

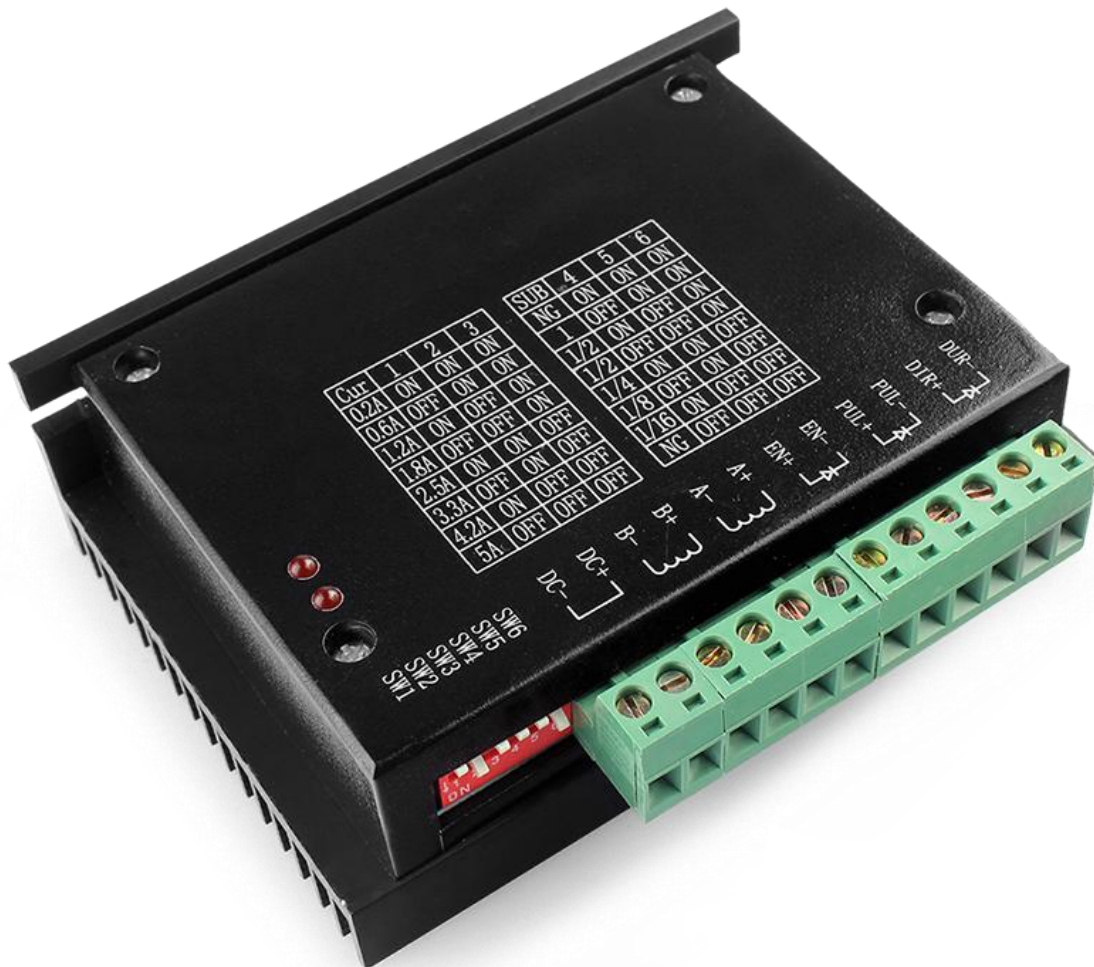
# User's Manual

For

## TB1H

### High Performance Microstepping Driver

Attention: Please read this manual carefully before using the driver!



