RAYTOOLS

BF330-6C SERIES

Scan Laser Welding Head - User Manual

Document History

Edit date	Version	Topic, revision, action taken
2024/5/23	V1.0	First edition

Thank you for choosing our product!

This manual describes the installation and commissioning of laser welding head in details so that you can use this product quickly. You can consult us directly for more details.

Due to the continuous updating of product functions, the product you receive may differ from the introduction in this manual in some aspects.

If you find any errors in this document, please inform us as soon as possible. The data contained in this manual is only used to describe the product and shall not be regarded as a statement of security interest.

For the benefit of our customers, we will constantly try to ensure that the products we develop comply with the latest technology.

Raytools AG

Email: sales@raytools.com
Website: www.raytools.ch

Disclaimer

- We reserve the right to change the design in order to improve the quality or expand the application or comply to manufacturing workmanship.
- We will not bear any responsibility for losses and accidents caused by wrong operation or improper handling of our products.
- Dismantling of product will lose all warranty claims excluding the normal replacement of worn parts and components required for maintenance or commissioning operations.
- Unauthorized modification of products or use of non-original spare parts will directly lead to the invalidation of warranty and liability exemption.
- It is recommended to only use the spare parts provided by us or submit them to us or the designated professional team for installation.

Use Regulations

- Ensure that the product is used in a dry environment.
- Ensure that the product is used in the environment required by EMC standards.
- The product is only allowed to run within the parameters specified in the technical data.

Personnel Responsibilities

- Be familiar with the basic provisions of work safety & accident prevention and have received equipment operation guidance.
- Read and understand basic safety instructions and operations.
- You must have studied the relevant regulations and safety instructions and understand the possible hazards.
- Comply with relevant regulations and implement corresponding protective measures.

Safety Instructions

Prevent Electric Shock

-  Parts of the laser head such as nozzle, sensor, sensor interface and attached fasteners may not be fully protected by the ground wire due to function fault. These parts may have low voltage. When installing electrical equipment, please pay attention to taking anti electric shock measures for relevant personnel.
-  Note that the equipment shall be grounded as specified.

Guard against Danger

- Never put your hands or other body under the laser head.
- Repair and maintenance work can only be carried out after the power is turned off.
- Do not exceed the specified maximum pressure.
- It must be ensured that the laser head is in normal condition at all times.
- All fasteners such as bolts and nuts must be tightened.

 **Laser Caution**

- Avoid direct laser radiation or scattering to the skin.
- Do not stare at the laser beam even when wearing optical equipment.
- Use special laser protective eyeglasses that meet the requirements of safety standards IEC 60825-1.

Prevent Waterway Corrosion

- In order to avoid corrosion, use the specified coolant and comply with relevant requirements and specified maintenance intervals.

Noise Prevention

- The corresponding measures shall be specified or explained and observed in order to prevent personnel from being harmed by noise when the cutting air pressure is high.

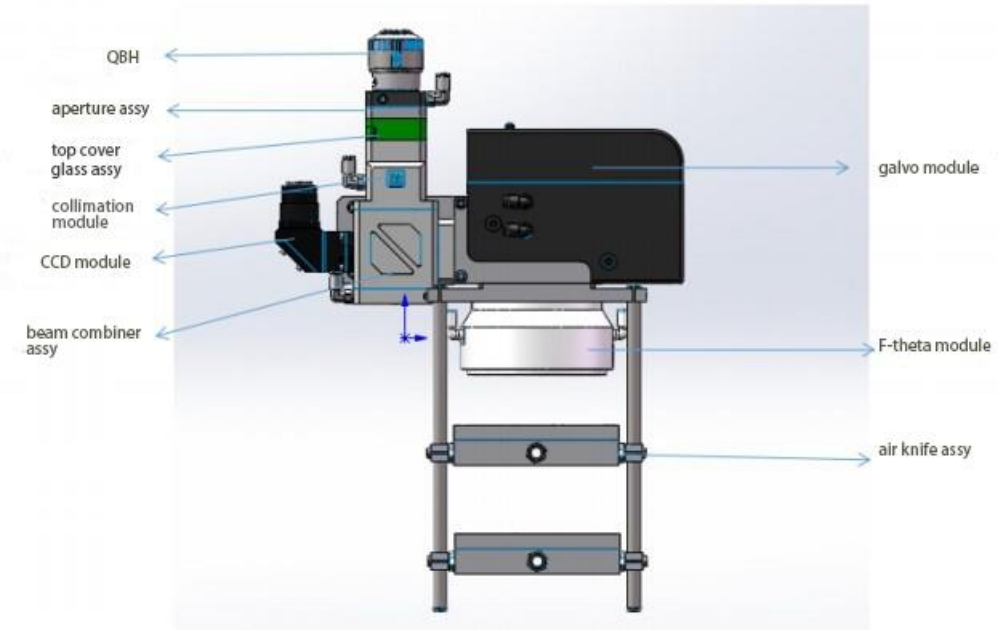
Storage and Transportation

- Observe the storage temperature range allowed by the technical data.
- Take reasonable measures to prevent fire, vibration or impact.
- Do not store in or near the magnetic field.

Contents

1 Laser Welding Head

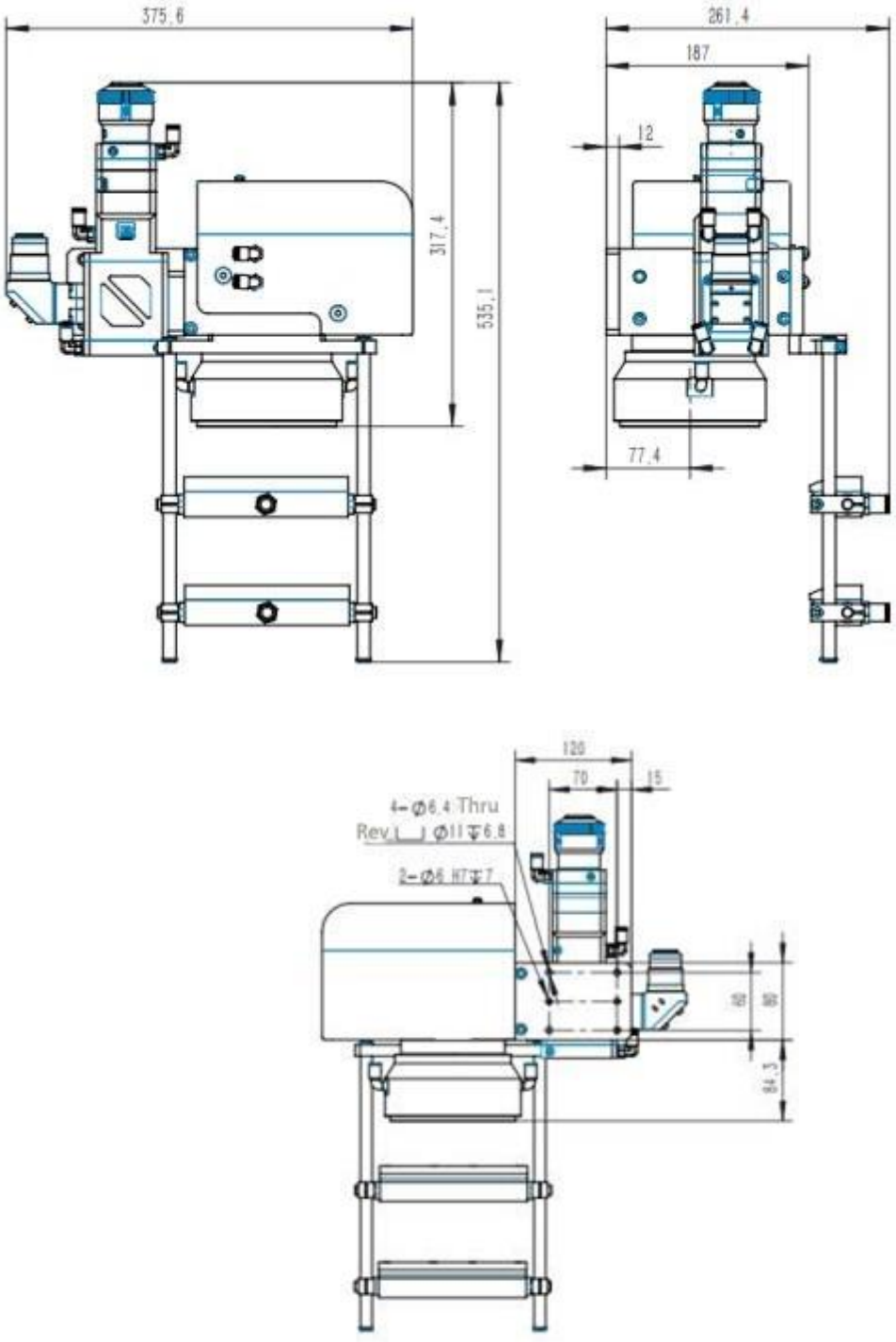
1.1 Structure



1.2 Technical Datasheet

Wavelength	1064nm
Fiber Interface	QBH (standard config.)/QD/LLK-B/LLK-D
Clear Aperture	30mm
Collimation Length (fC)	100mm/125mm/150mm
Focusing Length (fF)	330mm/420mm
Scan Field	180*180mm/200mm*200mm
Specification of Cover Glass	Φ37mm*1.6mm（top）
CCD Module	C/CS interface

1.3 Mechanical Size



2 Mechanical Installation

2.1 Package Inspection

1) Before opening package

1. Check whether the package is damaged.

2. Check whether the product mark is damaged and whether the product ID is consistent with your order.

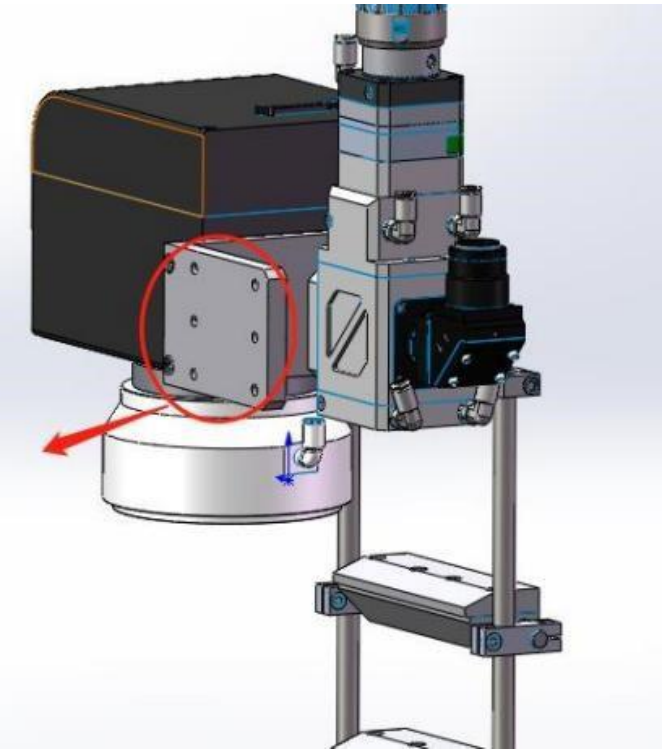
2) After opening package

1. Check goods according to shipping list inside.

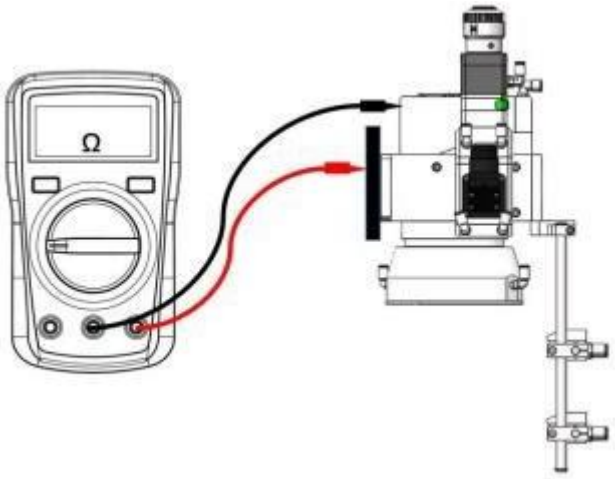
If any problems with above details, please contact RAYTOOLS personnel.

