USBLMC Client Use Handbook

IPG Board

Version	Date	Author	Comment
V1.2	2008-5-29		
V1.3	2009-8-1		
V1.4	2010-3-23		
V1.5			Modify start signal

Catalog

Safety During Installation And Operation

Please read these operating instruction completely before you proceed with installing and operating this product. If there are any questions regarding the contents of this manual, please contact BJJCZ.

1. Steps For Safe Operation
    - Carefully check your application program before running it. Programming errors can cause a break down 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 mechanical stress.
    - For storage and operation, avoid electromagnetic fields and static electricity. These can damage the electronics on the product. For storage, always use the antistatic bag.
    - The allowed operating temperature range is 25℃ ± 10℃.
    - The storage temperature should be between –20℃ and +60℃.
2. Laser Safety
    - This product is intended for controlling a laser scan system. Therefore all relevant laser safety directives must be known and applied before installation and operation. The customer is solely responsible for ensuring the laser safety of the entire system.
    - All applicable laser safety directives must be adhered to. Safety regulation may differ from country to country. It is the responsibility of the customer to comply with all local regulations.
    - Please observe all laser safety instructions as described in you scan head or scan module manual, and this manual.
    - **Always turn on the power of this product and the power supply for the scan head first before turning on the laser. Otherwise there is the danger of uncontrolled deflection of the laser beam.**
      We recommend the use of a shutter to prevent uncontrolled emission of laser radiation.

Summarize

USBLMC marking control card is developed specially for marking machine, it adopt USB interface form. USBLMC marking control card is made up of two PCB board: Main-board and IO board. Main board and IO board are connected by two sockets which with 50 pins. The main-boards are the same, the IO board is divided into three different kinds by application: Optic fiber module (IPG), common digital module, and common analog module. Among them, common digital module is with a conversion board.

Features of USBLMC
- Power
  USBLMC marking control card uses 5V power. We suggest adopt the power of 5V/3A to achieve power supply. Common digital module, common analog interface's power input signal is on CON2 socket of module; and the power input signal of the optic fiber module is on CON4 socket of module. Please check the corresponding instruction of PINS.
- The laser Control
  1) Offer 3 routes TTL signal: Laser Gate, PWM, FPK for laser control. Laser Gate signal used for controlling switch of laser; PWM signal can be regarded as PWM signal in CO2 laser machine or the repeated pulse frequency in Nd:Yag laser machine; FPK is for the first pulse inhibits signal in YAG laser machine.
  2) Offer 2 routes that are used for controlling the power of the laser power supply and repeated pulse frequency of Q switch.
  3) As to the YLP series of pulse optic fiber laser machine of IPG, which is supply special control signal.
  4) Laser Gate, PWM signal can be set up into high level available or low level available.
  5) Common digital module, common analog module can be used for pre-setting the output power of the laser power supply.

- Common digital input / output signal (TTL signal)
  There are 10 routes input and 7 routes output signal. Common digital signal is divided into two kinds, switch form of input signal (no need external power) and non-switch form of input signal (external component entities supply the electric current drive). Common output signal is belong to TTL output (Without optical-isolation), the max output electric current is 15 mA.

  Note: " The inputs / outputs signal " of this manual are all for USBLMC control card. The signals receiving by the USBLMC and driving by external component is input signals; signals driving by USBLMC control and receiving by external component is output signals.

- Support multi-card working pattern. One computer can control 8 sets of USBLMC at a time, makes and marks the control board to run side by side and operate. Different contents can be processed by 8 sets of control cards.

- Marking-on-fly
  Flying encoder can be connected to do real-time liner speed checking for good result of high speed marking.

- Extend axis (step motor / servo electrical motor) output
  Can output two directions/pulse signals of channels to control step motor (or servo electrical motor), applicable to pivot or join.

- Start signal
  Used when marking contents are the same and high speed is required. The Floor push can connect to Start signal, or to the common input signal as well. If there are variables in marking content, they have to be connected to the common input signal.

- Compatible with USB2.0 / USB1.0

Ways to differentiate modules

There are some texts at the right-bottom corner of the module. User can differentiate them by them. The contents are:

Markings	Types of Boards	Other Features
MODEL：FIBER_IO	Fiber module	"To IPG-YLP Fiber Laser Module" in the middle
MODEL：DIGIT_IO	Digital module	
ANALOG IO	Analog module	Have two BNC sockets.

I．Functions of Fiber Module (IPG) and Definitions of Pins

Each module is developed according the different applications. Therefore, its serial number, pin definition, jumper setting, and functional settings can vary. When in use please make sure to refer to the instructions of each particular type of module.

For example, 5V power input signal of USBLMC, on the common digital module and common analog module, should be inserted from 12/13/24/25 of the feet on CON2 socket; while on the optic fiber module, the power input signal is connected from 4/5/12/13 of the feet on CON4 socket.

1. Features

a). Specially set for the YLP pulse laser by IPG Company. CON2-DB25 pin is directly connected with the laser cube's 25-stitch pin.

b). Digital IO signal, with 1-way common output and 3-way common input signals.

IN0/IN1 are fixed as the input at fiber laser status; IN6 as the emergency-stop signal input for fiber laser. IN7 is to check whether the power of laser marking machine is turned on or off; IN2/3/5 are not applicable. IN4/8/9 are comment input signals. For specific connections and the suggested connections, please see the section "Digital IO Connection Instructions".

OUT0 is the common output; OUT2 s fixed as the red light of fiber laser; OUT3 is fixed as laser enabled. OUT1, and OUT4~6 are not used.

c). Output X-axis step motor to control signals. Y/Z axis cannot be output.

d). Connect rotary encoder for high speed marking.

e). Galvo output signals are digital outputs and can be set as non-encoded digital signal outputs, or set as digital signal outputs with extend codes.