Easy Commercial Global Technology Co., LTD

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## 1. Introduction, Features and Applications

### Introduction

The TB1H is a high performance microstepping driver based on the latest original TOSHIBA high-efficiency TB6600HG IC. The TB6600HG adopts PWM chopper-type single-chip bipolar sinusoidal to ensure the low vibration and high efficiency. Moreover, the brand new design with BiCD0.13 (50V) process technology on the chipset also ensures maximum 5.0A output current and 50V output withstand voltage. Consequently, as long as the current range of the stepper motor is within 0.2-5 amps, all the 2 Phase or 4 Phase of Nema17, Nema23, Nema24 and Nema34 stepper motors will work perfectly with this new-type TB6600HG Stepper Driver.

### Features

- High performance, cost-effective
- Automatic idle-current reduction
- Supply voltage up to 50V DC
- Output current up to 5.0A
- Suitable for 2-phase and 4-phase motors
- High speed optoelectronic isolation signal input
- Overload, overcurrent, overheat, overvoltage and undervoltage protection
- Single-chip PWM bipolar sinusoidal chopper ensures low vibration and high efficiency
- 1, 2, 4 (**New Mode**), 8, 16 adjustable microstep control, motors run more precisely and smoothly
- Equipped with the 3<sup>rd</sup> generation of breakout board, display panel and control pad to control the motor manually.
- Cooling Aluminium Box Design for Cooling, and protect the driver board from being damaged by dirt, dust or other liquids.

### Applications

Suitable for a wide range of stepping motors, from NEMA size 17 to 34. It can be used in various kinds of machines, such as X-Y tables, labeling machines, laser cutters, engraving machines, pick-place devices, and so on. Particularly adapt to the applications desired with low noise, low heating, and high speed performance.

## 2. Specifications

### I. Electrical Specifications (T<sub>j</sub> = 25 °C/77 °F)

Parameters	TB1H			
	Min	Typical	Max	Unit
Output current	1	-	5.0(3 RMS)	A
Supply voltage	+12	+24	+50	VDC
Logic signal current	7	10	16	mA
Pulse input frequency	0	-	300	KHz
Isolation resistance	500			MΩ

### II. Operating Environment and other Specifications

Cooling	Natural Cooling or Forced cooling	
Operating Environment	Environment	Avoid dust, oil fog and corrosive gases
	Ambient Temperature	0 °C — 50 °C (32°F — 122°F)
	Humidity	40%RH — 90%RH
	Operating Temperature	70 °C (158°F) Max
	Vibration	5.9m/s <sup>2</sup> Max
Storage Temperature	-20 °C — 65 °C (-4°F — 149°F)	
Weight	Approx. 250g	

