The 5-Phase Stepping Driver

PMAPA1S6B01
AC100V/115V
Micro-step (500 x 1 to 40 divisions)

● Applicable motors

□60 ø60 ø86 ø106

Characteristics

● **Conformity to UL Standards and CE Marking**
This driver 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**
Rush current prevention circuit built in the power circuit section improves the operation reliability when turning ON the power.

● **Connectors used for the PM driver I/O cable**
Connectors are employed for the high voltage section terminal in place of ourconventional model terminal block. Resulting operability is improved for the PM driver installation, maintenance, etc.

● **Alarm output signal logic selectable**
Signal logic output during the alarm circuit operation can be selected.

Built-in function

● **Low vibration mode**
Resolutions set to a rough 1- or 2-division enable smooth and low-vibration operations as same as one using the micro-step function. However, the low vibration mode and the micro-step function cannot be used simultaneously.

● **Micro-step function**
Resolutions set by using the rotary switch enable the micro-step drive.
However, the low vibration mode and the micro-step function cannot be used simultaneously.

● **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 resolutions ranging from 1- to 40-division can be set for the basic step angle of stepping motor by using the rotary switch.

● **Operation current switchover function**
Stepping motor operation current ranging from the rated one to 55% can be easily set by using the rotary switch.

● **Stopping current adjustment function**
Operation current when stopping the stepping motor can be set at 70% to 40% of specified operation current by using the selection switch.

□60 ø60 ø86 ø106 5 Phase

PM driver specifications

Item			PMAPA1S6B01
Standard specifications		Input source	Single phaseAC100V/115V+10,-15% 50/60Hz
		Source current	6A
	Environment	Protection class	Class Ⅰ
		Operating environment	Installation category (overvoltage category): Ⅲ, 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	Maximum 1000 m above sea level
		Vibration resistance	Tested under the following conditions: Frequency range: 10 to 55 Hz, 0.5 G along the X, Y, and Z axes for 2 hours
		Impact resistance	No abnormality for the NDS-C-0110 Standard, Section 3.2.2, Division "C".
		Withstand voltage	No abnormality against an AC 1500 V application between the power input terminal and the cabinet for one minute.
		Insulation resistance	Minimum 10 MΩ when applying the DC 500 V Megger between the power input terminal and the cabinet.
		Mass(Weight)	0.95kg(2.09 lbs)
Function		Protection function	Against PM driver overheat, main circuit power abnormality, and over current.
		Selection function	Pulse input system, automatic current reduction, power down, low-vibration mode, step angle, operation current, and stopping current.
		LED indicator	Power supply monitor, phase origin monitor, pulse monitor, and alarm indication
I/O signal		Command pulse input signal	Photocoupler input system, input resistance 330 Ω Input signal voltage: "H" level: 4.0 to 5.5 V, "L" level: 0 to 0.5 V Maximum input frequency
		Power down input signal	Photocoupler input system, input resistance 330 Ω Input signal voltage: "H" level: 4.0 to 5.5 V, "L" level: 0 to 0.5 V
		Step angle selection input signal	Photocoupler input system, input resistance 330 Ω Input signal voltage: "H" level: 4.0 to 5.5 V, "L" level: 0 to 0.5 V
		FULL/HALF selection input signal	Photocoupler input system, input resistance 330 Ω Input signal voltage: "H" level: 4.0 to 5.5 V, "L" level: 0 to 0.5 V
		Phase origin monitor output signal	Open collector output by photocoupler Output signal standard Vceo: Maximum 30 V, Ic: Maximum 5 mA
		Alarm output signal	Open collector output by photocoupler Output signal standard Vceo: Maximum 30 V, Ic: Maximum 5 mA

UL Standard and CE Marking

Product	UL standard		CE Marking		
	Applied standard	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 do not conform to UL Standard and CE Marking.Use the "STEPSYN M" series when the conformity is required.
- For the "STEPSYN M" series conformity, refer to the 5-Phase Stepping Motor Unit "BP2" Series (page 41 and after)
- See p.45 for recommended EMC-prevention component.

