

# User Manual

300W DUAL OUTPUT  
LASER WELDING MACHINE

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## Chapter 1 Machine Introduction

### **1-1 Prospect of AD metal letters/signage welding industry:**

With the booming of global advertising industry, metal letters has been more and more popular because of its colorfulness, attractiveness, heating-proof, frozen-proof, no deformation, no fadedness (8-10 years color preservation), corrosion proof, rain-proof, and spontaneous combustion proof and some other good features. AD metal letters are made of stainless steel, aluminum, copper or other metal sheet being cut, polished, hemmed, and welded. The core feature of AD metal letters is being rustproof, with long life span and dimensional looks. It's widely used in LED illuminated billboard, exterior/interior signs, branding, door plate and etc.

Regular combination and fixing of metal letters are done via glue, rivets or soldering, but all of them have big defects. Metal letters combined by glue always get loose with time goes by, especially at outdoors. Fixing by rivets sounds good, but not good-looking. Soldering is never a green way of fixing metal letters because of the poisoning gas produced when processing.

However, laser welding technology makes two metal sheets become one only by a few melting spots. From any aspect, laser welding is the best solution and the greenest.

### **1-2 Application:**

Applied for the welding of various metal letters, LED illuminated letters, customized metal signage, and exterior billboards.

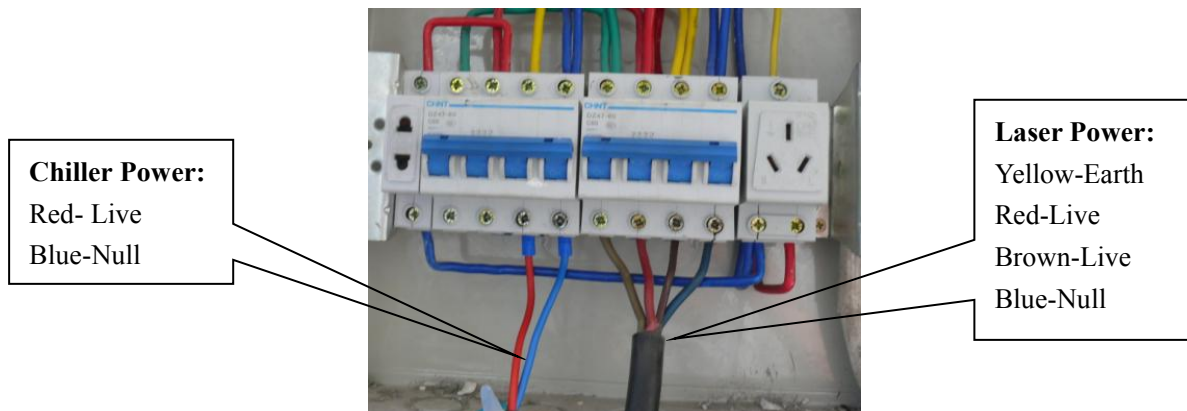
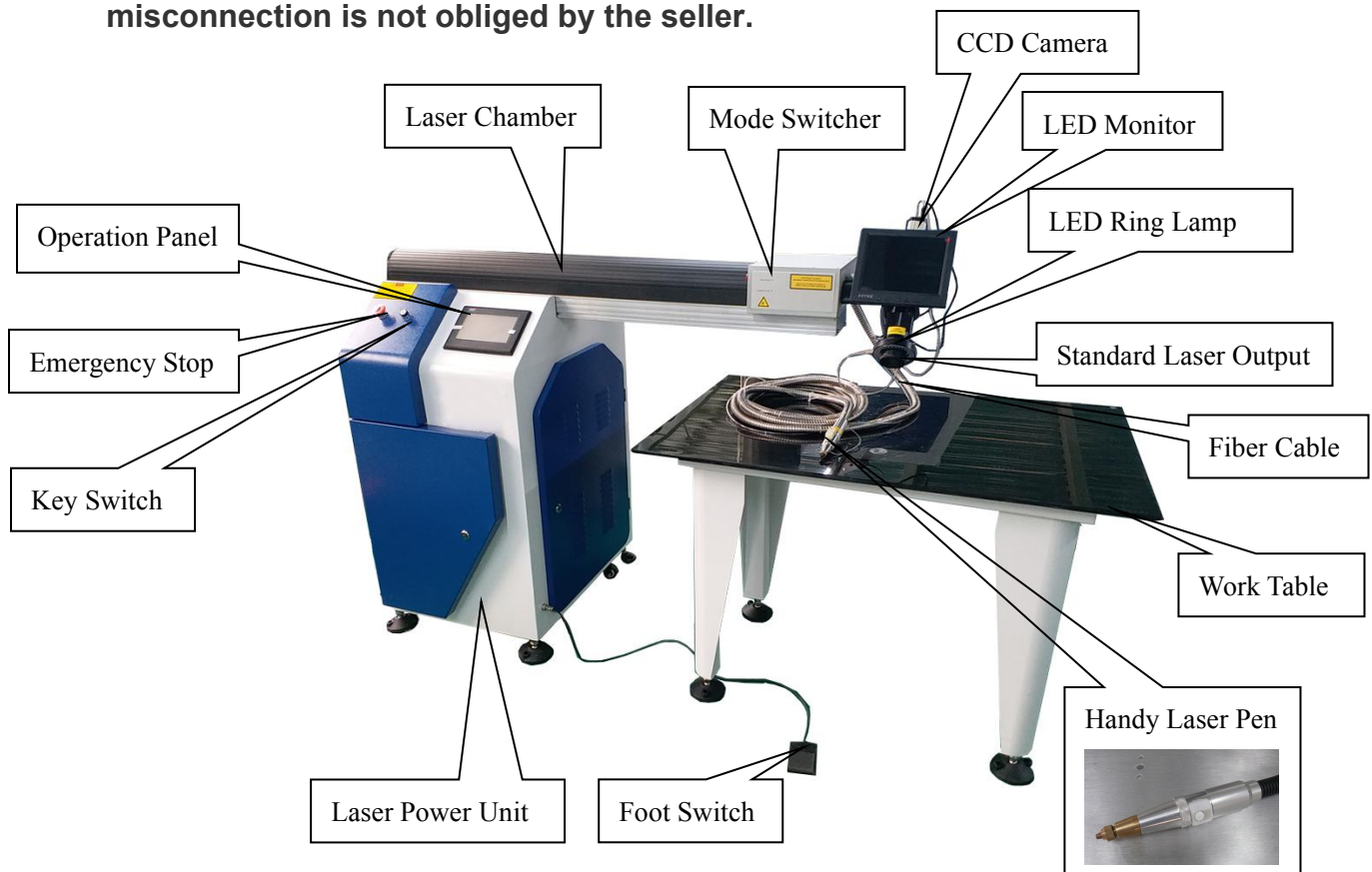
### **1-3 Features:**

1. Red light fast positioning, CCD display
2. Adjustable working table allows welding from small size to big size of work piece
3. Fast working speed; professional jig ensures the focus fixed and makes welding easier
4. Slight distortion and affect by heating.
5. Capable of partial heating process.
6. Able to deal with complex, profiled, or tiny letters.
7. Low noise and no pollution.
8. Ultrafine positioning rod makes the welding of tiny corner easier without changing spot position
9. New metal processing technology brings higher quality of end products.
10. Latest self-developed handy laser pen gives more possibilities other than AD signs & letters welding

## Chapter 2 Machine main parts and operation instruction

### 2-1 Machine Preview:

◆ This laser welder and water chiller both require 220V 50HZ power supply which means 6 square meter wires and 40A air switch/safety. Any damage caused by misconnection is not obliged by the seller.



◆ Make the laser chamber up and down by twisting the ring above standard laser welding head until you find the laser spot brightest, roundest and the laser shooting sounds loudest. Then it means you have the best laser quality to weld. To avoid penetration of material, you may decrease the current or enlarge the laser spot size manually to weaken single pulse energy

◆ Do not energize the machine before installation finished in order to avoid electric shock or other possible accidents.

◆ The water inside the chiller tank has to be changed once a month in winter, or twice a month in summer. Deionized water is preferable, but tanned drinking water is also acceptable.

## 2-2 Hardware installation:

- 1) Connect one water hose coming out of laser chamber to “OUTLET” of water chiller and another hose to “INLET” of water chiller, then tighten the two hose clamps.



- 2) Connect water chiller flow alarm plug (2 pins) and foot switch plug (3 pins). Please distinguish the two similar plugs carefully and don't mix them up.



