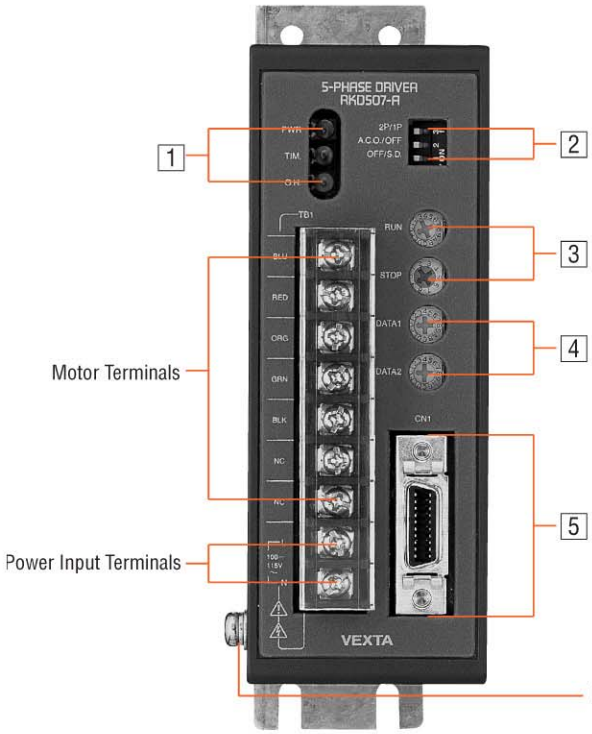
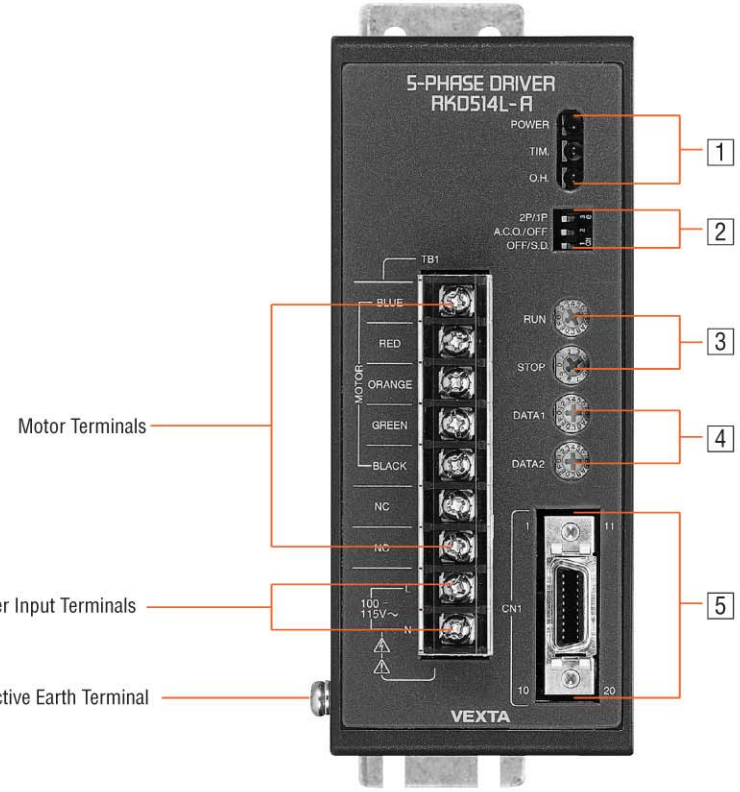
Connection and Operation



RKD507-A



RKD514L-A

1 LED Monitor Display

Indication	Color	Function
POWER	Green	Power Input Display
TIM.	Green	Excitation Timing Output Display
O.H.	Red	Overheat Output Display

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 inside the driver rises above 176˚F (80˚C), this function automatically switches the motor current off. The function can be set and defeated 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 and defeated 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 current at motor standstill.