### III. PCB Instructions & Specifications (unit: mm)

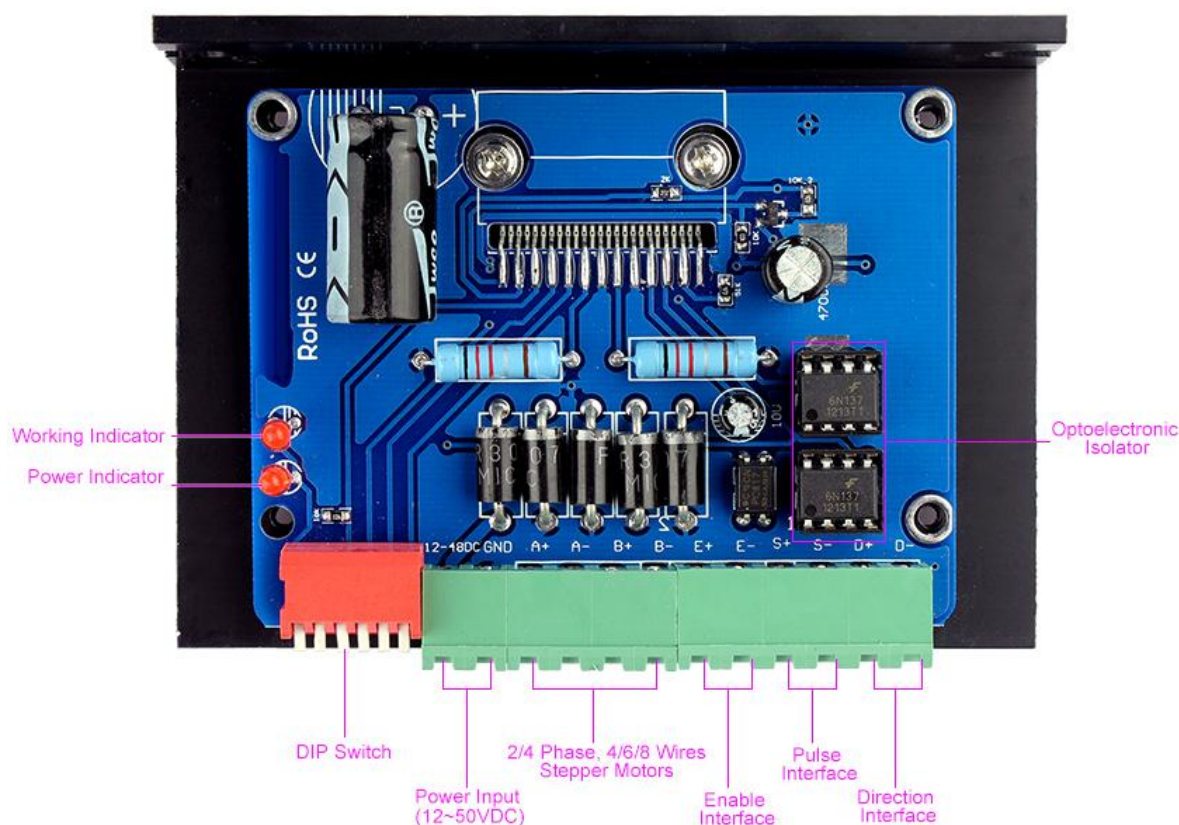


Figure 1: PCB Instructions & Specifications.

## 3. Pin Assignment & Instructions

### I. Control Signal Instructions:

Pin Function	Details
<b>PUL+ / PUL-</b>	PUL+: Step pulse signal input positive terminal PUL-: Step pulse signal input negative terminal.
<b>DIR+ / DIR-</b>	PUL+: Step direction signal input positive terminal PUL-: Step direction signal input negative terminal. 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.
<b>ENA+ / ENA-</b>	Enable signal: This signal is used for enabling/disabling the driver. High level (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 <b>UNCONNECTED (ENABLED)</b>

### II. Power Input Terminals & Motor connection Terminals

Pin Function	Details
<b>DC+ / DC-</b>	Switching power supply, 12~48 VDC.
<b>A+ / A-</b>	Motor Phase A
<b>B+ / B-</b>	Motor Phase B