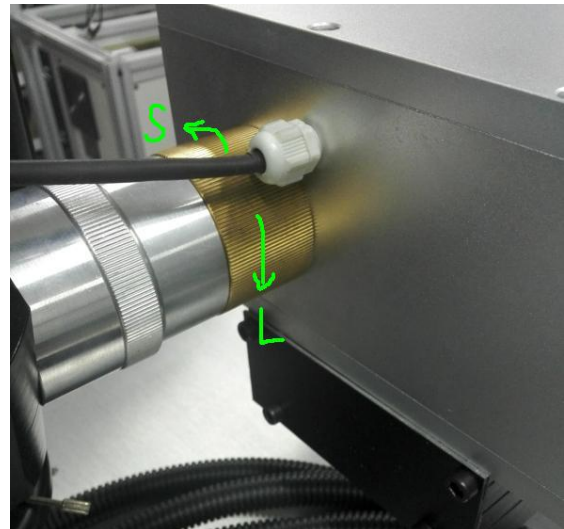
- 3) Loosen the laser chamber basement and slide it to the most comfortable position for the operator and tighten the basement again. There're 2 screws on each side of laser chamber







4) Check out Red Pointer Switch and Spot Size Adjust Knob. S=smaller, L=larger

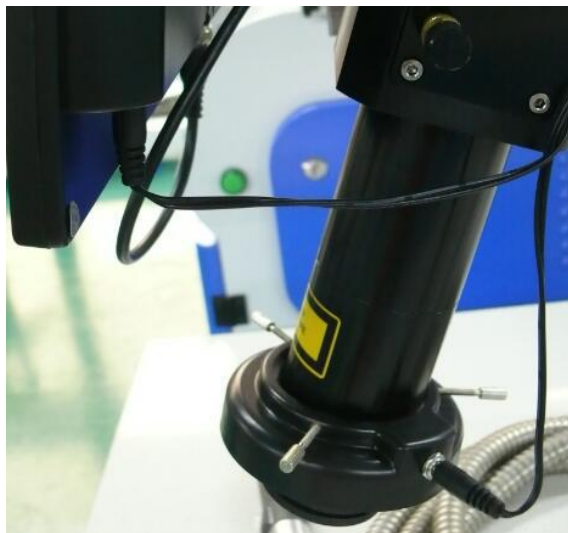


5) Fullfill cooling water

Fulfill the water chiller tank with bottled drinking water or deionized water until water surface submerges all cooling pipes.



## 6) Connection of monitoring system





7) Twist the ring around laser welding head for the right focus distance.



8) Connect compressed air / shield gas

To make fiber mode work, you MUST connect compressed air or shield gas.

If you are going to use shield gas for clean welding, we recommend Argon gas to be applied. Please connect this gas port with argon gas bottle directly and 1~3 MPa gas pressure is required.



If you are going to use compressed air just to cool down the fiber welding pen, please connect air compressor with this air purifier first, and then to the gas port behind the machine cabinet. Minimum 0.5MPa air pressure is required.



## 2-3 Machine operation

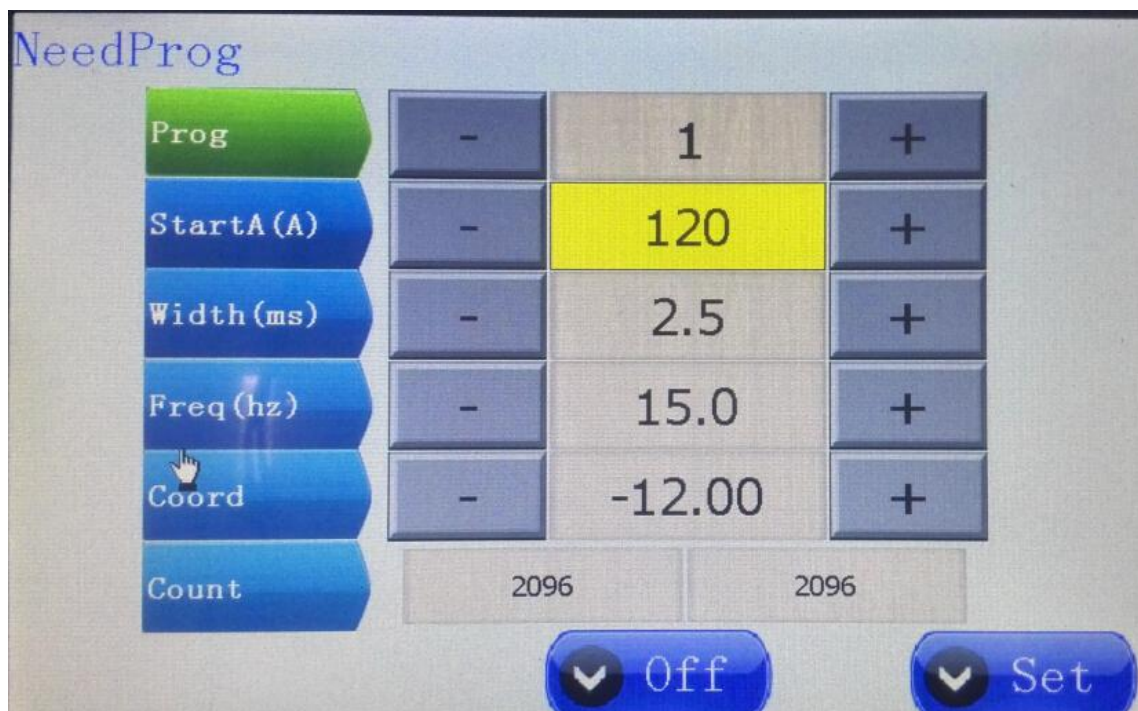
### 2.3.1 Start-up

- 1) Turn on safety fuse on the wall
- 2) Turn on water chiller and set water temperature < 30 Celsius degree, most often at 25 Celsius degree.  
Attention: Difference of water temperature and room temperature should be no more than 5 degrees in order to avoid laser cavity condensation
- 3) Turn on key switch and emergency switch.
- 4) When control panel shows “Sys closed” on top, press On at the bottom, then press Confirm On



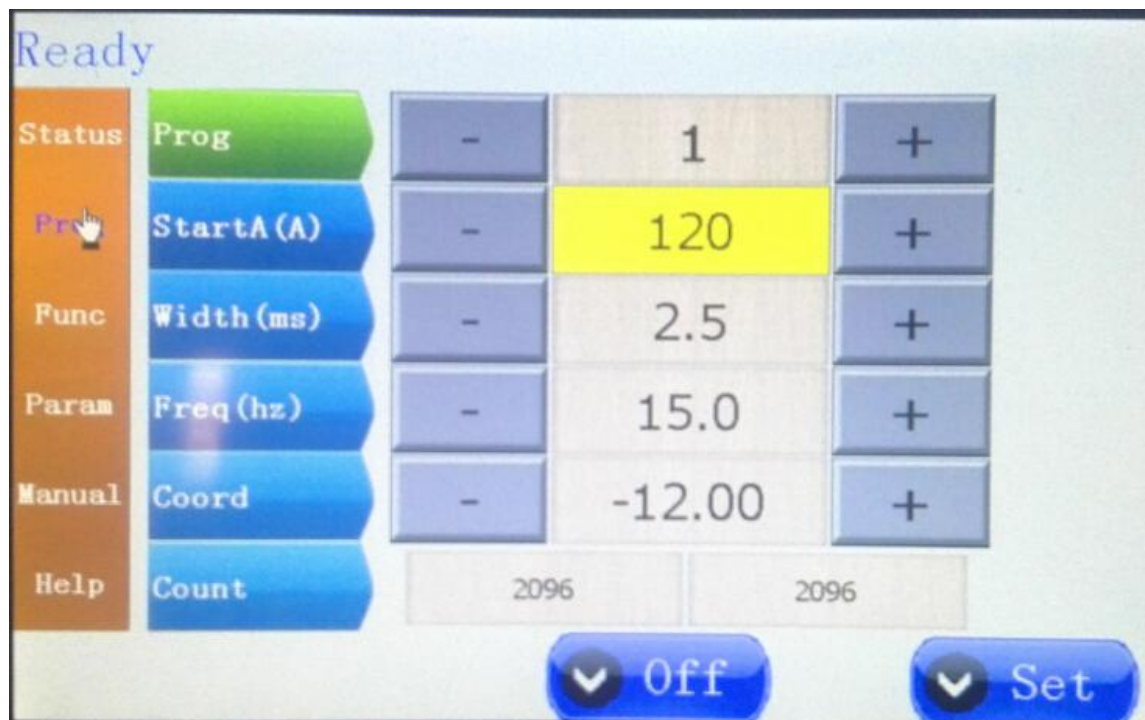
5) Wait for 1 minute for system initializing and capacitance charging. During this procedure, you will see the prompt Open Water Chiller, Open ZJ2, Soft Boot, 1st Time Pre-lighting displayed in chronological order.

6) After a few clanks and beeps, when the screen shows NeedProg on top, then you may select Prog and set working parameters according to different material and thickness (see Attachment 1:Parameters Setting Guide). **Do remember to click SEND button to make parameters work.**



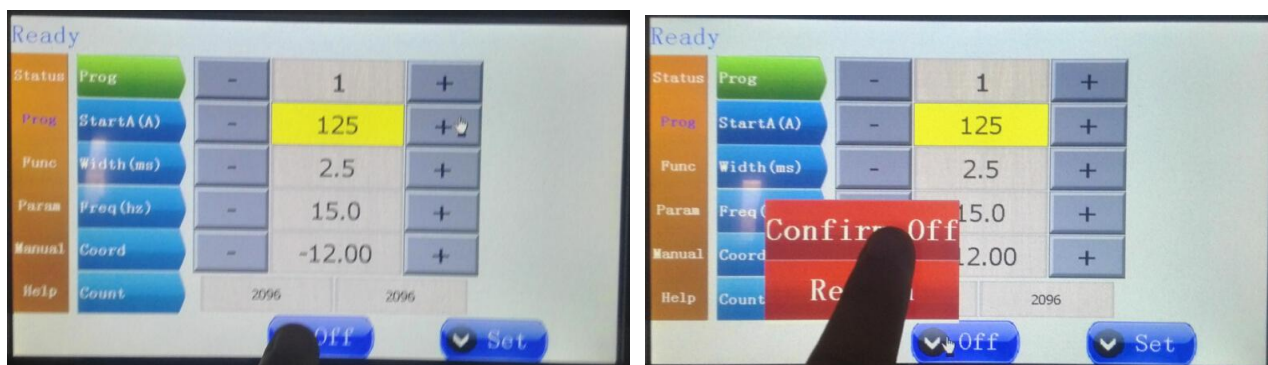
7) When it shows Ready on top of the screen, you may start welding.





