DBK21B User's Manual

Fiber Laser Control Card

Version recorder

version	Person in charge	Time	comment
V0.0	Wang Shuang-Jian	20140917	Original version

Remark: DBK21B control board is optimized from DBK21A control board, and has improvement on its outside shape. In addition, DBK21B increases a DC power socket for user. On particularly, the definition of I/O interface is also different from DBK21A. So operate DBK21B according to this Manual strictly, please.

CONTENT

1 Safety Instruction

Please read these operating instructions completely before you proceed with installing and operating DBK21B. If there are any questions regarding the contents of this manual, please contact Changsha Seathinking Information and Technology Ltd.

Follow the steps as following strictly when you switch on the power of this product: Computer, DBK21B control board, scan-head, laser; and the power supply for the scan headfirst before turning on the laser. Otherwise there is the danger of uncontrollable deflection of the laser beam. We recommend you use a shutter to prevent uncontrollable emission of laser radiation and wear protective goggles during the operation of the laser.

DBK21B is designed for controlling a laser scanning system. Please comply with all the safety instructions about operation of laser (including but not limited to descriptions in laser, scan-head and relevant sections in this document). Therefore all relevant laser safety instructions must be known and applied by customers before installation and operation. All applicable laser safety directives must be adhered to and the customer is solely responsible for ensuring the laser safety of the entire system. Safety rules may differ from country to country. It is the responsibility of the customer to comply with all local regulations.

Carefully check the application program before running it. Programming errors may cause a breakdown of the system. In this case, neither the laser nor the scan head can be controlled.

Protect the board from humidity, dust, corrosive vapors and mechanic stress.

For storage and operation, avoid electromagnetic fields and static electricity. These can damage the electronics on the product. For storage, use the antistatic bag and wear an antistatic protective glove with good ground terminal to the earth to contact computer adapter boards.

The storage temperature should be between -20°C and +60°C for computer adapter boards. The allowed operating temperature range is 0°C±45°C.

2 General instruction

DBK21B control board is a control board which is developed for the use of the fiber laser marking machine. The following figure 2-1 is the appearance illustration of the DBK21B control card:

