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User Manual of M335

High Performance Microstepping Driver

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1 Introduction, Features and Application

1.1 Introduction

The M335 is a high performance microstepping driver with low price. The M335 adopts single-chip PWM bipolar sinusoidal chopper to ensure the low vibration and high efficiency. It is suitable for driving 2-phase and 4-phase hybrid stepping motors, so the Nema16-Nema23 stepper motors with a 0.5A-3.5A current will be suitable. If you are looking for a device with low cost, low noise and high-speed, this is an excellent choice for you.

1.2 Features

- ✧ Low cost, Low noise and high-speed.
- ✧ 1, 2, 8, 16 adjustable micro step control for more accurate and smoother motor running.
- ✧ Supply voltage up to 30V DC.
- ✧ Output current up to 3.5A.
- ✧ Single-chip PWM bipolar sinusoidal chopper ensures low vibration and high efficiency
- ✧ Automatic idle-current reduction.
- ✧ Suitable for 2-phase and 4-phase motors.
- ✧ Pulse input frequency up to 400 KHz.
- ✧ Protection of power reversal.
- ✧ High speed optoelectronic isolation signal input.
- ✧ Non-creeping phenomenon under low speed. Low noise and non-resonant region.

1.3 Application

Suitable for a variety of small and medium sized automation equipment and instruments, such as: engraving machine, marking machine, cutting machine, laser typesetting, plotters, CNC machine tools, handling the devices.

2 Specifications

2.1 Electrical Specifications

Parameters	M335			
	Min	Typical	Max	Unit
Output Current	0.6		3A	A
Supply Voltage	+12	+24	+30	VDC
Logic Signal Current	7	10	16	mA
Pulse Input Frequency	0	-	300	KHZ
Isolation Resistance	500			MΩ

2.2 Operating Environment & Other Specifications

Cooling	Natural Cooling	
Operating Environment	Environment	Avoid dust, oil fog, corrosive gas
	Ambient Temperature	0℃-+50℃
	Operating Temperature	70℃(158 ˚F)
	Humidity	40-90% RH9
	Vibration	5.9m/S2 Max
Storage Temperature	-20℃-125℃	
Weight	Approx.200g	

2.3 Mechanical Specification

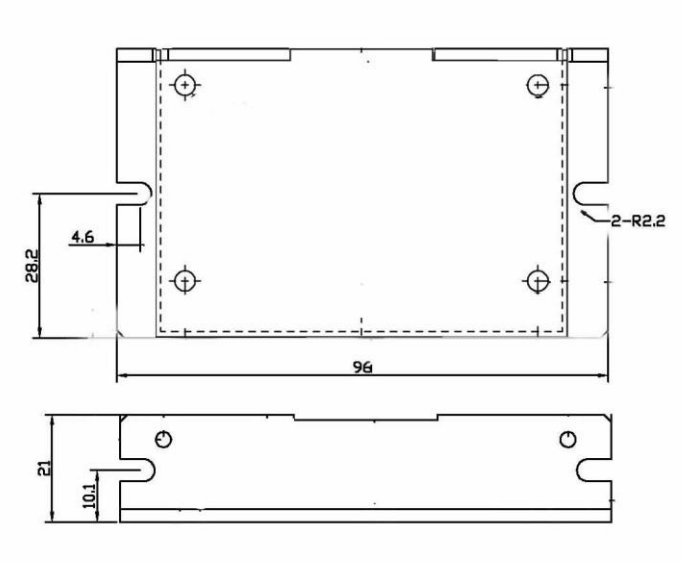


Figure 2.3 Mechanical Specification

Note: Recommend use side mounting for better heat dissipation Elimination of Heat

3 Interface and wiring Introduction

3.1 Weak Current Interface Description

Pin Function	Details
PUL+(+5V)	Pulse signal: Single pulse(pulse/direction) mode. 4-5V when PLU-HIGH, 0-0.5V when PUL-LOW. For reliable response, pulse width should be longer than 1.5uS. Series connect resistors for current-limiting when +12V or +24V used.
PUL-	
DIR（+5V）	DIR signal: This signal has low/high voltage levels, representing two directions of motor rotation; For reliable motion response, DIR signal should be ahead of

