MD2U Series   2-Phase 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
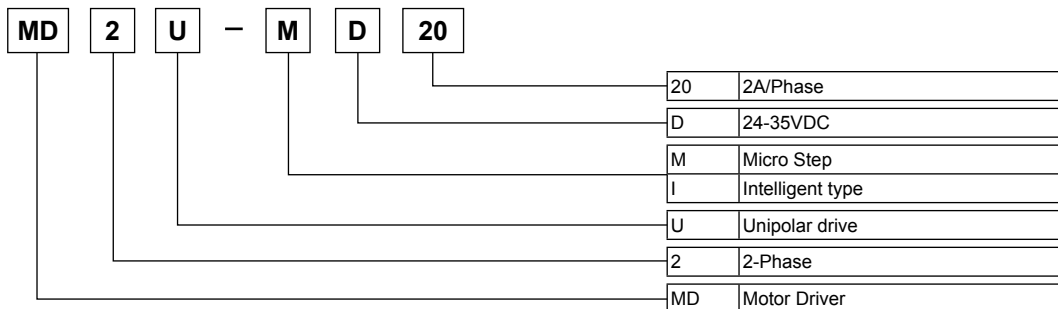- Power supply : 24-35VDC

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

CE

MD2U-MD20   **MD2U-ID20**

▣ Ordering information

MD	2	U	–	M	D	20

20	2A/Phase
D	24-35VDC
M	Micro Step
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		80 to 120% of the rating voltage	
RUN current[※2]		0.5 ~ 2A / Phase	
Drive method		Unipolar constant current drive type	
Current consumption[※3]		Max. 3A	
Resolution		1, 2, 4, 5, 8, 10, 16, 20 division[※3]	───
Input pulse spec.	Input pulse width	Min. 10μs	───
	Pulse duty	Max. 50%	───
	Rising/falling time	Max. 0.5μs	───
	Pulse input voltage	[H] 4-8VDC, [L] 0-0.5VDC	───
	Max. input pulse frequency	Max. 50kHz[※4]	───
Input resistance		300Ω(CW, CCW), 390Ω(HOLD OFF)	3.3kΩ(CW/CCW, RUN/STOP, HOLD OFF)
Insulation resistance		Min. 200MΩ(Based on 500VDC of electrification and non-electrification parts)	
Dielectric strength		1000VAC 60Hz for 1 minute(Between electrification and non-electrification parts)	
Noise resistance		±500V the square wave noise(pulse width: 1μs) by the noise simulator	
Vibration		1.5mm amplitude or 300m/s² at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours	
Shock	Vibration	300m/s²(approx. 30G) in each of X, Y, Z directions for 3 times	
Environ- ment	Ambient temperature	0 to 50℃, storage : -20 to 60℃	
	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, it should be mounted at a well-ventilated place due to increasing heat.
※2: The max. value of RUN current is based on RMS value in accordance with frequency of running motor, peak power can be changed by load fluctuation.
※3: Ambient temperature is 25℃ and ambient humidity is 55%RH.
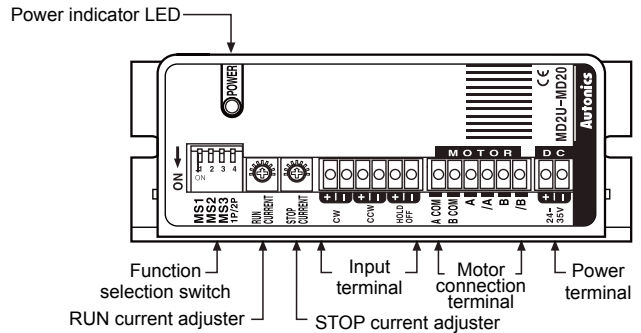※4: It can be changed by pull-out frequency and max. slewing frequency range.
※5: The weight with packaging and the weight in parentheses is only unit weight.
※Environment resistance is rated at no freezing or condensation.