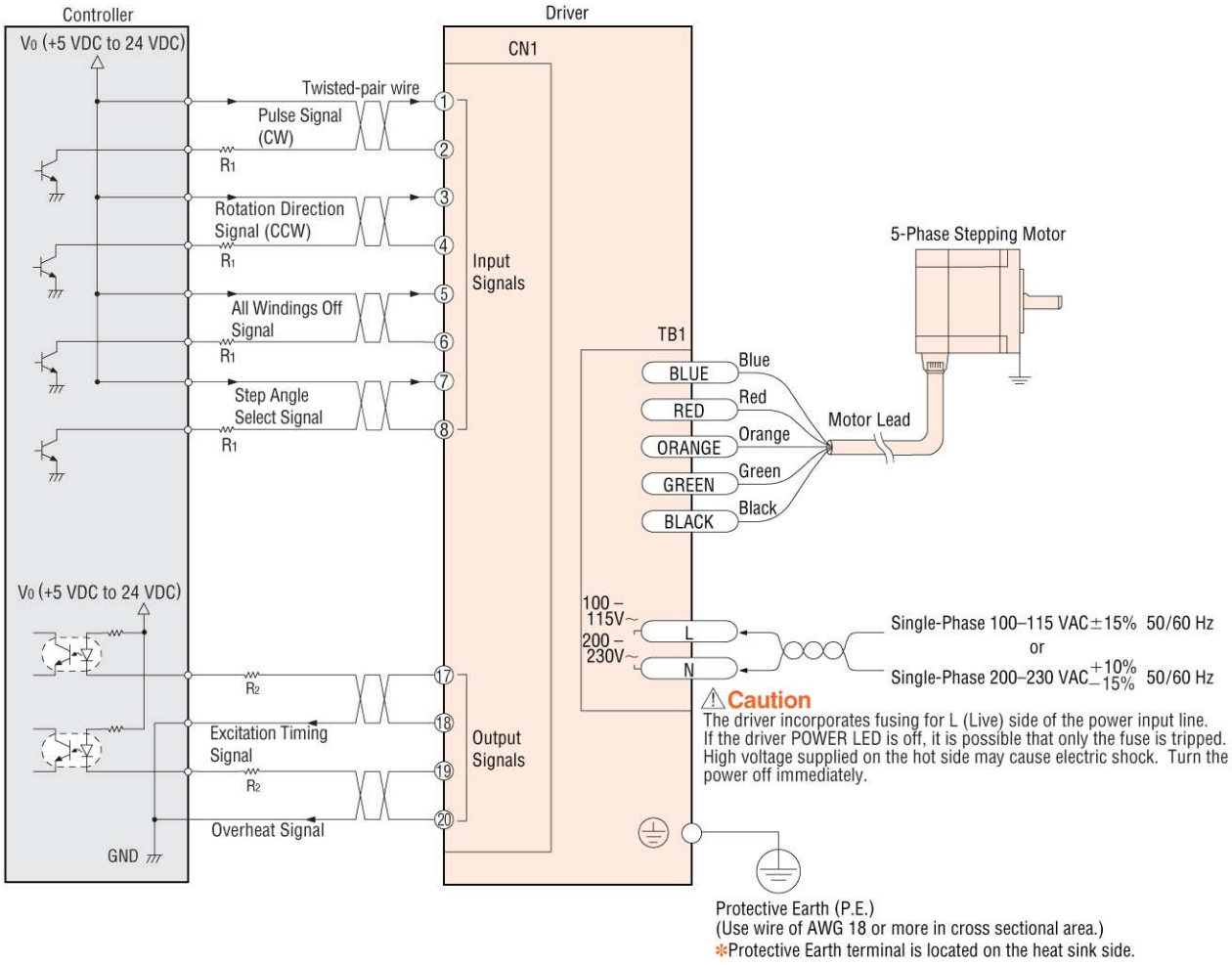
4 Resolution Select Switches

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

5 Input/Output Signals

Indication	Terminal No.	Input/Output	Terminal Name
CN1	1	Input Signals	Pulse Signal (CW Pulse Signal)
	2		
	3		Rotation Direction Signal (CCW Pulse Signal)
	4		
	5		All Windings Off Signal
	6		
	7		Step Angle Select Signal
	8		
	17	Output Signals	Excitation Timing Signal
	18		
	19		Overheat Signal
	20		

Connection Diagrams



♦ Power Supply

Can be used with single-phase 100-115 VAC or single-phase 200-230 VAC 50/60 Hz 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 rotate properly at high-speed (insufficient torque).
- Slow motor startup and stopping.

