

Size	Motor size		28 mm sq. (1.8° full step angle)		42 mm sq. (1.8° full step angle)	
	Motor length		32 mm	51.5 mm	33 mm	39 mm
Single shaft	Set order no.		DB14S281S	DB14S285S	DB14S421S	DB14S422S
	Motor model no.		SH2281-5771	SH2285-5771	SF2421-10B41	SF2422-10B41
Dual shaft	Set order no.		DB14S281D	DB14S285D	DB14S421D	DB14S422D
	Motor model no.		SH2281-5731	SH2285-5731	SF2421-10B11	SF2422-10B11
Holding torque		N·m	0.07	0.145	0.29	0.43
Rotor inertia		× 10 ⁻⁴ kg·m ²	0.01	0.022	0.031	0.046
Rated current		A/phase	1	1	1	1
Motor mass ⁽¹⁾		kg	0.11	0.2	0.23	0.3
Allowable thrust load		N	3	3	10	10
Allowable radial load ⁽²⁾		N	42	49	38	34

(1) For the driver mass, see ▶ p. 26

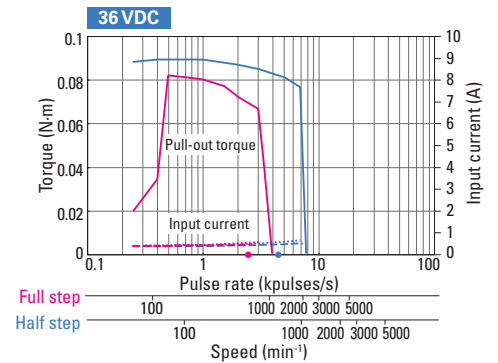
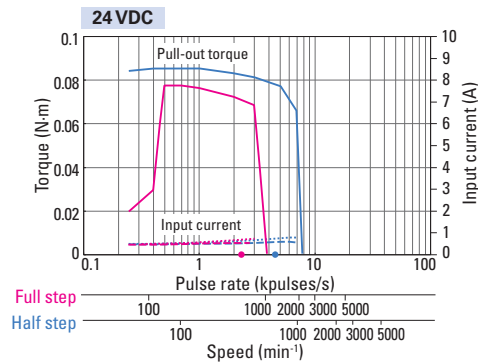
(2) Load is exerted to the shaft end.

Characteristics

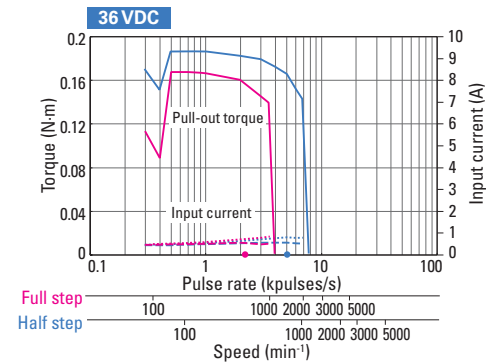
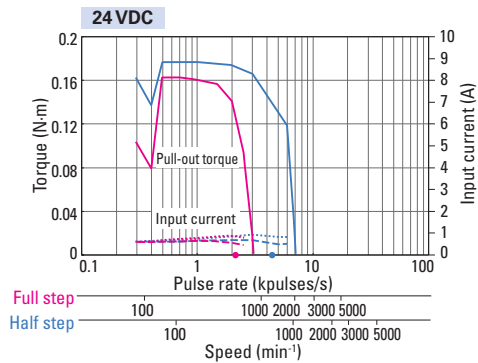
With rubber coupling used

Pull-out torque Full step — Half step — fs: Maximum starting pulse rate with no load Full step ● Half step ●
Input current (with no load) Full step - - - Half step - - - Input current (with load) Full step Half step

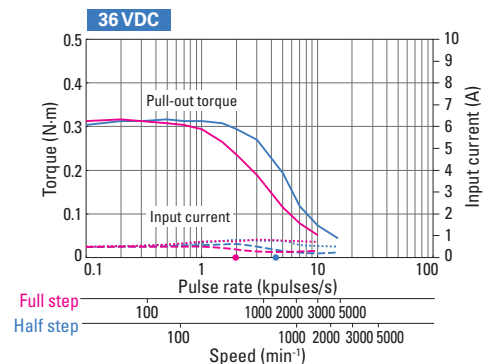
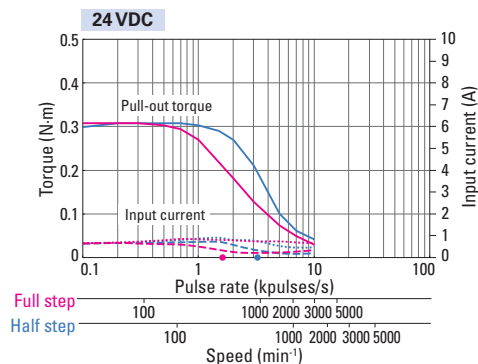
DB14S281S DB14S281D



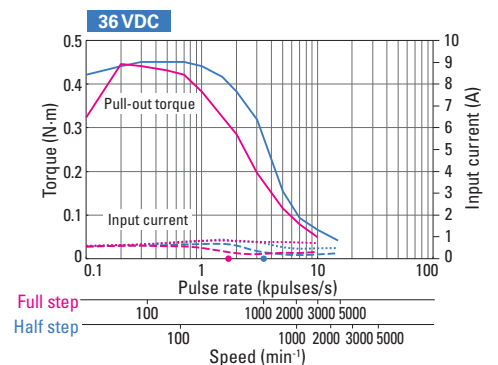
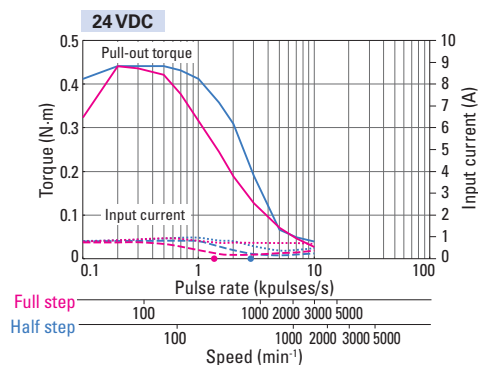
DB14S285S DB14S285D



DB14S421S DB14S421D



DB14S422S DB14S422D



Size	Motor size	42 mm sq. (1.8° full step angle)		42 mm sq. (0.9° full step angle)	
		48 mm	59.5 mm	33 mm	39 mm
Single shaft	Set order no.	DB14S423S	DB14S424S	DB16S141S	DB16S142S
	Motor model no.	SF2423-10B41	SF2424-10B41	SH1421-5241	SH1422-5241
Dual shaft	Set order no.	DB14S423D	DB14S424D	DB16S141D	DB16S142D
	Motor model no.	SF2423-10B11	SF2424-10B11	SH1421-5211	SH1422-5211
Holding torque		N·m		0.23	0.34
Rotor inertia		$\times 10^{-4}$ kg·m ²		0.044	0.066
Rated current		A/phase		2	2
Motor mass ⁽¹⁾		kg		0.24	0.29
Allowable thrust load		N		10	10
Allowable radial load ⁽²⁾		N		25	24

(1) For the driver mass, see ▶ p. 26

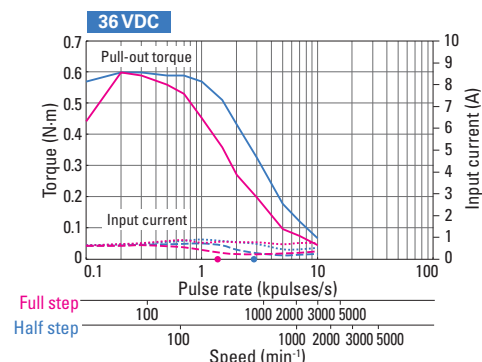
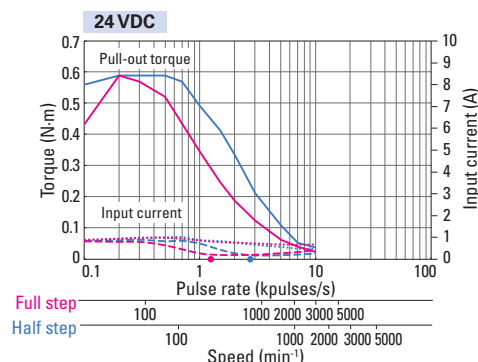
(2) Load is exerted to the shaft end.

