DBK4B
Laser Control Card
User Manual

ChangSha BSL Info. Tech. Co.,Ltd

Release Notes

Version	Revision Personnel	Revision Time	Description
V1.0		20211208	Initial version

Note:

DBK4B-B4 control card hardware design has been optimized, please strictly follow the instruction manual of the corresponding model to operate, not to be confused.

CATALOG

1 Safety Tips

- Please read this section carefully before installing and using the DBK4B-B4 control card. If you have any questions about this document, please contact Changsha BSL.

- **Please turn on the power of the machine strictly in the following order: computer, DBK4B-B4 control card, galvanometer, and laser. Otherwise, injuries may be caused by uncontrollable laser beams. We recommend that you use a light gate to avoid injuries caused by uncontrollable laser light and wear protective eye wear when operating the laser.**

- The DBK4B-B4 control card is designed to control a laser scanning system. Please follow all laser safety instructions (including, but not limited to, those described for the laser, the galvanometer, and the relevant sections of this document). All safety instructions for the laser system should be understood and implemented by the customer. The customer must strictly observe the relevant safety instructions and is independently responsible for the safety of the laser system used. Safety rules may vary from country to country. The customer is responsible for complying with all local regulations.

- Please check carefully before running the software. Software errors may cause the system to stop responding. In this case, neither the galvanometer nor the laser can be controlled.

- Avoid damage to the board from moisture, dust, corrosive substances, and impact from external objects.

- When storing and using the board, avoid damage from electromagnetic fields and static electricity. They may damage the electronics on the board. Please use an anti-static bag to store the board. Please wear well-grounded, anti-static protective gloves when touching the board.

- Please ensure that the board is stored at -20℃ to +60℃ Celsius. The permissible operating ambient temperature is 0℃ to +45 ℃.

2 Overview

The DBK4B-B4 control card was developed for marking machines using **pulsed fiber lasers, UV lasers, and CO2 lasers**. See Figure 2-1 for the external dimensions of the control card:

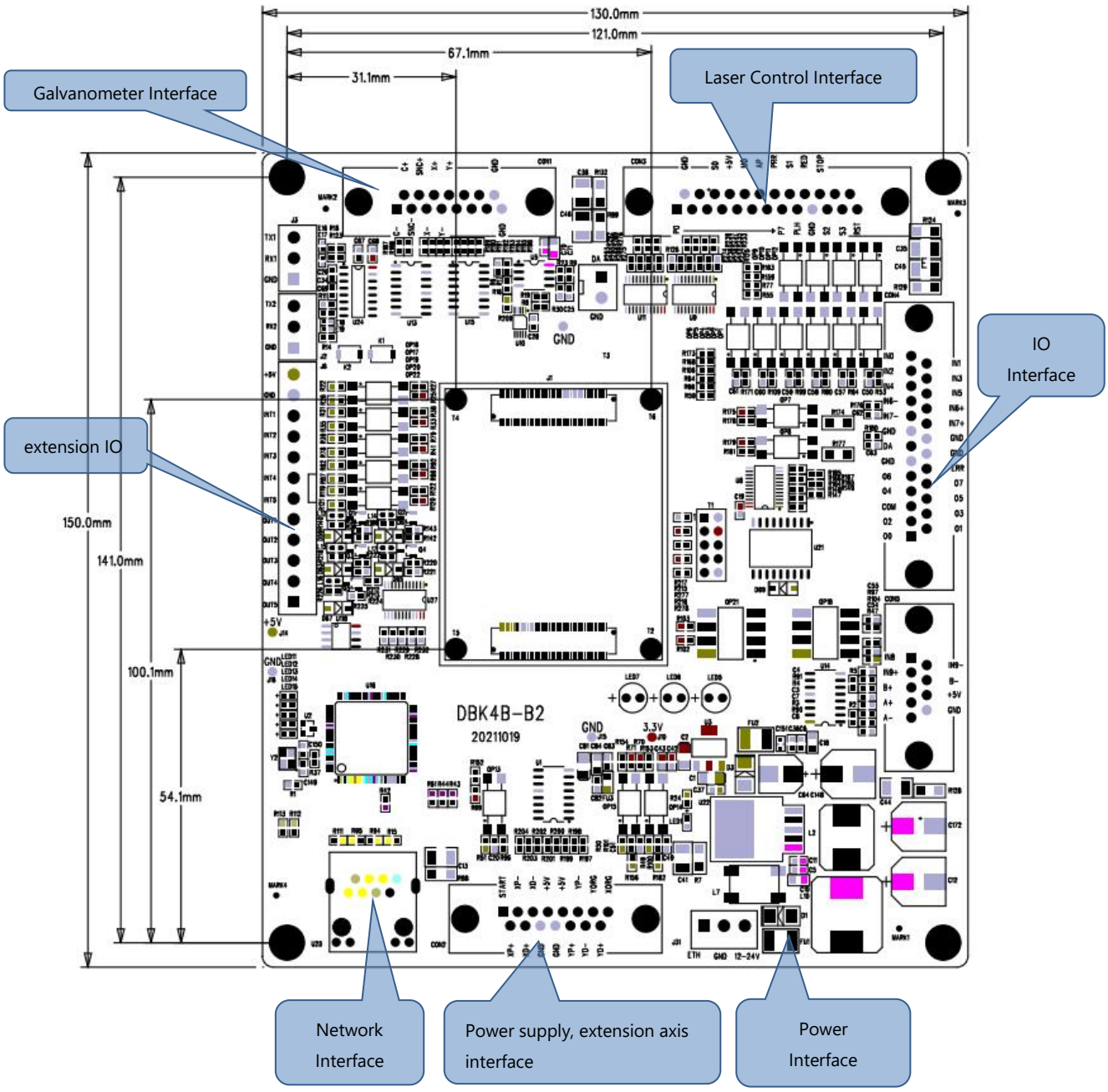


Figure2-1 DBK4B-B4 Control Card External Dimension Drawing

Interface Overview:

- A DB25 socket is used to output the laser control signal, which is directly connected to the pulsed fiber laser via a 25-pin cable.
- Adopting DB15 socket to output galvanometer signal, the galvanometer control signal is digital signal, which can be directly connected to the international digital galvanometer through XY-100 protocol.
- Extended Axis (Stepper Motor/Servo Motor) Output: Direction/pulse signals can be output to control stepper motors (or servo motors), which can be used for rotary axis or splicing.
- 8 general-purpose input signals. IN0 ~ IN5 are single-ended input signals, and IN6 and IN7 can be selected as single-ended or differential inputs via jumpers.
- 8 general-purpose output digital signals. Out0 ~ Out3 can be selected as TTL or OC outputs via jumpers, and OUT4 ~ OUT7 are TTL signal outputs.
- The network interface is connected to the PC, and the USB interface is temporarily unavailable.
- With encoder interface, it can be used as a standard card or as a flight marking card depending on the program written to the board.

Function Overview:

- Supports remote permanent update of FPGA programs over a network cable.
- Support network cable remote temporary update FPGA program.
- Supports remote permanent update of ARM programs over a network cable.
- 10/100M Ethernet support DHCP and manual static IP mode.
- Support online marking.
- Offline marking support.
- Bitmap mode support.
- Supports UV, CO2, fiber lasers, etc.
- Supports 2-way extension axis control.

3 Electrical Connection

3.1 Interface Description

3.1.1 Power supply interface

DBK4B-B4 control card supports 12V~24V DC power supply and 12~24V wide voltage input. The power supply can be accessed from J31 (Figure 2-1 Power Interface).

Note: the right side of the J31 interface is the 12~24V power supply positive pole, the center is GND, and the left side is ETH.

3.1.2 Galvanometer control interface

The galvanometer control interface CON1 uses a standard DB15 female socket. The galvanometer control signal is a digital signal and can be directly connected to a digital galvanometer. Since the digital signal transmission protocols used by digital galvanometers are not exactly the same, it is necessary to confirm which transmission protocol the digital galvanometer uses.

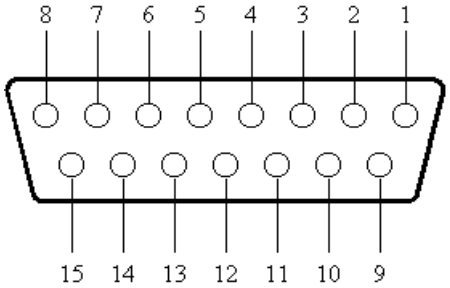


Figure3-1 Vibrating Mirror Control DB15 Female Socket Top View Pin Definitions

Table 3-1 below shows the pin definition description:

Table3-1 Galvanometer control pin description

Pin NO.	Signal Name	Description
1, 9	CLK－ / CLK＋	Clock Signal - / Clock Signal +
2, 10	SYNC－ / SYNC＋	Synchronization signal- /Synchronization signal+
3, 11	X Channel－ / X Channel＋	Galvanometer X signal - / Galvanometer X signal +
4, 12	Y Channel－ / Y Channel＋	Galvanometer Y signal - / Galvanometer Y signal +
5, 13	Z Channel－ / Z Channel＋	Galvanometer Z signal - / Galvanometer Z signal +

6, 7, 14	NULL	Reservations
8, 15	GND	Ground

Note: Differential digital signals require a twisted pair connection with a shield.