### 2.3.2 Shut-off

1) Press Off button and then Confirm Off



2) Turn the key switch off



ON → OFF



- 3) Turn off Emergency Stop
- 4) Turn off water chiller power
- 5) Shut down safety fuse on the wall

### 2.3.3 Pre-welding

Before you weld, please adjust laser head height by twisting the ring around laser head until you find the right focus length (when laser spot brightest, roundest and the laser shooting sounds loudest). Then it means you get the best laser beam quality. To avoid penetration of material, you may decrease the current or enlarge the laser spot size manually to weaken single spot energy

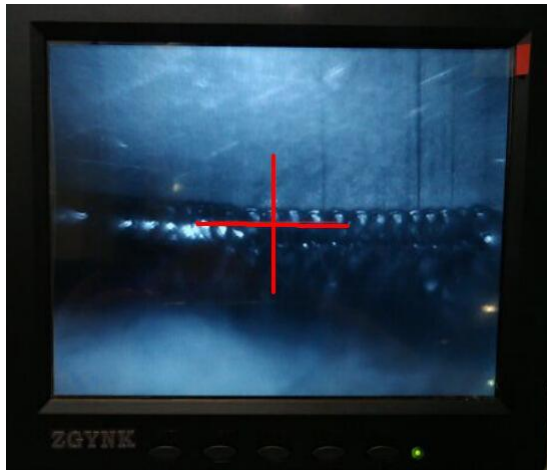
### 2.3.4 Welding

Firstly, the appropriate parameters (such as width, frequency and current) should be selected according to the nature of the work piece to be welded. *Current* decides the power of one single spot. *Pulse width* indicates the time duration one single spot stays. *Frequency* means how many spots can be produced in 1 second. Once parameters are properly set, operator can observe the work piece through monitor.

**Under standard mode:** During welding, work-piece can be moved upward or downward along the locating pin so that operator can see the welding spot clearly on the monitor. A perfect welding spot has the shape of fish scales, no concave or dent around the edge of facula can be seen .







**Under Fiber Mode:** Switch to fiber mode by pressing the red button for once, wait for 3 seconds and you will find the status light on.



We suggest you to turn red guide beam on when using handy welding torch because no other way you have to assist location. Guide beam switch is on the other end of laser chamber.



The best angle of holding the torch is 45 degrees towards the work-piece surface.



## Chapter 3 Technical index

### 3-1 Laser:

Working material: Nd<sup>3+</sup>: YAG

Wavelength: 1064um

Pulse xenon lamp:  $\phi$  7\*145mm

Pulse frequency: 0~20ms, gradational adjustable

Max single pulse energy: 100 joule

Rated laser power: 300W

### 3-2 Technical parameters

Model	CY-WF300HZ
Laser working substance	Nd <sup>3+</sup> : YAG
Max. Single-pulse Energy	100J
Max. Power Consumption	Max 9KW
Laser wavelength	1064nm
Focal facula diameter	$\phi$ 0.10-3.0mm adjustable
Rated output power	300W
Min. molten pool	0.3mm
Pulse width	0.5ms-15ms adjustable
Pulse depth	$\leq$ 3mm
Pulse frequency	1-50HZ adjustable
Observing system	CCD

### 3-3 Welding spot size:

Diameter: 0.1~1mm, adjustable

### 3-4 Optics system:

Extending ratio: 4 times

Focus-length of lens: 150mm

### 3-5 Cooling system

The equipment employs water cooling system in which the magnetic pump drives the circulating water to cool the laser crystal and pumping lamp, with overheat and overflow protection. The deionized water with resistance rate more than  $0.5\text{M}\Omega\text{-cm}$  is used as the circulating water, 15 liters for each time. The circulating heat is taken away by the refrigerating machine and finally discharged into the outside atmosphere by the fan.

**3-6 Power Supply:** single phase  $220\text{V}\pm 10\%$ , 50/60Hz

### 3-7 Working environment and continuous operation time

Working environment should be clean, oily fog and dust free, far from vibration, temperature  $5^{\circ}\text{C}\text{-}32^{\circ}\text{C}$ , humidity  $\leq 90\%$ . Continuous working time up to 16 hours.

## Chapter 4 Overall structures and maintenance

The integral machine is composed of five parts, namely, the control cabinet, cooling system, power cabinet, laser and optics processing system.

The equipment can also be divided into five parts in terms of functions, which are:

- 1) Laser;
- 2) Laser power supply;
- 3) Optics system;
- 4) Controlling system;
- 5) Cooling system.

### 4-1 Laser

#### (1) Structure

The laser is a device that converts the electrical energy into the laser energy. This machine employs  $\text{Nd}^{3+}$ : YAG Laser, consisting of the following parts:

- a) **Pumping lamp:** it converts the electrical energy into the optical energy that can activate the substances for laser processing. The machine adopts pulse xenon lamp with repetition rate of XMC7-125. Both the electrode and quartz glass tube surface need to be cooled during working.
- b) **Laser crystal:** it converts the optical energy into the laser energy. This machine employs the crystal  $\phi 8*145\text{mm}$   $\text{Nd}^{3+}$ : YAG as its working substance.
- c) **Condensing cavity:** it focuses the light from the pumping lamp onto the working materials.
- d) **The optical resonant cavity** can provide optical feedback, allowing the laser to be magnified to form high strength laser for output. This machine employs the plane and parallel cavity made up of flat mirrors with ceramics as its medium. The full reflector's

transmissivity is less than 0.4%, output reflecting mirror's transmissivity is 85%.

- e) **Other parts:** high voltage electrode, insulation base plate, positioning bracket, adjustable diaphragm frame and laser holder.

## **(2) Precautions and maintenance**

As the machine is highly precise equipment whose discharging features the high pulse voltage and charging features the large capacity, and the laser focusing energy is highly centralized, the operators must obtain professional knowledge and skills before they work on the machine.

### **A. Optical resonant cavity**

The two medium diaphragms of optical resonant cavity are absolutely parallel to the laser bar's end face, touching or random adjustment is not allowed. Do not open the outer hood of the laser randomly and keep the optics surface highly clean. Otherwise, the high-energy laser will damage the diaphragm layer. When the laser output energy is lowered down, the operator should first check whether the medium diaphragm is clean. If any dirt, he can use lens paper or cotton wool moistened by the cleaning agent (liquid mixture with ethanol absolute and ethanol respectively occupying 50%, the same when mentioned in the following part) to clean it gently. Then check the resonant cavity to see if it is misadjusted.

### **B. Cooling system**

The laser has one water inlet pipe and one outlet pipe, respectively connected to the cooling channels of the lamp and bar. Unsmooth water flow at any part will cause large loss. Each time when the equipment is assembled, the operator should check the water flow at each path and make sure no fault exists before starting up the laser.

### **C. Xenon lamp replacement**

The average service time of the pulse xenon lamp is  $10^8$  times of blinking if it works under its rated power and belongs to the consumptive pieces. To ensure the normal performance of the machine, the lamp must be replaced when it has reached its rated blinking times (about  $10^8$  times) and the energy becomes low.

In cases that the xenon lamp is damaged or its service time is shorted due to other causes (for example, it can't pre-illuminate or no energy output is available when the voltage is increased to 500V), the xenon lamp should also be replaced.

As the strength of the sealing at the lamp's two ends is relatively low and apt to being damaged, special caution should be offered when substituting the lamp. The following procedures should be followed:

- a. Turn off the machine, cut off the water supply and discharge the remaining electricity on the energy-storage capacitor;
- b. Remove the electrodes of lamp;
- c. Remove the gland of lamp, carefully pull out the lamp from the side of the full reflector;
- d. Use cotton moistened by cleaning agent to clean the sleeving;
- e. Check to see if the appearance, size and other aspects of the new lamp is conforming;
- f. Install the new lamp into the chamber, press the gland tight and mount the electrodes;
- g. Connect to the water supply and check the sealing of each part to see if they are reliable;

- h. Turn on the main power to check whether the lamp can discharge normally;
- i. Try single spot operation, check whether the output energy of laser meet the requirements. If the output is not ideal, repeatedly adjust the resonant cavity;
- j. Cover the laser with outer hood.

**D.**  $\text{Nd}^{3+}$ : YAG crystal is the core part of the laser, and is fairly expensive. Therefore it should be installed with great care. The two end faces of  $\text{Nd}^{3+}$ : YAG crystal bar is absolutely parallel to each other and has high cleanliness. If there is any pollutant on the end faces, the luminous efficiency will be lower, the facula mode will deteriorate, or even can't illuminate normally. In that case, the space housing this machine must be cleaned and professionals should be called for related treatment. Take out the  $\text{Nd}^{3+}$ : YAG crystal bar, use lens paper or absorbent cotton moistened by cleaning agent (liquid mixture with ethanol solution and another respectively occupying 50 %, ) to remove the dirt gently. The causes leading to the damage of crystal bar can be described as follows:

a. The flow of cooling water is over or interrupted, the energy input into the lamp makes the lamp and bar overheated, which results in the cracking of the lamp and bar;

b. The end face is bumped, scratched or even damaged by hard object;

c. As the diaphragm layer is polluted , the bar is damaged when the high strength laser passes by;

d. The bar is pressed too tightly or the applied force is uneven when it is installed, the over high interior stress breaks the bar. In this case, the operator should not open the hood of the laser, nor operate the YAG bar. If the end face is found polluted, professionals should be called for the related treatment.

