5-Phase Stepping Motor and Driver Specifications

(○ : General specifications, ◎ : High-torque specifications)

Motor					Driver		
Type		Model	Torque (kgf·cm)	A/phase (A)	MD5-HD14/MD5-ND14/ KR-5MC/KR-55MC	MD5-MF14 (KR-515M)	KR-505G
24 Square	Shaft type	02K-S523(W)	0.18	0.75	○	◎	
		04K-S525(W)	0.28	0.75	○	◎	
42 Square	Shaft type	A1K-S543(W)-□	1.3	0.75	○	◎	
		A2K-S544(W)-□	1.8	0.75	○	◎	
		A3K-S545(W)-□	2.4	0.75	○	◎	
	Geared built-in type	A10K-S545(W)-G5	10	0.75	○	◎	
		A15K-S545(W)-G7.2	15	0.75	○	◎	
		A15K-S545(W)-G10	15	0.75	○	◎	
	Hollow shaft type	AH1K-S543	1.3	0.75	○	◎	
		AH2K-S544	1.8	0.75	○	◎	
		AH3K-S545	2.4	0.75	○	◎	
60 Square	Shaft type / Shaft type + Brake built-in type	A4K-S564(W)-□ B	4.2	0.75	○	◎	
		A4K-M564(W)-□ B	4.2	1.4	○	◎	
		A8K-S566(W)-□ B	8.3	0.75	○	◎	
		A8K-M566(W)-□ B	8.3	1.4	○	◎	
		A16K-M569(W)-□ B	16.6	1.4	○	◎	
		A16K-G569(W)-□ B	16.6	2.8			◎
	Hollow shaft type	AH4K-S564(W)	4.2	0.75	○	◎	
		AH4K-M564(W)	4.2	1.4	○	◎	
		AH8K-S566(W)	8.3	0.75	○	◎	
		AH8K-M566(W)	8.3	1.4	○	◎	
		AH16K-M569(W)	16.6	1.4	○	◎	
		AH16K-G569(W)	16.6	2.8			◎
	Geared built-in type/ Geared + Brake built-in type	A35K-M566(W)-G B 5	35	1.4	○	◎	
		A40K-M566(W)-G B 7.2	40	1.4	○	◎	
		A50K-M566(W)-G B 10	50	1.4	○	◎	
	Rotary actuator / Rotary actuator + Brake built-in type	A35K-M566(W)-R B 5	35	1.4	○	◎	
		A40K-M566(W)-R B 7.2	40	1.4	○	◎	
		A50K-M566(W)-R B 10	50	1.4	○	◎	
85 Square	Shaft type / Shaft type + Brake built-in type	A21K-M596(W)-□ B	21	1.4	○	◎	
		A21K-G596(W)-□ B	21	2.8			◎
		A41K-M599(W)-□ B	41	1.4	○	◎	
		A41K-G599(W)-□ B	41	2.8			◎
		A63K-M5913(W)-□ B	63	1.4	○	◎	
		A63K-G5913(W)-□ B	63	2.8			◎
	Hollow shaft type	AH21K-M596(W)	21	1.4	○	◎	
		AH21K-G596(W)	21	2.8			◎
		AH41K-M599(W)	41	1.4	○	◎	
		AH41K-G599(W)	41	2.8			◎
		AH63K-M5913(W)	63	1.4	○	◎	
		AH63K-G5913(W)	63	2.8			◎
	Geared built-in type/ Geared + Brake built-in type	A140K-M599(W)-G B 5	140	1.4	○	◎	
		A140K-G599(W)-G B 5	140	2.8			◎
		A200K-M599(W)-G B 7.2	200	1.4	○	◎	
		A200K-G599(W)-G B 7.2	200	2.8			◎
		A200K-M599(W)-G B 10	200	1.4	○	◎	
		A200K-G599(W)-G B 10	200	2.8			◎

※ ( ) stands for dual shaft of motor. The brake built-in type provides single shaft only.
※ The motor has a big difference in torque by the characteristics of the driver.
　Please refer to the graph in this catalogue that shows the characteristics of motors and drivers.
　For MD5-HD14, MD5-ND14, KR-5MC and KR-55MC, the high-speed region torque characteristics are better at 35VDC than at 20VDC.
　In addition, MD5-HF14, MD5-MF14 and KR-505G have further improved torque characteristics in the high-speed area.
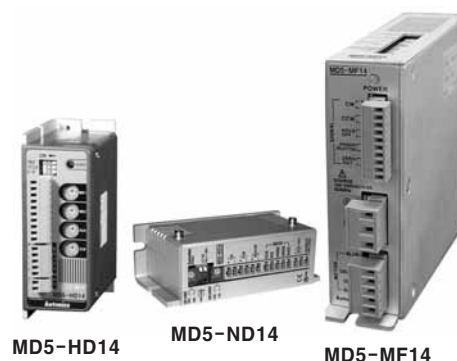※ 85 square stepping motor has further improved high speed characteristics of 1.4[A/phase] adjusting the phase current at that of KR-505G.

