



## The 5-Phase Stepping Driver

# PMAPA1S6A01

## AC200V/230V

### Micro-Step (500 x 1 to 40 divisions)



● Applicable motor



## Characteristics

- **Conformity to UL Standards and CE Marking**

The system conforms to UL Standards and CE Marking.

- **Micro-step function available**

Smooth operation without vibration at low speeds can be realized.

- **Rush current prevention circuit**

Thanks to the built-in rush current prevention circuit in the power circuit section, stabilized operation is ensured even during switching on.

- **Connector method for PM driver I/O cable**

The connector method is adopted for the high voltage section terminal, where the terminal base was conventionally used. This method facilitates PM driver installation and maintenance.

- **Alarm output signal logic selectable**

Logic of signal output during alarm circuit operation can be selected

## Built-in function

- **Low vibration mode**

Even setting division of resolution to a rough one or two divisions, operation can be as smooth and with as low vibration as for micro-step drive. However, the low vibration mode and the micro-step function cannot be adopted at the same time.

- **Micro-step function**

By manipulating the rotary switch that sets resolution, the micro-step drive may be used. However, the low vibration mode and the micro-step function cannot be adopted at the same time.

- **Pulse input system selection function**

Either "Pulse and direction mode" or "2-input mode" can be selected, using a dipswitch. Resolution setting function.

- **Resolution setting function**

Nine types of resolution, ranging from one to 40 divisions, can be set for a basic stepping motor step angle by using rotary switches.

- **Operating current switch function**

Regarding operation current of the stepping motor, currents ranging from rated current to 55% of rated current can be set using rotary switches.

- **Current adjustment function during operation halt**

When operation is halted, operation current for the stepping motor can be set at 40 to 70% of specified operation current by using selection switch.



## PM driver specifications

Item		PMAPA1S6A01	
Standard specifications	Input source	Single phase AC200V/230V+10,-15% 50/60Hz	
	Source current	6A	
	Environment	Protection class	Class I
		Operating environment	Installation category (overvoltage category): II , pollution degree:2
		Operating ambient temperature	0~+50°C
		Conservation temperature	-20~+70°C
		Operating ambient humidity	35~85%RH(no condensation)
		Conservation humidity	10~90%RH(no condensation)
		Operating altitude	MAX. 1000m above sea level
		Vibration resistance	0.5G Tested under the following conditions, frequency range: 10 to 55Hz, direction: along the X, Y, and Z axes, for 2 hours
		Impact resistance	Considering the NDS-C-0110 standard section 3.2.2 division "C", not influenced
		Withstand voltage	Not influenced when AC1500V is applied between power input terminal and cabinet for one minute
		Insulation resistance	10MΩ MIN when DC500V is applied between power input terminal and cabinet
		Mass(Weight)	1.5kg(3.31 lbs)
		Function	Protection function
	Selection function		Pulse input method, automatic current reduction, power down, low vibration mode, alarm output logic, step angle, operating current, and non-operating current
LED indicator	Power supply monitor, phase origin monitor, pulse monitor, alarm monitor		
I/O signals	Command pulse input signal	Photo coupler input method, input resistance: 330Ω Input signal voltage, H = 4.0 to 5.5V, L = 0 to 0.5V MAX. input frequency: 200kpulse/s	
	Power down input signal	Photo coupler input method, input resistance = 330Ω Input signal voltage, H = 4.0 to 5.5V, L = 0 to 0.5V	
	Step angle selection input signal	Photo coupler input method, input resistance = 330Ω Input signal voltage, H = 4.0 to 5.5V, L = 0 to 0.5V	
	FULL/HALF selection input signal	Photo coupler input method, input resistance = 330Ω Input signal voltage, H = 4.0 to 5.5V, L = 0 to 0.5V	
	Phase origin monitor output signal	Open collector output by photo coupler Output signal standard, Vceo = 30V MAX, Ic = 5mA MAX	
	Alarm output signal	Open collector output by photo coupler Output signal standard, Vceo = 30V MAX, Ic = 20mA MAX	

## UL Standard and CE Marking

Product	UL standards		CE Marking		
	Applied standards	File NO.	Low Voltage Directive	EMC Directive	
				Emission	Immunity
PM driver	UL508C	E179775	EN50178	EN50081-2 (Class A)	EN50082-2 (Class A)

- The "STEPSYN H" series does not conform to the UL standards and CE Marking. Use the "STEPSYN M" series if conformity is required.
- For the conformity of the "STEPSYN M" series, refer to 5-phase stepping motor unit, "AP1" series (page 11).
- See p.15 for recommended EMC-prevention component.