2-Phase micro stepper driver [MD2U-MD20]

Power indicator LED

Function selection switch
RUN current adjuster
Input terminal
STOP current adjuster
Motor connection terminal
Power terminal

◎ **Function selection switch**

● **Setting microstep**

	No.	Name	Function	Switch position	
				ON	OFF
	1	MS1	Microstep set 1	MS1 MS2 MS3 Resolution ON ON ON 1(Full-step) ON ON OFF 2-division	
	2	MS2	Microstep set 2	ON OFF ON 4-division ON OFF OFF 5-division OFF ON ON 8-division	
	3	MS3	Microstep set 3	OFF ON OFF 10-division OFF OFF ON 16-division OFF OFF OFF 20-division	
	4	1P/2P	Microstep set 3	1 Pulse method	2 Pulse method

● **Setting input type**

	1P / 2P
ON 4	1 Pulse input
ON 4	2 Pulse input

● **Resolution setting(MS1/ MS2/ MS3)**

※A switch to select micro step angle to drive a motor.
※Micro stepper is to make basic step angle of 2-phase motors (1.8°) divided into smaller angle according to setting values.
※The formula for microstep angle is;

$$\text{Rotation angle per pulse of 2-phase[°]} = \frac{1.8°}{\text{Resolution}}$$

※It may cause step-out if resolution is changed while motor is running.
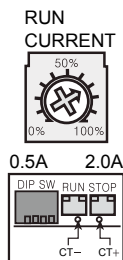
● **1P/2P**

※A switch to select pulse input type
※1-pulse input mode
　CW : Operation command pulse input, CCW : Rotation direction pulse input([H] : CW, [L] : CCW)
※2-pulse input mode
　CW : CW direction rotation pulse input, CCW : CCW direction rotation pulse input

◎ **RUN current setting**

RUN CURRENT

0.5A   2.0A

DIP SW RUN STOP

CT−   CT+

※RUN current is a phase current provided to 2-phase stepper motor.
※Be sure to set RUN current at the rated current or below. If not, it may cause heat generation, loss of torque or step-out.
※RUN current setting range : 0.5 to 2.0A
※RUN current setting : Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (Max. 150rpm)
　Ex) Input Voltage(3V)× 2 / 3 = 2A(Motor's excitation current)
※Adjust the RUN current in case severe heat generation occurs.
　Be sure that torque decreasing may occur when adjusting the current.
Note) Be sure to adjust RUN current while motor is running.

2-Phase Unipolar Stepper motor Driver

(A)
Photo electric sensor

(B)
Fiber optic sensor

(C)
Door/Area sensor

(D)
Proximity sensor

(E)
Pressure sensor

(F)
Rotary encoder

(G)
Connector/ Socket

(H)
Temp. controller

(I)
SSR/ Power controller

(J)
Counter

(K)
Timer

(L)
Panel meter

(M)
Tacho/ Speed/ Pulse meter

(N)
Display unit

(O)
Sensor controller

(P)
Switching mode power supply

(Q)
Stepper motor& Driver&Controller

(R)
Graphic/ Logic panel

(S)
Field network device

(T)
Software

(U)
Other

◎ STOP current setting

STOP CURRENT

50%

0%   100%

20%   70%

※Stop current is a phase current provided to 2-phase stepper motor at standstill.

※A function to reduce the current in order to suppress the heat generation at motor standstill / Use variable resistance ratio within 0 to 100% of RUN current to set STOP current (Actual setting range is 20 to 70% of RUN current).

Ex) If RUN current setting value is 2A and STOP current setting value is 0%, STOP current will be set to 0.4A.

※STOP current setting value may have some deviation depending on resistance impedance of motor.

※Auto current down function will be activated when HOLD OFF signal is [L]. When HOLD OFF signal is [H], the function is not activated since the current provided to each phase is cut off.

Note) Be sure to adjust STOP current while motor is at standstill.