#### 4. NPN, PNP Wiring Diagram for reference

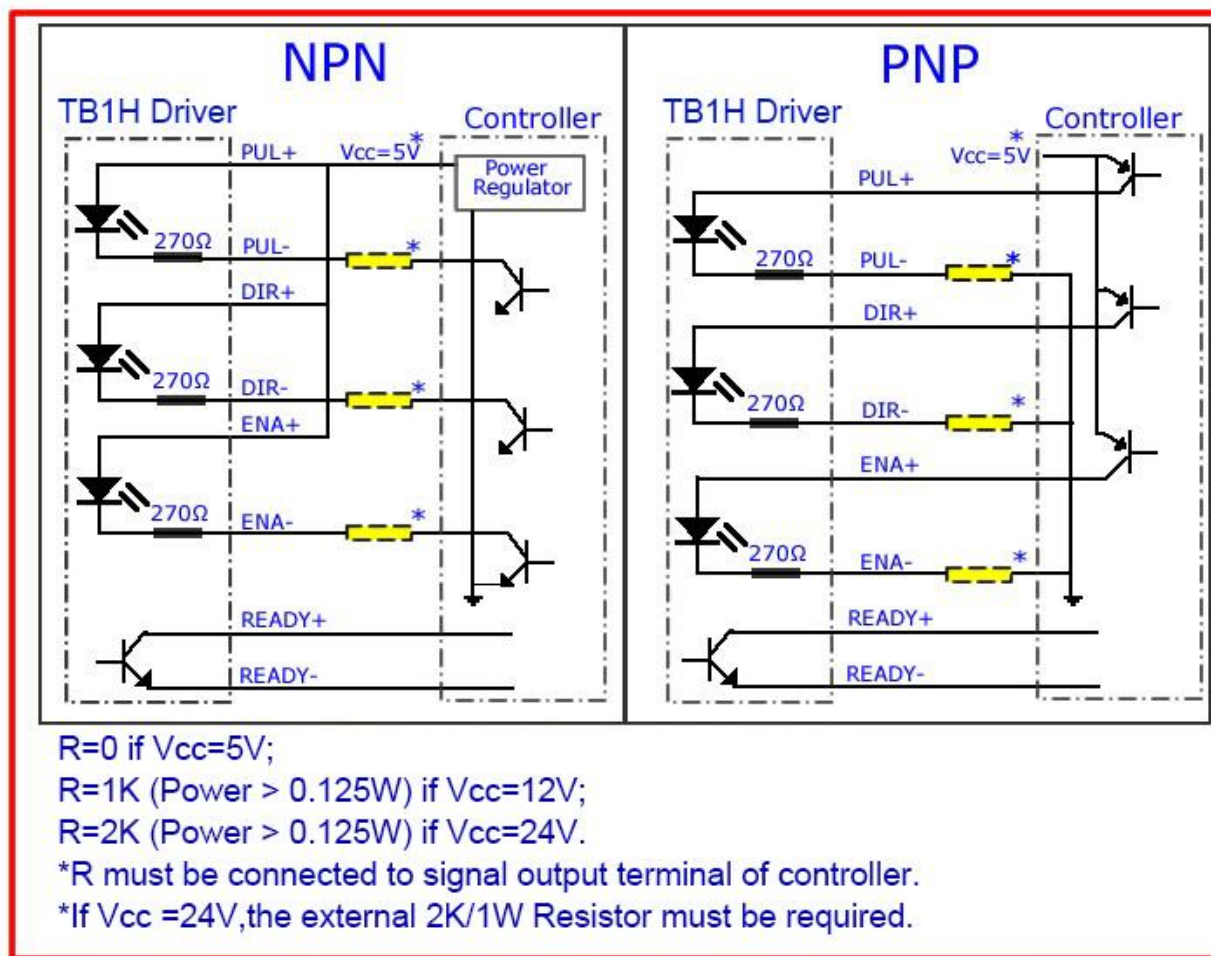


Figure 2: NPN/PNP Wiring Diagram

## 5. Selections & Connections about the Motors

The TB1H stepper driver can drive 2-phase and 4-phase hybrid stepping motors, including 4, 6 or 8 leads.

