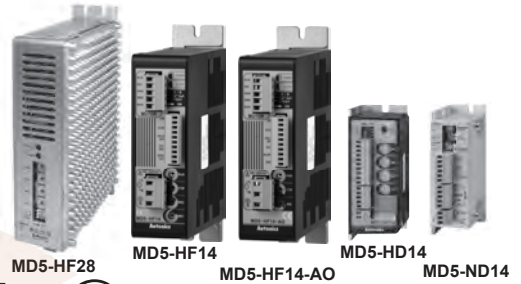


MD5 Series

Small, Light, High Speed & Torque 5-Phase Stepper Motor Driver

■ Features

- Bipolar constant pentagon drive method
- Includes auto current down and self-diagnosis function
- Low speed rotation and high accuracy controlling with microstep-driving (MD5-HD14, MD5-HF14, MD5-HF14-AO, MD5-HF28)
- [Max. resolution - 250 division / In case of 5-phase stepper motor of which basic step angle is 0.72°, it enables to control up to 0.00288° per pulse and it requires 125,000 pulses per rotation.]
- Photocoupler input insulation method to minimize the effects from external noise



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



■ Ordering Information

| | | | | | | | |
|--------------------------------|----------|----------|----------|----------|-----------|----------|--------------------------|
| MD | 5 | - | H | F | 14 | - | <input type="checkbox"/> |
| Item | | | | | | | |
| Motor phase | | | | | | | |
| Step type (Resolution) | | | | | | | |
| Power supply | | | | | | | |
| RUN current | | | | | | | |
| Output | | | | | | | |
| No mark | | | | | | | |
| Zero point excitation output*1 | | | | | | | |
| AO | | | | | | | |
| Alarm output | | | | | | | |
| 14 | | | | | | | |
| 1.4A/Phase | | | | | | | |
| 28 | | | | | | | |
| 2.8A/Phase | | | | | | | |
| D | | | | | | | |
| 20-35VDC | | | | | | | |
| F | | | | | | | |
| 100-220VAC 50/60Hz | | | | | | | |
| H | | | | | | | |
| Micro step (250-division) | | | | | | | |
| N | | | | | | | |
| Normal Step | | | | | | | |
| 5 | | | | | | | |
| 5-Phase | | | | | | | |
| MD | | | | | | | |
| Motor Driver | | | | | | | |

⊗ cULus: MD5-HF14

⊗ RoHS: MD5-ND14

⊗ KR-55MC can be replaced with MD5-HD14.

⊗ KR-5MC can be replaced with MD5-ND14.

⊗ MD5-MF14 can be replaced with MD5-HF14.

⊗ KR-505G can be replaced with MD5-HF28.