Notes:

- Keep the voltage Vo between 5 VDC and 24 VDC. When they are equal to 5 VDC, the external resistance R_1 is not necessary. When they are above 5 VDC, connect R_1 to keep the current between 10 mA and 20 mA, and connect R_2 to keep the current below 10 mA.
- Use twisted-pair wire of AWG 24 or thicker and 6.6 feet (2 m) or less in length for the signal line.
- Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases. (→ Technical Reference F-36)
- Use AWG 22 or thicker for motor lines (when extended) and power supply lines, and use AWG 18 or thicker for the wire for the protective earthing line.
- Use spot grounding for the grounding of the driver and external controller.
- Signal lines should be kept at least 3.9 inch (10 cm) away from power lines (power supply lines and motor lines). Do not bind the signal line and power line together.

♦ Recommended Crimp Terminals

- Round shape terminal with insulator
- U shape terminal with insulator

* Crimp terminals are not provided with the package. They must be furnished separately.

Setting the Step Angles (Resolution)

The driver can be preset to two different step angles (resolutions) using the step angle select switches DATA1 and DATA2. Use these switches to set the desired resolution from the 16 resolution levels available. (Refer to the table below.) After setting the two step angles (resolutions), 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

♦ Standard Type

Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle
0	1	0.72°
1	2	0.36°
2	2.5	0.288°
3	4	0.18°
4	5	0.144°
5	8	0.09°
6	10	0.072°
7	20	0.036°
8	25	0.0288°
9	40	0.018°
A	50	0.0144°
B	80	0.009°
C	100	0.0072°
D	125	0.00576°
E	200	0.0036°
F	250	0.00288°

♦ TH Geared Type

Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle at Output Shaft				
		Gear Ratio 3.6:1	Gear Ratio 7.2:1	Gear Ratio 10:1	Gear Ratio 20:1	Gear Ratio 30:1
0	1	0.2°	0.1°	0.072°	0.036°	0.024°
1	2	0.1°	0.05°	0.036°	0.018°	0.012°
2	2.5	0.08°	0.04°	0.0288°	0.0144°	0.0096°
3	4	0.05°	0.025°	0.018°	0.009°	0.006°
4	5	0.04°	0.02°	0.0144°	0.0072°	0.0048°
5	8	0.025°	0.0125°	0.009°	0.0045°	0.003°
6	10	0.02°	0.01°	0.0072°	0.0036°	0.0024°
7	20	0.01°	0.005°	0.0036°	0.0018°	0.0012°
8	25	0.008°	0.004°	0.00288°	0.00144°	0.00096°
9	40	0.005°	0.0025°	0.00188°	0.0009°	0.0006°
A	50	0.004°	0.002°	0.00144°	0.00072°	0.00048°
B	80	0.0025°	0.00125°	0.0009°	0.00045°	0.0003°
C	100	0.002°	0.001°	0.00072°	0.00036°	0.00024°
D	125	0.0016°	0.0008°	0.000576°	0.000288°	0.000192°
E	200	0.001°	0.0005°	0.00036°	0.00018°	0.00012°
F	250	0.0008°	0.0004°	0.000288°	0.000144°	0.000096°

♦ PN Geared Type

Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle at Output Shaft					
		Gear Ratio 5:1	Gear Ratio 7.2:1	Gear Ratio 10:1	Gear Ratio 25:1	Gear Ratio 36:1	Gear Ratio 50:1
0	1	0.144°	0.1°	0.072°	0.0288°	0.02°	0.0144°
1	2	0.072°	0.05°	0.036°	0.0144°	0.01°	0.0072°
2	2.5	0.0576°	0.04°	0.0288°	0.01152°	0.008°	0.00576°
3	4	0.036°	0.025°	0.018°	0.0072°	0.005°	0.0036°
4	5	0.0288°	0.02°	0.0144°	0.00576°	0.004°	0.00288°
5	8	0.018°	0.0125°	0.009°	0.0036°	0.0025°	0.0018°
6	10	0.0144°	0.01°	0.0072°	0.00288°	0.002°	0.00144°
7	20	0.0072°	0.005°	0.0036°	0.00144°	0.001°	0.00072°
8	25	0.00576°	0.004°	0.00288°	0.001152°	0.0008°	0.000576°
9	40	0.0036°	0.0025°	0.0018°	0.00072°	0.0005°	0.00036°
A	50	0.00288°	0.002°	0.00144°	0.000576°	0.0004°	0.000288°
B	80	0.0018°	0.00125°	0.0009°	0.00036°	0.00025°	0.00018°
C	100	0.00144°	0.001°	0.00072°	0.000288°	0.0002°	0.000144°
D	125	0.001152°	0.0008°	0.000576°	0.0002304°	0.00016°	0.0001152°
E	200	0.00072°	0.0005°	0.00036°	0.000144°	0.0001°	0.000072°
F	250	0.000576°	0.0004°	0.000288°	0.0001152°	0.00008°	0.0000576°

