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## Laser Welding Machine

FOB price□4900\$

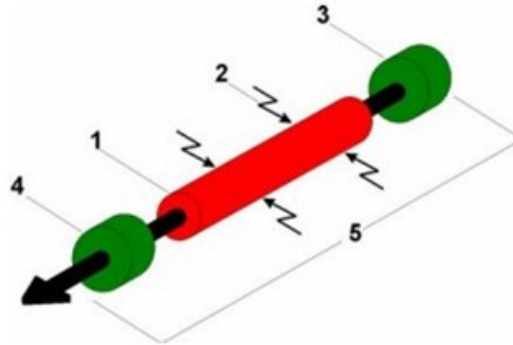


### 1. Laser basics

## 1.1 Introduction

The word “LASER” is an acronym for Light Amplification by Stimulated Emission of Radiation. The elements of a laser are---

1. Laser medium
2. Input “pump” energy
3. Rear total reflecting mirror
4. Front partial reflecting mirror
5. Resonator

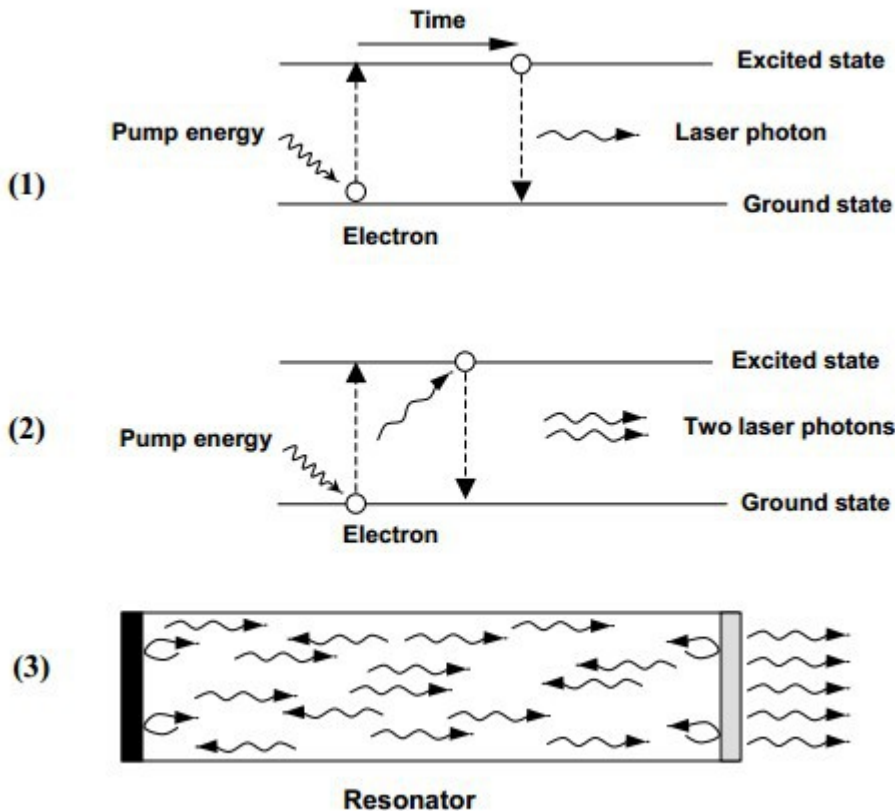


There are two of types of Nd: YAG laser welders; continuous wave and pulsed. The pulsed laser utilizes high peak power to create the weld, whereas the laser uses average power. This allow the pulsed laser to use less energy to create the weld, with a smaller heat affected zone. This provides the pulsed laser with unrivalled spot welding performance and minimal heat input seam welding.

