

## 2-Phase Stepping Motor and Driver Package

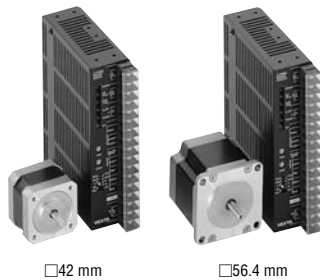
# UMK Series

The **UMK** series is a 2-phase stepping motor (resolution: 200 per rotation) with easy-handling AC input driver package. It provides enhanced high-speed characteristics compared with motor units combined with a DC input driver.

### Features

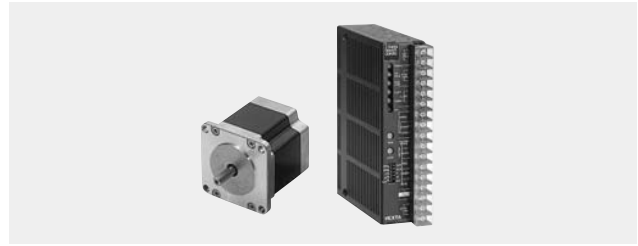
#### ● Selectable from Six Types of Motors

The product line now has two frame sizes (□42 mm, □56.4 mm). Three kinds of output torque are available for each size. (If lower vibration and lower noise are required, 5-phase stepping motors are recommended.)



□42 mm

□56.4 mm



#### ● Compact Driver

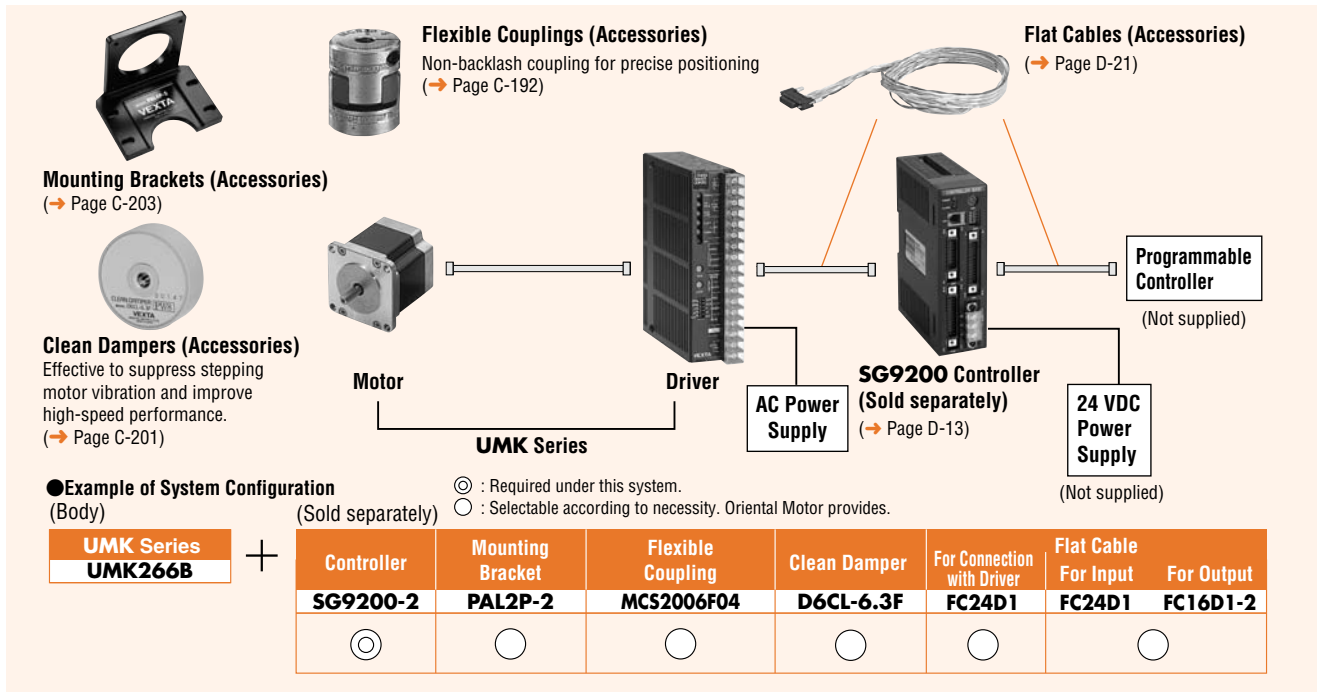
The **UMK** series driver offers high output of 0.95 to 2 A/phase in a compact body of 35 mm (W)×100 mm (D)×135 mm (H) based on surface mount technology and optimized heat design.

