Small, Light / High Speed And Torque 5-Phase Stepper Motor Driver

■ Features

- Bipolar constant pentagon drive method
- Includes auto current down and self-diagnosis function
- Low speed rotation and high accuracy controlling with microstep-driving (except for MD5-ND14)
  [Max. resolution - 250 division / In case of 5-phase stepper motor of which basic step angle is 0.72°, it enables to control up to 0.00288° per pulse and it requires 125,000 pulses per rotation.]
- Photocoupler input insulation method to minimize the effects from external noise

MD5-HF28 MD5-HF14 MD5-HF14-AO MD5-HD14 MD5-ND14

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

(except for MD5-HF14-AO, MD5-HD14, ND14)

■ Ordering Information

MD 5 – H F 14 – ☐

Output	No mark	Zero point excitation output※1
	AO	Alarm output
RUN current	14	1.4A/Phase
	28	2.8A/Phase
Power supply	D	20-35VDC
	F	100-220VAC
Step type (Resolution)	H	Micro step (250divisions)
	N	Normal Step
Motor phase	5	5-Phase
Item	MD	Motor Driver

※1: Except MD5-ND14

※KR-55MC can be replaced with MD5-HD14.
※KR-5MC can be replaced with MD5-ND14.
※MD5-MF14 can be replaced with MD5-HF14.
※KR-505G can be replaced with MD5-HF28.

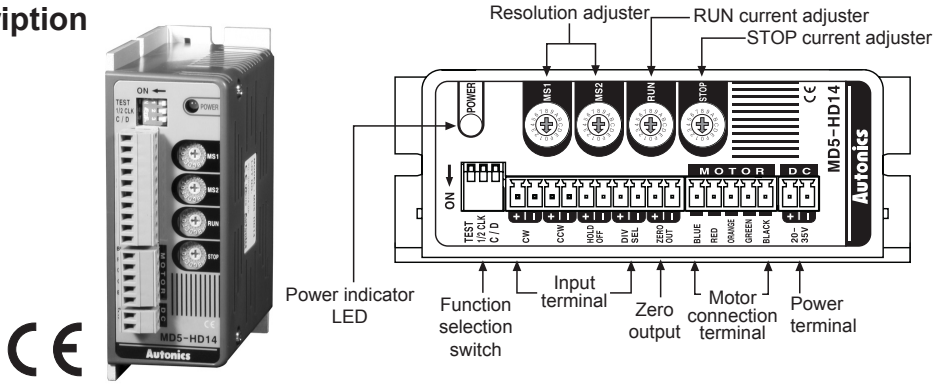
■ Specifications

Model		MD5-HD14	MD5-HF14	MD5-HF14-AO	MD5-HF28	MD5-ND14
Power supply		20-35VDC 3A※1	100-220VAC 50/60Hz			20-35VDC 3A
RUN current		0.4 to 1.4A / Phase			1.0 to 2.8A / Phase	0.5 to 1.5A / Phase
RUN method		Bipolar constant pentagon drive				
Standard 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)				1, 2 division (0.72°, 0.36°/ Step)
Input pulse characteristics	Pulse width	Min. 0.5μs				Min. 10μs
	Duty rate	50% (CW, CCW)				
	Rising/Falling time	Below 120ns (CW, CCW), Max. 20μs (HOLD OFF, DIVISION SELECTION, ZERO OUT)※3				Max. 120ns
	Pulse input voltage	High: 4.5-5.5VDC, Low: 0-0.5VDC				
	Pulse input current	7.5 to 1.4mA (CW, CCW), 10 to 16mA (HOLD OFF, DIVISION SELECTION, ZERO OUT)※3				
	Max. input pulse frequency※2	Max. 1MHz (CW, CCW), Max. 25kHz (HOLD OFF, DIVISION SELECTION, ZERO OUT)※3				50kHz
Environment	Ambient temperature	0 to 40℃, storage: -20 to 60℃	0 to 50℃, storage: -10 to 60℃		0 to 40℃, storage: -20 to 60℃	
	Ambient humidity	35 to 85%RH, storage: -10 to 90%RH	35 to 85%RH, storage: 35 to 85%RH			35 to 85%RH, storage: -10 to 90%RH
Approval		CE	CE cULus	CE	CE cULus	CE
Unit weight		Approx. 220g	Approx. 660g	Approx. 650g	Approx. 1kg	Approx. 120g

※1: When using over 30VDC, it should be mounted at ventilated place due to increasing heat.
※2: Max. pull-out frequency and max. slewing frequency are variable depending on resolution, or load.
※3: There is no DIVISION SELECTION, ZERO OUT for MD5-HF14-AO.
※Environment resistance is rated at no freezing of condensation.

5-Phase Micro Stepper Motor Driver [MD5-HD14]

▣ Unit Description



◎ Function selection switch

NO	Name	Function	Switch position	
			ON	OFF
1	TEST	Self-diagnosis	Rotate in 30rpm	Not using
2	1/2 CLK	Pulse input method	1-pulse input	2-pulse input
3	C/D	Auto current down	Not using	Using

● TEST

※Self-diagnosis function is to test motors and drivers.
※Motors rotate with 30rpm in full-step. Motor rotation speed is subject to change depending on resolution setting.
※Rotation speed = 30rpm / resolution
※The motor will rotate in CCW direction when in 1-pulse input mode and in CW direction when in 2-pulse input mode.
Note) Make sure that TEST switch is set to OFF before supplying the power.
It may cause injury or danger if TEST switch is set to ON when power is supplied.

● 1/2 CLK

※1/2 CLK switch is to select pulse input mode.
※1-pulse input mode: CW → operation command pulse input, CCW → rotation direction pulse input
([H]: CW rotation, [L]: CCW rotation)
※2-pulse input mode: CW → CW direction rotation pulse input, CCW → CCW direction rotation pulse input

● C/D (Auto current down)

※This function is to reduce current automatically according to STOP current setting value in order to suppress generated heat when motor is stopped.
※It activates when there is no pulse input of motor operation for over 100ms.

◎ RUN current setting

S/W No	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (Arms/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

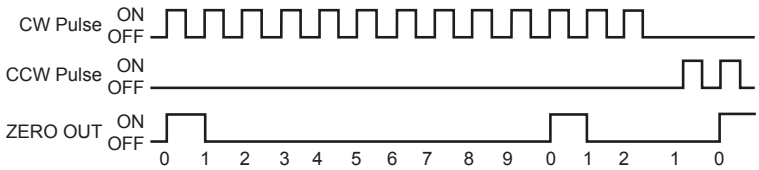
※RUN current is a phase current provided to 5-phase stepper motor.
※Be sure to set RUN current at the rated current or below.
※Adjust the RUN current in case severe heat generation occurs. Be sure that torque decreasing may occur when adjusting the current.
Note) Be sure to adjust RUN current while motor is running.

◎ STOP current setting

S/W 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 is a phase current provided to 5-phase stepper motor at standstill.
※It will be activated when C/D (Auto current down) is set to ON. By setting STOP current, it is possible to suppress the heat generation at motor standstill.
※STOP current setting value is the ratio of RUN current setting value (%).
E.g.) In case RUN current setting value is set to 1.4A and STOP current setting value is set to 50%, auto current down current is set to 0.7A.
※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.

◎ Zero point excitation output signal (ZERO OUT)



※The signal is output to indicate when the motor excitation status is in the initial stage. Used to check the rotation position of motor's axis.
※In case of full step, the signal is output every 7.2°. (50 times / rotation).
E.g.) Full step (0.72°/Step): Signal is output every 10 pulses
20 divisions (0.036°/Step): Signal is output every 200 pulses.