Characteristics

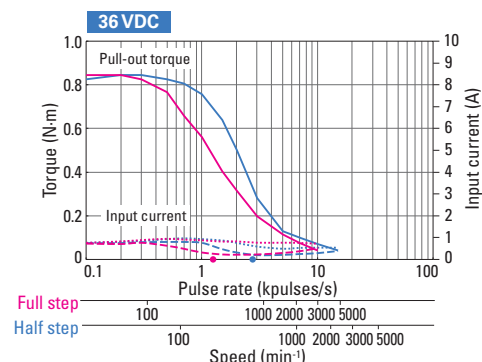
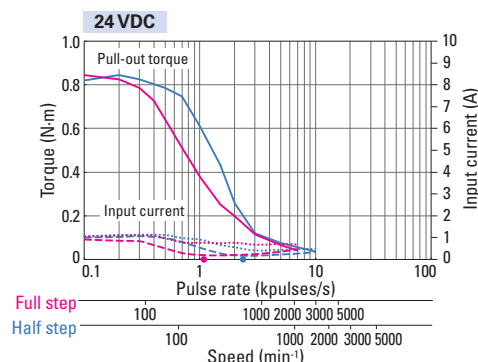
With rubber coupling used

Pull-out torque Full step — Half step — fs: Maximum starting pulse rate with no load Full step ● Half step ●
Input current (with no load) Full step - - - Half step - - - Input current (with load) Full step Half step

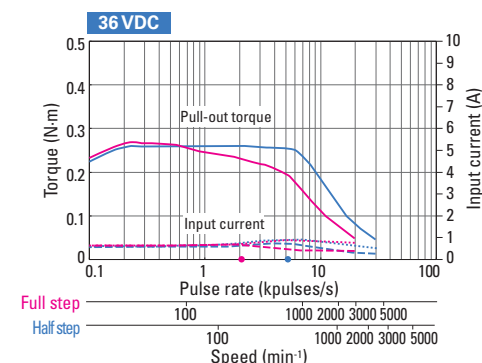
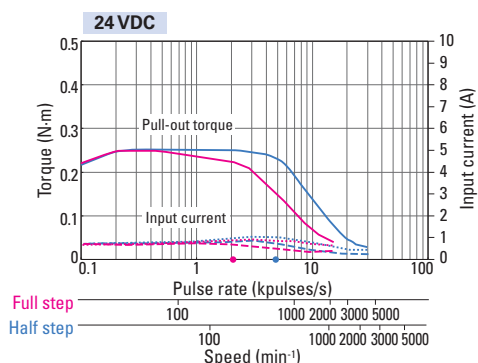
DB14S423S DB14S423D



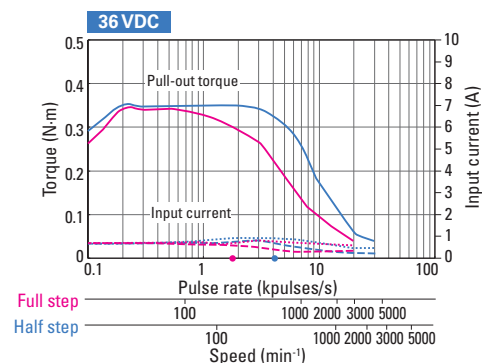
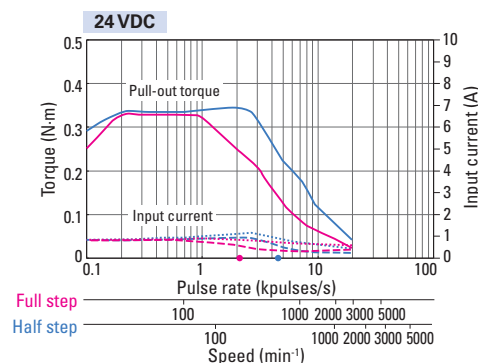
DB14S424S DB14S424D



DB16S141S DB16S141D



DB16S142S DB16S142D



Size		42 mm sq. (0.9° full step angle)	50 mm sq. (1.8° full step angle)		56 mm sq. (1.8° full step angle)
Motor size		48 mm	39.8 mm	51.3 mm	41.8 mm
Motor length		48 mm	39.8 mm	51.3 mm	41.8 mm
Single shaft	Set order no.	DB16S144S	DB16H671S	DB16H673S	DB16M711S
	Motor model no.	SH1424-5241	103H6701-5040	103H6703-5040	SM2561C20B41
Dual shaft	Set order no.	DB16S144D	DB16H671D	DB16H673D	DB16M711D
	Motor model no.	SH1424-5211	103H6701-5010	103H6703-5010	SM2561C20B11
Holding torque	N·m	0.48	0.28	0.49	0.75
Rotor inertia	$\times 10^{-4}$ kg·m ²	0.089	0.057	0.118	0.14
Rated current	A/phase	2	2	2	2
Motor mass ⁽¹⁾	kg	0.38	0.35	0.5	0.49
Allowable thrust load	N	10	15	15	20
Allowable radial load ⁽²⁾	N	20	79	75	113

(1) For the driver mass, see ▶ p. 26

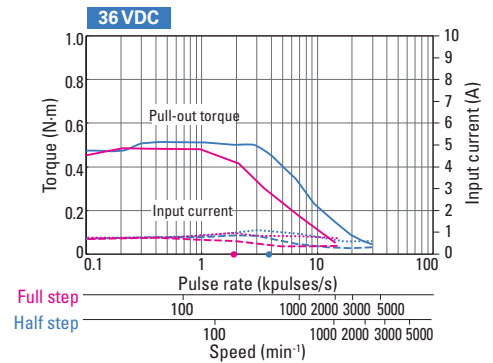
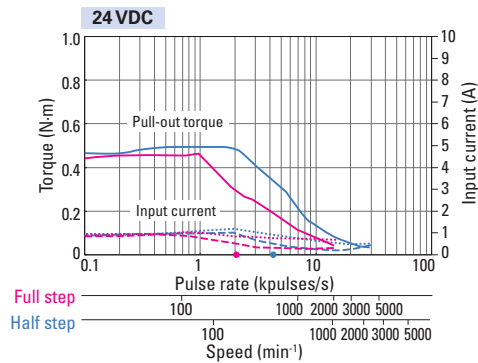
(2) Load is exerted to the shaft end.

Characteristics

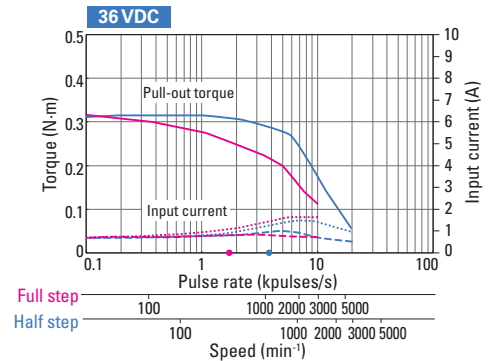
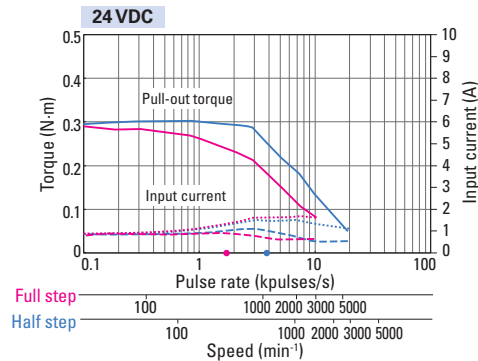
With rubber coupling used

Pull-out torque Full step — Half step — fs: Maximum starting pulse rate with no load Full step ● Half step ●
Input current (with no load) Full step - - - Half step - - - Input current (with load) Full step Half step

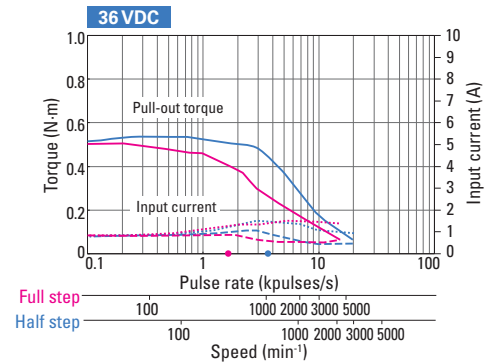
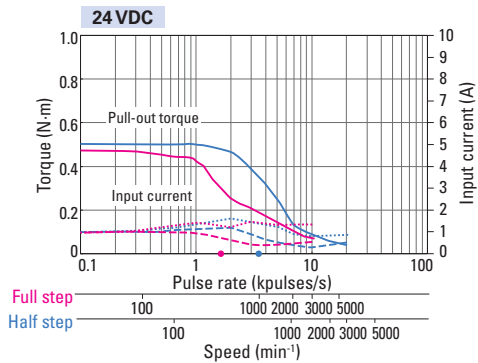
DB16S144S DB16S144D



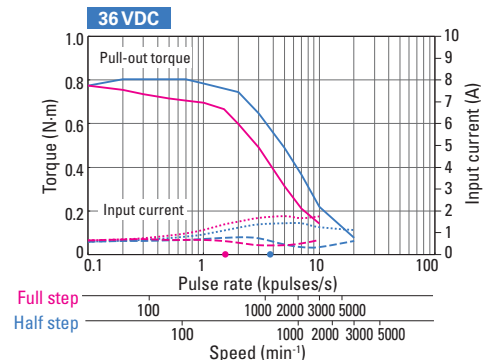
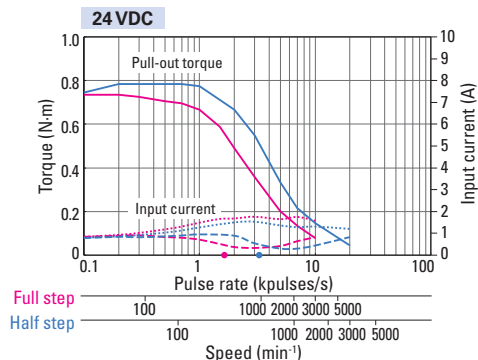
DB16H671S DB16H671D



