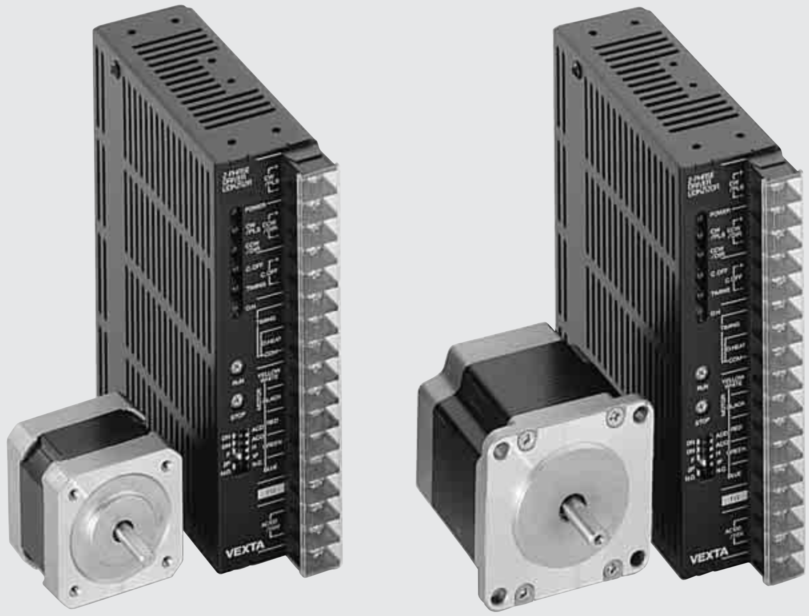


2-Phase Stepping Motor and Driver Package

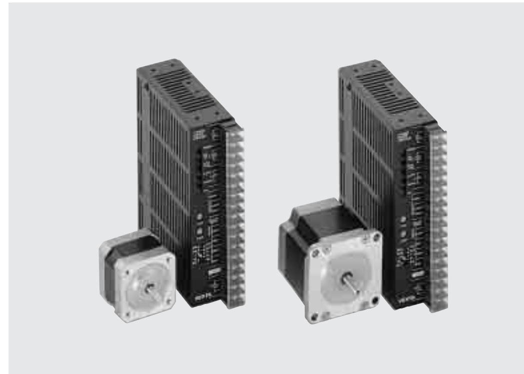
UMK Series

Additional Infomation

2-Phase Stepping Motor and Driver Package

UMK Series

The **UMK** Series provides high torque and low vibration.



Features

High Torque

Combines a high torque **PK** motor with a dedicated driver.
Maximum holding torque is as follows:

UMK24□: 22 oz-in (0.16 N·m)~45 oz-in (0.32 N·m)
UMK24□M: 22 oz-in (0.16 N·m)~45 oz-in (0.32 N·m)
UMK26□: 55 oz-in (0.39 N·m)~191 oz-in (1.35 N·m)
UMK26□M: 55 oz-in (0.39 N·m)~191 oz-in (1.35 N·m)

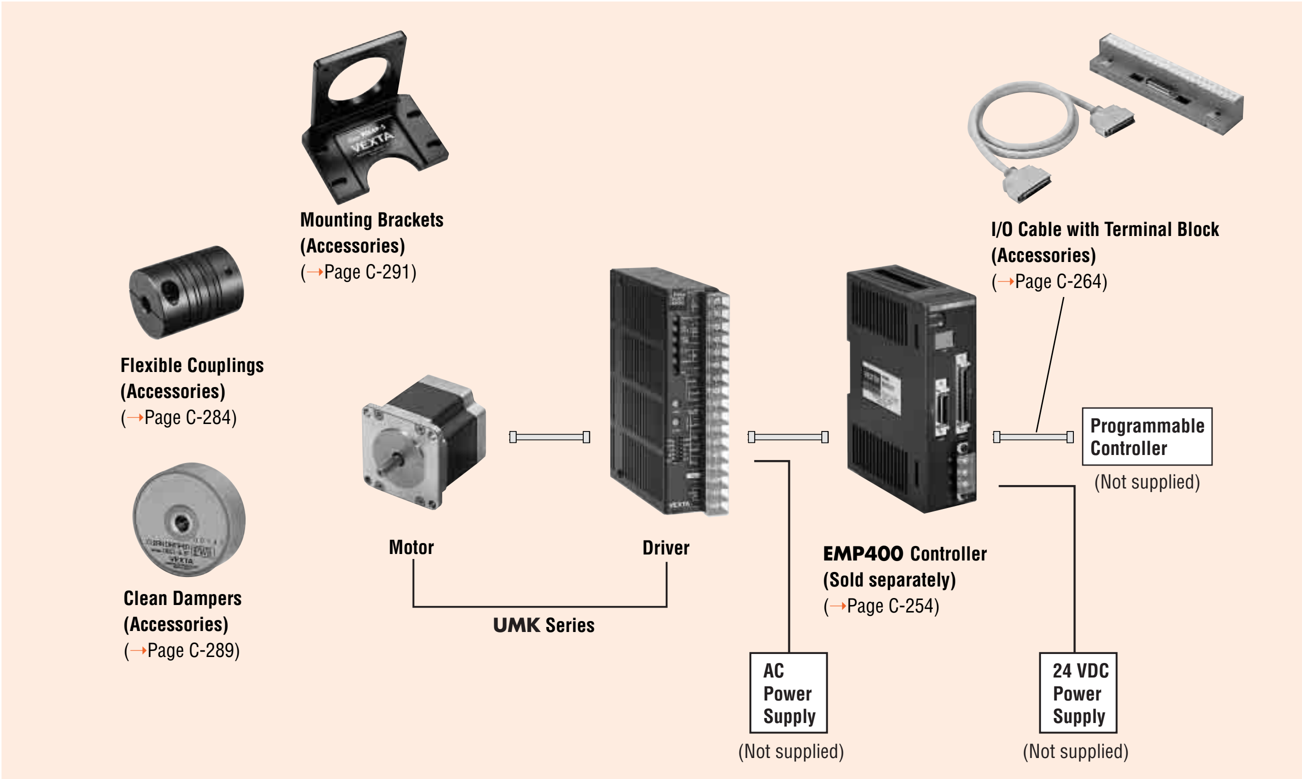
Low Vibration and Low Noise

Raising the torque can increase vibration and audible noise. The **UMK** Series was designed to ensure low vibration and low noise. For a 2-phase stepping motor running at full step, rotation is achieved by continuous 1.8˚ steps. This is a type of motion that leads naturally to vibration. To lower vibration and noise, it is important to make rotation as smooth as possible.