#### ● A Full Range of Functions

The **UMK** series has a range of built-in functions such as automatic current cutoff, pulse input mode switching, step angle switching and overheat output logic switching. All these functions can be controlled using the front panel switches and monitored by LEDs. The series also comes with a timing output that facilitates mechanical homing.

### System Configuration

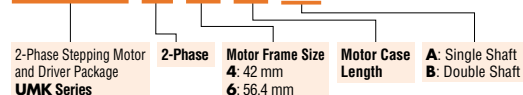
An example of a single-axis system configuration with an **SG9200** series controller.



● The system configuration shown above is an example. Other combinations are available.

### Product Number Code

## UMK 2 6 6 A



## Motor Frame Size 42 mm, 56.4 mm

### Specifications

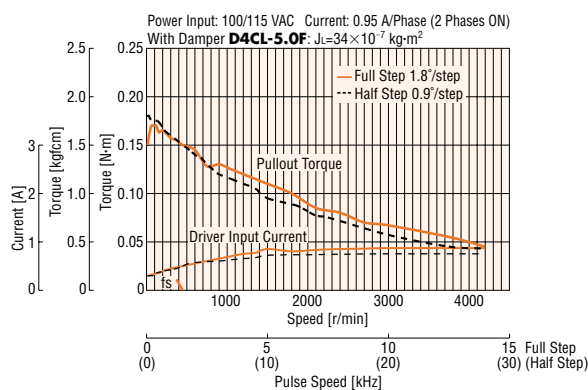
Model	Single Shaft	UMK243A	UMK244A	UMK245A	UMK264A	UMK266A	UMK268A	
	Double Shaft	UMK243B	UMK244B	UMK245B	UMK264B	UMK266B	UMK268B	
Maximum Holding Torque	N·m kgfcm	0.16 1.6	0.26 2.6	0.32 3.2	0.39 3.9	0.9 9	1.35 13.5	
Rotor Inertia	J: kg·m <sup>2</sup> gfc·m <sup>2</sup>	35×10 <sup>-7</sup> 35	54×10 <sup>-7</sup> 54	68×10 <sup>-7</sup> 68	120×10 <sup>-7</sup> 120	300×10 <sup>-7</sup> 300	480×10 <sup>-7</sup> 480	
Rated Current	A/Phase	0.95	1.2			2		
Basic Step Angle		1.8°						
Power Source		Single-Phase 100 VAC±15% 50/60 Hz 1 A Single-Phase 115 VAC±15% 60 Hz 1 A	Single-Phase 100 VAC±15% 50/60 Hz 1.4 A Single-Phase 115 VAC±15% 60 Hz 1.4 A	Single-Phase 100 VAC±15% 50/60 Hz 2.2 A Single-Phase 115 VAC±15% 60 Hz 2.2 A				
Excitation Mode		Full Step: 1.8°/step / Half Step: 0.9°/step						
Mass	kg	Motor	0.21	0.27	0.35	0.45	0.7	1.0
		Driver	0.47					
Dimension No.	Motor	1				2		
	Driver	3						

