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Find the *Kohzu Precision MD-501A* at our website: *Click HERE*

KOHZU

Operation Manual and Technical Specifications

5-Phase Microstep Motor Driver

Model **MD-501A**



- Thank you for purchasing our product.
- Before use, be sure to read this Operation Manual carefully for correct operations.
- Keep this Operation Manual at a specified location so that it can be referred to at any time when in doubt.

2002.4TI VOL.1

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1. Safety instructions

In order to use the product safely and correctly, and to prevent harm to customers and others and damage to property, follow the warnings and cautions in this Operation Manual.

Degrees of influence exerted in the case of failure to observe the precautions are as follows:

⚠ WARNING	Indicates that a possibility of death or serious injury is assumed.
⚠ CAUTION	Indicates that a possibility of bodily injury or occurrence of only property damage is assumed.

Malfunctions or accidents assumed in the case of failure to observe the precautions are as follows:

 Risk of fire	Indicates that a possibility of smoke or fire is assumed.	 Risk of injury	Indicates that a possibility of injury is assumed.
 Risk of breakage	Indicates that a possibility of breakage is assumed.	 Risk of high temperature	Indicates that a possibility of injury due to high temperature is assumed.
 Risk of electric shock	Indicates that a possibility of an electric shock is assumed.		

⚠ WARNING


Risk of fire


Risk of breakage


Risk of electric shock


Risk of injury


Risk of high temperature

General

◎ Do not use in explosive, flammable-gas or corrosive atmospheres, in locations splashed with water, oil or other liquids, or near combustibles.

◎ Do not mount, connect, move or inspect with the power on.
Perform such work after turning off the power.

◎ Mounting, connection and inspection should be performed by personnel having expert technical knowledge.

◎ Stepping motors may step out when stopping or driving depending on the magnitude of the load.
Especially, if they step out when used for up-and-down driving (Z-axis, etc.), the object being carried may drop. Use after careful testing under operating load conditions and check that the load can be driven securely.

◎ This product is not designed or manufactured for applications relating to nuclear power or posing a direct danger to life.

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Risk of electric shock


Risk of fire


Risk of injury


Risk of breakage


Risk of high temperature

Connection

◎ Perform connection securely in accordance with the connection diagram.

◎ Do not pull or pinch the power lines or motor connecting lines.

◎ Do not use except for the indicated power source (90V – 125V AC).

◎ Be sure to ground the FG terminal.


Risk of electric shock


Risk of fire


Risk of injury


Risk of breakage


Risk of high temperature

Drive

◎ When the motor free signal is input, the motor torque becomes zero (0), and the object being carried may not be held.
Especially, if this signal is input when used for up-and-down driving, the object being carried may drop, resulting in injury or breakage of equipment.

⚠ CAUTION


Risk of fire

◎ Do not use exceeding the spec values of the driver.

◎ Do not put fingers, metals or easy-to-burn objects in the openings of the driver such as the ventilation slots.


Risk of breakage

◎ Do not touch the motor or driver with your hands or body after turning on the power and immediately after turning off the power.

◎ Do not touch the rotating or moving body on the output shaft with your hands, body or with other objects during driving.


Risk of electric shock

◎ The motor temperature rises markedly depending on the driving conditions.

◎ Use with the motor case temperature 100°C or less.


Risk of injury

◎ Do not change the function selector switches with the power on. Otherwise, injury may result.

◎ This device is designed and manufactured for indoor use. Do not install in a location that will create excessive vibrations or shocks.