5-Phase Stepping Motor Driver

Small, light and high speed and torque 5-Phase stepping motor driver
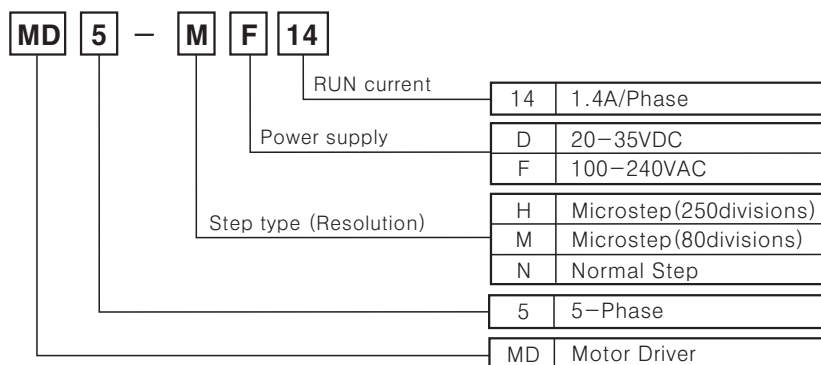
■Features

- ●Bipolar constant pentagon drive method
- ●Includes auto Current Down and self-diagnosis function
- ●Low speed rotation and high precision control with microstep drive (MD5-HD14, MD5-MF14)
  [Max. 250 divisions and it is enable to control as accurate as down to 0.0028° for basic step 0.72° of 5-Phase stepping motor and it needs 125,000 pulses for 1 rotation of motor.]
- ●Insulate using photocoupler to minimize the influence by external noise.

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

CE

MD5-HD14   MD5-ND14   MD5-MF14

■Ordering information

| MD | 5 | – | M | F | 14 |

RUN current	14	1.4A/Phase
Power supply	D	20-35VDC
	F	100-240VAC
Step type (Resolution)	H	Microstep(250divisions)
	M	Microstep(80divisions)
	N	Normal Step
	5	5-Phase
	MD	Motor Driver

※**KR-515M is changed as MD5-MF14.**

■Specifications

Model	MD5-HD14	MD5-ND14	MD5-MF14
Power supply	(※1) 20-35VDC 3A	20-35VDC 3A	100-240VAC 50/60Hz
RUN current	0.4~1.4A / Phase	0.5~1.5A / Phase	0.5~1.6A / Phase
RUN method	Bipolar constant pentagon drive		
Basic step angle	0.72° / 1Step		
Resolution	1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250 divisions (0.72° ~ 0.00288° / 1Step)	1, 2 divisions (0.72°, 0.36° / 1Step)	1, 2, 4, 5, 8, 10, 16, 20, 40, 80 divisions (0.72° ~ 0.009° / 1Step)
Input pulse width	Min. 0.25μs	Min. 0.5μs	
Input pulse interval	Min. 0.25μs	Min. 0.5μs	
Rising/Falling time	Max. 1μs		
Input pulse frequency	500kpps	50kpps	500kpps
Input voltage	High : 4-8VDC, Low : 0-0.5VDC		
Input resistance	270Ω (CW, CCW) 390Ω (HOLD OFF, DIVISION SELECTION)	390Ω (CW, CCW, HOLD OFF)	270Ω (CW, CCW) 390Ω (HOLD OFF, DIVISION SELECTION, CURRENT DOWN)
Ambient temperature	0 ~ 40℃ (at non-dew status)	0 ~ 40℃ (at non-dew status)	
Ambient humidity	35 ~ 85%RH		
Approval	CE		
Unit weight	Approx. 220g	Approx. 120g	Approx. 750g

※(※1)When using over 30VDC, it should be mounted at ventilated place due to increasing heat.

(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) Switching power supply
(J) Proximity sensor
(K) Photo electric sensor
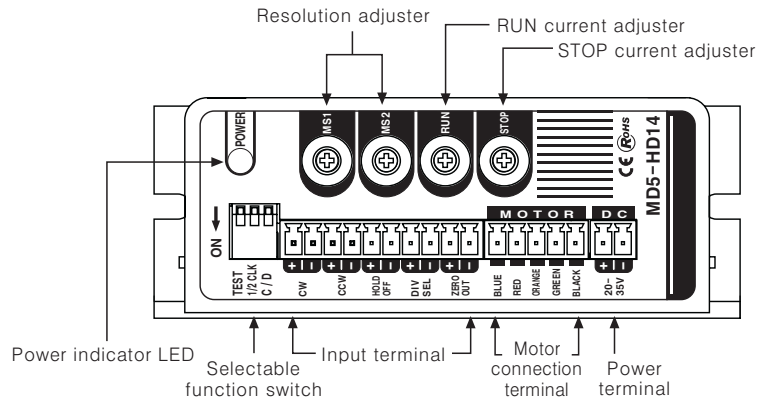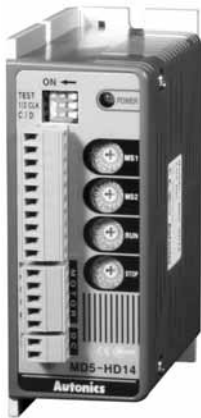(L) Pressure sensor
(M) Rotary encoder
(N) Stepping motor & Driver & Controller
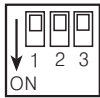(O) Graphic panel
(P) Production stoppage models & replacement

5-Phase microstepping motor driver [MD5-HD14]

Resolution adjuster — RUN current adjuster — STOP current adjuster

Power indicator LED | Selectable function switch | Input terminal | Motor connection terminal | Power terminal

◎Selectable function switch

NO	Name	Function	Switch position	
			ON	OFF
1	TEST	Self-diagnosis	Rotate in 250pps	Normal
2	1/2 CLK	Pulse input method	1 Pulse input	2 Pulse input
3	C/D	Auto Current Down	Disable	Enable

● TEST

※It rotates at a speed of 250pps in Full Step and it is changed depending on resolution.
※It rotates to CCW in 1 Pulse input method and CW in 2 Pulse input method.

