

## Connection and Operation

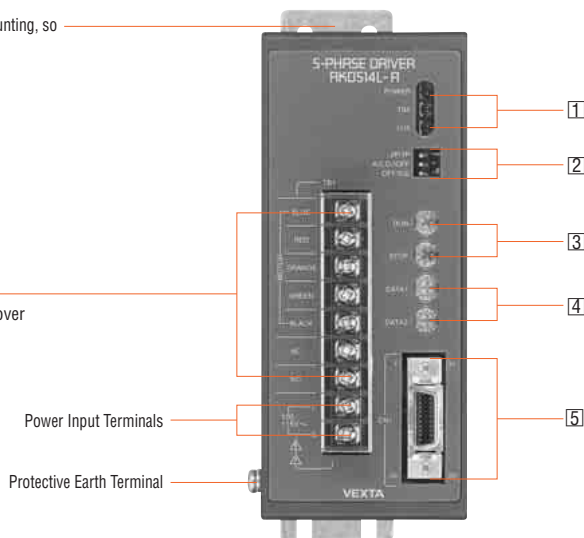
### Names and Functions of Driver Parts

The driver is designed for easy mounting, so it is easy to design the base.

Motor Terminals  
The one-touch terminal block cover uses anti slide shape to prevent it from detaching.

Power Input Terminals

Protective Earth Terminal



#### 1 Signal Monitor Display

Indication	Color	Function
POWER	Green	Power supply indication
TIM.	Green	Excitation timing indication
O.H.	Red	Overheat indication

#### 2 Function Select Switches

Indication	Switch Name	Function
2P/1P	Pulse input mode switch	Switches between 1-pulse input and 2-pulse input.
A.C.O./OFF	Automatic current off function switch	When the temperature of the driver heat sink rises above 80°C (176°F), this function automatically switches the motor current off. The function can be set or deactivated with this switch.
OFF/S.D.	Smooth drive function switch	Low vibration and low noise operation are available even in the low speed range without changing the step angle setting. The function can be set or deactivated with this switch.

#### 3 Current Adjustment Switches

Indication	Switch Name	Function
RUN	Motor run current switch	For adjusting the motor running current.
STOP	Motor stop current switch	For adjusting the motor current at standstill.

#### 5 Input/Output Signals

Indication	Input/Output	Pin No.	Signal Name	Function
CN1	Input	1	Pulse signal	Operation command pulse signal
		2	(CW pulse signal)	(The motor will rotate in the CW direction when in 2-pulse input mode.)
		3	Rotation direction signal	Rotation direction signal Photocoupler ON: CW, Photocoupler OFF: CCW
		4	(CCW pulse signal)	(The motor will rotate in the CCW direction when in 2-pulse input mode.)
	5	All windings off signal	Cuts the output current to the motor and allows the motor shafts to be rotated manually.	
	6			
	7	Step angle select signal	Switches to step angle set in DATA1 and DATA2.	
	8			
Output	17	Excitation timing signal	Outputs signals when the excitation sequence is at STEP "0."	
	18			
	19	Overheat signal	When the temperature of the driver heat sink rises above 80°C (176°F), this function automatically turns the output signal off.	
	20			

Description of input/output signals → Page C-119

#### 4 Step Angle Setting Switches

Indication	Switch Name	Function
DATA1	Step angle setting switch	Each switch can be set to the desired resolution from the 16 resolution levels.
DATA2		

Step Angle Setting Switch (Common to DATA1 and DATA2)	Microsteps/step	Resolution	Step Angle
0	1	500	0.72°
1	2	1000	0.36°
2	2.5	1250	0.288°
3	4	2000	0.18°
4	5	2500	0.144°
5	8	4000	0.09°
6	10	5000	0.072°
7	20	10000	0.036°
8	25	12500	0.0288°
9	40	20000	0.018°
A	50	25000	0.0144°
B	80	40000	0.009°
C	100	50000	0.0072°
D	125	62500	0.00576°
E	200	100000	0.0036°
F	250	125000	0.00288°