Risk of high temperature

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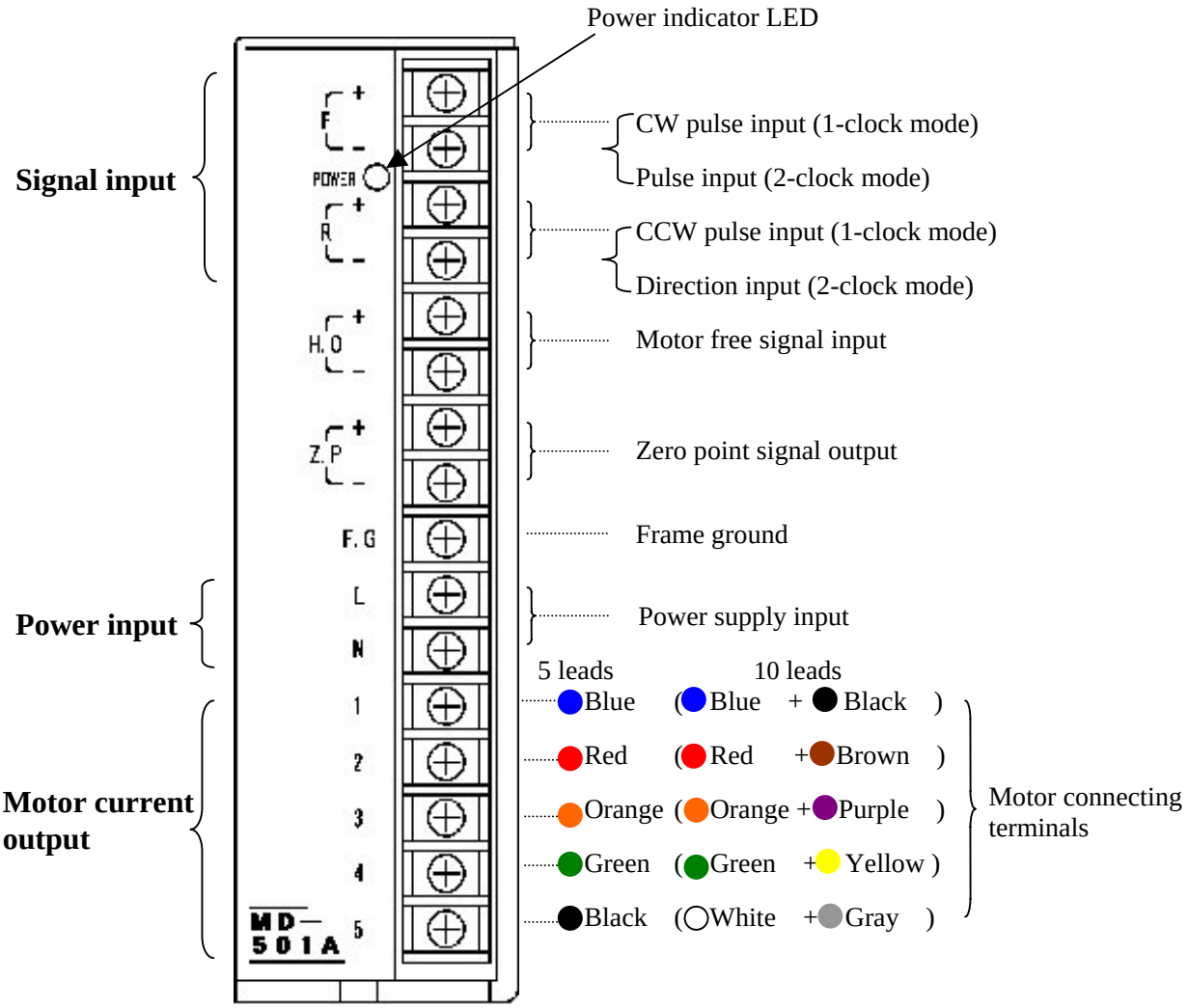
2. Outline

The MD-501A is a 5-phase bipolar pentagon microstep driver for 90V – 125V AC input. Microstep driving technology can be motion smoothly, low vibrations and low noise, compared with conventional convention drivers. In the case of using a standard motor with a step angle of 0.72°, driving of 125,000 pulses per rotation is possible at maximum. The drive is a bipolar pentagon type, and 16 varieties of microsteps can be selected by rotary switch. Selection of a full/half step angle will result in low-vibration driving by 16 divisions internally.

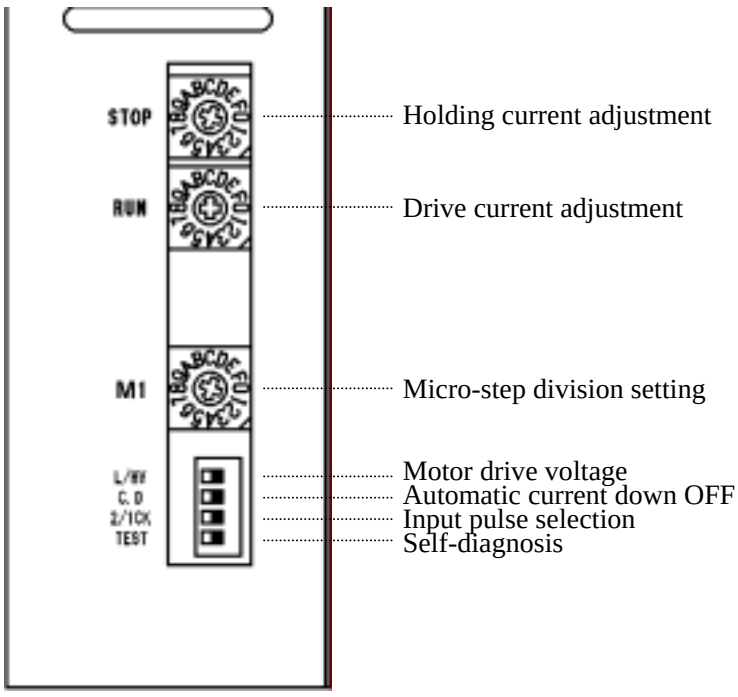
Target motors are 0.5A/phase – 1.4A/phase 5-phase stepping motors manufactured by TAMAGAWA SEIKI, ORIENTAL MOTOR, etc.

