

5-Phase stepping motor driver

5-Phase stepping motor driver

■ Features

- Realization of small, light and high speed/torque by a Custom IC.
- Bipolar constant current pentagon drive method.
- Various built-in functions, including an automatic current-down circuit and self-testing function.
- Available low-speed rotation and super-precision control with a micro-step drive.
(KR-55MC, KR-515M)
[Maximum 80 divisions, basic step of 0.72°, controlling as accurate as down to 0.009°. It needs 4000pulses for 1 revolution of motor.]
- Photo coupler input insulation method to minimize the effects from external noise.



⚠ Please read "Caution for your safety" in operation manual before using.

■ Ordering information

KR — **515** **M**

M	1.4A/Phase
G	2.8A/Phase
5	77×45×32mm
55	105×74×38mm
515	170×130×39mm
505	215×150×62mm
KR	Series

■ Specifications

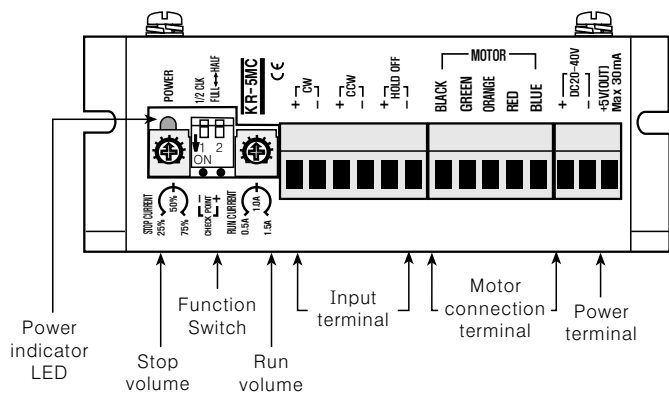
Model	KR-5MC	KR-5M	KR-55MC	KR-515M	KR-505G
Input power	20-40VDC (Max. rating) 3A			100-115VAC 50/60Hz (Max. rating) 330VA	100-115VAC 50/60Hz (Max. rating) 650VA
Drive current	1.4A / Phase (max)				2.8A / Phase (max)
Drive method	Bipolar constant current pentagon drive 0.72° (Full Step), 0.36° (Half Step)/1Step		Micro step 1, 2, 4, 5, 8, 10, 16, 20, 40, 80 division		Bipolar constant current pentagon drive 0.72° (Full Step), 0.36° (Half Step) /1Step
Pulse width	5μs Min.		5μs Min.		5μs Min.
Pulse interval	5μs Min.		5μs Min.		5μs Min.
Rising/falling time	Max. 1μs				
Pulse frequency	50kpps		500kpps		50kpps
Pulse input voltage	High : 4-8VDC, Low : 0-0.5VDC				
Input resistance	390Ω (CW, CCW, HOLD OFF)		300Ω (CW, CCW) 390Ω (HOLD OFF, DIVISION SELECTION)	300Ω (CW, CCW) 390Ω (HOLD OFF, DIVISION SELECTION, CURRENT DOWN) 10Ω (ZERO OUT)	390Ω (CW, CCW, HOLD OFF) 10Ω (ZERO OUT)
Ambient temperature	0 ~ 40°C				
Approval	CE		CE		—
Weight	Approx. 120g	Approx. 100g	Approx. 240g	Approx. 750g	Approx. 1.7kg

※ Absolute max. input is 40V. When using over 30V, be sure it is well ventilated due to increasing heating.

※ Note1) Torque may be different by the input power voltage.

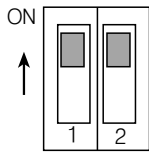
※ Note2) KR-5MC is case type of KR-5M.

5-Phase stepping motor driver [KR-5MC]



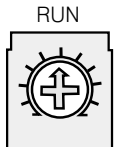
- (A) Counter
- (B) Timer
- (C) Temp. controller
- (D) Power controller
- (E) Panel meter
- (F) Tacho/Speed/Pulse meter
- (G) Display unit
- (H) Sensor controller
- (I) Proximity sensor
- (J) Photo electric sensor
- (K) Pressure sensor
- (L) Rotary encoder
- (M) 5-Phase stepping motor & Driver & Controller

◎S/W Function

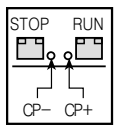


NO	Name	Function	Switch	
			ON	OFF
1	1/2CLK	Select input method	1-PULSE input	2-PULSE input
2	FULL↔HALF	Select rotation angle	0.72° (Full Step)	0.36° (Half Step)

◎Setting the Drive Current



※ To prevent temperature increase and to suppress the vibration of the Motor/Driver, readjust by reducing the drive current using the RUN volume. (Use only for less than the rated motor current. Care should be taken during adjustment since any modification may change the torque.)



※ To change the drive current, connect the CP- to the (-) terminal of the voltmeter and the CP+ to the (+) terminal of the voltmeter then adjust RUN volume. (Factory specification of drive current is 1.4A)
 ※ Phase current change

$$\text{Setting current(A)} = \frac{\text{CP measurement voltage}}{2}$$

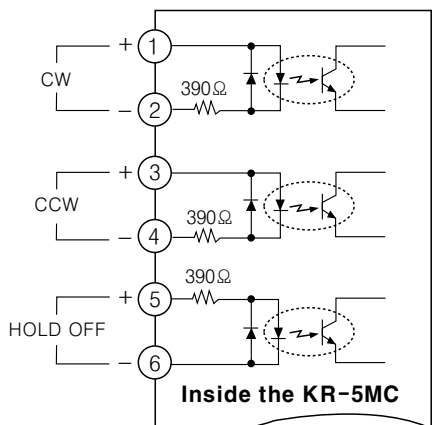
Note) The change of drive current must be set when Motor operates.
 Note) Motor temperature will increase if supplying over rated current.

◎Setting the current when stopping the motor(Current Down function)



※ Stopping current should be about 25~75% of drive current to minimize the heating.
 Ex) After set 1.0A for drive current then put STOP volume at 50%, the stopping current will be 0.5A.
 Note) The change of stopping current must be set when Motor stops.