2. Output Socket Definitions
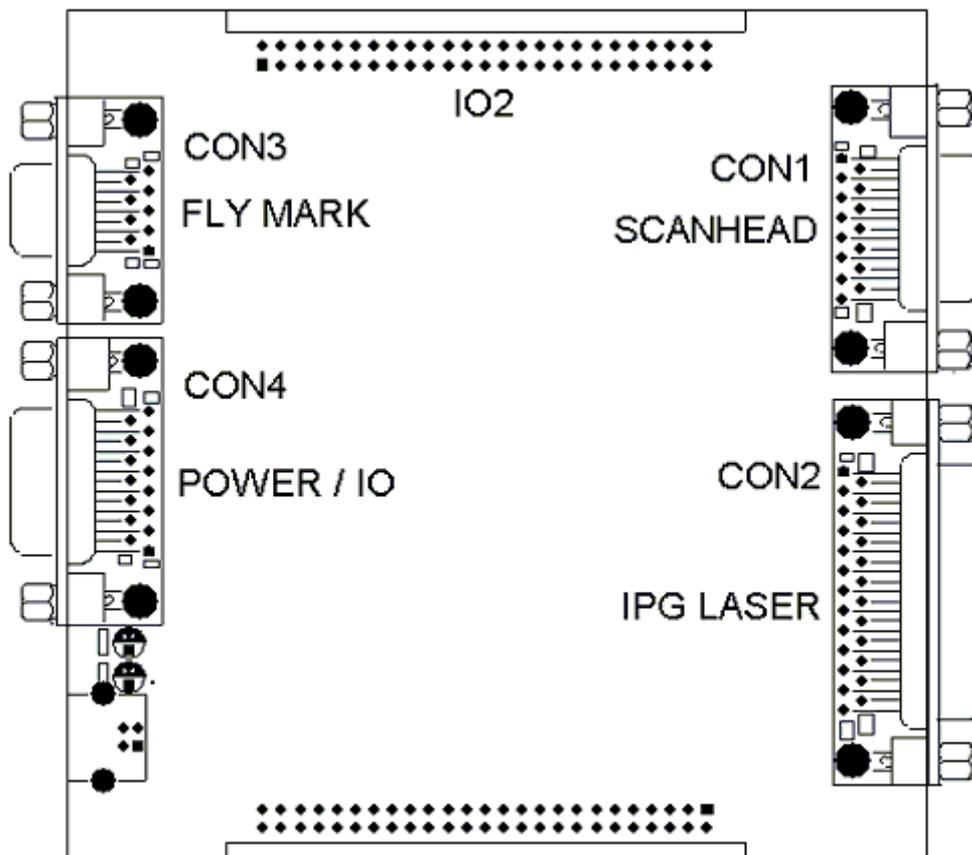
Fig. 1-1 Fiber Module – Socket Illustration

3. Definition of Output Socket Pin

a. CON1:DB15 Galvo Output

Galvo signals are digital signals which can be directly connected to digital Galvo. Digital galvo's signals transfer protocols are not exactly the same, therefore, it should be confirmed which type of transfer protocols is used by the digital galvo. The company also provides transfer boards, which are analog boards transferred from digital. It can also be transferred analog signal outputs and connected to analog galvo.
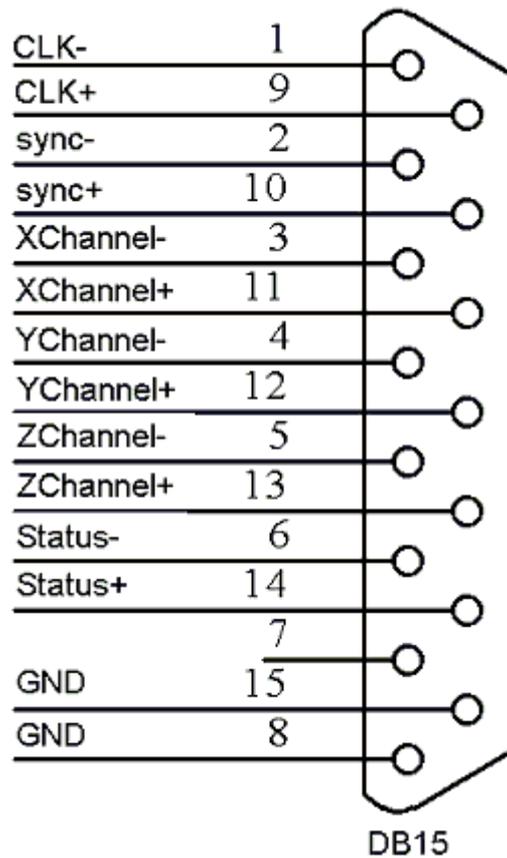

Fig. 1-2   CON1 of Fiber IO board

Pin No.	Signal name	Illustrations
1，9	CLK-/CLK+	Clock signal. Difference output
2，10	SYNC-/ SYNC+	Synchronized signal. Difference output
3，11	XChannel-/ XChannel+	Digital signal of X axis galvo. Difference output
4，12	YChannel-/ YChannel+	Digital signal of Y axis galvo. Difference output
5，13	ZChannel-/ ZChannel+	Digital signal of Z axis galvo. Difference output
6，14	Status-/ Status+	The state feedback signal of Galvo. Difference input
8，15	Gnd	The reference ground of control card.

For the common two-dimension Galvo, only connecting CLK, SYNC XChannel, Ychannel four groups with 8 signal lines is enough. We suggest use twisted-pair (such as net-line) for connecting for digital signal.