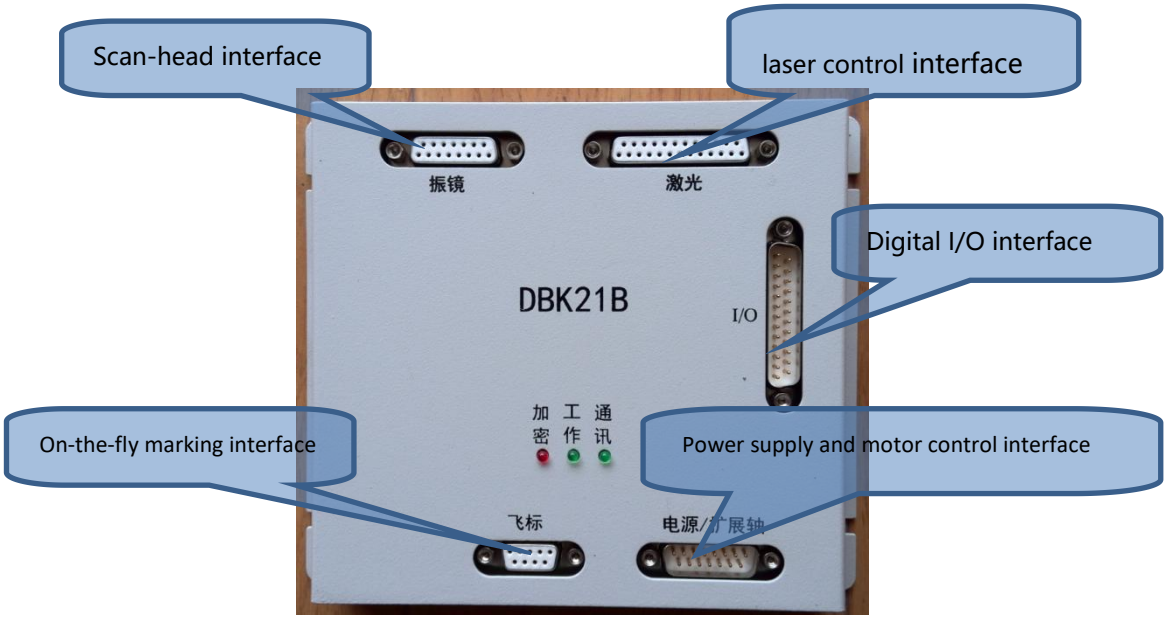


Figure 2-1 the DBK21B control board schematic diagram

2.1 Main Feature

- Standard DB25 connector, can be wire to IPG laser directly.
- Scan-head control signal is digital, which can connect to the general international digital Scan-head directly.
- On-the-fly marking feature. An encoder can be used to monitor the pipeline speed real-timely.
- Multiple boards on 1 computer: One computer can control up to 8 control board to mark different pattern simultaneously. [Remark: based on the support of computer USB channel]
- Extension axis(step motor or sever motor): two set of direction/pulse signal can be used to control 2 step(server) motors， which can be used for spinning axis or splicing.
- 8 general input signals(TTL campatible): In0-In7, 8 way input signals are input to digital I/O interface, insulated by optical couplers.
- 8 general output signals(TTL compatible): Out0-7 coming out of a socket. Out0 - 3 are TTL outputs. Out4-7 can be configured as OC outputs or TTL outputs.
- Compatible with USB2.0 specifications.

3 Electrical connection

3.1 Pin Definition

3.1.1 Power Supply

The control board needs a 5V DC power supply and the required voltage range is 4.75-5.25V. We recommend a 5V/2A DC power supply. The VCC and GND are 4/5 pin and 12/13 pin of "Power supply and motor control interface socket" respectively. 4/5 pin for anode,11/12 pin for cathode (low signal). "Power supply and motor control interface socket" is defined in detail in the following section3.1.5.

In addition, DBK21B increases a DC power socket, and a 5V/2A DC power adapter attached for user. We can feed DBK21B by this adapter directly. Other standard power adapter is not suggested to use.

3.1.2 Scan-head Control interface

Scan-head control interface is DB15 female socket. Scan-head control signals are digital. DBK21B support XY2-100 protocol. The protocol for driving digital scan-head is not compatible, so make sure what kind of protocol for scan-head at first before using.

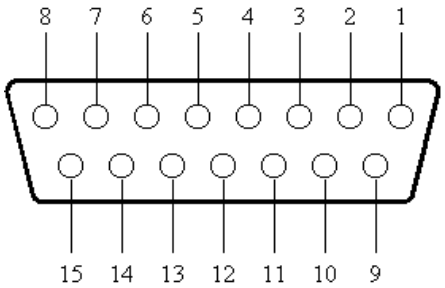


Fig. 3-1 pin definition for scan-head control DB15 top view of socket

The following table3-1 defines pin function:

Table 3-1 scan-head control pin definition

Pin	Name	Function
1, 9	CLK -/ CLK+	clock signal - / clock signal+
2, 10	SYNC -/ SYNC+	synchronous signal - / synchronous signal+
3, 11	X Channel / X Channel +	Scan-head X signal -/ scan-head X signal +
4, 12	Y Channel / Y Channel +	Scan-head Y signal -/ Scan-head Y signal+
5, 6, 7, 13, 14	NULL	Reserved
8, 15	GND	Reference signal

Remark: We recommend a shielded twisted-pair for differential digital signal.

3.1.3 FIBER LASER CONTROL INTERFACE DEFINITON

Laser control interface is standard DB25 female socket, 25 pin socket fiber laser via a 25 pin cable direct docking.