※1: Except MD5-ND14

■ Specifications

| Model | MD5-HD14 | MD5-HF14 | MD5-HF14-AO | MD5-HF28 | MD5-ND14 | |
|----------------------------|--|--|--|--|---|---------------------|
| Power supply | 20-35VDC*1 | 100-220VAC 50/60Hz | | | 20-35VDC*1 | |
| Allowable voltage range | 90 to 110% of the rated voltage | | | | | |
| Max. current consumption*2 | 3A | | | 5A | 3A | |
| RUN current*3 | 0.4-1.4A/Phase | | | 1.0-2.8A/Phase | 0.5-1.5A/Phase | |
| STOP current | 27 to 90% of RUN current (set by STOP current switch) | | | | 25 to 75% of RUN current (set by STOP current volume) | |
| Drive method | Bipolar constant current pentagon drive | | | | | |
| Basic step angle | 0.72°/Step | | | | | |
| Resolution | 1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250-division(0.72° to 0.00288°/Step) | | | | 1, 2-division (0.72°, 0.36°/Step) | |
| Input pulse characteristic | Pulse width | Min. 1μs (CW, CCW), Min. 1ms (HOLD OFF) | | | Min. 10μs (CW, CCW), Min. 1ms (HOLD OFF) | |
| | Duty rate | 50%(CW, CCW) | | | | |
| | Rising/Falling time | Below 130ns(CW, CCW) | | | | |
| | Pulse input voltage | [H]: 4-8VDC, [L]: 0-0.5VDC | | | | |
| | Pulse input current | 7.5-14mA(CW, CCW), 10-16mA(HOLD OFF, DIVISION SELECTION, ZERO OUT)*4 | | | | |
| | Max. input pulse frequency*5 | Max. 500kHz(CW, CCW) | | | | Max. 50kHz(CW, CCW) |
| Input resistance | 270Ω(CW, CCW), 390Ω(HOLD OFF, DIVISION SELECTION), 10Ω(ZERO OUT) | | 270Ω(CW, CCW), 390Ω(HOLD OFF), 10Ω(ALARM) | 270Ω(CW, CCW), 390Ω(HOLD OFF, DIVISION SELECTION), 10Ω(ZERO OUT) | 390Ω (CW, CCW, HOLD OFF) | |
| Insulation resistance | Over. 100MΩ (at 500VDC megger, between all terminals and case) | | | | | |
| Dielectric strength | 1000VAC 50/60Hz for 1min.(between all terminals and case) | | | | | |
| Noise resistance | ±500V the square wave noise (pulse width: 1μs) by the noise simulator | | ±2000V the square wave noise (pulse width: 1μs) by the noise simulator | | ±500V the square wave noise (pulse width: 1μs) by the noise simulator | |
| Vibration | Mechanical | 1.5mm amplitude at frequency of 5 to 60Hz (for 1 min.) in each X, Y, Z direction for 2 hours | | | | |
| | Malfunction | 1.5mm amplitude at frequency of 5 to 60Hz (for 1 min.) in each X, Y, Z direction for 10 min. | | | | |
| Environment | Ambient temp. | 0 to 40°C, storage: -10 to 60°C | | | 0 to 40°C, storage: -10 to 60°C | |
| | Ambient humi. | 35 to 85%RH, storage: 35 to 85%RH | | | | |
| Approval | CE | CE cULus | CE | CE | CE RoHS | |
| Weight*6 | Approx. 327.5g (approx. 220g) | Approx. 840g (approx. 680g) | Approx. 820g (approx. 660g) | Approx. 1.35kg (approx. 1.2kg) | Approx. 183g (approx. 130g) | |

※1: When using over 30VDC power supply, torque characteristics are improved but the driver temperature raise. The unit should be installed at the well ventilation environment.

※2: Based on ambient temperature 25°C, ambient humidity 55%RH.

※3: RUN current varies depending on the input RUN frequency and max. RUN current at the moment varies also varies depending on the load.

※4: In case of MD5-HF14-AO, MD5-ND14, there are no DIVISION SELECTION, ZERO OUT function.

※5: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.

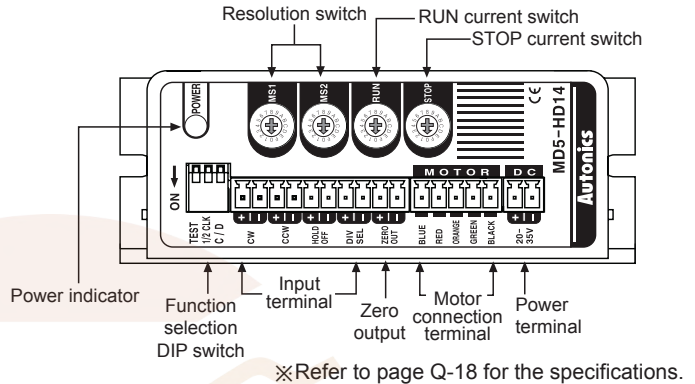
※6: The weight includes packaging. The weight in parentheses is for unit only.

※Environment resistance is rated at no freezing or condensation.