2.2 Mounting of Laser Welding Head

Mounting hole of laser welding head (add an isolation plate when using flange connection)



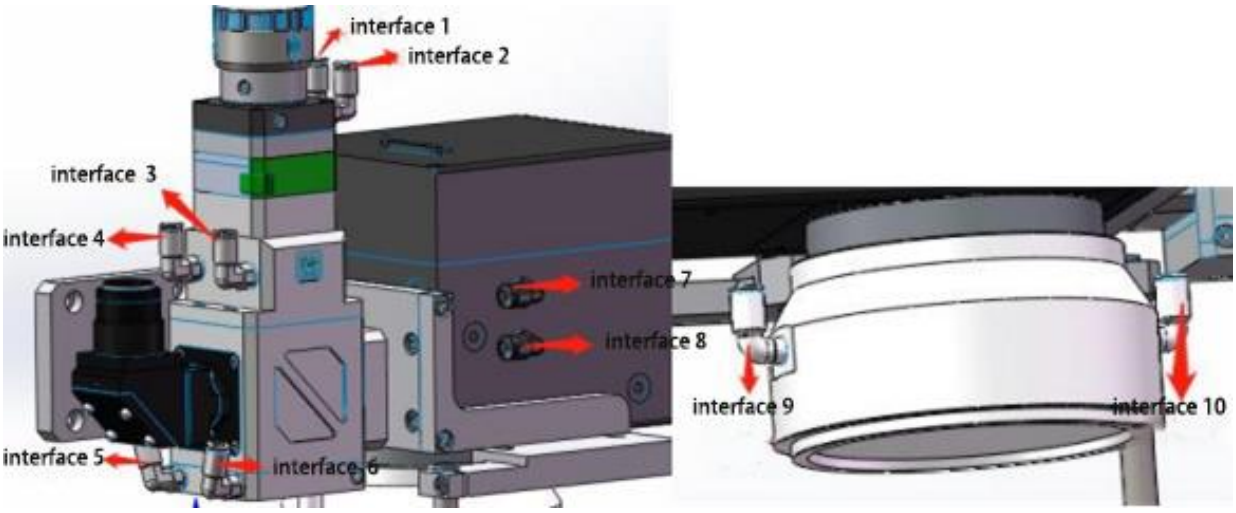
After mounting laser welding head, confirm that there is no disconnection of electrical conductor between the housing of the head and the frame of the isolation plate



1. Measure the resistance between the housing of the head and the frame of the isolation plate.
2. The resistance must be greater than 1 million Ω.

2.3 Connection of Cooling Water and Gas

2.3.1 Connection of Cooling Water



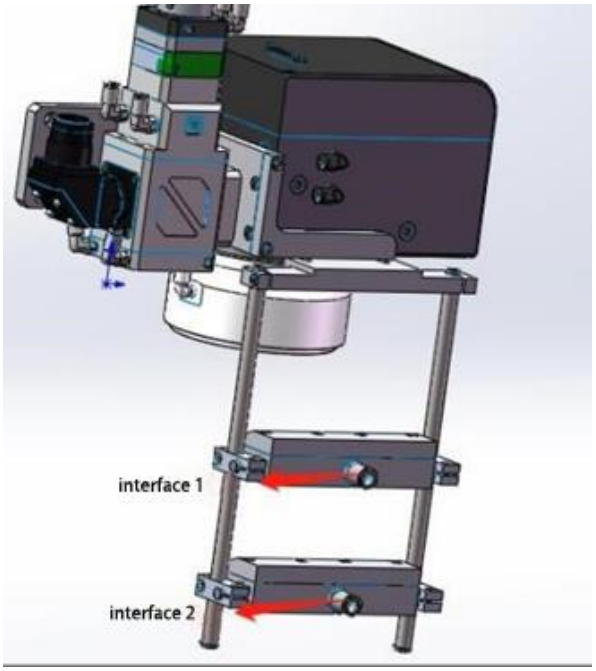
Water IN: interface 1

Chain Connection: interface 2-3-4-5-6-7-8-9

Water OUT: interface 10

Outer diameter of water hose	⌀6mm
Minimum flow speed	1.8 l/min
Entry pressure	＞0.4MPa
Entry temperature	≥room temperature /＞dew point
Hardness (relative to CaCO3)	＜250mg/liter
PH range	6 to 8
Particle size allowed	Diameter less than 200 microns

2.3.2 Connection of Gas

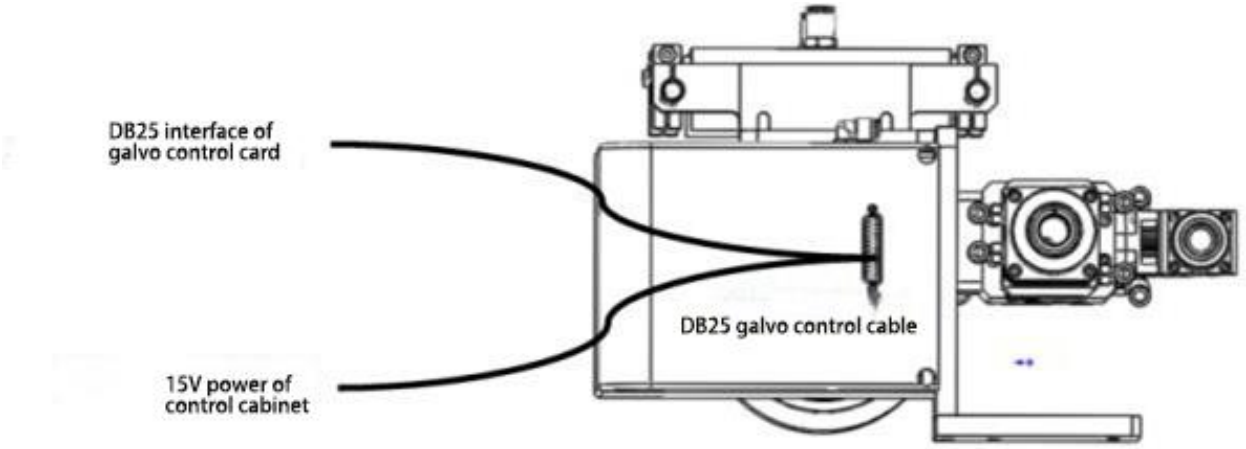


Diameter of gas pipe (Outer diameter): 10mm

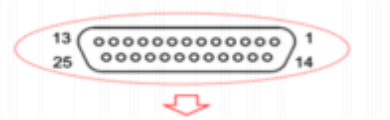
1.Connect dried and fine filtered air to air knife (gas pressure: 0.5~0.8MPa).

2.Before connecting gas to the welding head, blow gas pipe for 3-5min (gas pressure: ＞15bar), to remove impurities inside.

2.4 Connection of Welding Head Cable



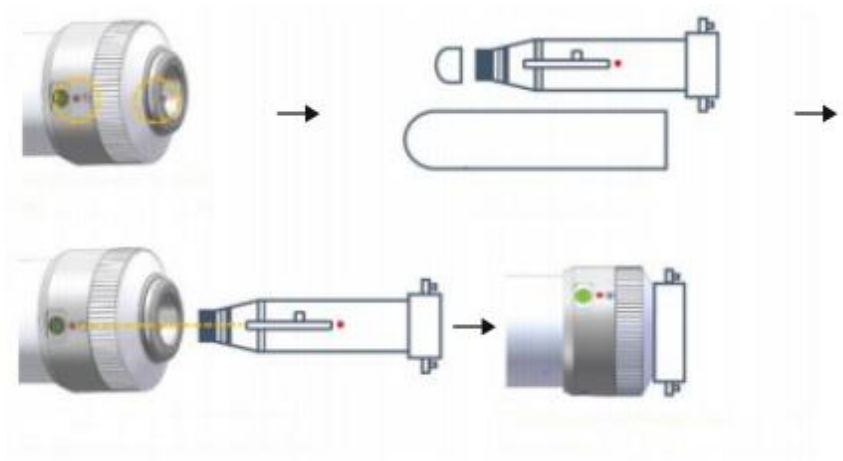
DB25 Galvo control interface definition:



PIN		SIGNAL	PIN		SIGNAL
1	I	Clk-	14	I	Clk+
2	I	Sync-	15	I	Sync+
3	I	X_data-	16	I	X_data+
4	I	Y_data-	17	I	Y_data+
5		NC	18		NC
6	O	STA-	19	O	STA+
7		SGND	20		SGND
8		NC	21		NC
9	*	V+	22	*	V+
10	*	V+	23		GND
11		GND	24		GND
12	*	V-	25	*	V-
13	*	V-	---		---

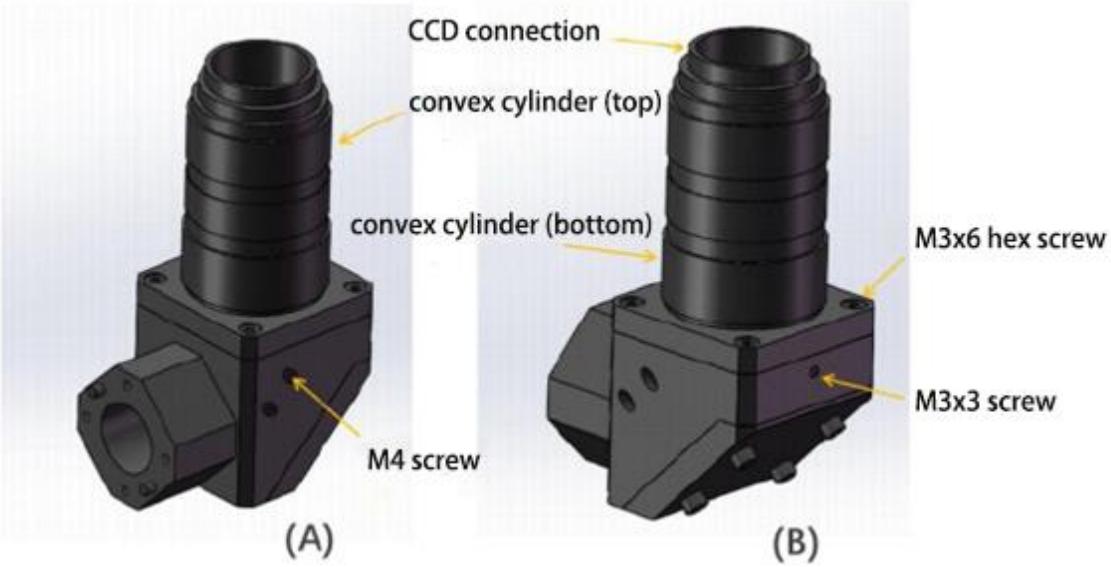
2.5 Fiber Insertion

WARNING: The optical components must be dust free and all dusts must be cleaned before use. The fiber shall be horizontally inserted into fiber interface to prevent dust from entering the interface and falling on the surface of the lens. Upper limit in the fiber before fixing the laser head.



