

MD2U Series 2-Phase Unipolar Stepper Motor Driver

Compact And High-Performance Of 2-Phase Stepper Motor Driver

■ Features

- Unipolar constant current drive type
- Enable to brake when it stops by STOP current adjustment
- Low speed and precise control with microstep (MD2U-MD20)
- Insulate using photocoupler to minimize the influence by external noise
- Power supply: 24-35VDC

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



MD2U-MD20

MD2U-ID20

■ Ordering Information

MD	2	U	-	M	D	20		
Item	Motor phase	Drive method		Step method (resolution)	Power supply	RUN current		
						20	2A/Phase	
						D	24-35VDC	
						M	Micro Step (20-division)	
						I	Intelligent type	
						U	Unipolar drive	
						2	2-Phase	
						MD	Motor Driver	

■ Specifications

Model	MD2U-MD20	MD2U-ID20
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 to 2A / Phase	
STOP current	20 to 70% of RUN current (set by STOP current volume)	
Drive 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 spec.	Input pulse width	Min. 10μs(CW, CCW), 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 frequency ^{※4}	Max. 50kHz (CW, CCW)
Input resistance	300Ω(CW, CCW), 390Ω(HOLD OFF)	3.3kΩ (CW/CCW, RUN/STOP, HOLD OFF)
Insulation resistance	Min. 200MΩ (at 500VDC megger, between all terminals and case)	
Dielectric strength	1000VAC 50/60Hz for 1 minute (between all terminals and case)	
Noise resistance	±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	Vibration	300m/s ² (approx. 30G) in each X, Y, Z direction for 3 times
Environment	Ambient temperature	0 to 50°C, storage: -10 to 60°C
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH
Approval	CE	
Weight ^{※5}	Approx. 295g (approx. 180g)	Approx. 303g (approx. 190g)

※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 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.

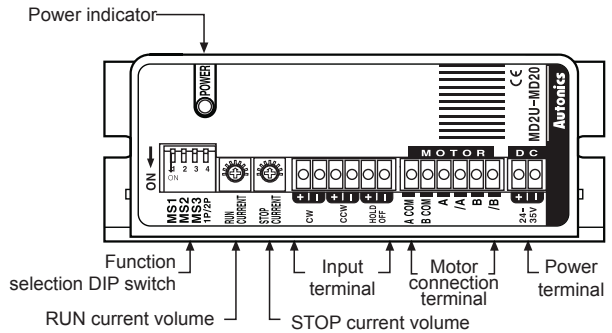
※Environment resistance is rated at no freezing or condensation.

(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

MD2U Series

2-Phase Micro Stepper Driver [MD2U-MD20]

■ Unit Descriptions



◎ Function selection DIP switch

● Microstep, pulse input method setting

	No.	Name	Function	Switch position			
				ON	OFF		
	1	MS1	Microstep setting	MS1	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
	2	MS2		OFF	ON	10-division	
				OFF	OFF	16-division	
	3	MS3		OFF	OFF	20-division	
				OFF	OFF		
	4	1P/2P		Pulse input method	1-pulse input method	2-pulse input method	

● 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 setting value.

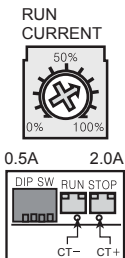
$$\text{E.g.) Set step angle} = \frac{\text{Basic angle (1.8°)}}{\text{Resolution}}$$

※ Must stop the motor before changing the resolution.

● 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 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.
- ※ RUN current setting range: 0.5 to 2.0A

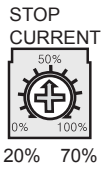
※ RUN current setting method: Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (Max. 150rpm)

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

※ Change RUN current only when the motor stops.

