

BL-240M (low-noise)  
(5.6A,20-70V,128 subdivision)

## Micro Step Driver Datasheet

Version 1.0

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【 Please read this manual carefully before using it 】



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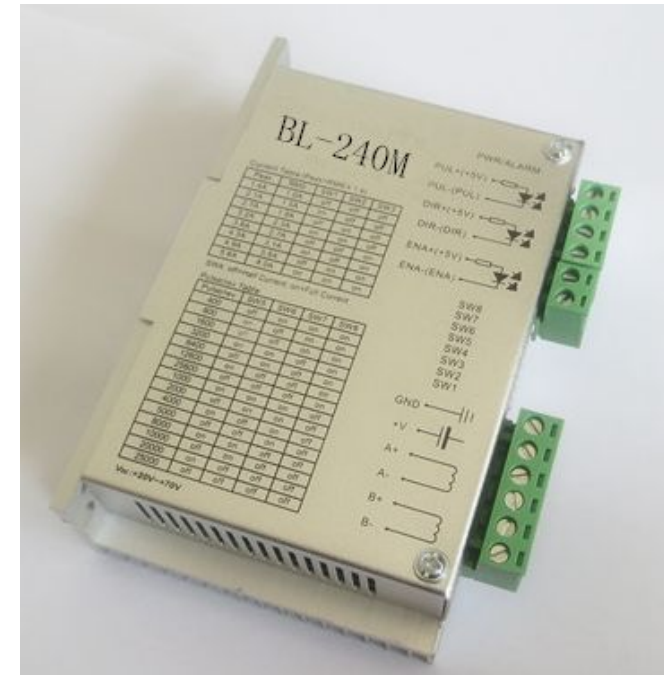
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## BL-240M Stepper Motor Driver

### Chapter One Introduction

#### 1.1 Outline

BL-240M is a high performance price ratio subdivision driver successfully developed by our company. Especially suitable for large volume and low cost usage ,the driver also has many advantages. As a result of the three-state control technology, this type of driver are significantly improved at noise and fever than the majority of low cost drivers in the market. This driver has as many as fifteen kinds of subdivision options with binary and five hex. In order to compatible with some PLC, this driver provides a backup function of the double pulse. Users only need to change the jumper in the driver, you can let the driver to accept CW positive pulse and reverse pulse CCW. The eight bit dial switch group (SW1-SW8), which can be used to set the dynamic current (eight bit three file), static current (SW4) and the subdivision of the selection (SW5-SW8). When SW4 stop,you can choose the flow or half flow, such as the choice of half flow, the pulse stop about 0.4 seconds after the motor current will be reduced to set the value of 60%, the calorific value will be reduced to half the total flow of the following (I2R). Compared with MA335B, the drive voltage and current range is expanded, the heat and noise of the motor is improved obviously, and the high speed performance is improved, and the size of the actuator is reduced. So it's highly competitive and attractive.compared to most of the small and medium drive on the market.

#### 1.2 Feature

- National patent technology
- Optical isolated differential signal input, the pulse response frequency is the highest up to 400KHz.
- Cheap price and high torque
- Supply voltage can reach 70VDC, the maximum output current can reach 5.6A (the

average value is 4.0A).

- e. Subdivision accuracy of 4, 6, 8,16,32,64,128,5,10, 20, 25, 40, 50,100,125 times subdivision options
- f. Three-state current control technology of motor produce low fever
- g. The little size (118 x 75.5 x 33mm)
- h. Current setting is convenient, eight optional files; when the motor is at rest, the current automatically halved
- i. Can drive 4, 6, 8 line two-phase or four-phase stepper motor
- j. It has over voltage, short circuit protection function
- k. Selectable pulse rising edge or falling edge triggered
- l. Pulse direction is CW or CCW

### 1.3 Usage

This type of driver is suitable for all kinds of small and medium automation equipment and apparatus.Such as engraving machine, marking machine, cutting machine, laser Phototypesetting, plotter, CNC machine tools, handling device and so on. Effect is particularly good In low cost, low noise and high speed equipment.

