



5-Phase Stepping Motor and Driver Package NanoStep® RK Series

Introduction	Motor & Driver Packages														
	Closed Loop QStep	5-Phase Microstep	5-Phase Full/Half	2-Phase Full/Half	2-Phase Stepping Motors	Driver	Controllers	Low-Speed Synchronous Motors	Accessories	Before Using a Stepping Motor					
AS	AS PLUS	ASC	RK	CRK II	CSK	PMC	UMK	CSK	PK/PV	PK	UI2120G	EMP401	EMP402	SG8030J	SMK
AC Input	DC Input	DC Input	AC Input	DC Input	DC Input	DC Input	AC Input	DC Input	with Encoder	with Indexer					

Additional Information

- Technical ReferenceF-1
- General InformationG-1

5-Phase Stepping Motor and Driver Package

RK Series

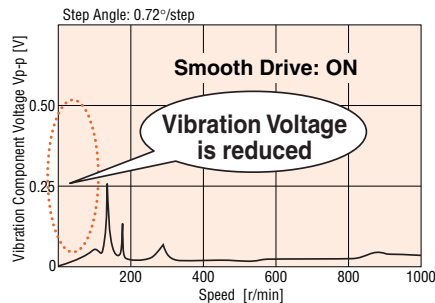
The **RK** series offers both the high resolution and smooth motion of a 5-phase microstepping system with the simplicity of a full step system. The **RK** Series “Smooth Drive” function achieves low vibration without the need for a higher cost pulse generator usually required for microstepping systems.



Features

1 Smooth Drive Function

Want to reduce vibration and noise during low-speed operation in microstepping mode without changing the full-step resolution? Or, are you looking for ways to use microstepping while keeping the pulse frequency low to accommodate the oscillator requirement? If so, the **RK** Series is the answer to your needs. The new and innovative Smooth Drive function ensures low-vibration and low-noise operation at low speeds by internally executing microstepping within the driver, working independently of the input pulse frequency of your controller.



2 Lower Vibration

● Microstepping System

The motor's basic step angle is divided by a maximum of 1/250 without the use of a reduction mechanism or other mechanical elements. This enables fine positioning and the further reduction of vibration and noise. A motion sequence of “low-speed transfer → high-speed return” can easily be performed without the need for changing from a microstep pulse frequency to a full step pulse frequency. The **RK** Series can also be used in full-step operation.

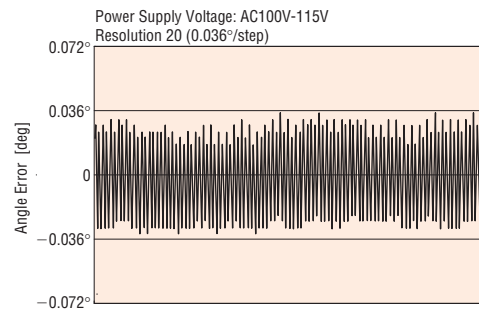


3 100-115 V, 200-230 V Power Source Variation

The **RK** Series can be used with most common power supplies available around the world.

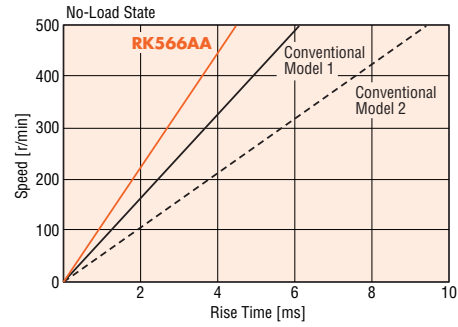
4 Improved Angle Accuracy

Angle accuracy may decrease during use of microstep drivers, due to the effect of current control. However, the drivers used in the **RK** Series are designed to ensure that the motor operates at maximum accuracy.



5 Improved Response

The **RK** Series, with its high starting frequency, shortens the machine cycle without affecting acceleration/deceleration rates. This produces a significant savings in time for an operation in which the same cycle is repeated thousands of times each day.



Wide Variations

The **RK** Series is comprised of motors in various sizes and with varying functions, such as high-accuracy, and non-backlash geared types.

Safe Operation in Major Countries around the World

Compliance with Safety Standards

The **RK** Series complies with the UL/CSA and EN standards. The CE marking certifies compliance with the EMC Directive and Low-Voltage Directive. Additionally, the **RK** Series conforms to the EMC Directive only through its use of surge protector. The **RK** Series doesn't require an external ferrite core or filter in the motor line or power line.

* With the **RK54** type, only the driver conforms to the CSA standard.

Standards/CE Marking

Products	Standards	Certification Body	File No.	CE Marking
Stepping Motor	UL1004, UL2111 CSA C22.2 No.100* ³ CSA C22.2 No.77* ³	UL	E64199	Low Voltage Directives EMC Directives
	EN60950 EN60034-1 EN60034-5	VDE * ²	114293	
	Driver	UL508C * ¹ CSA C22.2 No.14 EN50178	UL —	

*¹ Test Condition is Maximum Ambient Temperature 122°F (50°C) according to UL Standards. (UL508C)

*² Except for harmonic geared type **RK543-H**, **RK564-H**, and **PN** geared type **RK544-N**.

*³ Except for **RK54** type.

• When the system is approved under various safety standards, the model names in the motor and driver nameplates are the approved model names.

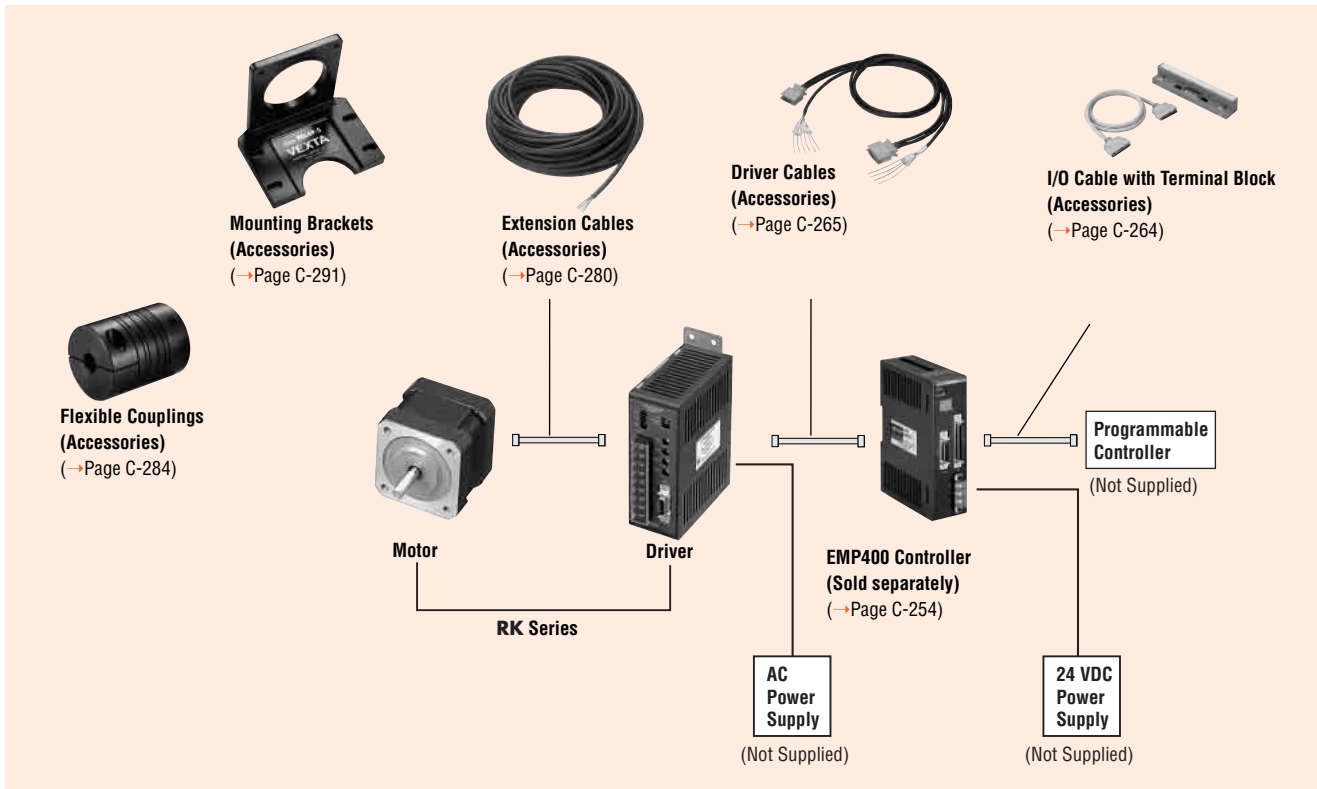
List of Motor and Driver Combinations → Page C-104

• **Details of Safety Standards** → Page G-2

• The EMC value changes according to the wiring and layout. Therefore, the final EMC level must be checked with the motor/driver incorporated in the user's equipment.

Motor & Driver Packages	
AS	Closed Loop <i>Q57ZP</i>
AS PLUS	AC Input
ASC	DC Input
RK	5-Phase Microstep AC Input
CRK II	DC Input
CSK	5-Phase Full/Half DC Input
PMC	DC Input
UMK	2-Phase Full/Half AC Input
CSK	DC Input
PK/PV	2-Phase Stepping Motors without Encoder
PK	with Encoder
UM2120G	Driver with Indexer
EMP401	Controllers
EMP402	
SG8030J	
SMK	Low-Speed Synchronous Motors
Accessories	
Before Using a Stepping Motor	

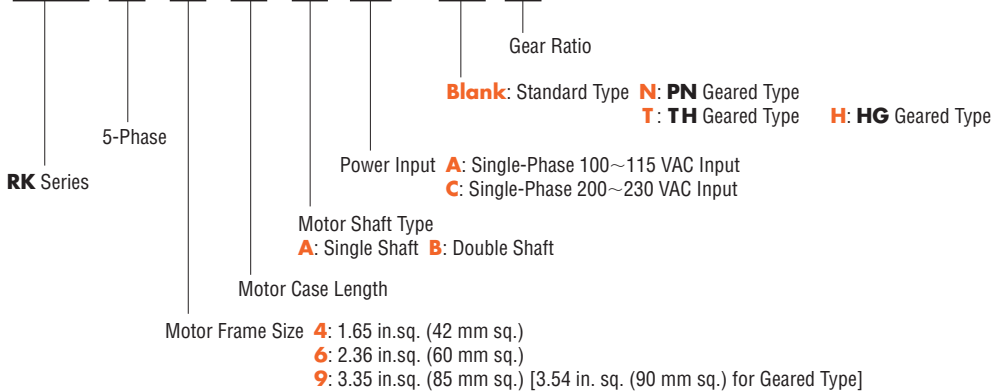
System Configuration



An example of a single-axis system configuration with the **EMP400** Series controller.

Product Number Code

RK 5 6 6 B A - N 5



Product Line

Type	Power Supply Voltage	Maximum Holding Torque		
		□1.65 in. (□42 mm)	□2.36 in. (□60 mm)	□3.35 in. (□85 mm) □3.54 in. (□90 mm) for geared type
Standard	Single-Phase 100-115 VAC	18.4~34 oz-in (0.13~0.24 N·m)	59~230 oz-in (0.42~1.66 N·m)	290~890 oz-in (2.1~6.3 N·m)
	Single-Phase 200-230 VAC	—	59~230 oz-in (0.42~1.66 N·m)	290~890 oz-in (2.1~6.3 N·m)
TH Geared	Single-Phase 100-115 VAC	3~13.2 lb-in (0.35~1.5 N·m)	11~35 lb-in (1.25~4 N·m)	39~106 lb-in (4.5~12 N·m)
	Single-Phase 200-230 VAC	—	11~35 lb-in (1.25~4 N·m)	39~106 lb-in (4.5~12 N·m)
PN Geared	Single-Phase 100-115 VAC	7~13.2 lb-in (0.8~1.5 N·m)	30~70 lb-in (3.5~8 N·m)	123~320 lb-in (14~37 N·m)
	Single-Phase 200-230 VAC	—	30~70 lb-in (3.5~8 N·m)	123~320 lb-in (14~37 N·m)
HG Geared	Single-Phase 100-115 VAC	30~44 lb-in (3.5~5 N·m)	48~70 lb-in (5.5~8 N·m)	220~320 lb-in (25~37 N·m)
	Single-Phase 200-230 VAC	—	48~70 lb-in (5.5~8 N·m)	220~320 lb-in (25~37 N·m)

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

Specifications How to Read Specifications Table →Page C-9

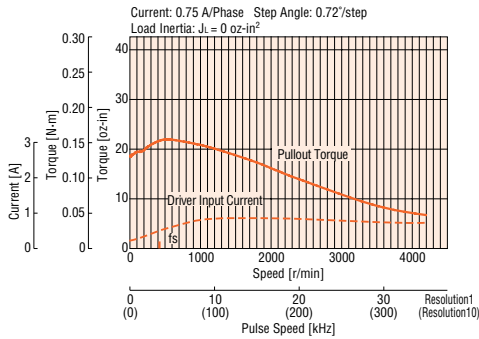
us (Only the driver conforms to the CSA standard.)

Model	Single-Phase	Single Shaft	RK543AA	RK544AA	RK545AA
	100-115 VAC	Double Shaft	RK543BA	RK544BA	RK545BA
Maximum Holding Torque	oz-in (N·m)		18.4 (0.13)	25 (0.18)	34 (0.24)
Rotor Inertia J	oz-in ² (kg·m ²)		0.191 (35×10 ⁻⁷)	0.3 (54×10 ⁻⁷)	0.37 (68×10 ⁻⁷)
Rated Current	A/Phase		0.75		
Basic Step Angle			0.72°		
Power Source Input	Single-Phase 100-115 VAC ±15% 50/60 Hz 1 A				
Excitation Mode	Microstep: Basic Angle/n* (/Step)				
Weight	Motor	lb. (kg)	0.55 (0.25)	0.66 (0.3)	0.88 (0.4)
	Driver	lb. (kg)			
Dimension No.	Motor		1		
	Driver		13		

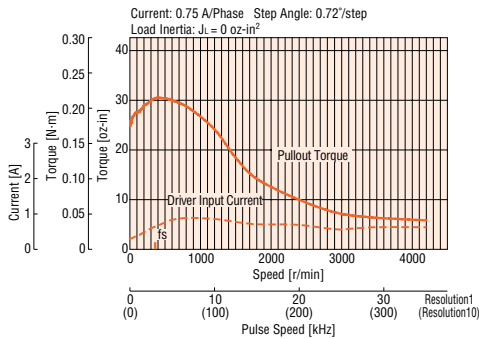
* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

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

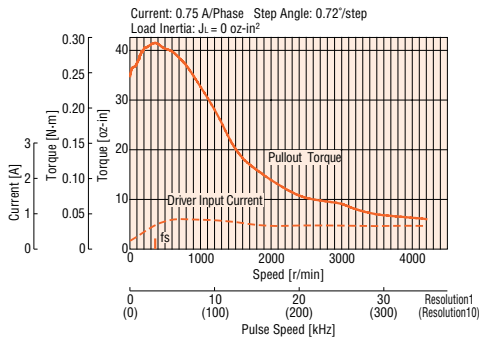
RK543 □A



RK544 □A



RK545 □A



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

Standard Type

 Motor Frame Size: 2.36 in. (60 mm), 3.35 in. (85 mm)


Specifications

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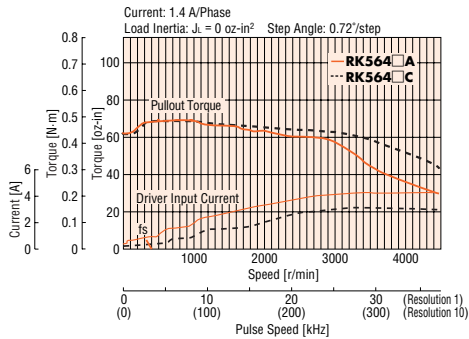
Model	Single-Phase	Single Shaft	RK564AA	RK566AA	RK569AA	RK596AA	RK599AA	RK5913AA
	100-115 VAC	Double Shaft	RK564BA	RK566BA	RK569BA	RK596BA	RK599BA	RK5913BA
	Single-Phase	Single Shaft	RK564AC	RK566AC	RK569AC	RK596AC	RK599AC	RK5913AC
	200-230 VAC	Double Shaft	RK564BC	RK566BC	RK569BC	RK596BC	RK599BC	RK5913BC
Maximum Holding Torque	oz-in (N·m)		59 (0.42)	117 (0.83)	230 (1.66)	290 (2.1)	580 (4.1)	890 (6.3)
Rotor Inertia J	oz-in ² (kg·m ²)		0.96 (175×10 ⁻⁷)	1.53 (280×10 ⁻⁷)	3.1 (560×10 ⁻⁷)	7.7 (1400×10 ⁻⁷)	14.8 (2700×10 ⁻⁷)	22 (4000×10 ⁻⁷)
Rated Current	A/Phase		1.4					
Basic Step Angle			0.72°					
Power Source Input			Single-Phase 100-115 VAC ±15% 50/60 Hz 4.5 A Single-Phase 200-230 VAC +10% -15% 50/60 Hz 3.5 A					
Excitation Mode			Microstep: Basic Angle/n * (/Step)					
Weight	Motor	lb. (kg)	1.3 (0.6)	1.8 (0.8)	2.9 (1.3)	3.7 (1.7)	6.2 (2.8)	8.4 (3.8)
	Driver	lb. (kg)	1.9 (0.85)					
Dimension No.	Motor		2			3		
	Driver		14					

* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

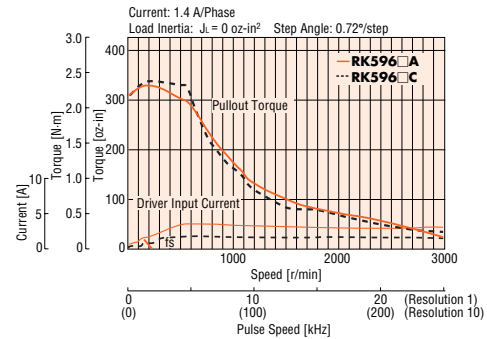
Speed — Torque Characteristics

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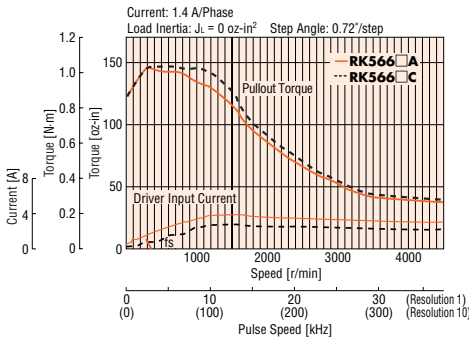
RK564□A RK564□C



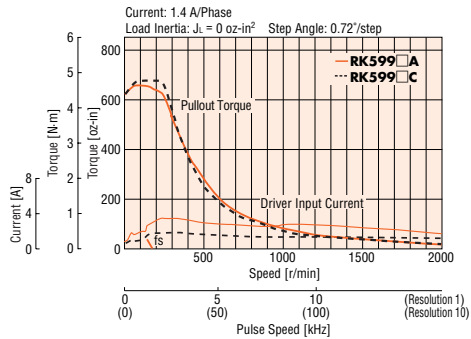
RK596□A RK596□C



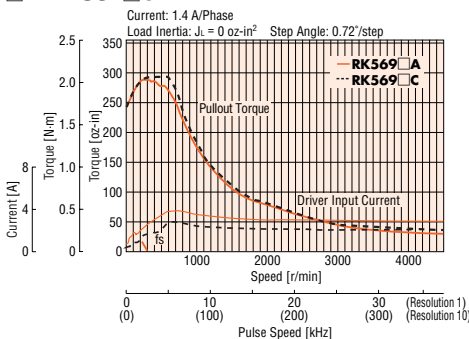
RK566□A RK566□C



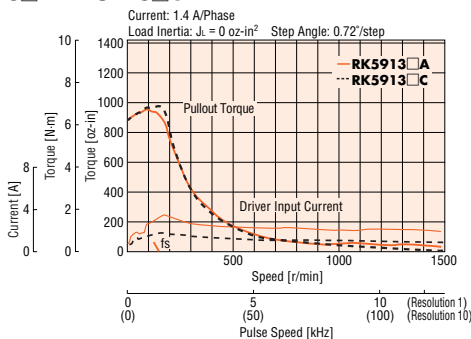
RK599□A RK599□C



RK569□A RK569□C



RK5913□A RK5913□C



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

TH Geared Type Motor Frame Size: 1.65 in. (42 mm)

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(Only the driver conforms to the CSA standard.)

Model	Single-Phase	Single Shaft	RK543AA-T3.6	RK543AA-T7.2	RK543AA-T10	RK543AA-T20	RK543AA-T30
	100-115 VAC	Double Shaft	RK543BA-T3.6	RK543BA-T7.2	RK543BA-T10	RK543BA-T20	RK543BA-T30
Maximum Holding Torque	lb-in (N·m)		3 (0.35)	6.1 (0.7)	8.8 (1.0)	13.2 (1.5)	
Rotor Inertia J	oz-in ² (kg·m ²)		0.191 (35×10 ⁻⁷)				
Rated Current	A/Phase		0.75				
Basic Step Angle			0.2°	0.1°	0.072°	0.036°	0.024°
Gear Ratio			3.6:1	7.2:1	10:1	20:1	30:1
Permissible Torque	lb-in. (N·m)		3 (0.35)	6.1 (0.7)	8.8 (1.0)	13.2 (1.5)	
Backlash	arc minute (degrees)		45 (0.75°)	25 (0.417°)		15 (0.25°)	
Permissible Speed Range	r/min		0~500	0~250	0~180	0~90	0~60
Power Source Input	Single-Phase 100-115 VAC ±15% 50/60 Hz 1 A						
Excitation Mode	Microstep: Basic Angle/n* (/Step)						
Weight	Motor	lb. (kg)	0.77 (0.35)				
	Driver	lb. (kg)	0.88 (0.4)				
Dimension No.	Motor		4				
	Driver		13				

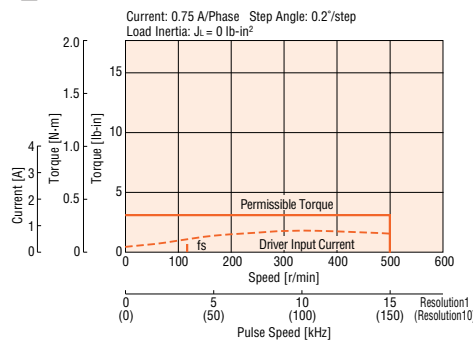
* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

Note:

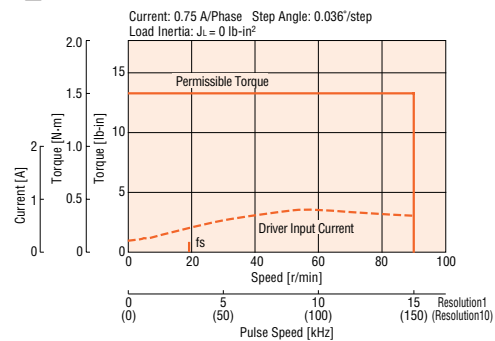
- Direction of rotation of the motor and that of the gear output shaft are the same for models with gear ratios of 3.6:1, 7.2:1 and 10:1. It is opposite for 20:1 and 30:1 gear ratio models.

