

Autonics

Motor Driver (5-phase Stepper Motor Driver)

MD5-HD14

INSTRUCTION MANUAL



Thank you for choosing our Autonics product.
Please read the following safety considerations before use.

Safety Considerations

- ※Please observe all safety considerations for safe and proper product operation to avoid hazards.
- ※Safety considerations are categorized as follows.
- Warning** Failure to follow these instructions may result in serious injury or death.
- Caution** Failure to follow these instructions may result in personal injury or product damage.
- ※The symbols used on the product and instruction manual represent the following
- ⚠ symbol represents caution due to special circumstances in which hazards may occur.

Warning

- Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.** (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.) Failure to follow this instruction may result in personal injury, fire, or economic loss.
- Installation, connection, operation, maintenance, and inspection should be handled by qualified individuals.** Failure to follow this instruction may result in fire, or personal injury.
- Use reinforced insulation DC power at primary and secondary part for DC type input product.** Failure to follow this instruction may result in product damage.
- Install the unit after considering counter plan against power failure.** Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of motor.
- Do not use the unit where is outside or flammable or explosive gas, corrosive material, water, vibration, or combustible material may be present.** Failure to follow this instruction may result in fire, or personal injury.
- Do not disassemble or modify the unit. Please contact us if maintenance necessary.** Failure to follow this instruction may result in fire, or product damage.
- Do not insert any objects at the openings of the unit.** Failure to follow this instruction may result in fire, or personal injury.

Caution

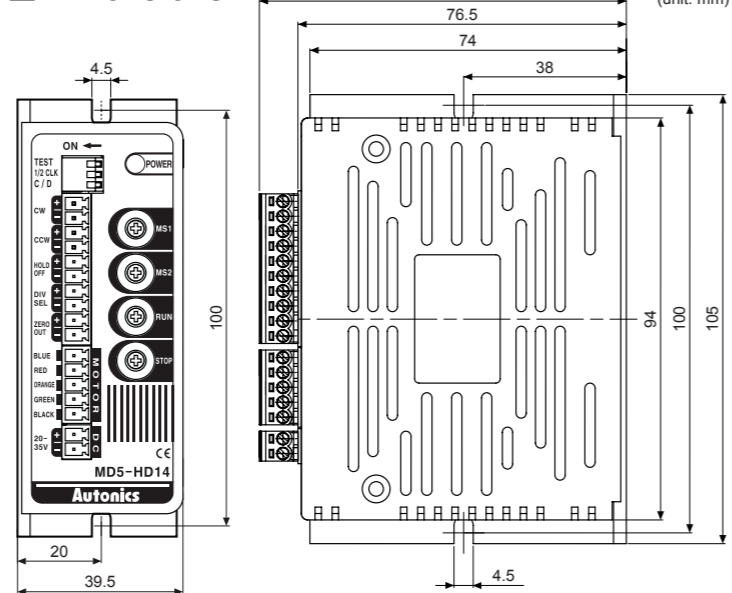
- Use the unit within the rated specifications.** Failure to follow this instruction may result in product damage, degradation, shorten the life cycle of the unit, personal injury, or peripheral devices damage.
 - When connecting the power input cables, use the unit within the rated power supply and over AWG18 (0.75mm²) cables.** Failure to follow this instruction may result in fire.
 - Refer to the connection diagrams and check the connection correctly before supplying the power.** Failure to follow this instruction may result in fire, or product damage.
 - Turn OFF the power when power is failed.** Failure to follow this instruction may result in personal injury or product damage due to sudden movement when recover power failure.
 - Do not touch the unit during or after operation for a while.** Failure to follow this instruction may result in burn due to high temperature of the surface.
 - Emergency stop should be available during operation.** Failure to follow this instruction may result in personal injury or product damage.
 - Check the control input signal of the unit before supplying the power.** Failure to follow this instruction may result in personal injury or product damage by unexpected signal input.
 - Do not turn on the HOLD OFF signal input while it is maintaining vertical position.** Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of motor.
 - Install safety device when it is required to remain the vertical position after turn off the power.** Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of motor.
 - Check HOLD OFF signal input is ON when moving the output axis (manual positioning etc.) manually.** Failure to follow this instruction may result in personal injury by unexpected signal input.
 - Stop the unit when mechanical problem occurs.** Failure to follow this instruction may result in fire, or personal injury.
 - Do not touch terminals when testing insulation resistance or dielectric strength.** Failure to follow this instruction may result in personal injury.
 - Do not use water or oil-based detergent when cleaning the unit. Use dry cloth to clean the unit.** Failure to follow this instruction may result in fire.
 - When disposing the unit, please categorize it as industrial waste.**
- ※The above specifications are subject to change and some models may be discontinued without notice.