**E.** The condensing cavity doesn't need maintenance work. Normally, it is not allowed to dismantle the condensing cavity.

## **F. Over voltage protection**

There are three kinds of voltage applied to the pulse xenon lamp in succession, namely, trigger voltage about 13-18 kv, pre-burning open-circuit voltage 1500-1800 v and arc-discharge voltage about 500-2500 v. Therefore, the lamp electrode should not get too close to other metal objects, and a distance of more than 15mm should be kept. The insulation panel's surface should be kept dry and clean so as to avoid pollutions which may lower down the insulation performance to bring short circuit.

## **4-2 Laser Power supply**

This machine can be operated either through the keys on the control panel or the joystick.

### **(1) Principle**

The laser power supply system with repetition rate is employed, the L—C resonance charging is adopted for the charging circuit. The capacitance-inductance energy storage network is used for supplying the power for the lamp. The control circuit is centered by the single-chip microprocessor, which can be used to adjust the output energy of power and the repeated frequency. The system also features its multiple linked protections, ensuring the



emergency stop of the power under abnormal conditions.

## **(2) Electric circuit**

The electric circuits are made up of the following parts:

Main return circuits: including the charging circuit, energy storage network, discharging circuit and pre-burning and trigger circuit.

Controlling circuits: including the electric controlling circuit, microprocessor controlling circuit and different kinds of protection circuits.

A. Step-up/rectification circuit: it employs the single-phase stepping up, which converts AC 220V into DV 500V that supplies power to the charging circuit.

### **B. Charging circuit**

The charging circuit is composed of the IGBT switch tubes. Such a charging mode will increase the repetition rate of the circuit.

### **C. Discharging circuit**

The discharging circuit can be controlled by the silicon controlled switch that must be kept shut off. After the energy storage network is charged, the silicon controlled switch is shut off, then after the delayed time, the discharging can be realized by turning on the silicon controlled switch. Once the energy storage capacitance is fully discharged, the silicon controlled switch will be automatically shut off.

### **D. Pre-burning and trigger circuit**

It is made up of the step-up and transforming circuit, high voltage bridge rectifier, filter, current-limiting resistor; current relay, high voltage pulse transformer and high voltage trigger circuit.

As the pulse xenon lamp is in the state of normal glow discharge when it is pre-burned, it has the nature of negative resistance. To ensure the normal glow discharge of the xenon lamp after the arc-discharge is finished, the pre-burning circuit must have the nature of high current source and its current-limiting resistor must be relatively high. The internal triggering mode is employed for this machine, with 50Hz automatic triggering. Once the pre-burning switch is closed, the high voltage pulse transformer will generate high voltage of 15-20 kv to be applied onto the resonance cavity. As long as the pre-burning is established, the trigger circuit will be disconnected immediately.

### **E. Protection circuit**

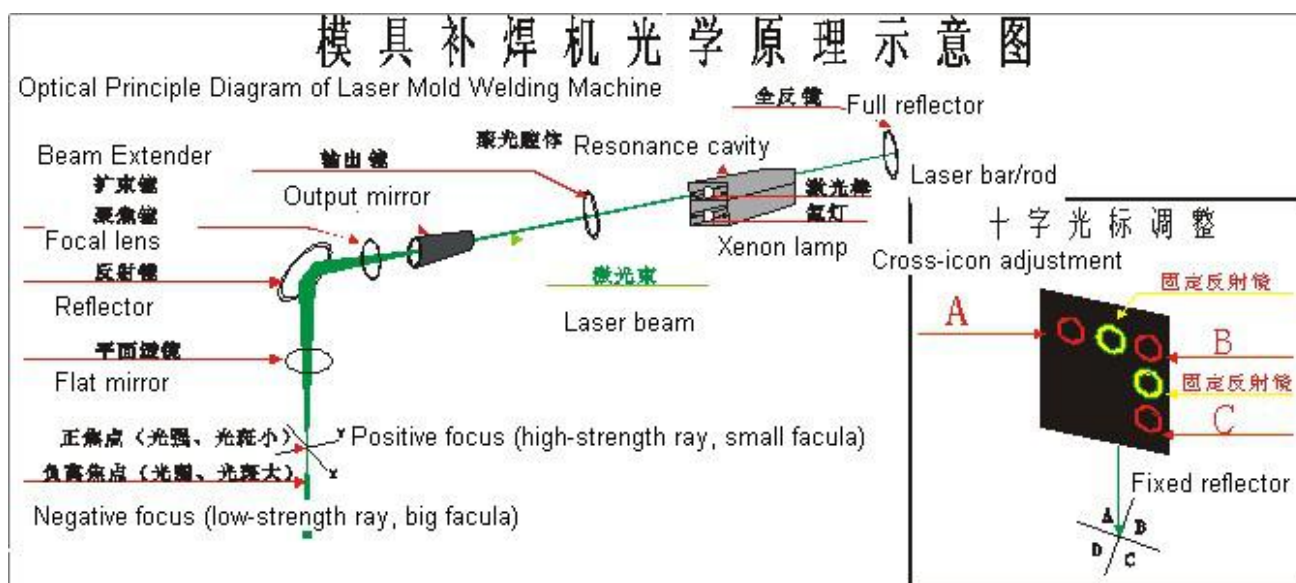
#### ***a) Pre-burning disconnection protection***

When the pre-burning current is shut off, the discharging circuit will have failure, the protection circuit will be activated to send out failure signal.

#### ***b) Flow interlocking protection***

When the flow of the circulating water inside the cooling system is insufficient, the flow breaker will be opened and the pre-burning circuit and main circuit will be disconnected, resulting in the shutoff of the whole machine.

## **4-3 Optical System Demonstration**



### Impact of Focus Setover on Welding Quality

The laser welding normally needs a certain degree of off-focus operation, for the welding point can be vaporized into a hole if the power density at facula center of laser focus is excessively high. The planes that are not with the laser focus will have relatively even distribution of power density.

Two off-focus modes are available: positive off-focus and negative off-focus. If the focal plane is above the work piece, it is called positive off-focus, contrarily; it is called negative off-focus. According to the theory of geometrical optics, when the positive off-focus distance is the same as the negative off-focus distance, the power density on corresponding planes will approximate to each other. However, the shape the obtained molten pool is different. Under the circumstance of negative off-focus, the large penetration depth could be reached, which is related to the forming of the molten pool. Experiments show that when the material is heated by laser for 50~200us, it begins to be molten, forms the liquid-phase metal and the evaporation appears to form the pressure-applying vapor that spurs at extremely high speed with dazzling white light. At the same time, the high density gas moves the liquid-phase metal to the edge of the molten pool to form the dent at the center of the molten pool. Under the circumstance of negative off-focus, the power density inside the material is even higher than the surface, which is apt to cause stronger melting and vaporizing that pass the optical energy into the in-depth part of the material. Therefore, in actual applications, if the large penetration depth is required, the negative off-focus operation should be carried out. When thin materials are welded, the positive off-focus operation is needed.

#### **(1) Microscope/ CCD**

This machine employs the binocular zoom stereo microscope, featuring its clear and stereo vision. The coated protection glass is added in front of the object lens to avoid the pollution which can be caused by the splashing metal articles during processing. For transportation and storage, the ocular can be removed by loosening the fixing screws.

### **(2) Laser extending and focusing system**

The machine employs the design that both the laser and microscope's beam path share the same object lens. The focus setover is determined by the welding process and adjusted by the off-focus handle, with procession graduation marks.

### **(3) Welding point indication**

There is a reticle in the object lens, the intersection point of which is overlapped with the laser point. Through the intersection point of the reticle, the laser beam can be aligned to the welding part during work.

### **(4) Precautions**

- A. The surface of optical parts can't be contacted or wiped with hand, cotton yarn or hard object, nor blown with mouth. The blowing ball can be used to remove the dust on them. If there is any pollutant, the operator can use cotton wool or lens paper moistened by cleaning agent to clean them
- B. To avoid damage, do not dismantle the parts. Otherwise, dust or smoke may enter into the inside of the optical system.
- C. When the protection glass needs to be replaced, the object lens and the press ring should be removed. Replacement work should be done with great care.

## **4-4 Cooling system**

### **(1) Structure**

The cooling system is enclosed water circulation system composed of heat exchanger, magnetic pump, filter, water tank, flow switch and temperature contactor, valve and other parts.

### **(2) Working principle**

The magnetic pump pumps the deionized water in the water tank that will cool the working material (YAG bar), xenon lamp, lamp electrode of the laser. The deionized water with absorbed heat will pass by the heat exchanger discharging the heat and flow back to the water tank.

The resistance rate of the deionized water is required to be higher than  $0.5\text{M}\Omega\text{—cm}$ . After some time of use, the deionized water's resistance rate will be lowered down and it may have impurities, dirt or turbidity that will make the xenon lamp not lightened or pollute the laser cavity and glass tube, and lower the luminous efficiency. If so, the used deionized water should be substituted immediately (if the machine is continuously operated, the deionized water in the system should be replaced once a week).

The heat exchanger works through the Freon to exchange the heat for the cooling water and carry away the heat in the purified water. A flow controller and over-temperature contactor are installed in the cooling system to monitor the water that comes into the laser. Once the flow of the circulating water is insufficient or the water pump in the system works abnormally, the power for the laser should be turned off immediately so as to avoid the accident that can be caused by the explosion of the lamp or YAG bar.