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

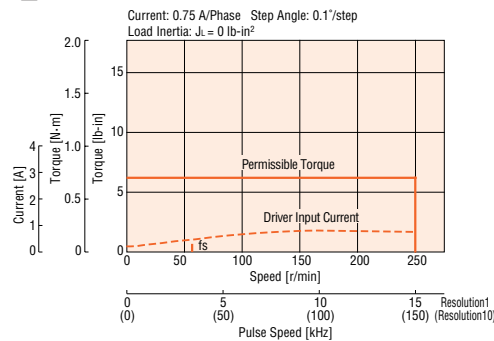
RK543□A-T3.6



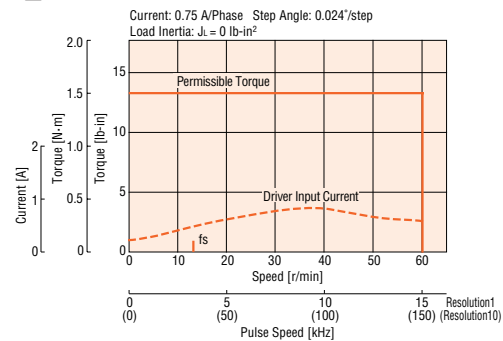
RK543□A-T20



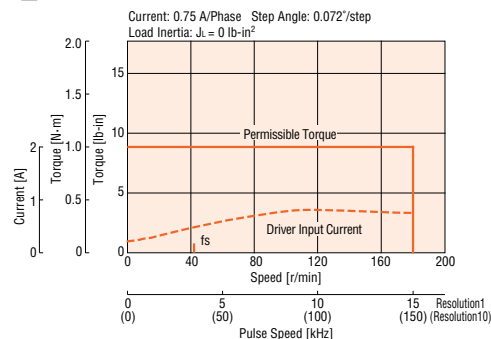
RK543□A-T7.2



RK543□A-T30



RK543□A-T10



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

TH Geared Type Motor Frame Size: □ 2.36 in. (□ 60 mm)



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Model	Single-Phase	Single Shaft	RK564AA-T3.6	RK564AA-T7.2	RK564AA-T10	RK564AA-T20	RK564AA-T30
	100-115 VAC	Double Shaft	RK564BA-T3.6	RK564BA-T7.2	RK564BA-T10	RK564BA-T20	RK564BA-T30
	Single-Phase	Single Shaft	RK564AC-T3.6	RK564AC-T7.2	RK564AC-T10	RK564AC-T20	RK564AC-T30
	200-230 VAC	Double Shaft	RK564BC-T3.6	RK564BC-T7.2	RK564BC-T10	RK564BC-T20	RK564BC-T30
Maximum Holding Torque	lb-in (N·m)		11 (1.25)	22 (2.5)	26 (3)	30 (3.5)	35 (4)
Rotor Inertia J	oz-in ² (kg·m ²)		0.96 (175×10 ⁻⁷)				
Rated Current	A/Phase		1.4				
Basic Step Angle			0.2°	0.1°	0.072°	0.036°	0.024°
Gear Ratio			3.6:1	7.2:1	10:1	20:1	30:1
Permissible Torque	lb-in. (N·m)		11 (1.25)	22 (2.5)	26 (3)	30 (3.5)	35 (4)
Backlash	arc minute (degrees)		35 (0.584°)	15 (0.25°)		10 (0.167°)	
Permissible Speed Range	r/min		0~500	0~250	0~180	0~90	0~60
Power Source Input	Single-Phase 100-115 VAC ±15% 50/60 Hz 4.5 A				Single-Phase 200-230 VAC ±15% 50/60 Hz 3.5 A		
Excitation Mode	Microstep: Basic Angle/n * (/Step)						
Weight	Motor	lb. (kg)	2.1 (0.95)				
	Driver	lb. (kg)	1.9 (0.85)				
Dimension No.	Motor		5				
	Driver		14				

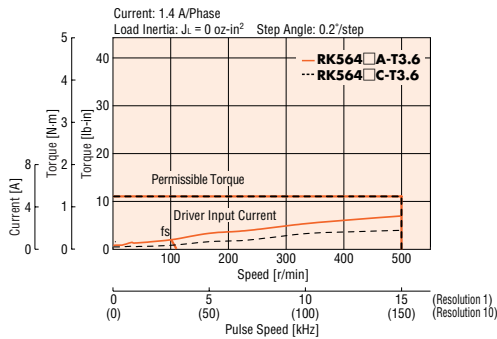
* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

Note:

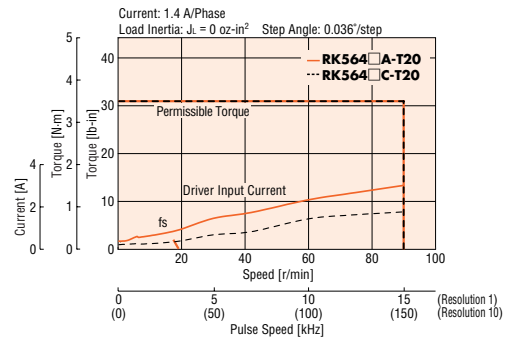
- Direction of rotation of the motor and that of the gear output shaft are the same for models with gear ratios of 3.6:1, 7.2:1 and 10:1. It is opposite for 20:1 and 30:1 gear ratio models.

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

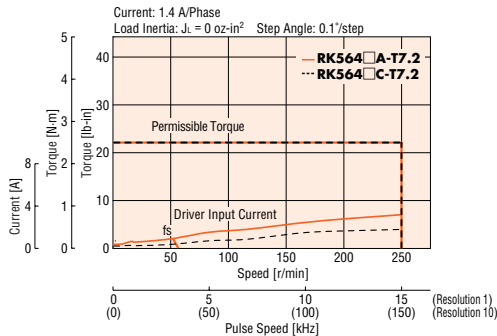
RK564□A-T3.6 RK564□C-T3.6



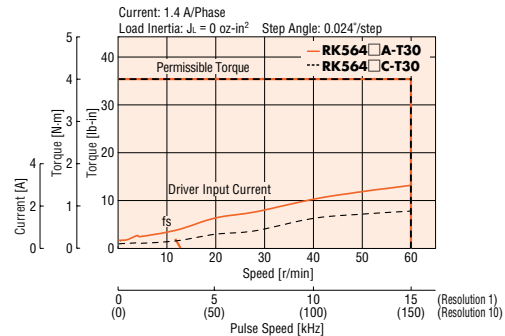
RK564□A-T20 RK564□C-T20



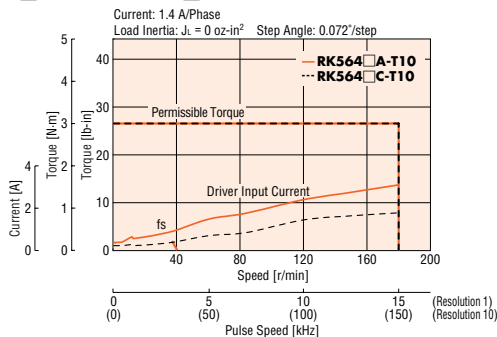
RK564□A-T7.2 RK564□C-T7.2



RK564□A-T30 RK564□C-T30



RK564□A-T10 RK564□C-T10



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

TH Geared Type Motor Frame Size: 3.54 in. (90 mm)



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Model	Single-Phase	Single Shaft	RK596AA-T3.6	RK596AA-T7.2	RK596AA-T10	RK596AA-T20	RK596AA-T30	
	100-115 VAC	Double Shaft	RK596BA-T3.6	RK596BA-T7.2	RK596BA-T10	RK596BA-T20	RK596BA-T30	
	Single-Phase	Single Shaft	RK596AC-T3.6	RK596AC-T7.2	RK596AC-T10	RK596AC-T20	RK596AC-T30	
	200-230 VAC	Double Shaft	RK596BC-T3.6	RK596BC-T7.2	RK596BC-T10	RK596BC-T20	RK596BC-T30	
Maximum Holding Torque	lb-in (N·m)		39 (4.5)		79 (9)		106 (12)	
Rotor Inertia J	oz-in ² (kg·m ²)		7.7 (1400×10 ⁻⁷)					
Rated Current	A/Phase		1.4					
Basic Step Angle			0.2°	0.1°	0.072°	0.036°	0.024°	
Gear Ratio			3.6:1	7.2:1	10:1	20:1	30:1	
Permissible Torque	lb-in. (N·m)		39 (4.5)		79 (9)		106 (12)	
Backlash	arc minute (degrees)		25 (0.417°)		15 (0.25°)		10 (0.167°)	
Permissible Speed Range	r/min		0~500	0~250	0~180	0~90	0~60	
Power Source Input	Single-Phase 100-115 VAC ±15% 50/60 Hz 4.5 A					Single-Phase 200-230 VAC ±10% _{-15%} 50/60 Hz 3.5 A		
Excitation Mode	Microstep: Basic Angle/n * (/Step)							
Weight	Motor	lb. (kg)					6.3 (2.85)	
	Driver	lb. (kg)					1.9 (0.85)	
Dimension No.	Motor						6	
	Driver						14	

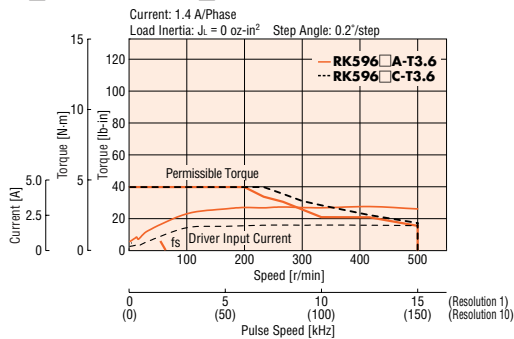
* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

Note:

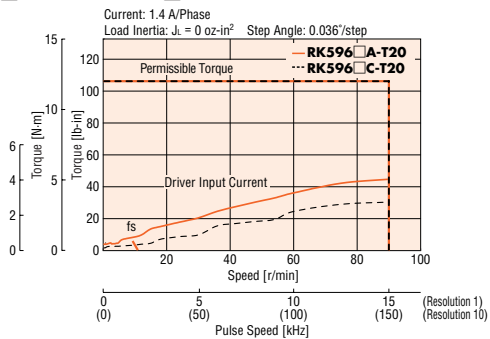
- Direction of rotation of the motor and that of the gear output shaft are the same for models with gear ratios of 3.6:1, 7.2:1 and 10:1. It is opposite for 20:1 and 30:1 gear ratio models.

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

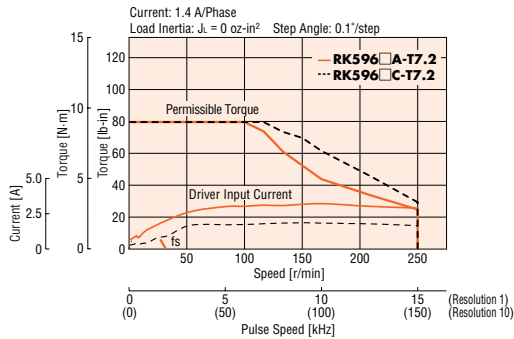
RK596□A-T3.6 RK596□C-T3.6



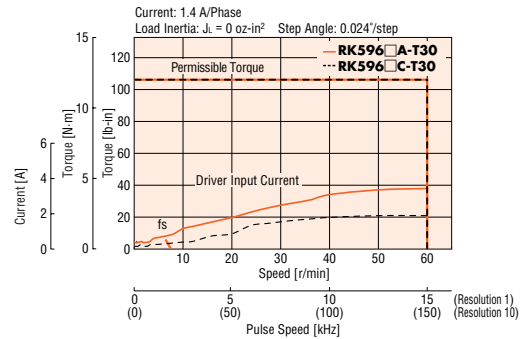
RK596□A-T20 RK596□C-T20



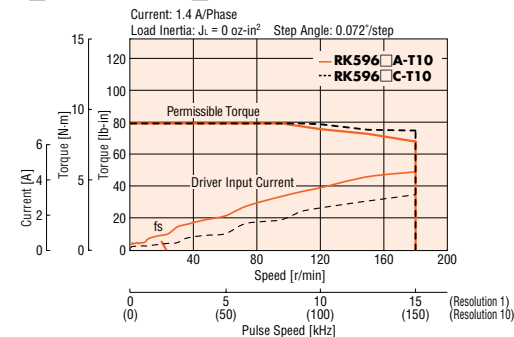
RK596□A-T7.2 RK596□C-T7.2



RK596□A-T30 RK596□C-T30



RK596□A-T10 RK596□C-T10



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

PN Geared Type

Motor Frame Size: 1.65 in. (42 mm)

Specifications

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 (Only the driver conforms to the CSA standard.) 

Model	Single-Phase 100-115 VAC	Single Shaft Double Shaft	RK544AA-N5		RK544AA-N7.2		RK544AA-N10	
			RK544BA-N5		RK544BA-N7.2		RK544BA-N10	
Maximum Holding Torque		lb-in. (N·m)	7 (0.8)		10.6 (1.2)		13.2 (1.5)	
Rotor Inertia J		oz-in ² (kg·m ²)			0.30 (54×10 ⁻⁷)			
Rated Current		A/Phase			0.75			
Basic Step Angle			0.144°		0.1°		0.072°	
Gear Ratio			5:1		7.2:1		10:1	
Permissible Torque		lb-in. (N·m)	7 (0.8)		10.6 (1.2)		13.2 (1.5)	
Maximum Torque		lb-in. (N·m)	13.2 (1.5)		17.7 (2)		17.7 (2)	
Backlash		arc minute (degrees)			2 (0.034°)			
Angle Error		arc minute (degrees)			6 (0.1°)			
Permissible Speed Range		r/min	0~600		0~416		0~300	
Power Source Input	Single-Phase 100-115 VAC ±15% 50/60 Hz 1 A							
Excitation Mode	Microstep: Basic Angle/n [*] (/Step)							
Weight	Motor	lb. (kg)			1.2 (0.56)			
	Driver	lb. (kg)			0.88 (0.4)			
Dimension No.	Motor				7			
	Driver				13			

* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

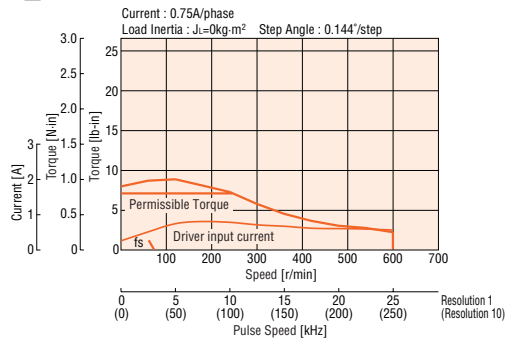
Notes:

- Direction of rotation of the motor and that of the gear output shaft are the same.
- The value of Maximum Torque is for the gear. Refer to the Speed-Torque Characteristics for the output torque of the geared motors.

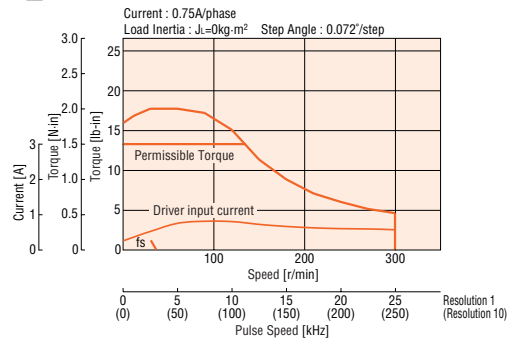
Speed — Torque Characteristics

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

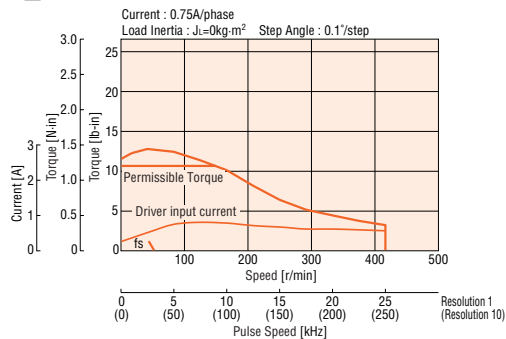
RK544□A-N5



RK544□A-N10



RK544□A-N7.2



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

PN Geared Type Motor Frame Size: □ 2.36 in. (□ 60 mm)



Specifications How to Read Specifications Table → Page C-9

Model	Single-Phase	Single Shaft	RK566AA-N5	RK566AA-N7.2	RK566AA-N10	RK564AA-N25	RK564AA-N36	RK564AA-N50
	100-115 VAC	Double Shaft	RK566BA-N5	RK566BA-N7.2	RK566BA-N10	RK564BA-N25	RK564BA-N36	RK564BA-N50
	Single-Phase	Single Shaft	RK566AC-N5	RK566AC-N7.2	RK566AC-N10	RK564AC-N25	RK564AC-N36	RK564AC-N50
	200-230 VAC	Double Shaft	RK566BC-N5	RK566BC-N7.2	RK566BC-N10	RK564BC-N25	RK564BC-N36	RK564BC-N50
Maximum Holding Torque	lb-in (N·m)		30 (3.5)	35 (4)	44 (5)	70 (8)		
Rotor Inertia J	oz-in ² (kg·m ²)		1.53 (280×10 ⁻⁷)			0.96 (175×10 ⁻⁷)		
Rated Current	A/Phase		1.4					
Basic Step Angle			0.144°	0.1°	0.072°	0.0288°	0.02°	0.0144°
Gear Ratio			5:1	7.2:1	10:1	25:1	36:1	50:1
Permissible Torque	lb-in. (N·m)		30 (3.5)	35 (4)	44 (5)	70 (8)		
Maximum Torque	lb-in. (N·m)		61 (7)	79 (9)	97 (11)	141 (16)	177 (20)	177 (20)
Backlash	arc minute (degrees)		2 (0.034°)			3 (0.05°)		
Angle Error	arc minute (degrees)		5 (0.084°)					
Permissible Speed Range	r/min		0~600	0~416	0~300	0~120	0~83	0~60
Power Source Input			Single-Phase 100-115 VAC ±15% 50/60 Hz 4.5 A			Single-Phase 200-230 VAC ±15% 50/60 Hz 3.5 A		
Excitation Mode			Microstep: Basic Angle/n* (/Step)					
Weight	Motor	lb. (kg)	3.3 (1.5)					
	Driver	lb. (kg)	1.9 (0.85)					
Dimension No.	Motor		8					
	Driver		14					

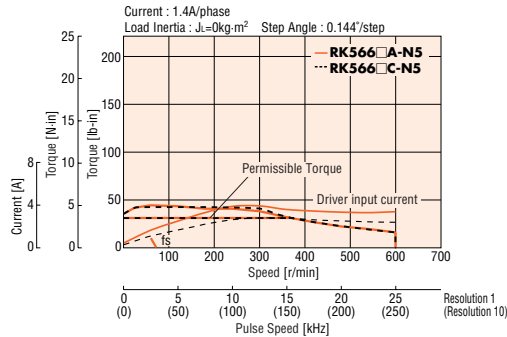
* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

Notes: • Direction of rotation of the motor and that of the gear output shaft are the same.

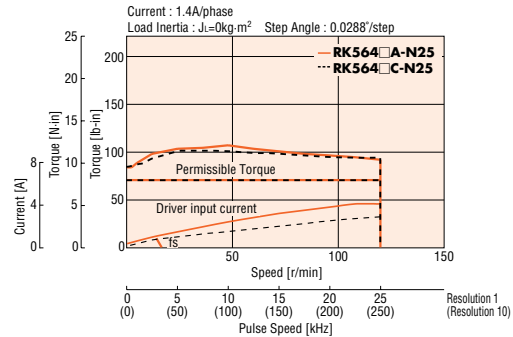
• The value of Maximum Torque is for the gear. Refer to the Speed-Torque Characteristics for the output torque of the geared motors.

