A Stepping Motors

Stepping Motors

This catalogue contains information necessary for informed product selection. Additional product details and information not outlined in this catalogue can be found in each product's individual operating manual. Operating manuals can be downloaded from our website or obtained by contacting technical support or your nearest Oriental Motor sales office.

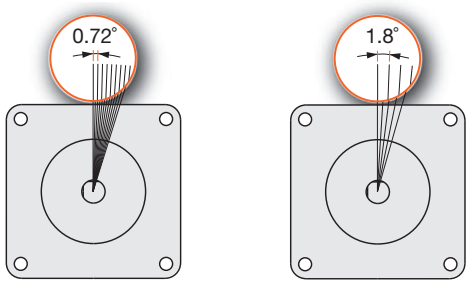
Overview of Stepping Motors

Stepping motors enable accurate positioning operations to be done easily.
Motors are used in various types of equipment for accurate rotation angle and rotation speed control using pulse signals.

Features

●Accurate Positioning in Fine Steps

A stepping motor rotates with a fixed step angle, just like the second hand of a clock. This angle is called "basic step angle." Oriental Motor offers 5-phase stepping motors with a basic step angle of 0.72° and 2-phase stepping motors with a basic step angle of 1.8°.

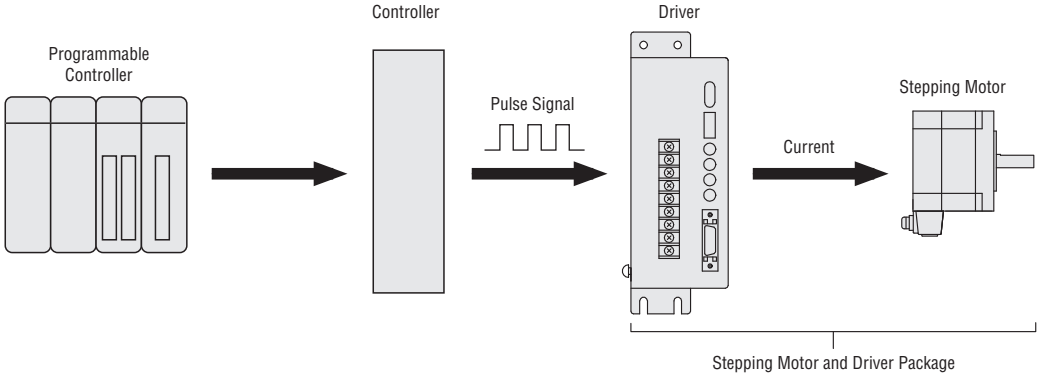


5-Phase Stepping Motor
(500 steps per revolution)

2-Phase Stepping Motor
(200 steps per revolution)

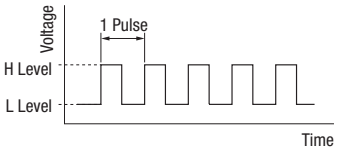
●Easy Control with Pulse Signals

A system configuration for high positioning accuracy is shown below. The rotation angle and rotation speed of the stepping motor can be controlled accurately using pulse signals from the controller.



◇What is a Pulse Signal?

A pulse signal is an electric signal whose voltage level changes repeatedly between ON and OFF.
Each ON/OFF cycle is counted as one pulse. A command with one pulse causes the motor output shaft to turn by one step angle.

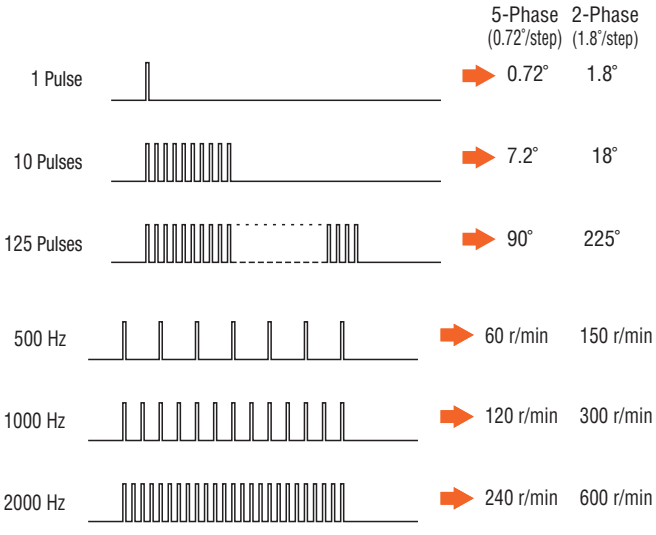


◇The Rotation Angle is Proportional to the Number of Pulses

The rotation angle of the stepping motor is proportional to the number of pulse signals (pulse number) given to the driver.
The relationship of the rotation angle of the stepping motor and number of pulses is expressed as follows:

$\theta = \theta s \times A$

θ : Rotation angle of the motor output shaft [deg]
θs: Step angle [deg/step]
A : Pulse number [pulses]



◇The Rotating Speed is Proportional to the Pulse Speed

The rotating speed of the stepping motor is proportional to the speed of pulse signals (pulse frequency) given to the driver.
The relationship of the pulse speed [Hz] and motor speed [r/min] is expressed as follows:

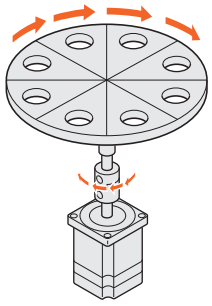
$N = \frac{\theta s}{360} \times f \times 60$

N : Speed of the motor output shaft [r/min]
θs: Step angle [deg/step]
f : Pulse speed [Hz]
(Number of pulses input per second)

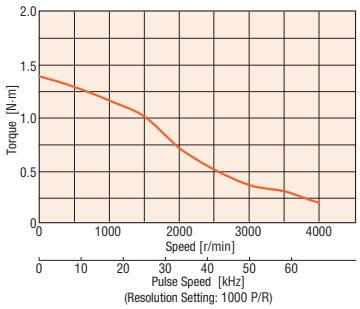
●Generating High Torque with a Compact Body

Stepping motors generate high torque with a compact body.
These features give them excellent acceleration and response, which in turn makes these motors well-suited for applications where the motor must be started and stopped frequently.
Even greater torque can be achieved by using geared motors.

