

## **1. Introduction**

### **1.1 Safety introduction**

The laser machine described here is a Class IV laser device and is dangerous. The laser will instantly ignite clothing, wood, paper, plastics, and many other common items and will Seriously Burn Flesh, Including Eyes. Care must be taken to avoid Serious Injury and/or Blindness. Always operate this and any other high power laser in an environment free of flammable materials, children, pets, spectators, etc. Always use Infrared Eye Protection Goggles when operating this laser. Failure to do so may result in Permanent Blindness. This laser uses Lethal High Voltages. Care must be taken when working with the high voltage. Failure to do so may result in Serious Injury or Death.

**Builder and/or User Assumes All Risks!**

By assembling this laser kit, or by using the information contained in this manual to build, repair, or otherwise work with lasers or other high voltage devices of any kind, You Do So At Your Own Risk.

### **1.2 Fittings prepared**

One large water bucket that has a capacity of about 25 kg purity water, using for cooling Laser.

A single stranded copper wire with 2MM diameter ,using for grounding.

You will need the following items in order to finish this machine:

An IBM Compatible PC -w-1.6 GHZ or more exclusive Processor. 512 MB RAM OR Greater with one available PCI Slot. Windows XP Operating System Required. \*\*\* PS2 Keyboard and Mouse Interface Required \*\*\* USB Keyboard is NOT Supported...

### **1.3 Technical character**

The laser engraver makes use of the high-energy laser beam focus on the surface of the work piece, and gasify the work piece material in order to cut the work piece successfully. And the numeral control worktable can cut the work piece to the designed shape.

The equipment adopt the CO2 glass laser tube, and use the high-pressure gas discharge to pump the material, the output beam waist of laser reflected to the setting focus mirror of the numeral control worktable. And the numeral control table drive the focus lens move, and according to the designed figure focus the laser on the working material to cutting the work piece.

technical character

1) Adopt high grade and exact orbit and bear to make sure the precision and guarantee the long time and stable production at the same time.

2) Adopt exhaust-fans, air-exhaust pipe, and track exhaust can blow away the exhaust gas efficiently to avoid smoking the lens and cooling machining surface, the down exhaust-fan can blow away the useless gas and have the sorption to the working material.

The speed and efficiency system become more faster.

3) High-power guarantee the system work without any disturbance.

4) Laser tube supply adopt the constant current high power switch power supply which can supply to laser continuously.

5) Laser tube can be chosen. The user can choose different power laser tube depends on different requirement. It also can upgrade from low power to high power conveniently

## **2. Function of Laser engraving machine**

The application scope of laser engraving machine is completely extensive. Different designs have been adapted to our laser machine to meet the needs of all fields. And we believe that the type

of machine you've chosen will surely be of great help to your work. The following introductions might provide you some inspirations with choosing and enlarging the scope of usage.

\*.Printing and packaging fields: engraving on rubber plate, laser cutting on paper, etc.

\*.Artwork and gift fields: engraving on bamboo, wooden book, redwood, double-colored plate, box-shaped artwork, chessboard, etc.

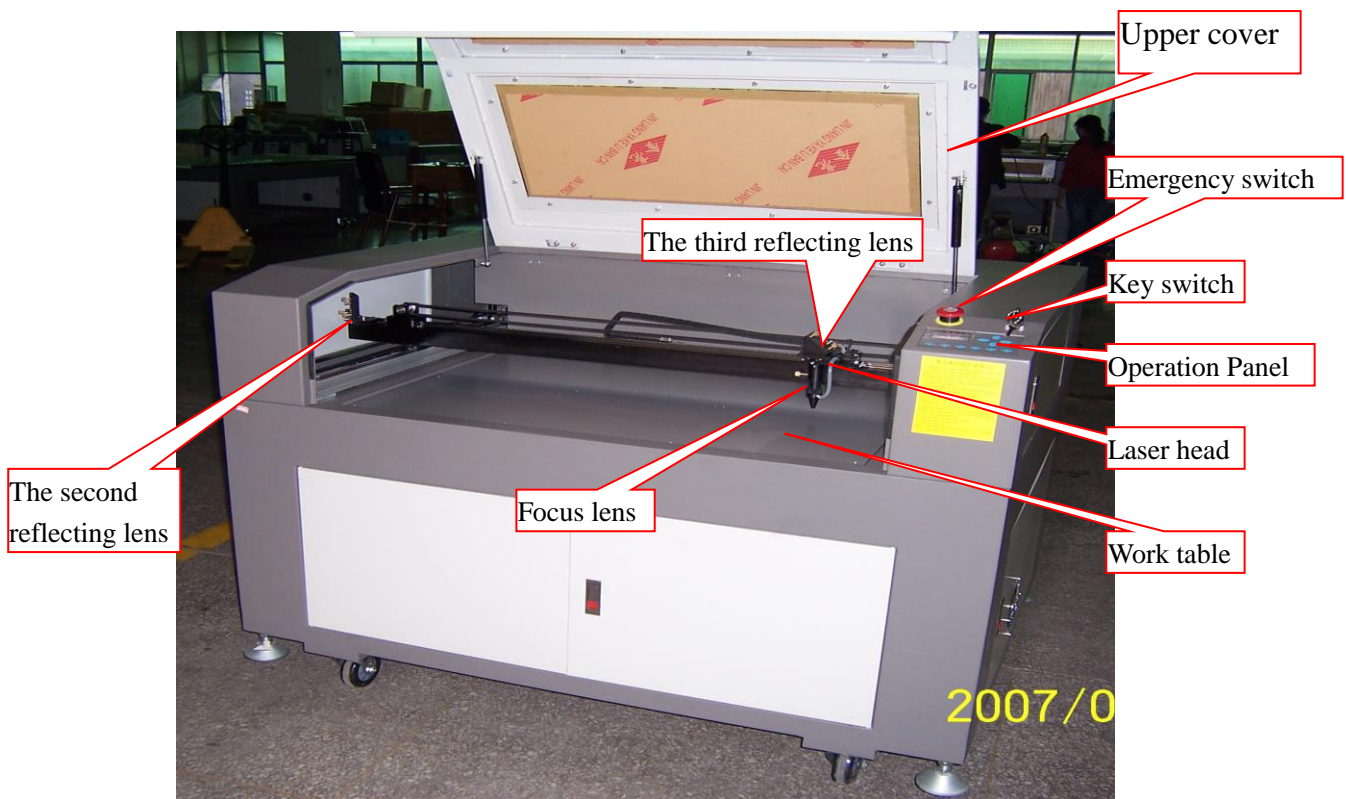
\*.Advertising field: engraving (cutting) on organic glass, various tablets and double-colored plate, etc.

\*.Leather and garments fields: cutting on genuine and synthetic leather and different kinds of shoes. And do engraving and cutting on the surface pattern. Cutting on various designs of garment and textiles, etc.

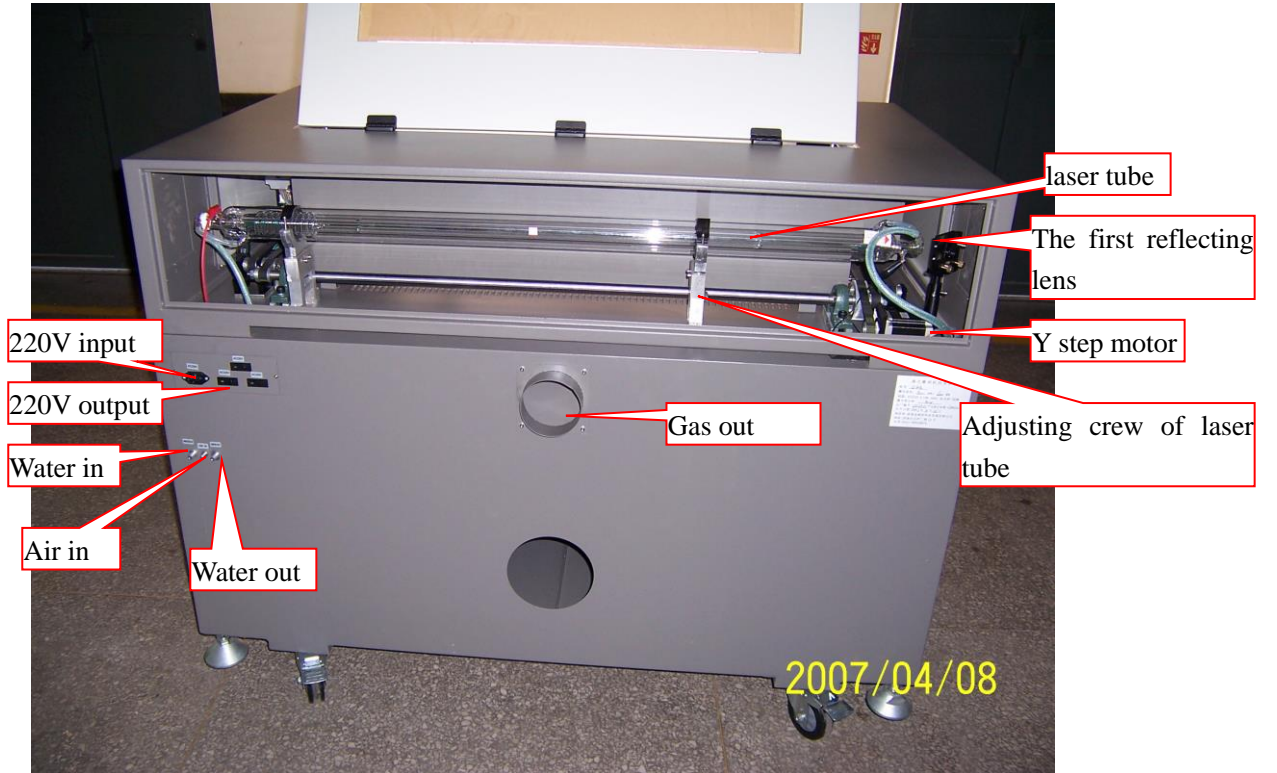
\*.Model fields: engraving (cutting) on architectural model, aviation and navigation models, cartoon figures and sample of industrial model, etc.

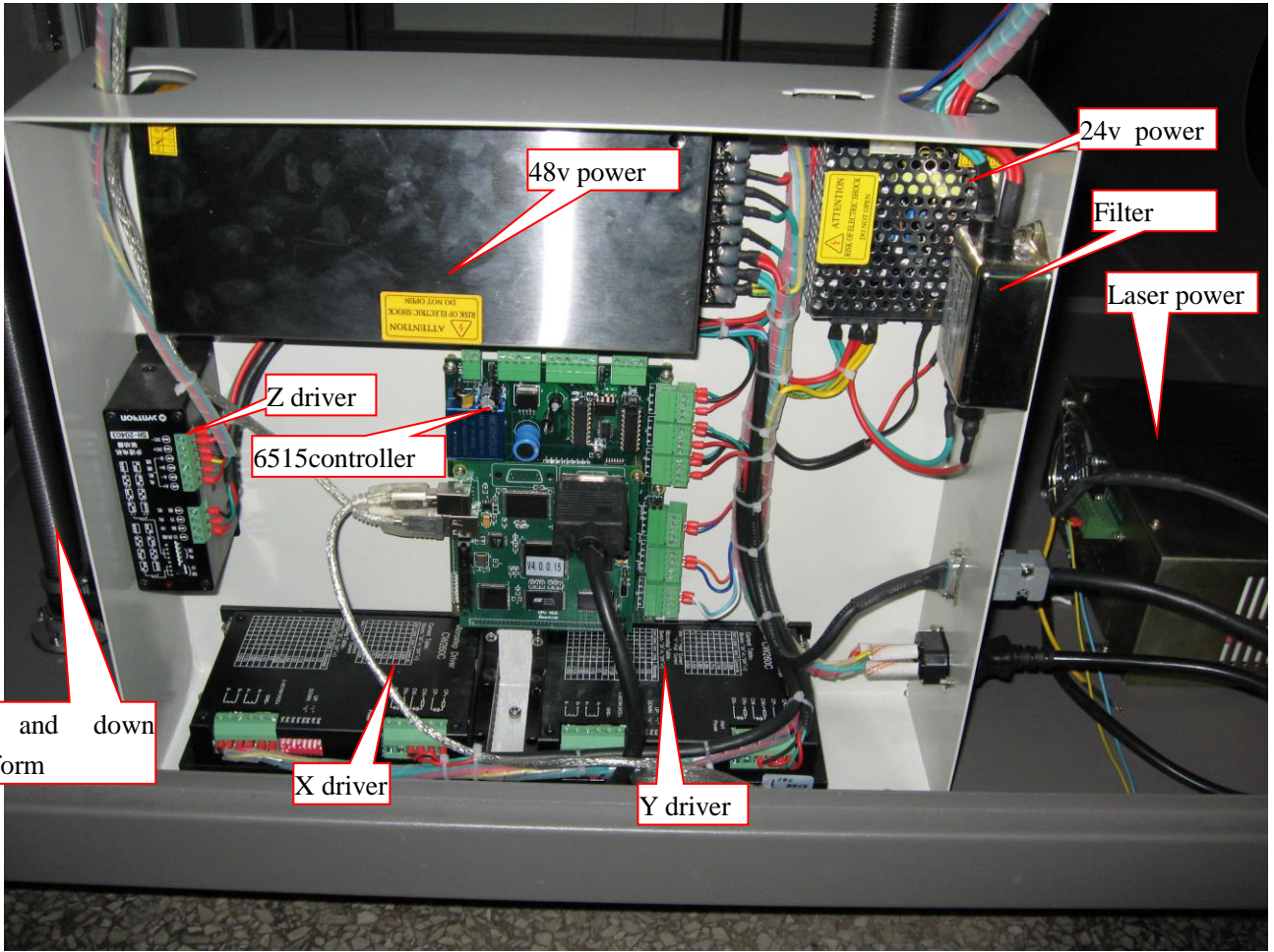
### 3. Structure of main machine

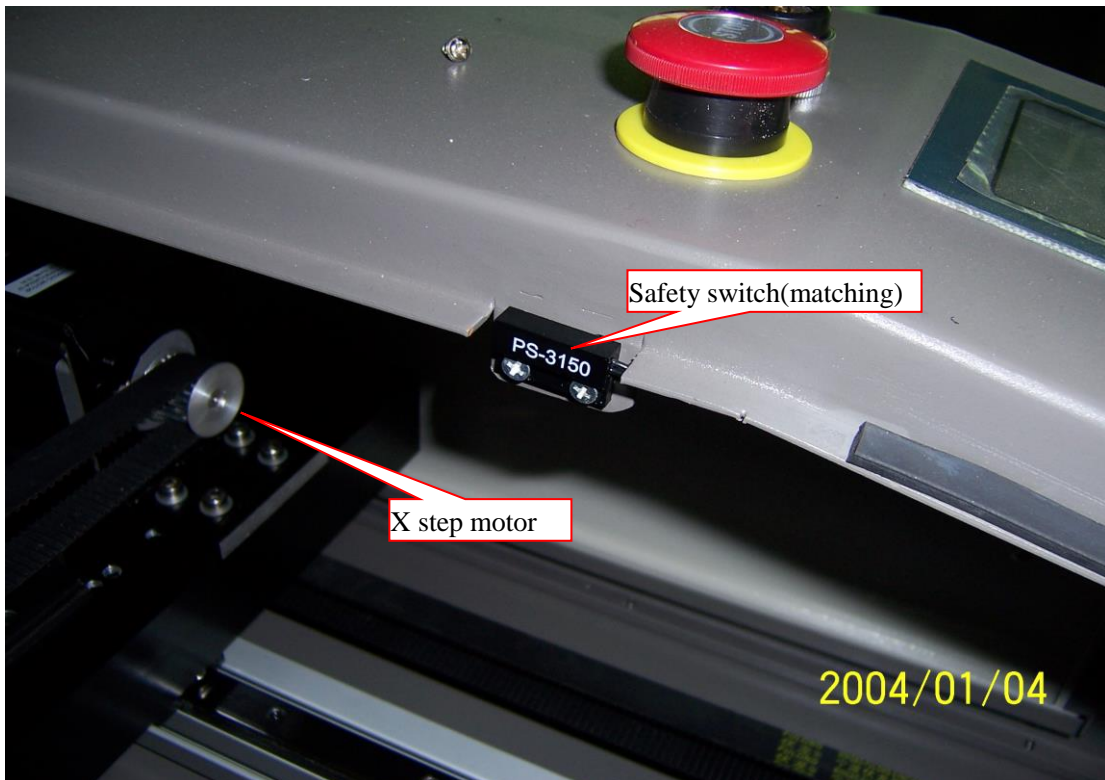
#### 3.1 Sketch map of the main machine



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Attention: The Laser machine can send out the light only when the upper cover is closed.

### 3.1.2 Operation panel and instruction



Reset: Laser head will move to the original point of the machine slowly.

Laser: Laser on/off.




Stop: Cease the processing operation.

Test: The laser head will run along the outline border of the processing data.

Start/Pause: Start/pause the processing operation.

Esc: Escape the current status window.

Menu: Enter accessory interface.

: Click this button, then  and  can move the Z axis. This function needs hardware (machine) support.

: Enter.

## 4. Installation

### 4.1 Installation of the main machine

#### 4.1.1 Working environment

**Attention: Only specialized or trained person is permitted to install and debug the equipment !**

1) the equipment working must located in the dry surrounding. If the environment is wet, it will cause abnormal conditions of the equipment .such as Component short circuit , high-voltage part discharge abnormally and so on. Besides the moisture environment will cause some metal parts rusted.

2) The facility must located in the less-dust room. . Too much dust will pollute the optic parts and reduce the equipment life, and speed up the abrasion of the mechanical parts

3) Working condition

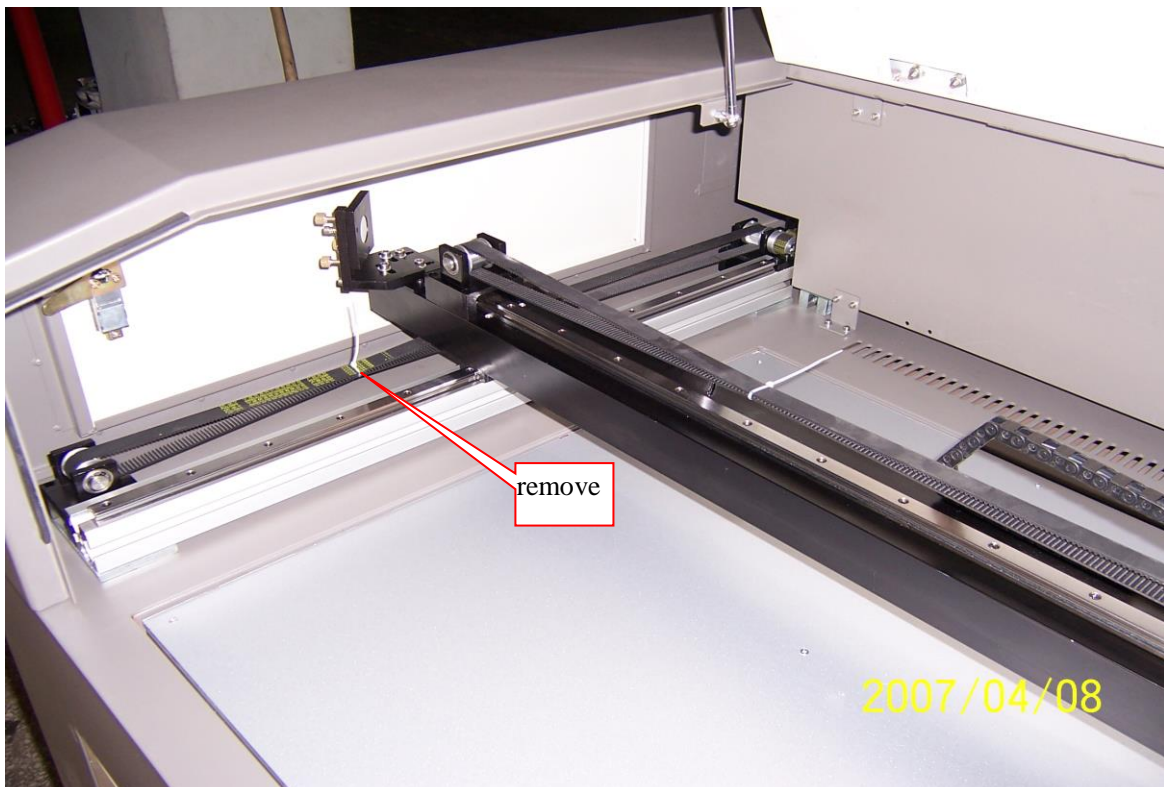
sounding temperature 10—30° C relative humidity <70%

power supply one phase 100-240V 50-60Hz

the fixing should be earthed well and the earthing resistance should less than 4Ω .

#### 4.1.2 Disassembly of the package

Open the case to get out the fittings and check them according to the fittings list. Remove the fastness strap.



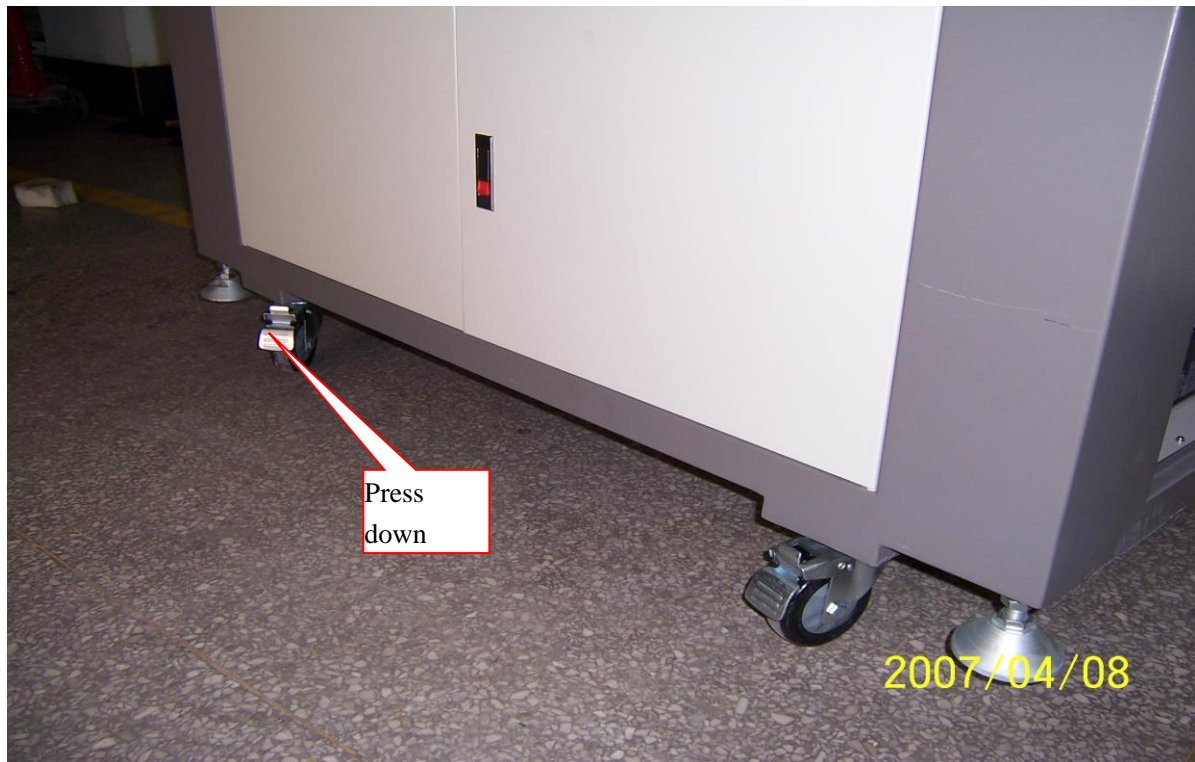
Put down the case from the machine, and check whether there is any damage when it is transported.