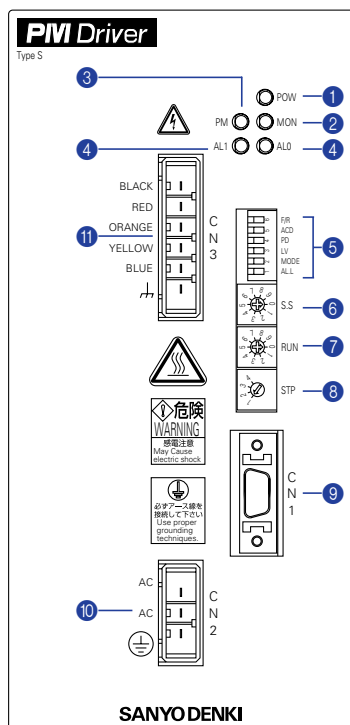
## Standard Combination of the stepping motor

Stepping motor dimensions	Stepping motor model number		Holding torque N·m(oz·in)	Rotor inertia x10 <sup>-4</sup> kg·m <sup>2</sup> (oz·in <sup>2</sup> )	Mass(Weight) kg(lbs)	Page
	Single shaft	Double shaft				
ø86mm	103H8581-8041	103H8581-8011	2.06(291.7)	1.45(7.93)	1.5(3.31)	P309
	103H8582-8041	103H8582-8011	4.02(569.3)	2.9(15.86)	2.5(5.51)	
	103H8583-8041	103H8583-8011	6.17(873.7)	4.4(24.06)	3.5(7.72)	
ø106mm	103H89582-8041	103H89582-8011	10.8(1529.4)	14.6(79.83)	7(15.43)	P311
	103H89583-8041	103H89583-8011	16(2265.7)	22(120.28)	10.4(22.93)	

- Refer to the relevant pages for the general specifications and external dimensions of each stepping motor.

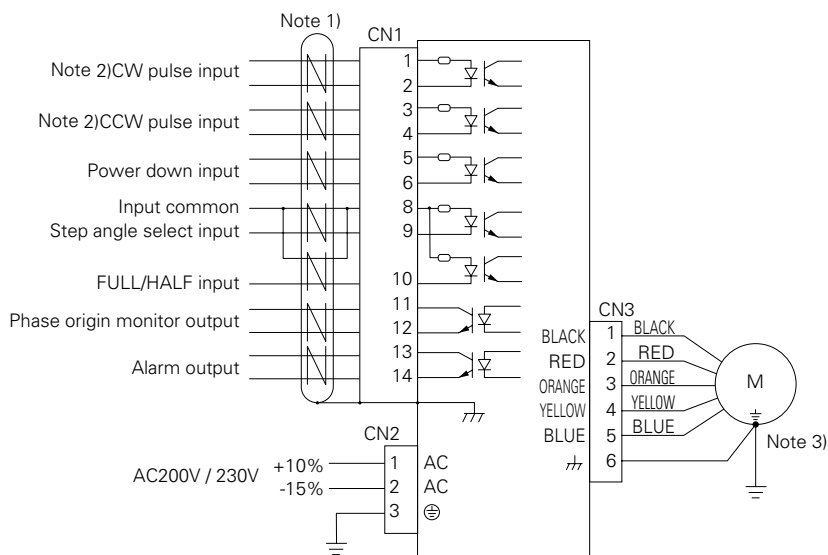
# Operation, connection, and function

## ● Name of the PM Driver components



- ① Internal power establishment(POW) ..... Indicates the internal power is established.
- ② Phase origin monitor(MON) ..... Indicates that the excitation phase is at the origin (that is when the power is turned on).
- ③ Input pulse monitor(PM) ..... Indicates the input pulse is applied.
- ④ Alarm monitor(AL0,AL1) ..... Turns on when the internal alarm circuit is operating.
- ⑤ Function select dipswitch ..... Functions can be selected according to specifications.  
(F/R,ACD,PD,LV,MODE,AL.L)
- ⑥ Step angle selection switch(S.S) ..... Basic step angle of the stepping motor can be set up to 40 divisions.
- ⑦ Operating current selection switch(RUN) ..... Stepping motor current value during operation can be selected.
- ⑧ Non-operating current selection switch(STP) ... Current of the non-operating stepping motor can be selected in the range from 40 to 70% when the automatic current reduction function is operating.
- ⑨ I/O signal connector(CN1) ..... Connection for I/O signal.
- ⑩ Power input connector(CN2) ..... Connection for single phase AC power
- ⑪ Motor output connector(CN3) ..... Connection for the stepping motor power line