- Align the red point at the end of the QBH interface to the red point of the handwheel.
- Remove QBH dustproof cover.
- Align the red mark of male fiber end to red mark on female QBH of cutting head when you insert the fiber end straightly to bottom of QBH interface of cutting head.
- Turn the QBH handwheel clockwise. It is in place when you hear the "Da" voice, then pull the handwheel up and turn clockwise to end.

2.6 CCD Adjustment



1) Brightness adjustment

Adjust convex cylinder (top) of A.

2) Focus adjustment

Adjust convex cylinder (bottom) of B.

3) Field center

Loosen/tighten 2*M4 screws of A.

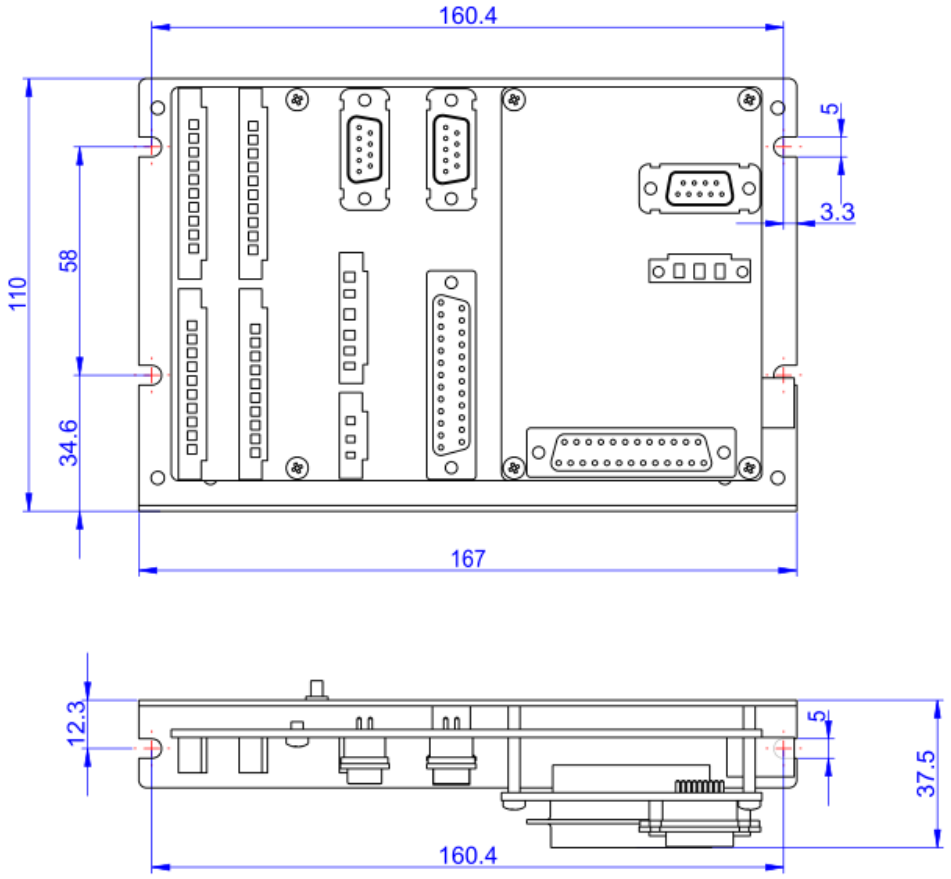
4) Field rotation

As shown in Figure B, loosen 4*M3x6 hex screws and M3x3 screw. Turn the top cylinder clockwise to adjust angle until the field direction is proper. Then tighten M3x6 and M3x3 screws.

3 PDU Control System

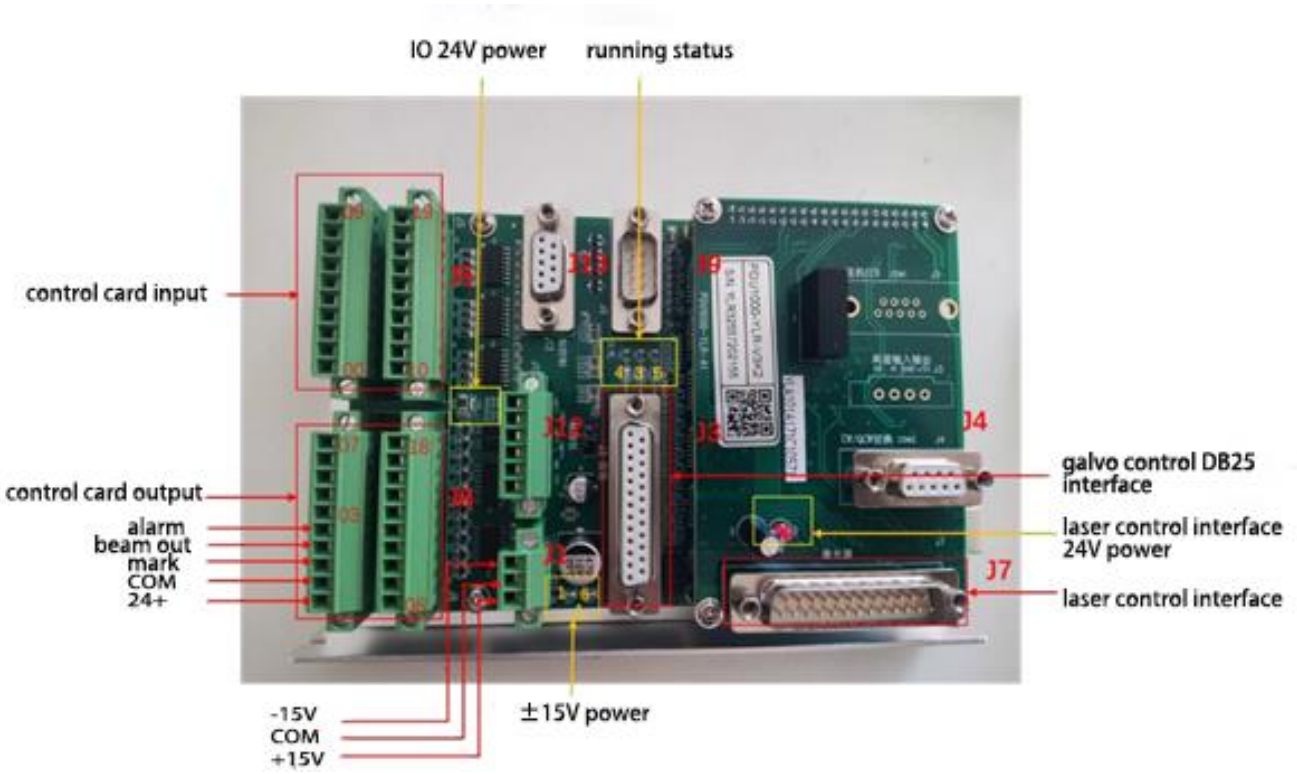
PDU1000-V3K2 series laser control card is designed for laser welding and marking, which is connected with computer through USB port.

3.1 Mechanical Size



3.2 LED

Check LED1 and LED6 status after the control card is power on. If there is abnormal lighting, power off and check wiring.



LED No.	Status Definition
LED1	Negative power supply
LED6	Positive power supply
LED3	Board absent
LED4	Board running normally
LED5	Board fault

3.3 Interface

3.3.1 Power Supply Interface (J1, 3PIN Terminal Block)

Galvo voltage: 8V ~ 18V; power: > 5W.

Wiring of galvo without board J3 port:

Pin No.	Mark	Direction	Voltage	Power
1	+15V	Input	8V ~ 18V	> 5W
2	GND	Input	GND	
3	-15V		/	

Wiring of galvo through board J3 port

Pin No.	Mark	Direction	Voltage	Power	Power cable dia.
1	+15V	Input	+15V	Galvo power +5W	⩾ 0.75 mm^2
2	GND	Input	GND	Galvo power +5W	⩾ 0.75 mm^2
3	-15V	Input	-15V	Galvo power +5W	⩾ 0.75 mm^2

3.3.2 Galvo Control Interface (J3, DB25 Female)

The galvo signal is difference signal. If the length of the signal cable is greater than 3m, twisted pair is required and the length of the cable should be less than 20m; if galvo power is supplied from J3 port, the diameter of the power supply cable should be not less than 0.75 mm^2.

Pin No.	Item	Description	Signal Direction		Pin No.	Item	Description	Signal Direction
1	Clk-	clock signal -	Output		14	Clk+	clock signal +	Output
2	Sync-	sync signal -	Output		15	Sync+	sync signal +	Output
3	X_data -	X galvo signal -	Output		16	X_data +	X galvo signal +	Output
4	Y_data -	Y galvo signal -	Output		17	Y_data +	Y galvo signal +	Output
5	X_fb- (A-)	X galvo feedback – (multiplexing, fly A-)	Input		18	X_fb+ (A+)	X galvo feedback+ (multiplexing, fly A+)	Input
6	Y_fb- (B-)	Y galvo feedback – (multiplexing, fly B-)	Input		19	Y_fb+ (B+)	Y galvo feedback + (multiplexing, fly B+)	Input
9/10/22	+15V	galvo power supply +15V	Output, connect with J1 Pin1		11/23/24	GND	GND, power supply reference	Output connect with J1 Pin2
12/13/25	-15V	galvo power supply -15V	Output，connect with J1 Pin3		7/8/20/21	NC	reserve	

3.3.3 Control Card Interface of Beamsplitting (J9, DB9 male)

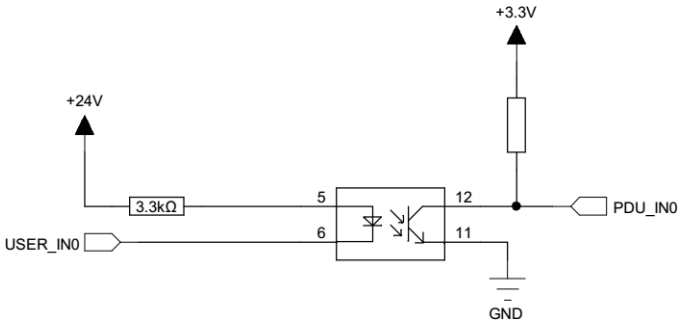
J9, as the control interface, is applied to communicate with the PDU1000-OSS control card for high-speed beamsplitting.

The beamsplitting signal is differential signal. If the length of signal cable is more than 3m, twisted pair is required, and the length of the cable should be less than 20m.