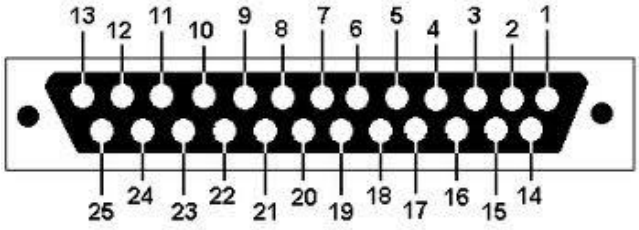


Figure 3-2 Top view of pin definition for laser control DB25 female socket

The following table 3-2 defines pin function:

Table 3-2 Laser control each pin definition

Pin No.	Signal	Illustration
1~8	P0~P7	Laser power. TTL output. (pin 2 can be multiplexed into a serial data input, and pin 3 can be multiplexed into a serial clock input.)
9	PLATCH	Laser Power latch signal. TTL output.
10, 14	GND	The reference ground of the control board
16, 21, 11, 12	SGIN0~3	Laser status signal of laser module
17	VCC	5V power output.
18	MO	Main oscillator signal. TTL output.
19	AP	Power amplifier signal. TTL output.
20	PRR	Pulse repetitive rate signal. TTL output.
22	Red Light/pulse width modulation	Red light pointer signal of laser can be multiplexed into pulse width modulation ENABLE, TTL output.
23	EMSTOP	Emergency stop signal. TTL output.
13, 24, 25	NULL	unconnected

Remark: description of the control interface :

1. P0 ~ P7 are 8 bit buses used for setting power. P0 for LSB, P7 for MSB. The input range is 0~255, which is corresponding to the nominal power of 0~100%.

Table 3-3 P0 ~ P7 Power definition

	Set 1	set 2	Set3	Set4	set 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
P6	1	1	1	1	1
output Nominal power	50%	75%	87.5%	93.75%	100%

2. P11, P12, P16 and P21 are inputs of laser status. Current laser input only defines P16 and P21. These two representative laser status as follows:

Table 3-4 the Input status definition

16 pin	21 pin	input state definition
L	L	laser temperature exceeds the range of working temperature
L	H	the normal state
H	H	MO anomaly

3. Coordination among P22, P2 and P3 of DB25 are used not only to basically control the laser, but also to control pulse width of laser (based on the support of laser):

Pin number	Description
22	Red indicator output is reusable for pulse width which can regulate modulate an enable signal. After selecting relevant laser, software checks the pulse width modulation function. And then build pulse width to adjust enable signal. After the completion of setting, it will switch to the red light pointer output automatically.
2	Laser power control signal modulates pulse width while multiplexing for serial data input.
3	Laser power control signal modulates pulse width while multiplexing for serial clock input.

4. The other pin definitions of laser control interface conform to the driving requirements of general fiber laser and there might be few differences in the driving time schedule among different lasers. The cooperated application software can be set in the interface so that lasers can work in the best condition. Under the normal circumstances, both laser and DBK21B can work normally after laser's connection basing on the definition with control interface of DBK21B.

3.1.4 On-the-fly marking Interface

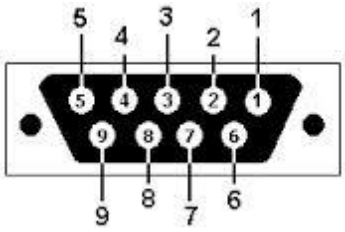


Figure 3-3 pin definition for flying marking DB9 female socket top view

The table3-5 below is the pin function:

Table 3-5 on-the –fly marking interface definition

Pin	Name	Function
1	FLYMARK_IN0	On-the-fly marking input0. Form a closed circuit with GND
2,6	FLYMARK_IN1 +, FLYMARK_IN1 -	On-the-fly marking input1. Difference input, section3.2.2 for detail using.
3, 7	BCODEP/ BCODEN	Encoder input B+/B-
4, 5	ACODEP/ACODEN	Encoder input A+/A -
8	VCC	+5V output, Form a closed circuit with P9
9	GND	Reference ground

Remark: for the internal circuit and use of input port, see the figure 3-6 and figure 3-7 behind.

3.1.5 POWER AND MOTOR DRIVING EXTENSION AXIS

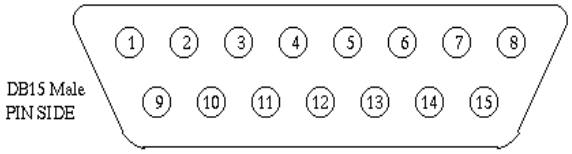


Figure 3-4 definition for power supply and motor driving DB15 male socket top view.

