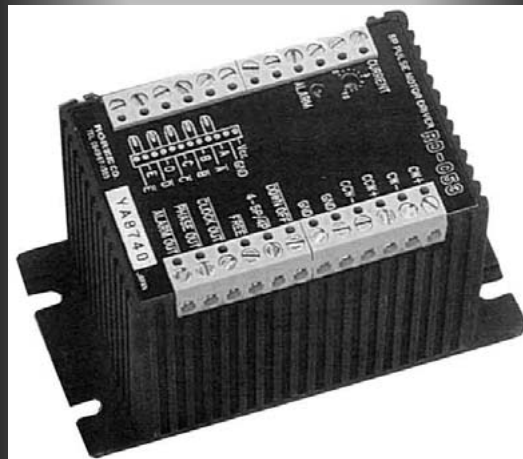


# RORZE

## **RORZE** Instruction Manual



2-ph Stepping Motor Driver  
**RD-053/RD-053N**  
RD-055/055N



## Be sure to read the following precautions for your safety.

This section describes safety precautions to avoid danger to you or someone else, to avoid damage of your property, and to use this product safely.

### Precautions before using this product

This product is designed to be incorporated into general industrial machinery, and is NOT developed to be used in devices such as aerospace machines, security equipment, or other safety devices where a failure or malfunction of this product may directly threaten human lives or health.

Even if you use this product in a general device, make sure that you establish a sufficient level of safety in your device by incorporating a protection function into your machine and guarantee your products based on safety tests on the whole set.

If you will use this product in devices like the above, please contact us. It should be noted that RORZE will not be responsible for any damage caused by using a product in such a device without the consent of RORZE.

## WARNING

**Ignoring the following warnings may cause a death or a serious injury.**

- ◇ Use this product at places where no explosive or flammable stuff exist nearby and no water is splashed on the product. Otherwise it may cause a fire and/or an injury.
- ◇ Turn off the power before moving or wiring the product. Otherwise you may suffer injuries or electric shocks.
- ◇ Do not forcibly bend, pull, or nip lead wires. Otherwise they may cause an electric shock, fire, and/or failure.
- ◇ Do not use lead wires with their sheath damaged. Otherwise they may cause an electric shock, fire, and/or failure.
- ◇ Make sure that wires are correctly and securely connected at electrical terminals. Otherwise they may cause an electric shock, fire, and/or failure.
- ◇ Do not touch the internal parts of this product.
- ◇ Do not disassemble or modify this product.
- ◇ Do not wire or operate a product with wet hands. Otherwise it may cause electric shocks.
- ◇ Assign a qualified person to transport, install, connect, operate, maintenance, or check this product. Otherwise it may cause an electrical shock, a fire and/or an injury.

## CAUTION

**Ignoring the following cautions may result in personal injuries and/or property damages.**

- ◇ Make sure that the delivered product is the one you ordered. Installing the wrong product may cause a fire and/or a failure.

**Check the following items before turning on the power.**

- ◇ The output voltage of the power supply is as described in the specifications.
- ◇ The voltage/current of the input/output terminals conforms to the ratings in the specifications.
- ◇ Input/output terminals are not incorrectly wired or accidentally short-circuited.
- ◇ Do not use with the motor except the stepping motor.
- ◇ Operate the rated current of stepping motor within the specified input current limits only.
- ◇ Please use the wire rod with the cross-section area corresponding to current value.
- ◇ Because this product generates heat, please make it stick to metal board etc. or put the fan and radiate enough.
- ◇ When connecting with terminal block, use a screwdriver whose tip fits an adjustment slot. Tighten the screw in the torque of less than 3.5kgf·cm(0.35N·m)(proper torque is 2.5kgf·cm(0.25N·m)).
- ◇ When you run a product for the first time, make sure that the operation can be stopped immediately under an emergency situation.

**Ignoring the above cautions may cause a fire and/or a failure.**

- ◇ Immediately turn off the power, if you hear an unusual noise. Otherwise it may cause a fire and/or an injury.
- ◇ Do not touch this product when it is in operation, as a malfunction may occur.
- ◇ Do not carry this product by holding its terminal blocks or lead wires. When the product is accidentally dropped, it may cause a personal injury.
- ◇ Do not place this product in unstable positions. When the product is accidentally dropped, it may cause a personal injury.

**Under some circumstances, ignoring the precaution described in the CAUTION section may also result in a death or a severe injury.**

**Follow the above precautions described in both the WARNING and the CAUTION section.**

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## INSTRUCTION MANUAL FOR RD-053/RD-053N

- Clock input method of RD-053 and RD-053N is different.  
The other functions are the same entirely.
- In case of using RD-055/055N, please replace the contents written in section 14 on page10 and read this instruction manual.