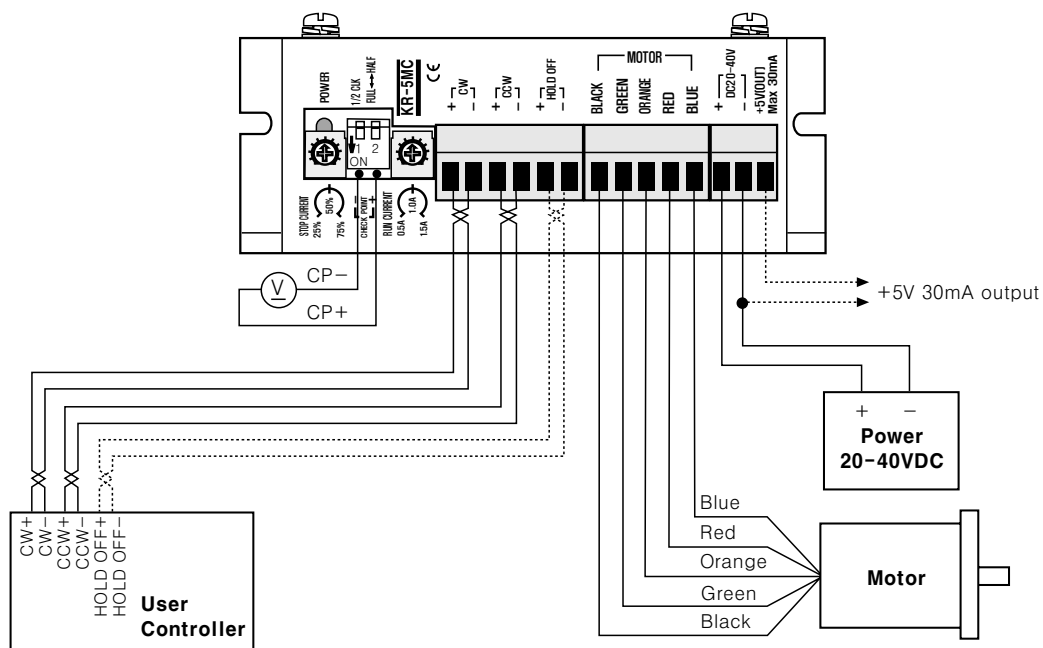
◎Signal input device



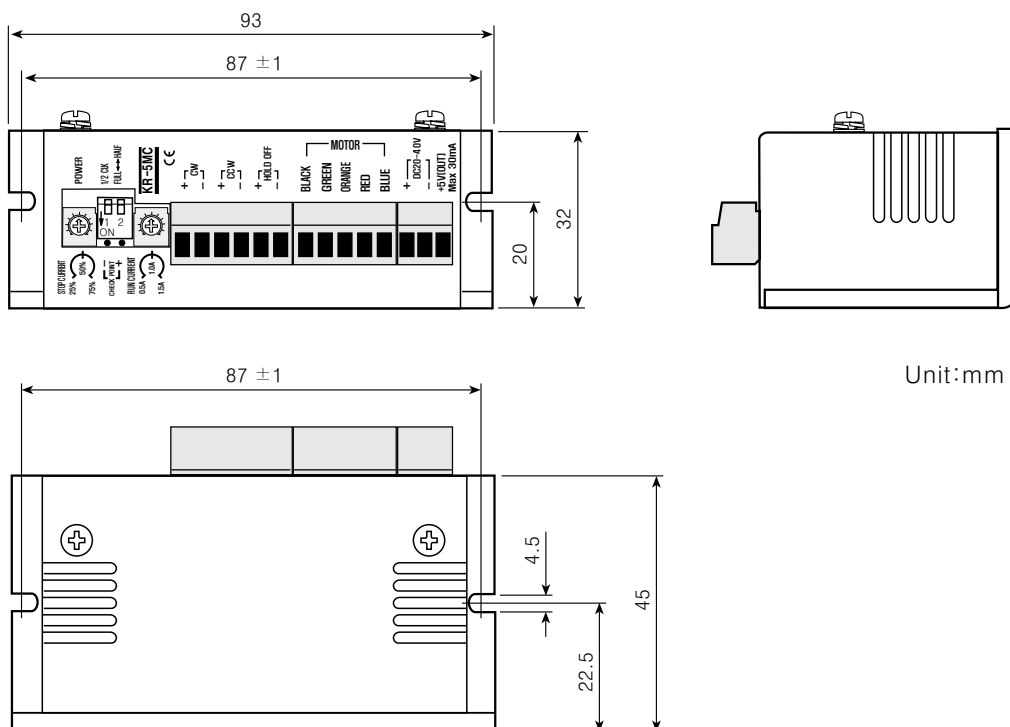
- ※ CW(FORWARD)
 - : 2-PULSE input method (Forward rotation signal input)
 - 1-PULSE input method (Pulse signal input)
 - ※ CCW(REVERSE)
 - : 2-PULSE input method (Reverse rotation signal input)
 - 1-PULSE input method (Rotating direction input) → "H": Forward rotation, "L": Reverse rotation
 - ※ H.O(HOLD OFF)
 - : Motor excitation OFF control signal → "H": Motor excitation OFF
- Note1) Please solder the semi-contact(JP1) on PCB in order to get +5V output.
 Note2) If the power for driving pulse from external source is over 5V, please connect a resistance.

5-Phase stepping motor driver

○Connections

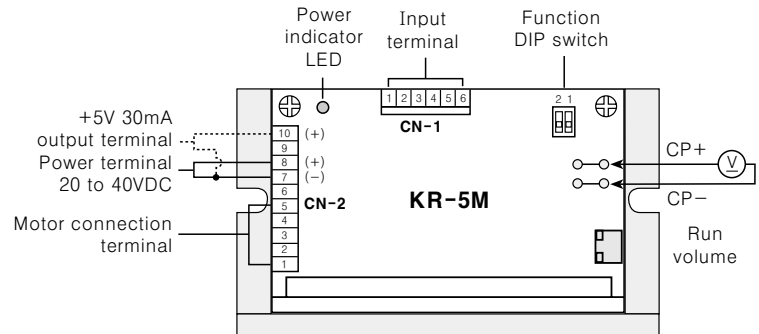


○Dimensions



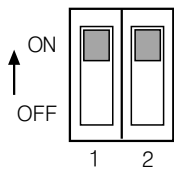
Unit:mm

■ 5-Phase Stepping Motor driver [KR-5M]