How to Read Specifications Table → Page C-8

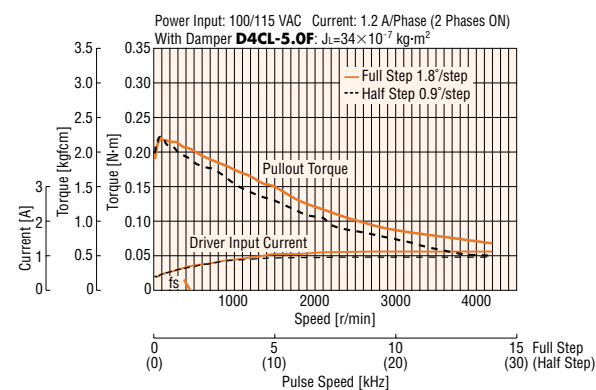
### Speed – Torque Characteristics

How to Read Speed-Torque Characteristics → Page C-8

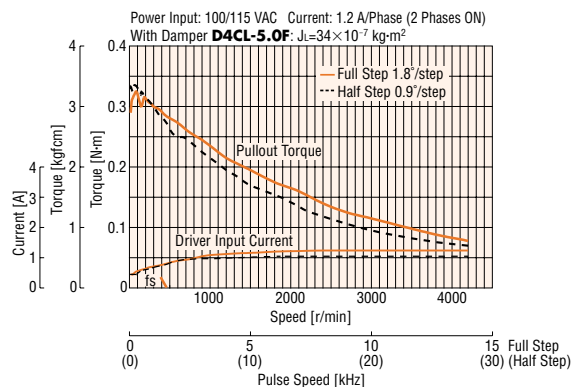
#### UMK243A/UMK243B



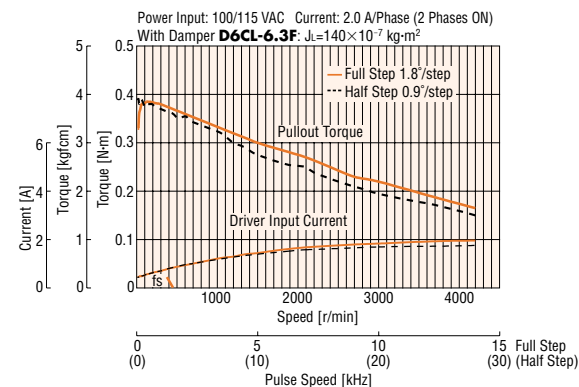
#### UMK244A/UMK244B



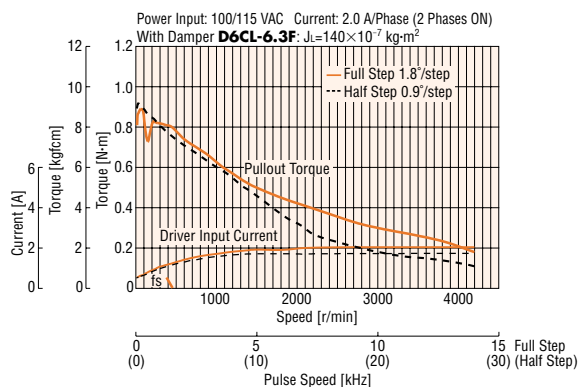
#### UMK245A/UMK245B



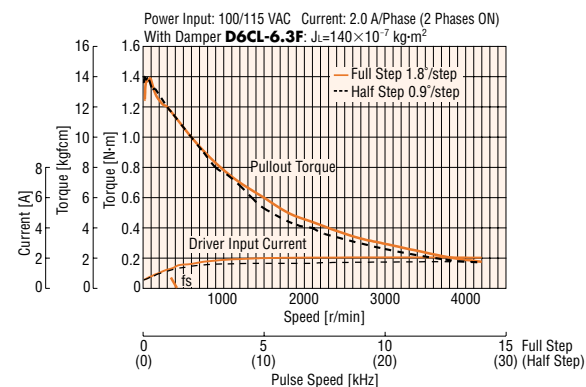
#### UMK264A/UMK264B



#### UMK266A/UMK266B



#### UMK268A/UMK268B



● The pulse input circuit responds to approximately 20 kHz with a pulse duty of 50%.

## Common Specifications

### Driver Specifications

Input Signals	Input Mode	Photocoupler input: Input resistance: 220 Ω, Input current: 10~20 mA Photocoupler ON: +4.5~+5 V, OFF: 0~+1 V (Voltage between terminals)
	CW Pulse Signal (Pulse Signal)	CW direction operation command pulse signal (Operation command pulse signal when in 1-pulse input mode) Pulse width: 5 μs minimum; Pulse rise/fall: 2 μs maximum, Pulse duty: 50% and below The motor moves one step when the pulse input is switched from photocoupler ON to OFF. Maximum input pulse frequency: 20 kHz (When the pulse duty is 50%) Negative logic pulse input
	CCW Pulse Signal (Rotation Direction Signal)	CCW direction operation command pulse signal (Rotation direction signal when in 1-pulse input mode Photocoupler OFF: CCW, Photocoupler ON: CW ) Pulse width: 5 μs minimum; Pulse rise/fall: 2 μs maximum, Pulse duty: 50% and below The motor moves one step when the pulse input is switched from photocoupler ON to OFF. Maximum input pulse frequency: 20 kHz (When the pulse duty is 50%) Negative logic pulse input
	All Windings Off Signal	When in the "photocoupler ON" state, the output current to the motor is cut off and the motor shaft can be rotated manually. When in the "photocoupler OFF" state, the output current set by the RUN potentiometer is supplied to the motor.
Output Signals	Output Mode	Photocoupler, Open-Collector Output (Emitter Common) External use condition: 24 VDC maximum, 10 mA maximum
	Excitation Timing Signal	The signal is output every time the excitation sequence returns to the initial stage "0". (Photocoupler: ON) Full step: signal output every 4 pulses, Half step: signal output every 8 pulses
	Overheat Signal	The signal is output when the internal temperature of the driver rises above approximately 90°C. (Photocoupler: ON or OFF, automatic return available when below 90°C) The motor current is shut off automatically if the automatic current off function is ON. The output logic of the photocoupler is based on the setting of the overheat output logic switch.
Functions		Automatic Current Cutback, All Windings Off, Step Angle Switch, Pulse Input Mode Switch, Overheat Output Logic Switch
Indicators (LED)		Power Source Input, CW/PLS Input, CCW/DIR Input, All Windings Off Input, Excitation Timing Output, Overheat Output
Driver Cooling Method		Natural ventilation

