INSTRUCTION MANUAL

5-phase micro stepping driver

Model: MC-7514PCL

First read this instruction manual to make you use the 5-phase Microstep driver correctly.
Keep this instruction manual at hand in a proper place to help prevent any misunderstandings.

MC MICRO STEP MICROSTEP Co.,Ltd.

Table of Contents

1. Precautions ・・・・・・・・・・・・・・・・・・・・・・・・・・・・ Page 1

2. Product overview ・・・・・・・・・・・・・・・・・・・・・・・・・・ Page 3

3. Driver and accessories ・・・・・・・・・・・・・・・・・・・・・・・ Page 3

4. Parts designations and functions ・・・・・・・・・・・・・・・・・・ Page 4

5. Installation ・・・・・・・・・・・・・・・・・・・・・・・・・・・・ Page 5
   - 5-1. Environment ・・・・・・・・・・・・・・・・・・・・・・・・ Page 5
   - 5-2. Installation method ・・・・・・・・・・・・・・・・・・・・・ Page 5
   - 5-3. Mounting hole dimensions ・・・・・・・・・・・・・・・・・・・ Page 5

6. Selection of the functions for the driver ・・・・・・・・・・・・・・・ Page 6
   - 6-1. Setting the motor running current ・・・・・・・・・・・・・・・ Page 6
   - 6-2. Current setting at motor standstill ・・・・・・・・・・・・・・・ Page 6
   - 6-3. Setting the step angle (Set the number of pulses per basic step) ・・ Page 7
   - 6-4. Setting the function switch ・・・・・・・・・・・・・・・・・・ Page 7

7. Input/output signal ・・・・・・・・・・・・・・・・・・・・・・・・・ Page 8
   - 7-1. CW pulse signal input, CCW pulse signal input ・・・・・・・・・・ Page 8
   - 7-2. Current reduction off input CD ・・・・・・・・・・・・・・・・・ Page 9
   - 7-3. Motor-free Input HO ・・・・・・・・・・・・・・・・・・・・・・ Page 9
   - 7-4. Step angle changeover signal DS ・・・・・・・・・・・・・・・・ Page 12
   - 7-5. Excitation timing signal ZP ・・・・・・・・・・・・・・・・・・ Page 12

8. Connection ・・・・・・・・・・・・・・・・・・・・・・・・・・・・ Page 12
   - 8-1. Entire connection example ・・・・・・・・・・・・・・・・・・・ Page 12
   - 8-2. Motor connection ・・・・・・・・・・・・・・・・・・・・・・・ Page 12
   - 8-3. Power connection ・・・・・・・・・・・・・・・・・・・・・・・ Page 13
   - 8-4 EMC Directive and the effective way of Installing and wiring to conform with EMC standards ・・・・・・・・・・・・・・・・・・・・・・・・ Page 13

9. Specifications ・・・・・・・・・・・・・・・・・・・・・・・・・・・ Page 15

10. Dimensions ・・・・・・・・・・・・・・・・・・・・・・・・・・・・ Page 16

1. Precautions

Follow the warnings and cautions explained in this instruction manual for safe and proper operation of this product and to protect people and property from damage.

The following problems can occur if you do not follow the procedures properly.

⚠ **Warning**	It is assumable that situations where persons may die or become seriously injured may occur.
⚠ **Caution**	It is assumable that situations where persons or property may be damaged may occur.

The following failures and accidents can occur if procedures are not followed properly.

 **Caution**	Caution against ignition Smoking and ignition are assumable.	 **Caution**	Caution against injury Injury is assumable
 **Caution**	Caution against damage Damage is assumable.	 **Caution**	Caution against high temperature Injury due to high temperature is assumable.
 **Caution**	Caution against electrical shock Electrical shock is assumable.		

⚠ Warnings


Caution against ignition


Caution against damage


Caution against electrical shock


Caution against injury


Caution against High temperature

General matters

◎ Do not use your driver in places with explosive gases or corrosive atmospheres. Likewise, do not use your drive in places where your driver is covered with water or oil or any liquids and where it is near combustible materials.

◎ Do not attempt to install, connect, move, and check a live system: First turn off the power before attempting to do such operation.

◎ Only qualified persons having expertise with the drive may be allowed to install, connect and check it.

◎ A load may prevent a stepping motor from stopping as well as preventing adjustments. In particularly, load can drop when the stepping motor cannot be adjusted because of the up-and-down movements (the Z-axis etc.). Be sure to test the equipment properly under an operating load and ensure that a load can be driven before using it.

◎ The drive is not designed for use in atomic power industry and in dangerous situations where lives are at stake.


Caution against electrical shock


Caution against ignition


Caution against injury


Caution against damage


Caution against High temperature

Connection

◎ Ensure electrical wires are securely fixed.
◎ Do not pull excessively bend or twist the power cord and motor's connection cord.
◎ Do not use your driver except within the proper power range specified (100V to 230V).
◎ Please ground the terminal FG.


Caution against electrical shock


Caution against ignition


Caution against injury


Caution against damage


Caution against High temperature

Drive

◎ Loads cannot be held when the motor-free signal is input and the motor-torque becomes 0 (zero). Particularly, when the motor-free signal is input for up-and-down movement, load may be dropped, causing the operator to be injured or equipment to be damaged.

⚠ Caution


Caution against fire


Caution against damage


Caution against electrical shock


Caution against injury


Caution against High temperature

◎ Never use your driver in exceeding the driver's specifications.
◎ Do not put fingers, metal particles or flammables into the air vents and other openings of the driver case.
◎ Do not allow your hand or body to touch the motor. The drive may be hot during operation and right after turning the power off.
◎ Do not allow your hand, body or anything else touches the motor shaft and the mobile unit in operation.
◎ During operation there is a possibility that the motor can become extremely hot.
◎ The motor-case must be operated under temperatures less than or equal to 100^0C(212^0F).
◎ Do not attempt to change the selection of functions during operation as it is dangerous to persons.
◎ The 5-phase stepping motor driver is designed for indoor use only. Do not locate your driver in an environment subject to vibration or shocks.
◎ The driver is designed and manufactured for installation in equipment.

