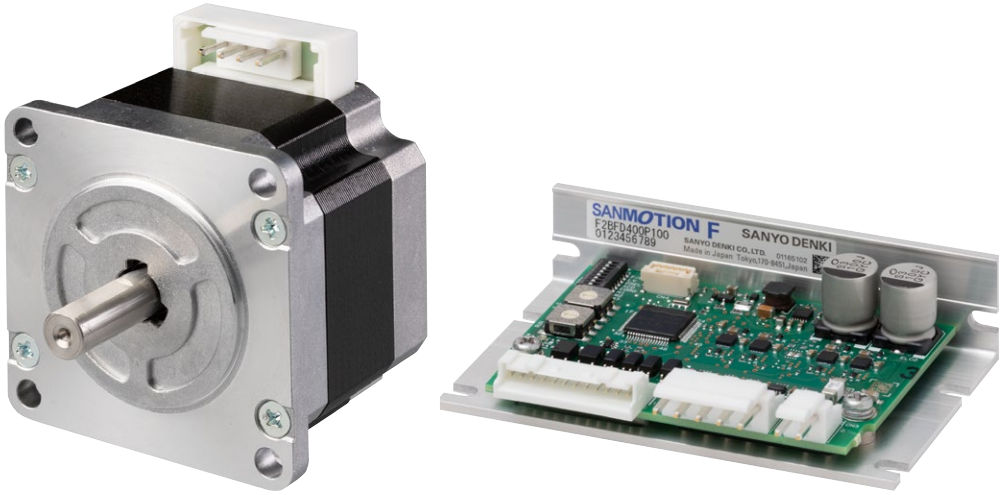
SANYO DENKI

2-PHASE STEPPING SYSTEMS

SANMOTION F2

2-Phase Stepping Systems

Ver.10
English



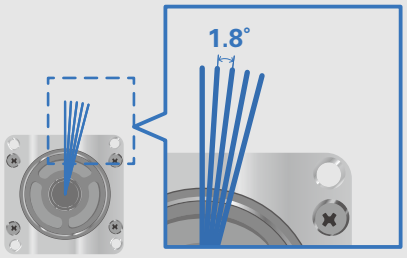
SANMOTION
2-PHASE STEPPING SYSTEMS
F2

CONTENTS

Easy positioning control

by simple encoderless stepping systems

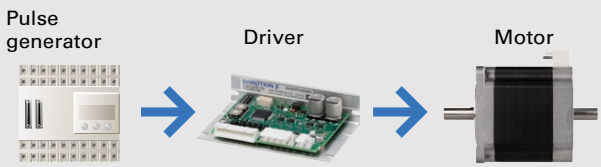
Stepping motors rotate precisely at a fixed angle (step angle) with each pulse the driver receives from a pulse generator.
SANMOTION F2 motors typically have a full step angle of 1.8˚.



Full step angle
1.8˚

200 steps

These use open-loop control without an encoder (position detection sensor), helping build simple and low-cost systems. Ease of use is a key point.
In addition, they use holding force when stopped, and feature stable stopping without micro vibrations.



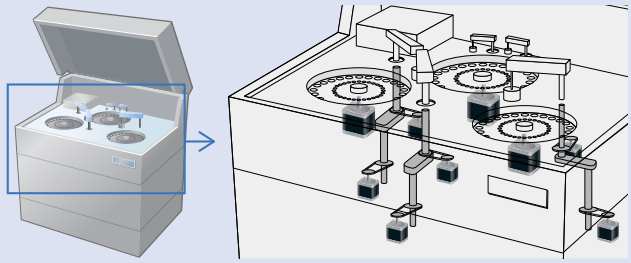
We hereby declare that the products listed in the catalog comply with the threshold values listed in Annex II, Directive (EU) 2015/863, which is an amendment to Directive 2011/65/EU of the European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment. However, the applications listed in ANNEX III of RoHS Directive 2011/65/EU are exempted from the restriction. Also, all models of the SANMOTION F2 drivers conform to CE/EN, UKCA, UL, and KC Mark as standard.

Application Examples

The SANMOTION F2 can be used in a wide variety of applications, including fixed-speed drive synchronized with command pulses, accurate positioning, and stable stopping.

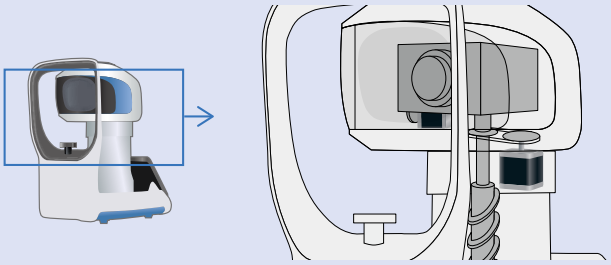
Blood analyzer

For rotating the specimen tray and rotary table



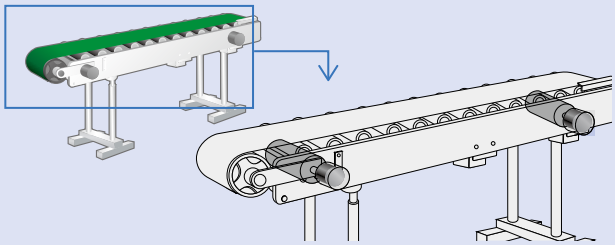
Ophthalmology inspection equipment

For moving the camera vertically and horizontally



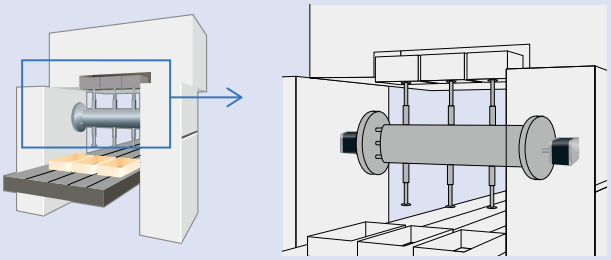
Belt conveyor

For driving the belt and rollers



Filling machine

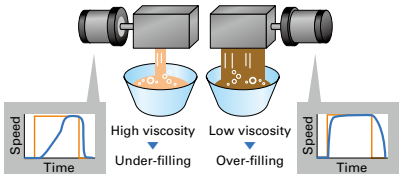
For filling liquids and pastes



Induction motors and stepping motors

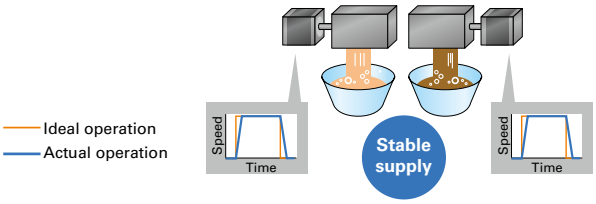
With an induction motor

As the motor speed is affected by the viscosity of the filling material, the number of rotations must be adjusted by an inverter. Startup time is also slow.



With a stepping motor

Stepping motors can stably dispense a constant amount because they simply rotate at a fixed angle regardless of the viscosity of the material. Startup time is also short.

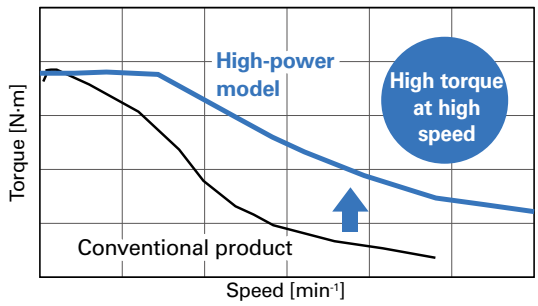


Features

High Torque

The high-power models achieve approximately 2 times higher torque at high speeds than our current models,(1) reducing the cycle time of your equipment and increasing productivity.

Torque characteristics



Microstepping Drive

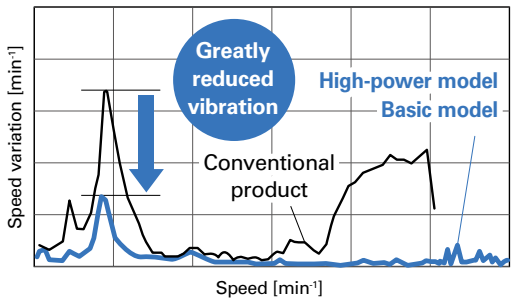
The full step angle can be set to a resolution of up to 256 divisions in 16 levels. This realizes smooth operation with low vibration.
The high-power model drivers feature an electronic gear.
Used with setup software, the motor resolution can be set according to the ball screw pitch or gear reduction ratio.

Application: Surveillance camera
Stable stopping and smooth operation reduce video shake

Low Vibration

Motor vibration during operation has been reduced to one-third or less compared to the current models.(1)
Thanks to their low vibration mode, SANMOTION F2 stepping drivers can smoothly operate stepping motors even at low resolution settings such as full-step and half-step modes. Vibrations can be suppressed regardless of the host controller.

Motor speed fluctuation characteristics



Compact and Lightweight

The high-power models are newly designed to achieve a 12% reduction in volume and 33% reduction in mass compared to the current model.(2)
The basic models achieve a 7% reduction in volume and 39% reduction in mass while maintaining compatibility with the current models.(2)

Various Useful Safety Functions

The high-power models are supported by setup software to adjust control parameters, analyze alarms, and monitor operating status from a PC.
Overcurrents and wire breakage caused by pinched motor power cables can be detected and notified with an alarm and motors can be stopped safely. Abnormal power supply voltage and heat generation can be notified even before the alarm goes off, ensuring the safety of your system.

Easy Replacement

The basic models have mounting and interface compatibility with the current models(2) for easy replacement. Equipment performance can be improved by simply replacing your current stepping driver with a new model, with your current motor unchanged.

(1) Comparison with our current model: BS1D200P10 combined with SM2562C□0B11
(2) Comparison with our current model: BS1D200P10

Setup Software

This setup software allows users to set control parameters and monitor the motor operating status from PCs.
It also facilitates analyzing equipment status thanks to the optimal adjustment tailored to customer equipment.
The software can be downloaded from Product Information on our website.　https://www.sanyodenki.com/

■ Setup software name

SANMOTION MOTOR SETUP SOFTWARE

■ Supported operating systems

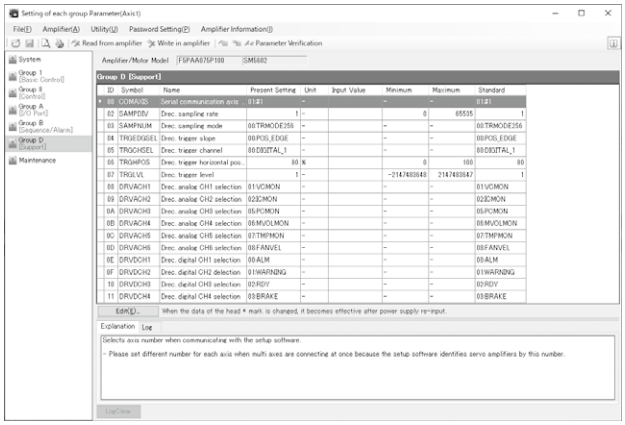
Windows 10/11

See our website for details on supported OS versions.

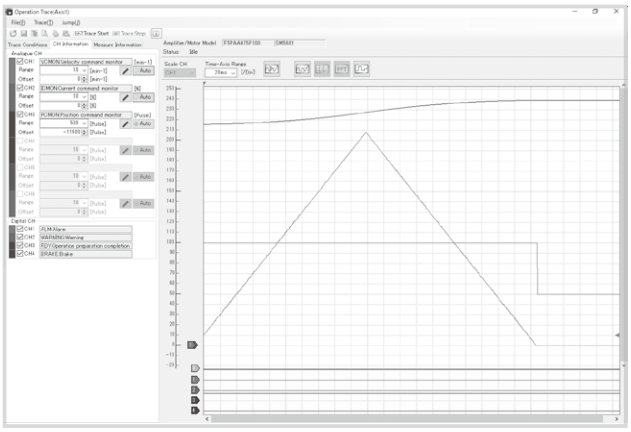
■ Main functions

Parameter settings (by group)
Diagnosis (alarm indicator, warning indicator, alarm cancellation)
Various measurement functions (operating waveform display)

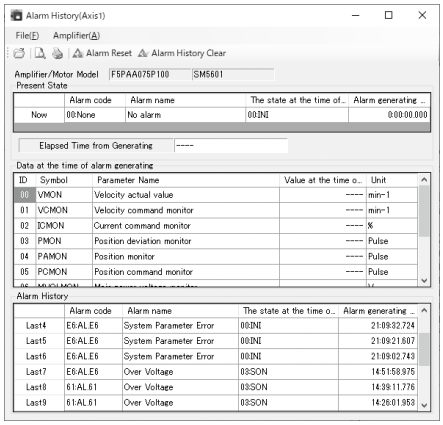
A dedicated setup software connection unit is required to connect a driver to a PC.



Parameter setting screen



Operation tracing screen



Alarm monitoring screen

Lineup

Drivers ▶p. 11–

Series	DC input High-power models High torque, high performance	DC input Basic models
		
Input voltage	24 VDC	24 VDC
Microsteps	2-phase mode: 1 to 256 5-phase mode: 2.5 to 625	2-phase mode: 1 to 256 5-phase mode: 2.5 to 625
Step angle	2-phase mode: 1.8 to 0.00703125° /pulse 5-phase mode: 0.72 to 0.00288° /pulse	2-phase mode: 0.9 to 0.003515625° /pulse 1.8 to 0.00703125° /pulse 5-phase mode: 0.36 to 0.00144° /pulse 0.72 to 0.00288° /pulse
Wiring of stepping motors	Bipolar winding	Bipolar winding
Rated current of stepping motors	3 A/phase, 4 A/phase	1 A/phase, 2 A/phase
Compatible motor size	56 mm sq./86 mm sq.	28 mm sq./42 mm sq./56 mm sq./60 mm sq./86 mm sq.
Control system	Pulse input, open loop	Pulse input, open loop
Page	p. 11–	p. 23–

Note: A driver, motor, and optional motor cable and connector need to be purchased individually.

Lineup

Stepping Motors ▶p. 42–

These stepping motors feature high torque. Select from among a broad lineup of products including an ultra-compact 14 mm sq. sized motor and a thin-profile motor with a 11.4 mm motor length.

Consult us regarding customization. ▶p. 40

Motor size	Full step angle	Holding torque [N·m]	Model no.	Page: Specifications/Characteristics/ Dimensions
14 mm sq. Ultra-compact	1.8°	0.0065 to 0.01	SH214□-5□□1	p. 42
28 mm sq.	1.8°	0.055 to 0.145	SH228□-5□□1	p. 43 to 44
35 mm sq.	1.8°	0.12 to 0.32	SH35□□-1□□□0	p. 45 to 46
42 mm sq.	0.9°	0.2 to 0.48	SH142□-□□□1	p. 47 to 48
42 mm sq. Thin-profile	1.8°	0.083 to 0.186	SS242□-50□□□	p. 49
42 mm sq.	1.8°	0.22 to 0.8	SF242□-1□□□1	p. 50 to 51
50 mm sq.	1.8°	0.28 to 0.53	103H670□-□□□0	p. 52 to 54
50 mm sq. Thin-profile	1.8°	0.1 to 0.215	SS250□-80□0	p. 55
56 mm sq. (UL)	1.8°	0.53 to 2.5	SM256□C□0□□1	p. 56 to 60
56 mm sq. (CE/UKCA)	1.8°	0.39 to 1.27	103H712□-6□□0	p. 69
60 mm sq.*	1.8°	It is recommended you use a 56 mm sq. motor (SM256□C□0□□1)		—
60 mm sq.	0.9°	0.57 to 2.15	SH160□-□□□0	p. 62 to 63
86 mm sq.	1.8°	2.5 to 9	SH286□-□□□1	p. 64 to 67
86 mm sq. (CE/UKCA/UL)	1.8°	2.5 to 9	SM286□-□□□□	p. 70 to 73
ø106 mm	1.8°	10.8 to 19	103H8922□-□□□1	p. 68

• We provide motor customization services such as motors with an encoder, gear, and brake. For more information, see respective specifications and characteristics pages.

* For 60 mm sq. size: It is recommended you use a 56 mm sq. motor (SM256□C□0□□1) that has equivalent torque as a conventional motor (103H782) in a smaller size. We also offer customization that makes the flange compatible with 60 mm sq. motors for easy replacement.

IP65-Rated Stepping Motors Water/Dust protection ▶p. 76–

These IP65-rated motors* have superior water and dust resistance, and can be safely used in water-exposed environments such as in food processing machines.

* Except for the shaft and cable ends.

Motor size	Full step angle	Holding torque [N·m]	Model no.	Page: Specifications/Characteristics/ Dimensions
56 mm sq. (CE/UKCA/UL)	1.8°	1 to 1.7	SP256□-5□□0	p. 77 to 78
86 mm sq. (CE/UKCA/UL)	1.8°	3.3 to 9	SP286□-5□□0	p. 79 to 80

In-Vacuum Stepping Motors Custom product ▶p. 81–

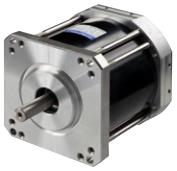
We can customize motors for use in low to ultra-high vacuum environments to suit your system requirements.

Motor size
42 mm sq. to ø106 mm

Synchronous Motors Custom product ▶p. 81–

Synchronous motors rotate at a constant speed in sync with the AC power frequency. Since they can be driven with AC power directly, a driver is not necessary.

Motor size
56 mm sq. to ø106 mm



Note: A driver, motor, and optional motor cable and connector need to be purchased individually.

Stepping Drivers/Motors

How to Read Specifications

Bipolar DC input driver (model: F2BFD400P100) and stepping motor

RoHS

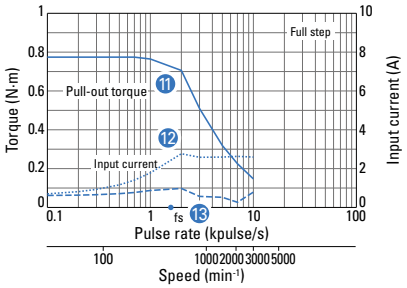
②	Motor size		56 mm sq. (1.8° full step angle)				56 mm sq. (1.8° full step angle)
②	Motor length		41.8 mm	53.8 mm	75.8 mm	85.8 mm	41.8 mm
③	Single shaft	Motor model no.	SM2561C30B41	SM2562C30B41	SM2563C30B41	SM2564C30B41	SM2561C40B41
③	Dual shaft	Motor model no.	SM2561C30B11	SM2562C30B11	SM2563C30B11	SM2564C30B11	SM2561C40B11
④	Holding torque	N·m	0.75	1.4	2.35	2.5	0.75
⑤	Rotor inertia	× 10^{-4}kg·m²	0.14	0.28	0.5	0.6	0.14
⑥	Rated current	A/phase	3	3	3	3	4
⑦	Motor mass(1)	kg	0.49	0.69	1.1	1.27	0.49
⑧	Allowable thrust load	N	20	20	20	20	20
⑨	Allowable radial load(2)	N	113	102	78	70	113

(1) For the driver mass, see ▶p. 18 (2) Load is exerted to the shaft end.

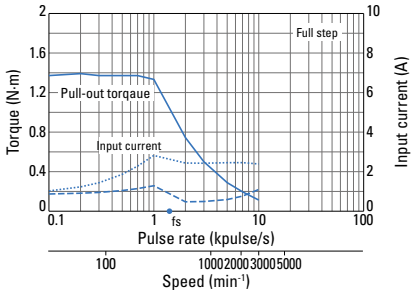
⑩ Characteristics

With rubber coupling used Pull-out torque —— Input current (with no load) - - - - Input current (with load) ····· fs: Maximum starting frequency with no load ●

SM2561C30B41 SM2561C30B11 24 VDC



SM2562C30B41 SM2562C30B11 24 VDC



① Model number of the driver.

② This is the flange size and length of the stepping motor. The full step angle is the angle at which the motor rotates with each pulse in full step mode. In half step mode, the motor rotates by a half the full step angle with each pulse.

③ This is the model number of the stepping motor. The model number varies depending on whether the motor's shaft is single shaft or dual shaft.

④ This is the maximum torque that is generated when the stepping motor is rotated by exerting an external force on the shaft at 2-phase excitation at the rated current.

⑤ This is the moment of inertia of the rotor.

⑥ This is the rated current that flows to the motor winding.

⑦ This is the mass of the stepping motor.

⑧ This is the maximum allowable load to the shaft in the axial direction. Take care not to exceed this limit.

⑨ This is the maximum allowable load to the shaft in the direction perpendicular to the axial direction. Take care not to exceed this limit.

⑩ This graph shows the relationship between the pulse rate (frequency), motor speed, and torque. The driver's input current is shown in addition to the torque.

⑪ The pull-out torque is the maximum torque in which synchronized operation with command pulses can be maintained. If a torque that exceeds this value is applied to the stepping motor will be unable to synchronize with command pulses (step-out). Thus, when selecting a motor, you should allow for a torque margin of 1.4 to 2 times, in order to avoid step-out.

⑫ This graph shows the current value of the power supply powering the driver.

- - - - - - - The blue dashed lines show the source current value when there is no load (motor by itself).

····· The blue dotted lines show the source current value when the maximum torque is applied to the stepping motor (with a load).

The required power supply capacity (W) is calculated from this graph.

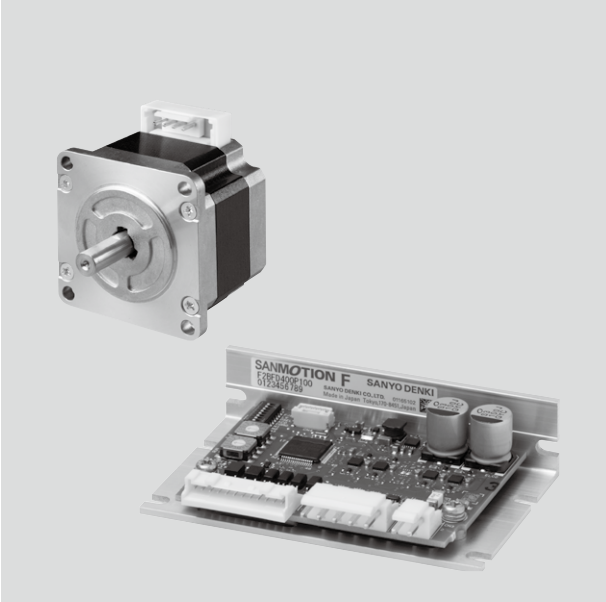
⑬ The blue-colored dots in the lower part of the graph show the upper limit for the maximum starting frequency (fs) of the stepping motor by itself (with no load). The stepping motor will not operate normally if it is started using pulse rates that exceed these values. For this reason, it is necessary to start the stepping motor using pulse rates that are lower than these values. The maximum starting pulse rate with loads (f_L) can be determined using the expression below.

$$f_L = \frac{fs}{\sqrt{1 + \frac{J_L}{J_M}}}$$

J_M: Rotor inertia
J_L: Load inertia
fs: Maximum starting pulse rate with no load

DC Input Drivers/Motors

High-power models



The high-power model is a high-output, high-performance driver. It can drive motors with high torque, contributing to shortening the cycle time of your equipment.

Lineup RoHS

Driver

Bipolar Model no.: F2BFD400P100 Input voltage: 24 VDC

- The Instruction Manual is available for download from our website.

Motor

(Only for 56 mm sq. motors)

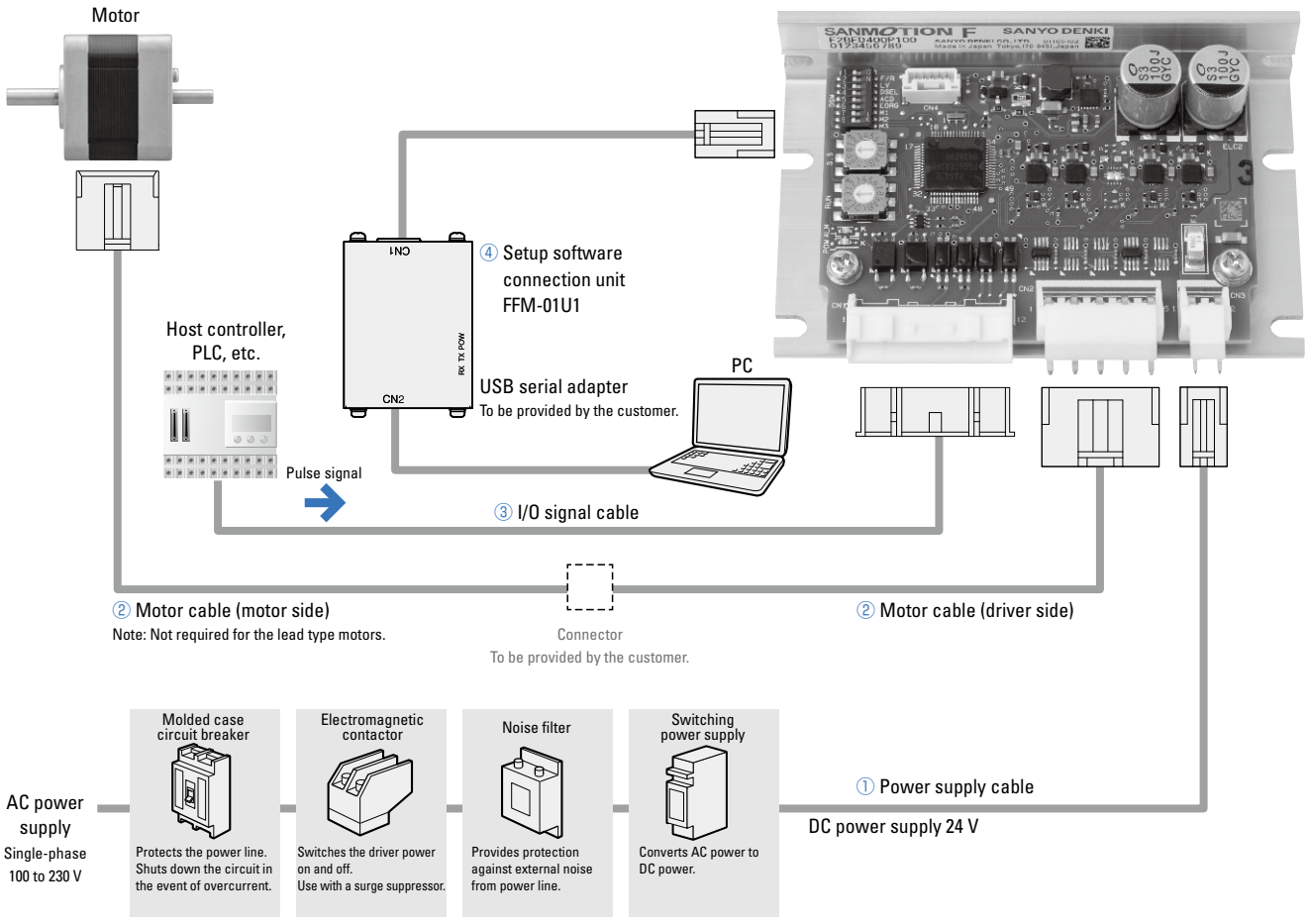
Motor sizes: 56 mm sq., 86 mm sq.

Options

Cable with connectors
Setup software connection unit

System Configuration

① Power supply cable (option)
② Motor cable (option)
③ I/O signal cable (option)
④ Setup software connection unit (option)



Combination Table

Motors marked with Ⓛ are lead-type motors. 300 mm or longer leads are attached to the motor.
Motors marked with Ⓒ are connector-type motors.

Motor								Driver		Options			
Model	Motor size	Single shaft		Dual shaft		Page		Model no.	Page	Power supply cable	Motor cable	I/O signal cable	Connection unit
						Specifications	Dimensions						
Standard models	56 mm sq.	**SM2561C30B41**	Ⓒ	**SM2561C30B11**	Ⓒ	p. 14, 17	p. 16	**F2BFD400P100**	p. 18	FC9P0010A	FC9M0010A(1) (Driver side) 4837961-1(2) (Motor side)	FC9S0010A	FFM-01U1
		SM2562C30B41	Ⓒ	**SM2562C30B11**	Ⓒ	p. 14, 17	p. 16						
		SM2563C30B41	Ⓒ	**SM2563C30B11**	Ⓒ	p. 14, 17	p. 16						
		SM2564C30B41	Ⓒ	**SM2564C30B11**	Ⓒ	p. 14, 17	p. 16						
	56 mm sq.	**SM2561C40B41**	Ⓒ	**SM2561C40B11**	Ⓒ	p. 14, 17	p. 16	**F2BFD400P100**	p. 18	FC9P0010A	FC9M0010A(1) (Driver side) 4837961-1(2) (Motor side)	FC9S0010A	FFM-01U1
		SM2562C40B41	Ⓒ	**SM2562C40B11**	Ⓒ	p. 15, 17	p. 16						
		SM2563C40B41	Ⓒ	**SM2563C40B11**	Ⓒ	p. 15, 17	p. 16						
		SM2564C40B41	Ⓒ	**SM2564C40B11**	Ⓒ	p. 15, 17	p. 16						
	86 mm sq.	**SH2861-5141**	Ⓛ	**SH2861-5111**	Ⓛ	p. 15, 17	p. 16	**F2BFD400P100**	p. 18	FC9P0010A	FC9M0010A(1) (Driver side)	FC9S0010A	FFM-01U1
		SH2862-5141	Ⓛ	**SH2862-5111**	Ⓛ	p. 15, 17	p. 16						

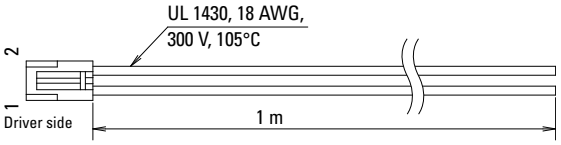
(1) Has a connector on the driver side. The motor-side connector/connection needs to be prepared by customers.
(2) Has a connector on the motor side. The cable relay connector/connection needs to be prepared by customers.

Options

● Cable with connectors

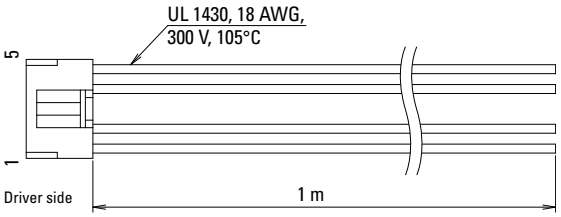
Power supply cable (Model no.: FC9P0010A)

Pin no.	Color
1	White
2	Black



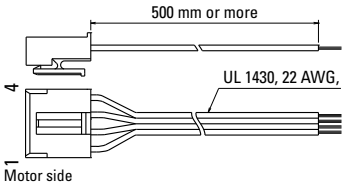
Motor cable Driver side (Model no.: FC9M0010A)

Pin no.	Color
1	Orange
2	Blue
3	–
4	Red
5	Yellow



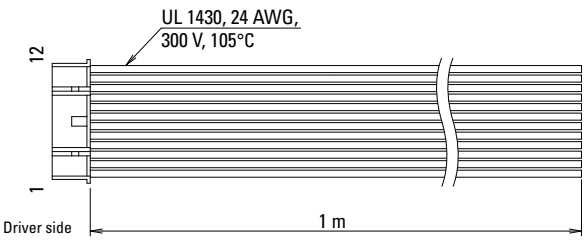
Motor cable Motor side (Model no.: 4837961-1)

Pin no.	Color
1	Orange
2	Blue
3	Red
4	Yellow



I/O signal cable (Model no.: FC9S0010A)

Pin no.	Color
1	Blue
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	



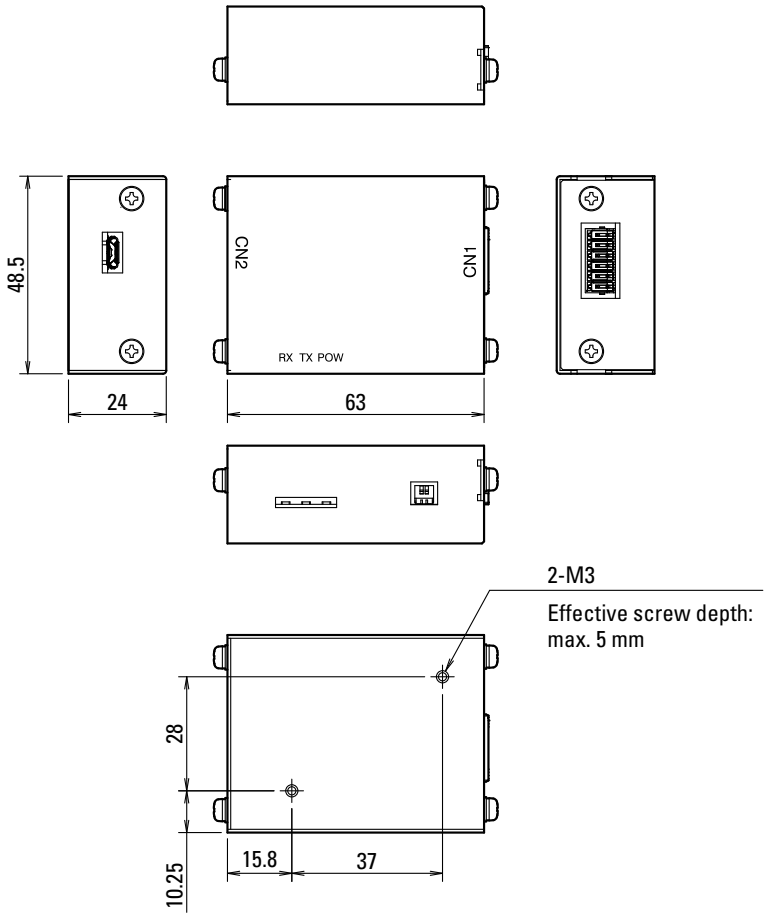
Options

● **Setup software connection unit** (Model no.: FFM-01U1)

A set of a communication converter (FFM-01) and a communication cable (between converter and driver)

Note: The USB cable to connect the FFM-01 to a PC should be provided by the customer as shown in the table below.

Interface	
PC side	USB Type-A
FFM-01 connector	USB 2.0 Type-B



Bipolar DC input driver (model: F2BFD400P100) and stepping motor

RoHS

Motor size		56 mm sq. (1.8° full step angle)				56 mm sq. (1.8° full step angle)
Motor length		41.8 mm	53.8 mm	75.8 mm	85.8 mm	41.8 mm
Single shaft	Motor model no.	SM2561C30B41	SM2562C30B41	SM2563C30B41	SM2564C30B41	SM2561C40B41
Dual shaft	Motor model no.	SM2561C30B11	SM2562C30B11	SM2563C30B11	SM2564C30B11	SM2561C40B11
Holding torque	N·m	0.75	1.4	2.35	2.5	0.75
Rotor inertia	$\times 10^{-4}$kg·m²	0.14	0.28	0.5	0.6	0.14
Rated current	A/phase	3	3	3	3	4
Motor mass(1)	kg	0.49	0.69	1.1	1.27	0.49
Allowable thrust load	N	20	20	20	20	20
Allowable radial load(2)	N	113	102	78	70	113

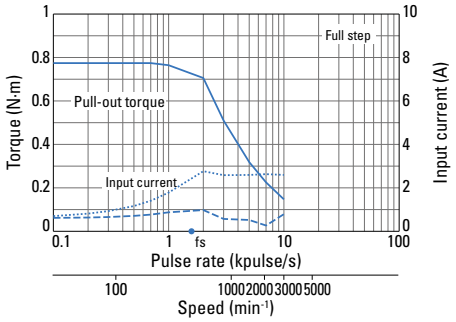
(1) For the driver mass, see ▶p. 18 (2) Load is exerted to the shaft end.

Characteristics

With rubber coupling used Pull-out torque —— Input current (with no load) - - - - Input current (with load) ····· fs: Maximum starting frequency with no load ●

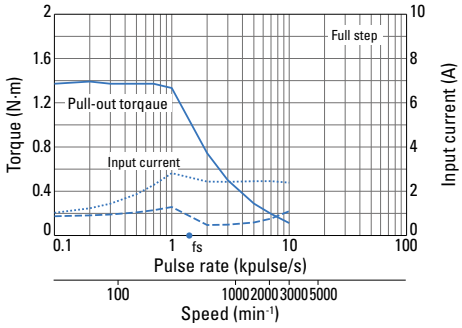
SM2561C30B41 SM2561C30B11

24 VDC



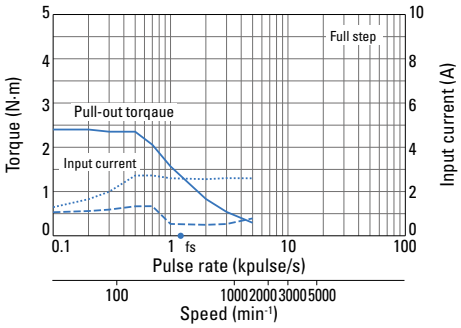
SM2562C30B41 SM2562C30B11

24 VDC



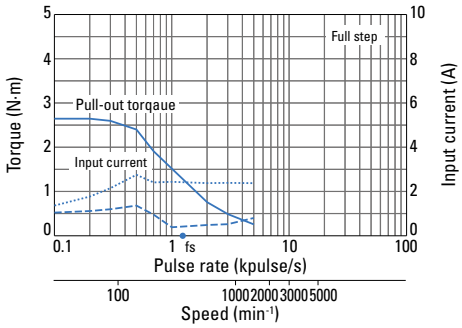
SM2563C30B41 SM2563C30B11

24 VDC



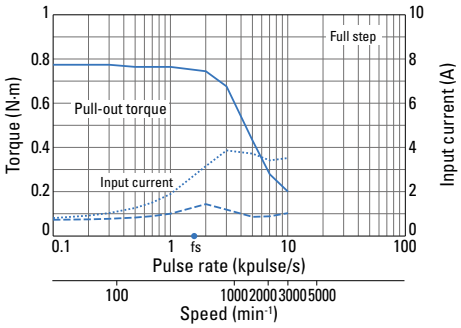
SM2564C30B41 SM2564C30B11

24 VDC



SM2561C40B41 SM2561C40B11

24 VDC



System Configuration... ▶p. 11 Combination Table... ▶p. 12 Motor Dimensions... ▶p. 16 Driver Dimensions... ▶p. 18

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Bipolar DC input driver (model: F2BFD400P100) and stepping motor

RoHS

Motor size		56 mm sq. (1.8° full step angle)			86 mm sq. (1.8° full step angle)	
Motor length		53.8 mm	75.8 mm	85.8 mm	66 mm	96.5 mm
Single shaft	Motor model no.	SM2562C40B41	SM2563C40B41	SM2564C40B41	SH2861-5141	SH2862-5141
Dual shaft	Motor model no.	SM2562C40B11	SM2563C40B11	SM2564C40B11	SH2861-5111	SH2862-5111
Holding torque	N·m	1.4	2.35	2.5	3.3	6.4
Rotor inertia	$\times 10^{-4}$kg·m²	0.28	0.5	0.6	1.48	3.0
Rated current	A/phase	4	4	4	4	4
Motor mass(1)	kg	0.69	1.1	1.27	1.75	2.9
Allowable thrust load	N	20	20	20	60	60
Allowable radial load(2)	N	102	78	70	200	200

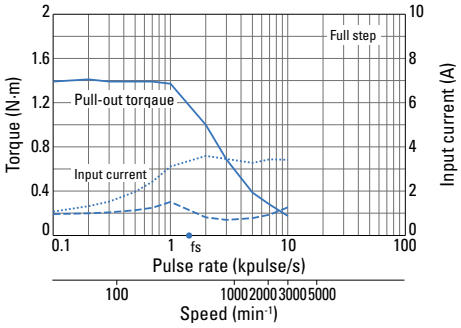
(1) For the driver mass, see ▶p. 18 (2) Load is exerted to the shaft end.

