Autonics

Motor Driver(5-Phase microstepping driver)

MD5-HD14

M A N U A L

CE

Thank you very much for selecting Autonics products.
For your safety, please read the following before using.

■ Caution for your safety

※Please keep these instructions and review them before using this unit.

※Please observe the cautions that follow;

⚠ **Warning** Serious injury may result if instructions are not followed.

⚠ **Caution** Product may be damaged, or injury may result if instructions are not followed.

※The following is an explanation of the symbols used in the operation manual.
⚠ Caution: Injury or danger may occur under special conditions.

⚠ Warning

1. **In case of using this unit with machinery(Ex: nuclear power control, medical equpment, ship, vehicle, train, airplane, combustion apparatus, safety device, crime/disaster prevention equipment, etc) which may cause damages to human life or property, it is required to install fail-safe device.**
   It may cause a fire, human injury or damage to property.
2. **Installation, connection, operation, control, maintenance should be executed by person who has been qualified.**
   It may cause a fire, electric shock or human injury.
3. **Please use DC power with reinforced insulating the primary and secondary part for the DC power product.**
   It may give an electric shock.
4. **Please install this unit after consider counterplan against power failure.**
   It may cause human injury or damage to product by releasing holding torque of motor.
5. **Do not use this unit outdoors or place where there are flammable, corrosive gas, water or too much vibration etc.**
   It may cause a fire or give an electric shock.
6. **Do not disassemble and modify this unit. If it is required, please contact us.**
   It may cause a fire, give an electric shock or damage to product.
7. **Please install protection equipment for board type unit.**
   It may cause a fire.

⚠ Caution

1. **Power input voltage must be used within rated specification and power line should be over than AWG 18(0.75mm²).**
   It may cause a fire or give an electric shock.
2. **Please check the connection with diagram before supplying the power.**
   It may cause a fire or give an electric shock, damage to product.
3. **Please turn off the power when power is failed.**
   It may cause human injury or damage to product due to sudden movement when recovering power failure.
4. **Do not touch this unit while it is operating or after stopping.**
   It may cause a burn due to high temperature in surface.
5. **The emergency stop should be available during operating.**
   It may cause human injury or damage to product.
6. **Please supply power after checking control input signal.**
   It may cause human injury or damage to product by sudden movement.
7. **Do not turn on the HOLD OFF signal input while it is maintaining vertical position.**
   It may cause human injury or damage to product by releasing holding torque of motor.
8. **Please install a safety device when it is required to remain the vertical position after turning off the power.**
   It may cause human injury or damage to product by releasing holding torque of motor.
9. **Please check if HOLD OFF signal input is ON when it is required to set the output manually.**
   It may cause human injury by sudden movement.
10. **Stop with emergency this unit when mechanical problem occurred.**
   It may cause a fire or human injury.
11. **Do not touch the terminal when measuring insulation resistance and testing insulation dielectric strength.**
   It may give an electric shock.
12. **Please observe rated specification.**
   It may cause a fire, give an electric shock or damage to product.
13. **In cleaning the unit, do not use water or an oil-based detergent.**
   It may cause a fire or give an electric shock.
14. **Please separate as industrial waste when disusing this unit.**

※**The above specifications are subject to change without notice.**

■ Features

- Microstep operation for silent and low vibration of rotation.
- Wide range of step angle can be applied by switching signal.
- It can be divided up to 250 of microstep and 5-phase stepping motor with 0.72˚ of basic step is rotated as 0.00288˚ per 1 pulse and it is required to input 125,000 pulse for 1 rotation of motor.
- Includes auto current down, self-diagnosis function.
- Small size, light weight and advanced quality by custom IC and surface mounted circuit.
- Photocoupler input insulation method to minimize the effects from external noise.

■ Specifications

| Model	MD5-HD14
Power supply	20-35VDC
Allowable voltage fluctuation range	-10%, +20% of power voltage
Consumption current※1	3A(Max.)
Run current※2	0.4 to 1.4A/Phase
Drive method	Bipolar constant current pentagon drive
Resolution	1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250 of microstep
Pulse width	Min. 0.5μs
Pulse Duty	Max. 50%
Rising/Falling time	Max. 120ns
Max. input pulse frequency※3	1MHz
Pulse input voltage	High: 4-8VDC, Low: 0-0.5VDC / 10~20mA
Input resistor	270Ω (CW, CCW), 390Ω (HOLD OFF, DIVISION SELECTION)
Environ-ment Ambient temperature	0 to 40℃, Storage: -20 to 60℃
Environ-ment Ambient humidity	35 to 85%RH, Storage: -10 to 90%RH
Approval	CE
Unit weight	Approx. 220g

※1: This is for when ambient temperature is 25℃, ambient humidity is 55%.
※2: Maximum of run current is RMS reference value based on run frequency of run motor and the maximum moment is different depending on loads.
※3: It is maximum input frequency of driver. Max. pull out frequency and max. slewing frequency are different depending on resolutions or loads.
※There is torque difference by input power.
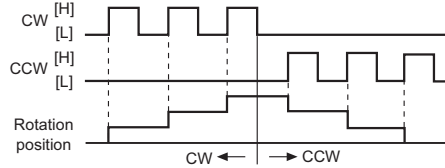※Environment resistance is rated at no freezing or condensation.