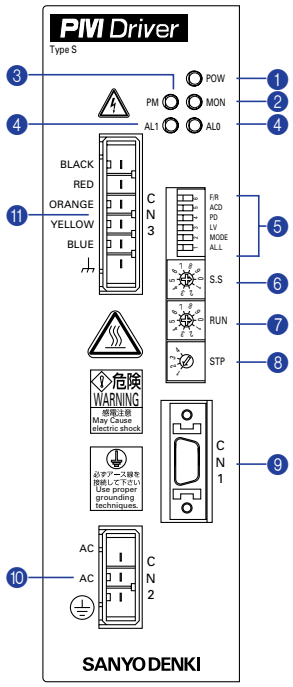
Standard Combination of the stepping motor

Stepping motor dimensions	Stepping motor model number		Holding torque	Rotor inertia	Mass(Weight)	page
	Single shaft	Double shaft	N·m(oz·in)	×10^{-4}kg·m^2(oz·in^2)	kg(lbs)	
□60mm	103H7852-8051 103H7853-8051	103H7852-8021 103H7853-8021	0.98(138.8) 1.86(263.4)	0.4(2.19) 0.84(4.59)	0.78(1.72) 1.36(3.00)	page 305
ø60mm	103H7522-8051 103H7523-8051	103H7522-8021 103H7523-8021	0.735(104.1) 1.568(222.0)	0.18(0.98) 0.423(2.31)	0.6(1.32) 1.1(2.43)	page 307
ø86mm	103H8581-8041 103H8582-8041 103H8583-8041	103H8581-8011 103H8582-8011 103H8583-8011	2.06(291.7) 4.02(569.3) 6.17(873.7)	1.45(7.93) 2.9(15.86) 4.4(24.06)	1.5(3.31) 2.5(5.51) 3.5(7.72)	page 309
ø106mm	103H89582-8041 103H89583-8041	103H89582-8011 103H89583-8011	10.8(1529.4) 16(2265.7)	14.6(79.83) 22(120.28)	7(15.43) 10.4(22.93)	page 311

- For the general specifications and dimensions of each stepping motor, refer to the reference pages

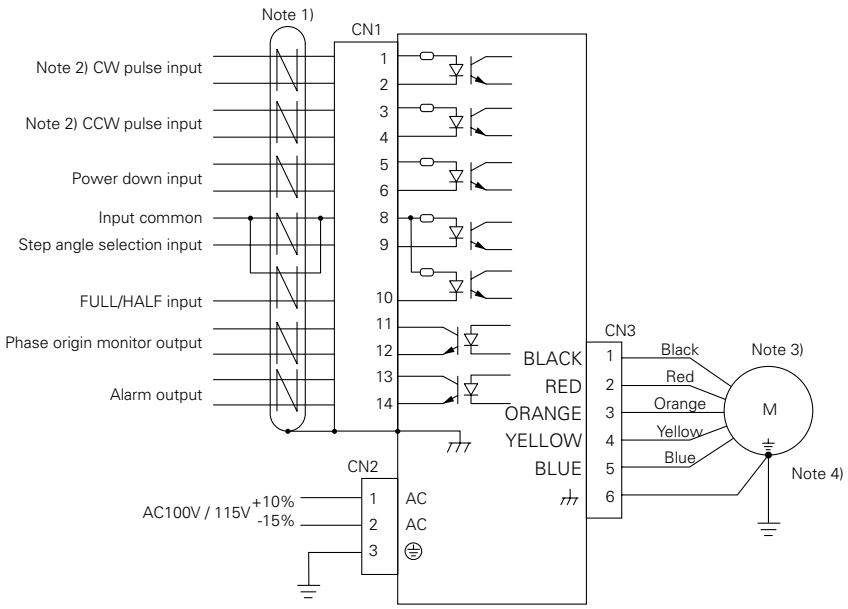
Operation, connection, and function

Each section name of the PM driver



1. Internal power establishment (POW) ····· Indicates that the internal power is established.
2. Phase origin monitor (MON) ····· Indicates that the excitation phase is at the origin (in the state when the power is turned ON)
3. Input pulse monitor (PM) ····· Indicates that the input pulse is applied
4. Alarm monitor(AL0 and AL1) ····· Turns ON when the internal alarm circuit operates.
5. Function selection dipswitch ····· Functions can be selected according to the specification. (F/R,ACD,PD,LV,MODE,AL.L)
6. Step angle selection switch (S.S) ····· Basic step angle of stepping motor can be divided into maximum 40 divisions.
7. Operation current selection switch (RUN) ····· Stepping motor current value during operation can be selected.
8. Stopping current selection switch (STP) ····· The current to stop the stepping motor can be selected in the range from 70% to 40% when the automatic currentreduction function is operated.
9. Connector for I/O signal (CN1) ··· The I/O signal is connected.
10. Power input connector (CN2) ····· Single-phase AC power is connected.
11. Motor output connector (CN3) ····· The stepping motor power line is connected.