**Attention: if you find any damage on the package before open it, or any damage on the machine while installation process, please inform our company or authorized agency.**

#### 4.1.3 Location of the machine

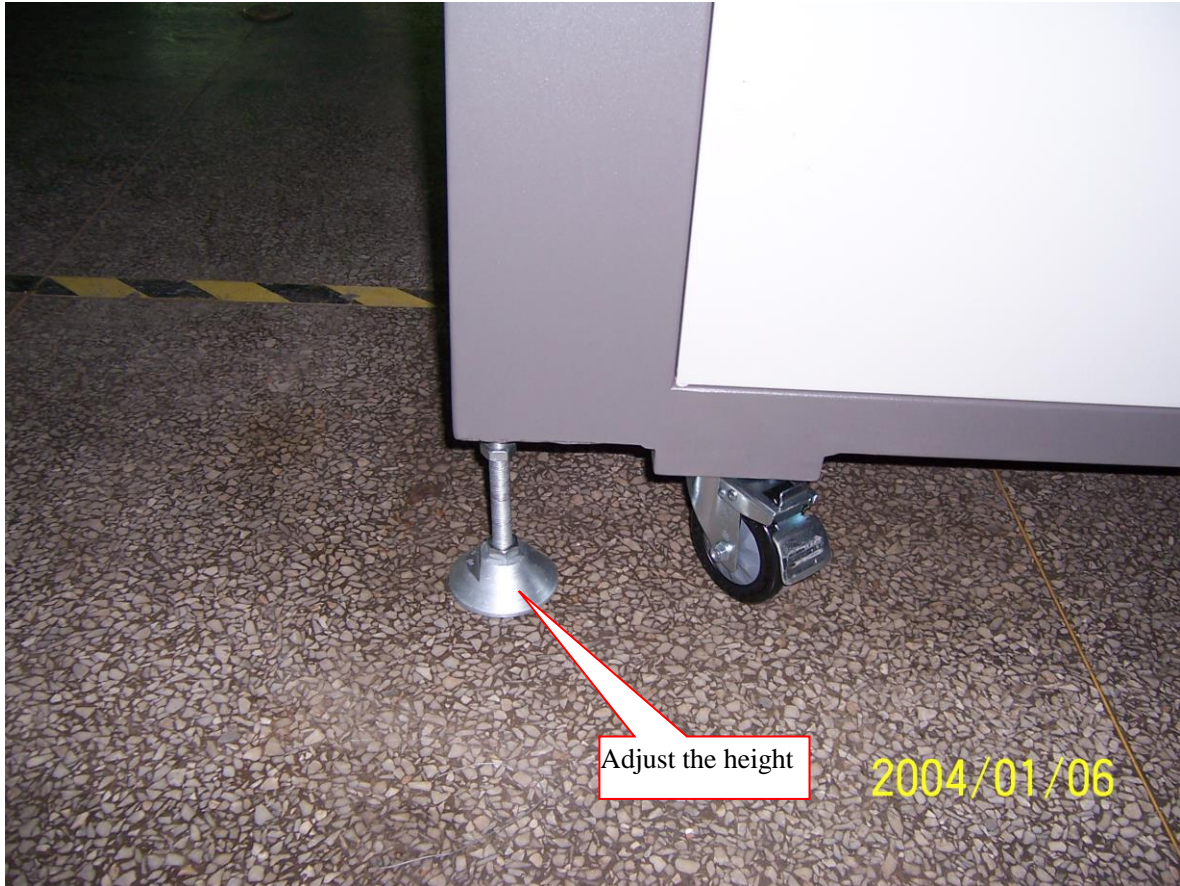
The machine should be located near the windows

Fix four trundles of the machine



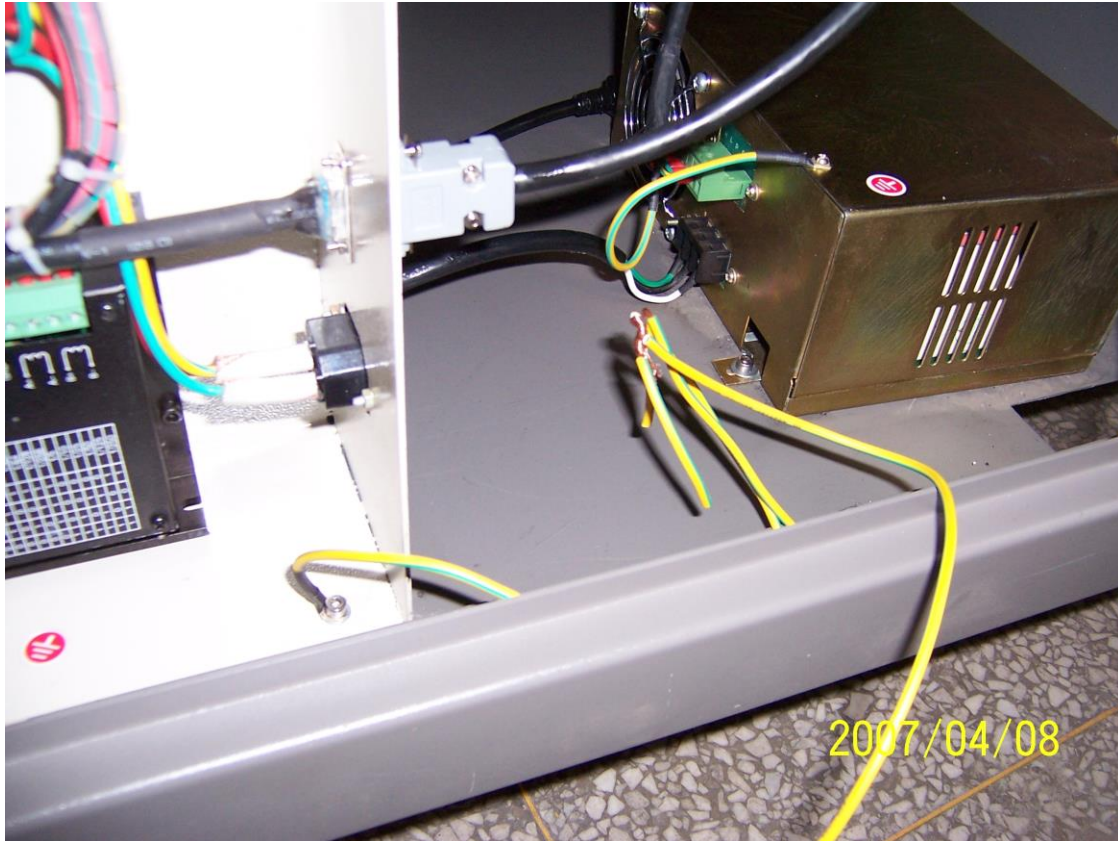
Adjust the height of the machine with a wrench, and tighten the nut.





#### 4.1.4 Grounding

Find out a single stranded copper wire with more than 2mm diameter.



Fix one side of it to the laser power of the laser, and the other side placed into underground.



4.1.5 Connection the power supply.

Insert power line into the INPUT of the back of the machine



#### 4.1.6 Installation of the accessory

##### 1) Installation of the water pump.

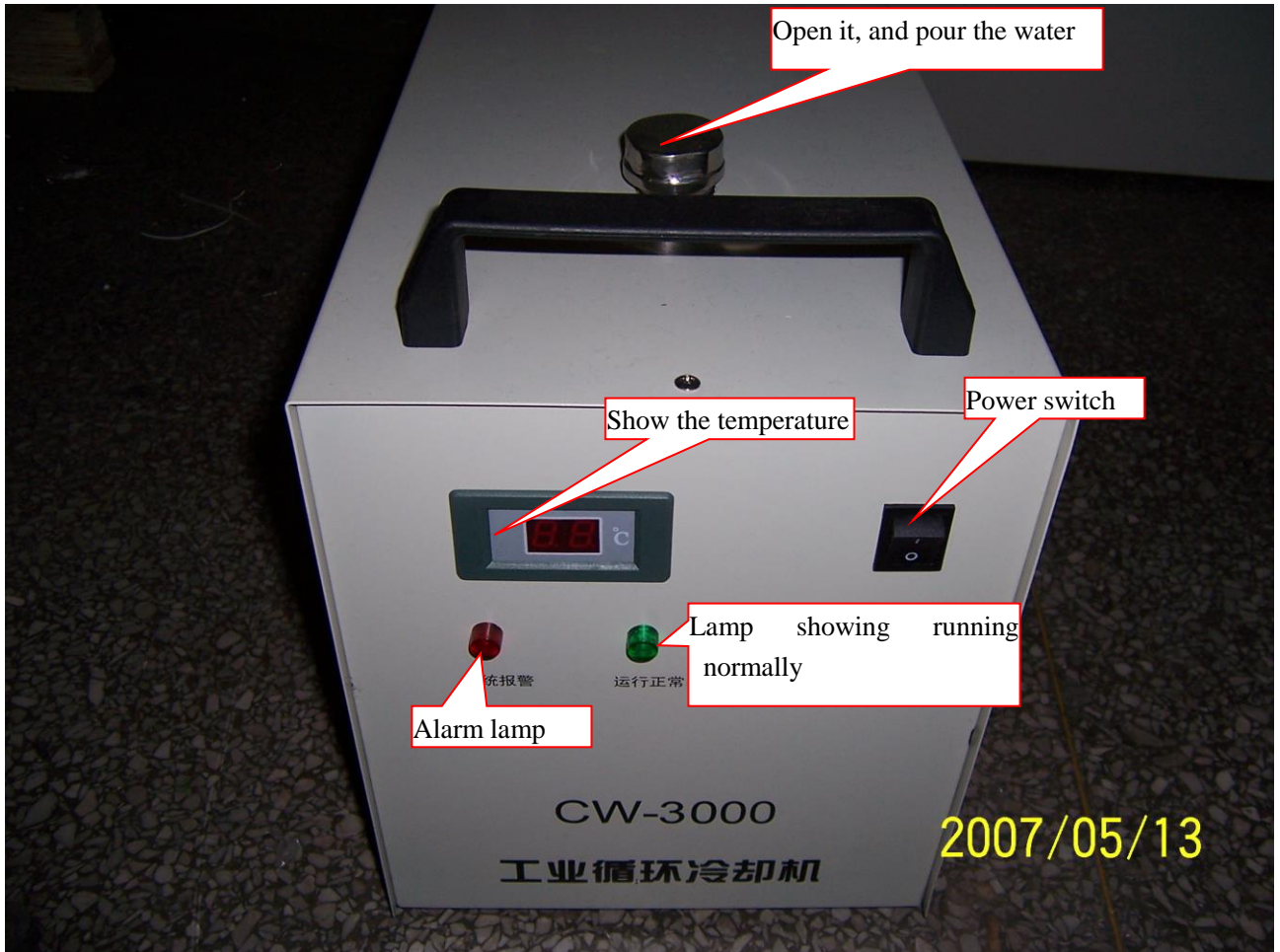
Put the water pump into the bucket, then insert the power wire into the main engine. Connect the water outlet with the water inlet of the machine and insert the water outlet of the machine into the rubber tube, at last put the rubber tube into the bucket.





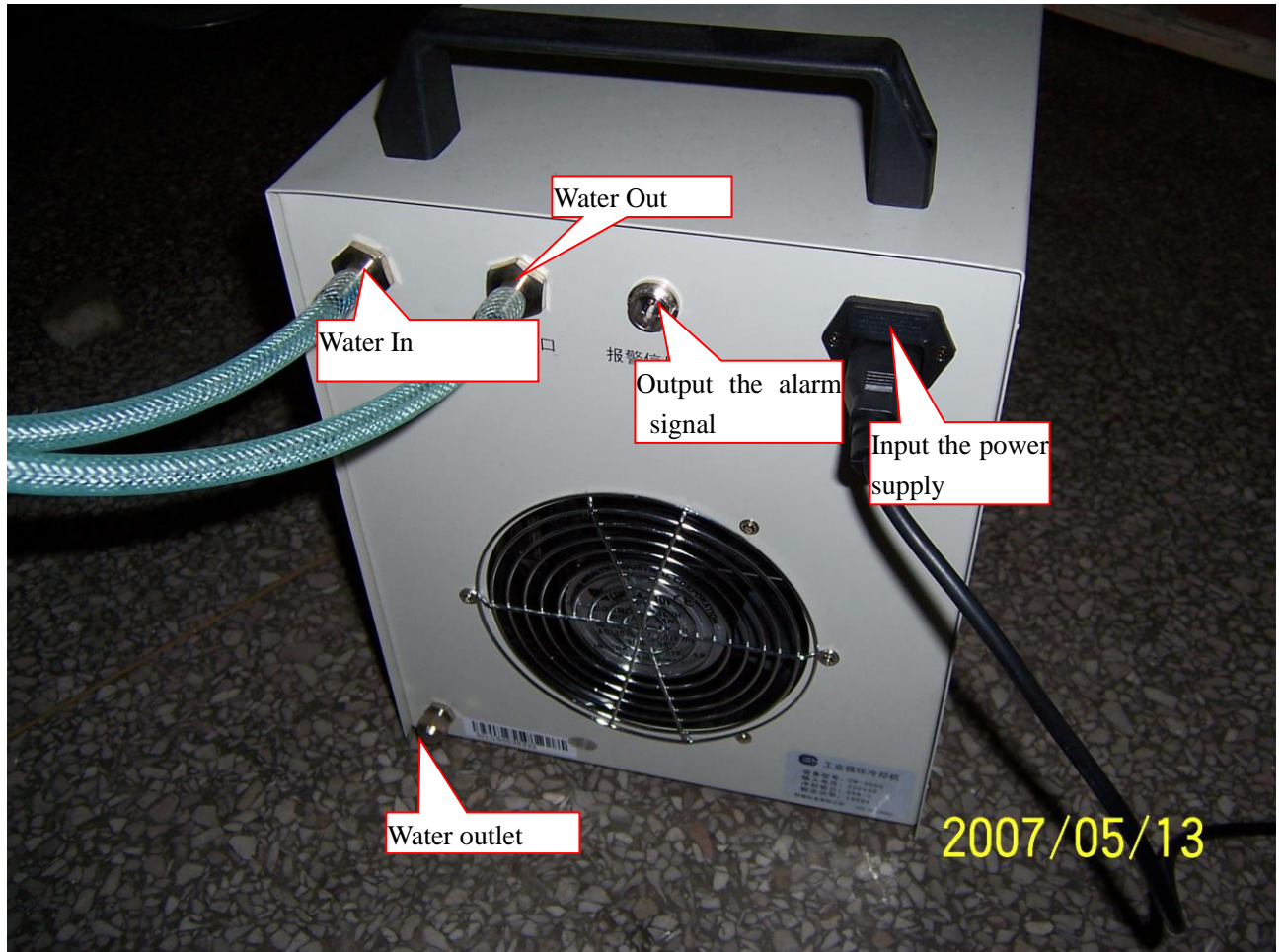
Installation of the chiller(optional feature)

Take down the cover of water inlet on the top of the chiller.



Pour purity water into the water tank until it is full.

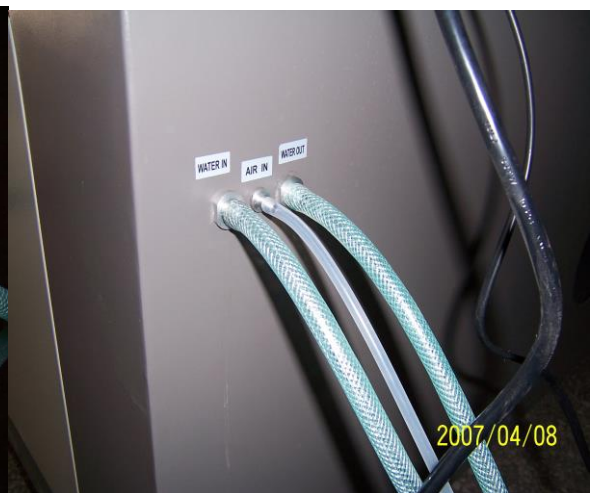
Connect the water outlet of the chiller with the water inlet of the machine, and the water inlet of it with the water outlet of the machine.



Plug in.

## 2) Installation of the air pump

Insert the power line of the air pump into the machine, then connect the rubber tube of gas outlet with the gas inlet of the machine





### 3) Installation of the smoke exhaust fan

Connect the air inlet of the fan with exhaust port by the blue tube, then plug in the power line of the fan.



### 4.1.7 Installation of the laser tube

Take off the screw from the two mounts which are used for fitting the laser tube.



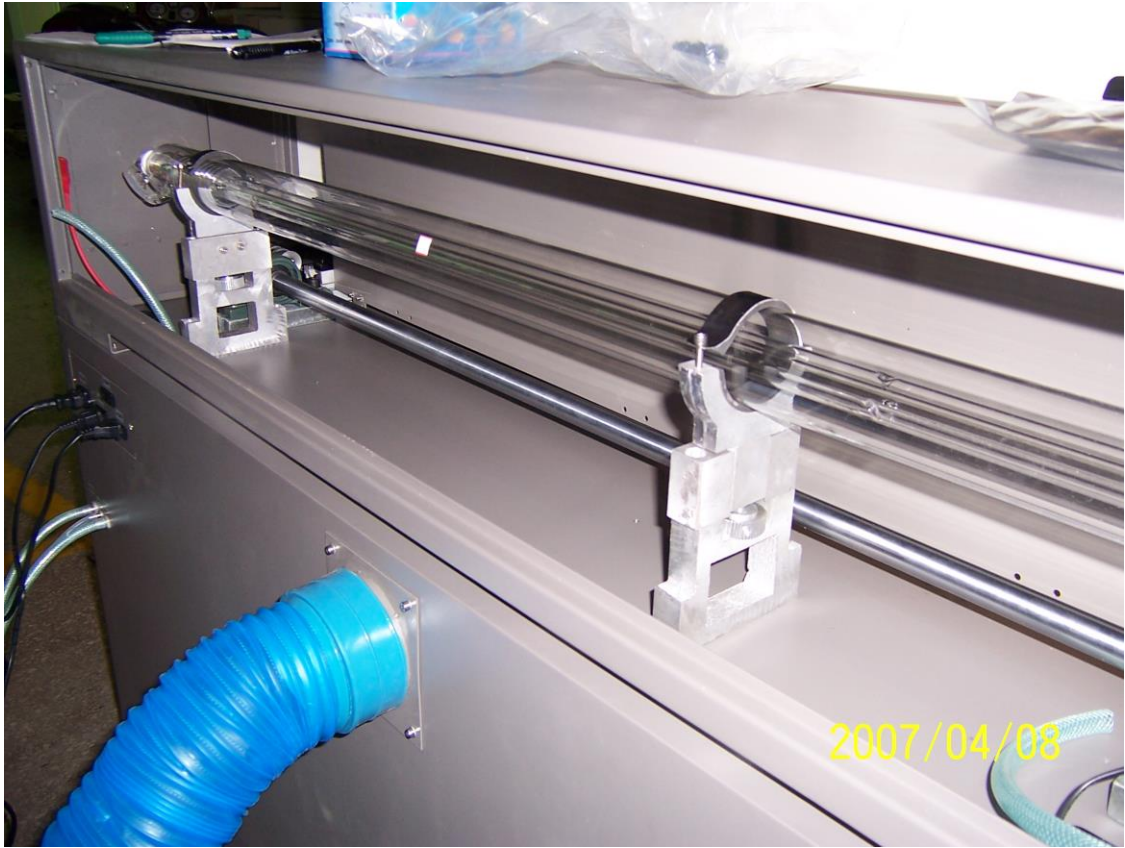
Put the laser tube on two bases.



Attention: Light outlet is on the right.



Fix the laser tube.

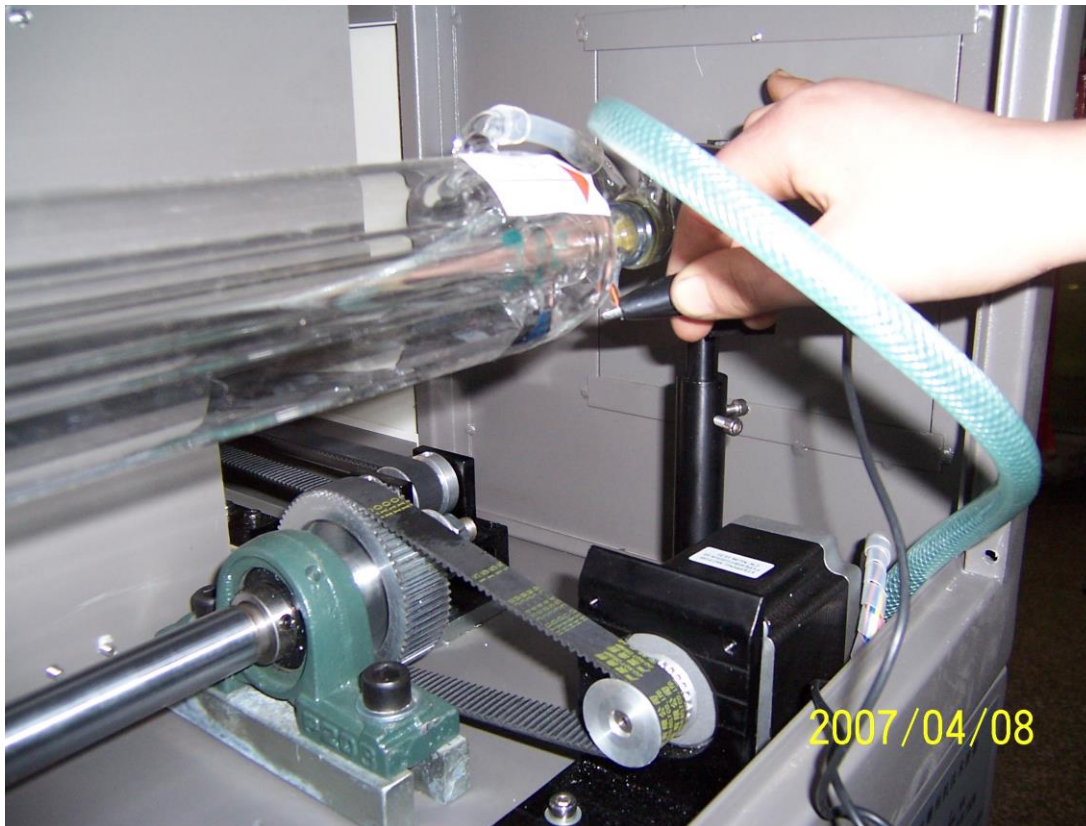


Plug in water inlet and outlet.





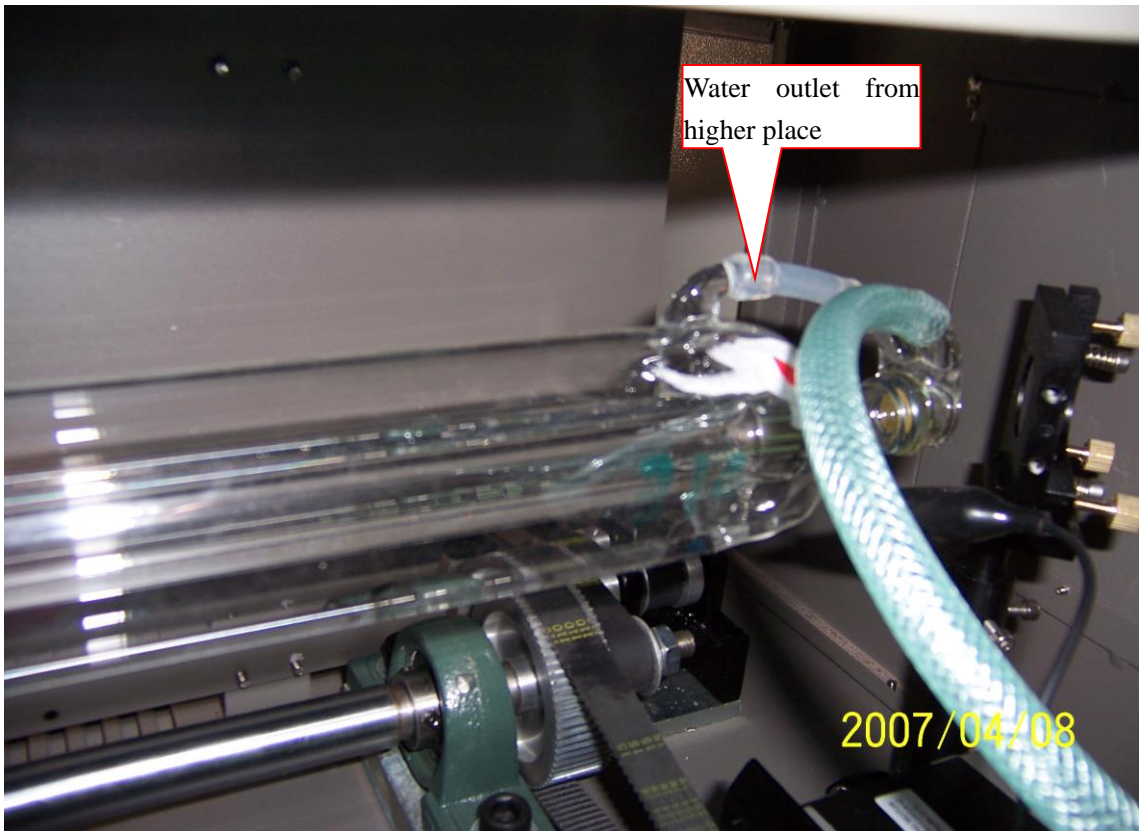
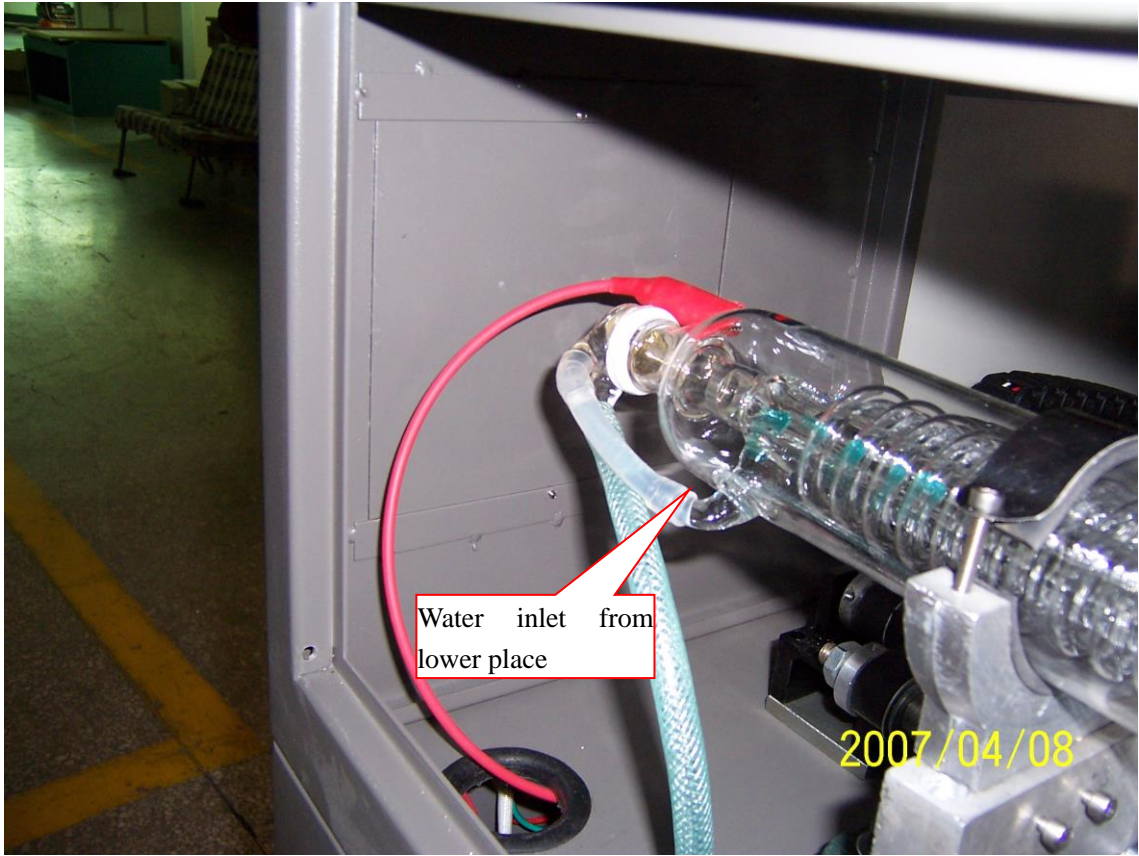
Connect with the anode and cathode of the laser power respectively.