DB16H673S DB16H673D



DB16M711S DB16M711D



Size	Motor size		56 mm sq. (1.8° full step angle)			60 mm sq. (0.9° full step angle)	
	Motor length		53.8 mm	75.8 mm	85.8 mm	42 mm	
Single shaft	Set order no.		DB16M712S	DB16M713S	DB16M714S	DB16S161S	
	Motor model no.		SM2562C20B41	SM2563C20B41	SM2564C20B41	SH1601-5240	
Dual shaft	Set order no.		DB16M712D	DB16M713D	DB16M714D	DB16S161D	
	Motor model no.		SM2562C20B11	SM2563C20B11	SM2564C20B11	SH1601-5210	
Holding torque		N·m	1.4	2.35	2.5	0.69	
Rotor inertia		$\times 10^{-4}$ kg·m ²	0.28	0.5	0.6	0.24	
Rated current		A/phase	2	2	2	2	
Motor mass ⁽¹⁾		kg	0.69	1.1	1.27	0.55	
Allowable thrust load		N	20	20	20	15	
Allowable radial load ⁽²⁾		N	102	78	70	78	

(1) For the driver mass, see ▶ p. 26

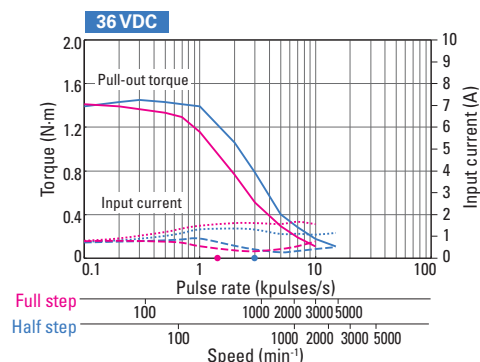
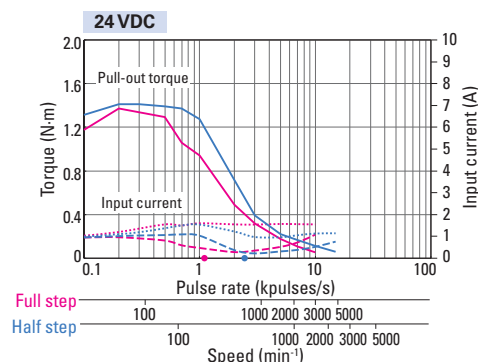
(2) Load is exerted to the shaft end.

Characteristics

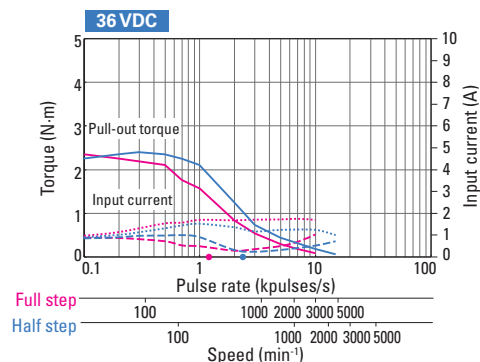
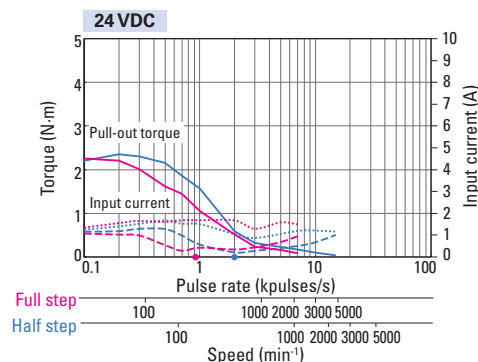
With rubber coupling used

Pull-out torque Full step Half step fs: Maximum starting pulse rate with no load Full step Half step
Input current (with no load) Full step Half step Input current (with load) Full step Half step

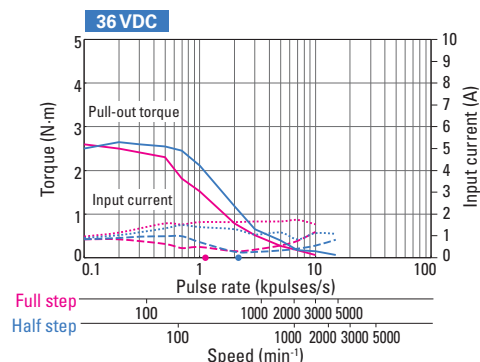
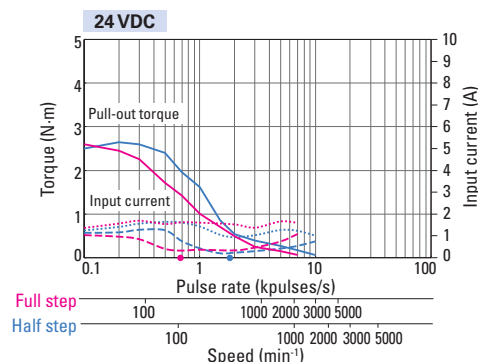
DB16M712S DB16M712D



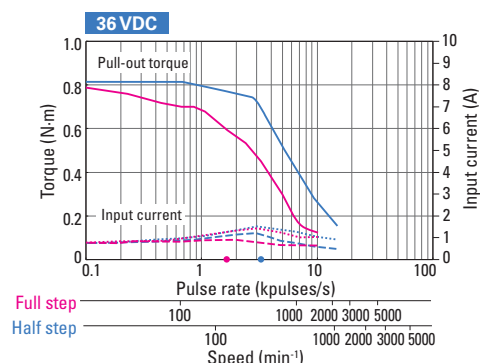
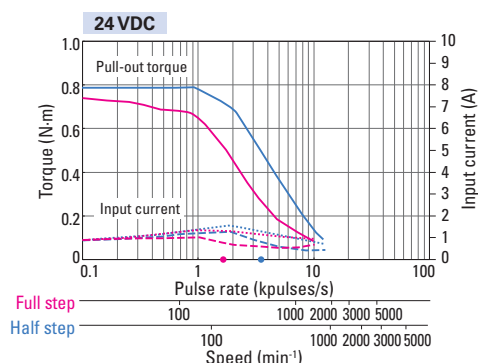
DB16M713S DB16M713D



DB16M714S DB16M714D



DB16S161S DB16S161D



Size	Motor size	60 mm sq. (0.9° full step angle)
	Motor length	54 mm
Single shaft	Set order no.	DB16S162S
	Motor model no.	SH1602-5240
Dual shaft	Set order no.	DB16S162D
	Motor model no.	SH1602-5210
Holding torque	N·m	1.28
Rotor inertia	$\times 10^{-4}$ kg·m ²	0.4
Rated current	A/phase	2
Motor mass ⁽¹⁾	kg	0.8
Allowable thrust load	N	15
Allowable radial load ⁽²⁾	N	65

(1) For the driver mass, see ▶ p. 26

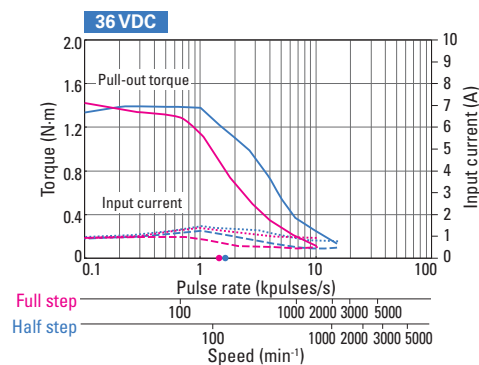
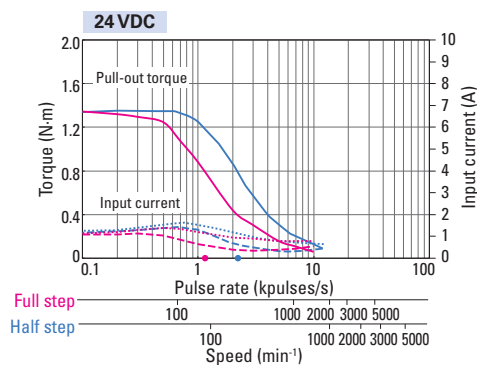
(2) Load is exerted to the shaft end.

Characteristics

With rubber coupling used

Pull-out torque Full step — Half step — fs: Maximum starting pulse rate with no load Full step ● Half step ●
Input current (with no load) Full step - - - Half step - - - Input current (with load) Full step Half step

DB16S162S
DB16S162D



SANMOTION F2

2-PHASE STEPPING SYSTEMS

2-Phase Stepping Driver

DC input



Applications

Medical equipment, semiconductor manufacturing equipment, measuring instruments, analyzers, and electron microscopes

Features

High Torque

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

Low Vibration

Motor vibration during operation has been reduced to one-third or less compared to the current model.⁽¹⁾ These drivers help make equipment motion smoother, improving the processing precision and reducing the noise.

Various Useful Safety Functions

- Using PC software, the high-power model offers fine settings of input/output signals, maintenance timing notifications, and current value selection optimized for customer equipment.
- 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 model⁽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.

