

Stepping Motor Driver

CVD driver **S Type**

I/O setting

24 VDC input
2-phase/5-phase bipolar Microstepping drive

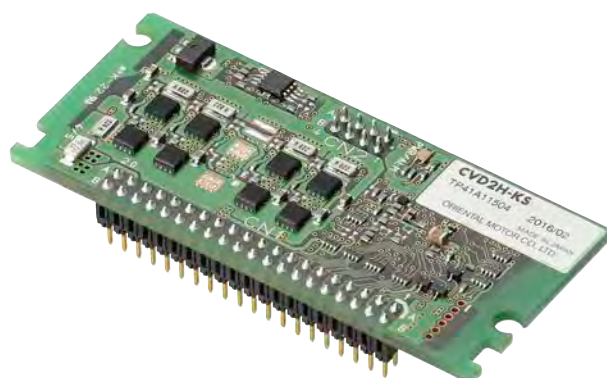


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Product introduction

■ Features

Driver module enabling to downsize equipment

- This is a board mounting type driver module allowing flexible design of equipment.
- Two installation directions, "horizontal placing" and "vertical placing," are available.
- Two setting methods, "I/O" and "SPI communication," are available to set parameters and motor selection.

Only an aluminum electrolytic capacitor required as an external component

- All functions required to drive a motor are equipped in the driver.
- Simply mounting an aluminum electrolytic capacitor on a mother board can operate a motor easily.
- Managing new components can be minimized.
- The mounting time of the driver circuit components can be shortened.

Possible to combine with motors of high-current specification

- Connecting a motor possible to combine can supply the rated current up to the maximum.
- Limiting the motor output will not be required in consideration of the heat generation of the driver circuit.

Same basic performance as CVK Series

- The basic performance is the same as the CVK Series.



■ Driver type

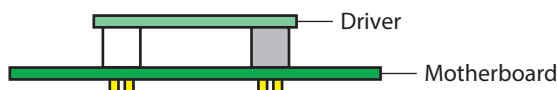
Number of phases	Model			
	I/O setting		SPI communication	
2-phase	CVD2H-K	CVD2V-K	CVD2H-KS	CVD2V-KS
5-phase	CVD5H-K	CVD5V-K	CVD5H-KS	CVD5V-KS

■ Motors for possible combinations

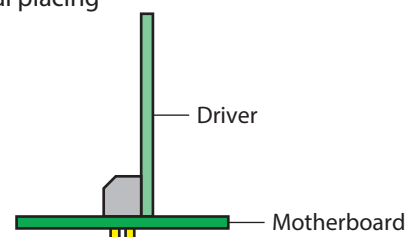
Driver				Motor rated current (A/phase)
Setting method	Number of phases	Installation direction	Model	
I/O	2-phase	Horizontal placing	CVD2H-K	0.5, 0.6, 0.85, 1.4, 1.5, 2.3, 2.8
		Vertical placing	CVD2V-K	
	5-phase	Horizontal placing	CVD5H-K	
		Vertical placing	CVD5V-K	
SPI communication	2-phase	Horizontal placing	CVD2H-KS	0.5, 0.6, 0.85, 1.4, 1.5, 2.3, 2.8
		Vertical placing	CVD2V-KS	
	5-phase	Horizontal placing	CVD5H-KS	
		Vertical placing	CVD5V-KS	

■ Installation direction (2 types)

- Horizontal placing



- Vertical placing



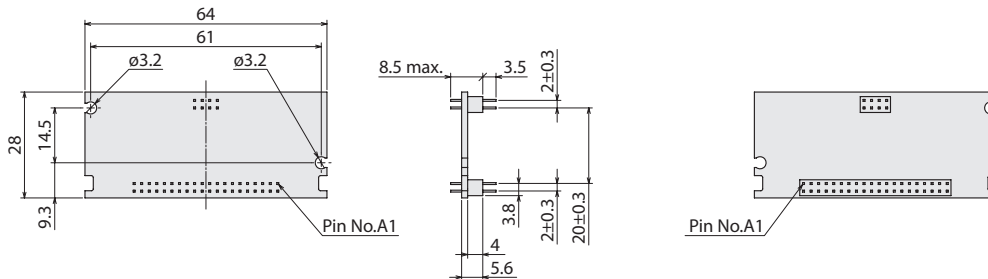
■ Dimension (unit: mm)

● Horizontal placing

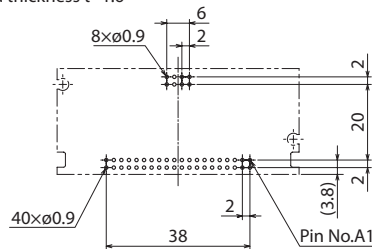
Number of phases	Model
2-phase	CVD2H-K
	CVD2H-KS
5-phase	CVD5H-K
	CVD5H-KS

● Pin header

CN1	IMSA-9224B-40Z10-GF (IRISO ELECTRONICS CO., LTD.)
CN2	IMSA-9220B-08Z89-GF (IRISO ELECTRONICS CO., LTD.)



- Recommended dimension for mounting holes on circuit board
(Dimension of holes seen from your equipment)
Recommended board thickness $t=1.6$

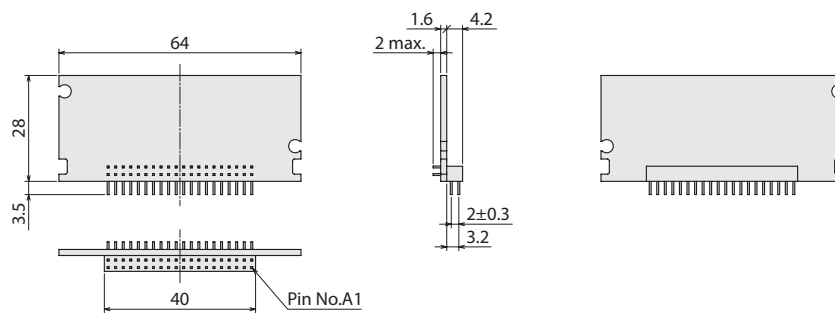


● Vertical placing

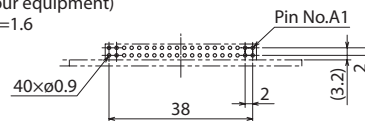
Number of phases	Model
2-phase	CVD2V-K
	CVD2V-KS
5-phase	CVD5V-K
	CVD5V-KS

● Pin header

CN1	IMSA-9224B-40A-GF (IRISO ELECTRONICS CO., LTD.)
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- Recommended dimension for mounting holes on circuit board
(Dimension of holes seen from your equipment)
Recommended board thickness $t=1.6$



■ Function setting method

Driver functions are set via I/O or SPI communication.

With the driver of SPI communication, select whether to use I/O or SPI communication to set the driver functions.

Differences between I/O setting and SPI communication setting are shown in the table below.

Function	I/O setting	SPI communication	
	Setting via I/O	Setting via I/O	Setting via SPI communication
Resolution	○	×	○
Motor frame size	○	○	○
Pulse input mode	○	×	○
Smooth drive	○	○	○
Command filter	× (Always OFF)	×	○
Operating current	○	○	○
Standstill current	○	○	○
Excitation ON/OFF	○	○	○
Alarm	○	○	○
Positioning operation	Operation by inputting pulses		

1 Before use

Only qualified personnel should work with the product.

Use the product correctly after thoroughly reading the "2 Safety precautions" on p.7. In addition, be sure to observe the contents described in warning, caution, and note in this document.