External wiring diagram



Note 1) Use shielded twisted-pair cables

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

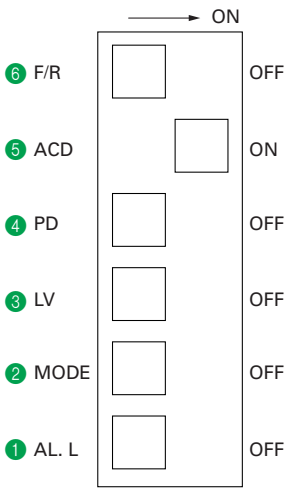
Note 3) Refer to the following table when connecting the 103H785 ** type stepping motor:

Product	Connector pin number				
PM driver (CN3)	1	2	3	4	5
Stepping motor connector	1	4	3	2	5

Note 4) Ground the stepping motor flange section and thestepping motor fastening screw by fixing them together. In addition, use a single point grounding

Operation, connection, and function

● Function selection dipswitch ---5



- Settings at the shipment are shown above.
- Turn OFF the PM driver power before changing switch settings to change the function selection dipswitch settings.

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

AL. L	Output logic
ON	Alarm is ON.
OFF	Alarm is OFF.

2 MODE (mode selection)
This switch is not used.
Do not turn ON this switch.

3 LV (low vibration mode selection)
Smooth operation with low vibration is enabled even when a rough resolution (1-, 2-division, etc) is set.

LV	Operation
ON	Low-vibration operation
OFF	Micro-step operation

4 PD (power down selection)
The stepping motor current value at the power down signal input is selected.

PD	Stepping motor windings current
ON	Current value of the selection switch STP (power low)
OFF	OA (power OFF)

5 ACD (automatic current reduction selection)
This switch is not used. Do not turn OFF this switch.

6 F/R (pulse input system selection)
A pulse input system is selected.

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

● Step angle selection switch (S. S) ---6

Number of basic step angle divisions during the micro-step drive is set.

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

- "1" is set at the shipment.

● Operation current selection switch (RUN) ----7

The operation current value of stepping motor can be selected.

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

- "0" is set at the shipment.

● Stopping current selection switch (STP) ---8

The stepping motor current value when the motor stops (at the automatic current reduction) and when the power down input signal is set to ON (the power low function is selected by dipswitches) can be selected.

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

- Percentages are for the operation current value selected by RUN.
- "3" is set at the shipment.