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3. Name and function of each part



Function selector switches



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4. Mounting

4-1 Environment of mounting location

Install the main body in the following environment.

① Indoors.

② Out of explosive, flammable and corrosive gases.

③ Where the ambient temperature is 0 – 40°C, and the ambient humidity is 0 – 85%.

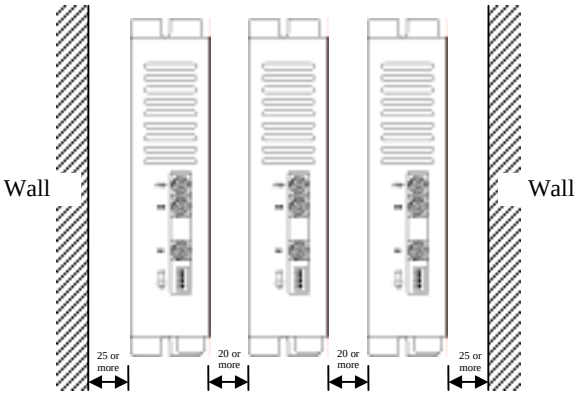
④ Out of water, oil, dust, etc.

⑤ Where the main body does not come into direct contact with objects, and is not subject to vibrations.

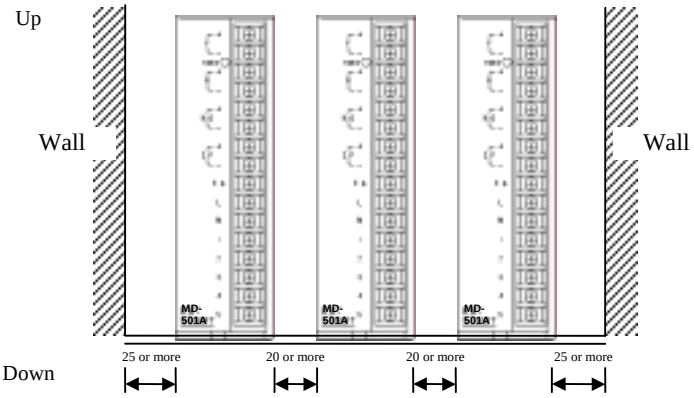
4-2 Mounting method

Since the main body is cooled by natural convection, mount so that it will not be filled with heat.

Mounting on a vertical surface



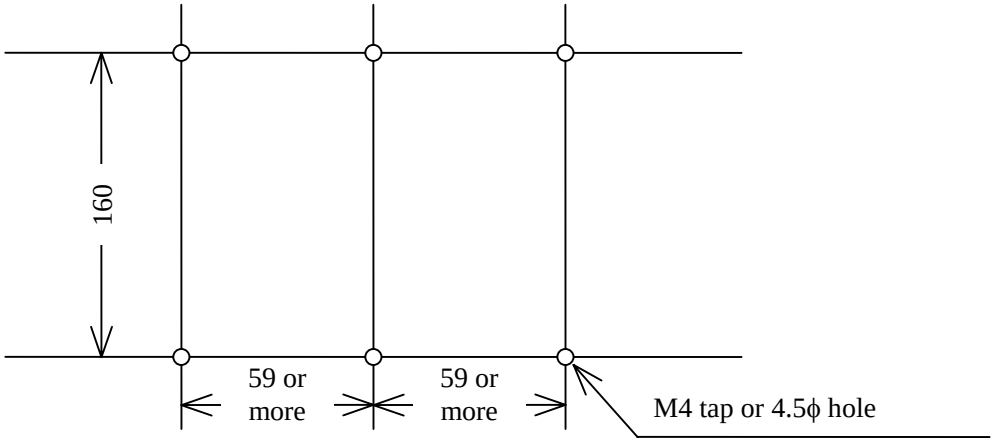
Mounting on a horizontal surface [Unit: mm]



Two mounting screws M4×8 (not attached)

4-3 Mounting hole dimensions

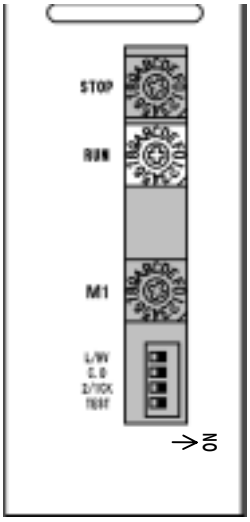
(Example: Hole dimension drawing for mounting three units parallel) [Unit: mm]



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5. Driver function selection settings

5-1 Drive current setting



Set the motor drive current by selecting the RUN rotary switch position in below table.