◎ HOLD OFF function

※When HOLD OFF input signal is [H], motor excitation is released.
   When HOLD OFF input signal is [L], motor excitation is in a normal status.

※A function used to rotate motor's axis using external force or used for manual positioning.

※HOLD OFF Input signal [H] and [L] represent Photocoupler ON/OFF in a circuit.

※Please do not use for stopping motor.

■ Input·Output diagram and connections

※CW
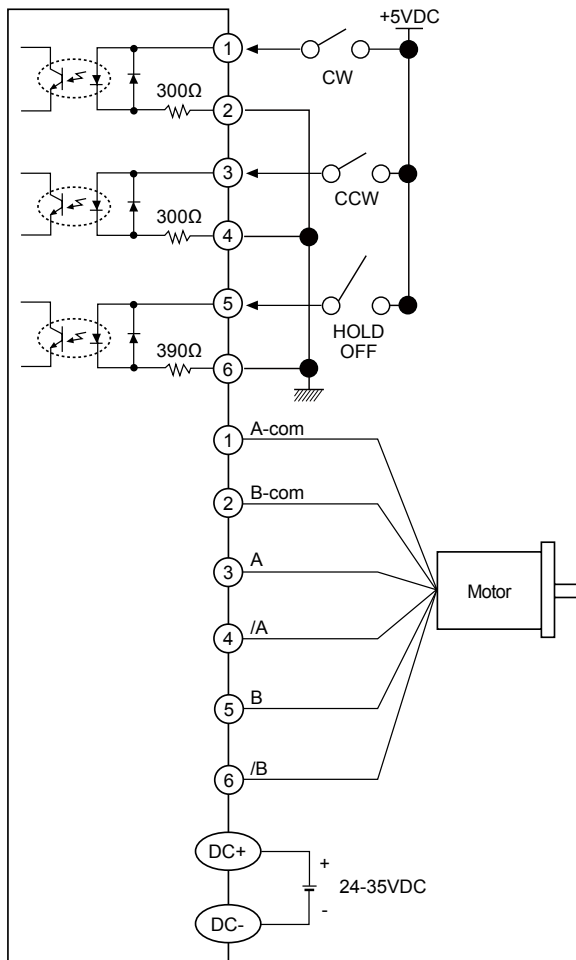
2-pulse input mode - CW direction rotation pulse input
1-pulse input mode - Operation command pulse input

※CCW

2-pulse input mode - CCW direction rotation pulse input
1-pulse input mode - Rotation direction pulse input   [H] : CW, [L] : CCW

※HOLD OFF

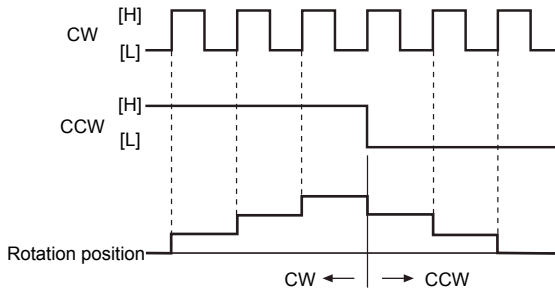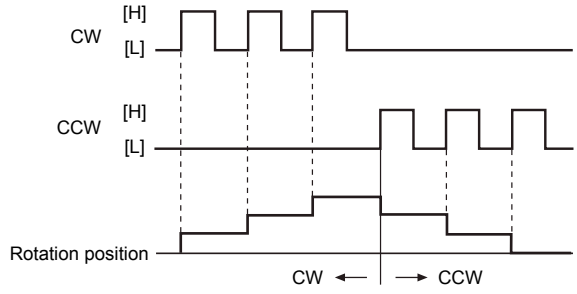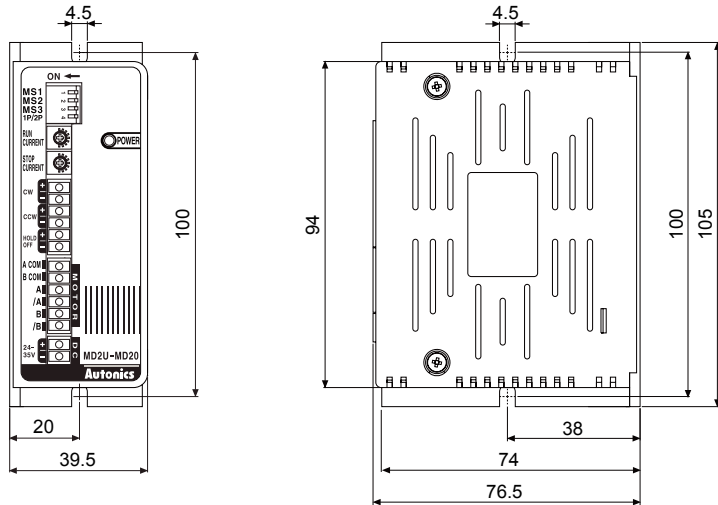MOTOR EXCITATION OFF CONTROL SIGNAL
[H] : MOTOR EXCITATION OFF