2. Product overview

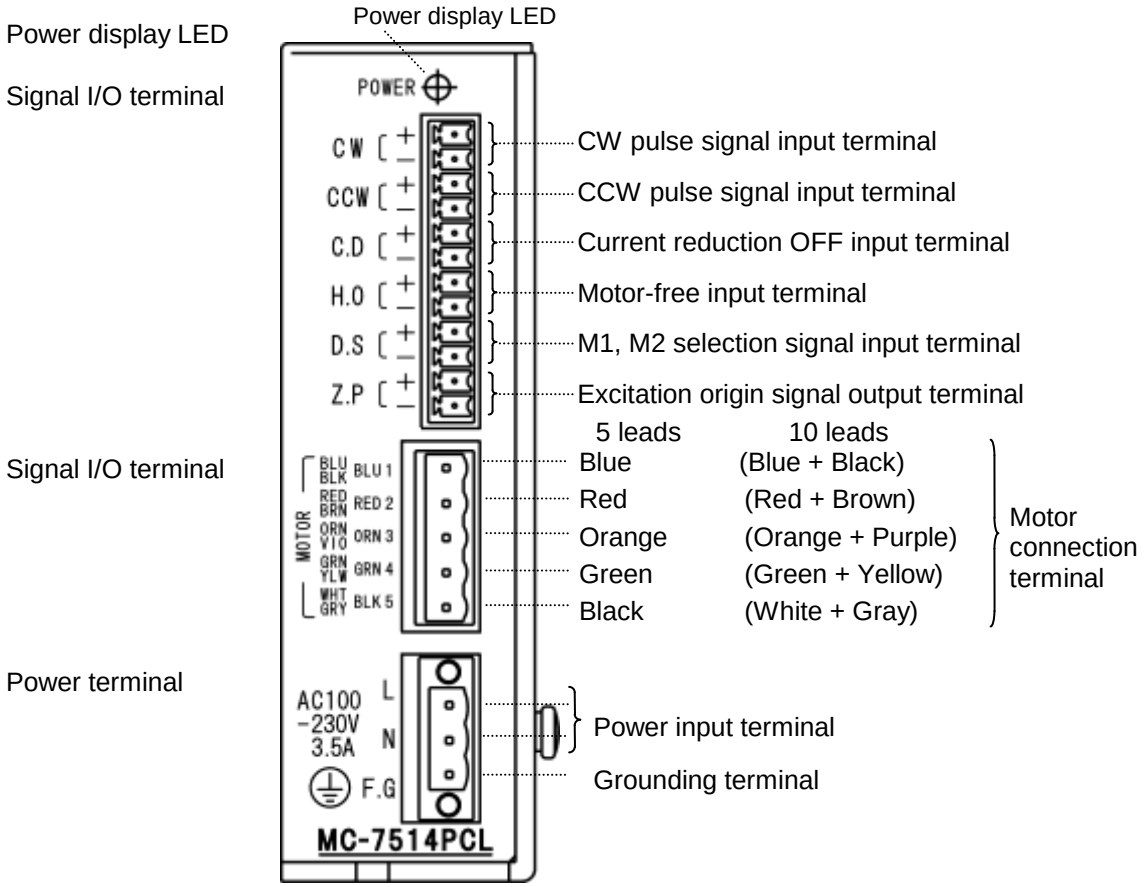
MC-7514PCL, 5-phase stepping motor driver is a micro-step driver with AC100V～230V input. The micro-step technology provides lower vibration, lower noise and highly divided steps compared with the conventional basic step driver. When using a motor with a standard step angle of 0.72 degree, it permits resolution of 125,000 steps per revolution. The applicable motor is a 5 phase stepping motor with 0.5A/Phase to 1.4A/Phase such as of Tamagawa Seiki, Oriental Motor. The driving method is of the bipolar pentagon drive. Further, you can pre-set two micro-step modes (such as minute feed and rapid feed) from 16 different resolutions and select the two modes by a signal. Even FULL step or HALF step is chosen for the step angle, with the low vibration switch is ON, it automatically provides 16 divided steps (processed internally) to achieve low vibration drive.

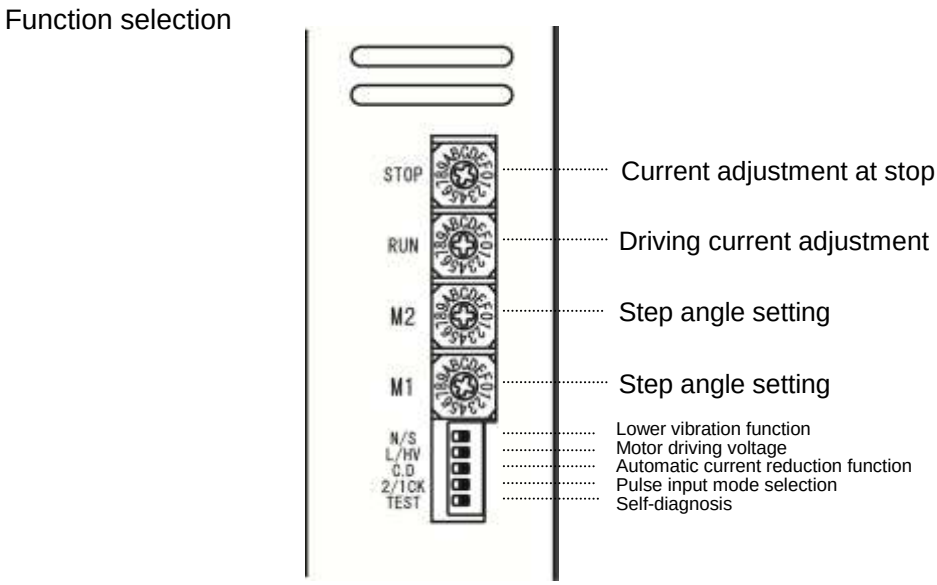
3. Driver and accessories

Make sure that you have everything listed below. Contact your local dealer or our office when any driver or accessories are missing.