♦ HG Geared Type

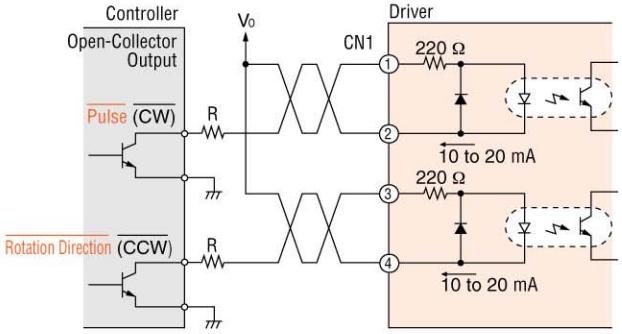
Step Angle Select Switch (Common to DATA1 and DATA2)	Resolution	Step Angle at Output Shaft	
		Gear Ratio 50:1	Gear Ratio 100:1
0	1	0.0144°	0.0072°
1	2	0.0072°	0.0036°
2	2.5	0.00576°	0.00288°
3	4	0.0036°	0.0018°
4	5	0.00288°	0.00144°
5	8	0.0018°	0.0009°
6	10	0.00144°	0.00072°
7	20	0.00072°	0.00036°
8	25	0.000576°	0.000288°
9	40	0.00036°	0.00018°
A	50	0.000288°	0.000144°
B	80	0.00018°	0.00009°
C	100	0.000144°	0.000072°
D	125	0.0001152°	0.0000576°
E	200	0.000072°	0.000036°
F	250	0.0000576°	0.0000288°

Notes:

- Do not change the step angle input setting unless the pulse signal is at rest.
  If the setting is changed while pulses are being input, a motor positional error may result.
- There is no positional error when changing the step angle with the motor is at rest.
- Step angle does not affect torque based on the shaft speed of the motor.

Pulse (CW) and Rotation Direction (CCW) Input Signal

♦Input Circuit and Sample Connection



The letters indicate signals under the 1-pulse input mode, while the letters in parentheses indicate signals under the 2-pulse input mode.

Note:

- When Vo is equal to 5 VDC, the external resistance (R) is not necessary. When Vo is above 5 VDC, connect the external resistance (R) and keep the input current between 10 mA and 20 mA.

1-Pulse Input Mode

Pulse Signal

The "Pulse" signal is input to the pulse signal terminal. When the photocoupler state changes from "ON" to "OFF", the motor rotates one step. The direction of rotation is determined by the rotation direction signal.

Rotation Direction Signal

The "Rotation Direction" signal is input to the rotation direction signal input terminal. A "photocoupler ON" signal input commands a clockwise direction rotation.
A "photocoupler OFF" signal input commands a counterclockwise direction rotation.

2-Pulse Input Mode

CW Pulse Signal

When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the clockwise direction.

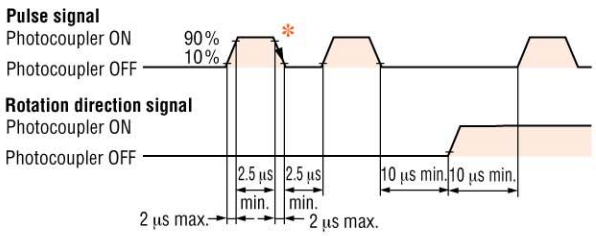
CCW Pulse Signal

When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the counterclockwise direction.

CW and CCW refer to clockwise and counterclockwise direction respectively, from a reference point of facing the motor output shaft.

♦Pulse Waveform Characteristics

(Photocoupler state corresponding to the input pulse)



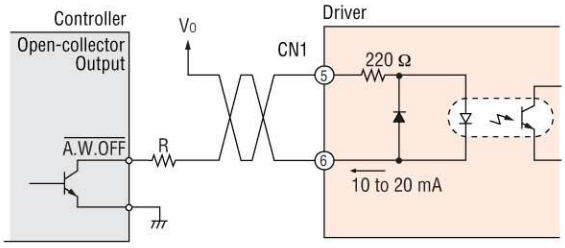
*The shaded area indicates when the photocoupler diode is ON. The motor moves when the photocoupler state changes from ON to OFF as indicated by the arrow.