b. CON2: DB25 Fibre socket

CON2 socket and optic fiber 25 stitch socket of laser instrument connect through 25 stitch rows of line directly.

```
P0        1
GND       14
P1        2
GND       15
P2        3
SGIN4     16
P3        4
VCC       17
P4        5
MO        18
P5        6
AP        19
P6        7
PRR       20
P7        8
SGIN1     21
PLATCH    9
OUT2      22
GND       10
EMSTOP    23
GND       11
GND       24
GND       12
          25
GND       13

        DB25
```
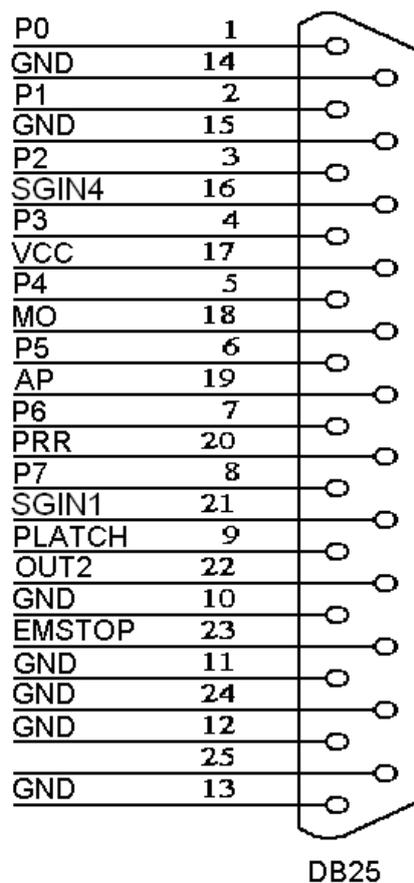
Fig. 1-3 Pins of CON2

Pins	Signal name	Illustrations
1——8	P0——P7	Laser power. TTL output.
9	PLATCH	Power latch signal. TTL output.
10，14	Gnd	Control card's Ground
11，12	Ver2：GND	Control card's Ground
	Ver3：SGIN2，SGIN3	Laser status input.
13,15,24	Ver2：GND	Control card's Ground
	Ver3：NULL	Reserved
16,21	SGIN4，SGIN1	Laser status input.
17	Vcc	5V power output of control card.

| 18	MO	Master Oscillator switch. TTL output
19	AP	Power amplifier. TTL output.
20	PRR	Repeat pulse power signal. TTL output.
22	Out2	Laser's red light indication signal. TTL output.
23	EMSTOP	Emergency stop signal. TTL output.
25	NULL	Reserved

c. CON3:DB9 Marking-on-fly Encoder
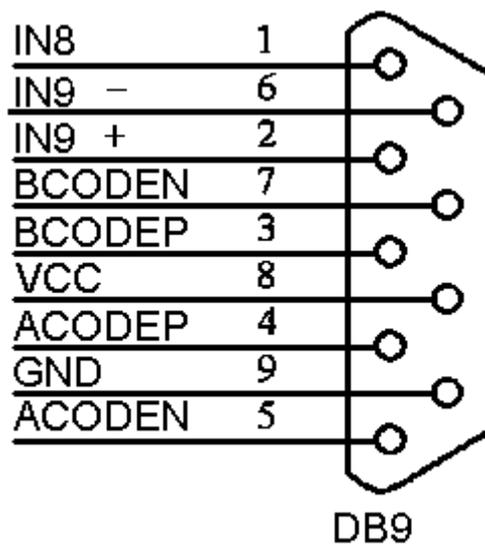
Fig.1-4 Pins of CON3

| PIN No.	Signals	Illustrations
1	IN8	Common input signal 8. Forms a return circuit with GND 9. To use this signal, connect it and GND respectively to either terminals of power.
2，6	IN 9+/ IN 9-	TTL input signal. Internal 1K current-limited resistor. External current-limited resistor is suggested when voltage is over 5V. Please refer to IN9 Port Illustration.
3，7	BCODEN/BCODEP	Encoder phase B input signal. Differential input.
4，5	ACODEN/ACODEP	Encoder phase A input signal. Differential input.
8	Vcc	Control card 5V output.
9	Gnd	Control card Ground. As the return circuit signal of pin 8 & 1.

d. CON4: DB15 Power
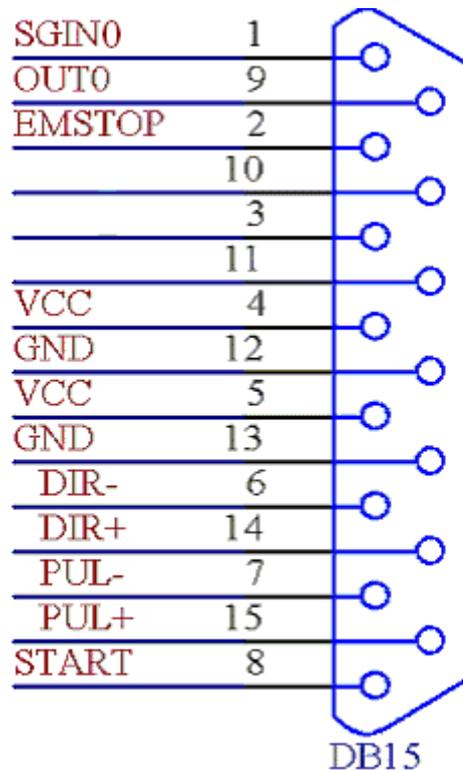
Fig.1-5 Fiber Interfere Board CON4 Socket Signals and the definitions

PIN No.	Signals	Illustrations
1	SGIN0	Common input signal 0. Forms a return circuit with ground 12 and 13 of the control board. To use this signal, connect it and the ground respectively to either terminal of the power. This is an input signal.
2	EMSTOP	Emergency-stop signal. Forms a return circuit with ground 12 & 13. To use this signal, connect it and the ground signal respectively to either terminal of the NORM-OPEN switch. When this EMSTOP is pressed, it means there is emergency and operation is immediately stopped. The signal is an input signal.
3	Ver 2: POW_BTN	Power signal of the laser instrument main power source. Forms a return circuit with the Ground 12 & 13 of the control board. To use this signal, connect it and the Ground signal respectively to either terminal of the NORM-OPEN switch. When the power button is pressed downward, pin 10 & 11 are connected; when the button is bounced upwards, they are disconnected. For the power connection, see "Power Connection". This is an input signal.