1	Driver	MC-7514PCL		1 unit
			Phoenix specifications	
2	Power connector	3P connector	(MSTB 2.5HC/3-STF-5.08)	1 piece
3	Motor connector	5P connector	(MSTB2.5/5-ST-5.08)	1 piece
4	Signal connector	12P connector	(MC1.5/12-ST-3.81)	1 piece

4. Parts designations and functions





5. Installation

5-1 Environment

Set up your driver in the following environment.

① Inside an enclosure that is installed indoors.

② A location free of explosive, flammable or corrosive gas

③ A location with an ambient temperature from 0 to 40^{0}C(104^{0}F) and ambient humidity from 0 to 85%

④ A location where your driver is not covered with water, oil or any dust

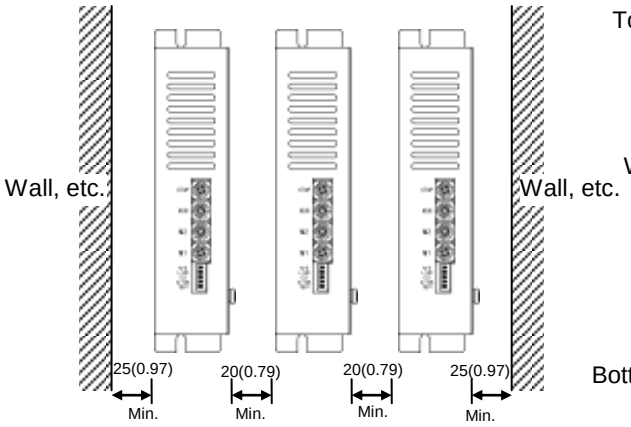
⑤ A location where your driver is not subject to direct impact and shocks.

5-2 Method of installation

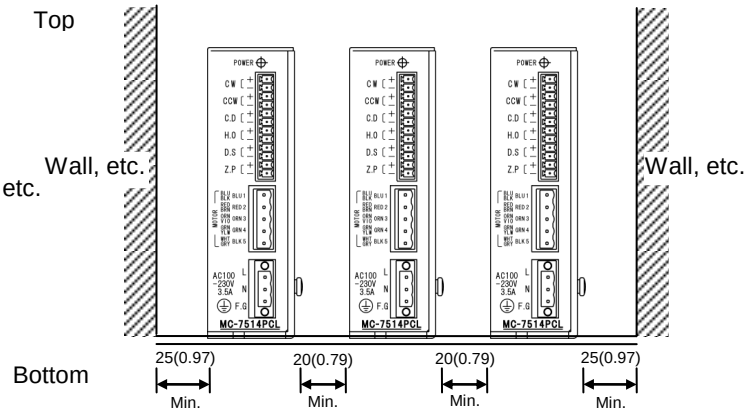
Install your driver in a way to avoid heat build up because it is of the natural convection cooling types.

Install the driver onto an appropriate flat metal plate having heat conductivity.

When mounted on a vertical face



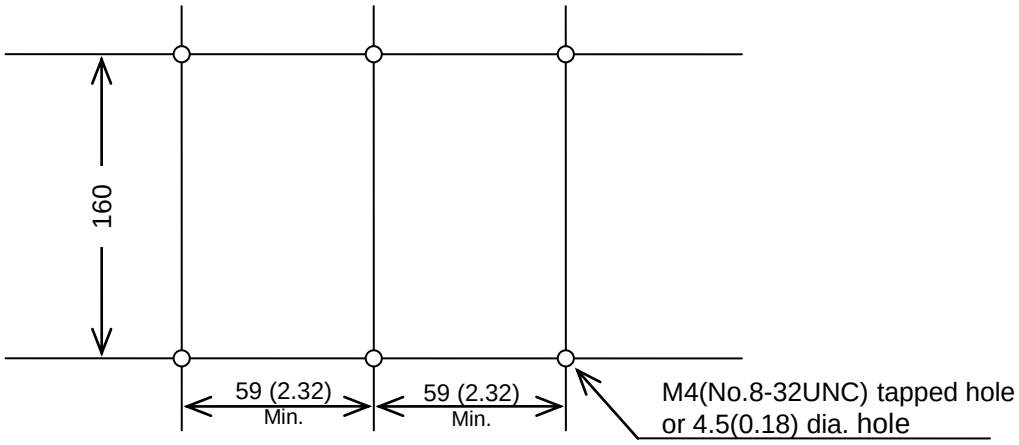
When mounted on a horizontal face



Mounting screw Panhead M4(No.8-32UNC) x 8 2 pieces (not available as accessory.)

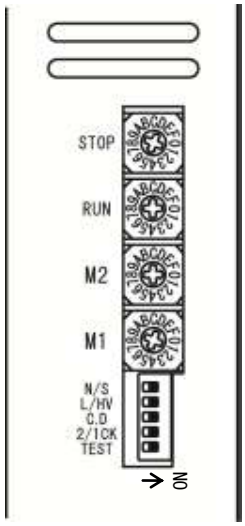
5-3 Mounting hole dimensions

(Example: Dimensional diagram when 3 units are mounted in parallel) [Unit：mm]



6. Selection of the function switches for the driver

6-1 Setting the motor running current (at motor rotation)



To set the motor running current, use the following table to choose the RUN rotary switch position.

（Factory setting：C）

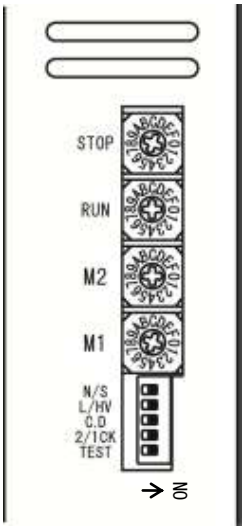
Switch position	0	1	2	3	4	5	6	7
Current at rotation (A)	0.5	0.58	0.66	0.75	0.81	0.88	0.96	1.03
Switch position	8	9	A	B	C	D	E	F
Current at rotation (A)	1.1	1.18	1.25	1.32	1.4	1.47	1.53	1.6

Example: When using a 1.4A motor, set C.

⚠CAUTION

If you make a setting mistake, the motor can become extremely hot or it may not provide enough torque

6-2 Setting the current at motor standstill.



To set the current at motor standstill, use the following table to choose the STOP rotary switch position. (The indication denotes the percentage with regard to the driving current.)