● 1/2 CLK

※Pulse input method selection
※1 Pulse method : Input pulse signal input in CW and rotating direction signal in CCW.
　　　　　　　　　It rotates to CCW when [L] and CW for [H].
※2 Pulse method : Motor is rotated to CW when input pulse in CW and to CCW
　　　　　　　　　when input pulse in CCW.

● Auto Current Down

※It reduces current when motor is at standstill to lower the heat generation automatically.
※Current is reduced from approx.500[ms] after the last pulse input.

◎RUN current setting

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	0.4	0.5	0.57	0.63	0.71	0.77	0.84	0.9	0.96	1.02	1.09	1.15	1.22	1.27	1.33	1.4

※RUN current is phase current provided to 5-phase stepping motor.
※RUN current is set under the rated current of motor, it may cause loss of torque.
※Torque is increased as raise RUN current, but, motor emits heat too much, therefore select depending on the load.

◎STOP current setting

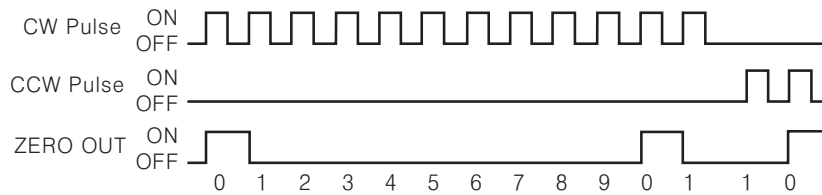| Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
%	27	31	36	40	45	50	54	58	62	66	70	74	78	82	86	90

※It sets current when motor is at standstill.
※Set STOP current is percentage of RUN current.
※It is operated when HOLD OFF is [L]. Current supplied to each phase is cut in [H], auto Current Down function does not work.

5-Phase Stepping Motor Driver

(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)
Switching
power
supply

(J)
Proximity
sensor

(K)
Photo
electric
sensor

(L)
Pressure
sensor

(M)
Rotary
encoder

(N)
Stepping
motor &
Driver &
Controller

(O)
Graphic
panel

(P)
Production
stoppage
models &
replacement

◎Zero point excitation output signal(ZERO OUT)

CW Pulse　ON / OFF

CCW Pulse　ON / OFF

ZERO OUT　ON / OFF

0 1 2 3 4 5 6 7 8 9 0 1 1 0

※It indicates the initial step of excitation status of stepping motor and rotation position of motor axis from previously set zero.

※ZERO OUT means the initial status of motor excitation(STEP 0), it outputs per 7.2° of rotation in Full Step. (It outputs 50times per 1 rotation of motor.)

　　Ex) Full step : It outputs one time when input 10 pulse.
　　　　20 division : It outputs one time when input 200 pulse.

◎HOLD OFF function
　※HOLD OFF is [H], the excitation is released.
　※HOLD OFF is [L], the excitation is in a normal status.
　※It rotates motor axis by external force or is used for manual positioning.
　※Input H/L means ON/OFF of photocoupler in a circuit.

◎Setting microstep(Microstep : Resolution)-MS1, MS2

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Resolution	1	2	4	5	8	10	16	20	25	40	50	80	100	125	200	250