Pin No.	Item	Description	Signal Direction		Pin No.	Item	Description	Signal Direction
1	Z _ Clk-	clock signal -	Output		6	Z _ Clk +	clock signal +	Output
2	Z _ Sync -	sync signal -	Output		7	Z _ Sync +	sync signal +	Output
3	Z _ data -	beamsplitting signal -	Output		8	Z _ data +	beamsplitting signal +	Output
4	Z _ FB-	beamsplitting feedback signal -	Input		9	Z _ FB +	beamsplitting feedback signal +	Input
5	GND							

3.3.4 User Input Signal (J5)

I/O interface circuit is as follows:

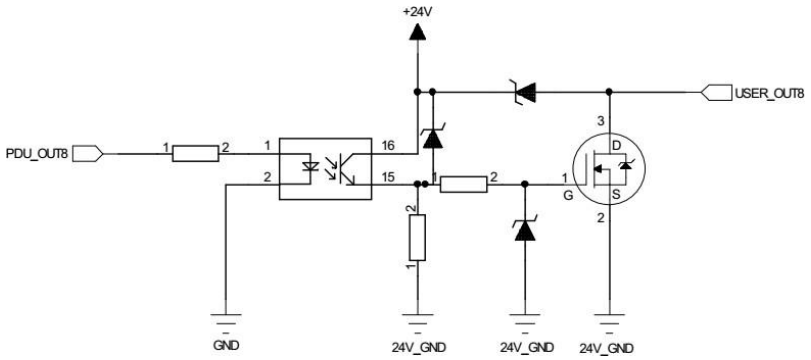


When NPN active, the current must be more than 2.5 mA/ VCC-VinL > 8V, and VinL must be less than 15V if the power supply voltage is 24V.
When PNP active, the current must be less than 0.25 mA/ VCC-VinH < 0.8V, and VinH must be greater than 23.2 V if the power supply voltage is 24V.

Pin No.	Item	Description		Pin No.	Item	Description
IN _ A				IN _ B		
1	I0	Foot (default)		11	I10	General-purpose input
2	I1	General-purpose input		12	I11	General-purpose input
3	I2	General-purpose input		13	I12	General-purpose input
4	I3	General-purpose input		14	I13	General-purpose input
5	I4	General-purpose input		15	I14	General-purpose input
6	I5	General-purpose input		16	I15	General-purpose input
7	I6	General-purpose input		17	I16	General-purpose input
8	I7	General-purpose input		18	I17	General-purpose input
9	I8	General-purpose input		19	I18	Pause Signal
10	I9	General-purpose input		20	I19	Stop Signal

3.3.5 User Output IO (J6)

00 ~ 07 is 500mA current output IO, the circuit is as follows:



Pin No.	Item	Max. Output Current	Description		Pin No.	Item	Output Current	Description
J6 _ A					J6 _ B			
1	I24V	Input, user I/O power supply	The supply current should be greater than the sum of I/O current		11	08	6mA	
2	ICOM	User I/O power supply Reference GND			12	09	6mA	
3	00	500mA	IO for Mark		13	010	6mA	
4	01	500mA	IO for Beam		14	011	6mA	
5	02	500mA	IO for Alarm		15	012	6mA	
6	03	500mA			16	013	6mA	
7	04	500mA			17	014	6mA	
8	05	500mA			18	015	6mA	
9	06	500mA			19	016	6mA	
10	07	500mA			20	017	6mA	

3.4 Laser Control Module

3.4.1 PDU1000-YLR-V3K2 Laser Control Interface

J4, DB9 female, serial port, used for switching between CW and QCW mode of YLR laser.

The interface definition is as follows:

Pin No.	Interface Definition	Description		Pin No.	Interface Definition	Description
2	TXD	data send pin		3	RXD	data receive pin
5	GND	reference GND		1/4/6/7/8/9	NC	

J7, DB25 male, used to control laser beaming and power, part of interfaces definition are as follows:

Pin No.	Item	Type	Description		Pin No.	Item	Type	Description
1/4/14	AGND		analog signal reference GND		16	AN0	Output	0 ~ 10V analog signal +, for controlling laser energy
5	Red _ las er	Output	laser red control pin		10	enable	Output	Laser enable signal
					23	DGND		9/10/17 reference GND
12	Modulation -	Output	Laser trigger signal negative input		24	Modulation +	Output	Laser trigger signal positive input
6	OUT4		Energy beamsplitting path application (disconnect for non-energy beamsplitting)		21	IN1		Energy beamsplitting response signal (disconnect for non-energy beamsplitting)
13	+ 24V_laser	Input	Input, laser control circuit + 24V		25	Laser _ gnd		13 laser control circuit + 24V reference GND

3.4.2 Wiring with IPG YLR Laser

Pin No.	Item	Description		Pin	Item	Description
1/4/14	AGND	analog signal reference GND, connect to IPG YLR laser Pin14		16	AN0	0 ~ 10V output analog signal, connect to IPG YLR laser Pin12, for laser energy control
5	Red _ laser	laser red control pin, connect to IPG YLR laser Pin17				
9	reset	Laser reset signal, connect to IPG YLR laser Pin21		10	enable	Laser enable signal, connect to IPG YLR laser Pin18
17	error	Laser alarm signal, connect to IPG YLR laser Pin19		23	DGND	9/10/17 reference GND, connect to IPG YLR laser Pin20
12	Modulation-	negative input interface of the laser trigger signal, connect to IPG YLR laser Pin16		24	Modulation +	Positive input interface of the laser trigger signal, connect to IPG YLR laser Pin15
6	OUT4	Energy beamsplitting path application (disconnect for non-energy beamsplitting)		21	IN1	Energy beamsplitting response signal (disconnect for non- energy beamsplitting)
13	+24V _ l aser	Input, laser control circuit + 24V		25	Laser _ gnd	Laser control circuit power supply reference GND

3.4.3 Wiring with YLS-K Laser

Control Card Pin No.	Control Card Signal Definition	Laser Pin No.	Laser Signal Definition	Remark
24	Modulation +	XPIF A: 1	Modulation enable	Laser trigger frequency signal
12	Modulation -	XPIF A: 2	Modulation enable return	
16	AN0	XPIF B: 1	Analog control input	Energy control
1	AGND	XPIF B: 2	Signal COM	
22	Laser ready	XP1:21	Laser Ready	Laser ready feedback signal
10	Laser ON	XP1:16	LASER ON	Laser drive
7	Startup laser	XP1: 1	Laser Request	Laser Request
9	Reset	XP1: 4	Reset	
5	Red	XP1: 5	Red	
23	Reference GND	XP1: 9	Reference GND	
		XP1: 6	Connect to 24V	Analog Ext. control
		XP1: 8-14	24V reference GND	Ext. control
13	24V	XP1:42	+ 24V DC	+ 24V DC (Customer-supplied)
25	Laser _ gnd	XP1: 41	+ 24V reference GND	Return from + 24V DC
		XPIF A: 7	Short	
		XPIF A: 8		
		XPIF A: 9	Short	
		XPIF A: 10		

3.4.4 Wiring with Raycus RFL-C1500S/2000S Laser

Control Card Pin No.	Control Card Signal Definition	Laser Pin No.	Laser Signal Definition	Remark
17	ERROR	24 (DB25)	Laser state signal	
16	Analog output	22 (DB25)	Analog input	Laser energy control
14	Analog output reference GND	25 (DB25)	Analog input reference GND	
10	Enable	6 (DB25)	Beaming enable	
24	Modulation +	Cable core	Modulate signal +	Laser beaming control signal
12	Modulation -	Ext. shielding	Modulate signal -	
13	24V	7 (DB25)	24V input	Ext. AD Mode
		20 (DB25)	24V input	Pin8/24 power supply
25	24V reference GND	9 (DB25)	24V reference GND	Require set
		6 (DB9)	Interlock	Short enable laser beaming
		7 (DB9)	Interlock	

3.4.5 Wiring with GW Laser - P Series

Control Card Pin No.	Control Card Signal Definition	Laser Pin No.	Laser Signal Definition	Remark
16	Analog output	1 (DB15)	PIN	Laser energy output control signal
14	Analog output reference GND	9 (DB15)	GNDA	
10	Enable signal	13 (DB15)	IN _ L0	Laser enable
5	Laser red	6 (DB15)	IN _ RG	Ext. control red
24	Modulation +	14 (DB15)	IN _ PULSE	Modulation signal
12	Modulation -	7 (DB15)	Pin7/5/6/12/13/14/15 reference digital GND	
23	Enable GND	7 (DB15)	Pin7/5/6/12/13/14/15 reference digital GND	
13	24V	15 (DB15)	24V	
25	24V reference GND	8 (DB15)	Pin7/5/6/12/13/14/15 reference digital GND	
		5 (DB15)	Emergency stop signal	Pin short
		12 (DB15)	Water	
		15 (DB15)	+24V	

4 Installation and Commissioning of Galvo Software

	Drive	Patch
USB	V3	V1, V2, V3
USB	V6	V6
PCIe	V6	V6

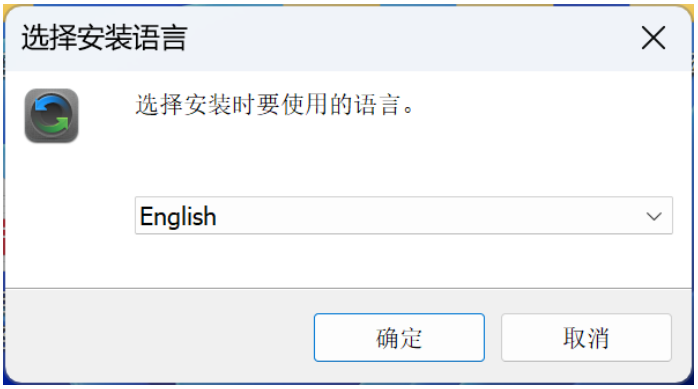
Note: When installing the software, select the corresponding drive and patch as above.

Dongle	Vision Software
Standard galvo	NO
Standard vision	YES

Note: The dongle should work with software as above.

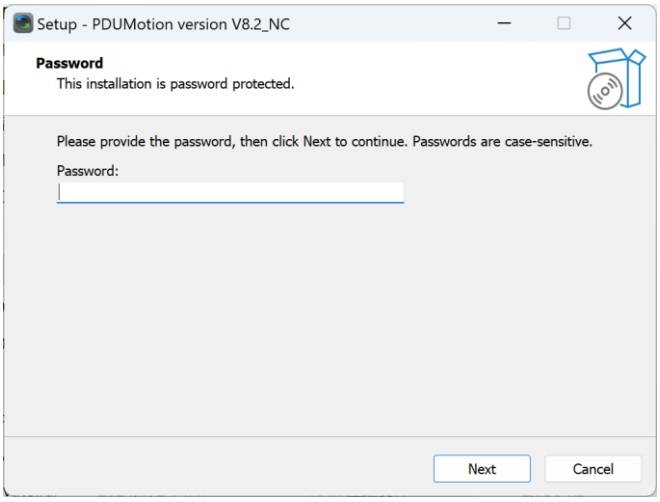
Installation:

1) Open the software  and select the language as English;

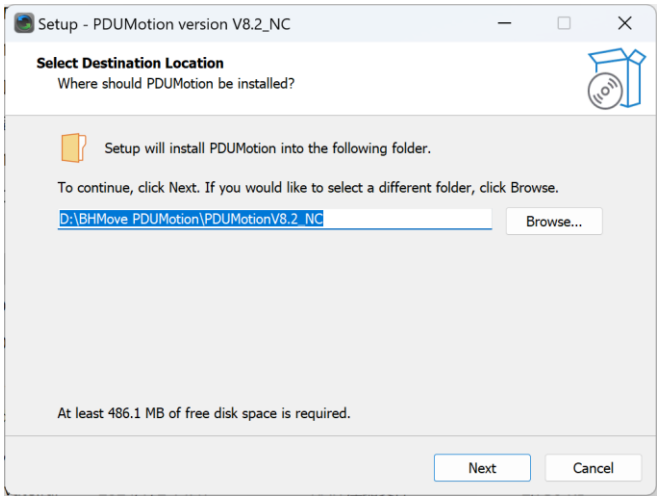


2) Click Next;