（Factory setting: 5）

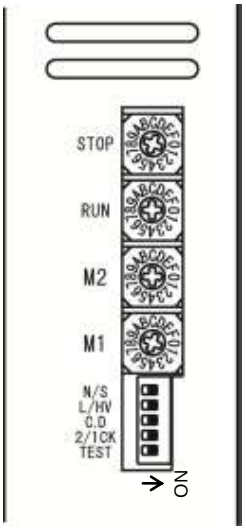
Switch position	0	1	2	3	4	5	6	7
Current at stop (%)	27	31	36	40	45	50	54	58
Switch position	8	9	A	B	C	D	E	F
Current at stop (%)	62	66	70	74	78	82	86	90

Example: To make a driving current of 1.4A and a stop current of 0.7A, set 5.

⚠**CAUTION**

Reducing a current at motor standstill causes less heat to be generated, thus reducing the holding torque.
When using the unit for up/down movement, take care to prevent the operator from injury and/or the equipment from damage due to the drop of the freight.

6-3 Setting the step-angle (Set the number of pulses per basic step.)



For the motors with a standard step angle of 0.72 degree, number of divisions X 500 provides the number of pulses per one rotation. To set the resolution, use the following table to select the M1 and M2 rotary switch positions.

(Factory setting: M1→5 : M2→0)

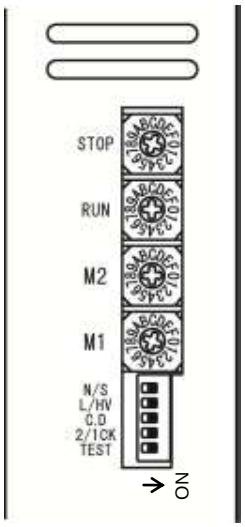
Switch position	0	1	2	3	4	5	6	7
No. of divisions	1	2	4	5	8	10	20	40
Switch position	8	9	A	B	C	D	E	F
No. of divisions	80	16	25	50	100	125	200	250

Note: When the selection signal DS of the signal input/output terminal is [0], the motor is driven based on the number of divisions of M1. When the DS signal is [1], the motor is driven by the number of divisions of M2. M1 and M2 allow you to set any value of the above 16 types. For example, changing the M1 and M2 selection signal allows changeover of the forward and backward movement speed.

⚠CAUTION

A mistake in setting the number of divisions may cause the operator to be injured and/or the equipment to be injured due to an unexpected movement.

6-4 Setting the function switch



N/S : Low-vibration function switch (Factory setting: ON)

- At ON state, the motor is driven with a low vibration even when the number of divisions is 1(Full Step) or 2(Half Step).

L/HV : Motor driving voltage changeover switch (Factory setting: OFF)

- Set the voltage applied to the motor at a high speed.
- Turning ON the switch sets a higher driving voltage and provides higher speed and torque.
- Turning OFF the switch provides driving the motor with less heat generation.

CD : Automatic current reduction switch (Factory setting: OFF)

- At “OFF” position the current will be reduced to the pre-set current at motor standstill (STOP rotary switch) at approximately 150mSec after the input pulse stopped.
- At “ON” position, automatic current reduction will not be functioning.
- The automatic current reduction automatically drops the motor current at motor standstill, and suppresses heat generation of the motor.

2/1CK : Pulse input mode selection switch (Factory setting: OFF)

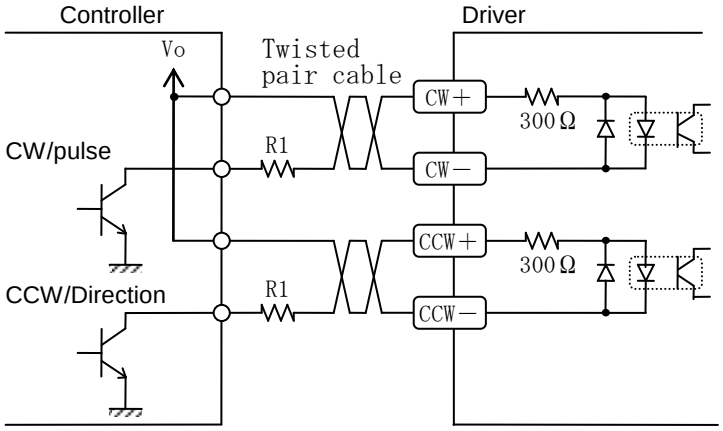
OFF : 2 Pulse Input Mode
ON : 1 Pulse Input Mode
(For details, see Item 7-1, I/O signal)

TEST : Self-diagnostic function switch (Factory setting: OFF)

- Turning ON the switch drives the motor at a rate of about 60 pps irrespective of the number of divisions.
  Stop the driving pulse signal before turning ON the switch,.
  Note: ・When the other signal is not found, CW revolution is provided for the 2-pulse system and CCW revolution is provided for the one-pulse system.
  ・**At ordinary driving, be sure to set OFF.**

7. Input/output signal

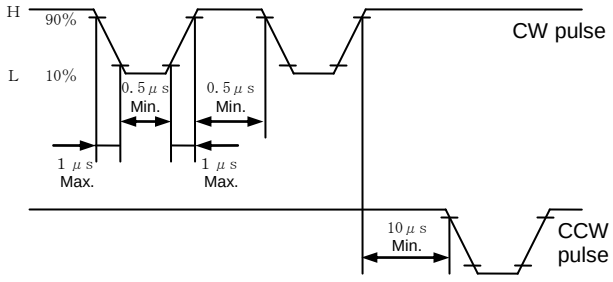
7-1 CW pulse signal input, CCW pulse signal input



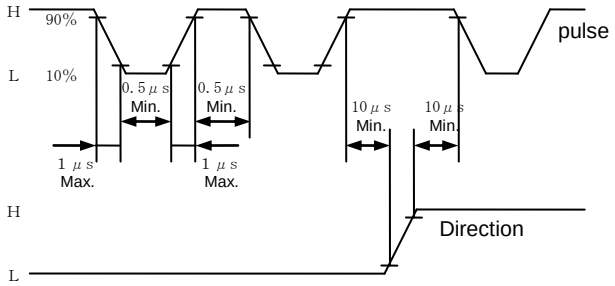
- In the case of 2-pulse input system:
  When the pulse signal is entered to the CW pulse input terminal, the motor is driven in the CW direction at the rise of the pulse. When the pulse signal is entered to the CCW pulse input terminal, the motor is driven in the CCW direction at the rise of a pulse.
- In the case of 1-pulse input system:
  When the pulse signal is entered to the CW pulse input terminal, the motor is driven at the rise of the pulse. The direction of rotation is determined by the input of the CCW pulse input signal. When the signal is entered to the CCW pulse input terminal, the motor drives in the CW direction.