## 1.2 Principle of Laser Generation

The generation of a laser beam is essentially a three-step process that occurs almost instantaneously

- 1) The pump source provides energy to the medium, exciting the laser medium atoms such that electrons held with in the atoms are elevated temporarily to higher energy states. The electrons held in this excited state cannot remain there indefinitely and drop down to a lower energy level. In this process, the electron looses the excess energy gained from the pump energy by emitting a photon. This is called spontaneous emission and the photons produced by this method are the seed for laser generation.
- 2) The photons emitted by spontaneous emission eventually strike other electrons in the higher energy states. “Eventually” is a very short time due to the speed of light and density of excited atoms! The incoming photon “knocks” the electron from the excited state to a lower energy level creating another photon. These two photons are coherent meaning they are in phase, of the same wavelength, and traveling in the same direction. This is called stimulated emission.
- 3) The photons are emitted in all directions, however some travel along the laser medium to strike the resonator mirrors to be reflected back through the medium. The resonator mirrors define the preferential amplification direction for stimulated emission. In order for the amplification to occur there must be a greater percentage of atoms in the excited state than the lower energy levels. This “population inversion” of more atoms in he excited state leads to the conditions required for laser generation.



## 2. Introduction of W200

This series laser spot welder is firstly designed for jewelry ornaments manufacturing, jewelry repairing, rings or bracelets resizing, gold and silver re-tipping, stone setting, eyewear welding or repairing, denture welding, small auto parts welding, etc. Generally, it is especially suitable for tiny target precision welding. It works on gold, platinum, titanium, silver, copper, nickel, aluminum, magnesium, stainless steel, etc.

### 2.1 Characteristics

- Energy, pulse width, frequency and focus can be adjusted within a wide range to achieve different welding effects.
- Ceramic reflector used in the laser pump chamber is imported, which is corrosion resistant, high temperature resistant, high electrical/optical conversion.
- World-leading automatic light shielding system is employed to remove harmful lighting on eyes during operation.
- 24-hour continuous operation, with stable operating performance,
- Free of maintenance within 10000 hours.
- Personalized design in compliance with ergonomics principles.

### 2.2 Specifications

Laser Source:	Nd3+:YAG
Wavelength:	1064nm
Pulse frequency:	1~100Hz adjustable
Pulse width:	0.1~10ms adjustable
Single pulse Energy:	125J
Rated Laser Power:	200W
Cover Gas Channel:	1 line quick connection
Focused Beam Diameter:	0.1~3mm 0.01-3mm
Welding depth□	0.01-0.5mm



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Expanding Ratio: 3X  
Microscope Ratio: 10X  
Focal Length: 110mm  
Power Supply: Single phase AC 220V±10%  
Running Environment: Temperature 5□~30□, humidity < 85%.  
Continuous Working Time: 24 hrs  
Shield Gas Connection: 1 line quick connection (argon)

## 2.3 Main Structure

The whole system is composed of:

A. Laser Generator B. Laser Power C. Optical System  
D. Control system E. Cooling system

## 2.4 Main configuration

Nu m	Configuration	Brand	Quantity	Original	Note
1	cavity	Morgan	1	UK	Ceramic Cavity
2	Constant temperature water cooler	Shenzhen Donglu Yang	1	Shenzhen	Low power, low noiseK, environ -mental quality
3	Lens	Singapore wavelength	1	Singapore	
4	Laser power	Self-produce	1	Self- produce	
5	microscope or CCD	Micro	1	Shenzhen	
6	Crystal pump	Beijing Leisheng strong style	1	Eleven institute	
7	xenon lamp	Anguang Institute	1	Hefei	

## A. Laser Generator

### 1. Brief introduction of laser generator

The laser is the device of transforming the electricity energy to the laser energy. In this system, the laser is Nd<sup>3+</sup>:YAG laser. It is mainly composed of the following parts: (1) pump lamp (2) laser rod (3) cavity (4) optical resonator (6) other accessories

Pump lamp excites the laser medium to transform the electricity energy to optical energy. The laser rod transforms the optical energy to laser energy. In this system, the pump lamp is the pulsed Xenon lamp and the laser medium is Nd<sup>3+</sup>:YAG rod.