3.1.3 Fiber laser control interface

The fiber laser control interface CON3 is a standard DB25 female socket and the 25-pin socket of the fiber laser is mated via a 25-pin cable.

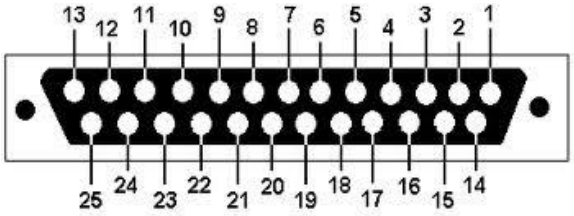


Figure 3-2 Laser Control DB25 Female Socket Top View Pin Definitions

Table 3-2 below illustrates the pin definitions：

Table3-2 Laser Control Pin Definitions

Pin NO.	Signal Name	Description
1~8	P0~P7	Laser power. TTL output. (Pin 2 can be reused as serial data input, and pin 3 can be reused as serial clock input.)
9	PLATCH	Power latch signal. TTL output.
10, 14	GND	The reference location of the control card.
16, 21, 11, 12	SGIN0~3	Laser status input
17	VCC	Control the 5V power output of the card.
18	MO	Main oscillator switching signal. TTL output.
19	AP	Power amplifier switching signal. TTL output.
20	PRR	Repeating pulse frequency signal. TTL output.
22	RedLight/ PWM Enable	The red light indication signal of the laser can be reused as pulse width adjustment ENABLE and TTL output.
23	EMSTOP	Emergency stop switch signal. TTL output.
13	RST	Laser reset signal
15, 24, 25	NULL	This pin is left floating and not connected.

Note: Control Interface Description

1) P0 ~P7 are 8-bit buses for setting power. P0 is LSB, P7 is MSB. Input range is 0~255, corresponding to 0~100% of nominal power value.

	Setting 1	Setting 2	Setting 3	Setting 4	Setting 5
P0	0	0	0	0	1
P1	0	0	0	0	1
P2	0	0	0	0	1
P3	0	0	0	0	1
P4	0	0	0	1	1
P5	0	0	1	1	1
P6	0	1	1	1	1
P7	1	1	1	1	1
Output Nominal Power	50%	75%	87.5%	93.75%	100%

2) Pins 11, 12, 16 and 21 are laser status inputs, which indicate different states depending on the laser. For example, the laser status input is only defined to use the two bits of pin 16 and pin 21. These two bits represent the following states of the laser.

Pin 16	Pin 21	Definition of Laser Status Input
L	L	Laser temperature outside operating temperature range*.
L	H	Normal status
H	H	MO abnormality

3) The other pins of the laser control interface are defined to meet the drive requirements of a typical fiber laser. Different lasers may have small differences in drive timing, and the application software working with them can be set up in the interface to make the lasers work in an optimal state. In general, the laser can work normally after connecting to the control interface of DBK4B-B4 according to the definition.

3.1.4 Power and extension axis interface

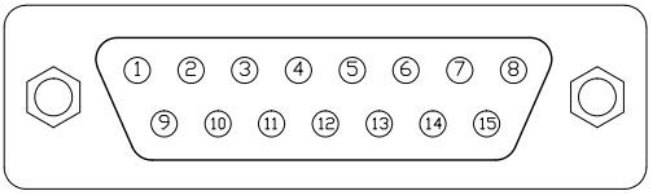


Figure 3-4 CON2 Power, Extansion Axis Interface
DB15 Male Socket Top View Tube

Table 3-6below illustrates the pin definitions:

Table 3-6 Definition of power supply and expansion axis interfaces

Pin NO.	Signal	Description
1	START	Not used yet. The universal input signal forms a loop with the GND (pin 11) of the control card. When using this signal, just connect the signal and ground to both ends of the switch. This signal is an input signal.
2, 9	XP-/XP+	Pulse signal of extended axis X. This signal is an output signal.
3, 10	XD-/XD+	The direction signal of the extended axis X. This signal is an output signal.
4, 5	+5V	Positive polarity terminal of 5V input power supply. This signal is an input signal.
6, 13	YP-/YP+	Pulse signal of extended axis Y. This signal is an output signal.
7	YORG	The zero position signal of the extended axis Y. Form a loop with the GND (pin 11) of the control card. When using this signal, just connect the signal and ground to both ends of the switch. This signal is an input signal.
8	XORG	Extend the zero position signal of axis X. Form a loop with the GND (pin 11) of the control card. When using this signal, just connect the signal and ground to both ends of the switch. This signal is an input signal.
11, 12	GND	The negative polarity end of the 5V input power supply is the GND signal of the control card. This signal is an input signal.
14, 15	YD-/YD+	Extended axis Y direction signal. This signal is an output signal.

3.1.5 IO interface

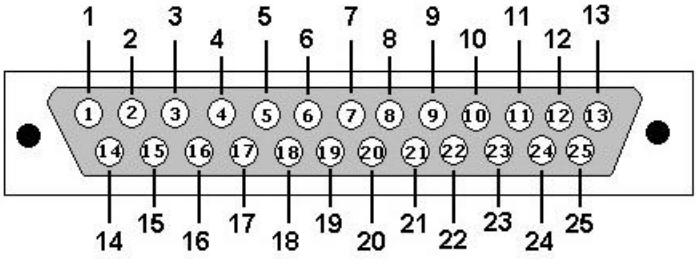


Figure 3-5 CON4 IO Interface DB25 Male Socket Top View Pin Definitions

Table 3-7 below shows the pin definition description:

Table 3-7 IO Interface Definition Description

Pin NO.	Signal	Description
1, 14, 2, 15	Out0 ~ Out3	General output signals 0, 1, 2, 3. TTL compatible. Form a loop with GND signal. It can be set to TTL output or open collector (OC) output through jumpers JP5, JP6, JP7, and JP8.
4, 16, 5, 17	Out4 ~ Out7	Universal output signals 4, 5, 6, 7. TTL compatible. Form a loop with GND signal.
3	COM	When the output signal uses OC output, connect this pin to the positive terminal of the OC power supply (maximum 24V) to prevent inductive loads (such as inductive relays) from destroying the output circuit.
6, 8, 19, 20	GND	The negative polarity end of the input power and output signal is the GND signal of the control card.
7	DA1	Analog output signal. It can control the output of 0~10V analog voltage for power adjustment of some lasers. (Not supported by the first version)
9, 21	IN7- / IN7+	General input signal IN7. Differential input, internally connected to a 1kΩ current limiting resistor. For usage methods, please refer to Section 3.2.2 Usage of General Differential Input Signals.
10, 22	IN6- / IN6+	Universal input signal IN6. Internally connected to a 1k Ω current limiting resistor, differential input. For usage methods, please refer to Section 3.2.2 Usage of General Differential Input Signals.

13, 25, 11, 23	IN0, IN1, IN4, IN5	Universal single-ended input signals IN0 ~ IN5. It forms a loop with the GND signal. For usage methods, please refer to the use of general single-ended input signals in Section 3.2.1 below. This signal is an input signal. Among them, the IN4 and IN5 standard cards are used as the limit signals of expansion axis 1.
12	IN2	Universal single-ended input signal IN2, used as the limit signal of expansion axis 2 when the standard card is used. It forms a loop with the GND signal. For usage methods, please refer to the use of general single-ended input signals in Section 3.2.1 below. This signal is an input signal.
24	IN3	Universal single-ended input signal IN3, used as the limit signal of expansion axis 2 when the standard card is used. It forms a loop with the GND signal. For usage methods, please refer to the use of general single-ended input signals in Section 3.2.1 below. This signal is an input signal.
18	LaserErr	Laser fault output indicates that the laser is in a fault state. OC output. When the laser fails, this signal is pulled down to GND.