●Resolution selection(DIV SEL)
　※It is set by MS1 when division selection is [L] and MS2 when it is [H].
　※It drives a motor dividing basic step angle(0.72°) by setting value of 5-phase stepping motor.
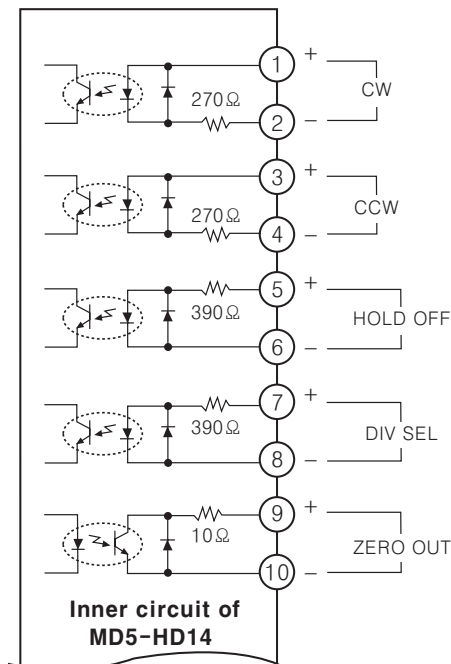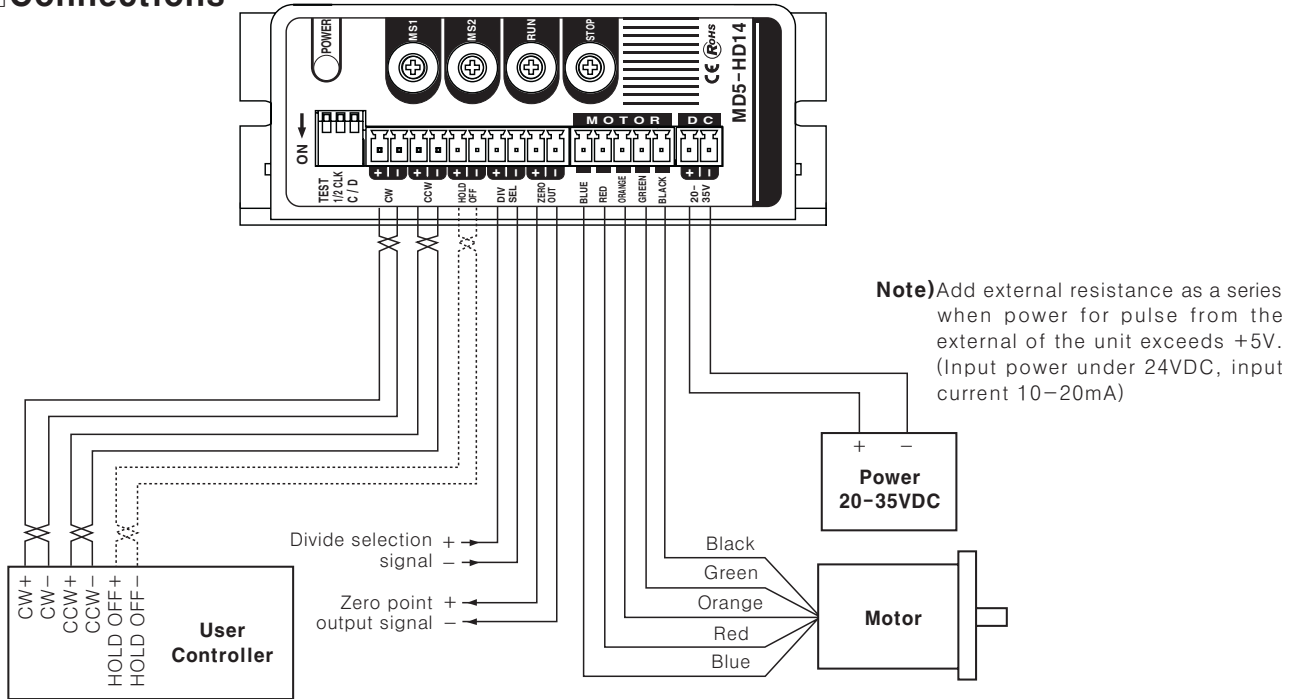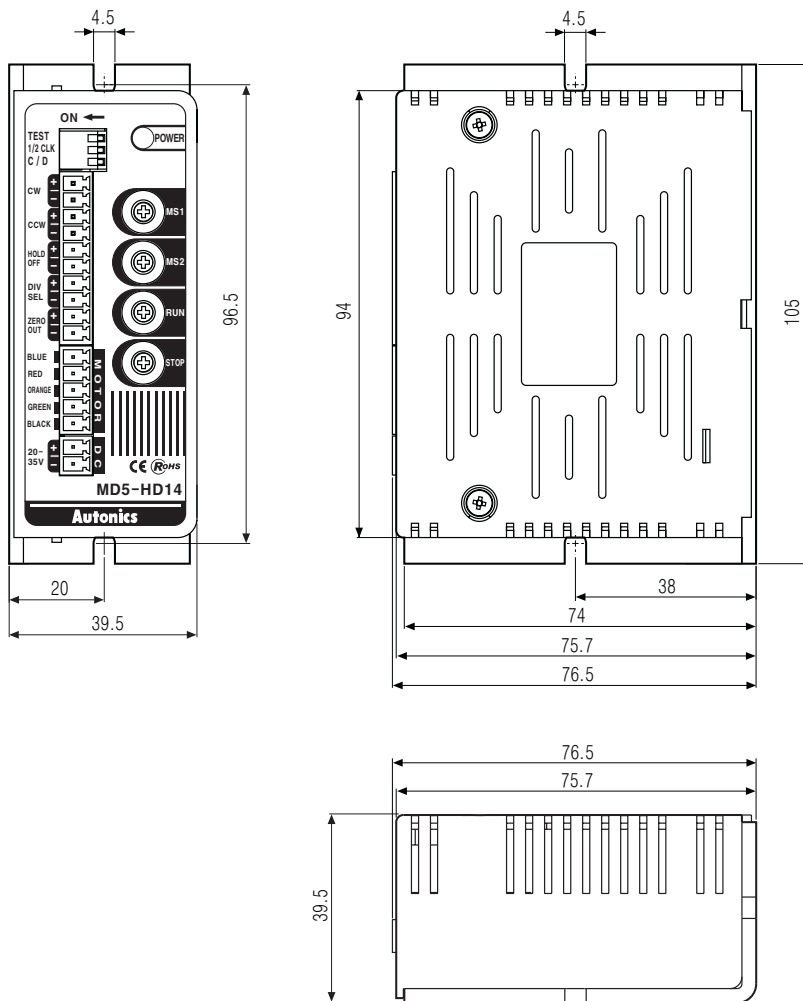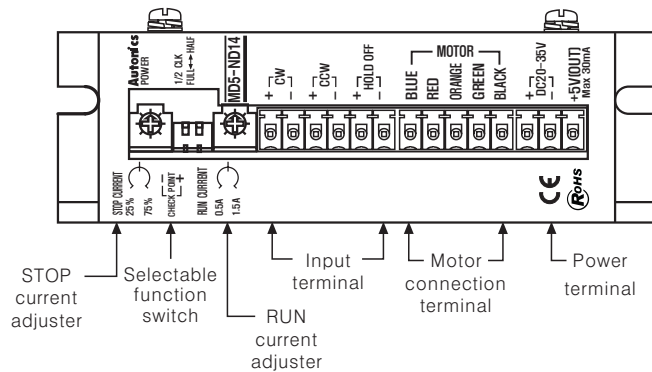　※The calculation formula of divided step angle is as below.

$$\text{Rotation angle of 5-phase stepping motor} = \frac{\text{Basic step angle}(0.72°)}{\text{Resolution}}$$

　※When resolution is changed during the operation of motor, it may cause a step-out of motor.