Characteristics

With rubber coupling used Pull-out torque —— Input current (with no load) - - - - Input current (with load) ····· fs: Maximum starting frequency with no load ●

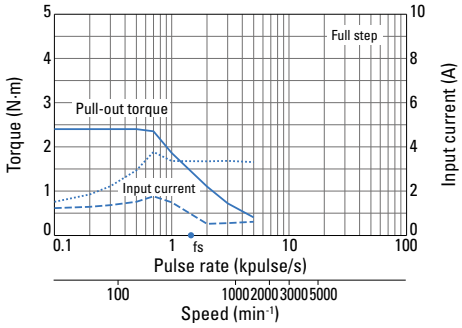
SM2562C40B41 SM2562C40B11

24 VDC



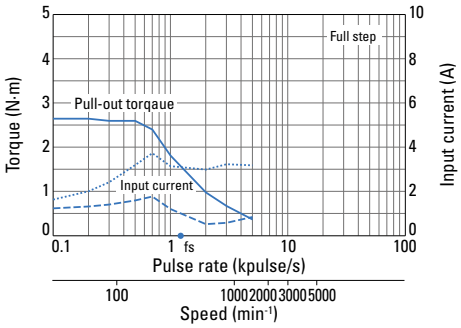
SM2563C40B41 SM2563C40B11

24 VDC



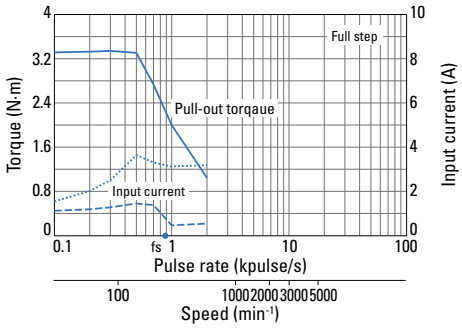
SM2564C40B41 SM2564C40B11

24 VDC



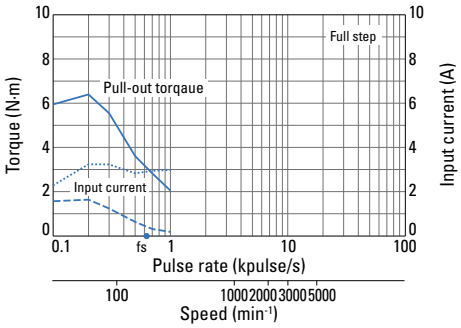
SH2861-5141 SH2861-5111

24 VDC



SH2862-5141 SH2862-5111

24 VDC

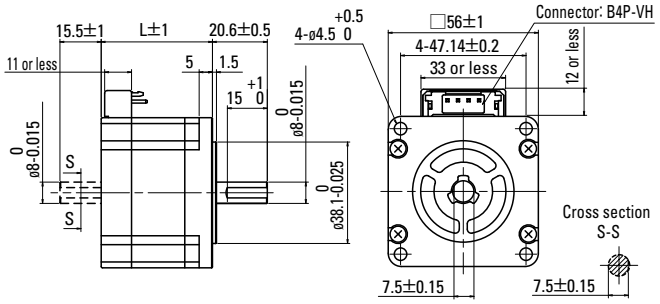


System Configuration... ▶p. 11 Combination Table... ▶p. 12 Motor Dimensions... ▶p. 16 Driver Dimensions... ▶p. 18

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

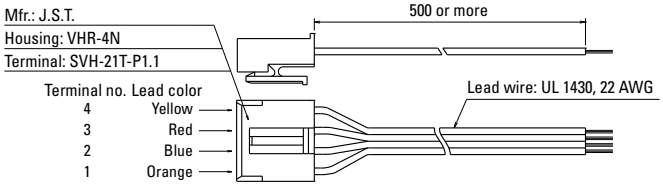
Stepping Motor Dimensions Unit: mm

56 mm sq.

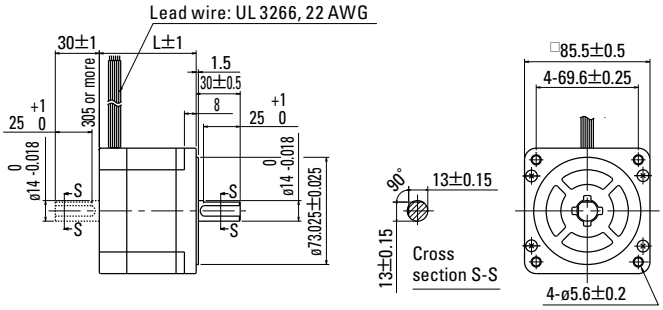


Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SM2561C30B41	SM2561C30B11	41.8
SM2562C30B41	SM2562C30B11	53.8
SM2563C30B41	SM2563C30B11	75.8
SM2564C30B41	SM2564C30B11	85.8
SM2561C40B41	SM2561C40B11	41.8
SM2562C40B41	SM2562C40B11	53.8
SM2563C40B41	SM2563C40B11	75.8
SM2564C40B41	SM2564C40B11	85.8

Bipolar motor cable 4837961-1



86 mm sq.



Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SH2861-5141	SH2861-5111	66
SH2862-5141	SH2862-5111	96.5

Stepping Motor General Specifications

Motor model no.	SM256□	SH286□
Operation type	—	
Operating ambient temperature	-10 to +50°C	
Storage temperature	-20 to +65°C	
Operating ambient humidity	20 to 90% RH (non-condensing)	
Storage humidity	5 to 95 % RH (non-condensing)	
Operating altitude	Up to 1000 m above sea level	
Vibration resistance	Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s^2 (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes.	
Shock resistance	Acceleration 500 m/s^2, duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times	
Thermal class	B (+130°C) (A for UL models)	B (+130°C)
Dielectric strength	1120 VAC for 1 minute (between motor winding and frame)	1000 VAC for 1 minute (between motor winding and frame)
Insulation resistance	100 MΩ min. at 500 VDC (between motor winding and frame)	
Protection rating	—	
Winding temperature rise	80 K or less (based on our own standard)	
Positional accuracy tolerance	±0.054°	±0.09
Thrust play (1)	0.075 mm (With a 10 N load)	0.075 mm (With a 10 N load)
Radial play (2)	0.025 mm (With a 5 N load)	0.025 mm (With a 5 N load)
Shaft runout	0.025 mm	0.025 mm
Concentricity of motor shaft and fitting part	ø0.075 mm	ø0.075 mm
Perpendicularity of mounting surface and motor shaft surface	0.1 mm	0.15 mm
Motor mounting orientation	Can be installed vertically or horizontally.	

(1) Thrust play: Shaft position displacement when a load is exerted in a direction parallel to the motor shaft.
(2) Radial play: Maximum shaft position displacement when a load is exerted in a direction perpendicular to the motor shaft. Load is exerted on the point 1/3 the shaft length from the shaft end.

Safety standards

Model no.:SM256□ UL models

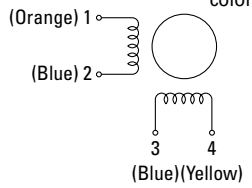
	Classification	Standards	File no.
UL	UL	UL 1004-1, UL 1004-6	E179832
	UL for Canada (cUL)	CSA C22.2 No. 100	

Internal Wiring and Rotational Directions

Connector type Model no.: SM256□

Internal wiring

In parentheses are lead colors of the motor cable



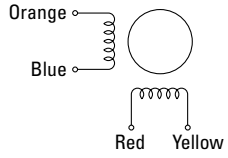
Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Connector pin no.			
		3	2	4	1
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

Lead type Model no.: SH286□

Internal wiring

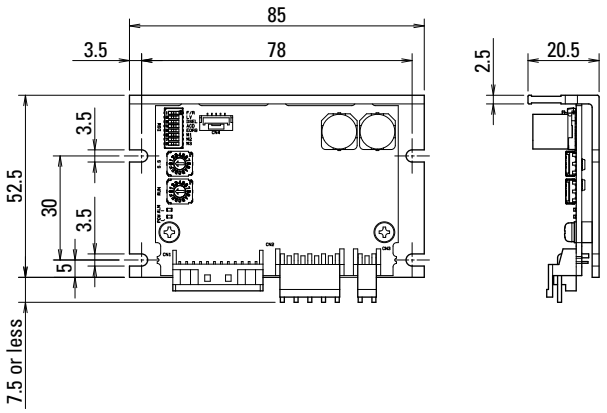


Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Lead color			
		Red	Blue	Yellow	Orange
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

Driver Dimensions Unit: mm



Driver Specifications

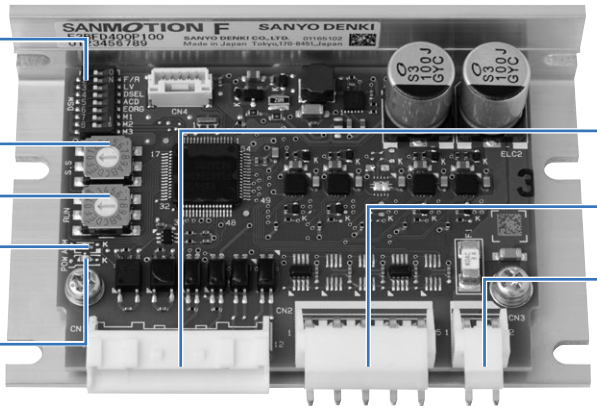
General specifications

Model no.			**F2BFD400P100**
General specifications	Input voltage		24 VDC ±10%
	Input current		5 A
	Environment	Protection class	Class III
		Operating environment	Installation category (Overvoltage category): I (CE), pollution level: 2
		Operating ambient temperature	0 to +50°C
		Storage temperature	-20 to +70°C
		Operating ambient humidity	Below 90% RH (non-condensing)
		Storage humidity	Below 90% RH (non-condensing)
		Operating altitude	Up to 1000 m above sea level
		Vibration resistance	5 m/s², at frequency of 10 to 55 Hz in each X, Y, and Z direction for 2 hours
		Shock resistance	20 m/s²
		Dielectric strength	700 VDC for 1 minute (between power input terminal and chassis)
		Insulation resistance	10 MΩ min. at 500 VDC (between power input terminal and chassis)
	Mass		0.06 kg
Functions	Mode selection		Pulse input mode (1-/2-input mode), low vibration mode (on/off), automatic current limiting (on/off), step division mode (2-/5-phase mode), initial excitation phase (excitation origin/excitation phase of last power off), motor selection, operating current, step angle
	Protection functions		Power supply voltage monitoring, overheat detection, overcurrent protection, non-volatile memory checksum error, hardware error, motor wire breakage detection, command speed error, limit reached
	LED indicators		Power supply monitoring, alarm status monitoring
	PC-based functions		Parameter customization, operating status monitoring
I/O signal	Command pulse input signal		Photocoupler input method; input resistance: 260 Ω High-level input signal voltage: 4.0 to 5.25 V, Low-level input signal voltage: 0 to 0.5 V Between the high- and low-levels shall be 4.0 V or more. Maximum input frequency 400 kpulse/s
	Power down input signal		Photocoupler input method; input resistance: 480 Ω High-level input signal voltage: 4.0 to 5.25 V, Low-level input signal voltage: 0 to 0.5 V
	Step angle selection input signal		Photocoupler input method; input resistance: 480 Ω High-level input signal voltage: 4.0 to 5.25 V, Low-level input signal voltage: 0 to 0.5 V
	Phase origin monitor output/ Alarm output signal		Open-collector output through photocoupler, collector-to-emitter voltage: 30 VDC or less Output current: 10 mA or less, Output saturation voltage: 1.0 V or less

Safety standards

Safety standards		Standards
Directive	Directive	
UL/cUL standards	—	UL 61800-5-1 (File No. E179775)
KC Mark (Korea Certification Mark)	—	KS C 9610-6-2, KS C 9610-6-4
CE marking for EU Directive	Low Voltage Directive (2014/35/EU)	EN 61800-5-1
	Electromagnetic Compatibility Directive (2014/30/EU)	EN 61000-6-2 EN 61000-6-4
	RoHS Directive (2011/65/EU)	EN IEC 63000: 2018
UKCA marking for Great Britain (UK Conformity Assessed Marking)	Electrical Equipment (Safety) Regulations 2016	EN 61800-5-1
	Electromagnetic Compatibility Regulations 2016	EN 61000-6-2 EN 61000-6-4
	RoHS Regulations 2012	EN IEC 63000: 2018

Driver Part Names and Functions



2 Function selection DIP switch (DSW)
3 Step angle selection switch (SS rotary switch)
1 Operating current selection switch (RUN rotary switch)
5 Alarm/Warning indicator LED (ALM)
4 Power supply monitoring LED (POW)

I/O signal connector (CN1)
Motor connector (CN2)
Power supply connector (CN3)

1 Operating current selection switch (RUN rotary switch)

The value of the motor operating current can be set with a rotary switch.

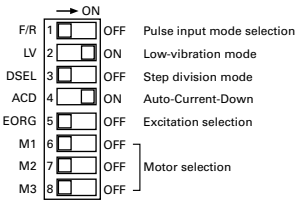
Dial	0	1	2	3	4	5	6	7
Motor current (A)	4	3.8	3.6	3.4	3.2	3	2.8	2.6
Dial	8	9	A	B	C	D	E	F
Motor current (A)	2.4	2.2	2	1.8	1.6	1.4	1.2	1

- The factory setting is F (1 A).
  Select the operating current after checking the rated current of the combination motor.
- If there are sufficient margins of motor torque, decreasing operating current value becomes effective for reduction in heat generation and vibration.
- Make sure to have sufficient operation margins before determining the motor current value to adjust operating current.

2 Function selection DIP switch (DSW)

Functions can be selected to suit your application.

Factory settings



- First, do the settings of the motor to be combined with the driver.
- Make sure to turn off the power supply of the driver when changing the settings of the function selection DIP switch.

Combination motor settings

M1	M2	M3	Wiring current: 3 A/phase(1)		Wiring current: 4 A/phase	
			Motor size	Model no.	Motor size	Model no.
OFF	OFF	OFF	Reserved		Reserved	
ON	OFF	OFF	Reserved		56 mm sq.	SM2561C40B□1
OFF	ON	OFF	56 mm sq.	SM2561C30B□1	56 mm sq.	SM2562C40B□1
ON	ON	OFF	Reserved		56 mm sq.	SM2563C40B□1
OFF	OFF	ON	56 mm sq.	SM2562C30B□1	56 mm sq.	SM2564C40B□1
ON	OFF	ON	56 mm sq.	SM2563C30B□1	86 mm sq.	SH2861-51□1
OFF	ON	ON	56 mm sq.	SM2564C30B□1	Reserved	
ON	ON	ON	Reserved		86 mm sq.	SH2862-51□1

(1)When using a 3 A/phase motor, be sure to set the operating current selection switch (RUN rotary switch) to 75% or less. Failure to follow this may cause the motor to overheat and burnout.

1. Pulse input mode selection (F/R)

Pulse input mode can be selected.

F/R	Pulse input mode
ON	1-input mode (CK, U/D)
OFF	2-input mode (CW, CCW)

2. Low-vibration mode selection (LV)

Motors can smoothly operate even at low-resolution settings such as full-step (1 subdivision) and half-step (2 subdivisions) modes.

LV	Operation mode
ON	Low-vibration mode enabled
OFF	Low-vibration mode disabled

3. Step division mode selection (DSEL)

Select the step angle selection switch (SS rotary switch) mode.

DSEL	Resolution mode
OFF	2-phase mode: Operable as a normal 2-phase stepping system with a step angle of 1.8° to 0.00703125° .
ON	5-phase mode: Operable as a normal 5-phase stepping system with a step angle of 0.72° to 0.00288° .

4. Auto-Current-Down (ACD)

This function reduces the motor current at rest (200 ms after the last pulse is applied), which is effective in suppressing heat generation and reducing the current consumption of the motor and driver.
The current and switching time when turned on can be changed by parameters.

ACD	Current at rest
ON	50% of driving current
OFF	100% of driving current

5. Excitation selection (EORG)

The excitation phase at the time of power-on is selected.

EORG	The excitation phase at power-on
ON	The excitation phase at power-off
OFF	Excitation origin

3 Step angle selection switch (SS rotary switch)

The number of subdivisions for a full step can be set with the rotary switch.

After selecting 2- or 5-phase mode by setting the "3" (DSEL) of the DSW (function selection DIP switch), set the step angle selection switch for the desired step angle.

5-phase mode: When the DSW's "3" (DSEL) is set to ON				2-phase mode: When the DSW's "3" (DSEL) is set to OFF			
SS	Microsteps	Resolution	Step angle	SS	Microsteps	Resolution	Step angle
0	2.5	500	0.72°	0	1	200	1.8°
1 (default setting)	5	1000	0.36°	1 (default setting)	2	400	0.9°
2	6.25	1250	0.288°	2	4	800	0.45°
3	10	2000	0.18°	3	5	1000	0.36°
4	12.5	2500	0.144°	4	8	1600	0.225°
5	20	4000	0.09°	5	10	2000	0.18°
6	25	5000	0.072°	6	16	3200	0.1125°
7	50	10000	0.036°	7	25	5000	0.072°
8	62.5	12500	0.0288°	8	32	6400	0.05625°
9	100	20000	0.018°	9	50	10000	0.036°
A	125	25000	0.0144°	A	64	12800	0.028125°
B	200	40000	0.009°	B	100	20000	0.018°
C	250	50000	0.0072°	C	125	25000	0.0144°
D	312.5	62500	0.00576°	D	128	25600	0.0140625°
E	500	100000	0.0036°	E	250	50000	0.0072°
F	625	125000	0.00288°	F	256	51200	0.00703125°

4 Power supply monitoring LED (POW)

Lights up when the control and main circuit power supply are turned on.

5 Alarm/Warning indicator LED (ALM)

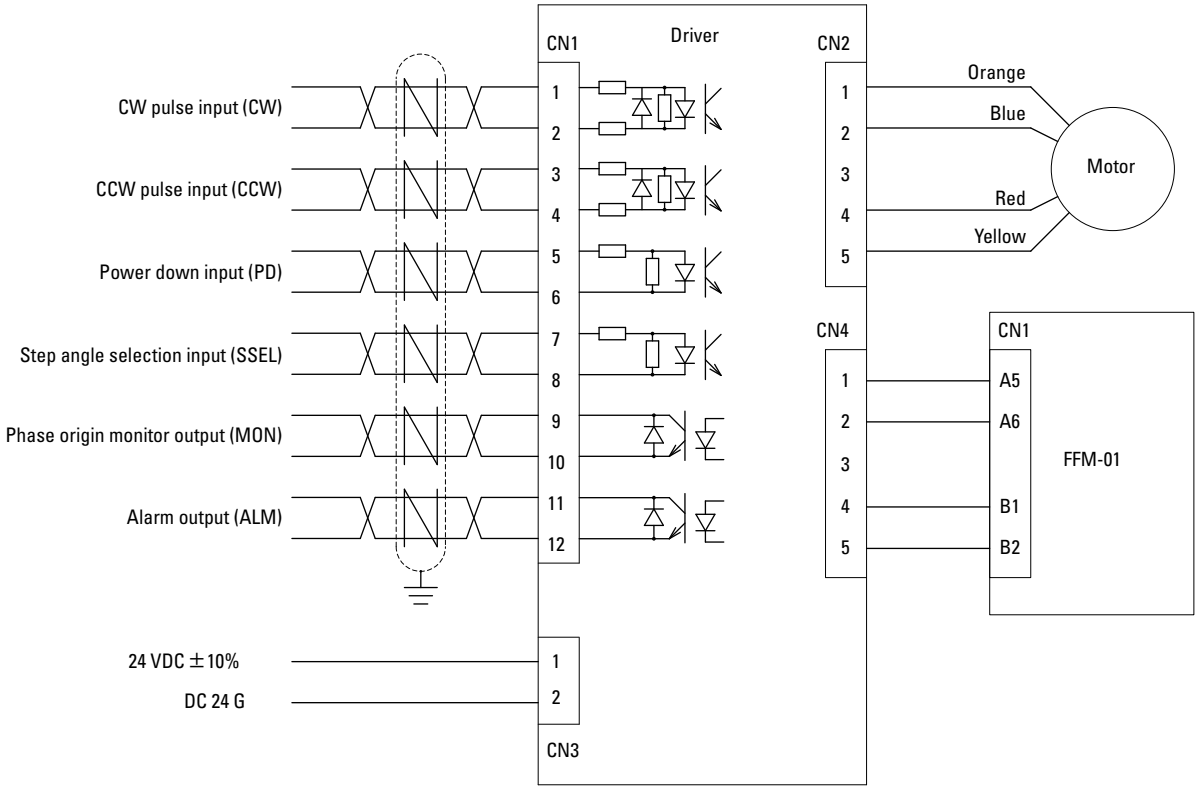
Flashes repeatedly when an alarm is generated.

LED indicators	Status
"ALM" blinks once repeatedly	Main power supply undervoltage
"ALM" blinks 2 times repeatedly	Main power supply overvoltage
"ALM" blinks 3 times repeatedly	Driver overheat
"ALM" blinks 4 times repeatedly	Overcurrent
"ALM" blinks 5 times repeatedly	Non-volatile memory checksum error
"ALM" blinks 6 times repeatedly	Hardware error
"ALM" blinks 7 times repeatedly	Motor wire breakage
"ALM" blinks 8 times repeatedly	Parameter error
"ALM" blinks 9 times repeatedly	Command speed error
"ALM" blinks 10 times repeatedly	Limit reached

- When an alarm occurs, the "ALM" LED blinks and the winding current of the stepping motor is cut off and the status will shift to a "non-excitation" state. At the same time, an output signal is transmitted from the alarm output terminal of the I/O signal connector to the outside.
- In the event of an alarm, identify the cause of the alarm from the number of LED blinks, eliminate the cause, and turn on the power supply again.
- In the case of an alarm, the LED will be lit for about 1 second followed by blinks; in the case of a warning, the LED will only blink.

Connections and Signals

External wiring diagram



Cable size

Type	Applicable wire	Insulation diameter	Wire length
Power cable (CN3)	20 AWG (0.5 mm^2) to 18 AWG (0.75 mm^2)	ø1.7 to ø3.0 mm	Below 3 m
I/O signal cable (CN1)	24 AWG (0.2 mm^2) to 22 AWG (0.3 mm^2)	ø1.0 to ø1.5 mm	Below 2 m
Motor cable (CN2)	20 AWG (0.5 mm^2) to 18 AWG (0.75 mm^2)	ø1.7 to ø3.0 mm	Below 10 m

Note: When bundling wire together or running wires through the duct, take the reduction rate of each wire allowable current into consideration.
When the ambient temperature is relatively high, the wire service life will be shortened due to thermal deterioration.
In this case, please use Heat-resistant Indoor PVC (HIV).

Input/output signal specification overview

Signal	CN1 Pin no.	Function overview
CW pulse input	1 2	When in 2-input mode, a CW-direction pulse is input.
Pulse train input	1 2	When in 1-input mode, a drive pulse train is input to rotate the motor.
CCW pulse input	3 4	When in 2-input mode, a CCW-direction pulse is input.
Rotational direction input	3 4	When in 1-input mode, a drive pulse is input to designate the rotational direction. Internal photocoupler ON ··· CW direction Internal photocoupler OFF ··· CCW direction
Power down input (Standard)	5 6	Shuts down the motor current. The terminal function can be selected in the setup software as a GPIO 1 signal.
Step angle selection input (Standard)	7 8	Enables the number of step divisions set with the setup software. The terminal function can be selected in the setup software as a GPIO 2 signal.
Phase origin monitor output (Standard)	9 10	Turned on when the excitation phase is at the origin. Output logic is the normally-open contact. The terminal function can be selected in the setup software as a GPIO 1 signal.
Alarm output (Standard)	11 12	Turned on when an alarm occurs. The motor shifts to a "non-excitation" state. Output logic is the normally-open contact. The terminal function can be selected in the setup software as a GPIO 2 signal.

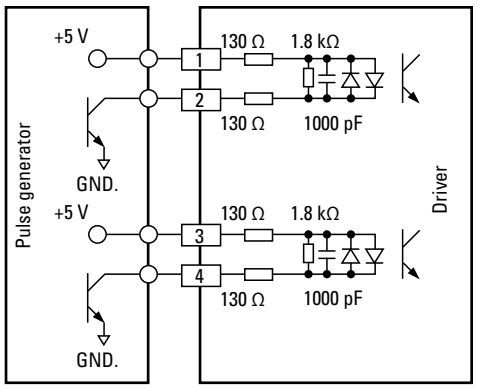
Note: The CW direction refers to the clockwise direction when the motor is viewed from the output shaft side.
The CCW direction refers to the counter-clockwise direction when the , motor is viewed from the output shaft side.

CW (CK) and CCW (U/D) Input Circuit Configuration

Connection example

Pulse crest value

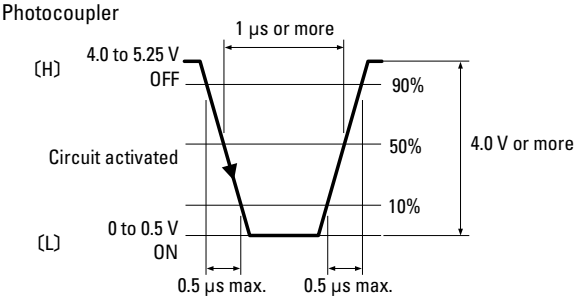
High-level: 4.0 to 5.25 V, low-level: 0 to 0.5 V, high-to-low: 4.0 V or more



- Ensure that the pulse duty is 50% or less.
- Maximum input frequency is 400 kpulse/s.
- If the peak voltage of the input signal exceeds 5.25 V, add an external current-limiting resistor R to limit the input current to around 10 mA.
  (Take the photocoupler forward voltage of 1.5 V into consideration.)

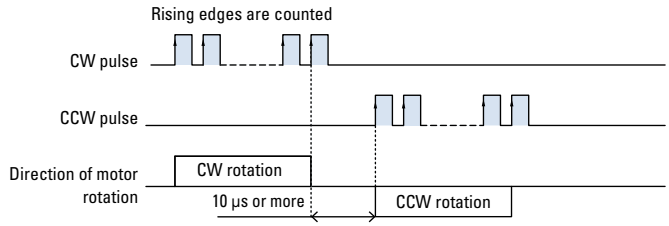
Input signal specifications

Photocoupler



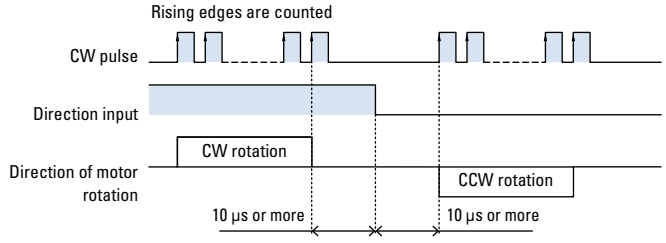
Command pulse timing

2-input mode



- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at the rising edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW-side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW-side internal photocoupler to OFF.
- The CW/CCW pulse switching time of "10 μ_S or more" is the operating time for the driver internal circuit, not the motor response time. Set a time in which the motor can respond for actual operations.
- 1- and 2-input modes can be switched by DIP switch (F/R) settings.

1-input mode



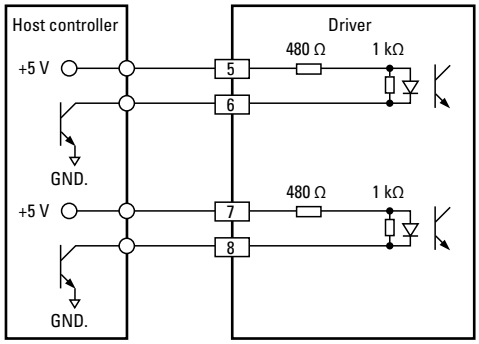
- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at the rising edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW-side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW-side internal photocoupler to OFF.
- The CW/CCW pulse switching time of "10 μ_S or more" is the operating time for the driver internal circuit, not the motor response time. Set a time in which the motor can respond for actual operations.
- 1- and 2-input modes can be switched by DIP switch (F/R) settings.

SSEL and PD Input Circuit Configuration

Connection example

Pulse crest value

High-level: 4.0 to 5.25 V, low-level: 0 to 0.5 V

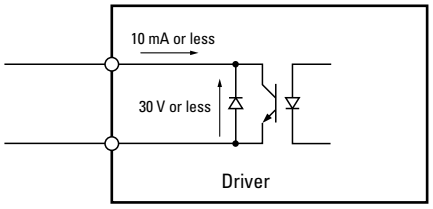


- If the peak voltage of the input signal exceeds 5.25 V, add an external current-limiting resistor R to limit the input current to around 6 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

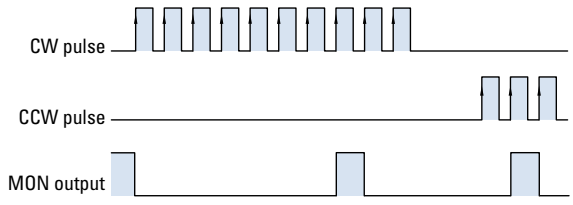
MON and ALM Output Circuit Configuration

Connection example

Collector-to-emitter voltage	30 VDC or less
Output current	10 mA or less
Output saturation voltage	1.0 V or less



MON output

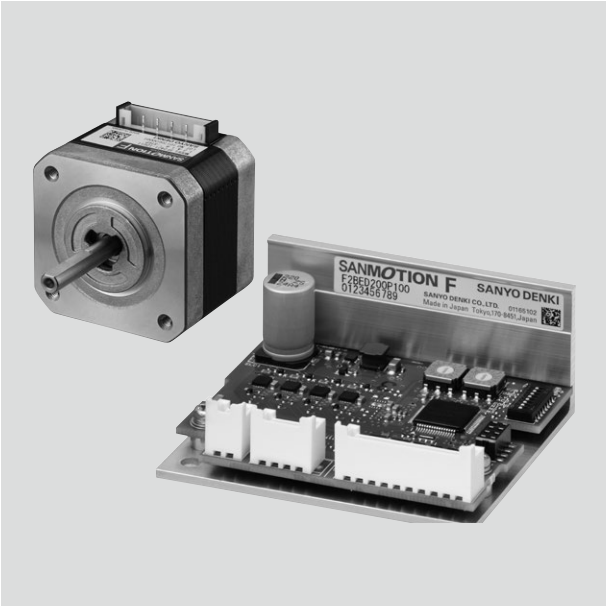


E.g., for 2-phase, 2-step (half-step) mode

- Photocoupler is turned on when the motor's excitation phase is at the origin.
- Inputting pulse turns on photocoupler every 7.2° of motor output axis from the phase origin (3.6° for a full step angle of 0.9°).
- Set command frequency to 30 kpulse/s or less when using the phase origin monitor.
- Perform switching of subdivisions via step angle selection input (SSEL) with phase origin monitor output turned on and motor being stopped.
- If the number of divisions is switched at a point other than the excitation origin, the phase origin monitor output may not be output correctly.

DC Input Drivers/Motors

Basic models



The small, lightweight basic models are compatible with the current models for easy replacement.

Lineup RoHS

Driver

Bipolar Model no.: F2BED200P100 Input voltage: 24 VDC

- The Instruction Manual is available for download from our website.

Motor

(Only for 56 mm sq. motors)

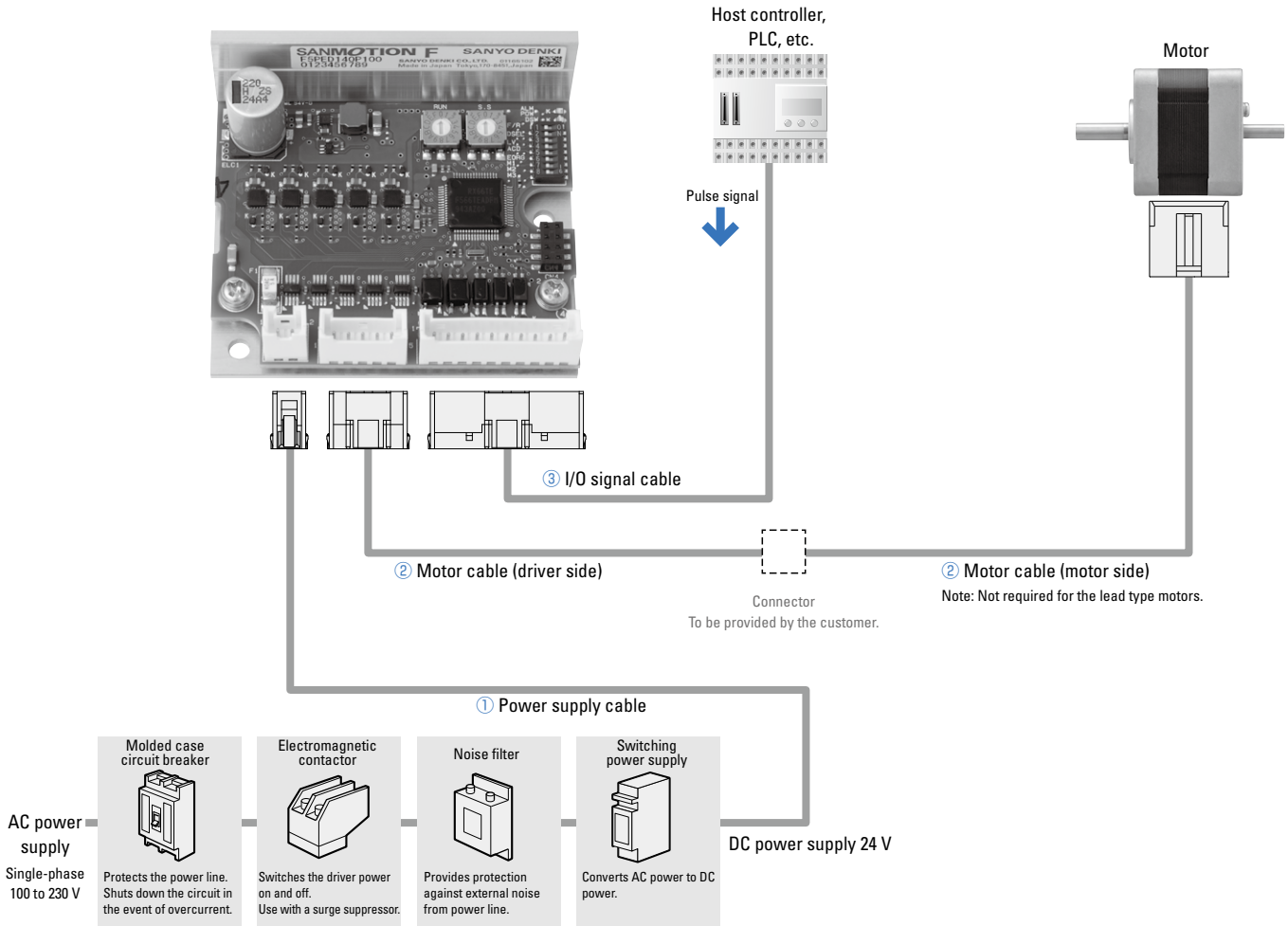
Motor size: 28 mm sq., 42 mm sq., 56 mm sq., 60 mm sq., 86 mm sq.

Options

Cable with connectors

System Configuration

① Power supply cable (option)
② Motor cable (option)
③ I/O signal cable (option)



Combination Table

Motors marked with Ⓛ are lead-type motors. 300 mm or longer leads are attached to the motor.
Motors marked with Ⓒ are connector-type motors.