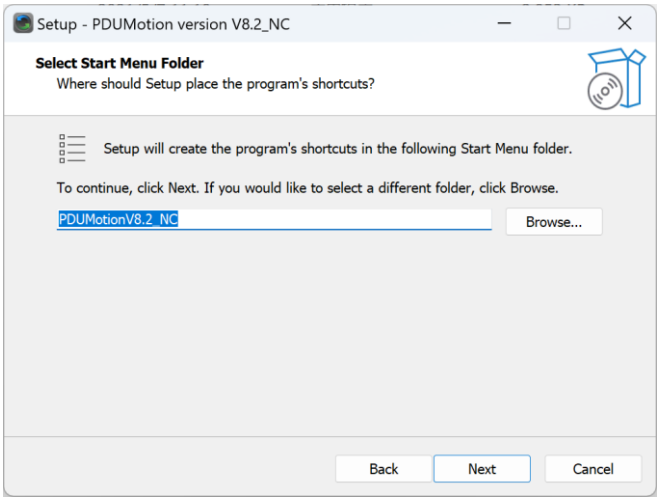
3) Input the installation password: JK0803;



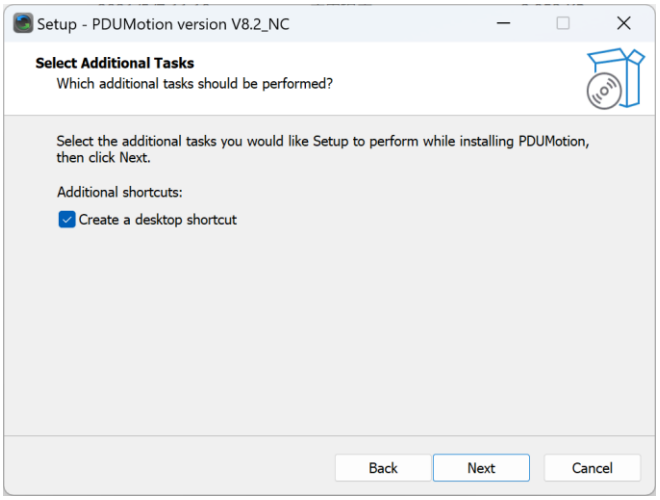
4) Select the installation location and click Next;



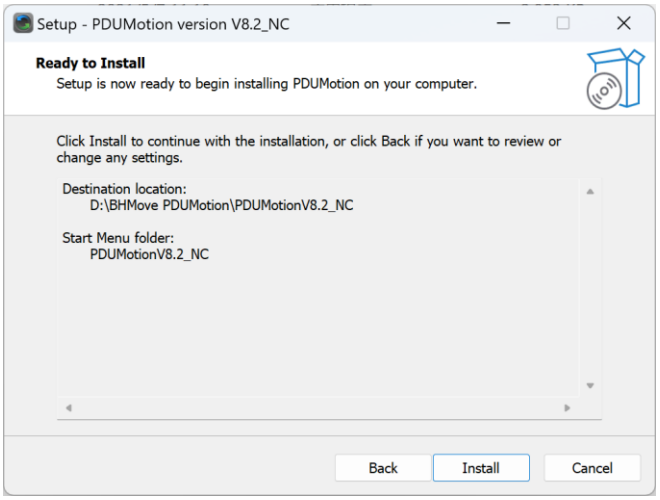
5) Create start menu and click Next;



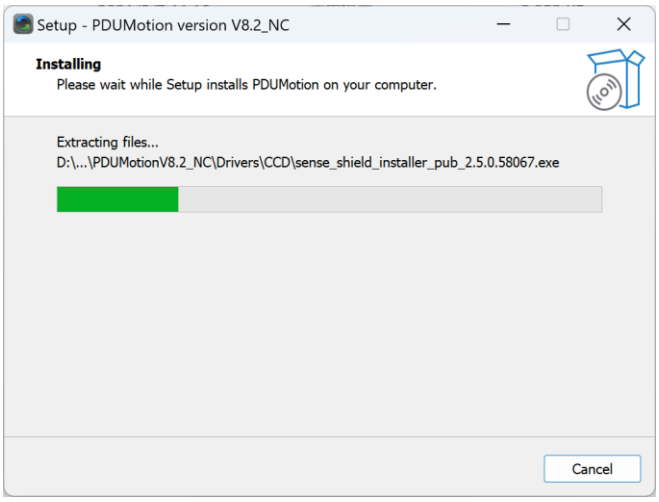
6) Check Create a desktop shortcut, and click Next;



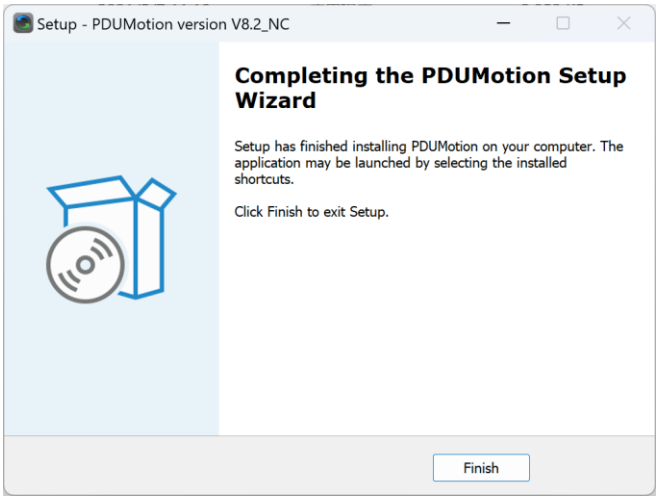
7) Click Install;



8) Wait for software installation.



9) Install PDU1000 card drive, motion control drive, dongle drive; vision dependency (optional) and galvo control card library. Then click Finish to end Setup.

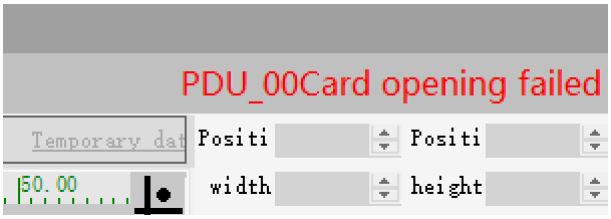


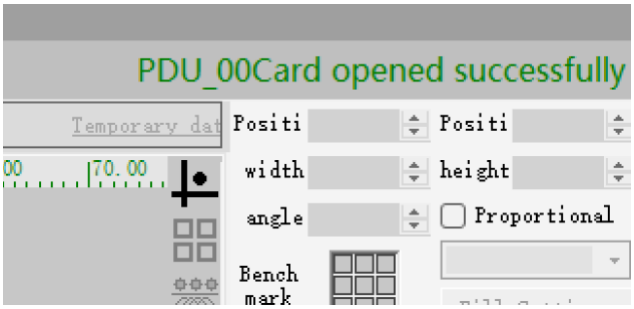
5 Troubleshooting

5.1 Error Code

Error Code	Description
H0007	No dongle.
H0033	The dongle drive is not installed.
H0031	Wrong dongle model.
H0041	The software is infected, users should reinstall the software after antivirus, and replace ini folder.
H0042	Install the newest dongle drive.

5.2 Control Card Opening Failed



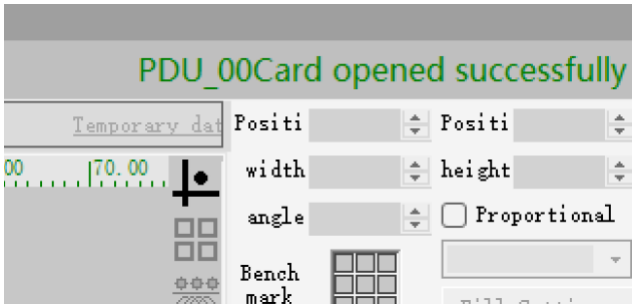


PDU_00 Card Opening failed	
Check hardware connection	Check hardware connection
Check whether the control card drive is installed properly.	Reinstall the drive, find the path of CCDVER test 7.4\ Drivers\ PengDin in the root directory of the marking software, and then select the drive of USB or PCIe.
Check whether the software PDU _ 1000 library version patch is selected correctly.	Reselect the card library version, find the path of CCDVER test 7.4\ Drivers\ PDU in the root directory of the marking software, select the drive of V3 or V6, select all the files in the folder, and copy them to the root directory of the marking software to replace the original files.

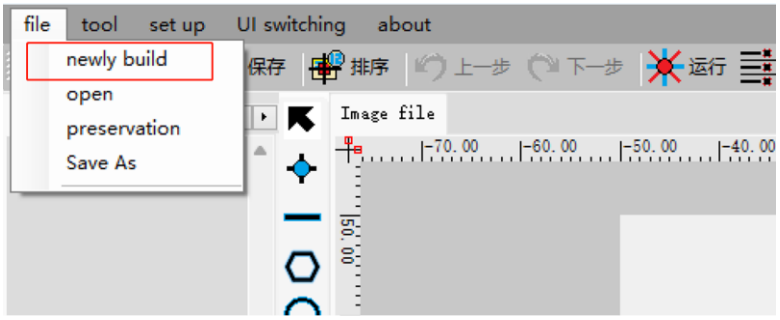
6 Laser Setting

6.1 Laser Commission

1. Connect the card, laser, and galvo;
2. Open the software. If the interface shows following mark, the software and card is connected successfully;



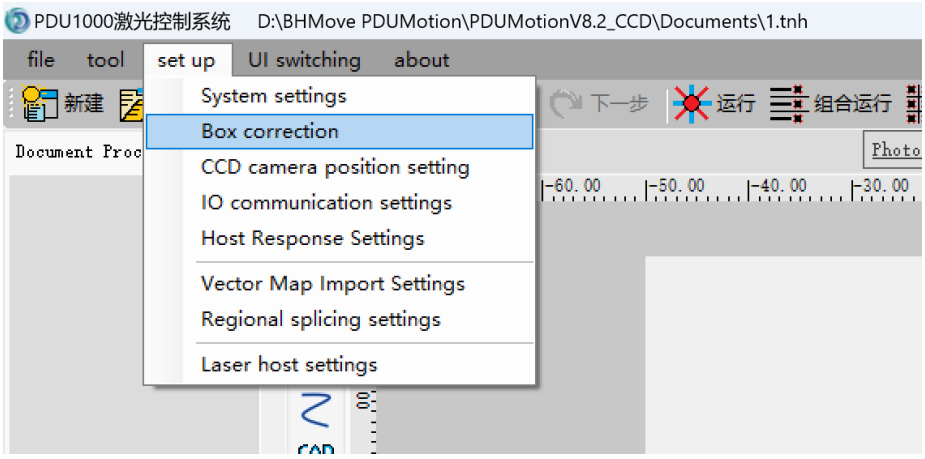
3. Build a new project;



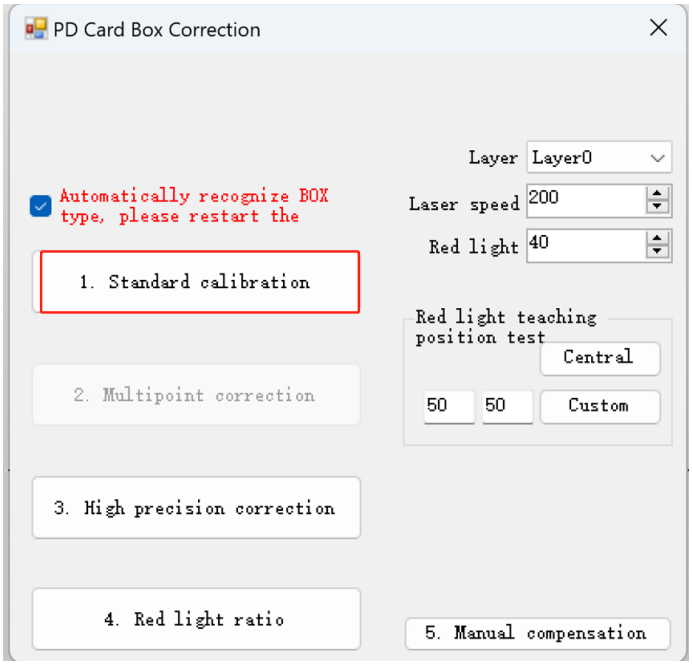
4. Draw a point and beam, and find the focus of the laser according to the intensity of the marking laser.