High-Resolution Type

The **UMK** Series also includes high resolution models for which the basic step angle (1.8˚/step) is cut in half to 0.9˚/step (for full steps).
The resolution is doubled from the 200 steps per rotation for the standard models to 400 steps per rotation. Consequently, the high-resolution model can be half-stepped to obtain 800 steps per rotation.

System Configuration



An example of a single-axis system configuration with an **EMP400** series controller.

Product Number Code

UMK 2 6 6 M A A

- **UMK** Series
- 2-phase
- Motor Frame Size **4**: 1.65 in. sq. (42 mm sq.)
  6: 2.22 in. sq. (56.4 mm sq.)
- Motor Case Length
- Blank: Standard Type
  M:High-Resolution Type
- Shaft Type **A**: Single Shaft
  B: Double Shaft
- U.S.A. Version

Product Line

Type	Power Supply Voltage	Maximum Holding Torque	
		1.65 inch (42 mm)	2.22 inch (56.4 mm)
Standard Type	Single-Phase 100/115 VAC	22~45 oz-in (0.16~0.32 N·m)	55~191 oz-in (0.39~1.35 N·m)
High-Resolution Type	Single-Phase 100/115 VAC	22~45 oz-in (0.16~0.32 N·m)	55~191 oz-in (0.39~1.35 N·m)

Standard Type

Motor Frame Size: □ 1.65 in. (□ 42 mm), □ 2.22 in. (□ 56.4 mm)

Specifications

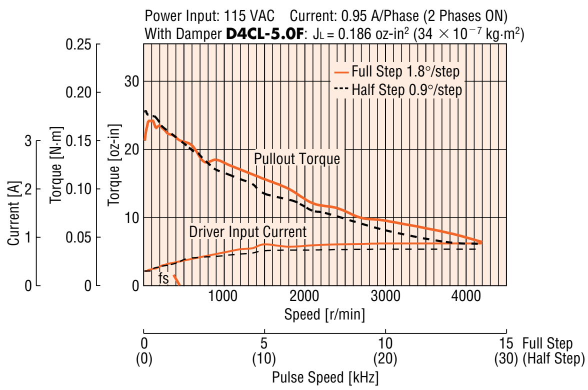
Model	Single Shaft	UMK243AA	UMK244AA	UMK245AA	UMK264AA	UMK266AA	UMK268AA
	Double Shaft	UMK243BA	UMK244BA	UMK245BA	UMK264BA	UMK266BA	UMK268BA
Maximum Holding Torque	oz-in (N·m)	22 (0.16)	36 (0.26)	45 (0.32)	55 (0.39)	127 (0.9)	191 (1.35)
Rotor Inertia J	oz-in²(kg·m²)	0.191 (35×10⁻⁷)	0.3 (54×10⁻⁷)	0.37 (68×10⁻⁷)	0.66 (120×10⁻⁷)	1.64 (300×10⁻⁷)	2.6 (480×10⁻⁷)
Rated Current	A/phase	0.95	1.2		2		
Basic Step Angle		1.8°					
Power Source		Single-Phase 115 VAC±15% 60 Hz or Single-Phase 100 VAC ±15% 50/60 Hz					
		1 A	1.4 A		2.2 A		
Excitation Mode		● Full Step (2 phase excitation): 1.8°/step ● Half Step (1-2 phase excitation): 0.9°/step					
Weight	Motor lb. (kg)	0.46 (0.21)	0.59 (0.27)	0.77 (0.35)	0.99 (0.45)	1.5 (0.7)	2.2 (1)
	Driver lb. (kg)	1 (0.47)					
Dimension No.	Motor	1			2		
	Driver	3					

