Stepping Drivers/Motors

DC Input - High-Power Models ▶p. 11

DC Input - Basic Models ▶p. 23

How to Read Specifications

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

RoHS

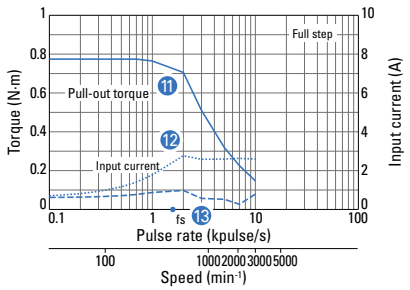
②	Motor size		56 mm sq. (1.8° full step angle)				56 mm sq. (1.8° full step angle)
	Motor length		41.8 mm	53.8 mm	75.8 mm	85.8 mm	41.8 mm
③	Single shaft	Motor model no.	SM2561C30B41	SM2562C30B41	SM2563C30B41	SM2564C30B41	SM2561C40B41
	Dual shaft	Motor model no.	SM2561C30B11	SM2562C30B11	SM2563C30B11	SM2564C30B11	SM2561C40B11
④	Holding torque	N·m	0.75	1.4	2.35	2.5	0.75
⑤	Rotor inertia	$\times 10^{-4}$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.

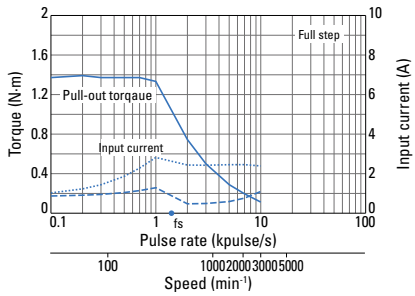
⑩ Characteristics

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.

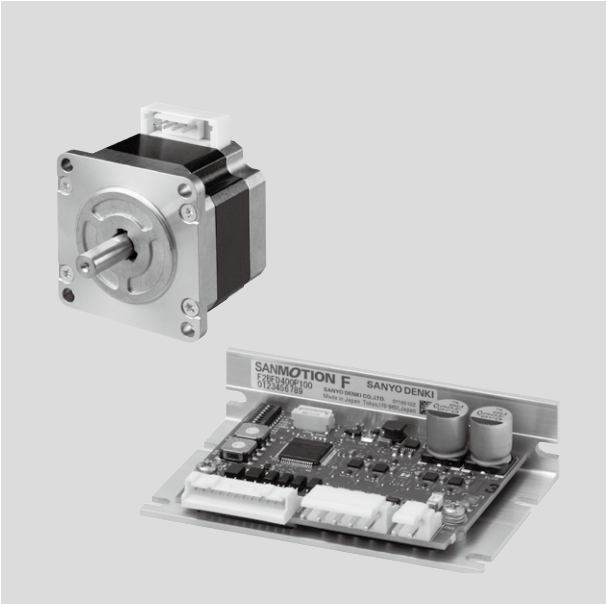
⑬ The blue-colored dots in the lower part of the graph show the upper limit for the maximum starting frequency (fs) of the stepping motor by itself (with no load). The stepping motor will not operate normally if it is started using pulse rates that exceed these values. For this reason, it is necessary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

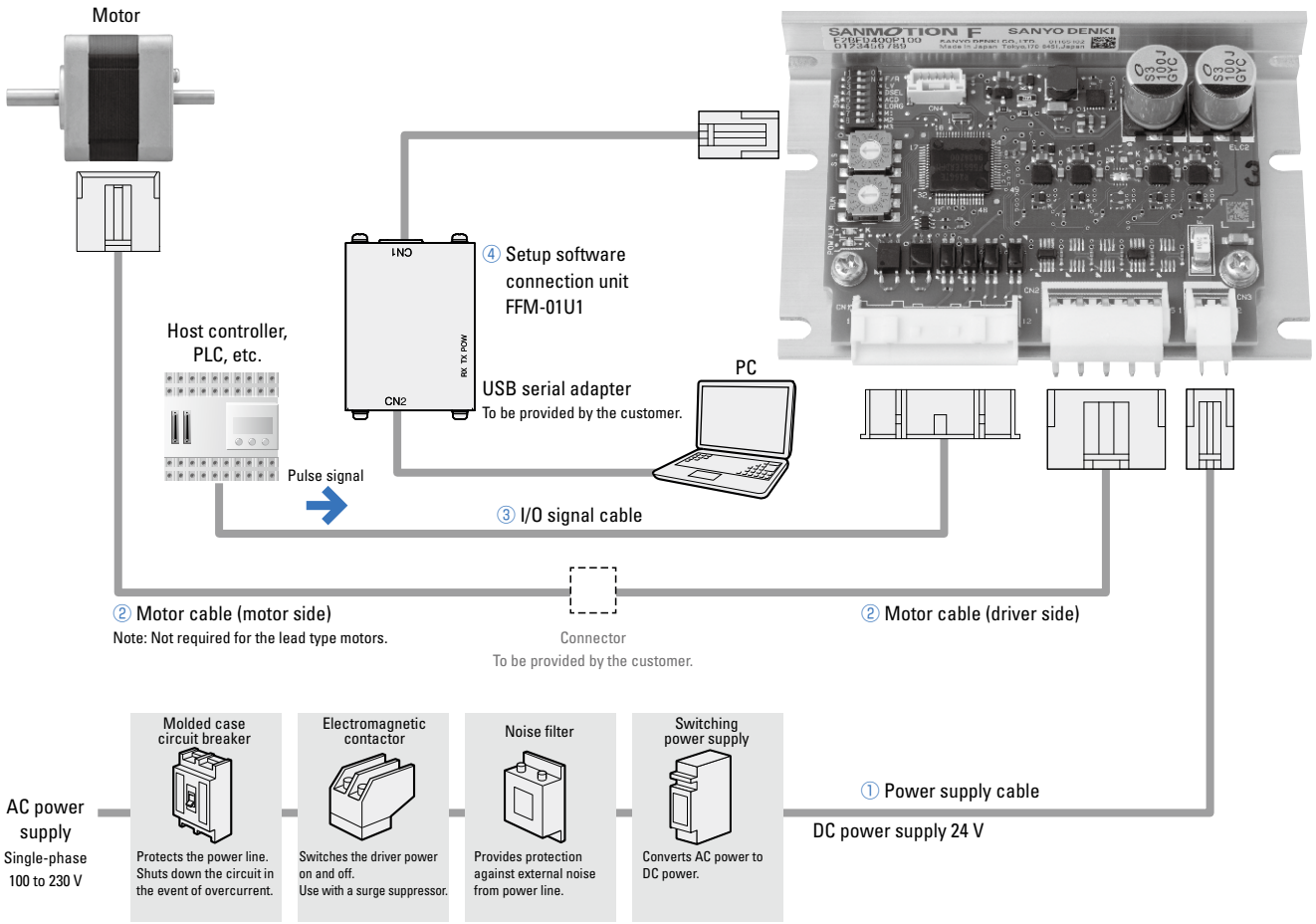
Motor sizes: 56 mm sq., 86 mm sq.

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**	C	**SM2561C30B11**	C	p. 14, 17	p. 16	**F2BFD400P100**	p. 18	FC9P0010A	FC9M0010A(1) (Driver side) 4837961-1(2) (Motor side)	FC9S0010A	FFM-01U1
		SM2562C30B41	C	**SM2562C30B11**	C	p. 14, 17	p. 16						
		SM2563C30B41	C	**SM2563C30B11**	C	p. 14, 17	p. 16						
		SM2564C30B41	C	**SM2564C30B11**	C	p. 14, 17	p. 16						
	56 mm sq.	**SM2561C40B41**	C	**SM2561C40B11**	C	p. 14, 17	p. 16	**F2BFD400P100**	p. 18	FC9P0010A	FC9M0010A(1) (Driver side) 4837961-1(2) (Motor side)	FC9S0010A	FFM-01U1
		SM2562C40B41	C	**SM2562C40B11**	C	p. 15, 17	p. 16						
		SM2563C40B41	C	**SM2563C40B11**	C	p. 15, 17	p. 16						
		SM2564C40B41	C	**SM2564C40B11**	C	p. 15, 17	p. 16						
	86 mm sq.	**SH2861-5141**	L	**SH2861-5111**	L	p. 15, 17	p. 16	**F2BFD400P100**	p. 18	FC9P0010A	FC9M0010A(1) (Driver side)	FC9S0010A	FFM-01U1
		SH2862-5141	L	**SH2862-5111**	L	p. 15, 17	p. 16						

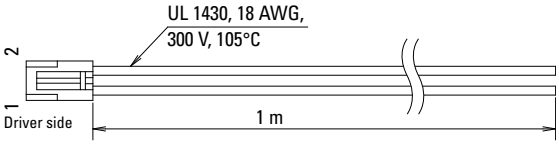
(1) Has a connector on the driver side. The motor-side connector/connection needs to be prepared by customers.
(2) Has a connector on the motor side. The cable relay connector/connection needs to be prepared by customers.