- (A) Counter
- (B) Timer
- (C) Temp. controller
- (D) Power controller
- (E) Panel meter
- (F) Tacho/ Speed/ Pulse meter
- (G) Display unit
- (H) Sensor controller
- (I) Proximity sensor
- (J) Photo electric sensor
- (K) Pressure sensor
- (L) Rotary encoder
- (M) 5-Phase stepping motor & Driver & Controller

◎ S/W Function

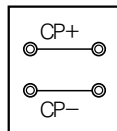


NO	Function	Switch	
		ON	OFF
1	Select rotation angle	0.72° (Full Step)	0.36° (Half Step)
2	Select input method	1-PULSE input	2-PULSE input

◎ Setting the Drive Current



※ To prevent temperature increase and to suppress the vibration of the Motor/Driver, readjust by reducing the drive current using the RUN volume.
(Use only for less than the rated motor current. Care should be taken during adjustment since any modification may change the torque.)



※ To change the drive current, connect the CP- to the (-) terminal of the voltmeter and the CP+ to the (+) terminal of the voltmeter then adjust RUN volume.
(Factory specification of drive current is 1.4A)

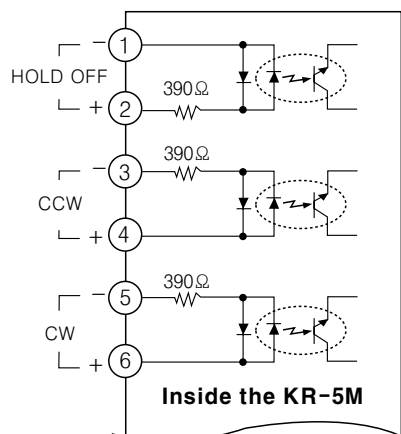
※ Phase current change

$$\text{Setting current(A)} = \frac{\text{CP measurement voltage}}{2}$$

Note) Supplying more than the rated current may cause motor heating.

Note) The stopping current is fixed as 60% of drive current setting value.

◎ Signal input device



※ H.O (HOLD OFF)

: Motor excitation OFF control signal → H⁰: Motor excitation OFF

※ CCW (REVERSE)

: 2-PULSE input method (Reverse rotation signal input)

1-PULSE input method (Rotating direction input) →

[H]: Forward rotation, [L]: Reverse rotation

※ CW (FORWARD)

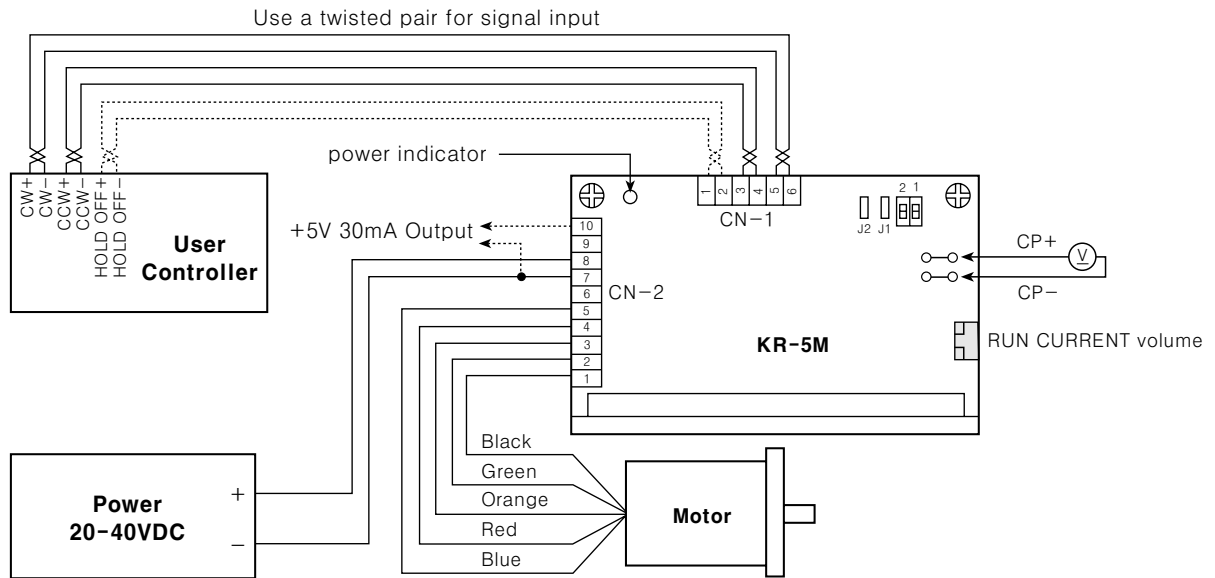
: 2-PULSE input method (Forward rotation signal input)

1-PULSE input method (Pulse signal input)

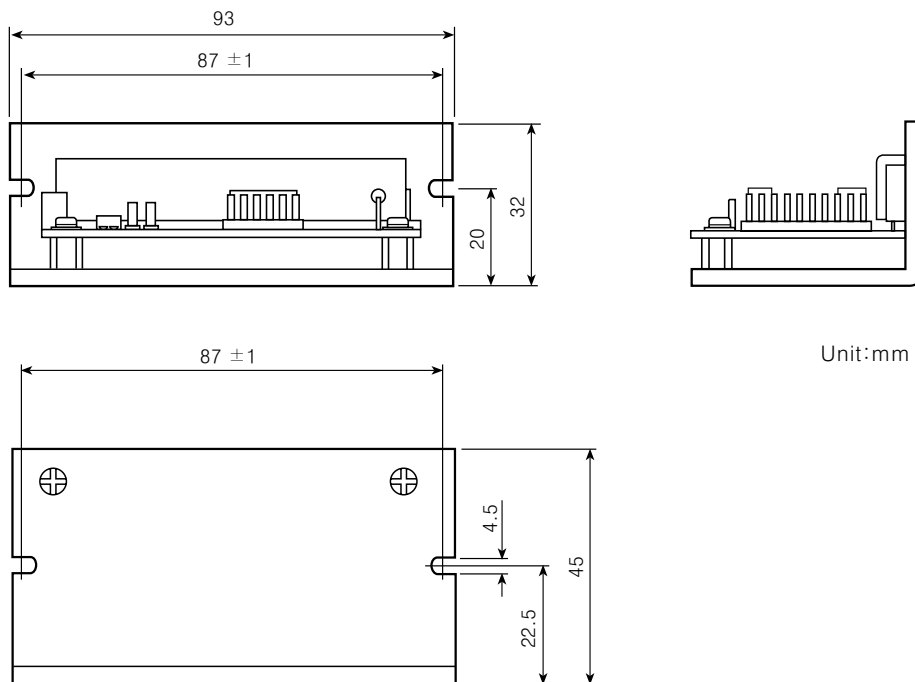
Note) If the power for driving pulse from external source is over 5V, please connect resistance.