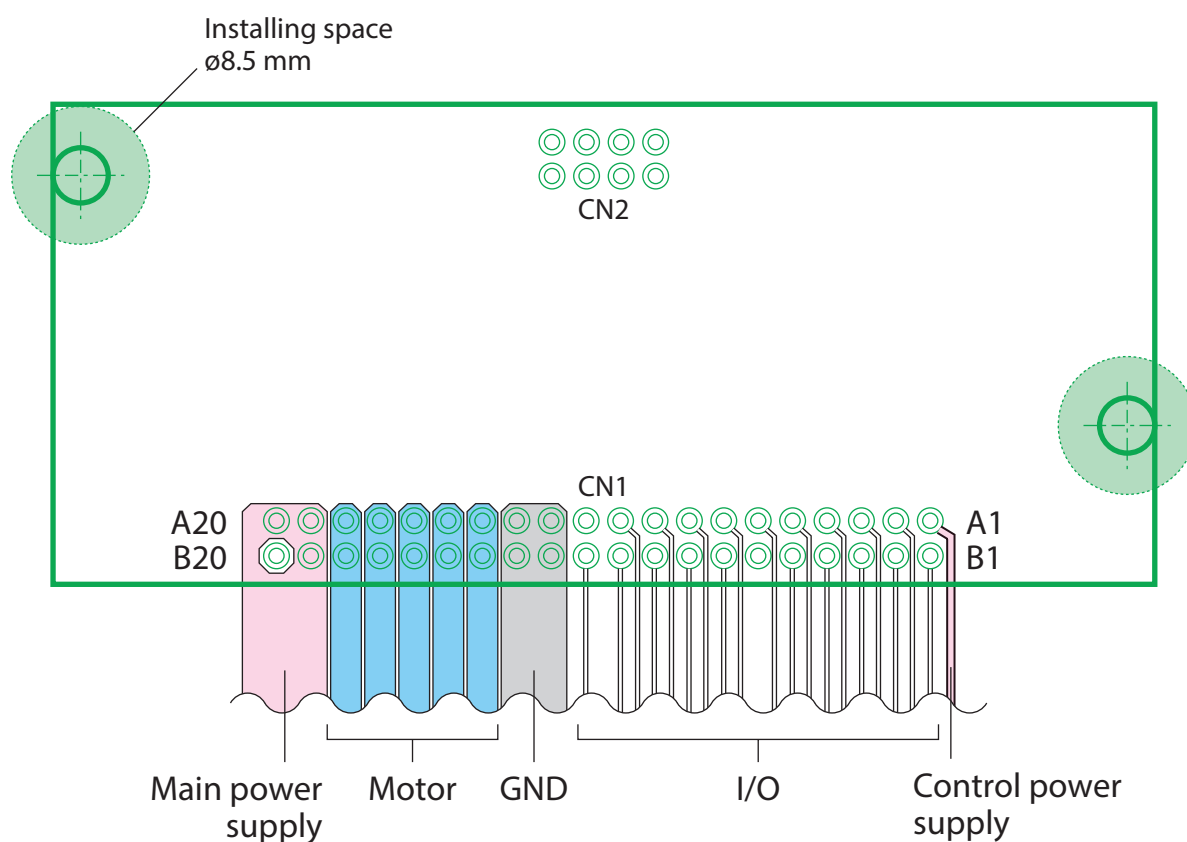
The product described in this document has been designed and manufactured to be incorporated in general industrial equipment. Do not use for any other purpose. Oriental Motor Co., Ltd. is not responsible for any damage caused through failure to observe this warning.

■ About pattern wiring

Design a wiring pattern considering the following points.

- Lay out an external aluminum electrolytic capacitor as close to the driver as possible.
- Do not lay out the motor pattern close to the I/O pattern or cross them. Doing so may result in malfunction.
- A large current flows in the patterns of the main power supply, motor, and GND. Lay out as thick and short as possible.
- If the thickness of copper foil is 35 μm , ensure the pattern width of 1 mm per 1 A. When the pattern width cannot be ensured, take measures to use a multi-layer board to wire in multiple layers in parallel or increase the thickness of copper foil.
- Do not connect anything to the pin numbers A11, B6, and B20. Doing so may cause a failure.
- The CN2 is a connector to fix the horizontal placing driver. Do not wire anything.
- Since the installing space is used when the horizontal placing driver is fixed on the motherboard, do not lay out any component other than a screw and spacer. About the outer diameters of the screw and spacer that are used for fixing, keep within the installing space.
- For the patterns of the CW (PLS) input (pin A10), the CCW (DIR) input (pin B10), and the AN-CRNT input (pin B11), lay out them as short as possible, in addition to keeping away from the patterns of power supply and motor.

● Pattern wiring example

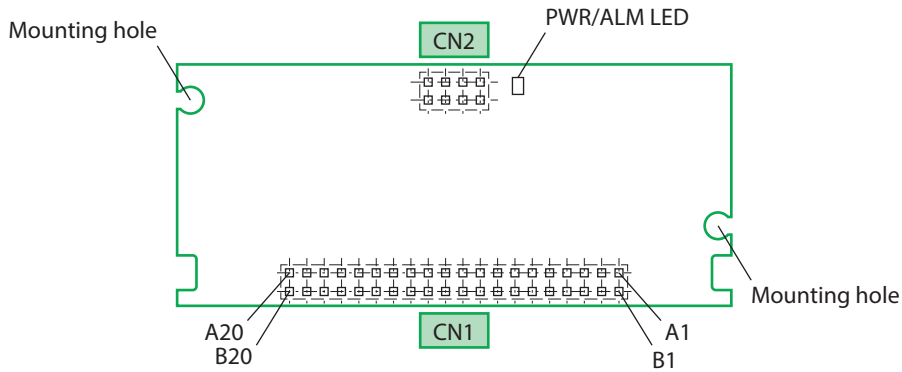


■ RoHS Directive

The products do not contain the substances exceeding the restriction values of RoHS Directive (2011/65/EU).

■ Names and functions of parts

This section explains using the driver which installation direction is the horizontal placing as an example.



Name	Description
PWR/ALM LED	<ul style="list-style-type: none"> This LED is lit in green while the control power supply and the main power supply are supplied. It blinks twice in green while the control power supply is only supplied. If an alarm generates, the LED will blink or lit in red.
CN1	Connects I/O signals, power supplies, GND, and a motor.
CN2	This is a pin header to fix the horizontal placing driver. The vertical placing driver does not use it.
Mounting hole	Uses when fixing the horizontal placing driver and motherboard.

● PWR/ALM LED




The status of the driver can be checked with the PWR/ALM LED.

LED indication	Control power supply input	Main power supply input	Alarm
OFF	OFF	—	—
Green blinking twice	ON	OFF	No alarm
Green Lit		ON	
Red blinking/Red Lit		—	Alarm generates



2 Safety precautions




The precautions described below are intended to prevent danger or injury to the user and other personnel through safe, correct use of the product. Use the product only after carefully reading and fully understanding these instructions.




Description of signs

 Warning	Handling the product without observing the instructions that accompany a "Warning" symbol may result in serious injury or death.
 Caution	Handling the product without observing the instructions that accompany a "Caution" symbol may result in injury or property damage.
 Note	The items under this heading contain important handling instructions that the user should observe to ensure the safe use of the product.

Description of graphic symbols

	Indicates "prohibited" actions that must not be performed.
	Indicates "compulsory" actions that must be performed.