(Default setting : 3)

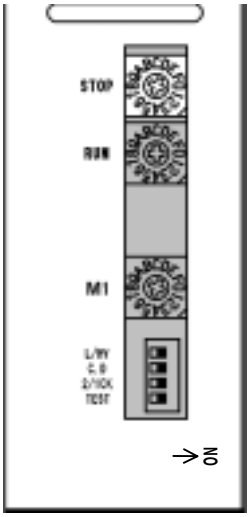
Switch No.	0	1	2	3	4	5	6	7
Drive current (A)	0.5	0.58	0.66	0.75	0.81	0.88	0.96	1.03
Switch No.	8	9	A	B	C	D	E	F
Drive current (A)	1.1	1.18	1.25	1.30	1.4	1.47	1.53	1.6

Example: Set “3” for using a 0.75A motor.

⚠CAUTION

If the current is set by mistake, the motor may heat up excessively or sufficient torque may not be obtained.

5-2 Holding current setting



Set the motor holding current by selecting the STOP rotary switch position in below table. (The percentage to the drive current is indicated.)

(Default setting : 5)

Switch No.	0	1	2	3	4	5	6	7
Holding current (%)	27	31	36	40	45	50	54	58
Switch No.	8	9	A	B	C	D	E	F
Holding current (%)	62	66	70	74	78	82	86	90

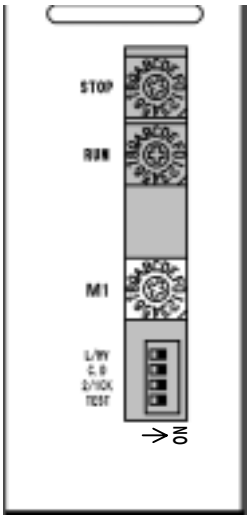
Example: Set “5” for drive current of 0.75A and holding current of 0.375A.

⚠CAUTION

Upon decreasing the holding current, not only does the motor heating decrease, but also the holding torque decreases.
Be careful not to cause an injury or breakage of the equipment due to dropping of a carried object when used for up-and-down movements.

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5-3 Microstep division setting (Set the number of pulses per basic step.)



In a standard motor with a step angle of 0.72°, the number of pulses per rotation is equal to the number of division×500. Set the microstep division by selecting the M1 rotary switch position in below table.

(Default setting : 1)

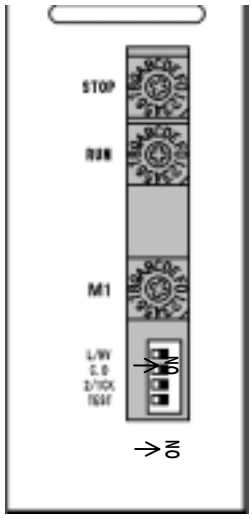
Switch No.	0	1	2	3	4	5	6	7
Number of divisions	1	2	4	5	8	10	20	40
Switch No.	8	9	A	B	C	D	E	F
Number of divisions	80	16	25	50	100	125	200	250

Note: Setting switch position “0” or “1” will result in low-vibration driving by 16 divisions internally.

⚠CAUTION

If the number of divisions is set by mistake, breakage of equipment, injury, etc., may result due to unexpected operation.

5-4 Function switch setting



L/HV: Motor drive voltage selector switch (default setting: OFF)

- Set the voltage to be applied to a high-speed motor.
- By turning on the switch, the drive voltage can be set high, so that high speed and high torque can be obtained.
- Turning off the switch allows driving with motor heating reduced.

C.D: Automatic current down off switch (default setting: OFF)

- By turning off the switch, the motor current is automatically lowered to the value indicated by the holding current setting (STOP) approx.imate 150ms after the drive pulse input signal is stopped.
- By turning on the switch, the automatic current down function is disabled.
- The automatic current down function automatically lowers the motor current when the motor is stopped to reduce the motor heating.

2/1CK: Input pulse selector switch (default setting: OFF)

- Two types of pulse inputs for general use can be prepared. (For details, see 7-1 Input/output signals mentioned later.)
- Set according to the pulse output form of the controller.
- By turning off the switch, the 2-clock mode is set, so that the motor is driven corresponding to the pulse signals of the two systems: CW and CCW.
- By turning on the switch, the 1-clock mode is set, so that the motor is driven corresponding to the signals of the two systems: pulse and direction of rotation.