Motor						Driver		Options		
Model	Motor size	Single shaft		Dual shaft		Page		Model no.	Page	Power supply cable	Motor cable	I/O signal cable
						Specifications	Dimensions					
Standard models	28 mm sq.	**SH2281-5771**	L	**SH2281-5731**	L	p. 25, 31	p. 29	**F2BED200P100**	p. 32	FC8P0010A	FC8M0010A(1) (Driver side)	FC8S0010A
		SH2285-5771	L	**SH2285-5731**	L	p. 25, 31	p. 29					
	42 mm sq.	**SH1421-5241**	L	**SH1421-5211**	L	p. 25, 31	p. 29	**F2BED200P100**	p. 32	FC8P0010A	FC8M0010A(1) (Driver side)	FC8S0010A
		SH1422-5241	L	**SH1422-5211**	L	p. 25, 31	p. 29					
		SH1424-5241	L	**SH1424-5211**	L	p. 25, 31	p. 29					
		SF2421-10B41	C	**SF2421-10B11**	C	p. 26, 31	p. 29				FC8M0010A(1) (Driver side) 4835775-1(2) (Motor side)	
		SF2422-10B41	C	**SF2422-10B11**	C	p. 26, 31	p. 29					
		SF2423-10B41	C	**SF2423-10B11**	C	p. 26, 31	p. 29					
		SF2424-10B41	C	**SF2424-10B11**	C	p. 26, 31	p. 29					
	56 mm sq.	**SM2561C20B41**	C	**SM2561C20B11**	C	p. 27, 31	p. 30	**F2BED200P100**	p. 32	FC8P0010A	FC8M0010A(1) (Driver side) 4837961-1(2) (Motor side)	FC8S0010A
		SM2562C20B41	C	**SM2562C20B11**	C	p. 27, 31	p. 30					
		SM2563C20B41	C	**SM2563C20B11**	C	p. 27, 31	p. 30					
		SM2564C20B41	C	**SM2564C20B11**	C	p. 27, 31	p. 30					
	60 mm sq.	**SH1601-5240**	L	**SH1601-5210**	L	p. 28, 31	p. 30	**F2BED200P100**	p. 32	FC8P0010A	FC8M0010A(1) (Driver side)	FC8S0010A
		SH1602-5240	L	**SH1602-5210**	L	p. 28, 31	p. 30					
		SH1603-5240	L	**SH1603-5210**	L	p. 28, 31	p. 30					
	86 mm sq.	**SH2861-5041**	L	**SH2861-5011**	L	p. 28, 31	p. 30	**F2BED200P100**	p. 32	FC8P0010A	FC8M0010A(1) (Driver side)	FC8S0010A
		SH2862-5041	L	**SH2862-5011**	L	p. 28, 31	p. 30					

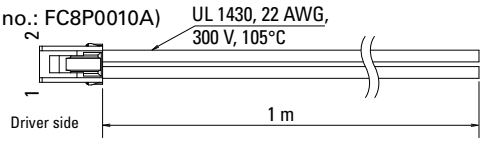
(1) Has a connector on the driver side. The motor-side connector/connection needs to be prepared by customers.
(2) Has a connector on the motor side. The cable relay connector/connection needs to be prepared by customers.

Options

● Cable with connectors

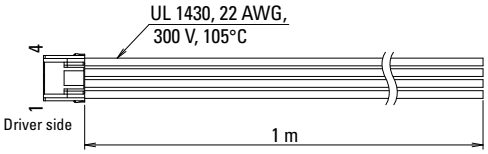
Power supply cable (Model no.: FC8P0010A)

Pin no.	Color
1	White
2	Black



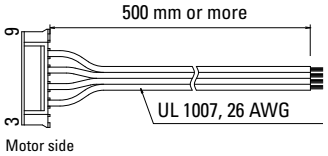
Motor cable Driver side (Model no.: FC8M0010A)

Pin no.	Color
1	Orange
2	Blue
3	Red
4	Yellow



Motor cable Motor side (Model no.: 4835775-1)

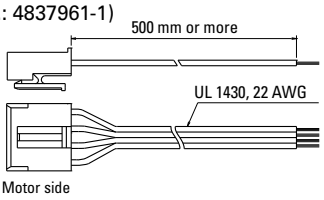
Pin no.	Color
9	Orange
7	Blue
5	Yellow
3	Red



This is a motor–driver cable for use with SF242□-10B□1 motors.

Motor cable Motor side (Model no.: 4837961-1)

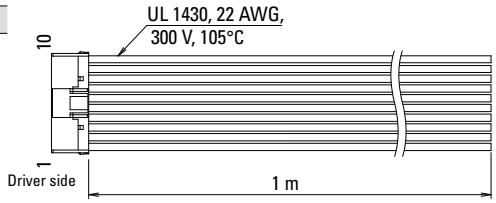
Pin no.	Color
1	Orange
2	Blue
3	Red
4	Yellow



This is a motor–driver cable for use with SM256□C20B□1 motors.

I/O signal cable (Model no.: FC8S0010A)

Pin no.	Color
1	Blue
2	
3	
4	
5	
6	
7	
8	
9	
10	



Bipolar DC input driver (model: F2BED200P100) and stepping motor

RoHS

Motor size		28 mm sq. (1.8° full step angle)		42 mm sq. (0.9° full step angle)		
Motor length		32 mm	51.5 mm	33 mm	39 mm	48 mm
Single shaft	Motor model no.	SH2281-5771	SH2285-5771	SH1421-5241	SH1422-5241	SH1424-5241
Dual shaft	Motor model no.	SH2281-5731	SH2285-5731	SH1421-5211	SH1422-5211	SH1424-5211
Holding torque	N·m	0.07	0.145	0.23	0.34	0.48
Rotor inertia	×10⁻⁴kg·m²	0.01	0.022	0.044	0.066	0.089
Rated current	A/phase	1	1	2	2	2
Motor mass(1)	kg	0.11	0.2	0.24	0.29	0.38
Allowable thrust load	N	3	3	10	10	10
Allowable radial load(2)	N	42	49	25	24	20

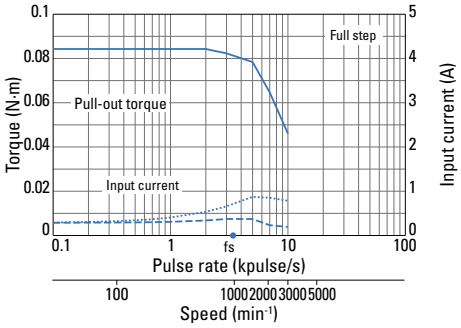
(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

Characteristics

With rubber coupling used Pull-out torque —— Input current (with no load) - - - - Input current (with load) ····· fs: Maximum starting frequency with no load ●

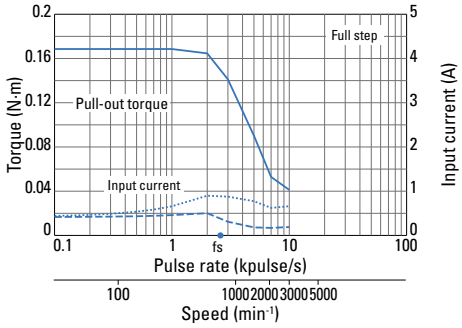
SH2281-5771 SH2281-5731

24 VDC



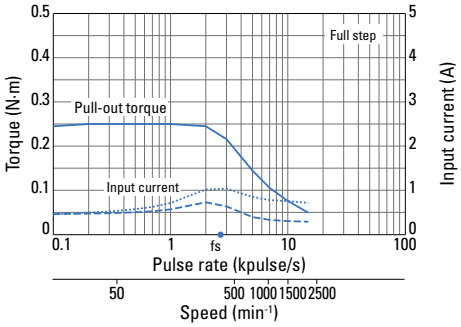
SH2285-5771 SH2285-5731

24 VDC



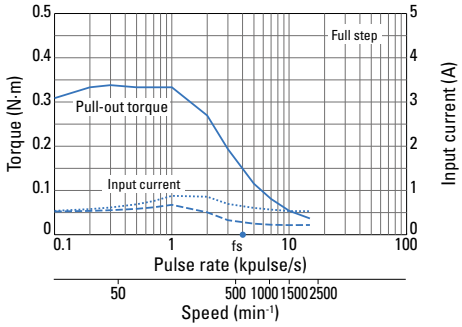
SH1421-5241 SH1421-5211

24 VDC



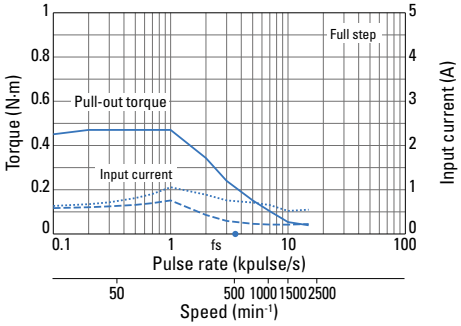
SH1422-5241 SH1422-5211

24 VDC



SH1424-5241 SH1424-5211

24 VDC



System Configuration... ▶p. 23 Combination Table... ▶p. 24 Motor Dimensions... ▶p. 29 to 30 Driver Dimensions... ▶p. 32

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Bipolar DC input driver (model: F2BED200P100) and stepping motor

RoHS

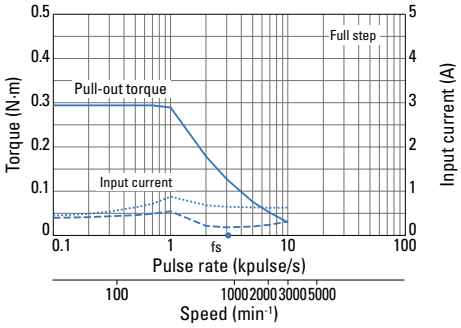
Motor size		42 mm sq. (1.8° full step angle)			
Motor length		33 mm	39 mm	48 mm	59.5 mm
Single shaft	Motor model no.	SF2421-10B41	SF2422-10B41	SF2423-10B41	SF2424-10B41
Dual shaft	Motor model no.	SF2421-10B11	SF2422-10B11	SF2423-10B11	SF2424-10B11
Holding torque	N·m	0.29	0.43	0.56	0.8
Rotor inertia	× 10^{-4}kg·m²	0.031	0.046	0.063	0.094
Rated current	A/phase	1	1	1	1
Motor mass(1)	kg	0.23	0.3	0.38	0.51
Allowable thrust load	N	10	10	10	10
Allowable radial load(2)	N	38	34	30	20

(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

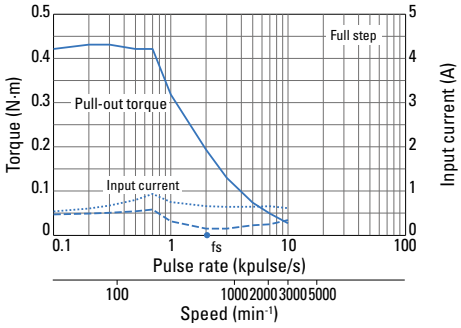
Characteristics

With rubber coupling used — Pull-out torque —— Input current (with no load) - - - - Input current (with load) ····· fs: Maximum starting frequency with no load ●

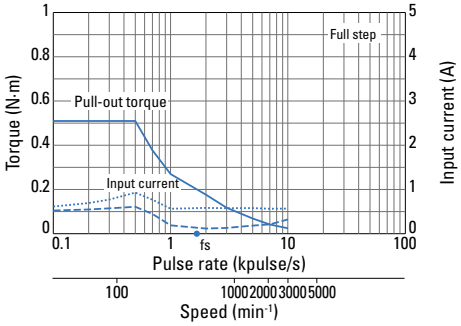
SF2421-10B41 SF2421-10B11 — 24 VDC



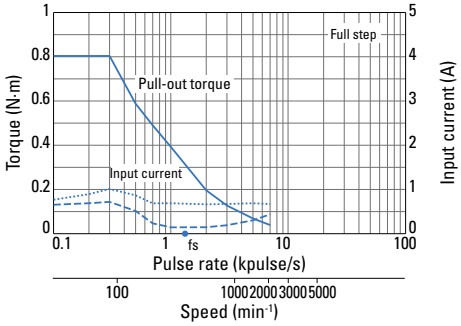
SF2422-10B41 SF2422-10B11 — 24 VDC



SF2423-10B41 SF2423-10B11 — 24 VDC



SF2424-10B41 SF2424-10B11 — 24 VDC



Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Bipolar DC input driver (model: F2BED200P100) and stepping motor

RoHS

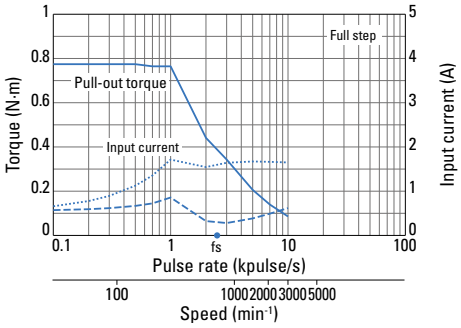
Motor size		56 mm sq. (1.8° full step angle)			
Motor length		41.8 mm	53.8 mm	75.8 mm	85.8 mm
Single shaft	Motor model no.	SM2561C20B41	SM2562C20B41	SM2563C20B41	SM2564C20B41
Dual shaft	Motor model no.	SM2561C20B11	SM2562C20B11	SM2563C20B11	SM2564C20B11
Holding torque	N·m	0.75	1.4	2.35	2.5
Rotor inertia	× 10^{-4}kg·m²	0.14	0.28	0.5	0.6
Rated current	A/phase	2	2	2	2
Motor mass(1)	kg	0.49	0.69	1.1	1.27
Allowable thrust load	N	20	20	20	20
Allowable radial load(2)	N	113	102	78	70

(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

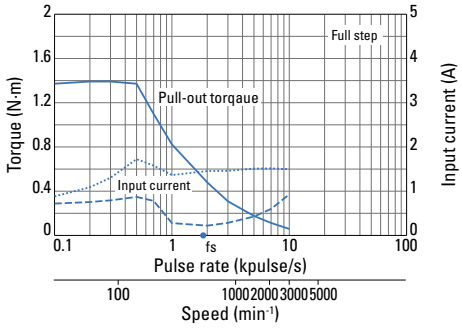
Characteristics

With rubber coupling used Pull-out torque —— Input current (with no load) - - - - Input current (with load) ····· fs: Maximum starting frequency with no load ●

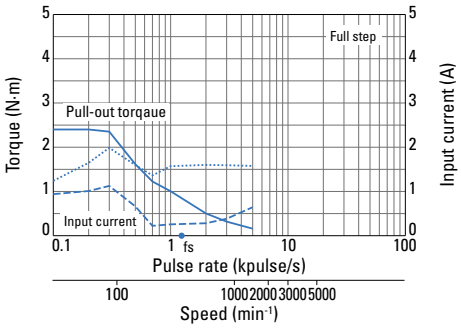
SM2561C20B41 SM2561C20B11 — 24 VDC



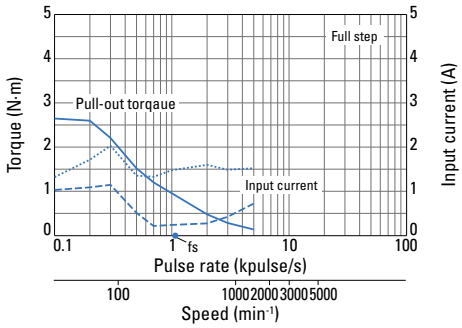
SM2562C20B41 SM2562C20B11 — 24 VDC



SM2563C20B41 SM2563C20B11 — 24 VDC



SM2564C20B41 SM2564C20B11 — 24 VDC



Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Bipolar DC input driver (model: F2BED200P100) and stepping motor

RoHS

Motor size		60 mm sq. (0.9° full step angle)			86 mm sq. (1.8° full step angle)	
Motor length		42 mm	54 mm	76 mm	66 mm	96.5 mm
Single shaft	Motor model no.	SH1601-5240	SH1602-5240	SH1603-5240	SH2861-5041	SH2862-5041
Dual shaft	Motor model no.	SH1601-5210	SH1602-5210	SH1603-5210	SH2861-5011	SH2862-5011
Holding torque	N·m	0.69	1.28	2.15	3.3	6.4
Rotor inertia	× 10^{-4}kg·m²	0.24	0.4	0.75	1.48	3.0
Rated current	A/phase	2	2	2	2	2
Motor mass(1)	kg	0.55	0.8	1.2	1.75	2.9
Allowable thrust load	N	15	15	15	60	60
Allowable radial load(2)	N	78	65	83	200	200

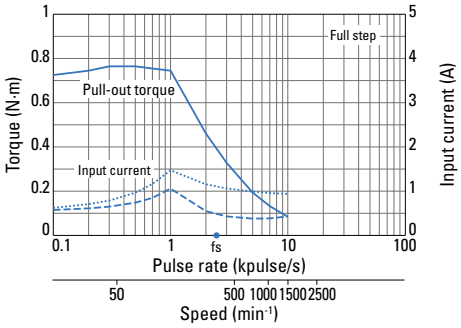
(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

Characteristics

With rubber coupling used Pull-out torque —— Input current (with no load) - - - - Input current (with load) ····· fs: Maximum starting frequency with no load ●

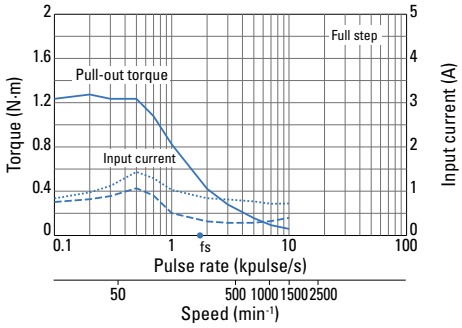
SH1601-5240 SH1601-5210

24 VDC



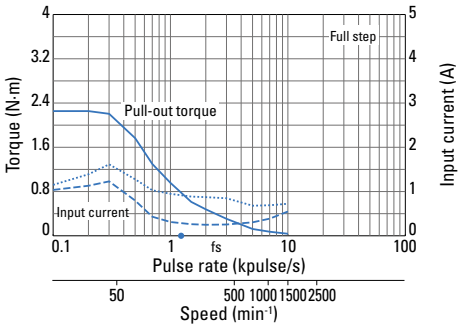
SH1602-5240 SH1602-5210

24 VDC



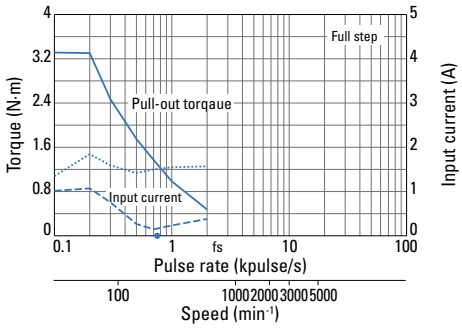
SH1603-5240 SH1603-5210

24 VDC



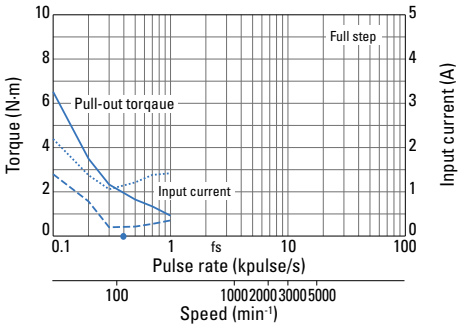
SH2861-5041 SH2861-5011

24 VDC



SH2862-5041 SH2862-5011

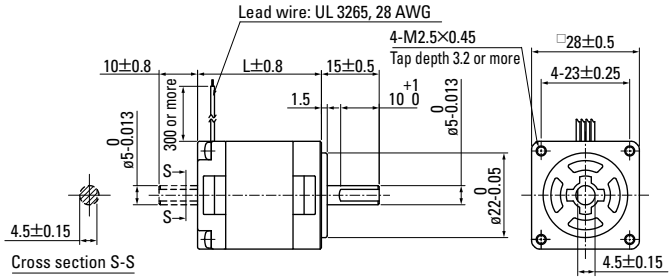
24 VDC



Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

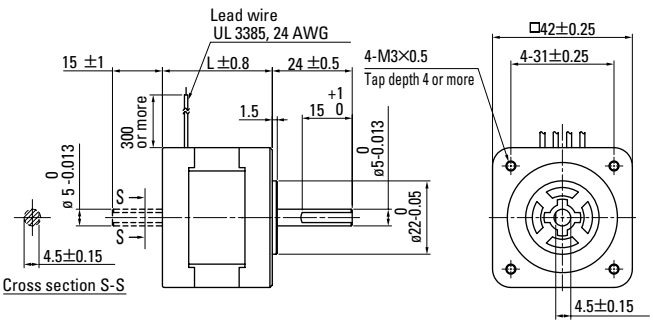
Stepping Motor Dimensions Unit: mm

28 mm sq.



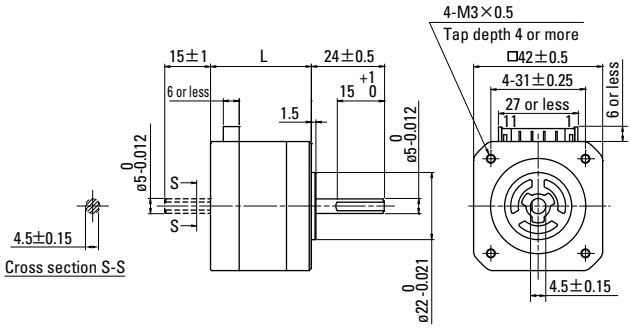
Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SH2281-5771	SH2281-5731	32
SH2285-5771	SH2285-5731	51.5

42 mm sq.



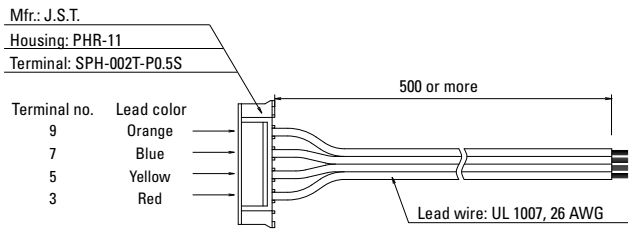
Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SH1421-5241	SH1421-5211	33
SH1422-5241	SH1422-5211	39
SH1424-5241	SH1424-5211	48

42 mm sq.



Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SF2421-10B41	SF2421-10B11	33 ± 0.5
SF2422-10B41	SF2422-10B11	39 ± 0.5
SF2423-10B41	SF2423-10B11	48 ± 0.5
SF2424-10B41	SF2424-10B11	59.5 ± 1

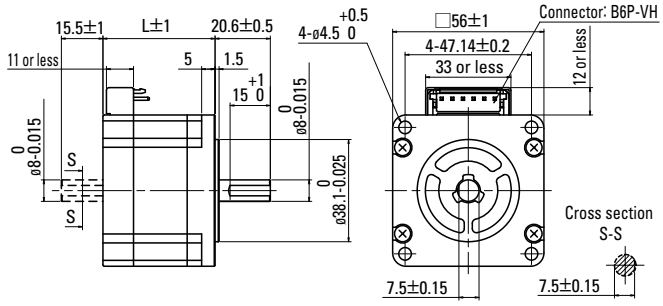
Bipolar motor cable 4835775-1



This is a motor–driver cable for use with SF242□-10B□1 motors.

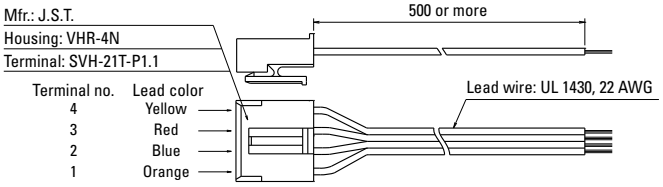
Stepping Motor Dimensions Unit: mm

56 mm sq.

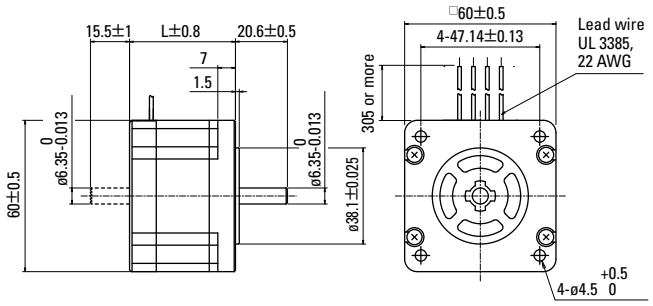


Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SM2561C20B41	SM2561C20B11	41.8
SM2562C20B41	SM2562C20B11	53.8
SM2563C20B41	SM2563C20B11	75.8
SM2564C20B41	SM2564C20B11	85.8

Bipolar motor cable 4837961-1

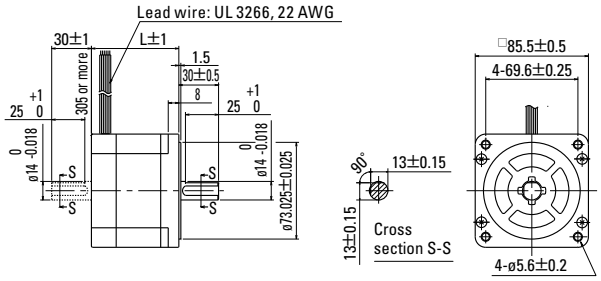


60 mm sq.



Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SH1601-5240	SH1601-5210	42
SH1602-5240	SH1602-5210	54
SH1603-5240	SH1603-5210	76

86 mm sq.



Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SH2861-5041	SH2861-5011	66
SH2862-5041	SH2862-5011	96.5

Stepping Motor General Specifications

Motor model no.	SH228□	SH142□	SF242□	SM256□	SH160□	SH286□
Operation type	—					
Operating ambient temperature	-10 to +50°C					
Storage temperature	-20 to +65°C					
Operating ambient humidity	20 to 90%RH (non-condensing)					
Storage humidity	5 to 95%RH (non-condensing)					
Operating altitude	Up to 1000 m above sea level					
Vibration resistance	Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes.					
Shock resistance	Acceleration 500 m/s², duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times					
Thermal class	B (+130°C)			B (+130°C) (A for UL models)	B (+130°C)	
Dielectric strength	500 VAC for 1 minute (between motor winding and frame)			1120 VAC for 1 minute (between motor winding and frame)	1000 VAC for 1 minute (between motor winding and frame)	
Insulation resistance	100 MΩ min. at 500 VDC (between motor winding and frame)					
Protection rating	—					
Winding temperature rise	80 K or less (based on our own standard)					
Positional accuracy tolerance	±0.09°	±0.054°	±0.09°	±0.054°	±0.054°	±0.09°
Thrust play (1)	0.075 mm or less (With a 1.5 N load)	0.075 mm or less (With a 5 N load)	0.075 mm (With a 5 N load)	0.075 mm (With a 10 N load)	0.075 mm (With a 10 N load)	0.075 mm (With a 10 N load)
Radial play (2)	0.025 mm (With a 5 N load)					
Shaft runout	0.025 mm					
Concentricity of motor shaft and fitting part	ø0.05 mm	ø0.05 mm	ø0.05 mm	ø0.075 mm	ø0.075 mm	ø0.075 mm
Perpendicularity of mounting surface and motor shaft surface	0.1 mm	0.1 mm	0.1 mm	0.1 mm	0.1 mm	0.15 mm
Motor mounting orientation	Can be installed vertically or horizontally.					

(1) Thrust play: Shaft position displacement when a load is exerted in a direction parallel to the motor shaft.
(2) Radial play: Maximum shaft position displacement when a load is exerted in a direction perpendicular to the motor shaft. Load is exerted on the point 1/3 the shaft length from the shaft end.

Safety standards

Model no.:SM256□ UL models

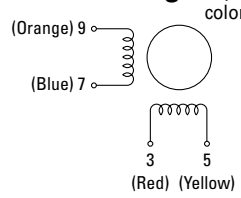
	Classification	Standards	File no.
UL	UL	UL 1004-1, UL 1004-6	E179832
	UL for Canada (cUL)	CSA C22.2 No. 100	

Internal Wiring and Rotational Directions

Connector type Model no.: SF242□

Internal wiring

In parentheses are lead colors of the motor cable



Direction of motor rotation

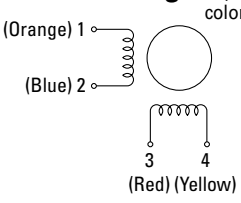
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Connector pin no.			
		3	7	5	9
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

Connector type Model no.: SM256□

Internal wiring

In parentheses are lead colors of the motor cable



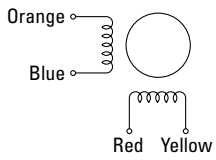
Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Connector pin no.			
		3	2	4	1
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

Lead type

Internal wiring

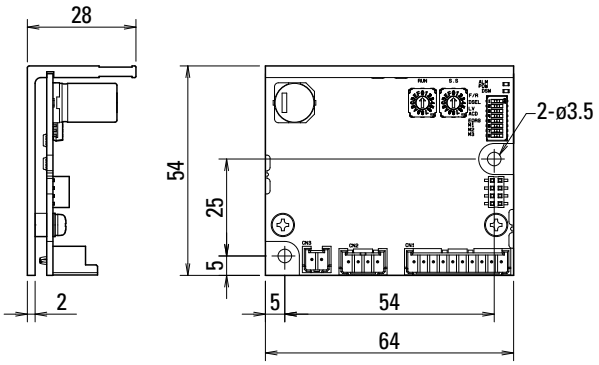


Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Lead color			
		Red	Blue	Yellow	Orange
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

Driver Dimensions Unit: mm



Driver Specifications

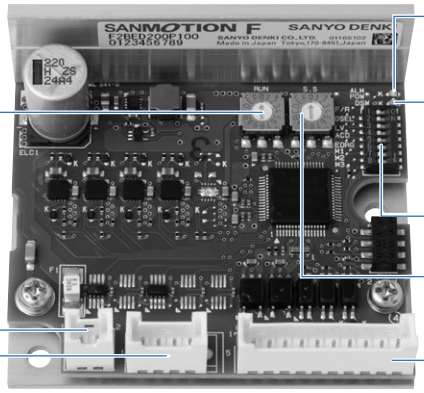
General specifications

Model no.			F2BED200P100
Basic specifications	Input voltage		24 VDC ±10%
	Input current		3 A
	Environment	Protection class	Class III
		Operating environment	Installation category (Overvoltage category): I (CE), pollution level: 2
		Operating ambient temperature	0 to +50°C
		Storage temperature	-20 to +70°C
		Operating ambient humidity	Below 90% RH (non-condensing)
		Storage humidity	Below 90% RH (non-condensing)
		Operating altitude	Up to 1000 m above sea level
		Vibration resistance	5 m/s², at frequency of 10 to 55 Hz in each X, Y, and Z direction for 2 hours
		Shock resistance	20 m/s²
		Dielectric strength	700 VDC for 1 minute (between power input terminal and chassis)
		Insulation resistance	10 MΩ min. at 500 VDC (between power input terminal and chassis)
	Mass		0.06 kg
Functions	Mode selection		Pulse input mode (1-/2-input mode), low vibration mode (on/off), automatic current limiting (on/off), step division mode (2-/5-phase mode), initial excitation phase (excitation origin/excitation phase of last power off), motor selection, operating current, step angle
	Protection functions		Power supply voltage monitoring, overheat detection, overcurrent protection, non-volatile memory checksum error, hardware error, motor wire breakage detection, command speed error
	LED indicators		Power supply, alarm/warning indicator
	PC-based functions		—
I/O signal	Command pulse input signal		Photocoupler input method; input resistance: 260 Ω High-level input signal voltage: 4.0 to 5.25 V, Low-level input signal voltage: 0 to 0.5 V high-to-low voltage: 4.0 V or more. Maximum input frequency 400 kpulse/s
	Power down input signal		Photocoupler input method; input resistance: 480 Ω High-level input signal voltage: 4.0 to 5.25 V, Low-level input signal voltage: 0 to 0.5 V
	Step angle selection input signal		—
	Phase origin monitor output/		Open-collector output through photocoupler, collector-to-emitter voltage: 30 VDC or less Output current: 10 mA or less, Output saturation voltage: 1.0 V or less

Safety standards

Safety standards		Standards
Directive	Directive	
UL/cUL standards	—	UL 61800-5-1 (File No. E179775)
KC Mark (Korea Certification Mark)	—	KS C 9610-6-2, KS C 9610-6-4
CE marking for EU Directive	Low Voltage Directive (2014/35/EU)	EN 61800-5-1
	Electromagnetic Compatibility Directive (2014/30/EU)	EN 61000-6-2 EN 61000-6-4
	RoHS Directive (2011/65/EU)	EN IEC 63000: 2018
UKCA marking for Great Britain (UK Conformity Assessed Marking)	Electrical Equipment (Safety) Regulations 2016	EN 61800-5-1
	Electromagnetic Compatibility Regulations 2016	EN 61000-6-2 EN 61000-6-4
	RoHS Regulations 2012	EN IEC 63000: 2018

Driver Part Names and Functions



1 Operating current selection switch (RUN rotary switch)

Power supply connector (CN3)

Motor connector (CN2)

5 Alarm/Warning indicator LED (ALM)

4 Power supply indicator LED (POW)

2 Function selection DIP switch (DSW)

3 Step angle selection switch (SS rotary switch)

I/O signal connector (CN1)

1 Operating current selection switch (RUN rotary switch)

The value of the motor operating current can be set with a rotary switch.

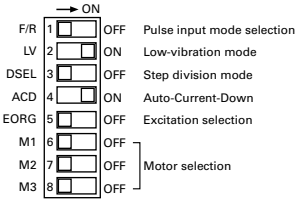
Dial	0	1	2	3	4	5	6	7
Motor current (A)	2	1.9	1.8	1.7	1.6	1.5	1.4	1.3
Dial	8	9	A	B	C	D	E	F
Motor current (A)	1.2	1.1	1.0	0.9	0.8	0.7	0.6	0.5

The factory setting is F (0.5 A). Select the operating current after checking the rated current of the combination motor.

2 Function selection DIP switch (DSW)

Functions can be selected to suit your application.

Factory settings



- First, do the settings of the motor to be combined with the driver.
- Make sure to turn off the power supply of the driver when changing the settings of the function selection DIP switch.

Combination motor settings

M1	M2	M3	Compatible motors	
			Motor size	Model no.
OFF	OFF	OFF	—	Reserved
ON	OFF	OFF	42 mm sq.	SH1421-52□1
OFF	ON	OFF	42 mm sq.	SH1422-52□1, SH1424-52□1
			56 mm sq.	SM2561C20B□1
			60 mm sq.	SH1601-52□0
ON	ON	OFF	56 mm sq.	SM2562C20B□1
			60 mm sq.	SH1602-52□0
OFF	OFF	ON	56 mm sq.	SM2563C20B□1
			60 mm sq.	SH1603-52□0
ON	OFF	ON	56 mm sq.	SM2564C20B□1
OFF	ON	ON	86 mm sq.	SH2861-50□1
ON	ON	ON	86 mm sq.	SH2862-50□1

1. Pulse input mode selection (F/R)

Pulse input mode can be selected.

F/R	Pulse input mode
ON	1-input mode (CK, U/D)
OFF	2-input mode (CW, CCW)

2. Low-vibration mode selection (LV)

Motors can smoothly operate even at low-resolution settings such as full-step (1 subdivision) and half-step (2 subdivisions) modes.

LV	Operation mode
ON	Low-vibration mode enabled
OFF	Low-vibration mode disabled

3. Step division mode selection (DSEL)

Select the step angle selection switch (SS rotary switch) mode.

DSEL	Resolution mode
OFF	2-phase mode: Operable as a normal 2-phase stepping system with a step angle of 1.8° to 0.00703125° (0.9° to 0.003515625° for a full step angle of 0.9°).
ON	5-phase mode: Operable as a normal 5-phase stepping system with a step angle of 0.72° to 0.00288° (0.36° to 0.00144° for a full step angle of 0.9°).

4. Auto-Current-Down (ACD)

This function reduces the motor current at rest (200 ms after the last pulse is applied), which is effective in suppressing heat generation and reducing the current consumption of the motor and driver.

ACD	Current at rest
ON	50% of driving current
OFF	100% of driving current

5. Excitation selection (EORG)

The excitation phase at the time of power-on is selected.

EORG	The excitation phase at power-on
ON	The excitation phase at power-off
OFF	Excitation origin

By turning on EORG, the excitation phase at the time of power-ff will be saved. Therefore, there will be no shaft displacement when the power is turned on next time.

3 Step angle selection switch (SS rotary switch)

The number of subdivisions for a full step can be set with the rotary switch.

After selecting 2- or 5-phase mode by setting the "3" (DSEL) of the DSW (function selection DIP switch), set the step angle selection switch for the desired step angle.

5-phase mode: When the DSW's "3" (DSEL) is set to ON				2-phase mode: When the DSW's "3" (DSEL) is set to OFF			
SS	Microsteps	Resolution	Step angle	SS	Microsteps	Resolution	Step angle
0	2.5	500	0.72°	0	1	200	1.8°
1 (default setting)	5	1000	0.36°	1 (default setting)	2	400	0.9°
2	6.25	1250	0.288°	2	4	800	0.45°
3	10	2000	0.18°	3	5	1000	0.36°
4	12.5	2500	0.144°	4	8	1600	0.225°
5	20	4000	0.09°	5	10	2000	0.18°
6	25	5000	0.072°	6	16	3200	0.1125°
7	50	10000	0.036°	7	25	5000	0.072°
8	62.5	12500	0.0288°	8	32	6400	0.05625°
9	100	20000	0.018°	9	50	10000	0.036°
A	125	25000	0.0144°	A	64	12800	0.028125°
B	200	40000	0.009°	B	100	20000	0.018°
C	250	50000	0.0072°	C	125	25000	0.0144°
D	312.5	62500	0.00576°	D	128	25600	0.0140625°
E	500	100000	0.0036°	E	250	50000	0.0072°
F	625	125000	0.00288°	F	256	51200	0.00703125°

4 Power supply monitoring LED (POW)

Lights up when the control and main circuit power supply are turned on.

5 Alarm/Warning indicator LED (ALM)

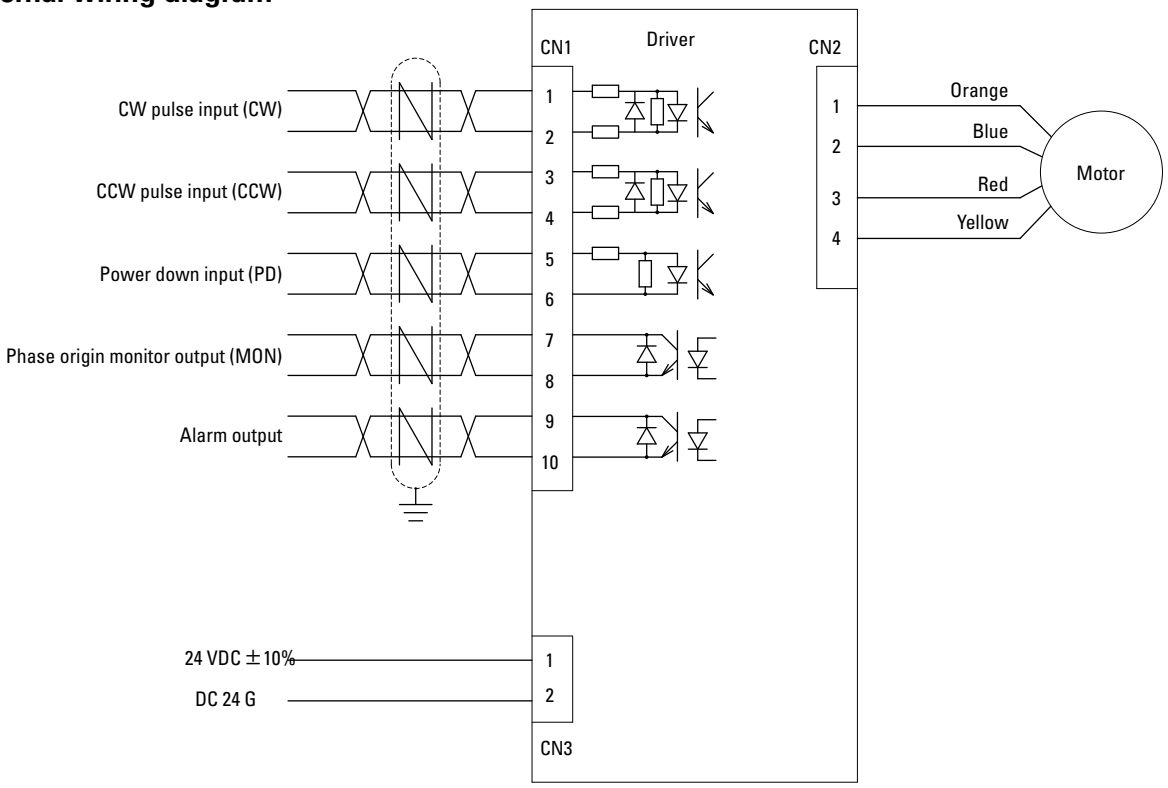
Flashes repeatedly when an alarm is generated.