5-Phase stepping motor driver

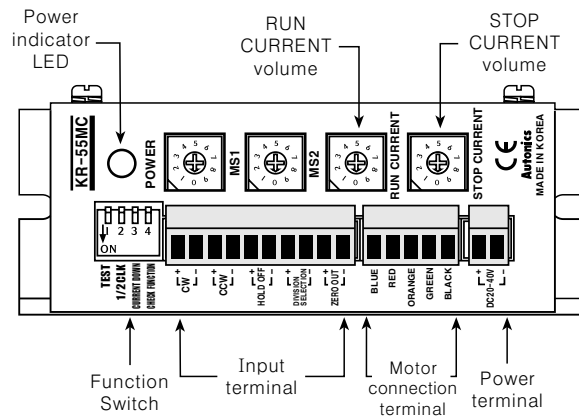
◎Connection diagram



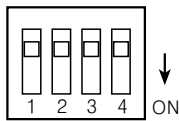
◎Dimensions



■ 5-Phase Micro step driver [KR-55MC]



◎ S/W Function



NO	Function	Switch	
		ON	OFF
1	Self-diagnosis	Rotate in 100pps	Normal
2	Select input signal method	1-PULSE input	2-PULSE input
3	Auto current-down	Not in use	In use
4	Check internal function	When driver is used, it will be OFF	

※ Self diagnosis function

: The self-diagnosis outputs a pulse of 100pps during S/W [ON] setting to test the motor and driver.
 Note) Check the self-diagnosis DIP S/W and set to S/W [OFF] prior to turning on the power.
 Turning on the power at an [ON] setting could be dangerous due to abrupt motor starting.

※ Auto current-down function

: The Auto Current-down reduces the drive current at a constant rate to minimize heating when stopping the motor.
 *When S/W is OFF, supply the current as much as S/W setting value.
 *When S/W is ON, drive current is supplied. (Auto Current Down function not used)
 ※ S/W4 is for checking function when it is at factory, please use it with S/W4 in OFF.

◎ Setting the drive current

RUN CURRENT

S/W NO	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A)	0.5	0.58	0.66	0.75	0.81	0.88	0.96	1.03	1.1	1.15	1.25	1.3	1.4	1.47	1.53	1.6

※ The motor drive current is adjustable with the RUN volume in order to suppress the vibration and rising temperature of motor and driver.

Note1) Use only for less than the rated motor current. Any modification may reduce the torque.

Note2) When using the RUN volume in the "D ~ F" region, do not forget to first check the rated motor drive current to prevent motor heating.

Note3) Increasing the motor drive current will make the torque higher. Since motor heating may be severe, set a drive current that is appropriate to the load.

◎ Setting the current when stopping the motor (Current Down function)

STOP CURRENT

S/W NO	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

※ If using the STOP current setting S/W is allowed (SW3 OFF) the set value is a percentage of the RUN set current.

Ex) In the case of a drive current with a 1.4A/phase, setting the S/W to "5" reduces it to 50% and sets the stopping current at a 0.7A/phase.

$$\text{Maintaining torque (kg} \cdot \text{cm)} = \frac{\text{Maximum excitation stop torque (kg} \cdot \text{cm)} \times \text{Stopping current [A]}}{\text{Rated Motor Current [A]}}$$

Note) If using this mode, first set the H.O. (Hold Off) signal to the [L] level.

(When using the H.O. signal, the Auto Current Down function does not work.)

(A) Counter

(B) Timer

(C) Temp. controller

(D) Power controller

(E) Panel meter

(F) Tacho/Speed/Pulse meter

(G) Display unit

(H) Sensor controller

(I) Proximity sensor

(J) Photo electric sensor

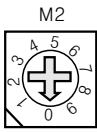
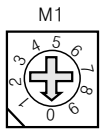
(K) Pressure sensor

(L) Rotary encoder

(M) 5-Phase stepping motor & Driver & Controller

5-Phase stepping motor driver

◎Setting Resolution



SW NO	0	1	2	3	4	5	6	7	8	9
Resolution	1	2	4	5	8	10	20	40	80	16

$$5\text{-Phase Motor Rotate Angle} = \frac{\text{Basic Step}(0.72^\circ)}{\text{Resolution}}$$

※ Enables the adjustment of resolution during stepping motor operation (rotation) and allows a double Micro-Step operation with the Divide Selection Signal (D.S.)

: Operates the selective resolution with M1 S/W on the selection signal [L] and M2 S/W on the selection signal [H] according to the Divide Selection Signal (D.S.)

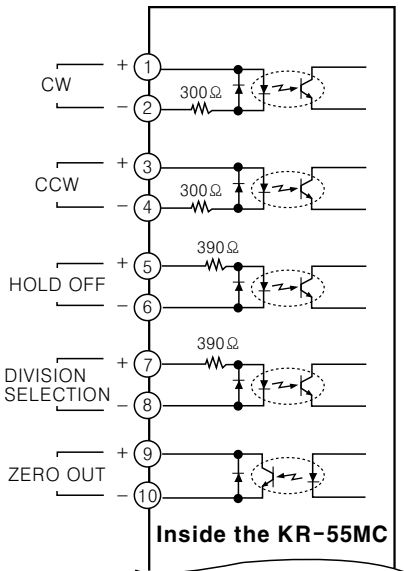
Ex) Maximum 80 divisions, basic step of 0.72° , controlling as accurate as down to 0.009° .