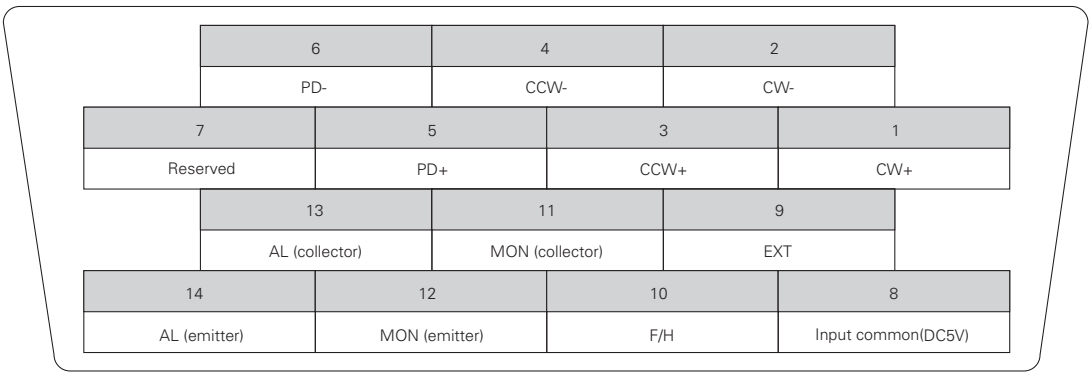
Operation, connection, and function

● I/O signal function (CN1) ---9

Signal name	Abbreviation	Pin number	Function
CW pulse input (standard)	CW+ CW-	1 2	When using "2-input mode" Drive pulse for the CW direction rotation is input.
Pulse column input	CK+ CK-	1 2	When using "Pulse and direction mode" Drive pulse train for the stepping motor rotation is input.
CCW pulse input (standard)	CCW+ CCW-	3 4	When using "2-input mode" Drive pulse for the CCW direction rotation is input.
Rotation direction input	U/D+ U/D-	3 4	The rotation direction signal of stepping motor is input for the "Pulse and direction mode". Internal photocoupler ON ····· CW direction Internal photocoupler OFF ····· CCW direction
Power down input	PD+ PD-	5 6	Inputting the PD signal cuts OFF the current flowing through the stepping motor(turns OFF the power). (The power down input can be changed to the power low function by selecting dipswitches.) PD input signal ON (internal photocoupler ON) ·····PD function enabled PD input signal OFF (internal photocoupler OFF)·····PD function disabled
Step angle selection input	EXT	8 9	Inputting the EXT signal enables the FULL/HALF selection input. EXT input signal ON (internal photocoupler ON)····· External input signal F/H enabled EXT input signal OFF (internal photocoupler OFF)····Main unit rotary switch S. S enabled
FULL/HALF selection input	F/H	8 10	When the EXT input signal is ON (internal photocoupler ON). F/H input signal ON (internal photocoupler ON) ····· 2-division setting F/H input signal OFF (internal photocoupler OFF)····1-division setting
Phase origin monitor output	MON (collector) MON (emitter)	11 12	It is turned ON when the excitation phase is at the origin (in the state when the power is turned ON) It is turned ON once per 10 pulses when setting to 2-division. It is turned ON once per 20 pulses when setting to 1-division.
Alarm output	AL (collector) AL (emitter)	13 14	The signal is externally output when one of several alarm circuits operates in the PM driver. At this time, the stepping motor is in the unexcited state.

- The CW rotation direction of stepping motor means the clockwise direction rotation as viewed from the output shaft side (flange side).
  The CCW rotation direction means the counterclockwise direction rotation as viewed from the output shaft side (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.

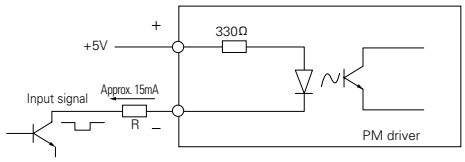
● Connectors to be used

PM driver side		Applicable connector model number	Manufacturer
Used for	Model number		
I/O signals (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 contactl: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 contact model number for CN3 is 1-175218-3.
- The applicable connectors should be either prepared by a user or ordered from the optional connector set for the specific stepping motor. (Refer to Option page 155.)

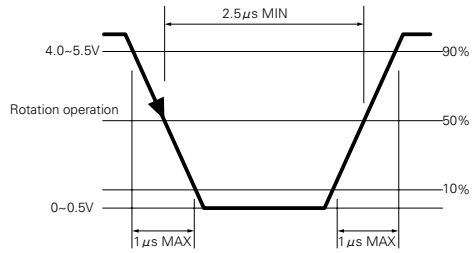
Operation, connection, and function

Input circuit configuration (CW and CCW)



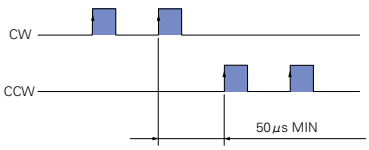
- Pulse duty is 50 % MAX.
- When the peak value of the input signal is 5V, the external limit resistance R is 0 Ω.
  If the peak value exceeds 5V, set the input current to approx. 15mA using the external limit resistance R.

Inputsignal specifications



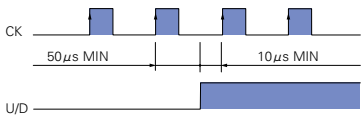
Timing of the command pulse

• 2-input mode (CW and CCW)



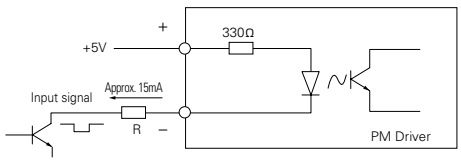
- The internal photocoupler turns ON at ■, and the internal circuit (steppingmotor)operates at the leading edge of the CK photocoupler "ON".
- When applying the pulse to CW, set the internal photocoupler on the CCW side to "OFF".
- When applying the pulse to CCW, set the internal photocoupler on the CW side to "OFF".

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



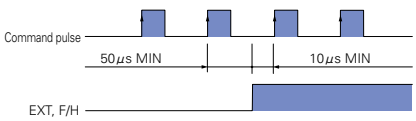
- The internal photocoupler turns ON at ■, and the internal circuit (steppingmotor)operates at the leading edge of the CK photocoupler "ON".
- Before switching the U/D input signals, turn OFF the internal photocoupler on the CK side.