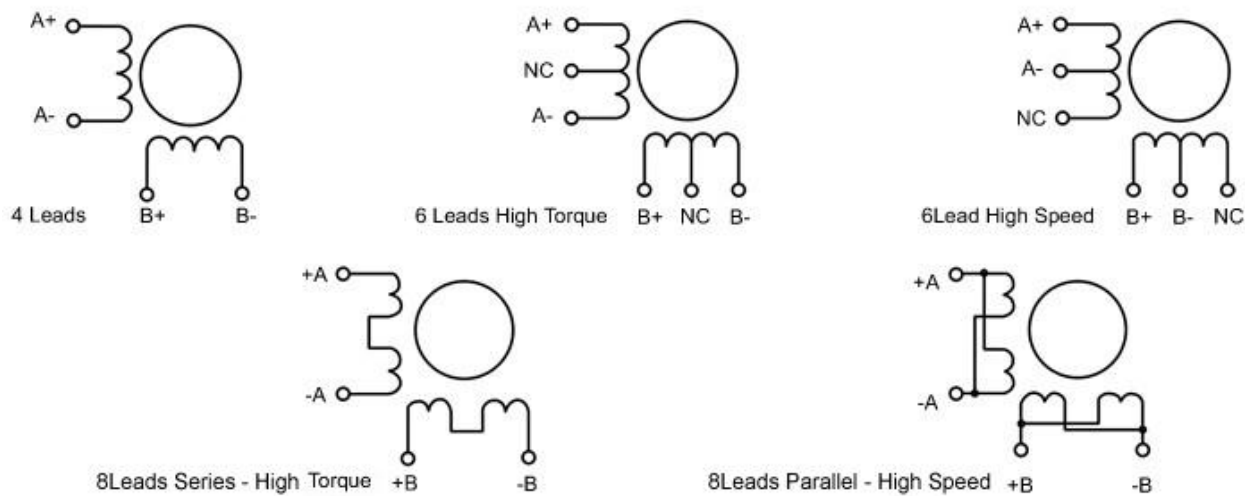


Figure 3: Wiring diagrams for 4/6/8 leads motors

### I. Connections of 4-lead Motors

4 lead motors are the least flexible but easiest to wire. Speed and torque will depend on winding inductance. In theory, during adjusting stepper driver's output current, the output current can be set to 1.4 times than the rated current of the motor on the premise that the 1.4 times of rated current is lower than the TB6600HG chip's 5.0A peak current.

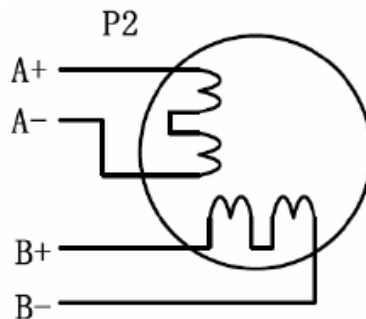


Figure 4: 4-lead Motor Connections

### II. Connections of 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.

#### i. 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.



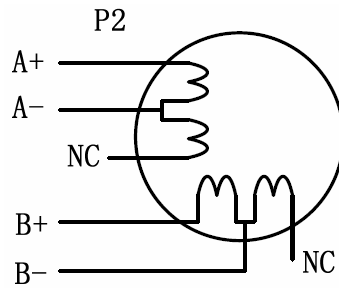


Figure 5: 6-lead motor half coil (higher speed) connections

## ii. 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.

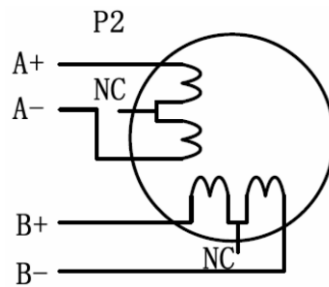


Figure 6: 6-lead motor full coil (higher torque) connections

## III. Connections of 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.

### i. 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.

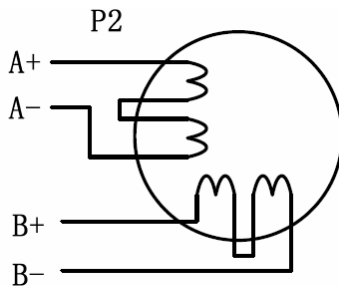


Figure 7: 8-lead motor series (higher torque) connections

### ii. 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.

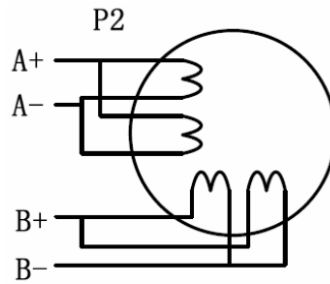


Figure 8: 8-lead motor parallel (higher speed) connections

## 6. Power Supply Selection

The TB1H stepper driver can match Large and small size stepping motors (from Nema size 17 to 34) made by us or other motor manufactures around the world, as long as the rated current of the motors is within **0.2-5.0A**(Peak Current) . 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 the motion speed requirement is low, it's better to use lower supply voltage to decrease noise, heating and improve reliability.