 Warning	
	<ul style="list-style-type: none"> • Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. This may cause fire or injury. • Do not forcibly bend, pull or pinch the cable. This may cause fire. • Do not turn the ENABLE input to H-level and the RST input to L-level during operation. Doing so may result in injury or damage to equipment. • Do not disassemble or modify the driver. This may cause injury.
	<ul style="list-style-type: none"> • Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire or injury. • If this product is used in a vertical application, be sure to provide a measure for the position retention of moving parts. Failure to do so may result in injury or damage to equipment. • When the driver generates an alarm (any of the driver's protective functions is triggered), first remove the cause and then clear the protective function. Continuing the operation without removing the cause of the problem may cause malfunction of the driver, leading to injury or damage to equipment. • Install the driver in an enclosure. Failure to do so may result in injury. • Keep the driver's input-power voltage within the specified range. Failure to do so may result in fire. • For the driver's power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may result in electric shock. • Connect the cables securely according to the wiring diagram. Failure to do so may result in fire. • Turn off the driver power in the event of a power failure. Failure to do so may result in injury or damage to equipment.

 Caution	
	<ul style="list-style-type: none"> • Do not use the driver beyond its specifications. This may cause injury or damage to equipment. • Do not touch the driver during operating or immediately after stopping. This may cause a skin burn(s). • Do not forcibly bend or pull the cable that was connected to the driver. Doing so may cause damage. • Keep the area around the driver free of combustible materials. Failure to do so may result in fire or a skin burn(s). • Leave nothing around the driver that would obstruct ventilation. Failure to do so may result in damage to equipment. • Do not place heat generation parts around the driver. A function of overheat protection may not activate properly depending on a use method or condition, leading to injury or damage to equipment.
	<ul style="list-style-type: none"> • Use a motor and driver only in the specified combination. Failure to do so may result in fire. • Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury. • Before supplying power to the driver, turn all input signals to the driver to OFF. Failure to do so may result in injury or damage to equipment. • Before moving the motor output shaft directly by hands (manual alignment, etc.), confirm that the ENABLE input of the driver is in H-level. Failure to do so may cause injury. • When an abnormal condition has occurred, immediately stop operation and turn off the driver power. Failure to do so may result in fire or injury. • Take measures against static electricity when touching the driver. Failure to do so may result in damage to equipment. • Dispose the product correctly in accordance with laws and regulations, or instructions of local governments.

3 Precautions for use

- **When conducting the insulation resistance measurement and the dielectric strength test, be sure to separate the connection between the motor and the driver.**

Conducting the insulation resistance measurement or dielectric strength test with the motor and driver connected may result in damage to products.

- **Regeneration**

When a large inertial load is operated at high speed, regeneration energy will generate and increase the power supply voltage, leading to damage to the driver. Check the operating condition so that regeneration voltage will not generate, or increase a capacitance of the external aluminum electrolytic capacitor.

4 Connection

4-1 Connection method

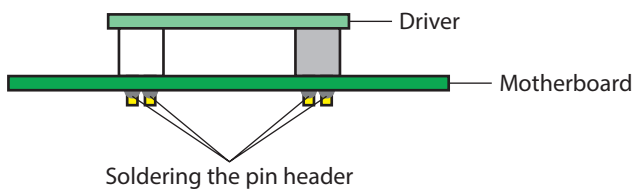
The following two methods are available for connection.

Note The driver uses parts that are sensitive to electrostatic charge. Take measures against static electricity since static electricity may cause the driver to malfunction or suffer damage.

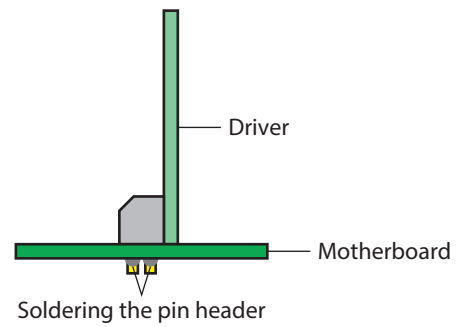
■ Soldering on a board

This is how to install the driver on a motherboard and solder the pin header.

● Horizontal placing



● Vertical placing



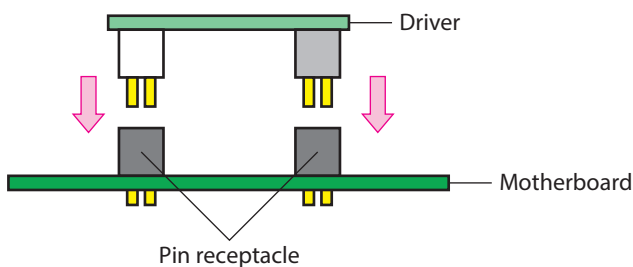
When soldering, do not exceed the following conditions. Soldering by a reflow furnace is not available.

Method	Temperature	Time	Number of times (maximum)
Flow soldering bath	250±5 °C (482±9 °F)	5±0.5 s	Once
Soldering iron	350±5 °C (662±9 °F)	3±0.5 s	Once

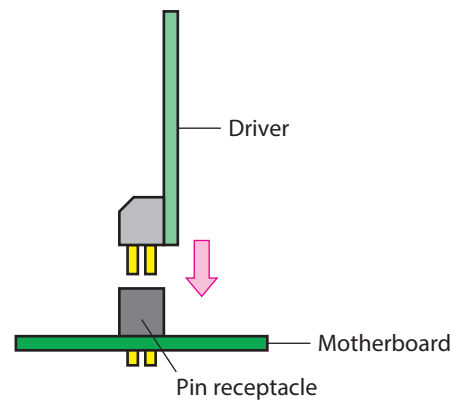
■ Using a pin receptacle

This is a method to connect the driver after soldering the specified pin receptacle on a motherboard.

● Horizontal placing



● Vertical placing



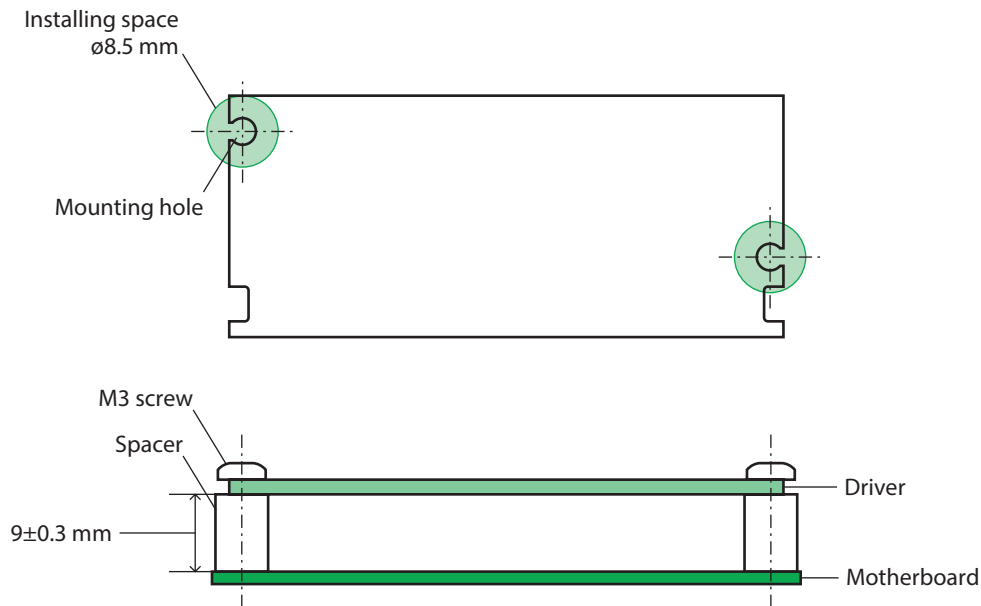
Specified pin receptacle

CN1	IMSA-9269S-40B-GFC (IRISO ELECTRONICS CO., LTD.)
CN2 *	IMSA-9269S-08B-GFC (IRISO ELECTRONICS CO., LTD.)