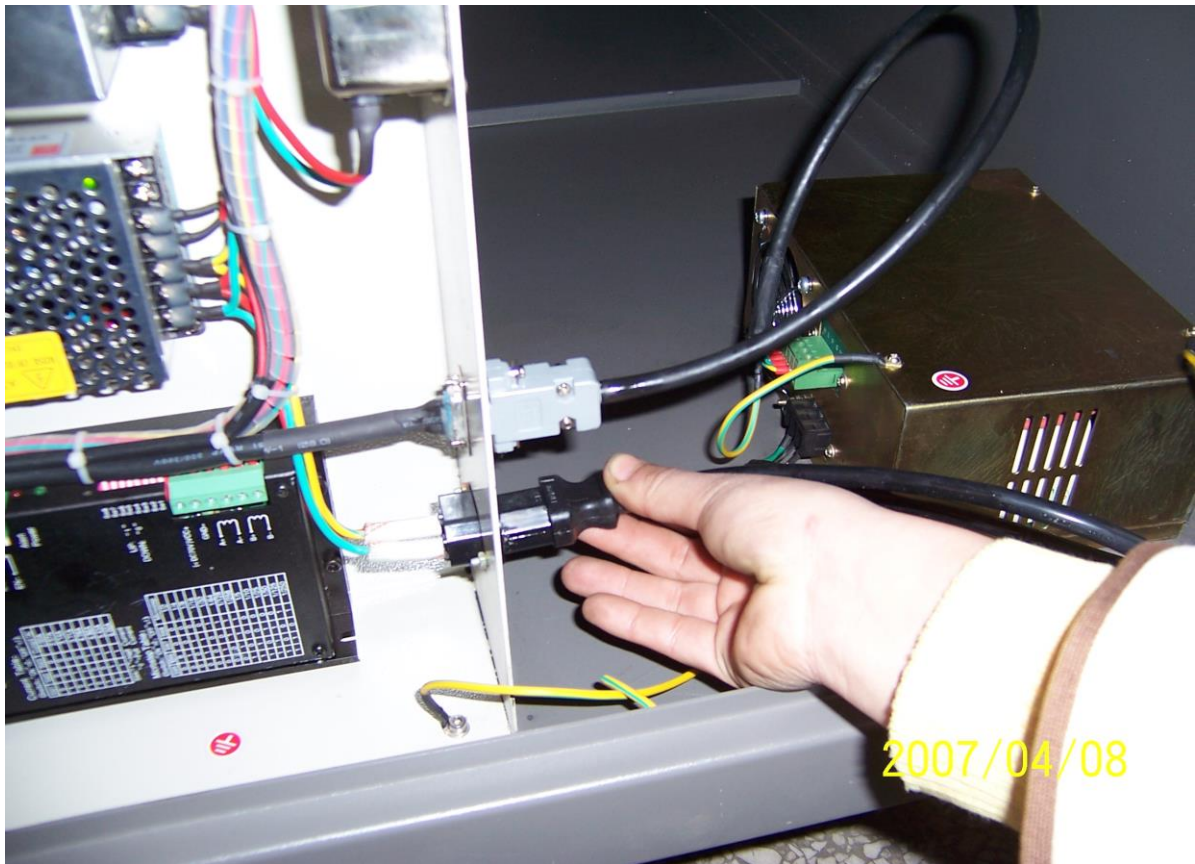
Open the power supply of the machine, then the water pump starts to work. Find out whether there is any bubble of the laser tube after one minute. Revolve the location of the laser tube to squeeze out the bubbles.

Attention: Water inlet of the laser tube should be in the lower place, and water outlet be in the higher, so there won't be any bubble.



#### 4.1.8 Installation of the laser power supply

.Insert the power line of the laser power supply into control box.



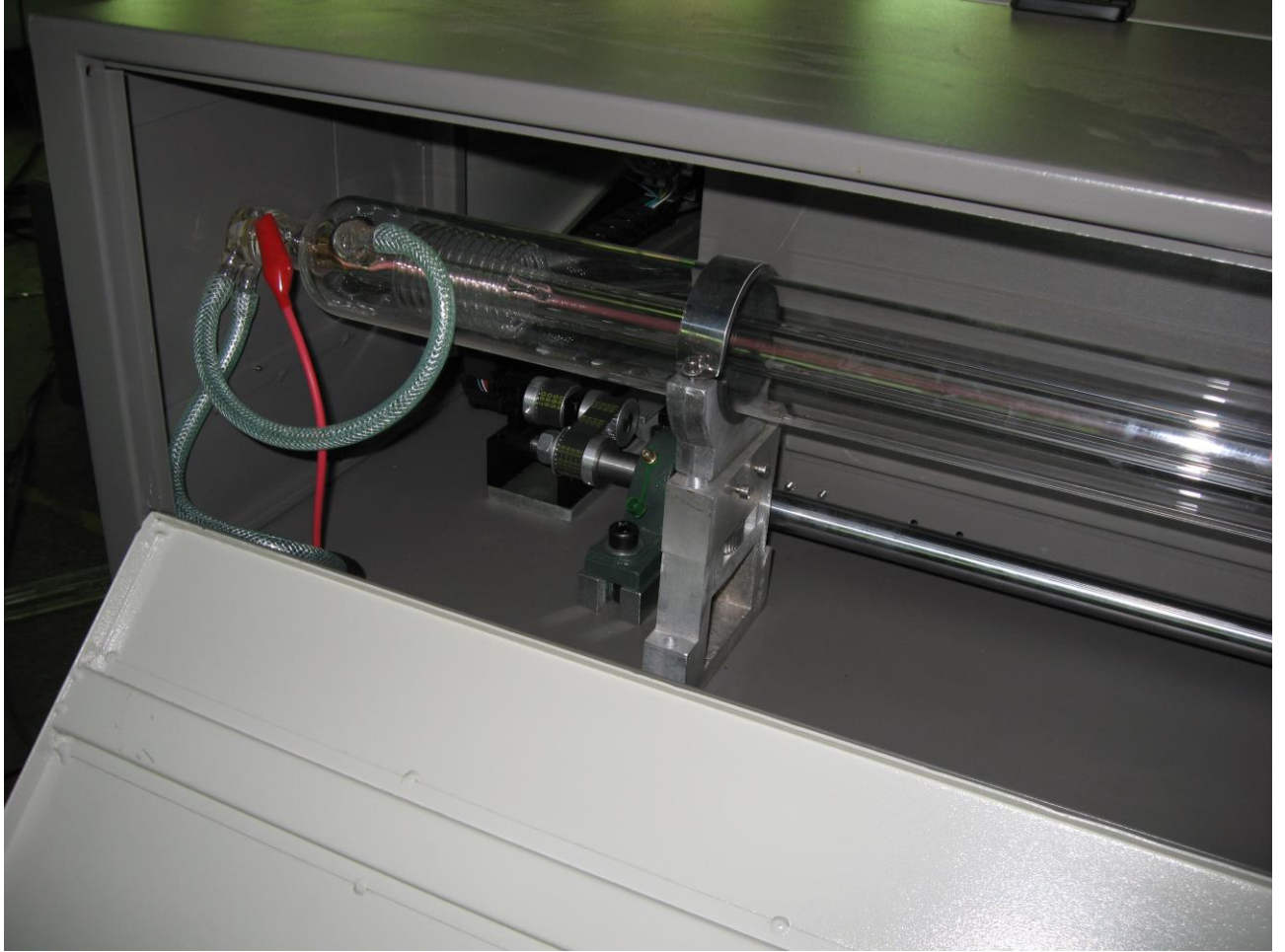
Attention: Do not connect up the power line of the laser power supply before connecting anode and cathode of the laser tube, otherwise it will burn out the power supply.

#### 4.1.9 Detection by boot-strap

Turn on the power supply, then the machine can reset to the top right corner automatically.

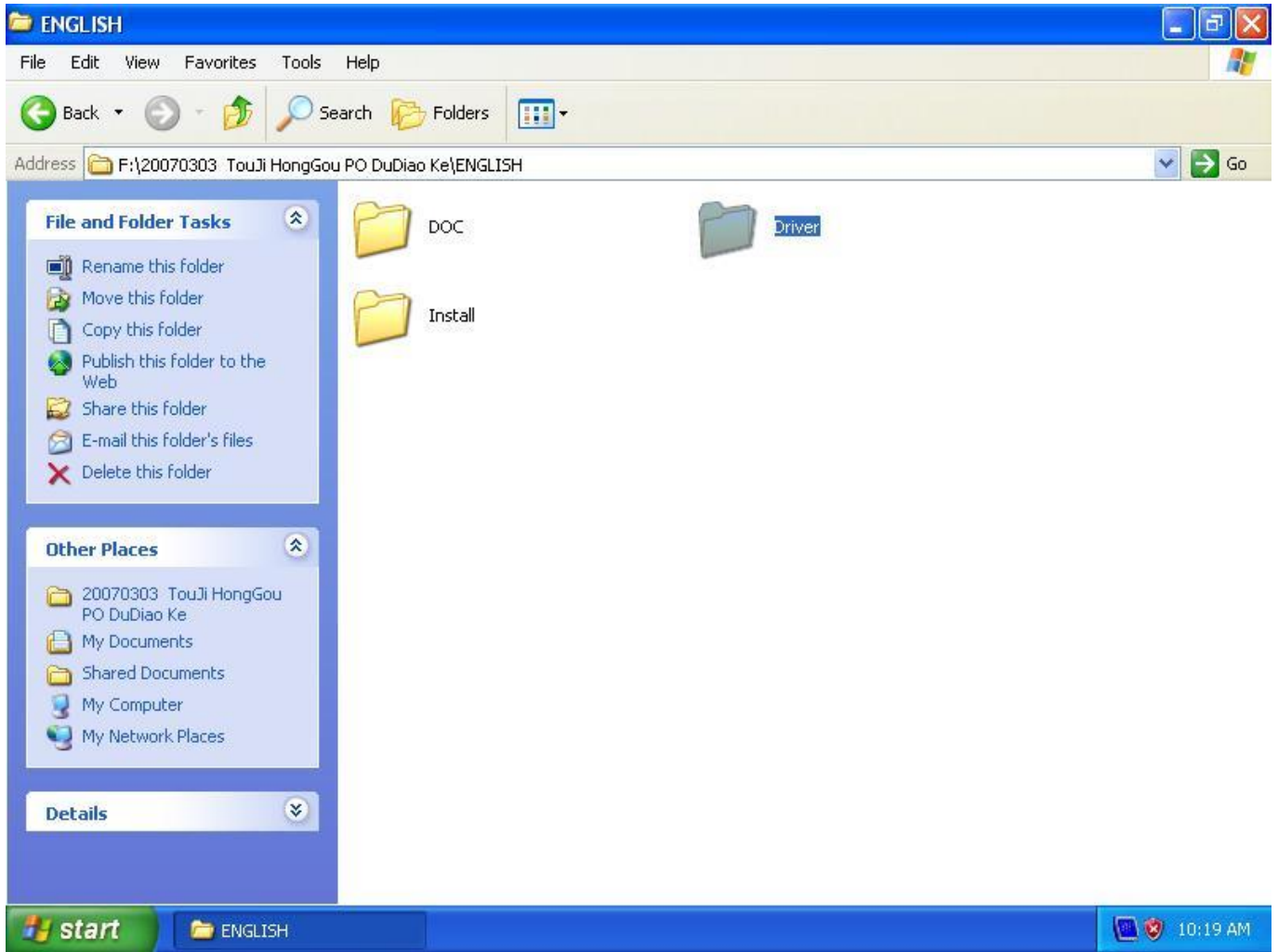
Press LASER, the laser tube will let out the laser.



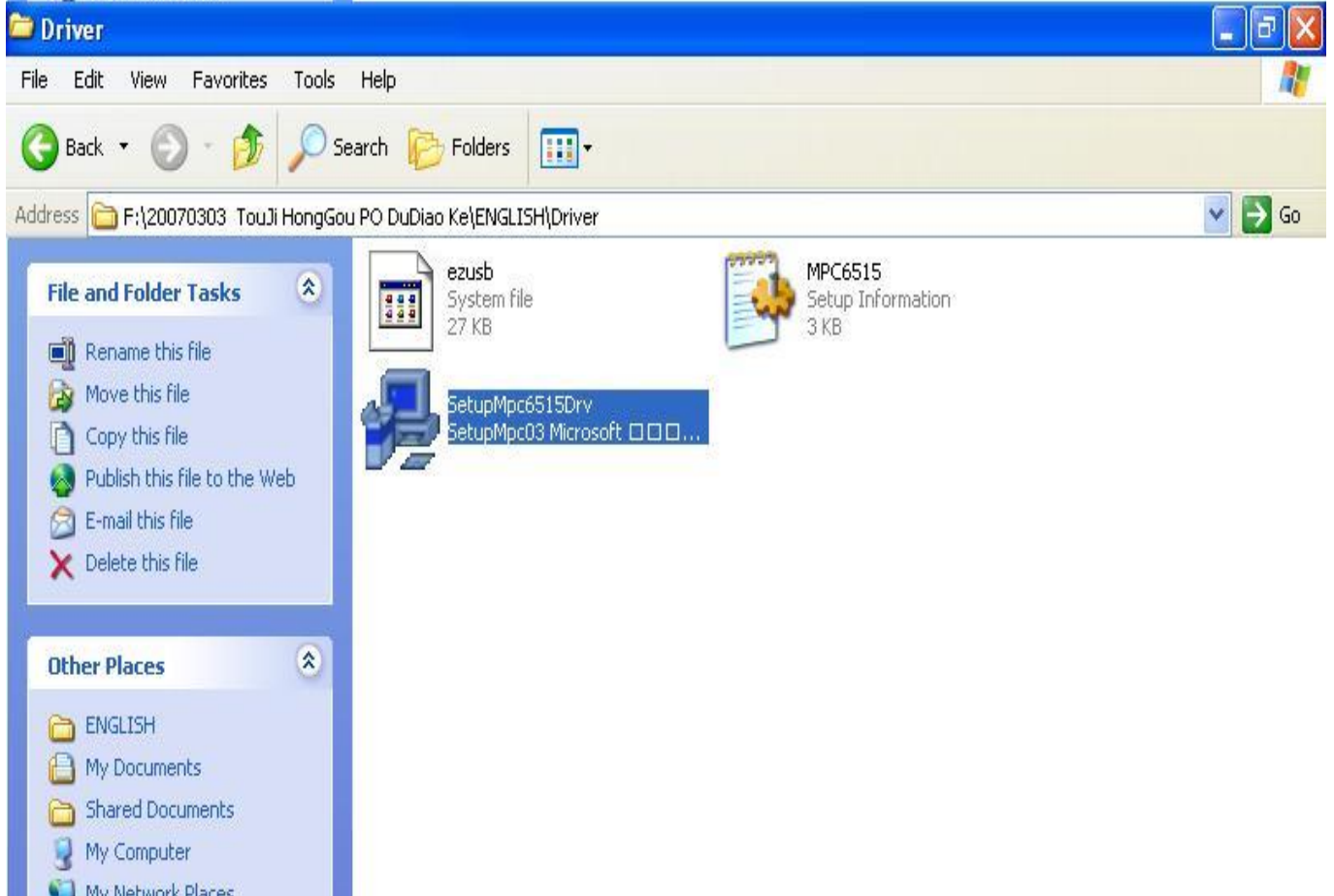
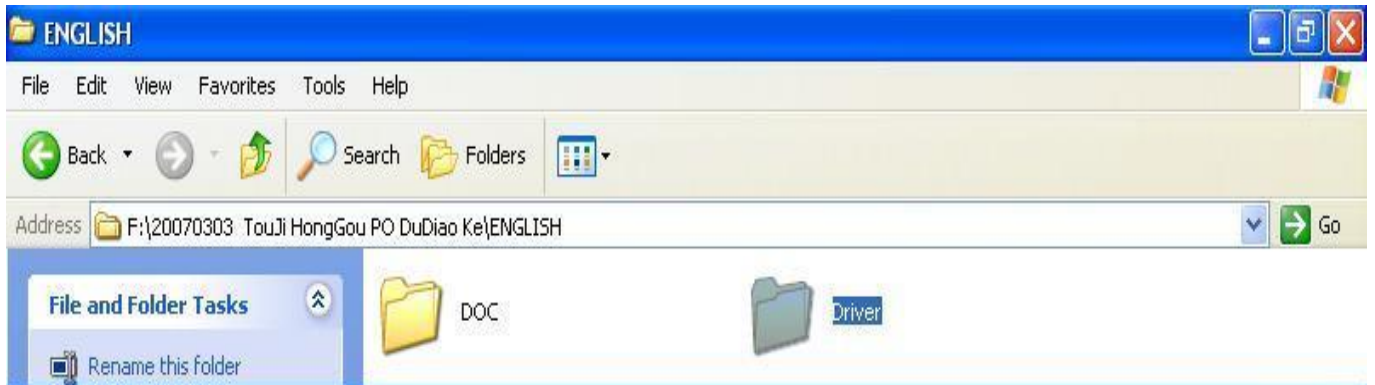


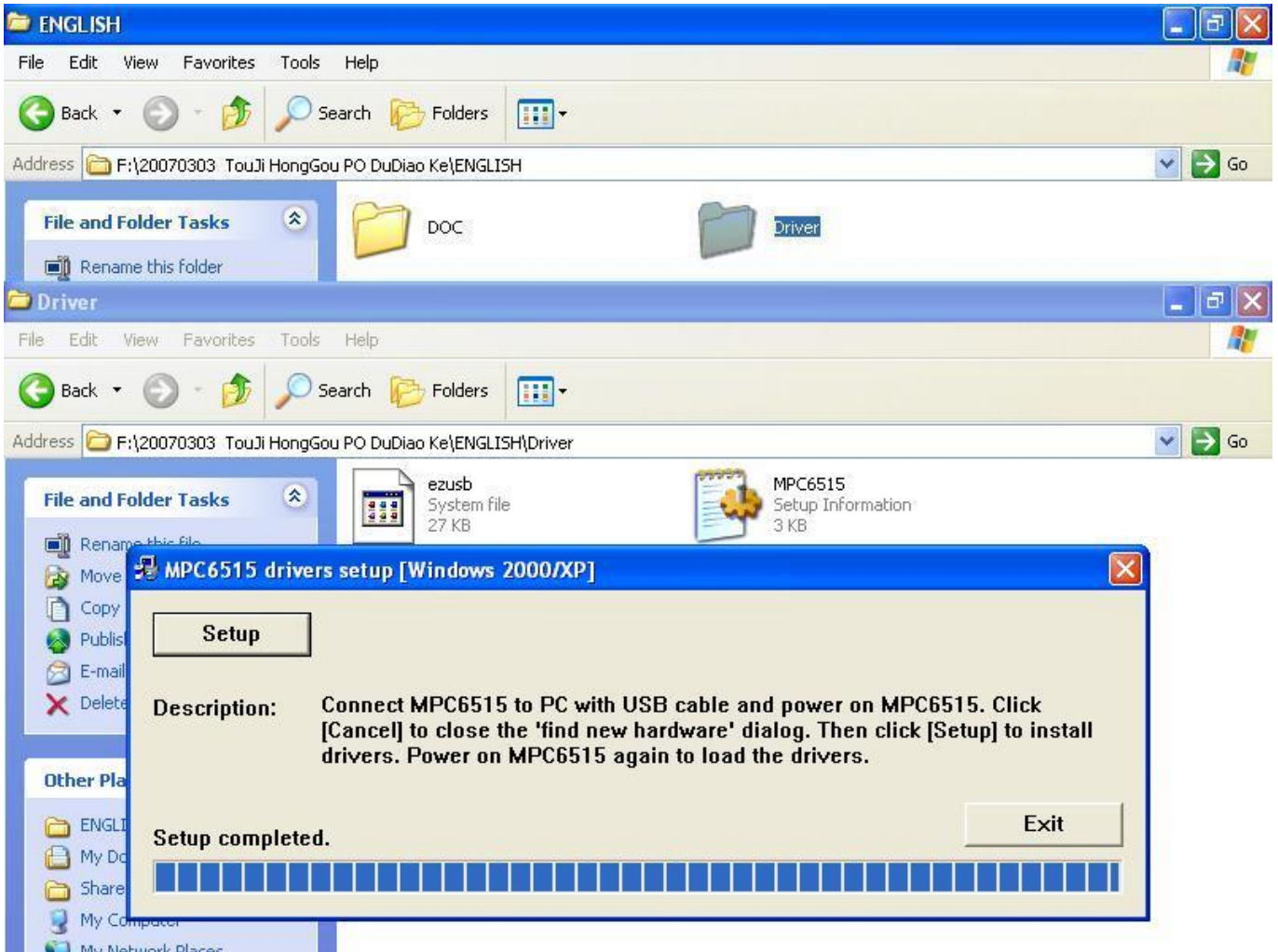
#### 4.2. Installation of the software

Install the MPC6515 driver first, then insert the USB data wire into the computer, and turn on the power supply of the main machine.