|		
	Ver 3: NULL	Reserved
4，5	VCC	5V input power positive terminal. This is an input signal.
8	REMARK	Re-Mark the content buffered in the LMC. Forms a return circuit with Ground 12 & 13. To use this signal, connect it and the Ground signal respectively to either terminal of the power. This is an input signal.
9	OUT0	Common output signal 0. Uses GND 12 & 13 signals as reference signals. This is an output signal.
10，11	Ver 2: POW_CON，POW_CON1	Connection port of power relay. Connect POW_CON to the anode of power relay's control power. One of the power relay's control ports should be connected with POW_CON1, and the other to the cathode of the cathode of power relay's control power. When the 3-point power is plugged in, POW_CON and POW_CON1 are connected. At that time, power relay's control port is connected to its control power, power relay picks up, and fiber laser main power is on. Please see "Power Connection" for reference.
	Ver 3: NULL	Reserved
12，13	Gnd	5V input power cathode (Ground signal), i.e. the control card's Ground signal. This is an input signal.
6，14	DIR-/DIR+	Output signal. Direction signal of the extend axis (step motor or servo motor). The output mode could be set up either as differential output, or as level output (TTL output). This is an output signal.
7，15	PUL-/PUL+	Pulse signal of extend axis (step motor or servo motor). The output mode could be set up either as differential output, or as level output (TTL output). This is an output signal.

e. CON5: IDC10 Socket
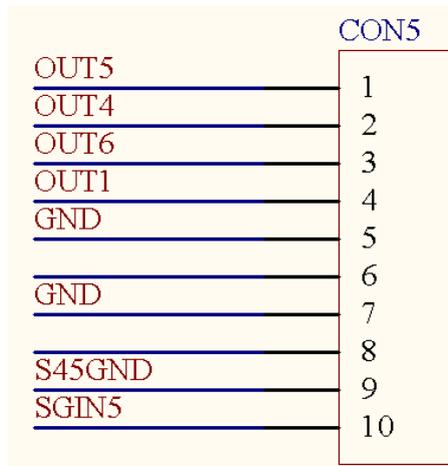
Fig. 1-6 CON5 Socket

PIN No.	Signals	Illustrations
1,2,3,4	OUT5/4/6/1	Common output signal 0. Uses GND 5 & 7 signals as reference signals. This is an output signal.
5,7	GND	Ground
6,8	NULL	Reserved
9,10	S45GND, SGIN5	Common input signal 5.

4. Jumper Illustration
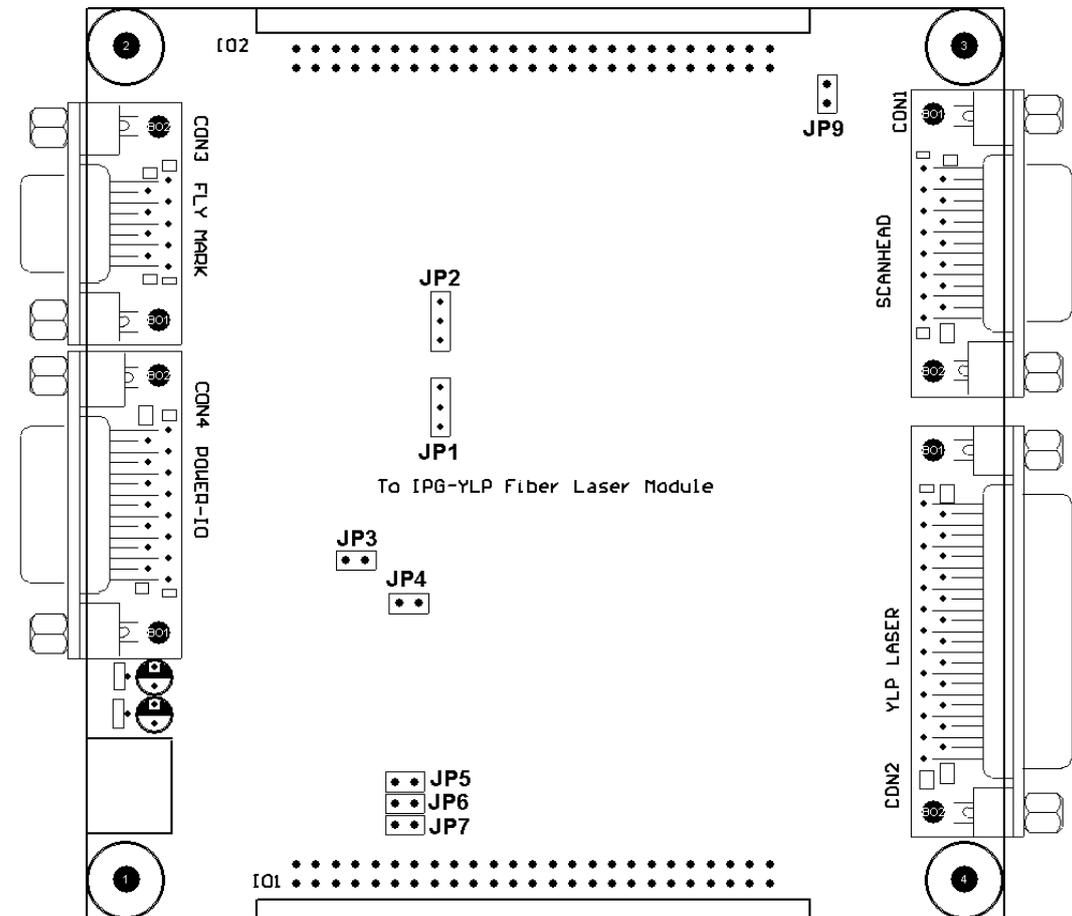
Fig. 1-7 Illustration of Fiber Interface board Module Jumper Location

See jumper illustration below:

Label	NO.	Illustrations
JP1，JP2	3	Extend axis direction/pulse signaling set up. JP1 set direction, JP2 set pulse signal. Short connection to pins 1-2 of jumper will make differential output of direction/pulse signal. CON4's DIR-, DIR+, PUL-, PUL+ should be respectively connected to step drive's DIR-, DIR+, PUL-, PUL+. Short connection to pins 2-3 of jumper will make level output of direction/pulse signal. In this case, CON4's VCC、DIR+、PUL+ should be respectively connected to step drive's VCC, DIR, PUL.
JP3	2	If pin NO. 3 of CON4 is not connected to power switch, this jumper should be connected short. Here correspond to that the power switch is push down always. For system that uses power switch, do not connect the jumper.
JP4	2	Not used.
JP5，JP6，JP7	2	Index numbers 0~7, used to differentiate various cards when many cards are working at a time. JP8-JP7-JP6 correspond to binary b2,

		b1, b0. Short connecting JUMPER means b0, and not short connecting it means b1.
JP9	2	Short connecting the JUMPER means galvo data excludes expanded code(s). Not short connecting it means it contains expanded code(s).