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

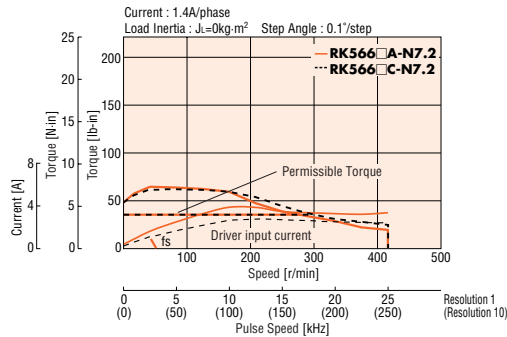
RK566□A-N5 RK566□C-N5



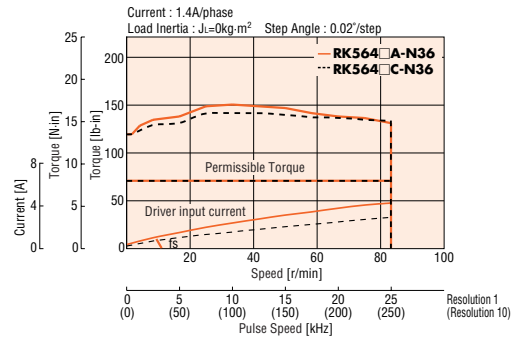
RK564□A-N25 RK564□C-N25



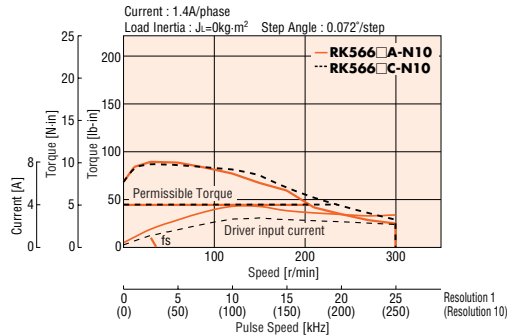
RK566□A-N7.2 RK566□C-N7.2



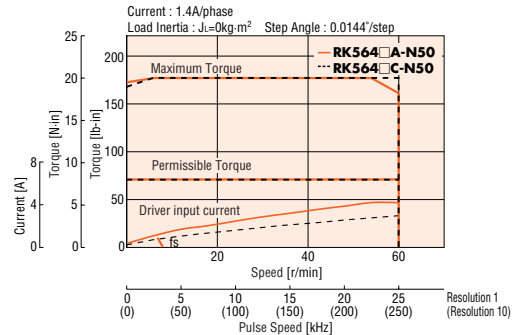
RK564□A-N36 RK564□C-N36



RK566□A-N10 RK566□C-N10



RK564□A-N50 RK564□C-N50



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

PN Geared Type

Motor Frame Size: □ 3.54 in. (□ 90 mm)



Specifications

How to Read Specifications Table → Page C-9

Model	Single-Phase	Single Shaft	RK599AA-N5	RK599AA-N7.2	RK599AA-N10	RK596AA-N25	RK596AA-N36	RK596AA-N50	
	100-115 VAC	Double Shaft	RK599BA-N5	RK599BA-N7.2	RK599BA-N10	RK596BA-N25	RK596BA-N36	RK596BA-N50	
	Single-Phase	Single Shaft	RK599AC-N5	RK599AC-N7.2	RK599AC-N10	RK596AC-N25	RK596AC-N36	RK596AC-N50	
	200-230 VAC	Double Shaft	RK599BC-N5	RK599BC-N7.2	RK599BC-N10	RK596BC-N25	RK596BC-N36	RK596BC-N50	
Maximum Holding Torque	lb-in. (N·m)		123 (14)		177 (20)		320 (37)		
Rotor Inertia J	oz-in ² (kg·m ²)		14.8 (2700×10 ⁻⁷)		7.7 (1400×10 ⁻⁷)				
Rated Current	A/Phase		1.4						
Basic Step Angle			0.144°	0.1°	0.072°	0.0288°	0.02°	0.0144°	
Gear Ratio			5:1	7.2:1	10:1	25:1	36:1	50:1	
Permissible Torque	lb-in. (N·m)		123 (14)		177 (20)		320 (37)		
Maximum Torque	lb-in. (N·m)		240 (28)		300 (35)		490 (56)		530 (60)
Backlash	arc minute (degrees)		2 (0.034°)		3 (0.05°)			530 (60)	
Angle Error	arc minute (degrees)		4 (0.067°)						
Permissible Speed Range	r/min		0~600	0~416	0~300	0~120	0~83	0~60	
Power Source Input			Single-Phase 100-115 VAC ±15% 50/60 Hz 4.5 A			Single-Phase 200-230 VAC ±10% 50/60 Hz 3.5 A			
Excitation Mode			Microstep: Basic Angle/n* (/Step)						
Weight	Motor	lb. (kg)	11 (5)			10 (4.7)			
	Driver	lb. (kg)	1.9 (0.85)						
Dimension No.	Motor		9						
	Driver		14						

* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

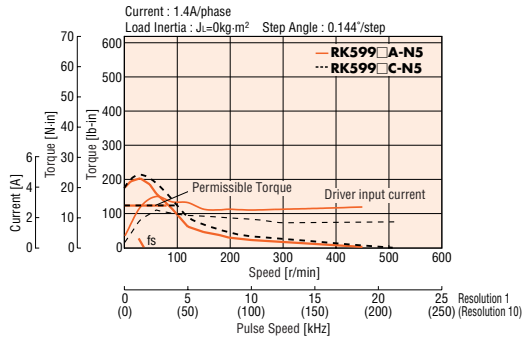
Notes: • Direction of rotation of the motor and that of the gear output shaft are the same.

• The value of Maximum Torque is for the gear. Refer to the Speed-Torque Characteristics for the output torque of the geared motors.

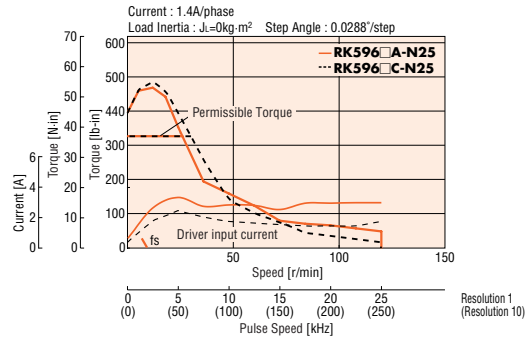
Speed — Torque Characteristics

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

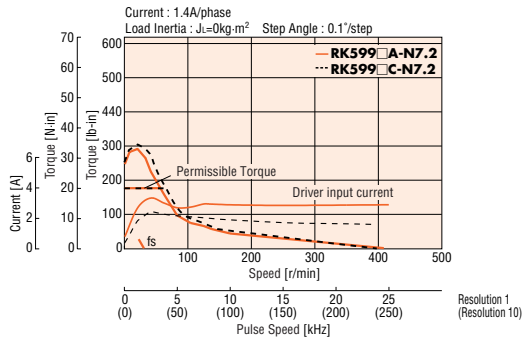
RK599□A-N5 RK599□C-N5



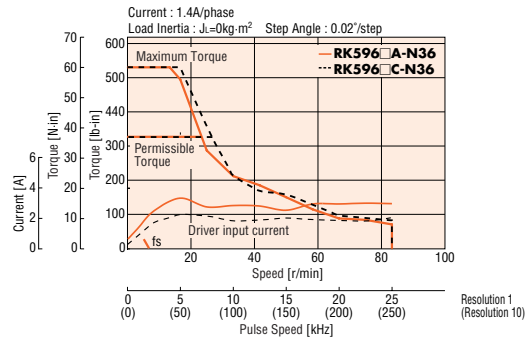
RK596□A-N25 RK596□C-N25



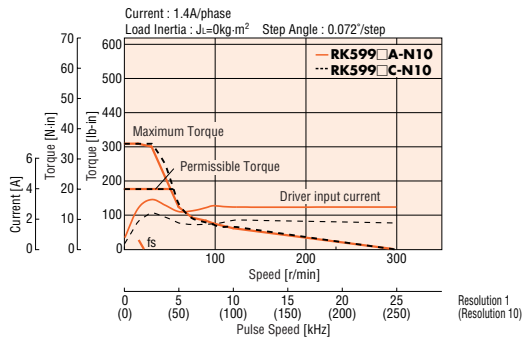
RK599□A-N7.2 RK599□C-N7.2



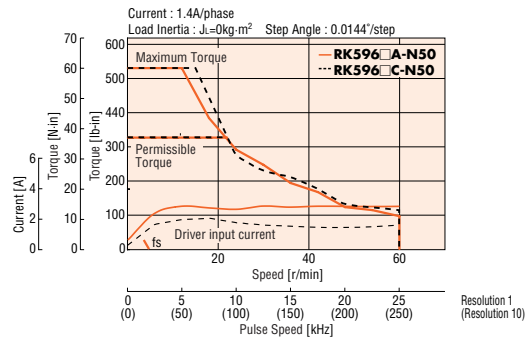
RK596□A-N36 RK596□C-N36



RK599□A-N10 RK599□C-N10



RK596□A-N50 RK596□C-N50



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

HG Geared Type Motor Frame Size: 1.65 in. (42 mm), 2.36 in. (60 mm), 3.54 in. (90 mm)

Specifications How to Read Specifications Table → Page C-9 us (With the **RK543** type, only the driver conforms to the CSA standard.)

Model	Single-Phase	Single Shaft	RK543AA-H50	RK543AA-H100	RK564AA-H50	RK564AA-H100	RK596AA-H50	RK596AA-H100
	100-115 VAC	Double Shaft	RK543BA-H50	RK543BA-H100	RK564BA-H50	RK564BA-H100	RK596BA-H50	RK596BA-H100
	Single-Phase	Single Shaft	—	—	RK564AC-H50	RK564AC-H100	RK596AC-H50	RK596AC-H100
	200-230 VAC	Double Shaft	—	—	RK564BC-H50	RK564BC-H100	RK596BC-H50	RK596BC-H100
Maximum Holding Torque	lb-in. (N·m)		30 (3.5)	44 (5.0)	48 (5.5)	70 (8)	220 (25)	320 (37)
Rotor Inertia J	oz-in ² (kg·m ²)		0.28 (52×10 ⁻⁷)		1.15 (210×10 ⁻⁷)		8.8 (1600×10 ⁻⁷)	
Rated Current	A/Phase		0.75		1.4			
Basic Step Angle			0.0144°	0.0072°	0.0144°	0.0072°	0.0144°	0.0072°
Gear Ratio			50:1	100:1	50:1	100:1	50:1	100:1
Permissible Torque	lb-in. (N·m)		30 (3.5)	44 (5.0)	48 (5.5)	70 (8)	220 (25)	320 (37)
Maximum Torque	lb-in. (N·m)		73 (8.3)	97 (11)	159 (18)	240 (28)	300 (35)	480 (55)
Lost Motion (Load Torque)	arc minute (degrees)		Maximum 1.5 (±0.16 N·m)	Maximum 1.5 (±0.2 N·m)	Maximum 0.7 (±0.28 N·m)	Maximum 0.7 (±0.39 N·m)	Maximum 1.5 (±1.2 N·m)	Maximum 1.5 (±1.2 N·m)
Permissible Speed Range	r/min		0~70	0~35	0~70	0~35	0~70	0~35
Power Source Input			Single-Phase 100-115 VAC ±15% 50/60 Hz 1 A		Single-Phase 100-115 VAC ±15% 50/60 Hz 4.5 A		Single-Phase 200-230 VAC ±10% 50/60 Hz 3.5 A	
Excitation Mode			Microstep: Basic Angle/n* (/Step)					
Weight	Motor lb. (kg)		1 (0.46)		2.4 (1.08)		8.1 (3.7)	
	Driver lb. (kg)		0.88 (0.4)		1.9 (0.85)			
Dimension No.	Motor/Driver		10/13		11/14		12/14	

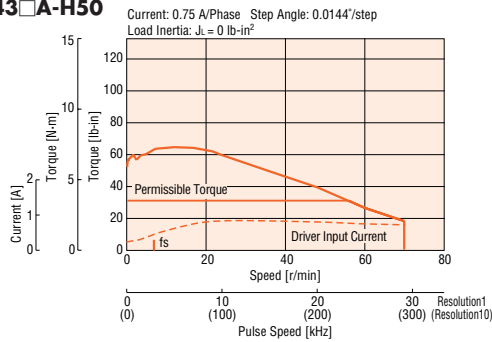
* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

Notes: • The inertia represents a sum of the inertia at the harmonic gear converted to a motor shaft value, and the rotor inertia.

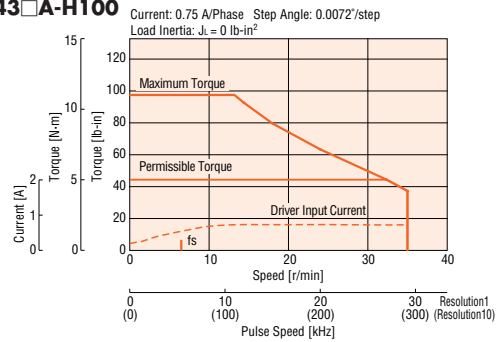
- Direction of rotation of the motor and that of the gear output shaft are the opposite.
- The value of Maximum Torque is for the gear. Refer to the Speed-Torque Characteristics for the output torque of the geared motors.

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

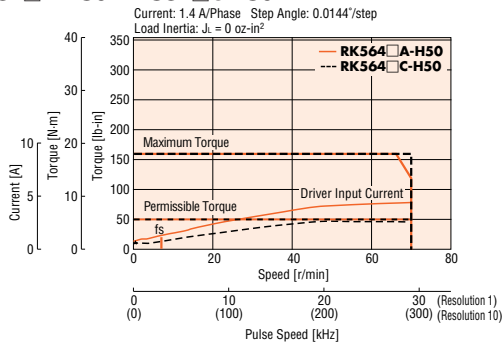
RK543□A-H50



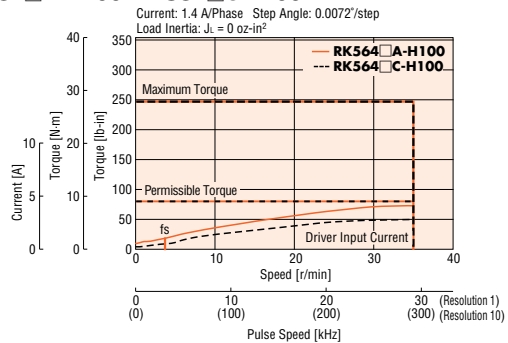
RK543□A-H100



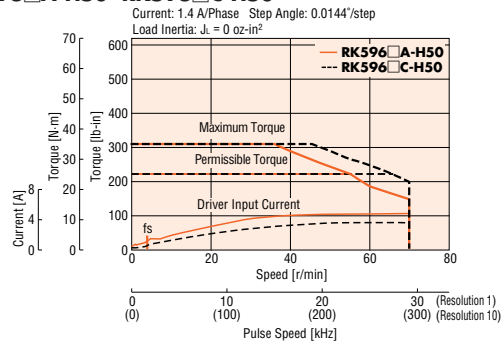
RK564□A-H50 RK564□C-H50



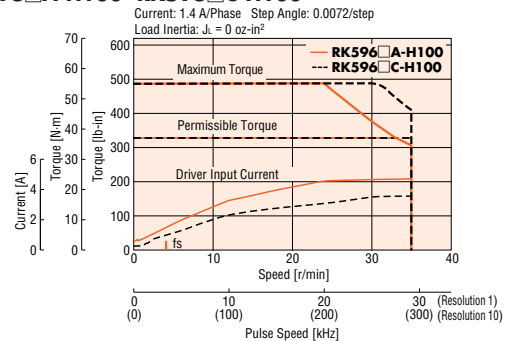
RK564□A-H100 RK564□C-H100



RK596□A-H50 RK596□C-H50



RK596□A-H100 RK596□C-H100



Note: The pulse input circuit responds to approximately 200 kHz with a pulse duty of 50%.

Common Specifications

Input Signal	Input Mode	Photocoupler input, Input impedance: 220 Ω; Input current: 10 to 20 mA ON: +4.5 V~5 V, OFF: 0~+1 V (Voltage between terminals)
	Pulse Signal (CW Pulse Signal)	Operation command pulse signal (CW direction operation command pulse signal when in 2-pulse input mode) Pulse width: 2.5 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 frequency: 200 kHz (When the duty is 50%) Negative logic pulse input.
	Rotation Direction Signal (CCW Pulse Signal)	Rotation direction signal, Photocoupler OFF: CCW; Photocoupler ON: CW (CCW direction operation command pulse signal when in 2-pulse input mode Pulse width: 2.5 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: 200 kHz (When the 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's shaft can be rotated manually. When in the "photocoupler OFF" state, the output current is supplied to the motor.
	Step Angle Select Signal	Step angle specified in DATA1 when photocoupler OFF Step angle specified in DATA2 when photocoupler ON
Output Signal	Output Mode	Photocoupler, Open Collector Output External usage conditions 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) 0.72°/step (1 resolution): Signal output every 10 pulses; 0.072°/step (10 resolutions): Signal output every 100 pulses
	Overheat Signal	Output is turned off when the driver's internal temperature rises to approximately 176°F (80°C) or above. (Photocoupler: OFF)
Functions		Automatic Current Cutback, Automatic current off, Step Angle Switch, Pulse Input Mode Switch, Smooth Drive Function
Indicators (LED)		Power input, Excitation Timing signal output, Overheat signal output
Cooling Method		Natural Ventilation

General Specifications

Specifications		Motor	Driver
Insulation Class		Class B [266°F (130°C)] [Recognized as Class A 221°F (105°C) by UL/CSA standard]	—
Insulation Resistance		100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC megger between the windings and the motor casing.	100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC megger between the following places: • Power input terminal - Protective earth terminal • Motor output terminal - Protective earth terminal • Electromagnetic brake power output terminal* - Protective earth terminal • Signal input/output terminals - Power input terminal • Signal input/output terminals - Motor output terminal • Signal input/output terminals* - Electromagnetic brake power output terminal * Only for electromagnetic brake type
Dielectric Strength		Sufficient to withstand 1.5 kV (1.0 kV for RK54□), 60 Hz applied for one minute between the windings and casing under normal temperature and humidity.	Sufficient to withstand the following for one minute, under normal temperature and humidity. • Power input terminal - Protective earth terminal 1.1 kVAC 60 Hz • Motor output terminal - Protective earth terminal 1.1 kVAC 60 Hz • Electromagnetic brake power output terminal* - Protective earth terminal 1.1 kVAC 60 Hz • Signal input/output terminals - Power input terminal 1.8 kVAC 60 Hz • Signal input/output terminals - Motor output terminal 1.8 kVAC 60 Hz • Signal input/output terminals* - Electromagnetic brake power output terminal 1.8 kVAC 60 Hz * Only for electromagnetic brake type
Operating Environment	Ambient Temperature	14°F~122°F (-10°C~+50°C) (nonfreezing) [Harmonic geared type: 32°F~104°F (0°C~+40°C)]	32°F~122°F (0°C~+50°C) (nonfreezing)
	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 144°F (80°C) or less. (at standstill, five phases energized)	—
Stop Position Accuracy *1		±3 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. (5 N)	—
Axial Play *3		0.003 inch (0.075 mm) max. of 2.2 lb. (10 N)	—
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 the size of the load.)

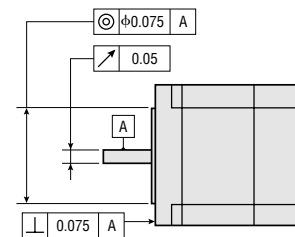
*2 Radial Play: Displacement in shaft position in the radial direction, when a 1.12 lb. (5 N) load is applied in the vertical direction to the tip of the motor's shaft.

*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.



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

Permissible Overhung Load and Permissible Thrust Load

Model	Overhung Load Distance from the Output Shaft End [inch (mm)]					Thrust Load	
	0 (0)	0.2 (5)	0.39 (10)	0.59 (15)	0.79 (20)		
RK543	4.5	5.6	7.6	11.7	—	The permissible thrust load [lb. (N)] shall be no greater than the motor mass.	
RK544	20	25	34	52	—		
RK545	14.1	16.8	21	29	42		
RK564	63	75	95	130	190		
RK566	58	65	76	87	108		
RK596	260	290	340	390	480		
RK599	2.2	3.1	4.5	6.7	—		3.3
RK5913	10	14	20	30	—		15
RK543-T □	15.7	18	22	27	33		9
RK564-T □	70	80	100	120	150		40
RK596-T □	49	56	67	78	90	22	
RK544-N □	220	250	300	350	400	100	
RK544-N □	22	27	33	42	—	22	
RK566-N5	100	120	150	190	—	100	
RK566-N5	45	49	56	63	72	22 100	
RK566-N7.2	200	220	250	280	320		
RK566-N10	56	60	67	76	87		
RK566-N10	250	270	300	340	390		
RK564-N25	74	81	90	101	117		
RK564-N36	330	360	400	450	520		
RK564-N50	108	117	123	130	139		
RK599-N5	480	520	550	580	620		
RK599-N7.2	108	121	135	153	177		
RK599-N10	480	540	600	680	790		
RK596-N25	191	210	230	240	260	67 300	
RK596-N25	850	940	1050	1110	1190		
RK596-N36	200	230	250	270	290		
RK596-N36	930	1030	1150	1220	1300		
RK596-N50	230	260	290	310	330		
RK596-N50	1050	1160	1300	1380	1490		
RK543-H □	40	49	60	81	114		49
RK543-H □	180	220	270	360	510		220
RK564-H □	72	83	99	123	162		101
RK564-H □	320	370	440	550	720		450
RK596-H □	240	250	270	290	310	290	
RK596-H □	1090	1150	1230	1310	1410	1300	

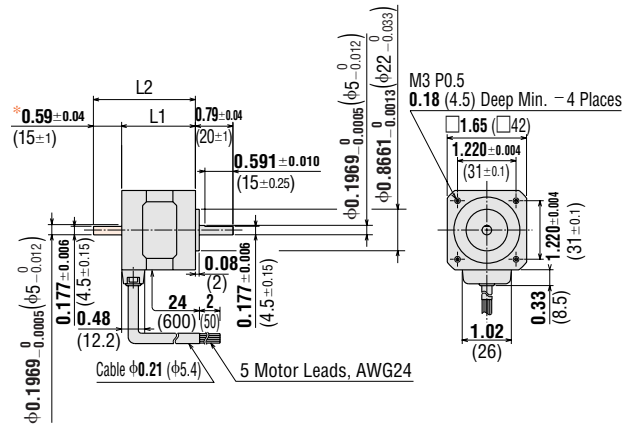
• Enter the gear ratio in the box (□) within the model numbers.