♦Pulse Signal Characteristics

- The pulse voltage is 4.5 to 5 V in the "photocoupler ON" state, and 0 to 1 V in the "photocoupler OFF" state.
- Input pulse signals should have a pulse width over 2.5 μs, pulse rise/fall below 2 μs, and a pulse duty below 50%.
- Keep the pulse signal at the "photocoupler OFF" state when no pulses are being input.
- The minimum interval time when changing rotation direction is 10 μs. This value varies greatly depending on the motor type, pulse frequency and load inertia. It may be necessary to increase this time interval.
- In 1-pulse input mode, leave the pulse signal at rest ("photocoupler OFF") when changing rotation directions.

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

♦Input Circuit and Sample Connection



Note:

- When Vo is equal to 5 VDC, the external resistance (R) is not necessary. When Vo is above 5 VDC, connect the external resistance (R) and keep the input current between 10 mA and 20 mA.

When the "All Windings Off" signal is in the "photocoupler ON" state, the current to the motor is cut off and motor torque is reduced to zero. The motor output shaft can then be rotated freely by hand.

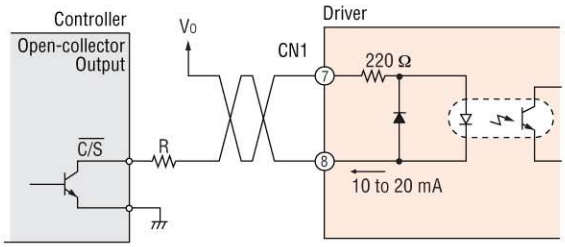
When the "All Windings Off" signal is in the "photocoupler OFF" state, the motor holding torque is proportional to the current set by the current adjustment rotary switches. During motor operation, be sure to keep the signal in the "photocoupler OFF" state.

This signal is used when moving the motor by external force or manual home position is desired. If this function is not needed, it is not necessary to connect this terminal.

Switching the "All Windings 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 ±3.6° from the position set after the "All Windings Off" signal is released.

Step Angle Select (C/S) Input Signal

♦Input Circuit and Sample Connection

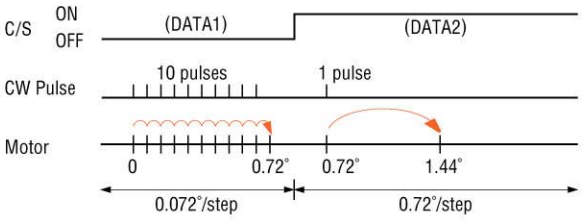


Note:

- When Vo is equal to 5 VDC, the external resistance (R) is not necessary. When Vo is above 5 VDC, connect the external resistance (R) and keep the input current between 10 mA and 20 mA.

You may select two step angles (resolutions) from 16 available step angles (resolutions) with the step angle select 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˚ to 0.72˚.

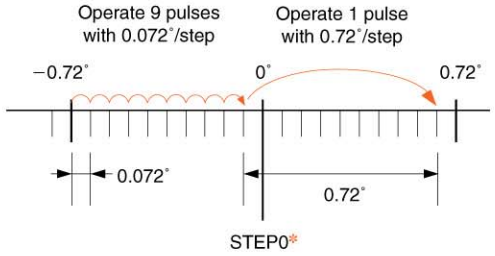


Notes:

- Be sure to change step angle setting inputs only when the pulse signals are at rest. Switching while moving may cause a positional error of the motor.
- There is no positional error if the step angle setting is changed with the motor at rest.
- When the step angle is changed by the "C/S" signal, the "TIMING" signal output shown below may become impossible for some combinations of step angles.When the "TIMING" signal is used, adjust the number of pulses so that the motor can operate with angles that are multiples of 7.2˚.

Example:

After operate 9 pulses with 0.072˚/step setting, change the step angle 0.72˚/step and operate with 1 pulse. In this case, "Excitation Timing" signal will not be output because step 0 position is skipped.