## General Specifications

Specifications	Motor	Driver
Insulation Class	Class B (130°C)	—
Insulation Resistance	100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC megger between the motor coils and casing.	100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC megger. •Case – Power input terminal •Case – Signal input/output terminal •Power input terminal – Signal input/output terminal
Dielectric Strength	Sufficient to withstand 1.0 kV (0.5 kV for <b>UMK24□</b> ), 50 Hz or 60 Hz applied between the motor coils and casing for one minute, under normal temperature and humidity.	Sufficient to withstand the following for one minute, under normal temperature and humidity. •Case – Power input terminal 1.0 k VAC 50/60 Hz •Case – Signal input/output terminal 1.0 k VAC 50/60 Hz •Power input terminal – Signal input/output terminal 1.0 k VAC 50/60 Hz
Operating Environment (In Operation)	Ambient Temperature	–10°C~+50°C (nonfreezing)
	Ambient Humidity	85% or less (noncondensing)
	Atmosphere	No corrosive gases, dust, water or oil.
Temperature Rise	Temperature rise of the coil measured by the change resistance method is 80°C or less. (at rated current, at standstill, two phases energized)	—
Static Angle Error*1	±3 arc minutes (±0.05°)	—
Shaft Runout	0.05 T.I.R.(mm)*4	—
Radial Play*2	0.025 mm max. of 5 N	—
Axial Play*3	0.075 mm max. of 10 N	—
Concentricity	0.075 T.I.R.(mm)*4	—
Perpendicularity	0.075 T.I.R.(mm)*4	—

\*1 This value is for full step under no load. (The value changes with the size of the load.)

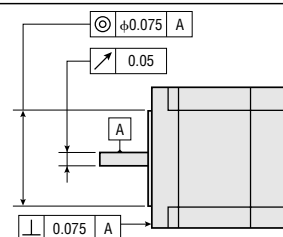
\*2 Radial Play: Displacement in shaft position in the radial direction, when a 5 N load is applied in the vertical direction to the tip of the motor's shaft.

\*3 Axial Play: Displacement in shaft position in the axial direction, when a 10 N load is applied to the motor's shaft in the axial direction.

\*4 T.I.R. (Total Indicator Reading): The total dial gauge reading when the measurement section is rotated one revolution centered on the reference axis center.

#### Note:

- Do not measure insulation resistance or perform the dielectric strength test while the motor and driver are connected.



## Permissible Overhung Load and Permissible Thrust Load

Unit = Upper values: N/Lower values: kgf

Model	Overhung Load Distance from Shaft End (mm)					Thrust Load
	0	5	10	15	20	
<b>UMK24□</b>	20 2	25 2.5	34 3.4	52 5.2	—	The permissible thrust load shall be no greater than the motor mass.
<b>UMK26□</b>	54 5.4	67 6.7	89 8.9	130 13	—	

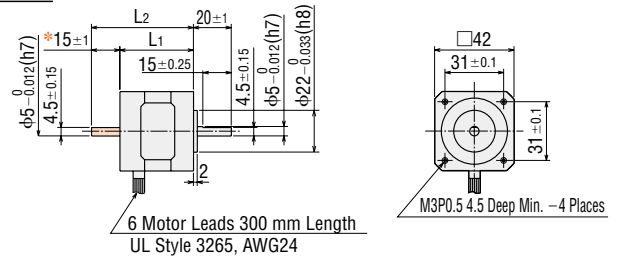
- Enter the length of motor case in the box (□) within the model name.

## Dimensions (Unit = mm)

### Motor

1 □42 mm

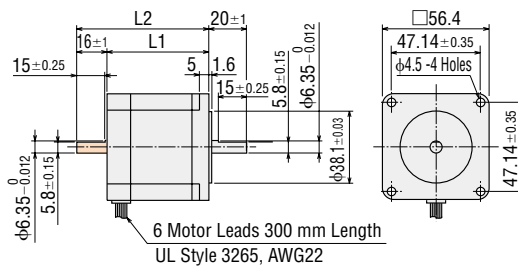
Model	Motor Model	L1	L2	Mass (kg)	CAD
<b>UMK243A</b>	PK243-01A	33	—	0.21	B081
<b>UMK243B</b>	PK243-01B		48		
<b>UMK244A</b>	PK244-01A	39	—	0.27	B082
<b>UMK244B</b>	PK244-01B		54		
<b>UMK245A</b>	PK245-01A	47	—	0.35	B083
<b>UMK245B</b>	PK245-01B		62		



\*The length of machining on double shaft model is  $15 \pm 0.25$ .