It needs 4000 pulses for 1 revolution of motor.

※ The Zero-point excitation signal is ON when the excitation sequence is 0.

: In the case of a 5-Phase motor with 0.72° with an output every 7.2° , changing the Step angle after turning on the power might not produce any output.

◎Signal input device



※ CW(FORWARD)

: 2-PULSE input method (forward rotation signal input)
1-PULSE input method (pulse signal input)

※ CCW(REVERSE)

: 2-PULSE input method (reverse rotation signal input)
1-PULSE input method (rotating direction signal input)
→ "H": Forward rotation, "L": Reverse rotation

※ H.O(HOLD OFF)

: Motor excitation OFF control signal → "H" Motor excitation OFF

※ D.S

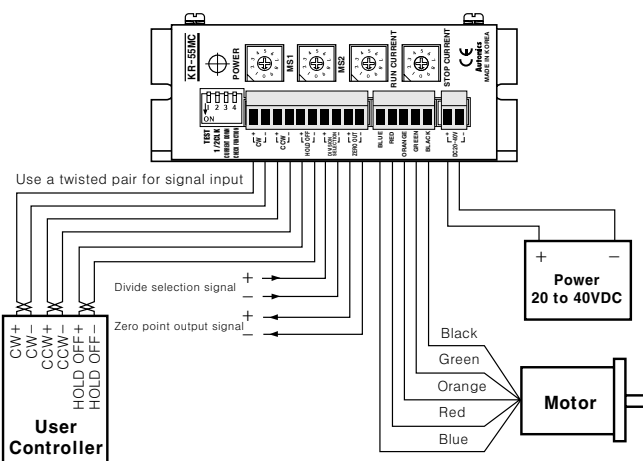
: Division selection signal → "L" M1, "H" M2

※ Z.P

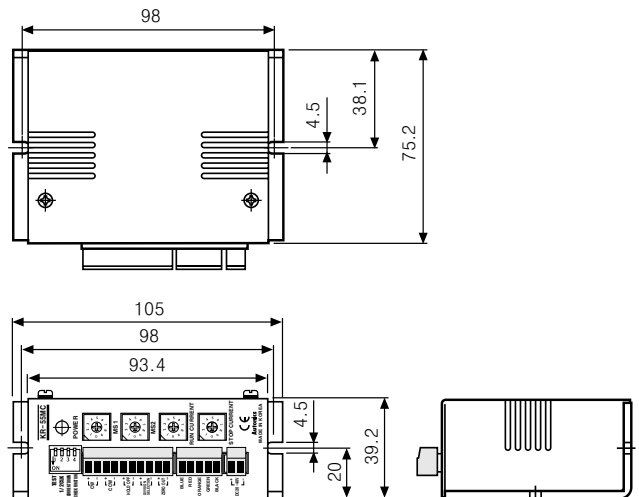
: Zero point excitation output signal → ON with Zero point excitation

Note) If the power for driving pulse from external is over 5V, please connect resistance.

◎Connections

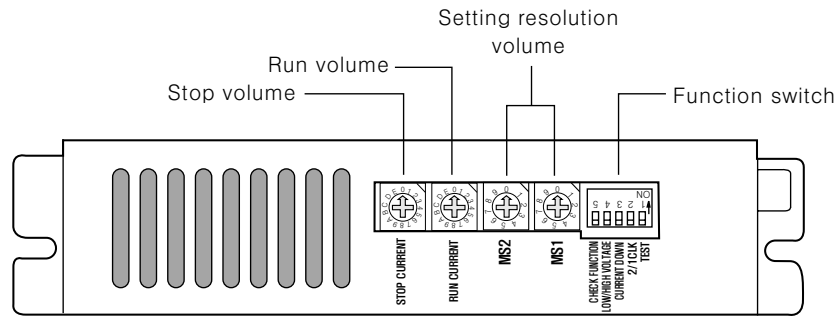


◎Dimensions

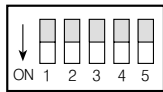


Unit:mm

■ 5-Phase Micro-step driver[KR-515M]



◎ S/W Function



NO	Name	Function	ON	OFF
1	TEST	Self-diagnosis	Rotate in 100pps	Normal
2	2/1 CK	Select input signal method	1-PULSE input	2-PULSE input
3	C.D	Auto current-down	Not in use	In use
4	L/HV	Drive voltage conversion	High speed torque	Normal
5	OP	Check internal function	When driver is used, it will be OFF	

※ Self-diagnosis

: The self-diagnosis outputs a pulse of 100pps during the S/W [ON] setting to test the motor and driver.

Note) Check the self-diagnosis DIP S/W and set to [OFF] prior to turning on the power.

Turning on the power at an [ON] setting could be dangerous due to abrupt motor starting.

※ Auto current-down function

: The Auto Current-down reduces the drive current at a constant rate to minimize heating when stopping the motor.

*When S/W is OFF, supply the current as much as S/W setting value.

*When S/W is ON, drive current is supplied (Auto Current Down function not used)

※ L/HV (Low/High Voltage) function

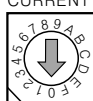
: This function is to increase the high speed torque of motor by changing drive voltage of motor.

Note) When using the high-speed and high-torque (S/W4 [ON]) care should be taken to prevent severe motor heating.

※ S/W5 is for checking function when it is at factory, please use it with S/W4 in OFF.

◎ Setting the drive current

RUN CURRENT



S/W NO	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current value(A)	0.5	0.58	0.66	0.75	0.81	0.88	0.96	1.03	1.1	1.15	1.25	1.3	1.4	1.47	1.53	1.6

※ The motor drive current is adjustable with the RUN volume in order to suppress the vibration and rising temperature of motor and driver.

Note1) Use only for less than the rated motor current. Any modification may reduce the torque.

Note2) When using the RUN volume in the "D to F" region, do not forget to first check the rated motor drive current to prevent motor heating.

Note3) Increasing the motor drive current will make the torque higher. Since motor heating may be severe, set a drive current that is appropriate to the load.

◎ Setting the current when stopping the motor (Current Down function)

STOP CURRENT



S/W NO	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

※ If using the STOP current setting S/W is allowed (SW3 OFF), and the set value is a percentage of the RUN set current.

