Autonics

2-Phase Microstep Stepper Motor Driver

MD2U-MD20

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

1. **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.
2. **Installation, connection, operation, maintenance, and inspection should be handled by qualified individuals.**
   Failure to follow this instruction may result in fire or product damage.
3. **Please use DC power with reinforced insulating the primary and secondary part for the DC power product.**
   Failure to follow this instruction may result in fire.
4. **Install the driver 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.
5. **Do not use the unit where flammable or explosive gas, corrosive material, water, or combustible material are likely to exist.**
   Failure to follow this instruction may result in fire or burn.
6. **Do not put a finger or any object into the opening of the driver.**
   Failure to follow this instruction may result in fire or personal injury.
7. **Do not disassemble or modify the unit. Please contact us if necessary.**
   Failure to follow this instruction may result in fire or product damage.
8. **Please use the adjuster with insulated screw driver.**
   Failure to follow this instruction may result in fire.

⚠ Caution

1. **Disconnect all power sources for installation, connection, inspection, or maintenance work.**
   Failure to follow this instruction may result in product damage.
2. **Power input voltage for this driver must be used within the rated specification and power line should be over than AWG 18 (0.75mm²).**
   Failure to follow this instruction may result in fire.
3. **Check whether the connection is correct, based on the connection diagram before supplying the power to the driver.**
   Failure to follow this instruction may result in fire or driver damage.
4. **Install over-current prevention device (e.g. the current breaker, etc) to connect the driver with power.**
   Failure to follow this instruction may result in fire.
5. **Turn OFF the driver power in case of a power failure.**
   Failure to follow this instruction may result in personal injury or product damage due to restoration.
6. **Do not touch the unit while operating or right after stopping the driver.**
   Failure to follow this instruction may result in burn due to high temperature in surface of the driver.
7. **The emergency stop should be available while the driver is operating.**
   Failure to follow this instruction may result in personal injury or product damage.
8. **Before supplying the power to the driver, check the control input signal of this unit.**
   Failure to follow this instruction may result in personal injury or product damage by unexpected signal input.
9. **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 the motor.
10. **Please install a safety device when requiring to maintain the vertical position after turning off the power of this driver.**
    Failure to follow this instruction may result in personal injury or product damage by releasing holding torque of the motor.
11. **Please check if HOLD OFF signal input is ON when it is required to set the output manually.**
    Failure to follow this instruction may result in personal injury by sudden movement.
12. **Stop with emergency this driver when any error occurs to this driver.**
    Failure to follow this instruction may result in fire or personal injury.
13. **Do not touch terminals during measuring insulation resistance or testing insulation dielectric strength of the driver.**
    Failure to follow this instruction may result in product damage.
14. **Use the unit within the rated specifications.**
    Failure to follow this instruction may result in product damage, performance loss, shortening the life cycle of the unit, personal injury, or ambient equipment damage.
15. **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.
16. **Use the designated 2-phase stepper motor only.**
    Failure to follow this instruction may result in fire or product damage.
17. **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.**
※**Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).**

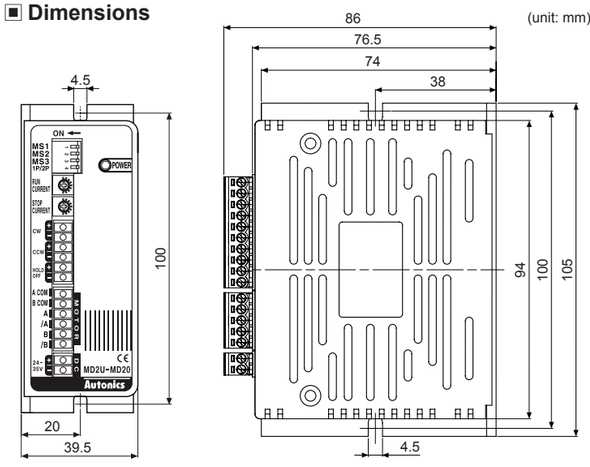
▣ Specifications

Model		**MD2U-MD20**
Power supply※1		24-35VDC⎓
Allowable voltage range		90 to 110% of the rated voltage
Max. current consumption※2		3A
RUN current※3		0.5-2A/Phase
STOP current		20 to 70% of RUN current (set by STOP current volume)
RUN method		Unipolar constant current drive type
Basic step angle		1.8˚/step
Resolution		1, 2, 4, 5, 8, 10, 16, 20-division (1.8˚ to 0.09˚/step)
Input pulse characteristic	Input pulse width	Min. 10μs (CW, CCW), Min. 1ms (HOLD OFF)
	Duty rate	50% (CW, CCW)
	Rising/Falling time	Max. 0.5μs (CW, CCW)
	Pulse input voltage	[H]: 4-8VDC⎓, [L]: 0-0.5VDC⎓
	Max. input current	4mA (CW, CCW), 10mA (HOLD OFF)
	Max. input pulse freq.※4	Max. 50kHz (CW, CCW)
Input resistance		300Ω (CW, CCW), 390Ω (HOLD OFF)
Insulation resistance		Over 200MΩ (at 500VDC megger, between all terminals and case)
Dielectric strength		1000VAC 50/60Hz for 1 minute (between all terminals and case)
Noise immunity		±500V the square wave noise (pulse width: 1μs) by the noise simulator
Vibration		1.5mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours
Shock		300m/s² (approx. 30G) in each X, Y, Z direction for 3 times
Environment	Ambient temp.	0 to 50℃, storage: -10 to 60℃
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH
Approval		CE
Weight※5		Approx. 295g (approx. 180g)