Input circuit configuration (PD, EXT, F/H)



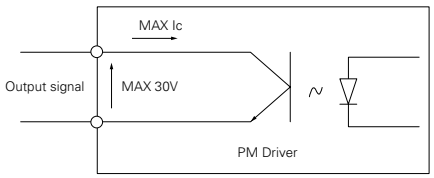
- When the peak value of the input signal is 5V, the external limit resistance R is 0 Ω.
  If the peak value exceeds 5V, set the input current to approx. 15mA using the external limit resistance R.

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



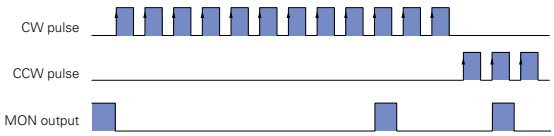
Operation, connection, and function

Output Circuit Configuration (MON, AL)



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

Timing of the MON output (when 1-division is specified)

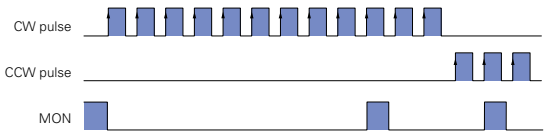


- The internal photocoupler turns "ON" at ■.

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. Command pulse is input.
PM turns ON.	Green	Turns on for Approx. 100ms for every one pulse input.

Timing of MON illumination (1-division setting)



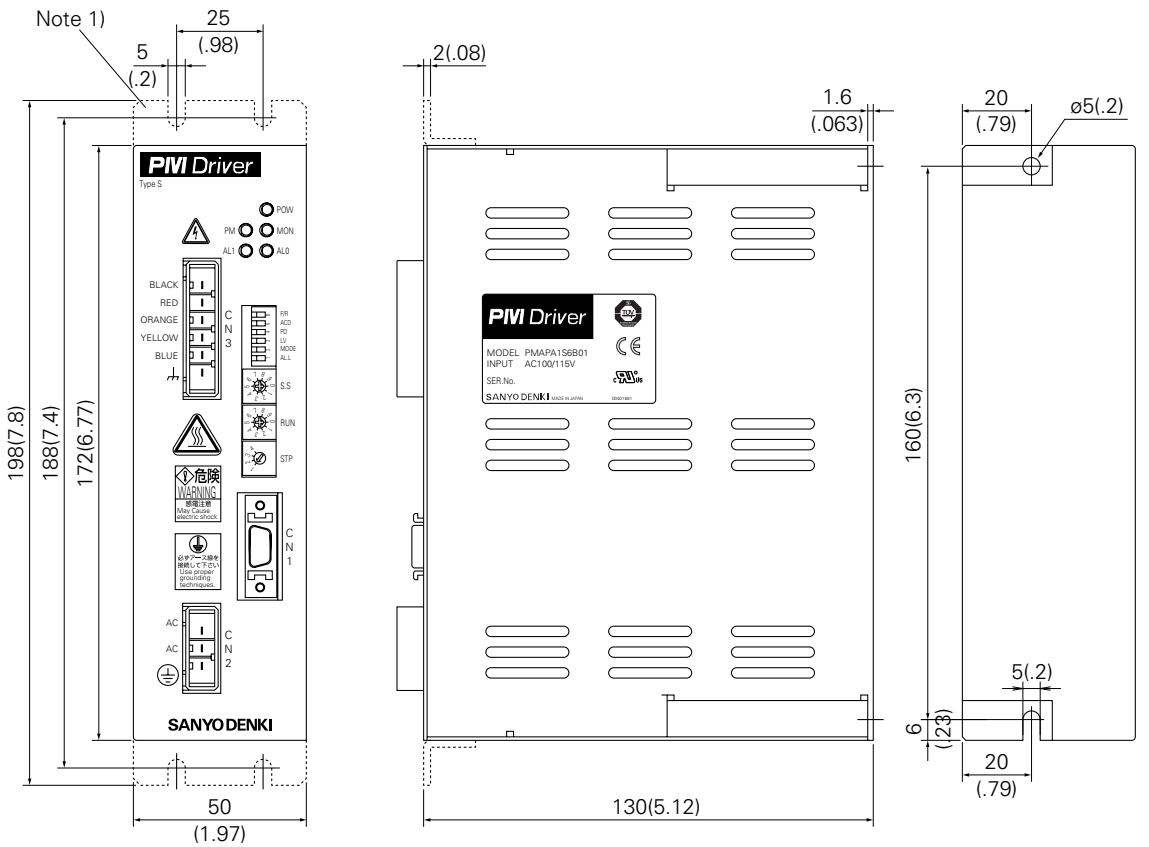
- The internal photocoupler turns "ON" at ■, and MON illuminates.