How to Read Specifications Table→Page C-9

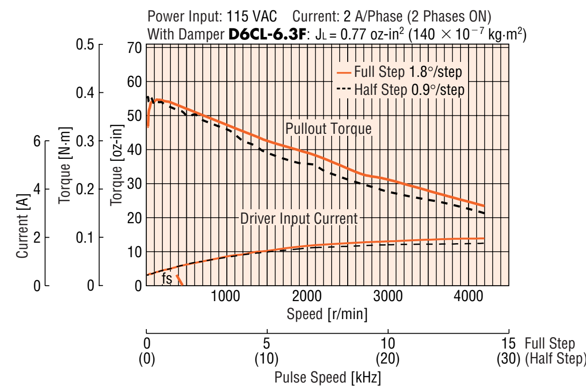
Speed — Torque Characteristics

How to Read Speed-Torque Characteristics→Page C-10

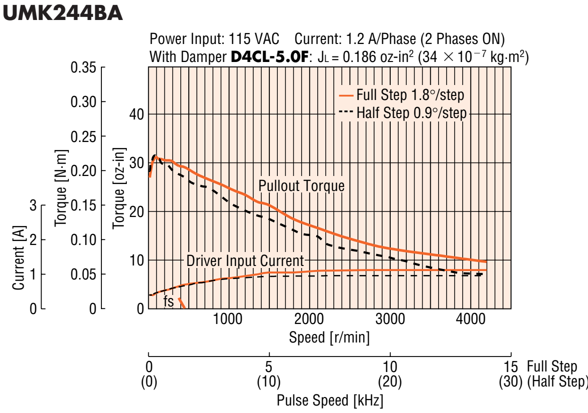
UMK243BA



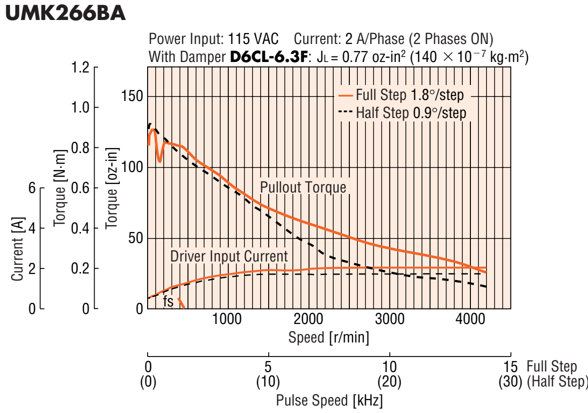
UMK264BA



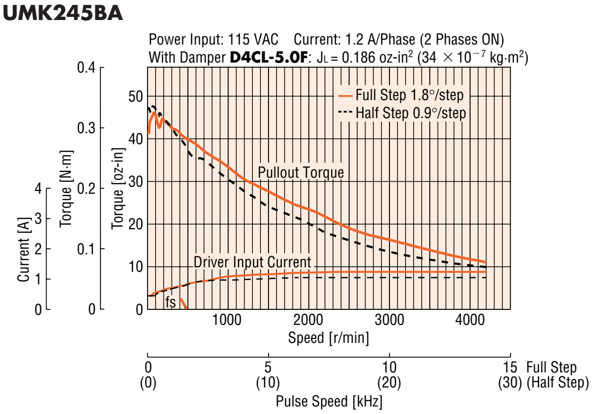
UMK244BA



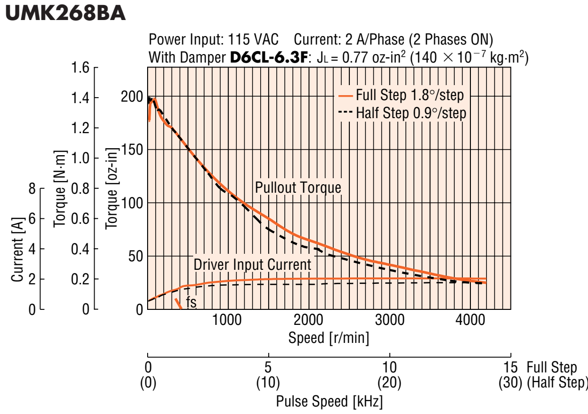
UMK266BA



UMK245BA



UMK268BA



Note:
The pulse input circuit responds up to approximately 20 kHz with a pluse duty of 50 %

High-Resolution Type Motor Frame Size: □ 1.65 in. (□ 42 mm), □ 2.22 in. (□ 56.4 mm)

Specifications

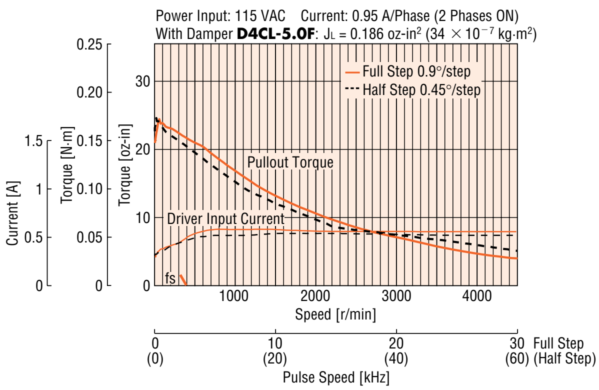
Model		Single Shaft	UMK243MAA	UMK244MAA	UMK245MAA	UMK264MAA	UMK266MAA	UMK268MAA
		Double Shaft	UMK243MBA	UMK244MBA	UMK245MBA	UMK264MBA	UMK266MBA	UMK268MBA
Maximum Holding Torque		oz-in (N·m)	22 (0.16)	36 (0.26)	45 (0.32)	55 (0.39)	127 (0.9)	191 (1.35)
Rotor Inertia J		oz-in² (kg·m²)	0.191 (35×10^{-7})	0.3 (54×10^{-7})	0.37 (68×10^{-7})	0.66 (120×10^{-7})	1.64 (300×10^{-7})	2.6 (480×10^{-7})
Rated Current		A/phase	0.95	1.2		2		
Basic Step Angle			0.9°					
Power Source			Single-Phase 115 VAC±15% 60 Hz or Single-Phase 100 VAC ±15% 50/60 Hz					
			1 A	1.4 A		2.2 A		
Excitation Mode			● Full Step (2 phase excitation): 0.9°/step ● Half Step (1-2 phase excitation): 0.45°/step					
Weight	Motor	lb. (kg)	0.53 (0.24)	0.66 (0.3)	0.81 (0.37)	0.99 (0.45)	1.5 (0.7)	2.2 (1)
	Driver	lb. (kg)	1 (0.47)					
Dimension No.	Motor		1			2		
	Driver		3					