The table3-6 below is the pin function definition:

Table 3-6 power supply and the motor driving interface definition

pin number	signal name	specification
1	Null	Reserved and unused
2, 9	MotorX_PUL-/MotorX_PULOUT	The impulse signal of motor X. See note c for the relevant introduction in detail in the following.
3,10	MotorX_DIR-/MotorX_DIROUT	The direction signal of motor X. See note a for the relevant introduction in detail in the following .
6,13	MotorY_PUL-/MotorY_PULOUT	The impulse signal of motor Y. See note d for the relevant introduction in detail in the following.
7	YORG0	The original signal of motor Y. Input signal and form it with GND of control board to represent this pin. Connect the signal with GND to both ends of the switch respectively.
8	XORG0	The original signal of motor X. Input signal and form it with GND of control board to represent this pin. Connect the signal with GND to both ends of the switch respectively.
14,15	MotorY_DIR-/MotorY_DIROUT	The direction signal of motor Y. See note b for the relevant introduction in detail in the following .
4,5	+5V	Anode of 5V input power
11,12	GND	Cathode of 5V input power (ground signal), that is the ground signal of control board.

Note a: MotorX_DIROUT Pin can be set to MotorX_DIR+ signal for differential output or MotorX_DIR signal for single-ended output through the JP1(the direction of the jumper settings described in Section 3.2). When set to a differential output, MotorX_DIR-/MotorX_DIR+ composed of a differential output signal; when being single end output, MotorX_DIROUT and GND consists of TTL output closed circuit.

Note b: MotorY_DIROUT Pin can be set to MotorY_DIR+ signal for differential output or MotorY_DIR signal for single-ended output through the P2(the direction of the jumper settings described in Section 3.2). When set to a differential output, MotorY_DIR-/MotorY_DIR+ composed of a differential output signal; when being single end output, MotorY_DIROUT and GND consists of TTL output closed circuit.

Note c: MotorX_PULOUT Pin can be set to MotorX_PUL+ signal for differential output or single-ended output through the JP2 (the direction of the jumper settings described in Section 3.2). When set to a differential output, MotorX_PUL-/MotorX_PUL+ composed of a differential output signal; when being single end output, MotorX_PULOUT and GND consists of TTL output closed circuit.

Note d: MotorY_PULOUT Pin can be set to MotorY_PUL+ signal for differential output or single-ended output through the P3 (the direction of the jumper settings described in Section 3.2). When set to a differential output, MotorY_PUL-/MotorY_PUL+ composed of a differential output signal; when being single end output, MotorY_PULOUT and GND consists of TTL output closed circuit.

3.1.6 DIGITAL I/O INTERFACE

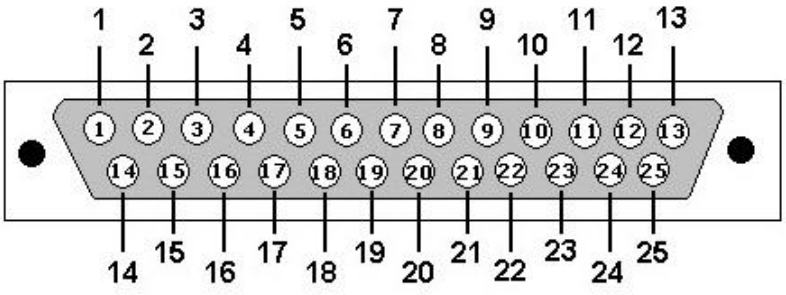


Figure 3-5 top view of pin definition for digital I/O DB25 male socket

The table 3-7 is pin function:

Table 3-7 digital I/O interface definition

Pin No.	Name	specification
1,14,2,15	Out0-Out3	General output signal 0,1,2,3. It can be set to TTL compatible output or open collector leakage output (OC) through the jumper P9, P8, P7, P6.
4,16,5,17	Out4-Out7	General output signal 4,5,6,7. TTL compatible. Form a closed circuit with GND signal.
3	OC_COM	When OC output using, connect it to plus end of the pull power(for example 24V), in case of the output circuit will be wracked by inductive load(for example: inductive relay)
6, 7, 8, 19, 20	GND	Reference ground
13,25,12,24	In0-In3	The input anode port of general input in signal0-3, formed a closed circuit with GND, the usage is shown in the next chapter3, the usage will be shown in the next chapter3.2.1
10	In4-/In5-	Form a closed circuit with In4+,In5+ as cathode.
11,23	In4+,In5+	input port In4,In5 as anode.
21	In6-/In7-	Form a closed circuit with In6+,In7+ as cathode.
9,22	In6+,In7+	input port In6,In7 as anode.
18	LaserErr	Not be used.