Note) Add external resistance when power for pulse from the external of the unit exceeds +5V.
   (Input power : Max. 24VDC, Input current : 10 to 20mA)

MD2U Series

▣ Time chart

● **1 Pulse input**

CW [H] [L]

CCW [H] [L]

Rotation position

CW ← | → CCW

● **2 Pulse input**

CW [H] [L]

CCW [H] [L]

Rotation position

CW ← | → CCW

▣ Dimensions

(unit: mm)

ON ◄—

MS1
MS2
MS3
1P/2P

RUN
CURRENT

STOP
CURRENT

○ POWER

CW

CCW

HOLD
OFF

A COM
B COM
A
/A
B
/B

24-
35V

MD2U-MD20

Autonics

4.5

100

20

39.5

4.5

94

100

105

38

74

76.5

Autonics

2-Phase intelligent stepper motor driver [MD2U-ID20]

START speed adjuster
RUN speed adjuster
ACC time setting adjuster
DEC time setting adjuster
Power indicator LED

MD2U-ID20

MOTOR   DC

Function selection switch
RUN current adjuster
Input terminal
STOP current adjuster
Motor connection terminal
Power terminal
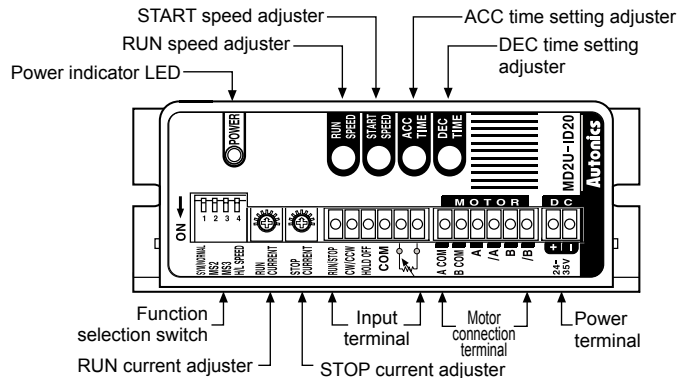
◎ Intelligent type stepper motor driver?

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)
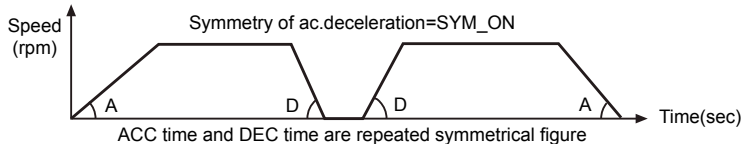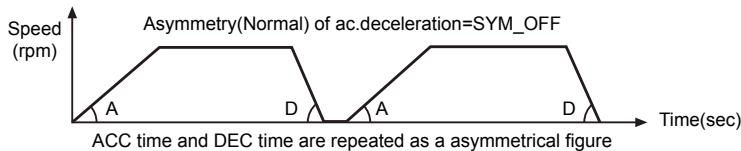
◎ Function selection switch