## ● External wiring



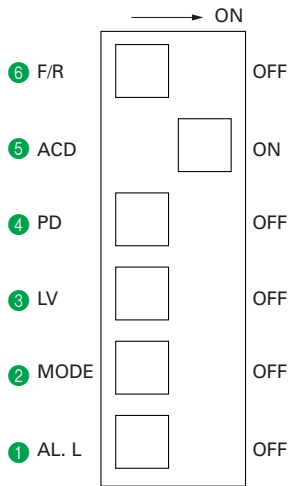
Note 1) Use a shielded twisted-pair cable.

Note 2) Either "2-input mode (CW pulse and CCW pulse)" or "Pulse and direction mode (CK+U/D)" can be selected by using the function selection switch F/R.

Note 3) From the stepping motor flange, ground with the stepping motor installation screw. Ground by single-point grounding.

## Operation, connection, and function

### ● Function Select Dipswitch ---5



- The setting shown above is the ex-factory setting.
- Turn off the power of the PM driver when changing the setting of the function selection dipswitch.

**1 AL. L (Alarm output logic selection)**  
The alarm output logic of the I/O signal connector (CN1) can be selected.

AL. L	Output logic
ON	On when alarm is on
OFF	Off when alarm is off

**2 MODE (Mode selection)**  
This switch is not used.  
Do not set to ON.

**3 LV (Low vibration mode selection)**  
Although the resolution is set to a rough one or two divisions, operation can be smooth and with low vibration.

LV	Operation
ON	Low vibration operation
OFF	Micro-step operation

**4 PD (Power down selection)**  
Selects the stepping motor current at the time of power down signal input.

PD	Stepping motor winding current
ON	Current specified by the selection switch STP (Power low)
OFF	0A (Power off)

**5 ACD (Automatic current reduction selection)**  
This switch is not used. Do not set to OFF.

**6 F/R (Pulse input method selection)**  
Selects the pulse input method.

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

### ● Step Angle Selection Switch(S.S) ---6

Specifies the number of divisions for the basic step angle during micro-step operation.

Scale	0	1	2	3	4	5	6	7	8	9
Number of divisions	1	2	2.5	4	5	8	10	20	40	40

- This switch is set to "1" at factory.

### ● Operating Current Selection Switch(RUN)---7

Selects the operating current value of the stepping motor.

Scale	0	1	2	3	4	5	6	7	8	9
Stepping motor current(%)	100(Rated)	95	90	85	80	75	70	65	60	55

- This switch is set to "0" at factory.

### ● Non-Operating Current Selection Switch(STP)---8

Selects the stepping motor current value for non-operating mode (automatic count reduction mode) and power down input signal ON mode (power low function selected by dipswitch).

Scale	1	2	3	4
Stepping motor current(%)	70	60	50	40

- The ratio is based on the operating current selected by RUN.
- This switch is set to "3" at factory.