Compact and Lightweight

The high-power model is newly designed to achieve a 12% reduction in volume and 33% reduction in mass compared to the current model.⁽²⁾

The basic model achieves a 7% reduction in volume and 39% reduction in mass while maintaining compatibility with the current model.⁽²⁾

(1) Current model: 2-phase stepping driver (model: BS1D200P10) combined with 56 mm sq. stepping motor (model: SM2562C□0B11)

(2) Current model: 2-phase stepping driver (model: BS1D200P10)

Specifications

Model		SANMOTION F2 high-power model	SANMOTION F2 basic model
Model no.		F2BFD400P100	F2BED200P100
Features		High torque, high performance	Compatible with our current models
Basic specifications	Input voltage	24 VDC $\pm$ 10%	
	Input current	4 A	2 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	1000 m or lower above sea level
		Vibration resistance	5 m/s ² , at frequency of 10 to 55 Hz in each X, Y, and Z direction for 2 hours
		Shock resistance	20 m/s ²
		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	60 g	55 g
Functions	Function selections	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	Overcurrent protection, power supply voltage monitoring, overheat detection, motor wire breakage detection, command speed error, memory error, hardware error	
	LED indicators	Power supply monitoring, alarm status monitoring	
	PC-based functions	Parameter customization, operating status monitoring	-

Compatible motors

Driver and motor combination table

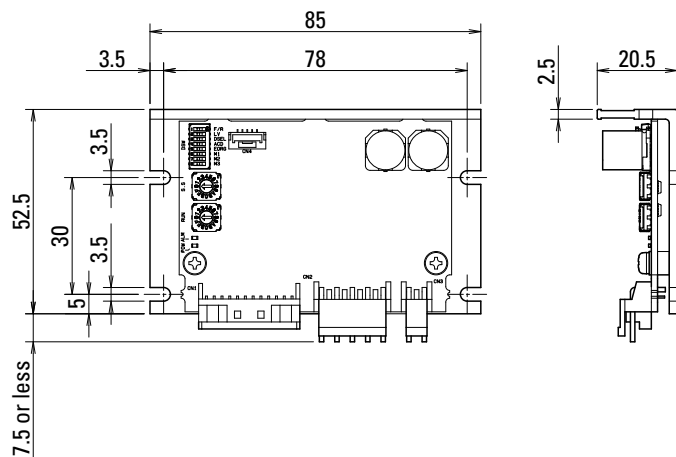
Driver model	Motor size	Single shaft	Dual shaft	Rated current	Full step angle
SANMOTION F2 high-power model	56 mm sq.	SM2561C30B41	SM2561C30B11	3 A/phase	1.8°
		SM2562C30B41	SM2562C30B11		
		SM2563C30B41	SM2563C30B11		
		SM2564C30B41	SM2564C30B11		
	56 mm sq.	SM2561C40B41	SM2561C40B11	4 A/phase	
		SM2562C40B41	SM2562C40B11		
		SM2563C40B41	SM2563C40B11		
		SM2564C40B41	SM2564C40B11		
	86 mm sq.	SH2861-5141	SH2861-5111	4 A/phase	
SANMOTION F2 basic model	42 mm sq.	SH1421-5241	SH1421-5211	2 A/phase	0.9°
		SH1422-5241	SH1422-5211		
		SH1424-5241	SH1424-5211		
	56 mm sq.	SM2561C20B41	SM2561C20B11	2 A/phase	1.8°
		SM2562C20B41	SM2562C20B11		
		SM2563C20B41	SM2563C20B11		
		SM2564C20B41	SM2564C20B11		
	60 mm sq.	SH1601-5240	SH1601-5210	2 A/phase	0.9°
		SH1602-5240	SH1602-5210		
		SH1603-5240	SH1603-5210		
	86 mm sq.	SH2861-5041	SH2861-5011	2 A/phase	1.8°
		SH2862-5041	SH2862-5011		

Note: Compatible motors are bipolar motors.

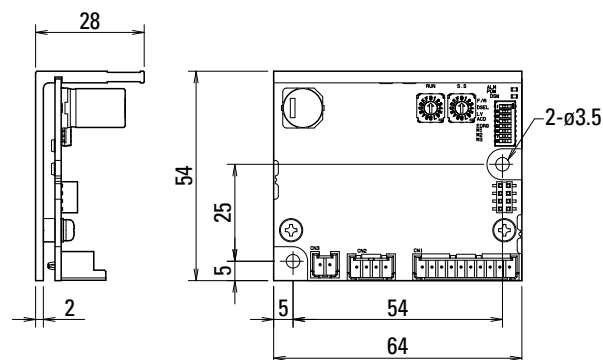
(The bipolar drive allows current to flow in both directions along the winding. The drive circuit is more complex, but it offers higher torque.)

Dimensions [Unit: mm]

SANMOTION F2 high-power model Model no.: F2BFD400P100



SANMOTION F2 basic model Model no.: F2BED200P100



SANMOTION F2

2-PHASE STEPPING SYSTEMS

2-Phase Stepping Driver

DC input



Applications

Medical equipment, semiconductor manufacturing equipment, measuring instruments, analyzers, and electron microscopes

Features

High Torque

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

Low Vibration

Motor vibration during operation has been reduced to one-third or less compared to the current model.⁽¹⁾ These drivers help make equipment motion smoother, improving the processing precision and reducing the noise.

Various Useful Safety Functions

- Using PC software, the high-power model offers fine settings of input/output signals, maintenance timing notifications, and current value selection optimized for customer equipment.
- 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 model⁽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.

Compact and Lightweight

The high-power model is newly designed to achieve a 12% reduction in volume and 33% reduction in mass compared to the current model.⁽²⁾

The basic model achieves a 7% reduction in volume and 39% reduction in mass while maintaining compatibility with the current model.⁽²⁾

(1) Current model: 2-phase stepping driver (model: BS1D200P10) combined with 56 mm sq. stepping motor (model: SM2562C□0B11)

(2) Current model: 2-phase stepping driver (model: BS1D200P10)

Specifications

Model		SANMOTION F2 high-power model	SANMOTION F2 basic model
Model no.		F2BFD400P100	F2BED200P100
Features		High torque, high performance	Compatible with our current models
Basic specifications	Input voltage	24 VDC $\pm$ 10%	
	Input current	4 A	2 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	1000 m or lower above sea level
		Vibration resistance	5 m/s ² , at frequency of 10 to 55 Hz in each X, Y, and Z direction for 2 hours
		Shock resistance	20 m/s ²
		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	60 g	55 g
Functions	Function selections	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	Overcurrent protection, power supply voltage monitoring, overheat detection, motor wire breakage detection, command speed error, memory error, hardware error	
	LED indicators	Power supply monitoring, alarm status monitoring	
	PC-based functions	Parameter customization, operating status monitoring	-

Compatible motors

Driver and motor combination table

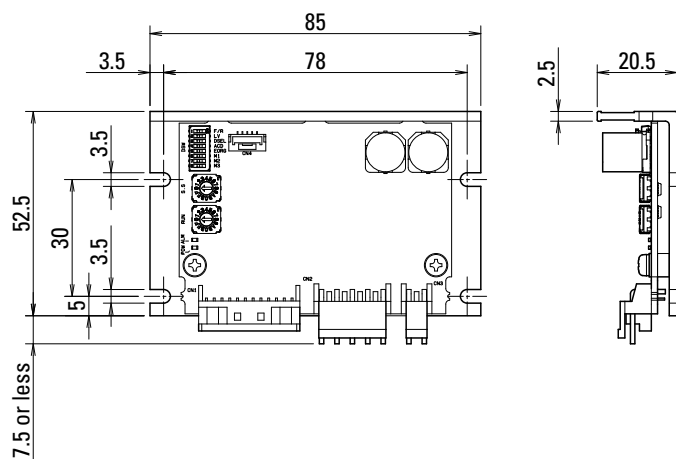
Driver model	Motor size	Single shaft	Dual shaft	Rated current	Full step angle
SANMOTION F2 high-power model	56 mm sq.	SM2561C30B41	SM2561C30B11	3 A/phase	1.8°
		SM2562C30B41	SM2562C30B11		
		SM2563C30B41	SM2563C30B11		
		SM2564C30B41	SM2564C30B11		
	56 mm sq.	SM2561C40B41	SM2561C40B11	4 A/phase	
		SM2562C40B41	SM2562C40B11		
		SM2563C40B41	SM2563C40B11		
		SM2564C40B41	SM2564C40B11		
	86 mm sq.	SH2861-5141	SH2861-5111	4 A/phase	
	SANMOTION F2 basic model	42 mm sq.	SH1421-5241	SH1421-5211	
SH1422-5241			SH1422-5211		
SH1424-5241			SH1424-5211		
56 mm sq.		SM2561C20B41	SM2561C20B11	2 A/phase	1.8°
		SM2562C20B41	SM2562C20B11		
		SM2563C20B41	SM2563C20B11		
		SM2564C20B41	SM2564C20B11		
60 mm sq.		SH1601-5240	SH1601-5210	2 A/phase	0.9°
		SH1602-5240	SH1602-5210		
		SH1603-5240	SH1603-5210		
86 mm sq.		SH2861-5041	SH2861-5011	2 A/phase	1.8°
		SH2862-5041	SH2862-5011		

Note: Compatible motors are bipolar motors.

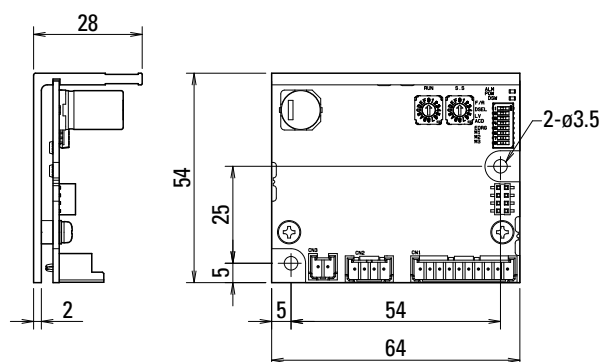
(The bipolar drive allows current to flow in both directions along the winding. The drive circuit is more complex, but it offers higher torque.)