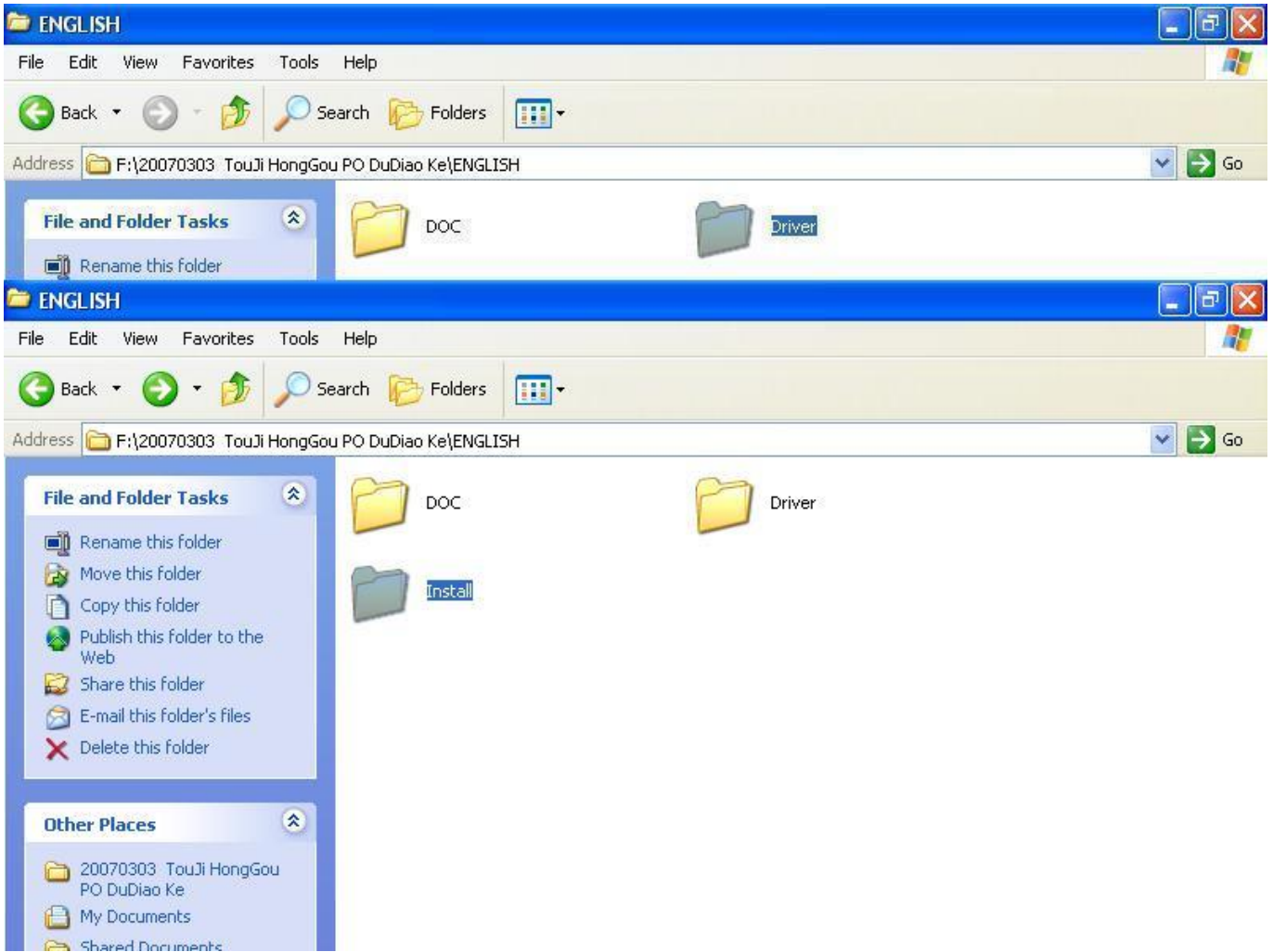




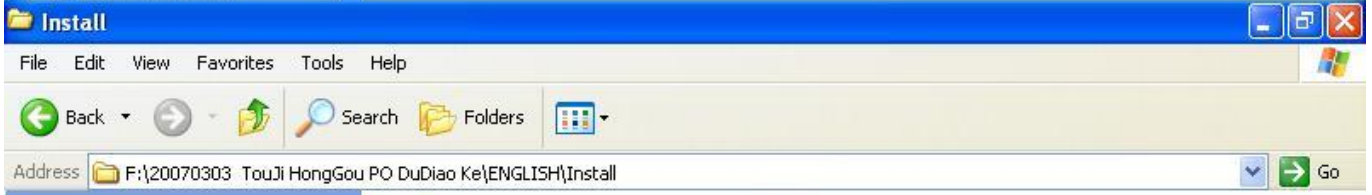
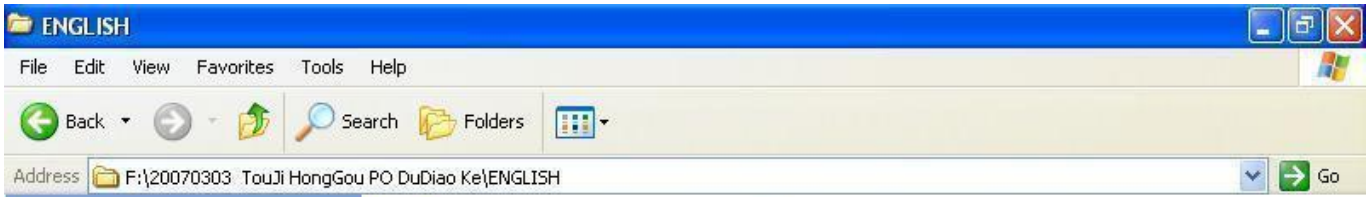


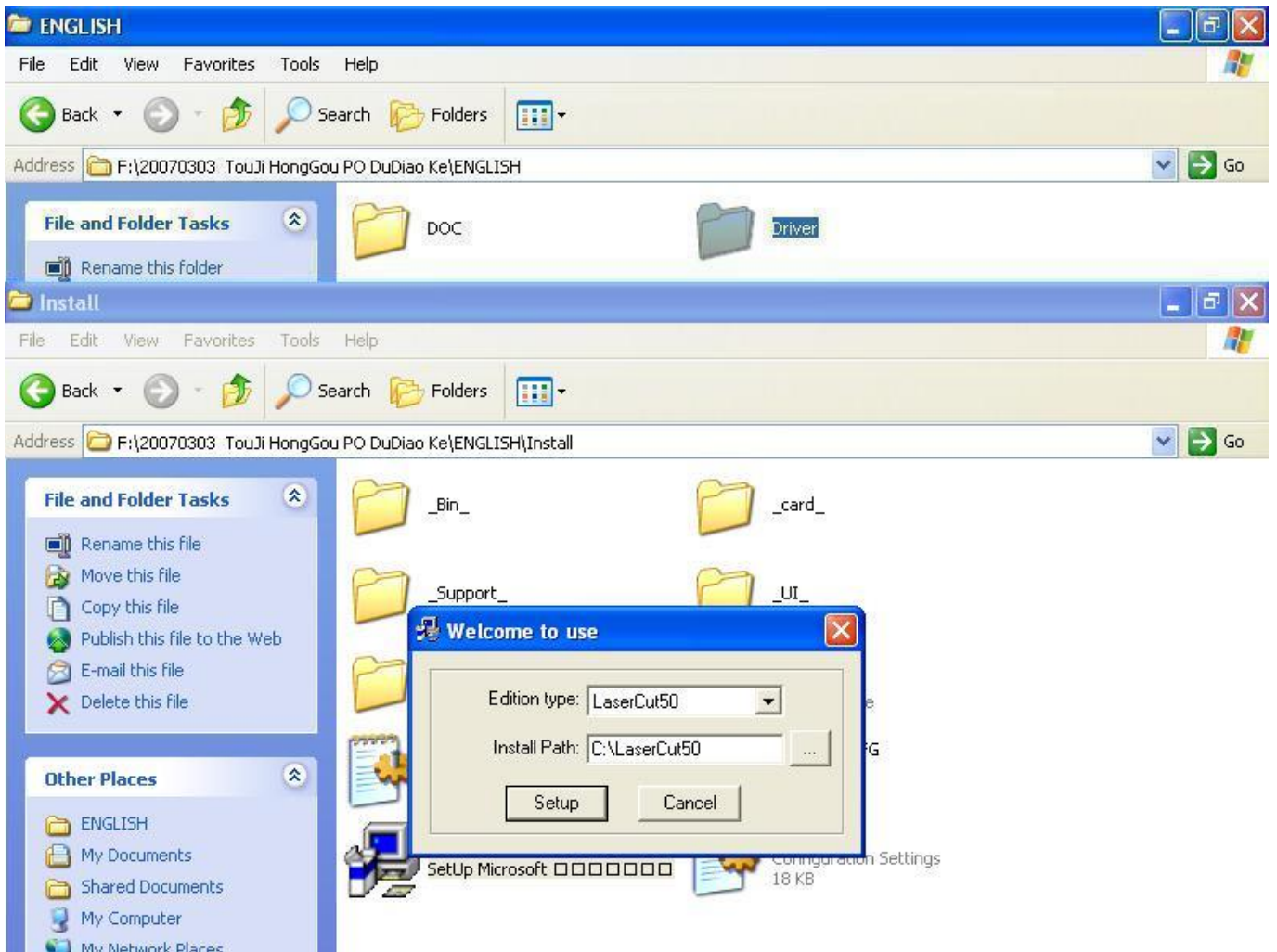


Install the software at last .Insert the soft dog into USB faucet, then click “INSTALL”

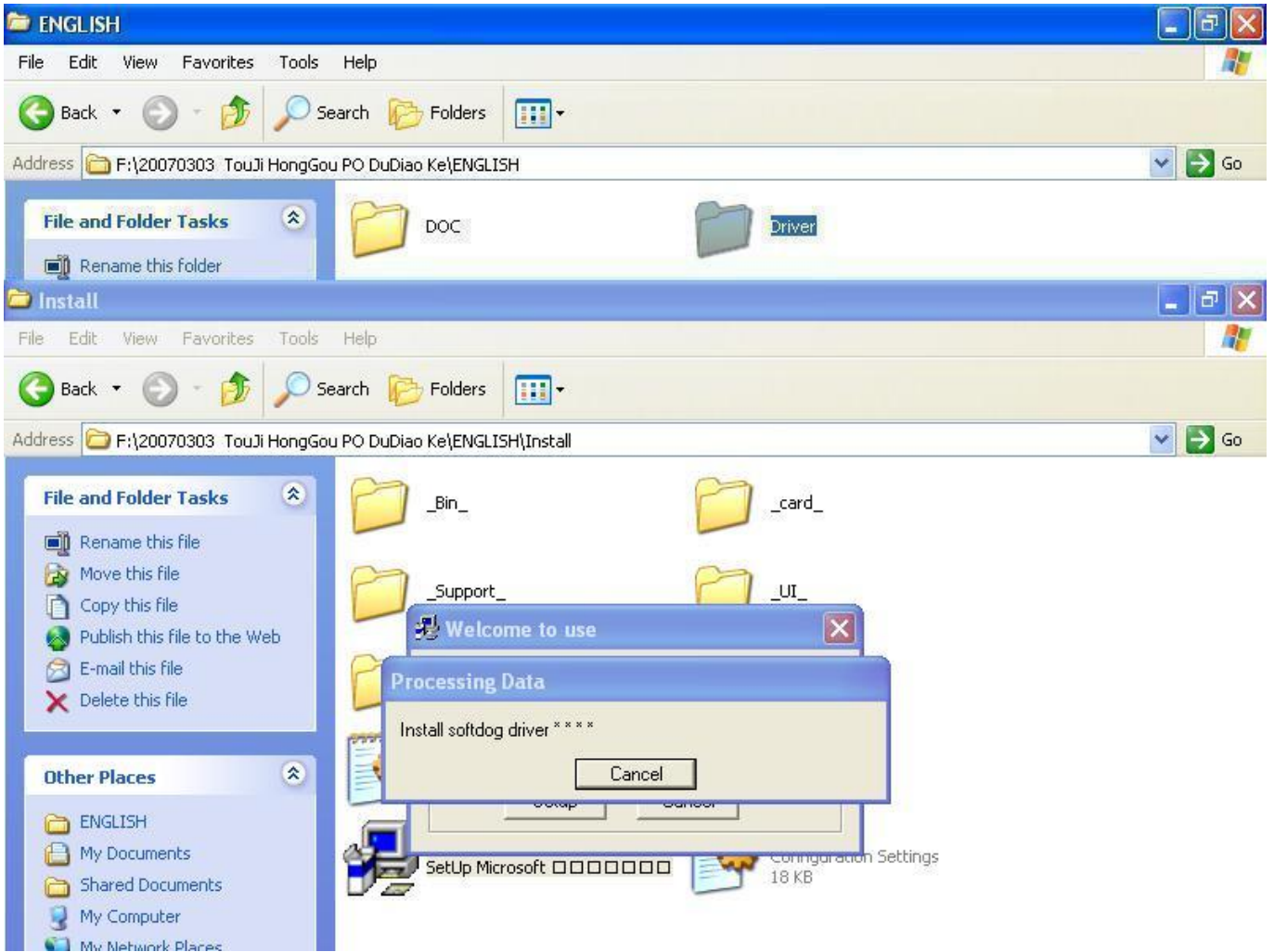


Click SETUP.

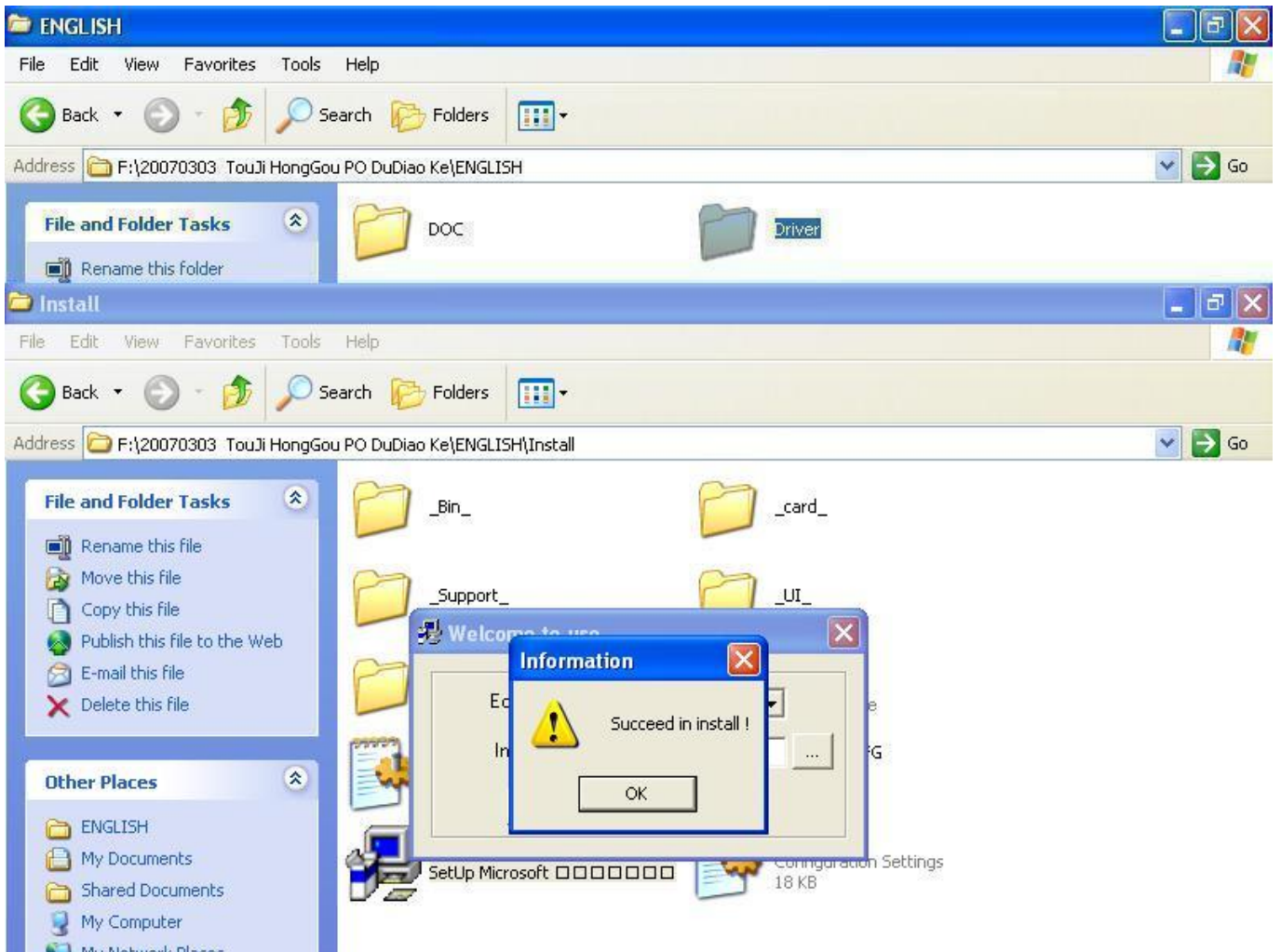




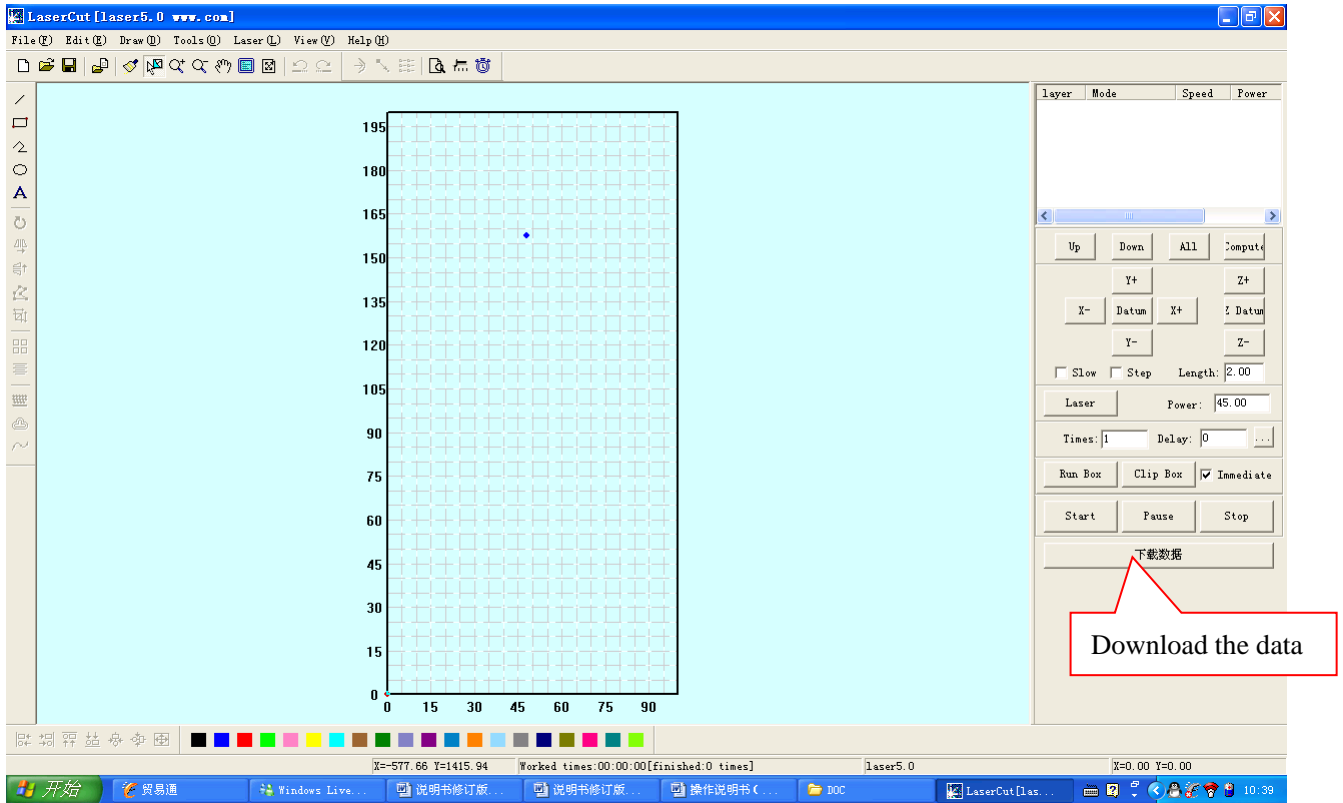
Click SETUP.



## Complete the installation



Dbclick the icon of the desktop to open the software.



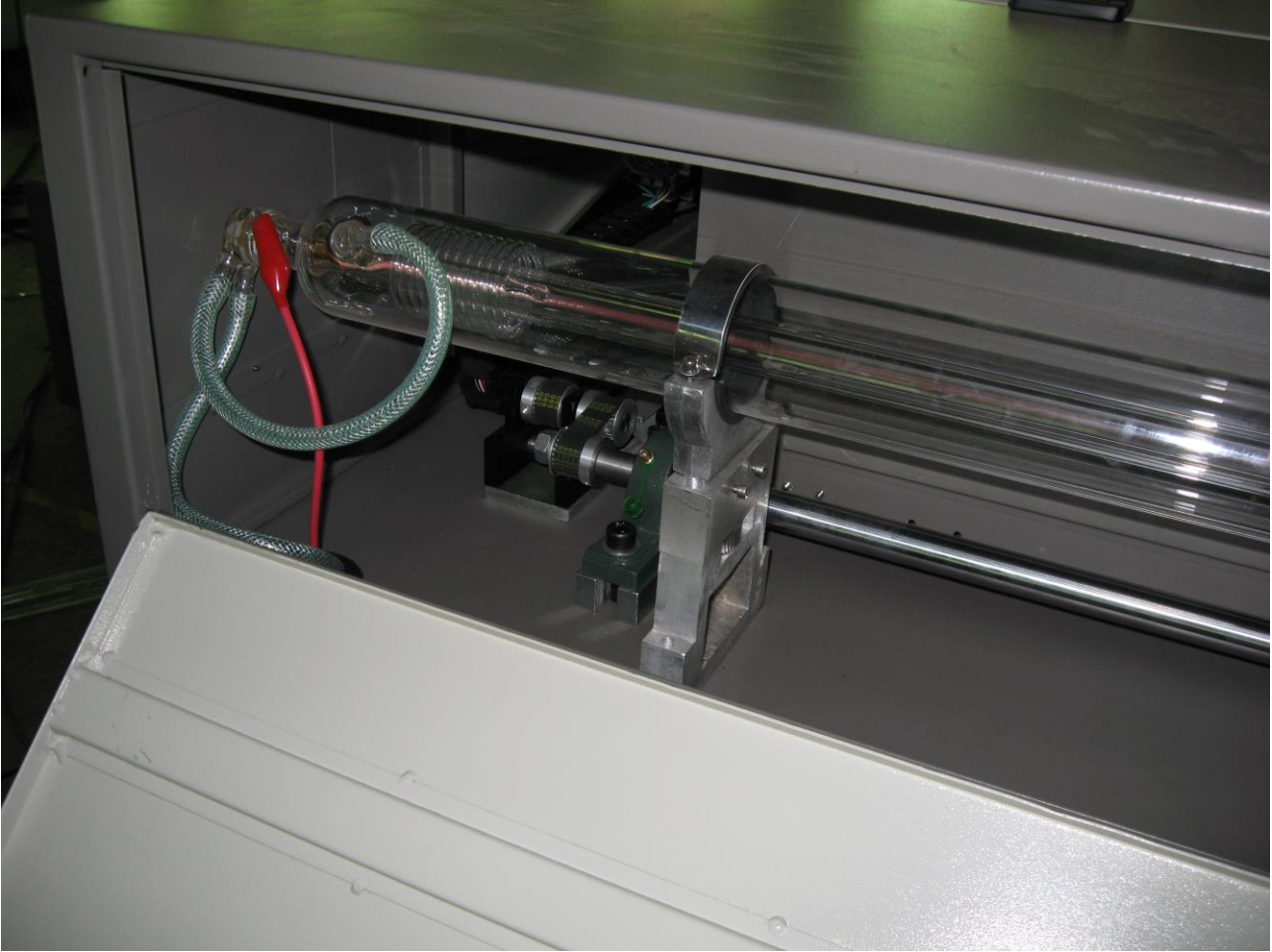
#### 4.3 Detection by boot-strap

.Open the software, then press every buttons on the surface of the machine to make sure they are running well

.Press the “LASER” button on the operation panel, it will give out the laser.





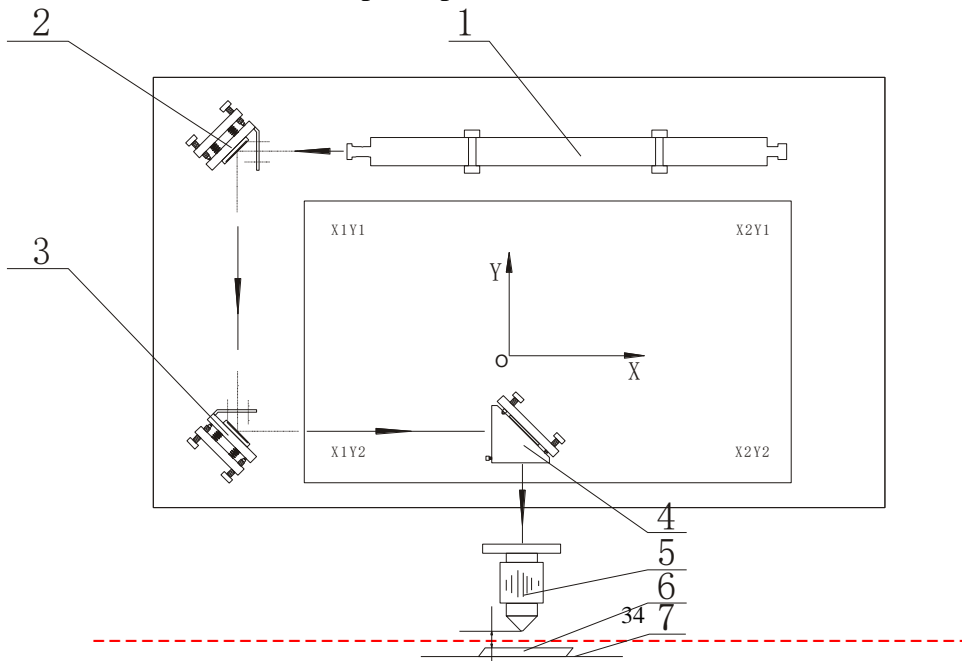


Attention: If there is a safety switch, it can give out laser only when you close the upper cover.