* The vertical placing driver does not use it.

Fixing method (horizontal placing driver only)

When mounting the driver using a pin receptacle, fix the driver and motherboard with screws (M3) so as not to fall off.



Note

- Use a screw and spacer for fixing which outer diameters fit within the installing space. Exceeding the installing space may cause damage to mounted components or a short of pattern.
- Use washers which outer diameters are $\phi 7$ mm or less if used. Larger washers may contact with mounted components, leading to a short of pattern.
- Provide 9 ± 0.3 mm for the distance between the driver and the motherboard. Failure to do so may cause the CN1 and CN2 connectors to float, leading to contact failure.

4-2 Functions details of CN1 connector

This section explains functions of the CN1 connector.
Set the driver functions using input signals.

- **Terminals list**

Pin No.	Signal name	Description
A1	VCC	Control power supply input
B1	ALM	Alarm output
A2	TIM	Timing output
B2	PLS-RDY	Pulse ready output
A3	STEP0	Resolution setting input (bit0)
B3	STEP1	Resolution setting input (bit1)
A4	STEP2	Resolution setting input (bit2)
B4	STEP3	Resolution setting input (bit3)
A5	MOT-SEL0	Motor frame size setting input (bit0)
B5	MOT-SEL1	Motor frame size setting input (bit1)
A6	MOT-SEL2	Motor frame size setting input (bit2)
B6	–	Do not connect.
A7	1P/2P	Pulse input mode setting input
B7	SD-EN	Smooth drive function setting input
A8	R1/R2	Resolution table setting input
B8	STOP-CRNT	Standstill current setting input
A9	RST	Reset input
B9	ENABLE	Excitation ON input
A10	CW (PLS)	CW pulse input (Pulse input)
B10	CCW (DIR)	CCW pulse input (Rotation direction input)
A11	–	Do not connect.
B11	AN-CRNT	Operating current setting input
A12	GND	GND
B12		
A13		
B13		
A14	MOTOR (BLUE)	Blue motor lead wire
B14		
A15	MOTOR (RED)	Red motor lead wire
B15		
A16	MOTOR (ORANGE)	Orange motor lead wire *
B16		
A17	MOTOR (GREEN)	Green motor lead wire
B17		
A18	MOTOR (BLACK)	Black motor lead wire
B18		
A19	POWER	Main power supply input
B19		
A20		
B20	–	Do not connect.

* Not used when combining with 2-phase stepping motors. Do not connect.

■ Power supply

Note If the motor is in a state of regeneration operation, the current may flow backward to the power supply from the main power-supply input of the driver. Also, if the main power supply voltage exceeds the permissible value by regeneration, the overvoltage alarm of the driver will generate. Reconsider the operating condition, or increase a capacitance of the external aluminum electrolytic capacitor. Contact your nearest Oriental Motor sales office when you consider changing the aluminum electrolytic capacitor.

- **VCC**
This is an input of a control power supply of the driver.
- **POWER**
 - This is an input of a main power supply of the driver.
 - It is a power supply of an inverter to drive a motor.

■ Input signal

● STEP0 to STEP3 input, R1/R2 input

Set a resolution using the STEP0 to STEP3 inputs and the R1/R2 input. The table shows resolutions of the standard type. The resolutions of the high-resolution type is twice as the standard type.

**Initial setting STEP0 to STEP3: All H level
R1/R2: H level**

STEP				R1/R2	
3	2	1	0	H level	L level
H	H	H	H	500	200
H	H	H	L	1,000	400
H	H	L	H	1,250	800
H	H	L	L	2,000	1,000
H	L	H	H	2,500	1,600
H	L	H	L	4,000	2,000
H	L	L	H	5,000	3,200
H	L	L	L	10,000	5,000
L	H	H	H	12,500	6,400
L	H	H	L	20,000	10,000
L	H	L	H	25,000	12,800
L	H	L	L	40,000	20,000
L	L	H	H	50,000	25,000
L	L	H	L	62,500	25,600
L	L	L	H	100,000	50,000
L	L	L	L	125,000	51,200

memo If a control power supply is turned on or the RST input is turned from L-level to H-level, the resolution will be set.

● **MOT-SEL0 to MOT-SEL2 input**

Set the MOT-SEL0 to MOT-SEL2 inputs according to the motor model used. Setting with combinations other than the values in the table will generate the motor frame size setting error alarm.

Note If the driver rated current and the motor rated current do not coincide with each other, set the MOT-SEL0 to MOT-SEL2 inputs first, and connect the analog voltage to the AN-CRNT input to set the operating current rate.
 Example) When the motor model is **PKP24□D08■2** (motor rated current 0.85 A/phase)
 Check the model **PKP24□D08■2** in the table, and set L, H, and H to the MOT-SEL2, MOT-SEL1, and MOT-SEL0 inputs respectively. This sets the driver rated current to 2.3 A/phase, so set the operating current rate with the analog voltage based on 2.3 A/phase being 100%.

Initial setting MOT-SEL0 to MOT-SEL2 inputs: All H level

MOT-SEL input			2-phase		5-phase	
2	1	0	Driver rated current (A/phase)	Motor model *	Driver rated current (A/phase)	Motor model *
H	H	H	0.5	PKP213D	0.35	PK513 PK52□
H	H	L	0.6	PKP214D	0.75	PK52□H PK54□
H	L	H	1.5	PKP22□D15 PKP23□D15 PKP24□MD15 PKP262FD	1.2	PKP52□
H	L	L	2.3	PKP23□D23 PKP24□D23	1.4	PK56□
L	H	H	2.3	PKP24□D08■2 PKP24□D15■2 PKP24□D23■2	1.8	PKP54□
L	H	L	2.8	PKP26□D14■2 PKP26□D28■2 PKP26□MD28	2.4	PKP56□FN24 PKP56□FMN

* □ in the model names indicates a number representing the motor length.
 ■ in the model names indicates **A** (single shaft) or **B** (double shaft) representing the motor type.

memo Turn on the control power supply or turn the RST input from L level to H level to enable the setting of the MOT-SEL0 to MOT-SEL2 inputs.

● **1P/2P input**

Set the pulse input mode.

Initial setting H level (1-pulse input mode)

1P/2P input	Pulse input mode
H level	1-pulse input mode
L level	2-pulse input mode

memo If a control power supply is turned on or the RST input is turned from L-level to H-level, the pulse input mode will be set.

● **SD-EN input**

Select whether to enable or disable the smooth drive. The setting is possible while the power supply is being on. The smooth drive is a function to achieve lower vibration and noise at low speeds operation without changing the step angle setting.

Initial setting H level (Enable)

SD-EN input	Smooth drive
H level	Enable
L level	Disable

● **STOP-CRNT input**

Select the standstill current rate of the driver. The setting is possible while the power supply is being on. The actual standstill current is a value that the set operating current is multiplied by the standstill current rate.