2 □56.4 mm

Model	Motor Model	L1	L2	Mass (kg)	CAD
<b>UMK264A</b>	PK264-02A	39	—	0.45	B084
<b>UMK264B</b>	PK264-02B		55		
<b>UMK266A</b>	PK266-02A	54	—	0.7	B085
<b>UMK266B</b>	PK266-02B		70		
<b>UMK268A</b>	PK268-02A	76	—	1.0	B086
<b>UMK268B</b>	PK268-02B		92		

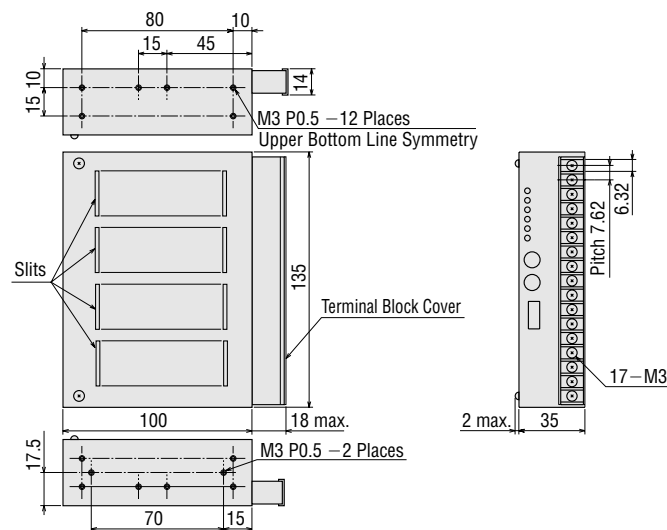


● These dimensions are for double shaft models. For single shaft models, ignore the shaded areas.

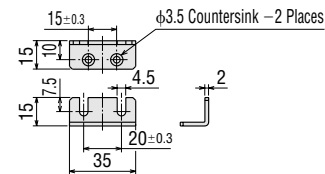
### Driver

3 Driver Model: UDK2109, UDK2112, UDK2120

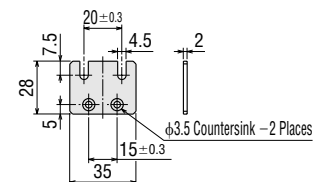
Mass 0.47 kg CAD B087



● Mounting Bracket A (2 pieces, included)

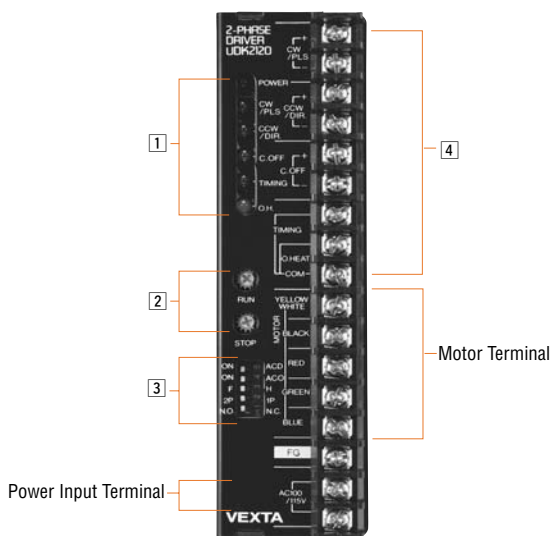


● Mounting Bracket B (2 pieces, included)



## Connection and Operation

### Names and Functions of Driver Parts



#### 1 Signal Monitor Display

Indication	Color	Name
POWER	Green	Power input display
CW/PLS	Green	CW pulse/Pulse input display
CCW/DIR	Green	CCW pulse/Rotation direction input display
C.OFF	Green	All windings off input display
TIMING	Green	Excitation timing output display
O.H.	Red	Overheat output display

#### 2 Current Adjustment Switches

Indication	Switch Name	Functions
RUN	Motor Run Current Potentiometer	For adjusting the motor running current
STOP	Motor Stop Current Potentiometer	For adjusting the current at motor standstill