How to Read Specifications Table→Page C-9

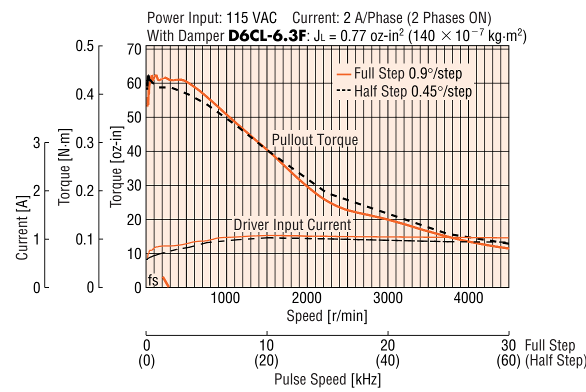
Speed — Torque Characteristics

How to Read Speed-Torque Characteristics→Page C-10

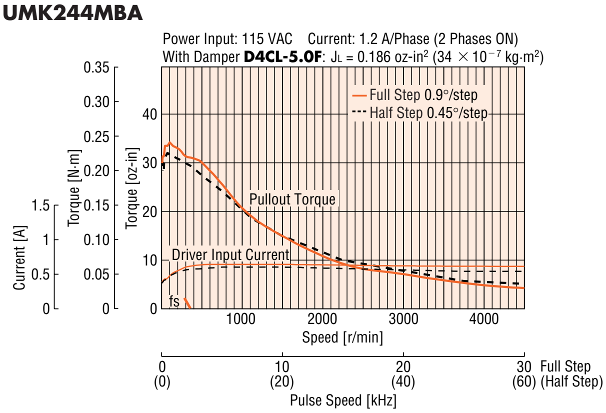
UMK243MBA



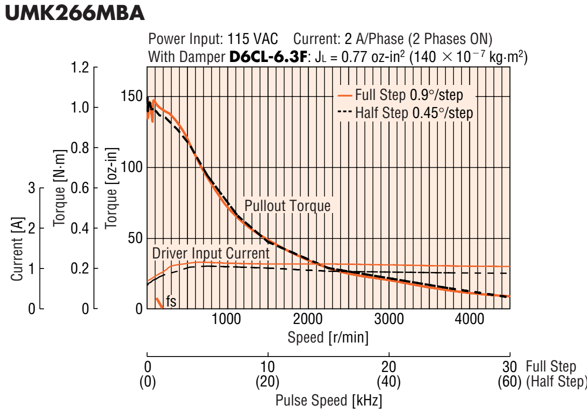
UMK264MBA



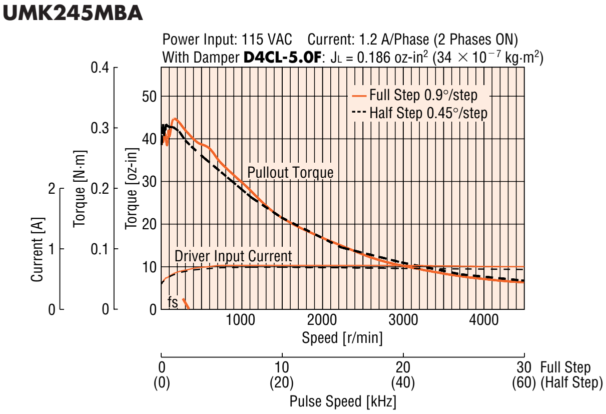
UMK244MBA



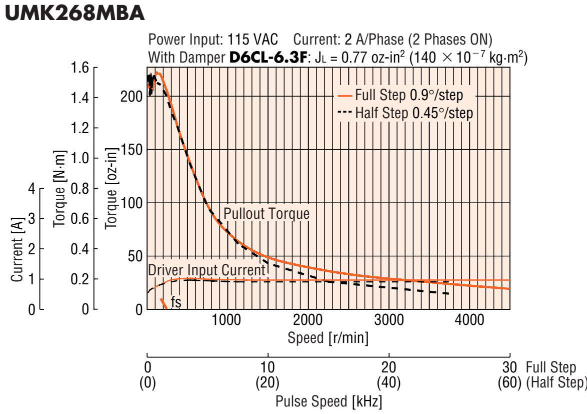
UMK266MBA



UMK245MBA



UMK268MBA



Note:
The pulse input circuit responds up to approximately 20 kHz with a pluse duty of 50 %

Common Specifications C-154 Dimensions C-155 Connection and Operation C-156 Motor and Driver Combinations C-160

Common Specifications

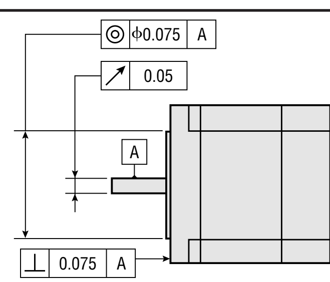
● Driver Specifications

Input Signals	Input Signal Circuit	Photocoupler input, Input resistance 220 Ω, Input current 10~20 mA maximum Signal voltage Photocoupler ON: +4.5~+5 V, Photocoupler OFF: 0~+1 V (voltate between terminals)
	● Pulse Signal (CW Pulse Signal)	Step command pulse signal (CW direction command pulse signal at 2-pulse input mode) Pulse width: 5 μs minimum, Pulse rise/fall: 2 μs maximum Pulse duty: Max 50% Motor moves when the photocoupler state changes from ON to OFF. Maximum input frequency: 20 kHz (when the pulse duty is 50 %) Negative logic pulse input.
	● Rotation Direction Signal (CCW Pulse Signal)	Rotation direction pulse signal, Photocoupler ON: CW, Photocoupler OFF: CCW (CCW direction command pulse signal at 2-pulse input mode. Pulse width: 5 μs minimum, Pulse rise/fall: 2 μs maximum, Pulse duty: Max. 50%. Motor moves when the photocoupler state changes from ON to OFF. Maximum input frequency: 20 kHz (when the pulse duty is 50 %) Negative logic pulse input.)
	● All Windings Off Signal	When in the "photocoupler ON" state, the current to the motor is cut off and the motor shaft can be rotated manually. When in the "photocoupler OFF" state, the current is supplied to the motor.
Output Signals	Output Signal Circuit	Photocoupler, Open-Collector Output 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 194°F (90°C). (Photocoupler: ON or OFF, automatic return available) 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, Pulse mode input switch, Step angle switch, Overheat output logic switch
Indicator (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 [266°F (130°C)]	–
Insulation Resistance		100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC megger between the motor coils and the motor casing.	100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC ● Case – Power input terminal ● Case – Signal input/output terminal ● Power input terminal – Signal input/output terminal
Insulation Strength		Sufficient to withstand 1.0 kV (0.5 kV for **UMK24□** and **UMK24□M** type), 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 60 Hz ● Case - Signal input/output terminal 1.0 k VAC 60 Hz ● Power input terminal - Signal input/output terminal 1.0 k VAC 60 Hz
Operating Environment	Ambient Temperature	14°F~122°F (−10°C~+50°C) (nonfreezing)	32°F~104°F (0°C~+40°C) (nonfreezing)
	Ambient Humidity	85% or less (non-condensing)	
	Atmosphere	No corrosive gases, dust, water or oil.	
Temperature Rise		Temperature rise of the coil measured by the Change Resistance Method is 144°F (80°C) or less. (at standstill, two phases energized)	–
Static Angle Error ✻1		±3 arc minutes (±0.05°)	–
Shaft Runout		0.002 inch (0.05 mm) T.I.R at top of output shaft ✻4	–
Radial Play ✻2		0.001 inch (0.025 mm) max. of 1.12 lb. (0.5 kg)	–
Axial Play ✻3		0.003 inch (0.075 mm) max. of 2.2 lb. (1 kg)	–
Concentricity		0.003 inch (0.075 mm) T.I.R ✻4	–
Perpendicularity		0.003 inch (0.075 mm) T.I.R ✻4	–

✻1 This value is for full step under no load. (The value changes with size of the load.)
✻2 Radial Play: Displacement in shaft position in the radial direction, when a 1.12 lb. (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 2.2 lb. (10 N) load is applied to the motor's shaft in the axial direction.
✻4 T.I.R. (Total Indicator Reading): Total dial gauge reading when the measurement section is rotated one revolution centered on a reference axis.