### I. Regulated or Unregulated Power Supply

Both of regulated and unregulated DC power supplies can be used to supply TB1H stepper driver. However, unregulated power supplies are preferred due to their ability to withstand current surge. If regulated power supplies (such as most off 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. Although the unregulated power supplies are preferred, considering the cost, the cheap and easy-to-use regulated switching supplies in the market is also a good choice for the TB1H stepper driver and motors, as long as the total output current of the regulated switching supplies is larger than the motor's total rated current. Anyway, if users don't know how to select the suitable power supplies for the TB1H stepper driver and motors, please feel free to contact with us for assistances.

### II. Selecting Supply Voltage

The TB1H stepper driver can actually operate within **12-50V**(Peak Voltage) DC for different motors. Higher supply voltage can increase motor torque at higher speeds, thus helpful for avoiding losing steps. However, higher voltage may cause more motor vibration at lower speed, and it may also cause motor overheat and drive damage. Therefore, it is suggested to choose 12-24V DC supply to power the Nema17 motors, 24-36V DC supply to power the Nema23/24 motors and 36V-48V DC supply to power the Nema34 Motors.



## 7. DIP Switches Settings (Microstep, Current)

This driver adopts a 6-bit DIP switch to set motor operating current and microstep mode, shown as below:

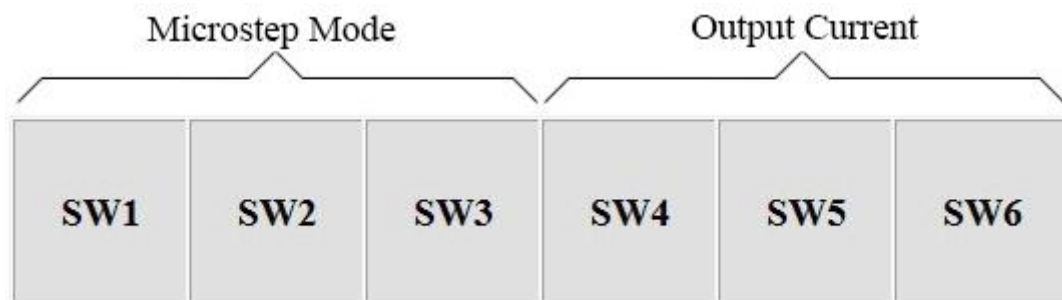


Figure 9: DIP Switches Settings

### I. Microstep Mode Selection:

Microstep Mode	SW1	SW2	SW3
N/A	ON	ON	ON
1(Full Step)	OFF	ON	ON
2	ON	OFF	ON
2	OFF	OFF	ON
4	ON	ON	OFF
8	OFF	ON	OFF
16	ON	OFF	OFF
N/A	OFF	OFF	OFF

### II. Output Current Selection:

Output Current	SW4	SW5	SW6
0.2A	ON	ON	ON
0.6A	OFF	ON	ON
1.2A	ON	OFF	ON
1.8A	OFF	OFF	ON
2.5A	ON	ON	OFF
3.3A	OFF	ON	OFF
4.2A	ON	OFF	OFF
5.0A	OFF	OFF	OFF

## 8. Wiring Notes

- In order to improve anti-interference performance of the driver, it is recommended to use twisted pair shield cable.
- Please shut down the power before plugging or unplugging the connectors from the driver.