#### 3 Function Select Switches

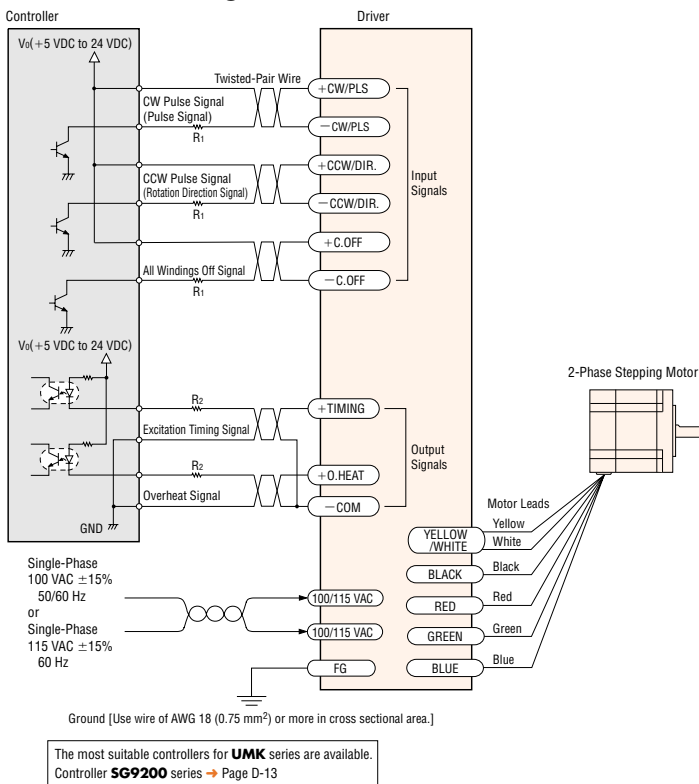
Indication	Switch Name	Functions
ON/ACD	Automatic current cutback function switch	Automatically decreases output current to motor at motor standstill.
ON/ACO	Automatic current off function switch	When the temperature inside the driver rises above 90°C, this function automatically switches the motor current off. The function can be set and released with this switch.
F/H	Step angle switch	Switches the motor's step angle. F (Full Step): 1.8°/step H (Half Step): 0.9°/step.
2P/1P	Pulse input mode switch	Switches between 1-pulse input and 2-pulse input.
N.O./N.C.	Overheat output signal logic switch	Select overheat alarm logic. N.O.: Normal open N.C.: Normal close Use according to your equipment.

#### 4 Input/Output Signal

Input/Output	Terminal Name	Functions
Input Signals	CW Pulse Signal (Pulse Signal)	The motor will rotate in the CW direction. (Operation command pulse signal when in 1-pulse input mode)
	CCW Pulse Signal (Rotation Direction Signal)	The motor will rotate in the CCW direction. (Rotation direction signal, Photocoupler OFF: CCW; Photocoupler ON: CW when in 1-pulse input mode)
	All Windings Off Signal	Cuts the output current to the motor and allows the motor shafts to be rotated by external force.
Output Signals	Excitation Timing Signal	Outputs signals when the excitation sequence is at STEP "0".
	Overheat Signal	When the temperature inside the driver rises above 90°C, this function automatically switches the motor current off.

\*Description of Input/Output Signals → Page C-113

### Connection Diagrams



#### ◇ Connecting Input/Output Signal

Keep the input signal voltage  $V_o$  between 5 VDC and 24 VDC.

When  $V_o$  is equal to 5 VDC, the external resistances  $R_1$  is not necessary. When  $V_o$  is above 5 VDC, connect  $R_1$  to keep the current between 10 mA and 20 mA.

Keep the output signal voltage  $V_o$  between 5 VDC and 24 VDC, current 10 mA or below. When  $V_o$  is above 10 mA, connect  $R_2$ .

#### ◇ Power Supply

Use a power supply that can supply sufficient input current. When power supply capacity is insufficient, a decrease in motor output can cause the following malfunctions:

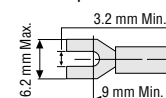
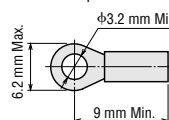
- Motor does not rotate properly at high-speed (insufficient torque).
- Slow motor startup and stopping.

#### ◇ Notes:

- Use twisted-pair wire of AWG 24 (0.2 mm<sup>2</sup>) or thicker and 2 m or less in length for the signal line.
- Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases. (→ **Technical Reference** Page G-35)
- Use AWG 22 (0.3 mm<sup>2</sup>) or thicker for motor lines (when extended) and power supply lines, and use AWG 18 (0.75 mm<sup>2</sup>) or thicker for the wire for the grounding line.
- Use spot grounding for the grounding of the driver and external controller.
- Signal lines should be kept at least 10 cm away from power lines (power supply lines and motor lines). Do not bind the signal line and power line together.