**Attention: make sure the cooling water cycle running well before the machine start to work, or it will damage the laser tube.**

#### 4.4 Adjustment of the optical path

##### 4.4.1 The structure chart of optical pat



1. Laser tube
2. The first reflecting lens
3. The second reflecting lens
4. The third reflecting lens
5. Focusing lens
6. Object being processed
7. Working platform

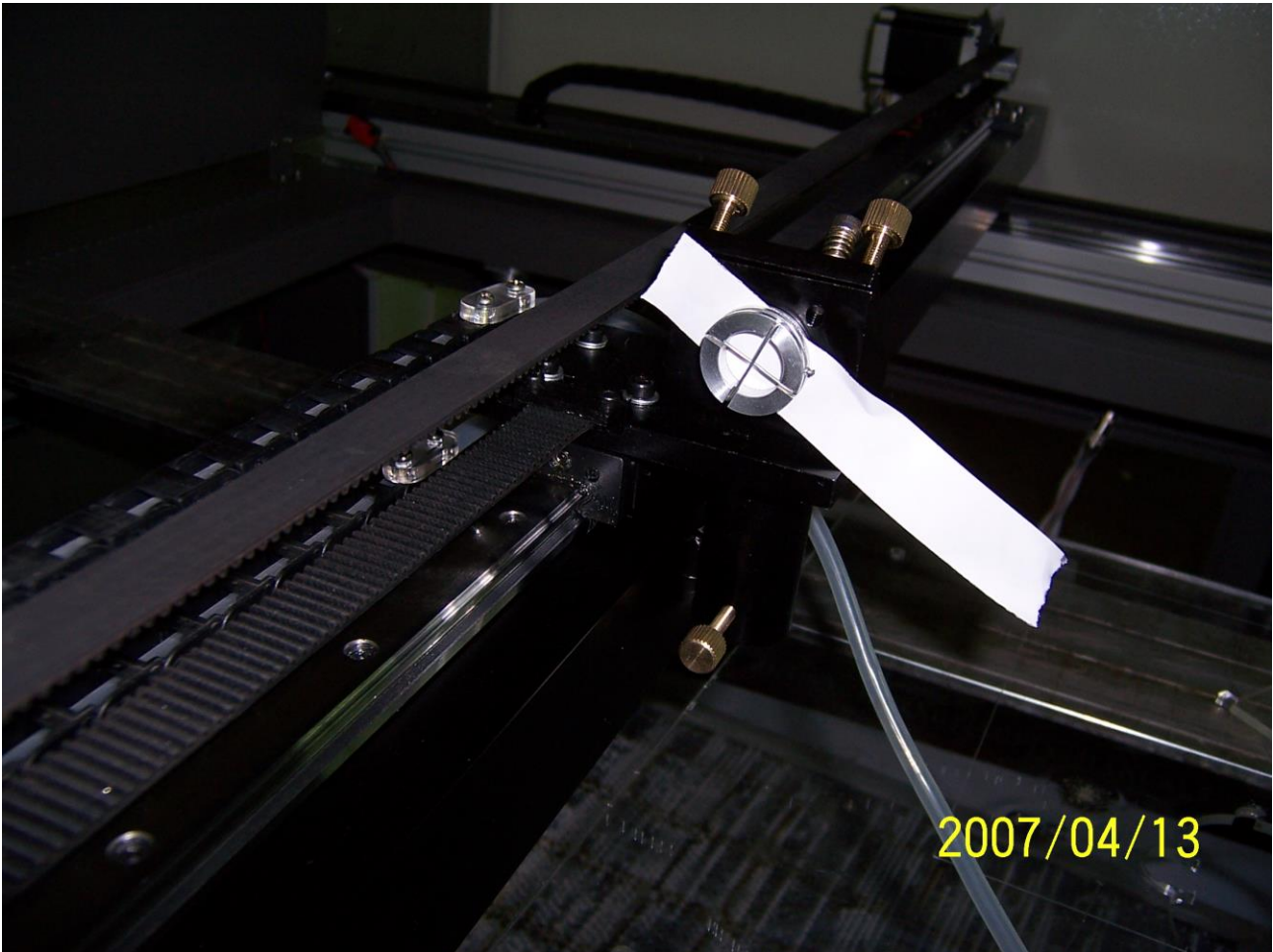
Ray path is ray guide system. Laser engraving machine has adopted aviation-optical system. The complete system is made up of laser tube, three reflecting mirrors, focusing lens and relevant adjusting devices. These are the main parts of the machine.

Ray path has close relationship with the effect of engraving and cutting. Therefore please be patient and careful when adjusting the ray path.

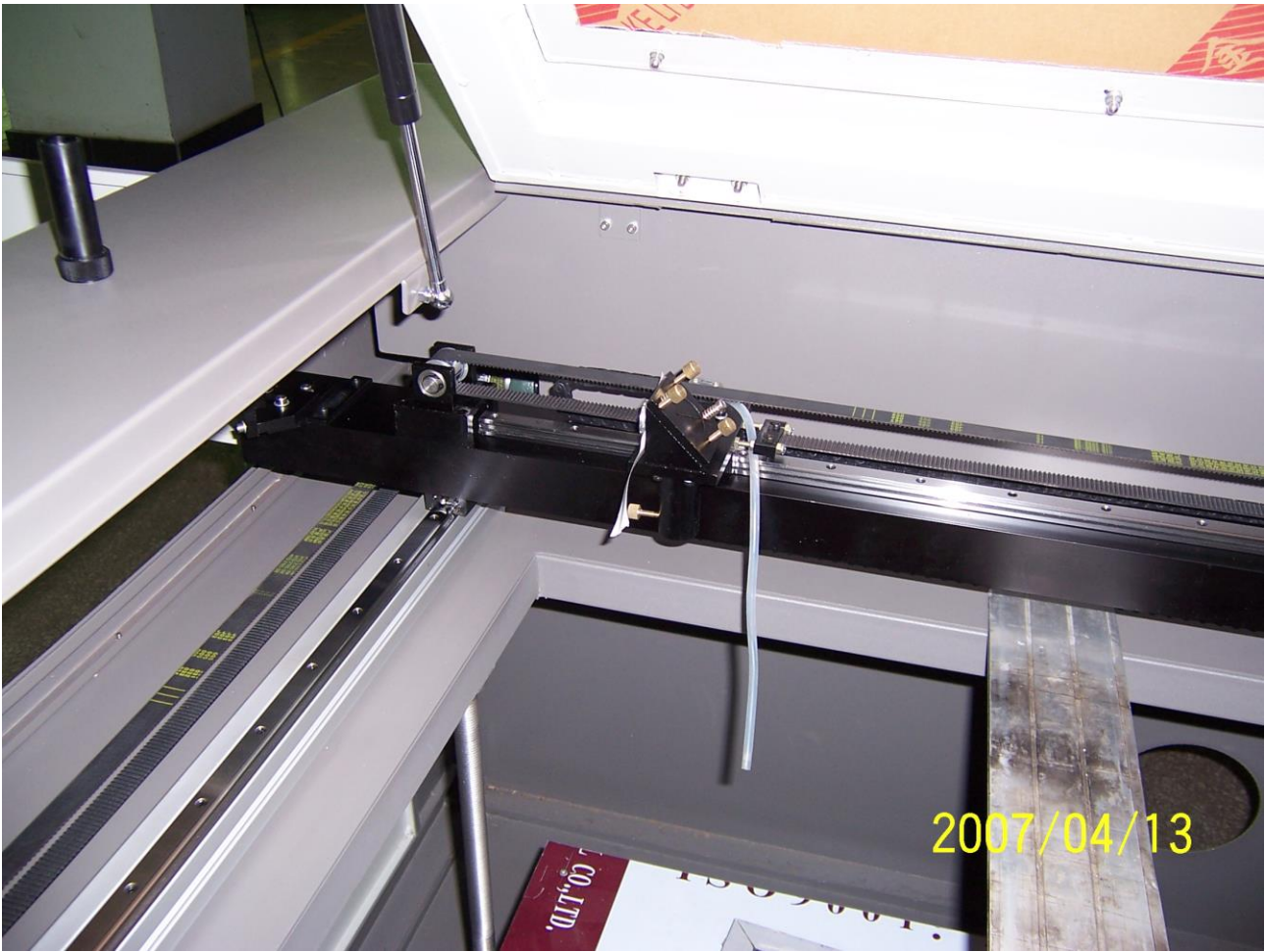
**Attention: make sure the cooling water cycle running well before the machine start to work, or it will damage the laser tube,**

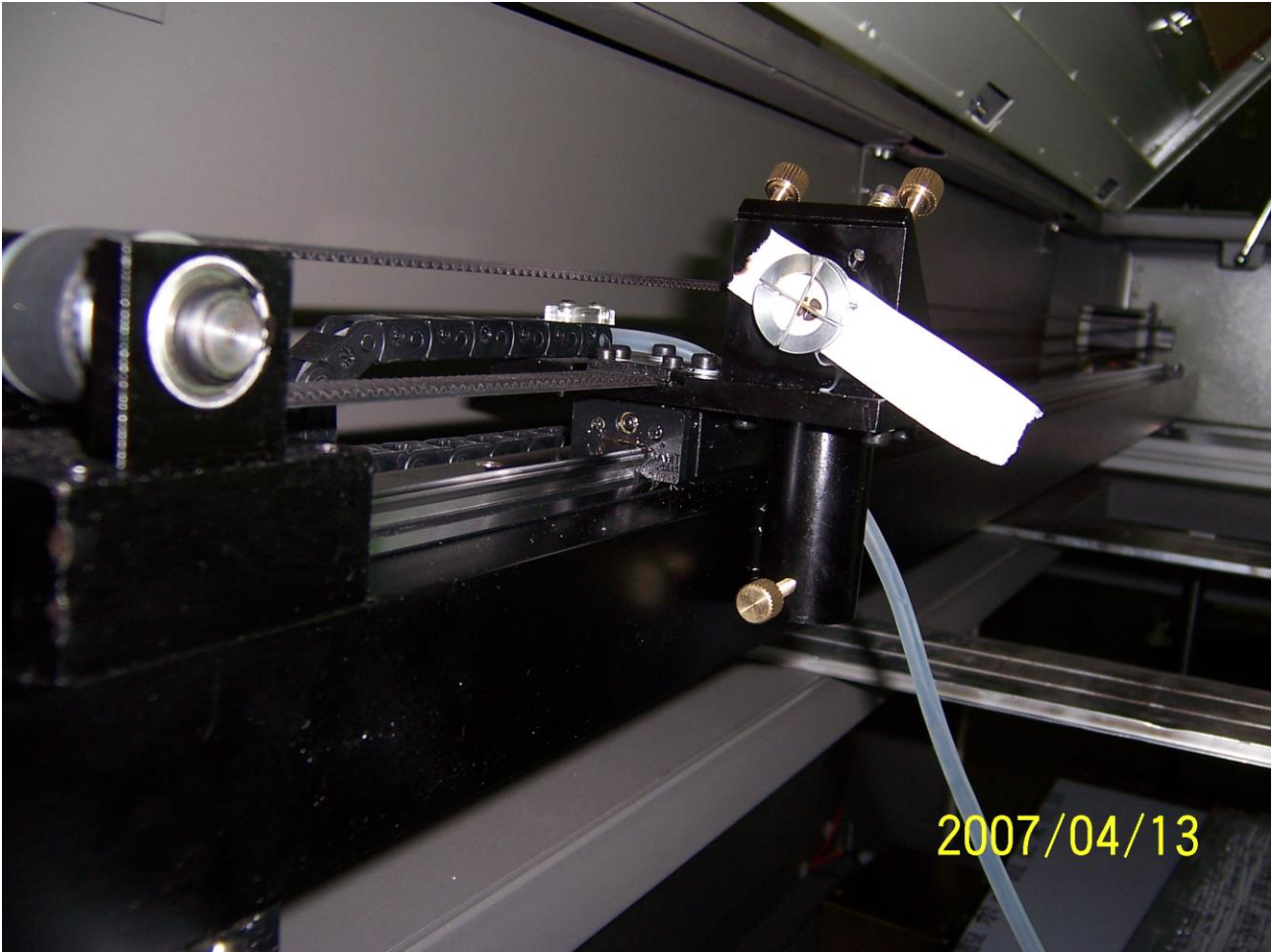
#### 4.4.2 Adjustment of the first reflecting lens

Put the indication ray center on the head of ray entrance hole, and stick a piece of double-face paper in it



then move the laser head to upper left corner of the machine. Press “LASER” button and make a dot





Then move the laser head to the lower left corner of the machine to make another dot. Using adjusting screw of the first reflecting lens(2) to make these two dots totally matched together





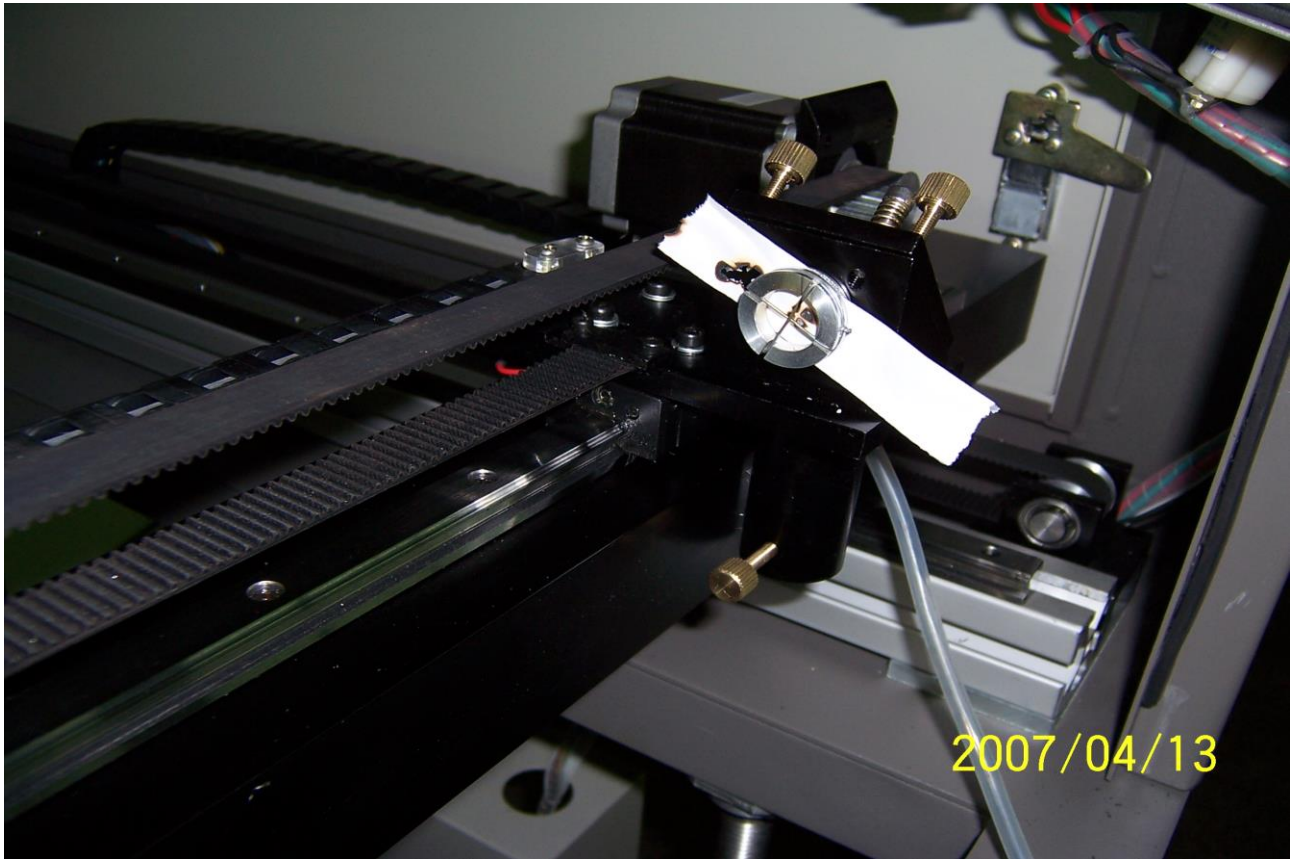
#### 4.4.3 Adjustment of the second reflecting lens

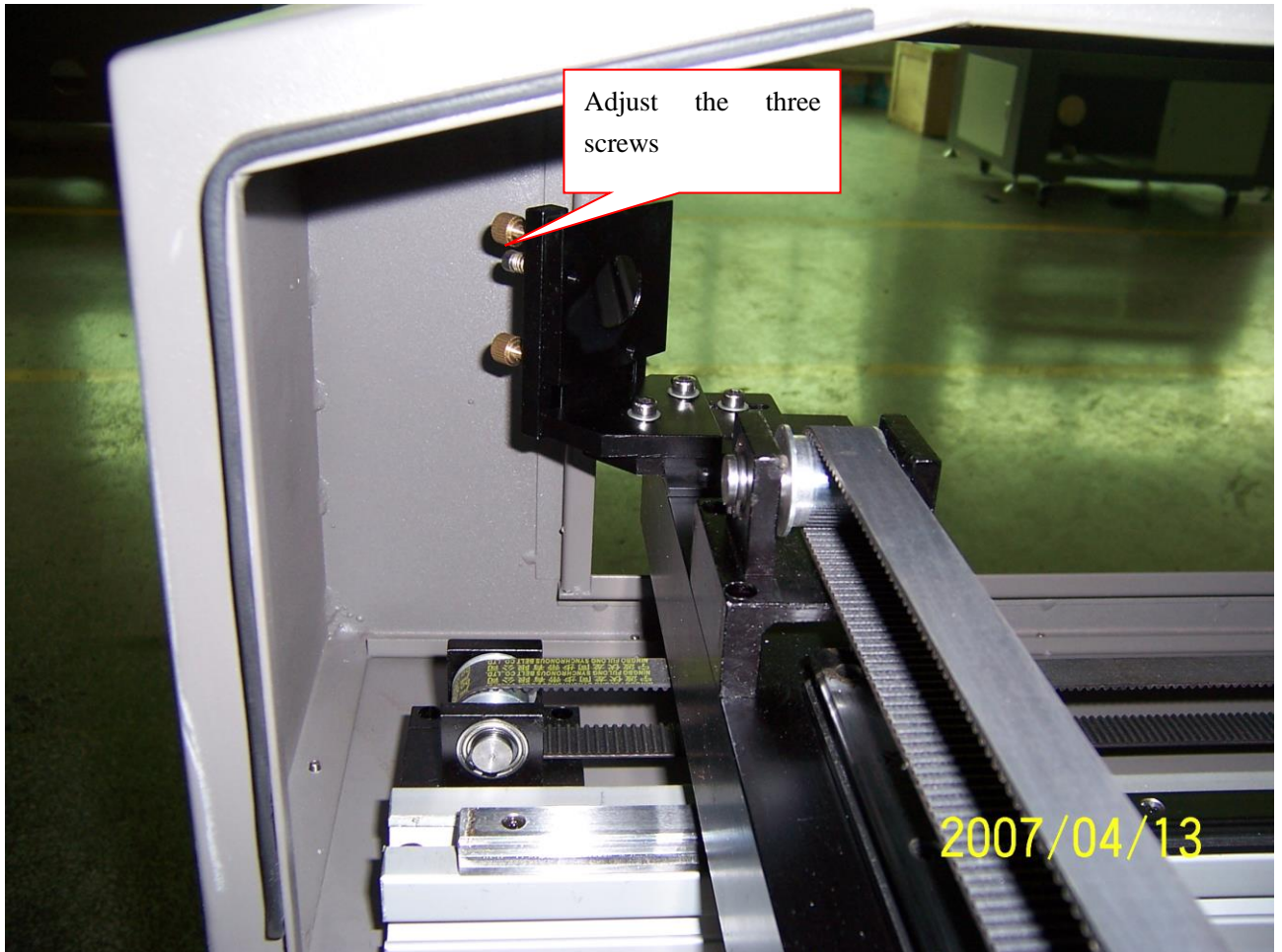
Then turn to ray path X. Move the laser head to the left of crossbeam. Press "LASER" button to make a dot



Then move it to the right to make another dot. Using adjusting screw of the second reflecting lens(3) to make these two dots totally matched together.