◎ 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.

◎ Setting microstep (Microstep: Resolution)

S/W 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°

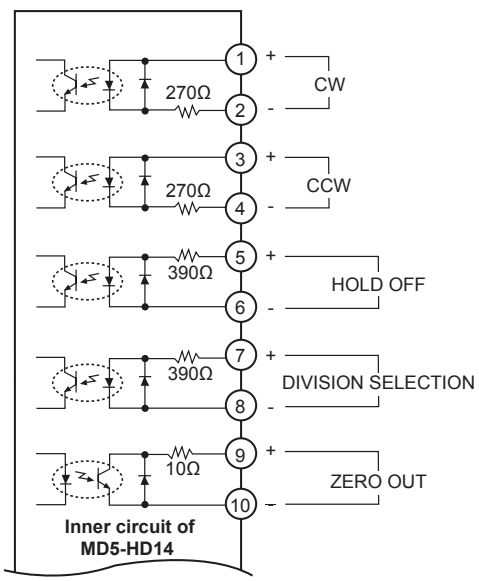
● Resolution setting (Same as MS1, MS2)

※It is set to MS1 when division selection signal is [L], and MS2 when division selection signal is [H].
※Two different micro step can be set using DIVISION SELECTION. Users can select one of them via external input signals.
※Microstep is to make basic step angle of 5-phase motors (0.72°) divided into smaller angle according to setting values.
※The formula for microstep angle is ;

$$\text{Motor revolution angle (5-phase motors)} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

※In case of geared motors, step angle shall be determined by dividing step angle by gear ratio.
E.g.) 0.72˚/ 10 (1:10) = 0.072˚
※It may cause step-out if resolution is changed while motor is running.

▣ Input·Output Diagram



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

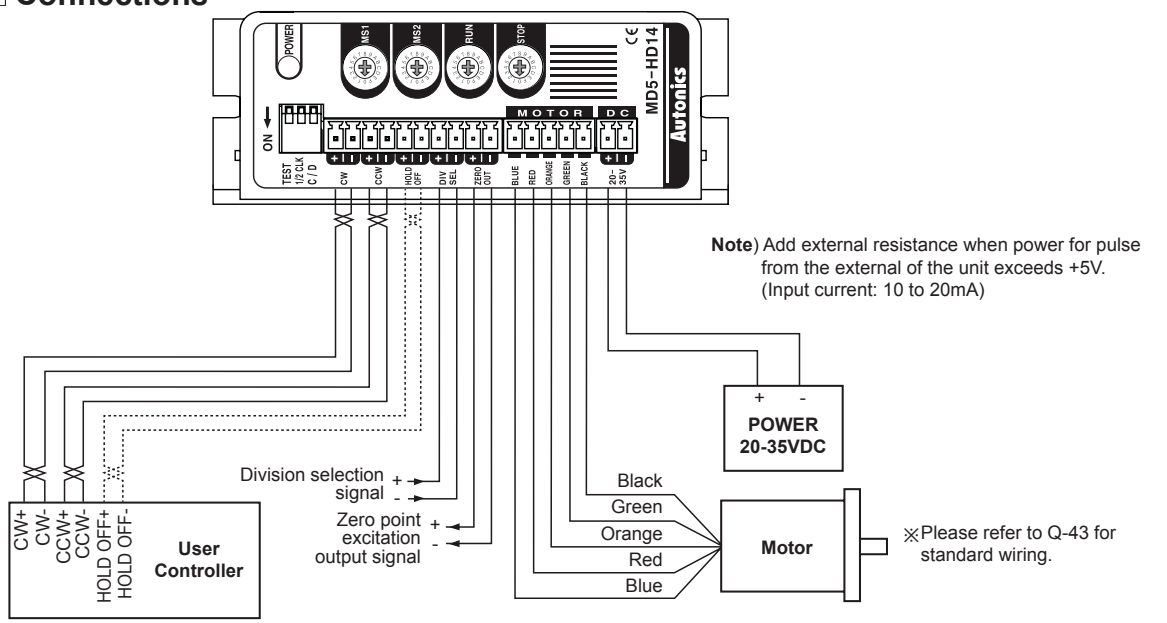
※CCW
2-pulse input mode - CCW direction rotation pulse input
1-pulse input mode - Rotation direction pulse input
[H]: CW, [L]: CCW

※HOLD OFF
Motor excitation OFF control signal
[H]: Motor excitation OFF

※DIVISION SELECTION
Division selection signal
→ [L]: Operated by MS1 setting resolution.
[H]: Operated by MS2 setting resolution.

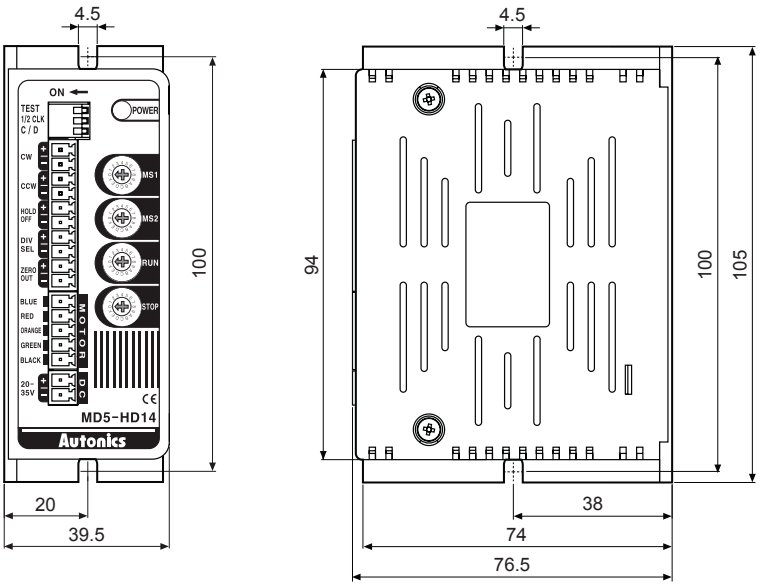
※ZERO OUT
Zero point excitation output signal ON for zero point excitation

▣ Connections



▣ Dimensions

(unit: mm)

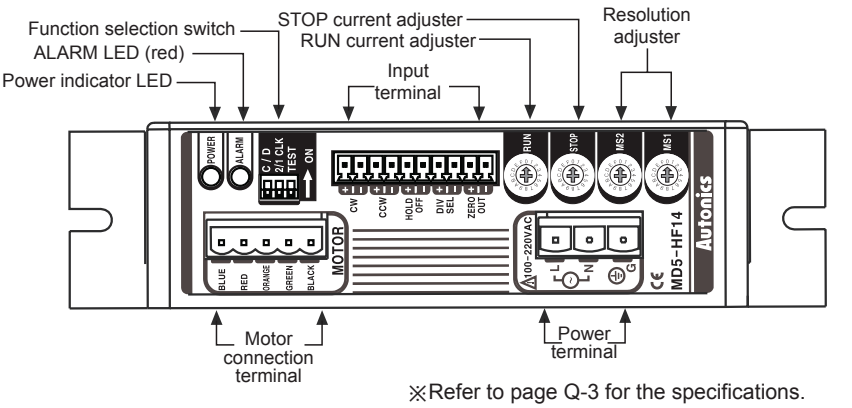


◎ Caution during use

1. For signal input
   ①Do 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.
   ②Current value of power supply in specifications is max. input of driver.
   ③Use power enough to supply RUN current for power input.
2. For cable connection
   ①Use Twisted pair (Over 0.2mm) for the signal wire which should be shorter than 2m.
   ②Use electric wire of AWG 18 (0.75mm) for motor (when extending it) and power connection.
   ③Check the power polarity before the drive.
3. For installation
   ①In order to increase heat protection efficiency, keep the heat sink as close as possible 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.
   (In case it is over 80℃, forcible cooling shall be required.)
4. For using function switches
   ①Self-diagnosis function enables to test motor and driver when 250Hz pulse is supplied in [ON] status.
   It may be dangerous if turn on the power in [ON] status, due to motor is worked instantly or cause a malfunction.
   ②Check self-diagnosis switch is [OFF] before power ON, or motor may start to drive instantly when it is ON.
   ③Auto CURRENT DOWN function is used to reduce RUN current when motor is at standstill to lower the heat generation automatically.
5. This unit may be used in the following environments.
   ①Indoor
   ②Altitude: Under 2,000m
   ③Pollution degree 2
   ④Installation category II

5-Phase Micro Stepper Motor Driver [MD5-HF14]

▣ Unit Description



※Refer to page Q-3 for the specifications.