### 1. Features

- High power (3A/phase max.)
- Large supply voltage range (18 to 40VDC)
- Circuitry to protect against overheating, over current, and low supply voltage
- Auto current down circuit to reduce heat generation when motor is stationary
- FREE input for rotation of motor by hand
- PHASE OUT output for location of home for excitation timing

## 2. Specifications

Supply voltage	Single 18 to 40VDC (including ripple)
Supply current	Approx. 2 times rated coil current of motor (max.)
Motor current	0.5 to 3A/phase (Adjustable by Current Adjustment Trimmer)
Drive method	Bipolar, constant current chopper method
Excitation method	Full step(4P) or Half step (4-5P)
Auto. current down	50% of the rated current after about 0.3 seconds of inactivity. Even if the motor rotation is stationary, the auto. current down doesn't work under the condition applying voltage between clock input terminals or turning DOWN OFF to Low level (connecting to GND potential).
Protective circuitry	Overheating, over current and low voltage protection
Response frequency	200 kpps max. (at 4.5V to 5.5V)
Weight	Approx. 580g (20.5oz.)
Outside dimensions	63H x 56W x 105Dmm (2.5"H x 2.2"W x 4.1"D)

## 3. Part Name

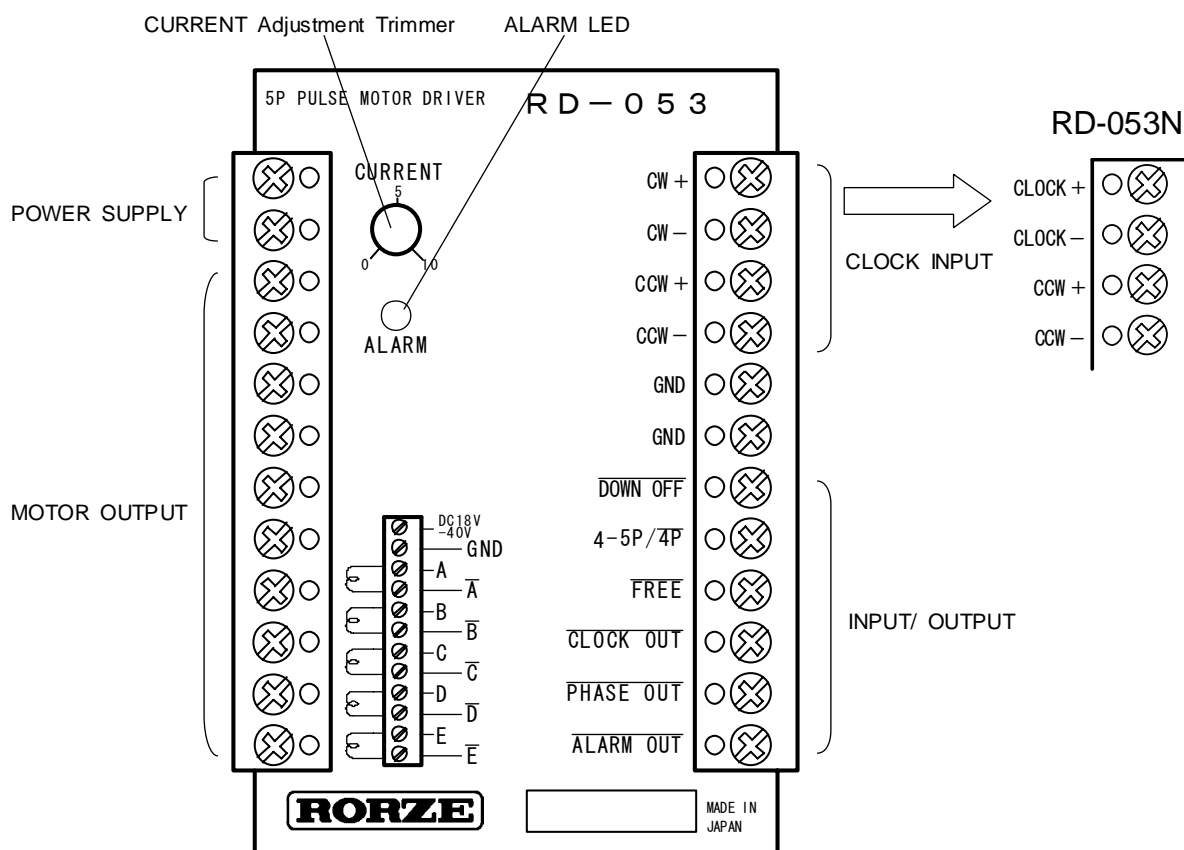


Fig.1. Name Plate

## 4. Current Adjustment

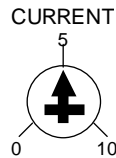


Fig.2. Current Setting Trimmer

## 4-1 Current Adjustment Trimmer

**Caution**

**Please use after adjusting the current within the motor rated current.  
Exceeding the rated current causes the failure of motor or fire.**

This is used to adjust the stepping motor drive current and in general it makes equal to the rated current.

If a motor is used at a high rpm with a lower-than-rated torque, better efficiency and less temperature rise can be obtained by using the motor with a current lower than the rated value.