	S/W No.	1	2	3	4	Max. speed
	Name	SYM/NORMAL	MS2	MS3	H/L SPEED	(rpm)
Switch		ON: Symmetry OFF:Asymmetry (Normal)	ON	ON	ON : High speed	1500
			ON	OFF		1350
			OFF	ON		1000
			OFF	OFF		500
		D※1	D※1	D※1	OFF: Low speed	150

※1: D=Don't care
※Reset the power after changing function selection switch operations.

◎ Selection of Symmetry/Asymmetry

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

Speed (rpm)
Asymmetry(Normal) of ac.deceleration=SYM_OFF
A   D   A   D
Time(sec)
ACC time and DEC time are repeated as a asymmetrical figure

Speed (rpm)
Symmetry of ac.deceleration=SYM_ON
A   D   D   A
Time(sec)
ACC time and DEC time are repeated symmetrical figure

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

◎ Selection of max. speed(MS2, MS3)

※A 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.
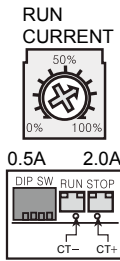※Lower the max. speed to run a motor smoothly.

◎ 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.

MD2U Series

◎ RUN current setting

RUN
CURRENT

0.5A   2.0A

DIP SW RUN STOP

CT− CT+

※RUN current is a phase current provided to 2-phase stepper motor.
※Be sure to set RUN current at the rated current or below. If not, it may cause heat generation, loss of torque or step-out.
※RUN current setting range : 0.5 to 2.0A
※RUN current setting : Measure the voltage by connecting a DC voltage meter to both CT+ and CT- terminals while the motor is running (Max. 150rpm).
Ex) Input Voltage(3V)× 2 / 3 = 2A(Motor's excitation current)
※Adjust the RUN current in case severe heat generation occurs.
Be sure that torque decreasing may occur when adjusting the current.
Note) Be sure to adjust RUN current while motor is running.

◎ STOP current setting

STOP
CURRENT

20% 70%

※Stop current is a phase current provided to 2-phase stepper motor at standstill.
※A function to reduce the current in order to suppress the heat generation at motor standstill / Use variable resistance ratio within 0 to 100% of RUN current to set STOP current (Actual setting range is 20 to 70% of RUN current).
Ex) If RUN current setting value is 2A and STOP current setting value is 0%(Actual setting value is 20%), STOP current will be set to 0.4A.
※STOP current setting value may have some deviation depending on resistance impedance of motor.
※Auto current down function will be activated when HOLD OFF signal is [L]. When HOLD OFF signal is [H], the function is not activated since the current provided to each phase is cut off.
Note) Be sure to adjust STOP current while motor is at standstill.

◎ RUN speed setting

RUN SPEED

0%   100%

※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

START SPEED

0%   100%
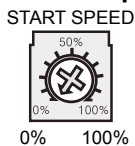
※It sets desired START speed.
※Max. START speed value is same with RUN speed value.
※START speed must be set within max. starting frequency. It is recommended to set up START speed within 0 to 50% for stable driving.
※Set the value when the motor stops.

◎ ACC time setting

ACC TIME

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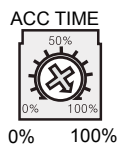
※It sets the acceleration time from START speed to max. driving speed.
※AT_1 operation mode when ACC time is under 33.3%, AT_2 operation mode when ACC time is under 66.6% and AT_3 operation mode when ACC time is over 66.6%.
※AT_1 is 0.5 sec. when RUN speed=100%, START speed=0%.
※AT_2 is 1 sec. when RUN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