Alarm Indication (LED)

Indication	Color	Explanation
AL0 turns on.	Red	The main source voltage monitoring alarm circuit operates. Source voltage specifications: AC100V/115V Undervoltage (U.V): Less than AC 85 V Overvoltage (O.V): AC 127 V or higher The circuit operates under either of the conditions mentioned above.
AL1 turns on.	Red	The overheat protection alarm circuit of the internal device operates.The circuit operates when both the internal temperature of the PM driver and the ambient temperature become 80℃ MIN.
AL0 and AL1 turn on	Red	The internal device abnormality alarm operates.The alarm operates if an overcurrent or an abnormal overheating of the power device in the PM driver occurs.

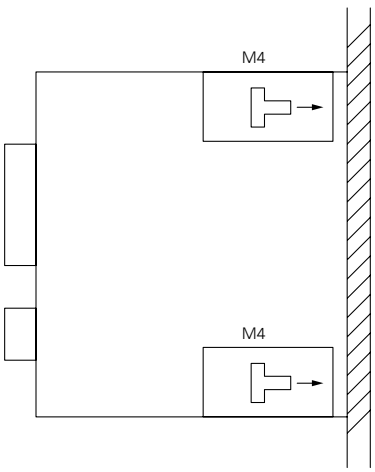
- Each alarm circuit operation turns on the alarm LED and cuts off the stepping motor current to result in the unexcited state.
  At the same time, the signal is output externally from the alarm output terminal (AL) of I/O signal connector (CN1).
  Once the alarm circuit operates, the state is maintained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

Dimensions [Unit:mm(inch)]



Note 1) Fitting metals are optional.

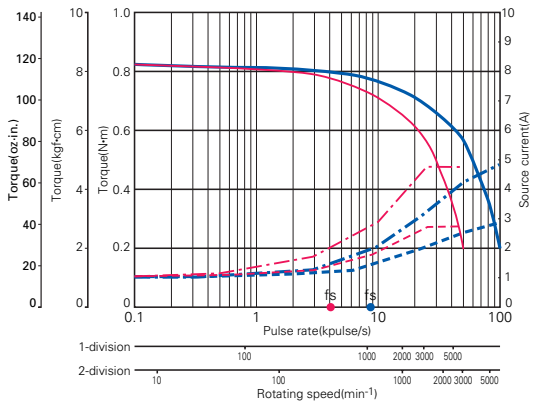
Installation Direction and the Position to be Installed



- Install the PM driver vertically.
- As shown in the figure, fix the PM driver by using the M4 screws through fitting holes on the back side of the driver (no fitting metals are necessary).
- The PM driver also can be installed on the front side by using the optional fitting metals for the front surface.

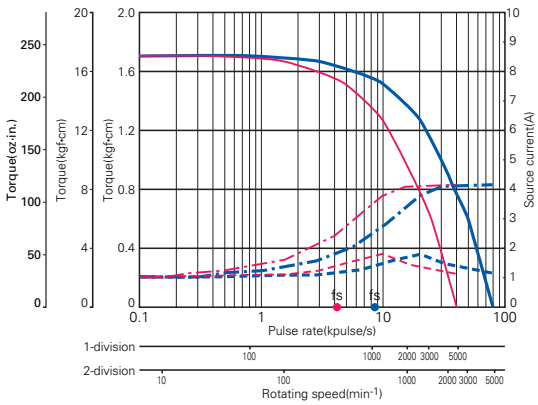
Pulse rate-torque characteristics/pulse rate-source current characteristics

●103H7522-80 □□ :100V



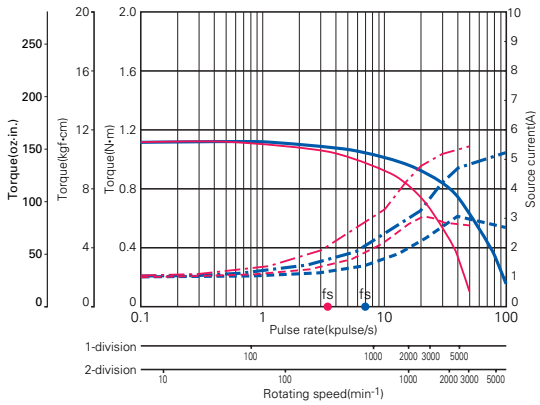
Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=2.6×10^{-4}kg·m^2 [14.22oz·in^2] Use the rubber coupling)
–·– Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