(Note: As the current decreases, the torque will lower.)

The drive current changes relative to the dial. The value of the setting will be  $\pm 10\%$  of the set value.

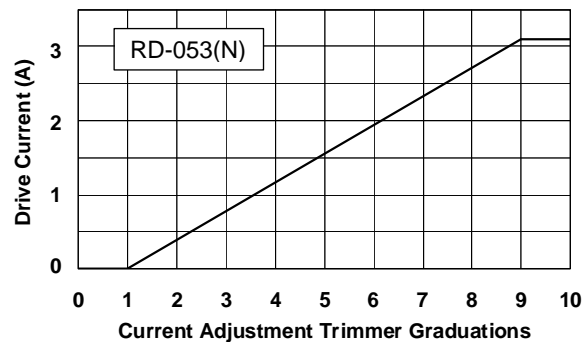


Fig.3. Current Setting

## 4-2 Wiring

In order to measure the exact drive current, connect an ammeter as shown in the 4. "Wiring dimension" and follow the next instructions.

1. Turn ON the power before input the pulse.
2. As reading an ammeter, adjust Current Trimmer and set it to the rated current/phase.

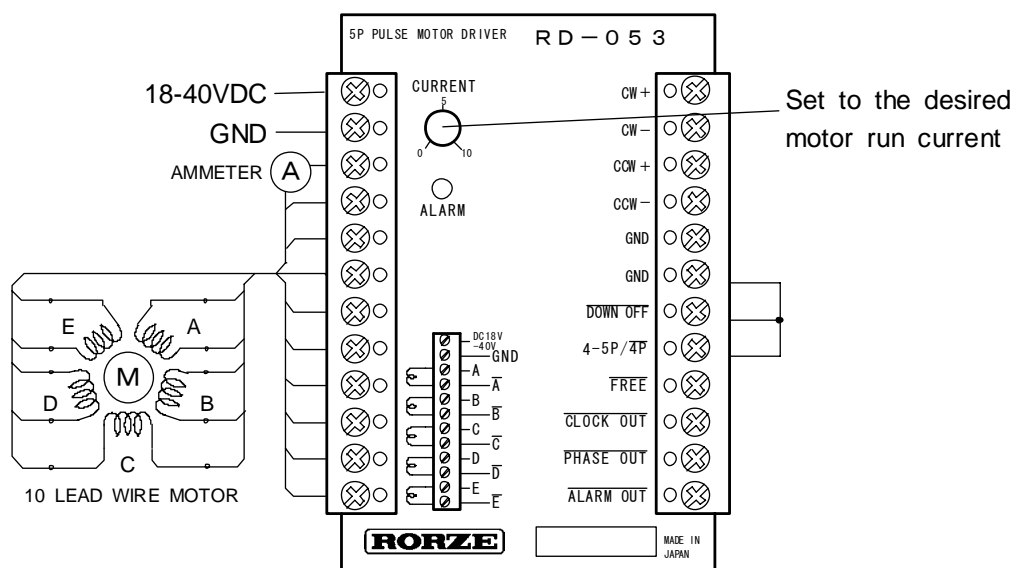


Fig.4. Wiring dimension

## 5. Terminals

### 5-1 Clock Input and Direction Input (CW(CLOCK, CCW)



## Caution

**Please set the current between clock input terminals in the range of 5 to 20mA.  
Do not exceed 20mA because of the danger of failure.  
Do not set the current to 5mA or less because of the danger of malfunction.**

**NOTE: Clock input method of RD-053 and RD-053N is different.**

#### RD-053

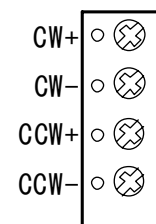
(Input 2 kinds of signals- CW clock pulse and CCW clock pulse)

##### CW+/-

Motor rotates in CW direction with a pulse current of 5 to 20mA from CW+ to CW- terminal.

##### CCW+/-

Motor rotates in CCW direction with a pulse current of 5 to 20mA from CCW+ to CCW- terminal.



**Fig.5. RD-053 Clock Input**

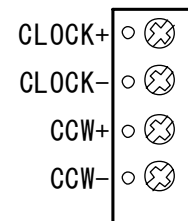
#### RD-053N

(Input clock pulse signal and rotation direction signal.(CLOCK, CCW))

##### CLOCK+/- & CCW+/-

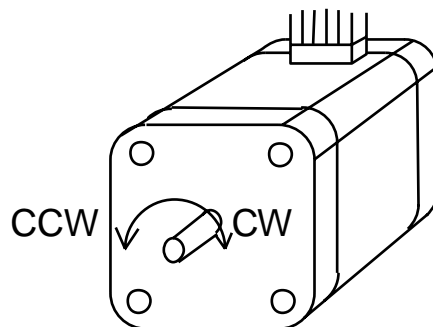
Motor rotates in CW direction with a pulse current of 5 to 20mA from CLOCK+ to CLOCK- terminal and CCW input OFF.