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

● Motor

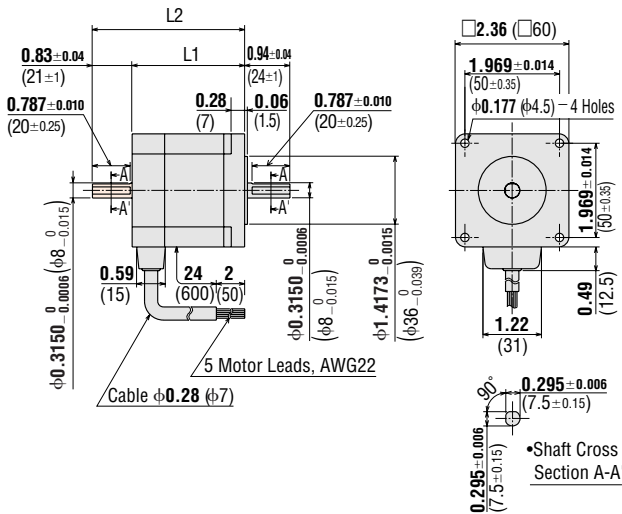
◆ Standard Type

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

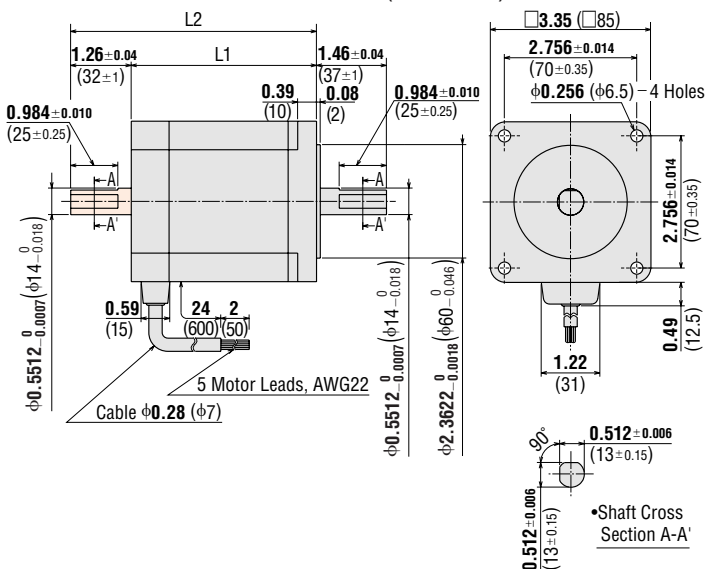


* The length of machining on double shaft model is 0.591 ± 0.010 (15±0.25).

2 Motor Frame Size: □2.36 in. (□60 mm)



3 Motor Frame Size: □3.35 in. (□85 mm)



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

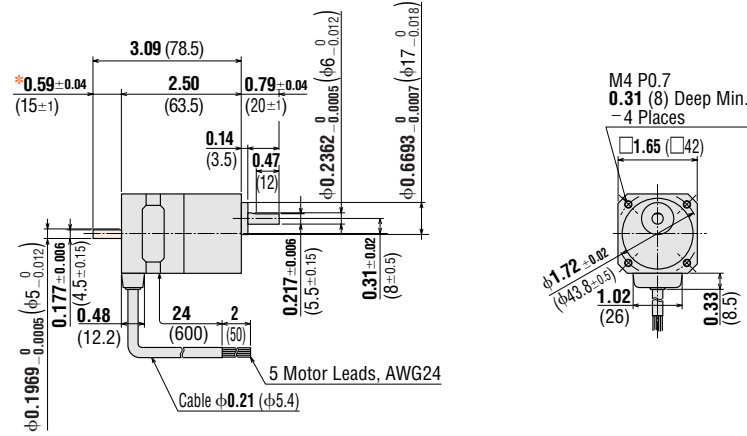
Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
RK543AA	PK543AW	1.3 (33)	—	0.55 (0.25)	B001
RK543BA	PK543BW		1.89 (48)		
RK544AA	PK544AW	1.54 (39)	—	0.66 (0.3)	B002
RK544BA	PK544BW		2.13 (54)		
RK545AA	PK545AW	1.85 (47)	—	0.88 (0.4)	B003
RK545BA	PK545BW		2.44 (62)		

Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
RK564AA	PK564AW	1.91 (48.5)	—	1.3 (0.6)	B004
RK564AC					
RK564BA	PK564BW	2.74 (69.5)	—	1.8 (0.8)	B005
RK564BC					
RK566AA	PK566AW	2.34 (59.5)	—	2.9 (1.3)	B006
RK566AC					
RK566BA	PK566BW	3.17 (80.5)	—	2.9 (1.3)	B006
RK566BC					
RK569AA	PK569AW	3.50 (89)	—	2.9 (1.3)	B006
RK569AC					
RK569BA	PK569BW	4.33 (110)	—	2.9 (1.3)	B006
RK569BC					

Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
RK596AA	PK596AW	2.68 (68)	—	3.7 (1.7)	B007
RK596AC					
RK596BA	PK596BW	3.94 (100)	—	6.2 (2.8)	B008
RK596BC					
RK599AA	PK599AW	3.86 (98)	—	8.4 (3.8)	B009
RK599AC					
RK599BA	PK599BW	5.12 (130)	—	8.4 (3.8)	B009
RK599BC					
RK5913AA	PK5913AW	5.04 (128)	—	8.4 (3.8)	B009
RK5913AC					
RK5913BA	PK5913BW	6.3 (160)	—	8.4 (3.8)	B009
RK5913BC					

◆ TH Geared Type

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

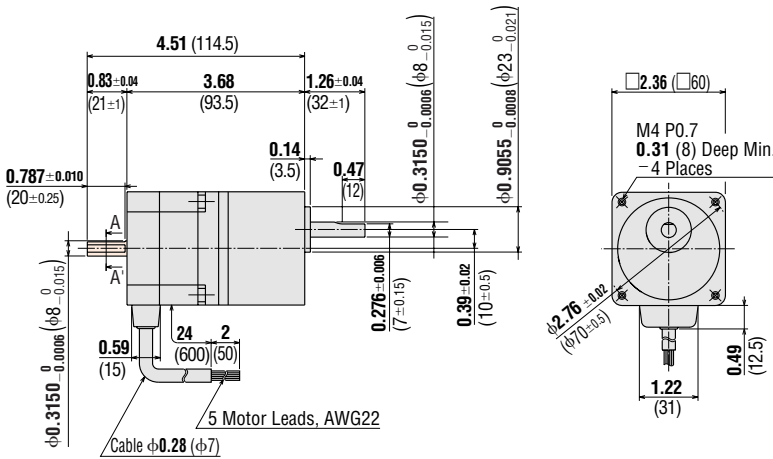


* The length of machining on double shaft model is 0.591 ± 0.010 (15±0.25).

Model	Motor Model	Gear Ratio	Weight lb. (kg)	DXF
RK543AA-T □	PK543AW-T□	3.6, 7.2	0.77 (0.35)	B183
RK543BA-T □	PK543BW-T□	10, 20, 30		

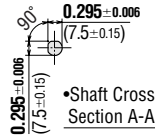
• Enter the gear ratio in the box (□) within the model number.

5 Motor Frame Size: □2.36 in. (□60 mm)

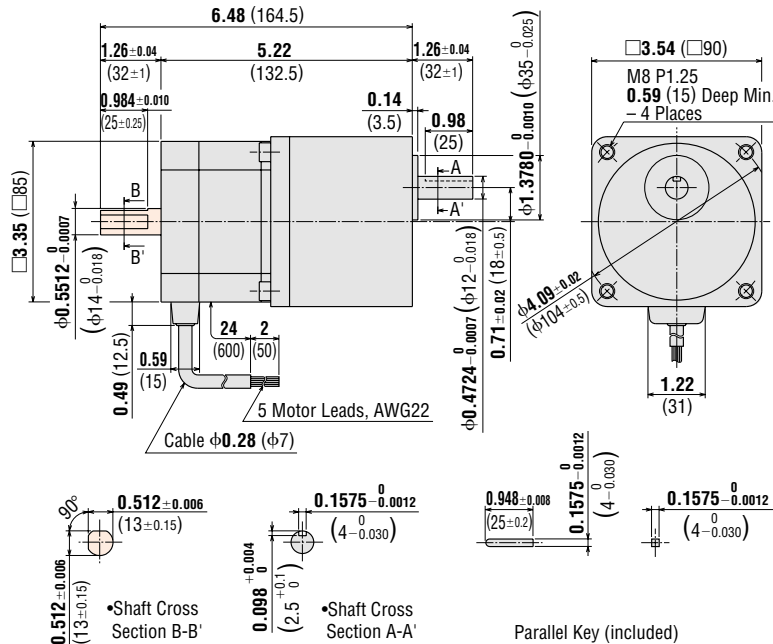


Model	Motor Model	Gear Ratio	Weight lb. (kg)	DXF
RK564AA-T □	PK564AW-T□	3.6, 7.2	2.1 (0.95)	B187
RK564AC-T □	PK564BW-T□			
RK564BA-T □	PK564BW-T□	10, 20, 30		

• Enter the gear ratio in the box (□) within the model number.



6 Motor Frame Size: □3.54 in. (□90 mm)



Model	Motor Model	Gear Ratio	Weight lb. (kg)	DXF
RK596AA-T □	PK596AW-T□	3.6, 7.2	6.3 (2.85)	B188
RK596AC-T □	PK596AW1-T□	10, 20, 30		
RK596AA-T □	PK596AW1-T□	10, 20, 30		
RK596AC-T □	PK596BW-T□	3.6, 7.2		
RK596BA-T □	PK596BW-T□	3.6, 7.2		
RK596BC-T □	PK596BW1-T□	10, 20, 30		

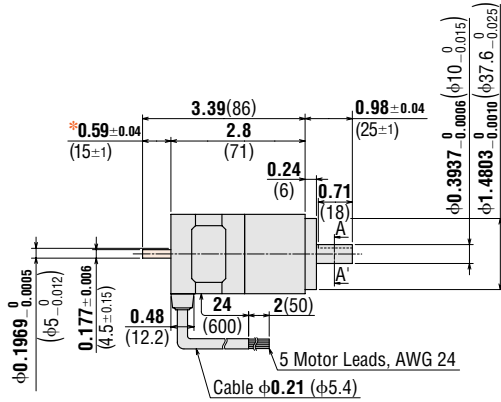
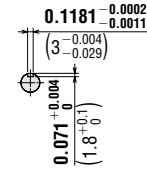
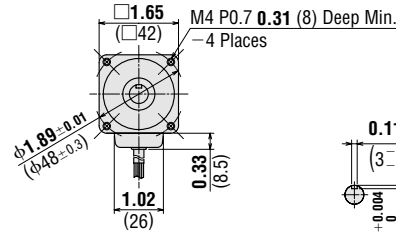
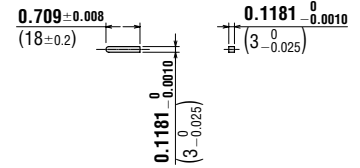
• Enter the gear ratio in the box (□) within the model number.

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

Introduction	Motor & Driver Packages	2-Phase Stepping Motors	Controllers
AS	Closed Loop <i>Q572P</i>	without Encoder	Low-Speed Synchronous Motors
AS PLUS	AC Input	with Encoder	Accessories
ASC	DC Input		Before Using a Stepping Motor
RK	5-Phase Microstep		
CRK II	AC Input		
CSK	DC Input		
PMC	5-Phase Full/Half		
UMK	AC Input		
CSK	DC Input		
PK/PV	2-Phase Full/Half		
PK	Encoder		
UI2120G	Driver with Indexer		
EMP401			
EMP402			
SG8030J			
SMK			

◆ PN Geared Type

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

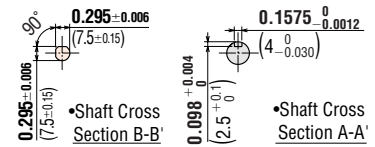
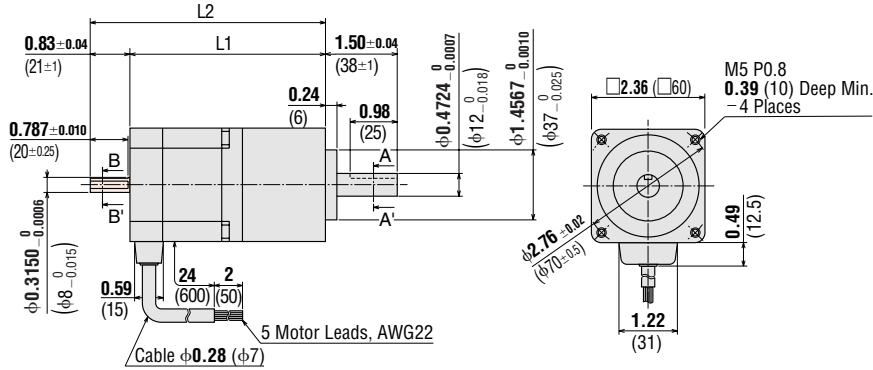
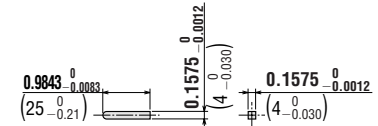
* The length of machining on double shaft model is 0.591 ± 0.010 (15±0.25).Shaft Cross
Section A-A'

Parallel Key (Included)

Model	Motor Model	Gear Ratio	Weight lb. (kg)	DXF
RK544AA-N □	PK544AW-N □	5, 7.2, 10	1.2 (0.56)	B312
RK544BA-N □	PK544BW-N □			

• Enter the gear ratio in the box (□) within the model number.

8 Motor Frame Size: □2.36 in. (□60 mm)

• Shaft Cross
Section B-B'• Shaft Cross
Section A-A'

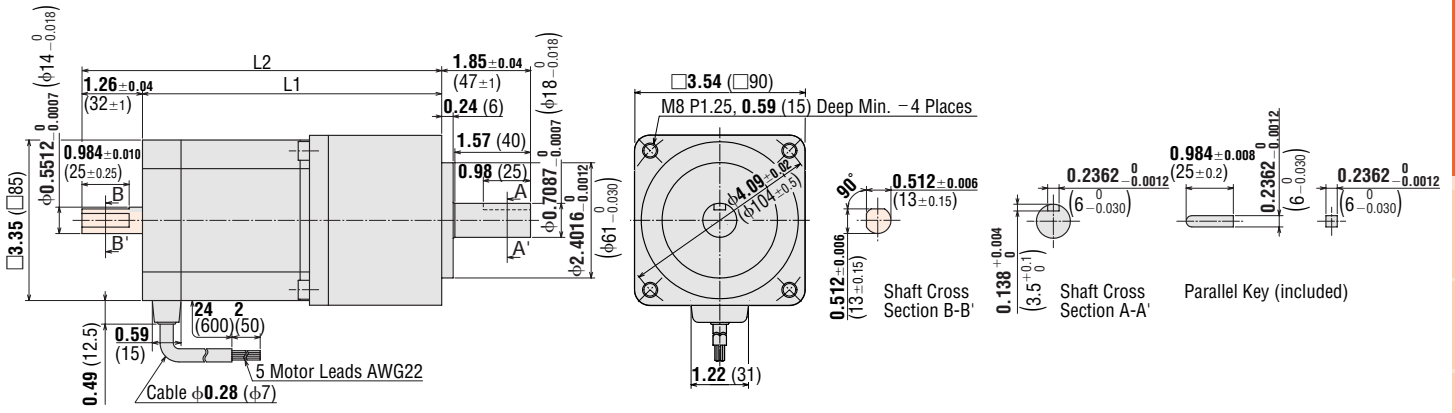
Parallel Key (Included)

Model	Motor Model	Gear Ratio	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
RK566AA-N □	PK566AW-N □	5, 7.2, 10	4.07 (103.5)	—	3.3 (1.5)	B190
RK566AC-N □	PK566BW-N □			4.90 (124.5)		
RK566BA-N □	PK566BW-N □			—		
RK564AA-N □	PK564AW-N □	25, 36, 50	4.27 (108.5)	—	3.3 (1.5)	B191
RK564AC-N □	PK564BW-N □			5.1 (129.5)		
RK564BA-N □	PK564BW-N □			—		

• Enter the gear ratio in the box (□) within the model number.

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

9 Motor Frame Size: □3.54 in. (□90 mm)

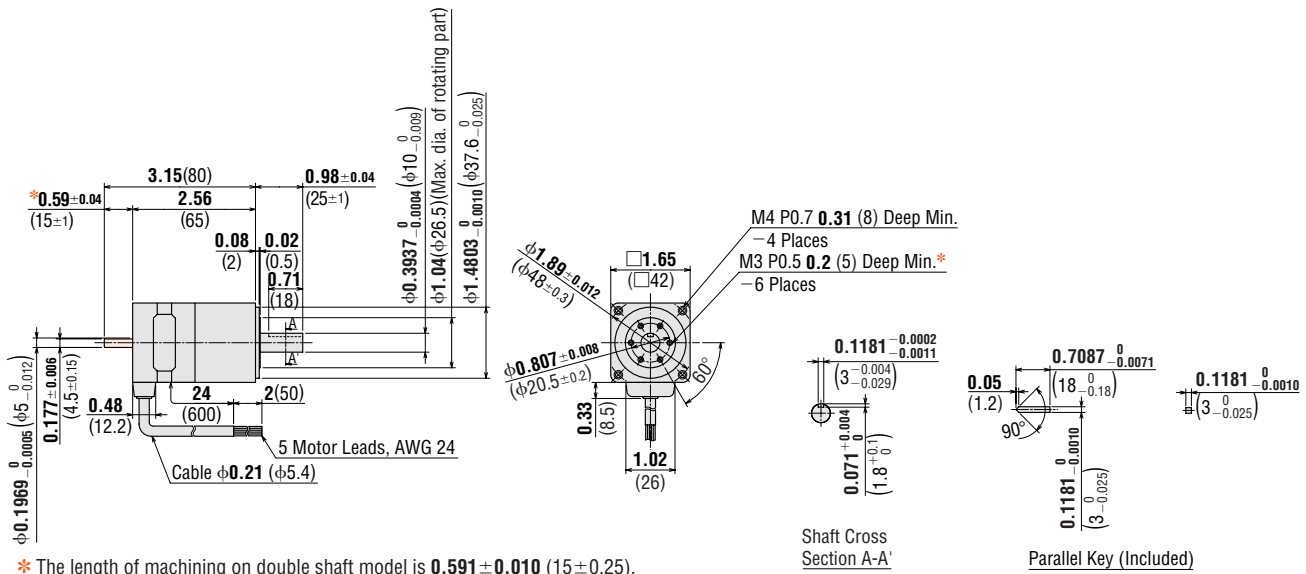


Model	Motor Model	Gear Ratio	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
RK599AA-N□	PK599AW-N□	5.7.2.10	6.22 (158)	—	11 (5.0)	B282
RK599AC-N□	PK599BW-N□			7.48 (190)		
RK599BA-N□	PK599BW-N□			—		
RK599BC-N□	PK599BW-N□	25.36.50	5.94 (151)	—	10 (4.7)	B283
RK596AA-N□	PK596AW-N□			7.20 (183)		
RK596AC-N□	PK596AW-N□			—		
RK596BA-N□	PK596BW-N□	—	—	—	—	—
RK596BC-N□	PK596BW-N□	—	—	—	—	—

• Enter the gear ratio in the box (□) within the model number.

◆ HG Geared Type

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



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

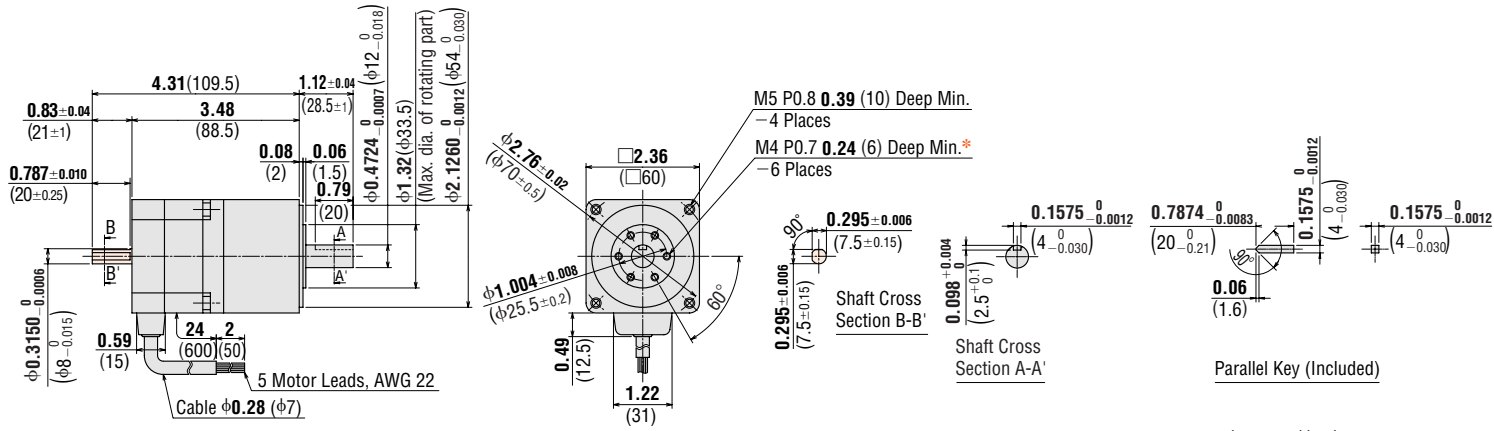
Model	Motor Model	Gear Ratio	Weight lb. (kg)	DXF
RK543AA-H□	PK543AW-H□S	50.100	1.0 (0.46)	B313
RK543BA-H□	PK543BW-H□S			

• Enter the gear ratio in the box (□) within the model number.

* The position of the key slot on the output shaft $\phi 0.3937$ ($\phi 10$) relative to the screw holes on a maximum diameter of $\phi 1.04$ ($\phi 26.5$) on the rotating part is arbitrary.