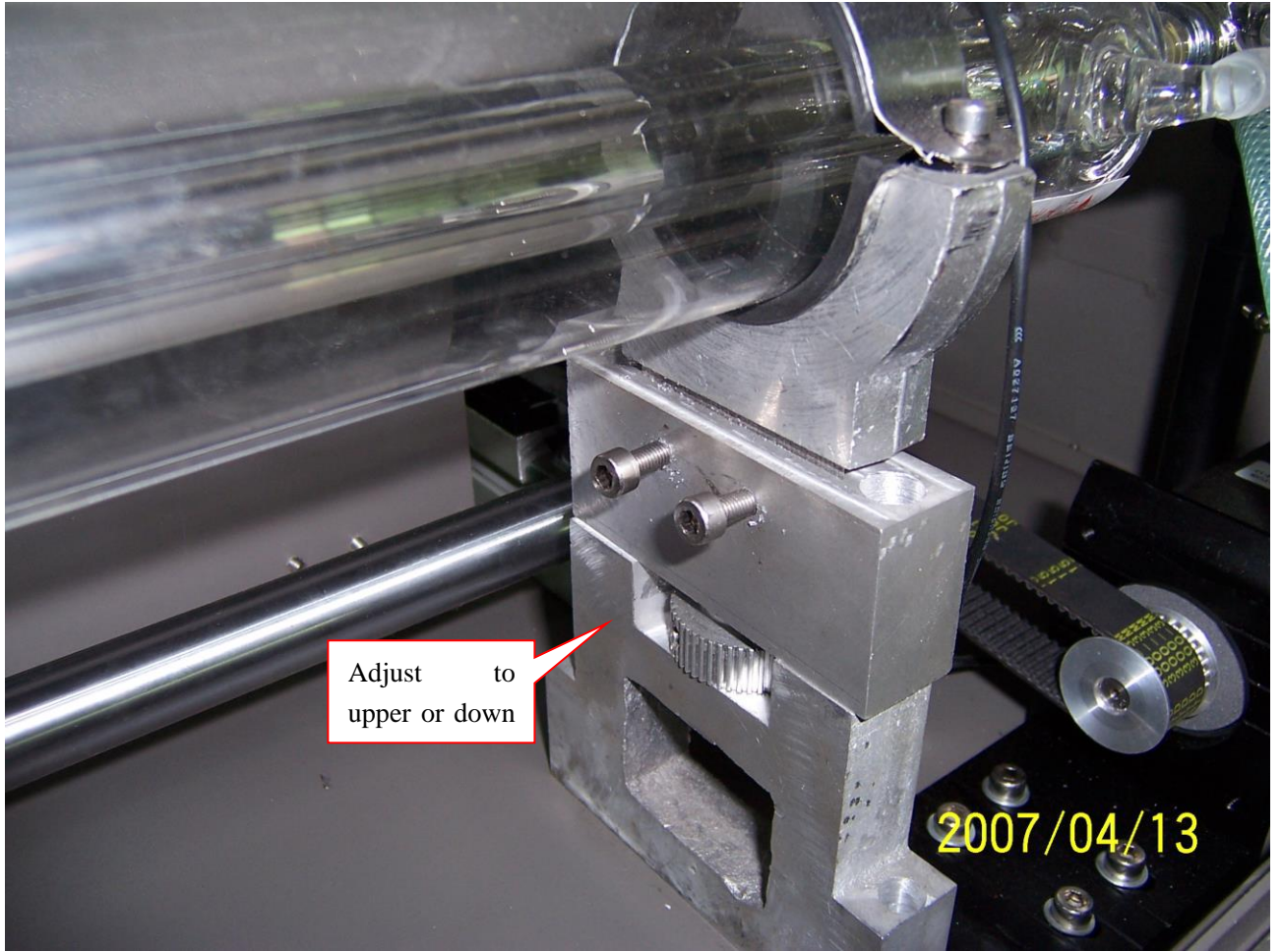


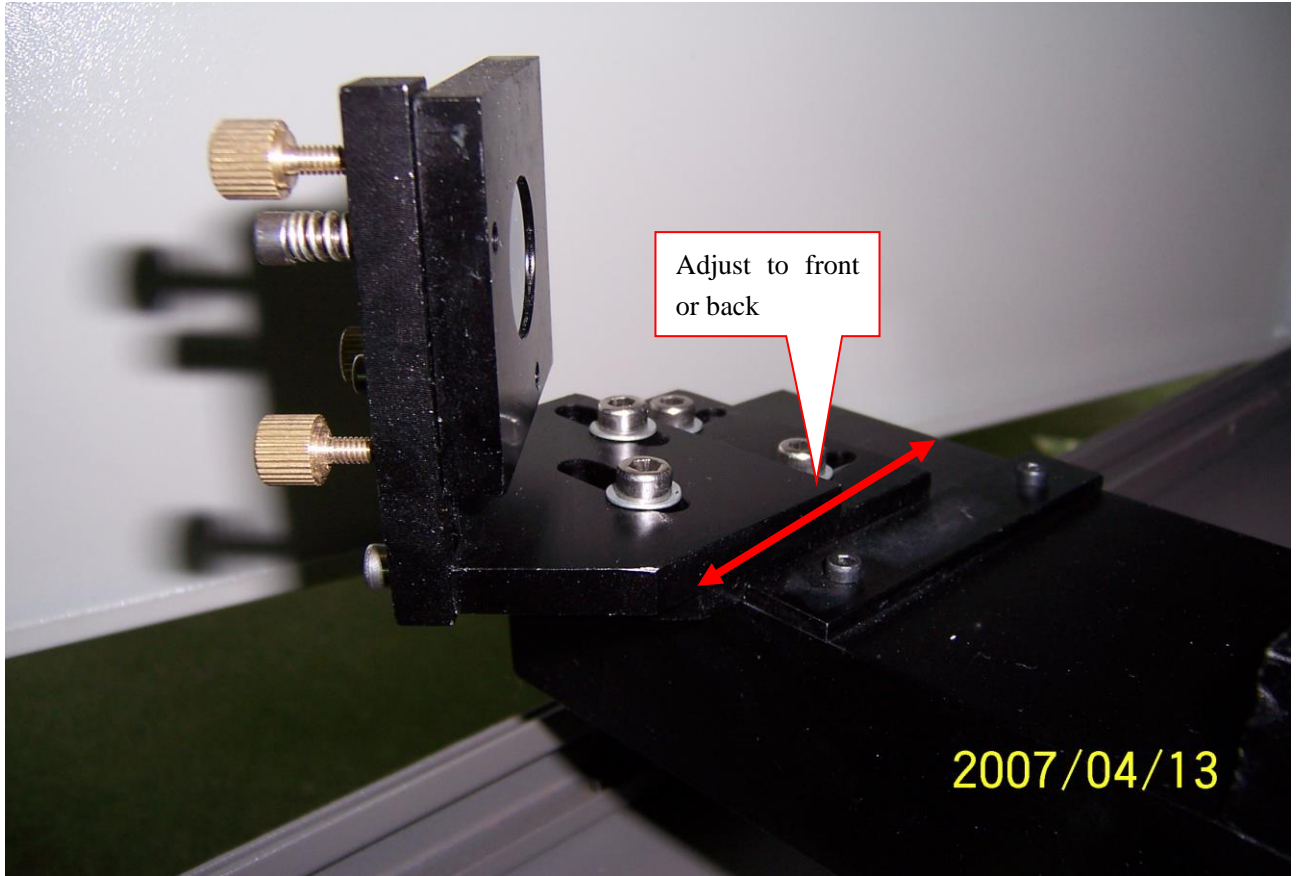


#### 4.4.4 Adjustment of the center of laser

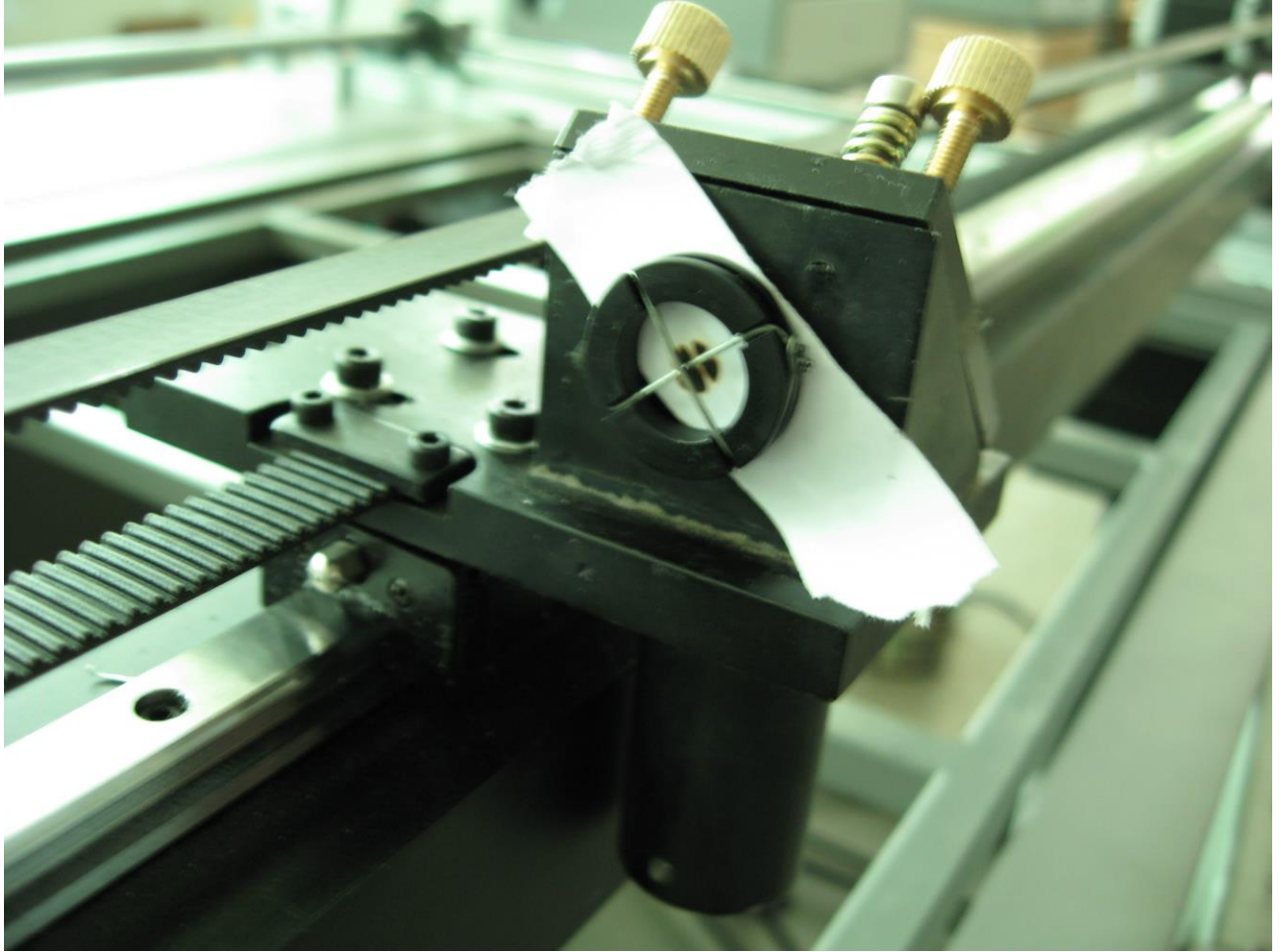
At last, you should make sure that the light was in the center of the indicating of the laser center. If it was not in the center, you should adjust the laser tube and the second reflecting lens to the center to make the light to the center part.

Laser tube can adjust the location of the laser up and down, the second reflecting lens mount can adjust the location of laser fore and after.

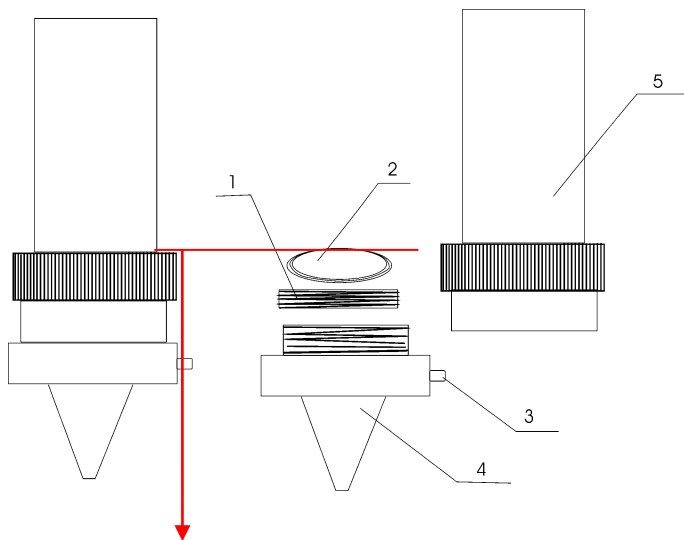
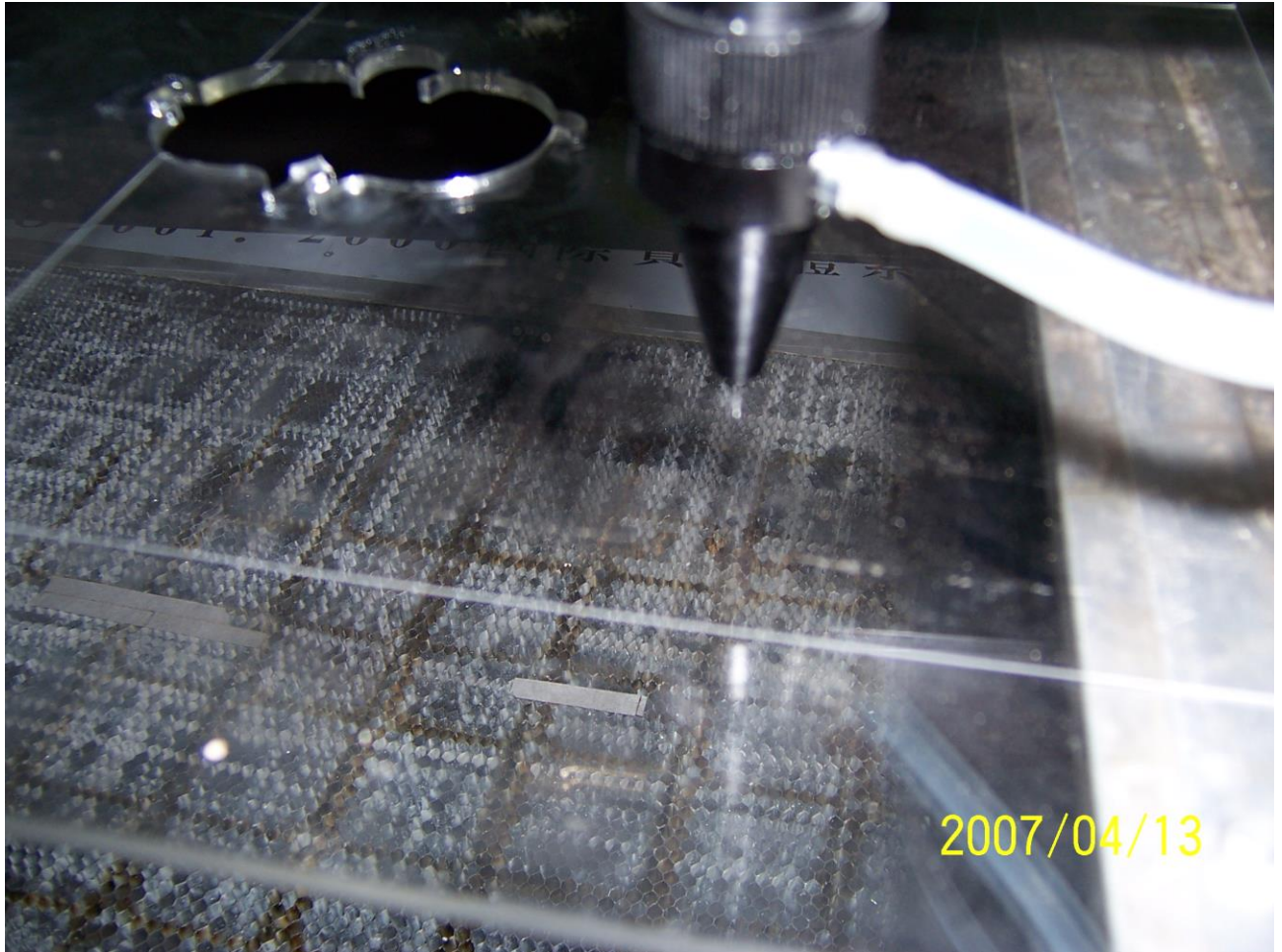




If the ray path is adjusted well, the light of the laser head should be in the center of each corner.



#### 4.4.5 Adjustment of the focus lens



Focal length:  $55 \pm 1 \text{MM}$  to the surface of object

1. Focusing lens cap

2. Focusing lens (convex side down)

3. Air-in nozzle

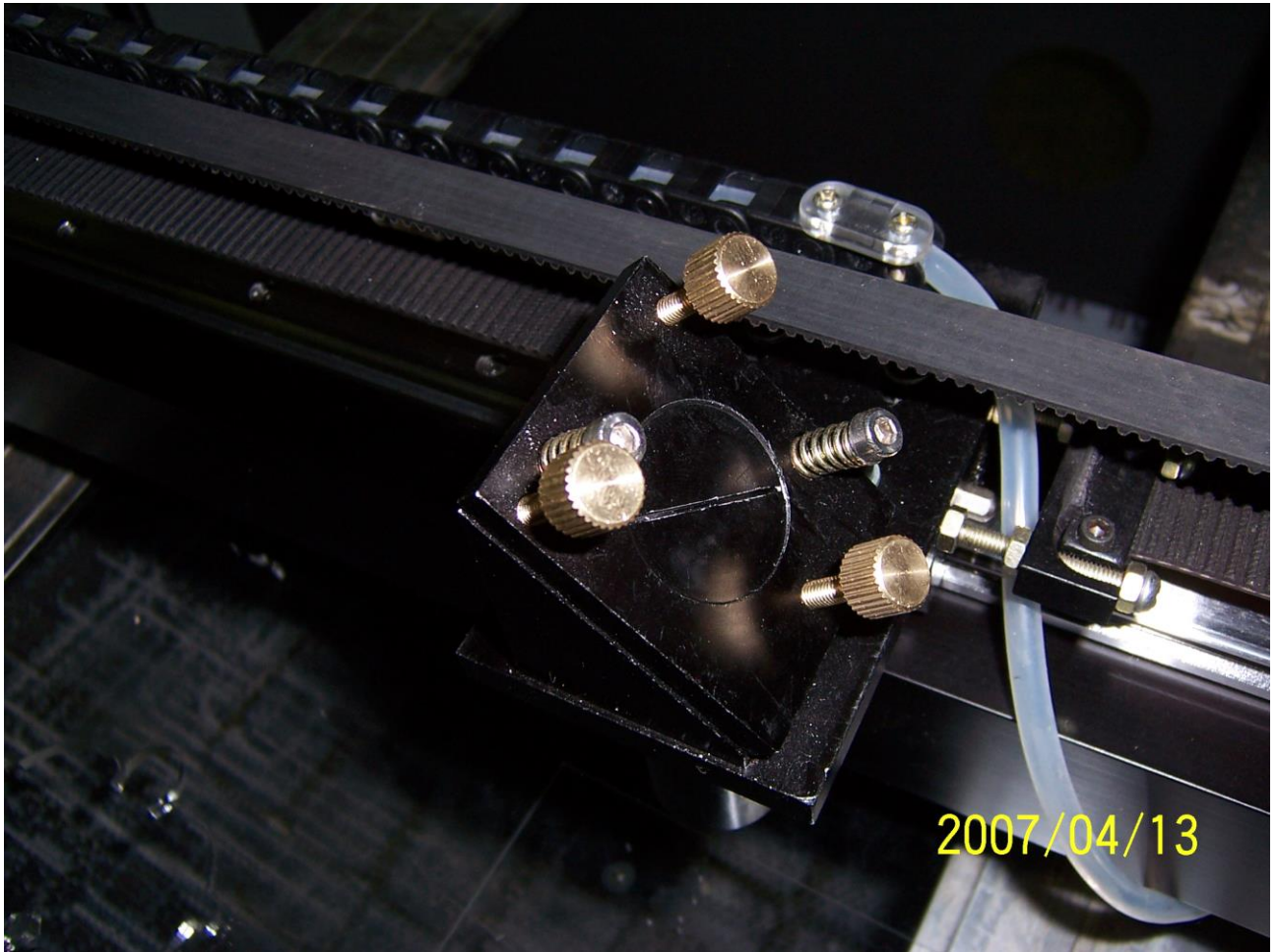
4. Air-out nozzle

5. Lens cone

Put an acrylic on the table, loosen the screw which is on the left of the laser head. Move the laser

head to 55mm plus-minus 1mm, then press the “test” button on the panel and observe the size of light. The best distance for focus lens is the one which makes the facula least.

#### 4.4.6 Adjustment of the third reflecting lens

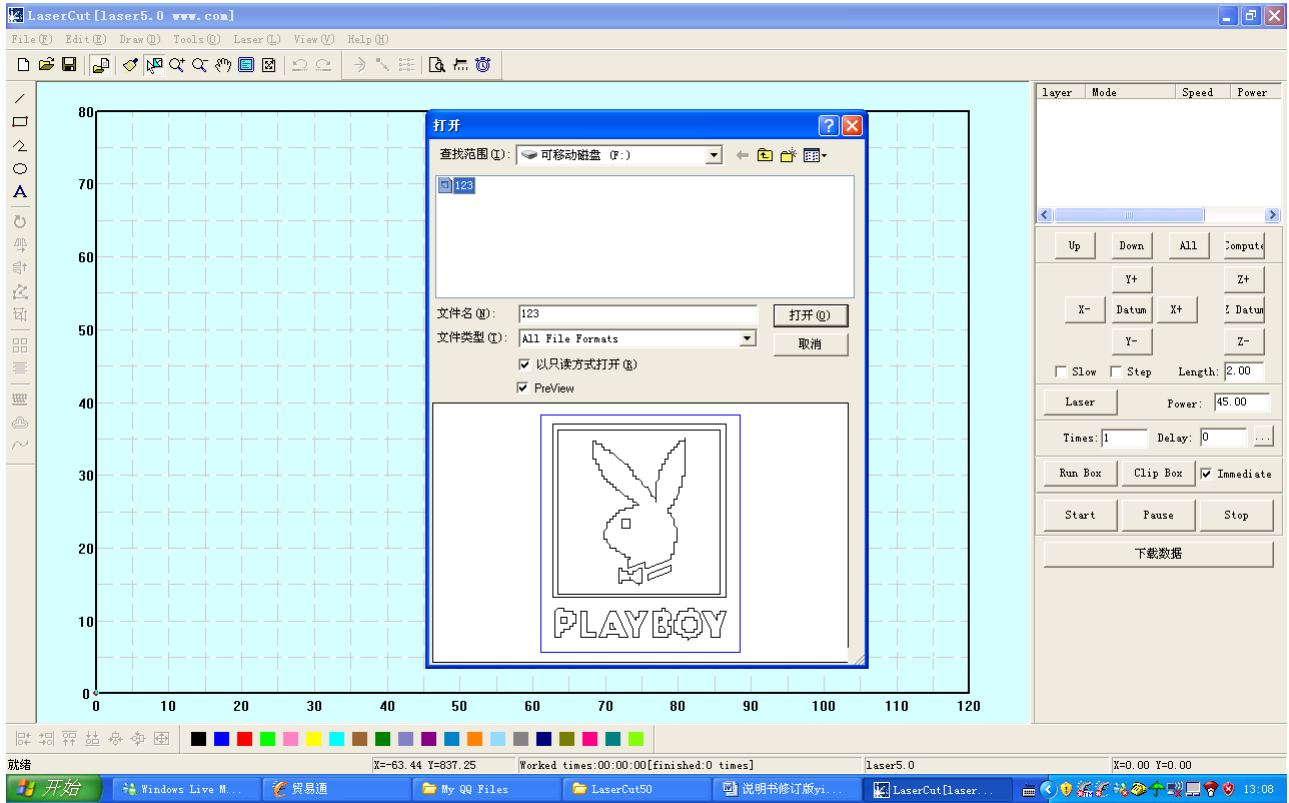


Make sure that whether the acryl is vertical through the spot testing, if not, adjust the third screw upper.

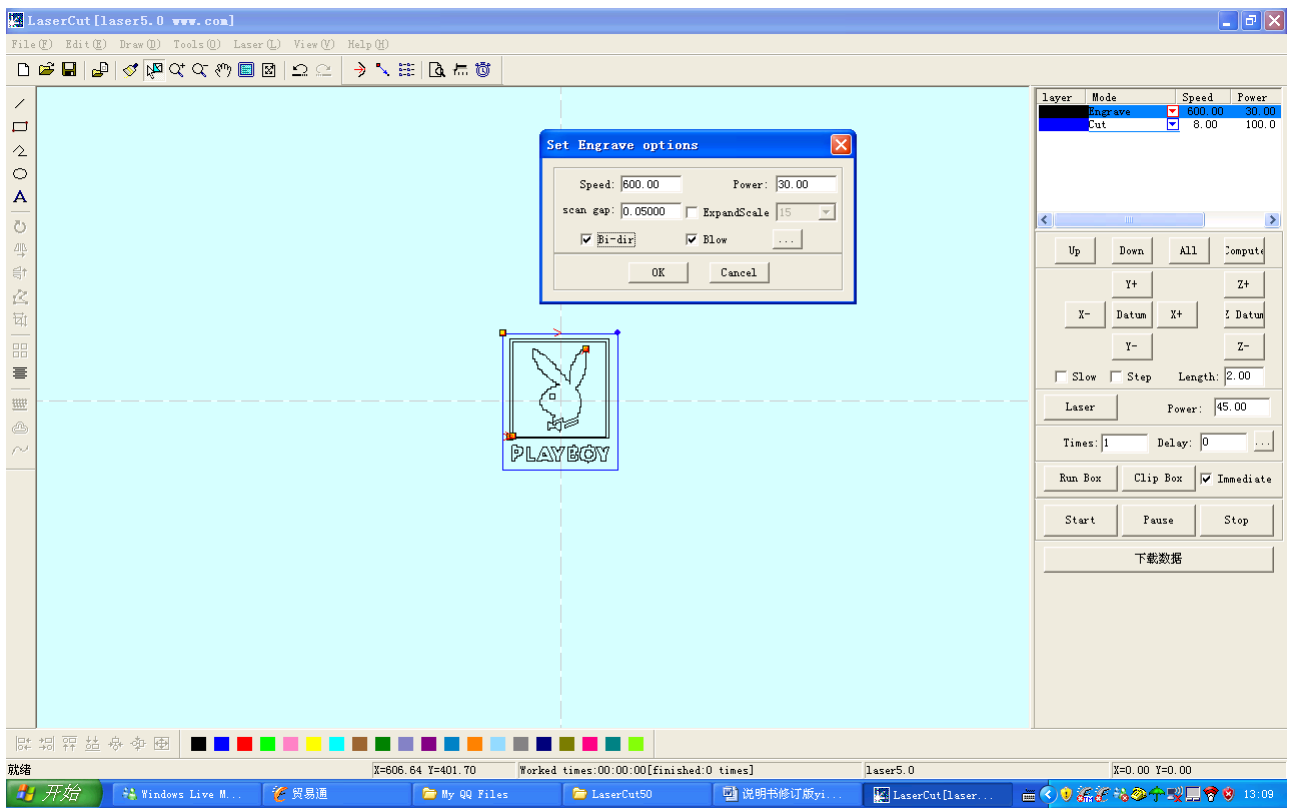
**Attention: make sure the cooling water cycle running well before the machine start to work, or it will damage the laser tube,**