Motor rotates in CCW direction with a pulse current of 5 to 20mA from CLOCK+ to CLOCK- terminal and CCW input turned ON.



**Fig.6. RD-053N Clock Input**

The current in case of using at 4.5 to 5.5V is 10 to 15mA.



**Fig.7. Direction of Rotation**



**5-2  $\overline{\text{DOWN OFF}}$  (Input)**

Turning this terminal to Low level (connecting to GND potential) overrides the current down circuit and holds the motor stationary with full current.

**5-3  $4\text{-}5\text{P}/4\text{P}$  (Input)**

Motor rotates with 4-5phase excitation (half step) when this terminal is High level (open) and with 4-phase excitation (Full step) when Low level (connects to GND potential).

**5-4  $\overline{\text{FREE}}$  (Input)**

Stepping motor drive current turns OFF at Low level (connects to GND potential) and the motor shaft can be rotated by hand.

When turning FREE input to High level (open) again, the motor is excited at the phase home.

NOTE: Do not turn this input ON when motor is running at high speed, this operation would damage the amplifier circuits.

**5-5  $\overline{\text{CLOCK OUT}}$  (Output)**

Outputs clock pulses input to Clock input terminal CW(CLOCK), CCW.

**5-6  $\overline{\text{PHASE OUT}}$  (Output)**

$\overline{\text{PHASE OUT}}$  output (open collector output) is turned ON at the phase home (when phase A through D is excited to plus side).

Once every 10 steps in full step operation (or once every 20 steps in half step), one pulse is put out. (One pulse is put out for every  $7.2^\circ$  rotation of  $0.72^\circ$  motor.)

**5-7  $\overline{\text{ALARM OUT}}$  (Output)**

This terminal puts out a L signal when Overheating protection circuit is in operation. (Open collector output is turned ON.)

**6. ALARM LED**

This will light when Overheating protection circuit is in operation.

7. Timing Diagrams

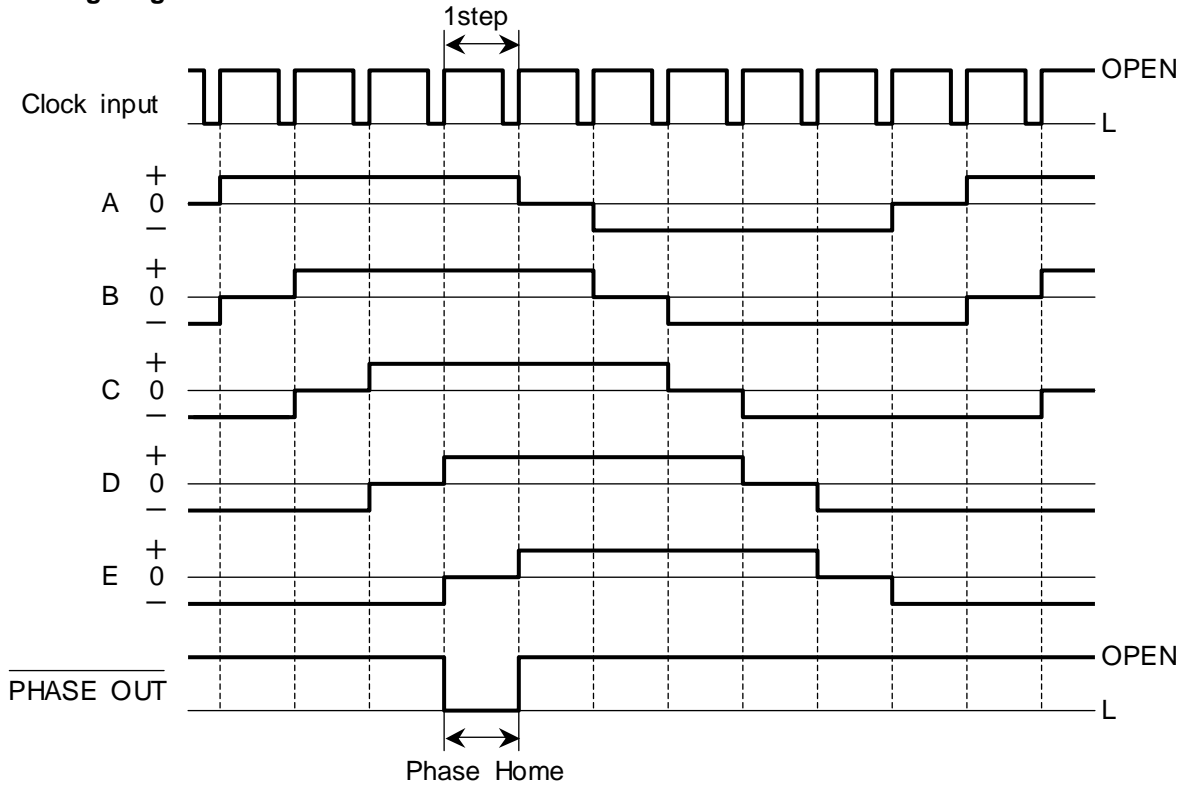


Fig.8. 4-phase Excitation Method (full step)