#### ◇ Recommended Crimp Terminals

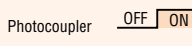
- Round shape terminal with insulator
- U shape terminal with insulator



\*Crimp terminals are not provided with the package. They must be furnished separately.

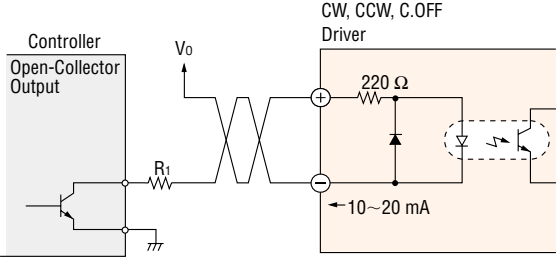
● Description of Input/Output Signals

Indication of Input/Output Signal "ON"/"OFF"  
 Input (Output) "ON" indicates that the current is sent into the photocoupler (transistor) inside the driver. Input (Output) "OFF" indicates that the current is not sent into the photocoupler (transistor) inside the driver. The input/output remains "OFF" if nothing is connected.

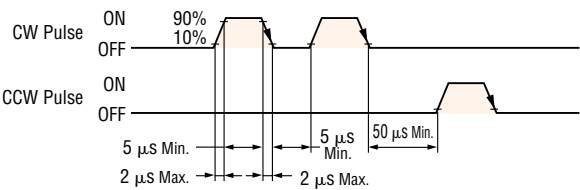


[ CW (Pulse) and CCW (Rotation Direction) Pulse Input Signal All Windings Off Input Signal ]

◇ Input Circuit and Sample Connection



◇ CW (Pulse) and CCW (Rotation Direction) Pulse Input Signal Pulse Waveform Characteristics



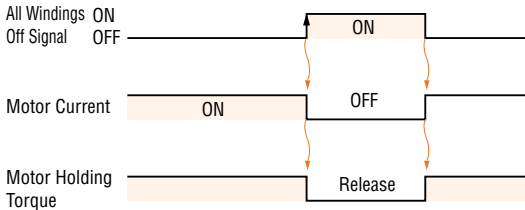
- The shaded area indicates when the photocoupler is ON. The motor moves when the photocoupler state changes from ON to OFF.
- The minimum interval time when changing rotation direction is 50 µs. This value varies greatly depending on the motor type and load inertia.

Pulse Signal Characteristics

- Keep the pulse signal at the "photocoupler OFF" state when no pulses are being input.
- Do not input a CW pulse and CCW pulse simultaneously.
- In 1-pulse input mode, leave the pulse signal at rest ("photocoupler OFF") when changing rotation directions.

◇ All Windings Off (C.OFF) Input Signal

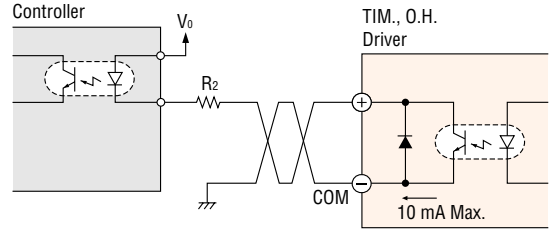
- Inputting this signal puts the motor in a non-excitation (free) state.
- This signal is used when moving the motor by external force or manual home position is desired. The photocoupler must be "OFF" when operating the motor.



The colored area indicates that the motor provides holding torque in proportion to standstill current set by STOP switch. Switching the "All Windings Off" (C.OFF) signal from "photocoupler ON" to "photocoupler OFF" does not alter the excitation sequence. When the motor shaft is manually adjusted with the "C.OFF" signal input, the shaft will shift up to ±3.6° from the position set after the "C.OFF" signal is released.

[ Excitation Timing (TIMING) Output Signal Overheat (O.H.) Output Signal ]

◇ Output Circuit and Sample Connection



◇ Excitation Timing (TIMING) Output Signal

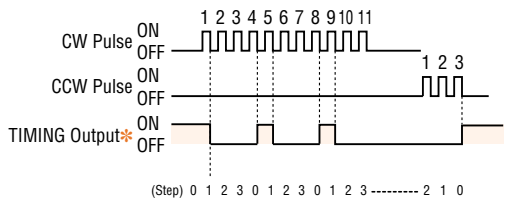
The "Excitation Timing" signal is output to indicate when the motor excitation (current flowing through the winding) is in the initial stage (step "0" at power up). The "Excitation Timing" signal is output simultaneously with a pulse input each time the excitation sequence returns to step "0". The excitation sequence will complete one cycle for every 7.2° rotation of the motor output shaft.

- Full Step: Signal is output once every 4 pulses.
- Half Step: Signal is output once every 8 pulses.