DIR-	PUL signal by 5μs at least. 4-5V when DIR-HIGH, 0-0.5V when DIR-LOW. Please note that motion direction is also related to motor-driver wiring match. Exchanging the connection of two wires for a coil to the driver will reverse motion direction.
EN+（+5V）	Enable signal: (NPN control signal, PNP and Differential control signals are on the contrary, namely Low level for enabling.) for enabling the driver and low level for disabling the driver. Usually left UNCONNECTED (ENABLED)
EN-	

3.2 Strong Current Interface Description

Pin Function	Details
DC+	Power supply, 12~30 VDC. Recommend voltage:24V
DC-	
A+, A-	Motor Phase A
B+, B-	Motor Phase B

3.3 Input Interface Description

The M335 can accept differential and single-ended inputs (including open-collector and PNP output). The M335 has 3 optically isolated logic inputs which are located on connector P1 to accept line driver control signals. These inputs are isolated to minimize or eliminate electrical noises coupled onto the drive control signals. We recommend to use line driver control signals to increase noise immunity of the driver in interference environments. In the following figures, connections to open-collector and PNP signals are illustrated.

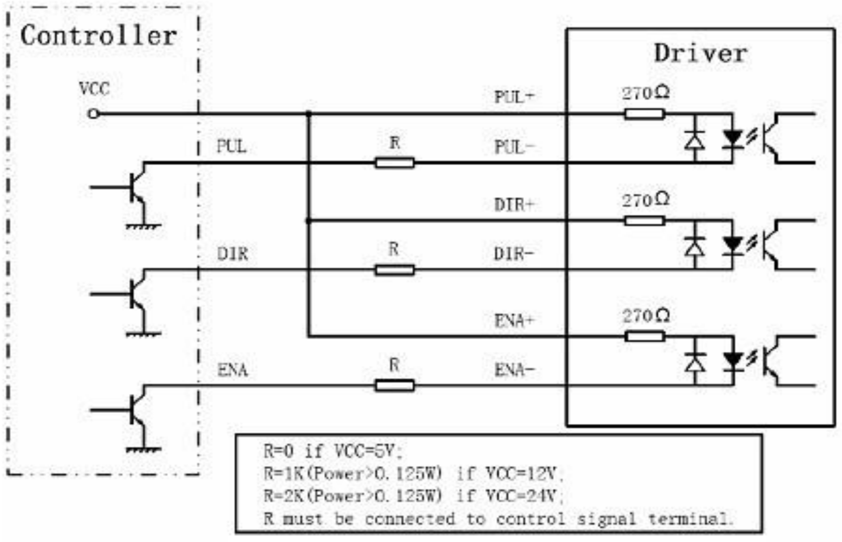


Figure 3.3-1 Connections to open-collector signal (common-anode)

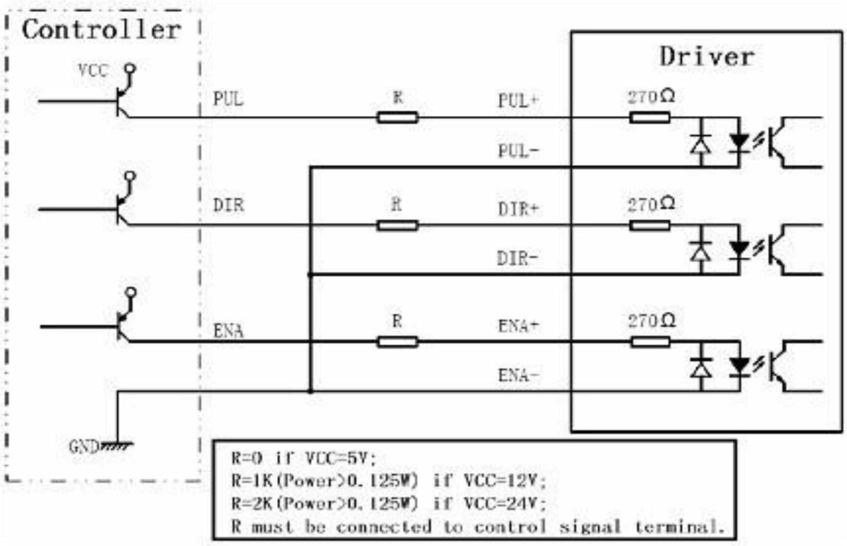


Figure 3.3-2 Connection to PNP signal (common-cathode)