### 5. Example of operation

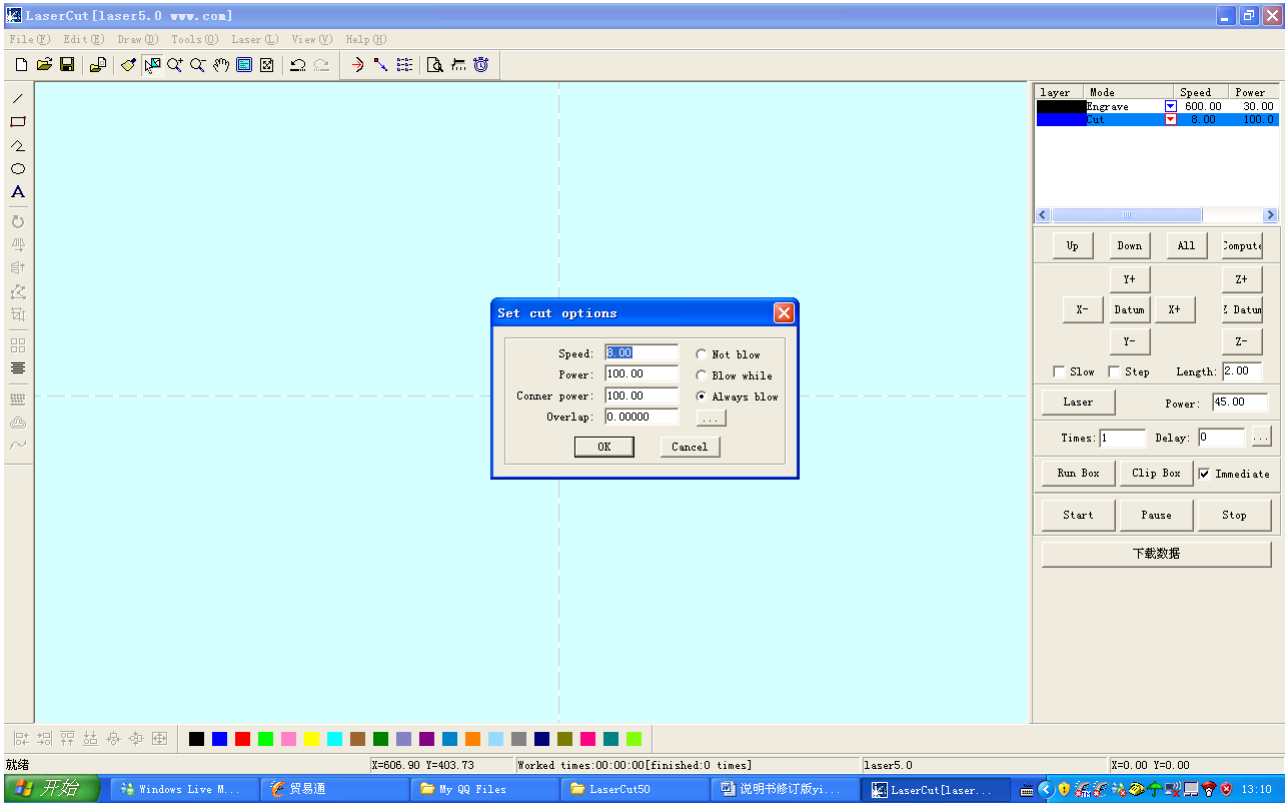
Open a PLT file format



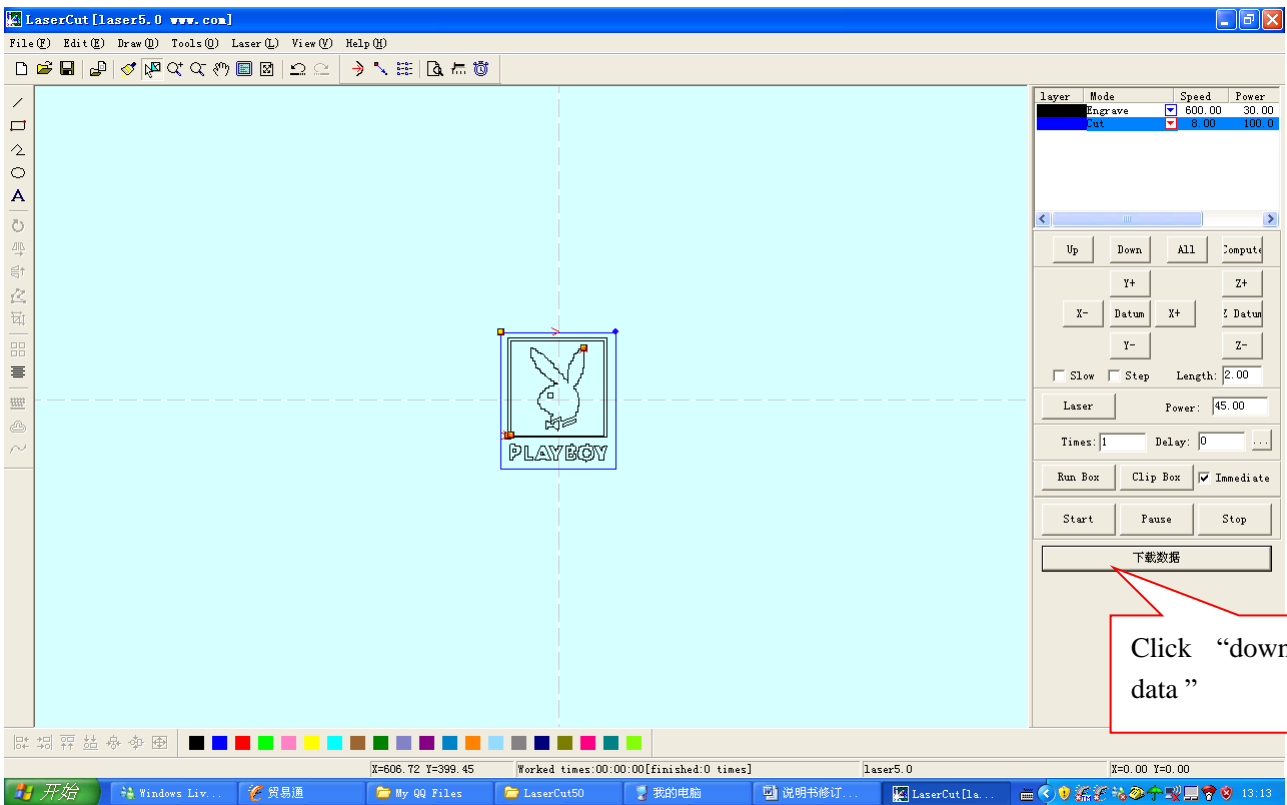
## Setup the parameter

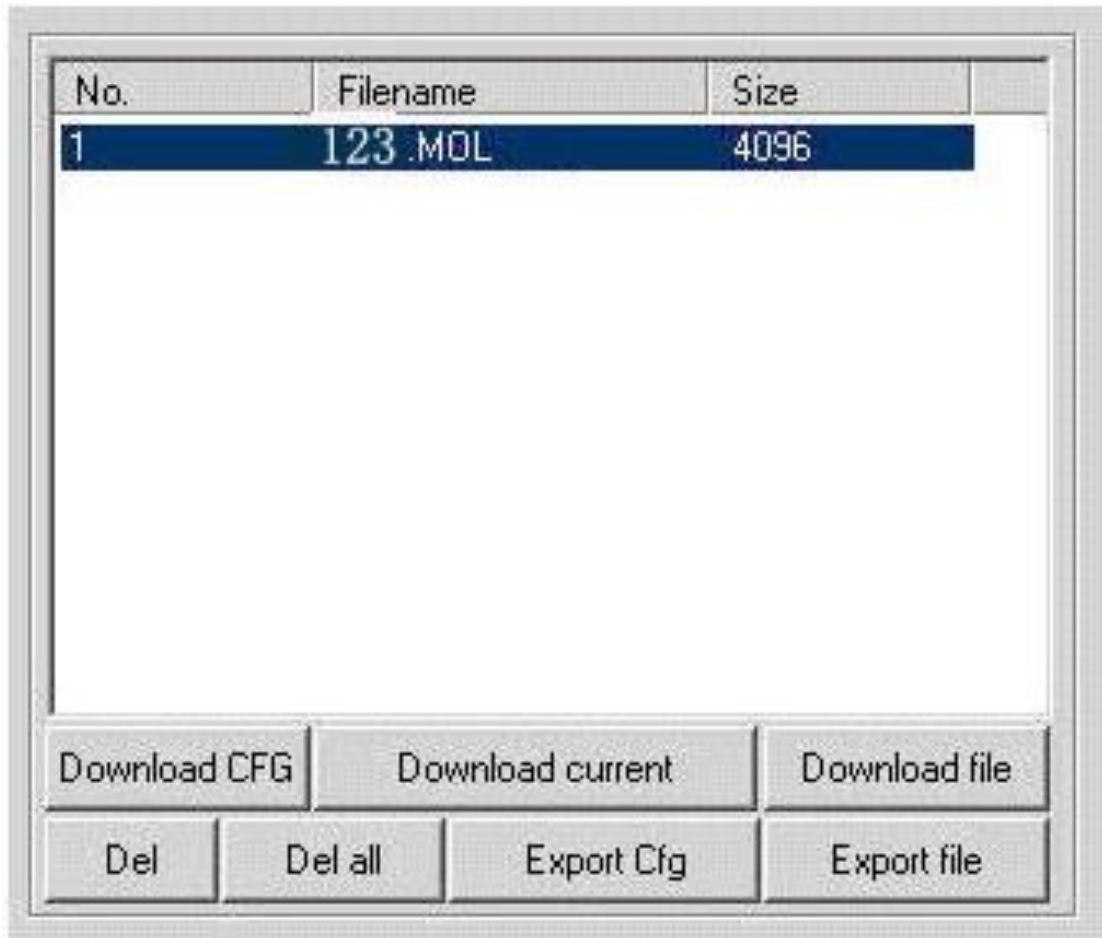






Download the file.

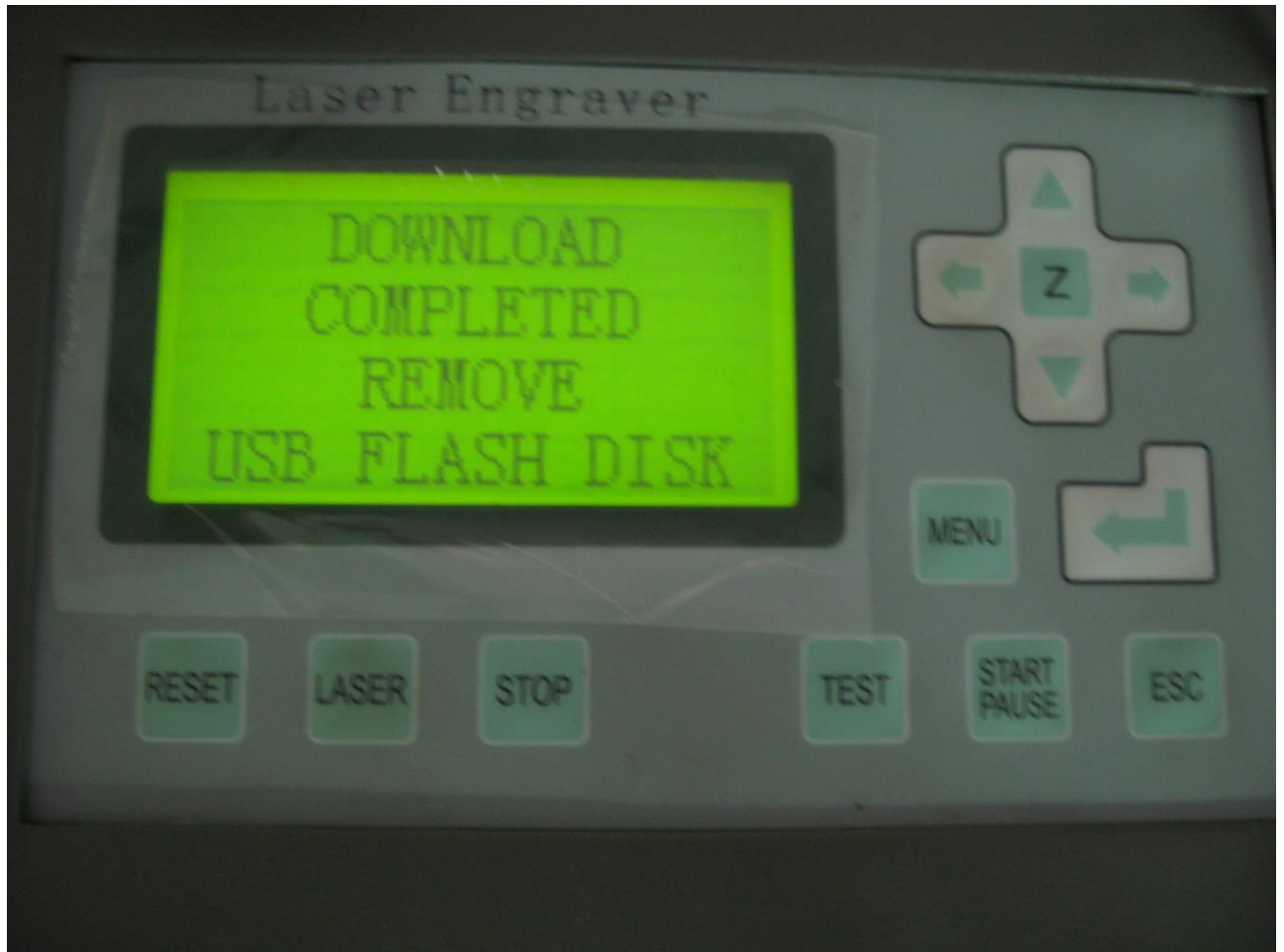




There are two methods. One is to use U disk, the other one is to transfer with software directly.

Using U disk to download the file: click “EXPORT FILE” to save the file to U disk, then insert the U disk into the computer.

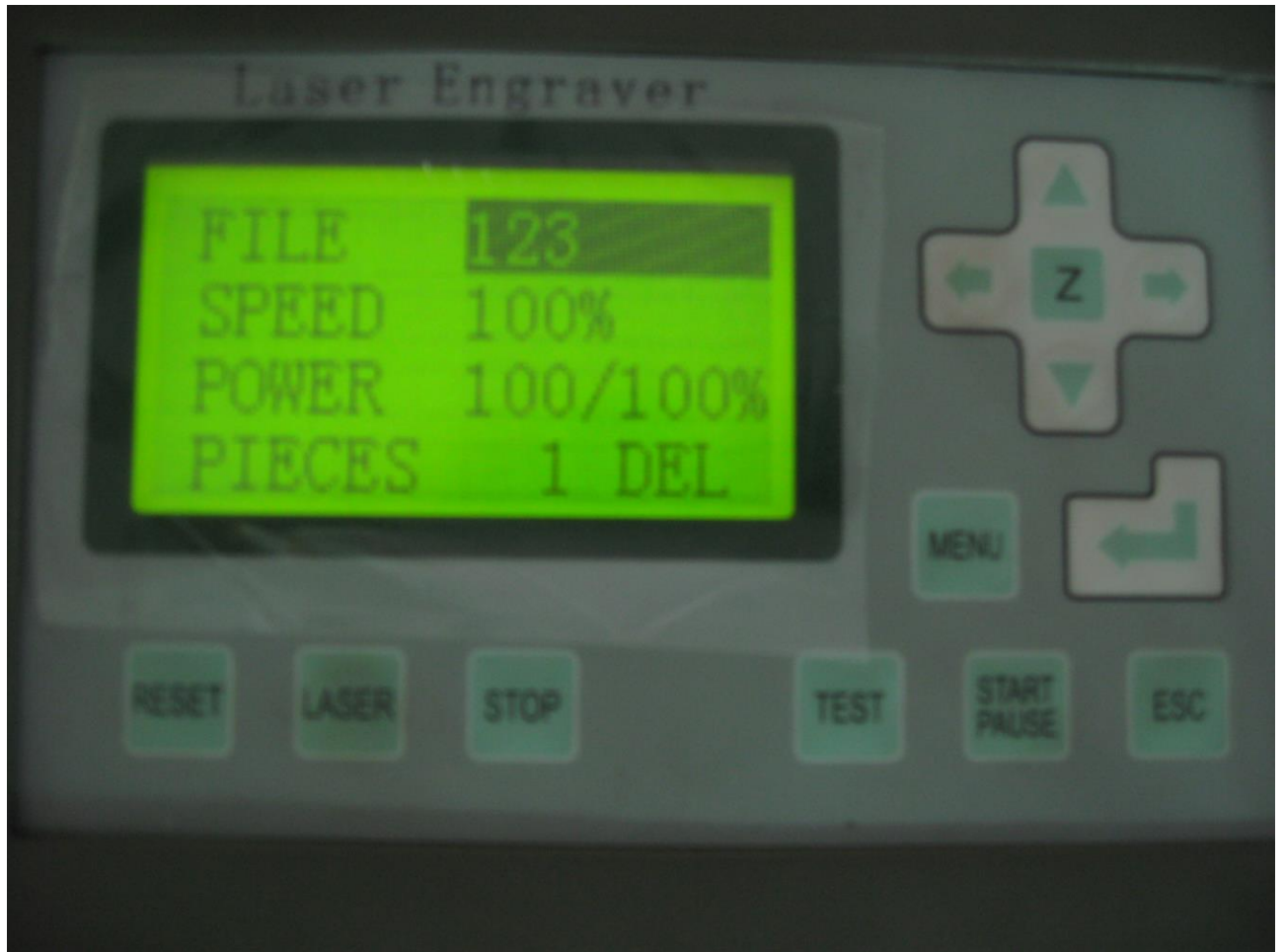




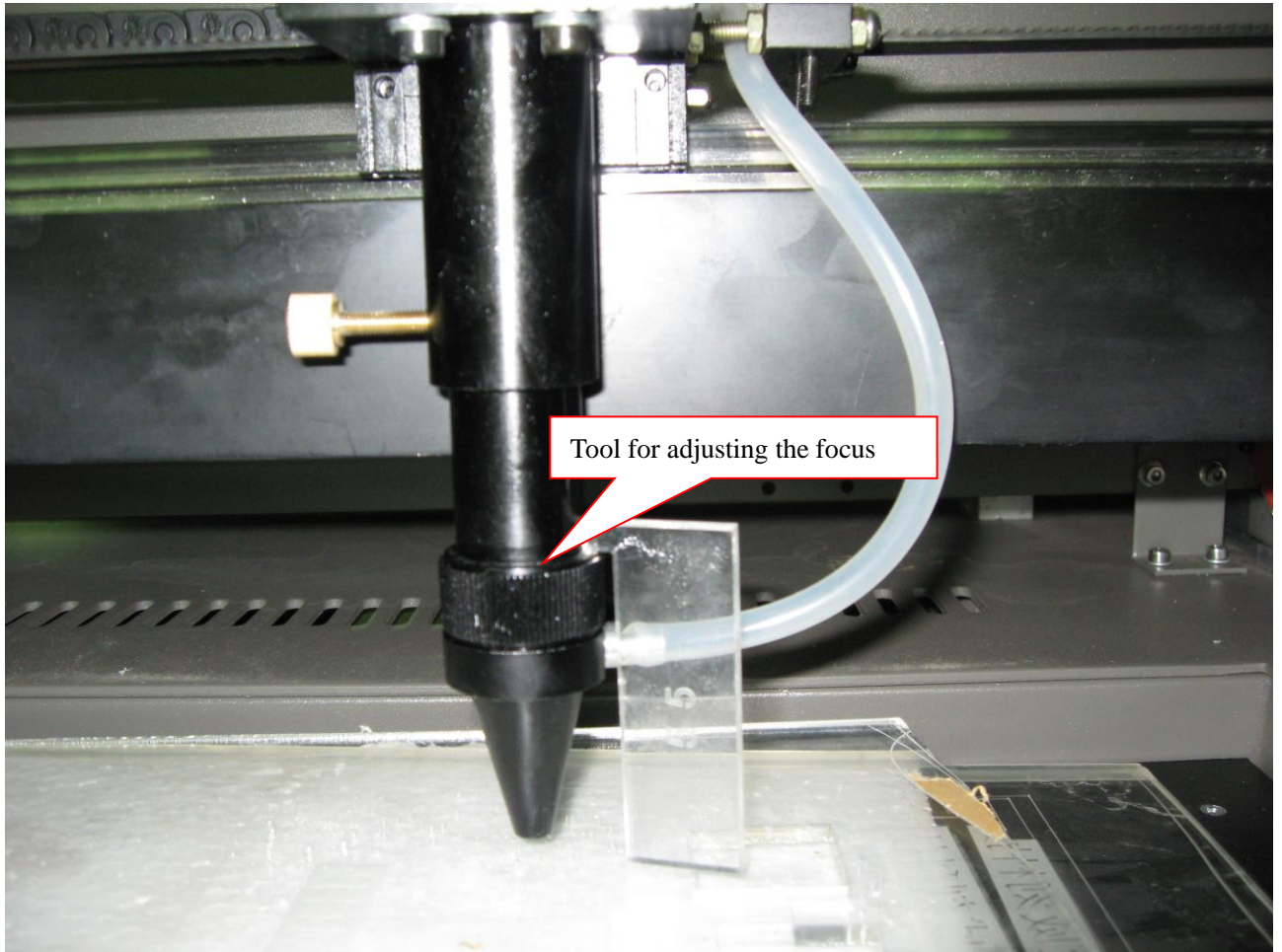
Pull out the U disk, then the file will be displayed on the LCD



The computer transfers data directly: Click Download Current.  
The file will be displayed on LCD after downloading.



Move the position of the laser head then adjust the focus.



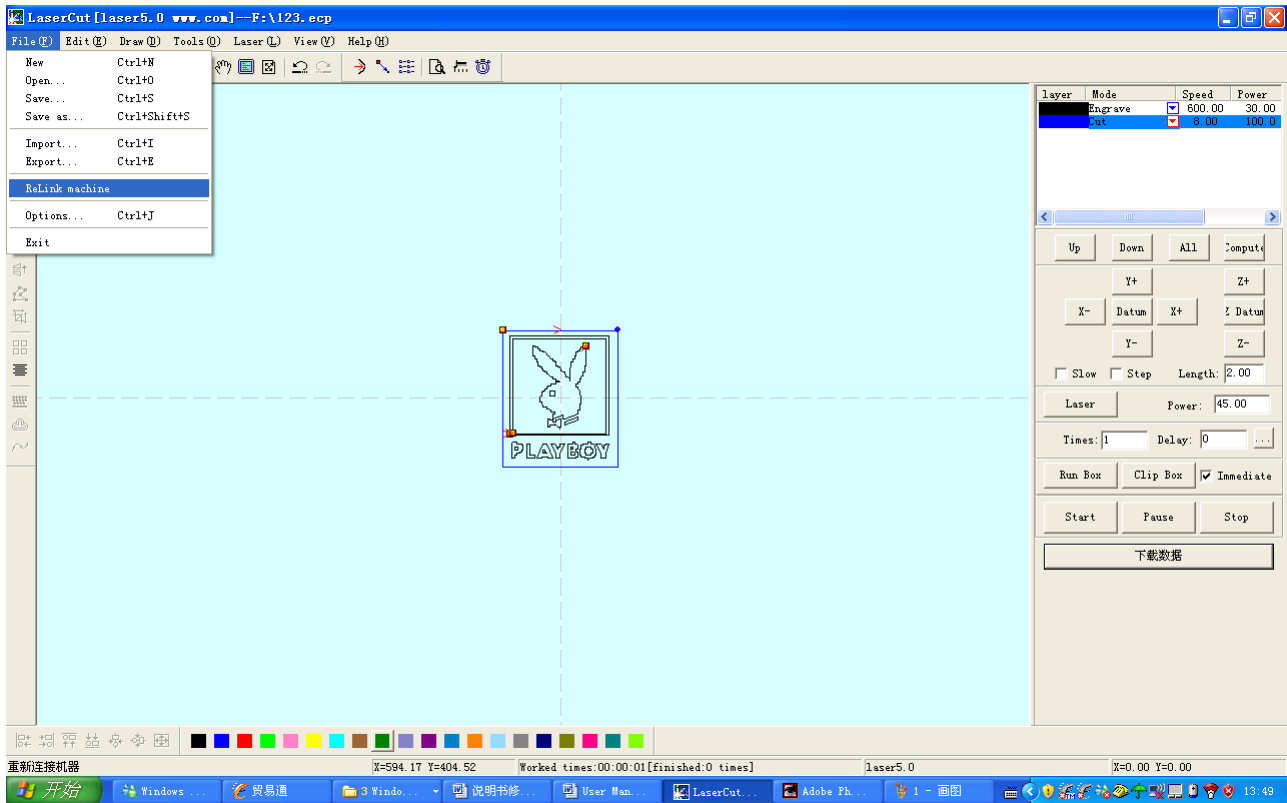
Click “start” on the operation panel, then the machine will start to work.

Complete processing



Attention: If there is some error when downloading current file, may be there is no communication between the laser machine and software. You can click ReLink machine to download the file renewedly.





After changing the parameter of the software, you should download CFG file to make the machine reset each time.

## 6. Safety consideration and maintenance

### 6.1 Safety consideration

#### 1. Safety cautions

1) It is forbidden to start the machine without grounding. The ground wire of laser power must be connected with the earth. It can not be connected on facilities such as doors, windows, water pipes and so on. The wire should be pulled to the outdoor ground.

2) Check the submersible pump to see if it can let the water out each time after starting the machine. It is forbidden to start the machine up when water can not come out from the pump.

3) Operators can not leave the machine when it is working in order to avoid unnecessary loss.

4) Water container should be a bit larger to make sure that there is 20 kilogram water in circulation. The water temperature should be about 25°C. If the temperature is too high, the water should be changed. It is better to use purified water so that there isn't any contamination. Circulating water should be changed regularly (every three days).