Dimensions [Unit: mm]

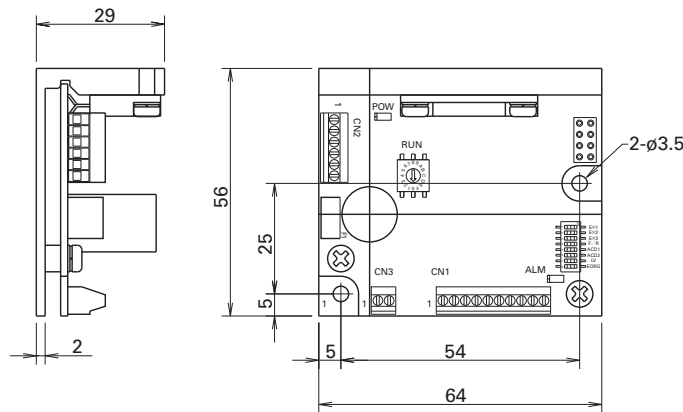
SANMOTION F2 high-power model Model no.: F2BFD400P100



SANMOTION F2 basic model Model no.: F2BED200P100



Driver Dimensions Unit: mm



Driver Specifications

General specifications

		Unipolar	Bipolar
Basic specifications	Model no.	US1D200P10	BS1D200P10
	Input voltage	24/36 VDC $\pm$ 10%	
	Input current	0.4 A	
	Environment	Protection class	Class III
		Operating environment	Installation category (Overvoltage category): I, pollution level: 2
		Operating ambient temperature	0 to +50°C
		Storage temperature	-20 to +70°C
		Operating ambient humidity	35 to 85 % RH (non-condensing)
		Storage humidity	10 to 90% RH (non-condensing)
		Operating altitude	Up to 1000 m above sea level
		Vibration resistance	5 m/s ² freq. range 10 to 55 Hz tested for 2 hours in each X, Y and Z-axis directions
		Shock resistance	Not abnormality observed as per IEC 60068-2-27 category C.
		Dielectric strength	500 VAC for one minute (between power input terminal and chassis)
		Insulation resistance	10 MΩ or more at 500 VDC (between power input terminal and chassis)
	Mass	0.09 kg	
Functions	Mode selection	Step angle mode, input pulse mode, low vibration mode, current at rest, operating current, initial excitation phase	
	Protective functions	Open phase, main circuit power supply undervoltage	
	LED indicators	Power supply monitoring, alarm indicator	
I/O signal	Command pulse input signal	Photocoupler input method; input resistance: 220 Ω, high-level input signal voltage: 4.0 to 5.5 V, low-level input signal voltage: 0 to 0.5 V, maximum starting pulse rate 150 pulses/s	
	Power down input signal	Photocoupler input method; input resistance: 220 Ω, high-level input signal voltage: 4.0 to 5.5 V, low-level input signal voltage: 0 to 0.5 V	
	Phase origin monitor output	Open-collector output through photo coupler, V _{ceo} : 40 V or less, I _c : 10 mA or less	
	Alarm output signal	Open-collector output through photo coupler, V _{ceo} : 40 V or less, I _c : 10 mA or less	

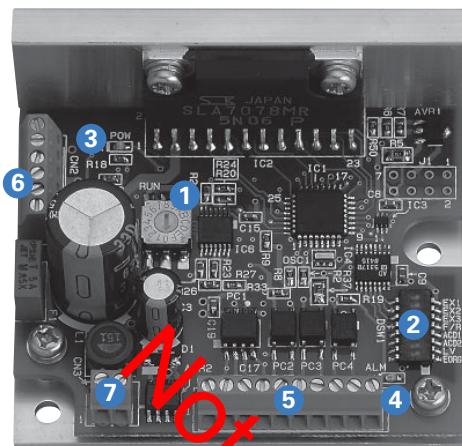
Safety standards

CE(TÜV)		UKCA In compliance from July 2022 production onwards.		
Directive	Category	Directive	Standards	Name
Low Voltage Directive	—	Electrical Equipment (Safety) Regulations 2016	EN 61010-1	—
EMC Directive	Emission	Electromagnetic Compatibility Regulations 2016	EN 61000-6-4	Terminal disturbance voltage
	Immunity		EN 61000-6-4	Electromagnetic radiation disturbance
			EN 61000-4-2	ESD (Electrostatic discharge)
			EN 61000-4-3	Radiated, radio-frequency, electromagnetic field
			EN 61000-4-4	Fast transients/burst
			EN 61000-4-6	Conducted disturbances
RoHS	Directive		Standards	
	RoHS Directive 2011/65/EU		EN 63000:2018	
UL	Classification		Standards	File no.
	UL		UL 508C	E179775
	UL for Canada (cUL)			

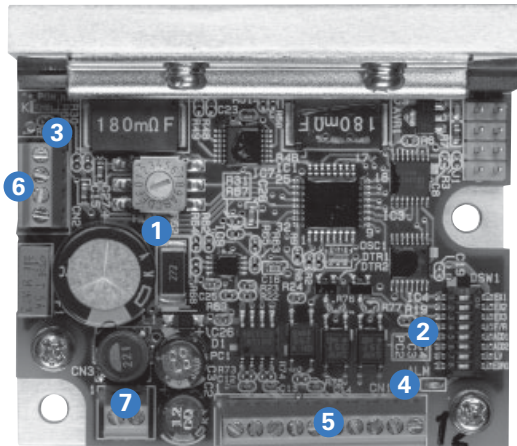
- Actual EMC levels vary depending on the configuration of the users' control panel where a driver and stepping motor are built in, and the placement layout of other electrical devices and wiring. EMC noise solution parts such as noise filters and toroidal type ferrite cores may be required in some cases.
- Validation test of drivers was performed as per Low-Voltage and EMC Directives at TÜV (TÜV product service) for self-declaration of CE and UKCA marking.
- Drivers can be purchased not only as a set but also as a single item. Connector-type drivers are also available. Contact us for details.

Driver Part Names and Functions

Unipolar



Bipolar



1 Operating current selection switch (RUN)

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)	2.0	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 switchpack

Functions can be selected to suit your application.

Factory settings

	OFF	ON	
EX1	☐	☐	OFF
EX2	☐	☐	OFF
EX3	☐	☐	OFF
F/R	☐	☐	OFF
ACD1	☐	☐	OFF
ACD2	☐	☐	OFF
LV	☐	☐	OFF
EORG	☐	☐	OFF
			8 subdivisions
			2-input mode (CW, CCW pulse input)
			Current at rest: 40% of driving current
			Microstepping
			Phase origin

1. Step angle selection (EX1, EX2, EX3)

Number of full step angle subdivisions can be selected.

EX1	EX2	EX3	Microsteps
ON	ON	ON	1 subdivision
OFF	ON	OFF	2 subdivisions
ON	OFF	OFF	4 subdivisions
OFF	OFF	OFF	8 subdivisions
OFF	OFF	ON	16 subdivisions

2. Input mode selection (F/R)

Input pulse mode can be selected.

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

3. Current selection when stopping (ACD1, ACD2)

Select the current value of the motor when stopping.

ACD2	ACD1	Motor current
ON	ON	100% of driving current
ON	OFF	60% of driving current
OFF	ON	50% of driving current
OFF	OFF	40% of driving current

- Initial factory setting is 40% of the rated value. Driver and motor should be operated at around 50% of rated value to reduce heat.

4. Low vibration mode select (LV)

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

LV	Initial excitation phase
ON	Low vibration
OFF	Microstepping

5. Excitation selection (EORG)

The excitation phase at the time of power activation is selected.

EORG	Initial excitation phase
ON	Excitation phase at power shutdown
OFF	Phase origin

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

3 Power supply monitoring LED (POW)

Lights up when the main circuit power supply is turned on.

4 Alarm indicator LED (ALM)

The LED lights up in either of the followings:

- Motor cable is damaged
- The switching device in the driver is damaged
- The main circuit power supply voltage is outside the specification range (below 19 VDC)

When "ALM" is lit, 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 (photocoupler ON) is transmitted from the alarm output terminal (AL) to outside. When the alarm circuit is activated, this state is maintained until it is reset by turning on the power supply again. When an alarm goes off, please take corrective actions to eliminate the cause of the alarm before turning on the power supply again.

5 I/O signal terminals (CN1)

For input/output signal connections.

6 Motor connection terminals (CN2)

For motor power connection.

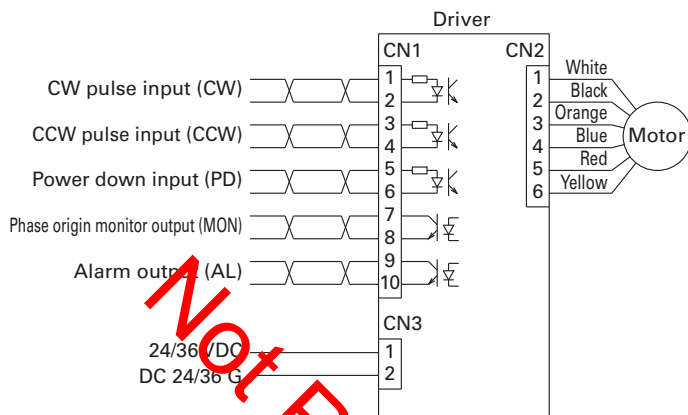
7 Power supply connection terminals (CN3)

For main circuit power supply connection.