Ex) In the case of a drive current with a 1.4A/phase, setting the S/W to '5' reduces it to 50% and sets the stopping current at a 0.7A/phase.

$$\text{Maintaining torque [kg.cm]} = \frac{\text{Maximum excitation stop torque [kg.cm]} \times \text{Stopping current [A]}}{\text{Rated Motor Current [A]}}$$

Note) To use this mode, first set the H.O. (Hold Off) signal to the [L] level.

(When using the H.O. signal, the Auto Current Down function does not work.)

(A) Counter

(B) Timer

(C) Temp. controller

(D) Power controller

(E) Panel meter

(F) Tacho/Speed/Pulse meter

(G) Display unit

(H) Sensor controller

(I) Proximity sensor

(J) Photo electric sensor

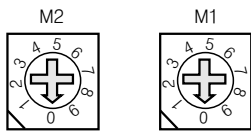
(K) Pressure sensor

(L) Rotary encoder

(M) 5-Phase stepping motor & Driver & Controller

5-Phase stepping motor driver

◎Setting Resolution



SW NO	0	1	2	3	4	5	6	7	8	9
Resolution	1	2	4	5	8	10	20	40	80	16

$$5\text{-Phase Motor Rotate Angle} = \frac{\text{Basic Step}(0.72^\circ)}{\text{Resolution}}$$

※ Enables the adjustment of resolution during stepping motor operation (rotation) and allows a double Micro-Step operation with the Divide Selection Signal (D.S.)

: Operates the selective resolution with M1 S/W on the selection signal [L] and M2 S/W on the selection signal [H] according to the Divide Selection Signal (D.S.)

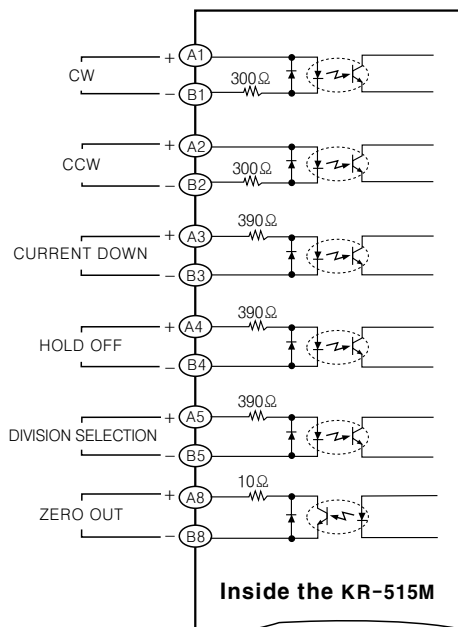
Ex) Maximum 80 divisions, basic step of 0.72° , controlling as accurate as down to 0.009° .

It needs 4000 pulses for 1 revolution of motor.

※ The Zero-point excitation signal is ON when the excitation sequence is 0.

: In the case of a 5-Phase motor with 0.72° with an output every 7.2° , changing the Step angle after turning on the power might not produce any output.

◎Signal input device



※ CW

: 2-PULSE input method (forward rotation signal input)
1-PULSE input method (pulse signal input)

※ CCW

: 2-PULSE input method (reverse rotation signal input)
1-PULSE input method (rotating direction signal input)
→ [H] forward rotation, [L] reverse rotation

※ C.D

: Auto Current Down → [H] : No Current Down

※ H.O

: Motor excitation OFF control signal → [H] Motor excitation OFF

※ D.S

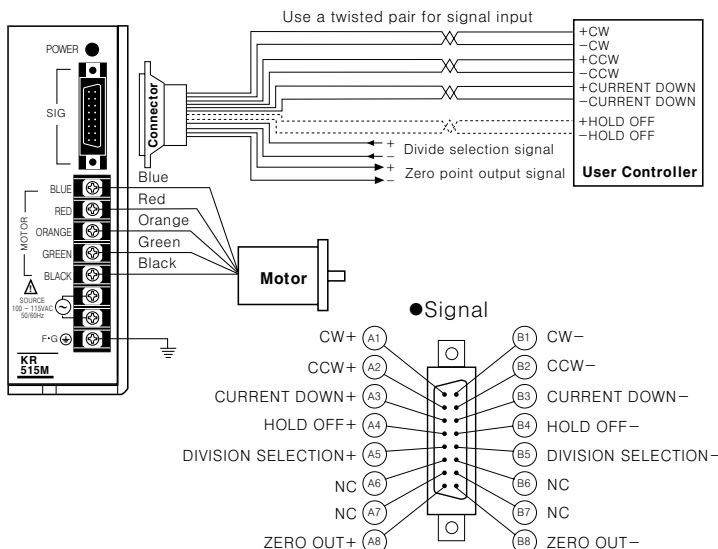
: Division selection signal → [L] : M1, [H] : M2

※ Z.P

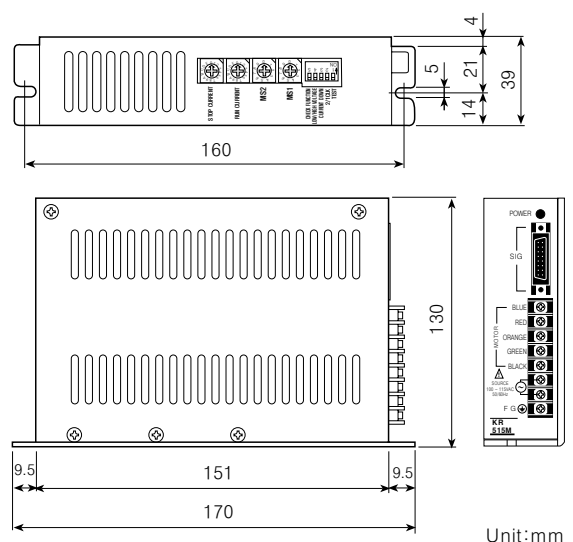
: Zero point excitation output signal → [ON with Zero point excitation]

Note) If the power for driving pulse from external is over 5VDC, please connect resistance.