#### ◇ Setting the Step Angles

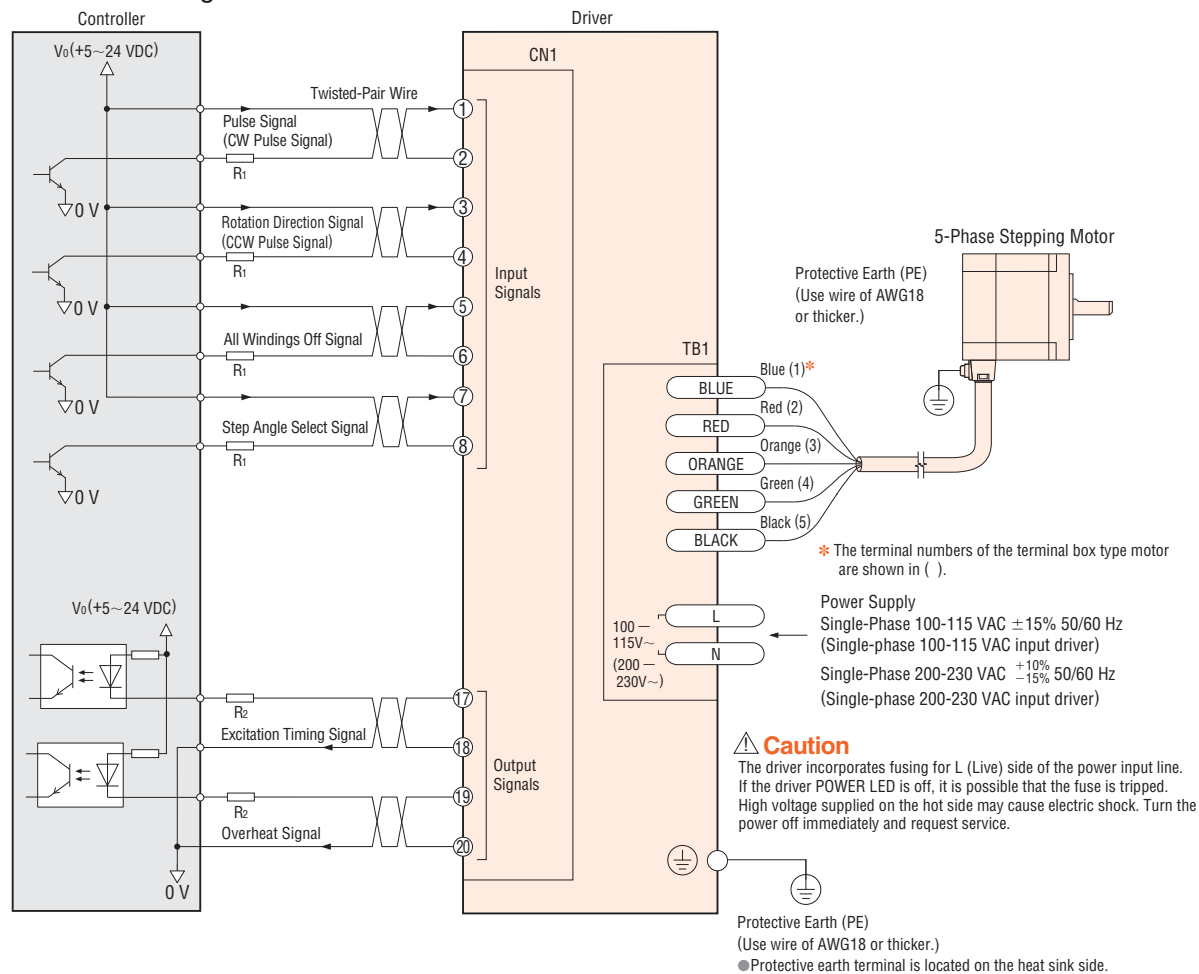
Selects and switches between the two step angle setting switches (DATA1 and DATA2).

