver as follows:

1. Loosen the terminal cover screws (M3) and remove the terminal cover.
2. Attach crimp terminals to the motor lead wires.
3. Loosen the terminal screws (M3), connect the motor lead crimp terminals to the driver terminals, and then tighten the terminal screws.  
(Screw tightening torque:  $0.5\text{N} \cdot \text{m}$ )
4. Reattach the terminal cover, and tighten the terminal cover screws. (Screw tightening torque:  $0.5\text{N} \cdot \text{m}$ )

- When extending the motor lead wires use wire of AWG20 ( $0.5\text{mm}^2$ ) or greater.



## 7. 5 Connecting the Driver and Controller

Connect the driver to the controller.

Confirm the following when making the connections.

- For signal lines, use twisted pair wire of AWG24 ( $0.2\text{mm}^2$ ) or greater, and 2m or less in length.
- Separate the signal lines from the power lines and motor lead wires by at least 10cm. Do not band the wires together. This is to prevent noise interference from entering the signal lines and subsequent erratic motor operation.
- Use an open collector transistor (sink type) for the controller signal output.

If electrical noise generated by other equipment causes operational errors, shield the signal lines with conductive tape or wire mesh etc. (prepared by users).

Connect the shield material to the driver's protective earth terminal for grounding.

### Note

- Do not excessively pull, bend, or pinch the signal lines. Damage may result.

## 7. 6 Ground

### 7. 6. 1 Grounding the Motor

The motor is designed with a Class I basic insulation construction.

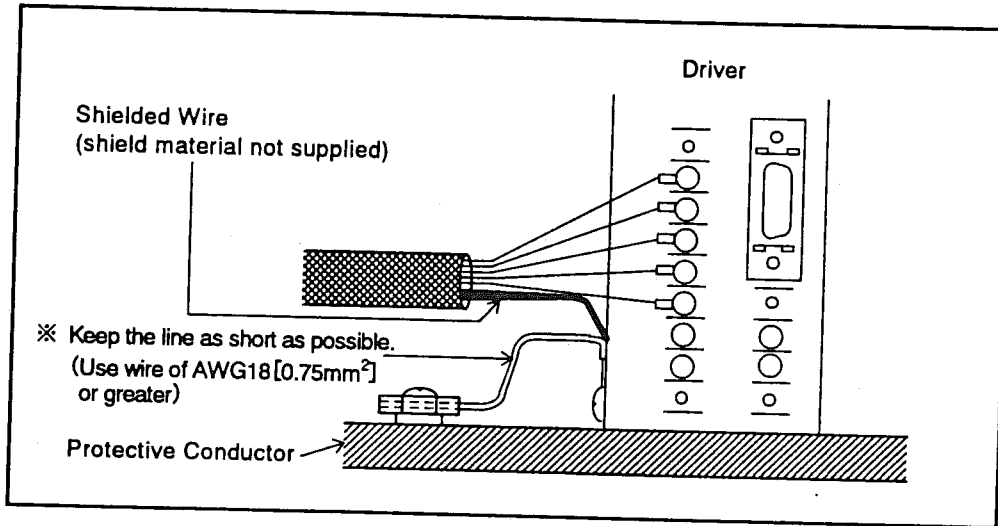
If electrical noise interference from the motor cable becomes a problem, shield the cable with conductive tape or wire mesh (prepared by users).

Connect the shield material to the driver's protective earth terminal for grounding.

## 7.6.2 Grounding the Driver

The driver is designed with a Class I basic insulation construction.

To prevent electric shock, connect the driver's protective earth terminal to a protective conductor.



## 7.7 Connecting the Power Source

Connect to a power source of single phase 100 – 115V ± 15% 50/60Hz.