Specifications

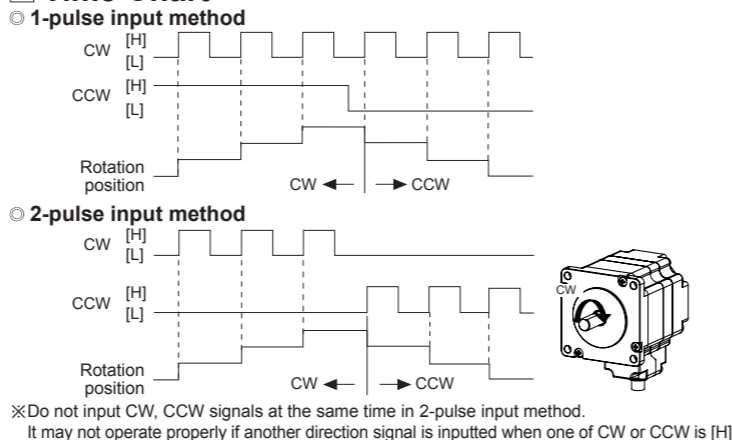
Model	MD5-HD14	
Power supply ^{※1}	20-35VDC	
Allowable voltage fluctuation range	90 to 110% of the rated voltage	
Max. current consumption ^{※2}	3A	
RUN current ^{※3}	0.4-1.4A/Phase	
STOP current	27 to 90% of RUN current (set by STOP current switch)	
Drive method	Bipolar constant current pentagon drive	
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)	
Input pulse characteristic	Pulse width	Min. 1μs (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)
Input pulse frequency ^{※4}	Max. input pulse frequency ^{※4}	Max. 500kHz (CW, CCW)
	Input resistance	270Ω(CW, CCW), 390Ω(HOLD OFF, DIVISION SELECTION), 10Ω(ZERO OUT)
Insulation resistance	Over. 100MΩ (at 500VDC megger, between all terminals and case)	
Dielectric strength	1,000VAC 50/60Hz for 1min. (between all terminals and case)	
Noise resistance	±500V the square wave noise (pulse width: 1μs) by the noise simulator	
Vibration	Mechanical	1.5mm amplitude at frequency of 5 to 60Hz(for 1min.) in each X, Y, Z direction for 2hours
	Malfuction	1.5mm amplitude at frequency of 5 to 60Hz(for 1min.) in each X, Y, Z direction for 10min.
Environment	Ambient temp.	0 to 40°C, Storage: -10 to 60°C
	Ambient humi.	35 to 85%RH, Storage: 35 to 85%RH
Approval	CE	
Weight ^{※5}	Approx. 327.5g (approx. 220g)	

- ※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: Max. input pulse frequency is max. frequency to be input and is not same as max. pull-out frequency or max. slewing frequency.
- ※5: The weight includes packaging. The weight in parentheses is for unit only.
- ※Environment resistance is rated at no freezing or condensation.