## Chapter Two Electrical, mechanical and environmental specification

### 2.1 Electrical

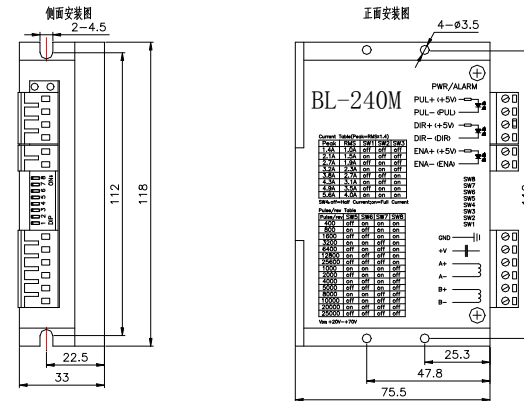
Instruction	BL-240M			
	Min	Typical	Max	Unit
Output current	0.54	-	5.6 (average 4)	A
Input power supply	20	60	70	VDC
Logic input current	7	10	16	mA
Step pulse frequency	0	-	300	KHz
Insulation resistance	500			MΩ

### 2.2 Environment and parameters

Type of cooling		Natural cooling or forced air cooling
Environment	Place	Avoid dust, oil mist and corrosive gas
	Temperature	0℃-50℃
	Max operating temperature	70℃
	Humidity	40-90%RH9 (No condensation and water)
	Vibration	5.9m/s2 Max
	Save temperature	-20℃-125℃
	Weight	280g

### 2.3 Mechanical installation diagram

Unit: mm



1 Mechanical installation diagram

(Recommended by the driver installed in the side, better heat dissipation!)

## 2.4 Heat dissipation method

- The reliable operating temperature of the actuator is usually within 60℃, and the operating temperature of the motor is within 80℃.
- Choose to use automatic half flow system (that is, the motor stop automatically when the current 60% reduction), to reduce the motor and the drive of fever.
- Please install the drive by the side mounted vertically, in order to make the effective heat dissipation area of the heat sink is the largest and form strong air convection. If necessary, you can install a fan near the driver in machine, forced cooling, to ensure that drivers in reliable working temperature range.

## Chapter Three Interface and wiring introduction

### 3.1 P1 weak electric signal interface description

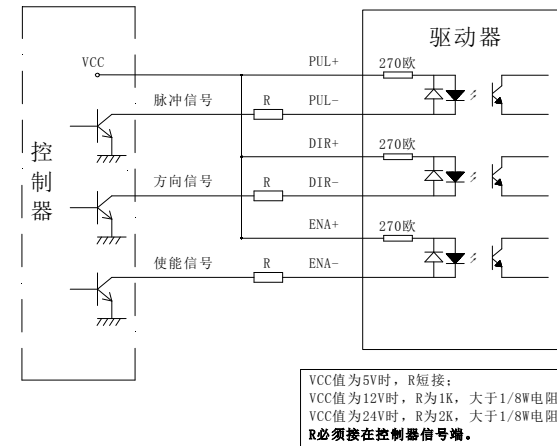
Name	Function
PUL+ (+5V)	Pulse control signal: pulse rising edges effective; PUL- high voltage is 4-5V, the low voltage is 0-0.5V. In order to respond the pulse signal reliably, pulse width can be set greater than 1 μs. When the working voltage is +12V or +30V, we need a series resistance.
PUL- (PUL)	
DIR+ (+5V)	Directional signal: High / low level signal, corresponding to the positive and negative motor. The signal should be established prior to the pulse signal at least 5 μs, in order to guarantee motor commutate reliability. The initial running direction of motor depends on the wiring. Swap any two wires which belongs to three-phase winding U, V, W can change the initial direction of the motor running, DIR-high voltage is 4-5V and the low is 0-0.5V.
DIR- (DIR)	
ENA+ (+5V)	Enable signal: this input signal is used to enable or disable. High level enable, low level can not work. The general situation can not be connected, so that it can be enabled automatically.
ENA- (ENA)	