2-Phase Unipolar Stepper Motor Driver

◎ Setting STOP current

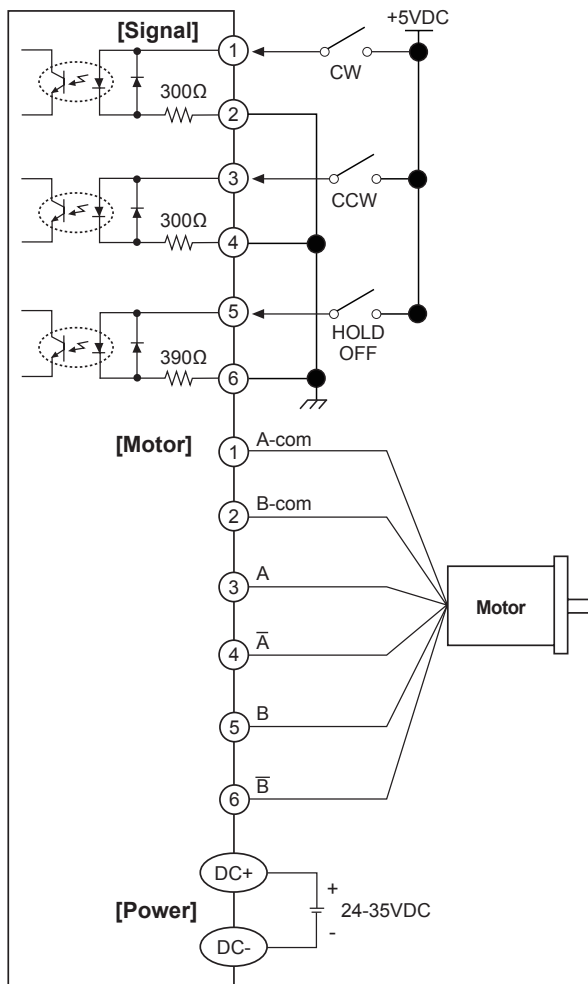


- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This function is for reducing the heat by variable resistance ratio setting within 0 to 100% of RUN current setting range (actual setting range: 20 to 70%) .
E.g.) In case of RUN current setting value is 2A and STOP current setting value is 0%(actual setting range: 20%), STOP current $0.4A = 2A \times 0.2$
- ※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.

◎ 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.

■ 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

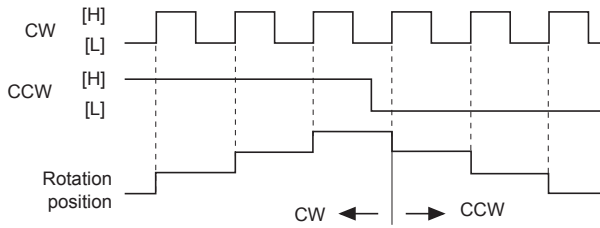
※If the power for driving pulse from external is over than +5VDC, please connect resistor at the outside.
(input power max. 24VDC, input current 10-20mA)

(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

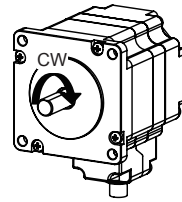
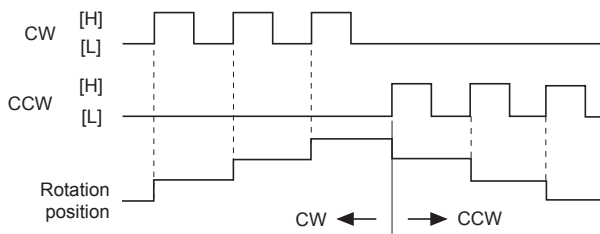
MD2U Series