Options

● Cable with connectors

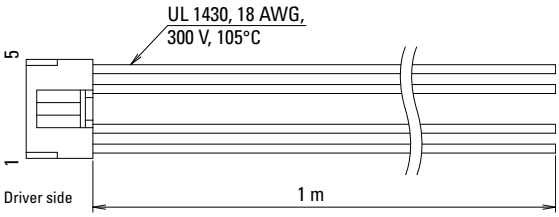
Power supply cable (Model no.: FC9P0010A)

Pin no.	Color
1	White
2	Black



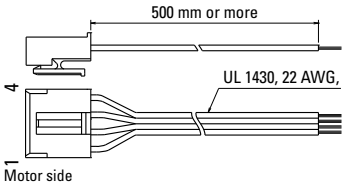
Motor cable Driver side (Model no.: FC9M0010A)

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



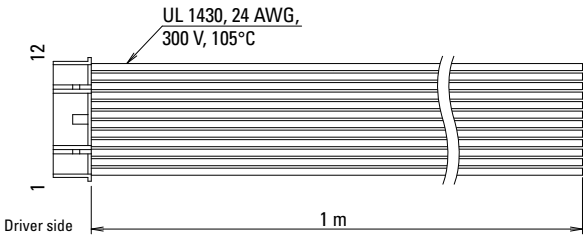
Motor cable Motor side (Model no.: 4837961-1)

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	



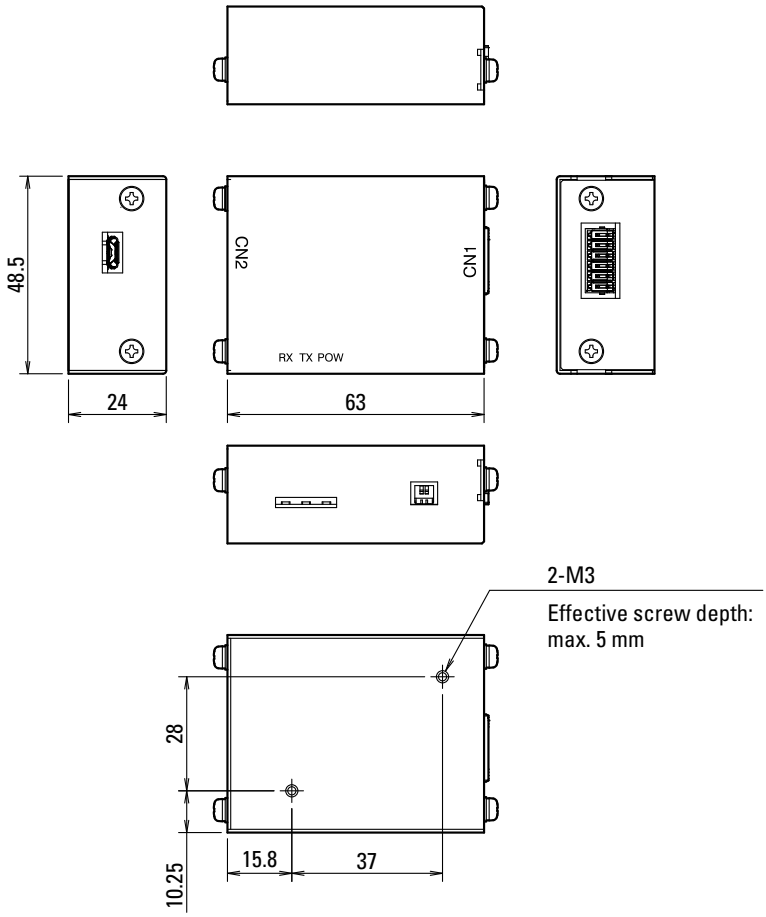
Options

● **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

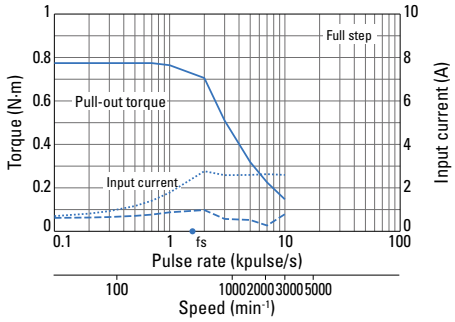
(1) For the driver mass, see ▶p. 18 (2) Load is exerted to the shaft end.

Characteristics

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

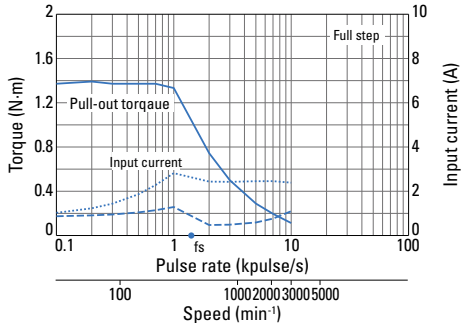
SM2561C30B41
SM2561C30B11

24 VDC



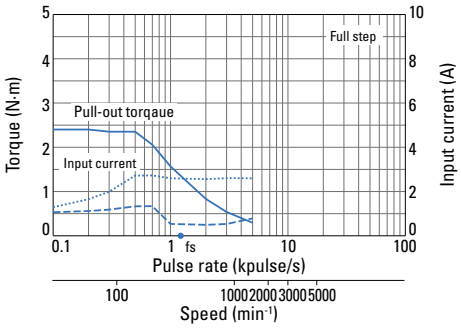
SM2562C30B41
SM2562C30B11

24 VDC



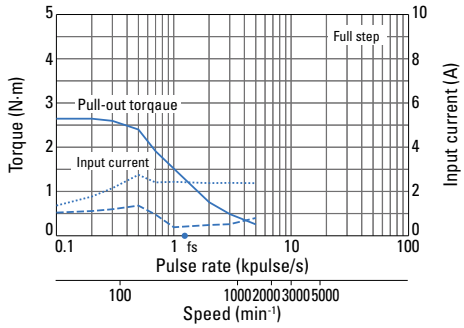
SM2563C30B41
SM2563C30B11

24 VDC



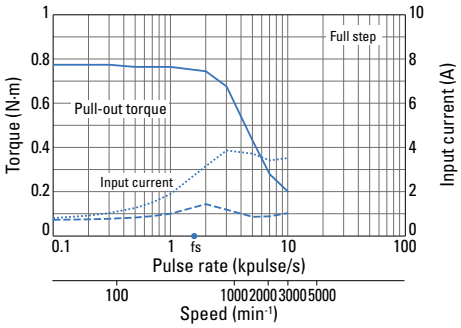
SM2564C30B41
SM2564C30B11

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

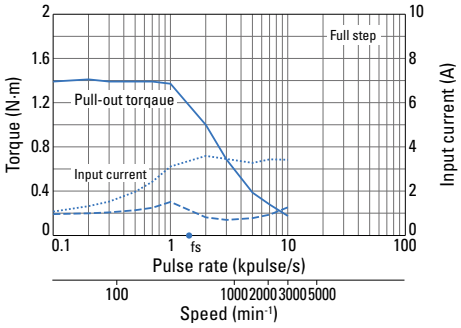
(1) For the driver mass, see ▶p. 18 (2) Load is exerted to the shaft end.