Note: ▪ The rise of pulse means the time when an electric current begins to flow through the photo coupler circuit.
▪ In the above diagram, the motor starts turning when the output transistor is switched from OFF to ON.

In the case of the 2-pulse input system



In the case of the 1-pulse input system



（In the case when the both are the above circuit）



Note: The CW rotation means that the motor shaft turns in the clockwise direction when viewed from the mounting flange-side.

Note: When the CW / CCW signal (Vo) exceeds 5V, use an external resistor (R1).

The calculation formula (standard value) of the external resistor R1 is as follows:

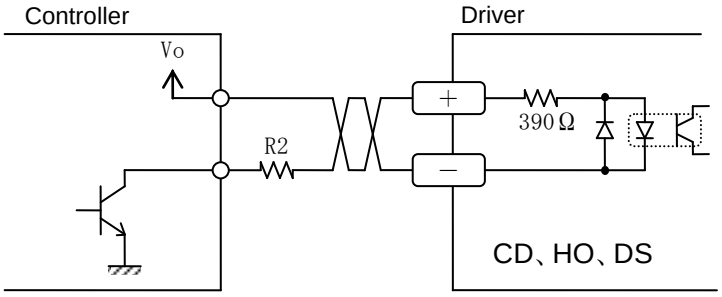
R1＝（Vo－2.2）／0.008－300

When you actually mounting a resistor, use the one with a value of ±20% of the above R1. When the Vo is 5V, R1 is not required.

Note: For the pulse voltage, set [1] ＝ 4V to 8V, [0] ＝ －8V to 0.5V. Set the pulse width to 0.5 μsec or more, the pulse interval to 0.5μsec or more, and the rise time to 1μs or less. Also set the interval time of the reverse direction to 10μsec or more (for both of (both of 2 pulse/ 1 pulse systems.)

7-2 Current reduction off input (CD)

When the signal is entered to the current reduction off input (CD input) terminal or when the switch CD is ON, automatic current reduction will not be functioning at motor standstill.



When the current reduction function is not used, the motor temperature may become too high.

⚠CAUTION When the CD is ON, the motor may becomes too hot depending on the running condition. Take care not to cause burn.

7-3 Motor free input (HO)

When the HO signal is turned on, the current to the motor is cut off and the motor shaft can be turned by an external force. Use this function HO when you want the motor shaft to be turned by external force and manually positioning the shaft.

Set HO to OFF at any time at motor operation.

Note: When the Motor Free Input is OFF after turning the motor shaft, the same motor winding (phase) is energized again. After re-energizing the phase, the position of the shaft will be shifted by multiple angle of 7.2 degree from the original position before the HO signal is input. (In case you do not input pulses when HO is on.) If you do not require this HO function, wiring to the terminal is not necessary.

⚠CAUTION When you enter the HO signal to your driver during up-and down movement, the load may be dropped, causing the operator to be injured and the equipment to be damaged.

7-4 Step angle select signal (DS)

By entering the DS signal, you can select the step angle at running.

For example : Running slow for forward direction and fast for reverse.

The step angle when the DS signal is not entered, is determined by the M1 setting.

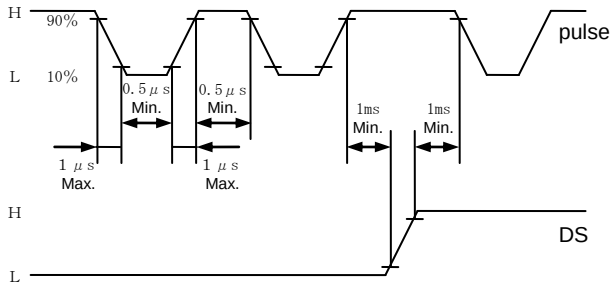
The step angle when the DS signal is entered, is determined by the M2 setting.

DS OFF M1

DS ON M2

⚠ CAUTION	Changing the DS signal during driving may cause the operator to be injured and the equipment to be damaged due to an unexpected move of the motor.

Note: The motor exciting phase is not changed by ON/OFF of the DS signal. Set a value of not less than 1msec for the step angle changeover and pulse input internal (for both of the two-pulse/one-pulse system.)



Note: With the CW, CCW signal, connect an external resistor R2 when Vo exceeds 5V.

Note: The formula of the external resistance value (standard) is as shown below.

R2＝（Vo－1.5）/ 0.008－390

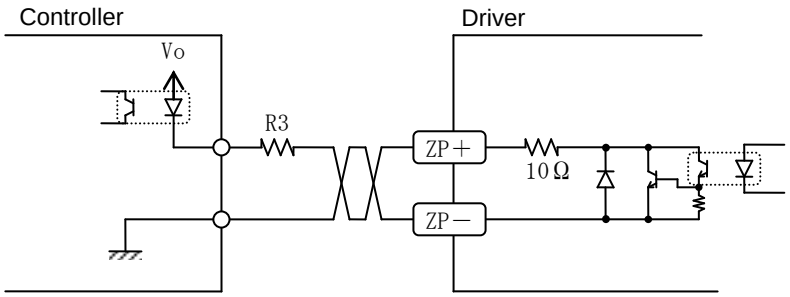
When actually mounting a resistor, use the one with ±20% of R2 in the above formula above. When Vo is 5V, R2 is not required.

Note: Set the pulse voltage to [1]＝4V to 8V, ［0］＝－8V to 0.5V.