- Standstill current = Set operating current × standstill current rate

Initial setting H level (50%)

STOP-CRNT input	Standstill current rate
H level	50%
L level	25%

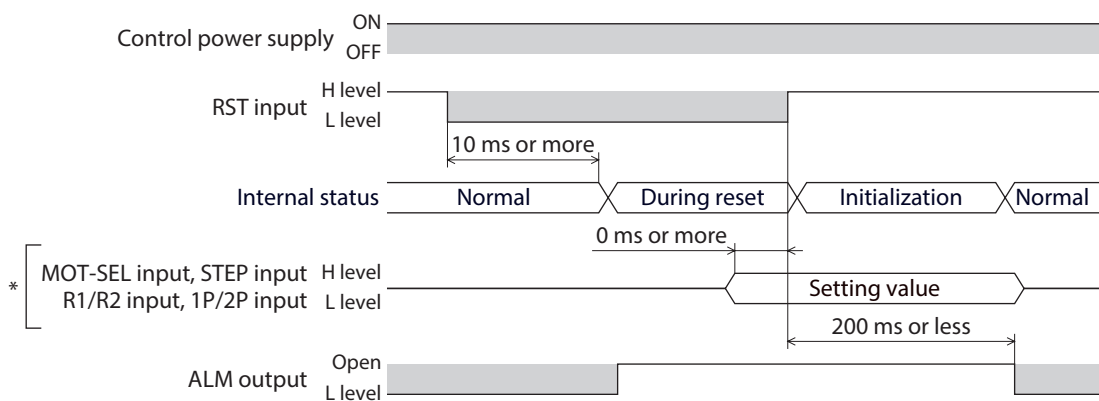
● **RST input**

Turning the RST input from H-level to L-level will reset the internal status of the driver. The status for when the driver is reset is shown below.

Item	Status
Excitation state	Motor non-excitation
Excitation position	Returns to the step "0" position
Alarm	Released

memo Input the RST input while the motor is stopped.

Timing of reading the RST input



* Before turning the RST input to H-Level, input the signal level to set the driver function. The signal level is read while the driver is being reset, and it will be applied when the initialization is complete. Do not change the signal level until the initialization is complete.

● **ENABLE input**

If the following conditions are satisfied, the motor will be excited when the ENABLE input turns to L-level.

- The control power supply is turned ON.
- The main power supply is turned ON.
- An alarm is not present.
- The RST input is in H-level.

● **CW (PLS) input, CCW (DIR) input**

These are positioning pulse signal inputs. Signal functions differ in the 1-pulse input mode and the 2-pulse input mode.



The driver can receive pulse input when the PLS-RDY output is in L-level.

1-pulse input mode

The PLS input and the DIR input are enabled.

PLS input	DIR input	Operation
	H level	The motor will rotate by one step in CW direction.
	L level	The motor will rotate by one step in CCW direction.
	H level	The motor will not rotate.
	L level	

2-pulse input mode

The CW input and the CCW input are enabled.

CW input	CCW input	Operation
	L level	The motor will rotate by one step in CW direction.
	H level	The motor will not rotate.
L level		The motor will rotate by one step in CCW direction.
H level		The motor will not rotate.

● **AN-CRNT input**

Set the operating current rate with the analog voltage. The setting is possible while the power supply is being on. If the load is small and there is an ample allowance for torque, motor temperature rise can be suppressed by setting a lower operating current.

The actual operating current is a value in which the operating current rate is multiplied by the motor rated current (100%).

- Operating current = Driver rated current × Operating current rate

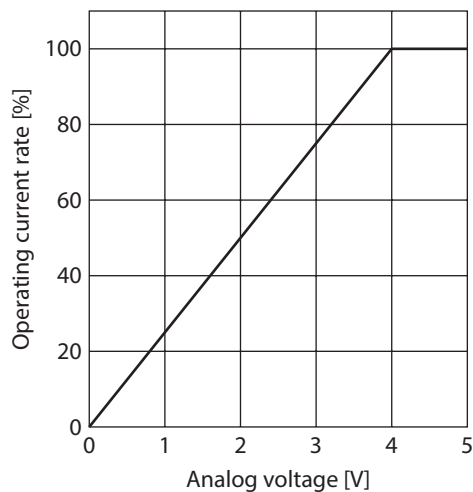
Initial setting 0 V (operating current rate 0.1%)

Setting range 0.1% to 100.0%



Caution Set the operating current to the motor rated current or lower. Failure to do so may result in fire or a skin burn(s).

The figure below shows relations between the analog voltage and the operating current rate.



■ Output signal

The output circuit is of open collector.

● ALM output

If an alarm generates, the ALM output will be open, and the motor excitation will be cut off. At the same time, the PWR/ALM LED on the driver will blink in red.

The alarm can be reset by turning on the control power supply again or using the RST input.

● TIM output

Output L-level when the motor excitation state is in the step "0" position.

Every time the motor output shaft rotates by 7.2° (3.6° for high-resolution type), the motor excitation state becomes the initial setting state.

If an AND circuit is configured with signals of the home sensor and TIM output when the home position in the equipment is detected, the tolerance for the motor stop positions in a detection range of the home sensor can be reduced and the further accurate home position can be detected.



- The TIM output will be output properly when the pulse frequency is 500 Hz or less.
- The motor excitation state returns to the step "0" position when the power is turned on or the RST input is turned from H-level to L-level.

● PLS-RDY output

Output L-level when an operation is possible.

If the following conditions are satisfied, the PLS-RDY output will turn to L-level.