Use the "Step Angle Select" signal to change the step angle.

Photocoupler OFF: Step angle (resolution) set by DATA1 is selected.

Photocoupler ON: Step angle (resolution) set by DATA2 is selected.

## ● Connection Diagram



### ◇ Input Signal Connection

Signals can be connected directly when 5 VDC is supplied. If the signals are used at a voltage exceeding 5 VDC, be sure to provide an external resistor to prevent the current exceeding 20 mA from flowing. Internal components will be damaged if a voltage exceeding 5 VDC is supplied directly without using an external resistor.

Example: If the voltage is 24 VDC, connect a resistor ( $R_1$ ) of 1.5 to 2.2 k $\Omega$  and 0.5 W or more.

### ◇ Output Signal Connection

Use output signals at 24 VDC or less and 10 mA or less.

If these specifications are exceeded, the internal components may be damaged. Check the specification of the connected equipment.

When the current is above 10 mA, connect an external resistor  $R_2$ .

### ◇ Power Supply

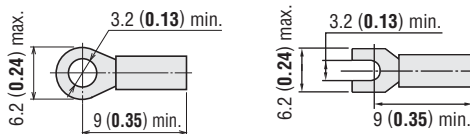
Use a power supply that can supply sufficient input current. When power supply capacity is insufficient, a decrease in motor output can cause the following malfunctions:

- Motor does not operate properly at high-speed.
- Slow motor startup and stopping

### ◇ Notes on Wiring

- Use twisted-pair wires of AWG24 or thicker and keep wiring as short as possible [within 2 m (6.6 ft.)].
  - Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases. Technical reference → Page F-54
  - Use wires of AWG22 or thicker for motor line (when extended) and power supply lines, and use a wire of AWG18 or thicker for protective earth line.
  - To ground the driver, lead the ground conductor from the protective earth terminal and connect the ground conductor to provide a common ground point.
  - Provide a minimum distance of 10 cm (3.9 in.) between the signal lines and power lines (AC lines, motor lines and other large-current circuits).
- Do not run the signal lines in the same duct as power lines or bundle them with power lines.

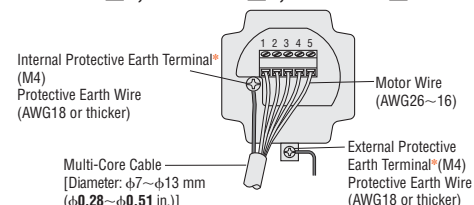
### ◇ Recommended Crimp Terminals Unit = mm (in.)



- Crimp terminals are not provided with the products. They must be purchased separately.

## ● Connection of Standard Type Terminal Box

### RK564A□T, RK566A□T, RK569A□T

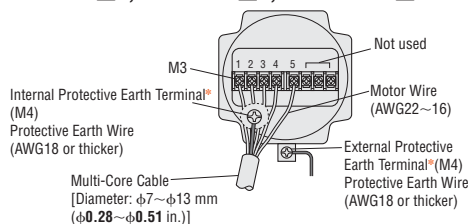


\* Use either the internal or external protective earth terminal for grounding.

- Enter the power supply voltage (**A** or **C**) in the box (□) within the model name.

## ● Connection of Standard Type Terminal Box

### RK596A□T, RK599A□T, RK5913A□T



● Description of Input/Output Signals

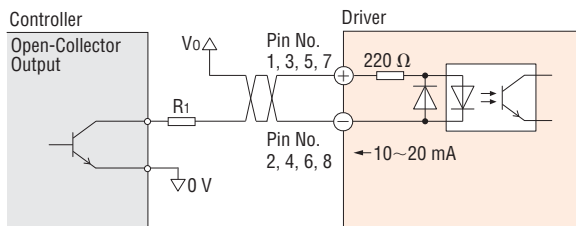
Indication of Input/Output Signal "ON"/"OFF"

Input (output) "ON" indicates that the current is sent into the photocoupler (transistor) inside the driver. Input (output) "OFF" indicates that the current is not sent into the photocoupler (transistor) inside the driver. The input/output remains "OFF" if nothing is connected.