In the cavity, the light emitted from the pump lamp is focused on the laser medium. In our system, it is the close ceramic cavity.

In the optical resonator, the laser is amplified to form the high intensity laser output. There are two high damage threshold coated plane mirrors which are set parallel in the resonator.

Only 3% of the electricity energy is transformed into laser energy during the laser working, the other electricity energy is transformed into heat and distributed in the pump lamp, laser rod, and the cavity body. To protect the laser, this heat has to be taken away. In this system, the pump lamp, laser rod and the cavity body are cooled by the circulation deionized water.

Besides the above parts, there are still the other accessories as follo:

(1) High voltage electrode (2) The insulating base (3) Positioning support, (4) The adjustable mirror support, (5) Laser support.

### 2. Things to be aware of:



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The laser system is the opto-mechano-electrically integrated. It is very precise and has to be operated by the authorized person who has the professional technology and technique.

### 3. Optical resonator

The optical resonator is composed of two coated plane mirrors which are set strictly parallel in the resonator. These two mirrors can not be touched and moved after the adjustment and keep clean, otherwise, the surface of the mirror may be destroyed. So, the laser cover can not be moved at any time. When the laser output becomes low, firstly, it has to be checked whether the surface of the mirrors are stained. If it has been stained, use the lens paper or absorbent cotton to erase softly with the cleaning liquid (the mixture of 50% no water ethanol and 50% aether). Then, check the adjustment of the resonator.

### 4. Cooling of laser

There are two water hoses connected to the pump lamp and the laser rob respectively. Either of the hoses is blocked, unredeemable damage may be caused. Every time when the system is reinstalled, before starting the laser, it has to be checked carefully that the water flow is correct.

### 5. Change flashing lamp

The pulse Xenon lamp is consumable part. Its service lifetime is  $10^6$  flash times. To guaranty the normally work of the system, the lamp has to be changed when it is out of service life or when the laser energy is weak

## B. Laser Power

### 1. Specification

The laser power supply in this system is pulse mode power supply. The IGBT is supplied by the L-C resonating charging and the energy storing circuit. The control circuit has two SCM as the core. So the output power and the repeatability can be adjusted conveniently. The power supply can be adjusted independently or together with the control system. There are multi-inter-lock protections in this system, to shut off the main power supply in emergency situation.

### 2. Description for the electric circuit

The electric circuit is composed of the followings:

Main circuit: include the charging circuit, energy storing circuit, discharging circuit loop and pre-igniting circuit.

The control circuit: include the electric control circuit, microcomputer control circuit and all kinds of the protection circuit.

#### a. Voltage rising/rectifying circuit

By raising the single-phase voltage, the voltage rising / rectifying circuit convert the 220 ACV to 620 DCV to supply the power of the charging circuit.

#### b. The charging circuit

The charging circuit is composed of the IGBT power transistors. This kind of circuit can increase the repeatability of the charging.

#### c. The discharging circuit loop

The discharging circuit loop is controlled by the SCR. During the discharge, the discharging IGBT power transistors have to be shut off. After the charging of the energy storing circuit, the charging IGBT power transistors are shut off, waiting for sometime delay, the discharging IGBT power transistors are turned on to discharge. When the energy storing capacitor discharging finished, the discharging IGBT power transistors will be shut off automatically.

#### d. The pre-igniting and the triggering circuit

It includes the voltage rising transformer, high voltage rectifier, filter, barrater, current relay, high voltage pulse transformer and high voltage triggering circuit.

The pulsed Xenon lamp is working in the aura discharging during the pre-igniting, which has the characteristic of the negative resistance. To maintain the aura discharging of the Xenon lamp after the arc discharging, the pre-





igniting circuit must have the characteristic of constant current. So the pre-igniting circuit must have very high limit resistance.