■ Dimensions

(Unit: mm)
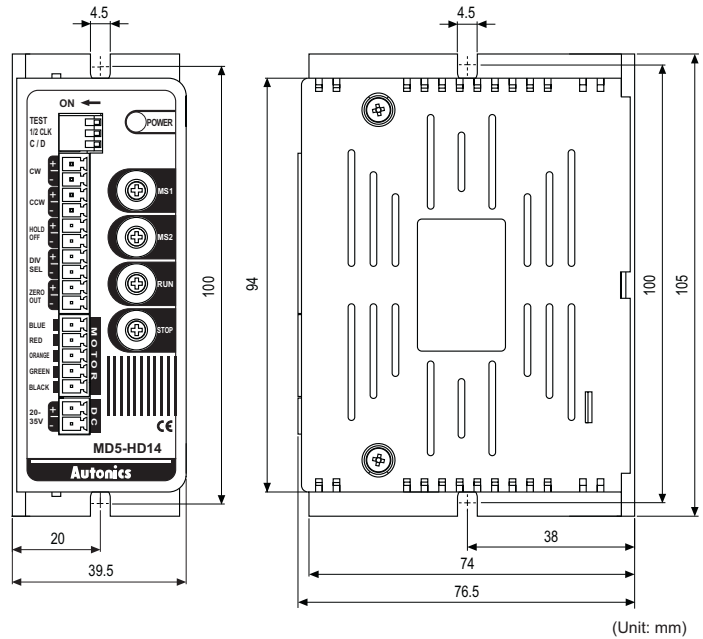
■ Time charts

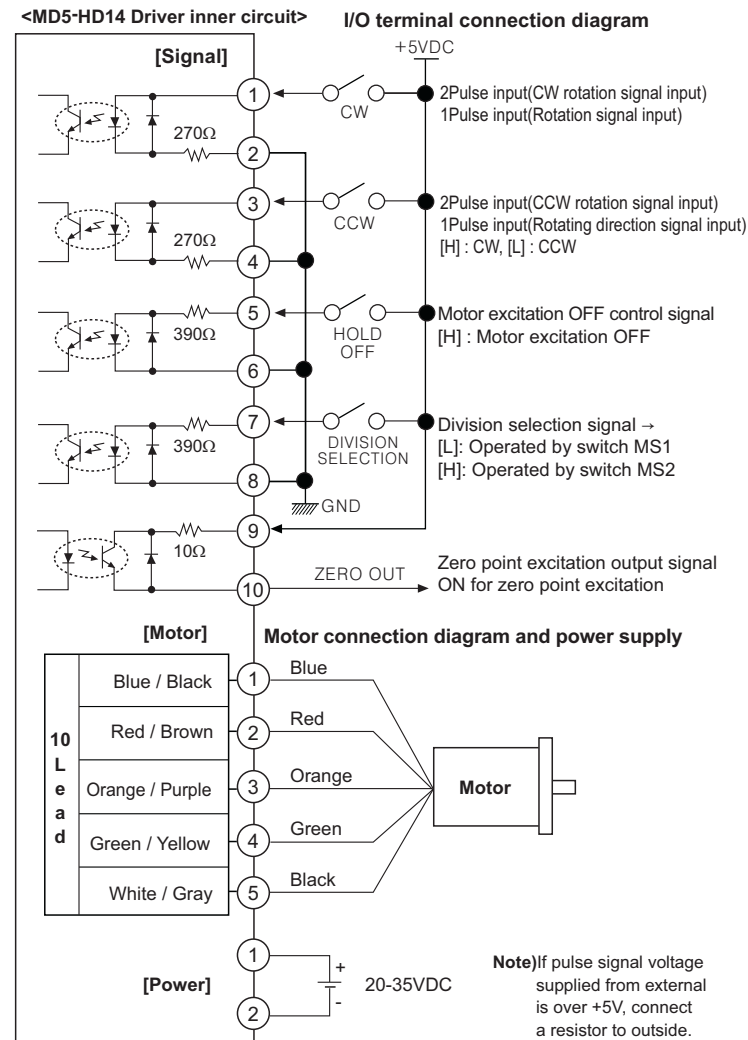### ⊙ 1Pulse input method
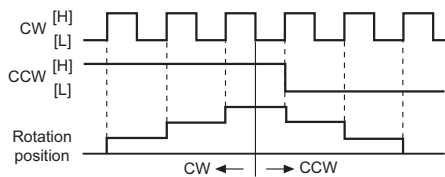
⊙ 2Pulse input method

Note) Do not input CW, CCW signal at the same time in 2Pulse input type.
: It may not work properly if another direction signal is inputted when one of CW or CCW is ON.