◎ Function selection switch

NO	Name	Function	Switch position	
			ON	OFF
1	TEST	Self-diagnosis	Rotate in 30rpm	—
2	2/1 CLK	Pulse input method	1-pulse input	2-pulse input
3	C/D	Auto current down	Not using	Using

●TEST

※Self-diagnosis function is to test motors and drivers.
※Motors rotate with 30rpm in full-step. Motor rotation speed is subject to change depending on resolution setting.
※Rotation speed = 30rpm / resolution
※The motor will rotate in CCW direction when in 1-pulse input mode and in CW direction when in 2-pulse input mode.
Note) Make sure that TEST switch is set to OFF before supplying the power.
It may cause injury or danger if TEST switch is set to ON when power is supplied.

●2/1 CLK

※2/1 CLK switch is to select pulse input mode.
※1-pulse input mode: CW → operation command pulse input, CCW → rotation direction pulse input
([H]: CW rotation, [L]: CCW rotation)
※2-Puls input mode: CW → CW direction rotation pulse input, CCW → CCW direction rotation pulse input

●C/D (Auto current down)

※This function is to reduce current automatically according to STOP current setting value in order to suppress generated heat when motor is stopped.
※It activates when there is no pulse input of motor operation for over 100ms.

S/W No	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (Arms/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

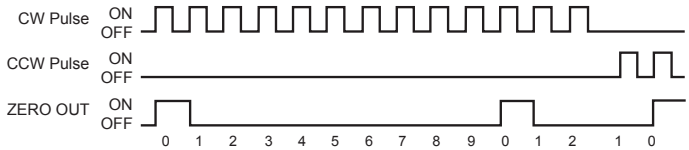
※RUN current is a phase current provided to 5-phase stepper motor.
※Be sure to set RUN current at the rated current or below.
※Adjust the RUN current in case severe heat generation occurs. Be sure that torque decreasing may occur when adjusting the current.
Note) Be sure to adjust RUN current while motor is running.

◎ STOP current setting

S/W 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 is a phase current provided to 5-phase stepper motor at standstill.
※It will be activated when C/D (Auto current down) is set to ON. By setting STOP current, it is possible to suppress the heat generation at motor standstill.
※STOP current setting value is the ratio of RUN current setting value (%).
E.g.) In case RUN current setting value is set to 1.4A and STOP current setting value is set to 50%, auto current down current is set to 0.7A.
※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.

◎ Zero point excitation output signal (ZERO OUT)



※The signal is output to indicate when the motor excitation status is in the initial stage. / Used to check the rotation position of motor's axis
※In case of full step, the signal is output every 7.2°. (50 times / rotation)
E.g.) Full step (0.72°/Step): Signal is output every 10 pulses.
20 divisions (0.036°/Step): Signal is output every 200 pulses.

◎ 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.

◎ Setting microstep (Microstep: Resolution)

S/W 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°

● Resolution setting (Same as MS1, MS2)

※It is set to MS1 when division selection signal is [L], and MS2 when division selection signal is [H].
※Two different micro step can be set using DIVISION SELECTION. Users can select one of them via external input signals.
※Microstep is to make basic step angle of 5-phase motors (0.72°) divided into smaller angle according to setting values.
※The formula for microstep angle is ;

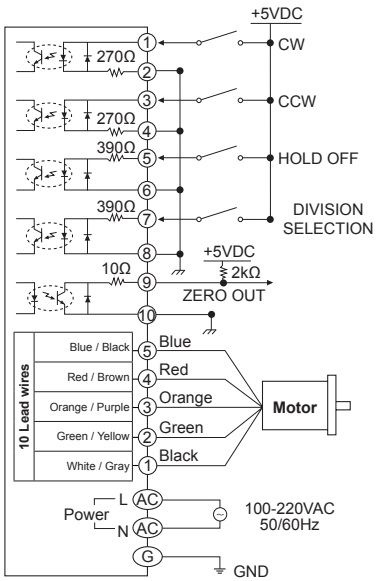
$$\text{Motor revolution angle (5-phase motors)} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

※In case of geared motors, step angle shall be determined by dividing step angle by gear ratio.
E.g.) 0.72˚/ 10 (1:10) = 0.072˚
※It may cause step-out if resolution is changed while motor is running.

◎ ALRAM Function

※Over heat: When the temperature in driver BASE is over 80℃, Alarm LED will be ON and motor will stop with holding the torque. Remove the Over Heat Alarm causing factors and reset the power in order to reset alarm function.
※Overcurrent: When overcurrent is applied to the motor due to driver damage or errors, Alarm LED will flash. In case of overcurrent, the motor will be HOLD OFF. Cut off the power and remove overcurrnet-causing factors in order to resume normal operation.

▣ Input·Output Diagram



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

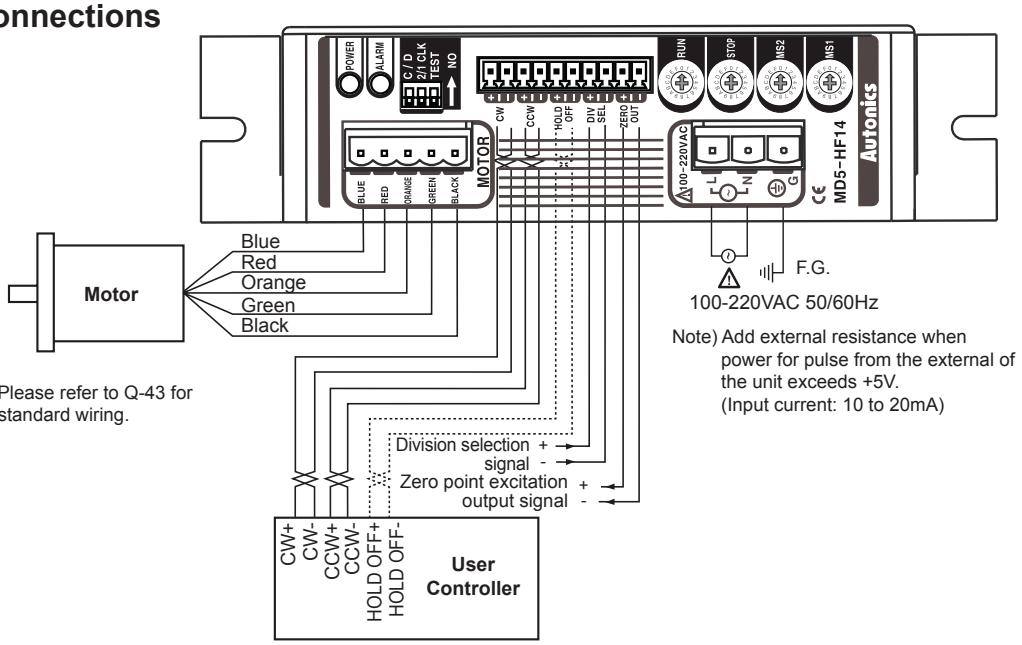
※CCW
2-pulse input mode - CCW direction rotation pulse input
1-pulse input mode - rotation direction pulse input
[H]: CW, [L]: CCW

※HOLD OFF
Motor excitation OFF control signal
[H]: Motor excitation OFF

※DIVISION SELECTION
Division selection signal
→ [L]: Operated by MS1 setting resolution.
[H]: Operated by MS2 setting resolution.