Default Settings:

JP1~JP2: Short connecting pin 2~3. Extend axis direction/pulse signals output level mode.

JP3: Not connecting.

JP4: Not connecting.

JP5~7: Not connecting.

JP9: Short connecting.
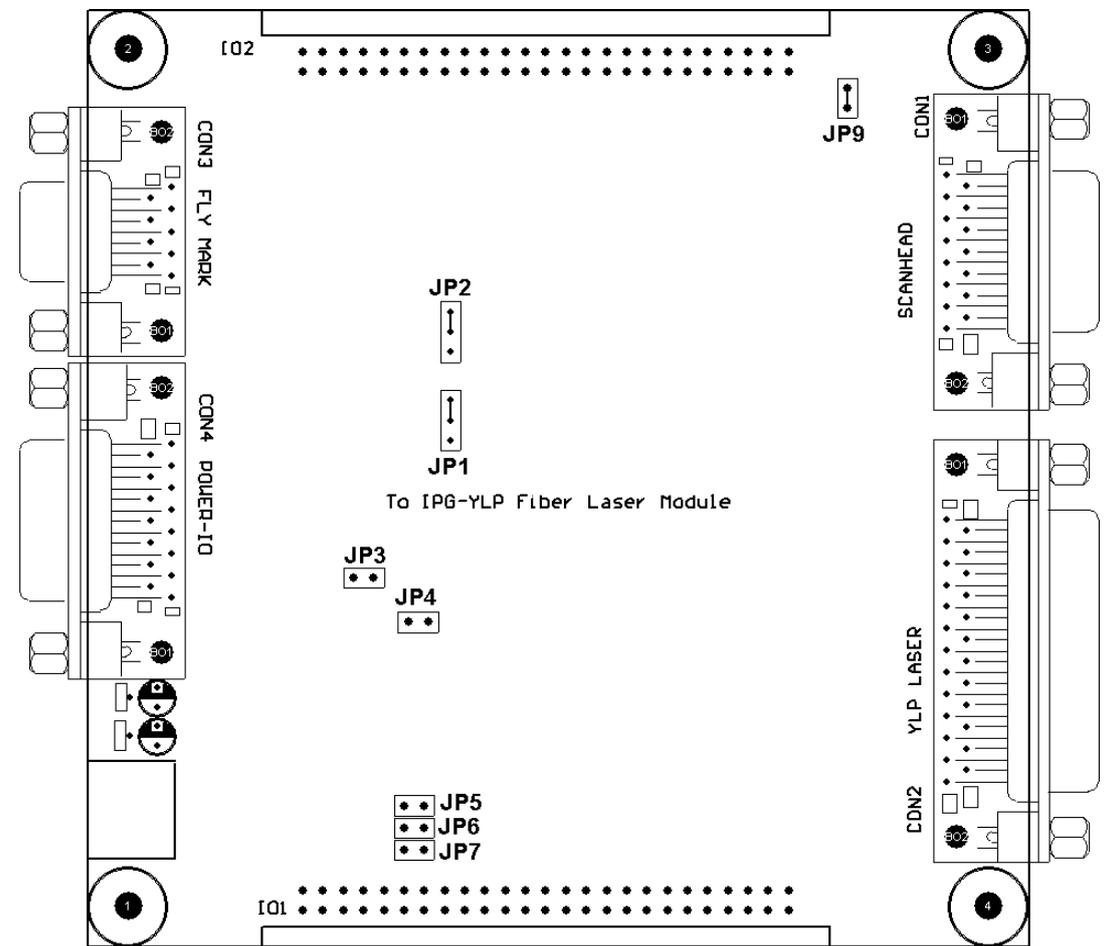
Fig. 1-8 Fiber module (Fiber Laser Module) Jumper Default Settings

5．Hardware Connection

a. Input signal IN0, IN8, Start, EMSTOP
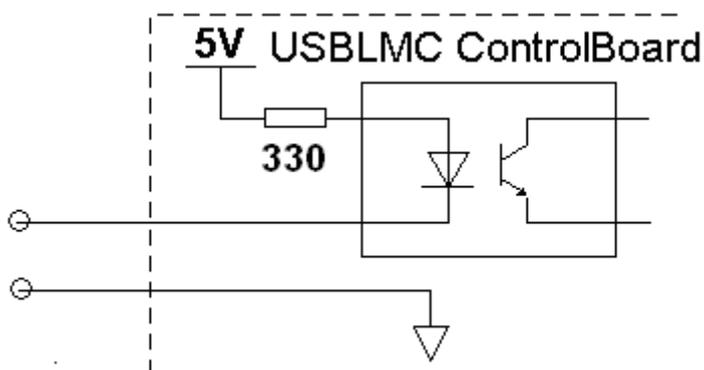
Fig. 1-9 input interface SGIN0、IN8、Start and EMSTOP
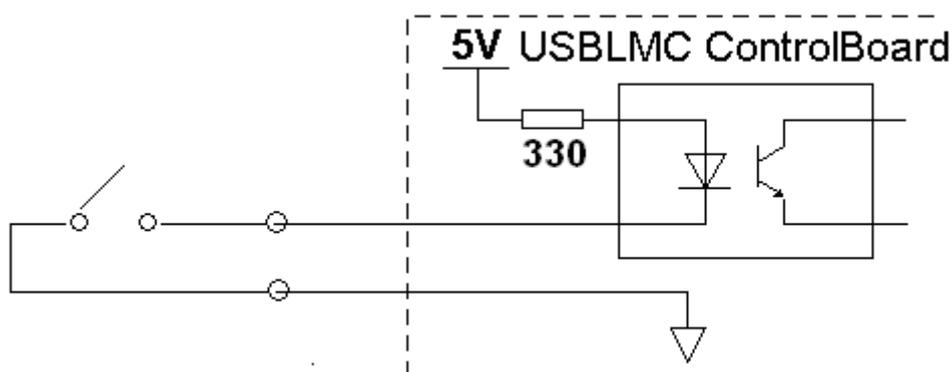
Fig. 1-10 Recommended Connection for Common Input Signal