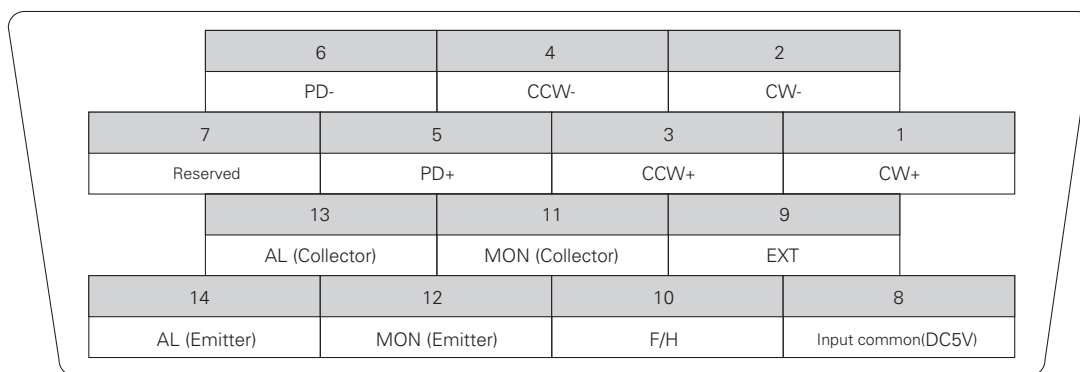
## Operation, connection, and function

### ● I/O Signal Function (CN1)---9

Signal Name	Abbreviation	Pin Number	Function
CW pulse input (Standard)	CW+	1	When using "2-input mode" Inputs drive pulse for clockwise rotation
	CW-	2	
Pulse column input	CK+	1	When using the "Pulse and direction mode" Inputs drive pulse column for the stepping motor rotation.
	CK-	2	
CCW pulse input (Standard)	CCW+	3	When using the "2-input mode" Inputs drive pulse for counterclockwise rotation.
	CCW-	4	
Rotation direction input	U/D+	3	Inputs signal for the stepping motor rotation direction when using the "Pulse and direction mode". The internal photo coupler is ON ..... clockwise direction The internal photo coupler is OFF ..... counterclockwise direction
	U/D-	4	
Power down input	PD+	5	PD signal input cuts off the stepping motor current (turns off the power). (Power down mode can be changed to the power low mode using the dipswitch.) PD input signal is ON (the internal photo coupler is ON) ..... PD function is valid. PD input signal is OFF (the internal photo coupler is OFF) ..... PD function is not valid.
	PD-	6	
Step angle selection input	EXT	8	EXT signal input makes the FULL/HALF selection input valid. EXT input signal is ON (the internal photo coupler is ON) ..... External input signal F/H is valid. EXT input signal is OFF (the internal photo coupler is OFF) ..... The main unit rotary switch S.S is valid.
		9	
FULL/HALF selection input	F/H	8	When the EXT input signal is on (the internal photo coupler is ON) F/H input signal is ON (the internal photo coupler is ON) ..... 2-division setting. F/H input signal is OFF (the internal photo coupler is OFF) ... 1-division setting
		10	
Phase origin monitor output	MON (Collector)	11	When excitation phase is at the origin (that is when the power is turned on), this signal is output. When 1-division is specified, the signal is output every 10 pulses. When 2-division is specified, the signal is output every 20 pulses.
	MON (Emitter)	12	
Alarm output	AL (Collector)	13	Outputs signal externally when an alarm circuit is activated in the PM driver. The stepping motor becomes unexcited state.
	AL (Emitter)	14	

- The clockwise (CW) rotation mentioned above is clockwise rotation when viewed from the output shaft (flange side).  
The counterclockwise (CCW) rotation is counterclockwise rotation when viewed from the output shaft (flange side).

### ● Arrangement of the connector terminals (CN1)



Arrangement of the CN1 Connector Terminals

\*The chart shown above is viewed from the connection section of the connector plug.

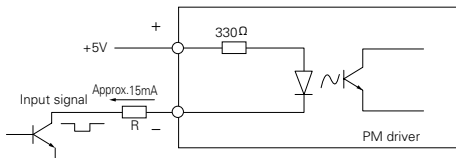
### ● Connectors

PM driver side		Applicable Connector model number	Manufacturer
Used for	Model number		
I/O signal (CN1)	10214-52A2JL	Applicable plug:10114-3000VE Applicable shell:10314-52A0-008	Sumitomo 3M
AC power (CN2)	1-178138-3	Applicable housing:1-178128-3 Applicable contact:1-175218-3	Japan AMP
Stepping motor (CN3)	1-316131-3	Applicable housing:1-178128-6 Applicable contact:1-175217-3	Japan AMP

- Regarding 103H8958□ type stepping motor, the applicable terminal model number for CN3 is "1-175218-3".
- Either the applicable connectors should be prepared by the user or the optional connector set should be ordered in accordance with the stepping motor (refer to options in page 142).

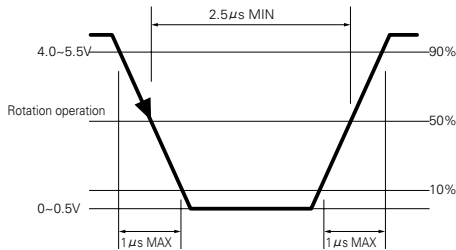
## Operation, connection, and function

### Input Circuit (CW, CCW)



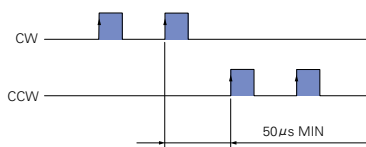
- Pulse duty is 50 % MAX
- When the peak value of the input signal is 5V, the external limit resistance R is 0 Ω. If the peak value exceeds 5V, set the input current to approximately 15mA using the external limit resistance R.