### 3.2 P2 heavy current interface description

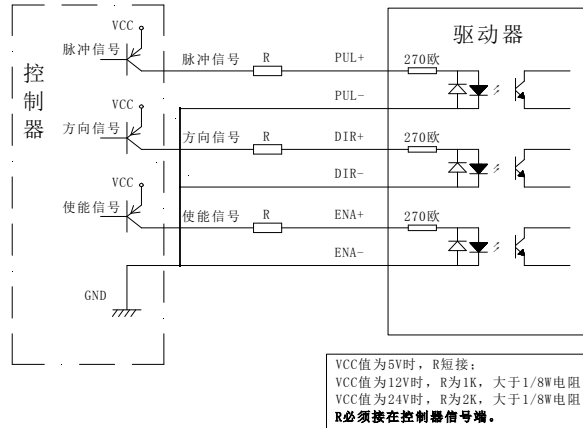
Name	Function
GND	DC power supply grounded
+V	DC power supply positive, +20V - +70V between any value can be, but it is recommended around +60VDC
A	A phase. A-, A+ can be replaced, then change the direction of a motor running
B	B phase. B-, B+ can be replaced, then change the direction of a motor running

### 3.3 Input interface description

BL-240M drive using differential interface circuit that suitable for differential signal. Single-ended used common cathode and common anode interfaces, high-speed optical coupler built-in, long drive allowed, signal of open collector and PNP output circuit. In the harsh environment applications, we recommend using long drive circuit because of its anti-interference ability. Now open collector and PNP output as an example, the interface circuit diagram is as follows:



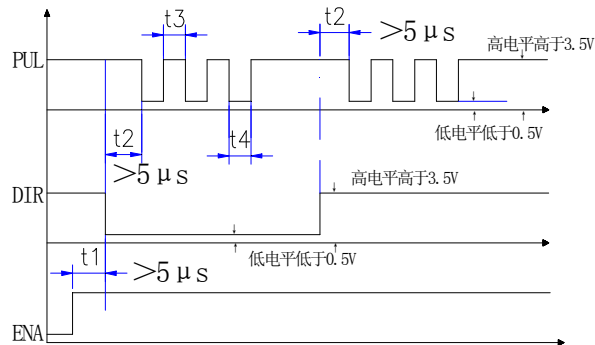
2 Input interface circuit of open collector (common anode)



3 Input interface circuit of PNP output (common cathode)

### 3.4 Control signal timing diagram

In order to avoid malfunctions and deviations, PUL, DIR and ENA should meet certain requirements, as follows:



4 timing diagram

Note:

A: ENA (enable signal) should be established prior to DIR at least 5 μs, ensure that to be high.

Under normal circumstances, proposed ENA+ and ENA- be left vacant.

B: DIR at least PUL in advance of the falling edge of 5μs to determine its status of high or low.

C: Pulse width of at least not less than 1μs.

D: Low-level width of not less than 1μs.

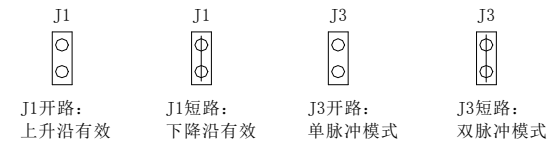
### 3.5 Internal jumper Description

a: Select the effective pulse edge

b: By setting a jumper row J1 inside the driver, determined BL-240M is receiving rising edge or falling edge, as shown below, factory setting is rising edge.

c: Choose single-pulse and double-pulse mode

d: Inside the drive has a jumper row J3 dedicated to set the pulse control mode, single pulse and double pulse mode is set as follows, factory setting is one-pulse mode.



### 3.6 Wiring Requirements

a. In order to prevent the driver from interference, we recommend the use of shielded twisted pair cable and connect the shield to the ground; the same machine can only be allowed at the same point, if it is not a real grounding line, may interfere with serious, the shielding layer is not connected at this time.

b. Pulse direction signal line and the motor line does not allow side by side together, preferably separated by at least 10cm or more, otherwise the motor noise easily disturb pulse direction signals cause the motor positioning allowed, system instability and other failures.

c. If one power supply for more than one drive, connected in parallel with the power supply, it is not allowed that supply taken at the first one and then another chain connection.

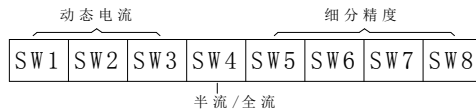
d. Prohibit electric plug drives strong electrical P2 terminals, when the motor is stopped still live large current flows through the coil, plug P2 terminal will lead to huge moment induced

electromotive force will burn drive.

e. Prohibited the lead after the first Makassar then access terminals, or may be due to the contact resistance increases, overheating and damage to the terminal.