The triggering mode in this laser is inner triggered by 50Hz pulse automatically. When the pre-igniting circuit works, the high voltage pulse transformer produces the high voltage of 15,000V ~ 20,000V. When the pre-igniting begins, the triggering circuit shut off automatically and immediately.

**e. Control circuit**

The control circuit includes two parts of operating circuit and microcomputer control circuit. The operating circuit controls the water pump, pre-igniting circuit, main power supply, the power supply of the control circuit and the inter-lock protection by means of the components such as the button, contactor and relay. The microcomputer control circuit is integrated in a PCB.

**f. Protection circuit**

When the pre-igniting circuit shut off, the pre-igniting shut-off protection circuit takes into function and sends out the fault signal.

When the water flow is low in the cooling system, the water flow relay breaks and shuts off the pre-igniting circuit and the main power supply, thus to stop the system.

**C. Optical System**

**1. Binocular microscope**

To observe the working piece clearly, the binocular large caliber and long focus length microscope has been used in this system. Before the object lens, there is a coated protection glass to protect the lens from the spatter during the laser processing. The ocular can be taken down by loosen the fixing bolt for the shipping and maintenance purpose.

**2. Laser beam expander and the focusing system**

To ensure the laser welding spot in the center of the view all the time during the focusing, the laser beam has to be co-axial with the beam path of the microscope. In this system, the laser beam and the optical path of the microscope share the same object lens. The offset of the focus

point is adjusted by the up and down keys. The offset of the focus point is determined by the experiment according to the welding processing technology.

**3. The indication of the welding spot**

Because the YAG laser is invisible infrared ray of 1.06μm, there is a cross in the ocular, whose intersection accords to the laser spot, to indicate the laser position. Thus the laser beam can be aimed at the welding position on the piece to be welded easily.

**D. Control System**

The system can be controlled by the operation panel before using, or by joystick inside the welding chamber during using.

**E. Cooling System**

**1. Construction**

The cooling system is the main part of the laser system. It is composed of the heat exchanger, magnetic pump, filter, water tank, switch of water flow, the temperature contactor, ABS hose and valves to form a closed circulation water system.



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## 2. The principle of the cooling

The inner deionized water in the water tank is pumped by the magnetic pump to cool the YAG rod, pulse lamp, two electrodes. The heated deionized water goes through the heat exchanger and returns to the water tank. The resistivity of the deionized water must be higher than 0.5 MΩ-cm. When the deionized water becomes dirty or the resistivity of it becomes higher, the Xenon lamp may can not be ignited and the laser cavity and the glass tube may be stained. In this situation, the deionized water has to be changed immediately. ( the deionized water should be changed one time every week when the laser system is operated continuously)

In the heat exchanger, the Freon is used to take the heat away from the inner deionized water. In order to ensure the proper working of the system, there is an over temperature contactor and over flow controller in the cooling system to supervise the water in the laser. Once there is no enough water flow or the water pump does not work properly, or there is no enough water in the water tank, the laser power supply will be turned off immediately to prevent from the lamp exploding or the rod exploding.