●Selectable resolution(Selectable Step angle)
　※Change into the resolution in MS1/MS2 by Resolution selection input.
　※Motor is rotated by resolution in MS1 when Resolution selection signal is [L] and MS2 for [H].
　※Change the resolution after motor is stopped or, it may cause a step-out of motor.
　※Input H/L means ON/OFF of photocoupler in a circuit.

▣ Input · Output diagram

① + CW
② −
270Ω

③ + CCW
④ −
270Ω

⑤ + HOLD OFF
⑥ −
390Ω

⑦ + DIV SEL
⑧ −
390Ω

⑨ + ZERO OUT
⑩ −
10Ω

Inner circuit of MD5-HD14

※CW
　2Pulse input(CW rotation signal input)
　1Pulse input(Rotation signal input)

※CCW
　2Pulse input(CCW rotation signal input)
　1Pulse input(Rotating direction signal input)
　[H] : CW, [L] : CCW

※HOLD OFF
　Motor excitation OFF control signal
　[H] : Motor excitation OFF

※DIV SEL(DIVISION SELECTION)
　Division selection signal → [L] : Operated by switch MS1
　　　　　　　　　　　　　　　　[H] : Operated by switch MS2

※ZERO OUT
　Zero point excitation output signal ON for zero point excitation

MD5 Series

▣Connections

Note) Add external resistance as a series when power for pulse from the external of the unit exceeds +5V. (Input power under 24VDC, input current 10-20mA)

Power 20-35VDC

Divide selection + signal −

Zero point + output signal −

User Controller

CW+
CW−
CCW+
CCW−
HOLD OFF+
HOLD OFF−

Black
Green
Orange
Red
Blue

Motor

▣Dimensions

(Unit:mm)

Autonics

5-Phase Stepping Motor Driver

5-Phase stepping motor driver [MD5-ND14]

(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)
Switching
power
supply

(J)
Proximity
sensor

(K)
Photo
electric
sensor

(L)
Pressure
sensor

(M)
Rotary
encoder

(N)
Stepping
motor &
Driver &
Controller

(O)
Graphic
panel

(P)
Production
stoppage
models &
replacement

STOP current adjuster — Selectable function switch — RUN current adjuster — Input terminal — Motor connection terminal — Power terminal

◎Selectable function switch

● Input method selection

	1	
OFF ON	■	1 Pulse input
OFF ON	■	2 Pulse input

● Resolution(Rotation angle) selection

	2	
OFF ON	■	×1(0.72°)
OFF ON	■	×2(0.36°)

◎RUN current setting

RUN CURRENT

DIP SW
STOP RUN

CP− CP+
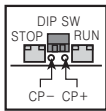
- In order to adjust run current for controlling temperature rise and vibration of motor and driver, change it using RUN current adjuster.
- To change the RUN current, connect the CP− to the (−) terminal of the voltmeter and the CP+ to the (+) terminal of the voltmeter then adjust RUN current adjuster.
  (Factory specification of Run current is 1.4A/Phase)
- Phase current change :

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

(Note)Run current should be changed during the operating of motor.

◎STOP current setting

STOP CURRENT

25%   75%

- In order to reduce the heat adjusting the current, change it using STOP current adjuster.
- The setting value of STOP current adjuster is a percentage of RUN current adjuster.
  Ex)After setting 1.0A for RUN current then put STOP current adjuster at 50%, the Stop current will be 0.5A.
(Note)RUN current should be changed during the operating of motor.

■Signal input circuit

① + CW
② −
390Ω

③ + CCW
④ −
390Ω

⑤ + HOLD OFF
⑥ −
390Ω
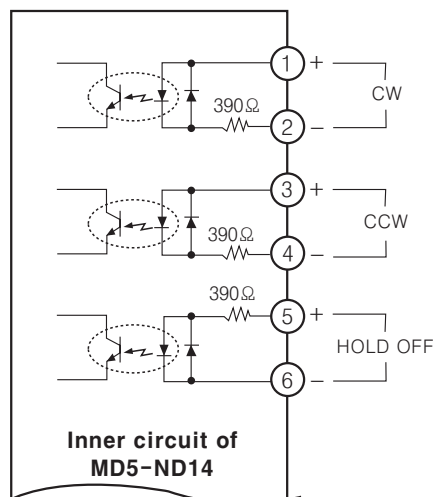
Inner circuit of MD5-ND14

※CW
  2 pulse input method(CW)
  1 pulse input method(Operating rotation signal input)
Note)If the power for driving pulse from external is over than +5V, please connect resistor.