## Chapter Four Current,subdivision and dial switch settings

The BL-240M driver uses eight bit dial switches to set the subdivision accuracy, the dynamic current and the half flow/ total flow. Details are as follows:



### 4.1 The current settings

The SW1-SW3 three bit dial switch is used to set the current (dynamic current) of the motor running, while the SW4 dial switch is used to set the quiescent current (quiescent current).

A. Work (dynamic) current set, with a total of three dial switch can be set to eight current levels, see table below.

MAX (A)	AVERAGE (A)	SW1	SW2	SW3
1.4	0.99	off	off	off
2.1	1.41	on	off	off
2.7	1.91	off	on	off
3.2	2.26	on	on	off
3.8	2.69	off	off	on
4.3	3.04	on	off	on
4.9	3.46	off	on	on
5.6	3.96	on	on	on

B. Stop (static) current setting, quiescent current can be set by SW4, off is set quiescent current (actually 60%)to half of the Dynamic current, on represents the static current and

dynamic current is the same. In general use SW4 should be set to off, so that the motor and drive heating reduction, increased reliability. About 0.2 seconds after the pulse train stops, the current is automatically reduced to 60% of the setting value, and the calorific value is reduced to 36% (proportional to the square of the heat and current).

### 4.2 Subdivision settings

Subdivision accuracy is set by SW5-SW8 four dial switches.

Subdivision	step/r (1.8°)	SW5	SW6	SW7	SW8
2	400	off	on	on	on
4	800	on	off	on	on
8	1600	off	off	on	on
16	3200	on	on	off	on
32	6400	off	on	off	on
64	12800	on	off	off	on
128	25600	off	off	off	on
5	1000	on	on	on	off
10	2000	off	on	on	off
20	4000	on	off	on	off
25	5000	off	off	on	off
40	8000	on	on	off	off
50	10000	off	on	off	off
100	20000	on	off	off	off
125	25000	off	off	off	off

### 4.3 Single and double pulse selection

In general, the factory is set to a single pulse mode (i.e., pulse plus direction) if you need to double pulse function to tell us in advance in order to special treatment.

## Chapter Five Power supply selection

Power supply voltage between **DC20V - 70V** can work normally, BL-240M driver is best to use the non regulated DC power supply, also can use the "transformer buck + bridge rectifier + capacitor filter" way, capacitor desirable 6800uf or 10000uf. However, the maximum value of the rectified voltage ripple does not exceed **70V**. Recommended to use + 30V-60V DC power supply to avoid power fluctuations over the drive voltage range. If you use regulated switching power supply, should pay attention to the power supply output current range must be greater than the motor current.

### Note :

- The power supply wiring do not reverse the positive and negative.
- It is better to use non regulated power supply.
- When using non regulated power supply,the supply current output capacity should be greater than current drive to 60%.
- When using regulated power supply, the output current of the power supply should be greater than or equal to the operating current of the drive.
- In order to reduce the cost, the two or three drivers can share a power supply, but should ensure that the power is large enough.

## Chapter Six Matching motor

BL-240M can be used to drive 4,6,8 line of two-phase and four phase hybrid step motor, step angle for 1.8 and 0.9 degrees can be applied. The choice of motor is mainly determined by the motor's torque and the rated current. The torque is mainly determined by the size of the motor, a large motor has a high torque. The current size is mainly concerned with the inductance, small motor inductance good high-speed performance, but the current is large. Please contact the Burroughs Corporation sales (0519-88372126 or E-MAIL:info@baolai-cn.com) to consult the specific method of motor selection!