Characteristics

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

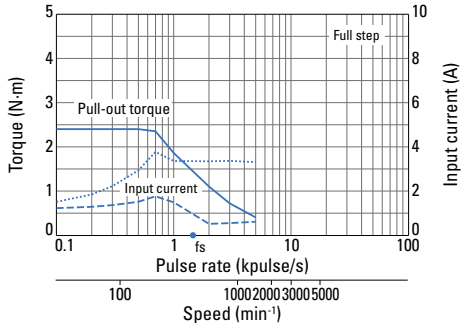
SM2562C40B41
SM2562C40B11

24 VDC



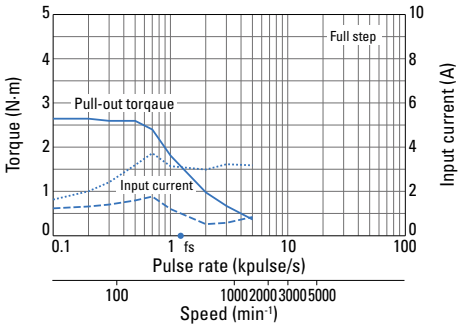
SM2563C40B41
SM2563C40B11

24 VDC



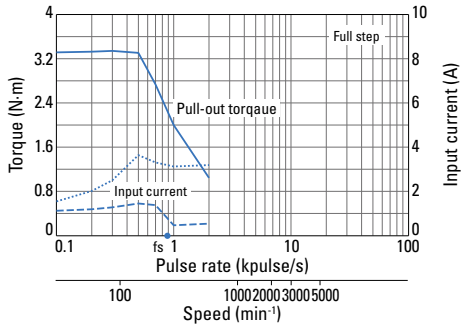
SM2564C40B41
SM2564C40B11

24 VDC



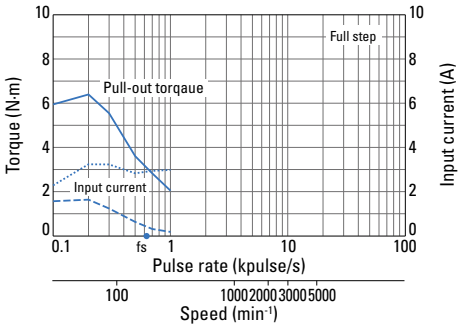
SH2861-5141
SH2861-5111

24 VDC



SH2862-5141
SH2862-5111

24 VDC

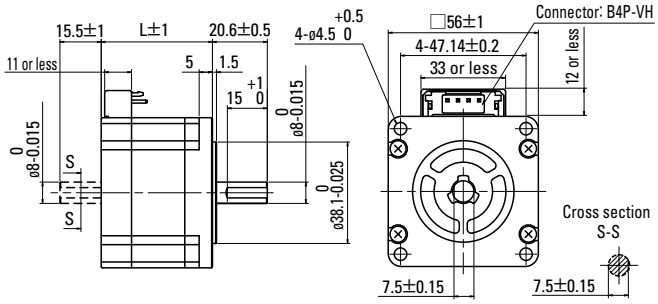


System Configuration...▶p. 11 Combination Table...▶p. 12 Motor Dimensions...▶p. 16 Driver Dimensions...▶p. 18

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

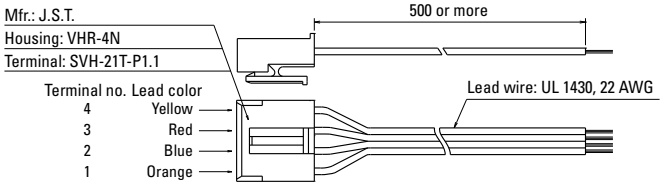
Stepping Motor Dimensions Unit: mm

56 mm sq.

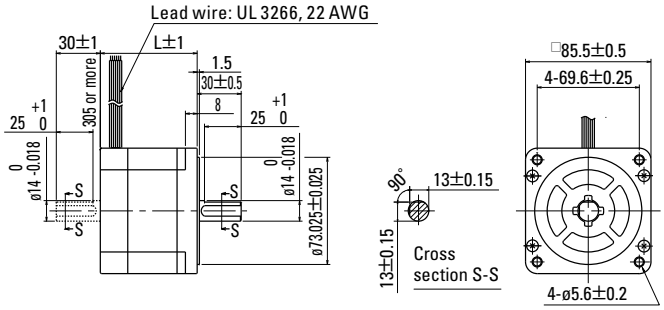


Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SM2561C30B41	SM2561C30B11	41.8
SM2562C30B41	SM2562C30B11	53.8
SM2563C30B41	SM2563C30B11	75.8
SM2564C30B41	SM2564C30B11	85.8
SM2561C40B41	SM2561C40B11	41.8
SM2562C40B41	SM2562C40B11	53.8
SM2563C40B41	SM2563C40B11	75.8
SM2564C40B41	SM2564C40B11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

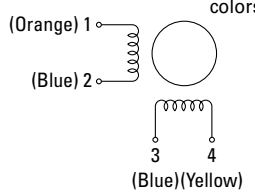
	Classification	Standards	File no.
UL	UL	UL 1004-1, UL 1004-6	E179832
	UL for Canada (cUL)	CSA C22.2 No. 100	

Internal Wiring and Rotational Directions

Connector type Model no.: SM256□

Internal wiring

In parentheses are lead colors of the motor cable



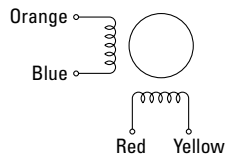
Direction of motor rotation

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

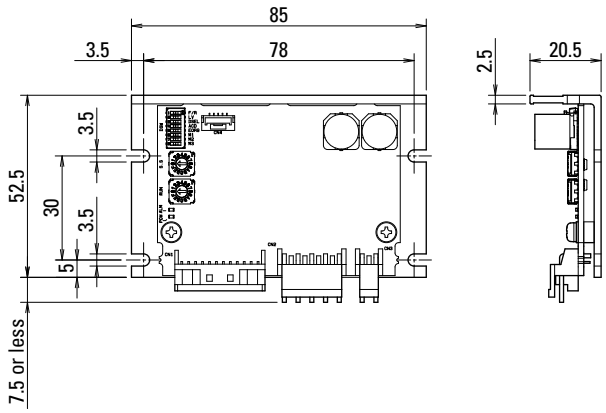


Direction of motor rotation

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

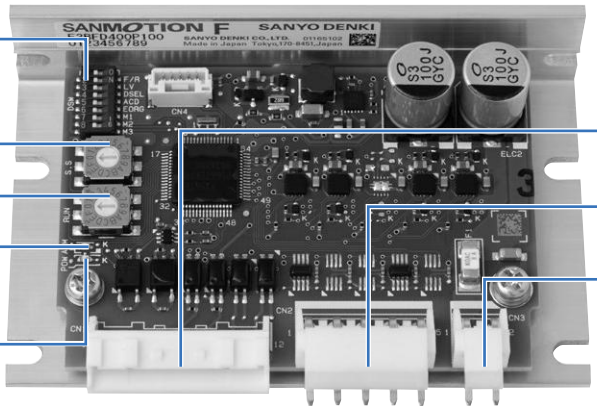
General specifications

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



1 Operating current selection switch (RUN rotary switch)

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

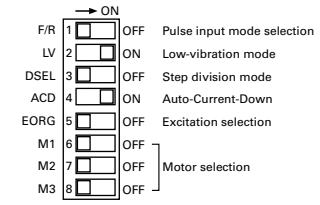
Dial	0	1	2	3	4	5	6	7
Motor current (A)	4	3.8	3.6	3.4	3.2	3	2.8	2.6
Dial	8	9	A	B	C	D	E	F
Motor current (A)	2.4	2.2	2	1.8	1.6	1.4	1.2	1

- 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)