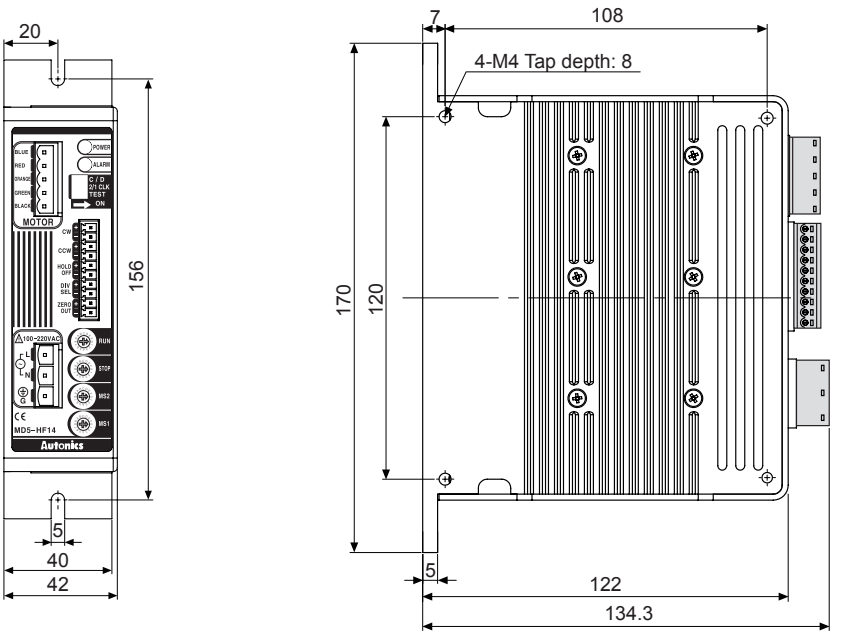
※ZERO OUT
Zero point excitation output signal ON for zero point excitation

▣ Connections



▣ Dimensions

(unit: mm)

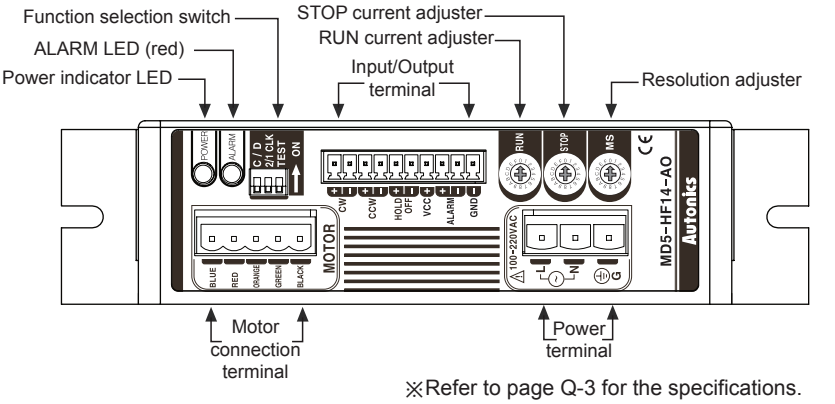


◎ Caution during use

1. Caution for signal input
   ①Do not input CW, CCW signal at the same time in 2 Pulse input type. It may not work properly if another direction signal is supplied when one of them is ON.
   ②In case, the signal input supply is higher than rated supply expressed on the specification, please connect the additional resistance to external part.
2. Caution for setting the RUN and STOP current
   ①RUN current must be set under a rated current of the motor because motor emits heat too much when RUN current is set over a rated current of the motor.
   ②STOP current is worked by Auto CURRENT DOWN function when the motor HOLD OFF signal is [L]. In case, the motor HOLD OFF signal is [H], or Auto CURRENT DOWN function is not set, STOP current setting value is not apply to the motor.
3. Caution for wiring
   ①Use Twisted pair (Over 0.2mm²) for the signal wire should be shorter than 2m.
   ②Please use an electric wire which is thicker than the motor lead when extending the motor wire connection.
   ③Please leave a space over 10cm between a signal wire connection and power wire.
4. Caution for installation
   ①In order to increase heat protection efficiency, keep the heat sink as close as possible 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. (In case it is over 80℃, forcible cooling shall be required.)
5. Caution during use function switches
   ①Check the position of self-diagnosis switch before turn on the power.
   It may be dangerous if turn on the power in [ON] status, due to motor is worked instantly or cause a malfunction.
   ②When the selection switch of input signal method is changed to 2 Pulse input method during the operation with 1 Pulse input method, it may cause danger as the revolution way of the motor is changed conversely. Please do not change the input signal method during the operation.
6. This unit may be used in the following environments.
   ①Indoor ②Altitude: Under 2,000m
   ③Pollution degree 2 ④Installation category II

5-Phase Micro Stepper Motor Driver [MD5-HF14-AO]

▣ Unit Description



※Refer to page Q-3 for the specifications.

◎ Function selection switch

NO	Name	Function	Switch position	
			ON	OFF
1	TEST	Self-diagnosis	Rotate in 30rpm	—
2	2/1 CLK	Pulse input method	1-pulse input	2-pulse input
3	C/D	Auto current down	Not using	Using

● TEST

※Self-diagnosis function is to test motors and drivers.

※Motors rotate with 30 rpm in full-step. Motor rotation speed is subject to change depending on resolution setting.

※Rotation speed = 30 rpm / resolution

※The motor will rotate in CCW direction when in 1-pulse input mode and in CW direction when in 2-pulse input mode.

Note) Make sure that TEST switch is set to OFF before supplying the power.
It may cause injury or danger if TEST switch is set to ON when power is supplied.

● 2/1 CLK

※2/1 CLK switch is to select pulse input mode.

※1-pulse input mode: CW → operation command pulse input, CCW → rotation direction pulse input
([H]: CW rotation, [L]: CCW rotation)

※2-pulse input mode: CW → CW direction rotation pulse input, CCW → CCW direction rotation pulse input

● C/D (Auto current down)

※This function is to reduce current automatically according to STOP current setting value in order to suppress generated heat when motor is stopped.

※It activates when there is no pulse input of motor operation for over 100ms.

◎ RUN current setting

S/W No	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (Arms/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 a phase current provided to 5-phase stepper motor.

※Be sure to set RUN current at the rated current or below.

※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

S/W 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 is a phase current provided to 5-phase stepper motor at standstill.

※It will be activated when C/D (Auto current down) is set to ON. By setting STOP current, it is possible to suppress the heat generation at motor standstill.

※STOP current setting value is the ratio of RUN current setting value (%).

E.g.) In case RUN current setting value is set to 1.4A and STOP current setting value is set to 50%, auto current down current is set to 0.7A.

※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.