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

11 Motor Frame Size: □2.36 in. (□60 mm)

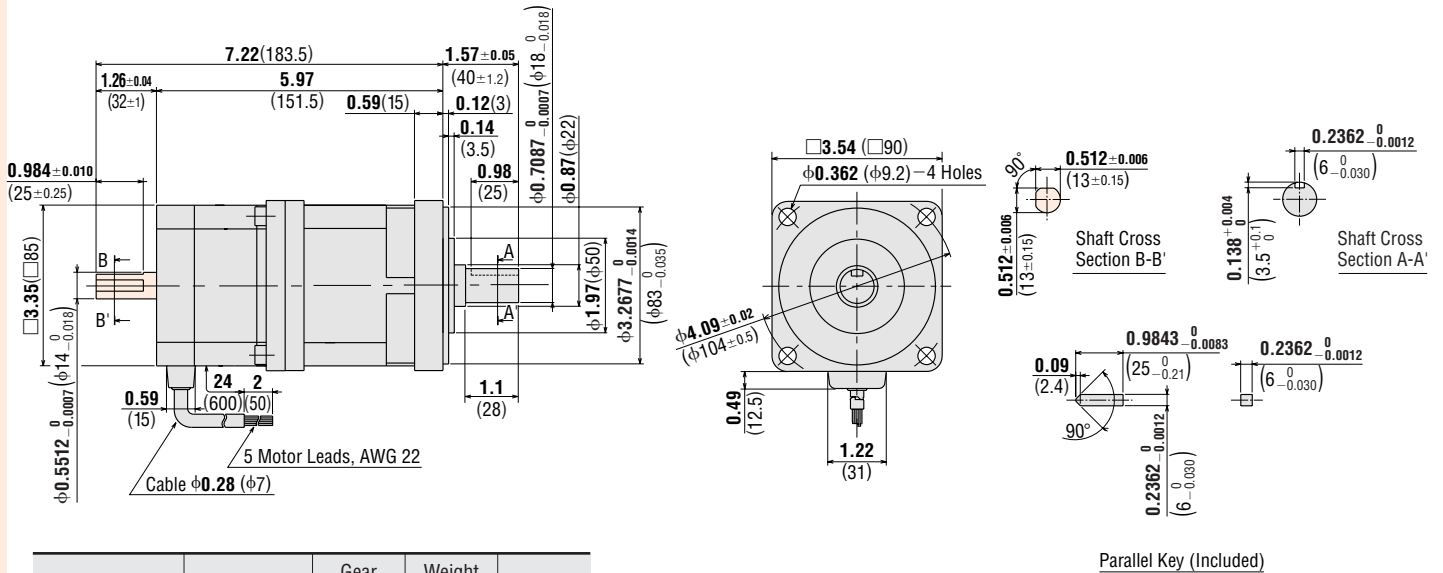


* The position of the key slot on the output shaft φ0.4724 (φ12) relative to the screw holes on a maximum diameter of φ1.32 (φ33.5) on the rotating part is arbitrary.

Model	Motor Model	Gear Ratio	Weight lb. (kg)	DXF
RK564AA-H□	PK564AW-H□S	50, 100	2.4 (1.08)	B314
RK564AC-H□				
RK564BA-H□	PK564BW-H□S	50, 100	2.4 (1.08)	B314
RK564BC-H□				

• Enter the gear ratio in the box (□) within the model number.

12 Motor Frame Size: □3.54 in. (□90 mm)



Model	Motor Model	Gear Ratio	Weight lb. (kg)	DXF
RK596AA-H□	PK596AW1-H□	50, 100	8.1 (3.7)	B136
RK596AC-H□				
RK596BA-H□	PK596BW1-H□	50, 100	8.1 (3.7)	B136
RK596BC-H□				

• Enter the gear ratio in the box (□) within the model number.

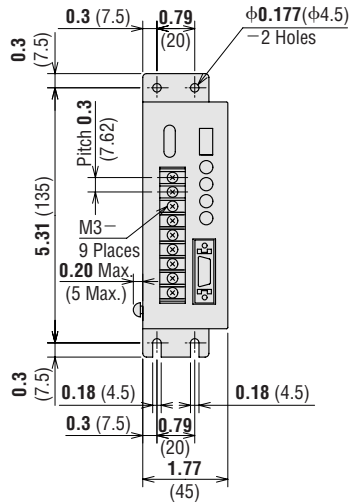
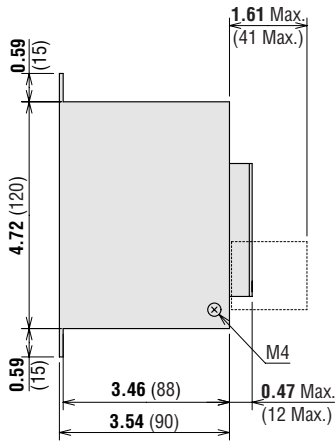
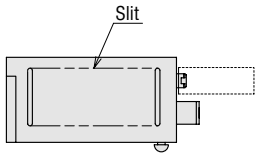
* These dimensions are for double shaft models. For single shaft models, ignore the shaded areas.

● Driver

13 RKD507-A

Weight: 0.88 lb. (0.4 kg)

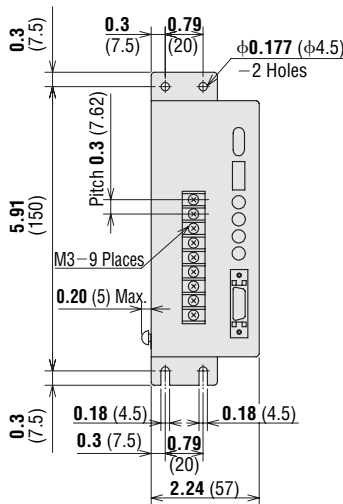
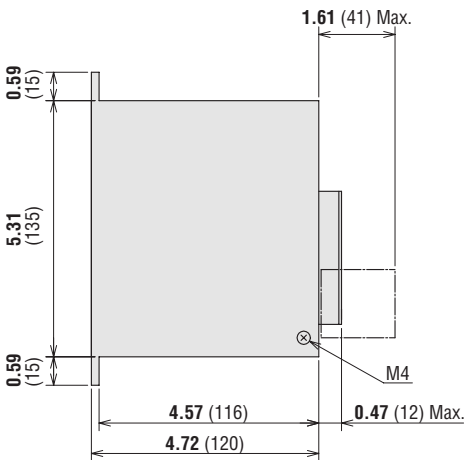
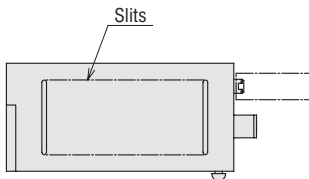
DXF B315



14 RKD514L-A, RKD514L-C, RKD514H-A, RKD514H-C

Weight: 1.9 lb. (0.85 kg)

DXF B284



● I/O Connector (included)

Connector: 54306-2011 (MOLEX)

Cover Assembly: 54331-1201 (MOLEX)

● I/O Connector (included)

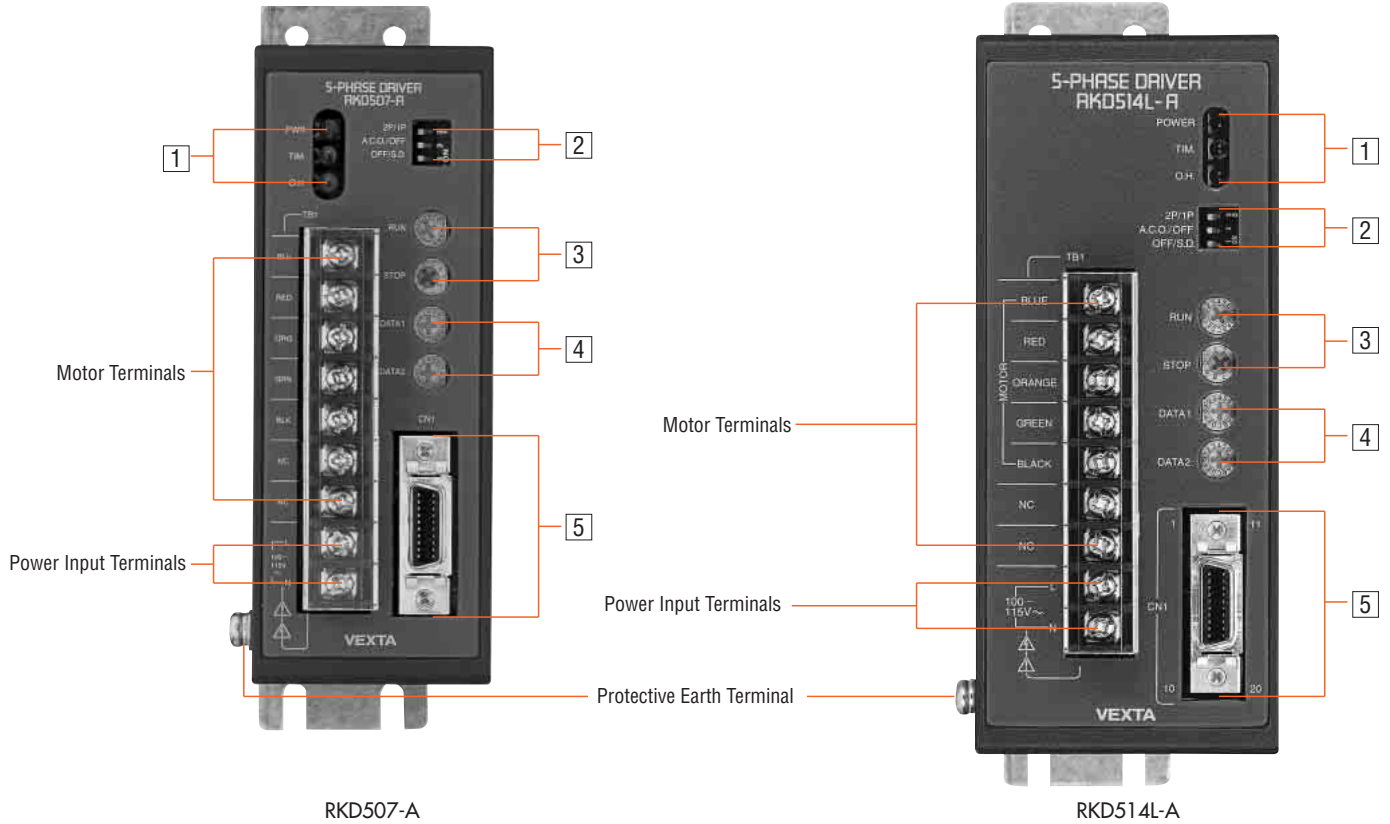
Connector: 54306-2011 (MOLEX)

Cover Assembly: 54331-1201 (MOLEX)

Introduction

		Motor & Driver Packages										2-Phase Stepping Motors		Controllers		Accessories	
AS	AS PLUS	ASC	RK	CRK II	CSK	PMC	UMK	CSK	PK/PV	PK	UI2120G	EMPA401	EMPA402	SG8030J	SMK	Before Using a Stepping Motor	
Closed Loop <i>Q57ZP</i>	AC Input	DC Input	DC Input	5-Phase Microstep	AC Input	DC Input	5-Phase Full/Half	DC Input	2-Phase Full/Half	AC Input	DC Input	2-Phase Full/Half	without Encoder	with Encoder	Driver with Indexer		
															Low-Speed Synchronous Motors		

Connection and Operation



RKD507-A

RKD514L-A

1 LED Monitor Display

Indication	Color	Function
POWER	Green	Power Input Display
TIM.	Green	Excitation Timing Output Display
O.H.	Red	Overheat Output Display

4 Resolution Switches

Indication	Switch Name	Function
DATA1	Step Angle Switch	Each switch can be set to the desired resolution from the 16 resolution levels.
DATA2		

2 Function Select Switches

Indication	Switch Name	Function
2P/1P	Pulse Input Mode Switch	Switches between 1-pulse input and 2-pulse input.
A.C.O./OFF	Automatic Current Off Function Switch	When the temperature inside the driver rises above 176°F (80°C), this function automatically switches the motor current off. The function can be set and defeated with this switch.
OFF/S.D.	Smooth Drive Function Switch	Low vibration and low noise operation are available even in the low speed range without changing the step angle setting. The function can be set and defeated with this switch.

3 Current Adjustment Switches

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

5 Input/Output Signals

Indication	Terminal No.	Input/Output	Terminal Name
CN1	1	Input Signals	Pulse Signal (CW Pulse Signal)
	2		
	3		Rotation Direction Signal (CCW Pulse Signal)
	4		
	5		All Windings Off Signal
	6		Step Angle Select Signal
	7		
	8		Output Signals
17			
18	Overheat Signal		
19			
20			

● Setting the Step Angles (Resolution)

The driver can be preset to two different step angles (resolutions) using the step angle select switches DATA1 and DATA2. Use these switches to set the desired resolution from the 16 resolution levels available. (Refer to the table below.) After setting the two step angles (resolutions), use the step angle select signal to change the step angle.

Photocoupler OFF: Step angle (resolution) set by DATA1 is selected

Photocoupler ON: Step angle (resolution) set by DATA2 is selected

◆ Standard Type

Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle
0	1	0.72°
1	2	0.36°
2	2.5	0.288°
3	4	0.18°
4	5	0.144°
5	8	0.09°
6	10	0.072°
7	20	0.036°
8	25	0.0288°
9	40	0.018°
A	50	0.0144°
B	80	0.009°
C	100	0.0072°
D	125	0.00576°
E	200	0.0036°
F	250	0.00288°

◆ TH Geared Type

Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle at Output Shaft				
		Gear Ratio 3.6:1	Gear Ratio 7.2:1	Gear Ratio 10:1	Gear Ratio 20:1	Gear Ratio 30:1
0	1	0.2°	0.1°	0.072°	0.036°	0.024°
1	2	0.1°	0.05°	0.036°	0.018°	0.012°
2	2.5	0.08°	0.04°	0.0288°	0.0144°	0.0096°
3	4	0.05°	0.025°	0.018°	0.009°	0.006°
4	5	0.04°	0.02°	0.0144°	0.0072°	0.0048°
5	8	0.025°	0.0125°	0.009°	0.0045°	0.003°
6	10	0.02°	0.01°	0.0072°	0.0036°	0.0024°
7	20	0.01°	0.005°	0.0036°	0.0018°	0.0012°
8	25	0.008°	0.004°	0.00288°	0.00144°	0.00096°
9	40	0.005°	0.0025°	0.00188°	0.0009°	0.0006°
A	50	0.004°	0.002°	0.00144°	0.00072°	0.00048°
B	80	0.0025°	0.00125°	0.0009°	0.00045°	0.0003°
C	100	0.002°	0.001°	0.00072°	0.00036°	0.00024°
D	125	0.0016°	0.0008°	0.000576°	0.000288°	0.000192°
E	200	0.001°	0.0005°	0.00036°	0.00018°	0.00012°
F	250	0.0008°	0.0004°	0.000288°	0.000144°	0.000096°

◆ PN Geared Type

Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle at Output Shaft					
		Gear Ratio 5:1	Gear Ratio 7.2:1	Gear Ratio 10:1	Gear Ratio 25:1	Gear Ratio 36:1	Gear Ratio 50:1
0	1	0.144°	0.1°	0.072°	0.0288°	0.02°	0.0144°
1	2	0.072°	0.05°	0.036°	0.0144°	0.01°	0.0072°
2	2.5	0.0576°	0.04°	0.0288°	0.01152°	0.008°	0.00576°
3	4	0.036°	0.025°	0.018°	0.0072°	0.005°	0.0036°
4	5	0.0288°	0.02°	0.0144°	0.00576°	0.004°	0.00288°
5	8	0.018°	0.0125°	0.009°	0.0036°	0.0025°	0.0018°
6	10	0.0144°	0.01°	0.0072°	0.00288°	0.002°	0.00144°
7	20	0.0072°	0.005°	0.0036°	0.00144°	0.001°	0.00072°
8	25	0.00576°	0.004°	0.00288°	0.001152°	0.0008°	0.000576°
9	40	0.0036°	0.0025°	0.0018°	0.00072°	0.0005°	0.00036°
A	50	0.00288°	0.002°	0.00144°	0.000576°	0.0004°	0.000288°
B	80	0.0018°	0.00125°	0.0009°	0.00036°	0.00025°	0.00018°
C	100	0.00144°	0.001°	0.00072°	0.000288°	0.0002°	0.000144°
D	125	0.001152°	0.0008°	0.000576°	0.0002304°	0.00016°	0.0001152°
E	200	0.00072°	0.0005°	0.00036°	0.000144°	0.0001°	0.000072°
F	250	0.000576°	0.0004°	0.000288°	0.0001152°	0.00008°	0.0000576°

◆ HG Geared Type

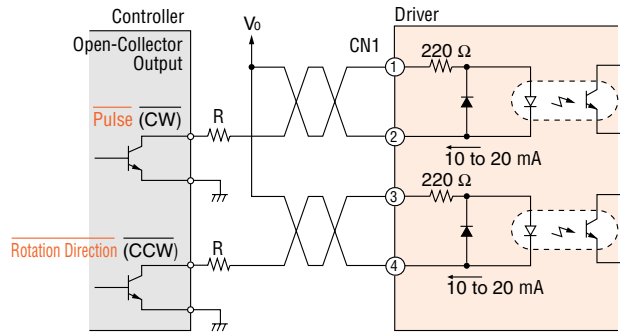
Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle at Output Shaft	
		Gear Ratio 50:1	Gear Ratio 100:1
0	1	0.0144°	0.0072°
1	2	0.0072°	0.0036°
2	2.5	0.00576°	0.00288°
3	4	0.0036°	0.0018°
4	5	0.00288°	0.00144°
5	8	0.0018°	0.0009°
6	10	0.00144°	0.00072°
7	20	0.00072°	0.00036°
8	25	0.000576°	0.000288°
9	40	0.00036°	0.00018°
A	50	0.000288°	0.000144°
B	80	0.00018°	0.00009°
C	100	0.000144°	0.000072°
D	125	0.0001152°	0.0000576°
E	200	0.000072°	0.000036°
F	250	0.0000576°	0.0000288°

Notes:

- Do not change the step angle input setting unless the pulse signal is at rest.
If the setting is changed while pulses are being input, a motor positional error may result.
- There is no positional error when changing the step angle with the motor is at rest.
- Step angle does not affect torque based on the shaft speed of the motor.

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

◆ Input Circuit and Sample Connection



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

Note:

- When V_0 is equal to 5 VDC, the external resistance (R) is not necessary. When V_0 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

The "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 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 Pulse Signal

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

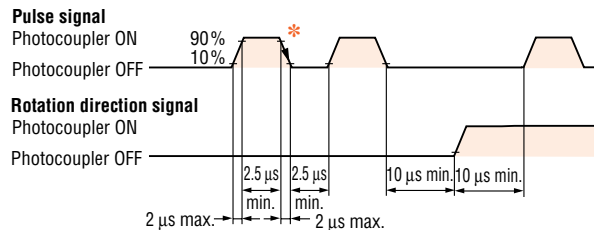
CCW Pulse Signal

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

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

◆ Pulse Waveform Characteristics

(Photocoupler state corresponding to the input pulse)



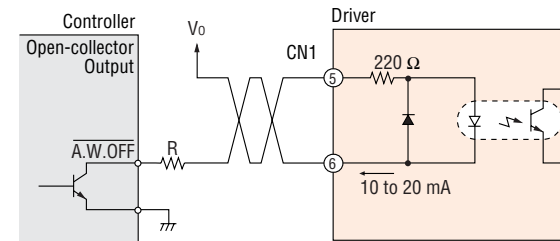
*The shaded area indicates when the photocoupler diode is ON. The motor moves when the photocoupler state changes from ON to OFF as indicated by the arrow.

◆ Pulse Signal Characteristics

- The pulse voltage is 4.5 to 5 V in the "photocoupler ON" state, and 0 to 1 V in the "photocoupler OFF" state.
- Input pulse signals should have a pulse width over 2.5 μ s, pulse rise/fall below 2 μ s, and a pulse duty below 50%.
- Keep the pulse signal at the "photocoupler OFF" state when no pulses are being input.
- The minimum interval time when changing rotation direction is 10 μ s. 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 V_0 is equal to 5 VDC, the external resistance (R) is not necessary. When V_0 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.

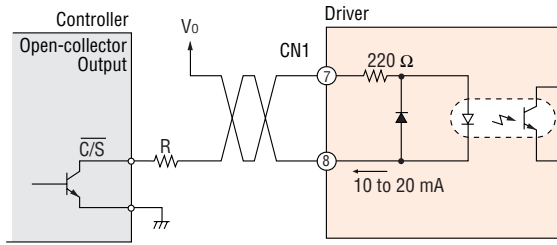
When the "All Windings Off" signal is in the "photocoupler OFF" state, the motor holding torque is proportional to the current set by the current adjustment rotary switches. During motor operation, be sure to keep the signal in the "photocoupler OFF" state.

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 $\pm 3.6^\circ$ from the position set after the "All Windings Off" signal is released.

Step Angle Select (C/S) Input Signal

◆ Input Circuit and Sample Connection

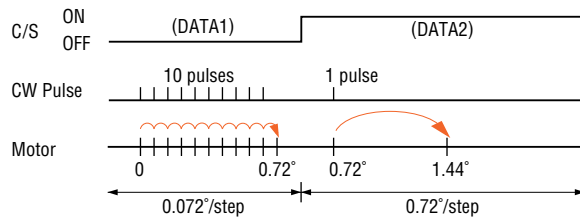


Note:

- When V_0 is equal to 5 VDC, the external resistance (R) is not necessary. When V_0 is above 5 VDC, connect the external resistance (R) and keep the input current between 10 mA and 20 mA.

You may select two step angles (resolutions) from 16 available step angles (resolutions) with the step angle select switches DATA1 and DATA2. When the signal is at "photocoupler OFF", a step angle set by DATA1 is selected; at "photocoupler ON", DATA2 is selected.

Example: Changing the step angle from 0.072° to 0.72° .

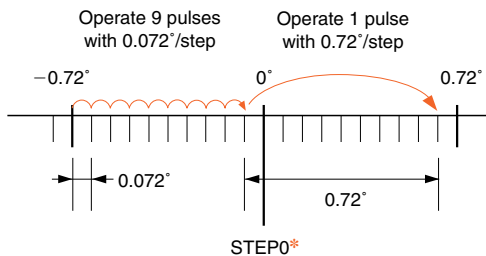


Notes:

- Be sure to change step angle setting inputs only when the pulse signals are at rest. Switching while moving may cause a positional error of the motor.
- There is no positional error if the step angle setting is changed with the motor at rest.
- When the step angle is changed by the "C/S" signal, the "TIMING" signal output shown below may become impossible for some combinations of step angles. When the "TIMING" signal is used, adjust the number of pulses so that the motor can operate with angles that are multiples of 7.2° .

Example:

After operate 9 pulses with $0.072^\circ/\text{step}$ setting, change the step angle $0.72^\circ/\text{step}$ and operate with 1 pulse. In this case, "Excitation Timing" signal will not be output because step 0 position is skipped.