Photocoupler OFF ON

Pulse (CW) and Rotation Direction (CCW) Input Signal  
 All Windings Off (A.W.OFF) Input Signal  
 Step Angle Select (C/S) Input Signal

◇ Input Circuit and Sample Connection

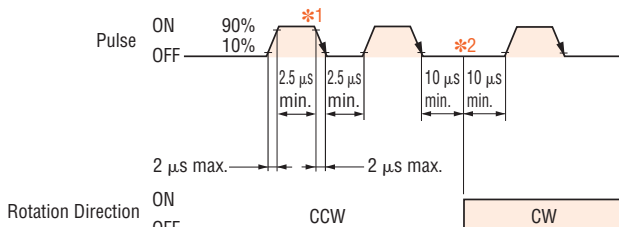


Note:

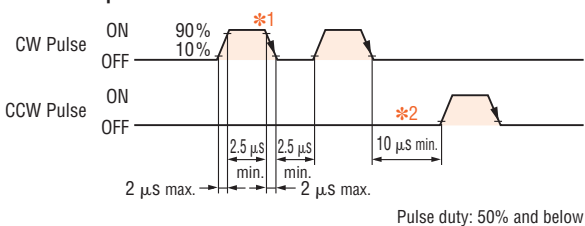
- Keep the voltage  $V_0$  between 5 VDC and 24 VDC. When  $V_0$  is equal to 5 VDC, the external resistor  $R_1$  is not necessary. When  $V_0$  is above 5 VDC, connect  $R_1$  to keep the current between 10 mA and 20 mA.

◇ Pulse (CW) and Rotation Direction (CCW) Input Signal  
 Pulse Waveform Characteristics

● 1-Pulse Input Mode



● 2-Pulse Input Mode



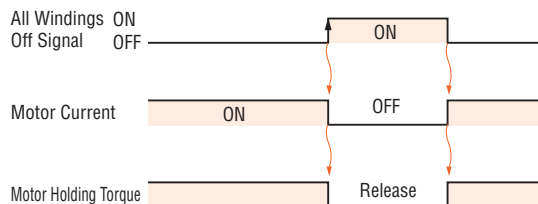
- \*1 The shaded area indicates when the photocoupler diode is ON. The motor moves when the photocoupler state changes from ON to OFF.
- \*2 The minimum interval time when changing rotation direction is 20 μs (10 μs minimum in 2-pulse input mode). This value varies greatly depending on the motor type and load inertia.

◇ Pulse Signal Characteristics

- Keep the pulse signal at the "photocoupler OFF" state when no pulses are being input.
- In 1-pulse input mode, leave the pulse signal at rest ("photocoupler OFF") when changing rotation directions.
- In 2-pulse input mode, do not input a CW pulse and CCW pulse simultaneously.

◇ All Windings Off (A.W.OFF) Input Signal

- Inputting this signal puts the motor in a non-excitation (free) state.
- This signal is used when moving the motor by external force or manual home position is desired. The photocoupler must be "OFF" when operating the motor.



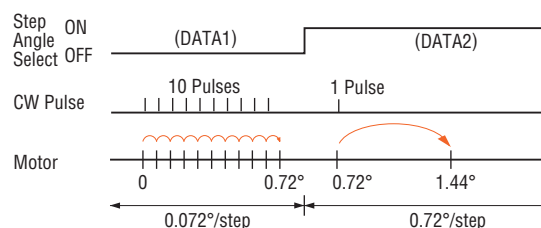
The shaded area indicates that the motor provides holding torque in proportion to standstill current set by STOP switch.

- Switching the "All Windings Off" (A.W. OFF) signal from "photocoupler ON" to "photocoupler OFF" does not alter the excitation sequence. When the motor shaft is manually adjusted with the "All Windings Off" signal input, the shaft will shift up to  $\pm 3.6^\circ$  (Geared type:  $\pm 3.6^\circ/\text{gear ratio}$ ) from the position set after the "All Windings Off" signal is released.