### Input signal specifications



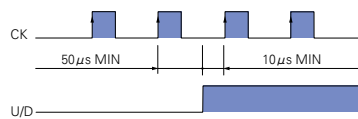
### Timing of the command pulse

#### • 2-input mode (CW, CCW)



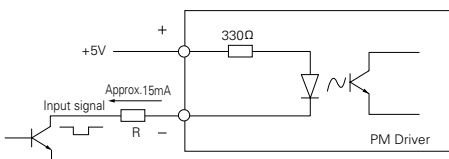
- The internal photo coupler turns ON at [blue square], and the internal circuit (stepping motor) operates at the leading edge of the photo coupler "ON".
- When applying the pulse to CW, set the internal photo coupler on the CCW side to "OFF".
- When applying the pulse to CCW, set the internal photo coupler on the CW side to "OFF".

#### • Pulse and direction mode (CK, U/D)



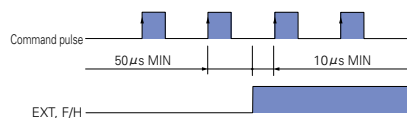
- The internal photo coupler turns ON at [blue square], and the internal circuit (stepping motor) operates at the leading edge of the CK photo coupler "ON".
- Before switching to the U/D input signal, turn OFF the internal photo coupler on the CK side.

### Input Circuit (PD, EXT, F/H)



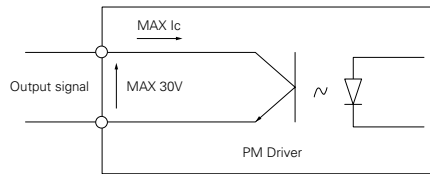
- When the peak value of the input signal is 5V, the external limit resistance R is 0Ω. If the peak value exceeds 5V, set the input current to approximately 15mA using the external limit resistance R.

### Timing of the command pulse, step angle selection, and FULL/HALF selection input signal



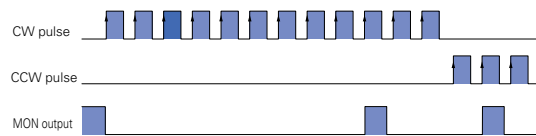
## Operation, connection, and function

### ● Output Circuit (MON, AL)



- MON, AL output signal  
Contact type: Open collector output by the photo coupler  
Contact capacity: DC30V  
MAX Ic current  
MON output: 5mA MAX  
AL output: 20mA MAX

### MON, AL output signal

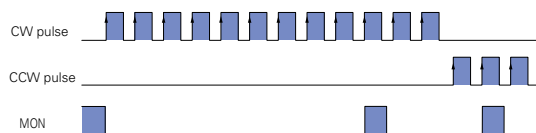


- The internal photo coupler turns "ON" at ■.

### ● State Indication (LED)

Indication	Color	Explanation
POW turns on.	Green	Internal power has been established.
MON turns on.	Green	Excitation phase is at the origin (the power is turned on). When 1-division is specified, turns on once in 10 pulses. When 2-division is specified, turns on once in 20 pulses.
PM turns on.	Green	Command pulse is being input. Turns on for approximately 100ms for every one pulse input.