Remark 1: Output signals Out4, Out5, Out6 and Out7 are TTL output, Out0, Out1, Out2 and Out3 can be set to open drain output (OC) by jumper P9 P8, P7, P6 (see chapter 3-2 jumper setting instructions). Short-circuit or ground must be avoided when using TTL output, otherwise it will damage the board. During the TTL output signal output, the output current guaranteed is less than 5mA.

Remark 2: when using OC output (open drain output), please connect with the input power in 3 pin OC_COM, especially in the time of the connecting inductive load (such as perceptual relays), positive terminal must be connected to the power supply. The OC output, whose allowed drive current is 250mA; the drive voltage is up to 40V.

3.2 Digital I/O operation

3.2.1 Use of Single-ended General Input Signals

Illustration of internal circuit of Single end general input signals such as P13,P25, P12, and P24 is in figure 3-6:

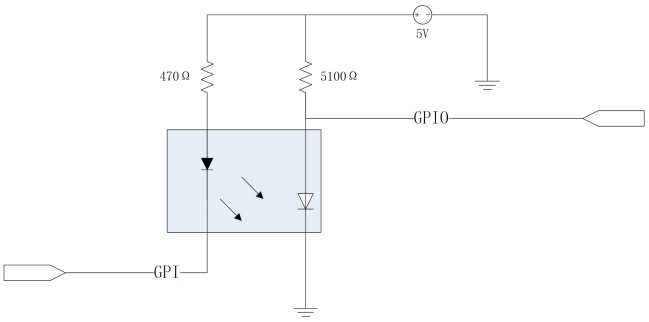


Figure 3-6 single end input drive circuit.

This input signal can be used as long as the GPI terminal is connected with a switch, of course, electronic switch also can be used in the external circuit, when the switch connect with the ground, input"0", when the switch open circuit, input"1".

3.2.2 Use of Differential General Input Signals

Illustration of internal circuit of differential general input signals are in figure 3-7, such as P10 and P11 or P2 and P6 of on-the-fly marking interface(Figure 3-3) :

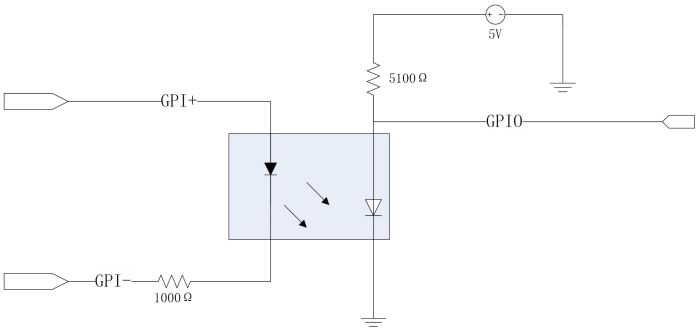


Figure 3-7 differential input drive circuit.

To use the differential input, please be in accordance with actual Vin value of the external power supply to determine whether you should series connect a limiting resistor, the goal is to ensure that the input current is between 10mA and 15mA. If the input voltage is over 12V, we recommend a current limiting resistor. Assumed that the input current you choose is 12mA, and then the resistor is calculated as follows (ohm):

$$R = Vin \times 1000/12 - 1000$$

3.2.3 Use of General Output Signals

The general output signals such as Out4-Out7, corresponding to the digital I/O interface in table 3-7, TTL compatible. The output voltage is on GND signals, direct output, the output must not be short-circuited or ground, otherwise the board can be damaged, and you should guarantee the output current is less than 5mA.