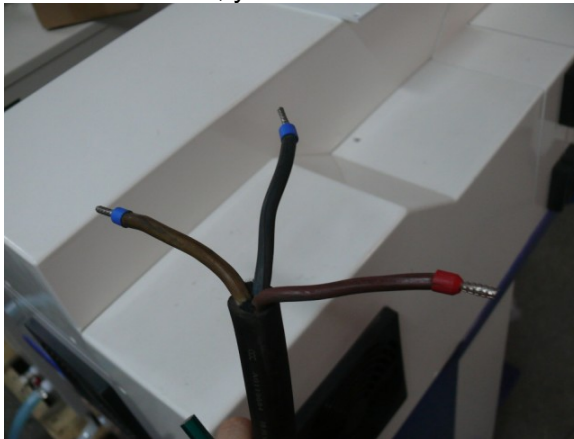
## 3. Machine detail use introduce

### 3.1 Hardware Connection

A. Connect water inlet and outlet with chiller inlet and outlet, then tighten the hose clamps



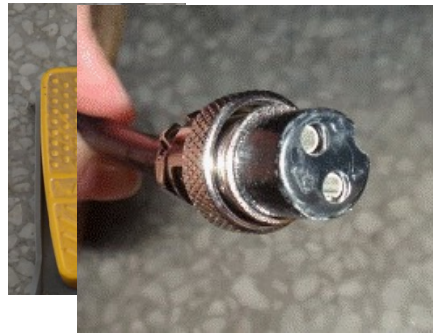
B. Connect the chiller power: red wire=live wire, yellow wire=earth wire, black wire=zero wire  
Connect the welder power: red wire=live wire, green wire=zero wire, yellow wire=earth wire



C. Connect the water protective cable



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D. Connect the Foot Switch

E. Fulfill the chiller tank with drinking water until the water surface covers all the pipes



### 3.2 Laser Activation

A. Take off the welder cover



B. Remove the sticker seals on two ends to activate laser system

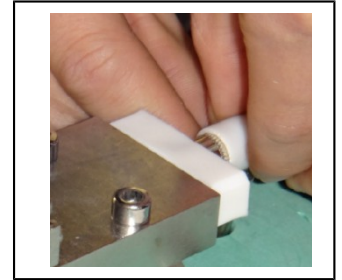
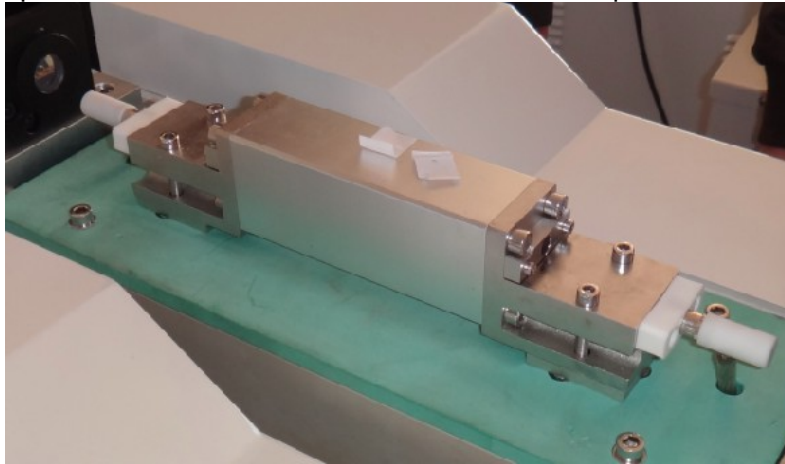
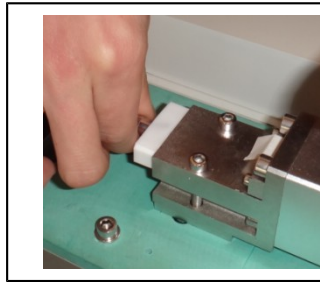






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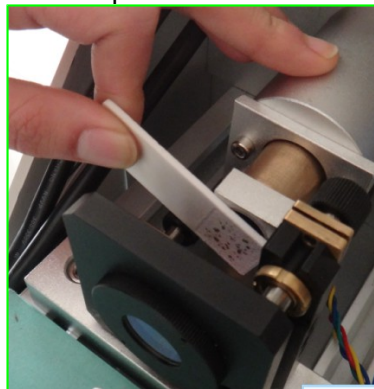
C. Take off the white caps and connect the two electrodes of xenon lamp



when you find the laser spot is not round any more or the laser energy becomes very weak, you may consider to do laser alignment.

A. Start the laser welder by twisting the key switch and set parameters as:  
Curt=100A / Wid =1ms / Fre =1 Hz

B. Hold the ceramic dimmer chip and put it in front of the brass tube with your left hand. Now the laser beam can be intercepted and becomes a green dot on the chip.