## Attachment 1: Parameters Setting Guide

### ●Under Standard Mode

Material Type	Current (A)	Pulse Duration (MS)	Frequency(HZ)
0.3MM S/S	60	2	5-20
0.5MM S/S	70	2	5-20
0.8MM S/S	75-80	2	5-30
1.2MM S/S	80-90	2	5-30
1.5MM S/S	90	3	5-30
2.0MM S/S	100	3	5-30
2.4MM S/S	120	3.5	5-20
3.0MM S/S	140	4	5-20
0.3MM Titanium Alloy	70	2	5-20
0.8MM Titanium Alloy	80	2	5-20
1.2MM Titanium Alloy	100	3	5-20
0.5MM Galvanized Iron	100	3.5	5-10
1.0MM Galvanized iron	110	3.5	5-15
1.5MM Galvanized iron	120	3	5-15
2.0MM Galvanized iron	140	3	5-15
0.3MM Aluminum	100	3.5	5-10
0.5MM Aluminum	110	3.5	5-10
0.8MM Aluminum	120	3.5	5-10
1.2MM Aluminum	130	4	5-10
1.6MM Aluminum	140	5	5-10
2.0MM Aluminum	150	5	5-10
0.6MM Brass	100	4	5-10
1.0MM Brass	110	5	5-10
1.4MM Brass	120	5	5-10
2.0MM Brass	140	5	5-10

### ●Under Fiber Pen Mode:

Material Type	Current (A)	Pulse Duration (MS)	Frequency (HZ)
0.3MM SS	100	3	5-20
0.5MM SS	105	3	5-20
0.8MM SS	110	3	5-20
1.2MM SS	115	3	5-20
1.5MM SS	120	3	5-20
2.0MM S/S	140	3.5	5-20
2.4MM S/S	140	3.7	5-20

3.0MM S/S	150	4	5-20
0.3MM Titanium	90	3	5-20
0.8MM Titanium	100	3.5	5-20
0.5MM Galvanized iron	120	3.5	5-20
1.0MM Galvanized iron	140	3.5	5-20
1.5MM Galvanized iron	150	3.7	5-20
2.0MM Galvanized iron	160	4	5-20
0.3MM Aluminum	180	4	5-10
0.5MM Aluminum	190	4	5-10
0.8MM Aluminum	200	4	5-10
1.2MM Aluminum	220	4	5-10
1.5MM Aluminum	240	4	5-10
2.0MM Aluminum	260	4	5-10

### ●Remarks:

a.No matter what materials you weld, the best finishing requires the best quality of laser spot. As we stated in video manual, when you find the laser spot roundest and the shooting sound loudest, that means the spot quality is the best. But when you weld S/S, too much sparks will interference your work so you'd better adjust off-focus a little.

b.To get the best welding performance, laser spot size is also an important factor. Generally speaking, smaller laser spot gives higher energy and melts deeper than bigger laser spot. But too small laser spots might penetrate your material. So please try to do some testing with different spot sizes in order to get a balance.

c.Parameters above only for your reference. You may adjust them a little bit higher or lower according to difference materials you're welding.

## Attachment 2: Common Troubleshooting

Fault	Possible Reasons	Proper Solutions
Machine won't work with the power on	1. Flow alert is not connected 2. AC fault	1.Check the water chiller connection 2.Check the total power supply
Xenon lamp won't light up with the power on	1.Lamp is broken 2.Lamp tube gets black 3.Pre-ignition circuit failure 4.Lamp's service life runs out 5.Lamp poles fall off	1.Replace a new lamp 2.Change the water in the chiller 3.Check the volts according to the circuit map 4.Replace a new lamp 5. Check and plug the poles
Cooling fan won't work with the power on	Fan power failure	Replace a new fan



Output energy reduce	1. Water polluted 2. lamp worn out 3. Condenser cavity worn out	1. Change the water in the chiller 2. Replace the lamp 3. Clean or replace the condenser cavity
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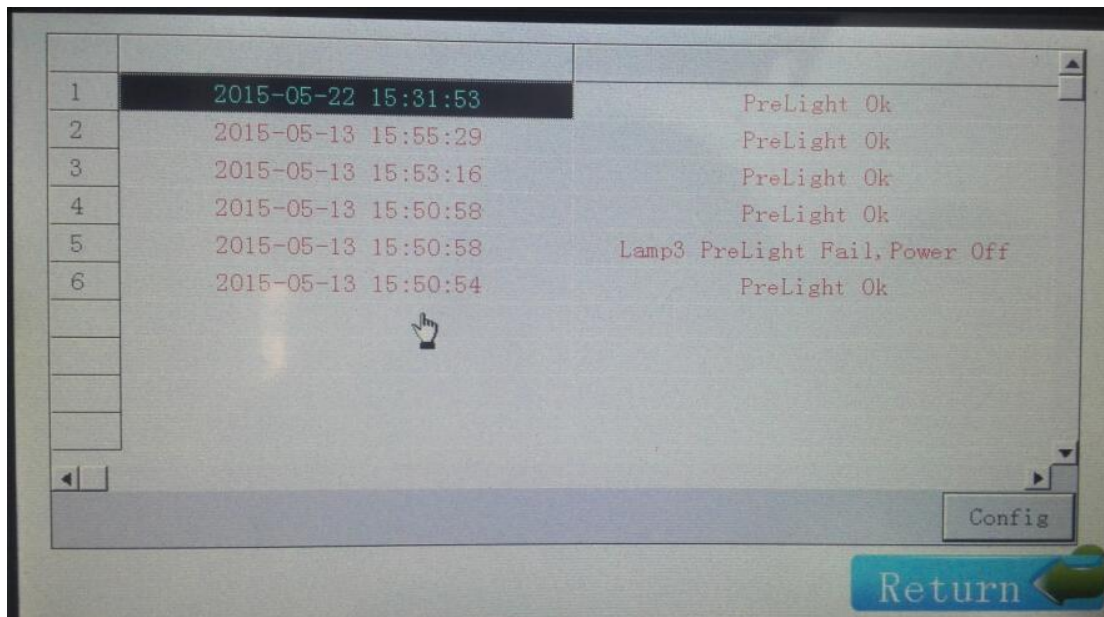
*If the above steps do not correct the malfunction, do not disassemble. Please do not hesitate to contact us and please operate under the guidance of our engineers.*

*When your machine can't work normally, the following two pages can be very helpful for our technician to find out the faulty in shortest time:*

### 1) Func Option- Check



### 2) Func Option - Fault History



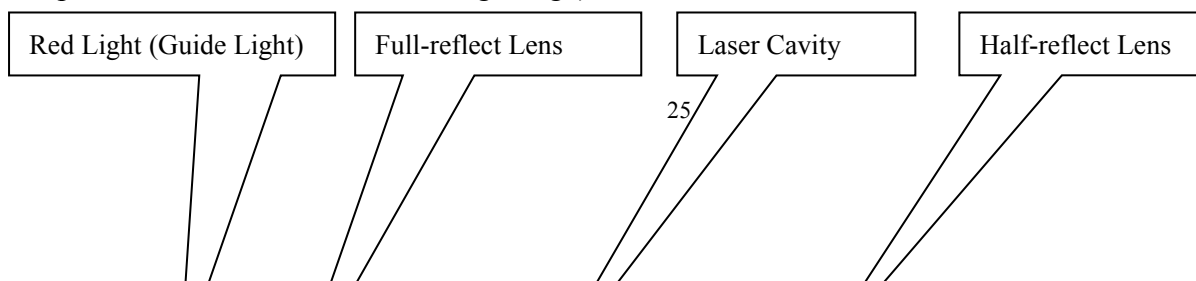
## Attachment 3: Alignment

### Part A. RED LIGHT ALIGNMENT

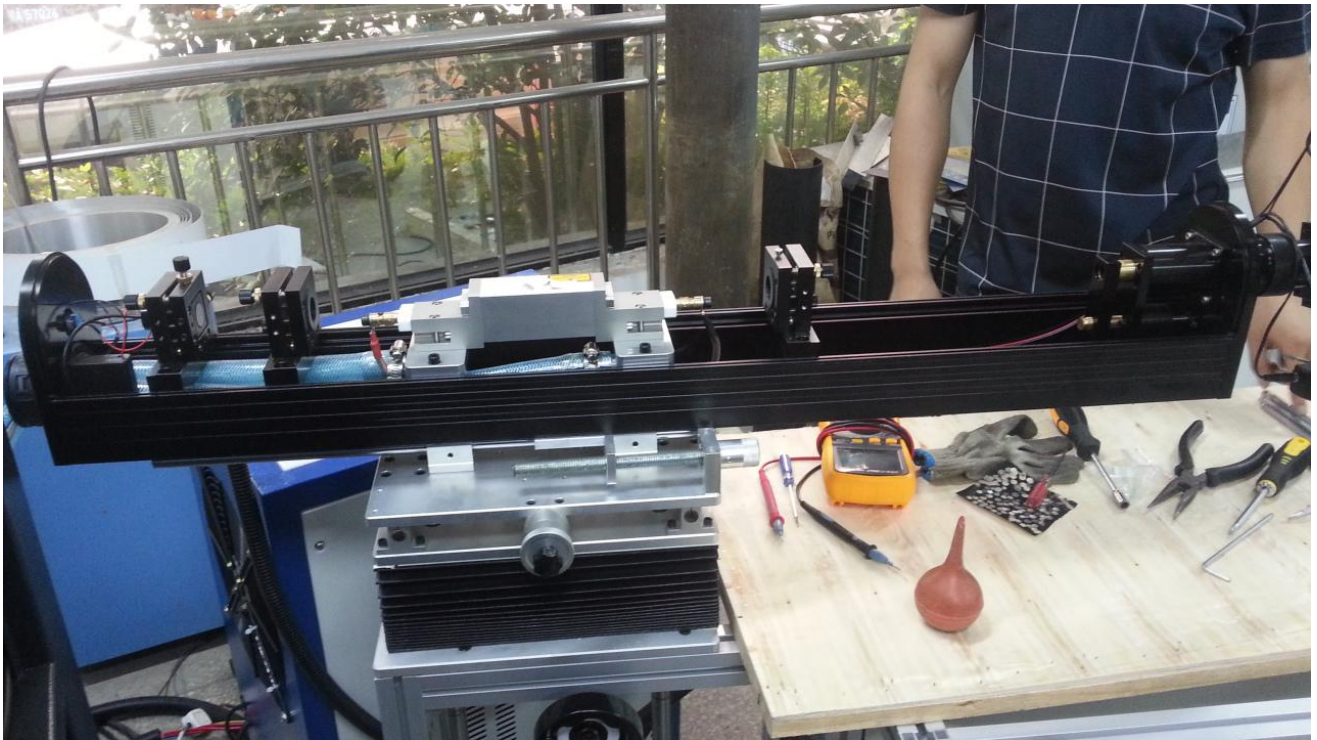
Red light pointer is the guide for observation. Don't energetic the welding machine when you do red light alignment. Just turn on red light by pressing the red button at the end of optical chamber and open the chamber lid.