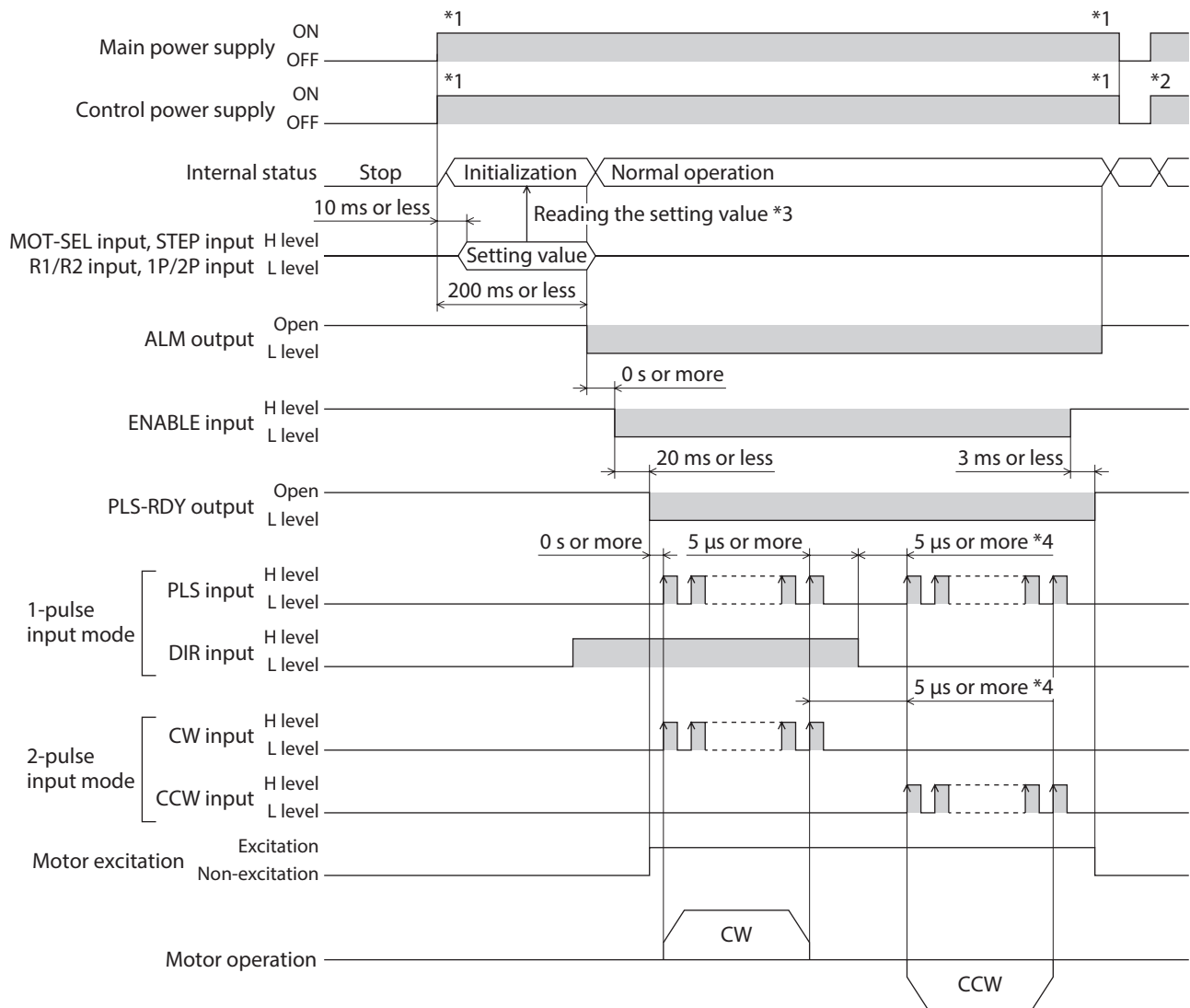
- The control power supply is turned ON.
- The main power supply is turned ON.
- An alarm is not present.
- The ENABLE input is in L-level.
- The RST input is in H-level.

■ Motor

● MOTOR

Connect a motor. Do not connect anything to the MOTOR (ORANGE) when combining with a 2-phase stepping motor.

4-3 Timing chart



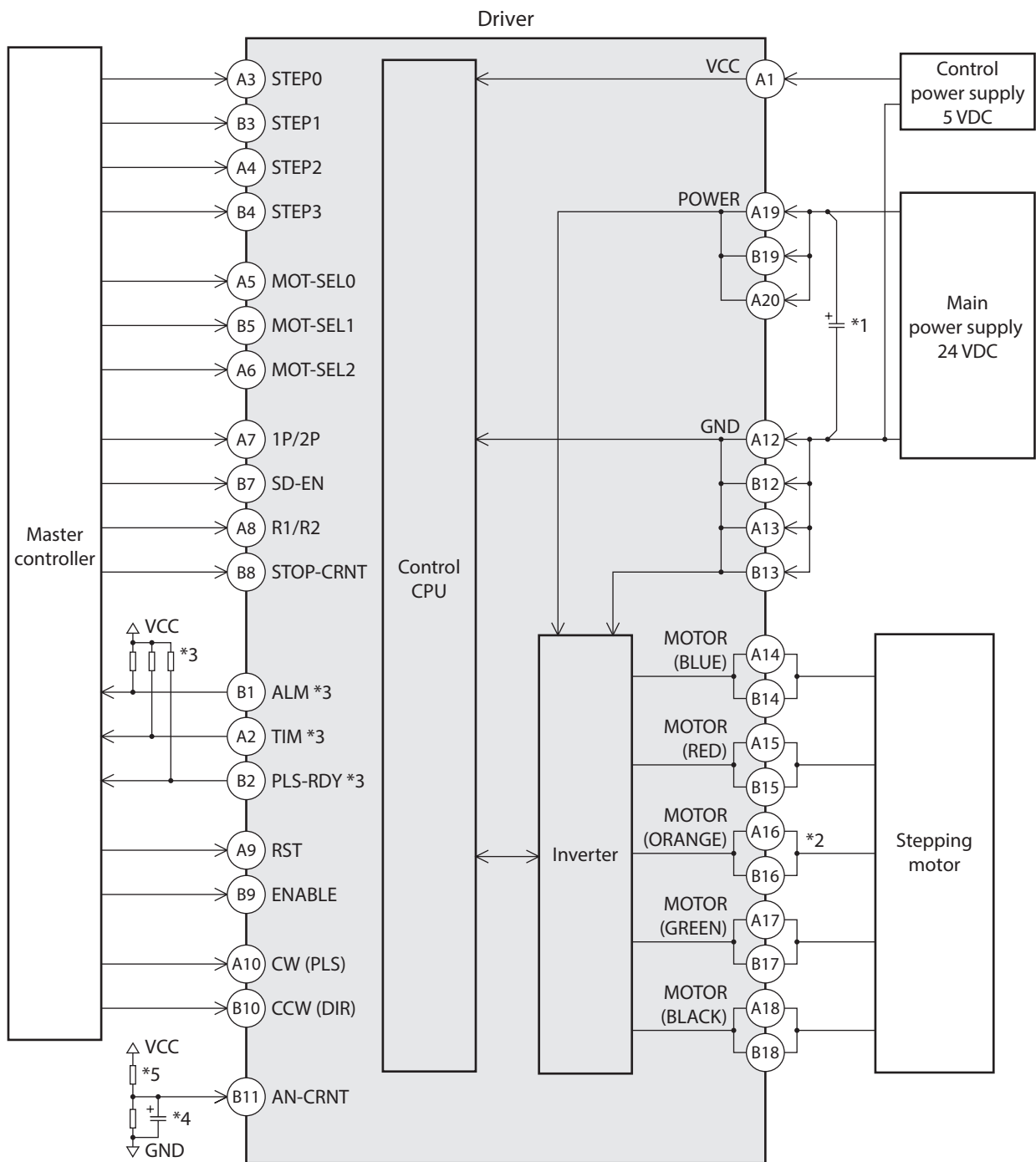
*1 The main power supply and the control power supply can be turned on or off in an arbitrary order.

*2 When cycling the control power, turn off the power and wait for the PWR/ALM LED to turn off.

*3 The signal level is read during initialization. Do not change the signal level until the initialization is complete.

*4 The interval for when the rotation direction is switched represents the response time of the driver. Set it to the time required for the motor to respond to the applicable pulse input.

4-4 Connection example



- *1 An external aluminum electrolytic capacitor is required in the main power supply line. Place as close to terminals as possible.
The aluminum electrolytic capacitor of a capacitance of 680 uF and a dielectric strength of 50 V is recommended. Contact us if you plan to change.
- *2 When using in combination with a 2-phase stepping motor, do not connect anything to the pin A16 and the pin B16.
- *3 To output H-level, an external pull-up resistor is required. Make sure the resistance value does not exceed the permissible current (10 mA) of the output.
- *4 Inserting a capacitor is recommended for protection against noise.
- *5 When using in a state where the operating current is fixed to 100%, input a voltage of 4 V or more using a method such as pulling up with a resistor of 10 kΩ.