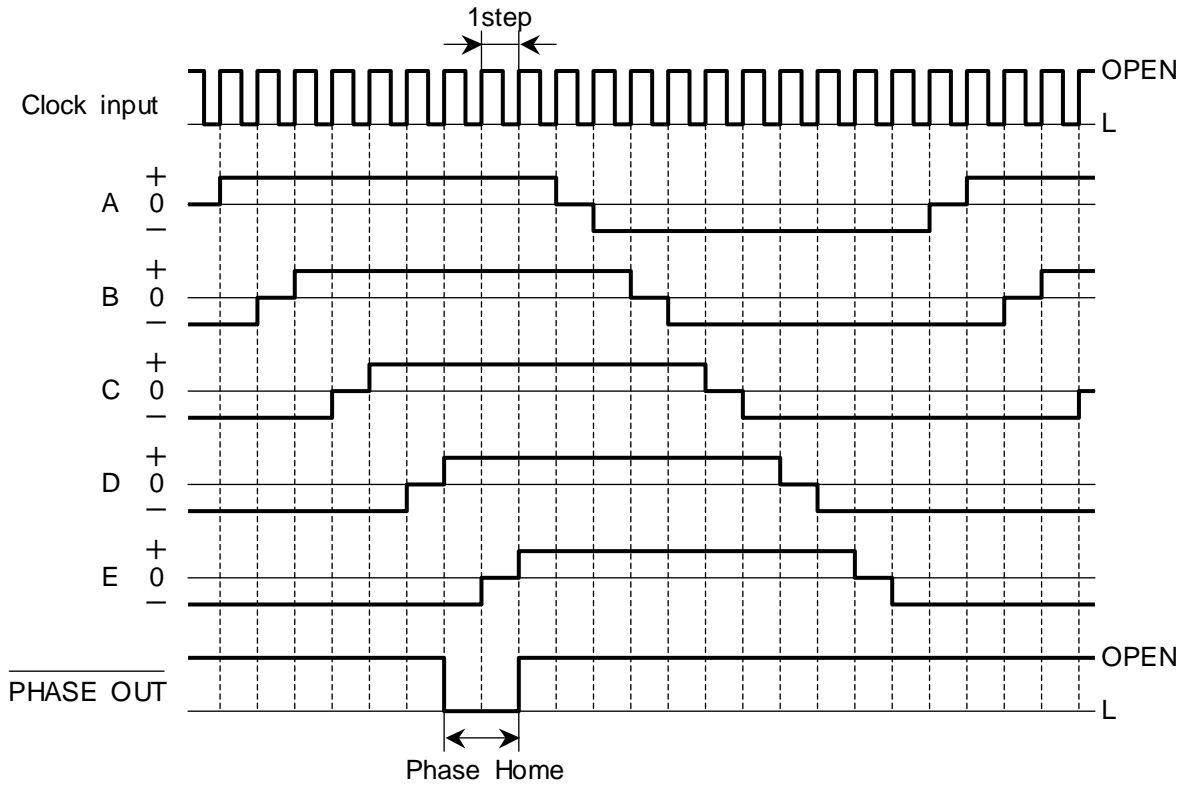


Fig.9. 4-5 phase Excitation Method (half step)

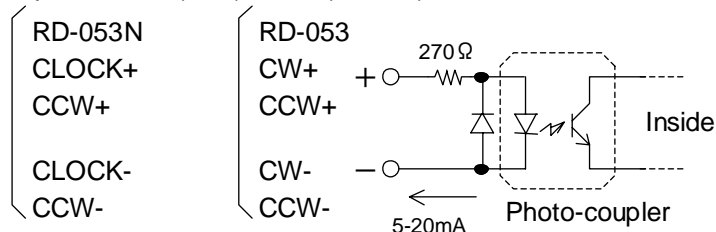
Note: Clock input in the above diagrams indicate voltage waveform of “-” terminal (negative logic) in case of connecting external power supply to each “+” terminal, and open-collector output of external controller to “-” terminal.