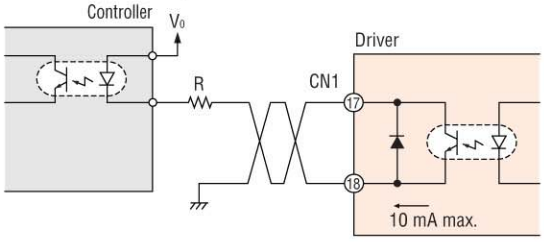


* "Excitation Timing" signal only output at step 0 sequence.

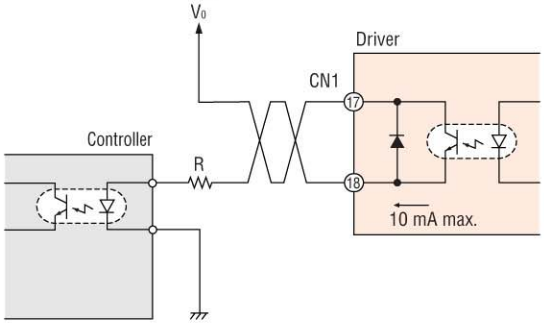
Excitation Timing (TIM.) Output Signal

♦Output Circuit and Sample Connection

Current Sink Output



Current Source Output



Note:

- Keep the voltage between 5 VDC and 24 VDC. Keep the current below 10 mA. If the current exceeds 10 mA, connect external resistance (R).

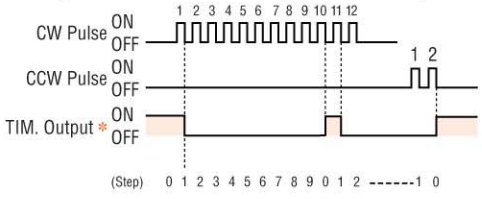
The "Excitation Timing" signal is output to indicate when the motor excitation (current flowing through the winding) is in the initial stage (step "0" at power up).
The "Excitation Timing" signal can be used to increase the accuracy of home position detection by setting the mechanical home position of your equipment (for example, a photo-sensor) to coincide with the excitation sequence initial stage (step "0").

The motor excitation stage changes simultaneously with pulse input, and returns to the initial stage for each 7.2˚ rotation of the motor output shaft.
When power is turned ON, the excitation sequence is reset to step "0".

The TIM. LED lights when the "Excitation Timing" signal is output. While the motor is rotating, the LED will turn ON and OFF at a high speed and will appear to be continuously lit.

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˚ rotation of the motor output shaft.
Resolution 1: Signal is output once every 10 pulses.
Resolution 10: Signal is output once every 100 pulses.

Timing chart at 0.72˚/step (Resolution 1)

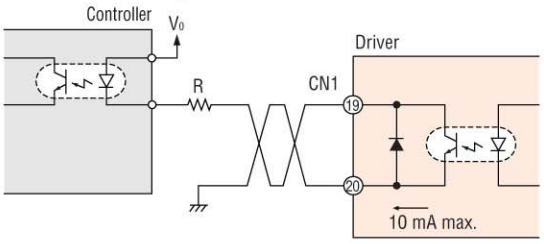


*When connected as shown in the example connection, the signal will be "photocoupler ON" at step "0".

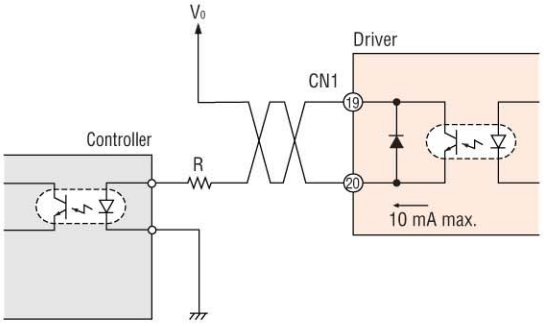
Overheat (O.HEAT) Output Signal

♦Output Circuit and Sample Connection

Current Sink Output



Current Source Output



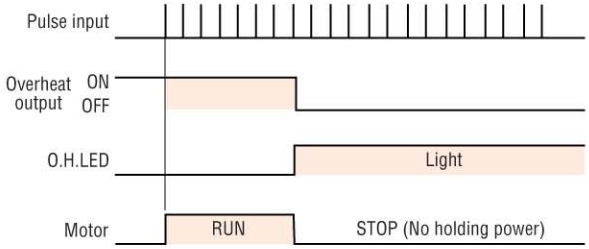
Note:

- Keep the voltage between 5 VDC and 24 VDC.
  Keep the current below 10 mA. If the current exceeds 10 mA, connect external resistance (R).