LED indicators	Status
"ALM" blinks once repeatedly	Main power supply undervoltage
"ALM" blinks 2 times repeatedly	Main power supply overvoltage
"ALM" blinks 3 times repeatedly	Driver overheat
"ALM" blinks 4 times repeatedly	Overcurrent
"ALM" blinks 5 times repeatedly	Non-volatile memory checksum error
"ALM" blinks 6 times repeatedly	Hardware error
"ALM" blinks 7 times repeatedly	Motor wire breakage
"ALM" blinks 9 times repeatedly	Command speed error

- When an alarm occurs, the "ALM" LED blinks and the winding current of the stepping motor is cut off and the status will shift to a "non-excitation" state. At the same time, an output signal is transmitted from the alarm output terminal of the I/O signal connector to the outside.
- In the event of an alarm, identify the cause of the alarm from the number of LED blinks, eliminate the cause, and turn on the power supply again.
- In the case of an alarm, the LED will be lit for about 1 second followed by blinks; in the case of a warning, the LED will only blink.

Connections and Signals

External wiring diagram



Cable size

Part	Cable size	Insulation diameter	Wire length
Power cable (CN3)	22 AWG (0.3 mm²)	ø1.15 to ø1.8 mm	Below 3 m
I/O signal cable (CN1)	22 AWG (0.3 mm²)	ø1.15 to ø1.8 mm	Below 2 m
Motor cable (CN2)	22 AWG (0.3 mm²)	ø1.15 to ø1.8 mm	Below 10 m

Note: When bundling wire together or running wires through the duct, take the reduction rate of each wire allowable current into consideration.
When the ambient temperature is relatively high, the wire service life will be shortened due to thermal deterioration.
In this case, please use Heat-resistant Indoor PVC (HIV).
When extending the motor wire, use the thickest wire possible.

Input/output signal specification overview

Signal	CN1 pin no.	Function overview
CW pulse input (Standard)	1 2	When in 2-input mode, a CW-direction pulse is input.
Pulse train input	1 2	When in 1-input mode, a drive pulse train is input to rotate the motor.
CCW pulse input (Standard)	3 4	When in 2-input mode, a CCW-direction pulse train is input.
Rotational direction input	3 4	When in 1-input mode, a drive pulse is input to designate the rotational direction. Internal photocoupler ON ··· CW direction Internal photocoupler OFF ··· CCW direction
Power down input	5 6	A PD signal input will cut off (power off) the current flowing to the motor. Internal photocoupler ON ··· PD function is enabled. Internal photocoupler OFF ··· PD function is disabled
Phase origin monitor output	7 8	Turned on when the excitation phase is at the origin (when power is turned on). In full step mode, turned on once for 10 pulses. In half step mode, turned on once for 20 pulses.
Alarm output	9 10	When the alarm circuit is activated inside the driver, an alarm signal is output to outside, which turns the stepping motor to non-excited state. The stepping motor shifts to a "non-excitation" state.

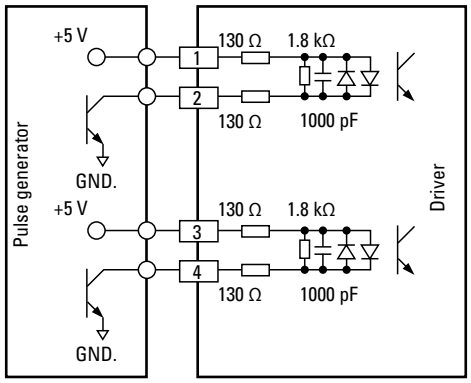
Note: The CW direction refers to the clockwise direction when the motor is viewed from the output shaft side.
The CCW direction refers to the counter-clockwise direction when the motor is viewed from the output shaft side.

CW (CK) and CCW (U/D) Input Circuit Configuration

Connection example

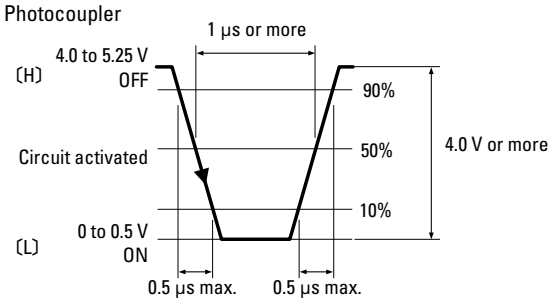
Pulse crest value

High-level: 4.0 to 5.25 V, low-level: 0 to 0.5 V, high-to-low: 4.0 V or more



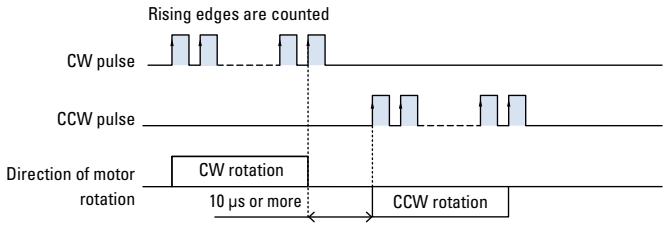
- Ensure that the pulse duty is 50% or less.
- Maximum input frequency is 400 kpulse/s.
- If the peak voltage of the input signal exceeds 5.25 V, add an external current-limiting resistor R to limit the input current to around 10 mA.
  (Take the photocoupler forward voltage of 1.5 V into consideration.)

Input signal specifications



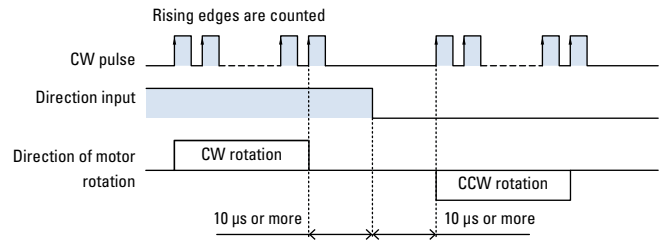
Command pulse timing

2-input mode (CW, CCW)



- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at the rising edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW-side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW-side internal photocoupler to OFF.
- The CW/CCW pulse switching time of "10 µs or more" is the operating time for the driver internal circuit, not the motor response time. Set a time in which the motor can respond for actual operations.
- 1- and 2-input modes can be switched by DIP switch (F/R) settings.

1-input mode (CK, U/D)



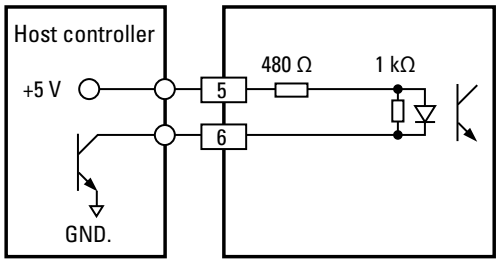
- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at the rising edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW-side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW-side internal photocoupler to OFF.
- The CW/CCW pulse switching time of "10 µs or more" is the operating time for the driver internal circuit, not the motor response time. Set a time in which the motor can respond for actual operations.
- 1- and 2-input modes can be switched by DIP switch (F/R) settings.

PD Input Circuit Configuration

Connection example

Pulse crest value

High-level: 4.0 to 5.25 V, low-level: 0 to 0.5 V

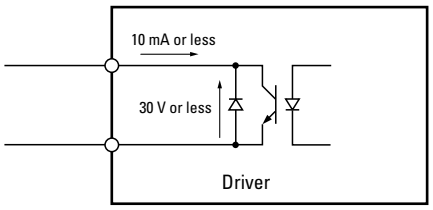


- If the peak voltage of the input signal exceeds 5.25 V, add an external current-limiting resistor R to limit the input current to around 6 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

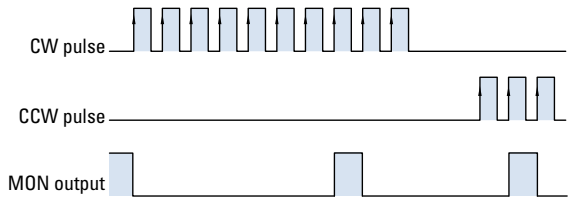
MON and ALM Output Circuit Configuration

Connection example

Collector-to-emitter voltage	30 VDC or less
Output current	10 mA or less
Output saturation voltage	1.0 V or less



MON output



E.g., for 2-phase, 2-step (half-step) mode

- Photocoupler is turned on when the motor's excitation phase is at the origin.
- Inputting pulse turns on photocoupler every 7.2° of motor output axis from the phase origin (3.6° for a full step angle of 0.9°).
- Set command frequency to 30 kpulse/s or less when using the phase origin monitor.
- Perform switching of subdivisions via step angle selection input (SSEL) with phase origin monitor output turned on and motor being stopped.
- If the number of divisions is switched at a point other than the excitation origin, the phase origin monitor output may not be output correctly.

Stepping Motors

How to Read Specifications

Bipolar, lead type

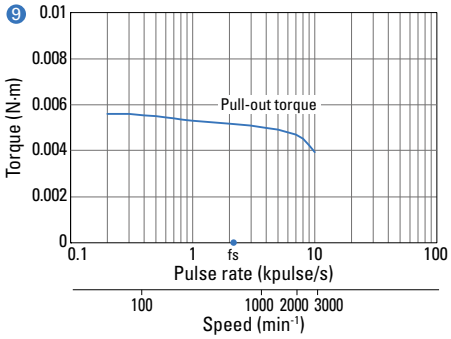
❶ Model no.		❷ Holding torque at 2-phase excitation	❸ Rated current	❹ Winding resistance	❺ Winding inductance	❻ Rotor inertia	❼ Mass	❽ Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	kg	mm
SH2141-5541	**SH2141-5511**	0.0065	0.3	21	4.2	0.00058	0.03	30
SH2145-5641	**SH2145-5611**	0.01	0.4	19	4	0.0011	0.042	43.8

Characteristics

SH2141-5541
SH2141-5511

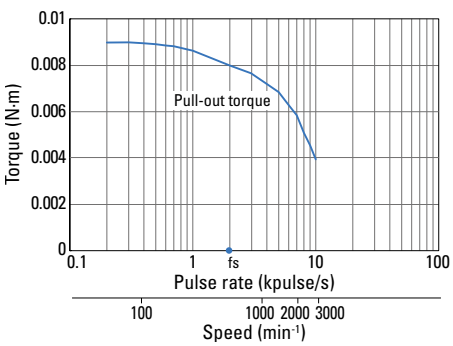
Constant current circuit
Input voltage: 24 VDC
Winding current: 0.3 A/phase
2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
f_S: Maximum starting pulse rate with no load

❾



SH2145-5641
SH2145-5611

Constant current circuit
Input voltage: 24 VDC
Winding current: 0.4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
f_S: Maximum starting pulse rate with no load



❶ This is the model number of the stepping motor.

❷ This is the maximum torque that is generated when the stepping motor is rotated by exerting an external force on the shaft at 2-phase excitation at the rated current.

❸ This is the rated current that flows to the motor winding. When current of this value flows through a motor, the torque generated will be the same as the holding torque.

❹ This is the resistance for one phase of stepping motor winding.

❺ This is the inductance for one phase of stepping motor winding.

❻ This is the moment of inertia of the rotor. This indicates the degree of ease with which the rotor accelerates or decelerates.

❼ This is the mass of the stepping motor.

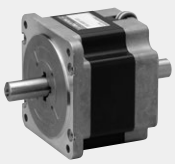
❽ This is the length of the stepping motor.

❾ This graph shows the relationship between the pulse rate (frequency), motor speed, and pull-out torque in a full-step mode.

Lineup

Stepping Motors RoHS

These motors can be purchased as a single item.

Motor size	Full step angle	Holding torque [N·m] Model no.	Custom options *	Page
14 mm sq. Ultra-compact 	1.8°	0.0065 to 0.01 SH214 □ -5 □□ 1	Hollow shaft Custom shaft	p. 42
28 mm sq. 	1.8°	0.055 to 0.145 SH228 □ -5 □□ 1	Hollow shaft Custom shaft Gear Encoder	p. 43 to 44
35 mm sq. 	1.8°	0.12 to 0.32 SH35 □□ -1 □□□ 0	Hollow shaft Custom shaft	p. 45 to 46
42 mm sq. 	1.8°	0.2 to 0.48 SH142 □ - □□□ 1	Hollow shaft Custom shaft Gear Encoder	p. 47 to 48
42 mm sq. Thin-profile 	1.8°	0.083 to 0.186 SS242 □ -50 □□□	Hollow shaft Custom shaft Encoder	p. 49
42 mm sq. 	1.8°	0.22 to 0.8 SF242 □ -1 □□□ 1	Hollow shaft Gear Encoder Brake	p. 50 to 51
50 mm sq. 	1.8°	0.28 to 0.53 103H670 □ - □□□ 0	Hollow shaft Custom shaft Encoder	p. 52 to 54
50 mm sq. Thin-profile 	1.8°	0.1 to 0.215 SS250 □ -80 □ 0	Hollow shaft Custom shaft	p. 55
56 mm sq. UL models 	1.8°	0.53 to 2.5 SM256 □ C □ 0 □□ 1	Hollow shaft Custom shaft Gear Encoder Brake	p. 56 to 60
60 mm sq. It is recommended you use a 56 mm sq. motor (SM256□C□0□□1)	1.8°			–
60 mm sq. 	0.9°	0.57 to 2.15 SH160 □ - □□□ 0	Hollow shaft Custom shaft Gear Encoder	p. 62 to 63
86 mm sq. 	1.8°	2.5 to 9 SH286 □ - □□□ 1	Hollow shaft Custom shaft Encoder Brake	p. 64 to 67

*Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Motor size	Full step angle	Holding torque [N·m] Model no.	Custom options *	Page
ø106 mm 	1.8°	10.8 to 19 103H8922 □ - □□□ 1	Hollow shaft Custom shaft Brake	p. 68
56 mm sq. CE/UKCA 	1.8°	0.39 to 1.27 103H712 □ -6 □□ 0	Hollow shaft Custom shaft	p. 69
86 mm sq. CE/UKCA/UL 	1.8°	2.5 to 9 SM286 □ - □□□□	Hollow shaft Custom shaft	p. 70 to 73

*Custom options availability varies depending on the model number and requested quantity. Contact us for details.

IP65-Rated Stepping Motors Water/Dust protection RoHS

Motor size	Full step angle	Holding torque [N·m] Model no.	Custom options *	Page
56 mm sq. CE/UKCA/UL 	1.8°	1 to 1.7 SP256 □ -5 □□ 0	Custom shaft	p. 77 to 78
86 mm sq. CE/UKCA/UL 	1.8°	3.3 to 9 SP286 □ -5 □□ 0	Custom shaft	p. 79 to 80

*Custom options availability varies depending on the model number and requested quantity. Contact us for details.

In-Vacuum Motors Custom product

Motor size	Page
42 mm sq. to ø106 mm 	p. 81

Synchronous Motors Custom product

Motor size	Page
56 mm sq. to ø106 mm 	p. 81

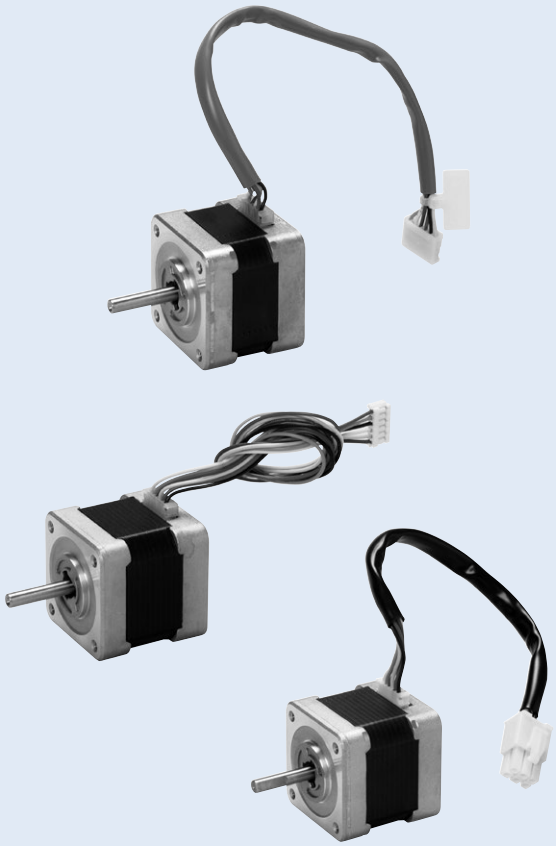
Customization Services

Custom options availability varies depending on the requested customization and quantity. Contact us for details.

Custom examples

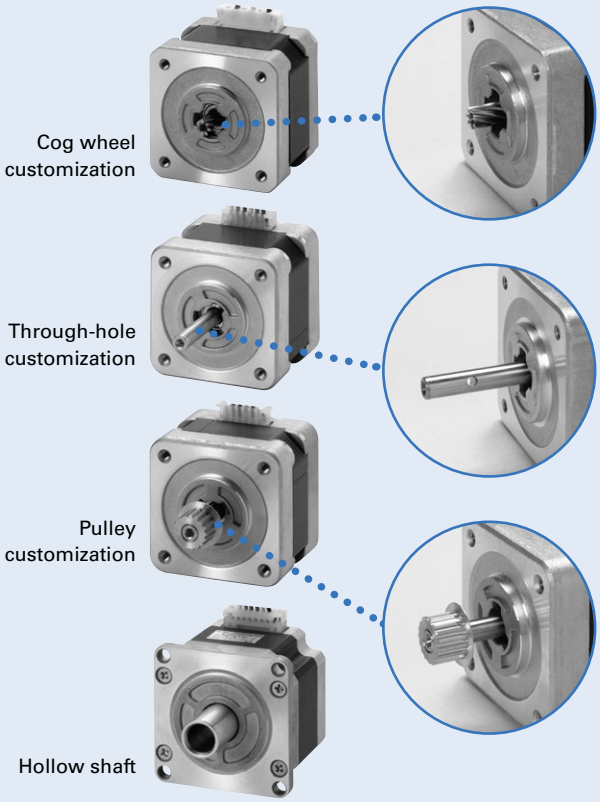
Custom harness

Connectors, cable ties, and plastic tubing can be added.



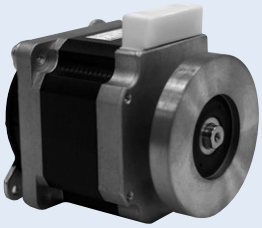
Custom shaft

We also offer custom options such as D-shaped shaft, addition of keyway and through-holes, and mounting of gear and pulley. The shaft can be made a hollow shaft for routing cables and air.



Rotary damper and surface mount damper

A damper can be added to reduce vibrations when rotating.

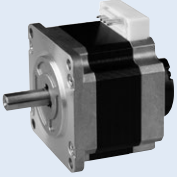


Rotary damper

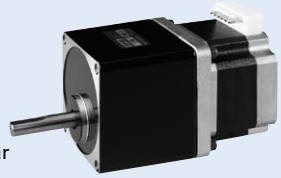
Surface mount damper

Gears, encoders, and brake

- A gear can be added for applications where a high load torque is exerted at low speeds.
- An encoder can be added for detecting motor position and speed.
- A brake can be added to hold the motor position at rest.



With encoder



With gear

Note: Custom options availability varies depending on the motor model and requested quantity. Contact us for details.

Geared models Compatible motors: 56 mm sq. Model no.: S□2561

Low-backlash gear models

These models feature low-backlash gear.

Allowable torque	N·m	1.25	2.5	3	3.5	4	4
Gear ratio	—	1:3.6	1:7.2	1:10	1:20	1:30	1:36
Backlash	° or less	0.55	0.25	0.25	0.17	0.17	0.17
Allowable speed	min^{-1}	500	250	180	90	60	50
Allowable thrust load	N	30	30	30	30	30	30
Allowable radial load*	N	100	100	100	100	100	100

* Load is exerted on the point 1/3 the shaft length from the shaft end.

•The motor and shaft rotate in the same direction for 1:3.6 and 1:7.2 gear ratios and in opposite directions for 1:10, 1:20, 1:30, 1:36 gear ratios.

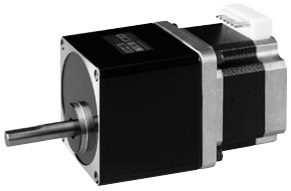
Harmonic gear models

These models have extremely low backlash and superb positioning precision. The lineup has high gear ratios of up to 1:100 available.

Allowable torque	N·m	5.5	8
Peak torque	N·m	14	20
Gear ratio	—	1:50	1:100
Lost motion	arcmin	0.4 to 3 (at ±0.28 N·m)	0.4 to 1.5 (at ±0.4 N·m)
Allowable speed	min^{-1}	70	35
Maximum speed	min^{-1}	100	50
Allowable thrust load	N	400	400
Allowable radial load*	N	360	360

* Load is exerted on the point 1/3 the shaft length from the shaft end.

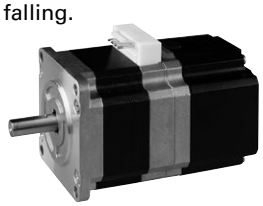
•The motor shaft and the gear output shaft rotate in opposite directions.



EM brake models Compatible motors: 56 mm sq. Model no. SF256□ Note: Non-UL certified

The non-excitation electromagnetic brake holds a workpiece while power is off, preventing it from falling.

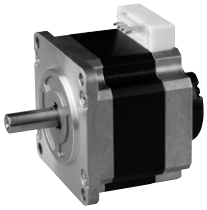
Brake activation type	—	Non-excitation type
Input voltage	—	24 VDC ±5%
Power consumption	W	6 (at 75°C)
Static friction torque	N·m or more	0.8
Polarity	—	Red: +, black: -



Encoder-mounted models Compatible motors: 56 mm sq. Model no. SM256

These models can detect vibration and step-out by monitoring the motor's operation status such as position and speed.

Microsteps	P/R	1000	2000	4000
Number of channels	Ch	3	3	3
Output circuit	—	Line driver (CMOS)		
Maximum response frequency	kHz	55	110	220
Input voltage	—	5 V ±5%	5 V ±5%	5 V ±5%
Current consumption	mA or less	100	100	100



Contact us for details of motors other than 56 mm sq. motors.

Stepping Motors

14 mm sq.

1.8°/step **Ultra-compact** **RoHS**

Bipolar, lead type

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

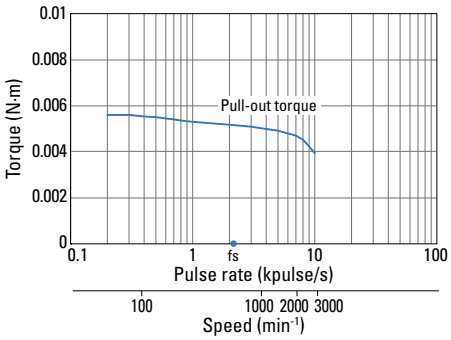
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SH2141-5541	**SH2141-5511**	0.0065	0.3	21	4.2	0.00058	10	0.7	0.03	30
SH2145-5641	**SH2145-5611**	0.01	0.4	19	4	0.0011	10	0.7	0.042	43.8

Characteristics

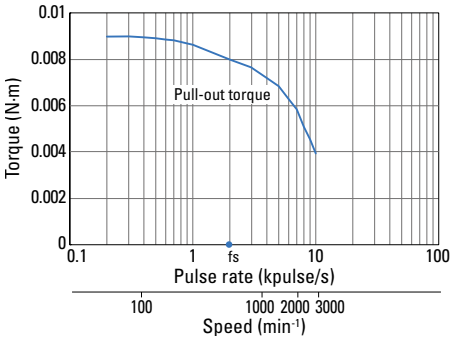
SH2141-5541
SH2141-5511

Constant current circuit
Input voltage: 24 VDC
Winding current: 0.3 A/phase
2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
f_S: Maximum starting pulse rate with no load

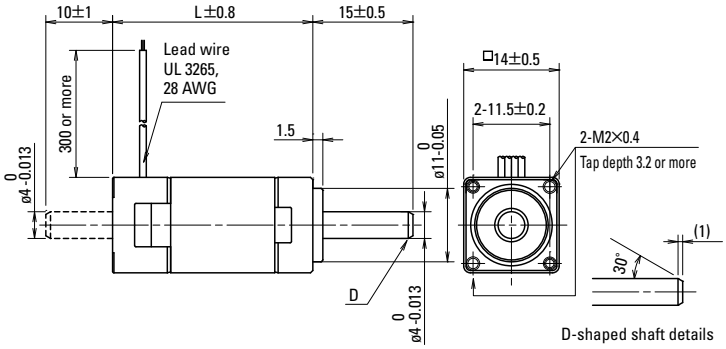


SH2145-5641
SH2145-5611

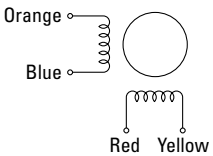
Constant current circuit
Input voltage: 24 VDC
Winding current: 0.4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
f_S: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

28 mm sq.

1.8°/step RoHS

Unipolar, lead type

Bipolar, lead type ▶p. 44

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Gear | Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

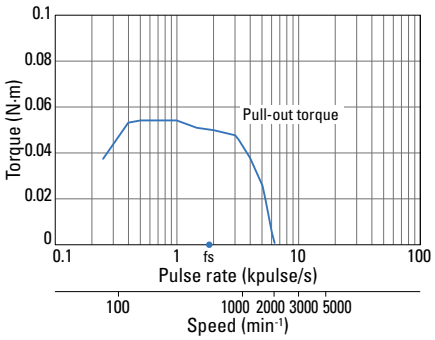
Unipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	×10⁻⁴kg·m²	N	N	kg	mm
SH2281-5171	**SH2281-5131**	0.055	0.5	10.5	3.7	0.01	42	3	0.11	32
SH2281-5271	**SH2281-5231**	0.055	1	2.85	1	0.01	42	3	0.11	32
SH2285-5171	**SH2285-5131**	0.115	0.5	17	7	0.022	49	3	0.2	51.5
SH2285-5271	**SH2285-5231**	0.115	1	4.1	1.9	0.022	49	3	0.2	51.5

Characteristics

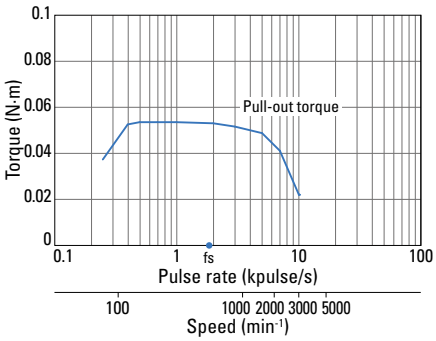
SH2281-5171 SH2281-5131

Constant current circuit
Input voltage: 24 VDC
Winding current: 0.5 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load



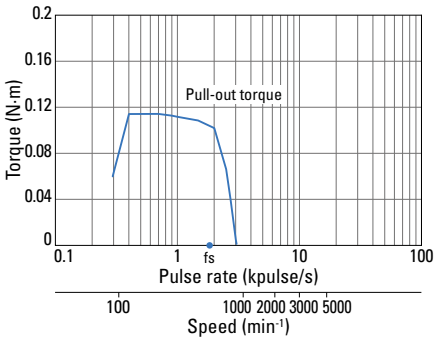
SH2281-5271 SH2281-5231

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load



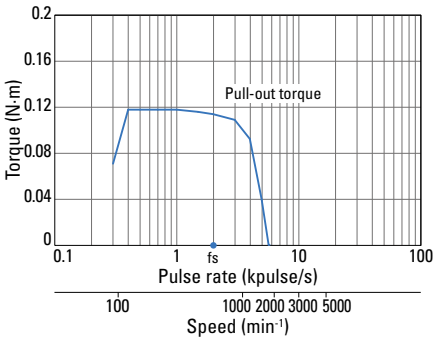
SH2285-5171 SH2285-5131

Constant current circuit
Input voltage: 24 VDC
Winding current: 0.5 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load

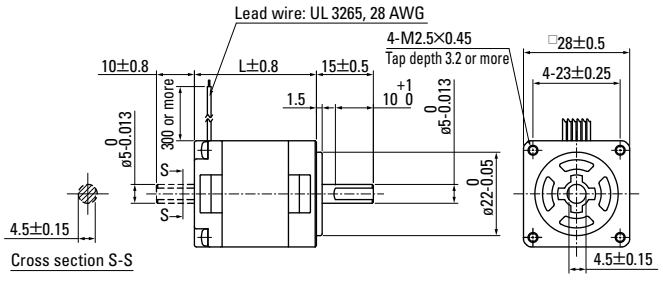


SH2285-5271 SH2285-5231

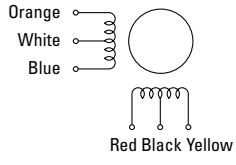
Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

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Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

28 mm sq.

1.8°/step RoHS

Bipolar, lead type

Unipolar, lead type ▶p. 43

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Gear | Encoder

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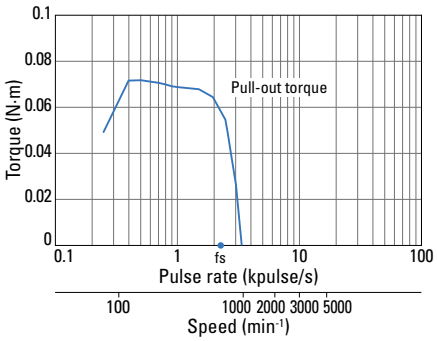
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	×10⁻⁴kg·m²	N	N	kg	mm
SH2281-5671	**SH2281-5631**	0.07	0.5	10.5	7.2	0.01	42	3	0.11	32
SH2281-5771	**SH2281-5731**	0.07	1	2.6	1.85	0.01	42	3	0.11	32
SH2285-5671	**SH2285-5631**	0.145	0.5	15	13.5	0.022	49	3	0.2	51.5
SH2285-5771	**SH2285-5731**	0.145	1	3.75	3.4	0.022	49	3	0.2	51.5

Characteristics

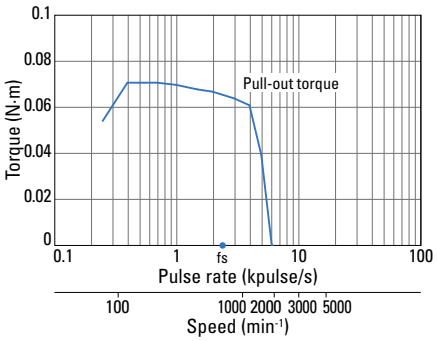
SH2281-5671 SH2281-5631

Constant current circuit
Input voltage: 24 VDC
Winding current: 0.5 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load



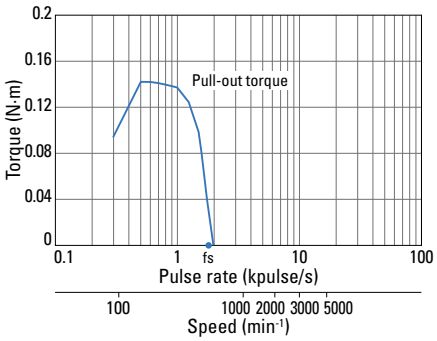
SH2281-5771 SH2281-5731

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load



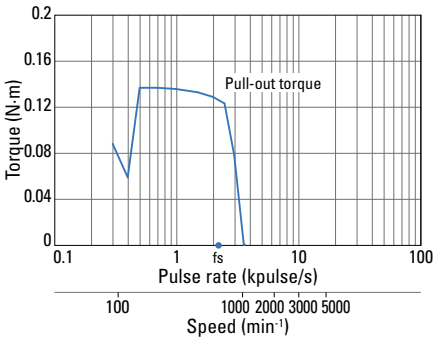
SH2285-5671 SH2285-5631

Constant current circuit
Input voltage: 24 VDC
Winding current: 0.5 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load

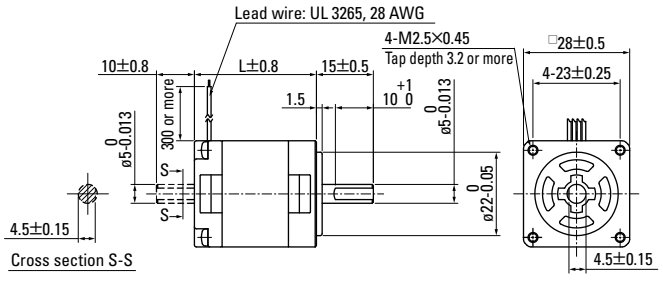


SH2285-5771 SH2285-5731

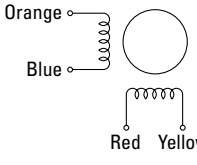
Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

- For motors SH228□-57□1 (1 A/phase)...
  Model no.: F2BED200P100 (DC input)
  Operating current selection switch setting: A
- For motors other than above...
  A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

35 mm sq.

1.8°/step RoHS

Unipolar, lead type

Custom options

Hollow shaft | Custom shaft

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

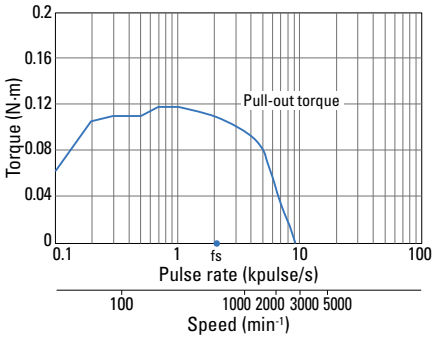
Unipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SH3533-12U40	**SH3533-12U10**	0.12	1.2	2.4	1.3	0.02	46	10	0.17	33
SH3537-12U40	**SH3537-12U10**	0.15	1.2	2.7	2	0.025	41	10	0.2	37
SH3552-12U40	**SH3552-12U10**	0.23	1.2	3.4	2.8	0.043	40	10	0.3	52

Characteristics

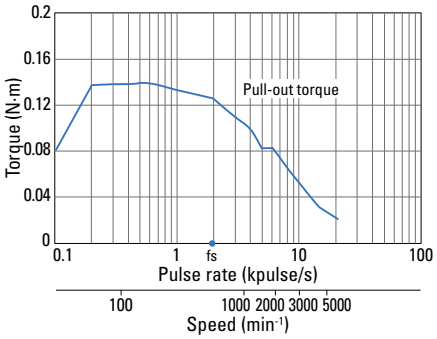
SH3533-12U40 SH3533-12U10

Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.33 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



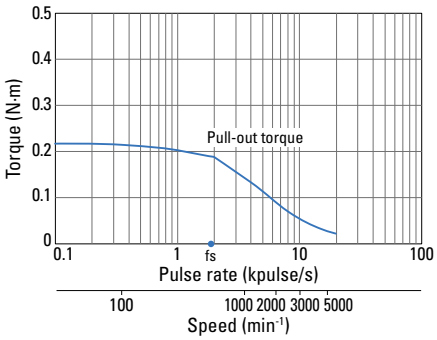
SH3537-12U40 SH3537-12U10

Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.33 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

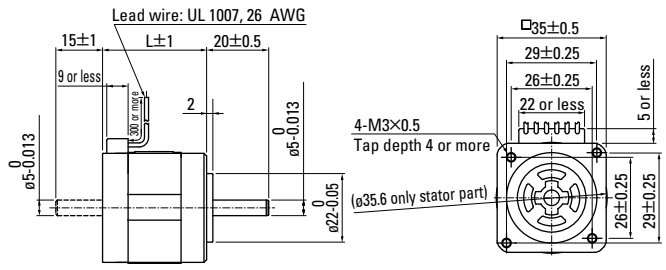


SH3552-12U40 SH3552-12U10

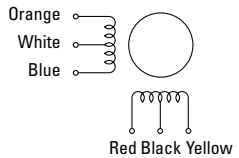
Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Note: The photo shows a unipolar motor.

35 mm sq.

1.8°/step RoHS

Bipolar, lead type

Custom options

Hollow shaft | Custom shaft

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

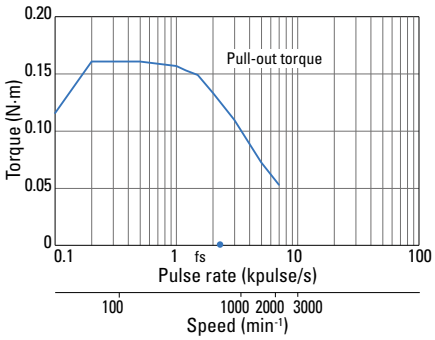
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SH3533-10B40	**SH3533-10B10**	0.155	1	3.3	3.9	0.02	41	10	0.17	33
SH3537-10B40	**SH3537-10B10**	0.195	1	3.9	5.5	0.025	41	10	0.2	37
SH3552-10B40	**SH3552-10B10**	0.32	1	4.45	7	0.043	40	10	0.3	52

Characteristics

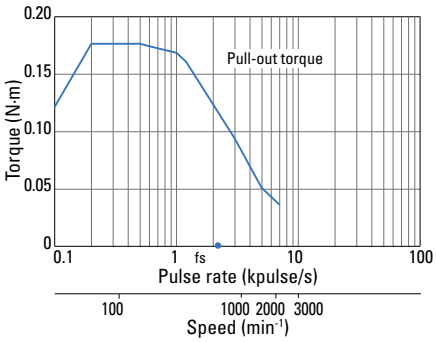
SH3533-10B40 SH3533-10B10

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.33 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



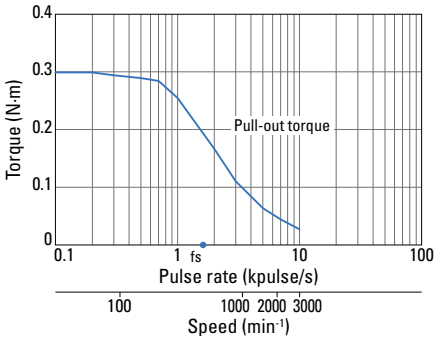
SH3537-10B40 SH3537-10B10

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.33 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

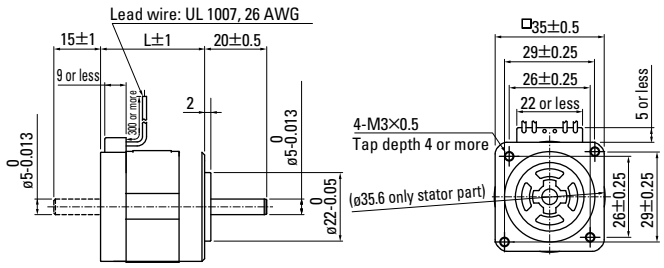


SH3552-10B40 SH3552-10B10

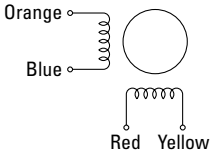
Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

Model no.: BS1D200P10 (DC input)
Contact us for details on drivers.