## 8. Input/Output Circuits

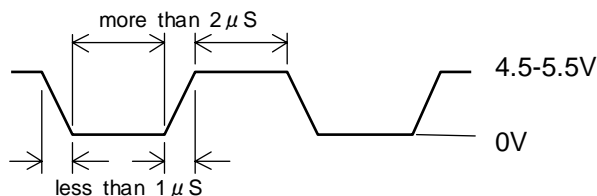
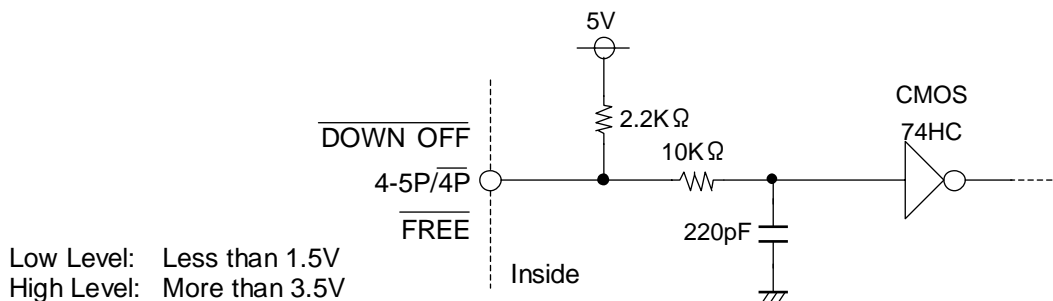
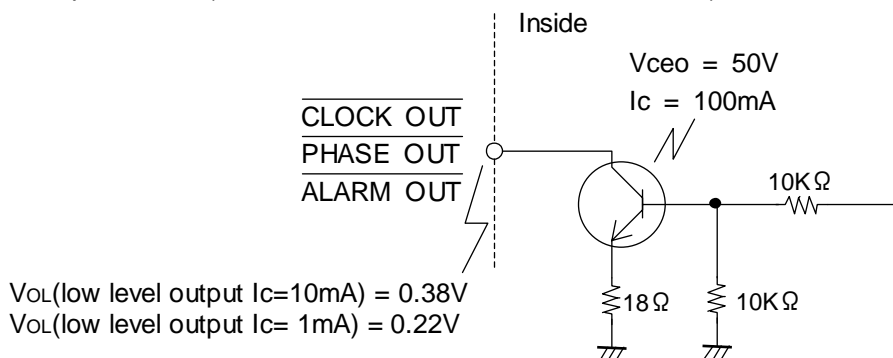
**Caution**

**Do not exceed max. rated current · voltage of each I/O circuit.  
It causes failure or malfunction.**

## 8-1 Clock Input Circuits (CW(CLOCK), CCW)

**Fig.10. Clock Inputs**

Please operate with a pulse current of 5 to 20mA. (10 to 15mA at 4.5 to 5.5VDC)  
If the current exceeds 20mA by connecting with power supply of high voltage (24V etc.) directly,  
please place resistor in series so that current can be set to 5 to 20mA.

**Fig.11. Pulse Specification**8-2 Other Input Circuits ( $\overline{\text{DOWN OFF}}$ , 4-5P/4P,  $\overline{\text{FREE}}$ )**Fig.12. Input Circuits**8-3 Output circuits ( $\overline{\text{CLOCK OUT}}$ ,  $\overline{\text{PHASE OUT}}$ ,  $\overline{\text{ALARM OUT}}$ )**Fig.13. Output circuits**

Do not supply the voltage more than 50V, the current more than 100mA to terminals.

## 9. Wiring Diagram

# **Caution**

**Make sure that there are no mis-wiring and short-circuiting and do not turn power on before wiring correctly. There is danger of fire or failure.**  
**Please tighten the terminals with the torque of less than 3.5kgf·cm (0.35N·m).**

Please use the wire rod with the cross-section area corresponding to current value.  
 Use twisted wire pair for the signal input wiring. Please tighten the terminals less than 3.5kgf·cm (0.35N·m). (Proper torque is 2.5kgf·cm (0.25N·m))

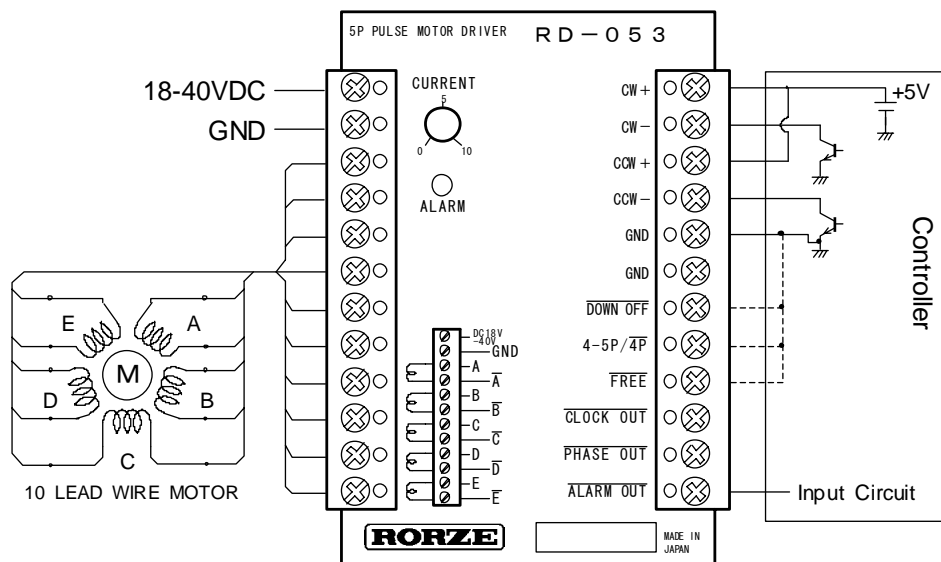


Fig.14. Wiring Diagram

## 9-1 Suitable Motor

You can use any HB(hybrid) or PM(permanent magnet) stepping motor with rating of 0.5 to 3A/ph. Select motors with rating of less than supply voltage  $\times 0.7(V)$ .