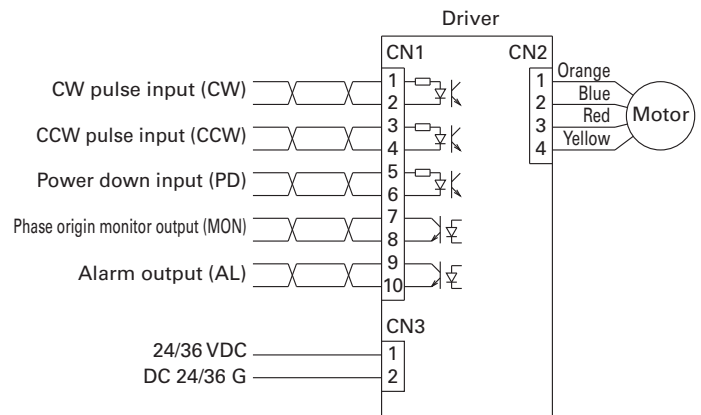
Connections and Signals

External wiring diagram

Unipolar



Bipolar



Cable size

Type	Cable Size	Maximum length
Power cable	22 AWG (0.3 mm ²)	2 m or less
I/O signal cable	24 AWG (0.2 mm ²) to 22 AWG (0.3 mm ²)	2 m or less
Motor cable	22 AWG (0.3 mm ²)	Below 3 m

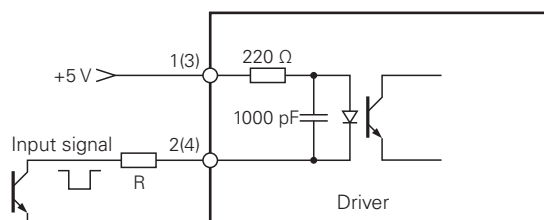
Input/output signal specification overview

Signal	CN1 Pin no.	Function overview
CW pulse input (CW) (Standard)	1 2	When in 2-input mode, a CW-direction pulse is input.
Drive pulse input (CK)	1 2	When in 1-input mode, a drive pulse is input to rotate the motor.
CCW pulse input (CCW) (Standard)	3 4	When in 2-input mode, a CCW-direction pulse is input.
Rotational direction input (U/D)	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 (PD)	5 6	A PD signal input will cut off (power off) the current flowing to the motor. PD input signal on (internal photocoupler on) ... PD function is enabled. PD input signal off (internal photocoupler off) ... PD function is disabled.
Phase origin monitor output (MON)	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 4 pulses. In half step mode, turned on once for 8 pulses.
Alarm output (AL)	9 10	When the alarm circuit is activated inside the driver, an alarm signal (photocoupler on) is output to outside, which turns the stepping motor to non-excited state.

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

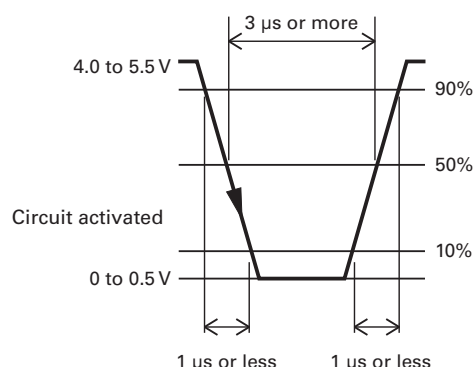
The CCW direction refers to the counter-clockwise direction when the motor is viewed from the output shaft side.

Circuit Configuration of Pulse Input CW (CK), CCW (U/D)



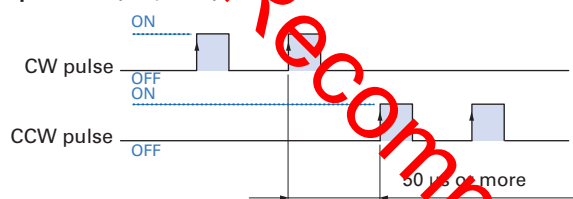
- Ensure that the pulse duty is 50% or less.
- Maximum starting pulse rate is 150 pulses/s.
- If the peak voltage of the input signal exceeds 5.5 V, add an external current-limiting resistor R to limit the input current to around 15 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

Input signal specifications



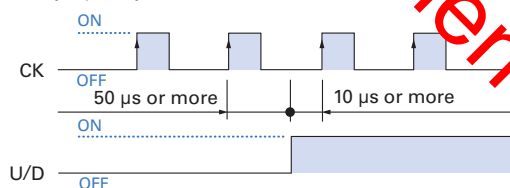
Command pulse timing

2-input mode (CW, CCW)



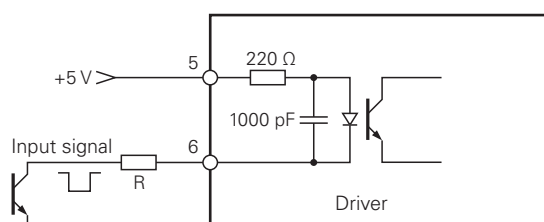
- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at leading edge of the photocoupler ON.
- When applying a pulse to CW, set the CCW side internal photocoupler to OFF.
- When applying a pulse to CCW, set the CW side internal photocoupler to OFF.

1-input mode (CK, U/D)



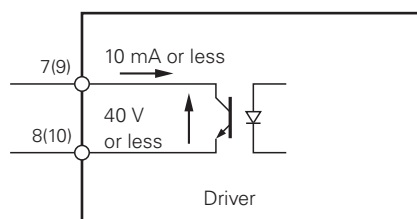
- Shaded areas indicate that internal photocoupler is ON. Internal circuit (motor) starts operating at leading edge of the CK-side photocoupler ON.
- Switching of U/D input signal must be done while the CK-side internal photocoupler is OFF.

Circuit Configuration of Power Down (PD) Input

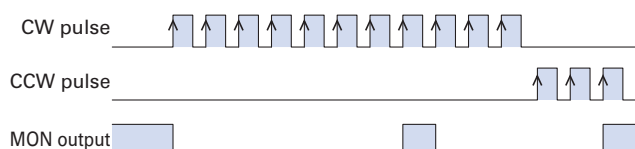


- If the peak voltage of the input signal exceeds 5.5 V, add an external current-limiting resistor R to limit the input current to around 15 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

Circuit Configuration of Phase Origin Monitor Output (MON) and Alarm Output (AL)



MON output



- Photo coupler is turned on when the motor's excitation phase is at the origin (when power is turned on).
- MON output is output every 7.2° rotation of the motor output shaft from the phase origin. (The figure on the left is for when the step angle setting is in a half-step mode)

Not Recommended for New Desings

Set Orders

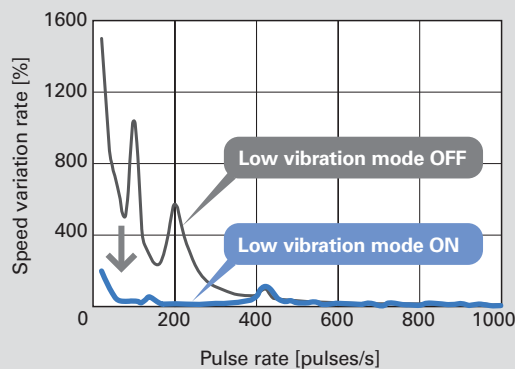
DC Input

► p. 10

Features

Low vibration

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.



Microstepping drive

Resolution settings up to 16 subdivisions of the full step angle can be used, enabling smooth equipment operation with low vibration.

How to Read Specifications

Unipolar

DC input driver (model: US1D200P10) and stepping motor

RoHS

Size	Motor size	28 mm sq. (1.8° full step angle)		42 mm sq. (1.8° full step angle)	
	Motor length	32 mm	51.5 mm	33 mm	39 mm
Single shaft	Set order no.	DU14S281S	DU14S285S	DU15S421S	DU15S422S
	Motor model no.	SH2281-5271	SH2285-5271	SF2421-12U41	SF2422-12U41
Dual shaft	Set order no.	DU14S281D	DU14S285D	DU15S421D	DU15S422D
	Motor model no.	SH2281-5231	SH2285-5231	SF2421-12U11	SF2422-12U11
Holding torque	N·m	0.055	0.115	0.22	0.33
Rotor inertia	$\times 10^{-4}$ kg·m ²	0.01	0.022	0.031	0.046
Rated current	A/phase	1	1	1.2	1.2
Motor mass ⁽¹⁾	kg	0.11	0.2	0.23	0.3
Allowable thrust load	N	3	3	10	10
Allowable radial load ⁽²⁾	N	42	49	39	37

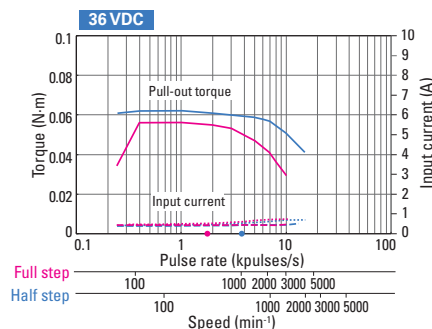
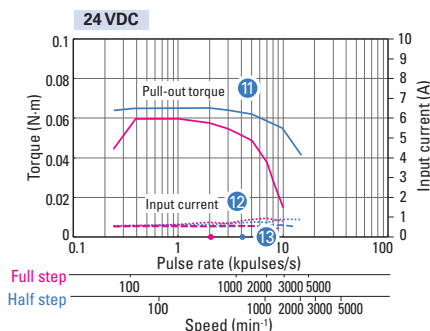
(1) For the driver mass, see p. 26 (2) Load is exerted to the shaft end.