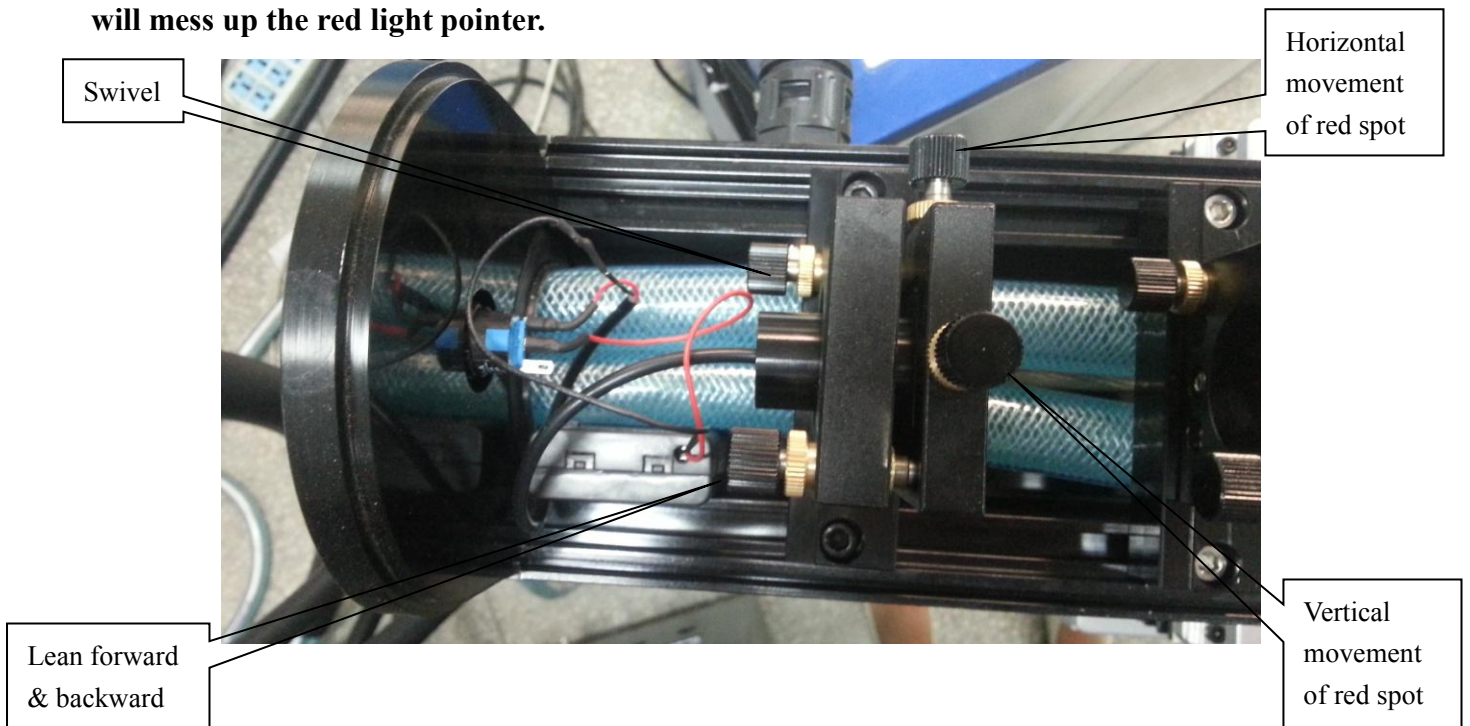
**General Introduction:** (WF300HZ has an extra light shifting box, but the main structure and optical components are same as the following image)



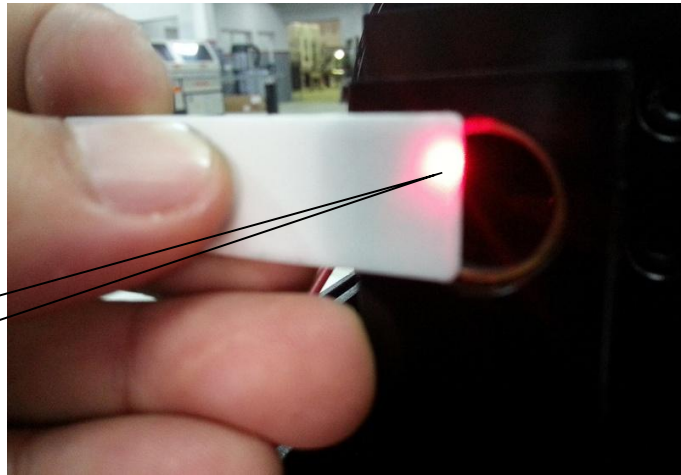




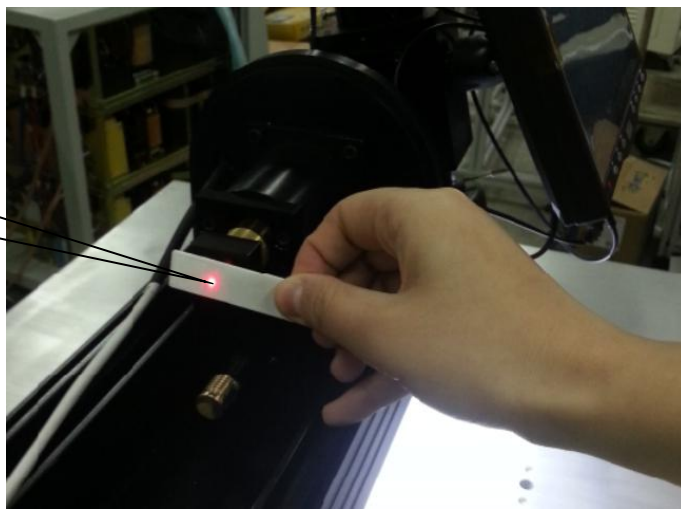
**Step 1: Adjust the four knobs to make red spot in the center of every place you test with laser detector. If you find the red dot is already in the center, then you skip this step. Otherwise you will mess up the red light pointer.**