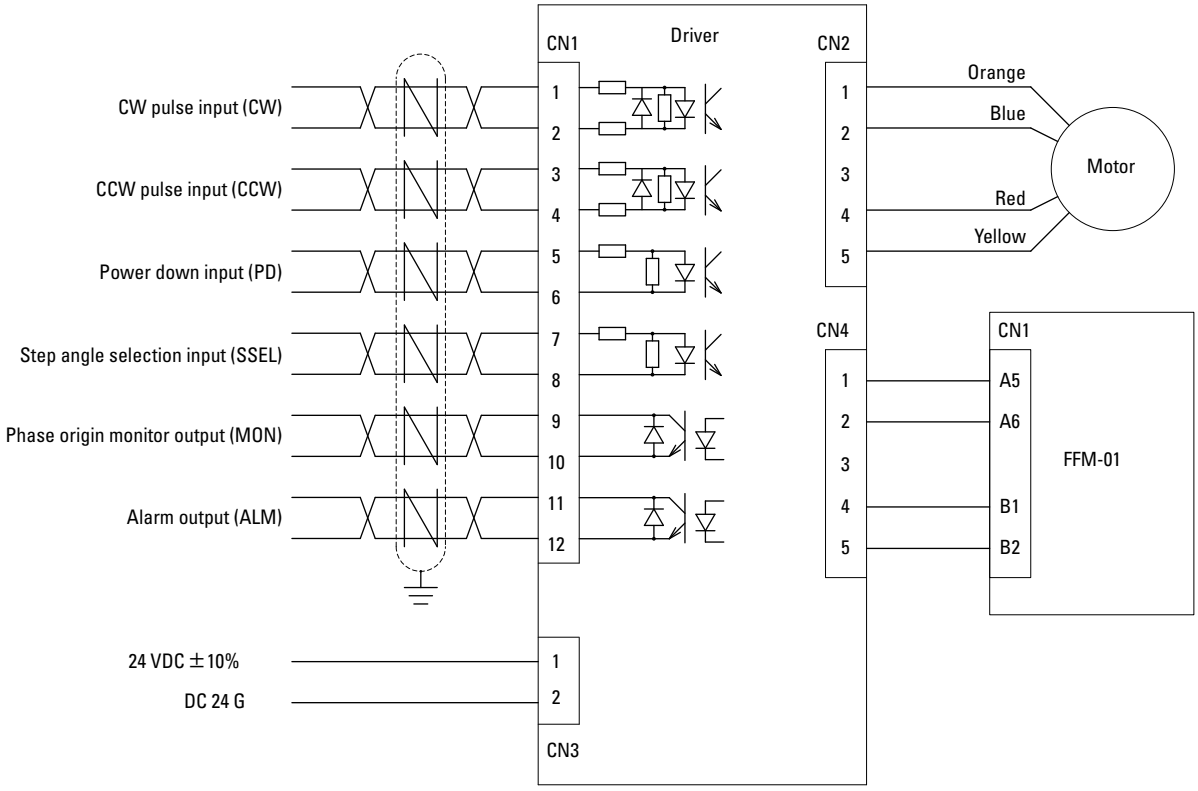
Flashes repeatedly when an alarm is generated.

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.

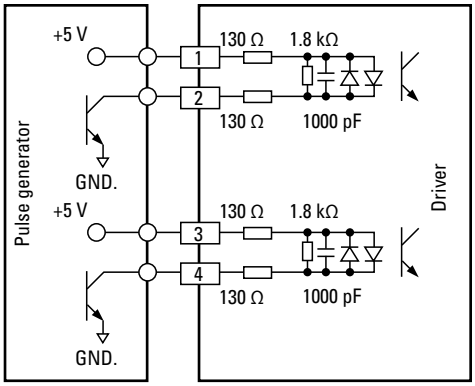
Note: The CW direction refers to the clockwise direction when the motor is viewed from the output shaft side.
The CCW direction refers to the counter-clockwise direction when the , motor is viewed from the output shaft side.

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

Connection example

Pulse crest value

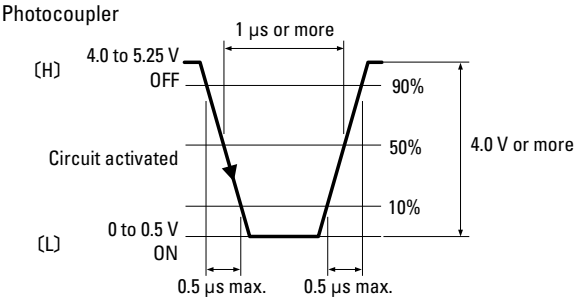
High-level: 4.0 to 5.25 V, low-level: 0 to 0.5 V, high-to-low: 4.0 V or more



- 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.)

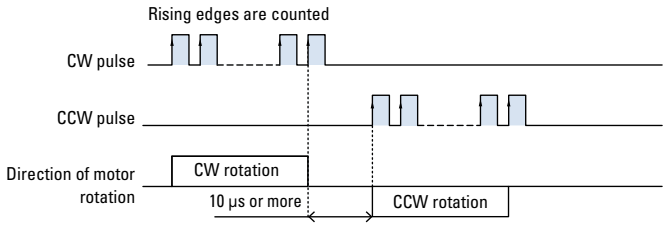
Input signal specifications

Photocoupler



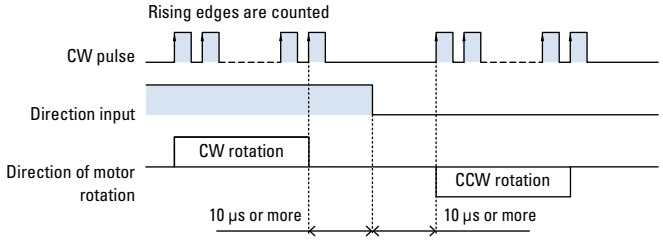
Command pulse timing

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 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



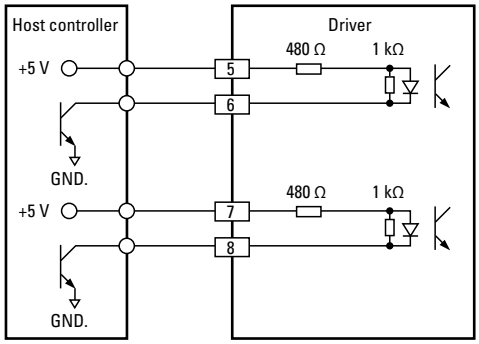
- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at the rising edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW-side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW-side internal photocoupler to OFF.
- 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.

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

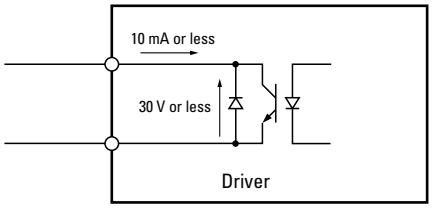


- If the peak voltage of the input signal exceeds 5.25 V, add an external current-limiting resistor R to limit the input current to around 6 mA.
  (Take the photocoupler forward voltage of 1.5 V into consideration.)

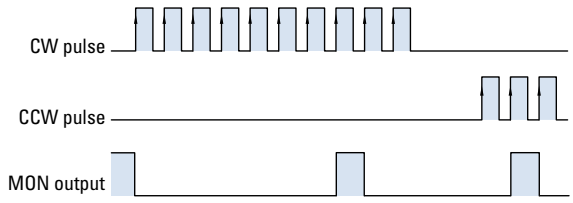
MON and ALM Output Circuit Configuration

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

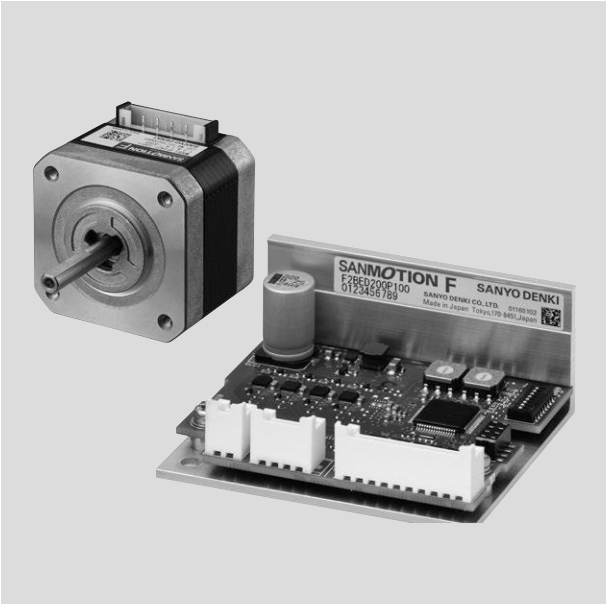


E.g., for 2-phase, 2-step (half-step) mode

- 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)