## 6.1 Matching motor selection

A. Determine the load torque, the transmission ratio operating speed range

$$T=C [(J \times a_1 \times \eta) / i^2 + I / 2 \mu \times M \times D + J_1 \times a_2]$$

J: Moment of inertia of the load a1: The maximum angular acceleration of load  
a2; Drive wheel or screw angular acceleration

M: Weight of load C: A safety coefficient ,1.2 1.4 recommended

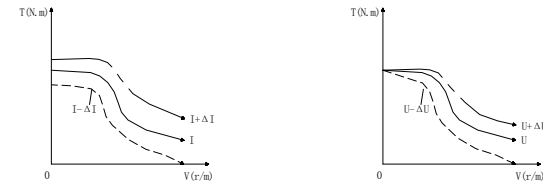
$\mu$ : The coefficient of friction  $\eta$ : Transmission efficiency D: Screw and wheel diameter

J1: Moment of inertia of rotating wheel or screw rod i: Rotation ratio

B. What factors can determine the motor output torque?

For a given step motor and the connection method, the output torque has the following characteristics:

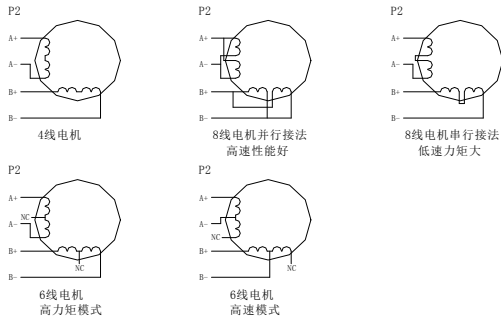
- The greater the motor working current, the greater the output torque, but the more motor copper loss ( $P=I^2R$ ), the more motor heat deflection;
- The higher the driver supply voltage, the higher the speed of the motor;
- By stepping motor torque-speed characteristic in the figure followed shows that high speed is smaller than in the low speed torque.



5 torque-speed characteristic

## 6.2 Motor wiring

For line 6, 8 stepper motor, the different connection leads to a significant difference on the effect, as described below:



6 motor wiring

### 6.3 The selection of the output voltage and output current

BL-240M driver can drive two phase and four phase hybrid stepping motor, in order to achieve the most satisfactory driving effect, it is necessary to select a reasonable power supply voltage and current. The power supply voltage determines the high speed performance of the motor, and the current setting value determines the torque of the motor.

#### A. The power supply voltage settings

Generally speaking, the higher the power supply voltage, the higher the torque of the motor is, the more it can avoid the losing step in a high speed. But on the other hand, the voltage is too high to cause over-voltage protection, motor heating is more, even can damage the driver. When working under high voltage, the vibration of the motor at low speed will be larger.

#### B. Current settings

For the same motor, the greater the current setting value, the greater the output torque is, but the fever of the motor and driver is more serious. The size of the specific heat is not only related to the setting value, but also related to the movement type and residence time. The following setting method is used as a reference for the rated current of the motor, but the optimal value of the actual application should be adjusted on the basis of this method. In principle, such as low temperature (less than 40), can be considered to increase the current setting value to increase the motor output power (torque and high-speed response).

a. Four wire motor and six wire motor in high speed mode: output current is set to be equal

to or less than the motor rated current value;

b. Six wire motor in high torque mode: output current motor rated current of 70%;

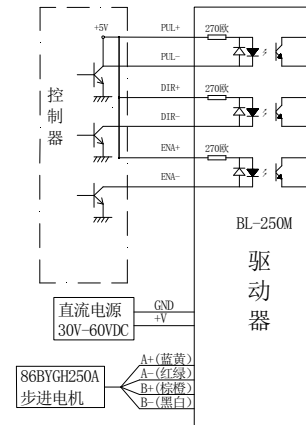
c. Eight wire motor series connection method: because the series resistance increases, the output current should be set to 70% of the rated current of the motor;

d. Eight wire parallel connection method: the output current can be set to 1.4 times the rated current of the motor.

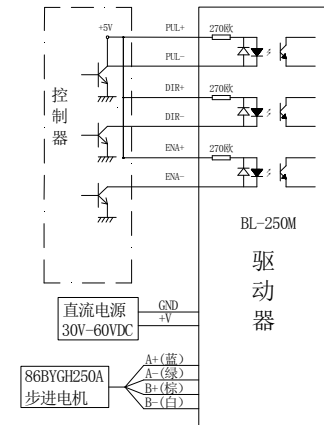
Note: Please operate motor 30 to 60 minutes after current setting, such as the motor temperature rise is too high ( $> 70^{\circ}\text{C}$ ), you should reduce the current settings. Therefore, the general situation is set to the current value of the motor warm but not too hot when long-term work.