Operating current selection switch setting: A

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

42 mm sq.

0.9°/step RoHS

Unipolar, lead type

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Gear | Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

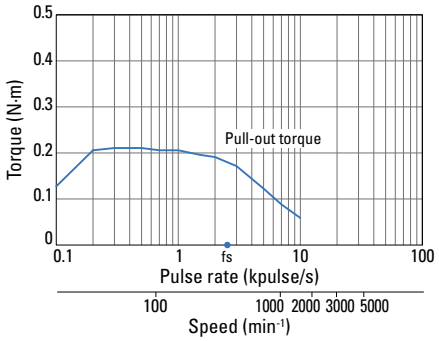
Unipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SH1421-0441	**SH1421-0411**	0.2	1.2	2.7	3.2	0.044	25	10	0.24	33
SH1422-0441	**SH1422-0411**	0.29	1.2	3.1	5.3	0.066	24	10	0.29	39
SH1424-0441	**SH1424-0411**	0.39	1.2	3.5	5.3	0.089	20	10	0.38	48

Characteristics

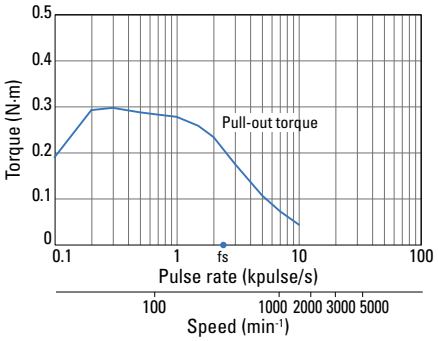
SH1421-0441 SH1421-0411

Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



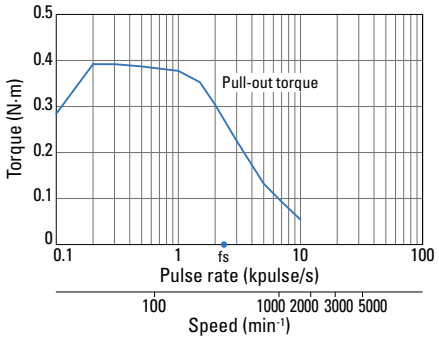
SH1422-0441 SH1422-0411

Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

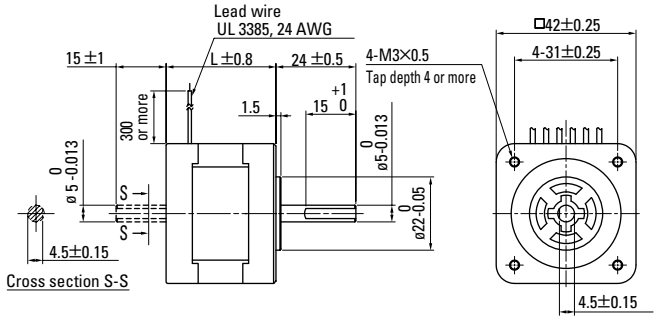


SH1424-0441 SH1424-0411

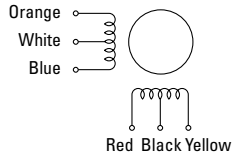
Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Note: The photo shows a unipolar motor.

42 mm sq.

0.9°/step RoHS

Bipolar, lead type

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Gear | Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

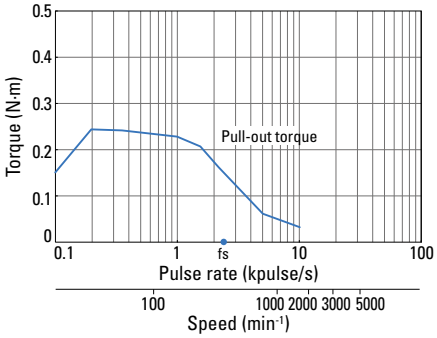
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	×10⁻⁴kg·m²	N	N	kg	mm
SH1421-5041	**SH1421-5011**	0.23	1	3.3	8.0	0.044	25	10	0.24	33
SH1421-5241	**SH1421-5211**	0.23	2	0.85	2.1	0.044	25	10	0.24	33
SH1422-5041	**SH1422-5011**	0.34	1	4.0	14.0	0.066	24	10	0.29	39
SH1422-5241	**SH1422-5211**	0.34	2	1.05	3.6	0.066	24	10	0.29	39
SH1424-5041	**SH1424-5011**	0.48	1	4.7	15.0	0.089	20	10	0.38	48
SH1424-5241	**SH1424-5211**	0.48	2	1.25	3.75	0.089	20	10	0.38	48

Characteristics

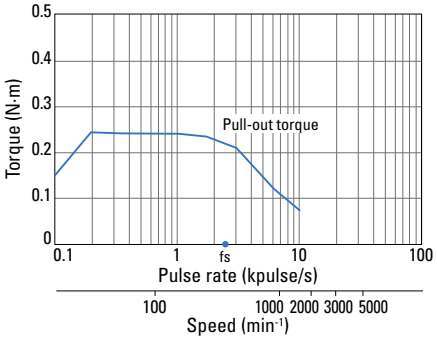
SH1421-5041 SH1421-5011

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



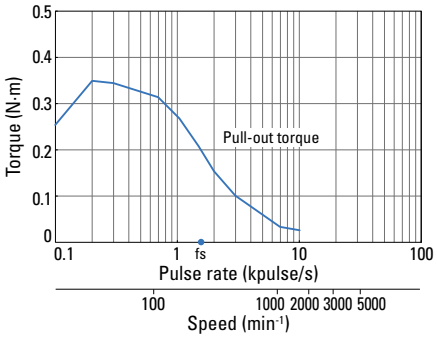
SH1421-5241 SH1421-5211

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



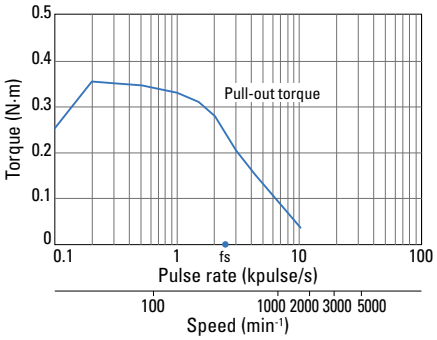
SH1422-5041 SH1422-5011

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



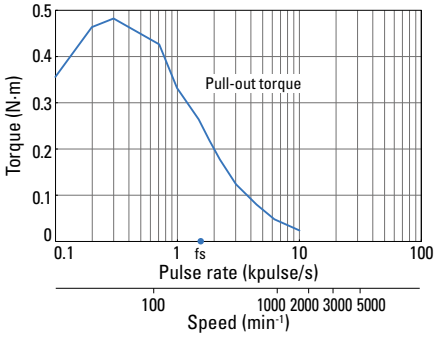
SH1422-5241 SH1422-5211

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



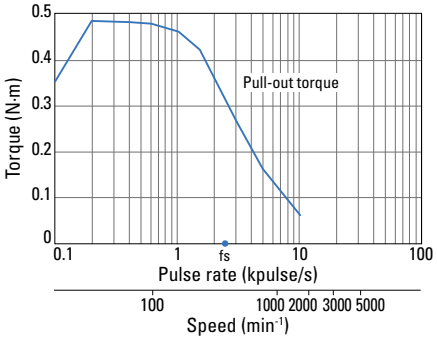
SH1424-5041 SH1424-5011

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

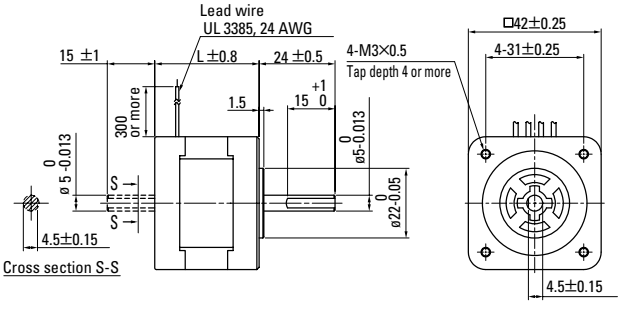


SH1424-5241 SH1424-5211

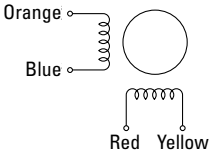
Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

- For motors SH142□-52□1 (2 A/phase)...
  Model no.: F2BED200P100 (DC input)
  Operating current selection switch setting: 0
- For motors SH142□-50□1 (1 A/phase)...
  Model no.: BS1D200P10 (DC input)
  Contact us for details on drivers.
  Operating current selection switch setting: A

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

42 mm sq.

1.8°/step Thin-profile RoHS

Bipolar, lead type

ECO PRODUCTS

Custom options

Hollow shaft Custom shaft Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Bipolar, lead type Radial load: 10 N

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SS2421-5041	**SS2421-5011**	0.083	1	3.5	1.2	0.015	10	4.9	0.07	11.6
SS2422-5041	**SS2422-5011**	0.186	1	5.4	2.9	0.028	10	4.9	0.14	18.6

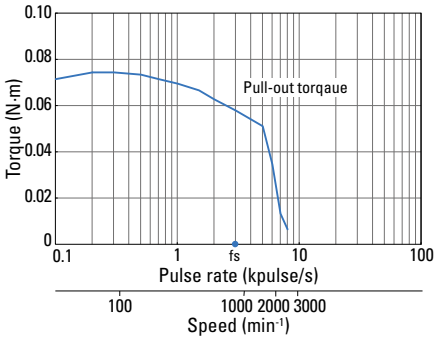
Bipolar, lead type Heavy duty Radial load: 25 N

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SS2421-50400	**SS2421-50100**	0.083	1	3.5	1.2	0.015	40	4.9	0.09	14.5
SS2422-50400	**SS2422-50100**	0.186	1	5.4	2.9	0.028	46	4.9	0.16	21.5

Characteristics

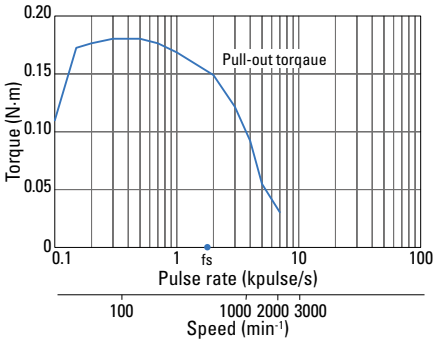
SS2421-5041
SS2421-5011
SS2421-50400
SS2421-50100

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.33 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



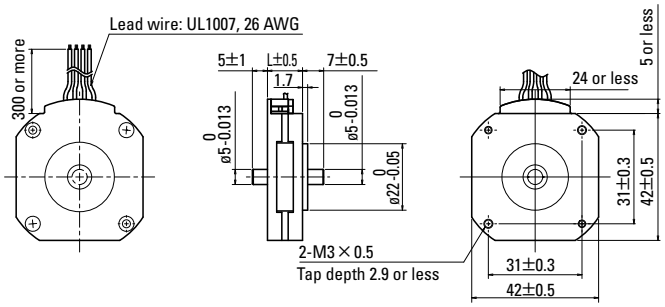
SS2422-5041
SS2422-5011
SS2422-50400
SS2422-50100

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.33 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

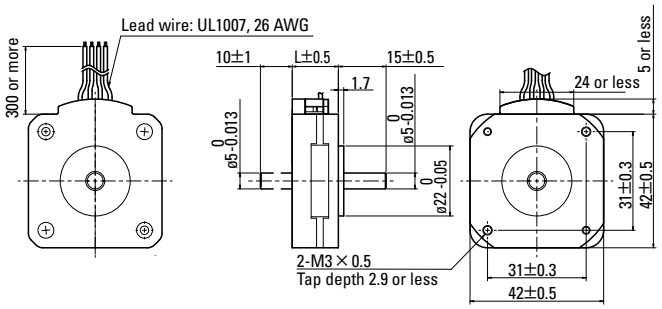


Dimensions (Unit: mm)

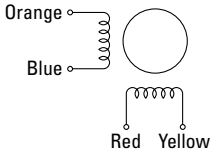
Model no.: SS242□-50□□



Model no.: SS242□-50□00



Internal winding



Compatible drivers

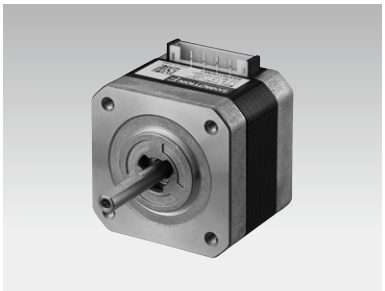
Model no.: BS1D200P10 (DC input)
Contact us for details on drivers.

Operating current selection switch setting: A

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



42 mm sq.

1.8°/step RoHS

Unipolar, connector type

Bipolar, connector type ▶p. 51

ECO PRODUCTS

Custom options

Custom shaft | Gear | Encoder | Brake

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Unipolar, connector type

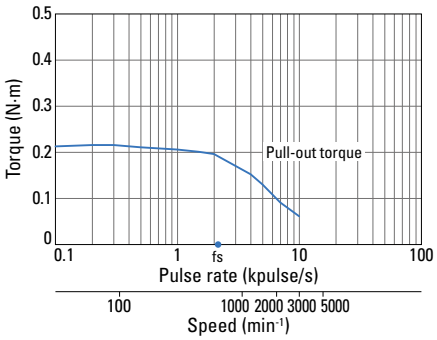
Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	×10⁻⁴kg·m²	N	N	kg	mm
SF2421-12U41	**SF2421-12U11**	0.22	1.2	2.4	2.4	0.031	39	10	0.23	33 ± 0.5
SF2422-12U41	**SF2422-12U11**	0.33	1.2	3	3.3	0.046	37	10	0.3	39 ± 0.5
SF2423-12U41	**SF2423-12U11**	0.4	1.2	3.4	3.9	0.063	35	10	0.38	48 ± 0.5
SF2424-12U41	**SF2424-12U11**	0.58	1.2	4.4	5.4	0.094	29	10	0.51	59.5 ± 1

Motor cable model no.: 4835774-1

Characteristics

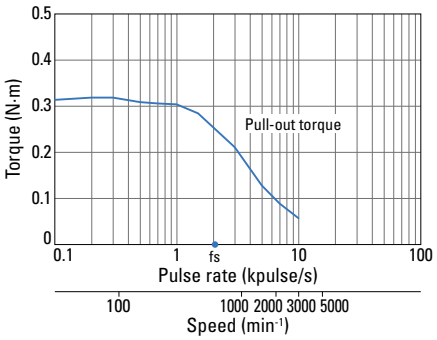
SF2421-12U41 SF2421-12U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



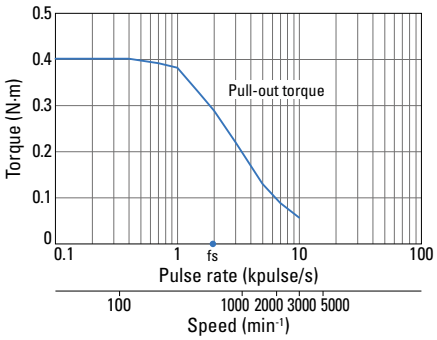
SF2422-12U41 SF2422-12U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



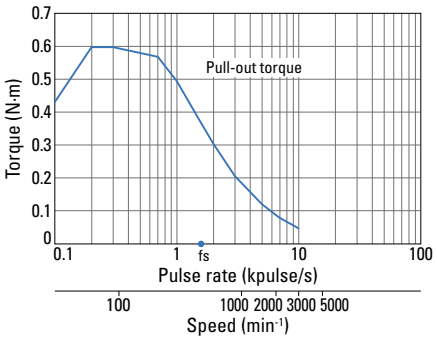
SF2423-12U41 SF2423-12U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load

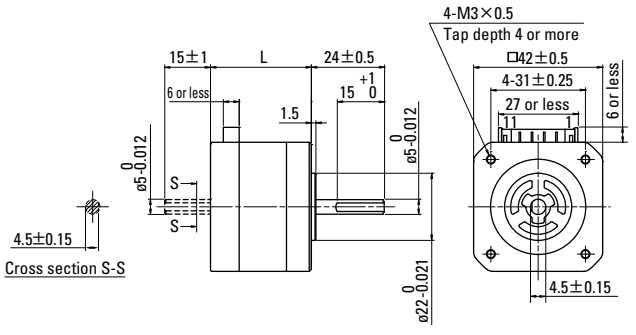


SF2424-12U41 SF2424-12U11

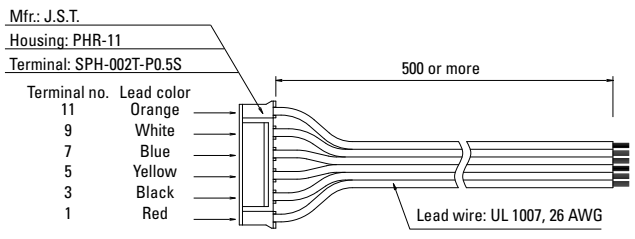
Constant current circuit
Input voltage: 24 VDC
Winding current: 1.2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



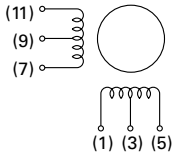
Separate option: Motor cable 4835774-1



This is a motor cable for model nos. SF242□-12U□1

Internal wiring

In parentheses are connector pin nos.



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Bipolar, connector type

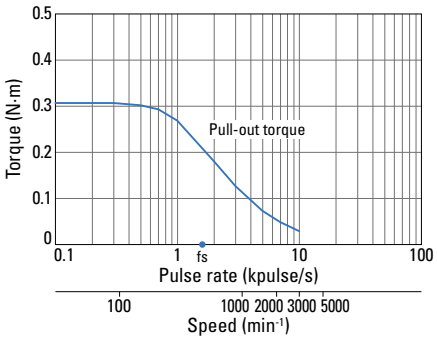
Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SF2421-10B41	**SF2421-10B11**	0.29	1	3.6	7	0.031	38	10	0.23	33 ± 0.5
SF2422-10B41	**SF2422-10B11**	0.43	1	4.6	9.6	0.046	34	10	0.3	39 ± 0.5
SF2423-10B41	**SF2423-10B11**	0.56	1	5.3	12.5	0.063	30	10	0.38	48 ± 0.5
SF2424-10B41	**SF2424-10B11**	0.8	1	6.5	16	0.094	20	10	0.51	59.5 ± 1

Motor cable model no.: 4835775-1

Characteristics

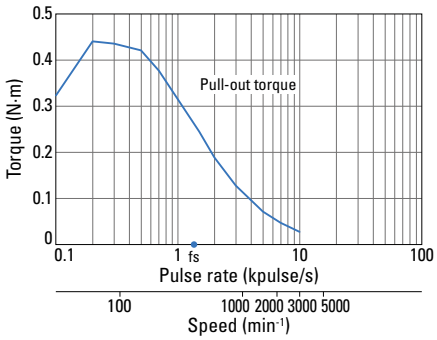
SF2421-10B41 SF2421-10B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



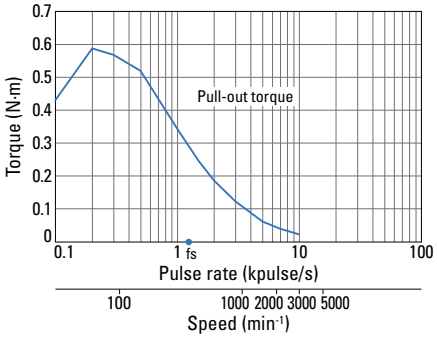
SF2422-10B41 SF2422-10B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



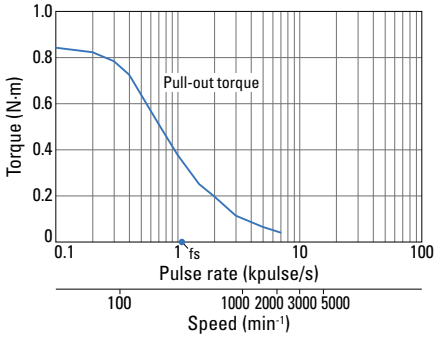
SF2423-10B41 SF2423-10B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load

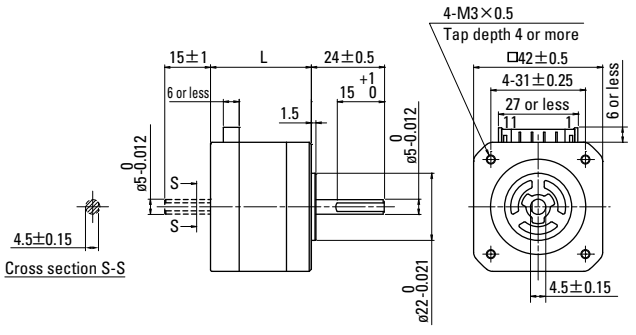


SF2424-10B41 SF2424-10B11

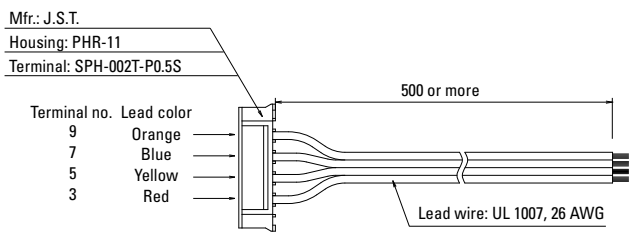
Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



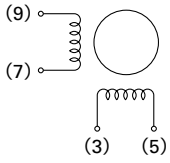
Separate option: Motor cable 4835775-1



This is a motor cable for model nos. SF242□-10B□1

Internal wiring

In parentheses are connector pin nos.

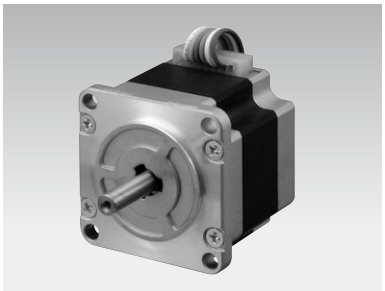


Compatible drivers

Model no.: F2BED200P100 (DC input)
Operating current selection switch setting: A
Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



50 mm sq.

1.8°/step RoHS

Unipolar, lead type

Bipolar, lead type ▶p. 54

Custom options

Hollow shaft | Custom shaft | Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

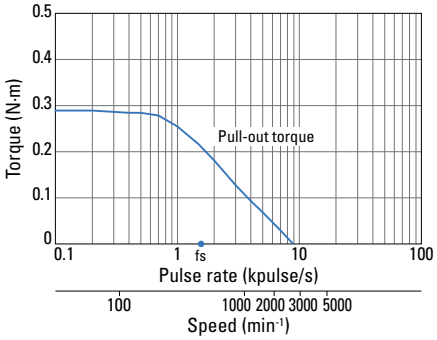
Unipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m^2	N	N	kg	mm
103H6701-0140	**103H6701-0110**	0.28	1	4.3	6.8	0.057	79	15	0.35	39.8
103H6701-0440	**103H6701-0410**	0.28	2	1.1	1.6	0.057	79	15	0.35	39.8
103H6701-0740	**103H6701-0710**	0.28	3	0.6	0.7	0.057	79	15	0.35	39.8
103H6703-0140	**103H6703-0110**	0.49	1	6	13	0.118	75	15	0.5	51.3
103H6703-0440	**103H6703-0410**	0.49	2	1.6	3.2	0.118	75	15	0.5	51.3
103H6703-0740	**103H6703-0710**	0.49	3	0.83	1.4	0.118	75	15	0.5	51.3
103H6704-0140	**103H6704-0110**	0.52	1	6.5	16.5	0.14	74	15	0.55	55.8
103H6704-0440	**103H6704-0410**	0.52	2	1.7	3.8	0.14	74	15	0.55	55.8
103H6704-0740	**103H6704-0710**	0.53	3	0.9	1.7	0.14	77	15	0.55	55.8

Characteristics

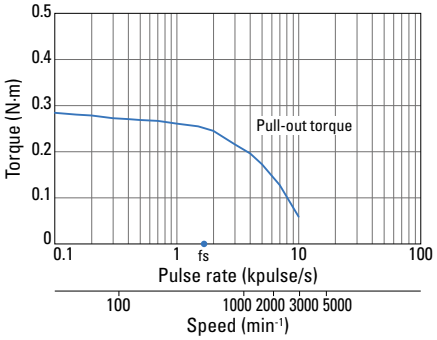
103H6701-0140 103H6701-0110

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·$m^2$
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



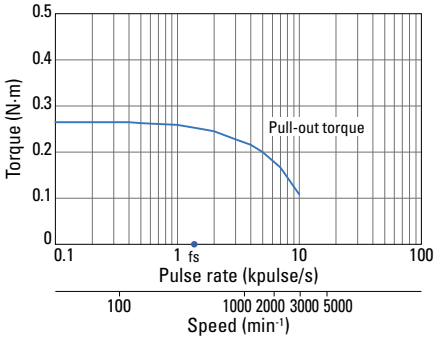
103H6701-0440 103H6701-0410

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·$m^2$
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



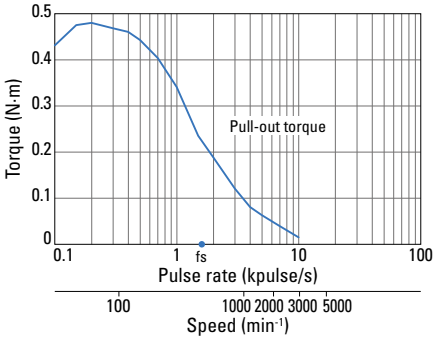
103H6701-0740 103H6701-0710

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·$m^2$
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



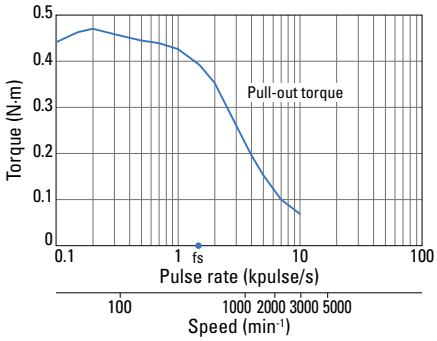
103H6703-0140 103H6703-0110

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·$m^2$
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



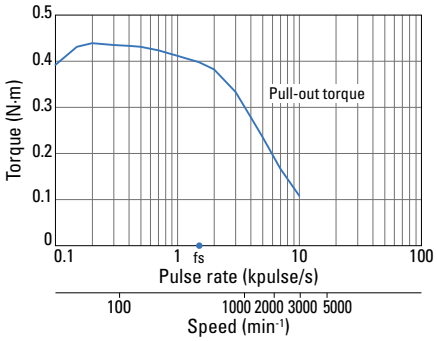
103H6703-0440 103H6703-0410

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·$m^2$
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



103H6703-0740 103H6703-0710

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·$m^2$
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



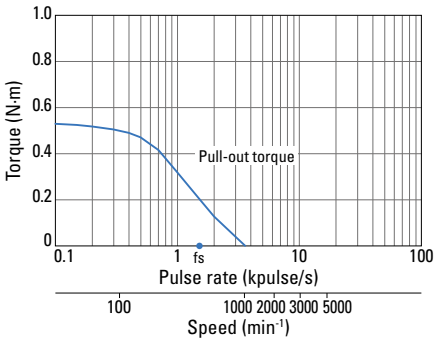
Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Characteristics

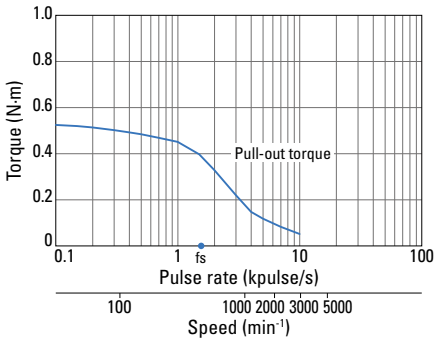
103H6704-0140
103H6704-0110

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$ kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



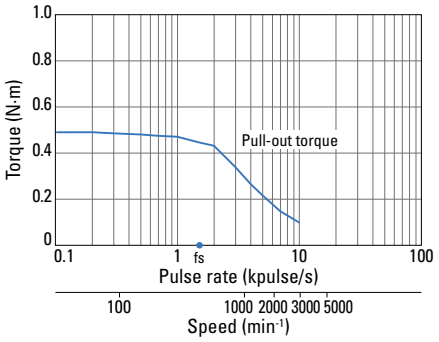
103H6704-0440
103H6704-0410

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$ kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

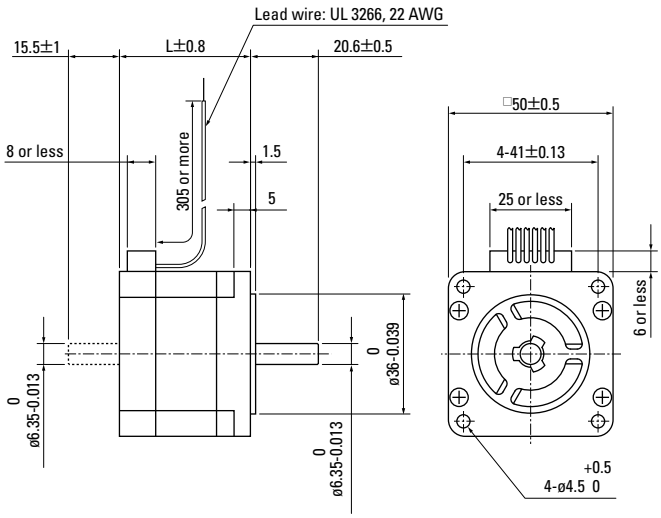


103H6704-0740
103H6704-0710

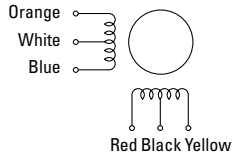
Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$ kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



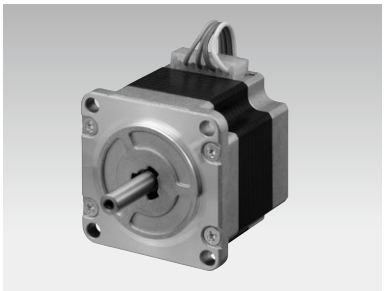
Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



50 mm sq.

1.8°/step RoHS

Bipolar, lead type

Unipolar, lead type ▶p. 52

Custom options

Hollow shaft | Custom shaft | Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

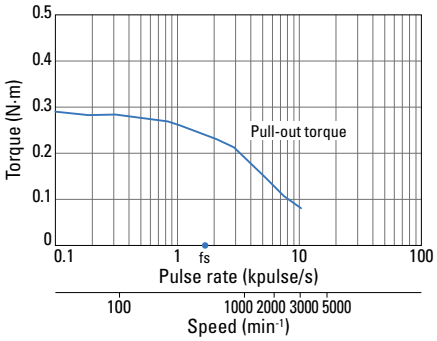
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	×10⁻⁴kg·m²	N	N	kg	mm
103H6701-5040	**103H6701-5010**	0.28	2	0.6	1.6	0.057	79	15	0.35	39.8
103H6703-5040	**103H6703-5010**	0.49	2	0.8	3.2	0.118	75	15	0.5	51.3
103H6704-5040	**103H6704-5010**	0.52	2	0.9	3.8	0.14	74	15	0.55	55.8

Characteristics

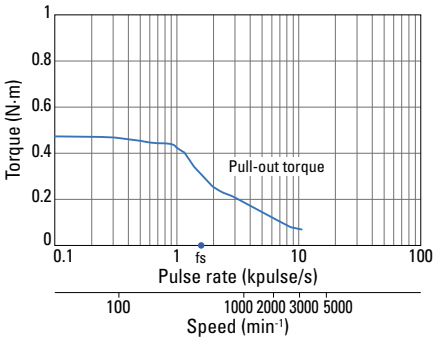
103H6701-5040 103H6701-5010

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



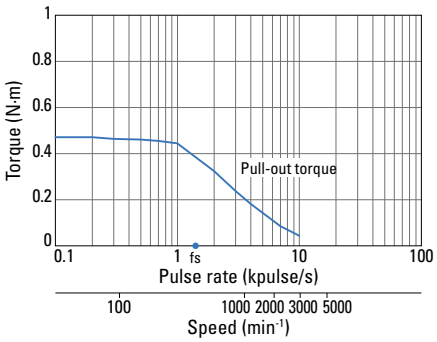
103H6703-5040 103H6703-5010

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

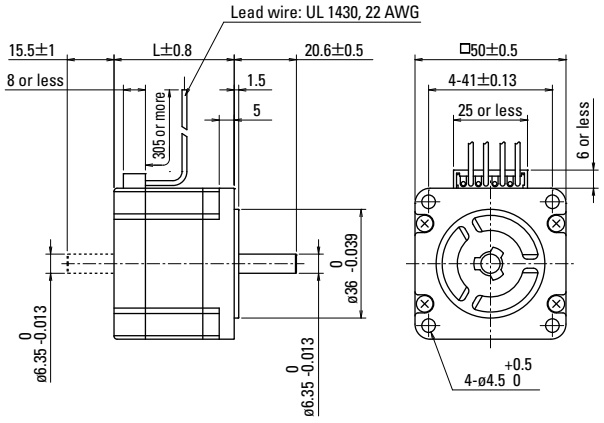


103H6704-5040 103H6704-5010

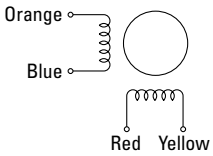
Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

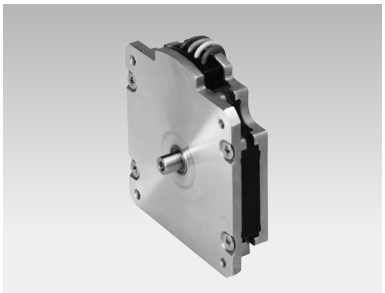
Model no.: BS1D200P10 (DC input)
Contact us for details on drivers.

Operating current selection switch setting: 0

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



50 mm sq.

1.8°/step Thin-profile RoHS

Bipolar, lead type

Custom options

Hollow shaft Custom shaft

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

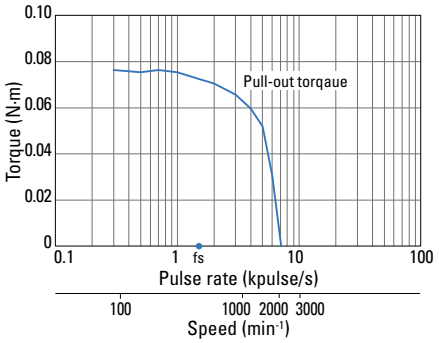
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SS2501-8040	**SS2501-8010**	0.1	1	4.5	2	0.026	8.5	4.9	0.09	11.4
SS2502-8040	**SS2502-8010**	0.215	1	5.9	3.2	0.049	8.5	4.9	0.15	16.4

Characteristics

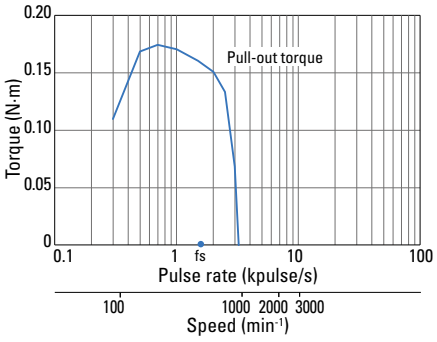
SS2501-8040
SS2501-8010

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
f_S: Maximum starting pulse rate with no load

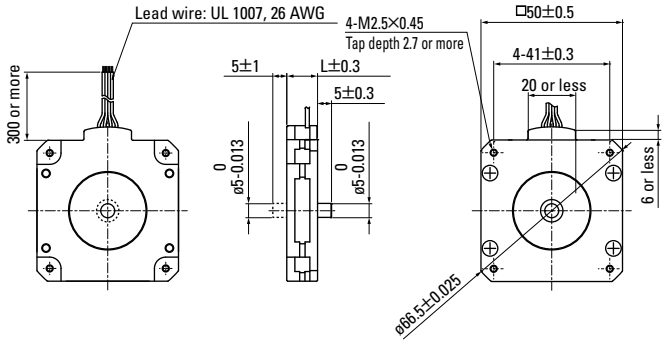


SS2502-8040
SS2502-8010

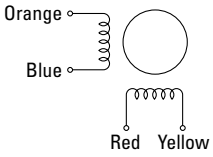
Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.01 \times 10^{-4}$kg·m²
(Pulley balancer method)
f_S: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

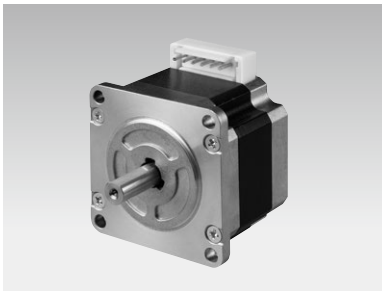
Model no.: BS1D200P10 (DC input)
Contact us for details on drivers.

Operating current selection switch setting: A

Note: The characteristics shown above are calculated using , our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



56 mm sq.