◎Connections

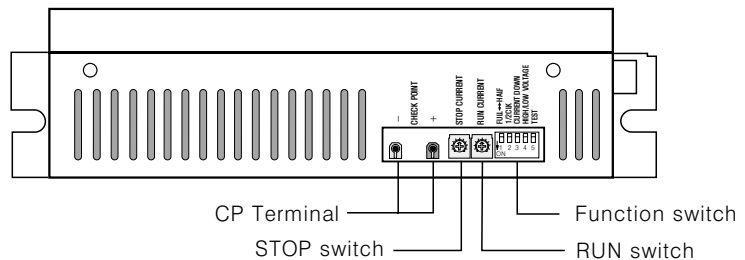


◎Dimensions



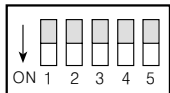
Unit:mm

■ 5-Phase stepping motor driver [KR-505G]



- (A) Counter
- (B) Timer
- (C) Temp. controller
- (D) Power controller
- (E) Panel meter
- (F) Tacho/ Speed/ Pulse meter
- (G) Display unit
- (H) Sensor controller
- (I) Proximity sensor
- (J) Photo electric sensor
- (K) Pressure sensor
- (L) Rotary encoder
- (M) 5-Phase stepping motor & Driver & Controller

◎ S/W Function



NO	Name	Function	Switch	
			ON	OFF
1	FULL↔HALF	Step angle	0.72° (Full step)	0.36° (Half step)
2	1/2 CLK	Select input signal method	1 Pulse input	2 Pulse input
3	CURRENT DOWN	Auto current-down	Not in use	In use
4	HIGH/LOW VOLTAGE	Change of drive voltage	High speed torque	Normal
5	TEST	Self-diagnosis	Rotate in 100pps	Normal

※ Auto current-down function

: The Auto Current-down reduces the drive current at a constant rate to minimize heating when stopping the motor.

*When S/W is OFF, supply the current as much as S/W setting value.

*When S/W is ON, drive current is supplied (Auto Current Down function not used.)

※ L/HV (Low/High Voltage) function

: When using the high-speed and high-torque (S/W4 [ON]) care should be taken to prevent severe motor heating.

※ Self-diagnosis

: The self-diagnosis outputs a pulse of 100pps during the S/W [ON] setting to test the motor and driver.

Note) Check the self-diagnosis DIP S/W and set to [OFF] prior to turning on the power. Turning on the power at an [ON] setting could be dangerous due to abrupt motor starting.

◎ Setting the drive current



※ The motor drive current is adjustable with the RUN switch in order to suppress the vibration and rising temperature of motor and driver.

※ To change the phase current, please follow below.

$$\text{Setting current (A)} = \frac{\text{CP measuring voltage (V)}}{2.25}$$

Note) The change of drive current must be set when motor operates.

Note) It causes motor gets high-temperature if supplying over current.

◎ Setting the current when stopping the motor (Current Down function)



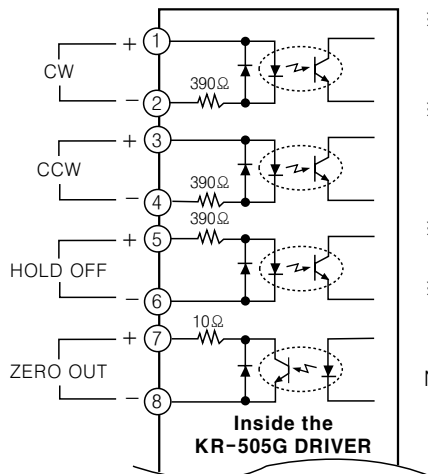
※ Motor STOP current should be about 25~75% of driver current to.

Ex) After setting the drive current as 2.0A then set STOP volume as 50%, the STOP current will be 1.0A.

Note) The change of stopping current must be set when motor stops.