Values of R1, R2

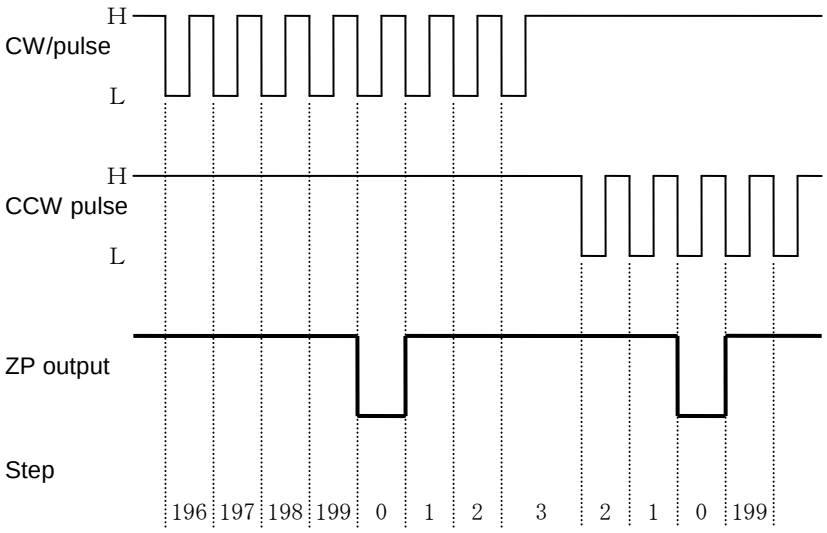
Vo＝12V	R1＝910Ω	(750Ω～1.1kΩ)	R2＝910Ω (750Ω～1.1kΩ)	1/2W or more
Vo＝24V	R1＝2.4kΩ	(2kΩ～3kΩ)	R2＝2.4kΩ (2kΩ～3kΩ)	1/2W or more

7-5 Excitation timing signal (ZP)



The above figure indicates an output circuit diagram and an example of connection with the controller. The excitation timing signal ZP is a signal indicating that the motor excitation sequence is at position 0 (zero). With a motor of 0.72 degrees, the signal is output every 7.2 degrees. This signal is used for a precise detection of the home position of your machine.

ZP timing chart/at 2-pulse input (at 20 divisions)

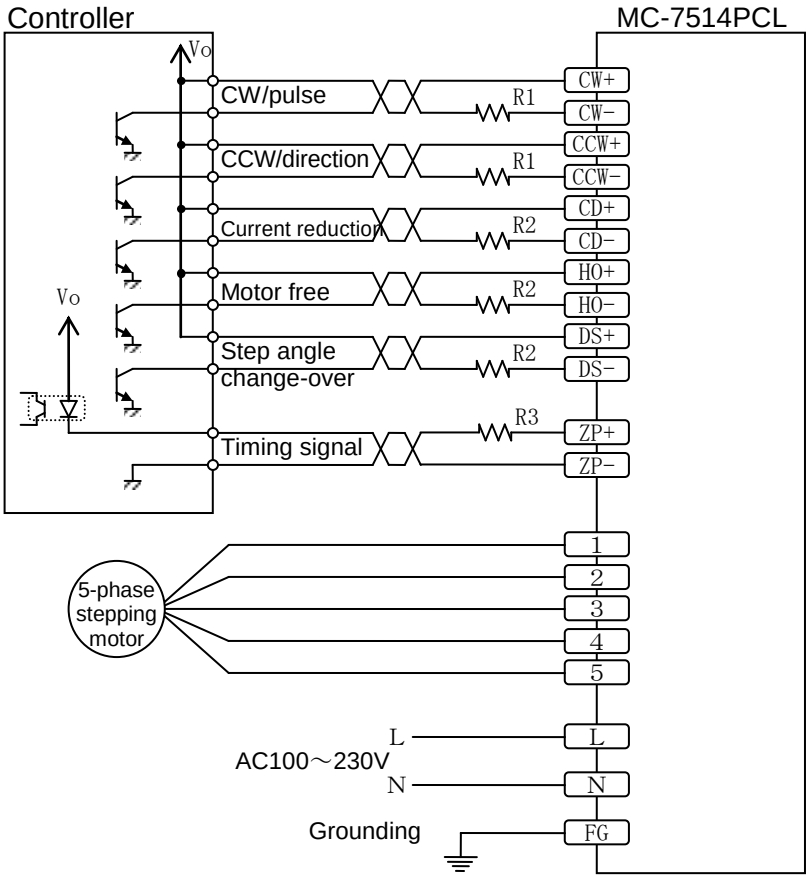


Note: Set Vo to 30 V or less. Adjust the value of an external resistor R3 to set the current value to 50 mA or less. After power ON, when turning ON the DS signal and changing over the step angle for driving the motor or operating the step angle select switch to set the current value to a different value, the ZP signal may not be output.

8. Connection

For field installed wiring , use copper conductors only and temperature rating shall be more than 80℃(176 ℉). Torque for field connecting terminal screws is rated from 0.5 to 0.6 Nm.

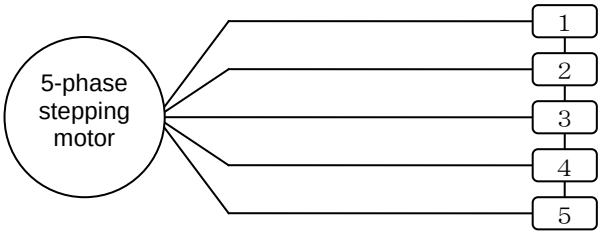
8-1 Entire connection example



MC-7514PCL doesn't incorporate any internal overload protection, and intended to be used with external or remote

8-2 Motor connection

Connect your motor according to the colors of lead wires as shown below.



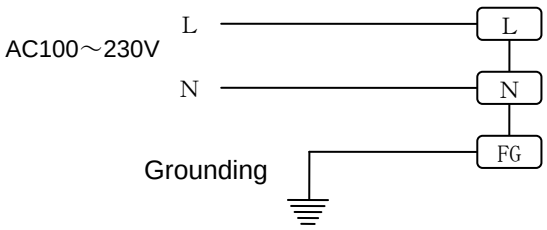
Nameplate marking	5 leads	10 leads
1	Blue	Blue/Black
2	Red	Red/Brown
3	Orange	Orange/Purple
4	Green	Green/Yellow
5	Black	White/Grey
	①	②

① 5 -lead motor of Tamagawa Seiki or Oriental Motor

② 10-lead motor

Note: To wire the motor, use wire material of AWG20 (0.5 mmsq) or more.