1.8°/step RoHS

Unipolar, connector type

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Gear | Encoder | Brake

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Unipolar, connector type

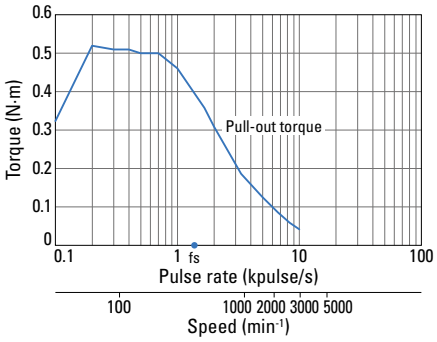
Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SM2561C10U41	**SM2561C10U11**	0.53	1	4.3	6.8	0.14	115	20	0.49	41.8
SM2561C20U41	**SM2561C20U11**	0.53	2	1.15	1.8	0.14	115	20	0.49	41.8
SM2561C30U41	**SM2561C30U11**	0.53	3	0.52	0.77	0.14	115	20	0.49	41.8
SM2562C10U41	**SM2562C10U11**	1.1	1	5.85	12.6	0.28	106	20	0.69	53.8
SM2562C20U41	**SM2562C20U11**	1.1	2	1.55	3.3	0.28	106	20	0.69	53.8
SM2562C30U41	**SM2562C30U11**	1.1	3	0.69	1.37	0.28	106	20	0.69	53.8
SM2563C10U41	**SM2563C10U11**	1.7	1	7.8	17	0.5	93	20	1.1	75.8
SM2563C20U41	**SM2563C20U11**	1.7	2	1.87	4.2	0.5	93	20	1.1	75.8
SM2563C30U41	**SM2563C30U11**	1.7	3	0.74	1.75	0.5	93	20	1.1	75.8
SM2564C10U41	**SM2564C10U11**	1.75	1	9	22	0.6	86	20	1.27	85.8
SM2564C20U41	**SM2564C20U11**	1.75	2	2.1	5.4	0.6	86	20	1.27	85.8
SM2564C30U41	**SM2564C30U11**	1.75	3	0.84	2.2	0.6	86	20	1.27	85.8

Motor cable model no.: 4837798-1

Characteristics

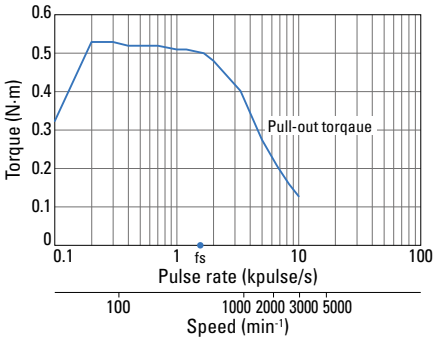
SM2561C10U41 SM2561C10U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



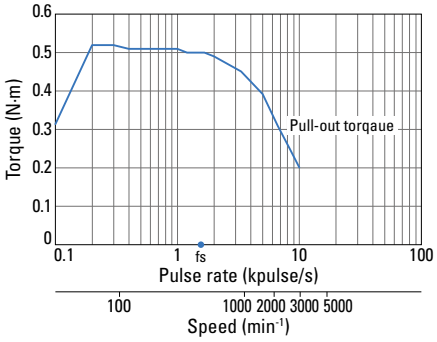
SM2561C20U41 SM2561C20U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



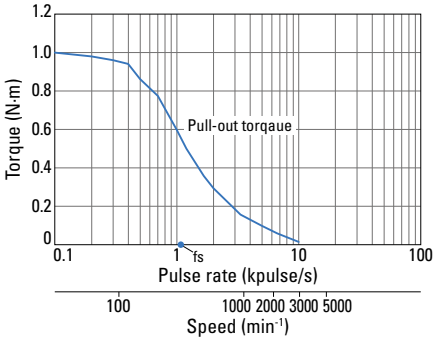
SM2561C30U41 SM2561C30U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



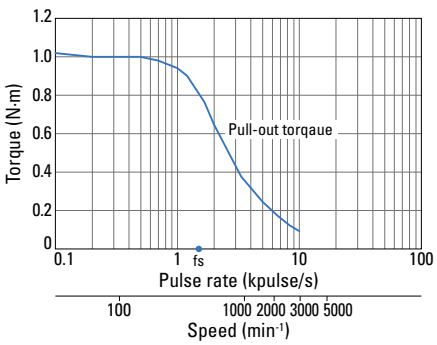
SM2562C10U41 SM2562C10U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



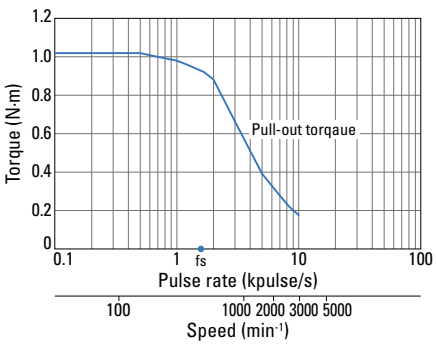
SM2562C20U41 SM2562C20U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



SM2562C30U41 SM2562C30U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



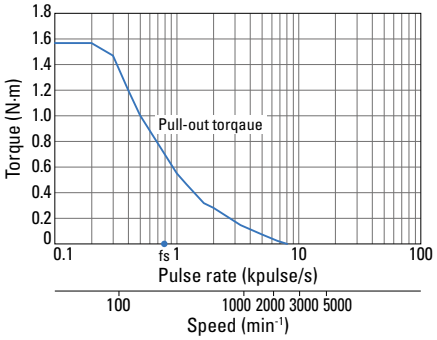
Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Characteristics

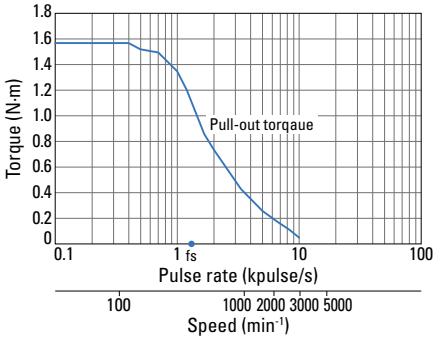
SM2563C10U41 SM2563C10U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



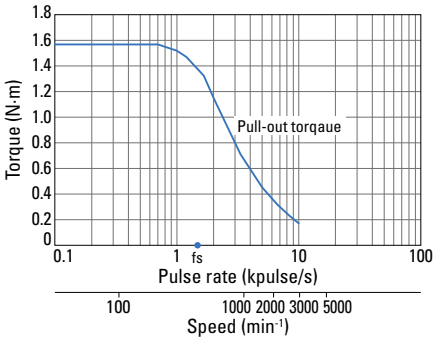
SM2563C20U41 SM2563C20U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



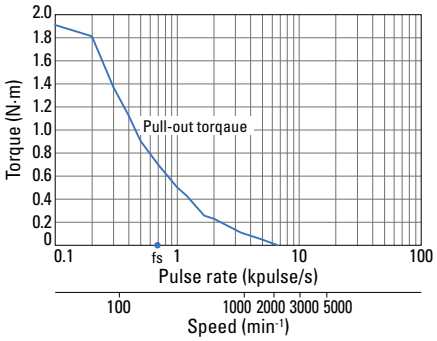
SM2563C30U41 SM2563C30U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



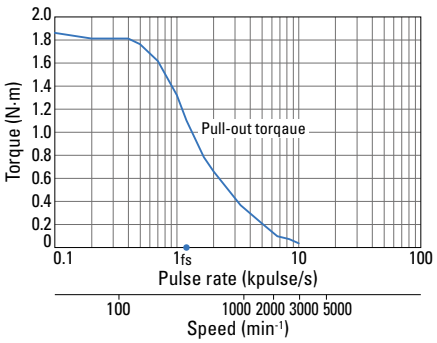
SM2564C10U41 SM2564C10U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



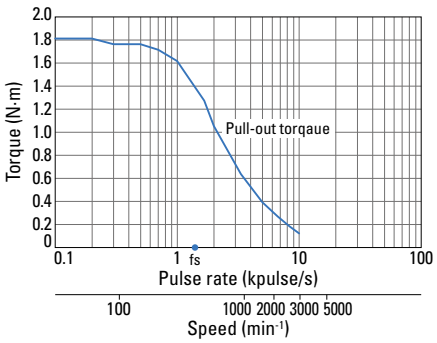
SM2564C20U41 SM2564C20U11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

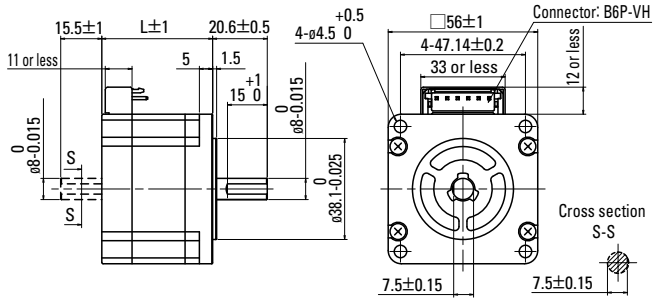


SM2564C30U41 SM2564C30U11

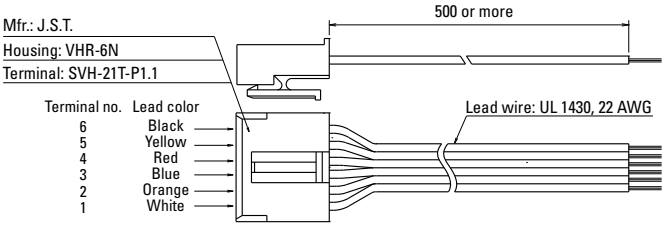
Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)

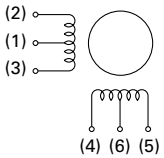


Separate option: Motor cable 4837798-1



Internal wiring

In parentheses are connector pin nos.



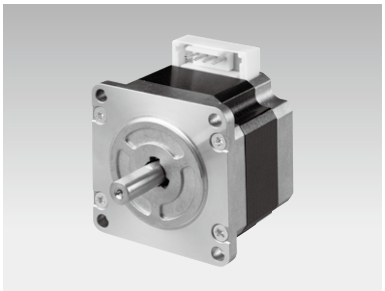
Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



56 mm sq.

1.8°/step RoHS

Bipolar, connector type

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Gear | Encoder | Brake

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Bipolar, connector type

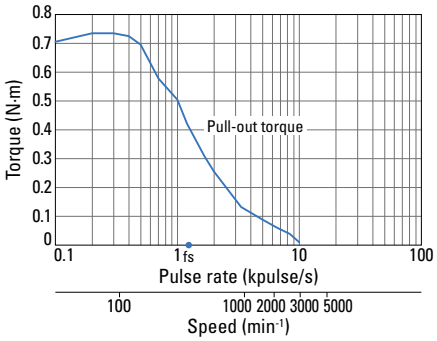
Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SM2561C10B41	**SM2561C10B11**	0.75	1	4.6	13.5	0.14	113	20	0.49	41.8
SM2561C20B41	**SM2561C20B11**	0.75	2	1.1	3.5	0.14	113	20	0.49	41.8
SM2561C30B41	**SM2561C30B11**	0.75	3	0.51	1.5	0.14	113	20	0.49	41.8
SM2561C40B41	**SM2561C40B11**	0.75	4	0.28	0.85	0.14	113	20	0.49	41.8
SM2561C60B41	**SM2561C60B11**	0.75	6	0.14	0.38	0.14	113	20	0.49	41.8
SM2562C10B41	**SM2562C10B11**	1.4	1	6.3	25.5	0.28	102	20	0.69	53.8
SM2562C20B41	**SM2562C20B11**	1.4	2	1.5	6.5	0.28	102	20	0.69	53.8
SM2562C30B41	**SM2562C30B11**	1.4	3	0.68	2.9	0.28	102	20	0.69	53.8
SM2562C40B41	**SM2562C40B11**	1.4	4	0.37	1.5	0.28	102	20	0.69	53.8
SM2562C60B41	**SM2562C60B11**	1.4	6	0.18	0.72	0.28	102	20	0.69	53.8
SM2563C10B41	**SM2563C10B11**	2.35	1	8.6	36	0.5	78	20	1.1	75.8
SM2563C20B41	**SM2563C20B11**	2.35	2	2.1	9.5	0.5	78	20	1.1	75.8
SM2563C30B41	**SM2563C30B11**	2.35	3	0.95	4.2	0.5	78	20	1.1	75.8
SM2563C40B41	**SM2563C40B11**	2.35	4	0.52	2.4	0.5	78	20	1.1	75.8
SM2563C60B41	**SM2563C60B11**	2.35	6	0.25	1.05	0.5	78	20	1.1	75.8
SM2564C10B41	**SM2564C10B11**	2.5	1	9.4	41	0.6	70	20	1.27	85.8
SM2564C20B41	**SM2564C20B11**	2.5	2	2.1	11	0.6	70	20	1.27	85.8
SM2564C30B41	**SM2564C30B11**	2.5	3	0.95	4.9	0.6	70	20	1.27	85.8
SM2564C40B41	**SM2564C40B11**	2.5	4	0.59	2.8	0.6	70	20	1.27	85.8
SM2564C60B41	**SM2564C60B11**	2.5	6	0.27	1.15	0.6	70	20	1.27	85.8

Motor cable model no.: 4837961-1

Characteristics

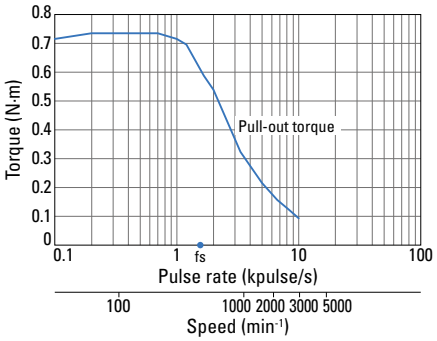
SM2561C10B41 SM2561C10B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



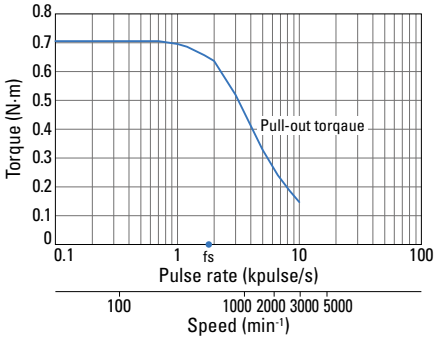
SM2561C20B41 SM2561C20B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



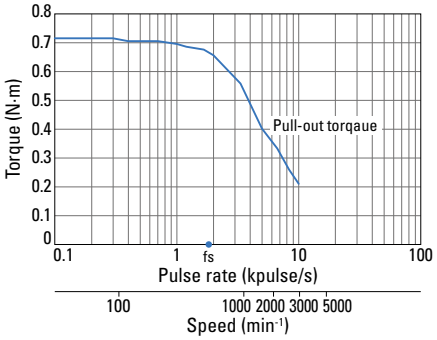
SM2561C30B41 SM2561C30B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



SM2561C40B41 SM2561C40B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



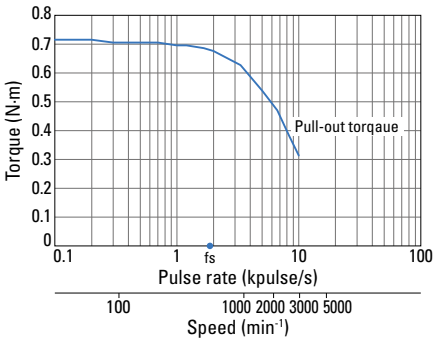
Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Characteristics

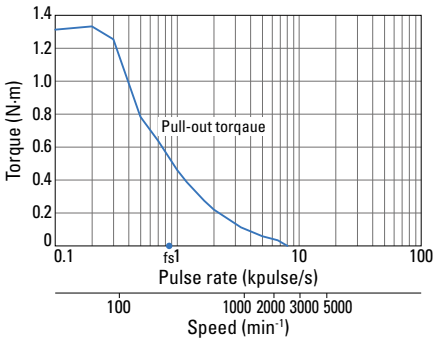
SM2561C60B41 SM2561C60B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



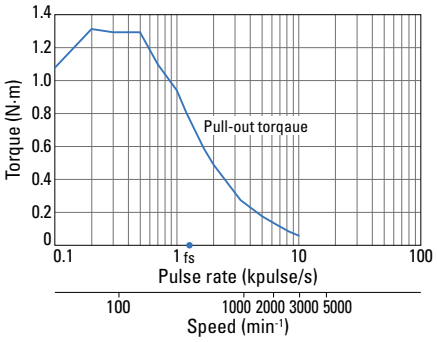
SM2562C10B41 SM2562C10B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



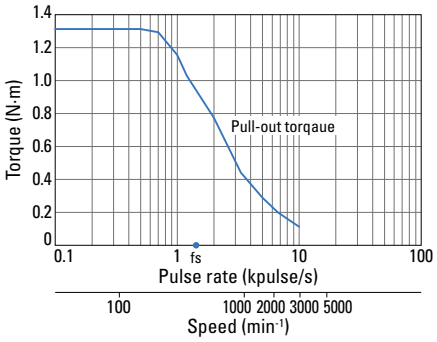
SM2562C20B41 SM2562C20B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



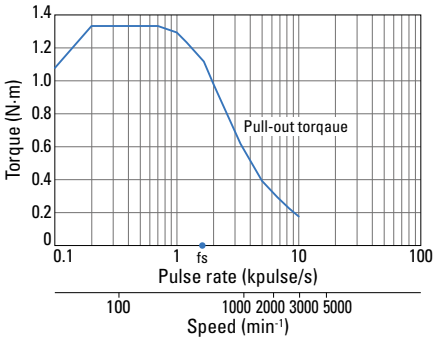
SM2562C30B41 SM2562C30B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



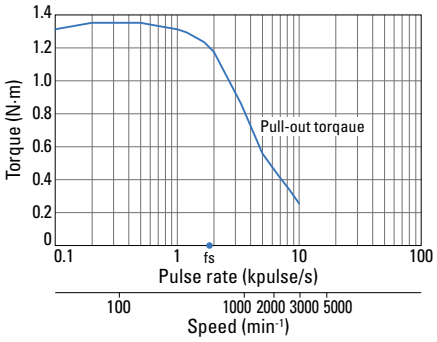
SM2562C40B41 SM2562C40B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



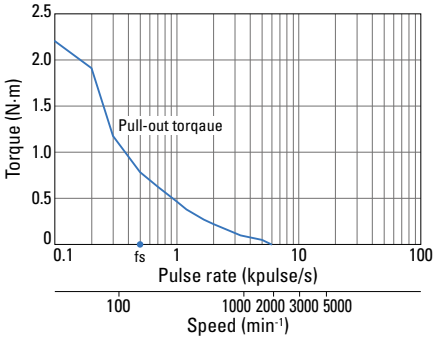
SM2562C60B41 SM2562C60B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



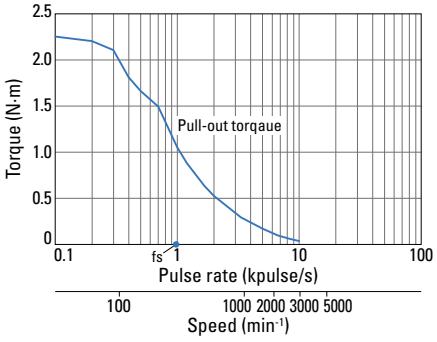
SM2563C10B41 SM2563C10B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



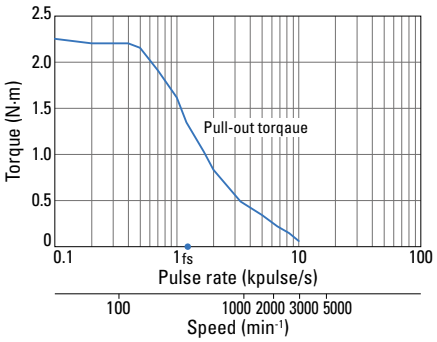
SM2563C20B41 SM2563C20B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



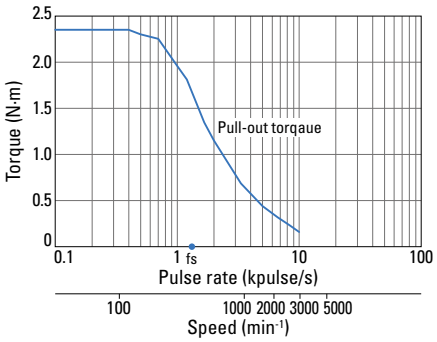
SM2563C30B41 SM2563C30B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



SM2563C40B41 SM2563C40B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

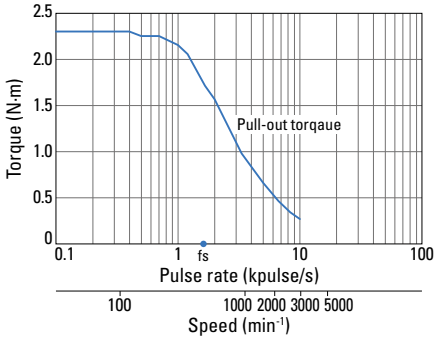
Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

56 mm sq. 1.8°/step

Characteristics

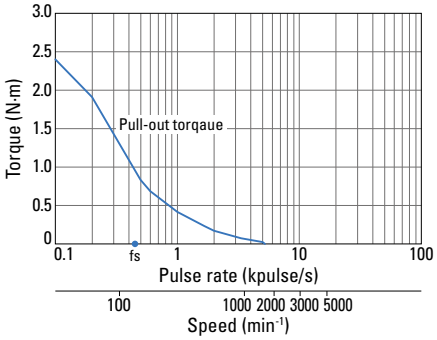
SM2563C60B41 SM2563C60B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



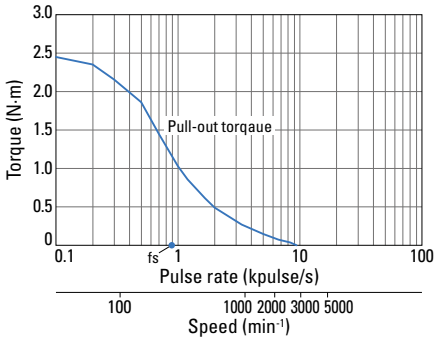
SM2564C10B41 SM2564C10B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



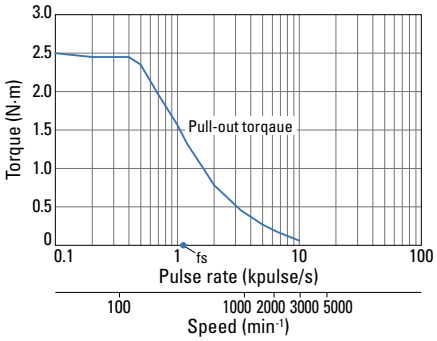
SM2564C20B41 SM2564C20B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



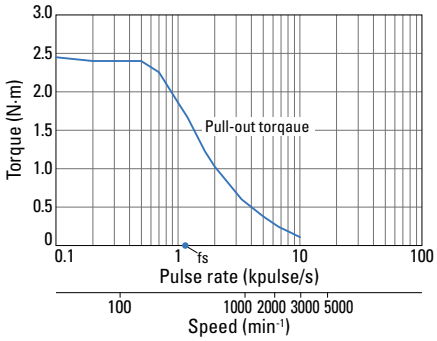
SM2564C30B41 SM2564C30B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



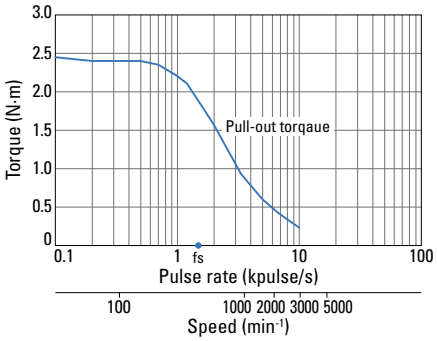
SM2564C40B41 SM2564C40B11

Constant current circuit
Input voltage: 24 VDC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

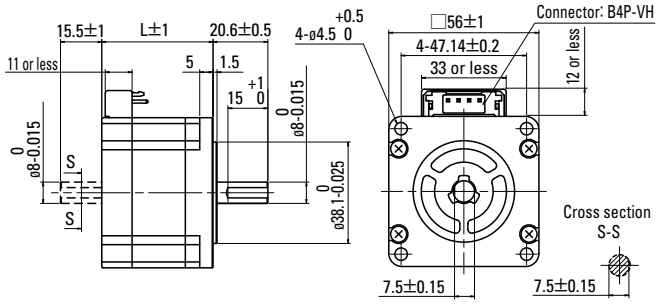


SM2564C60B41 SM2564C60B11

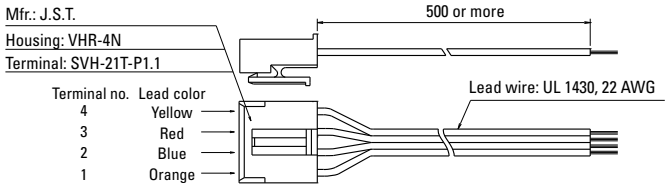
Constant current circuit
Input voltage: 24 VDC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)

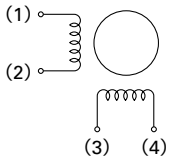


Separate option: Motor cable 4837961-1



Internal wiring

In parentheses are connector pin nos.



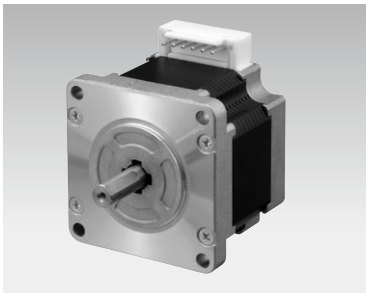
Compatible drivers

- For motors SM256□C20B□1 (2 A/phase)...
  Model no.: F2BED200P100 (DC input)
  Operating current selection switch setting: 0
- For motors SM256□C30B□1 (3 A/phase)...
  Model no.: F2BFD400P100 (DC input)
  Operating current selection switch setting: 5
- For motors SM256□C40B□1 (4 A/phase)...
  Model no.: F2BFD400P100 (DC input)
  Operating current selection switch setting: 0
- For motors other than above...
  A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



60 mm sq.

Our conventional 60 mm sq. motors (103H782□)

1.8°/step RoHS

It is recommended you use a 56 mm sq. motor (SM256□C□0□□1) that has equivalent torque in a smaller size.
We also offer customization that makes the flange compatible with 60 mm sq. motors for easy replacement.

60 mm sq.

0.9°/step RoHS

Unipolar, lead type

Bipolar, lead type

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Gear | Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

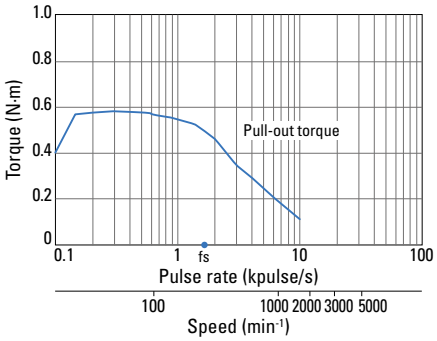
Unipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)	Shaft diameter (D)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	×10⁻⁴kg·m²	N	N	kg	mm	mm
SH1601-0440	**SH1601-0410**	0.57	2	1.35	2	0.24	80	15	0.55	42	0 ø6.35-0.013
SH1602-0440	**SH1602-0410**	1.1	2	1.8	3.5	0.4	70	15	0.8	54	0 ø6.35-0.013
SH1603-0440	**SH1603-0410**	1.7	2	2.3	4.5	0.75	90	15	1.2	76	0 ø8-0.015

Characteristics

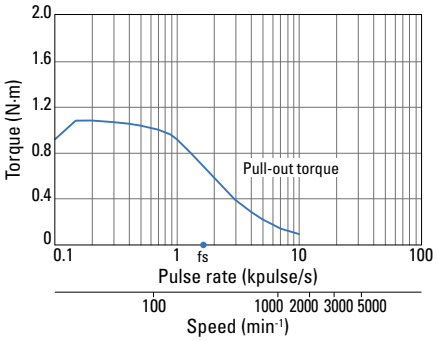
SH1601-0440 SH1601-0410

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



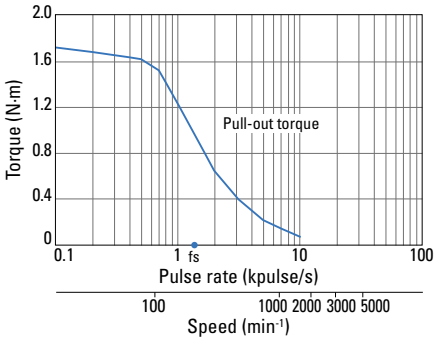
SH1602-0440 SH1602-0410

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

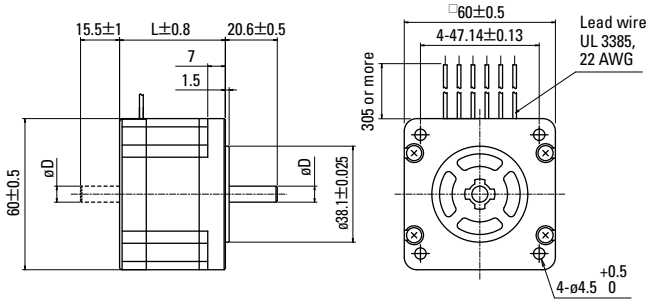


SH1603-0440 SH1603-0410

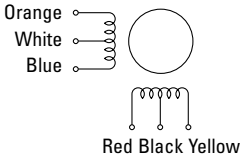
Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

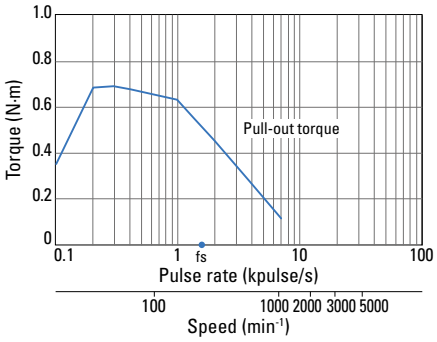
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)	Shaft diameter (D)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm	mm
SH1601-5240	**SH1601-5210**	0.69	2	1.2	3.5	0.24	78	15	0.55	42	0 ø6.35-0.013
SH1602-5240	**SH1602-5210**	1.28	2	1.65	6.1	0.4	65	15	0.8	54	0 ø6.35-0.013
SH1603-5240	**SH1603-5210**	2.15	2	2.3	8.8	0.75	83	15	1.2	76	0 ø8-0.015

Characteristics

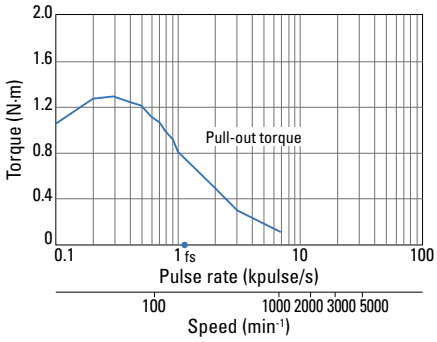
SH1601-5240 SH1601-5210

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



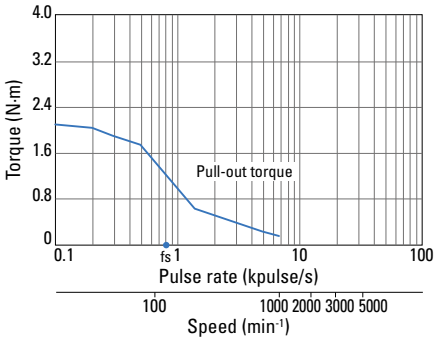
SH1602-5240 SH1602-5210

Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

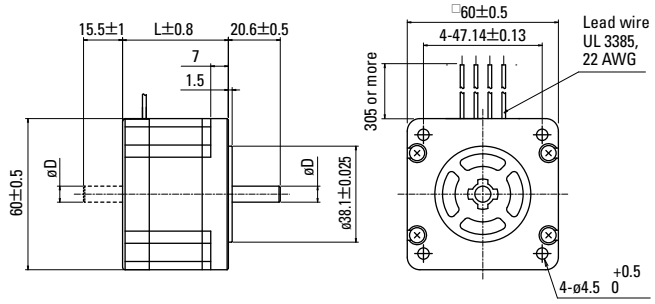


SH1603-5240 SH1603-5210

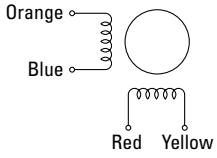
Constant current circuit
Input voltage: 24 VDC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding

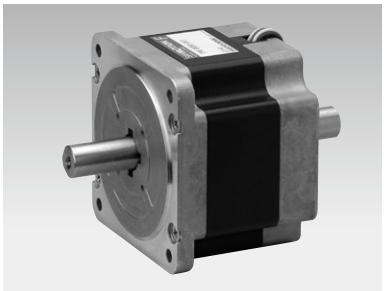


Compatible drivers

Model no.: F2BED200P100 (DC input)
Operating current selection switch setting: 0
Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



86 mm sq.

1.8°/step RoHS

Unipolar, lead type

Bipolar, lead type ▶p. 66

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Encoder | Brake

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

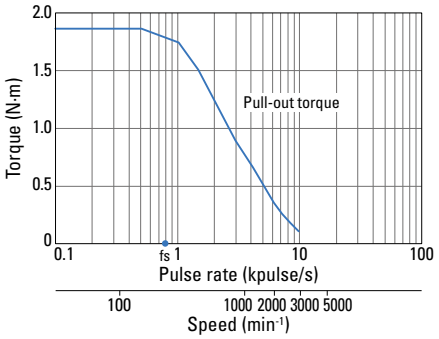
Unipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SH2861-0441	**SH2861-0411**	2.5	2	2.3	8.0	1.48	200	60	1.75	66
SH2861-0941	**SH2861-0911**	2.5	4	0.6	2.0	1.48	200	60	1.75	66
SH2862-0441	**SH2862-0411**	4.7	2	3.2	13.0	3.0	200	60	2.9	96.5
SH2862-0941	**SH2862-0911**	4.7	4	0.85	3.4	3.0	200	60	2.9	96.5
SH2863-0441	**SH2863-0411**	6.7	2	4.0	17.0	4.5	200	60	4.0	127
SH2863-0941	**SH2863-0911**	6.7	4	0.9	4.2	4.5	200	60	4.0	127

Characteristics

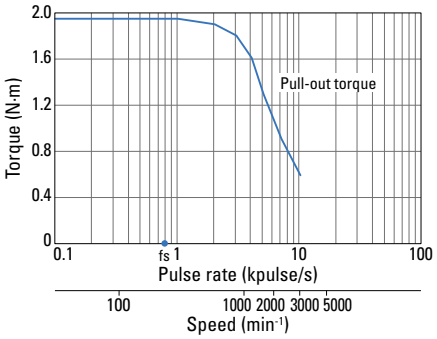
SH2861-0441 SH2861-0411

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



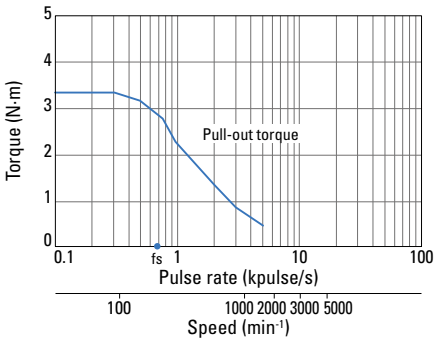
SH2861-0941 SH2861-0911

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



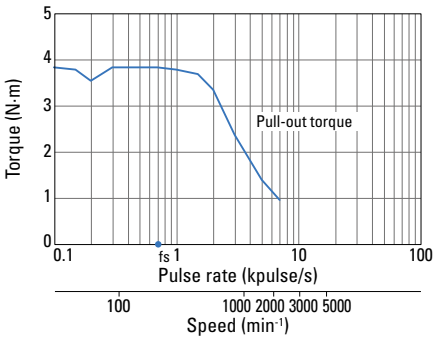
SH2862-0441 SH2862-0411

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



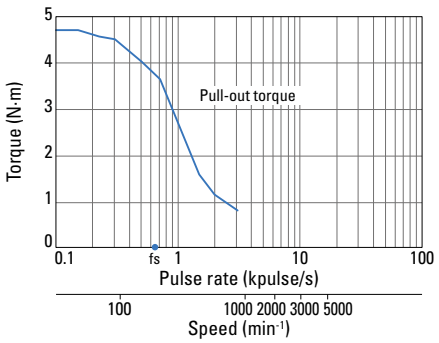
SH2862-0941 SH2862-0911

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



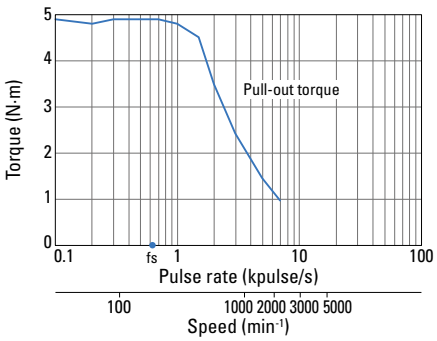
SH2863-0441 SH2863-0411

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



SH2863-0941 SH2863-0911

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load

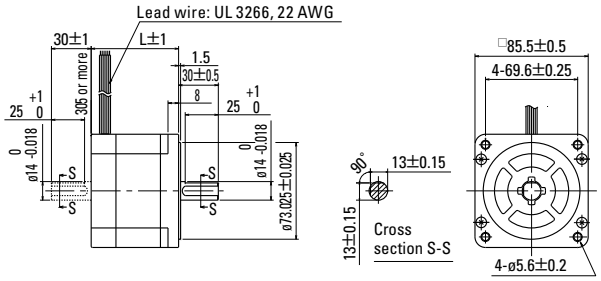


Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

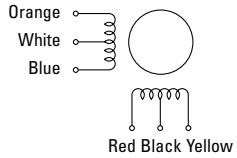
Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Dimensions (Unit: mm)

Lead type



Internal winding



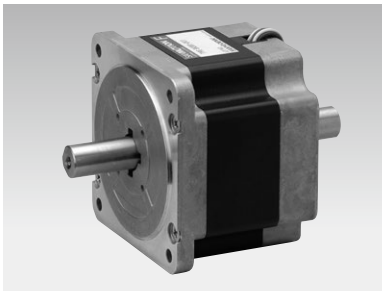
Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using , our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.



86 mm sq.