■ Input・Output diagram

⊙ Input・Output diagram

<MD5-HD14 Driver inner circuit> **I/O terminal connection diagram**

Note) If pulse signal voltage supplied from external is over +5V, connect a resistor to outside.

■ Function

⊙ Selectable function switch

No	Name	Function	Switch position	
			ON	OFF
1	TEST	Self diagnosis function	30rpm rotation	Normal
2	1/2 CLK	Pulse input method	1Pulse input	2Pulse input
3	C/D	Auto Current Down	Not use	Use

●**TEST**
※It rotates at a speed of 30rpm 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.

●**CURRENT DOWN**
※A function to reduce RUN current according to the setting rate of STOP current switch when motor stops in order to reduce motor's heat generation.
※It activates when there is no pulse input of motor operation for over 200ms.

⊙ Setting of RUN current

| 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. When it changes, it may cause loss of torque.
※Torque is increased as raised RUN current with too much motor heat. Select the proper RUN current depending on the load.

⊙ Setting of STOP current

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.
※Setting 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.

⊙ Zero point excitation output signal(ZERO OUT)
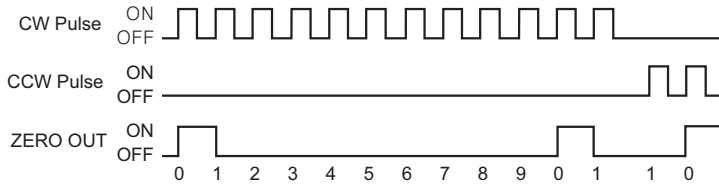
※It indicates the initial step of excitation status of stepping motor and rotation position of motor axis from previously set zero.
※ZERO OUT means the initial status(STEP 0) of motor excitation, it outputs per 7.2˚ of rotation in Full Step.(It outputs 50times per 1 rotation of motor.)
Ex) Full step: 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)

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

●**Setting resolution(Same for MS1, MS2)**
※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.

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

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

●**Setting resolution(Selectable Step angle)**
※Change into the resolution in MS1/MS2 by DIVISION SELECTION input.
※Motor is rotated by resolution in MS1 when DIVISION SELECTION signal is [L], or in 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.

■ Caution for using

1. For signal input
   ① Do not input CW, CCW signal at the same time in 2Pulse input type. It may not work properly if another direction signal is inputted when one of CW or CCW is ON.
   ② Current value of power supply in specifications is max.input of driver.
   ③ Use power enough to supply RUN current for power input.
2. For cable connection
   ① Use Twist pair(Over 0.2mm²) for the signal wire which should be shorter than 2m.
   ② Use electric wire of AWG 18(0.75mm²) for motor (when extending it) and power connection.
   ③ Check the power polarity before the drive.
3. For installation
   ① In order to increase heat protection efficiency, keep the heat sink as close as possible to metal panel and keep it well-ventilated.
   ② Excessive heat generation may occur on driver. Keep the heat sink under 80℃ when installing the unit.
   (In case it is over 80℃, forcible cooling shall be required.)
4. For using function switches
   ① Self-diagnosis function is enable to test motor and driver when 250Hz pulse is outputted in [ON] status.
   ② Check self-diagnosis switch is [OFF] before power ON, or motor may start to drive instantly when it is ON.
   ③ Auto CURRENT DOWN function is used to reduce RUN current when motor is at standstill to lower the heat generation automatically.
5. Installation environment
   ① It shall be used indoor
   ② Altitude Max. 2000m
   ③ Pollution Degree 2
   ④ Installation CategoryⅡ

※**It may cause malfunction if above instructions are not followed.**

■ Major products

- ■ Proximity sensors
- ■ Photoelectric sensors
- ■ Area sensors
- ■ Door/Door side sensors
- ■ Rotary encoders
- ■ Power controllers
- ■ Panel meters
- ■ Temperature controllers
- ■ Temperature/Humidity transducers
- ■ Tachometer/Pulse(Rate) meters
- ■ Graphic/Logic panels
- ■ Switching power supply
- ■ Field network device
- ■ Stepping motors/drivers/motion controllers
- ■ Laser marking system(CO₂, Nd:YAG)
- ■ Laser welding/soldering system
- ■ Timers
- ■ Counters
- ■ Fiber optic sensors
- ■ Pressure sensors
- ■ Display units
- ■ Sensor controllers

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