### ● Timing of MON lighting (1-division setting)



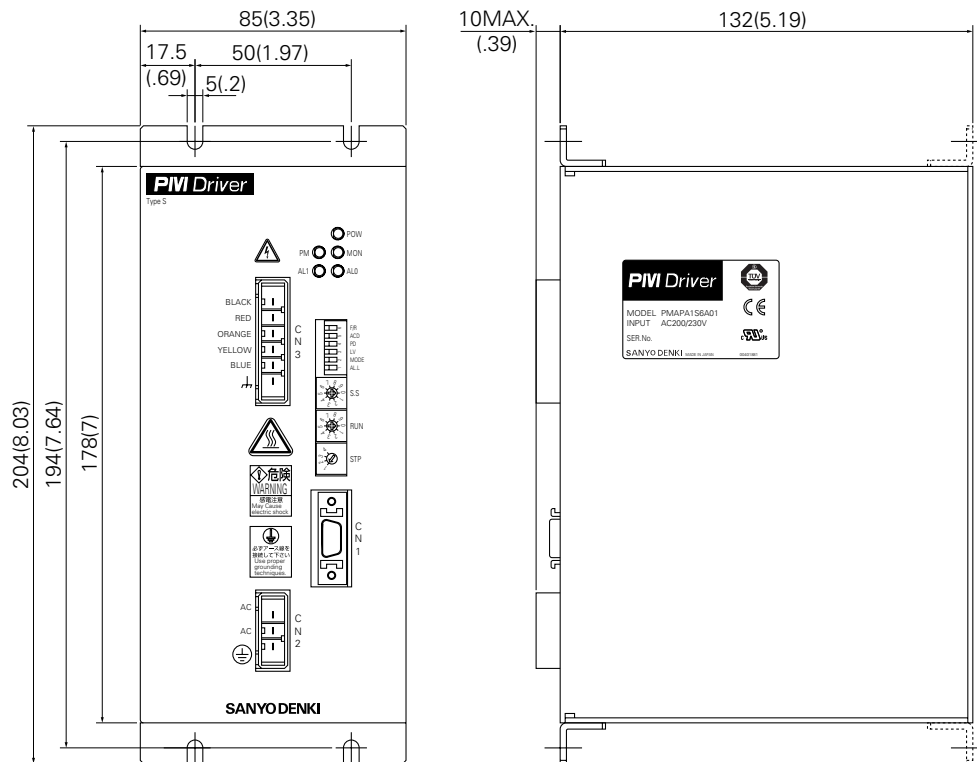
- The internal photo coupler turns "ON" at ■, and MON turns on.

### ● Alarm Indication (LED)

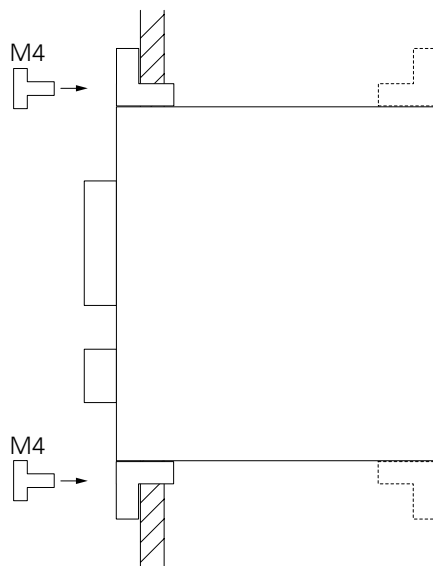
Indication	Color	Explanation
AL0 turns on.	Red	The main source voltage monitoring alarm circuit is operating.
		Source voltage specifications
		Undervoltage (U.V)
		Overvoltage (O.V)
AL1 turns on.	Red	The circuit operates under either of the conditions mentioned above..
AL0 and AL1 turn on.	Red	The circuit operates under either of the conditions mentioned above..

- Each alarm circuit operation turns on alarm LED and cuts off the current of the stepping motor to cause unexcited state.  
Simultaneously signal is output externally from the alarm output terminal (AL) of the I/O signal connector (CN1).  
Once an alarm circuit operates, the state is maintained, and the alarm state is reset by restarting.  
Correct the error before restart.

## Dimensions [Unit:mm(inch)]



## Installation Direction and the Position to be Installed

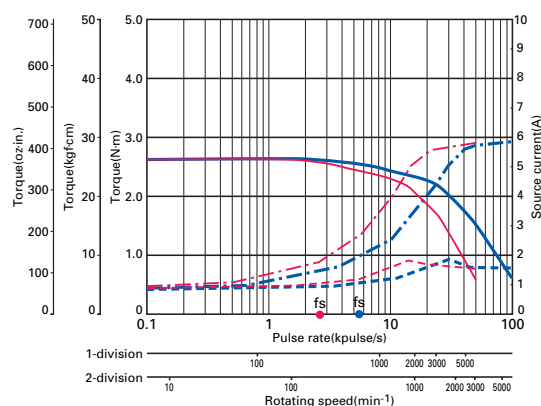


- Install the PM driver vertically.
- As shown in the figure, fix the PM driver, using the M4 screws through the holes in the fitting metals on the front side of the driver.
- The fitting metals on the front can be removed (fixed onto the PM driver by screws) so that they are used on the back of the driver.