## Chapter Seven Typical wiring case

BL-240M with 86BYGH250A series and parallel connection method (if the motor don't turns to the desired direction, only the exchange of A+, A- position will be OK). BL-240M driver can drive two phase and four phase stepping motor with four -line, six-line and eight-line. The details of wiring are as followed:



7 parallel connection



8 series connection



## Chapter Eight Protection function

### A. Over voltage protection

When the DC power supply voltage +V exceeds 80VDC, the protection circuit moves, the power indicator light turn to red and the protection function is started.

### B. Motor coil turn to turn short circuit protection

Electrical wiring coil windings shorted or the motor itself is damaged,the protection circuit moves, the power indicator light turn to red and the protection function is started.

### C. Motor fault phase protection

Protection function is activated when the motor winding two-phase sequence is wrong. When the protection function is started, the motor shaft is losing the self lock force, and the power indicator light is red. To resume normal work, we need to confirm the fault elimination, and then power on the power, the power indicator lights become green, the motor shaft is locked, the driver returned to normal.

**Note:** Because the drive does not have the function of reverse polarity protection, so please confirm again before the power supply that the positive and negative wiring is correct. Positive and negative reversed will cause the drive to the fuse burned out!

## Chapter Nine Common problem

The following are some of the common problems and Solutions:

phenomenon	possible causes	solution
Motor does not turn	Power light does not shine	Check the power supply circuit
	Powerful motor shaft	Pulse signal is weak, the signal current increase to 7-16mA
	Segments too small	Choose the right subdivision
	Current setting is too small	Choose the right current
	Drive is protected	Re-power
	Enable signal is low	Make signal high or not connected

	No response to a control signal	No-power
Motor steering error	Motor lines are wrong	Exchange of two-phase motor of the same line(E.g., A +, A- wiring exchange position)
	Motor lines are open circuit	Check and correct
Alarm indicator light	Motor lines are wrong	Check the wiring
	Voltage is too high or too low	Check the power
	Drive or motor burned	Replace the motor or drive
Location not allowed	Signal interference	Eliminate interference
	The shield is not connected	Grounded reliability
	Motor lines are open circuit	Check and correct
	Wrong subdivision	Set the subdivision
	Current is small	Increase the current
Motor stall during acceleration	Acceleration time is too short	Acceleration time extended
	Motor torque is too small	Choose high-torque motors
	Low voltage or current is too small	Increase the voltage or current

In case of other questions, please contact our Application Engineer:

TEL: 0519-88372126 FAX: 0519-88372780

## Chapter Ten Product warranty terms

A. The company provides one year starting from the date of shipment of raw materials and workmanship warranty on its products. Burroughs during the warranty period for the defective product to provide free maintenance service.

B. Column does not belong to warranty

- Improper wiring, such as positive and negative reversed power and electric plug
- Without permission to change the internal device
- Beyond the use of electrical and environmental requirements

●Environmental cooling bad

C. Maintenance procedures

As required maintenance products, will deal with the following scheme:

- a. Call customer pre-delivery service required to obtain the return authorization number;
- b. With goods enclose written explanation that repair drive failures, failure occurs when the voltage, current, and the use of the environment and situation; contact name, telephone number and mailing address information;
- c. Prepaid sent to Qishuyan Economic Develop Zone, Changzhou,Jiangsu,China (213025 ) Changzhou Baolai Electric Appliance Co., Ltd.. (return postage paid by the Baolai Electric Appliance Co., Ltd. )

D.Warranty restrictions

- a. Warranty scope is limited to the device and process of the product (i.e., the agreement)
- b. Do not guarantee that its products can be suitable for the specific purpose of the customer, because whether it is suitable for the purpose of the technical indicators and the use of conditions and environment.
- c. Do not recommend the use of this product for clinical medical use

E. Maintenance requirements

Please fill out "Maintenance Report" (This form can be downloaded on [www.baolai-cn.com](http://www.baolai-cn.com) or E-mail to [info@baolai-cn.com](mailto:info@baolai-cn.com)) to facilitate the maintenance analysis.

ADD: Qishuyan Economic Develop Zone, Changzhou,Jiangsu,China Changzhou Baolai Electric Appliance Co., Ltd..

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