Time Chart

1 pulse input method



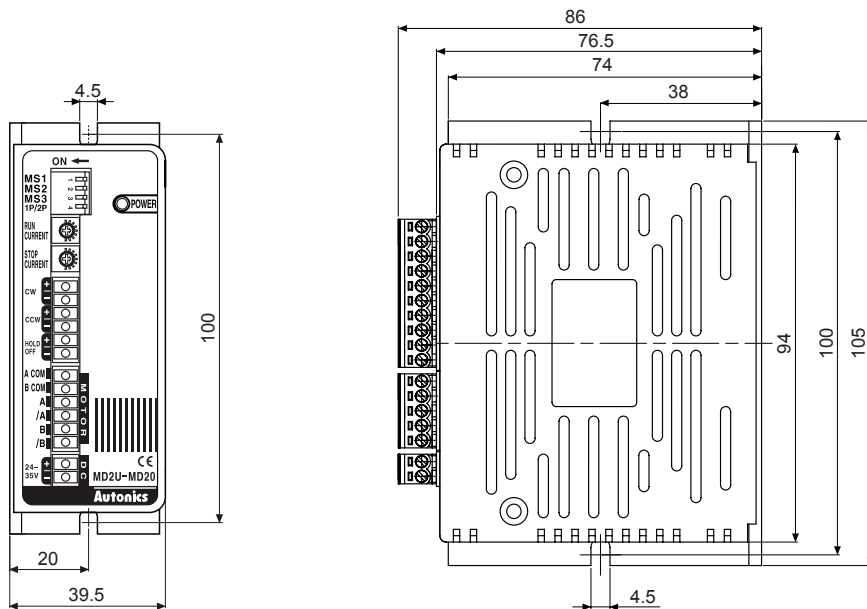
2 pulse input method



※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].

Dimensions

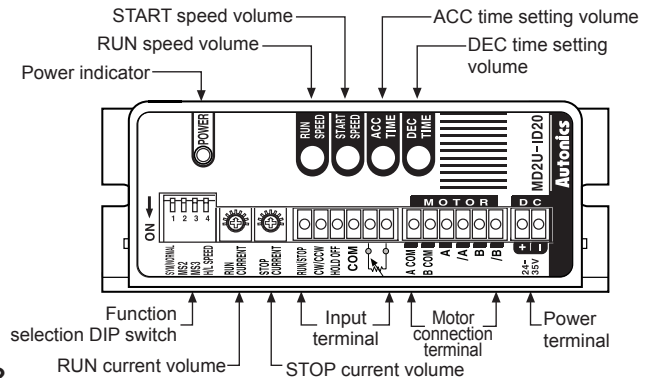
(unit: mm)



2-Phase Unipolar Intelligent Stepper Motor Driver

2-Phase Intelligent Stepper Motor Driver [MD2U-ID20]

Unit Descriptions



Intelligent type stepper motor driver?

MD2U-ID20 is an intelligent type stepper motor driver including all features to control 2-phase stepper motors so that no controllers are required.

- Realizing AC motor's driving features to stepper motors
- Controlling START speed, RUN speed and ACC/DEC speed
- User-friendly design to realize various functions (front switch and volume)

Function selection DIP switch

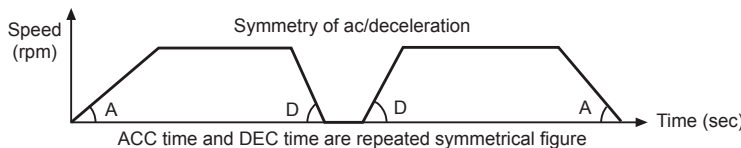
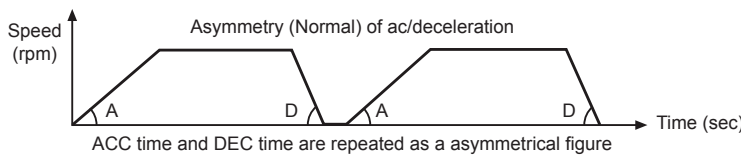
No.	Name	Function	Switch position				
			ON	OFF			
1	SYM/ NORMAL	SYM/NORMAL	Symmetry	Asymmetry			
2	MS2	Max. speed	MS2	MS3	H/L SPEED	Max. speed (rpm)	
3	MS3		ON	ON	ON: High speed		1500
			ON	OFF			1000
4	H/L SPEED	OFF	ON	OFF: Low speed	500		
		OFF	OFF		150		

※1: D=Don't care

※Reset the power after changing function selection switch operations.

Selection of Symmetry/Asymmetry

※The function to make the ACC/DEC time of run-speed as asymmetry or symmetry using DIP switch No. 1.



※It is able to set the gradient (acceleration and deceleration time) as ACC/DEC time.

Selection of max. speed (MS2, MS3)

- ※The function to select the max. speed of motors.
- ※The max. speed of stepper motor is changed by MS2/MS3 and Hi/Low speed.
- ※The features of run and vibration are able to change depending on MS2, MS3.
- ※Lower the max. speed to run a motor smoothly.