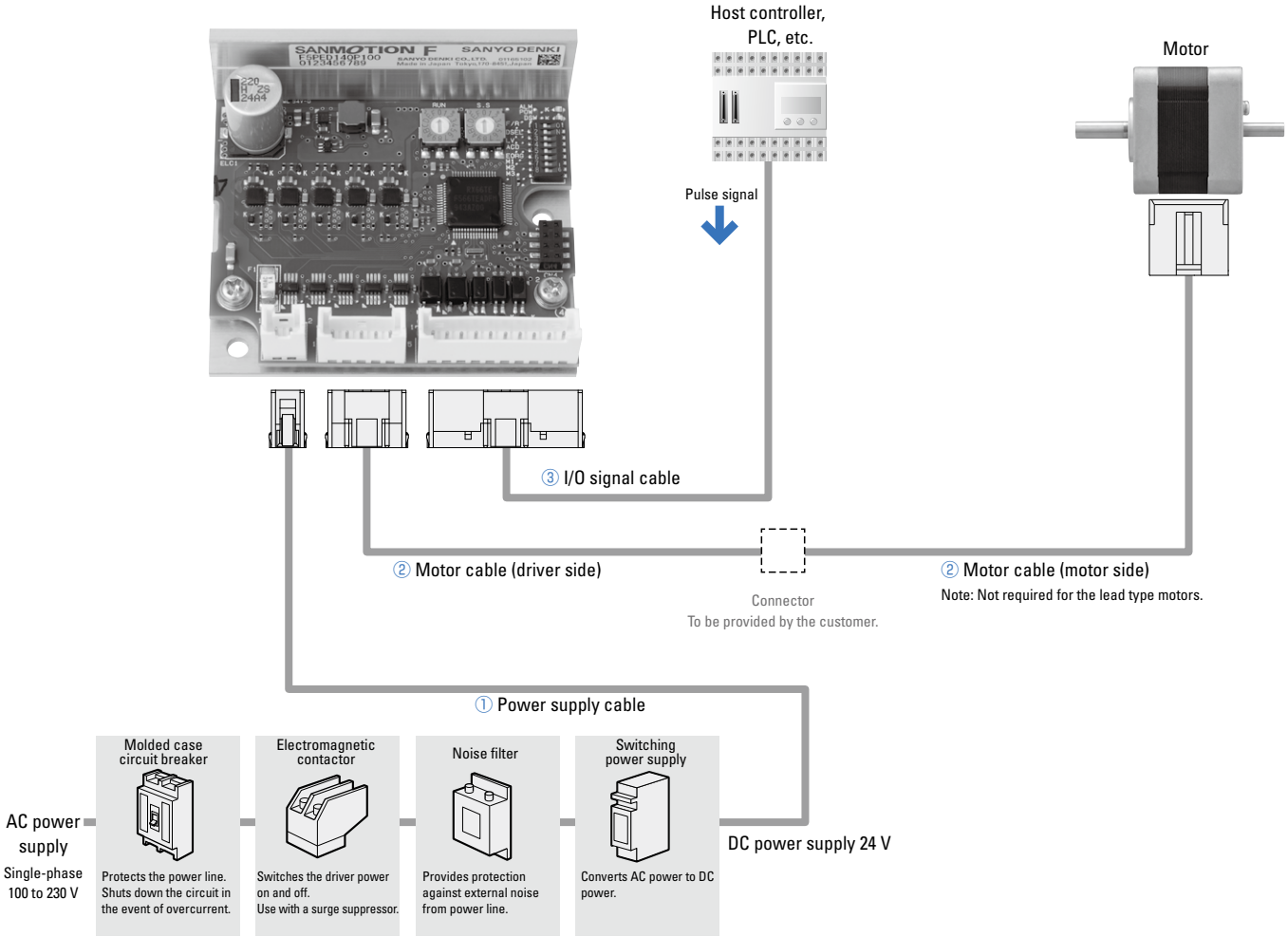
Motor size: 28 mm sq., 42 mm sq., 56 mm sq., 60 mm sq., 86 mm sq.

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					

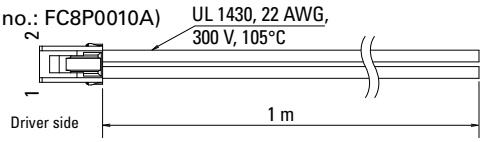
(1) Has a connector on the driver side. The motor-side connector/connection needs to be prepared by customers.
(2) Has a connector on the motor side. The cable relay connector/connection needs to be prepared by customers.

Options

● Cable with connectors

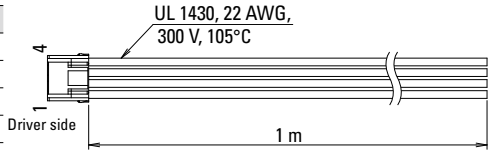
Power supply cable (Model no.: FC8P0010A)

Pin no.	Color
1	White
2	Black



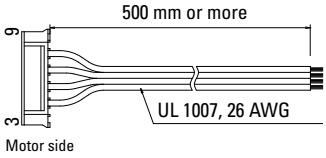
Motor cable Driver side (Model no.: FC8M0010A)

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



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

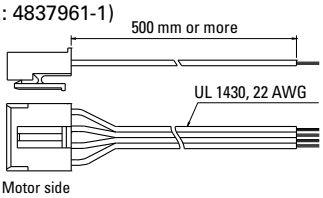
Pin no.	Color
9	Orange
7	Blue
5	Yellow
3	Red



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

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

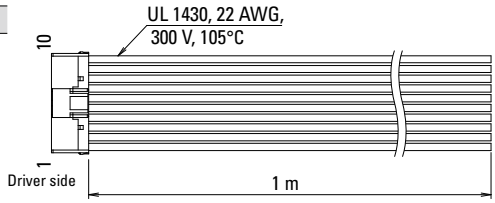
Pin no.	Color
1	Orange
2	Blue
3	Red
4	Yellow



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	$\times 10^{-4}$kg·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

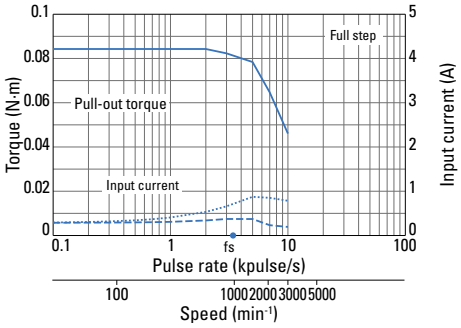
(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

Characteristics

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

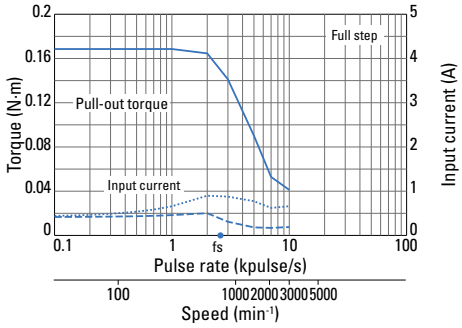
SH2281-5771
SH2281-5731

24 VDC



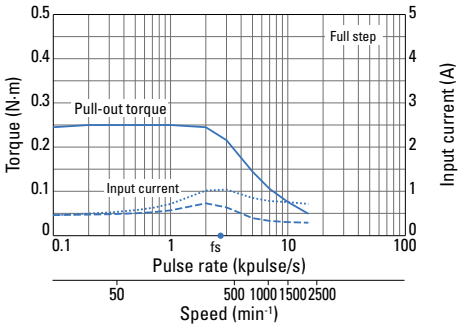
SH2285-5771
SH2285-5731

24 VDC



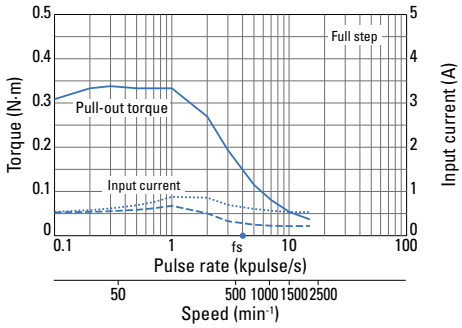
SH1421-5241
SH1421-5211

24 VDC



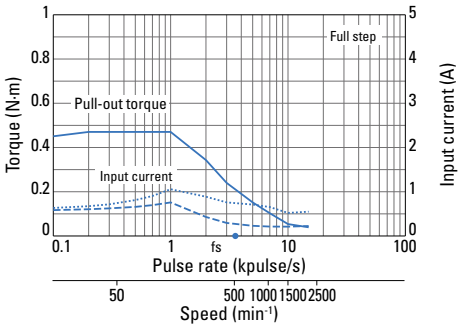
SH1422-5241
SH1422-5211

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	$\times 10^{-4}$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