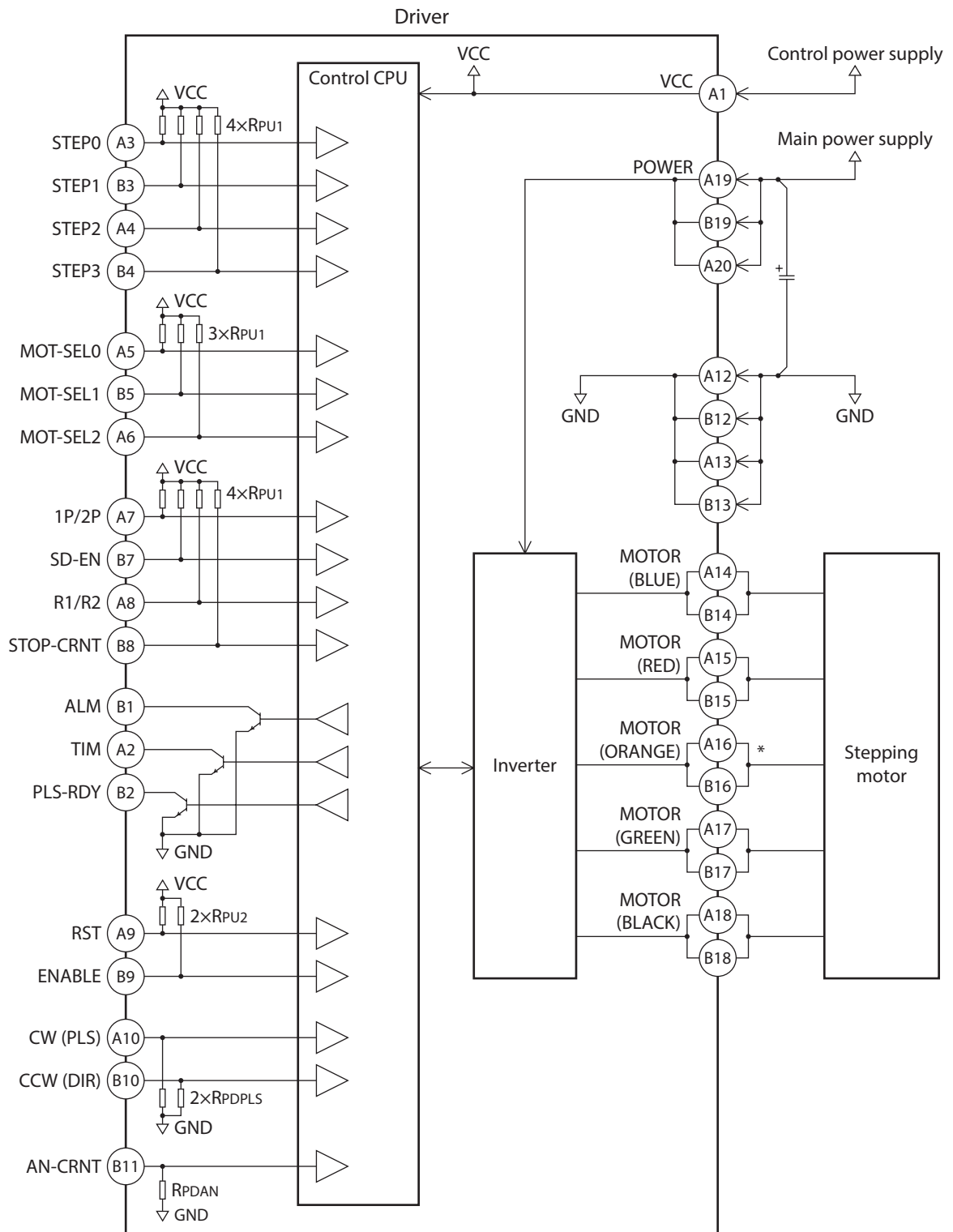
Note

- Do not connect a control power supply and a main power supply in reverse. Doing so may cause damage.
 - Do not connect anything to the pin numbers B6, A11 and B20. Doing so may cause a failure.
 - Do not externally apply a voltage to input terminals when a control power supply is not supplied. The setting may change before the power is supplied.
-

memo

- I/O terminals, power supplies, and motor output terminals are not insulated.
 - Be sure to connect all terminals for power supplies, GND, and a motor. However, when using in combination with a 2-phase stepping motor, do not connect anything to the pin numbers A16 and B16.
 - Be sure to connect a control power supply and a main power supply. A motor does not operate unless connected.
-

4-5 Internal circuit



* Not used when combining with 2-phase stepping motors. Do not connect.

4-6 Electrical specifications

● Absolute maximum rating

Type	Signal name	min	max	Unit
Power supply input	VCC	–	5.5	V
	POWER	–	40 *1	V
Control input	STEP0 STEP1 STEP2 STEP3 MOT-SELO MOT-SEL1 MOT-SEL2 1P/2P SD-EN R1/R2 STOP-CRNT RST ENABLE	–0.3	VCC+0.3	V
Control output	ALM TIM PLS-RDY	–0.3	30	V
Analog input	AN-CRNT	–0.3	VCC+0.3	V
Pulse input	CW(PLS) CCW(DIR)	–0.3	VCC+0.3	V
Board temperature	–	–	75 (167) *2	°C (°F)

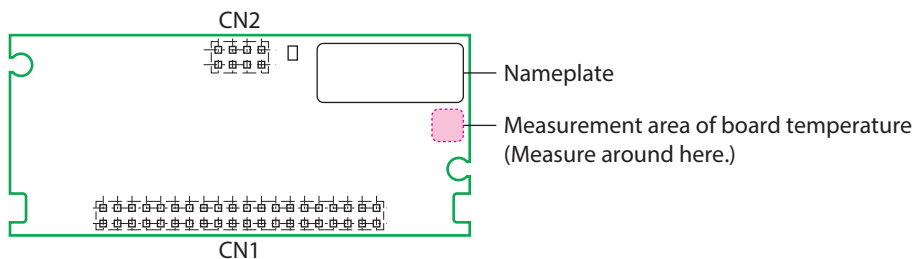
*1 To satisfy the specifications, use the input voltage to be in a range of 24 VDC±10%.

*2 Use in consideration of the derating.

About board temperature

To measure the surface temperature of the board, use the measurement area of the board temperature in the figure.

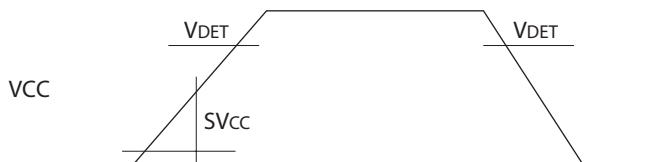
Number of phases	Rated current [A/phase]	Board temperature max (reference)
2-phase	0.5, 0.6, 1.5	75 °C (167 °F)
	2.3	60 °C (140 °F)
	2.8	50 °C (122 °F)
5-phase	0.35, 0.75 1.2, 1.4	75 °C (167 °F)
	1.8	65 °C (149 °F)
	2.4	50 °C (122 °F)



● **Electrical characteristics**

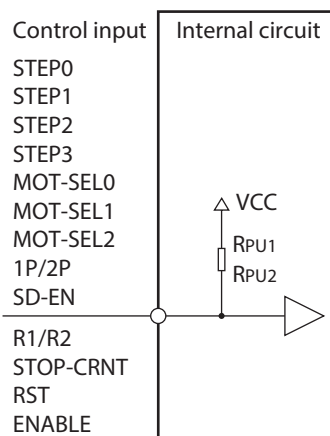
This shows under the terms of control power supply $V_{CC}=5.0\text{ V}\pm 5\%$ and ambient temperature $25\text{ }^\circ\text{C}$ ($77\text{ }^\circ\text{F}$).