## 9. Detailed Wiring Diagram for Reference

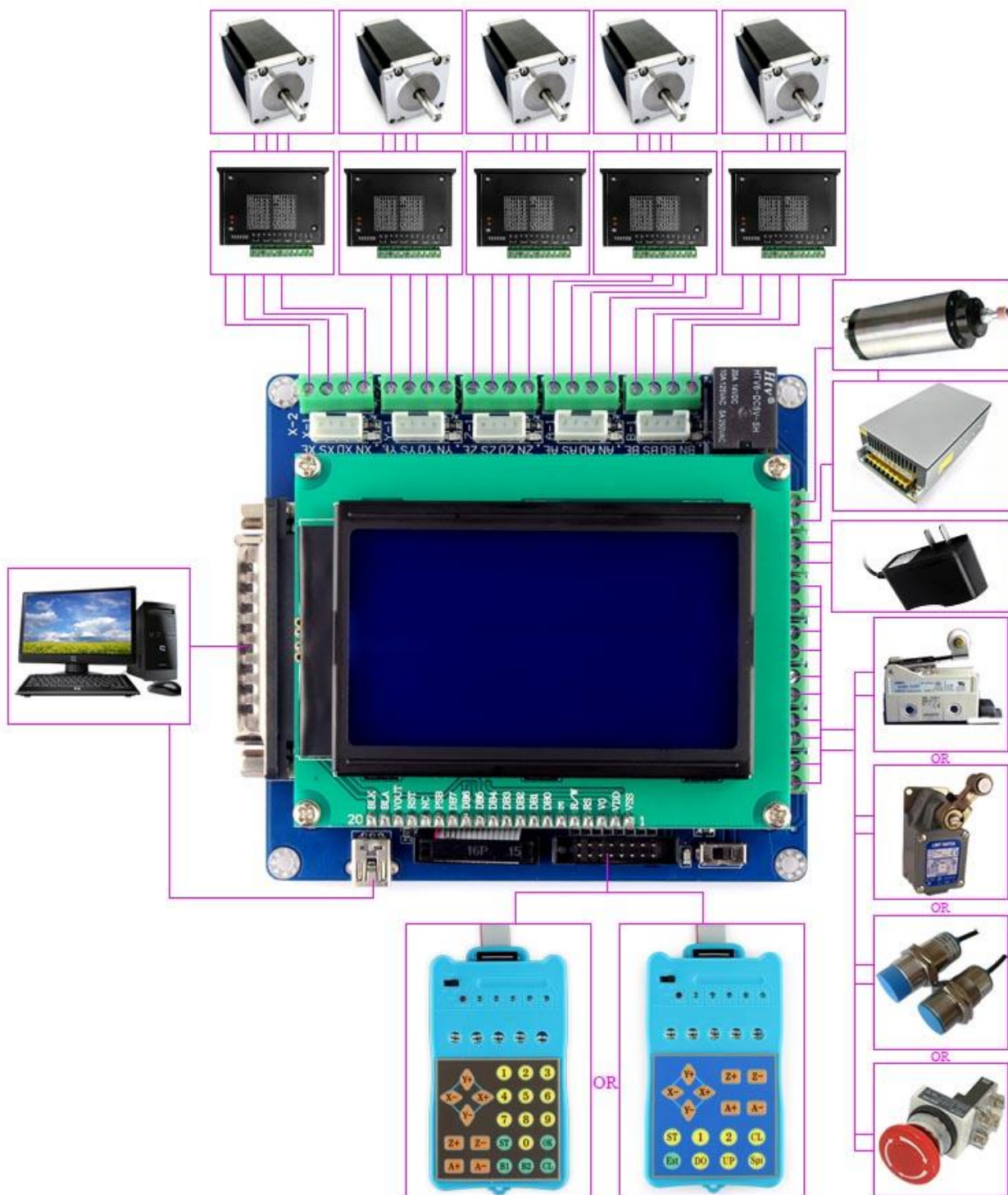


Figure 10: Wiring Diagram

## 12. Problem Symptoms and Possible Causes

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

Figure 11: Trouble shootings