Only an external switch is needed, and the contact resistance of the switch should be under 100 Ω.

b. Input signal IN5, IN9

Common input signal IN9 connection circuit and suggested connection are shown as in fig. 1-11 and 1-12. (CON5 PIN10 and PIN9 for IN5)

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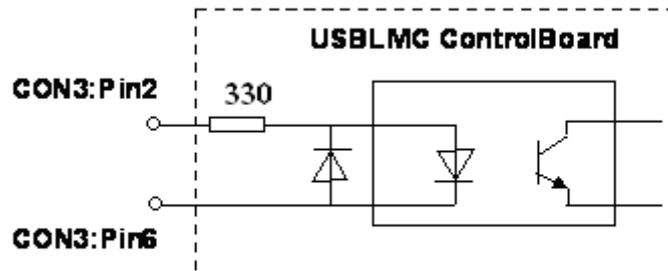
Fig. 1-11Common Input Signal IN9 connection Circuit Illustration
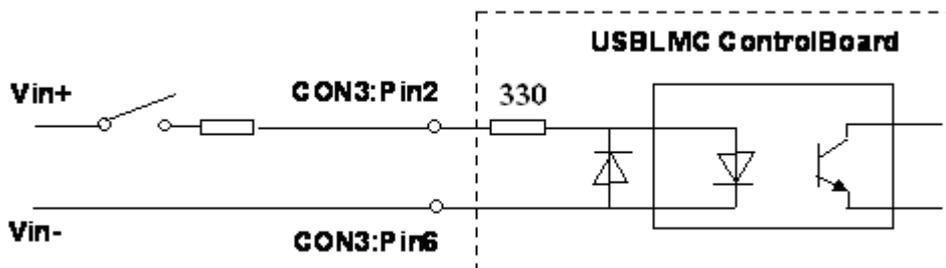
Fig. 1-12 Recommended Connection for Common Input Signal IN9

The external power supply needs proper input voltage to make sure the current is between 10mA ~15mA. When input voltage is over 5V, it is suggested that control carton connects current-limited resistor R1. Supposed the input current chosen is 12mA, then the input resistance R1 is calculated as per the following formula:

$$R1 = \left(\frac{Vin}{12} - 0.33 \right) \times 1000 \quad \Omega$$

b. Power Connection

See below fig. 1-13 for recommended power connection:
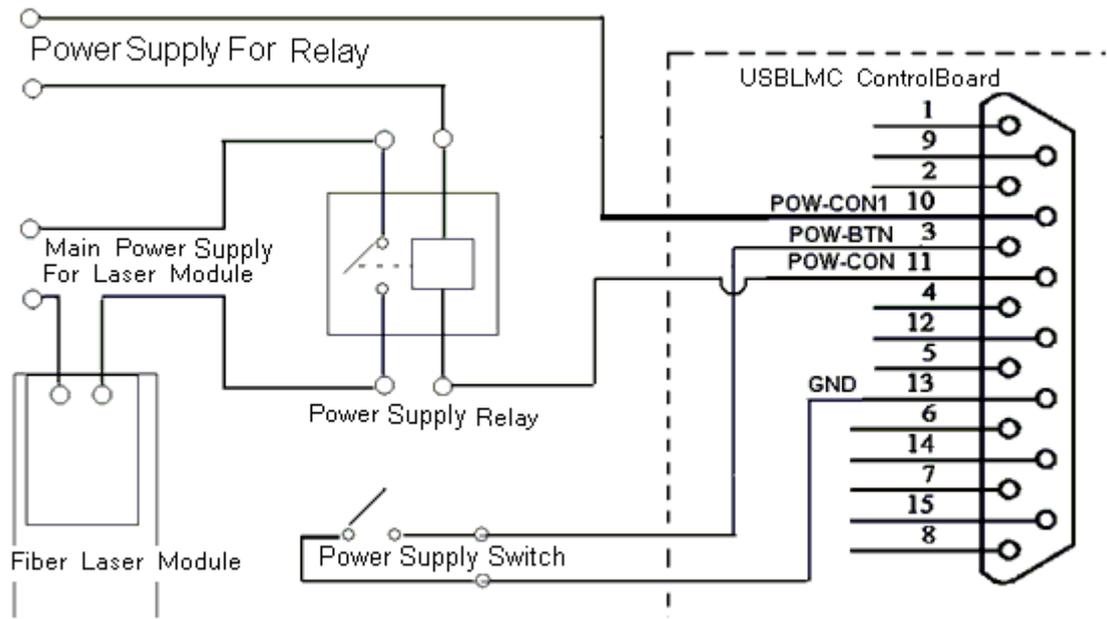
Fig.1-13 Recommended power connection way

When the power switch is on, the control card turns on the power relay, and the laser main power is connected to the fiber laser.