Signal name	Item	Code	min	typ	max	Unit
VCC	VCC rising gradient	SVCC	–	–	20	ms/V
	Operation start voltage	VDET	3.95	4.15	4.35	V



● **Control input**

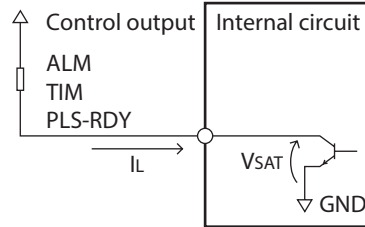
Signal name	Item	Code	min	typ	max	Unit
STEP0 STEP1 STEP2 STEP3	Input voltage	V _{IH1}	4.25	–	–	V
		V _{IL1}	–	–	0.9	
MOT-SEL0 MOT-SEL1 MOT-SEL2 1P/2P SD-EN R1/R2 STOP-CRNT	Built-in pull-up resistor	R _{PU1}	95k	100k	105k	Ω
RST ENABLE	Input voltage	V _{IH2}	4.25	–	–	V
		V _{IL2}	–	–	0.9	
	Built-in pull-up resistor	R _{PU2}	9.5k	10k	10.5k	Ω



● **Control output**

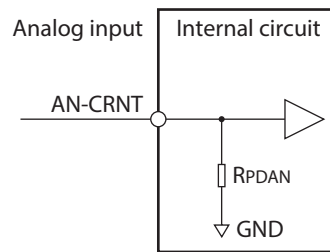
The control output is of open collector.

Signal name	Item	Code	min	typ	max	Unit
ALM TIM PLS-RDY	Output saturated voltage	V _{SAT}	–	–	0.3	V
	Load current	I _L	–	–	10	mA



● **Analog input**

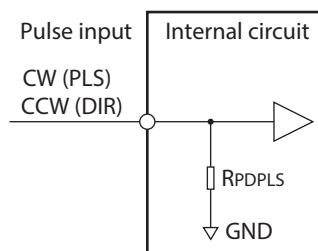
Signal name	Item	Code	min	typ	max	Unit
AN-CRNT	Input voltage range	V _{IAN}	0	–	4.0	V
	Built-in pull-down resistor	R _{PDAN}	95k	100k	105k	Ω



● **Pulse input**

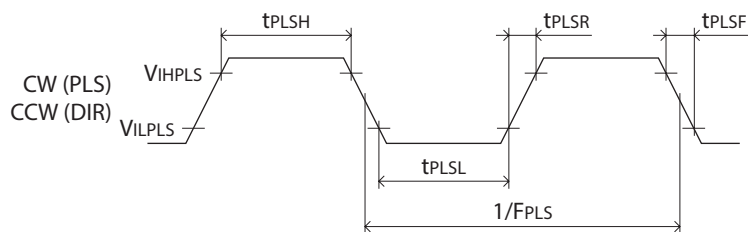
DC characteristics

Signal name	Item	Code	min	typ	max	Unit
CW (PLS) CCW (DIR)	Input voltage	V _{IHPLS}	3.8	–	–	V
		V _{ILPLS}	–	–	1.0	
	Built-in pull-down resistor	R _{PDPLS}	9.5k	10k	10.5k	Ω



AC characteristics

Signal name	Item	Code	min	typ	max	Unit
CW (PLS) CCW (DIR)	Input pulse frequency	FPLS	–	–	1	MHz
	Pulse H-level width	tPLSH	0.4	–	–	μs
	Pulse L-level width	tPLSL	0.4	–	–	μs
	Rise time	tPLSR	–	–	2	μs
	Fall time	tPLSF	–	–	2	μs



5 Alarm

If an alarm generates, a protective function of the driver will activate to open the ALM output. At the same time, the motor excitation will shut off, and the PWR/ALM LED on the driver will blink in red.

■ Alarm reset

Reset the alarm using either of the following methods.

- Cycle the control power supply.
- Turn the RST input to L-level.

■ Descriptions of alarms

Alarm type	Number of LED blinks	Motor excitation	Cause
Overheat	2	Non-excitation	The temperature of the circuit board exceeded the permissible value.
Overvoltage	3	Non-excitation	<ul style="list-style-type: none"> • The main power supply voltage exceeded the permissible value. • A large inertial load was stopped abruptly or vertical operation was performed. • The capacitance of aluminum electrolytic capacitor connected to the main power supply was insufficient.
Overcurrent	5	Non-excitation	Excessive current has flown through the output circuit in the motor.
Motor frame size setting error	8	Non-excitation	A motor frame size being outside of a range was set.
EEPROM error	9	Non-excitation	The stored data in the driver was damaged.
CPU error	Lit	Non-excitation	<ul style="list-style-type: none"> • An error or a malfunction was occurred in the CPU. • An error of the CPU clock was detected.

6 Specification

6-1 Basic specifications

■ General specifications

Main power supply	24 VDC±10%
Control power supply	5 VDC±5% 0.12 A
Driving method	Bipolar constant current drive
Excitation mode	Microstepping
Cooling method	Natural cooling
Degree of protection	IP00
Mass	10 g (0.35 oz.)
Insulation resistance	Non-isolated
Dielectric strength	Non-isolated

■ Input current

● 2-phase

Rated current [A/phase] (setting value)	0.5	0.6	1.5	2.3	2.8
Input current [A]	0.5	0.5	1.3	2.0	3.0

● 5-phase

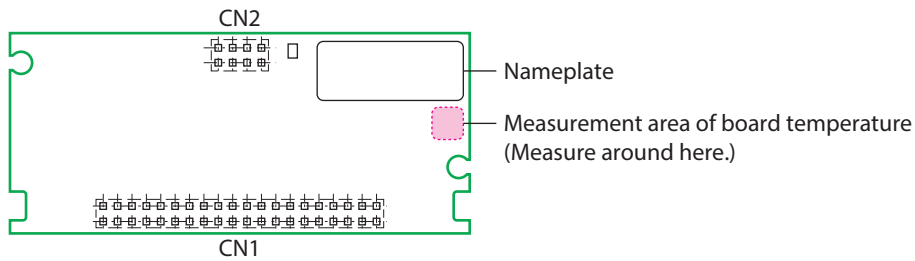
Rated current [A/phase] (setting value)	0.35	0.75	1.2	1.4	1.8	2.4
Input current [A]	0.6	1.4	1.7	1.8	2.8	3.0

6-2 Environmental conditions

■ Environmental conditions

Operation environment	Board temperature	0 to +75 °C (+32 to +167 °F) * (non-freezing)
	Ambient humidity	85% or less (non-condensing)
	Altitude	Up to 1000 m (3300 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Storage environment	Ambient temperature	-25 to +70 °C (-13 to +158 °F) (non-freezing)
	Ambient humidity	75% or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil
Shipping environment	Ambient temperature	-25 to +70 °C (-13 to +158 °F) (non-freezing)
	Ambient humidity	75% or less (non-condensing)
	Altitude	Up to 3000 m (10000 ft.) above sea level
	Surrounding atmosphere	No corrosive gas, dust, water or oil

* Measure the surface temperature of the board under the actual operating environment. To measure the surface temperature of the board, use the measurement area of the board temperature in the figure.



■ Revision record

Revision number	Revised contents
First edition	
Second edition	<ul style="list-style-type: none">• Amendment of dimensions• Addition of motors for possible combinations• Change of conditions for ambient temperatures

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