3.2.4 The use of OC Output (OPEN DRAIN OUTPUT) Signals

When the output is required to directly drive high current loads such as relays, it can be directly driven when using the OC output, Out0-Out3 can be set to OC output by a jumper setting (see table 3-8), corresponding to the Pin of digital I/O interface in table 3-7.

The following table 3-8 describes how to use Out0 OC output to drive relay circuit:

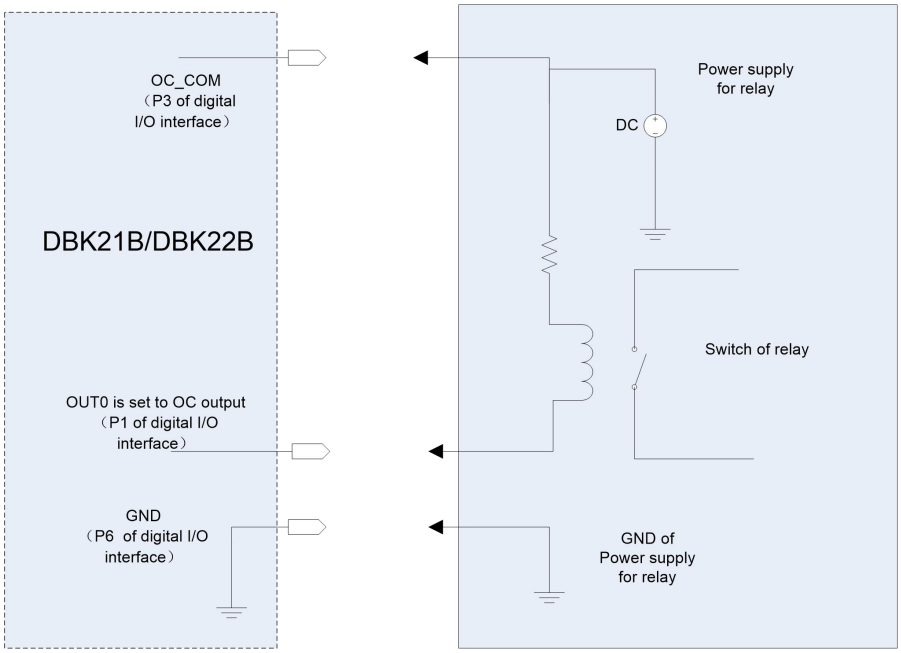


Figure 3-8 the connection method for OC output to drive the relay circuit

The allowed driving current of relay is 250mA, and the drive voltage can be up to 40V. The OC_COM pin internal of board connected clamping diode, it must be connected to the anode of the user's relay driving power supply when using the relay.

The allowable driving current and the maximum driving voltage of the relay are 250 mA and 40 V respectively. The clamp diode is wired in the pin OC_COM, and must be connected to the plus end of user's relay (if used) driving power.