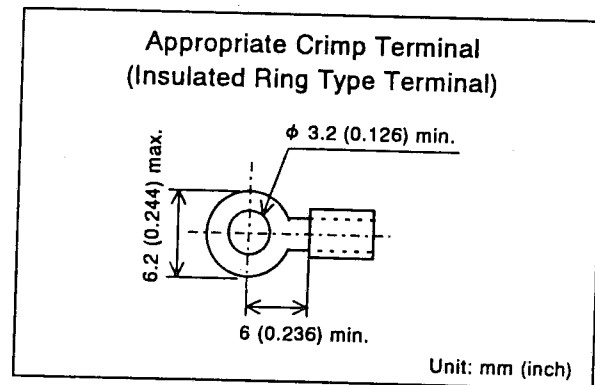
Use a power source which will supply sufficient input current.

The current value for input power as indicated in the specifications on pages 38,39 is the maximum value.

The current value will vary according to the pulse frequency.

Refer to the speed - torque characteristics in the product guide or the general catalog for the relationship between the input current and pulse frequency.

1. Loosen the terminal cover screws (M3) and remove the terminal cover.
2. Attach crimp terminals to the power lines.
3. Loosen the terminal screws (M3), connect the power line crimp terminals to the driver terminals, and then tighten the terminal screws.  
(Screw tightening torque: 0.5N · m)
4. Reattach the terminal cover, and tighten the terminal cover screws. (Screw tightening torque: 0.5N · m)



### Note

- For power lines, use wire type AWG18 (0.75mm<sup>2</sup>) or greater .
- If the current from the power source is insufficient the motor torque will be reduced and the transformer may be damaged. The following abnormalities may also occur.
  - Erratic motor rotation during high speeds
  - Delayed motor start-up and stopping

## 7.8 Turning On the Power

Before turning the power ON, be sure that the signal lines, motor lead wires, power line, and earth line are all properly connected, and that the terminal cover is attached.

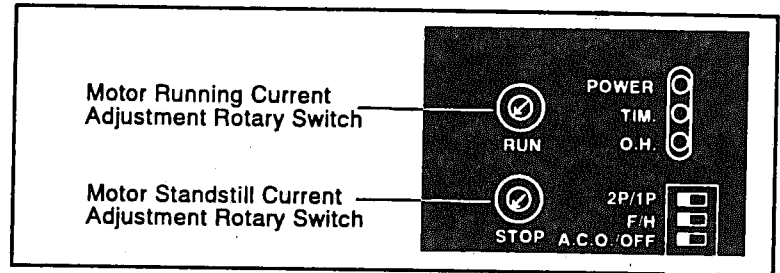
Leave more than 5 seconds for re-turning on the power.

# 8. Motor Current Adjustment

If maximum motor torque is not needed, the motor running current or the motor standstill current can be adjusted to reduce motor vibration and motor and driver heat generation.

- To reduce temperature rise of the motor and driver ⇒ Reduce the motor running current and the motor standstill current
- To reduce motor vibration ⇒ Reduce the motor running current

**Driver Front Panel**  
**UDK5107NW2**  
**UDK5107NW2-M**



## 8. 1 Motor Running Current Adjustment

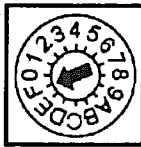
The motor running current is factory set to the motor's rated current.

(Motor running current adjustment switch RUN set to "F" )

Adjust the motor running current by turning the RUN rotary switch with a small slot screwdriver.

The RUN switch settings and corresponding current values are indicated in the following chart.

**RUN switch settings and corresponding current values (representative values)**



RUN Switch Settings	Running Current [A/phase]
	UDK5107NW2 UDK5107NW2-M
0	0.19
1	0.23
2	0.27
3	0.30
4	0.34
5	0.38
6	0.42
7	0.45
8	0.49
9	0.53
A	0.56
B	0.60
C	0.64
D	0.68
E	0.72
F	0.75

## 8. 2 Motor Standstill Current Adjustment

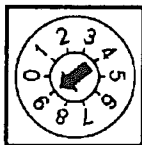
The current at motor standstill can be adjusted to reduce motor/driver heat generation. The motor standstill current factory set to approximately 50% of the rated current. (Standstill current adjustment switch STOP set to "9").