Note:
● Do not measure insulation resistance or perform a dielectric strength test while the motor and driver are connected.

Permissible Overhung Load and Permissible Thrust Load

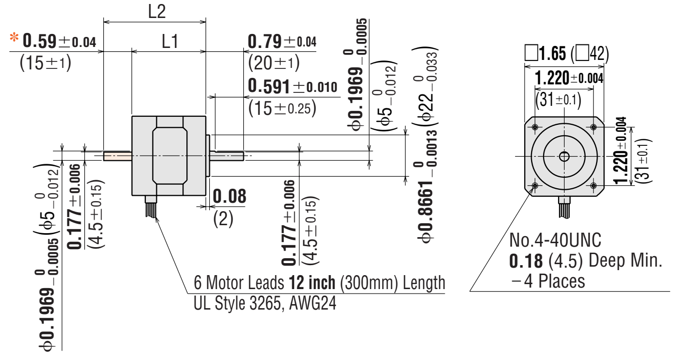
Unit = Upper values: lb./Lower values: N

Model	Overhung Load Distance from Shaft End [inch (mm)]					Thrust Load
	0	0.2 (5)	0.39 (10)	0.59 (15)	0.79 (20)	
UMK24□ **UMK24□M**	4.5 20	5.6 25	7.6 34	11.7 52	–	The permissible thrust load [lb. (N)] shall be no greater than the motor mass.
UMK26□ **UMK26□M**	12.1 54	15 67	20 89	29 130	–	

Dimensions Scale 1/4, Unit = **inch** (mm)

Standard and High-Resolution Type Motors

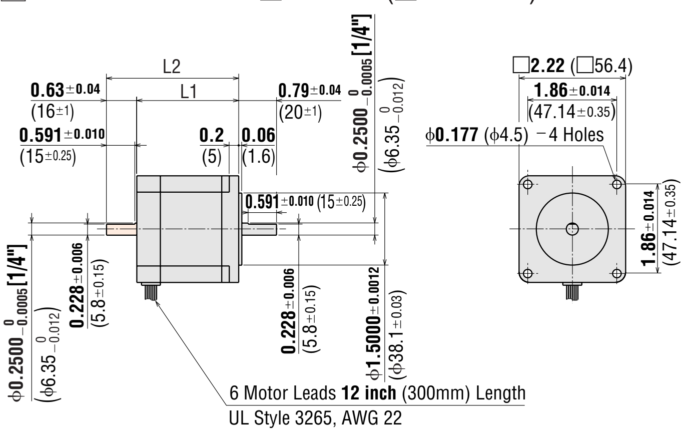
1 Motor Frame Size: □ 1.65 in. (□ 42 mm)



✻ The length of machining on double shaft model is **0.591±0.010** (15±0.25).

Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
UMK243AA	PK243-01AA	1.3 (33)	–	0.46 (0.21)	B081U
UMK243MAA	PK243MAA			0.53 (0.24)	
UMK243BA	PK243-01BA		1.89 (48)	0.46 (0.21)	
UMK243MBA	PK243MBA			0.53 (0.24)	
UMK244AA	PK244-01AA	1.54 (39)	–	0.59 (0.27)	B082U
UMK244MAA	PK244MAA			0.66 (0.3)	
UMK244BA	PK244-01BA		2.13 (54)	0.59 (0.27)	
UMK244MBA	PK244MBA			0.66 (0.3)	
UMK245AA	PK245-01AA	1.85 (47)	–	0.77 (0.35)	B083U
UMK245MAA	PK245MAA			0.81 (0.37)	
UMK245BA	PK245-01BA		2.44 (62)	0.77 (0.35)	
UMK245MBA	PK245MBA			0.81 (0.37)	

2 Motor Frame Size: □ 2.22 in. (□ 56.4 mm)



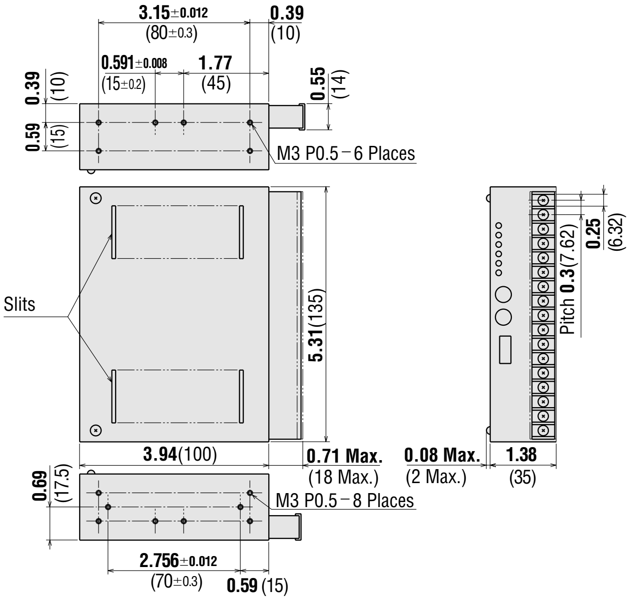
Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
UMK264AA	PK264-02A	1.54 (39)	–	0.99 (0.45)	B084
UMK264MAA	PK264MA				
UMK264BA	PK264-02B		2.17 (55)		
UMK264MBA	PK264MB				
UMK266AA	PK266-02A	2.13 (54)	–	1.5 (0.7)	B085
UMK266MAA	PK266MA				
UMK266BA	PK266-02B		2.76 (70)		
UMK266MBA	PK266MB				
UMK268AA	PK268-02A	2.99 (76)	–	2.2 (1)	B086
UMK268MAA	PK268MA				
UMK268BA	PK268-02B		3.62 (92)		
UMK268MBA	PK268MB				