RORZE 5-Ph Stepping Motors (Torque -- 1kgf·cm = 13.9oz·in Inertia -- 1g·cm<sup>2</sup> = 5.46745  $\times 10^{-3}$ oz·in<sup>2</sup>)

ModelNo.	Holding Torque		FullStep Angle (Degree)	Rated Current (A/ph)	Rotor Inertia (g·cm <sup>2</sup> )	Resistance ( $\Omega$ )	Inductance (mH)
	(kgf·cm)	(N·m)					
RM5407SM/DM	0.75	0.074	0.36	1.5	18.2	0.6	0.45
RM5411SM/DM	1.1	0.11	0.36	1.5	24	0.65	0.93
RM5414SM/DM	1.4	0.14	0.36	1.5	36	0.89	0.87
RM5623S/D	2.3	0.23	0.72	3.0	57	0.19	0.25
RM5640S/D	4.0	0.39	0.72	3.0	105	0.24	0.37
RM5685S/D	8.5	0.83	0.72	3.0	235	0.46	1.16
RM59A2S/D	12.5	1.23	0.72	3.0	520	0.33	2.0
RM59B2S/D	22.0	2.2	0.72	3.0	1200	0.36	2.5
RM59D0S/D	40.0	3.9	0.72	3.0	1800	0.66	5.4

## Color of RORZE motors wire

	Terminal									
	A	$\bar{A}$	B	$\bar{B}$	C	$\bar{C}$	D	$\bar{D}$	E	$\bar{E}$
RORZE MOTOR	Blue	Red	White	Yellow	Brown	Purple	Black	Gray	Orange	Green

## 10. Heat Dissipation



### Caution

**Please dissipate heat generated by driver and motor enough.  
If it is insufficient, temperature rise causes malfunction, failure or fire.**

Keep the motor's maximum case temperature below 100°C and driver's below 60°C by adjusting the drive current or by installing a cooling fin, fan, etc.

## 11. Other Functions

### 11-1 Auto. current down

After about 0.3 seconds of inactivity, current will be reduced to 50% of running current. This reduces driver and motor heat generation during idle periods.

Also even if the motor rotation is stationary, the auto. current down doesn't work under the condition applying the voltage between clock input terminals or turning DOWN OFF to Low level (connecting to GND potential).

### 11-2 Over heating protection circuit

This works when the internal temperature of the driver reaches  $85^{\circ}\text{C} \pm 4^{\circ}\text{C}$ . It turns ALARM OUT output ON and ALARM LED turns ON. Furthermore, if the temperature keeps on raising, it stops motor compulsively and works auto. current down to prevent the driver burn out. If the body temperature drops about 10°C below the triggered temperature, returns automatically.

### 11-3 Over current protection circuit

This works when abnormal current inside the driver occurred by mis-wiring or short-circuiting etc. has been detected.

### 11-4 Low voltage protection circuit

The driver has a built-in low voltage protection circuit to prevent current overload. The low supply voltage condition normally occurs when power is turned ON.

## 12. Consumption Current

The current consumed by driver and motor varies, depending on the supply voltage, pulse (clock) frequency, motor's inductance, rated current and holding torque. Also, the ripple according to the cycle of PWM (50kHz) and RPM is added into the consumption current. Please use the power supply which current is more than 2 times the rated current of the motor as a standard.

If other devices share the same power supply and voltage change can't be allowed, then use the power supply which can flow 1.7 times of the max value of the supply current, or incorporate a large capacitor.

### 1 3. Relationship between Frequency(pps) and Motor speed(rpm)

“pps” is about pulse speed and stands for the number of pulses per second.  
Formula to calculate rpm:

$$\text{Motor speed(rpm)} = \frac{\text{Step Angle} / \text{Resolution} \times \text{Frequency} \times 60}{360(\text{degree})}$$

Resolution ---- Full step: 1, Half step: 2

Example

Step Angle: 0.72degree, Half step (Resolution: 2), Frequency: 2,000pps

$$\text{Motor speed(rpm)} = \frac{0.72 / 2 \times 2,000 \times 60}{360} = \underline{120 \text{ rpm}}$$

### 1 4. Another Driver

#### 14-1 RD-055

- The motor current of RD-055 is 1A/phase to 5A/phase. Please refer to fig.15 for the current setting graph. (A motor with a current rating of up to 5A/phase can be used.)
- The other specifications of RD-055 are all the same as that of RD-053.