◇Frequent Starting/Stopping is Possible

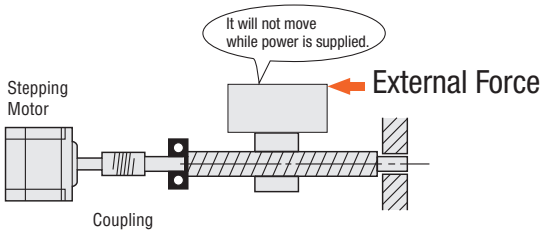


◇Speed – Torque Characteristics (Motor frame size 60 mm)



●The Motor Holds Itself at a Stopped Position

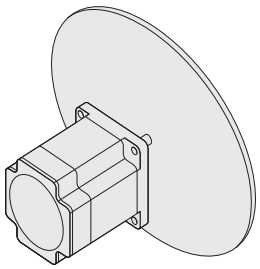
Stepping motors continue to generate holding force even at standstill. This means that the motor can be held at a stop position without using a mechanical brake.



●Capable of Driving Large Inertial Loads

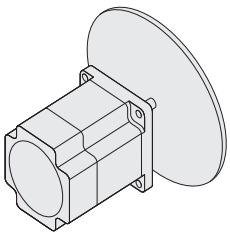
Stepping motors can drive larger inertial loads than servo motors of equivalent frame sizes.

•Comparison at 30 times of the rotor inertia



AR Series
Load Inertia 22.4×10^{-4} kg·m^2
(30 times the rotor inertial moment)

Load Inertia: Diameter: 169 mm,
Thickness: 10 mm,
Material: Aluminum
Motor: Frame size 60 mm
Length 90 mm



Conventional Servo Motor
Load Inertia 4.0×10^{-4} kg·m^2
(30 times the rotor inertia)

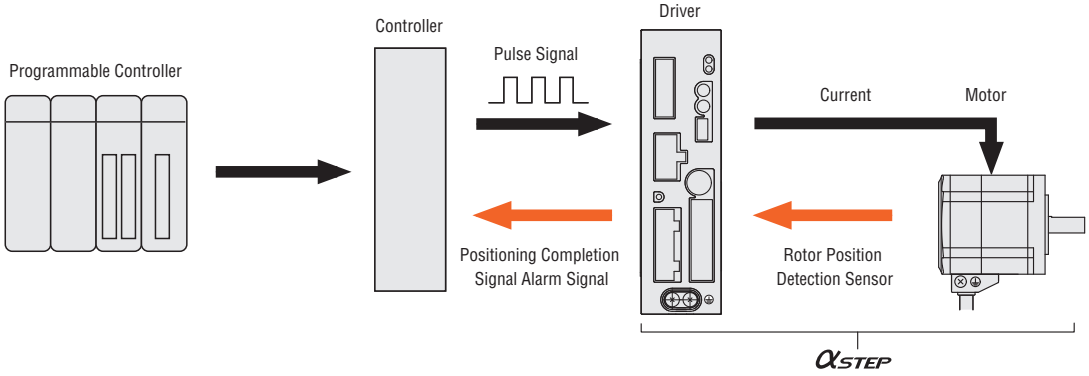
Load Inertia: Diameter: 110 mm,
Thickness: 10 mm,
Material: Aluminum
Motor: Frame size 60 mm
Length 96.5 mm

●Stepping Motor and Driver Package α_{STEP}

These products use our closed loop control to maintain positioning operation even during abrupt load fluctuations and accelerations. The rotor position detection sensor monitors the rotation. When an overload condition is detected, it will instantaneously regain control using the closed loop mode. When an overload condition continues it will output an alarm signal, thereby providing reliability equal to that of a servo motor.

Overview of stepping motor and driver packages α_{STEP} ➜ Page A-18

AR Series AC Input ➜ Page A-24
AR Series DC Input ➜ Page A-98

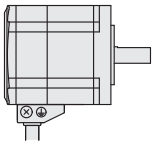


Motor Types

Stepping motors come in several different types including the standard type, electromagnetic brake type and various geared types. The availability of such a wide selection means that you can choose an optimal type according to the function and performance required in your specific application.
Typical examples are introduced below.

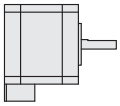
Standard Type

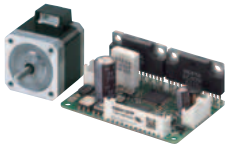
A basic model that is easy to use and designed with a balanced set of functions and characteristics.



High-Torque Type

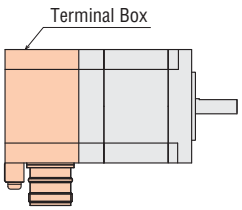
A high-torque motor has a higher torque of approximately 1.5 times compared with the conventional standard type motor.
The use of a smaller motor allows for compact equipment design.





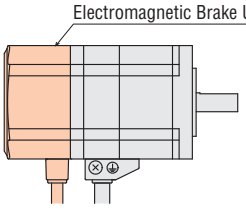
Terminal Box Type

These motors conform to the IP65 rating for protection against dust and water ingress.