The "Overheat" signal is output to protect the driver from heat damage if the internal temperature of the driver rises above 176˚F (80˚C).

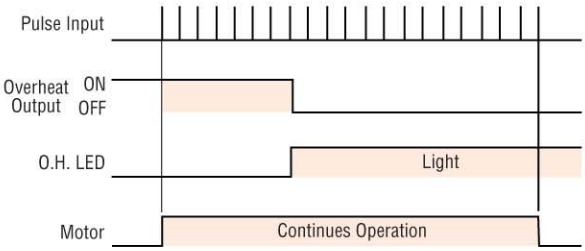
When connected as shown in the example connection, the signal will be "photocoupler OFF" during normal conditions, and "photocoupler ON" when the temperature exceeds 176˚F (80˚C).

When the "Overheat" signal is output, turn the driver power OFF, then adjust the operating conditions (ambient temperature, driver/controller settings), or use a fan to cool the driver. After taking appropriate measures, turn the power ON. Turning the power ON will reset the "Overheat" signal and release the "Automatic Current Off" condition.

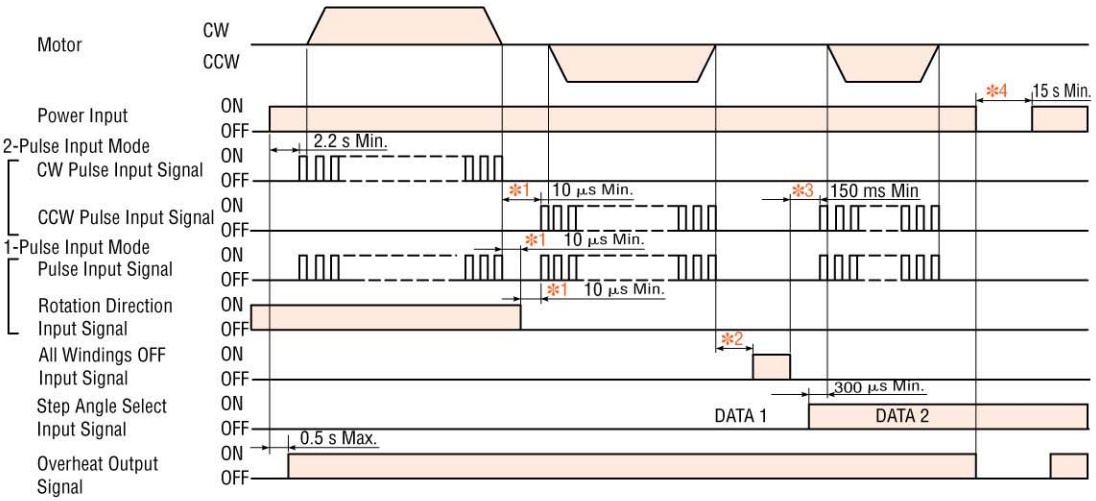


If the “Automatic Current Off” function switch is set to “OFF” position, the motor continues operation even when the “Overheat” signal is output. The output current does not cut off at this time.

When the “Overheat” signal is output, turn the driver power OFF, then adjust the operating conditions (ambient temperature, driver/controller settings), or use a fan to cool the driver. After taking appropriate measures, turn the power ON. Once the power has been turned OFF, wait at least 5 seconds before turning it ON again. After driver's temperature falls to 176˚F (80˚C) or less, turning the power ON will release the “Automatic Current Off” condition.



●Timing Chart



✻1 Switching time to change CW, CCW pulse (2-pulse input mode), and switching time to change direction (1-pulse input mode) 10 μ sec is shown as a response time of circuit. The motor may need more time.
✻2 Depends on load Inertia, load torque, and starting frequency.
✻3 Never input a step pulse signal immediately after switching the "All Winding Off" signal to the photocoupler off state. The motor may not start.
✻4 Wait at least 15 seconds before turning on the power.

List of Motor and Driver Combinations

Model numbers for motor driver combinations are shown below.