8-3 Power connection



Between L and N, connect a power of 100～230Vac, 50／60Hz.
Be sure to connect the live side to the L side and the neutral side of the power supply to the N side. A ground wire must be securely connected to the FG terminal.

Note: To wire the power supply, use wire material of AWG20 (0.5 mmsq) or more.
To wire the grounding line, use wire material of AWG16 (1.25 mmsq) or more.

8-4 EMC Directive and the effective way of Installing and wiring to conform with EMC standards

■ EMC Directive and Standards

MC-7514PCL is designed and manufactured as components that are built in the customer's machinery, but EMC Directive (2004/108/EC) requires that the entire machinery must be conformed to the standards.

Our company Microstep confirms MC-7514PCL conform to the standards in the state using the signal cable, the motor cable with the shield, the power supply noise filter, and the surge arrester, but it is expected EMC condition is affected by the driver, the motor, other control equipment themselves, and their layout and wiring in the entire machinery. Therefore, please confirm that the system conform to EMC standards after measuring the entire machinery by yourself.

Applicable Standards for MC-7514PCL

*Emission … EN61000-6-4:2007

*Immunity … EN61000-6-2:2005

■ The effective way of Installing and wiring to conform with EMC standards

It is explained the effective way of Installing and wiring for which customer’s system built in MC-7514PCL can be conformed with EMC standards.

Grounding the motor

When grounding the motor, use an external Protective Earth Terminal or fix the motor to a grounding metal plate.

Grounding the driver MC-7514PCL

Connect the Protective Earth Terminal (with earth mark) located on the driver side to the ground.

Note:For connecting Protective Earth Terminal,please never use except this attached 4×6 SEMS Screw.)

Connection of the motor cable

Use a braided shield cable (10m or less in length) for the motor cable.

(An example of the motor cable) → Kyowa Densen 5 lead MVV-S0.5

Wiring for the power cable and the power supply noise filter

Use a bi-pole with the ground (3m or less in length) for the power cable, and connect the ground line with the ground terminal of the power supply noise filter. It is effective to place the filter near the driver.
(An example of the power supply cable) → Hirakawa Hyutec (10A-250V) H05VV-F 3×1.0
(An example of the noise filter) → TDK-Lambda RSHN-2006

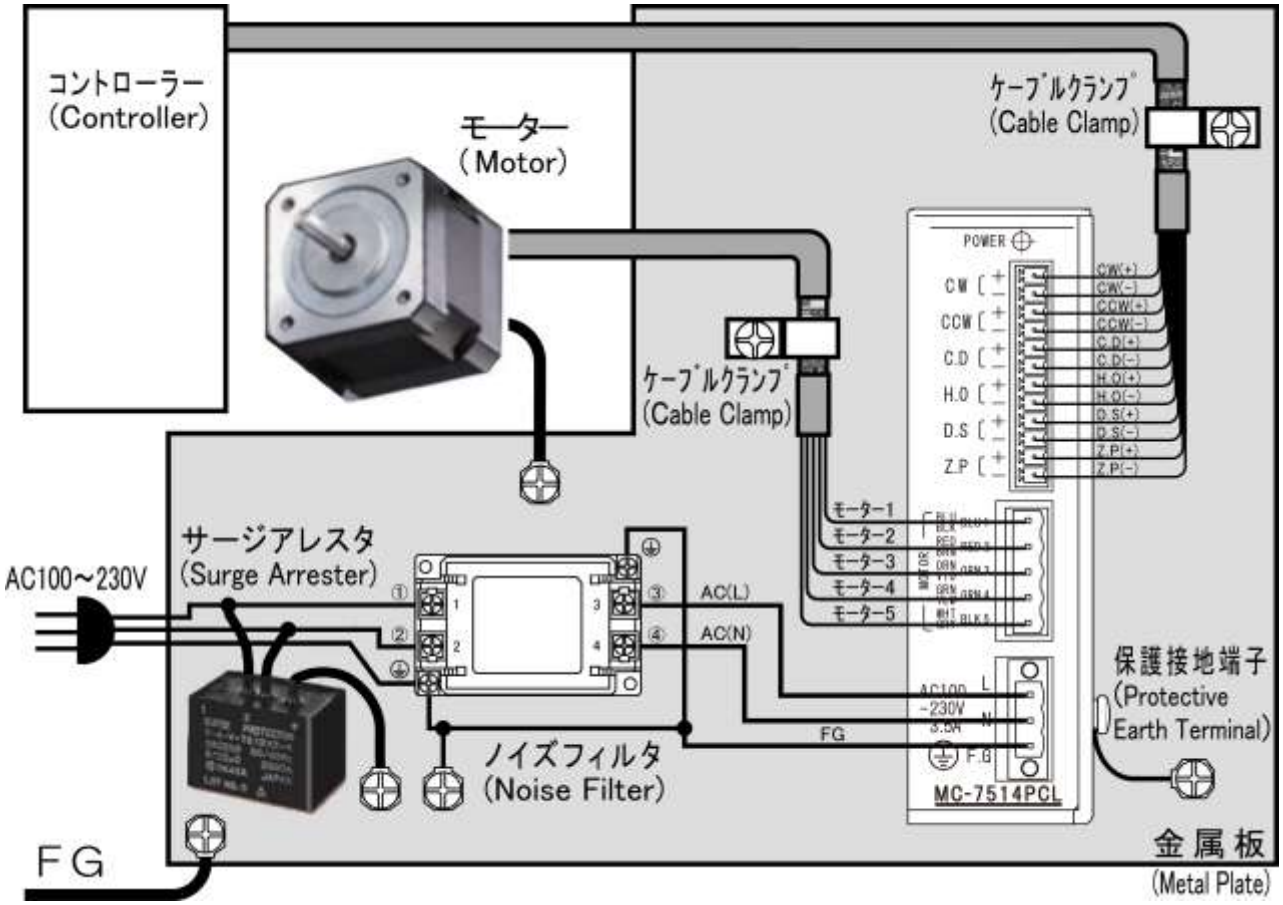
Wiring and grounding of the signal cable

Use a braided shield cable (10m or less in length) for the signal cable, and be careful that there is no remaining part. Use a metal cable clamp or similar device that will maintain the contact with the braided part of the shielded cable. It is effective to place the cable clamp as close to the end of the cable as possible. Do not bind the motor cable, the power supply cable and the signal cable, and place the cables separately from each other.