5-Phase Stepper Motor Driver (1.4A/Phase, DC Power)

5-Phase Micro Stepper Motor Driver [MD5-HD14]

Unit Description



Function selection DIP switch



| No. | Name | Function | Switch position | |
|-----|---------|-------------------------|----------------------|----------------------|
| | | | ON | OFF (default) |
| 1 | TEST | Self diagnosis function | 30rpm rotation | Not use |
| 2 | 1/2 CLK | Pulse input method | 1-pulse input method | 2-pulse input method |
| 3 | C/D | Auto current down | Not use | Use |

TEST

- Self diagnosis function is for motor and driver test.
- This function makes the motor rotate with 30rpm in full step. Rotation speed varies with resolution settings.
- Rotation speed = 30rpm/resolution
- In 1-pulse input method, it rotates to CCW, and in 2-pulse input method, it rotates to CW.
- ⊗ Be sure that the TEST switch is OFF before supplying the power.
- If the TEST switch is ON, the motor operates immediately and it may be dangerous.

1/2 CLK

- 1/2 CLK switch is to select pulse input method.
- 1-pulse input method: CW → operating rotation signal input, CCW → rotation direction signal input ([H]: CW, [L]: CCW)
- 2-pulse input method: CW → CW rotation signal input, CCW → CCW rotation signal input.

C/D (auto current down)

- This function is to reduce the current provided for motor automatically for preventing severe motor's heat when motor stops.
- If motor RUN pulse is not applied, the current provided for motor reduces as the set STOP current.
- ⊗ Be sure that when motor RUN current is reduced, the stop torque of motor also reduced.
- ⊗ Set the STOP current by the STOP current switch.

Setting RUN current

| S/W 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 setting is for the current provided for motor when the motor runs.
- ⊗ When RUN current is increased, RUN torque of the motor is also increased.
- ⊗ When RUN current is set too high, the heat is severe.
- ⊗ Set RUN current within the range of motor's rated current according to its load.
- ⊗ Change RUN current only when the motor stops.

Setting STOP current

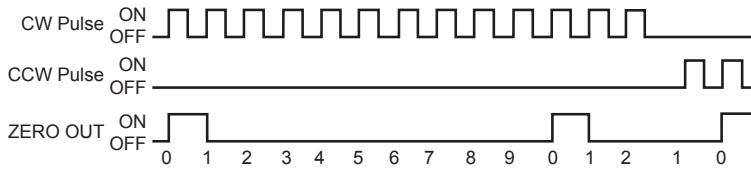
| S/W No | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| % | 27 | 31 | 36 | 40 | 45 | 50 | 54 | 58 | 62 | 66 | 70 | 74 | 78 | 82 | 86 | 90 |

- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This setting is applied when using C/D(Current down) function.
- Setting value of STOP current is percentage (%) ratio of the set RUN current.
E.g.) Set RUN current as 1.4A and STOP current as 40%.
STOP current is set as $1.4A \times 0.4 = 0.56A$
- ⊗ When STOP current is decreased, STOP torque of the motor is also decreased.
- ⊗ When STOP current is set too low, the heat is lower.
- ⊗ Change STOP current only when the motor stops.

- (A) Photoelectric Sensors
- (B) Fiber Optic Sensors
- (C) Door/Area Sensors
- (D) Proximity Sensors
- (E) Pressure Sensors
- (F) Rotary Encoders
- (G) Connectors/ Sockets
- (H) Temperature Controllers
- (I) SSRs / Power Controllers
- (J) Counters
- (K) Timers
- (L) Panel Meters
- (M) Tacho / Speed / Pulse Meters
- (N) Display Units
- (O) Sensor Controllers
- (P) Switching Mode Power Supplies
- (Q) Stepper Motors & Drivers & Controllers
- (R) Graphic/ Logic Panels
- (S) Field Network Devices
- (T) Software

MD5 Series

◎ Zero point excitation output signal (ZERO OUT)



- This output indicates the initial step of excitation order of stepping motor and rotation position of motor axis .
- This signal outputs every 7.2° of rotation of the motor axis regardless of resolution.
(50 outputs per 1 rotation of the motor.)
E.g.) Full step: outputs one time by 10 pulses input, 20-division: outputs one time by 200 pulses input.