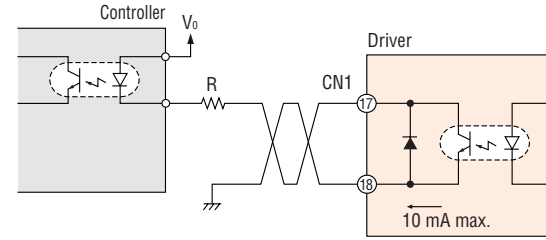


* "Excitation Timing" signal only output at step 0 sequence.

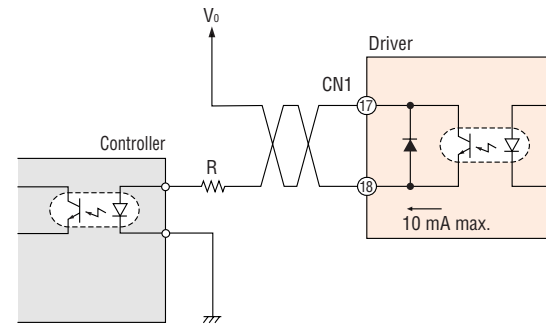
Excitation Timing (TIM.) Output Signal

◆ Output Circuit and Sample Connection

Current Sink Output



Current Source Output



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 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.

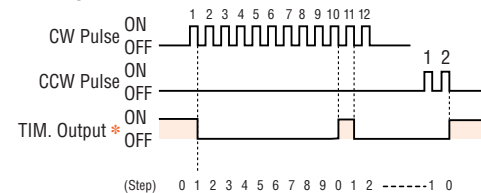
The "Excitation Timing" signal is output simultaneously with a pulse input each time the excitation sequence returns to step "0".

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

Resolution 1: Signal is output once every 10 pulses.

Resolution 10: Signal is output once every 100 pulses.

Timing chart at $0.72^\circ/\text{step}$ (Resolution 1)

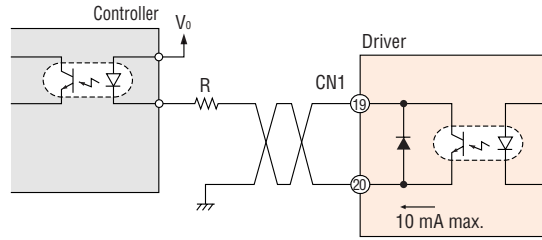


*When connected as shown in the example connection, the signal will be "photocoupler ON" at step "0".

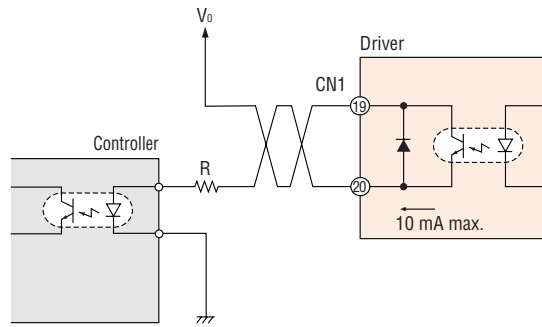
Overheat (O.HEAT) Output Signal

◆ Output Circuit and Sample Connection

Current Sink Output



Current Source Output



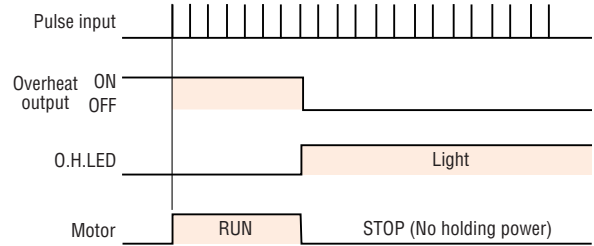
Note:

- 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 from heat damage if the internal temperature of the driver rises above 176°F (80°C).

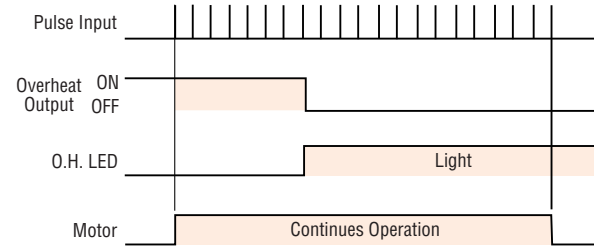
When connected as shown in the example connection, the signal will be "photocopler ON" during normal conditions, and "photocopler OFF" when the temperature exceeds 176°F (80°C).

When the "Overheat" signal is output, turn the driver power OFF, then adjust the operating conditions (ambient temperature, driver/controller settings), or use a fan to cool the driver. After taking appropriate measures, turn the power ON. Turning the power ON will reset the "Overheat" signal and release the "Automatic Current Off" condition.

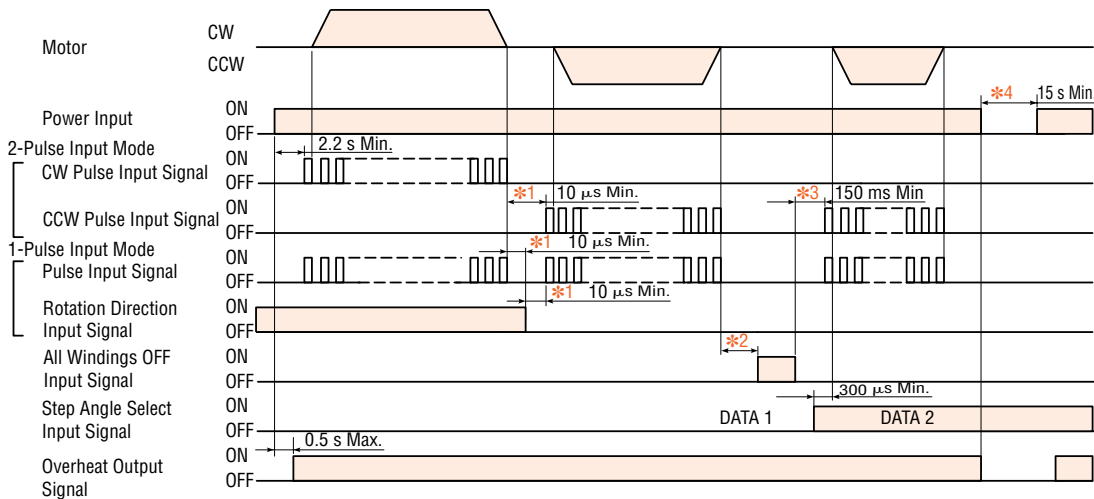


If the "Automatic Current Off" function switch is set to "OFF" position, the motor continues operation even when the "Overheat" signal is output. The output current does not cut off at this time.

When the "Overheat" signal is output, turn the driver power OFF, then adjust the operating conditions (ambient temperature, driver/controller settings), or use a fan to cool the driver. After taking appropriate measures, turn the power ON. Once the power has been turned OFF, wait at least 5 seconds before turning it ON again. After driver's temperature falls to 176°F (80°C) or less, turning the power ON will release the "Automatic Current Off" condition.



● Timing Chart



- *1 Switching time to change CW, CCW pulse (2-pulse input mode), and switching time to change direction (1-pulse input mode) 10 μs 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 Winding Off" signal to the photocopler off state. The motor may not start.
- *4 Wait at least 15 seconds before turning on the power.

Introduction

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Motor & Driver Packages

2-Phase Stepping Motors

Controllers

Low-Speed Synchronous Motors

Accessories

Before Using a Stepping Motor

List of Motor and Driver Combinations

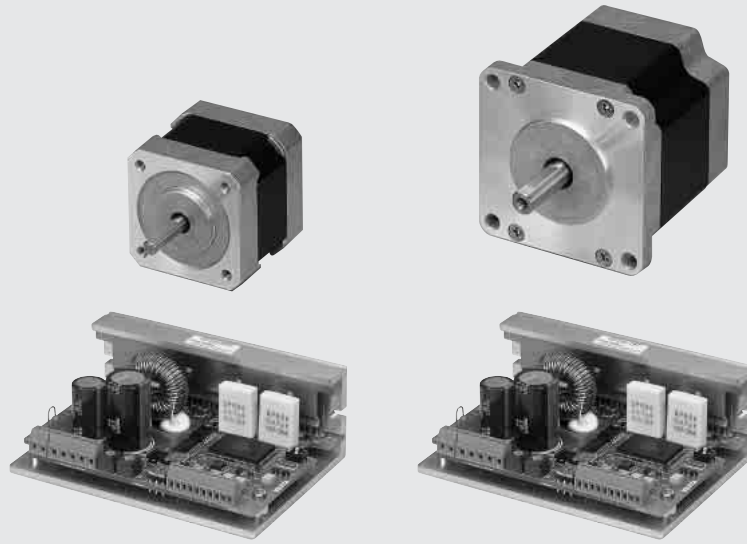
Model numbers for motor driver combinations are shown below.

Type	Model	Motor Model	Driver Model	
Standard	RK543 □ A RK544 □ A RK545 □ A	PK543□W PK544□W PK545□W	RKD507-A	
	RK564 □ A RK566 □ A RK569 □ A	PK564□W PK566□W PK569□W	RKD514L-A	
	RK596 □ A RK599 □ A RK5913 □ A	PK596□W PK599□W PK5913□W	RKD514H-A	
	RK564 □ C RK566 □ C RK569 □ C	PK564□W PK566□W PK569□W	RKD514L-C	
	RK596 □ C RK599 □ C RK5913 □ C	PK596□W PK599□W PK5913□W	RKD514H-C	
	TH Geared	RK543 □ A-T3.6 RK543 □ A-T7.2 RK543 □ A-T10 RK543 □ A-T20 RK543 □ A-T30	PK543□W-T3.6 PK543□W-T7.2 PK543□W-T10 PK543□W-T20 PK543□W-T30	RKD507-A
		RK564 □ A-T3.6 RK564 □ A-T7.2 RK564 □ A-T10 RK564 □ A-T20 RK564 □ A-T30	PK564□W-T3.6 PK564□W-T7.2 PK564□W-T10 PK564□W-T20 PK564□W-T30	RKD514L-A
		RK596 □ A-T3.6 RK596 □ A-T7.2 RK596 □ A-T10 RK596 □ A-T20 RK596 □ A-T30	PK596□W-T3.6 PK596□W-T7.2 PK596□W1-T10 PK596□W1-T20 PK596□W1-T30	RKD514H-A
		RK564 □ C-T3.6 RK564 □ C-T7.2 RK564 □ C-T10 RK564 □ C-T20 RK564 □ C-T30	PK564□W-T3.6 PK564□W-T7.2 PK564□W-T10 PK564□W-T20 PK564□W-T30	RKD514L-C
		RK596 □ C-T3.6 RK596 □ C-T7.2 RK596 □ C-T10 RK596 □ C-T20 RK596 □ C-T30	PK596□W-T3.6 PK596□W-T7.2 PK596□W1-T10 PK596□W1-T20 PK596□W1-T30	RKD514H-C

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

Type	Model	Motor Model	Driver Model	
PN Geared	RK544 □ A-N5 RK544 □ A-N7.2 RK544 □ A-N10	PK544□W-N5 PK544□W-N7.2 PK544□W-N10	RKD507-A	
	RK566 □ A-N5 RK566 □ A-N7.2 RK566 □ A-N10 RK564 □ A-N25 RK564 □ A-N36 RK564 □ A-N50	PK566□W-N5 PK566□W-N7.2 PK566□W-N10 PK564□W-N25 PK564□W-N36 PK564□W-N50	RKD514L-A	
	RK599 □ A-N5 RK599 □ A-N7.2 RK599 □ A-N10 RK596 □ A-N25 RK596 □ A-N36 RK596 □ A-N50	PK599□W-N5 PK599□W-N7.2 PK599□W-N10 PK596□W-N25 PK596□W-N36 PK596□W-N50	RKD514H-A	
	RK566 □ C-N5 RK566 □ C-N7.2 RK566 □ C-N10 RK564 □ C-N25 RK564 □ C-N36 RK564 □ C-N50	PK566□W-N5 PK566□W-N7.2 PK566□W-N10 PK564□W-N25 PK564□W-N36 PK564□W-N50	RKD514L-C	
	RK599 □ C-N5 RK599 □ C-N7.2 RK599 □ C-N10 RK596 □ C-N25 RK596 □ C-N36 RK596 □ C-N50	PK599□W-N5 PK599□W-N7.2 PK599□W-N10 PK596□W-N25 PK596□W-N36 PK596□W-N50	RKD514H-C	
	HG Geared	RK543 □ A-H50 RK543 □ A-H100	PK543□W-H50S PK543□W-H100S	RKD507-A
		RK564 □ A-H50 RK564 □ A-H100	PK564□W-H50S PK564□W-H100S	RKD514L-A
		RK564 □ C-H50 RK564 □ C-H100	PK564□W-H50S PK564□W-H100S	RKD514L-C
		RK596 □ A-H50 RK596 □ A-H100	PK596□W1-H50 PK596□W1-H100	RKD514H-A
		RK596 □ C-H50 RK596 □ C-H100	PK596□W1-H50 PK596□W1-H100	RKD514H-C

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



5-Phase Stepping Motor and Driver Package NanoStep® CFK II Series

Introduction

Motor & Driver Packages

2-Phase Stepping Motors

Controllers

Low-Speed Synchronous Motors

Accessories

Before Using a Stepping Motor

AS	AS PLUS	ASC	RK	CFK II	CSK	PMC	UMK	CSK	PK/PV	PK	UI2120G	EMP401	EMP402	SG8030J	SMK
Closed Loop <i>Q572P</i>		DC Input	5-Phase Microstep	5-Phase Full/Half	DC Input	2-Phase Full/Half	AC Input	DC Input	without Encoder	with Encoder	with Indexer	Controllers		Low-Speed Synchronous Motors	Accessories
AC Input		AC Input	DC Input	DC Input	DC Input	AC Input	DC Input	DC Input	Encoder	Encoder	Driver	EMP401	EMP402	SG8030J	SMK

Additional Information

Technical Reference	F-1
General Information	G-1

5-Phase Stepping Motor and Driver Package

NanoStep® CFK II Series

Offering high performance and simple operation in a compact size, the 5-phase **CFK II** Series microstepping driver and motor package is available in both standard and high speed versions. The **CFK II** Series provides unparalleled resolution and low vibration in an open loop system, as well as high torque in the high speed range.

■ Features

● Extensive Motor Selection

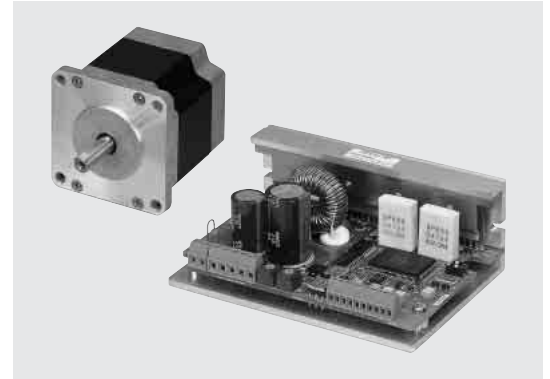
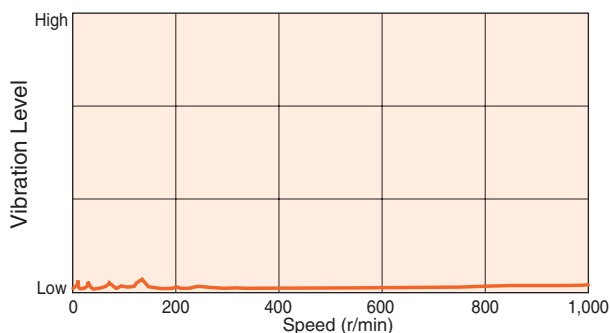
Oriental Motor has expanded the selection of its motors, which are now available in five frame sizes from □0.79 in. (20 mm) to □3.35 in. (85 mm) with torque ranging from 3.2 oz-in (0.0231 N-m) to 890 oz-in (6.3 N-m). The high-torque P-type, 0.79 in. (20 mm) square frame motor features our latest advances in technology providing high torque in a miniature motor, allowing for quick, easy connection.

● Compact, Highly Functional Board-Level Driver

The microstepping driver electronically divides the basic step angle of the motor by up to 250 (0.00288°) without the use of a reduction mechanism or other mechanical element. A total of 16 different step angles can easily be selected with a digital switch on the driver. The 24 VDC input driver has an automatic current cutback function and is capable of switching between two different step angles using a signal input. The excitation-timing signal output is convenient for detecting the mechanical home position. The size of this compact yet highly functional driver is 2.76 in. (70 mm) [W] × 3.94 in. (100 mm) [D] × 1.42 in. (36 mm) [H].

● Enables Low-Vibration Operation in the Low-Speed Range

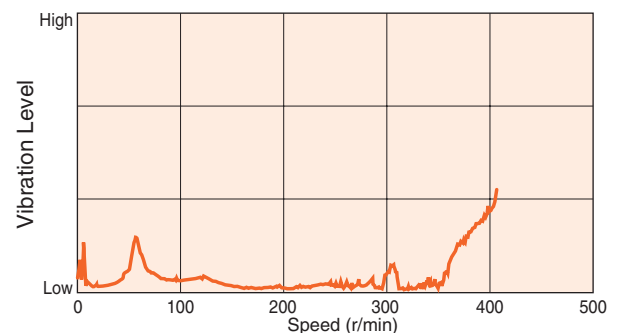
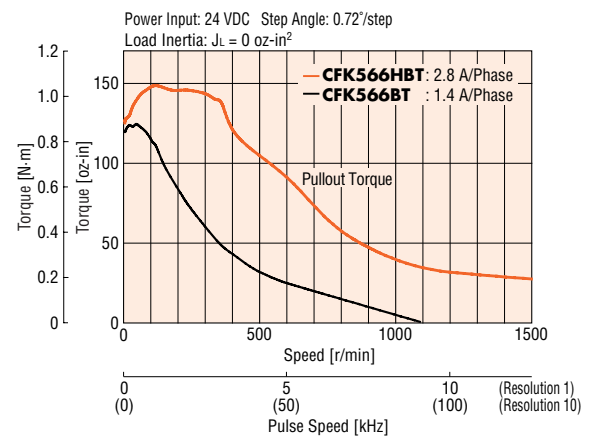
A typical 2-phase motor vibrates so much at 400 r/min, that it will start to lose synchronization (misstep). However, a typical 5-phase motor can go up to 1000 r/min without any significant increase in vibration.



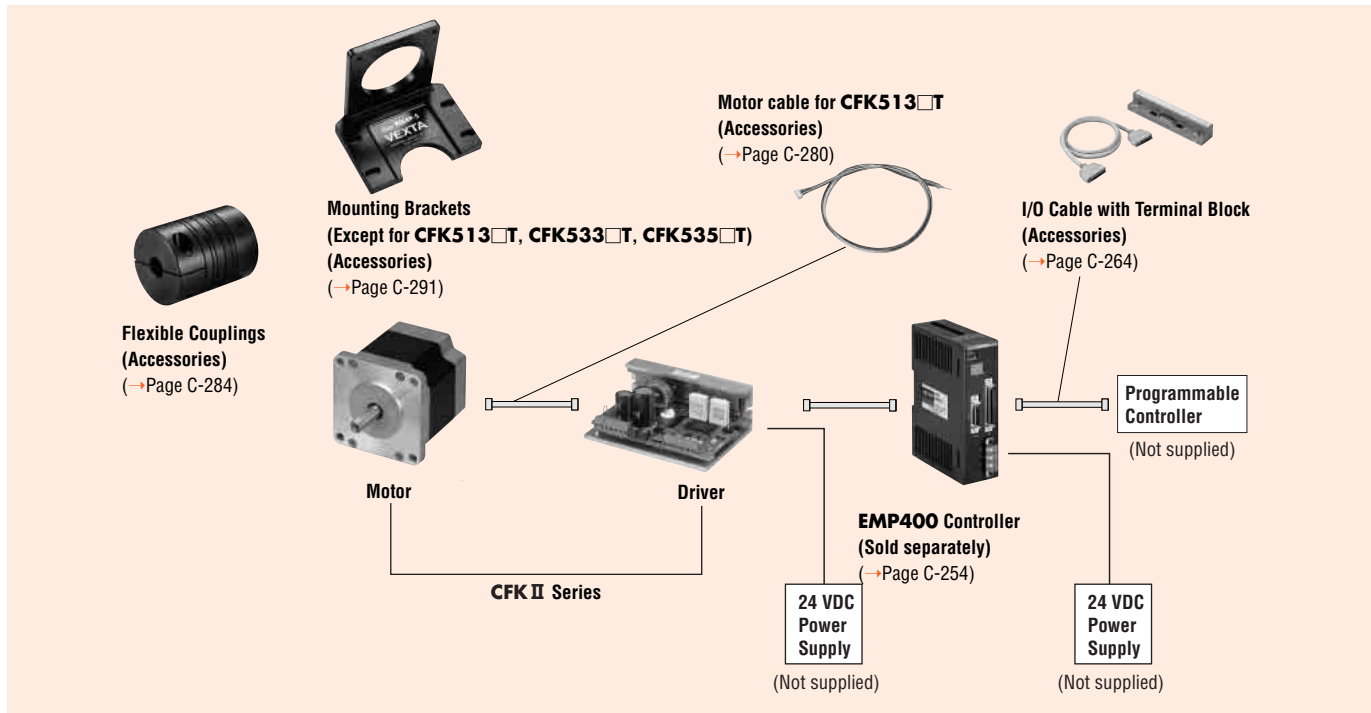
● High-Speed Versions Available

The high-speed versions provide more accurate positioning in the high-speed range, thereby reducing acceleration time.

◆ Comparisons of Speed-Torque Characteristics



System Configuration



An example of a single-axis system configuration with the **EMP400** Series controller.

Product Number Code

CFK 5 6 6 H A T

NanoStep
CFK II Series

5-Phase

Motor Case Length

Motor Frame Size **1**: 0.79 in. sq. (20 mm sq.)
3: 1.10 in. sq. (28 mm sq.)
4: 1.65 in. sq. (42 mm sq.)
6: 2.36 in. sq. (60 mm sq.)
9: 3.35 in. sq. (85 mm sq.)