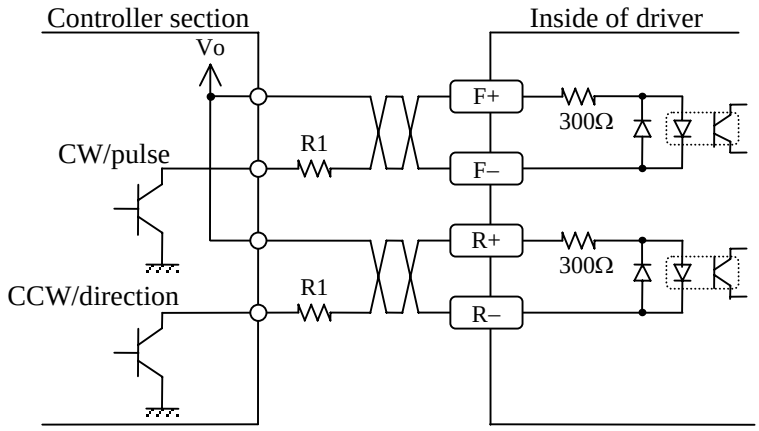
TEST: Self-diagnosis function switch (default setting: OFF)

- By turning on the switch, driving at approximately 60pps will result irrespective of the number of divisions.
  When turning on the switch, stop the drive signal.
  Notes:
  - With no other signals, CW rotation will result at a 2-clock mode, and CCW rotation will result at a 1-clock mode.
  - **Be sure to turn it off for normal driving.**

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6. Input/output signals

6-1 F input and R input



- In the case of the 2-clock mode

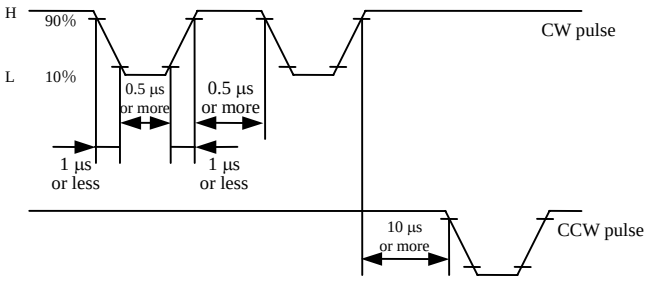
  When a pulse signal is input to the F signal input, the motor operates in the CW direction on the rising edge of the pulse.

  When a pulse signal is input to the R signal input, the motor operates in the CCW direction on the rising edge of the pulse. (The rising edge of the pulse indicates the time when current starts flowing into the photocoupler circuit.)

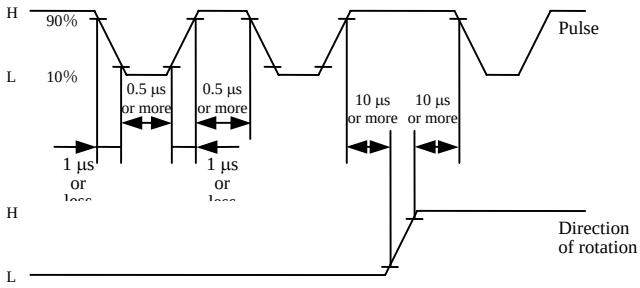
- In the case of the 1-clock mode

  When a pulse signal is input to the F signal input, the motor operates on the rising edge of the pulse. The direction of rotation of the motor is determined by the R signal input. The R signal input is the input of the direction of rotation. When a signal is input to the R signal input, the motor operates in the CW direction.

In the case of the 2-pulse input method



In the case of the 1-pulse input method



The CW rotation indicates that the motor shaft rotates in the clockwise direction when viewed from the motor mounting flange surface.



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Note: When Vo exceeds 5V with the CW/CCW signal, connect external resistance R1.
External resistance R1 (standard value) is calculated by the following expression.
R1=(Vo–2.2)/0.008–300
Use resistance of the above R1±20% for actual mounting.
When Vo is 5V, R1 is not needed.

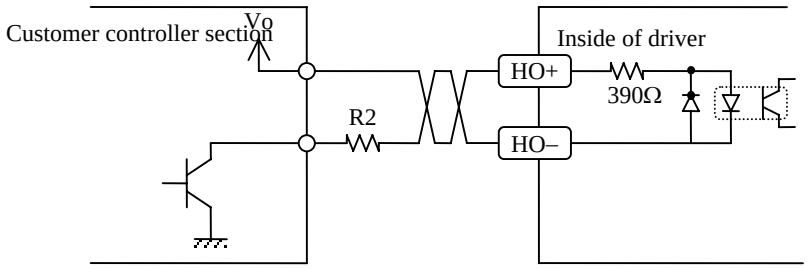
Note: Pulse voltages are as follows: H=4V – 8V, and L=–8V – 0.5V. Keep the pulse width 0.5 μs or more, the pulse interval 0.5 μs or more, and the rise time 1 μs or less.
Keep the direction reversing interval time (common to the 2-clock and 1-clock mode) 10 μs or more.