●103H7523-80 □□ :100V



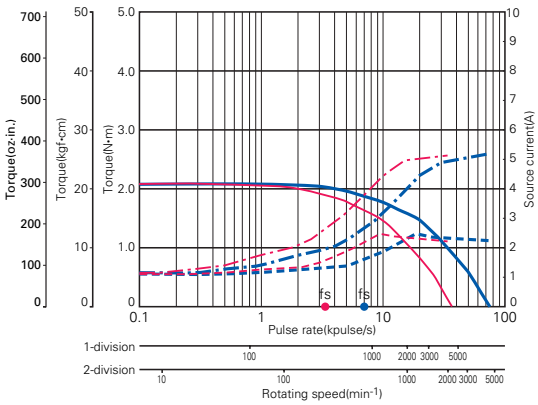
Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=7.4×10^{-4}kg·m^2 [40.46oz·in^2] Use the rubber coupling)
–·– Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

●103H7852-80 □□ :100V



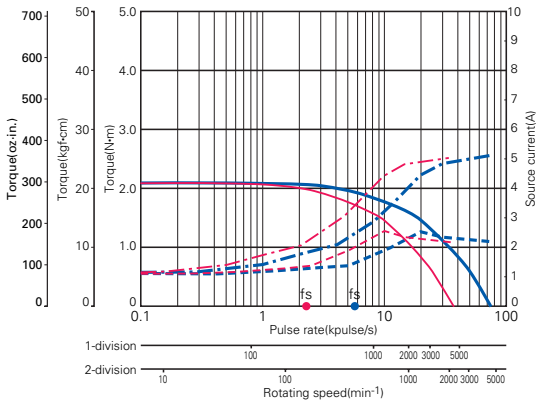
Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=2.6×10^{-4}kg·m^2 [14.22oz·in^2] Use the rubber coupling)
–·– Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

●103H7853-80 □□ :100V



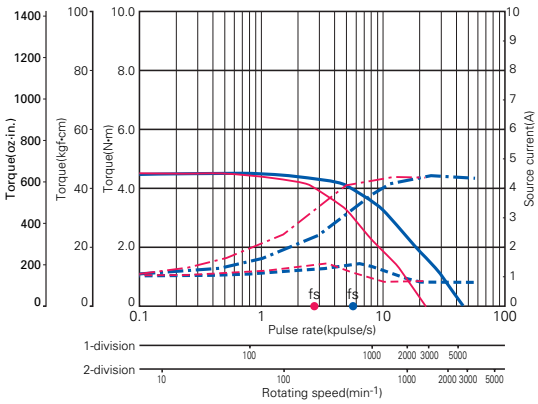
Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=7.4×10^{-4}kg·m^2 [40.46oz·in^2] Use the rubber coupling)
–·– Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

●103H8581-80 □□ :100V



Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=7.4×10^{-4}kg·m^2 [40.46oz·in^2] Use the rubber coupling)
–·– Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

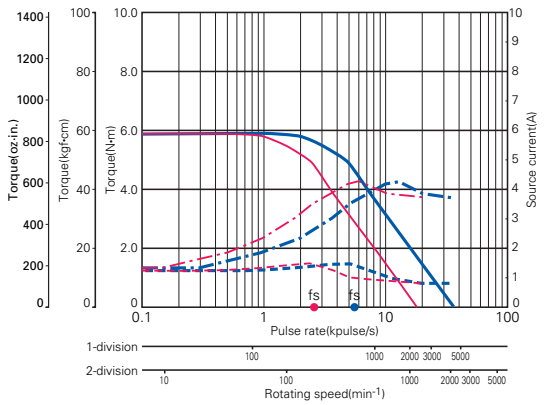
●103H8582-80 □□ :100V



Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=15.3×10^{-4}kg·m^2 [83.65oz·in^2] Use the rubber coupling)
–·– Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