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

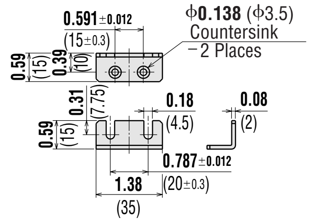
● Driver

3 UDK2109A, UDK2112A, UDK2120A

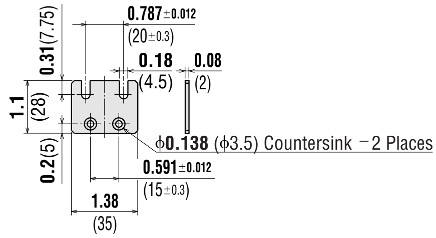
Weight: 1 lb. (0.47 kg) DXF B087



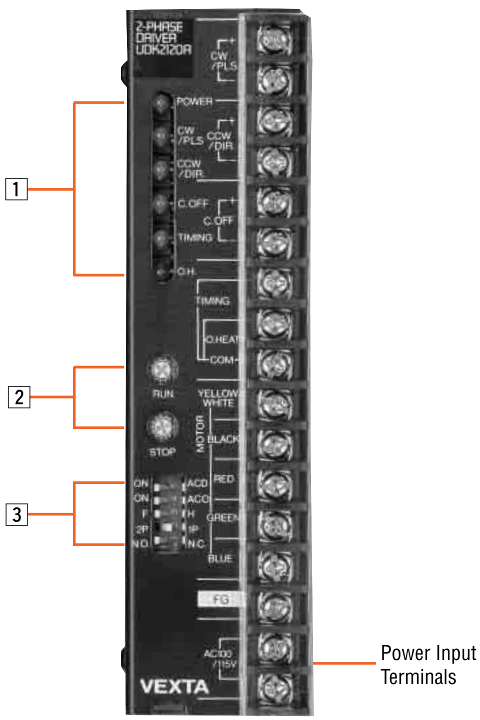
●Mounting Bracket A (2 pieces, included)



●Mounting Bracket B (2 pieces, included)



Connection and Operation



1 Signal Monitor Display

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

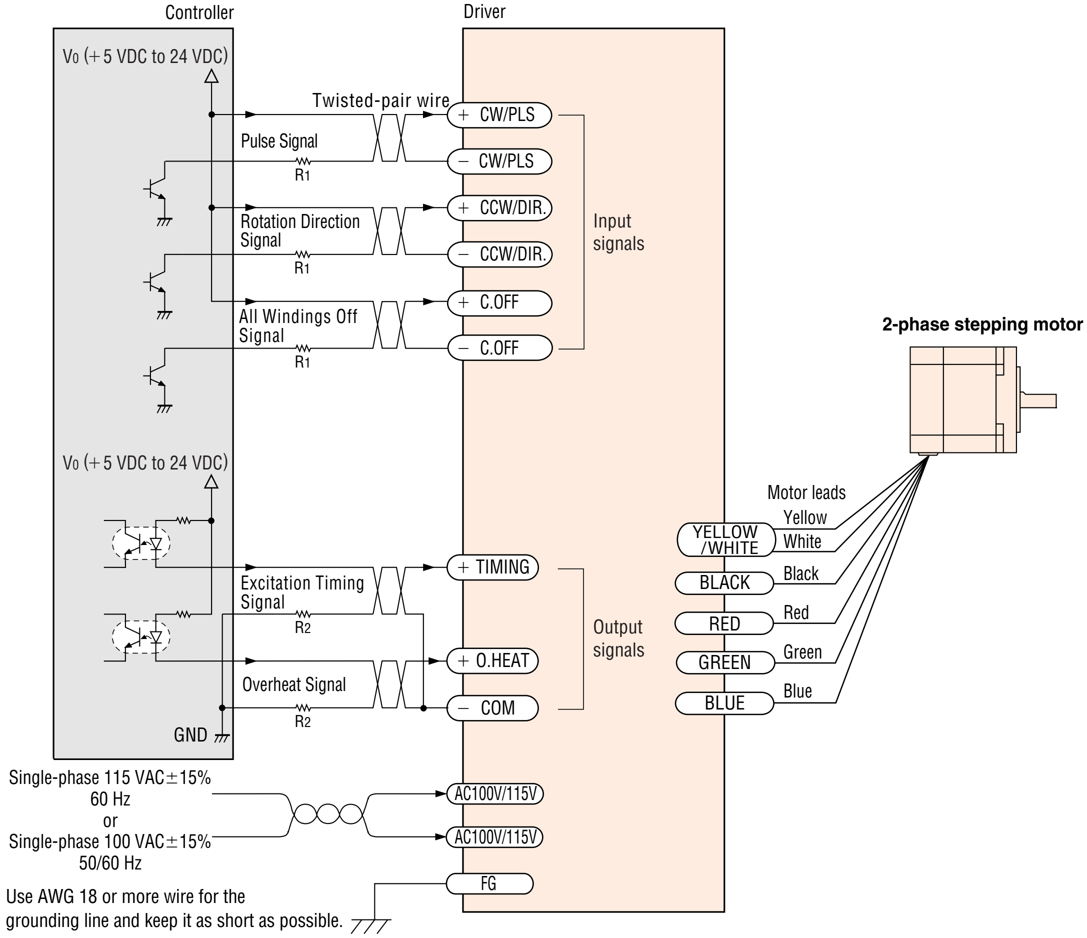
2 Current Adjustment Switches

Indication	Name	Functions
RUN	Motor run current switch	Adjusts the motor running current
STOP	Motor stop current switch	Adjusts the motor current at standstill

3 Function Select Switches

Indication	Switch Name	Functions
A.C.D./OFF	Automatic current cutback function switch	Automatically decreases output current to motor at motor standstill.
A.C.O./OFF	Automatic current off function switch	When the temperature inside the driver rises above 194°F (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. Standard type F: 1.8°/step, H: 0.9°/step High-resolution type F: 0.9°/step, H: 0.45°/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

Connection Diagrams



◆Power Supply

Can be used with a single-phase 115 VAC, 60 Hz or 100 VAC, 50/60 Hz power supply. Use a power supply that can supply sufficient input current. If power supply capacity is insufficient, a decrease in motor output can cause the following malfunctions:

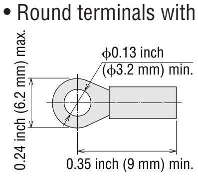
- Motor does not rotate properly at high-speed (insufficient torque).
- Slow motor startup and stopping.