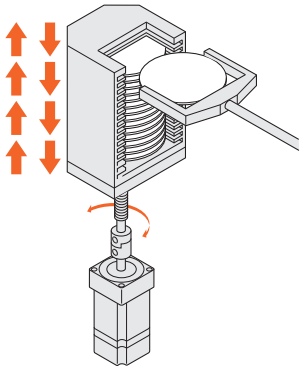


Electromagnetic Brake Type

These motors incorporate a non-excitation type electromagnetic brake. When the power is accidentally cut off due to power outage or other unexpected event, the electromagnetic brake holds the load in position to prevent it from dropping or moving.



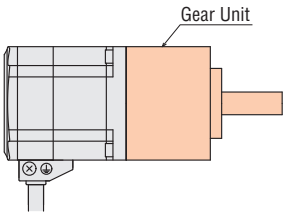
Once the power is cut off, the self-holding torque of the motor is lost and the motor can no longer be held at the stopped position in vertical operations or when an external force is applied. In lift and similar applications, use an electromagnetic brake type.



Geared Type

These motors incorporate a dedicated position-control gearhead with reduced backlash to make the most of the high controllability of the motors. The gearhead ensures highly accurate, smooth operation even in applications where a large torque is received.

Advantages of Geared Motors ➜ Page A-6
Geared Motor Line-Up ➜ Page A-7



◇AR Series Geared Type Typical Characterisics

Geared Type	Permissible Torque [N·m]	Backlash [min]	Resolution [°/pulse]	Speed [r/min]
TH Geared Type	12	45	0.012	500
PS Geared Type	37	25	0.0072	600
PN Geared Type	37	3	0.0072	600
Harmonic Geared Type	37	0	0.0036	70

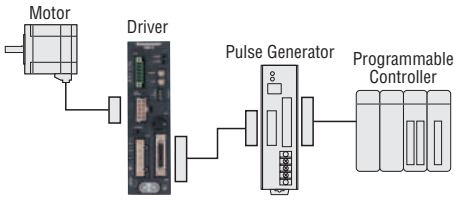
●The values shown above are reference. These values vary depending on the product.

Types of Operation Systems

Stepping motor and driver packages combine a stepping motor selected from various types with a dedicated driver. In addition to the pulse input type, drivers with a built-in controller type is also available. You can select a desired combination product according to the required operation system. Different drivers are explained below by using the **AR** Series as an example.

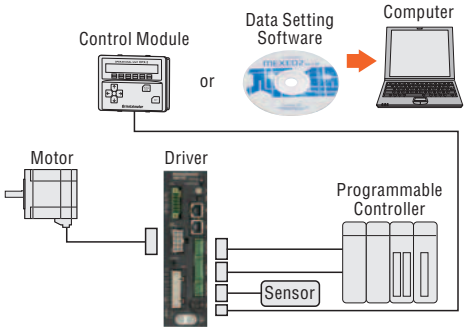
Pulse Input Packages

The motor can be controlled using a pulse generator provided by the customer. Operating data is input to the pulse generator beforehand, and you select the operating data on the programmable controller, then input the operation command.



Built-In Controller Packages

A built-in pulse generator allows the motor to be driven via a directly connected programmable controller. Since no separate pulse generator is required, the drivers of this type save space.
RS-485 communication (Modbus RTU) is also available.

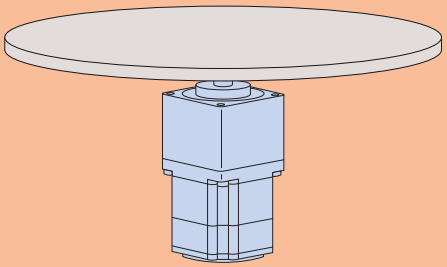


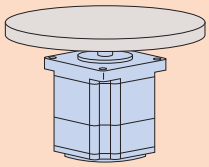
Advantages of Geared Motors

We offer motors pre-assembled with gears, as variations of stepping motors. Geared motors not only achieve deceleration, high torque and high resolution, but they also provide the following advantages:

Capable of Driving Large Inertial Loads

When a geared motor is used, the moment of inertial load that can be turned increases in comparison with a comparable standard motor in proportion to the square of the gear ratio. This means that larger inertial loads can be driven with geared motors.

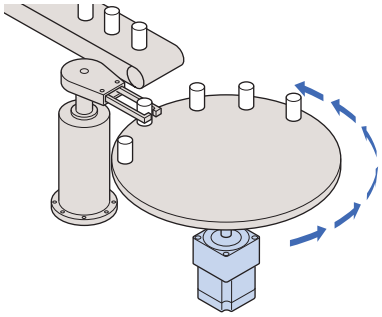


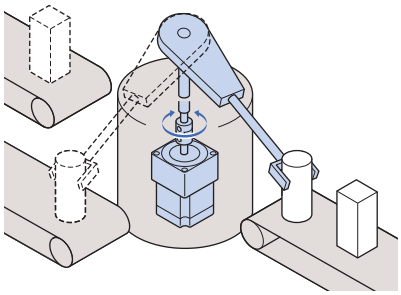


Motor Type	Geared Motor (Gear Ratio: 5)	Standard Motor
Product Name	**AR66AC-N5-1**	**AR66AC-1**
Load Inertia (30 times the rotor inertia)	285×10^{-4} kg·m²	11.4×10^{-4} kg·m²
Diameter of Load Inertia (Thickness: 10 mm, Material: Aluminum)	319 mm	143 mm

Improved Damping Characteristics at Start and Stop

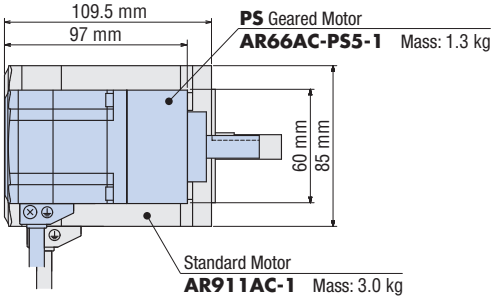
If the inertial load is large or acceleration/deceleration time is short, a geared motor can reduce damping more effectively and thereby ensure more stable driving compared to a standard motor. Geared motors are ideal for applications where a large inertia such as an index table or arm must be driven to perform quick positioning.