1.8°/step RoHS

Bipolar, lead type

Unipolar, lead type ▶p. 64

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Encoder | Brake

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

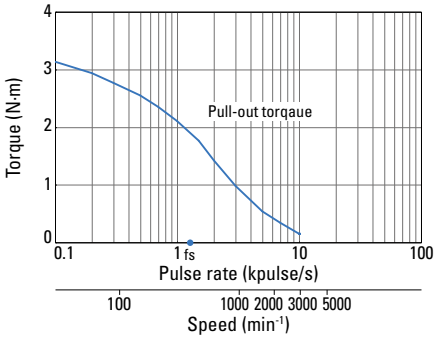
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SH2861-5041	**SH2861-5011**	3.3	2	2.2	15	1.48	200	60	1.75	66
SH2861-5141	**SH2861-5111**	3.3	4	0.56	3.7	1.48	200	60	1.75	66
SH2861-5241	**SH2861-5211**	3.3	6	0.29	1.7	1.48	200	60	1.75	66
SH2862-5041	**SH2862-5011**	6.4	2	3.2	25	3.0	200	60	2.9	96.5
SH2862-5141	**SH2862-5111**	6.4	4	0.83	6.4	3.0	200	60	2.9	96.5
SH2862-5241	**SH2862-5211**	6.4	6	0.36	2.8	3.0	200	60	2.9	96.5
SH2863-5041	**SH2863-5011**	9	2	4.0	32	4.5	200	60	4.0	127
SH2863-5141	**SH2863-5111**	9	4	1.0	7.9	4.5	200	60	4.0	127
SH2863-5241	**SH2863-5211**	9	6	0.46	3.8	4.5	200	60	4.0	127

Characteristics

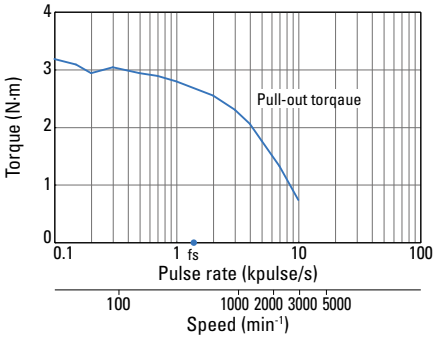
SH2861-5041 SH2861-5011

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



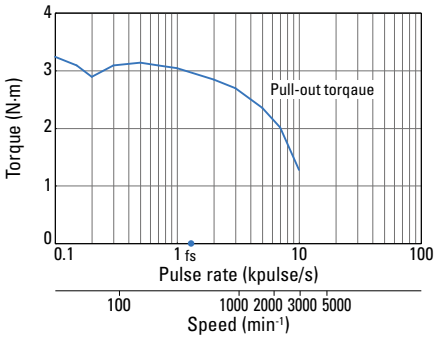
SH2861-5141 SH2861-5111

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



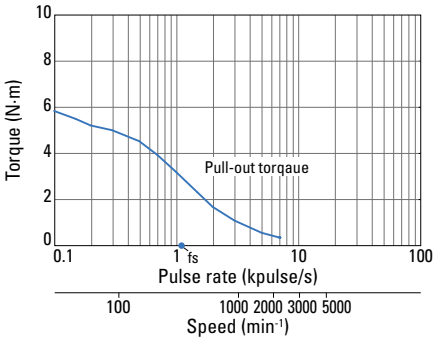
SH2861-5241 SH2861-5211

Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



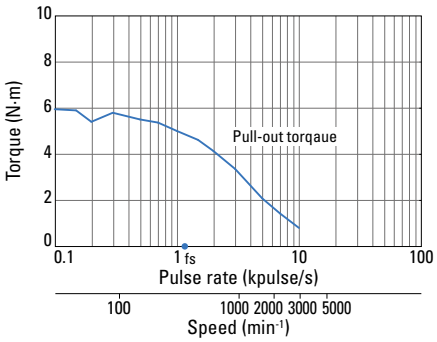
SH2862-5041 SH2862-5011

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



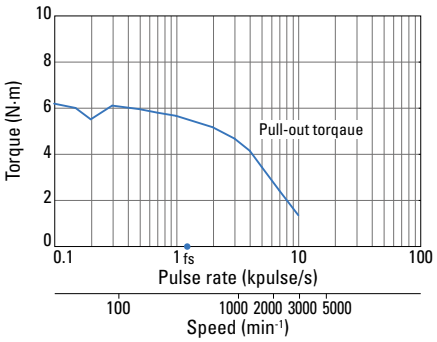
SH2862-5141 SH2862-5111

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



SH2862-5241 SH2862-5211

Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



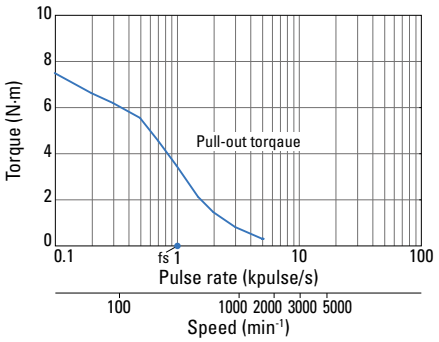
Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Characteristics

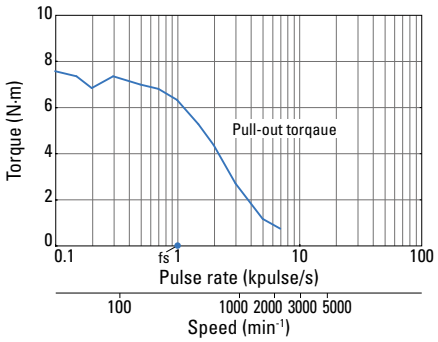
SH2863-5041
SH2863-5011

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



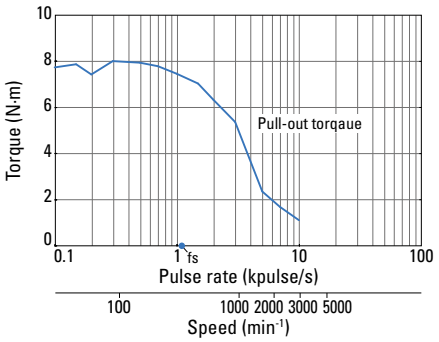
SH2863-5141
SH2863-5111

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

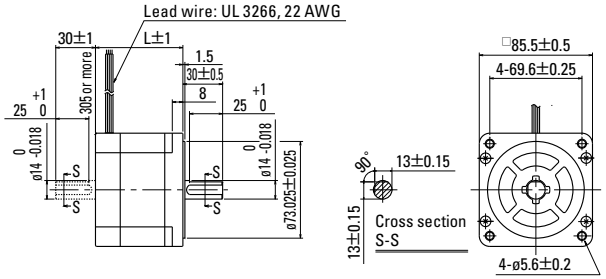


SH2863-5241
SH2863-5211

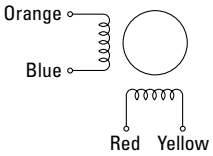
Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

- For motors SH2861-50□1(2 A/phase) or SH2862-50□1 (2 A/phase)...
  Model no.: F2BED200P100 (DC input)
  Operating current selection switch setting: 0
- For motors other than above...
  A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

ø106 mm

1.8°/step RoHS

Unipolar, lead type

Bipolar, lead type

Custom options

Hollow shaft | Custom shaft | Brake

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Unipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10⁻⁴kg·m²	N	N	kg	mm
103H89222-0941	**103H89222-0911**	10.8	4	0.98	6.3	14.6	350	100	7.5	163.3
103H89223-0941	**103H89223-0911**	15.5	4	1.4	9.7	22	340	100	10.5	221.3

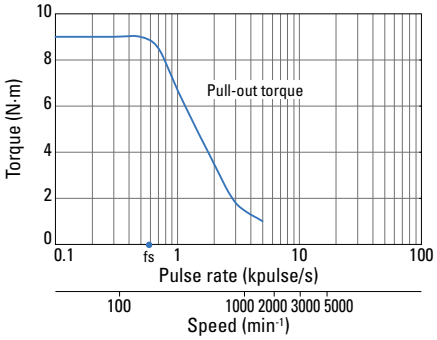
Bipolar, lead type

Model no.		Holding torque at 2-phase excitation	Rated curren	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10⁻⁴kg·m²	N	N	kg	mm
103H89222-5241	**103H89222-5211**	13.2	6	0.45	5.4	14.6	340	100	7.5	163.3
103H89223-5241	**103H89223-5211**	19	6	0.63	8	22	290	100	10.5	221.3

Characteristics

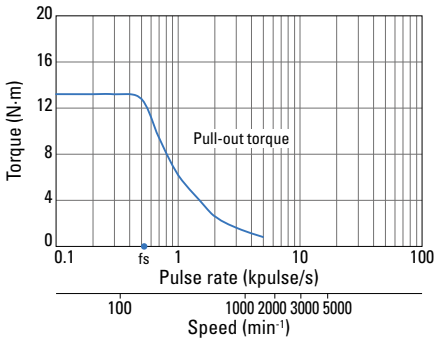
103H89222-0941
103H89222-0911

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



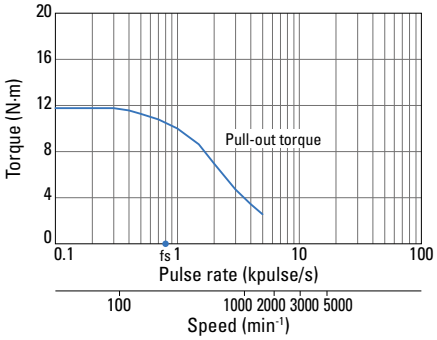
103H89223-0941
103H89223-0911

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



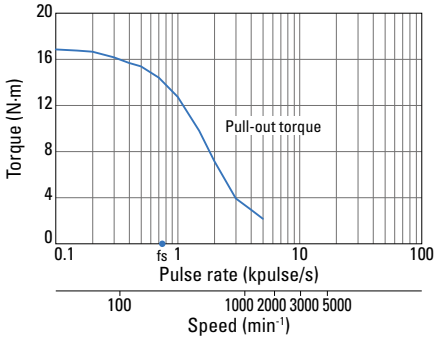
103H89222-5241
103H89222-5211

Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

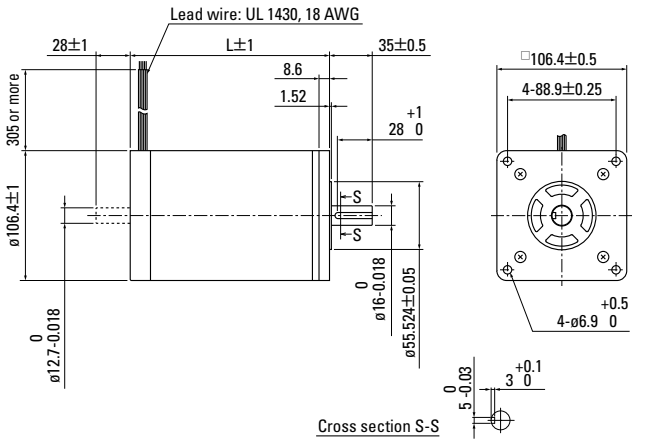


103H89223-5241
103H89223-5211

Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

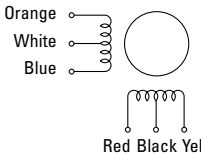


Dimensions (Unit: mm)

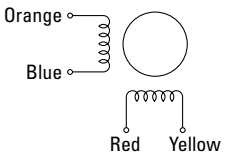


Internal winding

Unipolar



Bipolar



Compatible drivers

A driver is to be provided by the customer

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

56 mm sq.

1.8°/step RoHS

Unipolar, lead-type, CE/UKCA models

Custom options

Hollow shaft Custom shaft

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

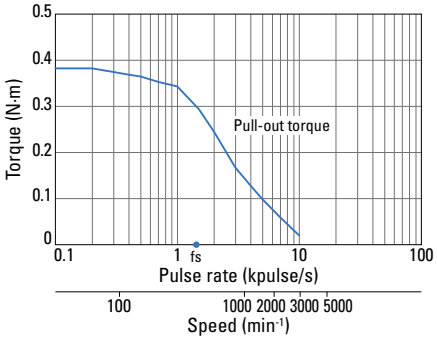
Unipolar, lead-type, CE/UKCA models

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	$\times 10^{-4}$kg·m²	N	N	kg	mm
103H7121-6140	**103H7121-6110**	0.39	1	4.8	8	0.1	78	15	0.47	41.8
103H7121-6740	**103H7121-6710**	0.39	3	0.6	0.8	0.1	78	15	0.47	41.8
103H7123-6140	**103H7123-6110**	0.83	1	6.7	15	0.21	71	15	0.65	53.8
103H7123-6740	**103H7123-6710**	0.78	3	0.77	1.58	0.21	71	15	0.65	53.8
103H7126-6140	**103H7126-6110**	1.27	1	8.6	19	0.36	62	15	0.98	75.8
103H7126-6740	**103H7126-6710**	1.27	3	0.9	2.2	0.36	62	15	0.98	75.8

Characteristics

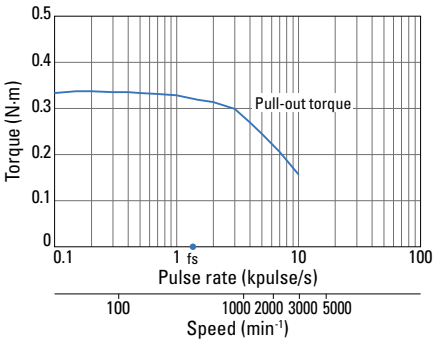
103H7121-6140 103H7121-6110

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



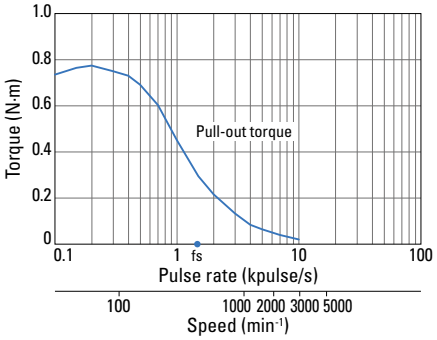
103H7121-6740 103H7121-6710

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



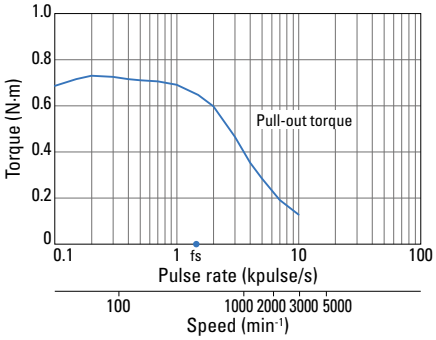
103H7123-6140 103H7123-6110

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



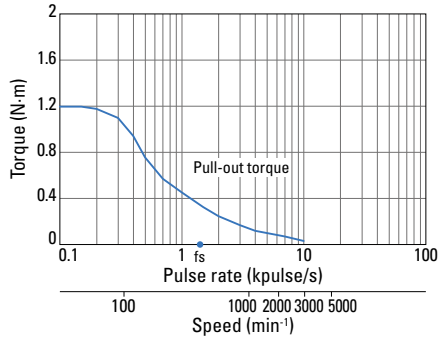
103H7123-6740 103H7123-6710

Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 0.94 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



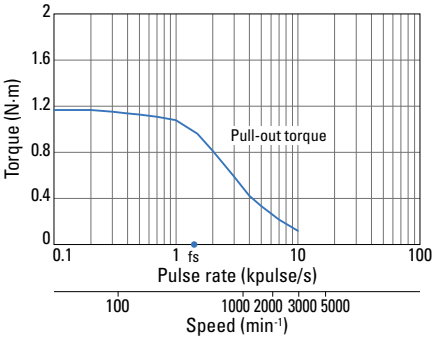
103H7126-6140 103H7126-6110

Constant current circuit
Input voltage: 24 VDC
Winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load

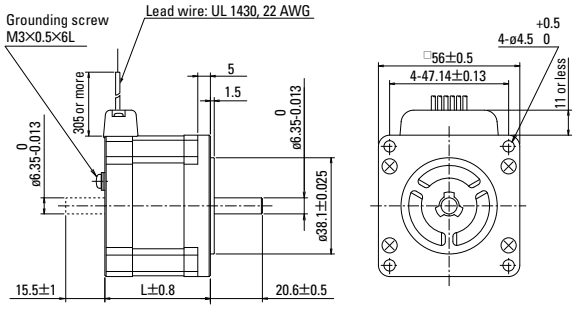


103H7126-6740 103H7126-6710

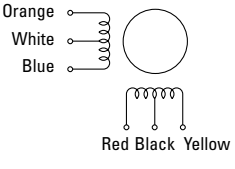
Constant current circuit
Input voltage: 24 VDC
Winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 2.6 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



Dimensions (Unit: mm)



Internal winding



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

86 mm sq.

1.8°/step RoHS

Unipolar, lead-type, CE/UKCA/UL models

Bipolar, lead-type, CE/UKCA/UL models ▶p. 72
Bipolar, terminal block-type, CE/UKCA/UL models ▶p. 72

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

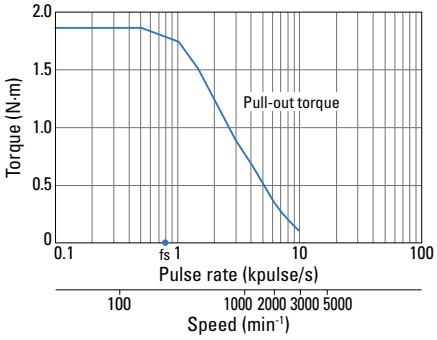
Unipolar, lead-type, CE/UKCA/UL models

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SM2861-0451	**SM2861-0421**	2.5	2	2.3	8.0	1.48	60	200	1.75	66
SM2861-0951	**SM2861-0921**	2.5	4	0.6	2.0	1.48	60	200	1.75	66
SM2862-0451	**SM2862-0421**	4.7	2	3.2	13.0	3.0	60	200	2.9	96.5
SM2862-0951	**SM2862-0921**	4.7	4	0.85	3.4	3.0	60	200	2.9	96.5
SM2863-0451	**SM2863-0421**	6.7	2	4.0	17.0	4.5	60	200	4.0	127
SM2863-0951	**SM2863-0921**	6.7	4	0.9	4.2	4.5	60	200	4.0	127

Characteristics

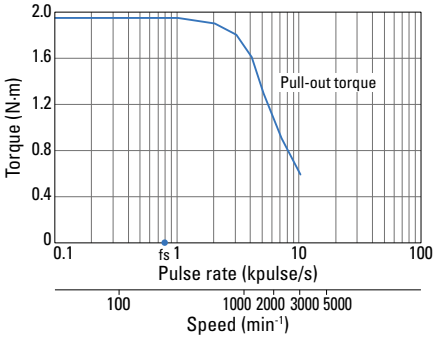
SM2861-0451 SM2861-0421

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



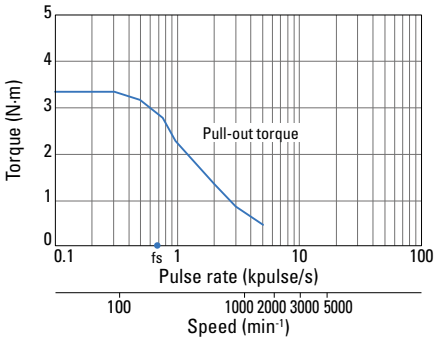
SM2861-0951 SM2861-0921

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 7.4 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



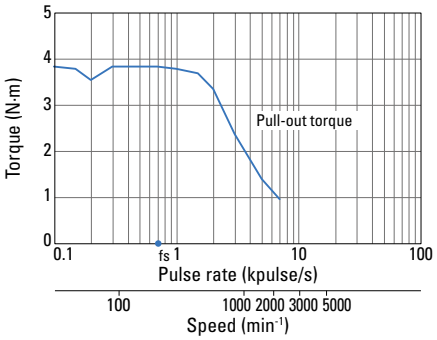
SM2862-0451 SM2862-0421

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



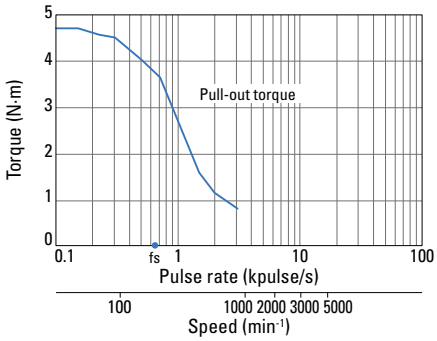
SM2862-0951 SM2862-0921

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



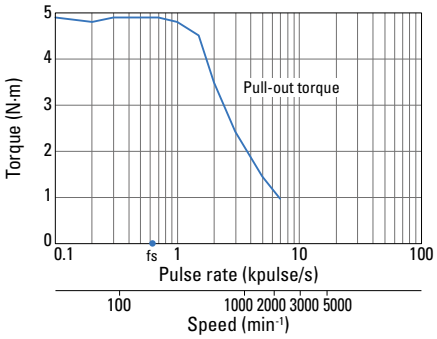
SM2863-0451 SM2863-0421

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



SM2863-0951 SM2863-0921

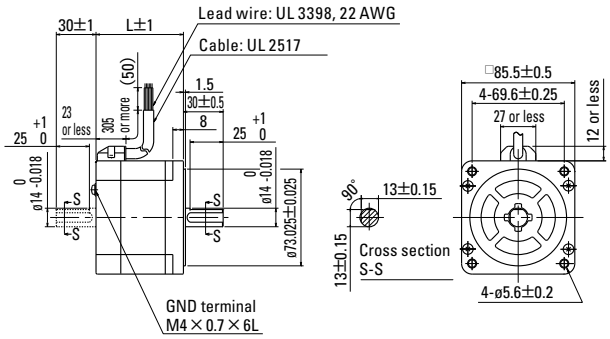
Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
fs: Maximum starting pulse rate with no load



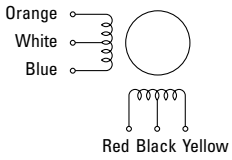
Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Dimensions (Unit: mm)



Internal winding



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

86 mm sq.

1.8°/step RoHS

Bipolar, lead-type, CE/UKCA/UL models
Bipolar, terminal block-type, CE/UKCA/UL models
Unipolar, lead-type, CE/UKCA/UL models ▶p. 70

ECO PRODUCTS

Custom options

Hollow shaft | Custom shaft | Encoder

Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Bipolar, lead-type, CE/UKCA/UL models

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	Dual shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SM2861-5051	**SM2861-5021**	3.3	2	2.2	15	1.48	200	60	1.75	66
SM2861-5151	**SM2861-5121**	3.3	4	0.56	3.7	1.48	200	60	1.75	66
SM2861-5251	**SM2861-5221**	3.3	6	0.29	1.7	1.48	200	60	1.75	66
SM2862-5051	**SM2862-5021**	6.4	2	3.2	25	3.0	200	60	2.9	96.5
SM2862-5151	**SM2862-5121**	6.4	4	0.83	6.4	3.0	200	60	2.9	96.5
SM2862-5251	**SM2862-5221**	6.4	6	0.36	2.8	3.0	200	60	2.9	96.5
SM2863-5051	**SM2863-5021**	9	2	4.0	32	4.5	200	60	4.0	127
SM2863-5151	**SM2863-5121**	9	4	1.0	7.9	4.5	200	60	4.0	127
SM2863-5251	**SM2863-5221**	9	6	0.46	3.8	4.5	200	60	4.0	127

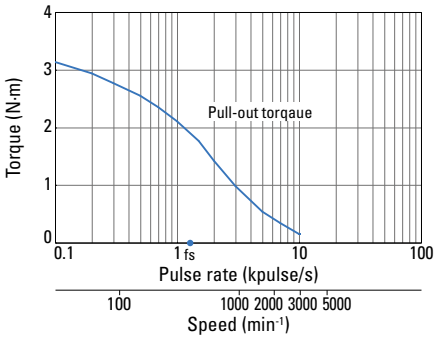
Bipolar, terminal block-type, CE/UKCA/UL models

Model no.	Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Allowable radial load	Allowable thrust load	Mass	Motor length (L)
Single shaft	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	N	N	kg	mm
SM2861-5066	3.3	2	2.03	15	1.48	200	60	1.9	97.9
SM2861-5166	3.3	4	0.52	3.7	1.48	200	60	1.9	97.9
SM2861-5266	3.3	6	0.27	1.7	1.48	200	60	1.9	97.9
SM2862-5066	6.4	2	3.08	25	3.0	200	60	3.05	128.4
SM2862-5166	6.4	4	0.79	6.4	3.0	200	60	3.05	128.4
SM2862-5266	6.4	6	0.33	2.8	3.0	200	60	3.05	128.4
SM2863-5066	9	2	3.83	32	4.5	200	60	4.15	158.8
SM2863-5166	9	4	0.96	7.9	4.5	200	60	4.15	158.8
SM2863-5266	9	6	0.48	3.8	4.5	200	60	4.15	158.8

Characteristics

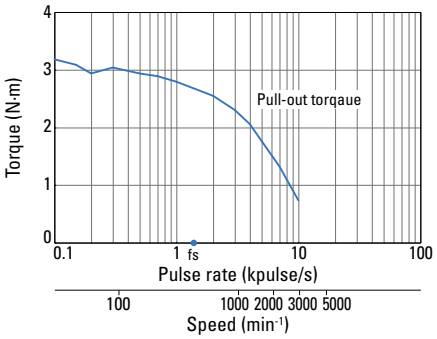
SM2861-5051
SM2861-5021
SM2861-5066

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
J_L = 15.3 × 10^{-4}kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



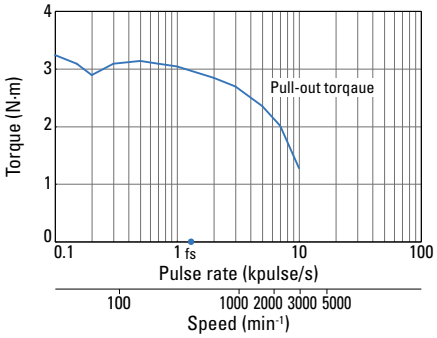
SM2861-5151
SM2861-5121
SM2861-5166

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
J_L = 15.3 × 10^{-4}kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



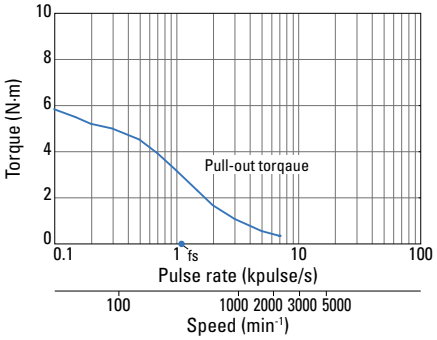
SM2861-5251
SM2861-5221
SM2861-5266

Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
J_L = 15.3 × 10^{-4}kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



SM2862-5051
SM2862-5021
SM2862-5066

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
J_L = 15.3 × 10^{-4}kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



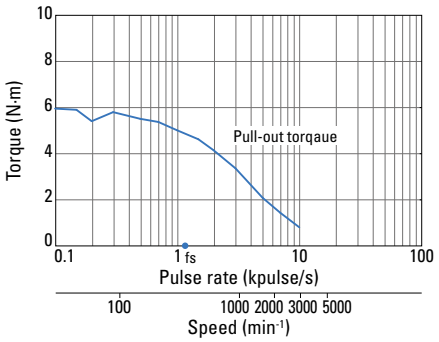
Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

Characteristics

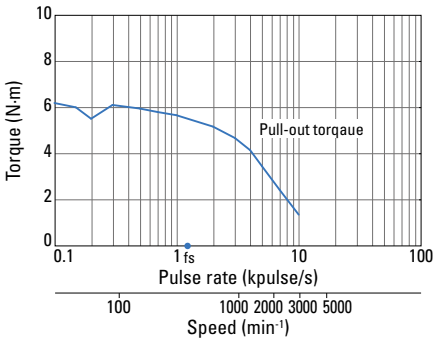
SM2862-5151 SM2862-5121
SM2862-5166

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



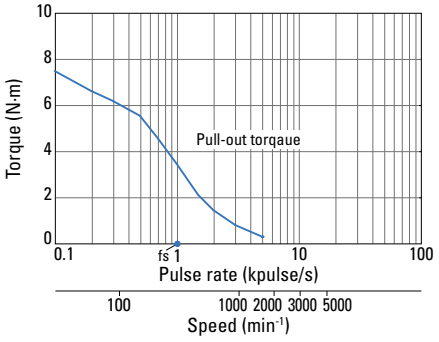
SM2862-5251 SM2862-5221
SM2862-5066

Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 15.3 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



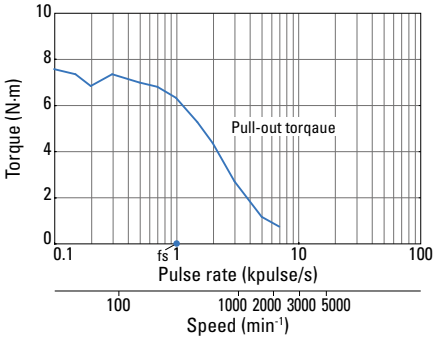
SM2863-5051 SM2863-5021
SM2863-5066

Constant current circuit
Input voltage: 100 VAC
Winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



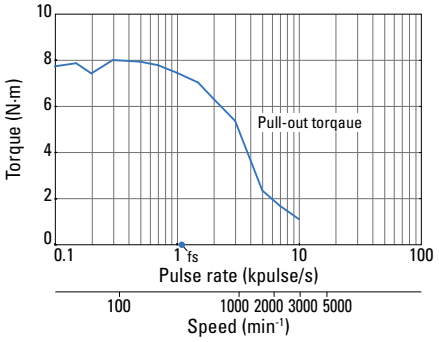
SM2863-5151 SM2863-5121
SM2863-5166

Constant current circuit
Input voltage: 100 VAC
Winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load



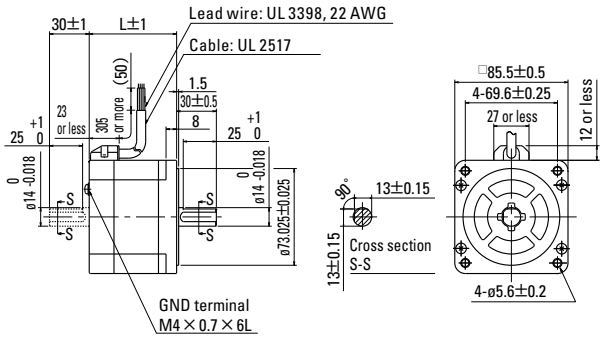
SM2863-5251 SM2863-5221
SM2863-5266

Constant current circuit
Input voltage: 100 VAC
Winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque:
$J_L = 44 \times 10^{-4}$kg·m²
(with rubber coupling used)
f_S: Maximum starting pulse rate with no load

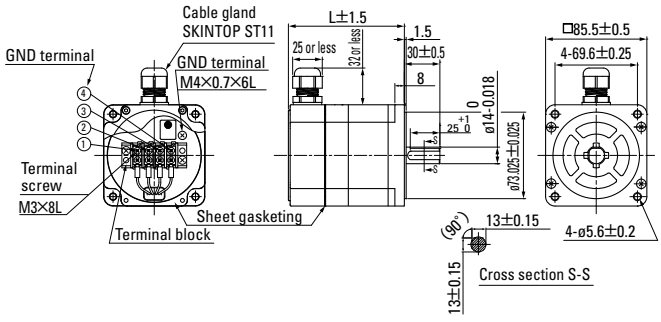


Dimensions (Unit: mm)

Lead type

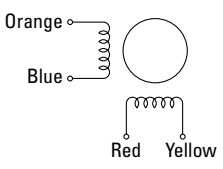


Terminal block type

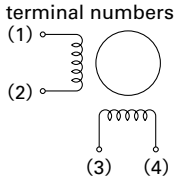


Internal winding

Lead type



Terminal block type
Inside parentheses are terminal numbers



Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

Internal Wiring and Rotational Directions... ▶p. 74 General Specifications... ▶p. 75

Data is measured under our drive conditions. Drive torque may vary depending on the actual machine precision.

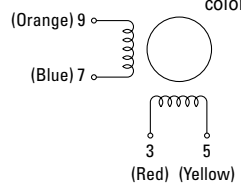
Internal Wiring and Rotational Directions

Bipolar winding

Connector type, model no.: SF242□

Internal wiring

In parentheses are lead colors of the motor cable



Direction of motor rotation

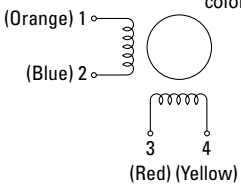
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Connector pin no.			
		3	7	5	9
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

Connector type, model no.: SM256□ (and 103H782□)

Internal wiring

In parentheses are lead colors of the motor cable



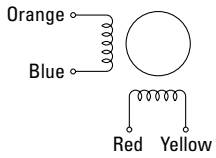
Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Connector pin no.			
		3	2	4	1
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

Lead type

Internal wiring



Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		Lead color			
		Red	Blue	Yellow	Orange
Excitation sequence	1	−	−	+	+
	2	+	−	−	+
	3	+	+	−	−
	4	−	+	+	−

General Specifications

Motor model no.	SH214□	SH228□	SH353□	SS242□	SH142□	SF242□	SS250□	103H670□
Operation type	—							
Operating ambient temperature	-10 to +50°C							
Storage temperature	-20 to +65°C							
Operating ambient humidity	20 to 90% RH (non-condensing)							
Storage humidity	5 to 95 % RH (non-condensing)							
Operating altitude	Up to 1000 m above sea level							
Vibration resistance	Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes.							
Shock resistance	Acceleration 500 m/s², duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times							
Thermal class	B (+130°C)							
Dielectric strength	500 VAC for 1 minute (between motor winding and frame)							1000 VAC for 1 minute (between motor winding and frame)
Insulation resistance	100 MΩ min. at 500 VDC (between motor winding and frame)							
Protection rating	—							
Winding temperature rise	80 K or less (based on our own standard)							
Positional accuracy tolerance	±0.09°				±0.054°	±0.09°		
Thrust play (1)	0.075 mm or less (With a 0.35 N load)	0.075 mm or less (With a 1.5 N load)	0.075 mm or less (With a 5 N load)	0.075 mm or less (With a 4 N load)	0.075 mm or less (With a 5 N load)	0.075 mm (With a 5 N load)	0.075 mm or less (With a 4 N load)	0.075 mm (With a 10 N load)
Radial play (2)	0.025 mm (With a 5 N load)							
Shaft runout	0.025 mm							
Concentricity of motor shaft and fitting part	ø0.05 mm	ø0.05 mm	ø0.075 mm	ø0.075 mm	ø0.05 mm	ø0.05 mm	ø0.075 mm	ø0.075 mm
Perpendicularity of mounting surface and motor shaft surface	0.1 mm	0.1 mm	0.1 mm	0.1 mm	0.1 mm	0.1 mm	0.1 mm	0.1 mm
Motor mounting orientation	Can be installed vertically or horizontally.							

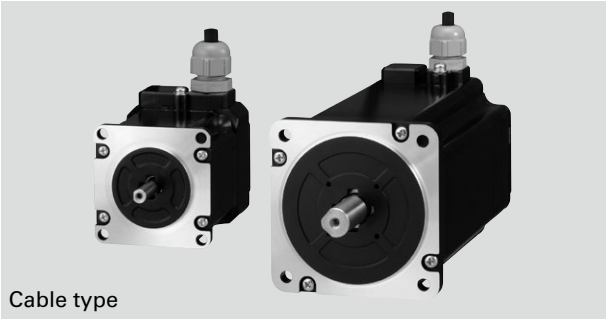
Motor model no.	SM256□ UL	SH160□	SH286□	103H8922□	SM286□ CE/UKCA/UL	103H712□-6□□0 CE/UKCA
Operation type	—				Continuous operation (S1)	
Operating ambient temperature	-10 to +50°C				-10 to +40°C	
Storage temperature	-20 to +65°C				-20 to +60°C	
Operating ambient humidity	20 to 90% RH (non-condensing)				95% RH or less: Below 40°C (non-condensing)	
Storage humidity	5 to 95% RH (non-condensing)				95% RH or less: Below 40°C, 57% RH or less: Below 50°C, 35% RH or less: Below 60°C (non-condensing)	
Operating altitude	Up to 1000 m above sea level					
Vibration resistance	Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes.					
Shock resistance	Acceleration 500 m/s², duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times					
Thermal class	B (+130°C) (A for UL models)	B (+130°C)			F (+155°C)	B (+130°C)
Dielectric strength	1120 VAC for 1 minute (between motor winding and frame)	1000 VAC for 1 minute (between motor winding and frame)		1500 VAC for 1 minute (between motor winding and frame)		
Insulation resistance	100 MΩ min. at 500 VDC (between motor winding and frame)					
Protection rating	—				IP43	
Winding temperature rise	80 K or less (based on our own standard)					
Positional accuracy tolerance	±0.054°		±0.09°			±0.054°
Thrust play (1)	0.075 mm (With a 10 N load)					
Radial play (2)	0.025 mm (With a 5 N load)	0.025 mm (With a 5 N load)	0.025 mm (With a 5 N load)	0.025 mm (With a 10 N load)	0.025 mm (With a 5 N load)	0.025 mm (With a 5 N load)
Shaft runout	0.025 mm					
Concentricity of motor shaft and fitting part	ø0.075 mm					
Perpendicularity of mounting surface and motor shaft surface	0.1 mm	0.1 mm	0.15 mm	0.1 mm	0.15 mm	0.1 mm
Motor mounting orientation	Can be installed vertically or horizontally.					

(1) Thrust play: Shaft position displacement when a load is exerted in a direction parallel to the motor shaft.
(2) Radial play: Maximum shaft position displacement when a load is exerted in a direction perpendicular to the motor shaft. Load is exerted on the point 1/3 the shaft length from the shaft end.