Adjust the motor standstill current by turning the STOP rotary switch with a small slot screwdriver.

The amount of current reduction is proportional to the setting of the motor running current.

$$\text{Standstill Current [A/phase]} = \frac{\text{Running Current Setting [A/phase]} \times \text{Standstill Current Setting [\%]}}{100}$$

**STOP switch settings and corresponding rate of current reduction (representative values)**



STOP Switch Settings	Standstill Current Setting [%]
	UDK5107NW2 UDK5107NW2-M
0	6
1	6
2	9
3	15
4	21
5	27
6	32
7	38
8	44
9	50

Consult the following chart if the motor is not functioning properly. If the motor is still not functioning properly after confirming the check points below, contact your nearest sales office as listed at the back of this manual.

PROBLEM	CHECK POINTS	MEASURES
<p>No excitation in the motor. (The motor has no holding torque and the shaft can be turned freely by hand)</p>	<p>1. Is the driver POWER LED On? (If On, condition is normal)</p>	<p>If the POWER LED is not On, check if the power source is properly connected. Verify that single phase 100 – 115V ± 15% 50/60Hz power is being input. <b>CAUTION:</b> Double-pole/neutral fusing 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.</p>
	<p>2. Is the output current off signal being input to the driver?</p>	<p>When the output current off signal is input the motor will lose all excitation (no holding torque). Return the output current off signal to "H" level.</p>
	<p>3. Is the driver overheat LED Off? (If Off, condition is normal)</p>	<p>The overheat LED lights when the overheat signal is output. If the automatic current off function switch is set to the "A.C.O." position when this signal is output, the motor will lose all excitation (no holding torque). Refer to items 24~27 (page 36) and take the necessary steps to prevent the overheat signal from being output.</p>
	<p>4. Are the driver and motor correctly connected?</p>	<p>Check the driver connection terminals. If the motor cable has been extended check the extension connection.</p>
	<p>5. Are the current adjustment rotary switches (RUN or STOP) set too low?</p>	<p>These rotary switches control the output current to the motor (refer to pages 32, 33). If they are set too low return them to the factory set positions.</p>
	<p>Note: If the motor still has no torque after checking the above conditions, the driver is probably defective. After reconfirming that the current voltage and connections are correct, contact your nearest sales office for service.</p>	
<p>The motor does not rotate.</p>	<p>First check the 5 items above.</p>	
<p>The motor does not rotate when a pulse signal is input.</p>	<p>6. Are the pulse signal lines correctly connected? Are the pulse signal waveform characteristics correct?</p>	<p>Check the connections, and check the pulse signal voltage, pulse waveform characteristics, and pulse signal logic (refer to pages 16,17,18). Use a controller which is able to output a standard pulse signal.</p>
	<p>7. While in 2 pulse input mode (pulse input mode switch set to the 2P position) is either the CW pulse/pulse or CCW pulse/rotation direction signal input terminal already at "L" level?</p>	<p>The motor will not rotate if a pulse signal is input when the other pulse signal input terminal is already at "L" level. Be sure to keep the pulse signal at "H" level.</p>
	<p>8. While in 1 pulse input mode (pulse input mode switch set to the 1P position) is the pulse signal connected to the CCW pulse/rotation direction signal input terminal?</p>	<p>Connect the pulse signal to the CW pulse/pulse signal input terminal.</p>
	<p>9. For the electromagnetic brake types, is the M.B.FREE signal (brake release) at "H" level while the electromagnetic brake function is set to OFF?</p>	<p>If the M.B.FREE signal is at "H" level, the brake is not released and the motor will not operate. Be sure to keep the M.B.FREE signal at "L" level during motor operation.</p>