6.2 BOX Correction (Manual)

1) Select BOX correction;



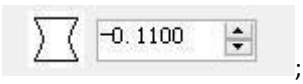
2) Select Standard calibration;

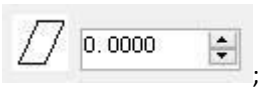


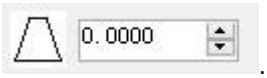
3) Set Correction Size (actual required marking size or galvo format);
4) Set Maximum BOX Correction Area (This value is recommended to be larger than the value of the Test rectangle size.) And the red light correction zoom ratio is 1;
5) Check Laser to turn it on;
6) Click Confirm for laser print;

7) Measure whether the lengths of the X and Y axes are equal to the value of Test rectangle size. If not, find the galvo of X/Y axis, click Calculating Box Ratio, fill in the measured value in Current length 

and click Calculation. Then click Laser Test to test again until two values are equal.

8) Click Confirm for laser print at Step 6). If printed rectangle shows curve, adjust the value in 

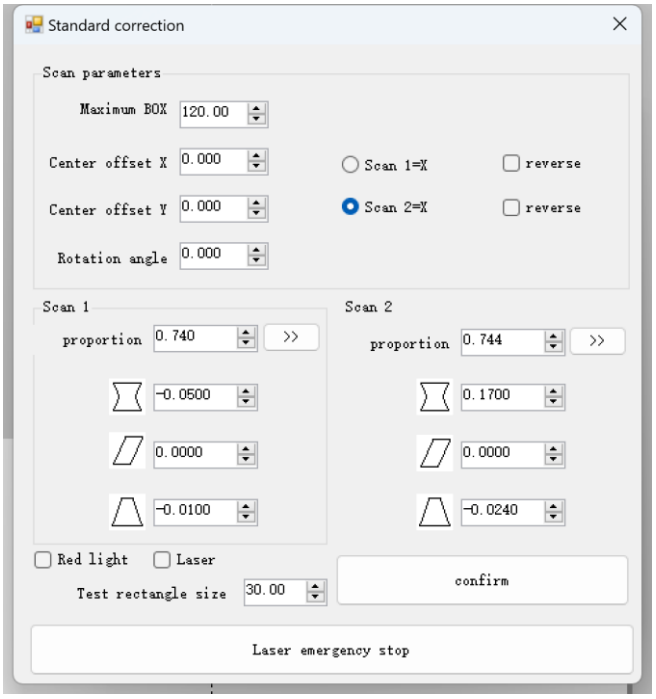
;If printed rectangle is a parallelogram, adjust the value in 

; If the printed rectangle is a trapezoid, adjust the value in 

. Repeat above adjustment until the printed graphic is proper.

9) Click OK at Step 6) to observe whether the printed coordinates of the X/Y axis meet the requirements, which can be adjusted by setting the corresponding relationship between the galvo and X/Y axis. If the direction of the X/Y axis is reversed, check reverse;

10) The default galvo center is (0, 0), which can be changed based on actual requirements, but the offset value should not be too large; Rotation angle is used to adjust the angle of the galvo coordinate according to the marking direction (Don't change the angle value and Center offset value without special requirements).

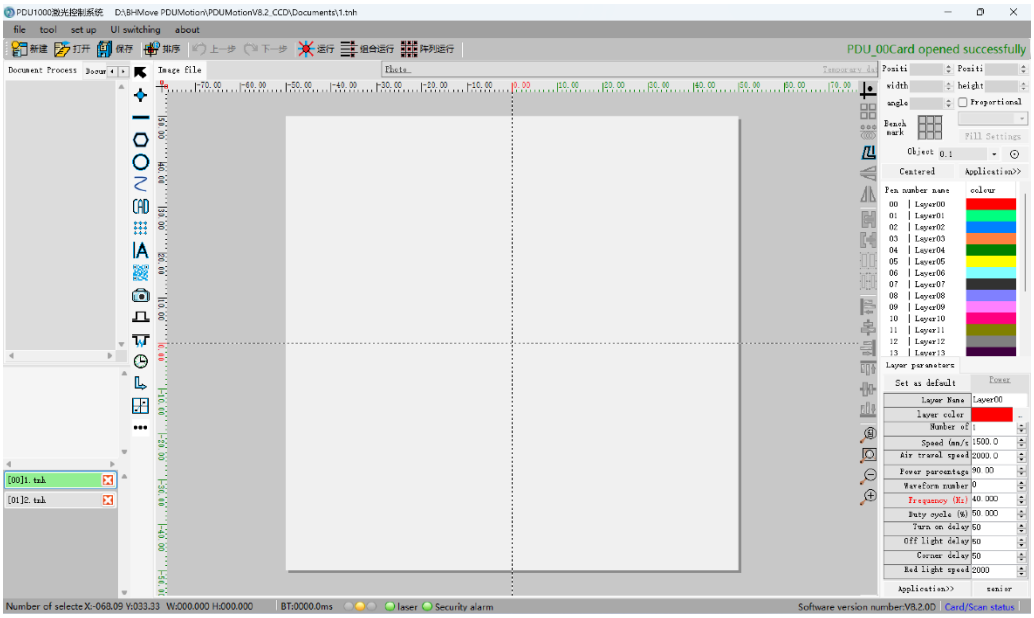


11) Check Red light and click Confirm;

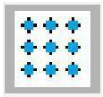
12) Observe whether the red running path coincides with the rectangle printed by the laser. If not, set the Scan 1/2 proportion to adjust the red running path; Click Red light test. If the spot does not coincide with the zero point of the laser print, set Center offset X/Y to adjust the spot position.

7 Software Interface and Tool

7.1 Software Interface



7.2 Sign

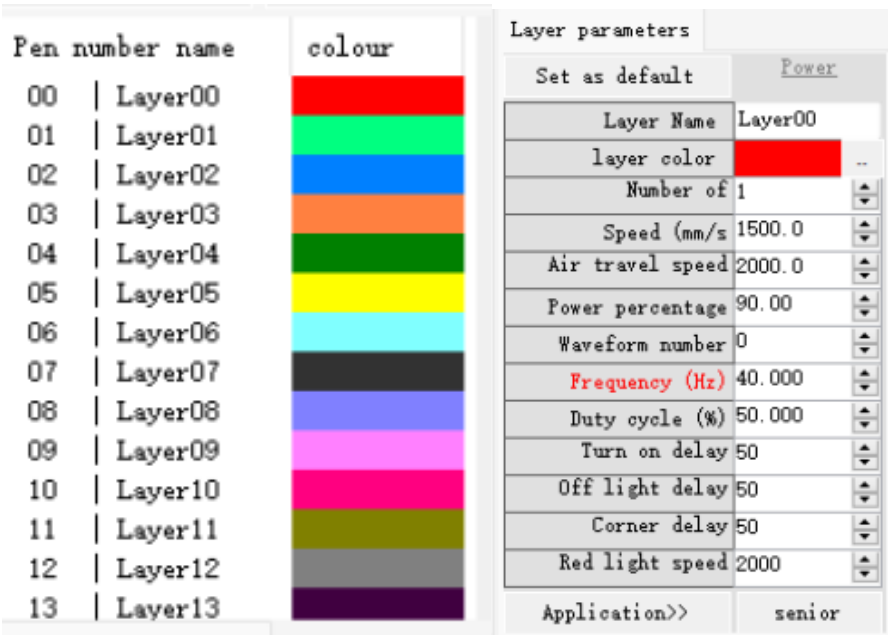
Sign	Tool	Description
	Single point	
	Line	
	Polygon	Rectangle (default). Click the icon to select other graphics: 
	Circle (arc)	Circle (default). Click the icon to use other arc tools 
	Lattice	

	Text	Edit text, enable text variables: S/N, date, time, serial communication, network communication, etc.
	QR code	
	CAD	Importing CAD graphics of dxf/plt format file.
	Bitmap	Import pictures of bmp format file.
	Delay	Marking delay tool.
	Platform motion	Set the platform moving position (X, Y).
	Mark point	
	SCR	Edit script
	Altimetry/ bar code	
	Time variable	
	Marked rectangle ROI	
	Fly Setting	
	Call subdocument	

	Coaxial CCD Painting	
	Array photo	
	Laser follow	
	Run	Keyboard shortcut F6
	Teach	

7.3 Layer and Parameter

Each layer corresponds to laser parameters, and users can change the name and the color of layers in the Parameter interface. Click a layer, the parameter bar will display its name, color, and parameter data. The parameter data includes number of processing, speed, power, etc. After modifying parameters, click Application to save the parameters to the current layer.



7.4 Laser Process

Why set delay parameters:

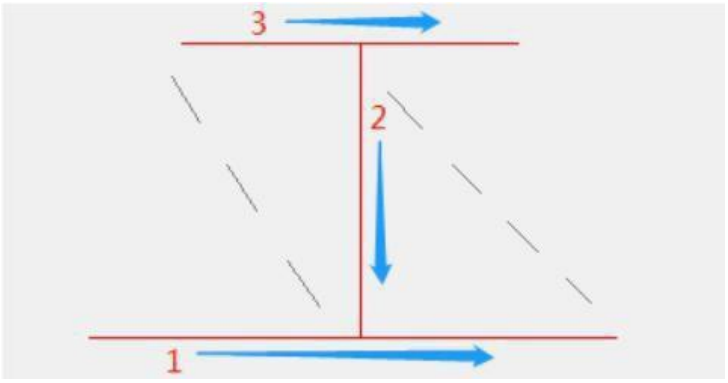
Delay occurs when transmitting signals between parts of galvo system, including drive plate, motor, and lenses. And the lenses have mechanical inertia, so there is uncertain delay between “marking card control galvo" and "real lens motion".

Delay types: laser on delay, laser off delay, jump delay, mark delay, and poly delay.

Unified process debugging graphics:

Graphics in marking generally don’t show direction, and it is not convenient to judge which process parameters lead to poor marking effect. Therefore, a directional graph should be drawn to adjust the process parameters.