◇ Step Angle Select (C/S) Input Signal

- You may select two step angles (resolutions) from 16 available step angles (resolutions) with the step angle setting switches DATA1 and DATA2.
- When the signal is at "photocoupler OFF," a step angle set by DATA1 is selected; at "photocoupler ON," DATA2 is selected.

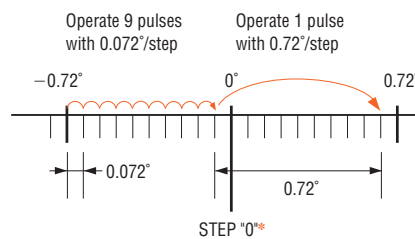
Example: Changing the step angle from  $0.072^\circ$  to  $0.72^\circ$



- Be sure to change step angle select inputs only when the pulse signals are at rest. Switching while moving may cause a positional error of the motor.
- When the step angle is changed by the "Step Angle Select" signal, the "Excitation Timing" signal output may become impossible for some combinations of step angles. When the "Excitation Timing" signal is used, adjust the number of pulses so that the motor can operate with angles that are multiples of  $7.2^\circ$ .

Example:

After moving 9 pulses with  $0.072^\circ/\text{step}$  setting, change the step angle to  $0.72^\circ/\text{step}$  and move 1 pulse. In this case, "Excitation Timing" signal will not be output because the step "0" position is skipped.



\* "Excitation Timing" signal is only output at step "0" position.

Introduction

AC Input OSTEP AS

DC Input OSTEP ASG

5-Phase Microstep RK

2-Phase Full/Half UMK

5-Phase Microstep CMK

DC Input 2-Phase Microstep RBK

2-Phase Microstep CMK

Without Encoder 2-Phase PK/PV

With Encoder 2-Phase PK

EMP400

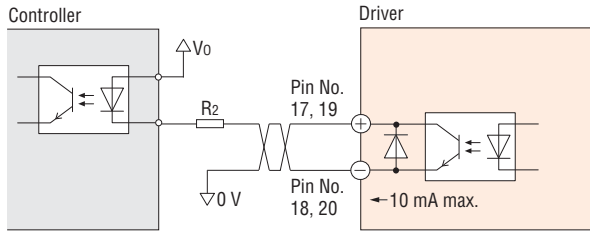
5G8030J

Accessories

Installation

## Excitation Timing (TIM.) Output Signal Overheat (O.H.) Output Signal

### ◇ Output Circuit and Sample Connection



#### Note:

- Keep the voltage  $V_0$  between 5 VDC and 24 VDC. Keep the current below 10 mA. If the current exceeds 10 mA, connect external resistor  $R_2$ .

### ◇ Excitation Timing (TIM.) Output Signal

- The "Excitation Timing" signal is output to indicate when the motor excitation is in the initial stage (step "0" at power up).
- The "Excitation Timing" signal is output simultaneously with a pulse input each time the excitation sequence returns to step "0." The excitation sequence will complete one cycle for every  $7.2^\circ$  rotation of the motor output shaft.

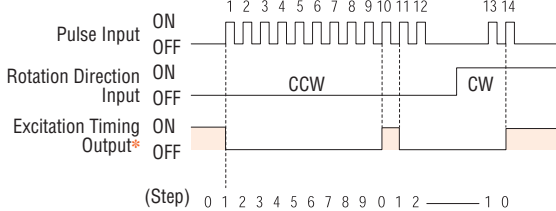
Microsteps/step 1: Signal is output once every 10 pulses.

Microsteps/step 10: Signal is output once every 100 pulses.

The TIM. LED on the front panel lights when the "Excitation Timing" signal is output.