3.4 Sequence Chart of Control Signal

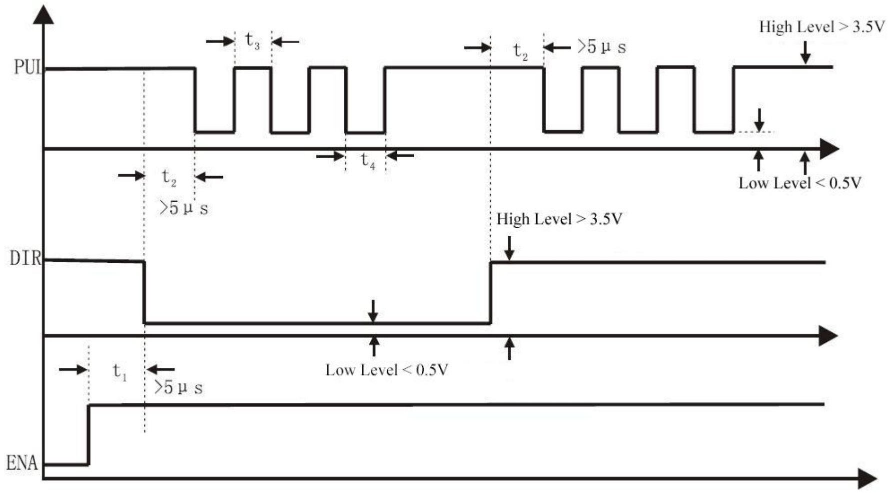


Figure 3.4 Sequence chart of control signals

Remark:

(1) t1: ENA must be ahead of DIR by at least 5 μs. Usually, ENA+ and ENA- are NC (not connected). See "Connector P1 Configurations" for more information.

(2) t2: DIR must be ahead of PUL effective edge by at least 5 μs to ensure correct direction;

(3) t3: Pulse width not less than 1.5 μs;

(4) t4: Low level width not less than 1.5 μs.

3.5 Wiring Notes

- In order to improve anti-interference performance of the driver, it is recommended to use twisted pair shield cable.

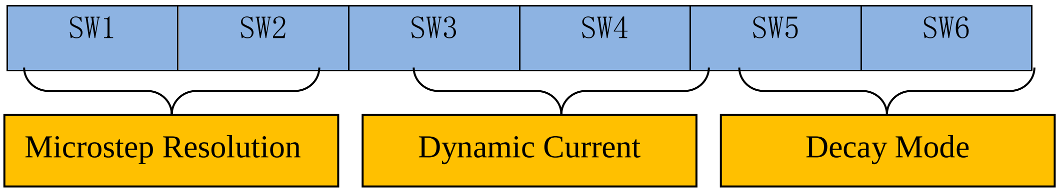
- To prevent noise incurred in pulse/dir signal, pulse/direction signal wires and motor wires should not be tied up together. It is better to separate them by at least 10 cm, otherwise the disturbing signals generated by motor will easily disturb pulse direction signals, causing motor position error, system instability and other failures.

- If a power supply serves several drivers, separately connecting the drivers is recommended instead of daisy-chaining.

- It is prohibited to pull and plug connector P2 while the driver is powered ON, because there is high current flowing through motor coils (even when motor is at standstill). Pulling or plugging connector P2 with power on will cause extremely high back-EMF voltage surge, which may damage the driver.