Pin POW_CON and pin POW_CON1 allow maximum current of 500 mA.

c. Typical Connection of Fiber Laser Module
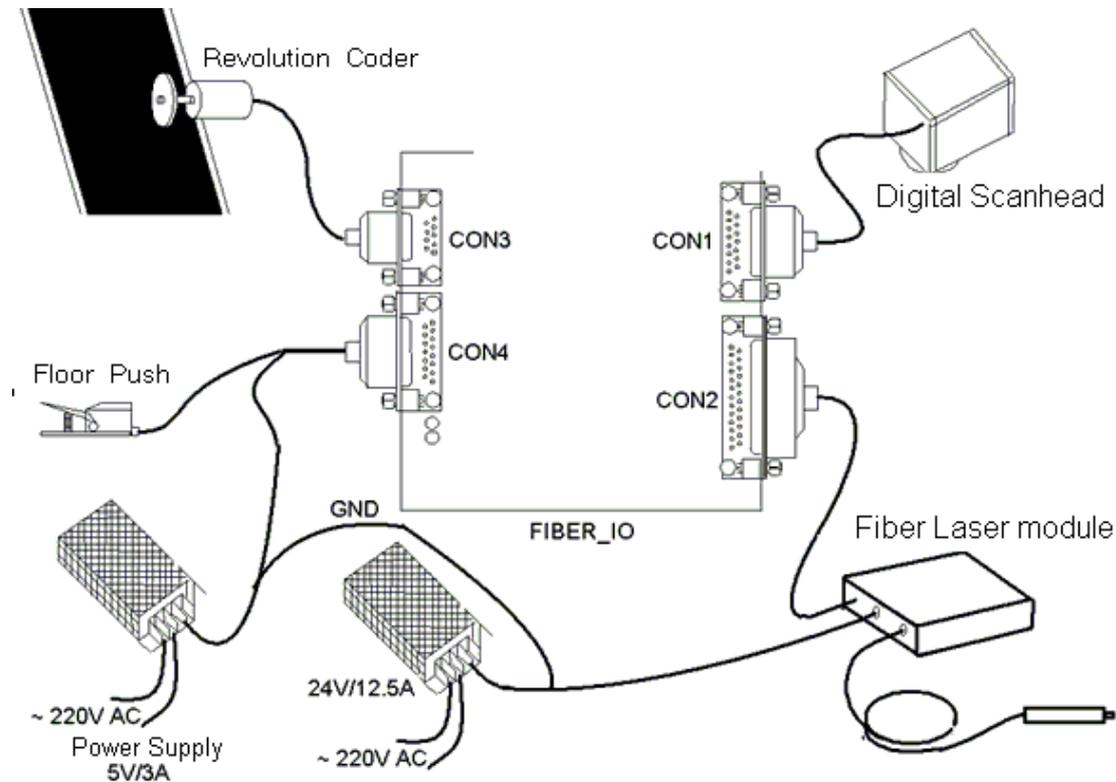
Fig. 1-14 Typical connection way of fiber interface board

For the Floor push, it depends whether the rotary encoder needs connected. If the marking-on-fly function is not used, then there is no need to connect the rotary encoder.

II. The common connection ways

1. The connection between User-defined digital Galvo conversion board & USBLMC control card

CON1 (Digital input signal socket): Connect User-defined digital Galvo conversion's DB15 with USBLMC control card's DB15 directly.

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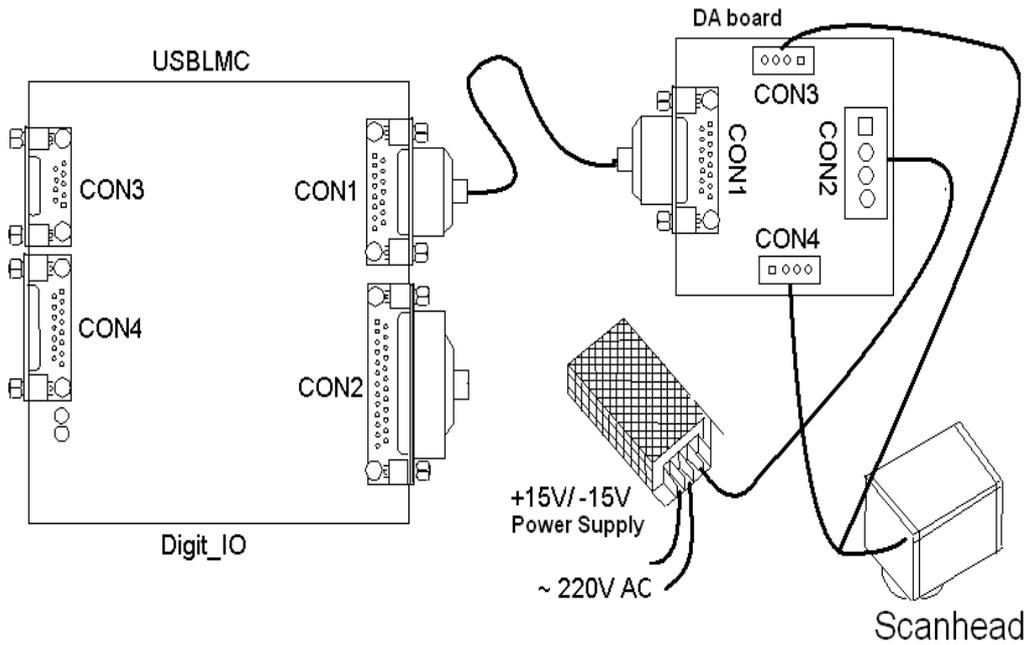
Fig. 3-1 Connection of conversion board

CON2 (Power socket): Connect the outside ±15V power to the corresponding pin, the range of the voltage is [±12V—±15V], as the following figure (Fig. 3-2)
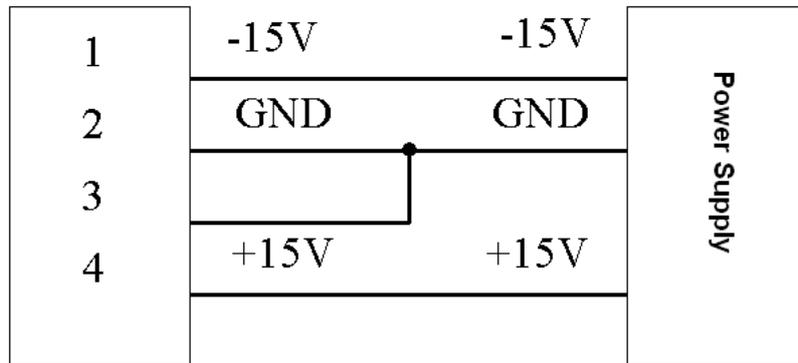

Fig. 3-2 Connection of Power supply

CON3/CON4 (Galvo control signal): It's divided into Single interface & Difference two connection ways, we should choose the most suitable connection way according the Galvo

Note: Difference connection's output voltage is twice of single interface's. We suggest use single interface connection. And while only confirmed the Galvo interface is Difference interface, we can consider to follow the Difference output way.