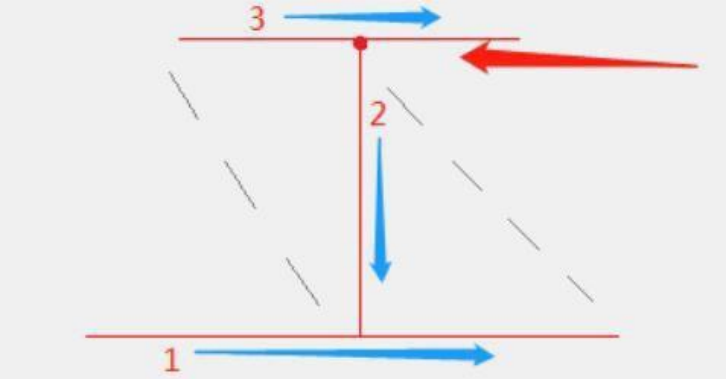
For example: Take Line 1 and Line 3 as a reference, and mainly observe welding effect of Line 2. Drawing line can refer to processing precision, or only confirm the shape through position and size parameters.



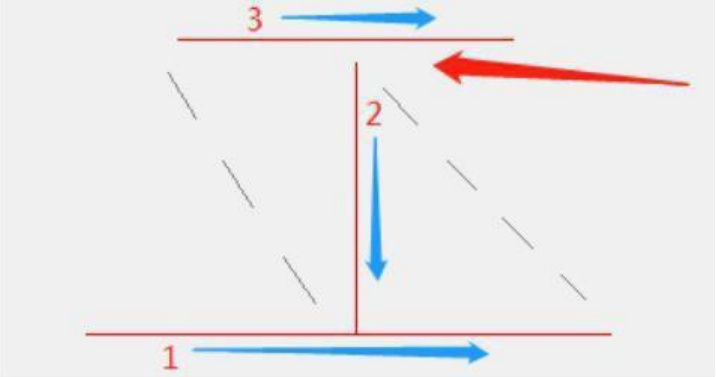
Laser On Delay (LOnD)

When laser on, the galvo jumps to the specified position and starts to move, but the laser beams out after delaying LOnD value. This value can be set as a negative value, which means when the galvo reaches the specified position, the galvo beams out for this value first and then starts motion.

If the LOnD value is set too small, a burst point will occur at the laser-on position (reason: the galvo starts to move at a low speed and the LOnD value is too small, so laser gathers at the start point and produce a burst point).



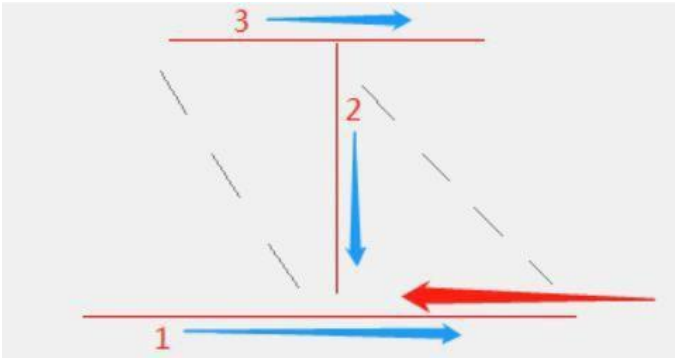
If the LOnD value is set too large, a welding short will occur (reason: the galvo starts to move, but beaming requires a long delay due to large LOnD value, which means beaning starts far form the start point and lead to a welding short).



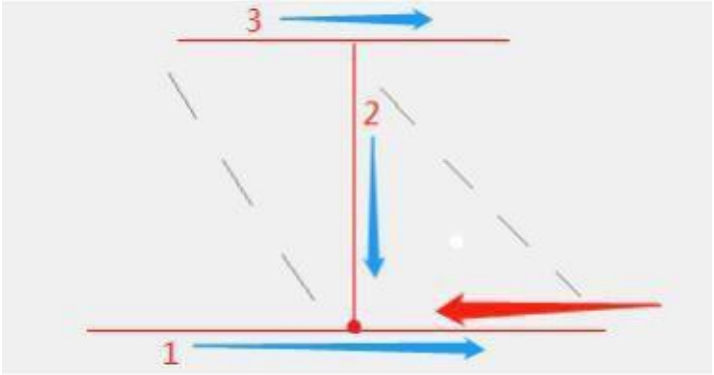
Laser Off Delay (LOffD):

When laser off, the galvo stops movements at the specified position, but laser turns off after a delay of the LOffD value. This value can be set as a negative value, which means laser off for LOffD value before the galvo reaches the specified position.

If the LOffD value is set too small, there is a short at the laser off position (reason: there is a time difference between the command and real motion when the galvo stops movement, that is, the galvo is considered to be in place but not in fact, and the LOffD is too small, so a short is not welded).



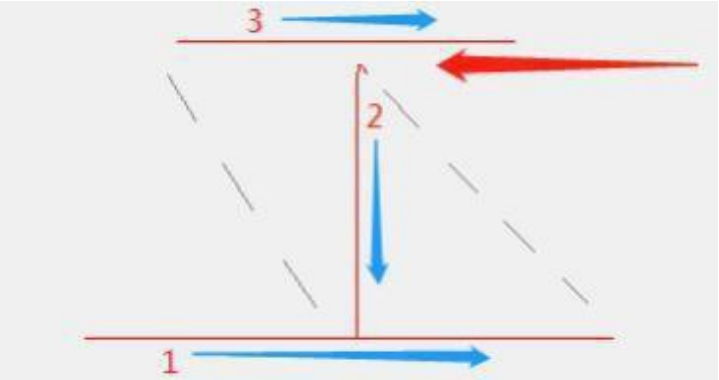
If the LOffD value is set too large, a burst point will occur at the laser off position (reason: when stopping movement, the galvo is in place. And the LOffD value is too large and laser is on, so laser gathers at the end point and produce a burst point).



Jump Delay (JumpD)

When the galvo jumps to a specified position, it starts the next movement after a delay of JumpD value.

If the JumpD value is set too small, unstable welding will occur at the beginning of the next movement (reason: the galvo motor is not in stable status when the galvo stops Jump movement, and the JumpD value is too small. At this time, the galvo is running unstably).

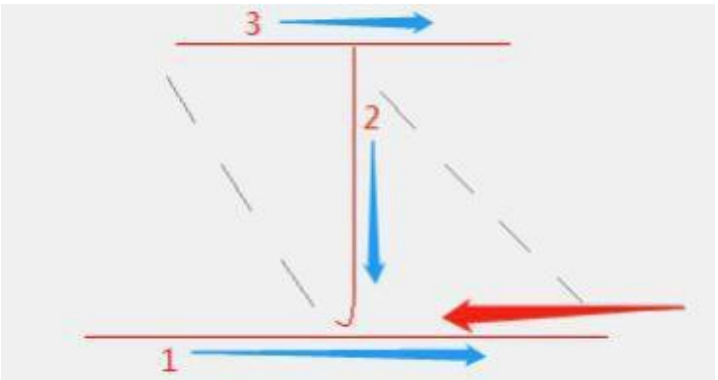


If the JumpD is set too large, welding efficiency will be affected. The setting of JumpD value is related to the galvo jump speed and the weight of the galvo lens. Generally, the greater the galvo jump speed and the lens weight, the larger the JumpD value.

Mark delay (MarkD)

The galvo starts the next jump motion for a delay of MarkD value after welding.

If the MarkD value is set too small, the galvo starts movement before the end welding position, resulting in a corner at the laser off place (reason: there is a time difference between the theoretical and the actual position of galvo motion, that is, the movement is in place in theory but not yet in fact. At that time, the next jump movement has already started.).

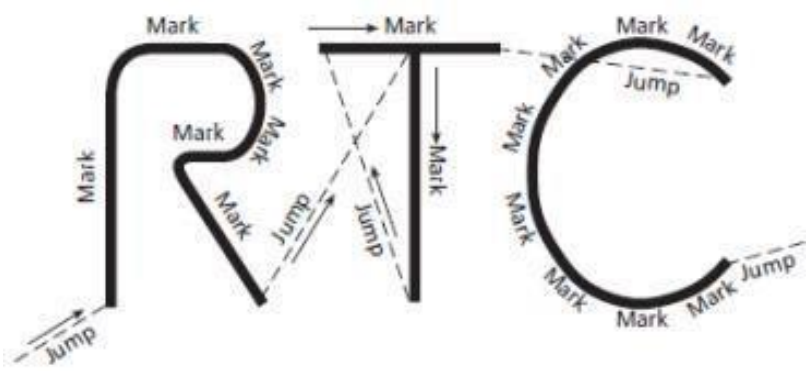


If the MarkD value is too large, it will affect welding efficiency even the galvo runs stably.

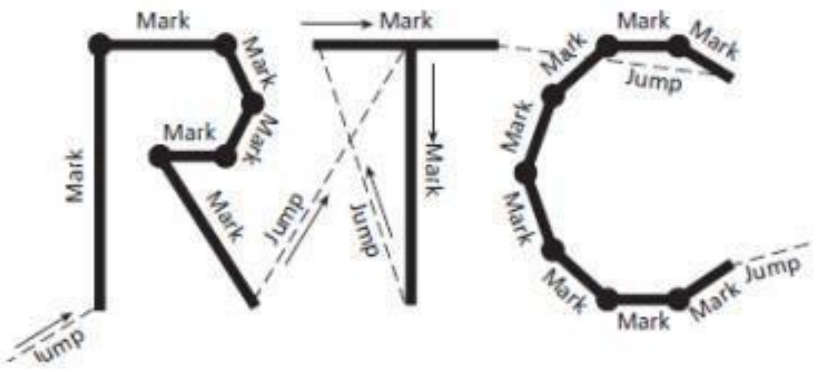
Poly Delay (PolyD)

PolyD occurs at the corner of two lines during continuous welding, that is, the galvo requires a delay of PolyD value and then starts next line motion after finishing last one, with beaming out continuously.

If the PolyD value is set too small, there is an arc at the corner between the two Mark movements, which is different form the actual graphic (reason: the galvo motor is not in place when finishing the last mark, and the PolyD value is too small. At this time, the galvo will take another quick path to start next movement).



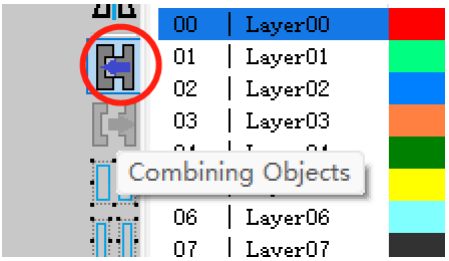
When the PolyD value is set too large, there is a burst point at the corner between the two Mark movements (reason: the galvo motor is already in place when finishing the last mark, and the PolyD value is too large. At that time, the next Mark movement has not yet started, but with laser on).