3.2 Input and output signal connection

3.2.1 Use of single-ended universal input signals

Single-ended general-purpose input signal such as pins 11, 12, 13, 23, 24 and 25 of the IO interface have the following internal circuitry in Figure 3-6:

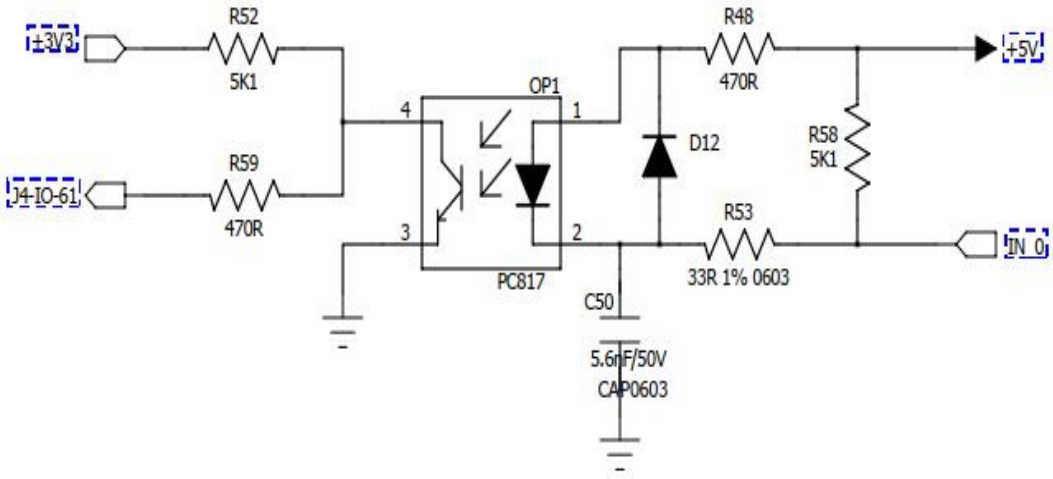


Figure 3-6 Single-Ended Universal Input Circuit

This input signal as long as the IN terminal to ground to connect a switch can be, of course, the external circuit using electronic switches can also be, when the switch to GND on, the input is "0", switch open circuit, the input is "1".

3.2.2 Use of Universal Differential Input Signals

Differential universal input signals, such as pins 9 and 21 (In7-/In7+), pins 10 and 22 (In6+/In6-) of the IO interface, their internal circuits are as shown in Figure 3-7：

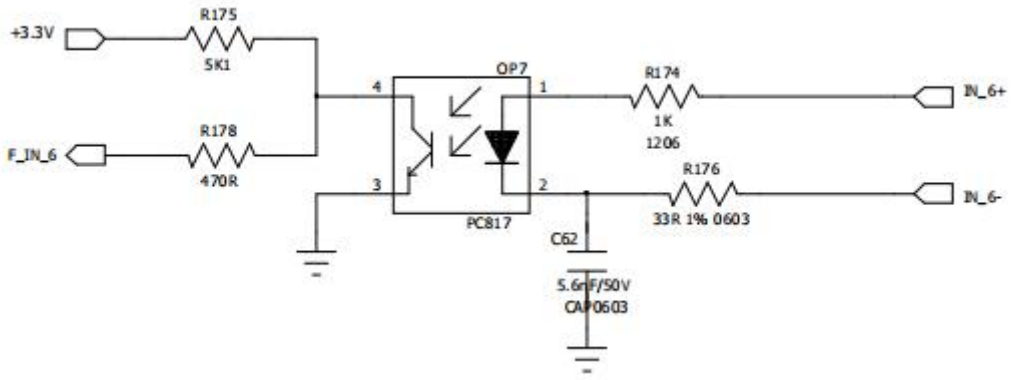


Figure 3-7 General Purpose Differential Input Circuit

When using differential input, decide whether to connect an external current-limiting resistor based on the actual voltage value of the external power supply VCC to ensure that the input current is between 5mA and 10mA. If the input voltage is greater than 12V, it is recommended to connect a current-limiting resistor in series outside the control card. Assuming that the input current is selected to be 10mA, the calculation method of the input resistor current limit R is as follows (unit ohms):

R = VCC×1000/10 − 1000

3.2.3 Use of general output signals

Universal output signals, such as pins 4, 5, 16, and 17 of the IO interface, are TTL compatible. The output voltage is directly output to the GND signal. The output must avoid short circuit or grounding, otherwise the board will be damaged, and the output current should be ensured to be less than 5mA.