◎ Setting microstep (Microstep: Resolution)

S/W 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°

● Resolution setting

※Microstep is to make basic step angle of 5-phase motors (0.72°) divided into smaller angle according to setting values.
※The formula for microstep angle is ;

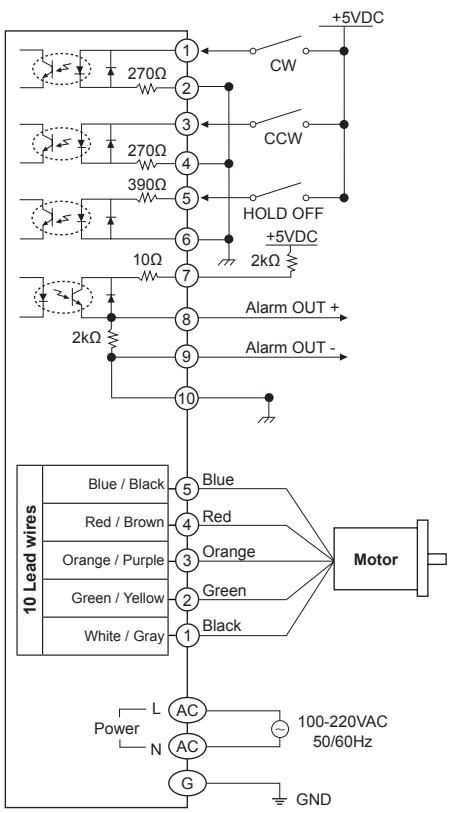
$$\text{Motor revolution angle (5-phase motors)} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

※In case of geared motors, step angle shall be determined by dividing step angle by gear ratio.
E.g.) 0.72˚/ 10 (1:10) = 0.072˚
※It may cause step-out if resolution is changed while motor is running.

◎ ALRAM OUTPUT Function

※Overheat: When the temperature of inner driver (Base) is over 80℃, Alarm LED (Red) is turned ON and motor becomes HOLD OFF. Turn OFF the power, remove the causes, and re-supply the power to clear the alarm.
※Overcurrent: When overcurrent is applied to motor due to damage by a fire of stepper motor, broken of inner driver, or occurrence of abnormal error, Alarm LED (Red) flashes and motor becomes HOLD OFF. Turn OFF the power, remove the causes, and re-supply the power to clear the alarm.

▣ Input·Output Diagram



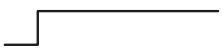
※CW
2-pulse input mode - CW direction rotation pulse
1-pulse input mode - Operation command pulse input

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

※HOLD OFF
Motor excitation OFF control signal
[H]: Motor excitation OFF

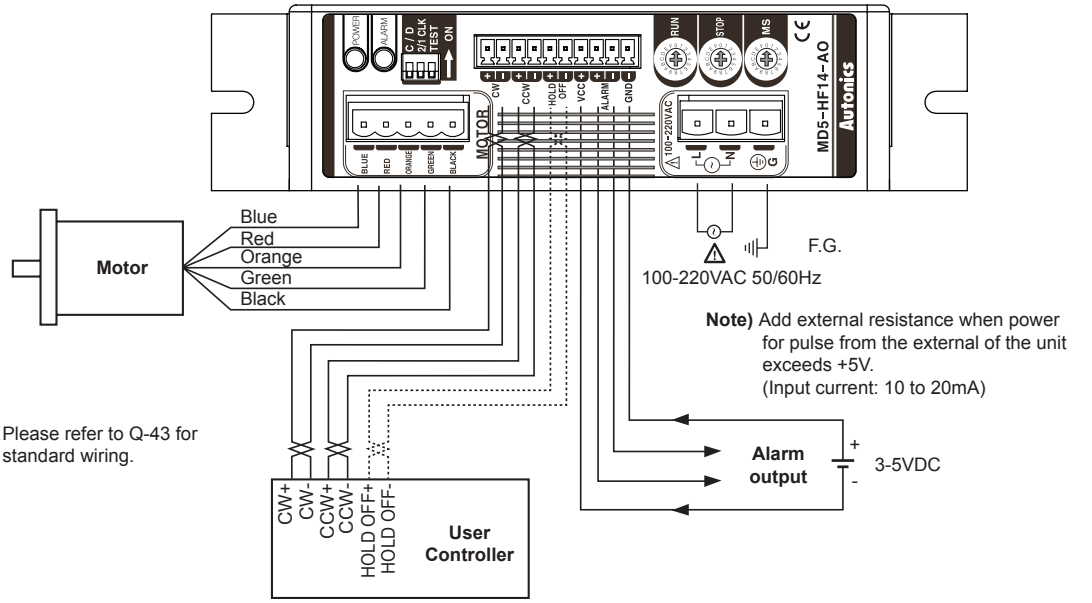
※When alarm occurs, it turns into HOLD OFF status. Cut off the power and remove overcurrent-causing factors in order to resume normal operation.

※Overheat :



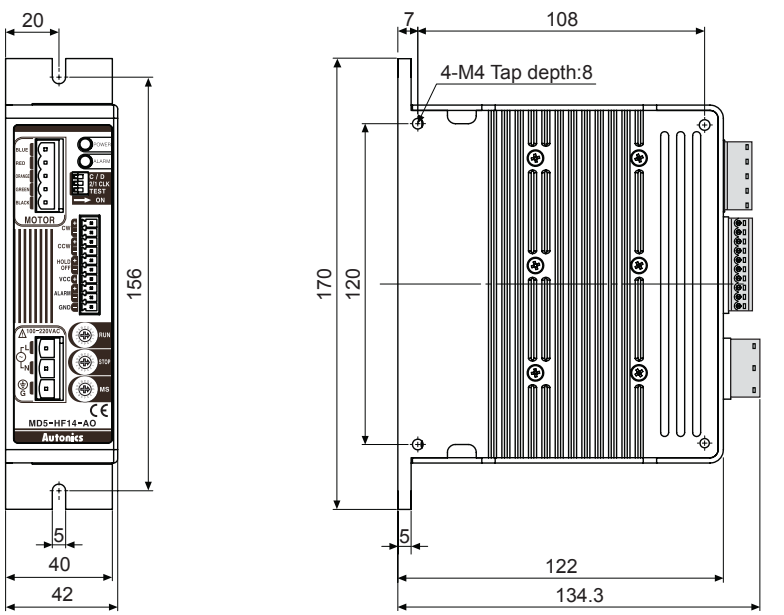
※Over current :

■ Connections



■ Dimensions

(unit: mm)