◎ DEC time setting

DEC TIME

0%   100%

※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.
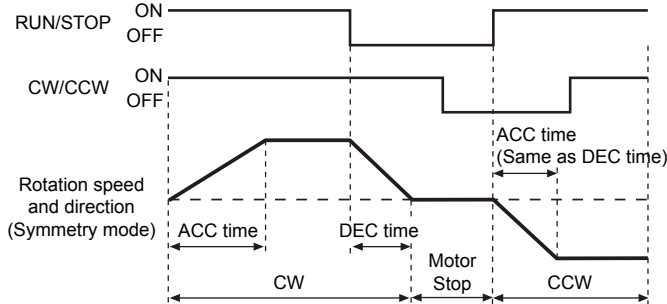※The figures above indicate the factory default for each value.

◎ HOLD OFF function
※When HOLD OFF input signal is [H], motor excitation is released.
When HOLD OFF input signal is [L], motor excitation is in a normal status.
※A function used to rotate motor's axis using external force or used for manual positioning.
※HOLD OFF input signal [H] and [L] represent Photocoupler ON/OFF in a circuit.
※Please do not use for stopping motor.

2-Phase Unipolar intelligent Stepper motor Driver

■ Time chart
● High speed mode

RUN/STOP ON / OFF

CW/CCW ON / OFF

ACC time (Same as DEC time)

Rotation speed and direction (Symmetry mode)

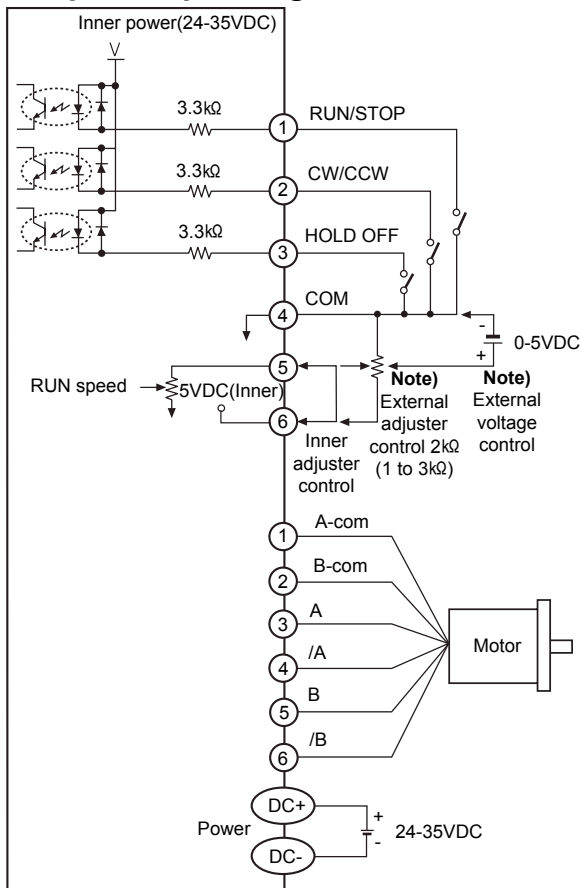ACC time | DEC time | Motor Stop

CW | CCW

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.

■ Input·Output diagram and connections

Inner power(24-35VDC)

3.3kΩ ① RUN/STOP
3.3kΩ ② CW/CCW
3.3kΩ ③ HOLD OFF
④ COM
0-5VDC
⑤
RUN speed → 5VDC(Inner)
⑥
Note) External adjuster control 2kΩ (1 to 3kΩ)
Note) External voltage control
Inner adjuster control

① A-com
② B-com
③ A
④ /A   Motor
⑤ B
⑥ /B

DC+
Power   24-35VDC
DC-

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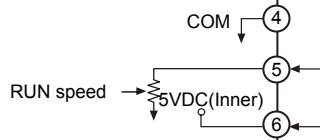
RUN/STOP signal input
→ [ON] : RUN, [OFF] : STOP