6-2 Motor free input HO

When the HO signal is on, no current flows into the motor, so that the motor shaft can be rotated by external force. Use it for moving the motor shaft externally or for manual positioning.

For motor driving, always set it at off.

Note: Motor exciting phases will not vary as a result of HO signal being on or off.
If this signal input is not used, nothing can be connected. If the motor shaft is rotated by external force after inputting the HO signal, it is held at a position where it is rotated by an integral multiple of 7.2° from a position where it was before inputting the HO signal (in the case where no pulse signal is input when the HO signal is input).



⚠CAUTION

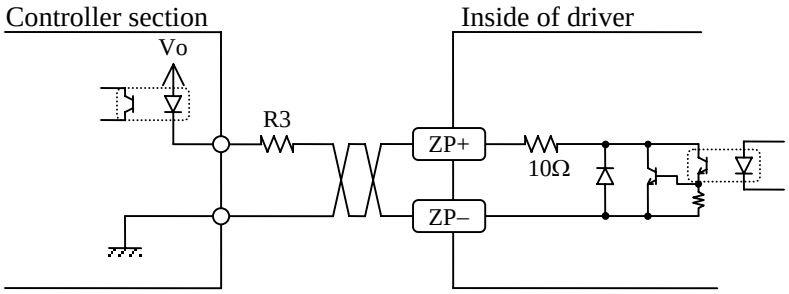
If the HO signal is input to the driver used for up-and-down movements, the object being carried may drop, resulting in injury or breakage of equipment.

Note: When Vo exceeds 5V with the HO signal, connect external resistance R2.
External resistance R2 (standard value) is calculated by the following expression.
R2=(Vo–1.5)/0.008–390
Use resistance of the above R2±20% for actual mounting.
When Vo is 5V, R2 is not needed.

Note: Pulse voltages are as follows: H=4V – 8V, and L=–8V – 0.5V.

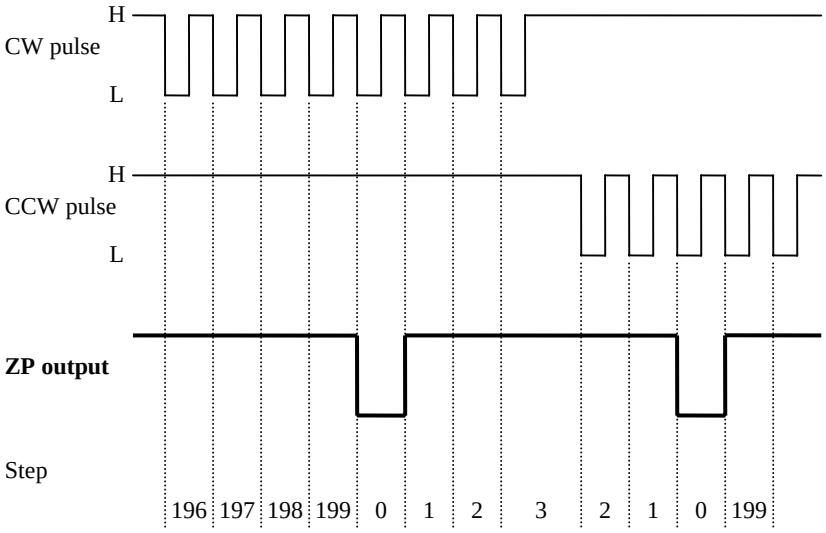
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6-3 Excitation timing output ZP



The output circuit diagram and an example of a connection with a controller are shown. The zero position signal ZP indicates that the motor excitation sequence is (0)-positioned. In the case of a 0.72° motor, it is output each 7.2°. Use it for detecting the origin more precisely to conform with the machine origin on the device side and the excitation origin (ZP) of the motor.