4 Selecting Microstep Resolution, Decay mode and Driver Output Current

This driver uses a 6-bit DIP switch to set micro step resolution, motor operating current and decay mode as shown in the following figure:



4.1 Microstep Resolution Selection

Microstep resolution is set by SW1, 2 of the DIP switch as shown in the following table:

SW1	SW2	Microstep resolution
OFF	OFF	1
ON	OFF	1/2
ON	ON	1/8
OFF	ON	1/16

Note: For smooth operation, please try to choose high segmentation, such as 1/16 segmentation

4.2 Current Settings

Output current is set by SW3, 24of the DIP switch as shown in the following table:

SW3	SW4	Full Current		Auto Half Current	
		Peak Current	RMS	Peak Current	RMS
OFF	OFF	3A	2.14A	1.5A	1.07A
ON	OFF	2.25A	1.6A	0.6A	0.42A
OFF	ON	1.5A	1.07A	1.5A	1.07A
ON	ON	0.6A	0.42A	0.6A	0.42A

Note: Output current is automatically switched to 50% after signal pulse stop for about 0.4 seconds (according to the table settings). This can make the motor and drive heating reduction, improved reliability. Theoretically 25% reduction in the heat (heat is proportional to the square of the current).

4.3 Decay Mode Settings

With the decay mode from 0% to 100%, the attenuation increases. Users can eliminate the stepper motor locked noise and improve motion stabilization by switch SW5, SW6.

SW5	SW6	Decay Mode
OFF	OFF	No Decay
ON	OFF	Slow Decay
OFF	ON	Medium Speed Decay
ON	ON	Fast Decay

5 Power supply selection

The M335 can match medium and small size stepping motors (from NEMA size 14 to 23) .To achieve good driving performances, it is important to select supply voltage and output current properly. Generally speaking, supply voltage determines the high speed performance of the motor, while output current determines the output torque of the driven motor (particularly at lower speed). Higher supply voltage will allow higher motor speed to be achieved, at the price of more noise and heating. If your speed requirement is low, it is better to use lower supply voltage to decrease noise, heating and improve reliability.

Both regulated and unregulated power supplies can be used to supply the driver. However, unregulated power supplies are preferred due to their ability to withstand current surge. If regulated power supplies (such as most switching supplies.) are indeed used, it is important to have large current output rating to avoid problems like current clamp, for example using 4A supply for 3A motor-driver operation. On the other hand, if unregulated supply is used, one may use a power supply of lower current rating than that of motor (typically 50%～70% of motor current). The reason is that the driver draws current from the power supply capacitor of the unregulated supply only during the ON duration of the PWM cycle, but not during the OFF duration. Therefore, the average current withdrawn from power supply is considerably less than motor current. For example, two 3A motors can be well supplied by one power supply of 4A rating.

The power MOSFETS inside the M335 can actually operate within +12～30VDC, including power input fluctuation and back EMF voltage generated by motor coils during motor shaft deceleration. Higher supply voltage can increase motor torque at higher speeds, thus helpful for avoiding losing steps. However, higher voltage may cause bigger motor vibration at lower speed, and it may also cause over-voltage protection or even driver damage. Therefore, it is suggested to choose only sufficiently high supply voltage for intended applications, and it is suggested to use power supplies with theoretical output voltage of +12～+ 24V, leaving room for power fluctuation and back-EMF

6 Connections to Stepping Motors

6.1 Connections to 4-lead Motors

4 lead motors are the least flexible but easiest to wire. Speed and torque depends on winding inductance. In setting the driver output current, multiply the specified phase current by 1.4 to determine the peak output current.

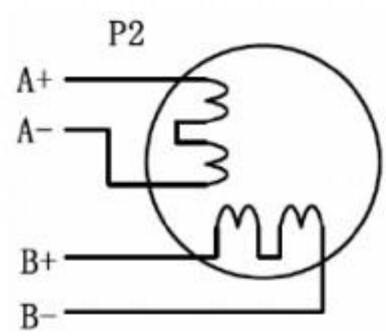


Figure 6.1 4-lead Motor Connections

6.2 Connections to 6-lead Motors

Like 8 lead stepping motors, 6 lead motors have two configurations available for high speed or high torque operation. The higher speed configuration, or half coil, is so described because it uses one half of the motor's inductor windings. The higher torque configuration, or full coil, uses the full windings of the phases.