C. Adjust the two black screws as the following picture with your right hand until you find the green dot roundest and brightest.



#### 4. Operation



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Step 1) Start the chiller and wait for 1-2 minutes until the water temperature reaches the target value you set. Normally 25 Celsius Degrees.



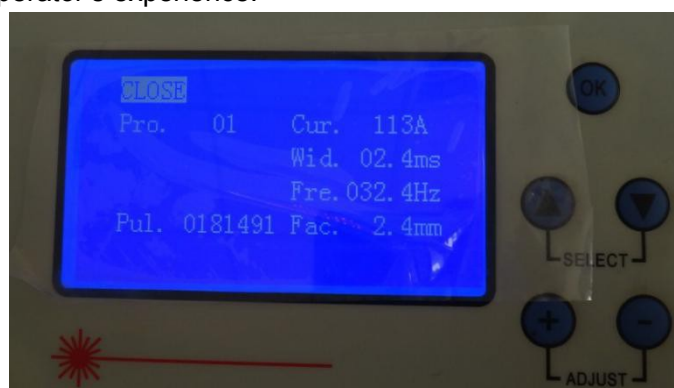
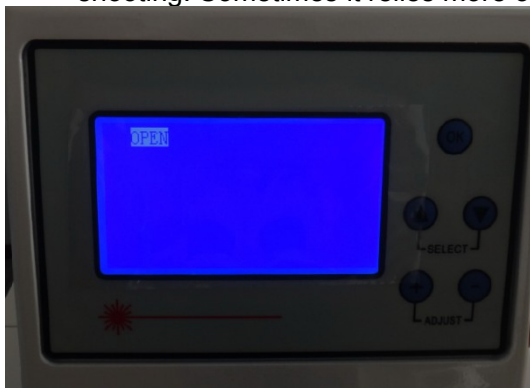
Step 2) Turn on the safety switch behind the welder (new model has no safety switch)



Step 3) Twist the key switch to start laser welder



Step 4) Press “OK” button on control panel, the word OPEN turns into CLOSE. Wait for 1 minute till capacitance charging is finished, then you'll hear a beep and all the parameters will be displayed. Select parameters and set values correctly based on the type of material and make small adjustment according to the result of test shooting. Sometimes it relies more on operator's experience.