PROBLEM	CHECK POINTS	MEASURES
The motor rotates in the wrong direction.	10 While in 2 pulse input mode (pulse input mode switch set to the 2P position) are the CW and CCW pulse signal lines connected backwards?	Connect the CW pulse signal line to the CW pulse/pulse signal input terminal, and connect the CCW pulse signal line to the CCW pulse/rotation direction signal input terminal.
	11. While in 1 pulse input mode (pulse input mode switch set to the 1P position) leave the CCW pulse/rotation direction signal input terminal unconnected and try inputting a pulse signal to the CW pulse/pulse signal input terminal.	If the motor rotates in a counterclockwise direction the motor and driver are normal. Recheck the rotation direction signal levels. ("L" level = clockwise, "H" level = counterclockwise)
Motor rotation is erratic.	First check items 4, 5, and 6.	
Motor start up is unstable.	12. Are the motor shaft and load properly aligned? Is the load too heavy for the motor?	Make sure the motor shaft and load are securely attached and properly aligned. Recheck the operating conditions, and if necessary lighten the load.
The motor rotates too far or not far enough.	13. Does the step angle required by your equipment match the step angle of the stepping motor?	Check the setting of the step angle switch located on the driver.
	14. Is the number of pulses set to match the amount of motor rotation?	Check the controller pulse setting.
The motor loses synchronization during acceleration or while running.	15. Is the overheat signal output LED Off? (If Off, condition is normal)	The overheat signal output LED lights when the overheat signal is output. If the automatic current off function switch is set to the "A.C.O." position when this signal is output, the motor will lose all excitation (no holding torque). Refer to items 24~27 (page 36) and take the necessary steps to prevent the overheat signal from being output.
	16. Is the starting pulse frequency too high?	Check this by decreasing the frequency.
	17. Is the acceleration/deceleration time too short?	Check this by increasing the acceleration/deceleration time.
	18. Is the motor being affected by noise interference?	Check this by running the motor while the machine suspected of producing the noise interference is off.
Motor vibration is very high.	19. Is the output torque too high?	Try reducing the motor running current with the current adjustment rotary switch "RUN".
	20. Try changing the pulse frequency.	If the vibration decreases after the pulse frequency has been adjusted, this means the motor is resonating. Either adjust the frequency or change the step angle. Also try installing the optional (sold separately) clean damper (for double shaft model only).

PROBLEM	CHECK POINTS	MEASURES
Motor temperature is very high.	21. Is the motor running time too long?	Shorten the running time or increase the restin time. (The temperature of the motor may ris considerably depending on the operatin conditions. During high speeds and dependin on the duty drive cycle, the motor could be susceptible to heat damage. Allow fo sufficient heat dissipation from the motor.) For UL standard, insulation is Class A (105°C (Keep the temperature of the motor case belo 75°C) For other standards insulation is Class B (130°C (Keep the temperature of the motor case belo 100°C)
The electromagnetic brake does not hold.	22. Is the electromagnetic brake function switch set to the MBF position while M.B.FREE (brake release) signal is at "H" level?	Set the electromagnetic brake function switch to the OFF position and keep the M.B.FREE (brak release) signal at "H" level.
	23. Is the power source turning on interval within 5 seconds after turning it off?	If that case, the electromagnetic brake may no engage. Make its interval over 5 seconds.
The overheat signal is output.	24. Is the driver ambient temperature 0°C ~ +50°C?	If not, take the necessary steps to keep th ambient temperature within 0°C ~ +50°C.
	25. Is the driver located in an enclosed or poorly ventilated area?	Install the driver in a well ventilated area, or install a ventilation fan.
	26. Is the driver mounted to a metal surface?	If not, mount the driver to a metal surface or install a ventilation fan.
	27. Is the driver continuously operating at a pulse rate, which requires the maximum input current?	If changing the pulse rate is a possibility, try adjusting it enough to decrease the input current. For details refer to the driver input curre indicated in the "speed vs. torque characteristi in the general catalog.