Half Coil Configurations

As previously stated, the half coil configuration uses 50% of the motor phase windings. This gives lower inductance, hence, lower torque output. Like the parallel connection of 8 lead motor, the torque output will be more stable at higher speeds. This configuration is also referred to as half chopper. In setting the driver output current multiply the specified per phase (or unipolar) current rating by 1.4 to determine the peak output current.

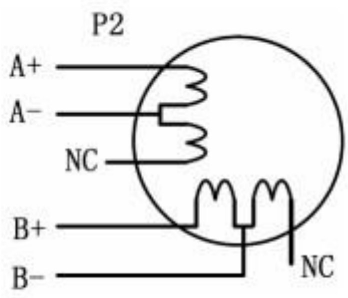


Figure 6.2-1 6-lead motor half coil (higher speed) connections

Full Coil Configurations

The full coil configuration on a six lead motor should be used in applications where higher torque at lower speeds is desired. This configuration is also referred to as full copper. In full coil mode, the motors should be run at only 70% of their rated current to prevent overheating.

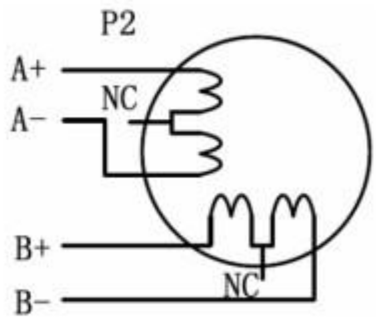


Figure 6.2-2 6-lead motor full coil (higher torque) connections

6.3 Connections to 8-lead Motors

8 lead motors offer a high degree of flexibility to the system designer in that they may be connected in series or parallel, thus satisfying a wide range of applications.

Series Connections

A series motor configuration would typically be used in applications where a higher torque at lower speeds is required. Because this configuration has the most inductance, the performance will start to degrade at higher speeds. In series mode, the motors should also be run at only 70% of their rated current to prevent overheating.

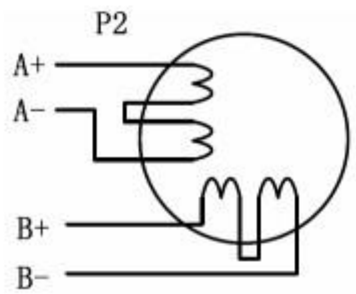


Figure 6.3-1 8-lead motor series connections

Parallel Connections

An 8 lead motor in a parallel configuration offers a more stable, but lower torque at lower speeds. But because of the lower inductance, there will be higher torque at higher speeds. Multiply per phase (or unipolar) current rating by 1.96, or the bipolar current rating by 1.4, to determine the peak output current.

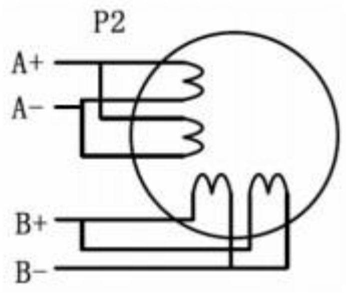


Figure 6.3-2 8-lead motor parallel connections

7 Frequently Asked Questions

Symptoms	Possible Problems
Motor is not rotating	No power
	Microstep resolution setting is wrong
	DIP switch current setting is wrong
	Fault condition exists
	The driver is disabled
Motor rotates in the wrong direction	Motor phases may be connected in reverse
The driver in fault	DIP switch current setting is wrong
	Something wrong with motor coil
Erratic motor motion	Control signal is too weak
	Control signal is interfered
	Wrong motor connection
	Something wrong with motor coil
	Current setting is too small, losing steps
Motor stalls during acceleration	Current setting is too small
	Motor is undersized for the application
	Acceleration is set too high
	Power supply voltage too low
Excessive motor and driver heating	Inadequate heat sinking / cooling
	Automatic current reduction function not being utilized
	Current is set too high