Smaller Size

When a standard motor is compared with a geared motor that generates equivalent torque at low speed, the geared motor has a smaller frame size and thus its mass and volume are also smaller.
Geared motors are effective when your equipment must be kept small and light.

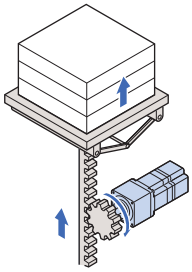


●High Rigidity, Resistant to Torsional Force

Geared motors have high rigidity and are therefore resistant to torsional force. Compared to standard motors, geared motors are less subject to load torque fluctuation. This means that stability and high positioning accuracy can be ensured even when the load size changes.

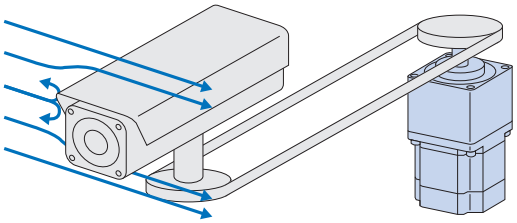
◇Applications: Elevator

The application can be stopped accurately even with elevators and other mechanisms that perform vertical operations where the number of loads or weight of loads changes.



◇Applications: Security Camera

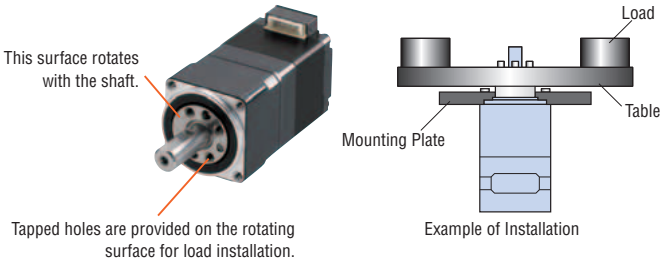
The position can be held securely even when the camera sways due to strong wind.



●Surface Installation of Load (Harmonic geared type)

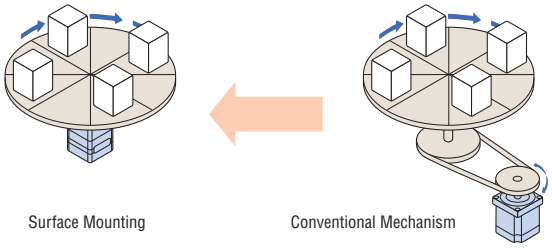
The harmonic geared type permits installation of a load directly on the rotating surface integrated with the shaft. (Except for geared motors with a frame size of 90 mm)

◇Appearance and Installation Example



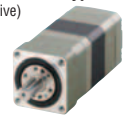
◇Application: Index Table

This not only reduces the number of parts/processes, but also improves reliability. They are also suitable for operating loads that receive moment loads.



■Geared Motor Line-Up

Example of **AR** Series

	Geared Type	Features	Permissible Torque Maximum Torque [N·m]	Backlash [arc min (degrees)]	Basic Resolution [deg/step]	Output Shaft Speed [r/min]
Low backlash	**TH** Geared Type (Parallel shaft) 	· A wide variety of low gear ratios, high-speed operations · Gear ratios: 3.6, 7.2, 10, 20, 30	12	45 (0.75)	0.012	500
Low backlash	**PS** Geared Type (Planetary) 	· High Speed (low gear ratio) · High permissible/maximum torque · A wide variety of gear ratios for selecting the desired step angle (resolution) · Centered output shaft · Gear ratios: 5, 7.2, 10, 25, 36, 50	Permissible Torque 37 / Maximum Torque 60	25 (0.42)	0.0072	600
Non-backlash	**PN** Geared Type (Planetary) 	· High speed (low gear ratio), high accuracy positioning · High permissible/maximum torque · A wide variety of gear ratios for selecting the desired step angle (resolution) · Centered output shaft · Gear ratios: 5, 7.2, 10, 25, 36, 50	Permissible Torque 37 / Maximum Torque 60	3 (0.05)	0.0072	600
Non-backlash	**Harmonic Geared Type** (Harmonic drive) 	· High accuracy positioning · High permissible/maximum torque · High gear ratios, high resolution · Centered output shaft · Gear ratios: 50, 100	Permissible Torque 37 / Maximum Torque 55	0	0.0036	70

Note

●The values shown above must be used as reference. These values vary depending on the frame size and gear ratio.
●For the principle and the structure of each geared type, refer to technical reference.

For stepping motor and servo motor gears ➜ Page G-65

Product Line-Up of Stepping Motors

The stepping motor product lines are shown by systems for each category and series.
Refer to “Type of Stepping Motors” on page A-10 for a comparison of the series.

Stepping Motor and Driver Packages

Closed Loop Stepping Motor and Driver Packages α_{STEP}

These products use our closed loop control to maintain positioning operation even during abrupt load fluctuations and accelerations. The rotor position detection sensor monitors the rotation speed and amount. When an overload condition is detected, it will instantaneously regain control using the closed loop mode. When an overload condition continues it will output an alarm signal, thereby providing reliability equal to that of a servo motor.

Features of α_{STEP} ➜ Page A-18

AC Power Supply Input

High-Efficiency AR Series

AC Power Supply Input

This series substantially reduces heat generation from the motor through the use of high-efficiency technology.
It allows you to take advantage of the beneficial features of the stepping motor to perform quick positioning operations over a short distance repeatedly without worrying about the duty cycle.