Notes:

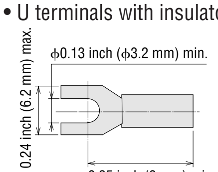
- Keep the voltage V_o between 5 VDC and 24 VDC. When it is equal to 5 VDC, the external resistance R_1 is not necessary. When it is above 5 VDC, connect R_1 to keep the current between 10 mA and 20 mA, and connect R_2 to keep the current below 10 mA.
- Use twisted-pair wire of AWG 24 or thicker and 6.6 feet (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 decrease.
  (→Technical Reference Page F-36)
- Use AWG 20 or thicker for motor lines (when extended) and power supply lines, and use AWG 18 or thicker for the wire for the grouding line.
- Use spot grounding for the grounding of the driver and external controller.
- Signal lines should be kept at least 3.9 inches (10 cm) away from power lines (power supply lines and motor lines). Do not bind the signal line and power line together.
- Use open collector transistors (sink type) for the signal output sections of the controller.

◆Terminals

- Round terminals with insulator



- U terminals with insulator

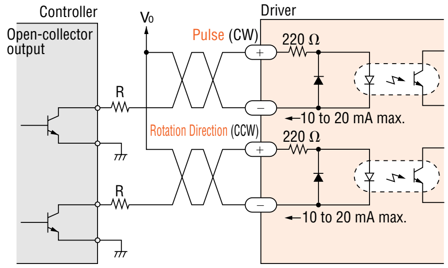


Crimp terminals are not provided with the package.

Description of Input/Output Signals

Pulse (CW) Input and Rotation Direction (CCW) Input Signal

◆Input Circuit and Sample Connection



The characters indicate signals under the 1-pulse input mode, while the characters in parentheses indicate signals under the 2-pulse input mode.

Note:

- When Vo is equal to 5 VDC, the external resistance (R) is not necessary. When Vo is above 5 VDC, connect the external resistance (R) and keep the input current between 10 mA and 20 mA.

1-Pulse Input Mode

Pulse Signal

"Pulse" signal is input to the pulse signal 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 signal.

Rotation Direction Signal

The "Rotation Direction" signal is input to the rotation direction signal input terminal. A "photocoupler ON" signal input commands a clockwise direction rotation. A "photocoupler OFF" signal input commands a counterclockwise direction rotation.

2-Pulse Input Mode

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

CW Pulse Signal

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

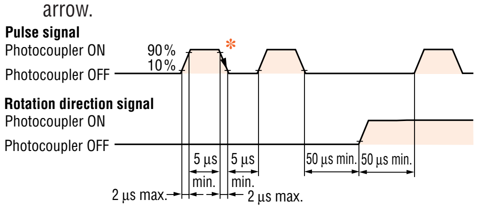
CCW Pulse Signal

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

◆Pulse Waveform Characteristics

(Photocoupler state corresponding to the input pulse)

✻ The shaded area indicates when the photocoupler is ON. The motor moves when the photocoupler state changes from ON to OFF as indicated by the arrow.

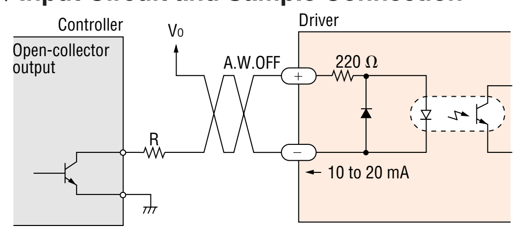


◆Pulse Signal Characteristics

- The pulse voltage is 4.5 to 5V in the "photocoupler ON" state, and 0 to 1V in the "photocoupler OFF" state.
- Input pulse signals should have a pulse width over 2µs, pulse rise/fall time below 1µs and a pulse duty below 50%.
- Keep the pulse signal at "photocoupler OFF" when no pulse is being input.
- The minimum interval time when changing rotation direction is 50 µs.
  This value varies greatly depending on the motor type, pulse frequency and load inertia. It may be necessary to increase this time interval.
- In 1-pulse input mode, leave the pulse signal at rest ("photocoupler OFF") when changing rotation directions.

All Windings Off (A.W.OFF) Input Signal

◆Input Circuit and Sample Connection



Note:

- When Vo is equal to 5 VDC, the external resistance (R) is not necessary. When Vo is above 5 VDC, connect the external resistance (R) and keep the input current between 10 mA and 20 mA.

When the "All Windings Off " signal is in the "photocoupler 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.

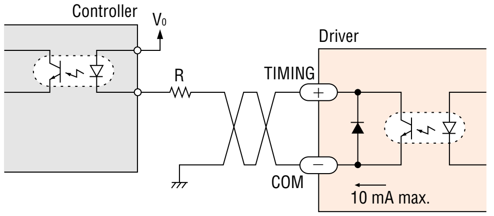
When the "All Windings Off " signal is in the "photocoupler OFF" state, the motor holding torque is proportional to the current set by the current adjustment rotary switches. During motor operation be sure to keep the signal in the "photocoupler OFF" state.

This signal is used when moving the motor by external force or manual home position is desired. If this function is not needed, it is not necessary to connect this terminal. Switching the "All Windings Off " signal from "photocoupler ON" to "photocoupler 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 up to ±3.6˚ from the position set after the "All Windings Off " signal is released.

Excitation Timing Signal (TIM.) Output Signal

◆Output Circuit and Sample Connection



Note:
- Keep the voltage between 5 VDC and 24 VDC.
  Keep the current below 10 mA.
  If the current exceeds 10 mA, 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 the mechanical home position of your equipment (for example, a photo-sensor) to coincide with the excitation sequence initial stage (step "0").