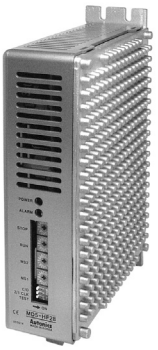


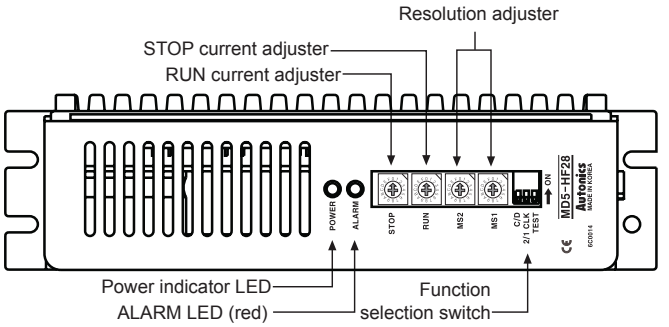
◎ Caution during use

1. Caution for signal input
   ①Do not input CW, CCW signal at the same time in 2 Pulse input type. It may not work properly if another direction signal is supplied when one of them is ON.
   ②In case, the signal input supply is higher than rated supply expressed on the specification, please connect the additional resistance to external part.
2. Caution for setting the RUN and STOP current
   ①RUN current must be set under a rated current of the motor because motor emits heat too much when RUN current is set over a rated current of the motor.
   ②STOP current is worked by Auto CURRENT DOWN function when the motor HOLD OFF signal is [L]. In case, the motor HOLD OFF signal is [H], or Auto CURRENT DOWN function is not set, STOP current setting value is not apply to the motor.
3. Caution for wiring
   ①Use Twisted pair (Over 0.2mm^2) for the signal wire should be shorter than 2m.
   ②Please use an electric wire which is thicker than the motor lead when extending the motor wire connection.
   ③Please leave a space over 10cm between a signal wire connection and power wire.
4. Caution for installation
   ①In order to increase heat protection efficiency, keep the heat sink as close as possible 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. (In case it is over 80℃, forcible cooling shall be required.)
5. Caution during use function switches
   ①Check the position of self-diagnosis switch before turn on the power.
   It may be dangerous if turn on the power in [ON] status, due to motor is worked instantly or cause a malfunction.
   ②When the selection switch of input signal method is changed to 2 Pulse input method during the operation with 1 Pulse input method, it may cause danger as the revolution way of the motor is changed conversely. Please do not change the input signal method during the operation.
6. This unit may be used in the following environments.
   ①Indoor
   ②Altitude up to 2,000m
   ③Pollution degree 2
   ④Installation category II

5-Phase Microstep Motor Driver [MD5-HF28]

▣ Unit Description





※**KR-505G can be replaced with MD5-HF28.**
※**Power supply 100-220VAC and socket type wire terminal blocks are upgraded comparing to KR-505G Series.**

※Refer to page Q-3 for the specifications.

◎ Function selection switch

NO	Name	Function	Switch position	
			ON	OFF
1	TEST	Self-diagnosis	Rotate in 30rpm	—
2	2/1 CLK	Pulse input method	1-pulse input	2-pulse input
3	C/D	Auto current down	Not using	Using

●TEST
※Self-diagnosis function is to test motors and drivers.
※Motors rotate with 30 rpm in full-step. Motor rotation speed is subject to change depending on resolution setting.
※Rotation speed = 30 rpm / resolution
※The motor will rotate in CCW direction when in 1-pulse input mode and in CW direction when in 2-pulse input mode.
Note) Make sure that TEST switch is set to OFF before supplying the power.
It may cause injury or danger if TEST switch is set to ON when power is supplied.

●2/1 CLK
※2/1 CLK switch is to select pulse input mode.
※1-pulse input mode: CW → operation command pulse input, CCW → rotation direction pulse input
([H]: CW rotation, [L]: CCW rotation)
※2-pulse input mode: CW → CW direction rotation pulse input, CCW → CCW direction rotation pulse input

●C/D (Auto current down)
※This function is to reduce current automatically according to STOP current setting value in order to suppress generated heat when motor is stopped.
※It activates when there is no pulse input of motor operation for over 100ms.

◎ RUN current setting

S/W No	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Current (Arms/Phase)	1.14	1.25	1.36	1.50	1.63	1.74	1.86	1.97	2.10	2.20	2.30	2.40	2.50	2.60	2.78	2.88

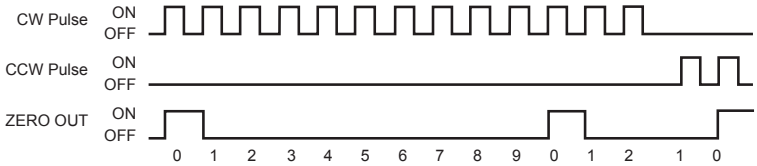
※RUN current is a phase current provided to 5-phase stepper motor.
※Be sure to set RUN current at the rated current or below.
※Adjust the RUN current in case severe heat generation occurs. Be sure that torque decreasing may occur when adjusting the current.
Note) Be sure to adjust RUN current while motor is running.

◎ STOP current setting

S/W 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 is a phase current provided to 5-phase stepper motor at standstill.
※It will be activated when C/D (Auto current down) is set to ON. By setting STOP current, it is possible to suppress the heat generation at motor standstill.
※STOP current setting value is the ratio of RUN current setting value (%).
E.g.) In case RUN current setting value is set to 1.4A and STOP current setting value is set to 50%, auto current down current is set to 0.7A.
※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.

◎ Zero point excitation output signal (ZERO OUT)



※ The signal is output to indicate when the motor excitation status is in the initial stage. / Used to check the rotation position of motor's axis.
※In case of full step, the signal is output every 7.2°. (50 times / rotation)
E.g.) Full step (0.72°/Step): Signal is output every 10 pulses. 20 divisions (0.036°/Step): Signal is output every 200 pulses.

◎ 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.

◎ Setting microstep (Microstep: Resolution)

S/W 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°

● Resolution setting (Same as MS1, MS2)

※It is set to MS1 when division selection signal is [L], and MS2 when division selection signal is [H].
※Two different micro step can be set using DIVISION SELECTION. Users can select one of them via external input signals.
※Microstep is to make basic step angle of 5-phase motors (0.72°) divided into smaller angle according to setting values.
※The formula for microstep angle is ;

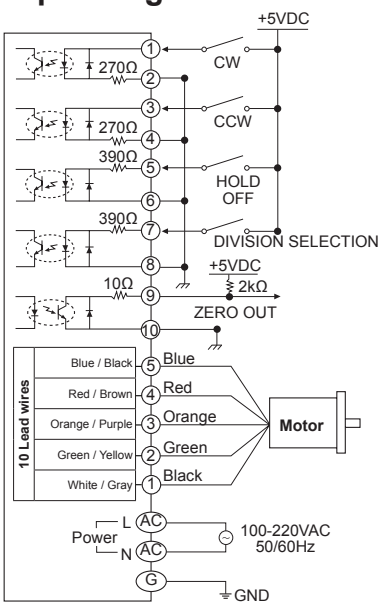
$$\text{Motor revolution angle (5-phase motors)} = \frac{\text{Basic step angle (0.72°)}}{\text{Resolution}}$$

※In case of geared motors, step angle shall be determined by dividing step angle by gear ratio.
E.g.) 0.72°/ 10 (1:10) = 0.072°
※It may cause step-out if resolution is changed while motor is running.

◎ ALARM Function

※Over heat: When the temperature in driver BASE is over 80℃, Alarm LED will be ON and motor will stop with holding the torque. Remove the Over Heat Alarm causing factors and reset the power in order to reset alarm function .
※Overcurrent: When overcurrent is applied to the motor due to driver damage or errors, Alarm LED will flash. In case of overcurrent, the motor will be HOLD OFF. Cut off the power and remove overcurrent-causing factors in order to resume normal operation.

▣ Input·Output Diagram



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

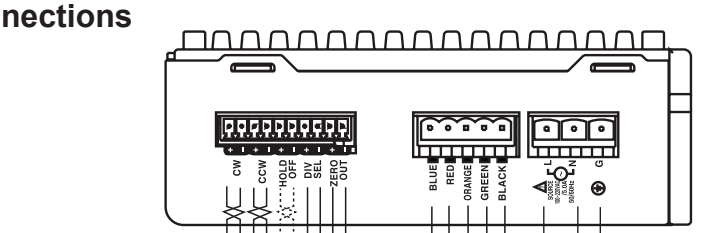
※CCW
2-pulse input mode - CCW direction rotation pulse input
1-pulse input mode - Rotation direction pulse input
[H]: CW, [L]: CCW

※HOLD OFF
Motor excitation OFF control signal
[H]: Motor excitation OFF

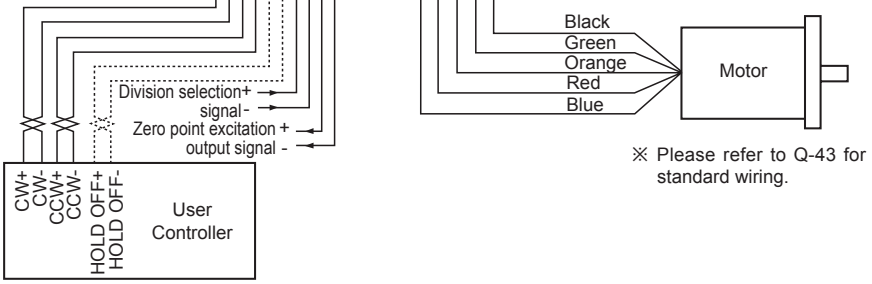
※DIVISION SELECTION
Division selection signal
→ [L]: Operated by MS1 setting resolution.
[H]: Operated by MS2 setting resolution.