Not in the center,  
**WRONG!**



In the center,  
**CORRECT!**

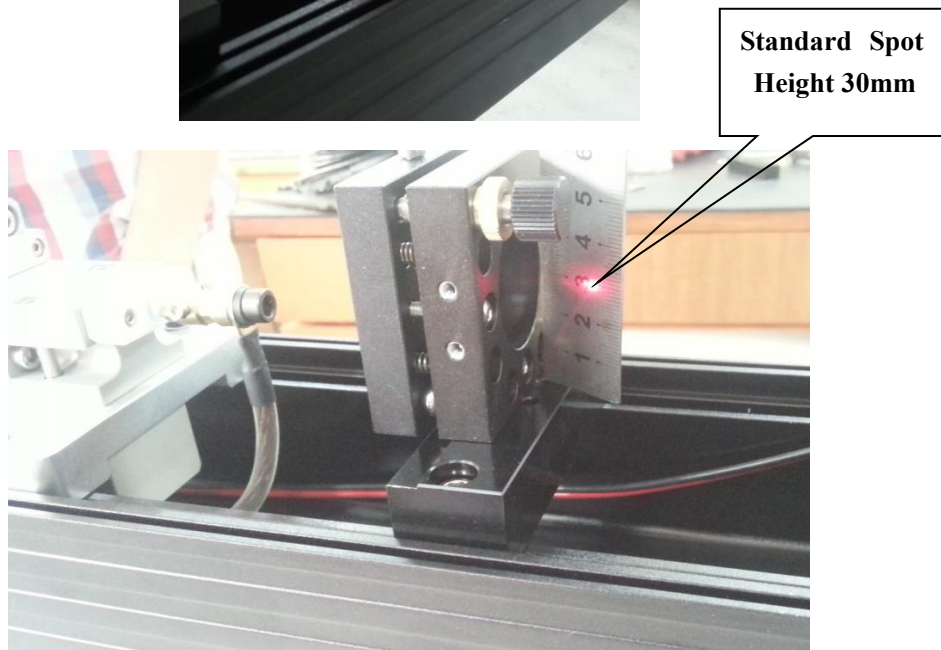
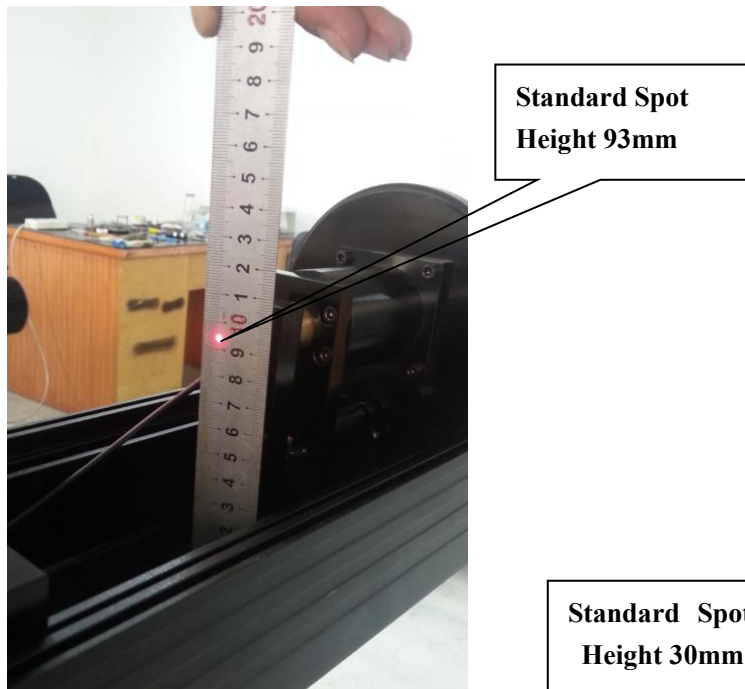
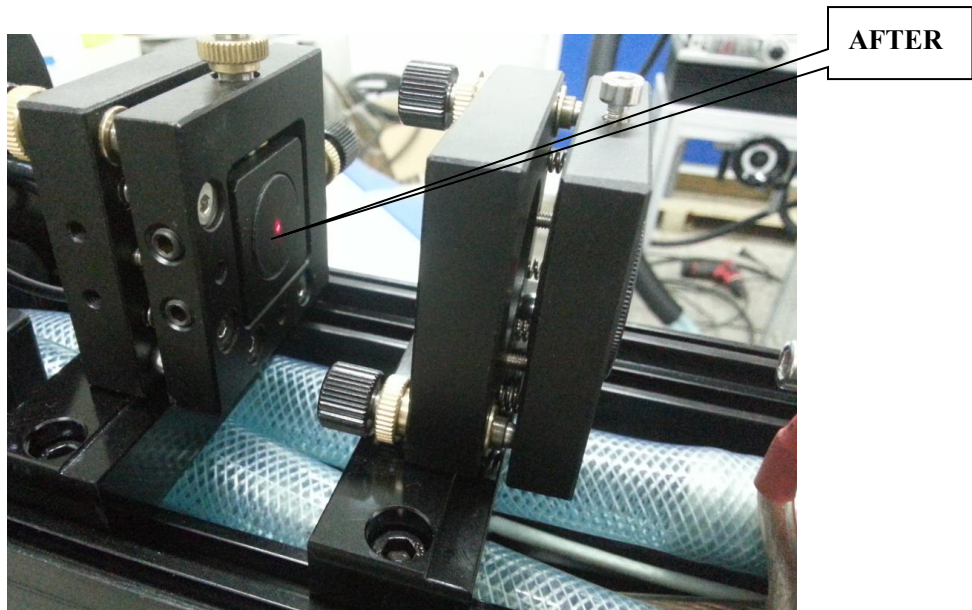


**Step 2: Adjust the two knobs on half-reflect lens to make all the small red spots becomes one. Measure the height of the spot and make sure it's at the right height.**

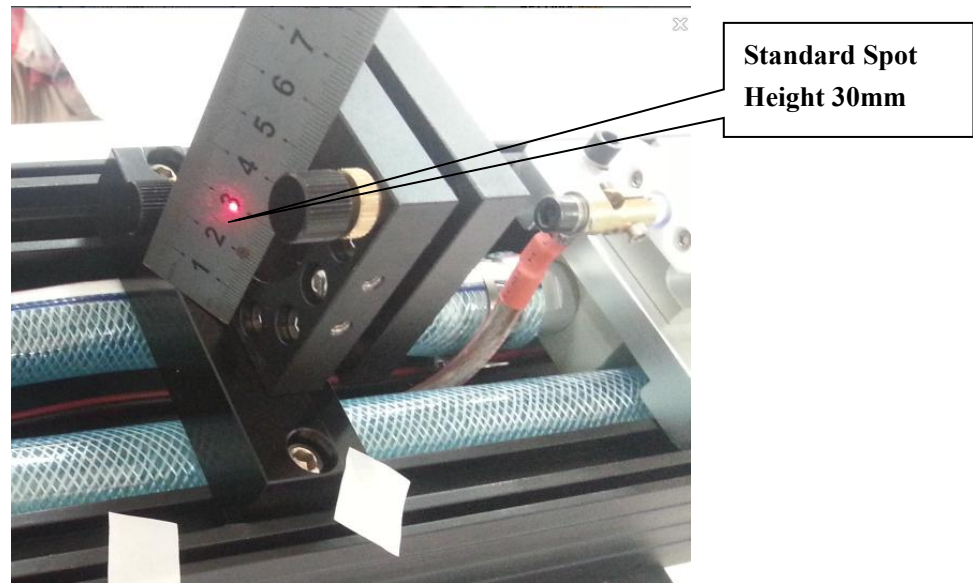
**BEFORE**





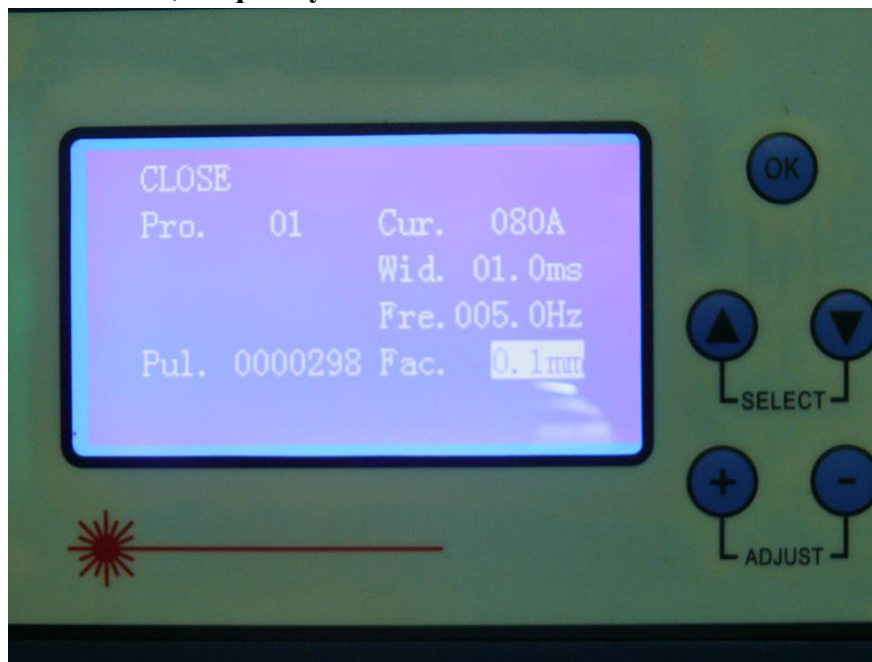




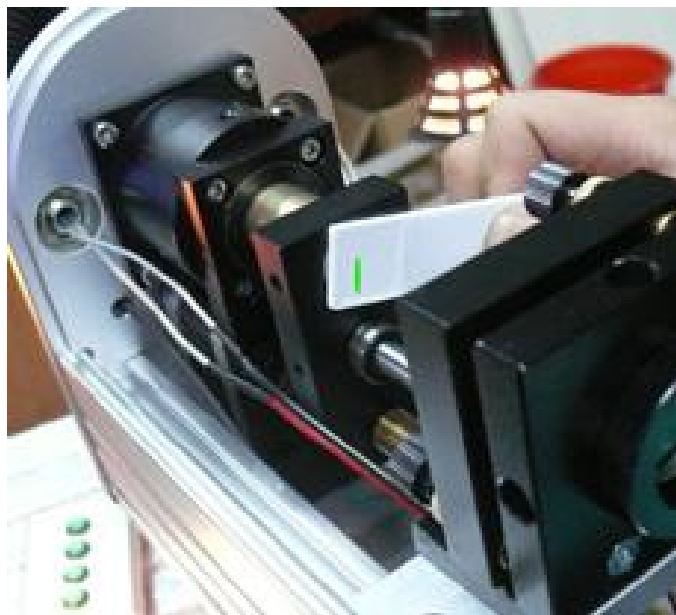
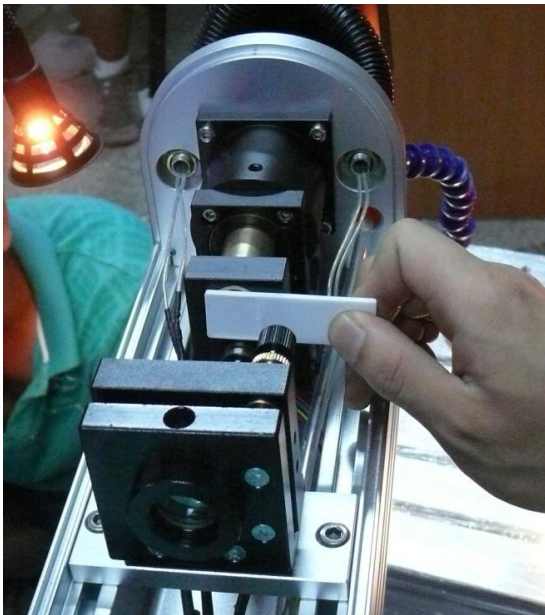