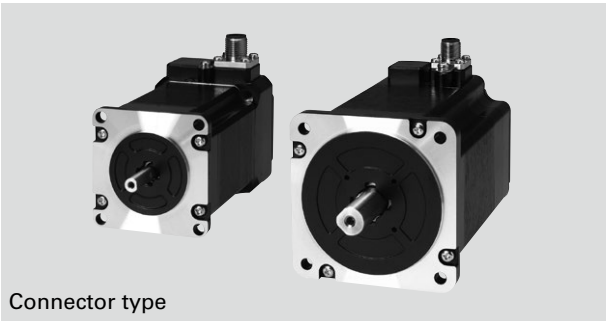
Safety standards

EU Directive CE mark	Directive		Standards
	Low Voltage Directive 2014/35/EU		IEC 60034-1, IEC 60034-5
	RoHS Directive 2011/65/EU		EN IEC 63000: 2018
UKCA marking for Great Britain (UK Conformity Assessed Marking)	Electrical Equipment (Safety) Regulations 2016		IEC 60034-1, IEC 60034-5
	RoHS Regulations 2012		EN IEC 63000: 2018
UL	Classification	Standards	File no.
	UL	UL 1004-1, UL 1004-6	E179832
	UL for Canada (cUL)	CSA C22.2 No. 100	

IP65-Rated Stepping Motors Water/Dust protection



Cable type



Connector type

Features

- These IP65-rated motors* have superior water and dust resistance, and can be safely used in water-exposed environments such as in food processing machines.
  * Except for the shaft and cable ends.
- Options such as a brake, encoder, and oil seal can be combined.

Safety standards

In compliant with CE, UKCA, and UL safety standards.

Specifications

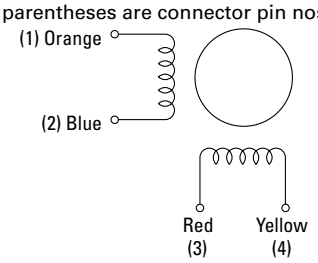
	56 mm sq.	86 mm sq.
Motor model no.	SP256□-5□□0	SP286□-5□□0
Operation type	Continuous operation (S1)	
Operating ambient temperature	-10 to +40°C	
Storage temperature	-20 to +60°C	
Operating ambient humidity	95% RH or less: Below 40°C (non-condensing)	
Storage humidity	95% RH or less: Below 40°C, 57% RH or less: Below 50°C, 35% RH or less: Below 60°C (non-condensing)	
Operating altitude	Up to 1000 m above sea level	
Vibration resistance	Frequency 10 to 500 Hz, amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, a total of 12 tests in both opposite directions for each of X, Y, and Z axes.	
Shock resistance	Acceleration 500 m/s², duration 11 ms, half sine wave, tested 3 times in both directions for each X, Y, and Z axis for a total of 18 times	
Thermal class	F (+155°C)	
Dielectric strength	1500 VAC for 1 minute (between motor winding and frame)	
Insulation resistance	100 MΩ min. at 500 VDC (between motor winding and frame)	
Protection rating	IP65 (excluding the hollow shaft part and cable ends)	
Winding temperature rise	100 K or less (based on our own standard)	
Positional accuracy	± 0.054°	± 0.09°
Thrust play	0.075 mm or less (With a 10 N load)	
Radial play	0.025 mm or less (With a 5 N load)	
Shaft runout	0.025 mm	
Concentricity of motor shaft and fitting part	ø0.075 mm	
Perpendicularity of mounting surface and motor shaft	0.1 mm	0.15 mm
Motor mounting orientation	Can be installed vertically or horizontally.	

Internal Wiring and Rotational Directions

Bipolar winding

Internal wiring

In parentheses are connector pin nos.



Rotational direction

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

Lead color		Red	Blue	Yellow	Orange
Connector pin no.		3	2	4	1
Excitation sequence	1	–	–	+	+
	2	+	–	–	+
	3	+	+	–	–
	4	–	+	+	–

Safety standards

EU Directive CE mark	Directive		Standards
	Low Voltage Directive 2014/35/EU		IEC 60034-1, IEC 60034-5
	RoHS Directive 2011/65/EU		EN IEC 63000: 2018
UKCA marking for Great Britain (UK Conformity Assessed Marking)	Electrical Equipment (Safety) Regulations 2016		IEC 60034-1, IEC 60034-5
	RoHS Regulations 2012		EN IEC 63000: 2018
UL	Classification	Standards	File no.
	UL	UL 1004-1, UL 1004-6	E179832
	UL for Canada (cUL)	CSA C22.2 No. 100	

Models with brake or oil seal have different model nos.
Models with an encoder have different model nos. and vibration resistance.

56 mm sq.

1.8°/step RoHS

Bipolar

ECO PRODUCTS

Custom options

Custom shaft

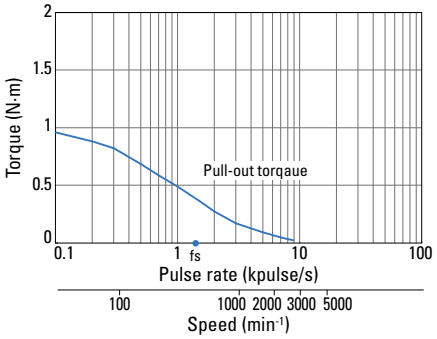
Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance	Winding inductance	Rotor inertia	Mass	Allowable thrust load	Allowable radial load
Cable type	Connector type	N·m or more	A/phase	Ω/phase	mH/phase	× 10^{-4}kg·m²	kg	N	N
SP2563-5060	**SP2563-5000**	1	1	5.8	29	0.21	0.9	15	52
SP2563-5160	**SP2563-5100**	1	2	1.5	7.3	0.21	0.9	15	52
SP2563-5260	**SP2563-5200**	1	3	0.75	3.4	0.21	0.9	15	52
SP2566-5060	**SP2566-5000**	1.7	1	7.8	35.4	0.36	1.2	15	23
SP2566-5160	**SP2566-5100**	1.7	2	2	9.2	0.36	1.2	15	23
SP2566-5260	**SP2566-5200**	1.7	3	1	4.4	0.36	1.2	15	23

• Models with a brake, encoder, or oil seal have different model nos., rotor inertia, and mass.

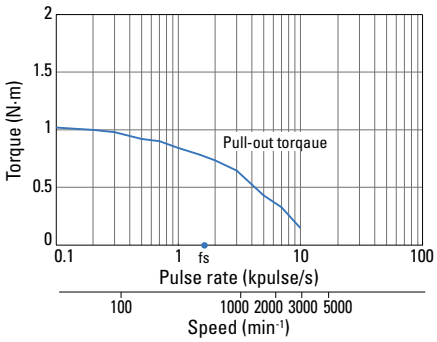
Characteristics

SP2563-5000
SP2563-5060



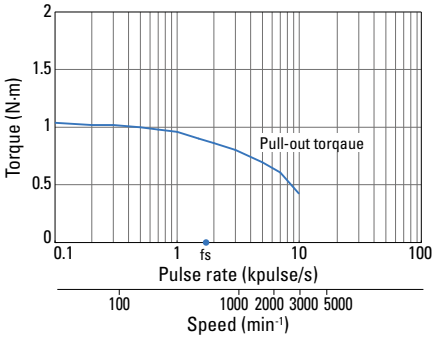
Constant current circuit
Input voltage: 100 VAC, winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=2.6×10^{-4}kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2563-5100
SP2563-5160



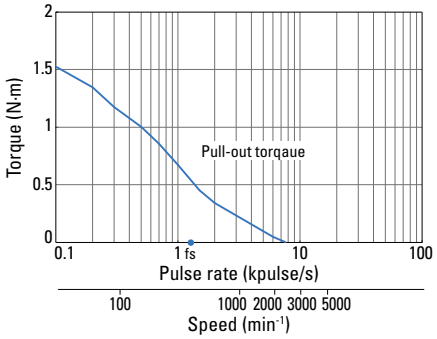
Constant current circuit
Input voltage: 100 VAC, winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=2.6×10^{-4}kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2563-5200
SP2563-5260



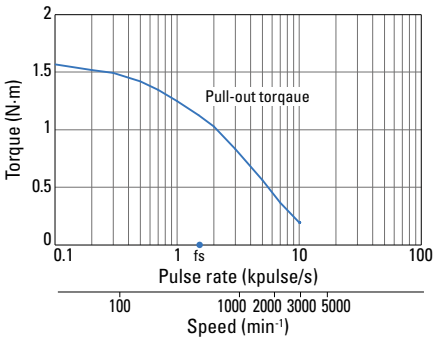
Constant current circuit
Input voltage: 100 VAC, winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=2.6×10^{-4}kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2566-5000
SP2566-5060



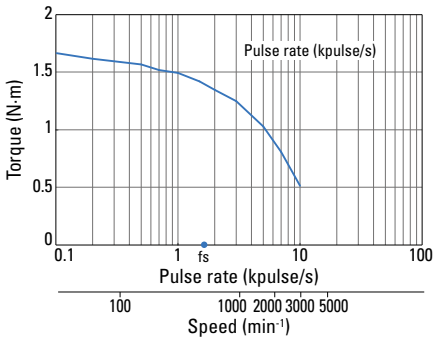
Constant current circuit
Input voltage: 100 VAC, winding current: 1 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=7.4×10^{-4}kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2566-5100
SP2566-5160



Constant current circuit
Input voltage: 100 VAC, winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=7.4×10^{-4}kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2566-5200
SP2566-5260

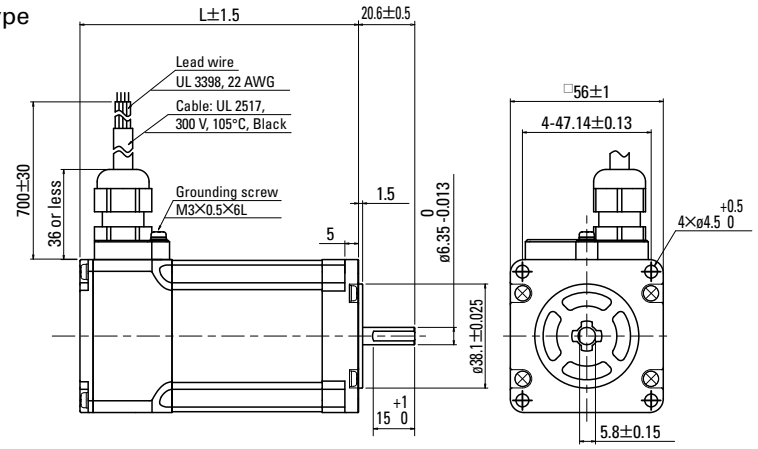


Constant current circuit
Input voltage: 100 VAC, winding current: 3 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=7.4×10^{-4}kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

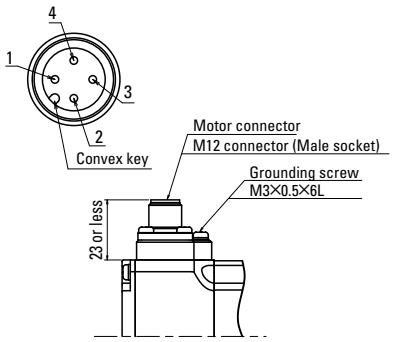
Dimensions Unit: mm

56 mm sq.

Cable type



Connector type



Model no.		Motor length
Cable type	Connector type	(L)
SP2563-5 □ 60	SP2563-5 □ 00	80
SP2566-5 □ 60	SP2566-5 □ 00	102

Compatible drivers

- For motors SP256□-52□0 (3 A/phase) or SP256□-50□0 (1 A/phase)...

  A driver is to be provided by the customer.

- For motors SP256□-51□0 (2 A/phase)...

  Model no.: BS1D200P10 (DC input)
  Contact us for details on drivers.

  Operating current selection switch setting: 0

Note: The characteristics shown above are calculated using our experimental circuit.

86 mm sq.

1.8°/step RoHS

Bipolar

ECO PRODUCTS

Custom options

Custom shaft

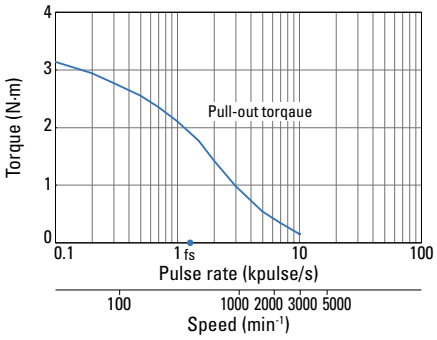
Note: Custom options availability varies depending on the model number and requested quantity. Contact us for details.

Model no.		Holding torque at 2-phase excitation	Rated current	Winding resistance		Winding inductance	Rotor inertia	Allowable thrust load	Allowable radial load	Mass
Cable type	Connector type	N·m or more	A/phase	Cable type Ω/phase	Connector type Ω/phase	mH/phase	×10⁻⁴kg·m²	N	N	kg
SP2861-5060	**SP2861-5000**	3.3	2	2.1	2.05	15	1.48	60	200	1.95
SP2861-5160	**SP2861-5100**	3.3	4	0.61	0.56	3.7	1.48	60	200	1.95
SP2861-5260	—	3.3	6	0.36	—	1.7	1.48	60	200	1.95
SP2862-5060	**SP2862-5000**	6.4	2	3.2	3.2	25	3	60	200	3.1
SP2862-5160	**SP2862-5100**	6.4	4	0.85	0.83	6.4	3	60	200	3.1
SP2862-5260	—	6.4	6	0.41	—	2.8	3	60	200	3.1
SP2863-5060	**SP2863-5000**	9	2	4	4	32	4.5	60	200	4.2
SP2863-5160	**SP2863-5100**	9	4	1.05	1	7.9	4.5	60	200	4.2
SP2863-5260	—	9	6	0.53	—	3.8	4.5	60	200	4.2

- Models with a brake, encoder, or oil seal have different model numbers, rotor inertia, and mass.
- Connector-type models are available for 4 A or lower rated voltages.

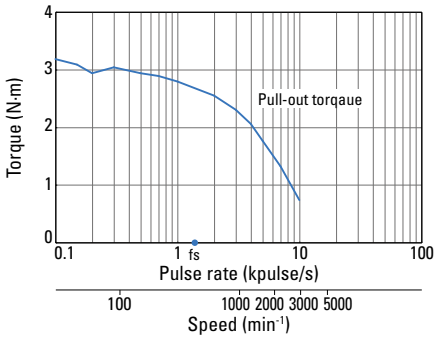
Characteristics

SP2861-5000 SP2861-5060



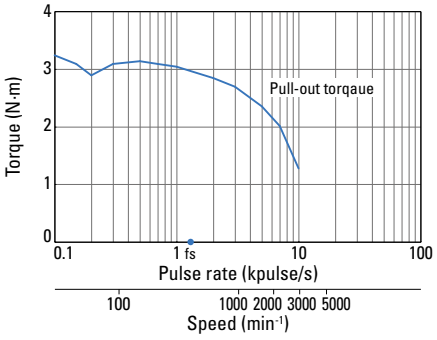
Constant current circuit
Input voltage: 100 VAC, winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=15.3×10⁻⁴kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2861-5100 SP2861-5160



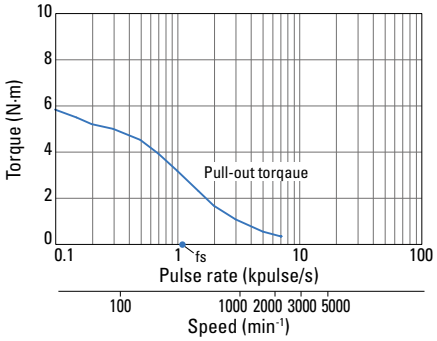
Constant current circuit
Input voltage: 100 VAC, winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=15.3×10⁻⁴kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2861-5260



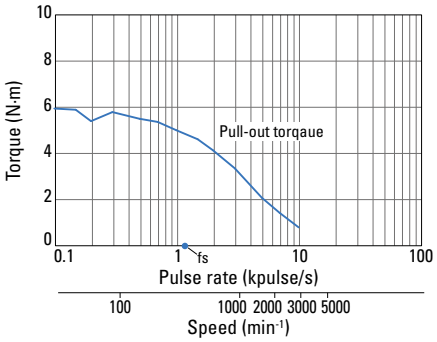
Constant current circuit
Input voltage: 100 VAC, winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=15.3×10⁻⁴kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2862-5000 SP2862-5060



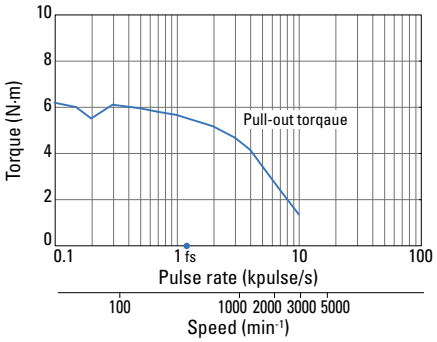
Constant current circuit
Input voltage: 100 VAC, winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=15.3×10⁻⁴kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

SP2862-5100 SP2862-5160



Constant current circuit
Input voltage: 100 VAC, winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=15.3×10⁻⁴kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

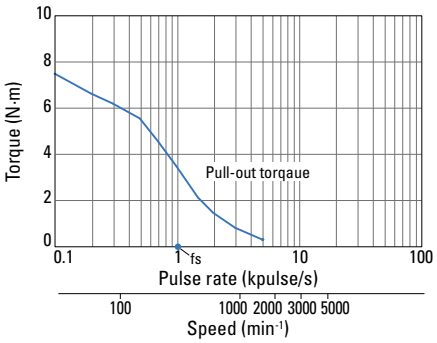
SP2862-5260



Constant current circuit
Input voltage: 100 VAC, winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=15.3×10⁻⁴kg·m² (with rubber coupling used)
fs: Maximum starting pulse rate with no load

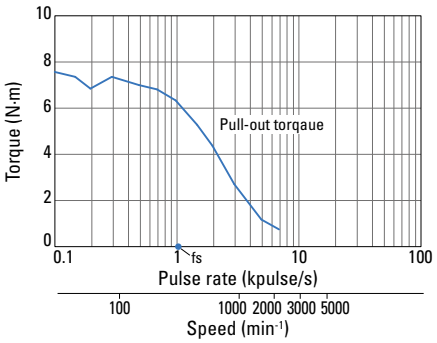
Characteristics

SP2863-5000
SP2863-5060



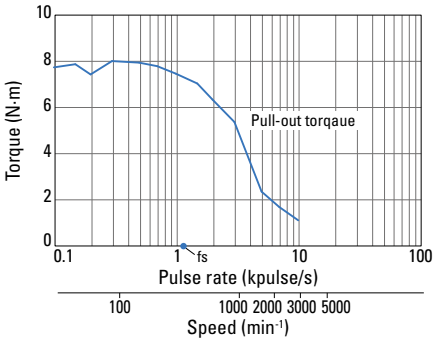
Constant current circuit
Input voltage: 100 VAC, winding current: 2 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=44 × 10^{-4}kg·m² (with rubber coupling used)
f_S: Maximum starting pulse rate with no load

SP2863-5100
SP2863-5160



Constant current circuit
Input voltage: 100 VAC, winding current: 4 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=44 × 10^{-4}kg·m² (with rubber coupling used)
f_S: Maximum starting pulse rate with no load

SP2863-5260

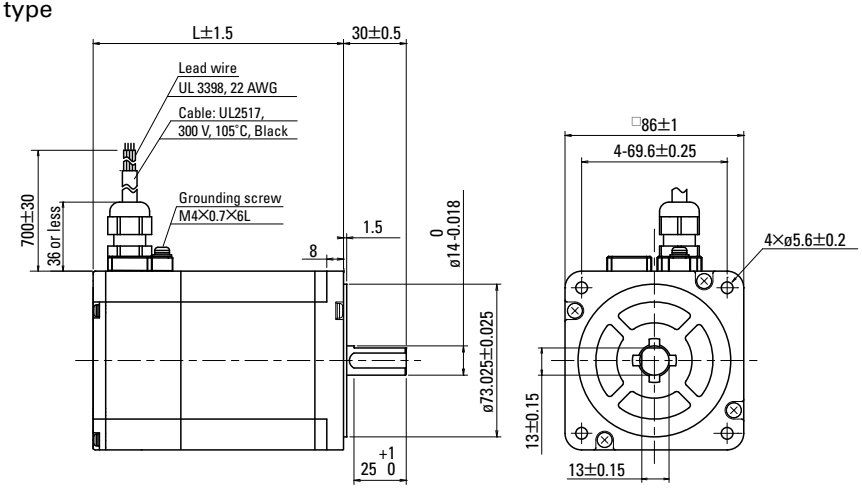


Constant current circuit
Input voltage: 100 VAC, winding current: 6 A/phase
At 2-phase excitation (full step)
Pull-out torque: J_L=44 × 10^{-4}kg·m² (with rubber coupling used)
f_S: Maximum starting pulse rate with no load

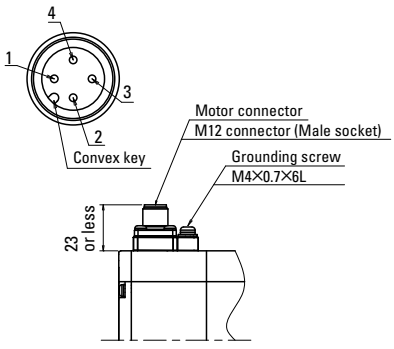
Dimensions Unit: mm

86 mm sq.

Cable type



Connector type



Model no.		Motor length
Cable type	Connector type	(L)
SP2861-5 □ 60	SP2861-5 □ 00	89.5
SP2862-5 □ 60	SP2862-5 □ 00	120
SP2863-5 □ 60	SP2863-5 □ 00	150

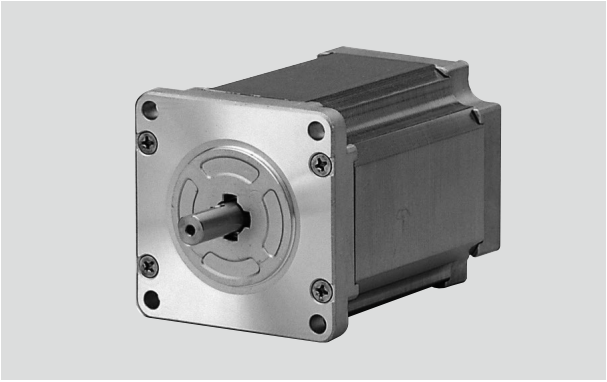
Compatible drivers

A driver is to be provided by the customer.

Note: The characteristics shown above are calculated using our experimental circuit.

In-Vacuum Motors

Custom product



Features

- These can be driven in vacuum environments without requiring a vacuum feedthrough. These stepping motors can be used as an actuator suitable for vacuum environments while maintaining the feature of a stepping motor—easy high-precision open-loop control.
- We also offer customization for use in a wide range of pressure environments from low vacuum to ultra-high vacuum.
- Baking at 200°C is possible.
- No significant size change from regular stepping motors.

Operable pressure environments

Low vacuum			Medium vacuum			High vacuum				Ultra-high vacuum				
10^5	10^4	10^3	10^2	10^1	1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	[Pa]

Applications

Ideal for the following applications. Contact us to discuss your particular application environment needs.

- Semiconductor manufacturing equipment
- Satellite robots
- Electron microscopes
- Large-scale research facilities such as accelerators, synchrotron radiation analysis equipment, etc.

Motor size

42 mm sq. to ø106 mm

Synchronous Motors

Custom product

Features

- Synchronous motors rotate at a constant speed in proportion to the AC power frequency without been affected by voltage or load level variations, preventing motor step-out.
- These motors can drive at ultra-low speeds with high torque without using gears.
- Since an AC power supply can be directly connected to the motor, a drive circuit is not required, simplifying your system.
- In addition to 2-phase motors, we also offer 3-phase motors, which don't require a phase shifter.
- Can be made compliant with safety standards.

Applications

Ideal for the following applications. Contact us to discuss your particular application environment needs.

- Belt conveyors
- Printers
- Cryopumps
- Cryocoolers
- Switching devices

Motor size

56 mm sq. to ø106 mm

Safety Precautions

The products in this catalog are designed to be used with general industrial equipment. When using them, pay sufficient attention to the following points.

- Read the included Instruction Manual carefully before installing, assembling, and using the product for proper use.
- Do not modify or alter the product in any way.
- Contact us or your point of sale for installation or maintenance services of the product.
- Consult us when using the product for the following uses, as these require special considerations for operations, maintenance, and management such as redundancy and emergency power generators.

  ❶ Use in medical equipment that may have an effect on human life or the human body
  ❷ Use in transportation systems or transport-related equipment such as trains or elevators that may have an effect on human life or the human body
  ❸ Use in computer systems that may have an impact on society or on the public
  ❹ Use in other devices that have a major impact on human safety or on maintaining public operations

- In addition to the above, contact us or your point of sale for use in an environment where vibrations occur, such as in automobiles or transportation.
- For use in space, aviation, or nuclear power-related applications, contact us or your point of sale.
- The products listed in this catalog fall into the category 16 of Appended Table 1 of the Export Trade Control Order. To export these products as an individual part or to export a device into which they are assembled, the "Inform Requirements" and "Objective Requirements"—established by the Ministry of Economy, Trade and Industry of Japan based on the "Catch-all Controls"—must be studied for applicability. Accordingly, appropriate export formalities must be performed.

Safety Precautions

Warning Labels on Products

Either or all of the following symbols are labeled on products depending on the model of driver or stepping motor.

This label is attached in the vicinity of high-voltage portions such as charging or cover-protected parts, to indicate locations with risk of electric shock.

This label is attached in the vicinity of the grounding terminals of drivers to indicate that grounding is required.

This label is attached to the portion of drivers where a voltage of 42.4 VAC or 60 VDC or more is applied, drawing attention to the risk of electric shock.

Indicates that the stepping motor may get hot, resulting in burns.

Indicates that the stepping motor should be grounded.

Safety Alert Symbols

The following safety symbols are used in the manual to indicate different hazardous situations and prohibited/required actions.

⚠ DANGER — Indicates hazards that could cause severe bodily injury or death as a result of failure to follow the instructions.

⚠ CAUTION — Indicates possible hazards that could cause moderate bodily injury or only property damage as a result of failure to follow the instructions.

> Note that even items with a ⚠ CAUTION symbol could potentially lead to serious outcomes, depending on the situation. They all indicate important situations, so be sure to observe them.

PROHIBITED — Indicates actions that must not be taken.

COMPULSORY — Indicates actions that must be taken.

⚠ DANGER

General

- Do not use the product in an explosive, flammable or corrosive atmosphere, watery place or near a combustible material. Failure to follow this may cause injury or fire.
- Only technically qualified personnel should transport, install, wire, operate, or perform maintenance and inspection on the product. Failure to follow this may cause electric shock, injury, or fire.
- Do not work on wiring, maintenance servicing, or inspection with power on. Perform either of those five minutes after turning the power off. Failure to follow this may cause electrical shock.
- When the protective functions of the motor are activated, turn the power off immediately and eliminate the cause. If continuing the operation without eliminating the cause, the product may operate improperly and cause injury or a breakdown of the system devices.
- Stepping motors may step-out when running and stopping depending on the amount of the load. Put the product into use after sufficient trial test operation in the maximum planned load conditions to check that the product can handle the load. Doing otherwise may cause a breakdown of the system. (When used for upward/downward movements, loads may fall due to step-out.)
- Do not touch the internal parts of the driver. Failure to follow this may cause electric shock.

Wiring

- Do not connect the stepping motor directly to a mains outlet. Failure to follow this may cause electric shock, injury, or fire. Stepping motors should be powered by stepping drivers (except for synchronous motors).
- Use an input voltage within the rated voltage range. Using otherwise may cause fire or an electric shock.
- Connect the driver and stepping motor to the ground. Failure to follow this may cause electric shock.
- Do not damage, apply excessive stresses, put heavy things on, or tuck down cables. Failure to follow this may cause electric shock.
- Perform wiring with the power cable as instructed by the wiring diagram or the Instruction Manual. Failure to follow this may cause electric shock or fire.
- Our stepping motor cables are for fixed-wiring use, so do not use products in applications where flex cables are required. Failure to follow this may cause electric shock, injury, or fire.

Operation

- Never touch the rotating part of the stepping motor during its operation. Failure to follow this may cause injury.
- Do not reach or touch the electric terminals while electric power is on. Failure to follow this may cause electric shock.
- Never disconnect any of the connectors while electric power is on. Failure to follow this may cause electric shock or product damage.
- Do not operate products with live parts exposed. Failure to follow this may cause electric shock.
- If smoke, fire, unusual smells, or unusual sounds are produced from the driver or stepping motor, turn off the power and stop using them immediately. Failure to follow this may cause electric shock, injury, or fire.

⚠ CAUTION

General

- Prior to installation, operation, maintenance servicing or inspection, be sure to read the Instruction Manual and follow the instructions. Failure to follow this may cause electric shock, injury, or fire.
- Do not use the driver or the stepping motor in conditions that exceed the specification values. Failure to follow this may cause electric shock, injury, or fire.
- Do not insert a finger or an object into the opening of the motor. Failure to follow this may cause electric shock, injury, or fire.
- Do not use a damaged driver or stepping motor. Doing so may cause injury or fire.
- Use the driver and stepping motor in the designated combination. Failure to follow this may cause fire or product failures.
- Be careful when the temperature rises in the operating driver, stepping motor or peripheral devices. Failure to follow this may result in a burn.
- Never disassemble, repair, modify, or alter the motor. Failure to follow this may cause electric shock, injury, or fire.
- Do not remove the nameplate. Using motors with incorrect ratings may result in fire.
- Be careful that this product does not fall or tip over when handling, as this can be dangerous.

Unpacking

- Unpack the box with the right side up. Failure to follow this may cause injury.
- Confirm that the product you received is the one that you have ordered. Installing an incorrect product may cause a breakdown.

Wiring

- Do not measure the insulation resistance or dielectric strength of the motor by yourself. Failure to follow this may cause product damage. Contact us or your point of sale instead, if such a measurement is required.
- Perform wiring work according to local standards of electrical installations. Failure to follow this may cause motor burnout or fire.
- Perform wiring correctly and securely. Incorrect wiring may cause the stepping motor to run out of control, resulting in injury.
- Insulate the attached condenser and external resistance connection terminals. Failure to follow this may cause electric shock.

Installation

- Do not stand on this product or place heavy objects on top of it. Failure to follow this may cause injury.
- Keep the air intake and exhaust vents free of obstructions and foreign matter. Failure to follow this may cause fire.
- Make sure to use the specified driver mounting direction. Failure to follow this may cause product failures.
- Keep a distance as instructed by the Instruction Manual for the driver from the inner surface of the control console or other devices. Failure to follow this may cause product failures.
- Install the motor with great care to avoid the risk of it falling or tipping over.
- Mount the motor to incombustible materials such as metals. Failure to do so may cause fire, injury, or device breakdown.
- Keep any combustible materials away from where the motor is installed. Failure to do so may result in fire or burns.
- Be sure to secure a ventilation path when installing the motor, and keep the intake and exhaust vents unblocked. Failure to do so may result in electric shock, fire, or device breakdown.
- Check the rotating direction of the motor before connecting it with equipment. Failure to follow this may cause injury or product damage.
- Do not touch the motor output spindle (including the keyway and gears) with your bare hand. Failure to follow this may cause injury.
- Do not apply loads to the motor shaft exceeding the specified allowable load.
- When attaching a pulley or coupling to the output shaft of a stepping motor, make sure that the motor unbalance is small enough. A large motor unbalance will increase vibration, which may result in shortened service life and premature damage.
- Make sure that the axial belt tension does not exceed the allowable load when operating the belt drive. The allowable load can be divided into the thrust (axial) load and radial load applied independently in the individual directions to the output shaft.
- Make sure that the output shaft of the motor and the mating machine are well aligned. Failure to follow this may increase vibration, which may result in shortened service life or premature damage.
- Fix the output shaft of the stepping motor to the mating machine around the entire shaft circumference to prevent fretting.

Operation

- Stepping motors are not equipped with any protective device. Prepare an overvoltage protection device, earth leakage breaker, overheat protection device, and emergency stop device to ensure safe operation. Failure to follow this may cause injury or fire.
- Do not touch the product for a period after the power is on or has been turned off, since the driver and stepping motor remain at a high temperature. Failure to do so may cause burns. In particular, the temperature of the stepping motor rises considerably depending on the operating conditions. Do not allow the motor surface temperature to exceed the following:

- Thermal class F (+155°C) stepping motors: 125°C
- Thermal class B (+130°C) stepping motors: 100°C
- Regardless of thermal class, 85°C for encoder-equipped stepping motors, and 150°C for in-vacuum stepping motors.

- Immediately stop operation in case of anomaly. Failure to do so may cause an electric shock, injury or fire.
- Do not make extreme setting changes as doing so may result in unstable operations. Failure to follow this may cause injury.
- During trial operations, firmly stabilize the stepping motor, and confirm operations by disconnecting from the mechanical system before connecting with it. Failure to follow this may cause injury.
- Take safety measures such as covering the rotating parts of the stepping motor during operation to prevent them from being touched. Failure to follow this may cause injury.
- When an alarm is activated, remove the cause and ensure safety before resuming operations. Failure to follow this may cause injury.
- Stay away from equipment when power is restored after an outage because the system may restart suddenly. (Take measures to secure the safety even when it restarts on such occasions.) Failure to do so may cause injury.
- Use the right power supply for the motor. Failure to follow this may cause product failures.
- The electromagnetic brake is designed to hold the motor position in place. Do not use it as dynamic braking. Doing so may cause the breakdown of the system.
- Secure the key when operating the motor with a key. Failure to follow this may cause injury.

- For use in applications where varying loads are applied to the shaft, contact us in advance. Use in environments with varying loads might result in failure.

Maintenance

- Be careful when performing maintenance services or inspection as the driver and stepping motor frames get hot. Failure to follow this may result in a burn.
- It is recommended that the electrolytic condenser of the driver is replaced with a new one as preventive maintenance after using for 5 years (the expected life in an average operating environment of 40°C). The expected life of the fuse is 10 years in an average operating environment of 40°C. Thus, periodical replacement is recommended.
- Contact us or your point of sale for repair. If the product is disassembled by the user, it may become inoperable.
- Stepping motor's oil seals, electromagnetic brakes, bearings are life-limited parts. Determine when to replace them based on the results of the actual equipment evaluation.

Transportation

- Handle the product with care during transportation so as to prevent from dangers such as tumbling or overturning.
- Do not hold with the cable or the motor shaft when transporting. Failure to follow this may cause product damage or injury.

Disposal

- Dispose of stepping drivers and motors as industrial waste.

PROHIBITED

Storage

- Avoid storing products in environments exposed to rain or water drops or with hazardous gas or liquid. Failure to follow this may cause failures.

Maintenance

- Do not disassemble or repair the product. Failure to follow this may cause fire or electric shock.

General

- Do not remove the nameplate. Using motors with incorrect ratings may result in fire.

COMPULSORY

Storage

- Store the product out of direct sunlight within the specified temperature and humidity ranges.
- If the driver has been stored for a long period (3 years or longer as a general guide), contact us. The capacitance of electrolytic capacitors can decrease through long-term storage, which may cause malfunctions.

Operation

- Install an emergency stop circuit to the outside of equipment to turn the power off immediately whenever needed.
- Operate the motor within the specified ambient temperature and humidity ranges.

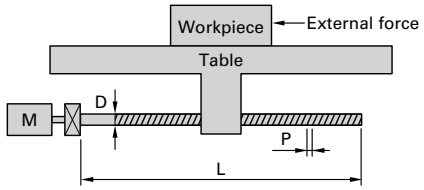
Transportation

- Follow the instructions displayed on the package box and avoid excessively stacking boxes.

■ Selection Guide by Mechanism

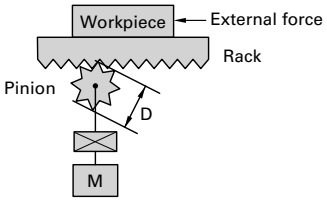
Typical mechanism examples and required selection criteria are shown below. Provide us with these information when consulting us for selection.

Ball screw



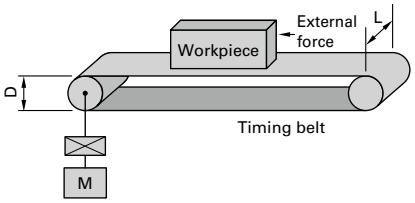
External force	F	N
Workpiece mass + table mass	W	kg
Ball screw diameter	D	m
Ball screw length	L	m
Ball screw pitch	P	m
Ball screw density	ρ	kg/m^3
Friction coefficient	μ	
Gear ratio *	G	
Mechanical efficiency	η	

Rack & Pinion



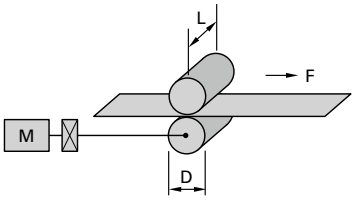
External force	F	N
Workpiece mass + rack mass	W	kg
Pinion diameter	D	m
Pinion thickness	L	m
Pinion density	ρ	kg/m^3
Friction coefficient	μ	
Gear ratio *	G	
Mechanical efficiency	η	

Belt drive



External force	F	N
Workpiece mass + belt mass	W	kg
Pulley diameter	D	m
Pulley width	L	m
Pulley density	ρ	kg/m^3
Gear ratio *	G	
Mechanical efficiency	η	

Roll feed



Sheet tension	F	N
Roll diameter	D	m
Roll width	L	m
Roll density	ρ	kg/m^3
Gear ratio *	G	
Mechanical efficiency	η	

Rotary indexing table

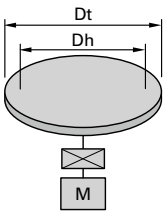
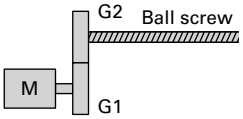


Table mass	W	kg
Table diameter	Dt	m
Table support diameter	Dh	m
Friction coefficient of table support	μ	
Gear ratio *	G	
Mechanical efficiency	η	

* Calculation of gear ratio (G)



$$G = \frac{\text{Number of screw threads (G2)}}{\text{Number of motor gear teeth (G1)}}$$

ECO PRODUCTS

■ ECO PRODUCTS

ECO PRODUCTS are designed to reduce the environmental impacts throughout the product's life cycle. Ranging from design to manufacturing stages, the environmental impact of a product and its packaging materials is assessed against the eco-design requirements.
Those products that satisfy the requirements are accredited as ECO PRODUCTS.

Notes Before Purchase

- Read the accompanying Instruction Manual carefully prior to using the product.
- Do not use this product in an environment where vibration is present, such as in moving vehicles or shipping vessels.
- Do not modify or alter the product in any way.

Please contact us beforehand if you intend to use this product in the following applications.

- Medical equipment that may have an effect on human life
- Systems or equipment that may have a major impact on society or on the public
- Special applications related to aviation and space, nuclear power,electric power, submarine repeaters, etc.

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