3.2.4 Use of OC output signal

OC output signals such as IO interface pin 1, 2, 14, 15, through the jumper JP5, JP6, JP7, JP8 can be set to OC output, the circuit principle is as follows Figure 3-8:：

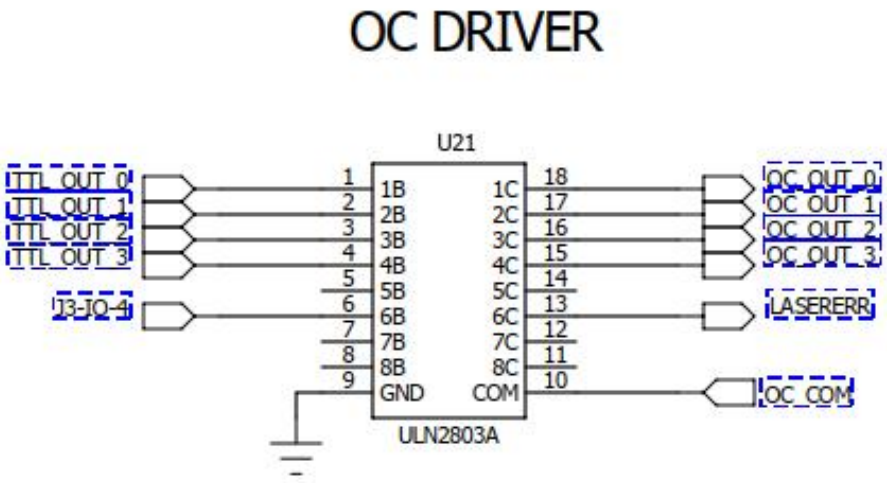


Figure 3-8 OC Output Circuit

When using OC output, the positive pole of the external load is connected to the power supply VCC, the negative pole of the external load is connected to the OC_OUT1 output signal terminal, and VCC is connected to the OC_COM terminal to prevent inductive loads (such as relays) from destroying the output circuit.