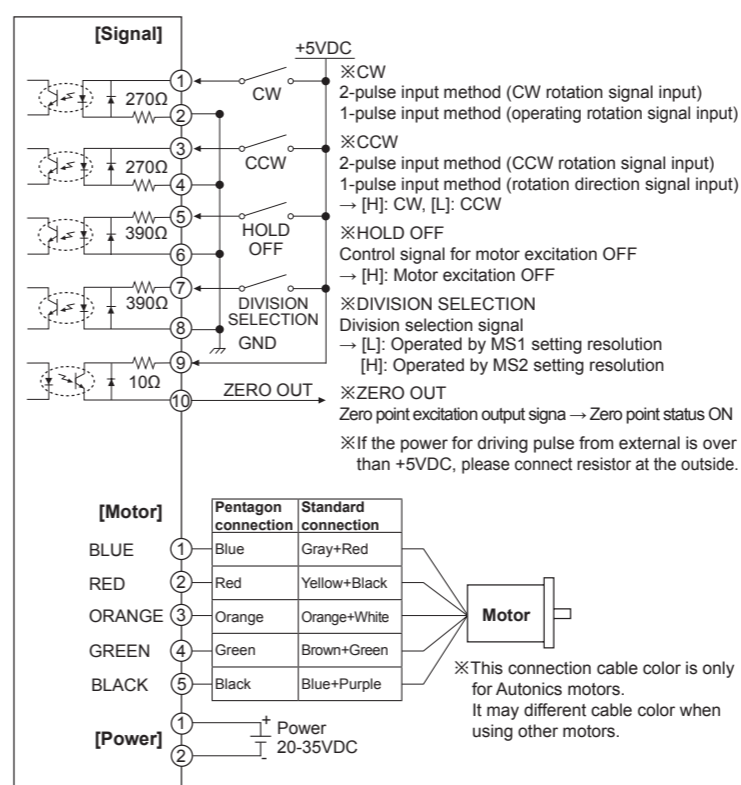
Dimensions



Time Chart



I/O Circuit And Connections



Functions

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 setting switch.

Setting 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

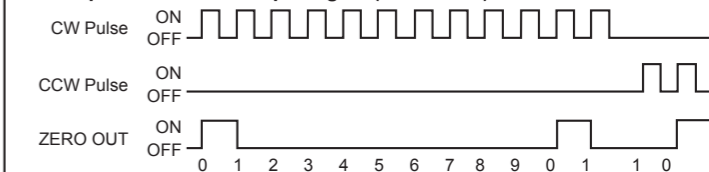
- RUN current setting is for the current provided for motor when the motor runs.
- When RUN current is increased, RUN torque of the motor is also increased.
- When RUN current is set too high, the heat is severe.
- Set RUN current within the range of motor's rated current according to its load.
- Change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

Setting STOP current

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 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×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.

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)

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
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.

Cautions During Use

- For signal input**
 - Do not input CW, CCW signal at the same time in 2-pulse input method. Failure to follow this instruction may result in malfunction. It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].
 - When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.
- For RUN current, STOP current setting**
 - Set RUN current within the range of motor's rated current. Failure to follow this instruction may result in severe heat of motor or motor damage.
 - If motor stops, switching for STOP current executed by the current down function. When hold off signal is [H] or current down function is OFF, the switching does not execute.
 - Use the power for supplying sufficient current to the motor.
 - Check the polarity of power before operating the unit.
- For cable connection**
 - Use twisted pair (over 0.2mm²) for the signal cable which should be shorter than 2m.
 - The thickness of cable should be same or thicker than the motor cable's when extending the motor cable.
 - Must separate between the signal cable and the power cable over 10cm.
- For installation**
 - In order to increase heat protection efficiency of the driver, must install the heat sink close to metal panel and keep it well-ventilated.
 - Excessive heat generation may occur on driver. Keep the heat sink under 80°C when installing the unit. (at over 80°C, forcible cooling shall be required.)
- For using function selection DIP switches**
 - 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.
 - Do not change the pulse input method during the operation. It may cause danger as the revolution way of the motor is changed conversely.
- This product may be used in the following environments.**
 - Indoor
 - Altitude under 2000m
 - Pollution degree 2
 - Installation category II

※Failure to follow these instructions may result in product malfunction.

Major products

- Photoelectric Sensors
- Fiber Optic Sensors
- Door Sensors
- Door Side Sensors
- Area Sensors
- Proximity Sensors
- Pressure Sensors
- Rotary Encoders
- Connector/Sockets
- Temperature Controllers
- Temperature/Humidity Transducers
- SSR/Power Controllers
- Counters
- Timers
- Panel Meters
- Tachometer/Pulse (Rate) Meters
- Display Units
- Sensor Controllers
- Switching Mode Power Supplies
- Control Switches/Lamps/Buzzers
- I/O Terminal Blocks & Cables
- Stepper Motors/Drivers/Motion Controllers
- Graphic/Logic Panels
- Field Network Devices
- Laser Marking System (Fiber, CO₂, Nd:YAG)
- Laser Welding/Cutting System

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