The two connection ways are as following figure (Fig. 3-3 Single interface of Galvo; Fig.3-4 The difference of Galvo)

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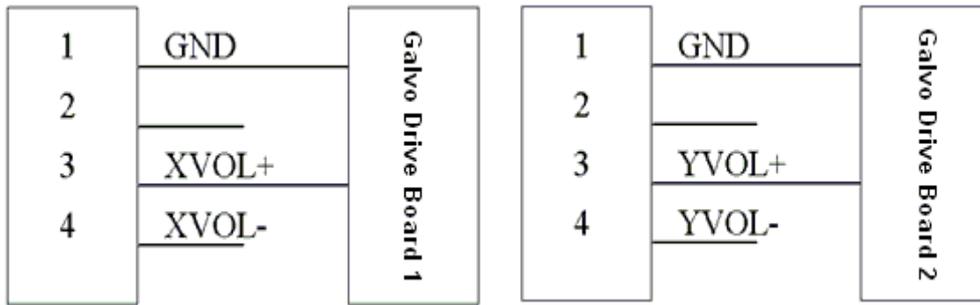
Fig. 3-3 Single interface of Galvo
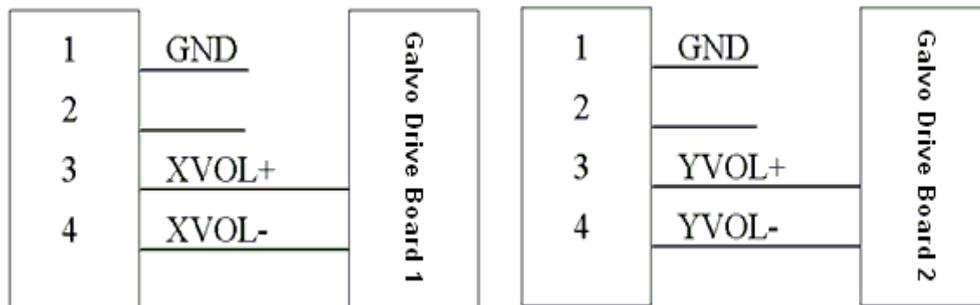
Fig. 3-4 The difference of Galvo

2．The encoder, photoelectric switch during marking-on-fly

USBLMC control card receives differential drive signal (eg DS26LS31 type) of encoder; use CON3:DB9 encoder and photoelectric switch socket of mark-on-fly. The connection as the following figure (Fig: 3-5)
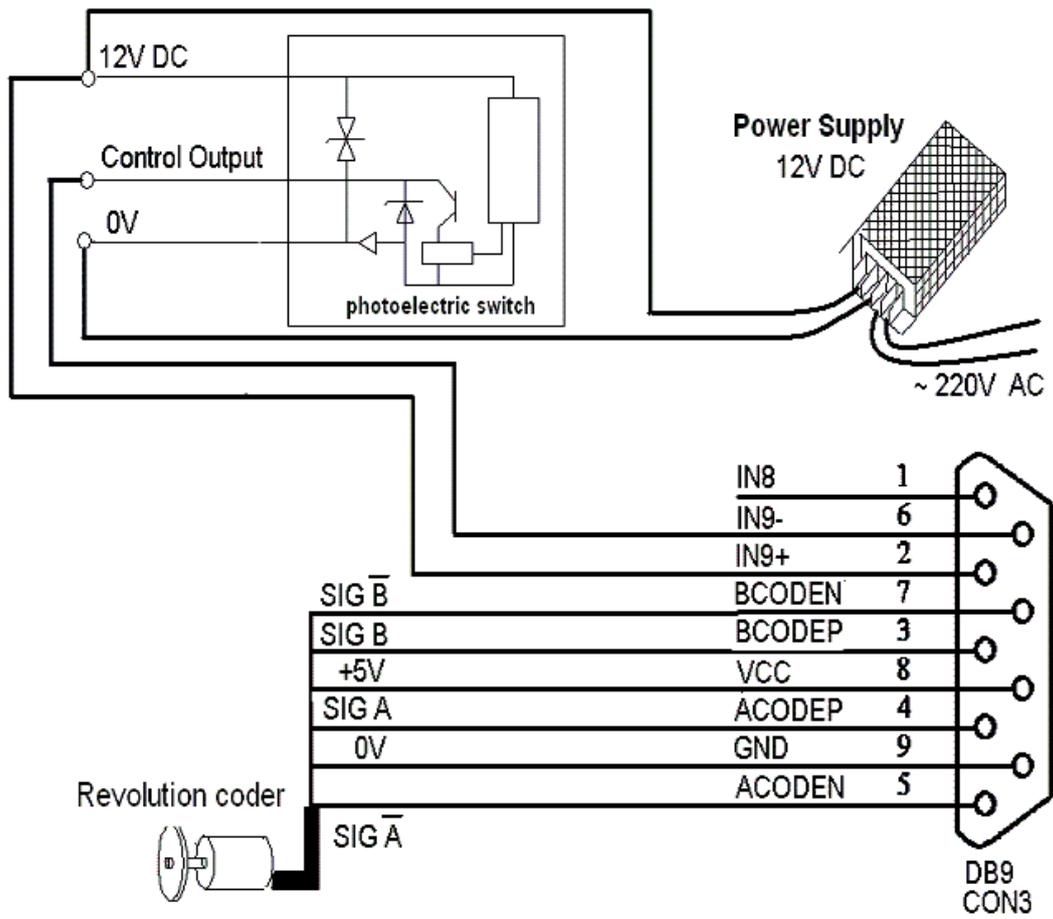
Fig. 3-5 Connection of encoder and photoelectric switch

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