※CCW
  2 pulse input method(CCW)
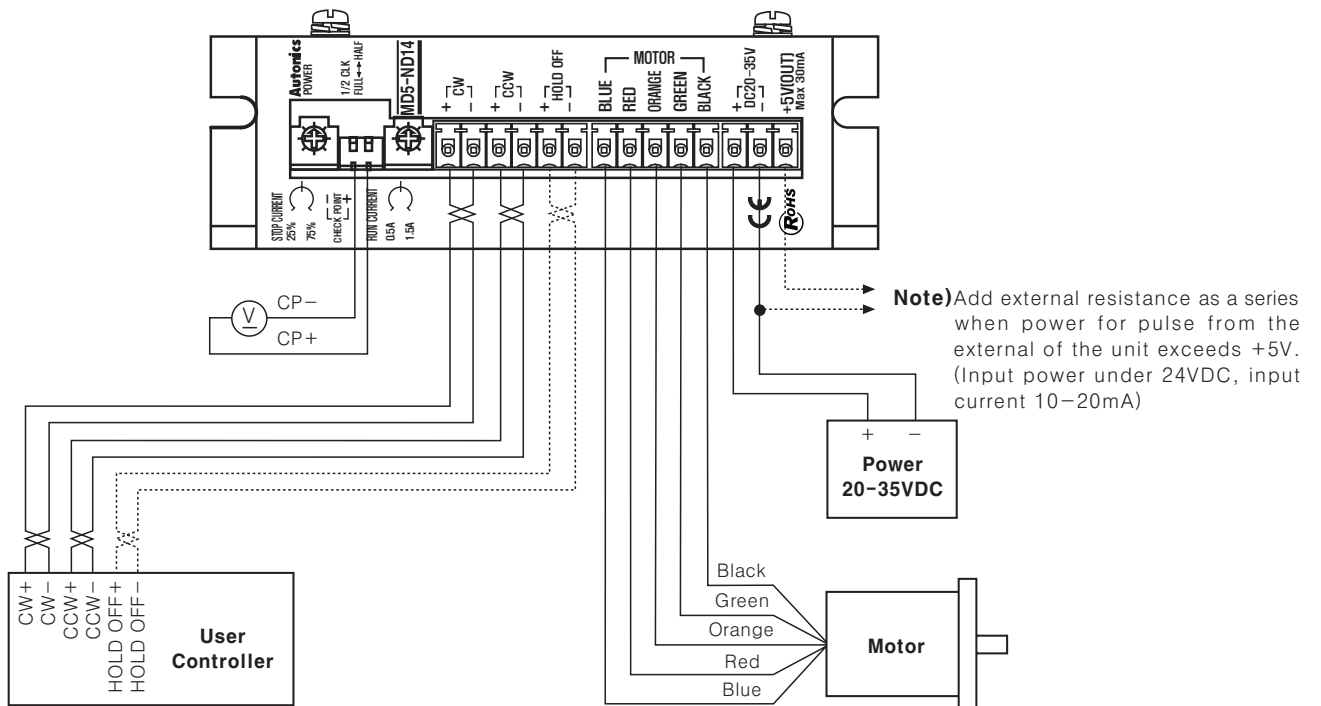 1 pulse input method(Rotating direction input) → [H] : CW, [L] : CCW

※HOLD OFF
  The control signal for hold off of Motor → [H] : Motor Hold OFF

Note) Add external resistance as a series when power for pulse from the external of the unit exceeds +5V.
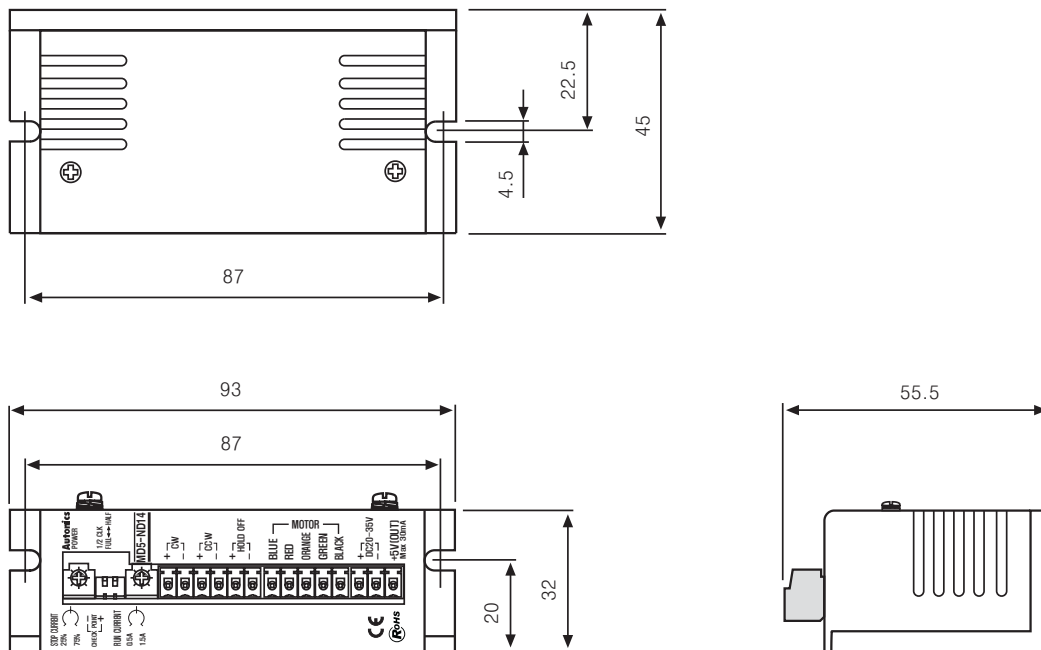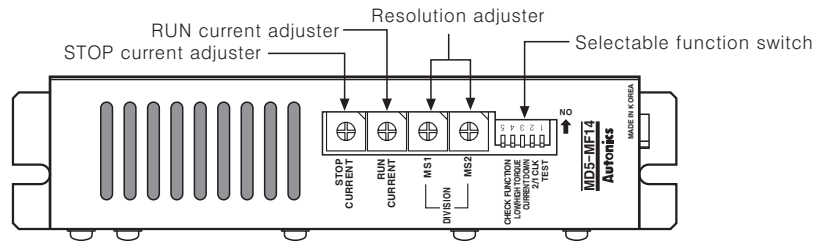 (Input power under 24VDC, input current 10−20mA)