◎ HOLD OFF function

- This signal is for rotating motor's axis using external force or used for manual positioning.
 - When hold off signal maintains over 1ms as [H], motor excitation is released.
 - When hold off signal maintains over 1ms as [L], motor excitation is in a normal status.
- ※Must stop the motor for using this function.
※Refer to I/O Circuit and Connections.

◎ Setting microstep (Microstep: Resolution)

| S/W 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 |
| Step angle | 0.72° | 0.36° | 0.18° | 0.144° | 0.09° | 0.072° | 0.045° | 0.036° | 0.0288° | 0.018° | 0.0144° | 0.009° | 0.0072° | 0.00576° | 0.0036° | 0.00288° |

● Setting resolution (same as MS1, MS2)

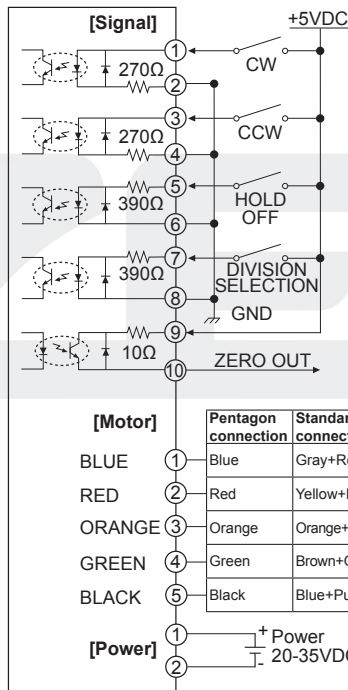
- The MS1, MS2 switches is for resolution setting.
- Select MS2 or MS2 by DIVISION SELECTION signal ([L]: MS1, [H]: MS2)
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle(0.72°) of 5-phase stepping motor by setting value.
- The calculation formula of divided step angle is as below.

$$\text{Set step angle} = \frac{\text{Basic step angle}(0.72^\circ)}{\text{Resolution}}$$

- When using geared type motor, the angle is step angle divided by gear ratio.
Step angle / gear ratio = Step angle applied gear
E.g) 0.72° / 10(1:10) = 0.072°

※Must stop the motor before changing the resolution.