※1: Since torque characteristics are improved but the driver temperature rises with the 30VDC power supply, the driver should be installed at the well ventilated environment.
Torque is variable by power supply.
※2: Based on the ambient temperature 25℃, ambient humidity 55%RH.
※3: RUN current varies depending on the input RUN frequency, and the max. instantaneous RUN current varies also.
※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 parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

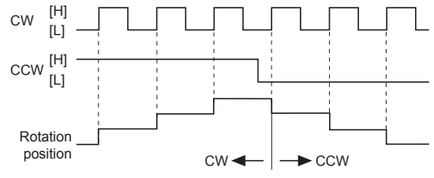
▣ Dimensions

(unit: mm)

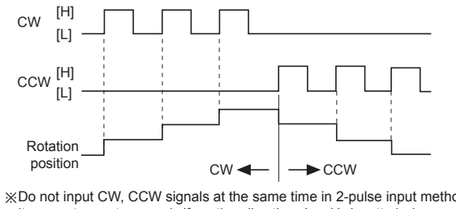


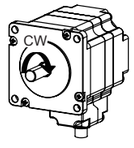
▣ Time Chart

◎ **1 pulse input method**



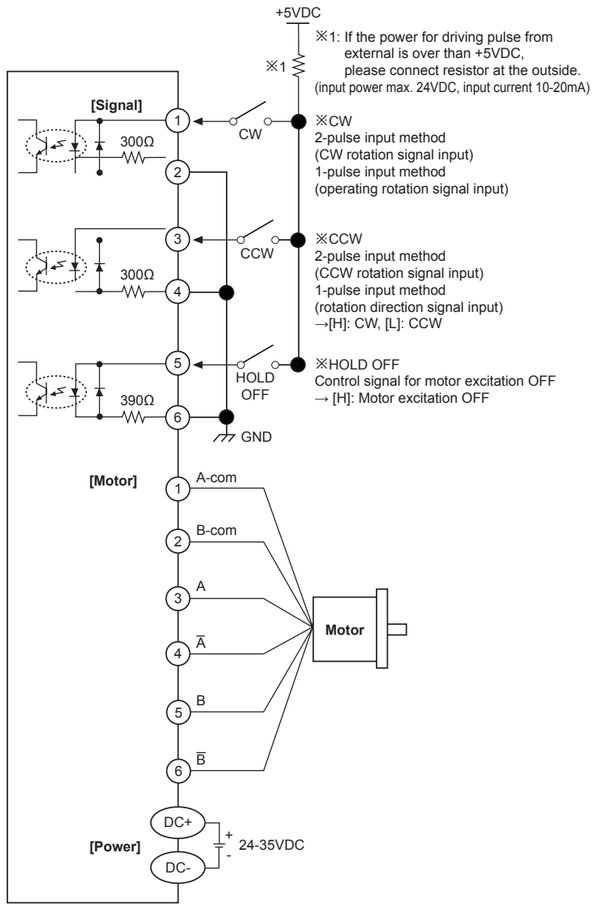
◎ **2 pulse input method**





※Do not input CW, CCW signals at the same time in 2-pulse input method.
It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].

▣ I/O Circuit and Connections



▣ Functions

◎ **Function selection DIP switch**

● **Microstep, pulse input method setting**

No.	Name	Function	Switch position	
			ON	OFF
1	MS1	Microstep setting		
2	MS2			
3	MS3			
4	1P/2P	Pulse input method	1-pulse input method	2-pulse input method

MS1	MS2	MS3	Resolution
ON	ON	ON	1 (Full-step)
ON	ON	OFF	2-division
ON	OFF	ON	4-division
ON	OFF	OFF	5-division
OFF	ON	ON	8-division
OFF	ON	OFF	10-division
OFF	OFF	ON	16-division
OFF	OFF	OFF	20-division

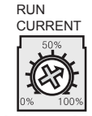
● **Resolution setting (MS1/ MS2/ MS3)**
- Select the step angle (motor rotation angle per 1 pulse).
- The set step angle is dividing basic step angle(1.8˚) of 2-phase stepping motor by set resolution value.