#### Timing chart at $0.72^\circ/\text{step}$ (Microsteps/step 1)

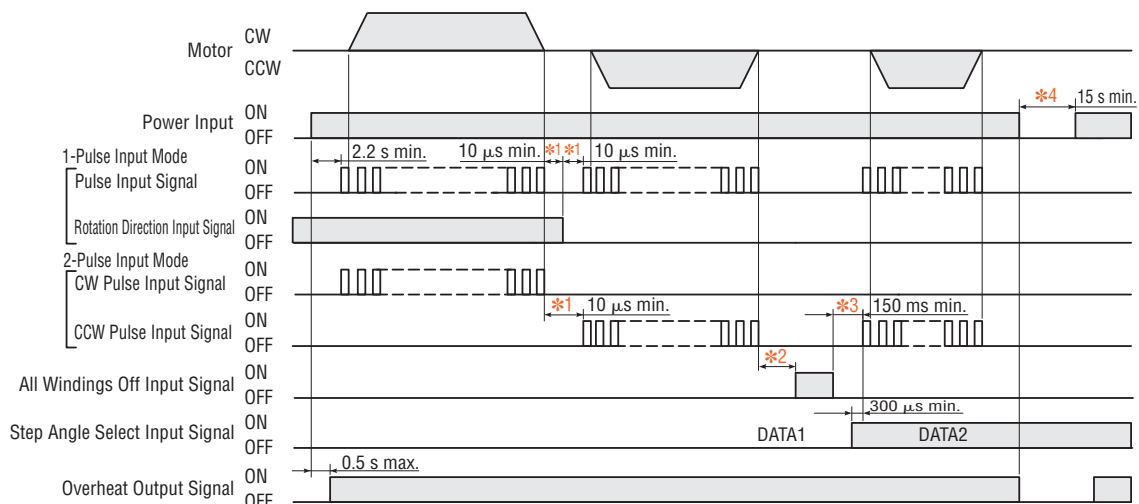
- \* When connected as shown in the sample connection, the signal will be "photocoupler ON" at step "0."



#### Note:

- When power is turned ON, the excitation sequence is reset to step "0" and the "Excitation Timing" signal is output.

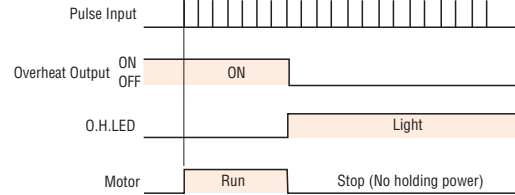
### ● Timing Chart



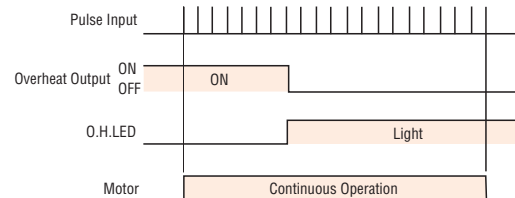
- \*1 The minimum switching time to change direction (1-pulse input mode), and switching time to change CW, CCW pulse (2-pulse input mode)  $10 \mu\text{s}$  is shown as a response time of circuit. The motor may need more time than that.
- \*2 Depends on load inertia, load torque and starting frequency.
- \*3 Never input a pulse signal immediately after switching the "All Windings Off" signal to the "photocoupler OFF" state. The motor may not start.
- \*4 Wait at least 15 seconds before turning on the power again.

### ◇ Overheat (O.H.) Output Signal

- The "Overheat" signal is output to protect the driver from heat damage if the temperature of the driver heat sink rises above  $80^\circ\text{C}$  ( $176^\circ\text{F}$ ). The O.H. LED lights on the front panel when the "Overheat" signal is output.
- You can select whether to stop the motor or continue the operation when an "Overheat" signal is output.
- If the automatic current off function switch is set to "A.C.O." position, output current is cut off to stop the motor when the "Overheat" signal is output.



- If the automatic current off function switch is set to "OFF" position, the motor continues operation when the "Overheat" signal is output.



- To clear the "Overheat" signal, first resolve the cause and check for safety, then turn power on again.
- The overheat output uses positive logic (normally closed), all other outputs use negative logic (normally open).