5) Because there is laser and high-pressure in the machine, non-professional workers should not disassemble the machine without authorization.

6) Reflecting mirror and focusing lens should be wiped with special camera lens paper or medical-use cotton wetted by mixture of alcohol and ether. (Proportion of ether and alcohol should be 1:1) Cleaning of mirrors and lens should be done once a week. It is required that the grounding of all parts of the machine and user's computer should be safe to avoid damage of machine and injuries caused by static electricity.

7) Blower fan must be turned on while engraving, so as to avoid pollutions on mirrors and lens. It is forbidden to put any flammable and explosive articles close to the equipment so as to avoid

fire.

8) Any irrelevant total reflection or diffuse reflection objects can not be placed in the equipment to prevent the laser from reflecting on human body or flammable articles directly.

9) The water in the laser tube should be drawn off in winter, in order to avoid frost cracking of the tube.

10) When the machine is working , operators should examine the working conditions (such as whether the laser ray has been blocked from shining on the paper used for crispening by the air coming from the air pump, unusual noise, temperature of circulating water, etc.) at any moment.

11) The crossbeam and larry can not be pulled by hand. The machine should be put in places where there is no interfere and harmful effect of pollution, strong electricity, strong magnetism, and so on.

12) When the voltage is not stable, please don't start the machine. It is suggested to use voltage regulator.

13) People who have not been trained should not use the machine.

14) Don't strike the keys and buttons strongly. Please press it lightly to avoid damages of those keys and buttons.

15) In case there is damage or fire, please turn off the power at once.

16) Don't start the machine when there is thunder or lightning.

Users should follow all the above mentioned regulations carefully. Otherwise the manufacturer will not take responsibility for any troubles of the machine or physical injuries.

## 6.2 Maintenance

### 6.2.1 Cooling water

It needs about 25 kilograms of cooling water, the temperature of the water is no higher than 35°C. Circulating water should use pure water, containing no impurity. It suggested choosing the cooling machine.

### 6.2.2 Laser tube

There should be no bubble in the laser tube, otherwise it will be destroyed. It is suggested that the current should be below 20MA when the laser tube is working. The higher current, the shorter life.

It should replace when the laser tube shatter or ending

**Warning: the follow step only operated by specialized or trained person.**

When operate the replacement of laser tube, you should disassembly it. And uninstal should obey follow steps:

Stop the running machine when disassembly it.

Let out the cooling water of laser tube. Please obey the cooling machine specification of chapter V to get the operation about the get rid of cooling water.

Open the back door

Pull out out/in water pipe of the laser tube joint, this operation need pull the two side pipe of the tube.

Take down the anode and cathode of the laser tube.

Take down the fixed screw

Draw out the laser tube form the end of the tube (the faraway of the reflecting lens I) carefully and then put in on the safe place.

**Attention : the useless laser tube is fragile and need dealing carefully. Please according to the rule of how to recycle the glasswork of local law to transact it. And the manufacturer don't take any responsibility for the useless glass tube.**

After uninstalling, and setting the new laser tube in term of the following process:

Fix the laser tube on the frame in the right direction which means the light outlet towards the first reflecting lens. Fix the fasten button..

Connect with the water inlet and outlet.

Connect the anode and cathode of the laser tube. Since there is high voltage with the anode, it is better to deal with insulation

.

Turn on the water pump, and cycle the water for one minute. Adjust the location of the laser tube to squeeze out the bubbles

Close the door.

Starting test.

### 6.2.3 Cleanness of the focus lens

The lens will empoison easily by the dirt and it should clean after use for a period of time.

focusing lens clean

1) Loosen the screw on the left and turn down the lower part. Twist off the gas outlet, then turn down the nut with a flat tool. You will take out the focus lens.

2) Use alcohol to clean the lens until there is not any dirty. 3) Use the alcohol to tidy the laser head and the inner parts to make sure its neatness.

4) Install the focus lens.

Attention: The flat surface of the focus should face up

### 6.2.4 Cleanness of the reflecting lens

Wet the lens tissue with alcohol to wipe it directly.

Attention: You should wipe the reflecting lens entoectad deasil circuit by circuit.

### 6.2.5 cleanness of Linear guide rail

Clean the filth with clean soft cloth, then spread some lubricating fluid.

### 6.2.6 Cleanness of Complete machine

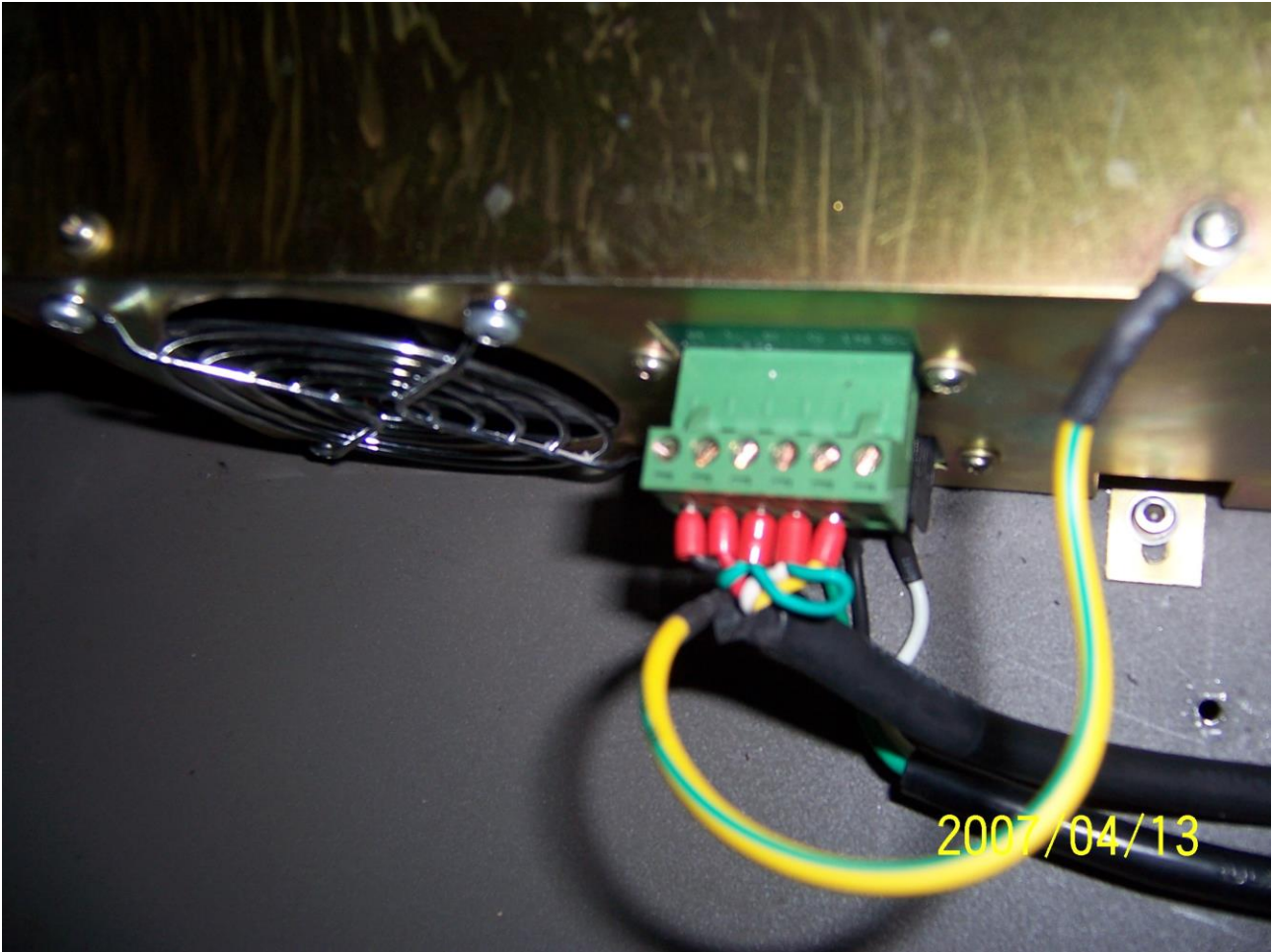
Clean the machine once a week.

## 7. Familiar malfunction and removal

### 7.1 Malposition of the engraving

Poor grounding and disturbed by high voltage

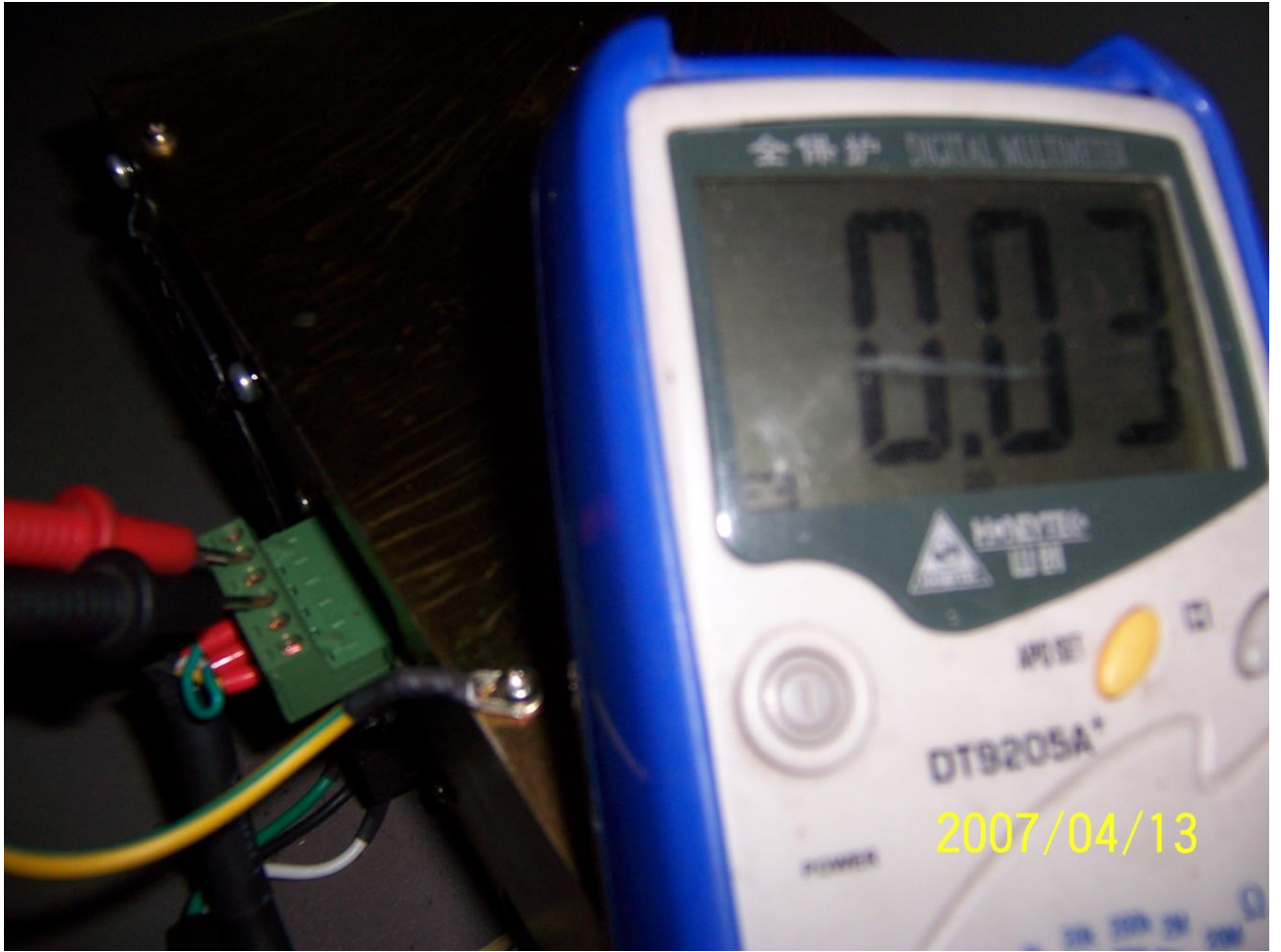
### 7.2 No laser given out



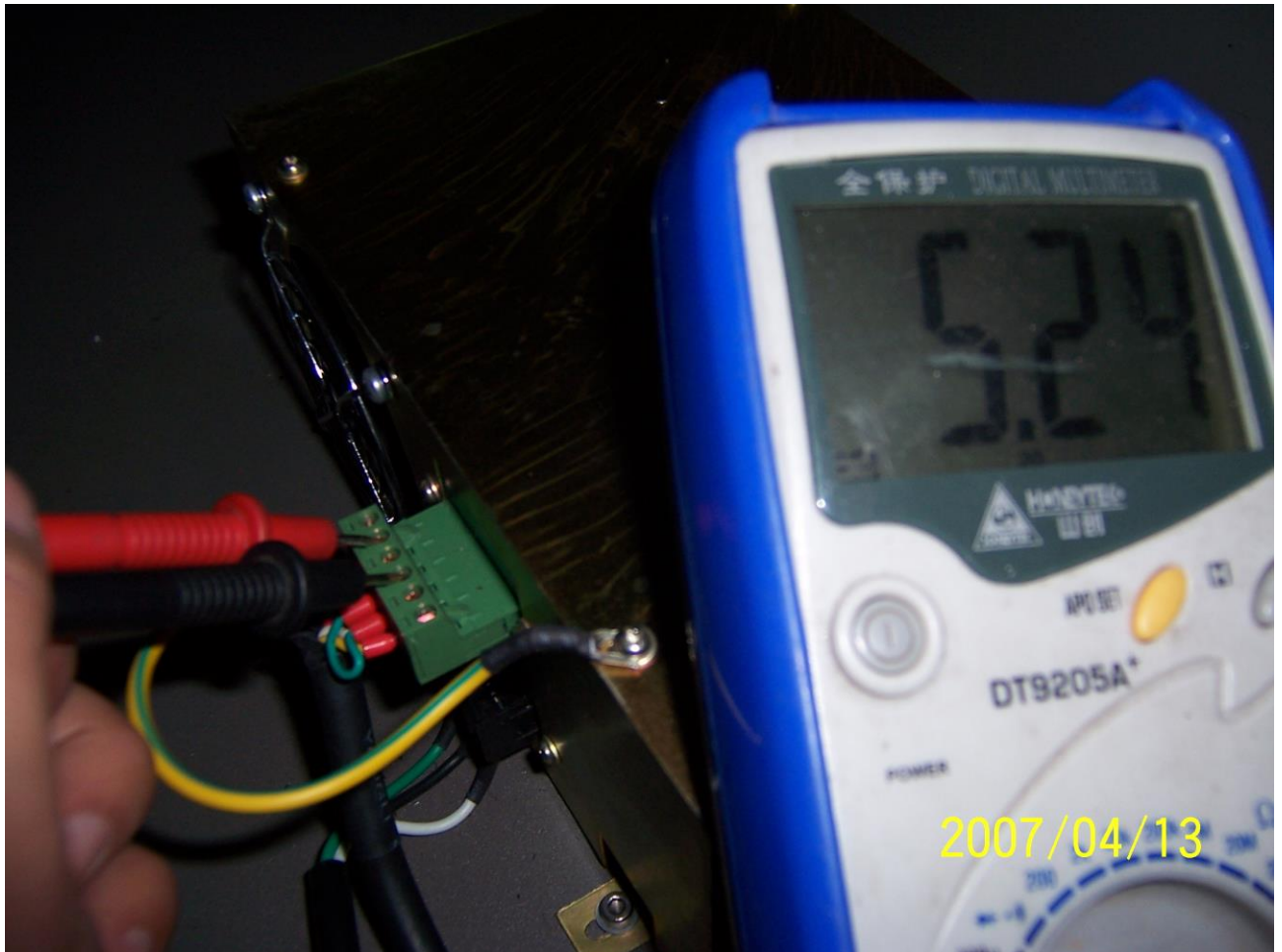
From left to right it is 1,2,3,4,5,6 respectively

2-4 Control the transmit ion of the laser. Close the laser with high tension, and give it out with low level. When it gives out the laser, the voltage of 2-4 is 0 V, otherwise it is 5 V.

When you press “Laser”



When you do not press it:



3,4,connect with the protection switch, if 3,4 short circuit, then the laser can give out light, if it opens circuit, the laser can not give out light.

3-4 can connect with the safety switch directly for the machine that with the safety switch

5: PWM signal controls the power of laser

If the voltage is 5V when pressing LASER, it indicates that there is something wrong with MPC6515.

If the voltage is 0V when pressing LASER, it indicates that there is something wrong with laser power supply or laser tube.

If the laser tube gives out red light without laser, it indicates that there is something wrong with the laser tube.

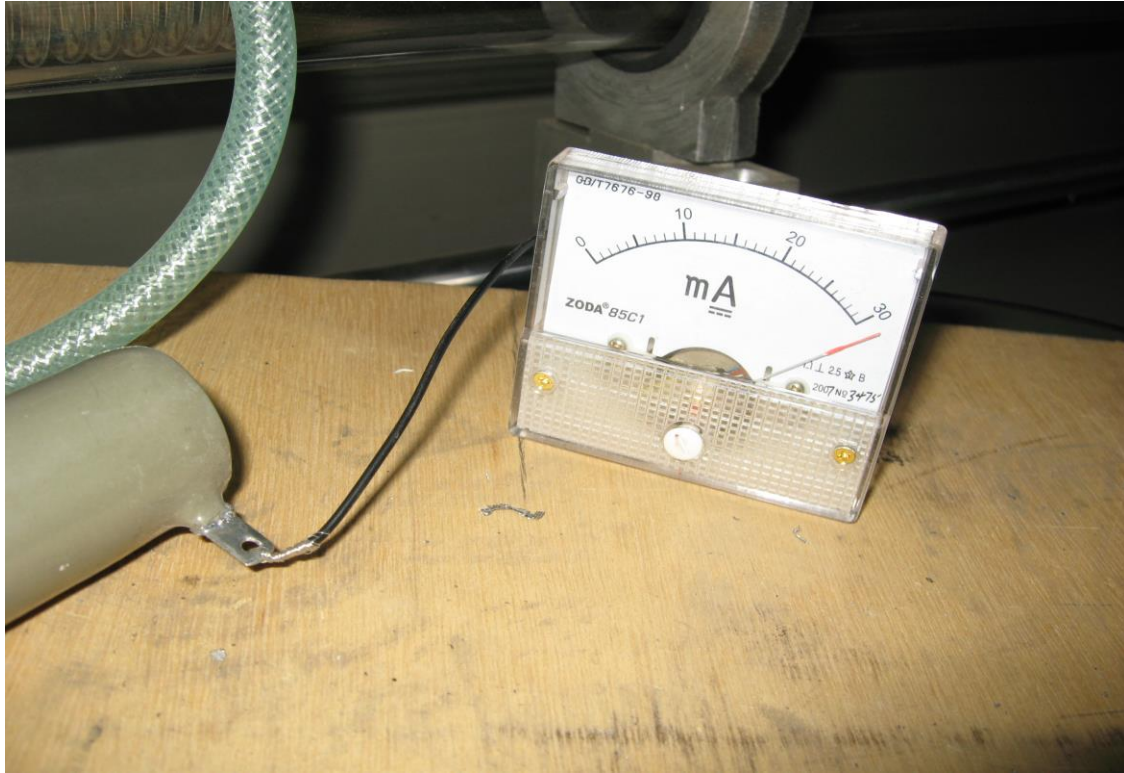
You can estimate the problem of the power supply and laser with the naked eye, for example you can find out the fan of the laser power supply doesn't go round and round, and there is crack in the laser. If you can't judge the problem, please use the methods as follows:





Press “LASER” the current meter will display as follows in normal condition





Otherwise, the laser tube goes wrong

Attention: you should cover a insulating board on the surface when testing ,the parameter of wire-wound resistor is 100W 20KΩ

wire-wound resistor

### 7.3 Low laser power

A: The laser tube should be changed

B: The optical path is askew

C: The reflecting lens is dirty

D: The focus lens is dirty

### 7.4 X..Y without movement

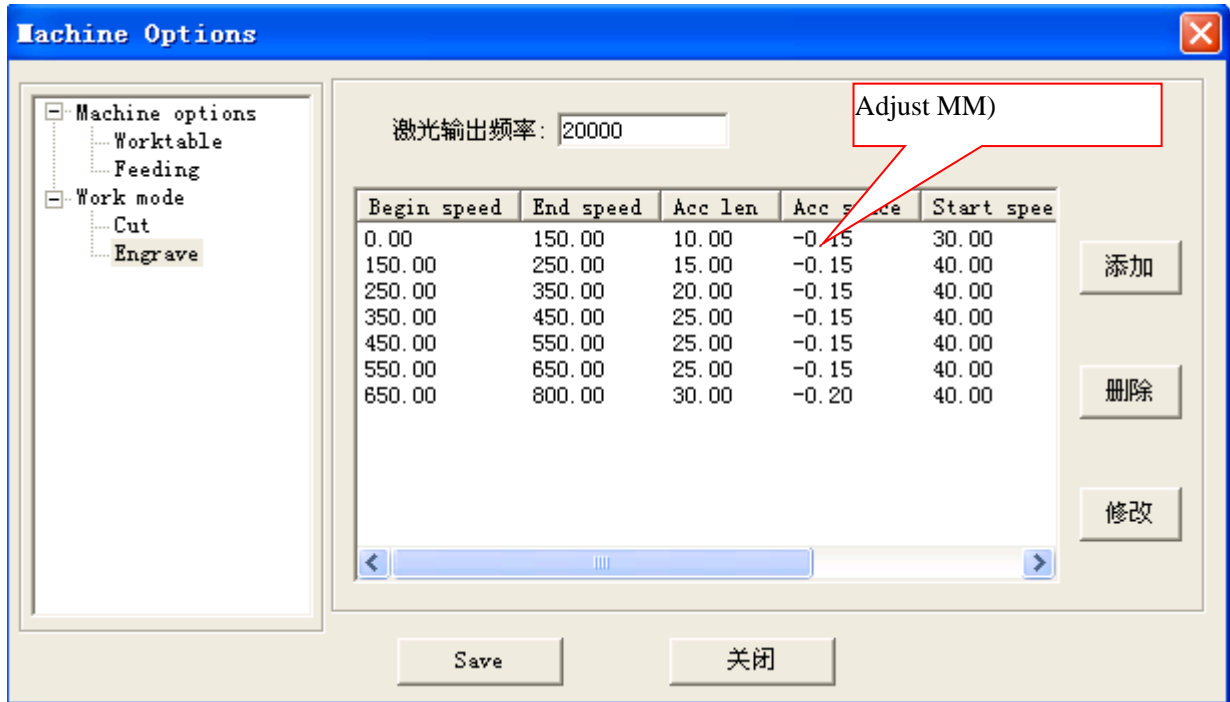
A. Download CFG file over again.

B. If LCD displays something after boot-strap, there is something wrong with 36V power. If it doesn't display, it indicates that MPC6515 main board is broken..

## 8. Debugging of the engraving accuracy

After changing the laser, the accuracy may be not good, then you can adjust it with the software.

You can change the engraving accuracy by amending the value of Acc space, it is from -0.3 to 0.3. The parameter has been set up when the machine leaves factory, so it is suggested that you do not amend it.



Attention: You should download configuration files after changing the parameter of the software, then it can executes the new parameter.

## 9 Technical parameter

Item	lao500	6090	1610
Machine size (length× width×height)	1360 × 710 × 1070 (mm <sup>3</sup> )	1360*1090*1070 (mm <sup>3</sup> )	2160 × 1410 × 1070 (mm <sup>3</sup> )
Maximum engraving range each time	500mm×300mm	600mm×900mm	1600 × 1000mm
Weight	158kg	300kg	450KG
Speed	0—60m/min		
Speed control	0-100% no segment control		
Laser tube cooling	Water cooling		
Working delicacy	0.0254mm		
Minimum shaping character	Chinese character 2mm, English 1mm		
Repositioning accuracy	±0.1mm		
Power supply	110-240V		
Total power	≤1000W		
Graphic format supported	BMP, PLT, DXF, DST		
Driving system	Step motor, subdivision driving		
Laser power	40/60/80/100w		
Operating temperature	0°C~45°C		
Operating humidity	5%~95%		

## 10 Accessories

Complete machine	1SET
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Wind pipe	1PC
Blower fan	1PC
Water pump	1 SET
Air pump	1 SET
Rubber pipe	3PCS
Communication cable	1PC
Power wire	1PC
CD	1PC
Software of engraving	1PC
Indiction of laser center	1PC
Control card	1PC
Laser tube	1PC
Soft dog	1PC
Qualified certificate	1PC
Warranty Certificate	1PC
Blower fan connector	1PC
2803 Chip	2PCS
Laser power source	1PC
Electricity wire	1PC
Laser power source controlling wire	1PC
Reset Switch	2PCS
U Disk	1PC
Key	3PCS
Lens tissue	1PC
20K Resistance	1PC
Focusing ruler	1PC