The TIMING LED on the front panel lights up during output.

Timing chart at 1.8°/step (Full step)

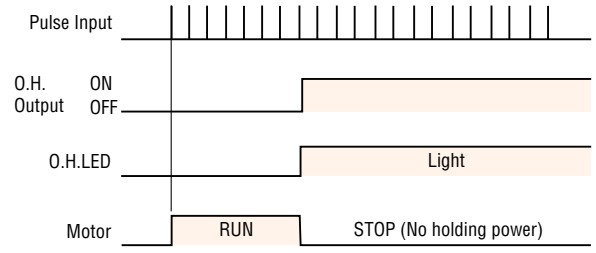
\*When connected as shown in the example connection, the signal will be "photocoupler ON" at step "0".



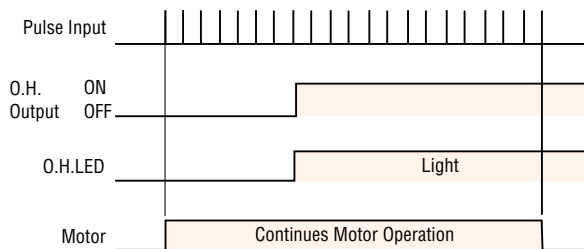
- Note:
- When power is turned ON, the excitation sequence is reset to step "0" and the TIM. LED lights up.

◇ Overheat (O.H.) Signal Output

- The "Overheat" (O.H.) signal is output to protect the driver from heat damage if the internal temperature of the driver rises above 90°C. The O.H. LED lights on the front panel when the "Overheat" signal is output.
- When used as shown in the sample connection with the overheat output logic switch set to "N.O.", the signal becomes "photocoupler ON". (Switch to "N.C." to set to the "photocoupler OFF".)
- You can select whether to stop the motor or continue the operation when an overheat signal is output.
- If the "Automatic Current Off" (A.C.O) function switch is set to "A.C.O" position, output current is shut off to stop the motor when the overheat signal is output.

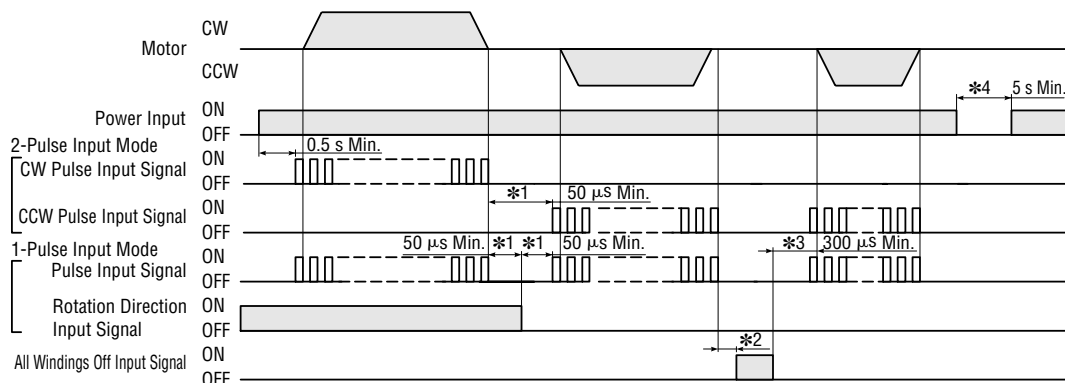


- If the "Automatic Current Off" function switch is set to "OFF" position, the motor continues operation when the overheat signal is output.



- To clear the "Overheat" signal, first resolve the cause and check for safety, then turn power on again.

## Timing Chart



\*1 Switching time to change CW, CCW pulse (2-pulse input mode), and switching time to change direction (1-pulse input mode) 50  $\mu$ s is shown as a response time of circuit. The motor may need more time.

\*2 Depends on load inertia, load torque, and starting frequency.

\*3 Never input a step pulse signal immediately after switching the "All Windings Off" signal to the "photocoupler OFF" state. The motor may not start.

\*4 Wait at least 5 seconds before turning on the power again.

## List of Motor and Driver Combinations

Model names for motor and driver combinations are shown below.

Model	Motor Model	Driver Model
<b>UMK243</b> □	PK243-01□	UDK2109
<b>UMK244</b> □	PK244-01□	UDK2112
<b>UMK245</b> □	PK245-01□	
<b>UMK264</b> □	PK264-02□	
<b>UMK266</b> □	PK266-02□	UDK2120
<b>UMK268</b> □	PK268-02□	

\*Enter **A** (Single shaft) or **B** (Double shaft) in the box (□) within the model name.