ZP timing chart/at 2-pulse input (4divisions)

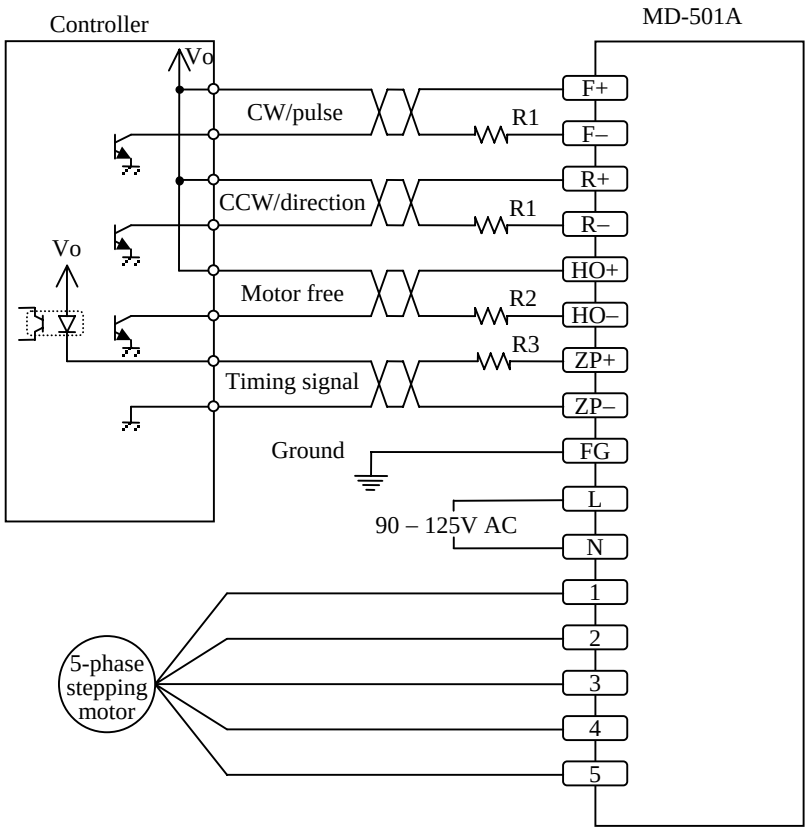


Note: Keep Vo 30V or less. Keep the current value 50mA or less by adjusting the value of external resistance R3. The ZP signal may not be output if a different value is set by operating the step angle selector switch after turning on the power.

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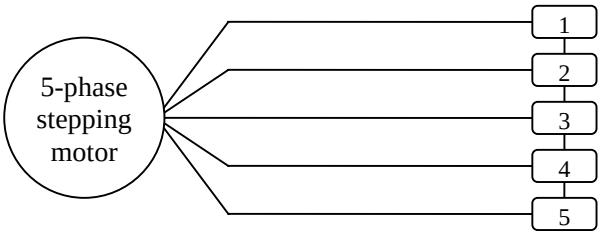
7. Connections

7-1 Example of entire connection



7-2 Motor connection

Connect the motor according to the following lead colors.



Nameplate indication	5 leads	10 leads
1	Blue	Blue Black
2	Red	Red Brown
3	Orange	Orange Purple
4	Green	Green Yellow
5	Black	White Gray
	①	②

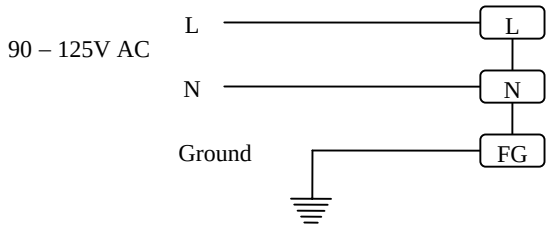
① 5-lead motor manufactured by TAMAGAWA SEIKI, ORIENTAL MOTOR, etc.

② 10-lead motor

Note: For motor connection, use AWG20 (0.5mmsq) or more wires.

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7-3 Power connection



Between L and N, connect a power source of 90 – 125V AC 50/60Hz.

On the L side, connect the line side of the power source, and on the N side, connect the neutral point side of the power source.

Be sure to connect a grounding conductor to FG.

Note: For power connection, use AWG20 (0.5mmsq) or more wires.
For grounding conductor connection, use an AWG16 (1.25mmsq) or more wire.