3.3 Illustration on Jumpers

Table 3-8 the jumper setting description

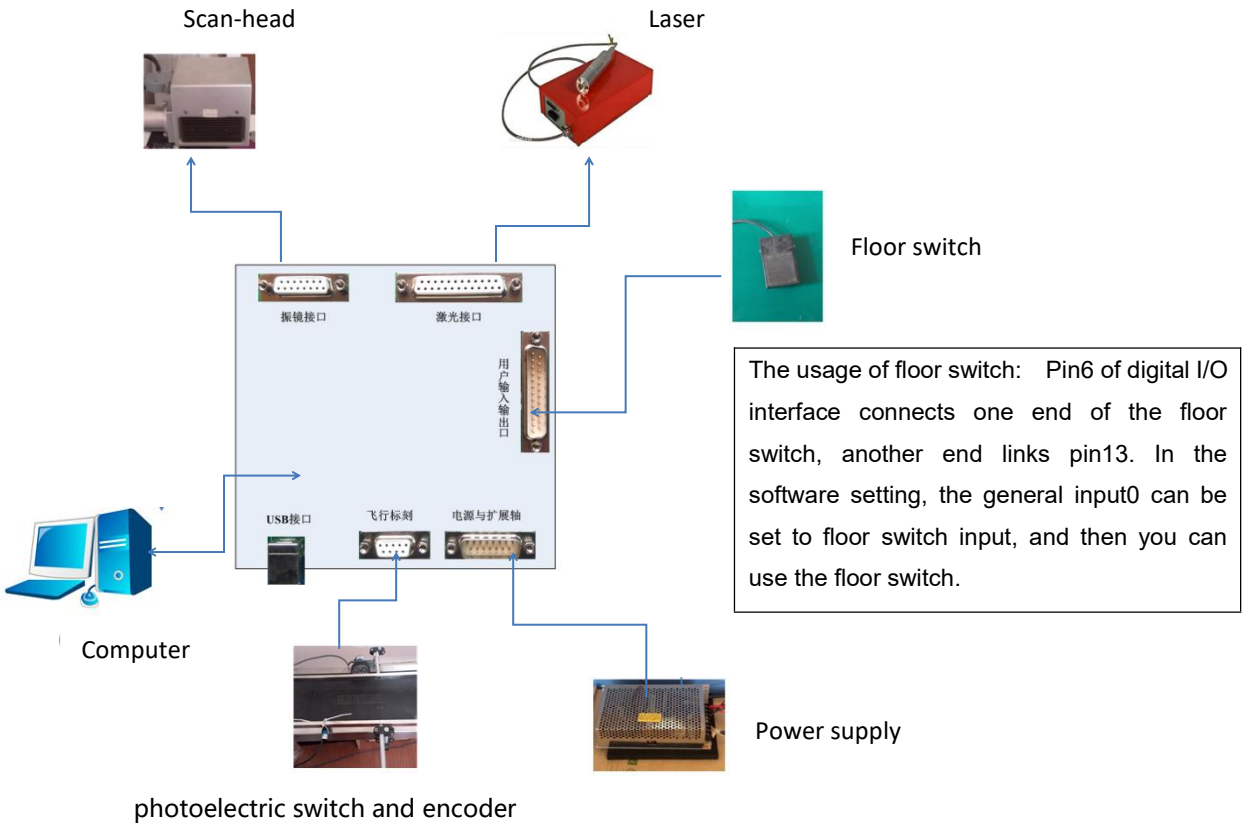
Number	signal description	short connecting 12	short connecting 23
JP1	The direction signal setting of motor X (MotorX_DIROUT)	MotorX_DIR+	TTL single end output
JP2	The pulse signal setting of motor X (MotorX_PULOUT)	MotorX_PUL+	TTL single end output
P2	The direction signal setting of motor Y (MotorX_DIROUT)	Motor Y_DIR+	TTL single end output
P3	The pulse signal setting of motor Y (MotorX_PULOUT)	Motor Y_PUL+	TTL single end output
P6	General output signal Out3	TTL output	OC output
P7	General output signal Out2	TTL output	OC output
P8	General output signal Out1	TTL output	OC output
P9	General output signal Out0	TTL output	OC output

Default settings:

JP1, JP2, P2 and P3: 23 are shorted, TTL single end output

P6-P9: 12shorted, TTL output

4 Typical connection



The usage of floor switch: Pin6 of digital I/O interface connects one end of the floor switch, another end links pin13. In the software setting, the general input0 can be set to floor switch input, and then you can use the floor switch.

The usage of on-the-fly marking: Pin8 of on-the fly marking interface output +5V, Pin9 for GND, which supply power for encoder, Pin1 and Pin9 connect a photoelectric switch, software corresponds to the input port 8 for on-the-fly marking. Pin3 and Pin7 are the encoder input B+/B-, Pin4,Pin5 for encoder input A+/A-, as the input signal of on-the –fly encoder.

Power supply and motor extension axis interface socket is power supply port, Pin4 and Pin 5 are the anode, Pin11 and Pin12 are cathode. It requires 5V to supply power, the voltage range is between 4.75 and 5.25V, and you can provide 1A current at least, but we recommend a 2A current.Attached power adapter can be used also.

Figure 4-1 a typical connection diagram for control card

In the figure, only the power, laser, scan head is a must. The encoder will be used only when the on-the-fly marking function is used, you should decide whether to use floor switch according to the real situation.