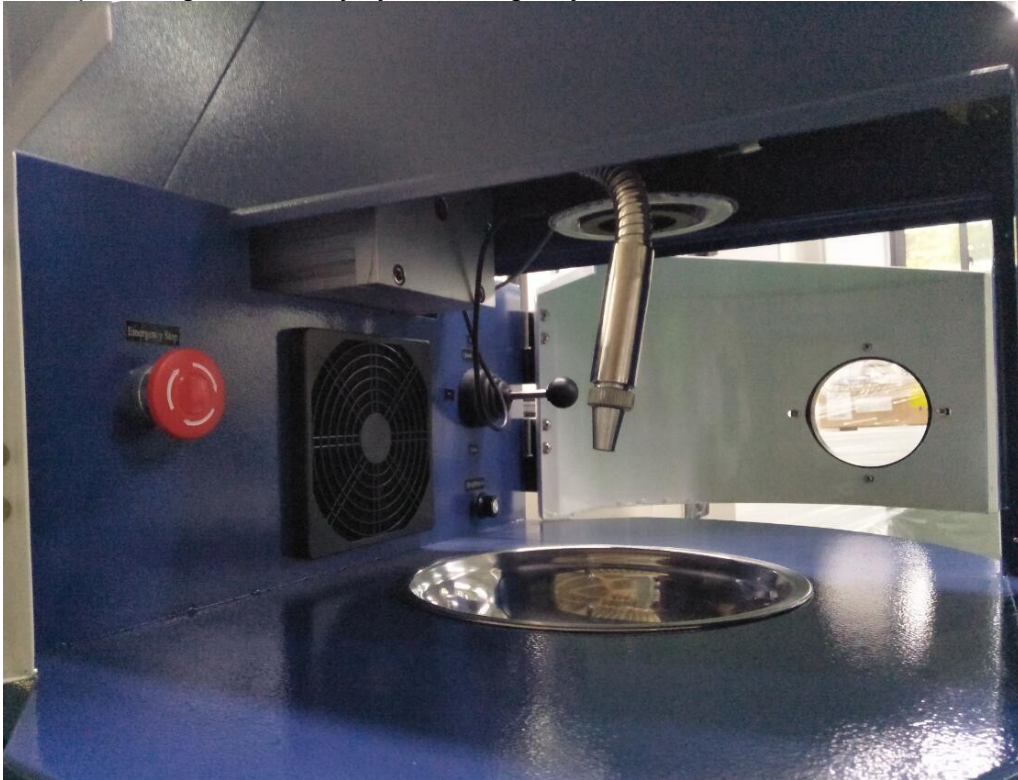




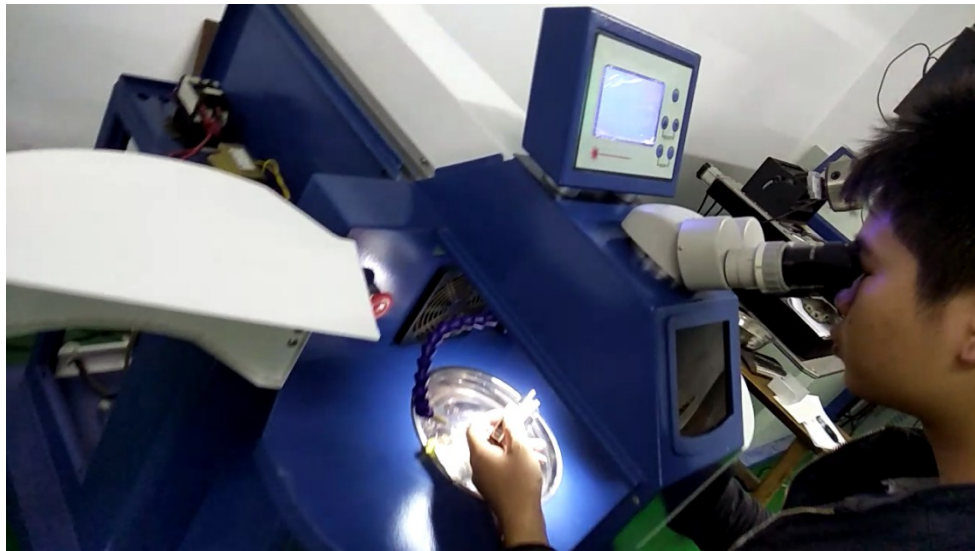
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Pro: program number      Cur: current      Wid: pulse width      Fre: frequency      Fac:  
laser spot size      Pul: pulse counter

Step 5) Turn on the LED light and adjust the position of shield gas nozzle before welding so that your work piece can be prevented from quick oxidation. You can also re-set parameters by the joystick inside the welding chamber or stop welding immediately by the emergency button.



Step 6) Now you are free to weld.



Step 7) When you finish welding, move the dash on CLOSE, press OK button, turn off the key switch, turn off the chiller and cut the total power.





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Finally, please open the protective cover and clean the dusts in the welding chamber. We strongly suggest you to do this at least once a week.