Selection of H/L SPEED

※H/L SPEED mode selection switch: Ac.deceleration control is not available in Low speed mode since all sections are included in Pull-in range.

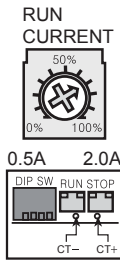
※Low speed mode: It is able to drive a motor up to 150rpm of max. drive speed.

※High speed mode: It is able to drive a motor up to 1500rpm of max. drive speed.

- (A) Photoelectric Sensors
- (B) Fiber Optic Sensors
- (C) Door/Area Sensors
- (D) Proximity Sensors
- (E) Pressure Sensors
- (F) Rotary Encoders
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- (H) Temperature Controllers
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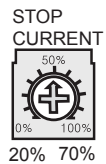
MD2U Series

◎ Setting RUN current



- 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.
- ※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) $\times \frac{2}{3} = 2A$ (motor excitation current)
- ※Change RUN current only when the motor stops.

◎ Setting STOP current



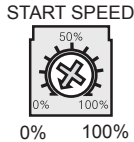
- STOP current setting is for the current provided for motor when the motor stops for preventing severe motor's heat.
- This function is for reducing the heat by variable resistance ratio setting within 0 to 100% of RUN current setting range (actual setting range: 20 to 70%) .
- E.g.) In case of RUN current setting value is 2A and STOP current setting value is 0%(actual setting range: 20%), STOP current 0.4A = 2A \times 0.2
- ※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.

◎ Setting RUN speed



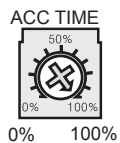
- ※It sets max. RUN speed.
- ※Max. RUN speed can be different depending on max. speed setting (MS2, MS3) and driving mode setting (Hi/Low speed).
- ※Consider motor type and its RUN current when setting max. RUN speed. Missing step could occur due to max. input pulse frequency of motors.
- ※Set the value when the motor stops.

◎ START speed setting



- ※It sets desired START speed.
- ※Max. START speed value is same with RUN speed value.
- ※START speed must be set within max. starting frequency. It is recommended to set up START speed within 0 to 50% for stable driving.
- ※Set the value when the motor stops.

◎ Setting ACC time



- ※It sets the acceleration time from START speed to max. driving speed.
- ※AT_1 operation mode when ACC time is under 33.3%, AT_2 operation mode when ACC time is under 66.6% and AT_3 operation mode when ACC time is over 66.6%.
- ※AT_1 is 0.5 sec. when RUN speed=100%, START speed=0%.
- ※AT_2 is 1 sec. when RUN speed=100%, START speed=0%.
- ※AT_3 is 2 sec. when RUN speed=100%, START speed=0%.
- ※Set the value when the motor stops.

◎ Setting DEC time



- ※It sets the deceleration time from max. RUN speed to STOP.
- ※DT_1 operation mode when DEC time is under 33.3%, DT_2 operation mode when DEC time is under 66.6% and DT_3 operation mode when DEC time is over 66.6%.
- ※DT_1 is 0.5 sec. when RUN speed=100%, START speed=0%.
- ※DT_2 is 1 sec. when RUN speed=100%, START speed=0%.
- ※DT_3 is 2 sec. when RUN speed=100%, START speed=0%.
- ※Set the value when the motor stops.

- ※ACC Time and DEC Time are declined in proportion to the setting value of START speed.
- ※The figures above indicate the factory default for each value.

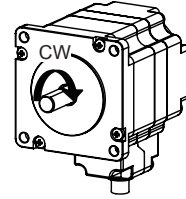
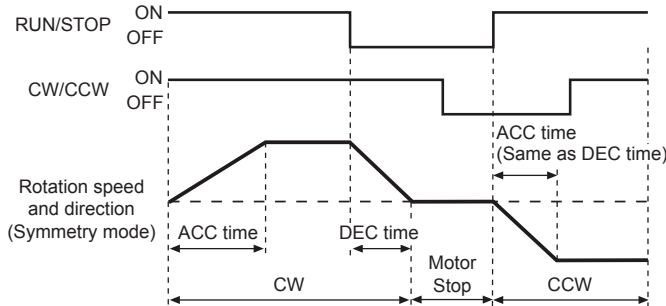
◎ HOLD OFF function

- 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.