The motor excitation stage changes simultaneously with pulse input, and returns to the initial stage for each 7.2˚ rotation of the motor output shaft. When the power is turned ON, the excitation sequence is reset to step "0".

The TIM. LED lights when the "Excitation Timing" 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.

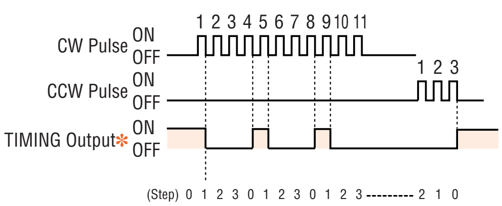
The "Excitation Timing" signal is output simultaneously with a pulse input each time the excitation sequence returns to step "0".

The excitation sequence will complete one cycle for every 7.2˚ rotation of the motor output shaft.

Full Step (the switch is set to F position): Signal is output once every 4 pulses.

Half Step (the switch is set to H position): Signal is output once every 8 pulses.

Timing chart at full step

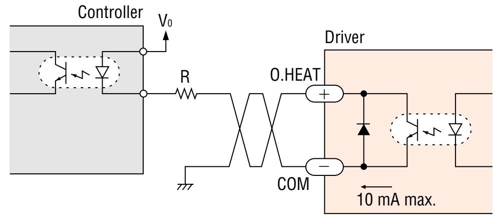


Notes:
- When the power is turned ON, the excitation sequence is reset to STEP 0 and the LED lights up.
- The LED flashes quickly while the motor runs, appearing continuously lit.

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

Overheat (O.HEAT) Output Signal

◆Output Signal and Sample Connection



Note:
- Keep the voltage between 5 VDC and 24 VDC.
  Keep the current below 10 mA.
  If the current exceeds 10 mA, connect external resistance (R).

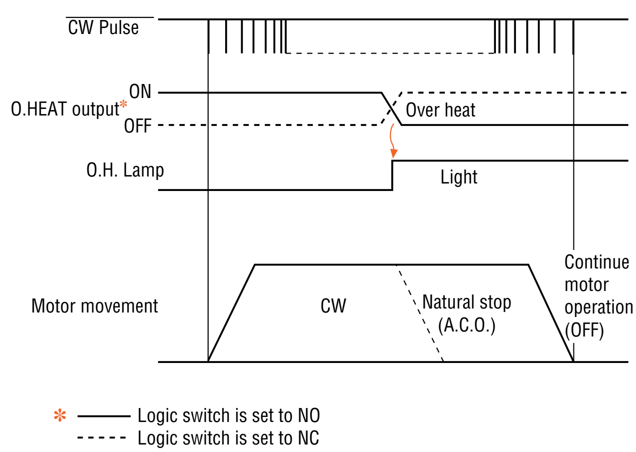
The "Overheat" signal is output to protect the driver against burnout when its internal temperature rises abnormally high due to high ambient temperature. The O.HEAT lamp on the front panel lights up when output.
When used as shown in the sample connection with the overheat output logic switch set to NO, the signal becomes "photocoupler ON". (Switch to NC to set to the "photocoupler OFF".)

If the A.C.O. (Automatic Current OFF) function is set, the output current to the motor drops to zero and the motor stops automatically.

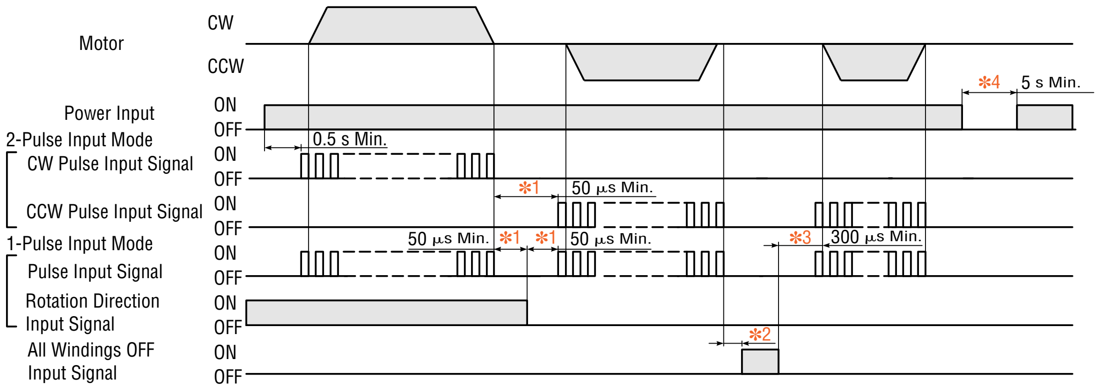
When the "Overheat" signal is output, check the operating conditions (ambient temperature, driver settings) and cool the driver.

The "Overheat" signal automatically releases as the internal temperature of the driver drops. The overheat signal turns "photocoupler OFF" and the O.HEAT indicator turns off.

Please be aware that the above return/release cannot be controlled by external signals or by restarting the system.



Timing Chart



✻1 Switching time to change CW, CCW pulse (2-pulse input mode)
Switching time to change direction (1-pulse input mode) 50 µs is shown as a response time of circuit. Motor needs a time more than that.
✻2 Depends on load inertia, load torque, start frequency.
✻3 Never input a step pulse signal immediately after switching the "All Winding Off" signal to the photocoupler off state. The motor may not start.
✻4 Wait 5 seconds before cycling the power on.

List of Motor and Driver Combinations

Type	Model	Motor Model	Driver Model
Standard	**UMK243□A**	PK243-01□A	UDK2109A
	UMK244□A	PK244-01□A	UDK2112A
	UMK245□A	PK245-01□A	
	UMK264□A	PK264-02□	UDK2120A
	UMK266□A	PK266-02□	
	UMK268□A	PK268-02□	
High-Resolution	**UMK243M□A**	PK243M□A	UDK2109A
	UMK244M□A	PK244M□A	UDK2112A
	UMK245M□A	PK245M□A	
	UMK264M□A	PK264M□	UDK2120A
	UMK266M□A	PK266M□	
	UMK268M□A	PK268M□	

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