## Part B. LASER ALIGNMENT UNDER STANDARD MODE

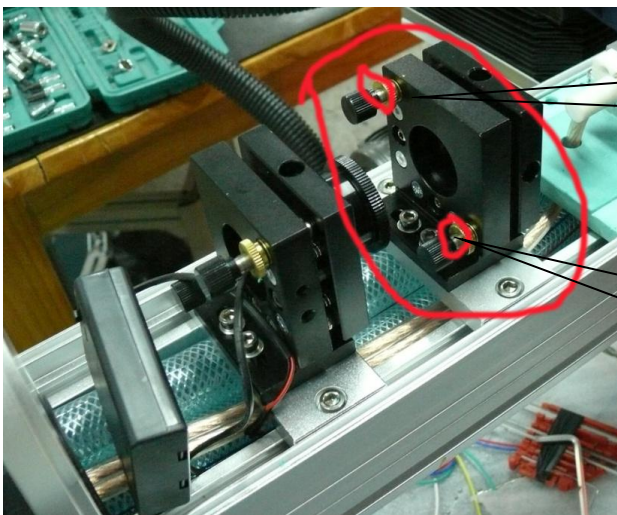
Before you start, please turn on the water chiller and laser machine ,and then set parameters as Current<80A,Width=1.0ms,Frequency=5.0HZ



Step 1: Put the ceramic laser detector in front of the brass tube and trigger the laser by foot switch, you will find a green spot on the detector. (It will be a white spot if you're using a black photo paper as the detector)



**Step 2: Turn the two knobs on full-reflect lens that marked in red to adjust the green spot as round as possible.**



Turn this knob and keep triggering laser to adjust the left semicircle and the right semicircle of green spot

Turn this knob and keep triggering laser to adjust the upper semicircle and the lower semicircle of green spot

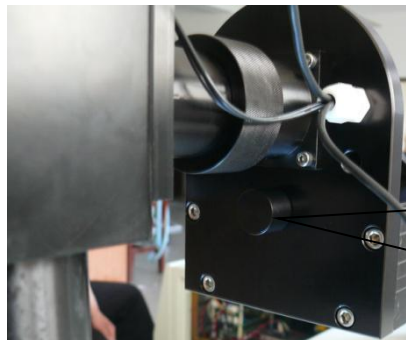


Before



After

**When you get the brightest and roundest green spot,the optical system is ready.  
But before welding, you still need to find the right focus by adjusting the angle and height of laser head.**

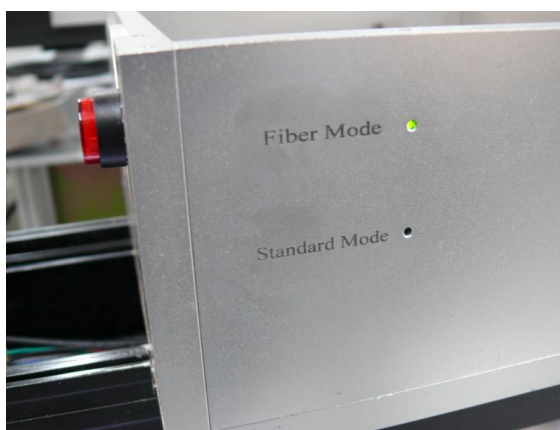


Laser spot size also decides the performance of welding. You can adjust it manually by this black knob. With same parameters,small spots gives more intensive energy than bigger spots and shoot deeper into the material. However,if you set the spot size too small,laser beam might penetrate the material and leave burnt spots on metal surface.

### **Part C. LASER ALIGNMENT UNDER FIBER MODE**

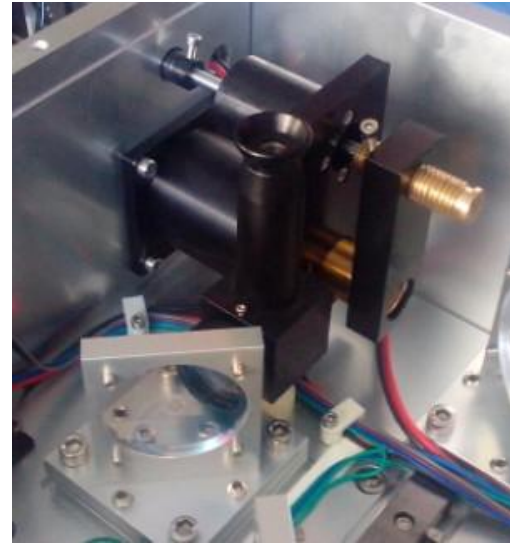
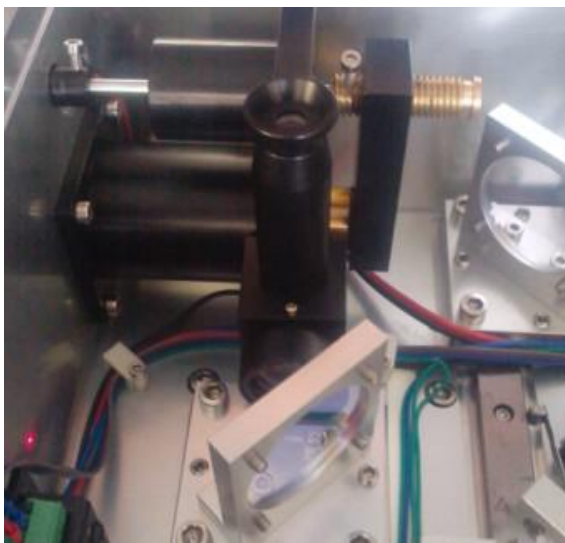
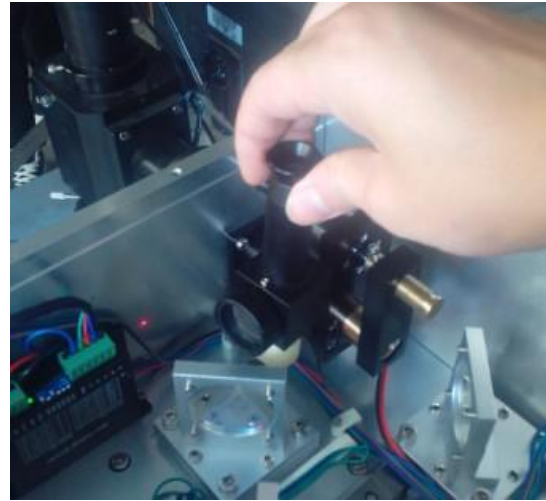
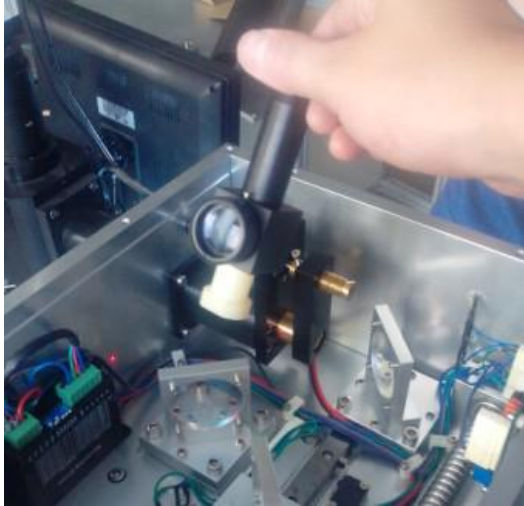
**Laser must go through the core center of the fiber cable in order to get the best quality laser beam. If there is any deviation, laser energy will be weakened and the fiber wire will be burnt.**

**Step 1: Switch to Fiber Mode by keep pressing this red button for 3 seconds, green light on.**

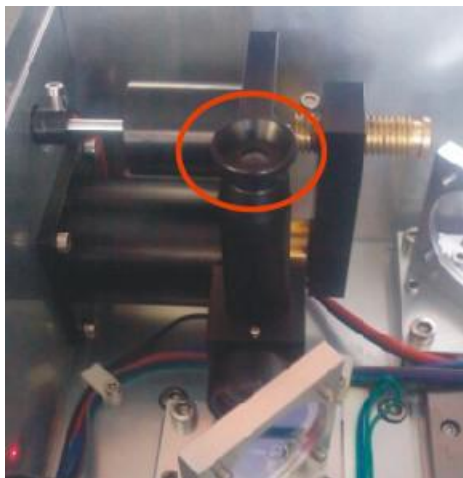


**Step 2:Remove the cover of the grey aluminum box and place the observer lens as shown in following figures.**





**Step 3: Point the fiber laser head to daylight or a lamp and observe through the top lens. As the enlargement figure shows, the small white light spot should be exactly in the center of the red light spot.**



**Step 4: If the white spot is not in the center of red spot, please adjust the six screws marked with red circle to adjust the position of the reflective lens until the position of white spot is perfectly right. Finally return the cover lid.**