MD5 Series

▣ Connections

Note) Add external resistance as a series when power for pulse from the external of the unit exceeds +5V. (Input power under 24VDC, input current 10−20mA)

Power 20−35VDC

Black
Green
Orange
Red
Blue

Motor

User Controller

▣ Dimensions

22.5
45
4.5
87

93
87
20
32

55.5

(Unit:mm)

Autonics

5-Phase Stepping Motor Driver

5-Phase microstepping motor driver [MD5-MF14]

RUN current adjuster
Resolution adjuster
STOP current adjuster
Selectable function switch

※**KR-515M is changed as MD5-MF14.**
※**Power supply 100-240VAC and connected socket are upgraded.**

◎Selectable function switch

No	Name	Function	Switch position	
			ON	OFF
1	TEST	Self-diagnosis	Rotate in 100pps	Normal
2	2/1 CLK	Pulse input method	1Pulse input	2Pulse input
3	Current Down	Auto Current Down	Disable	Enable
4	Low/High torque	RUN voltage conversion	High speed/torque	Normal
5	Check function	Check internal function	Disable	Normal

● TEST
It outputs 100pps of pulse during switch ON to test motor and driver.

● Auto Current Down
It reduces RUN current when motor is at standstill to lower the heat generation automatically and select STOP current by STOP current switch.
☞ Switch OFF : Current set by switch is supplied.
☞ Switch ON : RUN current is supplied. (Auto Current Down is disable.)

● RUN voltage conversion(LOW/HIGH TORQUE)
The function is to increase the high speed torque of motor by changing voltage.
☞ Switch OFF : LOW TORQUE ☞Switch ON : HIGH TORQUE

● Check internal function
It should be set as OFF because, all driver functions are stopped when switch is ON.

◎RUN current setting

Switch No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (A/Phase)	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

Reduce RUN current by RUN current switch to suppress vibration and temperature rising of motor and driver.
Note1)RUN current is set under the rated current of motor, it may cause loss of torque.
Note2)When use RUN current switch in "D−F", check the rated RUN current.
Note3)If RUN current is increased, torque will be higher and it emits heat too much, select the appropriate RUN current by load.

◎STOP current setting

Switch 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

STOP current is a percentage of RUN current by adjuster.
Ex)When use 1.4A/Phase of RUN current, set STOP current switch as "5", it is reduced to 50% and STOP current will be 0.7A/Phase.
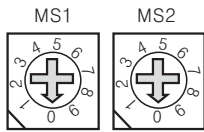
$$\text{Maintaining torque(kgf} \cdot \text{cm)} = \frac{\text{Maximum holding torque(kgf} \cdot \text{cm)} \times \text{STOP current(A)}}{\text{Rated motor current(A)}}$$

Note)It is operated by auto Current Down when HOLD OFF is [L] or vice versa.

MD5 Series

◎Setting resolution

Switch No.	0	1	2	3	4	5	6	7	8	9
Resolution	1	2	4	5	8	10	20	40	80	16

MS1   MS2

When the division selection signal is [L], it is operated as MS1 and MS2 when it is [H].

Ex) When select 80 as resolution by selectable switch, rotation angle per 1 pulse is 0.009 ° and it needs 40,000 pulses per 1 rotation of motor.

Note1) When changing a resolution at input frequency out of the start-stop frequency during the operation, stepping motor can be stepped out.

Note2) Change the resolution after executing Home Search or the motor can be stopped temporarily.

◎Zero point excitation output signal

Output is ON when excitation sequence is 0 and ZERO OUT signal is outputted at every 7.2 ° in 5-Phase stepping motor and it may not be worked when change step angle(resolution) after supplying power.

## ▣Signal Input · Output circuit

Inner circuit of MD5-MF14
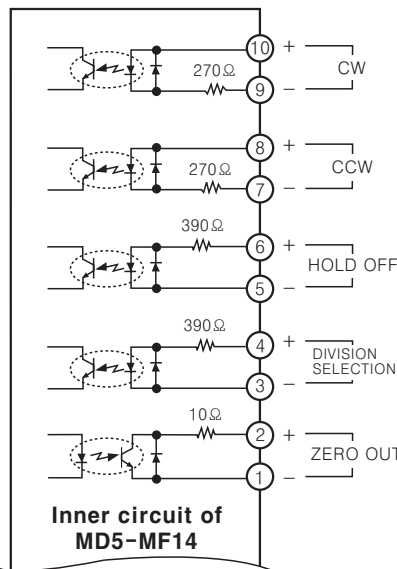
※CW
: 2Pulse input method(CW signal input)
  1Pulse input method(Rotation signal input)

※CCW
: 2Pulse input method(CCW signal input)
  1Pulse input method(Rotating direction signal input)
  →[H]:CW rotation, [L]:CCW rotation