## 5. Application

This series laser welding machine is specially designed for spot welding, perforating, repairing, retipping and resizing of gold/silver/titanium/platinum jewelries, stone caging and gap bridging of small accessories. It is also widely used in aviation, aerospace, sports products, eyewear frames, medical instruments, titanium alloy denture, instruments, electronics, machinery, automobile, etc. Applicable materials are various: gold, silver, steel,, copper, aluminum, titanium, brass, etc,

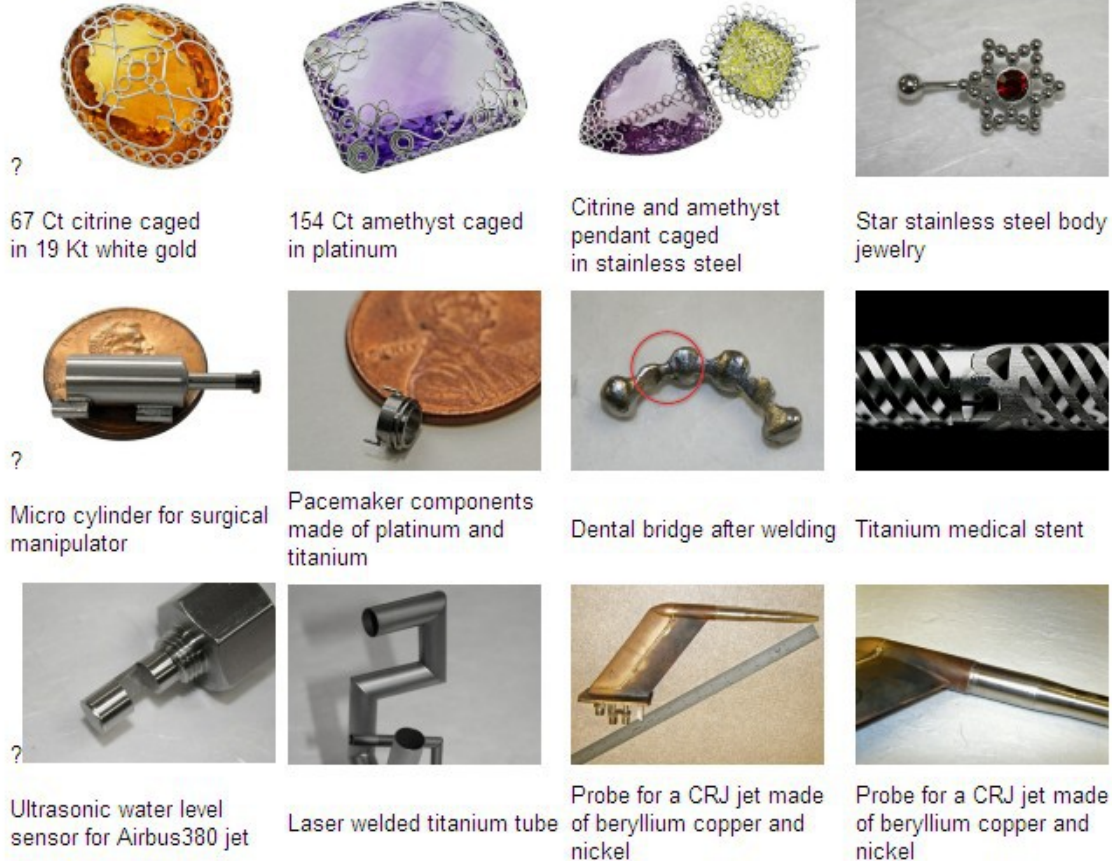




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#### Laser Welding Samples



### 6. Warranty & After-sale Service

We guarantee that the technical parameters of the machine W200 laser welder accord to the technical requirements.

The guarantee covers a period of twelve (12) months from the date of production.

The guarantee shall not apply in the event that the sub-assembly identification markings have been removed, defaced or altered or if any sub-assembly or part has been replaced or modified without the consent of Domain Laser. The guarantee does not apply to equipment or components for which inspection by Domain Laser shall disclose it has become defective or unusable due to misuse, mishandling, accidental damage, negligence or any other cause which does not comply with the requirements given in the instruction manual. For example:

The guarantee dose not includes shipping freight or postal fee for returned broken parts or new parts to be replaced.