2-Phase Unipolar Intelligent Stepper Motor Driver

Time Chart

High speed mode

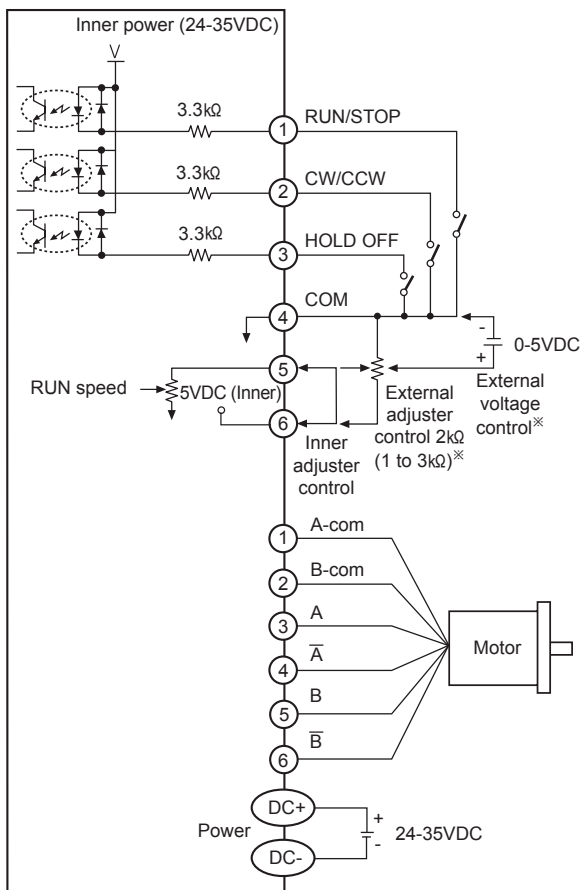


It accelerates up to RUN speed during ACC time after RUN signal is ON and decelerates during DEC time after it is OFF. It is disable to change the direction during the signal is ON and it takes 0.5sec. for deceleration when DEC time is "0%".

Low speed mode

Max. RUN speed is 150rpm and ACC and DEC time are not available. It is same with High speed to change RUN/STOP and direction.

I/O Circuit and Connections



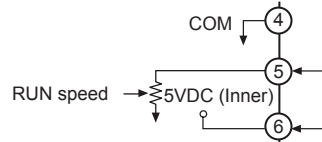
RUN/STOP signal input
→ [ON]: RUN, [OFF]: STOP

Direction signal input
→ [ON]: CW, [OFF]: CCW

HOLD OFF signal input
→ [ON]: HOLD OFF, [OFF]: HOLD ON

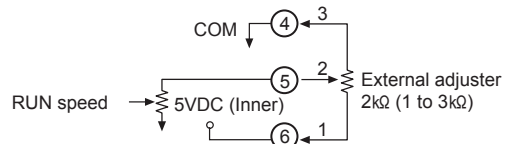
Inner adjuster control (Adjusting RUN speed with front VR)

Make the connection between terminal No.5 and No.6.



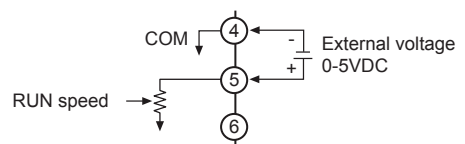
External adjuster control (Adjusting RUN speed with connecting external variable resistance)

Connect variable resistance 2kΩ (1 to 3kΩ) for external adjuster control. If variable resistance is too low, full range setting might not be possible. Make sure to adjust RUN speed VR to maximum for external adjuster control.



External voltage control (Adjusting RUN speed with external voltage input)

Make sure to adjust RUN speed VR to maximum external voltage control.



※ Inner adjuster is correlated to external adjuster control and external voltage control. Make sure that inner adjuster must be set to maximum in order to set maximum RUN speed using external adjuster and external voltage.