#### NOTE

- Please use the wire rod with the cross-section area corresponding to current value.
- RD-055 is a high power type. It generates much more heat than RD-053, so install a radiator board, fan and etc. to dissipate heat.

#### 14-2 RD-055N

- The motor current of RD-055N is 1A/phase to 5A/phase. Please refer to fig.15 for the current setting graph. (A motor with a current rating of up to 5A/phase can be used.)
- The I/O terminal of RD-055N is the same as that of RD-053N.
- The other specifications of RD-055N are all the same as that of RD-053.

#### NOTE

- Please use the wire rod with the cross-section area corresponding to current value.
- RD-055N is a high power type. It generates much more heat than RD-053, so install a radiator board, fan and etc. to dissipate heat.

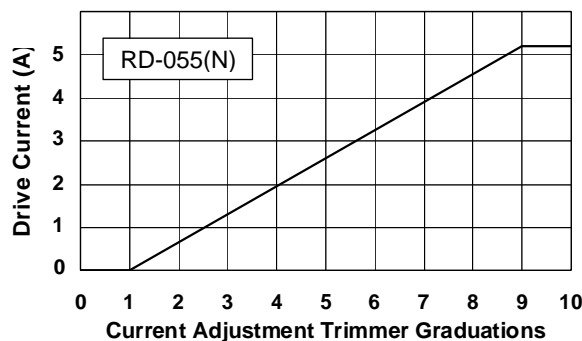


Fig.15. Current Setting

## 1 5. Dimensions

(RD-053N is the same.)

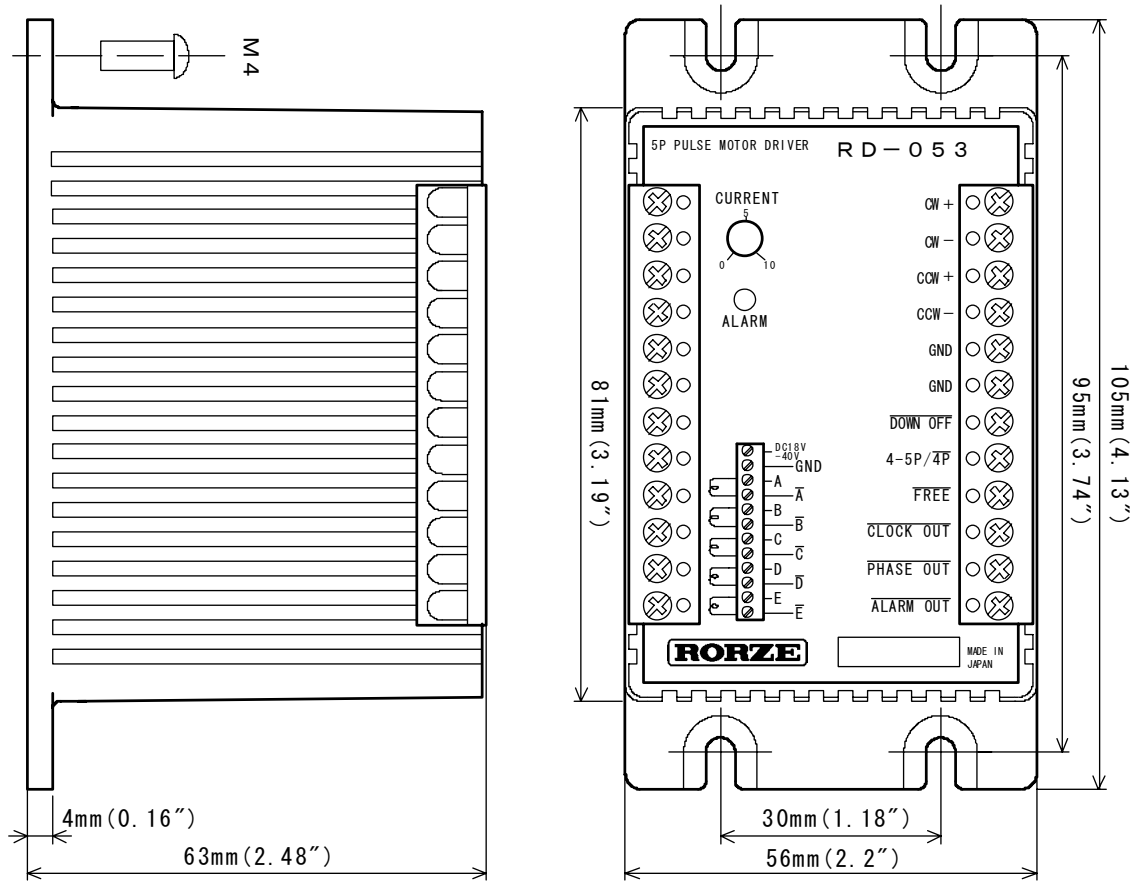


Fig.16. Dimensions

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\*Specifications and products are subject to change without any obligation on the part of the manufacturer.