Characteristics

With rubber coupling used

Pull-out torque Full step Half step fs: Maximum starting pulse rate with no load Full step Half step
Input current (with no load) Full step Half step Input current (with load) Full step Half step

DU14S281S
DU14S281D



- Model number of the driver included in the set.
- Flange size and length of the stepping motor included in the set. 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.
- The set order number and the model number of the stepping motor included in the set. The model number varies depending on whether the motor's shaft is single shaft or dual shaft.
- 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.
- This is the moment of inertia of the rotor.
- This is the rated current that flows to the motor winding.
- This is the mass of the stepping motor.
- This is the maximum allowable load to the shaft in the axial direction. Take care not to exceed this limit.
- This is the maximum allowable load to the shaft in the direction perpendicular to the axial direction. Take care not to exceed this limit.
- 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. Characteristics in full step mode is shown in red, and in half step mode is shown in blue.
- 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, it will be unable to syn-

chronize with command pulses. Thus, when selecting a motor, you should allow for a torque margin of 1.4 to 2 times, in order to avoid step-out.

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

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

The red and 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.

- The red- and blue-colored dots in the lower part of the graph show the upper limit for the maximum starting pulse rate (fs) of the stepping motor by itself (with no load). Values in full step mode is shown in red, and in half step mode is shown in blue. 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 (fL) can be determined using the expression below.

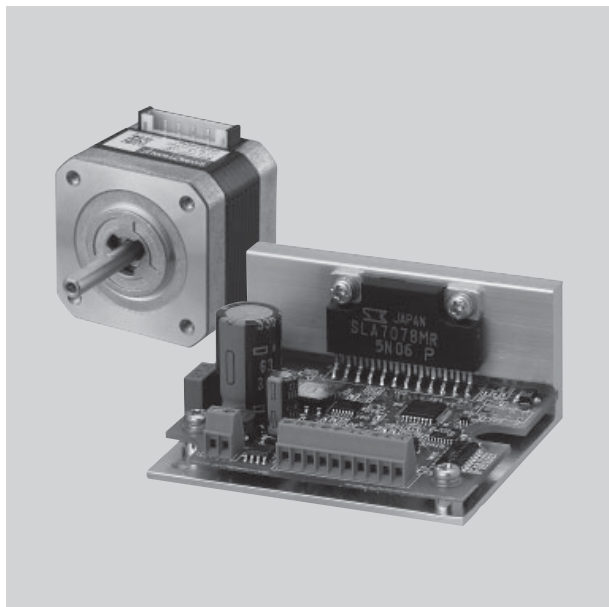
$$f_L = \frac{f_s}{\sqrt{1 + \frac{J_L}{J_M}}}$$

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

DC Input Set Orders

Unipolar/Bipolar

Items included in a set...▶p. 12 Specifications/Characteristics...▶p. 13 to 21
Motor dimensions...▶p. 22 to 23 Motor specifications...▶p. 24
Driver dimensions...▶p. 26 Driver specifications...▶p. 26



Items included in a set **RoHS**

Driver Terminal block type



Unipolar Model no.: US1D200P10 Input voltage: 24/36 VDC

Bipolar Model no.: BS1D200P10 Input voltage: 24/36 VDC

- The Instruction Manual is available for download from our website.
- Drivers are available for separate purchase.

Connector-type drivers are also available. Contact us for details.

Motor



(Only for 56 mm sq. motors)

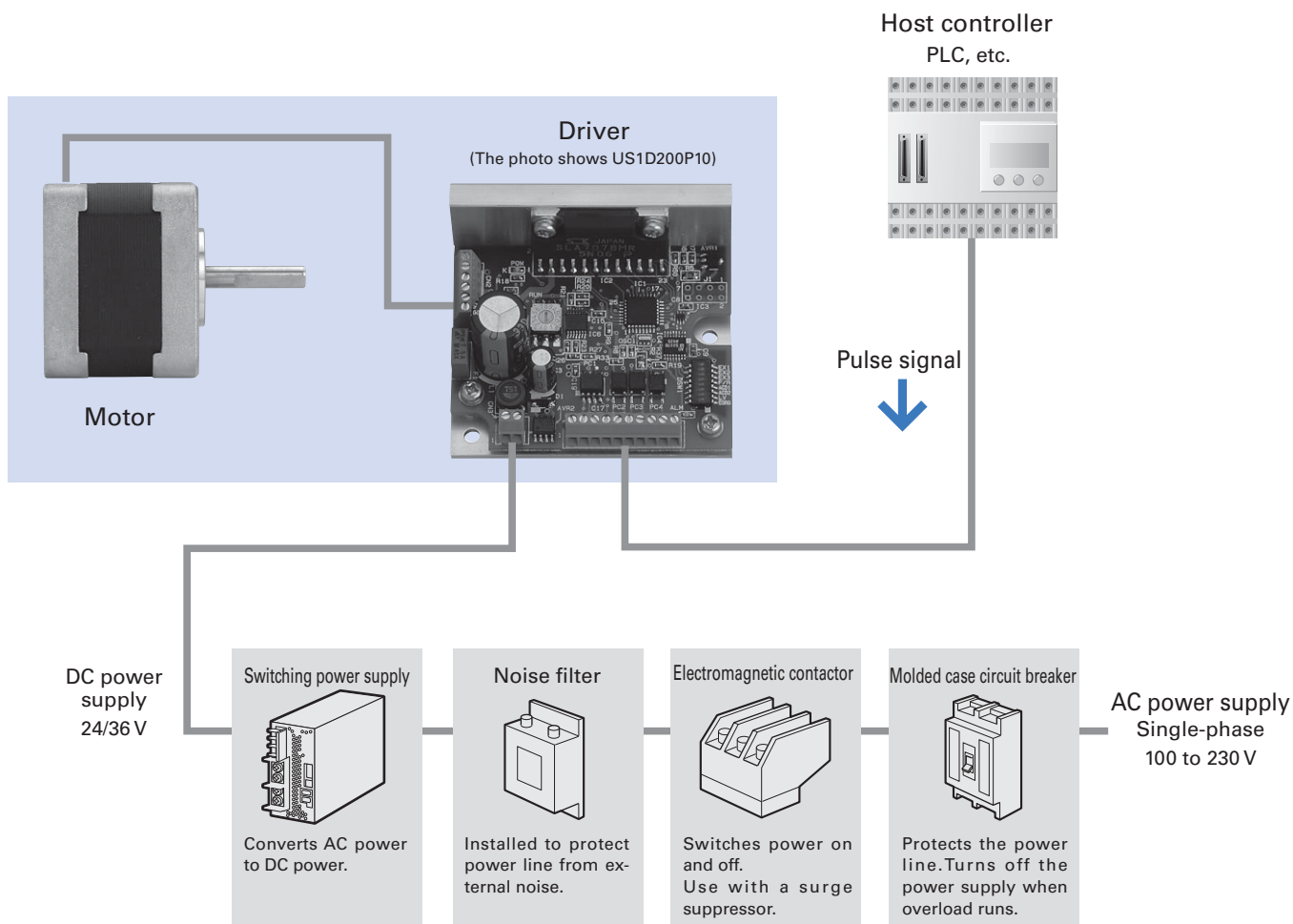
Unipolar motor sizes: 28 mm sq., 42 mm sq., 56 mm sq.

Bipolar motor sizes: 28 mm sq., 42 mm sq., 50 mm sq.,
56 mm sq., 60 mm sq.