■ I/O Circuit and Connections

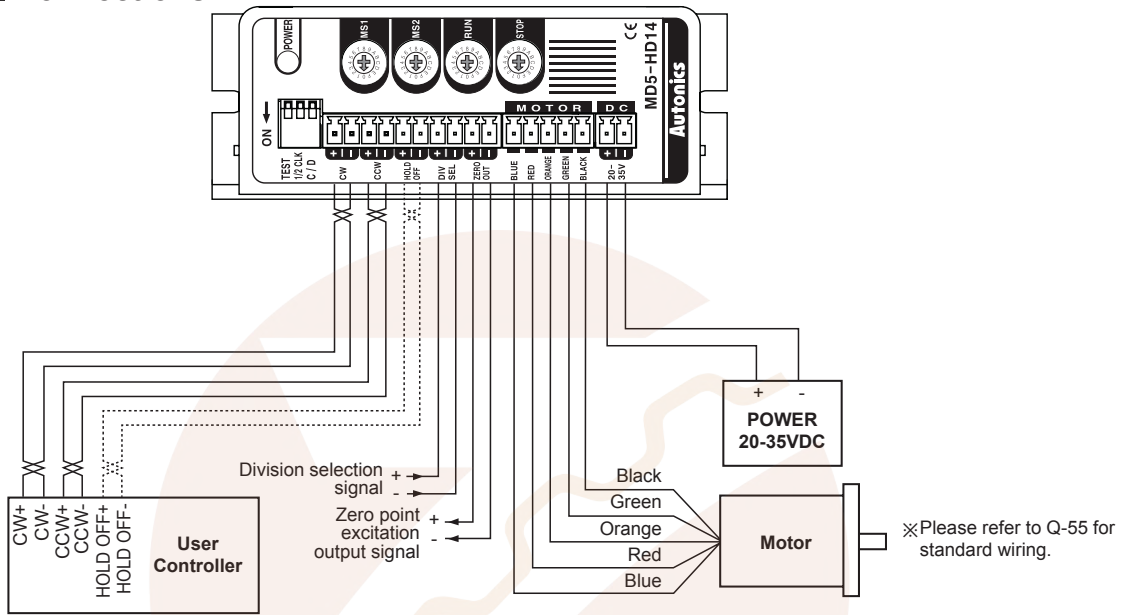


- ※CW
2-pulse input method (CW rotation signal input)
1-pulse input method (operating rotation signal input)
- ※CCW
2-pulse input method (CCW rotation signal input)
1-pulse input method (rotation direction signal input)
→ [H]: CW, [L]: CCW
- ※HOLD OFF
Control signal for motor excitation OFF
→ [H]: Motor excitation OFF
- ※DIVISION SELECTION
Division selection signal
→ [L]: Operated by MS1 setting resolution
[H]: Operated by MS2 setting resolution
- ※ZERO OUT
Zero point excitation output signal → Zero point status ON
- ※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.
(input power max. 24VDC, input current 10-20mA)

※This connection cable color is only for Autonics motors.
It may different cable color when using other motors.

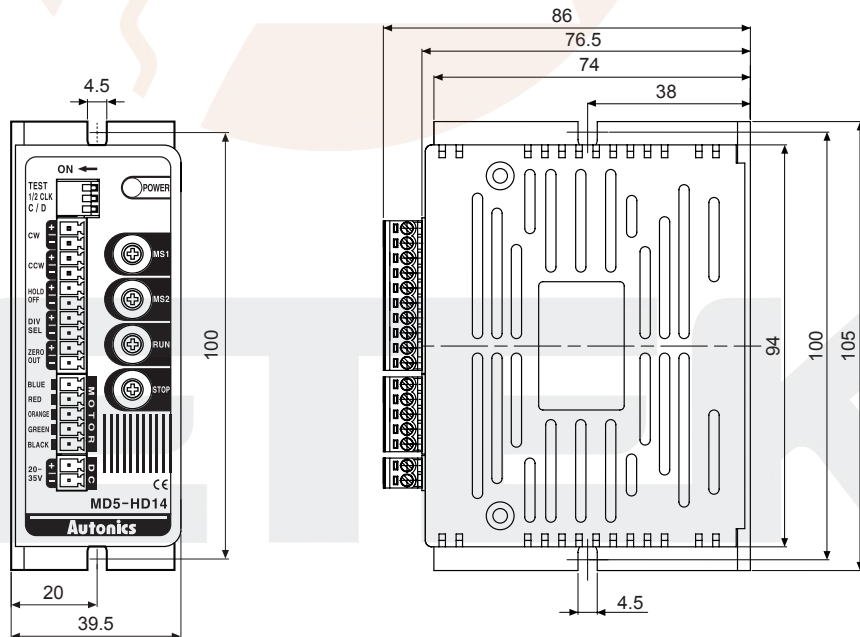
5-Phase Stepper Motor Driver (1.4A/Phase, DC Power)

Connections



Dimensions

(unit: mm)



| | |
|-----|--|
| (A) | Photoelectric Sensors |
| (B) | Fiber Optic Sensors |
| (C) | Door/Area Sensors |
| (D) | Proximity Sensors |
| (E) | Pressure Sensors |
| (F) | Rotary Encoders |
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