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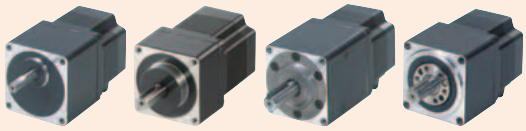
5-Phase Stepping Motor and Driver Packages

These packages contain a 5-phase stepping motor with a resolution of 500 steps per revolution (0.72°/step) and a driver. Oriental Motor provides a wide variety of motors, such as geared type, high-torque type, and high-resolution type.

Wide Variety of Geared Motor



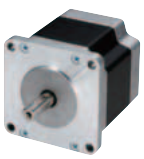
Line-up of Geared Motors ➜ A-71

2-Phase Stepping Motor and Driver Packages

These packages contain a 2-phase stepping motor with a resolution of 200 steps per revolution (1.8°/step) and a driver.

Stepping Motors (Motor Only)

5-Phase Stepping Motors



PK Series

These motors offer 500 steps per revolution (0.72°/step) and providing high-torque and low vibration.
(The dedicated driver is required separately to operate the motor.)

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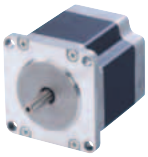
2-Phase Stepping Motors



PKP Series, PK Series

These motors offer 200 steps per revolution (1.8°/step) and providing high-torque and low vibration.
(The dedicated driver is required separately to operate the motor.)

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Type of Stepping Motors Page A-10

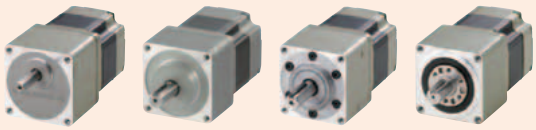
DC Power Supply Input

Difference between AC Power Supply Input and DC Power Supply Input Characteristics ➜ Page G-43

Selectable Drivers

Built-In Controller Driver　Pulse Input Driver

Wide Variety of Geared Motor



Line-up of **AR** Series ➜ Page A-26

Built-In Controller Package

Pulse Input Package

High-Efficiency AR Series DC Power Supply Input

DC Power Supply Input

This series substantially reduces heat generation from the motor through the use of high-efficiency technology.
It allows you to take advantage of the beneficial features of the stepping motor to perform quick positioning operations over a short distance repeatedly without worrying about the duty cycle.
Adopting a DC input driver with compact and lightweight.

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Standard Model

RK Series

AC Power Supply Input

This is a standard 5-phase stepping motor model. It uses an AC input driver with a smooth drive function, and provides a wide range of geared variations.

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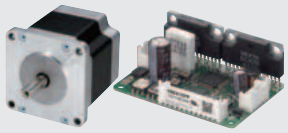
Built-In Controller Package



Pulse Input Package

CRK Series DC Power Supply Input

This series is a motor and driver package product that combines a high-performance, 5-phase stepping motor with a compact and low-vibration microstep driver.
The lineup consists of a Pulse Input Package or a Built-In Controller Package. Both packages are also available with high-torque types and compact geared motors.

Page A-146

RBK Series DC Power Supply Input

This series is a motor and driver package consisting of a 2-phase stepping motor and DC input microstep driver.
It includes Oriental Motor's proprietary Smooth Drive Function to easily achieve low vibration operation.

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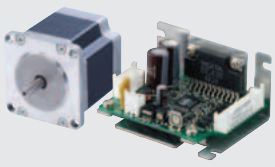

CMK Series DC Power Supply Input

This series is a motor and driver package consisting of a 2-phase stepping motor and a compact 24 VDC input microstep driver, allowing for a reduction in the size of your equipment and in vibration.

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Type of Stepping Motors

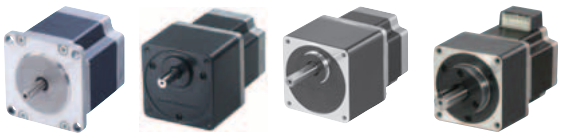
One feature of stepping motors is that they can perform accurate positioning operation with ease.
So that more users can enjoy the benefits of stepping motors, Oriental Motor has many different product series designed with different power supply specifications and different functions. There is also a wide spectrum of variations within each series, as models come in different frame sizes and with or without an electromagnetic brake and different gear types.

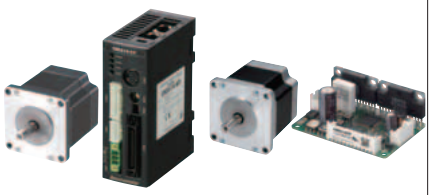
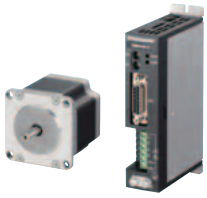
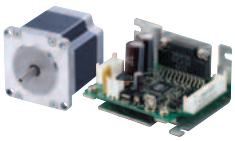
Stepping Motor and Driver Packages

Category		AC Input, Motor and Driver Package	
Series		α_{STEP} High-Efficiency **AR** Series  Built-In Controller  Pulse Input	5-Phase **RK** Series 
Page		A-24	A-68
Features		· High-efficiency, lower heat generation · RS-485 communications · Continuous operation, extended functions · Closed loop, no hunting, no gain tuning · Wide variety of motors	· Lowest vibration, lowest noise · Wide variety of motors
Control Method		Closed loop control	Open loop
Basic Step Angle		0.36°	0.72°
Excitation Method		Microstep	Microstep
Resolution		3.6°～0.036°	0.72°～0.00288° (16 steps)
Driver Type	Pulse Input	●	●
	Built-In Controller	●	–
Motor Frame Size	□20	–	–
	□28, □30, □35	–	–
	□42	●	●
	□50	–	–
	□56.4, □60	●	●
	□85, □90	●	●
Function	Electromagnetic Brake	●	●
	Encoder	–	–
	Terminal Box	–	●
Geared Type	**SH** Gear (Parallel Shaft)	–	–
	TH Gear (Parallel Shaft)	●	●
	PS/**PL** Gear (Planetary Gear)	●	●
	PN Gear (Planetary Gear)	●	●
	Harmonic Gear	●	●
Power Supply Input		Single-Phase 100-120 VAC (Pulse Input: Single-Phase 100-115 VAC) Single-Phase 200-240 VAC (Pulse Input: Single-Phase 200-230 VAC) Three-Phase 200-230 VAC ✻1	Single-Phase 100-115 VAC Single-Phase 200-230 VAC
Safety Standard		c UL us ✻1 ✻1 CE	c UL us CE