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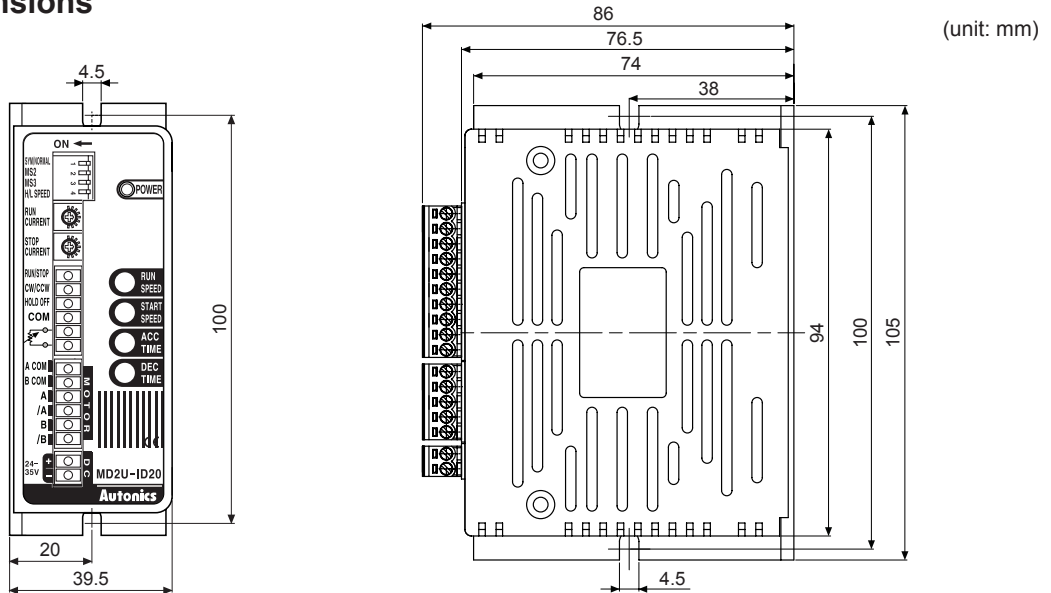
(R) Graphic/ Logic Panels

(S) Field Network Devices

(T) Software

MD2U Series

■ Dimensions



■ Proper Usage

◎ Failure diagnosis and management

- Check the connection of controller and driver, if motor does not rotate.
- Check the DIR input of driver, if motor rotates as a reverse direction, it is CW for [ON] and CCW for [OFF].
- If motor does not work properly,
 - Check the connection of driver and motor.
 - Check driver output current and RUN current of motor depending on current adjuster are correct.

◎ Caution during use

1. For signal input

- ① Do not input CW, CCW signal at the same time in 2-pulse input method. Failure to follow this instruction may result in malfunction. (MD2U-MD20)
- ② Direction cannot be changed during the operation. (MD2U-ID20)
- ③ When the signal input voltage is exceeded the rated voltage, connect additional resistance at the outside.

2. For RUN current, STOP current setting

- ① 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.
- ② Use the power for supplying sufficient current to the motor.

3. For cable connection

- ① Use twisted pair (over 0.2mm²) for the signal cable which should be shorter than 2m.
- ② The thickness of cable should be same or thicker than the motor cable's when extending the motor cable.
- ③ Must separate between the signal cable and the power cable over 10cm.

4. For installation

- ① In order to increase heat protection efficiency of the driver, must install the heat sink close to metal panel and keep it well-ventilated.
- ② 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.)

5. For using function selection DIP switches

- ① Do not change the pulse input method during the operation. It may cause danger as the revolution way of the motor is changed conversely.

6. Motor vibration and noise can occur in specific frequency period.

- ① Motor vibration and noise can be lowered by changing motor installation or attaching damper.
- ② Use the unit in a range without vibration and noise by changing RUN speed or resolution.

7. This product may be used in the following environments.

- | | |
|----------------------|----------------------------|
| ① Indoor | ② Altitude under 2000m |
| ③ Pollution degree 2 | ④ Installation category II |