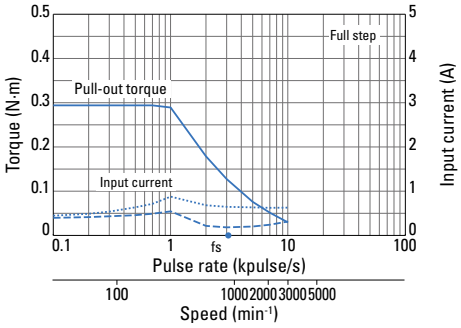
(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

Characteristics

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

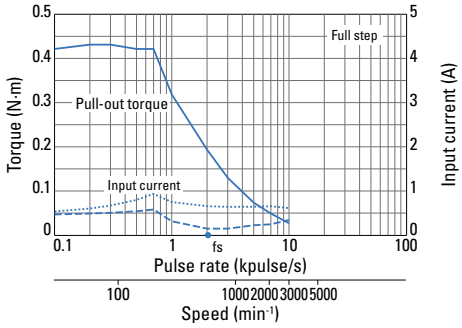
SF2421-10B41
SF2421-10B11

24 VDC



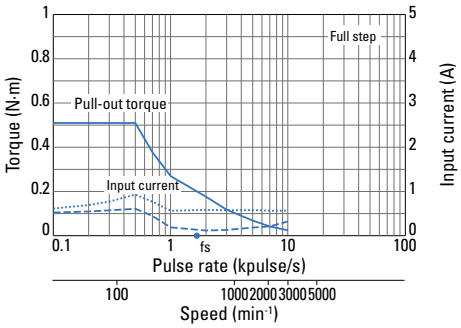
SF2422-10B41
SF2422-10B11

24 VDC



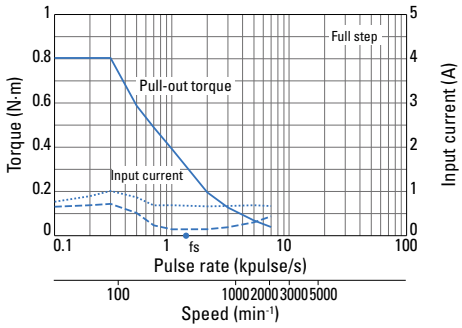
SF2423-10B41
SF2423-10B11

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	$\times 10^{-4}$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

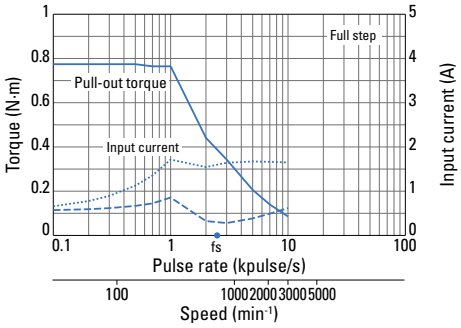
(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

Characteristics

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

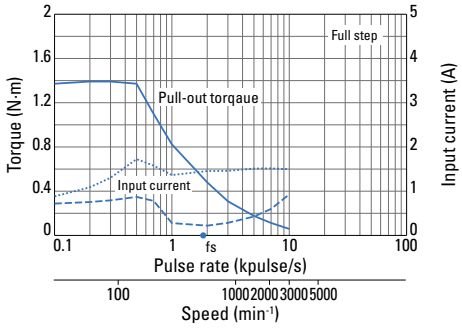
SM2561C20B41
SM2561C20B11

24 VDC



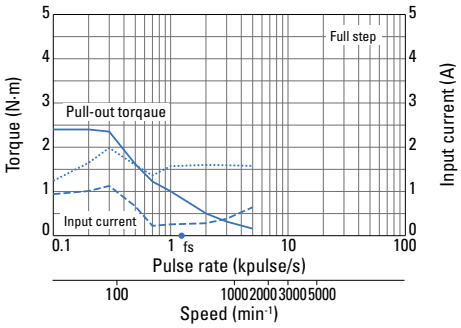
SM2562C20B41
SM2562C20B11

24 VDC



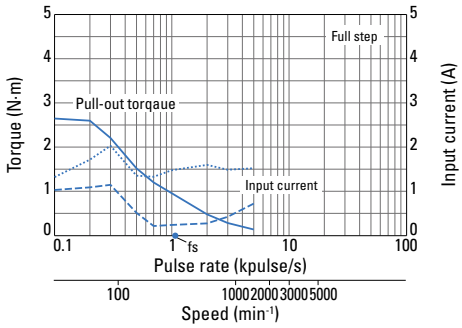
SM2563C20B41
SM2563C20B11

24 VDC



SM2564C20B41
SM2564C20B11

24 VDC



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		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	$\times 10^{-4}$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

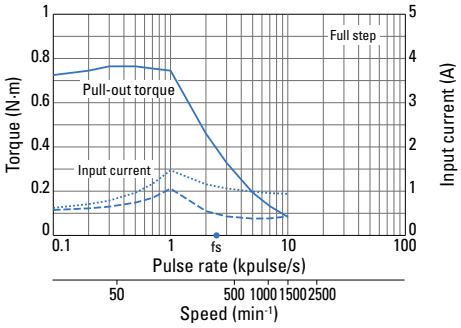
(1) For the driver mass, see ▶p. 32 (2) Load is exerted to the shaft end.