✻1 Pulse input package only
✻2 Terminal box type only

Stepping Motors (Motor Only)

Category	Stepping Motors (Motor Only) 5-Phase (0.72°), 2-Phase (0.9°, 1.8°), Geared
Series	**PKP** Series, **PK** Series 
Page	A-243
Features	• 3 basic step angles available (0.72°, 0.9°, 1.8°) • Many motor frame sizes available • Wide variety of motors • Encoder motors available

DC Input, Motor and Driver Package			
αSTEP High-Efficiency **AR** Series	5-Phase **CRK** Series	2-Phase **RBK** Series	2-Phase **CMK** Series
			
Built-In Controller Pulse Input	Built-In Controller Pulse Input		
A-98	A-146	A-192	A-218
• High-efficiency, lower heat generation • RS-485 communications • Continuous operation, extended functions • Closed loop, no hunting, no gain tuning • Wide variety of motors	• Lowest vibration, lowest noise • Compact driver • Wide variety of motors	• Low vibration, low noise • Highest torque for entire speed range • Wide variety of motors	• Low vibration, low noise • Compact driver • Wide variety of motors
Closed loop control	Open loop	Open loop	Open loop
0.36° (Resolution setting: 1000 P/R)	0.36°/0.72°	1.8°	0.9°/1.8°
Microstep	Microstep	Microstep	Microstep
3.6°~0.036°	0.36°: 0.9°~0.00144° (16 steps) 0.72°: 1.8°~0.00288° (16 steps)	1.8°~0.0140625° (16 steps)	0.9°: 0.9°~0.05625° (5 steps) 1.8°: 1.8°~0.1125° (5 steps)
●	●	●	●
●	●	–	–
–	●	–	–
●	●	●	●
●	●	●	●
–	–	●	●
●	●	●	●
●	–	●	–
●	–	–	–
–	●	●	●
–	–	●	–
–	–	–	●
●	●	–	–
●	●	●	●
●	●	–	–
●	●	–	–
24/48 VDC	24 VDC	Standard Type: 20~75 VDC High-Torque Type, **PS**/**PL** Geared Type: 20~40 VDC	24 VDC
CE	cULus *1 CE	cULus *2 CE *2	CE

How to Read Specifications Table

	Product Name	Single-Phase 200-230 VAC	Single Shaft	RK566ACE	RK566AMCE	RK566ACE-N5
			Double Shaft	RK566BCE	—	RK566BCE-N5
①	Maximum Holding Torque		N·m	0.83	0.83	3.5
②	Holding Torque at Motor Standstill		Power ON N·m	0.41	0.41	2
③	Rotor Inertia		J: kg·m^2	280×10^{-7}	440×10^{-7}	280×10^{-7}
④	Rated Current		A/Phase		1.4	
⑤	Basic Step Angle			0.72°	0.72°	0.144°
⑥	Gear Ratio			—	—	5
⑦	Permissible Torque		N·m	—	—	3.5
⑧	Maximum Torque		N·m	—	—	7
⑨	Backlash		arc minute (degrees)	—	—	2 (0.034°)
⑩	Permissible Speed Range		r/min	—	—	0～600
⑪	Power Supply Input			Single-Phase 200-230 VAC $^{+10\%}_{-15\%}$ 50/60 Hz 3.5 A		
⑫	Excitation Mode			Microstep		
⑬	Electromagnetic Brake	Type		—	Power Off Activated Type	—
		Power Supply		—	24 VDC	—
		Power Supply Current	A	—	0.25	—
		Static Friction Torque	N·m	—	0.8	—
		Brake Operating Time	ms	—	20	—
		Brake Release Time	ms	—	30	—
		Rating Time		—	Continuous	—

① Maximum Holding Torque

The holding torque (5-Phase: 5-Phase excitation, 2-Phase: 2-Phase excitation) is the maximum holding torque (holding force) the motor has when power (rated current) is being supplied but the motor shaft is not rotating. (With geared types, the value of holding torque considers the permissible strength of the gear.)
The driver's automatic current cutback function at motor standstill reduces the maximum holding torque by approximately 50% (or approximately 40% with the **CMK** Series).

② Holding Torque at Motor Standstill

When powered on: The holding torque with the automatic current cutback function working (the factory setting).
Electromagnetic brake: The static friction torque that the electromagnetic brake can generate when stopped (power off activated type).

③ Rotor Inertia

This refers to the inertia of rotor inside the motor. This is necessary when the required torque (acceleration torque) for the motor is calculated.

④ Rated Current

The rated current is determined by the motor temperature rise. It is the current value that can flow to the motor windings continuously at motor standstill. As a general rule, the current setting must be the rated current.

⑤ Basic Step Angle

The resolution is the angular distance (in degrees) that the motor moves upon input of one pulse signal from the driver. It differs depending on the motor structure and excitation mode.

⑥ Gear Ratio

This is the ratio in rotation speed between the input speed from the motor and the speed of the gear output shaft. For example, the gear ratio 1:10 indicates the input speed from the motor is 10 r/min and the output gear shaft is 1 r/min.