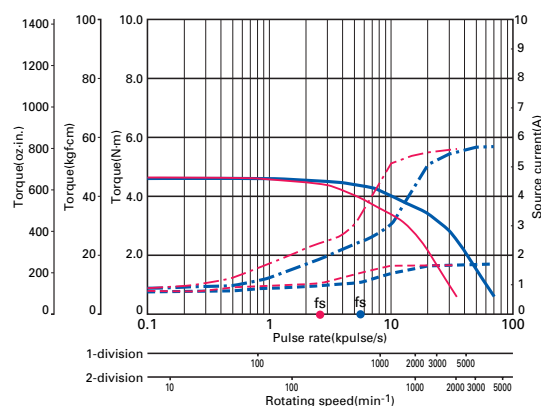
# Pulse rate-torque characteristics/pulse rate-source current characteristics

● 103H8581-80 □□ :200V



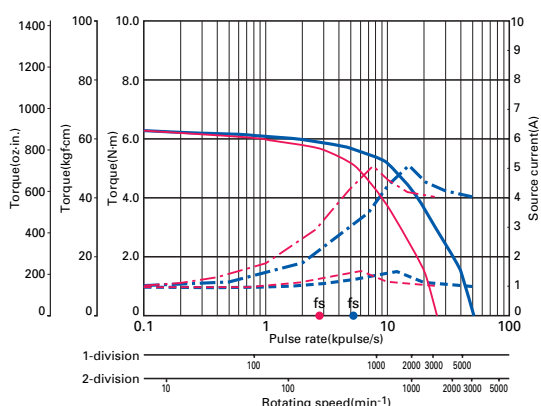
Source voltage: AC200V-Operating current: 1.5 A/phase  
 — Pull-out torque ( $J_L=7.4 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  [40.46 oz·in<sup>2</sup>] Use the rubber coupling)  
 - - - Source current ( $T_L=\text{MAX}$ ) - - - Source current ( $T_L=0$ )  
 fs: No load maximum starting pulse rate  
 ■ 1-division is specified ■ 2-division is specified

● 103H8582-80 □□ :200V



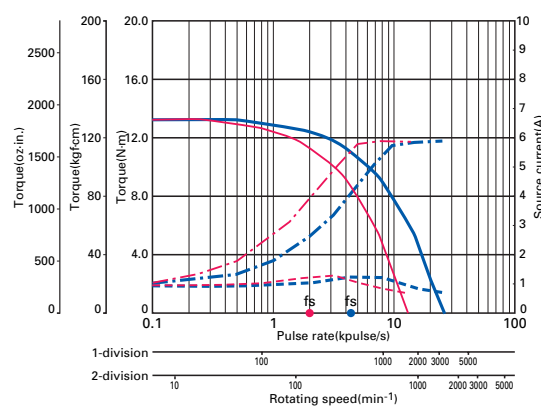
Source voltage: AC200V-Operating current: 1.5 A/phase  
 — Pull-out torque ( $J_L=15.3 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  [83.65 oz·in<sup>2</sup>] Use the rubber coupling)  
 - - - Source current ( $T_L=\text{MAX}$ ) - - - Source current ( $T_L=0$ )  
 fs: No load maximum starting pulse rate  
 ■ 1-division is specified ■ 2-division is specified

● 103H8583-80 □□ :200V



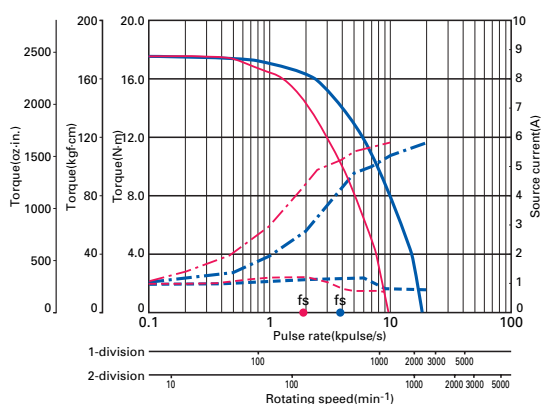
Source voltage: AC200V-Operating current: 1.5 A/phase  
 — Pull-out torque ( $J_L=43 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  [235.10 oz·in<sup>2</sup>] Use the rubber coupling)  
 - - - Source current ( $T_L=\text{MAX}$ ) - - - Source current ( $T_L=0$ )  
 fs: No load maximum starting pulse rate  
 ■ 1-division is specified ■ 2-division is specified

● 103H89582-80 □□ :200V



Source voltage: AC200V-Operating current: 1.5 A/phase  
 — Pull-out torque ( $J_L=43 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  [235.10 oz·in<sup>2</sup>] Use the rubber coupling)  
 - - - Source current ( $T_L=\text{MAX}$ ) - - - Source current ( $T_L=0$ )  
 fs: No load maximum starting pulse rate  
 ■ 1-division is specified ■ 2-division is specified