4 Typical Connection

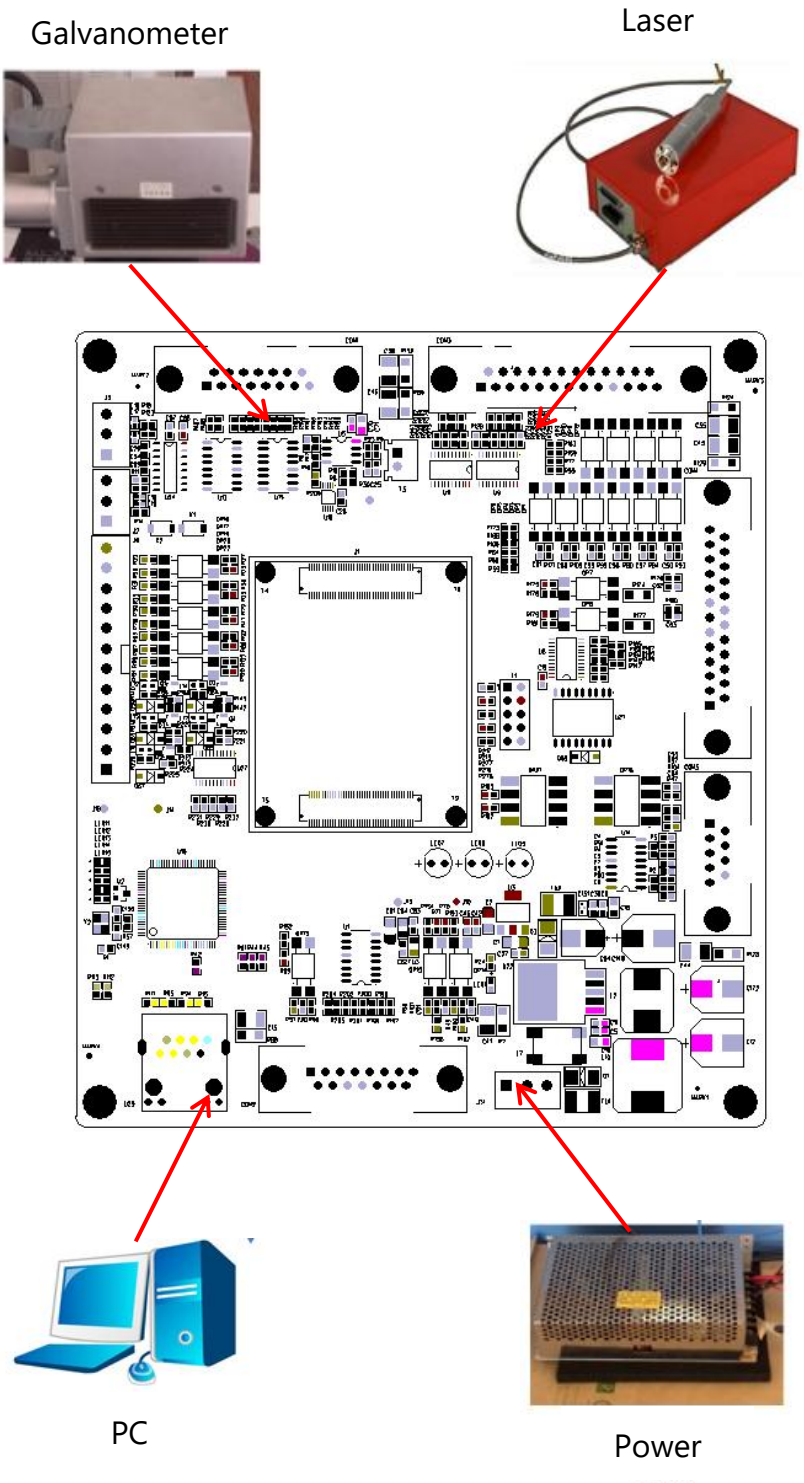


Figure 4-1 Typical Connection Diagram for DBK4B-B4 Control Card

5 Multi-Card Connection and Use

Take the example of a computer connected to two marking cards.

I Setting the computer IP

According to their own needs, the computer IP set to any number, such as 0 section, 192.168.0.1

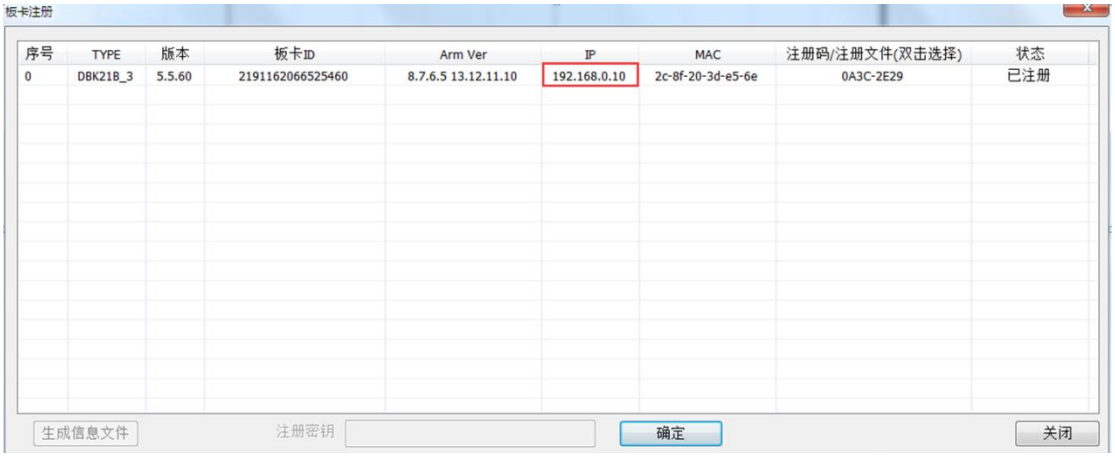
II Connect the marking card, set up two marking card IP separately

(1) Connect the card 1 network cable directly to the computer, or to the same switch or router as the computer, and power up the card 1;

(2) Open the software on your computer and wait for Card 1 to connect to the software;

(3) Modify the mac address as well as the ip of card 1;

Software board registration interface to set the board mac address and ip, as shown below. Double-click the mac address column, you can set the mac address, ip setting method with the same mac address, modify the completion of the blank and close the interface can be clicked. After the modification is completed, the board is powered off.



(4) In the same way set the mac address as well as the ip of card 2;

Note:

a. Card 1 and Card 2 must be set to different mac addresses, otherwise a multi-card connection will not be possible;

b. The IP of card 1 and card 2 must be set to different addresses in the same number segment, otherwise the multi-card connection cannot be made properly.

If you want to set them all to segment 0, you can set them as follows.

Card 1: 192.168.0.2

Card 2: 192.168.0.3

III Connect two marking cards at the same time

After both mac and IP are set up successfully, connect the computer, card 1, and card 2 to the same switch or router through network cables, open the software, power on the board, and wait for the two boards to connect to the software before you can perform multi-card labeling. Engraved.

If you need to connect multiple boards at the same time, you can set them in the same way.