※ZERO OUT
Zero point excitation output signal ON for zero point excitation

▣ Connections



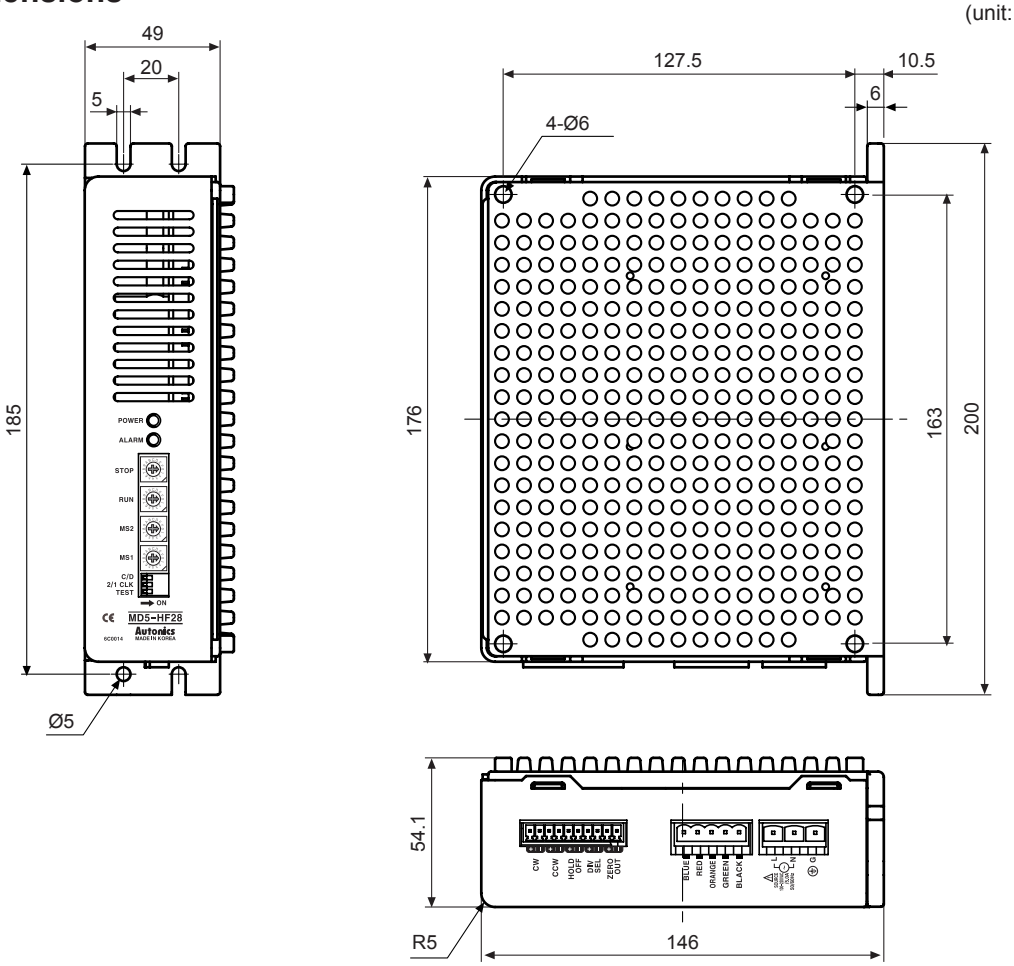
Note) Add external resistance when power for pulse from the external of the unit exceeds +5V. (Input current: 10 to 20mA)



※ Please refer to Q-43 for standard wiring.

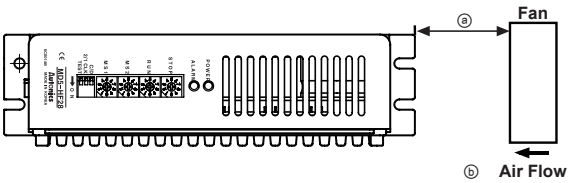
▣ Dimensions

(unit: mm)



◎ Caution during use

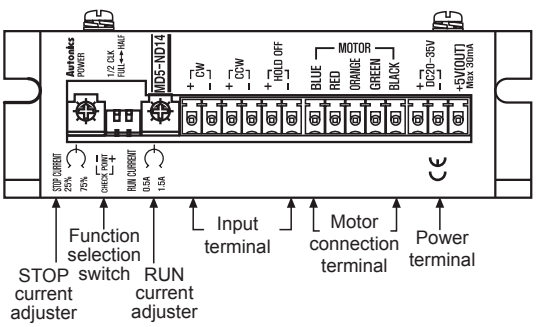
1. Caution for signal input
   ①Do not input CW, CCW signal at the same time in 2 Pulse input type. It may not work properly if another direction signal is supplied when one of them is ON.
   ②In case, the signal input supply is higher than rated supply expressed on the specification, please connect the additional resistance to external part.
2. Caution for setting the RUN and STOP current
   ①RUN current must be set under a rated current of the motor because motor emits heat too much when RUN current is set over a rated current of the motor.
   ②STOP current is worked by Auto CURRENT DOWN function when the motor HOLD OFF signal is [L]. In case, the motor HOLD OFF signal is [H], or Auto CURRENT DOWN function is not set, STOP current setting value is not apply to the motor.
3. Caution for wiring
   ①Use Twisted pair (Over 0.2mm^2) for the signal wire should be shorter than 2m.
   ②Please use an electric wire which is thicker than the motor lead when extending the motor wire connection.
   ③Please leave a space over 10cm between a signal wire connection and power wire.
4. Caution for installation
   ①In order to increase heat protection efficiency, keep the heat sink as close as possible 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. (In case it is over 80℃, forcible cooling shall be required.)
   ③Please make a ventilating opening when mount the unit around the panel board, closed or heat-generating place protecting from breakdown.
   ④Ventilating fans must be installed as shown in the figure in order to ventilate the heat generated from drivers. (ⓐ Installation distance: within 70mm, ⓑ Min. Air Flow: 0.71m^3/min at least)



5. Caution during use function switches
   ①Check the position of self-diagnosis switch before turn on the power.
   It may be dangerous if turn on the power in [ON] status, due to motor is worked instantly or cause a malfunction.
   ②When the selection switch of input signal method is changed to 2 Pulse input method during the operation with 1 Pulse input method, it may cause danger as the revolution way of the motor is changed conversely.
   Please do not change the input signal method during the operation.
6. This unit may be used in the following environments.
   ①Indoor ②Altitude: Under 2,000m
   ③Pollution degree 2 ④Installation category II

5-Phase Stepper Motor Driver [MD5-ND14]

▣ Unit Description



※Refer to page Q-3 for the specifications.