H: High Speed Type
P: High Torque Type
Blank: Standard Type

Shaft Type **A**: Single Shaft
B: Double Shaft

Terminal Connection Type

Product Line

Type	Power Supply Voltage	Maximum Holding Torque				
		□0.79 in. (□20 mm)	□1.10 in. (□28 mm)	□1.65 in. (□42 mm)	□2.36 in. (□60 mm)	□3.35 in. (□85 mm)
High Torque Type	24 VDC	3.2 oz-in (0.0231 N·m)	—	—	—	—
Standard Type		—	4.6~8.5 oz-in (0.033~0.06 N·m)	18.4~34 oz-in (0.13~0.24 N·m)	59~230 oz-in (0.42~1.66 N·m)	—
High-Speed Type		—	—	—	117~230 oz-in (0.83~1.66 N·m)	290~890 oz-in (2.1~6.3 N·m)

High Torque Type Standard Type

 Motor Frame Size: 0.79 in. (20 mm)

 Motor Frame Size: 1.10 in. (28 mm)

Specifications

Model	Single Shaft		CFK513PAT ^{*1}	CFK533AT	CFK535AT
	Double Shaft		CFK513PBT ^{*1}	CFK533BT	CFK535BT
Maximum Holding Torque	oz-in (N·m)		3.2 (0.0231)	4.6 (0.033)	8.5 (0.06)
Rotor Inertia J	oz-in ² (kg·m ²)		0.0142 (2.6×10 ⁻⁷)	0.049 (9×10 ⁻⁷)	0.098 (18×10 ⁻⁷)
Rated Current	A/phase		0.35	0.75	
Basic Step Angle			0.72°		
Power Source Input			24 VDC ±10% 0.6 A	24 VDC ±10% 1 A	
Excitation Mode			Microstep: Basic Step Angle/n ^{*2} (/step)		
Weight	Motor	lb. (kg)	0.11 (0.05)	0.22 (0.1)	0.37 (0.17)
	Driver	lb. (kg)		0.44 (0.2)	
Dimension No.	Motor		1	2	
	Driver			6	

How to Read Specifications Table → Page C-9

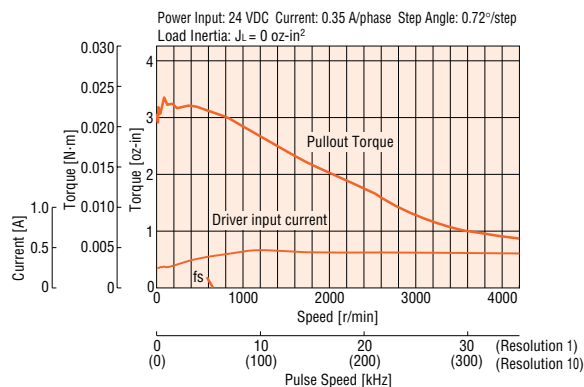
*1 A motor cable with a connector of [2 ft. (0.6 m)] is included with the motor and driver unit of connector type.

*2 Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

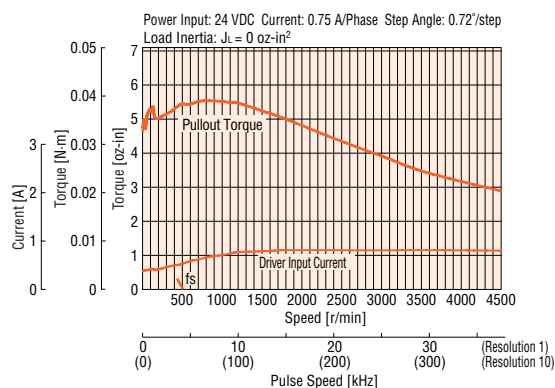
Speed — Torque Characteristics

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

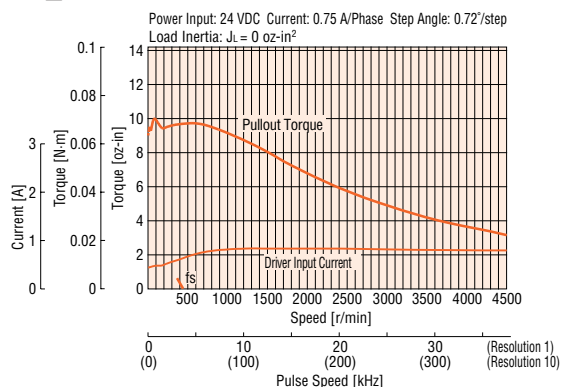
CFK513P□T



CFK533□T



CFK535□T



Note:

The pulse input circuit responds up to approximately 500 kHz with a pulse duty of 50%.

Standard Type Motor Frame Size: □ 1.65 in. (□ 42 mm), □ 2.36 in. (□ 60 mm)

Specifications

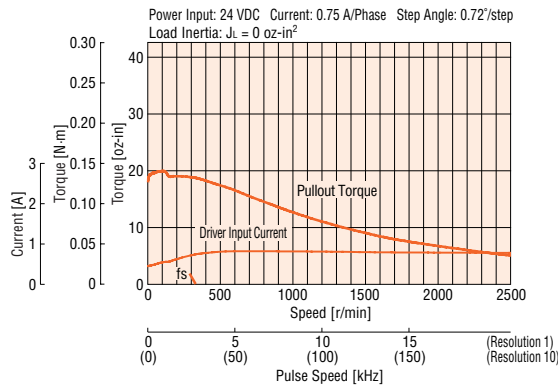
Model	Single Shaft		CFK543AT	CFK544AT	CFK545AT	CFK564AT	CFK566AT	CFK569AT
	Double Shaft		CFK543BT	CFK544BT	CFK545BT	CFK564BT	CFK566BT	CFK569BT
Maximum Holding Torque	oz-in (N·m)		18.4 (0.13)	25 (0.18)	34 (0.24)	59 (0.42)	117 (0.83)	230 (1.66)
Rotor Inertia J	oz-in ² (kg·m ²)		0.191 (35×10 ⁻⁷)	0.3 (54×10 ⁻⁷)	0.37 (68×10 ⁻⁷)	0.96 (175×10 ⁻⁷)	1.53 (280×10 ⁻⁷)	3.1 (560×10 ⁻⁷)
Rated Current	A/phase		0.75			1.4		
Basic Step Angle			0.72°					
Power Source Input			24 VDC±10% 1 A			24 VDC±10% 2 A		
Excitation Mode			Microstep: Basic Step Angle/n* (/step)					
Weight	Motor	lb. (kg)	0.46 (0.21)	0.59 (0.27)	0.77 (0.35)	1.3 (0.6)	1.8 (0.8)	2.9 (1.3)
	Driver	lb. (kg)	0.44 (0.2)					
Dimension No.	Motor		3			4		
	Driver		6					

How to Read Specifications Table → Page C-9

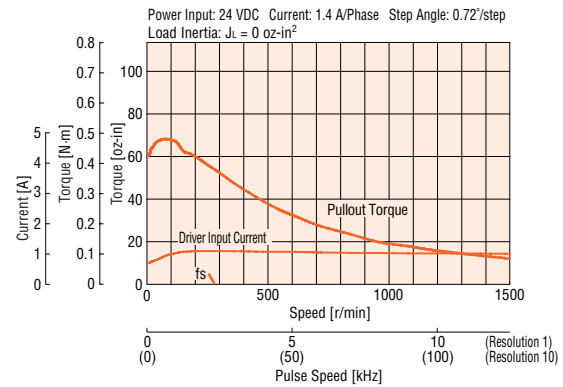
* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

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

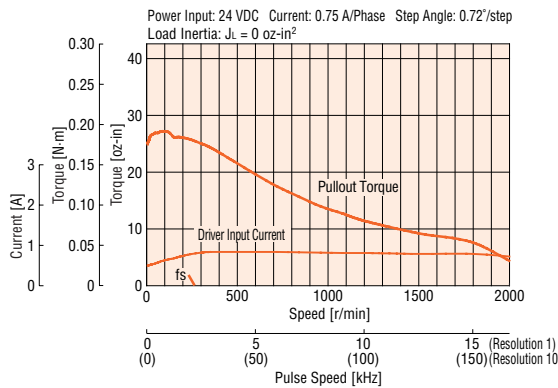
CFK543 □ T



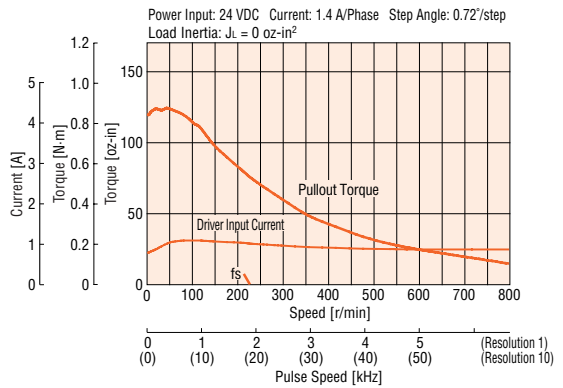
CFK564 □ T



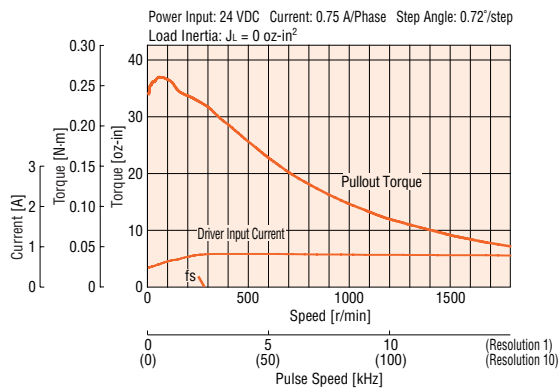
CFK544 □ T



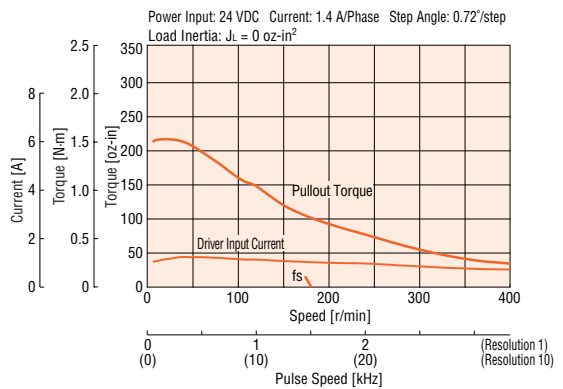
CFK566 □ T



CFK545 □ T



CFK569 □ T



Note:
The pulse input circuit responds up to approximately 500 kHz with a pulse duty of 50 %.

High-Speed Type

Motor Frame Size: 2.36 in. (60 mm), 3.35 in. (85 mm)

Specifications

Model	Single Shaft		CFK566HAT	CFK569HAT	CFK596HAT	CFK599HAT	CFK5913HAT
	Double Shaft		CFK566HBT	CFK569HBT	CFK596HBT	CFK599HBT	CFK5913HBT
Maximum Holding Torque	oz-in (N·m)		117 (0.83)	230 (1.66)	290 (2.1)	580 (4.1)	890 (6.3)
Rotor Inertia J	oz-in ² (kg·m ²)		1.53 (280×10 ⁻⁷)	3.1 (560×10 ⁻⁷)	7.7 (1400×10 ⁻⁷)	14.8 (2700×10 ⁻⁷)	22 (4000×10 ⁻⁷)
Rated Current	A/phase		2.8				
Basic Step Angle			0.72°				
Power Source Input			24 VDC±10% 4 A				
Excitation Mode			Microstep: Basic Step Angle/n* (/step)				
Weight	Motor	lb. (kg)	1.8 (0.8)	2.9 (1.3)	3.7 (1.7)	6.2 (2.8)	8.4 (3.8)
	Driver	lb. (kg)	0.48 (0.22)				
Dimension No.	Motor		4		5		
	Driver		6				

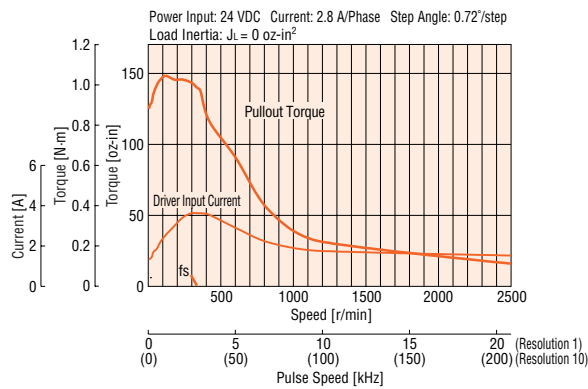
How to Read Specifications Table → Page C-9

* Sixteen resolutions are available, where n=1, 2, 2.5, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200 and 250.

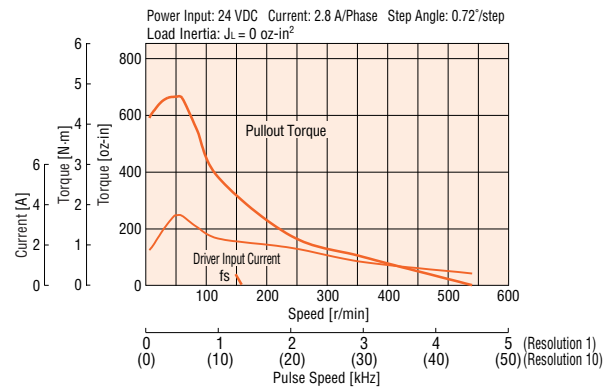
Speed — Torque Characteristics

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

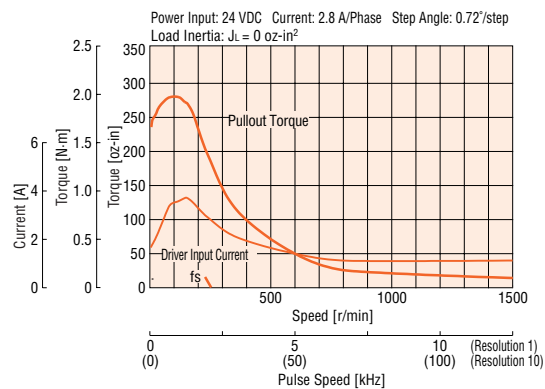
CFK566H□T



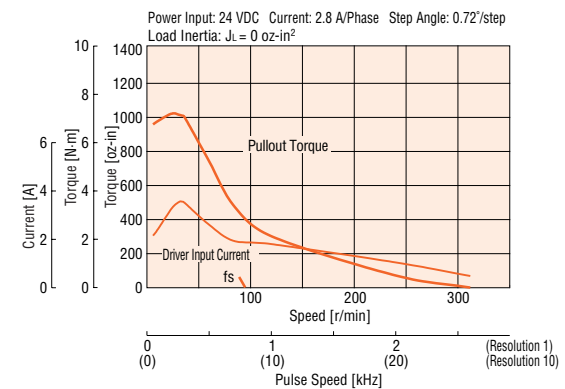
CFK599H□T



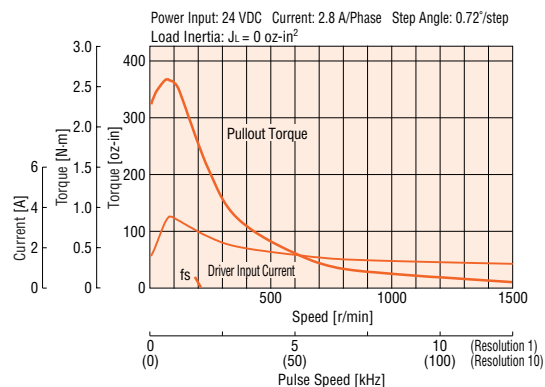
CFK569H□T



CFK5913H□T



CFK596H□T



Note:

The pulse input circuit responds up to approximately 500 kHz with a pulse duty of 50 %.

Common Specifications

Input Signal	Input Mode	Photocoupler input Signal Voltage Photocoupler "ON": +4.5~+5V Photocoupler "OFF": 0~+1 V (Voltage between terminals) Pulse, Direction Rotation Input: 20 mA maximum, input resistance 220 Ω All Windings OFF, Step Angle Select Input: 15 mA maximum, input resistance 470Ω
	Pulse Signal	Step command pulse signal (CW direction operation command signal in 2-pulse input mode) Pulse width: 1 μs minimum, pulse rise/fall: 2 μs maximum, Pulse duty : Max. 50 % The motor moves one step when the pulse input is switched from photocoupler On to Off. Maximum Input Pulse Frequency 500 kHz (When the pulse duty is 50 %) Negative logic pulse input.
	Rotation Direction Signal	Rotation direction command signal, Photocoupler "ON": CW; Photocoupler "OFF": CCW CCW direction operation command signal in 2-pulse input mode Pulse width: 1 μs minimum, pulse rise/fall: 2 μs maximum, Pulse duty : Max. 50 % The motor moves one step when the pulse input is switched from photocoupler On to Off. Maximum Input Pulse Frequency 500 kHz (When the pulse duty is 50 %) Negative logic pulse input.
	Step Angle Select Signal	Step angle specified by DATA1 when photocoupler is OFF. Step angle specified by DATA2 when photocoupler is ON.
	All Windings Off Signal	When in the "photocoupler ON" state, the output current to the motor is cut off and the motor's shaft can be rotated manually. When in the "photocoupler OFF" state, the operating current is supplied to the motor.
Output Signal	Output Mode	Photocoupler, Open collector output, External usage conditions: 24 VDC maximum, 10 mA maximum.
	Excitation Timing Signal	The signal is output each time the excitation sequence returns to the initial stage "0". (Photocoupler: ON) e.g. 0.72°/step (resolution 1): Signal output every 10 pulses; or 0.072°/step (resolution 10); Signal output every 100 pulses
	Functions	Step angle switch, Pulse input mode switch, Current check switch, Automatic current cutback
	Cooling Method	Natural ventilation

- The input power current supplied to the driver represents the maximum input value (which varies with pulse speed).

General Specifications

		Motor	Driver
Insulation Resistance		100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC megger between the windings and case.	—
Dielectric Strength		Sufficient to withstand 1.5 kV (CFK513 □T, CFK53 □T: 0.5 kV, CFK54 □T: 1.0 kV), 50 Hz power applied between the windings and casing for one minute under normal temperature and humidity.	—
Insulation Class		Class B [266°F (130°C)] Recognized as Class A [221°F (105°C)] by UL and CSA standards.	—
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 (noncondensing)	
	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, five phases energized)	—
Static Angle Error*1		±3 arc minutes (±0.05°) [CFK513: ±10 arc minutes (±0.17°), CFK53□: ±5 arc minutes (±0.084°)]	—
Shaft Runout		0.002 inch (0.05 mm) T.I.R.*4	—
Radial Play*2		0.001 inch (0.025 mm) max. [Load torque: 1.12 lb. (5 N)]	—
Axial Play*3		0.003 inch (0.075 mm) max. [Load torque: 2.2 lb. (10 N)]	—
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 with no load (value changes with size of load).

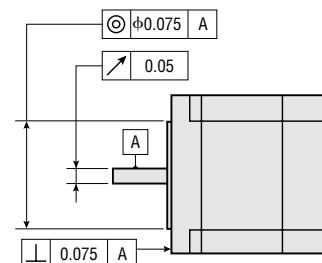
*2 Radial Play: Displacement in shaft position in the radial direction, when a 1.12 lb. (5 N) load is applied in the vertical direction to the tip of the motor's shaft.

*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 measured section is rotated one revolution centered on a reference axis.

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: lb./Lower values: N

Model	Overhung Load					Thrust Load
	0 (0)	0.2 (5)	Distance from Shaft End [in. (mm)]			
			0.39 (10)	0.59 (15)	0.79 (20)	
CFK513P <input type="checkbox"/> T	2.7 12	3.3 15	—	—	—	The permissible thrust load [lb.(N)] shall be no greater than the motor mass.
CFK533 <input type="checkbox"/> T	5.6	7.6	11.7	—	—	
CFK535 <input type="checkbox"/> T	25	34	52	—	—	
CFK543 <input type="checkbox"/> T	4.5	5.6	7.6	11.7	—	
CFK544 <input type="checkbox"/> T	20	25	34	52	—	
CFK545 <input type="checkbox"/> T	14.1	16.8	21	29	42	
CFK566 <input type="checkbox"/> T, CFK566H <input type="checkbox"/> T	63	75	95	130	190	
CFK569 <input type="checkbox"/> T, CFK569H <input type="checkbox"/> T	58	65	76	87	108	
CFK596H <input type="checkbox"/> T	260	290	340	390	480	
CFK599H <input type="checkbox"/> T						
CFK5913H <input type="checkbox"/> T						

• Enter the shaft type **A** or **B** in the box () within the model number.

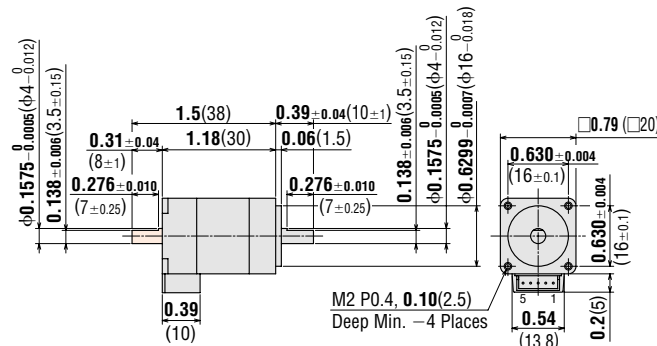
Dimensions Scale 1/4, Unit = inch (mm)

Motor

High Torque Type

1 Motor Frame Size: 0.79 in. (20 mm)

(Scale 1/2)



Model	Motor Model	Weight lb. (kg)	DXF
CFK513P <input type="checkbox"/> T	PK513P <input type="checkbox"/>	0.11 (0.05)	B316

- Enter the shaft type **A** or **B** in the box () within the model number.
- Motor cable with connector [2 ft. (0.6 m)] is included with the package. UL Style 3265, AWG24. If you are purchasing only a motor for maintenance purpose, etc., the motor cable with connector will not be supplied.