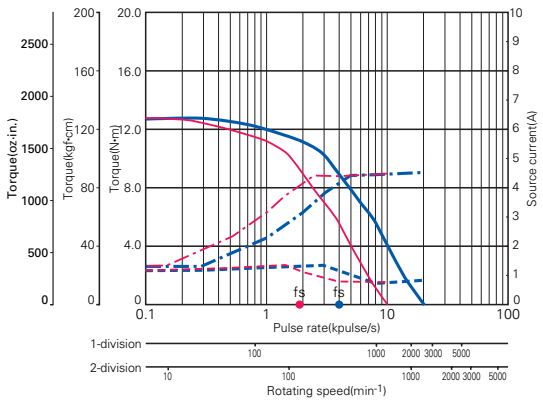
Pulse rate-torque characteristics/pulse rate-source current characteristics

●103H8583-80 □□ :100V



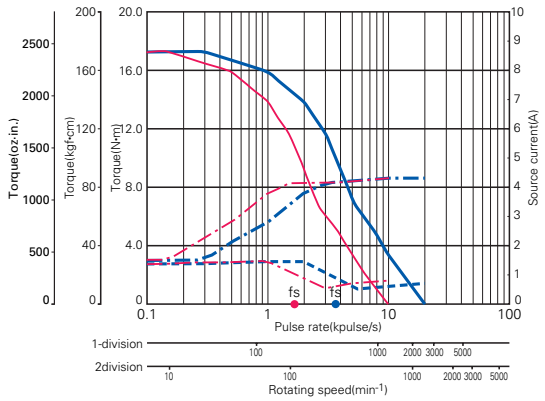
Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=43×10^{-4}kg·m^2 [235.10oz·in^2] Use the rubber coupling)
– · – Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

●103H89582-80 □□ :100V



Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=43×10^{-4}kg·m^2 [235.10oz·in^2] Use the rubber coupling)
– · – Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

●103H89583-80 □□ :100V



Source voltage:AC100V·Operating current: 1.5 A/phase
—— Pull-out torque(J_{L1}=43×10^{-4}kg·m^2 [235.10oz·in^2] Use the rubber coupling)
– · – Source current(T_L=MAX) – – – Source current(T_L=0)
fs:No load maximum starting pluse rate
■ 1-division is specified ■ 2-division is specified

Option

Connector set

Model number	Connector set configuration		Stepping motor combination
PM-AP-023	For signal (CN1)	Applicable plug:10114-3000VE Applicable shell:0314-52A0-008	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 ☐ 103H785 ☐ 103H752 ☐
	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.

Fitting metals

Model number	Quantity
PM-AP-022	One set

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)

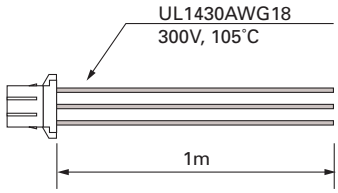
	Stepping motor model number
09	103H7852-80☐☐
	103H7853-80☐☐
	103H7522-80☐☐
	103H7523-80☐☐
	103H8581-80☐☐
	103H8582-80☐☐
	103H8583-80☐☐
10	103H89582-80☐☐
	103H89583-80☐☐

Option

● Cable 1 (power cable)

Driver side

Pin number	Color
1	White
2	Black
3	Green



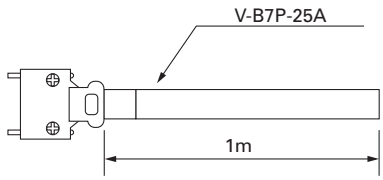
Cable model number	Length
PM-C03P0100-02	1m

● 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

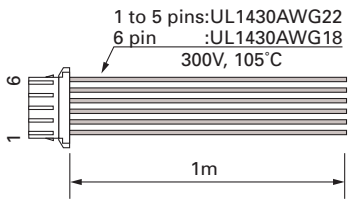


Cable model number	Length
PM-C14S0100-01	1m

● Cable 3 (stepping motor extension cable 1)

Driver side

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



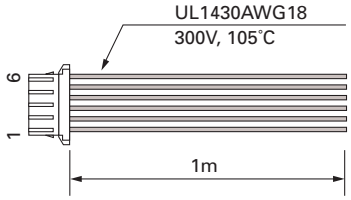
Cable model number	Length
PM-C06M0100-09	1m

Applicable stepping motors
103H7852-80☐☐
103H7853-80☐☐
103H7522-80☐☐
103H7523-80☐☐
103H8581-80☐☐
103H8582-80☐☐
103H8583-80☐☐

● 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☐☐
103H89583-80☐☐