5-Phase stepping motor driver

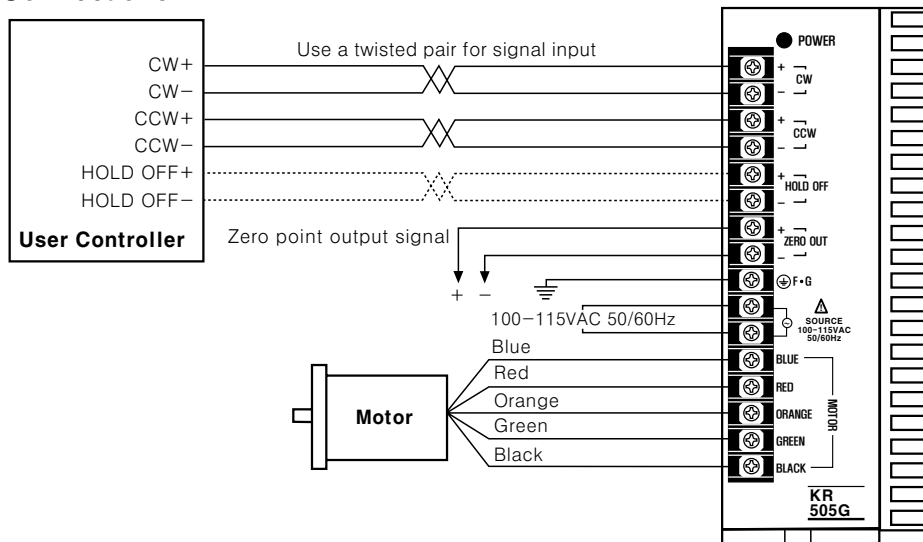
◎Signal Input device



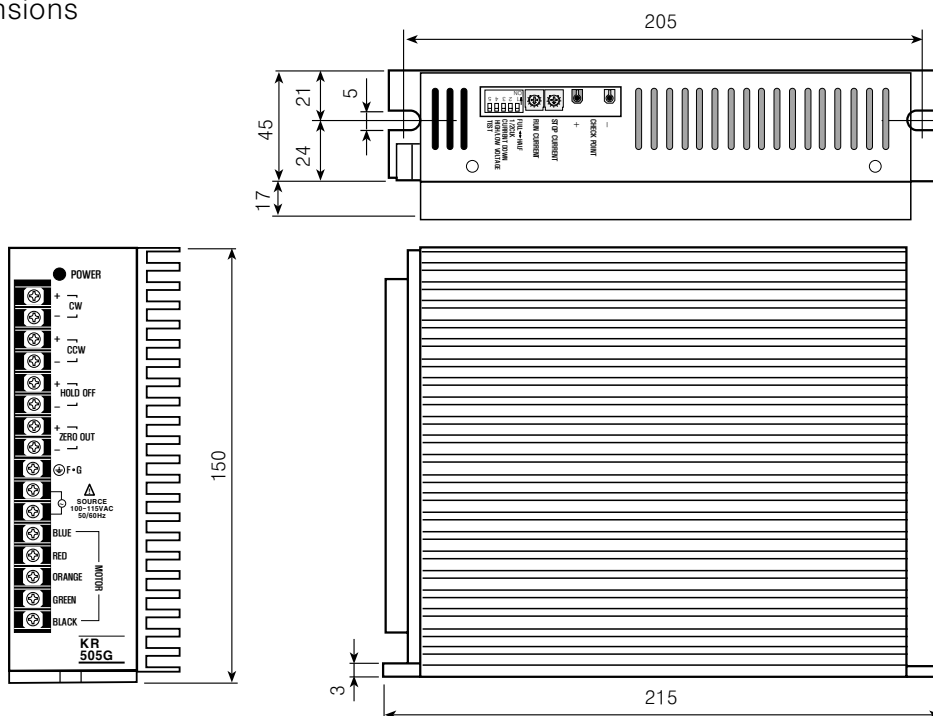
- ※ CW (Forward)
 - : 2-PULSE input method (forward rotation signal input)
 - 1-PULSE input method (pulse signal input)
- ※ CCW (Reverse)
 - : 2-PULSE input method (reverse rotation signal input)
 - 1-PULSE input method (rotating direction signal input)
 - "H" Forward rotation, "L" Reverse rotation
- ※ H.O (Hold OFF)
 - : Motor excitation OFF control signal → [H] : Motor excitation OFF
- ※ Z.P
 - : Zero point excitation output signal → [ON with Zero point excitation]

Note) If the power for driving pulse from external is over 5VDC, please connect resistance.

◎Connections



◎Dimensions



Unit:mm

■ Proper usage

◎ Precaution for input signal

- When using the 2-PULSE input method, do not input CW and CCW at the same time.
 - When one of the CW and CCW signals is at [H], a signal input in another directions may not work normally.
- The current value of power input is the max. input current value. (Velocity can be different by input pulse)
 - Please use enough capacity of power source for driving motor.
- H.O(Hold Off)signal will stop supplying current to motor and allow you to rotate the motor shaft with external force.
 - When using H.O signal, Current Down function will be disabled.

◎ Precaution for wiring

- Use Twisted pair (Min. 0.2mm) for the signal wiring and should be shorter than 2m.
- Please use over 0.75mm wire for ground wiring and use over 0.5mm wire for motor wiring (When it needs to extend and power wiring).

Motor drive current(A)	Wire thickness
0.75	AWG26(0.15mm ²)
1.4	AWG24(0.25mm ²)
2.8	AWG22(0.35mm ²)

- Signal wire should be over 10cm distance from power line and terminal ground should be separated.
- Please check the polarity of power before applying it.

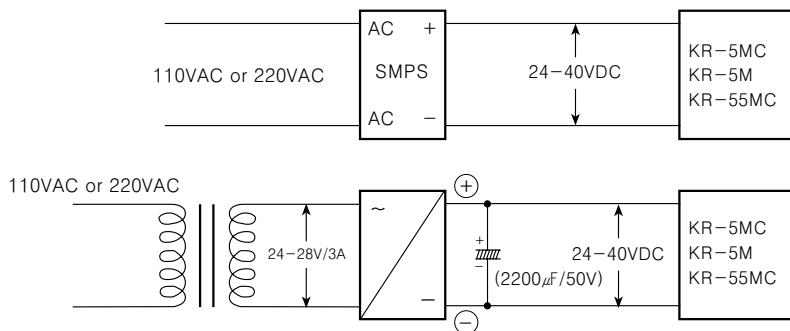
◎ Caution for using

- Please mount heating panel on metal surface tightly and in a well ventilated place in order to increase the heat transfer of heating panel.

◎ For Drive power supply

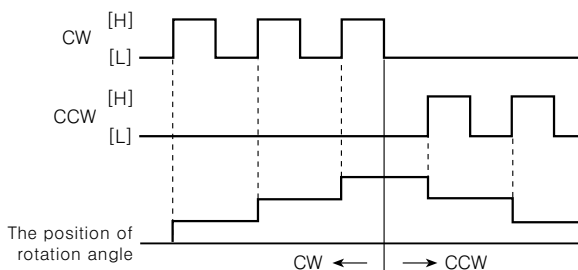
- The constant voltage power supply is most suitable for the power for the stepping motor drive. The following simple method is also available. KR-5MC, KR-5M and KR-55M include a constant current drive and constant voltage power circuit available up to 20-40V. Thus, the following method is simple to use for applications which do not require an accurate torque.

※ Notice not to exceed 40V

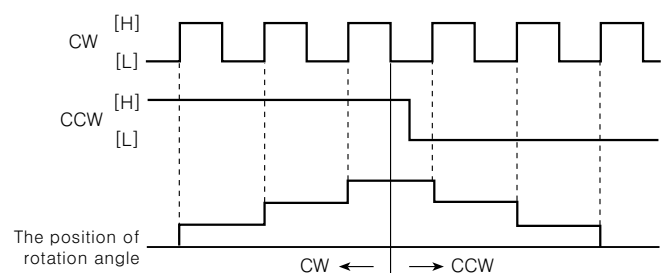


◎ Input time

- When it is 2 pulse input method



- When it is 1 pulse input method



Note) When using the 2-PULSE input method, do not input CW and CCW at the same time.

: When one of the CW and CCW signals is at [H], a signal input in another directions may not work normally.

(A)
Counter

(B)
Timer

(C)
Temp.
controller

(D)
Power
controller

(E)
Panel
meter

(F)
Tacho/
Speed/
Pulse
meter

(G)
Display
unit

(H)
Sensor
controller

(I)
Proximity
sensor

(J)
Photo
electric
sensor

(K)
Pressure
sensor

(L)
Rotary
encoder

(M)
5-Phase
stepping
motor &
Driver &
Controller