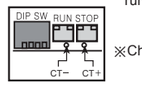
E.g.) Set step angle = $\frac{\text{Basic angle (1.8°)}}{\text{Resolution}}$

※Change resolution setting value only when the motor stops.

● **1P/2P**
- The 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.

◎ **Setting RUN current**





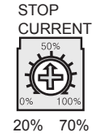
- RUN current setting is for the current provided to the motor in running status.

※When RUN current is increased, RUN torque of the motor is also increased.
※When RUN current is set too high, the heat of the motor is increased.
※Set RUN current properly for the load within the rated current range of the motor.
※RUN current setting range: 0.5 to 2.0A
※RUN current setting method: Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (max. 150rpm)

E.g.) Input voltage (3V) × $\frac{2}{3}$ = 2A (motor excitation current)

※Change RUN current only when the motor stops.

◎ **Setting STOP current**



- STOP current setting is for the current provided to the motor in stopped status, preventing severe heat of the motor.
- This function is for reducing the heat by variable resistance ratio setting within 0 to 100% of RUN current setting range (actual setting range: 20 to 70%) .

E.g.) In case of RUN current setting value is 2A and STOP current setting value is 0% (actual setting range: 20%), STOP current is 2A×0.2=0.4A.

※When STOP current is decreased, STOP torque of the motor is also decreased.
※When STOP current is set low, the heat of the motor is also low.
※Change STOP current only when the motor stops.

◎ **HOLD OFF function**
- This signal is for rotating axis of the motor with external force or 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.

※Use this function only when the motor stops.
※Refer to I/O Circuit and Connections.

▣ Troubleshooting

1. **When the motor does not rotate**
   ①Check the connection of controller and driver.
2. **When motor rotates to the reverse direction**
   ①Check the DIR input of the driver.
   ②DIR input is [ON] for CW, and [OFF] for CCW.
3. **When operation of motor is unstable**
   ①Check whether driver and motor are connected correctly.
   ②Check whether output current of the driver by current setting is proper for operation of the motor.

▣ Cautions during Use

1. **For signal input**
   ①Do not input CW, CCW signal at the same time in 2-pulse input method.
   Failure to follow this instruction may result in malfunction.
   ②When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside. (Connect 3kΩ of resistance when applying 24V of power)
2. **For RUN current, STOP current setting**
   ①Set RUN current within the rated current range of the motor.
   Failure to follow this instruction may result in severe heat of motor or motor damage.
   ②Use the power for supplying sufficient current to the driver.
3. **For rotating motor**
   ①For rotating the motor when driver power turns OFF, separate the motor from the driver. (if not, the driver power turns ON)
   ②For rotating the motor when driver power turns ON, use Hold OFF function.
4. **For cable connection**
   ①Use twisted pair (over 0.2mm²) for the signal cable which should be shorter than 2m.
   ②The thickness of the cable should be same or thicker than the motor cable when extending the motor cable.
   ③Must separate between the signal cable and the power cable over 10cm.
5. **For installation**
   ①In order to increase heat protection efficiency of the driver, must install the heat sink close to metal panel and keep it well-ventilated.
   ②Excessive heat generation may occur on driver. Keep the heat sink under 80℃ when installing the unit. (at over 80℃, forcible cooling shall be required.)
6. **For using function selection DIP switches**
   ①Do not change the pulse input method during the operation. It may cause danger as the revolution way of the motor is changed conversely.
7. **Motor vibration and noise can occur in specific frequency period.**
   ①Motor vibration and noise can be lowered by changing motor installation or attaching damper.
   ②Use the unit in a range without vibration and noise by changing RUN speed or resolution.
8. **This product may be used in the following environments.**
   ①Indoors
   ②Altitude max. 2000m
   ③Pollution degree 2
   ④Installation category II

※**Failure to follow these instructions may result in product damage.**

▣ Major Products

■ Photoelectric Sensors
■ Fiber Optic Sensors
■ Door Sensors
■ Door Side Sensors
■ Area Sensors
■ Proximity Sensors
■ Pressure Sensors
■ Rotary Encoders
■ Connector/Sockets
■ 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, CO_2, Nd: YAG)
■ Laser Welding/Cutting System
■ Temperature Controllers
■ Temperature/Humidity Transducers
■ SSRs/Power Controllers
■ Counters
■ Timers
■ Panel Meters
■ Tachometer/Pulse (Rate) Meters
■ Display Units
■ Sensor Controllers

Autonics Corporation
http://www.autonics.com
■ **HEADQUARTERS:**
18, Bansong-ro 513 beon-gil, Haeundae-gu, Busan, South Korea, 48002
TEL: 82-51-519-3232
■ **E-mail:** sales@autonics.com