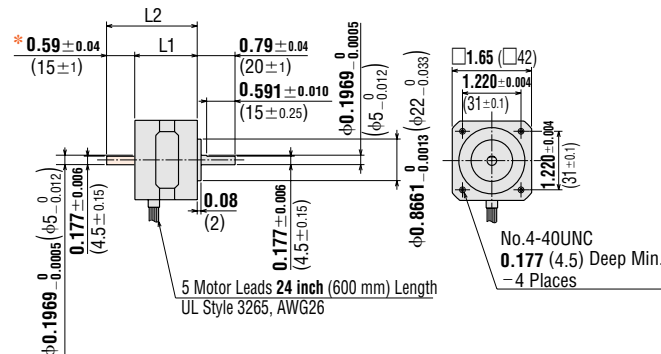
Applicable Connector

Contact Housing	51065-0500 (MOLEX)
Contact	50212-8100 (MOLEX)
Crimp tool	57176-5000 (MOLEX)

Note:

Connectors are not included.
Use the motor cables with connector (not included).

3 Motor Frame Size: 1.65 in. (42 mm)

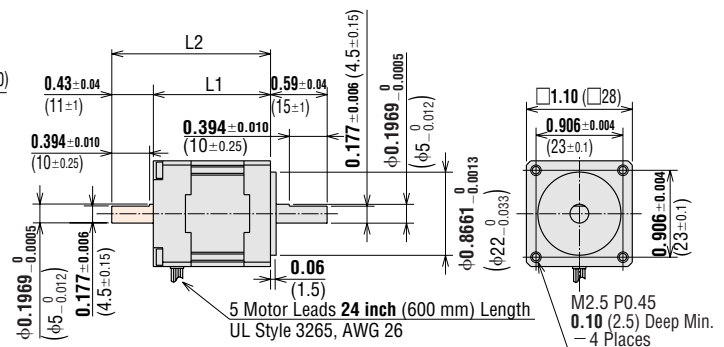


- These dimensions are for double shaft models. For single shaft models, ignore the shaded areas.

Standard Type

2 Motor Frame Size: 1.10 in. (28 mm)

(Scale 1/2)



Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
CFK533 <input type="checkbox"/> T	PMM33 <input type="checkbox"/> H2	1.22 (31)	1.65 (42)	0.22 (0.1)	B036
CFK535 <input type="checkbox"/> T	PMM35 <input type="checkbox"/> H2	1.99 (50.5)	2.42 (61.5)	0.37 (0.17)	B037

- Enter the shaft type **A** or **B** in the box () within the model number.

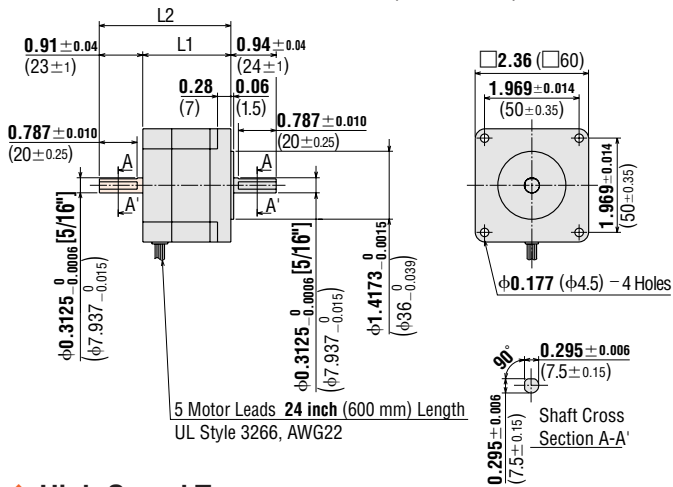
* The length of machining on double shaft model is 0.591 ± 0.010 (15±0.25).

Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
CFK543 <input type="checkbox"/> T	PK543N <input type="checkbox"/> WA	1.3 (33)	1.89 (48)	0.46 (0.21)	B068U
CFK544 <input type="checkbox"/> T	PK544N <input type="checkbox"/> WA	1.54 (39)	2.13 (54)	0.59 (0.27)	B069U
CFK545 <input type="checkbox"/> T	PK545N <input type="checkbox"/> WA	1.85 (47)	2.44 (62)	0.77 (0.35)	B070U

- Enter the shaft type **A** or **B** in the box () within the model number.

◆ Standard Type, High-Speed Type

4 Motor Frame Size: □ 2.36 in. (□ 60 mm)

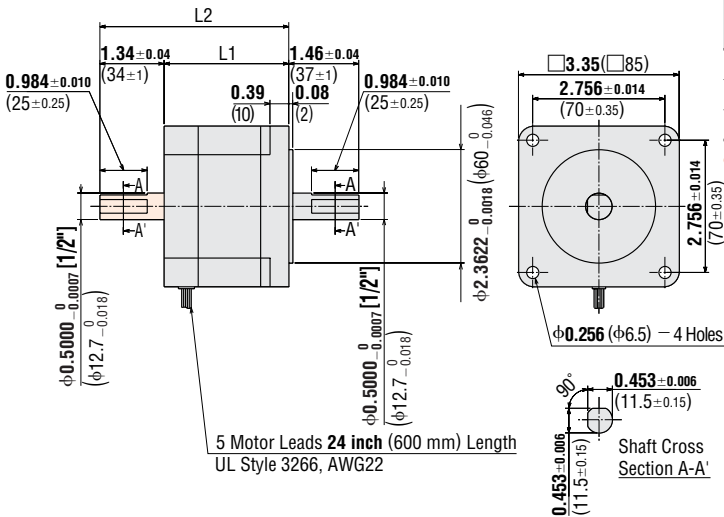


Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
CFK564 □T	PK564N□WA	1.83 (46.5)	2.74 (69.5)	1.3 (0.6)	B071U
CFK566 □T	PK566N□WA	2.26 (57.5)	3.17 (80.5)	1.8 (0.8)	B072U
CFK566H □T	PK566H-N□A				
CFK569 □T	PK569N□WA	3.43 (87)	4.33 (110)	2.9 (1.3)	B073U
CFK569H □T	PK569H-N□A				

• Enter the shaft type **A** or **B** in the box (□) within the model number.

◆ High-Speed Type

5 Motor Frame Size: □ 3.35 in. (□ 85 mm)



Model	Motor Model	L1 inch (mm)	L2 inch (mm)	Weight lb. (kg)	DXF
CFK596H □T	PK596-N□A	2.6 (66)	3.94 (100)	3.7 (1.7)	B155U
CFK599H □T	PK599-N□A	3.78 (96)	5.12 (130)	6.2 (2.8)	B156U
CFK5913H □T	PK5913-N□A	4.96 (126)	6.3 (160)	8.4 (3.8)	B157U

• Enter the shaft type **A** or **B** in the box (□) within the model number.

● Driver

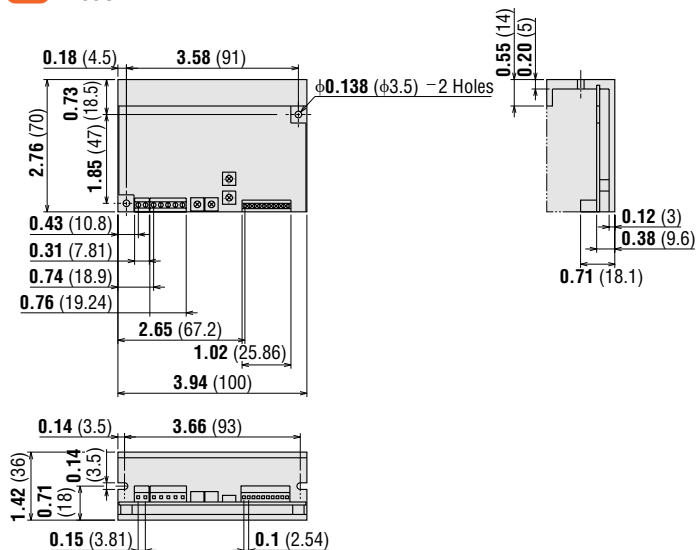
6 Model: DFC5103T, DFC5107T, DFC5114T

Weight: 0.44 lb. (0.2 kg)

Model: DFC5128T

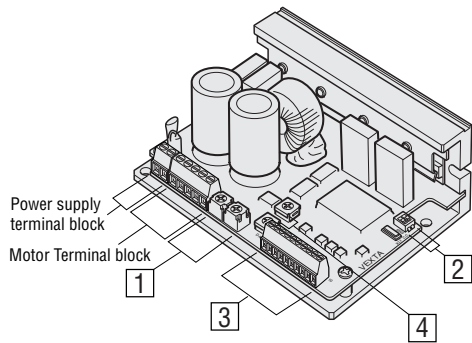
Weight: 0.48 lb. (0.22 kg)

DXF B285U



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

Connection and Operation



1 Current Adjustment Potentiometer

Indicator	Potentiometer Name	Function
RUN	Motor run current potentiometer	For adjusting the motor running current
STOP	Motor stop current potentiometer	For adjusting the current at the motor standstill

2 Function Select Switches

Indicator	Switch Name	Function
2P/1P	Pulse input mode switch	Switch between 1-pulse input mode and 2-pulse input mode.
C.C./OFF	DC check switch	Adjusts the motor's running current. When running current the motor, always have this switch set to OFF. The factory setting is OFF

3 Input/Output Signal

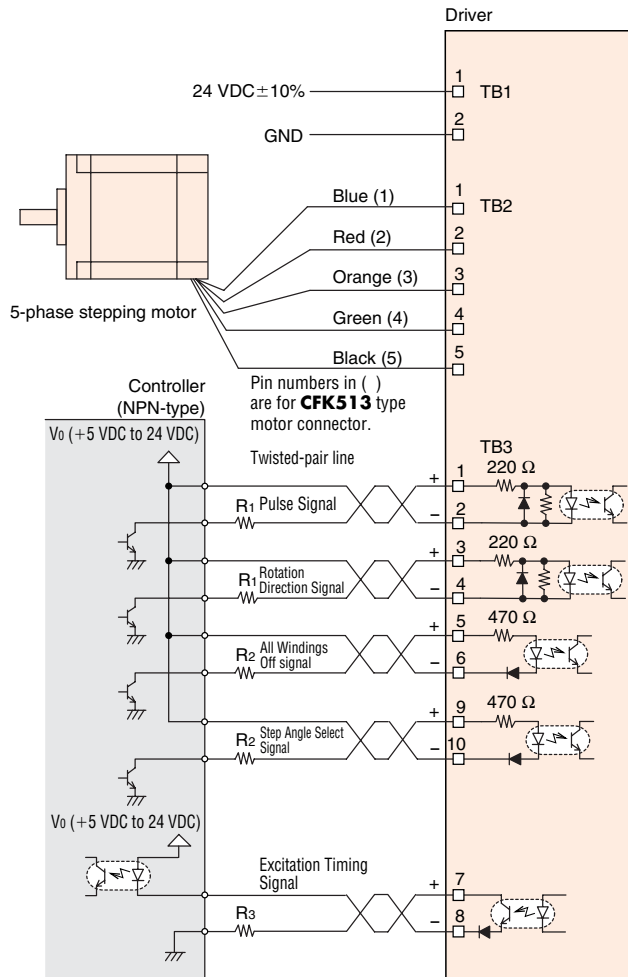
Indicator	Input/Output	Terminal No.	Signal Name
TB3	Input signal	1	Pulse Signal (CW Pulse Signal)
		2	
		3	Rotation Direction Signal (CCW Pulse Signal)
		4	
		5	All Windings Off Signal
		6	
	Output signal	7	Excitation Timing Signal
		8	
	Input signal	9	Step Angle Select Signal
		10	

4 Resolution Select Switches

Indicator	Switch Name	Function
DATA1	Step Angle Select Switch	Each switch can be set to the desired resolution from the 16 resolution levels.
DATA2		

Step Angle	Resolution	Step Angle Select Switch (Common to DATA 1 and DATA 2)
0.72°	1	0
0.36°	2	1
0.288°	2.5	2
0.18°	4	3
0.144°	5	4
0.09°	8	5
0.072°	10	6
0.036°	20	7
0.0288°	25	8
0.018°	40	9
0.0144°	50	A
0.009°	80	B
0.0072°	100	C
0.00576°	125	D
0.0036°	200	E
0.00288°	250	F

● Connection Diagrams



Notes:

- Keep the input single voltage V_o between 5 VDC and 24 VDC. When V_o is equal to 5 VDC, the external resistances R₁ and R₂ are not necessary. When V_o is above 5 VDC, connect R₁ and R₂ to keep the current as follows:
Pulse, Rotation Direction: 10 mA to 20 mA max.
All Windings Off, Step Angle Select: 10 mA to 15 mA max.
- Keep the output signal voltage V_o between 5 VDC and 24 VDC. When V_o is equal to 5 VDC, the external resistance R₃ is not necessary. When it is above 5 VDC, connect R₃ to keep the current below 10 mA max.
- Use twisted-pair wire of AWG 24 to AWG 22 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 decreases. (→ Technical Reference Page F-36)
- Suitable wire size for the TB1, TB2 and TB3 terminal block is between AWG20 and AWG26. Use AWG 22 to AWG 20 for standard type (DFC5103T, DFC5107T, DFC5114T) and AWG 20 to AWG 18 for high-speed type (DFC5128T) for power supply lines.
- Use spot grounding to ground 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.
- If noise generated by the motor lead wire causes a problem, try shielding the motor lead wires with conductive tape or wire mesh.
- Incorrect connection of DC power input will lead to driver damage. Make sure that the polarity is correct before turning the power on.

◆ Description of Input/Output Signals

Pulse Input and Rotation Direction Input

1-Pulse Input Mode

Pulse Signal

"Pulse" signal is input to the Pulse – terminal. When the photocoupler state changes from "ON" to "OFF", the motor rotates one step. The direction of rotation is determined by the rotation direction signal.

Rotation Direction Input

The "Rotation Direction" signal is input to D./CCW – terminal. A "photocoupler ON" signal input commands a clockwise direction rotation. A "photocoupler OFF" signal input commands a counter-clockwise direction rotation.

2-Pulse Input Mode

CW Pulse Signal

"Pulse" signal is input to the P./CW – terminal. When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the clockwise direction.

CCW Pulse Signal

"Pulse" signal is input to the D./CCW – terminal. When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the counterclockwise direction.

All Windings Off (A.W. OFF) Input

When the "All Windings Off" (A.W. 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. This signal is used when moving the motor by external force or the manual home position.

Step Angle Select (C/S) Input

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

Excitation Timing (TIMING) Output

The Excitation Timing signal is output once each time the excitation sequence returns to step "0" in synchronization with input pulse. The excitation sequence is designed to complete one cycle as the motor shaft rotates 7.2° .

0.72°/step (resolution 1): Signal is output once every 10 pulses.

0.072°/step (resolution 10): Signal is output once every 100 pulses.

● Step Angle Selection

With the **CFK II** Series, the motor speed and step distance can be changed without changing the input pulse frequency by switching the step angle switch. The step angle is set with step angle setting switches DATA1 and DATA2. DATA1 and DATA2 each have 16 settings from which one step angle each can be selected. The step angles that can be set are shown in the table below.

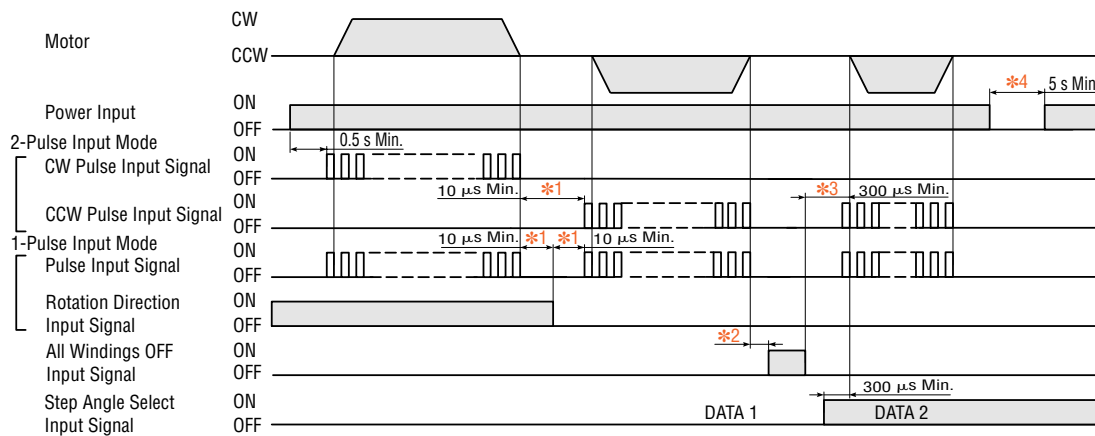
DATA1 and DATA2 are set to the scale corresponding to the step angle selected for each. The step angle is changed with the step angle select signals.

Photocoupler "OFF": The step angle set with DATA1 is selected.

Photocoupler "ON": The step angle set with DATA2 is selected.

Step Angle	Resolution	Step Angle Select Switch (Common to DATA 1 and DATA 2)
0.72°	1	0
0.36°	2	1
0.288°	2.5	2
0.18°	4	3
0.144°	5	4
0.09°	8	5
0.072°	10	6
0.036°	20	7
0.0288°	25	8
0.018°	40	9
0.0144°	50	A
0.009°	80	B
0.0072°	100	C
0.00576°	125	D
0.0036°	200	E
0.00288°	250	F

● Timing Chart



The shaded section indicates that the photocoupler is on.

- *1 Switching time to change CW, CCW pulse (2-pulse input mode), and switching time to change direction (1-pulse input mode) 10 μ sec 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 Winding Off" signal to the photocoupler off state. The motor may not start.
- *4 Wait at least 5 seconds before turning on the power.

Adjusting the Current

Adjusting the Motor Current

Use the "RUN" potentiometer to decrease the current and suppress the temperature rise in the motor/driver, or when there is sufficient motor torque and you want to suppress vibration by lowering the current.

Use the "STOP" potentiometer to readjust the current at motor standstill in relation to the holding-brake force of the motor.

Factory settings

Running current: Rated current

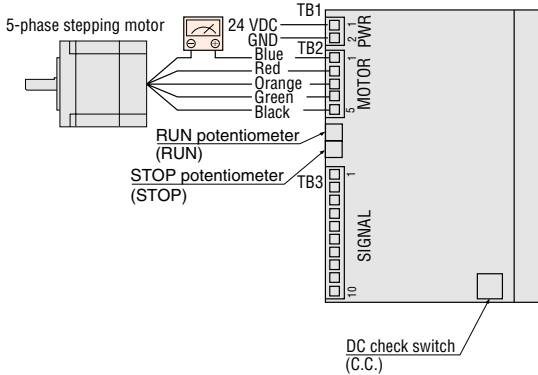
Current at motor standstill: Approx. 50% of rated current

Follow the procedure below to adjust the motor current.

1 Connecting an Ammeter

Connect a DC ammeter as illustrated below.

Connect an ammeter between pin ① of TB2 connector and the motor. Set all driver input signals to the "photocoupler OFF" state.



Note:

- Do not input pulse signals.

2 Adjusting the Motor Running Current

To adjust the motor running current, follow the procedure below:

- Set the current-checking switch to the "photocoupler ON" state. Keep other signals in the "photocoupler OFF" state.
- Turn on the power to the driver.
- Use the "RUN" potentiometer to adjust the motor's running current.
- When the power is turned on, the value measured by the ammeter represents the total current in two phases through the blue motor lead wire. The current for one phase is equivalent to one-half the ammeter value. (Example: To set the current to 1.0 A/phase, adjust the current level until the ammeter reads 2.0 A.)
- When the running current has been adjusted, set the current-checking switch back to the "photocoupler OFF" state.

Notes:

- Be sure to use the motor at the rated current or below.
- Adjusting the running current will also change the current at standstill.

3 Adjusting the Current at Motor Standstill

To adjust the current at motor standstill, follow the procedure below:

- Set the current-checking switch to the "photocoupler OFF" state. Keep other signals in the "photocoupler OFF" state.
- Turn on the power to the driver.
- Use the "STOP" potentiometer to adjust the motor's running current.
- When the power is turned on, the value measured by the ammeter represents the total current in two phases through the blue motor lead wire. The current for one phase is equivalent to one-half the ammeter value. (Example: To set the current to 1.0 A/phase, adjust the current level until the ammeter reads 2.0 A.)

$$\text{Holding Torque} \left[\text{oz-in (N-m)} \right] = \frac{\text{Maximum Holding Torque} \times \text{Current at Standstill [A]} \left[\text{oz-in (N-m)} \right]}{\text{Motor rated current [A]}}$$

Notes:

- Always set the running current first, turn off the driver power and turn it back on, and then set the current at standstill. Setting the running current after current at standstill may change the current setting at standstill.
- Setting the current at motor standstill too low may affect the starting of the motor or the position-holding action.

List of Motor and Driver Combinations

Type	Model	Motor Model	Driver Model
High Torque	CFK513P <input type="checkbox"/> T	PK513P <input type="checkbox"/>	DFC5103T
Standard	CFK533 <input type="checkbox"/> T	PMM33 <input type="checkbox"/> H2	DFC5107T
	CFK535 <input type="checkbox"/> T	PMM35 <input type="checkbox"/> H2	
	CFK543 <input type="checkbox"/> T	PK543N <input type="checkbox"/> WA	
	CFK544 <input type="checkbox"/> T	PK544N <input type="checkbox"/> WA	
	CFK545 <input type="checkbox"/> T	PK545N <input type="checkbox"/> WA	DFC5114T
	CFK564 <input type="checkbox"/> T	PK564N <input type="checkbox"/> WA	
	CFK566 <input type="checkbox"/> T	PK566N <input type="checkbox"/> WA	
High Speed	CFK569 <input type="checkbox"/> T	PK569N <input type="checkbox"/> WA	DFC5128T
	CFK566H <input type="checkbox"/> T	PK566H-N <input type="checkbox"/> A	
	CFK569H <input type="checkbox"/> T	PK569H-N <input type="checkbox"/> A	
	CFK596H <input type="checkbox"/> T	PK596-N <input type="checkbox"/> A	
	CFK599H <input type="checkbox"/> T	PK599-N <input type="checkbox"/> A	
	CFK5913H <input type="checkbox"/> T	PK5913-N <input type="checkbox"/> A	

● Enter the shaft type **A** or **B** in the box () within the model number.