Type	Model	Motor Model	Driver Model
tandard	**RK543□A**	PK543□W	RKD507-A
	RK544□A	PK544□W	
	RK545□A	PK545□W	
	RK564□A	PK564□W	RKD514L-A
	RK566□A	PK566□W	
	RK569□A	PK569□W	
	RK596□A	PK596□W	RKD514H-A
	RK599□A	PK599□W	
	RK5913□A	PK5913□W	
	RK564□C	PK564□W	RKD514L-C
	RK566□C	PK566□W	
	RK569□C	PK569□W	
	RK596□C	PK596□W	RKD514H-C
	RK599□C	PK599□W	
	RK5913□C	PK5913□W	
H Geared	**RK543□A-T3.6**	PK543□W-T3.6	RKD507-A
	RK543□A-T7.2	PK543□W-T7.2	
	RK543□A-T10	PK543□W-T10	
	RK543□A-T20	PK543□W-T20	
	RK543□A-T30	PK543□W-T30	
	RK564□A-T3.6	PK564□W-T3.6	RKD514L-A
	RK564□A-T7.2	PK564□W-T7.2	
	RK564□A-T10	PK564□W-T10	
	RK564□A-T20	PK564□W-T20	
	RK564□A-T30	PK564□W-T30	
	RK596□A-T3.6	PK596□W-T3.6	RKD514H-A
	RK596□A-T7.2	PK596□W-T7.2	
	RK596□A-T10	PK596□W1-T10	
	RK596□A-T20	PK596□W1-T20	
	RK596□A-T30	PK596□W1-T30	
	RK564□C-T3.6	PK564□W-T3.6	RKD514L-C
	RK564□C-T7.2	PK564□W-T7.2	
	RK564□C-T10	PK564□W-T10	
	RK564□C-T20	PK564□W-T20	
	RK564□C-T30	PK564□W-T30	
	RK596□C-T3.6	PK596□W-T3.6	RKD514H-C
	RK596□C-T7.2	PK596□W-T7.2	
	RK596□C-T10	PK596□W1-T10	
	RK596□C-T20	PK596□W1-T20	
	RK596□C-T30	PK596□W1-T30	

: Enter **A** (Single shaft) or **B** (double shaft) in the box (□) within the model numbers.

Type	Model	Motor Model	Driver Model
PN Geared	**RK544□A-N5**	PK544□W-N5	RKD507-A
	RK544□A-N7.2	PK544□W-N7.2	
	RK544□A-N10	PK544□W-N10	
	RK566□A-N5	PK566□W-N5	RKD514L-A
	RK566□A-N7.2	PK566□W-N7.2	
	RK566□A-N10	PK566□W-N10	
	RK564□A-N25	PK564□W-N25	
	RK564□A-N36	PK564□W-N36	
	RK564□A-N50	PK564□W-N50	
	RK599□A-N5	PK599□W-N5	RKD514H-A
	RK599□A-N7.2	PK599□W-N7.2	
	RK599□A-N10	PK599□W-N10	
	RK596□A-N25	PK596□W-N25	
	RK596□A-N36	PK596□W-N36	
	RK596□A-N50	PK596□W-N50	
	RK566□C-N5	PK566□W-N5	RKD514L-C
	RK566□C-N7.2	PK566□W-N7.2	
	RK566□C-N10	PK566□W-N10	
	RK564□C-N25	PK564□W-N25	
	RK564□C-N36	PK564□W-N36	
	RK564□C-N50	PK564□W-N50	
	RK599□C-N5	PK599□W-N5	RKD514H-C
	RK599□C-N7.2	PK599□W-N7.2	
	RK599□C-N10	PK599□W-N10	
	RK596□C-N25	PK596□W-N25	
	RK596□C-N36	PK596□W-N36	
	RK596□C-N50	PK596□W-N50	
HG Geared	**RK543□A-H50**	PK543□W-H50S	RKD507-A
	RK543□A-H100	PK543□W-H100S	
	RK564□A-H50	PK564□W-H50S	RKD514L-A
	RK564□A-H100	PK564□W-H100S	
	RK564□C-H50	PK564□W-H50S	RKD514L-C
	RK564□C-H100	PK564□W-H100S	
	RK596□A-H50	PK596□W1-H50	RKD514H-A
	RK596□A-H100	PK596□W1-H100	
	RK596□C-H50	PK596□W1-H50	RKD514H-C
	RK596□C-H100	PK596□W1-H100	

✻ Enter **A** (Single shaft) or **B** (double shaft) in the box (□) within the model numbers.