◎ Function selection switch

NO	Name	Function	Switch position	
			ON	OFF
1	1/2 CLK	Pulse input method	1-pulse input	2-pulse input
2	FULL ↔ HALF	Resolution Setting	0.72°	0.36°

• 1/2 CLK

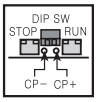
※1/2 CLK switch is to select pulse input mode.
※1-pulse input mode: CW → operation command pulse input, CCW → rotation direction pulse input
([H]: CW rotation, [L]: CCW rotation)
※2-pulse input mode: CW → CW direction rotation pulse input, CCW → CCW direction rotation pulse input

• FULL ↔ HALF

※FULL ↔ HALF switch is to set basic step angle for 5 phase stepper motors.
※If changing resolution while the motor is running, it may cause step-out.

◎ RUN current setting

RUN CURRENT



※RUN current is a phase current provided to 5-phase stepper motor.
※Be sure to set RUN current at the rated current or below.
※RUN current setting range: 0.5 to 1.5A
※When changing RUN current, connect CP+ to voltmeter (+) terminal and CP- to voltmeter (-) terminal, then adjust the volume.
※The formula for phase-current setting is ;

$$\text{Setting current (A)} = \frac{\text{CP Input Voltage (V)}}{2}$$

※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

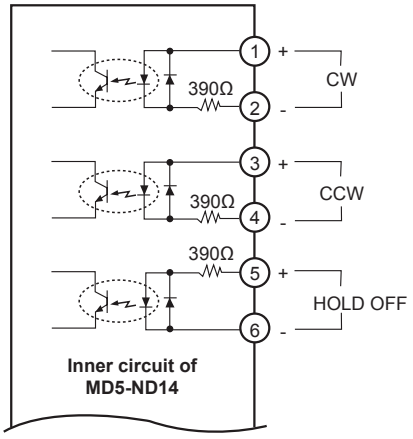
25% 75%

※STOP current is a phase current provided to 5-phase stepper motor at standstill.
※A function to reduce the current in order to suppress the heat generation at motor standstill / STOP current setting range: 25 to 75% of RUN current using VR
※In case Run current setting value is set to 1.0A and STOP current setting value is set to 50%, STOP current is set to 0.5A.
※STOP current setting value may have some deviation depending on resistance impedance of motor.
※STOP current 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.
※STOP current function will be activated when no operation command pulse is input within 500ms.
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 Diagram

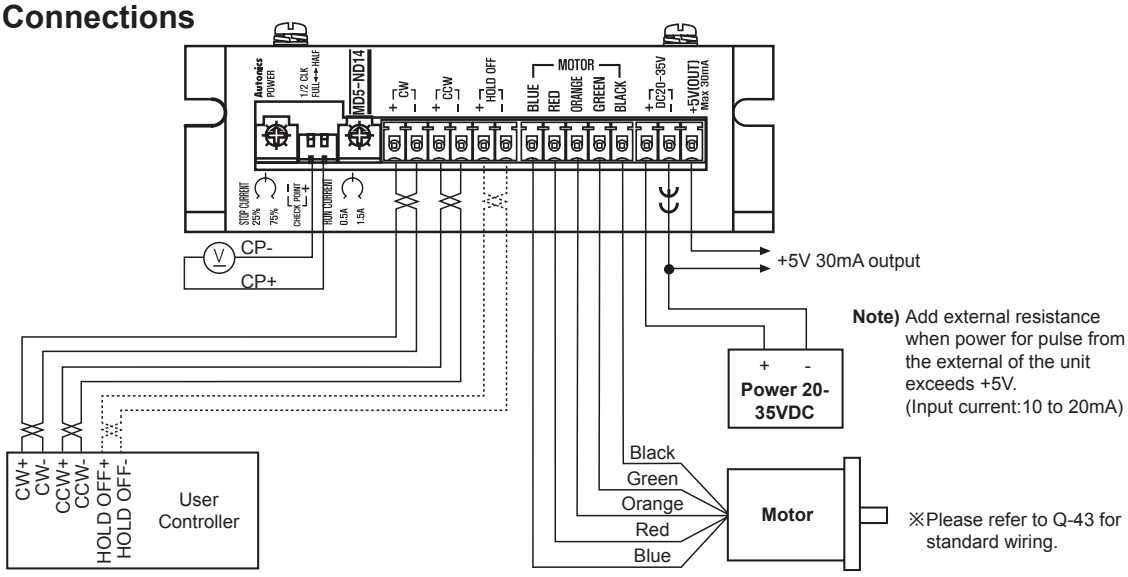


※CW
2-pulse input method (CW direction rotation pulse input)
1-pulse input method (Operating command pulse input)
Note) If the power for driving pulse from external is over than +5V, please connect resistor

※CCW
2-pulse input method (CCW direction rotation pulse input)
1-pulse input method (Rotating direction pulse input)
→ [H]: CW, [L]: CCW

※HOLD OFF
The control signal for hold off of Motor → [H]: Motor Hold OFF

▣ Connections

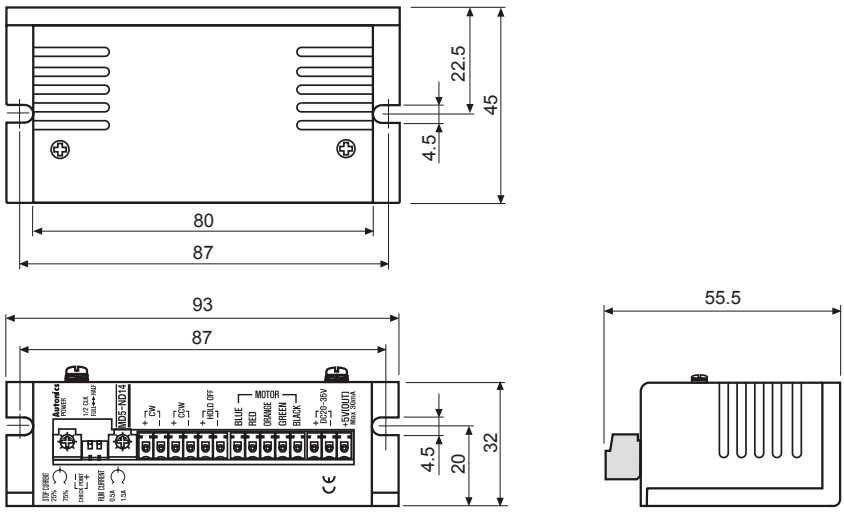


Note) Add external resistance when power for pulse from the external of the unit exceeds +5V. (Input current:10 to 20mA)

※Please refer to Q-43 for standard wiring.

▣ Dimensions

(unit: mm)



◎ Caution during use

1. For signal input
   ① Do not input CW, CCW signal at the same time in 2-pulse input type. It may not operate properly if another direction signal is inputted when one of CW or CCW is [H].
   ② When the power for pulse operation exceeds +5V, please connect resistor at the outside.
2. For supplying power
   ① Use the power enough to supply RUN current when turn on the power.
   ② The current value indicated on power supply is the max. input of driver.
   ③ Check the polarity of power before operating the unit.
3. For cable connection
   ① Use twisted pair (over 0.2mm^2) for the signal cable which should be shorter than 2m.
   ② Use electric wire of AWG 18 (0.75mm^2) for motor (for extending) and power connection.
4. For installation
   ① **The unit must be installed with heat protection. Follow the below ②, ③ cautions.**
   ② In order to increase heat protection efficiency of the driver, keep the heat sink as close as possible to metal panel and keep it well-ventilated.
   ③ Excessive heat generation may occur on driver. Keep the heat sink under 80℃ when installing the unit. (at over 80℃, forcible cooling shall be required.)
5. This unit may be used in the following environments.
   ① Indoor
   ② Altitude: Under 2,000m
   ③ Pollution degree 2
   ④ Installation category II