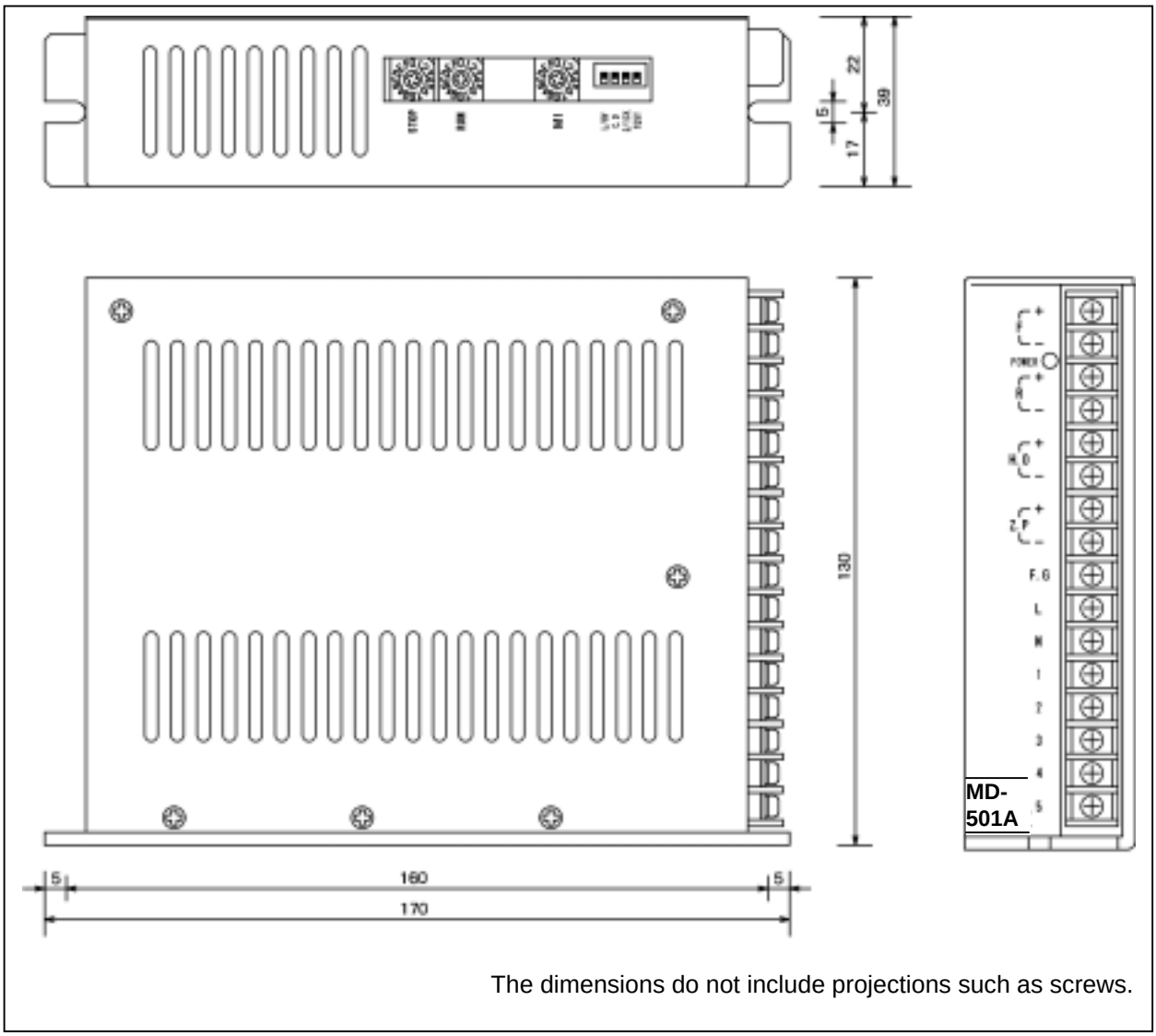
8. Specifications

Product name	5-phase stepping motor driver
Model	MD-501A
Drive system	Microstep driving
Power requirement	90 – 125V AC 50/60Hz 3.5A
Drive current	0.5 – 1.4A/phase
Applicable motor	Berger type 5-phase stepping motor
Number of divisions	1, 2, 4, 5, 8, 10, 16, 20, 25, 40, 50, 80, 100, 125, 200, 250
Low-vibration driving	Driving by 16 divisions internally when 1 or 2 is selected for the number of divisions.
Input signal	Photocoupler input [1]: 4 – 8V, [0]: –8 – 0.5V Input resistance F, R: 300Ω, HO: 390Ω
Maximum response frequency	500kpps
Output signal	Photocoupler open collector output External operating conditions: 30V DC or less, 50mA or less
Functions	Pulse input method selection, automatic current down, step angle selection, drive voltage selection, self-diagnosis function
Cooling	Air cooling by natural convection
Weight	750g
Insulation resistance	The value is 50MΩ or more when measured with a 500V DC insulation resistance tester between AC input and a case at normal temperature and humidity.
Withstand voltage	There is no problem when 1,500V AC is applied for 1 minute between AC input and a case at normal temperature and humidity.
Usage environment	0 – 40°C non-freezing, 0-85% non-condensing

The power source current is the maximum current value of the driver, which varies depending on the pulse speed, motor type, and load.

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9. Outline drawing [Unit: mm]



The dimensions do not include projections such as screws.

Please be aware that specifications are subject to change without notice due to improvements.

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