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

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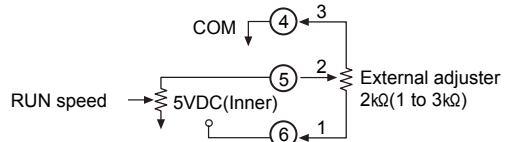→ [ON] : HOLD OFF, [OFF] : HOLD ON

● Inner adjuster control (Adjusting RUN speed with front VR)
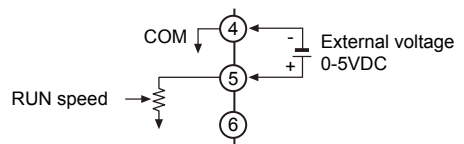Make the connection between terminal No.5 and No.6.

COM ④
⑤
RUN speed → 5VDC(Inner)
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.

COM ④ 3
⑤ 2 External adjuster 2kΩ(1 to 3kΩ)
RUN speed → 5VDC(Inner)
⑥ 1

● External voltage control (Adjusting RUN speed with external voltage input)
Make sure to adjust RUN speed VR to maximum external voltage control.

COM ④ External voltage 0-5VDC
⑤
RUN speed →
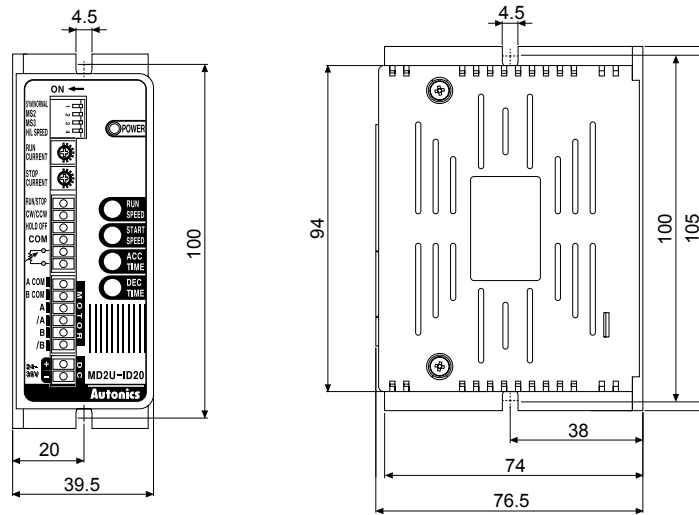⑥

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 for using
- Caution for signal input
  - When using the 2 pulse input method, do not input CW and CCW at the same time, or it may cause malfunction. (MD2U-MD20)
  - It can not be change the direction during the operation.(MD2U-ID20)
  - In case, the signal input supply is higher than rated supply expressed on the specification, please connect the additional resistance to external part.
- Caution for setting the RUN and STOP current
  Run current must be set under a rated current of the motor because motor emits heat too much when a RUN current is set over a rated current of the motor.
- Caution for wiring
  - Use Twist pair(Over 0.2mm^2) for the signal wire should be shorter than 2m.
  - Please use an electric wire thicker than the motor lead wire when lengthening the motor wire connection.
  - Please leave a space over 10cm between a signal wire connection and power wire.
- Caution for installation
  - Keep the heat sink as close as possible to metal panels and place the unit in well-ventilated area in order to increase heat protection efficiency of heat sink.
  - Heat generation may occur on drivers depending on installation environments. Place the unit with keeping the heat sink under 80℃.
- Caution for using function switch
  When the input switch is changed to 2P input method during the operation, it may be danger as the motor is rotated reversely. Please do not change the input signal method and resolution during the operation.
- Motor vibration and noise can be occurred in specific frequency period.
  - Motor vibration and noise can be lowered by change motor installation or attach damper.
  - Use the unit in a range without vibration and noise by RUN speed adjustment or microstep.(MD2U-MD20)
  - Use the unit a range without vibration and noise range by RUN speed adjustment.(MD2U-ID20)
- Installation environment
  - It shall be used indoor
  - Altitude Max. 2000m
  - Pollution Degree 2
  - Installation Category II

Autonics