● 103H89583-80 □□ :200V



Source voltage: AC200V-Operating current: 1.5 A/phase  
 — Pull-out torque ( $J_L=43 \times 10^{-4} \text{ kg} \cdot \text{m}^2$  [235.10 oz·in<sup>2</sup>] Use the rubber coupling)  
 - - - Source current ( $T_L=\text{MAX}$ ) - - - Source current ( $T_L=0$ )  
 fs: No load maximum starting pulse rate  
 ■ 1-division is specified ■ 2-division is specified

## Option

### ● Connector Set

Model Number	Components of the Connector Set		Stepping motors to be Combined
PM-AP-023	For signal (CN1)	Applicable plug:10114-3000VE Applicable shell:10314-52A0-008	Type 103H8958 □
	For AC power (CN2)	Applicable housing:1-178128-3 Applicable contact:1-175218-3	
	For stepping motor(CN3)	Applicable housing:1-178128-6 Applicable contact:1-175218-3	
PM-AP-024	For signal (CN1)	Applicable plug:10114-3000VE Applicable shell:10314-52A0-008	Type 103H858 □
	For AC power (CN2)	Applicable housing:1-178128-3 Applicable contact:1-175218-3	
	For stepping motor(CN3)	Applicable housing:1-178128-6 Applicable contact:1-175217-3	

□ :Serial number

- The connector set consists of the contacts and housings for the I/O signal, AC power, and stepping motor required for one shaft.
- The model number of the connector set differs depending on the combined stepping motor. Before ordering the connector set, check the combined stepping motor model number.

### ● Connector cable

Model Number	Application
PM-C14S0100-01	Connector cable for I/O signals (CN1)
PM-C03P0100-01	Connector cable for AC power source (CN2)
PM-C06M0100-□□	Connector cable for stepping motors (CN3)

□□ are spaces to be filled by the serial number 09 or 10 (refer to Supplement table 1).

- The connector cable is a 1-meter cable assembled with the connector.

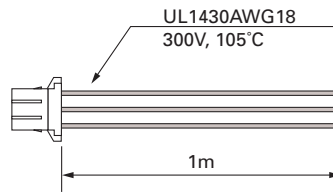
### Stepping motor cable model number (Supplement table 1)

	Model Number
09	103H8581-80□□
	103H8582-80□□
	103H8583-80□□
10	103H89582-80□□
	103H89583-80□□

## Option

### ● Cable 1 (power cable)

Driver side	
Pin number	Color
1	White
2	Black
3	Green

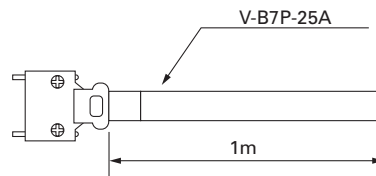


Cable model number	Length
PM-C03P0100-02	1m

### ● Cable 2 (I/O signal cable)

Driver side	
Pin number	Color
1	Red
2	Red*
3	Black
4	Black*
5	Green
6	Green*
7	
8	Yellow/Orange
9	Yellow
10	Orange
11	Blue
12	Blue*
13	Brown
14	Brown*

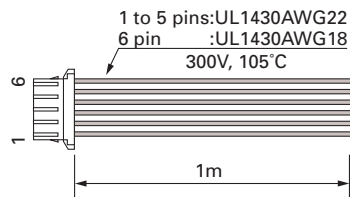
The pin marked with  has no connection.  
\*: White spiral



Cable model number	Length
PM-C14S0100-01	1m

### ● Cable 3 (stepping motor extension cable 1)

Driver side	
Pin number	Color
1	Black
2	Red
3	Orange
4	Yellow
5	Blue
6	Green

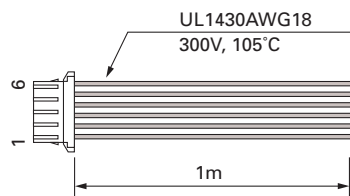


Cable model number	Length
PM-C06M0100-09	1m

Applicable stepping motors	
103H8581-80	<input type="checkbox"/>
103H8582-80	<input type="checkbox"/>
103H8583-80	<input type="checkbox"/>

### ● Cable 4 (stepping motor extension cable 2)

Driver side	
Pin number	Color
1	Black
2	Red
3	Orange
4	Yellow
5	Blue
6	Green



Cable model number	Length
PM-C06M0100-10	1m

Applicable stepping motors	
103H89582-80	<input type="checkbox"/>
103H89583-80	<input type="checkbox"/>