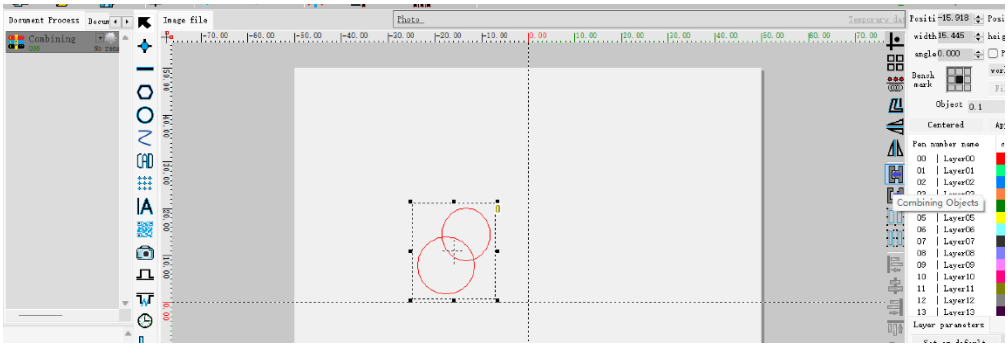
7.5 Software Tool

7.5.1 Combination

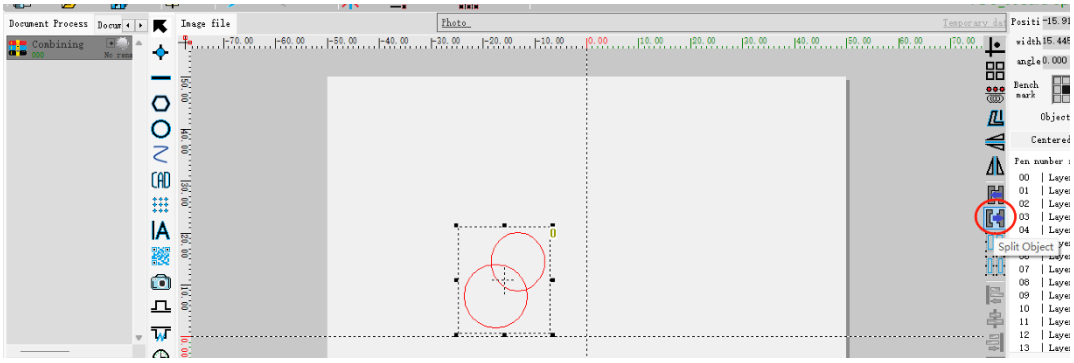
1. Press the CTRL key, select two circles, and click Combining Objects;



2. Two circles turn into an object;

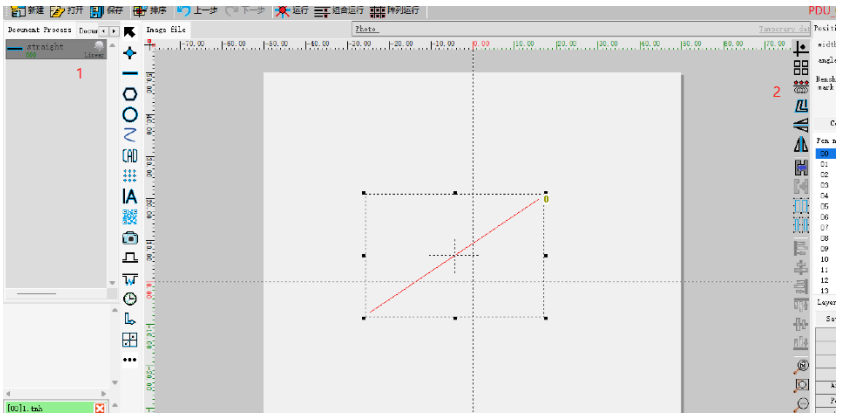


3. Select the combined object, and then click Split Object to split it;

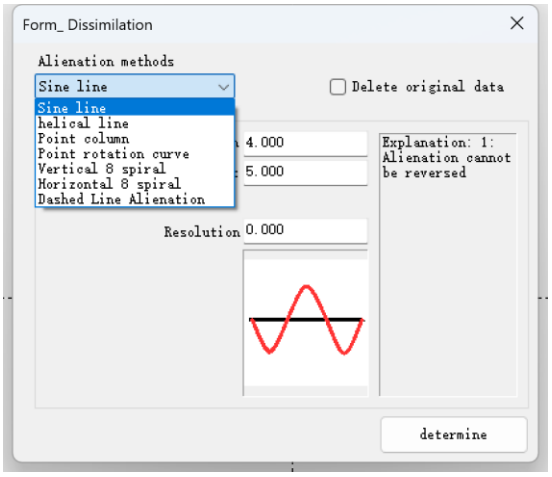


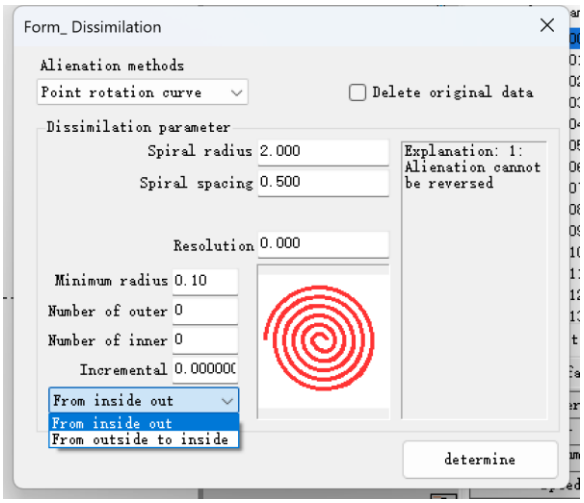
7.5.2 Form Dissimilation

1. Select a line and click Form Dissimilation;



2. Select alienation method and set parameters;

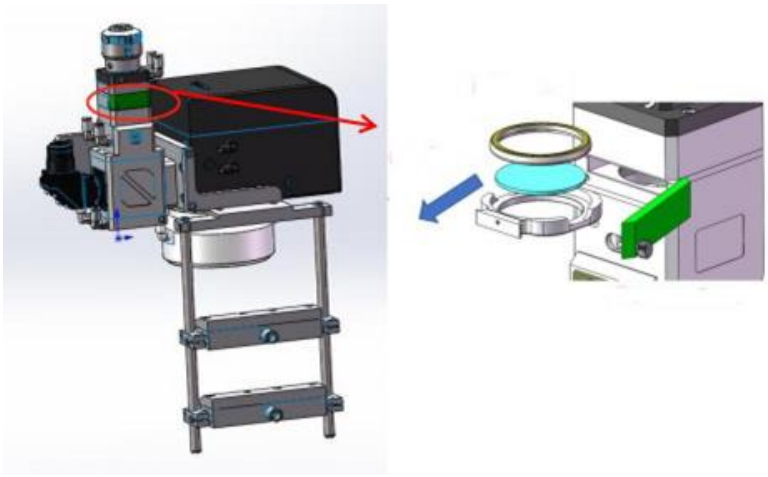




8 Maintenance

8.1 Removal and Installation of Top Cover Glass

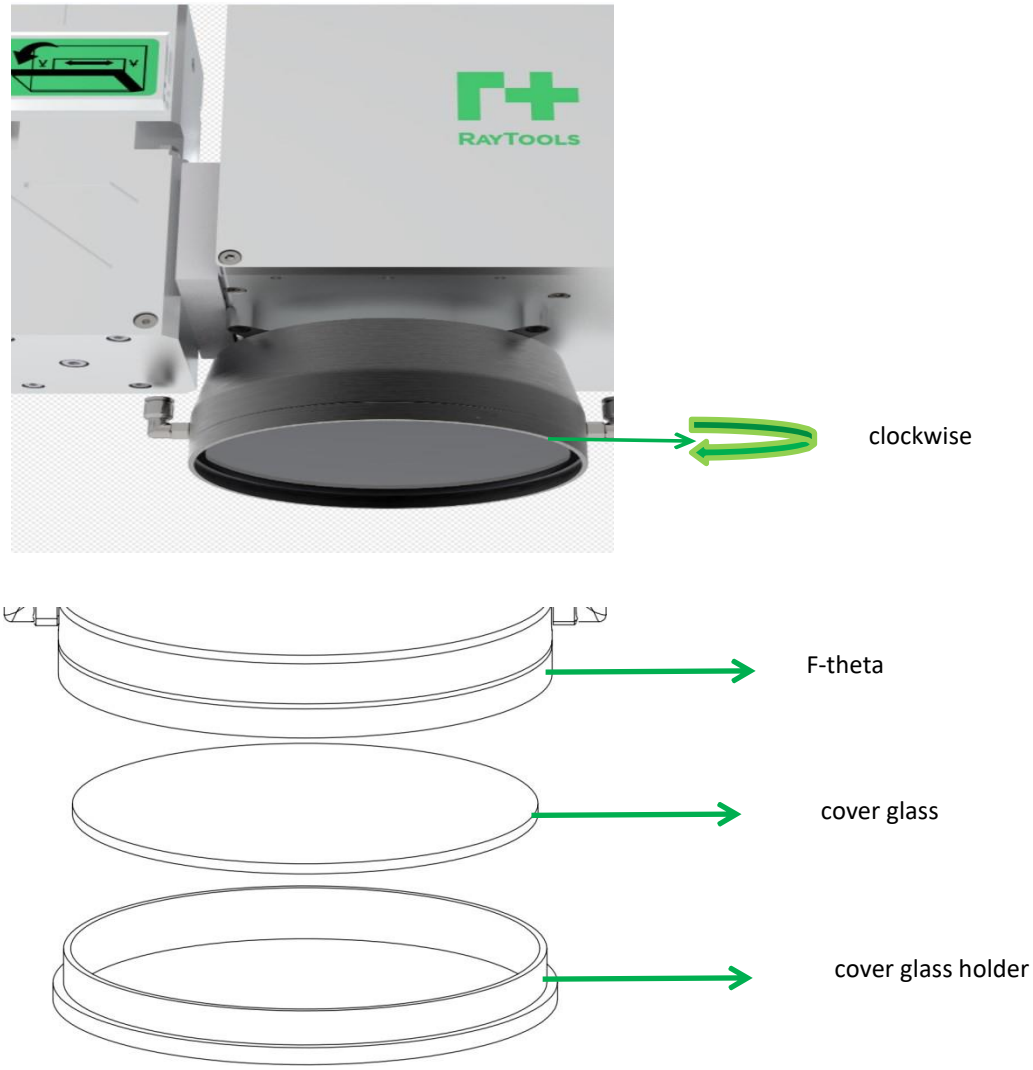
The cover glass is wearing part which needs to be replaced once it is damaged.



- Loose the 2 bolts to pull out cover glass holder by pinching 2 edges of drawer type holder.
- Seal the mounting openings by textured tape immediately.
- Remove the pressing ring and cover glass after wearing fingertips.
- Clean the cover glass holder and seal ring. The elastic seal ring should be replaced if it is damaged.
- Install the cleaned or new cover glass (regardless of the front or back surface) into the holder of cover glass.
- Install the pressing ring.
- Insert the cover glass holder back to the laser head and tighten the bolts.

Caution: **It is not allowed to pull out the edge of seal ring directly as it is very easy to damage the seal ring. Please wear the clean gloves or fingertips.**

8.2 Removal and Installation of F-theta Cover Glass



- Ensure that the laser is closed, place the scan welding head on the flat surface of the platform and hold the F-theta vertically.
- Use absolute alcohol (99% ethanol) to clean the dust on the surface of F-theta.
- Rotate the cover glass holder clockwise to remove it.
- Seal mounting openings by textured tape immediately.
- Clean or replace the cover glass.
- Install the cleaned or new cover glass into the cover glass holder.
- Tighten the bolts.

Note:

1. Ensure laser is power off before replacing or cleaning the cover glass and the motion axis enable is closed, to avoid accidents caused by beaming or motion axis movement.
2. It is recommended to prepare spare cover glasses for replacement.
3. Galvo should avoid direct contact with hot surface to avoid burning.
4. Ensure the galvo is cool completely before maintaining and cleaning cover glass.
5. Please wear the clean gloves or fingertips to avoid damage and pollution of cover glass.