Connecting the surge arrester

When carrying out the dielectric strength test against the equipment, we will recommend the arrester to be detached to prevent the surge arrester being damaged.
(An example of the surge arrester) → Okaya Electric RAV-781BWZ-4

An example of Installing Motor, Driver and wiring

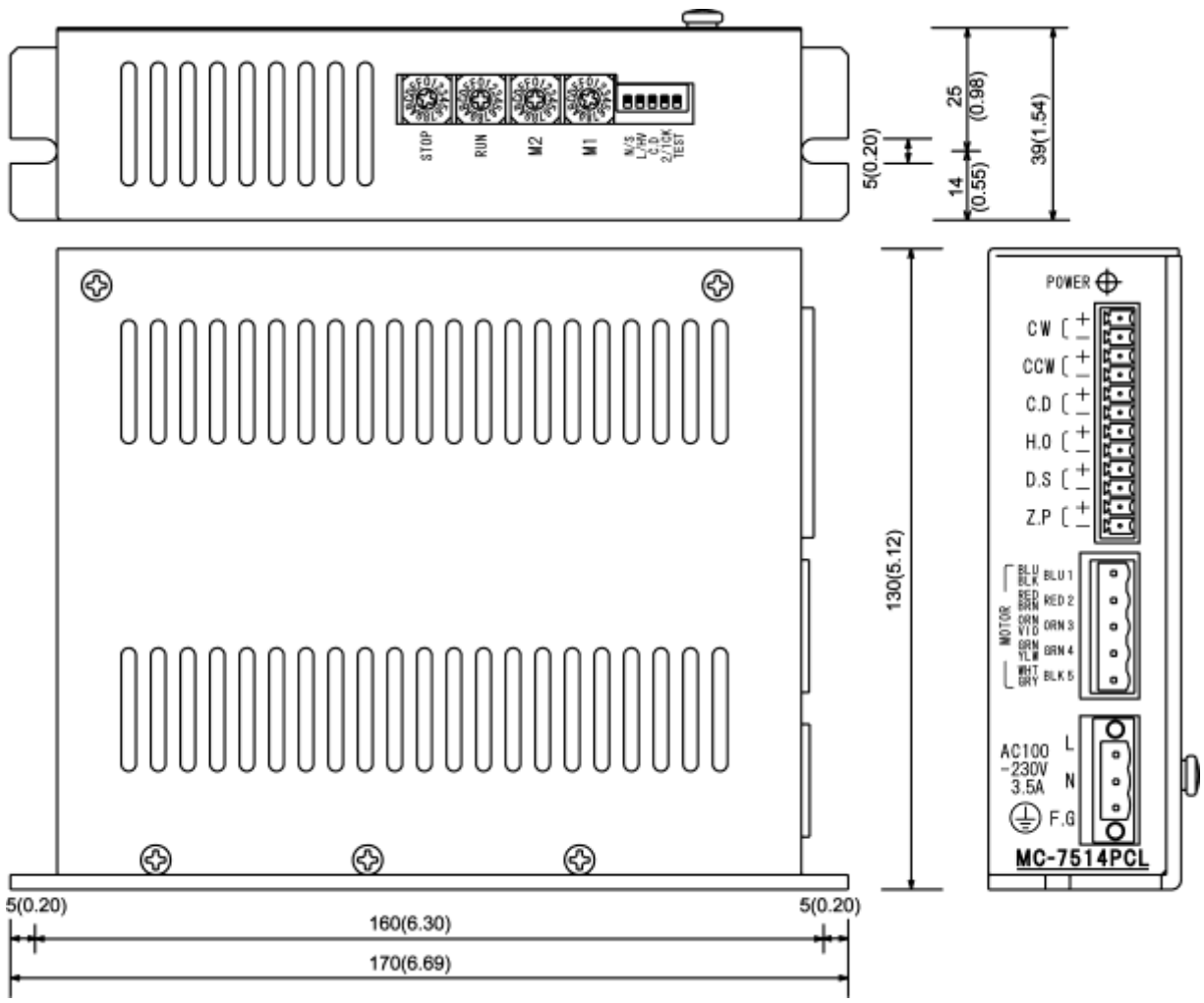


9. Specifications

Product name	5-phase stepping motor driver
Model	MC-7514PCL
Drive system	Microstep drive
Input power	AC100～230V±10% 50／60Hz 3.5A Max.
Drive current	0.5～1.4A/phase
No. of divisions	1,2,4,5,8,10,20,40,80,16,25,50,100,125,200,250
Input signal	Photo-coupler input ［1］:4～8v,［0］:-8～0.5v Input resistor CW, CCW：300Ω CD, HO, DS：390Ω
Maximum frequency response	500kpps
Output signal	Photo-coupler, open collector output External working conditions: Not more than 30Vdc, not more than 50mA
Functions	Pulse input mode changeover, automatic current-reduction, step-angle change-over, driving voltage changeover, Self-diagnostic function
Cooling system	Natural convection air-cooling type
Weight	750 g (26.5 oz)
Insulation resistance	In the normal temperature and normal humidity, the value obtained by measuring between the AC input and case using the 500Vdc meggar is 50M-ohms or more.
Withstand voltage	In the normal temperature and normal humidity, an error does not occur even when a power of 1,500Vac is applied between the AC input and case for one minute.
Operating ambient temperature	0～40°C(32～104^{0}F) Non-freezing.
Operating ambient humidity	0～85% Non-condensing.

Note: An electric source current will vary according to the pulse velocity and the motor’s load.

10. Dimensions [Unit: mm(in)]



Overhung of such screws is not considered in the dimensions.

Be acknowledged that specifications are subject to change without notice to upgrade the product.

12-09

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