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

※DIVISION SELECTION
: Division selection signal → [L] MS1, [H] MS2

※ZERO OUT
: Zero point excitation output signal → Signal is outputted when the motor drive sequence is at ZERO point.
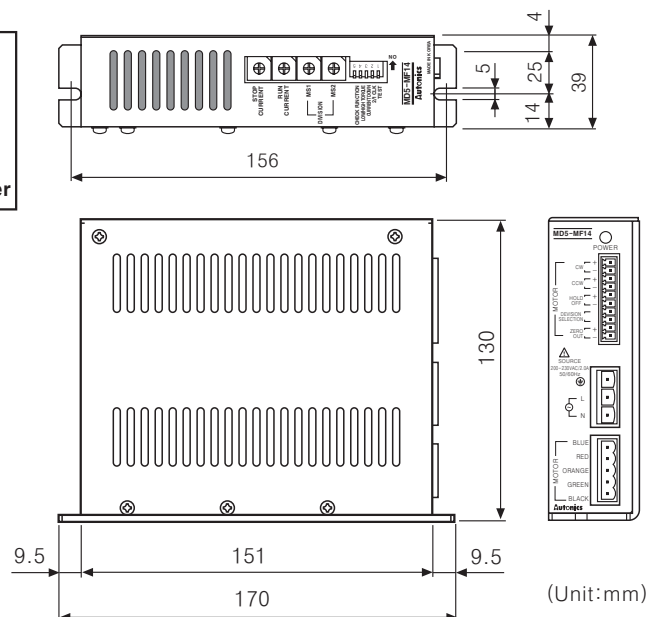
Note) Add external resistance as a series when power for pulse from the external of the unit exceeds +5V.
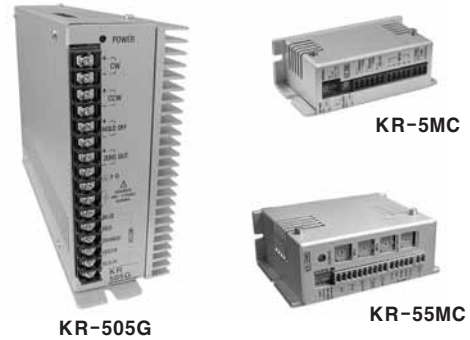(Input power under 24VDC, input current 10-20mA)

▣Connections
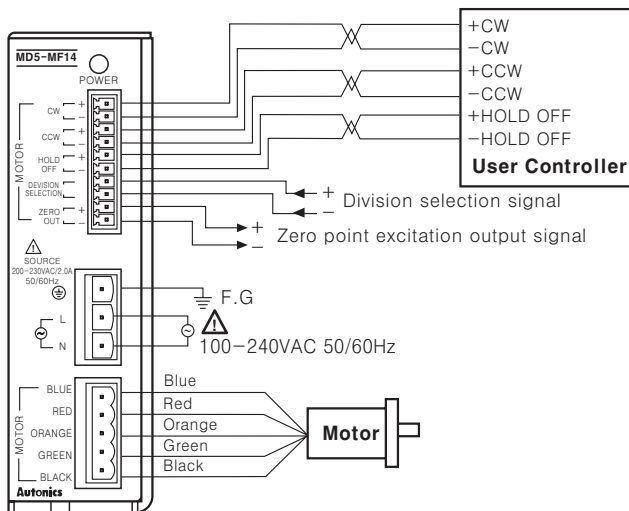
▣Dimensions

(Unit:mm)

Autonics

5-Phase Stepping Motor Driver

Small, light and high speed and torque 5-Phase stepping motor driver

■Features

- ●Bipolar constant pentagon drive method
- ●Includes auto Current Down and self-diagnosis function
- ●Low speed rotation and high precision control with microstep drive (KR-5MC, KR-55MC)
  [Max. 80 divisions and it is enable to control as accurate as down to 0.009 ° for basic step 0.72 ° of 5-Phase stepping motor and it needs 40,000 pulses for 1 rotation of motor.]
- ●Insulate using photocoupler to minimize the influence by external noise.

KR-5MC

KR-55MC

KR-505G

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

CE

(Except for KR-505G)

■Ordering information

| KR | − | 55 | MC |

RUN current

| MC | 1.4A/Phase |
| G | 2.8A/Phase |

Power supply / Step type (Resolution)

5	DC Type / Normal Step
55	DC Type / Microstep
505	AC Type / Normal Step

| KR | Series |

※KR-515M is changed as MD5-MF14.

■Specifications

Model	KR-5MC	KR-55MC	KR-505G
Power supply (※1)	20-35VDC 3A		100-115VAC 50/60Hz 650VA
RUN current	1.4A / Phase		2.8A / Phase
RUN method	Bipolar constant current pentagon drive		
Rotating angle	Micro step : 0.72 ° ~ 0.036 ° /1Step (1, 2 divisions)	Micro step : 0.009 ° ~ 0.72 ° / 1Step (1, 2, 4, 5, 8, 10, 16, 20, 40, 80 divisions)	Full Step : 0.72 ° / 1Step Half Step : 0.36 ° / 1Step
Input pulse width	Min. 5μs	Min. 0.5μs	Min. 5μs
Input pulse interval	Min. 5μs	Min. 0.5μs	Min. 5μs
Rising/Falling time	Max. 1μs		
Input pulse frequency	50kpps	500kpps	50kpps
Input voltage	High : 4-8VDC, Low : 0-0.5VDC		
Input resistance	390Ω (CW, CCW, HOLD OFF)	270Ω (CW, CCW) 390Ω (HOLD OFF, DIVISION SELECTION)	390Ω (CW, CCW, HOLD OFF) 10Ω (ZERO OUT)
Ambient temperature	0 ~ 40℃ (at non-dew status)		
Ambient humidity	35 ~ 85%RH		
Approval	CE		——
Unit weight	Approx. 120g	Approx. 240g	Approx. 1.7kg

(※1)When using over 30VDC, it should be mounted at ventilative place due to increasing heat.