Cable with connectors

Supplied only with connector-type motors

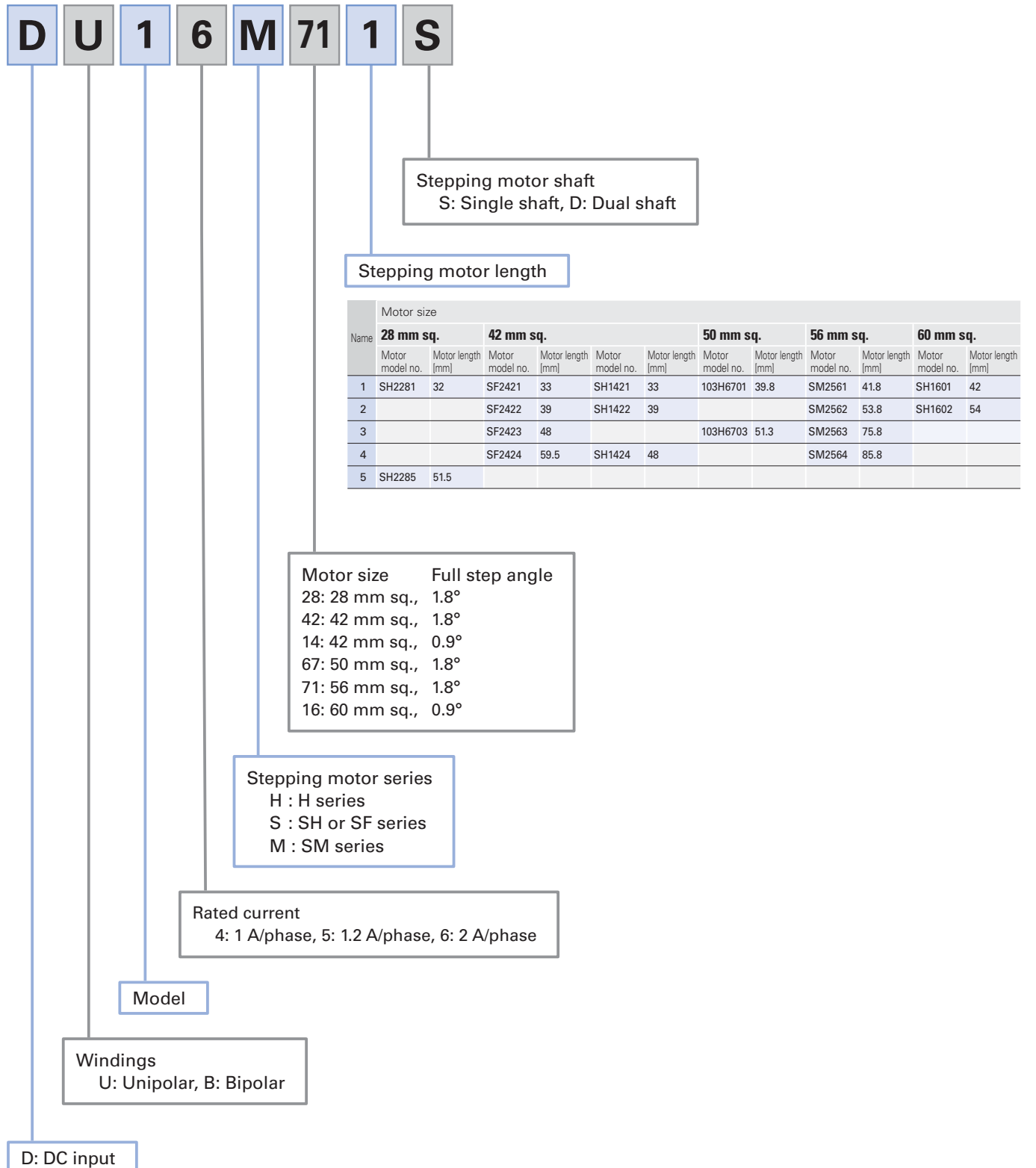
System Configuration



How to Read Set Order Numbers

Note that not all possible parameter combinations are valid. Contact us or see Items Included in a Set on the next page for details of the items included in individual sets.

e.g., The model number shown below is a set of a DC input driver (US1D200P10) and a motor (SM2561C20U41). The motor's specifications are: 56 mm sq. size, 41.8 mm length, and single shaft.



Items Included in a Set These sets include a driver, motor, and motor cable with connectors.

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

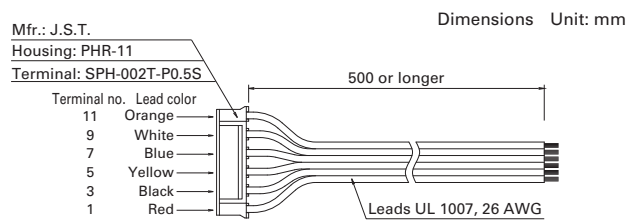
Motors marked with (C) are connector-type motors. The following motor cables with connectors are included.

Unipolar Bundled driver model no.: US1D200P10

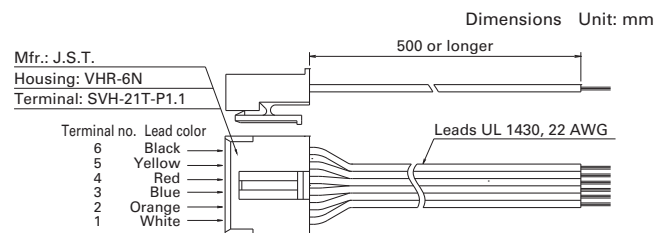
Motor size	Single shaft			Dual shaft			Full step angle	Rated current [A/phase]	Page			
	Set order no.	Items included in a set		Set order no.	Items included in a set				Specifi-cations	Dimen-sions		
		Motor model no.	Motor cable with connectors model no.		Motor model no.	Motor cable with connectors model no.						
28 mm sq.	DU14S281S	SH2281-5271	L	–	DU14S281D	SH2281-5231	L	–	1.8°	1	p. 13	p. 22
	DU14S285S	SH2285-5271	L	–	DU14S285D	SH2285-5231	L	–	1.8°	1	p. 13	p. 22
42 mm sq.	DU15S421S	SF2421-12U41	C	4835774-1	DU15S421D	SF2421-12U11	C	4835774-1	1.8°	1.2	p. 13	p. 22
	DU15S422S	SF2422-12U41	C	4835774-1	DU15S422D	SF2422-12U11	C	4835774-1	1.8°	1.2	p. 13	p. 22
	DU15S423S	SF2423-12U41	C	4835774-1	DU15S423D	SF2423-12U11	C	4835774-1	1.8°	1.2	p. 14	p. 22
	DU15S424S	SF2424-12U41	C	4835774-1	DU15S424D	SF2424-12U11	C	4835774-1	1.8°	1.2	p. 14	p. 22
	DU15S141S	SH1421-0441	L	–	DU15S141D	SH1421-0411	L	–	0.9°	1.2	p. 14	p. 22
	DU15S142S	SH1422-0441	L	–	DU15S142D	SH1422-0411	L	–	0.9°	1.2	p. 14	p. 22
	DU15S144S	SH1424-0441	L	–	DU15S144D	SH1424-0411	L	–	0.9°	1.2	p. 15	p. 22
56 mm sq.	DU16M711S	SM2561C20U41	C	4837798-1	DU16M711D	SM2561C20U11	C	4837798-1	1.8°	2	p. 15	p. 23
	DU16M712S	SM2562C20U41	C	4837798-1	DU16M712D	SM2562C20U11	C	4837798-1	1.8°	2	p. 15	p. 23
	DU16M713S	SM2563C20U41	C	4837798-1	DU16M713D	SM2563C20U11	C	4837798-1	1.8°	2	p. 15	p. 23
	DU16M714S	SM2564C20U41	C	4837798-1	DU16M714D	SM2564C20U11	C	4837798-1	1.8°	2	p. 16	p. 23

• **Motor cable with connectors** Note: Included with connector-type motors only

For 42 mm sq. unipolar motors (Model no.: 4835774-1)



For 56 mm sq. unipolar motors (Model no.: 4837798-1)

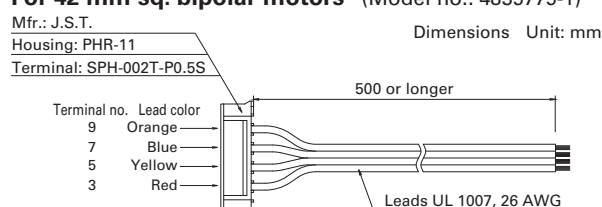


Bipolar Bundled driver model no.: BS1D200P10

Motor size	Single shaft				Dual shaft			Full step angle	Rated current [A/phase]	Page		
	Set order no.	Items included in a set		Set order no.	Items included in a set		Specifi- cations			Dimen- sions		
		Motor model no.	Motor cable with connectors model no.		Motor model no.	Motor cable with connectors model no.						
28 mm sq.	DB14S281S	SH2281-5771	L	—	DB14S281D	SH2281-5731	L	—	1.8°	1	p. 17	p. 22
	DB14S285S	SH2285-5771	L	—	DB14S285D	SH2285-5731	L	—	1.8°	1	p. 17	p. 22
42 mm sq.	DB14S421S	SF2421-10B41	C	4835775-1	DB14S421D	SF2421-10B11	C	4835775-1	1.8°	1	p. 17	p. 22
	DB14S422S	SF2422-10B41	C	4835775-1	DB14S422D	SF2422-10B11	C	4835775-1	1.8°	1	p. 17	p. 22
	DB14S423S	SF2423-10B41	C	4835775-1	DB14S423D	SF2423-10B11	C	4835775-1	1.8°	1	p. 18	p. 22
	DB14S424S	SF2424-10B41	C	4835775-1	DB14S424D	SF2424-10B11	C	4835775-1	1.8°	1	p. 18	p. 22
	DB16S141S	SH1421-5241	L	—	DB16S141D	SH1421-5211	L	—	0.9°	2	p. 18	p. 22
	DB16S142S	SH1422-5241	L	—	DB16S142D	SH1422-5211	L	—	0.9°	2	p. 18	p. 22
	DB16S144S	SH1424-5241	L	—	DB16S144D	SH1424-5211	L	—	0.9°	2	p. 19	p. 22
50 mm sq.	DB16H671S	103H6701-5040	L	—	DB16H671D	103H6701-5010	L	—	1.8°	2	p. 19	p. 23
	DB16H673S	103H6703-5040	L	—	DB16H673D	103H6703-5010	L	—	1.8°	2	p. 19	p. 23
56 mm sq.	DB16M711S	SM2561C20B41	C	4837961-1	DB16M711D	SM2561C20B11	C	4837961-1	1.8°	2	p. 19	p. 23
	DB16M712S	SM2562C20B41	C	4837961-1	DB16M712D	SM2562C20B11	C	4837961-1	1.8°	2	p. 20	p. 23
	DB16M713S	SM2563C20B41	C	4837961-1	DB16M713D	SM2563C20B11	C	4837961-1	1.8°	2	p. 20	p. 23
	DB16M714S	SM2564C20B41	C	4837961-1	DB16M714D	SM2564C20B11	C	4837961-1	1.8°	2	p. 20	p. 23
60 mm sq.	DB16S161S	SH1601-5240	L	—	DB16S161D	SH1601-5210	L	—	0.9°	2	p. 20	p. 23
	DB16S162S	SH1602-5240	L	—	DB16S162D	SH1602-5210	L	—	0.9°	2	p. 21	p. 23

• **Motor cable with connectors** Note: Included with connector-type motors only

For 42 mm sq. bipolar motors (Model no.: 4835775-1)



For 56 mm sq. bipolar motors (Model no.: 4837961-1)