⑦ Permissible Torque

The permissible torque represents the maximum value limited by the mechanical strength of the gear output shaft when operated at a constant speed.
For the types other than the **PS**, **PL**, **PN** and harmonic geared types, the total torque including acceleration/deceleration torque should also not exceed the permissible torque.

⑧ Maximum Torque (**PS**, **PL**, **PN** geared and harmonic geared types only)

This is the maximum torque that can be applied to the gear output shaft during acceleration/deceleration such as when an inertial load is started or stopped.

⑨ Backlash

This is the play of the gear output shaft when the motor shaft is fixed.
When positioning in bi-direction, the positioning accuracy is affected.

⑩ Permissible Speed Range

This is the range for rotation on the gear output shaft.

⑪ Power Supply Input

The current value of the power input is the maximum input current value. (The input current varies according to the rotation speed.)

⑫ Excitation Mode

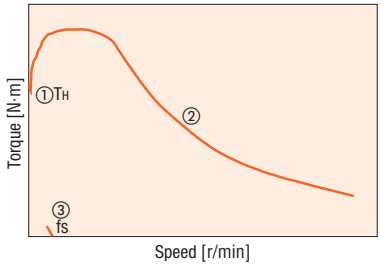
The driver has a function that can change the motor's step angle. Shown in the table is the step angle value at which the motor can be operated. (The step angle value for microsteps is explained separately.)

⑬ Static Friction Torque

This is an electromagnetic brake specification. This is the maximum holding torque (holding force) at which the electromagnetic brake can hold the position.

How to Read Speed – Torque Characteristics

The characteristics diagram below shows the relationship between the speed and torque when a stepping motor is driven. The required speed and torque is always used when selecting a stepping motor. On the graph of characteristics, the horizontal axis expresses the speed at motor output shaft while the vertical axis expresses the torque.



The speed – torque characteristics are determined by the motor and driver, so they vary greatly based upon the type of the driver used.

① Maximum Holding Torque

The holding torque (5-Phase: 5-phase excitation, 2-Phase: 2-phase excitation) is the maximum holding power (torque) the stepping motor has when power (rated current) is being supplied but the motor shaft is not rotating. The driver's automatic current cutback function at motor standstill reduces the maximum holding torque by approximately 50%.

② Pullout Torque

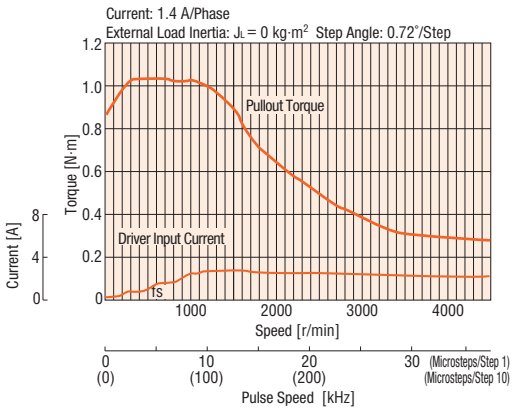
The pullout torque is the maximum torque that can be output at a given speed.
When selecting a motor, be sure the required torque falls within this curve.

③ Maximum Starting Frequency (fs)

This is the maximum pulse speed at which the motor can start or stop instantaneously (without an acceleration or deceleration time) when the frictional load and inertial load of the stepping motor are 0.
Driving the motor at greater than this pulse speed requires gradual acceleration/deceleration. This frequency drops when there is an inertial load on the motor.

● Inertial load – starting frequency characteristics in technical reference ➜ Page G-40

The figure below shows the speed – torque characteristics of the 5-phase stepping motor and driver package **RK** Series.



Common Specifications

Permissible Overhung Load and Permissible Thrust Load

AR Series

Unit = N

Type	Motor Frame Size mm	Product Name	Gear Ratio	Permissible Overhung Load Distance from Shaft End 0 mm	5 mm	10 mm	15 mm	20 mm	Permissible Thrust Load
Standard Type	28	**AR24**	–	25	34	52	–	–	1.5
		AR26							2.2
	42	**AR46**		35	44	58	85	–	4.6 [6.1]*
	60	**AR66**		90	100	130	180	270	8.8 [11.8]*
		AR69							13.7 [16.7]*
	85	**AR98**		260	290	340	390	480	18 [24]*
		AR911							29
TH Geared Type	28	**AR24**	**7.2**, **10**, **20**, **30**	15	17	20	23	–	10
	42	**AR46**	**3.6**, **7.2**, **10**, **20**, **30**	10	14	20	30	–	15
	60	**AR66**		70	80	100	120	150	40
	90	**AR98**		220	250	300	350	400	100
PS Geared Type	28	**AR24**	**5**, **7.2**, **10**	45	60	80	100	–	20
	42	**AR46**	**5**, **7.2**, **10**	73	84	100	123	–	50
			25, **36**, **50**	109	127	150	184	–	
	60	**AR66**	**5**	200	220	250	280	320	100
			7.2, **10**	250	270	300	340	390	
			25, **36**, **50**	330	360	400	450	520	
	90	**AR98**	**5**, **7.2**, **10**	480	540	600	680	790	300
			25	850	940	1050	1190	1380	
			36	930	1030	1150	1310	1520	
			50	1050	1160	1300	1480	1710	
PN Geared Type	28	**AR24**	**5**, **7.2**, **10**	45	60	80	100	–	20
	42	**AR46**		100	120	150	190	–	100
	60	**AR66**	**5**	200	220	250	280	320	
			7.2, **10**	250	270	300	340	390	
			25, **36**, **50**	330	360	400	450	520	
	90	**AR98**	**5**	480	520	550	580	620	300
			7.2, **10**	480	540	600	680	790	
			25	850	940	1050	1110	1190	
			36	930	1030	1150	1220	1300	
			50	1050	1160	1300	1380	1490	
Harmonic Geared Type	30	**AR24**	**50**, **100**	100	135	175	250	–	140
	42	**AR46**		180	220	270	360	510	220
	60	**AR66**		320	370	440	550	720	450
	90	**AR98**		1090	1150	1230	1310	1410	1300

● The motor product name has characters for identifying the serie's name.