Characteristics

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

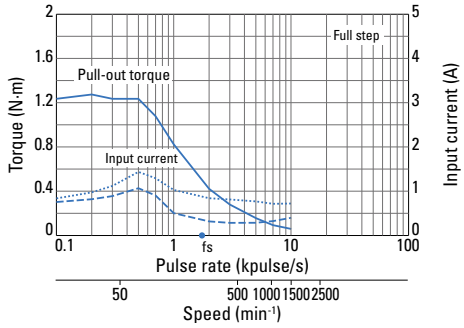
SH1601-5240
SH1601-5210

24 VDC



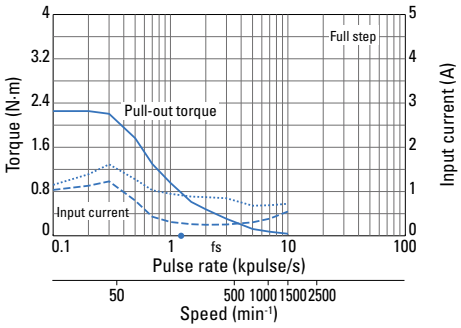
SH1602-5240
SH1602-5210

24 VDC



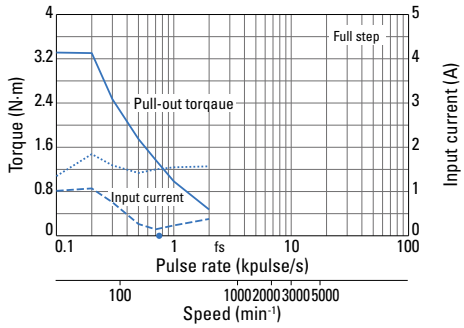
SH1603-5240
SH1603-5210

24 VDC



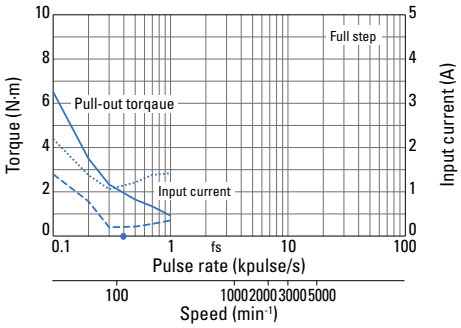
SH2861-5041
SH2861-5011

24 VDC



SH2862-5041
SH2862-5011

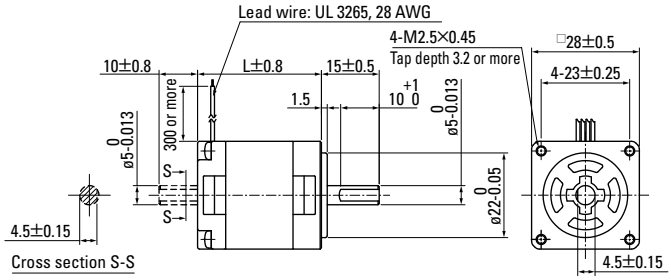
24 VDC



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

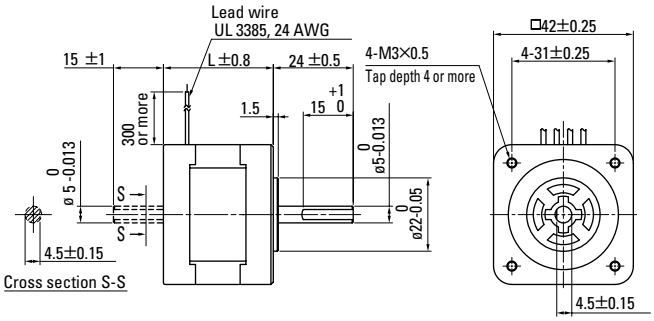
Stepping Motor Dimensions Unit: mm

28 mm sq.



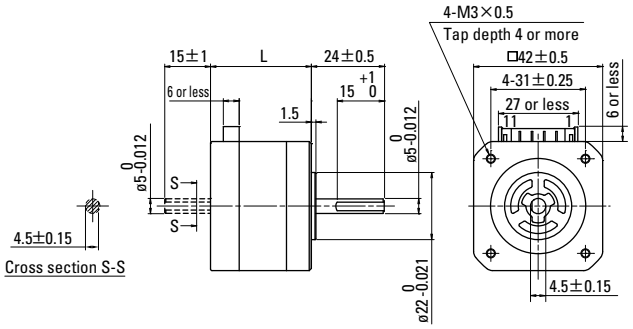
Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SH2281-5771	SH2281-5731	32
SH2285-5771	SH2285-5731	51.5

42 mm sq.



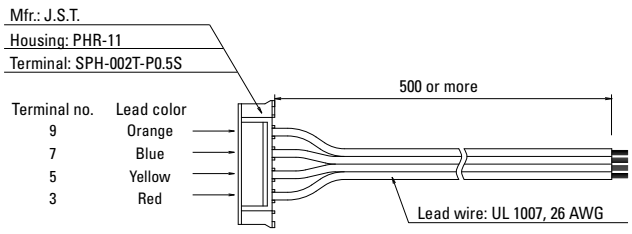
Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SH1421-5241	SH1421-5211	33
SH1422-5241	SH1422-5211	39
SH1424-5241	SH1424-5211	48

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

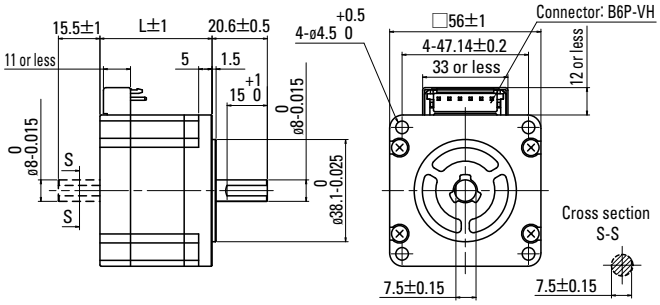
Bipolar motor cable 4835775-1



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

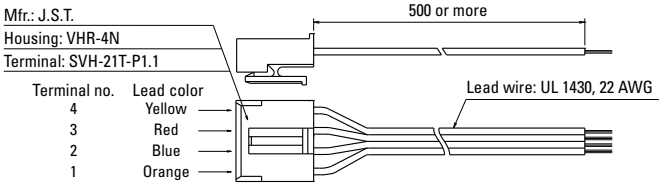
Stepping Motor Dimensions Unit: mm

56 mm sq.

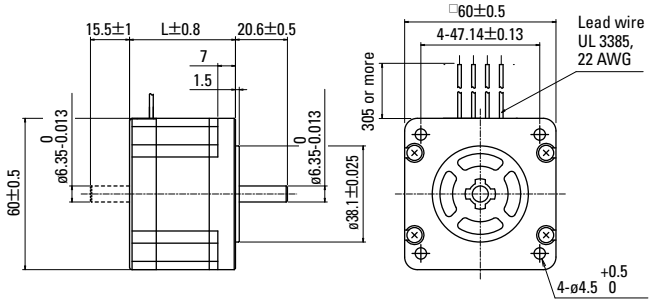


Motor model no.		Motor length
Single shaft	Dual shaft	(L)
SM2561C20B41	SM2561C20B11	41.8
SM2562C20B41	SM2562C20B11	53.8
SM2563C20B41	SM2563C20B11	75.8
SM2564C20B41	SM2564C20B11	85.8

Bipolar motor cable 4837961-1

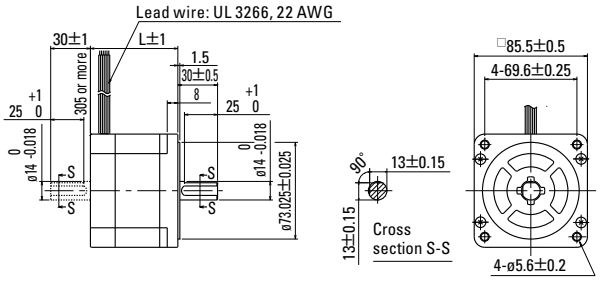


60 mm sq.



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

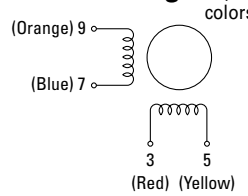
	Classification	Standards	File no.
UL	UL	UL 1004-1, UL 1004-6	E179832
	UL for Canada (cUL)	CSA C22.2 No. 100	

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

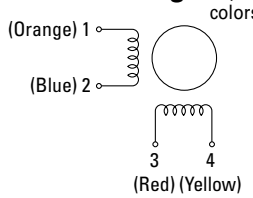
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

		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



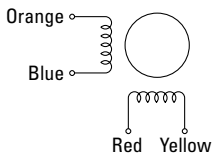
Direction of motor rotation

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

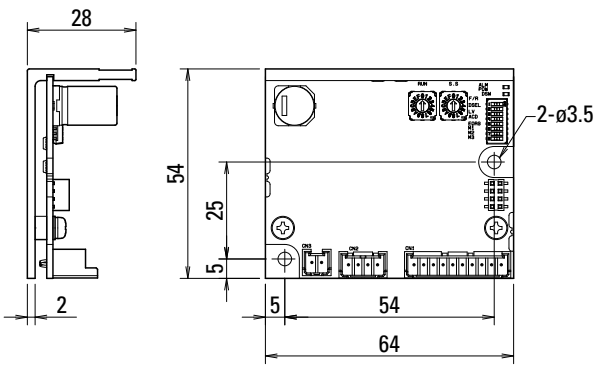


Direction of motor rotation

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

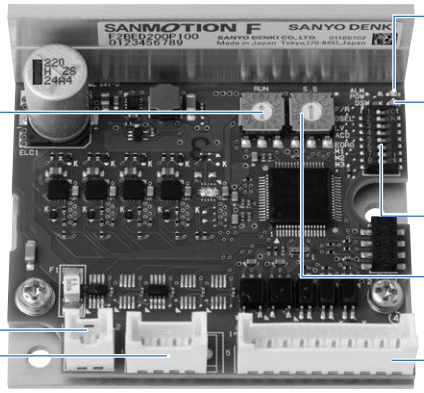
General specifications

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)