* The brackets [ ] indicate the value for the electromagnetic brake type.

Note

● With a double shaft product, the output shaft located on the opposite side of the motor output shaft is used to install a slit disk or similar device. Do not apply any load torque, overhung load or thrust load on this output shaft.

●**RK** Series, **CRK** Series, **RBK** Series, **CMK** Series, **PKP** Series, **PK** Series

Unit = N

Type	Motor Frame Size mm	Motor Product Name	Gear Ratio	Permissible Overhung Load Distance from Shaft End 0 mm	5 mm	10 mm	15 mm	20 mm	Permissible Thrust Load
High-Torque Type	20	PK513	–	12	15	–	–	–	The permissible thrust load shall be no greater than the motor mass.
	28	PK223, PK224, PK225, PK523, PK525		25	34	52	–	–	
	35	PK233, PK235		20	25	34	52	–	
	42	PK244, PK246, PK544, PK546		20	25	34	52	–	
	56.4	PK264, PK266, PK268		61	73	90	110	160	
	60	PK264, PK266, PK267, PK269		50	60	75	100	150	
High-Torque, High-Efficiency Type	42	PKE243, PKE244, PKE245		20	25	34	52	–	
High-Resolution Type	28	PK523, PK524, PK525		25	34	52	–	–	
	42	PK243, PK244, PK245, PK544, PK546		20	25	34	52	–	
	56.4	PK264, PK266, PK268		54	67	89	130	–	
	60	PK564, PK566, PK569		90	100	130	180	270	
Standard Type, Standard Type Terminal Box	20	PKP213, PKP214		12	15	–	–	–	
	28	PKP223, PKP224, PKP225		25	34	52	–	–	
	35	PKP233, PKP235		10	25	34	52	–	
	42	PKP243, PKP244, PKP245, PKP246 PK243, PK244, PK245, PK543, PK544, PK545		20	25	34	52	–	
	50	PK256, PK258		54	67	89	130	–	
	56.4	PKP264, PKP266, PKP268		61	73	90	110	160	
		PK264, PK266, PK268		54	67	89	130	–	
	60	PK564, PK566, PK569		63	75	95	130	190	
	85	PK296, PK299, PK2913, PK596, PK599, PK5913		260	290	340	390	480	
SH Geared Type	28	PKP223, PK223	**7.2**, **9**, **10**, **18**, **36**	15	17	20	23	–	10
	42	PKP243, PK243	**3.6**, **7.2**, **9**, **10**, **18**, **36**, **50***, **100***	10	15	20	30	–	15
	60	PKP264, PK264	**3.6**, **7.2**, **9**, **10**	30	40	50	60	70	30
			18, **36** , **50***, **100***	80	100	120	140	160	
	90	PK296	**3.6**, **7.2**, **9**, **10**, **18**, **36**	220	250	300	350	400	100
TH Geared Type	28	PK523	**7.2**, **10**, **20**, **30**	15	17	20	23	–	10
	42	PK243, PK543	**3.6**, **7.2**, **10**, **20**, **30**	10	14	20	30	–	15
	60	PK264, PK564		70	80	100	120	150	40
	90	PK596		220	250	300	350	400	100
PS Geared Type	28	PK223, PK523	**5**, **7.2**, **10**	45	60	80	100	–	20
	42	PK545	**5**, **7.2**, **10**	73	84	100	123	–	50
		PK543	**25**, **36**, **50**	109	127	150	184	–	
	60	PK566	**5**	200	220	250	280	320	100
			7.2, **10**	250	270	300	340	390	
		PK564	**25**, **36**, **50**	330	360	400	450	520	
	90	PK599	**5**, **7.2**, **10**	480	540	600	680	790	300
		PK596	**25**	850	940	1050	1190	1380	
			36	930	1030	1150	1310	1520	
			50	1050	1160	1300	1480	1710	
PL Geared Type	42	PK244	**5**, **10**	73	84	100	123	–	50
			36	109	127	150	184	–	
	60	PK266	**5**	200	220	250	280	320	100
			10	250	270	300	340	390	
		PK264	**36**	330	360	400	450	520	
PN Geared Type	28	PK523	**5**, **7.2**, **10**	45	60	80	100	–	20
	42	PK544	**5**, **7.2**, **10**	100	120	150	190	–	100
	60	PK566	**5**	200	220	250	280	320	
			7.2, **10**	250	270	300	340	390	
		PK564	**25**, **36**, **50**	330	360	400	450	520	
	90	PK599	**5**	480	520	550	580	620	300
			7.2, **10**	480	540	600	680	790	
		PK596	**25**	850	940	1050	1110	1190	
			36	930	1030	1150	1220	1300	
			50	1050	1160	1300	1380	1490	
Harmonic Geared Type	20	PK513	**50**, **100**	50	75	–	–	–	60
	30	PK523		110	135	175	250	–	140
	42	PK543		180	220	270	360	510	220
	60	PK564		320	370	440	550	720	450
	90	PK596		1090	1150	1230	1310	1410	1300

● The motor product name has characters for identifying the serie's name.
*Gear ratio 50 and 100 : Only for **PKP** Series.

Permissible Moment Load (Harmonic Geared Type)

If an eccentric load is applied when attaching an arm or table to the flange face, calculate the moment load with the following formula. The moment load should not exceed the permissible values shown in the table below.

Moment Load: M [N·m] = $F \times L$

Type	Motor Frame Size mm	Permissible Moment Load N·m
Harmonic Geared Type	20	0.7
	30	2.9
	42	5.6
	60	11.6