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

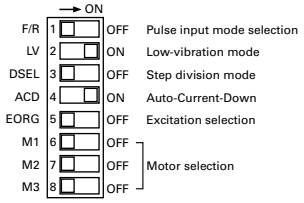
Dial	0	1	2	3	4	5	6	7
Motor current (A)	2	1.9	1.8	1.7	1.6	1.5	1.4	1.3
Dial	8	9	A	B	C	D	E	F
Motor current (A)	1.2	1.1	1.0	0.9	0.8	0.7	0.6	0.5

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)

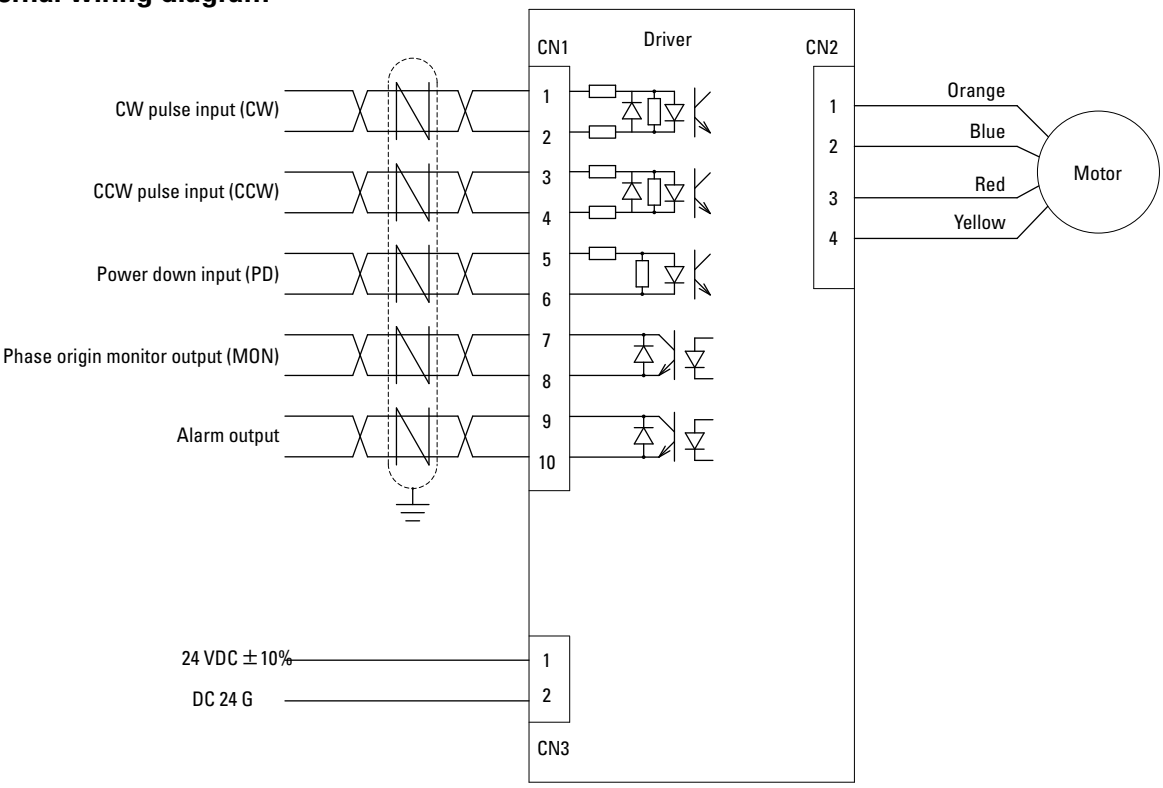
Flashes repeatedly when an alarm is generated.

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.

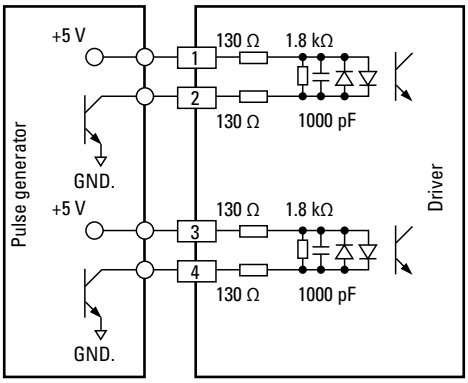
Note: The CW direction refers to the clockwise direction when the motor is viewed from the output shaft side.
The CCW direction refers to the counter-clockwise direction when the motor is viewed from the output shaft side.

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

Connection example

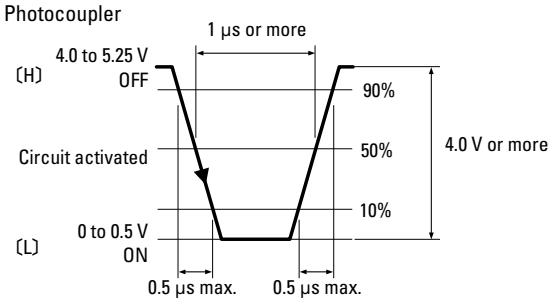
Pulse crest value

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



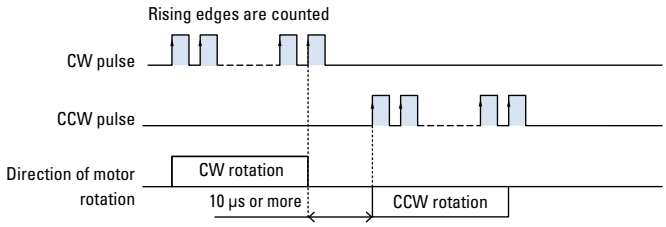
- Ensure that the pulse duty is 50% or less.
- Maximum input frequency is 400 kpulse/s.
- If the peak voltage of the input signal exceeds 5.25 V, add an external current-limiting resistor R to limit the input current to around 10 mA.
  (Take the photocoupler forward voltage of 1.5 V into consideration.)

Input signal specifications



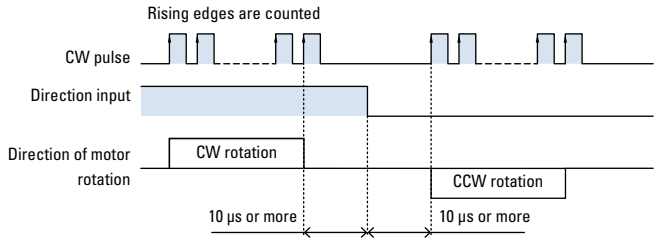
Command pulse timing

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)

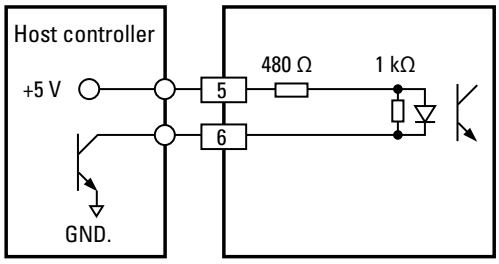


- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at the rising edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW-side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW-side internal photocoupler to OFF.
- 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

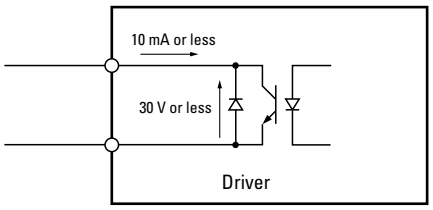


- If the peak voltage of the input signal exceeds 5.25 V, add an external current-limiting resistor R to limit the input current to around 6 mA.
  (Take the photocoupler forward voltage of 1.5 V into consideration.)

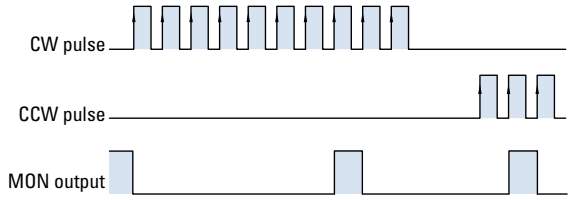
MON and ALM Output Circuit Configuration

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.